

Voice Communication Control System Specification

For

Don Mueang & Chiang Rai Towers



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1. INTRODUCTION

This document provides a functional and technical specification which sets out the requirements of Aeronautical Radio of Thailand Ltd. (AEROTHAI) in the Kingdom of Thailand for an Air Traffic Control **Voice Communication Control System (VCCS)** to be installed as a replacement at Don Mueang and Chiang Rai Towers.

- 9 working positions for Don Mueang Tower.
- 6 working positions for Chiang Rai Tower.
- 40 Analog Telephone Channels for Don Mueang Tower.
- 20 Analog Telephone Channels for Chiang Rai Tower.
- 20 IP Telephone Channels for Don Mueang Tower.
- 10 IP Telephone Channels for Chiang Rai Tower.
- 40 IP for Transmitter Radio Channels for Don Mueang Tower.
- 24 IP for Transmitter Radio Channels for Chiang Rai Tower.
- 40 IP for Receiver Radio Channels for Don Mueang Tower.
- 24 IP for Receiver Radio Channels for Chiang Rai Tower.
- 2 GPS Master Clocks for Don Mueang Tower and Chiang Rai Tower.
- 9 Slave Clocks for Don Mueang Tower.
- 2 Slave Clock for Chiang Rai Tower.
- 2 DC Power Supply backups for Don Mueang Tower and Chiang Rai Tower.

2 GENERAL

- 2.1 A computer-based VCCS shall be required for controlling (switching) and interfacing the intra-facility, and inter-facility voice communications used in the ATC operation (Detail as per Appendix 1).
- 2.2 The voice communications employed in the Air Traffic Control comprise the air-to-ground VHF and UHF radio telephony as well as telephone communications. The VCCS central equipment shall be functionally separated into different modules.
- 2.3 The design shall allow the expansion of the system capacity by addition of units or modules.

- 2.4 The VCCS architecture shall be capable that there are a sufficient number of simultaneous voice paths to carry the maximum offered voice traffic.
- 2.5 The VCCS can be monitored using the Simple Network Management Protocol (SNMP).
- 2.6 The Tenderer shall provide a list of all necessary standards documents and Interface Control Document (ICD) with regards to the VCCS-CCMS (AEROTHAI's Communication Control Monitoring System) information exchange.
- 2.7 The system has built-in redundancy on vital parts, have a distributed, decentralized, processing, modular design and be free from single-point-of-failures. And for safety reason, the interconnection between central racks and VCCS workstation facilities should use star topology. The system shall have high level of availability.
- 2.8 The manufacturing or assembly factory shall be certified with ISO9001.

3. WORKING POSITION

3.1 General

- 3.1.1 The working position shall consist of at least panel, foot push to talk (PTT) switch, loudspeakers, slave clock, headset/handset access and headset/handset.
- 3.1.2 All the working positions shall be able to use all radio lines and telephone lines.
- 3.1.3 Each working position shall be able to communicate with another position by selecting a button on the panel and be directly connected to the predetermined working position (Intercom).
- 3.1.4 The tenderer shall provide Short Time (or Term) Recording function on the panel for each working position.
- 3.1.5 The Short Time (or Term) Recording function shall have a minimum duration of at least 30 minutes for each working position.
- 3.1.6 As the proposed systems differ in size from existing consoles, the tenderer shall be required to modify the consoles in order that the proposed systems shall be successfully accommodated.
- 3.1.7 Each working position facility should be equipped with analog ambient recording output, the continuous (24x7) recording of any noise detected at an operator

position. An ambient microphone shall not be the same as the microphone of the handset or the headset. It shall be an independent microphone.

3.2 Touch Screen

- 3.2.1 The touch screen size shall not be less than 12.1 inches TFT-display with a resolution of at least 800x600 pixels associated with a touch-input device (TID).
- 3.2.2 The touch screen and the associated processor shall be a single integrated unit. No external wiring shall be used to connect the touch screen and the processor.
- 3.2.3 Each access facility of touch screen shall consist of a button with facility label.
- 3.2.4 The touch screen shall be supported with a telephone button group (for G/G communications) and a radio button group (for A/G communications) in the same page.
- 3.2.5 The touch screen shall give the status of radio channels and telephone lines, i.e. "busy state" , "call in" etc.
- 3.2.6 The telephone button group shall be integrated to some extent general control functions like conference, hold, etc.
- 3.2.7 To establish a dialled telephone connection, a dial pad shall be available.
- 3.2.8 The touch screen shall enable access to at least 8 radio frequencies simultaneous for transmission and reception by way of loudspeaker or headset/handset or both.
- 3.2.9 The frequency allocated to a radio channel shall be indicated with 6 digits plus decimal points (e.g. "119.075") or any other letter indicating the station symbol.
- 3.2.10 The RX button and TX button of radio frequency shall be provided.
- 3.2.11 The RX button shall be associated with each frequency assigned to the touch screen of working position.
- 3.2.12 By selecting the RX button on the radio button touch screen, the allocated radio channel shall be activated for the reception.
- 3.2.13 The TX button shall be associated with each frequency assigned to the touch screen of working position.
- 3.2.14 By selecting the TX button on the radio button touch screen, the allocated radio channel shall be selectable for the transmission.

- 3.2.15 Telephone communication access shall be activated via the telephone button.
- 3.2.16 Telephone button shall consist of Direct Access telephone button (DA) and Indirect Access telephone button (IA) functions.
- 3.2.17 Function button shall be separately provided from the Telephone button such as hold, conference, etc.
- 3.2.18 Relief Briefing shall allow two-way communications between the instructor and the operator and is typically used to pass information between the two operations during the change of shifts.
- 3.2.19 The audio from both Headset/handset accesses shall be made available for recording.
- 3.2.20 Relief Briefing shall not interrupt the position for use in A/G or G/G calls.

3.3 Headset/Handset

- 3.3.1 Both radio and telephone communications shall be operated via headsets or handsets.
- 3.3.2 The headset and handset accesses connector panel shall be provided by the Tenderer.
- 3.3.3 There shall be at least two connectors on the headset and handset access panel, one for the operator and the other one for the instructor.
- 3.3.4 Socket pins assignment of the headsets and handsets at the working positions shall be provided at a minimum for microphone, ear-cap and PTT switch.
- 3.3.5 Identical plugs shall be used for headsets and handsets.
- 3.3.6 15 headsets and 15 handsets with handset holders shall be provided by the Tenderer. The headsets shall be monaural headsets and shall have a quick disconnect connectors. The quick disconnect connectors shall be compatible with AEROTHAI's existing headsets (AEROTHAI's existing headsets are Plantronics SHS 2470-05 for PTT part and HW 251 N or HW 510 for Headset part).
- 3.3.7 The instructor facility shall override both microphone and PTT of the controller.
- 3.3.8 The controller and the instructor ear-cap shall be permitted independent volume adjustment.
- 3.3.9 With the volume control in minimum position, the audio level shall be adjustable remain sufficient for monitoring purpose.

3.4 Loudspeakers

- 3.4.1 Each working position shall have two loudspeakers, one for radio frequencies and another one for telephone.
- 3.4.2 The loudspeaker audio level shall be adjustable by the volume control.
- 3.4.3 The volume control at minimum position, the audio level shall be adjustable remain sufficient for monitoring purpose.

4. VCCS CENTRAL EQUIPMENT

4.1 Radio Part

- 4.1.1 The select or deselect any radio frequency shall be accessed via radio button assigned to the working position for transmission and/or reception.
- 4.1.2 The presence of a received voice signal from the receivers shall be indicated (Squelch Indication).
- 4.1.3 The main and standby channels of radio receiver shall be interlocked that only one of the channels will receive at a time even though both channels have been inadvertently selected by the controller.
- 4.1.4 The main and standby channels of radio transmitter shall be interlocked that only one of the channels will transmit at a time even though both channels have been inadvertently selected by the controller.
- 4.1.5 The radio transmission shall be activated when the operator push the PTT switch (Headset PTT switch or Handset PTT switch or Foot PTT switch).
- 4.1.6 When more than one radio channels are selected, the operator shall be able to transmit in the same time on all these channels by only pushing the PTT switch.
- 4.1.7 The system shall be provided with the automatic muting of the receiver when the transmitter is transmitting.
- 4.1.8 The radio frequency monitor shall enable any working position to monitor all radio traffic on channels that are available at the working position, even if they have been selected at other working positions.
- 4.1.9 The VCCS shall provide Receiver Voting function (Best Signal Selection), which will automatically select a receiver with the best quality of signal within a group of minimum 4 receivers.

- 4.1.10 While the Receiver Voting function is in operation the operators shall manually select a receiver of their choice.
- 4.1.11 The VCCS shall provide automatic selection of transmitter function when it is working together with Receiver Voting function.
- 4.1.12 The VCCS shall enable or disable automatic selection of transmitter.
- 4.1.13 Each radio frequency shall be provided with Main or Standby channel.
- 4.1.14 Faulty module(s) shall be immediately identified by the alarm indicator.
- 4.1.15 The system shall be capable of interfacing with VoIP (ED137C) format.
- 4.1.16 The Tenderer shall provide VCCS functional automatic radio selection Main/Standby, when radio alarm in VoIP (ED137C) interface.
- 4.1.17 The VCCS system shall be connected to main and standby IP Radio interfaces via 2 switches.
- 4.1.18 The VCCS system shall be consisted of 2 redundancy main IP Radio interfaces and 2 redundancy standby IP Radio interfaces.
- 4.1.19 The Tenderer shall provide 20 switches (10 switches for Don Mueang Tower and another 10 switches for Chiang Rai Tower) at least 24 ports per switch with IP SLA tracking for IPv4 static route, stackwise, EIGRP function and dual power supply for VoIP radio interface. The 20 switches for VCCS Central Rack, TX main, TX standby, RX Main and RX standby Stations. (Details as Appendix 2)
- 4.1.20 Each switch shall consist of 4 (four) SFP ports and 4 (four) SFP modules shall be provided by the tenderer.
- 4.1.21 The Tenderer shall provide all switches as stackwise topology.
- 4.1.22 Dark Fiber for Chiang Rai Tower shall be provided by Tenderer while Don Mueang Tower shall be provided by AEROTHAI.

4.2 Telephone Part

- 4.2.1 When selecting a single DA, a connection shall be established to a predetermined destination.
- 4.2.2 The identity of the IA caller shall be displayed on the panel.
- 4.2.3 After establishing a DA and IA connection and prior to the acceptance of the call by the called terminal, a ring-back tone shall be sent to the calling user.

- 4.2.4 The Hold function shall be available for both DA and IA. (This function will enable a user to have more than one incoming or outgoing call set up simultaneously from a working position, but will only allow one call to be connected to the headset/handset at any one time.)
- 4.2.5 The Conference function shall be available for both DA and IA. (This function will enable a user to interconnect a number of working positions and/or lines of varying types, allowing full speech facilities to all connected parties. There will be a Conference button available, and it will be possible to initiate a conference independent of whether the first call is incoming or outgoing.)
- 4.2.6 The Transfer function shall be available for both DA and IA. (This function will enable any call made or received at a working position to be manually redirected to any other party).
- 4.2.7 All incoming call of the telephone lines shall be disable/enable to announce by means of signaling tone from a buzzer or speaker.
- 4.2.8 It shall be able to switch off the signaling tone, but a visual indication on the allocated button is still remain indicated.
- 4.2.9 It shall be possible to make adjustable the signaling tone level.
- 4.2.10 Faulty module(s) shall be immediately identified by the alarm indicator.
- 4.2.11 The 2-Wire Public Switched Telephone Network (PSTN) and Private Automatic Branch Exchange (PABX) interface module shall be available. (This interface provides for the connection to the PSTN directly or via a PABX simulating a telephone set).
- 4.2.12 The 2-Wire PSTN and PABX interface module shall take all necessary signaling to the line at least, DC loop by off-hook status, generation of DTMF digit codes, detection of ringing voltage etc.
- 4.2.13 For safety reasons at maximum 2 telephone lines shall be connected to one telephone module.
- 4.2.14 The telephone line interface module shall at least support audio frequencies from 300 Hz (or lower) to 3400 Hz (or higher).
- 4.2.15 The amplifiers of telephone line interface module shall be adjustable both in transmit and receive directions.
- 4.2.16 The analog telephone channel shall provide recording output.

- 4.2.17 The system shall be capable of interfacing with the VoIP (voice over IP ED137B or ED137C Interoperability Standards for VoIP ATM Components) telephony system.
- 4.2.18 Two redundant SIP Servers or SIP Modules/Cards for IP Phone shall be provided to be installed in 42 U standard 19" rack and separated from TCU hardwares.
- 4.2.19 Redundant power supply shall be provided for each SIP Server or SIP Module/Card.
- 4.2.20 The Tenderer shall provide 2 hub switches at least 24 ports with EIGRP function and dual power supply for VoIP Telephone interface.

4.3 GPS Master Clock

- 4.3.1 The master clock shall have a time display on the front panel.
- 4.3.2 The master clock shall be fed from the GPS receiver.
- 4.3.3 The master clock shall automatically be operated without GPS receiver.
- 4.3.4 The master clock shall automatically be synchronized when reconnected to the GPS receiver.
- 4.3.5 In case of all AC power supply failure, master shall continue working.

4.4 Slave Clock

- 4.4.1 Slave clocks shall be installed in Tower control room and Watch room.
- 4.4.2 All slave clocks shall be fed from the master clock.
- 4.4.3 In case of the cable connecting the master clock be broken or disconnected, Slave Clock shall continue working by itself.
- 4.4.4 In case of all AC power supply failure, Slave Clock shall continue working.

4.5 Power Supply

- 4.5.1 A duplicate power supply shall be offered that working with 210 – 230 Vac 50 - 60 Hz (AC power) by 2 separate AC input source for central equipment.
- 4.5.2 Each unit of the duplicate power supply shall supply the whole complete system as a redundancy to each other.
- 4.5.3 The DC power system shall be operated with the 24 or 48 Vdc float charged battery system (DC power).

- 4.5.4 The DC power system shall be provided by the tenderer which the capacity of at least 4 hours for supply both the VCCS central equipment and working positions.
- 4.5.5 In the case of both AC power source failure, the VCCS systems shall automatically switch over to a DC power system without any interruption to the operation of the systems.
- 4.5.6 The Tenderer shall provide AC power inputs that working with 210 – 230 Vac 50 - 60 Hz and DC power inputs for touch screen panels. Both power inputs shall directly and separately be plugged into the touch screen panels. No combining shall be used to combine both power inputs prior to plug into the touch screen panels. In the case of either power input failure, the touch screen panels will automatically switch over to another power input without any interruption to the operation of the system.
- 4.5.7 In case the Tenderer provides hub switches they shall be came with dual power supplies.

5. SYSTEM INTERCONNECTION

- 5.1 The VCCS central equipment shall directly be interfaced with a main distribution frame : MDF (to be provided by Tenderer) where all necessary communications, as specified on Paragraph 4.2, are connected.
- 5.2 Lightning protection shall be provided for all analog telephone and record lines at the MDF.
- 5.3 Interconnections between the working positions and the VCCS central equipment, as well as between the VCCS central equipment shall be provided.
- 5.4 The Tenderer shall connect existing radio and telephone lines to the proposed systems and such connection be performed at a time advised by AEROTHAI.
- 5.5 The VCCS central equipment shall be installed in 42 U standard 19" rack.

6. TECHNICAL CONTROL UNIT (TCU)

- 6.1 The TCU shall be used for monitoring and configuration of the VCCS central equipment.
- 6.2 The TCU shall be installed with the VCCS central equipment in equipment rooms.

- 6.3 Two redundant TCU Servers shall be provided to be installed in 42 U standard 19" rack and separated from SIP Server hardwares.
- 6.4 The TCU shall provide standard CPU server and redundant power supply.
- 6.5 Internal Hard Disk to be installed in the TCU shall be RAID1 and can be hot swapped.
- 6.6 The TCU Client shall be provided and shall be installed in Watch room.
- 6.7 The TCU shall be at least equipped with a display, a keyboard, a mouse, and necessary software with legally licence.
- 6.8 The TCU shall be equipped statistical package data for recorded traffic load on individual controller positions, telephone lines, radio channels.
- 6.9 The TCU software shall include facilities to record an event logging.
- 6.10 The TCU software shall be possible to extract the activity and event logging from the system in a suitable industry standard format without any way affecting the operational service.
- 6.11 All configuration data in the VCCS central equipment and TCU shall not disappear when the VCCS central equipment was turn off.
- 6.12 In case of TCU is turn off, the VCCS System shall continue working.
- 6.13 When the TCU application program is started up, the operator shall enter the user name and password for login.
- 6.14 For security reason, the capability shall be provided for assigning difference access rights and level of access to the system and its database, based on the required function of the authorized.
- 6.15 The access right functions shall support the creation/update/modification of the access code for new or existing users.
- 6.16 Reconfiguration of the assigned radio channels for each working position shall be possible from the TCU.
- 6.17 Reconfiguration of the assigned frequency for a radio channel shall be possible from the TCU.
- 6.18 Reconfiguration of the assigned telephone channels for each working position shall be possible from the TCU.
- 6.19 Reconfiguration of telephone button assignments shall be possible from the TCU.

- 6.20 Reconfiguration of the telephone numbers of lines shall be possible from the TCU.
- 6.21 Reconfiguration for the adding/deleting for new working positions shall be possible from the TCU (Not exceed maximum capacity).
- 6.22 To make an online reconfiguration, different configurations shall be pre-programmed and called up from the TCU by way of menus.
- 6.23 The TCU shall raise an alarm, when malfunction of VCCS is detected.
- 6.24 If a malfunction of the VCCS is detected, an alarm shall be activated in both visual and audible on the TCU.
- 6.25 The failure message shall particularly contain at least type of failures, time of failures and equipment involved.
- 6.26 The VCCS equipment shall be accompanied with all VCCS software licence.
- 6.27 In addition, the VCCS equipment shall be monitored by indicating Alarm status using the Simple Network Management Protocol (SNMP V2 or V3).
- 6.28 SNMP database that shows the equipment status shall at least be kept in .MIB (Management Information Base) file and accessible.

7. VOICE RECORDING

- 7.1 The input/output of any received/transmitted voice signal from/to incoming/outgoing working position of both telephone and radio communication including relief briefing shall be amplified, or attenuated, and connected for recording to the existing analog AEROTHAI voice recorder (Position Record)
- 7.2 Working Position Ambient Noise shall be connected for recording to the existing analog AEROTHAI voice recorder (Ambient Record)
- 7.3 The input/output of any received/transmitted voice signal from/to incoming/outgoing interfaces of analog telephone interfaces shall be amplified, or attenuated, and connected for recording by the existing analog AEROTHAI voice recorder (Channels/Lines Record)
- 7.4 All cables and other accessories/tools using to connect recorded signal on item 7.1, 7.2 and 7.3 to the voice recorder shall be provided by the tenderer.

8. SYSTEM CAPACITY

- 8.1 The capacity of the working positions shall be 9 working positions for Don Mueang Towers and 6 working positions for Chiang Rai Towers as specified in the Appendix 2.
- 8.2 The telephone channels interface/module shall be capable to interfacing with 60 channels of 2-Wire PSTN and PABX interface/module as specified in the Appendix 3-4.
- 8.3 The capacity of the IP radio channels interface shall be at least 64 channels for Transmitter, 64 channels for Receiver as specified in the Appendix 5-6. AEROTHAI's existing IP Radios are PAE series 2&3 and R&S series 4200.

9. ENVIRONMENTAL CONDITIONS

The VCCS equipment shall be able to operate in a controlled environment of approximately 10-40 °C and relative humidity of up to 70%.

10. TECHNICAL MANUAL

- 10.1 The VCCS shall be accompanied by technical manuals. (2 sets of hard copy and 2 sets of soft copy)
- 10.2 The technical manuals shall include complete installation, operation and maintenance instructions.

11. TRAINING

- 11.1 The training shall be adequate to provide AEROTHAI's engineers with the following capabilities:
 - (a) To install the System, operate, maintain and diagnose the fault parts down to card (or module) level;
 - (b) To maintain, update and operate the operational software according to the requirements stated in this specifications;
 - (c) To utilize the support computer program facility in order to operate, maintain and configure the VCCS;
 - (d) To operate the ATC Functions.
- 11.2 The instruction and language used in training documentation shall be in English.

- 11.3 The Tenderer shall arrange training at least 10 working days for at least 6 (Six) AEROTHAI's engineers for technical training at Bangkok.
- 11.4 The Tenderer shall arrange on-the-job training for AEROTHAI's engineers and ATC Operational Training.
- 11.5 The AEROTHAI engineers shall participate in the hardware and software installation.

12. INITIAL SPARE CARDS (OR MODULES)

- 12.1 The Tenderer shall separately state the lists of initial spare parts sufficient for at least 10% (rounded up e.g. 3.1 = 4, 3.9 = 4) of cards or modules of the each system.
- 12.2 The Tenderer shall propose itemized lists of initial spare parts including the quantity suggested for each spare part against the total quantity of each in use in the each system in accordance with the following format ONLY.

Initial Spare Parts					
Item No	Description	Part Number	Vendor	Qty in use	Qty as Spare

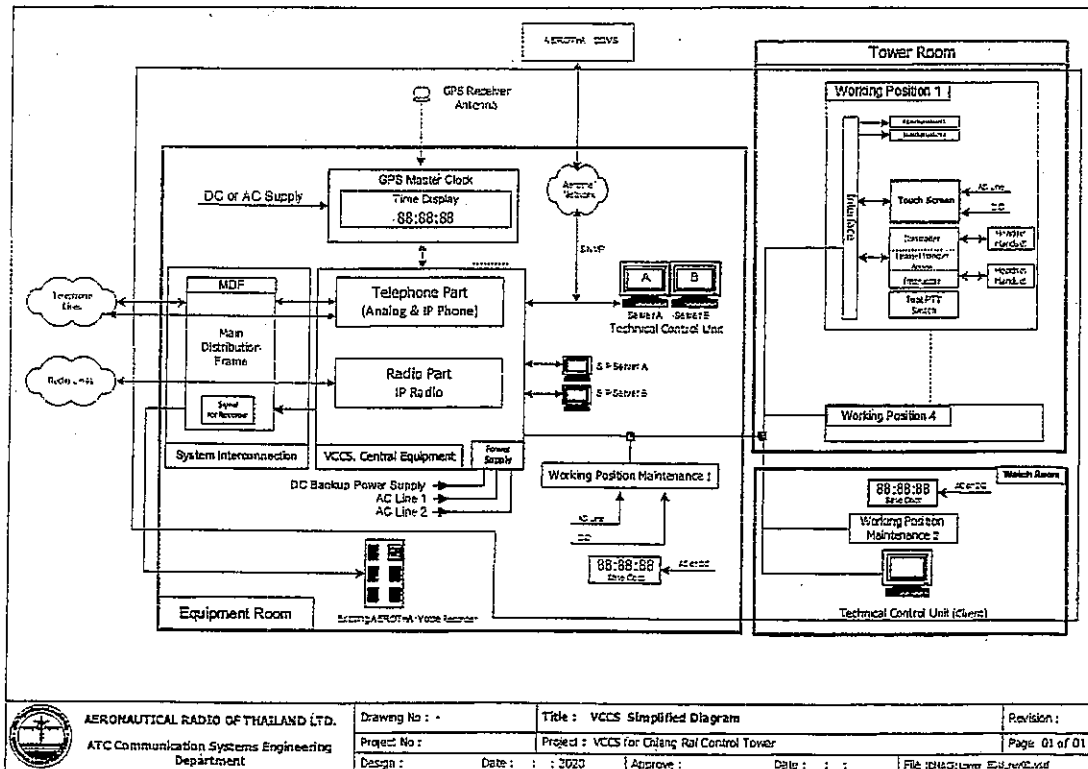
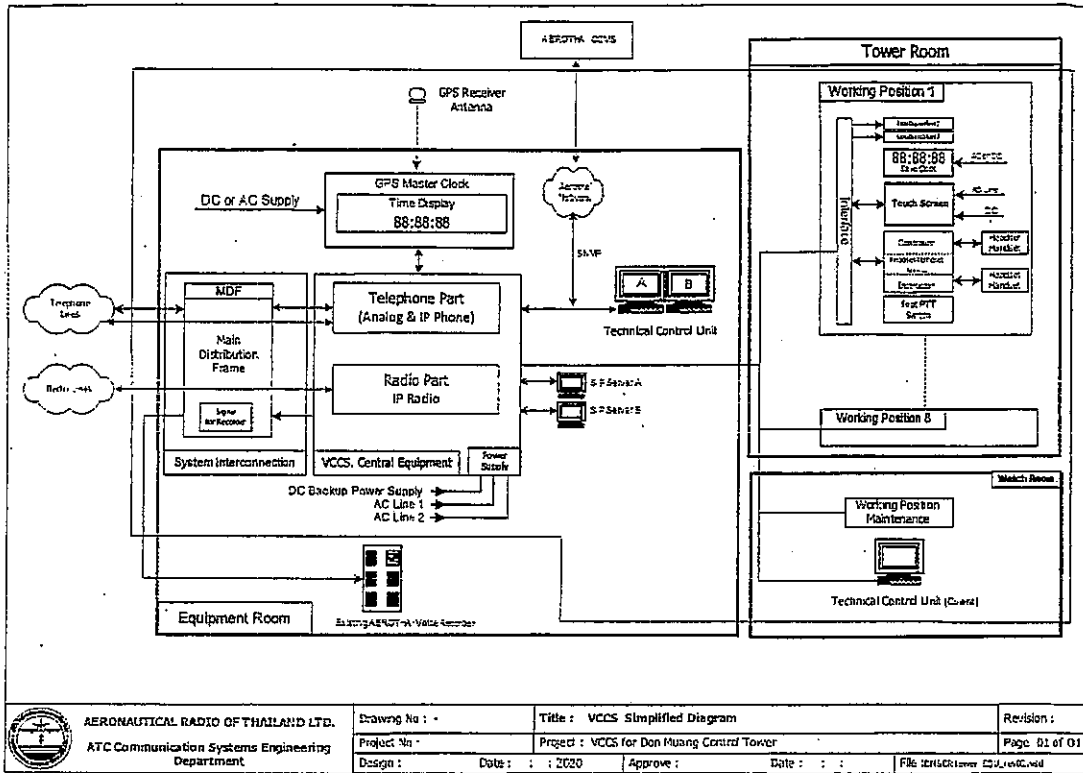
13. Warranty

The VCCS shall comes with 5 years warranty commencing on the date of the project Completion Date.

14. LIST OF ABBREVIATIONS

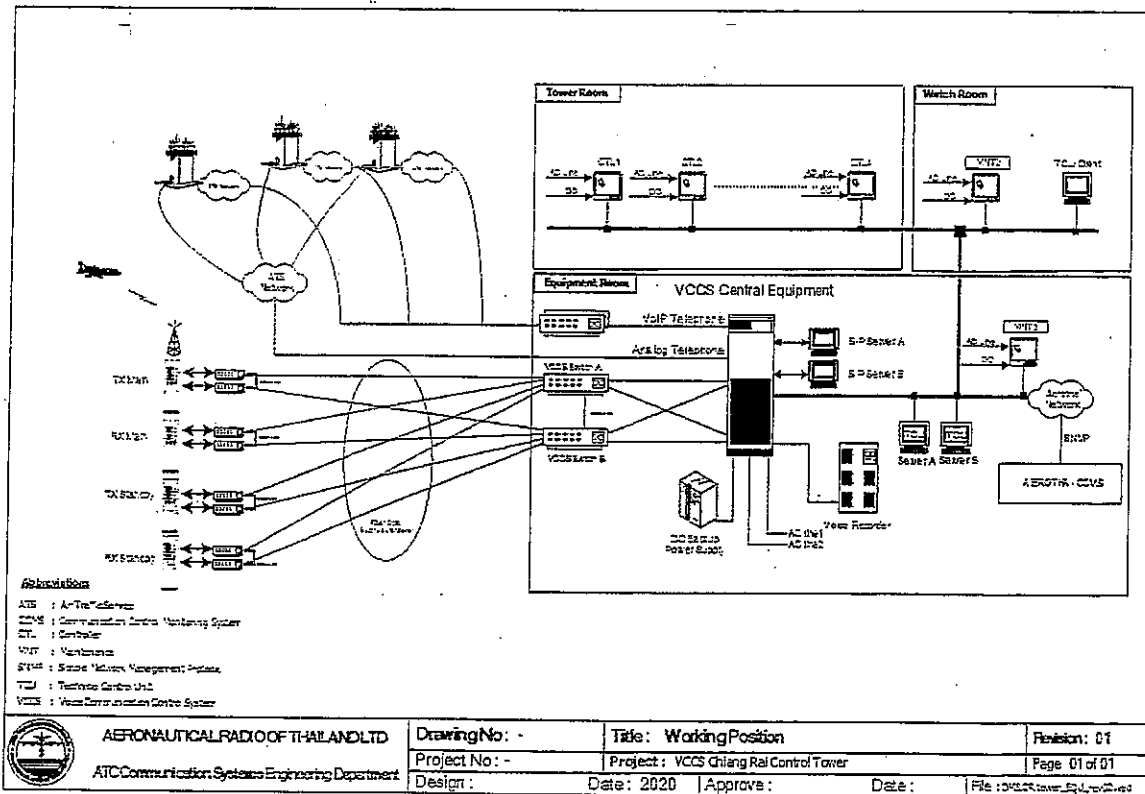
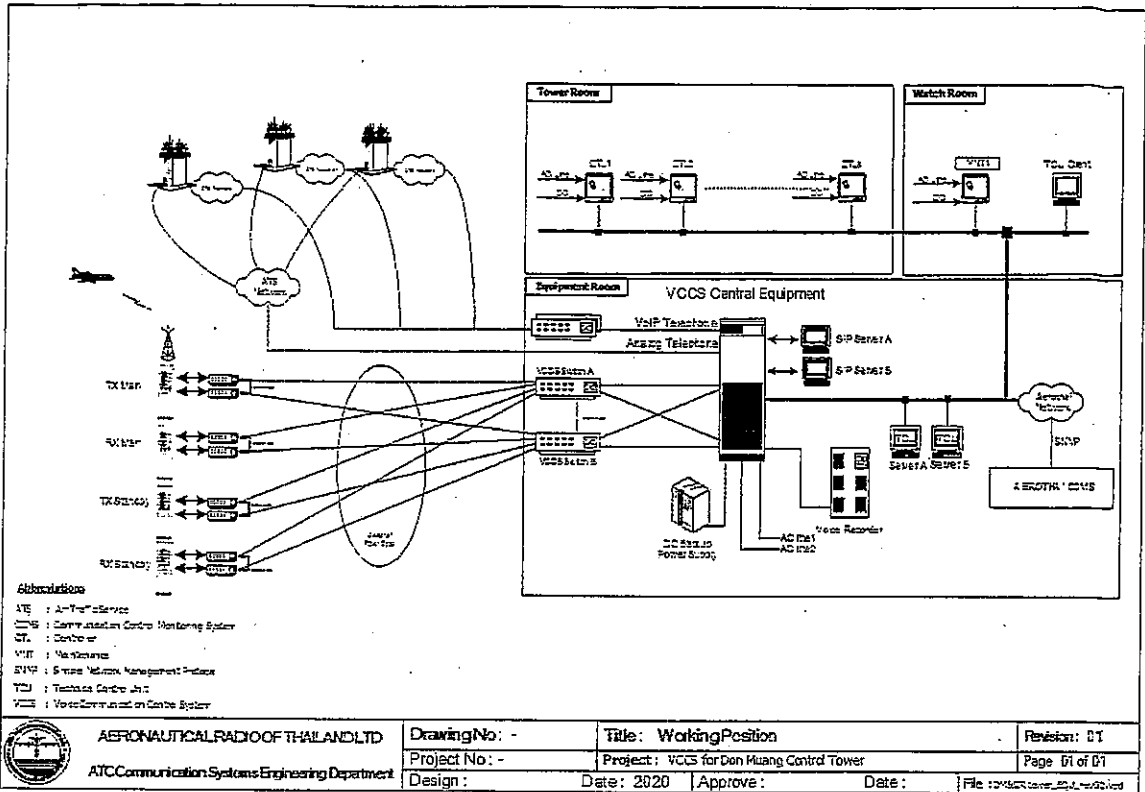
Abbreviations	Full Name
AC	Alternating Current
APP	Approach Control
DC	Direct Current
DA	Direct Access
DTMF	Dual Tone Multi-Frequency
EIGRP	Enhanced Interior Gateway Routing Protocol
IA	Indirect Access
GND	Ground Controller
LCL	Local Controller
MDF	Main Distribution Frame
MTN	Maintenance Engineer
PABX	Private Automatic Branch Exchange
PSTN	Public Switched Telephone Network
PTT	Push to Talk
RX	Receiver
SNMP	Simple Network Management Protocol
TID	Touch Input Device
TWR	Tower Control
TX	Transmitter
VCCS	Voice Communication Control System
VoIP	Voice over Internet Protocol

APPENDIX 1 : VCCS Simplify Diagram



Handwritten signature/initials

APPENDIX 2 : Working Positions Diagram



Handwritten signature

APPENDIX 3 : Telephone Channels Capacity for Don Mueang

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	WATCH SE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	WATCH NE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	AIS 1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	AIS\AERO	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	MET\VTBD	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	CCTV	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	APRON\AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	DFCP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	IFCP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	ACDM\4011	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	CCO\S1 (1S)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
13	ALL	CCO\S2 (6N)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
14	ALL	CCO\S3 (5S)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	CCO\S4 (3N)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	CCO\S4/1 (4N)	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	FIRE\DEPT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	DDP\H/L	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	DAR\H/L	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	AST\H/L	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
21	ALL	TCO\H/L	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
22	ALL	3282\AERO	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
23	ALL	3288\AERO	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
24	ALL	1333\AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
25	ALL	2303\RTAF	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
26	ALL	Spare 1	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
27	ALL	Spare 2	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
28	ALL	Spare 3	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
29	ALL	Spare 4	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
30	ALL	Spare 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
31	ALL	Spare 6	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
32	ALL	Spare 7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
33	ALL	Spare 8	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
34	ALL	Spare 9	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
35	ALL	Spare 10	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
36	ALL	Spare 11	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
37	ALL	Spare 12	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
38	ALL	Spare 13	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
39	ALL	Spare 14	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
40	ALL	Spare 15	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 4 : Telephone Channels Capacity for Chiang Rai

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	WATCH CE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	WATCH SE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	WATCH NE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	Hotline\1\CT_SEC	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	Hotline\2\CT_SEC	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	PABX\ATS\7703	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	4300\CR TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	4301\CR TWR	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	053\793\972	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	98230\AOT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	Spare 1	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
13	ALL	Spare 2	2-Wire	Loop-In/DTMF	Ring-Out	Telephone Set Interface
14	ALL	Spare 3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
15	ALL	Spare 4	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
16	ALL	Spare 5	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
17	ALL	Spare 6	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
18	ALL	Spare 7	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
19	ALL	Spare 8	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
20	ALL	Spare 9	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 5 : VoIP Radio Channels Capacity for Don Mueang

Channel	Working Position	Frequency (MHz)	Connect to TX/RX VoIP
1	Ground South	121.900	Local Main
2	Ground South	121.900	Local Stby
3	Ground North	122.500	Local Main
4	Ground North	122.500	Local Stby
5	Ground	257.800	Local Main
6	Ground	257.800	Local Stby
7	Local	118.100	Local Main
8	Local	118.100	Local Stby
9	Local	236.600	Local Main
10	Local	236.600	Local Stby
11	CDC	127.700	Local Main
12	CDC	127.700	Local Stby
13	VHF Emergency	121.500	Local Main
14	VHF Emergency	121.500	Local Stby
15	UHF Emergency	243.000	Local Main
16	UHF Emergency	243.000	Local Stby
17	Flight Check	132.050	Local Main
18	Flight Check	132.050	Local Stby
19	ATIS ARR	126.400	Local Main
20	ATIS ARR	126.400	Local Stby
21	ATIS ARR	344.600	Local Main
22	ATIS ARR	344.600	Local Stby
23	ATIS DEP	118.550	Local Main
24	ATIS DEP	118.550	Local Stby
25	SVB APP	121.700	Local Main
26	SVB APP	121.700	Local Stby
27	VHF Backup1	122.750	Local Main
28	VHF Backup1	122.750	Local Stby
29	VHF Backup2	133.300	Local Main
30	VHF Backup2	133.300	Local Stby
31	UHF Backup1	240.000	Local Main
32	UHF Backup1	240.000	Local Stby
33	All	Spare 1	Local Main
34	All	Spare 1	Local Stby
35	All	Spare 2	Local Main
36	All	Spare 2	Local Stby
37	All	Spare 3	Local Main
38	All	Spare 3	Local Stby
39	All	Spare 4	Local Main
40	All	Spare 4	Local Stby

APPENDIX 6 : VoIP Radio Channels Capacity for Chiang Rai

Channel	Working Position	Frequency (MHz)	Connect to TX/RX VoIP
1	Ground	121.900	Local Main
2	Ground	121.900	Local Stby
3	Ground	275.800	Local Main
4	Ground	275.800	Local Stby
5	Local	118.400	Local Main
6	Local	118.400	Local Stby
7	Local	236.600	Local Main
8	Local	236.600	Local Stby
9	APP	120.500	Local Main
10	APP	120.500	Local Stby
11	APP	257.800	Local Main
12	APP	257.800	Local Stby
13	VHF Emergency	121.500	Local Main
14	VHF Emergency	121.500	Local Stby
15	UHF Emergency	243.000	Local Main
16	UHF Emergency	243.000	Local Stby
17	ATIS ARR	127.850	Local Main
18	ATIS ARR	127.850	Local Stby
19	All	Spare 1	Local Main
20	All	Spare 1	Local Stby
21	All	Spare 2	Local Main
22	All	Spare 2	Local Stby
23	All	Spare 3	Local Main
24	All	Spare 3	Local Stby