AERONAUTICAL MOBILE COMMUNICATIONS PANEL (AMCP)

EIGHTH MEETING

Montreal, 4 to 13 February 2003

Agenda Item 5: Review of existing ICAO material on air/ground communication systems

PROPOSAL FOR ICAO AMSS SARPS AND GNSS SARPS HARMONIZATION

(Presented by V. Bondarenko)

SUMMARY

This document proposes modification of the aeronautical mobile-satellite service (AMSS) Standards and Recommended Practices (SARPs) requirements related to aircraft earth station (AES) unwanted emissions to make them consistent with the GNSS SARPs requirements for Global Navigation Satellite System (GLONASS) receiver interference thresholds.

Action by the AMCP is in paragraph 3.

1. INTRODUCTION

1.1 In 2000 and 2001 International Civil Aviation Organization (ICAO) adopted Amendments No. 75 and No. 76 to Annex 10. Amendment No. 75 to Volume III of Annex 10 contains some changes to standards for aeronautical mobile satellite system (AMSS SARPs). Amendment No. 76 to Volume I of Annex 10 contains standards for global navigation satellite system (GNSS SARPs) which core elements are global positioning system (GPS) and GLONASS.

1.2 This document provides comparative analysis of the above mentioned SARPs and proposes modification of the AMSS SARPs requirements for aircraft earth station (AES) unwanted emissions to ensure harmonization with the GNSS SARPs requirements.

2. COMPARATIVE ANALYSIS OF THE SARPS

2.1 The GNSS SARPs are developed with account for planned shift of the GLONASS operating frequency band so that after 2005 GLONASS receivers are eventually operated in the 1 592.9525 - 1 609.36 MHz band. At the same time the techniques of navigation signal processing (narrow correlators, etc.) that require receivers with broad bandpass filters similar to those utilized in GPS receivers would remain unchanged.

2.2 Continuous wave (CW) interference thresholds for GLONASS receivers used for precision approach on Satcom equipped aircraft given in GNSS SARPs Table B-83 (paragraph 3.7.2.2 of Appendix B to Annex 10, Volume I) are shown in Table 1.

Table 1. CW interference thresholds for GLONASS receiver

Frequency band, MHz	Admissible level of CW interference, dBW
<=1 315	-4.5
1 315 - 1 562.2	-4.5... -42
1 562.2 - 1 583.7	-42... -80
1 583.7 - 1 593	-80... -149
1 593 - 1 609.4	-149
1 609.4 - 1 613.7	-149... -80
1 613.7 - 1 626.2	-80... -22
1 626.2 - 2 000	-22... -8.5
> =2 000	-8.5

Note 1.— Values of frequencies are rounded.

Note 2.— Interference levels related to frequencies within an appropriate interval are determined by linear interpolation.

2.3 Figure 1 shows band-limited noise-like interference thresholds for GLONASS receiver. Upper line relates to the receiver to be installed in Satcom equipped aircraft (paragraph 3.7.3.2, Table B-85 and Figure B-18 of Appendix B to Annex 10, Volume I).

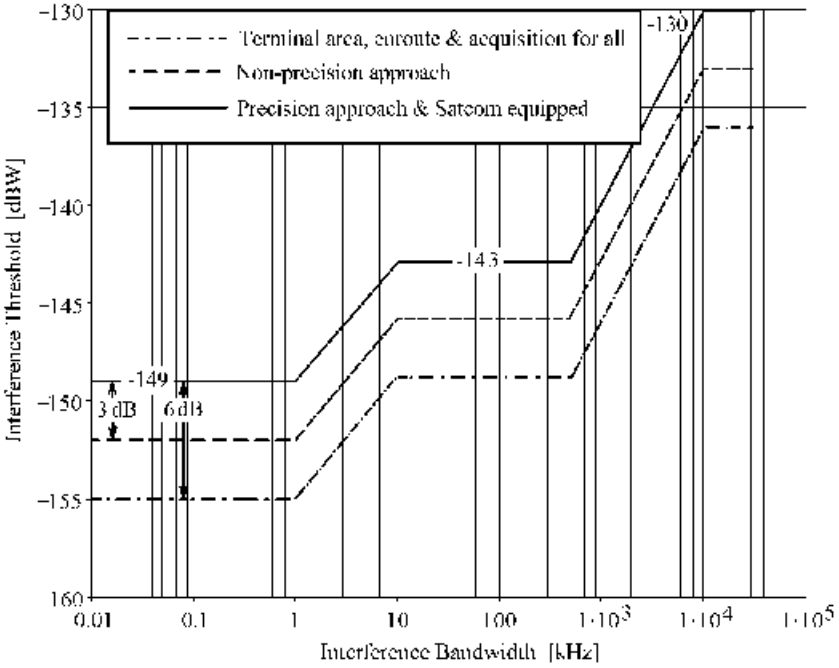

Figure 1. Interference thresholds versus bandwidth for GLONASS receiver

2.4 According to Table 1 in the 1 593 - 1 609.4 MHz frequency band the allowable CW interference level for GLONASS receivers used onboard Satcom equipped aircraft is equal to -149 dBW/MHz. For noise-like interference with 1 MHz bandwidth the allowable interference level according to Figure 1 is equal to -140 dBW/MHz.

2.5 Protection of such a receiver from unwanted emissions of Satcom station installed aboard the same aircraft is feasible provided that AES unwanted emissions level does not exceed -100 dBW/1 MHz (assumed antenna isolation is 40 dB).

2.6 Protection of GLONASS receiver from discrete components of AES unwanted emissions can be provided if the emissions level does not exceed:

-149 dBW + 40 dB = -109 dBW

2.7 It should be noted that the mentioned thresholds do not take into account a safety margin (approximately 6 dB), which ICAO normally applies to ensure protection of aircraft equipment from interference (Ref. ITU-R Recommendation M. 1477). Taking into account the safety margin, the unwanted emissions level at the AES antenna port in the 1 593 - 1 609.4 MHz frequency band shall not exceed:

-106 dBW/MHz for noise-like interference;

-115 dBW for CW intefrerence.

2.8 AMSS SARPs contain requirements for maximum (relative to carrier) harmonic, discrete spurious and noise density levels of AES emissions, which are presented in Table 2 (Table 4-3, Annex 10 Volume III, Part 1, page 74).

Table 2. Maximum relative levels of AES unwanted emissions

Frequency (MHz)	Equivalent isotropically radiated power (EIRP) (density)
below 1 525	-135 dBc/4 kHz
1 525 to 1 559	-203 dBc/4 kHz
1 559 to 1 585	-155 dBc/MHz
1 585 to 1 605	-143 dBc/MHz
1 605 to 1 610	-117 dBc/MHz
1 610 to 1 614	-95 dBc/MHz
1 614 to 1 660	-55 dBc/4 kHz[1]
1 660 to 1 670	-55 dBc/20 kHz[1]
1 670 to 1 735	-55 dBc/4 kHz
1 735 to 12 000	-105 dBc/4 kHz
12 000 to 18 000	-70 dBc/4 kHz

1. Within the transmit band, excluding the frequency band within ±35 kHz of the carrier.

2.9 The relative levels of AES EIRP (density) were converted to power at the AES antenna port in 1 MHz bandwidth assuming the AES antenna gain is 0 dBic (EIRP value is 22.8 dBW according to Annex 10, Volume III, Part 1, paragraph 4.2.3.5.1.1) to compare them with the allowable levels of interference to GLONASS receivers. Results of calculation are shown in Figure 2.

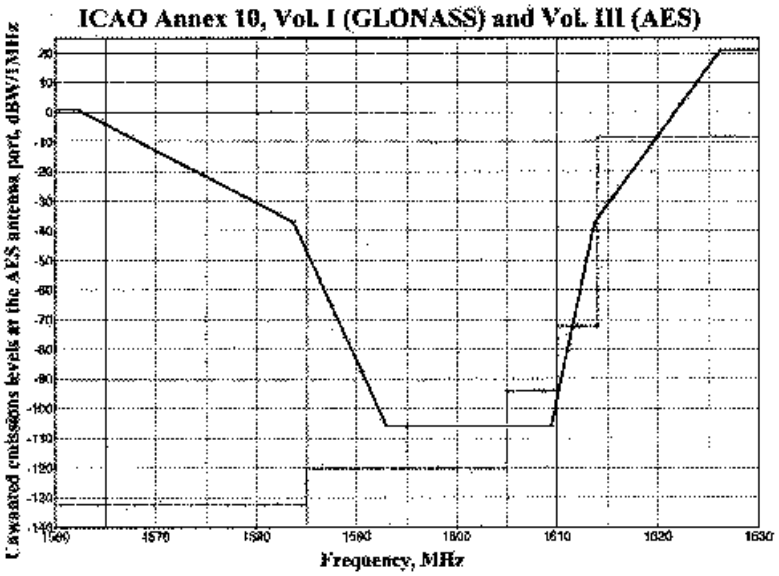

Figure 2. Comparison of Annex 10 requirements for AES and GLONASS

2.10 A solid line in Figure 2 shows allowable levels of interference to GLONASS receivers used onboard Satcom equipped aircraft with account of the safety margin. A dotted line shows the unwanted emissions level at the AES antenna port.

2.11 Figure 2 shows that for frequencies above 1 605 MHz the AES unwanted emissions levels exceed interference thresholds of GLONASS receivers. Such an exceeding is equal to 11.8 dB in the 1 605 - 1 610 MHz band.

2.12 Thus, under application of the mentioned AMSS SARPs there is a possibility of interference to GLONASS receivers from unwanted emissions of Satcom equipment if both GLONASS and Satcom equipment are operated simultaneously onboard the same aircraft.

2.13 Taking into account that allowable interference levels for GLONASS receivers are dictated by existing ICAO requirements for accuracy and efficiency of navigation solutions, it appears expedient to revise requirements for AES unwanted emissions.

3. ACTION BY THE AMCP

3.1 The AMCP is invited to:

a) consider the discrepancy between AES allowable unwanted emissions levels and GLONASS receiver interference thresholds highlighted in this document; and

b) recognize the need to harmonize the AMSS SARPs with the GNSS SARPs and initiate a harmonization process.

— END —