ITU - unlicensed devices & spectrum

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Spectrum as an Economic Resource
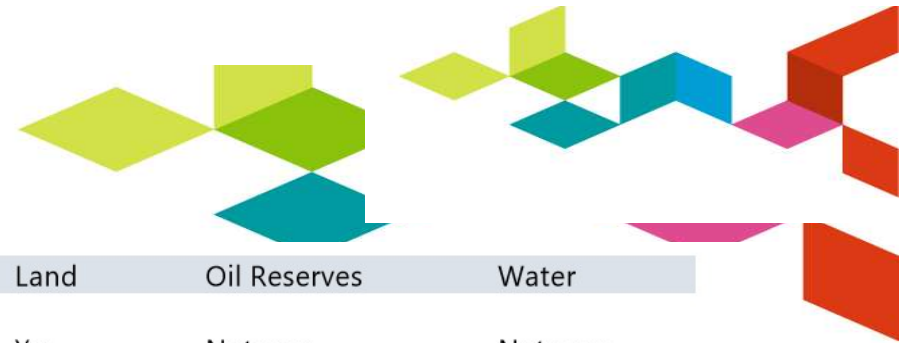
	Spectrum	Land	Oil Reserves	Water
Is the resource varied?	Yes	Yes	Not very	Not very
Is it scarce?	Yes	Yes	Yes	Yes
Can it be made more productive?	Yes	Yes	Yes	No
Is it renewable?	Yes	Partially	No	Yes
Can it be stored for later use?	No	No	Yes	Yes
Can it be exported?	No	No	Yes	Yes
Can it be traded?	Yes	Yes	Yes	Yes

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Approaches To Radio Spectrum Management

1. The traditional "administrative" approach, in which a regulator decides who can use what frequencies for what purposes in what locations under what conditions;

2. The newer "tradable/flexible/market-oriented" approach, in which those who are authorized to use spectrum are allowed to re-purpose or transfer some or all of their rights. Tenders or auctions are typically used for the initial distribution of rights;

3. "License-exempt commons," in which any number of users are allowed to share a band with no right of non-interference and no right to cause interference.

An advantage of open access, service neutral, shared bands is that there seem to be innumerable applications which were not predictably lucrative enough to justify the cost of securing a license, but which proved valuable in the aggregate once they existed

ISM Bands

The **industrial, scientific and medical (ISM) radio bands** are radio bands (portions of the radio spectrum) reserved internationally for the use of radio frequency (RF) energy for industrial, scientific and medical purposes other than telecommunications.

Examples of applications in these bands include radio-frequency process heating, microwave ovens, and medical diathermy machines.

For many people, the most commonly encountered ISM device is the home microwave oven operating at 2.45 GHz

The ISM bands are defined by the ITU Radio Regulations (article 5) in footnotes 5.138, 5.150, and 5.280 of the Radio Regulations

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Wi-Fi is essential to Smart City

Wi-Fi is one of the most important technologies operating in the unlicensed bands.

Wi-Fi is an operational tool for localities that use it for governmental and public safety communications,   Smart City innovations, and connectivity in schools and libraries.

Wi-Fi provides a highly affordable and scalable way to connect large numbers of IoT devices

Interference in the frequency is one the biggest problem, as the usage is rising

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Techniques to avoid interference

Frequency Agile Systems

Many RF communications systems are "frequency agile" in that they can be reconfigured to operate on an alternative frequency. In contrast to frequency hop systems, frequency agile systems generally remain on a single channel for sustained period of time.

Frequency Hop Spread Spectrum (FHSS)

A form of spread spectrum, FHSS systems distribute energy over the spectrum by hopping across different frequencies during a transmission. As with most spread spectrum systems this makes the system more immune to narrow-band interference.

Techniques to avoid interference … Cont…

Adaptive Frequency Hopping (AFH)

Used in FHSS (Frequency Hop Spread Spectrum) systems (e.g. Bluetooth), Adaptive Frequency Hopping (AFH) dynamically alters frequency hop sequences to avoid interference.

Adaptive Power Control (APC)

Static or dynamic power control is an effective method to control interference. In such cases transmitters radiate the minimum power necessary for effective communications.

Techniques to avoid interference … Cont…

Brute Force Increase of AP Power

One method to overcome interference is simply to use higher power (up to regulatory limits). Note however, that this technique often ends in a spiraling of increased power in all devices reverting back to the original problem.

Elimination of Noise Source

Under some situations it may be possible to locate and isolate and/or "reduce" the noise source(s). Often this is done using a directional antenna and a spectrum analyzer to find and isolate the interference sources.

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Common 10 Myths in using Unlicensed Spectrum

Myth #1: "The only interference problems are from other 802.11 networks."

Summary:- Devices include microwave ovens, cordless phones, Bluetooth devices, wireless video cameras, outdoor microwave links, wireless game controllers, Zigbee devices, fluorescent lights, WiMAX, and so on.

Myth #2: "My network seems to be working, so interference must not be a problem."

Summary:- Interference is out there. It's just a silent killer.

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Common 10 Myths in using Unlicensed Spectrum

Myth #3: "I did an RF sweep before deployment. So I found all the interference sources."

Summary:- You can't sweep away the interference problem. Non-802.11 types of interference typically don't work cooperatively with 802.11 devices.

Myth #4: "My infrastructure equipment automatically detects interference."

Summary:- Simple, automated-response-to-interference products are helpful, but they aren't a substitute for understanding of the underlying problem.

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Common 10 Myths in using Unlicensed Spectrum

Myth #5: "I can overcome interference by having a high density of access points."

Summary:- It's reasonable to over-design your network for capacity, but a high density of access points is no panacea for interference.

Myth #6: "I can analyze interference problems with my packet sniffer."

Summary:- You need the right tool for analyzing interference. In the end, it's critical that you be able to analyze the source of interference in order to determine the best course of action to handle the interference.

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Common 10 Myths in using Unlicensed Spectrum

Myth #7: "I have a wireless policy that doesn't allow interfering devices into the premises."

Summary:- You have to expect that interfering devices will sneak onto your premises

Myth #8: "There is no interference at 5 GHz."

Summary:- You can run, but you can't hide.

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Common 10 Myths in using Unlicensed Spectrum

Myth #9: "Wi-Fi interference doesn't happen very often."

Summary:- There's no point burying your head in the sand: Wi-Fi interference happens.

Myth #10: "Interference is a performance problem, but not a security risk."

Summary:- RF security doesn't stop with Wi-Fi. Do you know who is using your spectrum?

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