> GTA04
> * aus Sicht von OM's strategischen Ueberlegungen incl 'Prolog'
> * aus Benutzersicht (usecases)
> * aus technischer Sicht (Datenblatt)
> * Regeln zur Bewertung der Machbarkeit einzelner Details
> * Spezifikation fuer EE (=FG-W. Erweitertes Datenblatt mit BOM-
> Vorschlag)
> * aus Sicht des Projektleiters (OM-SOP and HR, timelines etc)

1 Positioning of GTA04 in Openmoko's line of products, characterization of GTA04, customers tageted.

[[to be done by management]]

based on GTA01, GTA02 case and product id.

Targeted customers: Geeks used to GTA02

2 GTA04 usecases

Run OM2007

Run OM2008

Run any standard Distribution of Linux, after cross-compile (e.g. Debian)

Use like a „usual“ cellphone, i.e. have the feature set like a standard Nokia phone, for selecting ringtones, profiles, constant or instant up display with info like „time of day“, „associated to GSM / signal strength“...

3 technical properties

[[this is an intermixed collection of user-targeted product specification (like in „product specifications:“ in a user-manual) and engineering notes which had to be reworded and move to §5.

Included are specs from GTA02 from wiki, which have to be reviewed and adapted to exclude details too specific technical (like e.g. manufacturers of components) and to be more specific at large where GTA02-specs were fuzzy or don't apply to GTA04]]

NEW FEATURES:

1. 3G(UMTS), preferably with HSPA, quadband

   Use pre-certified module for GSM/UMTS.
   Module should be changeable by user (use connectors, no soldering). Rationale: UMTS/3G royalties are percent of device value, so selling an expensive PDA without UMTS, plus a “cheap” module to be inserted by user will significantly reduce those costs.
   Connector shall have two signal lines from module to a SIM-multiplexer on main board, so a later module firmware update can enable multi-SIM operation.
   SIM control and data lines should be Y-routed to CPU GPIO for debug purposes. [see 9. Dual-SIM]

   Consider option to replace GSM module by a sat-phone module (e.g Iridium, Turaya)

Try to find out what such a module might look like and what we had to take care of to guarantee interchangeability.

2. additional data and signal inputs / outputs, wired

- Wired AV-connectivity

  We are using 3.5mm 4-pin AV-connector according to

  http://members.omtp.org/Lists/ReqPublications/Attachments/36/OMTP_Local_Connectivity_Wired_Analogue_Audio_v1_0.pdf.,

  augmented by definition of additional functions for particular pins.

  Basic pin definition of this de-facto standard is as follows (augments in *italic)*

pin	function1 [3)]	function2	function3	function4
1/base	GND	Antenna for <1GHz radio		
2/lower ring	hs-mic+bias mono, button *(detection of several buttons by probe of resistance to GND. TBD: specify valid R-values. E6?)*	CVBS video composite out	*CVBS video composite in*	*power source for stereo mic >1.5V, Ri<1k*
3/upper ring	right out *(HiFi-power [1)])*	*right line-in (HiFi [2)])*	*SP/DIF, PCM, Dolby digital link, in/out*	
4/tip	left out *(HiFi-power [1)])*	*left line-in (HiFi [2)])*	*A/Din DC, for sensors etc. May be programmed pullup to >=1.5V by 50K, to detect impedance of connected component*	

1): HiFi-power:
20~20,000Hz +/- 3dB @ 8Ohm~10kOhm load, Power: >20mW @ 16Ohm
THD and Noise S/N: >80dB @ 1Vrms @ 100Ohm and 20mW @ 16Ohm [[TBD]]

2): HiFi:
Input 2Vrms@1kOhm for +3dB at maximum attenuation. Boost amplifiers may be configured for higher sensitivity. THD+S/N according to 1)

3): Function of particular pins is indepenently selectable. For Mono applications, left is used.

Additional function of this 3.5mm receptacle is to provide optical TOS-Link digital output and input.

Receptacle should be closed to inside of device, to keep dust and water outside.
Mechanical sturdiness: [[TBD. Should survive drop-test. Compare 2.5mm datasheet]]
Electrical: Must survive short of any pins to each other, and short to GND of power-supply. ESD protection up to same level as rest of device, with any type of cable plugged in (I.e. direct ESD to any pin). Should survive or easy-repair-break on insertion of a common universal power supply, 3~12V AC/DC.

- USB

  One micro-USB-AB-connector for USB2.0-OTG highspeed.
  [http://www.usb.org/developers/onthego], capable of delivering 500mA USB-VBUS in host-mode.
  Connecting of host or device, and wake from USB-suspend should start device from suspend and from power-down, to handle event. (exception: USB-suspend isn't allowed for power-down state)
  Charging and battery-less startup of core-functions incl display, from host's USB-VBUS and standard-USB-charger.
  Charger detection according to USB2.0-charger specification.
  Receptacle should be closed to inside, to keep dust and water outside.
  Mechanical sturdiness: [[TBD. Should survive drop-test]]
  Electrical: Must survive short of any pins to each other, and short to GND of power-supply. ESD protection up to same level as rest of device, with any type of cable plugged in (I.e. direct ESD to any pin). Should survive or easy-repair-break on insertion of a common universal power supply, 3~12V AC/DC.

- Antennae:

  External GSM-connector, most common standard for receptacle - to connect car GSM-antenna.
  External connector (type: [[TBD]]) for combined BlueTooth- and WLAN-antenna.
  Internal or external GPS connector.

[[from here on TBD. Just some topics to give an idea until next version of this document]]

3. IrDA and IR-Remote:

   SIR OK, we don't need FIR (fast IRDA).

   IR-LED wavelength is the one used for widespread custom IR-Remote, not IrDA wavelength (Rationale: IrDA is fine with Remote-wavelength, for short distances, but remote has poor sensitivity/range with IrDA-wavelength). So we don't use IrDA-transceiver module.

   Device can „learn“ IR-remote codes **and** carrier-frequency (~30KHz) from IR-receiver photodiode.

   Remote (and IRDA) is sw-driven by CPU (Suggestion: UART in/out + one GPIO or better analog output/input from audio-mixer for carrier-freq detection/injection. Probably GPIO/analog ANDed with / gated by UART)

Boot-console outputs directly to IR-LED (via UART) at 19200baud, 8N1, to „connect“ debug terminal-RX by simply placing a photodiode next to IR-LED of GTA04. (purpose: contact-less debug-connector)

IR-LEDs high output type, should cover at least the two octants [long-axis:up, stylus-axis:up, hsjack-axis:left] and [long-axis:up, stylus-axis:up, hsjack-axis:right], means we probably need 4 IR-LEDs: left, up, right, front.

Photo-diode should be aligned long-axis:up

Photo-diode should also be sensitive to visible spectrum [IR..blue], and can be read out by A/D converter to sense ambient light.

4. NFC / RFID

   [[TBD. We need expertise for NFC, to define the functions/protocols we want to implement. What kind of RFID functionality are we talking about? Reader or emulate an RFID-tag?]]

5. Acceleration

   One 3-axis G-meter and one 3-axis gyro; alternatively one InertialMeasurementModule. G-meter must have programmable threshold and wake-from-suspend interrupt generation for CPU, like in GTA02, and shall be low-power for extended periods of standby-state of device. Gyro should be sensing range of automotive navi dead-reckoning (<15°/s [[TBD]]) up to moderate velocity gestures (~360°/s [[TBD]]); high accuracy on low rotational speeds has priority over extending upper limit of range (Rationale: dead-reckoning needs high accuracy, whereas gesture recognition probably can be done perfectly from rise- and fall-steepness of rotation plus duration or rotational movement). Gyro should be low power, or needs a separate enable to power down while wake-from-suspend (and powering up gyro) is handled solely by G-meter (rationale: We don't know of a situation, where device needs to wake from suspend on a pure rotational movement exactly through axis of G-meter. So we assume detection of linear acceleration component of any movement is sufficient to handle wake-on-move).

6. Optical mouse sensor as X/Y scroll-”wheel”

   Infrared optical mouse module located next to AUX-button, on the beginning of plane surface of “hs-jack-side”, so it can be operated with thumb of holding left hand. Additional use cases: ultra-precise detection of velocity, direction, and distance of movement of objects in relation to device, e.g. robotics, digitizing roads off paper maps, electronic “folding meter rule”...

7. graphics

   We use graphics acceleration of CPU Video driver. Should be sufficient for playing VGA-size movies, and do common 2D/3D-hw-acceleration [[TBD. Probably we should ask Raster]]

   If video / graphics circuitry supports CVBS video-out/in (PAL and NTSC), we will use this option and route the signal to AV-connector [see 2. Wired AV-connectivity]

8. Touchscreen

   - We will mill out ~70% of material thickness from front cover of housing, where LCM is touching the front cover – so LCM surface comes more into same plane with front surface, and fringe will be reduced where you can't touch TS because of nearby bevelled

edge of (black) front cover. Actually for tool that means we need a thin additional metal frame welded on to he tool, in a form resembling the rubber frame found on the inside of the front cover

- Device uses same resistive type TouchScreen as GTA02. The connection has to be different in a way to use a resistor between actual current-source of each plane, and the A/D-input pin. This setup is also known as 8-wire resistive TS scheme – please note that we don't actually need 8 wires on TS to implement this scheme. The purpose is we can measure for change in resistance of **one** plane in itself, caused by dual-point or large area contact to the other plane. We establish some kind of multitouch abilities this way
  [[TBD: give pointer to paper/powerpoint-document of c't-author on this topic]]
  Cost: 2 CPU-GPIO pins, 2 resistors.
- Put LCM on some piezo-actuator(s). Those can operate as sensors and deliver a voltage very linearly correlating to actual pressure on LCM, independent size of area this pressure is applied to. So with one piezo you can distinguish different force even when using a stylus. With 3 of these piezo-components, you have a completely independent way to sense force **AND position** of a touch, by simple trigonometrically evaluating the touch point from relation of value values.
  When applying external voltage to the piezo(s), they can move the whole screen direction in and out of the device for a fraction of a millimeter, this operation scheme has been tested with a iPhone by some university students IIRC to signal hitting borders of virtual buttons with the stylus moving over the screen – it results in a sensation like there was no flat surface but instead a noticeable profile like small gaps between keys of a keyboard. [[TBD: that's no spec, it's an essay :-/]]

9. second SD-card. external insertion of SD-Card.

   Device must have one internal swappable SDHC-card, to hold kernel and rootfs incl. /home. Should have a second externally accessible SDHC-card, that can be hot-swapped. Rationale: multimedia content should be rapidly swappable, e.g. for inserting different movies of some GB and living one a separate SD-card each, or rapid replacement of storage during camera use.

10. dual-SIM (triple-SIM?)

    Nice to have: 2..3 SIM-holders, multiplexed to SIM-datalines of GSM-module. Multiplexer circuitry should be able to operate on both, either GPIO from CPU (for “manual” switching between SIMs, by powering down GSM-module, selecting new card, and then powering up GSM-module again) or dedicated selectlines from GSM-module itself (option when GSM-firmware eventually learns to handle multiple identities/SIMs concurrently, so we want 1~2 dedicated address GPIO lines from GSM-module, WiredAnd with 1~2 GPIO from CPU, and controlling multiplexer. This way GSM-module also could read back which card was selected by CPU, and vice versa).
    SIM-datalines to multiplexer of GSM-module should also be monitored and controllable by CPU GPIO, for purposes like e.g. SIM-protocol analysis and Remote SIM-Access-Profile via BlueTooth handled by CPU.

11. Camera.

    Module, 180° rotation for front view (camera) and view to user (video-phone).
    Should be removable module, to address needs of business environment where camera isn't allowed. Idea is to have a plugable module, that's either a) located between screen and

lanyard hole, and can be plugged in two ways round, either to face stylus-axis:up or stylus-axis:down., or b) have a round “bolt” with camera module inside facing radial, which can protrude from small side “hs.jack-surface” to the left of device in a line along lower border of screen. When in active position this round bold can be rotated around it's long axis, thus making the camera face in any direction parallel to plane stylus-axis/long-axis. Pushing the bolt inside the case of device to form a plane surface is disabling the camera.
Protrude/retract and rotate action could be managed by a micromotor, thus creating a geeky experience, a remotely operable 360°-camera, and a mechanical actuator for e.g tilting the case of device (to adjust laserpointer) or robotics purposes maybe in combination with mouse scrollwheel sensor on same plane of case. [[TBD: graphics to make more clear, check actual size of camera module]]. This bolt coult be pulled out like a plug, to remove camera, and replace it with a dummy plug to close hole.
Quality of camera: [[TBD]]
Needs direct connection to CPU / video-out graphics core, for 30fps @ VGA or better.
If mechanical pattern b) is used, i.e. camera can face “up-front”, it should be able to use infrared flashlight from IrDA

12. photolight / torch
    Device needs a superbright white LED for camera flashlight and torch use. 1W or 5W xxx-type [[TBD]] preferred. Yet to be discussed whether it's mounted coaxial with camera (on module or in bolt), or should always face stylus-axis:down, for fast use as a torch light and user won't like camera light on video call.

13. laserpointer
    Hmm, well – a $0.30 red laser pointer aligned long-axis:up, on the right side (maybe a little bit tilted to the right [=ouside] – see below).
    Use cases:
        classic laser pointer (needs mode to operate from pushbutton)
        optical long range transmission, by modulating laser same way as IrDA/IR (reception via photodiode [see IrDA] which is aligned same axis)
        Laser spirit level in conjunction with G-meters.
    Especially for use case #2 and #3 the mechanical actuator function of camera bolt [see 10. Camera] comes in handy.

14. AM/FM-radio with TMC; DRB

    FM-stereo-radio (also AM if feasible). Of course audio is routed to audio-mixer, so device can record, route to any audio-sink (AV-connector, IR/RF/Saser-tx). Tuning controlled by CPU. Can decode Traffic Message Channel and associated data (station-id etc) superimposed on radio signal. Antenna via AV-connector.
    There should be a 0R which blocks radio functionality for countries where high taxes on selling radio devices are an issue. (rationale: user can easily remove 0R to enable radio, customs won't find a way to show any radio functionality as they aren't supposed to “break” device when testing)

15. DVBT

    Same as previous point, just we need decoder for MPEG DVB-T code, and sufficient bandwidth from this decoder (CPU or dedicated hardware) to video-buffer.

16. 433/866MHz transceiver (RF-remote and stereo-hs applications)

    The 433/866MHz band hosts a multitude of different low-power shortrange data/signal-transmission and remote devices, like garage door opener, home control, alarm systems, toy remote, remote climate sensors, serial data transmission, wireless stereo headsets, etc pp. All of these applications have in common a modulation that's either analog up to some xx Khz, or is similar to the digital coding / decoding scheme we use for IR-Remote/IrDA. So this radio is another subsystem modulated by same methods like IR-LEDs and Laser. Should use internal antenna (PCB-antenna) - mainly for xmit, and alternatively AV-connector antenna – mainly for rcv.

17. DECT-phone
    [[TBD. check feasibility, available chips, etc]]

18. Universal radio instead of prev. 4 points (and point #4)

    Consider whether the single-purpose transciever chip solutions for NFC, AM/FM-radio, DVB-T, and 433/866MHz radio, can be replaced by a single more general approach handling all of these. [[TBD: evaluate which of the functionality has to run concurrently, so we can't use same circuit for both. E.g. WLAN+BT need to run independently of all the above mentioned functions]]

19. Power

    - Barrel connector to supply power while in USB-host-mode (dual way power supply: USB & barrel)
    - Goldcap to supply phone suspend mode (low power, all xmitters off) during change of battery (>15sec). Switch to detect removal of battery *before* contact to battery is cut (to do emerency suspend just in time before power fails).
    - contact-less electromagnetic charge (electric tooth brush type)? Problem: needs huge coil.

      OR

    - gold/newsilver-plate contacts for easy cradle drop-in? (rationale: power is the only thing very difficult to substitute connection by some sort of wireless technology, and is needed most frequently. You don't exactly need USB always when in cradle, and you may connect CVBS-video occasionally, but power usually needs to be refreshed multiple times a day)

20. Thermo-, Baro-, Hygro-meter

    There are cheap chips. Sense altitude / barometric pressure (avionics!)
    Need to be placed in direct contact to environmental air (speaker breakout of housing?)

21. Proximinty Detector for earpiece

    To detect placing the earpiece speaker to the ear, so device can switch from speakerphone to handset profile. Also could be used to augment “dimensions” of gesture recognition. Suggestion: use an IR reflective sensor. There's been a similar concept in a Nokia-phone some years old [[TBD: replace this goofy-sentence with a decent pointer]]

22. outdoor ruggedized

23. ... to be continued

Features

Display- Topply o2.8, 480 x 640 pixels, VGA, 200 NIT minimum, resistance type touch, 8-wire connected for limited multitouch capabilities.

User Interface Navigation- Touch screen on LCD, 2 control “buttons”, 1 Power button, 1 Aux

Built-in 802.11b/g Radio with full support by FOSS driver, AP-mode, Monitor-mode Promiscuous mode for security audits and mesh applications. External Antenna-connector

Built-in Bluetooth 2.0 + EDR (CSR and support PCM audio, full A2DP support)

1 built-in Tri-Axis sensor, one Gyro-Sensor

Built in GPS Radio – -130 dBm with internal antenna, -157 dBm tracking on chipset specification, TTFF under 40 seconds with -130 dBm signal strength, and tracking (u-Blox)

Antenna – Specialized antenna for best in hand hold GPS, GPRS and Wi-Fi/Bluetooth performance are required, -105dBm on receiving, Tx 30dbm+2 on GSM

External Antenna – MMCX GPS connector

UMTS/3G Radio –GSM/GPRS radio. A Pre-PTCRB certified module will be preferred

Linux – Linux kernel 2.6.24 or later Openmoko kernel

USB2.0-OTG compliant - Client and Host mode switch-able (to be used for software downloading), provide host 500mA/5V power

Power- Normal mode power will be via 1200 mAh battery with built-in coulomb counter, [GTA02-smart-battery]. Battery will keep device in standby mode. Battery life (Approximation/Ideal Target) Standby time 150-200 Hrs (GSM) Talk time (Backlight off) Up to 3-4 hrs(GSM)

Charging of battery in device by autonomous dedicated charger circuitry, feedback of charging/full state via LED on power-button

LED- 3-color-LED indicator under Aux/Power button key

Hardware Specification

[edit]Hardware Electrical

400/500 MHz Samsung 2442B Processor/SOC (400 minimum, ARM920T core, ARMv4T)

Boot code in NAND FLASH or 2MB NOR FLASH (optional design)

128 MB SDRAM total, 64 MB CPU internal, 64 MB external

256MB NAND Flash MCP package.

[edit] Display

Topploy VGA ; 72.2mm (2.84”) diagonal, 480 x 640 pixels, 16 bit color depth

Transmissive display: good readability in high ambient light is essential

White LED backlight. Required brightness is 200 NIT minimum.

Resistance type touch panel.

[edit] WiFi 802.11 b/g transceiver

Must have GPL support source or GPL compatible policy

TX power at 11 Mbps: 13 dBm minimum

RX sensitivity at 11 Mbps: -89 dBm desired, -83 dBm minimum

AP mode desirable, not required

WEP and WPA supported

Atheros preferred because of its GPL policy

[edit] Serial interfaces (UART)

Three serial interfaces are required

Console

A-GPS and GPS

GSM/GPRS

[edit] Accelerometer

2x accelerometer required

Could support interrupt while suspend or power save mode

3 axis sensing

[edit] A-GPS

GPS chipset receiver and antenna

Sensitivity at Antenna port: -157 dBm tracking on chipset specification

LNA and SAW filter for maximum interference protection

Cold start time to first fix: 40 sec typical at -130 dBm, 60 sec max

Must support GPL for Assist-GPS function with open API

Industry quality GPS

Could fit in GTA01 GPS area on the PCB

[edit] GPS Antenna Performance

Antenna is passive and internal; 15 mm x 15 mm ceramic patch is nominal design

Antenna LNA and SAW filter are required to meet GPS performance

15 mm square ground plane (minimum 1 mm ground border around patch) (TBA)

There will be one external GPS antenna connector (MMCX)

C/N ratio should higher than 35 on production testing

[edit] Buttons

Touch screen over LCD is primary data entry mechanism

Two “hard” buttons: Power button (on side of Neo1973) is a mechanical switch actuated by a plastic pushbutton in a hole in the housing. Aux (911) button on the top of the device, All two of these buttons, when pushed by the operator, are binary inputs (on/off or pressed/not pressed) to the software. The effect of each button is determined by the application software in the device

Buttons may need to be backlit

50000 cycles on hardware specification

[edit] Sound outputs

Speaker in box (need good volume and acoustic behavior in noisy environments)

Audio is monophonic

Max volume: 100 dB at 5 cm to assure good performance in environment.

Support earphone with mic by jack

[edit] Power Design Requirements

Software based power management unit preferred

NXP PCF series preferred

Need support charge from USB function

Need support powered by USB function

Power switch: Neo1973 will have a power switch, for power on/off and suspend

Power/Aux switch must be backlit

Switch controls whether device is running or suspended by presses of the switch

Switch does not shut off the power; it only suspends/resumes the device

Internal Li-Ion or Li-Polymer battery is included. This battery supplies standby power to the device eliminates the rebooting of the device when local power is again reapplied. Battery is 1200 ma-hr.

Battery life (Approximation) Ideal/Target Standby time 150-200 Hrs (GSM) Talk time (Backlight off) Up to 4 hrs(GSM)

Estimated current draw for the entire device when in suspend mode (and ALL peripherals are turned off or set for deep sleep) is <5 mA at 3.6 volts (Li-Ion terminal voltage).

GSM module deep sleep(alive and keep contact with base station) stage should take less than 8mA

Battery will reach half capacity (~600 mAh) with *NOT LESS THAN* 500 charge-discharge cycles. This will occur in **NOT** less than 2 years of daily service. [[What a nonsense!! Our GTA02 battery musn't last longer than 2 years ??!!!??]]

When powered continuously, Neo1973 must suspend (to low power mode) based either on observed low battery voltage condition or a configurable time delay.

Neo1973 must monitor battery status while suspended and resume automatically if the charger is inserted.

Primary power connection: 1200mAh battery

USB charger have ID pin 47.5k pull down for Openmoko identification

Indicators: an LED indicator visible from the side of the unit will illuminate when charging or have missing incoming call

[edit] GSM/GPRS

850/1800/1900 and 900/1800/1900 MHz bands must be supported

Design should allow for multi-band version (850/900 MHz)

Module based GPRS transceiver could meeting PTCRB and appropriate FCC certifications. It

preferred that the module be pre-certified with PTCRB or OTA test

FCC/CE certification required for GSM/GPRS part

[edit] GSM-GPRS Antenna Performance

-105 dBm receiving on each channel (GSM/PCS)

30+2 dBm transmission on GSM channel

[edit] Wi-Fi Modules

Must support GPL driver

Atheros AR6k preferred

Flash version required

[edit] Wi-Fi Antenna Performance

The Wi-Fi antenna with TX 13 to 15 dBm

RX -89 to -83 dBm @802.11b 11Mbps or an equivalent performance antenna

[edit] Bluetooth

CSR BC4 or later solutions

[edit] USB

Neo FreeRunner GTA02 will have USB, client/host. Using USB 1.1

Provides USB host 5v power

Could be powered by USB

[edit] Microphone

1 microphone is in the device

[edit] Firmware Image

Using Linux 2.6.24 or later

Could support boot from NAND or Boot from NOR

Shipping image should come with basic phone function

Could do full firmware upgrade by USB cable

[edit] PSN

Device will have a PSN (product serial number) printed on the product label and machine readable in system NAND memory

[edit] IMEI

Production phase should have IMEI code written

[edit] Package Specification

Weight: ~133 grams with battery.

4 in 1 laser pen passed RoHs and safty regulation for laser equipment safty

1x 512MB microSD Card (SanDisk/Transcend)

1x USB cable Standard A to mini-B connector

1x 1200mAh smart/gauge battery

Quick start guide

5v USB power cord w/100-240 switchable power plug

Safety card, warranty card

Package could pass 1m to 1.5m drop test

AC USB charger,100v-240v, Passed UL and all required safety regulation

Must pass FCC/CE certification

Must pass NCC certification for Taiwan import regulation

RoHS Compatible

WEEE Report required

[edit] Life Cycle Specification

[edit] Product Life

The product is designed to last a minimum of 2 years.

[edit] Operating Temperature

Target operating range is –10°C to +60°C

[edit] Storage Temperature

-15 deg C to +70 deg C

[edit] ESD

The device can withstand a 4.0kV contact discharge and 8.0kV air

[edit] Drop test

Should pass 1m direct drop to concrete ground or 1.5m on slide with carpet

4 technical properties – detail changes from GTA02 (Details addressed to EE for design)

These are technical details that don't exactly make for new product features, from customer point of view, but instead line out improvement suggestions from the generic design of GTA02

Changes:

1. Speaker / Earpiece

   Don't use any more dedicated earpiece speaker, but instead place sounder/speakerphone speaker in place of earpiece small speaker. Build internal audio path and enclosure in a way so most / all of the sound is coming out of earpiece opening. See [21. proximity detector for earpiece] on how to avoid too high audio levels when listening to a call by holding the device to the ear.

2. instead of a vibrator the device uses the actenuators to vibrate the LCM for a better effect due to higher moved mass [[TBD: test for decent effect – though can't be worse than the weak vibrator]]

5 basic guidelines for evaluating feasibility of product features

As GTA04 is addressed to demanding geek customers, the first rule is to cram the device with as many features as possible, no matter whether they are reasonably usable in everyday use, or maybe just satisfy a niche demand. It's not important how may customers are actually using e.g the laserpointer on a everyday basis, it's more the point what potential exotic new scenarios are enabled by the particular feature, and of course how “geeky” and unique these new scenarios are in the imagination of the customer and his friends. So a mere laserpointer is a nice-to-have, but not really exciting – a modulated laserpointer that can establish virtually tap-proof communication over a distance of several kilometers, or a laser tripwire by simply using a cateye type of reflective, that's an exciting perspective absolutely unique to a device like this. Even when it never will get used in the real world, it's a property to distinguish GTA04 from every other phone you may find anywhere.

If we can think of potential uses like this laserpointer, and it's only a few cent to implement them, we always will want to do that. The less cost and real estate some feature costs in relation to the functionality we get from it, the better chance it makes it to final design. Same for features we don't think are mandatory, but we get them almost for free on the chips we use anyway (in the end it's the same story), like e.g. video-out on 6410 CPU, which only costs us an encoder chip for a few cents, but gives the quite unique feature to connect the GTA04 to a television and use it as a video-player.

Whenever we decide we don't want to implement a feature we **could** implement (like e.g. camera interface on GTA02's 2442 CPU), the first rule is to think how we can keep **the option** at least, by e.g. not spoiling the interface by dual use for some other functions we could realize in a different way as well. Instead we like to keep some -at least theoretical- path for customer to exploit the functions we didn't make use of in MP-design, by creating a small pad or via to access a pin, using

other GPIO pins to keep a complete function bank free of dual-usage blocking future extensions, etc pp.

The word for GTA04 isn't “do we need it?”, it's “can we do it? Let's do it even more smart! Get more function from same or less amount of hardware. Think synergy!”

In best Unix tradition, provide a set of building blocks, and the more generic and non tailored to fit a single purpose these are, the more amazing the results will be we will see from our creative customers.

6 OM SOP and HR

We give FG-W abstract spec (like "WLAN802.11") and a suggested BOM (e.g. "6410 CPU"). Then we ask them to create a schematics that is maximum SW-compatible to GTA03, while not sacrificing the better decision to compatibility. I'll stay in close contact with their EE dept, and based on a day by day discussion about new schematics details will try to guide them in a direction so we get a HW-design comparable to our own GTA03 design in the end.

The purpose of this operating procedure is twofold: We can not pass them out schematics for a base to evolve from there, as they could deny any responsibility for bugs in the final device. And we want to see a second design done by an independent group of developers, so we (i.e. me n the first instance) can compare the OM-solution with the FG-W-solution, so we end up with some sort of completely "double-checked" design.