Inmarsat response to Ofcom Consultation:
Licence Exemption of Wireless Telegraphy Devices - Candidates for 2011

16 June 2011

1 Introduction

Inmarsat is pleased to provide comments to Ofcom related to the proposals for licence exemption of Wireless Telegraphy Devices. Our comments here are limited to proposals related to 2 GHz MSS terminals.

Inmarsat is one of the two operators selected by the EC for the provision of mobile satellite services at 2 GHz. Inmarsat supports that MSS user terminals are included in the exemption regulations. We recognise that the technical conditions for MSS user terminals are currently being studied with the CEPT and we agree that conditions applied now should be considered interim, until such time as the studies are complete.

In assessing the technical limits for MSS user terminals (UTs) it is necessary to consider both the impact on the potential victims of interference from MSS UTs, and to consider the impact of possible constraints on MSS operations. The spectrum available to each 2 GHz MSS operator is 2x15 MHz and the application of guard bands, whether explicit or as a consequence of meeting certain out-of-band emission limits, could be a significant loss of spectrum for MSS operations.

We note that when Ofcom assessed the out-of-band emission limits for CGC base stations in the 2 GHz bands, Ofcom took the view that relatively relaxed emission limits should be applied, even if the adjacent band service (PMSE in that case) would not be protected to the full extent requested[1]. Addressing the possible application of more stringent limits, Ofcom stated (para 6.30 of the July 2009 statement) that "restricting CGC operation to such low power limits cannot be considered consistent with our obligation under the EU Decision to make the full 2 x 30 MHz available for CGC operation." This objective, of ensuring that the full MSS band is available, should be maintained when addressing the technical conditions for UTs. The technical conditions for CGC base stations and UTs should allow for the full use of 2x30 MHz for MSS and CGC operations. In contrast, in the consultation document, Ofcom has proposed in the interim limits to constrain all MSS UT emissions to the band 1980.1-2009.9 MHz and to apply other limits which may prevent the operation of some MSS UTs or lead to the need for significant additional guardbands.

[1] "Authorisation of terrestrial mobile networks complementary to 2 GHz mobile satellite systems (MSS)", Ofcom Statement dated 17 July 2009. See paras 6.25 to 6.45.

The equipment standards applicable for MSS UTs, whether operating as a CGC or directly to the satellite, have been developed by ETSI. EN 302 574-2 applies to wideband UTs, which operate in a CGC network. EN 302 574-3 applies to narrowband UTs. These standards have been developed to meet the essential requirements of article 3.2 of the R&TTE directive, in particular to avoid causing harmful interference. These standards have been completed by ETSI after a period of public consultation and have been cited in the Official Journal of the European Union. It is therefore neither necessary nor desirable to modify these standards, or to apply conditions which are inconsistent with those standards. ETSI standard ETSI EN 301 442 has also been developed to cover non-GSO MSS systems, but as both of the 2 GHz MSS operators will use GSO MSS systems, that standard is not relevant in the UK.

Ofcom proposes interim limits on the out-of-band emissions (Table 1 of the consultation document) and on the in-band emissions (Table 2 of the consultation document). The two sets of limits are discussed separately below.

2 Out-of-band emission limits

Ofcom has based the proposed limits, in part, on CEPT Report 39. These limits are based on protection of 2 GHz terrestrial mobile systems, which are the main concern of interference from MSS UTs operating in the band 1980-2010 MHz. Although the limits in Report 39 would apply to terrestrial mobile systems, they are a good basis to assess the potential limits for MSS UTs. However, MESs operating to the ETSI standards are not able to fully meet the Report 39 limits, irrespective of any guardbands. The ability of MSS UTs to comply with the Report 39 limits has been addressed by Inmarsat in a contribution to CEPT Project Team SE40, a copy of which is attached.

MSS UTs which comply with the wideband ETSI standard (EN 302 574-2), are able to meet the Report 39 limits, with no guard band required by either service, with the exception of the limit P_{BL} (-27 dBm in 5 MHz), which would apply to any frequencies used for terrestrial TDD networks, more than 10 MHz from the band edge[2]. However, as is discussed in the attachment, terrestrial UTs complying with the relevant terrestrial ETSI standards are also unable to meet this limit. The spurious emission limit applicable to terrestrial terminals is -30 dBm in 1 MHz – the same as that applying to wideband MSS UTs.

Consequently, Inmarsat proposes that for MSS UTs which comply with the wideband ETSI standard, no additional limits are required. In other words, compliance with the limits in the ETSI standard adequately protects adjacent band systems from out-of-band emissions. It should be noted that the current channel plan for terrestrial mobile systems in ECC Decision ECC/DEC/(06)01 effectively applies a guardband of 300 kHz below the lower edge of the MSS band, and a guardband of 500 kHz at the upper edge of the MSS band. This factor, not taken into account in Report 39, would provide an additional level of protection to terrestrial mobile systems.

[2] Note: Table 1 in the corrigendum to the consultation document erroneously applies this limit in the range 5-10 MHz from the band edge. As shown in Table 11 in CEPT Report 39, the value P_{BL} applies to TDD frequencies more that 10 MHz from the band edge.

The limits in the wideband ETSI standard are given as transmit power. It could be possible for an MSS UT to operate with a high gain antenna, thereby giving an EIRP higher than the transmit power in some directions. The current CEPT studies are considering the use of wideband terminals with an antenna gain of 15 dBi and transmit power of 33 dBm. However, as an interim measure, it is proposed that the maximum EIRP of a wideband MSS UT is limited to 39 dBm – the maximum transmit power in the ETSI standard.

For MSS UTs which comply with the narrowband ETSI standard (EN 302 574-3), the attached study shows that compliance with the Report 39 limits is not feasible without some adjustments. As for the wideband terminals it is not possible for narrowband UTs to meet the Report 39 P_{BL} limit of -27 dBm in 5 MHz, applicable for frequencies used for TDD networks, more than 10 MHz from the band edge. This conclusion applies irrespective of the guardband used by the MSS operator. It is therefore necessary to apply a higher limit for frequencies more than 10 MHz from the band edge. The results in the attachment show that narrow band terminals are able to meet a limit of -17.8 dBm in 5 MHz bandwidth for frequencies more than 10 MHz from the band edge. We note that Ofcom has not proposed to apply any limits more that 10 MHz from the upper and lower band edges. We support that for frequencies greater that 10 MHz from the band edge, the emission limits in the ETSI standard are adequate and there is no need for additional limits to be applied by Ofcom. If however Ofcom does wish to apply its own limits for frequencies more that 10 MHz from the band edge, the value should be no less than -17 dBm in 5 MHz bandwidth.

Narrowband MSS UTs are also unable to meet the Report 39 limits for the first adjacent 5 MHz channel, irrespective of the guardband, as shown in the attachment. Consequently, higher limits are required close to the band edge to allow for narrowband MSS operation. Ofcom has proposed limits within 2 MHz of the upper and lower band edge that would provide some relaxation of the Report 39 limits. While this approach is supported in principle, the proposed limits are consistent with those in the ETSI standard ETSI EN 301 442, which is applicable for non-GSO MSS systems and do not meet the requirements for GSO MSS systems.

Figure 1 below shows the emissions from a narrowband UT complying with EN 301 574-3, using the same assumptions as are given in the attachment. The Ofcom proposed mask is also shown with all values converted to a reference bandwidth of 3 kHz. The two lines showing the MSS UT emissions relate to different options contained within the ETSI standard[3].

[3] See section 4.2.2.2 of the ETSI standard EN 302 574-3.

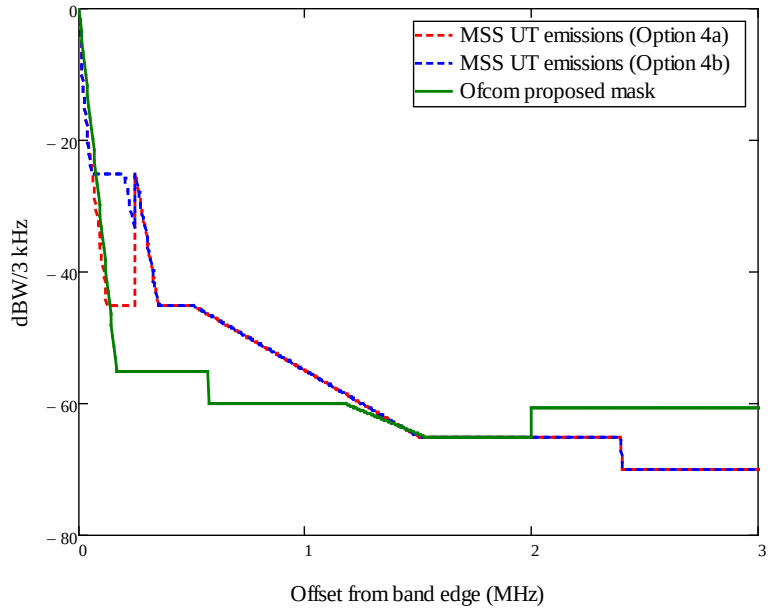

Figure 1 Out-of-band emissions for narrowband MSS UT (no guard band) and Ofcom proposed limit (EIRP)

It can be seen that the UT emissions exceed the proposed limit for frequencies up to about 1.5 MHz from the band edge. It is also notable that the Ofcom proposed limits, when converted to a reference bandwidth of 3 kHz, show lower values in the range 1.2-2 MHz than for frequencies above 2 MHz. Using the representative characteristics for narrowband MSS UTs given in the attachment, a guardband of 900 kHz would be required to meet the limits proposed by Ofcom close to the band edge. Inmarsat therefore proposes an alternative mask that would reduce the guardband required for narrowband MSS UTs.

The mask proposed by Inmarsat is shown in Figures 2a and 2b. Figure 2a shows the MSS UT emissions with respect to the proposed mask assuming no guardband, and Figure 2b shows the MSS UT emissions for an MSS guardband of 100 kHz with respect to the band edge. The proposed mask would apply from the upper and lower edges of the allocated band, i.e. from 1980 MHz and below, and from 2010 MHz and above.

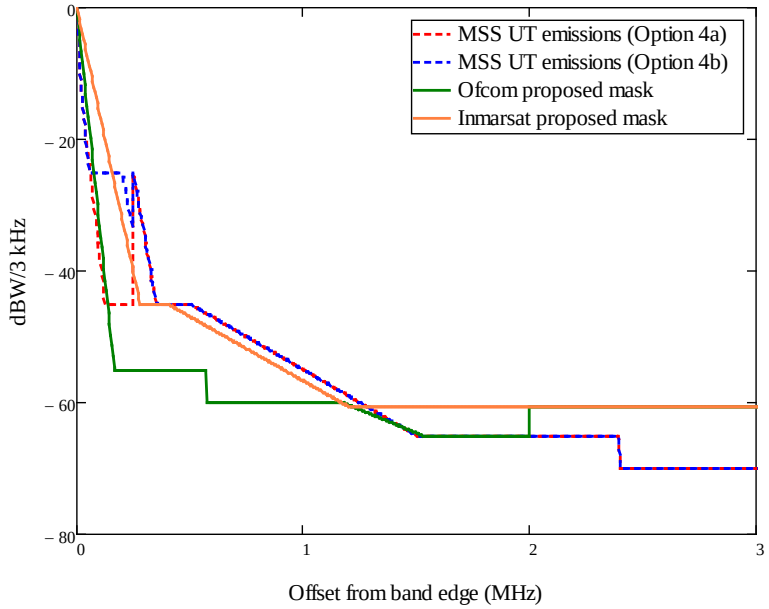

Figure 2a Out-of-band emissions for narrowband MSS UT (no guard band) and Inmarsat proposed limit

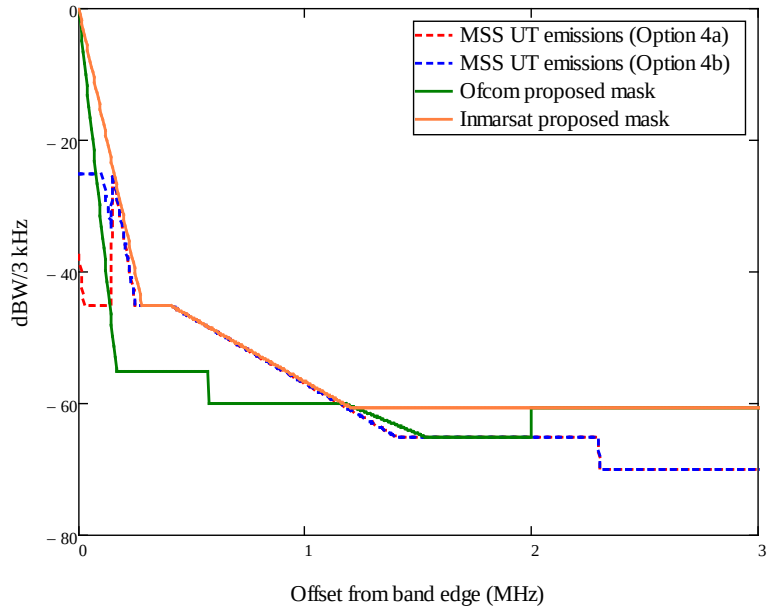

Figure 2b Out-of-band emissions for narrowband MSS UT (100 kHz guard band) and Inmarsat proposed limit

As can be seen from Figure 2a, MSS UTs with the assumed characteristics would not be able to meet the proposed limits without the inclusion of a guardband. A guardband of 100 kHz would be required to meet the proposed mask, as shown in Figure 2b. MSS UTs which, for example operate with a 0 dBi antenna (and consequently an EIRP 15 dB lower than that assumed here) would be able to meet the proposed mask with no guardband. Applying this mask would significantly improve the efficiency of use of the MSS spectrum. It should be

noted that the current channel plan for terrestrial mobile systems in ECC Decision ECC/DEC/(06)01 effectively applies a guardband of 300 kHz below the lower edge of the MSS band, and a guardband of 500 kHz at the upper edge of the MSS band. Hence, the out-of-band emissions in these ranges will not in any case affect terrestrial operations.

3 In-band emission limits

Ofcom has proposed the following in-band power limits, which we assume to be EIRP values. We assume that in the band 1985-2005 MHz, the higher of the two power limits would apply.

Frequency Range of emissions	Maximum mean power dBm	Measurement bandwidth
In-Band Power 1980.1-2009.9 MHz	+24dBm	55kHz to 5 MHz
In-Band Power 1985- 2005 MHz	+40dBm	55kHz to 5 MHz

The wideband ETSI standard is applicable to terminals with a transmit power of up to 39 dBm. As indicated above, the current studies in CEPT are considering a wideband UT with antenna gain of 15 dBi and transmit power of 33 dBm (i.e. an EIRP of 48 dBm). However as indicated above, Inmarsat proposes that wideband terminals are limited to an EIRP of 39 dBm as an interim measure. Under the interim limits proposed by Ofcom, such terminals could operate in only 10 MHz of the 15 MHz assigned to each operator. For narrowband MSS UTs, the assumed EIRP for the studies is 45 dBm and this is a typical value for MESs operated by Inmarsat in other frequency bands. Under the interim limits proposed by Ofcom, such terminals would be prohibited anywhere in the 2 GHz MSS bands. It can therefore be seen that the limits proposed by Ofcom would be a severe constraint on MSS operations.

The susceptibility of adjacent band systems to in-band interference from MSS UTs must be largely the responsibility of the victim service (terrestrial mobile networks in this case). The MSS UT out-of-band emissions are the consequence of less than ideal transmitter performance, and can to an extent be improved by better transmitter design. However, the MSS UT in-band emissions are as a consequence of the transmitter behaving as intended. Any interference effects due to the non-ideal performance of the victim receiver can, to an extent, be improved by better receiver design. Hence, any constraints on MSS UTs due to the performance of terrestrial network receivers would unfairly impact MSS operators and should not be applied by Ofcom. If there is an issue of in-band interference to terrestrial network receivers, this should be addressed by improved filtering at the receiver. Bearing in mind the guard bands which existing between the MSS band and the terrestrial systems, the use of filters in terrestrial receivers, if necessary, should be feasible.

The studies in Report 39 concluded that for terrestrial UTs, no in-block emission limits are necessary. In this context, Report 39 makes reference to the maximum power currently defined for terminals in 3GPP TS specifications which are in the range from 21-33 dBm

(conducted limits) for different power classes[4]. This suggests that an in-block power limit of at least 33 dBm should be acceptable, even for a channel immediately adjacent to the terrestrial channel. The existence of the current guardbands between the MSS and terrestrial network channels should increase the resilience of terrestrial receivers to interference.

The current UK IR 2016 permits a maximum transmit power of 9.8 dBW/25 kHz (=39.8 dBm/25 kHz) in the band 1997.5-2010 MHz. We cannot see any justification for a limit lower than 39.8 dBm in any part of the MSS band, considering such powers have been permitted in the UK regulations for many years. As there is no limit on the MSS UT emission bandwidth in IR 2016, the total power of any MSS UT emission may in fact be in excess of 39.8 dBm. For example a UT with a 50 kHz emission bandwidth could operate with an EIRP of 42.8 dBm in accordance with the current UK regulations. This suggests that an EIRP higher than 39.8 dBm should also be acceptable for GSO MSS UTs.

As an interim measure we propose the following in-band limits for narrowband UTs.

Frequency range of emissions	Maximum mean EIRP per UT (dBm)
1980-1985 and 2005-2010 MHz	40
1985-2005 MHz	50

These limits would allow MSS narrowband UT operation with EIRP greater than 40 dBm in two-thirds of the spectrum assigned to each operator. MSS narrowband UTs with EIRP less than 40 dBm could operate throughout the spectrum assigned to each operator. Since these limits would retain some inefficiency on MSS operations, we hope that in the future the higher EIRP limit could apply for all frequencies.

4 Summary

In summary, Inmarsat proposes the following interim conditions for 2 GHz MSS UTs:

- All MSS UTs comply with ETSI standard EN 302 574-2 or EN 302 574-3.

- For MSS UTs which comply with the wideband ETSI standard (EN 302 574-2), no further limits are required on the out-of-band emissions.

- For MSS UTs which comply with the narrowband ETSI standard (EN 302 574-3), the Inmarsat proposed EIRP mask shown in Figures 2a and 2b applies. In tabular form the limits would be as given in the table below.

Frequency Range of emissions	Maximum mean power dBm	Measurement bandwidth
-10 to -5 MHz from lower channel edge	-6	5 MHz

[4] See section 4.6.2 of CEPT Report 39.

-5 to -2 MHz from lower channel edge	+1.6	5 MHz
-2000 to -1200 kHz from lower channel edge	-20.6	30 kHz
-1200 to -400 kHz from lower channel edge	-5 -((offset - 400) × 15.6/800)	30 kHz
-400 to -280 kHz from lower channel edge	-5	30 kHz
-280 to 0 kHz from lower channel edge	30 - (offset × 45/280)	3 kHz
0 to 280 kHz from upper channel edge	30 - (offset × 45/280)	3 kHz
280 to 400 kHz from upper channel edge	-5	30 kHz
400 to 1200 kHz from upper channel edge	-5 -((offset - 400) × 15.6/800)	30 kHz
1200 to 2000 kHz from upper channel edge	-20.6	30 kHz
2 to 5 MHz from upper channel edge	+1.6	5 MHz
5 to 10 MHz from upper channel edge	-6	5 MHz

- The lower channel edge is 1980 MHz and the upper channel edge is 2010 MHz.

- The in-band power of any wideband MSS UT is limited to 39 dBm. The in-band power of any narrowband MSS UT is limited to 40 dBm EIRP in the bands 1980-1985 MHz and 2005-2010 MHz, and is limited to 50 dBm EIRP in the band 1985-2005 MHz.

These limits would retain some constraints on MSS operations which are undesirable and may not be necessary. We therefore believe these limits should be reviewed in the future, taking account of the CEPT studies when they are concluded. Inmarsat requests that Ofcom gives full consideration to these proposals. We are available to discuss and provide further information as necessary.

ATTACHMENT

CEPT ECC
Electronic Communications Committee

Working Group SE

of the Electronic

Communications Committee

SE 40

WGSE Project Team SE40 Meeting **SE40(11)xxx**

10-11 January 2011, London, UK

Source: **Inmarsat**

Subject: **Adjacent band compatibility between MSS user terminals and ECNs in the 2 GHz bands**

Date issued: **7 January 2011**

1 Introduction

SE40 is required to investigate potential compatibility issues between electronic communications networks (ECNs) and MSS User Terminals (UTs) at 2 GHz. This issue was considered in ERC Report 65 (published in 1999). Two ETSI standards have been developed for MSS UTs. EN 302 574-2 applies to wideband UTs, which operate in a CGC network. EN 302 574-3 applies to narrowband UTs. These standards have been developed to meet the essential requirements of article 3.2 of the R&TTE directive, in particular to avoid causing harmful interference. These standards have been completed by ETSI and cited in the Official Journal. It is therefore not necessary or desirable to modify these standards, or to apply conditions which are inconsistent with those standards. However there is the possibility of the need for guardbands to be applied to some UTs to ensure that in operation harmful interference is not caused to adjacent band users. This paper assesses the potential need for guardbands to be applied to MSS UTs.

2 Analysis

Recently, CEPT has assessed the requirements for in-band and out-of-band limits for ECNs in the 2 GHz band. These studies were carried out in the context of the WAPECS approach and the results of the studies are contained in CEPT Report 39, published in June 2010.

The studies in Report 39 have determined the in-band and out-of-band limits that could be applied to ECNs to provide adequate protection to other ECNs. Consequently, limits are determined that would apply to emissions in the bands 1900-1980 MHz, 2010-2025 MHz and 2110-2170 MHz.

According to Report 39, no in-band limits are required for terrestrial terminal stations. For out-of-band requirements, the limits applicable to ECN UTs are contained in section 4.6.2 of Report 39 and are shown below.

Frequency range of out-of-band emissions	Maximum mean out-of-band power	Measurement bandwidth
–10 to -5 MHz from lower channel edge	-6 dBm	5 MHz
–5 to 0 MHz from lower channel edge	+1.6 dBm	5 MHz
0 to +5 MHz from upper channel edge	+1.6 dBm	5 MHz
+5 to 10 MHz from upper channel edge	-6 dBm	5 MHz
Remaining Frequencies allocated to FDD uplink	-6dBm	5 MHz
Remaining Frequencies allocated to TDD	P_{BL}	5 MHz

Table 1 CEPT Report 39 out-of-band requirements for FDD TS applicable to TS used in the band 1920-1980 MHz

Two values of P_{BL} are given in Report 39, depending on assumptions regarding the probability of victim and interfering packets colliding. In this case, it is assumed that there is no synchronisation of the MSS and the applicable value of P_{BL} in this case is therefore -27 dBm/5 MHz

An example of the limits determined in Report 39 is shown in figure 1, which is an extract of Figure 18 in Report 39.

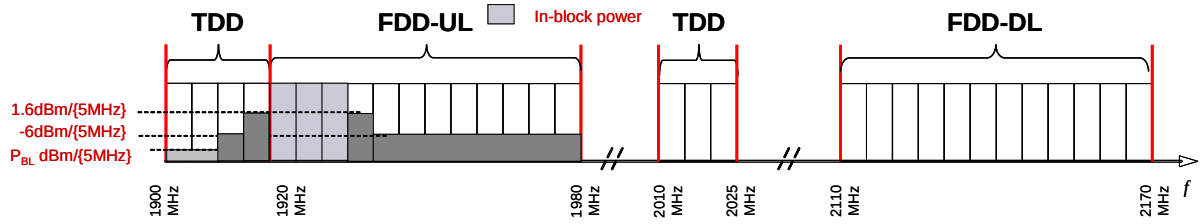

Figure 1 Example emission mask from CEPT Report 39

The band allocated for MSS UTs uplinks is 1980-2010 MHz and hence is adjacent to the ECN FDD-UL band at 1980 MHz and the ECN TDD band at 2010 MHz. The potential interference from MSS UTs can be considered as, in the worst case, equivalent to interference from ECN UTs, since the density of MSS UTs should not be any higher than the density of ECN UTs, whether the MSS UTs are operating in a Complementary Ground Component (CGC) or directly with the MSS satellite. Hence the Report 39 values provide a good reference for limits to protect ECNs in the bands adjacent to the MSS. Figure 2 shows how the CEPT Report 39 limits could be extended to apply to MSS UTs in the band 1980-2010 MHz.

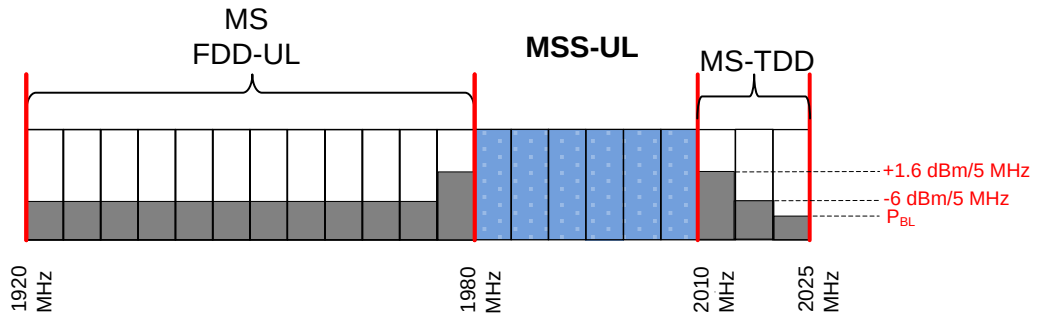

Figure 2 Report 39 block edge limits applied to the band 1980-2010 MHz

It needs to be considered whether MSS UTs can meet these proposed limits. The two ETSI standards applicable to MSS UTs are EN 302 574-2, applicable to wideband UTs, and EN 302 574-3, applicable to narrowband UTs. Each of the two new ETSI standards for MSS UTs is examined.

2.1 EN 302 574-2 (wideband)

This standard applies to wideband UTs, with channel bandwidth 1 MHz or greater. Different power classes are defined, as follows:

Power Class 1		Power Class 1bis		Power Class 2		Power Class 3	
Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
+39	+2,7/-2,7	+33	+1/-3	+27	+1/-3	+24	+1,7/-3,7

The limits of the Adjacent Power Leakage Ratio (ACLR) are given in section 4.2.7 of the standard. Taking the case of MSS UT with 5 MHz channel bandwidth, the following values result.

	1st adjacent channel		2nd adjacent channel	
power class	ACLR (dB)	absolute (dBm/5 MHz)	ACLR (dB)	absolute (dBm/5 MHz)
1	42	-3	52	-13
1bis	42	-9	52	-19
2	36	-9	46	-19
3	33	-9	43	-19

Table 1 MSS UT power in 1st and 2nd adjacent channels

Comparing with the Report 39 limits of 1.6 dBm in the first adjacent channel and -6 dBm in the second adjacent channel shows that the MSS UTs complying with the ETSI standard are able to meet those Report 39 requirements. Regarding compliance with the limit P_{BL} (=-27 dBm/5 MHz), this would be addressed by the spurious emission limits in section 4.2.5 of the standard. For frequencies greater than 10 MHz from the band edge, the limit is -30 dBm in 1 MHz, equivalent to -23 dBm in 5 MHz. This exceeds the Report 39 limit by 4dB. However, it is notable that in the ETSI standards applicable to ECN UTs (e.g. EN 301 908-2), the same spurious emission limit applies.

The above analysis is based on the assumption of a UT with 5 MHz channel bandwidth. MSS UTs with narrower bandwidths will have lower out-of-band emissions in the adjacent 5 MHz channels so as to meet the ACLR limits.

It is therefore considered that an MSS UT which conforms to EN 302 574-2 meets the requirements for protection of adjacent band systems from out-of-band emissions.

2.2 EN 302 574-3 (narrowband)

This standard applies to narrowband UTs, defined as having a bandwidth less than 1 MHz. The limits on the out-of-band emissions from UTs are defined by the limits in Tables 3a, 3b, 4a and 4b in the standard. There are no limits for ACLR, however using the out-of-band emission limits it is possible to integrate the OOB limits over the first, second and third adjacent channels of 5 MHz to effectively determine the maximum power in each channel. This is a conservative approach in that it effectively assumes that the UT OOB emissions conform exactly to the defined limits for each 5 MHz channel.

For the purpose of this analysis, we have assumed the following parameters for the UT.

Antenna gain	15 dBi
Peak eirp	15 dBW
Nominated bandwidth	200 kHz
Guard band (with respect to edge of allocated band)	adjustable from 0 Hz upwards

Table 2 Narrowband MSS UT parameters

The terminal manufacturer may choose between the limits in Table 4a and Table 4b in the ETSI standard and this has some bearing on the results. Consequently, results are presented for both cases.

Guard band (kHz)	1st Adjacent Channel	2nd Adjacent Channel	3rd Adjacent Channel
0	34.0	-13.0	-17.8
100	14.9	-13.0	-17.8
200	14.8	-13.0	-17.8
300	14.8	-13.0	-17.8
400	14.7	-13.0	-17.8
500	14.7	-13.0	-17.8

Table 3 Calculation of ACLR using limits in Table 4a
(values are the eirp in a 5 MHz channel in dBm)

Guard band (kHz)	1st Adjacent Channel	2nd Adjacent Channel	3rd Adjacent Channel
0	34.2	-13.0	-17.8
100	22.1	-13.0	-17.8
200	17.7	-13.0	-17.8
300	15.5	-13.0	-17.8
400	14.9	-13.0	-17.8
500	14.8	-13.0	-17.8

Table 4 Calculation of ACLR using limits in Table 4b
(values are the eirp in a 5 MHz channel in dBm)

Regarding the results for the 2nd adjacent channel, the values are consistently -13 dBm, which is lower than the Report 39 value of -6 dBm. The results for the 3rd adjacent channel are consistently -17.8 dBm. This is lower than the Report 39 value of -6 dBm which applies to terrestrial FDD uplink frequencies, but is higher than the Report 39 value of -27 dBm which applies to ECN TDD

frequencies. However, as the level of OOB emissions in the 3rd adjacent channel (and beyond) have already been agreed in the ETSI standard, and as the levels are independent of the chosen guard band, these results should be considered acceptable.

Regarding the 1st adjacent channel, it can be seen that the adjacent channel interference is between about 34 dBm and 15 dBm, depending on the guard band applied. These values are higher than the Report 39 value of +1.6 dBm applicable to the first adjacent channel. There are some mitigating factors which could be considered: Firstly, the calculated EIRP values apply in the direction of maximum radiation – generally towards the MSS satellite. Since an antenna gain for the UT is assumed to be 15 dBi, the average power radiated will be about 15 dB below the peak value. Secondly, as already noted above, it is quite conservative to assume that the UT OOB emissions exactly conform to the ETSI mask for all frequencies within a 5 MHz range. More typically the emissions may be just below the mask at some frequencies while being many dB below the mask at most frequencies. This is particularly the case when considering the shape of the ETSI mask for frequencies close to the band edge, as illustrated in Figure 3.

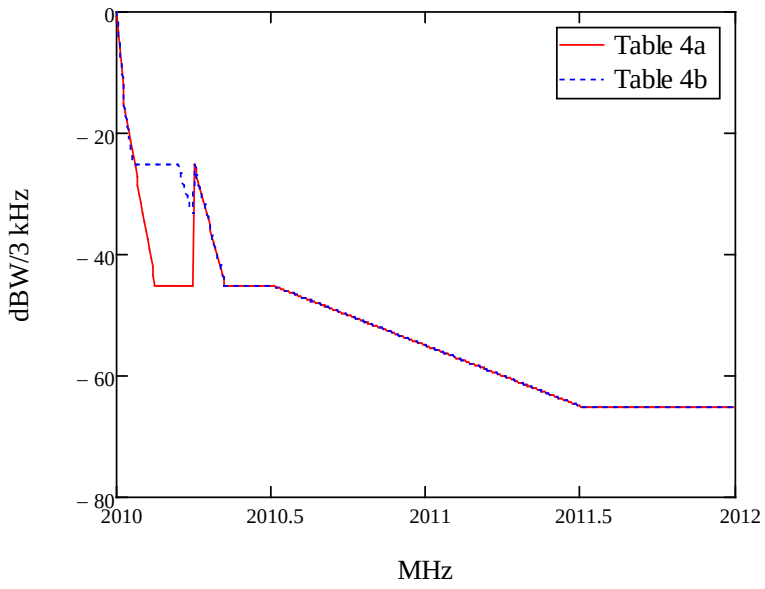

Figure 3 ETSI mask for OOB emissions close to the band edge (zero guard band)

The figure shows a jump in the level of OOB emissions at around 2010.25 MHz, which would not be followed by actual OOB emissions in practice. Consequently, the interference in the 1st adjacent channel is overestimated.

It can be seen from Table 3 and 4 that the guard band has limited effect on the 1st adjacent channel emissions. Using the Table 4a mask in the ETSI standard, lowest value is 14.7 dBm, and this is achieved (within 0.2 dB) with a guard band of 100 kHz. Using the Table 4b mask in the ETSI standard, lowest value is 14.8 dBm, and this is achieved (within 0.7 dB) with a guard band of 300 kHz. Hence, there is negligible benefit in applying guardbands higher than these values. Taking these factors into account, it is considered that a guardband should be applied in this case to limit the EIRP in the first adjacent channel to 15 dBm.

Summary

For MSS UTs which comply with ETSI standard EN 302 574-2, no further limits are required. For MSS UTs which comply with ETSI standard 302 574-3, some additional restrictions may be necessary to ensure an adequate guard band with respect to terrestrial ECNs. Further work would be necessary to quantify the benefit from the mitigating factors.

It should be noted that potential interference due to the in-band interference from MSS UTs received by ECNs within the MSS allocated band has not been addressed here. It is assumed that ECNs would be designed to be sufficiently resilient to any such interference since the band 1980-2010 MHz has been identified as a MSS uplink band for many years.