Re-planning options for frequency bands within 1710-2300 MHz

Submission | MBIE

29 May 2020

Contents

Introduction

1. Thank you for the opportunity to comment on your consultation relating to the best value use of several spectrum bands from 1710 to 2300MHz.

2. The paper proposes an approach for bands where existing management rights expire 31 March 2021.

3. We support the Ministry's proposed approach. The issues addressed by the consultation paper are discussed below.

Radio microphones in the 1800 MHz Duplex Gap

4. RSM proposes to re-purpose the 1800 MHz duplex gap (1785-1805 MHz) to accommodate radio microphones, complying with ETSI standard EN 300 422-1.

[1] Do you agree with the RSM proposal to use the 1800 MHz duplex gap (1785- 1805 MHz) for radio microphones? If not, what is a better use of this block of spectrum?

5. The frequency range 1785 - 1805MHz is the centre band gap of 3GPP band 3. We support the Ministry using the centre band gap for possible spectrum for wireless microphones use. This is already the case in other markets-such as Europe. The wireless microphones category commonly includes related devices such as in-ear monitors, devices used for cueing on-air talent, and intercom systems for backstage communications.

6. We also support the Ministry planning for the future clearance of the 600Mhz band as this is an important mobile communications band which has strong international market support. The 600 MHz band is standardised in 3GPP and has been already sold for private use in America (incentive auction in 2017) and its use in other markets for mobile/IMT purposes is likely to increase. This is strategically important and extremely desirable band for mobile communication.

7. We are seeing significant rural demand for broadband services and adding capacity using low frequency bands is currently the only economic means of serving customers at many rural sites. **[ ]SPKCI** The 600MHz and 1500MHz 5G bands are expected to be key bands for efficiently meeting this demand.

8. Radio microphones have a GURL licence and currently use frequencies 502-606 MHz and 622-698MHz. In these frequency ranges, radio microphone users are a secondary user in the spectrum, so have to work around the primary user (currently digital television) by making use of " TV white spaces" and unused channels the spectrum.

9. By using the centre band gap (duplex gap) of band 3, it will potentially free up the 600 MHz band (3GPP band 71 and arrangement A 12 in ITU R M 1036, 617- 652 MHz paired with 663-698 MHz).

10. Furthermore, the use of microphones in the 600 MHz band is declining internationally as authorities clear the band for 5G services. For example, the US will no longer make 600MHz spectrum available for wireless microphones from July 2020. This will in turn put pressure on continued supply of wireless microphone hardware in the 600 MHz band. This is especially relevant for NZ as we are a small market and rely on economies of scale by deploying equipment used in major markets worldwide.

11. Therefore, it is timely to think of other spectrum options for wireless microphones. Overseas authorities are also looking to the 1800MHz range for wireless microphones. For example, we note that:

a. There is precedence to use the cellular band duplex gap for wireless microphones as is the case in the USA[1].

b. ACMA permits providers to use the "centre band gap" in the 1800MHz cellular spectrum for radio microphone operation[2].

c. Ofcom also provides for shared use of the 1785 to 1805MHz range[3].

12. We are not aware of any other use for an alternative use of spectrum for the centre band gap. However, as discussed at question 2 below, there must be a guard band in the duplex gap and not all the duplex gap will be useable.

13. Australia has defined a narrower band than the overall gap between the two frequency bands used for mobile services (1785 – 1805 MHz) and this would provide a greater probability of satisfactory technical co-existence between these two services.

[2] What size guard band would be appropriate for achieving compatibility between radio microphone use and mobile networks operating below 1785 MHz and above 1805 MHz?

14. ECC Report 191 addresses the compatibility between MFCN and PMSE devices[4]. A block emission mask (**BEM**) is proposed for handheld and body worn devices.

15. The BEM implies a lower guard band of 200 kHz and upper guard band of 1.4 MHz for hand-held microphones with some relaxation for body worn devices due to body losses.

Table 1: BEM for handheld microphone

	Frequency Range	Handheld e.i.r.p.	Reasoning
OOB	< 1785 MHz	-17 dBm/200kHz	LTE UE spectrum emission mask
Restricted frequency range	1785-1785,2 MHz	4 dBm/200kHz	Blocking of GSM BS
	1785,2-1803,6 MHz	13 dBm/channel	
	1803,6-1804,8 MHz	10 dBm/200kHz[5]	Slow increase of LTE UE selectivity
Restricted frequency range	1804,8-1805 MHz	-14 dBm/200kHz	Blocking of GSM UE
OOB	> 1805 MHz	-37 dBm/200kHz	OOB calculation, in line with ERC/REC 74-01

[1] See https://www.fcc.gov/wireless/bureau-divisions/mobility-division/wireless-microphones
[2] See ACMA https://www.acma.gov.au/wireless-microphones for available ranges and RSM 2013 https://www.rsm.govt.nz/assets/Uploads/documents/consultations/2013-uhf-radio-microphones/6e90f7d151/uhf-radiomicrophones-opportunities-for-future-use-discussion-document.pdf]
[3] See Ofcom https://www.ofcom.org.uk/manage-your-licence/radiocommunication-licences/pmse/pmse-technical-info/mics-monitors/shared
[4] ECC Report 191 *Adjacent band compatibility between MFCN and PMSE audio applications in the 1785-1805 MHz frequency range*, September 2013
[5] With a limit of 13 dBm/channel

Table 2: BEM for body worn microphone

	Frequency Range	Body worn e.i.r.p.	Reasoning
OOB	< 1785 MHz	-17 dBm/200kHz	LTE UE spectrum emission mask
	1785-1804,8 MHz	17 dBm/channel	Restricted frequency range
	1804,8-1805 MHz	0 dBm/200kHz	Blocking of GSM UE
OOB	> 1805 MHz	-23 dBm/200kHz	OOB calculation[6]

16. Today the band is predominantly used for LTE. Since the 2013 report [compilation of], the transmission of GSM has ceased. However, the edge spectrum adjacent to the centre-band gap is now destined for NB Iot. These NB Iot edge 200kHz carriers can be equally impacted similar to GSM. Further analysis of NB Iot and Wireless microphone coexistence is required.

17. There are various use cases for wireless phones, however consideration should be given to large events where cell sites can be placed near events with a high density of wireless microphones such as concerts and shows.

Postponing a decision on the Unpaired 2000 MHz band

[2] Do you agree with RSM's proposal to postpone a decision on the Unpaired 2000 MHz band ([2010]-2025 MHz) until there is clarity on international harmonised use for the band? If not, what is the best value use for this band?

18. We agree that - until there is a clear harmonised use for this band - a decision on its use can be postponed.

19. We do note that this is 3GPP band 34 and is TDD but the adjacent bands (band 1) are FDD and this could be a potential for interference.

Fixed links in lower portion of Paired 2200 MHz Band

[3] Do you agree with RSM's proposal to use the lower portions of the Paired 2200 MHz band (2025-2081.5 MHz and 2200-2256.5 MHz) available for fixed links to enable clearing of the 'L' and 'LL' bands (1427-1524 MHz)?

20. MBIE notes that the 2025-2081.5 MHz and 2200-2256.5 MHz spectrum would be sufficient to accommodate the migration of fixed links from the fixed ‘L’ and ‘LL’ bands in the frequency range 1427-1524 MHz, spectrum that is likely to be necessary to accommodate growth in mobile broadband.

21. We agree that the L band is now a globally harmonised band for IMT, and it now lies effectively underutilised at least in urban and provincial areas. It has excellent propagation properties which is why it is one of the few bands that has all three regions subject to footnotes 5.341 A, 5.341B and 5.341C in the radio regulations.

22. As for re tuning the existing links to another band, see our response to question 5 below.

[6] For the body worn case the body loss is 14 higher than for the handheld case, therefore the -23 dBm for body worn is equivalent to -37 dBm for handheld.

23. While the L band is used for fixed links and rural connectivity services (Chorus legacy CMAR technology is currently deployed in this band), options are emerging for these services.

    The technology landscape for remote customers is continuously changing;

    a. Some of the customers serviced by CMAR are now captured by the footprint of RCG;

    b. There are various non GSO FSS satellite constellations/consortiums that aim to provide rural connectivity.

    c. High altitude platform stations (HAPS) are another alternative. WRC 19 agreed to identify more bands to HAPS and passed a resolution, *"current technologies, such as HAPS, can be used to deliver broadband applications for broadband connectivity and disaster-recovery communications with minimal ground network infrastructure"*. This can potentially enable lower-cost connectivity and faster deployment"[7].

    d. WRC 19 also approved a new agenda item for WRC-23

        to consider, in accordance with Resolution [COM6/4] 247 (WRC-19), the use of high altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level.

24. These technologies will provide an alternative platform to CMARs for rural services over time.

25. Nonetheless, we support the Ministry identifying the proposed lower portion of 2200 as a viable option for current L band services and the Ministry progressing to clear the L band fixed links.

[4] Do you agree that the proposed channel plan for fixed links in Figure 1 would be adequate to transition those affected licences in 'L' and 'LL' fixed link bands? If not, why not?

[5] Do you agree that the proposed channel plan for fixed links could also accommodate short-term licences that may or may not align with the channel raster on a case-by case basis and are subject to coordination with fixed links for TV outside broadcasts of major events and for space operation?

[6] Are there better uses for the lower portions of spectrum in the Paired 2200 MHz band? If so, what?

26. We agree with MBIE's proposal with the band plan shown in Fig 1.

27. We would also like to note the demand for Microwave outside broadcast (**OB**) links is probably much less now then as compared to 20 years ago when the ITU R F 1098 plan was introduced. There are now other alternatives to OB linking such as OB satellite linking or wired links that could be connected to permanently based OB vans in major outside and sporting event venues in NZ.

Space operation in the upper portion of the Paired 2200 MHz Band

[7] Do you agree with RSM's proposal to reserve 2081.5-2110 MHz and 2256.5-2290 MHz exclusively for space operation in New Zealand? If not, why not?

[7] see WRC -19 COM 4/3, 4/4, 4/5, 4/6 respectively.

[8] Do you agree that the reserved spectrum would be adequate to support the growing demand in space activities?

[9] Is there a better use for the spectrum between 2081.5-2110 MHz and 2256.5- 2290 MHz? If so, what?

28. We have no comment on the planned use of these frequencies for space operations. However, it's unclear why E-S and S-E allocations are not balanced, i.e. what is driving 44.5 MHz to the up-link and 28.5 MHz to the down link allocation.

Options for the Paired 2100 MHz Band Expansion

[10] Do you agree with the proposal to use 10 MHz guard bands in the frequency range 2290-2300 MHz?

29. The proposed duplex direction of space operations should first be verified. ITU-R SA.1154 (1995) considers Earth to Space in the lower duplex and Space to Earth in the upper duplex. The discussion paper allocates the upper duplex for uplink (earth to space).

30. Below both scenarios are looked at.

<u>Earth Receive as victim receiver from Mobile Station Tx (duplex as per ITU-R SA.1154)</u>

31. This scenario is analysed below with earth receive as the victim receiver from a mobile base station

32. Using values specified in ITU-R SA.1154 the protection limit for Space operations is set at -184 dBW/kHz (min elevation 3 degrees) or equivalent of -134 dBm/ 100kHz. Typical receive antenna gains (large dishes) have a minimum gain of -6dBi, 10dBi (off axis >5 degrees) rising to 30 dBi at 1.5 degrees and peaking at 40 – 50 dBi on axis. Conservatively a gain of around 31 dBi could be considered for interference purposes for near on axis and with 7.5 dBi considered as an average gain.

33. A simplified analysis is performed to calculate the coordination range of a space operations receive dish assumed to be receiving up to 2290 MHz from a Band 40 (2300 MHz) cell site

Mobile Base Station TX					
Base station unwanted emissions unfiltered			a	-35.0	dBm/100 kHz
Band edge filtering			b	50.0	dB
Antenna gain			c	18.0	dBi
EIRP			d=a-b+c	-67.0	dBm/100 kHz
Satelitte Earth Rx					
Protected level (ITU-R SA.1154)			e	-135	dBm/100kHz
MCL (Reference 0dBi Rx gain)			f=d-e	68.0	dB
Coordination Range					
	g	h=f-g	$i=10^{\wedge(h-32.4-20\log(2290))/20}$		
Satelitte Receive scenario	Rx Antenna gain dBi	Net MCL dB			
Off axis	-6.0	62.0	i	0.01	km
Average horizontal	7.5	75.5	i	0.06	km
Near on axis	31.0	99.0	i	0.93	km

34. Even with filtering some co-ordination will be required with Space operation receivers to avoid desensitisation. The scenario of a dish pointing at 3 degrees to the horizon with a Band 40 cell site on the horizon gives an effective gain of 31dBi. Correspondingly the coordination distance is in the order of 1km, i.e. do not locate within 1km of a mobile base station.

Mobile Base-station Receive as victim receiver to Satellite earth station Tx (duplex as per discussion paper)

35. This scenario is analysed below with the mobile base station as the victim receiver from a satellite earth station up link.

36. The unwanted emission levels from are estimated from a satellite uplink transmit a broadly estimated from the following assumptions as -22 dBm/100 kHz. This assumption requires validation.

Peak EIRP	a	78	dBW	ITU-R SA.1154
Peak Antenna gain	b	50	dBi	ITU-R SA.1154
Relative unwanted emission	c	-80	dBc/100 kHz	estimated
dBW to dBm	d	30	dB	Constant
Unwanted emission level	e= a-b+c+d	-22	dBm/ 100 kHz	

Mobile Base Station TX					
Base station unwanted emissions unfiltered			a	-22.0	dBm/100 kHz
Band edge filtering			b	50.0	dB
Antenna gain			c	18.0	dBi
EIRP			d=a-b+c	-54.0	dBm/100 kHz
Satelitte Earth Rx					
Protected level -10 dB (I/N)			e	-131	dBm/100kHz
MCL (Reference 0dBi Rx gain)			f=d-e	77.0	dB
Coordination Range					
	g	h=f-g	$i=10^{\wedge(h-32.4-20\log(2290))/20}$		
Satelitte Receive scenario	Rx Antenna gain dBi	Net MCL dB			
Off axis	-6.0	71.0	i	0.04	km
Average horizontal	7.5	84.5	i	0.18	km
Near on axis	31.0	108.0	i	2.63	km

37. This shows coordination distances of several km. I.e. do not locate within 2.5km of a mobile base station.

38. In conclusion, this analysis shows with nominal band edge filtering of 50dB some coordination is likely required. The availability of a 10 MHz guard band allows for reasonable filtering to of 50dB.

39. In the case that earth operation stations are the victim receiver. Assuming a duplex implementation aligned with ITU-R SA.1154 (not as per proposed duplex).

40. Given the expected limited number of Space Operation earth station locations compared to a wide area deployment of cellular base stations this is best managed by earth station placement. For a cellular implementation, especially with newer integrated active antennas additional filtering is not pragmatic. If location cannot be managed, then a larger guard band should be investigated.

41. In the case that Cellular base stations are the victim receiver (as per proposed duplex).

42. The limited number of earth stations should allow for enhanced filtering to be included to manage interference to cellular and or be located clear of cellular base stations. If location or enhanced filtering cannot be achieved, then a larger guard band should be investigated.

43. The analysis above implies a larger guard band maybe required assuming location and filtering are inadequate. However, operation with a 10 MHz guard band should be possible.

[11] What is the best value use for the Paired 2100 MHz band expansion?

44. We agree with the MBIE's proposal to use this paired 30 MHz for mobile expansion in the long term. 3GPP band 1 is 1920- 1980 MHz paired with 2110- 2170 Mhz. The 2Ghz band is a very valuable band, adding 30 MHz of paired bandwidth to it will result in increased per operator allocations and make it viable for 5G NR. We also note that 3GPP band 65 is 1920- 2010 MHz paired with 2110- 2200 Mhz. Therefore, compared to band 1, band 65 provides the 2 x 30 MHz expansion. The recent Covid-19 Pandemic has shown that cellular networks perform a vital and essential function for the country. In this regard more spectrum in these fundamental bands is a very desirable.

45. ITU R M 1036 defines the expansion as B6- see Table 4 and notes 4 ,5. Note 4 suggests expansion of band 1 and is copied below:

    The bands 1 980-2 010 MHz and 2 170-2 200 MHz in the frequency arrangement B6 are intended to be used in combination with the frequency arrangements B1 or B4 which provides even further optimization of the use of spectrum for paired IMT operation (see Note 1).

46. That said there are a lot of handsets in circulation that will only tune to band 1 and will not be able to take advantage of the expansion. Base station hardware also has filtering that complies with band 1 and, in effect, new RF portions of base stations are needed. At the moment, no one uses the expanded band, so sourcing hardware for a small market is problematic. Accordingly, MBIEs proposal is more likely to be a useful long-term option.

47. The MBIE document also suggests a possible allocation to Mobile Satellite (**MSS**). This was the original intention in band 1 but in the past attempts to have a satellite component to IMT have not been successful. Certainly, as stated in note 5 to Table 3 of M 1036:

    Co coverage, co frequency deployment of independent satellite and terrestrial IMT components is not feasible unless appropriate mitigation techniques are applied. When these components are deployed in adjacent geographical areas in the same frequency bands, technical or operational measures need to be implemented if harmful interference is reported.

48. If these paired bands were allocated to MSS, then adjacent band terrestrial IMT and MSS would also result in complicated co-existence issues for which there is no easy solution.

[End]