

ABSOLUTE CURRENT RATINGS

Application Note

v1.1

1. INTRODUCTION

This document describes the test results for absolute current ratings for the BTM41x in various modes of operation.

All results were achieved with a calibration against a digital multi meter to verify the 2.7 Ohm shunt resistor and calculate the mA scale for the scope measurements. This document also looks at data exchange rates at different baud rates.

It should be noted that the multi meter itself was not calibrated for these tests and therefore the results do not reflect 100% accuracy.

Note: All measurements were performed with a supply voltage of 3.25 V.

2. SUMMARY

Power up / reset	I_avg_reset	20.7 mA	
	t_reset_current_dur.	3.0 s	
Idle ²⁾	I_avg @ 9600 baud	2.60 mA	5sec average, no data at UART ²⁾
	I_avg @ 38400 baud	2.75 mA	
	I_avg @ 115200 baud	2.95 mA	
	I_avg @ 460800 baud	4.37 mA	
Connectable and Discoverable	I_avg_cycle	23.1 mA	AT+BTP / ATS512=4, 9600 Baud, average over 1 interval
Inquiry	I_avg_inquiry	42.1 mA	
Initiate pairing	I_avg_pair_ini	28.8 mA	
Accept pairing	I_avg_pair_acc	42.0 mA	
Initiate a connection (SPP)	I_avg_connect_ini	39.8 mA	
Accept a connection (SPP)	I_avg_connect_ini	37.2 mA	
Connected as master, no data exchange	I_avg_conn_master_idle	13.3 mA	Active mode
	I_avg_master_sniff_idle	13.6 mA	Sniff interval=50ms
	I_avg_master_ssr_idle	9.9 mA	SSR, interval=300ms
Connected as slave, no data exchange	I_avg_conn_slave_idle	29.0 mA	Active mode
	I_avg_slave_sniff_idle	12.7 mA	Sniff interval=50ms
	I_avg_slave_ssr_idle	9.9 mA	SSR, interval=300ms

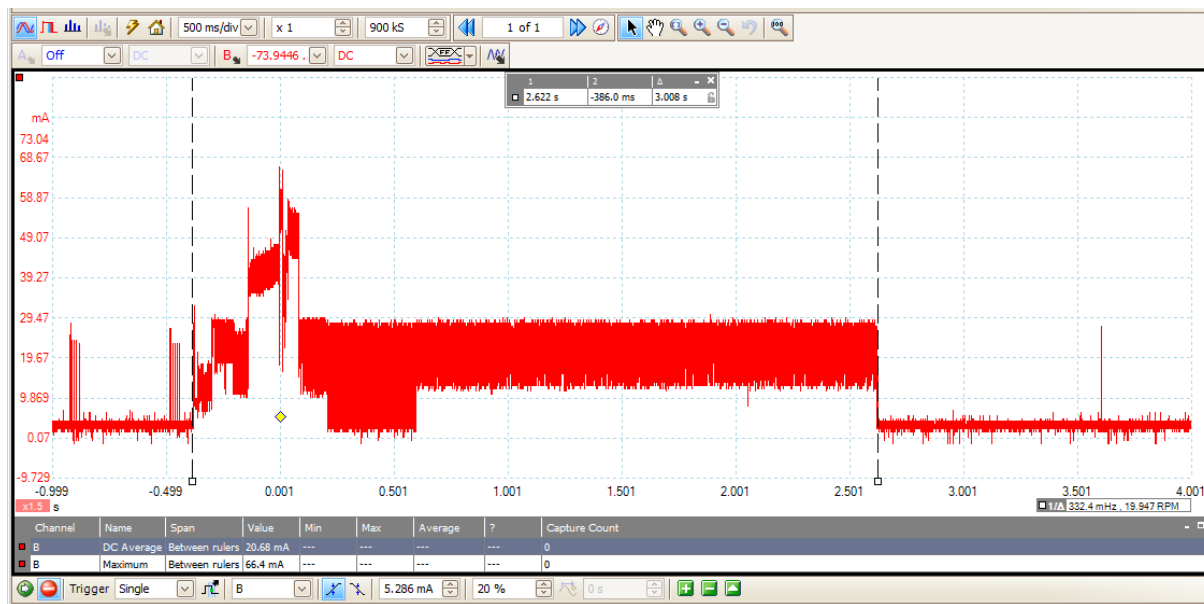
Notes: All current peaks measured were less than 86 mA.

Even when no data being transmitted, higher baud rates cause a higher standby current.

All measurements were performed with a supply voltage of 3.25 V.

3. POWER-UP / RESET

I_avg_reset	20.7 mA
I_peak_reset	66.4 mA
t_reset_current_dur.	3.0 s
Filename	2.7Ohm_reset_ATZ_9600.psdata

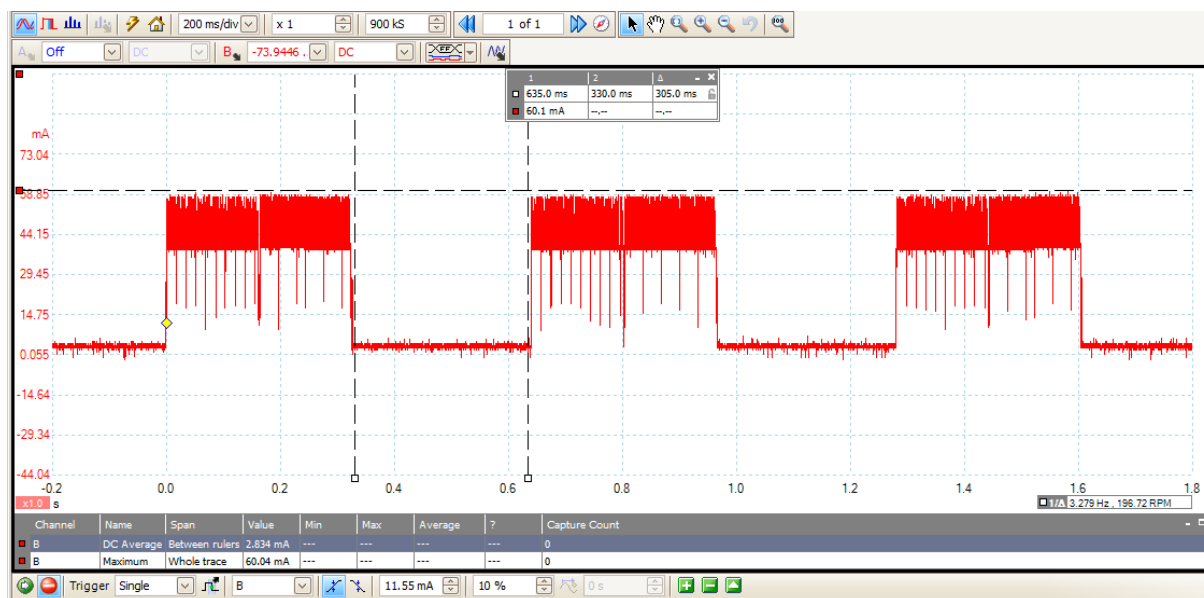


4. IDLE

I_avg @ 9600 baud	2.60 mA	5 sec average
I_avg @ 38400 baud	2.75 mA	5 sec average
I_avg @ 115200 baud	2.95 mA	5 sec average
I_avg @ 460800 baud	4.37 mA	5 sec average

5. CONNECTABLE/DISCOVERABLE (WITH STANDARD PARAMETERS)

I_avg_cycle	23.1 mA	9600
I_window_peak	60.1 mA	9600
I_window_avg	42.7 mA	9600
I_idle_avg	2.83 mA	9600
Filename	2.7Ohm_discoverable_connectable_9600.psdata	
I_avg_cycle	23.4 mA	115200
I_window_peak	59.4 mA	115200
I_window_avg	42.9 mA	115200
I_idle_avg	3.34 mA	115200
Filename	2.7Ohm_discoverable_connectable_115200.psdata	



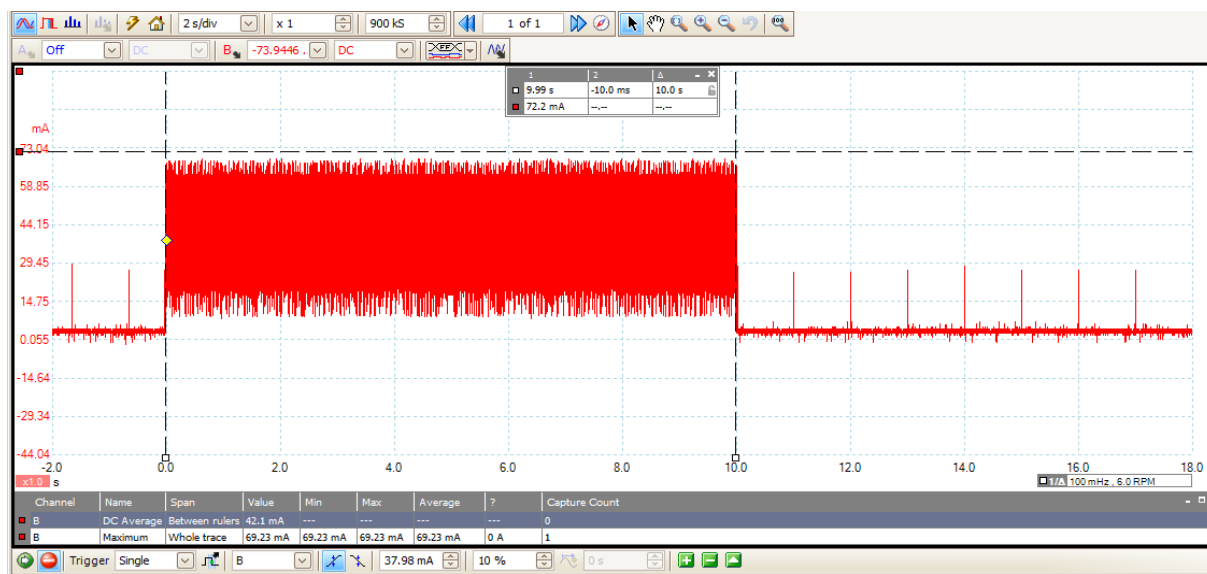
6. INQUIRY

AT+BTI, ATS517=10 (inquiry duration=10s)

I_avg_inquiry 42.1 mA

I_peak_inquiry 69.3 mA

Filename 2.7Ohm_inquiry_ATpBTI_9600.psddata

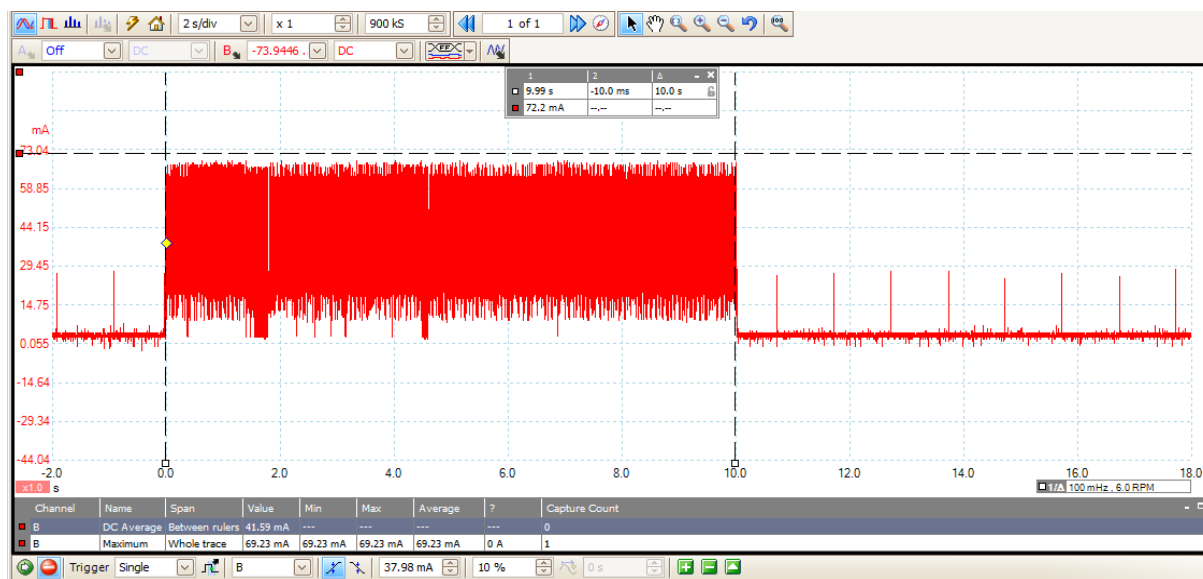


AT+BTIE, 2 devices found, first with EIR

I_avg_inquiry 42.0 mA

I_peak_inquiry 69.3 mA

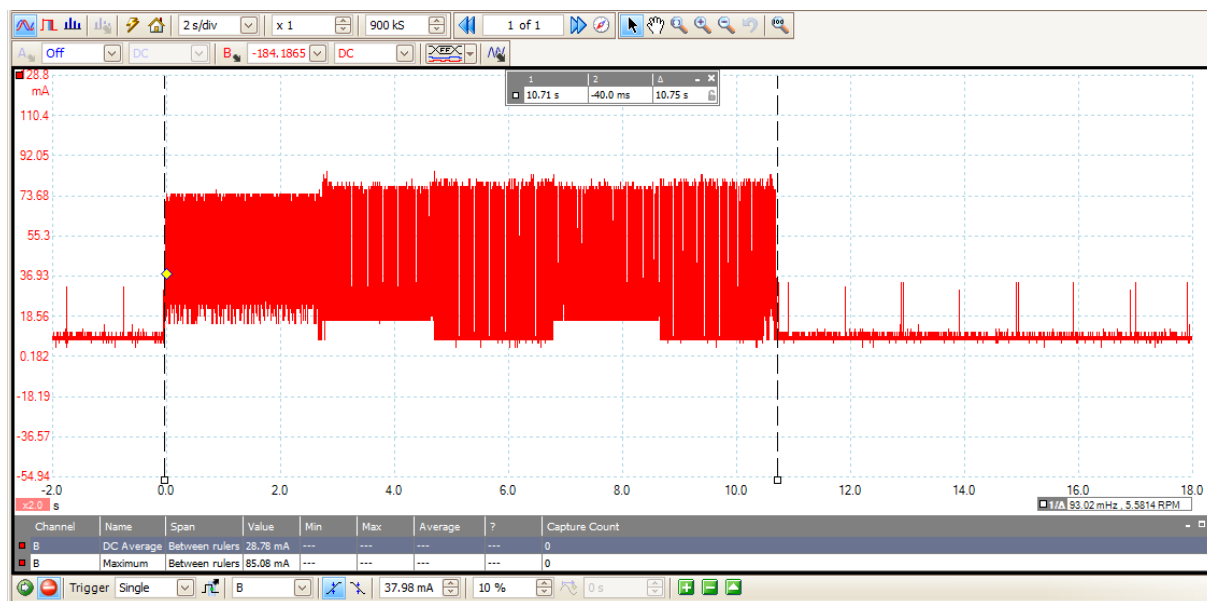
Filename 2.7Ohm_inquiry_ext_ATpBTIE_9600.psddata



7. INITIATE PAIRING

Initiate pairing to unknown BT2.1 device (SSP)

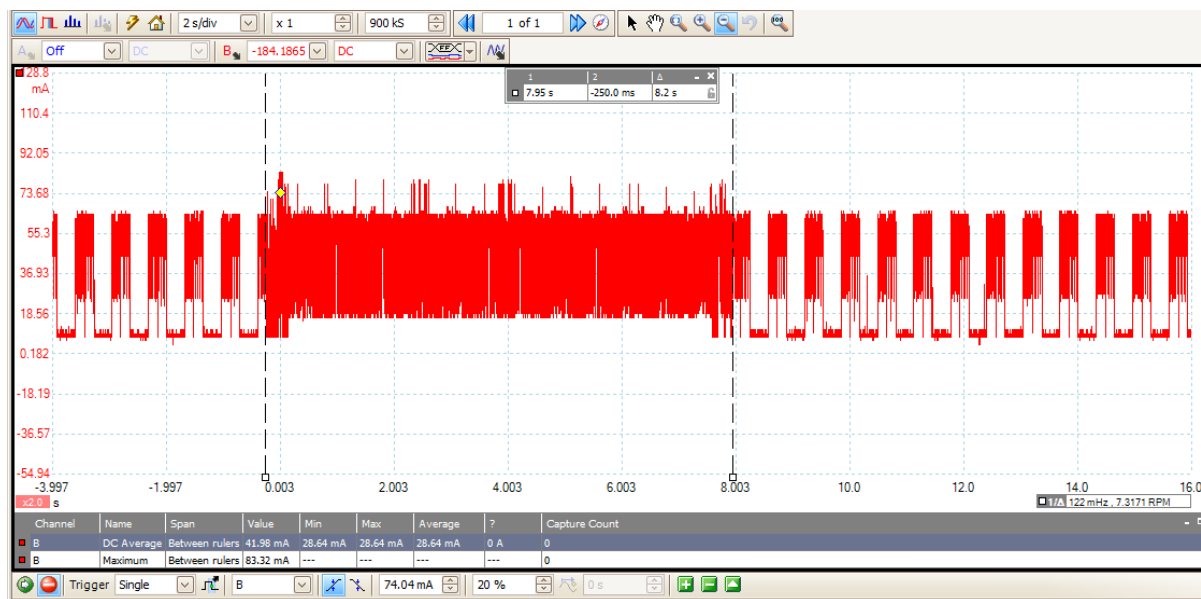
I_avg_pair_ini	28.8 mA
I_peak_pair_ini	85.1 mA
t_pairing_duration	10.75 s (average between two BTM41x)
Filename	2.7Ohm_pair_ini_ATpBTW_9600.psd



8. ACCEPT PAIRING

Accept Pairing from unknown BT2.1 device (SSP)

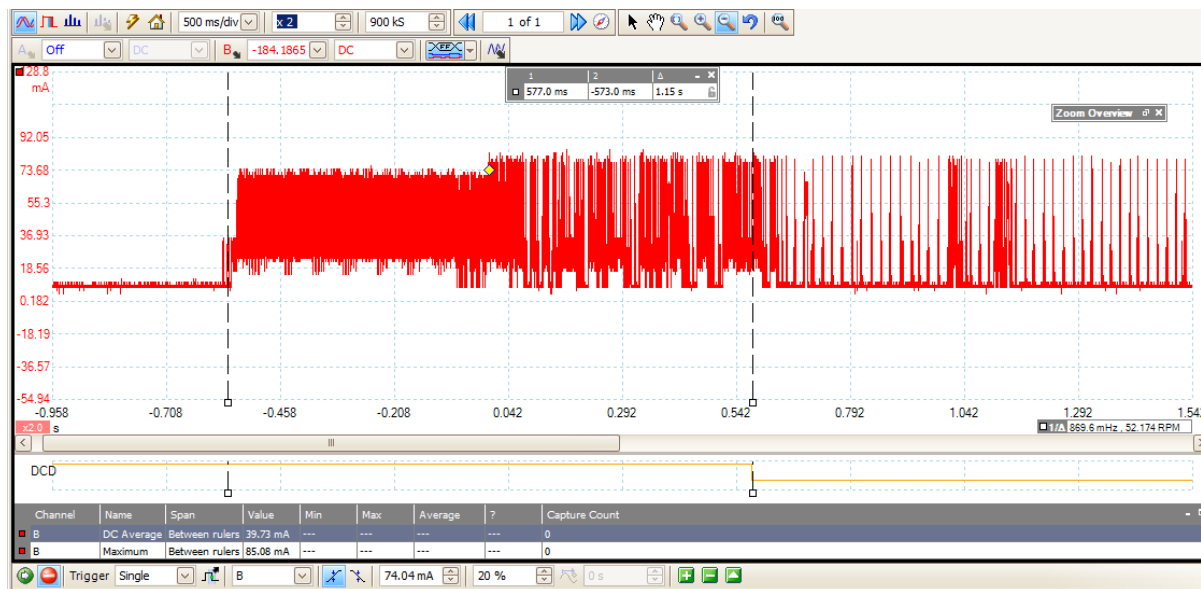
I_avg_pair_acc	42.0 mA
I_peak_pair_acc	83.3 mA
t_pairing_duration	8.2 s (average between 2 BTM41x)
Filename	2.7Ohm_pair_acc_ATpBTW_9600.psdata



9. INITIATING A CONNECTION

Devices already paired

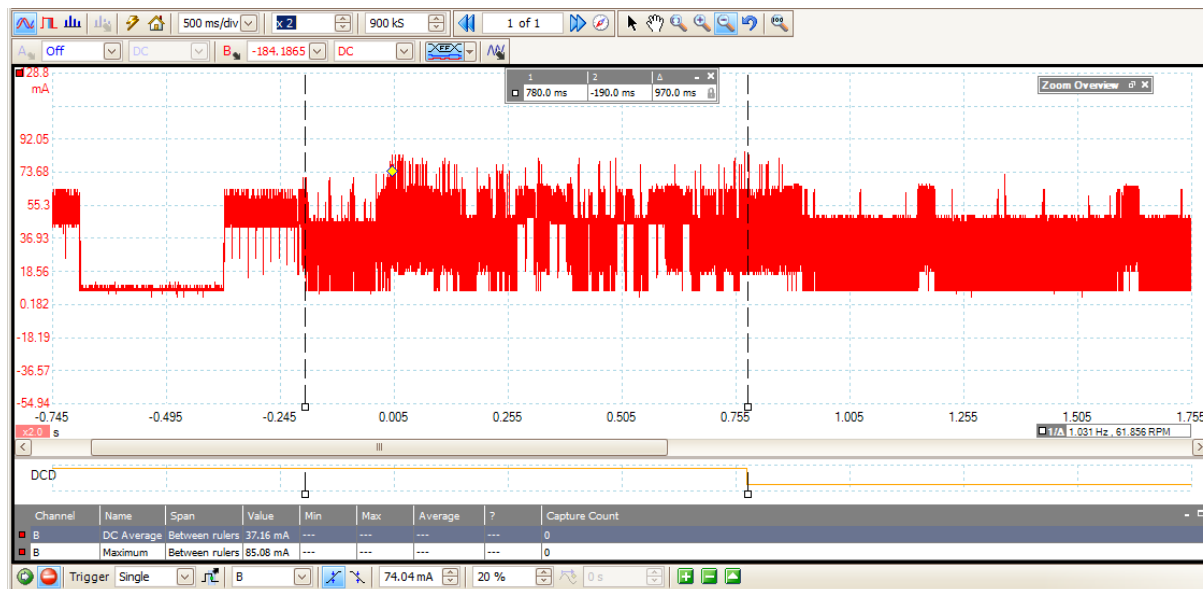
I_avg_connect_ini	39.8 mA
I_peak_pair_ini	85.1 mA
t_connect_duration	1.15 s (average between 2 BTM41x)
Filename	2.7Ohm_connect_ini_ATpSPD_9600.psddata



10. ACCEPTING A CONNECTION

Devices already paired

I_avg_connect_ini	37.2 mA
I_peak_pair_ini	83.4 mA
t_connect_duration	0.97 s (average between 2 BTM41x)
Filename	2.7Ohm_connect_acc_9600.psdata



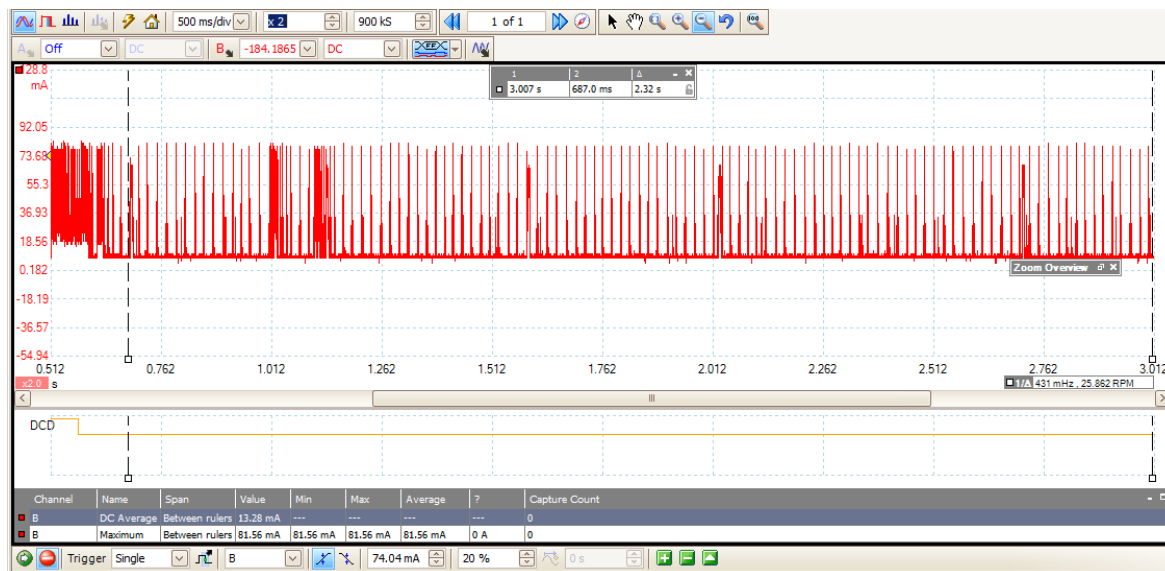
11. CONNECTED AS MASTER, IDLE (NO DATA EXCHANGE)

Active mode

I_avg_conn_master_idle 13.3 mA

I_peak_conn_master_idle 81.6 mA

Filename 2.7Ohm_connect_ini_ATpSPD_9600.psdata



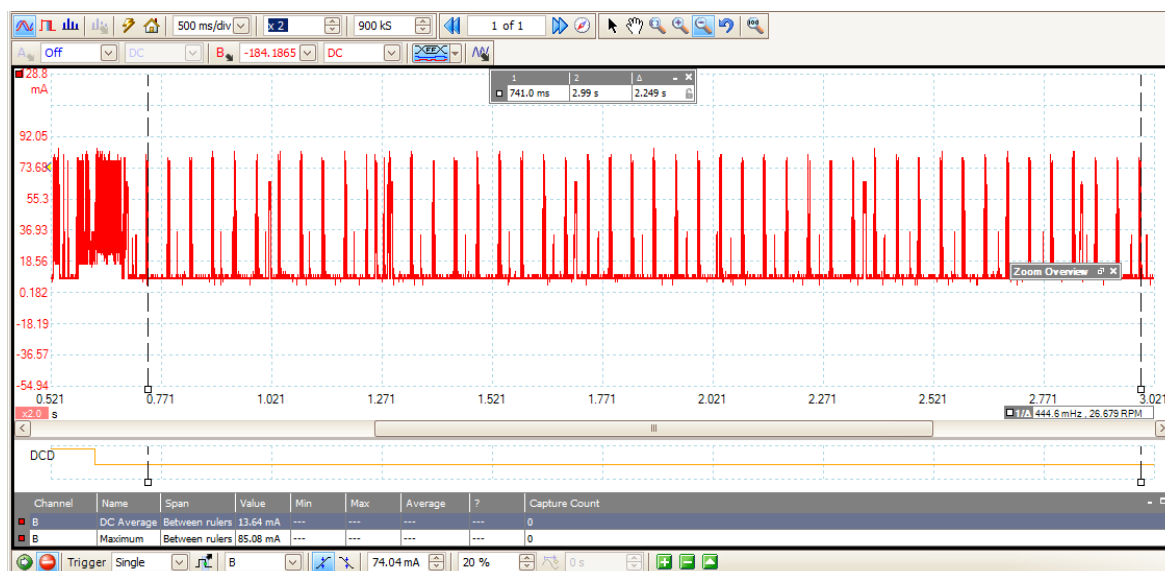
Sniff mode: attempt=5ms, timeout=20ms, interval=50ms

S561=2*, S562=10*, S563=40, S564=50 (* with firmware v16.1.3.1)

I_avg_master_sniff_idle 13.6 mA

I_peak_master_sniff_idle 85.1 mA

Filename 2.7Ohm_master_sniff_idle_9600.psdata

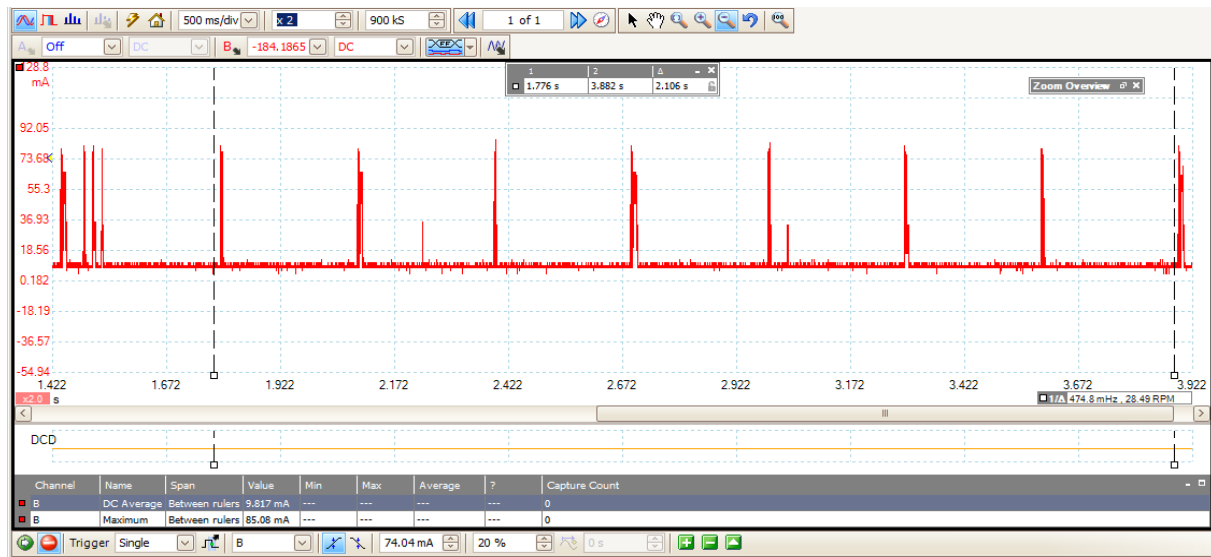


BTM41x Current Ratings

Application Note

Sniff Sub Rating: interval=300ms (permitted by remote device: S348=3 in case of BTM41x)

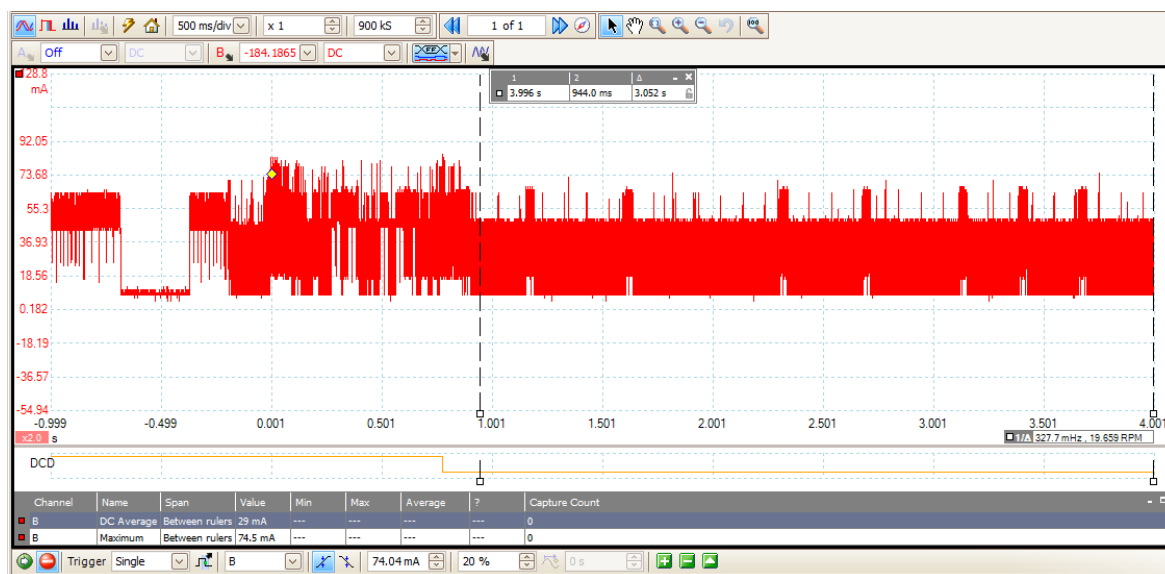
I_avg_master_ssr_idle	9.9 mA
I_peak_master_ssr_idle	85.1 mA
Filename	2.7Ohm_master_ssr_idle_9600.psdata



12. CONNECTED AS SLAVE, IDLE (NO DATA EXCHANGE)

Active mode

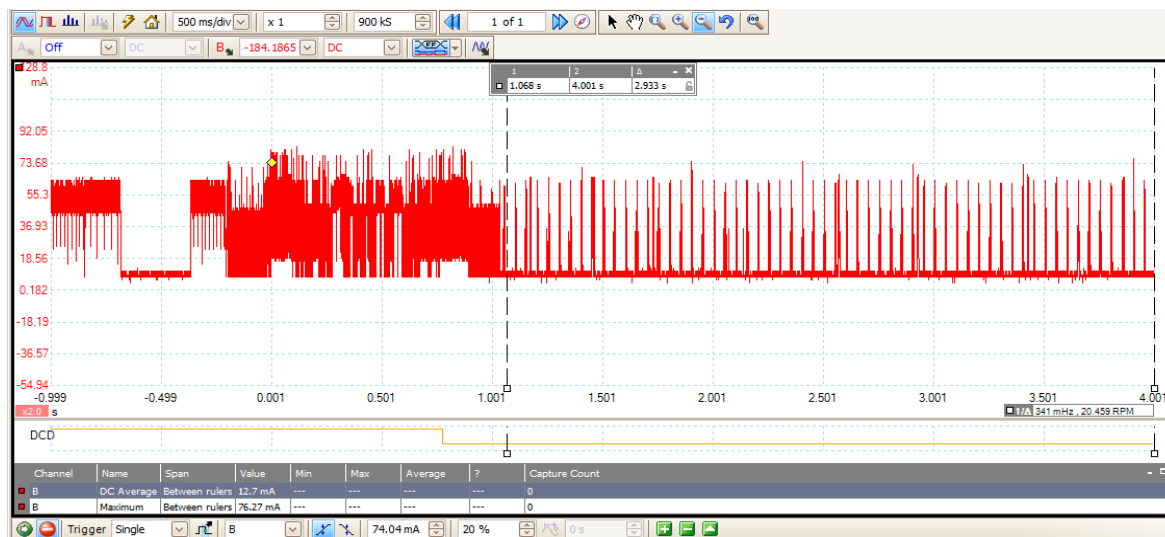
I_avg_conn_slave_idle	29.0 mA
I_peak_conn_slave_idle	74.5 mA
Filename	2.7Ohm_connect_acc_9600.psd



Sniff mode: attempt=5ms, timeout=20ms, interval=50ms

S561=2*, S562=10*, S563=40, S564=50, (* with firmware v16.1.3.1)

I_avg_slave_sniff_idle	12.7 mA
I_peak_slave_sniff_idle	76.3 mA
Filename	2.7Ohm_slaver_sniff_idle_9600.psd



BTM41x Current Ratings

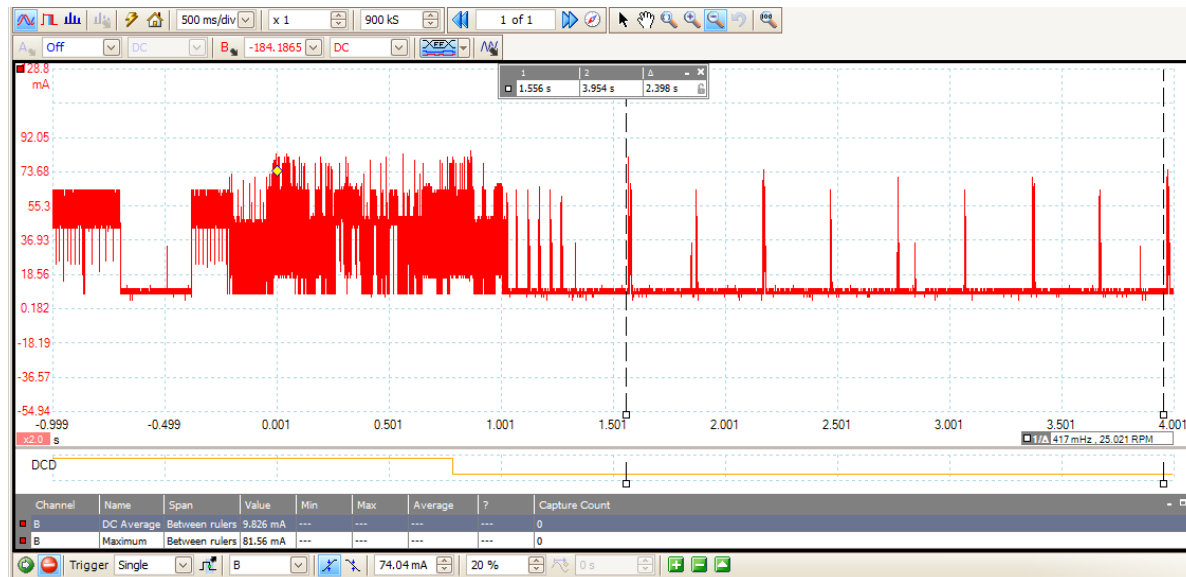
Application Note

Sniff Sub Rating: interval=300ms (permitted by remote device: S348=3 in case of BTM41x)

I_avg_slave_ssr_idle 9.9 mA

I_peak_slave_ssr_idle 85.6 mA

Filename 2.7Ohm_slave_ssr_idle_9600.pdata



13. DATA EXCHANGE

For data exchange, two typical current consumption states were observed:

- UART data buffering (TX only)
- RF activity for data exchange

As these patterns are likely to overlap in real usage, it is difficult to provide general data for absolute current measurements with data exchange. Data files have been acquired but they were not evaluated in detail yet. The files are available on request and can be viewed by picoscope software, which can be downloaded here for free:

<http://www.picotech.com/picoscope-oscilloscope-software.html>

(no need for demo device, go to menu and click **File > Open**)

For these measurements a data block of m bytes (m=50/200/500/1000) was transmitted in intervals of 1.2 seconds. In order to differentiate between UART buffering (TX) and RF activity, a sniff interval of one second was chosen. With this configuration, the buffer activity will always move towards the right relative to the sniff anchor points. It will always ensure that any overlapping of UART buffering and RF activity will be captured.

For Rx (data reception), UART buffering is not visible in the current pattern. For Rx, data will only be received at the one second sniff anchor points.

Configuration of one remote device (v16.1.3.1):

- S561=2 (attempt=5ms); S563=20 (timeout=40ms); S563=90; S564=1000 (sniff interval=1s);
- S348=S349=S350=0 (SSR disable);
- S364=0; S365=0; (initial mode=passive forever)
- Configuration of the measured device (v16.1.3.1):
- S561=S563=S563=S564=0 (sniff disable);
- S348=S349=S350=0 (SSR disable);
- S364=0; S365=0; (initial mode=passive forever)

13.1 Sending data (TX)

13.1.1 9600 Baud

Filename	2.7Ohm_Tx50_9600_slave.psdata
I_avg_buffering	26.8 mA
I_peak_buffering	35.7 mA
I_avg_tx	35.5 mA
I_peak_tx	83.4 mA
t_tx	85..90 ms
Filename	2.7Ohm_Tx50_9600_master.psdata
I_avg_buffering	26.8 mA
I_peak_buffering	35.7 mA

BTM41x Current Ratings

Application Note

I_avg_tx	21.4 mA
I_peak_tx	81.6 mA
t_tx	102..111 ms

Filename	2.7Ohm_Tx200_9600_slave.psdata	Ok
Filename	2.7Ohm_Tx200_9600_master.psdata	Ok
Filename	2.7Ohm_Tx200_9600_slave.psdata	ok
Filename	2.7Ohm_Tx200_9600_master.psdata	Ok
Filename	2.7Ohm_Tx1000_9600_slave.psdata	Ok
Filename	2.7Ohm_Tx1000_9600_master.psdata	Ok

13.1.2 115200 Baud

Filename	2.7Ohm_Tx50_115200_slave.psdata	Ok
Filename	2.7Ohm_Tx50_115200_master.psdata	Ok
Filename	2.7Ohm_Tx200_115200_slave.psdata	Ok
Filename	2.7Ohm_Tx200_115200_master.psdata	Ok
Filename	2.7Ohm_Tx500_115200_slave.psdata	Ok
Filename	2.7Ohm_Tx500_115200_master.psdata	Ok
Filename	2.7Ohm_Tx1000_115200_slave.psdata	Ok
Filename	2.7Ohm_Tx1000_115200_master.psdata	Ok

13.2 Receiving data (RX)

13.2.1 9600 Baud

Filename	2.7Ohm_Rx50_9600_slave.psdata	ok
Filename	2.7Ohm_Rx50_9600_master.psdata	Ok
Filename	2.7Ohm_Rx200_9600_slave.psdata	Ok
Filename	2.7Ohm_Rx200_9600_master.psdata	Ok
Filename	2.7Ohm_Rx500_9600_slave.psdata	Ok
Filename	2.7Ohm_Rx500_9600_master.psdata	Ok
Filename	2.7Ohm_Rx1000_9600_slave.psdata	Ok
Filename	2.7Ohm_Rx1000_9600_master.psdata	ok

13.2.2 115200 Baud

Filename	2.7Ohm_Rx50_115200_slave.psdata	ok
Filename	2.7Ohm_Rx50_115200_master.psdata	ok
Filename	2.7Ohm_Rx200_115200_slave.psdata	ok
Filename	2.7Ohm_Rx200_115200_master.psdata	ok
Filename	2.7Ohm_Rx500_115200_slave.psdata	ok
Filename	2.7Ohm_Rx500_115200_master.psdata	ok
Filename	2.7Ohm_Rx1000_115200_slave.psdata	ok
Filename	2.7Ohm_Rx1000_115200_master.psdata	ok

REVISION HISTORY

Revision	Date	Description	Approved By
1.0	26 June 2014	Initial Release	Jonathan Kaye
1.1	03 Mar 2015	Added Revision History	Sue White