



Government of  
The Republic  
of Vanuatu



Telecommunication &  
Radiocommunication  
Regulator

PO Box 3547  
Port Vila  
Vanuatu  
Tel: +678 27621

# A Consultation Paper on **Radio Spectrum Fees in Vanuatu**

INVITING PUBLIC COMMENT AND INPUT

8<sup>th</sup> February 2016

# Radio Frequency Spectrum Fees in Vanuatu

## Executive summary

In this paper the Telecommunications and Radiocommunications Regulator of Vanuatu (TRR) is seeking comment on its proposals to introduce a Spectrum Fee Schedule which would result in spectrum fees being levied on identified spectrum bands that are in high demand.

This public consultation addresses the methodology for the setting of radio frequency spectrum licence fees, and proposes a fee formula and schedule of fees to apply to spectrum fees.

Spectrum fees will be aimed at encouraging spectrum to be used efficiently in Vanuatu, where that spectrum is likely to be in high demand. In considering the level of proposed spectrum fees, TRR has gathered relevant information about prices for spectrum use in other countries including those in the region, as well as information from countries that have used spectrum auction and applied fees approaches.

TRR has looked at the range of uses of spectrum in Vanuatu to decide which bands should be subject to the spectrum fees. It has concluded that the spectrum fees should be limited to the following bands:

- Bands used for mobile telecommunications (900 MHz, 1800 MHz)
- Other wireless broadband spectrum (2.3 GHz, 2.5 GHz, 3.5 GHz)
- Broadcasting spectrum used for pay TV (510-550 MHz, 560-608MHz, 610-660 MHz)
- 700 MHz band following allocation (703-748 MHz, 758-803 MHz).

TRR proposes that a formula approach should be used for calculating Spectrum Fees. The basic formula to be used in establishing fees is:

$$\text{Fee} = V \times \text{BW} \times \text{Band} \times \text{SF} \times L \times T$$

(where V is the base value of spectrum, BW is bandwidth, Band is the Band factor, SF is the Service Factor, L is the Location factor and T is the type (one way or two way).

However where the spectrum is assigned on a nationwide basis), the formula would be:

$$\text{Fee} = V \times \text{BW} \times \text{Band} \times \text{SF} \times T$$

In establishing the values of the factors used in the formula, TRR has looked at values of similar spectrum in other identified countries (from spectrum auctions and applied fees) and has adjusted these values to reflect the relative population and economic development of the other countries compared to Vanuatu. The values proposed to be used are included in the paper at pages 21-23.

The proposed Schedule of spectrum fees is at page 24.

TRR welcomes comments from affected parties and the public on the proposed Schedule of fees.

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## 2 CONSULTATION FEEDBACK INFORMATION

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- TRR welcomes and invites comments and feedback to this consultation document from all interested parties;
- We would appreciate your provision of information to be clear by quoting the corresponding main sections and sub sections when providing your comments;
- More general comments on the consultation document should be indicated accordingly;
- In the interests of transparency, TRR will make public all or parts of any submissions made in response to this Consultation Document unless there is a specific request to treat all or part of a response in confidence. If no such request is made, TRR will assume that the response is not intended to be confidential. TRR will evaluate requests for confidentiality according to relevant legal principles;
- Respondents are required to clearly mark any information included in their submission that they consider confidential. They shall provide reasons why that information should be treated as such. Where information claimed to be confidential is included in a submission, respondents are required to provide both a confidential and a non-confidential version of their submission. TRR will determine, whether the information claimed to be confidential is to be treated as such, and, if so, will not publish that information. In respect of the information that is determined to be non-confidential, TRR may publish or refrain from publishing such information at its sole discretion.
  
- TRR has set out a number of questions throughout this consultation paper. These are summarised in Section 10. Wherever possible, please refer to these questions if you have specific questions to provide us with your queries;
- TRR will accept comments in English, French or Bislama;
- If comments are submitted in printed format, they must be submitted on A4 paper accompanied, wherever possible, by a disk containing the comments, in electronic format;
- Comments on this consultation document should be provided to TRR via the following means:
  - Email address [consultation@trr.vu](mailto:consultation@trr.vu)
  - Posted or hand delivered to:
    - **Public Input – Radio Spectrum Fees in Vanuatu**
    - Telecommunications and Radiocommunications Regulator
    - P O Box 3547, Port Vila, Vanuatu
  
- The deadline for public Comments is **4:30pm, 18 March 2016**; Please note that TRR’s consultation timeframe in accordance with TRR’s Consultation Guidelines is normally 28 days. For this plan, TRR considers a 6 week review period is necessary.
- For any phone enquiries regarding this Consultation document, please call the following numbers:
  - (678) 27621 or (678) 27487 and ask to speak with Brian Winji.
  
- TRR will consider every comment submitted when finalizing its report or decision. For transparency, a record of every comment received will be made available for public

information, unless comments are labeled 'In Confidence' (see also dot points 4 and 5 above);

- For more information about TRR's Consultation Guidelines, please visit the following website <http://www.trr.vu/index.php/en/public-register/guidelines/consultation-guideline>
- You are welcome to visit our website <http://www.trr.vu> for more details on the latest developments in the telecommunication services industry and other related matters.

### 3 GLOSSARY

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\$ MHz pop	Spectrum price measured in US\$ for 1 MHz per head of population. This is a measure that enables spectrum value to be compared between countries.
AIP	Administrative Incentive Pricing. A system in which prices are set by the administration in a way designed to mimic the prices that would be set by the market.
Per capita GDP	Gross Domestic Product of a country per head of population.
LF	Low Frequency
MF	Medium Frequency
HF	High Frequency
VHF	Very High Frequency
UHF	Ultra High Frequency
The Act	Telecommunications and Radiocommunications Regulation Act 2009
The Regulation	Radio Apparatus Licence and Spectrum Licence (Fees) Regulation Order No. 153 of 2012

## **4 INTRODUCTION AND PURPOSE**

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Under the Telecommunications and Radiocommunications Regulation Act 2009 (“the Act”), TRR manages the radio-frequency spectrum in order to promote national social and economic development in Vanuatu. Throughout the Act, TRR is the responsible authority pursuant to section 7 (2) (e) of the Act to “allocate, assign and manage the radio spectrum”.

Section 7(4) of the Act grants to TRR powers in relation to “prescribing standard terms in various licences and exemptions”; and “prescribing procedures, forms and fees in respect of any licence”. The Act also gives TRR powers in relation to “providing for the methodology by which any calculation required to be made under this Act is to be made”. Section 12 (2) of the Act provides that radiocommunications devices are not to be operated in Vanuatu without a licence or exception. Also, the Radio Apparatus Licence and Spectrum Licence (Fees) Regulation Order No. 153 of 2012 (“the Regulation”) states that persons operating radiocommunications equipment must have a radio apparatus licence and pay the prescribed fee for the licence (Section 3). (TRR consulted on the level of apparatus licence fees in 2014, and a new Apparatus Licence Fee Schedule is now in force).

Part III of the Regulation provides for spectrum licences. Section 6 states that a person is to apply to the Regulator for a spectrum licence and the assignment of that spectrum, and requires the Regulator to charge for the assignment of spectrum using administrative incentive pricing or spectrum auctions, whichever is appropriate under the circumstance.

The Regulator proposes to use the Administrative Incentive Price (AIP) method to charge radio-frequency spectrum fees.

Incentive pricing and spectrum fees are also covered in the Vanuatu Spectrum Planning, Allocation and Assignment Practices document<sup>1</sup> (the “Practices” document). Section 11 notes that spectrum pricing will be set using Administrative Incentive Pricing. It states that for existing licensees this is the only method available to take account of congestion and scarcity of spectrum. The document also states that AIP will be based on a formula taking account of the spectrum band, transmission characteristics and geographical parameters. The document states that fees are to be set at a level to provide incentives to make effective use of the radio spectrum.

This public consultation document discusses the method for setting radio frequency spectrum licence fees, and proposes a fee formula and schedule of fees to apply to spectrum fees. It also discusses which bands should be subject to the spectrum fees.

## **5 CHARGING FOR THE USE OF SPECTRUM**

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### **WHY HAVE BOTH APPARATUS LICENCE FEES AND SPECTRUM LICENCE FEES?**

Spectrum regulators around the world charge fees to users of the radiofrequency spectrum for one or both of the following reasons:

- To recover the cost of managing the radio spectrum from those who directly benefit (rather than those costs being borne by the whole community);

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<sup>1</sup> TRR, Spectrum Planning, Allocation and Assignment Practices, 20 December 2011

- To encourage the efficient use of the radio spectrum (by setting prices to reflect the real value of spectrum where this spectrum is congested or scarce).

In Vanuatu the system of apparatus licence fees is designed with the aim of recovering the costs incurred by TRR in managing the spectrum.<sup>2</sup> TRR intends that these apparatus licence fees should apply to spectrum bands where there is ample supply of spectrum compared to the level of demand. For most types of radio apparatus used in Vanuatu, the spectrum is not currently congested.

However, some spectrum bands in Vanuatu are more likely to be in scarce supply, at least in some locations. For example, there is likely to be greater demand for spectrum used for mobile telephone services and broadband delivery. (TRR has had a number of requests for access to spectrum suitable for these purposes.)

Radio spectrum is a vital resource which is a critical input into an ever widening range of services. Use of the radio spectrum is crucial to communications in Vanuatu and an important enabler in the national economy. It is important that the spectrum is used efficiently in Vanuatu: setting fees for spectrum in relatively high demand is an important instrument that influences the efficiency of spectrum use.

Also, in some bands (e.g. for mobile phones and broadband), the spectrum is used directly in earning income for businesses. Because of this, the spectrum can have a high commercial value. Businesses use that spectrum directly to create income and profits.

Thus, apparatus licence fees and spectrum licence fees serve two different objectives. Apparatus licence fees are aimed at cost recovery in those large parts of the spectrum where there is little demand and little commercial value. Spectrum fees are aimed at those parts of the spectrum which have high commercial value and are relatively scarce.

TRR does not expect that a licensee would pay both spectrum fees and apparatus fees for the same piece of spectrum; thus, there would be no double charging for the spectrum use.

## **ADMINISTRATIVE INCENTIVE PRICING (AIP)**

### *What is AIP?*

The concept of AIP was developed in the United Kingdom (by Ofcom and its predecessor, the Radiocommunications Agency). It is based on the idea that the assignment of spectrum should be determined by market forces rather than by government decision.

Many regulators and economists have taken the view that the best way of making sure that spectrum is assigned using market forces is to hold spectrum auctions. However, it is not possible or desirable to hold spectrum auctions in all cases. For example, the spectrum may already have been assigned to users; or it may be impractical to hold a spectrum auction because of the complexity involved in auctions.

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<sup>2</sup> To carry out its functions in managing the spectrum, TRR necessarily uses resources and incurs costs. Those costs should be recovered from the users of the spectrum to ensure that the management of the spectrum is carried out efficiently and fairly (it is unfair and inefficient to make all people in Vanuatu pay for services such as spectrum management that benefit a few. Those that can obtain a benefit from the use of a resource should bear the cost of providing that resource.)



In these circumstances, spectrum regulators have tried to come up with other ways of setting a market price for spectrum in the absence of a market mechanism such as an auction.

To address this problem, the UK introduced the AIP in 1998. Under AIP the regulator tries to set prices administratively to mimic the prices that would have been set in an open market (e.g. at an auction). The intention is to encourage the efficient use of the spectrum resource in the economy. In a well-functioning market, a price set at the point where supply equals demand will automatically provide spectrum users with the incentives to act efficiently. For example, if someone who uses spectrum very efficiently wishes to acquire spectrum, there will be an incentive for him to buy that spectrum off a less efficient user (the less efficient user makes more money by selling the spectrum than he could by using it; the more efficient user still can make money by the better use of the spectrum even after compensating the less efficient user).

### *Opportunity Cost*

Economists use the concept of *opportunity cost* to help them work out what an incentive price should be.

Opportunity cost is an economic concept that refers to the value of a particular good or resource in its next best use. It is defined as *the highest value alternative forgone*. A simple example helps to illustrate the meaning of opportunity cost. The opportunity cost of spectrum for a fixed link could be determined by finding out the cost of a fixed line between the same two points (that is, instead of putting in a new fixed link between two points, say a studio and a transmitter, a company could instead decide to put in a fixed line between the same points). The cost of the fixed line would define the maximum amount that the company would be prepared to pay for fixed link spectrum (after taking into account the cost of equipment for the link).

Another example is of a mobile telephone operator running out of capacity in its network. To tackle this problem, it could ask for additional spectrum from the regulator in order to increase capacity. Or, instead, it could decide to add more base stations in its network (and more backhaul capacity from those base stations) to achieve the same increase in capacity. The opportunity cost of the spectrum can be defined as the cost of the increased network infrastructure that would have to be put in place instead of acquiring more spectrum.

The opportunity cost of spectrum can also be estimated by reference to the value of that spectrum to another user. For example, the 700 MHz spectrum band is readily usable by Ultra High Frequency (UHF) TV broadcasting or by mobile broadband networks (there is ready availability of equipment for both services). The opportunity cost of broadcasting spectrum in the 700 MHz band could be estimated if you knew what broadband operators would be prepared to pay for it.

Where the price of a resource such as spectrum is set at the opportunity cost, then there is a built-in incentive to use spectrum efficiently. Going back to the earlier discussion, if a company is using the spectrum less efficiently, setting the price at the opportunity cost will mean that it will decide to use less spectrum (because the price is too high for it to make money in this less productive use). Efficient users will continue to use the spectrum even at the opportunity cost price.

TRR considers that the AIP method of price setting referred to earlier, is the most appropriate way to set prices at the opportunity cost of the spectrum.

For low value spectrum—where there is an excess supply of spectrum—opportunity cost is likely to be low or even zero. That is, if there is plenty of spectrum to go around, then no one would be prepared to pay for spectrum being used by a particular operator. In this circumstance, it would only be necessary to go to the regulator and get another spectrum allocation—it would not be necessary to buy the spectrum from an existing licensee. In the case of low value spectrum, therefore, the AIP approach should not be used (and prices should be based only on cost recovery).

## **SETTING ADMINISTRATIVE INCENTIVE PRICES**

Where administrative incentive pricing has been implemented most thoroughly (e.g. in the UK and Australia), detailed analysis has been undertaken of the market situation for the bands involved. The Australian Communications and Media Authority (ACMA) has published a useful paper setting out what needs to be considered in establishing such prices<sup>3</sup>. The paper notes that there is no one method (no “magic bullet”) for implementing opportunity cost pricing within a band. It says that the choice of approach to deriving opportunity cost estimates (that is, AIP) for a band depends on the objectives of the regulator, the frequency band being considered, and the quality of the information available.

In the case of small countries like Vanuatu, getting good information about market circumstances is likely to be difficult. Detailed, directly relevant market information is likely to be hard to find. No spectrum auctions have been conducted in Vanuatu, so no open market price has ever been established for any band in this country. (This is not the case in other countries that have adopted AIP like the UK and Australia, both of which have had a lot of experience in conducting spectrum auctions across a range of bands).

The type of information that is likely to be most available to assist us in setting incentive pricing in Vanuatu is information about prices paid for the same or similar spectrum in auctions in other countries. This information would, of course, need to be adjusted for differences in population, income and other relevant characteristics. This will be discussed later in the paper.

However, TRR would welcome any information that responders wish to provide about revenue expected to be raised from the use of the spectrum, or the costs of alternative technologies.

## **6 WHICH BANDS SHOULD BE SUBJECT TO SPECTRUM FEES?**

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As noted earlier, spectrum fees should only apply to high value spectrum bands (otherwise apparatus fees based on cost recovery would be more appropriate).

In Vanuatu, spectrum in most bands is unlikely to be in short supply (instead supply will exceed demand). In those bands where there is no shortage of spectrum to be assigned, it would not be appropriate to impose spectrum fees. To charge spectrum fees for these bands would tend discourage spectrum use.

The Practices document (Section 12, point 4) notes that “all users of spectrum which is either congested or where there is excess demand/competition for access, shall pay the spectrum fee.”

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<sup>3</sup> Australian Communications and Media Authority, *Opportunity Cost Pricing of Spectrum*, April 2009.

While there is little evidence of congestion across any spectrum band in Vanuatu, there is some evidence of strong demand for some specific bands. For example, the requests for access to the 700 MHz band indicates that demand for mobile and wireless broadband spectrum is quite strong, reflecting the growth of mobile and broadband services and the importance of wireless to deliver broadband in Vanuatu.

To decide which bands should be subject to spectrum fees, TRR has looked at the levels of demand across the various bands (both current and likely future demand). The following Table sets out an assessment of demand in the major categories of spectrum use.

**Table 1 Assessment of Spectrum Using Services**

<b>Category</b>	<b>Comment</b>
Aeronautical	No evidence of excess demand for aeronautical spectrum. Users already pay apparatus licence fees.
Amateur	Not used for commercial services, no evidence of demand.
Broadcasting	There is still a lot of unused broadcasting spectrum in Vanuatu. However, broadcasting spectrum is high value spectrum. TRR will monitor the situation and will determine whether spectrum fees should be levied in the future.
Broadcasting Pay TV	There is an operator that has a licence for a large amount of UHF TV spectrum which it is to use for its pay TV service. This is high value spectrum which should be considered for spectrum fees.
Fixed Services	No evidence of excess demand for fixed spectrum.
Land mobile	No evidence of excess demand. Land mobile spectrum across HF, VHF and UHF is not heavily utilised in Vanuatu.
Maritime	No evidence of excess demand. Users already pay apparatus licence fees.
Mobile Telecommunications and Broadband	Given the high mobile take-up in Vanuatu and requests for additional spectrum, mobile telephony bands (900 MHz, 1800 MHz as well as 700 MHz in the future) are strong candidates for spectrum fees. Future mobile/broadband bands such as 2.3 GHz, 2.5 GHz and 3.5 GHz are also highly commercial bands and should be considered for spectrum fees.
Radio determination, radiolocation etc	No evidence of excess demand.
Satellite	No evidence of excess demand. VSATs and other earth terminals already pay fees in the new Apparatus Licence Fee Schedule.
Wireless Access	Wireless broadband services are strong candidates for spectrum fees given the competition for spectrum and requests for additional spectrum.
Wireless access (Wifi)	Wifi services however use general user licence bands and could therefore not be charged a spectrum fee.

It can be seen from Table 1 that the bands that are candidates for the application of Spectrum Fees are:

- Bands used for mobile telecommunications (900 MHz, 1800 MHz)
- Other wireless broadband spectrum (2.3 GHz, 2.5 GHz, 3.5 GHz)
- Broadcasting spectrum used for pay TV (510-550 MHz, 560-608MHz, 610-660 MHz)
- 700 MHz band following allocation (703-748 MHz, 758-803 MHz).

However, some of the spectrum bands that would otherwise be good candidates for Spectrum Fees are not able to be subject to these fees. Notably, mobile spectrum allocated to TVL and Digicel under their carrier licences is specifically exempt from fees (See Section 7 of the Regulation, which states that “To avoid doubt, a spectrum assigned to Telecom Vanuatu Limited (TVL) and Digicel Vanuatu Limited (Digicel) at the time of issuance of their licence is not subject to a spectrum licence fee.” *It is therefore not proposed to levy spectrum fees on bands covered by the TVL and Digicel licences.* However TRR believes that this spectrum should be considered for spectrum fees after the current licences expire (in 2023).

However Section 8 of the Regulation goes on to say that the *additional* spectrum assigned to TVL and Digicel after the issuance of their licence is subject to the prescribed fees, and any application for additional spectrum made subsequently is also subject to the fees.

As TVL and Digicel are now using additional spectrum in the 900 MHz band, the 1800 MHz band and 2300 MHz band this spectrum should be subject to spectrum fees.

The Table above notes that broadcasting spectrum is high value spectrum, but that there is still unused spectrum available. TRR will continue to monitor demand for broadcasting spectrum, with a view to introducing spectrum fees if demand should increase significantly in the future.

Question 1: Do you agree with the list of bands proposed to be subject to spectrum fees? If not, what bands should be excluded from the list, or what additional bands should be included? What impact would fees have on telecommunications development and markets in Vanuatu?

## 7 SETTING SPECTRUM FEES

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The next issue to consider is how should spectrum fees for these bands be set?

Setting incentive prices is a complex task, and information will be hard to find for Vanuatu. Even where information is available from carriers about revenue produced from the use of their spectrum, it may be hard to work out how much revenue is earned from each band. For example, it may be difficult for even TVL and Digicel to work out how much of their revenue comes from their original spectrum allocations in the 900 MHz band and how much from the additional 900 MHz spectrum and the 1800 MHz spectrum. TRR would face even greater difficulties in calculating this.

Information is more readily available on spectrum values revealed in auction results for similar spectrum sold in other countries. There is also some information on licence fees in other countries. Use of this information for comparison purposes has some particular advantages:

- data is readily available;
- it can provide a ‘like for like’ comparison using the same spectrum bands; and
- data relates to actual prices that have been paid, or are being paid, in other markets.

However, before auction results and licence fees could be used, they would need to be carefully adjusted for Vanuatu circumstances. Prices paid for spectrum in developed countries are not likely to be directly applicable in developing countries like Vanuatu.

Some adjustment can be made by using values for “\$ per MHz pop”, i.e. the amount paid in US dollars per MHz of spectrum per head of population (US\$ are used to provide a readily understood value measure across countries). This provides a way of comparing spectrum prices across different countries with different populations. However, account will also need to be taken of different economic circumstances across countries. So an adjustment for per capita Gross Domestic Product (GDP) will also need to be made.

Two options could be considered for setting fees: a formula approach, or an individual band by band calculation of opportunity cost.

As noted earlier, the Vanuatu Spectrum Planning, Allocation and Assignment Practices document proposes a formula approach. It states that spectrum fees will be based on a formula taking account of the spectrum band, transmission characteristics and geographical parameters.

The case for using a formula is strengthened by the fact that there is likely to be a lack of detailed information available to enable opportunity costs to be calculated. Also opportunity costs are likely to change over time with changes in market circumstances and technological developments.

So a formula approach offers some practical advantages. It would enable judgments to be made and applied about the relative value of spectrum across different bands<sup>4</sup>.

TRR therefore proposes that a formula approach should be used for calculating AIP and hence Spectrum Fees.

Question 2: Do you agree that a formula approach should be used to guide the setting of spectrum fees? If not, how should spectrum fees be set?

### **7.1 A formula approach to setting Spectrum Fees**

The ITU has established some guidelines to assist administrations use fee formulas in order to improve fairness and transparency in fee setting. In its report *Economic Aspects of Spectrum Management*, the ITU states that “Pricing requires the development of formulae to operate effectively”. It notes that such formulas need to be fair, objective, transparent and simple. It recommends that only the minimum number of factors necessary for achieving the objectives be used (in other words formulas should not be made too complex).

The ITU suggests number of coefficients be considered, including:

- Bandwidth;

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<sup>4</sup> This question of whether to use a formula or individual calculation approach has been addressed by the ACMA in the consultation paper cited earlier. It proposed that values revealed by its opportunity cost evaluation exercise for the 400 MHz band would effectively replace the “location” (geographic) weighting for spectrum in the 400 MHz band *in its existing pricing formula* by new price levels based on opportunity costs. In other words, they suggested that where specific opportunity cost information is available, it should be included in the existing pricing formula.

- Band value (the position within the spectrum of the frequency);
- Number of frequency authorisations;
- Surface area covered;
- Reference monetary values (k1, k2 etc) specific to the applications in question.

Fees will vary according to the amount of spectrum used (bandwidth and surface area covered. The more surface area covered, the less the scope for others to use the same frequency). Fees will also vary according to the value of the bands (some bands are in more demand than others).

An example of a fee formula suggested by ITU (for a point to point fixed service allotment) is:

$$Rs=L*bf*a*c*k1$$

Where Rs= amount of annual spectrum fee; L= Allocated bandwidth; bf= band factor (the ITU notes that in practice a table is established giving the value for bf for each band under consideration); a= frequency usage authorisations; c= ratio between the surface area covered by the allotment and the total surface area of the country; and k1= reference monetary applicable to the fixed service.

Another example would be (for a private mobile radio assignment):

$$Rs=L*bf*c*k2$$

Where k2 is the reference monetary applicable the land mobile service. (Because this is for a single assignment, a=1, and can therefore be ignored.)

Several countries now use formulas to help work out fees. For example in this region, *Papua New Guinea* uses the following formula:

$$Fee=V x (2600 \div F) x B x T x L$$

Where **V** = Reference value of spectrum; **F**=Frequency, represented by a value (for frequencies below 30 MHz, the value of F is 30; for frequencies above 30 GHz, the value is 30,000; for frequencies between these marks the value F = the mid-point in MHz of the band in NICTA's band plan. For the 2.3-2.4 GHz band, for example, F= 2350); **B**=total bandwidth of licence in MHz; Type (**T**) is the relative extent to which the service denies spectrum to others (a fixed point to point service would have a lower value than a point to multipoint service for example); **L**=location (depending upon population and economic development).

PNG uses this formula to work out the Annual Variable Spectrum Fee, but a fixed fee is also charged. (The Annual Variable Spectrum Fee is very similar to an AIP). In addition, apparatus licences also pay a fixed fee which varies according to apparatus type. For example, TV broadcasters pay a fixed fee of 2500 Kina plus the variable fee (which in a major city could be as much as 55,000 Kina). The variable fee for spectrum used for mobile telephones in the 900 MHz band would be over 35,900 Kina per MHz (which is equivalent to US\$11,926 or 1.285 million Vatu); in addition to this a fixed fee of 4690 Kina would be payable for each base station in the network (US \$1558 or about 168,000 Vatu. (However, the population of PNG is much greater than that of Vanuatu, so these fee levels are not directly comparable to the situation in Vanuatu.)

It should be noted that PNG is the only developing country in the region which currently adopts a fee formula approach to calculate spectrum fees.

## 7.2 What factors should be included in a formula?

The Vanuatu Spectrum Planning, Allocation and Assignment Practices document proposes that the formula take account of the spectrum band, transmission characteristics and geographical parameters.

The use of parameters like these is appropriate in calculating spectrum fees: different bands have different characteristics (e.g. with regard to propagation and the availability of equipment) which need to be taken into account in assessing the value of the band; even where spectrum may be in high demand in some geographic areas (e.g. in large cities), it may be in plentiful supply in other areas (e.g. remote areas, outer islands).

Some guidance on what to include in a fee formula has been provided by the ITU in its publication *Economic Aspects of Spectrum Management*<sup>5</sup>. The ITU suggests the following factors be used in fee formulas:

- allocated *bandwidth*;
- position in the spectrum of the band in question (i.e. a *band factor*);
- surface area covered by the authorisations (*coverage*);
- reference monetary values specific to the applications in question (i.e. a *service factor*); and
- *frequency authorisations* by allotment (this can be used to provide for higher fees for two way services than for one way services, for example).

These factors are very similar to those used as a basis for calculating apparatus licence fees in TRR's consultation paper of August 2014. However, in that formula, there was no separate coverage factor; instead to keep the formula simple, the different coverage or propagation characteristics of services were incorporated in the Band and Service Factor components.

The one factor that is not covered explicitly in the ITU approach that could be considered is *geographic location* rather than just coverage. As noted earlier, even where spectrum may be in high demand in some geographic areas (e.g. in large cities), it may be in plentiful supply in other areas (e.g. remote areas, outer islands). To deal with this, a geographic demand factor could be built into the formula (i.e. this would mean a higher rate for spectrum in Port Vila and perhaps Luganville than for the rest of the country).

Whether to include such a geographic factor may depend on whether there is a national allocation for the spectrum in question or whether instead spectrum is assigned on a local basis only. For example, for mobile telephone spectrum a national allocation is most likely; for a fixed link, local assignments will be used covering particular geographic areas or paths only.

Where there is a national allocation only, it is appropriate to have a single rate applying to the fees.<sup>6</sup> Where there were local assignments, a geographic factor should be built into the formula, with a higher rate applying to Port Vila than elsewhere.

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<sup>5</sup> ITU, *Economic Aspects of Spectrum Management*, Report ITU-R, SM2012-3 (09/2010)

<sup>6</sup> In practice, this may just reflect the scarcity value in Port Vila, as there may be little demand for the spectrum in other parts of the country.



With one exception, it is proposed that Spectrum Fees should apply to bands where the spectrum is likely to be allocated on a national basis rather than locally. In these cases, it will not be necessary to include a geographic factor in the Spectrum Fees formula. The exception is for spectrum used for pay TV (510-550 MHz, 560-608MHz, 610-660 MHz). This spectrum has only been used in Port Vila. In this case a location (geographic) component will be included in the formula. If in future it is decided to impose spectrum fees on other bands, such as broadcasting, which are assigned on a local basis, then a geographic factor could be included for them also.

If a geographic component in the formula is not necessary, then the same basic formula can be used for Spectrum Fees as is applied to Apparatus Licence fees; that is:

$$\text{Fee} = V \times \text{BW} \times \text{Band} \times \text{SF} \times T$$

Where a geographic component is included, the formula would become:

$$\text{Fee} = V \times \text{BW} \times \text{Band} \times \text{SF} \times L \times T$$

(where V is the base value of spectrum, BW is bandwidth, Band is the Band factor, SF is the Service Factor, L is the Location factor and T is the type (one way or two way)).

For spectrum licences, however, the factors in the equation would be given different and higher weightings than for apparatus licensing, to reflect the greater scarcity value of the Spectrum Licence spectrum.

Proposal: Spectrum Fees should be based on the same formula used in apparatus licence fees, that is  $\text{Fee} = V \times \text{BW} \times \text{Band} \times \text{SF} \times T$ .

Question 3: Do you agree that the formula to be used to determine spectrum fees should be based on factors covering bandwidth, the value of the band used, the value of the service using the spectrum, the location (where appropriate) and the type of service?

Question 4: Do you agree with the formula proposed in this paper?

### 7.3 Spectrum Values in other Countries

It was noted earlier that some information is available on spectrum values revealed in auction results for similar spectrum sold in other countries. This includes information on many of the bands which this paper proposes should be subject to spectrum fees. Tables 2 to 7 set out auction values (including US\$ per MHz pop figures) for auctions in relevant spectrum bands in recent years. (Note that results from spectrum auctions held in the early years of the century during the 'dot com boom' have not been included. Including them would inflate the value of the spectrum beyond the levels that now exist). *Note: For these auctions, the auction results have been converted into US\$ equivalents using exchange rates that applied at the time of the auctions.*

**Table 2: 700 MHz Band auction results**

Country	Year	Revenue US\$m	US\$ per MHz pop
Fiji	2013	1.36	0.025
Australia*	2013	1997	0.43
USA	2008	19.1	0.98
Canada	2014	4800.1	2.11
NZ	2014	235.5	0.59

Note: The Australian auction covered both 700 MHz and 2.5 GHz bands, and it is not possible to separate out the prices paid for each band. The value in this Table almost certainly *underestimates* the value of the 700 MHz spectrum at the auction.

**Table 3: 800 MHz Band auction results**

Country	Year	Revenue US\$	US\$ per MHz pop
Spain	2011	1853.5	0.67
Germany	2010	4424.1	0.90
Italy	2011	2303	0.63
Portugal	2011	356	0.56
Sweden	2011	307.6	0.55

**Table 4: 900 MHz Band auction results**

Country	Year	Revenue US\$	US\$ per MHz pop
Portugal	2011	39.6	0.37
Spain	2011	240	0.53
Greece*	2011	514.5	0.41

Note: The auction in Greece covered both the 900 MHz and 1800 MHz bands. The result in the Table is likely to underestimate the value of the 900 MHz band.

**Table 5: 1800/1900 MHz Band auction results**

Country	Year	Revenue US\$	US\$ per MHz pop
Fiji	2013	0.8	0.011
Italy	2011	613	0.33
Korea	2013	1795	0.73
Portugal	2011	43.5	0.05
Germany	2010	129.1	0.03
Mexico	2010	408.9	0.08
India	2010	14600	0.85
Colombia	2011	80	0.07

**Table 6: 2.6 GHz Band auction results**

Country	Year	Revenue US\$	US\$ per MHz pop
Norway	2007	42.7	0.05
Sweden	2008	348.1	0.20
Finland	2009	5.7	0.006
Netherlands	2010	3.2	0.002
Denmark	2010	168.1	0.15
Germany	2010	424	0.03
Austria	2010	51.6	0.03
Colombia	2010	40	0.02
Italy	2011	651	0.07
Brazil	2012	1243	0.05

**Table 7: 3.5 GHz Band auction results**

Country	Year	Revenue US\$	US\$ per MHz pop
Austria	2009	0.2m	0.00054
Canada	2004/2009	38.1m	0.0048
Norway	2015	5.79m	0.0064

It is difficult to make precise comparisons across spectrum auction results in different countries. A number of different factors may contribute to auction results, including the degree of competition in the market and in the auction itself, how mature the communications markets are, and the relative wealth of the country concerned.

Nevertheless, it is possible to draw some representative spectrum values from these auction results. From the Tables, it appears that representative values for the bands are (ignoring very high results which may skew the outcome):

- 700 MHz band: \$0.25 to \$0.98 per MHz per head of population;
- 800/900 MHz bands: \$0.4 to \$0.6 per MHz pop;
- 1800 MHz band: \$0.011 to \$0.33 per MHz pop (this is a particularly wide variation);
- 2.6 GHz band: \$0.02 to \$0.07 per MHz pop;
- 3.5 GHz band: \$0.0005 to \$0.006 per MHz pop.

There have been very few auctions of 3.5 GHz spectrum so it is difficult to find a representative value. However, it is likely that the value of this band would be relatively low compared to other bands (both because of lesser propagation and the undeveloped nature of the band for mobile broadband).

The above values, however, need to be adjusted before they can be used as a guide to setting spectrum fees in Vanuatu. For a start, they are upfront payments not annual licence fees. To work out an annual fee equivalent, this paper has assumed a 15 year licence term (i.e. the MHz pop values have been divided by 15).

Secondly, the countries listed in the Tables have widely different states of development, including very different per capita GDP figures. For example, per capita GDP in Vanuatu is significantly higher than India but significantly lower than in many other countries.<sup>7</sup>

In calculating the proposed spectrum fees for Vanuatu, allowance has been made for relative GDP per capita figures.

Another measure of spectrum value that could be considered is the fee formula used in Papua New Guinea (discussed in Section 7.1 above). PNG fees calculated using the formula have been used to

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<sup>7</sup> In calculating proposed fees, a population figure of 270,000 for Vanuatu has been used. GDP per capita was assumed to be US\$ 3148 (World Bank estimate for 2014, the latest available figure).

check the values proposed in setting spectrum fees in Vanuatu (after allowing for PNG's greater population but lower per capita GDP). Fees proposed in Vanuatu, after these adjustments, are generally around the level of or lower than PNG fees. (Given that in PNG fees are also levied on base stations on top of the spectrum fees, the proposed Vanuatu fees are even lower compared to PNG fees).

#### **7.4 What values should be used in the formula?**

The value of spectrum varies with the use to which it is put. Some spectrum is very valuable because it is used for mobile telephones, for example. Mobile telephone services have the potential to produce very large revenue streams. Other spectrum with very similar coverage and information capacity but which is not used for mobile telephones is likely to be worth significantly less.

The value of the spectrum will also vary based on its physical characteristics, notably the coverage and the information carrying characteristics of the particular band. As a general rule, the lower the frequency, the greater the coverage of a transmitter using that frequency will be (i.e. the greater the propagation). However, spectrum with very low frequencies (for example, LF, MF, HF, VHF bands) lacks the information carrying capacity of higher frequency bands even though its coverage is better.

Bands with a combination of good coverage and high carrying capacity tend to be the most valuable parts of the spectrum. Broadly speaking, these are mainly in the UHF band (from 300 MHz to 3 GHz) although some higher bands are also sought after (e.g. the 3.5 GHz band).

Given these variations in spectrum value, the fee formula needs to contain values that reflect the relative value of spectrum. The factors in the formula are discussed below.

##### ***Base Value of Spectrum (V)***

The formula used in establishing apparatus licence fees has a value for V (the base value of spectrum) of 45,000 Vatu. TRR proposes to use the same value of V for the spectrum fees formula.

##### ***Bandwidth (BW)***

The factor for bandwidth (BW) is measured in MHz. BW is 1 for a one MHz bandwidth, 2 for a two MHz bandwidth and so on. Thus fees will vary directly according to the amount of spectrum covered by the spectrum licence.

##### ***Band Factor (B)***

As noted above, all spectrum bands are not valued equally. The formula will use different values for B depending on estimates of the value of different bands. The values proposed are contained in Table 8.

**Table 8: Band factors (B)**

Band	Band Factor (B)
UHF TV (Port Vila)	1
700 MHz	1
900 MHz	1.2
1800 MHz	0.7
2.3 GHz	0.25
2.5 GHz	0.25
3.5 GHz	0.2

***Service Factor (SF)***

Service Factor (SF) values represent an estimate of the value of spectrum used in a particular service. As noted above, spectrum used for mobile telephone service is particularly valuable because of the revenue opportunities it presents.

Service values proposed are contained in Table 9.

**Table 9: Service Factors (SF)**

Service	Service Factor (SF)
UHF TV	1.5
Mobile telephone/Mobile broadband	1.5
Broadband (2.3 GHz)	1.5

### ***Location (L)***

Where a geographic component is applied, it is proposed that a spectrum licence that only covered Port Vila would have an L factor of 0.2 compared to 1 for a nationwide licence.

### ***Type (T)***

The apparatus licence fee formula used by TRR includes a factor T (Type). A service can be two way (i.e. send and receive) or one way (transmission in one direction only). Nearly all the bands proposed initially for spectrum fees are two way services (i.e. for mobile telephones and broadband). In these cases, T would be set at 2. The exception is the 600 MHz spectrum used for one way (pay TV) broadcasting. In this case T would be set at 1.

If it is later decided to introduce a spectrum fee for other broadcasting services, T would also be set at 1.

Question 5: Do you agree with the proposed factor values to be incorporated into the fee formula? If not, what alternative values would you propose?

## **8 PROPOSED SPECTRUM FEE SCHEDULE**

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Using the proposed fee formula and the value for the factors set out in the previous chapter, it is proposed that the spectrum fees should be payable according to the following Schedule. *This Schedule has been calculated using the proposed formula and the factors outlined in the previous section. Figures for the fees in US\$ per MHz per head of population are provided to enable ready comparisons with spectrum values discussed in Section 7.3 above. The exchange rates used to calculate US\$ comparisons are as at 6 January 2016.*

**Table 10: Proposed Spectrum Fee Schedule**

Band	Fee (Vatu per MHz)*	US\$ per MHz pop	Total Revenue VUV
UHF TV (Port Vila)	13,500	0.0024	1,863,000
(8 MHz)	108,000		(US\$ 17,285)
700 MHz	135,000	.0046	12,150,000
			\$112,730
900 MHz	162,000	.0056	2,430,000
			\$22,546
1800 MHz	94,500	.0032	9,450,000
			\$87,680
2.3 GHz	33,750	.0012	3,375,000
			\$31,314
2.5 GHz	33,750	.0012	4,657,500
			\$43,213
3.5 GHz	27,000	.0009	2,700,000
			\$25,051

Question 6: Do you agree with the proposed new spectrum fees? If not, on what grounds do you object?



## 9 REGULATORY IMPACT ASSESSMENT

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9.1 As identified in TRR's 2014 and Onwards Work Program, this consultation addresses the methodology for the setting of new spectrum fees. While the Work Program proposed that the Spectrum Fees Schedule be implemented by the beginning of 2016, the TRR now intends to have the Spectrum Fee Schedule in place by 1 January 2017.

9.2 The arrangements are in line with the legislative framework, in particular the Act that governs spectrum management and the powers to allocate and assign radio-spectrum frequency in Vanuatu. In particular section 7 (2) (e) of the Act gives TRR the power to allocate, assign and manage the radio spectrum, while Section 7(4) (b) of the Act grants to TRR powers to prescribe "procedures, forms, and fees in respect of any licence". Section 7 (4) (c) of the Act gives TRR power to provide "for the methodology by which any calculation required under this Act is to be made".

9.3 The proposed arrangements are also in line with the Regulations made by TRR to give effect to the Act in particular sections relating to management of radio apparatus licence and Spectrum (Fees). The Regulation (Section 6) states that a person is to apply to the regulator for a spectrum licence for the assignment of spectrum, and requires the Regulator charge for the assignment of spectrum using administrative incentive pricing or spectrum auctions, whichever is appropriate under the circumstance.

9.4 Implementation of the new licence fees will support the object of the Act and the Government's National ICT Policy. In particular, it will facilitate the management of the radio-frequency spectrum to promote national social and economic development.

9.5 In its document *Spectrum Planning, Allocation and Assignment Practices* published in December 2011 the TRR listed objectives of spectrum charges and fees, including to

- encourage efficient use of the radio spectrum, and
- to reflect the socio-economic or market value of radio spectrum where such spectrum can be shown to be congested or scarce.

The fees set out in this consultation paper are designed to meet these objectives.

9.6 Licensees who currently have access to the spectrum bands covered by the Spectrum Fees Schedule will be affected, because they will have to pay fees on their use of the spectrum. Operators using licensed spectrum, however, had been advised of the imminent introduction of fees when enquiring for start-up or additional spectrum, as in the case for TVL and Digicel. TRR is undertaking this public consultation in order to ensure that the proposed fees do not impose unnecessary burdens on spectrum users and industry. TRR will take into account the views of responders to this consultation paper in making decisions about the level of spectrum fees.

9.7 The proposed system of spectrum fees will promote the interests of Vanuatu residents by:

- More accurately reflecting the value of the spectrum to the user;
- Helping to provide a predictable environment for the use of the radiofrequency spectrum, and in particular with regard to the level of spectrum fees for high value spectrum;
- Introducing a fair and transparent method for charging for the use of high value spectrum, to ensure a return to Vanuatu for the use of such commercially valuable spectrum;
- Bringing the system of charging for the use of spectrum more closely into line with that of other countries; and

- Promoting the efficient use of high value spectrum.

9.8 In preparing this consultation paper, TRR has considered the possible costs and benefits of introducing spectrum fees.

#### *Benefits*

The main benefits from introducing spectrum fees are expected to be:

- Spectrum fees would encourage the efficient use of high value spectrum, that is, the introduction of a charge for spectrum use would provide a disincentive for licensees to use spectrum wastefully;
- Fees would help TRR cover the costs of its spectrum management activities and assist it to move towards financial sustainability for TRR into the future when external support ends;
- This would also mean that spectrum users would contribute more to meeting the cost of managing the spectrum, rather than the entire burden falling on the community as a whole;
- Fees would discourage “spectrum squatting” or “spectrum hoarding” by which users might attempt to maintain access to spectrum they do not really need in order to prevent other competitors, or potential future competitors, from accessing that spectrum. In other words, fees could help competition in wireless markets;
- Revenue raised from spectrum will enable TRR to further develop its capability in terms of human resource, appropriate tools and test equipment for monitoring and compliance functions.

#### *Costs*

On the other hand, the introduction of spectrum fees could have some potential costs, particularly for licensees:

- Fees would impose additional costs on industry not currently subject to these fees;
- Depending on market circumstances additional fees could increase costs to users of telecommunications services, including consumers and downstream industries;
- If prices are set too high, the take up of telecommunications services could be adversely affected (that is if operators pass on the additional costs to consumers, those consumers may not be able to afford services that they otherwise would have bought);
- Fees would introduce some increased compliance costs for industry in setting up systems to pay license fees. However, these increased costs are likely to be modest;
- Introduction of fees would be likely to result in some increased enforcement costs for TRR in collecting fees not currently charged. Again these would be expected to be modest (especially if the number of bands liable for spectrum fees is kept small);
- Spectrum fees may raise the costs of entry into the Vanuatu telecommunications market for new players and hence have an adverse impact on competition. However, again this impact is likely to be modest given that spectrum fees would represent only a small part of the cost of setting up a new service (compared to such things as infrastructure costs and billing systems).

9.9 The actual level of costs and benefits is very difficult to estimate in money terms. It is important to note that the benefits are mainly expected to be public benefits (that is, benefits to the community as a whole) while the costs are expected to be mainly private costs (that is, they will be

borne by particular companies). Because of this, it would be expected that spectrum licensees are likely to be more conscious of the costs than the benefits.

9.10 TRR welcomes the views of those companies that would be subject to spectrum fees about the level and impact of the costs that would be imposed through the introduction of spectrum fees.

9.11 However, TRR considers that, provided that spectrum fees are relatively modest compared to the value of the services provided, the overall benefits of more efficient spectrum usage are likely to exceed the costs.

9.12 Although some users of the spectrum will be adversely affected by the introduction of fees, TRR considers that the adverse impacts of fee rises are justified because:

- Efficient use of high value spectrum is in the interests of the Vanuatu people and economy;
- Users have had access to high value spectrum for a number of years in many cases without paying fees, despite clear legislative and policy intent that fees should be charged on this spectrum;
- The proposed fees are generally low compared to the level of fees imposed by other countries (such as Papua New Guinea) or by the cost of acquiring spectrum in spectrum auctions in other countries;
- Introduction of spectrum fees will help to recoup the costs of managing spectrum imposed upon the community;
- The proposed fees are closely tied to the amount of spectrum used, and the economic value of the bands concerned.

9.13 The new Spectrum Fee Schedule will implement the intention of the provisions of the Radio Apparatus and Spectrum Licence (Fees) Regulation – Order No.30 of 2009 for spectrum licence fees based on administrative incentive pricing or spectrum auctions.

9.14 The new Spectrum Fee Schedule will come into effect on 1 January 2017. This public consultation will provide an opportunity for those affected to have their views considered. TRR believes that the time allowed for consultation on this process should be sufficient to enable smooth implementation. TRR considers that implementation of the new arrangements by 1 January 2017 is achievable and appropriate.

## 10 CONSULTATION QUESTIONS

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The TRR is seeking the views of responders on the following questions.

Question 1: Do you agree with the list of bands proposed to be subject to spectrum fees? If not, what bands should be excluded from the list, or what additional bands should be included? What impact would fees have on telecommunications development and markets in Vanuatu?

Question 2: Do you agree that a formula approach should be used to guide the setting of spectrum fees? If not, how should spectrum fees be set?

Question 3: Do you agree that the formula to be used to determine spectrum fees should be based on factors covering bandwidth, the value of the band used, the value of the service using the spectrum, the location (where appropriate) and the type of service?

Question 4: Do you agree with the formulas proposed in this paper?

Question 5: Do you agree with the proposed factor values to be incorporated into the fee formula? If not, what alternative values would you propose?

Question 6: Do you agree with the proposed new spectrum fees? If not, on what grounds do you object?