RaceGrade

Technical Note

Document Number		RG_TN-0011	
Title		Satellite Telemetry Radios	
Revision	**Date**	**Prepared By**	**Change History**
1.1	08/07/2012	Chris Brown	Updated operation details

Specifications:

Dimensions: 6.4" x 2.7" x 1.1"
Weight: 340 g
Operating Frequency: 1616 to 1626.5 MHz
Receiver Sensitivity: -118.5dBm
Voltage Supply: **4.0 to 32.0 v**
Nominal Voltage: **12.0 v**
Avg. Standby Current: 300mA @ 5.0 v
Avg. Data Call Current: 800mA @ 5.0 v
Peak Data Call Current: 2.5A @ 5.0v
Temp Range: **-30 C to 70 C**
Humidity Range: < 75% RH
Throughput: 2.4Kbits/s avg.

Mating Antenna Connection: TNC Male

Throughput Testing Results

        The radios will operate at almost any baud rate, but throughput is limited to 2400 bits per second. Testing results show that limiting the data stream to the radio's maximum is necessary, that is 2400 baud rate. Turning on the streaming function in dash manager is fine at that baud rate. If using 4800 baud rate you should not turn on streaming. It should be possible to receive GPS data and transmit out satellite telemetry data on the same serial port. Delay time for transmission of data was for the most part only 1 second. Sometimes the data might be delayed up to 4 seconds, but with a burst of data to catch up with buffered data. Specific testing shows:
        4800 baud rate, +streaming = does not work
        4800 baud rate, no streaming:
            12 channels = 6 Hz, 19 channels = 3.4 Hz good, 1.3 Hz bad
        4800 baud rate, limited to 2400, +streaming:
            20 channels = 4.2 Hz good, 0 Hz bad
        57600 baud rate, limited to 2400, +streaming (as when receiving GPS):
            20 channels = 4.3 Hz good 0 Hz bad

Rental Kit

The rental kit contains the following equipment:

- 2 NAS Satellite Telemetry Radios
- 2 Antennas
- 1 short TNC to TNC antenna cable
- 1 long TNC to N style antenna cable
- 1 adapter for N to TNC
- 1 power wire to cigarette lighter adapter
- 1 power wire with no ends

Installation

There are two radios, one for the car and one for the pit. There is also two antennas and two cables, one short enough for the car and one longer for the pit.

The pit radio has a RS232 serial connection which should be plugged directly into the laptop, or through a USB to serial adapter. There is also a 2 socket DTM connector for 12v, which may be wired up to a car battery or power supply which outputs a at least 3 amps.

> Pin 1 = ground
> Pin 2 = 12 volt battery +

The car radio also has the same 2 socket DTM for power. There is a 3 pin socket DTM for the serial connection to the MoTeC dash's telemetry output. Wiring connection is as follows:

> Pin 1 = 0v
> Pin 2 = serial data - connects to pin 67 of ADL
> Pin 3 = no connection

Warning: These radios ARE NOT waterproof or vibration proof. Insure they remain dry and the car radio must be mounted with soft Velcro only, not the industrial lock type.

Operation

To begin, the radios should be powered up, and have a satellite connection before beginning. This means both LEDs should be lit. Note the 3rd LED listed as Spare below has no function.

- P (red LED): LED lights up when power is provided to the A3LA-XM.
- I (green LED): LED stays solid when the signal strength is between 3–5, blinks when the signal strength is between 1 and 2 and is off when signal strength is 0. The LED also stays solid when the carrier detect (CD) goes high during a data call.
- S (green LED): Spare LED and not being used by the A3LA-XM

Once powered and ready, you will need to call the car's radio from the pit radio. This is best accomplished with HyperTermina (comes standard with Windows XP), or with the NAS terminal program called "SatTerm".   The problem with SatTerm is that it might crash often, and more so with baud rates other than 19200. I found it best to use HyperTerminal when working with a Windows XP machine. There are a bunch of free terminal programs if you want to download one and use it with Windows Vista or Win 7.

Make sure the baud rate and com port number is set correctly in the terminal program before continuing. When powering up the radio, the terminal program should show a bunch of header information about the radio. If the radio is already been powered before connecting to the terminal program you will not see any data appearing upon connection. Once connected you can verify connection by typing "**at**" and hitting enter. You should see the response "**OK**".

Now dial up the car's radio with the following command "**atd00881692451144**" followed by the enter key. After the command is issued, a short delay will occur until connection is established. This will be verified by the radio's response of "CONNECT". Telemetry data will now stream through. Close HyperTerminal and start Telemetry Monitor, making sure the baud rate and com port number is set correctly.   To end the call, disconnect power to the satellite radio.

Appendix A - Most Common Commands

All commands start with "at", upper or lower case doesn't matter. Spaces in the commands are generally ignored. When in tracking mode, no AT commands are listened for. To escape tracking mode type +++. When in data receiving mode, no AT commands appear to be listened for either. I'm not sure what to type to hang up a call.

at
  the radio will respond with OK as it can accept commands
atdnx..x
  where x..x is the number
  where n is
    L redial last number
    > direct dial from phonebook followed by entry #
at+cpbs=?
  query the phonebook
more phone book stuff on page 40
ats0=n
  where n is
    0 disable auto answer
    n>0 auto answer after n rings
ata
  answer
at+chup
  hang up
at&v
  view active and stored profile
at&yn
  use profile number as default settings
  where n is 0 or 1
at&Wn
  where n is
    0 store current config as user defined profile 2
    1 store current config as user defined profile 1
at+ipr=?
  lists the supported baud rates, and shows the set rate
at+ipr=n
  where n is
    4=4800,   5=9600,   6=19200 (factory default),   7=38400,   8=57600,   9=115200
at&kn
  Flow Control where n is
    0 disable
    3 enable RTS/CTS flow control
at&mn
  where n is
    0 normal asynchronous operation, default
at&qn
  select asynchronous mode where n is
    0,6 normal asynchronous operation w/o error correction
    5 asynchronous operation with error correction, default

The radio can store up to two configurations, and the default start up configuration may be selected to either configuration. A read out from the stored configuration yields the following, with the bolded text reporting the baud rate:

ACTIVE PROFILE 0:
E1 L2 M1 Q0 V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K0 &P0 &Q5 &R0 &S0 &X0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:004 S07:050
S08:004 S09:006 S10:014 S12:050 S14:170 S16:000 S18:000 S21:048
S22:246 S23:061 S25:005 S26:000 S27:009 S121:001S122:000S127:000
+IPR8 +CIER000 ^UE0 ^USMSE0 ^MPTDC0 ^MPTNC0 ^MPTFP0 ^MPTFR0 ^MODRST0
S15:0 S30:0 +CBST7,0,1 +CMEE0 +CSTA129 +SBDAREG0 +SBDMTA1 -MSVTR0 -MSVLS0

STORED PROFILE 0:
E1 L2 M1 Q0 V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K0 &P0 &Q5 &R0 &S0 &X0
S00:001 S14:170 S18:000 S21:048 S22:246 S23:061 S25:005 S26:000
S27:009 S121:001S122:000S127:000
+IPR8 +CIER000 ^UE0 ^USMSE0 ^MPTDC0 ^MPTNC0 ^MPTFP0 ^MPTFR0 ^MODRST0
S15:0 S30:0 +CBST7,0,1 +CMEE0 +CSTA129 +SBDAREG0 +SBDMTA1 -MSVTR0 -MSVLS0

STORED PROFILE 1:
E1 L2 M1 Q0 V1 W0 X4 Y0 &C1 &D0 &G0 &J0 &K0 &P0 &Q5 &R0 &S0 &X0
S00:001 S14:170 S18:000 S21:048 S22:246 S23:061 S25:005 S26:000
S27:009 S121:001S122:000S127:000
+IPR8 +CIER000 ^UE0 ^USMSE0 ^MPTDC0 ^MPTNC0 ^MPTFP0 ^MPTFR0 ^MODRST0
S15:0 S30:0 +CBST7,0,1 +CMEE0 +CSTA129 +SBDAREG0 +SBDMTA1 -MSVTR0 -MSVLS0

Appendix B - PinOut:

3.0 MULTI-INTERFACE CONNECTOR

The multi-interface connector is a male 25-pin miniature D-Sub type that includes seven interfaces—RS232, USB, DC input power, DC output power, ON/OFF control line, analog audio and Digital Peripheral Link (DPL). The multi-interface connector pin assignments are summarized in Table 1, which is 'pin-to-pin' the same as for models 9522A, A3LA-D, A3LA-D-NV and A3LA-SA except for Pin 2.

PIN #	SIGNAL	DESCRIPTION	INTERFACE
1	EXT_ON_OFF	Power on/off control input	DC Power
2	+12VDC	Output Voltage to Power the DPL Handset	DC Power
3	EXT_GND	External GND input	DC Power
4	EXT_B+	External 4.0VDC – 32.0VDC input	DC Power
5	SPKR_AUD	Speaker audio output	Analog Audio
6	DA_TX	PCM digital audio output	Digital Audio
7	RI	RS232 Ring Indicate	RS232 Data
8	RTS	RS232 Request To Send	RS232 Data
9	S_TX	RS232 Transmit Data/USB D–	RS232 Data
10	DCD	RS232 Data Carrier Detect	RS232 Data
11	DA_FS	PCM digital audio frame sync output	Digital Audio
12	DA_CLK	PCM digital 2.048MHz audio clock output	Digital Audio
13	S_RX	RS232 Receive Data/USB D+	RS232 Data
14	SIGNAL GND	RS232 Ground/USB Ground/Signal Ground	GND
15	MIC_AUD	Microphone audio input	Analog Audio
16	EXT_B+	External 4.0VDC – 32.0VDC input	DC Power
17	EXT_GND	External GND input	DC Power
18	DPL_TX	Digital Peripheral Link (DPL) data output	DPL UART
19	DTR	RS232 Data Terminal Ready/USB VBUS	RS232 Data
20	DPL_RX	Digital Peripheral Link (DPL) data input	DPL UART
21	DSR	RS232 Data Set Ready	RS232 Data
22	CTS	RS232 Clear To Send	RS232 Data
23	SIGNAL GND	RS232 Ground/USB Ground/Signal Ground	GND
24	DA_RX	PCM digital audio input	Digital Audio
25	SIGNAL GND	RS232 Ground/USB Ground/Signal Ground	GND