Information & Communication Technologies Authority

Consultation Ref: ICTA/01/08

CONSULTATION PAPER ON THE OPENING OF THE 1785 – 1805 MHz BAND FOR BROADBAND WIRELESS ACCESS

29 September 2008

Explanatory memorandum

Considering that:

1) the ICT Authority has as one of its functions, under section 18(*p*) of the Information and Communication Technologies Act 2001, to *"allocate frequencies and manage, review, and, where appropriate, reorganise the frequency spectrum"*;
2) the ICT Authority has as one of its objects, under section 16(*g*) of the Information and Communication Technologies Act 2001, to "*further the advancement of technology, research and development relating to information and communication technologies through modern and effective infrastructure taking into account the convergence of information technology, media, telecommunications, and consumer electronics*";
3) The Authority has received expressions of interest to operate in the frequency band 1785 – 1805 MHz ("the frequency band of interest");
4) The frequency band of interest is under the National Spectrum Allocation Plan allocated to the MOBILE and FIXED services on a primary basis and is currently used as the inter-band gap for Digital Communication System (DCS) 1800;
5) Operation in the band of interest has the potential of causing interference to the adjacent DCS-1800 systems.
6) Several countries around the world, including the UK, Australia, South Africa, Malaysia and Kenya have opened the frequency band of interest for operating telecommunication networks, including Broadband Wireless Access networks, and have specified technical and regulatory constraints to permit coexistence with existing systems operating in the bands adjacent to the band of interest.

The Information and Communication Technologies Authority resolves to:

1) make available for public consultation the Consultation Document Ref 2008/1;
2) invite views, contributions, and comments on the Consultation Document.

Mr. T. Dwarka
Chairman

Dr. M. K. Oolun
Executive Director

GUIDELINES ON RESPONDING TO THIS CONSULTATION

G.1 All comments are welcomed; however it would make the task of analyzing responses easier if comments were referenced to the relevant question numbers from this document. The questions are listed together at ANNEX A.

G.2 You are invited to send your written views and comments on the issues raised in this document to the **Executive Director, ICT Authority, 12th Floor The Celicourt, Celicourt Antelme Street, Port Louis**, or by email to icta@intnet.mu, at latest by 16h00 on 28 October 2008.

G.3 Should you be including confidential information as part of your responses, you are requested to clearly identify the said confidential materials and to place same in a separate annex to your response.

1.0 BACKGROUND

1.1 Section 18(1)(*p*) of the Information and Communication Technologies (ICT) Act (as amended) confers upon the Information and Communication Technologies Authority (ICTA) the function to *"allocate frequencies and manage, review, and, where appropriate, reorganize the frequency spectrum"*;

1.2 The Authority is currently in presence of requests to operate Broadband Wireless Access (BWA) services in the 1785 – 1805 MHz band;

1.3 The band 1785 – 1805 MHz is currently reserved as the inter-band gap between the uplink and downlink frequencies of Digital Cellular System (DCS) 1800;

1.4 The inter-band gap is an essential feature of Frequency Division Duplex (FDD) systems such as DCS-1800 as it helps to manage interference between base transmitters and base receivers. This reduces need for hardware isolation and subsequently cost of equipment (Whittaker 2006);

1.5 The aim of this consultation document is to:-

- Evaluate the possibility of allocating the said band to BWA whilst providing sufficient protection to both the existing DCS 1800 networks and the future BWA networks;
- Propose appropriate technical and regulatory parameters to enable efficient use of the frequency band of interest and to protect adjacent services from harmful interference; and,
- Consult with the stakeholders and the public at large on whether the 1785 – 1805 MHz band may be allocated to the BWA service.

2.0 POSSIBLE SERVICES TO BE IMPLEMENTED IN THE 1785 – 1805 MHz BAND

2.1 The frequency band of interest is located near the centre of the 1 – 3 GHz frequency range and is therefore considered to be of "good quality" for numerous applications including mobile ones. The 1 – 3 GHz range enjoys excellent propagation characteristics and allows for non line of sight (NLOS) applications. This spectrum range, due to its good characteristics and high demand, is extremely valuable. This is reflected by the network spectrum licence fees (initial fees of Rs30, 000/100 kHz and annual fees of Rs30, 000/100 kHz) prescribed for this frequency range in the Information and Communication Technologies (Licensing & Fees) Regulations 2003.

2.2 Several uses may be made of the 1785 – 1805 MHz band, many of which have been identified by the UK regulator, Ofcom, in its document entitled *"Award of available spectrum: 1785 – 1805"* (Ofcom 2006).

2.3 The uses identified in Ofcom (2006) are as follows:-

2.3.1 Programme Making and Special Events (PMSE)
2.3.2 Digital wireless microphones
2.3.3 Digital video links
2.3.4 Closed Circuit Television (CCTV)

2.3.5 Mobile technologies
2.3.6 Fixed links
2.3.7 Broadband Wireless Access (BWA)

2.4 Notwithstanding the fact that the uses of the frequency band of interest are numerous, for the purpose of this document only the deployment of BWA will be even though a technology neutral approach will be adopted to define the technical parameters to enable coexistence between the systems to be deployed in the frequency band of interest and the adjacent systems.

2.5 Ofcom (2006) has identified the following two issues associated with the use of the band for BWA applications to serve residential users, given that the band is limited by the size of the carriers that can be deployed once guard bands to protect adjacent services are taken into consideration:-

2.5.1 The ability to deliver the high capacity demanded by residential users;
2.5.2 The ability to increase the service access speeds to remain competitive with increasing throughput offered by other technologies

2.6 Ofcom (2006) further notes, however, that the provision of BWA to business users may be less demanding even if they may require mobility.

2.7 iBurst™ system is a mobile broadband Internet access system that is likely to be operated in the 1785 – 1805 MHz band. This system which is promoted by Kyocera Japan uses the HC-SDMA technology.

2.8 HC-SDMA uses frequency, time and spatial division multiplexing techniques to maximize available base station time slots (MCMC 2007).

2.9 iBurst™ operates in a 5 MHz bandwidth in Time Division Duplex (TDD) mode and each 5 MHz band supports eight radio frequency carriers with 625 kHz separation to support 1 Mbps Downlink subscriber connections (MCMC 2007).

3.0 EVALUATING INTERFERENCE POTENTIAL

3.1 Whittaker (2006) defines three categories of interference to which a radio receiver may respond to and for which management is required. These are shown in Figure 1 and are defined as follows:-

A. In-band interference (Linear Response) – Same Band – Adjacent Area (e.g. in-band emissions radiated from co-channel services);
B. In-band interference (Linear Response) – Same Area – Adjacent Band (includes out-of-band emissions radiated from adjacent channel transmitters)
C. Out-of-band interference (Non-linear Response) – Same Area – Adjacent Band (e.g., intermodulation products created within receiver input stages)

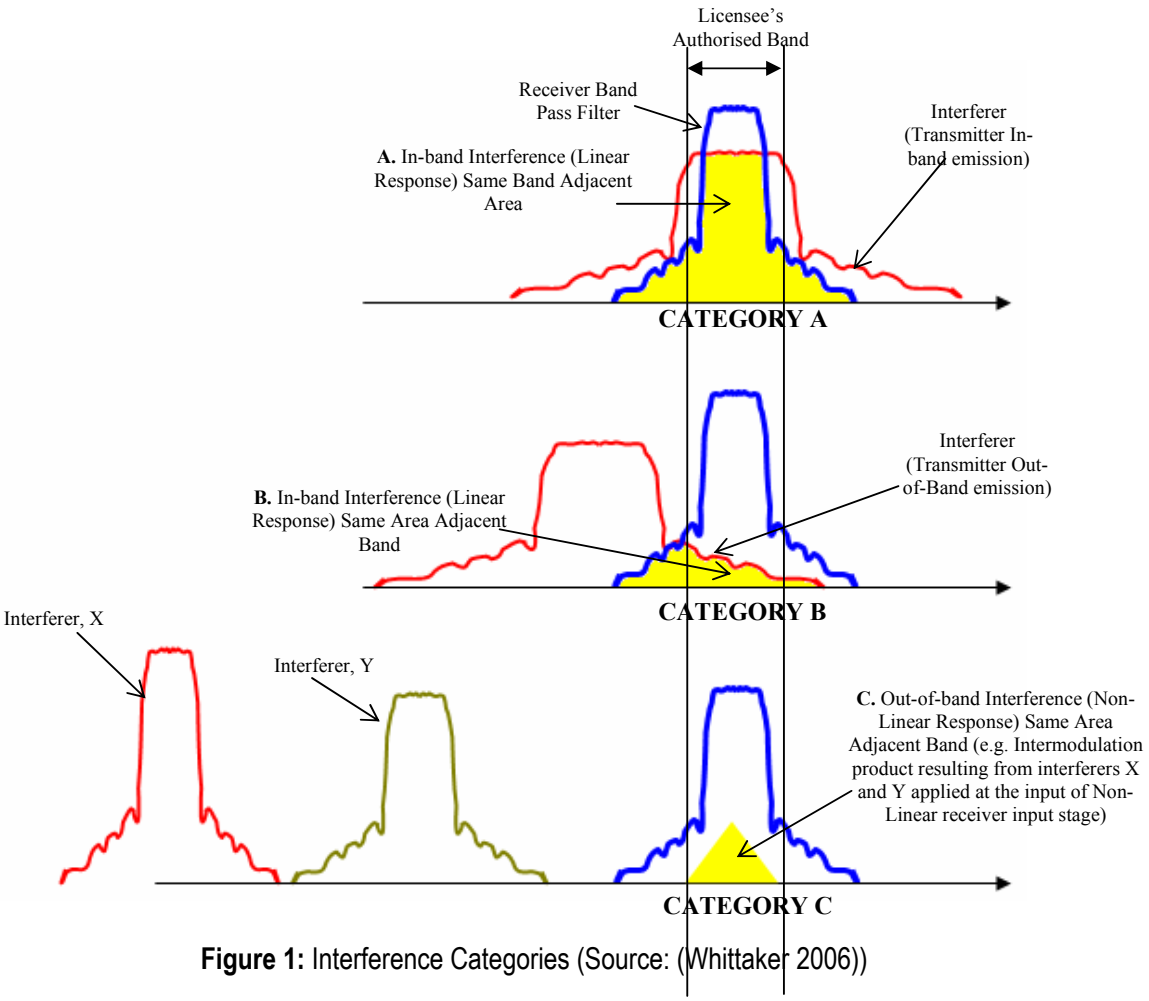

Figure 1: Interference Categories (Source: (Whittaker 2006))

3.2 Interference between the existing DCS 1800 systems and the proposed BWA systems will be assessed in this section.

3.3 The interference categories which are relevant to the current assessment are categories B and C.

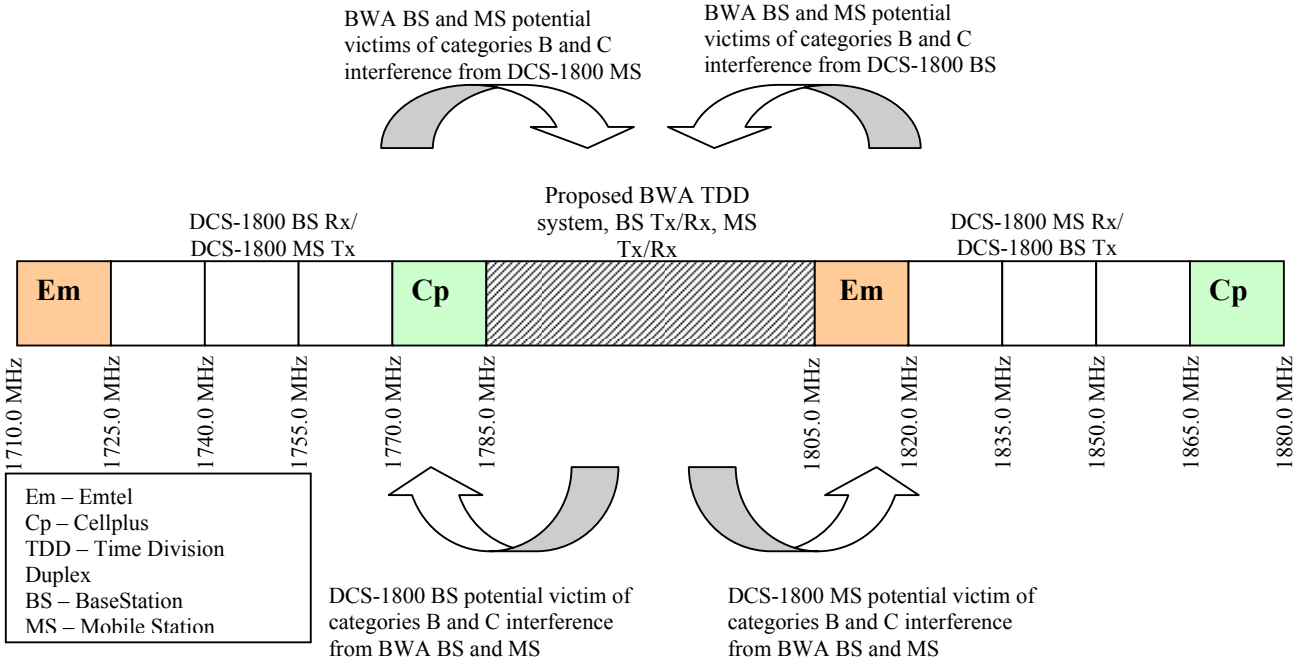

Figure 2: Current and proposed spectrum usage

3.4 CATEGORY B INTERFERENCE

3.4.1 Category B interference may occur when a transmitter has out-of band emissions falling within the frequency band of a frequency-adjacent licence (Whittaker 2006).

3.4.2 The ITU Radio Regulations (RR) defines *"out-of band emission"* as *"emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions"*.

3.4.3 The protection level for out of band emission proposed and adopted by Ofcom (2006) is of -126 dBm/100 kHz measured at a separation distance of 20m from the BWA base station (the interfering source). This protection level is intended to ensure a technology neutral block edge transmission mask which will provide an adequate protection level for the adjacent band systems from any new system deployed in the frequency band of interest.

3.4.4 The -126 dBm/100 kHz protection level is equal to the DCS 1800 noise floor minus 6 dB and is calculated as follows:-

- The equipartition law of Boltzmann and Maxwell (Freeman 1997) states that the available power per unit bandwidth of a thermal noise source is

$$P_n(f) = kT \quad \text{W/Hz}$$

Where *k* is the Boltzmann constant (1.3805×10^{-23} J/K) and *T* is the absolute temperature of the source in kelvins.

- For a receiver operating at room temperature (approx 300 K), the thermal noise level is a function of the bandwidth of the receiver and the noise figure *NF* of the receiver. Thus the DCS 1800 Receiver Noise level per 100 kHz may be computed as:

$$N = P_n(f)B(NF)$$

where B is the bandwidth in Hz and NF is the noise figure in dB

$$N = kTB(NF)$$

$$N = (1.38 \times 10^{-23})(300)(100 \times 10^{3})(2.512)$$

$$= 1.04 \times 10^{-15}$$

$$= -149.8\text{dBW or -}119.8\text{dBm per } 100\text{ kHz}$$

The noise figure of a typical DCS 1800 receiver is 4 dB corresponding to a noise factor of 2.512. The protection level is equal to the DCS 1800 noise level minus 6 dB = -119.8 – 6 = -126 dBm/100 kHz

- The Authority is of the view that formulating out-of-band emission in terms of field strength at a distance from the transmitter may be impractical due to measurement and prediction uncertainties. The views of the Authority are shared by Whittaker (2007). Another way of formulating the out-of-band emission in the frequency band of an adjacent DCS1800 licensee is in terms of power radiated at the antenna.

- The methodology used to determine the level of radiated out-of-band emission in the frequency band of an adjacent DCS1800 licensee (OOB EIRP dBm/100kHz) is as follows:-

From the receive signal level equation,

$\Pr = Pt_{(BWA)} + Gr_{(BSDCS)} - Lr_{(BSDCS)} - PL(d)$,

we may put $\Pr = \mathrm{Im}\,ax_{(BSDCS)}$ and $Pt_{(BWA)} = OOB_{(BWA)}$

and rearranging as

$$OOB_{(BWA)} = \mathrm{Im}\,ax_{(BSDCS)} - Gr_{(BSDCS)} + Lr_{(BSDCS)} + PL(d)$$

Where

$OOB_{(BWA)}$: Level of out – of – band emissions (EIRPdBm/100kHz)

$\mathrm{Im}\,ax_{(BSDCS)}$: Maximum allowed interference level in DCS1800 receiver (dBm/100kHz)

$Gr_{(BSDCS)}$: DCS1800 receiver base station antenna gain (dBi)

$Lr_{(BSDCS)}$: DCS1800 receiver base station feeder loss (dB)

d : Distance separation between stations (km)

PL(d) : Path loss at distance d (km), free space in this case (dB)

$Pt_{(BWA)}$: BWA base station radiated power (EIRP)

- This method of determining the level of out-of-band emission requires assumptions to be made regarding the technical parameters of the DCS1800 base station, especially those pertaining to antenna gain and feeder loss. The antenna gain is assumed to be 19 dBi and the feeder loss is assumed to be 4dB (ACMA 2006). These figures should be representative of what obtains in DCS1800 networks currently deployed in Mauritius.

- With the assumptions above, the radiated out-of-band emission in the frequency band of an adjacent DCS1800 licensee is computed as follows (PL(0.02 km) = 63.6dB):-

$$OOB_{(BWA)} = -126dBm/100kHz - 19dBi + 4dB + 63.6dB = -77.4dBm/100kHz$$

Question 1 (a): Which proposed method of formulating out-of-band emission level is better according to you?
(b) Do you think the assumptions made for antenna gain and feeder loss for DCS base station is representative of what obtains in DCS1800 networks currently deployed in Mauritius? If no, please suggest values which according to you are more appropriate.
(c) Do you think that the radiated out-of-band emission level of -77.4 dBm/100kHz may be achieved in practice without a guard band between the band of interest and the DCS1800 band?

3.5 CATEGORY C INTERFERENCE

3.5.1 To understand the possible effects of category C interference, it is important to review the architecture of a radio receiver

3.5.2 A receiver can arbitrarily be divided into three main functional blocks (Luzzatto 2007):

- Front End which consists of all the circuits that carry out operations at final Radio Frequency (RF), including RF front filters, low-noise amplifiers (LNA), high frequency mixers;
- Intermediate frequency (IF) chain which consists of all the circuits operating at non-zero IF;
- Backend which consists of all circuits operating at a frequency below first IF (if any) or other than final RF, such as baseband processing, detector etc.

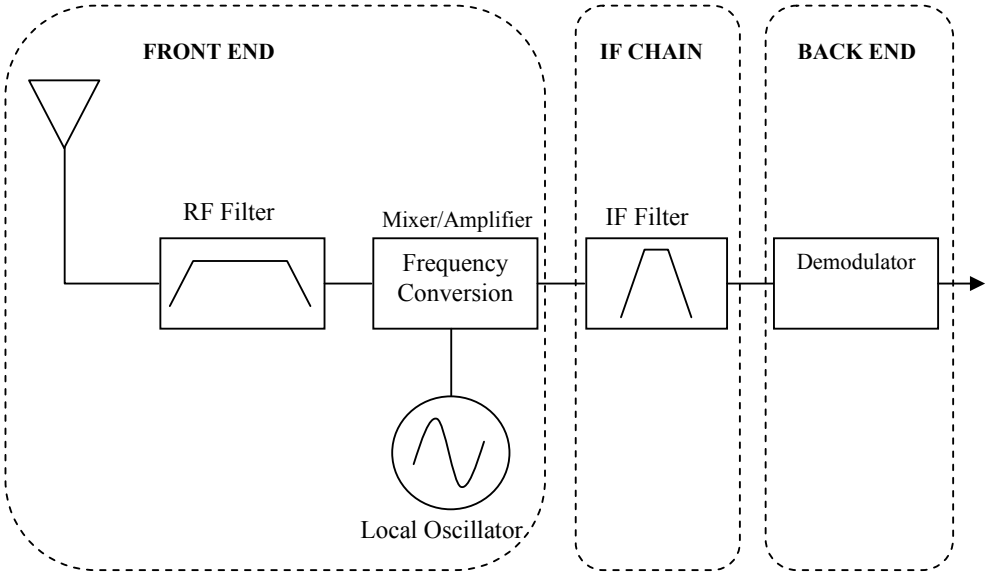

Figure 3: Radio Receiver Architecture

3.5.3 RECEIVER SELECTIVITY

3.5.3.1 Receiver selectivity is an interference of category C whereby an unwanted transmitted signal creates a noise-like signal within the IF pass band of the receiver through reciprocal mixing with the broadband noise of the receiver's local oscillator signal (Whittaker 2006).

3.5.4 RECEIVER BLOCKING

3.5.4.1 Receiver blocking is another interference of category C which is caused when an unwanted transmitted signal sufficiently overloads the receiver input amplifier or mixer stages to change their normal operating mode (Whittaker 2006).

3.5.5 RECEIVER SPURIOUS RESPONSE

3.5.5.1 Receiver spurious response is an interference of category C which is caused by an unwanted signal that is at a characteristic frequency usually greater than 3 MHz from the receiver's operating frequency. Spurious response immunity is largely a function of RF filter characteristics and spectral purity of the local oscillator (Whittaker 2006).

3.5.6 RECEIVER INTERMODULATION

3.5.6.1 Receiver intermodulation is an interference of category C which occurs when the radiated power of two or more transmitters, with specific amplitude and frequency relationships to the wanted signal are present in the receiver's circuitry with consequent production of discrete new signals through mixing of the signals. The interference occurs when the new signals, known as intermodulation products, fall within the IF passband of the receiver.

3.6 STUDY OF RED-M FOR Ofcom

3.6.1 Red-M is a UK based consultancy firm which has undertaken a study and produced a report (Red-M 2006) for Ofcom in support of the award of spectrum in the band 1785 – 1805 MHz.

3.6.2 This study takes into consideration real world GSM systems in its modeling exercise and evaluates categories B and C interference on same.

3.6.3 The study concludes that **the limiting scenario for un-coordinated use of the frequency band 1785 – 1805 MHz is GSM BTS Receiver Blocking when a new operator licensed to operate in the band of interest constructs a BTS close to an existing GSM operator**.

3.6.4 The report recommends a the spectrum mask depicted in Figure 4 to help protect existing GSM BTS from blocking effects caused by BTS installed by a new licensed operator.

3.6.5 The report further concludes that whereas Receiver Intermodulation presents a potential issue, GSM defence mechanisms such as slow frequency hopping and intra-cell handover have the effect of moving distant mobiles from affected timeslots. **Receiver Intermodulation is therefore not considered to be a limiting scenario in practice, since the probability of impact when it occurs is low.**

3.6.6 The results from the abovementioned study are taken as the technical basis of this consultation document to propose mechanisms to combat potential category C interference. It is to be noted that the results of the same study has been used in Malaysia by the Malaysian Communications and Multimedia Commission to draft the Standard

radio System Plan (SRSP) entitled: *"Requirements for Broadband Wireless Access (BWA) Systems Operating in the Frequency Band From 1790 MHz to 1800 MHz"* (MCMC 2007)

Question 2: Is it reasonable for the Authority to base itself exclusively on the findings of the Red-M study? If not, what measures do you think would be appropriate?

4.0 PROPOSED TECHNICAL, REGULATORY AND LICENSING CONDITIONS FOR OPERATING IN THE 1785 – 1805 MHz BAND

4.1 PROPOSED SPECTRUM MASKS

4.1.1 Four spectrum masks are proposed for stations that are installed and operated at a fixed location (base stations) within the 1785 – 1805 MHz band. The future licensees will have to use the spectrum mask that is relevant to the distance separating a station that is installed and operated at a fixed location within the band of interest and pre-existing DCS 1800 base stations operating in the band 1770 – 1785 MHz.

4.1.2 FIXED (BASE) STATION SPECTRUM MASKS

4.1.2.1 The spectrum masks for fixed (base) station are given in Figure 4.

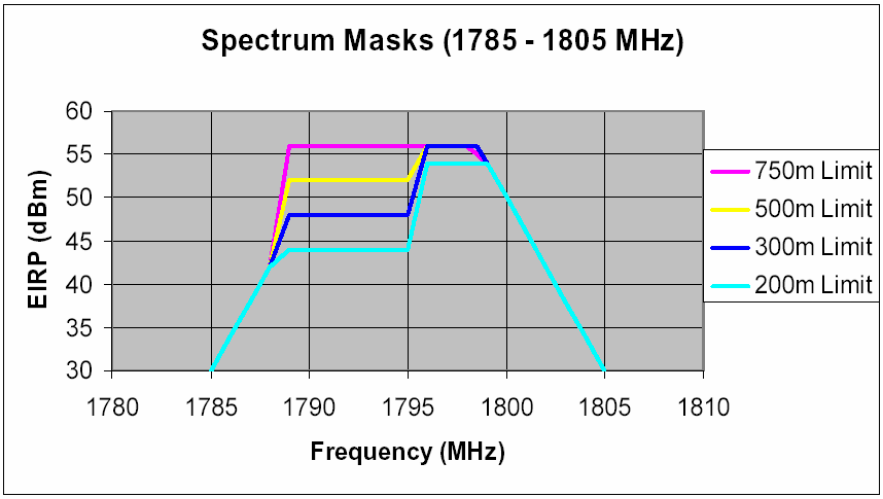

Figure 4: Fixed (base) station spectrum masks and coordination separation distances (Source: (Ofcom 2006))

4.1.2.2 The power limits corresponding to the above mask are given in tables 1 to 4. These limits are proposed to be applied as follows:-

- when a station is installed and operated at a fixed location that is 200 metres from a pre-existing DCS1800 base station operating in the band 1770 - 1785 MHz the power limits shown in table 1 will apply;

- when a station is installed and operated at a fixed location that is between 200 and 300 metres from a pre-existing DCS 1800 base station operating in the band 1770 - 1785 MHz the power limits shown in table 1 will apply;

- when a station is installed and operated at a fixed location that is between 300 and 500 metres from a pre-existing DCS 1800 base station operating in the band 1770 - 1785 MHz the power limits shown in table 2 will apply;

- when a station is installed and operated at a fixed location that is between 500 and 750 metres from a pre-existing DCs 1800 base station operating in the band 1770 - 1785 MHz the power limits shown in table 3 will apply.

- When a station is installed and operated at a fixed location that is at a distance greater than 750 metres from a pre-existing GSM 1800 base station operating in the band 1770 - 1785 MHz the power limits shown in table 4 will apply.

Frequency (MHz)	Maximum EIRP (dBm)
Below 1785	Unwanted Emission Level
1785	30
1785 - 1788	30 + (4*ΔF1) Note 1
1788 - 1789	42 + (2*ΔF2) Note 2
1789 - 1795	44
1795 - 1796	44 + (10*ΔF3) Note 3
1796 - 1799	54
1799 - 1805	54 - (4*ΔF4) Note 4
1805	30
Above 1805	Unwanted Emission Level

Note 1: ΔF1 is the positive offset in MHz to a maximum of 3 MHz
Note 2: ΔF2 is the positive offset in MHz to a maximum of 1 MHz
Note 3: ΔF3 is the positive offset in MHz to a maximum of 1 MHz
Note 4: ΔF4 is the positive offset in MHz to a maximum of 6 MHz

Table 1: Maximum EIRP for stations installed and operated at fixed locations at a separation distance of 200m (Source: (Ofcom 2006))

Frequency (MHz)	Maximum EIRP (dBm)
Below 1785	Unwanted Emission Level
1785	30
1785 - 1788	30 + (4*ΔF1) Note 1
1788 - 1789	42 + (6*ΔF2) Note 2
1789 - 1795	48
1795 - 1796	48 + (8*ΔF3) Note 3
1796 – 1798.5	56
1798.5 - 1799	56 - (4*ΔF4) Note 4
1799 - 1805	54 - (4*ΔF5) Note 5
1805	30
Above 1805	Unwanted Emission Level

Note 1: ΔF1 is the positive offset in MHz to a maximum of 3 MHz
Note 2: ΔF2 is the positive offset in MHz to a maximum of 1 MHz
Note 3: ΔF3 is the positive offset in MHz to a maximum of 1 MHz
Note 4: ΔF4 is the positive offset in MHz to a maximum of 0.5 MHz
Note 5: ΔF5 is the positive offset in MHz to a maximum of 6MHz

Table 2: Maximum EIRP for stations installed and operated at fixed locations at a separation distance of 300m (Source: (Ofcom 2006))

Frequency (MHz)	Maximum EIRP (dBm)
Below 1785	Unwanted Emission Level
1785	30
1785 - 1788	30 + (4*ΔF1) Note 1
1788 - 1789	42 + (10*ΔF2) Note 2
1789 - 1795	52
1795 - 1796	52 + (8*ΔF3) Note 3
1796 – 1798.5	56
1798.5 - 1799	56 - (4*ΔF4) Note 4
1799 - 1805	54 - (4*ΔF5) Note 5
1805	30
Above 1805	Unwanted Emission Level

Note 1: ΔF1 is the positive offset in MHz to a maximum of 3 MHz
Note 2: ΔF2 is the positive offset in MHz to a maximum of 1 MHz
Note 3: ΔF3 is the positive offset in MHz to a maximum of 1 MHz
Note 4: ΔF4 is the positive offset in MHz to a maximum of 0.5 MHz
Note 5: ΔF5 is the positive offset in MHz to a maximum of 6MHz

Table 3: Maximum EIRP for stations installed and operated at fixed locations at a separation distance of 500m (Source: (Ofcom 2006))

Frequency (MHz)	Maximum EIRP (dBm)
Below 1785	Unwanted Emission Level
1785	30
1785 - 1788	30 + (4*ΔF1) Note 1
1788 - 1789	42 + (14*ΔF2) Note 2
1789 - 1798	56
1798 - 1799	56 - ΔF3 Note 3
1799 - 1805	54 - (4*ΔF4) Note 4
1805	30
Above 1805	Unwanted Emission Level

Note 1: ΔF1 is the positive offset in MHz to a maximum of 3 MHz
Note 2: ΔF2 is the positive offset in MHz to a maximum of 1 MHz
Note 3: ΔF3 is the positive offset in MHz to a maximum of 1 MHz
Note 4: ΔF4 is the positive offset in MHz to a maximum of 6 MHz

Table 4: Maximum EIRP for stations installed and operated at fixed locations at a separation distance of 750m (Source: (Ofcom 2006))

Question 3: Are the proposed spectrum masks presented in this section appropriate and adequate to protect the existing DCS 1800 systems against interference? If not what measures do you think would be appropriate?

4.1.3 MOBILE STATION SPECTRUM MASK

4.1.3.1 The spectrum mask for mobile stations which are proposed to operate in the frequency band of interest is presented in Figure 5. This spectrum mask, according to the Red-M study (Red-M 2006), is effective in limiting the interference to GSM mobile terminals to a figure comparable to existing GSM design limits.

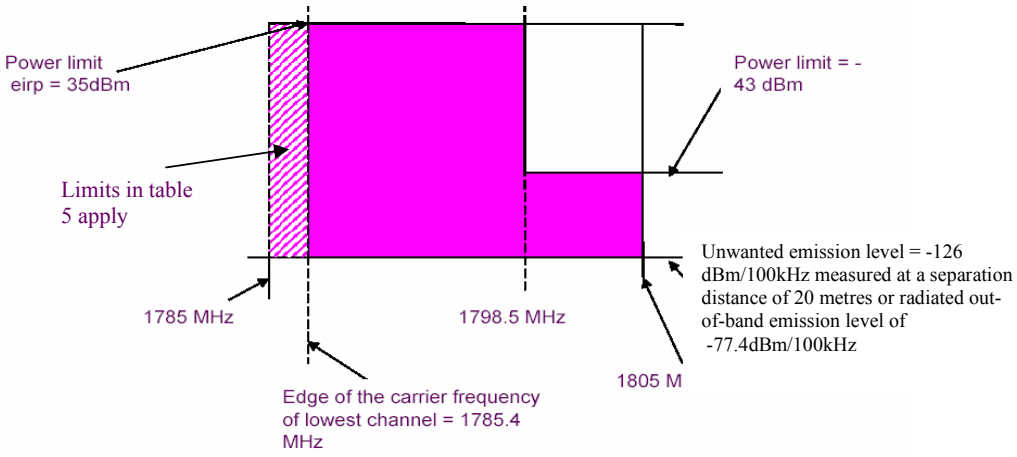

Figure 5: Spectrum Mask and power limits (mobile stations) (Source: (Ofcom 2006))

Frequency offset in kHz from the carrier (Note 1)	Upper EIRP limit (35 dBm) (notes 2 & 3)	Measurement Bandwidth (kHz)
100	0.5	30
200	-30	30
250	-33	30
400	-60	30
600 - <1200	-62	100
1200 - <1800	-65	100
1800 - < 6000	-67	100
6000	-80	100

Note 1: The frequency offset is taken from the edge of the carrier frequency of lowest channel = 1785.4 MHz

Note 2: An in band power limit of -43dBm is assumed inside the spectrum band 1798.5 to 1805 MHz

Note 3: The unwanted emission limit is -126dBm/100kHz measured at a separation distance of 20 metres or the radiated out-of-band emission level of -77.4 dBm/100 kHz as computed in section 3

Table 5: Power limits on emissions from mobile terminals (Source: (Ofcom 2006))

Question 4: Is the proposed spectrum mask presented in this section appropriate and adequate to protect the existing DCS 1800 systems against interference? If not what measures do you think would be appropriate?

4.2 SPECTRUM AVAILABLE FOR ASSIGNMENT

4.2.1 It is proposed **not** to make the entire 20 MHz available for assignment but to reserve a guard band of 5 MHz at either end of the band of interest for the protection of existing DCS 1800 operators as depicted in Figure 6. In effect therefore 10 MHz between 1790 MHz and 1800 MHz is proposed to be made available for assignment.

4.2.2 The 5 MHz guard band will therefore facilitate meeting the out-of-band emission level of -77.4 dBm/100kHz in the frequency band of the adjacent DCS1800 licensee.

4.2.3 Given the proposal of assigning only 10 MHz of spectrum, the Spectrum masks proposed above will be applicable between 1790 – 1800 MHz only.

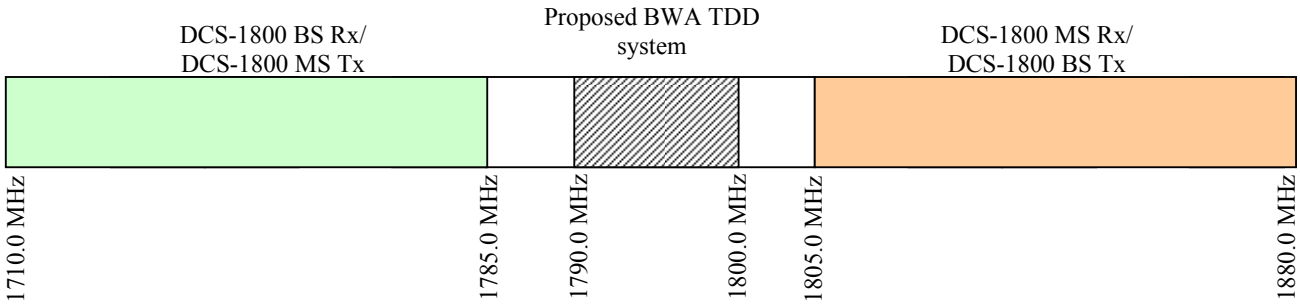

Figure 6: Available Spectrum

Question 5: Do you think that the proposal of the Authority to make available 10 MHz between 1790 – 1800 MHz available for assignment reasonable? If not what do you think would be appropriate?

4.3.1 The Authority proposes to assign a maximum of 10 MHz of spectrum to a single licensee. The reason for this is that as depicted by the spectrum masks above, the spectrum is not uniformly subject to the same technical constraints and is therefore not of the same quality throughout.

Question 6: Do you think that the proposal of the Authority to make the entire 10 MHz between 1790 – 1800 MHz available to a single licensee reasonable? If not what do you think would be appropriate?

4.3.2 DEALING WITH COMPETING REQUESTS

4.3.2.1 The proposal of the Authority to assign a maximum of 10 MHz of spectrum to one licensee poses the problem of how to deal with the competing requests.

4.3.2.2 Even though regulatory solutions exist, same have to be in compliance with the ICT Act 2001 (as amended).

4.3.2.3 In general, licensing methods may either be of the *"non-competing"* or of the *"competing"* types.

4.3.2.4 The non-competing licensing method is basically assigning spectrum on a *"first come, first serve"* basis. The Authority has so far been using this method for spectrum licensing.

4.3.2.5 The competing licensing methods are defined below (Netel@Africa)

- **Comparative processes (beauty contest)** – Under this method, the regulator decides as to whom the relevant spectrum is to be assigned based on such criteria a proposed tariffs, coverage, network rollout targets, quality and range of service commitments and efficient use of frequencies. The applicant must also show evidence of financial resource, technical capability and commercial feasibility of relevant spectrum licence applications. The beauty contest method is often criticized especially for its lack of transparency given the subjective element involved in the decision making process. This process has been used in the past by the Authority in the award of commercial licences. Hence it is in compliance with the law.

- **Auction –** Auctioning is a method that is increasingly being acclaimed by regulators worldwide as it is the market which ultimately determines who will hold the spectrum licences. The Auction method may not be used in Mauritius as it is not in compliance with the law.

- **Lotteries –** This method provides a fast, inexpensive and transparent approach for selecting from substantially similar or equally qualified applicants. Lotteries should in general be preceded by a form of qualification process to select the lottery participants so as not to prevent sector development. Whereas this method of selection has never been used by the Authority, same has not been found to be in contradiction with the ICT Act

Question 7: Which of the above methods (first come first served, beauty contest or lotteries) do you think the Authority should use to deal with the competing requests?

4.4 FREQUENCY COORDINATION

4.4.1 It is proposed that licensee in the band of interest will not be permitted to operate a fixed station that is closer that 200 metres to a pre-existing DCS 1800 base station operated in the 1770 – 1785 MHz band, unless it is successfully coordinated.

4.4.2 For the purpose of coordination, DCS 1800 operators and licensee in the band of interest will be required to exchange all relevant information.

4.4.3 The Authority proposes that the costs resulting from the coordination of stations in the spectrum band of interest with the pre-existing DCS-1800 base stations operated in the 1770 – 1785 MHz band be borne by the licensee in the band of interest.

4.4.4 As regards future DCS-1800 base stations and modifications to existing DCS-1800 base stations, it is proposed that the DCS-1800 operators seek coordination with the licensee in the band of interest with regard to same.

Question 8: Do you think that the proposed frequency coordination arrangements are reasonable, adequate and practical? If not what do you think would be appropriate?

5.0 LICENSING

5.1 In accordance with the *Information and Communication Technologies (amendment of Schedule) Regulations 2003* and the *Information and Communication Technologies (Licensing & Fees) Regulations 2003*, the licence applicable for operation in the band of interest is the *Network Spectrum Licence (operating in the frequency band equal to or more than 1 GHz but less than 3 GHz) – SPL.2*.

5.2 For the available 10 MHz of spectrum, the licensee will have to pay a licence fee amounting to Rs6, 000,000 for the first year (i.e. initial fee of Rs3, 000,000 and annual fee of Rs3, 000,000) and Rs3, 000,000 per annum for the subsequent years of validity of the licence.

5.3 From the expressions of interests received, it is the general understanding of the Authority that the band of interest will be used mainly to put up a last mile for offering Internet Services. It is also the understanding of the Authority that given the quality of the spectrum, especially in terms of propagation characteristics, the band will be preferred for mobile applications. Indeed, the iBurst™ technology, which is one candidate technology to operate in the frequency band of interest, is described as being *"a mobile broadband Internet access system"*.

5.4 The Authority has determined which types of Broadband Wireless Access services an ISP is allowed to offer in its decision ICTA/DEC/01/2005, entitled *"Information*

and Communication Technologies Authority Decision of 19 May 2005 on Spectrum Allocation for Broadband Wireless Access Services in Mauritius" (see ANNEX B).

5.5 The Authority is of the opinion that the same reasoning as expressed in the said decision will have to be applied in the present context. In other words, mobile Internet services may only be offered by the holders of both a PLMN and ISP licence. Indeed, operators currently offering mobile Internet services using for example the UMTS/HSDPA or the CDMA2000 EV-DO mobile systems, do so under both a PLMN and an ISP licence.

Question 9: Please provide your opinion on the application of the Authority's decision on the provision of Broadband Wireless Internet Access Services by Internet Service Providers (ISPs) as spelt out at ANNEX B in the present context? If you do not agree, please elaborate?

6.0 REFERENCES

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ANNEX A: LIST OF CONSULTATION QUESTIONS

Question 1 (a): Which proposed method of formulating out-of-band emission level is better according to you?
(b) Do you think the assumptions made for antenna gain and feeder loss for DCS base station is representative of what obtains in DCS1800 networks currently deployed in Mauritius? If no, please suggest values which according to you are more appropriate.
(c) Do you think that the radiated out-of-band emission level of -77.4 dBm/100kHz may be achieved in practice without a guard band between the band of interest and the DCS1800 band?

Question 2: Is it reasonable for the Authority to base itself on the Red-M study? If not what measures do you think would be appropriate?

Question 3: Are the proposed spectrum masks presented in this section appropriate and adequate to protect the existing DCS 1800 systems against interference? If not what measures do you think would be appropriate?

Question 4: Is the proposed spectrum mask presented in this section appropriate and adequate to protect the existing DCS 1800 systems against interference? If not what measures do you think would be appropriate?

Question 5: Do you think that the proposal of the Authority to make available 10 MHz between 1790 – 1800 MHz available for assignment reasonable? If not what do you think would be appropriate?

Question 6: Do you think that the proposal of the Authority to make the entire 10 MHz between 1790 – 1800 MHz available to a single licensee reasonable? If not what do you think would be appropriate?

Question 7: Which of the above methods (first come first served, beauty contest or lotteries) do you think the Authority should use to deal with the competing requests?

Question 8: Do you think that the proposed frequency coordination arrangements are reasonable, adequate and practical? If not what do you think would be appropriate?

Question 9: Please provide your opinion on the application of the Authority's decision on the provision of Broadband Wireless Internet Access Services by Internet Service Providers (ISPs) as spelt out at ANNEX A in the present context? If you do not agree, please elaborate?

ANNEX B: DECISIONS ON PROVISION OF BROADBAND WIRELESS INTERNET ACCESS SERVICES BY INTERNET SERVICE PROVIDERS (ISPS)

The Information and Communication Technologies Authority,

considering,

a. that the licensing regime as laid down in the Information and Communication Technologies (Amendment of Schedule) Regulations 2003 is technologically neutral and service based;

b. that the Information and Communication Technologies (Amendment of Schedule) Regulations 2003 provides for the Public Land Mobile Network (PLMN) Licence to establish and operate a Public Land Mobile Network (PLMN) and service to the public;

c. that the PLMN licence defines PLMN as:-

"a Public Telecommunication Network used for the provision of a Public Land Mobile (PLM) Service:

(i) in which the service can be used by a person while moving continuously between places; and
(ii) in which the Terminal Equipment used for the service is not in physical contact with any part of the Telecommunication Network through which the service is supplied;"

d. that the PLMN licence defines PLMN service as :-

"a Public telecommunication service provided by means of a PLMN, which includes voice, data, text, video and multi-media"

e. that the Information and Communication Technologies (Amendment of Schedule) Regulations 2003 provides for the Internet Services Licence to *"provide Internet services to the public".* Where *"The service providers may either use the public telecommunication network or set up their own last mile from their point of presence to the subscriber using any appropriate technology after taking the necessary spectrum licence where applicable"*;

f. that one of its functions under the ICT Act 2001 is to *"promote and maintain effective competition, fair and efficient market conduct between entities engaged in the information and communication industry in Mauritius and to ensure that this Act is implemented with due regard to the public interest and so as to prevent any unfair or anti-competitive practices by licensees";*

g. that according to the International Telecommunication Union, Broadband Wireless Access (BWA) may be of the following types:-
   i. Fixed Wireless Access (FWA);
   ii. Mobile Wireless Access (MWA), and,
   iii. Nomadic Wireless Access (NWA) (semi-fixed[1]);

[1] ITU-R Rec. M.1457.1

h. that ITU-T Rec. Q.1702 (02) defines *"Seamless Service"* as a service that *"will prevent users experiencing any service disruptions while maintaining mobility or portability"*;

i. that ITU-T Rec. Q.1761 defines *"mobility"* as the *"Ability to provide services irrespective of changes that may occur by user/terminal's activities. The user is able to change his network access point, as he moves, without interrupting his current service session, i.e., handovers are possible. In some situations, the handover may lead to a briefly suspended service session or it may require a change in the level of service provided as a consequence of the capabilities of the new access point to which the user has become connected through the handover process"*;

j. that seamless mobility may be defined as *"The ability for a user or machine to access services, while freely moving within and between network types, regardless of client type, domain or service provider without having to re-authenticate or re-logon while maintaining functionality of any application[2]"*;

k. that the licensing requirements for a PLMN licensee is different from those of an Internet Service Licensee, especially with regard to the scope of their respective licences and to the respective prescribed licence fees (Rs 8,000,000 per annum for the PLMN licence against Rs 50,000 per annum for the ISP licence);

DECIDES

1. that notwithstanding the fact that ISPs are authorised to set-up their own last mile, they should not be allowed to compete directly or indirectly with PLMN operators in as much as mobility is concerned;

2. that Internet Service Providers (ISP) shall **only** be allowed to offer FWA and NWA (semi-fixed) services;

3. that MWA services shall **only** be offered to the public by duly licensed PLMN operators;

4. that in the provision of NWA services, ISPs shall ensure:-

   (i) that the systems are **not capable of providing handover**;

   (ii) that their subscribers are able to access the Internet Services either when stationary or while moving between places **within** a hotspot coverage area at **pedestrian speed**;

   (iii) that when their subscribers move from one hotspot coverage area to another, their Internet session is **not seamlessly sustained**;

   (iv) that the service they offer may at **no times** be construed as being a mobile service offering **seamless mobility features** (e.g. handover, operation at vehicular speeds, roaming, etc…).

[2] http://www.itu.int/ITU-D/imt-2000/documents/Nairobi2005/Abstracts/Day%202/NairobiAbstract_2_1_1.pdf.