

Project Name

Procurement for 4 Systems of DVOR/DME

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SECTION 1

TECHNICAL SPECIFICATIONS

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1. DEFINITIONS

In the specification, the following words and expression shall have the meanings assigned to them here under except where the context otherwise requires:

AEROTHAI	Aeronautical Radio of Thailand Ltd.
Essential requirement specification [E]	Essential requirement specification which is mandatory requirement by which the Tenderer shall fully comply with AEROTHAI's requirement stipulated in Scope of Specifications. The Proposal will be rejected if the proposed system, functions of features fail to comply with Essential requirement specification.
Proposal	The response to the requirement specified in Scope of Specifications.
Tenderer	The juristic person, firm or company who offers to provide materials or perform a service or do a job with AEROTHAI at a specified cost or rate.
Contractor	The juristic person, firm or company whose Tender(s) /Proposal(s) has/have been accepted by AEROTHAI and who agrees to accomplish the activities for AEROTHAI.
ICAO Annex 10 Vol. I	Aeronautical Telecommunications: Volume I Radio Navigation Aids. Sixth Edition, July 2006, Amendments 90.
ICAO Annex 14 Vol. I	Aerodromes: Volume I Aerodrome Design and Operations. Seventh Edition, July 2016, Amendments 1-13-A.
ICAO Doc 8071 Vol. I	Manual on Testing of Radio Navigation Aids: Volume I Testing of Ground-Based Radio Navigation Systems. Fourth Edition-2000, Amendments 1.

2.	GENERAL REQUIREMENTS [E]	
2.1	The Project consists of DVOR/DME systems as the following:	
	2.1.1	Four (4) DVOR/DME Systems shall be installed to replace the current system at Ubon Ratchathani Airport, Chiang Rai Airport, Mae Hong Son Airport and Rayong Station.
	2.1.2	Each DVOR/DME antenna and Near field antenna shall be installed by contractor that follow the manufacturer installation manual.
	2.1.3	Cable ladders shall be provided and installed by contractor
2.2	The DVOR/DME Systems shall be designed based on dual transmitters and dual monitors configuration which consists of the following:	
	2.2.1	Dual DVOR Equipment;
	2.2.2	Dual DME/N Equipment;
	2.2.3	Antenna Systems for the above equipment;
	2.2.4	Local Control and Status Equipment of DVOR and DME include its local computer at DVOR/DME station, as specified in [5.1].
	2.2.5	Remote Status Unit (RSU) for the above equipment specified in 2.2.1-2.2.3 which shall be equipped at Control Tower; as specified in [5.4].
	2.2.6	Remote Control and Status Unit (RCSU) for the above equipment specified in 2.2.1-2.2.3 which shall be equipped at Technical Control Room; as specified in [5.3].
	2.2.7	Remote Maintenance and Monitoring (RMM) Equipment (Computer) for the above equipment specified in 2.2.1-2.2.3 which shall be equipped at Technical Control Room, as specified in [5.5].
2.3	The DVOR/DME systems shall have SNMP management capability are specified in clause 6.	
2.4	The system performance and its signal-in-space quality shall at least comply with the ICAO Annex 10 Vol. I.	
2.5	All RF Generators shall be synthesizers.	
2.6	The equipment shall be the modular design, or an easy plug-in card or modules for quick replacement with the purpose for easy maintenance and repair.	
2.7	The dual independent transmitters shall be housed in the cabinet (s) and operated as main and standby facilities. Maintenance on one equipment shall be accomplished without disruption the operation of the others.	
2.8	The equipment shall be designed in common of modules and printed circuit boards.	

2.9	The MTBO of each system shall be greater than 10,000 hours. The Tenderers shall submit reliability analysis (MTBF, MTBO) in the Proposal.
2.10	The DME equipment shall be installed in co-location with the DVOR equipment.
2.11	Each Line Replaceable Units (LRU) of DVOR/DME Equipment shall be easily exchangeable.
2.12	Indoor equipment shall be designed for continuous operation <u>at least</u> under the ambient temperature range of 0 °C to +50 °C with a relative humidity of up to 95%. Outdoor equipment shall be designed for continuous operation <u>at least</u> under the temperature range of -40 °C to +60 °C with a relative humidity of up to 100%, up to 100 mph (160 Km/h) wind velocity. All outdoor materials shall be suitably weather protected by appropriate coat or high grade paint in order to withstand severe ambient conditions of outdoor installation due to temperature, humidity, rainfalls, as specified in ICAO Annex 14 Vol. I.
2.13	AC/DC power lines, transmission lines, control lines, test cables and all relevant accessories shall be as follows:
2.13.1	All AC/DC power lines, transmission lines, control lines and relevant accessories (e.g. connectors, cable trays, conduits and cable ties) shall be provided by the contractor. The transmission line shall be the rodent protection type. If the installation work involves buried cables, they shall be "underground-type" and fitted in HDPE or RSC pipes which the inner diameter shall be wide enough for fitting all cables easily;
2.13.2	All transmission lines shall be laid in a different pipe separated from that of AC power lines;
2.13.3	The underground cable work shall be done by the Contractor. The trench for lying underground cable shall be dug with more than fifty (50) cms in depth from ground surface and not less than thirty (30) cms in width. The trench basement shall be covered with twenty (20) cms thick of sand which is the base of underground cable. Finally, the underground cable shall be covered with twenty (20) cms thick of sand topping with twenty (20) cms thick of soil;
2.13.4	All known power and control lines (or else cable routes) leading to the facility shall be marked out by the contractor;
2.13.5	Cable route markers shall be installed at every 10 meters for indicating underground cables. The cable route marker specifications are detailed in section 2: Counterpoise and Grounding System Requirements;
2.13.6	The Contractor shall take all responsible precautions to protect existing underground equipment and utilities;

	2.13.7	The tenderer shall submit all external RF connectors type and model that complied with IEC61169-16 or other international standards in the proposal.
	2.14	Power supply
	2.14.1	The DVOR/DME System shall be operated with 230 VAC \pm ($\geq 10\%$), 50 Hz \pm ($\geq 2\%$).
	2.14.2	The UPS & STS for the DVOR/DME System shall be provided and shall be installed at each site. (Refer to diagrams in clause 13.)
	2.14.3	Power supply module for DVOR and DME equipment shall be individually supplied.
	2.15	Lightning protection, surge protection and grounding system shall be as follows.
	2.15.1	All above system must be complied with IEC-62305 international standard or other international standards.
	2.15.2	The tenderer shall submit brand, model and the related document of lightning protection and grounding system in the proposal including <ul style="list-style-type: none"> - Air-Termination System. - Down Conductor System. - Earth-Termination System, the so-called "Grounding System". - Lightning Arrester, the so-called "Surge Protective Device (SPD)".
	2.15.3	The lightning protection system shall adequately protect all of the DVOR/DME and peripheral equipment in the event of a lightning strike.
	2.15.4	The surge protection for all Telecom line shall be provided.
	2.15.5	The surge protection system shall be provided to all Power line. Each unit of Arrester shall also be embedded with an indicator to alarm when damage/ failure occur.
	2.15.6	The power surge protection shall meet the following specifications:
	2.15.6.1	Maximum Continuous Operating Voltage (U_c) at least 320 VAC;
	2.15.6.2	Voltage Protection Level (U_p) less than 1.5 kV;
	2.15.6.3	Maximum Discharge Current (I_{max}) (8/20 μ s) at least 100 kA.
	2.15.7	The Contractor shall supply RF Coaxial cable surge protection for VOR band and DME band complied with IEC-62305 or other international standards.
	2.15.8	The Tenderer shall provide to "Lightning Protection and grounding System" at least a five (5) year-manufacturer warranty which starts from the completion of the final payment date according to the term of payment stipulated in "NON-TECHNICAL" term of reference.
	2.15.9	The Tenderer shall take responsibilities for "PREVENTIVE" maintenance-every year during the warranty period
	2.16	The total resistance of the grounding system shall not exceed 5 Ω

	2.17	The backup battery with charger unit for DVOR/DME equipment shall also be included in the power supply system.	
	2.18	The backup battery shall have sufficient capacity to enable to operate at least Three (3) hour in the event of an AC mains failure.	
	3.	DOPPLER VHF OMNI RANGE (DVOR) EQUIPMENT [E]	
	3.1	System Accuracy	
	3.1.1	Azimuth accuracy shall be better than ± 1 degree on ground measurement.	
	3.1.2	Azimuth stability shall be better than ± 0.5 degree measured at a monitor.	
	3.2	The dual DVOR equipment shall comprise, but not limited to:	
	3.2.1	Dual carrier transmitters;	
	3.2.2	Dual sideband transmitters;	
	3.2.3	Dual monitors;	
	3.2.4	DVOR test generator;	
	3.2.5	Antenna Switching Unit;	
	3.2.6	Antenna System.	
	3.3	Carrier Transmitter	
	3.3.1	Frequency band	- 108 MHz to 117.975 MHz
	3.3.2	Operating frequency	- 112.7 MHz for Ubon Ratchathani Airport - 116.5 MHz for Chiang Rai Airport - 115.5 MHz for Mae Hong Son Airport - 112.5 MHz for Rayong Station
	3.3.3	Frequency stability	- $\pm 0.002\%$ from the operating frequency
	3.3.4	Output power	- at least 50 watts (adjustable) - at least 100 watts for Rayong Station (adjustable)
	3.3.5	Carrier modulation:	
		3.3.5.1	Reference frequency - 30 Hz $\pm 0.2\%$
		3.3.5.2	Modulation depth - 30% (adjustable)
		3.3.5.3	Identification frequency - 1020 Hz ± 50 Hz
		3.3.5.4	Identification modulation Depth - 10% (adjustable)
		3.3.5.5	Speech channel filter - band pass at the range of 300 to 3000 Hz within 3 dB relative to the level at 1000 Hz

		3.3.5.6	Speech modulation depth - up to 30% (the transmission of speech shall not interfere in any way with basic navigation function (adjustable)
		3.3.6	The Identification unit shall be able to generate any three letters International Morse Code for both DVOR and DME equipment.
		3.3.7	The setting up of DVOR Identification code shall be computerized.
		3.3.8	The DME Identification shall be generated on every fourth DVOR Identification cycle.
		3.3.9	Protection shall be provided for the RF amplifier from damage caused by open or short circuit of the output.
		3.3.10	Four (4) sets Thrulines (line sections) with plug-in elements (<u>one set per site</u>) shall be equipped at RF power output of the transmitters. Four (4) RF Wattmeter (<u>one per site</u>) shall be provided for RF power reading. Type, model and diagram shall be submitted in the Proposal. <i>Thrulines (line sections) with plug-in elements shall be housed in the cabinet (s)</i>
	3.4	Sideband Transmitter	
		3.4.1	A double-sideband DVOR equipment shall be provided.
		3.4.2	The Sub-carrier modulation mid-frequency shall be 9960 Hz $\pm 1\%$.
		3.4.3	Phase control circuit shall maintain phase stability between the Sidebands and carrier signals.
		3.4.4	Sixteen (16) sets Thrulines (line sections) with plug-in elements (<u>Four sets per site</u>) shall be equipped at each RF power output of the transmitters. At least Sixteen (16) set of RF Wattmeter (<u>Four per site</u>) shall be provided for RF power reading. Type, model and diagram shall be submitted in the Proposal. Thrulines (line sections) with plug-in elements shall be housed in the cabinet (s)
	3.5	Monitor	
		3.5.1	The DVOR Monitor system shall be capable continuous monitoring fault (s) detection and producing alarm signal (s) for the following conditions occurs:
		3.5.1.1	A change in excess of 1 degree of the bearing information transmitted by the DVOR equipment;
		3.5.1.2	Reference signal 30 Hz modulation depth exceeds $\pm 2\%$ from the nominal value;
		3.5.1.3	Sub-carrier 9960 Hz modulation depth exceeds $\pm 2\%$ from the nominal value;

		3.5.1.4	Sub-carrier 9960 Hz deviation ratio exceeds 16 ± 1 .
		3.5.2	The bearing alarm limit shall be adjustable with the step of not more than 0.1 degree.
		3.5.3	The carrier RF level alarm limit shall be adjustable when the carrier level decreases at least 20 - 50% from the nominal value.
		3.5.4	The identification alarm shall be provided for the following conditions:
		3.5.4.1	Continuous keyed;
		3.5.4.2	Loss of identification.
		3.5.5	The Monitors shall be configurable such that both monitors are monitoring the operating (on-antenna) or standby (on-dummy) transmitter simultaneously.
		3.5.6	When two Monitors are monitoring the operating transmitter, the Monitors can be configured either in 'AND' mode or 'OR' mode for a changeover or shutdown in the event of failure.
		3.5.7	The Monitor shall provide a maintenance warning alarm to permit corrective action before an out-of-tolerance condition occurs. The warning indication shall be displayed at the designated control points and Remote Control and Status Unit (RCSU).
		3.5.8	The parameters of DVOR Transmitter and Monitor shall be provided and shown on display. Control and Selection for display of those parameters shall be done by computerization which is permanently located at site. The following parameters, including but not limited to, shall be available:
		3.5.8.1	The bearing information;
		3.5.8.2	Reference signal 30 Hz modulation depth;
		3.5.8.3	Sub-carrier 9960 Hz modulation depth;
		3.5.8.4	Sub-carrier 9960 Hz deviation ratio;
		3.5.8.5	Identification;
		3.5.8.6	Forward and reflected power or standing wave ratio.
		3.5.9	Alarm delay shall be adjustable.
		3.5.10	Alarm history shall be provided to identify the parameter that has deviated beyond the alarm limit and caused the alarm.
		3.5.11	- The <u>Near-field</u> Monitor (including the Antenna mast, RF surge protection, obstruction lighting) that is monitoring the radiated composite signal shall be provided for installation at any azimuth suitable for installation.

		<p>- Due to difficult terrain at Mae Hong Son Airport, Contractor can choose to provide Near-field Monitor (include at least 18 meter antenna mast, RF surge protection, obstruction lighting) or Counterpoise edge Monitor.</p> <p>- If choose Counterpoise Antenna, At least two (2) Counterpoise edge Monitor per site (including RF surge protection) shall be provided for installation on the top of counterpoise edge that is monitoring the radiated composite signal.</p> <p>Monitor type, and model shall be submitted in the Proposal.</p>
	3.5.12	<p>Four (4) sets Double LED obstruction lighting equipment with photo-switch (one set per site) shall be installed at <u>near-field</u> monitor's antenna. The LED obstruction lighting equipment shall conform with the ICAO Annex 14 Vol. I Chapter 6 – Visual Aids for Denoting Obstacles or Federal Aviation Administration (FAA) Specification for Obstruction Lighting Equipment (AC150/5345-43F OR 43G). Type and model shall be submitted in the Proposal.</p>
	3.6	Test Generator
	3.6.1	The Test Generator for DVOR equipment shall be able to check and calibrate the monitor to conform with ICAO Annex 10 Vol. I.
	3.6.2	Type and model of the Test Generator shall be submitted in the Proposal (in case of separated unit).
	3.6.3	Built-in-Test (BIT) or Fault Diagnostics shall be provided for all Lowest Replaceable Units (LRU) and capable of being initiated locally and remotely.
	3.7	Antenna Switching
	3.7.1	The RF Power Distributor in the Antenna Switching unit shall be broadband for operation in the range of 108 MHz to 117.975 MHz.
	3.7.2	Surge and Lightning Arrestors shall be provided for all output ports of the distributor.
	3.8	Antenna System
	3.8.1	The operating frequency of each Antenna element shall be adjusted from the factory.
	3.8.2	The method of sideband feed lines fabrication and any other adjustment procedures shall be described in DVOR/DME installation and equipment instruction manuals (in clause 9.2).
	3.8.3	The Antenna VSWR shall not exceed 1.2 : 1 for carrier and 1.2 : 1 for sideband.
	3.8.4	The Antenna System shall provide sufficient coverage as required in ICAO Annex 10 Vol. I Paragraph 3.3.4 except where topographical features are dictated.

4.	DISTANCE MEASURING EQUIPMENT (DME) [E]		
4.1	The DME equipment shall comprise:		
	4.1.1	Dual transponders;	
	4.1.2	Dual monitors;	
	4.1.3	Antenna system.	
4.2	Transponder		
	4.2.1	Frequency band	- 960 MHz to 1,215 MHz
	4.2.2	Operating channel	- CH 74X for Ubon Ratchathani Airport - CH 112X for Chiang Rai Airport - CH 102X for Mae Hong Son Airport - CH 72X for Rayong Station
	4.2.3	Transmitter characteristics	
		4.2.3.1	The radio frequency of operation shall not vary more than $\pm 0.002\%$ from the assigned frequency.
		4.2.3.2	Pulse shape and spectrum of pulse modulated signal shall meet the requirements for DME/N in ICAO Annex 10 Vol. I Paragraph 3.5.4.1.3. and 3.5.5.1.3
		4.2.3.3	Pulse spacing shall meet the requirements specified in ICAO Annex 10 Vol. I Paragraph 3.5.4.1.4.
		4.2.3.4	The peak power of constituent pulses of any pair of pulses shall not differ by more than 1 dB.
		4.2.3.6	The power amplifier of the transponder shall provide full peak output power of not less than 1000 watts to the antenna.
		4.2.3.7	DME equipment shall provide/embed the coupling port for measuring peak output power (External tool) <u>without</u> shutdown/turn OFF the equipment.
		4.2.3.8	Dead time, short distance echo suppression and long distance echo suppression shall be adequately adjustable for each DME station installed, in order to prevent any undesired signal degrading the system performance.
		4.2.3.9	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. <i>Note.— Operating DME transponders with quiescent transmission rates close to 700 pulse pairs per second will minimize the effects of pulse interference, particularly to other aviation services such as GNSS.</i>

		4.2.3.10	The maximum transmission rate shall be at least 4800 PPS.
		4.2.3.11	Identification shall meet the requirements specified in ICAO Annex 10 Vol. I Paragraph 3.5.3.6 for association with the DVOR identification.
	4.2.4	Receiver characteristics	
		4.2.4.1	The centre frequency of the receiver shall not vary more than $\pm 0.002\%$ from the assigned frequency.
		4.2.4.2	Interrogation pulse pairs with 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 and this value cause the transponder to reply with an efficiency of at least 70% complies with in ICAO Annex 10 Vol. I Paragraph 3.5.4.2.3.1, 3.5.4.2.3.2, 3.5.4.2.3.5 and 3.5.5.3.2.1.
		4.2.4.3	Bandwidth and selectivity shall meet the requirements specified in ICAO Annex 10 Vol. I Paragraph 3.5.4.2.6.
		4.2.4.4	CW and echo suppression shall be provided and meet the requirements specified in ICAO Annex 10 Vol. I Paragraph 3.5.4.2.9.
		4.2.4.5	DME/N-Decoder rejection. An interrogation pulse pair with a spacing of ± 2 μ s or more, from the nominal value, shall be rejected and meet the requirements specified in ICAO Annex 10 Vol. I Paragraph 3.5.4.3.3
		4.2.4.6	Receiver dead time shall be adjustable for echo suppression as measured after main delay time.
	4.2.5	Time Delay	
		4.2.5.1	The time delay shall meet the requirements specified for DME/N in ICAO Annex 10 Vol. I Paragraph 3.5.4.4.
		4.2.5.2	Reply delay, pulse spacing and pulse width shall be adjustable to the specified values without removing any module from the assembly.
	4.3	DME Monitor	
		4.3.1	The Monitor shall serve two purposes.
		4.3.1.1	To ensure that the transponder signal is within the tolerance as specified for DME/N in ICAO Annex 10 Vol. I Paragraph 3.5.4.7.2
		4.3.1.2	To be used as a Test signal generator in conjunction with a built-in test unit for calibration, testing and maintenance of the transponder.

	4.3.2	To be used as ensuring the transponder signal within the tolerance [ANNEX 10 / Vol. I / Paragraph 3.5.4.7.2]. The monitor system shall initiate an appropriate "WARNING" or "ALARM" indication & sound if any related abnormal condition occurs.
	4.3.2.1	Spacing error of transmitted pulse pair exceeds $\pm 1.0 \mu\text{s}$
	4.3.2.2	Reply delay error exceeds $\pm 1.0 \mu\text{s}$ for high powered DME.
	4.3.2.3	Transmitting pulse count (Pulse Repetition Frequency) falls below 700 pps.
	4.3.2.4	Continuous or loss of identification.
	4.3.2.5	A fall of 3 dB or more in transmitted power output
	4.3.2.6	A fall of 6 dB or more in the minimum transponder receiver sensitivity provided that this is not due to the action of the receiver automatic gain reduction circuits.
	4.3.3	The occurrence of primary alarm shall initiate a transfer action while the main transponder is operating (on-antenna) and a shutdown action while the standby transponder is operating (on-antenna). The primary alarms are generated by transmitting pulse spacing error (in 4.3.2.1) or reply delay error (in 4.3.2.2).
	4.3.4	The Monitors shall be configurable such that both monitors are monitoring the operating (on-antenna) and standby (on-dummy) transponder simultaneously.
	4.3.5	When two Monitors are monitoring the operating transponder, the monitors can be configured either in 'AND' mode or 'OR' mode for a changeover or shutdown in the event of failure.
	4.3.6	Alarm history shall be provided to identify the parameter that has deviated beyond the alarm limit and caused the alarm.
	4.3.7	Test signal generator output shall be selected, The channel frequency deviation of $\pm 100 \text{ kHz}$ and $\pm 900 \text{ kHz}$ of the transponder receiver can be tested.
	4.3.8	Test signal generator (interrogation) output level shall be adjustable at least from -91 dBm to -20 dBm at the transponder antenna connector.
	4.3.9	Test signal generator PRF shall be adjustable nearly 700 to at least 4800 PPS.
	4.3.10	At least the following Transponder and Monitor parameters shall be available for display at the designated control points:
	4.3.10.1	Reply delay;
	4.3.10.2	Reply pulse pair spacing;
	4.3.10.3	Reply efficiency;
	4.3.10.4	Transmit power;
	4.3.10.5	Transmitter pulse count;

		4.3.10.6	Identification.
		4.3.11	Settings and selection for display of the Transponder and Monitor parameters in 4.3.11 shall be done by a Desktop Computer (refer to 5.2.4. and 5.2.5)
	4.4	DME Antenna System	
		4.4.1	The radiation patterns of the Antenna System shall be submitted with the Tender. For the horizontal radiation pattern, the antenna shall be Omni-directional type. For the vertical radiation pattern, The antenna main lobe shall be maximum at three (3) degrees (see Figure C-20 of [ANNEX 10 / Vol. I / Attachment C / Paragraph 7.2.1]) in Appendix B.
		4.4.2	The Antenna shall be capable of radiating DME signal throughout the DME frequency band (960 MHz to 1,215 MHz) so that changing of the operating frequency needs no readjustment of the Antenna.
		4.4.3	The antenna gain shall <u>not</u> be less than +9 dBi.
		4.4.4	Four (4) sets Double LED obstruction lighting equipment with photo-switch (<u>one set per site</u>) shall be installed with the antenna. The LED obstruction lighting equipment shall conform to the ICAO Annex 14 Vol. I Chapter 6 – Visual Aids for Denoting Obstacles or Federal Aviation Administration (FAA) Specification for Obstruction Lighting Equipment (AC150/5345-43F OR 43G). Type and model shall be submitted in the Proposal.

5. CONTROL AND MONITORING [E]			
	5.1	DVOR Local Control Unit (LCU)	
		5.1.1	The DVOR equipment shall be able to operate on local or remote control. It shall have at least the following control and monitoring functions:
		5.1.1.1	Selecting the main;
		5.1.1.2	Turning on/off transmitter;
		5.1.1.3	Turning on/off the standby transmitter into dummy loads for testing purposes;
		5.1.1.4	Selecting Remote/Local Control;
		5.1.1.5	Resetting the alarm;
		5.1.1.6	Shutting down the station;
		5.1.1.7	Displaying operating status of the equipment;
		5.1.1.8	Bypassing the monitor.

	5.1.2	The DVOR Local Control Unit shall automatically transfer from the selected antenna to a standby antenna and/or shut down in the event of an alarm.
	5.1.3	Reset function shall be provided to clear fault condition (s) and restart normal operation.
	5.1.4	Four (4) sets of Desktop Computer (<u>one set per site</u>) shall be provided as part of the Local Control Unit for DVOR. The Desktop Computer for DVOR shall be provided separately from the Desktop Computer for DME. The Desktop Computer Specifications are specified in clause 11.
	5.1.5	The software for monitoring and controlling the DVOR equipment shall be installed in the Desktop Computer. The recovery CD/DVD for the software shall be provided. The user's license for the software shall be provided for AEROTHAI.
5.2	DME Local Control Unit (LCU)	
	5.2.1	The DME equipment shall be able to operate on local or remote control. It shall have at least the following control and monitoring functions:
	5.2.1.1	Selecting the main equipment;
	5.2.1.2	Turning on/off transponder;
	5.2.1.3	Turning on/off the standby transponder into dummy loads for testing purposes;
	5.2.1.4	Selecting Remote/Local control;
	5.2.1.5	Resetting the alarm;
	5.2.1.6	Shutting down the station;
	5.2.1.7	Displaying the operating status of the equipment;
	5.2.1.8	Bypassing the monitor.
	5.2.2	The DME Local Control Unit shall automatically transfer from the selected transponder to a standby transponder and/or shut down in the event of an alarm.
	5.2.3	Reset function shall be provided to clear fault condition (s) and restart normal operation.
	5.2.4	Four (4) sets of Desktop Computer (<u>one set per site</u>) shall be provided as part of the Local Control Unit for DME. The Desktop Computer for DME shall be provided separately from the Desktop Computer for DVOR. The Desktop Computer specifications are specified in clause 11.
	5.2.5	The software for monitoring and controlling the DME equipment shall be installed in the Desktop Computer. The recovery DVD for the software shall be provided. The user's license for the software shall be provided for AEROTHAI.

5.3	Remote Control and Status Unit (RCSU)	
	5.3.1	The DVOR/DME RCSU shall have at least the following control and monitoring functions:
	5.3.1.1	Turn on/off the selected transmitter/transponder with indicator;
	5.3.1.2	Transfer and shutdown with indicator;
	5.3.1.3	NORMAL/ALARM indicator and audible alarm;
	5.3.1.4	Alarm silence control with indicator;
	5.3.1.5	Alarm reset.
	5.3.2	The DVOR/DME RCSU shall be housed in a cabinet suitable for installation on either desktop or rack in the Technical Control Room at ATC tower.
	5.3.3	The DVOR/DME RCSU shall be connected via land line or the Microwave link (provided by the AEROTHAI).
5.4	Remote Status Unit (RSU)	
	5.4.1	The status indicator shall be provided with audible alarm that installed in the control room at ATC tower.
	5.4.2	The RSU shall have at least the following features:
	5.4.2.1	Display the operating status of the DVOR/DME in case of DVOR/DME system;
	5.4.2.2	Visual and audible alarm with an alarm silence control;
	5.4.2.3	Turn on/off switch for the status indicator.
5.5	Remote Monitoring and Maintenance Equipment (RMM)	
	5.5.1	The RMM Equipment shall monitor and control equipment by TCP/IP or better.
	5.5.2	The RMM Equipment shall have at least the following functions for each equipment:
	5.5.2.1	Selecting the main transmitter/transponder;
	5.5.2.2	Turning on/off transmitters/transponders;
	5.5.2.3	Turning on the standby transmitter/transponder into dummy loads for testing purposes;
	5.5.2.4	Bypassing the monitor;
	5.5.2.5	Resetting the alarm;
	5.5.2.6	Shutting down the station;
	5.5.2.7	Adjusting and displaying transmitter/transponder and monitor parameters.
	5.5.3	The RMM Equipment shall be interfaced to DVOR/DME station via land line or TCP/IP network with the Microwave link (provided by AEROTHAI).
	5.5.4	The communication for the RMM must be separated from that for the RCSU for redundancy propose.

	5.5.5	The RMM Equipment shall be performed by Desktop Computer.
	5.5.6	Four (4) sets of Desktop Computer (<u>one set per site</u>) shall be provided as part of the DVOR/DME RMM. The Desktop Computer Specifications are specified in clause 11.
	5.5.7	The RMM Equipment software for remote monitoring and controlling the DVOR/DME equipment from anywhere shall be installed in the Desktop Computer. The recovery CD/DVD or any portable data storage devices for the RMM software shall be provided. The user's license for the software shall be provided for AEROTHAI.

6.	INTERSYSTEM CONNECTION	
	6.1	The DVOR/DME System shall be connected with RCSU and RCMS (Provided by the contractor), CCMS and EMMC (provided by AEROTHAI) to send update information.
	6.2	The DVOR/DME operation status shall be updated by Simple Network Management Protocol (SNMP) over Ethernet port.
	6.3	The Tenderer shall provide and detail the DVOR/DME-RCMS, CCMS, EMMC information exchange.
	6.4	The Contractor shall provide a list of all necessary standards documents and Interface Control Documents (ICDs) with regards to the DVOR/DME-RCMS, CCMS and EMMC information exchange.

7.	SUPPLEMENTS	
	7.1	Portable Navigational Signal Analyzer (PNSA) [E]
	7.1.1	Four (4) sets of Portable Navigational Signal Analyzer (<u>one set per site</u>) shall be provided. They shall be used for ground test of the ILS, VOR and Marker beacon. Each PNSA shall comprises:
	7.1.1.1	Receiver for Localizer, Glide Slope, VOR and Marker Beacon;
	7.1.1.2	Built-in rechargeable battery;
	7.1.1.3	Antennas for Localizer, Glide Slope and VOR;
	7.1.1.4	Battery Charger;
	7.1.1.5	Antenna Pole;
	7.1.1.6	Accessories.
	7.1.2	The PNSA shall be designed for outdoor purpose with compact and weatherproof.
	7.1.3	All ILS/VOR channels shall be selectable.
	7.1.4	Performance analyzer of ILS Localizer, Glide Slope, Marker Beacon and VOR shall be performed in accordance with ICAO Doc 8071 Vol. I.

	7.1.5	All parameters shall be printed out directly or export to the external portable storage media e.g. HD/USB drive or other devices in text format.
	7.1.6	PNSA shall be provided real time measurement data directly via RS 232 C or USB port.
	7.1.7	PNSA shall be provided with the Interface Control Document (ICD) for extracting or decoding the real time measurement data.
	7.1.8	Battery charger shall be operated on 220 VAC $\pm 15\%$, 50 Hz $\pm 5\%$ single phase or better.
	7.2	DVOR Spare Parts
	7.2.1	Eight (8) sets of DVOR spare parts (two sets per site) shall be provided.
	7.2.2	The DVOR spare parts in 7.2.1 shall consist of one complete unit which is under single system configuration. The one complete unit shall consist of line replaceable module (LRM), printed circuit boards (PCBs), backplanes and RF switches (Coaxial relays), RF distribution units. Remark : "SINGLE" system configuration means "SINGLE" transmitter and "SINGLE" monitor.
	7.3	DVOR Antenna Spare Part
	7.3.1	Four (4) Sets of carrier antenna spare part (one sets per site) and Sixteen (16) set of sideband antenna spare part (four sets per site) shall be provided
	7.3.2	The carrier and sideband antenna spare parts shall consist of the antenna element, antenna cover, RF feeding cable and RF cable lightning protection kit
	7.4	DME Spare Parts
	7.4.1	Eight (8) sets of DME spare parts (two set per site) shall be provided.
	7.4.2	The DME spare parts in 7.3.1 shall consist of one complete unit which is under single system configuration. The one complete unit shall consist of line replaceable module (LRM), printed circuit boards (PCBs), backplanes and RF switches (Coaxial relays). Remark : "SINGLE" system configuration means "SINGLE" transmitter and "SINGLE" monitor.
	7.5	DME Antenna Spare Part
	7.5.1	Four (4) sets of DME antenna spare part (one set per site) shall be provided.
	7.5.2	The DME antenna spare parts shall consist of the antenna, RF feeding cable and RF cable lightning protection kit.

7.6	RCSU and RSU Spare Parts
	Eight (8) sets of RCSU and RSU spare parts for DVOR/DME systems (<u>two set per site</u>) shall be provided.
7.7	Double LED obstruction lighting Spare Parts (in clause 3.5.12 and 4.4.4)
	Eight (8) sets of Double LED obstruction lighting equipment for DVOR/DME systems (<u>two set per site</u>) shall be provided as spare parts.
7.6	The contractor shall provide manufacturer's certification for availability of spare parts for ten year from the expiration of the warranty period. The tenderer shall submit this certificates in the proposal

8.	TOOLS FOR INSTALLATION AND MAINTENANCE
	Four (4) sets shall provide. Each set comprises:
8.1	The contractor shall provide at least waveform analysis tools, thruline wattmeter, digital multi-meter, portable RF power analysis, frequency counter and additional tools that complies with manufacturer standard for DVOR/DME system installation, Maintenance and hardware adjustment. The contractor shall provide list of recommend installation and Maintenance tools from manufacturer.
8.2	Extension cards (if any) and cables as required for each module/ PCB of the DVOR and DME shall be provided for maintenance.
8.3	Test cables, dummy loads, RF adapter kits and attenuation kits for transmitter calibration and flight inspection shall be provided.
8.4	Installation materials such as external and internal cablings, cable trays, connectors, cable ties and conduits shall be provided.

9.	TECHNICAL DOCUMENTS AND TEST REPORTS [E]
	The Contractor shall provide the following documents:
9.1	Four (4) sets for hard copy and five (5) DVD sets for mechanical and electrical DVOR/DME drawings and whole network diagrams essential for installation, maintenance and troubleshooting of the equipment, including such drawings as are needed to identify the components and cable within the equipment or its sub units;
9.2	Five (5) sets for hard copy and six (6) sets for DVD, of DVOR/DME installation and equipment instruction manuals, setting out in detail the procedures for operation, routine maintenance, troubleshooting of the equipment, test and alignment procedures, including schematics and inter-cabling diagrams;

9.3	Five (5) sets for hard copy and six (6) sets for DVD, of DVOR/DME component part lists which includes manufacturer part numbers or descriptions of any generic component level devices (ICs, transistors, capacitors, etc.) in each Line Replaceable Modules (LRMs) shall be provided for the propose of comparing for the generic devices with electronic component in the market in order to repair the LRMs after the warranty period.
9.4	One (1) original and Four (4) hard copies of Factory Acceptance Test (FAT) report shall be provided at the factory after the completion of FAT.
9.5	Four (4) original and Five (5) sets hard copies of Site Acceptance Test (SAT) report shall be provided at the site after the completion of the commissioning flight check.
10. UNINTERRUPTED POWER (UPS)	
10.1	General Requirements
10.1.1	At minimum, the full UPS configuration shall consists of the components as depicted in the clause 13.
10.1.2	Two (2) sets of UPS Equipment for each site shall be provided.
10.1.3	Each set of UPS equipment, alone, shall provide enough electric power capacity for all equipment in the facility for a minimum of 15 minutes.
10.1.4	The Tenderer shall be responsible for electric current load calculation for each facility and each set of UPS equipment.
10.1.5	The Tenderer shall propose and detail the connection between UPS to equipment in the clause 13.
10.1.6	The Tenderer shall propose the list of UPS equipment and related components.
10.1.7	The Contractor shall be responsible to demonstrate a complete full load field test.
10.1.8	The Contractor shall be responsible to demonstrate that the UPS system compatible with AEROTHAI emergency backup generator.
10.1.9	The Contractor shall provide, install, and test a complete and operable UPS system in specified locations.
10.1.10	The Tenderer shall provide product description/Technical Characteristics of UPS systems and other related components.
10.1.11	The STS shall connect to both sets of UPS equipment to receive electric power supply as depicted in the clause 13
10.1.12	The STS shall automatically select electric power from available UPS to equipment in the condition that one of UPS is dysfunctional.
10.1.14	All UPS&STS equipment shall be new and factory tested.

	10.1.15	The contractor shall provide Five (5) years warranty to each UPS&STS equipment which starts from the completion of the each sites final payment date according to the term of payment stipulated in Non-technical term of reference.
	10.1.16	The contractor shall provide scheduled check and maintenance every 3 months during warranty period.
	10.1.17	The contractor shall provide complete batteries replacement including removal of old batteries and new battery installation at the start of the 5th warranty year.
	10.2	Characteristics of UPS
	10.2.1	The UPS shall be True On-Line Type with Double Conversion.
	10.2.2	The UPS shall be provided with protection against overcharging, over current and short-circuit, spill proof, maintenance free and with capability of latching shutdown on overload.
	10.2.3	In the event of a main electric power failure, the battery shall automatically take over without any interruption of the system operation.
	10.2.4	When UPS failure or overload is occurred, it shall be able to automatically transfer the load supplied by the inverter to the reserve line without any interruption of the system operation.
	10.2.5	Manual bypass switch shall be provided for maintenance purpose. When the manual bypass switch is selected, the system shall be able to operate without any interruption of the system operation.
	10.2.6	The Tenderer shall provide the detailed connection diagram between UPS system at DVOR/DME station to RCMS at the Technical Control Room and EMMC.
	10.2.7	The Contractor shall provide ICDs of the connection between UPS system at DVOR/DME station to the RCMS and EMMC at the Technical Control Room.
	10.2.8	The RCMS shall be provided with the facility to authorized user in order to monitor and control the functionality and system devices of the UPSs. The RCMS shall be performed by Desktop Computer (specified in clause 11).
	10.2.9	Both audible and visual alarm indications shall be provided upon detection of RCMS equipment fault and/or any out of tolerance parameters in the monitoring equipment.
	10.2.10	The visual alarm shall remain on RCMS until the fault is resolved.
	10.2.11	The SNMP usage shall be encouraged for RCMS function.

	10.2.12	The UPS shall send update information of system status warning, alarm messages and monitor parameters using SNMP protocol via AEROTHAI network to CCMS and EMMC.	
	10.2.13	The Tenderers shall provide the detailed connection diagram between UPS at DVOR/DME station to CCMS and EMMC.	
	10.2.14	The Contractor shall provide ICDs of the connection between UPS at DVOR/DME station to CCMS and EMMC.	
	10.2.15	The Tenderer shall provide network equipment and communication link and details for inter-system connection (UPS to RCMS, CCMS and EMMC) to AEROTHAI network at Technical Control Room as depicted in the clause 12.	
	10.2.16	The UPS System at DVOR/DME site shall be connected via land line and outdoor microwave link (provided by the AEROTHAI) as specified in clause 12.	
	10.2.17	Protection shall be provided against damage of semiconductors due to the battery polarity being inadvertently reversed.	
	10.2.18	The battery charger shall be capable of charging batteries which are completely discharged.	
	10.2.19	The battery shall be continuously float charged.	
	10.3	Technical Specification of UPS	
	10.3.1	Input	
		10.3.1.1	Voltage (Vrms) : 230 VAC \pm 10%
		10.3.1.2	Frequency : 50 Hz \pm 2%
		10.3.1.3	Phase : Single (2 Wire + GND)
		10.3.1.4	THD : \leq 10 % or better at full Load (Total harmonics distortion)
	10.3.2	Output	
		10.3.2.1	Voltage (Vrms) : 230 VAC \pm 1% or better for both Normal and Battery Mode
		10.3.2.2	Frequency : 50 Hz \pm 0.5% or better
		10.3.2.3	Number of Phase : Single (2 Wire + GND)
		10.3.2.4	Wave Form : Sine wave
		10.3.2.5	THD : \leq 3 % for 100% linear load (Total harmonics distortion)
		10.3.2.6	Power Factor : 0.8 lag or better
		10.3.2.7	AC to AC- Overall efficiency : \geq 85% at full load

		10.3.2.8	Crest factor	: 3:1 or better
	10.3.3	Overload capacity 110% Load		: 2 Minutes or better
	10.3.4	Environment		
		10.3.4.1	Ambient temperature	: 0°C to +40 °C (Continuous) or better
		10.3.4.2	Humidity	: ≥ 90% continuously with non-condensing
	10.3.5	Audible noise		: ≤ 55 dB(A) at 1 meter
	10.3.6	Battery		
		10.3.6.1	Type	: Maintenance-free sealed lead-acid
		10.3.6.2	Frame	: Durable Polypropylene or ABS Resins or better
		10.3.6.3	Life time	: 3 to 5 years at 25°C or better
		10.3.6.4	Back up time	: ≥ 15 minutes at full load of UPS
		10.3.6.5	Battery Standard	: UL 94-V0 or other international standards
	10.3.7	Status and Control Indicator the capability, including but not limited to, shall be as follows:		
		10.3.7.1	Display status and parameters, line input, inverter, output, load on bypass, battery and fault;	
		10.3.7.2	Provide visual and audible alarm when main fail, low battery and overload;	
		10.3.7.3	Enable and disable alarm.	
	10.3.8	UPS Standard		: Thai Industrial Standard 1291, Vol 1-3 (มอก.1291 เล่ม 1-3) or other international standard.
	10.4	Technical specification of STS		
	10.4.1	Input		
		10.4.1.1	Voltage (Vrms)	: 230 VAC ±10% (adjustable)
		10.4.1.2	Frequency	: 50 Hz ± 2%
		10.4.1.3	Number of Phase	: Single (2 Wire + GND)
	10.4.2	Output		
		10.4.2.1	Voltage (Vrms)	: 230 VAC ±10% (adjustable) or better
		10.4.2.2	Rating	: ≥ 5 kVA 32 A, ≥ 10 kVA 45 A
		10.4.2.3	Overload Capacity (110%)	: 1 minute or better

		10.4.2.4 Transfer time	: ≤ 5 ms for automatic transfer ≤ 10 ms for manual transfer
		10.4.2.5 Efficiency	: ≥ 95 %
	10.4.3	Environment	
		10.4.3.1 Operating Temperature	: 10 to 40 °C
		10.4.3.2 Relative Humidity	: non-condensed at least 90 %
		10.4.3.3 Noise Level	: ≤ 60 dBA
	10.4.4	Communication port	: RS232 standard and TCP/IP
	10.4.5	Standard	: IEC 62310 series, EN 62310 series, or compatible.
	10.5	Load Center	
	10.5.1	Standard	EIT-Thai Electrical Code 2013 or other international standards.
	10.6	Circuit Breakers	
	10.6.1	Standard	EIT-Thai Electrical Code 2013 or other international standards.

11. DESKTOP COMPUTER

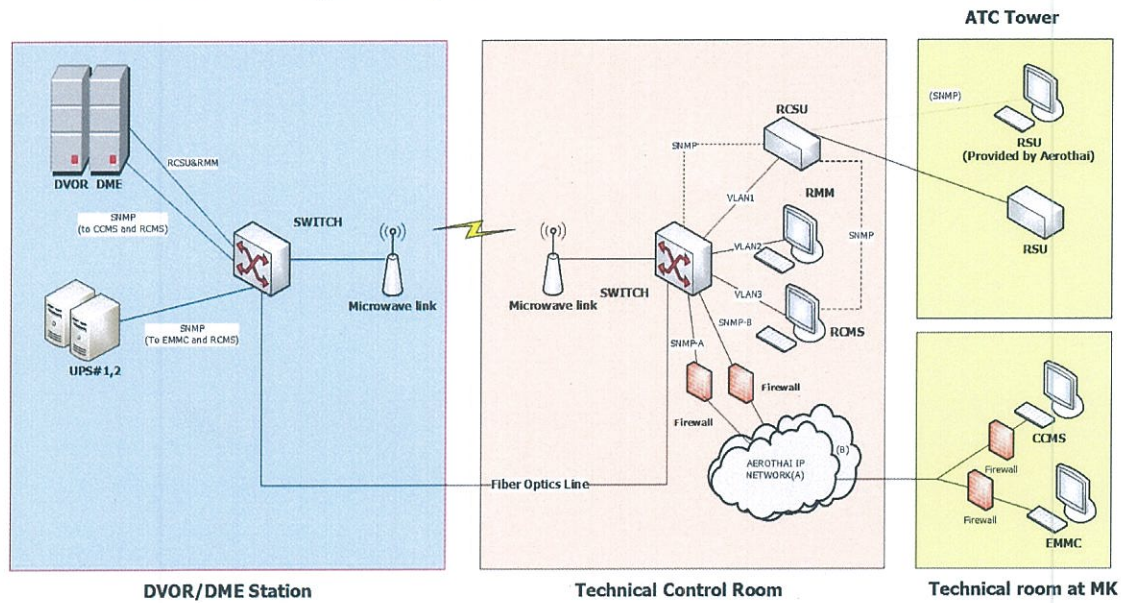
The Tenderers shall provide the Desktop Computer including all attached devices that are installed for system operation and monitoring. The Tenderers shall propose the technical specifications of Desktop Computer which comply with or are better than the following specifications.

11.1	All components shall be produced from the same manufacturer with permanent logo/brand on products.		
11.2	All in one computer		
11.3	Processor/ Chip set		
	11.3.1	≥ 4 Core or ≥ 8 Thread	
	11.3.2	Base clock frequency ≥ 3.2 GHz	
11.4	RAM		
	11.4.1	Technology – DDR3 or better	
	11.4.2	Capacity – ≥ 8 GB	
11.5	One (1) Hard disk Drive		
		SATA or better Capacity – ≥ 2.0 TB or Solid State Device ≥ 240 GB	

11.6	One (1) Optical Disc Drive
	Internal DVD/RW Drive
11.7	Graphic Controller
	Built-in graphic or Dedicated graphic controller with ≥ 1 GB memory
11.8	One (1) Display
	≥ 19 inches LED with resolution 1920 x 1080 pixels
11.9	Networking
	10/100/1000 Mbps Ethernet
11.10	One (1) Keyboard and One (1) Mouse
	Each key shall be permanently printed with both Thai and English characters
11.11	Operation System/ Software
	11.11.1 Shall be installed with the Desktop Computer
	11.11.2 Capable of operating with the software of the proposed DVOR/DME System.
	10.11.3 Recovery DVD with a copyright shall be provided
11.12	The operating system and license which is suitable for compute operating shall be provided.
11.13	One (1) set of Office table and chair which is suitable for computer operation shall be provided.
11.14	The contractor shall provide to the Desktop Computer a two (2) years Manufacturer warranty which starts from the completion of the final payment date according to the term of payment stipulated in non-technical term of reference.
11.14	The Desktop Computer shall have a manufacturer branch office authorized representative in Thailand.
11.15	The DVD for software driver shall be provided with the product.

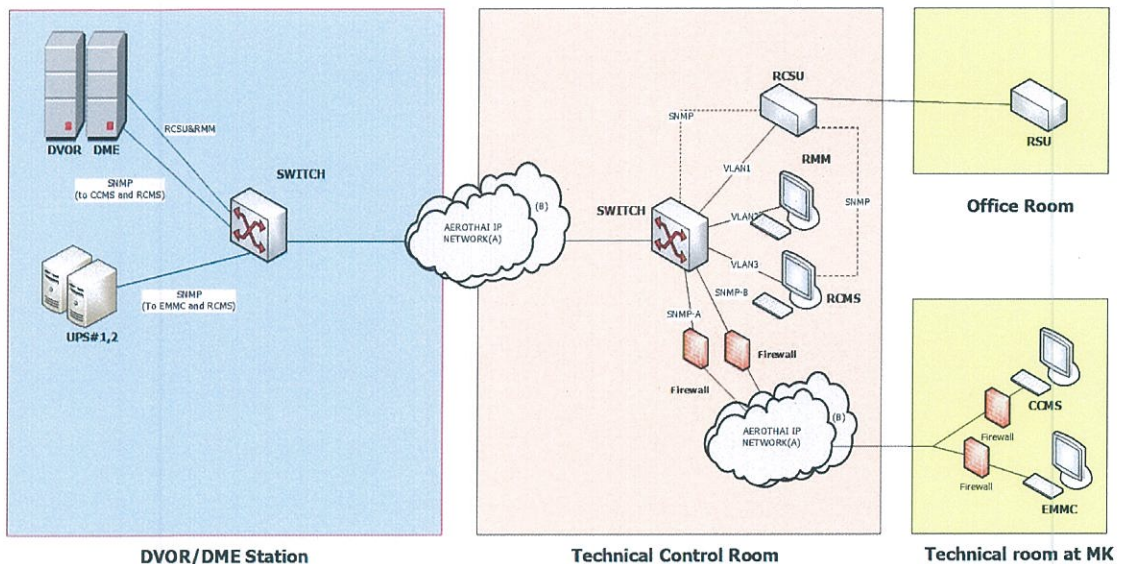
12. CONCEPTUAL DIAGRAM OF INTERSYSTEM CONNECTION AND COMMUNICATION

12.1 DVOR/DME Diagram for Ubon Ratchathani Airport, Chiang Rai Airport and Mae Hong Son Airport.



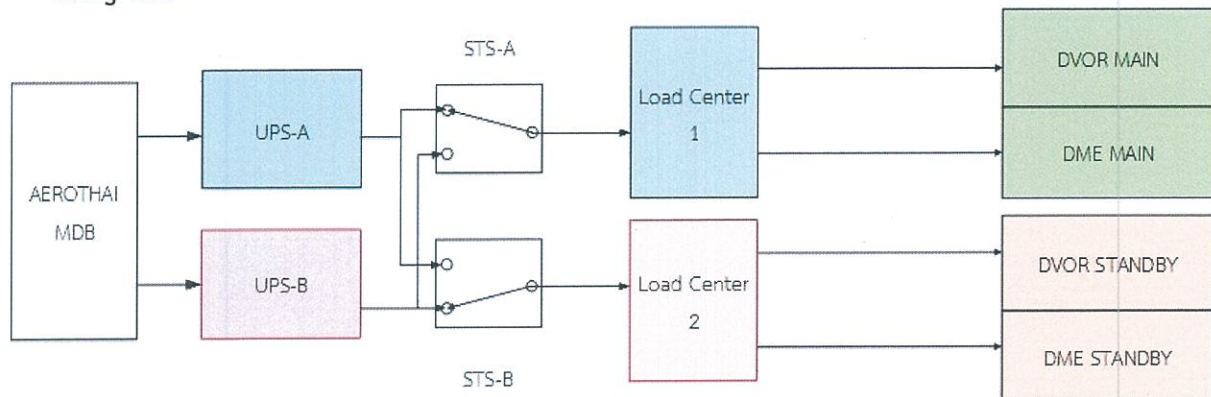
Note: Switch, Firewall, Microwave links, Fiber optics links, CCMS, EMMC provided by AEROTHAI

12.2 DVOR/DME Diagram for Rayong station.



Note: Switch, Firewall, Microwave links, Fiber optics links, CCMS, EMMC provided by AEROTHAI

13. CONCEPTUAL DIAGRAM OF POWER SUPPLY CONFIGURATION DVOR/DME UPS & STS
Diagram



Remark:

1. All UPSs are supplied with the electrical power from AEROTHAI MDB.
2. The specification of circuit breakers and all associated wires, provided by the contractor, must also be complied with the rate of the UPSs.
3. Figure above, is just a conceptual diagram, the real installation work may be adapted, depend on the personnel in charge; However, being still complied with the standard of ELECTRICAL AUTHORITY.

14.	การรับประกันความชำรุดบกพร่อง
<p>ผู้ชนะการประกวดราคาอิเล็กทรอนิกส์ จะต้องรับประกันความชำรุดบกพร่องของสิ่งของที่เสนอ นับจากวันส่งมอบสิ่งของงวดสุดท้ายให้กับ บวท. และคณะกรรมการได้ทำการตรวจรับไว้เรียบร้อยแล้ว ดังนี้</p> <ul style="list-style-type: none"> - อุปกรณ์ DVOR/DME พร้อม Spare Parts เป็นเวลาไม่น้อยกว่า ๕ ปี (ห้าปี) - อุปกรณ์ UPS&STS และส่วนที่เกี่ยวข้อง เป็นเวลาไม่น้อยกว่า ๕ ปี (ห้าปี) - อุปกรณ์คอมพิวเตอร์, TOOLS และงานปรับปรุงฯ ตามรายละเอียด Scope of Specifications Section 2 เป็นเวลาไม่น้อยกว่า ๒ ปี (สองปี) <p>นับถัดจากวันที่ บวท. ได้รับมอบสิ่งของงวดสุดท้ายไว้ถูกต้องครบถ้วนตามสัญญา โดยภายใน กำหนดเวลาดังกล่าว หากสิ่งของที่ส่งมอบดังกล่าวเกิดการชำรุด หรือขัดข้องอันมาจากการใช้งานปกติ ผู้ชนะการ ประกวดราคาอิเล็กทรอนิกส์จะต้องจัดการซ่อมแซม แก้ไขในเบื้องต้นให้อยู่ในสภาพที่ใช้งานได้ดังเดิม ณ สถานที่ติดตั้งแต่ละแห่ง เพื่อมิให้เกิดความเสียหายต่อภารกิจหลักของ บวท. ภายใน ๓๐ วัน (สามสิบวัน) นับถัดจากวันที่ได้รับแจ้ง จาก บวท. โดยไม่คิดค่าใช้จ่ายใด ๆ ทั้งสิ้น หากผู้ชนะการประกวดราคาอิเล็กทรอนิกส์ไม่จัดการซ่อมแซม หรือแก้ไข ภายในระยะเวลาที่กำหนดดังกล่าว บวท. มีสิทธิจะทำการนั้นเองหรือว่าจ้างผู้อื่นให้ทำการนั้นแทนผู้ชนะการประกวด ราคาอิเล็กทรอนิกส์ โดยผู้ชนะการประกวดราคาอิเล็กทรอนิกส์ต้องเป็นผู้ออกค่าใช้จ่ายเองทั้งสิ้น</p> <p>ในกรณีเร่งด่วนจำเป็นที่อุปกรณ์ DVOR/DME ไม่สามารถให้บริการการเดินอากาศได้ ผู้ชนะการ ประกวดราคาอิเล็กทรอนิกส์จำเป็นต้องแก้ไขภายใน ๒๔ ชั่วโมง นับตั้งแต่ บวท. แจ้งเหตุให้ผู้ชนะการประกวดราคา อิเล็กทรอนิกส์ทราบ เพื่อให้เป็นไปตามเงื่อนไขและข้อจำกัดแนบท้ายใบอนุญาตจัดตั้งเครื่องอำนวยความสะดวก ในการเดินอากาศของสำนักงานการบินพลเรือนแห่งประเทศไทย (กพท.) และหากจำเป็นต้องรีบแก้ไขเหตุชำรุด บกพร่องหรือขัดข้องโดยเร็ว โดยไม่อาจรอคอยให้ผู้ชนะการประกวดราคาอิเล็กทรอนิกส์แก้ไขในระยะเวลาที่กำหนด บวท. มีสิทธิเข้าจัดการแก้ไขเหตุชำรุดบกพร่องหรือขัดข้องนั้นเอง หรือให้ผู้อื่นแก้ไขความชำรุดบกพร่องหรือขัดข้อง โดยผู้ชนะการประกวดราคาอิเล็กทรอนิกส์ต้องรับผิดชอบชำระค่าใช้จ่ายทั้งหมด</p> <p>การที่ บวท. ทำการนั้นเอง หรือให้ผู้อื่นทำการแทนนั้นแทนผู้ชนะการประกวดราคาอิเล็กทรอนิกส์ ไม่ทำให้ผู้ชนะการประกวดราคาอิเล็กทรอนิกส์หลุดพ้นจากความรับผิดชอบตามสัญญา หากผู้ชนะการประกวดราคา อิเล็กทรอนิกส์ไม่خذค่าใช้จ่ายหรือค่าเสียหายตามที่ บวท. เรียกร้อง บวท. มีสิทธิบังคับจากหลักประกันการปฏิบัติ ตามสัญญาได้</p>	

APPENDIX A: LIST OF ABBREVIATIONS

Abbreviations	Full Name
°C	Degree Celsius
AC	Alternating Current
AEROTHAI	Aeronautical Radio of Thailand Ltd.
CCMS	Central Control and Monitoring System
cms	Centimeters
CW	Continuous Wave
dB	Decibel
DDM	Difference in Depth of Modulation
DME	Distance Measuring Equipment
DVOR	Doppler Very High Frequency Omnidirectional Range
EMMC	Electrical Monitoring and Management Center
FAA	Federal Aviation Administration
GHz	Giga Hertz
GS	Glide Slope
Hz	Hertz
HDPE	High Density Polyethylene
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ILS	Instrument Landing System
I _{max}	Maximum Discharge Current
Intl	International
kVA	Kilo Volt Amp
kms	Kilometers
kHz	Kilo Hertz
MHz	Mega Hertz
MTBF	Mean Time Between Failure
MTBO	Mean Time Between Outage
mph	Mile per hour
μs	Microsecond
PABX	Private Automatic Branch Exchange

Abbreviations	Full Name
PCB	Printed Circuit Board
PMDT	Portable Maintenance Data Terminal
PNSA	Portable Navigational Signal Analyzer
PVNA	Portable Vector Network Analyzer
RCMS	Remote Control and Monitoring System
RCSU	Remote Control and Status Unit
RF	Radio Frequency
RSC	Rigid Steel Conduit
RSU	Remote Status Unit
RMM	Remote Monitoring and Maintenance
SNMP	Simple Network Management Protocol.
SDM	Sum in Depth of Modulation
STS	Static Transfer Switch or one (1) Source Transfer Switch
Uc	Maximum Continuous Operating Voltage
Up	Voltage Protection Level
UHF	Ultra High Frequency
UPS	Uninterrupted Power Supply
USB	Universal Serial Bus
VAC	Voltage of Alternating Current
VOR	Very high frequency Omnidirectional Range

APPENDIX B: Figure C-20 of [ANNEX 10 / Vol. I / Attachment C / Paragraph 7.2.1].

The protected coverage of DME/N shall be determined by using Figure C-20 of [ANNEX 10/ Vol. I /Attachment C/Paragraph 7.2.1]. The propagation loss for paths without obstructions uses the IF-77 propagation model.

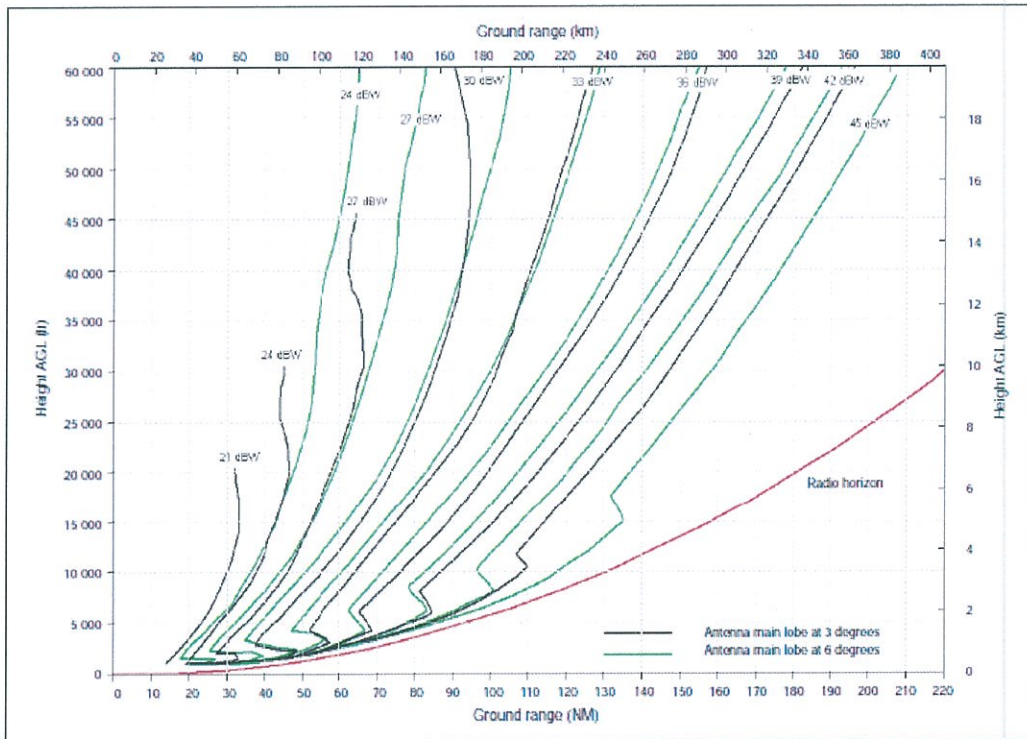


Figure C-20 of [ANNEX 10 / Vol. I / Attachment C / Paragraph 7.2.1]. Necessary EIRP of DME transponder to achieve a power density of -89 dBW/m² (at airborne receiver) as a function of height above and distance from the DME. The above figure is based on the following example,

1. Airborne receiver sensitivity : -120 dBW
2. Transmission line loss, mismatch loss, antenna polar pattern variation with respect to an isotropic antenna : +9 dB
3. Antenna height : +5 m (17 ft) AGL over flat terrain
4. Power density required at antenna : -111 dBW

Remark: Minus 111 dBW at the antenna corresponds to minus 89 dBW/m² at the mid-band frequency.

APPENDIX C: Location

DVOR/DME	Location
- Ubon Ratchathani Airport	104 51' 57.2400" N, 15 14' 42.6840" E
- Chiang Rai Airport	99 52' 59.3040" N, 19 56' 55.8240" E
- Mae Hong Son Airport	97 54' 43.6320" N, 19 19' 11.1000" E
- Rayong Station	101 40' 35.1120" N, 12 46' 43.2480" E

GUIDELINE FOR "Bill of Materials and Services"

ITEM	Description	Quantity	Remark	Reference Clause
EQUIPMENT				
1	DVOR Equipment	1 x 4		3
	DME Equipment	1 x 4		4
2	DVOR Antenna System	1 x 4	Complete antenna system including Antenna mast, RF surge protection, obstruction lighting	3.3, 3.4
	DME Antenna System	1 x 4		4.4
3	Near Field Monitor Antenna System	1 x 4 or 1 x 3	* Tenderer can provide 3 sets of Near field monitor, if choose to provide 2 sets of counterpoise edge monitor At Mae Hong Son Airport	3.5.11
	* Counter Poise Edge Monitor Antenna System (Mae Hong Son Airport)	2		
4	ThruLine (line sections) with plugin elements for carrier power reading	1 x 4		3.3.10
	RF power meter for thruLine (carrier)	1 x 4		3.3.10
	ThruLine (line sections) with plugin elements for sideband power reading	4 x 4		3.4.4
	RF power meter for thruLine (sideband)	4 x 4		3.4.4
5	DVOR/DME Lightning Protection System	1 x 4		2.15
	Near Field Monitor Antenna Lightning Protection System	1 x 4		2.15
6	UPS for DVOR/DME system	2 x 4		10.3
	STS for DVOR/DME system	2 x 4		10.4
	Load Center with circuit breaker for DVOR/DME system	1 x 4		10.5, 10.6

ITEM	Description	Quantity	Remark	Reference Clause
7	Double LED OBS Light for DME	1 x 4	Including photo switch	4.4.4
	Double LED OBS Light for Near Field Monitor Antenna	1 x 4	Including photo switch	3.5.12
8	DVOR LCU Computer	1 x 4		5.1.4
	DME LCU Computer	1 x 4		5.2.4
	DVOR/DME RMM Computer	1 x 4		5.5.6
	RCMS Computer	1 x 4		10.2.8
	Table and Chair for both LCU computer	1 x 4		11.13
SPARE PART				
9	Spare Part for DVOR Equipment	2 x 4	200 %	7.2
	Spare Part for DME Equipment	2 x 4	200 %	7.4
	Spare Part for DVOR carrier antenna	1 x 4		7.3.1
	Spare Part for DVOR sideband antenna	4 x 4		7.3.1
	Spare Part for DME antenna	1 x 4		7.5
	Spare Part for RCSU	2 x 4	200 % Whole unit	7.6
	Spare Part for RSU	2 x 4	200 % Whole unit	7.6
	Spare Part for Double LED OBS Light	2 x 4		7.7
10	List of recommend installation and Maintenance tools	1 x 4		8.1
	Portable Navigational Signal Analyzer (PIR)	1 x 4		7.1
	Waveform analysis tools (Oscilloscope)	1 x 4		8.1
	Thru-line wattmeter	1 x 4	Include Directional Coupler	8.1
	Digital multi-meter	1 x 4		8.1
	Portable RF power analysis	1 x 4		8.1

ITEM	Description	Quantity	Remark	Reference Clause
	Frequency counter	1 x 4		8.1
	Local Network Equipment	Recommend		6
	External Connector	Recommend		2.13.7
	Other equipment	Recommend		
	Accessories	Recommend		
11	Mechanical and electrical DVOR/DME drawings and whole network diagrams	4 (H), 5 (S)	"H" Stand for Hard Copy "S" Stand for Soft copy	9.1
	DVOR/DME installation and equipment instruction manuals	5 (H), 6 (S)		9.2
	DVOR/DME component part lists	5 (H), 6 (S)		9.3
	ICDs for DVOR/DME	1 x 4		6.4
	ICDs for UPS/STS	1 x 4		10.2.14
12	Factory Acceptance Test (FAT) report (Original)	1		9.4
	Factory Acceptance Test (FAT) report	4 (H)	9.4	
13	Site Acceptance Test (SAT) report (Original)	4	9.5	
	Site Acceptance Test (SAT) report	5 (H)	9.5	

**AIRCRAFT OPERATION DEPARTMENT
FLIGHT INSPECTION SERVICES BUREAU
AERONAUTICAL RADIO OF THAILAND LTD.**

FLIGHT INSPECTION REPORT - VOR, VOR/DME, VORTAC TACAN, VOT										FM-AV.PS-06					
1. STATION RAYONG DVOR/DME					2. LOCATION IDENT. RYN			3. DATE/DATES OF INSPECTION July 6, 2018							
4. TYPE OF INSPECTION								5. COMMON SYSTEM							
SITE EVALUATION		<input checked="" type="checkbox"/> PERIODIC		<input type="checkbox"/> SPECIAL				YES							
COMMISSIONING		<input type="checkbox"/> SURVEILLANCE		<input type="checkbox"/> INCOMPLETE				NO							
6. OWNER		DCA		USAF		OTHER (INDICATE ACTUAL OWNER)									
		RTAF		INTERNATIONAL		AERONAUTICAL RADIO OF THAILAND LTD.									
7. FACILITY/COMPONENT INSPECTED					<input checked="" type="checkbox"/> DVOR		<input type="checkbox"/> VORTAC		<input type="checkbox"/> TACAN		<input type="checkbox"/> VOT		<input checked="" type="checkbox"/> DME		
8. RADIAL DATA															
FACILITY SERVICE DESIGNATION		DVOR	DVOR	DVOR	DVOR	DVOR	DVOR	DVOR	DVOR						
RADIAL USE		MON	MON	W24	W24	R334	R334	N891	N891						
AZIMUTH		270	270	029	029	132	132	316	316						
TRANSMITTER(S)		1	2	1	2	1	2	1	2						
MSL ALTITUDE (in hundreds)		45	45	55	55	20	20	40	40						
DISTANCE (Nautical miles)		FROM	11.4	5.3	5.8	12.0	11.9	6.1	6.6	11.6					
		TO	5.3	11.2	12.2	6.0	5.5	12.2	13.0	5.0					
SENSITIVITY/MODULATION		S	S	S	S	S	S	S	S						
ROUGHNESS		0.2/8.4	0.5/5.3	4.9/9.4	1.4/9.0	0.2/8.2	0.4/7.2	0.4/12.0	0.3/5.4						
SCALLOPING		0	0	0	0	0	0	0	0						
BENDS		0.4/5.6	0.4/5.5	0.4/9.9	0.2/7.5	0.1/7.3	0.1/6.1	0.2/12.7	0.3/5.6						
POLARIZATION		-	-	-	-	-	-	0.4/12.0	-						
ALIGNMENT ERROR		0.0	+0.3	+0.4	+0.6	-0.9	-0.6	-1.3	-0.9						
TRANSMITTER DIFFERENCE		0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.4						
SIGNAL STRENGTH		50+	50+	50+	50+	50+	50+	50+	50+						
INTERFERENCE		S	S	S	S	S	S	S	S						
9. GENERAL			SAT.		UNSAT.		10. MONITORS								
STANBY POWER		-		LAST DATE INSPECTED July 6, 2018				TX		ALIGNMENT		ALARM +		ALARM -	
VOICE		N/A		DVOR		REFERENCE RADIAL MON 270/5.3-11.4/45		1		0.0		0.9		0.8	
IDENTIFICATION		X				CHECK POINT									
DME ACCURACY		X		TACAN		REFERENCE RADIAL / - /									
DME COVERAGE		X				CHECK POINT									
11. DISCREPANCIES AND/OR REMARKS											CORRECTED				
SEE ATTACHMENT											YES		NO		
FACILITY CLASSIFICATION			PILOT FLIGHT INSPECTOR												
UNRESTRICTED			<i>Kavin S K. Kangsom</i>												
<input checked="" type="checkbox"/> RESTRICTED			PANEL OPERATOR					THEODOLITE OPERATOR							
UNUSEABLE			<i>Jirada J. Chumpon</i>					N/A							
DIRECTOR, AIRCRAFT OPERATION DEPARTMENT			<i>Mr. Dr. Somvat V.</i>					6 Aug 2018							
APPROVED BY THE CIVIL AVIATION AUTHORITY OF THAILAND			<i>JB</i>					24 Aug 2018							



AIRCRAFT OPERATION DEPARTMENT
 FLIGHT INSPECTION SERVICES BUREAU
 AERONAUTICAL RADIO OF THAILAND LTD.

VOR, VOR/DME, VORTAC, TACAN ORBITAL PLOT				<input checked="" type="checkbox"/> DVOR	FM-AV.PS-06	
				TACAN		
				<input checked="" type="checkbox"/> DME		
1. STATION <p style="text-align: center;">RAYONG DVOR/DME</p>				2. DATE/DATES OF INSPECTION <p style="text-align: center;">July 6, 2018</p>		
3. ALTITUDE <p style="text-align: center;">45</p>						
4. AZIMUTH ERROR (+OR-) PLOTTING CODE: VOR #1 _____ VOR #2 _____ TACAN #1 _____ TACAN #2 _____						
5. CHECK POINT LOCATION						
6. TACAN DISTANCE LOCK ON						
7. TACAN AZIMUTH LOCK ON						
8. AREA OF INTERFERENCE						
9. ROUGHNESS +/- (Do not plot if less than +/- 1.0 degree)						
10. SCALLOPING +/- (Do not plot if less than +/- 1.0 degree)						
11. VOR COVERAGE SIGNAL STRENGTH #1 _____ SIGNAL STRENGTH #2 _____				FLAG ALARM #1 _____ FLAG ALARM #2 _____		
12. ORBITAL ERROR SPREAD		EQUIPMENT			13. ORBIT RADIUS 8 NM.	
<input checked="" type="checkbox"/> TX	<input type="checkbox"/> TP	NO. 1	-	+	SPREAD	PILOT FLIGHT INSPECTOR PANEL OPERATOR
			-1.3	+0.5	1.8	
<input checked="" type="checkbox"/> TX	<input type="checkbox"/> TP	NO. 2	-	+	SPREAD	
			-1.0	+0.9	1.9	

Kavit 9 K. Kanyon
 Jumbas, Chumpon



ATTACHMENT

RAYONG DVOR/DME DISCREPANCIES

1. This is a periodic check by aircraft register HS-ATS.
2. During checked found roughness out of tolerance on radial 029 degree distance 9.4 DME at altitude 5,500 feet.

NOTAM : RAYONG DVOR/DME unusable on radial 029 degree distance between
8 -10 DME altitude 5,500 feet.

3. Coverage orbit data refer from special check (reconfiguration):

Due to mountainous terrain surround DVOR/DME station, coverage check does not provide adequate signal to 40 NM. at required altitude in various areas.

RAYONG DVOR/DME:

- Radial 011-030 degree beyond 40 NM. should not below 6,000 feet.
- Radial 031-050 degree beyond 40 NM. should not below 3,000 feet.
- Radial 051-080 degree beyond 40 NM. should not below 5,000 feet.
- Radial 081-010 degree beyond 40 NM. should not below 3,000 feet.

4. Facility performance classified as "Restricted" due to item number 2 and 3 above.
5. Next periodic check is due on July 6, 2019.

(Extendable up to August 5, 2019)



**AIRCRAFT OPERATION DEPARTMENT
FLIGHT INSPECTION SERVICES BUREAU
AERONAUTICAL RADIO OF THAILAND LTD.**

FLIGHT INSPECTION REPORT - VOR, VOR/DME, VORTAC TACAN, VOT							FM-AV.PS-06													
1. STATION CHIANGRAI DVOR/DME			2. LOCATION IDENT. CTR		3. DATE/DATES OF INSPECTION May 16, 2018															
4. TYPE OF INSPECTION							5. COMMON SYSTEM													
SITE EVALUATION		<input checked="" type="checkbox"/>		PERIODIC		SPECIAL		YES												
COMMISSIONING				SURVEILLANCE		INCOMPLETE		NO												
6. OWNER		DCA		USAF		OTHER (INDICATE ACTUAL OWNER)														
		RTAF		INTERNATIONAL		AERONAUTICAL RADIO OF THAILAND LTD.														
7. FACILITY/COMPONENT INSPECTED			<input checked="" type="checkbox"/>		DVOR		VORTAC		TACAN		VOT		<input checked="" type="checkbox"/>		DME					
8. RADIAL DATA																				
FACILITY SERVICE DESIGNATION		DVOR		DVOR		DVOR		DVOR		DVOR		DVOR		DVOR						
RADIAL USE		MON		MON		W29		W29		W20		W20		-		-				
AZIMUTH		030		030		143		143		216		216		355		355				
TRANSMITTER(S)		1		2		1		2		1		2		1		2				
MSL ALTITUDE (in hundreds)		40		40		50		50		50		50		60		60				
DISTANCE (Nautical miles)		FROM		6.0		13.0		13.0		5.5		5.3		11.9		12.0		6.0		
		TO		13.1		6.6		6.8		14.0		14.5		5.9		5.8		12.3		
SENSITIVITY/MODULATION		S		S		S		S		S		S		S		S				
ROUGHNESS		0.8/6.5		0.2/7.3		0.3/7.7		1.0/13.7		0.4/12.8		0.3/10.1		0.8/10.0		1.5/10.1				
SCALLOPING		0		0		0		0		0		0		0		0				
BENDS		0.2/6.5		0.1/7.0		0.2/7.2		0.6/13.7		0.1/6.7		0.2/7.1		0.2/6.4		0.1/7.4				
POLARIZATION		-		-		-		-		0.3/12.0		-		-		-				
ALIGNMENT ERROR		0.0		+0.2		-1.5		-1.6		-0.6		-0.4		-0.8		-0.7				
TRANSMITTER DIFFERENCE		0.2		0.2		0.1		0.1		0.2		0.2		0.1		0.1				
SIGNAL STRENGTH		50+		50+		50+		50+		50+		50+		50+		50+				
INTERFERENCE		S		S		S		S		S		S		S		S				
9. GENERAL			SAT.		UNSAT.		10. MONITORS													
STANBY POWER		-				LAST DATE INSPECTED May 18, 2017					TX		ALIGNMENT		ALARM +		ALARM -			
VOICE		N/A				DVOR		REFERENCE RADIAL MON 030/8.5-12.2/40					1		-0.1		0.8		0.9	
IDENTIFICATION		X						CHECK POINT												
DME ACCURACY		X				TACAN		REFERENCE RADIAL / - /												
DME COVERAGE		X						CHECK POINT												
11. DISCREPANCIES AND/OR REMARKS													CORRECTED							
													YES		NO					
SEE ATTACHMENT																				
FACILITY CLASSIFICATION			PILOT FLIGHT INSPECTOR																	
			<i>[Signature]</i>																	
X RESTRICTED			PANEL OPERATOR						THEODOLITE OPERATOR											
			THIANCHAI, K...						N/A											
UNUSEABLE																				
DIRECTOR, AIRCRAFT OPERATION DEPARTMENT																				
<i>[Signature]</i> Mr. Ch. G... 15 June 2018																				
APPROVED BY THE CIVIL AVIATION AUTHORITY OF THAILAND																				



ATTACHMENT

CHIANGRAI DVOR/DME DISCREPANCIES

1. This is a periodic check by aircraft register HS-PBN.
2. Coverage orbit data refer from special checked (reconfiguration):

Due to mountainous terrain surround DVOR/DME station, coverage check does not provide adequate signal to 40 NM at required altitudes and distances in various areas as following:

- Radial 271 - 340 degree at 20 NM altitude should not below 6,500 feet.
(Due to border limited.)
- Radial 341 - 140 degree at 20 NM altitude should not below 5,000 feet.
(Due to border limited.)
- Radial 141 - 180 degree at 40 NM altitude should not below 5,000 feet.
- Radial 181 - 210 degree at 40 NM altitude should not below 7,500 feet.
- Radial 211 - 240 degree at 40 NM altitude should not below 9,000 feet.
- Radial 241 - 260 degree at 40 NM altitude should not below 12,000 feet.
- Radial 261 - 270 degree at 40 NM altitude should not below 10,000 feet.

Result found satisfactory.

3. Facility performance classified as "Restricted" due to item number 2 above.
4. Next periodic check is due on May 16, 2019.

(Extendable up to June 15, 2019)



**AIRCRAFT OPERATION DEPARTMENT
FLIGHT INSPECTION SERVICES BUREAU
AERONAUTICAL RADIO OF THAILAND LTD.**

FLIGHT INSPECTION REPORT – VOR, VOR/DME, VORTAC TACAN, VOT										FM-AV.PS-06				
1. STATION UBON DVOR/DME				2. LOCATION IDENT. UBL		3. DATE/DATES OF INSPECTION January 31, 2018								
4. TYPE OF INSPECTION										5. COMMON SYSTEM				
SITE EVALUATION		<input checked="" type="checkbox"/> PERIODIC				SPECIAL				YES				
COMMISSIONING				SURVEILLANCE		INCOMPLETE				NO				
6. OWNER		<input checked="" type="checkbox"/> DCA				USAF		OTHER (INDICATE ACTUAL OWNER)						
				RTAF		INTERNATIONAL								
7. FACILITY/COMPONENT INSPECTED				<input checked="" type="checkbox"/> DVOR				VORTAC						
								TACAN						
								VOT		<input checked="" type="checkbox"/> DME				
8. RADIAL DATA														
FACILITY SERVICE DESIGNATION		DVOR	DVOR	DVOR	DVOR	DVOR	DVOR	DVOR	DVOR					
RADIAL USE		MON	MON	A1	A1	-	-	W4	w4					
AZIMUTH		236	236	076	076	137	137	309	309					
TRANSMITTER(S)		1	2	1	2	1	2	1	2					
MSL ALTITUDE (In hundreds)		20	20	20	20	20	20	20	20					
DISTANCE (Nautical miles)		FROM	12.9	6.2	12.9	6.2	6.1	12.9	12.9	6.2				
		TO	5.9	13.0	5.9	13.7	13.0	5.8	5.9	13.1				
SENSITIVITY/MODULATION		S	S	S	S	S	S	S	S					
ROUGHNESS		0.2/12.7	0.3/6.2	0.4/11.1	0.3/13.0	0.3/12.2	0.2/6.6	0.3/7.9	0.3/12.6					
SCALLOPING		0	0	0	0	0	0	0	0					
BENDS		0.1/12.9	0.2/6.2	0.5/6.6	0.2/8.9	0.2/9.6	0.2/12.9	0.3/12.4	0.1/7.8					
POLARIZATION		-	-	-	0.3/13.0	-	-	-	-					
ALIGNMENT ERROR		-0.1	+0.3	0.0	-0.2	-1.5	-1.3	-1.3	-1.6					
TRANSMITTER DIFFERENCE		0.4	0.4	0.2	0.2	0.2	0.2	0.3	0.3					
SIGNAL STRENGTH		50+	50+	50+	50+	50+	50+	50+	50+					
INTERFERENCE		S	S	S	S	S	S	S	S					
9. GENERAL		SAT.		UNSAT.		10. MONITORS								
STANBY POWER		-				LAST DATE INSPECTED January 31, 2017				TX	ALIGNMENT	ALARM +	ALARM -	
VOICE		N/A				DVOR		REFERENCE RADIAL MON 236/6.0-12.9/20		1	0.0	0.9	0.7	
IDENTIFICATION		X				TACAN		REFERENCE RADIAL / - /						
DME ACCURACY		X				CHECK POINT								
DME COVERAGE		X				CHECK POINT								
11. DISCREPANCIES AND/OR REMARKS											CORRECTED			
SEE ATTACHMENT											YES		NO	
FACILITY CLASSIFICATION		PILOT FLIGHT INSPECTOR <i>R. Suthap</i>												
UNRESTRICTED		<i>John W</i>												
<input checked="" type="checkbox"/> RESTRICTED		PANEL OPERATOR <i>Rangsit J. Chatri</i>					THEODOLITE OPERATOR							
UNUSEABLE							N/A							
DIRECTOR, AIRCRAFT OPERATION DEPARTMENT <i>J. Mr. Chir Somrat V.</i>											13 FEB 2018			
APPROVED BY THE CIVIL AVIATION AUTHORITY OF THAILAND <i>SB</i>											27 MAR 2018			



ATTACHMENT

UBON DVOR/DME DISCREPANCIES

1. This is a periodic check by aircraft register HS-PBN.
2. Coverage orbit data refer from commissioning checked:
 - 2.1 Radial 071 – 110 degree at 30 NM. altitude should not below 2,000 feet
(due to border limited).
 - 2.2 Radial 111 – 070 degree at 40 NM. altitude should not below 2,000 feet
3. Facility performance classified as "Restricted" due to item number 2.1 above.
4. Next periodic check is due on January 31, 2019.
(Extendable up to March 2, 2019)



**AIRCRAFT OPERATION DEPARTMENT
FLIGHT INSPECTION SERVICES BUREAU
AERONAUTICAL RADIO OF THAILAND LTD.**

FLIGHT INSPECTION REPORT - VOR, VOR/DME, VORTAC TACAN, VOT							FM-AV.PS-06						
1. STATION MAE HONGSON DVOR/DME			2. LOCATION IDENT. MHS		3. DATE/DATES OF INSPECTION February 21, 2018								
4. TYPE OF INSPECTION							5. COMMON SYSTEM						
SITE EVALUATION		<input checked="" type="checkbox"/> PERIODIC		SPECIAL		YES							
COMMISSIONING		SURVEILLANCE		INCOMPLETE		NO							
6. OWNER		DCA		USAF		OTHER (INDICATE ACTUAL OWNER)							
		RTAF		INTERNATIONAL		AERONAUTICAL RADIO OF THAILAND LTD.							
7. FACILITY/COMPONENT INSPECTED			<input checked="" type="checkbox"/> DVOR		<input type="checkbox"/> VORTAC		<input type="checkbox"/> TACAN		<input type="checkbox"/> VOT <input checked="" type="checkbox"/> DME				
8. RADIAL DATA													
FACILITY SERVICE DESIGNATION		DVOR	DVOR	DVOR	DVOR	DVOR	DVOR	DVOR	DVOR				
RADIAL USE		MON	MON	-	-	W9	W9	-	-				
AZIMUTH		040	040	090	090	119	119	180	180				
TRANSMITTER(S)		1	2	1	2	1	2	1	2				
MSL ALTITUDE (In hundreds)		50	50	70	70	80	80	60	60				
DISTANCE (Nautical miles)		FROM	19.0	19.2	14.5	5.8	5.3	14.7	15.9	5.0			
		TO	12.8	13.3	5.0	14.2	14.7	5.0	5.0	14.9			
SENSITIVITY/MODULATION		S	S	S	S	S	S	S	S				
ROUGHNESS		0.8/14.7	1.1/14.5	8.3/7.2	12.5/7.2	23.3/7.3	12.7/10.0	3.1/8.2	3.8/9.9				
SCALLOPING		0	0	0	0	0	0	0	0				
BENDS		0.2/16.7	0.4/19.2	0.8/7.2	2.3/7.2	1.2/7.3	1.4/10.0	0.3/8.2	0.5/9.8				
POLARIZATION		-	-	-	-	0.5/13.6	-	-	-				
ALIGNMENT ERROR		+0.6	+0.6	+0.6	-0.3	-0.7	-1.4	-0.5	-0.6				
TRANSMITTER DIFFERENCE		0	0.0	0.9	0.9	0.7	0.7	0.1	0.1				
SIGNAL STRENGTH		50+	50+	50+	50+	50+	50+	50+	50+				
INTERFERENCE		S	S	S	S	S	S	S	S				
9. GENERAL		SAT.	UNSAT.	10. MONITORS									
STANBY POWER		-		LAST DATE INSPECTED February 21, 2018				TX	ALIGNMENT	ALARM +	ALARM -		
VOICE		N/A		DVOR		REFERENCE RADIAL MON040/16.0-19.5/50		1	+0.6	0.8	1.0		
IDENTIFICATION		X		TACAN		REFERENCE RADIAL / - /							
DME ACCURACY		X		CHECK POINT									
DME COVERAGE		X		CHECK POINT									
11. DISCREPANCIES AND/OR REMARKS										CORRECTED			
SEE ATTACHMENT										YES		NO	
FACILITY CLASSIFICATION		PILOT FLIGHT INSPECTOR Karin S. Juch											
<input type="checkbox"/> UNRESTRICTED		PANEL OPERATOR Krittip		THEODOLITE OPERATOR N/A									
<input checked="" type="checkbox"/> RESTRICTED													
<input type="checkbox"/> UNUSEABLE													
DIRECTOR, AIRCRAFT OPERATION DEPARTMENT Krittip				APPROVED BY THE CIVIL AVIATION AUTHORITY OF THAILAND 23 Mar 18									

Active



AIRCRAFT OPERATION DEPARTMENT
 FLIGHT INSPECTION SERVICES BUREAU
 AERONAUTICAL RADIO OF THAILAND LTD.

VOR, VOR/DME, VORTAC, TACAN ORBITAL PLOT				<input checked="" type="checkbox"/> DVOR	FM-AV.PS-06
				TACAN	
				<input checked="" type="checkbox"/> DME	
1. STATION MAE HONGSON DVOR/DME			2. DATE/DATES OF INSPECTION February 21, 2018		
3. ALTITUDE 75					
4. AZIMUTH ERROR (+OR-) PLOTTING CODE: VOR #1 _____ VOR #2 _____ TACAN #1 _____ TACAN #2 _____					
5. CHECK POINT LOCATION					
6. TACAN DISTANCE LOCK ON					
7. TACAN AZIMUTH LOCK ON					
8. AREA OF INTERFERENCE					
9. ROUGHNESS +/- (Do not plot if less than +/- 1.0 degree)					
10. SCALLOPING +/- (Do not plot if less than +/- 1.0 degree)					
11. VOR COVERAGE SIGNAL STRENGTH #1 _____ SIGNAL STRENGTH #2 _____				FLAG ALARM #1 _____ FLAG ALARM #2 _____	
12. ORBITAL ERROR		EQUIPMENT		13. ORBIT RADIUS	
<input checked="" type="checkbox"/> TX	<input type="checkbox"/> TP	NO. 1	-	+	SPREAD
			-1.4	+0.3	1.7
<input checked="" type="checkbox"/> TX	<input type="checkbox"/> TP	NO. 2	-1.6	+0.3	1.9
				8 NM.	
			PILOT FLIGHT INSPECTOR		
			Kavin S		
			PANEL OPERATOR		
			Krittip, 112		



ATTACHMENT

MAE HONGSON DVOR/DME DISCREPANCIES

1. This is a periodic check by aircraft register HS-ATS.
2. Both DVOR transmitters are satisfactory.
3. During checked found roughness out of tolerance on radial 090 distance between 5-9 DME altitude 7,000 feet, radial 119 distance between 5-10.5 DME altitude 8,000 feet and radial 180 distance between 7.5-10 DME altitude 6,000 feet.

NOTAM: MAE HONGSON DVOR/DME radial 090 distance between 5-9 DME altitude 7,000 feet, radial 119 distance between 5 -10.5 DME altitude 8,000 feet and radial 180 distance between 7.5 -10 DME altitude 6,000 feet unusable.

4. Coverage orbit data refer from commissioning checked:

Due to mountainous terrain surround DVOR/DME station coverage check does not provide adequate signal 40 NM. at the required altitude in various areas as follows.

- Radial 060 - 080 degree beyond 40 NM. altitude should not below 8,500 feet.
- Radial 081 - 120 degree beyond 40 NM. altitude should not below 11,000 feet.
- Radial 121 - 180 degree beyond 40 NM. altitude should not below 9,000 feet.
- Radial 181 - 059 degree unable to performed due to border limited.
- DME unusable 080 - 120 degree beyond 30 NM. altitude below 10,000 feet.

Result found satisfactory.

5. Facility performance classified as "Restricted" due to item number 3 and 4 above.
6. Next periodic check is due on February 21, 2019.

(Extendable up to March 23, 2019)

