Todos os requisitos listados são oriundos da ICAO - Anexo 10 "Aeronautical Telecommunications" para sistemas DME	
DME SYSTEM REQUIREMENTS	
General Features	
	3.5.2.1 The DME system shall provide for continuous and accurate indication in the cockpit of the slant range distance of an equipped aircraft from an equipped ground reference point.
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	3.5.2.4 DME/P shall have two operating modes, IA and FA.
	3.5.2.5 When a DME is associated with an ILS, MLS or VOR for the purpose of constituting a single facility, they shall: a) be operated on a standard frequency pairing in accordance with 3.5.3.3.4; b) be collocated within the limits prescribed for associated facilities in 3.5.2.6; and c) comply with the identification provisions of 3.5.3.6.4.
	3.5.2.6.1 Associated VOR and DME facilities shall be collocated in accordance with the following: a) for those facilities used in terminal areas for approach purposes or other procedures where the highest position fixing accuracy of system capability is required, the separation of the VOR and DME antennas does not exceed 80 m (260 ft); b) for purposes other than those indicated in a), the separation of the VOR and DME antennas does not exceed 600 m (2 000 ft).
	3.5.2.6.2 Association of DME with ILS Note.— Attachment C, 2.11 gives guidance on the association of DME with ILS.
	3.5.2.6.3.1 Recommendation.— If a DME/P is used to provide ranging information, it should be sited as close as possible to the MLS azimuth facility.
	3.5.2.7 The Standards in 3.5.3, 3.5.4 and 3.5.5 denoted by ‡ shall apply only to DME equipment first installed after 1 January 1989.

System Features	
RANGE	3.5.3.1.1 Range. The system shall provide a means of measurement of slant range distance from an aircraft to a selected transponder to the limit of coverage prescribed by the operational requirements for the selected transponder.
COVERAGE	3.5.3.1.2.1 When associated with a VOR, DME/N coverage shall be at least that of the VOR to the extent practicable.
	3.5.3.1.2.2 When associated with either an ILS or an MLS, DME/N coverage shall be at least that of the respective ILS or of the MLS azimuth angle guidance coverage sectors.
	3.5.3.1.2.3 DME/P coverage shall be at least that provided by the MLS azimuth angle guidance coverage sectors. Note.— This is not intended to specify the operational range and coverage to which the system may be used; spacing of facilities already installed may limit the range in certain areas.
ACURACY	3.5.3.1.3.1 System accuracy. The accuracy standards specified in 3.5.3.1.4, 3.5.4.5 and 3.5.5.4 shall be met on a 95 per cent probability basis.
	3.5.3.1.4 DME/P accuracy Note 1.— In the following, two accuracy standards, 1 and 2, are stated for the DME/P to accommodate a variety of applications.
	3.5.3.1.4.1 Error components. The path following error (PFE) shall be comprised of those frequency components of the DME/P error at the output of the interrogator which lie below 1.5 rad/s. The control motion noise (CMN) shall be comprised of those frequency components of the DME/P error at the output of the interrogator which lie between 0.5 rad/s and 10 rad/s.
	3.5.3.1.4.2 Errors on the extended runway centre line shall not exceed the values given in Table B at the end of this chapter.
	3.5.3.1.4.3 In the approach sector, away from the extended runway centre line, the allowable PFE for both standard 1 and standard 2 shall be permitted to increase linearly with angle up to plus or minus 40 degrees MLS azimuth angle where the permitted error is 1.5 times that on the extended runway centre line at the same distance. The allowable CMN shall not increase with angle. There shall be no degradation of either PFE or CMN with elevation angle.
	3.5.3.2 Radio frequencies and polarization. The system shall operate with vertical polarization in the frequency band 960 MHz to 1 215 MHz. The interrogation and reply frequencies shall be assigned with 1MHz spacing between channels.

CANALIZATION	3.5.3.3.1 DME operating channels shall be formed by pairing interrogation and reply frequencies and by pulse coding on the paired frequencies.
	3.5.3.3.2 Pulse coding. DME/P channels shall have two different interrogation pulse codes as shown in the table in 3.5.4.4.1. One shall be used in the initial approach (IA) mode; the other shall be used in the final approach (FA) mode.
	3.5.3.3.3 DME operating channels shall be chosen from Table A (located at the end of this chapter), of 352 channels in which the channel numbers, frequencies, and pulse codes are assigned.
	3.5.3.3.4 Channel pairing. When a DME transponder is intended to operate in association with a single VHF navigation facility in the 108 MHz to 117.95 MHz frequency band and/or an MLS angle facility in the 5 031.0 MHz to 5 090.7 MHz frequency band, the DME operating channel shall be paired with the VHF channel and/or MLS angle frequency as given in Table A.
	3.5.3.4.1 DME/N. The interrogator average pulse repetition frequency (PRF) shall not exceed 30 pairs of pulses per second, based on the assumption that at least 95 per cent of the time is occupied for tracking.
	3.5.3.4.2 DME/N. If it is desired to decrease the time of search, the PRF may be increased during search but shall not exceed 150 pairs of pulses per second.
	3.5.3.4.3 DME/N. Recommendation.— After 15 000 pairs of pulses have been transmitted without acquiring indication of distance, the PRF should not exceed 60 pairs of pulses per second thereafter, until a change in operating channel is made or successful search is completed.
	3.5.3.4.4 DME/N. When, after a time period of 30 seconds, tracking has not been established, the pulse pair repetition frequency shall not exceed 30 pulse pairs per second thereafter.
	3.5.3.4.5 DME/P. The interrogator pulse repetition frequency shall not exceed the following number of pulse pairs per second: a) search 40 b) aircraft on the ground 5.
ACF CAPACITY SYS	3.5.3.5.1 The aircraft handling capacity of transponders in an area shall be adequate for the peak traffic of the area or 100 aircraft, whichever is the lesser.
	3.5.3.5.2 Recommendation.— Where the peak traffic in an area exceeds 100 aircraft, the transponder should be capable of handling that peak traffic.

TRANSPONDER IDENTIFICATION	3.5.3.6.1 All transponders shall transmit an identification signal in one of the following forms as required by 3.5.3.6.5: a) an “independent” identification consisting of coded (International Morse Code) identity pulses which can be used with all transponders; b) an “associated” signal which can be used for transponders specifically associated with a VHF navigation or an MLS angle guidance facility
	3.5.3.6.2 Both systems of identification shall use signals, which shall consist of the transmission for an appropriate period of a series of paired pulses transmitted at a repetition rate of 1 350 pulse pairs per second, and shall temporarily replace all reply pulses that would normally occur at that time except as in 3.5.3.6.2.2. These pulses shall have similar characteristics to the other pulses of the reply signals.
	3.5.3.6.2.1 DME/N. Reply pulses shall be transmitted between key down times.
	3.5.3.6.2.2 DME/N. Recommendation.— If it is desired to preserve a constant duty cycle, an equalizing pair of pulses, having the same characteristics as the identification pulse pairs, should be transmitted 100 microseconds plus or minus 10 microseconds after each identity pair.
	3.5.3.6.2.3 DME/P. Reply pulses shall be transmitted between key down times.
	3.5.3.6.2.4 For the DME/P transponder, reply pulse pairs to valid FA mode interrogations shall also be transmitted during key down times and have priority over identification pulse pairs.
	3.5.3.6.2.5 The DME/P transponder shall not employ the equalizing pair of pulses of 3.5.3.6.2.2.
	3.5.3.6.3 The characteristics of the “independent” identification signal shall be as follows: a) the identity signal shall consist of the transmission of the beacon code in the form of dots and dashes (International Morse Code) of identity pulses at least once every 40 seconds, at a rate of at least 6 words per minute; and b) the identification code characteristic and letter rate for the DME transponder shall conform to the following to ensure that the maximum total key down time does not exceed 5 seconds per identification code group. The dots shall be a time duration of 0.1 second to 0.160 second. The dashes shall be typically 3 times the duration of the dots.
	3.5.3.6.4 The characteristics of the “associated” signal shall be as follows: a) when associated with a VHF or an MLS angle facility, the identification shall be transmitted in the form of dots and dashes (International Morse Code) as in 3.5.3.6.3 and shall be synchronized with the VHF facility identification code; b) each 40-second interval shall be divided into four or more equal periods, with the transponder identification transmitted during one period only and the associated VHF and MLS angle facility identification, where these are provided, transmitted during the remaining periods; c) for a DME transponder associated with an MLS, the identification shall be the last three letters of the MLS angle facility identification specified in 3.11.4.6.2.1.
	3.5.3.6.5.1 The “independent” identification code shall be employed wherever a transponder is not specifically associated with a VHF navigational facility or an MLS facility.
	3.5.3.6.5.2 Wherever a transponder is specifically associated with a VHF navigational facility or an MLS facility, identification shall be provided by the “associated” code.

IDT TRNP	3.5.3.6.5.3 When voice communications are being radiated on an associated VHF navigational facility, an “associated” signal from the transponder shall not be suppressed.
TRANSITION MODE DME/P	3.5.3.7.1 The DME/P interrogator for standard 1 accuracy shall change from IA mode track to FA mode track at 13 km (7 NM) from the transponder when approaching the transponder, or any other situation when within 13 km (7 NM).
	3.5.3.7.2 For standard 1 accuracy, the transition from IA mode to FA mode track operation may be initiated within 14.8 m (8 NM) from the transponder. Outside 14.8 km (8 NM), the interrogator shall not interrogate in the FA mode.
	3.5.3.8 *System efficiency.* The DME/P system accuracy of 3.5.3.1.4 shall be achieved with a system efficiency of 50 per cent or more.
Detailed technical characteristics of transponder and associated monitor	
TRANSMITTER	3.5.4.1.1 Frequency of operation. The transponder shall transmit on the reply frequency appropriate to the assigned DME channel (see 3.5.3.3.3).
	3.5.4.1.2 *Frequency stability.* The radio frequency of operation shall not vary more than plus or minus 0.002 per cent from the assigned frequency.
	3.5.4.1.3 Pulse shape and spectrum. The following shall apply to all radiated pulses: a) Pulse rise time.
	3.5.4.1.5.1 DME/N. Recommendation.— The peak EIRP should not be less than that required to ensure a peak pulse power density of approximately minus 83 dBW/m2 at the maximum specified service range and level.
	3.5.4.1.5.2 DME/N. The peak equivalent isotropically radiated power shall not be less than that required to ensure a peak pulse power density of minus 89 dBW/m2 under all operational weather conditions at any point within coverage specified in 3.5.3.1.2.
	3.5.4.1.5.3 DME/P. The peak equivalent isotropically radiated power shall not be less than that required to ensure the following peak pulse power densities under all operational weather conditions: a) minus 89 dBW/m2 at any point within the coverage specified in 3.5.3.1.2 at ranges greater than 13 km (7 NM) from the transponder antenna; b) minus 75 dBW/m2 at any point within the coverage specified in 3.5.3.1.2 at ranges less than 13 km (7 NM) from the transponder antenna; c) minus 70 dBW/m2 at the MLS approach reference datum; d) minus 79 dBW/m2 at 2.5 m (8 ft) above the runway surface, at the MLS datum point, or at the farthest point on the runway centre line which is in line of sight of the DME transponder antenna.
	3.5.4.1.5.4 The peak power of the constituent pulses of any pair of pulses shall not differ by more than 1 dB.
	3.5.4.1.5.5 Recommendation.— The reply capability of the transmitter should be such that the transponder should be capable of continuous operation at a transmission rate of 2 700 plus or minus 90 pulse pairs per second (if 100 aircraft are to be served).

TRANSMITTER	3.5.4.1.5.6 The transmitter shall operate at a transmission rate, including randomly distributed pulse pairs and distance reply pulse pairs, of not less than 700 pulse pairs per second except during identity. The minimum transmission rate shall be as close as practicable to 700 pulse pairs per second. For DME/P, in no case shall it exceed 1 200 pulse pairs per second.
	3.5.4.1.6 Spurious radiation. During intervals between transmission of individual pulses, the spurious power received and measured in a receiver having the same characteristics as a transponder receiver, but tuned to any DME interrogation or reply frequency, shall be more than 50 dB below the peak pulse power received and measured in the same receiver tuned to the reply frequency in use during the transmission of the required pulses. This provision refers to all spurious transmissions, including modulator and electrical interference.
	3.5.4.1.6.1 DME/N. The spurious power level specified in 3.5.4.1.6 shall be more than 80 dB below the peak pulse power level.
	3.5.4.1.6.2 DME/P. The spurious power level specified in 3.5.4.1.6 shall be more than 80 dB below the peak pulse power level.
	3.5.4.1.6.3 Out-of-band spurious radiation. At all frequencies from 10 to 1 800 MHz, but excluding the band of frequencies from 960 to 1 215 MHz, the spurious output of the DME transponder transmitter shall not exceed minus 40 dBm in any one kHz of receiver bandwidth.
	3.5.4.1.6.4 The equivalent isotropically radiated power of any CW harmonic of the carrier frequency on any DME operating channel shall not exceed minus 10 dBm.
RECEPTOR	3.5.4.2.1 Frequency of operation. The receiver centre frequency shall be the interrogation frequency appropriate to the assigned DME operating channel (see 3.5.3.3.3).
	3.5.4.2.2 Frequency stability. The centre frequency of the receiver shall not vary more than plus or minus 0.002 per cent from the assigned frequency.
	3.5.4.2.3.1 In the absence of all interrogation pulse pairs, with the exception of those necessary to perform the sensitivity measurement, interrogation pulse pairs with the correct spacing and nominal frequency shall trigger the transponder if the peak power density at the transponder antenna is at least: a) minus 103 dBW/m2 for DME/N with coverage range greater than 56 km (30 NM); b) minus 93 dBW/m2 for DME/N with coverage range not greater than 56 km (30 NM); c) minus 86 dBW/m2 for DME/P IA mode;
	3.5.4.2.3.2 The minimum power densities specified in 3.5.4.2.3.1 shall cause the transponder to reply with an efficiency of at least: a) 70 per cent for DME/N;
	3.5.4.2.3.3 DME/N dynamic range. The performance of the transponder shall be maintained when the power density of the interrogation signal at the transponder antenna has any value between the minimum specified in 3.5.4.2.3.1 up to a maximum of minus 22 dBW/m2 when installed with ILS or MLS and minus 35 dBW/m2 when installed for other applications.

RECEPTOR	3.5.4.2.3.4 DME/P dynamic range. The performance of the transponder shall be maintained when the power density of the interrogation signal at the transponder antenna has any value between the minimum specified in 3.5.4.2.3.1 up to a maximum of minus 22 dBW/m2.
	3.5.4.2.3.5 The transponder sensitivity level shall not vary by more than 1 dB for transponder loadings between 0 and 90 per cent of its maximum transmission rate.
	3.5.4.2.3.6 DME/N. When the spacing of an interrogator pulse pair varies from the nominal value by up to plus or minus 1 microsecond, the receiver sensitivity shall not be reduced by more than 1 dB.
	3.5.4.2.3.7 DME/P. When the spacing of an interrogator pulse pair varies from the nominal value by up to plus or minus 1 microsecond, the receiver sensitivity shall not be reduced by more than 1 dB.
	3.5.4.2.4.1 DME/N. Recommendation.— When transponder loading exceeds 90 per cent of the maximum transmission rate, the receiver sensitivity should be automatically reduced in order to limit the transponder replies, so as to ensure that the maximum permissible transmission rate is not exceeded. (The available range of sensitivity reduction should be at least 50 dB.)
	3.5.4.2.4.2 DME/P. To prevent transponder overloading the transponder shall automatically limit its replies, so as to ensure that the maximum transmission rate is not exceeded. If the receiver sensitivity reduction is implemented to meet this requirement, it shall be applied to the IA mode only and shall not affect the FA mode.
	3.5.4.2.5 Noise. When the receiver is interrogated at the power densities specified in 3.5.4.2.3.1 to produce a transmission rate equal to 90 per cent of the maximum, the noise generated pulse pairs shall not exceed 5 per cent of the maximum transmission rate.
	3.5.4.2.6.1 The minimum permissible bandwidth of the receiver shall be such that the transponder sensitivity level shall not deteriorate by more than 3 dB when the total receiver drift is added to an incoming interrogation frequency drift of plus or minus 100 kHz.
	3.5.4.2.6.2 DME/N. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3.
	3.5.4.2.6.3 DME/P — IA mode. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3. The 12 dB bandwidth shall not exceed 2 MHz and the 60 dB bandwidth shall not exceed 10 MHz.
	3.5.4.2.6.4 DME/P — FA mode. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3. The 12 dB bandwidth shall not exceed 6 MHz and the 60 dB bandwidth shall not exceed 20 MHz.
	3.5.4.2.6.5 Signals greater than 900 kHz removed from the desired channel nominal frequency and having power densities up to the values specified in 3.5.4.2.3.3 for DME/N and 3.5.4.2.3.4 for DME/P shall not trigger the transponder.

RECEPTOR	3.5.4.2.7 Recovery time. Within 8 microseconds of the reception of a signal between 0 dB and 60 dB above minimum sensitivity level, the minimum sensitivity level of the transponder to a desired signal shall be within 3 dB of the value obtained in the absence of signals. This requirement shall be met with echo suppression circuits, if any, rendered inoperative.
	3.5.4.2.8 Spurious radiations. Radiation from any part of the receiver or allied circuits shall meet the requirements stated in 3.5.4.1.6.
	3.5.4.2.9 *CW and echo suppression* Recommendation.— CW and echo suppression should be adequate for the sites at which the transponders will be used.
	3.5.4.2.10 *Protection against interference* Recommendation.— Protection against interference outside the DME frequency band should be adequate for the sites at which the transponders will be used.
DECODING	3.5.4.3.1 The transponder shall include a decoding circuit such that the transponder can be triggered only by pairs of received pulses having pulse duration and pulse spacings appropriate to interrogator signals as described in 3.5.5.1.3 and 3.5.5.1.4.
	3.5.4.3.2 The decoding circuit performance shall not be affected by signals arriving before, between, or after, the constituent pulses of a pair of the correct spacing.
	3.5.4.3.3 DME/N — Decoder rejection. An interrogation pulse pair with a spacing of plus or minus 2 microseconds, or more, from the nominal value and with any signal level up to the value specified in 3.5.4.2.3.3 shall be rejected such that the transmission rate does not exceed the value obtained when interrogations are absent.
	3.5.4.3.4 DME/P — Decoder rejection. An interrogation pulse pair with a spacing of plus or minus 2 microseconds, or more, from the nominal value and with any signal level up to the value specified in 3.5.4.2.3.4 shall be rejected such that the transmission rate does not exceed the value obtained when interrogations are absent.

TIME DELAY	3.5.4.4.1 When a DME is associated only with a VHF facility, the time delay shall be the interval from the half voltage point on the leading edge of the second constituent pulse of the interrogation pair and the half voltage point on the leading edge of the second constituent pulse of the reply transmission.
	3.5.4.4.2 When a DME is associated with an MLS angle facility, the time delay shall be the interval from the half voltage point on the leading edge of the first constituent pulse of the interrogation pair and the half voltage point on the leading edge of the first constituent pulse of the reply transmission. This delay shall be 50 microseconds for mode X channels and 56 microseconds for mode Y channels, when it is desired that aircraft interrogators are to indicate distance from the transponder site.
	3.5.4.4.2.1 For DME/P transponders, no time delay adjustment shall be permitted.
	3.5.4.4.3 Recommendation.— For the DME/N the transponder time delay should be capable of being set to an appropriate value between the nominal value of the time delay minus 15 microseconds and the nominal value of the time delay, to permit aircraft interrogators to indicate zero distance at a specific point remote from the transponder site.
	3.5.4.4.3.1 DME/N. The time delay shall be the interval from the half voltage point on the leading edge of the first constituent pulse of the interrogation pair and the half voltage point on the leading edge of the first constituent pulse of the reply transmission.
	3.5.4.4.3.2 DME/P — IA mode. The time delay shall be the interval from the half voltage point on the leading edge of the first constituent pulse of the interrogation pulse pair to the half voltage point on the leading edge of the first constituent pulse of the reply pulse pair.
	3.5.4.4.3.3 DME/P — FA mode. The time delay shall be the interval from the virtual origin of the first constituent pulse of the interrogation pulse pair to the virtual origin of the first constituent pulse of the reply pulse pair. The time of arrival measurement points shall be within the partial rise time of the first constituent pulse of the pulse pair in each case.
	3.5.4.4.4 DME/N. Recommendation.— Transponders should be sited as near to the point at which zero indication is required as is practicable.

ACCURACY	3.5.4.5.1 DME/N. The transponder shall not contribute more than plus or minus 1 microsecond (150 m (500 ft)) to the overall system error.
	3.5.4.5.1.1 DME/N. Recommendation.— The contribution to the total system error due to the combination of the transponder errors, transponder location coordinate errors, propagation effects and random pulse interference effects should be not greater than plus or minus 340 m (0.183 NM) plus 1.25 per cent of distance measure.
	3.5.4.5.1.2 DME/N. The combination of the transponder errors, transponder location coordinate errors, propagation effects and random pulse interference effects shall not contribute more than plus or minus 185 m (0.1 NM) to the overall system error.
	3.5.4.5.2 DME/N. A transponder associated with a landing aid shall not contribute more than plus or minus 0.5 microsecond (75 m (250 ft)) to the overall system error.
	(DME/P - FA mode) 3.5.4.5.3.1 Accuracy standard 1. The transponder shall not contribute more than plus or minus 10 m (plus or minus 33 ft) PFE and plus or minus 8 m (plus or minus 26 ft) CMN to the overall system error.
	(DME/P - FA mode) 3.5.4.5.3.2 Accuracy standard 2. The transponder shall not contribute more than plus or minus 5 m (plus or minus 16 ft) PFE and plus or minus 5 m (plus or minus 16 ft) CMN to the overall system error.
	3.5.4.5.4 DME/P — IA mode. The transponder shall not contribute more than plus or minus 15 m (plus or minus 50 ft) PFE and plus or minus 10 m (plus or minus 33 ft) CMN to the overall system error.
	3.5.4.5.5 Recommendation.— When a DME is associated with an MLS angle facility, the above accuracy should include the error introduced by the first pulse detection due to the pulse spacing tolerances.
EFFICIENCY	3.5.4.6.1 The transponder reply efficiency shall be at least 70 per cent for DME/N and DME/P (IA mode) and 80 per cent for DME/P (FA mode) at all values of transponder loading up to the loading corresponding to 3.5.3.5 and at the minimum sensitivity level specified in 3.5.4.2.3.1 and 3.5.4.2.3.5.
	3.5.4.6.2 Transponder dead time. The transponder shall be rendered inoperative for a period normally not to exceed 60 microseconds after a valid interrogation decode has occurred. In extreme cases when the geographical site of the transponder is such as to produce undesirable reflection problems, the dead time may be increased but only by the minimum amount necessary to allow the suppression of echoes for DME/N and DME/P IA mode.
	3.5.4.6.2.1 In DME/P the IA mode dead time shall not blank the FA mode channel and vice versa.

MONITORING AND CONTROL	3.5.4.7.1 Means shall be provided at each transponder site for the automatic monitoring and control of the transponder in use.
	(DME/N monitoring action) 3.5.4.7.2.1 In the event that any of the conditions specified in 3.5.4.7.2.2 occur, the monitor shall cause the following action to take place: a) a suitable indication shall be given at a control point; b) the operating transponder shall be automatically switched off; and c) the standby transponder, if provided, shall be automatically placed in operation.
	(DME/N monitoring action) 3.5.4.7.2.2 The monitor shall cause the actions specified in 3.5.4.7.2.1 if: a) the transponder delay differs from the assigned value by 1 microsecond (150 m (500 ft)) or more; b) in the case of a DME/N associated with a landing aid, the transponder delay differs from the assigned value by 0.5 microsecond (75 m (250 ft)) or more.
	(DME/N monitoring action) 3.5.4.7.2.3 Recommendation.— The monitor should cause the actions specified in 3.5.4.7.2.1 if the spacing between the first and second pulse of the transponder pulse pair differs from the nominal value specified in the table following 3.5.4.4.1 by 1 microsecond or more.
	(DME/N monitoring action) 3.5.4.7.2.4 Recommendation.— The monitor should also cause a suitable indication to be given at a control point if any of the following conditions arise: a) a fall of 3 dB or more in transponder transmitted power output; b) a fall of 6 dB or more in the minimum transponder receiver sensitivity (provided that this is not due to the action of the receiver automatic gain reduction circuits); c) the spacing between the first and second pulse of the transponder reply pulse pair differs from the normal value specified in 3.5.4.1.4 by 1 microsecond or more; d) variation of the transponder receiver and transmitter frequencies beyond the control range of the reference circuits (if the operating frequencies are not directly crystal controlled).
	(DME/N monitoring action) 3.5.4.7.2.5 Means shall be provided so that any of the conditions and malfunctioning enumerated in 3.5.4.7.2.2, 3.5.4.7.2.3 and 3.5.4.7.2.4 which are monitored can persist for a certain period before the monitor takes action. This period shall be as low as practicable, but shall not exceed 10 seconds, consistent with the need for avoiding interruption, due to transient effects, of the service provided by the transponder.
	(DME/N monitoring action) 3.5.4.7.2.6 The transponder shall not be triggered more than 120 times per second for either monitoring or automatic frequency control purposes, or both.

MONITORING AND CONTROL	*(DME/P monitoring action)3.5.4.7.3.1 The monitor system shall cause the transponder radiation to cease and provide a warning at a control point if any of the following conditions persist for longer than the period specified:* *a) there is a change in transponder PFE that exceeds the limits specified in either 3.5.4.5.3 or 3.5.4.5.4 for more than one second. If the FA mode limit is exceeded, but the IA mode limit is maintained, the IA mode may remain operative;* *b) there is a reduction in the EIRP to less than that necessary to satisfy the requirements specified in 3.5.4.1.5.3 for a period of more than one second;* *c) there is a reduction of 3 dB or more in the transponder sensitivity necessary to satisfy the requirements specified in 3.5.4.2.3 for a period of more than five seconds in FA mode and ten seconds in IA mode (provided that this is not due to the action of the receiver automatic sensitivity reduction circuits);* *d) the spacing between the first and second pulse of the transponder reply pulse pair differs from the value specified in the table in 3.5.4.4.1 by 0.25 microsecond or more for a period of more than one second.*
	(DME/P monitoring action)3.5.4.7.3.2 Recommendation.— The monitor should cause a suitable indication to be given at a control point if there is an increase above 0.3 microseconds or a decrease below 0.2 microseconds of the reply pulse partial rise time which persists for more than one second.
	(DME/P monitoring action)3.5.4.7.3.3 The period during which erroneous guidance information is radiated shall not exceed the periods specified in 3.5.4.7.3.1. Attempts to clear a fault by resetting the primary ground equipment or by switching to standby ground equipment, if fitted, shall be completed within this time. If the fault is not cleared within the time allowed, the radiation shall cease. After shutdown, no attempt shall be made to restore service until a period of 20 seconds has elapsed.
	(DME/P monitoring action)3.5.4.7.3.4 The transponder shall not be triggered for monitoring purposes more than 120 times per second in the IA mode and 150 times per second in the FA mode.
	(DME/P monitoring action)3.5.4.7.3.5 DME/N and DME/P monitor failure. Failure of any part of the monitor itself shall automatically produce the same results as the malfunctioning of the element being monitored.

TRANSMITTER	3.5.5.1.1 Frequency of operation. The interrogator shall transmit on the interrogation frequency appropriate to the assigned DME channel (see 3.5.3.3.3).
	3.5.5.1.2 Frequency stability. The radio frequency of operation shall not vary more than plus or minus 100 kHz from the assigned value.
	3.5.5.1.3 Pulse shape and spectrum. The following shall apply to all radiated pulses: a) Pulse rise time. 1) DME/N. Pulse rise time shall not exceed 3 microseconds. 2) DME/P. Pulse rise time shall not exceed 1.6 microseconds. For the FA mode, the pulse shall have a partial rise time of 0.25 plus or minus 0.05 microsecond. With respect to the FA mode and accuracy standard 1, the slope of the pulse in the partial rise time shall not vary by more than plus or minus 20 per cent. For accuracy standard 2 the slope shall not vary by more than plus or minus 10 per cent. 3) DME/P. Recommendation.— Pulse rise time should not exceed 1.2 microseconds. b) Pulse duration shall be 3.5 microseconds plus or minus 0.5 microsecond. c) Pulse decay time shall nominally be 2.5 microseconds, but shall not exceed 3.5 microseconds. d) The instantaneous amplitude of the pulse shall not, at any instant between the point of the leading edge which is 95 per cent of maximum amplitude and the point of the trailing edge which is 95 per cent of the maximum amplitude, fall below a value which is 95 per cent of the maximum voltage amplitude of the pulse. e) The spectrum of the pulse modulated signal shall be such that at least 90 per cent of the energy in each pulse shall be within 0.5 MHz in a band centred on the nominal channel frequency. f) To ensure proper operation of the thresholding techniques, the instantaneous magnitude of any pulse turn-on transients which occur in time prior to the virtual origin shall be less than one per cent of the pulse peak amplitude. Initiation of the turn-on process shall not commence sooner than 1 microsecond prior to the virtual origin.
	(Pulse spacing)3.5.5.1.4.1 The spacing of the constituent pulses of transmitted pulse pairs shall be as given in the table in 3.5.4.4.1.
	(Pulse spacing)3.5.5.1.4.2 DME/N. The tolerance on the pulse spacing shall be plus or minus 0.5 microsecond.
	(Pulse spacing)3.5.5.1.4.3 DME/N. Recommendation.— The tolerance on the pulse spacing should be plus or minus 0.25 microsecond.
	(Pulse spacing)3.5.5.1.4.4 DME/P. The tolerance on the pulse spacing shall be plus or minus 0.25 microsecond.
	(Pulse spacing)3.5.5.1.4.5 The pulse spacing shall be measured between the half voltage points on the leading edges of the pulses.
	(Pulse repetition frequency) 3.5.5.1.5.1 The pulse repetition frequency shall be as specified in 3.5.3.4.
	(Pulse repetition frequency) 3.5.5.1.5.2 The variation in time between successive pairs of interrogation pulses shall be sufficient to prevent false lock-on.
	(Pulse repetition frequency)3.5.5.1.5.3 DME/P. In order to achieve the system accuracy specified in 3.5.3.1.4, the variation in time between successive pairs of interrogation pulses shall be sufficiently random to decorrelate high frequency multipath errors.

TRANSMITTER	*(Pulse repetition frequency)3.5.5.1.6 Spurious radiation. During intervals between transmission of individual pulses, the spurious pulse power received and measured in a receiver having the same characteristics of a DME transponder receiver, but tuned to any DME interrogation or reply frequency, shall be more than 50 dB below the peak pulse power received and measured in the same receiver tuned to the interrogation frequency in use during the transmission of the required pulses. This provision shall apply to all spurious pulse transmissions. The spurious CW power radiated from the interrogator on any DME interrogation or reply frequency shall not exceed 20 microwatts (minus 47 dBW).*
	(Pulse repetition frequency)3.5.5.1.7 Recommendation.— The spurious pulse power received and measured under the conditions stated in 3.5.5.1.6 should be 80 dB below the required peak pulse power received.
	3.5.5.1.8 DME/P. The peak EIRP shall not be less than that required to ensure the power densities in 3.5.4.2.3.1 under all operational weather conditions.
TIME DELAY	3.5.5.2.1 The time delay shall be consistent with the table in 3.5.4.4.1.
	3.5.5.2.2 DME/N. The time delay shall be the interval between the time of the half voltage point on the leading edge of the second constituent interrogation pulse and the time at which the distance circuits reach the condition corresponding to zero distance indication.
	3.5.5.2.3 DME/N. The time delay shall be the interval between the time of the half voltage point on the leading edge of the first constituent interrogation pulse and the time at which the distance circuits reach the condition corresponding to zero distance indication.
	3.5.5.2.4 DME/P — IA mode. The time delay shall be the interval between the time of the half voltage point on the leading edge of the first constituent interrogation pulse and the time at which the distance circuits reach the condition corresponding to zero distance indication.
	3.5.5.2.5 DME/P — FA mode. The time delay shall be the interval between the virtual origin of the leading edge of the first constituent interrogation pulse and the time at which the distance circuits each the condition corresponding to zero distance indication. The time of arrival shall be measured within the partial rise time of the pulse.

RECEIVER	3.5.5.3.1 Frequency of operation. The receiver centre frequency shall be the transponder frequency appropriate to the assigned DME operating channel (see 3.5.3.3.3).
	3.5.5.3.2.1 DME/N. The airborne equipment sensitivity shall be sufficient to acquire and provide distance information to the accuracy specified in 3.5.5.4 for the signal power density specified in 3.5.4.1.5.2.
	3.5.5.3.2.2 DME/P. The airborne equipment sensitivity shall be sufficient to acquire and provide distance information to the accuracy specified in 3.5.5.4.2 and 3.5.5.4.3 for the signal power densities specified in 3.5.4.1.5.3.
	3.5.5.3.2.3 DME/N. The performance of the interrogator shall be maintained when the power density of the transponder signal at the interrogator antenna is between the minimum values given in 3.5.4.1.5 and a maximum of minus 18 dBW/m2.
	3.5.5.3.2.4 DME/P. The performance of the interrogator shall be maintained when the power density of the transponder signal at the interrogator antenna is between the minimum values given in 3.5.4.1.5 and a maximum of minus 18 dBW/m2.
	(Bandwidth) 3.5.5.3.3.1 DME/N. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3, when the input signals are those specified in 3.5.4.1.3.
	(Bandwidth) 3.5.5.3.3.2 DME/P — IA mode. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.4.1.3. The 12-dB bandwidth shall not exceed 2 MHz and the 60-dB bandwidth shall not exceed 10 MHz.
	(Bandwidth) 3.5.5.3.3.3 DME/P — FA mode. The receiver bandwidth shall be sufficient to allow compliance with 3.5.3.1.3 when the input signals are those specified in 3.5.5.1.3. The 12-dB bandwidth shall not exceed 6 MHz and the 60-dB bandwidth shall not exceed 20 MHz.
	(Interference rejection) 3.5.5.3.4.1 When there is a ratio of desired to undesired co-channel DME signals of at least 8 dB at the input terminals of the airborne receiver, the interrogator shall display distance information and provide unambiguous identification from the stronger signal.
	(Interference rejection) 3.5.5.3.4.2 DME/N. DME signals greater than 900 kHz removed from the desired channel nominal frequency and having amplitudes up to 42 dB above the threshold sensitivity shall be rejected.
	(Interference rejection) 3.5.5.3.4.3 DME/P. DME signals greater than 900 kHz removed from the desired channel nominal frequency and having amplitudes up to 42 dB above the threshold sensitivity shall be rejected.
	(Decoding) 3.5.5.3.5.1 The interrogator shall include a decoding circuit such that the receiver can be triggered only by pairs of received pulses having pulse duration and pulse spacings appropriate to transponder signals as described in 3.5.4.1.4.
	(Decoding) 3.5.5.3.5.2 DME/N — Decoder rejection. A reply pulse pair with a spacing of plus or minus 2 microseconds, or more, from the nominal value and with any signal level up to 42 dB above the receiver sensitivity shall be rejected.
	(Decoding) 3.5.5.3.5.3 DME/P — Decoder rejection. A reply pulse pair with a spacing of plus or minus 2 microseconds, or more, from the nominal value and with any signal level up to 42 dB above the receiver sensitivity shall be rejected.

ACCURACY	3.5.5.4.1 DME/N. The interrogator shall not contribute more than plus or minus 315 m (plus or minus 0.17 NM) or 0.25 per cent of indicated range, whichever is greater, to the overall system error.
	3.5.5.4.2 DME/P — IA mode. The interrogator shall not contribute more than plus or minus 30 m (plus or minus 100 ft) to the overall system PFE and not more than plus or minus 15 m (plus or minus 50 ft) to the overall system CMN.
	(DME/P — FA mode)3.5.5.4.3.1 Accuracy standard 1. The interrogator shall not contribute more than plus or minus 15 m (plus or minus 50 ft) to the overall system PFE and not more than plus or minus 10 m (plus or minus 33 ft) to the overall system CMN.
	(DME/P — FA mode) 3.5.5.4.3.2 Accuracy standard 2. The interrogator shall not contribute more than plus or minus 7 m (plus or minus 23 ft) to the overall system PFE and not more than plus or minus 7 m (plus or minus 23 ft) to the overall system CMN.
	(DME/P — FA mode) 3.5.5.4.4 DME/P. The interrogator shall achieve the accuracy specified in 3.5.3.1.3.4 with a system efficiency of 50 per cent or more.