CETECOM™

INTERFERENCE FREE COEXISTENCE

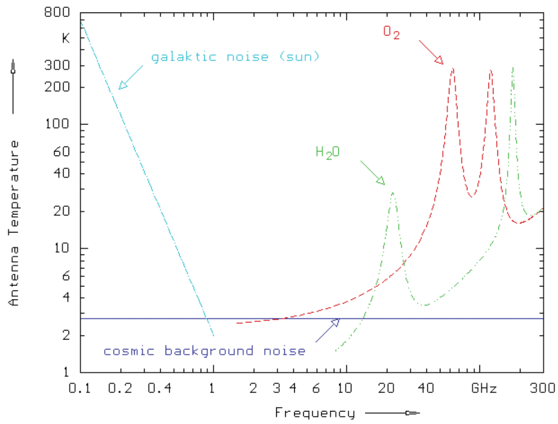
In the Realm of Wireless: Best possible outcome from any given situation

INTERFERENCE FREE COEXISTENCE

At higher frequencies often line of sight is required because of the impact of humidity in the air, at lower frequencies other sources of radiation. The need for a too large sized antenna becomes less convenient.

THE ISSUE

For the classic wireless communication services in our world there exists a so-called "frequency window" between several hundred MHz and 10 GHz. In particular frequencies between 600 MHz and 3 GHz are of special value due to its capability to penetrate buildings to a certain amount. At higher frequencies often line of sight is required because of the impact of humidity in the air and at lower frequencies other sources of radiation (e.g. our sun) and the need for a large antenna size (wavelength related, for resonances in the range of meters) becomes less convenient.



In particular in the light of the Internet of things it is anticipated that the frequency space becomes even more crowded than today.

This makes the frequency range a natural kind of resource which can be used only once at a given time within a certain geographical area. Therefore, already in early stages, mobile communication systems used different channels, time slots (GSM) or codecs (CDMA: "languages") to avoid problems, when more than one type of communication is used in the same area at the same time. The demand of capacities and data throughput or speed of this virtual communication lines are growing. In particular in frequency bands where there is no special license required, the traffic is on a level where coexistence issues become a subject of discussion.

The 2.4 GHz WLAN band is so crowded that even in normal residential areas it is almost impossible to find an available free channel for a new access point. What happens when a Bluetooth device becomes active simultaneously to a WLAN network in terms of real time spectrum? The Bluetooth device utilizes frequency hopping to avoid interference with other devices whereas a WLAN is using one fixed broad channel separate from other WLAN networks by frequency. These different approaches do not work well together under all circumstances.
Also imagine what would happen when a ZigBee device becomes active on top of a larger number of WLAN devices or a microwave oven starts to operate. Such scenarios have caused severe issues in US hospitals. As a result the FDA (U.S. Food and Drug Administration) has raised concerns about an increasing use of wireless communication links in medical devices and simultaneously a growing application of home telehealth, with wireless devices going with patients into a wider variety of environments. In response to these concerns, in 2011 ANSI ASC C63 SC7 commissioned a task group to study the need for wireless coexistence evaluation methods. The current draft of the new ANSI C63.27 is entitled "Standard for Evaluation of Wireless Coexistence".The current version is 0.54 and a ballot is in preparation for this year. Regulators, IT system planners and others need tests that accurately evaluate the ability of wireless devices to operate in their intended environments, particularly in the vicinity of nearby in-band and adjacent-band transmitters.

THE TECHNICAL APPROACH

The industry has responded to this effect by introducing "intelligence" to wireless devices long before 2011. Listen Before Talk (LBT) or sometimes called Listen Before Transmit is an example for such a technique. This device in radio communications first senses its radio environment before it starts an RF transmission. LBT can be used by a radio device to find a network, the device is allowed to operate on or to find a free radio channel to operate on. LBT is used in GSM by the mobile to find a network to connect to and in DECT to find a free radio channel. Others, newer techniques are Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA), RTS/CTS (Request To Send/ Clear To Send) or the Dynamic Frequency Selection (DFS) which was introduced in 2003 for 802.11h at 5 GHz, to avoid trouble with Weather Radar installations.

A number of such functionalities are about the same technology being used in the very same band. Only a few of those techniques are covering other signals present within the same operating frequency band or even adjacent RF resources. Latter is a very prominent example for impeding the introduction of new services: The existing street toll collect system (EETS = European Electronic Toll Service) already

In order to assess what the impact of an interfering signal means, two elements need to be discussed: First: to simulate and test a device in an for its use typical "hostile" environment, and secondly, to assess what an interfering signal does actually mean to the wanted communication link.

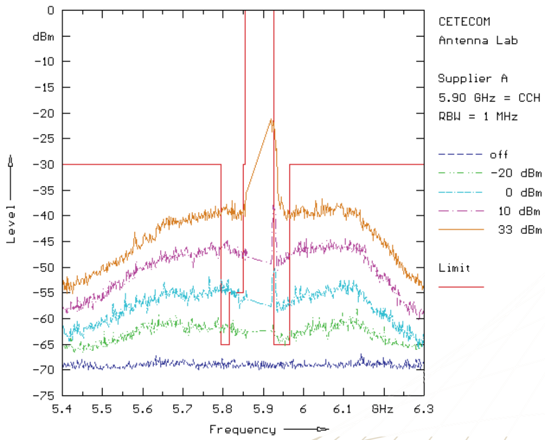
exists and operates partly at frequencies around 5.8 GHz, using devices which do require a protection from nearby transmitters to an extend of -65 dBm. Upcoming new services, such as car-to-car communication has been granted usage at a direct adjacent frequency band (ITS = Intelligent Transport Systems). Therefore the appropriate current EN specification (EN 302 571) for those devices calls for a spectrum mask basically unreachable for standard electronic. As a result, the specification "allows" – or better yet calls for a Decentralized Congestion Control (DCC), which is a mandatory mechanism to be used in order to ensure the radio channel is not congested by too many transmitters within a certain geographical range. The mechanism is such that the ITS device adapts its transmitter output power and transmission timing dynamically based on the current occupation of the channel.

The use of different frequency channels, different codecs, output power and time slots will be extended in the future by sophisticated means, such as e.g. beamforming using more than one antenna.

The problem is: The implementation of such "trouble avoidance" techniques differ in its effectiveness. Additionally, even basic RF parameters such as RF sensitivity are different for different chip sets from different suppliers. Sometimes filters are used to reduce the susceptibility to other RF sources at other frequencies. Those differences do call for: Executing measurements and assessments. Hence appropriate specifications are needed. Covering these needs is exactly what the new ANSI C63.27 is aiming for.

THE TEST RELATED APPROACH

Obviously, a complete loss of a communication link is always critical. When considering a Wi-Fi based application in a hospital, an intermittent disturbance of a communication link could have a minor effect and can be mitigated e.g. by means of re-transmission for time uncritical applications, whereas the same interference signal could completely ruin a picture streaming related application. Therefore, for example the ANSI C63.27 draft calls in one step for a review of the devices total functionality and for identifying a subset of the total functionality that would result in unacceptable consequences if degraded or disrupted (by e.g. resulting in unacceptable consequences for a patient). In another step, an appropriate test method shall be selected out of a number of described scenarios. Besides conducted tests, radiated set ups are also described as well as the use of a large shielded anechoic chamber. In the end, only probabilities can become estimated. The target value in the ANSI norm is therefore a Likelihood of Coexistence (LoC), which is an estimation of the equipment under the test's ability to provide its functional wireless performance in the intended environmental use.



OUTLOOK

But on the other side, a very positive development is the ever-increasing computing power of a reasonable price which leads to devices (chipsets for mobile phones) with almost number crunching capability any engineers in the past could only dream of! This enables the device designer(s) to implement all kinds of "trouble avoidance" strategies by means of hardware and software: The use of different frequency channels, different codecs, output power and time slots will be extended in the future by sophisticated means, such as e.g. beamforming using more than one antenna.

But all of them must be assessed in respect to their efficiency – whether they will really increase the level of "the probability of coexistence" or not. One way is about testing.

ABOUT CETECOM

CETECOM is renowned as an independent industry partner for telecommunication technologies. With over 400 employees worldwide, CETECOM offers a series of services that cover various technologies. Beside testing of familiar standards like GSM, WCDMA, LTE, CDMA, Bluetooth, Wi-Fi and NFC, CETECOM also performs a wide range of consulting and testing of mobile software applications, OTA Antenna testing, SAR, EMC, Smart Card, field trials, acoustics and batteries. In addition, CETECOM supports new developments in the markets of „internet of things,“ especially for the domains of connected car and smart energy. CETECOM also participates in the development of global standards and test specifications.

info@cetecom.com
www.cetecom.com

CETECOM™