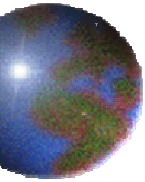


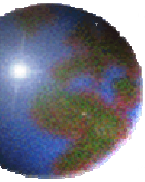
**FCC Filing Exhibits:  
Block Diagram  
Operation Description  
Tune Up**

***Tim Dwyer***



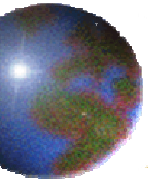
## **SCOPE:**

- **Block Diagram,**
- **Operation Description**
- **Tune-Up Exhibits**
- **Purpose**
- **Content**
- **Consistency**
- **Checklist**

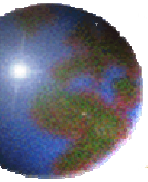


## BLOCK DIAGRAM

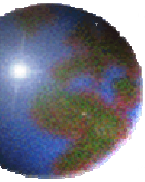
- ***2.1033(b)(5) A block diagram showing the frequency of all oscillators in the device. The signal path and frequency shall be indicated at each block. The tuning range(s) and intermediate frequency(ies) shall be indicated at each block. A schematic diagram is also required for intentional radiators.***
- ***2.1033(c)(10) A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.***



- **One of most important documents to application technical reviewer.**
- **Should work in conjunction with the Operation Description**
- **Should contain enough information to provide the reviewer with a quick assessment of the capabilities of the device to be certified.**
- **Wireless section(s) of device should be clearly identifiable.**
- **All wireless functions should be included.**
- **Block diagram should show all RF outputs and antennas.**

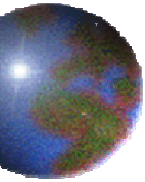


- **In case of multiple outputs and or antennas, circuits between the outputs and antenna(s) (e.g. FEM) should clearly show whether they are switch type devices or combiner type devices.**
- **For multiple output devices, it should be clear whether power can be delivered to multiple antennas simultaneously and if simultaneous operation on multiple bands or channels is possible.**
-

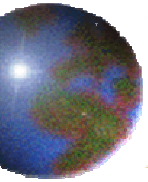


## Operation Description

- ***2.1033(b)(4) A brief description of the circuit functions of the device along with a statement describing how the device operates. This statement should contain a description of the ground system and antenna, if any, used with the device.***
- ***15.204(c)(3) Manufacturers shall supply a list of acceptable antenna types with the application for equipment authorization of the intentional radiator.***
- ***2.1033(c)(10) A schematic diagram and a description of all circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power.***

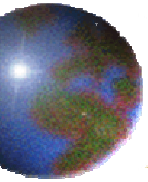


- **Should provide the functional capabilities of the device including types of modulation, operating frequency ranges, and output powers.**
- **Should work in conjunction with the Block Diagram**
- **In a case where a generic device or module is used that has certain capabilities disabled, this should be stated.**
- **E.g. If a WiFi + BT module is used, but BT is disabled, state that BT is disabled.**
- **Description of antenna(s) types, gain, frequency range, type of connector used, etc. Sometimes submitted as a separate antenna specification exhibit**



- **For multiple output devices, it should be clearly described whether power can be delivered to multiple antennas simultaneously and if simultaneous operation on multiple bands or channels is possible.**





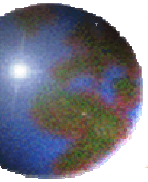
***2.1033(c)(4) Type or types of emission.***

***2.1033(c)(5) Frequency range.***

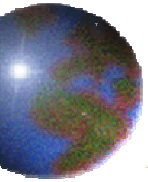
***2.1033(c)(6) Range of operating power values or specific operating power levels, and description of any means provided for variation of operating power.***

***2.1033(c)(7) Maximum power rating as defined in the applicable part(s) of the rules.***

- The above information must be submitted for licensed devices and should be included in a document provided by the manufacturer.
- Probably most convenient to provide all of the above in a single document type “Operation Description”

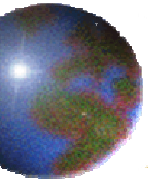


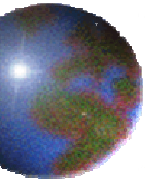
- It needs to show the maximum power possible for the device including any tolerances.
- It is preferable to provide a single value for maximum power instead of nominal power and tolerance.
- So Maximum Output Power: 32 dBm
- Instead of Maximum Power: +/- 2 dBm
- In applications involving SAR evaluation, the maximum specified output power must be consistent with target power used for SAR scaling.
- The maximum power value must be provided for each frequency range over which the device operates.



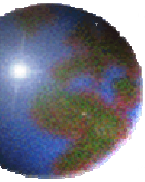
## **Tune-Up Procedure**

- ***2.1033(c)(9) Tune-up procedure over the power range, or at specific operating power levels.***
- **Traditionally required for legacy devices that required tuning of the RF output stages to achieve maximum output power.**
- **In many cases, the tune-up exhibit has been used to provide information about maximum power. It is probably better to put it in another document.**



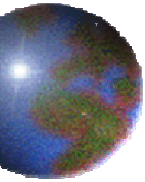


- **May not be required for many current products, however the FCC system requires that an exhibit be uploaded with type “Parts List/Tune-Up”**
- **If a “Tune-up” exhibit is not provided, then a brief document should be provided explaining why it is not needed. This will be uploaded with the application to fulfill the system requirement.**



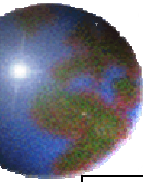
## Consistency

- **Information in these technical documents must be consistent with information in other application documents.**
- **Example 1: Block diagram and Op Desc show capability in 850, 1700, and 1900 Mhz bands, so the Part 22/24/27 test report should have test data for all three bands and for the modulations specified.**
- **Example 2: The block diagram shows a single WLAN antenna. The test setup photos should show only a single antenna. The test report should not show test results for MIMO**



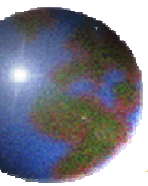
# Checklist Examples

	OK	NOK
<b>Block Diagram</b>		
Shows signal paths		
Shows frequencies of all oscillators		
Shows all RF outputs, connections and antennas. (e.g. 3 x3 MIMO should show 3 antennas, 3 RF ports, interface circuits (switch/combiner), signal paths, for each		
Shows tuning ranges and frequencies delivered to each antenna.		
Block diagram separate from operation description to fulfill FCC filing system requirement		
If multiple output (e.g. MIMO) it clearly shows whether power can be delivered to more than one antenna simultaneously.		
Simultaneous operation on multiple channels or bands indicated		

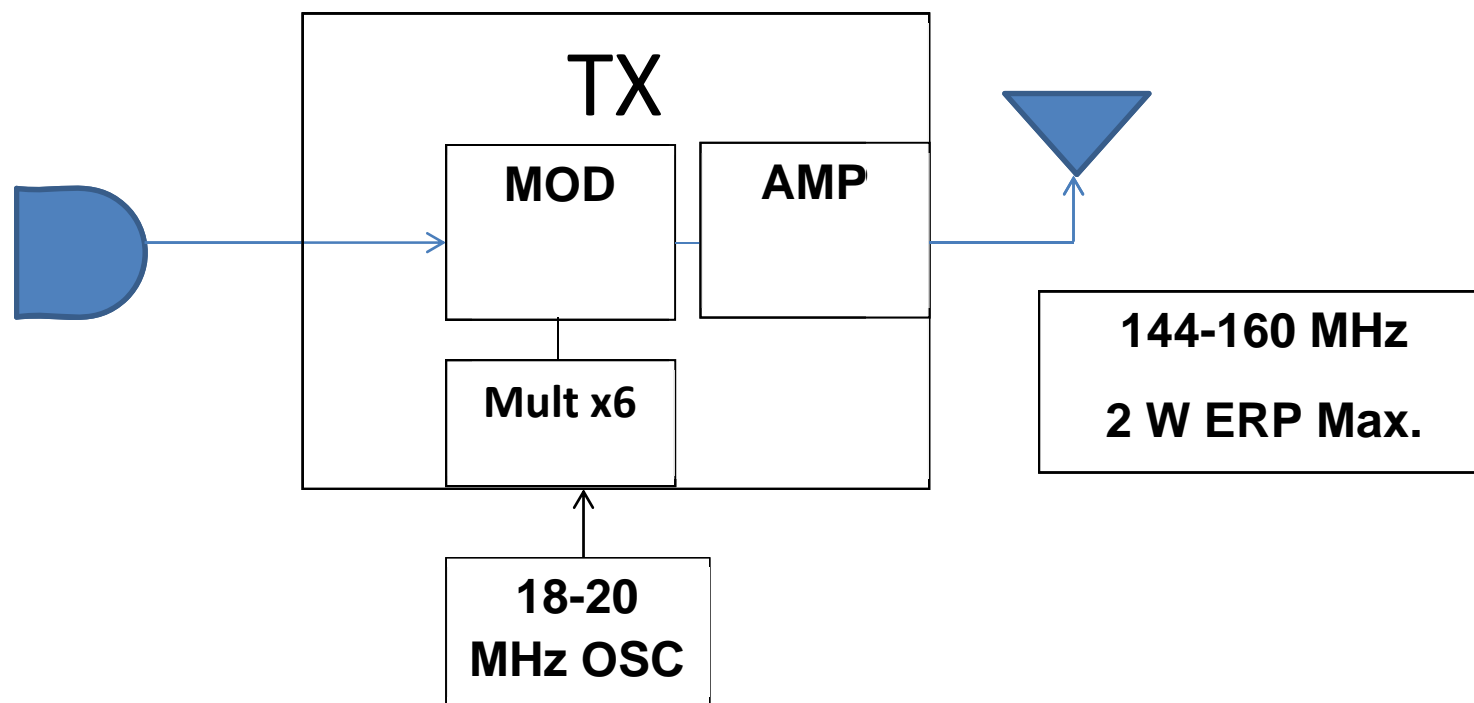


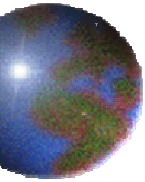
	<b>OK</b>	<b>NOK</b>
<b>Operation Description</b>		
<b>Frequency Range(s), Channel List</b>		
<b>Maximum power for each frequency range and modulation</b>		
<b>Type(s) of emission (i.e. modulation type and emission designator)</b>		
<b>Antenna(s) list and description</b>		
<b>Compliance with antenna requirements of 15.203 &amp; 15.204</b>		
<b>Functional description consistent with information provided in the block diagram.</b>		
<b>Statement confirming and describing how hardware and or software settings are made inaccessible to users. (May be a separate document)</b>		
<b>Client or master per 15.202</b>		
<b>Active/Passive Scanning</b>		
<b>Ad Hoc, WiFi Direct, Hotspot, ANT+ etc.</b>		
<b>BT version, BLE implemented?</b>		



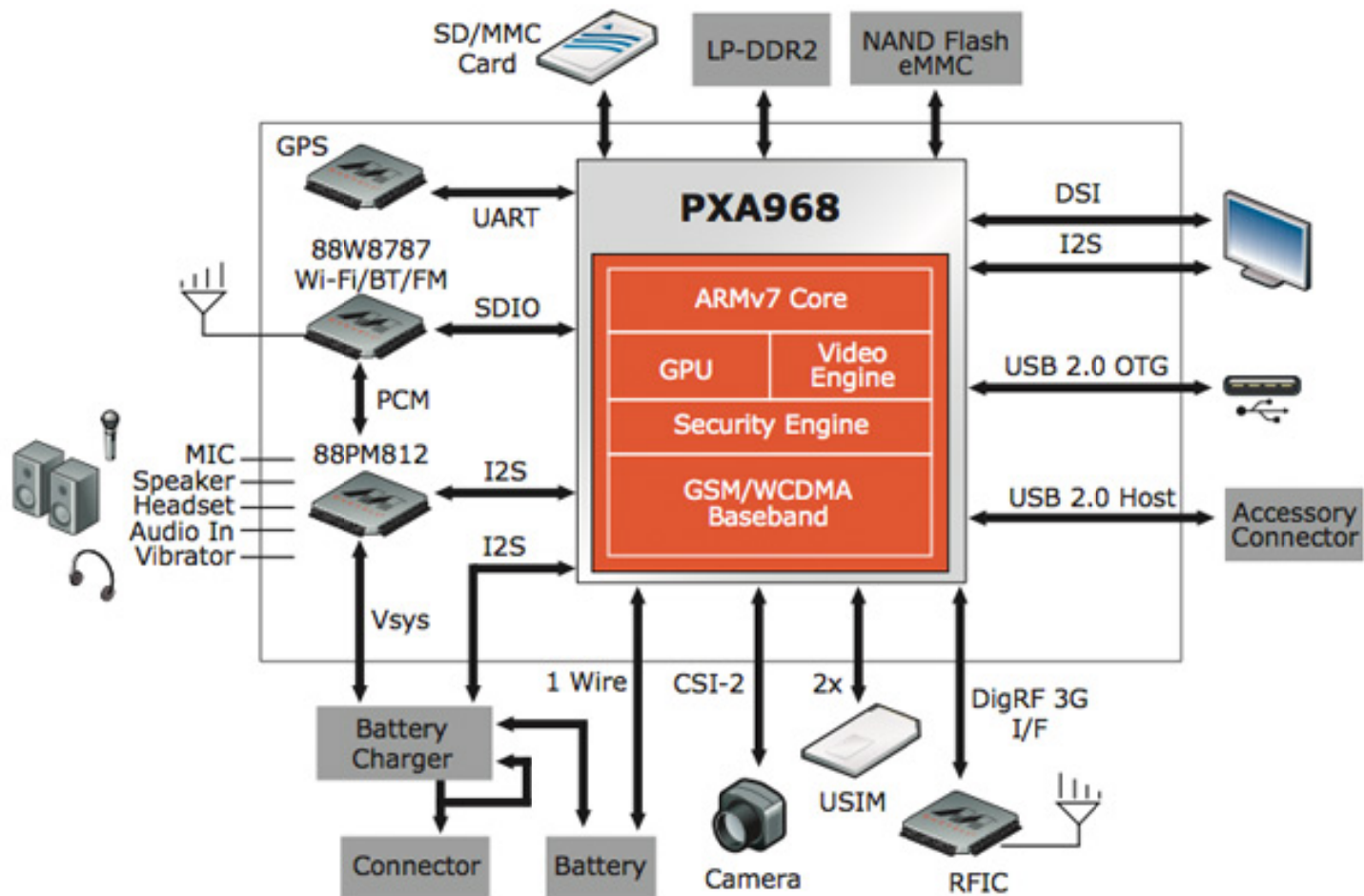


# The way it was....



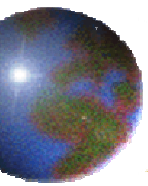


### BLOCK DIAGRAM



The way it us **Figure 1: ARMADA 968 Application Processor**

From Marvell <http://www.marvell.com/communication-processors/pxa968/>



# BLOCK DIAGRAM

2412-2462 MHz 802.11bg WLAN  
 2402-2480 Mhz BT 4.0 + BLE  
 FM 88-108 MHz RX ONLY TX PERMANENTLY DISABLED IN THIS APPLICATION

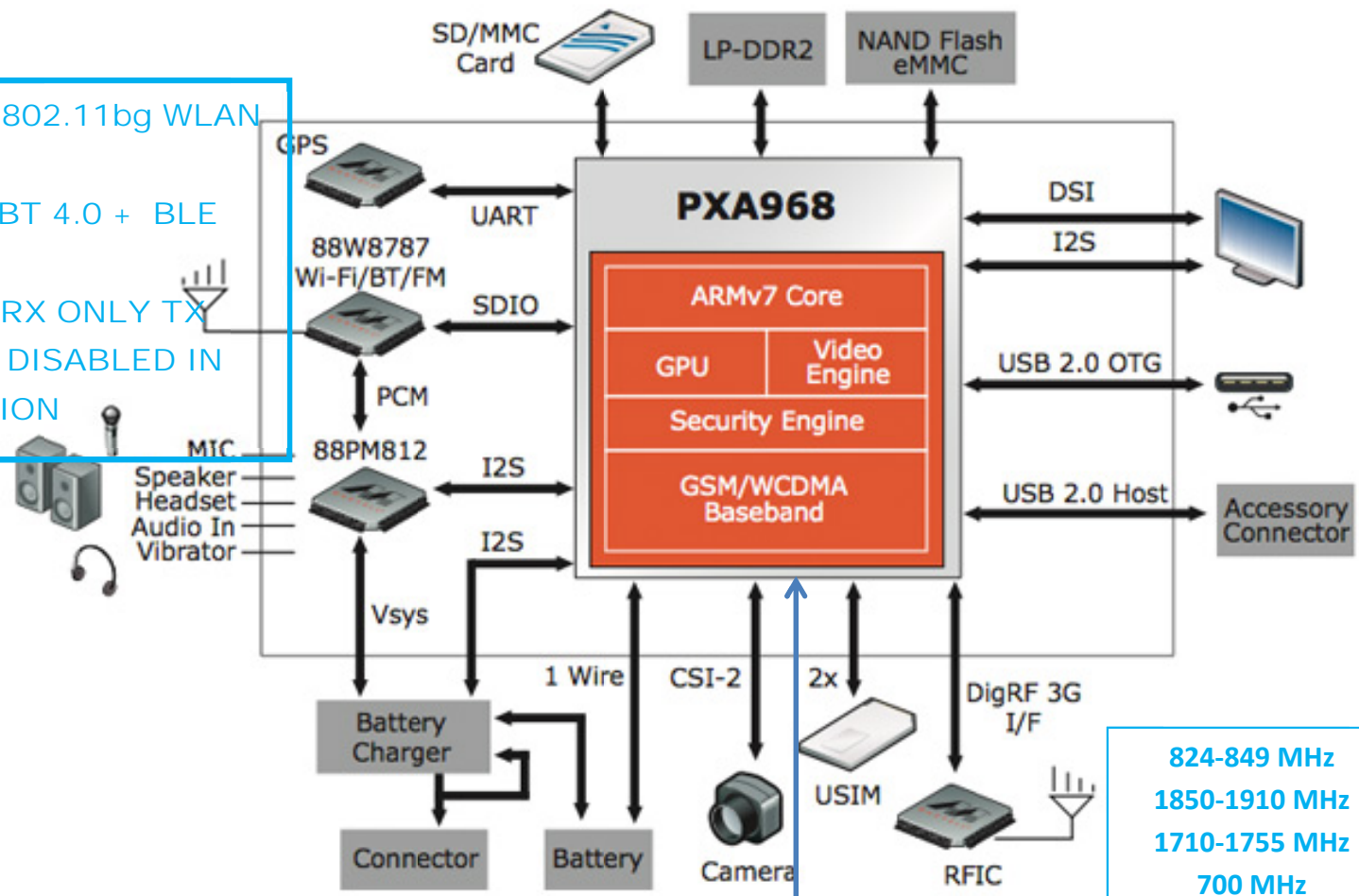
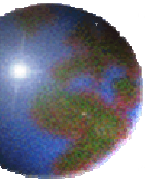
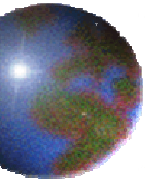


Figure 1: ARMADA 968 Application Processor



## OPERATION DESCRIPTION (EXAMPLE)

Frequency Range (MHz)	Max Peak Cond Power (dBm)	Max Avg Cond Power (dBm)	Modulation	Nominal BW (MHz)	Emission Designator
2412-2462(1)	25	20	802.11b/g DSSS/OFDM	20	G1D
2422-2452	20	17	OFDM	40	D1D
2402-2480	5	5	GFSK	1	F1D
824-849	29.5	29.5	GSM/GPRS	.25	GXW
824-849	19.5	17.5	HSDPA	4	F9W
1850-1910	26.5	26.5	GSM/GPRS	.25	GXW
1850-1910	21.5	18.5	HSDPA	4	F9W
1710-1755	19.5	18.5	HSDPA	4	F9W
88-108(2)	na	na	Rx Only TX Disabled.	na	na
700 MHz(3)	na	na	Disabled	na	na



- (1) Channels 1-11 only. Channels 12-14 are permanently disabled.**
- (2) FM TX capability is permanently disabled.**
- (3) 700 MHz chip capability is permanently disabled.**

**>>>>>ADDITIONAL INFORMATION ABOUT THE PRODUCT AND ITS CAPABILITIES<<<<<<<<<**

**“The Model ZYZ is a cellular phone operating GSM/GPRS/HSDPA in the 850, 1700 and 1900 MHz bands. It features 2.4 GHz WLAN, BT 4.0, and FM radio receiver. It is based on the xxx chipset.....”**

**>>>>>Additional capabilities, specifications, functional description, etc<<<<<<<**