Manpack Transceiver 2110 series
Repair Guide

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The English version takes precedence over any translated versions.

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Table of contents

Interconnection diagrams and listed spares drawings

Functional description of PCBs

Repair procedures, tests, and adjustments

Options

Definitions

Specifications

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List of figures

This page has been left blank intentionally.

List of tables

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Index

G

H

I

L

M

N

O

P

R

S

T

U

V

W

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Overview of this guide

This Repair Guide is intended for use by personnel at Codan-trained Service Centres and Accredited Service Centres, enabling rapid and cost-effective servicing of the 2110 series Manpack Transceiver.

This guide provides an overview of the equipment and its specifications, functional descriptions, fault diagnosis to board level, board replacement, functional testing and interconnection drawings for the 2110 series Manpack Transceiver. The fault diagnosis and testing procedures provided assume that the transceiver does not have any hardware options fitted. A list of available hardware options is included with this guide.

This guide assumes that you have a good understanding of electronics with a technical background, and that you understand operation and setup processes for the transceiver. It also assumes that you have access to the relevant Getting Started Guide or Reference Manual for your manpack transceiver.

This guide contains the following sections:

Contact information—provides details of how to access up-to-date contact information from Codan's website

Ordering information—explains the details required by Codan to ensure prompt service and delivery

Overview—general description of the 2110 series Manpack Transceiver

Brief description—brief technical description of the 2110 series Manpack Transceiver including a general description of the major circuit functions for the control, reception and transmission of signals

Interconnection diagrams and listed spares drawings—provides drawings that are required during repair of a 2110 series Manpack Transceiver

Functional description of PCBs—functional description of each PCB, including a list of test points and PCB layouts

Repair procedures, tests, and adjustments—provides flowcharts and tests for identifying faulty subassemblies, and a test sheet for recording test data

Options—provides drawings and instructions for identifying and checking correct operation of hardware options in the transceiver

Definitions—lists all standards, acronyms, abbreviations and units used in this guide

Specifications—provides specifications for the 2110 series Manpack Transceiver

How to use this guide

The printed version of this guide supplied by Codan contains pages that fold out beyond the folder on either side. This enables you to view block diagrams, test-point layouts and flowcharts while reading relevant text on tests and procedures.

Begin the fault diagnosis process by using the Repair flowchart (see Figure 29 on page 95). The same flowchart is also used to confirm that a transceiver is operating correctly.

Follow the steps in the Repair flowchart systematically to ensure the correct fault is isolated. If you step out of the flowchart to a test procedure, return to the same point on the flowchart upon completing the test, and continue as prompted.

At some points where a pass criteria is not met, the Repair flowchart refers to a function-specific fault diagnosis flowchart. Some steps require a simple task to be performed. Other steps require a test to be performed. In such a case, the PCB, test point, and test condition are provided.

NOTE Not all faults may be diagnosed from the fault diagnosis flowcharts due to the complex nature of the transceiver. In such an instance, or to confirm that a PCB is faulty, see page 27, *Functional description of PCBs*.

Board replacement philosophy

To facilitate rapid and cost-effective servicing, and to effectively manage the increasing sophistication of electronic assemblies, a strategy of board replacement applies to all 2110 series Manpack Transceivers.

As part of this strategy, all boards are designed and tested so that any individual board can be replaced, while maintaining factory specifications of the entire unit.

If functional spare boards are held in stock, they may be substituted during the fault diagnosis process in order to positively localise the fault to one board.

Disposal

Depending on the regulations within your country, some items from the transceiver may need to be returned to a recycling facility for correct disposal. Please be aware of any such regulations in your country and act accordingly.

CAUTION This product contains lead solder.

Please be aware of your organisation’s policies for safeguarding the disposal of security products. Please contact your Codan representative for further information on this matter, if required.

Circuit board precautions

Connection/Disconnection

Ensure that any power supply or battery is switched off or disconnected before making connections or disconnections between circuit boards.

Handling

Handle circuit boards by the edges only. Use antistatic bags or trays to store and transport PCBs.

Grounding

Ground any items that may come into contact with the circuit board as follows:

- Discharge static charges, which may build up on a person, by touching a grounded metal surface with both hands. This should be done before working on circuit boards, and at frequent intervals while working on circuit boards.
- Wear a suitably grounded conductive wrist strap and use an anti-static mat. This minimises the build up of static on you.
- Ensure that all test equipment is properly earthed through its power connection or by earthing it to the workbench or anti-static mat.

Soldering

Excessive heat from soldering may lift tracks from the circuit boards and cause serious damage. Avoid the use of high-powered soldering irons. A soldering iron rated at a maximum of 60 W, preferably temperature-controlled at approximately 370°C, is sufficient for most tasks. A soldering iron rated at a slightly higher temperature of 425°C may be required for heavier components such as PA transistors. Only apply the soldering iron long enough to de-solder an existing joint, or to solder a new one.

CAUTION Do not use lead-free solder for new soldering work.

De-soldering

When de-soldering a component, use a solder sucker or solder wick to remove existing solder.

CAUTION Do not use sharp metal tools such as screwdrivers or twist drills to remove components as these may damage the printed circuit track and plated thru-holes.

A special de-soldering station is recommended for plated thru-holes.

Transmitter precautions

When making measurements of the low-level stages of the exciter, it is advisable to remove the drive to the PA & Filter PCB. The supply voltage is applied to the PA at all times when the transceiver is switched on.

CAUTION Caution should be exercised when connecting test equipment to avoid incorrect readings and/or damage.

Probe precautions

Observe the following when connecting oscilloscope probes to the transceiver:

- When connecting probes to the PA assembly, the earth clip lead should be wound around the body of the probe so that the earth clip can be earthed to the ground plane as close as possible to the point of measurement. This reduces stray RF pick-up.
- It is not advisable to connect two probes at the same time, particularly when one is earthed to the PA ground plane and the other is earthed to the exciter. This may cause earth loop problems.
- Probes should be connected before power has been applied to the transceiver and the test equipment. The earth connection should be made first and disconnected last.

Contact information

If the fault diagnosis guidelines do not locate the faulty module or cable, or if further technical assistance is required for any other reason, please see our contact details on the internet at www.codan.com.au. Click on  at the top of the page.

Outside of normal office hours, Codan has Customer Service Engineers on call to provide emergency technical assistance. They will either answer your call immediately or return your call as soon as possible.

If you are connected to a voice mail system when you call, please follow the instructions carefully, that is, leave your name and contact phone number (including the country code), then a brief, clear description of your problem.

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Ordering information

Orders for replacement parts/modules must include the following information:

- equipment type (e.g. Type 2110 Transceiver)
- Codan part number (e.g. 08-06039)
- module description (e.g. Antenna Tuner PCB)

This ensures that the correct items are supplied, and speeds up delivery times.

NOTE

The ordering information for some boards requires an extension to the Codan part number, for example, -101 or -201. Please refer to the listed spares drawings for this correct extension (see page 25, *Interconnection diagrams and listed spares drawings*).

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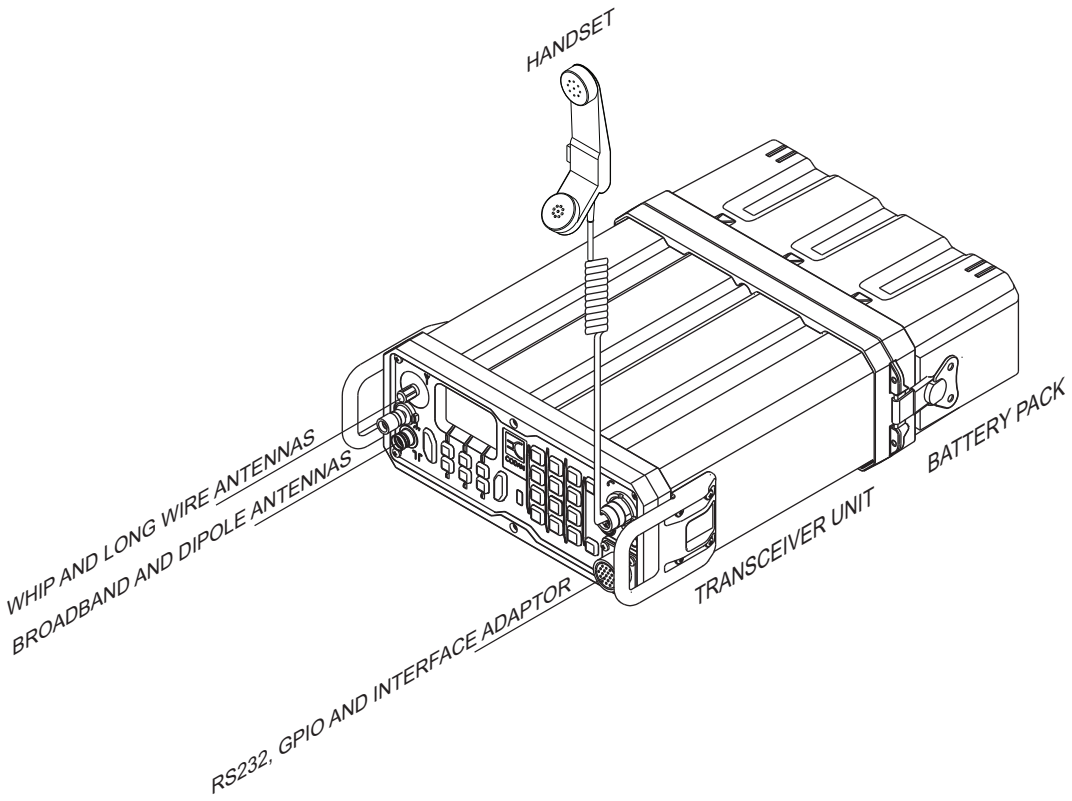
This section contains the following topics:

General

The 2110 series Manpack Transceiver typically consists of:

- a transceiver unit
- a battery pack
- a handset

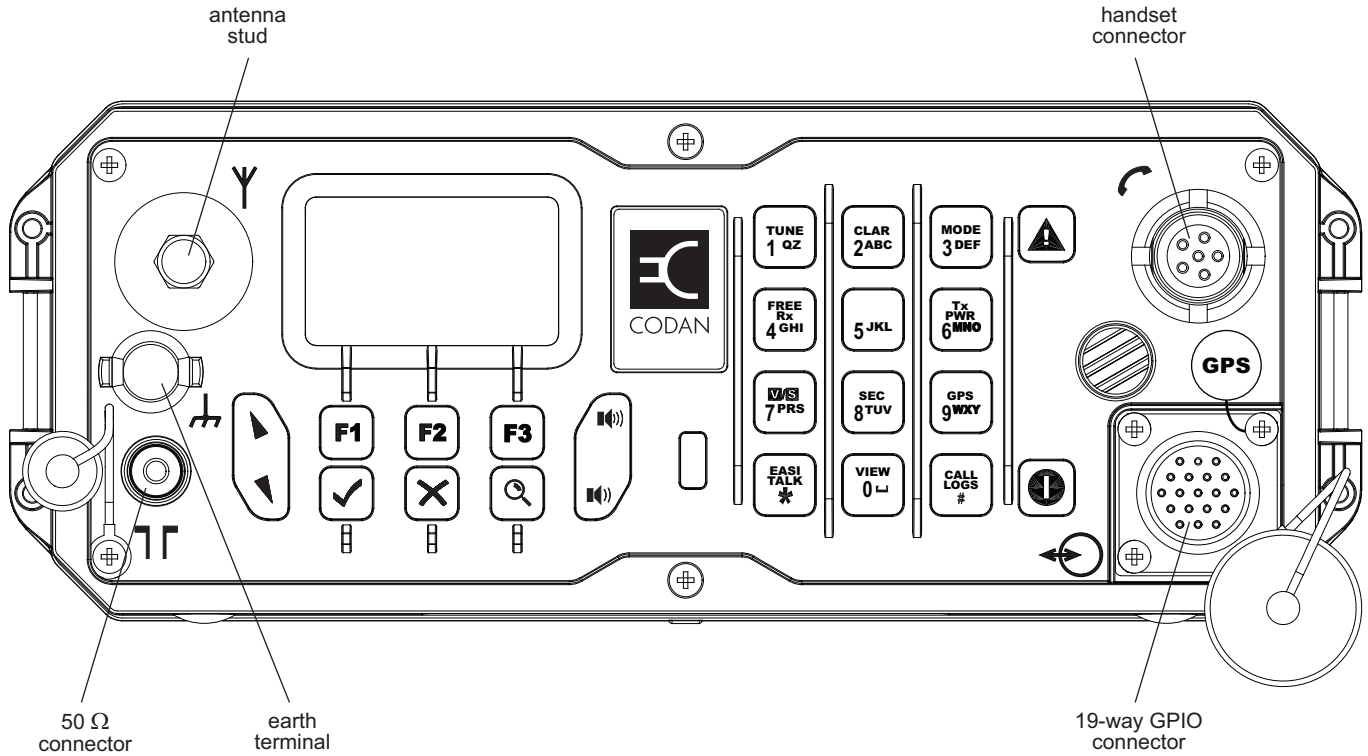
Figure 1: The 2110 series Manpack Transceiver



Connectors

Front panel

Figure 2: Front panel of the transceiver (2110 model shown)



NOTE The 2110v Manpack Transceiver uses a 5-way connector in the place of the 19-way GPIO connector ( ).

NOTE The **GPS** connector is optional for the 2110 Manpack Transceiver (see page 115, *Options*).

HF antenna connectors

The HF antenna connectors comprise:

- an antenna stud (Y)
- a 50 Ω connector (⊓⊓)

The HF antenna connectors are grounded using the earth terminal (⏚).

Pinouts of the handset connector

Figure 3: Front view of the handset connector

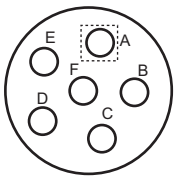


Table 1: Pinouts of the handset connector

Pin no.	Function	Input/output	Signal level
A	Ground		0 V
B	Earphone	Output	10 V p–p maximum (600 Ω)
C	PTT	Input	Active low for PTT
D	Microphone (switched)	Input	15 mV p–p (ALC threshold)
E	Power	Output	+12 V nominal
F	Not used		

Pinouts of the external GPS antenna connector (2110 only)

The external GPS antenna connector provides an interface for GPS signals. It automatically detects signals and sends these to the internal GPS receiver for processing.

Figure 4: Front view of the external GPS antenna connector (2110 only)

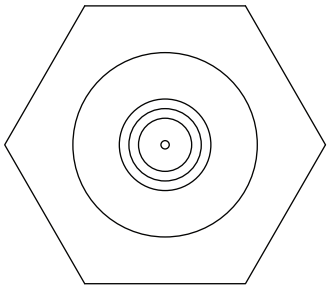


Table 2: Pinouts of the external GPS antenna connector (2110 only)

Connection	Function
Centre pin	Active GPS antenna
Sleeve	GPS antenna ground

For specifications of this connector see Table 25 on page 131.

Pinouts of the 19-way GPIO connector

Figure 5: Front view of the 19-way GPIO connector (2110 only)

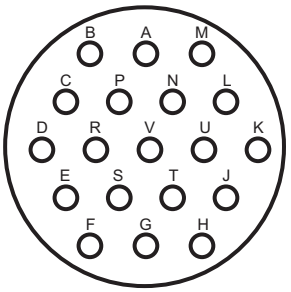


Table 3: Pinouts of the 19-way GPIO connector (2110 only)

Pin no.	Function	Input/output	Signal level
A	Line audio	Input	300 mV p–p (ALC threshold) I/P approx. 50 kΩ bridging
B			
C	Line audio	Output	1 V p–p (20 dB above AGC) 600 Ω load maximum
D	Morse	Input	Active low
E	RS232 Tx data	Output	RS232
F	RS232 Rx data	Input	
G	PTT	Input	Active low
H	Power and signal ground		0 V DC
J	Speaker (+) audio bridging	Output	1 W into 4 Ω
K	Protected, switched supply from battery	Output	12 V DC nominal 10 to 15 V DC range 1 A maximum
L	Speaker (–) audio paired with J	Output	1 W into 4 Ω
M	Power in for charging battery	Input	15.5 V DC approx. 1 A maximum, current limiting
N	Antenna control	Input	3.3 V DC logic 5 V DC maximum
P		Input/output	3.3 V DC logic 5 V DC maximum
R	Scan	Output	Open collector with 1 kΩ pull-down

Table 3: Pinouts of the 19-way GPIO connector (2110 only) (cont.)

Pin no.	Function	Input/output	Signal level
S	RS232 RTS	Output	RS232
T	RS232 CTS	Input	
U	External PA ALC	Input	0 to 5 V DC analogue
V	Quiet	Input	Active low

Pinouts of the 5-way connector

Figure 6: Front view of the 5-way connector (2110v only)

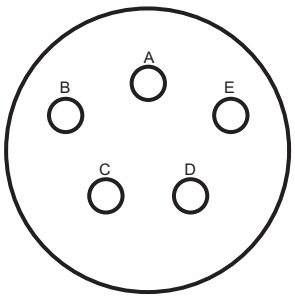
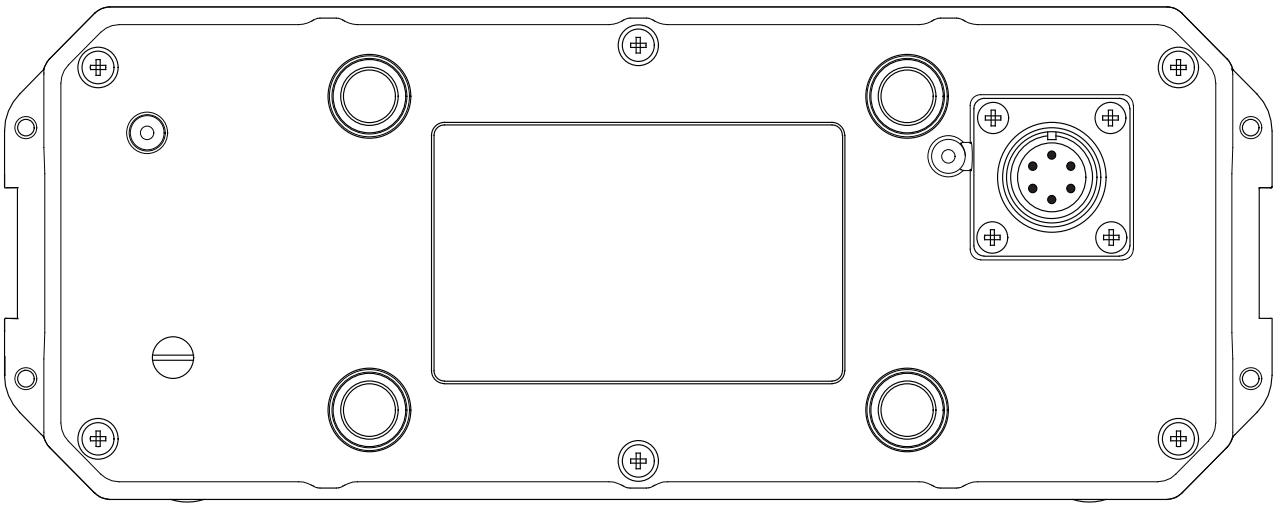


Table 4: Pinouts of the 5-way connector (2110v only)

Pin no.	Function	Input/output	Signal level
A	Power in for charging battery	Input	15.5 V DC approx. 1 A maximum, current limiting
B	RS232 Tx data (for programming)	Output	RS232
C	Morse	Input	Active low
D	Ground		0 V
E	RS232 Rx data (for programming)	Input	RS232

Back panel

Figure 7: Back panel of the transceiver unit



Pinouts of the battery connector on the transceiver unit

Figure 8: Front view of the battery connector on the transceiver unit

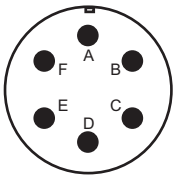
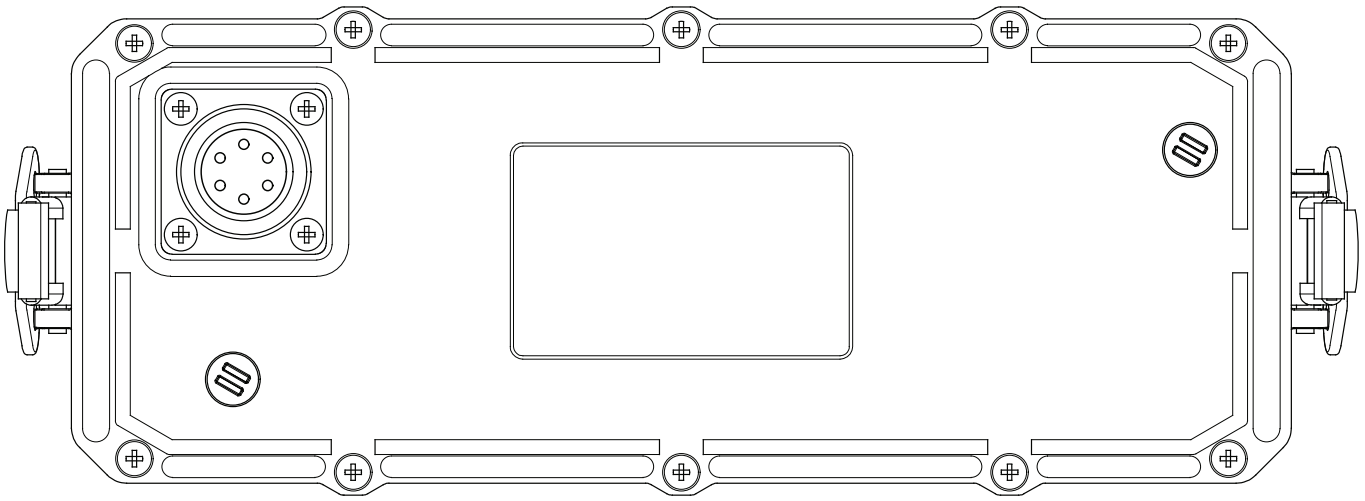


Table 5: Pinouts of the battery connector on the transceiver unit

Pin no.	Function	Input/output	Signal level
A	Ground		0 V DC
B	Charge out	Output	15.5 V DC @ 1 A maximum, current limiting
C	Battery (+)	Input	12 V DC nominal
D	SMB data	Input/output	3.3 V DC logic
E	SMB clock	Input/output	3.3 V DC logic
F	External PA ALC	Input	0 to 5 V DC analogue

Battery pack

Figure 9: Front view of the battery pack



Pinouts of the battery connector on the battery pack

Figure 10: Front view of the battery connector on the battery pack

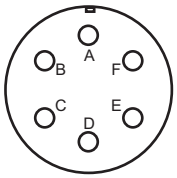


Table 6: Pinouts of the battery connector on the battery pack

Pin no.	Function	Input/output	Signal level
A	Ground		0 V DC
B	Charge in	Input	15.5 V DC @ 3 A maximum, current limiting
C	Battery (+)	Output	12 V DC nominal
D	SMB data	Input/output	3.3 V DC logic
E	SMB clock	Input/output	3.3 V DC logic
F	Spare		

Brief description

This section contains the following topics:

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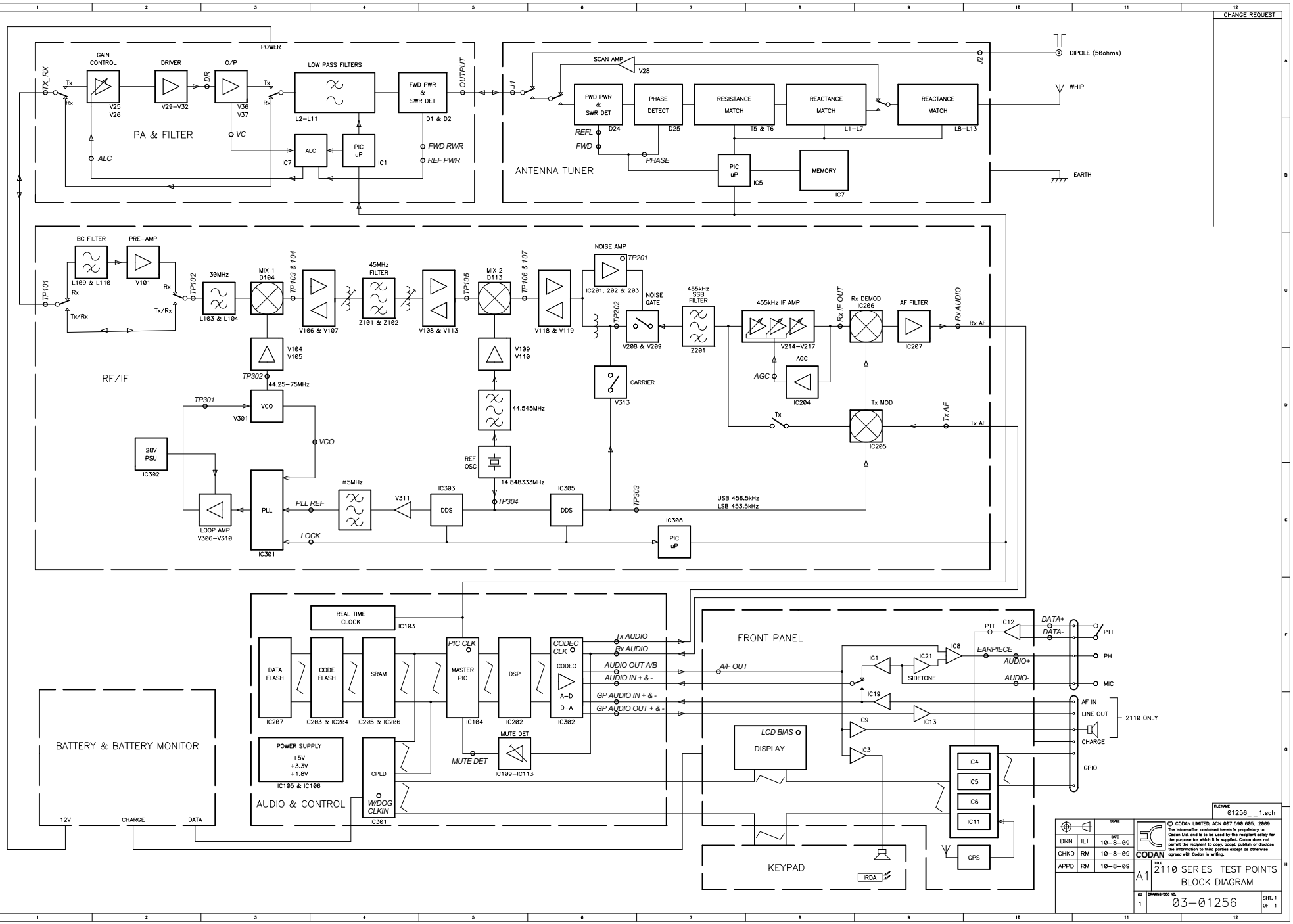
CHANGE REQUEST
POWER
GAIN CONTROL
DRIVER
O/P
LOW PASS FILTERS
FWD PWR & SWR DET
OUTPUT
TX_RX
Tx
Rx
V25
V26
V29–V32
V36
V37
L2–L11
D1 & D2
DR
VC
ALC
PA & FILTER
ALC
IC7
PIC uP
IC1
FWD RWR
REF PWR
J1
SCAN AMP
V28
FWD PWR & SWR DET
PHASE DETECT
RESISTANCE MATCH
REACTANCE MATCH
REACTANCE MATCH
T5 & T6
L1–L7
L8–L13
REFL
FWD
D24
D25
PHASE
PIC uP
IC5
MEMORY
IC7
ANTENNA TUNER
J2
DIPOLE (50ohms)
WHIP
EARTH
BC FILTER
PRE–AMP
L109 & L110
V101
TP101
TP102
30MHz
L103 & L104
MIX 1
D104
TP103 & 104
V106 & V107
45MHz FILTER
Z101 & Z102
V108 & V113
TP105
MIX 2
D113
TP106 & 107
V118 & V119
NOISE AMP
TP201
IC201, 202 & 203
NOISE GATE
TP202
V208 & V209
CARRIER
V313
455kHz SSB FILTER
Z201
455kHz IF AMP
V214–V217
AGC
IC204
Rx IF OUT
Rx DEMOD IC206
AF FILTER
IC207
Rx AUDIO
Rx AF
V104
V105
TP302
V109
V110
44.25–75MHz
44.545MHz
RF/IF
TP301
VCO
V301
VCO
28V PSU
IC302
REF OSC
14.848333MHz
TP304
TP303
IC303
DDS
IC305
DDS
≈5MHz
V311
PLL REF
LOCK
PLL
IC301
LOOP AMP
V306–V310
IC308
PIC uP
USB 456.5kHz
LSB 453.5kHz
Tx MOD
IC205
Tx AF
REAL TIME CLOCK
IC103
DATA FLASH
IC207
CODE FLASH
IC203 & IC204
SRAM
IC205 & IC206
PIC CLK
MASTER PIC
IC104
DSP
IC202
CODEC CLK
CODEC
A–D
D–A
IC302
Tx AUDIO
Rx AUDIO
AUDIO OUT A/B
AUDIO IN + & -
GP AUDIO IN + & -
GP AUDIO OUT + & -
POWER SUPPLY
+5V
+3.3V
+1.8V
IC105 & IC106
CPLD
W/DOG CLKIN
IC301
MUTE DET
MUTE DET
IC109–IC113
AUDIO & CONTROL
BATTERY & BATTERY MONITOR
12V
CHARGE
DATA
FRONT PANEL
A/F OUT
LCD BIAS
DISPLAY
KEYPAD
IRDA
IC1
IC21
IC8
SIDETONE
IC19
IC9
IC13
IC3
IC12
PTT
EARPIECE
AUDIO+
AUDIO-
DATA+
DATA-
PTT
PH
MIC
AF IN
LINE OUT
CHARGE
GPIO
2110 ONLY
IC4
IC5
IC6
IC11
GPS
FILE NAME
01256__1.sch
DRN ILT 10-8-09
CHKD RM 10-8-09
APPD RM 10-8-09
SCALE
DATE
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CODAN
TITLE
A1
2110 SERIES TEST POINTS BLOCK DIAGRAM
ISS 1
DRAWING/DOC NO.
03–01256
SHT. 1 OF 1

General information

NOTE The information in this section should be read in conjunction with the block diagram (Codan part number 03-01256).

The transceiver uses double conversion in both the Receive and Transmit modes. The 455 kHz sideband filter, the 45 MHz BPF, the mixers MIX 1 and MIX 2, and the local oscillators VCO and REF OSC, are common to both modes of operation.

Transmit path

Front Panel PCB

Microphone transmit audio appears at the handset connector. It is pre-amplified on the Front Panel PCB, then passed onto the Audio & Control PCB.

Audio & Control PCB

Pre-amplified audio from the Front Panel PCB passes through the optional encryptor module (where fitted), the codec, and DSP on the Audio & Control PCB. The processing utilises a compression algorithm that converts the audio signal to a relatively constant level. The signal is passed to the RF/IF & Synthesiser PCB.

RF/IF & Synthesiser PCB

The audio is mixed with the local oscillator to produce double sideband. It is filtered by a 2.5 kHz sideband filter centred on 455 kHz so that only the wanted sideband is passed to the second mixer. It is then mixed with the reference oscillator to produce an IF signal centred on 45 MHz.

The transmit signal is filtered by a BPF with a bandwidth of 15 kHz, before being passed to the input of the first mixer.

At the first mixer, the signal mixes with the local oscillator VCO to produce the required channel frequency. The signal is passed to the PA & Filter PCB.

PA & Filter PCB

On the PA & Filter PCB, the signal passes through the first transmit/receive relay to the amplifier. Following amplification, it passes through the second transmit/receive relay to the selected LPF.

The output from the LPF passes via the VSWR DETECTOR circuit to the output connector. From there it is connected by coaxial cable to the Antenna Tuner PCB.

Antenna Tuner PCB

The signal from the PA & Filter PCB is either directly switched to the 50 Ω antenna connector (J2) or switched via a set of impedance-matching components to the antenna stud. Matching components are selected during an iterative tuning process (see page 24, *Antenna tuning process*).

Receive path

Antenna Tuner PCB

The antenna tuner switches the signal received through either the 50 Ω antenna connector (J2) or the antenna stud to the PA LPF. The signal from the 50 Ω antenna connector is switched directly. The signal from the antenna stud is connected via a set of matching components, selected during the tuning process or via the scanning amplifier.

PA & Filter PCB

The receive signal from the Antenna Tuner PCB passes through a PA LPF to the transmit/receive relays. It is then passed to the Tx/Rx connector on the RF/IF & Synthesiser PCB.

RF/IF & Synthesiser PCB

From the receiver input, the signal passes via a selectable pre-amplifier V101 to the input of the first balanced mixer. Here it mixes with the local oscillator VCO to produce an IF signal centred on 45 MHz.

The 45 MHz signal is filtered using a BPF with a bandwidth of 15 kHz, before being passed to the second balanced mixer. The signal mixes with the third harmonic (44.545 MHz) of the reference oscillator to produce an IF signal centred on 455 kHz.

The output of the second mixer passes through a 2.5 kHz sideband filter so that only the wanted sideband is fed to the high-gain AGC IF amplifier.

The amplified 455 kHz signal is demodulated to produce an audio signal and also to operate an AGC circuit. This circuit controls the gain of the IF amplifier to prevent overloading when strong signals are received. It also maintains constant audio output with changing input levels.

Audio & Control PCB

Analogue receive audio from the RF/IF & Synthesiser PCB passes though the optional encryptor module (where fitted), then through the codec and DSP on the Audio & Control PCB. The codec produces separate outputs, which can be either unprocessed (raw) audio, or enhanced (noise-reduced, volume-controlled) audio, which then passes via separate, balanced paths to the Front Panel PCB.

Front Panel PCB

Unprocessed (raw) audio from the Audio & Control PCB is typically passed by the Front Panel PCB to the line output on the 19-way GPIO connector. Enhanced (noise-reduced, volume-controlled) audio is passed to three separate audio amplifiers on the Front Panel PCB. These feed the GPIO external speaker output, the military handset earphone, and the internal speaker. These outputs can be selectively controlled.

Antenna tuning process

Tuning is an iterative process in which selection of impedance-matching components is determined by an on-board microcontroller. A frequency-dependent algorithm decides on a consecutive selection, taking into account the phase and VSWR measurements. The process is repeated until matching is achieved.

Synthesiser operation

The transceiver uses a single-loop synthesiser. The synthesiser VCO is used as the first mixer LO, generating an oscillator frequency in 10 Hz steps. In Receive mode, the frequency of the oscillator ranges from 45.25 MHz to 75 MHz. In Transmit mode, the frequency of the oscillator ranges from 46.6 MHz to 75 MHz.

The reference oscillator at 14.848333 MHz is fed through a 44.5 MHz BPF to select the third harmonic to produce the 44.545 MHz second mixer LO. The 14.848333 MHz frequency is also fed to two DDS ICs to produce a variable reference frequency for VCO with 10 Hz resolution.

The second DDS IC produces 456.5 kHz for USB and 453.5 kHz for LSB for the transmit modulator (Tx MOD) and receive demodulator (Rx DEMOD) circuits.

Control and switching

Most functions of the transceiver are controlled by a DSP and microcontrollers. The DSP reads key strokes entered by the user. Update information is sent to the LCD via a dedicated bus.

Information exchange between the DSP on the Audio & Control PCB and the PA & Filter PCB, RF/IF & Synthesiser PCB, and Antenna Tuner PCB is accomplished via four microcontrollers that share a communications bus. Information exchange between the Audio & Control PCB and Front Panel PCB is accomplished via a separate dedicated data bus.

Interconnection diagrams and listed spares drawings

The drawings in this section are required during repair of a 2110 series Manpack Transceiver.

Please refer to the listed spares drawings for ordering information. For example, if you need to order a new Audio & Control PCB 08-06128-001, the listed spares drawing for this indicates that you should order 08-06128-101.

Table 7: List of drawings

Title	Drawing number
Interconnection Diagram	04-03515
2110 Unit, with front handles—Listed Spares	16-00116 (sheet 1)
	16-00116 (sheet 2)
	16-00116 (sheet 3)
	16-00116 (sheet 4)
	16-00116 (sheet 5)
	16-00116 (sheet 6)
	16-00116 (sheet 7)
2110 Unit, with side handles—Listed Spares	16-00120 (sheet 1)
	16-00120 (sheet 2)
	16-00120 (sheet 3)
	16-00120 (sheet 4)
	16-00120 (sheet 5)
	16-00120 (sheet 6)
	16-00120 (sheet 7)

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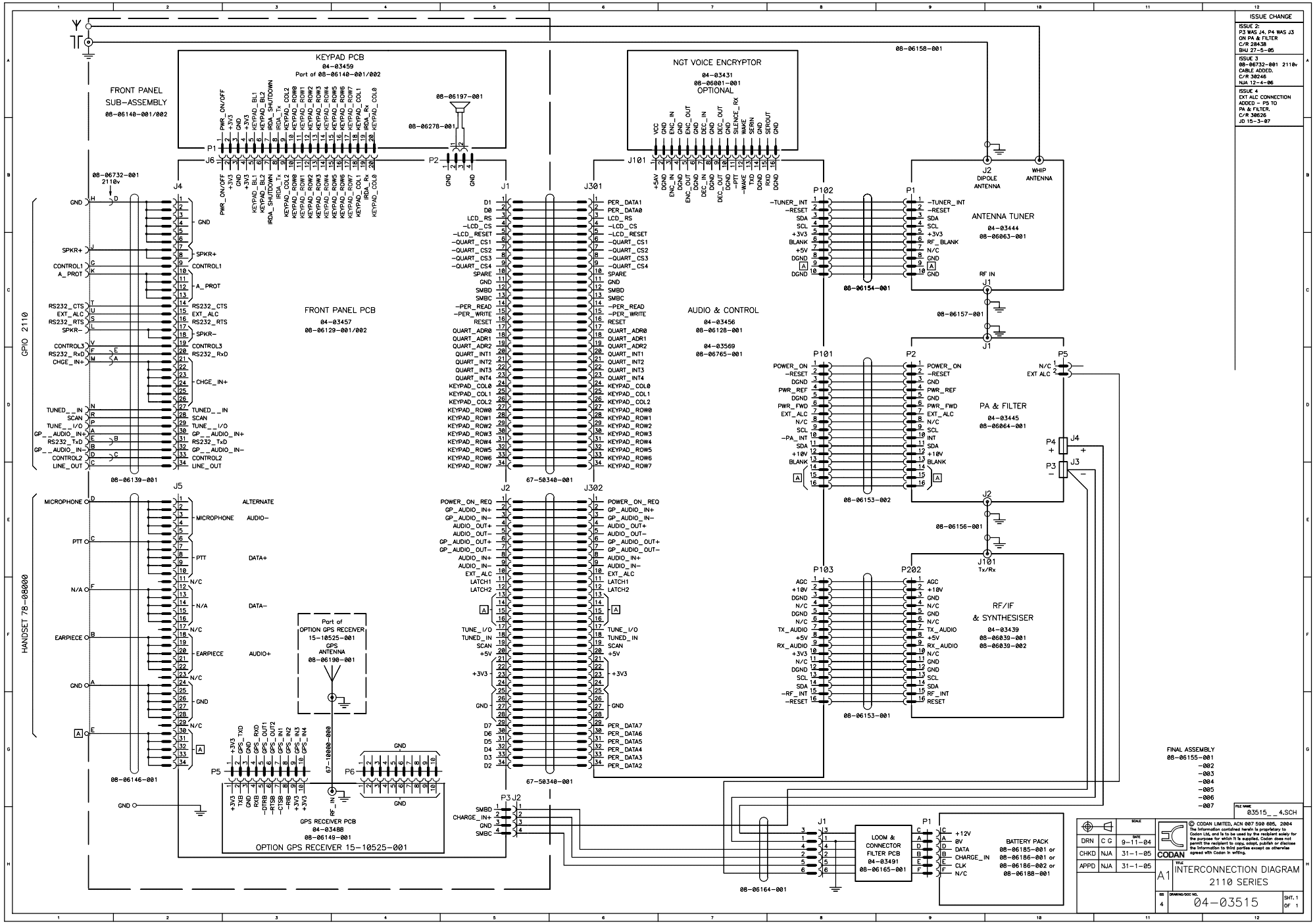
ISSUE CHANGE
ISSUE 2:
P3 WAS J4, P4 WAS J3
ON PA & FILTER
C/R 28438
BHJ 27-5-05
ISSUE 3
08-06732-001 2110v
CABLE ADDED.
C/R 30246
NJA 12-4-06
ISSUE 4
EXT ALC CONNECTION
ADDED - P5 TO
PA & FILTER.
C/R 30626
JD 15-3-07
KEYPAD PCB
04-03459
Part of 08-06140-001/002
FRONT PANEL
SUB-ASSEMBLY
08-06140-001/002
08-06197-001
08-06278-001
NGT VOICE ENCRYPTOR
04-03431
08-06001-001
OPTIONAL
08-06158-001
J2
DIPOLE
ANTENNA
WHIP
ANTENNA
08-06732-001
2110v
J4
GPIO 2110
HANDSET 78-08000
FRONT PANEL PCB
04-03457
08-06129-001/002
AUDIO & CONTROL
04-03456
08-06128-001
04-03569
08-06765-001
P102
P1
ANTENNA TUNER
04-03444
08-06063-001
08-06154-001
RF IN
08-06157-001
P101
P2
P5
PA & FILTER
04-03445
08-06064-001
P4
P3
J4
J3
08-06153-002
08-06156-001
P103
P202
RF/IF
& SYNTHESISER
04-03439
08-06039-001
08-06039-002
08-06153-001
J101
Tx/Rx
08-06139-001
08-06146-001
J5
ALTERNATE
67-50340-001
J1
J301
J2
J302
67-50340-001
Part of
OPTION GPS RECEIVER
15-10525-001
GPS
ANTENNA
08-06190-001
67-10000-000
P5
P6
GPS RECEIVER PCB
04-03488
08-06149-001
OPTION GPS RECEIVER 15-10525-001
P3 J2
08-06164-001
LOOM &
CONNECTOR
FILTER PCB
04-03491
08-06165-001
BATTERY PACK
08-06185-001 or
08-06186-001 or
08-06186-002 or
08-06188-001
FINAL ASSEMBLY
08-06155-001
-002
-003
-004
-005
-006
-007
FILE NAME
03515__4.SCH
DRN C G 9-11-04
CHKD NJA 31-1-05
APPD NJA 31-1-05
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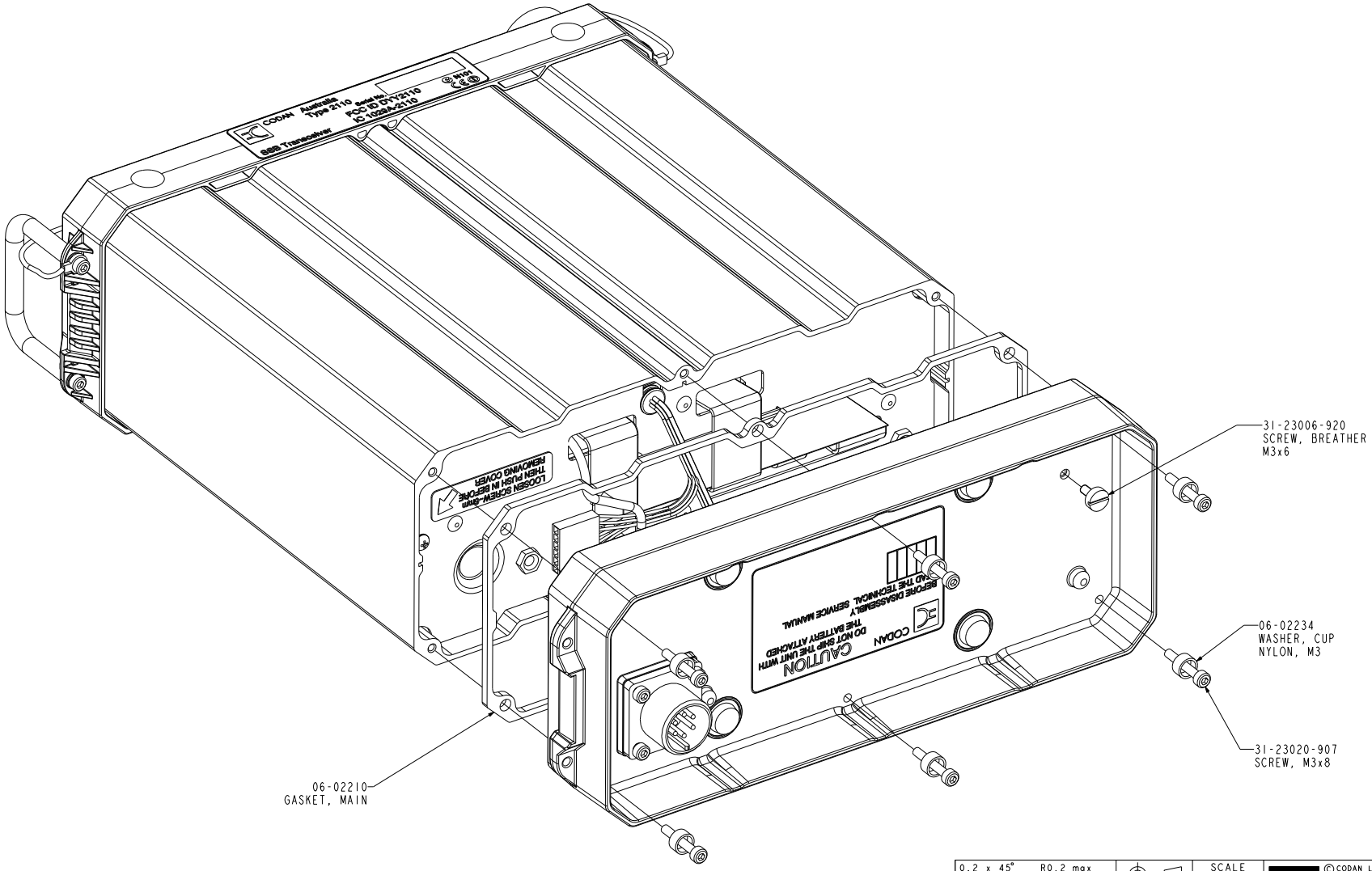
CODAN
TITLE
INTERCONNECTION DIAGRAM
2110 SERIES
SIZE A1
ISS 4
DRAWING/DOC NO. 04-03515
SHT. 1 OF 1

DO NOT SCALE

ISSUE 6
RPM 16-11-2009



TRANSCEIVER	PART No.
2110	08-06155-002
2110V	08-06155-003

DIMENSIONS IN mm

0.2 x 45° R0.2 max

MATERIAL

FINISH

			SCALE 1:1
DRN	FR	DATE	10-04-2008
CHKD	RM		10-04-2008
APPD	RM		10-04-2008

TOLERANCES UNLESS OTHERWISE SPECIFIED
LINEAR ± 0.2
ANGULAR ± 0.5°
FLATNESS ± 0.2
ROUGHNESS 1.6 µmRa

CODAN

A2

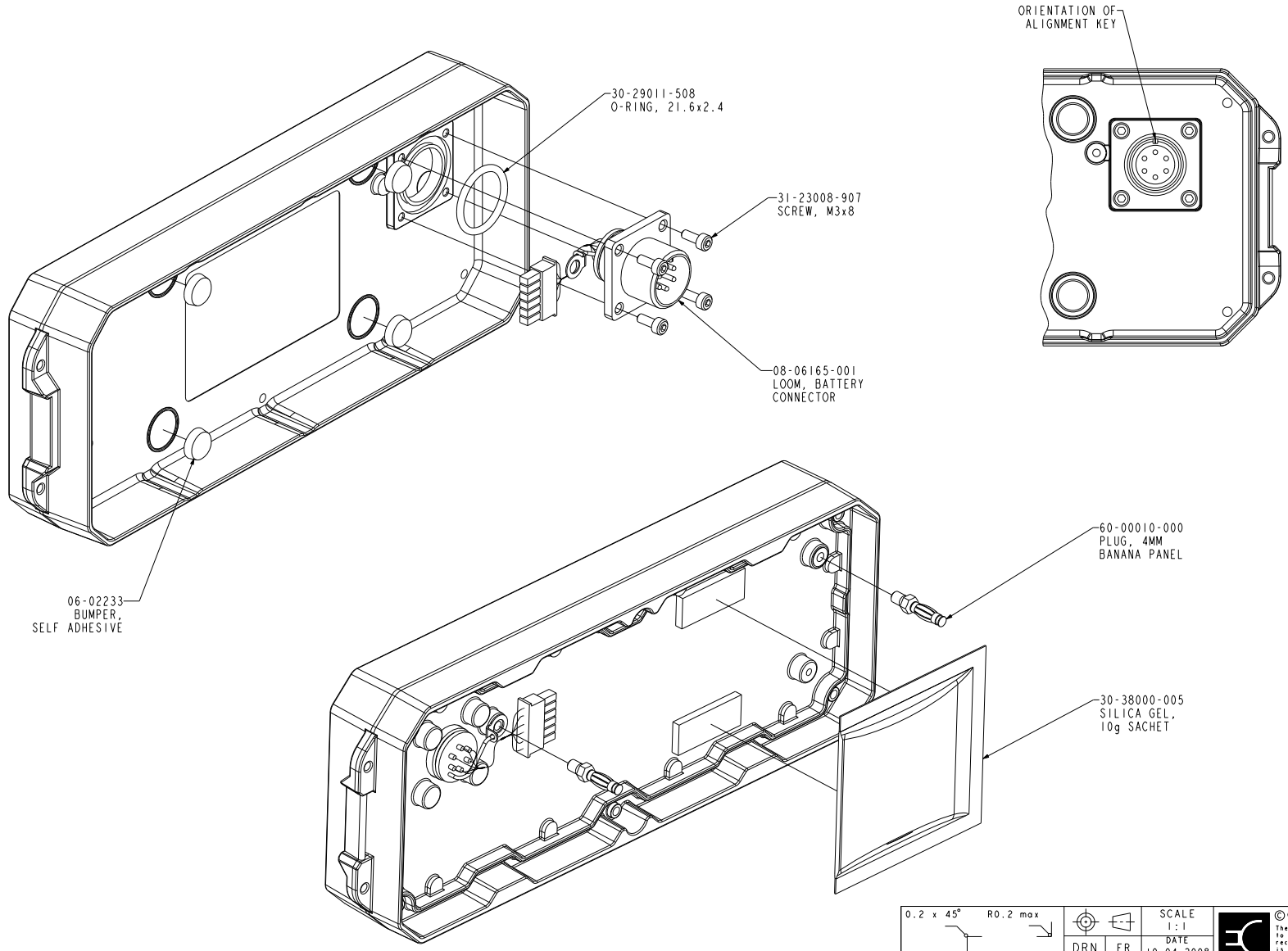
TITLE
LISTED SPARES
2110, WITH FRONT HANDLES

ISS 6

DRAWING/DOC NO. 16-00116

SHT. 1 OF 7

DO NOT SCALE



DIMENSIONS IN mm

0.2 x 45° R0.2 max

MATERIAL

FINISH

SCALE			1:1
DRN	FR	DATE	10-04-2008
CHKD	RM		10-04-2008
APPD	RM		10-04-2008

TOLERANCES
UNLESS OTHERWISE SPECIFIED
LINEAR ± 0.2
ANGULAR ± 0.5°
FLATNESS ± 0.2
ROUGHNESS 1.6 µmRa

CODAN

A2

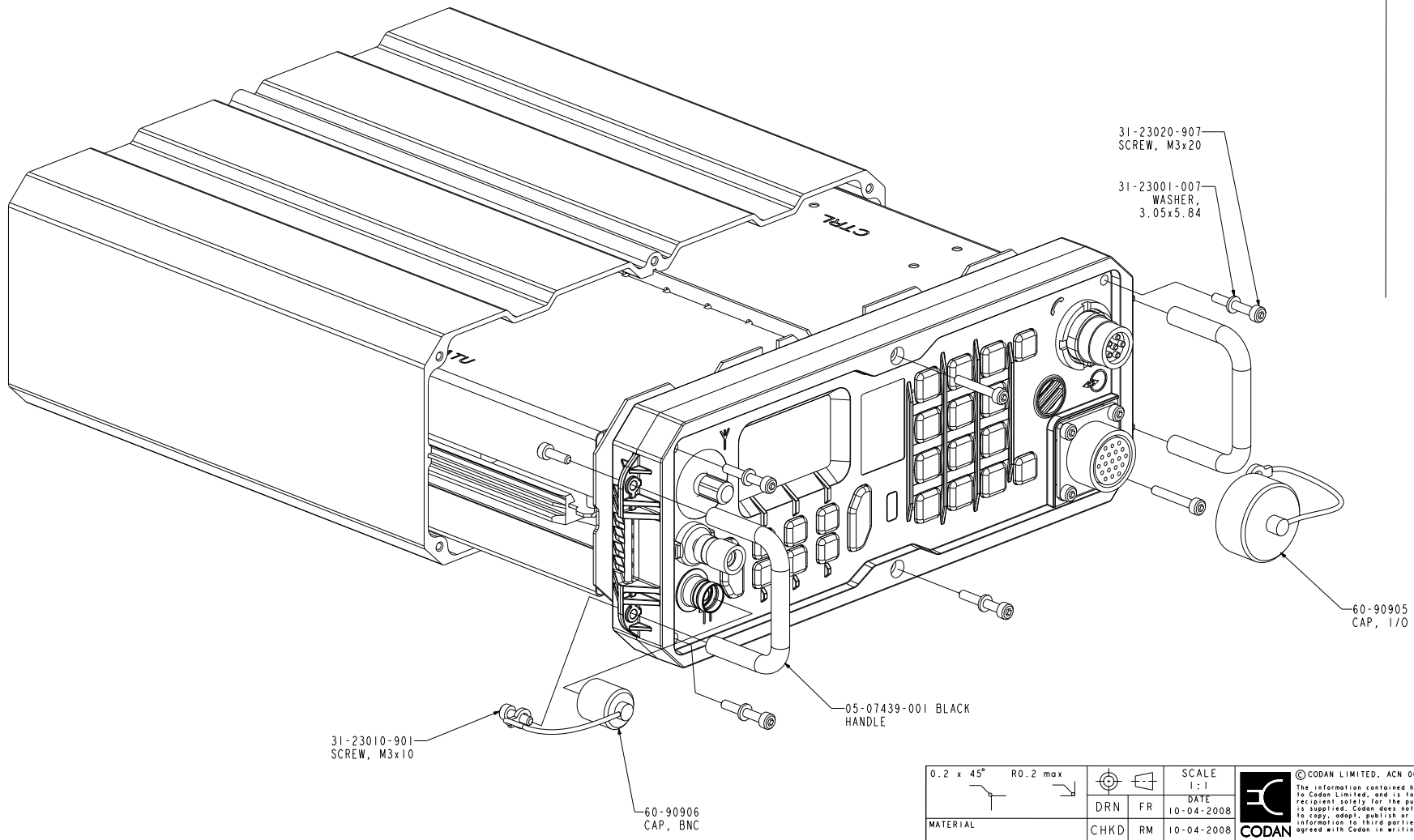
TITLE
LISTED SPARES
2110, WITH FRONT HANDLES

ISS 6

DRAWING/DOC NO. 16-00116

SHT. 2 OF 7

DO NOT SCALE



DIMENSIONS IN mm

0.2 x 45° R0.2 max			SCALE 1:1
	DRN	FR	DATE 10-04-2008
MATERIAL	CHKD	RM	10-04-2008
	APPD	RM	10-04-2008
FINISH	TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR ± 0.2		
	ANGULAR ± 0.5°		
	FLATNESS ± 0.2		
	ROUGHNESS 1.6 µmRa		

CODAN

A2

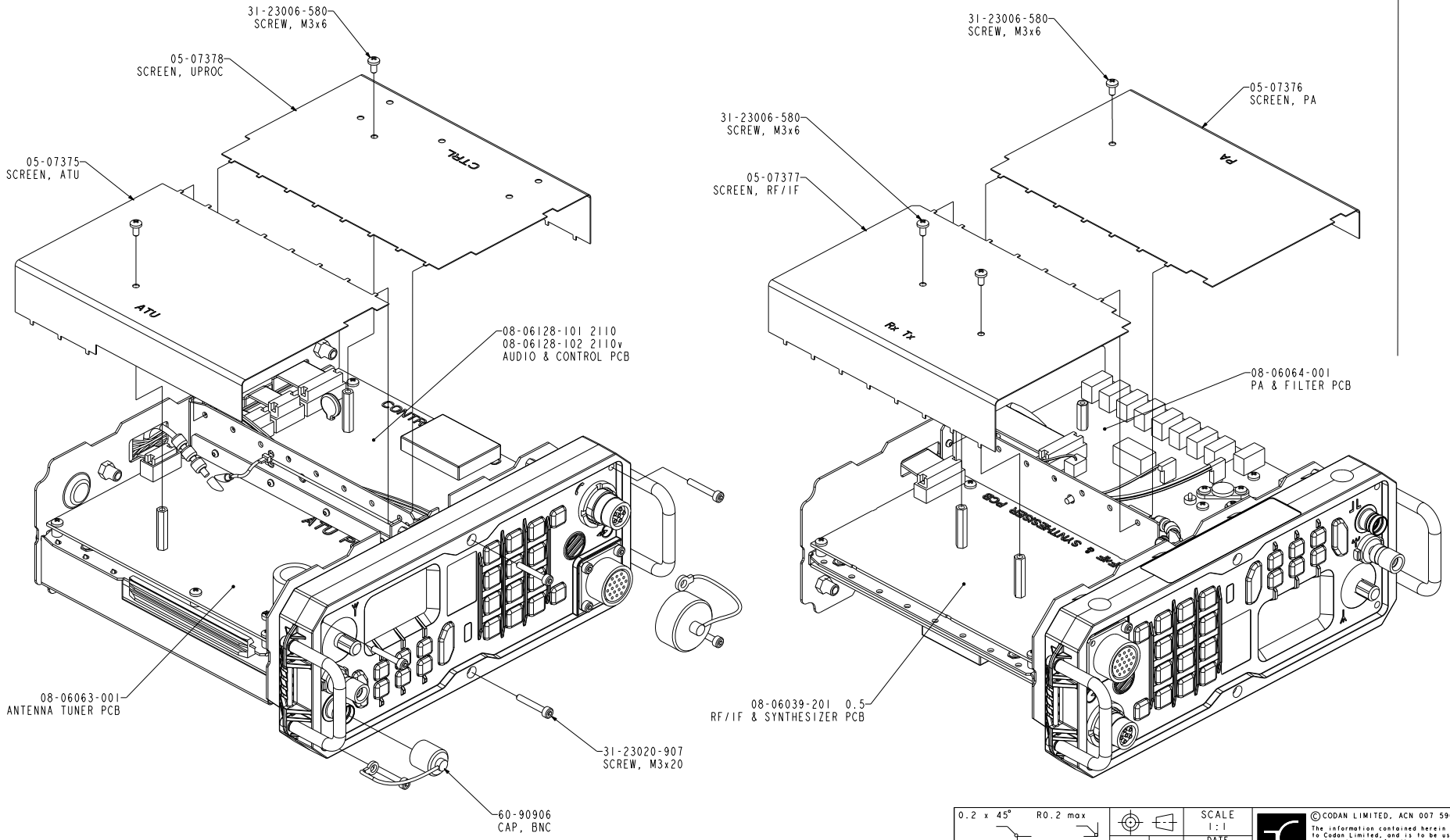
TITLE
LISTED SPARES
2110, WITH FRONT HANDLES

ISS 6

DRAWING/DOC NO. 16-00116

SHT. 3 OF 7

DO NOT SCALE



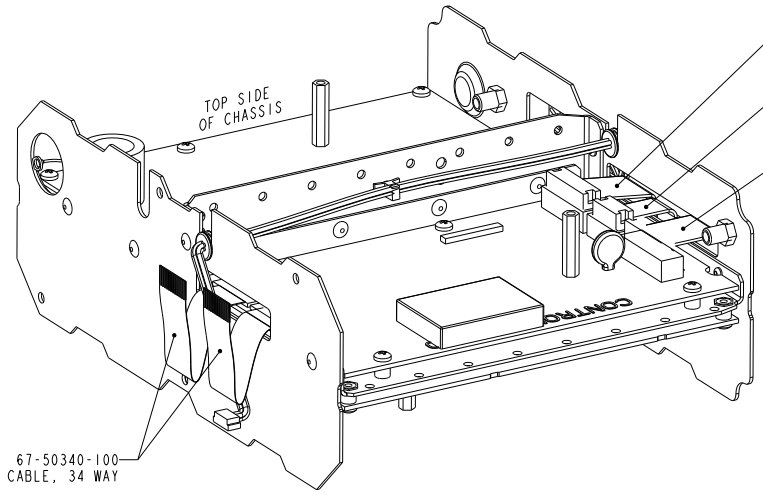
DIMENSIONS IN mm

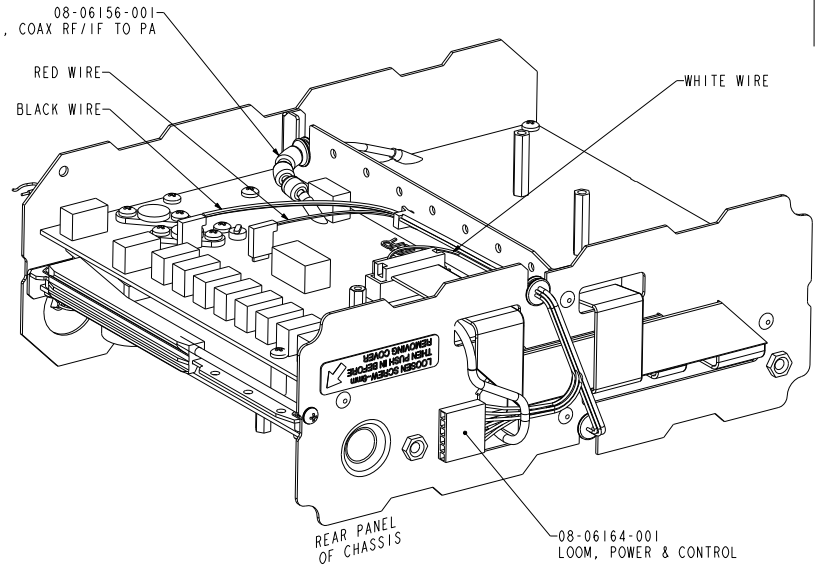
0.2 x 45° R0.2 max		SCALE	1:1
	DRN	FR	DATE 10-04-2008
MATERIAL	CHKD	RM	10-04-2008
	APPD	RM	10-04-2008
FINISH	TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR ± 0.2		
	ANGULAR ± 0.5°		
	FLATNESS ± 0.2		
	ROUGHNESS 1.6 µmRa		

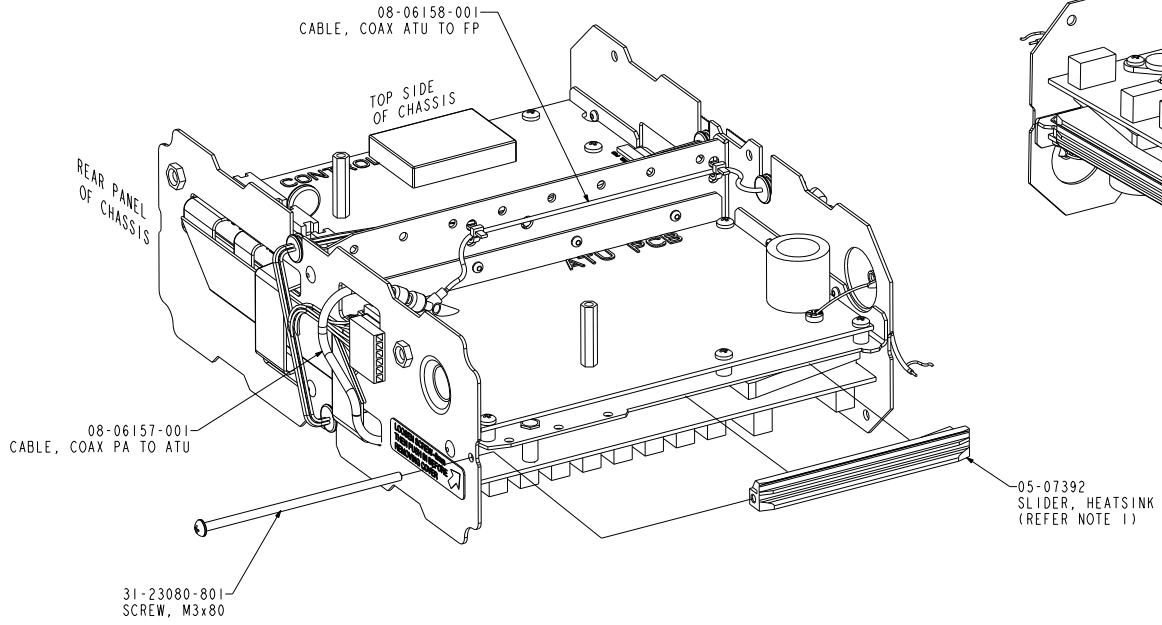
CODAN

A2	TITLE: LISTED SPARES 2110, WITH FRONT HANDLES	
ISS 6	DRAWING/DOC NO. 16-00116	SHT.4 OF 7

DO NOT SCALE







NOTE:
1. USE 71-31000-006
HEAT TRANSFER COMPOUND

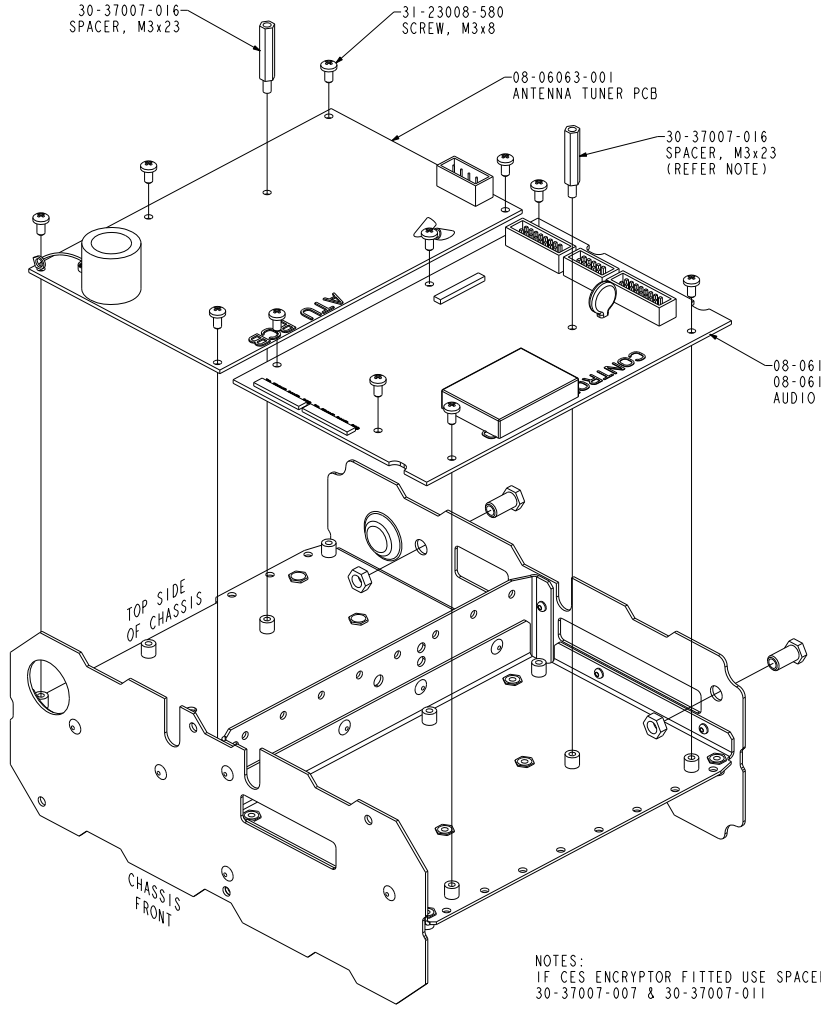
DIMENSIONS IN mm

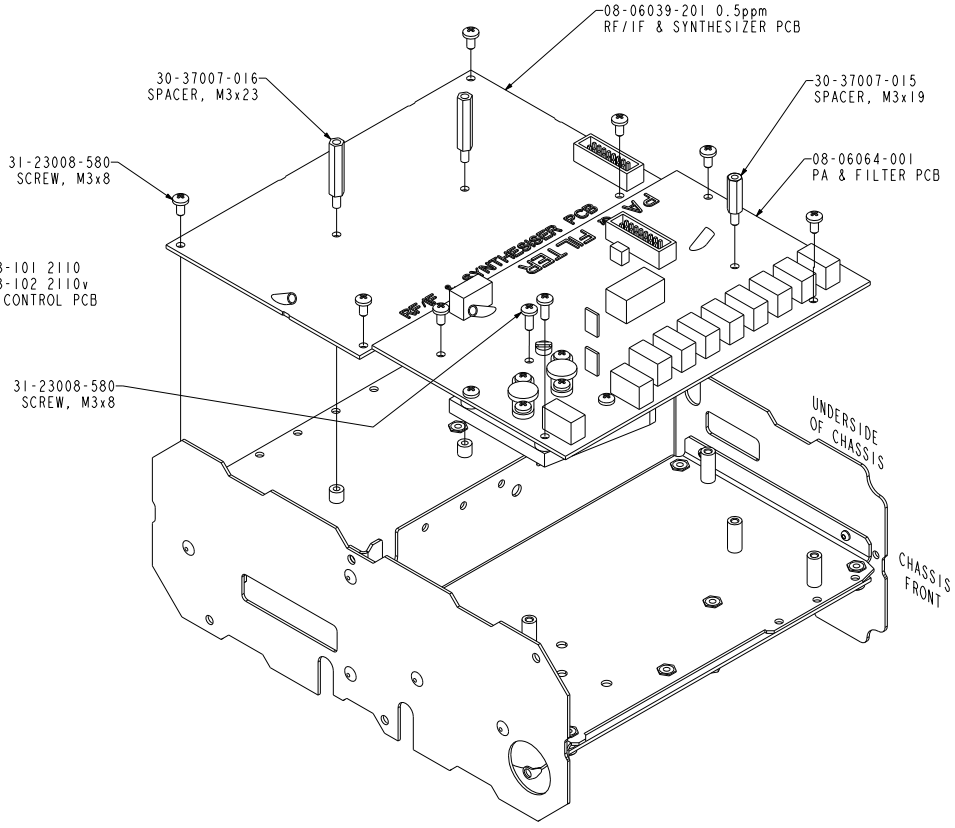
0.2 x 45° R0.2 max		SCALE 1:1	
MATERIAL	DRN	FR	DATE 10-04-2008
	CHKD	RM	10-04-2008
FINISH	APPD	RM	10-04-2008
	TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR ± 0.2		
	ANGULAR ± 0.5°		
	FLATNESS ± 0.2		
	ROUGHNESS 1.6 µmRa		

CODAN

A2	TITLE: LISTED SPARES 2110, WITH FRONT HANDLES	
ISS 6	DRAWING/DOC NO. 16-00116	SHT.5 OF 7

DO NOT SCALE





NOTES:
IF CES ENCRYPTOR FITTED USE SPACER
30-37007-007 & 30-37007-011

DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE 1:1	
MATERIAL	DRN FR	DATE 10-04-2008	
	CHKD RM	10-04-2008	
FINISH	APPD RM	10-04-2008	
	TOLERANCES UNLESS OTHERWISE SPECIFIED LINEAR ± 0.2 ANGULAR ± 0.5° FLATNESS ± 0.2 ROUGHNESS 1.6 µmRa		

CODAN

A2

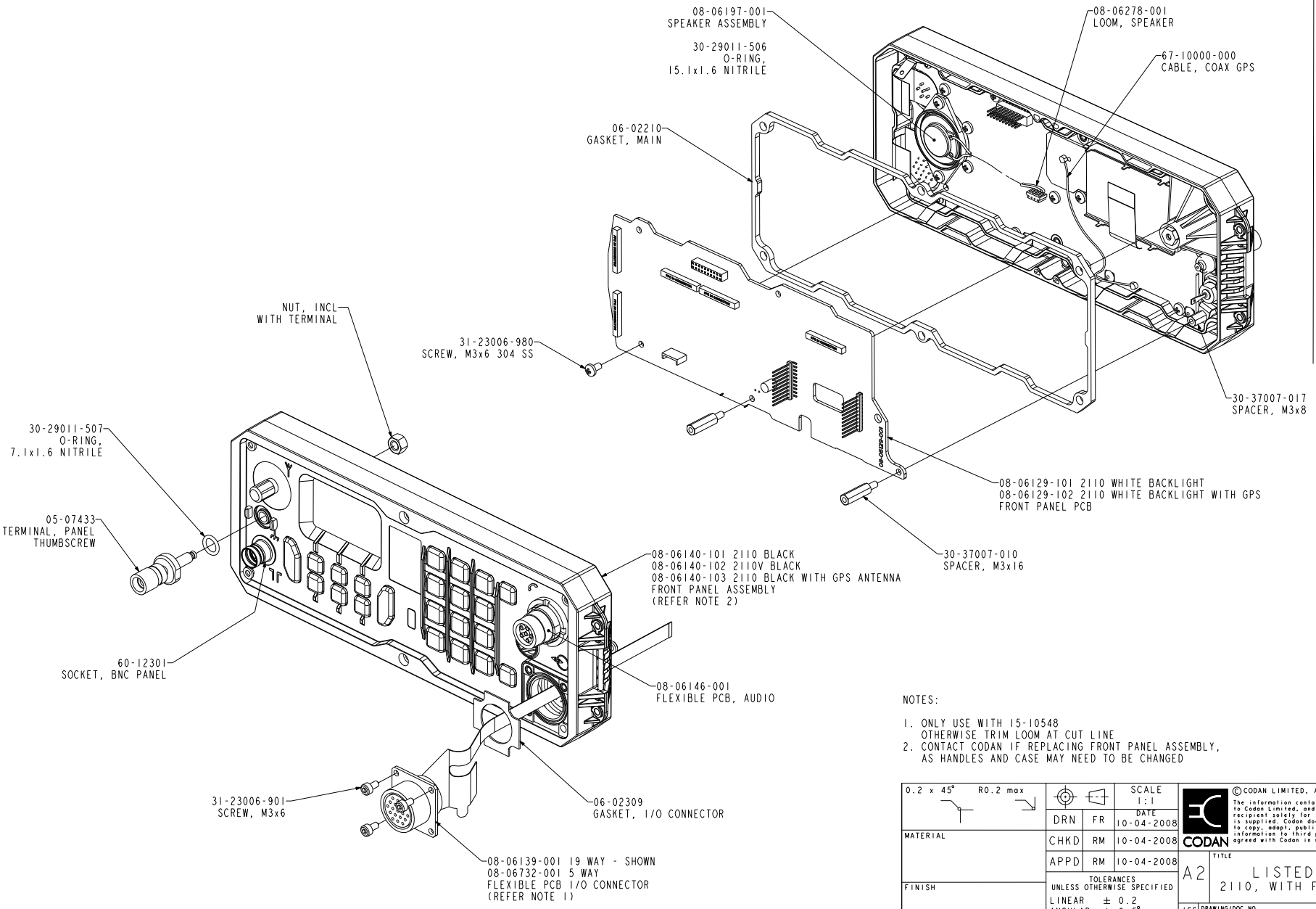
TITLE
LISTED SPARES
2110, WITH FRONT HANDLES

ISS 6

DRAWING/DOC NO. 16-00116

SHT. 6 OF 7

DO NOT SCALE



NOTES:

1. ONLY USE WITH 15-10548
   OTHERWISE TRIM LOOM AT CUT LINE
2. CONTACT CODAN IF REPLACING FRONT PANEL ASSEMBLY,
   AS HANDLES AND CASE MAY NEED TO BE CHANGED

DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE 1:1	
MATERIAL	DRN	FR	DATE 10-04-2008
	CHKD	RM	10-04-2008
	APPD	RM	10-04-2008
FINISH	TOLERANCES UNLESS OTHERWISE SPECIFIED LINEAR ± 0.2 ANGULAR ± 0.5° FLATNESS ± 0.2 ROUGHNESS 1.6 µmRa		

CODAN

A2

TITLE: LISTED SPARES
2110, WITH FRONT HANDLES

ISS 6

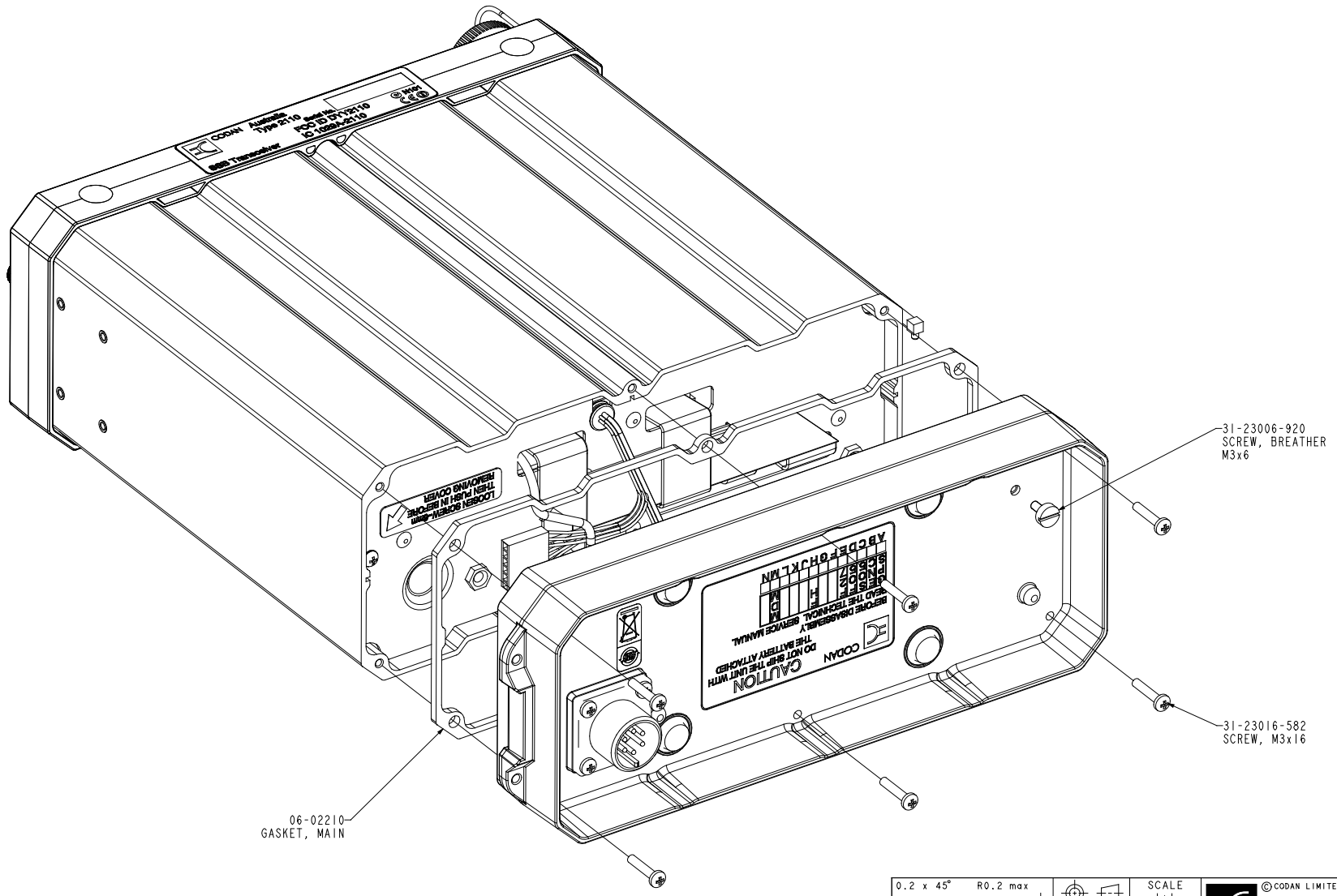
DRAWING/DOC NO. 16-00116

SHT. 7 OF 7

DO NOT SCALE

ISSUE 2
DI 31834
ILT 19-11-2009

ISSUE 3
DI 32154
SG/PJH 17-06-2010



DIMENSIONS IN mm

0.2 x 45° R0.2 max

MATERIAL

FINISH

DRN	GS	SCALE 1:1	
CHKD	RPM	DATE 06-05-2009	
APPD	RPM	06-05-2009	

TOLERANCES UNLESS OTHERWISE SPECIFIED
LINEAR ± 0.2
ANGULAR ± 0.5°
FLATNESS ± 0.2
ROUGHNESS 1.6 µmRa

CODAN

A2

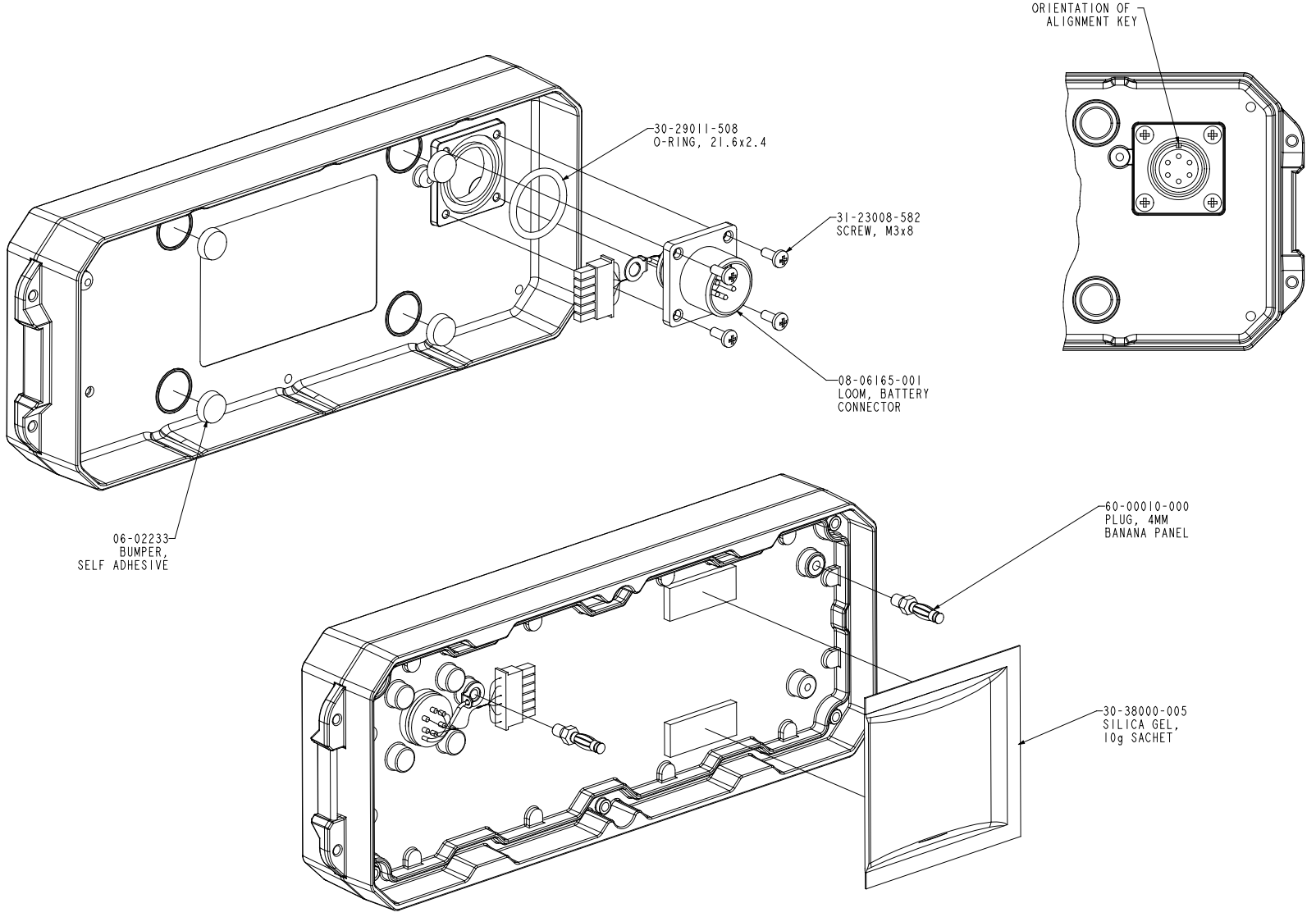
TITLE
LISTED SPARES 2110, WITH SIDE HANDLES

ISS 3

DRAWING/DOC NO. 16-00120

SHT. 1 OF 7

DO NOT SCALE



DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE 1:1	
MATERIAL	DRN GS	DATE 23-04-2009	
	CHKD RPM	06-05-2009	
FINISH	APPD RPM	06-05-2009	
	TOLERANCES UNLESS OTHERWISE SPECIFIED LINEAR ± 0.2 ANGULAR ± 0.5° FLATNESS ± 0.2 ROUGHNESS 1.6 µmRa		

CODAN

A2

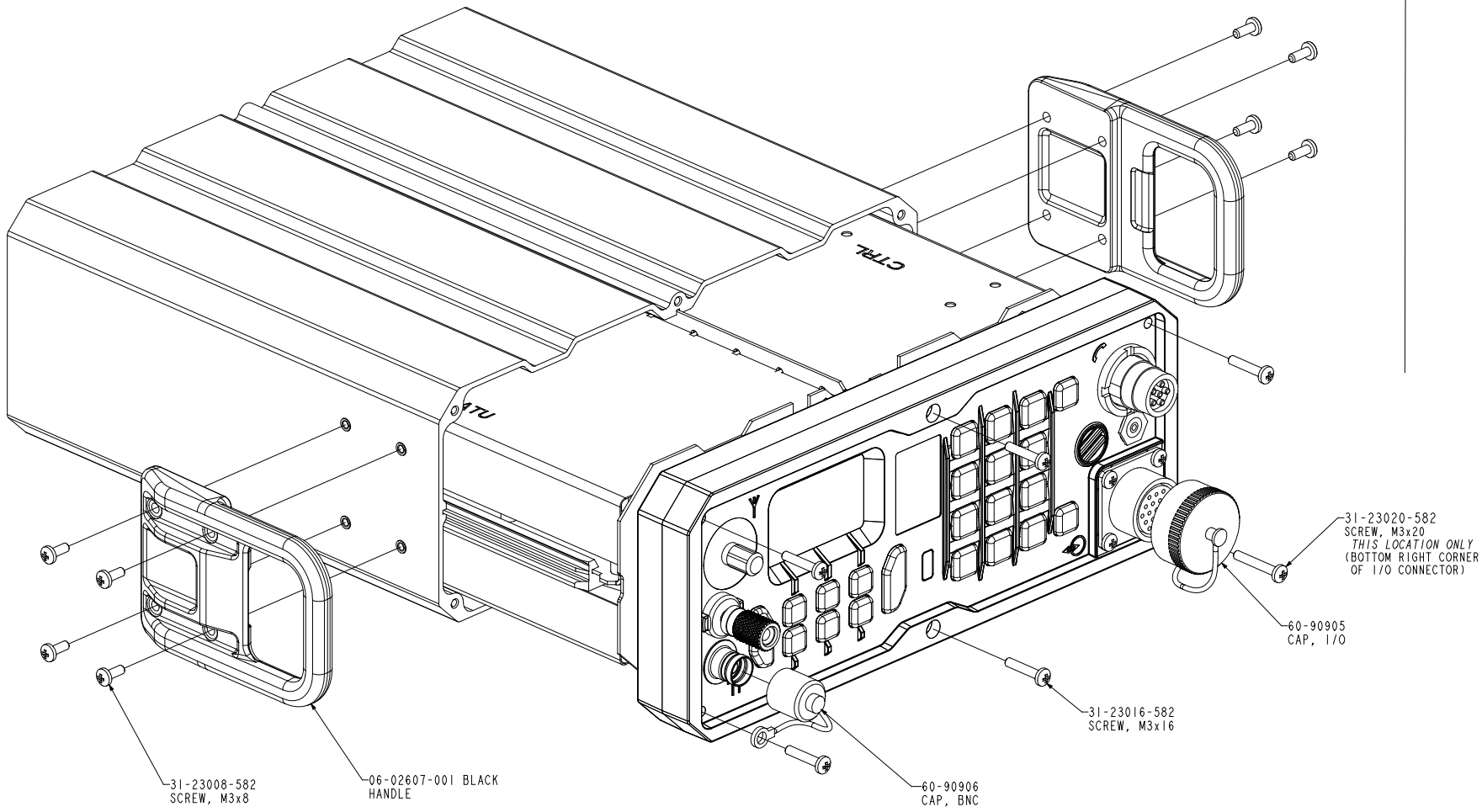
TITLE
LISTED SPARES 2110, WITH SIDE HANDLES

ISS 3

DRAWING/DOC NO. 16-00120

SHT.2 OF 7

DO NOT SCALE



DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE	1:1
MATERIAL	DRN	GS	DATE 23-04-2009
	CHKD	RPM	06-05-2009
FINISH	APPD	RPM	06-05-2009

TOLERANCES UNLESS OTHERWISE SPECIFIED
LINEAR ± 0.2
ANGULAR ± 0.5°
FLATNESS ± 0.2
ROUGHNESS 1.6 µmRa

CODAN

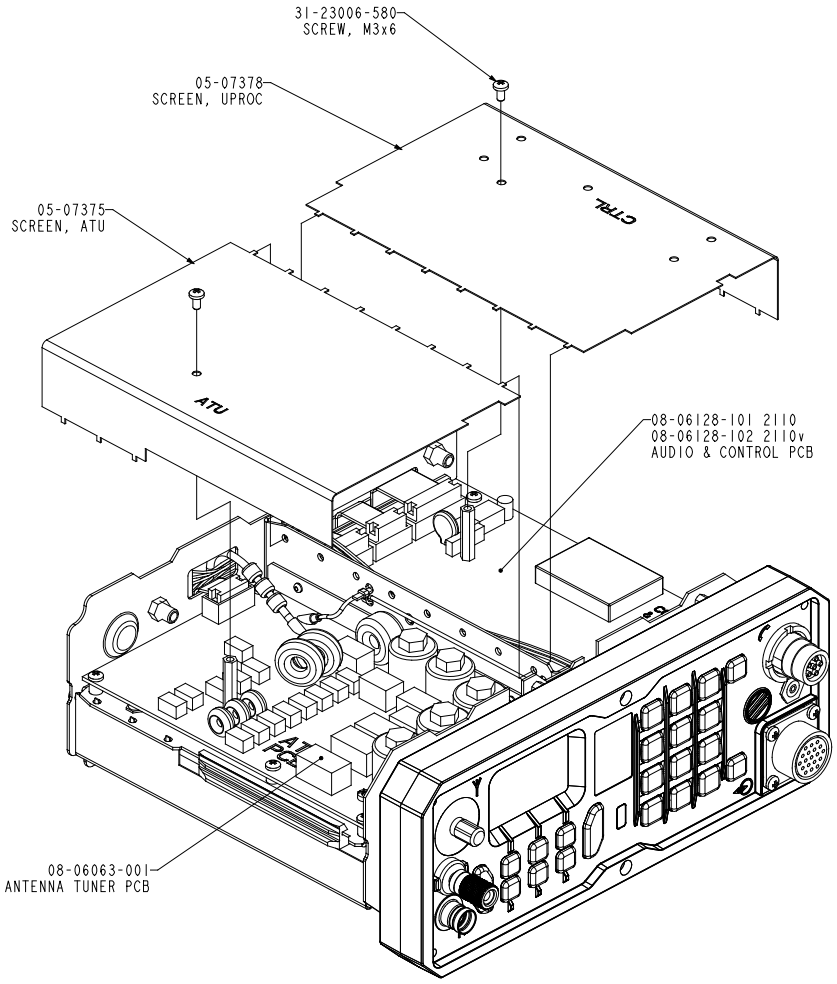
A2

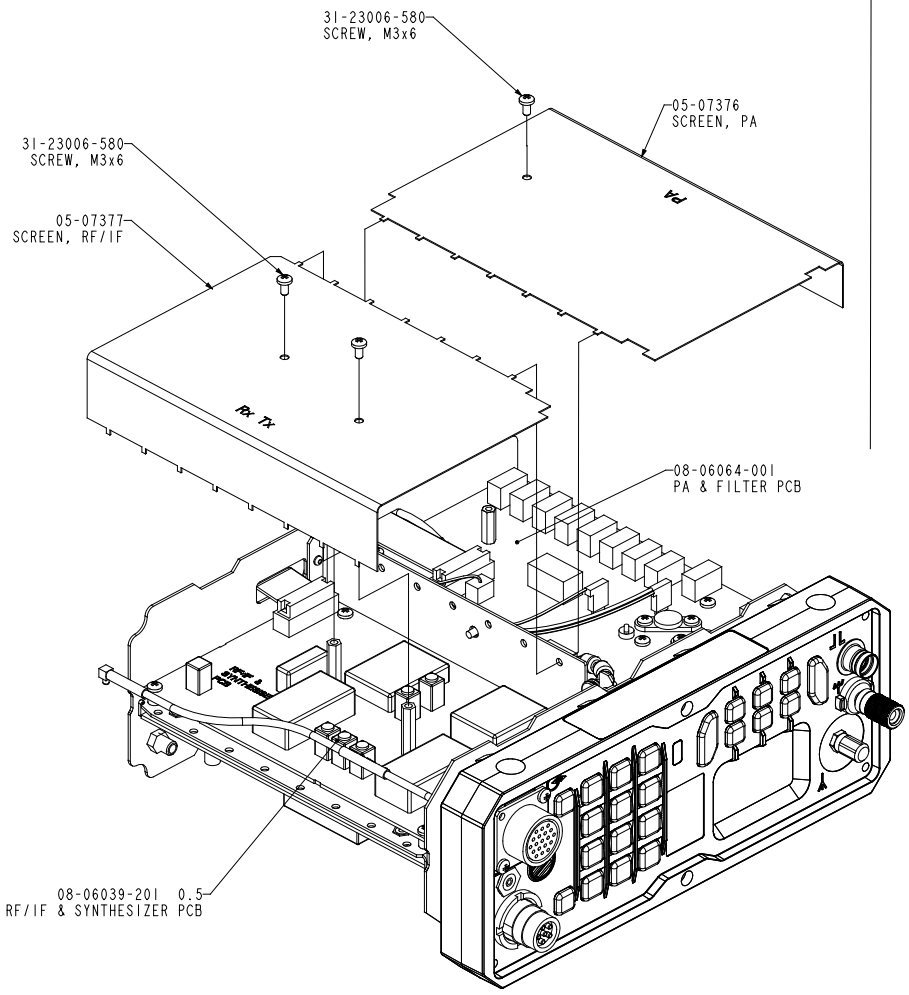
TITLE
LISTED SPARES 2110, WITH SIDE HANDLES

ISS 3

DRAWING/DOC NO. 16-00120

DO NOT SCALE





DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE	1:1
	DRN	GS	DATE 23-04-2009
MATERIAL	CHKD	RPM	06-05-2009
	APPD	RPM	06-05-2009
FINISH	TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR ± 0.2		
	ANGULAR ± 0.5°		
	FLATNESS ± 0.2		
	ROUGHNESS 1.6 µmRa		

CODAN

A2

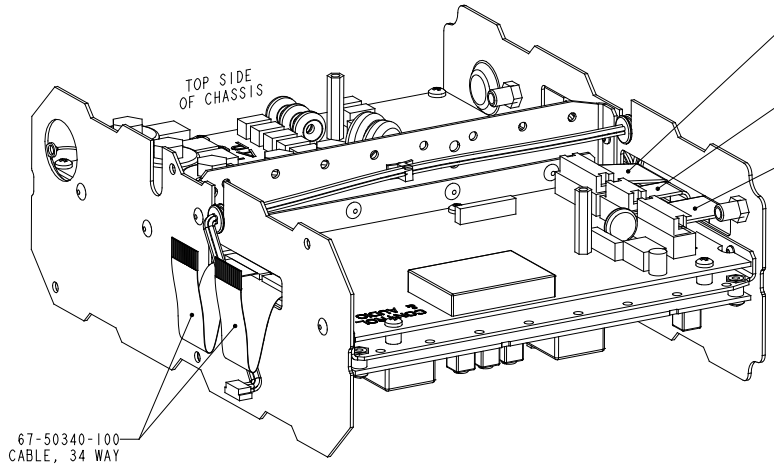
TITLE: LISTED SPARES 2110, WITH SIDE HANDLES

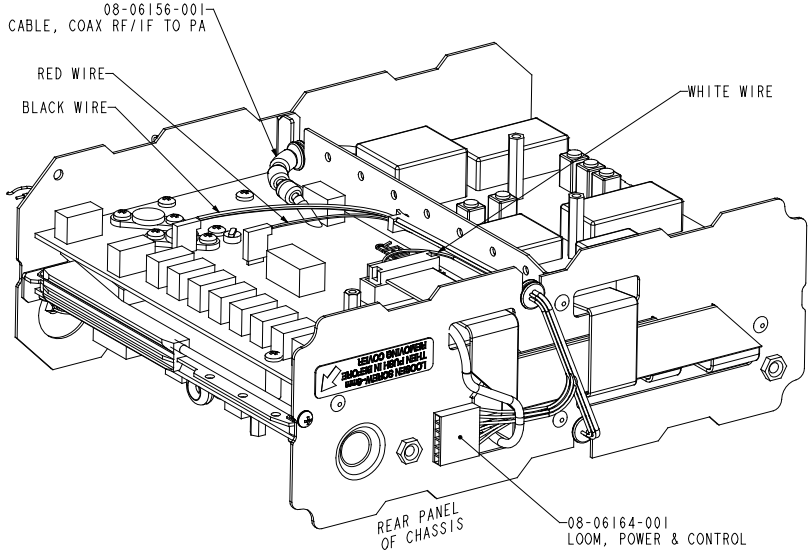
ISS 3

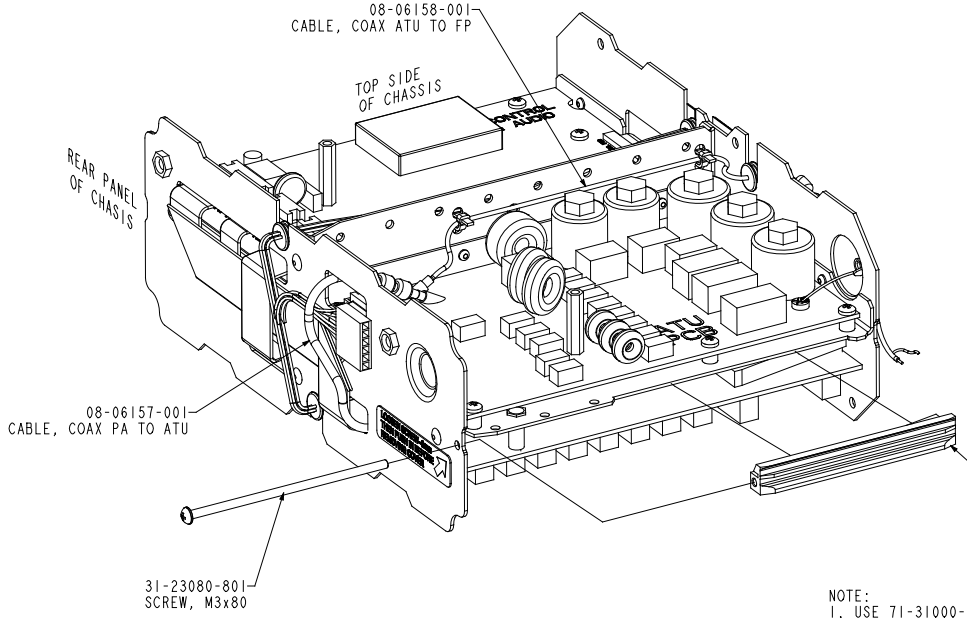
DRAWING/DOC NO. 16-00120

SHT.4 OF 7

DO NOT SCALE







NOTE:
1. USE 71-31000-006
HEAT TRANSFER COMPOUND

DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE 1:1	
	DRN	GS	DATE 23-04-2009
MATERIAL	CHKD	RPM	06-05-2009
	APPD	RPM	06-05-2009
FINISH	TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR ± 0.2		
	ANGULAR ± 0.5°		
	FLATNESS ± 0.2		
	ROUGHNESS 1.6 µmRa		

CODAN

A2

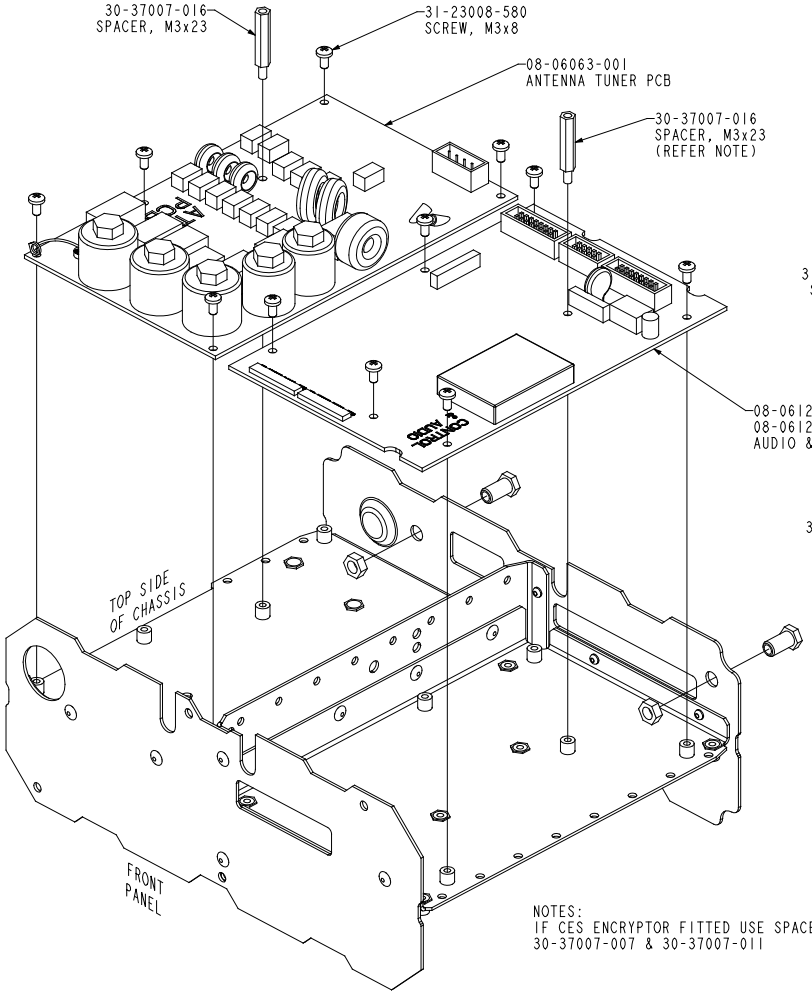
TITLE
LISTED SPARES
2110, WITH SIDE HANDLES

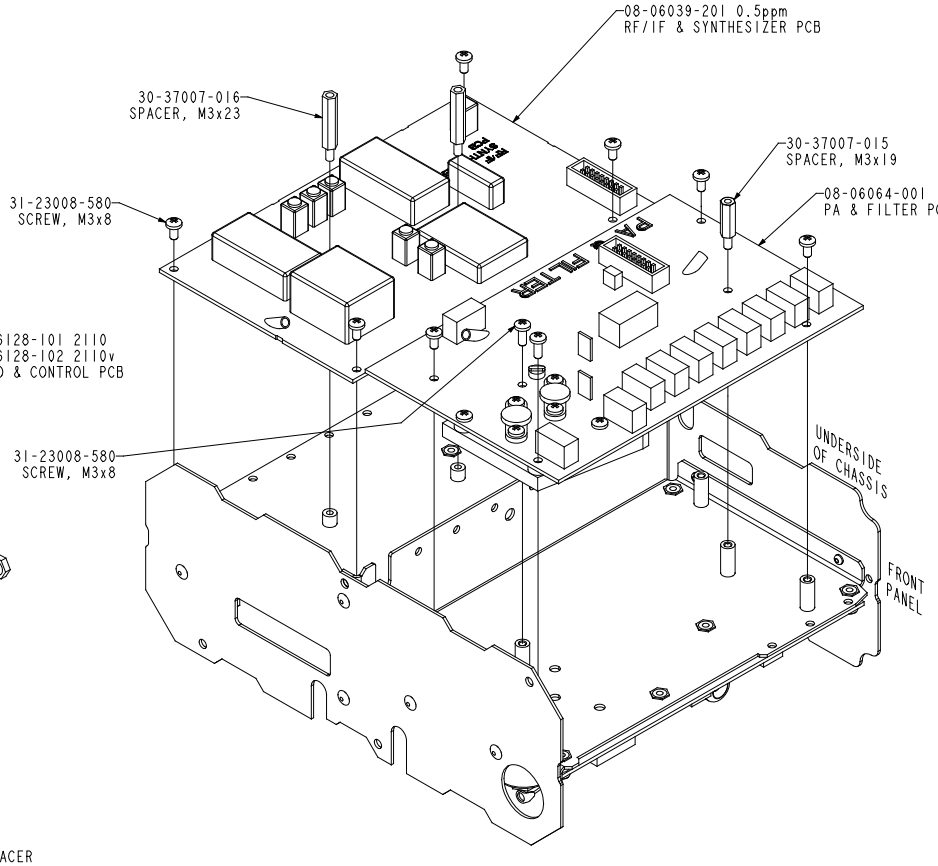
ISS 3

DRAWING/DOC NO.
16-00120

SHT.5 OF 7

DO NOT SCALE





NOTES:
IF CES ENCRYPTOR FITTED USE SPACER
30-37007-007 & 30-37007-011

DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE 1:1	
MATERIAL	DRN GS	DATE 23-04-2009	
	CHKD RPM	06-05-2009	
FINISH	APPD RPM	06-05-2009	
	TOLERANCES UNLESS OTHERWISE SPECIFIED LINEAR ± 0.2 ANGULAR ± 0.5° FLATNESS ± 0.2 ROUGHNESS 1.6 µmRa		

CODAN

A2

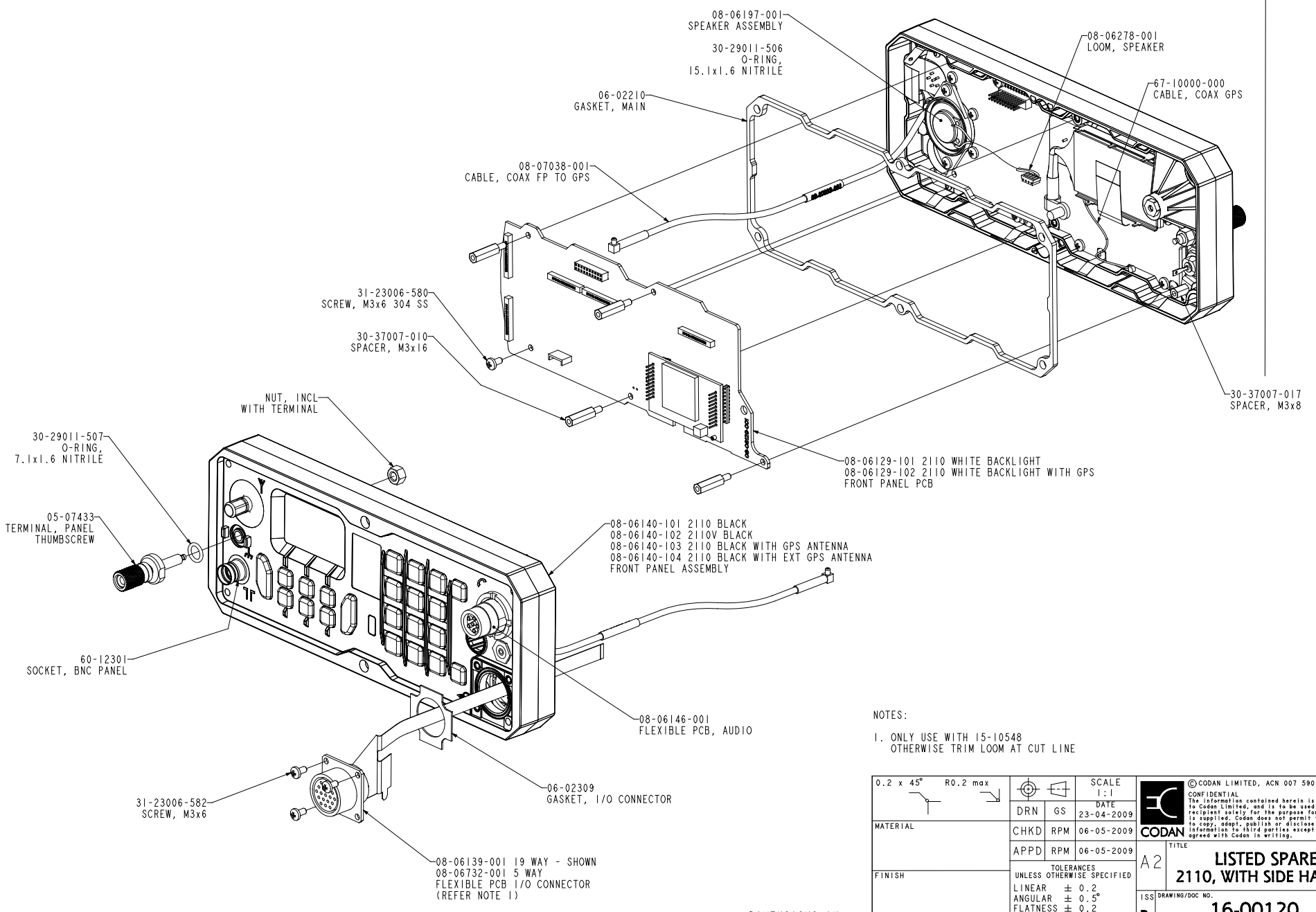
TITLE
LISTED SPARES
2110, WITH SIDE HANDLES

ISS 3

DRAWING/DOC NO. 16-00120

SHT.6 OF 7

DO NOT SCALE



NOTES:

1. ONLY USE WITH 15-10548
   OTHERWISE TRIM LOOM AT CUT LINE

DIMENSIONS IN mm

0.2 x 45° R0.2 max		SCALE 1:1	
MATERIAL	DRN	GS	DATE 23-04-2009
	CHKD	RPM	06-05-2009
FINISH	APPD	RPM	06-05-2009
	TOLERANCES UNLESS OTHERWISE SPECIFIED		
	LINEAR ± 0.2		
	ANGULAR ± 0.5°		
	FLATNESS ± 0.2		
	ROUGHNESS 1.6 µmRa		

CODAN

A2

TITLE
LISTED SPARES
2110, WITH SIDE HANDLES

ISS 3

DRAWING/DOC NO. 16-00120

SHT.7 OF 7

Functional description of PCBs

This section contains the following topics:

NOTE The functional description should be read in conjunction with the brief description (see page 19, *Brief description*).

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Figure 11: RF/IF & Synthesiser PCB (08-06039-001)

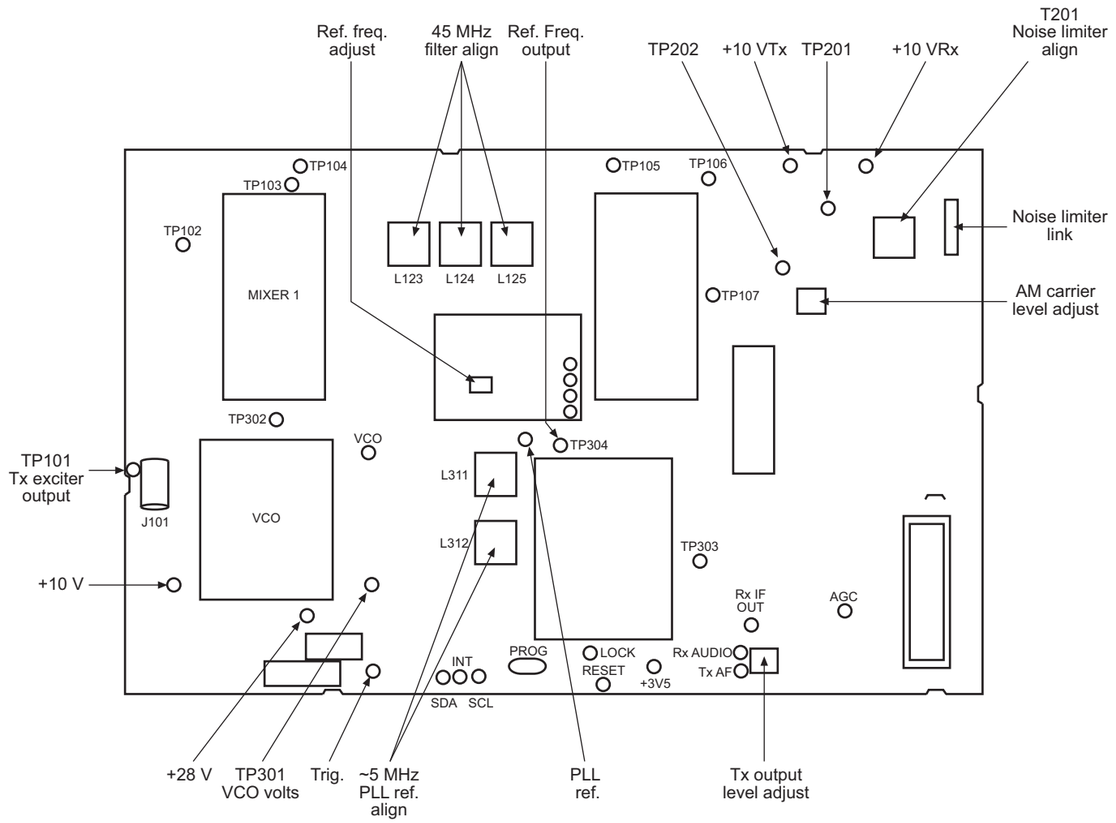
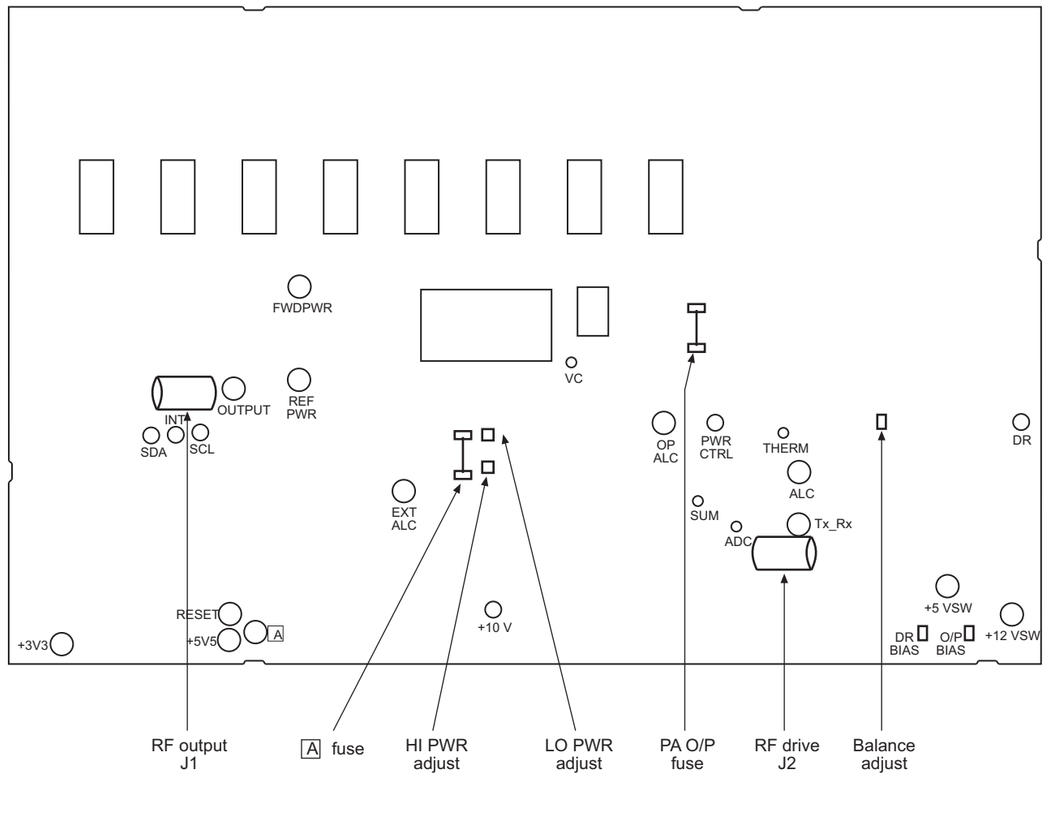
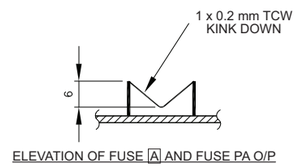


Figure 12: PA & Filter PCB (08-06064-001)





ELEVATION OF FUSE A AND FUSE PA O/P

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Figure 13: Audio & Control PCB (08-06128-001)

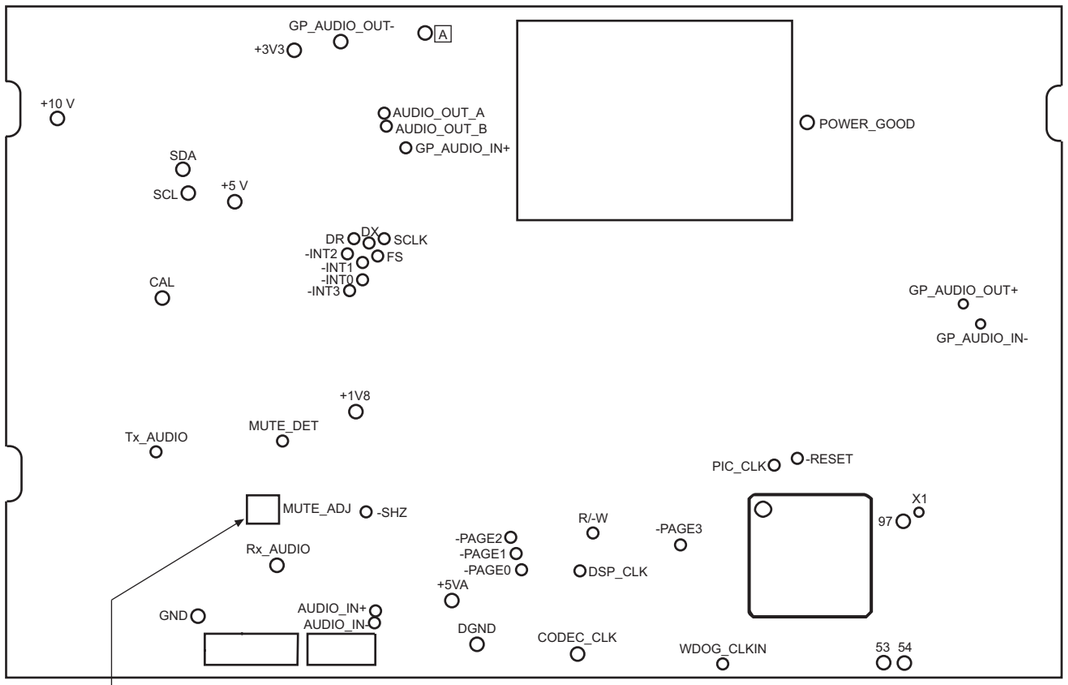


Figure 14: Antenna Tuner PCB (08-06063-001)

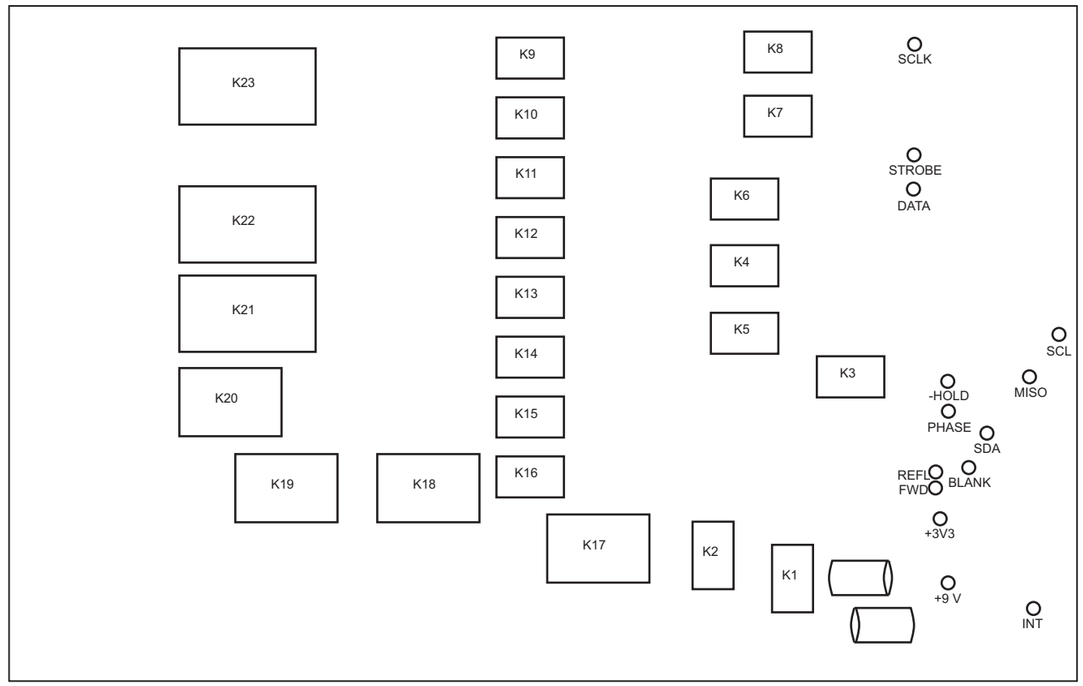
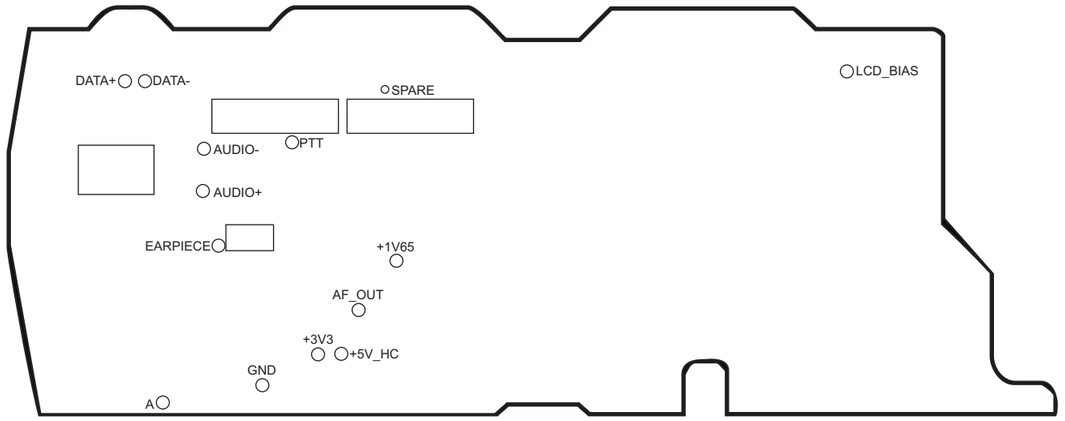


Figure 15: Front Panel PCB (08-06129-001)



RF/IF & Synthesiser PCB

The RF/IF & Synthesiser PCB performs the following functions:

- provides a low-level RF signal at the channel frequency, modulated with the Tx audio
- switches the Tx/Rx paths
- modulates and demodulates the audio signal
- mixes the 455 kHz IF, band-pass filtering (Z201), and amplification
- mixes the 45 MHz IF, band-pass filtering (Z101, Z102), and amplification
- limits noise
- provides a REF OSC for the DDS, PLL and LO2 circuits
- generates 45.25 to 75 MHz references for the 1st mixer via a VCO and PLL
- provides switchable RF pre-amplification of the incoming Rx signal
- switches between USB and LSB
- provides the RF source for a tune signal
- provides AGC control
- interprets commands from the Audio & Control PCB

The RF/IF & Synthesiser PCB contains:

- Tx mixers
- Rx mixers
- a noise limiter
- a Tx modulator
- an Rx demodulator
- a PLL
- a DDS
- a VCO
- a PIC microcontroller
- a Crystal Oven PCB

For details on the RF/IF & Synthesiser PCB, Codan part number	**See...**
08-06039-001	Table 8 on page 34 and Figure 11 on page 30

08-06039-001

CAUTION

If this PCB is replaced, ensure that:

- IC308 has the same (or later) firmware version as the original
- the reference oscillator has the same part number and/or required stability
- the replacement PCB has the same (or later) PCB version as the original, that is 07-02012-vv

When ordering a replacement PCB, use the information in the listed spares drawing to select the correct assembly (see page 25, *Interconnection diagrams and listed spares drawings*).

NOTE

All input signals for measuring Tx voltages are –10 dBv two-tone signals from the 0208 test set (or equivalent), unless stated otherwise. This signal level provides maximum ALC and therefore maximum output power for taking the measurement.

NOTE

All input signals for measuring Rx voltages are –10 dBm from the RF signal generator at ±1 kHz from SCF.

Table 8: Test points for the RF/IF & Synthesiser PCB (08-06039-001)

Test point	Correct signal	Explanation	Source
+10V	+10 V DC	+10 V regulated supply	via Audio & Control PCB
+10VRX	+10 V DC	+10 V in Rx	V401, V402, V403
+10VTX	+10 V DC	+10 V in Tx	V501, V502, V503
+28V	+28 V	+28 V from charge pump	IC302 and +10 V
+3V5	+3.5 V DC	+3.5 V regulated supply	IC208, V222, V225
AGC	+6.4 V DC no signal	Output of AGC circuit	IC204
INT	+3.5 V DC		
LOCK	0 V DC, locked +3.5 V DC, unlocked	Indicates if the PLL is locked	IC301
PLL REF	2 V p–p @ approx. 5 MHz	5 MHz reference for PLL	V311, REF OSC
RESET	+3.3 V DC	Reset line for PIC	IC104 master PIC, Audio & Control PCB
Rx AUDIO	500 mV p–p Rx with –110 dBm (0.7 µV EMF) @ 50 Ω port 1 V p–p Rx with –47 dBm (1 mV EMF) @ 50 Ω port	Output Rx audio to Audio & Control PCB	IC206, IC207

Table 8: Test points for the RF/IF & Synthesiser PCB (08-06039-001) (cont.)

Test point	Correct signal	Explanation	Source
Rx IF OUT	500 mV p–p Rx with –110 dBm @ 455.5 kHz 900 mV p–p Rx with –47 dBm @ 455.5 kHz	IF output of Rx signal prior to demodulation	V217
SCL	–	Data (PIC clock)	IC104, Audio & Control PCB
SDA	–	Data (PIC data)	IC104, Audio & Control PCB
TP101	160 mV p–p Tx 175 mV p–p Rx	RF input/output J101 to PA & Filter PCB J2	
TP102	160 mV p–p Tx RF Pre-amp off: 175 mV p–p Rx RF Pre-amp on: 420 mV p–p Rx	Output of the Rx RF Pre-Amp	V101
TP103	370 mV p–p Tx @ 45000.5 kHz	Between MIX 1 and 45 MHz filter	
TP104	+1 V DC	V106, V107 Bias	
TP105	+1 V DC @ 45000.5 kHz	V108, V113 Bias between 45 MHz filter and MIX 2	
TP106	300 mV p–p Tx 270 mV p–p Rx @ 455.5 kHz	Between MIX 2 and Noise Amp/Gate	
TP107	+1.2 V DC	V118 and V119 Bias	
TP201	+3.5 V DC 0 V DC	Noise gate control from noise amp	IC202
TP202	440 mV p–p Tx Noise limiter off: 6.3 V p–p Rx @ 455.5 kHz Noise limiter on: 4.8 V p–p Rx @ 455.5 kHz	RF side of 455 kHz filter	

Table 8: Test points for the RF/IF & Synthesiser PCB (08-06039-001) (cont.)

Test point	Correct signal	Explanation	Source
TP301	+2 to 22 V DC Test 1: +1.5 V DC and +3.5 V DC @ 45.25 MHz Test 2: +7 V DC and +10.5 V DC @ 60 MHz Test 3: +10 V DC and +20 V DC @ 75 MHz	DC output of the PLL feeding the VCO	V306 to V310
TP302	400 mV p–p +3.3 V DC 45.25 to 75 MHz in 10 Hz steps	Output of the VCO	V305
TP303	200 mV p–p USB: 456.5 kHz LSB: 453.5 kHz	Output of the divided REF OSC frequency to Tx modulator	IC307
TP304	3.5 V p–p 14.848333 MHz	Output of the REF OSC	REF OSC
TRIG	+3.5 V DC		
Tx AF	900 mV p–p Tx	Audio input to Tx DEMOD	IC302, Audio & Control PCB
VCO	200 mV p–p 45.25 to 75 MHz in 10 Hz steps	Output of VCO to the PLL	V303, VCO

PA & Filter PCB

The PA & Filter PCB performs the following functions:

- amplifies the modulated Tx input signal to 25 W
- provides ALC for the Tx signal
- provides linear dynamic bias for the output transistors
- provides ALC (detection of forward and reflected powers, PA collector voltage, battery voltage, Tx/Rx relay failures, and thermal control of PA stage)
- provides low-pass filtering to reduce spurious emissions

The PA & Filter PCB contains:

- a gain control circuit (V25, V26)
- a pre-driver circuit (V29 to V32)
- the main power amplifier circuit (V36, V37)
- a PIC (IC1)
- a DC power relay (K12)
- forward and reflected power detection (D1, D2)
- an ALC circuit (IC7, IC8))
- thermal control circuit (IC8)

For details on the PA & Filter PCB, Codan part number	**See...**
08-06064-001	Table 9 on page 38 and Figure 12 on page 30

08-06064-001

If this PCB is replaced, ensure that IC1 has the same (or later) firmware version as the original.

CAUTION If the output FETs are replaced, some adjustments must be made (see page 79, *Adjusting the PA*). Complete all the adjustments within this section.

When ordering a replacement PCB, use the information in the listed spares drawing to select the correct assembly (see page 25, *Interconnection diagrams and listed spares drawings*).

NOTE All input signals for measuring Tx voltages are –10 dBv two-tone signals from the 0208 test set (or equivalent), unless stated otherwise. This signal level provides maximum ALC and therefore maximum output power for taking the measurement.

NOTE All input signals for measuring Rx voltages are –10 dBm from the RF signal generator at ±1 kHz from SCF.

WARNING Ensure that the earth lead from the CRO probe is short when measuring at the TX_RX test point.

Table 9: Test points for the PA & Filter PCB (08-06064-001)

Test point	Correct signal	Explanation	Source
+10V	+10 V DC	Regulated supply	V2
+12VSW	+12 V DC	A rail, PTT active	V8
+3V3	+3.3 V DC	Regulated supply	IC10
+5V5	+5.5 V DC	Regulated supply	V38
+5VSW	+5.5 V DC	Rail, PTT active	V39
A	+12 V DC	Switched, unregulated battery supply	Battery or power via Fuse F3–F4
ADC		ALC (µP control)	IC1
ALC	Approx. +3 V DC Tx	ALC (output to PA stage)	IC7
DR	+12 V DC	Driver collector voltage	V29 to V32
EXT ALC		ALC from external device (only if X1 linked)	Direct from GPIO port (2110 only)
FWD PWR	18 V p Tx	ALC (forward power)	D1
INT	–	Data (interrupt for PIC)	IC104 master PIC, Audio & Control PCB
OP ALC	Approx. +4.3 V DC Tx		IC7
OUTPUT	110 V p–p Tx	Input/output for Antenna Tuner PCB	Filter stage

Table 9: Test points for the PA & Filter PCB (08-06064-001) (cont.)

Test point	Correct signal	Explanation	Source
PWR CTRL	Approx. 3.5 V DC Tx		IC8, V23, V43
REF PWR	100 µV p Tx	ALC (reflected power)	D2
RESET	+3.3 V DC	PIC reset line	IC301 CPLD, Audio & Control PCB
SCL	–	Data (synchronous clock for PIC)	IC104 master PIC, Audio & Control PCB
SDA	–	Data (serial data for PIC)	IC104 master PIC, Audio & Control PCB
SUM	+4.2 V DC Tx	ALC (combined output power control)	IC8
THERM	0 V DC	ALC (thermal output power control, prevents heatsink from exceeding 100°C)	IC8
TX_RX (ensure that the earth lead from the CRO probe is short)	120 mV p–p Tx	Input/output for RF/IF & Synthesiser PCB	
VC	+2.2 V DC	ALC (output PA collector voltage)	**A** rail after F1–F2

Audio & Control PCB

The Audio & Control PCB performs the following functions:

- provides ADC and DAC conversion for both the Tx and Rx audio path via the codec (IC302)
- compresses the digitised microphone Tx audio and reduces noise on the digitised Rx audio via the DSP (IC202)
- controls the output level of the Tx and Rx audio
- voice mutes the Rx audio path (IC109, IC110, IC111, IC112, IC113)
- provides power on/off function
- stores the firmware for the transceiver
- stores the unique transceiver profile programmed by NSP
- stores real-time data such as transceiver addresses, signal strength and other parameters for ALE
- regulates the battery voltage down to +5 V DC, +3.3 V DC and +1.8 V DC
- connects to the optional voice encryptor module
- provides battery-backed real time clock

The Audio & Control PCB contains:

- a codec, ADC (IC302)
- a DSP (IC202)
- a master PIC (IC104)
- a CPLD (IC301)
- an SRAM (IC205, IC206)
- a code flash (IC203, 204)
- a data flash (IC207)
- a real-time clock (IC103)
- a mute-detection circuit (IC109, IC110, IC111, IC112, IC113)
- several voltage regulators (IC105, 106, 108)
- a battery (G101)
- two crystals (Z101, Z201)

For details on the Audio & Control PCB, Codan part number	**See...**
08-06128-001	Table 10 on page 41 and Figure 13 on page 32

08-06128-001

CAUTION

If this PCB is replaced, ensure that:

- IC104 and IC301 have the same (or later) firmware version as the original
- the replacement PCB has the same (or later) PCB version as the original, that is 07-02028-vv

When ordering a replacement PCB, use the information in the listed spares drawing to select the correct assembly (see page 25, *Interconnection diagrams and listed spares drawings*).

NOTE

All input signals for measuring Tx voltages are –10 dBv two-tone signals from the 0208 test set (or equivalent), unless stated otherwise. This signal level provides maximum ALC and therefore maximum output power for taking the measurement.

NOTE

All input signals for measuring Rx voltages are –10 dBm from the RF signal generator at ±1 kHz from SCF.

Table 10: Test points for the Audio & Control PCB (08-06128-001)

Test point	Correct signal	Explanation	Source
53	–	Not used	
54	–	Not used	
97		Not used	
+10V	+10 V DC	+10 V regulated supply	PA & Filter PCB
+1V8	+1.8 V DC	+1.8 V regulated supply	IC106
+3V3	+3.3 V DC	+3.3 V regulated supply	IC106
+5V	+5 V DC	+5 V regulated supply	IC105
+5VA	+5 V DC	+5 V regulated supply to encryptor	V105
A	+12 to 13.2 V DC	Switched, unregulated battery supply	PA & Filter PCB
AUDIO_IN–	170 mV p–p, single tone	Pre-amplified Tx audio from the microphone prior to compression	Front Panel PCB
AUDIO_IN+			
AUDIO_OUT_A		Rx audio for the earphone, internal and external speaker after processing	IC302
AUDIO_OUT_B			
CAL	+5 V DC		IC103

Table 10: Test points for the Audio & Control PCB (08-06128-001) (cont.)

Test point	Correct signal	Explanation	Source
CODEC_CLK	3.3 V p–p @ 27.648 MHz	Clock signal from CPLD to CODEC	IC301
DGND	0 V DC	Digital ground	
DR	–	Data	IC302
DSP_CLK	3.3 V p–p @ 55.296 MHz	Clock signal from CPLD to display	IC301
DX	–	Data	IC302
FS	3.3 V p	4 µs pulse every 128 µs	IC302
GND	0 V DC	Ground	
GP_AUDIO_IN–		Pre-amplified Tx audio from the GPIO connector prior to compression	GPIO connector via Front Panel PCB
GP_AUDIO_IN+			
GP_AUDIO_OUT–		Rx audio for the GPIO connector after processing	IC302
GP_AUDIO_OUT+			
INT0	–	Data	IC202
INT1	–	Data	IC202
INT2	–	Data	IC202
INT3	–	Data	IC202
MUTE_DET	+3.3 V DC, voice present 0 V DC, no voice	Indicates the state of the voice mute	IC113
PAGE0	–	Data	IC301
PAGE1	–	Data	IC301
PAGE2	–	Data	IC301
PAGE3	–	Data	IC301
PIC_CLK	3.3 V p–p @ 6.912 MHz	Clock signal from CPLD to PIC	IC301
POWER_GOOD	+3.3 V DC, good 0 V DC, bad	Indicates state of 3.3 V and 1.8 V regulator	IC106
R/-W	–	Data	IC301
RESET	+3.3 V DC	Master reset line	IC104
RX_AUDIO	1 V p–p	Rx audio	RF/IF & Synthesiser PCB

Table 10: Test points for the Audio & Control PCB (08-06128-001) (cont.)

Test point	Correct signal	Explanation	Source
SCL	–	Data	IC103
SCLK	3.3 V p–p, 250 kHz square wave	Synchronous clock for PIC	IC302
SDA	–	Data (serial data for PIC)	IC103
SHZ	–	Data	IC301
TX_AUDIO	1 V p–p	Tx audio	Front Panel PCB
WDOG_ CLKIN	3.3 V p–p @ 14 Hz	Clock signal from CPLD to CPLD	IC301
X1	–	Not used	

Antenna Tuner PCB

The Antenna Tuner PCB performs the following functions:

- detects VSWR
- detects phases
- provides scanning amplification of Rx signal
- matches the antenna
- stores the last-tune settings in memory
- microcontrols tuning

The Antenna Tuner PCB contains:

- a PIC microcontroller (IC5)
- an EEPROM (IC7)
- a load-matching circuit

For details on the Antenna Tuner PCB, Codan part number	See...
08-06063-001	Table 11 on page 45 and Figure 14 on page 32

08-06063-001

CAUTION If this PCB is replaced, ensure that IC5 has the same (or later) firmware version as the original.

When ordering a replacement PCB, use the information in the listed spares drawing to select the correct assembly (see page 25, *Interconnection diagrams and listed spares drawings*).

NOTE All input signals for measuring Tx voltages are –10 dBv two-tone signals from the 0208 test set (or equivalent), unless stated otherwise. This signal level provides maximum ALC and therefore maximum output power for taking the measurement.

NOTE All input signals for measuring Rx voltages are –10 dBm from the RF signal generator at ±1 kHz from SCF.

Table 11: Test points for the Antenna Tuner PCB (08-06063-001)

Test Point	Correct Signal	Explanation	Source
+3V3	+3.3 V DC	Regulated supply	Audio & Control PCB
+9V	+9 V DC	Regulated supply	IC6
BLANK			
DATA		Serial data for matching selector	IC5
FWD		Forward power for VSWR detector	D24/A
HOLD	+3.3 V DC		3.3 V DC rail
INT	+3.3 V DC		
J1	100 V p–p Tx	RF input from PA	
J2	100 V p–p Tx	Output to 50 Ω port	
MISO			
PHASE		Phase detector output	IC4
REFL		Reflected power for VSWR detector	D24/B
RESET		Reset for all matching relays	IC5
SCL		Synchronous clock for PIC	IC104 master PIC, Audio & Control PCB
SCLK		Synchronous clock for matching	IC5
SDA		Serial data for PIC	
SET		Set for all matching relays	IC5
STROBE			

Front Panel Assembly

The Front Panel Assembly consists of the Front Panel PCB and associated connectors, the Keypad PCB and key membrane, the audio speaker, and the GPS equipment (if fitted).

This assembly performs the following functions:

- arranges the key inputs into a signal matrix connected via P1 to the Front Panel PCB
- provides infrared transmission/reception connected via P1 to/from the Front Panel PCB
- illuminates the front panel via P1 on the Front Panel PCB
- provides audio output from the Front Panel PCB
- contains the connectors that direct the inputs and outputs from the GPIO and handset connectors to/from the Front Panel PCB via a flexible ribbon cable
- contains the 50 Ω RF connector, which connects via a coaxial cable to the RF/IF & Synthesiser PCB
- contains the antenna stud, which connects via a wire to the Antenna Tuner PCB
- contains the GPS antenna, if fitted
- contains the external GPS connector, if fitted

The Front Panel Assembly contains:

- keypad membrane and Keypad PCB
- infrared transceiver (H13)
- LED backlighting
- waterproof audio speaker
- 19-way or 5-way GPIO connector depending on variant
- 6-way handset connector
- 50 Ω BNC connector
- antenna stud
- GPS antenna, if fitted
- external GPS antenna connector, if fitted

08-06140-001

CAUTION If this PCB is replaced, ensure that the replacement PCB has the same (or later) PCB version as the original, that is 07-02032-vv.

There are no dedicated test points for this assembly.

When ordering a replacement PCB, use the information in the listed spares drawing to select the correct assembly (see page 25, *Interconnection diagrams and listed spares drawings*).

Front Panel PCB

The Front Panel PCB performs the following functions:

- interprets data from the Audio & Control PCB and displays it on the LCD
- reads keypad entries and sends data to the Audio & Control PCB
- provides an RS232 port for programming/control
- amplifies the audio for the internal and external speakers
- pre-amplifies microphone audio and external audio input
- provides side-tone for the handset
- provides contrast adjustment for the LCD
- backlights the LCD
- passes the key inputs directly to the Audio & Control PCB

The Front Panel PCB contains:

- a UART to provide GPIO control (IC6)
- an RS232 driver/receiver (IC11)
- an octal D-type latch (IC4, IC5) for switching speaker, RS232 functions, speaker on/off etc
- audio amplifiers to drive the handset earphone (IC8), internal speaker (IC3) and an external speaker (IC9)
- amplifiers to provide pre-amplification of microphone (IC1) and external audio in (IC19)
- an amplifier to produce side-tone to the earphone (IC21)
- an LCD (H2) and drivers (IC16, IC17, IC18)
- a connection to the Front Panel Assembly
- a connection to the GPS antenna, if fitted
- a connection to the external GPS antenna connector, if fitted
- a LED (H1) for backlighting

For details on the Front Panel PCB, Codan part number	**See...**
08-06129-001	Table 12 on page 49

08-06129-001

CAUTION If this PCB is replaced, ensure that the replacement PCB has the same (or later) PCB version as the original, that is 07-02029-vv.

When ordering a replacement PCB, use the information in the listed spares drawing to select the correct assembly (see page 25, *Interconnection diagrams and listed spares drawings*).

NOTE All input signals for measuring Tx voltages are –10 dBv two-tone signals from the 0208 test set (or equivalent), unless stated otherwise. This signal level provides maximum ALC and therefore maximum output power for taking the measurement.

NOTE All input signals for measuring Rx voltages are –10 dBm from the RF signal generator at ±1 kHz from SCF.

Table 12: Test points for the Front Panel PCB (08-06129-001)

Test Point	Correct Signal	Explanation	Source
+1V65	+1.65 V DC	+1.65 V quiet for op-amp bias	IC1
+3V3	+3.3 V DC	Regulated supply	Audio & Control PCB
A	+12 V DC	Switched, unregulated battery supply	PA & Filter PCB via Audio & Control PCB
AF_OUT		AF output to internal/external speaker and earphone on handset	IC1
AUDIO–		Direct audio to/from handset connector	
AUDIO+			
DATA–	–	Not used	
DATA+	–	Not used	
EARPIECE		Output to earphone on handset	IC8
GND			
LCD_BIAS	Approx. –6 V DC	Regulated, temperature-compensated supply for LCD bias	IC16, IC17, IC18
PTT	+3.3 V DC, unkeyed 0 V DC, keyed	PTT from handset	IC12
SPARE	–	Not used	

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This section contains the following topics:

Test equipment

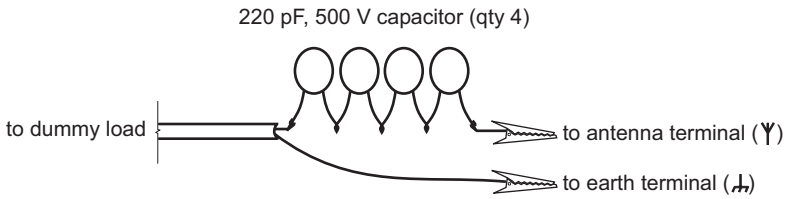
Table 13: Test equipment

Equipment	Notes
Codan 0208 Test Set, or a two-tone test set	With associated cables
50 MHz oscilloscope	External trigger capability
10× oscilloscope probe	Input impedance of 10 MΩ and less than 20 pF
50 Ω RF dummy load	100 W RMS
Power meter	Rated at a minimum of 20 W RMS
RF signal generator	400 kHz to 30 MHz Calibrated output of –130 to 0 dBm (0.2 µV to 10 mV) Source impedance of 50 Ω
50 MHz frequency counter	Resolution of 1 Hz
Regulated DC power supply, or 3020 Transceiver Supply with a current meter	13.6 V ±0.2 V at 20 A peak 20 A, mA range
Digital multimeter	10 MΩ input impedance
AC voltmeter	10 mV to 10 V with dB scale
RF spectrum analyser (optional)	Capable of measuring intermodulation 100 Hz resolution
Artificial antenna assembly	Four 220 pF/500 V capacitors (connected in series) 50 Ω coaxial cable with leads and banana/crocodile clips for connecting capacitors to antenna port/50 Ω dummy load (see Figure 16)
Banana plug adaptor for the antenna stud (optional)	
RF sampler	50 Ω, 200 W maximum, –40 dB, 200 MHz (see Figure 17)
Table earth mat	
Wrist earth strap	
PC with serial COM port	PCMCIA-type is acceptable USB-type is not suitable
Codan NSP software	15-04164-EN
Programming cable (19-way)	For 2110 (08-06237-001)
Programming cable (5-way)	For 2110v (08-06737-001)
DC power cable	For 2110
Codan vacuum test jig	

Table 13: Test equipment (cont.)

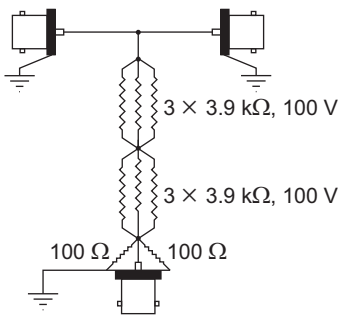
Equipment	Notes
Test tank to fit 2110	
Temperature-controlled soldering iron	
Soldering iron tip, large	
Soldering iron tip, flat	
Solder, 0.91 mm 60/40 Ersin 362	
Driver, hexagonal nut, 13 mm Driver, hexagonal nut, 8 mm Driver, hexagonal nut, 5 mm	
Screwdriver, hexagonal, 2.5 mm Screwdriver, slotted, 150 mm × 8 mm Screwdriver, pozi drive, PZ1 × 80 mm Screwdriver, torque	

Figure 16: Setup for artificial antenna



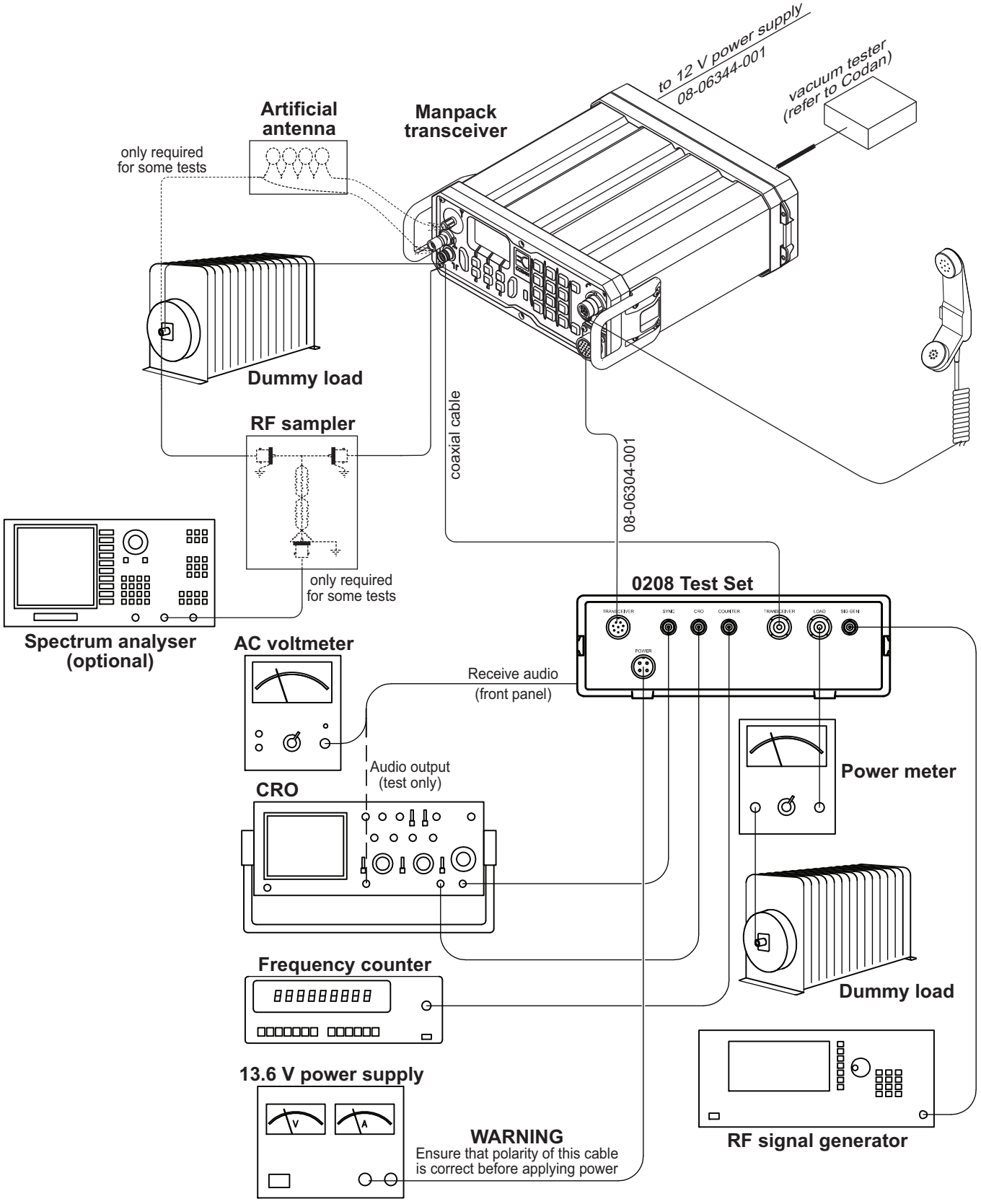
WARNING High voltages exist on this artificial antenna when it is in use. Capacitors must be properly insulated from earth.

Figure 17: Setup for RF sampler



Setup of test equipment for 2110

Figure 18: Setup for 2110



Repair procedures and fault diagnosis

NOTE The fault diagnosis and repair procedures assume that the transceiver has no software or hardware options installed. See page 115, *Options* to identify any specific testing for options.

General

The information in this section should be read in conjunction with the appropriate flowchart. See below to determine which flowchart you should view.

NOTE All fault diagnosis should begin with the Repair flowchart (see Figure 29 on page 95). Check voltages on boards as required.

NOTE All measurements for output power are in PEP.

You should not disassemble the 2110 until the preliminary checks in the Repair flowchart are completed. If the Repair flowchart refers you to any of the other flowcharts, you should disassemble the transceiver only when this is indicated in the process.

WARNING When taking measurements, keep the earth lead on the probe as short as possible.

Flowchart	**See...**
Repair flowchart	Figure 29 on page 95
Disassembly flowchart	Figure 30 on page 97
Power On fault diagnosis flowchart	Figure 31 on page 99
Receive fault diagnosis flowchart 1	Figure 32 on page 101
Receive fault diagnosis flowchart 2	Figure 33 on page 103
Transmit fault diagnosis flowchart 1	Figure 34 on page 105
Transmit fault diagnosis flowchart 2	Figure 35 on page 107

Setting up the test equipment

To set up the test equipment for the operational tests:

❑ Connect the test equipment (see Figure 18 on page 54) and use the settings provided in Table 14.

NOTE Do not connect the transceiver.

Table 14: Settings for test equipment

Item	Setting
Power supply	13.6 V DC
AC voltmeter	Suit audio level
Frequency counter	10 samples/second If accuracy greater than ±20 Hz is required, connect the counter to a traceable reference
0208 Test Set	Balance: Centre position (two tones) Output level: (left knob) –20 dBv Output level: (right knob) –50 dBv Speaker/Load: Speaker Noise: Up position (noise is off) PTT: Up position (PTT is off)
Power meter	≥ 25 W PEP, 2 to 30 MHz
Spectrum analyser	Span: 20 kHz Resolution bandwidth: 100 Hz
RF signal generator	Output: –121 dBm RF: Off Modulation: Off
CRO	5 V/div 0.1 µs/div

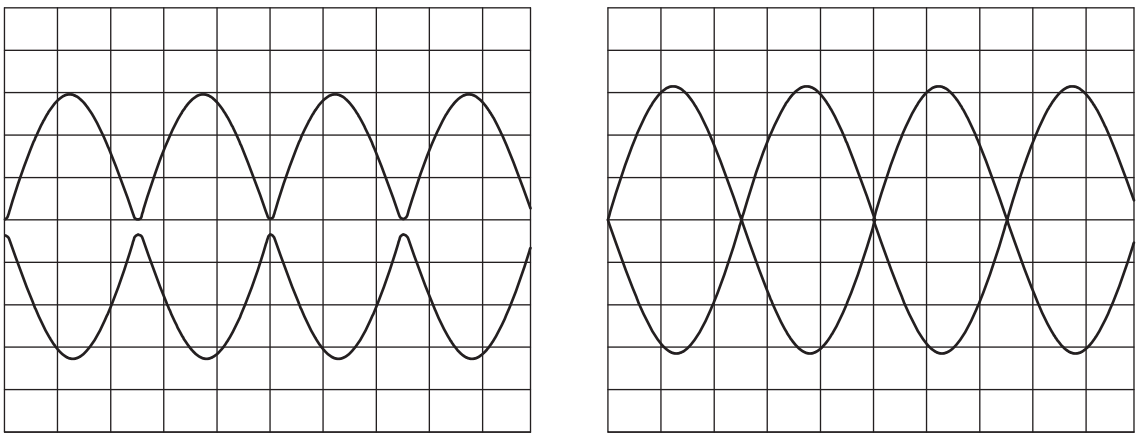
❑ Connect the transceiver to the test equipment.

Setting the balance on the 0208

To set the balance on the 0208:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select the channel on the oscilloscope to which the **CRO** output of the 0208 is connected.
- ❑ Select a channel on the transceiver to test.
- ❑ Ensure both output level controls on the 0208 are set to the minimum level.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver reaches a maximum (approximately –23 dBv on the 0208).
- ❑ Adjust the oscilloscope to view the RF envelope.
- ❑ Adjust the balance control on the 0208 for zero crossover (balanced) on the oscilloscope.

Figure 19: Balance control on the 0208



Unbalanced

Balanced (zero crossover)

- ❑ Switch off PTT on the 0208.

Mechanical inspection

Inspecting the transceiver for damage

To inspect the transceiver unit and battery pack:

- ❑ Check for:
  - physical damage (that is, crushed and/or distorted cables, cracked case)
  - signs of water ingress (vapour on inside of screen)
  - corrosion
- ❑ Check that:
  - the connectors are clear of foreign material
  - the connectors are free from corrosion
  - the pins on all connectors are straight and not distorted
- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Operational tests

Performing the Power On test

To perform the Power On test:

- ❑ Connect the battery.
- ❑ Press ❶ on the front panel to switch on the transceiver.

  Pass — Front panel screen displays the Codan logo, then the home screen (typically the channel screen).

- ❑ *Hold* ❶ on the front panel for 2 seconds to switch off the transceiver.
- ❑ Disconnect the battery from the transceiver.
- ❑ Connect the power supply to the connector at the base of the transceiver unit.
- ❑ Press ❶ on the front panel to switch on the transceiver.
- ❑ Tap ❶ on the front panel until the backlight is switched off.
- ❑ Measure the current at the power supply.

  Pass — Current drawn is < 220 mA.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Examining the profile in the transceiver

Certain frequencies and settings are required within the transceiver so that measurements can be taken across a range of operating conditions.

NOTE A standard test profile may be created using NSP. It should contain suitable frequencies and hot keys to access entries in the Control List, for example, Cfg RF Pre-Amp.

NOTE You must log in as administrator to access entries in the Control List for which you want to create hot keys.

To set up a profile that is suitable for performing all of the tests:

- ❑ Load and save the existing profile from the transceiver.

  NOTE This profile is programmed back into the transceiver at the end of repair and testing.

- ❑ Create a profile for the transceiver that contain frequencies from each of these bands:
  - 1600 to 2399.9 kHz (Band 1)
  - 2400 to 3699.9 kHz (Band 2)
  - 3700 to 5599.9 kHz (Band 3)
  - 5600 to 8499.9 kHz (Band 4)
  - 8500 to 12999.9 kHz (Band 5)
  - 13000 to 19699.9 kHz (Band 6)
  - 19700 to 30000.0 kHz (Band 7)

  NOTE The frequencies may use USB or LSB. If possible, use a frequency near the centre of each band.

- ❑ Set up the test profile with the settings listed in Table 15.

Table 15: Default settings for the transceiver during testing

Item	Location	Setting
Address	Control List	Leave blank, or set within an address range that is not used in your HF communication network
Auto Resume Mode	Control List	**Off**
Cfg Auto Tune Mode	Control List	**ATU/50 Ohm/Codan** (antenna selection icon **Auto** ⅂⌐ is displayed on screen)
Cfg Power Preference	Front panel (**Tx PWR** key) Control List	**High** (**Hi** is displayed on screen)

Table 15: Default settings for the transceiver during testing (cont.)

Item	Location	Setting
Cfg RF Pre-Amp	Control List	**On**
Cfg Speaker External	Control List	**Enabled**
Cfg Speaker Internal	Front panel (**MUTE** key) Control List	**Disabled** (*hold* **MUTE**)
Easitalk®	Front panel (**EASITALK** key) Control List	**Off**
Key Beep	Control List	**Off**
Mute	Front panel (**MUTE** key) Control List	**Off** (S or V is not reverse highlighted on screen)
Screen Brightness	Front panel (❶ key to toggle default/off, or ❶ + **0** to go to setting in Control List)	**Dark**

- ❑ Use NSP to program the test profile into the transceiver.

  NOTE You can also make changes directly to the profile in the transceiver using the front panel.

- ❑ Record the name of the test profile that you have programmed into the transceiver (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Front Panel test

To perform the Front Panel test:

- ❑ *Hold down* ⏻ and press **#**.

  The display prompts you to press a key.

- ❑ Press each key on the keypad one at a time, except ✕.

Pass	The key name is displayed on the screen as each key is pressed.
Pass	After one second, the front panel test screen flashes at 2 Hz to ensure all pixels are functional.

- ❑ Tap ⏻ several times to check that the backlight operates correctly.

NOTE	Switch off the backlight when you have finished testing its operation.

- ❑ Check that mute is switched off (**S** or **V** is not highlighted in the display).
- ❑ *Hold* **MUTE** to switch on the internal speaker, then listen for noise.

NOTE	Switch off the internal speaker when you have finished testing its operation.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Press ✕ to exit the Front Panel test.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Checking basic operation

To check basic operation:

- ❑ Press ✕ to see the home screen.
- ❑ Press **SCAN** to toggle scan on and off.

NOTE	If the channels have not been added to a network, or no networks are set to be scanned, an error message appears.

- ❑ Use ◣ or ◥ to change channels.
- ❑ Press **CALL** to go to the first call screen.
- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Receive tests

Performing the Basic Receive test

To test if the transceiver can receive:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test.
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.
- ❑ Set the RF output level of the RF signal generator to –20 dBm.
- ❑ Switch on the RF output from the RF signal generator.
- ❑ Switch the 0208 speaker to **Load**.
- ❑ Adjust the volume via the front panel to full volume.

  Pass A 1 kHz tone is audible from the 0208, –6 dB at full volume.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Switch the 0208 speaker to **Speaker**.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Antenna Tuner test (receive)

To test the antenna tuner in receive:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Connect the signal generator to the antenna stud on the front panel of the transceiver using a BNC-to-banana plug/clip adaptor and the screw-on adaptor.
- ❑ Set the Cfg Auto Tune Mode to **ATU**.
- ❑ Select a channel in Band 1 (see page 60, *Examining the profile in the transceiver*).
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.
- ❑ Switch the 0208 speaker to **Load**.
- ❑ Adjust the volume via the front panel to full volume.

  Pass A reading on the AC voltmeter that is approximately –20 dBm.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.

- ❑ Switch the 0208 speaker to **Speaker**.
- ❑ Return the antenna to the 50 Ω connector (ꟻꟻ).
- ❑ Return the Cfg Auto Tune Mode to **ATU/50 Ohm/Codan**.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Sensitivity test

To test the sensitivity of the transceiver to received signals:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test, preferably near the centre of one of the designated bands (see page 60, *Examining the profile in the transceiver*).
- ❑ Adjust the volume via the front panel to full volume.
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Set the 0 dB reference on the AC voltmeter to the level of the background noise (approximately –28 dBm).

  NOTE Meter damping may be required in noisy environments.

- ❑ Set the RF output level of the RF signal generator to –120 dBm.
- ❑ Switch on the RF output from the RF signal generator.

  Pass A reading on the AC voltmeter that is an increase of > 10 dB from the 0 dBm reference point.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF pre-amp in the transceiver.
- ❑ Repeat the test, this time setting the 0 dB reference on the AC voltmeter to the level of the background noise (approximately –31 dBm).
- ❑ Set the RF output level of the RF signal generator to –114 dBm.
- ❑ Switch on the RF output from the RF signal generator.

  Pass A reading on the AC voltmeter that is an increase of > 10 dB from the 0 dBm reference point.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Switch on the RF pre-amp in the transceiver.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the AGC test

To test the AGC of the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test.
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.
- ❑ Set the RF output level of the RF signal generator to –13 dBm.
- ❑ Adjust the volume via the front panel so the tone is clearly audible.
- ❑ Set the 0 dB reference on the AC voltmeter to the level of the tone (approximately –5 dBm at full volume).
- ❑ Reduce the RF output level of the RF signal generator until the reading on the AC voltmeter reduces by 6 dB.

  Pass — An RF output level from the RF signal generator that is < –106 dBm (RF pre-amp on).

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Audio Output test

To test the audio output from the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Replace the AC voltmeter with an oscilloscope.
- ❑ Adjust the oscilloscope to view a 1 kHz tone at 1 V p–p.

  NOTE — This is typically 0.2 V/div, sweep 0.5 µs/div.

- ❑ Select a channel to test.
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.
- ❑ Set the RF output level of the RF signal generator to –60 dBm.
- ❑ Switch on the RF output from the RF signal generator.
- ❑ Switch the 0208 speaker to **Load**.

- ❑ While viewing the tone on the oscilloscope, use the volume control on the front panel to increase the audio level to full volume.

  Pass — A waveform that does not clip, and reaches a maximum of 1.0 V p–p.

  NOTE — The receive audio output from the 0208 is half that of the speaker on the 2110, that is, the audio output from the 2110 should reach approximately 2 V p–p at full volume.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Switch the 0208 speaker to **Speaker**.
- ❑ Replace the oscilloscope with an AC voltmeter.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Selectivity test

To test the selectivity of the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test, preferably near the centre of one of the designated bands (see page 60, *Examining the profile in the transceiver*).
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.

  NOTE — The setting varies slightly depending on the selected channel with respect to its positioning along the filter band and the noise from the RF signal generator.

- ❑ Set the RF output level of the RF signal generator to –120 dBm.
- ❑ Switch on the RF output from the RF signal generator.
- ❑ Adjust the volume via the front panel to full volume.
- ❑ Set the 0 dB reference on the AC voltmeter to the level of the tone (approximately –16 dBm).
- ❑ Set the RF signal generator to 1.0 kHz *below* the SCF of the selected USB channel or 1.0 kHz *above* the SCF of the selected LSB channel.
- ❑ Increase the RF output level of the RF signal generator to –55 dBm.

  Pass — A reading on the AC voltmeter that is < 0 dB.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).

- ❑ Set the RF signal generator to 4.0 kHz above the SCF of the selected USB channel or 4.0 kHz below the SCF of the selected LSB channel.

  Pass A reading on the AC voltmeter that is < 0 dB.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Noise Limiter test

To test the noise limiter circuit in the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test.
- ❑ Set the RF signal generator to 1.0 kHz above the SCF of the selected USB channel or 1.0 kHz below the SCF of the selected LSB channel.
- ❑ Set the RF output level of the RF signal generator to –115 dBm.
- ❑ Switch on the RF output from the RF signal generator.
- ❑ Adjust the volume via the front panel so the tone is clearly audible.
- ❑ Switch on the noise on the 0208.

  Pass Faint 1 kHz tone with buzzing is audible from the 0208 speaker.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off the RF output from the RF signal generator.
- ❑ Switch off the noise on the 0208.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Transmit tests

Performing the Basic Transmit test

To test if the transceiver can transmit:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a frequency between 4 and 6 MHz.
- ❑ *Hold down* PTT on the handset, then whistle into the microphone on the handset.

Pass	A reading on the RF power meter that is approximately 10 to 25 W PEP. The current drawn on any channel should be < 5 A.
NOTE	Equivalent readings for power meters that do not have PEP and dB scales are listed in Table 16 on page 71.

- ❑ Release PTT on the handset.
- ❑ Press **Tx PWR** until **Lo** is selected.
- ❑ *Hold down* PTT on the handset, then whistle into the microphone on the handset.

Pass	A reading on the RF power meter that is approximately 5 W PEP. The current drawn on any channel should be < 2 A.

- ❑ Release PTT on the handset.
- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Press **Tx PWR** until **Hi** is selected.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Antenna Tuner test (transmit)

To test the antenna tuner in transmit:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Connect the artificial antenna to the 2110 (see Figure 18 on page 54).
- ❑ Set the Cfg Auto Tune Mode to **ATU**.
- ❑ Select a channel in Band 1 (see page 60, *Examining the profile in the transceiver*).

NOTE — Use the same channel as used in the receive Antenna Tuner test (see page 63, *Performing the Antenna Tuner test (receive)*).

- ❑ Press **TUNE**, then press PTT to start the tuning process.
- ❑ View the SWR on the tuning screen.

Pass — The SWR starts at a high value and should reduce to < 2.

The power to load must be approximately 25 W PEP.

- ❑ Select a channel in the next band, then repeat the test.
- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Disconnect the artificial antenna and reconnect the dummy load to the 50 Ω connector.
- ❑ Return the Cfg Auto Tune Mode to **ATU/50 Ohm/Codan**.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Frequency test

NOTE — Wait for at least five minutes after switching on the transceiver before checking the frequency.

To test the frequency of the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel with a high frequency (ideally 30 MHz).
- ❑ Press **TUNE** on the front panel.
- ❑ *Hold down* PTT on the handset, then read the carrier frequency from the frequency counter.

Pass — A reading on the frequency counter that is within 20 Hz of the channel frequency.

- ❑ Release PTT on the handset.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the ALC test

To test the ALC of the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test.
- ❑ Set the fine output level adjustment on the 0208 to minimum.
- ❑ Switch on PTT on the 0208.
- ❑ Monitor the output power of the RF envelope on the oscilloscope.
- ❑ Slowly increase the audio output level on the 0208 until the RF output power of the transceiver stops increasing.

  This is the ALC threshold.
- ❑ Record the PEP and the output level (see page 109, *Test sheet for the 2110 series Manpack Transceiver*), then increase the audio output level on the 0208 by 10 dB.

Pass	A display on the power meter that shows an increase in RF output power that is < 0.5 dB (approximately 10 W).
NOTE	Equivalent readings for power meters without PEP and dB scales are listed in Table 16 on page 71.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).

To protect the ALC:

- ❑ Reduce the output level on the 0208 until the RF output power of the transceiver is 3 dB below the ALC threshold.
- ❑ Switch off PTT on the 0208.
- ❑ Record the DC supply current from the power supply.
- ❑ Disconnect the coaxial cable from the 50 Ω connector (┐┌).
- ❑ Switch on PTT on the 0208.

Pass	A reading on the power supply that shows a reduction in the DC supply current of approximately 50% from the reading taken with the load connected.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off PTT on the 0208.

- ❑ Reconnect the coaxial cable to the 50 Ω connector (┐┌).
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the RF Output Power test

To test the RF output power of the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select any frequency between 4 and 6 MHz.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.

  Pass — A reading on the RF power meter that is between 20 and 25 W PEP.

  NOTE — Equivalent readings for power meters without PEP and dB scales are listed in Table 16.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ For each band, adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.

  Pass — A reading on the RF power meter that is between 20 and 25 W PEP for each band.

  NOTE — Equivalent readings for power meters without PEP and dB scales are listed in Table 16.

Table 16: 20/25 W output power scale

PEP (W)	PEP (dBm)	Variation from 25 W (dB)	RMS responding meter (W)	Average responding meter (Bird 43) (W)	V p–p
20	43	–1.0	10	8	90
25	44	0.0	13	10	100

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).

  NOTE — The V p–p reading is directly across the 50 Ω load. The 0208 Test Set gives a sampled output.

- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Low Power test

To test the low output power of the transceiver:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Press **Tx PWR** until **Lo** is selected.
- ❑ Select any frequency between 4 and 6 MHz.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.

Pass — A reading on the RF power meter that is between 4 and 5 W PEP.

NOTE — Equivalent readings for power meters without PEP and dB scales are listed in Table 17.

Table 17: 4/5 W output power scale

PEP (W)	PEP (dBm)	Variation from 5 W (dB)	RMS responding meter (W)	Average responding meter (Bird 43) (W)	V p–p
4	36.0	–1.0	2	1.6	40
5	37	0.0	2.5	2	45

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ For each band, adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.

Pass — A reading on the RF power meter that is between 4 and 5 W PEP for each band.

NOTE — Equivalent readings for power meters without PEP and dB scales are listed in Table 17.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).

NOTE — The V p–p reading is directly across the 50 Ω load. The 0208 Test Set gives a sampled output.

- ❑ Switch off PTT on the 0208.
- ❑ Press **Tx PWR** until **Hi** is selected.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Distortion test using an oscilloscope

To test distortion and spurious signals using an oscilloscope:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.
- ❑ Analyse the RF envelope using Figure 20, Figure 21, Figure 22, and Figure 23.

Pass	The RF waveform envelope is acceptable.
NOTE	If the waveform is acceptable, there is no need to perform the Intermodulation test.

Figure 20: Acceptable two-tone RF envelope

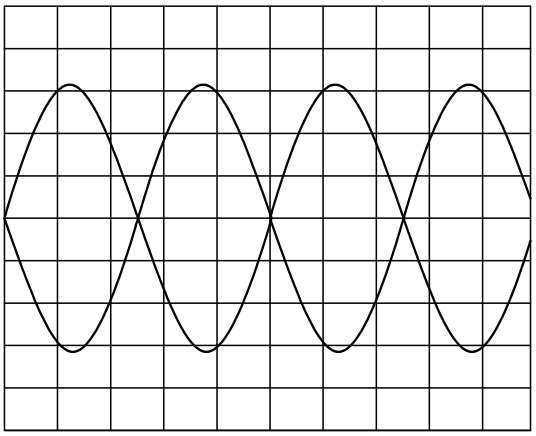


Figure 21: Defective two-tone RF envelope (typical overbias of PA)

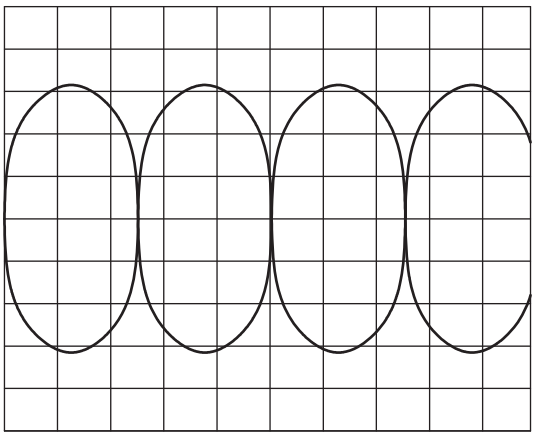


Figure 22: Defective two-tone RF envelope (typical underbias of PA)

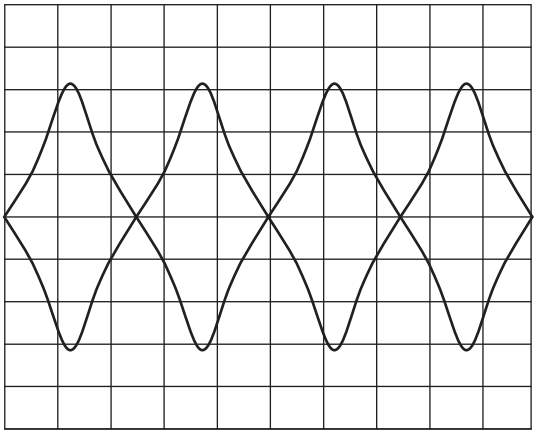
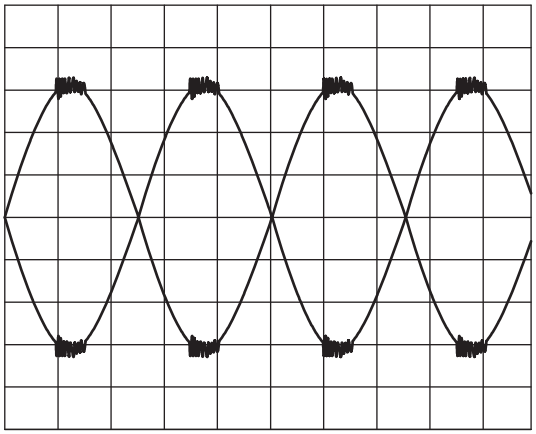


Figure 23: Defective two-tone RF envelope (typical spurious-related problems)



- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Performing the Intermodulation test using a spectrum analyser (optional)

To test the intermodulation products using a spectrum analyser:

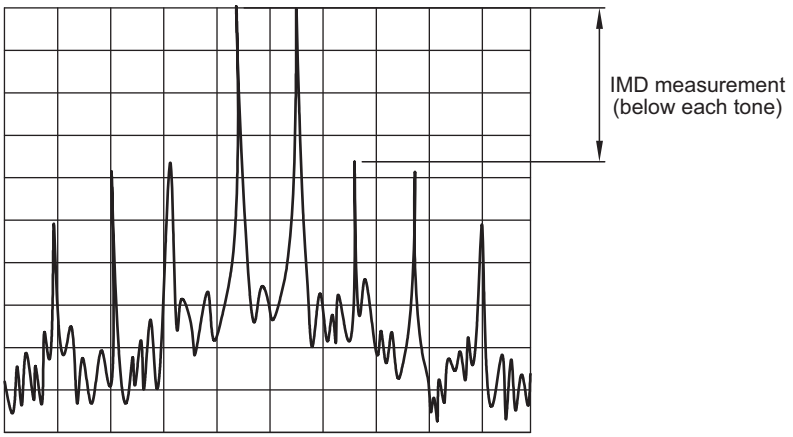
- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Connect the spectrum analyser via a high input impedance probe to the 50 Ω connector (┐┌) with the dummy load still connected.
- ❑ Select any channel in Band 1.
- ❑ Set up the spectrum analyser as follows:

Centre frequency	Carrier frequency
Frequency span	20 kHz
Video bandwidth	300 Hz
Trigger	Continuous sweep
Vertical scale	10 dB per division
Reference level	Adjust once the transceiver is transmitting at full power

- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.
- ❑ Analyse the display on the spectrum analyser using Figure 24.

Pass	Intermodulation products are 26 dB down.

Figure 24: Intermodulation measurements using a spectrum analyser



- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).

- ❑ For each band, adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.
- ❑ Analyse the display on the spectrum analyser using Figure 24.

Pass	Intermodulation products are 26 dB down for each band.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

To check spurious transmissions and harmonics using a spectrum analyser:

- ❑ Set up the equipment (see page 56, *Setting up the test equipment*).
- ❑ Select a channel to test.
- ❑ Set up the spectrum analyser as follows:

Start frequency	600 kHz
Stop frequency	200 MHz
Video bandwidth	3 kHz
Trigger	Continuous sweep
Vertical scale	10 dB per division
Reference level	Adjust once the transceiver is transmitting at full power

- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 10 dB.
- ❑ Observe the output from the spectrum analyser.

Pass	Unwanted emissions typically > 60 dB below peak carrier level.
NOTE	If unwanted emissions are < 50 dB below the peak carrier level, ensure your test set is calibrated before any further analysis of the transceiver is performed.

- ❑ Record your results and actions (see page 109, *Test sheet for the 2110 series Manpack Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95).

Disassembling the transceiver

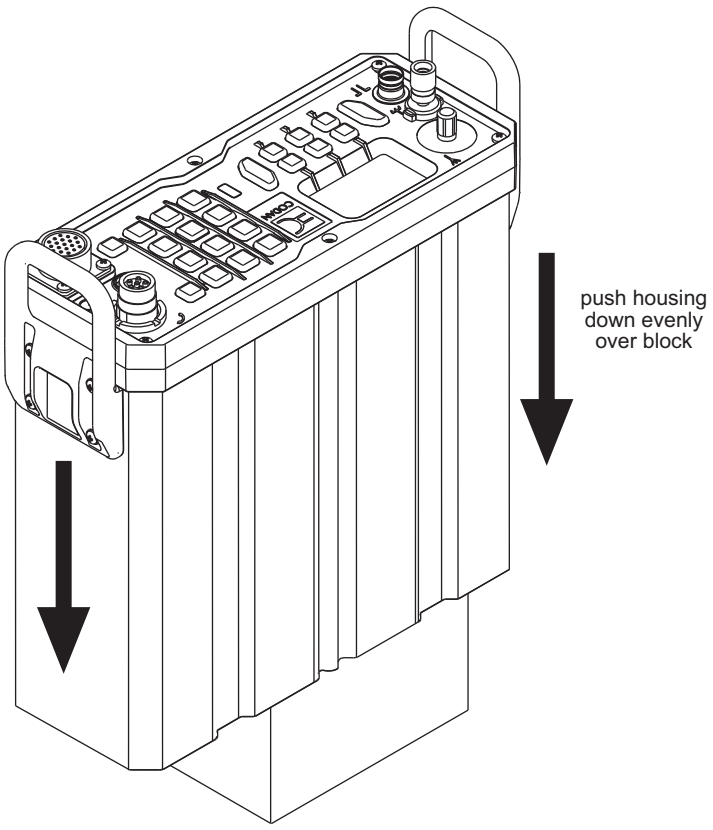
NOTE Disassembling the transceiver is the reverse of the assembly procedure.

NOTE Follow the Disassembly flowchart (see Figure 30 on page 97).

To disassemble the transceiver:

- ❑ Disconnect any cables or antennas attached to the front panel.
- ❑ Remove the battery pack from the base of the transceiver.
- ❑ Stand the transceiver on its front panel.
- ❑ Remove the six screws from the back panel and ease the panel away from the chassis.
- ❑ Disconnect the battery connector.
- ❑ Loosen the labelled screw about 5 mm, then push the screw back into the hole.
- ❑ Stand the transceiver upright.
- ❑ Remove the six screws from the front panel.
- ❑ Locate the open end of the housing over a block of wood that fits within the housing and is approximately 100 mm high, then push the housing down to expose the chassis.

Figure 25: Removing the housing from the chassis



WARNING Do not use the front panel to pull the chassis out of the housing.

- ❑ Ensure that:
  - all plugs and sockets are orientated correctly
  - all cables are positioned correctly and clamped where necessary
  - cables are not pinched by shields, or touching any sharp edges
  - all PCBs and mechanical assemblies are fixed securely

NOTE If any cables, connectors or PCBs appear damaged, replace these items before proceeding.

NOTE Ensure all screens are in place to provide shielding.

- ❑ If you want to access the:
  - Antenna Tuner PCB, remove the ATU screen
  - Audio & Control PCB, remove the CTRL screen
  - RF/IF & Synthesiser PCB, remove the Rx Tx screen
  - PA & Filter PCB, remove the PA screen

NOTE The name of each PCB function is printed on the screen covering the board.

To access the Front Panel PCB and Front Panel Assembly:

- ❑ Undo the screw on the rear of the antenna stud to disconnect the antenna tuner.
- ❑ Remove the four screws at the rear of the Front Panel PCB that hold the chassis to the front panel.
- ❑ Remove the screw and four spacers from the Front Panel PCB, then carefully separate the connectors holding the PCBs together.
- ❑ If the GPS option is fitted to the Front Panel PCB, disconnect the thin coaxial cable that passes through to the Front Panel Assembly.
- ❑ If the external GPS antenna connector is fitted, disconnect the thick coaxial cable that passes through to the Front Panel Assembly.

CAUTION Do not remove the PCB that covers the keymat from the Front Panel Assembly. This can only be re-sealed in the factory.

Adjustments

Adjusting frequency

RF/IF & Synthesiser PCB (08-06039-001) (see Figure 11 on page 30)

All the channels are synthesised and locked to the 14.848333 MHz reference crystal oscillator Z1.

NOTE Wait for at least five minutes after switching on the transceiver before adjusting the frequency.

To adjust the frequency:

- ❑ Select a channel with a high frequency (ideally 30 MHz).
- ❑ Press **TUNE** on the front panel.
- ❑ *Hold down* PTT on the handset.
- ❑ Read the carrier frequency from the frequency counter.
- ❑ Adjust the reference frequency using trimpot R2 on the REF OSC PCB (located on the RF/IF & Synthesiser PCB) for an exciter output frequency within 3 Hz of the SCF.
- ❑ Release PTT on the handset.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95), if required.

Adjusting the PA

NOTE You may need to program specific channel frequencies into the transceiver to perform these adjustments.

NOTE These adjustments assume that the transceiver does not have any hardware options. See page 115, *Options* to identify any hardware options. You should read the information provided with the options and make adjustments accordingly.

Adjusting the driver bias

PA & Filter PCB (08-06064-001) (see Figure 12 on page 30) and
RF/IF & Synthesiser PCB (08-06039-001) (see Figure 11 on page 30)

To adjust the driver bias:

- ❑ Switch off the transceiver.
- ❑ Disconnect the exciter output from the PA by removing the RF drive between connector J2 (Tx coaxial) on the PA & Filter PCB and connector J101 on the RF/IF & Synthesiser PCB (see Figure 11 on page 30).
- ❑ Set a multimeter to the DC low voltage range and connect it between the +12VSW and DR test points on the PA & Filter PCB.

  WARNING Do not short the multimeter leads to the chassis.

- ❑ Switch on the transceiver.
- ❑ Select any transmit channel and *hold down* PTT for at least 30 seconds.
- ❑ Check that the voltage measures 160 mV ±10 mV.

  If the current is out of the specified limit stated above, change it by adjusting DR BIAS (R101) (see Figure 12 on page 30).
- ❑ Release PTT on the handset.
- ❑ Switch off the transceiver, disconnect the multimeter, then reconnect the RF drive between connector J2 on the PA & Filter PCB and connector J101 on the RF/IF & Synthesiser PCB.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95), if required.

Adjusting the PA bias

PA & Filter PCB (08-06064-001) (see Figure 12 on page 30) and
RF/IF & Synthesiser PCB (08-06039-001) (see Figure 11 on page 30)

To adjust the bias of the PA output transistors:

- ❑ Switch off the transceiver.
- ❑ Disconnect the exciter output from the PA by removing the RF drive between connector J2 (Tx coaxial) on the PA & Filter PCB and connector J101 on the RF/IF & Synthesiser PCB (see Figure 11 on page 30).
- ❑ De-solder the fuse F1–F2 next to the output transistors on the PA & Filter PCB (this removes the DC supply to the output transistors V36 and V37) (see Figure 12 on page 30).
- ❑ Set a multimeter to DC 1 A range and connect it in place of the removed fuse (positive nearest to transistors).
- ❑ Switch on the transceiver.

- ❑ Select any transmit channel and *hold down* PTT for at least 30 seconds.
- ❑ Check that the output current measures 200 mA ±20 mA.

  If the current is out of the specified limit stated above, change it by adjusting the pre-set potentiometer O/P BIAS (R105) (see Figure 12 on page 30).
- ❑ Release PTT on the handset.
- ❑ Switch off the transceiver, disconnect the multimeter, then resolder the fuse F1–F2.

  If the fuse is broken, replace it with one strand (0.2 mm TCW) taken from a piece of 7 × 0.2 mm cable. Extend the centre of the wire down from the two stakes to form a V, ensuring it does not touch the PCB. Solder the wire to the two stakes, making sure the solder does not run down the strand of wire (see Figure 12 on page 30).
- ❑ Reconnect the RF drive between connector J2 on the PA & Filter PCB and connector J101 on the RF/IF & Synthesiser PCB.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95), if required.

Adjusting high output power

PA & Filter PCB (08-06064-001) (see Figure 12 on page 30)

NOTE The output power is factory-set, so it is not likely to be outside the specified limits. Check that there are no faults with the transmitter circuits before attempting to adjust the output power.

To adjust the high output power:

- ❑ Select any frequency between 4 and 6 MHz.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 3 dB.
- ❑ Adjust HI PWR (R56) for 25 W PEP (see Figure 12 on page 30).

  NOTE Equivalent readings for power meters without PEP and dB scales are listed in Table 16 on page 71.
- ❑ Check that the two-tone waveform is clean and undistorted.

  If it is not clean and undistorted, further analysis is required.
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95), if required.

Adjusting low output power

PA & Filter PCB (08-06064-001) (see Figure 12 on page 30)

NOTE Before adjusting the low output power, set the high output power (see page 81, *Adjusting high output power*).

To adjust the low output power:

- ❑ Select any frequency between 4 and 6 MHz.
- ❑ Press **Tx PWR** until **Lo** is selected.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the transceiver stops increasing, then increase the output level of the 0208 by 3 dB.
- ❑ Adjust LO PWR (R124) for 5 W PEP (see Figure 12 on page 30).
- ❑ Check that the two-tone waveform is clean and undistorted.

  If it is not clean and undistorted, further analysis is required.
- ❑ Switch off PTT on the 0208.
- ❑ Press **Tx PWR** until **Hi** is selected.
- ❑ Return to the Repair flowchart (see Figure 29 on page 95), if required.

Re-assembling the transceiver

When re-assembling the transceiver you must:

- check that gaskets are not damaged and that they retain waterproof integrity
- use original screws or genuine replacements
- tighten all M3 screws to 0.7 Nm with a torque screwdriver

To re-assemble the Front Panel PCB onto the Front Panel Assembly and onto the chassis:

- ❑ Reconnect the speaker to connector P2 on the Front Panel PCB.
- ❑ If the GPS option is fitted, align the coaxial cable in the recess in the Front Panel PCB, then connect the cable to P1 on the GPS Receiver PCB.
- ❑ If the external GPS antenna connector is fitted, align the thick coaxial cable in the recess in the Front Panel PCB, then connect the cable to J1 on the GPS Receiver PCB.
- ❑ Carefully align the connector pins on the PCB in the Front Panel Assembly with the sockets on the Front Panel PCB, then gently push the PCBs together.
- ❑ Re-insert the screw and four spacers on the Front Panel PCB.
- ❑ Place the Front Panel PCB against the chassis, then re-insert the four screws that hold the chassis to the PCB.
- ❑ Tighten the screw on the rear of the antenna stud to reconnect the antenna tuner.

To re-assemble the transceiver:

- ❑ Place any screen covers that have been removed from the PCBs back into their correct positions.
- ❑ Stand the housing on its bottom end, then slide the transceiver chassis into the housing.

  WARNING Ensure that the transceiver slides in parallel to the housing.

  CAUTION Apply firm pressure to the front panel to ensure that the o-ring is in contact with the housing.

- ❑ Re-insert the six screws into the front panel.
- ❑ Stand the transceiver on its front panel.
- ❑ Tighten the screw that required loosening (labelled).
- ❑ Check the integrity of the sealing gasket, and replace with a new gasket if necessary.
- ❑ Reconnect the battery connector.
- ❑ Push the back panel onto the chassis, then re-insert the six screws.

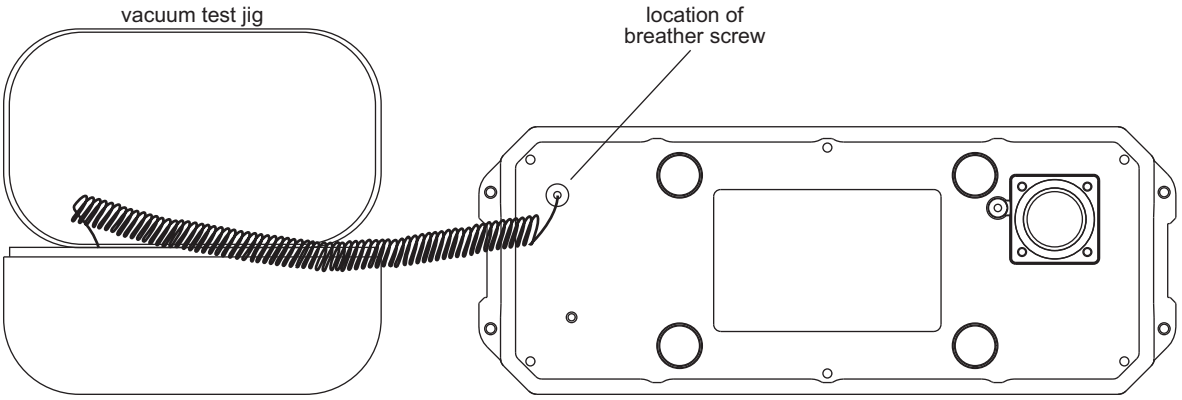
To test the sealing in the transceiver:

WARNING Do not perform this test in a humid environment as ambient air is sucked into the transceiver following the test.

WARNING The pressure must remain within the range –700 to +500 millibars.

- ❑ Remove the breather screw from the back panel (see Figure 26).
- ❑ Connect the vacuum adaptor to the back panel of the transceiver, then tighten with your fingers.

Figure 26: Setup for vacuum test



- ❑ Plug the hose from the vacuum test jig into the vacuum adaptor on the back panel.
- ❑ Move the vacuum control valve to the open position.
- ❑ Switch on the vacuum pump, then wait until the gauge reads approximately –500 millibars.
- ❑ Move the vacuum control valve to the closed position.
- ❑ Switch off the vacuum pump immediately.

  The vacuum reading on the gauge should stabilise at approximately –250 millibars.

  If the reading is between approximately –250 and –300 millibars, proceed with the test.

  If the reading is between approximately –250 and 0 millibars, repeat the setup steps above, but allow the vacuum pump to create a vacuum of up to approximately –700 millibars.
- ❑ Record the reading on the gauge.
- ❑ Wait 5 minutes, then record the reading on the gauge.

  Pass Final reading is within 3 millibars of the original reading.

- ❑ Unplug the hose from the vacuum adaptor on the back panel.
- ❑ Unscrew the vacuum adaptor.

- ❑ Wait a minute for the transceiver to return to atmospheric pressure.
- ❑ Screw the breather screw back into place, then tighten to 0.7 Nm using a torque screwdriver.
- ❑ Connect the battery pack to the base of the transceiver.

Checking the battery charging process

You may use any of the following chargers to charge the battery:

- a 3121 AC Battery Charger (1 A), which uses a universal AC mains input of 90 to 264 V AC
- a 3122 DC Battery Charger (1 A), which may be powered from any 12 to 60 V DC source (for example, from a 12 V DC outlet in a vehicle, or from a 24 V vehicle battery)
- a 3123 Fast AC Battery Charger (3 A), which uses a universal AC mains input of 90 to 264 V AC
- a solar battery charger and lead (1 A nominal in full sunlight)
- a hand-powered battery charger (1 A at 60 rpm)

The Codan 3121 AC Battery Charger and 3122 DC Battery Charger are specially designed for low-noise operation, so receiver performance remains optimal while charging the battery pack via the front panel.

NOTE The 3123 Fast AC Battery Charger connects directly to the battery pack for charging. You cannot use this charger through the 19-way or 5-way connector on the front panel of the transceiver.

CAUTION Charging is recommended between 0 and 40°C (104°F). The battery will not commence charging if the temperature is at or above 40°C (104°F). If charging is already in progress, and the temperature rises to 50°C (122°F), charging is stopped automatically.

CAUTION To prevent damage to the battery, Codan recommends the use of the Codan battery chargers to charge the battery pack.

Table 18: Typical charging times for Codan battery packs

Charger type	Rating (A)	Charging time (h)		
		7 Ah and 8 Ah	13 Ah	17 Ah
3121	1	10	16	
3122	1			20
Solar battery charger	1 (nominal in full sun)			
Hand-powered battery charger	1 (@ 60 rpm)			
3123	3	3	5	7

Figure 27: Typical front panel of a battery charger

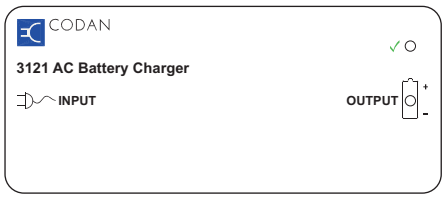


Table 19: LED indications

Charger type	LED	Status	Meaning
3121 3122	✓	Green, solid	The charger has an appropriate power supply connected.
		Off	The charger does not have an appropriate power supply connected.
	OUTPUT	Orange, solid	The charger is charging the battery pack.
		Off	The charger has finished charging the battery pack.
3123	✓	Green, solid	The charger has an appropriate power supply connected.
		Off	The charger does not have an appropriate power supply connected, or is not functioning correctly.
	OUTPUT	Yellow, solid	The charger is charging the battery pack.
		Yellow, slow flash	The charger has finished charging the battery pack.
		Yellow/red, alternating flash	The battery pack has an overtemperature condition.
		Red, double flash then long pause	The battery pack has a faulty fuse.
		Red, rapid flash	The battery pack is unserviceable and cannot be charged.

Charging a battery

WARNING The battery pack should be charged with the connector facing upward and the vents clear of obstructions so that any gas created during the charging process is released.

CAUTION Provide clear notification that charging is underway. Ensure there is adequate ventilation around the battery during charging.

NOTE If the voltage of the battery is below 10 V, the **OUTPUT** LED on the charger flashes orange for a period of time before charging commences. The ✓ LED may also flash during this period.

To charge a battery:

- ❑ Do one of the following:
  - For 2110 Manpack Transceivers with the battery attached to the transceiver, use cable 08-06215-001 to connect the output of the 3121, 3122, solar or hand-powered battery charger to the 19-way connector on the front panel of the transceiver.
  - For 2110v Manpack Transceivers with the battery attached to the transceiver, use cable 08-06738-001 to connect the output of the 3121, 3122, solar or hand-powered battery charger to the 5-way connector on the front panel of the transceiver.

    NOTE The 3123 Fast AC Battery Charger cannot be used to charge a battery pack via the front panel of the transceiver.

  - If the battery is detached from the transceiver, use cable 08-06214-001 to connect the output of any of the Codan battery chargers to the 6-way connector on the top of the battery pack.
- ❑ Connect the charger to an appropriate power source.

  NOTE If you are using a solar battery charger, ensure that the panel is oriented at right angles to the rays of the sun.

  NOTE If you are using a hand-powered battery charger, strap it to a tree, or attach it to the stand provided.

  If the transceiver is operational during charging, the battery status indicator on the front panel screen shows that the battery pack is charging. When charging is complete, the battery status indicator is full.

  NOTE It takes approximately 16 seconds following appropriate connections for the 3121, 3122, solar and hand-powered battery chargers to commence charging the battery pack.

Requirements for alternative chargers

The Codan battery packs may be charged using alternative supplies, for example, third-party solar panels or hand-powered battery chargers. In this situation, the voltage level must not exceed 15.5 V and the current must be within 1 to 3 A. These chargers must be connected between pin B (charge in) and pin A (ground) of the connector on the battery pack.

Notes on charging batteries

A battery requires 3 to 5 discharge/recharge cycles when new before it reaches its full capacity. In order to increase the battery service life, it is recommended that the battery *is not* fully discharged during each cycle. Full discharge should only be carried out periodically as follows:

Type	Full discharge
NiMH	Two full discharge/recharge cycles every 20 charge cycles
SLA	One full discharge/recharge cycle every 20 charge cycles
$LiFePO_4$	No full discharge required

For the periodic full-discharge cycle, run the battery down to zero capacity using the transceiver. The transceiver switches off automatically when the battery is fully discharged.

WARNING If you are using alternative means to discharge the battery, the battery voltage must not go below 10 V.

WARNING An SLA battery must be charged immediately after discharge to prevent damage to the battery.

The Codan battery packs have in-built monitoring, which is reported in the Battery entry in the Control List. You should view the Battery Cycle setting for the number of times the battery has received input current (that is, has been charged).

NOTE You must log in as administrator to see the Control List.

Replacing battery cells

WARNING

Battery cells are electrically live at all times and must be treated with extreme caution. They may supply high short-circuit currents even if they appear to be damaged or inoperable.

Batteries are considered non-serviceable, and if faulty within the warranty period should be returned via the normal channels to Codan. The instructions below are general.

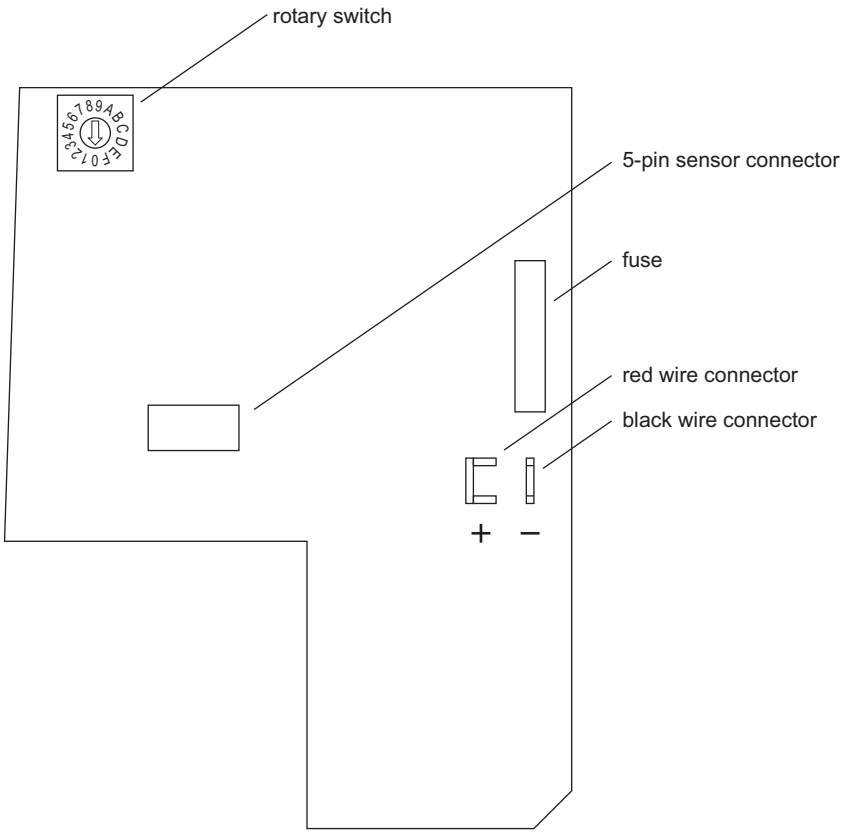
To replace the battery cells:

- ❑ Stand the battery pack on its base.
- ❑ Remove the 10 screws from the lid of the battery pack.
- ❑ Lift the lid away from the base carefully, taking care with the attached PCB.

WARNING

The PCB must be disconnected from the batteries before replacing the cells. You must disconnect the PCB in the specific order stated below.

Figure 28: Connections between the battery cells and the Battery Monitor PCB



- ❑ Disconnect the black wire by easing its connector away from the PCB.
- ❑ Disconnect the red wire by easing its connector away from the PCB.

- ❑ Disconnect the sensor by easing the large 5-pin connector away from the PCB.
- ❑ Replace the battery cells with equivalent rechargeable battery cells.

  WARNING The overall amp-hour rating of the battery cells must remain the same as the original.

- ❑ Combine the battery cells together in the same orientation and with the same connections as the original battery cells.
- ❑ Remove the resistor and cable assembly from the original battery cells and connect this into the new arrangement of battery cells in the same position and orientation.
- ❑ Place the battery cells into the foam lining inside the battery pack.
- ❑ Reconnect the 5-pin sensor connector.
- ❑ Reconnect the red wire to the + terminal.
- ❑ Reconnect the black wire to the – terminal.
- ❑ Rotate the head of the arrow on the rotary switch to position **F** to reset the battery data.
- ❑ Rotate the head of the arrow on the rotary switch to one of the following positions:

Battery type	**Switch position**
8 Ah NiMH equivalent	1
13 Ah NiMH equivalent	4
7 Ah SLA equivalent	B
17 Ah $LiFePO_4$ equivalent	F

- ❑ Check that the gasket is clean, and sitting correctly within its groove.
- ❑ Gently position the lid onto the battery pack, taking care with the PCB, wiring and the foam lining.
- ❑ Secure the lid in place with the 10 screws.

Replacing the fuse in the battery pack

To replace the fuse:

- ❑ Stand the battery pack on its base.
- ❑ Remove the 10 screws from the lid of the battery pack.
- ❑ Lift the lid away from the base carefully, taking care with the attached PCB.
- ❑ Remove the fuse from the PCB (see Figure 28 on page 90 for the location of the fuse).

- ❑ Replace the fuse with one of the following equivalent fuses:

Name	**Part number**
Bussman	GDB-10A
Littelfuse	216010
Conquer	UBM-10A

- ❑ Check that the gasket is clean, and sitting correctly within its groove.
- ❑ Gently position the lid onto the battery pack, taking care with the PCB, wiring and the foam lining.
- ❑ Secure the lid in place with the 10 screws.

Flowcharts

All fault diagnosis should begin with the Repair flowchart (see Figure 29 on page 95).

You should not disassemble the 2110 until the preliminary checks in the Repair flowchart are completed. If the Repair flowchart refers you to any of the other flowcharts, you should disassemble the transceiver only when this is indicated in the process.

WARNING When taking measurements, keep the earth lead to the probe as short as possible.

Flowchart	See...
Repair flowchart	Figure 29 on page 95
Disassembly flowchart	Figure 30 on page 97
Power On fault diagnosis flowchart	Figure 31 on page 99
Receive fault diagnosis flowchart 1	Figure 32 on page 101
Receive fault diagnosis flowchart 2	Figure 33 on page 103
Transmit fault diagnosis flowchart 1	Figure 34 on page 105
Transmit fault diagnosis flowchart 2	Figure 35 on page 107

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Figure 29: Repair flowchart

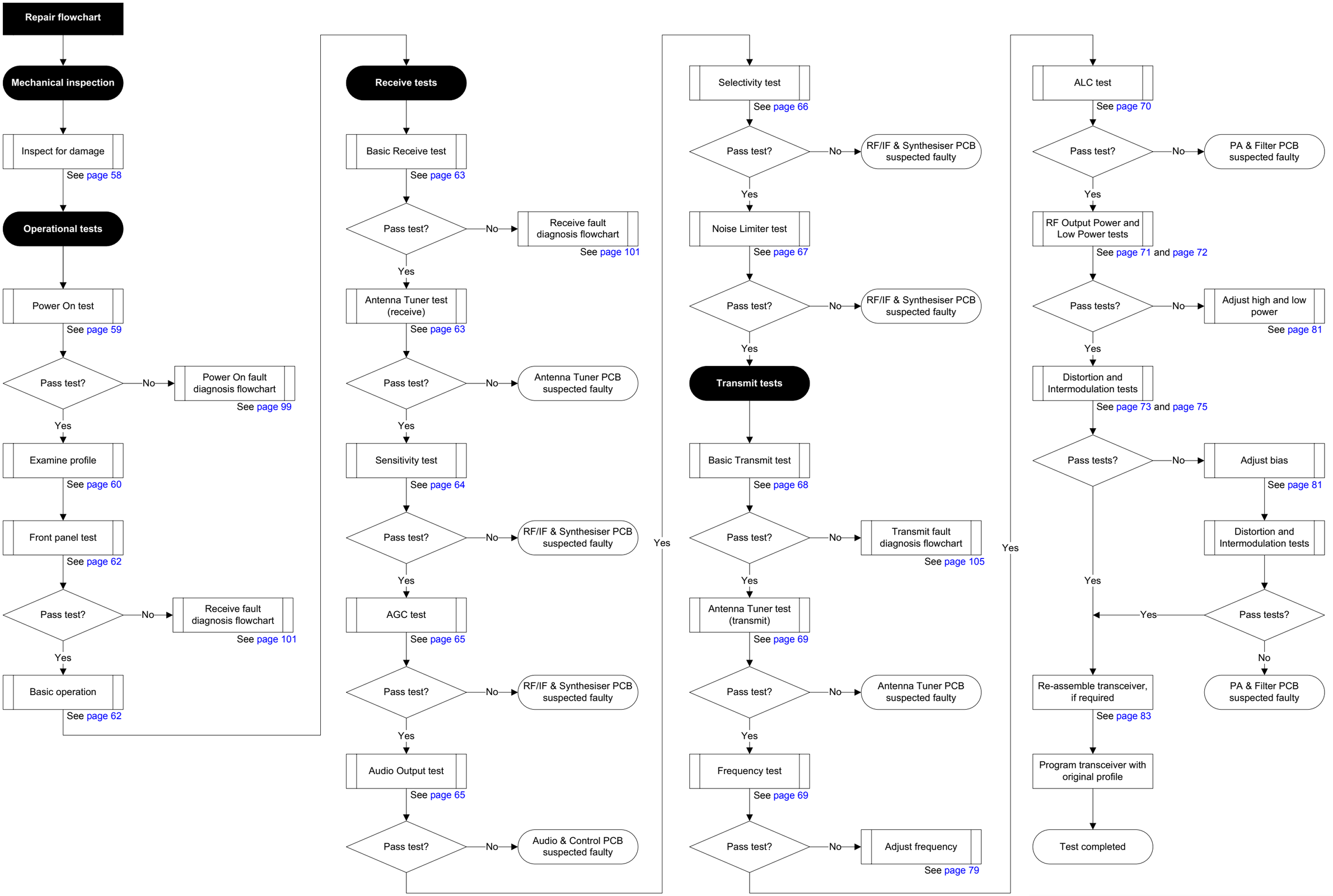

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Figure 30: Disassembly flowchart

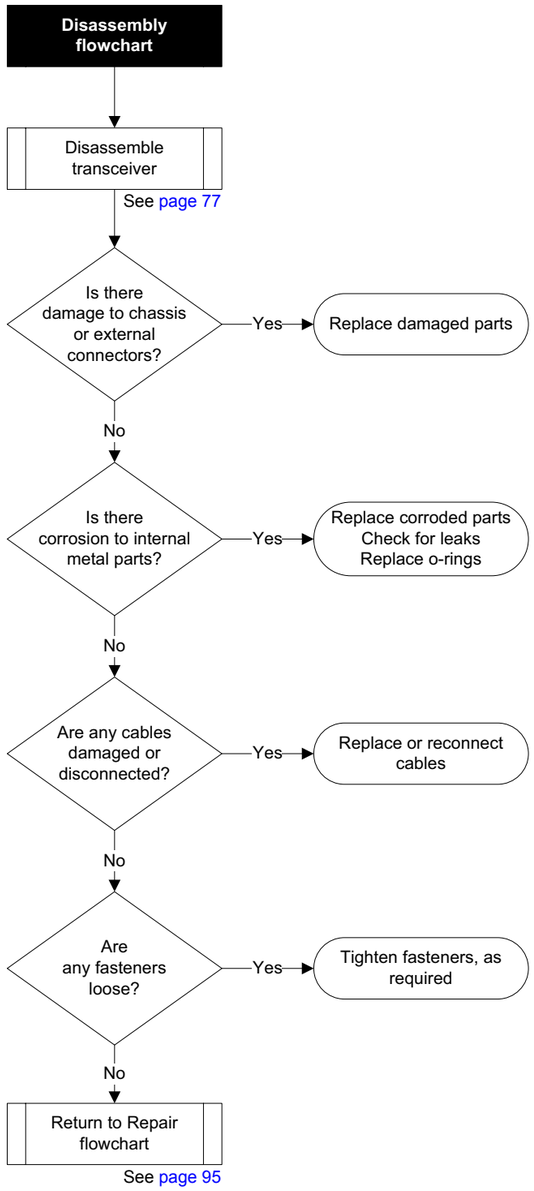

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Figure 31: Power On fault diagnosis flowchart

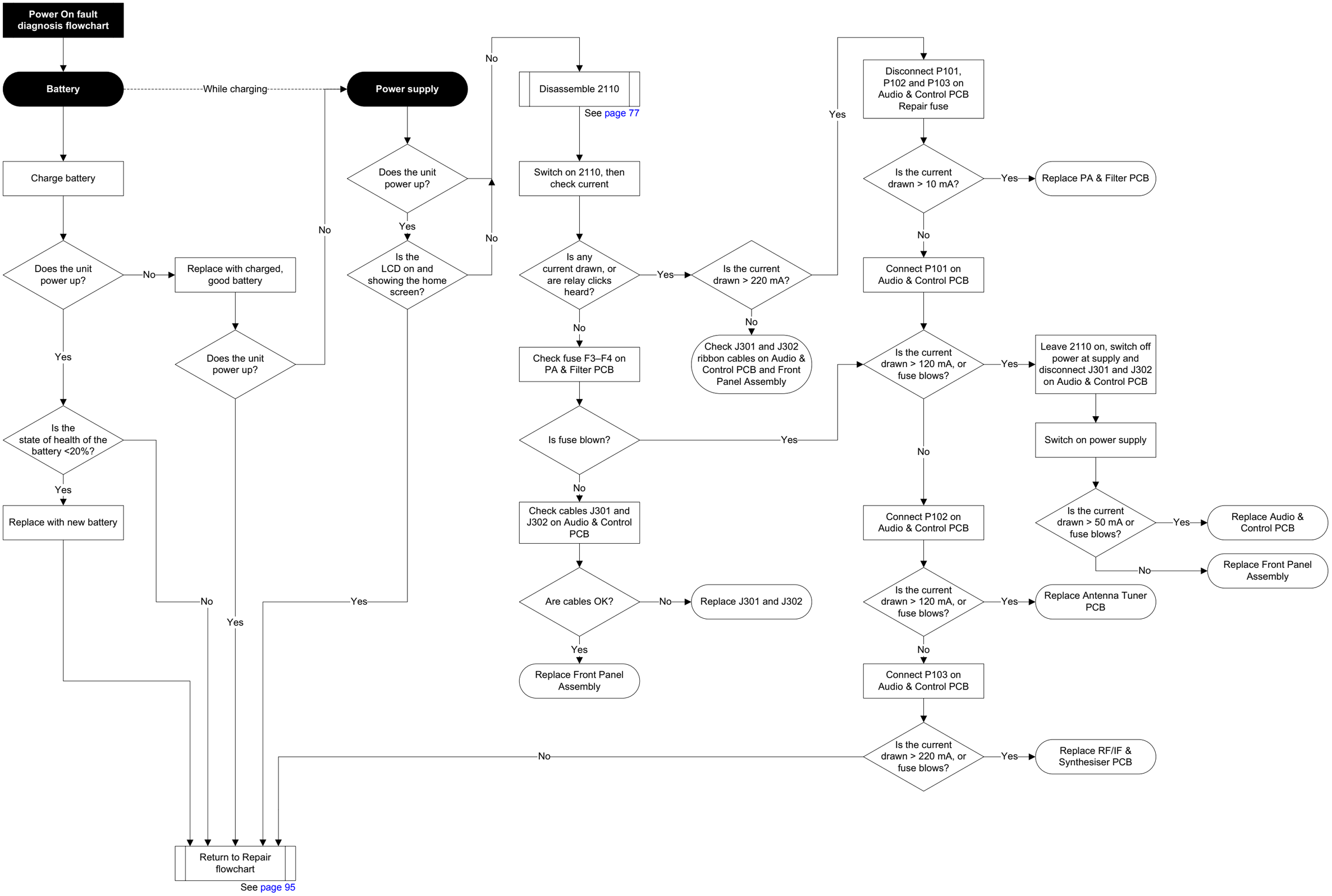

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Figure 32: Receive fault diagnosis flowchart 1

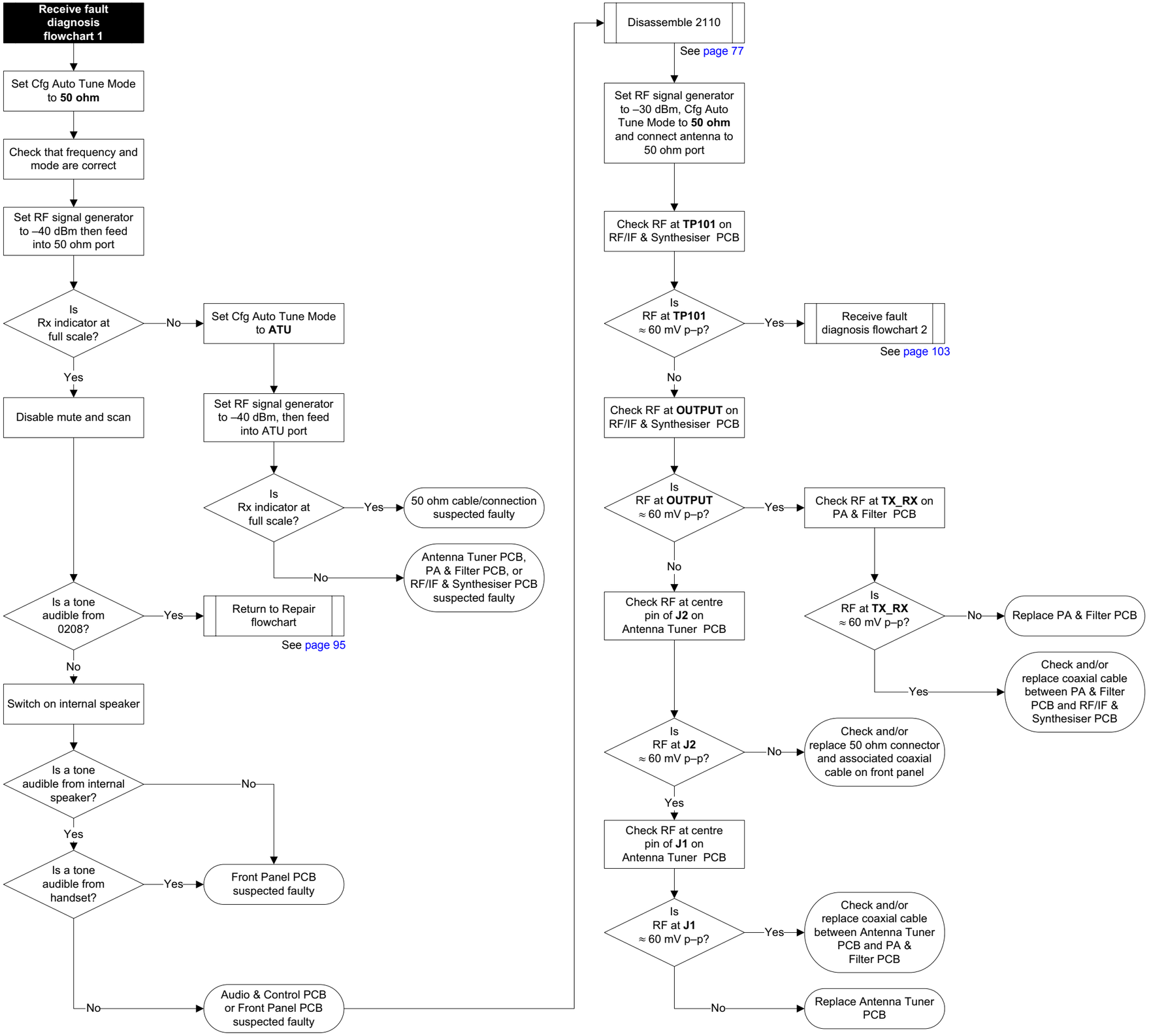

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Figure 33: Receive fault diagnosis flowchart 2

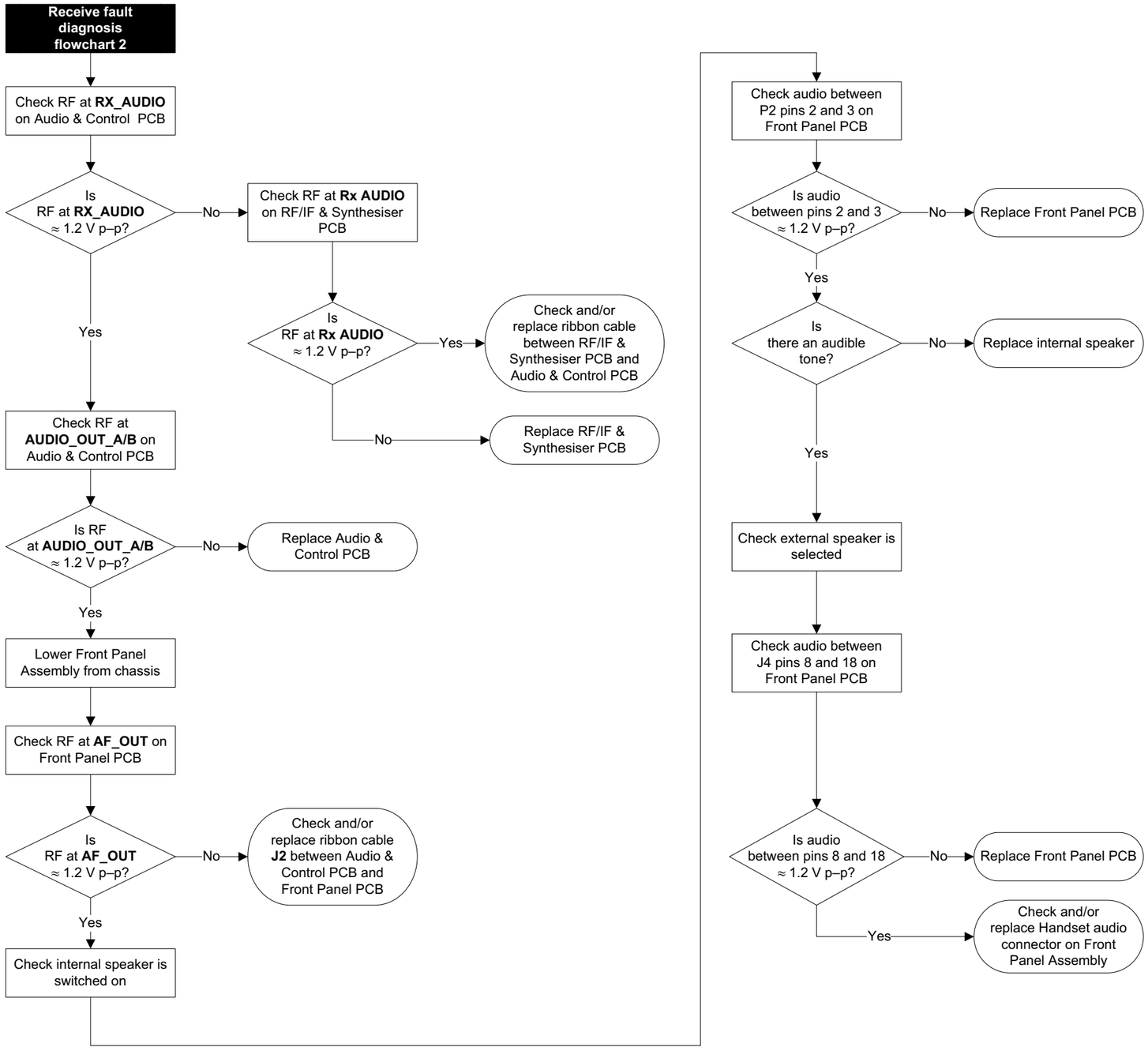

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Figure 34: Transmit fault diagnosis flowchart 1

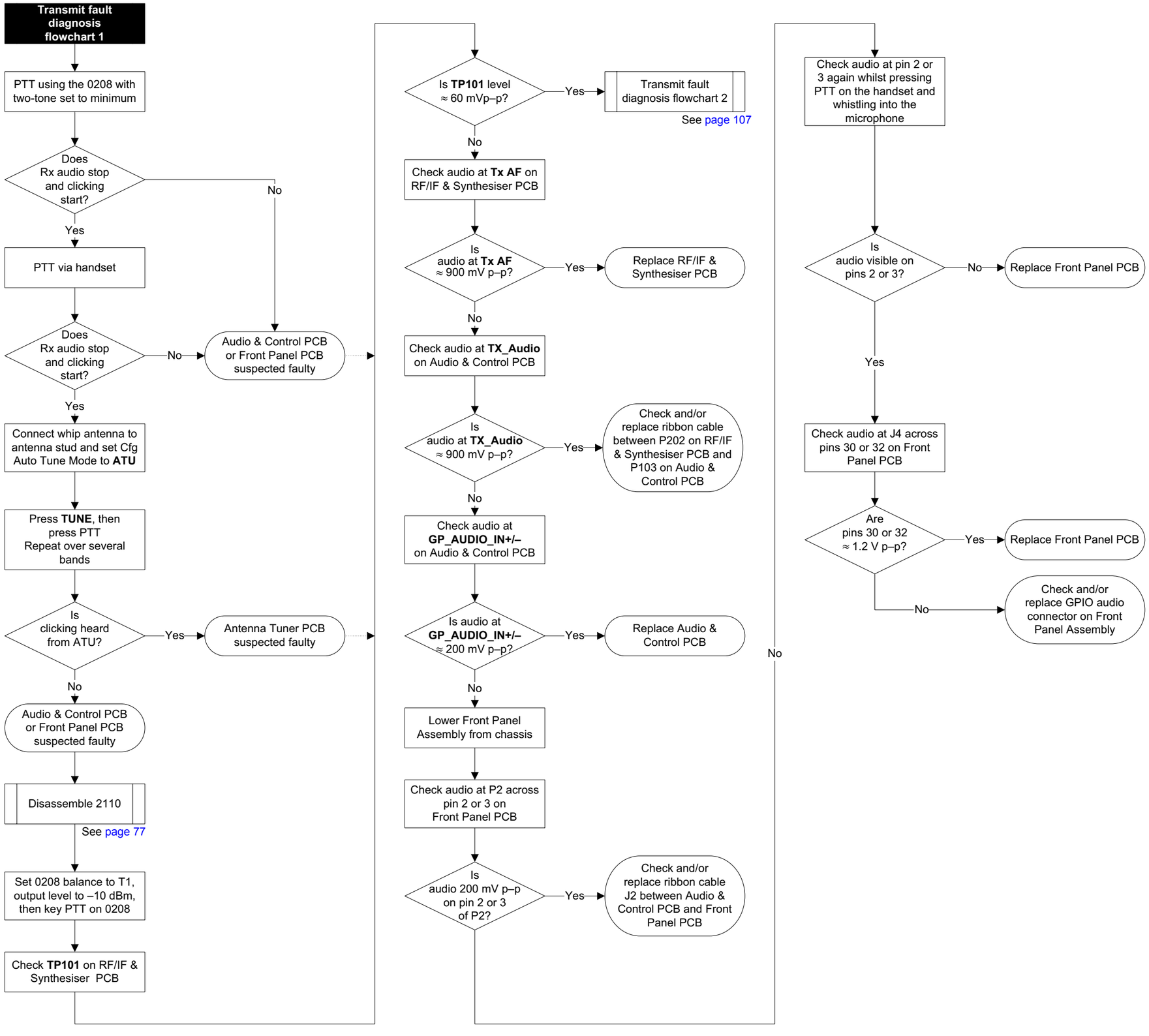

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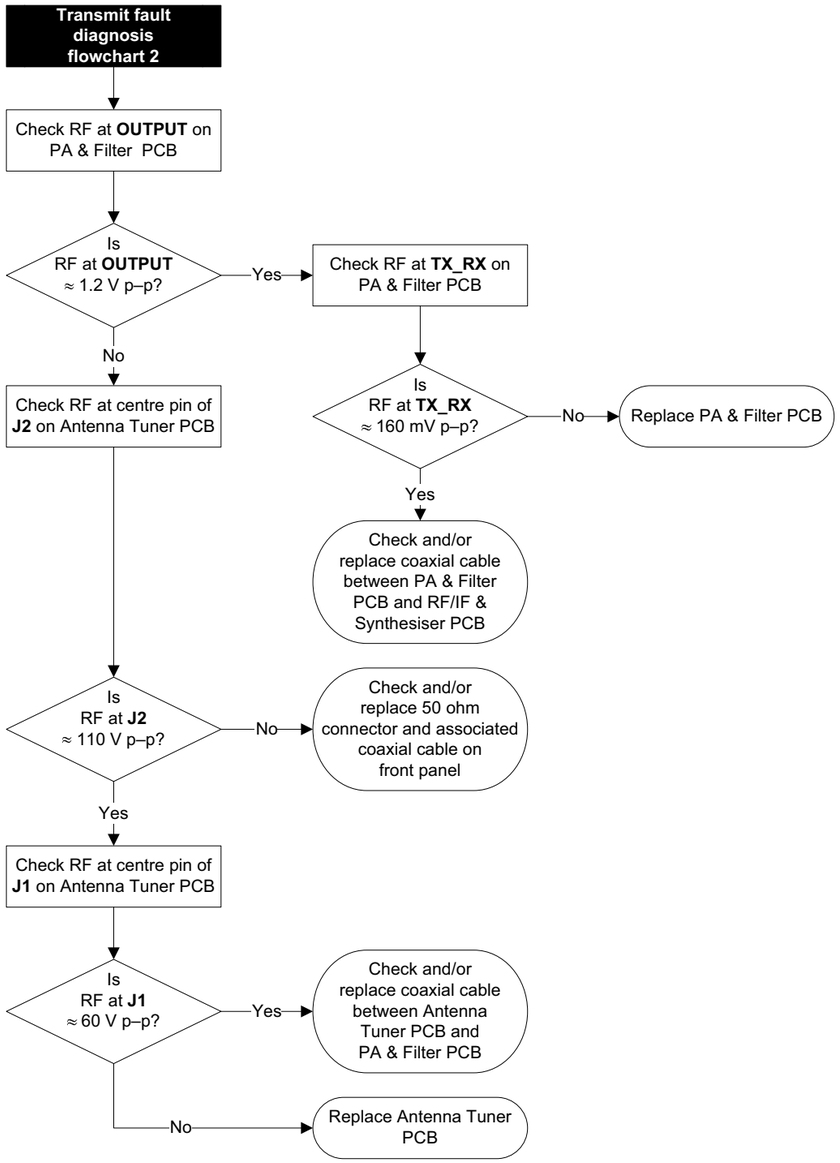
Figure 35: Transmit fault diagnosis flowchart 2



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Test sheet for the 2110 series Manpack Transceiver

Job details

Job number:	Date:
Technician:	
Reported fault:	
Test sheet is used for diagnostic / functional test (circle as required)	

Transceiver details

Unit	Serial number	Firmware version
2110 Transceiver Unit		
Battery pack		
Handset		
Options fitted:		

Mechanical inspection

Inspect for...	Yes/No	Action
Physical damage		
Water ingress		
Corrosion		
Connector pins straight		

Operational tests

Test	Criteria	Reading	Pass/Fail	Action
Power On (Battery)	Front panel displays Logo screen			
Power On (Power supply)	Current drawn < 220 mA with backlight off			
Existing profile saved as:				
Test profile saved as:				

Operational tests

Test	Criteria	Reading	Pass/Fail	Action
Front panel screen	All pixels flash			
	Each key is displayed on screen when pressed			
	Backlight on/off			
	Internal speaker			
Basic operation	Scan on/off			
	Calling process			

Receive tests

Test	Criteria	Reading	Pass/Fail	Action
Basic Receive	Audible 1 kHz tone from 0208, –6 dB at full volume			
Antenna Tuner	AC voltmeter reading approx. –20 dBm			
Sensitivity	RF amp on, RF output level –120 dBm, AC voltmeter reading > 10 dB			
	RF amp off, RF output level –114 dBm, AC voltmeter reading > 10 dB			
AGC	RF output level from signal generator < –106 dBm			
Audio Output	RF output level –60 dBm with audible tone from 0208			
	Waveform that does not clip and reaches 1.0 V p–p			
Selectivity	±1 kHz from SCF, RF output level from signal generator –55 dBm, AC voltmeter reading < 0 dB			
	±4 kHz from SCF, RF output level from signal generator –55 dBm, AC voltmeter reading < 0 dB			
Noise Limiter	Faint 1 kHz tone with buzzing is audible from 0208			

Transmit tests

Test	Criteria	Reading	Pass/Fail	Action
Basic Transmit	Tx PWR Hi: RF power meter reading approx. 10 to 25 W PEP, current drawn < 5 A Tx PWR Lo: RF power meter reading approx. 5 W PEP, current drawn < 2 A			
Antenna Tuner	SWR reduces to < 2, power to load > 25 W PEP	Band 1		
		Band 2		
		Band 3		
		Band 4		
		Band 5		
		Band 6		
		Band 7		
Frequency	Frequency counter reading within 20 Hz of channel frequency (MHz)			
ALC	PEP @ ALC threshold			
	Output level @ ALC threshold			
	Increase in RF output level < 0.5 dB			
	DC supply current @ 3 dB below ALC threshold (with load)			
	DC supply current reduced by 50% @ 3 dB below ALC threshold (without load)			

Transmit tests (cont.)

Test	Criteria	Reading	Pass/Fail	Action
RF Output Power	RF power meter reading between 20 and 25 W PEP for each band	4 to 6 MHz		
		Band 1		
		Band 2		
		Band 3		
		Band 4		
		Band 5		
		Band 6		
		Band 7		
Low Power	RF power meter reading between 4 to 5 W PEP for each band	4 to 6 MHz		
		Band 1		
		Band 2		
		Band 3		
		Band 4		
		Band 5		
		Band 6		
		Band 7		
Distortion	Oscilloscope: RF waveform envelope is acceptable		If Fail, what type?	

Transmit tests (cont.)

Test	Criteria	Reading	Pass/Fail	Action
Intermodulation	Spectrum analyser: IMD products 26 dB down on each band	Band 1		
		Band 2		
		Band 3		
		Band 4		
		Band 5		
		Band 6		
		Band 7		
	Spectrum analyser: spurious transmissions and harmonics typically > 60 dB below peak carrier level			

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NOTE Fitted options are indicated on the label on the back panel of the transceiver.

The figures in this section are required for identifying a fitted option. If an option is also supported in the firmware, ensure that the option is not active at the time of testing, for example, the voice encryptor is not active.

For information on option...	See...
GPS Receiver	Figure 36
Connector for External GPS Antenna	Figure 37
Voice Encryptor	Figure 38
Filters	Figure 39

Figure 36: GPS receiver

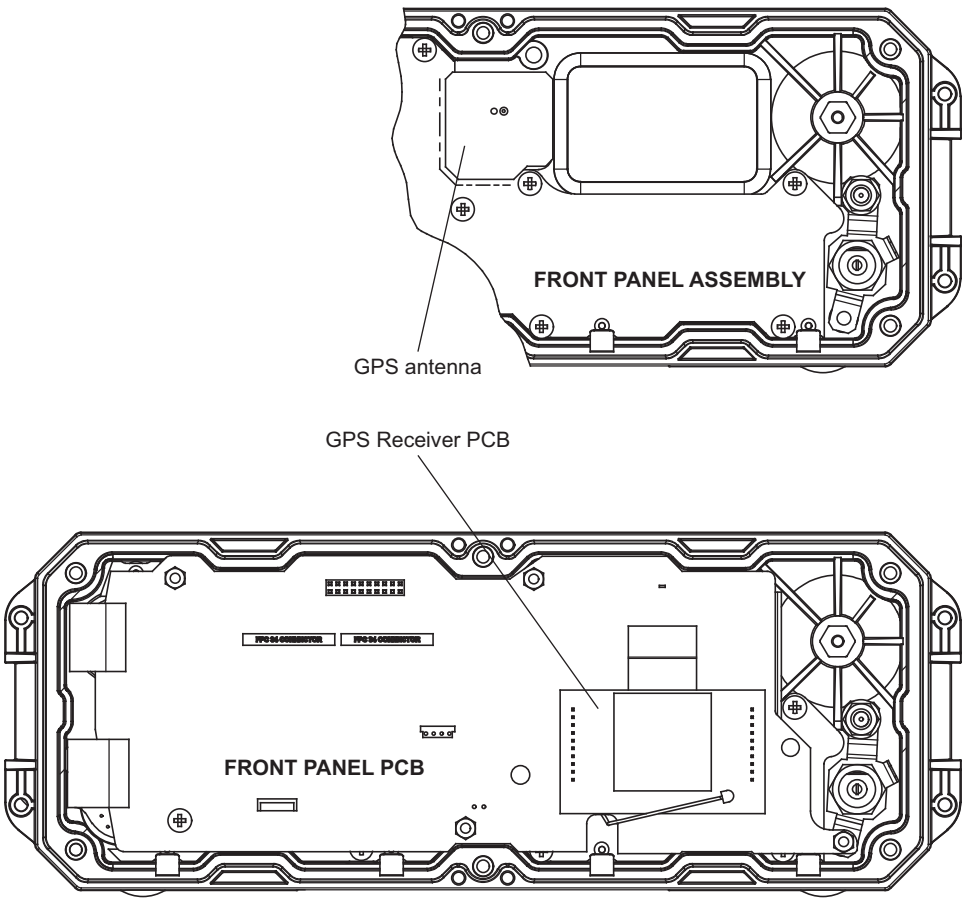
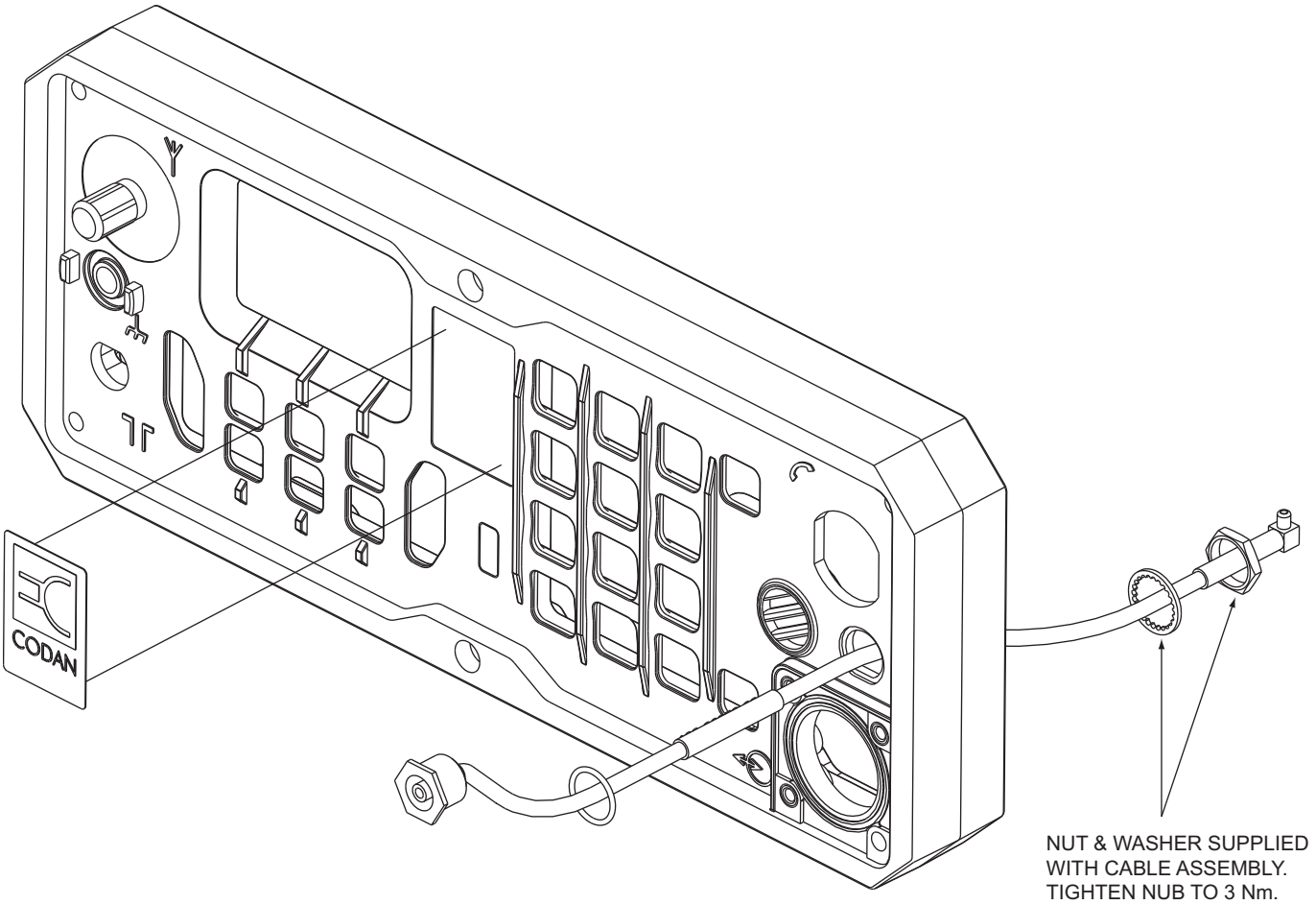


Figure 37: Connector for external GPS antenna



NOTE The connector for the external GPS antenna is part of the Front Panel Assembly. The **GPS** connector is optional for 2110 Manpack Transceivers. It is not available for the 2110v.

Table 20: Front Panel Assembly and Final Assembly with GPS connector

Transceiver	Front Panel Assembly	Final Assembly
2110	08-06140-003	08-06155-008 08-06155-009

Figure 38: Voice encryptor

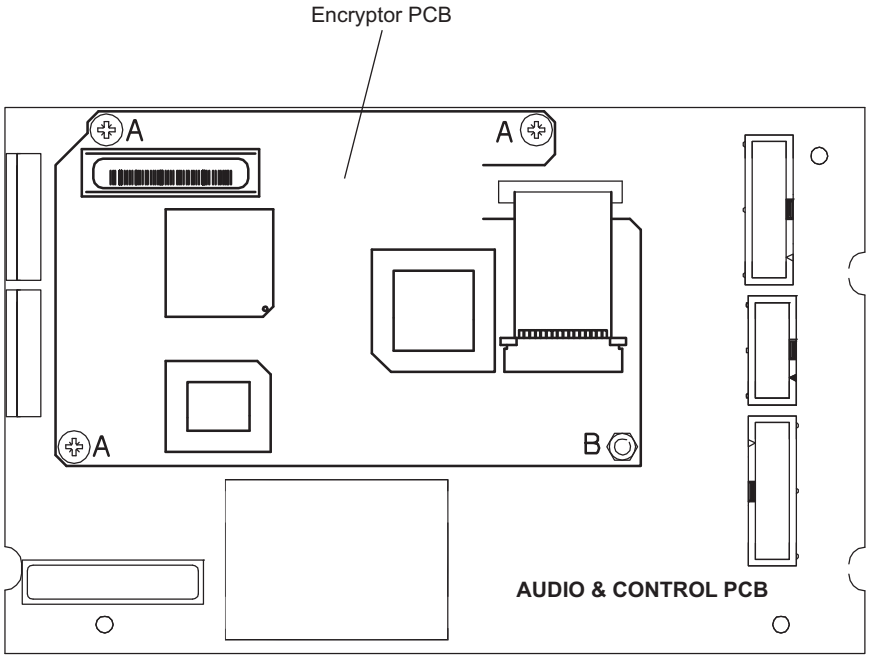
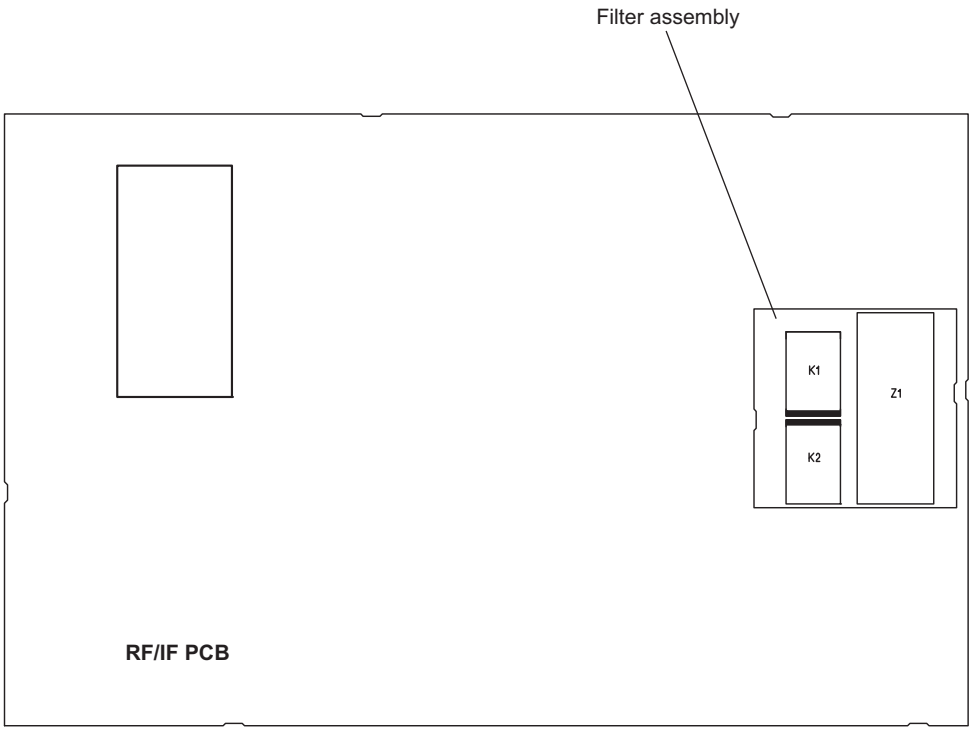


Figure 39: Filters



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Standards and icons

The following standards and icons are used in this guide:

This typeface...	Means...
Bold	name of an entry in a list
Italics	a cross-reference, or text requiring emphasis

This icon...	Means...
WARNING	your actions may cause harm to yourself or the equipment
CAUTION	proceed with caution as your actions may lead to loss of data, privacy or signal quality
NOTE	the text provided next to this icon may be of interest to you
❑	a step to follow

Definitions

Acronyms and abbreviations

This acronym...	Means...
A/F, AF	audio frequency
AC	alternating current
AGC	automatic gain control
ALC	automatic level control
ALE	automatic link establishment, address latch enable
AM	amplitude modulation
ATU	antenna tuner unit
BPF	band-pass filter
CALM	Codan automated link management
codec	coder/decoder
CPLD	complex programmable logic device
CRO	cathode ray oscilloscope
CTS	clear to send
CW	continuous wave, carrier wave
DAC	digital to analogue converter
DC	direct current
DDS	direct digital synthesis
DSP	digital signal processor/processing
EEPROM	electrically erasable programmable read only memory
EXT	external
FET	field-effect transistor
FWD	forward
GPIO	general purpose input/output
GPS	global positioning system
HF	high frequency
I/P	input
IC	integrated circuit
IF	intermediate frequency

This acronym...	Means...
IMD	intermodulation distortion
LCD	liquid crystal display
LED	light-emitting diode
LO	local oscillator
LPF	low-pass filter
LSB	lower sideband
Modem	modulator-demodulator
NiMH	nickel metal hydride
NSP	NGT system programmer
O/P	output
PA	power amplifier
PC	personal computer
PCB	printed circuit board
PD	potential difference
PEP	peak envelope power
p–p	peak-to-peak
ppm	parts per million
PTT	press-to-talk
PWR	power
REF OSC	reference oscillator
RF	radio frequency
RMS	root mean square
RTS	request to send
Rx	receive, receiver
SCF	suppressed carrier frequency
SCL	serial clock
SDA	serial data
SINAD	(signal+noise+distortion)-to-(noise+distortion) ratio
SMB	system management bus
SLA	sealed lead acid
SSB	single sideband
TCW	tinned copper wire

This acronym...	Means...
THD	total harmonic distortion
Tx	transmit, transmitter
UART	universal asynchronous receiver/transmitter
USB	upper sideband
VCO	voltage-controlled oscillator
VSWR	voltage standing wave ratio

Glossary

This term...	Means...
channel	A frequency range over which signals can be transmitted and received.
coder/decoder	A device combining analogue to digital and digital to analogue converters.
digital signal processor (DSP)	A microprocessor-like device that is designed to provide real-time processing of high-volume digital data streams.
Easitalk®	A feature that enables the user to reduce the level of background noise that is present when listening to a channel.
frequency	The number of cycles per second of a radio wave, usually expressed in kilohertz.
front panel	A panel on the transceiver that is used to control the functions of the transceiver. It consists of a display, keypad and connectors.
handset	A hand-held device that consists of a microphone, PTT button, and earphone.
PTT button	Press-to-talk button, located on the left side of the handset. This button enables you to communicate during voice calls, switch mute off, cancel voice calls prior to the point where voice can be transmitted, cancel calls where data is being transmitted, and exit out of editable screens without saving changes.
transceiver unit	The unit in a transceiver that modulates audio signals onto radio frequencies that can be transmitted on air, and demodulates the radio frequencies it receives into audio signals.

Circuit reference designations

Abbreviation	Designation
A	assembly
B	transducer—microphone, loudspeaker etc
C	capacitor
D	diode—small signal and power
E	heating device
F	protection device—fuse etc
G	generator—battery etc
H	signalling/indicating device—lamp, LED, buzzer etc
IC	integrated circuit, thick film hybrid etc
J	jack socket
K	relay, key switch
L	inductor
M	indicating device—meter etc
P	plug
R	resistor
S	switch
T	transformer, common mode choke
TP	test point
U	modem, modulator-demodulator
V	semiconductor (not including small signal and power diodes)
X	terminals
Z	quartz crystal, crystal filter, frequency network

Units

Measurement	Unit	Abbreviation
Current	ampere	A
Frequency	hertz	Hz
Impedance	ohm	Ω
Length	metre (inch/feet/yard/mile)	m (in/ft/yd/mi)
Mass	gram (pound)	g (lb)
Power	watt	W
Power	decibels relative to 1 mW	dBm
Power	decibels relative to 1 mV	dBv
Power ratio	decibel	dB
Temperature	degrees Celsius (degrees Fahrenheit)	°C (°F)
Time	hour	h
	second	s
Voltage	volt	V

Unit multipliers

Unit	Name	Multiplier
p	pica	0.000000000001
µ	micro	0.000001
m	milli	0.001
d	deci	0.1
k	kilo	1000
M	mega	1000000

About this issue

This is the first issue of the Manpack Transceiver 2110 series Repair Guide.

Associated documents

This guide is one of a series of documents related to the 2110 series Manpack Transceiver. Other associated documents are:

- Manpack Transceiver 2110 series Getting Started Guide (Codan part number 15-04136-EN)
- Manpack Transceiver 2110 series Reference Manual (Codan part number 15-04135-EN)
- Manpack Transceiver 2110 series Technical Service Manual (Codan part number 15-02071-EN)
- NGT System Programmer Help (Codan part number 15-04164-EN)
- Declaration of Conformity for the 2110 SSB Transceiver (Codan part number 19-40157)

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The figures listed for specifications will normally be exceeded by production equipment. Where relevant, typical values are given in brackets [ ]. All measurements are made at 13.6 V DC, with 50 Ω source and load resistances at 25°C ambient temperature, unless otherwise specified.

General

Table 21: General specifications

Item	Specification		
Frequency range	Transmit:	1.6 to 30 MHz	
	Receive:	0.25 to 30 MHz	
Channel capacity (single or two-frequency simplex channels)	400 channels 600 channels if MIL-STD-188-141B ALE option is installed		
Frequency generation	All frequencies generated by PLL and DDS synthesisers with 10 Hz resolution		
Operating modes	Single sideband (J3E) USB or LSB or switched USB/LSB (AM H3E optional)		
Frequency stability	±1.5 [1] ppm	(–30 to +60°C)	(standard)
	±0.5 ppm	(–30 to +60°C)	(high stability)
Programming	Configuration of transceiver is via the GPIO port using NSP programming software and a PC, or via the front panel by qualified personnel or, where permitted, by the operator		
RF input/output impedance	Whip/long wire antenna via internal antenna tuner, or 50 Ω nominal at 50 Ω antenna port		
Supply voltage	12 V DC nominal from supplied battery, negative earth Nominal operating range: 10.5 to 15.5 V DC Reverse polarity protected		
Overvoltage protection	Shut down at 16 V ±0.5 V DC nominal for duration of overvoltage		
Low voltage switch off	Switch off @ 10 V		
Supply current	Transmit:	see Table 23 on page 130	
	Receive:	no signal 120 mA nominal (standby mode) no signal 145 mA nominal (operating mode) average speech 1 A for battery life calculations	

Table 21: General specifications (cont.)

Item	Specification	
Useable battery life (Tx:Rx ratio of 1:9)	17 Ah $LiFePO_4$:	65 h
	13 Ah NiMH battery pack:	50 h
	8 Ah NiMH battery pack:	30 h
	7 Ah SLA battery pack:	15 h
Environment	Ambient temperature:	–30 to +60°C (–22 to 140°F)
	Relative humidity:	95% non-condensing
	Derate upper ambient temperature by 1°C per 330 m above sea level	
	MIL-STD-810F compliance:	
	Method 500.4: Low Pressure (Altitude) Method 506.4: Rain Method 507.4: Humidity Method 508.5: Fungus Method 509.4: Salt Fog Method 510.4: Sand and Dust Method 512.4: Immersion Method 514.5: Vibration Method 516.5: Shock	
Cooling	Convection from case	
Size	2110 (including battery):	245 mm W × 350 mm D × 92 mm H (9.8 in W × 14.0 in D × 3.7 in H)
	2110 only:	245 mm W × 250 mm D × 92 mm H (9.8 in W × 10.0 in D × 3.7 in H)
Weight	2110 only:	2.5 kg (5.5 lb)
	17 Ah $LiFePO_4$ battery pack:	2.6 kg (5.7 lb)
	13 Ah NiMH battery pack:	2.9 kg (6.4 lb)
	8 Ah NiMH battery pack:	2.1 kg (4.6 lb)
	7 Ah SLA battery pack:	3.2 kg (7.1 lb)
Sealing	IP68 (MIL-STD 810F):	immersion for 1 hour at a depth of 1 m (3 ft)
Finish colour	Dark Grey	
Microphone	Standard military handset with microphone, earphone and PTT push-button switch	

Receiver

Table 22: Receiver specifications at 50 Ω antenna connector

Item	Specification		
Type	Dual conversion, superheterodyne		
IF frequencies	45 MHz and 455 kHz		
Sensitivity	Frequency: 0.25 to 30 MHz	RF amp off: 0.45 [0.28] µV PD –114 [–118] dBm	
	Frequency: 1.6 to 30 MHz	RF amp on: 0.22 [0.14] µV PD –120 [–124] dBm	
	For 10 dB SINAD with greater than 50 mW audio output power		
Input protection	Will withstand 50 V p–p RF from a 50 Ω source		
Selectivity	Greater than 65 [70] dB at –1 kHz and +4 kHz reference SCF USB		
	Maximum pass band level variation:	8 [6] dB	@ 300 to 2600 Hz
	Ripple:	4 [2] dB p–p	@ 500 to 2500 Hz
Desensitisation	10 dB SINAD reduced to 7 dB SINAD		
	–1 and +4 kHz (ref SCF) USB		50 [55] dB
	±10 kHz		65 [70] dB
	±50 kHz		80 [85] dB
Blocking	As for Desensitisation		
	For frequencies > ±50 kHz > 80 dB		
Image rejection	Better than 85 [90] dB		
Spurious responses	Better than 70 [80] dB		
	No more than 10 self-generated signals > 0.15 µV PD		
Intermodulation	To produce a third order intermodulation product equivalent to a wanted signal producing 10 dB SINAD, two unwanted signals, greater than 30 kHz removed from the wanted signal, must have a level greater than 80 [82] dB above the wanted signal		
	Third order intercept (unaffected by AGC): +10 [+13] dBm with RF amp off +0 [+3] dBm with RF amp on		
AGC	Less than 6 dB variation in output for input variation between 2.0 [1.0] µV and 100 mV PD (RF amp on)		
	Fast attack, slow release (selectable release time)		

Table 22: Receiver specifications at 50 Ω antenna connector (cont.)

Item	Specification		
A/F power and A/F distortion	Internal speaker:	0.5 W typical into 8 Ω, 10% THD 0.4 W minimum, 5% THD	
	External speaker on GPIO connector:	1 W typical into 4 Ω, 10% THD 0.75 W minimum, 5% THD	
Clarifier	±10 ppm (nominal) above 5 MHz ±50 Hz below 5 MHz Clarifier is automatically reset to mid-frequency with channel change		
Signal to noise vs input signal	An increase of input level of 40 dB above the sensitivity level increases the signal-to-noise ratio to at least 35 dB		

Transmitter

Table 23: Transmitter specifications at 50 Ω antenna connector

Item	Specification		
Power output	25 W PEP ±0.5 dB (high power) 5 W PEP ±0.5 dB (low power) CW or single tone: approximately 60% of PEP with average PEP control (average control disabled on handset PTT)		
Duty cycle	50%:	normal speech over full temperature range	
	50%:	multi-tone continuous data mode (5 minutes on maximum) at ambient temperature up to 40°C (104°F) using 50 Ω antenna port	
Supply current	Two-tone into 50 Ω:	2.5 to 3.5 A	
	Average speech:	1 A for battery life calculations	
Protection	Safe under all load conditions by limiting reflected power to 4 W PEP and limiting PA transistor collector voltage swing Thermal protection against excessive heatsink temperature		
A/F response	Overall response of microphone and transmitter rises approximately 6 dB/octave 300 to 2700 Hz		
	Electrical input:	–8 [–6] dB	300 to 2600 Hz
	Ripple:	4 [2] dB p–p	500 to 2500 Hz
Spurious and harmonic emissions	Better than 60 [65] dB below PEP		
Carrier suppression	50 [60] dB below PEP		
Unwanted sideband	55 [70] dB below PEP (400 Hz) 65 [70] dB below PEP (1 kHz)		

Table 23: Transmitter specifications at 50 Ω antenna connector (cont.)

Item	Specification
Intermodulation (Two-tone test)	26 [30] dB below each tone 32 [36] dB below PEP
ALC	A 10 dB increase in signal input above compression threshold produces less than 0.5 dB increase in power output Maximum ALC range greater than 30 dB ALC attack time approximately 1 ms
Microphone	Standard military handset with Dynamic mic insert

Antenna tuner

Table 24: Antenna tuner specifications

Item	Specification	
Tuning limit	< 1.5:1 typical SWR All tuning activity performed at 5 W nominal	
Antenna types @ antenna stud	Short Whip 1.5 m (5 ft) (nominal): Long Whip 3 m (10 ft) (nominal): Long Wire 10 m (33 ft):	from 3 to 30 MHz from 2 to 30 MHz from 1.6 to 30 MHz
Memory capacity	The last 100 frequencies selected	
Tuning time (antenna types as in General specifications)	First-time tuning: From memory:	2.5 s typical 50 ms typical
Duty cycle @ antenna stud	10%:	normal speech over full temperature range
Protection	Safe under all load conditions	

GPS connector

Table 25: GPS connector specifications

Item	Specification
DC level	3.3 V ±10%
Current limit	150 mA ±50 mA
Operating current	5 to 30 mA 10 mA nominal

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