Scope of Specifications

Technical Specifications

Voice Communication Control System

For Mae Sot, Tak, Sukhothai, Phrae, Phetchabun, Trat, Ranong, Trang and Narathiwat Control Tower

Table of Contents

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 Mae Sot, Tak, Sukhothai, Phrae, Phetchabun, Trat, Ranong, Trang and Narathiwat Control Towers.

- 10 working positions for Mae Sot and Narathiwat Control Towers (5 working positions for each site).
- 28 working positions for Tak, Sukhothai, Phrae, Phetchabun, Trat, Ranong and Trang Control Towers (4 working positions for each site)
- 216 Analog Radio Channels (24 Analog Radio Channels for each site)
- 108 Analog Telephone Channels (12 Analog Telephone Channels for each site)
- 216 IP for Transmitter Radio Channels (24 IP for Transmitter Radio Channels for each site)
- 216 IP for Receiver Radio Channels (24 IP for Receiver Radio Channels for each site)
- 9 GPS Master Clocks
- 38 Slave Clocks

2. GENERAL

2.1 A computer-based VCCS shall be required for controlling (switching) and inter-facing 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.

3. WORKING POSITION

3.1 General

3.1.1 Each working position shall consist of at least touch screen panel, foot push to talk (PTT) switch, loudspeakers, headset and handset accesses, headset and 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 ambient noise recording facility, capable of retaining the information recorded during at least the last twenty-four hours of operation.

3.2 Touch Screen Panel

3.2.1 The touch screen size shall not be less than 12 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. “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 dialed 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 operators during the change of shift.

3.2.19 The Relief Briefing audio from both Headset/handset accesses shall be made available for position 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 access 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 headset~~s~~ ~~or~~ and handset~~s~~ at the working positions shall be provided at a minimum for microphone, ear-cap and PTT switch.

3.3.5 The Tenderer shall provide headset and handset with handset holder as follow:

- 10 headsets and 10 handsets with handset holders for Mae Sot and Narathiwat Control Towers (5 headsets and 5 handsets with handset holders for each site).
- 28 headsets and 28 handsets with handset holders for Tak, Sukhothai, Phrae, Phetchabun, Trat, Ranong and Trang Control Towers (4 headsets and 4 handsets with handset holders for each site).
- 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 1890-15 for PTT part and HW 251 N, H 51 N, H 91 N for Headset part).

3.3.6 Identical plugs shall be used for headsets and handsets.

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 The volume control at 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

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 all these channels simultaneously 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 radio line interface module shall be adjustable delay time of transmit signal, receive signal and PTT signal from 0 to 1000 ms (or more).

4.1.10 The delay time of each channel in the radio line interface module shall be adjustable via software on Technical Control Unit (TCU) independently of other channels.

4.1.11 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 6 receivers. And each signal shall be adjustable delay time up to 1,000 ms.

4.1.12 The best quality of signal will be selected by the evaluation of signal-to-noise ratio.

4.1.13 While the Receiver Voting function is in operation the operators shall manually select a receiver of their choice.

4.1.14 The VCCS shall provide automatic selection of transmitter function when it is working together with Receiver Voting function.

4.1.15 While the automatic selection of transmitter function is in operation the operators shall switch to manual selection whenever needed.

4.1.16 The system shall be capable of interfacing with the digital transmission E1 (Digital Voice G.703, G.704 and G.711)/VoIP (ED137) format.

4.1.17 The Tenderer shall provide VCCS functional automatic radio selection Main/Standby, when radio alarm (PAE T6 IP-version) in VoIP interface.

4.1.18 For safety reasons, the maximum of 2 radio channels shall be connected to one analog radio line interface module.

4.1.19 Each radio line interface module/card shall be provided with Main or Standby channel.

4.1.20 The main and standby transmitter and receiver shall have its own selector.

4.1.21 The main and standby transmitter and receiver shall have its own channeling throughout.

4.1.22 Faulty module(s) shall be immediately identified by the alarm indicator.

4.1.23 The radio line interface module shall response audio frequencies from 300 Hz to 3400 Hz.

4.1.24 The amplifiers of the radio line interface module shall be adjustable both in transmitting and receiving directions.

4.1.25 The nominal impedance at the four-wire input and output interfaces shall be 600 ohms balanced.

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 ringing from a buzzer or speaker.

4.2.8 It shall be able to switch off the ringing, but a visual indication on the allocated button is still remain indicated.

4.2.9 It shall be possible to make adjustable the ringing level.

4.2.10 Faulty module(s) shall be immediately identified by the alarm indicator.

4.2.11 The 2-Wire Telephone Set interface module shall be available. (This interface provides for the connection to a 2-Wire DTMF analogue telephone set.)

4.2.12 The 2-Wire Telephone Set interface module shall support an interface to connect a 2-Wire analogue telephone set that conform to ITU-T Recommendation Q.23.

4.2.13 The 2-Wire Telephone Set interface module shall take all necessary signaling to the line such as; DC current source, generation of ringing voltage etc.

4.2.14 The incoming call shall be able to operate with loop start call signal.

4.2.15 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.)

4.2.16 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, detection of DTMF codes etc.

4.2.17 For safety reasons, the maximum of 2 telephone lines shall be connected to one telephone module.

4.2.18 The system shall be capable of interfacing with the E1 Digital Voice: G.703, G.704 and G.711

4.2.19 The system shall be capable of interfacing with the VoIP (voice over IP ED-137B – Interoperability Standards for VoIP ATM Components) telephony system.

4.2.20 The telephone line interface module shall response audio frequencies from 300 Hz to 3400 Hz.

4.2.21 The amplifiers of telephone line interface module shall be adjustable both in transmit and receive directions.

4.3 GPS Master Clock

4.3.1 The GPS master clock shall have a time display on the front panel.

4.3.2 The GPS master clock shall be fed synchronized signal from the GPS receiver.

4.3.3 The GPS master clock shall automatically be operated without GPS receiver.

4.4 Slave Clock

4.4.1 Each working position shall have slave clock.

4.4.2 All slave clocks at all working positions shall be fed from the master clock.

4.4.3 All slave clocks shall be displayed on top of each console.

4.4.4 In case of the cable connecting the master clock be broken or disconnected, Save Clock shall continue working by itself.

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 redundance 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 plugged into the touch screen panals. 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.

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 4.1 and 4.2, are connected.

5.2 Lightning protection shall be provided for all radio and telephone 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 42U 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 The TCU shall be at least equipped with a display, a keyboard, a mouse, a loading device, a printer and necessary software with legally licence.

6.4 The TCU shall be equipped statistical package data for recorded traffic load on individual controller positions, telephone channels, radio channels.

6.5 The TCU software shall include facilities to record an event logging.

6.6 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.

6.7 All configuration data in the VCCS central equipment and TCU shall not disappear when the VCCS central equipment was turn off.

6.8 When the TCU application program is started up, the operator shall enter the user name and password for login.

6.9 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.

6.10 The access right functions shall support the creation/update/modification of the access code for new or existing users.

6.11 Reconfiguration of the assigned radio channels for each working position shall be possible from the TCU.

6.12 Reconfiguration of the assigned frequency for a radio channel shall be possible from the TCU.

6.13 Reconfiguration of the assigned telephone channels for each working position shall be possible from the TCU.

6.14 Reconfiguration of telephone button assignments shall be possible from the TCU.

6.15 Reconfiguration of the telephone numbers of lines shall be possible from the TCU.

6.16 Reconfiguration for the adding/deleting for new working positions shall be possible from the TCU (Not exceed maximum capacity).

6.17 To make an online reconfiguration, different configurations shall be pre-programmed and called up from the TCU by way of menus.

6.18 The TCU shall raise an alarm, when malfunction of VCCS is detected.

6.19 If a malfunction of the VCCS is detected, an alarm shall be activated in both visual and audible on the TCU.

6.20 The failure message shall particularly contain at least type of failures, time of failures and equipment involved.

6.21 The VCCS equipment shall be accompanied with all VCCS software licence.

6.22 In addition, the VCCS equipment shall be monitored by indicating Alarm status using the Simple Network Management Protocol (SNMP V1 or V2 or V3).

6.23 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 AEROTHAI voice recorder (Position Record)

7.2 Working Position Ambient Noise shall be connected for recording to the existing AEROTHAI voice recorder (Ambient Record)

7.3 The input/output of any received/transmitted voice signal from/to incoming /outgoing interfaces of both telephone and radio interfaces shall be amplified, or attenuated, and connected for recording by the existing 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 5 working positions each for Mae Sot and Narathiwat tower control. 4 working positions each for Tak, Sukhothai, Phrae, Phetchabun, Trat, Ranong and Trang tower control as specified in the Appendix 2 and 3.

8.2 3 working positions each shall be installed in Mae Sot and Narathiwat Control Tower rooms.

8.3 2 working positions each shall be installed in Tak, Sukhothai, Phrae, Phetchabun, Trat, Ranong and Trang Control Tower rooms.

8.4 1 position shall be installed in equipment room in every tower control.

8.5 1 position shall be installed in engineer watched room in every tower control.

8.6 The telephone channels interface/module shall be capable to interfacing with 12 channels of 2-Wire PSTN and PABX interface/module. (as specified in the Appendix 4-12)

8.7 The capacity of the 4-Wire analog radio channels interface/module shall be at least 12 channels for main and 12 channels for standby as specified in the Appendix 13-21.

8.7 The capacity of the IP radio channels interface/module shall be at least 12 channels for main Transmitter, 12 channels for main Receiver, 12 channels for standby Transmitter, and 12 channels for standby Receiver as specified in the Appendix 22-30.

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 14 (Fourteen) AEROTHAI's engineers for technical training at the factory.

11.4 The cost of travel and accommodation for the AEROTHAI's staff will be borne by AEROTHAI.

11.5 The Tenderer shall arrange on-the-job training for AEROTHAI's engineers and ATC Operational Training.

11.6 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 system of each site.

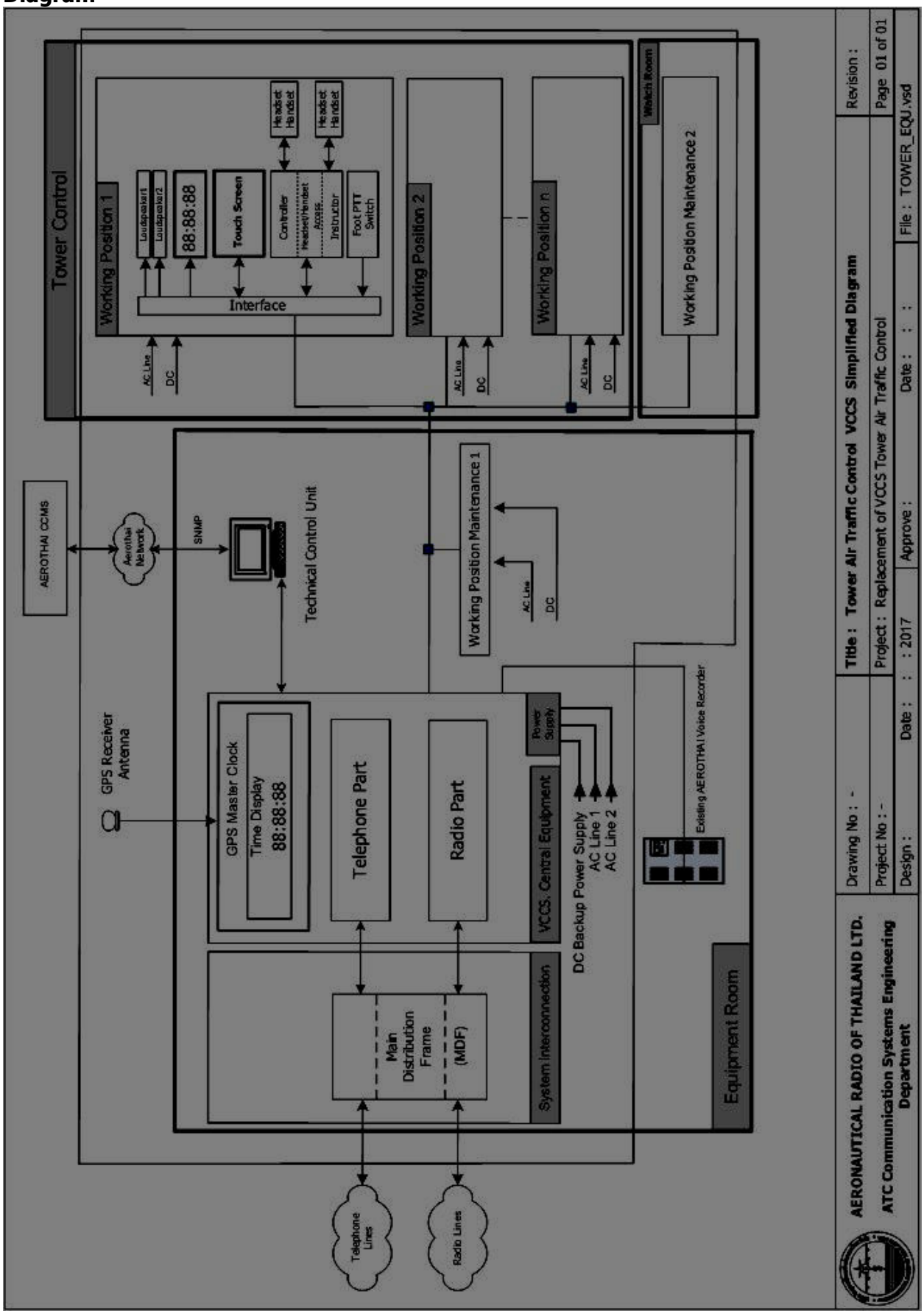
12.2 The Tenderer shall propose itemized lists of initial spare parts including the quantity suggested for each spare part against the total quantity of each in use in the system of each site in accordance with the following format ONLY.

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

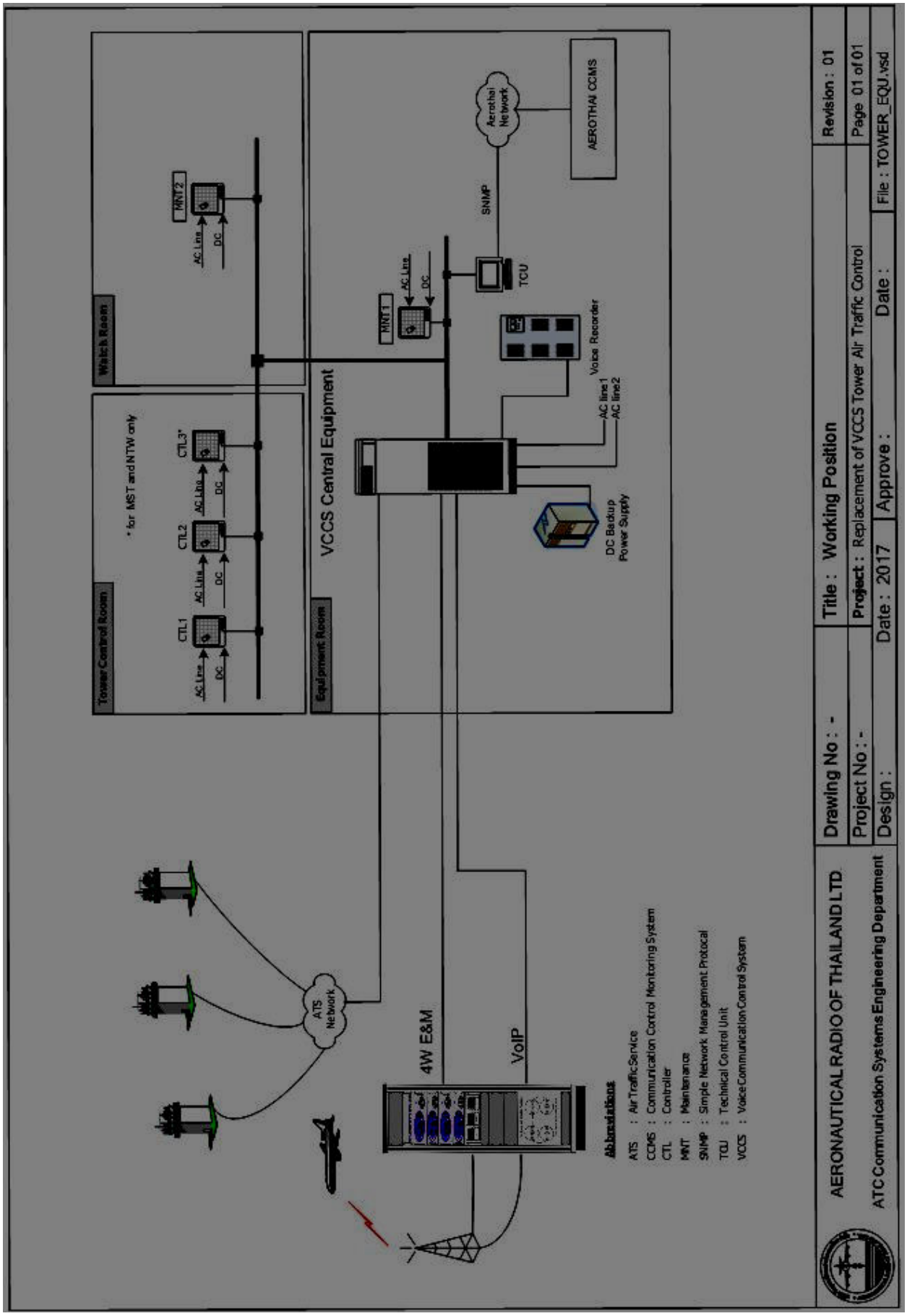
13. LIST OF ABBREVIATIONS

Abbreviations	Full Name
AC	Alternating Current
CCMS	Central Control and Monitoring System
DA	Direct Access
DC	Direct Current
DTMF	Dual Tone Multi-Frequency
E1	E1 Digital Voice: G.703, G.704 and G.711
IA	Indirect Access
ICD	Interface Control Document
MDF	Main Distribution Frame
PABX	Private Automatic Branch Exchange
PSTN	Public Switched Telephone Network
PTT	Push to Talk
RX	Receiver
SNMP	Simple Network Management Protocol
TCU	Technical Control Unit
TID	Touch Input Device
TX	Transmitter
VCCS	Voice Communication Control System
VoIP	Voice over Internet Protocol: ED-137B – Interoperability Standards for VoIP ATM Components

APPENDIX 1 : VCCS Simplify Diagram



APPENDIX 2 : Working Position Diagram



APPENDIX 3 : Position Capacity

Location	Position	MST	NTW	TAK	THS	PAE	PCB	TRT	RAN	TRN
Tower Control Room	GND	1	1	1	1	1	1	1	1	1
	TOWER	1	1	1	1	1	1	1	1	1
	COR	1	1	-	-	-	-	-	-	-
Equipment Room	MTN1	1	1	1	1	1	1	1	1	1
Watch Room	MTN2	1	1	1	1	1	1	1	1	1
Total		5	5	4	4	4	4	4	4	4

APPENDIX 4 : Telephone Channels Capacity for MST

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	4700	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	4701	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	4702	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS 6752	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS 2610	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	055-563-334	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 5 : Telephone Channels Capacity for TAK

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	8910	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	8911	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	ATS 7727	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	055-515-312	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 6 : Telephone Channels Capacity for THS

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	6300	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	6301	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	ATS 7737	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	055-647-227	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 7 : Telephone Channels Capacity for PAE

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	4500	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	4501	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	ATS 7701	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	054-531-306	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 8 : Telephone Channels Capacity for PCB

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	7300	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	7301	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	TEL SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	056-713-700	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

11	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 9 : Telephone Channels Capacity for TRT

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	9525	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	7717	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	120	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	039-525-761	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	039-525-762	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	039-525-763	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 10 : Telephone Channels Capacity for RAN

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	5400	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	5401	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	TEL SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	077-862-264	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	077-862-265	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 11 : Telephone Channels Capacity for TRN

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	6200	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	6201	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	TEL SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	075-572-160	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

8	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE3	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 12 : Telephone Channels Capacity for NSW

No.	Working Positions	Connect to	Type	Signaling		Remark
				Call In	Call Out	
1	ALL	6600	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
2	ALL	6601	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
3	ALL	TEL SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
4	ALL	ATS IP	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
5	ALL	ATS SAT	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
6	ALL	073-565-077	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
7	ALL	23414	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
8	ALL	DOA	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
9	ALL	MET	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
10	ALL	FIRE	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
11	ALL	SPARE1	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface
12	ALL	SPARE2	2-Wire	Ring-In	Loop-Out/DTMF	PSTN & PABX Interface

APPENDIX 13 : Analog Radio Channels Capacity for MST

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	118.350	F5 MAIN
10	ALL	118.350	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	120.650	F7 MAIN
14	ALL	120.650	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN

22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 14 : Analog Radio Channels Capacity for TAK

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN	
2	ALL	121.500	F1 STBY	
3	ALL	243.000	F2 MAIN	
4	ALL	243.000	F2 STBY	
5	ALL	GND VHF	F3 MAIN	
6	ALL	GND VHF	F3 STBY	
7	ALL	GND UHF	F4 MAIN	
8	ALL	GND UHF	F4 STBY	
9	ALL	118.800	F5 MAIN	
10	ALL	118.800	F5 STBY	
11	ALL	236.600	F6 MAIN	
12	ALL	236.600	F6 STBY	
13	ALL	120.600	F7 MAIN	
14	ALL	120.600	F7 STBY	
15	ALL	UHF APP	F8 MAIN	
16	ALL	UHF APP	F8 STBY	
17	ALL	ATIS VHF	F9 MAIN	
18	ALL	-	F9 STBY	
19	ALL	Spare1	F10 MAIN	
20	ALL	Spare1	F10 STBY	
21	ALL	Spare2	F11 MAIN	
22	ALL	Spare2	F11 STBY	
23	ALL	Spare3	F12 MAIN	
24	ALL	Spare3	F12 STBY	

APPENDIX 15 : Analog Radio Channels Capacity for THS

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	122.900	F5 MAIN
10	ALL	122.900	F5 STBY
11	ALL	UHF TWR	F6 MAIN

12	ALL	UHF TWR	F6 STBY
13	ALL	120.700	F7 MAIN
14	ALL	120.700	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 16 : Analog Radio Channels Capacity for PAE

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	118.600	F5 MAIN
10	ALL	118.600	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	120.100	F7 MAIN
14	ALL	120.100	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 17 : Analog Radio Channels Capacity for PCB

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	122.300	F5 MAIN
10	ALL	122.300	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	126.600	F7 MAIN
14	ALL	126.600	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 18 : Analog Radio Channels Capacity for TRT

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	122.250	F5 MAIN
10	ALL	122.250	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	120.250	F7 MAIN
14	ALL	120.250	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY

17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 19 : Analog Radio Channels Capacity for RAN

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	122.250	F5 MAIN
10	ALL	122.250	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	125.100	F7 MAIN
14	ALL	125.100	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 20 : Analog Radio Channels Capacity for TRN

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	GND VHF	F3 MAIN
6	ALL	GND VHF	F3 STBY

7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	118.400	F5 MAIN
10	ALL	118.400	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	125.100	F7 MAIN
14	ALL	125.100	F7 STBY
15	ALL	UHF APP	F8 MAIN
16	ALL	UHF APP	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 21 : Analog Radio Channels Capacity for NTW

Channel	Working Position	Frequency (MHz)	Connect to
1	ALL	121.500	F1 MAIN
2	ALL	121.500	F1 STBY
3	ALL	243.000	F2 MAIN
4	ALL	243.000	F2 STBY
5	ALL	121.900	F3 MAIN
6	ALL	121.900	F3 STBY
7	ALL	GND UHF	F4 MAIN
8	ALL	GND UHF	F4 STBY
9	ALL	122.700	F5 MAIN
10	ALL	122.700	F5 STBY
11	ALL	236.600	F6 MAIN
12	ALL	236.600	F6 STBY
13	ALL	125.55	F7 MAIN
14	ALL	125.55	F7 STBY
15	ALL	284.000	F8 MAIN
16	ALL	284.000	F8 STBY
17	ALL	ATIS VHF	F9 MAIN
18	ALL	-	F9 STBY
19	ALL	Spare1	F10 MAIN
20	ALL	Spare1	F10 STBY
21	ALL	Spare2	F11 MAIN
22	ALL	Spare2	F11 STBY
23	ALL	Spare3	F12 MAIN
24	ALL	Spare3	F12 STBY

APPENDIX 22 : IP Radio Channels Capacity for MST

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	118.350	F5 MAIN TX	F5 MAIN RX
10	ALL	118.350	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	120.650	F7 MAIN TX	F7 MAIN RX
14	ALL	120.650	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 23 : IP Radio Channels Capacity for TAK

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	118.800	F5 MAIN TX	F5 MAIN RX
10	ALL	118.800	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	120.600	F7 MAIN TX	F7 MAIN RX
14	ALL	120.600	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX

17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 24 : IP Radio Channels Capacity for THS

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	122.900	F5 MAIN TX	F5 MAIN RX
10	ALL	122.900	F5 STBY TX	F5 STBY RX
11	ALL	TWR UHF	F6 MAIN TX	F6 MAIN RX
12	ALL	TWR UHF	F6 STBY TX	F6 STBY RX
13	ALL	120.700	F7 MAIN TX	F7 MAIN RX
14	ALL	120.700	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 25 : IP Radio Channels Capacity for PAE

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX

7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	118.600	F5 MAIN TX	F5 MAIN RX
10	ALL	118.600	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	120.100	F7 MAIN TX	F7 MAIN RX
14	ALL	120.100	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 26 : IP Radio Channels Capacity for PCB

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	122.300	F5 MAIN TX	F5 MAIN RX
10	ALL	122.300	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	126.600	F7 MAIN TX	F7 MAIN RX
14	ALL	126.600	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 27 : IP Radio Channels Capacity for TRT

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	122.250	F5 MAIN TX	F5 MAIN RX
10	ALL	122.250	F5 STBY TX	F5 STBY RX
11	ALL	TWR UHF	F6 MAIN TX	F6 MAIN RX
12	ALL	TWR UHF	F6 STBY TX	F6 STBY RX
13	ALL	120.250	F7 MAIN TX	F7 MAIN RX
14	ALL	120.250	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 28 : IP Radio Channels Capacity for RAN

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	122.250	F5 MAIN TX	F5 MAIN RX
10	ALL	122.250	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	125.100	F7 MAIN TX	F7 MAIN RX
14	ALL	125.100	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX

17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 29 : IP Radio Channels Capacity for TRN

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	GND VHF	F3 MAIN TX	F3 MAIN RX
6	ALL	GND VHF	F3 STBY TX	F3 STBY RX
7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	118.400	F5 MAIN TX	F5 MAIN RX
10	ALL	118.400	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	125.100	F7 MAIN TX	F7 MAIN RX
14	ALL	125.100	F7 STBY TX	F7 STBY RX
15	ALL	UHF APP	F8 MAIN TX	F8 MAIN RX
16	ALL	UHF APP	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX

APPENDIX 30 : IP Radio Channels Capacity for NTW

Channel	Working Position	Frequency (MHz)	Connect to	
1	ALL	121.500	F1 MAIN TX	F1 MAIN RX
2	ALL	121.500	F1 STBY TX	F1 STBY RX
3	ALL	243.000	F2 MAIN TX	F2 MAIN RX
4	ALL	243.000	F2 STBY TX	F2 STBY RX
5	ALL	121.900	F3 MAIN TX	F3 MAIN RX
6	ALL	121.900	F3 STBY TX	F3 STBY RX

7	ALL	GND UHF	F4 MAIN TX	F4 MAIN RX
8	ALL	GND UHF	F4 STBY TX	F4 STBY RX
9	ALL	122.700	F5 MAIN TX	F5 MAIN RX
10	ALL	122.700	F5 STBY TX	F5 STBY RX
11	ALL	236.600	F6 MAIN TX	F6 MAIN RX
12	ALL	236.600	F6 STBY TX	F6 STBY RX
13	ALL	125.550	F7 MAIN TX	F7 MAIN RX
14	ALL	125.550	F7 STBY TX	F7 STBY RX
15	ALL	284.000	F8 MAIN TX	F8 MAIN RX
16	ALL	284.000	F8 STBY TX	F8 STBY RX
17	ALL	ATIS VHF	F9 MAIN TX	F9 MAIN RX
18	ALL	-	F9 STBY TX	F9 STBY RX
19	ALL	Spare1	F10 MAIN TX	F10 MAIN RX
20	ALL	Spare1	F10 STBY TX	F10 STBY RX
21	ALL	Spare2	F11 MAIN TX	F11 MAIN RX
22	ALL	Spare2	F11 STBY TX	F11 STBY RX
23	ALL	Spare3	F12 MAIN TX	F12 MAIN RX
24	ALL	Spare3	F12 STBY TX	F12 STBY RX