Craoladh Digiteach Ionadail
Local Digital Broadcasting

Future authorisation of the 1900–1920 MHz band

CDI Response

May 2023

Overview of Craoladh Digiteach Ionadail

Craoladh Digiteach Ionadail (CDI) means ‘local digital broadcasting’ in Gàidhlig/Scots Gaelic. We are the prospective Small Scale Digital Audio Broadcaster (SSDAB) for the Scottish Western Isles, also known as the Outer Hebrides. This area was part of Ofcom’s Seventh Round of licensing, the applications for which closed on 29th April 2025.

Our geographic extent consists of the main islands, from north to south, of Lewis, North Harris, South Harris, North Uist, Benbecula, South Uist, Barra and Vatersay. The linear extent from ‘tip to toe’ is roughly the same as the distance from London to Sheffield.

Although we are applying for the licence to broadcast in Ofcom’s default advertised polygon centred on the Isle of Lewis, once this Digital Audio Broadcasting (DAB) coverage commitment is fulfilled we intend to expand coverage across the entirety of the Outer Hebridean islands. If no licensees apply for the mainland northwest Scotland polygons north of Oban, we shall also apply to extend coverage into these areas of the natural Gaeltacht, or Gàidhlig speaking areas of western Scotland.

In the latter regard, the spectrum former unpaired 3G spectrum between 1900 to 1920 MHz would be very useful to facilitate low-cost repeater-based DAB coverage extension.

Spirit in which this Response is offered

A DAB/DAB+ network is an ensemble of transmitters operating in Band III, extending from 175 MHz to 230 MHz. National, regional and local broadcasters operate one or more transmit sites as a ‘Single Frequency Network’, where a data stream is sent synchronously to all sites on the same frequency block to create overlapping coverage.

In fringe areas between transmitters, DAB/DAB+ receivers can combine the signals from two or more transmitters to obtain better performance than would be available from any one transmitter on its own.

Due to the way the DAB/DAB+ broadcast standard has been created, multi-transmitter coverage can also be created where a second transmitter, rather than broadcasting a datastream that it is fed, can receive and rebroadcast the signal from a neighbouring transmitter on the same frequency block.

Such an ‘On Channel Repeater’ (OCR) is possible due to Digital Signal Processing (DSP) creating a high level of cancellation of parasitic coupling between receive and transmit antennas on the same mast.

There are instances where coverage extension via OCR is more difficult; examples include chained transmitters in hilly terrain such as wide valleys, where later OCRs accumulate undesirable delay spread, or cumulative echo, in the signal.

Another example is where the receive antenna of an OCR cannot be pointed away from potentially interfering signals on the same frequency block; in anomalous propagation conditions, such victim OCRs will experience unwanted interference from distant DAB/DAB+ broadcasters.

The spectrum 1900-1920 MHz offers a solution to the OCR delay and interference problem.

Question 1: Do you agree with our analysis of potential demand for the 1900 MHz band? Are you aware of any other potential demand for this spectrum, including any demand specific to Northern Ireland?

Yes, however on the question of any other potential demand see later response to question 8.

Question 2: Do you agree with our identification of FRMCS as the optimal use of the 1900–1910 MHz spectrum?

Yes.

Question 3: Do you agree with our identification of ESN Gateways as the optimal use of the 1910–1915 MHz spectrum in Great Britain? Do you agree that it is too early to identify an optimal use of the 1910–1915 MHz spectrum in Northern Ireland at present?

No opinion expressed.

Question 4: Are you aware of any low power use cases suitable for the 1915–1920 MHz spectrum?

Yes, see response to question 8.

Question 5: Do you have any comments on our proposed authorisation approach for FRMCS?

No opinion expressed.

Question 6: Do you have any views on our proposed non-technical conditions for the new FRMCS licence?

No opinion expressed.

Question 7: Do you have any views on our proposed licensing process for the FRMCS licence?

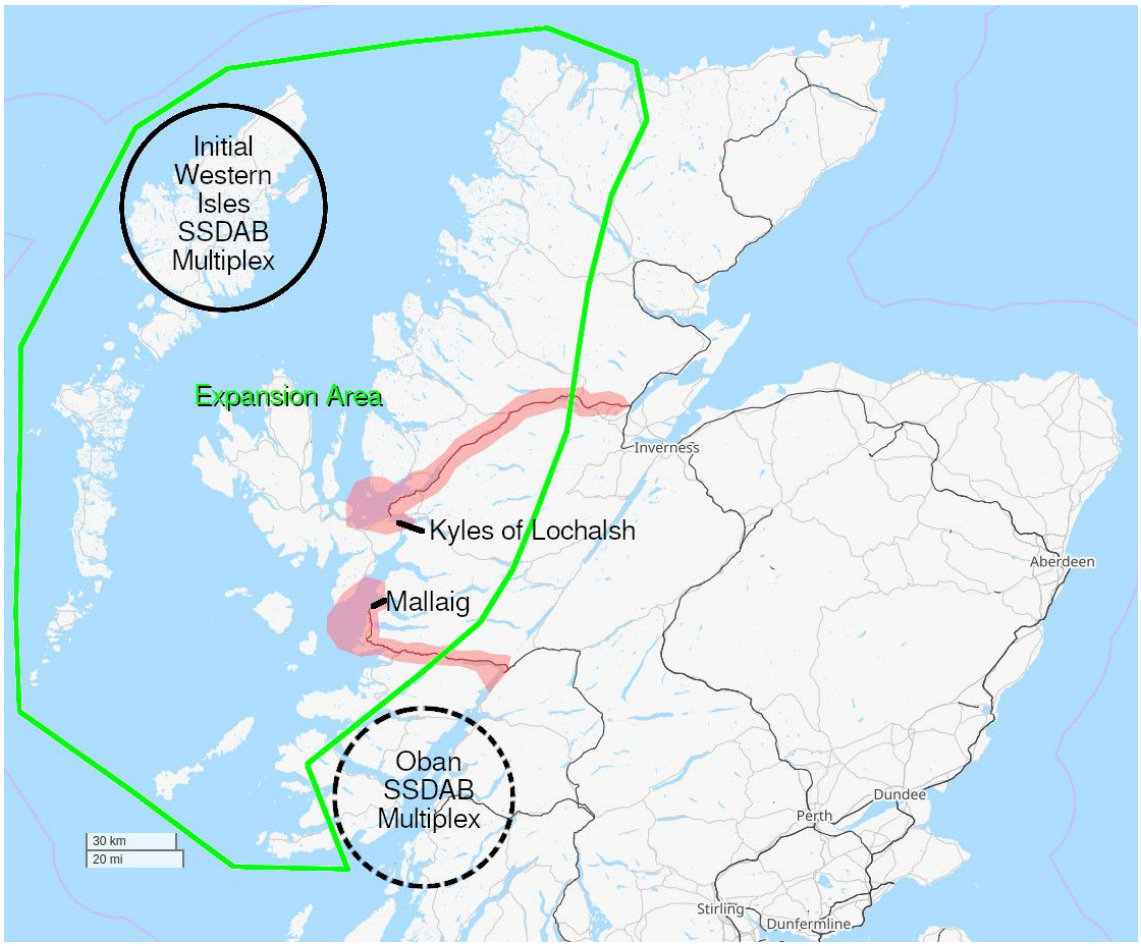
No.

Question 8: Are you aware of any uses that can coexist with FRMCS without creating a risk of harmful interference? If so, please provide evidence.

Background

The unpaired spectrum 1900-1920 MHz offers an ideal band via which to extend DAB/DAB+ coverage in areas where conventional OCRs would be difficult to implement due to excessive accumulated delay spread, or incoming anomalous interference from co-block services.

The illustration below shows CDI's prospective licensed area, and the area into which we might extend coverage with Ofcom's permission following activation of the default Isle of Lewis polygon:



Assuming an FRMCS inter-site distance of 5km, an inland interference zone of 5km based on along-line directional antennas, and an over-water interference zone of approximately 20km, the areas in red show the only zones in which FRMCS is applicable in CDI's prospective zone of influence.

Conversely, this illustrates that if the 1900 MHz spectrum were to be excluded from any use other than FRMCS, then it would lie fallow in nearly all of the north west coast of Scotland and all of the Outer Hebrides, where there is no rail service and very likely never will be.

Use Case

Ofcom have provisionally allocated DAB/DAB+ frequency block 9C (~206 MHz) for the Western Isles SSDAB multiplex and have confirmed that, due to the remoteness of the area to be covered, there are no outgoing or incoming interference considerations to be managed.

However, a proviso is that Ofcom reserve the right to allocate the same frequency block to future SSDAB operators, and as such any fringe coverage areas in the Western Isles, where service is initially possible, might not experience reliable coverage in future years.

If we were to roll out coverage based on low-cost DAB/DAB+ OCRs, as is the most cost-effective route to market, then this will not be an issue for OCR receive antennas with boresight to the north or west within the desired coverage area, as no interfering signals will originate from these directions.

OCR receive antennas oriented south or east, however, may experience co-block interference during anomalous propagation or ‘lift’ conditions, expected to occur between 1% and 5% of time and particularly during periods of high atmospheric pressure such as the summer months. This would reduce the radiated signal to noise ratio, to which is added the local noise plus interference at the receiver itself.

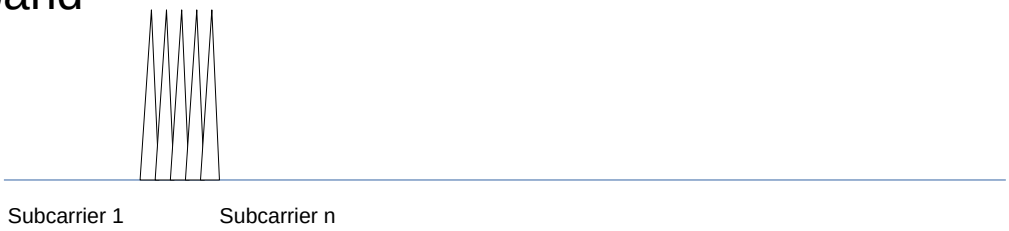
Considering also our prospective expansion area in north west mainland Scotland, where coverage would extend up sea lochs and valleys away from the coast, rather than implement relatively expensive and difficult-to-implement IP links it would be desirable to ‘daisy chain’ OCRs in these areas.

However, with the relatively broad beam receive antennas that are practicable for Band III, reflections from surrounding valley walls and hills will both degrade the DAB/DAB+ guard interval ‘window’ of approx 240 microseconds, so called ‘delay spread’. The reflections also create roughly equal power signal images which will multiply the crest factor at the transmitter output.

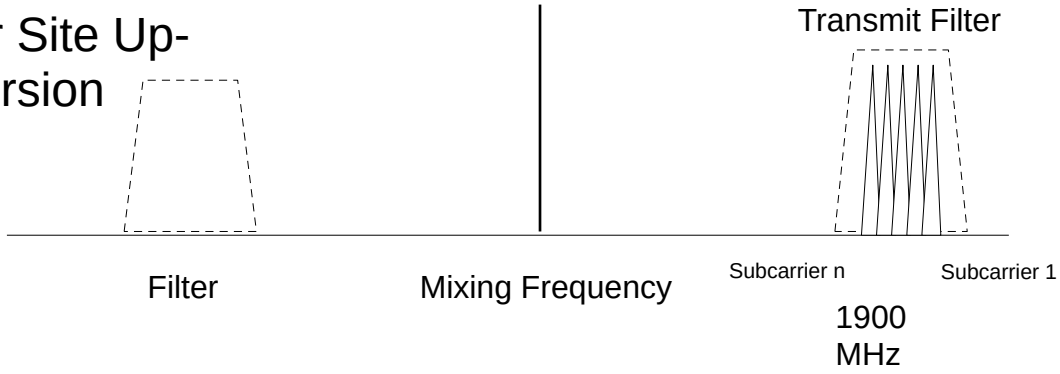
The 1900 MHz spectrum offers a solution to both the incoming interference and delay spread/crest factor issues. If a parent transmitter up-converts the DAB/DAB+ transmission as ‘baseband’ to an equal bandwidth transmission (i.e. approximately 1.5 MHz) within the frequency range 1900-1910 MHz, then the destination site down-converts the block back to 200 MHz ‘baseband’, this can be implemented very cheaply and cost effectively in such a way that renewable power could be used.

In block diagram form, this is represented below:

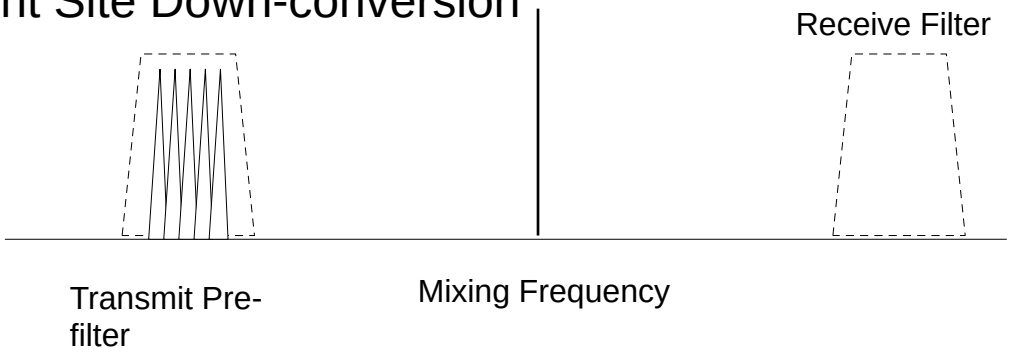
Donor Site
‘Baseband’



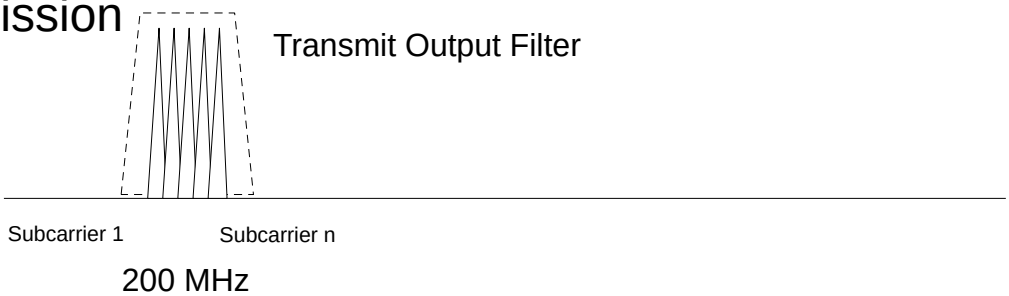
Donor Site Up-conversion



Recipient Site Down-conversion



Recipient Site Transmission



1900 MHz offers the advantage of much more directional antennas than at 200 MHz, with higher gain in shrouded Yagi form. This narrows both donor and recipient site antenna bandwidths, reducing signal reflections and thus delay spread. As the recipient site receives on a frequency that is not being interfered with at baseband, incoming and outgoing signal to noise ratio is preserved.

Question 9: Do you agree with our proposed approach for authorising ESN gateways in 1910–1915 MHz?

No opinion expressed.

Question 10: Do you have any views on our proposed non-technical licence terms for the ESN gateways licence?

No opinion expressed.

Question 11: Do you have any views on our proposed licensing process for the ESN gateway licence?

No.

Question 12: Are you aware of any uses that can coexist with ESN Gateways without causing risk of harmful interference? If so, please provide evidence.

No.

Question 13: Do you have any comments on our assessment of the coexistence of FRMCS in 1900–1910 MHz with existing DECT services and FDD uplinks?

No, the analysis seems accurate.

Question 14: Do you have any comments on our assessment of the coexistence of ESN Gateways in 1910–1915 MHz with existing DECT and FDD uplinks?

No.

Question 15: Do you have any comments on our assessment of the coexistence of ESN Gateways in 1910–1915 MHz with FRMCS in 1900–1910 MHz?

No.

Question 16: Do you have any comments on the feasibility of the additional mitigation measures we have identified, or additional suggestions for measures that could further reduce the likelihood and/or impact of interference?

No.

Question 17: Do you have any comments on our proposed technical licence conditions for FRMCS and ESN gateways?

No.

Question 18: Do you agree with our provisional conclusion that there is likely to be excess demand for the 1900–1915 MHz band, in future, if cost-based fees were applied; and, therefore, that an AIP fee is appropriate? Please provide any evidence to support your position.

No opinion expressed.

Question 19: Do you agree with our approach to fees, including fee level and adjustments? Please provide any evidence to support your position.

No opinion expressed.