1. Objective

1.1. This directive is part of the CNS inspector handbook.

1.2. This directive provides guidance for evaluating and approving Distance Measuring Equipment (DME) Transponders Navigation Radio Stations.

2. General

2.1. Under article 35(a) to the Israeli Air Navigation Law 2011 any navigation aid is required to have CAAI approval before being established or used.

2.2. Navigation Radio Station is specifically included in the definition of navigation aids Article 1 to the ANL, 2011.

2.3. This document sets out the requirements for approval of DME Navigation Radio Stations established or used within Israel to provide air traffic services.

2.4. Abbreviations

ANL	-	Air Navigation Law
ANR	-	Air Navigation Regulations
ATC	-	Air Traffic Control
ANS	-	Air Navigation Service
ATS	-	Air Traffic Service
DOC	-	Designated Operational Coverage
UHF	-	Ultra High Frequency

3. Reference Material ,Form& Job-Aids

3.1. Law & Regulation

3.1.1. ANL 2011 articles 35(a) & 27(a) & 29

3.1.2. ANR (Operation of Aircraft and Rules of Flight), 1981 - Reg 66(c).

3.1.3. ANR (Safety at Aerodromes of the Airport Authority), 1992 - Reg 3.

3.2. CAAI AP & Directives

3.2.1. AP 1.7.005 / 2.7.005 - ATS equipment installation, maintenance, operation & approval

3.2.2. ANS 1.7.025 – ILS approval.

3.3. ICAO annexes & documents

3.3.1. ICAO Annex 10 Aeronautical Telecommunications Volume I- Radio Navigation Aids.

3.3.2. ICAO Annex 10 Aeronautical Telecommunications Volume V (Aeronautical Radio Frequency Spectrum Utilization).

3.3.3. ICAO Annex 11 Air Traffic Services.

3.3.4. ICAO Doc 8071 Volume I – Testing of Ground-Based Radio Navigation System

3.3.5. ICAO Doc 7192 - Training Manual Part E-2 Air Traffic Safety Electronics Personnel (ATSEP)

Note: This document incorporates the relevant SARPs from ICAO Annex 10 and Annex 11 together.

3.4. **Forms & Job-Aids**

3.4.1. CAAI Form ANSF 1.7.005-1 -Navigational Aid (NAVAID) Data Form

3.4.2. CAAI Form ANSF 1.7.005-1 - Navigational Aid (NAVAID) Data Form

4. Process

4.1. Technical Requirements

This document sets out the Engineering Requirements for all Distance Measuring Equipment (DME) Transponders intended for use in the provision of an ATS.

4.1.1. Safety objective

The DME Transponder equipment shall not radiate a signal which falls outside standard operating tolerances or provide false information over its Designated Operational Coverage area (DOC).

4.1.2. General Requirements

4.1.2.1 SARPs Compliance

In addition to the requirements below, DME transponder systems shall comply with the SARPs in ICAO Annex 10 Volume 1 Chapter 2 General Provisions for Radio Navigation Aids and Chapter 3 Section 3.5 Specification for UHF Distance Measuring Equipment (DME).

4.1.2.2 Radio Spectrum Management

4.1.2.2.1. The equipment and systems shall be installed, operated and maintained in compliance with the terms of specific location dependent or general frequency assignment(s) and the terms and conditions of the Approval granted in respect of the ATS being provided.

4.1.2.2.2. The DOCs associated with the frequency assignments for ATS Communications Facilities and Radio Navigation and Landing Aids at aerodromes, shall be published in the Remarks column of sections AD of the AIP respectively.

4.1.2.2.3. Frequencies for En-route Navigation Facilities shall have their DOCs published in the AIP section ENR under the associated Remarks column.

4.1.2.2.4. All Aeronautical Radio Stations shall be suitably licensed by the ministry of communication.

4.1.2.2.5. Failure to renew the ministry of communication radio license will invalidate the associated CAAI Approval and the associated frequency assignment will be withdrawn. Renewal

after the withdrawal of the ministry of communication radio license will be treated as a new application.

4.1.2.2.6. For new installations that operate on aeronautical frequency assignments, initial applications to establish an Aeronautical Radio Station shall be made to the CAAI, which will trigger the process with the ministry of communication.

4.1.2.2.7. All frequency assignments shall be coordinated and registered in ICAO data base.

4.1.2.2.8. Inspection of Aeronautical Radio Stations - The equipment and systems at aeronautical radio stations and associated records shall be inspected by CAAI Inspector.

4.1.2.2.9. Demonstration of compliance will be required. This may include measurements to verify transmitter frequency, modulation depth, transmitter output power and a determination of effective radiated power. The ATS Provider is expected to provide this information.

4.1.2.2.10. The equipment shall transmit only on the frequency assigned by the CAAI and as appears in the schedule to the radio license issued under the Wireless Telegraphy order (1972).

4.1.2.3 **Coverage of the DME.**

The DOC will be determined as part of a standard flight check during the commissioning of the DME.

4.1.2.4 **Identification**

4.1.2.4.1. The identification signal shall employ the International Morse Code and consist of two or three letters.

4.1.2.4.2. The Identification shall be suppressed when the DME is not available for operational purposes, e.g. under maintenance.

Note: The normal identity code may be radiated for short periods during maintenance or flight inspection as necessary.

4.1.2.4.3. Requirements for identification when associated with an ILS are detailed in directive ANS 1.7.025

4.1.2.5 **Standby Power**

Standby power supplies shall be provided commensurate with the service being supported.

4.1.2.6 **Status Information**

4.1.2.6.1. ATC directly responsible for approach, landing and take-off at the aerodrome(s) with which they are concerned shall be provided with information on the operational status of radio navigation services, on a timely basis, consistent with the use of the service(s) involved.

4.1.2.6.2. Where status information is reliant upon a visual status indicator, then an audible alarm should be provided which indicates that the visual indicator has changed state.

4.1.2.7 **Use of DME as a Ranging Element with Precision Approach**

The DME shall be sited to keep the triangulation error at the point at which the distance is required to a minimum.

4.1.2.8 **Communications Availability**

Adequate safety assurance, risk assessment and mitigation shall be performed by the Service Provider to ensure that the equipment and system design, installation, operation and maintenance ensures availability of communications appropriate for the Air Traffic Services and environment in which it is being provided.

4.1.2.9 **Ground testing**

Ground testing shall be carried out in accordance with the requirements in paragraph 4.2.

4.1.2.10 **Flight Inspection**

Flight inspection shall be carried out in accordance with the requirements in paragraph 4.3.

4.2. DME Ground testing Types and Requirements

Ground test requirements are listed in Table I.

Table I - Summary of ground test requirements - DME

Parameter	Annex 10 Volume I Reference	Doc 8071 Volume I Reference	Measured	Tolerance	Uncertainty	Periodicity (Note 3)
Transmitter						
Frequency stability	3.5.4.1.2	3.2.4	Frequency	Assigned channel frequency, ±0.002%	0.001%	12 months
Pulse spectrum	3.5.4.1.3	3.2.5	Power	Output radiated within each 0.5 MHz band centered at ±0.8 MHz from the nominal frequency is not more than 200 mW; output radiated within each 0.5 MHz band centered at ±2 MHz from the nominal frequency is not more than 2 mW. Amplitude of successive lobes decreases in proportion to their frequency separation from the nominal frequency	1 dB	6 months
Pulse shape	3.5.4.1.3	3.2.6	Time, amplitude	Rise time ≤3 µS Duration 3.5 µS, ±0.5 µS Decay time ≤3.5 µS Amplitude, between 95% rise/fall amplitudes, ≥95%	0.1 µS 1%	6 months
Pulse spacing	3.5.4.1.4	3.2.7	Time	X-channel: 12 ±0.25 µS Y-channel: 30 ±0.25 µS	0.1 S	6 months
Peak power output (see Note 1)	3.5.4.1.5			Peak EIRP such that field density ≥ -89 dBW/m^2 at service volume limits	1 dB	6 months
Peak variation	3.5.4.1.5.4			Power difference between pulses of a pair ≤1 dB	0.2 dB	6 months
Pulse repetition frequency	3.5.4.1.5.6			≥700 pps	10 pulse pairs	6 months

Parameter	Annex 10 Volume I Reference	Doc 8071 Volume I Reference	Measured	Tolerance	Uncertainty	Periodicity (Note 3)
Receiver						
Frequency stability	3.5.4.2.2	3.2.11	Frequency	Assigned channel frequency, ±0.002%	0.001%	6 months
Sensitivity (see Note 2)	3.5.4.2.3.1	3.2.12	Power	Such that power density at antenna ≥ -103 dBW/m2	1 dB	6 months
Sensitivity variation with load	3.5.4.2.3.5	3.2.13	Power	<1 dB for loadings between 0 and 90% of maximum transmission rate	0.2 dB	6 months
Bandwidth	3.5.4.2.6	3.2.14		Such that sensitivity degrades ≤ 3 dB for interrogation frequency drift of ±100 kHz.	0.5 dB	6 months
Decoder	3.5.4.3	3.2.15	Count	No response to interrogations with pulse spacing more than 2 µs from nominal	10 pulse pairs	6 months
Time delay	3.5.4.4	3.2.16	Time	X-channel: 50 µS Y-channel: 56 µS	1 µS	6 months
Identification	3.5.3.6	3.2.17	Identification	1350 pulse pairs during key down periods proper Morse code Sequence dot length = 0.1 to 0.16 S; dash = 0.3 to 0.48 S; spacing between dot and dash = dot length ±10%; spacing between letters ≥3 dots total length of one code sequence ≤10 seconds	10 pulse pairs 10 µS 0.5 S	12 months
Monitor action	3.5.4.7.2.2	3.2.18	Time	Monitor alarms when: Reply delay varies by more than 1 µs (0.5 µs for DME associated with a landing aid)	0.2 µS	12 months
Monitor action delay	3.5.4.7.2.5		Time	Delay ≤10 seconds	0.5 S	12 months

Notes:
1. Peak power output should be as set at commissioning.
2. Receiver sensitivity should be as set at commissioning.
3. The frequency with which such tests should be performed should be based on experience with each type of equipment and the quality of maintenance. The suggested periodicities are given only as general guidance and may require modification based on the manufacturer's advice or practical experience.

4.2.1. **General**

4.2.1.1 The parameters of the ground equipment that should be regularly checked are indicated in Table I.

4.2.1.2 The frequency with which such tests should be performed should be based on experience with each type of equipment and the quality of maintenance. The suggested periodicities are given only as general guidance and may require modification based on the manufacturer's advice or practical experience. The procedures and test equipment to be employed in ground testing a DME transponder vary according to the commercial product involved. The appropriate manufacturer's technical manuals should be used as guidance.

4.2.1.3 Recommended general instructions for testing of DME specific parameters are provided in the following paragraphs. The DME should be checked in accordance with the test procedures proposed in the manufacturer's equipment instruction book.

4.2.2. **Transmitter frequency stability.**

Use the frequency counter to measure the transmitter frequency in accordance with the procedure in the equipment instruction book. Adjust the frequency as required

4.2.3. **Pulse spectrum.**

Use the spectrum analyzer to measure the spectrum of the output pulse according to the procedure in the equipment instruction book. Check and correct the modulation level (pedestal and Gaussian pulse) and adjust the transmitter stages if provided. Note the output power and pulse shape during adjustments

4.2.4. **Pulse shape.**

Use the oscilloscope to measure the shape of the output pulse according to the procedure in the equipment instruction book. If setting is necessary, refer to the adjustments of the output pulse spectrum in the paragraph above. After adjusting the pulse shape, it is very important to recheck the time decay. Check the pulse peak (refer to Annex 10, Volume I, 3.5.4.1.3 d)).

4.2.5. **Pulse spacing.**

Use the oscilloscope to measure the spacing of the output pulse according to the procedure in the equipment instruction book. Adjustments are generally not provided.

4.2.6. **Peak power output.**

Use the peak power meter and the calibrated load, or the variable attenuator when available, to measure the peak power output of the transmitter according to the procedure in the equipment instruction book. Refer to the adjustments of the Gaussian modulation pulse shape and transmitter stages in the previous paragraphs if adjustment is necessary. After adjustment, the time delay and pulse shape should be checked. Tolerances up to ±1dB of the power output are acceptable because these variations result in a change of the operational range by only 10 per cent. It is more important to obtain the output pulse spectrum and pulse shape within the requirements. Check the reflected power of the facility using the directional coupler.

4.2.7. **Peak variation.**

Measure the power drop of the output pulse using the oscilloscope. The variation in power level at the peak of any pair should not deviate from the average peak power by more than ±1 dB

4.2.8. **Transmitter pulse repetition frequency (PRF).**

The DME is set to a variable duty cycle or, if provided, to a constant duty cycle at commissioning. Measure the transponder reply pulse rate using the frequency counter, following the procedure of the equipment instruction book. If the system is set to variable duty cycle, the measured reply pulse rate depends on the manufacturer's design, which will be described in the detailed technical characteristics of the equipment. In any case, it should not be less than 700 pulse pairs per second (pps), or more than 1350 ±90 pps in the absence of interrogations.

4.2.9. **Receiver frequency stability.**

Use the frequency counter to measure the receiver frequency in accordance with the procedure in the equipment instruction book.

The accuracy of the receiver frequency depends on the accuracy of the transmitter frequency, and if provided with crystals, from their tolerances. Note that the transmitter frequency is always separated from the receiver frequency by ±63 MHz The sign depends on operating channel mode.

4.2.10. **Receiver sensitivity.**

Use the calibrated built-in or external DME test equipment to measure the on channel sensitivity to 70 per cent reply efficiency at an interrogation rate of 30 to 40 pulse pairs per second. The receiver sensitivity can be set at commissioning to different values depending on the required output power. Use the procedures and settings of the test equipment as described in the instruction book.

4.2.11. **Receiver sensitivity variation with load.**

Use the calibrated built-in or external DME test equipment to measure the on-channel sensitivity to 70 per cent reply efficiency at an interrogation rate from 0 to 90 per cent of the maximum transponder transmission rate (depends on the requirements).

4.2.12. **Receiver bandwidth.**

Use the calibrated built-in or external DME test equipment to measure the receiver sensitivity, as described in the paragraph “receiver sensitivity”, except:

a) With an incoming frequency drift of ±100 kHz from the center frequency. Check the loss in sensitivity; and/or

b) With an incoming frequency drift of ±900 kHz from the center frequency and with a level of 80 dB above receiver threshold. Check the interrogation pulse rejection.

4.2.13. **Decoder.**

Use the calibrated built-in or external DME test equipment to measure the receiver sensitivity as previously described, except:

a) With a shift of 0.4 μs in the pulse spacing of the interrogation signal. Check that there is no change in sensitivity;

b) With a shift between 0.5 μs and 2 μs in the pulse spacing of the interrogation signal. Check that the loss in sensitivity is less than 1 dB; and

c) With a shift of more than 2 μs in the pulse spacing of the interrogation signal. Check the interrogation pulse rejection.

4.2.14. **Time delay.**

Use the calibrated built-in or external DME test equipment and the oscilloscope to measure the time between the first pulse of the interrogation to the first pulse of the reply using the 50 per cent point of the leading edge. Follow the settings of the test equipment and the procedures of the manufacturer’s instruction book to make sure that the measurement is made precisely. The nominal transponder time delay is:

X-Mode: 50 μS

Y-Mode: 56 μS

Operational requirements at commissioning may justify setting the time delay to another value. It is recommended that the time delay variation be checked with different interrogation levels (from the receiver sensitivity threshold to 80 dB above the threshold) to verify that the slant distance accuracy is not dependent upon the level. Follow the procedure of the instruction book.

Note.- The above figures are for first-pulse timing. If the transponder is set to second-pulse timing, the nominal time delay is 50 μs for both X-Mode and Y-Mode.

4.2.15. **Identification.**

The identification signal consists of a series of paired pulses transmitted at a repetition rate of 1350 pps. The identification keying is pre-settable for associated or independent facilities. Use the frequency counter and a stopwatch to measure the time of the dots, the dashes, the spacing between dots and/or dashes and the spacing between consecutive letters or numerals. Check the total period of transmission of one identification code group. Check the repetition time between the code groups.

4.2.16. **The automatic monitor control.**

Check and verify, using the milli-watt meter, the oscilloscope and the frequency counter that the monitor RF pulse peak output signal is correct (reference calibrated level: 0 dBm).

Follow the test procedures of the instruction book. Use the calibrated built-in or external DME test equipment and the oscilloscope, and the test procedures in the equipment instruction book, to confirm the parameter alarm circuits operate within the tolerances. Check the indications and automatic functions for changing over the standby transponder, or switching off the transponder, if any alarm occurs.

4.3. DME Flight Inspection Types and Requirements

4.3.1. It is a requirement that all DME systems and associated Instrument Flight Procedures are checked by flight inspection at prescribed intervals.

4.3.2. Flight inspection ensures that the DME provides an accurate and uncorrupted source of guidance information within the DOC.

4.3.3. Flight test requirements are listed in Table II

Table II - Summary of flight inspection requirements - DME

Parameter	Annex 10 Volume I Reference	Doc 8071 Volume I Reference	Measured	Tolerance	Uncertainty	Inspection type (See Notes 1-3)
Coverage	3.5.3.1.2	3.3.5 to 3.3.8	AGC Level	Signal strength such that field density >= -89 dBW/m^2 at limits or operational requirements	1 dB	S ,C
Accuracy	3.5.4.5	3.3.9	Distance	≤150 m ≤75 m for DME associated with landing aids	20 m	S, C, P
Identification	3.5.3.6	3.3.13	Identification	Correct, clear, properly synchronized	N/A	S, C, P
Pulse shape	3.5.4.1.3	3.3.10	Time, Amplitude (Note 4)	Rise time ≤3 µS Duration 3.5 µS, ±0.5 µS Decay time ≤3.5 µS Amplitude, between 95% rise/fall amplitudes, ≥95% of maximum amplitude	0.1 µS 1%	
Pulse spacing	3.5.4.1.4	3.3.11	Time, Amplitude (Note 4)	X channel: 12 ±0.25 µS Y channel: 30 ±0.25 µS	0.05 µS	
Reply efficiency		3.3.14	Change in efficiency, position	Note areas where this changes significantly	N/A	S, C, P
Unlocks		3.3.15	Unlocking, position	Note where unlocking occurs	N/A	S, C, P

Parameter	Annex 10 Volume I Reference	Doc 8071 Volume I Reference	Measured	Tolerance	Uncertainty	Inspection type (See Notes 1-3)
Standby equipment		3.3.16	Suitability	Same as primary transmitter	N/A	S, C, P
Standby power		3.3.17	Suitability	Should not affect transponder parameters	N/A	S, C, P

Notes

1. *Site proving tests (S) are usually carried out to confirm facility performance prior to final construction of the site.*
2. *Commissioning checks (C) are to be carried out before the DME is initially placed in service. In addition, re-commissioning may be required whenever changes that may affect its performance (e.g. variations or repairs to the antenna system) are made.*
3. *Periodic checks (P) are typically made annually.*
4. *Those parameters can be checked in ground test instead of flight test (Doc 8071 Volume I Reference table I-3-3)*

4.3.4. Coverage

The coverage is measured by recording the automatic gain control (AGC) level of the airborne DME receiver. When combined with the reference system, a horizontal and vertical pattern can be plotted. A high assurance of continuous coverage should be established for all flight procedures based on the use of DME.

4.3.4.1 Horizontal coverage

The aircraft is flown in a circular track with a radius depending on the service volume of the associated facility around the ground station antenna at an altitude corresponding to an angle of elevation of approximately 0.5^{o} above the antenna site, or 300 m (1000 ft.) above intervening terrain, whichever is higher. If there is no associated facility, the orbit may be made at any radius greater than 18.5 km (10 NM). Since this flight is performed close to the radio horizon, it is possible to evaluate variations in field strength by recording the AGC voltage. Flight inspection of the coverage at maximum radius and minimum altitude, as prescribed by the operational requirements for the selected transponder, is usually necessary only on commissioning checks, when major modifications are made in the ground equipment, or if large structures are built in the vicinity of the antenna. The signal strength at the aircraft is generally adequate to maintain the interrogator in the tracking mode. Thus, the equipment itself can be used by the pilot for the desired orbit track guidance.

Note: checking of the associated VOR can be performed on the same flight. For a terminal class VOR, an orbit of 46.3 km (25 NM) can be flown.

4.3.4.2 Vertical coverage

4.3.4.2.1. The following flight inspection may be made to evaluate the lobbing pattern of a DME transponder. The flight test aircraft is used to perform a horizontal flight at approximately 1500 m (5000 ft.) on a bearing found suitable. The flight inspector records the RF-level or the AGC from the airborne receiver. Airspace procedures based on the use of DME are evaluated at the minimum flight altitude. The flight inspector verifies that the distance information is properly available in the aircraft at ATC reporting points, along air routes.

4.3.4.2.2. It is possible to check that the interrogator-transponder system is operating properly at every point of the airspace under consideration by recording the AGC voltage. The measurements made in flight provide data for plotting a graph showing the range in relation to the altitude. This graph makes it possible to:

- Form a clear picture of the different lobes of the radiation

pattern and thus evaluate the characteristics of the antenna and its environment;

- Show the cone as seen from directly overhead; and
- Foresee any limitations of the transponder coverage and their operational implications.

4.3.5. **Accuracy**

The accuracy of the system can be evaluated by comparing the measured DME distance with a three dimensional reference. It is good practice to make the calculations in three-dimensional space to avoid errors based on differences between slant range and the range on the ground. The accuracy can be checked on both orbital and radial flights. The DME transponder's contribution to the total error budget is principally the main delay. The most accurate calibration of this parameter is by ground measurement.

4.3.6. **Pulse shape**

It is not easy to measure the pulse shape of the DME transponder signal in orbital or radial flight due to multipath effects. The amplitude of the RF signal will vary along the flight path. The preferred method is to store a waveform of the pulse pair on a digital oscilloscope and use the timing functions of the instrument to average the calculated parameters over a series of samples

4.3.7. **Pulse spacing**

The same technique applies for the measurement of the pulse space as for the pulse shape.

4.3.8. **Identification**

The identification signal should be checked for correctness and clarity, with the aircraft in orbital or radial flight. A DME associated with an ILS localizer or VOR should be checked for correct synchronization of the two identification signals

4.3.9. **Reply efficiency**

Throughout the flight inspection, the reply efficiency should be monitored and recorded. This provides data on the service provided by the ground transponder to the aircraft within the service area. It can be used to indicate problem areas due to multipath and interference.

4.3.10. **Unlocks**

Areas where persistent unlocks occur should be investigated by further flight inspection to determine whether engineering action or promulgation is necessary.

4.3.11. **Standby equipment**

The standby DME transponder should be spot checked to ensure that it meets the same tolerances as the primary equipment. This should be done at the most critical points during the facility check in order to obtain the comparison. These points are normally at the maximum orbit or radial distances. There should be no appreciable difference in the characteristics of the transponder (spectrum of pulses, energy radiated, etc.) between the primary and standby equipment.

4.3.12. **Standby power**

The standby power check can normally be performed satisfactorily on the ground. During commissioning and periodic inspections, this provision may be checked by observing operation and noting any appreciable differences in radiated signal characteristics that result from a changeover to standby power. The transponder characteristics (spectrum of pulses, energy radiated, etc.) should not be degraded when switched to standby power.

4.3.13. **Flight Inspection Interval**

4.3.13.1 The prescribed interval between successive inspections is 12 months.

4.3.13.2 This interval may be extended if the service provider can demonstrate that the system is stable and that multipath interference does not affect the guidance signals.

4.3.14. **Flight Inspection Organizations**

All DME flight inspections shall be made by an organization having CAAI approval for DME inspection..

4.3.15. **Analysis of Flight Inspection Records**

4.3.15.1 The ATS Provider shall analyze the flight inspection report at the earliest opportunity for operational systems and prior to entering a facility into operational service, to ensure that the flight inspection requirements are met.

4.3.15.2 The ATS Provider shall address any deficiencies or non-compliance to ensure a safe service is provided.

4.3.15.3 An ATS Provider may delegate the task of analyzing the flight inspection report to a third party specialist organization. This may be the flight inspection organization that provided the report.

4.3.15.4 The responsibility for addressing any deficiencies identified remains with the ATS Provider.

4.3.15.5 The person who conducts the analysis shall be competent to do so.

Note: This may include training on a specific flight inspection report format

4.4. **Summary of testing requirements — DME**

Table III - Summary of testing requirements — DME

Parameter	Annex 10, Volume I, reference	Testing
Coverage	3.5.3.1.2	F
Accuracy	3.5.3.1.3	F
Transmitter		
Frequency stability	3.5.4.1.2	G
Pulse spectrum	3.5.4.1.3	G
Pulse shape	3.5.4.1.3	F/G
Pulse spacing	3.5.4.1.4	F/G
Peak power output	3.5.4.1.5	G
Variation of peak power in any pair of pulses	3.5.4.1.5.4	G
Pulse repetition frequency (PRF)	3.5.4.1.5	G
Receiver		
Frequency stability	3.5.4.2.2	G
Sensitivity (reply efficiency)	3.5.4.2.3	G
Bandwidth	3.5.4.2.6	G
Decoder		
Decoder rejection	3.5.4.3.3	G
Time delay	3.5.4.4, 3.5.4.5	G
Identification	3.5.3.6	F/G
Monitor	3.5.4.7.2	G

Legend: F = Flight test/inspection
G = Ground test

4.5. Maintenance of DME Navigation Radio Stations

4.5.1. General Requirements

4.5.1.1 Maintenance arrangements shall be established to ensure the continued availability and reliability of all DME Navigation Radio Stations, associated with the provision of an ATC service.

4.5.1.2 In addition to the requirements below, DME Navigation Radio Stations systems maintenance shall comply with ICAO Doc 8071 Volume I – Testing of Ground-Based Radio Navigation System.

4.5.1.3 All the technicians will be properly trained on the DME Navigation Radio Stations.

4.5.1.4 A record of any functional test, flight checks and particulars of any maintenance, repair, overhaul, replacement or modification shall be kept in respect of the equipment and systems at DME Navigation Radio Stations, as or a period of two years.

4.5.1.5 Provision is made in the certificates for a record of an individual's proficiency. This may be used to record how often an individual performs maintenance duties on specific equipment and/or lapses in competency on specific equipment.

4.5.2. Training

4.5.2.1 A training program ensuring that the employees shall execute their positions and the activities laid upon them in an appropriate professional level according to the service provider procedures;

4.5.2.2 The training will be according to ICAO Doc 7192

4.5.2.3 The training program is accepted by the CAAI

4.5.2.4 The training program shall include separate parts according to these details:

4.5.2.4.1. Initial training;
4.5.2.4.2. Periodic training;
4.5.2.4.3. Special training;
4.5.2.4.4. Human factor training;
4.5.2.4.5. Work safety;

4.5.3. Maintenance program

4.5.3.1 A maintenance program is the source of scheduled inspections, relevant controls and supporting data. The Maintenance Program should always be active (subject to review and amendment) and utilized such as to enable effective maintenance to be carried out in a logical, concise, clear and controllable manner.

4.5.3.2 The CAAI approval of the Maintenance Program provides a mechanism to record minimum standards that the service provider must comply with.

4.5.3.3 The maintenance program may be applicable to more than one

DME Navigation Radio Stations of the same type.

4.5.3.4 The inspector will review the maintenance program according to applicable supporting information provided by the service provider.

4.5.3.5 The maintenance program will be designed to meet Human Factors principles.

4.5.3.6 Consideration should be given to routinely monitoring equipment at adverse weather conditions (i.e. salt laden atmosphere, high humidity, extreme heat etc.). These considerations should include increasing maintenance inputs for cleaning, lubrication and inspection of protective finishes as an example.

4.5.3.7 The maintenance program should include:

4.5.3.7.1. Preface that include the following:

- The type/model of the equipment and, where applicable, power systems.
- A list of the manuals (reference, revision numbers) that were used to prepare the maintenance manual (supporting information).
- A statement signed by the service provider accountable manager that:
  - The specified equipment will be maintained according to the maintenance program; and
  - The program will be reviewed and updated as required; and
  - Practices and procedures to satisfy the maintenance program will be to the standards specified in the manufacture Maintenance Instructions. In the case of approved practices and procedures that differ, the statement should refer to them.

4.5.3.7.2. List of scheduled inspections that include for each task the following information:

- Task description
- Interval
- Reference to manufacturer manual or other supporting information.
- Skill of technician – if required.
- Applicability – if the maintenance program is used for more than one facility.
- List of items with life limitation (including the life limitation for each item).
- Required test equipment (including manufacturer, model, S/N and next calibration date)

4.5.3.7.3. Forms

- All the forms/log books that are going to be used will be part of the maintenance program.

4.5.3.7.4. Additional procedures if required

4.5.3.7.5. Permitted variations to maintenance periods

4.6. Additional information

The inspector will review all the other documents required by CAAI AP 1.7.005 / 2.7.005 (ATS equipment installation, maintenance, operation & approval)

4.7. Demonstration and Inspection Phase

4.7.1. CAAI requires service providers to demonstrate their ability to comply with regulations and safe operating practices before issuing approval to the ATS equipment.

4.7.2. These demonstrations include actual performance of activities and/or operations while being observed by the inspector.

4.7.3. The demonstration will include:

4.7.3.1 Compliance checklist of ground test requirements to ICAO annex 10 volume I and ICAO doc 8071 Volume I, including all the supporting documents (if applicable):

4.7.3.1.1. Manufacture compliance check list to ICAO documents.

4.7.3.1.2. Compliance for the specific Model and S/N

4.7.3.1.3. Factory Acceptance Test (FAT)

4.7.3.1.4. Customer Acceptance Test (CAT)

4.7.3.1.5. Site Acceptance Test (SAT)

4.7.3.1.6. Any other document that supporting the compliance.

4.7.3.2 Compliance checklist of flight test requirements to ICAO annex 10 volume I and ICAO doc 8071 Volume I, including all the supporting documents

4.7.3.3 Compliance checklist of maintenance program requirements to ICAO annex 10 volume I and ICAO doc 8071 Volume I

4.7.4. The demonstration will include on-site evaluations of equipment maintenance and support facilities.

4.7.5. During these demonstrations and inspections, the inspector will evaluate the effectiveness of the policies, methods, procedures, and instructions as described in the Service provider manuals and other documents.

4.7.6. Deficiencies will be brought to the attention of the service provider and corrective action must be taken before an approval is issued.

5. Task Outcomes

5.1. After the document compliance and the demonstration and inspection phases have been completed satisfactorily, the inspector will prepare the navigation aid Certificate that include all the information (equipment model, frequencies, identification, location, limitations etc.).

5.2. The service provider must acknowledge receipt of these documents.

5.3. The process above should be documented in the Sharedocs/Saar system.