SUMMARY OF AN ANALYSIS OF THE ITU-R MODEL FOR FORECASTING IMT SPECTRUM DEMAND

BACKGROUND:

ITU-R Report M.2290 presents forecasts for growth in the total amount of mobile traffic in the World to 2020 and then models the demand for spectrum for IMT services based on the forecast traffic. The model is relatively sophisticated and breaks down traffic into different service environments which are intended to correspond to dense urban, suburban and rural areas, in home, office and public area usage locations. The model forecasts that between 1340 and 1960 MHz of spectrum will be needed for IMT service by 2020 (in low and high demand situations respectively). Given the importance placed on ITU reports by spectrum regulators, these values will drive decisions on the allocation of spectrum for IMT services at the World Radiocommunication Conference in 2015.

A CLOSER LOOK AT THE MODEL REVEALS

The model uses a bottom-up prediction based on population density and traffic use to determine traffic densities in each of the service environments. Having benchmarked the population and traffic density figures in the model against accepted forecasts of population and mobile data growth and usage, it is evident that the traffic densities in the ITU model are at least 100 times higher than any realistic benchmarks. This is based on unrealistic use of super-high-speed data services together with excessive population densities. For example:

- The urban population density used in the model is the equivalent of putting the **population of the USA into an area the size of Paris**;
- The population density that the model assumes for high mobility traffic (e.g. that in vehicles) is the equivalent of that which would be found on **a 500 lane highway**.

Even the *suburban* population density assumed in the ITU model is in excess of *urban* population benchmarks. Similarly, the amount of traffic generated by each user is higher than any forecasts, by a factor of at between 5 and 50 times, depending on the service environment.

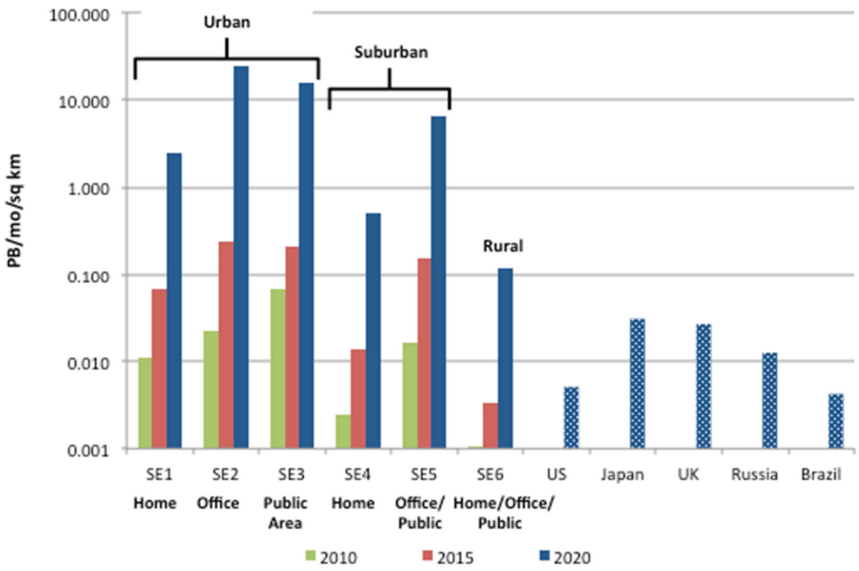

Figure 1: Monthly data traffic per square km; the figures from the low density settings in the ITU model compared with benchmark values for urban area traffic in five example countries

Figure 1 above illustrates the traffic that the model shows in each of the service environments (measured in PetaBytes per month per square km), compared to generally accepted forecasts for urban areas in several different countries. Note that the scale is logarithmic and that the values from the ITU model are taken from the low demand setting.

Given the unrealistic values in the model, the outputs cannot be applied to any country. The traffic which the ITU model indicates would be generated in any service environment, generally exceeds that which would be expected to be generated across the whole country in question.

Other factors in the model are at also at variance from real-world values (for example spectrum efficiency), hence the model produces a seemingly believable result, albeit based on a set of completely unrealistic inputs. The model does not distinguish between different types of spectrum and assumes that, for example, traffic generated by those on the move is handled in the same spectrum as those in an office, whereas in reality they would be handled using different network solutions in different bands. There are a number of other modifications which could be applied to the model so that it produces more valuable results.

Having examined a number of alternative spectrum demand models as used by other parties (e.g. the FCC and GSMA), many of which are based simply on predictions on growth in traffic and expected improvements in spectrum efficiency, it becomes clear that the ITU model itself, is by far the most comprehensive and robust. As such, whilst the values in the model are unrealistic, the model itself is a good basis for IMT spectrum calculations.

CONCLUSIONS & RECOMMENDATIONS

From the analysis summarised above, a number of distinct conclusions become apparent:

- The ITU model itself is a good basis for calculating demand for IMT spectrum but would benefit from further enhancements (for example, to consider how demand is focussed in different frequency bands);
- The population density and traffic usage values in the ITU model are orders of magnitude too high;
- Other inputs to the ITU model (e.g. spectrum efficiency) are similarly unrealistic;
- The model cannot be applied to any country for the purposes of assessing IMT spectrum demand in that country.

As a result of these conclusions, it is recommended that:

- To be a sound basis for responsible, international decision-making, the inputs to the ITU model need to based on real-world values;
- Regulators should not take decisions based on the existing ITU model results - as the inputs are unrealistic, so equally are the outputs;
- Spectrum demand should not be based on values representing the most densely populated area(s) in the world;
- Any country should be able to apply the model to its own situation and obtain valid results if it is to take a decision based on that model.