

§ 171.317

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(c) The period during which erroneous guidance information is radiated must not exceed the periods specified in §171.315(a). If the fault is not cleared within the time allowed, the ground equipment must be shut down. After shutdown, no attempt must be made to restore service until a period of 20 seconds has elapsed.

§ 171.317 Approach elevation performance requirements.

This section prescribes the performance requirements for the elevation equipment components of the MLS as follows:

(a) *Elevation coverage requirements.* The approach elevation facility must provide proportional guidance information in at least the following volume of space (see Figure 13):

(1) Laterally within a sector originating at the datum point which is at least equal to the proportional guidance sector provided by the approach azimuth ground equipment.

(2) Longitudinally from 75 meters (250 feet) from the datum point to 20 nautical miles from threshold in the direction of the approach.

(3) Vertically within the sector bounded by:

(i) A surface which is the locus of points 2.5 meters (8 feet) above the runway surface;

(ii) A conical surface originating at the datum point and inclined 0.9 degree above the horizontal and,

(iii) A conical surface originating at the datum point and inclined at 15.0 degrees above the horizontal up to a height of 6000 meters (20,000 feet).

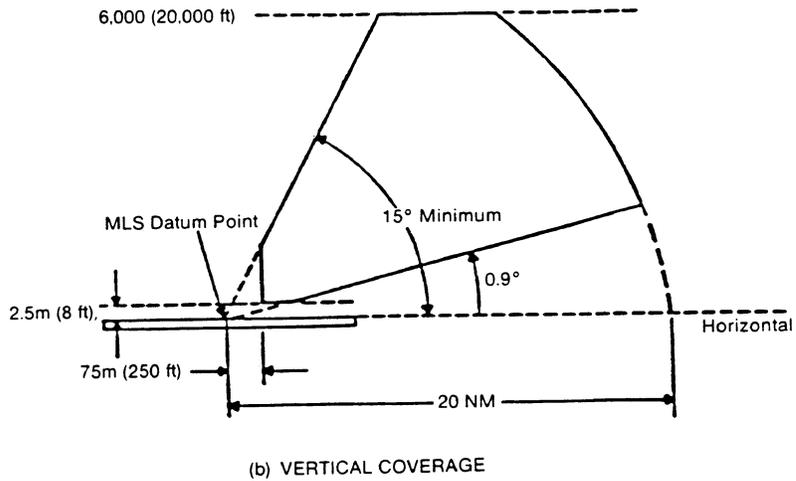
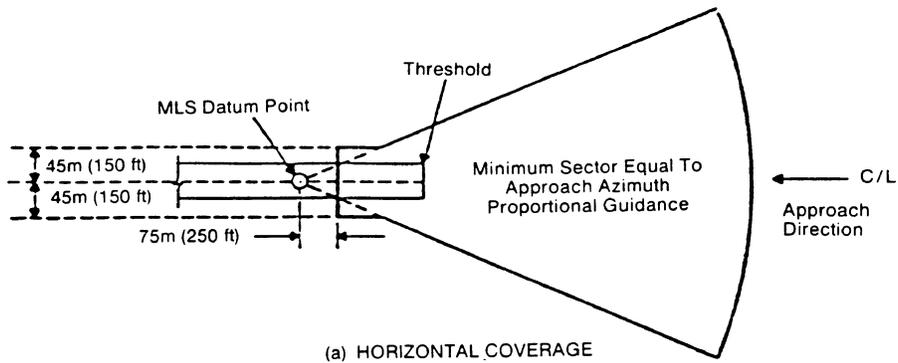


Figure 13. Approach Elevation Coverage

Where the physical characteristics of the approach region prevent the achievement of the standards under paragraphs (a) (1), (2), and (3) of this

section, guidance need not be provided below a conical surface originating at the elevation antenna and inclined 0.9 degree above the line of sight.

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(4) Within the elevation coverage sector defined in paragraphs (a) (1), (2) and (3) of this section, the power densities must not be less than those shown in Table 9, but the equipment design must also allow for:

(i) Transmitter power degradation from normal by -1.5 dB.

(ii) Rain loss of -2.2 dB at the coverage extremes.

(b) *Elevation siting requirements.* The Elevation Antenna System must:

(1) Be located as close to runway centerline as possible (without violating obstacle clearance criteria).

(2) Be located near runway threshold such that the asymptote of the minimum glidepath crosses the threshold of the runway at the Approach Reference Datum height. Normally, the minimum glidepath should be 3 degrees and the Approach Reference Datum height should be 50 feet. However, there are circumstances where other glideslopes and reference datum heights are appropriate. Some of these instances are discussed in FAA Order 8260.34 (Glide Slope Threshold Crossing Height Requirements) and Order 8260.3 (IFR Approval of MLS.)

(3) Be located such that the MLS Approach Reference Datum and ILS Reference Datum heights are coincident within a tolerance of 3 feet when MLS is installed on a runway already served by an ILS. This requirement applies only if the ILS glide slope is sited such that the height of the reference datum meets the requirements of FAA Order 8260.34.

(c) *Antenna coordinates.* The scanning beams transmitted by the elevation subsystem must be conical.

(d) *Elevation accuracy.* (1) The accuracies shown in Table 13 are required at the approach reference datum. From the approach reference datum to the coverage limit, the PFE, PFN and CMN limits shall be allowed to linearly increase as follows:

(i) With distance along the runway centerline extended at the minimum glide path angle, by a factor of 1.2 for the PFE and PFN limits and to ±0.10 degree for the CMN limits;

(ii) With azimuth angle, from runway centerline extended to the coverage extreme, by a factor of 1.2 for the PFE

and PFN limits and by a factor of 2.0 for the CMN limits;

(iii) With increasing elevation angles from +3 degrees to +15 degrees, by a factor of 2.0 for the PFE and PFN limits;

TABLE 13—ELEVATION ACCURACIES AT THE APPROACH REFERENCE DATUM

Error type	System	Angular error (degrees)	
		Ground subsystem	Airborne subsystem ⁴
PFE	^{1,2} ±0.133	(³)	±0.017
CMN	¹ ±0.050	±0.020	±0.010

Notes:

¹ Includes errors due to ground and airborne equipment and propagation effects.

² The system PFN component must not exceed ±0.087 degree.

³ The mean (bias) error component contributed by the ground equipment should not exceed ±0.067 degree.

⁴ The airborne subsystem angular errors are provided for information only.

(iv) With decreasing elevation angle from +3 degrees (or 60% of the minimum glide path angle, whichever is less) to the coverage extreme, by a factor of 3 for the PFE, PFN and CMN limits; and

(v) Maximum angular limits. the CMN limits shall not exceed ±0.10 degree in any coverage region within ±10 degrees laterally of runway centerline extended which is above the elevation angle specified in (iv) above.

NOTE: It is desirable that the CMN not exceed ±0.10 degree throughout the coverage region above the elevation angle specified in paragraph (d)(1)(iv) of this section.

(2) The system and ground subsystem accuracies shown in Table 13 are to be demonstrated at commissioning as maximum error limits. Subsequent to commissioning, the accuracies are to be considered at 95% probability limits.

(e) Elevation antenna characteristics are as follows:

(1) *Drift.* Any elevation angle as encoded by the scanning beam at any point within the coverage sector must not vary more than 0.04 degree over the range of service conditions specified in §171.309(d) without the use of internal environmental controls. Multipath effects are excluded from this requirement.

(2) *Beam pointing errors.* The elevation angle as encoded by the scanning beam at any point within the coverage sector

must not deviate from the true elevation angle at that point by more than ± 0.04 degree for elevation angles from 2.5° to 3.5° . Above 3.5° these errors may linearly increase to ± 0.1 degree at 7.5° . Multipath and drift effects are excluded from this requirement.

(3) *Antenna alignment.* The antenna must be equipped with suitable optical, electrical, or mechanical means or any combination of the three, to align the lowest operationally required glidepath to the true glidepath angle with a maximum error of 0.01 degree. Additionally, the elevation antenna bias adjustment must be electronically steerable at least to the monitor limits in steps not greater than 0.005 degrees.

(4) *Antenna far field patterns in the plane of scan.* On the lowest operationally required glidepath, the antenna mainlobe pattern must conform to Figure 10, and the beamwidth must be such that in the installed environment, no significant ground reflections of the mainlobe exist. In any case, the beamwidth must not exceed 2 degrees. The antenna mainlobe may be allowed to broaden from the value at boresight by a factor of $1/\cos\theta$, where θ is the angle of boresight. Anywhere within coverage, the -3 dB width of the antenna mainlobe, while scanning normally, must not be less than 25 microseconds (0.5 degrees) or greater than 250 microseconds (5 degrees). The sidelobe levels must be as follows:

(i) *Dynamic sidelobe levels.* With the antenna scanning normally, the dynamic sidelobe level that is detected by a receiver at any point within the proportional coverage sector must be down at least 10 dB from the peak of the mainlobe. Outside the proportional coverage sector, the radiation from the scanning beam antenna must be of such a nature that receiver warnings will not be removed or a suitable OCI signal must be provided.

(ii) *Effective sidelobe levels.* With the antenna scanning normally, the sidelobe levels in the plane of scan must be such that, when reflected from the ground, the resultant PFE along any glidepath does not exceed 0.083 degrees.

(5) *Antenna far field pattern in the horizontal plane.* The horizontal pattern of the antenna must gradually de-empha-

size the signal away from antenna boresight. Typically, the horizontal pattern should be reduced by at least 3 dB at 20 degrees off boresight and by at least 6 dB at 40 degrees off boresight. Depending on the actual multipath conditions, the horizontal radiation patterns may require more or less de-emphasis.

(6) *Data antenna.* The data antenna must have horizontal and vertical patterns as required for its function.

(f) *False guidance.* False courses which can be acquired and tracked by an aircraft shall not exist anywhere either inside or outside of the MLS coverage sector. False courses which exist outside of the minimum coverage sector may be suppressed by the use of OCI.

NOTE: False courses may be due to (but not limited to) MLS airborne receiver acquisition of the following types of false guidance: reflections of the scanning beam and scanning beam antenna sidelobes and grating lobes.

§ 171.319 Approach elevation monitor system requirements.

(a) The monitor system must act to ensure that any of the following conditions do not persist for longer than the periods specified when:

(1) There is a change in the ground component contribution to the mean glidepath error component such that the path following error on any glidepath exceeds the limits specified in § 171.317(d) for a period of more than one second.

NOTE: The above requirement and the requirement to limit the ground equipment mean error to ± 0.067 degree can be satisfied by the following procedure. The integral monitor alarm limit should be set to ± 0.067 degree. This will limit the electrical component of mean glidepath error to ± 0.067 degree. The field monitor alarm limit should be set such that with the mean glidepath error at the alarm limit the total allowed PFE is not exceeded on any commissioned glidepath from the limit of coverage to an altitude of 100 feet.

(2) There is a reduction in the radiated power to a level not less than that specified in § 171.317(a)(4) for a period of more than one second.

(3) There is an error in the preamble DPSK transmission which occurs more than once in any one second period.