



ECC Recommendation (17)03

Guidance for the harmonised use and coordination of
Maritime Broadband Radio (MBR) systems on board ships
and off-shore platforms operating within the frequency
bands 5852-5872 MHz and 5880-5900 MHz

Approved 19 May 2017

INTRODUCTION

This ECC Recommendation addresses the use of Maritime Broadband Radio (MBR) systems which operate within the frequency bands 5852-5872 MHz and/or 5880-5900 MHz. A high-speed MBR link may be implemented with adaptive antenna arrays that will enable beamforming and high directivity towards the MBR receiver. A radiocommunication system with advanced beamforming and digital processing may greatly increase the capability and capacity of the radio system.

The main use for an MBR system is between vessels as well as between vessels and fixed structures such as oil installations at sea which are cooperating in complex operations at sea within a well-defined area of operations, typically with link length shorter than 20 km. As the system is completely digital, it can be used for voice, video and data transmission. Data rates will typically be in the order of 10 Mbit/s or more. The communication content will typically be different kinds of operational data, navigational data, administration data, update of chart data, messaging, live video from cameras, etc.

The MBR system is a mobile point-to-point/point-to-multipoint radio link system. The MBR system is solely maritime, and there is no station based on-shore. The MBR links (there are usually more than one) are only used between elements at the off-shore site which are relatively short ranged. MBR systems may operate in national¹ and international waters.

Transmission of data rates at long distance over sea is by no means a trivial matter. Problems due to sea reflections and reflections from structures may frequently occur and should be mitigated by suitable processes in the digital processing platform. Moreover, the high directivity obtained with phasing of antenna arrays makes it possible to establish a dynamic link communication system between several entities. The antenna directivity and pointing angle can be dynamically adjusted both in azimuth and elevation thereby optimising the link budget under different conditions. Moreover, phasing of antennas can be used to create antenna nulls in directions which should not be illuminated with high e.i.r.p. or to suppress interfering signals from specific directions.

At the writing of this Recommendation, a number of initial off-shore MBR networks, mostly for test purposes, have already been successfully deployed, confirming the technical feasibility of MBR links. No interference to other systems has been reported [1].

ETSI has developed the system reference document TR 103 109 [2] that provides the technical characteristics of Maritime Broadband Radio (MBR) systems.

For MBR system equipment on vessels that is used while in motion, this ECC Recommendation is useful to ensure that MBR system equipment complies with the necessary technical and regulatory requirements, and it provides for the harmonised use of frequencies of these terminals in national CEPT and adjacent international waters.

Two separate independent MBR operations within the same geographical areas are a realistic scenario. Even when considering high levels of antenna discrimination and interference robustness of the MBR system, the minimum separation distance to operate two different MBR networks are of an order of magnitude of tens of kilometres. This implies the need to allocate two different frequency carriers to allow MBR operations for distinct maritime activities in close geographical areas. Alternatively, time division would be needed which limits first of all the capacity for each operator.

In most cases, the MBR network operational area will be in use for a limited time e.g. from a few days up to one or only a few months.

¹ territorial waters as defined in the UN Convention of the Sea (UNCLOS, 1982)

ECC RECOMMENDATION OF 19 MAY 2017 GUIDANCE FOR THE HARMONISED USE AND COORDINATION OF MARITIME BROADBAND RADIO (MBR) SYSTEMS ONBOARD SHIPS AND OFF-SHORE PLATFORMS OPERATING WITHIN THE FREQUENCY BANDS 5852-5872 MHZ AND 5880-5900 MHZ (ECC/REC/(17)03)

“The European Conference of Postal and Telecommunications Administrations,

considering

- a) that the introduction of new MBR systems will enhance broadband communications between ships and between ships and off-shore platforms within defined areas;
- b) that MBR systems will require up to two frequencies within the range 5850-5925 MHz to allow deployment of a system where one frequency is already in use by an MBR or other system;
- c) that in the ITU Radio Regulations (ITU RR), the band 5850-5925 MHz is allocated in Region 1 to the Fixed Satellite Service (FSS) (Earth-to-space), the Fixed Service (FS) and the Mobile Service (MS) on a primary basis, while footnote 5.150 in the ITU Radio Regulations for ISM (Industrial, Scientific, Medical) applications applies for the frequency band 5725-5875 MHz;
- d) that ECC Recommendation (06)04 [3] designates the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA) applications;
- e) that ERC Recommendation 70-03 [4] designates the band 5725-5875 MHz for non-specific Short Range Devices (SRD) applications;
- f) that ECC Recommendation (08)01 [5] designates the band 5855-5875 MHz for Intelligent Transport Systems (ITS) non-safety applications;
- g) that ECC Decision (08)01 [6] designates the band 5875-5905 MHz for ITS traffic-safety applications;
- h) that the use of MBR systems on ships and off-shore platforms at international waters requires authorisation for the use of frequencies by the relevant national Administration of the country where the ship or off-shore platform is registered and may also require an authorisation from countries where its Exclusive Economic Zone overlaps with the location of the ships and off-shore platforms;
- i) that, according to the results of ECC Report 259 [7], the use of MBR systems in defined off-shore areas of operation in international waters may require coordination for the MBR area of operation with on-shore broadband fixed wireless access networks, radiolocation systems, and other terrestrial fixed stations;
- j) that use in national waters will require a frequency authorisation issued by the relevant national authorities, noting the owner and user of the MBR system is responsible for obtaining such an authorisation prior to putting the MBR system into operation;
- k) that in EU/EFTA countries the radio equipment that is under the scope of this Recommendation should comply with the Radio Equipment Directive, and conformity with the essential requirements of the Radio Equipment Directive may be demonstrated by compliance with the applicable harmonised European standard(s) or by using the other conformity assessment procedures set out in the Radio Equipment Directive;
- l) that ETSI has published the European harmonised standard EN 303 276 [8] for MBR systems;

recommends

1. that CEPT administrations should:
 - a. make the frequency bands 5852-5872 MHz and 5880-5900 MHz available for the operation of MBR systems;
 - b. apply the technical and operational conditions necessary to ensure harmful interference is not caused by MBR systems to stations of the Fixed Satellite Service (FSS), the Fixed Service (FS) and the Mobile Service (MS) as described in Annex 1, taking into account the guidelines as provided in Annex 2;
 - c. inform the Office, through the ECO Frequency Information System (EFIS), whether frequencies within 5852-5872 MHz and 5880-5900 MHz are designated for MBR system operations, or not, within their territory;
 - d. apply individual authorisation for MBR systems;
2. that within the frequency ranges 5852-5872 MHz and 5880-5900 MHz, MBR systems should operate only in the portions of these frequency ranges identified for their use within the territory of operation.”

Note: Please check the Office documentation database <http://www.ecodocdb.dk> for the up to date position on the implementation of this and other ECC Decisions and Recommendations.

ANNEX 1: TECHNICAL REQUIREMENTS FOR MBR SYSTEMS OPERATING IN THE BAND 5850-5900 MHz

MBR operating within the frequency bands 5852-5872 MHz and 5880-5900 MHz should comply with the following technical requirements:

Table 1: MBR transmitter parameters

Parameter	MBR
Carrier centre frequency	5862 MHz and 5890 MHz
Maximum channel bandwidth	20 MHz
Minimum antenna gain at maximum radiated power	24 dBi (circular polarised) 21 dBi (linear polarised)
Maximum e.i.r.p.	25 dBW (circular polarised) 22 dBW (linear polarised)
Maximum radiated spectral power density (e.i.r.p.)	-48 dBW/Hz
Minimum Adaptive Transmitter Power Control (ATPC) range	25 dB

The MBR has power reduction facility where the output power of the transmitter is reduced until the lowest necessary level. Each transmitted package contains information on the transmitted power level, the receiver measures the received signal strength, calculates the quality of the link and indicates suitable power reduction and the output power will automatically be reduced up to 25 dB.

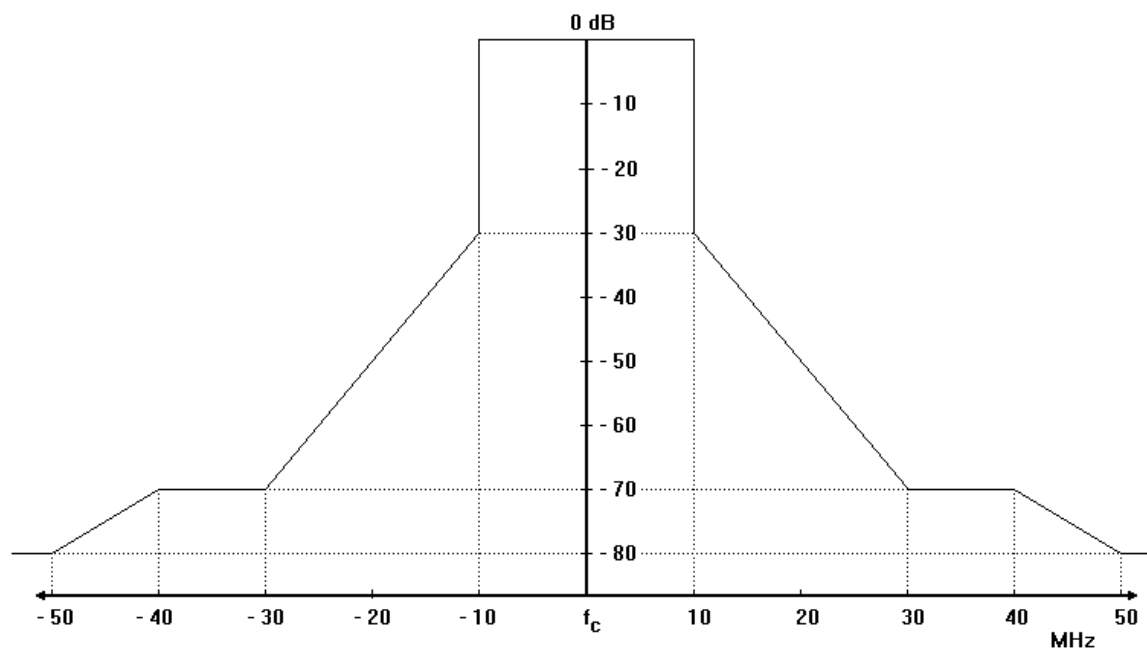


Figure 1: Transmitter output power spectrum mask

MBR systems should be self-monitoring and, should a malfunction be detected which could cause harmful interference to FSS or terrestrial networks, the MBR must automatically cease its transmissions.

MBR systems should be in conformance with the Harmonised European Standard 303 276 [8] for Maritime Broadband Radio (MBR) links for ships and fixed installations in off-shore activities.

ANNEX 2: GUIDANCE ON COORDINATION REQUIREMENTS FOR MBR SYSTEMS

A2.1 OVERVIEW OF THE RESULTS CONTAINED IN ECC REPORT 259 AND POSSIBILITIES TO REDUCE THE SEPARATION DISTANCES

ECC Report 259 [7] studied the sharing and compatibility between Maritime Broadband Radio (MBR) in the 5850-5900 MHz frequency band and other systems.

The studies in ECC Report 259 are to a large degree based on scenarios with low probability and probability calculations have not been taken into account. Practical regulatory implementation based on national use may give shorter protection distances.

MBR links should be operated in a well-defined area of operation at sea with all MBR links between several vessels and fixed structures which are cooperating in their operations. Concerned CEPT administrations should therefore define the area of operations before coordination with other radio services takes place.

Coordination may be required for MBR areas of operation with on-shore broadband fixed wireless access networks, radiolocation systems and other terrestrial fixed stations.

A2.2 GENERAL

The ECC Report 259 on "Sharing and compatibility studies between Maritime Broadband Radio (MBR) in the 5850-5900 MHz frequency band and other systems" describes to some extent the worst case scenarios.

As MBR is a mobile system and the MBR antenna beam is quite narrow, the link may point in any direction in the horizontal plane and the direction may vary relatively rapid during operations. In addition, for radio system with directional antennas, interference may only occur when the victim system's transmitter and receiver as well as the MBR transmitter and receiver, are all located on the same straight line which has very low probability.

Most of the MBR operations are taking place within 10 km distance (typically not more than 20 km). This means that under normal operating conditions, the MBR output power is considerably below the maximum value as the output power may automatically be reduced up to 25 dB, especially for MBR operations within 20 km.

Interference scenarios with MBR have therefore generally low probability and often with short duration. In this regard, CEPT administrations may include the possibility for a review of the authorisation conditions after an initial period of MBR operations when first practical experience, e.g. test cases and reports, has been gained.

The MBR system employs a forward error correcting technique, and the communication link employs a request for repetition technique that results in retransmission if corrupted data frames are received. In addition, the shaping and tailoring of the antenna beam minimises the interference to and from the MBR. The MBR link is therefore very robust and almost insensitive to interference from other radio systems.

A2.3 WITH BROADBAND FIXED WIRELESS ACCESS (BFWA)

Considering an MBR maximum e.i.r.p. of 25 dBW, MBR transmitters will not exceed the interference criterion for BFWA receivers at distances above 112 km when BFWA is placed at the coastline at heights more than 120 m above sea level. In the case when BFWA is used on an off-shore platform, MBR transmitters will not exceed the interference criterion for BFWA receivers at distances above 96 km.

However, the MBR antennas may point in any direction in the horizontal plane. The -3 dB beam width is 10°. It is therefore only $10/360 = 2.8\%$ probability that the MBR transmitting main lobe is pointing in a specific direction. For a sectorised BFWA antenna, the beam width may be around 20°. Maximum mutual

interference will only occur when both transmitters and both receivers are all on an approximately straight line which has low probability and generally short duration.

Hence, a possibility is seen to include provisions in the authorisation process for MBR that defines rules and enables adequate coordination in case of the occurrence of an interference case. It is recommended that such rules should be applied in case of experienced problems and not ex-ante, i.e. not before the occurrence of the problem; but rules should be clear and serve an immediate resolution of the local problem.

The upper MBR channel (5880-5900 MHz) is not co-frequency allocated with BFWA systems operating on frequencies below 5875 MHz. BFWA systems may use one of up to 7 different channels in the band 5725-5875 MHz where only one of these has co-frequency allocation with the lowest MBR channel.

BFWA systems are often local systems with limited operational range and antenna heights of less than 120 m above sea level, resulting in shorter protection distances. Furthermore, BFWA antennas mounted off the coast may be shielded by terrain.

CEPT administrations concerned about the coordination of MBR links with BFWA should take into account the following guidance:

- The lower MBR channel centred at 5862 MHz should be considered not to be used in national waters. Another possibility is to consider reduced radiated power for MBR links in smaller MBR operational areas;
- For MBR operations in international waters, coastal terrain information should be considered to define a reduced minimum separation of the MBR operational area from the coastal line.

A2.4 WITH (INTELLIGENT TRANSPORT SYSTEMS) ITS

As for the interference from MBR to ITS receivers, the minimum distance is depending on the Line Of Sight and not on the attenuation of the radio waves. The Line Of Sight is different for different coasts depending on the height and for a road height of 160 m above sea level, a minimum distance between MBR and the coast line is calculated to be 77 km. ITS transmitters will not interfere with MBR receivers at distances above 11 km from the coast. For MBR coordinated activities farther away than 77 km off the coast, sharing between ITS and MBR seems feasible. Mutual interference takes place only when the MBR transmitter, the MBR receiver and ITS equipment are all on the same straight line and the MBR transmitter is directed towards the coast (coastal road at sea level). The average height of the coastal roads should be taken into account when defining a minimum separation distance between the MBR area of operation and the coastal line.

The Line Of Sight reduces with lower antenna heights and there are extremely few roads in Europe where the roads in the coastal areas are located at 160 meters above sea level. Further, roads at a distance from the coast may be shielded by terrain obstructive between the coast and the antenna, such as hills, woods and mountains.

CEPT administrations concerned about coordination of MBR links with ITS should take into account the following guidance:

- Only the higher MBR channel centred at 5890 MHz is operating in the same band as ITS for traffic safety and may be considered not to be authorised in national waters;
- The probability that MBR radiation is pointing towards a certain point on land is less than 3 % and the moving nature of antenna pointing of mobile services like MBR gives the radiation in a certain direction short duration;
- Outside of national waters, the coordination considerations should take into account coastal terrain information and in particular the height of the coastal roads. In addition, detailed information about fixed ITS infrastructure stations in the concerned coastal section should be taken into account. It should be noted that the MBR transmitter pointing towards the coast (due to Line of Sight consideration in ECC Report 259 [7]) is placed further away from the coast than the edge of the MBR operational area and inland roads are by the terrain quickly protected from radiation;
- For MBR operational areas with hop-lengths of less than 20 km, the output power is generally reduced by up to 25 dB. A reduction in MBR radiated power with 10 dB (to 45 dBm) at the border of the national

waters leads to a situation that MBR operations outside of the national water is feasible without coordination for the protection of ITS;

- The considerations concerning the coexistence between MBR links and fixed ITS stations may often be superseded by the protection requirements of other primary services such as Fixed Links and land-based radiolocation systems.

A2.5 WITH RADIOLOCATION

Considering an MBR maximum e.i.r.p.=25 dBW, the protection distance from an MBR transmitter to radiolocation system receivers is up to 80 km for ground based radar and 11 km for shipborne radar for the lower MBR channel, while distances are 6 km and 1 km for the upper MBR channel respectively. To protect an MBR receiver from radiolocation service (RLS) interference a protection distance of 180 km is required. It is therefore proposed to clearly indicate in the authorisation/ operational rules for MBR that no protection from interference from radiolocation systems can be ensured.

CEPT administrations should consider for coordination considerations that:

- MBR and radiolocation systems are not operating in the same frequency band and use of the upper MBR channel gives very short protection distances, both to land and ship installations;
- Mutual interference may only occur when the MBR link and the radar are pointing directly towards each other. Additionally, the extremely narrow radar antenna beam with high antenna rotating speed and pulsed transmissions will mutually interfere with the pulsed time-division-multiple access (TDMA) transmissions of the MBR at a very rare time slots. Therefore, mutual interference has negligible probability;
- If possible, details of the concerned radars should be taken into account since the calculations in ECC Report 259 are only based on two types of land based radars and one shipborne radar type.

A2.6 WITH FIXED LINKS

Considering an MBR maximum e.i.r.p.=25 dBW, separation distances of up to 99 km would be required for land based fixed links and up to 74 km for off-shore fixed service links for FS receivers with selectivity attenuation less than only 50 dB at 100 MHz off-set which is highly unlikely and unusual.

CEPT administrations should note for coordination considerations that:

- MBR and the fixed service (FS) are not operating in the same band and the lowest FS carrier is more than 40 MHz away from the carrier of the upper MBR channel;
- The selectivity of FS receivers is generally considerably better than 50 dB at 100 MHz off-set or else other FS links on the adjacent and neighbouring channels as well as other radio systems could not operate in the same geographical area;
- The calculated interference scenarios are only applicable for FS channels in the lowest part of the FS band (i.e. exactly above 5925 MHz);
- The probability of interference depends very much on the antenna gain of the involved systems since both the MBR links and FS systems have highly directive antennas and therefore interference may only occur when the MBR transmitter and the receiver as well as the FS transmitter and receiver are all on the same straight line.

A2.7 WITH OTHER MBR SYSTEMS

As described in the ETSI system reference document TR 103 109 [2], operations of two independent MBR systems on the same channel do not allow simultaneous operations of these systems in the same or overlapping operational area.

Even when considering high levels of antenna discrimination, the minimum separation distance to operate two different MBR networks operating on the same channel is of the order of magnitude of several tens of kilometres. A geographical separation of 50 km is considered to be sufficient for re-using the same MBR channel again (at maximum MBR link radiated power).

Frequency planning will be necessary to avoid interference and network outages, specifically when considering maritime simultaneous operations and real time data links which are likely to require a high level of availability.

A2.8 WITH FIXED SATELLITE SERVICE (FSS)

With output power 25 dBW, MBR emissions are not exceeding the coordination triggering level of $\Delta T/T = 6\%$ for any FSS system in geostationary orbit and there is only a minimal probability that $\Delta T/T$ is above 1 % for a small number of geostationary satellite systems.

MBR is not operating on the same frequencies as any non-geostationary satellite system.

There is therefore generally no need to coordinate MBR with FSS systems.

A2.9 INTERNATIONAL COORDINATION CONSIDERATIONS

For the situation where stations are within the territories of different administrations, the use of these guidelines within bilateral agreements may help to expedite cross border coordination. In deploying new stations, administrations and operators should be cognisant of the need to minimise constraints on other services, and this should be ensured by the coordination process.

The information available at the Office about the MBR areas of operation can be used to decide whether coordination actions should be triggered.

A2.10 COORDINATION PRINCIPLES

Coordination with MBR operational areas should be carried out on a case-by-case basis, since no single separation distance, guard-band or signal strength limit can be provided. The ITU-R P.452 [9] model should be used for more detailed coordination purposes.

The following key principles related to the coordination should be considered at national level or between neighbouring countries in order to ensure coexistence between these systems:

1. Coordination is primarily about national implementation, local propagation conditions and national licensed use, which is best dealt with by national administrations.
2. The principle should be that the operator who introduces changes to his network has to trigger a coordination process (e.g. a new MBR operational area or a new fixed station in one of the concerned services);
3. The implementation of these guidelines is at the discretion of the national administrations to the extent this may help them;
4. Coordination processes and associated protection should only apply to registered/licensed spectrum users;
5. The coordination process should be both accurate and fast to enable all operators to efficiently plan spectrum utilisation and network deployments;
6. Interference scenarios with MBR have generally low probability and often short duration. In this regard, CEPT administrations may include the possibility for a review of the authorisation conditions after an initial period of MBR operations when first practical experience will have been gained;
7. Well-defined MBR operation areas less than 20 km and which are outside national waters (12 nautical miles) give normally sufficient protection due to the power reduction and detailed coordination may not be necessary with land based systems.

ANNEX 3: LIST OF REFERENCE

This annex contains the list of relevant reference documents.

- [1] FM_CG_MBR(16)07: Kongsberg Report on deployment of MBR networks
- [2] ETSI Technical Report TR 103 109 V1.1.1: Broadband communication links for ships and fixed installations engaged in off-shore activities operating in the 5 GHz to 8 GHz range.
- [3] ECC Recommendation (06)04: Use of the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA)
- [4] ERC Recommendation 70-03: Relating to the use of Short Range Devices (SRD)
- [5] ECC Recommendation (08)01: Use of the band 5855-5875 MHz for Intelligent Transport Systems (ITS)
- [6] ECC Decision (08)01: ECC Decision of 3 July 2015 on the harmonised use of the 5875-5925 MHz frequency band for Intelligent Transport Systems (ITS)
- [7] ECC Report 259: Sharing and compatibility studies between Maritime Broadband Radio (MBR) in the 5850-5900 MHz frequency band and other systems
- [8] ETSI EN 303 276: Electromagnetic compatibility and Radio Spectrum (ERM); Maritime Broadband Radio (MBR) links for ships and fixed installations engaged in off-shore activities; Harmonized EN covering the essential requirements of article 3.2 of the Radio Equipment Directive
- [9] Recommendation ITU-R P.452: Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz