TECHNICAL NOTE TN-1260-AN

**TMAA01-05 and TMAA01-07
Options Extender Board Configuration**

25th June 2007

Applicability

Applies to anyone fitting either a TMAA01-05 or TMAA01-07 (options extender board) with PCB IPN: 220-65203-05 to a TM8000 mobile radio.

1.   Introduction

Improvements for the current version of TMAA01-05 (PCB IPN:220-65203-02) have resulted in an updated PCB (IPN:220-65230-05). With the addition of a new 'Enhanced' version (TMAA01-07) 2 variants are now available.

Table 1 indicates which features are fitted as standard or are optional for the TMAA01-05 and TMAA01-07.

Option	TMAA01-05		TMAA01-07	
	Fitted	Optional	Fitted	Optional
Hardware Handshaking		✓		✓
Internal ESD protection	✓		✓	
+5 volt pull-ups on the GPIO lines		✓		✓
Q1		✓	✓	
Q2		✓	✓	
Q3		✓	✓	
Relay 1		✓	✓	
Routing of RX Audio to DB15		✓		✓
8 spare 0E 0805 resistor links	✓		✓	

Table 1

2.   Details

PCB Information
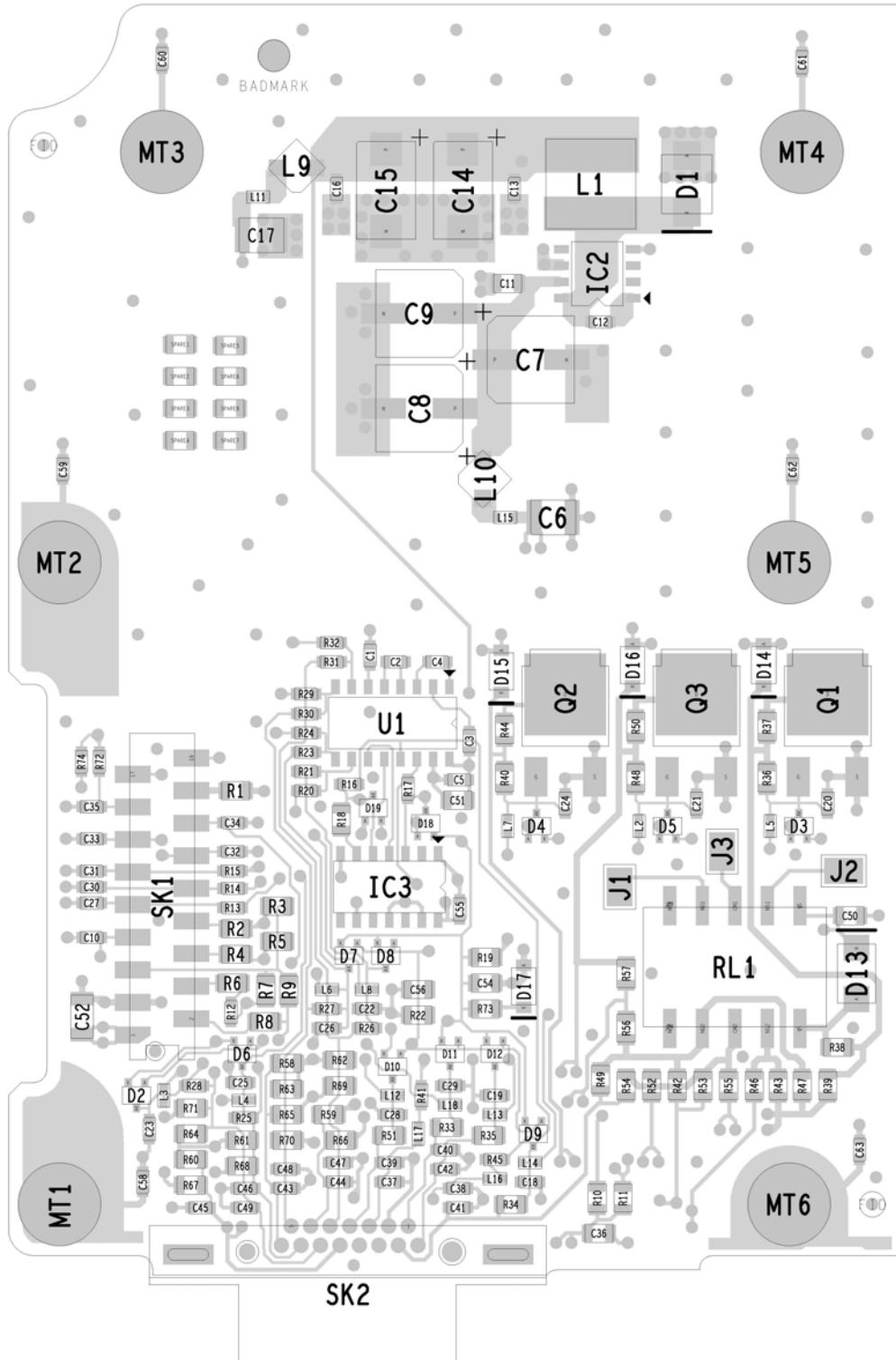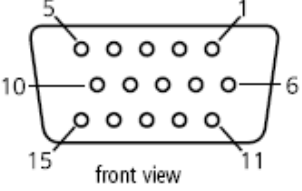
Figure 1 – TMAA01-05 / -07 PCB overlay IPN: 220-65203-05

3.   Configuration Options

	Pin	Signal	Description
	2	13V8_SW	13V8 supply
	6	AUD_TAP_OUT	Programmable tap point out of the Rx or Tx audio chain. DC-coupled
	7	AGND	analogue ground
	11	AUX_MIC_AUD	Auxiliary microphone input, with electret microphone biasing provided. Dynamic microphones are not supported.
	1	AUD_TAP_IN	Programmable tap point into the Rx or Tx audio chain. DC-coupled.
	3	RSSI	analogue RSSI output
	15	GPIO1	programmable function and direction
	14	GPIO2	programmable function and direction
	13	GPIO3	programmable function and direction
	10	GPIO4	programmable function and direction
	9	GPIO5	programmable function and direction
	5	GPIO6	programmable function and direction
	4	GPIO7	programmable function and direction
	12	IOP_RXD	an RS-232 compliant asynchronous serial port - receive data
	8	IOP_TXD	an RS-232 compliant asynchronous serial port - transmit data

Table 2 – External options connector - pins and signals

Hardware Handshaking

RS-232 communications now includes an optional hardware hand-shaking capability.

The CTS signal from the radio can be linked-in to replace IOP_GPIO4 or IOP_GPIO5 (GPIO4 or GPIO5 on the DB15 connector).

The RTS signal from the DTE to the radio can be linked-in to replace IOP_GPIO6 or IOP_GPIO7 (GPIO6 or GPIO7 on the DB15 connector).

Table 3 and 4 detail the components that must be fitted/ not fitted to accomplish CTS and RTS operation respectively. (Refer to Figure 1 for component location).

Enable CTS on line	Remove Resistor	Add Resistor	IPN	Ensure Not Fitted
GPIO4 (SK2 Pin 10)	R25	- R20 0E (0603) - R32 100E (0603)	038-10000-00 038-13100-00	R56, R57, R61 and R68
GPIO5 (SK2 Pin 9)	R26	- R21 0E (0603) - R31 100E (0603)	038-10000-00 038-13100-00	R62 and R69

Table 3 – CTS connection options

Enable RTS on line	Remove Resistor	Add Resistor		IPN	Ensure Not Fitted
GPIO6 (SK2 Pin 5)	R27	-	R23 0E (0603)	038-10000-00	R55, R63 and R70
		-	R30 100E (0603)	038-13100-00	
GPIO7 (SK2 Pin 4)	R28	-	R24 0E (0603)	038-10000-00	R64 and R71
		-	R29 100E (0603)	038-13100-00	

Table 4 – RTS connection options

The RS-232 option can also be bypassed entirely providing a direct pin-out of IOP_TXD and IOP_RXD at the DB15 by removing IC1 and IC3, and fitting 0E links R16 & R17. ESD protection is provided for these two lines.

Voltage pull-ups for IOP_GPIO1 to 7

Pull up from 3.30 Volts to 5 Volts is available for GPIO1 through to GPIO7. This is achieved through fitting resistors R58 through to R64.

NOTE: The value of the pull-up resistor on each GPIO is dependent on the application. Ensure that the limits of each IOP_GPIO are not being exceeded (Refer to section 4 within this Technical Note for these limits).

Pull-Up Voltage required	Add Resistors	IPN	Ensure Not fitted
5.0 Volts	R58 through to R64	See note above	R65 through to R71

Table 5 – GPIO +5 Voltage Pull-Up option

MOSFETs

On the TMAA01-05 MOSFETs can be optionally placed on GPIO1 to GPIO3 to provide higher current / voltage outputs. These outputs can be open-drain or pulled up to 5V or 13V8. These are fitted as standard on the TMAA01-07.

When the MOSFET option is enabled the line cannot be used as an input. Table 6 shows the components that are fitted to enable their use.

NOTE: Due to the limits of the Ground return current, the Options Extender Board **current must not exceed 2.5Amps.** Refer to section 4 for more details on these limits.

Enable MOSFET operation on Line	Remove	Add		
		Designation	Description	IPN
GPIO1	R36	Q1	SMD MTD3055EL-T4 Fet NCh	000-10305-51
		D14	DIODE SMF36A TVS 36V SOD123FL	001-10360-00
		R37	0E (0805)	036-10000-00
		R58 (Optional for 5 volt pull-up)	(0805)	
		R65 (Optional for 13 volt pull-up)	(0805)	
GPIO2	R40	Designation	Description	IPN
		Q2	SMD MTD3055EL-T4 Fet NCh	000-10305-51
		D15	DIODE SMF36A TVS 36V SOD123F	001-10360-00
		R44	0E (0805)	036-10000-00
		R59 (Optional for 5 volt pull-up)	(0805)	
		R66 (Optional for 13 volt pull-up)	(0805)	
GPIO3 & (optionally parallel) GPIO4	R48. (Also R25 & R32 if placing R57)	Designation	Description	IPN
		Q3	SMD MTD3055EL-T4 Fet NCh	000-10305-51
		D16	DIODE SMF36A TVS 36V SOD123F	001-10360-00
		R50	0E (0805)	036-10000-00
		R57 (Optional. Parallels GPIO3 and GPIO4)	0E (0805)	036-10000-00
		R60 (Optional for 5 volt pull-up)	(0805)	
		R67 (Optional for 13 volt pull-up)	(0805)	

Table 6

Relay Operation

On the TMAA01-05 Relay (RL1) can be optionally placed and controlled using IOP_GPIO1. This requires the placement of one MOSFET on the GPIO1 line. Refer to Table 7 for modification details.

The TMAA01-07 has the relay fitted as standard.

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Relay Contact Options

Numerous relay connection options are available at SK2. The type of connection is dependent on the configuration of the available options.

Tables 8a to 8c detail the components that will need to be fitted and/or removed and also the Pin and its function that will be disabled when a Relay contact is used.

Current through the relay is limited to 1 Amp by the DB15 connector.
 2 Amps is achievable by combining 2 pins in parallel.

Note: Care must be taken when selecting which links to install when using the relay, and particular attention must be taken to ensure that the appropriate links are removed. It is possible to damage the radio if one of the links that should have been removed is left on!

Depending on the application, it may also be necessary to remove the 470pF and 10nF capacitors on the SK2 end of the selected lines. Refer to the TMAA01-0x PCB Schematic IPN:220-65203-05.for the circuit reference and component values.

Remove	Add	Description	IPN
R36, R39	R37, R38	RES 0805 0R 1/8W	036-10000-00
	Q1	XSTR SMD MTD3055EL-T4 Fet NCh	000-10305-51
	D14	DIODE SMF36A TVS 36V SOD123FL	001-10360-00
	D9	DIODE MRA4004T3 1A/400V	001-10011-74
	RL1	RELAY 12V DPDT 10pin SMD	237-10010-00

Table 7 - Enable Relay Operation on the TMAA01-05

Common Contact on SK2 Replaces	Remove Link	Add 0E Resistor Link (IPN: 036-10000-00)	Ensure Not Placed
RSSI (Pin 3)	R51	R52	
AUD_TAP_IN (Pin 1)	R33	R53	R42
MIC_IN (Pin 11)	R34	R54	R49
GPIO6 (Pin 5)	R27	R55	R30, R63, R70

Table 8a- Common Relay Contact options

Normally Open Contact Replaces	Remove Link	Add 0E Resistor Link (IPN: 036-10000-00)	Ensure Not Placed
AUD_TAP_IN (Pin 1)	R33	R42	R53
MIC_IN (Pin 11)	R34	R49	R54
GPIO1 (Pin 15)		R47	R43, R39, R58, R65
GPIO4 (Pin 10)	R25	R56	R32, R57, R61, R68

Table 8b- Normally Open Contact options

Normally Closed Contact Replaces	Remove Link	Add 0E Resistor Link (IPN: 036-10000-00)	Ensure Not Placed
AUD_TAP_OUT (Pin 6)	R35	R46	
GPIO1 (Pin 15)		R43	R39, R47, R58, R65

Table 8c- Normally Closed Contact options

Routing Rx Audio

Signals on RX_AUD can be routed to be made available on GPIO7 (SK2 Pin 4). Table 9 details the components that will need to be fitted and or removed.

RX_AUD Replaces	Remove Resistor	Add 0E Resistor Link (IPN: 036-10000-00)	Ensure Not Placed
GPIO_7 (SK2 Pin 4)	R72, R28	R74, R28	R24, R29, R64, R71

Table 9 – RX_AUD Option

13.80 Volt and 5.0 Volt output Options

Pin 2 of SK2 can provide either 5.0 Volts (400mA max) or 13.80 Volts (Max 1 amp) depending on the link settings in table 10.

Voltage Required on Pin 2 of SK2	Remove Resistor	Add 0E Resistor Link (IPN: 036-10000-00)
13.80 Volts (Switched)	R10	R11
5.0 Volts (Regulated)	R11	R10

Table 10 – SK 2 Voltage Options

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4. Voltage and Current Limits

Ground Current

The maximum return current through ground is 2.5Amps.
This means the **total** current sunk by Q1, Q2 and Q3 and sourced by either +13V8_SW / +5V0_REG **must not exceed 2.5Amps**.

FET Voltage Limit

The voltage on the drain of Q1, Q2, Q3 must not exceed 35V.
The FETs are protected against ESD discharge, however if the FET's are used to switch an external relay or other inductive load, protection must be included at the load to remove the back EMF generated when it is switched off.

FET Current Limit

Q1 and Q2 can sink a maximum of 1 Amp (limited by the current handling capabilities of the DB15 socket).
Q3 can sink 1Amp through GPIO3 (SKT2 pin 13), however it is possible for Q3 to sink 2Amps by connecting pins 13 and 10 in parallel. This is accomplished by placing 0E R57 and removing / ensuring not placed: R25, R32, R56.

Note: that the Options Extender Board can source / sink a total of 2.5Amps Maximum.

Voltage pull-ups for IOP_GPIO1-7

The maximum Sink and Source current for IOP_GPIO 1 to 7 is 100µAmps

Relay Voltage Limit

The Relay can switch a maximum of 30V AC or DC.

Relay Current Limit

With one of SK2's pins connected to the Relay contacts, the Relay can switch a maximum of 1 Amp. With two of SK2's pins connected in parallel to each of the relay contacts, a maximum of 2 Amps can be switched.

+5V0 Regulator

400mA max

+13V8_SW

1 Amp total. This includes control head current etc.

5. Issuing Authority

Name and Position of Issuing Officer

Malcolm Brown
Senior Customer Support Engineer

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