MOTOROLA
Americas Parts Division

Smart Radio Interface Box
User's Guide

Americas Parts Division
1313 E. Algonquin Road, Schaumburg, IL 60196

68-80309F20-A

SmartRIB Specifications

Operating temperature range	0°C to 50°C
Storage temperature range	-30°C to 70°C
Dimensions less battery(HxWxD)	1.375 x 4 x 5.875 in.

Current Drain

Standby	42 mA
Transparent mode	50 mA
Smart mode(FLASHing)	110 mA

Battery Life	50 hrs - Standby
	20 hrs-FLASHing

Power Supply

120VAC Wall Adapter	12 Vdc @ 300mA, nominal
220VAC Wall Adapter	12 Vdc @300mA, nominal
Mobile B+	16 Vdc, maximum
Battery	9 Vdc, nominal

Note: The SmartRIB detects low battery when the supply voltage drops below 7.5 V. As a result, the LED will blink continuously until the SmartRIB is reset.

Programming Specifications

Vpp	11.98 Vdc <= Vpp <= 12.63 Vdc
Alt. Vpp	12.48 Vdc <= Alt. Vpp <= 13.22 Vdc
Ipp	30mA (maximum)

Note: The programming voltage is referenced to pins #10 and #14 of J2 when the SmartRIB is in the Smart Mode.

Add to SRIB manual (6880309F20-A) for „D“ version

1. Add C102 (220PF) (2113740B57) between Pins 12 and 13 of U17 and ground.
2. Add a connection between Pin 32 of U4 and Pin 82 of U3.
3. Change cathode connection of VR1 (15V Zener) (4813830A28) from U3 Pin 41 to junction of R22&C37. The anode remains connected to ground.
4. Add R44 (10R) (0660076A01) from junction of R22, C37 and VR1 to SWAB

HW-SMR

MOTOROLA INC.

6/27/95
SMR #6126

INSTRUCTION MANUAL REVISION

GENERAL: This revision outlines changes that have occurred since the printing of your instruction manual.

MANUAL AFFECTED: 68P80309F20-A, Smart Radio Interface Box User's Guide

REVISION

DETAILS:

1) Replace page 5/6 with the enclosed page. Changes are on page 5 and are as follows.
Add note describing difference between RLN1015A and RLN1015B.

2) Replace page 7/8 with the enclosed page. Changes are on page 7 and are as follows.
Change Crystal Pull Circuit theory of operation paragraph to reflect changes in the RLN1015C.

3) Replace page 9/10 with the enclosed page. Changes are on page 10 and are as follows.
Change RLN1015C bill of material to reflect modfied crystal pull circuit.

4) Add page 11/12 and 13/14 to explain schematic differences between RLN1015A, RLN1015B and RLN1015C.

SMR-6126 has been incorporated into this manual. This gold sheet is included for your reference.

Introduction

The Smart Radio Interface Box, or SmartRIB, is the next generation Radio Interface Box, or RIB (RLN4008B). The SmartRIB performs two functions. First, the SmartRIB performs all the functions of the current RIB, allowing the Radio Service Software (RSS) run from the host personal computer to communicate directly with the radio under test. Second, the SmartRIB's microprocessor can communicate with the host personal computer and the radio under test to perform a new set of functions, such as a FLASHport® upgrade. In this second function, the SmartRIB is a key part of the FLASHport® system, but it is NOT the only part of the system. Consult your FLASHport User's Guide to correctly identify the other necessary FLASHport® system components as well as the different radio models that may be upgraded.

Upon power up, the SmartRIB is compatible and is interchangeable with the standard RIB. The SmartRIB may be used in the same programming systems with the same Radio Service Software (RSS) that require the current RIB.

The SmartRIB requires the accessories listed in Table 1. Consult your Radio Service Software (RSS) manual or your FLASHport User's Guide to identify how your system is set up as well as the other necessary system components.

Item	Part Number
Computer Interface Cable:	
• 9-to-9 PC-to-SmartRIB cable*	30-80390B48
or	or
25-to-9 PC-to-SmartRIB cable*	30-80390B49
Power:	
• 120VAC Power Pack	01-80302E27
or	or
220VAC Power Pack	25-80373E86
and/or	and/or
Battery Pack	RLN-4488A

* Standard RS232, shielded cable. Different than standard PC-to-RIB cable.

Table 1: SmartRIB Accessories

Getting Started

Figure 1 illustrates the equipment required to program a radio with Radio Service Software (RSS). Note that the FLASHport® equipment requirements are different; consult your FLASHport User's Guide for required equipment and system setup. To set up the SmartRIB to run RSS the following steps are required.

1. Connect the 120VAC power pack (01-80302E27) **OR** the 220VAC power pack (25-80373E86) to the power jack (J1, next to the DB9 pin connector) **AND/OR** the battery pack (RLN-4488A) to the bottom of the SmartRIB. If using the battery pack, refer to the installation instructions included with the battery pack.

2. If you are using an AC power pack, plug the 120VAC/220VAC plug into an outlet.

3. Connect the 9 pin male side of the computer interface cable to the DB9 pin connector (J3) on the SmartRIB.

4. Connect the 25 pin side (30-80390B49) or the 9 pin female side (30-80390B48) of the computer interface cable to the appropriate serial port on the computer.

5. Connect the appropriate radio programming and test cable to the DB25 pin connector (J2) of the SmartRIB and to the radio under test.

6. Turn on the SmartRIB by setting the three position power switch to the "1" position. Position "0" is off, and position "XP" enables the crystal pull circuit. The "XP" position is only used when aligning a radio's receiver and electromagnetic interference (EMI) from the SmartRIB is degrading radio performance. Upon successful power up, the power on LED (CR2) will be on in a steady mode . If the LED is blinking, an error condition exists, defined by the rate of blinking according to the table

below. See the LED Modes section below for further explanation of the Hardware Error causes.

Low SWB+ Error	
LED Flash Rate:	Continuous blink of 200ms on, 200ms off
Condition:	The input SWB+ voltage is too low for proper operation.
Kernel Mode	
LED Flash Rate:	Continuous blink of 100ms on, 100ms off, 100ms on, 500ms off, continuous cycling
Condition:	SmartRIB is in kernel mode, the SSN I/O port (pin 21 of connector J2) is tied to ground. The short may be on the SmartRIB board or in the radio cable. In either case, this shorted condition must be removed for normal operation.
Hardware Error	
LED Flash Rate:	Continuous blink of 100ms on, 100ms off, 100ms on,100ms off, 100ms on, 100ms off, 100ms on, 900ms off
Condition:	One of six possible hardware errors has been detected. Four of the six errors involve microprocessor U3. These are fatal errors and can only be corrected by the Test Equipment Service Depot.

Table 2: Error Conditions

7. Consult your Radio Service Software user's guide for instructions to program or upgrade your radio.

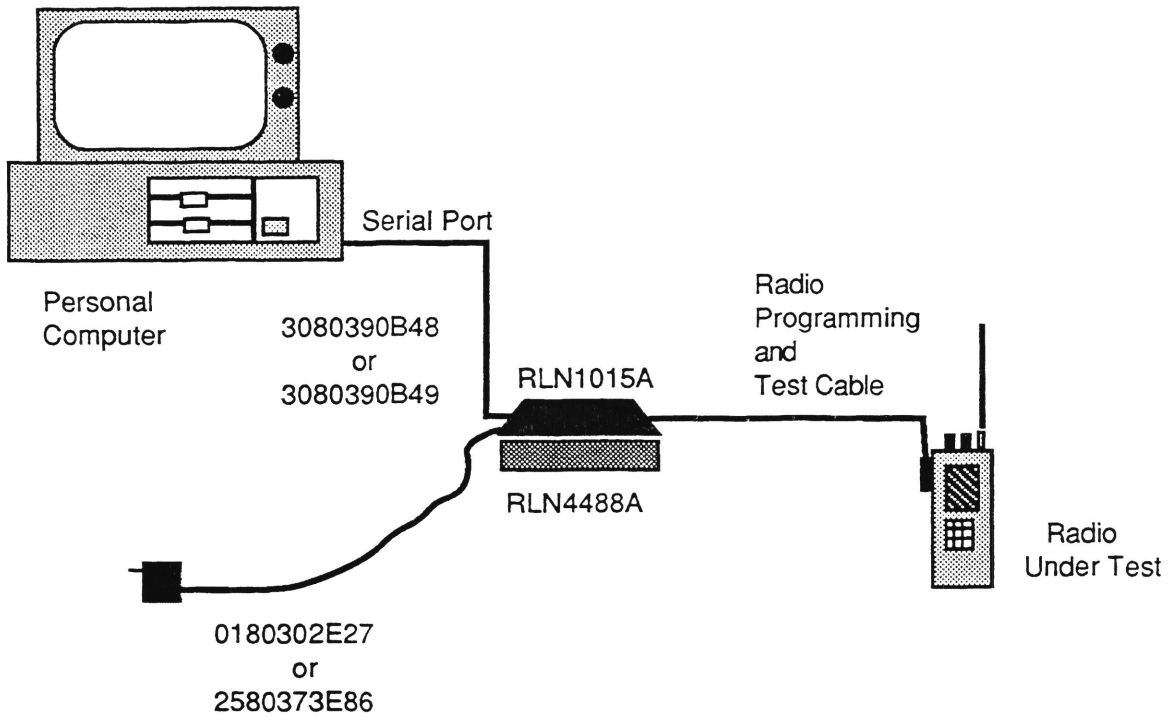


Figure 1: SmartRIB Radio Service Software (RSS) setup for codeplug programming.

Theory of Operation

Power up

The SmartRIB can be powered by one of three sources: 1) the 120VAC-to-12VDC wall transformer OR the 220VAC-to-12VDC wall transformer, 2) the 9-volt battery pack, or 3) in the case of a mobile radio, the radio's switched B+ line. Both the 120VAC-to-12VDC wall transformer and the 220VAC-to-12VDC wall transformer plug into power jack J1. The battery pack is fastened to the bottom of the SmartRIB housing; battery voltage reaches the main board through a power cable that plugs into J4. When the SmartRIB is connected to a mobile radio, the switched B+ voltage from the radio enters the SmartRIB through pin 12 of connector J2.

The power switch, S1, located on the top of the SmartRIB is a three position, double pole double throw switch. The middle position is OFF; the other two positions are ON. One of the ON positions enables the crystal pull circuitry (Q8) described under the Crystal Pull subsection. When the power switch is toggled to either ON position, the SmartRIB will power up and perform a self test. If the self test is successful, the microprocessor, U3, will turn on green LED CR2 by applying Vdd to the gate of Q18. If an error is detected during the self test, the microprocessor will flash CR2 at a predetermined rate dependent upon the error. Possible errors are listed below in subsection LED Modes.

NOTE: It has been determined that an unpowered RLN1015A model SmartRIB may cause certain mobile radios to key up if the mobile radio is powered when the SmartRIB is attached. This situation is corrected by turning on the SmartRIB. For RLN1015B and later models, when mobile radio B+ is present at the SmartRIB input (J2, pin 12), the SmartRIB will be powered up if the mobile radio is powered up independent of the setting of power switch S1. This prevents the mobile radio from keying up.

Operating Modes

The SmartRIB has two modes of operation, Transparent Mode and Smart Mode. In Transparent Mode, the SmartRIB allows the host computer to communicate directly with the radio under test as the current RIB does. In Smart Mode, the host computer communicates directly with the SmarRIB microprocessor U3; U3 communicates with the radio under test. FLASHport® upgrades are performed with the SmartRIB in Smart Mode.

The SmartRIB powers up in Transparent Mode. In this mode, input "A" of 2:1 MUX U10 is selected by microprocessor U3. RSS puts the SmartRIB into Smart Mode; in this mode, input "B" of 2:1 MUX U10 is selected by microprocessor U3.

Power Supplies

The SmartRIB has three power supplies: SWB+, Vdd, and Vpp. The OR function of diodes CR1 and CR4 determine the SWB+ source. The highest voltage from the wall adapter input jack (J1) or the battery pack input (J4) or the mobile radio B+ (J2, pin 12) becomes the SmartRIB SWB+ supply. SWB+ powers both the LED circuit (R10, CR2, Q18) and the Vdd regulator circuit (U2).

SWB+ Source	SWB+ Range
•9.0V Battery Pack	8.4Vdc, nominal
•120VAC/220VAC wall adapter	13.0Vdc - 17.8Vdc
•Mobile B+	11.0Vdc - 16.0Vdc

Table 3: SWB+ Range versus Source

Micropower voltage regulator U2 supplies Vdd at pin 3. Vdd powers all SmartRIB circuitry. Pin 6 of U2 provides the RESET signal, forcing the microprocessor U3 into reset when Vdd begins to drop due to low SWB+. RESET is active logic low, less than 0.8Vdc.

Vdd Range
4.90Vdc - 5.10Vdc

Table 4: Vdd Range

U7, a DC-to-DC converter, generates Vpp. Vpp is the programming voltage required for FLASHport® upgrades. U7 steps up the Vdd voltage through L3, CR3, and C16. Capacitor C14 sets the switcher's operating frequency. Pin 8 of U7 is the collector of the transistor that drives the switching transistor; the switching transistor's collector is at pin 1 and the emitter is at pin 2 of U7. Pin 7 of U7 is the current limit sense input. A maximum of 250mVdc - 350mVdc will appear across R15 in maximum current draw from the circuit. Since R15 is a 1.0 ohm resistor, the current limit of U7 is 250mA - 350mA. Pin 5 of U7 is the reference comparator input; the voltage measured at this point is 1.25Vdc +/- 2%. The value of Vpp is set by R13, R14, and R60 and the value of the reference comparator input voltage. Microprocessor U3 may select one of two different output voltages for Vpp by turning Q17 on or off. With Q17 off, the nominal value of Vpp is 12.33Vdc measured at C17. With Q17 on, the nominal value of Vpp is 12.92Vdc measured at C17. Microprocessor U3 turns on Q3 and thus Q2 to supply Vpp to the radio at the Vpp port, pin 10 of J2. Microprocessor U3 turns on Q5 and thus Q7 to supply Vpp at the MOD CNTL port, pin 14 of J2.

Vpp (Q17 off):	11.98Vdc - 12.63Vdc
Alternate Vpp (Q17 on):	12.48Vdc - 13.22Vdc

Table 5: Vpp Ranges Measured at C17

Computer Interface

The SmartRIB communicates with the host personal computer through an RS232 link. RS232 driver/receiver U1 translates RS232 voltage level signals into logic voltage level signals and logic voltage level signals to RS232 voltage level signals for the SmartRIB and radio under test. From Vdd, U1 generates a positive RS232 voltage of +5Vdc to +10Vdc at pin 17 by means of an on chip charge pump at pins 18 and 20 with capacitor C6 and zener diode VR28. U1 generates a negative RS232 voltage of -5Vdc to -9Vdc at pin 4 by means of an on chip charge pump at pins 1 and 3 with capacitor C5 and zener diode VR29. Once in Smart Mode, Asynchronous Serial Controller (ASC) U6 formats the serial data and controls the RS232 bus signals required to communicate with the host personal computer's serial port.

Radio Interface

The SmartRIB is capable of programming a radio's codeplug or of performing a FLASHport® upgrade. The commands for each of these operations come from the Radio Service Software (RSS), which sets the SmartRIB's operating mode (Smart versus Transparent). Consult your RSS manual or your FLASHport® User's Guide to understand the details of these processes.

Crystal Pull Circuit

The SmartRIB microprocessor clock is determined by the frequency of crystal Y1A. With the power switch set to the "1" position, Y1A operates at 14.7456MHz. In this mode, Q8 is turned on and shorts out inductor L5, preventing it from being electrically in series with the crystal. When the power switch is in the "XP" position, Q8 is turned off permitting L5 to be electrically in series with Y1A. This forces the crystal to beome slightly detuned or pulled, causing the crystal's operting frequency to change. The crystal frequency change causes the microprocessor's clock frequency to change, moving any SmartRIB generated electrical noise off the current radio receiver channel. The XP function may be used when tuning a radio's receiver and any SmartRIB generated Radio Frequency Interference (RFI) is degrading receiver measurements.

LED Modes

The SmartRIB indicates error conditions by flashing the power on LED (CR2) at specific rates. The following error modes are provided.

Low SWB+ Error

LED Flash Rate: Continuous blink of 200ms on, 200ms off

Condition: The input SWB+ voltage is too low for proper operation.

Kernel Mode

LED Flash Rate: Continuous blink of 100ms on, 100ms off, 100ms on, 500ms off, continuous cycling

Condition: SmartRIB is in kernel mode, the SSN I/O port (pin 21 of connector J2) is tied to ground. The short may be on the SmartRIB board or in the radio cable. In either case, this shorted condition must be removed for normal operation.

Hardware Error

LED Flash Rate: Continuous blink of 100ms on, 100ms off, 100ms on,100ms off, 100ms on, 100ms off, 100ms on, 900ms off

Condition: One of six possible hardware errors has been detected. Four of the six errors involve microprocessor U3. These are fatal errors and can only be corrected by the Test Equipment Service Depot.

Error	Type/Impact
1. K4 mask ROM checksum error	Fatal/ SmartRIB may not function correctly
2. Internal RAM error	Fatal/ SmartRIB may not function correctly
3. Internal EEPROM checksum error	Fatal/ SmartRIB may not function correctly

4. Flash ROM checksum error	Non-Fatal/SmartRIB will operate in Transparent Mode but not Smart Mode
5. External RAM error	Non-Fatal/SmartRIB will operate in Transparent Mode but may not in Smart Mode, check U5
6. Config register error	Fatal/ SmartRIB may not function correctly

SmartRIB Software Upgrades

Changes in SmartRIB operating software will be downloaded with each FLASHport® upgrade package. Therefore, there are no separate SmartRIB software upgrade packages available.

Field Replaceable Parts

The following list contains field replaceable parts; we recommend that you make any part replacements ONLY with the Motorola specified part to insure proper SmartRIB operation. The microprocessor (U3) and FLASH memory chip (U4) are not field replaceable; these parts may only be replaced by the appropriate service depot. For North American customers, the service depot is:

Motorola Test Equipment Service Depot
1308 Plum Grove Road
Schaumburg, IL 60173 U.S.A.

Field Replaceable Components:

Reference Designator	Description	Motorola Part Number
U1	RS232 DRIVER/RECEIVER	51-13811A11
U2	VOLTAGE REGULATOR	51-80364E09
U5	SRAM	51-80364E07
U6	RS232 ASC	51-80364E06
U7	DC-TO-DC CONVERTER	51-2198J31
U8	COMPARATOR	51-84785R26
U9	BILATERAL SWITCH	51-5750U28
U10	2:1 MUX	51-80364E08
U11,U16	3 STATE BUFFER	51-13805A75
U15,U17,U19	NAND GATE	51-13808A01
U18	8 BIT LATCH	51-13805A75
Q1,Q10,Q13,Q14,Q19	TRANSISTOR,NPN	48-80141L02
Q2,Q6,Q7	TRANSISTOR, PNP	48-5128M40
Q3,Q4,Q5	TRANSISTOR, NPN	48-80048M01
Q8,Q11,Q16	TRANSISTOR, PNP	48-80141L01
Q17,Q18	TRANSISTOR, FET	48-5218N11
CR1	DIODE, DUAL	48-5129M12
CR2	LED	48-5776C02
CR3,CR4,CR5,CR9	DIODE	48-5129M05
VR1-VR16,VR19,VR27	DIODE,ZENER 5.1V	48-80140L06
VR17,VR18,VR20,VR23, VR25,VR30,VR32	DIODE,ZENER,15V	48-80140L20
VR21,VR22,VR24,VR26, VR28,VR29,VR31,VR33, VR34	DIODE,ZENER,10V	48-80140L15
C4,C9,C10	CAP 24pF	21-13740F36
C24-C101	CAP,220pF	21-13740F59
C14	CAP,820pF	21-13741F23
C3,C7,C8,C11,C13,C18,C19	CAP,CER, .100uF	21-13743K15
C12	CAP,TANT,1uF	23-11049A07
C20	CAP,TANT,2.2uF	23-11049A10
C15	CAP,TANT 47uF	23-11049A23
C5,C6,C20-C23	CAP,TANT,10uF	23-11049J25
C2,C16,C17	CAP,TANT,33uF	23-11049J40
L2	COIL,1.3uH	24-5452C63
L5	COIL,10uH	24-5452C68
L1	COIL,10uH	24-62575A07
L3	COIL, 300uH	24-80372E15
L4	COIL,	24-84657R01
J1	RECEPTACLE,POWER	09-80371E98
J2	PLUG, PCB 25 POS D	28-80372E55
J3	CONN D-SUB,9 PIN	0905214U06
J4	PLUG 3 PIN	28-83143M06
S1	SWITCH,2 POLE, 2 THROW	40-80372E56
Y1	CRYSTAL	48-80372E28
	SCREW, TAPPING	03-10945A14
	COVER SHIELD	15-5793X01
	SHLD FENCE	26-5792X01

Field Replaceable Components (continued):

Reference Designator	Description	Motorola Part Number
	SEAL, DUST	32-80372E49
	HOUSING, TOP, SMART RIB	15-80371E77
	PLATE,COVER	64-80382B12

Pin Descriptions for Connectors

J2:	1	GND	14	MOD CNTL
	2	MIC HI	15	Bus+
	3	SCI RX+	16	NC
	4	Bias	17	Freeze
	5	SCI RX-	18	SCL
	6	Busy	19	ACC Vpp
	7	NC	20	MOSI
	8	/Busy	21	SSN I/O
	9	SCK	22	MISO
	10	Vpp	23	Reset CNTL
	11	Bus-	24	Bus+2
	12	Mobile B+	25	GPIO 1
	13	Bus-2		

J3:	1	CD	Data Carrier Detected
	2	RXD	Receive Data
	3	TXD	Transmit Data
	4	DTR	Data Terminal Ready
	5	GND	Ground
	6	DSR	Data Set Ready
	7	RTS	Request To Send
	8	CTS	Clear To Send
	9	RI	Ring Indicator

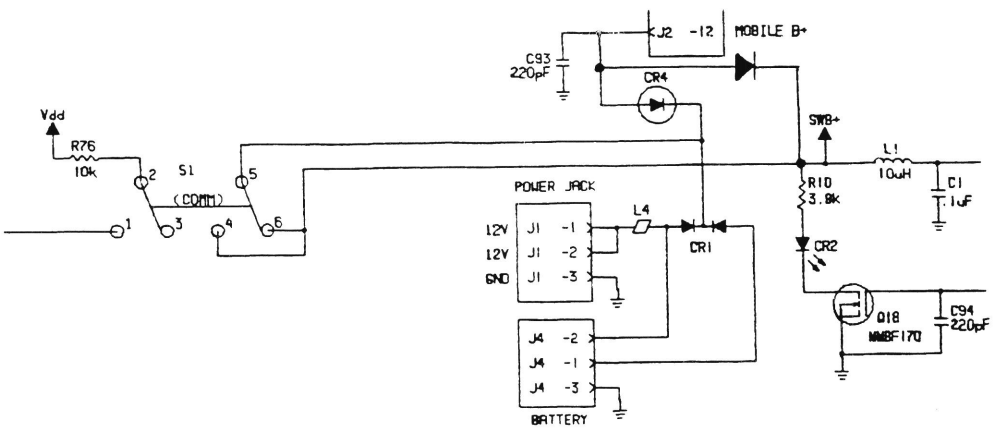
Schematic Differences Per Model Issue

RLN1015A:

The attached electrical schematic applies to ALL SmartRIB version A models, identified by the part number RLN1015A.

RLN1015B:

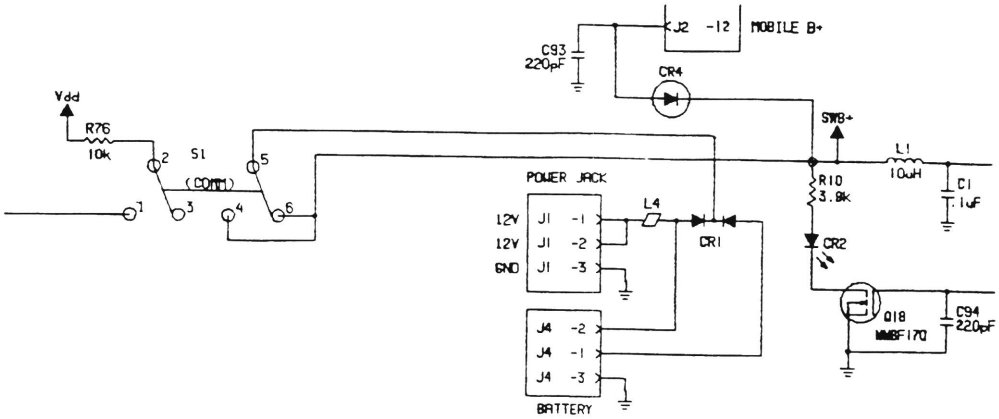
The attached electrical schematic for the RLN1015A is the same for the version B models except in that area where MOBILE B+ (J2-12) enters SWB+. The RLN1015B has a leaded diode (Part Number 4883654H01) soldered between J2-12 and S1-6. The diode's anode is soldered to J2-12, and the diode's cathode is soldered to S1-6. This diode powers the SmartRIB up when the unit is attached to a powered up mobile radio. Note that the position of the diode defeats the operation of S1. This is intentional, to keep the mobile radio from keying up when an unpowered SmartRIB is attached. This modified portion of the schematic appears below.



RLN1015B with leaded diode

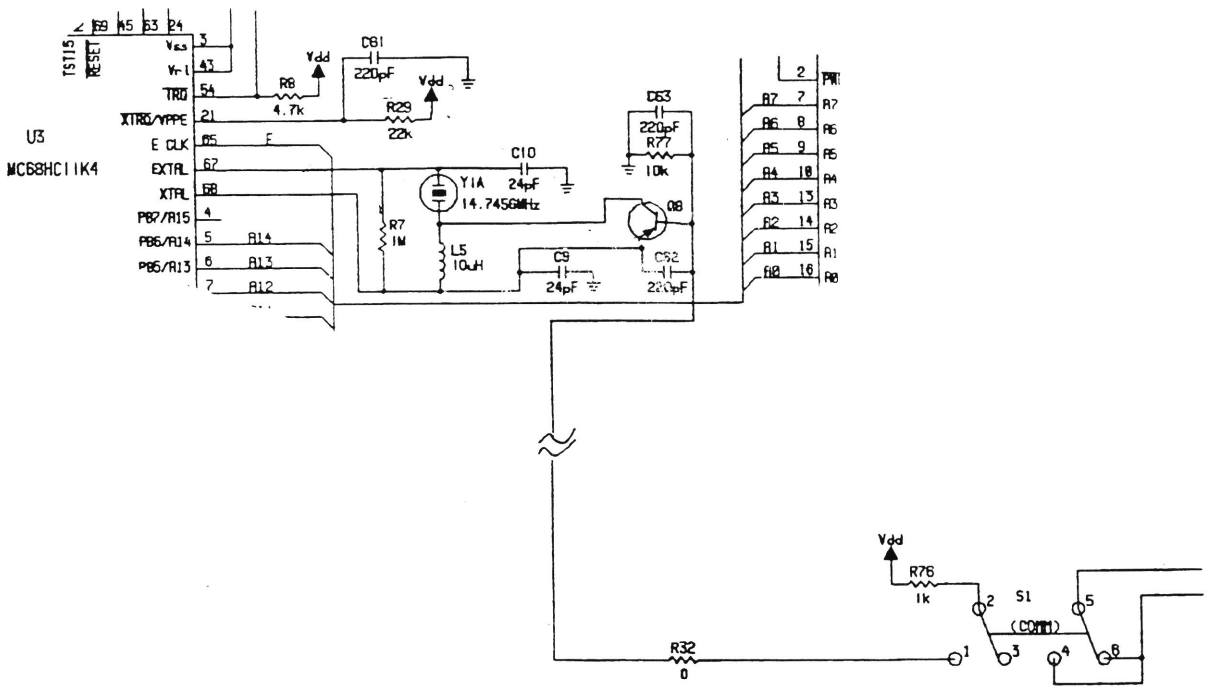
RLN1015C:

The attached electrical schematic for the RLN1015A is the same for the version C models except in that area where MOBILE B+ (J2-12) enters SWB+ and in the Crystal Pull circuit. Early versions of the RLN1015C have a leaded diode (Part Number 4883654H01) soldered between J2-12 and S1-6. The diode's anode is soldered to J2-12, and the diode's cathode is soldered to S1-6. This diode powers the SmartRIB up when the unit is attached to a powered up mobile radio. Note that the position of the diode defeats the operation of S1. This is intentional, to keep the mobile radio from keying up when an unpowered SmartRIB is attached (see the section titled Power up for complete details). This modified portion of the schematic appears above in the schematic titled Early version RLN1015B with leaded diode. Later versions of the RLN1015C implement the diode change on the printed circuit board. In these versions, the cathode of CR4 is electrically connected to S1-6. This version of the circuit is shown below. Functionally, the later version is identical to the early C version, powering the SmartRIB up when the unit is attached to a powered up mobile radio.

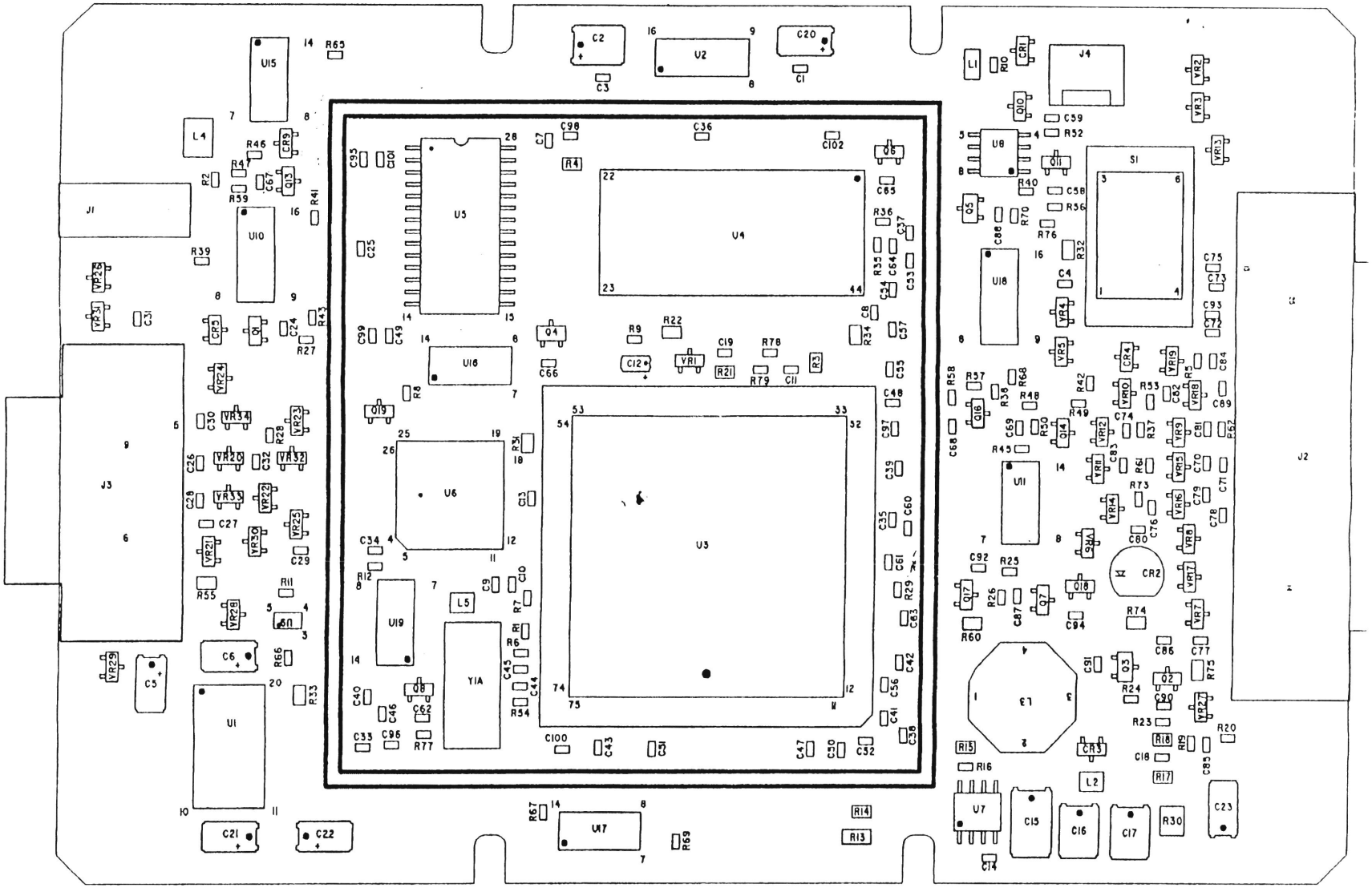


Later version RLN1015C with printed circuit board change

The RLN1015 C model Crytal Pull circuit differs from the A model Crystal Pull circuit in that crystal pull transistor Q8 has been changed from an NPN device to a PNP device, the value of R77 has been changed from 100kohms to 10kohms, and the value of R76 has been changed from 10kohms to 1kohm. These changes are shown in the schematic below.



RLN1015C and Later Model Crystal Pull Circuit


U15
U2
U5
U4
U10
U16
U6
U3
U19
U1
U17
U8
U18
U11
S1
J1
J3
J4
J2
YIA
L3
CR2