RADIO TECHNICAL COMMISSION FOR AERONAUTICS
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CHANGE NO. 2

-TO-

RTCA/DO-177

MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR MICROWAVE LANDING SYSTEM (MLS) AIRBORNE RECEIVING EQUIPMENT

RTCA Paper No. 465-86/EC-980
September 19, 1986

Page 7: Paragraph 1.4.1:
Delete the last sentence, "Optional sensitivities may be provided."

Paragraph 1.4.2: 1st subparagraph, 1st line, Change "may" to "will".
Paragraph 1.4.2: 1st subparagraph, 1st sentence, Insert the word "optionally" between the words "or" and "manual".

Page 15: Paragraph 1.8, 1st subparagraph, 1st sentence:
Insert the phrase "except for the data word formats described in Appendix F" after the word "format".

Add following the 2nd subparagraph:

"NOTE: It is anticipated that ICAO Annex 10 will be revised to reflect the data word formats described in Appendix F.

Page 21: Paragraph 2.2.1.2.2, line 2:
Delete "standard"

Page 22: Paragraph 2.2.1.2.3, line 2:
Delete "standard"

Page 27: Paragraph 2.2.2.2:
Change title to "Warnings Derived From Basic, Auxiliary, and Aircraft Specific Data"

Paragraph 2.2.2.2.1:
Replace the existing paragraph with the following:

"Warning Derived From Glide Path Angle Selection

A warning shall be presented when any of the following conditions exist:

a. The selected glide path angle is below the minimum glide path angle encoded in Basic Data Word 2.

b. The selected glide path angle is above the highest angle the aircraft has been certified to use for approach operations or 4.0 degrees, whichever is higher.

c. The minimum glide path message has not been decoded."

Paragraph 2.2.2.2.2, 2nd line:
Delete the words "beyond ±10 degrees"

After paragraph 2.2.2.2.4, Add the following new paragraph:

"2.2.2.2.5 Criteria for Warning Removal

Warnings shall be removed within 6 seconds in the presence of the signal levels specified in 2.2.1.1 and all data outputs from the receiver shall then have a probability of an undetected error of less than 1 x 10-6."

Paragraph 2.2.2.3, "Concurrently Generated Warnings":
Renumber paragraph 2.2.2.1.7 to 2.2.2.3.

Page 28: Paragraph 2.2.6.1, "Proportional Azimuth Coverage for Compensated Outputs":
Replace the text of the existing paragraph with the following:

"For azimuth, electrical outputs intended to drive a deviation indicator shall be compensated by the azimuth-to-threshold distance encoded in Basic Data Word 1 to provide linear outputs in accordance with the following:

Azimuth-to-Threshold Distance Value	Range of Linear Proportional Coverage
0 - 400 meters	±3.6 degrees ±10%
500 - 1900 meters	±3.0 degrees ±10%
2000 - 4100 meters	±350 feet ±10% at the runway threshold
4200 - 6300 meters	±1.5 degrees ±10%

Add NOTE: "This paragraph does not prevent alternative compensation using range information to convert specified angular deviations to linear deviations which do not exceed the values in the tables. Where this is done, the values used shall be declared by the manufacturer."

Page 30: Paragraph 2.2.8:
Delete the words "or a Morse code transmission" at the end of the first sentence.
Change the word "four" to "at least three".
Add to the second sentence "if audio is used."
Add a new last sentence "The response should be MMLS or MLS if a visual display is provided."

Page 31: After Paragraph 2.2.10, Add the following new paragraph:

"2.2.10.1 Response to Embeded Preambles

Receivers shall meet the performance requirements of Section 2.2 in the presence of any code sequence which matches the preamble codes identified in the Function Identifier Table in Appendix F generated by DPSK data bits, scanning beam radiation, or sidelobe radiation from any function."

Page 32: Paragraph 2.2.12:
Delete "Option" in the title.
Delete the following portion of the first sentence: "Unless otherwise specified, when the capability to process high-rate azimuth signals is provided,"
Delete the NOTE.

Paragraph 2.2.13:
Add the following new last sentence: "The display of the selected angle shall be the angle about which the receiver is out-putting course deviations."

Paragraph 2.2.13.1, "Elevation Reference Angle Selection":
Replace the text of the entire paragraph including the NOTE with the following:

"Elevation Reference (glide path) angle shall be automatically selected to the minimum glide path angle encoded in Basic Data Word 2. As an option, the glide path may also be manually selected. The range of selection and increments shall be declared by the equipment manufacturer."

Paragraph 2.2.13.2, "Azimuth Reference Angle Selection":
Replace the text of the entire paragraph with the following:

"Approach azimuth reference angle shall be automatically selected to the reciprocal of the approach azimuth magnetic orientation encoded in Basic Data Word 4. As an option, the approach azimuth reference angle may also be manually selected from 0 to 359 degrees, with increments to be declared by the equipment manufacturer."

Add "NOTE: The angular reciprocal of an angle is the sum of 180 degrees and that angle, expressed as a value between 0 and 359 degrees."

Page 51: Paragraph 2.4.2.3, subparagraph h.:
Add "b," between "steps" and "d"

Paragraph 2.4.2.4, subparagraph a.:
Add 2nd sentence "Set the MLS Test Set to the standard test signal."

Page 53: Paragraph 2.4.2.4, subparagraph h.:
Add the following new sentence in front of "Adjust .. etc.":
"Steps h. through 1. are tested at -95 dBm only."

After subparagraph 1. add the following note:

"NOTE: Varying the signal generator as specified in subparagraph (c) and (e) slowly enough to keep all interference components within the receiver pass band, may take an impractical period of time. Compliance with this paragraph may be accomplished by any other equivalent method."

Page 54: Paragraph 2.4.2.5:
Insert the word "azimuth" between "a" and "scanning" and add the following to the end of the 2nd sentence: "and an elevation beamwidth of 2.0 degrees."

Paragraph 2.4.2.5, subparagraph d.:
Insert the word "azimuth" between "a" and "scanning" and add the following to the end of the sentence: "and an elevation beamwidth of 3.0 degrees."

Page 55: Paragraph 2.4.2.8, 1st subparagraph:
Add the following last sentence: "Tests which generate an azimuth warning shall also generate a concurrent elevation warning."

Page 56: Paragraph 2.4.2.8
Delete subparagraph e.
Renumber subparagraphs f, g, h, i, and j to e, f, g, h, and i respectively.

Add the following note after new subparagraph 2.4.2.8 i.:

"NOTE: The maximum time for warnings to be removed is 6 seconds in each test."

Page 57: Paragraph 2.4.2.8.2:
Renumber to paragraph 2.4.2.8.1.

Paragraph 2.4.2.8.2.1:
Renumber to paragraph 2.4.2.8.1.1 and replace with the following:

"2.4.2.8.1.1 Warning Derived from Glide Path Angle Selection (Paragraph 2.2.2.2.1)

a. Remove the minimum selectable glide path word. Verify that a warning is provided.

b. For all selected glide path angles, check that when the minimum glide path exceeds the selected glide path a warning is provided.

c. Apply the manufacturers specified control for 4.0 degrees maximum selectable glide path (in accordance with paragraph 2.2.2.2.1 b.). Set the minimum glide path data in Basic Data Word 2 to 4.0 degrees. No warning should be displayed.

d. Set the minimum glide path data in Basic Data Word 2 to the value chosen in step c. +0.1 degrees. A warning should be displayed.

e. Repeat steps c. and d. with manufacturer provided input of maximum selectable glide path (if provided) set as nearly as possible to 5.7 degrees.

f. If manual selection of approach glide path is provided, repeat steps c., d. and e. with the approach glide path set to the values initially given for the minimum glide path.

g. Repeat step f. for range and increments of manufacturer provided maximum glide path inputs, as declared by the manufacturer."

Paragraph 2.4.2.8.2.2:
Renumber the paragraph to 2.4.2.8.1.2 and replace the NOTE with the following: "This procedure applies only to receivers with manual azimuth selection capability."

Paragraph 2.4.2.8.1.2, subparagraph b.:
Insert ",350 degrees," between "degrees" and "and"

Page 58: Paragraph 2.4.2.8.1.2, subparagraph e.:
Delete the words ", if provided" from line 2.

Paragraph 2.4.2.8.2.3:
Renumber to paragraph 2.4.2.8.1.3

Paragraph 2.4.2.8.2.4:
Renumber existing paragraph to 2.4.2.8.1.5

Add new paragraph 2.4.2.8.1.4 as follows:

"2.4.2.8.1.4 Warning Derived From Approach Azimuth Magnetic Orientation

Remove the approach azimuth magnetic orientation data word. Verify that a warning is provided."

Page 63: Paragraph 2.4.2.13.1:
Replace existing subparagraph "f." and Add subparagraphs "g." through "j." as follows:

"f. Repeat steps c. and d. The results must be within 10% of +3 degrees and -3 degrees.

g. Adjust the test set basic data to provide an azimuth-to-threshold distance code of 400 meters.

h. Repeat steps c. and d. The results must be within 10% of +3.6 degrees and -3.6 degrees.

i. Adjust the test set basic data to provide an azimuth-to-threshold distance code of 4500 meters.

j. Repeat steps c. and d. The results must be within 10% of +1.5 degrees and -1.5 degrees."

Page 70: Paragraph 2.4.2.18:
Insert after the word "interval" on the last line of subparagraph 2.4.2.18 c. "or 6 seconds whichever is less".

Add after subparagraph 2.4.2.18 c. the following note:

"NOTE: This test shall be conducted sufficient to demonstrate that all data outputs will have a probability of an undetected error of less than 1×10^{-6} at -95 dBm."

Page 78: Paragraph 3.2.5:
Replace the existing paragraph with the following:

"3.2.5 Display of Selected Angles

Whether selected manually or automatically the elevation and azimuth reference angles in use by the equipment shall be available to the pilot. Unless otherwise annunciated the displayed angles shall be the angles about which the equipment is outputting course deviations."

APPENDIX C

Page C-2: Under Basic Data Add a new subparagraph e.:
"e. Approach azimuth magnetic orientation 180 degrees"

Add the following new penultimate paragraph:

"Auxiliary Data -

a. Aux Data A - bits I-58 thru I-69 set to represent the preamble for Basic Data Word 1.

b. Aux Data B - bits I-58 thru I-69 set to represent the preamble for Basic Data Word 1.

c. Aux Data C - bits I-58 thru I-69 set to represent the preamble for Basic Data Word 1."

APPENDIX F Add the attached APPENDIX F, "MLS DATA WORD FORMAT"