**3.2 5G Main Development Challenges:**

**3.2.1 Cognitive Radio (CR)-New ways of Using Spectrum**

New mobile generations are typically assigned new frequency bands and wider spectral bandwidth per frequency channel, but there is little room for new frequency bands or larger channel bandwidths. This could include the use of unlicensed spectrum, or secondary spectrum primarily used for other communication services. Cognitive radio technology allows different radio technologies to share the same spectrum efficiently by adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved in a distributed fashion, and relies on software-defined radio.

**3.2.2 Software Defined Radio (SDR)-Reconfigurability enabler**

Software Defined Radio (SDR) [31] benefits from today’s high processing power to develop

multiband, multi-standard base stations and terminals. Several infrastructure gains are expected from SDR. For example, to increase network capacity at a specific time (e.g. during festivals or sport events), an operator will reconfigure its network adding several modems at a given Base Transceiver Station (BTS). SDR makes this reconfiguration easy. In the context of the expected 5G systems, SDR will become an enabler for terminal and network reconfigurability through software download. For manufacturer, this can be a powerful aid to providing multi-standard, multi-band equipment with reduced development effort and costs.

# 3.2.3 Reconfigurable-Interoperability between several types of wireless access

**network**

The IEEE 802.21 is focused on uninterrupted handover facilitation between different wireless networks in heterogeneous environments regardless of the type of medium for seamless access. The heart of the 802.21 framework is the Media Independent Handover Function (MIHF), responsible for communication with different terminals, networks and remote MIHFs, which will have to be implemented in every IEEE 802.21 compatible device (in either hardware or software).

The selection could be made based on several criteria such as:

* + - Comparison between the availability of access resources and specific service
* Load balancing and sharing between different spatially coexisting wireless networks.
* Efficient spectrum sharing.
* Congestion control.

**3.2.5 Network Energy Efficiency**

Today, reduced energy consumption also in the radio access network is receiving increased attention; the cost of energy is a far from negligible part of

the overall operational cost for the operator. With sufficiently low energy consumption,

reasonably sized solar panels could be used as power source, instead of the diesel generators commonly used today.

**3.2.8 All IP Network**

AIPN focused primarily on the enhancements of packet switched technology. The key benefits of AIPN architecture includes a variety of different access systems’ provision, lower costs, universal seamless access, increased user-satisfaction and reduced system latency. But with the advantages of IP come some dangers: as data flow more freely and the internet is open not only to developers but also to all manner of criminals and viruses, developers and operators face new security challenges.

**3.2.9 Cloud computing**

Cloud computing allows consumers and business to use applications without installation and access their personal files at any computer with internet access. The same concept is going to be used in multi-core technology where the user tries to access his private account form a global content provider through cloud computing.