



BERMUDA

**REGULATORY
AUTHORITY**

Fairness ~ Innovation ~ Integrity

**World On Wireless
700 MHz Spectrum Migration Proposal**

**Final Decision
and Order**

Consultation Summary

Final Decision
and Order

Matter: SC-1501-2014

Date: 31 March 2015

TABLE OF CONTENTS

1	DEFINITIONS	2
2	EXECUTIVE SUMMARY	3
3	PROCEDURE	5
3.1	PROCEDURAL HISTORY	5
3.2	SCOPE OF THIS FINAL DECISION AND ORDER	6
4	LEGISLATIVE CONTEXT	6
5	BACKGROUND TO MIGRATION PROPOSAL	7
5.1	WORLD ON WIRELESS	7
5.2	700 MHz SPECTRUM AND THE DIGITAL DIVIDEND	7
6	PRELIMINARY CONSULTATION ISSUES	9
6.1	MIGRATION COSTS.....	9
6.2	MIGRATION TIMELINE PROPOSED BY WOW	9
6.2.1	<i>WOW's proposed timeline relating to implementation of Migration Process set out in Preliminary Consultation</i>	9
6.2.2	<i>Comments on WOW's proposed timeline</i>	9
6.2.3	<i>Authority's Responses to comments on WOW's proposed timeline</i>	10
6.2.4	<i>Migration Milestones</i>	11
6.3	ASSIGNMENT OF 500 MHz BAND	13
6.3.1	<i>Consideration of migration to alternative spectrum bands</i>	13
6.3.2	<i>Possible conflict with future band plans under consideration by the FCC</i>	13
6.3.3	<i>Digicel's recommendation that WOW should only be assigned 30 MHz in the 500 MHz band</i>	14
6.3.4	<i>Possible interference issues raised by CableVision</i>	14
6.3.5	<i>Authority's response to CableVision's concerns</i>	15
6.3.6	<i>Consideration of reserving 608 – 614 MHz for radio astronomy use</i>	16
7	WOW'S RESPONSE TO CONSULTATION ON DRAFT FINAL DECISION AND ORDER	17
8	LICENSING	17
9	FINAL DECISION AND ORDERING CLAUSES	20
9.1	ORDERING CLAUSES	20
APPENDIX A		22
REPORT OF THE AUTHORITY TO THE MINISTER AND DEPARTMENT OF TELECOMMUNICATIONS ON COMMENTS RECEIVED FROM STAKEHOLDERS IN RELATION TO WOW'S MIGRATION COSTS		22
1	INTRODUCTION	23
2	TOTAL MIGRATION COSTS ESTIMATES	23
2.1	COMMENTS ON WOW'S RELIANCE ON ITS EXISTING EQUIPMENT VENDOR.....	24
2.2	AUTHORITY'S RESPONSE TO COMMENTS ON WOW'S RELIANCE ON ITS EXISTING EQUIPMENT VENDOR	24
2.3	SPECIFIC EQUIPMENT AND INSTALLATION ESTIMATES	25
2.4	OTHER ESTIMATES.....	25
2.5	COMMENTS ON WOW'S COST ESTIMATES	26
2.6	COMMENTS ON WHETHER ANY BENEFITS MAY BE CONFERRED ON WOW	26
2.7	AUTHORITY'S RESPONSE TO COMMENTS ON WHETHER ANY BENEFITS MAY BE CONFERRED ON WOW	27

1 DEFINITIONS

1. In this Final Decision and Order, unless the context otherwise requires:

“500 Band Frequencies” means the frequencies between 512 – 608 MHz (Channels 21 – 36, or for the purposes of this proceeding, the 500 MHz band) the Authority has decided to assign to WOW under the 500 Band Transitional Licence to facilitate implementation of WOW's Migration Proposal;

“500 Band Transitional Licence” means the transitional licence that will be granted to WOW to facilitate its migration into the 500 Band Frequencies and will expire 30 weeks from the date it is issued;

“600 Band Frequencies” means the frequencies between 614 – 692 MHz (Channels 38 – 51, or for the purposes of this proceeding, the 600 MHz band) that are being retained by WOW and are not affected by WOW's Migration Proposal;

“600 Band Spectrum Licence” means the ten-year spectrum licence that will be granted to WOW pursuant to this proceeding in accordance with ECA Section 38(7);

“700 Band Frequencies” means the frequencies between 698 – 806 MHz (Channels 52 – 69 or 700 MHz band) currently assigned to WOW under the Current Transitional Licence;

“700 Band Transitional Licence” means the amended Current Transitional Licence that the Authority has decided to amend to facilitate WOW's migration from the 700 Band Frequencies and will expire 30 weeks from the date the amended licence is issued;

“Authority” means Regulatory Authority of Bermuda;

“BDC” means Bermuda Digital Communications Limited;

“BEST Shipping” means Bermuda Export Sea Transfer Limited;

“CableVision” means Bermuda CableVision Limited;

“CPE” means Customer Premises Equipment;

“Channel 37” means the frequencies between 608 – 614 MHz;

“Current Transitional Licence” means WOW's current Transitional Spectrum Licence (Licence Number: 021-WCS-01T) granted by the Authority pursuant to ECA Section 73(2)(c), which allows WOW to use its Currently Assigned Frequencies until the date prescribed in the Authority's FD&O in this proceeding;

“Currently Assigned Frequencies” means the 600 Band Frequencies and the 700 Band Frequencies i.e. 614 – 806 MHz contiguous (covering UHF broadcasting Channels 38 - 69) currently assigned to WOW under Current Transitional Licence;

“Digicel” means Telecommunications (Bermuda & West Indies) Limited;

“DoT” means the Department of Telecommunications;

“ECA” means the Electronic Communications Act 2011;

“FCC” means the United States Federal Communications Commission;

“FD&O” means Final Decision and Order of the Authority;

“Fee Regulations” means the Government Fees Amendment (No. 4) Regulations 2014;

“Government” means the Government of Bermuda;

“GSMA” means Groupe Speciale Mobile Association;

“ICOL” means Integrated Communications Operating Licence;

“ITU” means the International Telecommunication Union;

“MEED” means the Minister of Education and Economic Development;

“MoT” means the Minister of Telecommunications prior to the establishment of the Authority;

“Migration Period” means the period starting 1 January 2015 and ending on the expiry or termination date of the Transitional Licences (i.e. no later than 30 weeks following the issue date of the Transitional Licences);

“Migration Process” means the process by which WOW will vacate the 700 Band Frequencies and complete the transfer of its wireless cable television operations to the 500 Band Frequencies no later than 30 weeks following the date on which the Transitional Licences are issued, in conformity with the provisions of this FD&O and the Transitional Licences;

“Migration Milestones” means the timetable setting out the milestones that WOW shall be required to meet during the Migration Process, as set out in Table 1 of this FD&O;

“Migration Proposal” means those elements of the memorandum prepared by WOW entitled “Implementation & Cut-over Plan” and dated 7 May 2013, pursuant to which WOW will migrate from the 700 Band Frequencies to the 500 Band Frequencies;

“MMDS” means Multichannel Multipoint Distribution Service;

“Post-Migration Frequencies” means the 500 Band Frequencies and the 600 MHz Band Frequencies i.e. the frequencies between 512 – 608 MHz and 614 – 692 MHz (Channels 21 – 36 and 38 – 51);

“Preliminary Consultation” means the consultation entitled "Spectrum Consultation: World on Wireless 700 MHz Spectrum Migration Proposal"; Matter: SC-1501 / 2014, dated 31 January 2014, available at <http://rab.bm/images/PDF/1501.pdf>;

“RAA” means the Regulatory Authority Act 2011;

“Transitional Licences” means the 700 Band Transitional Licence and the 500 Band Transitional Licence;

“UHF” means ultra-high frequency;

“US” means the United States of America;

“VHF” means very high frequency; and

“WOW” means World on Wireless Limited.

2 EXECUTIVE SUMMARY

2. The Authority has decided to approve the Migration Proposal submitted by WOW in response to discussions initiated by the Department of Telecommunications in 2010. Pursuant to the Migration Proposal, WOW agrees to surrender its 700 Band Frequencies (698 – 806 MHz or Channels 52 – 69) so that they may be reallocated and reassigned for mobile communications. In exchange for surrendering these frequencies, WOW has: (1) requested a new assignment in the 500 MHz band by the Authority; and (2) compensation by the Government for

reasonably incurred migration costs as well as clarification from the Government that it will not apply any high-demand spectrum fees that might otherwise be applicable to the frequencies that WOW has volunteered to vacate during the Migration Period¹.

3. Following consideration of the Migration Proposal and comments received in response to the Preliminary Consultation, the Authority reconfirms, in line with the DoT, that an important public interest will be served by clearing frequencies in the 700 MHz band for use by mobile communications services. Along with spectrum in the 800 MHz band, spectrum in the 700 MHz band has been allocated to, and is now being commercialised worldwide for, mobile broadband use. The importance of both of these bands for mobile broadband stems both from the physical propagation characteristics of spectrum below 1 GHz, and the commercialization of these bands by equipment manufacturers for mobile use following the allocation of these bands for that purpose at the ITU level. This includes Region 2, which encompasses Bermuda.
4. The development of mobile Internet services and applications is a policy priority for the Government of Bermuda and the availability of spectrum below 1 GHz, particularly in the 800 MHz and 700 MHz bands, is critical to that objective.
5. WOW's wireless cable broadband services can be delivered in the 500 MHz band without affecting the quality of service, and there is equipment available for the provision of wireless cable that is compatible with use in the 500 MHz band.
6. WOW estimates, conservatively, that the migration could take as long as 30 weeks to complete and the Authority has agreed with WOW certain Migration Milestones that WOW will be required to meet as part of the Migration Process. The Authority has decided to accept the Migration Milestones as the maximum period of time for completion of the migration, and the Transitional Licences will be issued accordingly. However, the Authority is of the view that the Migration Process can be accomplished without disruption to WOW's business or its customers in a shorter period of time. The Authority encourages WOW to take all steps necessary to clear the 700 Band Frequencies as expeditiously as possible so that these frequencies can be made available for re-assignment for mobile communications.²
7. As a consequence, and in order to ensure that WOW makes all reasonable efforts to fully vacate the 700 Band Frequencies and become fully operational in the 500 Band Frequencies in accordance with its Migration Milestones, the Authority has decided to:
 - (a) amend WOW's Current Transitional Licence so that it (1) is limited to assignment of the 700 Band Frequencies, and (2) expires 30 weeks from the date the amended licence is issued;
 - (b) grant WOW a new transitional spectrum licence that (1) assigns WOW use of the 500 Band Frequencies, and (2) expires 30 weeks from the date it is issued; and
 - (c) grant WOW a ten-year spectrum licence re-assigning WOW use of the 600 Band Frequencies that it currently holds (and which are not covered by the Migration Proposal).

¹ The issue relating to the disposition of potentially applicable spectrum licence fees in the 700 MHz band arises

² A separate consultation process will shortly be launched by the Authority to determine the criteria, format and process for re-assignment of available spectrum in the 700 MHz and 800 MHz bands to existing mobile providers and/or new entrants into Bermuda's mobile market.

8. The Authority will take these actions promptly following receipt of a formalized arrangement in writing between the Government and WOW with respect to the issue of compensation for WOW's reasonable migration costs.

3 PROCEDURE

3.1 Procedural History

9. The procedural history of this proceeding is as follows:
 - (a) In 2010, the DoT sent an audit request to all licensees to determine the spectrum assigned to each licensee.
 - (b) In 2012, as part of the DoT's review of spectrum assignments against the FCC Band Plan and changes in ITU allocations, the DoT and WOW met to discuss the need to migrate from the 700 Band Frequencies to the 500 MHz band in order to clear the former for mobile communications.
 - (c) Following discussions with the DoT, on 12 November 2012, WOW submitted to the DoT a memorandum discussing mobile licensees' interest in the 700 MHz Band and WOW's position regarding a potential migration.
 - (d) On 7 May 2013, WOW provided the Authority with a memorandum entitled "Implementation & Cut-over Plan" describing a proposal to migrate out of the 700 MHz band.
 - (e) On 22 November 2013, the Authority sent WOW a series of questions regarding its Migration Proposal.
 - (i) WOW provided written responses on 2 December and 11 December 2013.
 - (f) On 6 January 2014, the Authority sent WOW supplemental questions.
 - (i) WOW provided a written response on 10 January 2014.
 - (g) On 31 January 2014, the "Spectrum Consultation: World on Wireless 700 MHz Spectrum Migration Proposal" (Preliminary Consultation) was published.
 - (h) On 14 February 2014, CableVision met with the Staff of the Authority to discuss concerns regarding radio frequency interference.
 - (i) On 21 February 2014, responses to the questions in the Preliminary Consultation were received from:
 - (i) BDC;
 - (ii) CableVision;³ and
 - (iii) Digicel.
 - (j) On 13 March 2014, the Authority contacted WOW to request a response to CableVision's concerns regarding radio frequency interference.
 - (i) On 20 March 2014, WOW provided its response to the Authority's request.
 - (k) On 30 October 2014, WOW was issued the Current Transitional Licence to allow it to continue operating in the 600 and 700 Band Frequencies (its Currently Assigned Frequencies).
 - (l) On 2 March 2015, the Authority published its consultation on a draft form of this FD&O entitled "World On Wireless: 700 MHz Spectrum Migration Proposal, Draft Final Decision and Order".

³ CableVision's comments were limited to Question 11 and Question 13.

- (i) On 9 March 2015, WOW provided a written response to the Authority's consultation.

3.2 Scope of this Final Decision and Order

10. This FD&O formally enacts the Authority's draft FD&O, published on 2 March 2015, as amended, in which the Authority proposed to approve WOW's Migration Proposal as described below in Section 6.
11. In this FD&O, except insofar as the context otherwise requires, words or expressions shall have the meaning assigned to them by the Regulatory Authority Act 2011, the Electronic Communications Act 2011 and the Interpretation Act 1951.

4 LEGISLATIVE CONTEXT

12. ECA Section 35(1) recognizes "the importance of radio spectrum as a scarce national resource and a public good of social, cultural and economic value".
13. As a threshold matter, the Authority notes that it may, under the general powers accorded it by Section 41 of the ECA, require a spectrum licence holder to release or to vacate its assigned frequencies to ensure efficient use so that it may be re-licensed to others.⁴ The Authority has elected not to proceed under Section 41 in light of WOW's voluntary proposal. However, in light of the important public interest in freeing up the 700 MHz band for mobile communications use as expeditiously as possible, the Authority reserves the right to take action pursuant to ECA Section 41 if WOW's migration is not completed on a timely basis.
14. The Authority has instead elected to proceed in accordance with its general powers under Part 7 of the ECA concerning the use of radio spectrum and equipment for electronic communications.
15. ECA Section 36(2)(k) authorizes the Authority to conduct public consultations "to evaluate the extent to which spectrum is available for use for radiocommunications in Bermuda [and] to assess current and potential demand".
16. ECA Section 37 sets out the objectives of spectrum management and requires that:
 - (1) In performing their functions under this Part, the Minister and the Authority shall ensure that radio spectrum is managed in a manner that—
 - (a) is objective, transparent and non-discriminatory;
 - (b) is economically and technically efficient;
 - (c) facilitates the introduction and evolution of new technologies and innovative electronic communications services;
 - (d) gives due recognition to the level of investment in existing equipment configured for specific frequencies and the cost of migrating to other frequencies;
 - (e) preserves or promotes effective and sustainable competition in the provision of electronic communications services subject to this Act;

⁴ The Authority's draft FD&O concerning the transitional spectrum investigation carried out pursuant to ECA Section 78 (dated 15 October 2014) confirmed that because WOW was already subject to this separate proceeding concerning its Migration Proposal, the transitional spectrum investigation would not address disposition of WOW's spectrum licence(s) (Section 4.2.7). This was also recognised by the Authority in the final decisions issued to BDC, Digicel, Logic Communications Limited pursuant to the Authority's transitional spectrum investigation (dated 23 December 2014).

- (f) is compatible with the Convention; and
 - (g) meets the radiocommunications needs of Government Departments and agencies.
17. ECA Section 9(2)(c)(xii) states that the functions of the Authority include the making of administrative determinations to provide for the control and conduct of public electronic communications, including the assignment of spectrum and the establishment of conditions and requirements for the operation and use of radio stations and apparatus for the provision of electronic communications.
 18. Further, RAA Section 63(1)(b) provides that the Authority may issue Orders that "approve, modify or disapprove any submission received from a sectoral participant". This is the basis upon which the Authority has decided to issue its FD&O to WOW approving WOW's Migration Proposal.

5 BACKGROUND TO MIGRATION PROPOSAL

5.1 World On Wireless

19. WOW was awarded a Subscription Radio Service Licence by the DoT in January 2003. This licence permitted WOW to maintain and operate a wireless cable television system. At that same time, WOW was awarded its Currently Assigned Frequencies in the 600 MHz and 700 MHz bands (i.e. 614 – 806 MHz contiguous covering UHF broadcasting Channels 38 - 69).⁵ In May 2004, WOW commenced commercial services using these frequencies to deliver subscription entertainment services.
20. Following adoption of the new regulatory framework, on 29 April 2013, the Authority replaced WOW's Subscription Radio Service Licence with an Integrated Communication Operating Licence and an associated Spectrum Licence of 18 months' duration pursuant to ECA Section 73(2)(c). This Spectrum Licence (No. SpecLic201321Rev1-789) expired on 29 October 2014 and was replaced by the Current Transitional Licence⁶ which allows WOW to continue operating in its Currently Assigned Frequencies until the date determined by the Authority in the FD&O in this proceeding.

5.2 700 MHz Spectrum and the Digital Dividend

21. The 700 MHz band covers the frequencies between 698 - 806 MHz. In many jurisdictions, the 700 MHz band was historically allocated for use by analogue broadcast television (specifically, UHF Channels 52 – 69). However, beginning in the late 1990s, many countries began the process of encouraging and/or requiring television broadcasters to transition from analogue to digital transmission because digital broadcast television is more spectrally efficient.⁷ The transition to a more efficient standard enabled some broadcast television spectrum to be reallocated and reassigned for new uses, including mobile communications. This newly available spectrum is generally referred to as the 'Digital Dividend' generated by the conversion to digital television transmission.

⁵ WOW was originally assigned spectrum by the Minister in the 2.5 – 2.7 GHz range to support Multichannel Multipoint Distribution Service. However, following a challenge by another company which claimed that it had already been assigned the same spectrum, the Minister resolved the conflict by granting WOW the Currently Assigned Frequencies.

⁶ <http://rab.bm/images/PDF/021-WCS-01T.pdf>

⁷ For example, the United Kingdom and United States initiated the digital television transition process in 1998.

22. In the United States, the 700 MHz band portion of the Digital Dividend has been allocated for mobile use.⁸ The use of the 700 MHz band for the provision of mobile broadband services is broadly viewed as providing the potential for very significant economic benefits. This is particularly the case given the exponential growth in mobile data traffic which results in a need to provide further spectrum for provision of mobile broadband services.
23. In general terms, frequencies below 1 GHz enjoy favourable propagation characteristics that allow for:
- (a) coverage over greater distances than the use of higher frequency spectrum resulting in a lower number of cell-sites required to supply service to a given area; and
 - (b) improved in-building coverage because relatively lower frequencies can more easily penetrate buildings.
24. Having access to reasonable amounts of spectrum below 1 GHz is therefore important to the efficient operation of a mobile network. As the United States Federal Communications Commission (FCC) has observed, “not all spectrum is created equal.”⁹ In a recently issued Report and Order, the FCC observed that:
- "Spectrum below 1 GHz has, compared to spectrum above 1 GHz, distinct propagation advantages for network deployment over long distances, while also reaching deep into buildings and urban canyons ... In this sense, spectrum below 1 GHz may be thought of as “coverage” spectrum ... While other cost-related factors exist, **ensuring that multiple providers are able to access a sufficient amount of low-band spectrum is a threshold requirement for extending and improving service in both rural and urban areas.**"¹⁰ (emphasis added)
25. To date, the superior physical characteristics of the sub-1GHz band (including the 700 MHz band¹¹) are evidenced by the multiple requests received by the Authority for such assignments from mobile network operators. These requests are being made even though there is currently unassigned spectrum allocated to mobile services above 1 GHz.¹² Thus, the actions of the mobile network operators suggest that they do not believe that their needs could be met by using a higher frequency band.
26. As a result, there is a growing consensus on the part of governments and regulatory bodies internationally that mobile communication is a superior use for the 700 MHz Band. Indeed, Section 3.3.2 of the Preliminary Consultation

⁸ “The digital dividend usually relates to frequency bands from 174 - 230 MHz (VHF) and from 470 - 862 MHz (UHF). However, the location and size of digital dividend vary among countries due to the factors including geographical position and penetration of satellite/cable services.” See: http://en.wikipedia.org/wiki/Digital_dividend_after_digital_television_transition#Digital_Dividend_Allocation_for_Mobile_Services

⁹ FCC Mobile Spectrum Holdings Report and Order, FCC 14-63 (Released: 2 June 2014), par.3; <http://www.fcc.gov/document/mobile-spectrum-holdings-report-and-order>

¹⁰ *Ibid.*

¹¹ The Authority notes that although frequencies in the 700 MHz band, like those in the 800 MHz band, have propagation characteristics that are particularly favourable for mobile communications that require indoor penetration, the 700 MHz band lacks some of the commercial advantages associated with frequencies in the 850 MHz band in Region 2. This is because at present, mobile device manufacturers generally have not made available equipment that allows for the provision of carrier-grade voice services using the 700 MHz band.

¹² For example, the 2100 MHz Band (i.e.1710 - 1755 MHz and 2110 - 2155 MHz)

addressed the reasons why “governments and regulatory bodies internationally have typically concluded that mobile broadband is a superior use for the 700 MHz spectrum band”.

27. Following this global trend, in 2010, the DoT approached WOW about the need to migrate from the 700 Band Frequencies to the 500 Band Frequencies. Subsequently, the Minister of Education and Economic Development¹³ approved, in principle, WOW's migration out of the 700 MHz band in keeping with the ITU digital dividend allocation timeline of 2015.
28. Following from this, the Authority initiated the Preliminary Consultation to assess WOW's Migration Proposal.

6 PRELIMINARY CONSULTATION ISSUES

6.1 Migration Costs

29. As part of the Preliminary Consultation, the Authority consulted on the estimates provided by WOW in relation to the cost of migrating from the 700 Band Frequencies to the 500 Band Frequencies. Under the unusual circumstances presented in this case, it has been determined that the issue of compensation to WOW for its reasonable migration costs is a matter for the Government and will be dealt with by separate agreement between WOW and the Department of Telecommunications. The Authority has compiled a summary of the comments received from stakeholders concerning WOW's proposed migration costs and setting out the Authority's comments in relation to same for the benefit of the Minister and the Department of Telecommunications. A copy of this report is contained in Appendix A.

6.2 Migration timeline proposed by WOW

6.2.1 WOW's proposed timeline relating to implementation of Migration Process set out in Preliminary Consultation

30. The Preliminary Consultation set out at Table 2 WOW's proposed implementation timeline.

6.2.2 Comments on WOW's proposed timeline

31. BDC claimed that without a more detailed description of the technical specification of WOW's Migration Proposal, it was difficult for BDC to comment on the reasonableness of the scope of work involved and associated timeline. However, BDC suggested that the timelines appeared to be reasonable, possibly aggressive.¹⁴
32. Digicel noted that it was reliant on the Authority to verify WOW's statements in this respect but on the face of things this appears to be a substantial task to undertake and therefore WOW should be afforded a reasonable period of time to do so.¹⁵
33. WOW has estimated that completion of its migration will take approximately 30 weeks.

¹³ The Minister of Education and Economic Development is responsible for Telecommunications.

¹⁴ BDC response to Q10.

¹⁵ Digicel response to Q2.

6.2.3 Authority's Responses to comments on WOW's proposed timeline

34. In discussions with WOW subsequent to the Preliminary Consultation, WOW has committed to meet the Migration Milestones set out at Table 1 below. The Authority considers that the Migration Milestones are verifiable by the Authority (as indicated in Table 1 below) and has decided to include these milestones as licence conditions in both Transitional Licences.¹⁶
35. The Authority encourages WOW to use all reasonable endeavours to complete the migration as quickly as possible while minimizing and service disruption or customer inconvenience. Moreover, in order to minimize disruption, WOW should communicate its plans to the Authority regarding its timetable and plan for notifying and assisting its customers concerning the transition to the new UHF channels, as WOW's customers will have to perform a relatively simple procedure in their homes in order to activate a factory reset and channel download, which will erase the programming from the old frequencies and add programming to the 500 Band Frequencies.
36. In line with the commitments made by WOW, the Authority intends to include the following conditions in both Transitional Licences:
 - (a) WOW shall inform the Authority of the planned date and time of its migration from the 700 Band Frequencies, and shall cooperate with the Authority in ensuring that customers are informed of the migration date at least 15 calendar days in advance of the cutover date in a manner to be approved by the Authority;
 - (b) WOW shall keep the Authority informed on a regular basis, and, at a minimum, every 4 weeks, of its progress in migrating out of the 700 Band Frequencies and meeting the Migration Milestones by filing a written representation in a form and manner to be prescribed by the Authority;
 - (c) WOW shall provide any such information as may be required by the Authority to determine compliance with the Migration Milestones. WOW shall otherwise cooperate fully with the Authority to allow it to verify compliance with the Migration Milestones, including allowing the Authority, or any party delegated by the Authority, to inspect any site or premises in order to verify compliance with the Migration Milestones;
 - (d) the Chief Executive Officer (CEO) of WOW shall provide a written undertaking to the Government within 2 business days of the date on which each of the Migration Milestones has been satisfied by WOW; and
 - (e) if, and as soon as, it appears that WOW may not meet any of the interim Migration Milestones, the CEO of WOW shall immediately inform the Authority in writing and provide a full explanation for the delay and shall submit to the Authority for its approval, a revised plan for completing the migration on or before the 30 week deadline (Milestone 6).
37. The Authority intends that the timeline for implementation of the Migration Milestones will commence on the date that the Authority issues the Transitional Licences. Both Transitional Licences will expire 30 weeks from the date on which they are issued by the Authority.

¹⁶ The Authority notes that the Government funding of WOW's Migration Proposal is conditional on WOW meeting certain milestones as separately agreed between WOW and the Government.

6.2.4 Migration Milestones

38. The following table sets out the Migration Milestones that the Authority plans to include in WOW's Transitional Licences.

Table 1 – Migration Milestones

Milestone	Verifiable Task	Incremental Weeks	Cumulative Weeks
1. Order Placement (Deposit)	WOW places purchase order with its chosen equipment vendor for the equipment required for the migration and included in WOW's estimate of migration costs.	0	
	WOW receives Purchase Order confirmation.	1	1
2. Physical Receipt of Equipment at WOW Head-End	Vendor equipment is built and delivered.	16	17
3. Physical Placement/Installation	Completion of new equipment installation.	3	20
	Completion of customer communication and assistance regarding the resetting of set top boxes and associated channel downloads to accommodate the new channel frequencies.	3	23
4. Equipment Installation (Including Wiring, Light-up Network)	Equipment powered up, with all wiring complete	1	24
5. Testing 500 MHz Network (Sign-Off on Successful Testing)	500 MHz system testing	1	25
6. Completion of Cut Over to 500 MHz (Shut-Down of 700 MHz Network)	New transmitters brought on-line.	1	26
	Transmitters for Channels 51 - 69 are taken off-line and removed from facility.	3	29
	Migration completion and sign-off. WOW's CEO provides a written undertaking to the Government that the final Migration Milestone has been met i.e. it has vacated the 700 Band Frequencies and is fully operational in the 500 Band Frequencies.	1	30

6.3 Assignment of 500 MHz band

6.3.1 Consideration of migration to alternative spectrum bands

39. The Authority asked WOW to consider the costs and operational concerns associated with migrating to a frequency range other than the 500 Band Frequencies proposed. WOW claimed that a move to a frequency range other than the 500 Band Frequencies would require a complete retooling of its network. Such a move would require replacing all WOW's Customer Premises Equipment (CPE), and broadcast and receiving antenna, in addition to transmitters at WOW's head-end. According to WOW, a move to a different frequency range, such as in the Gigahertz range specifically, would likely require WOW to install multiple repeater locations in order to maintain its coverage area. WOW argues that such a move would have significant financial impact on the firm and result in a complete change to WOW's current business model.
40. WOW estimated that a conservatively low cost estimate of a move to a frequency range other than the 500 Band Frequencies would be approximately \$9 million for new CPE, transmitters, transmitting antennae, combiners and filters. This estimate does not consider the labour costs of such a significant undertaking or the inconvenience to WOW's customer base.
41. The Authority tentatively concluded that given the present facts and circumstances before it requiring WOW to migrate to an alternative frequency range would be overly burdensome and costly.
42. BDC suggested that the Authority's tentative conclusion was reasonable given the high cost of using Gigahertz range frequency bands.¹⁷
43. The Authority affirms its tentative conclusion that requiring WOW to migrate to an alternative frequency range would be overly burdensome and costly.

6.3.2 Possible conflict with future band plans under consideration by the FCC

44. In its Preliminary Consultation, the Authority agreed with WOW's proposal to migrate into the 500 MHz band. Given that this spectrum is currently unassigned, and no other parties have previously expressed an interest in its assignment, the Authority saw no reason to consider assignment of this spectrum to an alternate licensee. The Authority also noted that it appreciates WOW's cooperation in these matters. As such, the Authority tentatively concluded that the 500 Band Frequencies should be assigned to WOW.
45. BDC agreed with the Authority's tentative conclusion but noted that some of the spectrum that WOW is proposing to occupy may conflict in the future with band plans currently under consideration by the FCC. BDC asserted that it is possible that devices that work in the US in the 600 MHz band may not work in Bermuda or may interfere with WOW's operations. BDC acknowledged that the difficulty, of course, is that the rules and band plans are still under consideration by the FCC and are unlikely to be finalized in the timeframe identified for implementing WOW's Migration Proposal. BDC maintained that further guidance may have come from the FCC later in 2014.¹⁸ As such, BDC recommends that the Authority take into consideration the shifting spectrum landscape in the US to ensure that Bermudan devices and services are interoperable with US devices and services.¹⁹

¹⁷ BDC response to Q11.

¹⁸ See footnote 20.

¹⁹ BDC response to Q1.

46. The Authority recognizes that some of the spectrum in the 500 Band Frequencies may conflict in the future with band plans currently under consideration by the FCC. However, as noted by BDC, the rules and band plans are still under consideration by the FCC and will not be finalized in the near term.²⁰ Furthermore, even if further guidance were to be provided in the near term, the reallocation, reassignment, and new equipment required to make use of this spectrum is likely to be years away.²¹ As such, the Authority finds the potential activities of the FCC insufficient reason to deny this spectrum to WOW at this time.²²

6.3.3 Digicel's recommendation that WOW should only be assigned 30 MHz in the 500 MHz band

47. Digicel noted that the 500 Band Frequencies may be used for future mobile broadband usage by organisations such as the GSMA.²³ Therefore, Digicel recommended that only the necessary amount of spectrum should be assigned. Digicel argues that there is no need or justification to allocate nearly 100 MHz (512 - 608 MHz) to WOW. Digicel claims that approximately 30 MHz would more than suffice for WOW's spectrum purposes.²⁴
48. Digicel provided no explanation of, or support for, its claim that 30 MHz would more than suffice for WOW's spectrum purposes. If adopted, Digicel's proposal would require WOW to operate in only 19 Channels (Channels 33 - 51). Given that WOW currently provides approximately 140 programming channels, it would be forced to place more than 7 programming channels in each 6 MHz channel it is assigned. The Authority believes that this could result in an unacceptable loss of picture quality and limit, or even reduce, the number of High Definition programming channels WOW could offer. For these reasons, the Authority rejects Digicel's proposal.

6.3.4 Possible interference issues raised by CableVision

49. CableVision expressed concern regarding the proposal to assign WOW the 500 MHz band because this frequency range is also used by CableVision to transmit signals in its wired network.²⁵ CableVision claims that because the 500 MHz band has not previously been assigned for use in Bermuda, as a practical matter, it has never been necessary for the Government, CableVision, or any other entity to be concerned with potential signal egress from or ingress to CableVision's system in this band.²⁶ CableVision contends that relocating WOW to the 500

²⁰ In October 2014 "The FCC decided to delay the start of the 600 MHz broadcast TV spectrum incentive auction from mid-2015 to early 2016. The delay marks the second time in less than a year the FCC has pushed back the start date of the auction, and is an indication of the both the complexity in designing the auction and the problems stemming from a legal challenge against the auction by the National Association of Broadcasters. See: <http://www.fiercewireless.com/tech/story/spectrum-refarming-wireless-broadband-fraught-twists-and-turns/2014-08-20>

²¹ For example, the FCC's first 700 MHz spectrum auction was begun in January 2008 but Verizon did not first begin offering mobile services using this spectrum until December 2010.

²² In any event, in light of Bermuda's island situation, it is not obligated to follow the FCC if there is an overriding public interest not to do so.

²³ Groupe Speciale Mobile ("GSM") Association

²⁴ Digicel response to Q9, Q11, and Q13.

²⁵ Generally, a multiple service cable network like CableVision's use wires (i.e. artificial guides) to transmit signals using frequencies whose upper bound is as low as 450 MHz or as high as 1 GHz.

²⁶ Ingress and egress are types of radio frequency interference. Ingress describes the situation in which over the air radio frequency transmissions find their way into a wired network. Egress, also called 'leakage', describes the situation in which radio frequency transmissions exit the wired network.

MHz band may well create problems for CableVision and its customers that the Authority has not yet investigated or considered, and/or lead to problems with the reception or use of WOW's services in some situations.²⁷ CableVision also observes that resolving signal interference problems can be complex and contentious.

50. CableVision has therefore recommended that prior to reaching a conclusion on whether it is appropriate to move WOW to the 500 MHz band, the Authority should work with WOW, CableVision, and any other potentially affected entities to conduct a series of actual field tests to determine when and under what conditions egress from or ingress to CableVision's cable system, or to consumer-owned equipment served by CableVision's cable system, might occur in that band. CableVision asserts that it is ready to cooperate with the Authority to identify what testing regime would be appropriate and to assist in carrying it out.
51. Because relocating WOW to another band (whether the 500 MHz band or otherwise) may impose costs, interference problems, and customer inconvenience, CableVision argued that it would not be unreasonable to expect the actual beneficiaries of the move (presumably the mobile broadband providers) to bear those costs. CableVision claimed that if those entities are not prepared to do so, it suggests that the actual value to them of using the 700 MHz band is lower than the Authority has estimated, which undermines the logic of the WOW relocation in the first instance.²⁸

6.3.5 Authority's response to CableVision's concerns

52. The Authority has thoroughly investigated any potential interference that CableVision's customers may experience and does not consider there to be any significant risk of interference that may harm consumers. Indeed, DMTV are currently operating at 500 – 512 MHz and the Authority is not aware of any complaints made by DMTV or its consumers in relation to interference at these frequencies.
53. However, the Authority will monitor WOW's migration closely and will work with CableVision and all other Licensees, with regards to any interference issues that may arise.
54. Of course, if CableVision does identify any specific issues, the Authority will work closely with CableVision and WOW to do all it can to ensure the migration transition is as smooth as possible. Indeed, the Authority is well accustomed to working with CableVision, and all ICOL holders, to limit and resolve interference issues.
55. Moreover, the Authority is firmly of the view that it is pursuing the correct course of action in line with ECA Section 42(2), which provides that:

"The Authority shall adjudicate any complaints alleging harmful interference in accordance with this Act, any applicable general determinations, and the respective rights and obligations of the licence or permit holders involved."²⁹
56. In relation to whether mobile broadband providers could effectively use a band other than the 700 MHz band, in the course of preparing the Preliminary Consultation, the Authority did consider the 'alternative arrangements' suggested

²⁷ CableVision response to Q11 and Q13.

²⁸ CableVision response to Q11 and Q13.

²⁹ The Authority also notes that CableVision's ICOL does not grant it protection from interference from broadcasters or any other licensed spectrum assignee.

by CableVision such as migrating WOW to an assignment other than the 500 MHz Band (addressed at paragraph 43, above).

57. However, as explained in paragraphs 23 - 25 above, in general terms, frequencies below 1 GHz enjoy favourable propagation characteristics. Further, superior physical characteristics of the sub-1GHz band are evidenced by the multiple requests received by the Authority for such assignments from mobile network operators. These requests are being made even though there is currently unassigned spectrum allocated to mobile services above 1 GHz.³⁰ Thus, the actions of the mobile network operators suggest that they do not believe that their needs could be met by using a higher frequency band.
58. Further, the Authority considers that the potential (and unsubstantiated) interference concerns raised by CableVision regarding signal egress from or ingress to CableVision's system or customer equipment in the 500 MHz band (or any other band) are no basis for delaying the award of the 500 Band Frequencies to WOW, since CableVision has not been licensed to use the 500 MHz band (or any other radio frequencies).³¹ For the same reasons, the Authority does not consider it necessary to reserve a guard band to prevent any interference at the lower end of the 500 Band Frequencies.
59. The Authority, however, will work with CableVision and WOW to minimize and resolve any interference issues. The Authority does, however, appreciate CableVision's willingness to work with the Authority and other interested parties to resolve any interference issues that may arise. The Authority, as a general policy matter, encourages this type of cooperation and will work with the parties to resolve any issues that may arise.

6.3.6 Consideration of reserving 608 – 614 MHz for radio astronomy use

60. Pursuant to Section 4(b) of its Current Transitional Licence, WOW's Migration Proposal included surrendering the 700 Band Frequencies (i.e. 698 - 806 MHz (Channels 52 - 69)) in exchange for the 500 Band Frequencies (i.e. 512 – 608 MHz (Channels 21 – 36) plus the Channel 37 frequencies (i.e. 608 – 614 MHz) and compensation from the Government for the reasonable expenses it will incur to migrate to the new spectrum assignment.
61. The Authority noted that 608 - 614 MHz (Channel 37) is reserved for radio astronomy use in other ITU Region 2 jurisdictions such as the United States and Canada. The Authority indicated that absent compelling arguments to the contrary, Bermuda should seek to harmonize its band plan with these other jurisdictions, and the US in particular, to encourage the interoperability of devices and benefit from all available economies of scale regarding equipment.
62. BDC asserted that it did not have an opinion regarding reallocation of Channel 37 from radio astronomy to broadcast use by WOW. However, BDC noted in the current proceedings in the US to reallocate spectrum in the 600 MHz band from broadcasting to mobile services the FCC proposed that Channel 37 remain clear for radio astronomy purposes.³²
63. Digicel offered no objection to the assignment of Channel 37 but suggested that the Authority seek further comments from parties interested in radio astronomy.
64. WOW assured the Authority that there are no interoperability concerns regarding the function of its equipment in Channel 37.

³⁰ For example, the 2100 MHz Band (i.e. 1710 - 1755 MHz and 2110 - 2155 MHz)

³¹ See CableVision's ICOL at page 29.

³² BDC response to Q1.

65. Because it is unclear whether demand for radio astronomy use may develop over time, and consistent with the harmonisation of Bermuda's band plan with that followed in Region 2, the Authority has concluded that this spectrum should be reserved for radio astronomy purposes, and should therefore not be assigned to WOW.

7 WOW'S RESPONSE TO CONSULTATION ON DRAFT FINAL DECISION AND ORDER

66. On 2 March 2015, the Authority consulted on its draft Final Decision and Order with regard to WOW's Migration Proposal. WOW was the only party to submit comments at this stage.
67. WOW's comments indicate that its proposal is predicated on reaching final agreement with the Government with regard to payment of compensation for its migration costs. WOW's response also indicates its concern that there is a lack of clarity regarding the applicability to WOW of an obligation to pay spectrum licence fees for its use of 700 MHz spectrum, pursuant to the Government Fees Amendment (No. 4) Regulations 2014 which became effective on 1 January 2015. WOW contends that it should not be required to pay any fees for its use of the 700 MHz band during of the Migration Period.
68. As set out in the Authority's consultation on the draft FD&O, it has been determined that the issue of payment of compensation to WOW for its reasonable migration costs is a matter for the Government and is being dealt with by separate agreement between WOW and the Department of Telecommunications. However, the Authority recognizes that WOW's Migration Proposal is predicated on its reaching agreement on these issues.
69. Following discussions with the MEED, the Authority has been made to understand that WOW and the Government have finalized an arrangement with respect to reimbursement of WOW's reasonable costs of migration and the disposition of any potentially applicable spectrum licence fees in the 700 MHz band during the Migration Period. The Authority also understands that WOW and the Government intend to formalize their arrangement with respect to reimbursement of WOW's reasonable costs of migration.
70. Accordingly, the Authority will proceed to implement the ordering clauses of this decision upon received from Government a copy of a written agreement between WOW and the Government with respect to the issue of compensation for WOW's reasonable migration costs.
71. WOW's response also explains that it would not expect to be penalised for any delay in meeting its Migration Milestones as a result of an event that is outside of its control, such as a significant delay in receipt of equipment and related materials.
72. The Authority notes that Section 2(e) of WOW's ICOL incorporates documents referred to in the ICOL and deems such documents to form part of the ICOL. This would include the Transitional Licences. The Authority further notes that Clause 22.2 of the ICOL (incorporated into the Transitional Licences) contains a force majeure clause that should alleviate WOW's concerns in this regard.

8 LICENSING

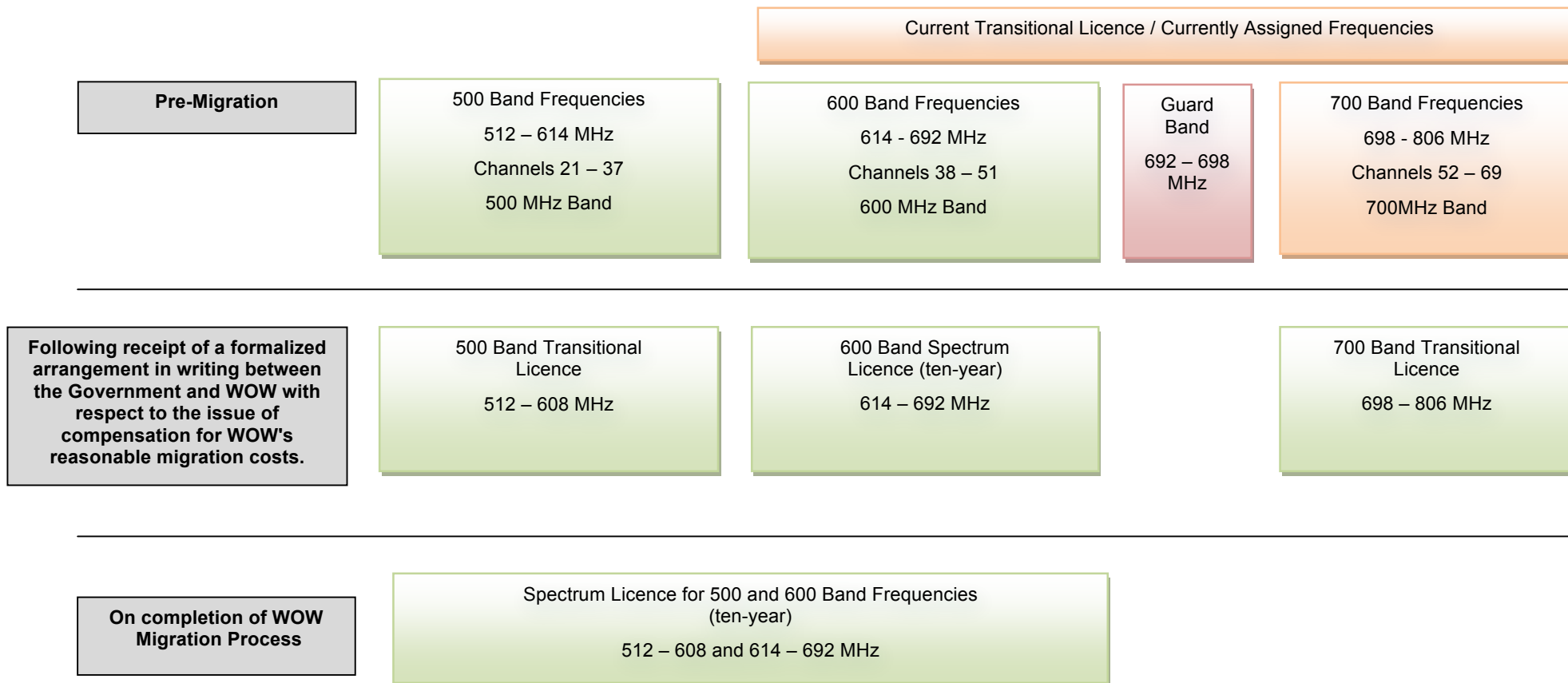
73. WOW is currently assigned the 600 Band Frequencies and the 700 Band Frequencies pursuant to Current Transitional Licence. After consideration of

WOW's Migration Proposal, the Authority has decided to approve WOW's proposal to:

- (a) migrate out of the 700 Band Frequencies and into the 500 Band Frequencies; and
 - (b) retain the 600 Band Frequencies.
74. In order to facilitate implementation of WOW's Migration Proposal, the Authority has decided that upon receipt from Government of a copy of a written agreement between the Government and WOW with respect to the issue of compensation for WOW's reasonable migration costs, the Authority will promptly:
- (a) amend WOW's Current Transitional Licence so that it is (1) limited to assignment of the 700 Band Frequencies, and (2) expires 30 weeks from the date the Authority issues the amended licence (referred to herein as the 700 Band Transitional Licence, as set out in Appendix B of this FD&O);
 - (b) grant WOW a new transitional spectrum licence (500 Band Transitional Licence) that (1) assigns WOW use of the 500 Band Frequencies, and (2) expires 30 weeks from the date it is issued (as set out in Appendix C of this FD&O); and
 - (c) grant WOW a ten-year spectrum licence (600 Band Spectrum Licence) re-assigning WOW use of the 600 Band Frequencies that it currently holds (and which are not covered by the Migration Proposal) (as set out in Appendix D of this FD&O).
75. This Migration Process is illustrated in Diagram 1 below.
76. Upon WOW's CEO providing a written undertaking to the Government that the final Migration Milestone (6) has been met, and the Authority having verified the same, then on the completion of the Migration Process either:
- (a) WOW shall surrender its Transitional Licences if the migration is completed prior to the expiry of the Transitional Licences; or
 - (b) the Transitional Licences will expire of their own accord; and
 - (c) the 600 Band Spectrum Licence shall be amended to assign WOW the 500 Band Frequencies (in addition to the 600 Band Frequencies already assigned) for the remainder of the term of the ten-year 600 Band Spectrum Licence, in accordance with ECA Section 38(7).
77. The Authority reminds WOW of the licence condition set out in Condition 7.3 of each of the spectrum licences that the Authority has decided to issue pursuant to this proceeding which requires WOW to "make efficient use of the Assigned Frequencies for the Authorized Use ... [and] notify the Authority promptly if the Licensee no longer requires the use of any or all of the Assigned Frequencies."³³

³³ This constitutes Condition 7.3 included in all spectrum licences awarded by the Authority pursuant to the ECA.

Diagram 1 – Overview of WOW Migration Process



9 FINAL DECISION AND ORDERING CLAUSES

78. Following the Authority's review of WOW's Migration Proposal and responses to its Preliminary Consultation, the Authority has decided to approve WOW's Migration Proposal as described above in Section 6 for WOW's migration out of the 700 Band Frequencies into the 500 Band Frequencies. WOW will retain the 600 Band Frequencies.
79. The Government of Bermuda has separately agreed to compensate WOW for the reasonable costs incurred in migrating from the 700 Band Frequencies to the 500 Band Frequencies. In order to facilitate implementation of WOW's Migration Proposal, the Authority has decided to:
 - (a) amend WOW's Current Transitional Licence so that it (1) is limited to assignment of the 700 Band Frequencies, and (2) expires 30 weeks from the date the amended licence is issued;
 - (b) grant WOW a new transitional spectrum licence that (1) assigns WOW use of the 500 Band Frequencies, and (2) expires 30 weeks from the date it is issued; and
 - (c) grant WOW a ten-year spectrum licence re-assigning WOW use of the 600 Band Frequencies that it currently holds (and which are not covered by the Migration Proposal).

9.1 Ordering Clauses

80. WOW shall migrate from the 700 Band Frequencies to the 500 Band Frequencies as described above in Section 6. WOW shall be re-assigned its currently assigned frequencies in the 600 MHz band (i.e. the frequencies between 614 – 692 MHz (Channels 38 – 51)) for a period of ten years.
81. Upon receipt from Government of a copy of a written agreement between the Government and WOW with respect to reimbursement for WOW's reasonable migration costs from Government, the Authority will promptly:
 - (a) amend WOW's Current Transitional Licence so that it is (1) limited to assignment of the 700 Band Frequencies, and (2) expires 30 weeks from the date the Authority issues the amended licence (referred to herein as the 700 Band Transitional Licence, as set out in Appendix B of this FD&O);
 - (b) grant WOW a new transitional spectrum licence (500 Band Transitional Licence) that (1) assigns WOW use of the 500 Band Frequencies, and (2) expires 30 weeks from the date it is issued (as set out in Appendix C of this FD&O); and
 - (c) grant WOW a ten-year spectrum licence (600 Band Spectrum Licence) re-assigning WOW use of the 600 Band Frequencies that it currently holds (and which are not covered by the Migration Proposal) (as set out in Appendix D of this FD&O).
82. As Table 1 above indicates, the maximum elapsed time for the completion of WOW's Migration Process is 30 weeks. In line with this timetable:
 - (a) the commencement date of the Migration Milestones proposed by WOW is the date the Transitional Licences are issued.
 - (b) WOW shall inform the Authority of the planned date and time of its migration from the 700 Band Frequencies, and shall cooperate with the Authority in ensuring that customers are informed of the migration date at least 15

calendar days in advance of the cutover date in a manner to be approved by the Authority;

- (c) WOW shall keep the Authority informed on a regular basis, and, at a minimum, every 4 weeks, of its progress in migrating out of the 700 Band Frequencies and meeting the Migration Milestones by filing a written representation in a form and manner to be prescribed by the Authority;
 - (d) WOW shall provide any such information as may be required by the Authority to determine compliance with the Migration Milestones. WOW shall otherwise cooperate fully with the Authority to allow it to verify compliance with the Migration Milestones, including allowing the Authority, or any party delegated by the Authority, to inspect any site or premises in order to verify compliance with the Migration Milestones;
 - (e) the Chief Executive Officer (CEO) of WOW shall provide a written undertaking to the Government within 2 business days of the date on which each of the Migration Milestones has been satisfied by WOW; and
 - (f) if, and as soon as, it appears that WOW may not meet any of the interim Migration Milestones, the CEO of WOW shall immediately inform the Authority in writing and provide a full explanation for the delay and shall submit to the Authority for its approval, a revised plan for completing the migration on or before the 30 week deadline (Milestone 6).
83. Upon WOW's CEO providing a written undertaking to the Government that the final Migration Milestone (6) has been met, and the Authority having verified the same, then on the completion of the Migration Process either:
- (a) WOW shall surrender its Transitional Licences if the migration is completed prior to the expiry of the Transitional Licences; or
 - (b) the Transitional Licences will expire of their own accord; and the 600 Band Spectrum Licence shall be amended to assign WOW the 500 Band Frequencies (in addition to the 600 Band Frequencies already assigned) for the remainder of the term of the ten-year 600 Band Spectrum Licence, in accordance with ECA Section 38(7).
84. WOW is to be compensated in accordance with its agreement with the Government of Bermuda for the reasonable costs incurred by WOW in migrating out of the 700 Band Frequencies.



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APPENDIX A

**REPORT OF THE AUTHORITY TO THE MINISTER AND DEPARTMENT OF
TELECOMMUNICATIONS ON COMMENTS RECEIVED FROM STAKEHOLDERS IN
RELATION TO WOW'S MIGRATION COSTS**

Appendix A

Report of the Authority to the Minister and Department of Telecommunications on comments received from stakeholders in relation to WOW's migration costs

1 INTRODUCTION

1. In line with the Government's agreement to reimburse WOW for the reasonable and documented costs of its migration from the 700 Band Frequencies to the 500 Band Frequencies up to a maximum of \$803,204.00, the Authority has prepared this report to assist the Minister and the Department of Telecommunications in evaluating the migration cost estimate provided by WOW.

2 TOTAL MIGRATION COSTS ESTIMATES

2. Using inputs from its preferred equipment vendor, and BEST Shipping, WOW provided the following cost estimates³⁴ for the migration:

Table 1 - Migration Cost Estimates

Item	Cost Estimates
Transmitters (N+1 configuration)	\$450,000
RF Combining & Switching System	\$269,458
TV Equipment Total	\$719,458
Installation / Commissioning	\$31,380
TV Equipment Vendor Total	\$750,838
Ocean Freight	\$2,086
Documentation	\$95
Fuel Surcharge	\$236
Terminals	\$308
Disbursements	\$400
Customs Clearance	\$75
Inland Freight	\$700
Delivery	\$400
Shipping Insurance (3.5% of TV Equipment Total)	\$25,181
Shipping and Insurance Total	\$29,481

³⁴ Copies of the Equipment Vendor and Shipping & Insurance price quotes can be found in Appendix B of the Preliminary Consultation. The name of the equipment vendor has been redacted from this document at the request of the equipment vendor. Only the portions addressing cost estimates are included in this document. Note also that some of the costs estimates set out above are lower than those provided in the quotes. For example, WOW originally expected to require 20 transmitters although now only requires 18, reducing the quote by \$50,000; the shipping and insurance quote (being 3.5% of the equipment total) was reduced accordingly; and the work permit costs were updated.

Electrical Breaker and Installation	\$8,000
Engineering support (5 person days)	\$5,000
Travel / Accommodations / Meals	\$2,000
Temporary Work Permits (5 people)	\$2,925
Incidentals	\$5,000
General Support Total	\$22,885
Total Migration Cost Estimate	\$803,204

- The Authority received responses to the Preliminary Consultation from BDC, Digicel and CableVision.

2.1 Comments on WOW's reliance on its existing equipment vendor

- As noted above, WOW's migration costs estimate is based upon a single source contract with its existing equipment vendor. WOW claimed this arrangement was necessary to minimize costs and to reduce complexity regarding vendor support and spare equipment. In this regard, the Authority tentatively found WOW's migration costs estimate to be reasonable.
- BDC submitted that it had no issue with a single source vendor contract provided that a formal tender process was followed by WOW where multiple vendor quotes were obtained and hence the "best price" achieved.³⁵ Digicel did not express opposition to WOW's proposal to rely exclusively on its existing equipment provider.³⁶ CableVision did not respond to the Authority's question on this issue.

2.2 Authority's response to comments on WOW's reliance on its existing equipment vendor

- The Authority's view is that while quotes from multiple vendors can be useful to achieve the "best price" and verify the reasonableness of cost estimates, they are not the only means to do so. The Authority has confirmed that the equipment cost estimates provided by WOW in order to implement its Migration Proposal are consistent with the prices WOW previously paid to its vendor for similar equipment.³⁷ Further, the Authority is satisfied that it may be inefficient for a new vendor to be used.
- As such, the Authority is satisfied that the cost estimates have not been inflated and that no upward bias has been introduced into the estimates as a result of WOW's anticipation that the Government would provide compensation for WOW's migration costs.
- Furthermore, in these circumstances and for the reasons stated in paragraph 6, the Authority finds WOW's decision to exclude other vendors from consideration reasonable. WOW indicated that it has used the vendor in question since 2004 and WOW is very satisfied with its product offering. The Authority sees no benefit or rationale to require WOW to sever this relationship for the purposes of implementing its Migration Proposal.

³⁵ BDC response to Q12.

³⁶ Digicel response to Q12.

³⁷ Confidential WOW Invoice dated 29 April 2013.

2.3 Specific equipment and installation estimates

Based on the evidence provided to it, the Authority is persuaded that the migration of a wireless cable television business from frequencies in the 700 MHz band to frequencies in the 500 MHz band will incur non-trivial costs.

9. The 18 transmitters in WOW's migration costs estimate are based on an "N+1" configuration in which WOW would require a new transmitter to be installed for each of the 17 new channels (Channels 21 - 37) it receives plus an additional transmitter for redundancy/backup purposes.³⁸ WOW has said that new transmitters are required because the existing transmitters operating in the frequencies occupied by Channels 52 - 69 are frequency specific and cannot be reused in the lower frequency range contemplated by the migration.³⁹ WOW estimated the cost of the transmitters to be \$450,000.⁴⁰
10. The RF output filter combiner and switching system in WOW's migration costs estimate assumes that there will be 10 blocks interconnected to from the 10 station mask filter/combiner system for even channels and 9 blocks interconnected for the odd channels. WOW estimated the costs for these products to be \$269,458.⁴¹
11. The TV transmitter installation and proof of performance in WOW's migration costs estimate includes installation and all mechanical and interconnect materials for a standard installation. Also included are the complete checkout and commissioning of the digital transmitter system and proof-of-performance testing of the transmitter to be performed into station load. WOW proposed that one original set of the tests and measurements taken will be provided. WOW estimated the cost of these services to be \$31,380.
12. In order to facilitate seamless transition, WOW maintains that it will require a new electrical circuit breaker panel to be installed in its Devonshire facility to handle the additional equipment that will be operating during the transition period. WOW's plan requires both sets of transmitters to be operational (e.g. both existing & new) during the cutover in order to ensure that all services are maintained during the migration. WOW estimated the costs for this equipment and associated labour will be \$8,000.
13. In addition to support provided by the equipment vendor, WOW claims that there is also a need to have on-site engineering support from its encoding/transcoding provider to assist with reconfiguring WOW's systems to the 500 Band Frequencies. WOW estimated these costs to be \$5,000.

2.4 Other estimates

14. WOW estimated that it will cost \$4,300 to ship the equipment from Southwick, Maryland, USA, to Bermuda. The cost of insuring the shipment is estimated to

³⁸ The Authority notes that the Equipment Vendor price quote attached at Appendix B of the Preliminary Consultation is based on 20 Channels, not 18. The transmitter cost estimate has been reduced by \$50,000 to reflect 2 fewer transmitters ($\$500,000 / 20 \text{ units} = \$25,000 \text{ per unit}$).

³⁹ WOW claims that some of the transmitters' components may be salvaged as spares but the vast majority of this equipment cannot be repurposed.

⁴⁰ The Authority notes that WOW's migration costs estimate does not require it to provide new set top boxes or other customer premise equipment.

⁴¹ According to WOW, the cost of the RF Combining & Switching Systems would be the same for 18 or 20 transmitters so no adjustments have been made to the vendor quote.

be 3.50% of the equipment cost, or \$25,181.⁴² The total cost for Shipping and Insurance is estimated to be \$29,481.

15. WOW estimated that travel costs, and meals and accommodations expenses for on-site support vendors will be \$2,000.
16. WOW has estimated that this project will require temporary work permits for 5 on-site vendor technicians. Based on the current work permit fee of \$585 per-person the estimated cost is \$2,925.
17. WOW's migration costs estimate includes a line item for incidentals associated with the migration. WOW estimated these costs to be \$5,000.

2.5 Comments on WOW's cost estimates

18. BDC claimed that without having a detailed description of the technical specification for the migration it was difficult for it to comment on the reasonableness of the scope of work involved, the equipment being cited in the proposal, and the associated cost estimates. BDC assumes that the Authority fully vetted the technical requirements and the vendor's pricing proposal.⁴³
19. Digicel suggested that further information was needed to make a full evaluation of WOW's cost estimates. For example, Digicel recommends a more granular split of the main cost areas namely: "Transmitters (N+1 configuration)" valued at \$450,000; and, "RF Combining & Switching System" valued at \$269,458. According to Digicel, that breakdown would, inter alia, detail how many transmitters are being replaced and which model and brand of replacements are being used and whether new or refurbished equipment is to be installed. Digicel stated that its answers to many of the questions posed by the Authority would be contingent on having access to such further information.⁴⁴
20. Both BDC and Digicel claimed that without more granular information it was difficult to evaluate WOW's migration costs estimate, and in particular, the cost estimates for the "Transmitters" and "RF Combining & Switching System". Digicel specifically requested detail regarding how many transmitters are being replaced and which model and brand of replacements are being used and whether new or refurbished equipment is to be installed.
21. The Authority notes that while the vendor's name, and the model and brand of replacements were redacted from the quote provided in the Preliminary Consultation, the number of transmitters, the per unit costs, and a generic description of the replacement equipment was provided in the Preliminary Consultation at paragraph 24 and Appendix B. The Authority finds that the information provided in the Preliminary Consultation was sufficient for parties to evaluate WOW's migration costs estimates. Further, based on the comments received and its own analysis, the Authority is satisfied that the cost estimates provided by WOW are reasonable, and should be used to determine the compensation WOW receives from Government for its migration.

2.6 Comments on whether any benefits may be conferred on WOW

22. The Authority asked parties if they believed any benefits would be conferred upon WOW as a result of implementation of WOW's Migration Proposal. BDC

⁴² The Authority has adjusted the insurance cost estimate to reflect the actual equipment cost estimates reflected in Table 1 of this Appendix.

⁴³ BDC response to Q2.

⁴⁴ Digicel response at Introduction.

did not think any commercial or technical benefits would be conferred on WOW by way of the migration.⁴⁵ However, BDC argued that WOW could benefit based on resale value of the equipment being decommissioned. BDC assumes that the decommissioned equipment could be sold and the proceeds used to reduce the overall cost of the project. BDC urged the Authority to consider this cost recovery in determining WOW's actual migration costs.⁴⁶

23. Digicel also noted that the decommissioned equipment may retain some value so offsetting recovery of costs from selling or retaining the decommissioned equipment should be considered.⁴⁷

2.7 Authority's response to comments on whether any benefits may be conferred on WOW

24. The Authority considers that, because the equipment WOW proposes to decommission is designed to operate in frequencies that are not generally used for broadcast entertainment services in other jurisdictions, there is little scope for resale in this instance. This also makes it difficult to assign a value to any equipment retained by WOW for use as spares. The Authority asked WOW to provide an itemized estimate of the value of the equipment being decommissioned, and to identify any parts that would be retained as spares. WOW responded that it was difficult to estimate the salvage value of these components as they are at the end of their service life and WOW's vendor is unable to provide pricing. WOW also indicated that "to avoid unnecessary aggravation" WOW has decided not to keep any components from the decommissioned equipment.⁴⁸
25. Given the age of the equipment, its remaining service life, the pace of technological change and the operating frequencies, the Authority is of the opinion that the salvage value of the equipment being decommissioned is effectively zero.

⁴⁵ BDC response to Q9.

⁴⁶ BDC response to Q2.

⁴⁷ Digicel response to Q12 and Q14.

⁴⁸ Email from Stanley Wright to Michael Wells, dated 31 March 2014.