BENCHMARK OF PRICING METHODS FOR THE USE OF FREQUENCIES FOR MICROWAVE LINKS OF PUBLIC NETWORKS IN NINE AFRICAN COUNTRIES

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« Spectrum Management:Economic Aspects »
Teheran – 21-23 November 2016

Benchmark context

Goal: Determine the methods for the calculation of frequency usage fees for microwave links in 9 countries.

Methods :

- Interviews and meetings with regulators in each visited country ,
- Review of collected regulatory reports and texts.

Period: 29/02/2016-02/04/2016

Benchmark context

Visited countries:

BENCHMARK OF PRICING METHODS FOR THE USE OF FREQUENCIES FOR MICROWAVE LINKS IN NINE AFRICAN COUNTRIES

Pricing methods

Based on	Capacity	Number of used RF channels/ frequencies	Zone	Channel re-use	Frequency Band	Bandwidth
Cameroon	X	X				
Ivory Coast	X					
Chad		X	X			X
Kenya			X		X	X
Mali	X			X	X	
Ghana		X		X	X	X
Senegal	X					
Uganda		X		X	X	X
Nigeria		X			X	X
Mauritius					X	X

Cameroon

Frequencies usage fees:

- Link capacity ≤ 8 Mbits/s : 7 164 $
- 8 Mbits/s< Link capacity≤ 34 Mbits/s :11 943 $
- Link capacity > 34 Mbits/s: 31 182 $
- $K=1+ (N-1)/10$, N = number of radio frequencies channels used on the same link

Ivory Coast

Frequencies usage fees:

- Link capacity ≤ 8 Mbits/s : 9 686$
- 8 Mbits/s < Link capacity ≤ 34 Mbits/s :17 434 $
- 34 Mbits/s< Link capacity ≤ 70 Mbits/s : 24 215 $
- Link capacity > 70 Mbits/s : 29 058 $

Chad

Frequencies usage fees:

Total fees $= [835 \$ * (N_i)(1/2)] * k + C_f * N_f * \Delta f / 7$:

- N_i : Number of links (Link= couple of frequencies),
- N_f : Number of frequencies allocated to the operator,
- $k=2$ for the cities of N'Djaména, Moundou, Abéché and Sarh, $k=1$ for other cities;
- Δf : Bandwidth
- $C_f = 500$ \$ if $\Delta f \geq 7$ MHz and 83 \$ if $\Delta f < 7$ MHz.

Kenya

Frequencies usage fees:

$$\text{Fees/Transmitter} = (\text{RFBW}/8{,}5 \text{ kHz}) \times K_1 \times \text{Unit fee} \times F_Z$$

- Unit fee= 5,6 $
- K_1: frequency band factor,
  = 0,9 for frequency band ≤ 1 GHz
  = 0,3 for frequency band > 1 GHz and ≤ 10 GHz
  = 0,21 for frequency band > 10 GHz and ≤ 20 GHz
  = 0,15 for frequency band > 20 GHz and ≤ 30 GHz
  = 0,1 for frequency band > 30 GHz
- RFBW : RF bandwidth in KHz
- F_Z Zone factor
  = 1 for Zone A,
  = 0,5 for Zone B.
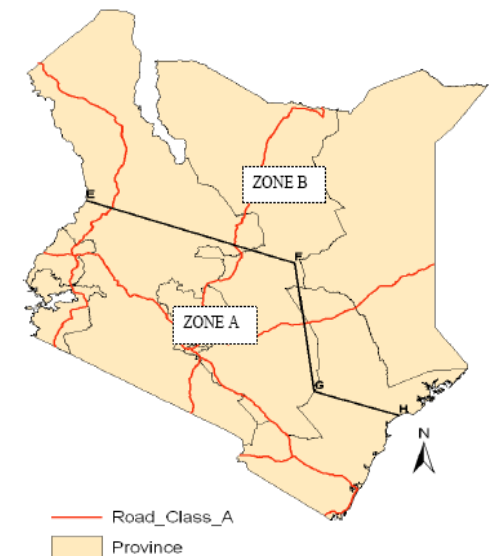
ZONE B

ZONE A

— Road_Class_A

Province

Mali

Frequencies usage fees:

[1-3] GHz Frequency band and according to channel capacitiy :
  9,6 Kbps to 2 Mbps : 890 $,
  2 Mbps to 4 Mbps : 1 057 $,
  4 Mbps to 8 Mbps : 1 224 $,
  8 Mbps to 34 Mbps :1 391$,
  Beyond 34 Mbps and for each 10 Mbps) : 167 $,
Frequency band > 3 GHz : 25% less on tariffs mentioned above.

Number of stations	Degressivity factor
Up to 5 stations	1
6 to 15	0,8
16 to 25	0,6
26 to 35	0,4
Over 35	0,2

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Ghana

Frequencies usage fees:

$$\text{Total fee} = N * \alpha * \beta * \gamma * \text{Unit fee}$$

α : band factor :
    6/7/8 GHz bands, $\alpha=1$
    13 GHz band, $\alpha=0,8$
    15-18 GHz bands, $\alpha=0,7$
    19-23 GHz bands, $\alpha=0,5$.

β : bandwidth factor :
    Bandwidth = 3,5 MHz, $\beta= 1$,
    Bandwidth = 7 MHz, $\beta= 2$,
    Bandwidth = 14 MHz, $\beta= 4$,
    Bandwidth = 28 MHz, $\beta= 8$,
    Bandwidth > 28 MHz, $\beta= 16$.

γ : Congestion factor (Channel re-use factor) :
    1-19 links : $\gamma=1$,
    20-30 links : $\gamma=0,875$,
    31-40 links : $\gamma=0,75$,
    41-50 links : $\gamma=0,625$,
    $\geq$ 50 links : $\gamma=0,5$.

N : Total number of links where RF channel is used.

Unit fee = 250$

Senegal

Frequencies usage fees:

Capacity	Annual fees
< 2 Mb/s	3 340 $
≥ 2 Mb/s and < 8 Mb/s	6 680 $
≥ 8 Mb/s and < 34 Mb/s	10 020 $
≥ 34 Mb/s and < 70 Mb/s	13 360 $
≥ 70 Mb/s and < 140 Mb/s	16 700 $
≥ 140 Mb/s	20 040 $

Uganda

Frequencies usage fees :

$$FM = U_p \times K_1 \times BW \times N_F \times F_r$$

- Up=130 \$ per transmit frequency per site
- K_1:Frequency band factor, where :
    - K1=0,7 for f ≤8GHz,
    - K1=0,6 for 8GHz<f ≤ 15GHz,
    - K1=0,5 for 15GHz<f ≤23GHz,
    - K1=0,4for 23GHz<f ≤38GHz,
    - K1=0,3for f>38GHz.
- N_F= Number of same transmit frequency in the network,
- BW : Bandwidth,
- F_r frequency re-use factor, where :
    - F_r= 1 for first 10 frequencies reuse,
    - Fr =0,3 for next 10 frequencies reuse,
    - Fr =0,1 for frequencies reuse >20

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Nigeria

Frequencies usage fees :

$$\text{Fee per hop} = \text{Unit fee} * F_1 * F_2 * N$$

- F_1:Band factor :
    - 1-4 GHz, $F_1 = 1,2$
    - 6/7/8 GHz, $F_1 = 1$
    - 13 GHz, $F_1 = 0,8$
    - 15-18 GHz, $F_1 = 0,7$
    - 19-25 GHz, $F_1 = 0,5$.
- F_2 : Bandwidth factor :
    - BW= 3,5 MHz, $F_2 = 1$,
    - BW= 7 MHz, $F_2 = 2$,
    - BW= 14 MHz, $F_2 = 4$,
    - BW= 28 MHz, $F_2 = 8$,
    - BW=56 MHz, $F_2 = 16$.
- N : Number of RF channel per link,
- Unit fee= 57 $.

BENCHMARK OF PRICING METHODS FOR THE USE OF FREQUENCIES FOR MICROWAVE LINKS IN NINE AFRICAN COUNTRIES-MAURITIUS

Description	Annual fees ($)
Frequency band: [1GHz-3GHz[with bandwidth <1 MHz).	1 170
Frequency band: [1GHz-3GHz [with bandwidth [1MHz-7MHz [	1 755
Frequency band: [1GHz-3GHz [with bandwidth [7MHz-14MHz [	2 340
Frequency band: [1GHz-3GHz [with bandwidth [14MHz-28MHz [	2 926
Frequency band: [1GHz-3GHz [with bandwidth ≥ 28MHz	3 511
Frequency band: [3GHz-5GHz [with bandwidth <1 MHz	836
Frequency band: [3GHz-5GHz [with bandwidth [1MHz-7MHz).	1 254
Frequency band: [3GHz-5GHz [with bandwidth [7MHz-14MHz).	1 672
Frequency band: [3GHz-5GHz [with bandwidth [14MHz-28MHz).	2 090
Frequency band: [3GHz-5GHz [with bandwidth ≥28 MHz.	2 508
Frequency band: [5GHz-8GHz [with bandwidth < 1MHz)	668
Frequency band: [5GHz-8GHz [with bandwidth [1MHz-7MHz)	1 003
Frequency band: [5GHz-8GHz [with bandwidth [7MHz-14MHz)	1 337
Frequency band: [5GHz-8GHz [with bandwidth [14MHz-28MHz).	1 672
Frequency band: [5GHz-8GHz [with bandwidth ≥ 28MHz	2 006
Frequency band: [8GHz-10GHz [with bandwidth < 1 MHz).	500
Frequency band: [8GHz-10GHz [with bandwidth [1MHz-7MHz)	752
Frequency band: [8GHz-10GHz [with bandwidth [7MHz-14MHz).	1 003
Frequency band: [8GHz-10GHz [with bandwidth [14 MHz-28MHz).	1 254
Frequency band: [8GHz-10GHz [with bandwidth ≥ 28MHz).	1 504
Frequency band: ≥10GHz with bandwidth < 1 MHz.	334
Frequency band: ≥10GHz with bandwidth [1 MHz-7MHz [.	500
Frequency band: ≥10GHz with bandwidth [7 MHz-14MHz [.	668
Frequency band: ≥10GHz with bandwidth [14 MHz-28MHz [	836

Synthesis

Country	Strengths	Weaknesses
Senegal	NA	❖ The model does not take into account the frequency band, ❖ Revenue generated by the regulator does not cover the expense of the latter, ❖ Princing based on the capacity does not take into account technological advances.
Uganda	❖ The model takes into account the frequency bands and promotes the use of high frequencies, ❖ The model takes into account the bandwidth	NA
Nigeria	❖ The approach is simple, ❖ Fees are easy to calculate.	The model does not take into account the reuse factor.
Mauritius	The model takes into account the frequency bands and bandwidths	The model does not take into account the reuse factor.
Ivory Coast	NA	❖ This regulation is old and is based on 1997 technology, ❖ Spectrum pricing ignores frequency bands, ❖ Pricing considers only the capacity and not the used bandwidth; this forces the regulator to check with the operator the capacity and make it match with the appropriate bandwidth.

Synthesis

Country	Strengths	Weaknesses
Cameroon	NA	❖ This regulation is old and is based on 1997 technology, ❖ Spectrum pricing ignores frequency bands, ❖ Pricing considers only the capacity and not the used bandwidth; this forces the regulator to check with the operator the capacity and make it match with the appropriate bandwidth.
Chad	Frequencies fees do not depend on technology but on frequency band.	The method is complicated and difficult to implement
Kenya	❖ The approach is simple, ❖ Frequency usage fees is based on frequency bands which can promote the high bands.	Although the formula favors the zone B to zone A, operators still refuse to invest in Zone B for reasons related to security and lack of infrastructure.
Mali	❖ The approach is simple, ❖ The model takes into account the capacity and the frequency bands.	Pricing based on the capacity does not take into account technological advances.
Ghana	❖ The approach is simple, ❖ Fees are easy to calculate.	NA

Thank you!

- ➢ Adress : **81, Hédi CHAKER Street, 1002, Tunis– TUNISIE**
- ➢ Tel. : **+216 71 845 248**
- ➢ Fax : **+216 71 845 249**
- ➢ Contact : **info@sfmtelecom.com**
- ➢ Web site: **www.sfmtelecom.com**