Appendix B:

Specification – HF Radio Replacement Project

Airports Fiji Limited

Nadi Airport

Namaka Nadi, Fiji

Contents

ABBREVIATIONS USED IN THIS SPECIFICATION

ADC	-	Analog to Digital Converter
ATC	-	Air Traffic Controller
ATMC	-	Air Traffic Management Centre
DSP	-	Digital Signal Processing
FA	-	Airports Fiji Limited
FAT	-	Factory Acceptance Test
HF	-	High Frequency
ICAO	-	International Civil Aviation Organization
ICD	-	Interface Control Document
IMD	-	Intermodulation Distortion
LAN	-	Local Area Network
LCU	-	Local Control Unit
LRM	-	Local Remote Maintenance
LRU	-	Line Replacement Unit
MOSFET	-	Metal Oxide Semiconductor Field Effect Transistor
MTBF	-	Mean Time Between Failure
MTTR	-	Mean Time To Repair
PA	-	Power Amplifier
PEP	-	Peak Envelop Power
PTT	-	Push To Talk
RAT	-	Reliability Acceptance Test
RCDU	-	Remote Control and Display Units
RCMS		Remote Control and Monitoring System
RCP	-	Required Communication Protocol
RF	-	Radio Frequency
RMA	-	Reliability, Maintainability, Availability
RMM	-	Remote Monitoring Maintenance
SARPS	-	Standards and Recommended Practices
SAT	-	Site Acceptance Test
SDR	-	Software Defined Radio
SSB	-	Single Side Band
TCP/IP	-	Transmission Control Protocol/Internet Protocol
VOIP	-	Voice over IP
VSWR	-	Voltage Standing Wave Ratio

REFERENCE DOCUMENTS

ICAO Annex 10, Volume III Edition 6,
ICAO High Frequency Guidance Material For the South Pacific Region
EUROCAE ED-137
AsA HF RAMP Document

RELEVANT STANDARDS

Electrical Standards – AS/NZS 3000:2007
Structural Steel Standards – AS/NZS 4100, AS/NZS 4600, AS/NZS 5131
Software Standards – AS/NZS 14598.3:2000- Information Technology Software Product Evaluation, AS/NZS 4216 Information Technology Software Product Evaluation, Quality characteristics & guidelines for their use
Building Code – BCA (Building code of Australia)
Lightning Protection – AS/NZS 1768:2007
Vibration Standards – AS 2436-2010 (Guide to noise and vibration control on construction, demolition and maintenance site
Frangibility Standards – ICAO Annex 14 , ICAO Aerodrome Design Manual Part 6 – Frangibility

Scope Overview

Fiji Airports currently operates and maintains High Frequency (HF) voice communication network, which is used to provide Air Traffic Services to the aviation community within Nadi Flight Information Region (FIR). The HF Air-Ground-Air communication is centrally controlled and operated from Nadi Air Traffic Management Operations Centre in Nadi. It covers both Domestic and Oceanic air routes.

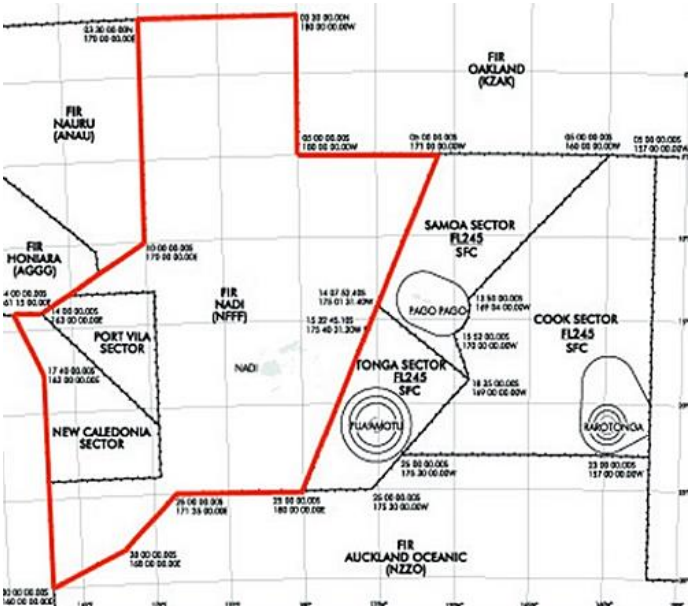


Figure 1.0 Fiji FIR Boundary ($6x10^6$ km^2)

The existing Airband HF Radio is obsolete and well past its designed life and is due for replacement. This project will be implemented in a two phases approach as follows to replace the current HF Radio communication at Nadi Airport:

Stage 1 – 2022

Replacement of 2 x 10kW PEP HF Radio Transmitters
Replacement of 12 x HF Receivers and 2 x aerial multi-coupler.
Installation of 2 x high power Wideband HF Transmitting antenna.
Replacement of 1 x Wideband HF Receiving antenna

Stage 2 – 2024

Replacement of 2 x 5kW HF Radio Transmitters
Replacement of 12 x HF Receivers and 1 x aerial multi-coupler.
Replacement of 1 x Wideband HF Receiving antenna

All tenderers are to allow for co-ordination between different trades and to ensure that all of the following has also been included for:

a) Permits and approvals as required under applicable legislation and referenced in this document including submissions of a method of works plan.

b) Contractor Submissions as required by this document to the satisfaction of Fiji Airports including any necessary rework and resubmissions required to receive approval.

c) Removal of waste materials from the site and disposal in an agreed location within 1km of the site.

d) Liaison and meetings as required with Fiji Airports, CAAF and associated Contractors.

e) Personal Protective Equipment for your staff onsite.

f) The Contractor to also allow for the arrangement of airside passes for Contractor personnel and vehicles accessing the site.

g) Access to site to be maintained as clean and clear and adjacent roadways are not to be impacted without prior written approval in the form of traffic plan which will generally limit impacts to afterhours road closures.

h) Protection to all roadways and adjacent pavements, including cleaning of the pavements daily should dirt or dust be trafficked onto the pavements.

A schedule of day work rates for plant and labour is also to be provided should any unforeseen works arise.

1.2 Existing HF Radio

Fiji Airports operate the JRC HF Radio Transmitter & Receiver. There are 4 x 10 KW transmitter and 2 x 5KW HF Transmitters installed at the Enamanu transmitting station and configured with 15 channel frequencies. There are 30 HF radio receivers configured with Receiver A & B for the 15 fixed receiver frequencies that are installed at Nasoso receiving station. The HF Radios are remotely operated from the Harris C4i Voice Communication Switch (VCS) located at the Nadi Air Traffic Management Operation centre.

1.2.1 General

Indicative performance requirements include:

System Component	Availability	MTBF
HF Transmitter and Receiver Radio	> 0.9999	> 10000HRS
HF Antenna and Supporting Structures	> 0.9999	> 28000HRS
Coupling Unit	> 0.9999	> 28000HRS

1.3 Scope of works

1.3.1 General Obligations

Completion of the works and compliance with the requirements as detailed herein and as detailed in the documents listed under the contract documents.

1. Supply, Installation and Commissioning of HF Radio and associated hardware.
2. Compliance to the technical specification
3. Provision of the Design and Submissions as required.
4. Complete Equipment Schedule (CES), technical data, and appropriate training to allow for the introduction into service of the vehicles. FA seeks a non-developmental solution which has a demonstrated and proven track record in deployment on other airport sites.
5. Supply of spare parts for the period of 10 years.
6. Provide a 3-year warranty for maintenance and support.

The delivery methodology is as a Supply delivery and training solution incorporating the following hold points:

1. Tender submission
2. Tender approval
3. Technical compliance review
4. Contract Award
5. System Design Review – On Site
6. Pre-FAT Training & Factory Acceptance Testing (FAT)
7. Shipment & Site delivery
8. Site Acceptance Testing (SAT)
9. Onsite Training – Technical Maintenance Training
10. Reliability Acceptance Testing (RAT)
11. Commissioning/Handover.

1.3.2 Design and Submissions

Further to the submissions as required by the RFT response of this document, the scope in general terms is to within four (4) weeks of contract award to action the following:

1) Pending the Respondent's advice and input, liaison with the project stakeholders/ design consultants to select and recommend any additional requirements and facilities as required/ available for approval

2) Prepare a fully itemized equipment schedule including quantities, costs and any ongoing software licensing fees and charges if applicable.

3) Work with stakeholders to ensure to ensure the HF Radio listing and quantities are correct and meet user requirements

4) Prepare a detailed HF Radio installation program and then provide fortnightly monitoring during the periods where close control is required.

5) Detail any enabling or interface works required to enable the effective installation and operation of HF Radio scheduled or specified for the works.

1.3.3. Service Maintenance and Reliability

The Supplier shall provide written undertakings associated with the following that:

1. The Supplier will maintain current spare parts for the HF Radio and associated hardware under procurement for a period of 10 years post-delivery of HF Radio.

2. The Supplier will be able to provide remote support for the supply of spare parts during normal business hours in their place of business for 10 years post-delivery HF Radio and associated hardware.

3. The Supplier will ensure to provide maintenance support for spare parts of the HF Radio, including aerial and coupling system for 10 years.

4. The Supplier will allow for mid-life health inspection check for HF Radio and provide refresher training during the time of same visit. Mid-life is usually 5 years after this system has been commissioned.

1.3.4 General Items for Pricing

RATES TO INCLUDE:

Item	Responsibility
Transport to site	Contractor
Cranage onsite	Fiji Airports
Installation Labour	Fiji Airports
Installation Supervision	Contractor
Airport Identification Passes per person – requires police report issued within prior 3 months, passport photo and verified copy of suitable proof of identification (passport/drivers licence etc).	Contractor:- $12.50 for 3 month pass each
Vehicle/ equipment passes – vehicle registration details and roadworthy	Contractor:- $100 per annum

- High Visibility workwear required.
- The Contractor must comply with Fiji Airports Rules and Regulations
- Allow 1.5 hours for Site Inductions. The Client will not pay additional funds for any additional meetings & toolbox meetings

Contractors are to suitably resource the project in terms of both supervision and labour for the design, manufacture and installation of the works.

The Contractor is required to employ suitable systems to manage the project correctly.

Contractors are to submit a proposed management structure and associated C.V.'s with tender returns.

2.0 Technical Specifications

2.1 General

2.2 Section 1 Scope of Works and Local Conditions

2.2.1. Introduction

2.2.1.1 Airports Fiji Ltd intends to replace its High Frequency Radio System (HF) at Nadi Airport currently operating in split site mode. This includes:

HF Transmitter and aerial system installed at Enamanu Transmitting Station

HF Receiver and aerial system installed at Nasoso Receiving Station

2.2.1.2 This document specifies the minimum requirements specification for the High Frequency Radio System, hereafter referred as “SYSTEM” to be supplied to Fiji Airports (hereafter referred as FA) for operational use.

2.2.1.3 The SYSTEM shall operate in conformity to the relevant standards, procedures and recommended practices (SARPs) prescribed by International Civil Aviation Organisation (ICAO) Annex 10 and relevant standards including EUROCAE.

2.2.1.4 The SYSTEM shall be developed based on mature technology that has been proven for operational use in other international airport(s) and Air Navigation Service providers.

2.2.2. Scope of Works

2.2.2.1 This project is to supply, install and commission HF radio system to replace the existing HF system used for aeronautical mobile services.

2.2.2.2 The HF radio will be installed at the existing shelter of the transmitter and receiver sites.

2.2.2.3 The duration to complete the project for Phase 1 shall be 18 months from the date of the award of the contract and 24 months for Phase 2.

2.2.2.4 The installation of the new HF radio system shall be planned and implemented with minimal or nil disruption of services to the existing HF system.

2.2.2.5 The Contractor shall be responsible for improving or replacing the existing HF mast, and as well as supply and install high gain aerial system at both sites.

2.2.2.6 The Contractor shall also be responsible for:

2.2.2.6.1 Improving the grounding system and the lightning protection system.

2.2.2.6.2 Providing installation material such as external and internal cablings, cable trays, connectors, cable ties, conduits etc deemed necessary for successful implementation and commissioning of this project.

2.2.2.7 The proposed equipment list of the new Nadi HF radio is provided in Annexure 1.0.

The list is non-exhaustive. The Contractors are invited to submit a complete solution and pricing for equipment supply and project services. The Contractors are to add to the miscellaneous item where necessary or delete items where there is no need seen. The Contractors must endeavor to provide the best value solution to FA and where necessary explain why items are added or deleted.

2.2.2.8 The Contractors are to identify all civil works that may be required (if any) in order to successfully implement the replacement under this project within the contract delivery time.

2.2.3. Implementation

2.2.3.1 Implementation of this project will be delivered in two stage approach, and the Contractor is required submit both costing in this tender.

2.2.3.2 Two stage implementation approach will be as follows:

Stage 1 – 2022

Replacement of 2 x 10kW PEP HF Radio Transmitters
Replacement of 12 x HF Receivers and 2 x aerial multi-coupler.
Installation of 2 x high power Wideband HF Transmitting antenna.
Replacement of 1 x Wideband HF Receiving antenna

Stage 2 – 2024

Replacement of 2 x 5kW HF Radio Transmitters
Replacement of 12 x HF Receivers and 1 x aerial multi-coupler.
Replacement of 1 x Wideband HF Receiving antenna

2.2.4. Site Visit

2.2.4.1 The Contractor will be required to conduct a site visit at own cost to survey the site and understand the scope of work. This is necessary for the Contractor to make recommendation to FA if for example, the existing HF equipment shelter and antenna civil structure will need to be improved or replaced.

2.2.4.2 The layout of the existing site in the Nadi Airport aerodrome is provided in Annexure 2.0

2.2.5. Site Information

2.2.5.1 Before submitting a Tender, the Contractor is urged to make every effort to be thoroughly acquainted with the location and accuracy of all aspects of the Works.

2.2.5.2 The Contractor shall not be entitled to additional payments on the grounds that any information acquired from FA is incorrect or misleading or inadequate.

2.2.6. Weather Condition

2.2.6.1 The Contractor shall be deemed to have taken into account all possible weather conditions when preparing the tender and it shall not be entitled to extra payment by

reason of the occurrence or effect of temperature or humidity or any other meteorological phenomena.

2.2.6.2 Without limiting its liabilities under the Contract, the Contractor shall make suitable arrangements to protect the Works and all equipment against the effects of weather.

2.2.7. Climatic and Equipment Operating Conditions

2.2.7.1 Fiji is 17° 45.4' South of the Equator.

2.2.7.2 Climate: Tropical marine; only slight seasonal temperature variation

2.2.7.3 Operational Temperature range: -10° to +55° C

2.2.7.4 Mean absolute humidity: 14.6 to 21.5 gm/m3

2.2.7.5 Rainfall: Average Monthly (Max.) 250mm (March)

2.2.7.6 Wind speed: National requirement for structure installation is 70m/s.

2.2.7.7 Solar Radiation: 18.1 Mega Joules/m^2

2.3 Technical & Engineering Requirement

2.4 Section 3 General Technical Requirements

2.4.1 Performance Design Standards

2.4.1.1 Unless otherwise stated, all equipment supplied under the contract shall be designed to meet the performance requirements defined in the following clauses and Section of the Specification.

2.4.1.2 Where applicable, all equipment delivered in accordance with this specification shall also conform to the requirements of the International Civil Aviation Organization (ICAO), Annex 10 to the Convention on International Civil Aviation, Sixth Edition as amended up to the date of Invitation to Tender.

2.4.1.3 The equipment shall be capable of maintaining its rated performance when continuously operated at all times and must not degrade unless environmental conditions fall outside the specified standards. The acoustical noise levels produced by the equipment in operation shall be as low as is practically possible.

2.4.1.4 The equipment performance availability shall not be less than 99.99%

2.4.2 Statutory and Other Regulations

2.4.2.1 The Works and all Equipment, and materials forming part of this Project shall comply in all

respects with all relevant local statutory regulations, By-laws and orders and also with the Factories Act of Fiji and any subsequent amendments thereto.

2.4.3 Maintenance and Accessibility

2.4.3.1 It is of primary importance that the equipment shall operate at a very high standard of performance, without requiring frequent maintenance and adjustment.

2.4.3.2 All adjustments and alignment procedures required to be performed by maintenance staff shall be as simple and straight forward as possible, involving the minimum number of controls, and without the need for difficult and critical adjustment.

2.4.4 Duplicated Equipment

2.4.4.1 Equipment provided in duplicate to function as working and standby units shall be identical in all aspects and shall be set up and tested independently of the other unit.

2.4.4.2 All units, with the same part number, shall be supplied to the identical modification state and shall be fully interchangeable with any other such units.

2.4.5 Grounding/Earthing/Safety Earth Systems

2.4.5.1 The earthing systems for all electronic/electrical equipment supplied under this Contract shall conform to the best international practices, AS/NZS3000:2018. Each equipment cabinet shall be fitted with a safety earth terminal comprising a minimum size M12 stud, which shall have good continuity with any other metal part of the equipment. All safety earths within the equipment shall be connected to this terminal.

2.4.5.2 The Contractor shall provide a common (copper) earth bus bar in each zone where equipment supplied under this contract is installed. The common earth terminal of each equipment cabinet, referred to above, shall be individually connected to this common bus bar. The common bus bar shall be provided with a low impedance earth system.

2.4.6 Safety Assessment/or Safety Case

2.4.6.1 The Contractor shall provide a safety assessment and or safety case of the overall system being installed and commissioned.

2.4.7 Tropicalisation

2.4.7.1 All materials used shall be finished to be resistant to mould growth. Equipment supplied for external applications shall be finished to withstand 10 years normal operation.

2.4.8 Planning Documents

2.4.8.1 The Contractor shall provide following project documents:

2.4.8.1 Project Management Plan (PMP)

2.4.8.2 Systems Engineering Management Plan (SEMP)

2.4.8.3 HF Radio Compliance document

2.4.8.4 Test and Evaluation Master Plan (TEMP) which includes Factory Acceptance Testing requirements (FAT), Site Acceptance Testing requirements (SAT), Reliability Testing (RAT), This should address test failures, re-testing and cost responsibility.

2.4.8.5 Quality & Safety Assurance Plan (QSAP)

2.4.8.6 Software Development Plan (SDP) if any software is non- commercially based.

2.4.8.7 Installation Management Plan (INMP)

2.4.8.8 Method of Works Plan (MOWP)

2.4.8.9 Transition Plan from the current to the new SYSTEM outlining the process to show minimum outage time possible.

2.4.8.10 Interface Control Document (ICD)

2.4.8.11 Interface Management Plan (IMP)

2.4.8.12 Risk Management Plan (RMP)

2.4.8.13 Configuration Management Plan (CMP)

2.4.8.14 Logistics Support Plan (LSP)

2.4.8.15 Work Breakdown Structure (WBS)

2.4.8.16 Project Timetable and Network Schedule, PERT and GANTT

2.4.8.17 Environmental Management Plan

2.4.8.18 List of suppliers the Contractor will use for equipment, components, hardware and software.

2.4.9 Operation and Maintenance Manuals

2.4.8.1 General

2.4.8.1. 1 The general requirements for Contractor supplied documentation are described in the following sections.

2.4.8.2 Manuals

2.4.8.2.1 Manuals shall be divided into logical sections which contain installation instructions, operating instructions, alignment and adjustment procedures, detailed theory of operation (in particular pertaining to the interactions of the sub-assemblies and modules and associated interfaces as part of the total system), maintenance routines, fault finding procedures, troubleshooting procedures, detailed LRU lists, and drawings.

2.4.8.2.2 Associated software and hardware descriptions, in particular as they relate to system operation, shall be included. The contents shall be sufficiently detailed to

enable qualified technical personnel to thoroughly understand how the system functions, to be able to trace signals, to measure parameters throughout the system, and to troubleshoot down to the LRU level. Schematics and diagrams shall be of a quality to enable clear and unambiguous comprehension.

2.4.8.2.3 The Contractor shall supply six (6) sets of the Operation and Maintenance Manuals for each system and/or facility as detailed elsewhere in this specification.

2.4.8.2.4 The manuals shall generally include but not limited to the following information:-

2.4.8.2.4.1 System User Manual
2.4.8.2.4.2 System Administrator Manual
2.4.8.2.4.3 System Maintenance Manual

2.4.8.2.5 Maintenance Procedures and Fault finding procedures including:-

2.4.8.2.5.1 System Diagrams
2.4.8.2.5.2 Circuit diagrams
2.4.8.2.5.3 Installation procedures
2.4.8.2.5.4 Fault Finding Flow Charts.
2.4.8.2.5.5 Complete Parts list giving manufacture's details of Part Nos., Circuit References, Component designations

2.4.8.2.6 Associated Software Information including:-

2.4.8.2.6.1 Software Overview Manual
2.4.8.2.6.2 Software Maintenance Manuals

2.4.10 Other Documents

2.4.10.1 The Contractor shall also provide one (1) complete set of any documentation (MASTER) in hardcopy & Soft copy inclusive of System Design and Layout with all components clearly marked.

2.4.11 Labelling of Equipment

2.4.11.1 Labels shall be provided to indicate the function and any possible hazards within the equipment. All labels shall be positioned so they can be seen clearly.

2.4.12 Labelling of Connectors and Cables

2.4.12.1 All interconnecting cables within the equipment cabinets shall be identified and labelled clearly with a unique alphanumeric reference number enabling the user to identify and trace the function/service of each conductor.

2.4.13 Cable Entries

2.4.13.1 Wherever possible the Contractor shall restrict to top entry/exit of RF cables whilst power cables to run from underneath the equipment racks.

2.4.14 Operating and Maintenance Instructions and Parts List

2.4.14.1 When the general arrangement and details of the Equipment have been finalized, the Contractor shall submit to FA, for approval, the draft copies of the operation and maintenance instructions and parts list for the main equipment and all associated ancillary equipment as supplied under the Contract.

2.4.14.2 The planned maintenance instructions shall include summaries of periodic tests recommended by the Manufacturer and an agreed number of maintenance log sheets for the equipment provided.

2.4.15 System Training

2.4.15.1 Maintenance Staff Training

2.4.15.1.1 The Contractor shall provide a detailed training program with the ultimate objective of technicians becoming competent on the system and comply with ICAO DOC 10057 (Manual on ATSEP Competency Based Training & Assessment).

2.4.15.1.2 Technical training shall cover in detail, the theory, operation, test and alignment procedures and fault recognition techniques relevant to the HF equipment. Preventive maintenance procedures shall be covered, however, the greater percentage of time and emphasis is to be placed on alignment and operating procedures, fault finding, and techniques for efficient and expeditious maintenance of the equipment.

2.4.15.1.3 A detailed list of course objectives, based on the HF system maintenance philosophy shall be provided. Those objectives shall be stated in terms of what the student will be trained to do on completion of the course. The submission of course objectives shall also contain a statement defining how trainee achievement of the course objectives will be measured.

2.4.15.1.4 The Contractor shall provide Pre-FAT training for technical staff who will participate in FAT.

2.4.15.1.5 In consultation with FA, the Contractor shall develop and provide a Technical Training Plan that will address the training of all FA technical personnel required to operate and maintain the new systems. The Technical Training Plan shall detail the standards to be met including:

2.4.15.1.5.1 Training objectives
2.4.15.1.5.2 Training programs
2.4.15.1.5.3 Training structure
2.4.15.1.5.4 Course content
2.4.15.1.5.5 Course Duration

2.4.15.1.6 The Contractor shall provide all training facilities, equipment and instruction manuals and all other documentation required for all technical staff attending the course.

2.4.15.1.7 The Contractor shall provide to FA a training analysis report regarding competency of trainees and is to be completed by the trainer immediately after the end of the course.

2.4.16 Reports on Training

2.4.16.1 An evaluation of each participant shall take place at suitable intervals during, and at the end of each training course, to monitor the progress of each trainee and to revalidate the effectiveness of the instructional method. Following each course, the Contractor shall report on the performance of each trainee. During each course, should a trainee experience learning variances which warrant withdrawal from the course, the Contractor shall immediately advise the FA's Project Manager.

2.4.16.2 During the conduct of the training FA will validate the training course to ensure that the expected level of competency is attained through the offered program.

2.4.17 Contractor's Personnel

2.4.17.1 The Contractor shall provide a suitable number of competent and qualified instructors capable of providing a high quality training experience. Fiji Airports reserves the right to examine the background, training and experience of the nominated instructors in order to assess their competency and verify on their acceptability.

2.4.18 Fiji Airports Personnel

2.4.18.1 Candidates for training will be properly qualified Electronics Technicians with minimum qualification of Diploma Electrical & Electronics plus several years of experience in maintenance or installation of aeronautical telecommunication equipment.

2.4.18.2 Student handouts shall be provided, including one copy of the equipment technical manual, for each trainee's use during the training. Those course materials shall be retained by the trainee, for future reference.

2.4.18.3 The Contractor shall also state the pre-requisite for the HF Radio technical training.

2.4.19 Pre-FAT Training

2.4.19.1 The Pre-FAT training shall be conducted at the supplier’s factory where the FAT will be conducted.

2.4.19.2 The Contractor shall provide Pre-FAT training for four (4) FA representative for 10 working days prior to the commencement of FAT.

2.4.19.3 The Contractor shall also propose the recommended duration for the pre-FAT training that will enable the participant to be competent to perform FAT of the SYSTEM.

2.4.19.4 The Contractor shall arrange for suitable accommodation for FA personnel that will

be attending the pre-FAT training & FAT of the SYSTEM.

2.4.20 On-Site Training

2.4.20.1 The on-site training will be conducted at the site at Nadi Airport.

2.4.20.2 The Contractor shall provide on-site training for minimum of ten (10) Technicians for minimum of 10 working days

2.4.20.3 The Contractor shall also propose the recommended duration for the on-site training that will enable the participant to be competent on the system.

2.4.20.4 As part of the regulation on licensing requirement for Technician on the SYSTEM, FA will require the Contractor to conduct system training, on the job training and assessment for competency and rating of the Technician for a period not less than three (3) months. The Tender shall also propose the best method to enable FA to have competent rated Technicians to support the SYSTEM.

2.4.21 Factory Acceptance Testing (FAT)

2.4.21.1 FA reserves the right to attend the Factory Acceptance Tests of all equipment supplied under this Contract. The Contractor is to give written notice to FA to be received at least 21 working days in advance, of the date and place where the acceptance tests are to be conducted.

2.4.21.2 The Contractor shall submit, at the time of notification of the tests, their Pre-FAT test results and a Factory Acceptance Test Procedures detailing the tests to be conducted to prove compliance with the Contract Specifications

2.4.21.3 FA requires the FAT procedure with the Tender documents and a FAT report and FAT certificate to be issued after successful completion of FAT. The FAT tests shall normally be held at the same premises where the equipment is manufactured.

2.4.21.4 FA reserves the right to request additional tests to prove the conformance of the equipment under test

2.4.21.5 The Contractor shall also submit their FAT procedures as part of the Tender response.

2.4.21.6 Only after the successful completion of FAT shall the equipment shipped to the customer sites.

2.4.22 Site Acceptance Test (SAT)

2.4.22.1 The purpose of the Site Acceptance Tests is to demonstrate that the SYSTEM is generally compliant under the operational environment specified in the agreed Site acceptance testing procedures with the technical and operations requirements specified in the Specification.

2.4.22.2 FA requires a SAT procedure with the Tender document and a SAT report and SAT certificate to be issued after successful completion of SAT.

2.4.22.3 The SAT document shall consist of tests specified in the FAT document, plus specific tests taking into account the site environment.

2.4.22.4 The Contractor shall submit for approval a detail final SAT documents (three sets) four weeks before the beginning of the SAT

2.4.22.5 The Site Acceptance Test of the System shall be carried out after quality assurance checks and successful mitigation of all deficiencies in the presence of FA representatives

2.4.22.6 SAT shall be designed to verify the full compliance of the installed equipment with this Specification.

2.4.22.7 The Contractor shall be responsible for incorporating and testing any modification to its design found necessary as a result of the tests. However, after the start of any system functional test or the Site Acceptance Test, no design changes or modification will be made without the approval of FA. If any changes are found to be necessary, FA reserves the right to require any completed test to be re-run to verify that no adverse effects result from the change.

2.4.22.8 If modifications are necessary as approved by FA, the Contractor shall be responsible for updating the system documentation of block diagrams, electrical and mechanical drawing, installation drawings, part lists, logic flow charts and diagrams, computer programs functional specification, listing and all associated descriptive materials. The updating shall be accomplished periodically to maintain the above described documentation in current status.

2.4.23 Reliability Acceptance Test (RAT)

2.4.23.1 The purpose of the Reliability Acceptance Tests (specified in the agreed Reliability Acceptance Test procedures) is to demonstrate, after successful SAT, that the SYSTEM is compliant under the operational environment and ready for commissioning.

2.4.23.2 FA requires a RAT report and RAT certificate to be issued after successful completion of each RAT

2.4.23.3 There shall be a continuous period of thirty (30) days of RAT during which the Equipment performance shall be monitored for full compliance of the SYSTEM specifications and operation environment. The System shall satisfactorily operate continuously, 24/7, during this thirty (30) days period.

2.4.23.4 The System shall be deemed to have satisfactory fulfilled the System Reliability Test when:

2.4.23.4.1 No failure to system or sub-system level; and

2.4.23.4.2 No more than one (1) automatic system changeover in any sub-system or system level (due to system failure)

2.4.23.4.3 All technical and operational requirements are complied with.

2.4.23.5 If the System failed to satisfy any of the above mentioned conditions, the Contractor shall submit to FA a report with the cause of failure and corrective measures including timelines for consideration.

2.4.23.6 FA shall decide whether to re-conduct the RAT or demand alternative solutions at Contractor's cost.

2.4.24 Commissioning

2.4.24.1 The purpose of the Commissioning is to certify that the SYSTEM is ready for operational use. Prior to commissioning the Contractor shall submit to FA all updated and as- built documents.

2.4.24.2 FA requires a Commissioning report and Commissioning certificate to be issued after successful completion of RAT.

2.4.24.3 The Contractor shall provide onsite support during commissioning of the equipment.

2.4.25 Test Equipment

2.4.25.1 The Contractor shall supply a recommended set of tools and test equipment, which shall be adequate for all planned maintenance of the Equipment, and the costs thereof, shall be entered in the Tender.

2.4.25.2 The Contractor shall submit a full list together with details in a Schedules of Tools and Test Equipment.

2.4.25.3 Manufacturer's standard brochures shall be incorporated in the Contractor's offer provided they refer particularly to the equipment offered and all extraneous matter has been marked as inapplicable. Due to the remoteness of Fiji, FA would like to be able to support its equipment, as far as practically possible, without having to rely upon the services of a remote supplier.

2.4.26 Spares & Support

2.4.26.1 The Contractor shall supply their recommended critical on-site spares to ensure that the system performance availability of 99.99% is achieved.

2.4.26.2 The Contractor shall provide a written undertaking to support and supply spare parts for 10 years.

2.4.27 Warranty and Post Warranty Support

2.4.27.1 The warranty of the SYSTEM shall be covered for three (3) years.

2.4.27.2 Where and when required, the Contractor shall upgrade the system software or

hardware without additional charge, such change to overcome errors or problems found by users of the system or part of the system.

2.4.27.3 The Contractor shall immediately inform FA of any hardware & software errors or deficiencies which become known to them and shall promptly rectify such deficiencies.

2.4.27.4 FA shall advise the Contractor of any deficiencies as they arise and the Contractor shall promptly respond and apply corrective solutions.

2.4.27.5 The Contractor shall provide draft post warranty support contract that will include a mid-life health check of the system and refresher training during the same visit. Mid-life upgrade is usually considered five (5) years after the system has been commissioned.

2.5 HF Radio Technical Specification

2.6 Section 4 HF Radio for Nadi Airport

2.6.1 General

2.6.1.1 The Contractor shall offer a HF radio system complete with associated control, monitoring, and aerial system including mast, dummy load and equipment power supply, for long range radio link coverage for air-ground voice communications over route areas in MWARAs and RDARAs frequencies (High Frequency Guidance Material in the South Pacific Region) and transmission coverage in the Nadi FIR (boundary of 6x106 km2) as provided in the table below:

#	MWARA Frequency (kHz)	RDARA Frequency (kHz)	SAR Frequency (kHz)
1	3467	3425	3023
2	5643	6553	5680
3	8867	8846	
4	13261	11339	
5	17904		

2.6.1.2 The current HF radio system operates in a split site mode i.e transmitter at one site and receiver on the other approximately 7km apart.

2.6.1.3 The HF system shall comprise transmitter and receiver equipment's with automatic immediate changeover facilities if any to ensure a high level of availability in service.

2.6.1.4 The HF transmitter where possible shall be connected to one antenna to allow immediate transfer when a fault is detected on one transmitter.

2.6.1.5 The HF radio shall meet ICAO Annex 10 Volume III performance requirements.

2.6.1.6 The HF radio shall be IP based capable to be integrated with the existing C4i SwitchPlus IP VCS for VOIP communication which complies with EUROCAE ED 137 standards for VOIP.

2.6.1.7 A comprehensive Remote Control and Monitoring System (RCMS) shall be provided to facilitate remote monitoring, control and diagnostic functions associated with the HF radio to be conducted from the Nadi ATMC Equipment Room.

2.6.1.8 The MTTR, Availability, Reliability and MTBF of the HF radio shall be provided in the tender.

2.6.1.9 The Contractor shall also be responsible for:

2.2.2.6.3 Improving the grounding system and the lightning protection system.

2.2.2.6.4 Providing installation material such as external and internal cablings, cable trays, connectors, cable ties, conduits etc deemed necessary for successful implementation and commissioning of this project.

2.2.2.6.5 Improving/Replacing existing antenna mast.

2.2.2.6.6 Providing high gain aerial system.

2.6.1.10 The Contractor shall inspect and propose upgrade or refurbishment of existing shelters to meet the requirement for installation of the new equipment.

2.6.1.11 Interface Control Document (ICD) with full details shall be provided for integration to the current operational C4i SwitchPlus VCS system.

2.6.2 HF Radio Transmitter

2.6.1.1 General

2.6.1.1.1 The equipment shall be based on latest and proven product on hardware and software.

2.6.1.1.2 The equipment shall be fully solid state design with extensive Built – In Testing program (BITE).

2.6.1.1.3 The design shall incorporate software designed radio (SDR), for reliability and maintainability purposes, hence lowering spare parts and maintenance cost.

2.6.1.1.4 The design shall incorporate modular design at both device and system level, and present a tailor made solution, addressing specific requirements on user case basis i.e is easily customizable.

2.6.1.1.5 The radio shall be designed with flexible and scalable architecture based on IP for VOIP.

2.6.1.1.6 Processing of RF waveform shall be based on latest technology such as Digital Signal Processing (DSP)and extensively use digital I/Q modulation technique.

2.6.1.1.7 The power amplifier modules for the equipment shall be designed with rugged solid state transistor such as MOS-FET and protection for output load shall be incorporated in the design.

2.6.1.1.8 The Transmitter shall support 32 Bit SELCAL function

2.6.1.1.9 Remote control of the equipment shall be provided via TCP/IP interface.

2.6.1.1.10 The equipment shall have the capability for future data communication and available without any modification to the hardware or the software of the system.

2.6.1.1.11 The equipment shall be in general accord with the guidance contained in ICAO Annex 10.

2.6.3 HF Radio Transmitter

2.6.3.1 The HF Transmitter shall comply with ICAO Annex 10 Volume III.

2.6.3.2 The rated output transmitted RF power shall not exceed 6.0KW peak envelope power PEP as specified in ICAO Annex 10 Volume III.

2.6.3.3 It shall allow presetting of up to 100 spot frequencies in the range of 2.0000 to 29.9999MHz in 100Hz steps.

2.6.3.4 Tone frequency tolerance for the transmitter shall be as follows:

2.6.3.3.1 1500Hz ±10Hz (SSB)

2.6.3.5 Transmitting frequency tolerance shall be within ±10Hz.

2.6.3.6 Audio frequency response for the transmitting system shall be as follows:

2.6.3.5.1 Within 2dB from 250 to 3000Hz for fixed SSB

2.6.3.7 Harmonic and spurious emission for transmitting system shall be -60dB or less relative to PEP.

2.6.3.8 Intermodulation distortion of the transmitting system shall be -35dB or less relative to either of two equal tones at rated PEP.

2.6.3.9 Carrier level, noise level and unwanted sideband level shall be as follows:

2.6.3.8.1 Full carrier level : -6dB ± 1dB relative to PEP
2.6.3.8.2 Suppressed carrier level : -50dB ± 2dB or less relative to PEP
2.6.3.8.3 Noise level : -50dB ± 2dB or less relative to PEP
2.6.3.8.4 Unwanted sideband level : -50dB ± 2dB or less relative to PEP

2.6.3.10 The occupied band width on the reduced and full carrier SSB mode shall be 3kHz or less at 99% of mean emitted power.

2.6.3.11 The transmitter shall operate in following mode:

2.6.3.10.1 Single sideband (J3E) suppressed carrier SSB for voice communication

2.6.3.10.2 AM Equivalent (AME) for SELCAL transmission

2.6.3.12 A highly stable temperature compensated crystal oscillator or similar shall be used to generate the carrier frequency.

2.6.3.13 I/Q modulation technique shall be realized by latest technologies such as Digital Signal Processing (DSP).

2.6.3.14 Digital technique shall be used to improve the linearity of the power amplifier and likewise to reduce the Inter-modulation Distortion (IMD)

2.6.3.15 Microprocessor or FPGA based control shall monitor and control the operation of the entire equipment and shall display the status of the equipment on the display panel.

2.6.3.16 The frequency channel memory shall store up to 100 preset frequency channel and shall include information such as transmitting frequency, emission mode, tuning conditions and the output power level.

2.6.3.17 The front panel of the transmitter shall indicate the emission mode, the transmitting frequency, the voltages and the currents of PA, the forward power RF

power (Pf), the reflected RF power (Pr), the output RF power (Po), the VSWR of the antenna, the peak value of the AF input level and the warning alarm.

2.6.3.18 The power amplifier shall employ rugged power MOSFETS with high linearity.

2.6.3.19 The transmitter shall be designed to ensure less radiation of higher harmonics and eliminate VHF-band interference.

2.6.3.20 If the power amplifier is modular design, then each module shall be protected with individual overload, over-VSWR and overheat circuit.

2.6.3.21 If a malfunction occurs, the affected power amplifier module shall go into alarm state, and is turned off automatically to protect the circuit. The alarm shall be displayed on the front panel and also at the remote control and monitoring system located at ATM equipment room.

2.6.3.22 The PA module shall also incorporate a cooling fan and designed with an efficient forced-air-cool heat sink, to ensure low acoustic noise of less than 30dB even in continuous operation under server environment.

2.6.3.23 The rpm of the cooling fan and idle current of the amplifier module shall be controlled by PTT signal or voice input signal such that economical benefit in terms of power usage and fan life is achieved.

2.6.3.24 When there is no PTT or input signal, the transmitter shall automatically go into ideal state and shall consume as much as less power as such state, and the Contractor shall state this.

2.6.3.25 Matching part shall be designed in such a way to suppress higher harmonics and shall obtain the matching of the transmitter with the impedance of the feeder line of the antenna system in use.

2.6.3.26 The matching part shall be designed in a manner that it automatically tunes to the unknown impedance of the antenna system and once optimum conditions are achieved, the matching conditions shall be stored in a memory for each frequency channel.

2.6.3.27 In any condition where transmitting frequency channel changes, the matching condition that is stored shall be recalled. This shall be done within less than a second.

2.6.3.28 Whenever the impedance of the antenna system changes during operation, the matching part shall automatically adjust and maintain the optimum matching conditions at all times.

2.6.3.29 All operations of the transmitter shall be controlled from the front panel in a local and in remote mode.

2.6.3.30 Remote control and monitoring shall be provided via TCP/IP network at Nadi ATMC equipment room.

2.6.3.31 The BITE shall be run from the front panel displaying all the parameters results displayed on it for convenience in checking all parameters such as the RF level, DC voltages/currents in respective circuits, etc and likewise any malfunction in the transmitter.

2.6.3.32 The front panel shall also have provision for Ethernet and RS-232C port for connection to a PC for monitoring and control of all parameters that is available through BITE.

2.6.3.33 The transmitter shall be designed in compliance with relevant ICAO standards to ensure high reliability and ease of operations/maintenance.

2.6.3.34 The solid state transmitter design and/or Software Defined Radio (SDR) shall minimize maintenance with safety, ensure long life and low running cost as compared to conventional transmitters.

2.6.3.35 To ensure reliable performance of the system, the temperature and humidity of the transmitting equipment shall be as follows:

Preheating time : < 1minute
Operating Temperature : +18 to +70
Operating Humidity : 95% non-condensing

2.6.4 Control & Monitoring system (CMS)

2.6.4.1 Monitoring equipment shall be provided to monitor system and sub-system performance in accordance to ICAO Annex 10 Volume III and manufacturer's specifications

2.6.5 Local Maintenance Terminal

2.6.5.1 For ease of access and operation by maintenance personnel, the Contractor shall provide a suitable Local Maintenance Terminal connected to the transmitter system via Ethernet port.

2.6.5.2 The Local Maintenance Terminal shall as a minimum

2.6.5.2.1 connect to the Transmitter cabinet via an Ethernet port.

2.6.5.2.2 display all executive and maintenance indications of all parameters.

2.6.5.2.3 allow for System monitoring and control functions.

2.6.5.2.4 allow for verification/adjustment of operational and monitoring parameters.

2.6.5.2.5 shall be password protected such that system adjustments are

possible only with entry of the proper security codes, using user level with corresponding privileges for access and modification of system parameters and configurations. All privileges to be managed by the Administrator

2.6.5.2.6 ability to generate user login report with changes made to the system. This shall only be available to the Administrator.

2.6.6 Remote Control & Monitoring System (RCMS)

2.6.6.1. Remote Maintenance Terminal

2.6.6.1.1 For ease of access and operation by maintenance personnel, the Contractor shall provide a suitable Remote Maintenance Terminal connected to the transmitter system via Fiji Airport network on LAN.

2.6.6.1.2 The Remote Maintenance Terminal shall as a minimum:

2.6.6.1.2.1. connect to the Transmitter cabinet via an Ethernet port.

2.6.6.1.2.2. display all executive and maintenance indications of all parameters.

2.6.6.1.2.3. allow for System monitoring and control functions.

2.6.6.1.2.4. allow for verification/adjustment of operational and monitoring parameters.

2.6.6.1.2.5. shall be password protected such that system adjustments are possible only with entry of the proper security codes, using user level with corresponding privileges for access and modification of system parameters and configurations. All privileges to be managed by the Administrator

2.6.6.1.2.6. ability to generate user login report with changes made to the system. This shall only be available to the Administrator.

2.6.7 HF Radio Transmitter Dummy Load

2.6.7.1 The contractor shall supply one (1) 25KW dummy load for the HF Radio Transmitter.

2.6.7.2 The dummy load impedance shall be 50 ohms

2.6.7.3 The dummy load shall be of Bird, USA product.

2.6.7.4 The dummy load shall have a life cycle of 10 years or better. The contractor shall submit the equipment specification of the Dummy Load

2.6.8 HF Radio Receiver

2.6.8.1 General

2.6.8.1.1 The HF receiver shall comply with ICAO Annex 10 Volume III.

2.6.8.1.2 The equipment shall be based on latest and proven product on hardware and software.

2.6.8.1.3 The equipment shall be fully solid state design with extensive Built – In Testing program (BITE).

2.6.8.1.4 The design shall incorporate software designed radio (SDR), for reliability and maintainability purposes, hence lowering spare parts and maintenance cost.

2.6.8.1.5 The design shall incorporate modular design at both device and system level, and present a tailor made solution, addressing specific requirements on user case basis i.e is easily customizable.

2.6.8.1.6 The radio shall be designed with flexible and scalable architecture based on IP for VOIP.

2.6.8.1.7 Processing of RF waveform shall be based on latest technology such as DSP and extensively use digital I/Q modulation technique.

2.6.8.1.8 High performance Analog – to – digital converter (ADC) shall be used in the design to achieve high dynamic range characteristics and selectivity performance.

2.6.8.1.9 Radio design shall incorporate noise reduction function such that the intelligence is free from noise and interference.

2.6.8.1.10 Remote control and monitoring of the equipment shall be provided via TCP/IP interface.

2.6.8.1.11 The equipment shall have the capability for future data communication and available without any modification to the hardware or the software of the system.

2.6.8.1.12 The equipment shall be in general accord with the guidance contained in ICAO annex 10.

2.6.9 Receiver Radio

2.6.9.1 A high performance and fully solid state receiver shall be proposed, incorporating modern techniques to process intelligence free of noise and interference.

2.6.9.2 Receiving Frequency: The receiving frequency shall be in the range of 90kHz to 30MHz

2.6.9.3 The receiving system shall be designed using RF direct sampling method, eliminating the need for conventional method of analog signal mixing or latest cutting-edge technology.

2.6.9.4 Reception mode for the receiver shall be suppressed carrier SSB and shall have preset channel capacity of 200 or more channels.

2.6.9.5 Sensitivity is an important component of the receiver system and shall be ≤ 1µV or better with a signal to noise ratio (SNR) of 20 dB or better for frequency range from 90 kHz to 30MHz for suppressed carrier SSB.

2.6.9.6 The Contractor shall demonstrate the selectivity of the receiver as follows:

Bandwidth ~~Attenuation~~	6dB Bandwidth	60dB Bandwidth
6 kHz	4.5 kHz to 7.0 kHz	14.0 kHz or narrower
3 kHz	2.7 kHz to 3.3 kHz	4.4 kHz or narrower
2.7 kHz	2.4 kHz to 3.0 kHz	4.1 kHz or narrower
1 kHz	1.0 kHz to 1.5 kHz	3.0 kHz or narrower
0.5 kHz	0.45 kHz to 0.6 kHz	2.0 kHz or narrower
0.3 kHz	0.27 kHz to 0.3 kHz	1.1 kHz or narrower

2.6.9.7 The basic frequency stability of the receiving function shall be such that, with the transmitting function stabilities specified above, the overall frequency difference between ground and airborne functions achieved in service and including Doppler shift, does not exceed 45Hz

2.6.9.8 Spurious response of the receiving function shall be as follows:

2.6.9.8.1 Image frequency rejection ratio : 70dB or better
2.6.9.8.2 Intermediate frequency rejection ratio : 80dB or better

2.6.9.9 Overall Distortion: The ratio of 1000Hz output to its unwanted frequency component shall be 20dB or more under condition where output level is set to 500mW by input level of 30 µV.

2.6.9.10 AGC characteristics of receiving function shall be such when the audio frequency output is varied for the antenna input of 1µV to 100mV shall be 4 dB or less.

2.6.9.11 Conducted spurious emission shall be as low possible i.e power emitted from the antenna terminal shall be negligible.

2.6.9.12 Nominal input impedance shall be 50 ohms, unbalanced.

2.6.9.13 Auxiliary functions such as scan, seep, squelch, noise blanker, self-test, AGC selection, built-in-loud speaker and other function which is deemed necessary shall be provided on the receiving unit.

2.6.9.14 Variable range of BFO/Clarifier shall be as follows:

2.6.9.17.1 BFO : +/-9.9999 kHz (1 Hz step)
2.6.9.17.2 Clarifier :+/-200 Hz (1 Hz step)

2.6.9.15 Following are the basic parameters shall be controlled locally and remotely and the contractor shall also indicate the list of available parameters to be control.

2.6.9.18.1 Receiving frequency
2.6.9.18.2 Reception mode
2.6.9.18.3 Bandwidth

2.6.9.18.4 AGC
2.6.9.18.5 ATT
2.6.9.18.6 BFO/Clarifier
2.6.9.18.7 Noise Blanker
2.6.9.18.8 RF Gain
2.6.9.18.9 Channel
2.6.9.18.10 Self Test
2.6.9.18.11 Status Request
2.6.9.18.12 Hold
2.6.9.18.13 Scan
2.6.9.18.14 Sweep
2.6.9.18.15 Squelch

2.6.9.16 All operations of the receiver shall be controlled from the front panel in a local and in remote mode.

2.6.9.17 Remote control and monitoring of the receiver shall via TCP/IP network provided at ATMC equipment room.

2.6.9.18 The BITE shall be run from the front panel displaying all the parameters results displayed on it for convenience in checking all parameters such as the RF level, DC voltages/currents in respective circuits, etc including listed parameters and likewise any malfunction in the receiver.

2.6.9.19 The front panel shall also have provision for Ethernet andRS-232C port for connection to a PC for monitoring and control of all parameters that is available through BITE.

2.6.9.20 The receiver shall be designed in compliance with relevant ICAO standards to ensure high reliability and ease of operations/maintenance.

2.6.9.21 The solid state receiver design and/or Software Designed Radio (SDR) shall minimize maintenance with safety, ensure long life and low running cost as compared to conventional receivers.

2.6.9.22 To ensure reliable performance of the system, the temperature and humidity of the receiving equipment shall be as follows:

Preheating time : < 1minute
Operating Temperature : +18 to +70
Operating Humidity : 95% non-condensing

2.6.10 Receiver Antenna Multi-coupler Unit (AMU)

2.6.10.1 The antenna multicoupler shall allow up to 32 receiver's to be connected with one common antenna.

2.6.10.2 The frequency range for the antenna multicoupler shall be in the range between

400kHz to 30MHz.

2.6.10.3 The design of antenna multicoupler shall ensure low distortion factor, high linearity and low noise characteristics.

2.6.10.4 The antenna multicoupler shall have following electrical characteristics:

2.6.10.4.1 Input/output impedance 50ohm nominal
2.6.10.4.2 VSWR 1.5 or less
2.6.10.4.3 Gain 2dB ± 2dB
2.6.10.4.4 Isolation – Between two outputs 30dB or more and outputs to input 50dB or more

2.6.11 Control & Monitoring System (CMS)

2.6.10.1 Monitoring equipment shall be provided to monitor system and sub-system performance in accordance to ICAO Annex 10 Volume III and manufacturer's specifications.

2.6.12 Local Maintenance Terminal

2.6.11.1 For ease of access and operation by maintenance personnel, the Contractor shall provide a suitable Local Maintenance Terminal connected to the transmitter system via Ethernet port.

2.6.11.2 The Local Maintenance Terminal shall as a minimum

2.6.11.2.1 connect to the Transmitter cabinet via an Ethernet communications port.

2.6.11.2.2 display all executive and maintenance indications of all parameters.

2.6.11.2.3 allow for System monitoring and control functions.

2.6.11.2.4 allow for verification/adjustment of operational and monitoring parameters.

2.6.11.2.5 shall be password protected such that system adjustments are possible only with entry of the proper security codes, i.e. using user level with corresponding privileges for access and modification of system parameters and configurations. All privileges to be managed by the Administrator.

2.6.11.2.6 ability to generate user login report with changes made to the system. This privilege shall only be available to the Administrator.

2.6.13 Remote Control & Monitoring System (RCMS)

2.6.14 Remote Maintenance Terminal

2.6.14.1 For ease of access and operation by maintenance personnel, the Contractor shall

provide a suitable Remote Maintenance Terminal connected to the receiver system via Fiji Airport network on LAN.

2.6.14.2 The Remote Maintenance Terminal shall as a minimum:

2.6.13.2.1 connect to the Transmitter cabinet via an Ethernet communications port.

2.6.13.2.2 display all executive and maintenance indications of all parameters.

2.6.13.2.3 allow for System monitoring and control functions.

2.6.13.2.4 allow for verification/adjustment of operational and monitoring parameters.

2.6.13.2.5 shall be password protected such that system adjustments are possible only with entry of the proper security codes, i.e. using user level with corresponding privileges for access and modification of system parameters and configurations. All privileges to be managed by the Administrator.

2.6.13.2.6 ability to generate user login report with changes made to the system. This privilege shall only be available to the Administrator.

2.6.15 VCS Integration

2.6.15.1 Fiji Airports currently operates and maintains the C4i SwitchPlus IPVCS to operate the HF Radio Transmitter & Receiver, which was installed and commissioned in 2018.

2.6.15.2 C4i VCS is fully compliant to EUROCAE ED-137 standard for VOIP and the Contractor shall be responsible for the integration of the proposed HF Radio (Transmitter/Receiver) system with the available VCS.

2.6.15.3 The Contractor shall ensure that the existing VCS CWP customized design for Radio operator to operate it from the VCS CWP shall be simple with the three actions or less to tune the HF radio transmitter

2.6.15.4 The primary means communication between the VCS and the radio site is via fibre and backed up by copper lines over modem. FA is planning to replace copper with wireless link in near future.

2.6.15.5 The Contractor shall indicate clearly in the tender submission the scope and cost of the system configuration for the VCS integration.

2.6.15.6 The Contractor shall indicate clearly in the tender submission how the VCS integration is achieved to meet the operator customized requirements.

2.7 HF Air-Ground-Air Antenna Equipment

2.7.1 Introduction

2.7.1.1 Following specification applies to the High Frequency (HF) Single Side Band Transmit and Receive antenna equipment described in functional terms below.

2.7.1.1.1 HF wideband Receive Antenna
2.7.1.1.2 HF wideband Transmit Antenna

2.7.2 Electrical Requirements

General

2.7.2.1.1 Polarisation**:** The polarization shall be circular/elliptical, such that an earth mat or counterpoise is not required.

2.7.2.1.2 Polarisation: Antennas using circular or elliptical polarization shall be suitable for use in the Southern Hemisphere.

2.7.2.1.3 Directivity: The power gain shall be omnidirectional within 1db in the azimuthal plane across the entire frequency range.

2.7.2.1.4 Power Gain: The power gain shall be at least 4dBi (nominal) over perfect ground across the defined band.

2.7.2.1.5 VSWR: Should not exceed 2.5:1 over the entire frequency range.

2.7.2.1.6 Efficiency: The efficiency of the antenna across the entire frequency band must be at least 99%.

2.7.2.1.7 Termination: Any use of resistive terminations must be clearly stated and allowed for efficiency calculations.

2.7.2.1.8 Feed: 50 Ohm coaxial cable

2.7.2.1.9 Communication: The antenna shall be capable of short, medium and long-range communication.

2.7.3 Transmit Requirements

2.7.3.1 Transmission: The transmit antenna must be capable of transmission from single transmitter i.e. one transmitter connected to one antenna, with following requirement:

2.7.3.1.1 Transmitter input to the antenna must provide full frequency agility from

2MHz to 30MHz, at high and low take-off angle with the principal or secondary gain lobe in the elevation plane being at 90^0 to horizontal.

2.7.3.1.2 Transmit antenna listed in scope of works must be capable of transmission from one 10kW & one 5kW transmitters.

2.7.4 Receive Requirements

2.7.4.1 Reception: The receive antenna must be capable of simultaneous reception of signals incident upon the antenna at both high and low take-off angles via separate feeds as follows:

2.7.4.1.1 Reception from 2MHz to 30MHz with the principal gain lobe in the elevation plane being at 90^0 to horizontal.

2.7.5 Mechanical Requirements

2.7.5.1 Construction

2.7.5.1.1 Height: The height of the antenna, with lightning protection where applicable should not exceed 35m.

2.7.5.1.2 Ground Area: The antenna must not require more than 40m x 40m of land for installation, including guy anchor points.

2.7.5.1.3 Modularity: The tower(s) must be of modular construction, with section lengths not exceeding 10 feet.

2.7.5.1.4 Exclusion of vermin: All ventilation areas and opening in the antenna coupling unit should be covered with fine stainless steel wire mesh or similar, such as to exclude entry of insects. It shall be easily detachable during maintenance for cleaning purposes and the design shall be such to block entry of dust particles practically as possible.

2.7.5.1.5 Special Tools: Any special tools required for installation and maintenance (including cranes) must be clearly specified

2.7.5.1.6 Corrosion Protection: Steelwork shall be stainless steel or hot dip galvanized to AS/NZS 4202/4000, or equivalent, after fabrication.

2.7.5.1.7 Zinc plating will not be accepted as a substitute for galvanizing.

2.7.5.1.8 The equipment finish shall be durable and protect against corrosion, black molds and defacement of the equipment or equipment parts in normal use.

2.7.5.1.9 Bolts, nuts and washers shall be stainless steel or hot dipped galvanized and their strength/grade marking shall be clearly stamped or embossed and every effort shall be made to clearly explain the characteristics of grade mentioned above.

2.7.5.1.10 Inserts, anchor bolts and embedded fixings shall be hot dipped galvanized or stainless steel.

2.7.5.1.11 High strength structural bolting to AS 1252 shall be used for all structural

connections.

2.7.5.1.12 Jointing of prefabricated and galvanized modules/elements shall be by bolting with an arrangement offering optimal resistance to corrosion.

2.7.5.1.13 Field erection shall proceed without the necessity to ream holes or alter the galvanized steel in any way.

2.7.5.1.14 Welding of galvanized steelwork shall not be required for installation.

2.7.5.1.15 Hollow section members shall incorporate a suitable opening for drainage of internally collected water or be completely and permanently sealed

2.7.5.1.16 The inside of any hollow steel sections should be coated with a fish oil product. H

2.7.5.1.17 Nameplates and Labelling: Every LRU, module or detachable sub-assembly of the antenna coupling unit must be uniquely identified with an indelible mark. As a minimum, the markings must indicate both Part and Serial numbers.

2.7.6 Environmental

2.7.6.1 Wind Survival: Antennas shall have wind survival of ≥81m/s, tested in accordance with AS 1170.2 or similar. Any further functionality which enhances the antenna's ability to resist severe weather conditions should be clearly stated.

2.7.6.2 Lightning Protection: Lightning protection for all structures shall comply with AS/NZS 1768 Lightning standards or similar. The design and installation of the air termination and earthing system shall not degrade the performance of the systems supported at the site, and shall be agreed with Fiji Airports.

2.7.6.3 Earthing system most suitable for the tower shall be proposed with complete diagram showing connectivity from the lightning arrestor, tower and any other unit which is deemed to be earthed. Lightning is common in Fiji and every care shall be taken when designing the earthing system. Conductor size connecting to the earthing system should be also shown.

2.7.6.4 Lightning/Surge Arrestors if deemed necessary to be connected along the system shall be clearly specified so to protect the system from surge currents.

2.7.6.5 The supplier shall state if the coaxial cables need to be earthed to provide another layer of protection.

2.7.6.6 The earth resistance of the earthing system shall be less than 5 ohms. The supplier shall make every effort to provide drawings to show how this reading will be achieved by using a suitable earth tester and which method will be used to determine the correct resistance.

2.7.6.7 Earth cleats, or similar means of connecting the earthing system, shall be

provided at, or just above, the base of each mast leg.

2.7.7 Safety and Maintainability

2.7.7.1 The tower supporting the matching unit should be fitted with a ladder for the purpose of maintenance access.

2.7.7.2 Ladders, where equipped, should be fitted with a fall arrest system.

2.7.7.3 The antenna coupling unit shall bear, or be delivered with, prominent warning signs of high RF voltages.

2.7.7.4 All designations on the equipment shall be in the English language, and shall be protected from wear and fading due to normal installation and maintenance procedures.

2.7.8 Maintenance Requirements

2.7.8.1 Maintenance of the antenna shall be dependent on Contractor advice on a suitable maintenance regime.

2.7.8.2 Maintenance of the antenna coupling unit shall be dependent on Contractors advice on a suitable maintenance regime.

2.7.8.3 The specified maintenance interval should not be less than 24 months.

2.7.9 Civil Requirements

2.7.9.1 Construction

2.7.9.1.1 Tower**:** All detailed drawings for assembly and construction of tower shall be provided for ease of installation at the site.

2.7.9.1.2 Foundation: The foundation details for the tower base and the guy anchor pads shall be supplied for the purpose of tower construction.

2.7.9.1.3 Reinforcement: Type of steel bar, size of steel bar, number of steel bars, tying of steel bars and other details which may be deemed necessary for the construction of foundation shall be supplied so that steel reinforcements is done in a correct manner to prevent tower from collapsing due to weight, and during natural disasters when erected.

2.7.9.1.4 Anchor Bolt Guide/Base Plate: The supplier shall provide guide/base plates for the anchor bolts so that it is positioned accurately underneath concrete in order for the base of the tower to fit in properly to the anchor bolts and bolted.

2.7.9.1.5 Concrete Strength**:** The supplier shall state the mpa of the concrete mix to be used for tower and guy anchor pad foundation to avoid concrete from deteriorating and cracking. The supplier shall also state the curing time for the concrete before tower can be erected.

2.7.9.1.6 Stay/Guy Wire: The drawing shall clearly show the total number of support cable and angle of support cable from the tower base. The guy anchor pads shall be clearly marked showing the angle and distance from the tower base such that exact position is known. The diameter of such support cable shall be also provided.

2.7.9.1.7 Dimension: All dimensions on drawings shall be given in millimeters (mm)

2.7.9.1.8 Endorsement: All drawings for civil works shall be endorsed by a registered civil & structural engineer for compliance to AS1170 and the associated codes and standards as applicable under the Fiji National Building Code.

2.7.10 RMA

2.7.10.1 The antenna equipment shall achieve minimum MTBF figures as shown in Table below:

Equipment	MTBF (Hrs)
Antenna and Supporting Structures	28,000
Coupling Unit	28,000

2.7.11 Coaxial Cable

2.7.11.1 Where the Contractor provides coaxial cable, it must meet the following specification:

2.7.11.2 Attenuation: Must not be greater than the following:

Frequency (MHz)	Attenuation dB/100f	Attenuation dB/100
2	0.095	0.311
10	0.213	0.698
20	0.305	0.999

2.7.11.3 The conditions assumed for the attenuation tests must be provided by the Contractor.

2.7.11.4 Impedance**:** The impedance must be 50 Ohms (± 1).

2.7.11.5 Velocity: Must be greater than 87%

2.7.11.6 Peak Power Rating: Must be greater than 25kW

2.7.11.7 DC breakdown: Must be greater than 3500 Volts

2.7.11.8 Capacitance(pF/m): Must be within the range 22.8 to 23.2

2.7.11.9 Inductance (μ H/m): Must be within the range 0.186 to 0.192

2.8 Annexure 1.0

Nadi HF Replacement Project Requirements

1.1 HF Replacement – Stage 1

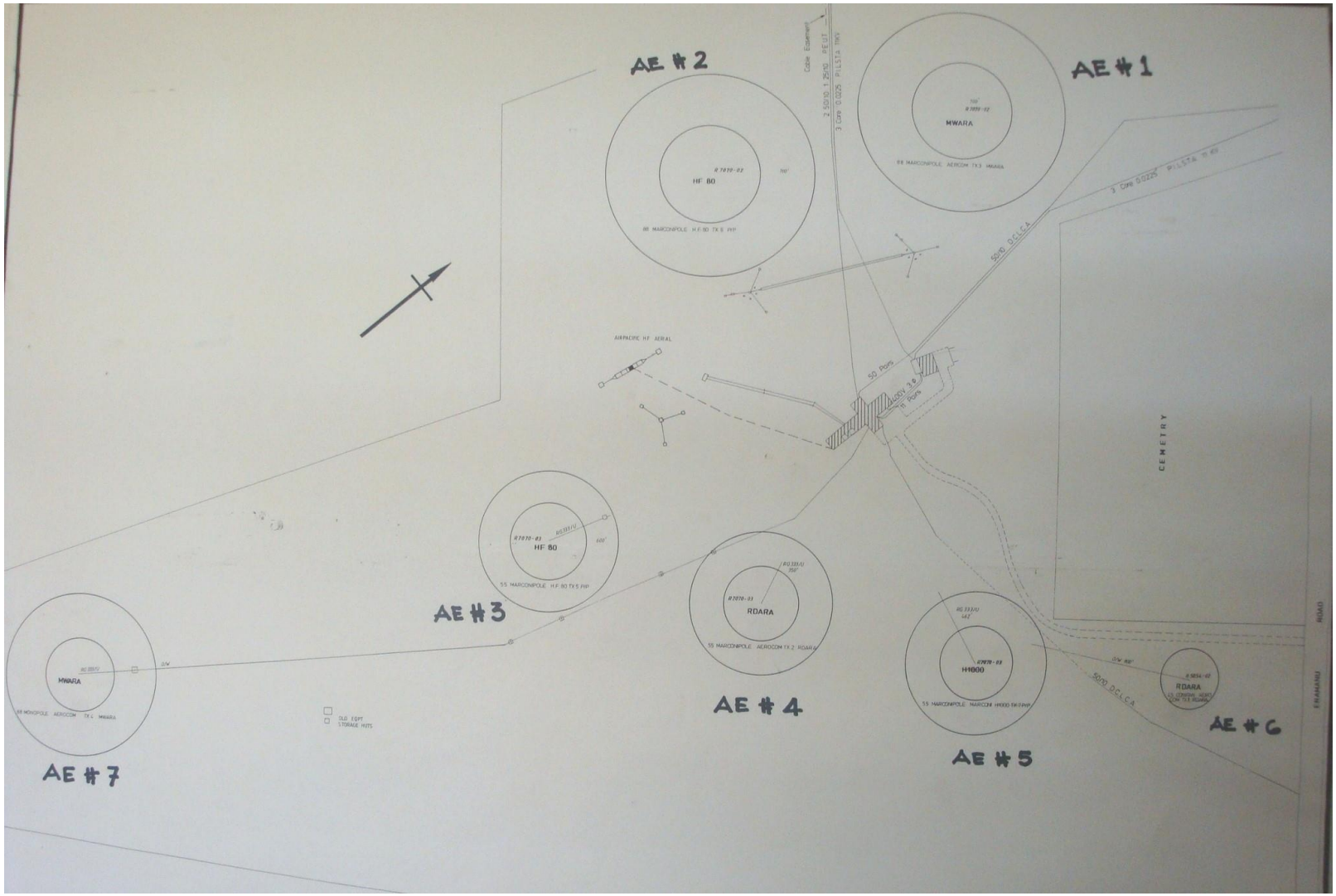
#	HF REQUIREMENT	QTY	REMARKS
1	10kW HF Transmitter	2	Installed at current site – Enamanu Transmitting station
2	HF Receiver	12	Installed at current site – Nasoso Receiving Station
3	HF Receiver Aerial Multi-Coupler	2	Installed at receiver site – Nasoso Receiving station
4	HF High power wide band transmitting antenna	2	Installed at transmitter site - Enamanu Transmitting station (refer aerial farm layout – Appendix 3.0)
5	HF High Power Wide Band Receiving Antenna	1	Installed at receiver site - Nasoso Receiving station (refer aerial farm layout – Appendix 4.0)
6	25kW Dummy Load	1	Installed at transmitter site - Enamanu Transmitting station
7	Communication Link	4	Installed at ATMOC equipment room & at the site

1.2 HF Replacement – Stage 2

#	HF REQUIREMENT	QTY	REMARKS
1	5kW HF Transmitter	2	Installed at current site - Enamanu Transmitting station
2	HF Receiver	12	Installed at current site - Nasoso Receiving Station
3	HF Receiver Arial Multi-Coupler	1	Installed at receiver site - Nasoso Receiving Station
4	HF High Power Wide Band Receiving Antenna	1	Installed at receiver site - Nasoso Receiving station (refer aerial farm layout – Appendix 4.0)

2.9 Annex 2 HF Replacement Project Sites (Transmitter & Receiver)

2.10 Annexure 3 HF Transmitter Station Aerial Farm



ISSUE	AMENDMENT	ORIGIN	DRGM	APPD	DATE	ORIGIN	K DAINAKI	
						DESIGN	K DAINAKI	
						DRAWN		
						CHECKED		
						RECOMND		

APPROVED

K DAINAKI
MANES

DATE

AIRPORTS FIJI LIMITED

Airports Fiji Limited

NADI INTERNATIONAL AIRPORT

Transmitting Station Aerial Farm

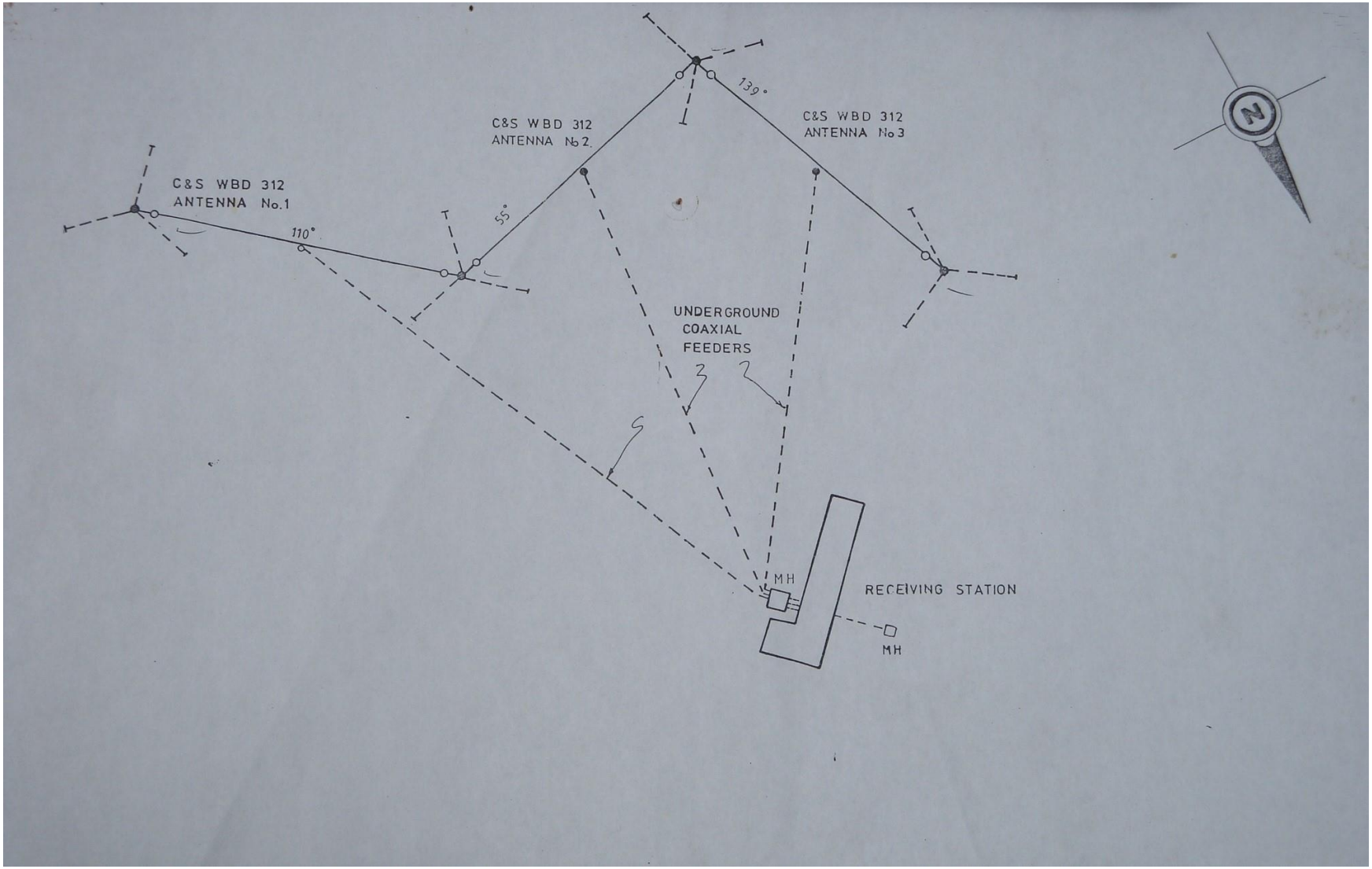
ISSUE

Sheet 1 of 1

Scale : nts

DRG. No.

2.11 Annexure 4 HF Receiver Station Aerial Farm



ISSUE	AMENDMENT	ORIGIN	DRGM	APPD	DATE	ORIGIN	K DAINAKI	
						DESIGN	K DAINAKI	
						DRAWN		
						CHECKED		
						RECOMND		

APPROVED

K DAINAKI
MANES

DATE

AIRPORTS FIJI LIMITED

Airports Fiji Limited

NADI INTERNATIONAL AIRPORT

Receiving Station Aerial Farm

ISSUE

Sheet 1 of 1

Scale : nts

DRG. No.