Explanatory Memorandum - Spectrum Pricing Model 2021

1   Introduction

1.1   Background

The Eswatini Communications Commission ('the Commission') developed a new Spectrum pricing framework (Formula) which resulted in the Commission publishing a Spectrum Fee Schedule 2018, in terms of section 17 of the Electronic Communications (Radio Communications and Frequency Spectrum) Regulations 2016) ('the Spectrum Regulations'). The schedule was developed in such a way that it would be forward looking and be technology neutral so that future reviews would be easily implemented by changing only specific factors, taking into consideration the current trends and best practices.

In accordance with the Spectrum Regulations, (3) The Commission shall review and publish the pricing formula for frequency spectrum at least once in every three (3) years, therefore the Commission has initiated a process to review the Spectrum pricing formula in order to publish a new schedule.

17. (1) The Commission shall adopt a pricing formula that reflects the economic value of frequency spectrum in order to encourage efficient use of frequency spectrum and stimulate growth.

(2) The pricing formula adopted under sub-regulation (1) shall consider the-

(a) size of spectrum assigned;

(b) frequency band and level of congestion within the band;

(c) market demand;

(d) power output;

(e) geographical usage; and

(f) such other factors as the Commission may from time to time determine.

(3) The Commission shall review and publish the pricing formula for frequency spectrum at least once in every three (3) years.

1.2   Intention of the Commission

The Commission is seeking continuity in the spectrum pricing which will still maintain the basic requirements such as:

- Promote efficient use of spectrum.
- Prevent stockpiling of spectrum.
- Provide incentives to move to less congested spectrum.
- Provide incentives to hand back spectrum that is not needed.
- Encourage users to switch to spectrally efficient technologies.
- Reflects the relative economic value of spectrum
- Be forward looking, technologically neutral and sustainable.
- Be user friendly and easy to implement.
- Be flexible and be tuneable to meet alternative spectrum fee revenue objectives.
- Stimulate economic growth.

- Be appropriate for Swaziland conditions and SCCOM resources.

The new Spectrum pricing formula and Spectrum fee schedule seeks to address the following:

- Maintain the status quo on the technical evaluation and computation of spectrum fees.

- Determine the new unit price that shall be applicable for the review period of the spectrum pricing schedule.

- Consideration of developments in the Amateur space where new agreements have been forged with the international community and review the spectrum pricing for both Satellite and Terrestrial Amateur services.

- Consider future technological developments in the mobile space such as IMT 2020 which require a different approach in the Spectrum pricing when considering the size of bandwidth required for such technologies.

2 Technical Evaluation and computation of fees

The proposed model still maintains an administrative pricing model with incentives to promote the efficient use of spectrum and national development. It promotes the use of higher frequency bands by incentivising them with a cost reduction factor. The new model charges licensees for the spectrum they use, incentivises them to only use the spectrum they need and to use such spectrum efficiently. It is also intuitively fair to all users, especially as a uniform Unit Price is charged. The model is structured in such a way that it allows for technology and service neutrality and it also allows for spectrum users to work on different parameters in order to manage their operational costs. It also allows for initiatives such as spectrum refarming without additional cost which are essential in the development of technologies.

The model maintains the four formulae consisting of several factors as follows:

Point to Area Formula

Fee = (UNIT * FREQ-M * BW * HD * SHR * AF)

Point to Point Formula

Fee = (UNIT * FREQ-F * BW *HD * SHR * HOPMINI)

Hub Ground Station Satellite Formula
Hub ground station Fee = Max ($_{UL}$; UNIT * BW_{UL})

Non-hub VSAT Ground Station Satellite Formula
Non-hub VSAT Fee = Max ($_{VSAT}$; UNIT * BW_{UL})

The factors used in in the model are defined as follows:

UNIT	Unit Price per MHz of assigned spectrum
BW	Bandwidth in MHz being the total unpaired assigned bandwidth
FREQ-F	Frequency factor that is based on the propagation characteristics of the frequency locations meaning that higher frequencies cost less than lower frequencies, applicable for Terrestrial Fixed services
FREQ-M	Frequency factor that is based on the propagation characteristics of the frequency locations meaning that higher frequencies cost less than lower frequencies, applicable for Terrestrial Mobile services
HD	High Demand Factor set by the Commission for spectrum in High Demand which may include spectrum subject to congestion

SHR	Sharing factor that gives a discount of 50% to licensees who are prepared to share spectrum
AF	Area Factor that reflects the land area covered by a point to area assignment based on the radial distance that corresponds to the area in square kilometres
HOPMINI	Minimum Hop Length, which will be applied to point to point links and penalises licensees who make undue use of low frequency bands for links with relatively short hop lengths
BW_{UL}	The bandwidth of the uplink connection
$\$_{UL}$	The current minimum fee for Hub satellite ground station uplink connections
$\$_{VSAT}$	The current minimum fee for non- hub satellite ground station uplink connections

The HOPMINI factor is still set at one (unity) until the next review in order to allow the hop lengths to be calculated. The High Demand factor imposes a premium on certain "High Demand" frequency bands, as designated by the Commission. This factor is used instead of a congestion factor. The frequency band to which the High Demand factor will be applied may be updated by the Commission during its triennial reviews.

The frequency factor FREQ has been replaced by two factors namely, FREQ-M and FREQ-F which are the frequency factors for mobile and fixed services respectively.

3   The Unit price

The unit price is equal to the equivalent value of 1MHz of Spectrum being issued to communications service providers. This review assesses the Unit Price which was originally set to be at SZL 2,000 for three years. The new value for 1MHz of spectrum reflects an annual increase of 4% over the three-year period, however the Commission has taken into consideration the prevailing circumstances in the communications sector as well as future projections to waive the increment for the first year and set the unit price for the next three (3) year cycle to be as follows:

2021/2022   SZL 2000

2022/2023   SZL 2080

2023/2024   SZL 2164

4   Technological advancements

The developments of new technologies and systems warrant the continuous review of the spectrum licensing regime. Services like the Amateur stations are being regulated differently because of the limited economic value they bring into the world today, they are more of a social medium of communication, even though they can also be used albeit in a very small scale in case of emergencies and disasters. This has prompted the review of the pricing for amateurs to bring it down to the levels adopted across the globe and guided by the ITU. The application fee for amateurs has been removed and the price for license has been reduced significantly to SZL 148.00.

Furthermore, with the in-advent development of communications technologies such as IMT 2020 which is already being implemented worldwide covering different sectors of the economy, the pricing of spectrum has to be more of an enabler than a hindrance to the development of new technologies. IMT 2020 requires a larger bandwidth in order to operate effectively and based on the current pricing

framework, it would be impossible to justify the cost of spectrum used for technologies such as 5G, therefore there was an adjustment that was made on the formulae for calculating the pricing which incorporates these bandwidth requirements. The new factors are as shown in the table below as highlighted.

Frequency Band	Centre Frequency	FREQ-M Factor
VLF	3-30 kHz	1.2
LF	30-300 kHz	1
MF	0.3-3 MHz	0.87
HF	3 - 30 MHz	0.7
VHF	30 - 300 MHz	0.54
UHF	0.3 - 1 GHz	0.38
UHF	1 - 3 GHz	0.29
SHF	3 - 5 GHz	0.084
SHF	5 - 30 GHz	0.042
EHF	30 - 60 GHz	0.032
EHF	above 60 GHz	0.01

The New Schedule

Spectrum Fee Schedule 2021

The Eswatini Communications Commission ('the Commission') hereby publishes a revised Spectrum Fee Schedule, in terms of section 17 of the Electronic Communications (Radio Communications and Frequency Spectrum) Regulations 2016) ('the Spectrum Regulations') which thereby, with effect from 1st April 2021 repeals the spectrum fee schedule 2018 for radio frequency spectrum license fees.

Schedule

1. Definitions

In this Schedule, unless the context otherwise requires –

$\$_{UL}$	means the minimum fee for satellite uplink connections
Act	means the Electronic Communications Act, 2013
AF	means Area Factor
Area Factor	means a factor that is applied to reflect an area that is denied to other users of a frequency assignment
Amateur	means a person who is interested in the radio technique solely for a private reason and not for financial gain and to whom the Commission has granted an amateur radio station licence and shall mean a natural person and shall not include a juristic person or an association: provided that an amateur radio station licence may be issued to a licensed radio amateur acting on behalf of a duly founded amateur radio association
Assignment	means the authorisation given by the Commission to a licensee to use a radio frequency or radio frequency channel under specified conditions
BW_{UL}	means the uplink bandwidth in MHz
BW	means Bandwidth Factor
Bandwidth Factor	means the total unpaired bandwidth assigned to a licensee in MHz
EHF	means Extremely High Frequency
FDD	means Frequency Division Duplex
FREQ-F	means Frequency band Factor for fixed services
FREQ-M	means Frequency band Factor for Mobile services
Frequency band Factor	means a factor that is based on the propagation characteristics of the frequency locations meaning that higher frequencies cost less than lower frequencies.
GHz	means Gigahertz of Radio Frequency Spectrum;
HD	means High Demand factor
High Demand Factor	means factor set by the commission for spectrum that is considered to be in high demand, which may include spectrum subject to congestion
HOPMINI	means minimum hop length factor

Minimum Hop Length Factor	means factor which will be applied to point to point links and penalises licensees who make undue use of low frequency bands for links with relatively short hop lengths
kHz	means Kilohertz of radio frequency spectrum
Land mobile service	means a mobile radio-communication service between fixed stations and mobile land stations, or between land mobile stations
LF	means Low Frequency
LMR	means Land Mobile Radio
MHz	means Megahertz of radio frequency spectrum;
Minimum Fee	means the minimum fee paid for a radio frequency spectrum licence
PMR	means private mobile radio
PtM	means Point to Multipoint
PtP	means Point to Point
SHF	means Super High Frequency
SHR	means Sharing Factor
Sharing Factor	means factor that affords a discount for the sharing of spectrum
TDD	means Time Division Duplex
UNIT	means unit price
UHF	means Ultra High Frequency
UL	Uplink
VHF	means Very High Frequency
VLF	Very Low Frequency
VSAT	means Very Small Aperture Terminal and is a two-way satellite ground station that is smaller than 3 metres in diameter

2. Intentions of the Commission

(a) The intention of the Commission is to publish a revised system of spectrum fees that are in line with the Spectrum Regulations and meet the following criteria:

   i. Promote efficient use of spectrum

   ii. Prevent stockpiling of spectrum

   iii. Provide incentives to move to less congested spectrum

   iv. Provide incentives to hand back spectrum that is not needed

    v.   Encourage users to switch to spectrally efficient technologies

    vi.   Reflects the relative economic value of spectrum

    vii.   Be forward looking, technologically neutral and sustainable

    viii.   Be user friendly and easy to implement

    ix.   Be flexible and be tuneable to meet alternative spectrum fee revenue objectives

    x.   Stimulate economic growth

    xi.   Be appropriate for Swaziland conditions and the Commission's resources.

3. Pricing Approach

(a) The Commission shall adopt a pricing formula that reflects the relative economic value of radio frequency spectrum in order to:

    i.   encourage the efficient usage of radio frequency spectrum and stimulate growth.

    ii.   Discourage hoarding of Spectrum

    iii.   To provide transparency in Spectrum pricing

(b) The price of radio frequency spectrum shall be directly proportional to the size of radio frequency spectrum assigned.

(c) The price of radio frequency spectrum shall vary depending on the frequency band.

(d) The price of the radio frequency spectrum may also reflect all or some of the following factors:

    i.   the area sterilised (denied to other users),

    ii.   the propagation characteristics,

    iii.   whether the band in question is determined to be in high demand or not,

    iv.   the degree of sharing and the minimum hop length of an assignment of a single link.

(e) The fees payable for radio frequency spectrum shall be at least sufficient to cover the costs of radio frequency spectrum management and monitoring.

4. Application Fees

(a) The standard application fees are provided in Annexure A.

(b) Application Fees for cellular bands and any other bands identified by the Commission will be specified in an invitation to apply or otherwise separately.

5. Annual Fee Determination

(a) The annual fees payable for each category of radio frequency spectrum shall either be determined by a pricing formula as described in this Schedule or by application of the minimum fee.

(b) The unit price per MHz of frequency spectrum is as stated in Annexure B to this Schedule and may be reviewed from time to time as directed by the Spectrum Regulations.

6. Exceptions

(a) Equipment that is licence-exempt as determined by the Spectrum Regulations is not subject to a radio frequency spectrum licence fee.

(b) For short duration licenses, the spectrum fees shall be prorated based on the license period.

7. Formulae

The following formulae shall be used:

(a) Point-to-area formula

Applied to all point to area services except for amateur and aeronautical with exclusive band assignments.

Fee = (UNIT * FREQ-M * BW * HD * SHR * AF)

The fee is the multiplication of the unit price (UNIT) by the frequency factor (FREQ-M), the bandwidth (BW) in MHz, the high demand factor (HD), the sharing factor (SHR) and the area factor (AF).

(b) Point-to-point formula

Applied to all fixed links whether below or above 1GHz. The formula is as follows:

Fee = (UNIT * FREQ-F * BW *HD * SHR * HOPMINI)

The fee is the multiplication of the unit price (UNIT) by the frequency factor (FREQ-F), the bandwidth factor (BW) in MHz, the high demand factor (HD), the sharing factor (SHR) and the minimum hop length (HOPMINI).

(c) Hub Ground Station Satellite Formula

The fee for a principle hub station for uplink is determined by the following fee:

Hub ground station Fee = Max ($UL; UNIT * BWUL)

The fee is either the multiplication of the unit price (UNIT) by the uplink bandwidth (BW_{UL}) in MHz or $\$_{UL}$, the minimum fee for satellite uplink connections, depending on which yields the largest value.

(d) Non-hub VSAT Ground Station Satellite Formula

The fee for a non-hub Very Small Aperture Station for uplink is determined by the following fee:

Non-hub VSAT Fee = Max ($VSAT; UNIT * BWUL)

The fee is either the multiplication of the unit price (UNIT) by the uplink bandwidth (BW_{UL}) in MHz or $\$_{VSAT}$, the minimum fee for non-Hub VSAT stations, as determined by the Commission, depending on which yields the largest value.

8. Factors and Look-up Tables

(a) Unit Price (UNIT) – UNIT is applied per MHz of bandwidth. The value of UNIT is provided in Annexure B.

(b) Bandwidth (BW) – BW is expressed as the total unpaired bandwidth assigned to a licensee in MHz.

(c) Frequency factor (FREQ-F) - The FREQ-F values associated with various frequency ranges are as follows:

Frequency Band	Centre Frequency	FREQ-F Factor
VLF	3-30 kHz	1.2
LF	30-300 kHz	1
MF	0.3-3 MHz	0.87
HF	3 - 30 MHz	0.7
VHF	30 - 300 MHz	0.54
UHF	0.3 - 1 GHz	0.38
UHF	1 - 3 GHz	0.29
SHF	3 - 8 GHz	0.21
SHF	8 - 30 GHz	0.14
EHF	above 30 GHz	0.05

(d) Frequency factor (FREQ-M) - The FREQ-M values associated with various frequency ranges are as follows:

Frequency Band	Centre Frequency	FREQ-M Factor
VLF	3-30 kHz	1.2
LF	30-300 kHz	1
MF	0.3-3 MHz	0.87
HF	3 - 30 MHz	0.7
VHF	30 - 300 MHz	0.54
UHF	0.3 - 1 GHz	0.38
UHF	1 - 3 GHz	0.29
SHF	3 - 5 GHz	0.084
SHF	5 - 30 GHz	0.042
EHF	30 - 60 GHz	0.032
EHF	above 60 GHz	0.01

(e) High Demand Factor (HD) – The HD values are as follows:

HIGH DEMAND	HD
High Demand	2
Not in High Demand	1

    i.   The High Demand frequency bands will be determined by the Commission.

(f) Sharing Factor (SHR) – The SHR values associated with the various degrees of sharing are as follows:

Sharing	Value of sharing factor
Exclusive	1
Shared	0.5

    i.   Sharing is considered to exist in instances where two or more licensees share a common frequency assignment within a common geographical area.

(g) Area Factor (AF) - The following table shows the various values of AF:

Area (sq km)	AF
0-1	0.6
1-10	1.8
10-100	5.6
100-1000	17.8
1000-5000	39.9
5000-10,000	56.4
10,000 above	73.6

(h) Minimum hop length (HOPMINI) - The following table shows the minimum path lengths by frequency. Frequencies not appearing specifically in this table shall be rounded to the next highest value in the table.

Frequency Band	Min Path Length (Km)
400 MHz	100
800 MHz	60
1.4/1.6/2 GHz	30
4 and 5 GHz	16
7.5 GHz	14
10 and 11 GHz	10
13/14/15 GHz	9
17/18 GHz	4
22/23 GHz	3
25/26 GHz	3
28 GHz	2
31 and 32 GHz	1.5
38 GHz	1
Higher	0

(i) Where the actual path length of the licensee's link is shorter than the minimum path length for the frequency, the HOPMINI factor in the formula shall be calculated as the square root of the ratio between the minimum path length for the frequency requested and the actual path length of the licensee's link SQRT(Minimum Path Length for the Frequency / Actual Path Length).

(ii) Where the actual path length is equal to the minimum path length for frequency spectrum, the value of HOPMINI in the formula will be 1.

9. Minimum Fees

(a) The Minimum Fees are as stated in the Annexure B.

(b) The Minimum fees are applicable to the services as defined in Annexure A.

(c) Where the radio frequency spectrum licence fee computed by the relevant formula is lower than the minimum fee, then the minimum fee shall apply.

(d) For satellite hub uplink stations, the minimum fee for satellite hub uplink stations shall apply.

Annexure A   SPECTRUM LICENSE FEES SUMMARY

Description		Application Fee	Formula
1	**Land Mobile Services (non-cellular)**		
1.1	Mobile two-way radio stations	SZL 1,000.00	Point to Area formula
1.2	Cross Border	SZL 1,000.00	Point to Area formula (land area within Swaziland)
1.3	Alarm system including base station with remote stations	SZL 1,000.00	Point to Area formula
1.4	Paging systems	SZL 1,000.00	Point to Area formula
2	**Satellite Services**		
2.1	Earth station/ VSATs -Transmit/ Receive (TX/RX) - Corporate	SZL 1,000.00	Satellite or VSAT formula
2.2	Earth Station / VSATs – Transmit/Receive – Solar and Heliospheric Observatory (SOHO)	SZL 1,000.00	Satellite or VSAT formula
2.3	Amateur	Nil	Minimum Price
2.4	Terminal for radio determination services	SZL 1,000.00	Point to Area formula
2.5	Landing rights:	SZL 1,000.00	Point to Area formula
3	**Radio-determination/Aeronautical Services**		
3.1	Aeronautical stations (per airport)	SZL 1,000.00	Minimum Price
3.2	Aircraft Licence (per aircraft)	SZL 1,000.0	Minimum Price
3.3	Radio - operators Certificate	Nil	Nil
3.4	Aeronautical earth station	SZL 1,000.0	Minimum Price
3.5	Radiolocation stations e.g. Radar	SZL 1,000.0	Minimum Price
4	**Fixed services**		
4.1	Point to Point Link	SZL 1,000.00	Point to Point formula
4.2	Point to Multi-Point Link	SZL 1,000.00	Point to Area formula
4.3	Amateur Radio	Nil	Minimum Price
5	**Telemetry/Tele-command: e.g. radio equipment for measuring seismic movements**	**SZL 1000.00**	Point to Area formula
6	**Broadcasting Services**		
6.1	Sound		
6.1.1	MF-AM	SZL 1,000.00	Point to Area formula
6.1.2	HF-AM	SZL 1,000.00	Point to Area formula
6.1.3	VHF-FM	SZL 1,000.00	Point to Area formula
6.2	Television		
6.2.1	VHF	SZL 1,000.00	Point to Area formula
6.2.2	UHF	SZL 1,000.00	Point to Area formula
7	**Land Mobile Services (Cellular)**	Application Fees will be specified in the invitation to apply.	Point to Area (max AF) and max HD Factor

Annexure B

A   The Unit Price per MHz paired is as follows:

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2021/2022	SZL 2000
2022/2023	SZL 2080
2023/2024	SZL 2164

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B   The Minimum Fee for Amateur is SZL 148

C   The Minimum Fee is SZL 500

D   The Minimum fee for a Satellite Hub Station is SZL 15,000

E   The Minimum fee for non-Hub VSAT stations, is SZL 2,500

F   The HOPMINI Factor will be 1 for all point to point assignments until otherwise determined by the Commission

G   The High Demand Factor of 2 is applied to Land Mobile Cellular Services.