CNS MANUAL

1/1/2013

Contains information, guidance, procedures and instructions applicable to

ACS, KATIHAR

[***Responsibility for Compilation & Documentation:***

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AIRPORTS AUTHORITY OF INDIA

"To be a world-class organization providing leadership in air traffic services and airport management & making India a major hub in Asia Pacific region by 2016."

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DOCUMENT IDENTIFICATION AND CONTROL

1. Title:

This document is identified as Station Manual of Communication Navigation & Surveillance (CNS) abbreviated as Station CNS Manual for ACS, KATIHAR.

2. Purpose:

- 2.1 This document has been prepared as per the instructions contained in Para 7.2 of CNS Manual Volume-I, dated 1st August, 2006, issued by Corporate Headquarter (CHQ) of Airports Authority of India (AAI), New Delhi.
- 2.2 The purpose of this document is to provide station specific Information, Guidance and Instructions applicable to CNS facilities and the procedure being followed for maintenance of these facilities.

3. Responsibility for documentation, review, amendments and publication:

Officer-In-Charge, AAI, ACS, Katihar is responsible for development, review and amendments of this manual.

4. Distribution of the Manual:

- 4.1 Master Copy in soft and hard forms will be held by Officer-In-Charge (CNS), AAI, ACS, Katihar.
- 4.2 Controlled copies shall be distributed to:

  - (i)The General Manager (CNS-ER), AAI, NSCBI Airport, Kolkata- 52
  - (ii)The Executive Director (CNS-OM), AAI, CHQ, New Delhi- 03

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Abbreviations and Interpretation

Interpretation

- **Standard:** Any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is **recognized as necessary** for safety or legislative compliance.
- **Practice:** Any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is **recognized as desirable** for safety or legislative compliance.

Abbreviations

A/C	***AIRCRAFT***
AAI	***AIRPORTS AUTHORITY OF INDIA***
ACAS	***AIRBORNE COLLISION AVOIDANCE SYSTEM***
ACP	***AZIMUTH CONTROL PULSE***
ACS	***AERONAUTICAL COMMUNICATION STATION***
AFIS	***AERODROME FLIGHT INFORMATION SERVICE***
AFTN	***AERONAUTICAL FIXED TELECOMMUNICATION NETWORK***
AGA	***AIR-GROUND-AIR***
AGC	***AUTOMATIC GAIN CONTROL***
AGL	***ABOVE GROUND LEVEL***
AM	***AMPLITUDE MODULATION***
AMC	***ANNUAL MAINTENANCE CONTRACT***
AMF	***AUTOMATIC MAINS FAILURE***
AMSL	***ABOVE MEAN SEA LEVEL***
AMSS	***AUTOMATIC MESSAGE SWITCHING SYSTEM***
ARP	***AZIMUTH REFERENCE PULSE***
ATC	***AIR TRAFFIC CONTROLLER***
ATM	***AIR TRAFFIC MANAGEMENT***
ATS	***AIR TRAFFIC SERVICES***
BIPM	***Bureau International des Poids et Mesures***
BISR	***BUILT-IN SELF REPAIR***
BIST	***BUILT IN SELF TEST***
BSEB	***BIHAR STATE ELECTRICITY BOARD***
BSNL	***BHARAT SANCHAR NIGAM LIMITED***

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BW	***BANDWIDTH***
CAL	***CALIBRATION***
CAR	***CIVIL AVIATION REQUIREMENT***
CATC	***CIVIL AVIATION TRAINING COLLEGE***
CHQ	***CORPORATE HEAD QUARTER***
CNS	***COMMUNICATION NAVIGATION & SURVEILLANCE***
CRC	***CYCLIC REDUNDANCY CHECK***
CRSD	***CENTRAL RADIO STORES DEPOT***
CTRA	***TRANSMITTER RECIEVER ANTENNA INTERFACE CONTROL***
CTTx	***TRANSMITTER TRA ASSEMBLY***
CTU	***CONTROL TRANSMITTER UNIT***
CW	***CONTINUOUS WAVE***
DAMA	***DEMAND ASSIGNED MULTIPLE ACCESS***
DGCA	***DIRECTORATE GENERAL OF CIVIL AVIATION***
DGPS	***DIFFERENTIAL GLOBAL POSITIONING SYSTEM***
DME	***DISTANCE MEASURING EQUIPMENT***
DOP	***DELEGATION OF POWERS***
DPSK	***DIFFERENTIAL PHASE SHIFT KEYING***
DSB	***DOUBLE SIDE BAND***
DSCN	***DEDICATED SATTELITE COMMUNICATION NETWORK***
DVOR	***DOPPLER VHF OMNI RANGE***
DVTR	***DIGITAL VOICE TAP-RECORDER***
ELM	***EXENDED LENGTH MESSAGE***
EMU	***EXCITER MODULATOR UNIT***
FFM	***FAR FIELD MONITOR***
FIU	***FLIGHT INSPECTION UNIT***
FM	***FREQUENCY MODULATION***
FMI	***FM INDEX***
GND	***GROUND***
GPS	***GLOBAL POSITIONING SYSTEM***
HDLC	***HIGH-LEVEL DATA LINK CONTROL***
HF	***HIGH FREQUENCY***
ICAO	***INTERNATIONAL CIVIL AVIATION ORGANIZATION***
ILS	***INSTRUMENT LANDING SYSTEM***

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INSAT	***INDIAN NATIONAL SATELLITE SYSTEM***
IP	***INTERNET PROTOCOL***
IST	***INDIAN STANDARD TIME***
LAN	***LOCAL AREA NETWORK***
LCSU	***LOCAL CONTROL & STATUS UNIT***
LED	***LIGHT EMITTING DIODE***
LL	***LOWER LIMIT***
LOG	***LOGARITHMIC***
LSB	***LOWER SIDE BAND***
MEX	***MODE-S EXTRACTOR***
MFEX	***MODE-S EXTRACTOR POWER SUPPLY UNIT***
MFTDMA	***MULTI FREQUENCY TIME DIVISION MULTIPLE ACCESS***
MICAx	***ADVANCE CONTROL & INTERFACE MODULES***
MORCO	***MORSE CODE***
MRU	***MULTICHANNEL RECEIVER UNIT***
MSL	***MEAN SEA LEVEL***
MSSR	***MONOPULSE SECONDARY SURVEILLANCE RADAR***
MTBF	***MEAN TIME BETWEEN FAILURES***
MTTR	**MEAN TIME TO REPAIR**
MVEX	***MODE-S EXTRACTOR FANS UNIT***
NDB	***NON-DIRECTIONAL BEACON***
NOTAM	***NOTICE TO AIRMEN***
OCV	***ON-CHANNEL VIDEO***
ODU	***OUT-DOOR UNIT***
OFC	***OPTICAL FIBRE CABLE***
OOK	***ON-OFF KEYING***
PAMA	***PRE-ASSIGNED MULTIPLE ACCESS***
PPI	***PULSE POSITION INDICATOR***
PPS	***PULSE PAIR PER SECOND***
PRF	***PULSE REPITITION FREQUENCY***
PROM	***PROGRAMMABLE READ ONLY MEMORY***
PS	***POWER SUPPLY***
PSR	***PRIMARY SURVEILLANCE RADAR***
RADAR	***RAdio Detection And Ranging***

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RAM	***RANDOM ACCESS MEMORY***
RCAG	***REMOTE CONTROL AIR/GROUND***
RCDU	***RADIO CONSTRUCTION AND DEVELOPMENT UNIT***
RF	***RADIO FREQUENCY***
RHQ	***REGIONAL HEAD-QUARTER***
RMM	***REMOTE MAINTENANCE AND MONITORING***
ROM	***READ ONLY MEMORY***
RSLS	***RECEIVER SIDE LOBE SUPRESSION***
RTC	***REGIONAL TRAINING CENTRE***
RWS	***REMOTE WORKSTATION***
Rx.	***RECEIVER***
SARP	***STANDARD AND RECOMMENDED PRACTICES***
SATNAV	***SATELLITE NAVIGATION***
SAU	***SUM AMPLIFIER UNIT***
SDLC	***SYNCHRONOUS DATA LINK CONTROL***
SDU	***SUM DRIVER UNIT***
SLS	***SIDE-LOBE SUPRESSION***
SMU	***SPECIAL MAINTENANCE UNIT***
SQI	***SQUITTER***
SSB	***SINGLE SIDE-BAND***
SSO	***SHIFT SUPERVISORY OFFICER***
SSR	***SECONDARY SURVEILLANCE RADAR***
STC	***SENSITIVITY TIME CONTROL***
TCP	***TRANSMISSION CONTROL PROTOCOL***
TFU	***TRANSMITTER FAN UNIT***
TPS	***TRANSMITTER POWER SUPPLY***
TRA	***TRANSMITTER RECEIVER ANTENNA INTERFACE***
TSG	***TEST SIGNAL GENERATOR***
TSP	***TECHNICAL AND STANDARD PRACTICES***
Tx.	***TRANSMITTER***
UHF	***ULTRA HIGH FREQUENCY***
UL	***UPPER LIMIT***
UPS	***UNINTERRUPTABLE POWER SUPPLY***
USB	***UPPER SIDE-BAND***

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UTC	***CO-ORDINATED UNIVERSAL TIME***
VC	***VOICE COMMUNICATION***
VCS	***VOICE COMMUNICATION SYSTEM***
VHF	***VERY HIGH FREQUENCY***
VSAT	***VERY SMALL APERTURE ANTENNA***
VSWR	***VOLTAGE STANDING WAVE RATIO***
WPC	***WIRELESS PLANNING AND CO-ORDINATION***

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Introduction To ACS Katihar

- **History and Administrative setup of the Katihar District :** The district of Katihar is situated in the plains of North Eastern part of Bihar State, surrounded by Purnea district in the North, Bhagalpur district in the west, Sahebganj district in the South and West Bengal in the East. It was one of the Subdivisions of the old Purnea district and was bifurcated as a separate district on 2nd October, 1973. This district has three Subdivisions – Katihar, Barsoi and Manihari and Sixteen community development blocks. There are 238 Panchayats and 1548 Villages in Katihar district. Area of Katihar District is 3057 Sq. Kms. Katihar district is situated between Latitude 25^0 42' - 26^0 22' N and Longitude 87^0 10' - 88^0 05' E.

- The Aeronautical Communication Station(ACS), Katihar is situated alongside the State Highway No.62 at around 06 KMs from the Katihar Railway Station. The ACS station in its current location was established in 1968-69. The station occupies a total area of 2.23 Acres acquired from the State govt. of Bihar. A land of 8.29 Acres has been acquired alongside the State Highway No.62 at around 05 KMs further away from MSSR station for DVOR/DME site. The Locality is known as Rampur, Bhasna.

- Except for DVOR/DME all other existing CNS Equipments along with the antenna structure are installed in the ACS Building Complex, which comprises of about 2.3 acres of land. To cater to the needs of Power Supply, the mains power supply (150KW) HT Supply is provided by the State Electricity Board (BSEB) and the standby supply is provided with one 250KVA DG set, which are installed in the Power House within the ACS premises itself.

TECHNICAL INFORMATION

Aerodrome Reference Point:

Latitude	25° 34' 36" N
Longitude	087° 33' 37" E
Elevation	31m above MSL
Land Area:	2.3 acres at MSSR Site and 8.29 acres at DVOR Site

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1. NAV-AIDS FACILITIES AT ACS KATIHAR

Sl. No.	FACILITIES	MAKE	MODEL	FREQUENCY	CALL SIGN	DATES OF COMMISSIONING	Location	STATUS OF SPARES
1	DVOR	THALES	AIRSYS 432	113.7 MHZ	KHR	01.01.2012	DVOR BUILDING 26°36′52.65″N087°33′20″E	Not available.
2	DME (High Power)	THALES	AIRSYS 435	1108 MHZ 1171 MHZ	KHR	01.01.2012	DVOR BUILDING 26°36′52.65″N087°33′20″E	----Do----

2. REMOTE CONTROLLED AIR/GROUND(RCAG) -TX AND RX

TYPE OF EQUIPT& CONFIG	MAKE & MODEL	FREQUENCY IN MHz	CHANNEL ASSIGNMENT	LOCATION	Date of Installed
VHF TX MAIN & ST. BY	PAE / T6T	120.1	Extended Coverage of Area Frequency	MSSR BUILDING	17.01.2009
VHF RX MAIN & ST.BY	PAE / T6R	120.1	Extended Coverage of Area Frequency	MSSR BUILDING	17.01.2009

3. MONOPULSE SECONDARY SURVEILLANCE RADAR

TYPE OF EQUIPT& CONFIG	MAKE & MODEL	FREQUENCY IN MHz	LOCATION	Date of Installed
MODE-S RADAR	INDRA IRS 20-MP/S	INTERROGATION FREQ. – 1030 REPLY FREQ. - 1090	MSSR BUILDING	09.11.2012

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AIRPORTS AUTHORITY OF INDIA
ACS KATIHAR
LIST OF TELEPHONE / MOBILE NOs.

Sl No.	Name	Designation	Telephone office	Mobile No
OIC				
1.	Mr. D.P.Upadhyay,	AGM (CNS)	06452239526	09473198066
UIC RADAR & DSCN/RCAG				
2.	Mr. K.Pal,	AGM (CNS)	06452239526	08544036016
UIC DVOR & DME				
3.	Mr. Debashis Biswas,	AGM (CNS)	06452239526	08544389605
OFFICERS				
4.	Mr. Amit Kumar Yadav	AM (Elex)	06452239526	09470166334
5.	Mr.Himanshu Choudhary	AM (Elex)	06452239526	08252623047
6.	Mr. Devendra Tiwari	AM (Elex)	06452239526	09471828462
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STAFFS				
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12.	Mr. Lalan Prasad	Asstt.Optr.(Eng.E)	06452239526	09430636093
13.	Mr. U S Mishra	Sr,Attendt	06452239526	09471040641

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DUTIES AND RESPONSIBILITIES

Communication Navigation, Surveillance In-charge at ACS

(i) Title: - CNS in charge

(ii) Job Summary:- Supervision of preventive and break down maintenance of CNS/ATM system facilities, Airport Security equipments and associated facilities of Aeronautical Communication Station/ Airport, timely procurement of spares, working out training requirement of CNS personnel's working under him for training at regional training centre (RTC) and CATC and submission of same to Regional Headquarter , carryout associated administrative function and financial activities like preparation of annual budget, exercise of financial powers and any other function assigned to him.

(iii) Duties and Responsibilities:-

Maintenance

• To ensure availability of Preventive maintenance schedules of CNS and Airport Security equipments installed at the ACS/Airport and CNS circulars issued from time to time to the units;

• To ensure availability of relevant ICAO Annex and documents ACS/airport;

• To ensure availability of technical manuals to the ACS/Airport for module level maintenance;

• To supervise for strict adherence to preventive maintenance schedules, their related documentation and guidelines of the CNS circulars in respect of CNS/ATM systems and security equipments;

• Carry out annual review of preventive maintenance schedules in consultation with his subordinates and provide his inputs to Regional headquarter;

• To keep main and standby channel of a facility always serviceable at the Stations under his control by:-

a) Organize timely actions to procure adequate spare parts/modules within his power;

b) Project requirements of spare modules/parts sufficiently in advance to Regional head quarter (RHQ)/ central Radio stores depot (CRSD) for their timely procurement;

• To take adequate advance actions for renewal of maintenance contracts under his delegation of powers, if required.

• Carry out annual evaluation of the performance of CNS facilities in his region and;

(i) Advise station for corrective action

(ii) Recommend to RHQ actions to improve their performance or replace them if service life exceeds its specified life time;

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• To organize preparation of survey reports of decommissioned and to be discarded CNS and Airports security equipment at Airport/ACS within a time frame of one month from the date of decommissioning;

• To monitor the performance, if available, of HF communication channels, and AFTN channels and take action for upgrading or additional channels if congestion is above AAI/ICAO limits;

• To coordinate and liaison with external service providers of communication facilities;

• To initiate action for preliminary site selection of CNS and associated facilities and as per CHQ directions forward reports in this regard to RHQ.

• To monitor the working of the Notam Office at the Airport.

• Coordinate with RHQ for flight inspection of Navigation facilities within its specified time period.

• To organize with all concerned for annual physical verification of CNS assets.

• To generate and forward MIS and other reports/returns to RHQ/CHQ on regular basis.

• Yearly review of Station CNS manuals under his control.

• Ensure adherence to safety management requirements of the CNS/ATM systems and Airport security equipments at ACS/airport

• Ensuring corrective is taken on the aviation safety reports of stations received from DGCA/Aviation Safety Directorate in respect of CNS/ATM facilities and Airport Security equipments and to bring into notice of RHQ/CHQ, requiring action at RHQ/CHQ level.

Training

• To deploy trained or proficient manpower for the maintenance works by:-

a) Organize actions to work out requirement of annual training of station maintenance personnel after transfers preferably in the month of August and forward the requirement to CATC and RHQ;

b)To nominate CNS personnel for training in CATC/RTC as per approved training calendar;

Administrative function

• Conducts interactive meeting with staff once every month and take follow up action to implement actionable points of the minutes of meeting;

• To inspect ACS /Airport as and when required and to advise/take remedial action on the shortcomings noticed during inspection;

• Takes actions to promote harmonious relation among the employee;

• Takes administrative action to maintain discipline.

Financial Activities

• Exercises financial power as per DOP to accord administrative and expenditures actions to support maintenance of CNS facilities;

• Takes actions for preparation of proposals which are beyond his powers and forward to superior authorities for obtaining expeditious approval;

• Takes timely action to prepare annual budget of CNS and forward to concerned department;

• Follow vigilance guidelines and promote culture of honesty and transparency in discharging official functions.

Additional works

Carry out additional works assigned to him by superior authorities.

(iv) Accountability

He is accountable to Airport Director/Airport controller or Station in Charge as the case may be.

Asst. General Manager/Sr. Manager (DVOR/DME Systems)

(i) Title: - Asst. GM/SM(DVOR/DME Systems)

(ii) Job Summary: - Supervision of preventive and break down maintenance of DVOR/DME Systems, Coordinate for projection of requirement of spares of DVOR/DME Systems for their timely procurement and carry out associated administrative functions and any other works assigned to him.

(iii) Duties and Responsibilities:-

Maintenance

Supervise to ensure strict adherence to preventive maintenance schedules, their related documentation and guidelines of the CNS circulars.

• Coordinating with other agencies like GFS, Civil wing for maintaining critical and sensitive area of DVOR/DME Unit

• Carry out annual review of preventive maintenance schedules in consultation with his subordinates and provide inputs to DGM/Jt GM in charge of the facility.

• To take regular debriefing reports for facilities and take remedial action accordingly.

• Carry out flight inspection of the facility and to take coordination action so that flight inspection is carried out within the stipulated time.

• To go through the shift log books of maintenance staff on regular basis and take remedial measures for the problems maintenance difficulties encountered by shift staff and bring the same in the notice of DGM/Jt. GM.

• To visit field units regularly at least once daily.

• To keep main and standby channel of a facility always serviceable and

(i) Provide effective guidance to his subordinates.

(ii) Take actions for immediate dispatch of unserviceable modules to Special Maintenance Unit (SMU) and coordinates for return of serviced modules from SMU.

• To bring into notice of DGM/Jt. GM for renewal of maintenance contracts of DVOR/DME Systems, if required.

• Helping DGM/Jt. GM in carrying out annual evaluation of the performance of DVOR/DME Systems.

• Initiate action of preparation of survey reports of decommissioned and to be discarded DVOR/DME Systems within a time frame of one month from the date of decommissioning.

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• Ensure availability of work instructions and suitable test equipment's for carrying out monitoring and maintenance activities.

• Ensure there is a effective control on the monitoring and measurement and all the related system documents.

• Ensuring there is an effective control on non conforming products like old software version , u/ s hardware and obsolete documents and prevent its unintended use.

• Ensure there is a continual improvements in handling failures by doing fault analysis , improving maintenance philosophy , and taking timely corrective and maintenance actions.

• Improving the effectiveness and efficiency by reducing system failures or waste in material and time.

• Ensure well documented procedure exists for logging all maintenance activities

Administrative Functions

• Conducts interactive meeting with DVOR/DME Systems maintenance personnel at least once every week and take follow up action with DGM/Jt. GM to implement actionable points of the minutes of meeting.

• Takes actions to promote harmonious relation among the DVOR/DME Systems Unit personnel.

• If required to bring into notice of DGM/Jt. GM for initiating administrative action to maintain discipline.

Financial activities

• Helping DGM/Jt. GM in projecting budget requirements of DVOR/DME unit for incorporation in annual budget of ACS.

• Follow vigilance guidelines and promote culture of honesty and transparency in discharging official functions.

Additional works

Carry out additional works assigned by superior authorities.

(iv) Accountability

He is accountable to DGM/Jt. GM in charge of the concerned unit.

(v)Knowledge, experience, skills and abilities

• Posses proficiency and trained at concept level and equipment level on DVOR/DME unit

• Should have working experience of at least two years in DVOR/DME unit.

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• Have knowledge of all maintenance schedules and CNS circulars related to DVOR/DME unit

• Possess sound knowledge of Annex 10 Vol. 1, Vol. V, DOC 8071 Vol. I and related DGCA Civil aviation requirements.

• Ability to independently carry adjustment of DVOR/DME unit.

• Have working knowledge of AAI financial management system and Delegation of financial power (DOP).

• Have the ability to effectively manage human resource working under him and promote harmonious relation among them.

• Should have familiarity of working with ATC functionalities, ATC terminologies and basic understanding of Air Traffic control.

Asst. GM/ Sr. Manager (Surveillance Systems)

(i) Title : Asst. GM/SM (Surveillance System)

(ii) Job Summary: - Supervise proper functioning of all facilities/ equipment, test equipment etc. in the Unit. Ensure and carry out preventive maintenance schedule. Ensure corrective maintenance / repair action for faulty equipment. Ensure NOTAM action when facility is off the air. Check and ensure proper maintaining of logbooks. Ensure upkeep of the inventory. Carry out associated administrative function and any other function assigned to him.

(iii) Duties and Responsibilities:-

Maintenance

• Ensure proper maintenance and serviceability of main and standby channels of Surveillance facilities

• Supervise all preventive maintenance and maintain records of maintenance of the surveillance facilities as per prescribed maintenance schedule

o ensure pre-monsoon maintenance

o ensure special maintenance on Antenna, Rotating Assembly, Motor Drive Assembly by greasing, lubricating and changing oil as prescribed manufacturers

• To initiate all corrective/ breakdown maintenance and keep Jt GM/DGM informed of the un-serviceability

o If required to coordinate with outside agencies in consultation with Jt GM/DGM (Surveillance) to carryout special repair works and to develop indigenous substitute of imported items

• Take NOTAM action incase when facility goes off the air in consultation with Jt GM/DGM and GM (CNS)

• To discuss and analyze the cause of breakdown with other officers and staff of the unit, to avoid similar problem from reoccur in the future

• Check the unit logbook on routine basis and initiates appropriate corrective action.

• To brief the concerned Jt GM/DGM regarding the status of the unit on daily basis.

• To coordinate with Civil/Electrical Wing and other concerned for smooth functioning of the unit.

• To make arrangements for calibration of all critical Test equipment pertaining to the Surveillance Unit.

• To make arrangements for inspections/ audit of internal or external parties as and when instructed by concerned Jt GM/DGM

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• To supervise maintenance of all records and spares related to the Unit.

• To project requirements of routine / regular/ special items well in advance for carrying out maintenance and replacement incase of expiry of its life, like battery, oil etc.

• To timely dispatch all routine operational and administrative reports and also as and when required.

• To coordinate with all concerned for annual physical verification of assets as decided by GM (CNS).

• To project requirements for spares and test equipment in consultation with the Jt GM/DGM

• To ensure serviceability of remote links between site and ATS building

• Ensure upkeep of the inventory

• Ensure availability of work instructions and suitable test equipment's for carrying out monitoring and maintenance activities.

• Ensure there is a effective control on the monitoring and measurement and all the related system documents.

• Ensuring there is an effective control on non conforming products like old software version, u/ s hardware and obsolete documents and prevents its unintended use.

• Ensure there is a continual improvements in handling failures by doing fault analysis , improving maintenance philosophy , and taking timely corrective and maintenance actions.

• Improving the effectiveness and efficiency by reducing system failures or waste in material and time.

• Ensure well documented procedure exists for logging all maintenance activities

Training

• To access the training needs for staff and officers working directly under him and recommend training to Jt GM/DGM

Administrative function

• To prepare the duty roster for the unit in consultation with Jt GM/DGM(Surveillance).

• To recommend leaves of all officers of the unit for approval by the concerned Jt GM/DGM.

• To maintain and preserve attendance/leave registers and all files/records pertaining to the Surveillance Unit.

• To verify over time/Out of pocket allowance statements of staff and officers of Unit for approval by Jt GM/DGM and GM (CNS).

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• To coordinate, if assigned with additional responsibility, with all concerned for project related work pertaining to Surveillance and brief the same to concerned Jt GM/DGM.

• Ensure attendance for staff and officers

• Ensure wearing of uniform by staff and officers

• Takes actions to promote harmonious relation among the employee.

• He acts as the reporting officer for all Managers / AM/ Superintendent/ Sr Assistants for ACRs in the Unit

• To groom/ guide officers under him to take independent responsibilities in future on promotion

• Additional responsibilities, if assigned

Financial Activities

• Additional responsibilities, if assigned:

• Assist GM (CNS)/Jt GM/DGM in preparation of annual budget of Surveillance Unit/ CNS wing;

• Maintain Imprest account.

(iv) Additional works

• Carry out additional works assigned to him by superior authorities, such as: 1) Installation 2). Stock verification

(v) Accountability

He reports to Jt GM/ DGM (Surveillance)

(vi) Knowledge, experience, skills and abilities

• Posses proficiency or trained at concept level and equipment on surveillance equipment

• Have knowledge of all maintenance schedules and CNS circulars related to Surveillance facilities

• Maintain good working relationship with higher authorities and subordinates.

• Have the ability to effectively manage human resource working under him and promote harmonious relation among them.

Manager/Asst. Manager /JET (Junior Executive Trainee) (VHF communication Systems) :-

(i) Title: - Manager/Asst. Manager /JET(VHF communication Systems)

(ii) Job Summary: - Carrying out preventive and break down maintenance of VHF communication Systems and other associated systems, keeping maintenance record, Coordinating with other agencies for smooth functioning of VHF communication Systems and carry out associated administrative functions and any other works assigned to him.

(iii) Duties and Responsibilities:-

Maintenance

• Carrying out preventive maintenance schedules of VHF communication Systems and associated facilities as per approved maintenance schedules, their related documentation as per maintenance schedule and related guidelines;

• Carrying out/helping in breakdown maintenance of VHF communication Systems and associated system either alone or as part of maintenance team as the need may arise;

• To check the quality of voice logger recording as per standard procedure;

• Coordinating with other agencies like Civil and Electrical wing for maintaining equipment room and effective air-conditioning and to bring into notice ofAsst.GM /DGM pending issues in this regard;

• Helping Unit in charge in carrying out annual review of preventive maintenance schedules of the facilities;

• To take regular debriefing reports for facilities and take remedial action and bring into notice of his superiors accordingly any unresolved issue;

• Maintain Site /Shift log books and to bring out into notice of Asst. GM/Sr. Manager maintenance and other issues which cannot be resolved by him.

• To check the performance of backup systems at least once daily/shift and keep a record of same;

• To bring into notice of Sr. Manager /Jt. GM maintenance contracts issues of VHF communication Systems, if required;

• Helping Asst. GM/Sr. Manager in carrying out annual evaluation of the performance of VHF communication Systems;

• Helping in initiating action of preparation of survey reports of decommissioned and to be discarded VHF communication Systems within a time frame of one month from the date of decommissioning.

• Ensure effective implementation of Maintenance contract wherever applicable and to the extent possible.

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• Preparation of fault report of unserviceable modules and coordination action for dispatching of faulty modules to SMU or repairing of the same at the station level.

• Maintaining inventory of unit;

• When doing shift duty to check operational and environmental parameters of the facilities;

Additional works

Carry out additional works assigned by superior authorities.

(iv) Accountability

He is accountable to Unit in charge of the concerned unit or Shift Supervisory officer as the case may be. .

(v) Knowledge, experience, skills and abilities

• Posses proficiency and trained at concept level and equipment level on VHF communication Systems;

• Have knowledge of all maintenance schedules and CNS circulars related to VHF and other associated systems;

• Possess knowledge of Annex 10 Vol. III, V and related DGCA Civil aviation requirements;

• Ability to carrying out Maintenance/adjustment of VHF communication Systems independently or as a part of maintenance team;

• Posses' knowledge about use of general and special purpose test equipments essential for maintenance of VHF communication Systems and associated systems;

• Have knowledge about initiation for Notam action in respect of VHF communication Systems in case of break down or maintenance of the facility;

• Should have familiarity of working with ATC functionalities, ATC terminologies and basic understanding of Air Traffic control;

• Should know about remote control line lay out and electric power distribution of the facilities and in case of breakdown of the mains power supply for the long duration the alternative action to be taken;

• While working in the shift should have effective communication with other shift officers and ATC for debriefing of the facility;

• Should have knowledge about the emergency communication facilities available in the unit;

Manager/Asst. Manager /Junior Executive Trainee (Surveillance Systems) :-

(i) Title: - Manager/Asst. Manager /JET(Surveillance Systems)

(ii) Job Summary: - Carrying out preventive and break down maintenance of Surveillance systems and other associated systems, keeping maintenance record, Coordinating with other agencies for smooth functioning of Surveillance systems and carry out associated administrative functions and any other works assigned to him.

(iii) Duties and Responsibilities:-

Maintenance

• Carrying out preventive maintenance schedules of Surveillance systems and associated facilities as per approved maintenance schedules, their related documentation as per maintenance schedule and related guidelines;

• Carrying out/helping in breakdown maintenance of Surveillance systems and associated system either alone or as part of maintenance team as the need may arise;

• To check the quality of voice logger recording as per standard procedure

• Coordinating with other agencies like Civil and Electrical wing for maintaining equipment room and effective air-conditioning and to bring into notice ofAsst.GM /DGM pending issues in this regard;

• Helping Unit in charge in carrying out annual review of preventive maintenance schedules of the facilities;

• To take regular debriefing reports for facilities and take remedial action and bring into notice of his superiors accordingly any unresolved issue;

• Maintain Site /Shift log books and to bring out into notice of Asst. GM/Sr. Manager maintenance and other issues which cannot be resolved by him.

• To check the performance of backup systems at least once daily/shift and keep a record of same;

• To bring into notice of Sr. Manager /Jt. GM maintenance contracts issues of Surveillance systems, if required;

• Helping Asst. GM/Sr. Manager in carrying out annual evaluation of the performance of Surveillance systems;

• Helping in initiating action of preparation of survey reports of decommissioned and to be discarded Surveillance systems within a time frame of one month from the date of decommissioning.

• Ensure effective implementation of Maintenance contract wherever applicable and to the extent possible.

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• Preparation of fault report of unserviceable modules and coordination action for dispatching of faulty modules to SMU or repairing of the same at the station level.

• Maintaining inventory of unit;

• When doing shift duty to check operational and environmental parameters of the facilities;

Additional works

Carry out additional works assigned by superior authorities.

(iv) Accountability

He is accountable to Unit in charge of the concerned unit or Shift Supervisory officer as the case may be.

(v) Knowledge, experience, skills and abilities

• Posses proficiency and trained at concept level and equipment level on Surveillance systems ;

• Have knowledge of all maintenance schedules and CNS circulars related to Surveillance and other associated systems;

• Possess knowledge of Annex 10 Vol. III, IV,V and related DGCA Civil aviation requirements;

• Ability to carrying out Maintenance/adjustment of Surveillance systems independently or as a part of maintenance team;

• Posses' knowledge about use of general and special purpose test equipments essential for maintenance of Surveillance systems and associated systems;

• Have knowledge about initiation for Notam action in respect Surveillance Systems in case of break down or maintenance of the facility;

• Should have familiarity of working with ATC functionalities, ATC terminologies and basic understanding of Air Traffic control;

• Should know about remote control line lay out and electric power distribution of the facilities and in case of breakdown of the mains power supply for the long duration the alternative action to be taken;

• While working in the shift should have effective communication with other shift officers and ATC for debriefing of the facility;

• Should have knowledge about the emergency communication facilities available in the unit;

Manager/Asst. Manager /Junior Executive Trainee (DVOR/DME)

(i) Title :-Manager/Asst. Manager /JET(DVOR/DME) :-

(ii) Job Summary: - Carrying out preventive and break down maintenance of DVOR/DME and other associated systems, keeping maintenance record, coordinating with other agencies for smooth functioning of DVOR/DME and carry out associated administrative functions and any other works assigned to him.

(iii) Duties and Responsibilities:-

Maintenance

• Carrying out/helping in preventive maintenance schedules of DVOR/DME and associated facilities as per approved maintenance schedules, their related documentation as per maintenance schedule and related guidelines;

• Carrying out/helping in breakdown maintenance of Surveillance systems and associated system either alone or as part of maintenance team as the need may arise;

• Coordinating with other agencies like GFS, Civil and Electrical wing for maintaining critical and sensitive area of DVOR/DME, Equipment room and effective air-conditioning and to bring into notice of Asst.GM /DGM pending issues in this regard;

• To assist Asst. GM /Sr. manager during flight check of the facility and to do coordination work in this regard;

• To assist Unit in charge in carrying out annual review of preventive maintenance schedules of the facilities;

• To take regular debriefing reports for facilities and take remedial action and bring into notice of his superiors accordingly any unresolved issue;

• Maintain Site /Shift log books and to bring out into notice of Asst. GM/Sr. Manager unresolved maintenance and other issues ;To check the performance of back up systems at least once daily/shift and keep a record of same;

• To bring into notice of Sr. Manager /Jt. GM maintenance contracts issues of DVOR/DME, if required;

• Helping Asst. GM/Sr. Manager in carrying out annual evaluation of the performance of DVOR/DME;

• Helping in initiating action of preparation of survey reports of decommissioned and to be discarded DVOR/DME within a time frame of one month from the date of decommissioning.

• Ensure effective implementation of Maintenance contract wherever applicable and to the extent possible.

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• Preparation of fault report of unserviceable modules and coordination action for dispatching of faulty modules to SMU or repairing of the same at the station level if the SMU for the facility is not available;

• Maintaining inventory of unit;

• When doing shift duty to check operational and environmental parameters of the facilities;

Additional works

Carry out additional works assigned by superior authorities.

(iv) Accountability

He is accountable to Unit in charge of the concerned unit or Shift Supervisory officer as the case may be. .

(v) Knowledge, experience, skills and abilities

• Posses proficiency and trained at concept level and equipment level on DVOR/DME ;

• Have knowledge of all maintenance schedules and CNS circulars related to DVOR/DME and other associated systems;

• Possess knowledge about ground adjustments required during flight check of the facility;

• Possess knowledge of Annex 10 Vol.I, III, IV DOC 8071 and related DGCA Civil aviation requirements;

• Ability to carrying out Maintenance/adjustment of DVOR/DME independently or as a part of maintenance team;

• Posses' knowledge about use of general and special purpose test equipments essential for maintenance of DVOR/DME and associated systems;

• Have knowledge about initiation for Notam action in respect of DVOR/DME in case of break down or maintenance of the facility;

• Should have familiarity of working with ATC functionalities, ATC terminologies and basic understanding of Air Traffic control;

• Should know about remote control line lay out and electric power distribution of the facilities and in case of breakdown of the mains power supply for the long duration the alternative action to be taken;

• While working in the shift should have effective communication with other shift officers and ATC for debriefing of the facility;

• Should have knowledge about the emergency communication facilities available in the unit;

CNS EQUIPMENTS/ FACILITIES

Except for DVOR/DME all other existing CNS Equipments along with the antenna structure are installed in the ACS Building Complex, which comprises of about 2.3 acres of land. To cater to the needs of Power Supply, the mains power supply (150KW) is provided by the State Electricity Board (BSEB) and the standby supply is provided with two 250KVA DG sets, which are installed in the Power House within the ACS premises itself.

➢ RCAG

Facility : RCAG

- Frequency : 120.1 MHz
- Hours of Operation : H24
- Geo Co-ordinates : 25° 34’ 36” N, 087° 33’ 37” E
- MAKE : PAE
- MODEL : T6T & T6R
- DATE of Installation : 20-01-2009
- OFC medium is being maintained by BSNL

RCAG equipment of PAE make installed on 17.01.2009 and yet to be commissioned. 3 sets of PAE T6 Series VHF TX and Rx are fitted in the rack as Main, StdBy -1 and StdBy - 2. 02 Nos. of TX and Rx Antennas are mounted on the roof top of Office and power house buildings at a height of 50fts approximately.

- Frequency of operation : TX – 120.1 MHZ
- Rx – 120.1 MHz
- Facility running on test basis with Kolkata area control on OFC and DSCN as per instructions from RHQ, Kolkata
- Spare Modules not available
- OFC Link provided and maintained by BSNL
- Facility due for commissioning

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Technical Standards and Practices (Very High Frequency (VHF) Air-Ground-Air (AGA) Voice Communication Service)

1 Purpose

1.1 This TSP applies to ground based equipment utilized in the Very High Frequency (VHF) Air-Ground-Air (AGA) voice communication service utilizing double sideband amplitude modulation.

1.2 It does not apply to VHF data modes or to voice services using time domain multi access techniques.

1.3 The purpose of this TSP is to specify the technical performance standards and practices applicable to VHF AGA voice communications services.

2 References

A) Annex 10 to the Convention on International Civil Aviation, Aeronautical Telecommunications, Volume III, Part II, Voice Communications Systems.

B) DGCA CIVIL AVIATION REQUIREMENTS SECTION 4 – AERODROME STANDARDS & AIR TRAFFIC SERVICESERIES 'D', PART II

C) Equipment Manual

3 Definitions:

All definitions given in reference 2) above.

4 Standards and Practices

4.1 General

4.1.1 License For Frequency

4.1.1.1 The authorization for use of frequency shall be obtained from Wireless Planning and Coordination, Ministry of Telecommunications, Government of India. GM (Com), CHQ coordinates with WPC, Dept. Of Telecom, Govt. of India in this regard. The use of ILS frequency is also coordinated with ICAO Regional office by GM (Com), CHQ

4.1.2 Polarisation

4.1.2.1 The design polarization of emissions shall be vertical.{Ref A:2.1.1.4}

4.2 Ground Transmitter

4.2.1 Frequency

4.2.1.1 The transmitter shall operate on the assigned frequency or frequencies.

4.2.2 Frequency Stability

4.2.2.1 The transmitted radio frequency, except as detailed in 4.2.2.2, shall not vary more than ± 0.002 per cent from the assigned frequency.

4.2.2.2 Where 8.33 kHz channel spacing is implemented, the transmitted radio frequency shall not vary more than ± 0.0001 per cent from the assigned frequency.{Ref A:2.2.1.1}

4.2.2.3 **Offset carrier systems:** The stability of individual carriers of an offset carrier system shall be such as to prevent first-order heterodyne frequencies of less than 4 kHz and, additionally, the maximum frequency excursion of the outer carrier frequencies from the assigned carrier frequency shall not exceed 8 kHz. Offset carrier systems shall not be used on 8.33 kHz spaced channels.{Ref A:2.2.1.1.1}

4.2.3 Spectral Characteristics

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4.2.3.1 Spurious emissions radiated by the station shall be -70dB reference to an unmodulated carrier.{Ref A:2.1.1.2}

4.2.4 Modulation

4.2.4.1 The modulation shall be double sideband (DSB) amplitude modulated (AM) carrier.{Ref A:2.1.1.1}

4.2.4.2 A peak modulation factor of at least 0.85 (85%) shall be achievable.{Ref A:2.2.1.3}

4.2.4.3 (P) Means should be provided to maintain the average modulation factor at the highest practicable value without over modulation.{Ref A:2.2.1.4}

4.2.5 Power

4.2.5.1 The radiated power of the station, except as permitted by 4.2.5.2, shall be such as to produce a field strength of at least 75μV/m (-109 dBW/m2) at all points within the operational service volume of the station.{Ref A:2.3.2.2.1}. Each station shall identify operational service volume in coordination with ATC.

4.2.5.2 Extended range stations shall radiate power sufficient to produce a field strength of at least 30μV/m (-117 dBW/m2) at all points within the operational service volume of the station.{Ref A:2.3.2.2.1}.

4.2.6 Time-Out Function

4.2.6.1 All transmitters used for two-way simplex communication on aeronautical frequencies shall be provided with a facility which disables the transmitter after a period of not more than 90 seconds of continuous transmission. Reactivation of the transmitter (following disabling by the time-out function) shall be initiated only after the release and re-keying of the transmit control circuitry (e.g. release and re-operation of the 'press-totalk').

4.2.6.2 (P) The time-out period should be adjusted to less than 90 seconds but long enough to allow normal communications without disruption. Recommended periods are:-

a) Tower, TMA and Radar Sectors, 30 seconds
b) Non-radar sectors, 90 seconds
c) Mobile and Portable and non-ATS fixed stations, 60 seconds

4.2.6.3 (P) Tone Warning: A short duration audio tone should be generated at the operator position whenever the time-out function disables a transmitter.

4.2.6.4 Application: The Time-Out Function shall apply to all designated transmitters commissioned on or after 1 November 2000. Designated transmitters commissioned prior to 1 November 2000 shall comply with this standards by 1 November 2003.

4.3 Ground Receiver

4.3.1 Frequency stability.

4.3.1.1 Where 8.33 kHz channel spacing is employed the receiver frequency of operation shall not vary more than ± 0.0001 per cent from the assigned frequency.{Ref A:2.2.2.1}

4.3.2 Sensitivity.

4.3.2.1 The sensitivity of the receiving function shall be such as to provide an audio output signal with a wanted/unwanted ratio of 15 dB, with a 50 per cent amplitude modulated (A3E) radio signal having a field strength of 20μV/m (-120 dBW/m2) or more at the receiving antenna. {Ref A:2.2.2.2} 4.3.2.2 The receiving antenna shall be sited and have a radiation pattern such that an aircraft station with the characteristics specified in Annex 10 Section 2.3 (Ref (a)) and located anywhere within the service volume, is be capable of producing a field strength as specified in 4.3.2.1{Ref A:2.2.2.2}

4.3.3 Effective acceptance bandwidth.

4.3.3.1 When tuned to a channel having a width of 25 kHz, 50 kHz or 100 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal

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specified at 4.3.2.1 above has a carrier frequency within ± 0.005 per cent of the assigned frequency. When tuned to a channel having a width of 8.33 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal specified at

4.3.2.1 above has a carrier frequency within ± 0.0005 per cent of the assigned frequency.{Ref A:2.2.2.3}

4.3.4 Adjacent channel rejection.

4.3.4.1 The receiving system shall ensure an effective rejection of 60 dB or more at the next assignable channel. {Ref A:2.2.2.4} Note:--The next assignable frequency will normally be ± 50 kHz. Where this channel spacing will not suffice, the next assignable frequency will be ± 5 kHz, or ± 8.33 kHz.

4.3.5 Interference immunity performance

4.3.5.1 Receiving systems shall provide satisfactory performance in the presence of two signal, third-order inter modulation products caused by VHF FM broadcast signals having levels at the receiver input of -5 dBm. {Ref A:2.3.3.1}

4.3.5.2 Receiving system shall not be desensitized in the presence of VHF FM broadcast signals having levels at the receiver input of -5 dBm.{Ref A:2.3.3.2}

4.4 Service Availability

4.4.1 The availability of an individual transmitter and/or receiver shall be sufficient to ensure the required operational performance from the total system is achieved.

4.5 Performance Assurance

4.5.1 The complete system shall be inspected to assure performance is in accordance with this TSP.

4.5.2 The system should be inspected periodically as given in the maintenance schedules. The periodicity indicated in the maintenance schedules shall be reviewed annually taking into consideration demonstrated accuracy, reliability and integrity of the system.

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- **DSCN**

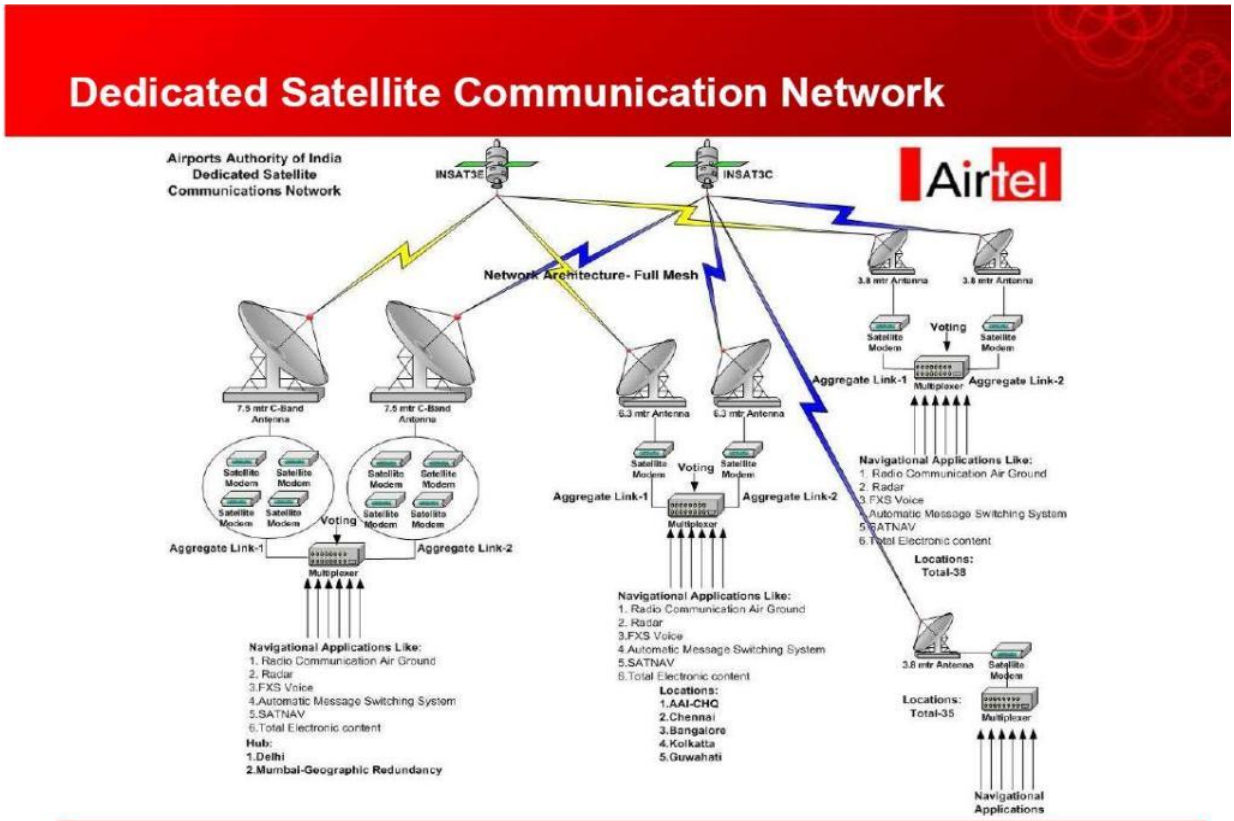
Facility (Medium) : DSCN

- Hours of Operation : H24
- Geo Co-ordinates : 25°34’36”N, 087°33’37”E
- Antenna Identification : INSAT 4B & INSAT 3C
- IFL Cable Length : 25 meters for both INSAT 3C and 4B
- Size of antenna : 3.8 Meter
- Nos. of antenna : Two
- Type of VSAT : Voting
- Year of Installation : 2008

  - DSCN equipment and antenna installation completed. Commissioning is yet to be done.

About the Network

- Dedicated Satellite Communication Network is a VSAT Networkconsisting of Two Hubs and 78 Remotes
- DSCN Network is operated on C-Band on INSAT 3C & INSAT 4Bsatellite.
- Network employs MFTDMA mesh product “ LINKWAY”
- The network contains three types of stations Type A, B & C
- Type A station : 6/7M with voting function
- Type B station : 3.8M with voting function
- Type C station : 3.8M with voting function
- Type C station : 3.8M without voting function.
- No of stations with Voting function : 45
- No of station without voting function :35
- The network facilitates Voice, Fax, AMSS- X.25 , AMSS- IP , RWS ,Radar Networking, RCAG channel, Video Conferencing & SATNAV Dataapplications.
- Total satellite BW for DSCN Network = 18 MHz on each satellite



Application	Data Rate	Interface
RCAG	64 Kbps	E&M RJ-45
Radar	32 Kbps	IP/RS-232/V.35
X.25	16 Kbps	RS-232
SATNAV	64 Kbps scaleable To 2 Mbps	V.35
Voice	16 Kbps	FXS RJ-11
LAN/TEC	64 Kbps scaleable To 2 Mbps	IP- RJ45
VC	384 Kbps	IP- RJ45

OEM's

- Viasat - Linkway Hub & IDU's
- Agilis - RFT's
- Memotec - Multiplexer with voting function
- Anritsu - L Band Spectrum Analyzer, power meter
- Consultronics - Datacom Analyzer

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- IFR - L Band spectrum Analyzer
- Agilent - Protocol Analyzer, RF signal generator

INDIGENOUS

- Comsat - Antenna
- Power one - UPS
- Valrack - Racks

Applications planned on DSCN

- Network will support following applications :
- DAMA Voice/Fax at 16 Kbps
- PAMA Voice at 64 Kbps for the specific purpose of RCAG application.
- PAMA Data channel at 16 Kbps for message exchange using X.25protocol and IP AMSS,RWS.
- PAMA Data channel at 32 Kbps for exchange of Radar data usingHDLC/SDLC protocol.
- DAMA Data channels of 64kbps software configurable up to 2Mbps forexchange of LAN Data and also for asymmetric applications like internetbrowsing and intranet.
- Video conferencing channel at 384 Kbps in DAMA mode.
- PAMA channel at 128 kbps for transfer of error signals (SATNAV) toMCC.
- DAMA Channel at 64 kbps for transfer of Total Electronic Content (TEC)data. This channel have a scope for expanding up to 2 Mbps.

Dopppler VHF Omni-Range (DVOR)

Facility : DVOR

- Frequency : 113.7 MHz
- Call Sign : KHR
- Geo Co-ordinates : 25°36’52.65”N, 087°33’19.20”E
- MAKE : THALES
- MODEL : DVOR – 432
- TYPE : 100W Dual
- DATE OF RECEIPT : 11-05-2009
- DATE OF CALLIBRATION : 22.09.2011
- DATE OF COMMISSIONING : 01-01-2012

The VOR (Very high frequency Omnidirectional Radio range) is a radio navigation aid recommended by the ICAO and introduced internationally for short and medium range aircraft guidance. It can be remote controlled and remote monitored.The DVOR radio navigation equipment is a further development of the conventional VOR. Through its utilisation of the Doppler effect and a wide−based antenna system it is able to produce a considerably more precise azimuth signal. DVOR radio navigation installations are used mainly where the geographical conditions are difficult.

The principle on which the (D)VOR operates is based on the measurement of the phase angle of two 30 Hz signals radiated by the station. One signal (reference signal) is radiated with the same phase in all directions. For the second 30 Hz signal (variable signal), the phase relationship relative to the first signal changes as a function of the azimuth. The electric phase angle measured in the airborne receiver corresponds to the azimuth angle.

Using the VOR receiver installed in his aircraft the pilot is able to obtain the following information from a DVOR or VOR radio navigation installation:

- The azimuth indication of the aircraft’s position relative to the ground beacon, i.e. the angle between magnetic North and the direction ground beacon to aircraft.
- The bearing which indicates whether the aircraft is flying to the left or right of the preselected course (position line) or whether it is exactly on it.
- The "from/to" indication which shows whether the aircraft is flying toward the (D)VOR beacon or away from it.

DVOR Method

In the DVOR the functions of the two 30 Hz modulations have been interchanged as compared with the conventional VOR. This means that the 30 Hz modulation which amplitude−modulates the VHF carrier now acts as the reference signal, whilst the directional, frequency−modulated 30 Hz modulation (variable signal) is contained in the 9960 Hz subcarrier. The modulated carrier signal is transmitted omnidirectionally by a stationary center antenna. It is amplitude−modulated with the voice (300...3000 Hz) and the identity code in addition to the 30 Hz reference signal. The 9960 Hz subcarrier signal is transmitted by a sideband radiator, which can be considered to be rotating along a circular path. The radiated sideband frequency is offset by +9960 Hz or −9960 Hz with respect to the carrier frequency. If the sideband radiator rotates

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with a frequency of 30 Hz, the Doppler effect will cause the subcarrier to be frequency−modulated as a function of the azimuth.
A circle with radius "R" of 7.5...6.5 m is required in the frequency range from 108 to 118 MHz, in order to obtain the frequency deviation of ±480 Hz stipulated by the ICAO. The equation for determining "R" is derived from the formula for the Doppler effect.

The different methods used to generate the two 30 Hz signals in the VOR and DVOR is of equipment− internal significance only. The VOR receiver installed in the aircraft has no means of determining externally whether the received signal originates from a VOR or DVOR ground station. However the DVOR permits a considerably more precise azimuth specification thanks to the wide−base antenna system which can be realized only by utilisation of the Doppler effect. The two 30 Hz signals have a particular phase relationship with respect to one another and with respect to magnetic north in accordance with the azimuth. With an azimuth angle of 0° (North) the phase angle between the two signals is 0°. With an azimuth angle of 180° (South) the phase angle is 180°, with an azimuth angle of 90° (East) it is 90° and with an azimuth angle of 270° (West) it is 270°. The radio reference lines, along which the azimuth angle remains constant, are radial with respect to the DVOR installation.

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Technical Standards and Practices

1 Purpose

1.1 This TSP applies to VHF Omni directional Radio Range (VOR) and specifies technical standards and practices. Performance requirements apply to the complete facility inclusive of transmitter, antenna and site.

2 References

A) Annex 10 to the Convention on International Civil Aviation, Aeronautical Telecommunications, Volume 1, Radio Navigation Aids

B) Navigation Aid - Siting Criteria CNS Manual Vol. III

C) Navigation Aid - Status Reporting, Appendix 2.1

D) Navigation Aid - Test Transmissions, Appendix 2.13

E) Navigation Aid - Distance Measuring Equipment - Narrow Band (DME-N), Appendix 2.4

F) Navigation Aid - Flight Inspection CNS Manual Vol. IV

G) DGCA CIVIL AVIATION REQUIREMENTS SECTION 4 – AERODROME STANDARDS & AIR TRAFFIC SERVICESERIES 'D', PART

H) Manufacturer's Technical Manuals

3 Definitions

All definitions given in reference 2) above.

4 Standards and Practices

4.1 License For Frequency

4.1.1 The authorization for use of VOR frequency is obtained from Wireless Planning and Coordination, Ministry of Telecommunication, Government of India. GM (Com), CHQ coordinates with WPC, Dept. Of Telecom, Govt. of India in this regard. The use of ILS frequency is also coordinated with ICAO Regional office by GM (Com), CHQ.

4.2 General

4.2.1 Rotation

4.2.1.1 The VOR shall be constructed so that the phase difference between a 30Hz signal frequency modulated on to a 9960Hz sub-carrier and a 30Hz amplitude modulated signal increases, degree for degree, as a measurement point moves in a clockwise rotation around the VOR. The angular position of the measurement point shall be from the VOR with the zero degree reference being magnetic north.

4.2.2 Sensing

4.2.2.1 At other than magnetic north the phase of the 30Hz signal on the 9960Hz subcarrier shall lead the phase of the 30 Hz amplitude modulated signal. At magnetic north the two signals shall be in phase.

4.3 Radio Frequency

4.3.1 Carrier Frequency

4.3.1.1 The VOR shall operate in the frequency range of 111.975 MHz to 117.975 MHz.

4.3.1.2 The highest assignable frequency shall be 117.975 MHz. Frequencies shall be allocated on channels selected in 50 kHz steps reference to the highest assignable frequency.

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4.3.2 Frequency Tolerance

4.3.2.1 The frequency tolerance of the radio frequency carrier shall be ± 0.002per cent.

4.3.3 Spectrum

4.3.3.1 Throughout the service volume the presence of VHF FM broadcasting signals shall have levels in accordance with the following:-

Frequency (MHz)	Maximum level of unwanted signal at receiver input
88-102	+15 dBm
104	+10 dBm
106	+5 dBm
107.9	-10 dBm

The relationship is linear between adjacent points designated by the above frequencies. The receiving system is assumed to be a typical aircraft installation utilizing a receiver which complies with Section 3.3.8 of Annex 10, Volume 1.

4.4 Polarisation and Pattern Accuracy

4.4.1 The emission from the VOR shall be horizontally polarized. The vertically polarized component of the radiation shall have the value as specified in CNS Manual Vol. IV

4.4.2 The accuracy of the bearing information conveyed by the horizontally polarized radiation from the VOR at a distance of approximately four wavelengths for conventional VORs and 300m for Doppler VORs for all elevation angles between 0 and 40 degrees, measured from the centre of the VOR antenna system, shall be within ± minus 2º .

4.4.3 Within the service volume the displacement of the course by a bend shall not exceed 3.5º from either the correct magnetic azimuth or the average on-course provided by the facility.

4.4.4 (P) The environment in which the VOR is located should be carefully observed to detect changes which may degrade the accuracy of the radiated course information.

4.5 Coverage

4.5.1 The VOR shall provide signals such as to permit satisfactory operation of a typical aircraft installation at levels and distances required for operational reasons, and to an elevation angle of 40 degrees. The minimum signal strength within the service volume shall be 90 μV/m (-107 dBW/m_2).

4.6 Modulation of Navigational Signals

4.6.1 The radio frequency carrier as observed at any point within the service volume shall be amplitude modulated by two signals as follows:

a) a sub-carrier of 9960Hz of constant amplitude frequency modulation at 30 Hz and having a deviation ratio of 16±1 (i.e. 15 to 17), and

b) a 30 Hz amplitude modulation component.

4.6.2 The depth of modulation of the radio frequency carrier due to the sub-carrier of 9960Hz shall be within the limits of 28 to 32 per cent.

4.6.3 The depth of modulation of the radio frequency carrier due to the 30 Hz or 9960 Hz signals, as observed at any angle up to 5º, shall be with the limits of 28 to 32 per cent.

4.6.4 The '30 Hz' modulation frequency shall be 30 Hz within ±1 per cent.

4.6.5 The sub carrier modulation mid-frequency shall be 9960 Hz within ±1 per cent.

4.6.6 The percentage of amplitude modulation of the 9960 Hz sub carrier shall for a conventional VOR not exceed 5 percent and for a doppler VOR shall not exceed 40 per cent when measured at a point at least 300 m from the VOR.

4.6.7 The sideband level of the harmonics of the 9960 Hz component in the radiated signal shall not exceed the following levels referred to the level of the 9960 Hz sideband:-

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Sub-carrier	Level
9960 Hz	0 dB (reference)
2nd harmonic	-30 dB
3rd harmonic	-50 dB
4th harmonic and Above	-60 dB

4.7 Voice Broadcast: Not used in India

4.8 Identification

4.8.1 Each VOR shall be individually identified by a two or three letter International Morse Code groups transmitted at a rate corresponding to approximately 7 words per minute.

4.8.2 The identification signal shall be on the same radio frequency carrier as used for the navigation function. The radiation of this service shall be horizontally polarized.

4.8.3 The modulation tone of the identification shall be 1020 Hz ±50 Hz.

4.8.4 Modulation Depth

4.8.4.1 The modulation depth of the radio frequency carrier due to the identification signal shall be as close to, but not in excess of 10 per cent except that, where a voice broadcast service is not provided, it shall be permissible to increase the modulation by the code identification signal to a value not exceeding 20 percent.

4.8.5 Repetition Rate

4.8.5.1 The complete identification shall be transmitted at least once every 30 seconds.

4.8.5.2 (P) The identification signal should be transmitted at least three times each 30 seconds, equally spaced within that time period.

4.8.5.3 When associated with a Distance Measuring Equipment (DME), the VOR shall synchronize with the DME so that in a 40 second cycle, the VOR transmits the complete identification code 3 times in 30 seconds and the DME transmits the identification once within the remaining 10 seconds of the cycle.

4.9 Monitoring

4.9.1 A monitoring system shall be provided which continually samples the radiated signal and will take executive action to cease radiation or to remove the identification signal and navigation components from the carrier if any one or a combination of the following deviations from established conditions arises:

a) A change in excess of 1 degree at the monitor site of the bearing information transmitted by the VOR;

b) A change of 15 per cent in the modulation component of the radio frequency carrier if either the sub carrier or 30 Hz amplitude modulation signals, or both;

c) The monitoring system itself fails.

4.9.2 (P) The monitoring system should detect the following condition however no executive action is required.

a) A decrease in carrier power of more than 50 per cent below that required for the service volume.

b) Failure to transmit the identification signal.

4.9.3 The monitoring system shall take executive action within 10 seconds of the occurrence of the conditions described in 4.9.1

4.10 Status Reporting

4.10.1 Remote status reporting shall be provided in accordance with Navigational Aid-Status Reporting Document.

4.11 Service Availability

4.11.1 The availability of a VOR shall be sufficient to ensure the required operational performance is achieved.

4.12 Performance Assurance

4.12.1 The complete system shall be inspected to assure performance is in accordance with this TSP.

4.12.2 The VOR shall be flight inspected in accordance with CNS Manual Vol. IV.

4.12.3 The system should be inspected periodically as given in the maintenance schedules. The periodicity indicated in the maintenance schedules shall be reviewed annually taking into consideration demonstrated accuracy, reliability and integrity of the system.

Monitoring in DVOR

The monitor subsystem of the DVOR processes a sample of the signal radiated by the beacon antenna to determine whether the main parameters of the transmitted signal are within preset tolerances. A monitor antenna located about 80 meters from the center of the antenna array receives the signal used by the monitor. The parameters monitored are:

a. 30 Hz AM level
b. 9960 Hz subcarrier level
c. Bearing
d. Antenna fault (notch)
e. Identification code.

In addition the monitor incorporates a fail-safe facility that gives an alarm if the bearing counter circuits stop functioning. Any of the alarms signaled by the monitor will cause the DVOR rack to cease transmitting.

The DVOR monitor may be configured for single or dual operation. In dual operation, both monitors are active, and will process the signals received from the radiating transmitter.

6.3.1 Alarm Parameters

The following conditions cause alarm conditions to be raised by the monitor facilities:

Change in transmitted bearing Information:	1degree maximum (adjustable)
Reduction in modulation depth of sub-carrier	Adjustable, set to 15% of nominal
30 Hz or both:	level
Identity code failure:	Continuous or absent tone
Antenna monitoring:	Failure of a single antenna

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ACTIONS TO BE INITIATED BEFORE AIR CALIBRATION:

1. Grasses and bushes around the antenna to be cleaned.
2. Check operational parameters of the equipment and ensure conformity with last air calibration reading. In case any deviation, bring the parameter nearer to a value obtained in last air calibration by adjustment in the equipment in order to save the air calibration time.
3. Keep all the record of ground reading at the site.
4. Keep all required test equipments at the site.
5. Ensure availability of power supply at theodolite platform.
6. Keep the last air calibration reading at the site.
7. Note the specific problem of the equipment, which is required to be checked during the flight calibration.

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Technical specification of DVOR (Thales 432)

Parameter	Standard	Tolerance
a. Max Antenna VSWR	1.0:1	≤1.2:1
b. Power Output		
(1) Carrier	Value established by flight inspection	50% of standard (-3 dB)
(2) Sideband	For 30% AM	Nominal, ±2%
c. Frequencies		
(1) Carrier	Assigned Freq.	Nominal, ±0.002%
(2) 9960 Hz	9960 Hz	±1%
(3) 30 Hz Variable	30 Hz	±1%
(4) 30 Hz Reference	30 Hz	±1%
(5) Ident	1020 Hz	±20 Hz
(6) Ident (Dot Length)	100 ms	±5 ms
d. Modulation		
(1) 30 Hz	30%	±2%
(2) 9960 Hz	30%	±2%
(3) 9960 Hz Deviation	16:1	±1
(4) Ident	5%	±1%
(5) Voice	30%	+0, -2%

Parameter	Standard	Tolerance
e. Reflected Powers		
(1) Reference VSWR	1.0:1	≤1.2:1
(2) Sideband VSWR	1.0:1	≤1.2:1
f. Monitor Alarms		
(1) 30 Hz	30% ±2%	±1%
(2) 9960 Hz	30% ±2%	±1%
(3) 9960 Hz Deviation	16:1 ±1	±0.2
(4) Azimuth Shift	1 degree	±0.2 degree
g. Power Supply Limits		
(1) AC Voltage	115/230 Vac	±15%
(2) DC Voltage	48 Vdc	±10%
h. Monitor 1 Test Generator		
(1) Azimuth Angle	Established Monitor Radial	±0.2°
(2) 30 Hz AM Modulation	30%	29 to 31%
(3) 9960 Hz Modulation	30%	29 to 31%
(4) 9960 Hz Deviation	16.0	15.6 to 16.4

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Parameter	Standard	Tolerance
i. Monitor 2 Test Generator		
(1) Azimuth Angle	Established Monitor Radial	±.2°
(2) 30 Hz AM Modulation	30%	29 to 31%
(3) 9960 Hz Modulation	30%	29 to 31%
(4) 9960 Hz Deviation	16.0	15.6 to 16.4
j. Monitor Limits		
(1) Azimuth Angle Low	Executive Monitor Radial	-1°
(2) Azimuth Angle High	Executive Monitor Radial	+1°
(3) 30 Hz AM Modulation Low	Established by flight check or 30%	-2% of Standard
(4) 30 Hz AM Modulation High	Established by flight check or 30%	+2% of Standard
(5) 9960 Hz Modulation Low	Established by flight check or 30%	-2% of Standard
(6) 9960 Hz Modulation High	Established by flight check or 30%	+2% of Standard

VOR Flight Inspection

1. VOR Parameters Checks

Following are the various Flight Inspection Checks carried on VOR.

a. Sensing and Rotation check.
b. Identification Coding Check
c. Modulation Level Check
d. Orbit Check
e. Radial check
f. Polarization Check
g Coverage Check
h. Monitor Alarm check

1.1 Sensing and rotation:

The purpose of this check is to assure proper orientation of the antenna; Proper connection of its RF feed lines. Course azimuth increases in a clockwise direction and 'TO-FROM' indications are correct.

Flight Inspection aircraft flies any outbound radial to check sensing. After sensing is checked, Orbit check starts.

If it is found to be incorrect, the most probable cause would be reversed sideband antenna feed cables.

1.2 Identification check

Identification check is carried out to see the correctness, clarity and to ensure that there is no adverse effect on VOR course structure. This check is performed anytime while flying a radial.

1.3 Modulation Levels Check

1.3.1 Purpose:

To confirm that modulation levels of 30 Hz AM, 9960 KHz Sub-carrier and the 30 Hz FM (deviation ratio of 9960 KHz sub-carrier) are set properly.

1.3.2 Flight Procedure:

Calibration aircraft flies on any radial and modulation levels of the parameters are checked and adjusted accordingly

Mod. Depth of 30 Hz AM adjusted for 30%	± 2 %
9960 KHz adjusted for 30%	± 2%
Deviation ratio 30 Hz FM 16	± 1

Final adjustments are carried out during Orbit check.

1.4 Orbit Checks

1.4.1 5 Nm Orbit :

1.4.1.1 Purpose:

i To evaluate the error in azimuth alignment , the roughness and scallopingof sectors and the signal strength over the orbit.

ii To determine the accuracy and overall alignment error distribution of the radials over 360 degrees.

This check is carried out during Commissioning and routine flight checks.

1.4.1.2 Flight Procedure:

Calibration aircraft flies an orbit radius of normally 5 Nm or more in a Counter Clock wise direction at a minimum altitude of 1000' AGL or above.

1.4.1.3 Position reference system:

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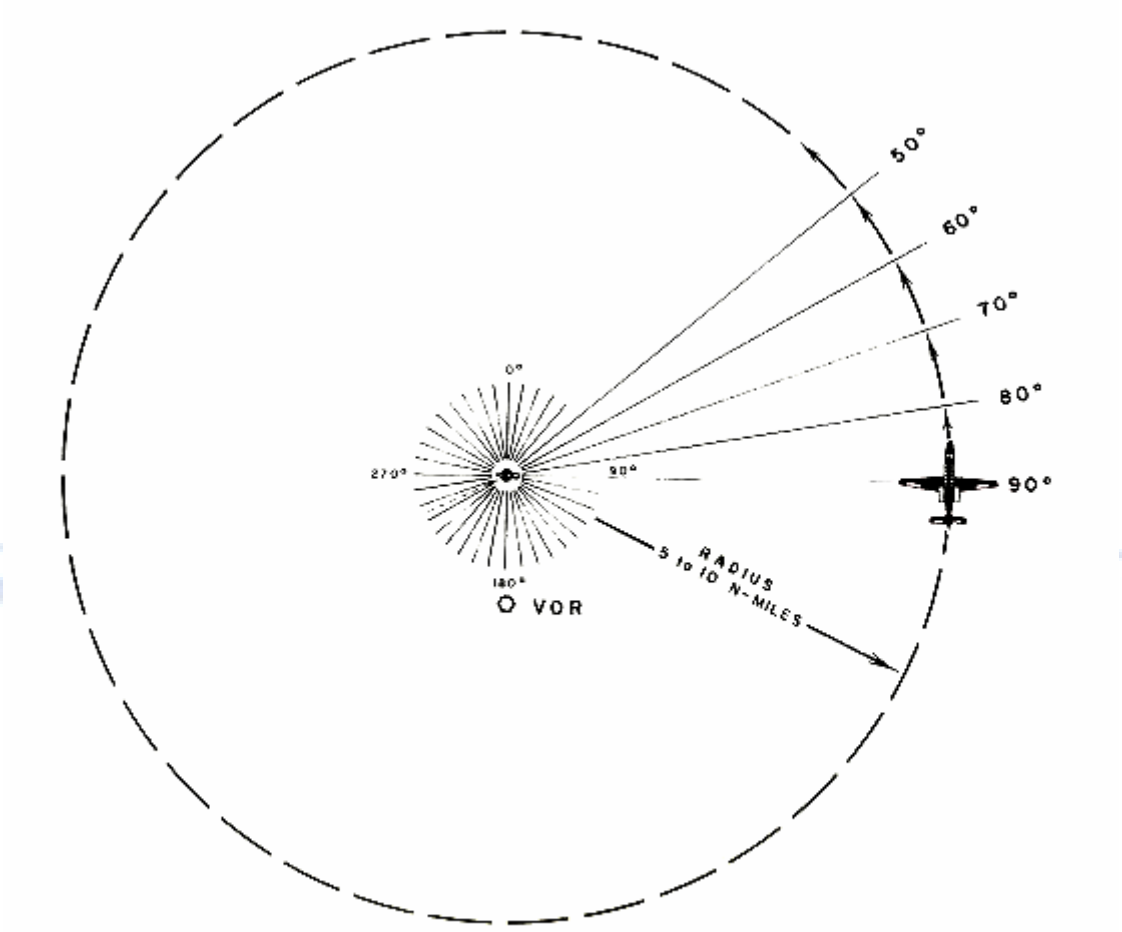
Calibration Aircraft is automatically tracked by GPS available on board with AFIS. Its omnistar GPS receiver receives correctional data from service provider via satellite to give submeter accuracy under DGPS mode.

1.4.1.4 Ground Facility Adjustment

Adjustments are made on the basis of analysis of flight inspection data to establish and maintain optimum error distribution. Ground staff is required

1. To adjust modulation levels of 30 Hz AM, 9960 Sub carrier, the FMI of 30Hz FM and 1020 Hz Ident.

2. To adjust the north bearing for alignment with magnetic north and to optimize the error distribution throughout radials.



VOR ORBIT CHECK FLIGHT PROCEDURE

1.4.2 25 Nm Orbit check :

1.4.2.1 Purpose:

i To evaluate Bends ,roughness , scalloping and signal strength.

ii. To establish Ground check points.

This check is carried out only during Commissioning

1.4.2.2 Flight Procedure:

Calibration aircraft flies an orbit radius of normally 25 Nm in a Counter Clock wise rotation at a minimum altitude of 1000’ AGL.

1.4.2.3 Position reference system:

Calibration Aircraft is automatically tracked by GPS available on board with AFIS.

1.4.2.4 Ground Facility Adjustment

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Normally no adjustment is carried out for above exercise. After the Half the Orbit, a change over of Tx is carried out.

1.4.2.5 Ground check points: Ground checkpoints, evenly distributed around the facility are selected from an aeronautical map and transferred over the VOR Orbit. Each checkpoint is marked by the pilot and is compared with actual azimuth reading by the flight inspector. Overall sectoral quality of signal, roughness, scalloping, bend or noise can be detected for the VOR at 25 Nm which could be used during the radial checks. This method also reassures radial alignment through physical matching of ground features.

1.4.2.6 Desired Results and tolerances:

30 Hz AM % mod depth : 30%	± 2 %
9960 KHz % mod depth : 30%	± 2 %
Deviation ratio 30 Hz FM :	15 to 17
Azimuth Alignment :	± 2.0°
Signal Strength :	90 µV/m
Bends :	± 3.5°
Roughness :	± 3.0°
Scalloping :	± 3.0°

1.5 Radial Checks

1.5.1 Purpose:

i To check that the quality of course signals is satisfactory. Course bends, roughness, scalloping (all combined together) should be within tolerance limits

ii Minimum 8 radials with at least one radial in each quadrant including PDRs are checked during commissioning. During Routine inspections, only PDRs are checked.

1.5.2 Flight Procedure

i Calibration A/C flies on enroute radials either inbound or outbound along the radial to a distance of 40 Nm. The minimum altitude is 1000ft above the highest terrain. .

1.5.3 Ground Adjustment

Normally no adjustment is carried out for above exercise. .

1.5.4 Desired Results and Tolerances

i. **Alignment**

Signal strength	> 90 µv/m
Bends :	± 3.5°
Roughness :	± 3.0°
Scalloping :	± 3.0°

1.6 Polarization Check

1.6.1 Purpose:

To confirm, that no adverse effect will be encountered, while flying on course due to undesired vertical polarization component.

The desired polarization of VOR is **HORIZONTAL**

1.6.2 Flight Procedure :

Calibration A/C flies in-bound OR out-bound on any radial and The A/C is made to Bank 30° each side between 5-20 NM. while heading is not changed.

1.6.3 Desired Result

Course deviations as a result of aircraft banking should not exceed 2 degree Bearing deviation : ± 2 .0°

1.7 Coverage Check

1.7.1 Purpose:

To confirm that VOR provides coverage to the defined service volume even when operating on Stby Power Supply.

1.7.2 Flight Procedure:

The FIU A/C flies on any radial outbound at a minimum altitude of 1000'AGL.

1.7.3 Ground Facility Adjustment

The field strength *of* the VOR signal is measured on course at greatest distance at which it is expected to be used while operating with stby Supply.

1.7.4 Desired Result: –

Throughout the coverage volume:

Minimum Signal Strength : more than 90 µV/m

1.8 Bearing Monitor alarm check

Monitor alarm limits are cross checked. Ground maintenance personnel actuate alignment monitor alarm condition with North Alignment Control. Calibration aircraft detects the deviation to confirm that the deviation is within the tolerance limits. Calibration A/C flies on any radial either inbound or outbound. Give the equipment on alarm with north alignment control when advised by flight inspector. Normalise the equipment after Alarm check.

Tolerance: Bearing Monitor : ± 1 .0°

1.9 FLYABILITY - Must be Satisfactory

Flyability is a subjective assessment by the Pilot during the inspection. Assessment of Flyability is performed on operational radials and during procedures based on the VORs.

1.10 RECEIVER CHECK POINTS:

Fixed check points are established both on the ground and in the air where pilots may check the accuracy of their aircraft VOR Receivers. These points are established during Commissioning check.

1.10.1 Airborne Check Points: The aircraft flies either inbound or outbound directly over easily identified ground features at specific altitudes near the airport at a distance between 5 Nm to 30 Nm. The radial and distance above the check point will be published as Receiver air check point azimuth.

1.10.2 Ground Check points: The aircraft position on the ramp or on a taxiway over a selected location. The indicated radial and distance will be published as Ground check point.

Table for Acceptable Limits of VOR

S.No.	Parameter	Lower limit	Ideal value/Result	Upper limit	Remarks
1	Polarization	-2°	0	+2°	
2	Pattern Accuracy				
	Alignment	-2°	0	+2°	
	Bends	-3.5°	0	+3.5°	
	Roughness	-3°	0	+3°	
	Scalloping	-3°	0	+3°	
3	Coverage field strength	90µv/m	>= 90µv/m		or -107 dBW/m2 or -77 dBmW/m2
4	9960 Hz deviation	15	16	17	
5	9960 Hz Modulation depth	0.28	0.3	0.32	
6	30 Hz Modulation	0.28	0.3	0.32	
7	Ident		Clearly audible		
8	Bearing Monitor	-1°		+1°	

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Distance Measuring Equipment (DME)

Facility : DME

- Frequency : TX – 1171 MHz; RX – 1108 MHz
- Call Sign : KHR
- Geo Co-ordinates : 25°36’52.65”N, 087°33’19.20”E
- MAKE : THALES
- MODEL : DME – 435
- TYPE : 1KW Dual
- DATE OF RECEIPT : 20-10-2007
- DATE OF CALLIBRATION : 22.09.2011
- DATE OF COMMISSIONING : 01-01-2012

DME (*D*istance *M*easuring *E*quipment) has been standardized by the ICAO as a radio aid for short and medium-distance navigation. It is a secondary type of radar, which allows several aircraft to simultaneously measure their distance from a ground reference (DME transponder). The distance is determined by measuring the propagation delay of a RF pulse, which is emitted by the aircraft transmitter and returned at a different frequency by the ground station after reception.

In conjunction with a VOR, the DME, which should preferably be installed at the same location as a VOR/DME, enables to determine the direction and the distance (rho-theta method).

DME PRINCIPLE

Aircraft's equipped with DME transmit encoded interrogating RF pulse pairs on the beacon's receiving channel. The beacon, in turn, emits encoded reply pulse pairs on the receiving channel of the air-borne equipment, which is 63 MHz apart from the transmitter frequency former.

The time interval between interrogation emission and reply reception provides the aircraft with the real distance information from the ground station; this information may be read by the pilot or the navigator directly on the airborne indicator.

The ground transponder is able to answer up to about 200 interrogators at a time (i.e. 4800 pulse pairs/s). Generates random pulse pairs ("squitter") to maintain a minimum PRF of 800 to 2700 pulse pairs per second (programmable) whenever the number of decoded interrogations is lower than that.

This reply is received and decoded by the airborne receiver, where special timing circuits automatically measure the lapse between interrogation and reply and convert this measurement into electrical output signals. The beacon introduces a fixed delay, called *reply delay*, between the reception of each encoded interrogating pulse pair and the transmission of the corresponding reply.

The transponder periodically transmits special identification pulse groups, interleaved with the reply and squitter pulses that can be decoded by the aircraft as a Morse tone, keyed with the beacon code name.

The airborne receiver is able to recognize the replies to its own interrogations, among the many other pulses transmitted by the beacon, by means of a stroboscope procedure.

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Each operational channel in the DME system is defined by two frequencies (interrogation and reply frequencies), spaced 63 MHz apart, and by the pulse code for the assigned channel (X or Y channel). The DME system transmits on a pre-selected channel among the 252 available ones. These channels are divided into 126 X channels and 126 Y channels providing a frequency ranging from 1025 to 1150 MHz for aircraft transmission (interrogation). Moreover, a 962 to 1213 MHz frequency for signal reception by the aircraft (ground beacon reply transmission). Interrogation and reply frequencies are assigned with one MHz spacing between channels.

En-route DME 435: a 1 kW solid-state DME to be installed in co-location with VOR or DVOR.

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.

Flight Inspection of DME

DME Flight Inspection

All DME Checks are carried out in conjunction with checks on their associated facilities (VOR & ILS).

Parameters Checks Results and Tolerances:

- **Identification:** The identification code should be clear and correct throughout the area of coverage. The ID Code frequency should be 1350 Hz. The ID should be properly synchronized with that of the associated facility.
- **Distance accuracy**: The indicated Slant range distance must be within the limits
- **Coverage:** The area of coverage of the DME will be at least that of its associated facility (VOR & ILS)
- **Signal Strength (AGC)**: The signal strength must be at least –82 dBm throughout the area of coverage.
- **Squitter Rate**: The normal squitter rate should be 2700 ± 90 pps. On certain type facilities, rates as low as 700 pps are normal.
- **False replies** : No false replies should be present which could result in false locks-ons. Within the area of coverage. This may occur at any location especially in the presence of vertical nulls.
- **Ground Adjustments:** When the measured distance is out of tolerance, then the system delay of both Transmitters is to be adjusted by the ground personnel. System delay is to be increased to reduce the range error and vice versa.

Tolerances:

- For Terminal (ILS) DME : ± 75 meters
- Enroute (VOR) DME : ± 150 meters

Technical Standards and Practices

1 Purpose

1.1 This TSP applies to Ultra High Frequency (UHF) Narrow Band Distance Measuring Equipment (DME-N) and specifies technical standards and practices. Performance requirements apply to the complete facility inclusive of transponder, antenna and site.

2 References

A) Annex 10 to the Convention on International Civil Aviation, Aeronautical Telecommunications, Volume 1, Radio Navigation Aids

B)) DGCA CIVIL AVIATION REQUIREMENTS SECTION 4 – AERODROME STANDARDS & AIR TRAFFIC SERVICESERIES 'D', PART II

C) Manufacturer's Technical Manuals

D) Navigation Aid - Siting Criteria CNS Manual Vol. III

E) Navigation Aid - Status Reporting, Appendix 2.1

F) Navigation Aid - Flight Inspection CNS Manual Vol. IV

G) Manufacturer's Technical Manuals

3 Definitions

All definitions given in reference 2) above.

4 Standards and Practices

4.1 License for Frequency

4.1.1 The authorization for use of DME frequency is obtained from Wireless Planning and Coordination, Ministry of Telecommunication, Government of India. GM (Com), CHQ coordinates with WPC, Dept. Of Telecom, Govt. of India in this regard. The use of ILS frequency is also coordinated with ICAO Regional office by GM (Com), CHQ.

4.2 General

4.2.1 The DME system shall provide for continuous and accurate indication in an aircraft of the slant range distance of the aircraft from an equipped ground reference point.

4.2.2 An airborne interrogator shall interrogate a ground based transponder. The ground transponder shall reply to on-channel interrogations, as determined by frequency and pulse coding, with synchronized response pulses. Range is determined from the propagation delay and fixed delay in the ground transponder.

4.2.3 Association and Co-location

4.2.3.1 (P) A DME may be combined with an instrument landing system (ILS) and VHF Omni directional Range (VOR). A DME may also be co-located with a non-direction beacon (NDB).

4.2.3.2 When associated with an ILS or VOR, the DME channel shall be paired with the frequency of the associated aid. Refer to Annex 10, Volume 1, Table A for channel and pairing information.

4.2.3.3 (P) When associated with an ILS the DME should be located at a point close to the runway to minimize errors along the approach. Normally the DME is sited adjacent to the glide path antenna. In the situation of a localizer only facility the DME should be located close to or on the centre line of the served runway at a location to suit the approach procedure.

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4.2.3.5 The DME antenna and zero reference point shall be as near as practicable to the centre point of a VOR and shall not be in excess of 30m from a conventional VOR and not in excess of 80m from a Doppler VOR.

4.2.3.6 (P) There is no proximity or association requirement for NDB and DME.

4.2.3.7 The identification of the DME shall be synchronized with the associated aid.

4.3 System Characteristics

4.3.1 Coverage

4.3.1.1 (P) When associated with a VOR the coverage of the DME should at least equal to the service volume of the VOR.

4.3.1.2 (P) When associated with an ILS the DME coverage should be equal to the service volume of the ILS and extend to service the maneuvering area required to intercept the approach and throughout the missed approach segment.

4.3.2 Accuracy

4.3.2.1 The total system error, including airborne avionics and ground transponder, shall not exceed ± 370m (0.2 NM).

Note 1: This system accuracy is predicated upon the achievement of an airborne interrogator error contribution of not more than ± 315 m (0.17 NM)

Note 2: Geographic survey accuracy contributes to the total system error.

4.3.3 Channeling

4.3.3.1 DME operating channels shall be formed by pairing interrogation and reply frequencies and by pulse coding on the paired frequencies.

4.3.3.2 Channels shall be chosen from Annex 10, Volume 1, Table A. Refer to paragraph 4.2.3.2 for channel requirements when associated with other aids.

4.3.4 Aircraft Handling Capacity

4.3.4.1 The aircraft handling capacity of transponders in an area shall be adequate for the peak traffic of the area or 100 aircraft, which ever is the lesser.

4.3.4.2 (P) Where the peak traffic in an area exceeds 100 aircraft, the transponder should be capable of handling that peak traffic.

4.3.5 Transponder Identification

4.3.5.1 All transponders shall transmit an identification signal consisting of a two or three letter International Morse Code group.

4.3.5.2 When the DME is not associated with another aid it shall generate an ‘independent’ identification code. If associated with an ILS or VOR the identification code shall be the same for both devices and is referred to as an ‘associated’ identification code.

4.3.5.4 The identification shall use signals, which shall consist of the transmission of an appropriate period of a series of paired pulses transmitted at a repetition rate of 1,350 pulse pairs per second. During the key down time, the identification generated pulses shall replace the normally occurring reply pulses. In the intervals between key down periods normally occurring reply pulses shall be transmitted.

4.3.5.5 The identification code shall be transmitted at least once every 40 seconds.

4.3.5.6 When associated, each 40 second interval shall be divided equally into 4 periods, with the transponder identification transmitted during one period only and the associated VOR or ILS facility transmitting identification during the remaining periods.

4.3.5.7 The maximum key down time shall not exceed 5 seconds per identification code group. The characteristics of the coding shall be:

a) The dot duration shall be between 0.1 and 0.16 seconds,

b) The dash duration shall be three time a dot duration,

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c) The duration between elements shall be equal to one dot duration ±10 percent,

d) The duration between characters shall not be less than three dots, and

e) The total period for transmission of an identification code group shall not exceed 10 sec.

4.3.5.8 (P) In the event of a failure of the associated aid, the DME transponder should continue to operate with 'independent' identification.

4.4 Transmitter

4.4.1 Frequency

4.4.1.1 The transponder shall transmit on the reply frequency appropriate to the assigned DME channel.

4.4.1.2 The radio frequency of operation shall not vary more than ± 0.002 per cent from the assigned frequency.

4.4.2 Pulse shape and spectrum

4.4.2.1 Pulse rise time shall not exceed 3 µs.

4.4.2.2 Pulse duration shall be 3.5 µs ± 0.5 µs.

4.4.2.3 Pulse decay time shall nominally be 2.5 microseconds but shall not exceed 3.5 µs.

4.4.2.4 The instantaneous amplitude of the pulse shall not, at any instant between the point of the leading edge which is 95 per cent of the 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 percent of the maximum voltage amplitude of the pulse.

4.4.2.5 The spectrum of the pulse modulated signal shall be such that during the pulse the effective radiated power contained in a 0.5 MHz band centred on frequencies 0.8 MHz above and 0.8 MHz below the nominal channel frequency in each case shall not exceed 200 MW, and the effective radiated power contained in a 0.5 MHz band centred on frequencies 2 MHz above and 2 MHz below the nominal channel frequency shall not exceed 2 MW. The effective radiated power contained within any 0.5 MHz band shall decrease monotonically as the band centre frequency moves away from the nominal channel frequency.

4.4.2.6 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 1µs prior to the virtual origin.

4.4.3 Pulse spacing

4.4.3.1 The spacing of the constituent pulses of the transmitted pulses shall be for:-

Channel Suffix 'X'	12µS
Channel Suffix 'Y'	30µS

4.4.3.2 The tolerance on the pulse spacing shall be ± 0.25 µs.

4.4.3.3 (P) The tolerance on the pulse spacing should be plus or minus 0.10 µs.

4.4.3.4 The pulse spacing shall be measured between the half voltage points on the leading edges of the pulses.

4.4.4 Peak Output Power

4.4.4.1 The peak equivalent isotropically radiated power shall not be less than that required to ensure a peak pulse power density of minus 89 dBW/m_2 under all operating conditions at any point within the service volume.

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4.4.4.2 The peak power of a constituent pulse of any pair of pulses shall not differ by more than 1 dB.

4.4.4.3 (P) 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 ± 90 pulse pair per second (if 100 aircraft are to be served).

4.4.4.4 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.

4.4.5 Spurious radiation

4.4.5.1 During the 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 80 dB below the peak pulse power received and measured in the same receiver tune to the reply frequency in use during transmission of the required pulses. This provision refers to all spurious transmissions, including modulator and electrical interference.

4.4.5.2 At all frequencies from 10 to 1800 MHz, but excluding the band of frequencies from 960 to 1215 MHz, the spurious output of the DME transponder transmitter shall not exceed minus 40 dBm in any one kHz of receiver bandwidth.

4.4.5.3 The equivalent isotropically radiated power of an continuous wave harmonic of the carrier frequency on any DME operating channel shall not exceed minus 10 dB.

4.5 Receiver

4.5.1 Frequency

4.5.1.1 The transponder shall receive on the interrogation frequency appropriate to the assigned DME channel.

4.5.1.2 The centre frequency of operation shall not vary more than ± 0.002 per cent from the assigned frequency.

4.5.2 Sensitivity

4.5.2.1 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 -103 dBW/m^2

4.5.2.2 The minimum power density specified in 4.5.2.1 shall cause the transponder to reply with an efficiency of at least 70 per cent.

4.5.2.3 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 4.5.2.1 up to a maximum of minus 22 dBW/m^2 when associated with an ILS and minus 35 dBW/m^2 when installed for other applications.

4.5.2.4 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.

4.5.2.5 When the spacing of an interrogation pulse pair varies from the nominal value by up to ±1μs, the receiver sensitivity shall not be reduced by more than 1 dB.

4.5.3 Loading Limiting

4.5.3.1 (P) When transponder loading exceeds 90 per cent of the maximum transmission rate, the receiver sensitivity should automatically reduce in order to limit the transponder replies, so as to ensure that the maximum permissible transmission rate is not exceeded.

4.5.4 Noise

4.5.4.1 When the receiver is interrogated at the power density specified in 4.5.2.1 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.

4.5.5 Bandwidth

4.5.5.1 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 ±100 kHz.

4.5.5.2 The receiver bandwidth shall be sufficient to allow compliance with the accuracy requirements of 4.3.2 when the interrogator signals are those specified in Annex 10Volume 1 Section 3.5.5.1.3.

4.5.5.3 Signals greater than 900 kHz removed from the desired channel nominal frequency and having power densities up to the values specified in 4.5.2.3 shall not trigger the transponder. Signals arriving at the intermediate frequency shall be suppressed at least 80 dB. All other spurious response or signals within 960 to 1,215 MHz band and image frequencies shall be suppressed at least 75 dB.

4.5.6 Recovery time

4.5.6.1 Within 8 μs 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 with 3 dB of the value obtained in the absence of signals. The requirements shall be met with echo suppression circuits, if any, rendered inoperative. 8μs are to be measured between the half voltage points on the leading edges of the two signals, both of which conform in shape with the requirements for airborne interrogators. The specification of interrogator pulse shapes is presented in Annex 10, Volume 1, Section 3.5.5.1.3.

4.5.7 Spurious radiation

4.5.7.1 Radiation from any part of the receiver or allied circuits shall meet the requirements stated in 4.4.5.

4.5.8 CW and echo suppression

4.5.8.1 (P) CW and echo suppression should be adequate for the site at which the transponder will be used.

4.5.9 Protection against interference

4.5.9.1 Protection against interference outside the DME band should be adequate for the site at which the transponder will be used.

4.5.10 Decoding

4.5.10.1 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 spacing appropriate to the operating channel.

4.5.10.2 The decoding circuit shall not be affected by signals arriving before, between, or after, the constituent pulses of a pair of the correct spacing.

4.5.10.3 An interrogation pulse pair with a spacing of ±2μs, or more, form the nominal value and with any signal level up to the value specified in 4.5.2.3 shall be rejected such that the transmission rate does not exceed the value obtained when interrogations are absent.

4.5.11 Time Delay

4.5.11.1 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 consistent pulse of the reply transmission. This delay shall be 50 μs for mode X, and 56 μs for mode Y channels.

4.5.11.2 Time delays to offset the zero reference point from the DME antenna shall not be implemented except where zero reference point is required to be changed during commissioning of the facility.

4.5.11.3 (P) The transponder should be sited as near to the point at which the zero indication is required as possible.

4.5.12 Accuracy

4.5.12.1 The transponder shall not contribute more than ± 0.5μs (75m) to the over-all system error. (see 4.3.2).

4.5.13 Efficiency

4.5.13.1 The transponder reply efficiency shall be at least 70% at all values of transponder loading up to the maximum handling capacity of the system and the minimum sensitivity level specified in 4.5.2.4.

4.5.13.2 The transponder shall be rendered inoperative for a period normally not exceeding 60 microseconds after a valid interrogation decode has occurred. In extreme cases when the geographic 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.

4.6 Monitoring and Control

4.6.1 The DME transponder shall have a monitoring system which shall take executive action to remove the transponder from service if:-

a) The transponder delay differs from the assigned value by 1μs (150m) or more;

b) If associated with a landing system, the transponder delay differs from the assigned value by 0.5μs (75m) or more;

c) Failure of the monitor itself.

4.6.2 (P) The monitor should take executive action if the spacing between the first and second pulse of the transponder pulse pair differs from the nominal value specified for the channel by 1μs or more.

4.6.3 (P) The monitor should cause a suitable indication at a control point (refer to 4.7) if executive action is taken in accordance with 4.6.1 and additionally if any of the following conditions arise:

a) A fall of 3 dB or more in transponder transmitted power output;

b) A fall of 6dB in the minimum transponder sensitivity not associated with load limiting;

c) The spacing between the first and second pulse of the transponder reply pulse pair differs from the normal value by 1μs 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.

4.6.4 Monitor action may be delayed to overcome transient effects however this delay period shall be as short as practicable and shall not exceed 10 seconds.

4.6.5 The transponder shall not be triggered more than 120 times per second for either monitoring or automatic frequency control.

4.7 Status Reporting

4.7.1 Remote status reporting shall be provided in accordance with Navigational Aid-Status Reporting Document..

4.8 Service Availability

4.8.1 The availability of a DME shall be sufficient to ensure the required operational performance is achieved.

4.9 Performance Assurance

4.9.1 The complete system shall be inspected to assure performance is in accordance with this TSP.

4.9.2 The DME shall be flight inspected in accordance with CNS Manual Vol. IV.

4.9.3 (P) The system should be ground inspected periodically as given in the maintenance schedules. The periodicity indicated in the maintenance schedule shall be reviewed annually taking into consideration demonstrated accuracy, reliability and integrity of the system.

Flight Inspection of DME

1. DME Flight Inspection

All DME Checks are carried out in conjunction with checks on their associated facilities (VOR & ILS).

1.1 Parameters Checks Results and Tolerances:

1.1.1 Identification: The identification code should be clear and correct throughout the area of coverage. The ID Code frequency should be 1350 Hz. The ID should be properly synchronized with that of the associated facility.

1.1.2 Distance accuracy: The indicated Slant range distance must be within the limits

1.1.3 Coverage: The area of coverage of the DME will be at least that of its associated facility (VOR & ILS)

1.1.4 Signal Strength (AGC): The signal strength must be at least –82 dBm throughout the area of coverage.

1.1.5 Squitter Rate: The normal squitter rate should be 2700 ± 90 pps. On certain type facilities, rates as low as 700 pps are normal.

1.1.6 False replies : No false replies should be present which could result in false locks-ons. Within the area of coverage. This may occur at any location especially in the presence of vertical nulls.

1.2 Ground Adjustments:

When the measured distance is out of tolerance, then the system delay of both Transmitters is to be adjusted by the ground personnel. System delay is to be increased to reduce the range error and vice versa.

Tolerances:

For Terminal (ILS) DME :	± 75 meters
Enroute (VOR) DME :	± 150 meters

Mono-Pulse Secondary Surveillance RADAR (MSSR)

Facility : MSSR

- Frequency
  - Interrogation : 1030 MHz
  - Reception : 1090 MHz
- Geo Co-ordinates : 25°34’36”N, 087°33’37”E
- MAKE : INDRA
- MODEL : IRS 20-MP/S
- TYPE : MODE-S
- DATE OF SAT : 09-11-2012
- DATE OF COMMISSIONING : AWAITED

The secondary surveillance radar (SSR) system provides ground-based surveillance of transponder fitted aircraft and allows data link communication between ground stations and aircraft where both are fitted with appropriate Mode S equipment.

The system has four modes of interrogation reply: Mode A, Mode C, Mode S and intermode. Ground stations, will either be Mode A/C ground stations, which can interrogate and receive replies only on Mode A/C, or Mode S ground stations, which can interrogate and receive replies on all modes. There are two classes of transponders: Mode A/C transponders, which can respond to Mode A, Mode C and intermode interrogations only, and Mode S transponders, which can respond to all modes. The use of these modes for interrogations and replies is illustrated in Figure

The SSR system can provide two categories of service, as illustrated in Table-2-1:

a) Mode A/C service: Range and azimuth surveillance, identification (4 096) codes, altitude reporting; and
b) Mode S service: All Mode A/C services, selective addressing, specific services and full two-way data link, both uplink and downlink.

In a mixed environment with Mode A/C and Mode S ground stations and transponders, the Mode A/C service is always available. Upgrading of ground stations or transponders to Mode S does not prevent the provision of a Mode A/C service, thus ensuring compatibility between Mode A/C and Mode S.
The replies to all modes of interrogation can be used to determine aircraft position by measurement of the range and bearing of the reply.

Service level available as a function of ground station and transponder class

Transponder	Ground station	
	Mode A/C	Mode S
Mode A/C	Mode A/C service	Mode A/C service
Mode S	Mode A/C service	Mode S service

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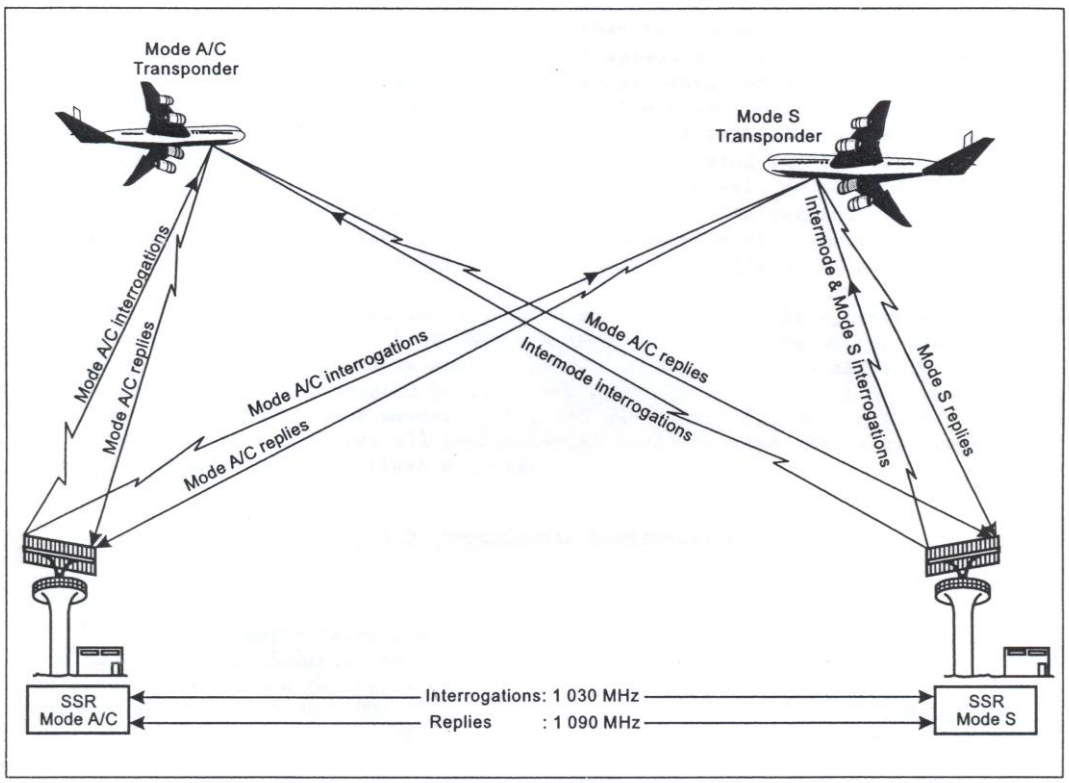
Monopulse

Without requiring modification of system design, the use of monopulse techniques in the ground receiver can considerably improve the azimuth accuracy, and consequently, the effects of synchronous garbling can be greatly reduced. Since fewer replies are needed to ensure decoding and satisfactory position measurement, the techniques permit a reduction in the pulse repetition frequency of ground interrogators. Saturation of the SSR system due to traffic increases, therefore, may be postponed.

SSR Mode S

A technique using a unique address for each aircraft, known as SSR Mode S, compatible with existing SSR modes, has been developed to establish an air-ground data link. A new type of transponder will be required on board, but it will operate in Modes A and C as well as in Mode S; thus, carriage of two equipments is avoided. In the same way Mode S interrogators will operate compatibly with Modes A and C, thus enabling acquisition of aircraft equipped with present transponders.



References

ICAO Annex 10 Aeronautical Telecommunications
Volume IV Surveillance Radar and Collision Avoidance System

MODE-S RADAR INDRA IRS 20-MP/S SPECIFICATIONS

Interrogator Technical Features.

PARAMETER	NOMINAL VALUE
Range Coverage	Range: 256NM Altitude: 66000 ft
Probability of Deteccion (Pd)	SSR: ≥ 97% Mode S: ≥ 99%
Probability of Code Validation	Mode 3/A: ≥ 98% Mode C: ≥ 96% Mode S: ≥ 99%
Validated False Codes	Mode 3/A: < 0.1% Mode C: < 0.1%
False Targets	< 0.1%
Range Bias Error	≤ 14m
Range Random Error	SSR: 1σ ≤15m Mode S: 1σ ≤ 30m
Azimuth Bias Error (ϕ =elevation angle)	$0 < \phi < 6^{\circ}$: ≤ 0.022° $6^{\circ} < \phi < 10^{\circ}$: ≤ 0.033°
Azimuth Random Error	1σ ≤ 0.068°
Precision	Range: ≤ 1/128 NM Azimuth: ≤ 0.022°
Global Jumps Rate	< 0.05 %
Target Load per scan Per 45° sector Per 3.5° sector	≥ 900 ≥ 225 ≥ 54
Useful Duty Cycle	15 years
MTBF	> 40,000 h
MTTR	< 20 min

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Transmitter Unit: Technical Features

PARAMETER	NOMINAL VALUE
Interrogation Frequency	1030MHz ±0.01Mhz
Interrogation Modes	1, 2, 3/A, B, C, D and S
P1, P2, P3, P5 Pulses	▪ Width: 0.8 ± 0.1 μs ▪ Rise time: 50 – 100 ns ▪ Fall time: 50 – 200 ns
P4 Pulse	▪ Width: 0.8 ± 0.1 μs (Short) 1.6 ± 0.1 μs (Long) ▪ Rise time: 50 – 100 ns ▪ Fall time: 50 – 200 ns
P6 Pulse	▪ Width: 16.25 ± 0.25 μs (Short) 30.25 ± 0.25 μs (Long) ▪ Rise time: 50 - 100ns
	Fall time: 50 – 200 ns
Nominal Peak Power	▪ Peak power: ≥ 64dBm ▪ Output Impedance: 50 Ohms ▪ P1-P3 difference of Peak power level ≤ 1 dB.
Channel Isolation	▪ ≥ 70 dB
Output Power Stability (measured over a 2000 hour period)	▪ SSR: -0.5 dB between P1 and P3/P4 ▪ Mode S: -1 dB between P1 and the end of P6
Output Power Control	▪ Level 7: Pmax ≥ 64dBm ▪ Level 6: Pmax - 2dB ± 1dB ▪ Level 5: Pmax - 4dB ± 1dB ▪ Level 4: Pmax - 6dB ± 1dB ▪ Level 3: Pmax - 8dB ± 1dB ▪ Level 2: Pmax - 10dB ± 1dB ▪ Level 1: Pmax - 12dB ± 1dB
Duty Cycle	▪ Long term: SUM Channel: 6% ▪ Long term: OMNI Channel: 2% ▪ Short term (2,4ms) SUM Channel: 63.7%
PRF	▪ Internal Trigger: 50-450 interrogations/second can be selected manually when NO mode S is used. ▪ Pseudo-random PRF is internally generated if STAGGER function is selected. This functionality is performed by MEX and sectoring is defined by user on SLG/SRG workstations ▪ When mode S operation is selected, PRF depends on strategy chosen. Level 4: Pmax - 6dB ± 1dB
Alarms	▪ Low/High Power at SAU/CTU outputs ▪ Temperature Warning and Alarm (60°/62° in radiator) ▪ High SWR at SDU, SAU and CTU outputs ▪ Power Supply Failure ▪ SAU/CTU switched off warning

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MRU Technical Features

PARAMETER	NOMINAL VALUE
Nominal Receiver Frequency	1090 ± 0.5MHz
Bandwidth (-3dB)	10 MHz
Receiver Tangential Sensitivity	< -87 dBm
Minimum Detectable Signal (MDS)	< -95 dBm
Receiver Noise (Noise figure)	< 5 dB
Dynamic Range	▪ 70 dB ▪ Typical tranfer graph is logarithmic
Side band suppression	F< 1060 MHz and f>1120 MHz: Suppession > 90dB
Image Frequency Suppression	> 80 dB
Intermediate Frequency	60 MHz
Interferences	The receiver is capable of operating in the presence of CW (from 95 dBm to -20 dBm). Following the removal of the detected CW interference, replies will be detected, decoded and processed no later than 2ms after the end of the interference.

FFM

TRANSMISSION CHARACTERISTICS

PARAMETER	VALUE
Transmitted power	>54 dBm
Transmission frequency	1090±0.5 MHz
Duty cycle	1% maximum
Spurious emissions in no transmission state	≤ -67dBm
Modulation	On-off keying (OOK) Amplitude (Mode SIF, Intermode) BPPM- Amplitude (Mode S)

RECEPTION CHARACTERISTICS

PARAMETER	VALUE
Sensitivity (at TXP-1000D RF connectors)	Min (>90% replies): -75±3 dBm Max(<10% replies): <-80dBm
Reception frequency	1030 MHz
Selectivity	1% maximum
Spurious emissions in no transmission state	≤ -40 dBm for 1018 MHz to 1042 MHz ≤ -60 dBm for 1005 MHz to 1055 MHz
Image frequency rejection	Minimum -60dB

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Technical Standards and Practices (Secondary Surveillance Radar (SSR))

1 Purpose

1.1 This TSP applies to SSR and specifies Technical Standard and Practices. Performance requirement apply to the complete facility inclusive of Transmitters, Receivers etc.

2. References

A) Annex 10 of ICAO, Volume IV, SSR and ACAS

B) DGCA CIVIL AVIATION REQUIREMENTS SECTION 4 – AERODROME STANDARDS & AIR TRAFFIC SERVICESERIES 'D', PART II

C) Manufacturer's Technical Manuals

3. Definitions:

All definitions are given in Reference 2) above.

4. Standards and Practices:

4.1 Licenses for Frequency:

The authorization for frequency shall be obtained from Wireless Planning and Coordination. Ministry of Telecommunication, Government of India. . GM (Com), CHQ coordinates with WPC, Dept. Of Telecom, Govt. of Indi .

4.2 SSR Mode Interrogation Transmissions (1030 MHz)

An MSSR mode transmission consists of pulses P1, P2 and P3 for interrogation modes 1, 2, 3/A, B, C or D. P1 and P3 are the interrogation pulses and P2 is the control pulse. Control pulses are used by the airborne equipment for side lobe suppression (SLS).

4.3 SSR Mode Replies

Replies are received as 1090 MHz modulated pulse trains by the Receivers via the Receiver Interface. Pulse combinations are:-

Mode 1 - two framing pulses with 6 information pulse positions

Mode2, 3/*A, B, C, D* - two framing pulses with 12 information pulse positions.

4.4 Mode S Interrogation Transmissions

Mode S interrogations are generated from a series of pulses numbered P1 to P6 with P1, P2 and P3 pulses being the same as those used in SSR modes. Mode S adds a further three pulses, P4, P5,and P6, which are used in various combinations with the existing pulses to create the three types which make up the Mode S interrogation set. These interrogation types are:-

(a) The Mode A/C/S All - call interrogation which is used for surveillance of SSR Mode A/C transponders and for the acquisition of Mode S transponders.

(b) The Mode A/C-only All-call elicits a reply from SSR Mode A/C transponders but not from Mode S transponders.

(c) The Mode S interrogation which only elicits a reply from Mode S transponders. This interrogation, with various codings in P6, is used for Mode S only All-call, Mode S addressed surveillance, and data link. New aircraft can enter the coverage area at any time and All-call interrogations. Must be transmitted at a continuous low rate to acquire these new aircraft. In the acquisition phase, either of two Allcall formats can be used. The Mode A/C/S All-call I

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interrogation (the P4 Allcall) elicits a reply in a downlink format. This reply contains data fields which include the aircraft address and other pertinent information. The second All-call type is the Mode S-only All – call which utilizes a Mode S uplink format. When acquired, Mode S track data are maintained by Mode S scheduled interrogations.

4.5 Mode A/C/S and Mode A/C-only All –calls

The Mode A/C/S and Mode A/C-only All -calls are similar to SSR interrogations, but with an additional pulse, P4, following P3. A P4 pulse width of 1.6μs is used in the Mode A/C/S All -call interrogation, while a P4 pulse width of 0.8 μs is used in the Mode A/C-only All-call. Mode A/C transponders are not affected by the presence of the P4 pulse, and thus they respond with the appropriate Mode A or Mode C reply. A Mode S transponder detects the P4 pulse and if it is short (0.8 us) recognizes the interrogation as an SSR Mode A/C-only All-call and does not reply. However, if the P4 is long (1.6 us) the Mode S transponder recognizes the reply as a Mode S All-call and sends a Mode S reply containing its address. In the above two interrogation types, side-lobe suppression is accomplished by the transmission of the P2 pulse on a side-lobe suppression control pattern. If this pulse is received by either an SSR Mode A/C or a Mode S transponder at amplitude above that of the P1 pulse the tr5ansponder will not reply.

4.6 Mode S only All-calls:

The Mode S only all- call utilizes a Mode S uplink format which contains two control fields:

(a) The interrogator identifier (II) field, which identifies the interrogator; and

(b) The probability of reply field, which performs certain control functions.

The format also elicits the All-call reply format.

4.7 Mode S Scheduled Interrogations:

The Mode S interrogation is formed by three pulses P1, P2 and P6 Pulses P1 and P2 form the preamble and are spaced 2μs apart. An SSR Mode A/C transponder which receives this interrogation interprets the pairs as an SSR side-lobe suppression command and will suppress for a period of time between 25 and 45us. The P6 pulse is transmitted from the Interrogator during this period. Without such suppression the P6 pulse would, with high probability, trigger the SSR Mode /C transponder causing a spurious reply. The P6 pulse of the Mode S interrogation is either 16.25 or 30.25μs long and contains the data in the form of differential phase shift keyed (DPSK) modulation. The data chips are 0.25μs long and a phase reversal at the beginning of each chip represents a binary "1", while the absence of such a reversal denotes a binary "0". The chip length represents a 4 Mbps rate, which permits transmission of 112-bit messages within the minimum available suppression interval.

4.8 Side-lobe suppression:

It is accomplished for Mode S interrogations by the transmission of the P5 control pulse on a side-lobe suppression pattern. If the control pulse amplitude received by the transponder exceeds the amplitude of the interrogation, the sync phase reversal will be obscured, and the interrogation will be rejected. With discrete address interrogations, transmitted side-lobe suppression is not required to prevent sidelobe replies because, in general, an aircraft will be interrogated only when in the main beam of the interrogating antenna. However, transmitted side-lobe suppression on All-call interrogations prevents side-lobe replies, because all transponders which are not locked out could reply.

4.9 Mode S. Replies:

A Mode S reply consists of a preamble and a data block containing 56 or 112 pulses. The preamble consists of a series of four 0.5µs pulses. The data block begins 8µs after the leading edge of the first preamble pulse. Binary data transmitted at a 1 Mbps data rate using pulse position modulation in the following way:-

In the 1µs interval corresponding to each data bit, a 0.5µs pulse is transmitted in the first half of the interval if the data bit is a "1" and in the second half if the data bit is "0". The group of four pulses forming the preamble is designed to be easily distinguishable from Mode A and Mode C replies. Ppm for the data block permits reliable bit detection in the presence of SSR (Modes A and C) interference.

4.10 Plot Extraction:

In the Receivers, the incoming RF signals are mixed with the 1030 MHz Local Oscillator signal, amplified in a linear and then in a logarithmic amplifier and converted to an 8 bit digital output in the analogue to digital converter. Sum (Σ) or control (Ω) or difference (Δ) data are output and additionally, raw video. The Plot Extractor system accepts outputs from the Receivers, i.e. 8bit (Σ, ΔorΩ, and produces output plots in a variety of formats.

5 BRIEF SPECIFICATION

5.1 Transmitter

Coverage :	360 deg azimuth, 250 NM.
Beam Width :	2.4 deg at 3 dB point
Range Accuracy:	± 30 feet 25 ft rms jitter
Azimuth Accuracy:	0.068 deg, 1sigma rms error
Frequency:	1030+0.01MHz Σ (sum) and Ω (control)
Output power:	30.5 dBW min (Σ), 30.0 dBW min (Ω)
Pulse Width:	0.8 ± 0.05 µs
Power droop:	Not to exceed 1.0 dB from start to end of interrogation (SSR and Mode S)
Mismatch:	Operation into a 1.5:1 load mismatch with 0.3 dB reduction in power.
Peak duty cycle :	Constant duty cycle of 4.2% up to 40^{0}C (Σ channel). Constant duty cycle of 0.1% up to 40^{0}C (Σ channel).
Frequency spectrum:	CW at 1030+0.2 MHz not to exceed -76 dBm when not interrogating.
Pulse frequency Spectrum :	80 dB relative to peak power outside the range 930 MHz to 1130 MHz (excluding harmonics) Harmonic radiated power at least 60 dB below fundamental radiated power.
Polarization :	Predominantly vertical

5.2 Receiver:

Centre frequency :		1090 MHz nominal
Local oscillator frequency :		1030+0.01 MHz
Intermediate frequency :		60MHz
Bandwidth	30 dB :	1085.5+0.5 MHz to 1094.5+0.5 MHz
	40dB :	>1078 and <1102 MHz
	60dB :	>1065 and <1115 MHz
Mean of -3 dB points :		1090+0.5 MHz
Spurious & image response :		60 dB below response at 1090 MHz
Tangential sensitivity :		better than -90 dBm
Dynamic range :		-16 to -96 dBm
Video output :		8 bits digitized for (Σ) Sum (Δ) difference and (Ω) (control) 1 bit (left/right of bore sight), 1 bit sign confidence 16 MHz
Video Processing :		Range gating 2 km to 500 km. : Sensitivity Time Control (STC), site adaptable and on/off control with selectable linear, sector or on/off control. : Pre-settable sensitivity rejection of multi path and jamming : Short pulse elimination : 6dB detection : Receiver side lobe suppression (RSLS) : Phase detector/ sign indication

5.3 Mode / Trigger Selection

Interrogation Modes :

Mode	Pulse spacing (us)	
1	3	P1 to P3 pulse spacing, each pulse is
2	5 0	.8µs in width, P2 is spaced at 2 us...
3/A	8	from P1.
B	17	
C	21	
D	25	

Mode Interlace : Sixteen SSR modes and four Mode S interlace programmes are available for programming. All 20 are defined with default settings encompassing the above modes in various combinations of single dual, triple sequences etc. The Mode S interlace patterns allows the combination of SSR Mode A/C interrogations with the three types of Mode S Allcall.

Internal trigger : Selectable 50 to 450 Hz in 1 Hz steps

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Staggered trigger :	The trigger may be staggered by 5% of the PRF in a pseudorandom sequence.

Trigger outputs Suppression :

Mode1	6us
Mode2	8us
Mode 3/A	11us
Mode B	20us
Mode C	24us
Mode D	28us

System trigger :	1.0+0.1µs width, PRF as internal or external divided down, position adjustable between P3 and P3-500µs steps.
Display trigger :	1.0+0.1us width, position variable between P3-30 and P3+97us
Plot Extractor Trigger :	0.5+0.1us at P3-30 us
Mode identity pulses (TX Ident) :	P1 and P3

5.4 Control

Transmitter controls :	Trigger Stagger; Linear/Staggered Stagger Variation; Low/Off RF (TX) Enable; Off/On PRF Value (Hz) Modes interlace programme selection; 1-16 Non-Mode S operation 17-20 Mode S operation
Receiver Decoder Correlator :	STC (SSR/All Call); Off/Linear /Programmed Mode S Scheduled STC; Off/On
Tracker :	primitive Zones; Off/On Self-Adaptive Reflectors; Off/On Site Monitor; Off/On
Operational Modes :	Channel Mode; Operational/Maintenance

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5.5 Plot Extraction

Azimuth determination

- Mono pulse with sliding window processing when no mono pulse data is available

Video Processing

- Spike elimination
- Dynamic and minimum threshold detector
- Jamming detection
- 6dB detection
- RSLS flag generation
- Internal/external range amplitude threshold (STC)
- PSV generation
- Short pulse elimination
- Leading edge and trailing edge detection (with pseudo leading edge generation)
- Wide pulse elimination
- Low difference threshold
- Sum difference ratio generator

Decoding

- Mode 1,2,3/A,B,C,D and S
- Bracket detection
- Range zero determination and range gating
- Measure reply range and azimuth
- Determine code and code garble including emergency and special identity replies (both civil and military)
- Hardware defruiting (all modes) ON/OFF selectable
- Preamble detection
- Mode-S CRC checking
- Mode-S reply data extraction

Plot and Track Processing

- Reply to reply correlation
- Surveillance (Track) processing
- Mode S Interrogation Scheduling
- Reflector Detection and reflection suppression
- Mode S to SSR Track combination
- Target report formatting
- Output; protocol handling
- Mode-S Datalink
- Interface for Uplink and Downlink data
- Extended Length Message (ELM) Processing

Azimuth distribution

- Accepts serial data - azimuth count pulses (ACP) with north marker or 14 bit parallel azimuth data
- Azimuth data for Interrogator
- Azimuth data for external equipments e.g. RMM/PPI, PSR etc.

Self test

- Self test reply data generator
- Synthetic target data generator
- Built-in self test (BIST) includes PROM, RAM or MPC and so on

Monitoring

- Azimuth data
- Trigger
- Clocks
- Watchdog
- LEDs for error, failure in process indication etc.
- Transmitter/Receiver, power supply, mode generator cabinet and other external sources via a serial link to the control and BIT PEC.

6.0 Service Availability

6.1 The availability of SSR shall be sufficient to ensure that the required operational performance is achieved.

7.0 Performance Assurance:

7.1 The complete system shall be inspected to assure performance is in accordance with this TSP

7.2 This system should be inspected periodically as given in the maintenance schedules. The periodicity indicated in the schedule shall be reviewed annually taking in to consideration demonstrated accuracy, reliability and integrity of the system.

Air Traffic Services - Time Standards

1 Purpose

1.1 This TSP states the standards for 'time of day' clocks used in air traffic services.

1.2 The TSP does not apply to a chronometer that forms part of an electronic system and is necessary for the correct operation of the system. An example application is a chronometer necessary for the synchronization of a digital link. The performance requirements of such chronometers will be a function of the system design.

2 References

A) Annex 11 to the Convention on International Civil Aviation, Air Traffic Services, Chapter

B) DGCA CIVIL AVIATION REQUIREMENTS SECTION 4 - AERODROME STANDARDS & AIR TRAFFIC SERVICESERIES 'D', PART II

C) Manual of Air Traffic Services – Part 1

3 Definitions

Time of day: The time expressed in hours and minutes and, when required, seconds of the 24-hour day beginning at midnight based on Co-ordinated Universal Time

UTC: Co-ordinated Universal Time as calculated by the Bureau International des Poids et Mesures (BIPM)

4 Standards and Practices

4.1 Types of Time Systems:

The following systems shall be in operation at the airports:-

a) Digital Master / Slave Clocks System

b) Clock System based on GPS

c) Stand Alone Clock System

4.2 Time Display

4.2.1 Time displays in Air Traffic Service units shall display the time in hours, minutes and seconds, clearly visible from each operating position in the unit concerned. {Ref: A).2.24.2, Ref: CNS Circular No. 4 of 2003}

4.2.2 For units not using data link communications the displayed time shall be set to UTC ± 1 second and maintained within ± 5 seconds of UTC.

4.2.3 For units using data link communications the display time shall be set and maintained within ± 1 second of UTC.

4.3 Time Synchronization:

4.3.1 Where Master/Slave clock system is in operation, the master clock is to be corrected / synchronized every day in the morning at 0230 UTC from the time signal obtained from All India Radio or from a standard time station.

4.3.2 All the slave clocks shall require to be synchronized with the master clock. The clocks can also be corrected and synchronized through GPS wherever such system is installed.

4.3.3 The time of stand alone working positions like Radars, AMSS, DVTR/Voice Loggers and other positions shall be required to be synchronized with the time of the master clock.

4.3.4 The stations where master/slave clock system is not provided the time of stand alone clocks provided at working positions, the time shall be corrected /synchronized with the time signal obtained from All India Radio or from a standard time station.

4.3.5 An entry in the daily shift log book shall be recorded for time correction / synchronization of all operational clocks.

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4.4 Loggers and Recorders

4.4.1 Time stamping introduced by a logger or recorder shall be set to UTC ± 1 second and maintained within ± 30 seconds of UTC

4.4.2 (P) Logger and recorder time should be maintained within ± 5 seconds of UTC where practical.

4.4.3 In the situation where reproduction of a recorded signal requires greater accuracy than specified in 4.2.1 a more accurate timing record shall be stored either as part of the required signal or as a separate timing signal on the recording media.

4.5 Performance Assurance

4.5.1 The complete system shall be inspected to assure the performance is in accordance with this TSP.

4.5.2(P) The system should be inspected periodically at nominal interval of one month to assure compliance with this TSP.

Support & maintenance of CNS facilities

Name of Facility	Details of Battery		Details of Battery			Details of ACs
	Make	Rating	No. of Batteries	Rating	Date of Installation	
MSSR	Numeric (DUAL-UPS)	30KVA	80	12V 100A	23/08/2011	4(Four)
DVOR	Power-One	5KVA	20	12V 18A	25/07/2012	4(Four)
DME	Power-One	5KVA	20	12V 18A	25/07/2012	
RCAG	Numeric	5KVA & 2KVA	11	12V 65A	25/07/2012	2(Two)
DSCN	Power-One	3KVA	16	12V 7A	25/07/2012	

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POWER SUPPLY SYSTEM

Transmitting station and DVOR site both are looked after by separate Power House at those sites.

MAINS SUPPLY :

i) At MSSR site provided by BSEB through 150 KVA line

ii) At DVOR site provided by BSEB through 11KV line and 63 KVA step-down transformer.

STANDBY : Is equipped with the following to provide uninterrupted power supply.

At MSSR Site:

1. 250KVA Diesel Generators (1 Nos.), with associated AMF Panels are in operation.
2. 30KVA UPS (Make: Numeric) 2 No. for MSSR.
3. 5KVA UPS (Make: Numeric) 1 No. for RCAG.
4. 3KVA UPS (Make: Power One) 02 Nos. for DSCN Link Way modem/ Memotec.
5. 2KVA UPS (Make: Numeric) 1 No. spare

At DVOR Site:

1. 25KVA Diesel Generators (2 Nos.) Make: Kirloskar with associated AMF Panels are in operation.
2. 5KVA UPS (Power One make) 2 Nos. for DVOR & DME.

Advanced lightning arrestor system has been installed at the MSSR Building complex and at DVOR site.

Maintenance Checks For Lightning Protection System
Following checks should be carried out at regular interval – **once every quarter**:

Inspection of Air Terminal
Physical inspection of air terminal and functionality checks with air terminal test meter.

Inspection of Down-conductors

- ✓ Check for corrosion
- ✓ Continuity testing by continuity tester, across all types of conductors in lightning protection and grounding system. The resistance should be **less than 0.5 ohms**.
- ✓ The down conductors are routed, located and electrically bonded as required.

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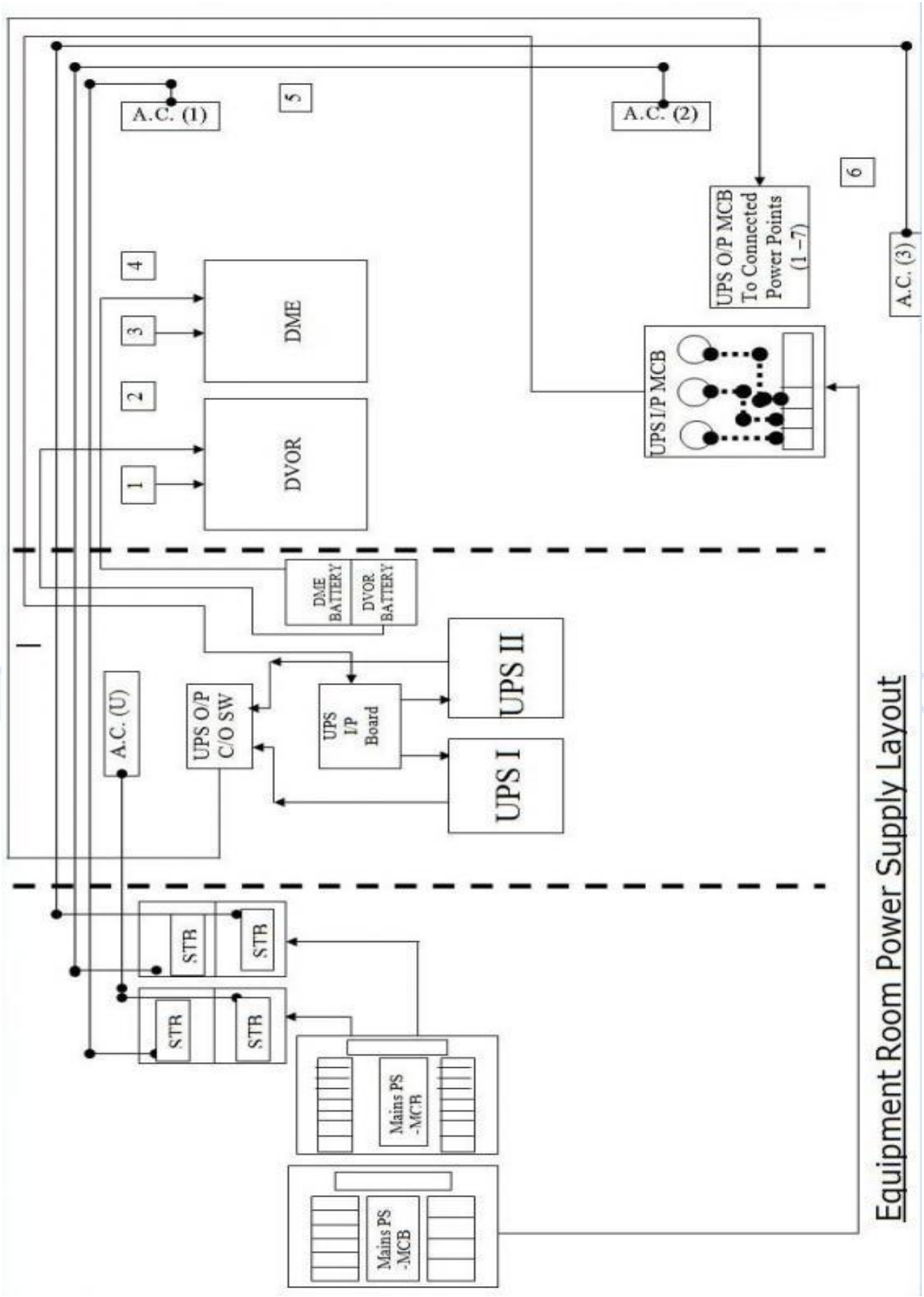
Periodic Check for earthing system:

- ✓ Earth resistance will be checked at the **interval of 3 months** with the standard process of measurement (Three point method) and recorded. If the measured value is beyond specified standards, corrective action must be taken.
- ✓ Earth termination systems are interconnected. Where a conductor is totally hidden, its electrical continuity should be tested.
- ✓ In case specified standards of earth resistance are not met, ground conductivity may be improved by Refilling of earth pit with electrolytic compound for electrolytic grounding system where provided.
- ✓ Recharging of earth pits in case conventional grounding system is installed. Physical inspection of connection between ground rod and down conductor near grounding system for corrosion, bad contacts followed by corrective action.

Series Filter and Surge Protector has been provided in the Electrical distribution system separately for Electrical portion and equipment at both DVOR & MSSR site.

Inspection of Surge Protection devices:

All surge protection devices should be checked at an interval of 3 months for their functionality.
Indications provided with surge protection system should be monitored and recorded on daily basis.
Faulty devices should be replaced.



DVOR / DME ROOM POWER SUPPLY

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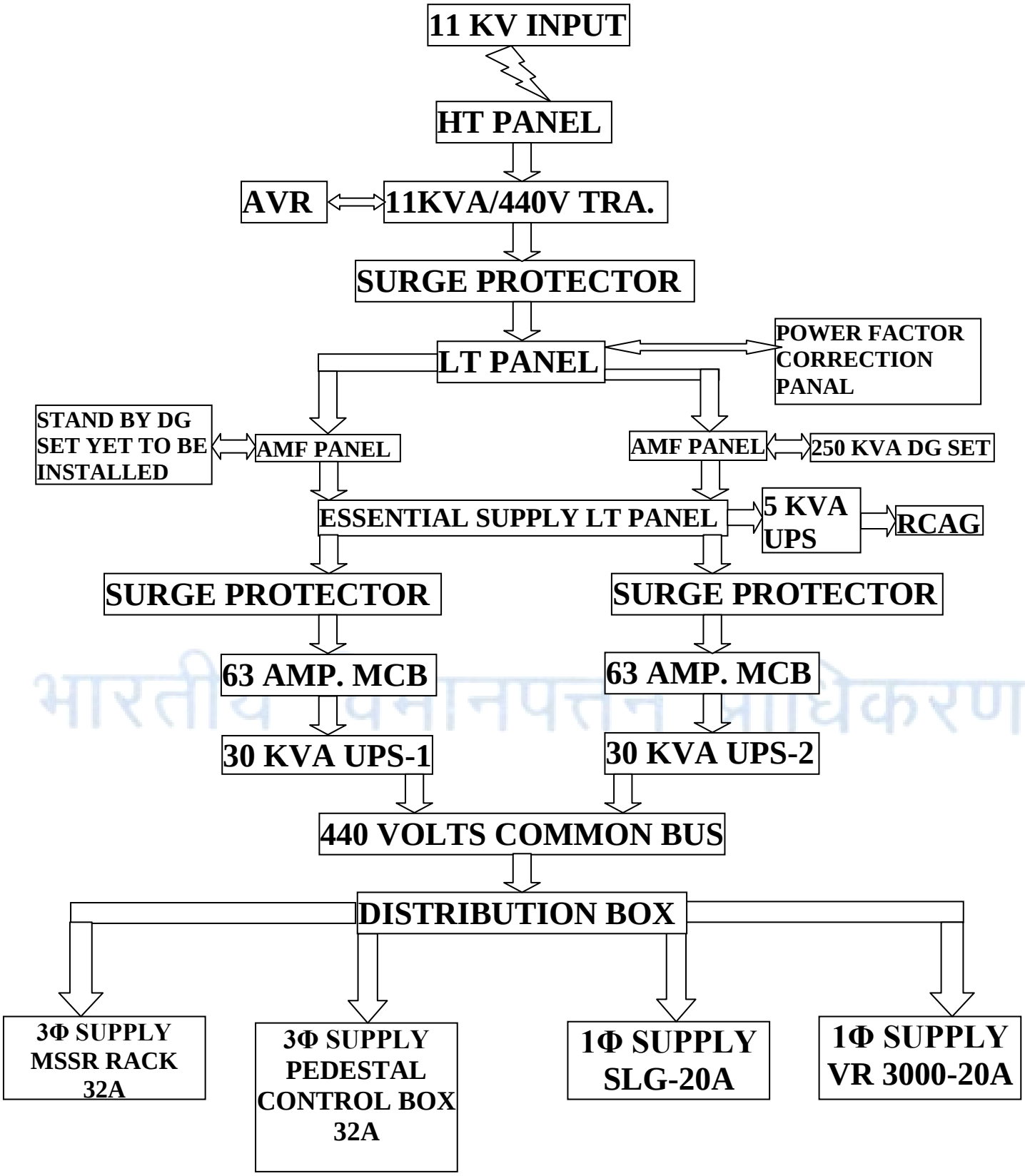

MSSR & RCAG ROOM POWER SUPPLY

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MAINTENANCE SCHEDULE

PREVENTIVE MAINTENANCE SCHEDULE- DAILY

Station: **Region:** **Facility : DVOR**
Make: Thales **Model: 432** **Frequency:** **MHz**

Sl. No.	Parameters to be checked	Normal Status	Measured Status	
1	Equipment Shelter Cleanliness	Dust free		
2	Status of air conditioners	Serviceable		
3	Equipment Shelter temperature	<20°C		
4	UPS input voltage / Frequency	220±10%		
5	UPS output voltage / Frequency	220±10%		
6	UPS battery voltage/ Output Load %			
7	Status of equipment battery operation	Normal		
8	Status of antenna foreground/critical area	OK		
9	Status of obstruction lights	OK		
10	Status of remote controls/indications in E/Room	OK		
11	Status of remote indications in ATC Tower	OK		
12	Change of Channels	OK		
13	Hours of operation	Tx-1 / Tx-2		
14	Alarm if any	Nil		

Signature of Duty Officer Signature of Unit-in-Charge

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PREVENTIVE MAINTENANCE SCHEDULE- WEEKLY

Station: **Region:** **Facility: DVOR**

Make: Thales **Model: 432** **Frequency: MHz**

Parameters	*Nominal Value	Measured Value				Remarks
		Tx – 1		Tx - 2		
1.Transmitter Data						
Carrier power	Tx-1 Tx-11					
AM 30Hz	Tx-1 Tx-11					
AM 1020Hz	Tx-1 Tx-11					
USB Level	Tx-1 Tx-11					
USB RF Phase	Tx-1 Tx-11					
LSB Level	Tx-1 Tx-11					
2.Measurement of DC voltages		MON-1	MON-2	MON-1	MON-2	
+5.1 volts MV	+5V					
+15 volts MV	+15V					
-15 volts MV	-15V					
+28 volts MV	+28 V					
+5.1 volts Mon	+5 V					
3. Near Field Antenna						
Azimuth	Tx-1 Tx-11					
RF Level	Tx-1 Tx-11					
30Hz AM Depth	Tx-1 Tx-11					
9960 AM Depth	Tx-1 Tx-11					
FM Index	Tx-1 Tx-11					
1020 Hz AM Depth	Tx-1 Tx-11					
4. Internal Integral						
Carrier Frequency	Tx-1 Tx-11					
USB Frequency	Tx-1 Tx-11					
LSB Frequency	Tx-1 Tx-11					
5. Alarm Limits						
Azimuth UL Near Field	Tx-1 Tx-11					
Azimuth LL Near Field	Tx-1 Tx-11					
30 Hz AM UL	Tx-1 Tx-11					
30 Hz AM LL	Tx-1 Tx-11					

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9960 Hz AM UL	Tx-1 Tx-11					
9960 Hz AM UL	Tx-1 Tx-11					
FM Index UL	Tx-1 Tx-11					
FM Index LL	Tx-1 Tx-11					
1020 Hz AM UL	Tx-1 Tx-11					
1020 Hz AM LL	Tx-1 Tx-11					
6. Measurement TSG						
TSG Level	Tx-1 Tx-11					
TSG 30Hz AM Depth	Tx-1 Tx-11					
TSG FM Index	Tx-1 Tx-11					
TSG 9960 Hz AM Depth	Tx-1 Tx-11					
TSG Azimuth	Tx-1 Tx-11					
7. Calibration Dipole						
Internal CSB RF Level AGC	Tx-1 Tx-11					
Internal CSB RF Level Digital	Tx-1 Tx-11					
Internal 9960 Hz AM AGC Adjust	Tx-1 Tx-11					
Internal 9960 Hz AM Digital AGC Adjust	Tx-1 Tx-11					
Internal 30 Hz AM Cal Factor	Tx-1 Tx-11					
8. TSG Alarm Limits						
TSG Signal Level UL	Tx-1 Tx-11					
TSG Signal Level LL	Tx-1 Tx-11					
30 Hz AM Depth UL	Tx-1 Tx-11					
30 Hz AM Depth LL	Tx-1 Tx-11					
FM Index UL	Tx-1 Tx-11					
FM Index LL	Tx-1 Tx-11					
9960 Hz AM Depth UL	Tx-1 Tx-11					
9960 Hz AM Depth UL	Tx-1 Tx-11					

9. BATTERY DATA		**LRCI**		
Battery volt				
Batt. half volt. diff.				
Battery current				
Eqpt. current				

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Actual Batt capacity				
10.Hours of operation				
11. Change over of Channels		Tx-1 to Tx-2	Tx-2 to Tx-1	
12. Maintenance of Eqpt. Battery		Done on:		
13. Maintenance of UPS Battery		Done on:		

*Nominal Value: Final value after Flight calibration on _____.

( )
SIGNATURE OF DUTY OFFICER
NAME:
DESIG:

COMMENTS/ACTION TAKEN DETAILS:

( )
SIGNATURE OFUNIT INCHARGE
NAME:
DESIG:

(THIS MAINTENANCE SCHEDULE IS BASED ON RECOMMENDATIONS OF ICAO DOCUMENTS (DOC 8071, ANNEX 10) AND MANUFACTURERS TECHNICAL MANUAL.)

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PREVENTIVE MAINTENANCE SCHEDULE- MONTHLY

Station: Region: Facility: DVOR
Make: Thales Model: 432 Frequency: MHz

Description	Status		Remarks
1. Physical condition of antennas	OK/NOT OK		
2. Status of Remote Lines	OK/NOT OK		
3. Status of RMM	OK/NOT OK		
4. Maintenance of UPS	Done/Not Done		
5. Ground calibration Done on			
6. Error Spread	Tx-1	Tx-2	
7. Monitor Antenna and its surroundings	Ok/Not Ok		
8. Verify Counter poise weld joints Condition of Antenna Radome, RF Cables and conduits			
9. Lightning Arrestor and Earth resistance	Ok/Not Ok		
10. Alarm C/O time	Within Tolerance (<20Sec)		

( )
SIGNATURE OF DUTY OFFICER
NAME:
DESIG:

COMMENTS/ACTION TAKEN DETAILS:

( )
SIGNATURE OFUNIT INCHARGE
NAME:
DESIG:

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MAINTENANCE SCHEDULE – MONTHLY

Station: Region: Date:
Equipment: DVOR Make: Thales Model: 432

DVOR GROUND CHECKS

TRANSMITTER - 1				TRANSMITTER – 2			
S. No.	Normal Bearing in degrees	Measured Bearing in degrees	Bearing Deviation in degrees	S. No.	Normal Bearing in degrees	Measured Bearing in degrees	Bearing Deviation in degrees
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
17				17			
18				18			
19				19			
20				20			
21				21			
22				22			
23				23			
24				24			
	ERROR SPREAD				ERROR SPREAD		

( )
SIGNATURE OF DUTY OFFICER
NAME:
DESIG:

COMMENTS/ACTION TAKEN DETAILS:

( )
SIGNATURE OFUNIT INCHARGE.
NAME:
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PREVENTIVE MAINTENANCE SCHEDULE- QUARTERLY

Station: **Region:** **Facility: DVOR**
Make: Thales **Model: 432** **Frequency:** **MHz**

STATUS OF EARTHS, LIGHTENING & SURGE PROTECTION SYSTEM

1. System Earth Resistance: ---------- Ohms
2. Earth Resistance at Antenna Site (as applicable) ---------- Ohms
3. Earth resistance at Monitor Site (as applicable) ---------- Ohms
4. Earth to Neutral Voltages ---------- Volts
5. Earth resistance of Lightening Protection System ---------- Ohms
6. LED Indication of Lightening Protection System OK/ Not OK
7. Earth resistance of Surge Protection System ---------- Ohms
8. LED Indication of Surge Protection System OK/ Not OK

( )
SIGNATURE OF DUTY OFFICER
NAME:
DESIG:

COMMENTS/ACTION TAKEN DETAILS:

( )
SIGNATURE OFUNIT INCHARGE.
NAME:
DESIG:

(THIS MAINTENANCE SCHEDULE IS BASED ON RECOMMENDATIONS OF ICAO DOCUMENTS (DOC 8071, ANNEX 10) AND MANUFACTURERS TECHNICAL MANUAL.)

PREVENTIVE MAINTENANCE SCHEDULE - Yearly

Station: **Region:** **Date:**
Make: THALES **Model: 432** **Frequency:** **MHz**

S No	Parameter	Reference CAR Section 4, Series 'D' Part II	Reference DOC 8071 Volume I	Measured	Tolerance	Actual Value of Parameter measured	
						TX 1	TX 2
1	Carrier Frequency	3.3.2	2.2.9	Frequency	+/-0.02%		
2	9960 Hz deviation	3.3.5.1	2.2.11	Ratio	16+/-1		
3	9960 Hz modulation depth	3.3.5.2	2.2.12	Modulation depth	28 to 32 %		
4.	30 Hz Modulation depth	3.3.5.3	2.2.15 to 2.2.18	Modulation depth	28 to 32 %		
5.	30 Hz Modulation frequency	3.3.5.4	2.2.19	Frequency	30 Hz+/-1 %		
6.	9960 Hz sub-carrier frequency	3.3.5.5	2.2.20	Frequency	9960 Hz+/-1 %		
7.	DVOR AM modulation of 9960 Hz sub carrier	3.3.5.6	2.2.22	Modulation depth	</= 40%		
8.	Identification speed	3.3.6.5	2.2.27	Time	7 words per minute		
9	Identification repetition	3.3.6.5	2.2.28	Time	>/= 2 times/ min		
10.	Identification tone frequency	3.3.6.5	2.2.29	Frequency	1020 +/- 50 Hz		
11.	Identification modulation depth With communications channel No communications channel	3.3.6.6	2.2.30	Modulation depth	</= 10% </= 20%		
12.	Bearing Monitor	3.3.7.1	2.2.32	Deviation	+/- 1 Deg		

( )
SIGNATURE OF DUTY OFFICER
NAME:
DESIG:

COMMENTS/ACTION TAKEN DETAILS:

( )
SIGNATURE OFUNIT INCHARGE
NAME:
DESIG:

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MAINTENANCE SCHEDULE –DAILY
Approved by ED CNS

Station Name: Region: Duration:

Equipment Name: DME (Thales) Make: Model No: 435(HP) / 415(LP)

S. No.	Parameters to be checked	Normal Status	Observed status						
	1. GENERAL								
1.1	Equipment shelter cleanliness	Dust free							
1.2	Battery room cleanliness	Dust free							
1.3	Status of the air conditioners	Serviceable							
1.4	Equipment shelter temperature	22° ±2° C							
1.5	Mains Power supply	220 V±10%							
1.6	Stabilizer output	220 ±5V							
1.7	Voltage of Battery bank	24 V							
1.8	Status of Monitor	OK							
1.9	Status of remote indications at: a) Equipment room b) A.T.C	 OK OK							
1.10	Change of Channels	Tx I to II and Vice-Versa							
1.11	Alarms. If any	Nil							
1.12	Any Unusual noise	No							
1.13	Battery operation	Normal							
1.14	Humidity in shelter								
1.15	Status of Electrical Fittings/works	No. of lights No. of fans							
1.16	Status of mast light	OK							
1.17	Signature of Officer								

Signature

(Manager) (Sr. Manager)

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MAINTENANCE SCHEDULE –DAILY

Station Name: Region: Duration:

Equipment Name: DME (Thales)

Make: Model No: 415/435

S. No.	Parameters to be checked	Normal Status	Measured status	
1.a	**Executive monitoring on Antenna**	**TX-1**	**MON-1**	**MON-II**
1.a.1	System delay	50±0.2 µs		
1.a.2	Pulse pair spacing (SEPN)	12± 0.25 µs		
1.a.3	Reply efficiency	>70%		
1.a.4	Transmission Rate			
1.a.5	Peak power output	1 KW		
1.a.6	Peak power output	100W		
1.a.7	Min Replies	720± 50Hz		
1.a.8	Max. Replies	4800± 90Hz		
1.a.9	Transmitter frequency			
1.b	**Executive monitoring on Antenna**	**TX-II**		
1.b.1	System delay	50±0.2 µs		
1.b.2	Pulse pair spacing (SEPN)	12± 0.25 µs		
1.b.3	Reply efficiency	>70%		
1.b.4	Transmission Rate			
1.b.5	Peak power output	1 KW		
1.b.6	Peak power output	100W		
1.b.7	Min Replies	720± 50Hz		
1.b.8	Max. Replies	4800± 90Hz		
1.b.9	Transmitter frequency			
2.	**IDENT (VIA MONITOR 1 & MONITOR 2**	**Keying is repeated at 30 seconds**		
3.	**SELF TEST**	**(every12 s)**		
4.	**Push Button Status on LCSU**			
4.1	Equipment ON/OFF	OK		
4.2	Change over	OK		
4.3	Select	OK		
4.4	Request / Release	OK		
4.5	Lamp Test	OK		
4.6	Silence	OK		
5.0	**POWER SUPPLY UNIT**			
5.1	AC/DC1	54±1V		
5.2	AC/DC2	54±1V		
5.3	Signature of Officer			

Signature

(Manager) (Sr. Manager)

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MAINTENANCE SCHEDULE –WEEKLY

Station Name: Region: Date:

Equipment Name: DME (Thales) Make: Model No: 415/435

S.No.	Parameters to be checked	Normal Status	Measured status	
1.	**D.C.SUPPLY**		**`TX-1**	**TX-II**
1.1	PS1	+5 ± 0.25 V		
1.2	PS2	+5 ± 0.25 V		
1.3	PS1	+15 ± 0.25 V		
1.4	PS2	+15V ± 0.25 V		
1.5	PS1	-15V ± 0.25 V		
1.6	PS2	-15V ± 0.25 V		
2.0	**AC Supply**	**230±35 V**		
3.0	**Parameters**			
3.1	System delay	50±0.2 µs		
3.2	Pulse pair spacing (SEPN)	12± 0.25 µs		
3.3	Reply efficiency	>70%		
3.4	Transmission Rate			
3.5	Peak power output	1 KW		
3.6	Peak power output	100W		
3.7	Min Replies	720± 50Hz		
3.8	Max. Replies	4800± 90Hz		
3.9	Transmitter frequency			
4.0	**Transponder Details:**			
4.1	Read antenna position			
4.2	On/off status commanded from Mon1			
4.3	On/off status commanded from Mon2			
4.4	On/off status sent to monitors			
4.5	Debug bridge status			
5	**Monitor Details:**		**Mon-I**	**Mon-II**
5.1	Commanded antenna position			
5.2	Transponder 1 on/off "must be"			
5.3	Transponder 2 on/off "must be"			
5.4	Transponder 1 on/off Flag			
5.5	Transponder 2 on/off Flag			
5.6	Tx 1 Alarm status sent to other monitor			
5.7	Tx 2 Alarm status sent to other monitor			
5.8	Tx 1 Alarm status got from other monitor			
5.9	Tx 2 Alarm status got from other monitor			

Signature

Manager Sr. Manager

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MAINTENANCE SCHEDULE –Monthly

Station Name: Region: Date:

Equipment Name: DME (Thales) Make: Model No: 415/435

S.No.	Parameters to be checked	Normal status (Reference)			Measured Status		
	TX-I Measurements						
1.a	**STD measurement and routine checks on antenna / dummy load (Parameters)**	On Antenna	On dummy load	Mainten. (Manual)	On Antenna	On dummy load	Mainten. (Manual)
1.a.1	Peak power output						
1.a.2	Peak power Droop						
1.a.3	Pulse shape						
1.a.4	Pulse shaping						
1.a.5	Transmitter frequency						
1.a.6	Transmission rate						
1.a.7	Adjacent channel rejection						
1.a.8	Bandwidth						
1.a.9	Echo suppression						
1.a.10	Reply efficiency						
1.a.11	Sensitivity						
1.a.12	Dead time						
1.a.13	decoder						
1.a.14	Replay delay variation with level						
1.a.15	Transmitter power						
1.a.16	Identity code reading						
1.a.17	Identity code time						
1.a.18	Automatic gain reduction						
1.a.19	Ident priority on reply						
1.a.20	Adjacent channel desensitization						
1.a.21	Sensitivity variation with load						
1.a.22	Recovery time						
1.b	**STD measurement and routine checks on antenna / dummy load(Parameters)**	TX-II Measurements					
1.b.1	Peak power output						
1.b.2	Peak power Droop						
1.b.3	Pulse shape						
1.b.4	Pulse shaping						
1.b.5	Transmitter frequency						
1.b.6	Transmission rate						
1.b.7	Adjacent channel rejection						
1.b.8	Bandwidth						
1.b.9	Echo suppression						
1.b.10	Reply efficiency						
1.b.11	Sensitivity						
1.b.12	Dead time						
1.b.13	decoder						

1.b.14	Replay delay variation with level						
1.b.15	Transmitter power						
1.b.16	Identity code reading						
1.b.17	Identity code time						
1.b.18	Automatic gain reduction						
1.b.19	Ident priority on reply						
1.b.20	Adjacent channel desensitization						
1.b.21	Sensitivity variation with load						
1.b.22	Recovery time						

2. STD Measurement Routine check on Monitors

S.No.	**Parameters to be checked**	**Normal status**		**Observed status**			
				Mon-I		**Mon-II**	
2.1	Interrogation 1st & 2nd pulse level						
2.2	Interrogation pulse spacing						
2.3	Interrogation 1st & 2nd pulse shape						

3.0 Parameter setting

	Transponder Parameter	**Normal status**	**Observed status**	
			TX-I	**TX-II**
3.1	Channel & Mode	1 to 126 Channel X or Y Mode		
3.2	Reduced Power	Off, -1dB, -2 dB, -3 dB		
3.3	Ist Identity Code	Max number 4 characters		
3.4	2nd Identity Code	Max number 4 characters		
3.5	Transmission Rate	2700 - 4800 pps 800- 4800 pps		
3.6	Reply Delay	35 to 75 µs X- Channel 50 to 75 µs Y Channel		
3.7	Dead Time	0 to 150 µs		
3.8	Short Echo Suppression	On / Off		
3.9	Thr. Lg. Dist. Echo	0 to -60 dB		
3.10	Sensitivity N	-74 to -94 dBm		
3.11	Antiecho Duration	50 to 300 µs		
3.12	Morse Code Mode	Master Code Master Trigger Slave Code Slave Trigger		
3.13	Ind. Id. Recovery	No On Signal On Sensing		
3.14	Dot Duration	100 to 160 ms		
3.15	Transmitter Switch Logic	Both Monitors must be agree / One Monitor is enough		
			Mon-I	**Mon-II**
4	**Monitor Threshold:**		Low High	Low High
4.1	Reply Delay			
4.2	Reply Efficiency			
4.3	Pulse Spacing			
4.4	Identification			
4.5	Peak Power Output			
4.6	Transmission Rate			

4.7	Transmission Frequency										
5.a	**DME Standard configuration parameters**				**Tx-I**			**Tx-II**			
5.a.1	Battery presence	YES									
5.a.2	Mains presence	YES									
5.a.3	Associated equipment	YES									
5.a.4	Dual Transponder	YES									
5.a.5	Dual Monitor	YES									
5.b	**DME Configuration Extended:**				**Tx-I**			**Tx-II**			
5.b.1	DME Type	100Wp. 1kWP									
5.b.2	Mains Power Supply	BCPS, FRANKO									
5.b.3	Monitor Cable Loss	0 to 6 dB									
5.b.4	Antenna Probe Coupling	15 to 30 dB									
5.b.5	Antenna Cable Loss	0 to 6 dB									
5.b.6	Antenna Cable Delay	0 to 1000ns									
5.b.7	Module AC/DC1 Present										
5.b.8	Module AC/DC2 Present										
5.b.9	Module AC/DC3 Present										
5.b.10	Module AC/DC4 Present										
6.0	**Monitor threshold**	Alarm Thr.	Alarm Delay	Alarm type	Mon-I			Mon-II			
6.1	Reply Delay	±0.1µs	4 Sec.	Primary							
6.2	Reply Efficiency	66%	10Sec.	Secondary							
6.3	Pulse Spacing	±0.25µs	4 Sec.	Primary							
6.4	Identification	-	2cycles	Secondary							
6.5	Peak Power Output	3.0dB	4Sec.	Primary							
6.6	Transmission Rate	80pps	10Sec	Secondary							
7.0	**Restart Delay**				Default values						
7.1	Restart Attempt	0 to 3			0						
7.2	1st Restart Delay	20 to 3600 s in steps of 1sec.			60s						
7.3	2nd Restart Delay	20 to 3600 s in steps of 1sec.			120s						
7.4	3rd Restart Delay	20 to 3600 s in steps of 1sec.			120s						
7.5	Time to reset cycle	60 to 3600 s in steps of 60sec.			240s						

Remarks:

Signature

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MAINTENANCE SCHEDULE –SIX MONTHLY

Station Name: Region: Date:

Equipment Name: DME (Thales) Make: Model No: 415/435

S.No.	Parameters to be checked	Normal status	Measured Status	Remarks
1.0	**Functional test**			
1.1	Monitor Operation	OK		
1.2	Transfer action	OK		
1.3	Shut down performance	OK		
2.0	**Operate station on batteries**	**OK**		
3.0	**Other ground checks and Maintenance**	**OK**		
4.0	**Transponder Frequency Check**			
4.1	Transponder A	fc MHz±0.001%		
4.2	Transponder B	fc MHz±0.001%		

Signature

Manager Sr. Manager Deputy Manger / AGM

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MAINTENANCE SCHEDULE –YEARLY

Station Name: Region: Date:

Equipment Name: DME (Thales) Make: Model No: 415/435

	Parameters to be checked (External Test Points)			
1.	**Power Supply PWS Module**	**Normal Status**	**TX-I**	**TX-II**
1.1	TP1	(5.1±0.1V)		
1.2	TP2	(+15±0.1V)		
1.3	TP3	(-15.1±0.1V)		
1.4	TP4	(GND)		
1.5	SW1	(Check operation to eliminate transient failure of module when red LED is lighted)		
2	**Monitor MON Module**	**Normal Status**		
	AN11	H MORCO – Identity Code		
	AN34	ADC input signals		
	AN23	A MOD- Analogue signals of the interrogation modulation		
	AN71	MEAS. SYNC.- Signal trigger on oscilloscope for BITE measurement		
	AN2	LM INT. – Star generation and acquisition signal. Trigger on oscilloscope for check executive monitoring measurements.		
	AN45	GND		
3	**RECEIVER RX MODULE**	**Normal Status**		
3.1	AN (a)	OCV analog- On Channel Validation analog signals pair pulses		
3.2	AN (b)	OCV gate- On Channel Validation trigger gate digital signals		
3.3	AN19	LOG N – Detected log signal output		
3.4	AN7	CAL – Gate during pilot pulse calibration. Signal trigger for log detected measurement on oscilloscope.		
3.5	AN18	GND		
4.	**Digital Processor DPR Module**	**Normal Status**		
4.1	AN20	SQI – Squitter pulses		
4.2	AN19	OPNSQ – Squitter reply pulses		
4.3	AN18	DAET – Dead time signal gate		
4.4	AN17	MORCO – Used to check Morse Code Identity		
4.5	AN32	LOG- Remake log Rx signal from internal digital-to –analog converter (DAC)		
4.6	AN13	OVRL- Transmission rate overload frequency (4800 Hz)		
4.7	AN56	GND		
4.8	AN16	SPINH – spacing inhibit (minimum squitter spacing)		
4.9	AN15	IDENT- Identity frequency 1350 Hz		

4.10	AN52	TRG OUT – Output trigger delay-compare comparator		
4.11	AN40	TOA N- TOA output digital trigger		
4.12	AN39	MOD ST- Modulation start		
4.13	AN5	MD- Main delay gate		
4.14	AN7	HRXINH- Gate RX Inhibit during transmitted pulse		
4.15	AN1	CAL- Calibration gate for scope trigger used to check pilot pulse signal		
4.16	AN41	SQIDBP-Squitter-Identity		
4.17	AN9	GF- gate former decoded		
4.18	AN43	GND		
4.19	AN59	NPR- DC level of presetting RX sensitivity		
4.20	AN51	THCOMP- Threshold time of arrival signal comparator		
4.21	AN50	DISCH-discharge gate TOA signal		
4.22	AN57	DISAB- disable TOA signal		
5	**Digital Modular DMD Module**	**Normal Status**		
5.1	AN24	RF-ON – Gate RF transmitter enable		
5.3	AN23	LRX INH – Gate RX Inhibit		
5.4	AN26	MOD N – Modulation pulse (Gaussian and pedestal waveforms)		
5.5	AN10	CALIB- Gate calibration of pilot pulse		
5.6	AN39	GND		
6	**Transmitter/ Driver TX Module**	**Normal Status**		
6.1	AN17	DC-DC Converter regulated voltage -100 W module (Typical values: 50V transmitter/ 40V Driver)		
6.2	AN13	V MOD Video Modulation Voltage (Gaussian and pedestal waveform)		
6.4	AN11	MOD SQR – Modulation square gate		
6.5	AN7	RF DET- Output RF detected signal		
6.6	AN21	GND		
7	**RF 1 KW Amplifier TKW Module**	**Normal Status (DME 435 only)**		
7.1	AN1	200W DC-DC regulated voltage, output value 50 V±0.5V		
7.2	AN2	Used to verify the absorption current of the final driver RF power amplifier, typical value measured between AN2 and reference point AN1 . Typical value ≤ 350 mV (conversion factor 1mV/ 1mA)		
7.3	AN3	Similar to AN2 but used to verify the current of the first power amplifier final		
7.4	AN4	Similar to AN2 but used to verify the current of the second power amplifier final		
7.5	AN5	Similar to AN2 but used to verify the current of the third power amplifier final		
7.6	AN6	Similar to AN2 but used to verify the current of the fourth power amplifier final		
7.8	AN7	Used to verify the detected RF signal output by TKW module		

7.9	AN8	GND		
8	**CSB Module Test Points**			
8.1	AN1	INTSSC0- Interrupt serial c0mm. controller- TTL level		
8.2	AN2	BT1 – backup battery-3.6 Normal , 5V full charge, 2.8 V depleted		
8.3	AN3	Frequency Xtal Q1 14745.6 kHz-pseudo-sine wave		
8.4	AN4	VBAC-RTC supply voltage 3.6 V with standard load		
8.5	AN5	BRG baud rate generator- Frequency= 7,372, 800 Hz		
8.6	AN6	WR- CPU writ		
8.7	AN7	RD- CPU read		
8.8	AN8	BATF- BT1 battery defective or depleted – Normal flag –High		
8.8	AN9	GND		
9	**AC/DC Module Test Points**	**Normal Status**		
9.1	TP+/TP-	Used to verify 54 V voltage		
9.2	V Adj	Output voltage adjustment ±1V max variation		

Normal Status may be verified from the technical manual while carrying out the measurement.

Remarks:

Signature

Manager

Sr. Manager

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PREVENTIVE MAINTENANCE SCHEDULE OF MSSR -DAILY

MAKE: INDRA **MODEL : IRS 20MP/S**

Station : **Date**

Parameters to be Checked		Normal Status	Status Observed	Remarks
1.0	General			
1.0.1	Cleanliness	Dust Free		
1.0.2	Temp	18 - 22 Deg C		
1.0.3	Equipment Cleanliness	Dust Free		
1.0.4	Obstruction Light	Working Okay		
1.1	On Line Transmitter	CTT1 or CTT2		Observations on SLG
1.1.1	Status of Online TX	G / O / R		
1.1.1.1	Status of SAU	G / O / R		
1.1.1.2	Status of SDU	G / O / R		
1.1.1.3	Status of TRA	G / O / R		
1.1.1.4	Status of EMU	G / O / R		
1.1.1.5	Status of CTU	G / O / R		
1.1.1.6	Status of TPS	G / O / R		
1.1.2	Status of Standby TX	Y/ O / R		

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1.1.2.1	Status of SAU	G / O / R		
1.1.2.2	Status of SDU	G / O / R		
1.1.2.3	Status of TRA	G / O / R		
1.1.2.4	Status of EMU	G / O / R		
1.1.2.5	Status of CTU	G / O / R		
1.1.2.6	Status of TPS	G / O / R		
1.2	Status Ant. Motor1	G / O / R		
1.3	Status Ant. Motor2	G / O / R		
1.4	On Line Extractor	MEX-MRU1 /MEX-MRU2		
1.4.1	Status of Online MEX-MRU	G / O / R		
1.4.1.1	Status of MRU	G / O / R		
1.4.1.2	Status of MCPU	G / O / R		
1.4.1.3	Status of MICA 2	G / O / R		
1.4.1.4	Status of MICA 3	G / O / R		
1.4.1.5	Status of MFEX	G / O / R		
1.4.1.6	Status of MVEX	G / O / R		
1.4.2	Status of S/By MEX-MRU	Y/ O / R		
1.4.2.1	Status of MRU	G / O / R		
1.4.2.2	Status of MCPU	G / O / R		
1.4.2.3	Status of MICA 2	G / O / R		

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1.4.2.4	Status of MICA 3	G / O / R		
1.4.2.5	Status of MFEX	G / O / R		
1.4.2.6	Status of MVEX	G / O / R		
1.5	External Signals			
1.5.1	ACP1	G / O / R		
1.5.2	ARP1	G / O / R		
1.5.3	ACP2	G / O / R		
1.5.4	ARP2	G / O / R		
1.5.5	FFM	G / O / R		
1.5.6	UTC1	G / O / R		
1.5.7	UTC2	G / O / R		
1.6	Data Output Sources			
1.6.1	Asterix 01	LAN/COM		
1.6.2	Asterix 48	LAN/COM		
1.7	Measurements			
1.7.1	SUM Channel			
1.7.1.1	Direct Power	dBm		
1.7.1.2	Reflected Power	dBm		
1.7.1.3	VSWR			

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1.7.2	OMNI Channel			
1.7.2.1	Direct Power	dBm		
1.7.2.2	Reflected Power	dBm		
1.7.2.3	VSWR			
1.7.3	Sensitivity	dBm		
1.7.4	RSLS	dBm		
1.8	Print Outs of Tabs			
1.8.1	General	Obtained		
1.8.2	Strategies	Obtained		
1.8.3	Communication	Obtained		
1.8.4	Targets	Obtained		
1.8.5	Measures	Obtained		
1.9	Change of over of the Channel	1 to 2 or Vice versa		

COMMENTS/ACTION TAKEN DETAILS:

SIGN OF UNIT INCHARGE.

NAME:
DESIGNATION:

SIGN OFCNS INCHARGE

NAME:
DESIGNATION:

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PREVENTIVE MAINTENANCE SCHEDULE OF MSSR - Monthly

MAKE: INDRA **MODEL : IRS 20MP/S**

Station : **Date :**

Parameters to be Checked		Normal Status	Status observed	Remarks
1.0	General Inspection			
1.0.1	Antenna Pedestal	1) No Oil Spillage 2) No Unusual sound 3) Fans operating Okay		
1.0.2	All earth pits	Clear of Grass/ Connections intact		
1.1	Pedestal Control Box			
1.1.1	Motor 1 oil level lamp	Not lit		
1.1.2	Motor 2 oil level lamp	Not Lit		

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1.1.2	Push Test Lamp Switch	All lamps lit		
1.1.3	Check the Fan	Operating okay		
1.1.4	Out Put of PS1	24V +/- 1 V		
1.1.5	Out Put of PS2	24V +/- 1 V		
1.1.6	Out Put of PS3	24V +/- 1 V		
1.1.7	Out Put of PS4	15V +/- 1 V		
1.1.8	Out Put of PS5	15V +/- 1 V		
1.1.9	Check Status of RV1 (AC discharges)	If Red Replace the cartridge		
1.1.10	Check Status of RV2 (AC discharges)	If Red Replace the cartridge		
1.1.11	Check Status of RV3 (AC discharges)	If Red Replace the cartridge		
1.1.12	Check all VDC dischargers	Replace if any found faulty		
1.2	Mode-S Interrogator-I			
1.2.1	TPS Voltages			
	+ 48 V	+48V +/- 5V		
	+28 V	+28V +/- 3 V		
	+ 15 V	+15V +/- 1.5 V		

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	+5 V	+5V +/-0 .5 V		
	- 15 V	-15V +/- 1.5V		
1.2.2	MEX Power Supplies			
	+ 5 V	+5V +/- 0.5V		
	+ 12 V	+12V +/- 1.2 V		
	- 12 V	-12V +/- 1.2 V		
	+ 15 V	+15V +/- 1.5 V		
	- 15 V	-15V +/- 1.5 V		
	+ 3.3 V	+3.3V +/- 0.2V		
1.3	Mode-S Interrogator-II			
1.3.1	TPS Voltages			
	+ 48 V	+48V +/- 5V		
	+28 V	+28V +/- 3 V		
	+ 15 V	+15V +/- 1.5 V		
	+5 V	+5V +/-0 .5 V		
	- 15 V	-15V +/- 1.5V		
1.3.2	MEX Power Supplies			

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	+ 5 V	+5V +/- 0.5V		
	+ 12 V	+12V +/- 1.2 V		
	- 12 V	-12V +/- 1.2 V		
	+ 15 V	+15V +/- 1.5 V		
	- 15 V	-15V +/- 1.5 V		
	+ 3.3 V	+3.3V +/- 0.2V		
1.4	Print outs			
1.4.1	Site / Tracking Tab			
1.4.2	GTC map Tab			
1.4.3	Power Tab			
1.4.4	Reflector Tab			

COMMENTS/ACTION TAKEN DETAILS:

SIGN OF UNIT INCHARGE.
NAME:
DESIGNATION:

SIGN OFCNS INCHARGE
NAME:
DESIGNATION:

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PREVENTIVE MAINTENANCE SCHEDULE OF MSSR - Six Monthly

MAKE: INDRA MODEL : IRS 20MP/S

Station : Date :

Parameters to be Checked		Normal Status	Status observed	Remarks
1.0	Monthly Maintenance	Carried out		
2.0	Frequency Checks			
2.1	Transmission Frequency Channel 1	1030 +/- .01 MHz		
2.2	Transmission Frequency Channel 2	1030 +/- 0.01 MHz		
3.0	Extractor Antenna Interface Checks: Channel 1			
3.1	Encoder 1			
3.1.1	ARP Present	Present		
3.1.2	ACP Present	Present		
3.1.3	ACP per ARP	16384		
3.2	Encoder 2			

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3.2.1	ARP Present	Present		
3.2.2	ACP Present	Present		
3.2.3	ACP per ARP	16384		
4.0	*Extractor Antenna Interface Checks: Channel 2*			
4.1.	***Encoder 1***			
4.1.1	***ARP Present***	***Present***		
4.1.2	***ACP Present***	***Present***		
4.1.3	***ACP per ARP***	***16384***		
4.2	***Encoder 2***			
4.2.1	***ARP Present***	***Present***		
4.2.2	***ACP Present***	***Present***		
4.2.3	***ACP per ARP***	***16384***		
5.0	*Reflector Map generation Channel - I*			
5.1	***Reflector Generation***	***Generated***		
5.2	***Add the selected Reflectors***	***Added***		
5.3	***Manual reflectors***	***Add if needed***		

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6.0	Reflector Map generation Channel - II			
6.1	Reflector Generation	Reflector Generation		
6.2	Add the selected Reflectors	Added		
6.3	Manual reflectors	Add if needed		
7.0	Monopulse Curve Generation Channel - I			
7.1	Generate the Curve	Generated		
7.2	Compare with main Map	Identical		
8.0	Monopulse Curve Generation Channel - II			
8.1	Generate the Curve	Generated		
8.2	Compare with main Map	Identical		

COMMENTS/ACTION TAKEN DETAILS:

SIGN OF UNIT INCHARGE.
NAME:
DESIGNATION:

SIGN OFCNS INCHARGE
NAME:
DESIGNATION:

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PREVENTIVE MAINTENANCE SCHEDULE OF MSSR – Annually

MAKE: INDRA **MODEL : IRS 20MP/S**

Station : **Date :**

Parameters to be Checked		Normal Status	Status observed	Remarks
1.0	Monthly Maintenance	Carried out		
2.0	Six Monthly Maintenance	Carried out		
3.0	Pedestal Checks			
3.1	Bearing Ring greasing	Carried out		
3.2	Check oil level in motor / gear box	Level OK		
3.3	Check Pedestal fan	OK		
3.4	Check heater	OK		
3.5	Check Date of Last Labyrinth Greasing	If more than 2 years Grease		
3.6	Check Date of Last Mechanical AITS Greasing	If more than 2 years Grease		
3.7	Check Date of Motor/Gear Box Oil Change/Greasing	If more than 2 years Change oil/Grease the bearings		

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3.8	Check condition of Fans	Replace if required		
3.9	Check condition of pedestal seals	Replace if required		
4.0	Check Receiver Raw Video Output			
4.1	Channel – I			
4.1.1	Video Present at TP-23 VS-MRU	Present		
4.1.2	Video Present at TP-12 VO-MRU	Present		
4.1.3	Video Present at TP-6 VD-MRU	Present		
4.2	Channel - II			
4.2.1	Video Present at TP-23 VS-MRU	Present		
4.2.2	Video Present at TP-12 VO-MRU	Present		
4.2.3	Video Present at TP-6 VD-MRU	Present		
5.0	Measure Receiver Nominal Frequency			
5.1	Channel - I			
5.1.1	Sum	1090 +/- 0.5 MHz		
5.1.2	Omni	1090 +/- 0.5 MHz		
5.1.3	Difference	1090 +/- 0.5 MHz		
5.2	Channel - II			
5.2.1	Sum	1090 +/- 0.5 MHz		
5.2.2	Omni	1090 +/- 0.5 MHz		
5.2.3	Difference	1090 +/- 0.5 MHz		
6.0	Measure the Receiver Bandwidth			
6.1	Channel – I			
6.1.1	SUM			
6.1.1.1	At 3 dB			
6.1.1.2	At 40 dB	>/= 2.5 times at 3 dB		

6.1.1.3	At 60 dB	>/= 4.5 times at 3 dB		
6.1.2	OMNI			
6.1.2.1	At 3 dB	> 8 MHz		
6.1.2.2	At 40 dB	>/= 2.5 times at 3 dB		
6.1.2.3	At 60 dB	>/= 4.5 times at 3 dB		
6.1.3	DIFFERENCE			
6.1.3.1	At 3 dB	> 8 MHz		
6.1.3.2	At 40 dB	>/= 2.5 times at 3 dB		
6.1.3.3	At 60 dB	>/= 4.5 times at 3 dB		
6.2	Channel – II			
6.2.1	SUM			
6.2.1.1	At 3 dB	> 8 MHz		
6.2.1.2	At 40 dB	>/= 2.5 times at 3 dB		
6.2.1.3	At 60 dB	>/= 4.5 times at 3 dB		
6.2.2	OMNI			
6.2.2.1	At 3 dB	> 8 MHz		
6.2.2.2	At 40 dB	>/= 2.5 times at 3 dB		
6.2.2.3	At 60 dB	>/= 4.5 times at 3 dB		
6.2.3	DIFFERENCE			
6.2.3.1	At 3 dB	> 8 MHz		
6.2.3.2	At 40 dB	>/= 2.5 times at 3 dB		
6.2.3.3	At 60 dB	>/= 4.5 times at 3 dB		
7.0	Measure the Receiver Dynamic Range			
7.1	Channel - I			
7.1.1	Plot for SUM	Graph Plotted		
7.1.2	Plot for OMNI	Graph Plotted		
7.1.3	Plot for DIFFERENCE	Graph Plotted		
7.2	Channel - II			
7.2.1	Plot for SUM	Graph Plotted		
7.2.2	Plot for OMNI	Graph Plotted		
7.2.3	Plot for	Graph Plotted		

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	DIFFERENCE			
8.0	Measure Receiver Tangential Sensitivity			
8.1	Channel - I			
8.1.1	SUM	< -87 dBm		
8.1.2	OMNI	< -87 dBm		
8.1.3	DIFFERENCE	< -87 dBm		
8.2	Channel - II			
8.2.1	SUM	< -87 dBm		
8.2.2	OMNI	< -87 dBm		
8.2.3	DIFFERENCE	< -87 dBm		
9.0	Measure Receiver Out of Band Rejection			
9.1	1090 + 25 MHz			
9.1.1	Channel - I			
9.1.1.1	SUM	>/= 60 dB		
9.1.1.2	OMNI	>/= 60 dB		
9.1.1.3	DIFFERENCE	>/= 60 dB		
9.1.2	Channel – II			
9.1.2.1	SUM	>/= 60 dB		
9.1.2.2	OMNI	>/= 60 dB		
9.1.2.3	DIFFERENCE	>/= 60 dB		
9.2	1090 – 25 MHz			
9.2.1	Channel - I			
9.2.1.1	SUM	>/= 60 dB		
9.2.1.2	OMNI	>/= 60 dB		
9.2.1.3	DIFFERENCE	>/= 60 dB		
9.2.2	Channel - II			
9.2.2.1	SUM	>/= 60 dB		
9.2.2.2	OMNI	>/= 60 dB		
9.2.2.3	DIFFERENCE	>/= 60 dB		

COMMENTS/ACTION TAKEN DETAILS:

SIGN OF UNIT INCHARGE.
NAME:
DESIGNATION:

SIGN OFCNS INCHARGE
NAME:
DESIGNATION:

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Safe Operation

System efficiency and reliability can be improved by adopting systematic maintenance methods. It serves to enhance the life of equipments, so that they continue to function with optimum efficiency and reliability.

PERFORMANCE CHECKS

Normally the daily/weekly maintenance schedules give a very good information about the status of equipment/module in operation. In most cases this data is available at the test jacks
Check manual/automatic shut down and restart.
Voltage and current checks.

Voltages and currents are checked to verify that transmitters and associated equipment are operating properly. Low voltage readings can cause premature failures as well as changes in transmitter operational parameters i.e. frequency and power output. Higher than normal voltage can also cause rapid equipment failures. High current readings indicate areas that require immediate action.

I. Check Changeover of system Main to Standby & Vice Versa.
II. Verify monitor alarm points. Monitor alarm points are set initially during installation. This check is to verify that the initial alarm limits have not changed.
III. Measure and record all modulation percentages and observe the shape of side band and carrier waveforms.
IV. Check field monitor levels.
V. Measure and record system operating frequency.
VI. Check RF amplifier output power and gain.
VII. Measure and record antenna feed cable VSWR
VIII. Perform check and calibration of built in test equipment
IX. Transmission line insulation resistance.

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PREVENTIVE MAINTENANCE

There are many preventive steps taken at regular intervals to avoid any deterioration in performance of a system. The first step in such maintenance is inspection of the equipment in cold condition i.e. in Power OFF condition. The main aspects of inspection are:

1. Building condition, protection from roof leakage and build up of dirt, moisture, insects etc.
2. Cleanliness of equipment.
3. Electrical Connections (Cables & plug in modules)
4. Mechanical joints and linkages including switches.
5. Wiring condition, frayed, broken or damaged wiring.
6. Corrosion, broken or burnt parts.
7. Improper lubrication of moving parts

If anything is found amiss, suitable corrective action is to be taken.

CORRECTIVE MAINTENANCE

Since we are working with electrical and electronic equipments, it is possible that breakdown may take place, either due to ageing of the equipment or failure of some critical component. In this event the maintenance procedures being employed are known as Corrective maintenance or Breakdown maintenance.

Corrective maintenance of system is carried out as per the troubleshooting guide provided with the Technical manual of the Equipment.

TROUBLE SHOOTING

A generalized Troubleshooting procedure to locate and correct a fault is as under:

1. Check for signs of excessive heat.
2. Check that all IC chips are firmly placed; there should be no bent pins.
3. Check the flexible ribbon cable connectors especially at the points of fold.
4. Check the power. Carry out Cold check, if satisfactory carry out hot check also:
    a. Measure the power supply voltages and verify that they are within specifications.
    b. Using an oscilloscope verify that the power supply output are ripple- free.

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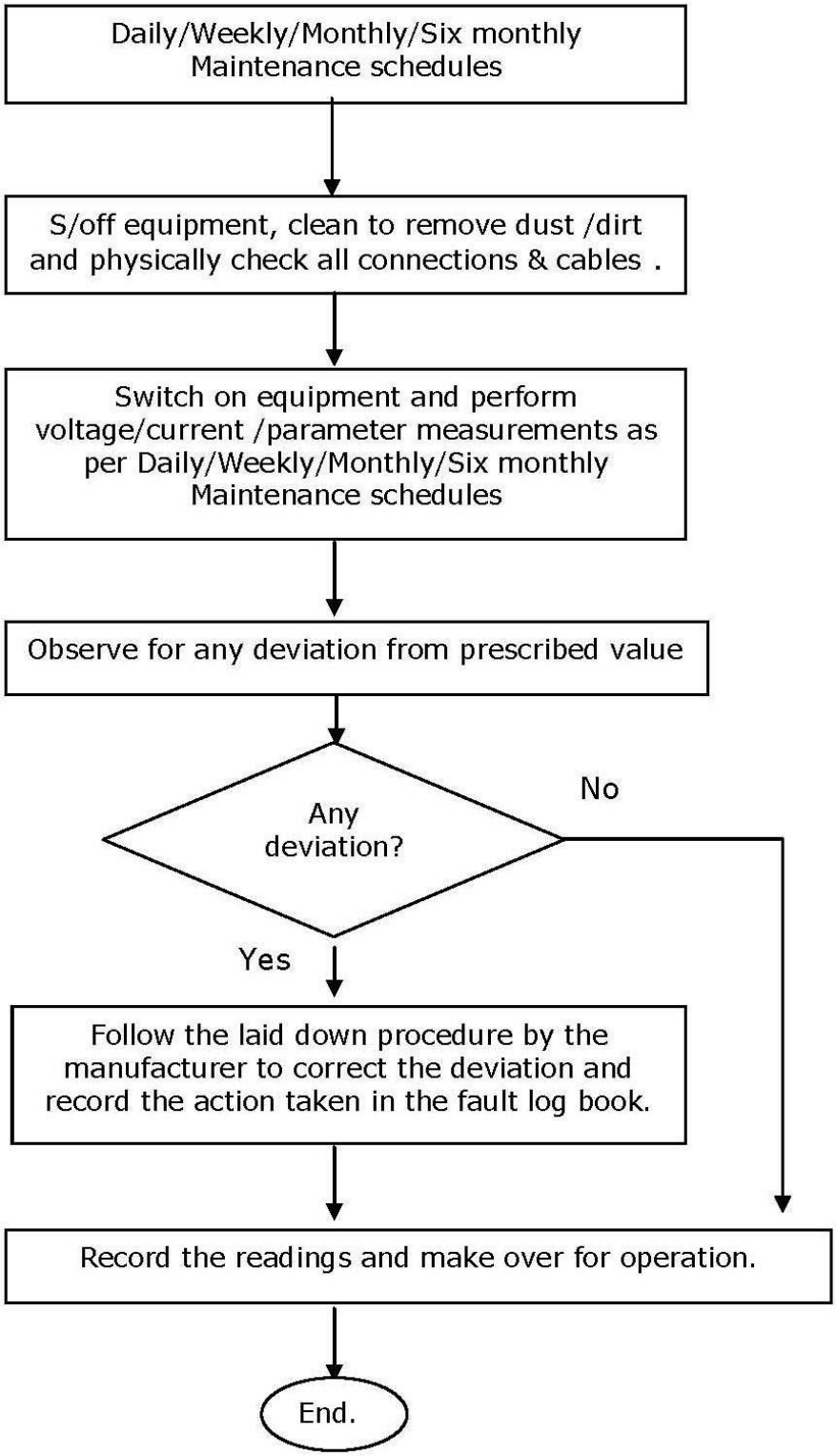
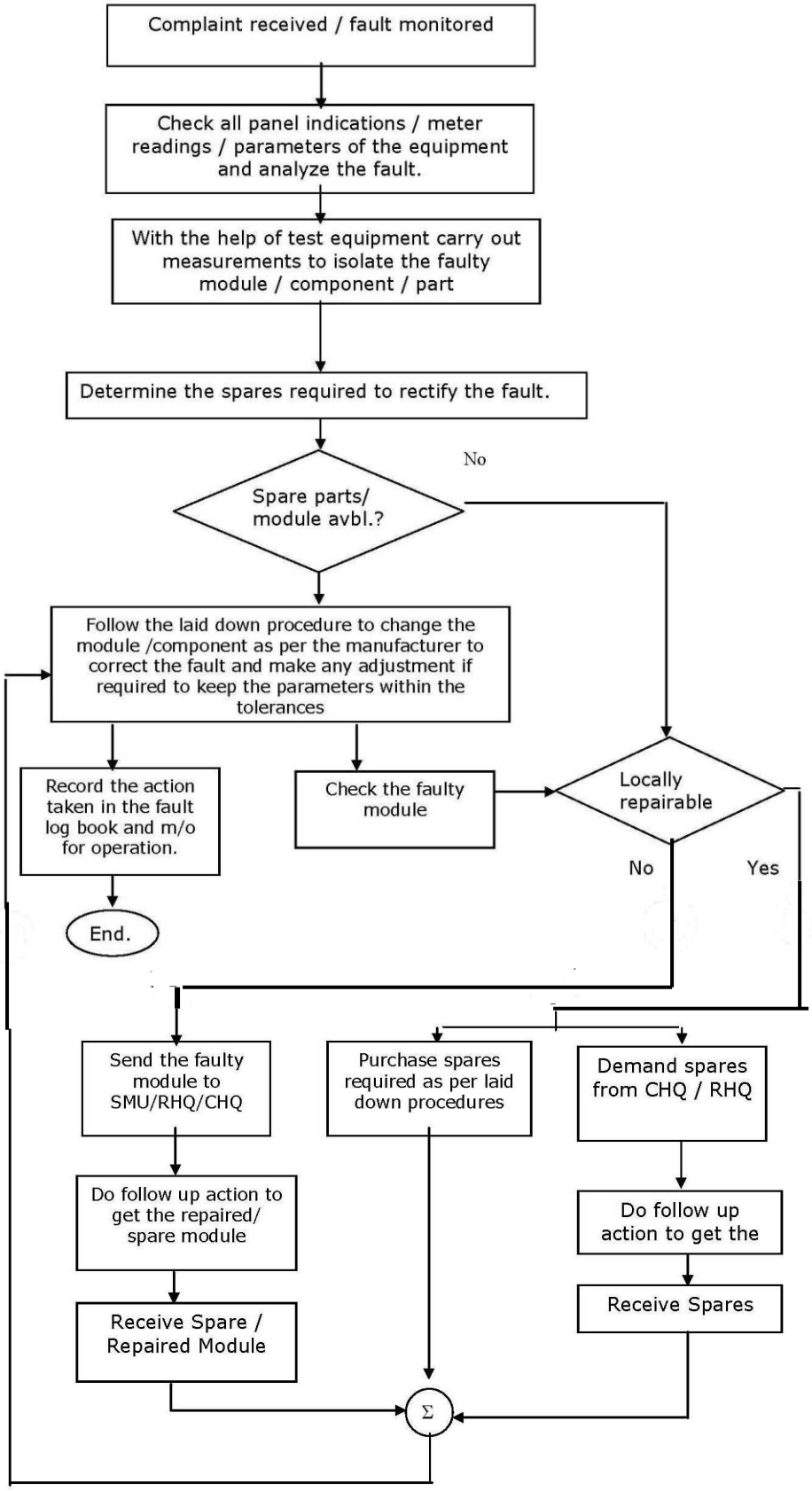
PREVENTIVE MAINTENANCE FLOWCHART



CORRECTIVE MAINTENANCE FLOWCHART



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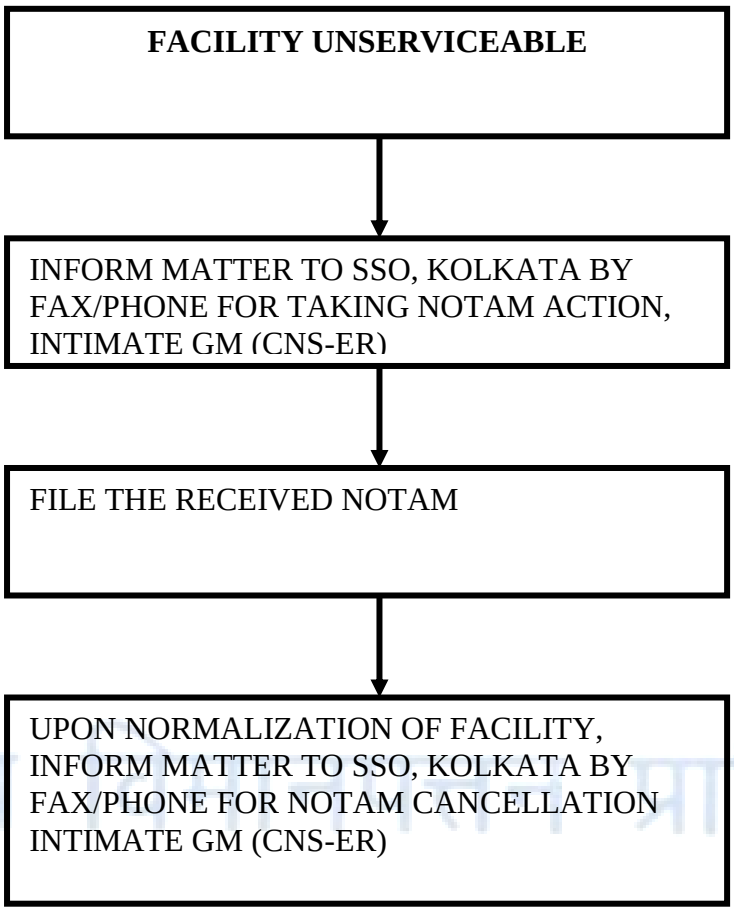
PROCESS FOR TAKING NOTAM ACTION AND NOTAM CANCELLATION



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MAINTENANCE OF FACILITIES

- Executing prescribed preventive maintenance schedules, i.e. daily, weekly, monthly, quarterly and half yearly, as applicable. The unit in charge also makes necessary entries in the records.
- Monitoring system performance with the help of various test equipments and carrying out necessary adjustments in various parameters as and when required.
- Attending the fault in case of breakdown.
- Ensuring proper environmental conditions at equipment room where the facilities are installed. These conditions include room temperature, dust free environment and humidity.
- Coordinating with Civil/ Electrical AMC for maintaining proper environmental conditions in equipment room.
- Maintenance of PC and accessories belonging to AAI, installed at Office-cum-TX. Station complex.

RECORD SYSTEM OF DME

1. Preventive Maintenance Schedule – Daily
2. Preventive Maintenance Schedule – Weekly
3. Preventive Maintenance Schedule – Monthly
4. Preventive Maintenance Schedule – Six Monthly
5. Preventive Maintenance Schedule – Yearly
6. Log book
7. Fault log book

RECORD SYSTEM OF DVOR

1. Preventive Maintenance Schedule – Daily
2. Preventive Maintenance Schedule – Weekly
3. Preventive Maintenance Schedule – Monthly
4. Preventive Maintenance Schedule – Quarterly
5. Preventive Maintenance Schedule – Yearly
6. Log book

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7. Fault log book

RECORD SYSTEM OF MSSR

1. Preventive Maintenance Schedule – Daily
2. Preventive Maintenance Schedule – Monthly
3. Preventive Maintenance Schedule – Six Monthly
4. Preventive Maintenance Schedule – Yearly
5. Log book
6. Fault log book

RECORD SYSTEM OF RCAG

*RCAG facility with Kolkata area control (120.1 MHz) is operational on test basis on OFC and DSCN medium and is in the final stage of commissioning.

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AVAILABILITY OF DOCUMENTS AT THE STATION

Standards:

The stations shall keep those documents that are necessary as basic references for the CNS services and functions.

Technical manuals of RCAG/ VHF TX/RX (T6T, T6R)/DVOR/DME and MSSR are available with the station. Manual for DSCN Linkway, Memotec and Out Door Unit (ODU) are not available at the station. Also, technical manuals of test equipments are available.

The documents that shall be required are:

- CNS Manual
- ICAO Annex 10 Vol. I & III : Available at the station.
- ICAO Annex 10 Vol. IV : Not available at the station.
- *DOC 8071* Vol. I & III : Available at the station.
- *DOC 8400, DOC 7169, DOC 8259* : Not available at the station.
- *DOC 9684, DOC 9688, DOC 9705* : Not available at the station.
- AERADIO : Available
- Civil Aviation Requirement in respect of CNS facilities as notified by DGCA : Not available at the station.
- Other required documents which may be station and service specific.

Station CNS manual containing the following:-

1) **Human Resource:** (Describing Name, Designation, wing and proficiency, if applicable).
2) **Technical description:** Giving details of the following:
    a. The kind and location of each facility.
    b. The technical specification of each kind of facility.
    c. How each facility interconnects with any other facility or service?
    d. The way in which the service provider monitors each facility to ensure that it is operating in accordance with its technical specifications.
3) **Safe Operation:** describing the following:
    a. The procedure to be used to monitor the performance of each Service and facility, and to compare the results with the appropriate technical specification.

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b. The procedure to be used if a service fails or a facility fault occurs, including the way in which the failure or fault is to be reported and rectified.
c. The procedure to be used to report and rectify any defects found during operation and maintenance of the facility.
d. The procedure to be used to detect and correct any latent defects in equipment.

4) **Facility operation and maintenance plan**: Describing for each kind of facility, an operation and maintenance plan that includes the following:
   a. The procedures for maintenance, including the procedures used for repair;
   b. A description of the system used in schedule maintenance;
   c. A copy of the operating and maintenance instructions for the facility;
5) **Interruption to service:** describing the following:
   a. The procedure to be used if an Aeronautical Communication or Radio Navigation or Surveillance service is interrupted.
   b. Specify an acceptable recovery time for each service.
   c. The procedure to be used if the acceptable recovery time of a service is exceeded.

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SERVICEABLE TEST EQUIPMENTS WITH CALIBRATION STATUS

1. DIGITAL OSCILOSCOPE

MAKE	: APLAB
MODEL	: 3305SA
TYPE	: 20MHz DUAL TRACE OSCILOSCOPE
YEAR OF PURCHASE	: May'2006
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

2. OSCILOSCOPE

MAKE	: Tektronix
MODEL	: TDS220
YEAR OF PURCHASE	: Received from ACS Jamshedpur Dt. 27/04/11
CALIBRATION STATUS	: Last Calibrated on 20/04/2011

3. DIGITAL MULTIMETER

MAKE	: HIL
MODEL	: HIL2605
Date of Receipt	: 17.05.1989
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

4. DIGITAL MULTIMETER

MAKE	: MASTECH
MODEL	: MS8220T
Date of Receipt	: 17.11.2006
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

5. DIGITAL MULTIMETER

MAKE	: MASTECH
MODEL	: MY-63
Date of Receipt	: Received from ACS Jamshedpur Dt. 27/04/11
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

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6. MEGGER

MAKE	: CHICAGO RADIO
MODEL	: 250V
Date of Receipt	: 13.04.1964
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

7. PEAK POWER METER

MAKE	: ANRITSU
MODEL	: ML2488B
Date of Receipt	: 15.12.2012
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

8. SPECTRUM ANALYZER

MAKE	: ANRITSU
MODEL	: MS2511E
Date of Receipt	: 15.12.2012
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

8. FREQUENCY COUNTER

MAKE	: BK Precision
MODEL	: 1856C
Date of Receipt	: Received from ACS Ranchi Dt. 2011
CALIBRATION STATUS	: Last Calibrated on 12/04/2010

8. SPECTRUM ANALYZER

MAKE	: Coaxial Dynamics
MODEL	: 81000-A
Date of Receipt	: Received from ACS Jamshedpur Dt. 27/04/11
CALIBRATION STATUS	: TO BE CARRIED OUT ANNUALLY

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SPARES

RCAG

Transmitter/ Receivers

1. T6T(Park Air) - 01 No. with its antenna and cable
2. T6R(Park Air) - 01 No. with its antenna and cable

DSCN

1. MEMOTEC MUX CX-800 - 01 No.(Without E&M Card)

DVOR & DME

No Spares Available

MSSR

No Spares Available

25 KVA DG SET

All operating DG sets are under AMC for the purpose of O&M.

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CNS CIRCULARS OF 2012

Airports Authority of India
Directorate of CNS -OM

Maintenance and Calibration of Test Equipments

CNS Circular 01 of 2012

Sub: Maintenance and Calibration of Test Equipments used for Operation and Maintenance of CNS/ATM Automation and other associated Facilities.

1. INTRODUCTION

1.1 DGCA, CIVIL AVIATION REQUIREMENT (CAR) SECTION 9 – AIR SPACE AND AIR TRAFFIC MANAGEMENT SERIES 'D', PART I ISSUE II – "Requirements of Maintenance/ inspection of Communication, Navigation, Landing and other equipment installed at Airports and en-route" lays down the requirements of maintenance/inspection of Communications, Navigation, Landing and other equipments installed at airports/en route stations and used for aircraft operations.

1.2 As per above CAR Para 3.3, "Calibration of Test Equipment" Quote " the operator shall ensure that all the test equipment used for maintenance and periodical checks of the facilities are kept properly calibrated and certified by recognized standards institutions". Unquote

1.3 These test equipments indicate the performance of the various aspects of CNS/ATM Automation Facilities, other associated instruments and equipments. They are also used for inspection, fault analysis, preventive and corrective maintenance of the facility. Any inaccuracy in test equipment may result in incorrect operation of the facility. It is, therefore, necessary that such test equipments and their accessories are checked and calibrated at regular intervals for their correct functioning and indication. For this purpose, the test equipments and their accessories require regular maintenance and calibration against Primary Standards at Laboratories or with the help of test equipments which are expected to be accurate and error free during their use.

2. Maintenance of Test Equipments

2.1 The proper functioning of test equipments is vital because functioning of CNS/ATM Automation Facilities and other associated equipments depends on the serviceability and the accuracy of the test equipments. The test equipments, therefore, should be maintained in accordance with the recommendations of the manufacturers given in the Manuals. A proper maintenance schedule as per manufacturer guidelines should be framed so that the test equipment is subjected to proper inspection and servicing at regular intervals.

2.2 The interval of maintenance schedule may also be based on the frequency of the use. The test equipments which are not frequently used may require different maintenance schedules and checks compared to the test equipments which are frequently used. Accordingly, the maintenance schedules may be based on either the calendar period or the hours of operation depending on the amount of work (use).

2.3 It shall be the responsibility of concerned Unit in Charge and Station CNS in charge to ensure that only duly serviced/calibrated test equipment in accordance with manufacturer recommendation and as per provision of Para 3.4 is deployed for maintenance and operation of facilities. This shall be documented in Station CNS Manual.

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3. Calibration of the Test Equipments

3.1 Why Calibrate?

Calibration ensures the accuracy of the measuring and test equipments which are used for operation and maintenance of Communication, Navigation, Surveillance, ATM Automation and other associated Facilities. Calibration minimises measurement errors and uncertainties to acceptable levels. For calibration of measuring and test equipments, acceptable levels of uncertainty are defined by the tolerance limits of the equipment's parameters established by the manufacturer. The outcome is maintenance of the equipment within the defined accuracy of the manufacturer's design tolerances.

3.2 Calibration :-

Apart from maintenance, test equipments have to be calibrated with reference to the primary standards. Such primary standards are generally available with the National laboratories or the approved test houses established by the various scientific departments of Government of India/ State Governments or other organisations. A list of such laboratories at various places within country, both Government and other organisations, which are approved by National Accreditation Board for Testing and Laboratories (NABL), Department Science and Technology, Government of India is available at Web site "www.nabl-org". Correspondence address of NABL is " 3rd Floor, NISCAIR, 14, Satsang Vihar Marg, New Mehrauli Road – New Delhi 110067.

3.3 Calibration Procedure:-Test equipments should be always calibrated at a NABL accredited laboratory. However, for some general purpose test equipments calibration, similar test equipment, which has been already calibrated at a NABL accredited laboratory, may be used as a secondary standard for calibration. Following procedure may be followed by field stations for Calibration of Test Equipment(s):-

3.3.1 Calibration Against Primary Standards:- Following Test equipments shall be calibrated against primary Standards at a NABL accredited laboratory:-
(i)Test equipments which may not be required for day to day use like Signal & Spectrum Analyser, Vector Voltmeters, Radio communication Test Set etc.;
(ii)Special purpose test equipment like Portable ILS Receivers(PIR)/ILS FTS); and (iii)All the test equipments which are used at Speciliased Maintenance Units (SMU), RCDU and FIU.

3.3.2 Calibration Against Secondary Standards:- General purpose Test Equipments required for day to day work like Digital Mumlitmeter, Oscilloscopes, Frequency counters, Wattmeter's, Power Meters etc can be calibrated in house at Regional /Station level against Secondary Standards. Guidelines in this regard are enclosed at Annex –I.

3.4 Periodicity of Calibration: Test equipments are required to be calibrated at the interval as specified or recommended by the manufacturer. If no periodicity is specified or recommended by manufacturer the test equipment shall be calibrated at least once in a year.

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3.5 Special Calibration of Test Equipment:-

Besides periodic calibration of test equipment as mentioned in Para 3.3 above, there may be need for special calibration of a test equipment. Generally, special calibration may be required to be performed at the following occasions:-

(i)Unless, it comes with a calibration certificate, after initial purchase of the test equipment and prior to putting it into regular use;
(ii)After a test equipment has undergone major repairs;
(iii) Whenever accuracy of test equipment is in doubt; and
(iv) If required by Regulatory Authority during any accident/incident or any other investigation.

3.6 Out of Tolerance Action:-

3.6.1 Out of Tolerance Action may occur when a Test Equipment or its accessory (s) as a result of a scheduled calibration check is found to be out of tolerance. An out of tolerance calibration result provides a warning that facility(s) whose maintenance and operations was carried out or undertaken based on the use of a particular test equipment, which has shown out of tolerance result during calibration, are potentially non-compliant with the required specification.

3.6.2 A risk analysis, therefore, needs to be carried out to determine the extent, of any remedial action that may be required for facilities that are affected by test equipment showing out of tolerance calibration results. An out of tolerance action should include a review of all work carried out using the out of tolerance equipment and maintaining a record of any re-work, retesting or alignment required or carried out .

3.7 Calibration certification:-

3.7.1 The calibration laboratory should provide a calibration report in respect of individual test equipment for all work carried out by them during calibration. This calibration report should invariably include:-

(i) Name and address of Calibration Laboratory;
(ii) NABL registration number ;
(iii) Unique identification of report;
(iv) Description of test equipment or its accessory being calibrated;
(v) Identification of specific method;
(vi) Results of measurement including correction charts and tables, if any;
(vii) A statement of measurement uncertainties achieved and any limitations of detection that apply;
(viii) Printed details, signature and title of an authorised member of the laboratory that accepts responsibility for the report and the testing work upon which it was based;
(ix) Means of traceability of the measurement results to the National Standard including identification of the test equipment; and
(x) Environmental conditions under which the calibration was performed.

3.7.2 Whenever, any test equipment has been calibrated against secondary standards as provided in Para 3.3.2 above, the calibration report shall also indicate above parameters including that of secondary test equipment against which it has been calibrated.

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3.8 Record keeping:-

A proper record should be maintained of the calibration done and also the next calibration due in respect of all the test equipments available at a station. All the test equipment shall display a proper calibration tag, which will show description of test equipment, date of calibration and next due date of calibration. A format for record which shall be kept at stations is enclosed as Annex –II. These records shall be also part of Station CNS Manual.

4. Validation of Built in Test Equipment (BITE) or Software of Computers used as Test Equipment

Built in Test Equipment (BITE) or Software of Computers used as Test Equipment in various CNS equipments or ATM Automation facilities, which will give results identical to the values given in specifications of equipment being tested shall be periodically checked and tested as per manufacture recommendations. BITE or SELF test accuracy should also be clearly indicated and procedure be documented in the maintenance schedule of the facility.

5. Arrangement with NABL accredited laboratories for test equipment calibration requirement:-

5.1 Normally Field stations are getting their test equipments calibration done at ERTL or other government affiliated calibration laboratories. However, it is observed that there are delays some times in the calibration process at government affiliated calibration laboratories, which invites adverse observations from regulatory authority during their surveillance inspection of CNS/ATM facilities at field stations. Hence, stations for their test equipment calibration requirements, where ever possible, may like to enter into any suitable arrangements with any NABL accredited laboratory by following suitable procedures like NIQ or any other suitable Codal procedures. A list of such laboratories at various places within country, both Government and other organisations, which are approved by National Accreditation Board for Testing and Laboratories (NABL), Department Science and Technology, Government of India is available at Web site "www.nabl-org".

5.2 Test equipment calibration being a regular and mandatory requirement, action has been initiated to set up an in house NABL accredited Test equipment calibration laboratory at Hyderabad. Till such time in house infrastructure is made available, above guidelines are to be followed by field stations for calibration of test equipments.

[Ravi Prakash]
Executive Director [CNS-OM]

References:-

1. DGCA, CIVIL AVIATION REQUIREMENT (CAR) SECTION 9 – AIR SPACE AND AIR TRAFFIC MANAGEMENT SERIES 'D', PART I ISSUE II – "Requirements of Maintenance/ inspection of Communication, Navigation, Landing and other equipment installed at Airports and en-route"
2. DGCA CIVIL AVIATION REQUIREMENT (CAR) SECTION 2 – AIRWORTHINESS SERIES 'I' PART III ISSUE I,DATED 24TH APRIL '1992 – "Maintenance of Test Equipments"

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Airports Authority of India

Directorate of CNS -OM

Annex-I
Maintenance and Calibration
of
Test Equipments

Sub: Guidelines regarding Test Equipments which can be used as Secondary Standard for calibrating other similar test equipments

1. The following guidelines can be used to allow a test equipment to be used as secondary standard for calibrating other similar test equipments:-

(i) Test equipments to be used as Secondary Standard for other similar test equipments should meet following requirements:-

(a) It should be used for secondary calibration only.

(b) It should not have undergone any major maintenance in previous one year.

(c) It should not have any previous history of out of tolerance action.

(d) It should have been calibrated at specified interval at any of the NABL accredited laboratories for at least two times continuously without any deviation.

(ii) The secondary calibration process should be done in a controlled environment.

(iii) Whenever any reasonable doubt/uncertainty is there about accuracy of a test equipment during secondary calibration process, it shall be always calibrated against Primary Standards only.

(iv) All the test equipments used in Speciliased Maintenance Unit(SMU), RCDU and FIU are to be calibrated against primary standards only.

(v) In a Region one or two stations may be identified where Test equipments can be calibrated against secondary standards to meet the requirements of other stations. At these stations, laboratory where test equipments can be calibrated against primary standards should be available. Already established SMUs in regions may also be considered for creating suitable infrastructure in this regard.

2. Test equipments which can be calibrated against secondary standards at field stations are given below:-

3.

S. NO	Test Equipment	Remarks
1	Multimeter	Digital/Analogue
2	Oscilloscope	Digital/Analogue/Storage/trace etc
3	Earth Tester	Digital /Analogue
4	Frequency counter	
5	Thru Line wattmeter	With different elements
6	Power Meter	Directional
7	RF Power Meter	
8	Meggar	
9	Insulation Tester	
10	Variable DC Power Supply	
11	RF Wattmeter	Digital/Analogue
12	Cell tester	
13	Voltmeter	

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Airports Authority of India

Annex-II

Maintenance and Calibration of Test Equipments

Directorate of CNS -OM

Test Equipment Record at Stations

Name of Station ..... Region .....

S. NO	Test Equipment	Description of Test Equipment	Manufacturer	Received from	Date of Receipt	Initially calibrated on	Schedule Date of Calibration

Next Date of Calibration	Last Calibrated at (Name of Laboratory)	Calibrated against primary or secondary standard	Unit(s) in which used	Any deviation observed during previous calibration(s)	Any major maintenance carried out since receipt at Station	Remarks

Note :- Any other record, if required, may also be included.

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***CNS CIRCULAR 02 OF 2012 N/A**

CNS CIRCULAR 03/2012

Alternate means for provision of information on the operational status of Radio Navigation Aids

March, 2012

भारतीय विमानपत्तन प्राधिकरण

Airports Authority of India

संचार, दिक्चालन एव्म निगरानी-प्रचालन एवं अनुरक्षण निदेशालय

Directorate of CNS-OM

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CNS Circular 03 of 2012

Sub: Alternate means for provision of information on the operational status of radio navigation aids

1. INTRODUCTION

1.1 DGCA, CIVIL AVIATION REQUIREMENT (CAR) SECTION 9 – AIR SPACE AND AIR TRAFFIC MANAGEMENT SERIES 'D', PART II ISSUE II Dated 08th January 2010– "Aeronautical Telecommunication –Radio Navigation Aids" lays down the requirements to be followed in respect of provision of Aeronautical Telecommunications – Radio Navigation Aids.

1.2 As per above CAR, Para 2.3.1 – "Provision of information on the operational status of radio navigation aids" shall be made in following manner:-

"Aerodrome control towers and units providing approach control service shall be provided without delay with information on the operational status of radio navigation aids essential for approach, landing and take-off at the aerodrome(s) with which they are concerned."

1.3 Further, as per Para 3.3.7 – "VOR Monitoring" and Para 3.5.4.7.2 – DME Monitoring " following is stated:-

"Where it is not possible to provide status indication to a control point, the same shall be published in AIP."

1.4 Accordingly, Radio Navigational aids are provided with Remote Status Units (RSUs) as part of equipment accessory. These RSU provides information on the operational status of radio navigation aids to the ATC.

1.5 However, for some of the Navigational Aids, provision of Remote status has not been possible due to various limitations/constraints. Further, in some cases operational status of Radio Navigational aids at the intended ATC Units may not be available temporarily for limited duration due to faulty Remote Status Unit or Remote Control Cable cutting etc.

2. Purpose of the Circular:-

The purpose of this circular is to provide guidance for providing Operational status of radio navigation aids by alternate means due to non availability of Remote Status of the facility.

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3. Alternate means for Provision of Operational status of radio navigation aids:

Whenever remote operational status of Radio Navigational Aids could not be provided by means of RSU, following alternate action is required to be taken by all concerned :-

(i) Navigational aids shall be suitably manned by maintenance personnel during flight operations.
(ii) The maintenance personnel manning the Nav-aid shall be provided with suitable means of communication so as intimate any changes in operational status of facility to the ATC.
(iii) Where it is not possible to provide status indication to a control point, permanently in case of VOR/DME, action is also required to be taken as per CAR Para 3.3.7 – "VOR Monitoring" and Para 3.5.4.7.2 – DME Monitoring" as mentioned above.

5. As per the existing instructions, the RHQs shall continue to send the information on the non availability of Remote status of Navigational Aids and Action Taken Report to restore the same in the form NS122A to CHQ.

[Ravi Prakash]
Executive Director [CNS-OM]

References:-
1.DGCA, CIVIL AVIATION REQUIREMENT (CAR) SECTION 9 – AIR SPACE AND AIR TRAFFIC MANAGEMENT SERIES 'D', PART II ISSUE II Dated 08th January 2010 – "Aeronautical Telecommunication –Radio Navigation Aids".

CNS CIRCULAR No. 04/2012

Empanelment of OJT Instructors

September 2012

भारतीय विमानपत्तन प्राधिकरण

Airports Authority of India

संचार, दिक्चालन एव्म निगरानी-प्रचालन एवं अनुरक्षण निदेशालय

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CNS Circular 04 of 2012

Sub: Selection, Duties & Responsibilities of On the Job Training (OJT) Instructors in CNS Discipline

1. INTRODUCTION

1.1 DGCA, CIVIL AVIATION REQUIREMENT (CAR) SECTION 9 – AIR SPACE AND AIR TRAFFIC MANAGEMENT SERIES 'D', PART I ISSUE II Dated 08th January 2010– "Requirements of Maintenance/Inspection of Communication, Navigation, Landing and other equipment installed at Airports and en-route" lays down the requirements of maintenance/inspection of Communications, Navigation, Landing and other equipments installed at airports/en route stations and used for aircraft operations.

1.2 As per above CAR Para 3.6, "All personnel entrusted with the maintenance/checks of a facility should have undergone necessary training. They should undergo periodical on the-job checks at least once in a year and refresher course at least once in three years."

1.3 In compliance with above CAR, Suitable training courses are being organised at Vendor's Premises (Factory Training), CATC, RTC and other training Centres under the aegis of CATC/RTC for the operation and maintenance of CNS /ATM Automation systems available and operational in the department. Further, a CNS proficiency scheme has also been promulgated for making available deployment of proficient personnel on the operation and maintenance of various operational CNS and ATM Automation systems.

2. Purpose:- This CNS circular lays down the criteria/procedure for empanelment of OJT instructors for CNS/ATM Automation systems/equipments and their duties and responsibilities. These OJT instructors shall work as "Check instructors" to monitor and check performance of the CNS personnel engaged in the maintenance and operation of CNS/ATM automation systems so as to maintain the required level of competency and proficiency in the maintenance and operation of CNS/ATM automation systems in compliance of above CAR and CNS proficiency scheme. They will also provide refresher training and other trainings being imparted at Regional Training Centres / other Training Centres under the control and guidance of CATC.

3. Applicability

This CNS circular is applicable to all the CNS personnel engaged in the operation and maintenance of CNS/ATM Automation systems/equipments.

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4. Definitions

(i) Refresher training: Training designed to review, reinforce or upgrade existing Knowledge and skills.

(ii) Conversion/revalidation training: Training designed to provide knowledge and skills appropriate to a change in job category (new discipline or new system/equipment proficiency), environment (new maintenance or other procedures) or system (system upgrade or change of system/equipment, new project).

(iii) On Job Training: The integration in practice of previously acquired job-related routines and skills under the supervision of a qualified person in a working environment.

Note: The term 'On-Site Training (OST)' is preferred to 'On-the-Job Training (OJT) in systems operation and maintenance training. *Because,* training is mainly on-site based, but for safety reasons it is not always possible for the personnel to be trained on systems which are in current operational use. *Further, in technical maintenance and operation activities, training cannot be systematically imparted with "live traffic situation" as is the case in most of the OJT activities.*

***(iv)* On Job Training Instructor (OJTI)**: A term used to describe an instructor whose role depends on instructional objectives and the instructional problem to be resolved. This role can be lecturing, reviewing, guiding and consulting.

5. General Requirement for empanelment of OJT instructors (OJTI)

5.1 Selection Criterion:-

5.1.1 GM (CNS)/CNS in Charge of the station, from amongst the CNS personnel in the grade of Manager, Sr. Manager, Dy.GM and Jt.GM shall prepare a panel (to be submitted along with Form at Annex-A) for selection of OJT instructors based on the following criteria:-

(i) Have undergone required ab-initio course prescribed for CNS personnel at CATC/RTC.

(ii) Have current Proficiency on the relevant CNS/ATM Automation system/equipment for which he/she is being considered for empanelment as an OJTI.

(iii) Have at least 5 years experience in Operation and maintenance of CNS/ATM Automation facilities at field stations/SMU or system/equipment installation and flight calibration experience at RCDU/FIU.

(iv) Should have an impeccable record during the preceding two years and should not have failed in any proficiency assessment during last two years.

(v) Should have expressed the willingness in writing to perform instructional duties to train the CNS personnel.

5.1.2 While recommending the CNS executives who fulfils above criterion for empanelment as an OJTI, the CNS in charge shall take into account that officer:-

(i) Has a proven track record of working confidently in the maintenance of the systems during degradation, breakdown etc.
(ii) Has an aptitude for imparting training and counselling.

5.2 Selection Process:

(i) Directorate of CNS-OM at CHQ will constitute a Board to conduct a viva-voce examination and to make final selection amongst the panel of CNS officers as drawn above.

(ii) The Board for conducting the viva-voce and assessment for Mumbai/Kolkata/Delhi/Chennai/Hyderabad/Bangalore Airport will comprise the following officers:-

(a) ED (CNS-OM) or his nominee	: Chairman
(b) GM(CNS) of Airport	: Member
(c) Jt.GM/DGM of respective unit	:Member

Note: In case the nominee of ED(CNS-OM) is GM/Jt.GM/DGM then the Senior most officer shall be the Chairman of the Board.

(iii) The Board for conducting the viva voce and assessment for other Airports/ACS will comprise the following officers:-

(a) ED (CNS-OM) or his nominee	: Chairman
(b) GM(CNS) Region	: Member
(c) Jt.GM/DGM (CNS) of Airport or RTC/Region	:Member

Note: In case the nominee of ED (CNS-OM) is GM/Jt.GM/DGM then the Senior most officer shall be the Chairman of the Board.

(iv)In exceptional circumstances, ED (CNS-OM) may constitute the Board consisting of members other than mentioned in Para 5.2 (ii) and 5.2(iii) above.

(v) After the Viva-voce examination "Evaluation proforma for Selection of CNS OJTI" i.e. Form Annex-B is to be filled and forwarded to CHQ CNS-OM Directorate along with the appropriate Comments/Recommendations of the Board.

(vi) It shall be the responsibility of the DGM/Jt.GM RTC to process for OJTI empanelment in the Region. In Case of NER, GM (CNS) NER will be responsible for processing for OJTI empanelment.

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6. Responsibility of OJTI:-

(i) The OJT instructors shall work as a Key Human Resource and will be identified as Key Person for training, operation and maintenance on the particular system/equipment.

(ii) OJTI will be considered as first point of contact and will be required to give suitable guidance/ advice to maintenance personnel at the field stations in early restoration of the equipment/systems in case of breakdown.

(iii) Their services will be shared by RTCs and CATC on need basis and will be deputed to meet any specific requirement of the CATC/RTC Training programme.

(iv) They may be required to prepare, update and review the courseware(s) for Proficiency and Refresher/Revalidation training related to their System/equipment.

(v) They may be required to prepare, update and review the preventive maintenance schedules related to the system/equipment.

(vi) They may be required to contribute towards updating of the question bank with CATC / RTCs.

(vii) They may be nominated as examiners for practical / viva examinations at RTCs / CATC.

(viii) They will be required to undertake OJT on individual / group basis on the particular system/equipment as per operational requirement; and

(ix) Any other responsibility prescribed/delegated by competent authority.

7. Privileges of OJTI :-

The privileges of the OJTI shall be as given below:-

(i) OJTI shall work as check instructors also and will be authorised to conduct on the job checks to monitor and check performance of the CNS personnel engaged in the maintenance and operation of facilities so as to maintain the required level of their competence and proficiency in the maintenance and operation of particular CNS/ATM automation systems in compliance of above DGCA CAR and CNS proficiency scheme;

(ii) They will be authorised to conduct proficiency revalidation of personnel on the particular system/equipment as per CNS proficiency scheme;

(iii) They will be authorised to draw OJT instructor allowance as circulated vide CHQ HR Dept letter no. A 60011/81/2011/PP/Pt-1 Dated 18th April 2012 – "Revision of CATC and OJT instructor allowance" and as amended from time to time. Necessary Orders to this effect shall be issued by concerned RTC in Charge/GM (CNS) NER only after completion of approval process in all respect from CHQ.

8. Withdrawal and restoration of OJTI

8.1 Withdrawal:-

ED (CNS-OM) may withdraw the authorisation of OJTI at any time:-

(i) If the performance of the OJTI is reported to be unsatisfactory based on trainees feedback and recommendation of GM (CNS) in charge of Airport /Region;
(ii) If the concerned OJTI is involved in any incident/accident;
(iii) If his proficiency is withdrawn or is de-rostered from duty as per the advice of enquiry officer/regulatory authority;
(iv) Refusal without any reasonable ground by OJT instructor to render services after his/her approval as OJT instructor;
(v) In case an OJTI has not taken any OJT job/instructional duty in the past one year his/her OJTI privilege will be withdrawn automatically and
(vi) Any other reason which may be at the behest of regulatory authority or other competent authority.

Note:- OJT instructor allowance shall be ceased to be drawn from the first day of the concerned month of such withdrawal.

8.2 Restoration:-

8.2.1 OJT Instructorship of an individual may be restored at the discretion of ED[CNS-OM] CHQ , if:-

(i) In case of involvement in any incident/accident, after the submission of report on the incident/accident by the inquiry officer/regulatory authority and no fault is attributed to the concerned OJTI.
(ii) In other cases after the recommendation of Regional empanelment committee and approval by ED (CNS-OM) at CHQ.

8.2.2 If any fault/deficiency is attributed to the concerned OJTI by the enquiry officer/regulatory authority, he/she may be considered for OJTI only after a period of two years from the date of restoration of his proficiency.

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9. Validity

(i) The authorization for empanelment of OJTIs on specific system/equipment shall be initially valid initially for a period of 2 years.
(ii) Authorisation may be renewed for the next two years at the station of deployment only after assessment by a board constituted by ED [CNS-OM].
(iii) GM(CNS) of Station/Region shall taken into account the following points before recommending the names of OJTI for renewal of the OJTI instructorship:-

(a) The performance of the OJT Instructor during the preceding one year.
(b) Interest and initiative taken shown by the OJTI in imparting training.
(c) Total number of CNS personnel trained during the preceding one year.

(iv) The names of the OJT Instructors whose performance during the preceding year is not found satisfactory, shall not be recommended for the renewal and such cases be intimated to CHQ in writing.

10. OJTI Record Maintenance:-

10.1 It shall be the responsibility of the concerned RTC in charge/GM (CNS) NER to maintain record (As per Form Annex-C) of all OJTI under their control in respect of:-
(i) OJT undertaken by OJTI;
(ii) Instructional duty undertaken by OJTI for regular proficiency linked course or refresher course on the particular system/equipment at CATC/RTC;
(iii) On the Job checks carried out;
(iv) Proficiency revalidation carried out and
(v) Any other record prescribed by competent authority.

10.2 The record shall be forwarded to GM(CNS) CATC Yearly basis with a copy to CHQ.

11. For any clarification/comments matter may please be referred to CHQ.

[Ravi Prakash]
Executive Director [CNS-OM]

Reference:-
DGCA, CIVIL AVIATION REQUIREMENT (CAR) SECTION 9 – AIR SPACE AND AIR TRAFFIC MANAGEMENT SERIES 'D', PART I ISSUE II Dated 08th January 2010 – "Requirements of Maintenance/Inspection of Communication, Navigation, Landing and other equipment installed at Airports and en-route"

Encl:-

(i)	OJTI Application Proforma-	Form Annex-A
(ii)	OJTI Evaluation Proforma-	Form Annex-B
(iii)	OJTI Record Maintenance Proforma-	Form Annex-C

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Form Annex-A

OJTI Application Proforma

(To be filled in by candidate while applying for selection of OJTI)

Part –A : To be filled by Individual executive:-

S. No	Description	Details	Remarks
1	Name of Applicant:-		
2	CNS No.		
3	Designation:-		
4	Station:-		
5	Region		
6	Unit:-		
7	Date of Birth		
8	Educational Qualification		
9	Date of Joining Service/Promoted as executive		
10	Name of Equipment/System on which applying as OJTI		
11	Details of Training undergone		Verified/Not Verified
12	Proficiency(s) Held:-		Verified/Not Verified
13	Whether previously posted at CATC. If yes, mention period	Yes/No	Verified/Not verified
14	Whether involved with any incident/accident. If yes, short brief	Yes/No	Verified/Not verified
15	Whether taken classes as an instructor previously in any course at CATC/RTC. If Yes, Details	Yes/No	Verified/Not verified
16	Preparation of any CNS related documents viz., SOPs, Manuals etc. If yes, Give Details.	Yes/NO	Verified/Not verified
17	Signature of applicant		

Part- B (for official use)

1. **Column 11 to 16 Verified Yes/No**
2. **Remarks of RTC in Charge**

(Signature of RTC In charge)
Name/Desig

3. **Remarks of GM(CNS)**

Forwarded/not forwarded to CHQ

(Signature)

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Form Annex-B

OJTI Evaluation Proforma
(To be filled in by Board)

S. No	Description	Details		Remarks
1	Station:-			
2	Region			
3	Unit:-			
4	Date of Assessment			
5	Name of OJTI:-			
6	CNS No.			
7	Designation:-			
8	Details of Training undergone			Verified/Not Verified
9	Proficiency(s) Held:-			Verified/Not Verified
10	Name of Equipment/System for which being assessed as OJTI			
11	Holds Proficiency on the Equipment/ System for which being assessed as OJTI	Yes	No	
12	Meets the Training and experience requirements for OJTI	Yes	No	
13	Knowledge Check (Oral/Written)	Competent	Not Competent	Knowledge of standards & Maintenance Procedures on the system/Equipt.
14	Practical Competency Check	Competent	Not Competent	
15	Aptitude for imparting training and counselling	Satisfactory	Not Satisfactory	
16	Efforts made to update information available in concerned Unit	Satisfactory	Not Satisfactory	
17	Comments of the Chairman of Evaluation Board			
18	Conclusion	Recommended	Not recommended	
19	Signatures of Member (s) of Board			
20	Signature of Chairman of Board			

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Form Annex-C

OJTI Record Maintenance Proforma

(To be filled in by RTC/GM(CNS) NER and forwarded to GM(CNS) CATC)

Record Period:-

S. No	Description	Details	Comments
1	Station:-		
2	Region		
3	Unit:-		
4	Year:-		
5	Name of OJTI:-		
6	Designation:-		
7	Proficiency Held:-		
8	Details of Training undergone during the period		
9	Details of Instructional duty undertaken by OJTI during the period		
10	Details of OJT undertaken by individual OJTI during the period		
11	Details of Proficiency revalidation carried out during the period		
12	Details of On the Job checks carried out during the period		
13	Any other details to be added		
14	OJTI Signature		
15	Signature of RTC In charge/CNS in charge		
16	Signature of GM(CNS)		

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CNS CIRCULAR 05/2012

Provision of Fire Detection and Fire alarm system in CNS Facilities

November, 2012

भारतीय विमानपत्तन प्राधिकरण

Airports Authority of India

संचार, दिक्चालन एव्म निगरानी-प्रचालन एवं अनुरक्षण निदेशालय

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-2/22-

भारतीय विमानपतन प्राधिकरण

Provision of Fire Detection and Alarm system in CNS facilities.

CNS Circular 05 of 2012

File Reference No:- AAI/NS/DGCA Audit/206/11-Pt(II)

Sub: Provision of Fire Detection and Alarm Systems in CNS Facilities.

1. While carrying out Safety audit of CNS facilities at airports, DGCA has observed that there is no provision of Fire Detection and alarm system in many CNS units particularly at unmanned sites. Fire incidents in safety critical CNS facilities, besides, leading to non availability of facilities like ILS etc for operation also damages PCBs of the facility which sometimes may lead into a situation of facility/PCB becoming BER (Beyond Economical Repair).

2. Some of Field stations while submitting Action Taken Report (ATR) on the observations have stated that guidelines are not available for provision of Fire Detection and alarm system in CNS facilities.

3. It is brought into notice that following guidelines have been issued in this regard for implementation by all concerned:-

(i) CHQ Engineering Department, Technical Circular Reference no AAI/NAD/CHQ/ENGG(E)/TC/2009 Dated 09/02/2009 for provision of Fire prevention Methods in ILS & unmanned CNS facilities.

(ii) CHQ Fire Department Fire Order -05/2010 - FIRE PREVENTION AND PROTECION [Terminal Building, ATS, CNS installation Building, Cargo and Aircraft Hanger]

4. It is reiterated that suitable action may please be taken for provision of Fire Detection and alarm system in CNS Facilities as per above guidelines, wherever, same is not provided.

[Ravi Prakash]
Executive Director [CNS-OM]

Encl.

(i) CHQ Engineering Department, Technical Circular reference no AAI/NAD/CHQ/ENGG(E)/TC/2009 Dated 09/02/2009; and

(ii) CHQ Fire Department Fire Order -05/2010 - FIRE PREVENTION AND PROTECION.

Page 2/2 November 2012

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-3/22-

AIRPORTS AUTHORITY OF INDIA
CHQ, RAJIV GANDHI BHAWAN
ENGINEERING WING

Ref:- AAI/NAD/CHQ/ENGG(E)/TC/2009 Dt.09/02/2009

TECHNICAL CIRCULAR

Sub:-Fire Prevention Methods in ILS & Unmanned CNS Facilities.

In the recent past damages to NAV-AIDS equipment due to fire incident the equipmen
room of localizer building were reported. Fire incident not only led to no a lability of vita
ILS services at the airport but also damaged electronic circuit boards f the localize
equipment.

Investigations revealed that fire incident occurred due to short circuit in one the indoor AC
unit installed in the equipment room causing heat and heavy smoke th consequen
accumulation of carbon deposit in the room and on the LLZ equipment.

To avoid recurrence of such fire incidents following guidelines and pr sions shall be
implement at the earliest:

A Measures to be taken for existing system:

(i) The split Air-conditioners of NAV-AIDS units shall be provided v separate auto
trip overload & short-circuit protections for the motor of indoor u . in case these
protections are not available. Also the grills, power cables etc. all be painted
with fire retardant paint.

(ii) The AC units shall not run continuously for more than 6 hrs here shall be
provision of timers to interchange the operation of main & stand b C units.

(iii) All NAV-AIDS units shall have fire detection & alarm systen hich shall be
provided with **auto dialer facility** and this shall be interconnec with existing
intercom of NAV-AIDS unit, so that in case of fire, preset num s e.g. control
tower, fire station and equipment room shall be alerted automatica

(iv) Also the materials of wall paneling, ceiling, flooring etc. of NAV-/ S building to
be painted with fire retardant paint.

B Measures to be taken for all the systems to be provided in futu

(i) In future, wherever the new NAV-AIDS Buildings are planned tl uctable split
air-conditioners along with automatic fire dampers shall be prov d. Wherever
due to site constraints ductable split air-conditioners as mentione ove are not
feasible (e.g. replacement of split air-conditioners) the split air-con ners having
indoor unit made of fire retardant material along with in built ove d and short-
circuit protection specially for motor of indoor unit shall be provid from market

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survey it is observed that the LG make [model no. LSK1862CI((1.5 TR), LSK2462CIG (2TR)] and Carrier make split air-conditioners mani icture fire retardant indoor unit are available which are also on DGS & D rate cor act.

(ii) Also the materials of wall paneling, ceiling, flooring etc. of NAV-AID building to be provided with non-flammable materials.

It is reiterated that selection of MCBs/MCCBs, cables, fire detection sys m shall be appropriate & the maintenance schedule issued for the air-conditioners d electrical installations shall be followed meticulously.

(S. Baheti) 09/04

Executive D ector (Engg)

Distribution: - As per list enclosed.

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सुरक्षा महित सेवा

AIRPORTS AUTHORITY OF INDIA

FIRE ORDER – 05

[Year of Revision: 2010]

सुरक्षा सहित सेवा

AFS

भारतीय विमानपत्तन प्राधिकरण

FIRE PREVENTION & PROTECTION

[Terminal Building, ATS, CNS Installation Building, Cargo & Aircraft Hanger]

1

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1. FOREWORD:

1.1 Airport terminal building, ATS/CNS installation building and Airport Hanger are classified under Business-cum-Assembly and storage & hazardous based on the classification of building and hence are required to comply with proper fire prevention and fire protection, confirming to high hazard occupancy as per National Building Code (NBC) and also as per National Fire Protection Association (NFPA)/Bureau of Indian Standard (BIS).

During the current decade, most of our airfields have come under municipal limits hereby obligation of local authorities have become binding on our part which envisages safety of occupants and avoidance of fire risks to equipments and surroundings, failing which a building and other installation can be declared unsafe for occupancy.

1.2 Airport Fire Service have also become binding on safety of occupants and avoidance of fire risks to equipments,. building and vital installation, hence the design of fire protection and fighting system from planning stage to installation work to be approved from Directorate of Fire Service and also testing of fire prevention and protection equipment and stage wise inspection to be carried out by this Directorate.

1.3 Insurance of building and valuable equipments has been found one of the ideal ways to minimize the risk of loss by such eventualities and to reduce the premium of insurance, it is mandatory to have proper fire protection cover.

1.5 While the direct losses can be safeguarded by way of insurance, the indirect losses which are normally in multiples of direct losses can be reduced only if proper fire protection is provided as it is always easy to knock-down fire at initial stage than wait for fire brigade.

1.6 Besides above in view of increasing fire incidents in Terminal buildings, Technical /ATS buildings and other vital installations the nature of fire likely to be encountered in this type of multifunctional occupancy and ongoing public awareness, it is imperative to evolve a suitable yardstick and standard of fire protection.

1.7 Since all airfields have almost identical unit with identical surface areas and functions barring a few, it was felt necessary to evolve a uniform scale of fire prevention and fire protection.

1.8 Building fire protection systems have been categorised into Active measures and Passive measures. Active measures involved the control of smoke spread, detection and alarm that informs the occurrence of a fire and triggers sort of counteraction towards fire extinguishment and Passive measures are concerned with building structure integrity, compartmentation. Passive fire protection measures are proactive approach taken at building design stage.

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1.9 Housekeeping or maintenance of orderly cleanliness is a basic factor in fire safety. Good housekeeping practices, both indoors and outdoors, by disposal of unwanted combustibles, limitation or segregation of combustibles, reduce the danger of fire.

2. SCOPE:

2.1 This order gives the guidelines of fire prevention and protection at Terminal building, Technical building, CNS installation building and Aircraft hangar.

2.2 Categorization of Airport Building based on occupancy, equipment, storage and hazardous.

2.3 Site planning and Building Design and Construction based on Fire Safety Point as per National Building Code of India, National Fire Protection Association, Bureau of Indian Standard (BIS).

3. CATEGORIZATION OF BUILDING:

3.1 Categorization of Airport Terminal Building:-

3.1.1 **Major:** - Airfield operational category 7 to 9 with passenger facilities more than 500.

3.1.2 **Intermediate:** - Airfield operational category 5 to 6 with passenger facilities more than 200 but less than 500.

3.1.3 **Small:** - Airfield operational Category 3 to 4 with passenger facilities more than 100 but less than 200.

3.2 Categorization of ATS Building:-

3.2.1 High rise building: - Above 15 meter in height

3.2.2 Low rise building: - Less than 15 meter in height.

3.3 Categorization of CNS Installation:-

3.3.1 **Major:** -Building with area more than 365 sq meters and sub divided in 6 or more compartments/rooms.

3.3.2 **Intermediate:** -Building with area more than 150 sq meters and less than 365 sq meter area and divided in 3 to 5 compartments.

3.3.3 **Small:** -Building with less than 150 square meters within one or two compartments.

3.4 Categorization of Aircraft Hanger:-

3.4.1 **Group 1: - [**group of hangers having at least one criteria]:

3.4.1.1 An aircraft access door height over 8.5m

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3.4.1.2 An undivided area within the hanger which could be subject to loss by a single fire because of the lack of sub division (single fire area) larger than 3715 sq meter.

3.4.1.3 Provision for housing an aircraft with a tail height over 8.5 meters.

3.4.2 **Group 2:- [**group of hangers having both of the following criteria]:

3.4.2.1 An aircraft access door height of 8.5 meter

3.4.2.2 A single fire area which may vary from 465 sq meters upwards but may not be larger than 3715 sq meter

3.4.3 **Group 3**:- [group of hangers having:]

3.4.3.1 A hanger having an access door height of 8.5 meter or less.

3.4.3.2 A single fire area varying from 465 sq meters up to 2790 sq meter.

3.5 Categorization of Cargo Building:-

3.5.1 **Single occupancy cargo building**:

A single occupancy cargo building is one that accommodates a single user and may involve export, import or a combination of both.

3.5.2 **Multiple occupancy cargo building**:

A multiple occupancy cargo building is accommodates a number of users.

4. SITE PLANNING OF AIRPORT BUILDING FOR FIRE SAFETY:

Decisions need to be made early in the design or planning process for a new Airport building to provide an effective and safe design from a fire safety point. Consideration need to be given to both Active and Passive Fire Protection.

4.1 Traffic and Transportation Patterns:-

Response time for fire tender and other emergency vehicle is a vital consideration in designing a building or site. All roads, thoroughfares and traffic congestion patterns should be reviewed and considered for new site projects so that emergency vehicles have limited response time and distance.

4.2 Fire Service Access:-

Fire apparatus/equipments are a major consideration in new construction. The fire service personnel must be able to get hose lines to all portions of the building. Buildings may require that Fire Tender, Rescue Tender, Hydraulic Platform access roads need to be wide enough to support the equipment used by the fire service. They also need to be able to support the weight of Fire Tender/Rescue Tender/ Hydraulic Platform. Access roads are needed

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for emergency uses are designated as fire lanes and vehicle parking is prohibited.

4.3 **Fire fighting water suppliers:-**

The lack of water supply severely hampers fire fighting operations. Adequate quantity of Water supply for different category of Airport building shall be maintained in static/ underground tanks as per National Building Code / National Fire Protection Association to be available for fire service to fight a fire in a building.

5. TYPE OF BUILDING CONSTRUCTION:

The constructions of building are divided into three basic types.

Type	Construction
Type I	Fire Resistive construction
Type II	Complete non combustible construction i.e. element of structure, floor and wall
Type III	Traditional Ordinary construction i.e. non combustible walls with combustible floors
Type IV	Structural members which are portion of walls are of approved non-combustible or limited combustibles material.
Type V	Structural members which are wholly or partially of wood or other approved combustible material.

5.1 Approval of non-combustible or limited combustible materials with sufficient fire resistive relating to withstand the effect of fire and prevent its spread should be as per National Building Code/NFPA.

5.2 Other type of construction has also been used for consideration wherever applicable to meet the local climate conditions with latest fire protection system as per National Building Code/ National Fire Protection Association.

5.3 Materials used for construction shall conform to the specifications issued by Bureau of Indian Standards specification/ International standards.

6. STRUCTURAL FIRE PROTECTION:

The priority of Structural Fire Protection is to carry out search & rescue operation without the building collapsing and prevent disproportionate damage to property.

6.1 Structural fire protection shall be achieved by controlling spread of fire & smoke by compartmenting, stability of structure exposed to a fire during the escape period and preventing building materials due to expose from high temperature.

6.2 If fire protection systems are to be disrupted, ensure procedures are incorporated to maintain equivalent levels of fire protection and provide formal notification to the facility while systems are down.

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6.3 Hydrant system design installation to comply with NFPA/ NBC Standards.

6.4 In new construction the fire pump must be in a separate room from other mechanical and electrical equipment. Pump room shall be normally located detached in the compound of the building and shall be preferably 6 meters away from the building. Where this is not feasible, the pump room can be located inside the building provided it is segregated from the remainder of the building in accordance with regulations and access to the pump room outside of the building shall be either direct or through a passage which has opening to pump room.

6.5 Fire main pumps shall start automatically below jockey pump start pressure. Pumps shall be manually shut down. Main and diesel fire pump of such capacity to be provided to support 3 to 4 hydrants at a time.

6.6 Provide jockey pumps to supply not less than 3.0 liter per second. The jockey pump should have DG back –up. Jockey pump shall maintain pressure as required to prevent the fire pump from operating to maintain system pressure.

7. MEANS OF ESCAPE:

All buildings should be designed such that occupant could escape to the place of ultimate safety this should be in the open air where dispersal, away from the building, can be achieved when fire occurs and to ensure that the routes are:-

7.1 Adequate number and dimensions of escape routes/emergency exists should be provided.

7.2 Travel distance should be limited & acceptable and walking speed under normal conditions within crowded area is between 0.7m/s and 0.9m/s. Where escape is possible in more than one direction , direct travel distance shall not be exceed 30 meters to place of safety with a minimum angle between exit routes of 45 degree. The maximum escape time should be 2 min.30 secs. with a total evacuation time of 15 minutes.
Escape routes should be protected from fire & smoke.

7.3 Fire exits plans will be conspicuously posted on each floor showing clearly the routes to appropriate exits. Direction toward exits from interstitial spaces. Provide emergency lighting for adequate egress illumination in the event of a power outrage.

7.4 Signage with relevant wording in English, Hindi and local language.

7.5 Free, non- obstructed.

7.6 Smoke Control System.

7.7 Protected from automatic sprinkler system.

8. EXIT DESIGN:-

The exit design should be as per National Building Code and NFPA.

8.1 An exit may be a doorway, corridor, passageway(S) to an internal staircase or external staircase or to a verandah or terrace(s), which have access to the street or to the roof of a building or a refuge area. An exit may also include a horizontal exit leading to an adjoining building at the same level.

8.2 Lifts and escalators shall not be considered as exits.

8.3 Every exit, exit access or exit discharge shall be continuously maintained free of all obstructions or impediments to full use in the case of fire or other emergency.

8.4 No building shall be so altered as to reduce the number, width or protection of exits to less than that required.

8.5 Exits shall be clearly visible and the route to reach the exits shall be clearly marked and signs posted to guide the occupants of the floor concerned. Signs shall be illuminated and wired to an independent electrical circuit on an alternative source of supply. The sizes and colours of the exit signs shall be in accordance with good practice. The colour of the exit signs shall be green.

8.6 Fire doors with 2 hr fire resistance shall be provided at appropriate places along the escape route and particularly at the entrance to lift lobby and stair well where a 'funnel or flue effect' may be created inducing an upward spread of fire to prevent spread of fire and smoke.

8.7 All exits shall provide continuous means of egress to the exterior of a building or to an exterior open space leading to a street.

8.8 Exits shall be so arranged that they may be reached without passing through another occupied unit.

8.9 The travel distance to an exit from the dead end of a corridor shall not exceed half the distance specified in following table except in assembly and institutional occupancies in which case it shall not exceed 6m.

8.10 Exits shall be so located that the travel distance on the floor shall not exceed the distance given in table

Travel Distance for Occupancy and Type of Construction

Sr.No	Group of occupancy	Maximum Travel Distance Construction	
		Type 1 & 2 (m)	Type 3 & 4 (m)
i	Residential (A)	30	22.5
Ii	Educational (B)	30	22.5
iii	Institutional (C)	30	22.5
iv	Assembly (D)	30	30
V	Business (E)	30	30
Vi	Mercantile (F)	303	30
Vii	Industrial (G)	45	1)
Viii	Storage (H)	30	1)
ix	Hazardous (J)	22.5	1)

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Notes:

1. For fully sprinklered building, the travel distance may be increased by 50 percent of the values specified.
2. Ramps shall be protected with automatic sprinkler system and shall be counted as one of the means of escape.

1) Construction of type 3 or 4 is not permitted.

8.10 No exit doorway shall be less than 1000 mm in width except assembly building where door width shall be not less than 2000 mm in height.

8.11 Emergency / Fire Exit doorways preferably shall open outwards, that is away from the room but shall not obstruct the travel along any exit. No door, when opened shall reduce the required width of stairway or landing to less than 900 mm; overhead or sliding doors shall not be installed.

8.12 Exit door shall not open immediately upon a flight of stairs a landing equal to at least the width of the door shall be provided in the stairway at each doorway; the level of landing shall be the same at that of the floor which it serves.

8.13 Exit doorways shall be openable from the side which they serve without the use of a key.

8.14 Mirrors shall not be placed in exit ways or exit doors to avoid confusion regarding the direction of exit.

8.15 A staircase shall not be arranged round a lift shaft.

8.16 Hollow combustible construction shall not be permitted.

8.17 No gas piping or electrical panels shall be allowed in the stairway. Ducting in stairway may be permitted if it is of 1 hr fire resistance rating.

8.18 The minimum width of tread without nosing shall be 250 mm for internal staircase of residential buildings. This shall be 300 mm for assembly, hotels, educational, institutional, business and other buildings. The treads shall be constructed and maintained in a manner to prevent slipping.

8.19 External stairs shall have straight flight not less than 1250 mm wide with 250 mm treads and risers not more than 190 mm. The number of risers shall be limited to 15 per flight.

8.20 Handrails shall be of a height not less than 1000 mm and not exceeding 1200 mm. There shall be provisions of balusters with maximum gap of 150 mm.

8.21 All occupants exposed to the fire environment must be able to evacuate to a safe area within 90 seconds of alarm.

8.22 Alternative route leading to a protected escape route should be provided.

8.23 Travel distance of exits and their location must be such that the occupants of the building can safely escape without being overcome by the effects of fire.

8.24 Phase construction as necessary to ensure blocking of exits is minimized or avoided. If exits are blocked during construction provide alternate exit routes during each phase of construction and identify them on the construction drawings.

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9. COMPARTMENTATION:

Fire compartments should be included in building design to limit fire and smoke spread so that people have longer time to escape.

9.1 Factors affecting the level of compartmentation:-

9.1.1 Occupancy load

9.1.2 Building type or purpose

9.1.3 Fire load

9.1.4 Height of building

9.1.5 Active fire protection system

9.1.6 Burning characteristics of materials

9.2 Compartment Sizes shall be depends on the fire load, purpose of the building and building height

9.3 Construction Requirement:-

9.3.1 Compartment walls, floors, separations and lobbies should be constructed such that all joints are completely fitted with non- combustible materials to prevent the passage of smoke or flame.

9.3.2 The load bearing capacity of the compartment element should be ability to carry the load without collapsing.

9.3.3 The integrity of the element should have ability to resist the development of cracks or perfections to allow passage of smoke and flame from one side to the other side of the element.

9.3.4 The insulation should have ability to prevent heat transfer from one face to the other face of the element.

9.3.5 In false ceiling, only fire retardant (e.g. metallic) materials should be used. Wherever inflammable false ceilings, including frame work, the planning and design of adequate/ appropriate replacement should be commenced forthwith.

9.3.6 False ceiling should be compartmentalized to the possible extent as per fire zoning of the building.

9.3.7 Where physical compartmentation is not possible (example like watch tower, adjustant building, etc.) consideration may be given to installation of automatic water curtains (drencher system) or pressurization system for achieving the objective of compartmentation.

10. SMOKE MANAGEMENT SYSTEM:

The primary objective of smoke management system is to reduce the hazard due to smoke by control of its movement.

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10.1 Factors that effect the smoke movement:-

10.1.1 Low rise building: In low rise buildings, the influences of the fire, such as heat, convective movement and fire pressures are the major factors that cause smoke movement.

10.1.2 High rise buildings: In high rise buildings, the same factors are complicated by the stack effect, which is the vertical neutral air movement through the building caused by the differences in temperatures and densities between the inside and outside air.

The stack effect is influenced by the effect of wind pressure which modifies the natural air movement within a building to shift up & down the building.

10.2 Smoke Control:-

10.2.1 Pressurization of staircases.

10.2.2 Effect of Pressure difference across barrier

10.2.3 Single injection system

10.2.4 Multiple injection system

10.2.5 Smoke logged system

10.2.6 Passive and Active smoke extraction system The National Building Code has specified the smoke control system.

11. VENTILATION SYSTEM:

Ventilation is an essential part of the tactical and strategic objective of modern fire extinguishment.

11.1 Ventilation requirement:-

11.1.1 For respiration of occupants

11.1.2 To dilute inside air to prevent vitiation by body odours.

11.1.3 To remove any products of combustion or other contaminates in air.

11.1.4 Provide heat balance to prevent discomfort injury and fire.

11.2 Ventilation design: The ventilation design and planning should be as per National Building Code and NFPA.

12. AIR CONDITIONING SYSTEM:

12.1 Fire Protection requirements of air conditioning systems should be in accordance with National building Code.

12.2 There shall be seperate ducts for supply and return air. Carrying return air through false ceiling must be avoided unless it is boxed exclusively for return air.

12.3 Fire dampers should be provided in AHU.

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13. ELECTRICAL SYSTEM:

13.1 Electrical installation and equipment in building must conform to requirement laid down in accordance with National Building Code. All electrical appliances, fixtutres, equipment or wiring shall be installed and maintained in accordance with NFPA 70, Indian Electricity Rules.

13.2 The power cables to various appliances, AC units, Distribution boards should be run through cable tray only from end to end.

13.3 No loose and exposed cable should be permitted. No work shall be permitted without proper three- pin plug, socket.

13.4 No wire should be laid in PVC flexible conduit only metal conduit should be used.

13.5 Sufficient air space should be ensured for the cable at duct crossing locations.

13.6 No joint in cable or wire should be permitted beyond the main electrical panels. The extension cords shall be maintained in good condition without splice, deterioration or damage.

13.7 Proper rated switch gears (MCB/MCCB) should be used. Wire fuse should not be permitted and only HRC fuse should be used.

13.8 One control gear (Switch Gear/MCB/MCCB) should not control more than one appliances. Overloading of electrical circuits must not be allowed.

13.9 All the wires and cable should be FRLS Type.

13.10 Proper earth connection of electrical appliances should be ensured.

13.11 All electrical boxes should be closed to prevent the possibility of contact with combustible materials.

14. LIGHTNING PROTECTION:

Lightning protection shall also be considered and included in the building plans as per National Building Code.

14.1 The tall lighting masts, terminal buildings and aerobridges should be earthed permanently, where ever possible for effective lightning protection.

14.2 Provision of lightning protected structures at remote bay areas.

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15. FIRE PROTECTION IN TERMINAL BUILDING:

15.1 Automatic fire detection system should be installed in all areas used by public except those where passenger and staff will be present all the times during the use of building as per National Fire Protection Association.

15.2 Automatic sprinkler system are required to be provided in the terminal building as per NBC.

15.3 All furniture, fixture, floor and wall coverings should be made of low flammability ratings or non combustible material.

15.4 All shafts, stairwells, subways and vertical openings should have minimum one hour fire resistance for their structure.

15.5 Subways and links should have smoke compartmentation design and each compartment being no greater than 90 meters long and fitted with smoke stop doors held open on electromagnetic catches.

15.6 Hydrant system/wet riser should be provided for fire protection of terminal building.

15.7 Fire pump of such capacity to be provided to support 3 to 4 hydrants at a time.

15.8 Water supply of minimum overall capacity should conform to National Building Code.

16. FIRE PROTECTION AT ATS & CNS BUILDING:

16.1 Automatic fire detection and alarm system should be installed CNS installation building.

16.2 All furniture, fixture, floor and wall coverings should be made of low flammability ratings or non combustible material.

16.3 All shafts, stairwells, subways and vertical openings should have minimum one hour fire resistance for their structure.

16.4 Fire extinguishers should be installed as per BIS standards.

16.5 Riser/ Fixed fire fighting installation should be provided for ATS building as per NBC.

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17. FIRE PROTECTION AT CARGO BUILDING:

17.1 Proper aisles are required in storage areas to permit access by materials handling equipment.

17.2 Hot work operations (like welding, cutting, grinding or any such job which creates splatters or flame, etc) should be prohibited in storage areas. If hot work conducted in storage occupancy, extraordinary precautions must be taken to prevent ignition of the stored material. Hot work permit/ permit to work should be issued.

17.3 All furniture, fixture, floor and wall coverings should be made of low flammability ratings or non combustible material.

17.4 Lighting and heating appliance should be installed with proper clearance between lighting fixtures & storage and observed NFPA 70/ Indian Electricity Rules.

17.5 Smoking should be prohibited in storage areas.

17.6 Fire hydrants should be installed outside the cargo building as per standard.

17.7 Automatic sprinkler system should be provided as per NFPA 13.

17.8 All fire protection equipment including hydrants, fire pump, extinguisher, alarm system must be properly inspected, tested & maintained.

18. FIRE PROTECTION SYSTEM OF HANGERS:

18.1 Specification for Fire Protection System in different groups of hanger should be as per National Fire Protection Association and NBC.

18.2 The maximum floor area should be protected by Foam – water deluge system within aircraft storage and maintenance areas.

18.3 The spacing of the sprinkler heads should be same as per extra high hazard of National Fire Protection Association for aircraft storage and maintenance in the Hangers.

18.4 The discharge from sprinklers heads should be calculated on a maximum variation of 15% above the required discharge rates in litres per minute per square meter and no variation below the required discharge rate specified.

18.5 Extra sprinkler heads should be installed where there is any interference to sprinkler discharge and the pattern of distribution for maximum and effective floor coverage.

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18.6 The discharge devices for foam water system must be able to generate foam supplied from concentrate under pressure and should be of the air aspirating type.

18.7 The deflectors of the discharge devices should be able to produce discharge patterns similar to those of standard sprinkler heads.

18.8 The minimum orifice size of the discharge device should be as per National Fire Protection Association for used with the type of foam concentration.

18.9 The discharge rate should be not be less than 8 litres per min/sq.meter of floor area for air-aspirating system & 6.5 Litres min/sq. meter of floor area for non-aspirating system.

18.10 The discharge rate of foam compound for supplying the system for a minimum period of 10 minutes plus a 100% reserve kept.

18.11 Where foam concentrate feeder pipes run below ground level or have a run of more than 15 m above ground, then the concentrate within the pipe should be pressurized to ensure that there is no delay in foam application.

18.12 The control valves tanks and injection equipments should be outside of aircraft storage and maintenance areas where ambient climatic conditions will not adversely affect the performance of the system.

18.13 Where monitors nozzles are use, they should be provided with individual manual shutoff valves for each nozzle.

18.14 The water supply should be sustaining the discharge rate at sufficient pressure for the above operation for a minimum of one hour except where foam water systems and secondary fire protection are installed, then the duration of the water supply can be reduced to 45 minutes.

18.15 The system installed for primary fire protection should be actuated by detectors.

19. FIRST AID FIRE FIGHTING EQUIPMENT:

First aid fire fighting appliances are required to be provided at all Terminal Building, Technical/ATS Building, Communication Navigation Surveillance Installation Building and Aircraft Hanger.

19.1 Guidelines for Installing fire extinguisher:-

The basic guidelines for determining number, location, type and sizes are provided in IS: 2190. The calculation based on IS:2190 shall be done by Station in charge of fire services / Regional in charge of fire services for terminal /technical/CNS Installation building and Aircraft hanger etc. for different station.

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19.2 Inventory Maintenance:-

19.2.1 Each officer in charge / station in charge of Fire Service /Regional in-charge of Fire Services shall maintain fire extinguishers register besides normal stock register as per Fire Order No.-1.

19.2.2 Each extinguisher shall be serially numbered with type, Date of purchase, Date of monthly inspection, Quarterly maintenance test, Date of refilling and year of Hydraulic test before displaying in the building/Area/ Unit etc.

19.3 Maintenance of Fire Extinguisher:-

19.3.1 Airport Fire Service shall be responsible to maintain all the extinguishers for the facilities that belong to AAI.

19.3.2 Wherever Airport Fire Service personnel are not available Regional In charge of Fire service shall maintain inspection, training, hydraulic testing, checking, etc.

19.3.3 Maintenance should include an examination of the extinguishers mechanical parts, the extinguishing agent and the expelling means.

19.3.4 Repairs to the extinguisher must be made immediately or a replacement extinguisher provided.

19.4 Display of Extinguisher:-

19.4.1 Extinguisher should be displayed in accordance with IS: 2190.

19.4.2 Extinguisher should be located at a convenient and visible location. Wall hanging of extinguishers should be done in such a way that their location does not become obstruction to the public or occupier.

19.4.3 Provision of stands should be made to install extinguisher as far as possible instead of wall hanging, especially in passenger lounge.

19.4.4 Extinguishers should preferably be provided outside the room and on escape routes.

19.4.5 Distance of a nearest extinguisher should not be more than 22 M. from any place of protection.

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20. TESTING /INSPECTION:

20.1 Automatic fire detection/Alarm system serviceability shall be ensured in each shift. Any mal- function should be immediately brought to the notice of the electrical maintenance deptt for rectification and logged in the log book, maintained in the building fire control room.

20.2 Detailed checks of fire detection and alarm system (under simulated conditions) to be carried out in such a fashion so as to cover all zones and all detectors within a quarter.

20.3 Similar checks shall also be carried out for pill boxes within the respective zones within quarter.

20.4 Details of such checks as indicated above be recorded along with corrective action, where taken in separate register.

20.5 Fire Hydrant system wherever provided be physically checked in such a fashion that all hydrant points are checked for functional perations at least once in a week. During this check, Hose pipes coupling and branch shall also be checked and corrective action may be taken immediately.

20.6 Detailed checks of Hydrant points be so rostered so that each hydrant points should be checked at least once in a quarter to ensure that it with stand the required pressure. These detailed checks should be conducted by fire prevention wing.

20.7 Sprinkler system should be checked for functional operation once in every week.

20.8 All first aid fire fighting appliance should be rostered so that each appliances is checked and tagged for the date on which tested.

20.9 Station in charge of Fire Service / Regional in charge of Fire Service shall ensure inspection, maintenance, testing, recharge as per standard procedure.

21. FIRE PREVENTION:

21.1 Joint regular monthly inspection by a team comprising fire, civil and electrical executives should be carried out to ensure pruning of loose cables / wires to avoid short circuit.

21.2 The team should also check functioning of the fire dampers, in the AHU i.e. testing and inter- locking with blower motor.

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-22/22

21.3 The inspection team should also identify inflammable material stored at fire risk locations to ensure that the same area got removed/ relocated.

21.4 Record of these instructions should be kept in a separate register, to be maintained by the Fire Service Department In charge.

21.5 Periodic exercises be undertaken to familiarize the fire staff at the airport to enable them to have easy access to the terminal/technical /CNS Installation building and Aircraft hanger etc.

21.6 Officer in-charge of the respective airports to undertake an in-depth survey, annually, to assess the adequacy/augmentation of fire fighting facilities such as:-

21.6.1 Water supply sources for Fire Fighting
21.6.2 Capacity of water storage tanks for Fire Fighting
21.6.3 Hydrant, Wet risers and Sprinkler System
21.6.4 Fire Detection/ Alarm system
21.6.5 First Aid Fire Fighting Appliances
21.6.6 Any other Fire Fighting Equipment /Accessories to combat fire or to ensure effective fire protection.

22. WORK PERMIT SYSTEM:

22.1 Hot / cold work permit system should be issue to all contractors working within airport boundary. A copy of format as per Fire Order No. 06 which must be issued to fire station for taking necessary precautions.

22.2 Any work in the nature of preventive / breakdown maintenance, condition Monitoring, excavation work, etc. where the work is to be performed by personnel other than operations will require hot / cold work permit.

12.03.10

(V K YADAVA)
EXECUTIVE DIRECTOR (ATM)

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भारतीय विमानपत्तन प्राधिकरण
संचार, दिक्चालन एव्म निगरानी- प्र. एवं अ. निदेशालय

CNS CIRCULAR 06/2012

Electrostatic Discharge (ESD) Control - Use of Anti-Static Devices in Handling of Electronic PCB/Modules of CNS/ATM Systems

December, 2012

भारतीय विमानपत्तन प्राधिकरण
Airports Authority of India

संचार, दिक्चालन एव्म निगरानी- प्रचालन एवं अनुरक्षण निदेशालय

Directorate of CNS-OM

Reference:- File No AAI/CRS-(P)/Anti Static Devices/2012

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भारतीय विमानपत्तन प्राधिकरण

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CNS Circular 06 of 2012

Sub: Use of Anti-Static Devices in Handling of Electronic PCB/Modules.

1. **INTRODUCTION:-** Awareness in respect of Electrostatic Discharge(ESD) and preventive measures to be taken for avoiding its harmful effects are important for electronic devices and personnel associated with electronics. As Integrated Circuits (ICs) become more compact, sizes shrink, active devices as well as some passive devices are becoming more prone to damage by Electrostatic Discharge. To combat its effects and to prevent damage to electronic components from the effects of static, preventive measures such as :-

(i) Use of anti static storage devices for storing spares/PCBS etc;
(ii) Use of protective antistatic workbenches for repair and maintenance of Electronic PCB/Modules;
(iii) Use of Anti static Bags for shipping Electronic components; and
(iv) Implementing measures for ensuring people are not carrying static are all used.

Accordingly, Modern Electronic and Electronically controlled CNS/ATM equipments are no exception and are susceptible to damage from Electrostatic Discharge.

2. **Objective**:- Use of anti static measures contained in this circular will help to reduce the frequency and minimise the effects of ESD events specially during handling PCBs/Modules/PWB for shipments. All electronic circuitry that contains miniaturised or solid state components shall be considered as ESD susceptible.

3. **Use of Anti static devices in Handling Electronic PCBs/PWB/Modules of CNS/ATM Equipments:-**

4.1 It has been observed that sometimes field stations are sending unserviceable PCBs/PWB/Modules of CNS/ATM Equipments to CRSD New Delhi for onward dispatch to OEM/Suppliers for repair and return in improper packing. While packing these modules, the handling is also improper. Similar improper packing /handling is used while sending PCBs/PWB/Modules of CNS/ATM Equipments to SMUs and to other stations. This improper packing/handling includes:-

(i) Handling PCBs/PWB/Modules without using Anti static wrist bands at the equipment sites or at work benches.
(ii) Handling PCBs/PWB/Modules of CNS/ATM Equipments while packing without using protective antistatic workbenches and anti static mats.
(iii) Not using anti static bags while shipping PCBs/PWB/Modules to CRSD/SMUs for repair and return.

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(iv) Not using antistatic dissipative materials for storing PCBs/PWB/Modules and other spares.

3.2 In order to avoid damage to costly PCBs/PWB/Modules of CNS/ATM equipments from ESD; all concerned should take preventive measures such as :-

(i) Use of Anti-static areas using protective antistatic workbenches and antistatic straps for ensuring maintenance personnel are not carrying static while working or handling the PCBs/PWB/Modules;
(ii) Use of Anti static Bags for shipping Electronic components. It is important that the bags only be opened at static-free workstations as mentioned above;
(iii) Use of proper packing while shipping PCBs/PWB/Modules to avoid mechanical damage;
(iv) Shelves, Drawers and Bins used for storage of PCBs/PWB/Modules should be made of anti static dissipative materials. Static generative materials should not be used where static sensitive items are stored; and
(v) Any other special instructions/advice by manufacturer for handling PCBs/PWB/Modules at work bench or during shipment.

4. It must be ensured that anti static devices such as anti static work benches, mats and wrist straps etc. are being tested at regular intervals as per the manufacture guidelines. Similarly, if anti static bag used for storing/shipment for PCBs/Modules has crinkled or acquired small holes, it is safer to discard it and not to be used for shipment of electronic components.

5. Using above preventive measures which should be implemented at the earliest, the destructive effects of static on electronics equipment especially during shipping can be virtually removed.

[Ravi Prakash]
Executive Director [CNS-OM]

References/Standards:-

1. EIA standard EIA-625 – Requirement for handling Electrostatic Discharge Sensitive Devices.
2. ANSI/EIA-541-88 - Packaging Material Standards for ESD Sensitive Items

Use of Anti-Static Devices in Handling of Electronic PCB/Modules of CNS/ATM Systems

SMU DETAILS

भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

विशेष अनुरक्षण प्रकोष्ठ (सी.एन.एस.)
Special Maintenance Units (CNS)

नाम व पदनाम (श्री/श्रीमती)	कार्यालय	निवास	फैक्स	मोबाइल
Name & Design (Mr / Ms)	**Office**	**Residence**	**Fax**	**Mobile**

01. दिल्ली DELHI

उपस्कर Equipments :
VOR / DME / ILS; Make/Model : ASII

संयुक्त महाप्रबन्धक				
Jt GM	011-2565 3907	2508 9412	2565 3052	9871 333 520
मदन लाल				
Madan Lal		madansohal@aai.aero		
सहायक महाप्रबन्धक				
Asst GM	2565 3052		2565 3052	9968 278 426
पी. के. कुलश्रेष्ठ				
P K Kulshrestha		smu_navaids@aai.aero		
सहायक महाप्रबन्धक				
Asst GM	2565 3052		2565 3052	8800 369 215
पवन खन्ना				
Pawan Khanna		pawankhanna@aai.aero		

02. सफदरजंग विमानक्षेत्र, दिल्ली Safdarjung Airport, Delhi

उपस्कर Equipments :
i) X-BIS; Model/Make : 6040i / 100100v; M/s Smith Hiemann, Germany
ii) NDB; Model/Make : SA 100 / SA 500; M/s Southern Avionics Company, USA

संयुक्त महाप्रबन्धक				
Jt GM	011-2469 1285		2469 1283	9910 850 505
एन. सी. गुप्ता				
N C Gupta		ncgupta@aai.aero		

सहायक महाप्रबन्धक Asst GM गुल मोहम्मद Gul Mohammad	011-2462 0809		2469 1283	9811 310 980
		smu_sap@aai.aero		
सहायक महाप्रबन्धक Asst GM आर. के. लालवानी R K Lalwani	011-2462 0809	25547715	2469 1283	9891 724 176
		smu_sap@aai.aero		

03. मुम्बई Mumbai

उपस्कर Equipments :

i) Marathan DVTR; Make : M/s ASC Telecom, Germany

ii) Ricochet DVTR; Make : M/s Ricochet, Norway; Supplier - M/s ST Electronics, Singapore

उप महाप्रबन्धक DGM जी. के. खरे G K Khare	022- 2681 9437		2682 8000	9869 056 972
		govendra@aai.aero		
सहायक महाप्रबन्धक Asst GM विजय एस. जगझाप Vijay S Jagzap	2681 9521	2832 8089	2682 9951	9819 510 613
		dvtrsmu@aai.aero		

04. चेन्नई CHENNAI

उपस्कर Equipments :

i) ILS; Make/Model : NORMARC 3500 / 7000

ii) ASR-9/MSSR; Make/Model : NGOSCO

iii) VHF Tx/Rx; Make/Model : OTE / PAE

iv) Radar Monitor; Make/Model : Sony / Barco

महाप्रबन्धक GM के. गणेशन K Ganeshan	044-2256 1542	2224 0200	2256 1542	9840 903 555
		gmcnssr@aai.aero		
सहायक महाप्रबन्धक Asst GM एस. मरिअप्पन S Mariappan	044-2256 1540	2498 7175	2256 1540	9444 333 224
		smuchennai@aai.aero		

05. कोलकाता KOLKATA

उपस्कर Equipments :
DME; Make/Model : GCEL 751/751A/752/753

संयुक्त महाप्रबन्धक
Jt GM 033-2511 8240 2511 0046 033-2511 8240 9836 068 064
संजीत बासु
Sanjit Basu s_basu@aai.aero

सहायक महाप्रबन्धक
Asst GM 033-2511 8240 033-2511 8240

smukol@aai.aero

06. अहमदाबाद AHMEDABAD

उपस्कर Equipments :
i) DVOR; Make/Model : GCEL 755

संयुक्त महाप्रबन्धक
Jt GM 079-2286 1665 2286 2936 2288 5888 9898 385 781
एस. के. स्वामी
skswami@aai.aero

वरिष्ठ प्रबन्धक
SM 2288 5888 2288 5888 9426 032 923
एस. के. घोष
S K Ghosh smuahm@aai.aero

वरिष्ठ प्रबन्धक
SM 2288 5888 2288 5888 9998 257 298
डी. वी. डोबिकर
D V Dobikar smuahm@aai.aero

07. हैदराबाद HYDERABAD

उपस्कर Equipments :
i) DME; Make/Model : Thales 435

उप महाप्रबन्धक
DGM 2790 6530 7893 382 828
वी. के. य्होमे
V K Yhome yhomevk@aai.aero

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DETAILS OF LAND IN POSSESSION

The land details of Katihar Airport are as follows:

The necessary Record Of Rights (ROR) of the following land assets as mentioned below are at present available with AAI:

Sl. No.	Mouza	Area (in Acres)
1	Dalan (Present MSSR Site)	2.3
2	Rampur (DVOR Site)	8.29

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MANPOWER DATA

Group	Total Manpower	No. of employees belonging to SC	No. of employees belonging to ST	No. of employees belonging to OBC
A	3	1	-	-
B- Exec	7	-	-	5
B- Non-Ex	1	-	-	-
C	2	-	-	-
D- Others	-	-	-	-
D- Safai	-	-	-	-
Total	**13**	**1**	-	**5**

SPLIT FIGURES ARE AS FOLLOWS:

CNS Staff:

S/N	CNS NO	NAME SH/SMT	DESIG.	DOB	QUALIFICATION	PROFICIENCY	STATION SERVED	REM
1	770	Mr. Durga Prasad Upadhyay	AGM(CNS)	01/01/61		1. VHF 2. HF/NDB 3. AMSS OPS 4. AMSS HARDWARE 5. SECURITY 6. DVOR(THALES) 7. DME(THALES) 8. PRIMARY RADAR	CATC Allahabad, Katihar (ER)	
2	1110	Mr. Karunamoy Pal	AGM(CNS)	03/11/60		1. VHF 2. HF/NDB 3. AMSS OPS 4. AMSS HARDWARE 5. SECURITY 6. DVOR(THALES) 7. DME(THALES) 8. PRIMARY RADAR 9.SECONDARY RADAR	Kolkata, Mumbai, Katihar (ER)	
3	1611	Mr. Debasis Biswas	AGM(CNS)	01/05/66		1. VHF 2. HF/NDB 3. AMSS OPS 5. SECURITY 6. DVOR(THALES) 7. DME(THALES)	Kolkata, Guwahati, Katihar (ER)	
4	3159	Mr. Amit Kumar Yadav	AM (Elex)	04/07/80	B.Tech (Electronics& Communication)	1. VHF 2. AMSS OPS 3. AMSS HARDWARE 4. DVOR(THALES) 5. DME(THALES)	Ranchi(ER), Katihar (ER)	

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5	3195	Mr. Devendra Tiwari	AM (Elex)	20/07/86	B.Tech (Electronics& Communication)	1. VHF 2. HF/NDB 3. AMSS OPS 4. AMSS HARDWARE 5. DVOR(THALES)	Patna(ER), Katihar (ER)	
6	3201	Mr.Himanshu Choudhary	AM (Elex)	01/07/79	B.Tech (Electronics& Communication)	1. VHF 2. HF/NDB 3. AMSS OPS 4. AMSS HARDWARE 5. DVOR(THALES)	Vizag(SR), Katihar (ER)	
7	3219	Mr. Devkant Sharma	AM (Elex)	04/07/85	M.Tech (Electronics& Communication)	1. VHF 2. HF/NDB 3. AMSS OPS 4. SECURITY	Palam(NR), Katihar (ER)	
8	3372	Mr. Manjit Kamal	Jr Exec (Elex)	27/06/82	M.Sc. (Electronics)/M. Tech(VLSI)	1. VHF 2. HF/NDB 3. AMSS HARDWARE 4. DVOR(THALES) 5. DME(THALES)	Katihar (ER)	
9	3320	Sanjeev Kr Shivendu	Jr Exec (Elex)	07/10/83	B.Tech (Electronics& Communication)	1. VHF 2. HF/NDB 3. AMSS HARDWARE 4. DVOR(THALES)	Katihar (ER)	
10	3305	Mr. Shambhu Kumar	Jr Exec (Elex)	03/04/82	B.Tech (Electronics& Communication)	General	Palam(NR), Katihar (ER)	
11		Mr. Soumendu Nandy	Supdt (Elex)	05/01/76	Diploma (Electronics)	General	Patna(ER), Port Blair(ER), Kolkata (ER), Katihar (ER)	
12	N/A	Mr. Uma Shankar Mishra	Sr.Attdt(R/C)	23/09/54	VIII Pass	General	Katihar (ER)	

Engineering Staff:

S/N	CNS NO	NAME H/SMT	DESIG.	DOB	QUALIFI-CATION	PROFICIENCY	STATION SERVED	REM
1	N/A	Mr. Lalan Prasad	Assistant (Engg-Operator)	03/01/62	VII Pass	General	Katihar (ER)	

Security guards and MTD:

06 (Six) no. of Gunmen are engaged on contract for MSSR site. And 06 (Six) no. of Gunmen are engaged on contract for DVOR site

01 MT driver is engaged on contract for the purpose of driving office vehicle.

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