Technical Specification and Conceptual Drawing of

C-Band Dual Polarization Doppler Weather Surveillance Radar

Technical Specifications

Specifications of Solid-State C-Band Dual Polarization Doppler Weather Radar

Radome	Quantity	: 1 set
	Type	: Sandwich panel (spherical surface)
	Dimension	: As per requirements of antenna and maintenance requirements
	Surface	: White color, suitable non-observant, non-water stickling finish for making smooth surface and suitable for all weather conditions.
	Survival wind speed/ Hail storm	: 120 m/s (3-second gust), Hail resistance: 25 mm diameter hailstones at 90 km/h.
	Transmission loss	: 0.3 dB or less on one way path in dry conditions
	Relative humidity	: 0% - 100%
	Lightning protection	: Lightning rods
	Obstruction light	: LED (red color), automatic switch control (on/off), waterproof
	Steel base ring including necessary installation materials	
Antenna	Quantity	: 1 set
	Type	: Parabolic antenna
	Reflector size	: As per design requirements
	Beam width	: 1.0 degrees or less at -3dB point without Radome
	Antenna gain	: 44.5 dB or more without Radome (for 1.0° beamwidth) OR 45 dB or more without Radome (for 0.9° beamwidth)
	Polarization	: Simultaneous dual polarization (horizontal and vertical)
	1st Side lobe level	: -26dB or less without Radome
	Angular positioning accuracy	: 0.05 degrees or less

	Pedestal structure : Pedestal including the motor and rotary joint for azimuth and elevation Driving range : Azimuth 360 degrees, elevation -2 degrees – +90 degrees Rotation speed Azimuth : 0rpm to 6rpm or higher, selectable Elevation : 0 to 15 degrees per second, selectable, or up to 2.5 RPM VSWR : 1.4 or less without Radome Dehydrator : Yes BITE : Web-browser based BITE with trend graphics
Transmitter	Quantity : 1 set
	Transmitter type : Solid-state power amplifier Transmitting frequency : to be selected from 5,605MHz – 5,795MHz (±2.5MHz) Observation Range :300Km or more Occupied frequency bandwidth : 10MHz or less Range Side Lobe Suppression : at least 70 dB (Integrated Side Lobe suppression) at IF level Short pulse width operation : Selected transmitting frequency +1.25MHz Long pulse width operation : Selected transmitting frequency -1.25MHz Transmitting power : 2.5 kW peak or higher (per channel H & V), ideal value 7.5 kW or higher Power amplifier protection : High VSWR protection, High Temperature protection and to inhibit operation individually in case of abnormal high temperature in chassis Radiation blanking : It shall be able to set both azimuth and elevation Pulse width : from 1μs to 100μs

	Pulse repetition frequency (PRF): from 250Hz to 2000 Hz, selectable Duty : 10% Maximum BITE : Yes
Digital Receiver & Signal Processor	Quantity : 1 set
	Receiver type : Coherent IF digitizer Receiver Noise figure : 3dB or less at the input terminal of low noise amplifier (LNA) Clutter rejection capability : Yes Pulse compression type : Chirp modulation Pulse compression ratio : 128 or higher Sensitivity : -115 dBm or better Range bin : 8000 or more Signal Processing techniques : Shall employ advanced signal processing techniques for clutter suppression, spectral analysis, and dual-polarization parameter estimation, meeting or exceeding NEXRAD Level II or equivalent standards Processing area : (Intensity mode) throughout 0 km to 300 km or more in range and 0 to 360 degrees in azimuth (Doppler mode) throughout 0 km to 200km or more in range and 0 to 360 degrees in azimuth Intensity signal process: -Dynamic range : 94dB or more -Logarithmic linearity: within ±1dB throughout 70dB -Range correction: depending on radar equation -Air-attenuation correction: 0.01dB/km in observation range Velocity signal process: -Processing type: pulse pair or FFT (selectable) -Trigger control: Dual-PRF ratio selectable (2:3, 3:4, 4:5)

	-De-aliasing of doppler velocity: Real-time processing by Dual-PRF - Maximum de-aliasing Doppler velocity: 90 m/s or more (in case of 4:5 dual PRF ratio) -Maximum mean radial velocity: 64m/s or more (depends on PRF) 2nd-trip echo suppression : Real-time processing by random phase control Output data : Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρHV) Output data grid Azimuth : 1 degree or less Range : 150m or finer at 300 km observation range Output data resolution : up to 32 bites Output data indicating interval: : within 1 minute after automatic scan BITE : Web-browser based BITE with trend graphics
Duplexer	Quantity : 1 set
	Type : Dual backup type TR limiter or isolator with diode limiter
Radar Controller	Quantity : 1 set
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more

	Monitor display : Color LCD type, 19 inches or more Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent Application software: [Radar control and monitoring] -Antenna scanning and radiation to control by pointing device -Monitoring of the result of the radar control -Fault monitoring including temperature alarm inside of the equipment -True north confirmation [Observation scheduling] -Antenna scanning mode (PPI, RHI, Volume Scan) -Elevation angle setting -Selection of pulse width (Long range observation mode / Short range observation mode)

	-Resolution of the azimuth and range -Data elements (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) -Setting for the clutter filter level -Selection of PRF and processing mode [Radar echo display] -X-Y coordinates image in the form of PPI indication (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit
Data & Protocol Converter	Quantity : 1 set
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : Color LCD type, 19 inches or more Input power : AC 230V, single phase, 50Hz

	Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent Application software: [Data receiving, converting and transfer] -Collection of ingested data -Compression processing of raw data -Dissemination of raw data over the network - FTP data transfer through live IP -GRIB-2, ASCII, NETCDF, GEOTIFF, PNG format etc. -The software shall include an interface for administrators and operators to create and schedule automatic export of products in various formats (e.g., GRIB2, ASCII, NetCDF, GeoTIFF, PNG) to external sources via FTP/SFTP or other compatible protocols. [Parameter setting] -Setting of dissemination schedule -Selection of products to be disseminated

	[Display processing] -Latest data display by the PPI style (selectable of Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) -Display of receiving status [Time adjustment] -Automatic adjustment by GPS NTP server (including GPS antenna) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit
Radar Data Display Unit	Quantity : 2 sets
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : 65 inches or more-LED or video wall Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45)

	Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent Application software: [Basic data monitoring feature] -Display of X-Y coordinates image in the form of PPI indication (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) [Weather product processing] -PPI (plan position indicator) -RHI (range height indicator) -CAPPI (constant altitude PPI) -RTI (range time indicator) -Maximum value on X-Y axis -Rainfall near surface -VIL (vertically integrated liquid) -3-dimensional data display -Warning output of heavy rainfall -Rainfall and strong wind warning output of specified district

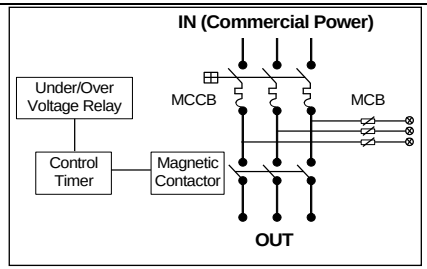
	-Calculation of KDP from φDP -Rain rate and rainfall near surface by DP (dual polarization) (Capable to set the combination of multiple polarization parameters and calculation algorithms) -Arbitrary N-hours rainfall accumulation by DP -Horizontal wind profile (wind direction and speed) -Time series wind profile of the upper layer -Wind shear and microburst detection -Multi window feature -Z-R and dual polarization parameter registration -Image file output as JPG file format [Map projection] -Conical projection or Mercator projection -Map data edit function [Product display & retrieval] -Automatic updating of the received product -Display of the necessary information Observed date and time Site code Name of product

	Product range information Legend (color code) -Data display area Map overlay feature Indication of information of a location pointed by pointing device (Location, radar echo value, distance of specified span) -Zooming display 2 or 4 times selectable for the desired area -Animation Animation displays of selected product Selectable items -Type of product -Retrieving period -Retrieving speed -Retrieving direction (Forward and Reverse) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit

Radar Power Maintenance Panel	Quantity	: 1 set
	Circuit breaker	: No-fuse-breaker type

	Main breaker	: No-fuse-breaker type or magnetic-breaker
	Power distribution	: No. of outputs as required including 2 spare
	Input power	: AC 400V, three phase four wire, 50Hz
	Output power	: AC 230V, single phase two wire, 50Hz
Dual Switch	Quantity	: 1 set
	LAN interface	: IEEE 802.3 Ethernet
	Connection port	: 100BASE-TX or more, eight (8) ports or more
	Input power	: AC 230V, single phase, 50Hz
	Each port and power supply shall be duplicated	
Dual Optical Repeater	Quantity	: 2 sets
	LAN interface	: IEEE 802.3 Ethernet
	Connection port	: 100BASE-TX or more: one (1) port or more, optical fiber interface: one (1) set, multi-mode (100Mbps)
	Input power	: AC 230V, single phase, 50Hz
	Each port and power supply shall be duplicated.	
Optical Fiber Cable	Quantity	: 1 set
	Cable type	: Multi mode 2C
	Connector	: ST
	Length	: As per requirements
Dual Router	Quantity	: 1 set
	LAN interface	: IEEE 802.3 Ethernet
	Connection port	: 100BASE-TX or more, three (3) ports or more

	Routing : IP routing Input power : AC 230V, single phase, 50Hz Each port and power supply shall be duplicated

Phase Change Protector	Quantity	: 1 set
	Component MCCB triple pole Magnetic contactor triple pole Control breaker, single pole MCB Under and over voltage relay, 500V Control timer 0-30sec. Indication lamp	
Isolation Transformer	Quantity	: 1 set
	Capacity	: 20kVA or more
	Input power	: AC 360V, 370V, 380V, 400V selectable, three phase four wire, 50Hz
	Output power	: AC 400V, three phase four wire, 50Hz
	Insulation	: Class B
	Surge voltage	: 30kV or more
Automatic Voltage Regulator (AVR)	Quantity	: 1 set
	Capacity	: 25 KVA or more

	Input power	: AC 400V ±20%, three phase four wire, 50Hz
	Output power	: AC 400V ±5%, three phase four wire, 50Hz
Power Backup Unit	Quantity	: 1 set
	Input voltage	: AC 400V, three phase four wire, 50Hz
	Output voltage	: AC 400V, three phase four wire, 50Hz
	Back up time	: 5 minutes or longer for all the equipment indicated above
	Energy storage	: Lithium-ion battery
	Others	: Bypass function
Grounding System	Quantity	: 2 set
	The installation of complete grounding system for the protection of radar equipment and its peripherals at the site. The grounding procedures must comply with national and international regulations.	
	Groundig test terminals	: 3 or more
	Grounding terminal box	: Number of terminals as required, with a connection cable to the grounding cable
	Grounding resistance value	: 5 or less

Diesel Engine Generator for supporting all the Radar Equipment and the Air Conditioner specified below	Quantity	: 1 set
	Output	: 30KVA or more at continuous
	Output voltage	: AC 400V, three phase four wire
	Frequency	: 50Hz
	Control unit	: Automatic transfer switch
	Exhaust System	: Silencer, expansion joints, vibration isolators and flexible connections
	Fuel tank	: 200L or more
	Accessories	: Starting battery, fuel supply & lubricating systems, lubricating oil supply system, steel structural common bed and anchor bolts for generator and auxiliaries, spare parts for 3,000 hours and tools for

	maintenance.	
Hybrid Solar System with Green meter	20KVA	
Air Conditioners for Radar Equipment and operation room		
	Type	: Air cooled floor/wall mounted type
	Capacity	: Inverter AC's as per the cooling requirement of the equipment
	Automatic operation	: Thermostatic control
	Controller	: Body/Remote type

Spare Parts	Timing belt for antenna (for azimuth drive)	1 set
	Timing belt for antenna (for elevation drive)	1 set
	Encoder or resolver for antenna (for azimuth angle signal)	1 set
	Encoder or resolver for antenna (for elevation angle signal)	1 set
	Motor for antenna (for azimuth drive)	1 set
	Motor for antenna (for elevation drive)	1 set
	Servo unit for antenna controller (for azimuth drive)	1 set
	Servo unit for antenna controller (for elevation drive)	1 set
	Power supply unit for antenna controller	1 set
	Power supply unit for transmitter	1 set
	Power supply unit for digital receiver and signal processor	1 set
	Solid-state power amplifier	5 sets (if modules are in cascaded) otherwise 1 spare module amplifier
	Signal processor	1 set
	Receiver	1 set

	Fan unit for radar equipment	2 sets
	LAN arrester	3 sets
	Obstruction light	1 set
	Solid State Back up of all Softwares for radar operation	2 sets
External Storage	Shall provide sufficient storage capacity (at least 100 TB) for saving the last 10 years of Radar data	

Step-down Transformer	Capacity	: 100kVA (or as per the requirement of the Office)
	Output power	: AC 400V, three phase four wire, 50Hz
TEST EQUIPMENT	The following equipment should be provided as per radar testing requirement: -Spectrum Analyzer -Test Signal Generator -Power Meter -Power Sensor -Frequency Counter -Detector -Attenuator Set -Terminator for Detector -Digital Oscilloscope -Digital Multimeter -Clump Multi Meter -CW Converter -Portable Power Supply Unit	

	Tool Kit :All necessary tools for radar maintenance for electrical/mechanical Step Ladder Type : Extension type 11m or more
Consumables	Grease with pump and oil with jug for antenna Slip ring carbon Brush
Calibration and Validation	Calibration: The radar system shall be calibrated in accordance with recognized meteorological standards (e.g., WMO or equivalent) to ensure accurate and consistent measurements of reflectivity, Doppler velocity, and other meteorological parameters. The calibration process shall include: • Internal calibration using built-in test equipment and reference signals. • External calibration using calibrated targets or reference radars. • Regular verification of system performance through routine maintenance and quality control procedures. Validation: The radar data shall be validated against independent measurements (e.g., rain gauges, disdrometers, radiosondes) to assess the accuracy and reliability of the radar-derived products. The validation process shall include: • Comparison of radar-estimated rainfall with ground-based rain gauge measurements. • Evaluation of radar-derived wind profiles against radiosonde observations. • Assessment of the radar's ability to detect and characterize severe weather phenomena.
Maintenance and Support	The vendor shall provide a comprehensive maintenance and support plan, including on-site training, remote troubleshooting, and software updates, with a guaranteed maximum response time of 2 days for critical issues.

Additional Software/hardware Features:

TDME (Test Diagnostic Measurement Equipment)

- ATE/ STTE : automatic test equipment, solid state test equipment for simulation
- complete consumable / replaceable components list required during repairing / replacement, along with warranty of provision of such components for not less than 15 years.
- List of single point failure component.
- software : packages to run TDME with firmware, O.S and procedure manuals
- The Radar system should be having required menu driven software with both GUI and command line controls for Operating the Radar.
- The antenna tracking sweep should be visible on all the visualization/ application software display systems
- The process of setup of various scan parameters should be easily accessible to operators using GUI.
- Software should have storm tracking and nowcasting features.
- Generation of alerts and warning.
- Setup of display overlayed on map of Pakistan with political boundaries of international borders, provinces and district boundaries, river catchment etc. using shape files.
- Provision to incorporate the Bias Values for correction
- Monitoring the health of the Radar as well as logging of subsystem level information at fixed intervals while Radar in operation.
- Interlock, status and analog parameters from sub systems should be available in Radar controller GUI display for monitoring and should be included in the Radar operation for the system and subsystem safety.
- The system should be capable of detecting failures of subsystems and should provide indication locally and remotely.
- System should have the feature of blanking RF radiation for selective sector.
- Real Time display of base products for the selected scan. Base Product display with zooming options, lat-long display, selectable parameter displays and colour coded. Simultaneous display of data having more than one parameter. Base product display with terrain

map – GIS. Provision for recording and playback of data.

- System should have provision for remote access for monitoring and control including equipment power supply.
- The base data (output of Radar processor) shall be stored automatically on Product archival workstations in compressed form. At least three-month past data shall be available on the local computer disk at a time. Data converter should be available on the system for automatic conversion of real-time Radar base data to other common formats such as NetCDF, HDF5, KML, KMZ, gridded binary and NEXRAD-Level II . Base data product images to be archived in different image formats like GIF, JPEG, PNG.
- The system should have concise interactive menus for monitoring and managing the process, which makes it easy to trace data all the way from the radar receiver to the end user.
- Display applications for 3D rendering of data and a web interface for accessing the data via a browser.
- Should be a fully scalable system architecture and works just as well with a single radar as a network of radars.
- Integration of Radar system in existing PMD RADARs network to enable central management, data archiving and generation of integrated products.
- Supplier shall be responsible to provide tool and will perform calibration and optimize R-Z, values for radar rainfall estimation and authentication of all the products. Complete verification report of Radar Rainfall estimation shall be furnished with satisfactory performance scores.
- Provision of web access of radar software(Client / Server architecture).
- Software should be fully licensed and supports installation /operation on other work stations.
- The final composite view should look like a Satellite clouds image as a layer one, AWS data as layer two, Radar data as layer 3, LDN data as layer 4 and weather model products as layer 5.
- Pulse radar transmit code data should also be made temporarily for research and analysis purposes of significant weather events.
- Generation of real time Mosaic view with existing radars of PMD.
- Platform independent: Running on Linux, only
- Radar software must support writing our own python based module of data analysis which can be added by the user.
- Consistent user interface offering easy navigation with MDI

(Multi Document Standard).

- Generation of movie loop and saving it in .mp4 format. Comprehensive combination products such as Severe Weather Indicator (consisting of micro-burst detection, meso-cyclone detection, divergence and convergence detection and storm structure analysis).

Open ended radar software supported with an option of adding additional regional or local features as modules.

Inspections and Tests

The following tests have to be performed before the system as a whole can be approved for operational services.

- **Factory Acceptance Test (FAT)**
- **Provisional Site Acceptance Test (PSAT)**

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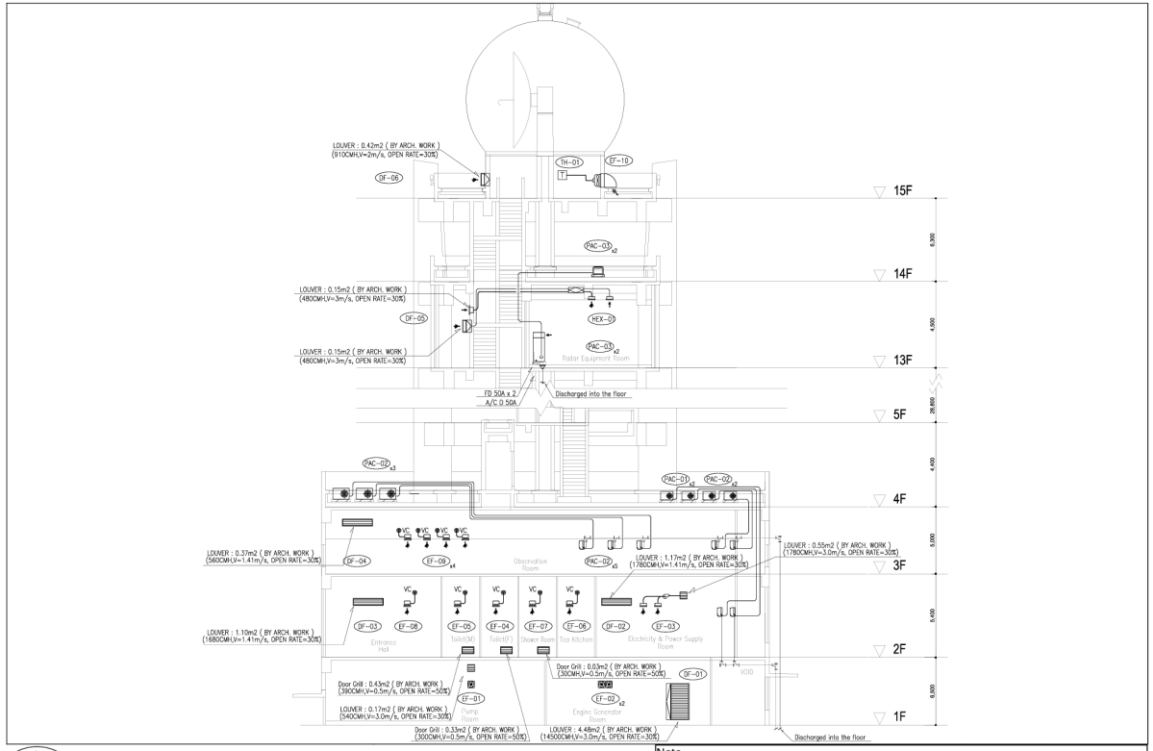
Conceptual Drawings



Project Description: Modernization of Hydromet Services of PMD in Pakistan
Integrated Flood Resilience and Adaptation Project (IFRAP)

Note:
These are all conceptual drawings only for the preperation of bids. Designs of all civil structures including foundations will be the responsibility of the bidder and design and drawings will be implemented after due approval of management consultants.

Technical Specification and Conceptual Drawing of

S-Band Dual Polarization Doppler Weather Surveillance Radar

Technical Specifications

Specifications of S-Band Dual Polarization Doppler Weather Radar

Radome	Quantity : 1 set
	Type : Sandwich panel (spherical surface) Dimension : As per requirements of antenna and maintenance requirements Surface : White color, suitable non-observant, non-water stickling finish for making smooth surface and suitable for all weather conditions. Survival wind speed/ Hail storm : 120 m/s (3-second gust), Hail resistance: 25 mm diameter hailstones at 90 km/h. Transmission loss : 0.3 dB or less on one way path in dry conditions Relative humidity : 0% - 100% Lightning protection : Lightning rods Obstruction light : LED (red color), automatic switch control (on/off), waterproof Steel base ring including necessary installation materials
Antenna	Quantity : 1 set
	Type : Parabolic antenna Reflector size : As per design requirements Beam width : 1.3 degrees or less at -3dB point without Radome Antenna gain : 42-43 dB or more without Radome (for 1.0° beamwidth) OR 45 dB or more without Radome (for 0.9° beamwidth) Polarization : Simultaneous dual polarization (horizontal and vertical) 1st Side lobe level : -26dB or less without Radome first sidelobe Angular positioning accuracy : 0.05 degrees or less Pedestal structure : Pedestal including the motor and rotary joint for azimuth and elevation Driving range : Azimuth 360 degrees, elevation -2 degrees – +182 degrees Rotation speed Azimuth : 0rpm to 6rpm or higher, selectable Elevation : 0 to 20 degrees per second, selectable, or up to 2.5 RPM VSWR : 1.4 or less without Radome Dehydrator : Yes BITE : BITE with trend graphics
Transmitter	Quantity : 1 set
	Transmitter type : Solid-state power amplifier Transmitting frequency : to be selected from 2,7MHz – 2,9MHz (±2.5MHz) Observation Range :450Km or more Occupied frequency bandwidth : 10MHz or less

	Transmitting power : 10kW or higher Power amplifier protection : High VSWR protection, High Temperature protection and to inhibit operation individually in case of abnormal high temperature in chassis Radiation blanking : It shall be able to set both azimuth and elevation Pulse width : from 0.4 μs to 2.0 μs Pulse repetition frequency (PRF): from 250Hz to 1800 Hz, selectable Duty : 0.001 duty BITE : Yes
Digital Receiver & Signal Processor	Quantity : 1 set
	Receiver type : Coherent IF digitizer Receiver Noise figure : 3dB or less at the input terminal of low noise amplifier (LNA) Clutter rejection capability : Yes Sensitivity : -115 dBm or better Range bin : 8000 or more Signal Processing techniques : Shall employ advanced signal processing techniques for clutter suppression, spectral analysis, and dual-polarization parameter estimation, meeting or exceeding NEXRAD Level II or equivalent standards Processing area : (Intensity mode) throughout 0 km to 300 km or more in range and 0 to 360 degrees in azimuth (Doppler mode) throughout 0 km to 200km or more in range and 0 to 360 degrees in azimuth Intensity signal process: -Dynamic range : 94dB or more -Logarithmic linearity: within ±1dB throughout 70dB -Range correction: depending on radar equation -Air-attenuation correction: 0.01dB/km in observation range Velocity signal process: -Processing type: pulse pair or FFT (selectable) -Trigger control: Dual-PRF ratio selectable (2:3, 3:4, 4:5) -De-aliasing of doppler velocity: Real-time processing by Dual-PRF - Maximum de-aliasing Doppler velocity: 90 m/s or more (in case of 4:5 dual PRF ratio) -Maximum mean radial velocity: 64m/s or more (depends on PRF) Output data : Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρHV) Output data grid Azimuth : 1 degree or less Range : 150m or finer at 300 km observation range

	Output data resolution : up to 32 bits Output data indicating interval: : within 1 minute after automatic scan BITE : BITE with trend graphics
Duplexer	Quantity : 1 set
	Type : Dual backup type TR limiter or isolator with diode limiter
Radar Controller	Quantity : 1 set
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : Color LCD type, 19 inches or more Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent Application software: [Radar control and monitoring] -Antenna scanning and radiation to control by pointing device -Monitoring of the result of the radar control -Fault monitoring including temperature alarm inside of the equipment -True north confirmation [Observation scheduling] -Antenna scanning mode (PPI, RHI, Volume Scan) -Elevation angle setting -Selection of pulse width (Long range observation mode / Short range observation mode) -Resolution of the azimuth and range

	-Data elements (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) -Setting for the clutter filter level -Selection of PRF and processing mode [Radar echo display] -X-Y coordinates image in the form of PPI indication (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit
Data & Protocol Converter	Quantity : 1 set
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : Color LCD type, 19 inches or more Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent Application software: [Data receiving, converting and transfer] -Collection of ingested data -Compression processing of raw data -Dissemination of raw data over the network - FTP data transfer through live IP

	-GRIB-2, ASCII, NETCDF, GEOTIFF, PNG format etc. -The software shall include an interface for administrators and operators to create and schedule automatic export of products in various formats (e.g., GRIB2, ASCII, NetCDF, GeoTIFF, PNG) to external sources via FTP/SFTP or other compatible protocols. [Parameter setting] -Setting of dissemination schedule -Selection of products to be disseminated [Display processing] -Latest data display by the PPI style (selectable of Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) -Display of receiving status [Time adjustment] -Automatic adjustment by GPS NTP server (including GPS antenna) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit
Radar Data Display Unit	Quantity : 2 sets
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : 65 inches or more-LED or video wall Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent

	Application software: [Basic data monitoring feature] -Display of X-Y coordinates image in the form of PPI indication (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) [Weather product processing] -PPI (plan position indicator) -RHI (range height indicator) -CAPPI (constant altitude PPI) -RTI (range time indicator) -Maximum value on X-Y axis -Rainfall near surface -VIL (vertically integrated liquid) -3-dimensional data display -Warning output of heavy rainfall -Rainfall and strong wind warning output of specified district -Calculation of KDP from φDP -Rain rate and rainfall near surface by DP (dual polarization) (Capable to set the combination of multiple polarization parameters and calculation algorithms) -Arbitrary N-hours rainfall accumulation by DP -Horizontal wind profile (wind direction and speed) -Time series wind profile of the upper layer -Wind shear and microburst detection -Multi window feature -Z-R and dual polarization parameter registration -Image file output as JPG file format [Map projection] -Conical projection or Mercator projection -Map data edit function [Product display & retrieval] -Automatic updating of the received product -Display of the necessary information

	Observed date and time Site code Name of product Product range information Legend (color code) -Data display area Map overlay feature Indication of information of a location pointed by pointing device (Location, radar echo value, distance of specified span) -Zooming display 2 or 4 times selectable for the desired area -Animation Animation displays of selected product Selectable items -Type of product -Retrieving period -Retrieving speed -Retrieving direction (Forward and Reverse) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit

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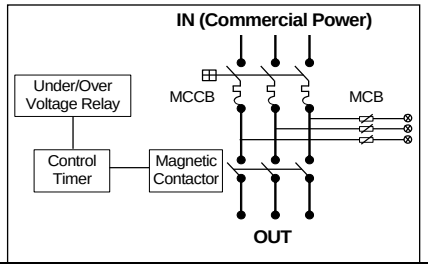
	Circuit breaker	: No-fuse-breaker type
	Main breaker	: No-fuse-breaker type or magnetic-breaker
	Power distribution	: No. of outputs as required including 2 spare
	Input power	: AC 400V, three phase four wire, 50Hz
	Output power	: AC 230V, single phase two wire, 50Hz
Dual Switch	Quantity	: 1 set
	LAN interface	: IEEE 802.3 Ethernet
	Connection port	: 100BASE-TX or more, eight (8) ports or more
	Input power	: AC 230V, single phase, 50Hz
	Each port and power supply shall be duplicated	
Dual Optical	Quantity	: 2 sets

Repeater	LAN interface	: IEEE 802.3 Ethernet
	Connection port	: 100BASE-TX or more: one (1) port or more, optical fiber interface: one (1) set, multi-mode (100Mbps)
	Input power	: AC 230V, single phase, 50Hz
	Each port and power supply shall be duplicated.	
Optical Fiber Cable	Quantity	: 1 set
	Cable type	: Multi mode 2C
	Connector	: ST
	Length	: As per requirements
Dual Router	Quantity	: 1 set
	LAN interface	: IEEE 802.3 Ethernet
	Connection port	: 100BASE-TX or more, three (3) ports or more
	Routing	: IP routing
	Input power	: AC 230V, single phase, 50Hz
	Each port and power supply shall be duplicated	

Phase Change Protector	Quantity	: 1 set
	Component MCCB triple pole Magnetic contactor triple pole Control breaker, single pole MCB Under and over voltage relay, 500V Control timer 0-30sec. Indication lamp	
Isolation Transformer	Quantity	: 1 set
	Capacity	: 20kVA or more
	Input power	: AC 360V, 370V, 380V, 400V selectable, three phase four wire, 50Hz
	Output power	: AC 400V, three phase four wire, 50Hz
	Insulation	: Class B
	Surge voltage	: 30kV or more
Automatic Voltage Regulator (AVR)	Quantity	: 1 set
	Capacity	: 25 KVA or more
	Input power	: AC 400V ±20%, three phase four wire, 50Hz
	Output power	: AC 400V ±5%, three phase four wire, 50Hz
Power Backup Unit	Quantity	: 1 set
	Input voltage	: AC 400V, three phase four wire, 50Hz
	Output voltage	: AC 400V, three phase four wire, 50Hz

	Back up time	: 5 minutes or longer for all the equipment indicated above
	Energy storage	: Lithium-ion battery
	Others	: Bypass function
Grounding System	Quantity	: 2 set
	The installation of complete grounding system for the protection of radar equipment and its peripherals at the site. The grounding procedures must comply with national and international regulations.	
	Groundig test terminals	: 3 or more
	Grounding terminal box	: Number of terminals as required, with a connection cable to the grounding cable
	Grounding resistance value	: 5 or less

Diesel Engine Generator for supporting all the Radar Equipment and the Air Conditioner specified below	Quantity	: 1 set
	Output	: 30KVA or more at continuous
	Output voltage	: AC 400V, three phase four wire
	Frequency	: 50Hz
	Control unit	: Automatic transfer switch
	Exhaust System	: Silencer, expansion joints, vibration isolators and flexible connections
	Fuel tank	: 200L or more
	Accessories	: Starting battery, fuel supply & lubricating systems, lubricating oil supply system, steel structural common bed and anchor bolts for generator and auxiliaries, spare parts for 3,000 hours and tools for maintenance.
Hybrid Solar System with Green meter	20KVA	
Air Conditioners for Radar Equipment and operation room		
	Type	: Air cooled floor/wall mounted type
	Capacity	: Inverter AC's as per the cooling requirement of the equipment
	Automatic operation	: Thermostatic control
	Controller	: Body/Remote type

Spare Parts	Timing belt for antenna (for azimuth drive)	1 set
	Timing belt for antenna (for elevation drive)	1 set
	Encoder or resolver for antenna (for azimuth angle signal)	1 set
	Encoder or resolver for antenna (for elevation angle signal)	1 set
	Motor for antenna (for azimuth drive)	1 set
	Motor for antenna (for elevation drive)	1 set
	Servo unit for antenna controller (for azimuth drive)	1 set
	Servo unit for antenna controller (for elevation drive)	1 set
	Power supply unit for antenna controller	1 set
	Power supply unit for transmitter	1 set
	Power supply unit for digital receiver and signal processor	1 set
	Solid-state power amplifier	5 sets (if modules are in cascaded) otherwise 1 spare

	module amplifier Signal processor 1 set Receiver 1 set Fan unit for radar equipment 2 sets LAN arrester 3 sets Obstruction light 1 set Solid State Back up of all Softwares for radar operation 2 sets
External Storage	Shall provide sufficient storage capacity (at least 100 TB) for saving the last 10 years of Radar data

Step-down Transformer	Capacity : 100kVA(or as per the requirement of the Office) Output power : AC 400V, three phase four wire, 50Hz
TEST EQUIPMENT	The following equipment should be provided as per radar testing requirement: -Spectrum Analyzer -Test Signal Generator -Power Meter -Power Sensor -Frequency Counter -Detector -Attenuator Set -Terminator for Detector -Digital Oscilloscope -Digital Multimeter -Clump Multi Meter -CW Converter -Portable Power Supply Unit Tool Kit :All necessary tools for radar maintenance for electrical/mechanical Step Ladder Type : Extension type 11m or more
Consumables	Grease with pump and oil with jug for antenna Slip ring carbon Brush
Calibration and Validation	Calibration: The radar system shall be calibrated in accordance with recognized meteorological standards (e.g., WMO or equivalent) to ensure accurate and consistent measurements of reflectivity, Doppler velocity, and other meteorological parameters. The calibration process shall include: • Internal calibration using built-in test equipment and reference signals. • External calibration using calibrated targets or reference radars. • Regular verification of system performance through routine maintenance and quality control procedures. Validation: The radar data shall be validated against independent measurements (e.g., rain gauges, disdrometers, radiosondes) to assess the accuracy and reliability of the radar-derived products. The

	validation process shall include: • Comparison of radar-estimated rainfall with ground-based rain gauge measurements. • Evaluation of radar-derived wind profiles against radiosonde observations. • Assessment of the radar's ability to detect and characterize severe weather phenomena.
Maintenance and Support	The vendor shall provide a comprehensive maintenance and support plan, including on-site training, remote troubleshooting, and software updates, with a guaranteed maximum response time of 2 days for critical issues.

Additional Software/hardware Features:

TDME (Test Diagnostic Measurement Equipment)

- ATE/ STTE : automatic test equipment, solid state test equipment for simulation
- complete consumable / replaceable components list required during repairing / replacement, along with warranty of provision of such components for not less than 15 years.
- List of single point failure component.
- software : packages to run TDME with firmware, O.S and procedure manuals
- The Radar (RCP) system should be having required menu driven software with both GUI and command line controls for Operating the Radar.
- The antenna tracking sweep should be visible on all the visualization/ application software display systems
- The process of setup of various scan parameters should be easily accessible to operators using a workstation GUI.
- Software should have storm tracking and nowcasting features.
- Generation of storm vectors (SCITs).
- Setup of display overlayed on map of Pakistan with political boundaries of international borders, provinces and district boundaries, river catchment etc. using shape files.

- Provision to incorporate the Bias Values for correction
- Monitoring the health of the Radar as well as logging of subsystem level information at fixed intervals while Radar in operation.
- Interlock, status and analog parameters from sub systems should be available in Radar controller GUI display for monitoring and should be included in the Radar operation for the system and subsystem safety.
- The system should be capable of detecting failures of subsystems and should provide indication remotely.
- System should have the feature of blanking RF radiation for selective sector.
- Real Time display of base products for the selected scan. Base Product display with zooming options, lat-long display, selectable parameter displays and colour coded. Simultaneous display of data having more than one parameter. Base product display with terrain map – GIS. Provision for recording and playback of data.
- System should have provision for remote access for monitoring and control including equipment power supply.
- The base data (output of Radar processor) shall be stored and accessible to the user. At least three-month past data shall be available on the local computer disk at a time. Data converter should be available on the system for automatic conversion of real-time Radar base data to other common formats such as NetCDF, HDF5, KML, KMZ, gridded binary and NEXRAD-Level II . Base data product images to be archived in different image formats like GIF, JPEG, PNG.
- The system should have concise interactive menus for monitoring and managing the process, which makes it easy to trace data all the way from the radar receiver to the end user.
- Display applications for 3D rendering of data in a workstation and a web interface for accessing 2D data via a browser.
- Should be a fully scalable system architecture and works just as well with a single radar as a network of radars.
- Integration of Radar system in existing PMD RADARs network to enable central management, data archiving and generation of integrated products.
- Supplier shall be responsible to provide tool and will perform calibration and optimize R-Z, values for radar rainfall estimation and

authentication of all the products. Complete verification report of Radar Rainfall estimation shall be furnished with satisfactory performance scores.

- Provision of radar software (Client / Server architecture).
- Software should be fully licensed and supports installation /operation on work stations specification defined by the manufacturer.
- The final composite view should look like a Satellite clouds image as a layer one, AWS data as layer two, Radar data as layer 3, LDN data as layer 4 and weather model products as layer 5.
- Pulse radar transmit code data should also be made temporarily for research and analysis purposes of significant weather events.
- Generation of real time Mosaic view with existing radars of PMD.
- Platform independent: Running on Linux or Windows
- Radar software must support writing our own python based module of data analysis which can be added by the user.
- Consistent user interface offering easy navigation with MDI (Multi Document Standard).
- Generation of movie loop and saving it in .mp4 format. Comprehensive combination products such as Severe Weather Indicator (consisting of meso-cyclone detection, divergence and convergence detection and storm structure analysis).

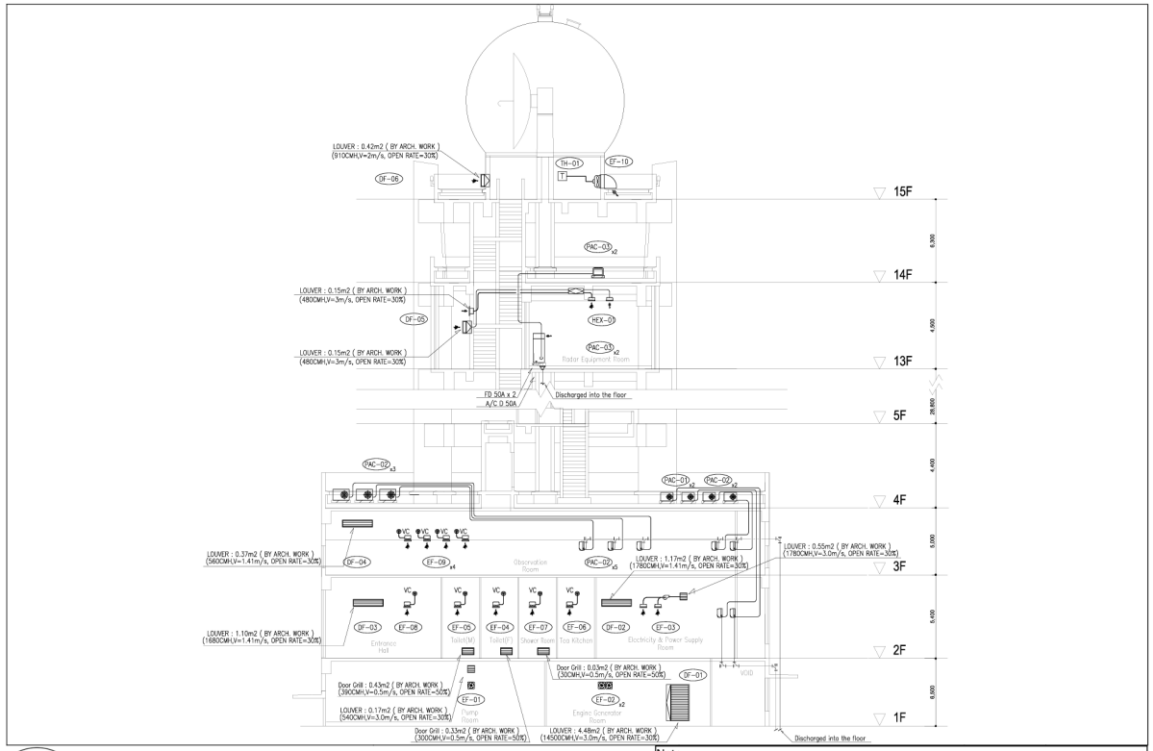
Inspections and Tests

The following tests have to be performed before the system as a whole can be approved for operational services.

- Factory Acceptance Test (FAT)

- Provisional Site Acceptance Test (PSAT)

Conceptual Drawing



Project Description: Modernization of Hydromet Services of PMD in Pakistan
Integrated Flood Resilience and Adaptation Project (IFRAP)

Note:
These are all conceptual drawings only for the preperation of bids. Designs of all civil structures including foundations will be the responsibility of the bidder and design and drawings will be implemented after due approval of management consultants.

Technical Specification and Conceptual Drawing of

C-Band Dual Polarization Doppler Weather Surveillance Radar

Technical Specifications

Specifications of Solid-State C-Band Dual Polarization Doppler Weather Radar

Radome	Quantity	: 1 set
	Type	: Sandwich panel (spherical surface)
	Dimension	: As per requirements of antenna and maintenance requirements
	Surface	: White color, suitable non-observant, non-water stickling finish for making smooth surface and suitable for all weather conditions.

	Survival wind speed/ Hail storm : 120 m/s (3-second gust), Hail resistance: 25 mm diameter hailstones at 90 km/h. Transmission loss : 0.3 dB or less on one way path in dry conditions Relative humidity : 0% - 100% Lightning protection : Lightning rods Obstruction light : LED (red color), automatic switch control (on/off), waterproof Steel base ring including necessary installation materials
Antenna	Quantity : 1 set
	Type : Parabolic antenna Reflector size : As per design requirements Beam width : 1.0 degrees or less at -3dB point without Radome Antenna gain : 44.5 dB or more without Radome (for 1.0° beamwidth) OR 45 dB or more without Radome (for 0.9° beamwidth) Polarization : Simultaneous dual polarization (horizontal and vertical) 1st Side lobe level : -26dB or less without Radome Angular positioning accuracy : 0.05 degrees or less Pedestal structure : Pedestal including the motor and rotary joint for azimuth and elevation Driving range : Azimuth 360 degrees, elevation -2 degrees – +90 degrees Rotation speed Azimuth : 0rpm to 6rpm or higher, selectable Elevation : 0 to 15 degrees per second, selectable, or up to 2.5 RPM VSWR : 1.4 or less without Radome Dehydrator : Yes

	BITE : Web-browser based BITE with trend graphics
Transmitter	Quantity : 1 set
	Transmitter type : Solid-state power amplifier Transmitting frequency : to be selected from 5,605MHz – 5,795MHz (±2.5MHz) Observation Range :300Km or more Occupied frequency bandwidth : 10MHz or less Range Side Lobe Suppression : at least 70 dB (Integrated Side Lobe suppression) at IF level Short pulse width operation : Selected transmitting frequency +1.25MHz Long pulse width operation : Selected transmitting frequency -1.25MHz Transmitting power : 2.5 kW peak or higher (per channel H & V), ideal value 7.5 kW or higher Power amplifier protection : High VSWR protection, High Temperature protection and to inhibit operation individually in case of abnormal high temperature in chassis Radiation blanking : It shall be able to set both azimuth and elevation Pulse width : from 1μs to 100μs Pulse repetition frequency (PRF): from 250Hz to 2000 Hz, selectable Duty : 10% Maximum BITE : Yes
Digital Receiver & Signal Processor	Quantity : 1 set
	Receiver type : Coherent IF digitizer Receiver Noise figure : 3dB or less at the input terminal of low noise amplifier (LNA) Clutter rejection capability : Yes

	Pulse compression type : Chirp modulation Pulse compression ratio : 128 or higher Sensitivity : -115 dBm or better Range bin : 8000 or more Signal Processing techniques : Shall employ advanced signal processing techniques for clutter suppression, spectral analysis, and dual-polarization parameter estimation, meeting or exceeding NEXRAD Level II or equivalent standards Processing area : (Intensity mode) throughout 0 km to 300 km or more in range and 0 to 360 degrees in azimuth (Doppler mode) throughout 0 km to 200km or more in range and 0 to 360 degrees in azimuth Intensity signal process: -Dynamic range : 94dB or more -Logarithmic linearity: within ±1dB throughout 70dB -Range correction: depending on radar equation -Air-attenuation correction: 0.01dB/km in observation range Velocity signal process: -Processing type: pulse pair or FFT (selectable) -Trigger control: Dual-PRF ratio selectable (2:3, 3:4, 4:5) -De-aliasing of doppler velocity: Real-time processing by Dual-PRF - Maximum de-aliasing Doppler velocity: 90 m/s or more (in case of 4:5 dual PRF ratio) -Maximum mean radial velocity: 64m/s or more (depends on PRF) 2nd-trip echo suppression : Real-time processing by random phase control Output data : Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρHV)

	Output data grid Azimuth : 1 degree or less Range : 150m or finer at 300 km observation range Output data resolution : up to 32 bites Output data indicating interval: : within 1 minute after automatic scan BITE : Web-browser based BITE with trend graphics
Duplexer	Quantity : 1 set
	Type : Dual backup type TR limiter or isolator with diode limiter
Radar Controller	Quantity : 1 set
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : Color LCD type, 19 inches or more Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery

	Application software: • Operating System platform independent Application software: [Radar control and monitoring] -Antenna scanning and radiation to control by pointing device -Monitoring of the result of the radar control -Fault monitoring including temperature alarm inside of the equipment -True north confirmation [Observation scheduling] -Antenna scanning mode (PPI, RHI, Volume Scan) -Elevation angle setting -Selection of pulse width (Long range observation mode / Short range observation mode) -Resolution of the azimuth and range -Data elements (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) -Setting for the clutter filter level -Selection of PRF and processing mode

	[Radar echo display] -X-Y coordinates image in the form of PPI indication (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit
Data & Protocol Converter	Quantity : 1 set
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : Color LCD type, 19 inches or more Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software:

	• Operating System platform independent Application software: [Data receiving, converting and transfer] -Collection of ingested data -Compression processing of raw data -Dissemination of raw data over the network - FTP data transfer through live IP -GRIB-2, ASCII, NETCDF, GEOTIFF, PNG format etc. -The software shall include an interface for administrators and operators to create and schedule automatic export of products in various formats (e.g., GRIB2, ASCII, NetCDF, GeoTIFF, PNG) to external sources via FTP/SFTP or other compatible protocols. [Parameter setting] -Setting of dissemination schedule -Selection of products to be disseminated [Display processing] -Latest data display by the PPI style (selectable of Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) -Display of receiving status

	[Time adjustment] -Automatic adjustment by GPS NTP server (including GPS antenna) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit
Radar Data Display Unit	Quantity : 2 sets
	Hardware CPU : Intel® Xeon or equivalent latest generation & Series or higher Main memory (RAM) : 64GB or more Hard disk : 1TB (SSD) × two (2) drives or more (RAID-5) Media drive : Solid State LAN interface: : 10Base-T, 100Base-TX and 1000Base-T, two (2) port or more Monitor display : 65 inches or more-LED or video wall Input power : AC 230V, single phase, 50Hz Accessories : English keyboard, mouse, LAN arrester (RJ45) Software Operation system: As per OEM with support till 10 years from time of delivery Application software: • Operating System platform independent

	Application software: [Basic data monitoring feature] -Display of X-Y coordinates image in the form of PPI indication (Reflectivity (Z), Doppler velocity (V), Spectrum width (W), Differential reflectivity (ZDR), Differential phase shift (φDP), Specific differential phase shift (KDP), Polarimetric correlation coefficient (ρhv)) [Weather product processing] -PPI (plan position indicator) -RHI (range height indicator) -CAPPI (constant altitude PPI) -RTI (range time indicator) -Maximum value on X-Y axis -Rainfall near surface -VIL (vertically integrated liquid) -3-dimensional data display -Warning output of heavy rainfall -Rainfall and strong wind warning output of specified district -Calculation of KDP from φDP -Rain rate and rainfall near surface by DP (dual polarization) (Capable to set the combination of multiple polarization parameters and calculation algorithms) -Arbitrary N-hours rainfall accumulation by DP -Horizontal wind profile (wind direction and speed) -Time series wind profile of the upper layer

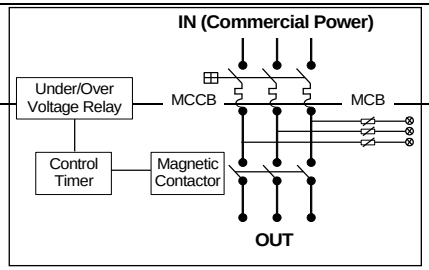
	-Wind shear and microburst detection -Multi window feature -Z-R and dual polarization parameter registration -Image file output as JPG file format [Map projection] -Conical projection or Mercator projection -Map data edit function [Product display & retrieval] -Automatic updating of the received product -Display of the necessary information Observed date and time Site code Name of product Product range information Legend (color code) -Data display area Map overlay feature Indication of information of a location pointed by pointing device (Location, radar echo value, distance of specified span)

	-Zooming display 2 or 4 times selectable for the desired area -Animation Animation displays of selected product Selectable items -Type of product -Retrieving period -Retrieving speed -Retrieving direction (Forward and Reverse) [Automatic shutdown] -Automatic graceful shutdown upon signal from the Power Backup Unit

Radar Power Maintenance Panel	Quantity	: 1 set
	Circuit breaker	: No-fuse-breaker type
	Main breaker	: No-fuse-breaker type or magnetic-breaker
	Power distribution	: No. of outputs as required including 2 spare
	Input power	: AC 400V, three phase four wire, 50Hz
	Output power	: AC 230V, single phase two wire, 50Hz
Dual Switch	Quantity	: 1 set
	LAN interface	: IEEE 802.3 Ethernet

	Connection port : 100BASE-TX or more, eight (8) ports or more Input power : AC 230V, single phase, 50Hz Each port and power supply shall be duplicated
Dual Optical Repeater	Quantity : 2 sets
	LAN interface : IEEE 802.3 Ethernet Connection port : 100BASE-TX or more: one (1) port or more, optical fiber interface: one (1) set, multi-mode (100Mbps) Input power : AC 230V, single phase, 50Hz Each port and power supply shall be duplicated.
Optical Fiber Cable	Quantity : 1 set
	Cable type : Multi mode 2C Connector : ST Length : As per requirements
Dual Router	Quantity : 1 set
	LAN interface : IEEE 802.3 Ethernet Connection port : 100BASE-TX or more, three (3) ports or more Routing : IP routing Input power : AC 230V, single phase, 50Hz Each port and power supply shall be duplicated

Phase Change Protector	Quantity : 1 set
	Component MCCB triple pole



	Magnetic contactor triple pole Control breaker, single pole MCB Under and over voltage relay, 500V Control timer 0-30sec. Indication lamp	
Isolation Transformer	Quantity	: 1 set
	Capacity	: 20kVA or more
	Input power	: AC 360V, 370V, 380V, 400V selectable, three phase four wire, 50Hz
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	Insulation	: Class B
	Surge voltage	: 30kV or more
Automatic Voltage Regulator (AVR)	Quantity	: 1 set
	Capacity	: 25 KVA or more
	Input power	: AC 400V ±20%, three phase four wire, 50Hz
	Output power	: AC 400V ±5%, three phase four wire, 50Hz
Power Backup Unit	Quantity	: 1 set
	Input voltage	: AC 400V, three phase four wire, 50Hz
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	Back up time	: 5 minutes or longer for all the equipment indicated above
	Energy storage	: Lithium-ion battery
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	Grounding resistance value	: 5 or less

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	Output	: 30KVA or more at continuous
	Output voltage	: AC 400V, three phase four wire
	Frequency	: 50Hz
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Consumables	Grease with pump and oil with jug for antenna Slip ring carbon Brush
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Validation	Doppler velocity, and other meteorological parameters. The calibration process shall include: • Internal calibration using built-in test equipment and reference signals. • External calibration using calibrated targets or reference radars. • Regular verification of system performance through routine maintenance and quality control procedures. Validation: The radar data shall be validated against independent measurements (e.g., rain gauges, disdrometers, radiosondes) to assess the accuracy and reliability of the radar-derived products. The validation process shall include: • Comparison of radar-estimated rainfall with ground-based rain gauge measurements. • Evaluation of radar-derived wind profiles against radiosonde observations. • Assessment of the radar's ability to detect and characterize severe weather phenomena.
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- The base data (output of Radar processor) shall be stored automatically on Product archival workstations in compressed form. At least three-month past data shall be available on the local computer disk at a time. Data converter should be available on the system for automatic conversion of real-time Radar base data to other common formats such as NetCDF, HDF5, KML, KMZ, gridded binary and NEXRAD-Level II . Base data product images to be archived in different image formats like GIF, JPEG, PNG.
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- Radar software must support writing our own python based module of data analysis which can be added by the user.
- Consistent user interface offering easy navigation with MDI (Multi Document Standard).
- Generation of movie loop and saving it in .mp4 format. Comprehensive combination products such as Severe Weather Indicator (consisting of micro-burst detection, meso-cyclone detection, divergence and convergence detection and storm structure analysis).

Open ended radar software supported with an option of adding additional regional or local features as modules.

Inspections and Tests

The following tests have to be performed before the system as a whole can be approved for operational services.

- Factory Acceptance Test (FAT)
- Provisional Site Acceptance Test (PSAT)

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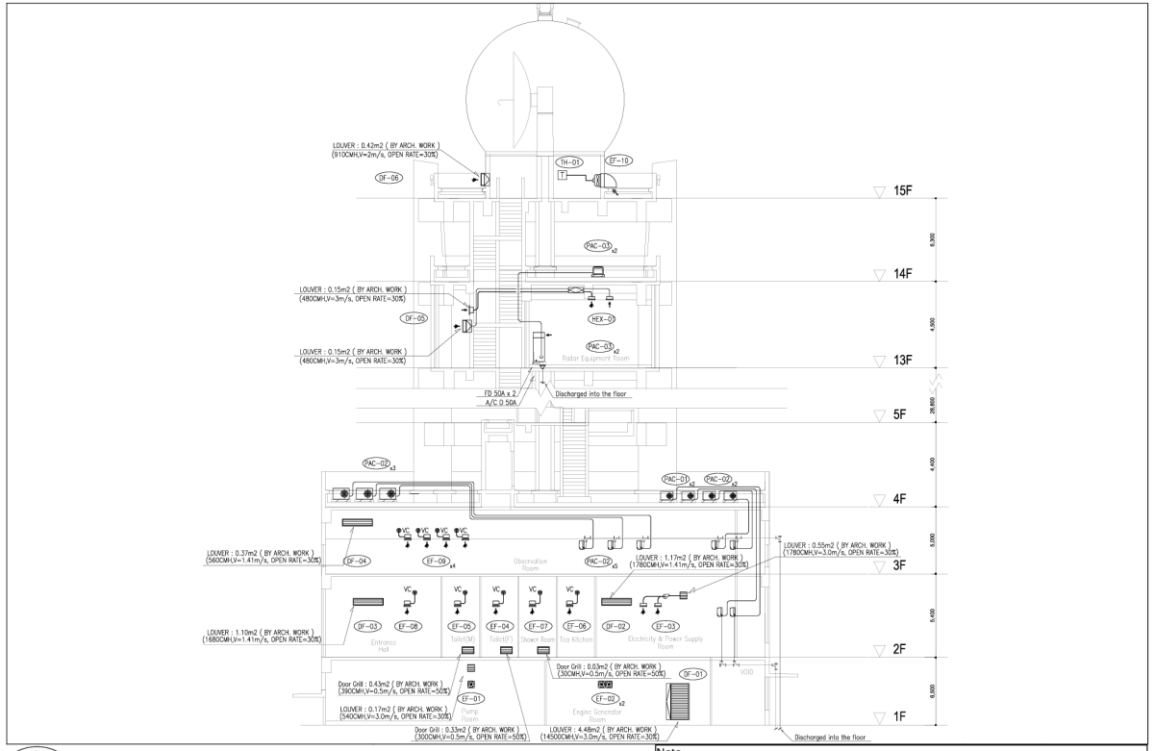
Conceptual Drawings



Project Description: Modernization of Hydromet Services of PMD in Pakistan
Integrated Flood Resilience and Adaptation Project (IFRAP)

Note:
These are all conceptual drawings only for the preperation of bids. Designs of all civil structures including foundations will be the responsibility of the bidder and design and drawings will be implemented after due approval of management consultants.