Scanner	• X,Y, and Z must have closed-loop feedback, with an option for open-loop mode. • X-Y range of 90 microns • Z-range of 40 microns, with/without extension, for both imaging and characterization modes. • Z-sensor noise-floor < 0.5 nm across the 0.1 Hz to 1 kHz bandwidth • Above-mentioned noise-floor should be demonstrably independent of Z-travel, in repetitive Z-scan tests. • Compatible with all scanning/force-spectroscopy operating modes (as listed below). • X-Y and Z motions should be mutually independent. • Use of piezo-tube is not acceptable. • Minimum sample size = 50 mm in diameter and 10 mm in height.
Operating modes	• Following modes of operation must be available: a) Contact (lateral force, topography, deflection, feedback error, one auxiliary) b) Force Curve Mode (Time, deflection, force, piezo position, event-time) c) Lateral Force Mode (LFM) d) AC Mode (Tapping Mode) e) Phase Imaging f) Nanolithography/ Nanomanipulation g) Electric Force Microscopy (EFM) h) Kelvin Probe Force Microscopy (KPFM) i) Magnetic Force Microscopy (MFM) j) Piezo-response Force Microscopy (PFM) k) Dual AC Resonance Tracking (DART) l) AC Mode with Q-control m) Force Mapping Model • For (a) and (b), the signals noted in the corresponding parentheses must be recordable simultaneously. • Each of these signals must be recorded in both trace and retrace scan directions.
Optical Lever Light Source	• The instrument optical lever arm must use a low coherence light source or equivalent (for example, a super luminescent diode, SLD) to reduce

	artefacts from optical interference effects. • The instrument must use an infrared SLD (or equivalent) for the optical lever arm to eliminate optical crosstalk with epi- and transmission- fluorescence measurements.
System Optics	• View of the cantilever and sample from above or below. • Must have field-of-view between 250 microns and 700 microns.
Environment controller	• System must include or optionally support (specify which) an Environment controller. • Must offer heating, cooling, and humidity options. • Operation to be based on closed loop operation to ensure precision and accuracy. • The interface should auto-configure each accessory for easy plug and play operation. • System to include a temperature controlled stage for variable temperature studies from -25°C or less to 300°C (nominal, accuracy better than 0.5 deg. C). • Stage should support samples up to 20 mm in diameter. • The environment-controller kit should include all necessary accessories for sealed operation. • Should have a port less dish, with features that limit evaporation.
AFM Controller and Electronics	• System must use at least 24-bit digital-to-analog converters (DACs) in order to generate the XY and Z piezo scan signals. • Allow thermal tuning of the cantilevers of the softest available cantilever, up to at least 2 MHz. • Must include software controlled relays for the X, Y and Z high voltage supplies and the laser power. • Must provide access to all major signals on BNC connectors on the controller front panel including: deflection (A-B), sum (A+B), amplitude, phase, lateral force, X, Y and Z sensors, three user inputs, three user outputs, X,Y and Z piezo drive voltages, and user X, Y and Z

	modulation voltage inputs compatible with external hardware. • Must include auto-configuration of external hardware and accessories. • Device parameters must be stored in non-volatile RAM on the device itself and read into the software when the device is plugged in. • Allow multi-frequency AC mode (tapping mode) operation with two specific driving frequencies and amplifiers to measure the amplitude and phase response at both these frequencies. • Must include or optionally support (specify which) an imaging mode that is capable of generating quantitative maps of storage and loss modulus, and loss tangent (loss modulus divided by storage modulus), at high pixel resolution (at least 1024x1024 pixels). • Data capture must occur during normal AC mode imaging of topography at normal scan rates.
Software	• System must use at least 24-bit digital-to-analog converters (DACs) in order to generate the XY and Z piezo scan signals. • Control and analysis must be user-programmable natively in an entirely open-source software programming language. • Software must include a one-click configuration tool that sets up the software for both standard and user-defined operation modes. • Capable of recording individual image sizes of 6000x6000 pixels^2 or greater. • AFM control software must include 3D rendering for image display. • Allow the user to generate, display, visualize, and export color-coded 3D & 4D real-time scan images, as well as off-line processing, exported in commonly compatible formats such as .xls, or .mat files. • Must include drift compensation module. • Drift compensation must be available for each operational mode. • Software must allow a region of interest to be tracked in real time to within 1nm

	of precision while eliminating any scan distortion in the image. • Must have a push-button non-destructive determination of cantilever spring constant using thermal noise and hydrodynamic methods. • Thermal tuning measurements of softest cantilevers (~ 10 pN/nm) must be admissible up to 2.5MHz, from within the AFM controlling software interface. • Automatic calibration of the cantilever sensitivity (deflection sensitivity) and spring constant by selecting the probe type and fluid. • At no point during automatic calibration may the tip touch the sample. • It must not use nominal tabulated values for the sensitivity and spring constant. • Must allow opening of multiple images and channels of a single scan such as phase, amplitude, topography, MFM, conductivity. • Must allow viewing of images in 3D by simply clicking and dragging on the image to pan, rotate, tilt and zoom into specific areas of the image.
Noise Isolation	• An enclosure that provides isolation from both vibration and acoustic noise. • The entire AFM, including the top-view optics, must be contained within this enclosure whereas the controller must be separately accessible. • The vibration isolation platform must not require compressed gas. • Allow at least 20dB of acoustic isolation. • The system must include an auto-levelling, active vibration isolation table.

Warranty, Support, and Services	• 24 month warranty on all parts and labour. • Free AFM software upgrades for the life of the instrument. • Local application and service support in India from the manufacturer. • Offer must include user-training every 6 months, for at least 18 months from the date of installation, not counting the training-session provided to users upon installation. • Training must cover all aspects of AFM operation and trouble-shooting, and must dedicate separate time-slots for every specialized mode of operation. • The duration of each such specialized training time-slot must be agreed to be at the discretion of the buyer. • Standard AFM cantilever must be provided by the support-staff at the time of training sessions. • At least 50 standard AFM tips to be provided as accessories, for the initial period.