5.3.4 Dynamic Range

Setup for a BER measurement. Set R-attenuator so that the received signal level as measured with the spectrum analyzer is -40 dBm. Remove attenuation until the measured BER increases above 1E-5 or all attenuation has been removed. At this point measure received signal power level on spectrum analyzer. The difference between this measurement and the sensitivity measurement performed previously, is the Dynamic Range of the radio.

5.3.5 Carrier Frequency

Set the DUT to Transmit mode. Select DUT's desired operating frequency and set the spectrum analyzer's center frequency to the same value. Measure the radio's frequency by activating the analyzer's built-in frequency counter.

5.3.6 Modulation BW

Set the DUT to Transmit mode. Set the spectrum analyzer to 2dB/div, a 500 KHz/div span, a 100 KHz resolution BW (this is the only measurement in which the spectrum analyzer's resolution BW is not 1 MHz). Set its center frequency to the DUT's frequency. Adjust the spectrum analyzer's reference level to bring the peak of the modulation spectrum to the top of the screen. Measure the bandwidth 3 divisions down this point.

5.3.7 Processing Gain

Processing Gain can be defined as the modulation BW divided by the information rate (data clock rate in our case). This number can be converted to decibels using the following formula: PG = 10 x LOG (BW / R).

5.3.8 Data Clock Rate

Guaranteed by design.

5.3.9 Emissions outside [902-928] MHz band

5.3.9.1 Harmonic Distortion

Set the DUT to Transmit mode. Tune the spectrum analyzer to the DUT frequency and measure the peak power level (remember to use 1MHz resolution BW). Now tune the spectrum analyzer to twice the radio frequency and measure the peak power level again. The difference between these two measurements is the relative emission level of the second harmonic in dBc. Repeat this process for the third harmonic.

5.3.9.2 L.O. Leakage

Set the DUT to receive mode. Tune the spectrum analyzer to the DUT's frequency plus 44 MHz and adjust the spectrum analyzer's reference level until the L.O. leakage is clearly distinguishable above the noise floor. Measure the peak power level in dBm.

5.3.10 Power Consumption

Power consumption for the DUT is measured with an Amp Meter in series with the +5V supply. Measure the power consumption on the 5V line in Transmit, Receive and Standby modes. The measurements are made by setting the DUT to the desired mode and measuring the current with an amp meter on the desired line.

5.4 Supplementary Characteristics Test

5.4.1 Undesired Signal Rejection

Undesired signal rejection is a measure of how large an undesired signal the radio can tolerate while maintaining a BER of less than 1E-5. These measurements should be performed at received signal level of -75 dBm.

Setup the DUT for a BER measurement. Select the desired frequency of operation. Set the R-attenuator until the received signal level measured at the spectrum analyzer is -45 dBm. Set the Interference Signal Generator (ISG) to the desired frequency (this frequency will vary depending on whether interference, image or adjacent channel rejection is being measured).

Set the I-attenuator to 75 dB and adjust the ISG level until the spectrum analyzer measures the same interference level as that of the DUT. Add 30 dB of attenuation to both the R- attenuator and the ISG. The desired and interfering signal levels should now be -75 dBm. Set the ISG to internal frequency modulation at 1 KHz and 1.3 MHz of deviation. Take out I-attenuation until the BER increases above 1E-5. Subtract the I-attenuation value from 75. The result is the interference, image or adjacent channel rejection figure in dBc. Each of these three measurements will cover specific interfering frequencies which are described in the following sections.

5.4.1.1 Adjacent Channel Rejection

Set the ISG's frequency to the adjacent channel to be measured (i.e. one of 906,912,918 or 924 MHz) and proceed to measure rejection as described above.

5.4.1.2 Interference Rejection

Set the ISG's frequency the same as the DUT and proceed to measure rejection as described above. Note that in this case I-attenuation will most likely have to "increase" by 1 to 4 dB reflecting a negative rejection figure. Also, make sure the DUT level and the ISG level are as close to -75 dBm as possible. It is a good idea to recheck the levels with the spectrum analyzer after the 30 dB of additional attenuation are added.

5.4.1.3 Image Rejection

Set the ISG's frequency to the image frequency; that is 88 MHz above the DUT's frequency. Proceed to measure rejection as described above.

5.4.2 Receiver Turn-on Time

Setup for a receiver sensitivity test. Set the attenuation for a received signal strength of -75 dBm. Drive the DUT TX/$\overline{RX}$ line with a pulse generator. The pulse generator should be set to output an HCMOS level pulse of 20 msec period and 50% duty cycle. With the oscilloscope monitor the DUT's TX/$\overline{RX}$ line and its RXDATA line. Set the pattern generator to an all "0" pattern.

Triggering the oscilloscope on the TX/$\overline{RX}$ line's negative edge, measure the time it takes the RXDATA line to settle to the all "0" state. This is the receiver's turn-on time (note that while in transmit mode, the radio sets the RXDATA line to its high state).

5.4.3 Transmitter Turn-on Time

Setup for a transmitter measurement test. Set the attenuation for a received signal strength of -20 dBm. Drive the DUT TX/$\overline{RX}$ line with a pulse generator. The pulse generator should be set as it was for the receiver turn-on time test. With the oscilloscope, monitor the DUT's TX/$\overline{RX}$ line and the REF Radio's RXDATA line. Once again, set the pattern generator to an all "0" pattern.

Triggering the oscilloscope on the DUT's TX/$\overline{RX}$ line's positive edge, measure the time it takes the RXDATA line to settle to the all "0" state. This is the transmitter's turn-on time.

5.4.4 Transmitter Turn-off Time

With the same setup used in transmitter turn-on time, now trigger the oscilloscope on the DUT's TX/$\overline{RX}$ line's negative edge. You will observe that the REF Radio's RXDATA line will still be receiving zeros for a time after the transmitter is instructed to turn off. Once the transmitter is completely off, the REF Radio will be receiving noise only and the RXDATA line will begin to jump. The time elapsed between the transition on the TX/$\overline{RX}$ and the first jump on the RXDATA line is the transmitter turn-off time.

5.4.5 Receiver Turn-on Time

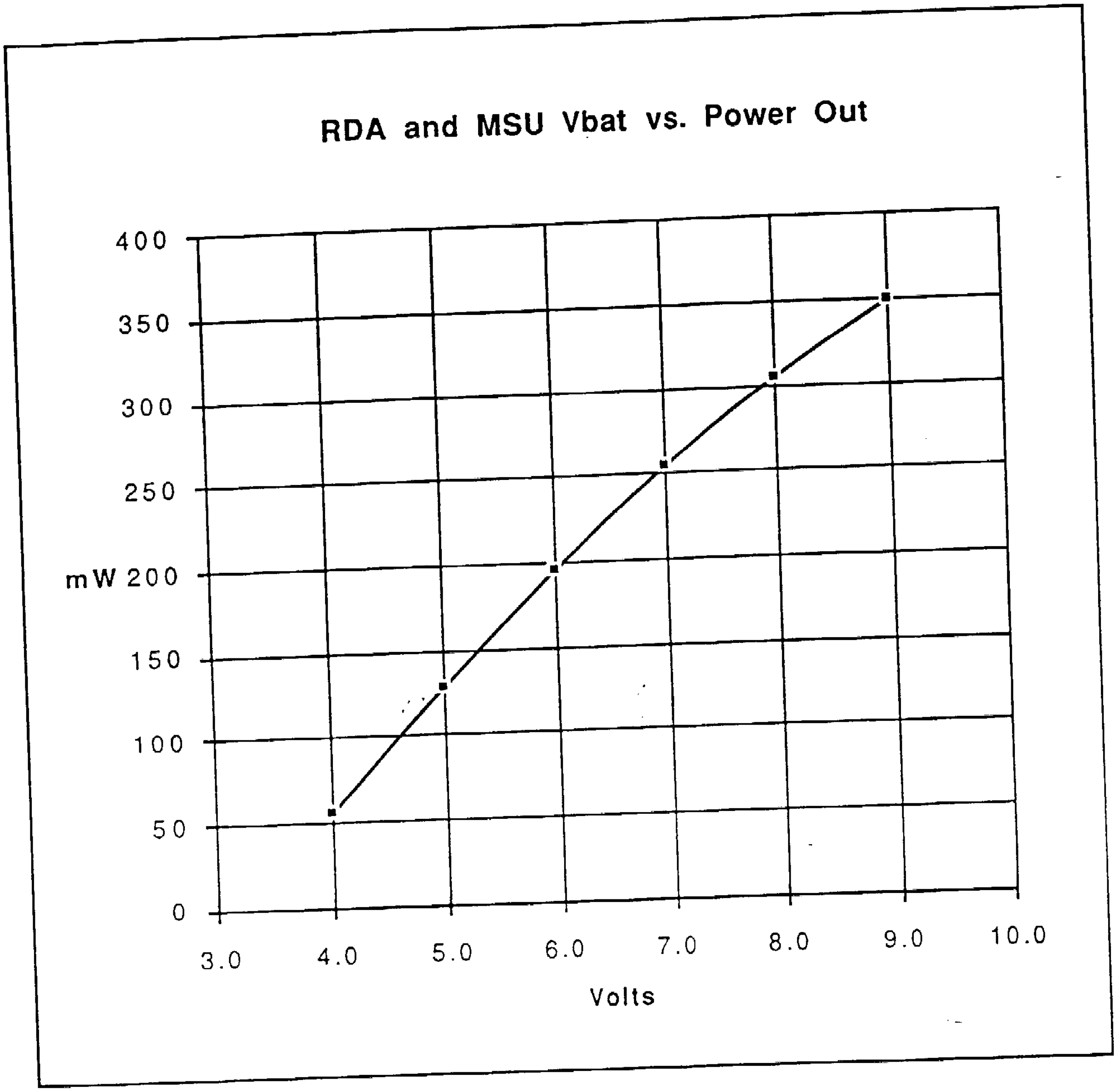
Setup for a receiver sensitivity test. Set the attenuation for a received signal strength of -75 dBm. Drive the DUT $\overline{STANDBY}$ line with a pulse generator with a 20 msec period and 50% duty cycle. With the oscilloscope monitor the DUT's $\overline{STANDBY}$ line and its RXDATA line. Set the pattern generator to an all "0" pattern.

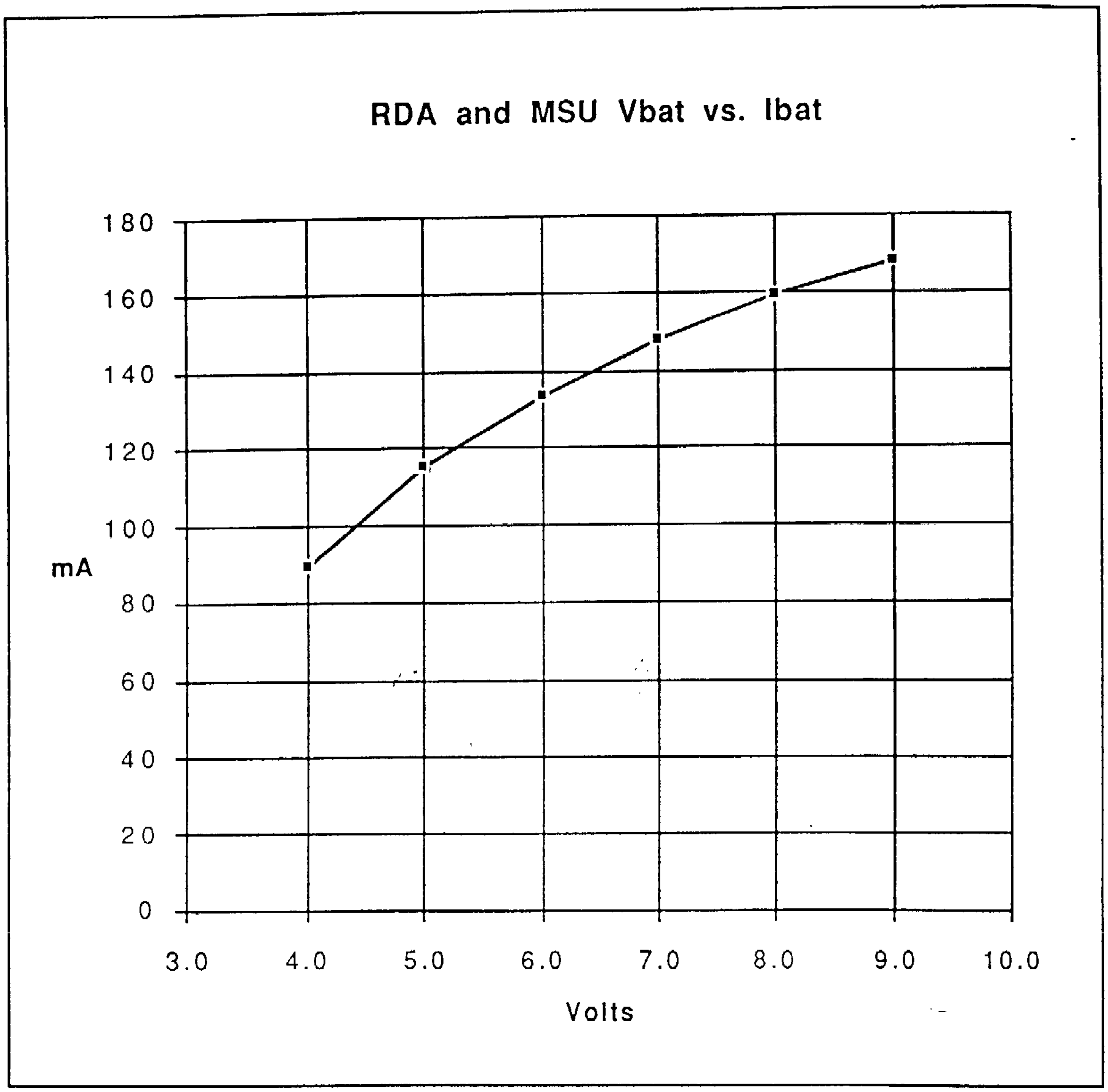
Triggering the oscilloscope on the $\overline{STANDBY}$ line's positive edge, measure the time it takes the RXDATA line to settle to the all "0" state. This is the receiver's turn-on time.

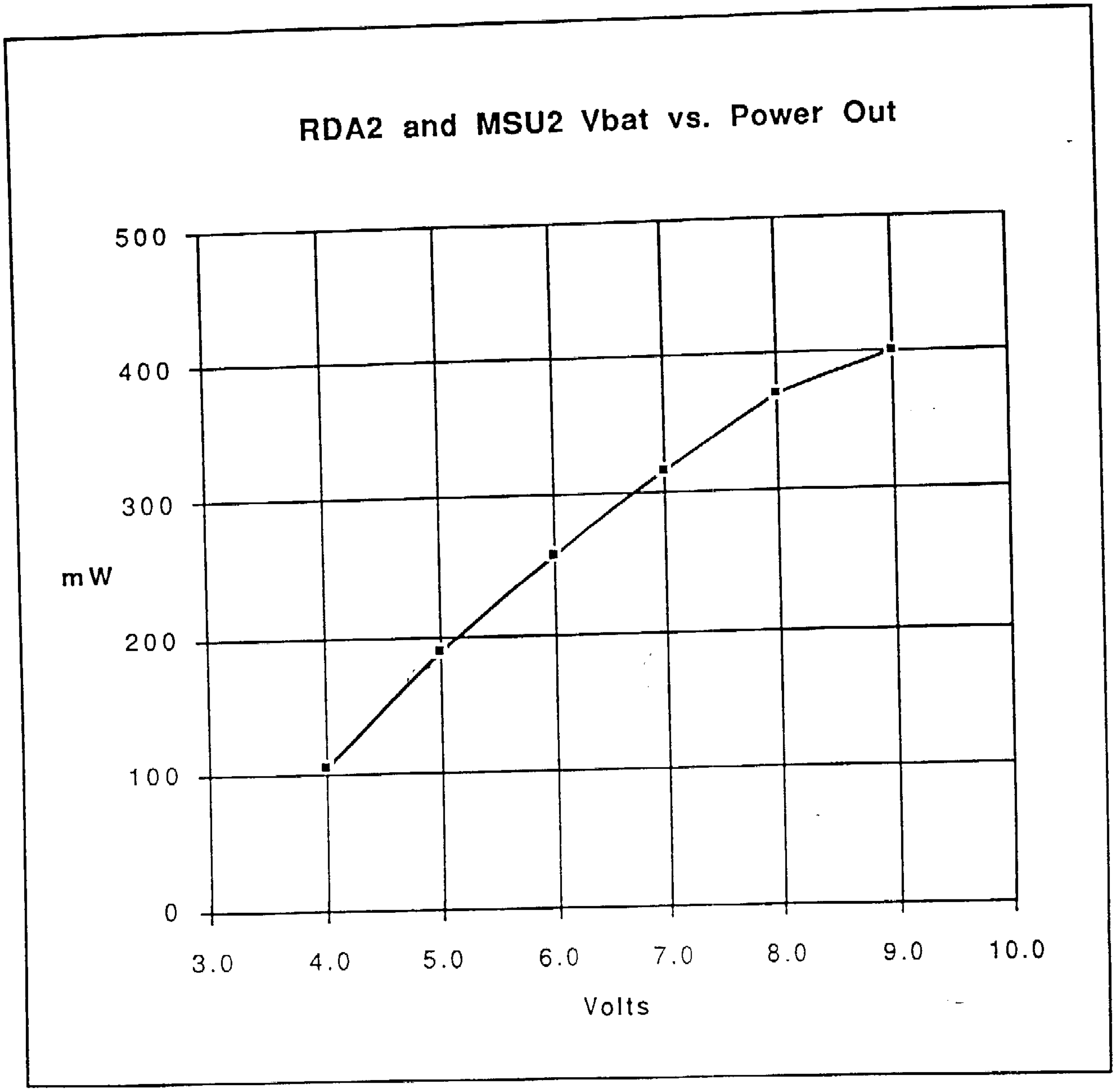
5.4.6 RSSI

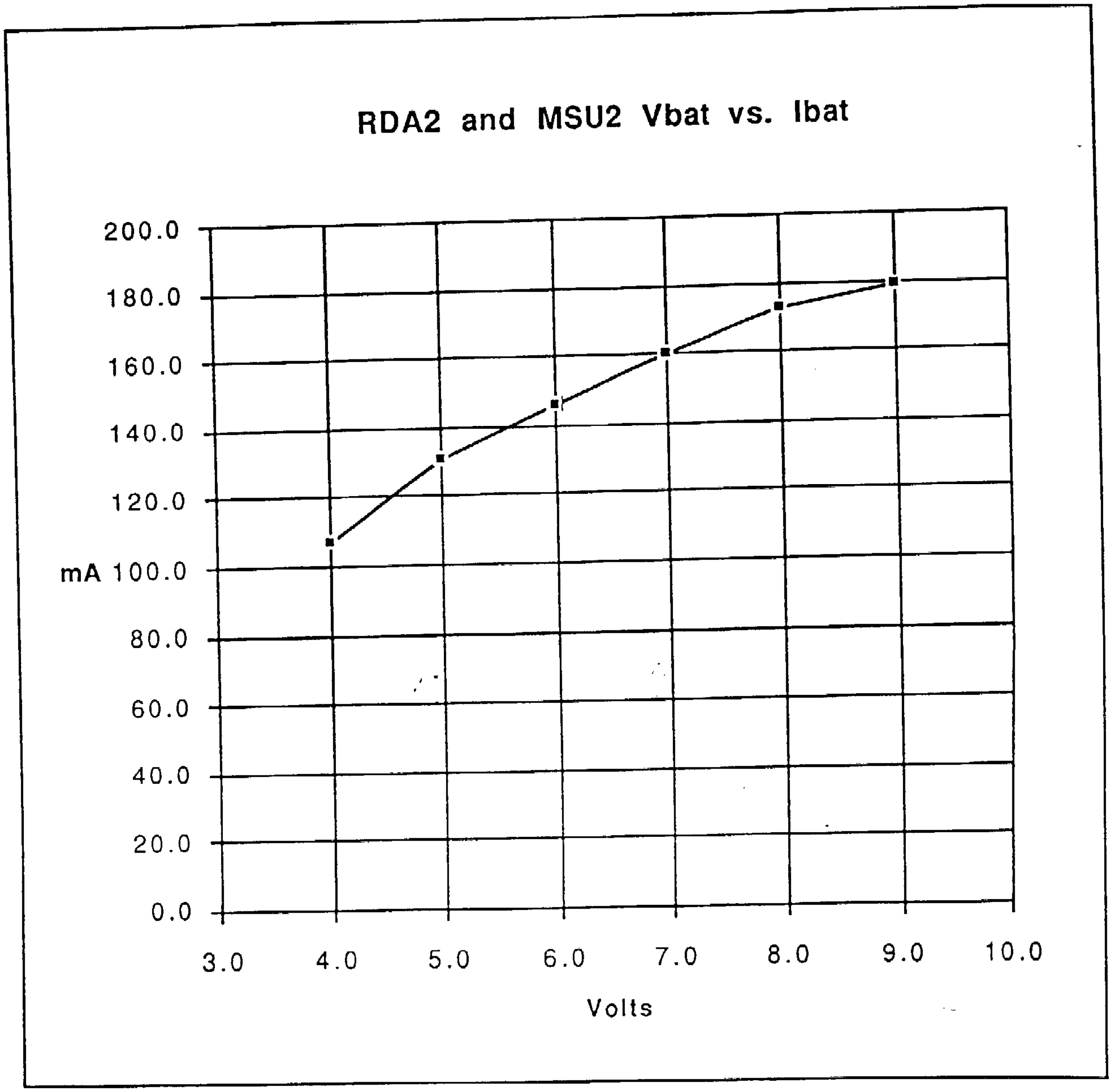
Received Signal Strength Indicator voltage varies monotonically between about 1V and 4V for input signal level variations between -100 dBm and -30 dBm. To measure the characteristics of this curve first setup for a receiver measurement test. Then adjust attenuation until received signal level is -30 dBm as indicated by the spectrum analyzer. With a DVM measure the DC voltage at the test point labeled RSSI. Repeat this measurement for all desired levels of input signal.

Addendum A-Vbat vs. Power Out and Ibat Graphs




RDA and MSU Vbat vs. Ibat
mA
180
160
140
120
100
80
60
40
20
0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Volts


RDA2 and MSU2 Vbat vs. Power Out
500
400
300
mW
200
100
0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Volts


RDA2 and MSU2 Vbat vs. Ibat
200.0
180.0
160.0
140.0
120.0
mA 100.0
80.0
60.0
40.0
20.0
0.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Volts