Information & Communication Technologies Authority

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RESPONSE TO CONSULTATION PAPER ON THE OPENING OF 700 MHz AND 800 MHz BANDS FOR IMT-ADVANCED

8 May 2019

1. Background

The Authority released a consultation paper on 18 June 2018 on the opening of the 700 MHz and 800 MHz bands for IMT-Advanced. Comments were invited from stakeholders by 20 July 2018. The Authority has received comments from (i) MBC, (ii) MCML, (iii) MTML, (iv) Emtel and (v) Cellplus Communication Ltd.

This paper summarises the comments received for each consultation questions and gives the views of the Authority accordingly. The paper finally gives an action plan for the opening of the said frequency bands. In the light of the actions that have been identified, the initial target of 30 June 2019 will have to be postponed.

2. Assessing Interest in the 700 MHz and 800 MHz band and Opening Options

The prime objective of the consultation exercise was to gauge the level of interest from PLMN operators in the 700 MHz and 800 MHz bands, the timeframe within which they plan to start the deployment of networks using these frequency bands and the preferred option for the opening of the frequency bands.

The aim of the Authority in consulting stakeholders on the above is to minimize disruption to existing operations in the frequency bands of interest as well as ensuring that customers and society benefit from the timely operation of mobile networks in the said frequency bands.

The consultation document proposed two options with respect to the opening of the two frequency bands. These options are summarised as follows:-

(i) Option 1: Opening the 800 MHz band prior to 30 June 2019 and 700 MHz band after that date;
(ii) Option 2: Opening both 700 MHz and 800 MHz bands after 30 June 2019

Option 1 was further divided into two sub-options named Option 1a and Option 1b. In option 1a the full 800 MHz band (i.e. 30 MHz) was proposed to be made available prior to 30 June 2019 whereas in option 1 b only half of the 800 MHz band (i.e. 15 MHz) was proposed to be made available prior to 30 June 2019 in order provide for a guard band of 16 MHz between the LTE800 downlink and the DTTB Channel 60.

Below are the consultation questions with a summary of the responses received.

Q1. Please indicate your interest, as a PLMN operator, for operating in the 700 MHz and 800 MHz bands. Kindly also indicate the time frame within which you plan to start any deployment in the said bands

All three PLMN operators expressed their interest in operating in the 700 MHz and 800 MHz bands.

Emtel has indicated that it would deploy its network using the 800 MHz band within six to eight weeks as from the date of award and using the 700 MHz band six month after award. Cellplus on its side has indicated that it would be ready to deploy as from June 2019. MTML however indicated that it does not intend to use the band in the next two years. They have also indicated that clearing the 800 MHz band from CDMA2000 may only take place after December 2019.

Q2. Please provide your substantiated preference with respect to Options 1a, 1b and 2 above. Please indicate any other appropriate options that may be considered.

MTML and Cellplus have shown their preference for option 2 whereas EMTEL is for Option 1a

2.1 Views of the Authority

It is clear from the received contributions that there is interest from the mobile operators for spectrum in the 700 MHz and 800 MHz bands even if the timeframes for network deployment vary between six weeks to two years. Both Emtel and Cellplus have highlighted the added benefits that may be derived from operation in those frequency bands. These added benefits relate to better propagation characteristics of the bands, better indoor coverage and more stable communication while in motion at high speeds. Cellplus has indicated there preference for spectrum in the 800 MHz band as compared to the 700 MHz band.

It is understood from the contributions received that Emtel has a preference for Option 1a. The main drawback of opening the bands at different times is that filters will have to be provided on two separate occasions given that as of now, filters that have been found to be available on the market cover the 700 MHz and 800 MHz bands separately. The decision for the preferred option will therefore be taken in the light of the field test.

3. Field Test Methodology

A field test methodology has been proposed in the consultation document. The objective of the test is to obtain an on field appreciation of the effect of operating LTE in the 800 MHz band on DTTB reception. The test also should provide an indication of the number of affected households and hence an estimate of the cost of providing filters. Below is a summary of the responses received to the consultation questions:-

Q3. Please provide your general comments with respect to the proposed field test methodology.

MTML suggests a joint team of all operators along with ICTA and MCML to conduct the field test so as to avoid a waste of resources. Cellplus requests to take predictive modelling into consideration.

Q4. Please indicate the maximum EIRP at which the tests may be conducted.

Cellplus: 52 dBm
Emtel: 60 dBm

Q5a. For the purpose of the field test, kindly propose candidate LTE800 DTTB receiver filters, including their technical characteristics.

Emtel suggested Prism DVB-T protection filters with the following technical characteristics:-

Pass-band	100 – 790 MHz
Return loss	≥12 dB
Insertion Loss	100 – 778 MHz ≤ 1.0 dB, typical 778 – 786 MHz ≤ 2.0 dB
Insertion Loss variation	782.19 – 789.81 MHz ≤ 6.0 dB
Attenuation	791 – 793 >15 793 – 821 > 30 832 – 862 > 15
Impedance	75 Ω

Q5b. Kindly also propose candidate LTE700 DTTB receiver filters, including their technical characteristics.

Emtel suggests to use the Macab 700LP Filter with the following technical characteristics:-

Pass-band	5 – 694 MHz
Insertion Loss	2 dB, typical
Rejection Band	703 – 1000 MHz

Emtel also noted that according to its suppliers the 700 MHz filters are not widely deployed.

Q6. For the purpose of the field test, kindly propose candidate LTE800 Base Station Cavity Filters including their technical characteristics.

Emtel suggests the E10923-Double BPF 791-821/ 832-862 MHz, while Cellplus states that there is no need for cavity filters.

The LTE800 Base Station filter proposed by Emtel has the following characteristics:-

Pass-band	791 – 821 MHz and 832 – 862 MHz
Return Loss	≥ 18 dB
Insertion Loss	≤ 1.6 dB
Isolation	55 dB @ 824 – 829 MHz & 869 – 880 MHz
Power handling	50 W AVG (500 W Peak)

Q6b. Kindly also propose candidate LTE700 Base Station Cavity Filters including their technical characteristics.

Emtel suggests E10941 – BPF 703-803 MHz, while Cellplus states that there is no need for cavity filters.

The LTE700 Base Station filter proposed by Emtel has the following characteristics:-

Pass-band	703 – 803 MHz
Return Loss/VSWR	≤ 19 dB/1.25
Insertion Loss	≤ 0.5 dB
Isolation	50 dB @ 824 – 2000 MHz
Power handling	200 W

3.1 Views of the Authority

The need for carrying out field tests has not been disputed by the contributors. Whereas the consultation document has provided for a high level field test methodology, a more detailed methodology will have to be worked out in consultation with all stakeholders. On this score it is recommended that a committee under the aegis of the Authority be set-up in order to work out the testing methodology, the time frame and the communication campaign that will be required to inform televiewers of the potential interference that these tests will create and actions to be taken should any image degradation be experienced.

Emtel has proposed technical characteristics for filters that may be provided to affected households. For the sake of comparison, the filters which are being used in France for the 700 MHz and 800 MHz bands are presented below:-

DVB-T Channel/LTE800 Block	Frequency (MHz)	Attenuation (dB)
Channel 59 (Insertion Loss)	774 – 782	<1.0
Channel 60 (Insertion Loss)	782 – 790	<2.0
LTE800 Block A	791 – 801	>25.0
LTE800 Block B	801 – 811	>25.0
LTE800 Block C	811 – 821	>25.0
Channel 59	782	<1.0
Channel 60	790	<6.0

800 MHz Filter Characteristics[1]

DVB-T Channel/LTE700 Block	Frequency (MHz)	Attenuation (dB)
Channel2 21 - 47	470 - 686	<1.0
Channel 48	686 – 694 694	<2.0
Uplink LTE 700 MHz	698 698 - 733	>5
Duplex Gap	733 – 758	>25.0
Downlink LTE 700 MHz	758 – 788	>25.0
Downlink LTE 800 MHz	791 – 821	>25.0
Uplink LTE 800 MHz	832 – 862	>25.0

700 MHz Filter Characteristics[1]

The Attenuation at the edge of the LTE bands is larger (>25 dB) for the filters used in France as compared to the attenuation between 791 – 793 MHz of the filters proposed by Emtel which present an attenuation of >15 dB. It is to be noted however that the filter proposed by Emtel presents better attenuation characteristics in the band 793 – 821 MHz (>30 dB) as compared to the >25 dB for the filters used in France. As regards attenuation for the 700 MHz filters proposed by Emtel, no information has been provided.

[1] https://www.anfr.fr/fileadmin/mediatheque/documents/sites/Processus_deploiement_LTE_700-800_en_metropole_-012018.pdf

4. LTE800 and LTE700 Uplink to DTTB receiver Interference

The consultation paper indicated that interference between the LTE800 and LTE700 Uplink on DTTB receivers is not expected except in specific circumstances where a combination of effects, including poor TV receiver, poor quality aerial installation with high system gain, an antenna system pointing towards an area with high mobile use and weak DTTB signal level.

A summary of the responses to the consultation questions is given below:-

Q7. Please provide your comments/views with respect to LTE700 and LTE800 Uplink interference to DTTB.

Cellplus depicted several scenarios where uplink interference may potentially take place, especially when the LTE user equipment is outdoors and relative close (22m, assuming 10 m antenna height) to fixed rooftop antennas. Emtel on its part has stated that they do not expect many cases of uplink interference given that there is enough guard band.

4.1 Views of the Authority

The Authority is of the view that the field test will provide more information on the uplink interference to DTTB reception.

5. Co-Existence issues with PMSE (Wireless Microphone) in the 470 – 862 MHz

In the consultation paper, the Authority has highlighted that it has recently started to issue licences to operate PMSE devices in the 470 – 862 MHz band. The Authority proposed to give prior notice to the users of PMSE devices to retune same to the 470 – 694 MHz band.

The responses received to the consultation question is summarised below:-

Q8. Please provide your comments/views with respect to LTE700 and LTE800 interference to PMSE.

Cellplus proposed to re-tune the PMSE equipment within 470 – 694 MHz frequency band. Further, Emtel suggests testing the operation of the PMSE applications in the white spaces and/or duplex gap of frequency band 470 – 862 MHz.

5.1 Views of the Authority

In the light of responses received, the proposal to provide prior notice to PMSE users to retune their devices in view of the opening of the band for mobile services is maintained. The possibility of operating PMSE in the duplex gaps, as proposed by Emtel, may be tested.

6. Co-Existence with other SRDs

The consultation document noted the risk of interference between LTE800 uplink band and Short Range Devices operating on non-interference and non-protection basis in the 862 – 870 MHz band.

The contributions received are summarised below:-

Q9. Please provide your comments/views with respect to LTE700 and LTE800 interference to other SRDs.

Operators agreed that there are risks of adjacent band interference between SRDs and LTE UEs because of the small guard band of 1 MHz. Further, Emtel has proposed that testing for interference

should be made in indoor environments where SRDs and LTE UEs are more likely to co-exist in the same premises.

6.1 Views of the Authority

The Authority is of the view that improvement in SRD receivers operating in the 862 – 870 MHz should help mitigate the risk of interference. The interference from LTE UE into SRDs, occurs at short distances (less than 10 m)[2] and should usually be brief given that the LTE UE would not usually remain at a fixed location.

7. Cost implications

The consultation paper has identified several cost implications related to the opening of the 700 MHz and 800 MHz bands as follows:-

1. Refarming costs to be incurred by MCML in order to migrate the STLs as well as the broadcasting transmitters outside the 694 - 862 MHz band;
2. Interference mitigation costs to be incurred by operators. This includes the cost of additional filtering at the base stations, the cost of providing filters to households and the cost of the communication campaign;
3. Field Test cost to be incurred by:-
    a. Operators regarding equipment to be tested and interference mitigation measures;
    b. ICTA and MCML regarding the receivers to be tested and the measurements to be carried out and;
    c. ICTA and the operators regarding the communication campaign;
8. Costs to be incurred by PMSE and other SRD users in order to mitigate any interference to their system operating on non-interference and non-protection basis.

A summary of the responses received to the consultation questions are provided below:-

Q10. Please provide your comments on the costs identified above, indicating any other cost that has not been identified.

As per MCML, payment for the new replacement of STL link should be borne by the ICTA. Further, MCML suggested that the operators should contribute in the frequency shift exercise given that the latter will share the liberated spectrum which was once reserved for broadcasters.

Should option 1 be favoured, Emtel recommends that the cost of interference mitigation can be shared equitably among all the operators.

Cellplus stated that the interference may not only be due to LTE interference, but may also be due to poor receiver, installation and signal levels. Cellplus is of the view that the setting up of a hotline by mobile operators to record complaints from DTTB users is unfair even if the sharing of such cost may be looked into. The cost for additional filtering used for mobile base stations can be borne by Cellplus, but does not agree to bear the cost for providing filters to households. Further, all communication-related costs to be borne by the ICTA and MCML.

Q11. Please provide your views on the proposal for the equitable interference mitigation cost sharing among operators.

[2] http://ec.europa.eu/DocsRoom/documents/8268/attachments/1/translations/en/renditions/native

MTML does not agree that equitable interference mitigation cost to be shared among operators. According to MTML, all incurred costs should be borne by the Government either from USF or from other funds as this project is in national interest.

Emtel agrees with the proposal for equitable sharing of interference mitigation cost among operators. Further, filters should be supplied by one common contractor, while ICTA be the coordinator between the operator and the contractor in order to ensure the relevant cost are equitably shared.

Cellplus is of the view that operators should be allowed to choose between the 700 MHz and 800 MHz bands and where the latter band is chosen, the mobile operator should perceive any cost advantage as well as bear any technical downside that are associated with the said band.

4.1 Views of the Authority

4.1.1 Clearing of the 800 MHz band from STL Links

As indicated in section 2.0 of the consultation paper, Studio to Transmitter Links (STL) for Private Radio Broadcasting are currently operated by Multicarrier Mauritius Ltd (MCML) in the 790 MHz – 862 MHz. These links will either have to be migrated to another frequency band or be implemented using a wired technology.

In response to the consultation paper, MCML has indicated that the mobile operators should contribute in the clearing of the band given that the latter will derive benefits from the cleared spectrum which was once allocated to Broadcasting Services only.

The Authority shares the view of MCML that neither the broadcasters nor MCML itself should bear the cost of clearing the 800 MHz band. The appropriate funding mechanism will have to be determined in consultation with all parties concerned.

4.1.2 Clearing the 800 MHz band from CDMA2000

MTML which operates CDMA2000 in the 800 MHz band has indicated that it wishes to continue operating the said network at least until December 2019. MTML has indicated that it still has 30,000 customers on the CDMA2000 network. It is the view of the Authority that any cost related to the switching off will have to be borne by MTML itself.

4.1.3 Clearing the 700 MHz band from DVB-T

With respect to the clearing of the 700 MHz band MCML has also indicated that funding would be required to come from the mobile operators.

As for the STLs, the Authority shares the view of MCML that neither the broadcasters nor MCML itself should bear the cost of clearing the 700 MHz band. The appropriate funding mechanism will have to be determined in consultation with all parties concerned.

4.1.4 Clearing the 700 MHz and 800 MHz band from PMSE and other Short Range Devices

The Authority notes that no contribution has been received from the PMSE users community. As such, those who have taken out licences from the Authority will be required to re-tune their devices so that same are restricted within the 470 – 694 MHz band.

4.1.5 **Cost of Protecting DVB-T Reception**

Should option 2, where both the 700 MHz and 800 MHz bands are to be opened concurrently, be adopted, the cost of protecting DVB-T reception is expected to be significantly reduced. The guard band between the 700 MHz downlink band and the closest DVB-T channel should be sufficient to make additional filtering at the operators' base stations unnecessary. This is expected to be the case even for the operator which will be assigned the edge frequency block closest to the Broadcasting band.

Television reception filters on the other hand will still be required and the distribution of same to affected televiewers will have to be funded. From the received contributions, there is no consensus, at this stage, on whether mobile operators should bear the cost of protecting DVB-T reception. Experience from countries which have deployed IMT in the 700 MHz and 800 MHz bands, however, show that operators have borne the cost of remedying television interference including the provision of filters to affected televiewers. A few examples of those countries include UK[3], France[4] and Sweden[5].

Case of the UK

In the UK, Digital Mobile Spectrum Limited (DMSL), which uses the name 'at800' in its communications with the public, is a company which has been set up under Government direction to ensure that televiewers can continue to receive television services either through terrestrial broadcasting or a suitable alternative, when mobile services are put into service at 800 MHz.

DMSL is funded by the UK mobile operators who operate 4G mobile services at 800 MHz. DMSL reports to the 4G/TV Co-existence Oversight Board representing consumers, broadcasters, mobile operators and the regulator, Ofcom.

DMSL is responsible for attending to complaints from televiewers, investigating those complaints and send filters including fitting instructions free of charge to the complainants who may then fit same to their television installation by themselves. In cases where the interference is not resolved, DMSL may send a technician to visit the complainant, free of charge, to investigate the problem.

Case of France

In the case of France, interference complaints are received by the regulator, ANFR. The complaint is thereafter directed to the operators. The latter are under the obligation to address these complaints by sending a technician to the complainant and to resolve same within 72 hours. The technician will install a filter where the origin of the interference has been confirmed to be the operation of mobile services in the 700 MHz or 800 MHz bands. The cost of the intervention in such cases are entirely borne by the responsible operator. In case the source of the problem is linked to the installation of the televiewer, the technician is allowed to propose its services to fix the issue. In this case the cost is borne by the televiewer himself.

Case of Sweden

In Sweden, the licence conditions impose upon licensees to cooperate in view of remedying television interference related to the operation of mobile services in the 800 MHz band. This cooperation includes a joint point of contact where the televiewers may report interference complaints. The

[3] https://at800.tv/about/

[4] https://www.anfr.fr/fileadmin/mediatheque/documents/sites/Processus_deploiement_LTE700-800MHz_metropole_0916.pdf

[5] https://www.pts.se/contentassets/2a002b99e7574e1cbf9b57a3cf9667d3/2012-2013-report-800-mhz-impact-rollout-terrestrial-television-pts-er-2014-23.pdf

commitment to cooperate with other licence holders and remedy television interference was a precondition for participating in the 800 MHz auction. The operators have commissioned Swedish Telecom Advisors as the joint contact to the public. The Swedish Telecom Advisors is an impartial independent organisation that provides free information, guidance and assistance for telephone, TV and Internet consumers.

Upon the occurrence of an interference due to the operation of mobile services in the 800 MHz band, the operator is required to deactivate the equipment causing the interference and keep it turned off until the interference has been remedied. The operators may remedy the problem in various ways including the installation of filters, adjustments to the base stations (e.g. antenna reorientation). The operator who has caused a television interference is required to cover the cost of the measures necessary to remedy the interference.

4.1.6 **Method of Assignment: First-Come-First-Served (FCFS) vs Auctioning**

Frequencies in Mauritius have so far been assigned on a First-come-First-Served (FCFS) basis on the assumption that all frequency assignments are equivalent and that no operator would gain more benefits over a competitor by being awarded a specific frequency block or by being awarded a frequency block before or after its competitors.

This assumption does not hold true with respect to the 700 MHz and 800 MHz bands given that an operator being awarded spectrum first will have to handle interference complaints and the remedial of same by itself. Once that operator would have provided filters to televiewers in the area around its base station, a second comer may benefit from this situation in case its base station is located in the same area as the first operator. Moreover, should operators be allowed to apply for spectrum within their own timeframes, it is believed that no consensus will be reached with respect to cooperation and cost sharing for the protection of DVB-T reception.

In order to avoid this situation and ensure a level playing field, the Authority is of the considered view that assignment using FCFS is not appropriate for the bands of interest.

In this respect, therefore, a more suitable alternative method of assignment will have to be adopted so as to achieve the following objectives:-

1. The total spectrum resource in the 700 MHz and 800 MHz bands are awarded concurrently;
2. The awardees to be responsible collectively and contribute equitably towards the protection of DVB-T reception;

Whether auctioning could be the appropriate method of assignment is yet to be determined even if it is recognised that same could potentially help satisfy the two above-stated criteria. Further, part of the proceeds of the auctioning, when paid up front, could potentially finance the protection of DVB-T reception, including the provision of filters to affected households. It is to be noted however that the legislation, at this stage, does not provide for auctioning of the radio spectrum. The Authority will further study the frequency assignment mechanisms that would be suitable for awarding licences in the bands of interest.

9. Action Plan

As a result of the consultation exercise, the following action plan has been prepared as a worst case scenario timeframe where both the 700 MHz and 800 MHz bands are cleared concurrently. Should it be found during the discussions to be held with stakeholders that it is technically and commercially feasible to clear the 800 MHz band before the 700 MHz band, the timeframe for the opening of the 800 MHz band alone may be shorter. Figure 1 provides a Gantt Chart illustrating the action plan:-

Actions	Comments	Indicative Time Frame
1. Finalise Testing Methodology	The Authority will conduct consultative meetings with all stakeholders in order to define a detailed testing methodology, including the test set-up, regions where tests will be carried out, operators to be involved in the test, filters to be tested, duration of the test etc…	Start of process – beginning of May 2019 End of process – end May 2019
2. Conduct Tests	Tests to be conducted over a proposed period of two months.	Start of process – mid July 2019 (in order to allow for procurement of any equipment necessary for the test) End of process – mid September 2019
3. Define funding mechanisms for the Clearing of the frequency bands	Discussions to be held with the relevant stakeholders on the basis of the conducted tests	Start of process – mid September 2019 End of process – mid December 2019
4. Finalise the schedule for Clearing of the frequency bands	In parallel with the process of defining appropriate funding mechanisms, a time frame for the clearing of the bands will be defined	Start of process – mid September 2019 End of process – mid December 2019
5. Define appropriate assignment mechanisms	The Authority will undertake an appropriate study in view of determining the assignment mechanism to be applied to the 700 MHz and 800 MHz bands	Start of process – mid September 2019 End of process – mid December 2019
6. Define appropriate funding mechanisms for protection of DVB-T reception	In parallel with the above study, the funding mechanism will be defined	Start of process – mid September 2019 End of process – mid December 2019
7. Define process for interference complaint reporting and attending to such complaints		Start of process – mid September 2019 End of process – mid December 2019

8. Televiewers to be informed of changes on DTTB frequencies.	Once the schedule for clearing of the bands have been determined, televiewers will have to be informed of changes in a timely manner.	Start of process – mid December 2019 End of process – end of January 2020
9. Start Clearing of the bands	The 700 MHz band has to be cleared of DVB-T. The 800 MHz band has to be cleared of STL. MTML to clear the 800 MHz band of CDMA by December 2019	Start of process – beginning of February 2020 End of process – End of June 2020
10. The 700 MHz and 800 MHz bands to be made available for assignment		Start of process: July 2020 End of process: End of September 2020
11. Undertake information campaign	An information campaign will have to be conducted informing the public of the changes taking place and of the possibility of interference as well as the measures that may be taken in case interference is experienced. Process will have to take place both on a national level and on regional levels as and when deployment takes place.	Start of Process – Start of October 2020

	Name
1	Finalise Testing Methodology
2	Conduct Tests
3	Define funding mechanisms for the Clearing of the frequency bands
4	Finalise the schedule for Clearing of the frequency bands
5	Define appropriate assignment mechanisms
6	Define appropriate funding mechanisms for protection of DVB-T reception
7	Define process for interference complaint reporting and attending to such complaints
8	Televiewers to be informed of changes on DTTB frequencies
9	Start Clearing of the bands
10	The 700 MHz and 800 MHz bands to be made available for assignment
11	End of project
12	Undertake information campaign