Aakash IV Technical Specifications

Preface

Aakash is a series of Android-based tablet computers produced by an initiative of Ministry of Human Resource Development, Government of India. It is a low-cost tablet computer with a 7-inch touch screen. The device was developed as part of the country's aim to link 25,000 colleges and 400 universities in an e-learning program. The cost of basic version for a student was only Rs.1500 which was around USD35. In July 2010, Honorable Minister of Human Resource Development, Sri Kapil Sibal unveiled a prototype of Aakash, which was later given out to 500 college students to collect feedback. The tablet was officially launched as Aakash in New Delhi on 5 October 2011. Ministry of Human Resource Development, Government of India announced an upgraded second-generation model called Aakash 2 in April 2012. In this series, the new version of Aakash has been named as Aakash IV.

A Committee regarding continuous R&D and timely delivery of "Aakash" was constituted by the Department of Electronics and Information Technology, Ministry of Communications and Information Technology, vide Order No.8(195)/2011-IPHW dated 22nd December, 2011. A Sub-Committee comprising of technical experts has prepared vendor neutral Technical Specifications of Aakash IV. These specifications have been developed with a view to have a device at a low cost. The Specifications of Aakash IV are as under.

Sl No		
1	**Minimum Hardware Requirements**	
	1.1	Processor Performance Specification should be as per **Appendix-A** with the latest benchmark apks (with the desired minimum/maximum scores)
	1.2	Hardware accelerator for playing true HD720p with at least 30fps
	1.3	Hardware accelerator should be capable of supporting OpenGL ES 2.0. Hardware accelerator performance should be as per specification given in **Appendix-A** with the latest benchmark apks (with the desired minimum/maximum scores)
	1.4	**Memory (RAM):**1 GB LPDDR2/DDR3 SDRAM 1066 MT/S or better
	1.5	**Storage (Internal):**4 GB or more integrated flash
	1.6	**Storage (External):** Micro SD Card 2.0 (SD High Capacity) Interface (up to 32GB supported).
	1.7	**USB Interfaces:** The tablet must support one of the following three formats (A), (B) or (C). Option (B) will not be an acceptable option in case the tablet power adapter/battery charger uses micro-USB interface. (A) One non-powered USB OTG Micro-AB Receptacle (USB 2.0 Compliant) and one powered USB Type A Standard Receptacle (USB 2.0 Compliant). (B) One powered USB OTG Micro-AB Receptacle (USB 2.0 compliant) along with an external non-powered USB hub to provide interface to up to 2 devices. (C) One powered USB OTG Micro-AB Receptacle and one non-powered USB OTG Micro-AB Receptacle (both USB 2.0 compliant). The powered USB ports (type A or micro) must be able to interface to external non-powered USB hub. All USB ports (powered or non-powered) must be able to interface to an external powered USB hub. In case, the charging option for the tablet is provided through USB Micro-AB port, the charging port on the tablet must also be usable as data port. USB ports should be reliable and of high quality. USB port manufacturer's name and its

		quality certification should be provided.	
		1.7.1	The powered USB port must be able to source up to 500mA current to attached devices.
		1.7.2	Support for the following external devices 1. USB Storage Device 2. Keyboard 3. Mouse 4. USB Hub 5. All popular 2G and 3G Phone / Data Connectivity Dongles in India 6. USB to Ethernet adaptors 7. USB Printers
	1.8	USB and SD card should be detected and be able to work simultaneously. Should support file browsing facility	
	1.9	USB should be able to support USB mouse and USB keyboard simultaneously through external USB Hub	
	1.10	**Combined Audio-in and Audio-out**: 3.5 mm jack (Order: Tip, Ring, Microphone, Ground) for connecting stereo headphones and integrated speaker(s) as well as for external microphone and integrated microphone. Speaker section capable of generating at least sound of 85 dB +/- 3dB in the frequency range of 20 Hz and 20000 Hz. Microphone section capable of receiving minimum sound of -45 dB +/-4dB in the frequency range of 300 Hz to 3400 Hz	
	1.11	**Display and Resolution:** 7" LCD display with at least 800x480 resolutions with 16 bit or higher colour depth. LCD brightness should be a minimum of 250 cd/m2, and its contrast ratio should be a minimum of 500.	
	1.12	**Input Devices:** 7"multi-point projective capacitive touch with a minimum capability of five simultaneous touches	
	1.13	**Connectivity and Networking**	
		1.13.1	**WiFi IEEE 802.11 b/g/n** 1. Portable Wi-Fi Hotspot functionality 2. Maximum transmit power >= 15 dBm 3. Minimum receive sensitivity <= -83 dBm 4. Maximum TCP data rate >= 25 Mbps (for both upload and download) 5. Performance base line: Sustaining throughput >= 1 Mbps for 2 hours of line of sight distance between tablet and Access Point being 30 m
		1.13.2	**Bluetooth (Version 2.1 Class 2 or better) IEEE 802.15.1** 1. Certification is to be obtained as per Bluetooth SIG **2.** All Bluetooth Profiles supported by the Android should be enabled
		1.13.3	**GSM network connectivity** 1. Through a SIM insertable in to the Tablet 2. 2G GSM, GPRS, EDGE Connectivity 3. Frequency of operation: GSM 900 and GSM 1800 minimum 4. Transmit power exceeding 30dBm 5. Talk time: 5 hours minimum (LCD in standby mode, Audio speaker at a volume of 60dB and WiFi off) 6. Performance baseline: Sustained throughput of more than 40kbps for GPRS download, 10kbps for GPRS upload, 192kbps for EDGE for 2 hours of line of sight distance between tablet and GSM base station of 1km (max).
	1.14	**Power and Battery**	
		1.14.1	**Battery** 1. **Battery Capacity:** Minimum 3 Hrs for online 720p video playback

			(LCD with a brightness of 250 cd/m2, Audio speaker at a volume of 85 dB, WiFi ON with a receive signal strength between -65 dBM and -70 dBm), Minimum 4 Hrs for offline video playback (LCD with a brightness of 250 cd/m2, Audio speaker at a volume of 60 dB, WiFi OFF), Minimum 5 Hrs on web browsing (LCD with a brightness of 250 cd/m2, Audio speaker at a volume of 60 dB, WiFi ON with a receive signal strength between -65 dBM and -70 dBm, Cumulative 80MB download through repeated web page load over 5 hrs), 6 Hrs on e-reader (LCD with a brightness of 250 cd/m2, Audio speaker at a volume of 60 dB, WiFi OFF) 2. **Battery Charging:** Should be able to charge from AC from 10% to 80% of battery capacity within 2 hours from external power adapter when the tablet is switched OFF, support charging from USB port or from DC power port with receptacle compliant to EIA-J-02 (standardizing on power connector). Two colour LED indication for charging and full charge. 3. **Battery Life:** a. At 25 degree centigrade, battery should have a life of 600 cycles or 2 years (whichever is earlier) with a minimum left over battery capacity of 50%. b. Capacity to be >= 80% at the end of 300 charge cycles, Capacity to be >= 50% at the end of 600 cycles (One cycle consists of standard charging, resting for half an hour, discharging with LCD with a brightness of 250 cd/m2, Audio speaker at a volume of 85 dB, WiFi ON with a receive signal strength between -65 dBM and -70 dBm until the tablet is turned OFF). 4. **Self discharge**: Battery charge should be >= 90% even after 30 days (when the tablet is turned OFF) 5. **Safety**: Should comply with IEC 62133 : 2002 6. **Battery Warranty:** 1 year 7. **Battery Datasheet:** Manufacturer of the Aakash tablet is to provide battery data sheet provided by manufacturer of battery. 8. Short circuit and over charge protection capability.
		1.14.2	**Battery Charger**
			1. AC input plug: 2-pin Plug (Compliant to Indian Standard) 2. Input voltage range: 100-270V AC 3. AC frequency: 50/60 Hz 4. Cable length: >= 1 m 5. DC output plug: One number compliant to EIA J-02 or Micro USB 6. Nominal DC output voltage: 5 V 7. Safety and compliance: IS13252
	1.15	**3-Axis Accelerometer**	
		1.15.1	Number of axis: 3
		1.15.2	Orientation change response time for home screen: <= 3 seconds
		1.15.3	Orientation change response time for browser: <= 3 seconds
		1.15.4	Range (m/s2) : >= 19.6 (Using Z-device or android sensor tool box application. Equivalent to +/- 2g)
	1.16	Drivers for Phone Functionality	
	1.17	Data functionality with optional external dongle for 3G networks	
	1.18	Video/Photo Camera (front facing) with a resolution of 0.3 M Pixel (VGA) or higher	

	1.19	Warranty against manufacturing defect of all parts (except battery) for two years. Breakage, wear and tear, water/liquid spill damages are excluded from the warranty.	
	1.20	Protective LCD screen guard	
	1.21	Hardware reset (for example through pin-hole, or through long press of power-on key) to reboot the tablet	
	1.22	Buttons: Power, Volume up and down.	
		1.22.1	Short press of power button for Sleep Mode, long press of power button for shut down options
		1.22.2	Advanced Android recovery option possible through key combination (Volume up and down for navigation and power button for selection). 1. Reboot system now. 2. Wipe data / Factory reset. 3. Apply Android OS update from external SD Card. 4. Backup user data. 5. Restore user data.
2	**Minimum Software Requirements** **<u>Sections 2.1 through 2.6 apply only for Android. Section 2.7 applies only for GNU/Linux.</u>**		
	2.1	**Operating System, System Software.**	
		2.1.1	An open source operating system complying with an Open License approved by the Open Source Initiative (OSI) 1. Default installed OS should be latest Android stable version (At the time of drafting this specification, it is Android 4.2.1 (Jelly Bean)) 2. Dual bootable (through external SD Card) GNU/Linux distribution. Refer section 2.7 for additional OS (Linux) specification.
		2.1.2	Open source generic device drivers (for both in-built hardware including Modules/ICs, touchscreen, and external peripherals mentioned in Sec. 1.7.2) for Android should be made available. The device drivers need to be enabled at kernel level.
		2.1.3	File Manager / File Browser with capabilities to archive and extract files and folders
		2.1.4	Open GL ES 2.0 Support
		2.1.5	Maximum cold boot time of 35 seconds
		2.1.6	Maximum switching time of 5 seconds between the applications Antutu (Version 3.0.3) and Nenamark (Version 2.4) as per the provided script.
		2.1.7	Maximum image (PNG, 720p with 3M minimum file size) rendering time of 2 seconds on clicking the file in the file manager
		2.1.8	Maximum video (H.264, 720p with 100 M minimum file size) rendering time of 5 seconds on clicking the file in the file manager
		2.1.9	Android DRM support should be enabled.
		2.1.10	All 'User's' as well as 'System' applications should have writable permission to an external storage (external SD card).
	2.2	**Document Support**	
		2.2.1	Rendering and editing of document formats: DOC, DOCX, PPT, PPTX, XLS, XLSX, ODT, ODP, ODS
		2.2.2	PDF viewer
		2.2.3	Text-editor and basic note taking application
		2.2.4	E-book reader should support formats such as .epub and .pdf
		2.2.5	Most commonly used Indian Languages/Scripts read/edit capabilities 1. Read and edit capabilities of Indian Languages Hindi, Kannada, Telugu, Malayalam, Tamil, Marathi, Guajarati, Punjabi, Bengali, Oriya,

			Bihari, Assamese, Bishnupriya ,Manipuri, Urdu, Sanskrit, Devanagari scripts and languages, and new scripts and Indic languages at OS level in the latest OS and right in the rendering engine 2. Virtual keyboard (such as MultiLing) should be pre-installed for above languages and scripts at OS level or at Application level 3. Should have Unicode support at OS level 4. Default language/script should be set to English by Manufacturer. If necessary, user can set to different default language/script from the Settings panel.
		2.2.6	20 KB (all text) word document(2007) to be opened in 5 seconds from the file manager
	2.3	**Multimedia and Image Display**	
		2.3.1	Image-viewer supporting PNG, JPG, BMP, TIFF and GIF display
		2.3.2	Media software with the following playing and recording capabilities 1. Audio Formats: MP3, AAC, WAV 2. Video Formats: MPEG-2, MPEG-4, AVI, 3GP 3. Should be able to play at-least 720p. Should be able to play at a minimum speed of 30 fps
	2.4	**Communication and Internet**	
		2.4.1	Web-browser (HTML 5(with audio and video tags support), xHTML 5 compliant, JavaScript 1.8 compliant)
		2.4.2	Audio/Video/Text Chat Conferencing (minimum three way) applications
		2.4.3	Separate application for online video (capable of playing at least YouTube video)
		2.4.4	E-mail client with POP, IMAP, SMTP
		2.4.5	Calendar
		2.4.6	Default time zone (set to IST) and default language (set to English) pre-configured at the factory
	2.5	**Other utilities**	
		2.5.1	Scientific Calculator is to be pre-installed
		2.5.2	File compression & decompression utility as part of the file manager and standalone
		2.5.3	Google Play and accessibility tool (similar to talkback) should be pre-installed.
	2.6	**Developer Support**	
		2.6.1	All developer options supported by the Android OS to be made available
		2.6.2	ADB via USB and Wifi to be supported. ADB developer options need to be enabled.
		2.6.3	Device drivers for connecting the Tablet to a PC in developer mode (USB debugging) to be provided for the following OS – Windows XP/Vista/7/8
		2.6.4	Desired applications (including talkback) should be certified with Aakash Market Place and drivers need to be preloaded by the manufacturer. ADB developer option needs to be enabled. Any application that is capable of opening and editing docs (doc, docx, ppt, pptx, xls, xlsx, odt, ods, odp) need to be pre-installed.
		2.6.5	Factory reset through software settings
	2.7	**Additional OS: [Dual bootable (through external SD Card) GNU/Linux distribution]**	
		2.7.1	A stable Linux kernel with all supporting drivers for tablet hardware (including touchscreen). Vendor to provide the distribution with complete source that works with the tablet.
		2.7.2	Kernel should include drivers for generic printers, USB pen drive, USB mouse, USB keyboard, USB hub, USB to serial, USB-CDC network drivers, 3G-

			Modems, webcams
		2.7.3	The device drivers need to be enabled at kernel level.
		2.7.4	A GNU/linux distribution such as Ubuntu 12.04 LTS or Fedora 18 or Debian 7 (Wheezy). Higher versions are also acceptable.
		2.7.5	Linux distribution should support full hardware acceleration with OpenGL and Direct rendering (DRI2)
		2.7.6	Battery status indicator with functional sleep mode (power saving mode, screen turns off)
		2.7.7	Web browser with Java support (through plugin)
3.	**Mechanical and Environmental Specification**		
	3.1	Weight should be less than 500g	
	3.2	Width, height and thickness should be less than 7.5", 5" and 0.6" respectively.	
	3.3	Ambient operating temperature: 0 to 50 degree Celsius	
	3.4	Storage temperature: -10 to 65 degree Celsius	
	3.5	Operating humidity: 0% to 90% (Non-water vapour condensing). Humidity resistance for 95% humidity exposure for 10 hrs under power off conditions.	
	3.6	Maximum tablet temperature during non-charging operation should be <= 45 degree Celsius at a room temperature of 25 degree Celsius	
	3.7	LCD touch screen withstanding a pressure of 100 gm/cm^2 over full screen. Finger test of 3.14 cm^2 to be applicable at any point on the screen.	
	3.8	Scratch resistant screen for pencil/pen marks: No scratches for 0.25mm^2 tip (steel material) exerting at 50gm/cm^2 and moving at a speed of 1 m/s	
	3.9	Bending of device: Minimum of 0.25mm/100mm	
	3.10	Impact resistance of 0.5J for casing and 0.22J for display. Corner impact resistance of 1J. Tests shall be carried out using the impact hammer.	
	3.11	The exposure to dust must not allow the dust to enter in sufficient quantity to interfere with the satisfactory operation of the equipment; The testing procedure similar to IP50 may be used.	
4.	**Safety and other standards compliance**		
	4.1	Material: RoHS, WEEE	
	4.2	Safety: IS 13252	
	4.3	CISPR22/CISPR24	
	4.4	Environmental & Durability: IS9000 as applicable for equipments and as follows. **Durability Tests:** Drop (freefall)Test Height:1000mm, No. of falls: 8(4 corners + 4 edges) unpacked **Vibration test:** Frequency range:10-55Hz Acceleration:1g Duration: 45 Min/axis No. of axes: 3, Condition: Unpacked in Power Off mode **Dry heat test** Temperature:55 deg. Centigrade Duration: 16 hrs. Condition: unpacked in Power Off mode **Damp heat cyclic test** Temperature: 40 deg. Centigrade Relative Humidity:>= 90% Duration: 48h (2cycles) Condition: unpacked in Power off mode **Cold Test** Temperature: -10^{0}C Duration: 2hrs Condition: unpacked in Power off mode	

		Burn-in Test Temperature 45 deg Centigrade Duration: 48 hrs. Condition: Power on mode with mains connection through battery charger After the exposure to test conditions, the Tablet shall satisfy Visual examinations and functional requirements.	
5.	**Maintenance and Serviceability**		
	5.1	Build the following as replaceable modules for easy serviceability at qualified service centres	
		5.1.1	Battery
		5.1.2	Touch-screen and LCD module
		5.1.3	Front Camera
		5.1.4	Speaker
		5.1.5	Motherboard
		5.1.6	Casing and Plastic parts for buttons
		5.1.7	Charger (with 2-pin Indian plug/micro-USB) with the cable containing standard tablet connector
		5.1.8	Entire Tablet Casing
	5.2	Should support OTA firmware updates and upgrades through Aakash Market Place	
6	**Other Features**		
	6.1	Ability to build on Assistive Technologies – Talkback (android accessibility tool) must be pre-installed	
	6.2	All spare parts should be available for repair, service, and maintenance for a minimum of 3 years.	
	6.3	Aakash Marketplace Support with necessary security	
	6.4	User manual of the hardware, operating system, pre-loaded device drivers and pre-installed applications should be provided by the manufacturer.	
7	**Tablet Package Contents**		
	7.1	Tablet	
	7.2	External Charger/C Adapter for charging battery certified by BIS	
	7.3	USB adapter cable with Micro-B plug and Standard-A plug (minimum 1 m)	
	7.4	User Manual (Electronic form)	
	7.5	Application Manual (Electronic form)	
	7.6	Quick setup manual in print form	
8	**Testing** **<u>The tablets shall be subjected to acceptance test criteria, random sampling based test criteria and performance test based criteria.</u>**		

Appendix A – Performance Specification

Android Benchmark Test Scores Specification				
Benchmark Test	**Version**	**Min/Max Score**	**Better Criteria**	**Remarks**
CPU				
Quadrant Standard	**2.1.1**			
Overall		1469	Higher	
CPU		1469	Higher	
Antutu	**3.0.3**			
Overall		3537	Higher	
ALU-integer		689	Higher	
Floating point		163	Higher	
AndEBench	**1605**			
AndEMark Native		1565	Higher	
AndEMark Java		63	Higher	
PassMark Performance	**1.0.3000**			
Sytem		971	Higher	
CPU Tests		1299	Higher	
RealPi	**1.0.6**			
pi value calculation in Seconds (10000 digits after decimal)		0.91	Lower	
Calculation of last n digits in Seconds using gourdon's formula (here n=9)		8.436	Lower	
CF BENCH	**1.2**			
Overall		2404	Higher	
Mhz		1008	Higher	
Native MIPS		335	Higher	
Java MIPS		76	Higher	
Native MSFLOPS		122	Higher	
Java MSFLOPS		42	Higher	
Native MDFLOPS		122	Higher	
Java MDFLOPS		34	Higher	
Native MALLOCS		19688	Higher	
Java efficiency MIPS in %		23	Higher	
Java efficiency MSFLOPS in %		34	Higher	
Java efficiency MDFLOPS in %		30	Higher	
Benchmark Test	**Version**	**Min/Max Score**	**Better Criteria**	**Remarks**
Memory				
Quadrant Standard	**2.1.1**			
Memory		3679	Higher	
Antutu	**3.0.3**			
RAM		542	Higher	
PassMark Performance	**1.0.3000**			
Disk Tests		1580	Higher	
Memory Tests		1045	Higher	
CF BENCH	**1.2**			
Native memory read		818	Higher	
Java memory read		131	Higher	
Native memory write		850	Higher	
Java memory write		434	Higher	
Native disc read		240	Higher	
Native disc write		306	Higher	
Java efficiency memory read in %		21	Higher	
Java efficiency memory write in %		97	Higher	