Promoting investment and innovation in the Internet of Things (IoT)

Neul Ltd, October 2014

1. Nature of IoTwireless systems

We believe that wireless IoT systems will require:

- Improved link budget compared to existing cellular systems by ~20dB, in excess of 160 dB.
- Higher latency>10sec
- Low cost terminal implementation (< 5$)
- High terminal density. Given that urban environments can reach 285 persons per hectares. We expect base stations to be able to support 10^5 terminals per base station.
- The application payload size of the IoT traffic will typically be between 20 and 200 bytes.
- Battery operation whereby 10 years battery life is possible

Anarrowband approach that meets those requirements by reusing the existing cellular infrastructure is being promoted at 3GPP GERAN by Neul, Vodafone and Huawei and is called Cellular Internet of Things (CioT).

2. Spectrum requirements

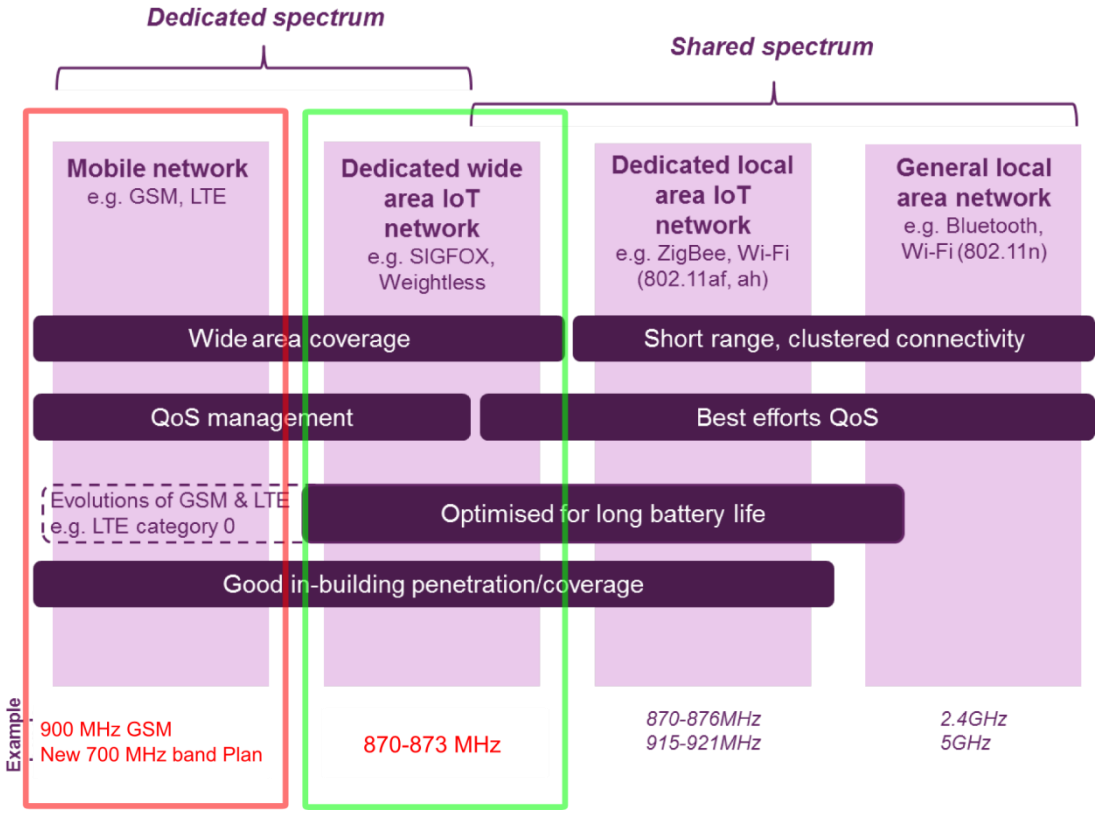
We think that two categories of deployments would exist

- Licensed spectrum where
  - The Quality of service can be guaranteed.
  - The downlink has enough capacity to schedule the uplink and provide reasonable latency.
- Licensed exempt where
  - The traffic is dominated by the uplink
  - Some downlink can be provided for synchronisation and very limited acknowledgment.

In both cases we think that to reach a low cost terminal implementation, a harmonized spectrum allocation in the European Union is of prime importance.

The target frequencies should ideally be below 1GHz. Although VHF frequencies could be attractive for their improved propagation characteristics the following factors needs to be taken into account:

- Using VHF frequencies will increase the fractional bandwidth which determines the antenna size for a given efficiency.
- The noise floor at VHF frequencies can be highly variable as highlighted in the Man-Made Noise Measurement Programme[1]
- The possibility of a European Harmonisation.



Licensed (or dedicated) spectrum

With respect to the harmonisation aspect we think that

- The ECC PT1 700 MHz band plan proposal[2] by the UK is a very positive step in reaching a 2x3 MHz consensus for a European IoT allocation.
- We also think that the coexistence of a narrow band approach (CioT) to be placed in E-GSM 900 spectrum should be evaluated. To that effect even without a stabilized standard the required spectral mask could be established. Starting the coexistence study in parallel to the standardisation should be envisaged.

[1] Man-Made Noise Measurement Programme (AY4119) see http://goo.gl/82GxsM

[2] ECC PT1 UK 700 MHz band plan proposal see http://goo.gl/ICsyRE

Licensed exempt(or shared) spectrum

Operators that don't have access to licensed spectrum could deploy a low power wide area network solution which is uplink centric using licensed exempt spectrum. Given the harmonisation requirements we think that the 870-873 MHz band is a good candidate. Although the 2.5 % duty cycle is viable on the uplink the licensed terms to operate a downlink at a duty cycle up to 10% still need to be determined. While this is part of another consultation, we would favour a scheme which has the most chances to be harmonised across the EU.

3. Security

The low cost terminal target should not be at the price of lower security. In order to fulfil article 8 para 8f of the EU Framework Directive[3]OFCOM could with the help of the industry specify a minimum set of security measures that need to be implemented.

4. Addressing

We think that addressing will naturally fall in the activities of the IANA and RIPE. We don't think that a regional UK numbering solution is adequate for the IoT.

[3]DIRECTIVE 2002/21/EC,