

SAR Analysis Report

(Based upon upper bound transmission duty factor)

E-Reader

Model No: POCKETBOOK 603/903

FCC ID: YDUERD100

For

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Rev. A

Revision History

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1. Executive Summary:

This document presents an analysis demonstrating that the Advanced Multi Tech POCKETBOOK 603/903 eReader (the “POCKETBOOK 603/903”) qualifies for SAR test exclusion. It includes the calculation of an Upper Bound Transmission Duty Factor (“UBTDF”) for the POCKETBOOK 603/903, based on FCC guidelines set forth in “Information requirements for FCC considerations of relevant upper bound transmission duty factors to qualify e-book devices/e-readers for SAR text exclusions,” dated January 7, 2010 and “RF Exposure procedure review: e-reader – estimating a conservative transmission duty factor” TCB council workshop presentation dated April 28, 2010. The max. data size limitation via 3G network is 10 MB via cellular network.

2. Product Overview:

POCKETBOOK 603/903 is a hand-held content reader embedded a 802.11b/g/n WiFi+ BT combo card, granted under FCC ID: YDUPB602R1/ YDUPB902R1. Its relevant features are as follows:

- The POCKETBOOK 603/903 allows an end user to browse, purchase and download books and periodicals via 3G (Subject to service availability) / WiFi / Bluetooth wireless data access.
- POCKETBOOK 603 is 6 inches eBook reader and POCKETBOOK 903 is 9.7 inches eBook reader.
- WiFi SAR has been evaluated under FCC ID: YDUPB602R1/ YDUPB902R1 already.
- This RF exposure assessment will be applied to the FCC ID: YDUERD100 which is seeking for C2PC filing for alternating the portable hosts of POCKETBOOK 603/903.

3. Wireless Technology:

- For WiFi connectivity, POCKETBOOK 603/903 uses a 802.11b/g/n WiFi+ BT combo module from Broadcom / BCM4329 which is embedded inside POCKETBOOK to connect WLAN to access the eBook store. (FCC ID: YDUPB602R1/ YDUPB902R1)
- The POCKETBOOK 603/903 uses 3G wireless mobile broadband module manufactured by Sierra Wireless / MC5728V (FCC ID: N7N-MC5728 and changed in ID to Advanced Multi Tech FCC ID: YDUERD100) without voice communication capability. The wireless interface supports CDMA2000 1x RTT and 1xEV-DO REV A data services.

4. Radio Protocols:

The POCKETBOOK 603/903 supports following RF protocols:

1. CDMA2000 / 1xEVDO Rev A
FDD BAND II (1900 MHz band)
FDD BAND V (850 MHz band)
2. WiFi
802.11 b (2.4 GHz band)

- 802.11.g (2.4 GHz band)
- 3. 802.11n (2.4 GHz band)
- Bluetooth (2.4GHz band)

WiFi / Bluetooth is always the preferred radio access technology. POCKETBOOK 603/903 will connect by WiFi / Bluetooth before connection to the cellular network through any of the RF protocol it supports. If a supported WiFi WLAN / Bluetooth is not found, POCKETBOOK 603/903 will register and authenticate to the cellular network while continuing to search for WLAN access points at regular intervals. However, in no case will POCKETBOOK 603/903 use more than one radio access technology at a time.

In summary, POCKETBOOK 603/903 uses WiFi / Bluetooth as the default means of connection and if WiFi is not available, it will use the cellular network.

5. Software Connection Manager:

When using a wireless connection the following priorities are used when content is required:

- 1) By WiFi, if a WLAN is available
- 2) By the cellular network if WiFi is not available.
- 3) Once the connection is made either via WLAN, Bluetooth or 3G network, the software connection manager will apply to WiFi or 3G connectivity in the same way.

The software connection manager sequence of the POCKETBOOK 603/903 in 3G network is as follows:

- The default mode of the POCKETBOOK 603/903 wireless radio is OFF; user has to turn on the wireless function by switch on the wireless function.
- Once wireless function is turned on, POCKETBOOK 603/903 will be seeking the connection to WLAN; only if WLAN access is not available, POCKETBOOK 603/903 will be seeking the connection to the public network.
- When the POCKETBOOK 603/903 receives any of the following requests, it powers ON the 3G module using the order of priority listed above in order to seek to wireless connection and prompts a download from the eReader Store:
 - 1) A download request directly from the end user
 - 2) For subscribed content, where the end user has purchased a subscription to receive a new edition of periodical content on a daily, weekly or monthly basis, the Advanced Multi Tech eReader Store server attaches a parameter to each edition of the downloaded content. This parameter designates the timing of the next download. The POCKETBOOK 603/903 then activates the 3G module based on this parameter to access Advanced Multi Tech eReader Store server and download the current edition.
- Following the completion of a download, and upon receipt of a command from the Advanced Multi Tech eReader Store, the POCKETBOOK 603/903 returns the 3G module to an IDLE state.
- After 10 minutes in the IDLE state without any further content requests, the POCKETBOOK 603/903 switches OFF the 3G module off automatically.

6. Intended Use Cases:

POCKETBOOK 603/903 uses its 3G or WLAN access functionality to allow the user to use the eReader Store as follows:

1. Browse and Search for content at the eReader Store.
 - The end-user may use the POCKETBOOK 603/903 to access eReader Store home page, which displays lists of available digital book content based on certain categories, such as bestsellers or new arrivals.
 - The user may also search for available digital book content by author or title.
2. Purchase and download the content from the eReader Store.
 - After identifying a selection, the end user can view an overview of the content, information about the author of the content, user reviews of the content, and recommendations for additional content based on the title and the author of the selected content.
 - The end user may then select the content to buy on the store by following the purchase process and then will download the content to the device for reading.
3. Synchronize/Download previously purchased content from the eReader Store to the POCKETBOOK 603/903.
 - The end user may download content to a personal computer using the Reader Library PC software and then re-download the content to POCKETBOOK 603/903 wirelessly via WiFi or 3G radio.
 - The end user may also transfer previously purchased content from a PC to the POCKETBOOK 603/903 via USB cable.
 - The end user may also schedule the POCKETBOOK 603/903 to download periodical content at pre-determined times.

The POCKETBOOK 603/903 does not allow 3G wireless downloads of device software or firmware. The end user must perform any necessary software or firmware updates by downloading the update to a personal computer and then transferring the update to the POCKETBOOK 603/903 or can be transferred via wireless LAN.

The POCKETBOOK 603/903 is a data only device and does not support voice communications.

7. Data Rates

Table 1

Protocol	Average Downlink		Average Uplink		Worst Case
	Low	Max	Low	Max	Download Data rate
1xRTT	80 kbps	100 kbps			100 kbps
EVDO	300 kbps	700 kbps	80 kbps	100 kbps	300 kbps

8. EVDO UBTDF

8.1. Content categories

The available content in the bookstore is categorized according to sizes and types of content.

File size categories:

The following size categories can be found in the book store:

- < 5 MB
- 5 – 10 MB
- 10 – 20 MB

Content categories:

Based on recorded values, the percentage of types of content downloaded are the following:

Content Category	Table 2/ Percentage of Total Downloads (%)
eBooks	80
Newspapers	5
Magazines	15

These numbers were recorded directly in the Multi Tech e-Reader Store (<http://www.bookland.net>) . It is forecast that these numbers also will not have a noticeable change in the future.

8.2. Upper bound transmission duration

For each file size category, it is possible to calculate the longest download time. The transmission duration can be calculated according to the following formula:

$$\text{Upper bound transmission duration} = \frac{\text{File size}}{\text{upper bound data rate}}$$

The following table lists the upper bound transmission duration of each file size category and the percentage of the total downloads for each file size category.

Table 3/ File Size Distribution for Each Content Type				
File Size (MB)	Upper Bound Transmission Duration (seconds)	eBook file Size Distribution (%) of total download	Newspaper file size Distribution (%) of total download	Magazine file size Distribution (%) of total download
< 5 MB	136.53	80	99	50
5 – 10 MB	273.07	15	1	40
10- 20 MB	546.13	5	0	10

The above numbers are based on assumptions for current as well as future distributions in the book store.

8.3. Weighted download duration

The average download time of each type of downloadable content is calculated as follows:

Download duration = upper bound transmission duration · % of total downloads

Example: File Category 2-5 MB

Download duration = 58.51 seconds · 11.37 % = 58.51 seconds · 0.1137 = 6.66 seconds

The total average download duration of each type of content equals the sum of all download durations of all different file size categories.

Table 4/ Original Download Size Distribution before adjusted for large download > 10 MB							
File Size (MB)	Upper Bound Transmission Duration (seconds)	eBook file Size Distribution (%) of total download	Weighted eBook download duration (seconds)	Newspaper file size Distribution (%) of total download	Weighted Newspaper download duration (seconds)	Magazine file size Distribution (%) of total download	Weighted Magazine download duration (seconds)
< 5	136.53	80.00	109.22	99.00	135.16	50.00	68.27
5 – 10	273.07	15.00	40.96	1.00	2.73	40.00	109.23
10- 20	546.13	5.00	27.31	0.00	0.00	10.00	54.61
Total			177.49		137.90		232.11

Table 5/ Content Category Distribution before adjusted for large file size (>10MB)			
A	B	C	D
Content	Weighted Total time to download (s)/ From Table 4/column D/F/H/J	% of total download / from Table 1	Weighted composite Download time per category (s)

EBook	177.49	80	141.99
Newspapers	78.51	5	3.93
Magazines	23.08	15	3.46
Total Weighted Composite Download Time (s)			149.38

Exposure concerns may arise for infrequent occurrences of continuous transmissions more than a couple minutes; especially when user may not be aware of such circumstances with respect to wireless modes, data rates, expected transmission durations etc. To address such concerns, the frequency of occurrences for downloads larger than 10 MB should be limited.

The download time is computed according to the slowest download rate (currently 300 kbps for EVDO) and the upper range of each download file size. This transmission time is weighted by the frequency of occurrences for the download size and content category. For each download size range, the combined frequency of occurrences for all content categories for download sizes larger than 10 MB should be limited. The percentage of occurrences for download size is multiplied by the percentage of occurrences for the corresponding content category in each download size range and summed across all content categories for that download size range. The aggregate percentage across all content categories for each download size range should be less the maximum percentage computed by the equation below.

The weighted download duration is also adjusted according to the ratio of the actual download size (MB_{range}) to a 10 MB download to qualify for SAR exclusion.

$$\text{Max. allowed \% (large downloads)} = \frac{10 \text{ second}}{\frac{MB_{range} * 1024 * 8}{300 \text{ kbps}}} * \frac{10\text{MB}}{MB_{range}} * 100\%$$

The maximum percentages calculated using the above equations for selected MB_{range} are listed below. A download size step range of 10 MB is typically appropriate; however, it should not be less than 5 MB or larger than 20 MB. For conservativeness, only the high end of each range (MB_{range}) should be used in the calculations.

Table 6 (Max. Allowed % for large file size Vs Sum of actual download % for each category)

A	B	C	D

MB (range)	Un-weighted time (second)	Actual %	Max. Allowed (%)
< 5 MB	136.53	76.45	14.65
5 – 10 MB	273.07	18.05	3.66
10- 20 MB	546.13	5.50	0.92
The sum of actual percentage for each download size range should be less than the max. allowed percentage shown in above to qualify for SAR exclusion.			
Conclusion: The actual % for above 10 MB is greater than the max. allowed percentage, SAR exclusion cannot be qualified.			

Column B / un-weighted time= (MB (range) * 1024 *8) / 300 kbps.

Column C / Actual %:

For example:

Step 1: Column A: for file size in the range of 10 – 20 MB size, use upper file size which is 20 MB

Step 2: As indicated in table 3, 1% of eBook download is for file size in 10 -20 MB range. As indicated in table 2, eBook content distribution percentage is 30%.

Step 3: Combined %=download % *content %; = $0.05 \times 0.8 = 0.04 = 4\%$

Step 4 : repeat the same steps as indicated above to calculate combined % for newspaper/magazine and internet content.

Step 5: Sum the combined % for all category for specific file range.

Column C = 4 /ebook+0/newspaper+1.5/magazine =5.5%

Table 7/ Adjusted for large download							
File Size (MB)	Upper Bound Transmission Duration (seconds)	eBook file Size Distribution (%) of total download	Weighted eBook download duration (seconds)	Newspaper file size Distribution (%) of total download	Weighted Newspaper download duration (seconds)	Magazine file size Distribution (%) of total download	Weighted Magazine download duration (seconds)
< 5 MB	136.53	80	109.22	99.00	135.16	50.00	68.27
5 – 10 MB	273.07	15	40.96	1.00	2.73	40.00	109.23
For download sizes > 10 MB:							
Combined download size and content category distributions are indicated in (); where combined %=download % *content %;							
for example, $0.05 \times 0.8 = 0.04 = 4\%$. The sum of these for each download size range should be less than the max. allowed percentage shown in Table X to qualify for SAR exclusion.							
10- 20 MB	546.13	5.00	27.31	0.00	0.00	10.00	54.61
		(4%)	54.62	0	0	(1.5%)	109.22
Total		204.8		137.89		286.72	

When multiplying these numbers with the download durations of the appropriate type of content, the result is the weighted download time per type of content:

Weighted download time per type of content = download duration * percentage of content

Example: eBook downloads

Weighted download duration = 172.02 seconds * 0.8 = 137.62 seconds

The weighted download duration of all types of content is the sum of the different weighted download times.

Table 8 / Content Category Distribution adjusted for large download sizes > 10 MB			
Type of Content	Weighted Download Duration (seconds)	Percentage of total content (%)	Weighted Download Duration (seconds)
eBook	204.8	80	163.84
Newspaper	137.89	5	2.96
Magazine	286.72	15	18.43
Weighted Download Time			185.23

The weighted download time represents the average download duration regardless of its size or type.

8.5. Duration of Events - UBTDF calculation (EVDO)

Calculation of the UBTDF requires the definition of the various events that an end user follows when searching for and purchasing an random content downloads or periodical on the POCKETBOOK 603/903.

The following table describes these events, and lists the duration of each event and the measured TX-ON time for each event. Both the measured TX-on times and event duration are conservative values that represent a worst-case condition.

Table 9 / Upper bound transmission duty factor based upon weighted composite download			
<u>STEP</u>	<u>EVENT</u>	<u>Event Duration [sec.]</u>	<u>TX-ON Duration [sec.]</u>
1	Power up module and register on Network The wireless module is powered on and established authentication with cellular network	30	10
2	Launch embedded Reader Application	30	0
3	Review on Book Store Home menu	60	0
4-1	Search for content (1)	40	8
4-2	Review search results	25	0
4-3	Select an item for purchase.	11	6
4-4	Review search results	160	0
5-1	Search for content (2).	40	9
5-2	Review search results	25	0

5-3	Select an item for purchase	9	9
5-4	Review search results	150	0
6-1	Purchase transaction.	20	10
6-2	Download content.	193.23*	185.23
6-3	Purchase completed.	10	1
Total (sec.)		803.23	238.23
UBTDF		<u>29.66%</u>	

Some steps require an action from a user. The duration of these events is based on the duration that a person needs to complete these actions. These duration values are derived from user program testing and reflect conservative usage durations to ensure upper bounds limitations are being tested. The TX-ON times have been all measured except for the event “Download content”. For this event, the duration is calculated by adding (8) seconds* to the weighted download time calculated in a previous section (185.23 seconds).

* Eight (*) seconds are needed for the PDP (Packet Data Protocol) context to be finished.

9. 1xRTT Analysis

In the 1xRTT mode of operation, there is little uplink activities during the file download. The pilot signal is primary used for equalization, reference and control purpose. In the 1xRTT mode of operation, it is not required to send UL acknowledgement during download. As provided in table 1, the worst case download data rate used is 100 kbps.

1XRTT analysis is based on the longest uplink transmission and shortest downlink transmission. As indicated in table 3 (data size distribution), using 5MB file size with highest download data rate will maximize UBTDF when the download duration is minimized.

Download Duration = 5 Mbyte)*1024 (Kbyte/Mbyte) * 8 (Bit/Byte)/100 Kbps=409.6 seconds

Table 9 / Upper bound transmission duty factor based upon weighted composite download			
STEP	EVENT	Event Duration [sec.]	TX-ON Duration [sec.]
1	Power up module and register on Network The wireless module is powered on and established authentication with cellular network	30	10
2	Launch embedded Reader Application	30	0
3	Review on Book Store Home menu	60	0
4-1	Search for content (1)	40	8
4-2	Review search results	25	0
4-3	Select an item for purchase.	11	6
4-4	Review search results	160	0
5-1	Search for content (2).	40	9
5-2	Review search results	25	0
5-3	Select an item for purchase	9	9
5-4	Review search results	150	0
6-1	Purchase transaction.	20	10
6-2	Download content.	417.6*	0
6-3	Purchase completed.	10	1
Total (sec.)		1027.6	53
UBTDF		<u>5.16%</u>	

10. RF Conducted Output Power Measurement

RF Power Output Results for EV-DO Rev A

Cell Band

FETAP-Traffic Format	RETAP-Data Payload Size	Channel	f (MHz)	Conducted power (dBm)	
				Average	Peak
307.2k, QPSK/ ACK channel is transmitted at all the slots	4096	1013	824.70	25.00	29.81
		384	836.52	25.07	29.82
		777	848.31	24.70	29.22

PCS Band

FETAP-Traffic Format	RETAP-Data Payload Size	Channel	f (MHz)	Conducted power (dBm)	
				Average	Peak
307.2k, QPSK/ ACK channel is transmitted at all the slots	4096	25	1851.25	24.30	28.71
		600	1880.00	24.77	29.11
		1175	1908.75	24.90	28.98

RF Power Output Results for 1XRTT

1xRTT - Cell Band							
Radio Configuration (RC)	Service Option (SO)	Conducted Output Power (dBm)					
		Ch. 1013/824.7MHz		Ch. 384/836.52MHz		Ch. 777/848.31MHz	
		Average	Peak	Average	Peak	Average	Peak
RC1 (Fwd1, Rvs1)	1 (Voice)						
	2 (Loopback)	24.65	28.90	24.86	28.71	24.40	28.20
	3 (Voice)						
	55 (Loopback)	24.75	29.10	24.86	28.99	24.50	28.60
	68 (Voice)						
RC2 (Fwd2, Rvs2)	9 (Loopback)	24.65	28.92	24.85	29.02	24.45	28.66
	17 (Voice)						
	55 (Loopback)	24.70	29.01	24.80	29.04	24.63	28.78
	32768 (Voice)						
RC3 (Fwd3, Rvs3)	1 (Voice)						
	2 (Loopback)	24.70	28.67	24.80	28.76	24.45	28.29
	3 (Voice)						
	55 (Loopback)	24.70	28.69	24.86	28.67	24.45	28.23
	32 (+ F-SCH)	24.68	28.65	24.88	28.64	24.50	28.36
	32 (+ SCH)	24.90	29.15	24.90	29.05	24.50	28.65
RC4 (Fwd4, Rvs3)	1 (Voice)						
	2 (Loopback)	24.68	28.75	24.85	28.68	24.43	28.34
	3 (Voice)						
	55 (Loopback)	24.70	28.61	24.82	28.75	24.43	28.18
	32 (+ F-SCH)	24.70	28.71	24.85	28.69	24.50	28.28
	32 (+ SCH)	24.85	28.84	24.87	28.75	24.45	28.18
RC5 (Fwd5, Rvs4)	9 (Loopback)	24.65	28.70	24.75	28.73	24.51	28.32
	17 (Voice)						
	55 (Loopback)	24.65	28.79	24.75	28.72	24.43	28.23
	32768 (Voice)						

1xRTT – PCS Band

Radio Configuration (RC)	Service Option (SO)	Conducted Output Power (dBm)					
		Ch. 25/1851.25MHz		Ch. 600/1880MHz		Ch. 1175/1908.75 MHz	
		Average	Peak	Average	Peak	Average	Peak
RC1 (Fwd1, Rvs1)	1 (Voice)						
	2 (Loopback)	24.20	27.80	24.55	28.18	24.65	28.35
	3 (Voice)						
	55 (Loopback)	24.20	28.00	24.56	28.57	24.65	28.48
	68 (Voice)						
RC2 (Fwd2, Rvs2)	9 (Loopback)	24.20	28.05	24.63	28.43	24.65	28.41
	17 (Voice)						
	55 (Loopback)	24.20	28.02	24.53	28.48	24.70	28.35
	32768 (Voice)						
RC3 (Fwd3, Rvs3)	1 (Voice)						
	2 (Loopback)	24.30	27.95	24.62	28.22	24.63	28.27
	3 (Voice)						
	55 (Loopback)	24.20	27.85	24.60	28.26	24.64	28.25
	32 (+ F-SCH)	24.40	27.98	24.65	28.17	24.72	28.23
	32 (+ SCH)	24.40	28.10	24.67	28.59	24.74	28.49
RC4 (Fwd4, Rvs3)	1 (Voice)						
	2 (Loopback)	24.30	27.92	24.4	28.07	24.65	28.20
	3 (Voice)						
	55 (Loopback)	24.20	27.84	24.52	28.21	24.67	28.28
	32 (+ F-SCH)	24.40	28.06	24.58	28.39	24.63	28.33
	32 (+ SCH)	24.30	27.88	24.55	28.32	24.65	28.48
RC5 (Fwd5, Rvs4)	9 (Loopback)	24.30	27.98	24.50	28.16	24.60	28.25
	17 (Voice)						
	55 (Loopback)	24.20	27.83	24.62	28.13	24.63	28.22
	32768 (Voice)						

11. SAR Analysis

a. RF Exposure Low Power Threshold (60/f(GHz))

Frequency Band	60/f(GHz) f(GHz)= middle frequency in GHz	Low Power Threshold
Cellular / Part 22H	60/0.836	71.77 mW
PCS / Part 24E	60/1.88	31.91 mW

b. 1xEVDO Analysis

1xEVDO Upper Bound Transmission Duty Factor =29.66% = -5.28 dB		
Frequency Band	UBTDF Power	Adjusted Power
Cellular / Part 22H	25.05 dBm - 5.28dB = 19.77 dBm	94.84 mW
PCS / Part 24E	24.90 dBm - 5.28dB = 19.62 dBm	91.62 mW
Conclusion		Adjusted Power is above RF Exposure Low Power Threshold. SAR evaluation is required.

c. 1xRTT Analysis

1xRTT Upper Bound Transmission Duty Factor =5.16% = -12.87 dB		
Frequency Band	UBTDF Power	Adjusted Power
Cellular / Part 22H	24.90 dBm - 12.87 dB = 12.03 dBm	15.96 mW
PCS / Part 24E	24.74 dBm - 12.87 dB = 11.87 dBm	15.38 mW
Conclusion		Adjusted Power is below RF Exposure Low Power Threshold. SAR evaluation is not required.

12. Conclusion

In conclusion, as indicated in table 6 and section 12 b and c, eBook reader is above max. allowed percentage for data size greater than 10 MB and the adjusted output power based upon UBTDF correction is above low power threshold, SAR evaluation is required.

The highest measured body SAR with direct contact to the phantom is the following:

a. Model POCKETBOOK 603

1xEVDO mode

Frequency Band	Measured SAR -1g	UBTDF	Adjusted SAR values
Cellular Band	0.797 W/kg	29.66%	0.24 W/kg
PCS Band	4.5W/kg	29.66%	1.33 W/kg

1xRTT mode

Frequency Band	Measured SAR -1g	UBTDF	Adjusted SAR values
Cellular Band	0.864 W/kg	5.16%	0.04 W/kg
PCS Band	4.56 W/kg	5.16%	0.24 W/kg

b. Model POCKETBOOK 903

1xEVDO mode

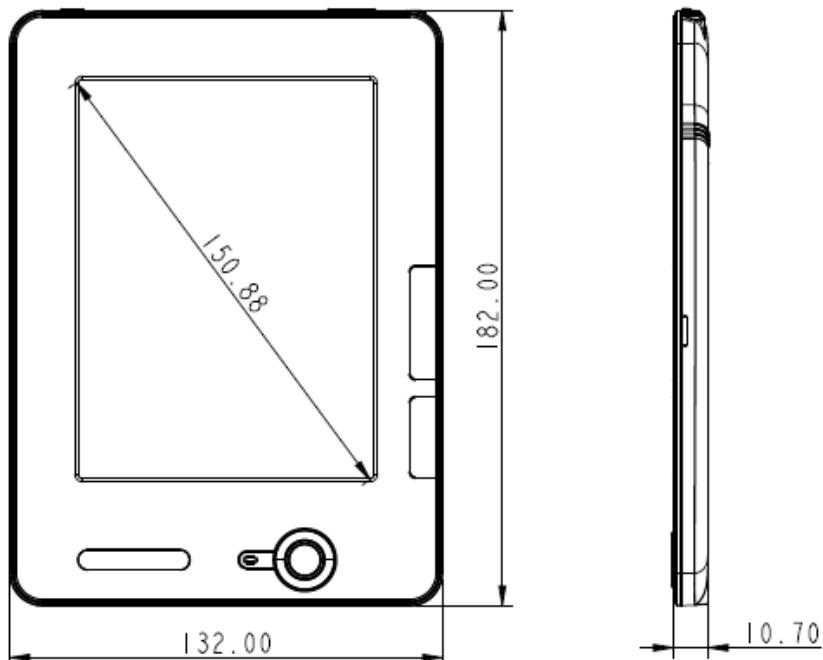
Frequency Band	Measured SAR -1g	UBTDF	Adjusted SAR values
Cellular Band	3.28 W/kg	29.66%	0.97 W/kg
PCS Band	3.22W/kg	29.66%	0.96 W/kg

1xRTT mode

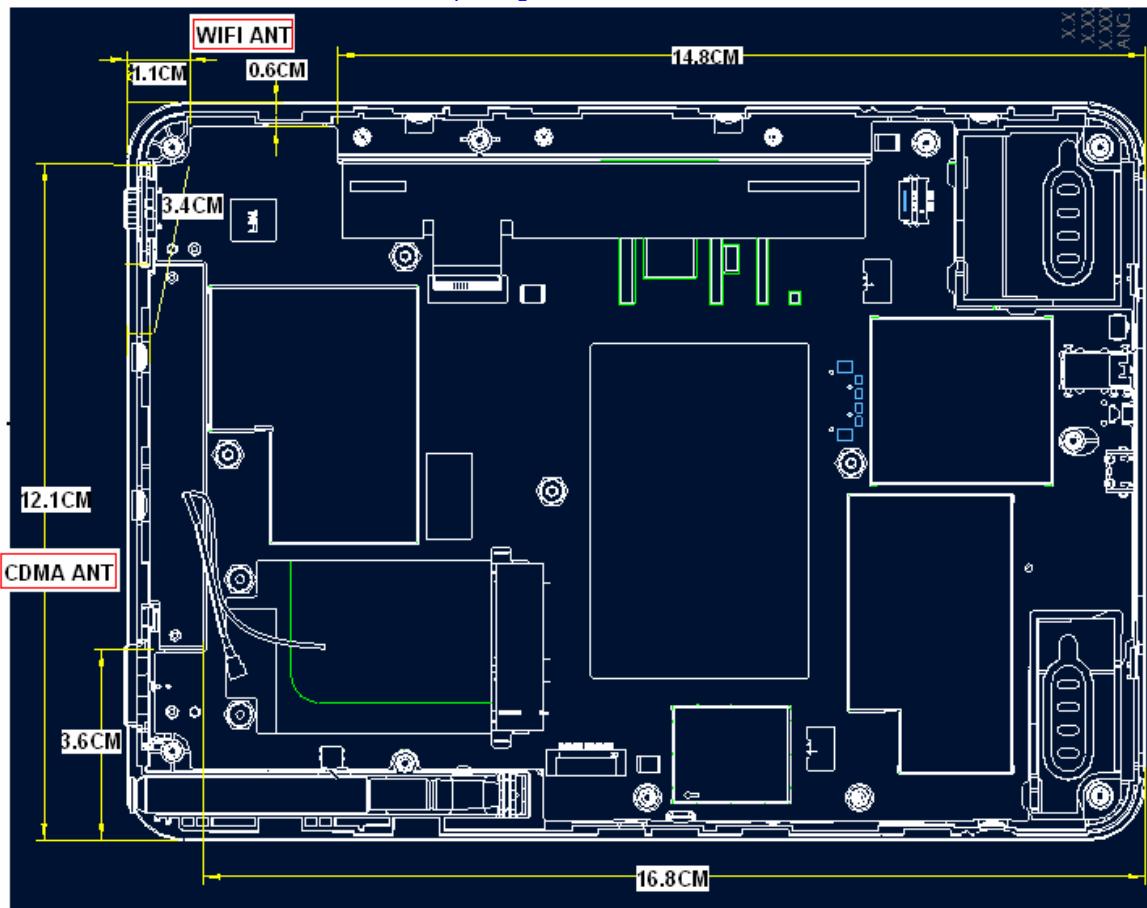
Frequency Band	Measured SAR -1g	UBTDF	Adjusted SAR values
Cellular Band	3.25 W/kg	5.16%	0.17 W/kg
PCS Band	3.88 W/kg	5.16%	0.2 W/kg

POCKETBOOK 603

1. Product dimensions : 132 x 182 x 10.6 mm, Diagonal dimension of display-screen: 6 inch 150.88mm

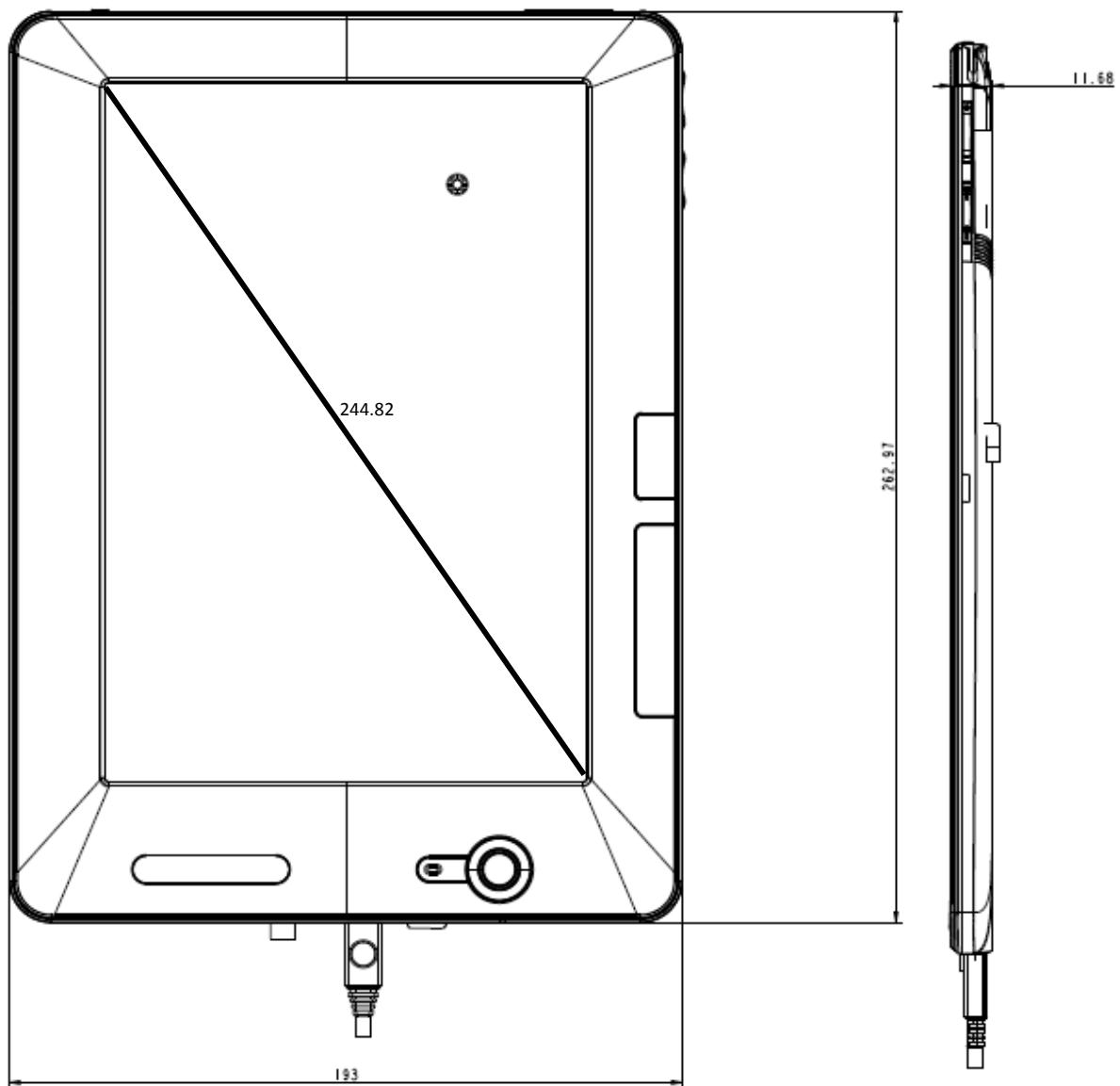


2. Antenna locations and dimensions and spacings



POCKETBOOK 903

1. Product dimensions : 193 x 263 x 11.5 mm, Diagonal dimension of display-screen: 9.7inch 244.82mm



2. Antenna locations and dimensions and spacings

