INFORMATION AND COMMUNICATION TECHNOLOGIES AUTHORITY (ICTA)

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Consultation Document: Ref. 2005/2

Consultation Paper on Spectrum Allocation for Broadband Fixed Wireless Access Services in Mauritius

14 February 2005

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) According to the National Telecommunication Policy 2004 (NTP-2004), the *"Government recognises emerging interactive broadband products as being a key component of telecommunications business in the promotion of a wide range of high speed and broadband access options"*. The NTP-2004 also adds that *"The regulator will tailor proper regulatory framework to facilitate the establishment of alternative infrastructure in the access network*";
4) The ICT Authority has received several expressions of interest and requests for type approval for equipment working in different frequency bands to be used in Fixed Wireless Access (BFWA) systems. Such frequency bands include the 450 MHz, 3.5 GHz, 40 GHz and 2.5 GHz ;
5) Internet Service Providers (ISPs) may, under their licence, set up the last mile to their subscribers and wireless access network is becoming more and more popular;
6) Around the world, different organisations including regulators have recently released consultation documents, decisions and resolutions with regard to the use of spectrum for WLL. Indeed, WRC-03 adopted ITU-R Resolution 229 on *"Use of the bands 5 150-5 250, 5 250-5 350 MHz and 5 470-5 725 MHz by the mobile service for the implementation of Wireless Access Systems including Radio Local Area Networks",* also the Electronic Communications Committee (ECC) has

released a decision on 9 July 2004 on *"the harmonised use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)"*, finally the *Autorité de Régulation des Télécommunications (ART)* has released a consultation document in June 2004 on BFWA in the 3.4 – 3.8 GHz band.

The Information and Communication Technologies Authority resolves to:

1) make available for public consultation the Consultation Document Ref 2005/2;

2) invite views, contributions, and comments on the Consultation Document, which shall be sent to the **Executive Director, ICT Authority, Jade House, Remy Ollier street, Port Louis**, or by email to icta@intnet.mu, at latest by 14th March 2005.

Dr. M. K. Oolun
Executive Director, ICT Authority

1.0 Introduction

The term 'local loop' or 'last mile' has traditionally been used in telecommunications in reference to the final connection between a customer and the lowest order telecommunication network node of the service provider (e.g. the copper cable from the customers premises back to the local telephone exchange).

In the recent years, with advancement in technology, the copper cables in the local loop are being replaced by wireless access systems which have the advantage of rapid and low cost deployment. The said wireless access systems are commonly referred to as Broadband Fixed Wireless Access (BFWA). In fact, these systems provide an opportunity to increase competition in the telecommunication market and provide more choice and innovation to consumers[1].

BFWA is generally accepted as being a means of introducing competition in the local loop and as an alternative to Local Loop Unbundling (LLU). Indeed, BFWA may be used as a substitute to the copper cable for the provision of telephony services and also as a means to provide direct access to broadband data networks such as the Internet.

It is to be noted that in Mauritius, several frequency bands are already being used for the provision of BFWA, these include the 800 MHz band, which is currently in use by the incumbent operator for the provision of telephony services, the 2.4 GHz band which is mainly used by corporates in Radio Local Area Networks (RLANs) and the 2.5 GHz band which is used for point-to-multipoint services. The Authority is of the view that, as a strategic measure, more bands have to be allocated for the provision of broadband services in the local loop in line with recommendations from the International Telecommunication Union and also in consonance with the global trend.

The ICT Authority would wish to attain the following objectives through the present consultation:-

1) Earmark new frequency bands for the provision of BFWA services;

[1] Office of the Director of Telecommunication Regulation, *Expanding Opportunities in the Radiocommunications market: Fixed Wireless Access (BFWA),* ODTR 02/19, Dublin, 2002

2) Establish the necessary technical and regulatory requirements regarding the use of earmarked bands;
3) Review where appropriate the technical and regulatory requirements of certain specific bands, such as the 450 MHz, 2.4 GHz and 2.5 GHz bands for the benefit of frequency users.

2.0 Frequency Bands of Interest

The following bands are under consideration in this consultation document to be earmarked for the deployment of BFWA. It is to be noted though that the ICT Authority reserves the right not to allocate any of the bands listed below for deployment of BFWA systems.

a. 450 MHz;
b. 2.400 – 2.4835 GHz;
c. 2.500 – 2.690GHz;
d. 3.400 – 3.800 GHz;
e. 5.150 – 5.250 GHz;
f. 5.250 – 5.350 GHz;
g. 5.474 – 5.725 GHz;
h. 5.725 – 5.850 GHz
i. 23 - 32 GHz;
j. 40.5 – 43.5 GHz.

In this consultation document, the ICT Authority has taken into consideration the imminent demand for WIMAX deployment in the country. The term "WiMAX" describes a set of standards being developed to deliver broadband, wide area wireless communication over a wide range of frequencies between 1 and 60 GHz. The standards are being developed within the US IEEE standards body, under the IEEE 802.16 banner.

The WiMAX Forum is currently focussing on the 2.5 GHz, 3.5 GHz and 5.8 GHz bands, using both TDD and FDD technology. It is worth noting that WIMAX applications are not restricted to access. WIMAX can also be used for backhauling purposes.

2.1 The 450 MHz band

The 440 – 470 MHz band is allocated in Mauritius for the mobile service, especially Private Mobile Radio (PMR) and also for fixed point-to-point service.

In many countries worldwide the 450 MHz band has been used for Fixed Wireless Access systems using the CDMA 2000 technology including CDMA 3G-1X and CDMA EV-DO[2]. Data rates may reach up to 153 kbps per user with the CDMA 3G-1X and up to 2.4 Mbps per user with the CDMA EV-DO[2].

Table 1 below gives the bands which are used in different countries for BFWA in the 450 MHz band:-

Band Sub-Class	**Mobile Station Frequency**	**Base Station Frequency**
A	452.5-457.475	462.5-467.475
B	452-456.475	462-466.475
C	450-454.8	460-464.8
D	411.675-415.850	421.675-425.850
E	415.5-419.975	425.5-429.975
F	479-483.48	489-493.48
G	455.23-455.99	465.23-469.99
H	451.31-455.73	461.31-465.73

Table 1: Bands used in different countries for BFWA in the 450 MHz band[2]

Band Sub-Class A is the most popular band and is used in countries such as Bulgaria, Denmark, Portugal, Spain, Sweden and Tunisia.

[2] Lucent Technologies, Lucent Technologies submission on Wireless Broadband Communications in Australia

While considering that the 450 MHz band may, in the future, be used for BFWA, the Authority has to consider the services which are currently in use within the band and also future Private Mobile Radio services which may require spectrum therein. One of such PMR service uses the TETRA standard. TETRA operates in the following bands:-

i) 389 - 400 MHz Harmonised emergency services band;

ii) 410 - 430 MHz Civil TETRA band, not yet fully harmonized;

iii) 450 - 470 MHz Future TETRA band.

Currently, no free spectrum exists for deploying BFWA services in the 450 MHz band. It is worth noting, however, that migration of fixed point-to-point services from the 400 MHz band to higher bands is the worldwide tendency and hence, a migration strategy will have to be envisaged in case the Authority determines that there is high demand for the 400 MHz band for deployment of BFWA services.

Q2.1.1 Please indicate your opinion with regard to the opening of the 450 MHz band to BFWA.

Q2.1.2 Please indicate the type of project you may have in the 450 MHz band.

Q2.1.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.1.4 Do you envisage having an island wide deployment? Else specify the intended regions your project may cover.

Q2.1.5 What is the time frame for implementation of your project?

2.2 The 2.400 – 2.4835 GHz ISM band

The 2.400 – 2.4835 GHz band is used in Mauritius for RLAN indoor point-to-multipoint, outdoor point-to-multipoint and outdoor point-to-point applications. The band is shared among users without formal frequency assignment; this is known as the "public park" concept[3]. Users within the band cannot claim protection against harmful interference and should not cause harmful interference on other services.

As stated above, the 2.400 – 2.4835 GHz band is used in outdoor applications as point-to-point links as an alternative to microwave links and leased lines. A recent survey carried out by the Authority has revealed that the most popular application made of RLAN equipment, in Mauritius, is with directional antennas. The same survey has also revealed that the effective isotropic radiated power (eirp) of such systems exceeds 20 dBm in most cases, reaching up to 39 dBm. Also, the range or hop length, in most cases, exceeds 1km reaching distances of up to 15km.

It is to be noted that all RLAN equipment working in the 2.400 – 2.4835 GHz band have been type approved in compliance with the IEEE 802.11b standard. The now repealed First Schedule to the ICT Act 2001 as amended, specified the Radio Local Area Network Licence (2.4 – 2.5 GHz) (OR4). Under this licence, a limit of 20 dBm erp (22.15 dBm eirp) was imposed on all RLAN installations. *The Information and Communication Technologies (Amendment of Schedule) Regulations 2003*, which replaces the First Schedule to the ICT Act 2001, defines the RA19 licence as *"Extended Radio-based Private Network device (ELAN/ WLAN beyond 1 km range and/or EIRP > 20 dBm)*.

Originally, IEEE 802.11 devices were developed to provide wireless local area networks with small cell deployments of around say, 300 to 500 metres range. The main applications of these devices were intended to be within commercial office blocks, airports or cafés. In fact, IEEE 802.11b standard sets the maximum equivalent isotropic radiated power (eirp) to 100mW or 20dBm and given this specification, only minimum interference among users may be expected. CEPT decision ERC/DEC/(01)07 also limits the eirp for RLAN applications to 100mW. In its guidelines entitled *"Changes in the Wireless LAN licensing system from 25 July 2003"*, published in July 2003, the Autorité de Régulations des Télécommunications (ART) states that *"Operators must respect the specified maximum radiated power* (as specified in ERC/DEC/(01)07) *especially when establishing point-to-point links"*

It is true that the data throughput and communication range of 802.11 devices declines as the number of other systems generating unwanted signals grows in any local area[3]. This

[3] ACA, RLAN Interference Management, 2002

becomes apparent at lower levels of usage when 802.11 devices are being used to provide **wider** area networks[3]. That is, interference is a function of the density of users and has the effect of reducing the data rate or the range of operation[3].

Spectrum surveys carried out by the Authority in the Port-Louis area have revealed a particularly high noise floor (-60 dB) and it is expected that IEEE 802.11b devices or other spread spectrum devices, which work on the "public park" concept, will suffer from severe interference if this situation continues to prevail.

It would be wise to take into consideration the conclusions of the Electronic Communications Committee (ECC) Report 57 entitled *"(O)RLANS in the Frequency band 2400 – 2483.5 MHz"* and published in September 2004. According to the ECC Report 57, *"the consequences of transmitting with higher power levels, 100mW output power in connection with a directive antenna, will lead to an increase of the noise level in this frequency band. The quality of the services in this band will be reduced. To counteract this effect the users of impacted systems are tempted to increase their own transmitting power and this again, will lead to more noise". Also,* according to the ECC Report 57, *"users will turn away from new products and services if new facilities being rolled-out fail to operate due to misuse and pollution of the spectrum";*

With a view to remedy to the situation, the Authority is therefore proposing to set a limit to the eirp and range/hop length for RLAN devices working in the 2.400 – 2.4835 GHz band.

2.2.1 Proposal of the Authority

The Authority therefore proposes to limit the maximum eirp of outdoor IEEE 802.11b/g devices, both point-to-multipoint and point-to-point, to **23 dBm** and to limit their range/hop length to **5 km**. **All outdoor** RLAN devices will have to be declared to the Authority failing which legal actions may be taken against the unauthorised operators. **All** RLAN devices operating at a power greater than 20 dBm eirp and/or range/hop length greater than 1 km will have to be licensed in accordance with the *Information and Communication Technologies (Amendment of Schedule) Regulations 2003*. The

Authority also proposes to limit the maximum eirp for **indoor** IEEE 802.11b/g devices to **20 dBm**.

The Authority believes that such measures will help reduce the noise floor and allow users to make use of the 2.400 – 2.4835 GHz band in the public park concept.

Q2.2.1 Do you agree that it is becoming more and more difficult to use the 2.400 – 2.4835 GHz band for RLAN because of spectrum pollution?

Q2.2.2 Do you agree that to share the 2.400 – 2.4835 GHz band as a public park the eirp and range/hop-length have to be limited? Please substantiate your answer.

Q2.2.3 Do you agree with the proposal of the Authority with regard to the eirp and range/hop-length limits? Please substantiate your answer.

2.3 The 2.500 – 2.690 GHz band

This band is used for multichannel multipoint distribution service (MMDS) Point-to-Multipoint (P-MP) transmission and may be used for entertainment, business, social or community purposes.

The current MMDS plan used in Mauritius has 8MHz wide channels as shown in table 1. The plan is used both for analogue television services and for private data networks. In the latter case, the MMDS plan is used in conjunction with the Multichannel Distribution Service (MDS) band, which ranges from 2150 MHz to 2162 MHz. This band is used for upstream traffic and is found within the band which has been earmarked for implementation of IMT-2000 in Mauritius.

WRC 2000 has reserved the bands 2500 – 2690 MHz for IMT-2000 and Resolution 225 of WRC-03, invites administrations wishing to implement the satellite component of IMT-2000 to make available, the bands 2500 – 2520 MHz and 2670 – 2690 MHz. The same resolution notes that depending on market development, the same bands may be used in the longer term for the terrestrial component of IMT-2000.

The Authority believes that there is an urgent need to revise the current plan so as to make more efficient use of the spectrum. Also, usage of the MDS band is to cease and made available for IMT-2000 deployment.

channel no.	Low frequency (MHz)	Centre frequency (MHz)	High frequency (MHz)
1	2500.0000	2504.0000	2508.0000
2	2508.0000	2512.0000	2516.0000
3	2516.0000	2520.0000	2524.0000
4	2524.0000	2528.0000	2532.0000
5	2532.0000	2536.0000	2540.0000
6	2540.0000	2544.0000	2548.0000
7	2548.0000	2552.0000	2556.0000
8	2556.0000	2560.0000	2564.0000
9	2564.0000	2568.0000	2572.0000
10	2572.0000	2576.0000	2580.0000
11	2580.0000	2584.0000	2588.0000
12	2588.0000	2592.0000	2596.0000
13	2596.0000	2600.0000	2604.0000
14	2604.0000	2608.0000	2612.0000
15	2612.0000	2616.0000	2620.0000
16	2620.0000	2624.0000	2628.0000
17	2628.0000	2632.0000	2636.0000
18	2636.0000	2640.0000	2644.0000
19	2644.0000	2648.0000	2652.0000
20	2652.0000	2656.0000	2660.0000
21	2660.0000	2664.0000	2668.0000
22	2668.0000	2672.0000	2676.0000
23	2676.0000	2680.0000	2684.0000

Table 1: Current 8 MHz bandwidth MMDS plan

2.3.1 Proposal of the Authority

The Authority proposes two options for the frequency plan to be adopted for MMDS. Option one is based on 6 MHz channel in compliance with ITU-R Rec. F.755-2. This channelisation plan can be used for full-duplex systems. This plan consists of 31 downstream channels allowing a data rate of 30 Mbps per channel and 48 upstream channels allowing a data rate of 200 kbps per channel. Option one proposes that a hybrid analogue/digital channel be adopted pending the migration of Analogue TV Broadcasting to digital.

Option two is also a hybrid plan; however the spectrum for digital MMDS is divided into Frequency Division Duplex (FDD) and Time Division Duplex (TDD).

The Authority also seeks the views of stakeholders with regard to whether the bands 2500 – 2690 MHz have to be reserved for IMT-2000 applications.

Option one:-

channel no.	Low frequency (MHz)	Centre frequency (MHz)	High frequency (MHz)
1	2500.0000	2504.0000	2508.0000
2	2508.0000	2512.0000	2516.0000
3	2516.0000	2520.0000	2524.0000
4	2524.0000	2528.0000	2532.0000
5	2532.0000	2536.0000	2540.0000
6	2540.0000	2544.0000	2548.0000
7	2548.0000	2552.0000	2556.0000

Table 2: Option 1 Analogue MMDS Plan (Analogue TV Broadcasting)

m=1

Channel	Centre f	f'
1	2503.0000	2686.0625
2	2515.0000	2687.0625
3	2527.0000	2688.0625
4	2539.0000	2689.0625

m=2

Channel	Centre f	f'
1	2509.0000	2686.1875
2	2521.0000	2687.1875
3	2533.0000	2688.1875
4	2545.0000	2689.1875

m=3

Channel	Centre f	f'
1	2551.0000	2686.3125
2	2563.0000	2687.3125
3	2575.0000	2688.3125
4	2587.0000	2689.3125

m=4

Channel	Centre f	f'
1	2557.0000	2686.4375
2	2569.0000	2687.4375
3	2581.0000	2688.4375
4	2593.0000	2689.4375

m=5

Channel	Centre f	f'
1	2599.0000	2686.5625
2	2611.0000	2687.5625
3	2623.0000	2688.5625
4	2635.0000	2689.5625

m=6

Channel	Centre f	f'
1	2605.0000	2686.6875
2	2617.0000	2687.6875
3	2629.0000	2688.6875
4	2641.0000	2689.6875

m=7

Channel	Centre f	f'
1	2647.0000	2686.8125
2	2659.0000	2687.8125
3	2671.0000	2688.8125
4	2683.0000	2689.8125

N.B: The shaded channels are within the Analogue TV Broadcasting plan

Key:	f: the transmit frequency	f': the response frequency

Table 3: Option 1 Digital MMDS Plan

Option two:-

channel no.	Low frequency (MHz)	Centre frequency (MHz)	High frequency (MHz)	
1	2500	2503	2506	Analogue TV Broadcasting
2	2506	2509	2512	
3	2512	2515	2518	
4	2518	2521	2524	
5	2524	2527	2530	
6	2530	2533	2536	
7	2536	2539	2542	
8	2542	2545	2548	
9	2548	2551	2554	
10	2554	2557	2560	
*11	2560	2563	2566	FDD paired with ch 23-25
*12	2566	2569	2572	
*13	2572	2575	2578	
#14	2578	2581	2584	FDD paired with ch 26-28
#15	2584	2587	2590	
#16	2590	2593	2596	
17	2596	2599	2602	One way applications or TDD applications
18	2602	2605	2608	
19	2608	2611	2614	
20	2614	2617	2620	
21	2620	2623	2626	
22	2626	2629	2632	
23	2632	2635	2638	
24	2638	2641	2644	
25	2644	2647	2650	
*26	2650	2653	2656	FDD paired with ch 11-13
*27	2656	2659	2662	
*28	2662	2665	2668	
#29	2668	2671	2674	FDD paired with ch 14-16
#30	2674	2677	2680	
#31	2680	2683	2686	

Table 4: Option 2 MMDS digital plan

Q2.3.1 Do you think that there is a need to reserve the 2500 – 2690 MHz for MMDS?

Q2.3.2 Which option do you consider most appropriate for the current applications of the MMDS band?

Q2.3.3 With regard to option 2, please indicate whether, in your opinion, spectrum has to be earmarked for FDD applications.

Q2.3.3 Please indicate the type of project you may have in the band 2500 – 2690 MHz.

Q2.3.4 Do you think that the bands 2500 – 2690 MHz has to be reserved for IMT-2000?

2.4 The 3.400 – 3.700 GHz band

The frequency band 3 400 – 3 600 MHz has been allocated to the fixed service and fixed satellite (space-to-earth) service on a primary basis, and to radiolocation and mobile services on a secondary basis according to the spectrum allocation plan for Mauritius. Also frequency band 3 600 – 3 700 MHz has been allocated to fixed service and fixed satellite (space-to-earth) service on a primary basis, and to mobile service on a secondary basis.

It is to be noted, also, that Very Small Aperture Terminals (VSATs) operate in the 3 600 – 4200 MHz frequency band for Space to Earth communication.

It is believed that this band may be of major importance in the near future as it is being considered for the operation of equipment which complies with the most promising WIMAX (IEEE 802.16) standard.

2.4.1 Technical Consideration for the 3.400 – 3.700 GHz band

(i) ITU-R recommendation SF.1486 considers that there is a need to protect co-primary services within the 3 400 – 3 700 frequency band from interference from each other. Two possible interference scenarios are:

(a) Interference from the BFWA base station and/or remote station into the VSAT receiver

(b) Interference from the FSS transmitter into the receivers of the BFWA base station or remote station

The interference scenario (a) is considered to be more serious and ITU-R SF.1486 recommends a methodology for the protection of VSATs from interference from BFWA systems.

(ii) ITU-R recommendation SF.1486 also recommends that precautions be adopted during the planning and deployment of VSATs and Fixed Wireless Access Systems and proposes interference mitigation techniques for the installation of VSATs and Point-to-Multipoint systems.

(iii) Co-frequency sharing between VSAT and Point-to-multipoint BFWA systems may be difficult for VSATs operating at low elevation angles.

(iv) Since the C-Band starts at 3 600 MHz, only the 3 400 – 3 600 MHz band may be considered for Fixed Wireless applications in order to avoid all risks of interference to VSAT stations.

2.4.2 Frequency allocation plan

The International Telecommunications Union considers that the use of a flexible block arrangement for the implementation of Fixed Wireless Access systems in the 3 400 – 3 800 frequency range, or parts of this band is desirable in order to accommodate various technologies. ITU-R F.1488 recommends that the frequency blocks edge frequencies be exactly divisible by 0.25 MHz and that the frequency blocks be assigned according to the capacity of systems and the technology used. The International Telecommunications Union further recommends that the frequency arrangements within the 3 400 – 3 800 MHz band be based on either on 25 MHz blocks or on blocks formed from the aggregation of 0.25 MHz slots.

***Option 1**: Frequency arrangement based on 25 MHz sub-bands in the 3 400 MHz– 3 600 MHz[3]*

This arrangement consists of 8 adjacent 25 MHz sub-bands in the 3 400 – 3600 range as per figure 2.

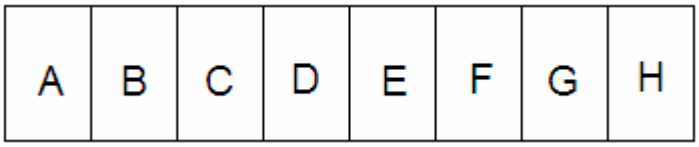


Figure 2 – Frequency arrangement based on 25 MHz blocks.

Any of these blocks may be paired for Frequency Division Duplex operation and any single block may be used for Time Division Duplex operation. Two or more 25 MHz blocks may be aggregated for applications requiring higher bandwidth.

Frequency arrangement based on blocks formed from the aggregation of 0.25 MHz slots [3].

An alternative arrangement proposed by ITU-R F.1488 consists of allocation blocks formed from the aggregation of 0.25 MHz frequency slots. The edge frequencies of each sub-band are as defined below.

***Option 2:** Frequency duplex allocation with a duplex spacing of 100 MHz for the 3 400-3 600 MHz band[3]*

Lower Blocks (MHz)	$0.25\ N + 3400$ to $0.25\ (N + k) + 3400$
Upper Blocks (MHz)	$0.25\ (N + 400) + 3400$ to $0.25\ (N + k + 400) + 3400$
$1 \leq k \leq 400,\ 0 \leq N \leq 399,\ k + N \leq 400$	

Option 3: *Frequency duplex allocation with a duplex spacing of 50 MHz for the 3 400-3 600 MHz band*

3 400 – 3 500 MHz

Lower Blocks	0.25 N + 3400 to 0.25 (N + k) + 3400
Upper Blocks	0.25 (N + 200) + 3400 to 0.25 (N + k + 200) + 3400
$1 \leq k \leq 200$, $0 \leq N \leq 199$, $k + N \leq 200$	

3 500 – 3 600MHz

Lower Blocks	0.25 N + 3400 to 0.25 (N + k) + 3400
Upper Blocks	0.25 (N + 200) + 3400 to 0.25 (N + k + 200) + 3400
$1 \leq k \leq 200$, $0 \leq N \leq 199$, $k + N \leq 200$	

Where k defines the width of each block and N defines the lower edge of each block.

2.4.3 Proposal of the Authority

The Authority proposes to open the 3.4 to 3.6 GHz band and to apply an individual licensing regime. The Network Spectrum Licensing as defined in the Licensing Regulation shall apply.

It is proposed that licensees be assigned frequencies using channel plan proposed in **option 2**.

Q2.4.1 Please indicate your opinion with regard to the opening of the 3.4 – 3.6 GHz band to BFWA and also with regard to the technical and regulatory proposals of the Authority.

Q2.4.2 Please indicate the type of project you may have in the band 3.4 – 3.6 GHz.

Q2.4.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.4.4 Do you envisage having an island wide deployment? Else specify the intended regions your project may cover.

Q2.4.5 What is the time frame for implementation of your project?

2.5 The 5.150 – 5.250 GHz, 5.250 – 5.350 GHz, 5.470 – 5.725 GHz bands

The World Radiocommunication Conference 2003 (WRC-03) by **Resolution 229** decided to make allocations in the 5150 – 5250 MHz, 5250 – 5350 MHz and 5470 – 5725 MHz frequency ranges to support wireless access systems (WAS) in the mobile service including radio local area networks (RLANs).

Wireless Access Systems (WAS) are broadband radio systems which can be deployed either inside or outside buildings, usually in geographically limited areas[4]. Broadband RLANs (Radio Local Area Networks), a subset of WAS, are the major type equipment deployed today and are predominantly used inside buildings[4]. Typical WAS/RLANs include public and private applications offered in homes, schools, hospitals, hotels, conference centres, railway stations, airports, shopping centres etc.

2.5.1 Technical Characteristics for the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands

According to ECC Decision of 09 July 2004 on the harmonised use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs), (ECC/DEC/(04)08), the following technical characteristics are applicable:-

[4] ECC/DEC/(04)08

- **5 150-5 350 MHz**

  Only indoor use, mean e.i.r.p.[5] limited to 200 mW, and use of dynamic frequency selection (DFS) as well as transmitter power control (TPC) are required above 5 250 MHz;

- **5 470-5 725 MHz**

  Indoor as well as outdoor use allowed, mean e.i.r.p.[1] limited to 1 W, use of dynamic frequency selection (DFS) and transmitter power control (TPC) required.

Resolution 229 of WRC-03, has specified that the above bands should be used exclusively for Mobile Services, hence, point-to-point applications will not be permitted in these bands.

2.5.2 Regulatory requirements for the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands

Many countries around the world, including UK, have declared the bands of interest as licence exempt. It is proposed that the bands be exempted from licence requirements in Mauritius as well.

Q2.5.1 Please indicate your opinion with regard to the opening of the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands for Wireless Access Systems.

Q2.5.2 Please indicate the type of project you may have in the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands.

Q2.5.3 Do you think that the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands should be exempted from licence conditions?

2.6 The 5.725 – 5.850 GHz band

The 5.725 – 5.830 GHz frequency band has been allocated in RR Region 1 to FIXED-SATELLITE (Earth-to-space) and RADIOLOCATION on a primary basis and to Amateur service on a secondary basis. The 5.830 – 5.850 frequency band has been allocated in RR Region 1 to FIXED-SATELLITE (Earth-to-space), RADIOLOCATION

[5] The "mean e.i.r.p." refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented.

on a primary basis and Amateur and Amateur-satellite (space-to-Earth) on a secondary basis. Also it is to be noted that the band has been defined as Industrial Scientific and Medical (ISM) band under provision No. 5.150 of the Radio Regulations.

2.6.1 Proposal of the Authority

It is proposed that the 5.725 – 5.850 GHz be open for both point-to-point and point-to-multipoint applications. The band will be assigned on a shared, non-interference and non-protected basis with a **maximum eirp of 2W** and Power Spectral Density not exceeding 100mW/MHz.

The proposed channelisation plan for the band is as shown in table 5.

Carrier centre frequency f_c (MHz)		
5 MHz channelisation	10 MHz channelisation	20 MHz channelisation
5727.5, 5732.5, 5737.5, 5742.5, 5747.5, 5752.5, 5757.5, 5762.5, 5767.5, 5772.5, 5777.5, 5782.5, 5787.5, 5792.5, 5817.5, 5822.5, 5827.5, 5832.5, 5837.5, 5842.5, 5847.5	5730, 5740, 5750, 5760, 5770, 5780, 5820, 5830, 5840	5735, 5755, 5775, 5835,

Table 5: Proposed Channelisation plan for 5.725 – 5.850 GHz

The Authority proposes to apply an apparatus licensing regime for devices operating in the 5.725 – 5.850 GHz band. It is also expected that this band will be used for the operation of IEEE 802.16 (WIMAX) devices.

It is important to note that the 5.725 – 5.850 GHz band is also allocated to Non-Specific Short Range Devices according to CEPT/ERC/REC 70-03 and that the power limit for this category of devices is **25 mW eirp**.

Q2.6.1 Please indicate your opinion with regard to the opening of the 5.725 – 5.850 GHz band for Wireless Access Systems.

Q2.6.2 Please indicate the type of project you may have in the 5.725 – 5.850 GHz band.

Q2.6.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.6.4 Do you think that an apparatus licensing regime is appropriate for apparatus 5.725 – 5.850 GHz band?

2.7 The 24.5 – 26.5 GHz and 27.5 – 29.5 GHz bands

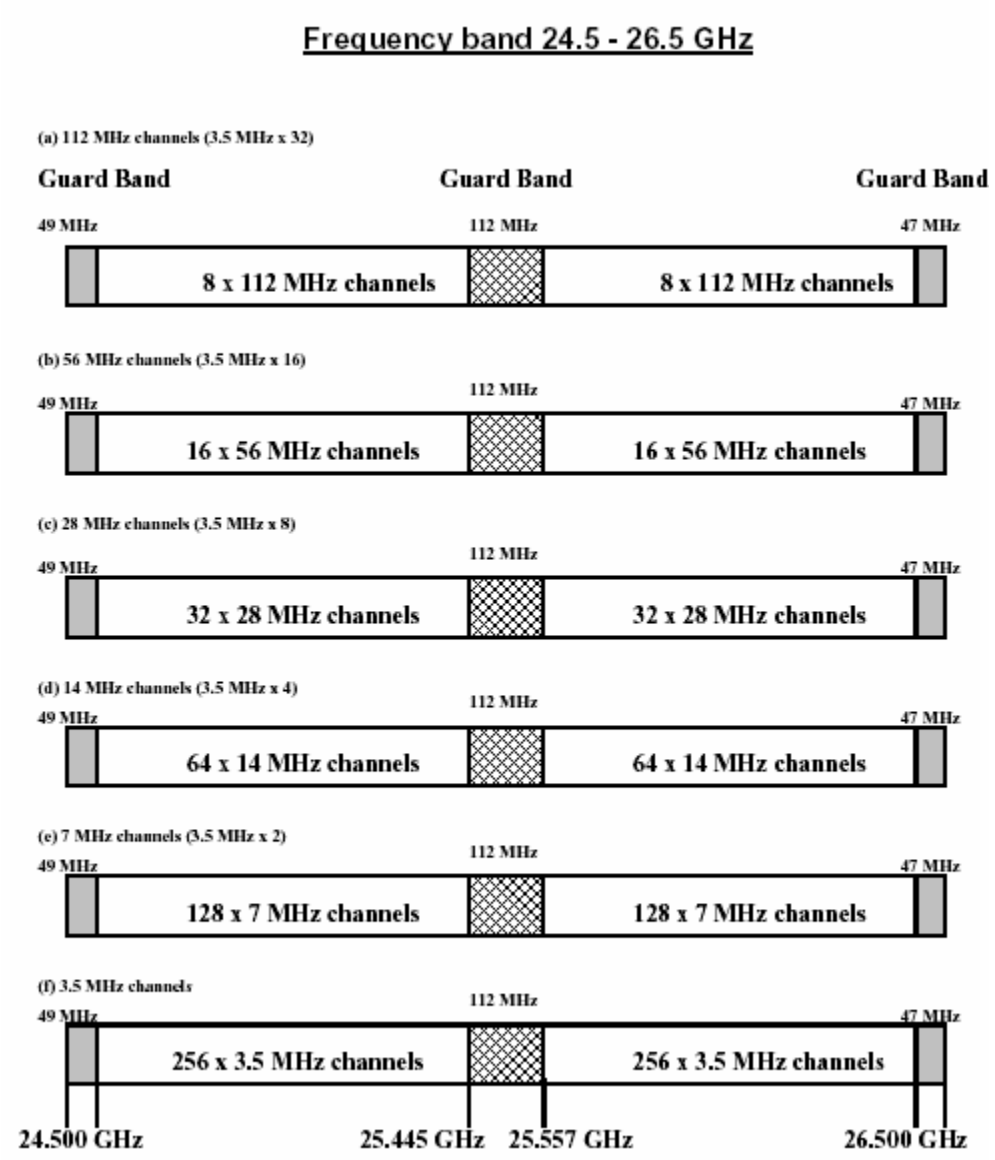
LMDS, also referred as the local multipoint communications system (LMCS), is a broadband, fixed-wireless access system, which allows for two-way digital communications for voice, broadcast video, VoD, and high-speed data communication, without the need for terrestrial wired networks to communicate back to the central office[6]. LMDS uses licensed frequencies in the range of 24.5 – 26.5 GHz and 27.5 – 29.5 GHz bands.

In this band, high density P-MP systems operate between terrestrial stations as fixed wireless systems for the delivery of voice, video, and data services. These applications typically provide a communications path for commercial and residential communications for the last few kilometres of a distribution network as an alternative to coax, fibre, or twisted pair solutions.

The licensing regime applicable for this band is a Network Spectrum Licence as specified in the *Information and Communication Technologies (Amendment of Schedule) Regulation 2003*

The proposed band plan (ITU-R Rec. F.748) for the 24.5 – 26.5 GHz band is as follows:-

6 Theodore B. Zahariadis, "Wireless Home Access Network Alternatives," in *Home Networking Technologies and Standards*, Artech House, 2003



Let

fo be the centre frequency of 25501.0 MHz

fn be the centre frequency of the radio-frequency channel in the lower half of the band

fn' be the centre frequency of the radio-frequency channel in the upper half of the band

TX/RX separation = 1008 MHz

Centre gap = 112 MHz

then the frequencies of individual channels are expressed by the following relationships:

a) for systems with a carrier spacing of 112 MHz

lower half of the band: fn = fo - 1008 + 112n

upper half of the band: fn’ = fo - + 112n where n = 1, ... 8

b) for systems with a carrier spacing of 56 MHz

lower half of the band: fn = fo - 980 + 56n

upper half of the band: fn’ = fo + 28 + 56n where n = 1, ... 16

c) for systems with a carrier spacing of 28 MHz

lower half of the band: fn = fo - 966 + 28n

upper half of the band: fn’ = fo + 42 + 28n where n = 1, ... 32

d) for systems with a carrier spacing of 14 MHz

lower half of the band: fn = fo - 959 + 14n

upper half of the band: fn’ = fo + 49 + 14n where n = 1 , ... 64

e) for systems with a carrier spacing of 7 MHz

lower half of the band: fn = fo - 955.5 + 7n

upper half of the band: fn’ = fo + 52.5 + 7n where n = 1 , ... 128

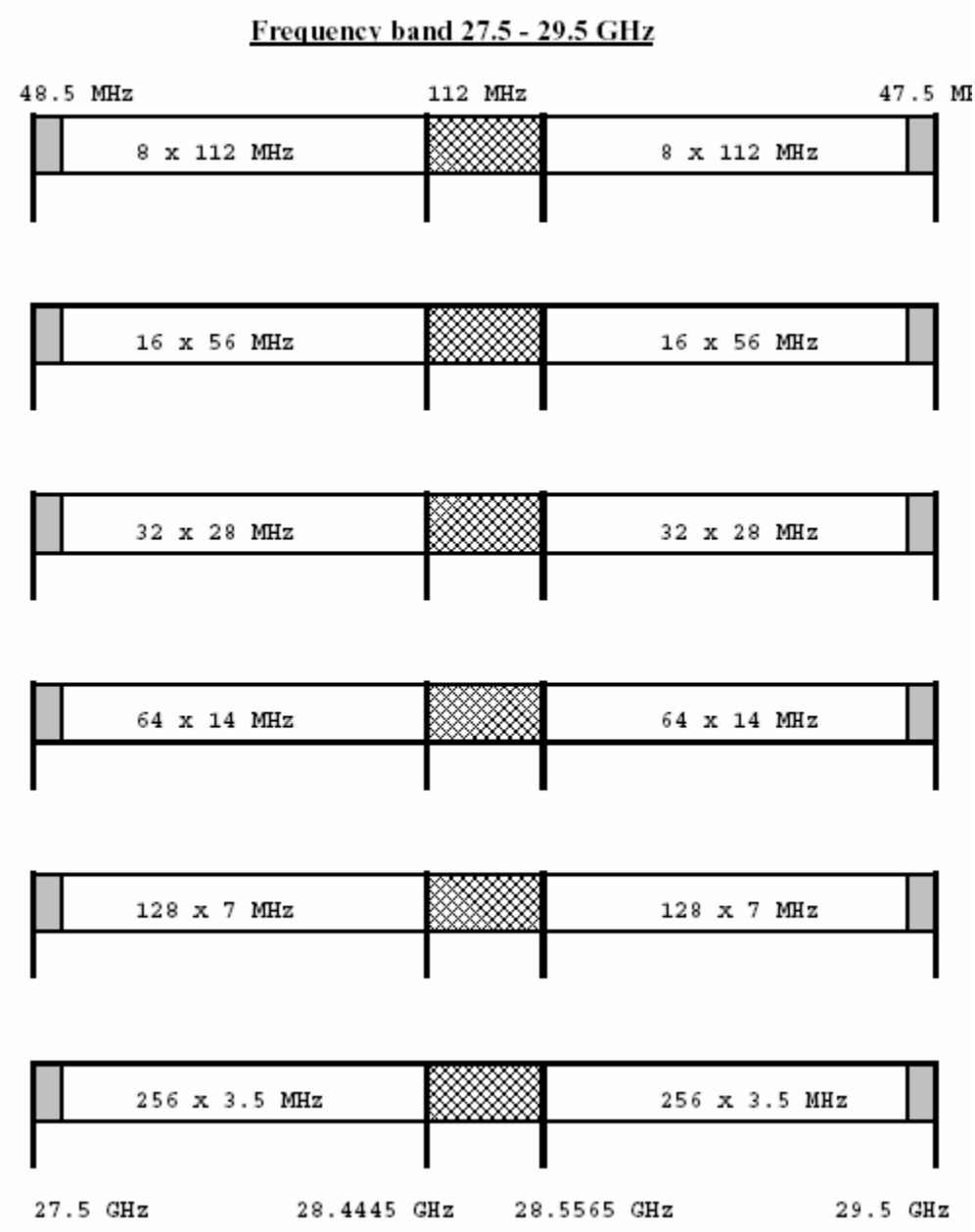
f) for systems with a carrier spacing of 3.5 MHz

lower half of the band: fn = fo - 953.75 + 3.5n

upper half of the band: fn’ = fo + 54.25 + 3.5n where n = 1 , ... 256

The arrangement f) above uses frequencies spaced by 3.5 MHz but interleaved between the homogenous pattern with an offset of 1.75 MHz.

The proposed band plan (ITU-R Rec. F.748) for the 27.5 – 29.5 GHz band is as follows:-



Let

fo be the centre frequency of 28500.5 MHz

fn be the centre frequency of the radio-frequency channel in the lower half of the band

fn' be the centre frequency of the radio-frequency channel in the upper half of the band

TX/RX separation = 1008 MHz

Centre cap = 112 MHz

then the frequencies of individual channels are expressed by the following relationships :

a) for systems with a carrier spacing of 112 MHz

lower half of the band: fn = fo - 1008 + 112n

upper half of the band: fn' = fo + 112n where n = 1, ... 8

b) for systems with a carrier spacing of 56 MHz

lower half of the band: fn = fo - 980 + 56n

upper half of the band: fn' = fo + 28 + 56n where n = 1 , ... 16

c) for systems with a carrier spacing of 28 MHz

lower half of the band: fn = fo - 966 + 28n

upper half of the band: fn' = fo + 42 + 28n where n = 1 , ... 32

d) for systems with a carrier spacing of 14 MHz

lower half of the band: fn = fo - 959 + 14n

upper half of the band: fn' = fo + 49 + 14n where n = 1 , ... 64

e) for systems with a carrier spacing of 7 MHz

lower half of the band: fn = fo - 955.5 + 7n

upper half of the band: fn' = fo + 52.5 + 7n where n = 1 , ... 128

f) for systems with a carrier spacing of 3.5 MHz

lower half of the band: fn = fo - 953.75 + 3.5n

upper half of the band: fn' = fo + 54.25 + 3.5n where n = 1 , ... 256

The arrangement f) above uses frequencies spaced by 3.5 MHz but interleaved between the homogenous pattern with an offset of 1.75 MHz.

Q2.7.1 Please indicate your opinion with regard to the opening of the 24.5 – 26.5 GHz and 27.5 – 29.5 GHz bands for Wireless Access Systems.

Q2.7.2 Please indicate the type of project you may have in the 24.5 – 26.5 GHz and 27.5 – 29.5 GHz bands.

Q2.7.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

2.8 The 40.5 – 43.5 GHz band

The frequency band 40.5 – 42.5 has been allocated by the ITU, in Region 1, on a co-primary basis to fixed, fixed-satellite (Space-to-Earth), broadcasting and broadcasting-

satellite services and on a secondary basis to the mobile services. Also, the frequency band 42.5 – 43.5 has been allocated by the ITU, in Region 1, on a co-primary basis to fixed, fixed-satellite, Mobile and radio astronomy services.

As at date, there are currently no frequency allocations in the 40.5 – 43.5 GHz frequency band in Mauritius, however, it has been designated for Multimedia Wireless Systems including Multipoint Video Distribution Systems (MVDS) in Europe within the European Conference of Postal and Telecommunications (CEPT) Administrations (ERC/DEC/(99)15). These systems operate in the Point-to-multipoint mode. The ERC/DEC/(99)15, defines Multimedia Wireless Systems "*as terrestrial multipoint*[7] *systems which have their origin in telecommunication and/or broadcasting, including MVDS, and which provide fixed wireless access direct to the end user for multimedia services. These MWS systems may offer different degrees of interactivity"*. MWS can offer a variety of user bit rates including those from Primary Rate (144 kbit/s) up to as high as 25 Mbit/s.

The CEPT has released a recommendation (ECC RECOMMENDATION (01)04) entitled "RECOMMENDED GUIDELINES FOR THE ACCOMMODATION AND ASSIGNMENT OF MULTIMEDIA WIRELESS SYSTEMS (MWS) IN THE FREQUENCY BAND 40.5 – 43.5 GHz", same may be adopted for Mauritius if the band 42.5 – 43.5 GHz is allocated to MWS systems.

Q2.8.1 Please indicate your opinion with regard to the opening of the 40.5 – 43.5 GHz band for Multimedia Wireless Systems (MWS).

Q2.8.2 Do you consider that there is a demand for MWS in Mauritius?

Q2.8.3 Please indicate the type of project you may have in the 40.5 – 43.5 GHz band.

Q2.8.4 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

[7] See ITU document 9/79, 15 October 98

3.0 Summary of Consultation questions

Q2.1.1 Please indicate your opinion with regard to the opening of the 450 MHz band to BFWA.

Q2.1.2 Please indicate the type of project you may have in the band 450 MHz band.

Q2.1.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.1.4 Do you envisage having an island wide deployment? Else specify the intended regions your project may cover.

Q2.1.5 What is the time frame for implementation of your project?

Q2.2.1 Do you agree that it is becoming more and more difficult to use the 2.400 – 2.4835 GHz band for RLAN because of spectrum pollution? Please substantiate your answer.

Q2.2.2 Do you agree that to share the 2.400 – 2.4835 GHz band as a public park the eirp and range/hop-length have to be limited? Please substantiate your answer.

Q2.2.3 Do you agree with the proposal of the Authority with regard to the eirp and range/hop-length limits?

Q2.3.1 Do you think that there is still a need to reserve the 2500 – 2690 MHz for MMDS?

Q2.3.2 Which option do you consider most appropriate for the current applications of the MMDS band?

Q2.3.3 Please indicate the type of project you may have in the band 2500 – 2690 MHz.

Q2.3.4 Do you think that the bands 2500 – 2690 MHz has to be reserved for IMT-2000?

Q2.4.1 Please indicate your opinion with regard to the opening of the 3.4 – 3.6 GHz band to BFWA and also with regard to the technical and regulatory proposals of the Authority.

Q2.4.2 Please indicate the type of project you may have in the band 3.4 – 3.6 GHz.

Q2.4.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.4.4 Do you envisage having an island wide deployment? Else specify the intended regions your project may cover.

Q2.4.5 What is the time frame for implementation of your project?

Q2.5.1 Please indicate your opinion with regard to the opening of the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands for Wireless Access Systems.

Q2.5.2 Please indicate the type of project you may have in the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands.

Q2.5.3 Do you think that the 5.150 – 5.350 GHz and 5.470 – 5.725 GHz bands should be exempted from licence conditions?

Q2.6.1 Please indicate your opinion with regard to the opening of the 5.725 – 5.850 GHz band for Wireless Access Systems.

Q2.6.2 Please indicate the type of project you may have in the 5.725 – 5.850 GHz band.

Q2.6.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.6.4 Do you think that an apparatus licensing regime is appropriate for apparatus 5.725 – 5.850 GHz band?

Q2.7.1 Please indicate your opinion with regard to the opening of the 24.5 – 26.5 GHz and 27.5 – 29.5 GHz bands for Wireless Access Systems.

Q2.7.2 Please indicate the type of project you may have in the 24.5 – 26.5 GHz and 27.5 – 29.5 GHz bands.

Q2.7.3 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)

Q2.8.1 Please indicate your opinion with regard to the opening of the 40.5 – 43.5 GHz band for Multimedia Wireless Systems (MWS).

Q2.8.2 Do you consider that there is a demand for MWS in Mauritius?

Q2.8.3 Please indicate the type of project you may have in the 40.5 – 43.5 GHz band.

Q2.8.4 Please indicate proposed network topology (point-to-multipoint, mesh, etc…)