

Radio Specifications

For 264 sets of Year 2014

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1. INTRODUCTION

1.1 SCOPE OF REQUIREMENTS

This document provides a functional and specific requirements and sets out the requirements of Aeronautical Radio of Thailand Ltd. (AEROTHAI) in the Kingdom of Thailand for Radio Communication Equipment (VHF Transmitter and UHF Transmitter, VHF Receiver and UHF Receiver, VHF Multi Channel Transceiver, VHF/UHF Multi channel Transceiver and Initial spare cards or modules) procurement.

1.2 REFERENCE RECOMMENDATIONS

- 1.2.1 ICAO Annex 10 Aeronautical Telecommunications Volume III (Digital Data Communication Systems and Voice Communication Systems)
- 1.2.2 ICAO Annex 10 Aeronautical Telecommunications Volume V (Aeronautical Radio Frequency Spectrum Utilization)
- 1.2.3 ETSI EN 300 676-1 European Standard (Telecommunication series)
- 1.2.4 ITU-T G.703, ITU-T G.704 and ITU-T G.711
- 1.2.5 ED-137 Interoperability Standards for VoIP ATM Components

1.3 ABBREVIATIONS

A3E	: Amplitude Modulation, Double Sideband, Full Carrier, Voice
ac	: Alternating Current
AEROTHAI	: Aeronautical Radio of Thailand Ltd.
AF	: Audio Frequency
AGC	: Automatic Gain Control
BIT	: Built-In-Test
dB	: Decibel
dBc	: Decibel relative to the carrier
dBm	: decibels-milliwatt
dc	: Direct Current
DDP	: Delivered Duty Paid
E1	: E1 Digital Voice G.703, G.704 and G.711
EMF	: Electro Magnetic Field
etc.	: et cetera
Hz	: Hertz
ICAO	: International Civil Aviation Organization
IF	: Intermediate Frequency
KHz	: Kilohertz
mA	: Milliampere
MHz	: Megahertz

ms	: Millisecond
mV	: Millivolt
mW	: Milliwatt
NBTC	: Office of The National Broadcasting and The Telecommunications Commission (NBTC)
PTT	: Push To Talk
ppm	: part per million
RCMS	: Remote control and monitoring system
RF	: Radio Frequency
rms	: root-mean-square
RX	: Receiver
S	: Second
S+N/N	: Signal plus Noise to Noise Ratio
SINAD	: Signal plus Noise plus Distortion to Noise plus Distortion Ratio
SQ	: Squelch
TCP/IP	: Transmission Control Protocol /Internet Protocol
THD	: Total Harmonic Distortion
TX	: Transmitter
UHF	: Ultra High Frequency
Vac	: Alternating Current Volt
Vdc	: Direct Current Volt
VDL	: VHF Digital Link
VHF	: Very High Frequency
VSWR	: Voltage Standing Wave Ratio
W	: Watt

2. TECHNICAL REQUIREMENTS

2.1 FUNCTIONAL REQUIREMENTS

2.1.1 VHF and UHF Transmitter

2.1.1.1 The Transmitter front panel shall at least have a display to indicate: (1) power on, (2) transmitting indicator, (3) alarm indicator functions and (4) channel frequency display.

2.1.1.2 The Transmitter front panel controls shall at least include: (1) local frequency and preset channel selector, (2) local / remote control switch and (3) a microphone socket.

2.1.1.3 One or several measuring instruments on the front panel shall at least provide (1) all ac and dc voltages which are necessary for fault location, (2) all RF levels which are necessary for tuning and fault location, (3) output power/reflected power, (4) modulation depth and (5) VSWR measurements.

2.1.1.4 An interface shall at least be available for remote operation and signaling of (1) TX ready, (2) PTT, (3) power on/off signaling, (4) power on/off switching (or standby), (5) channel frequency setting and (6) Built-In-Test (BIT) facilities for enabling immediate fault location in case of failure.

2.1.1.5 The Transmitter shall have a built-in VoIP interface.

2.1.1.6 The Transmitter shall have a built-in or external E1 interface.

2.1.1.7 The Transmitter shall at least be available for RCMS and minimum RCMS functionality of: (1) remote control, (2) status monitoring, (3) alarm message and (4) fault management.

2.1.1.8 Both software and hardware for RCMS shall be supplied including all necessary interfaces as described in 2.2.5.3.1. (RCMS Supervisor)

2.1.2 VHF and UHF Receiver

2.1.2.1 The Receiver front panel shall at least have a display to indicate (1) power on, (2) SQ indication, (3) alarm indication functions (4) received signal strength and (5) channel frequency display.

2.1.2.2 The Receiver front panel controls shall at least include: (1) local channel selection, (2) a loudspeaker with an adjustable volume control.

2.1.2.3 An interface shall at least be available for remote control of: (1) Rx-ready indication, (2) SQ, (3) channel frequency setting and (4) BIT facilities for enabling immediate fault location in case of failure.

2.1.2.4 The Receiver shall have a built-in VoIP interface.

2.1.2.5 The Receiver shall have a built-in or external E1 interface.

2.1.2.6 The Receiver shall at least be available for RCMS and minimum RCMS functionality are: (1) remote control, (2) status monitoring, (3) alarm message and (4) fault management.

2.1.2.7 Both software and hardware for RCMS shall be supplied including all necessary interfaces as described in 2.2.5.3.1. (RCMS Supervisor)

2.1.3 VHF and VHF/UHF Multi Channel Transceiver

2.1.3.1 The Transceiver front panel shall at least have a display to indicate: (1) power on, (2) transmitting indication, (3) SQ indication, (4) alarm indication functions, (5) channel frequency display and (6) received signal strength.

2.1.3.2 The Transceiver front panel controls shall at least include: (1) local frequency and preset channel selection, (2) local / remote control switch, (3) a microphone socket and (4) a loudspeaker with an adjustable volume control.

2.1.3.3 One or several measuring instruments on the front panel shall at least provide (1) all ac and dc voltages which are necessary for fault location, (2) all RF levels which are necessary for tuning and fault location, (3) output power/reflected power, (4) modulation depth, and (5) VSWR measurements.

2.1.3.4 An interface shall at least be available for remote operation and signaling of (1) TX ready, (2) PTT, (3) power on/off signaling, (4) power on/off switching (or standby), (5) channel frequency setting, (6) Rx-ready indication, (7) SQ and (8) Built-In-Test (BIT) facilities for enabling immediate fault location in case of failure.

2.1.3.5 The Transceiver shall have a built-in or external VoIP interface.

2.1.3.6 The Transceiver shall have a built-in or external E1 interface.

2.1.3.7 The Transceiver shall at least be available for RCMS and minimum RCMS functionality for: (1) remote control, (2) status monitoring, (3) alarm message and (4) fault management.

2.1.3.8 Both software and hardware for RCMS shall be supplied including all necessary interfaces as described in 2.2.5.3.1. (RCMS Supervisor)

2.1.4 E1 Signaling Management

Both software and hardware for E1 signaling management of all radio shall be supplied including all interfaces necessary for configuration as described in Attachment 1, 2.

2.1.5 Initial Spare Cards (or Modules)

2.1.5.1 The bidder shall separately state the lists of parts in-use and the initial spare cards (or modules) for at least 10% (rounded up e.g. 3.1 = 4 , 3.9 = 4) of cards (or modules) of the VHF and UHF Receiver, VHF and UHF Transmitter, VHF and VHF/UHF Multi Channel Transceiver and Accessories in accordance with the following format only.

Example

ITEM NO	DESCRIPTION	PART NUMBER	USED FOR*	QTY IN USE	QTY SPARE	UNIT PRICE (DDP**)	TOTAL PRICE (DDP**)
1	Power Supply	123456	TX V, TX U, RX V, RX U, TR V, TR V/U	183	19	100	1900
* Identify the part is used for which equipment				** Delivered Duty Paid			

2.1.5.2 The bidder shall provide the initial spare cards (or modules) in 2.1.5.1. and manual (service manual and/or maintenance manual) which describe the amount of cards (or modules) in-use.

2.2 SPECIFIC REQUIREMENTS

2.2.1 VHF and UHF Transmitter

The following specifications are used as specifications for both VHF and UHF Transmitters unless specified individually.

2.2.1.1 RF Characteristics

2.2.1.1.1 Frequency Range and Channel Spacing

2.2.1.1.1.1 The VHF Transmitter shall be tunable over the range of 118 to 136.975 MHz without any change of elements.

2.2.1.1.1.2 The UHF Transmitter shall be tunable over the range of 225 to 399.975 MHz without any change of elements.

2.2.1.1.1.3 The channel spacing for the VHF Transmitter shall be selectable between 8.33 KHz and 25 KHz without any change of elements.

2.2.1.1.1.4 The channel spacing for the UHF Transmitter shall be 25 KHz.

2.2.1.1.2 Frequency Oscillator

2.2.1.1.2.1 The Transmitter shall be a single channel, synthesizer oscillator.

2.2.1.1.2.2 The frequency error shall be within ± 1 ppm over the range of 118 to 136.975 MHz for VHF Transmitter and 225 to 399.975 MHz for UHF Transmitter under the environmental conditions as specified in paragraph 2.2.5.1. (Environment)

2.2.1.1.3 Modulation

2.2.1.1.3.1 VHF transmitter's emission type shall be Double Side Band Amplitude Modulation A3E for speech and data that comply with VDL mode 2.

2.2.1.1.3.2 UHF transmitter's emission type shall be Double Side Band Amplitude Modulation A3E for speech.

2.2.1.1.3.3 The Bidder shall supply with software for A3E and VDL mode 2 installed in the VHF Transmitters. The Transmitters shall include all interfaces for speech and VDL modes and the selection of mode shall be selected by the software without any need to replace/modify or re-configure the hardware.

2.2.1.1.3.4 The modulation depth shall be adjustable up to 85 % or greater.

2.2.1.1.4 Output Characteristics

2.2.1.1.4.1 The carrier power output delivered into a 50 OHM load shall be greater than or equal to 30 W continuous.

2.2.1.1.4.2 The carrier output power shall be adjustable to the required preset lower limit and upper limit.

2.2.1.1.4.3 The second harmonics of the carrier frequency shall not exceed -36 dBm.

2.2.1.1.4.4 A limiter shall ensure that the maximum modulation depth not exceed 95 %.

2.2.1.1.4.5 Protection against mismatch output impedance shall be provided and any mismatch shall not cause the RF output damage.

2.2.1.1.4.6 Spurious Output shall be lower than the carrier frequency at least 70 dBc.

2.2.1.2 AF and Push to Talk Contact Characteristics

2.2.1.2.1 The AF input shall be designed for 600 OHM balanced, and a level between – 30 dBm and +10 dBm.

2.2.1.2.2 The 3 dB AF bandwidth shall be 300 Hz to 3.4 kHz (for 25 kHz channel spacing) and 350 Hz to 2.5 kHz (for 8.33 kHz channel spacing).

2.2.1.2.3 The Total Harmonic Distortion (THD) shall be less than 10 % measured with 1 kHz test tone at 90% modulation depth.

2.2.1.2.4 Local operation shall be provided by means of a microphone with a push to talk (PTT) input.

2.2.2 VHF and UHF Receiver

The following specifications are used as specifications for both VHF and UHF Receivers except when specified individually.

2.2.2.1 RF Characteristics

2.2.2.1.1 Frequency Range and Channel Spacing

2.2.2.1.1.1 The VHF Receiver shall be tunable over the range of 118 to 136.975 MHz without any change of elements.

2.2.2.1.1.2 The UHF Receiver shall be tunable over the range of 225 to 399.975 MHz without any change of elements.

2.2.2.1.1.3 The channel spacing for the VHF Receiver shall be selectable between 8.33 kHz and 25 kHz without any change of elements.

2.2.2.1.1.4 The UHF Receiver channel spacing shall be 25 kHz.

2.2.2.1.2 Frequency Oscillator

2.2.2.1.2.1 The Receiver's frequency oscillator shall be the single channel, synthesizer oscillator.

2.2.2.1.2.2 The frequency error shall be within ± 1 ppm over the range of 118 to 136.975 MHz for VHF Receiver and 225 to 399.975 MHz for UHF Receiver under the environmental conditions as specified in paragraph 2.2.5.1. (Environment)

2.2.2.1.3 Demodulation

2.2.2.1.3.1 VHF Receiver's reception type shall be Double Side Band Amplitude Modulation, A3E for speech and data that comply with VDL mode 2.

2.2.2.1.3.2 UHF Receiver's reception type shall be Double Side Band Amplitude Modulation, A3E for speech.

2.2.2.1.3.3 The Bidder shall supply the software for A3E, VDL mode 2 installed in the VHF receivers. The receivers shall include all interfaces for speech and VDL mode 2 and the selection of mode shall be selected by the software without any need to replace/modify or re-configure the hardware.

2.2.2.1.4 RF Input Characteristics

2.2.2.1.4.1 The input impedance shall be 50 OHM.

2.2.2.1.4.2 The VSWR shall be better than 2:1 at the tuned frequency.

2.2.2.1.4.3 The sensitivity shall be less than or equal to -107 dBm (VHF) and less than or equal to -101 dBm (UHF) for a SINAD at the receiver output 12 dB at least for an input signal modulated 30 % at 1 KHz. (ITU-T P.53 weighted)

2.2.2.1.4.4 The audio output level variation shall not exceed 3 dB for the RF input level from -107 dBm to +7 dBm (VHF) and -101 dBm to +1 dBm (UHF).

2.2.2.1.4.5 The permissible input voltage without causing damage shall at least be +25 dBm independently of the signal frequency.

2.2.2.1.4.6 The spurious response rejection shall be at least 70 dB.

2.2.2.1.4.7 The image response rejection shall at least be 70 dB.

2.2.2.1.4.8 The IF Response Rejection shall at least be 70 dB.

2.2.2.1.4.9 The selectivity shall at least be 70 dB at ± 25 kHz from channel frequency.

2.2.2.1.4.10 A pre-set SQ control shall be provided to cover the range from -107 dBm to -77.5 dBm (VHF) and -101 dBm to -77.5 dBm (UHF).

2.2.2.2 AF and Squelch Contact Characteristics

2.2.2.2.1 The audio output shall be provided by means of a balanced 600 ohm transformer and a level adjustable over the range -30 dBm to +10 dBm.

2.2.2.2.2 The audio output level shall vary less than or equal to ± 2 dB with 1 KHz 30 % and 90 % modulated.

2.2.2.2.3 The 3 dB AF bandwidth shall be 300 Hz to 3.4 kHz (for 25 kHz channel spacing) and 350 Hz to 2.5 kHz (for 8.33 kHz channel spacing).

2.2.2.2.4 The THD shall not exceed 5 % at 0 dBm audio output with RF input between -47 dBm and -7 dBm 90 % modulated at 1 kHz.

2.2.2.2.5 The ratio of (S+N)/N shall be greater or equal to 45 dB at 0 dBm audio output with RF input between -47 dBm and -7 dBm 80 % modulated at 1 kHz.

2.2.2.2.6 A SQ contact shall be available.

2.2.3 VHF Multi Channel Transceiver

2.2.3.1 General

2.2.3.1.1 The Multi Channel Transceiver shall be tunable over the range of 118 to 136.975 MHz without any change of elements.

2.2.3.1.2 The channel spacing shall be 25 KHz.

2.2.3.1.3 The tuning increment shall be made on the step of 25 kHz or less.

2.2.3.1.4 The frequency error shall be within ± 1 ppm over the range of VHF band under the environmental conditions as specified in paragraph 2.2.5.1. (Environment)

2.2.3.1.5 The type of emission and reception shall be Double Side Band Amplitude Modulation (A3E) for speech.

2.2.3.1.6 A pre-selection channel shall at least consist of 10 channels.

2.2.3.1.7 The Transceiver shall include a handset and a headset for local operation and a set of interfacing.

2.2.3.1.8 The Transceiver shall include a remote control unit for remote operation.

2.2.3.2 Receiver Characteristics

2.2.3.2.1 The sensitivity shall be less than or equal to -105 dBm for 12dB (SINAD) with 30 % modulation at 1 kHz (ITU-T P.53 weighted).

2.2.3.2.2 The Input impedance shall be 50 OHM.

2.2.3.2.3 Image response shall at least be 70 dB.

2.2.3.2.4 Spurious response shall at least be 70 dB.

2.2.3.2.5 Audio response shall be in the frequency band from 300 Hz to 3.4 kHz or wider.

2.2.3.2.6 The audio output shall be provided by means of a balanced 600 ohms transformer.

2.2.3.2.7 A pre-set SQ control shall be provided to cover the range from -107 dBm to -77.5 dBm.

2.2.3.3 Transmitter Characteristics

2.2.3.3.1 The carrier power output delivered into a 50 OHM load shall be greater than or equal to 30 W continuous.

2.2.3.3.2 Spurious Output shall be lower than the carrier frequency at least 70 dBc.

2.2.3.3.3 The second harmonics of the carrier frequency shall not exceed -36 dBm.

2.2.4 VHF/UHF Multi Channel Transceiver

2.2.4.1 General

2.2.4.1.1 The Multi Channel Transceiver shall be tunable over the range of 118 to 136.975 MHz for VHF band without any change of elements.

2.2.4.1.2 The Multi Channel Transceiver shall be tunable over the range of 225 to 399.975 MHz for UHF band without any change of elements.

2.2.4.1.3 The channel spacing shall be 8.33 KHz, 25 kHz for VHF band and 25 kHz for UHF band.

2.2.4.1.4 The frequency error shall be within \pm 1ppm over the range of VHF band and UHF band under the environmental conditions as specified in paragraph 2.2.5.1. (Environment)

2.2.4.1.5 The type of emission and reception shall be Double Side Band Amplitude Modulation (A3E) for speech.

2.2.4.1.6 A minimum pre-selection shall consist of 10 channels.

2.2.4.2 Receiver Characteristics

2.2.4.2.1 The sensitivity shall be less than or equal to -99 dBm for a SINAD at the receiver output 12 dB at least for an input signal modulated 30 % at 1 KHz. (ITU-T P.53 weighted)

2.2.4.2.2 Input impedance shall be 50 OHM.

2.2.4.2.3 Image response shall at least be 70 dB.

2.2.4.2.4 Spurious response shall at least be 70 dB.

2.2.4.2.5 Audio response shall be in the frequency band from 300 Hz to 3.4 kHz or wider.

2.2.4.2.6 The receiver shall have a built-in VHF/UHF (121.5/243.0 MHz) guard receiver.

2.2.4.3 Transmitter Characteristics

2.2.4.3.1 The carrier power output delivered into a 50 OHM load shall be greater than or equal to 30 W continuous.

2.2.4.3.2 Spurious Output shall be lower than carrier frequency at least 70 dBc.

2.2.4.3.3 The second harmonics of the carrier frequency shall not exceed -36 dBm.

2.2.5 Supporting System

The word “radio equipment” in this section is referring to VHF and UHF Receiver, VHF and UHF Transmitter, VHF Multi Channel Transceiver and VHF/UHF Multi Channel Transceiver.

2.2.5.1 Environment Conditions

All radio equipment shall be able to operate in a controlled environment of approximately 10-45 degree Celsius and relative humidity up to 70 %.

2.2.5.2 Power Supply

2.2.5.2.1 VHF and UHF Receiver, VHF and UHF Transmitter.

2.2.5.2.1.1 The power supply of all equipment shall be designed for using with 210-230 Vac 50 Hz.

2.2.5.2.1.2 The power supply shall be capable of operating with the 24 Vdc float charged batteries system.

2.2.5.2.1.3 All equipment shall be automatically switched to dc power when ac power failure without any interruption to the operation of equipment.

2.2.5.2.2 VHF and VHF/UHF Multi Channel Transceiver

2.2.5.2.2.1 The power supply of all equipment shall be designed for using with 210-230 Vac 50 Hz.

2.2.5.2.2.2 The power supply shall be capable of operating with the 24 Vdc float charged batteries system.

2.2.5.2.2.3 All equipment shall automatically switched to dc power when ac power failure occurs without any interruption to the operation of equipment.

2.2.5.2.2.4 The 24 Vdc power system for each VHF and VHF/UHF Multi Channel Transceiver shall be provided, consisting of (1) sealed-lead rechargeable batteries 12 V 100 Ah 2 ea, (2) charger 24V 100 A (3) inverter 24 V 1500 W with ATS (Automatic Transfer Switch) included and (4) DC cable red and black color 16 sq.mm. 20 meters length with cable lugs.

2.2.5.3 Accessories

2.2.5.3.1 The bidder shall provide RCMS supervisor software and radio diagnostic software for maintenance, repair and configuration for all VHF and UHF Receivers, VHF and UHF Transmitters, VHF Multi Channel Transceivers, VHF/UHF Multi Channel Transceivers. Both hardware and software (with licenses) for RCMS shall be supplied including all interfaces necessary for configuration as described in Attachment 1, 2.

2.2.5.3.2 The bidder shall provide 3 sets of E1-generate and analysis for all radio E1 interface measurement.

2.2.5.3.3 The bidder shall provide 3 sets of IP-analysis for all radio IP interface measurement.

2.2.5.3.4 The bidder shall provide 3 sets of USB Spectrum analysis for all radios measurement.

2.2.5.3.5 The bidder shall provide 40 sets of VHF single cavity filter for all VHF Receivers and horizontal installation not exceed 60 cm. depth of standard 19" rack.

2.2.5.3.6 The bidder shall provide 23 sets of UHF single cavity filter for all UHF Receivers and horizontal installation not exceed 60 cm. depth of standard 19" rack.

2.2.5.3.7 The bidder shall provide (1) a handset for local operation, (2) a set of interfacing connectors, (3) a headset or handset for remote control unit, (4) a base station antenna and (5) a set of VHF dual auto-tune cavity filter for each VHF Multi Channel Transceiver.

2.2.5.3.8 The bidder shall provide (1) a handset for local operation, (2) a set of interfacing connectors, (3) a headset or handset and VoIP ED137 remote control unit, (4) a base station antenna and (5) a set of VHF/UHF dual auto-tune cavity filter for each VHF/UHF Multi Channel Transceiver.

2.2.5.3.9 All VHF and UHF Receivers, VHF and UHF Transmitters, VHF Multi Channel Transceivers, VHF/UHF Multi Channel Transceivers shall be standard 19" rack mounted size and shall include slides suitable for mounting and maintenance, and all hardware necessary to permit fitting into a standard 19" rack.

2.2.5.3.10 The bidder shall provide 18 racks (42U 600X800 standard 19")

2.2.5.3.11 The bidder shall provide all spare AC&DC fuses and 3-core copper 1.0 sq.mm. AC cords.

2.2.5.3.12 The bidder shall provide 1 set of accessories consisting of

- MDF disconnection module for installation MDF panel 909 ea
- MDF 3U Standard 19" panel 15 way recessed with Stainless Steel type 36 ea

- MDF disconnection module 2-pole test cord 2/2 with cord 1.5m open end 36 ea
- MDF disconnection module 4-pole test cord 2/4 with cord 2.5m open end 36 ea
- MDF disconnection Plug for 10 pair (red color) 100 ea
- Jumper cable for wiring MDF disconnection module for installation MDF panel (white and red color) 545 meters
- Telephone cable TIVE 4C size 0.65 sq.mm. for wiring all radio installation 1818 meters
- Antenna patch panel for installation 12 antenna lightning protections, Copper silver plated size W 24 cm X L 42 cm 12 ea
- DC distribution box for installation 12 radio DC Connectors and common ground, box size W 6 cm X L 90 cm X H 6 cm 36 ea
- AC distribution box for installation 24 radio AC Connectors, and 1 AC 32 Amp breaker, box size W 7.5 cm X L 95 cm X H 4 cm 36 ea
- Ground cable green/yellow size 4.0mm. with cable lugs for wiring all radio installation 454 meters
- 2 way splitter bandwidth 5 to 500MHz, Insertion Loss 3dB \pm 1dB, Female N-type Connector 104 ea
- RF coaxial relay 24 Vdc, Current \leq 80mA, Insertion Loss \leq 0.1dB over Frequency 118 – 400 MHz, Female N-type Connector 135 ea
- Antenna lightning protections DC Blocking type, Insertion Loss \leq 0.1dB, RF Power rating \geq 375 W at 50 – 220 MHz and \geq 125 W at 220 – 700 MHz, Female N-type Connector 135 ea

2.2.5.3.13 The bidder shall provide 1 set of cables comprising of

- CAT-5 cable 4-pair 24 AWG, Also ETL verified to TIA/EIA-568-B.2 CAT.5E 1818 meters
- RF cable RG-142/U impedance 50 ohm, max operating frequency 6 GHz, center connector copper silver plated, outer conductor 1 copper silver plated, outer conductor 2 copper silver plated and Dielectric PE 272 meters
- RF cable RG-223/U impedance 50 ohm, max. operating frequency 6 GHz, centre connector copper silver plated, outer conductor 1 copper silver plated, outer conductor 2 copper silver plated, Dielectric PE and weight 5.5 kg/100m. 909 meters
- RF cable RG-214/U impedance 50 ohm, max. operating frequency 6 GHz, centre connector copper silver plated, outer conductor 1 copper silver plated, outer conductor 2 copper silver plated, Dielectric PE and weight 18.5 kg/100m. 909 meters

2.2.5.3.14 The bidder shall provide 1 set of RF connector comprising of

- Male N-type RF connector (for RG-223/U cable) straight cable plug, Impedance 50 ohm, frequency range DC to 2GHz, return loss \geq 26 dB, center contact crimped, outer contact crimped 909 ea
- Male N-type RF connector (for RG-214/U cable) straight cable plug, Impedance 50 ohm, frequency range DC to 2GHz, return loss \geq 30 dB, center contact crimped, outer contact crimped 909 ea
- Female N-type RF connector (for RG-223/U) straight bulkhead cable feed through, impedance 50 ohm, frequency max. 11GHz, center contact crimped, outer contact crimped 909 ea
- Female N-type RF connector (for RG-214/U cable) straight bulkhead cable feed through, impedance 50 ohm, frequency max 11 GHz, center contact crimped, outer contact crimped 909 ea
- Male PL-259 RF connector (for RG-214/U cable) straight cable plug, Impedance 50 ohm, frequency range DC to 1GHz, center contact crimped, outer contact crimped 454 ea
- Male PL-259 RF connector (for RG-223/U cable) straight cable plug, Impedance 50 ohm, frequency range DC to 1GHz, center contact crimped, outer contact crimped 454 ea
- Male BNC RF connector (for RG-223/U cable) straight cable plug, Impedance 50 ohm, frequency range DC to 2GHz, center contact crimped, outer contact crimped 454 ea
- Adapter Male N-type to Male N-type Impedance 50 ohm, frequency range DC to 1GHz 454 ea
- Adapter Female N-type to Female N-type Impedance 50 ohm, frequency range DC to 1GHz 454 ea
- Adapter Male N-type to Female PL-259 Impedance 50 ohm, frequency range DC to 1GHz 454 ea
- Adapter Female N-type to Male PL-259 Impedance 50 ohm, frequency range DC to 1GHz 454 ea
- Adapter Female N-type to Male BNC Impedance 50 ohm, frequency range DC to 1GHz 454 ea
- Adapter Male N-type to Female BNC Impedance 50 ohm, frequency range DC to 1GHz 454 ea

Radio & Site Quantity for RCMS Network

Station	VHF RX	UHF RX	VHF TX	UHF TX	VHF TX/RX	VHF/UHF TX/RX
A CM HUB						
A1 INT RCAG	2	-	-	-	-	-
A2 LP RCAG	-	1	-	1	-	-
B PL HUB						
B1 MST TWR	-	-	-	-	-	1
B2 NAN TWR	-	-	-	-	-	1
B3 PCB TWR	1	1	1	-	-	-
C UDN HUB						
C1 UDN TWR	-	3	-	5	-	1
C2 UDN RCAG	2	-	1	-	-	-
C3 LOI TWR	1	-	-	-	-	-
C4 NKP TWR	-	1	3	1	-	-
C5 SKN TWR	-	1	-	-	-	1
C6 KKN RCAG	2	3	-	2	-	-
D NKR HUB						
D1 NKR TWR	7	2	-	-	-	-
D2 NKR RCAG	1	-	-	1	-	-
D3 BU TWR	1	-	1	-	-	-
D4 UBL TWR	1	1	1	6	-	-
D5 UBL RCAG	2	3	-	1	-	-
D6 ROT TWR	5	-	2	-	-	-
D7 SUR TWR	-	-	-	-	1	-
E MK HUB						
E1 MK RX	14	5	-	-	-	-
E2 MK TXM	-	-	5	8	5	1
E3 MK TXS	-	-	8	10	-	-
E4 DM	9	8	1	2	5	1
E5 SB	16	-	16	-	-	-
E6 HHN TWR	-	-	-	-	-	1
E7 KMN RCAG	-	2	-	2	-	-
E8 NSW RCAG	1	2	1	2	-	-
F SRT HUB						
F1 SRT TWR	2	2	1	-	-	1
F2 SRT RCAG	1	1	-	-	-	-
F3 CMP TWR	3	1	1	-	-	-
F4 NKS TWR	2	3	3	3	-	1
F5 SMU KP RCAG	4	5	1	3	-	-
F6 SMU TWR	-	-	-	-	2	-
G PUT HUB						
G1 PUT TWR	-	-	-	-	2	1
G2 PUT RCAG	2	1	1	-	-	-
G3 RAN TWR	4	2	1	2	-	-
G4 KBI TWR	1	2	-	2	-	-
H HTY HUB						
H1 HTY RCAG	3	2	-	-	-	-
H2 NTW TWR	-	-	-	1	-	-
TOTAL	264 SETS	87	52	48	52	15
					15	10

