

Proposed 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 the proposed vendor neutral Technical Specifications of Aakash IV. These specifications have been developed with a view to have a device at a low cost. The proposed Specifications of Aakash IV are as under. All interested stakeholders may examine the proposed specifications and provide their comments especially from the point of vendor neutrality, usability and functionality. The comments may sent to Prof. Rajat Moona, Director General, C-DAC (Head Quarters), Pune University Campus, Ganesh Khind, Pune - 411 007 (Telephone No.: 020-25696565, e-mail IDs: moona@cdac.in and bkm@cdac.in) by 12/ 07/ 2013.

SI 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 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). SD Card interface should be compatible with NFC based SD card.
1.7	Peripherals: One non-powered USB OTG Micro-AB Receptacle (USB 2.0 Compliant) and one powered USB Type A Standard Receptacle (USB 2.0 Compliant). USB OTG Micro-AB Receptacle can be used to connect external powered USB host or external non-powered devices through external powered USB Hub. USB Type A Standard Receptacle will be used to connect external non-powered USB device. USB ports should be reliable and of high quality. USB port manufacturer's name and its quality certification should be provided.
	1.7.1 USB Type A Standard Receptacle based port will be able to source maximum of 500mA current to attached devices
	1.7.2 Support for the following external devices 1. USB Storage Device

			<ol style="list-style-type: none"> 2. Keyboard 3. Mouse 4. USB Hub 5. All popular 2G/3G/4G 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 290 cd/m ² , 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 <ol style="list-style-type: none"> 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 6. Certification is to be obtained from WiFi Alliance
		1.13.2	Bluetooth (Version 2.1 Class 2 or better) IEEE 802.15.1 <ol style="list-style-type: none"> 1. Certification is to be obtained as per Bluetooth SIG 2. All Bluetooth Profiles supported by the Android should be enabled
	1.14	Power and Battery	
		1.14.1	Battery <ol style="list-style-type: none"> 1. Battery Capacity: Minimum 3 Hrs for online 720p video playback (LCD with a brightness of 290 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), 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 <u>when the tablet is switched OFF</u>, support charging from USB port, support charging from DC power port with receptacle compliant to EIA-J-02 (standardizing on power connector). Two colour LED indication for charging and full charge.

			<p>3. Battery Life:</p> <p>a. At 25 degree centigrade, battery should have a life of 600 cycles or 2 years (whichever is earlier) <u>with a minimum left over battery capacity of 50%.</u></p> <p>b. Capacity to be \geq 80% at the end of 300 charge cycles, <u>Capacity to be \geq 50% at the end of 600 cycles</u> (One cycle consists of standard charging, resting for half an hour, discharging with LCD with a brightness of 290 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).</p> <p>4. Self discharge: Battery charge should be \geq 90% even after 30 days (when the tablet is turned OFF)</p> <p>5. Safety: Should comply with IEC 62133 : 2002</p> <p>6. Battery Warranty: 1 year</p> <p>7. Battery Datasheet: Manufacturer of the Aakash tablet is to provide battery data sheet provided by manufacturer of battery.</p> <p>8. Short circuit and over charge protection capability.</p>
		1.14.2	Battery Charger
			<ol style="list-style-type: none"> 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: \geq 1 m 5. DC output plug: Compliant to EIA J-02 6. Nominal DC output voltage: 5 V 7. Safety and compliance: IS13252, EN 301 489-34
	1.15	3-Axis Accelerometer	
		1.15.1	Number of axis: 3
		1.15.2	Orientation change response time for home screen: \leq 3 seconds
		1.15.3	Orientation change response time for browser: \leq 3 seconds
		1.15.4	Range (m/s ²) : \geq 19.6 (Using Z-device or android sensor tool box application. Equivalent to +/- 2g)
	1.16	Driver for Phone Functionality with external dongle	
	1.17	Data functionality with external 2G or 3G or 4G dongle	
	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 (through pin-hole) 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	<p>Advanced Android recovery option possible through key combination (Volume up and down for navigation and power button for selection).</p> <ol style="list-style-type: none"> 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) <ol style="list-style-type: none"> 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 (Latest Ubuntu). 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 <ol style="list-style-type: none"> 1. Read and edit capabilities of Indian Languages Hindi, Kannada, Telugu, Malayalam, Tamil, Marathi, Gujarati, 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 <ol style="list-style-type: none"> 1. Audio Formats: MP3, AAC, WAV

			<ol style="list-style-type: none"> 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)	<ol style="list-style-type: none"> 1. Flash 9 or later support (through plugin) 2. Java support for GNU/Linux OS.
	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	SD Card interface should support NFC based SD card.	
	2.5.4	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: Ubuntu Linux Specification [Dual bootable (through external SD Card) GNU/Linux distribution]	
	2.7.1	Latest 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 tablet specific touch optimised linux distribution (e.g. Plasma Active)	
	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	<u>Width, height and thickness</u> should be less than 7.5", 5" and 0.75" 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)
	3.6	Maximum tablet temperature <u>during non-charging operation</u> 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
	3.8	Scratch resistant screen for pencil/pen marks: No scratches for 0.25mm ² tip 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 0.5G for casing and 0.25G for display. Corner impact resistance of 1G.
	3.11	Protection degree: IP50 standard
4.	Safety and other standards compliance	
	4.1	CE certification
	4.2	Material: RoHS, WEEE
	4.3	Safety: IS 13252 / IEC60950-1, IEC62115
	4.4	EMC: IEC 61000, CISPR22/CISPR24
	4.5	Environmental & Durability: IS9000 applicable for tablet pc
	4.6	Radio: EN301489-1, EN-301489-17, EN 300328, SAR
	4.7	ISI certification
	4.8	BIS Certification
	4.9	IP50
5.	Maintenance and Serviceability	
	5.1	Build the following as replaceable modules for easy serviceability <u>at qualified service centres</u>
	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) 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	<u>Quick setup manual in print form</u>

8	Testing <u>The tablets shall be subjected to acceptance test criteria, random sampling based test criteria and performance test based criteria.</u>
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Appendix A – Performance Specification

Android Benchmark Test Scores Specification					
Test Category					
Test Applications					
Sub-tests					
Benchmark Test	Version	Serial No.	Min/Max Score	Better Criteria	Remarks
CPU					
Quadrant Standard	2.1.1	A1.1			
Overall		A1.1.1	1469	Higher	
CPU		A1.1.2	1469	Higher	
Antutu	3.0.3	A1.2			
Overall		A1.2.1	3537	Higher	
ALU-integer		A1.2.2	689	Higher	
Floating point		A1.2.3	163	Higher	
AndEBench	1605	A1.3			
AndEMark Native		A1.3.1	1565	Higher	
AndEMark Java		A1.3.2	63	Higher	
PassMark Performance	1.0.3000	A1.4			
Sytem		A1.4.1	971	Higher	
CPU Tests		A1.4.2	1299	Higher	
RealPi	1.0.6	A1.5			
pi value calculation in Seconds (10000 digits after decimal)		A1.5.1	0.91	Lower	
Calculation of last n digits in Seconds using gourdon's formula (here n=9)		A1.5.2	8.436	Lower	
CF BENCH	1.2	A1.6.1			
Overall		A1.6.2	2404	Higher	
Mhz		A1.6.3	1008	Higher	
Native MIPS		A1.6.4	335	Higher	
Java MIPS		A1.6.5	76	Higher	
Native MSFLOPS		A1.6.6	122	Higher	
Java MSFLOPS		A1.6.7	42	Higher	
Native MDFLOPS		A1.6.8	122	Higher	
Java MDFLOPS		A1.6.9	34	Higher	

Native MALLOCs		A1.6.10	19688	Higher	
Java efficiency MIPS in %		A1.6.11	23	Higher	
Java efficiency MSFLOPS in %		A1.6.12	34	Higher	
Java efficiency MDFLOPS in %		A1.6.13	30	Higher	
Android Benchmark Test Scores Specification					
Test Category					
Test Applications					
Sub-tests					
Benchmark Test	Version	Serial No.	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	

Android Benchmark Test Scores Specification					
Test Category					
Test Applications					
Sub-tests					
Benchmark Test	Version	Serial No.	Min/Max Score	Better Criteria	Remarks
Database with SQL					
AndroBench	3.4				

IOPS stands for Input/Output Operations per Second and TPS stands for Transactions Per Second					
Sequential Read in MB/s			15.73	Higher	
Sequential Write in MB/s			18.8	Higher	
Random Read			9.9	Higher	
Random Write			0.45	Higher	
SQLite Insert(TPS)			214.59	Higher	
SQLite Update(TPS)			151.13	Higher	
SQLite Delete(TPS)			223.88	Higher	
Antutu	3.0.2				
Database			260	Higher	
RL Benchmark SQL	1.3				
1000 INSERT in (s)			0.76	Lower	
25000 INSERTs in a Transaction in (s)			2.892	Lower	
25000 INSERTs into an indexed table in a Transaction in (s)			2.84	Lower	
100SELECTs without index			0.1	Lower	
100 SELECTs on a string comparison in (s)			0.07	Lower	
Creating an index in (s)			0.86	Lower	
5000 SELECTs with an index in (s)			2.6	Lower	
1000 UPDATES without an index in (s)			6.08	Lower	
25000 UPDATES with an index in (s)			6.64	Lower	
INSERTs from a SELECT in (s)			1.7	Lower	
DELETE without an index in (s)			2.12	Lower	
DELETE with an index in (s)			2.33	Lower	
DROP TABLE in (s)			0.39	Lower	
Overall in Seconds			29.9	Lower	

Android Benchmark Test Scores Specification					
Test Category					
Test Applications					
Sub-tests					
Benchmark Test	Version	Serial No.	Min/Max Score	Better Criteria	Remarks
Video Performance					
Antutu	3.0.3				
2D graphics			400	Higher	
3D graphics			1400	Higher	
BaseMark GUI	1.0				
Basemark GUI score with native resolution			37.345894	Higher	
Basemark GUI score with 720p (offscreen)			23.159739	Higher	
NenaMark 2 in fps	2.4		30.7	Higher	
PassMark Performance	1.0.3000				
2D Graphics Tests			1308	Higher	
3D Graphics Tests			593	Higher	
Phone Tester	1.82				
DPI X			160	Higher	
DPI Y			164.42	Higher	
Dimensions			800X480	Higher	

Android Benchmark Test Scores Specification					
Test Category					
Test Applications					
Sub-tests					
Benchmark Test	Version	Serial No.	Min/Max Score	Better Criteria	Remarks
Web Browsing Performance					
Octane	1.0				
Richards			1181	Higher	
Deltablue			709	Higher	

Crypto			1122	Higher	
Raytrace			714	Higher	
EarleyBoyer			1355	Higher	
Regexp			223	Higher	
Splay			407	Higher	
NavierStokes			437	Higher	
pdf.js			580	Higher	
Mandreel			357	Higher	
GB Emulator			1056	Higher	
CodeLoad			658	Higher	
Box2DWeb			317	Higher	
Octane Score			620	Higher	
BrowserMark	2.0				
Score			590	Higher	
Conformity CSS3 2.0 in %			44	Higher	
Conformity HTML5 2.0 in %			47	Higher	
SunSpider	0.9.1				
3D in ms			347.9	Lower	
Access in ms			247.6	Lower	
Bitops in ms			185.1	Lower	
Control Flow in ms			19.8	Lower	
Crypto in ms			202.2	Lower	
Date in ms			530.7	Lower	
Math in ms			243.5	Lower	
Regexp in ms			132.9	Lower	
String in ms			1098.7	Lower	
Total in ms			3008.4	Lower	

Android Benchmark Test Scores Specification					
Test Category					
Test Applications					
Sub-tests					
Benchmark Test	Version	Serial No.	Min/Max Score	Better Criteria	Remarks
Battery					
Battery Test					
Wi-Fi OFF (Mins)			592	Higher	
Wi-Fi ON Not Connected to an AP (Mins)			501	Higher	
Wi-Fi ON Connected to an AP (Mins)			497	Higher	
Wi-Fi ON 20 MB download (Mins)			454	Higher	
Wi-Fi On 80MB download (Mins)			420	Higher	
Without Interference 80MB Download (Mins)			454	Higher	
% of battery discharge from 100% in a stronger signal (-30 dB to -40 dB) strength (carried out for 60 min) with 80MB download			15	Lower	
% of battery discharge from 100% in a weaker signal (-70dB to -85dB) strength (carried out for 60 min) with 80MB download			22	Lower	
AnTuTu Tester	1.3.5				
Battery Test			567	Higher	