CODAN

NGT Transceiver System
Repair Guide

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The English version takes precedence over any translated versions.

CODAN

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Overview of this guide

This Repair Guide is for Codan Accredited Service Centres, enabling them to provide rapid and cost-effective service to customers, through diagnosis and repair of faulty equipment.

This guide provides an overview of the equipment and its specifications, functional descriptions, fault diagnosis to board level, board replacement, functional testing and interconnection diagrams for the NGT series Transceivers. The fault diagnosis and testing procedures provided assume that the transceiver is unoptioned.

This guide assumes that you have a good understanding of electronics, and a technical background.

This guide contains the following sections:

Compliance—compliance information and safety notices

Contact information—explains how to contact Codan if technical assistance is required

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

Overview—general description of the transceivers

Brief description (2010 RF Unit with 2030 Junction Box)—brief technical description of the 2010 RF Unit with 2030 Junction Box and 2020 Handset, including a general description of the major circuit functions for the control, reception and transmission of signals

Brief description (2011/2012 RF Unit)—brief technical description of the 2011/2012 RF Unit with 2020 Handset, 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 an NGT series 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 flow charts 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—specifications for the NGT series Transceivers

How to use this guide

This guide contains pages that fold out beyond the folder on either side. This enables you to view block diagrams, test point layouts and flow charts while reading relevant text on tests and procedures.

Begin the fault diagnosis process by using Figure 45 on page 121. The same flow chart is also used to confirm that a transceiver is operating correctly.

Follow the steps in Figure 45 on page 121 systematically to ensure the correct fault is isolated. If you step out of the flow chart to a test procedure, return to the same point on the flow chart upon completing the test, and continue as prompted.

At some points where a pass criteria is not met, the Repair flow chart refers to a function-specific fault diagnosis flow chart. 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 flow charts due to the complex nature of the transceiver. In such an instance, or to confirm that a PCB is faulty, see page 49, *Functional description of PCBs*.

Board replacement philosophy

To facilitate rapid and cost-effective service to customers, and to effectively manage the increasing sophistication of electronic assemblies, a strategy of board replacement applies to all NGT series 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.

Circuit board precautions

Switching off

Ensure that power supplies are switched off before making connections or disconnections between circuit boards.

Handling

Handle circuit boards as little as possible.

Grounding

Anything connected to or touching the circuit board tracks should be grounded as follows:

- Ground test equipment connected to a board through its mains lead.
- 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, and at frequent intervals while working on circuit boards.
- Wear a suitably grounded conductive wrist strap. This will minimise the build up of static on you.

Excessive heat

Excessive heat may lift the track from the circuit boards. This will 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 unsolder an existing joint, or to solder a new one.

Unsoldering

When unsoldering a component, use a solder sucker or solder wick to remove 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.

Transmitter precautions

When making measurements of the low-level stages of the exciter, it is advisable to remove the drive to the PA 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 probes to avoid incorrect readings.

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 just reaches the probe tip. This reduces stray RF pick-up.
- The earth clip should be connected to the ground plane, adjacent to the point of measurement.
- 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 after power has been applied to the transceiver and the test equipment. The earth connection should be made first and disconnected last.

Compliance

This section contains the following topics:

Introduction

This section describes how to ensure that an NGT series Transceiver complies with the European Electromagnetic Compatibility Directive 89/336/EEC and the European Low Voltage Directive 73/23/EEC as called up in the European Radio and Telecommunications Terminal Equipment Directive 1999/5/EC.

The CE Declarations of Conformity and Expert Letters of Opinion for this product range are listed on page 156, *Associated documents*. These documents can be made available upon request to Codan or a Codan-authorised supplier.

This section also contains the requirements for FCC compliance, IC certification and C-tick.

European Radio and Telecommunications Terminal Equipment Directive

The NGT series Transceivers have been tested and comply with the following standards and requirements (articles of the R&TTE Directive):

- Article 3.1b: ETSI EN 301 489-1
- Article 3.1b: ETSI EN 301 489-15
- Article 3.2: Australian type approval according to AZ/NZS 4770:2003 or ECR 209
- Article 3.1a: assessed against ICNIRP and FCC requirements
- Article 3.1a: EN 60950

Product marking and labelling

Any equipment supplied by Codan that satisfies these requirements is identified by the CE0191 ⊙, CE0191, or CE markings on the model label of the product.

Declarations of Conformity and Expert Letters of Opinion

The CE Declarations of Conformity and Expert Letters of Opinion for this product range are listed on page 156, *Associated documents*. These documents can be made available upon request to Codan or a Codan-authorised supplier.

Protection of the radio spectrum

CAUTION

Most countries restrict the use of HF radio communications equipment to certain frequency bands and/or require such equipment to be licensed. It is the user's responsibility to check the specific requirements with the appropriate communications authorities. If necessary, contact Codan for more information.

Electromagnetic compatibility and safety notices

Radiation safety

To ensure optimal transceiver performance and to avoid exposure to excessive electromagnetic fields, the antenna system must be installed according to the instructions provided.

WARNING High voltages exist on the antenna during transmission and tuning. Do not touch the antenna during these activities. RF burns may result.

WARNING Install the grounding system or counterpoise as directed to prevent RF burns from any metal part of the transceiver.

WARNING You should not transmit from your transceiver or tune the antenna unless people are beyond the safe working distance of:

- 1.5 m (5 ft) of any part of a mobile antenna
- 2 m (7 ft) of any part of a fixed antenna in a data installation of up to 125 W output
- 5 m (17 ft) of any part of a fixed antenna in a data installation of up to 1 kW output

Safe working distance is based on continuous exposure to CW-type transmissions, as set out in the ICNIRP Exposure Guidelines (1998) for occupational exposure. Safe working distance can be reduced with normal voice communication.

Electromagnetic compatibility

To ensure compliance with the EMC Directive is maintained, you must:

- ❑ Use standard shielded cables supplied from Codan (where applicable).
- ❑ Ensure the covers for the equipment are fitted correctly.

  CAUTION If it is necessary to remove the covers at any stage, they must be refitted correctly before using the equipment.

- ❑ Cover unused connectors on the junction box (if fitted) and RF unit with the protective caps supplied to prevent electrostatic discharge passing through your NGT equipment.

Electrical safety

To ensure compliance with the European Low Voltage Directive is maintained, you must install and use the NGT series Transceiver in accordance with the instructions in the relevant *NGT Transceiver Getting Started Guide* and *NGT Transceiver Reference Manual*.

When using equipment that is connected directly to the AC mains these precautions must be followed and checked before applying AC power to the unit:

- ❑ Use the standard AC mains cable supplied.
- ❑ Ensure the covers for the equipment are fitted correctly.

CAUTION — If it is necessary for a qualified electronics technician to remove the covers during servicing, they must be refitted correctly before using the equipment.

WARNING — A protective earth connection must be included in the mains wiring to the 3020 Transceiver Supply (see below, *Earth symbols*).

The protective cover must always be fitted when the 3020 Transceiver Supply is connected to the AC mains.

Earth symbols

Chassis earth connection points are provided on the NGT series Transceiver and 3020 Transceiver Supply. A protective earth is provided in the AC mains wiring of the 3020 Transceiver Supply. This protective earth must be connected at the AC mains supply outlet. The symbols shown in Table 1 are used to identify the earths on the equipment.

Table 1: Earth symbols

Symbol	Meaning
	Chassis earth
	Protective earth

FCC compliance

FCC Part 90 certification

The 2010 RF Unit with 2030 Junction Box and 2020 Handset complies with FCC standards (FCC identifier code DYYNGT-3).

The 2011/2012 RF Unit with 2020 Handset complies with FCC standards (FCC identifier code DYYNGT-11).

FCC Part 15 compliance

Any modifications made to the NGT series Transceiver (2010 RF Unit with 2030 Junction Box and 2020 Handset, or 2011/2012 RF Unit with 2020 Handset) and 3020 Transceiver Supply that are not approved by the party responsible for compliance may void your equipment's compliance under Part 15 of the FCC rules.

The NGT series Transceiver (2010 RF Unit with 2030 Junction Box and 2020 Handset, or 2011/2012 RF Unit with 2020 Handset) and 3020 Transceiver Supply have been tested and found to comply with the limits for a Class B device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by switching the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna
- increase the separation between the equipment and receiver
- connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- consult the dealer or an experienced radio/TV technician for help

IC certification

Product markings and labelling

The 2011/2012 RF Unit with 2020 Handset is certified to IC standards (IC identifier 1029A-NGT-3).

C-tick approval

The 2012 RF Unit with 2020 Handset meets the requirements of the Australian Communications Authority Radiocommunications (MF and HF Radiotelephone equipment—Land Mobile Services) Standard 2003 (AS/NZS 4770).

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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 details on the internet at www.codan.com.au. In the HF Radio Communications section, click on Product Support.

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. This will ensure that the correct items are supplied, and speed up delivery times.

- equipment type (e.g. Type 2020 Handset)
- part/module location (e.g. *SR* Handset assembly, 08-05629-001)
- full part/module description (e.g. Handset power/Emergency key PCB)

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Overview

This section contains the following topics:

Overview

The NGT is a transceiver that can be installed in a vehicle or used as a base station. The minimum NGT system comprises:

- any one of:
  - a 2010 RF Unit with 2030 Junction Box, or
  - a 2011 RF Unit, or
  - a 2012 RF Unit
- a 2020 Handset

The handset is a hand-held device with a microphone, PTT button, display and keypad. A desk console unit for the handset is available for use in base stations.

The junction box is a unit to which the handset, 2010 RF Unit, speaker and related units are connected in a complex system. In transceivers that use the 2011 or 2012 RF Unit, the handset and speaker are connected to the RF unit via the handset and speaker connector and 10-way connector.

The RF unit modulates audio signals received from the handset onto radio frequencies and transmits these frequencies. It also demodulates received radio frequencies into audio signals.

The 2010 RF Unit and 2030 Junction Box are connected together using a versatile and flexible bus system called the Codan interconnect bus (CIB). Transceivers that use the 2011 RF Unit do not have system connection capabilities. Transceivers that use the 2012 RF Unit have limited system connection capabilities.

Figure 1: Relationship of the 2010 RF Unit, 2030 Junction Box, and 2020 Handset

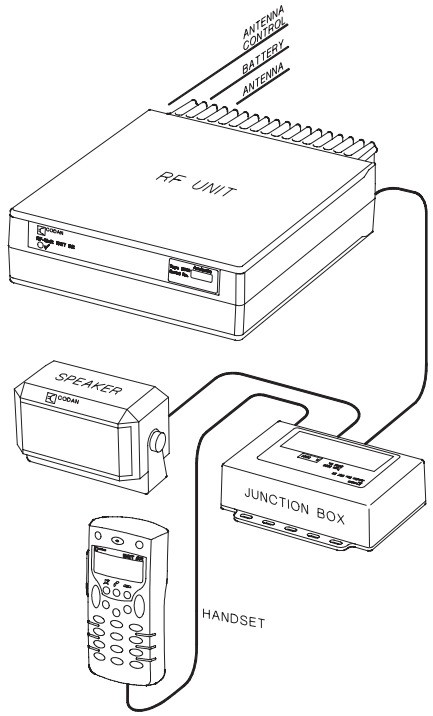
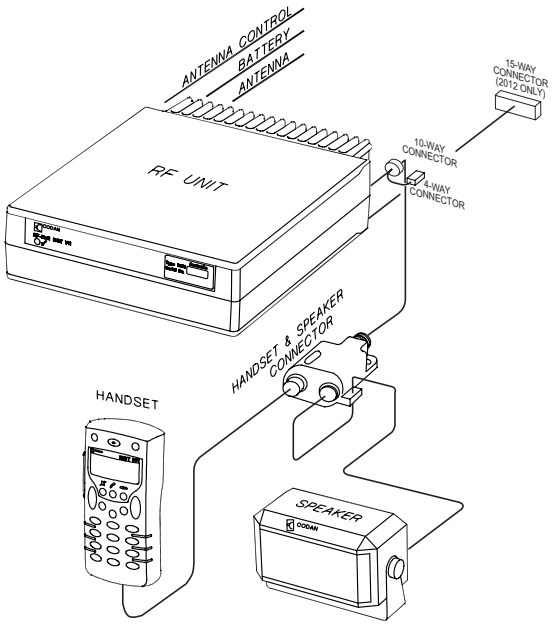


Figure 2: Relationship of the 2011/2012 RF Unit and 2020 Handset



Pin connections

RF unit

Figure 3: Rear panel of the 2010 RF Unit

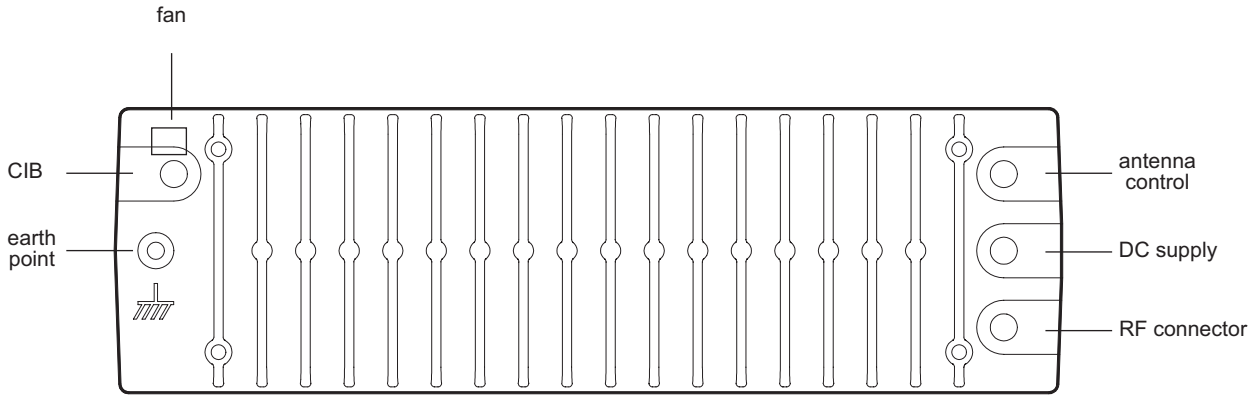


Figure 4: Rear panel of the 2011 RF Unit

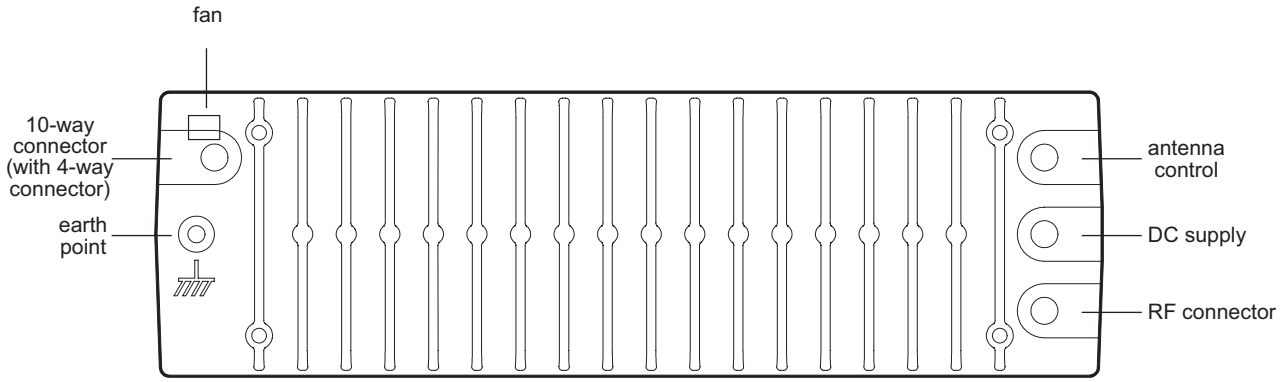
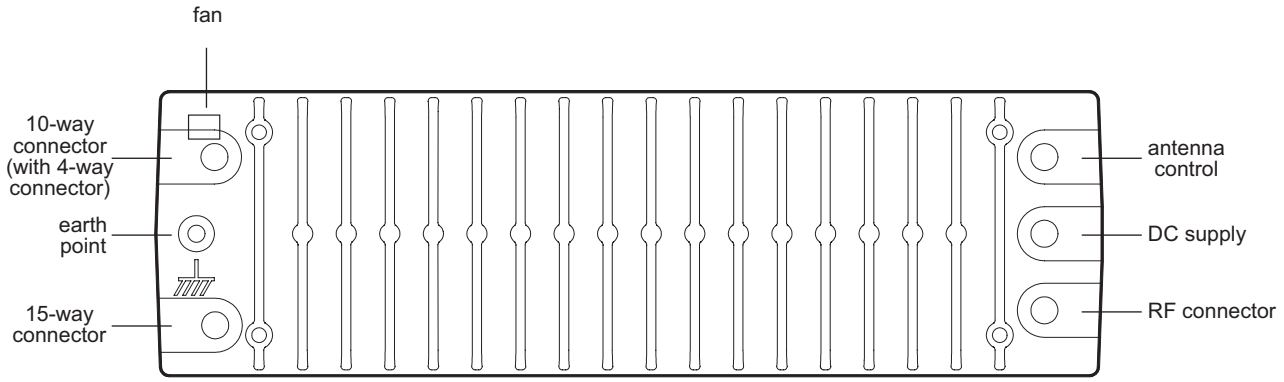


Figure 5: Rear panel of the 2012 RF Unit



Pinouts of the CIB connector on the RF unit (2010 RF Unit only)

Figure 6: Front view of the CIB connector on the RF unit (2010 RF Unit only)

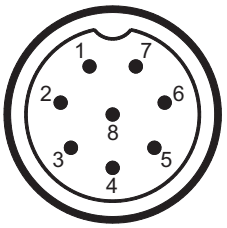


Table 2: Pinouts of the CIB connector on the RF unit (2010 RF Unit only)

Pin no.	Function	Signal levels
1	Ground	0 V
2	System data	1 to 5 V logic
3	System data	1 to 5 V logic
4	Power on	Momentary 0 V = PWR ON
5	+6 V standby	+6 V
6	System audio	5 to 10 V sync and TDM
7	System audio	0 to 5 V sync and TDM
8	**A** rail protected (2 A)	+13.6 V nominal

Pinouts of the antenna control connector on the RF unit

Figure 7: Front view of the antenna control connector on the RF unit

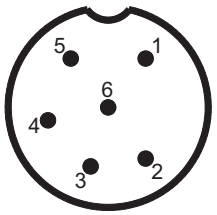


Table 3: Pinouts of the antenna control connector on the RF unit

Pin no.	Function	Signal levels
1	Tune in/out	5 V logic, active low
2	Scan	Active low (open collector)
3	Tuned in	5 V logic
4	**A** rail protected (1 to 2 A) nominal	+13.6 V nominal
5	External ALC input	Control at 3.6 V
6	Ground	0 V

Pinouts of the DC supply connector on the RF unit

Table 4: Pinouts of the DC supply connector on the RF unit

Pin no.	Function
1	+12 V nominal (10.8 to 16 V DC)
2	Ground

RF connector

The RF connector is a flying lead located on the right side of the rear panel. It is used to connect to an antenna.

Pinouts of the fan connector on the RF unit

Figure 8: Front view of the fan connector on the RF unit

Table 5: Pinouts of the fan connector on the RF unit

Pin no.	Function
–	0 V
+	+13.6 V nominal (when fan is activated)

Pinouts of the 10-way connector on the RF unit (2011/2012 RF Unit only)

Figure 9: Front view of the 10-way connector on the RF unit (2011/2012 RF Unit only)

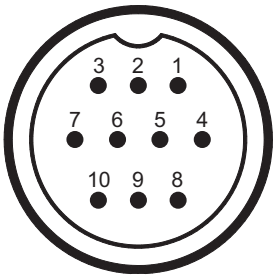


Table 6: Pinouts of the 10-way connector on the RF unit (2011/2012 RF Unit only)

Pin no.	Function	Signal levels
1	Speaker audio +	Approx. 12 V p–p at onset of clipping
2	Speaker audio –	0 V
3	Microphone audio +	Nominally 500 mV p–p to ground with normal speech
4	Microphone audio –	Nominally 500 mV p–p to ground with normal speech
5	Handset data +	1 to 5 V logic
6	Handset data –	1 to 5 V logic
7	Power on	Momentary 0 V = PWR ON
8	Standby power for handset	+5 V standby power or +9 V handset power
9	**A** rail protected (1 A nominal)	+13.6 V nominal
10	Ground	0 V

Pinouts of the 4-way connector on the RF unit (2011/2012 RF Unit only)

Figure 10: Front view of the 4-way connector on the RF unit (2011/2012 RF Unit only)

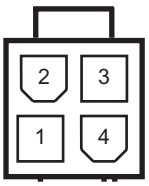
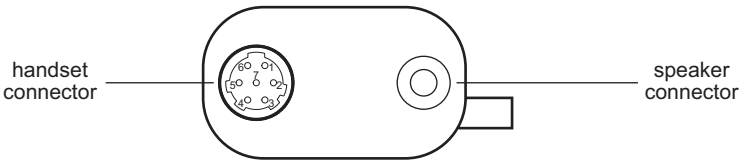


Table 7: Pinouts of the 4-way connector on the RF unit (2011/2012 RF Unit only)

Pin no.	Function	Signal levels
1	**A** rail protected (2 A)	+13.6 V nominal
2	Ground	0 V
3	RS232 Transmit data	RS232 output
4	RS233 Receive data	RS232 input

Pinouts of the handset and speaker connector attached to the RF unit (2011/2012 RF Unit only)

Figure 11: Front view of the handset and speaker connector attached to the RF unit (2011/2012 RF Unit only)



For details on the pinouts of the handset connector see Table 9 on page 27. For details on the pinouts of the speaker connector see Table 11 on page 28.

Pinouts of the 15-way GPIO connector on the RF unit (2012 RF Unit only)

Figure 12: Front view of the 15-way GPIO connector on the RF unit (2012 RF Unit only)

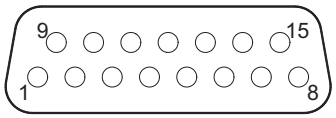


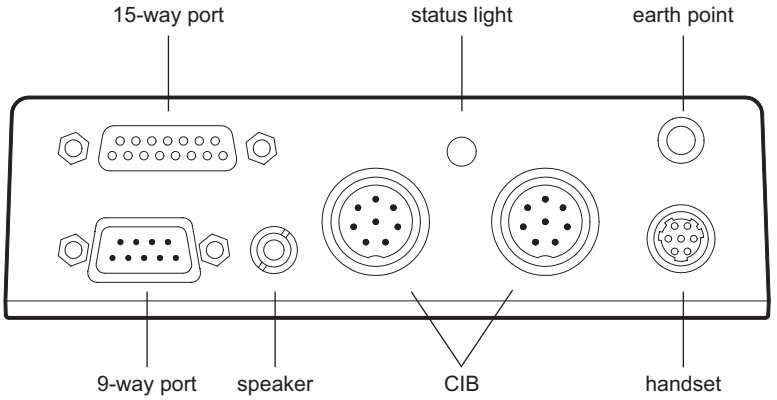
Table 8: Pinouts of the 15-way GPIO connector on the RF unit (2012 RF Unit only)

Pin no.	Function	Signal levels
1	RTS	RS232 output
2	RS232 Receive data	RS232 input
3	RS232 Transmit data	RS232 output
4	Ground	0 V
5	Tx audio input (10 kΩ balanced)	300 mV p–p ALC threshold
6	External alarm relay contact (NO or NC depending on jumper P10)	Contacts rated 50 V, 1 A
7	External alarm relay common, or 600 Ω balanced audio output	Contacts rated at 5 V, 1 A, or 600 Ω audio output
8	**A** rail protected	+13.6 V nominal
9	CTS	RS232 input
10	PTT input	5 V TTL logic active low
11	Morse input	5 V TTL logic active low
12	Busy/output	5 V TTL logic
13	Quiet (Q) line input	5 V TTL logic active high when Fax/Data Mode selected 5 V TTL logic active low when all other modes selected
14	System audio output unbalanced, or 600 Ω balanced audio output	100 Ω audio output 1 V p–p, or 600 Ω balanced audio output
15	Tx audio input (10 kΩ balanced)	300 mV p–p ALC threshold

NOTE The 600 Ω output option is selected by internal links (pins 7 and 14).

Junction box (used with 2010 RF Units only)

Figure 13: Connector panel of the junction box



Pinouts of the handset connector on the junction box

Figure 14: Front view of the handset connector on the junction box

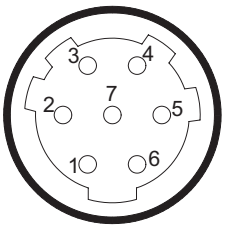


Table 9: Pinouts of the handset connector on the junction box

Pin no.	Function	Signal levels
1	Standby power for handset	+5 V standby power or +9 V handset power
2	Handset data	1 to 5 V logic
3	Handset data	1 to 5 V logic
4	Ground	0 V
5	Microphone audio	Nominally 500 mV p–p to ground with normal speech
6	Microphone audio	Nominally 500 mV p–p to ground with normal speech
7	Power on	Momentary 0 V = PWR ON

Pinouts of the CIB connectors on the junction box

Figure 15: Front view of a CIB connector on the junction box

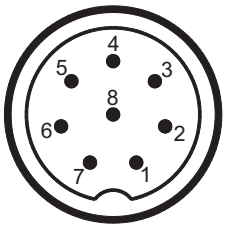


Table 10: Pinouts of the CIB connectors on the junction box

Pin no.	Function	Signal levels
1	Ground	0 V
2	System data	1 to 5 V logic
3	System data	1 to 5 V logic
4	Power on	Momentary 0 V = PWR ON
5	+6 V standby	+6 V
6	System audio +	5 to 10 V sync and TDM
7	System audio –	0 to 5 V sync and TDM
8	**A** rail protected (2 A)	+13.6 V nominal

Pinouts of the speaker connector on the junction box

The speaker should be 4 Ω with a power rating of 5 W.

Table 11: Pinouts of the speaker connector on the junction box

Connection	Function
Tip	Speaker audio output
Sleeve	Ground

Pinouts of the 9-way serial data connector on the junction box

Figure 16: Front view of the 9-way serial data connector on the junction box

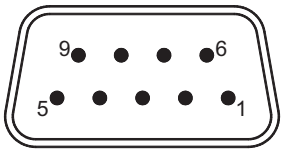


Table 12: Pinouts of the 9-way serial data connector on the junction box

Pin no.	Function	Signal levels
1	N/C	
2	RS232 Receive data	RS232 input
3	RS232 Transmit data	RS232 output
4	DTR	RS232 output
5	Ground	0 V
6	DSR	RS232 input
7	RTS	RS232 output
8	CTS	RS232 input
9	N/C	

Pinouts of the 15-way GPIO connector on the junction box

Figure 17: Front view of the 15-way GPIO connector on the junction box

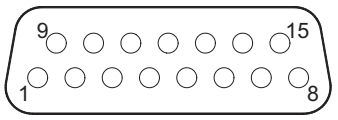


Table 13: Pinouts of the 15-way GPIO connector on the junction box

Pin no.	Function	Signal levels
1	RTS	0 to 5 V
2	RS232 Receive data	RS232 input
3	RS232 Transmit data	RS232 output
4	Ground	0 V
5	Tx audio input (50 kΩ balanced)	300 mV p–p ALC threshold
6	External alarm relay	Contacts rated 50 V, 1 A
7	External alarm relay	Closed for alarm
8	**A** rail	+13.6 V nominal
9	CTS	RS232 input
10	PTT input	5 V TTL logic active low
11	Morse input	5 V TTL logic active low
12	Spare input/output	5 V TTL logic
13	Spare input/output	5 V TTL logic
14	System audio output	1 V p–p (maximum load 1 kΩ)
15	Tx audio input (50 kΩ balanced)	300 mV p–p ALC threshold

NOTE Pins 6, 7 and 9 may be linked internally to select normally open or closed. The pins can be configured to switch to ground or the **A** rail.

Pinouts of the headphone jack on the desk console

Table 14: Pinouts of the headphone jack on the desk console

Connection	Function
Ring	Audio
Tip	Audio
Sleeve	Ground

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Brief description (2010 RF Unit with 2030 Junction Box)

This section contains the following topics:

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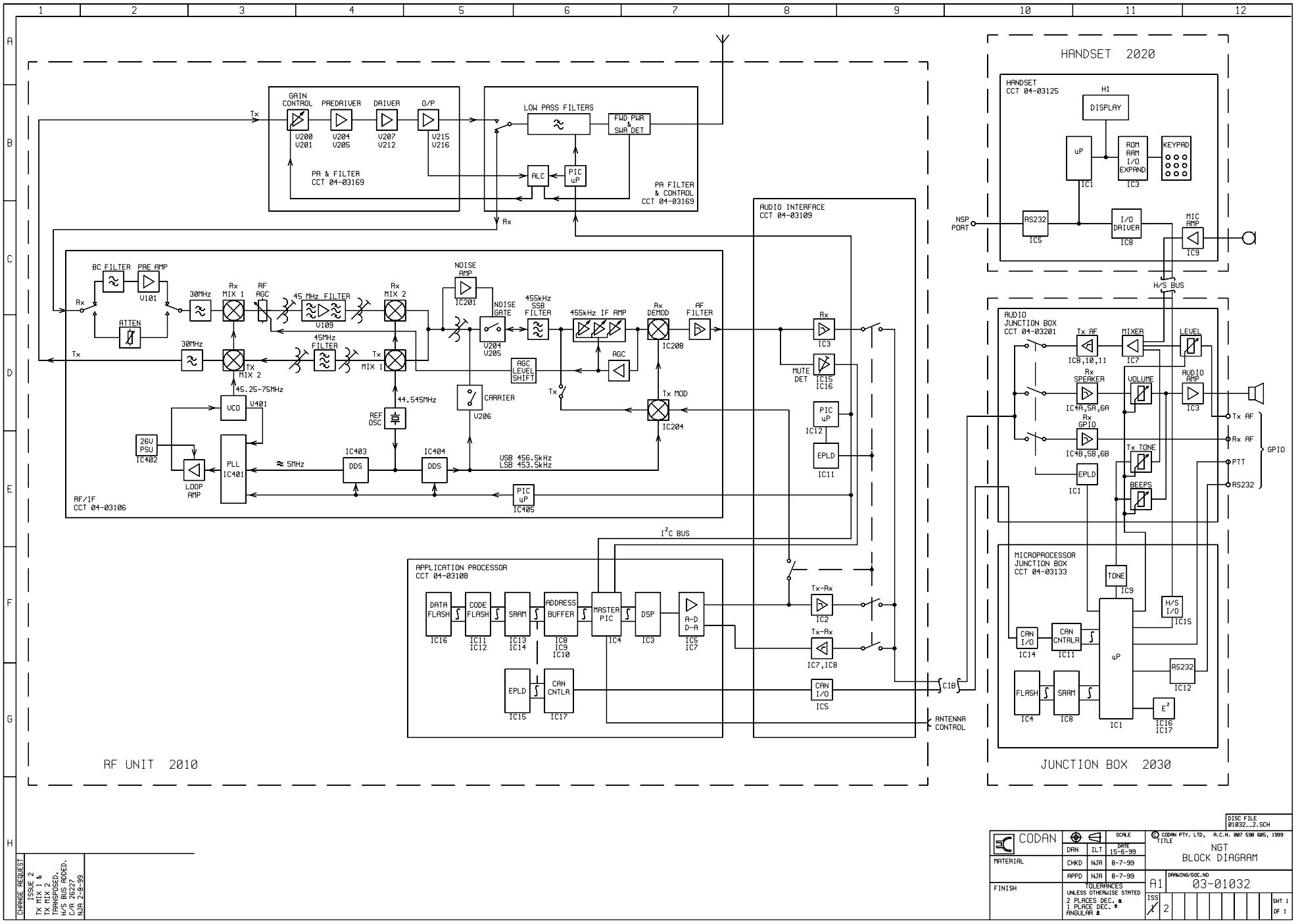
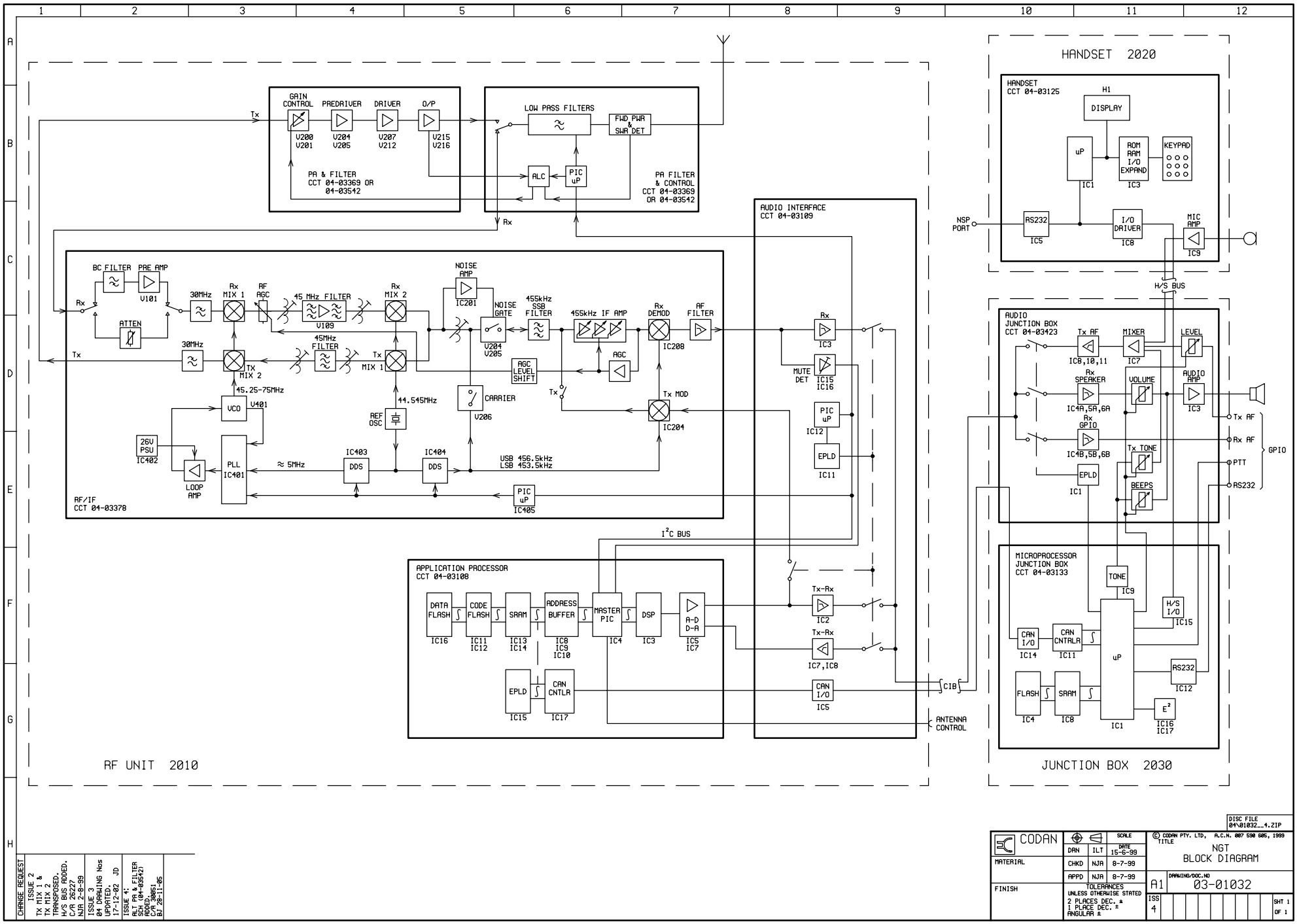


CHANGE REQUEST	
ISSUE 2	
TX MIX 1 & TX MIX 2 TRANSPOSED. H/S BUS ADDED. C/A 26227 NJA 2-8-99	

CODAN		SCALE	© CODAN PTY. LTD, A.C.N. 007 590 685, 1999
	DRN ILT	DATE 15-6-99	TITLE NGT BLOCK DIAGRAM
MATERIAL	CHKD NJA	8-7-99	
	APPD NJA	8-7-99	DRAWING/DOC.NO 03-01032
FINISH	TOLERANCES UNLESS OTHERWISE STATED 2 PLACES DEC. ± 1 PLACE DEC. ± ANGULAR ±		A1 ISS 2 SHT 1 OF 1

DISC FILE 01032...2.SCH



CHANGE REQUEST
ISSUE 2 TX MIX 1 & TX MIX 2 TRANSPOSED. H/S BUS ADDED. C/A 26227 NJA 2-8-99
ISSUE 3 04 DRAWING Nos UPDATED. 17-12-02 JD
ISSUE 4: ALT PA & FILTER OPTION (04-03542) ADDED. C/A 30851 BJ 28-11-05

DISC FILE
04-01032_4.ZIP

CODAN

DRN	ILT	DATE 15-6-99
CHKD	NJA	8-7-99
APPD	NJA	8-7-99

SCALE

MATERIAL

FINISH

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±
1 PLACE DEC. ±
ANGULAR ±

TITLE
NGT
BLOCK DIAGRAM

A1

DRAWING/DOC.NO
03-01032

ISS 4

SHT 1 OF 1

General information

The information in this section should be read in conjunction with the appropriate issue of the block diagram for the NGT series Transceiver. See below to determine which issue of the block diagram you should be viewing.

For transceivers with:

Codan part number of PCB assembly	**See...**
Audio PCB (2030 Junction Box) 08-05470 Application Processor PCB (2010 RF Unit) 08-05265 RF/IF PCB (2010 RF Unit) 08-05261 PA PCB (2010 RF Unit) 08-05415 08-05416 08-05511	03-01032 Issue 2
Audio PCB (2030 Junction Box) 08-05986 RF/IF PCB (2010 RF Unit) 08-05889 PA PCB (2010 RF Unit) 08-05869 or 08-06461 08-05910	03-01032 Issue 4

The transceiver uses double conversion in both the Receive and Transmit modes. Only the 455 kHz sideband filter and the local oscillators VCO and REF OSC are common to both modes of operation.

The signal routing is determined by switching and control voltages according to the selected mode.

Transmit path

Handset transmit path

The microphone audio is amplified in the handset and passed to the junction box via the handset bus.

Junction box transmit path

The audio from the handset is amplified and gated to produce TDM channel audio on the Audio PCB in the junction box. There are eight time slots for the TDM, comprising one synchronisation channel and seven audio channels.

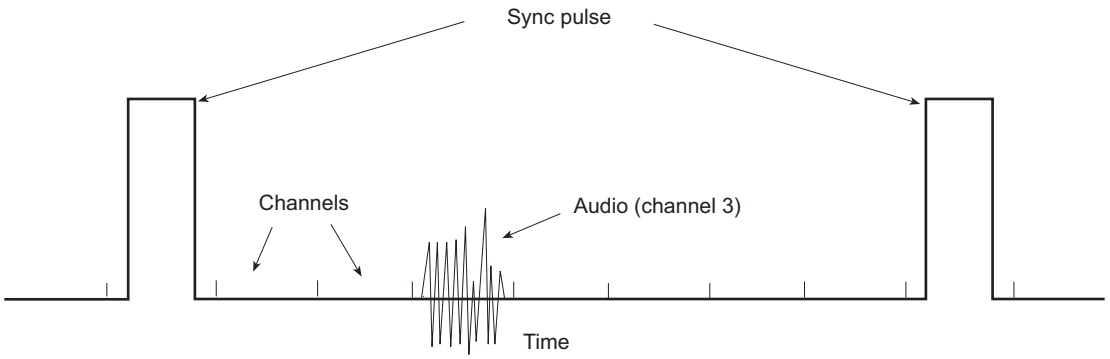
The audio is passed to the RF unit via the CIB.

Time division multiplex audio channels

The system audio uses TDM to produce seven channels of audio and one synchronisation pulse to reference the channel timing to pass audio between the RF unit and the junction box(es).

The audio is sampled at a rate of 12.5 kHz by the TDM gates. The position of the audio channel varies depending on the requirements of the system.

Figure 18: Representation of the waveform



The TDM audio is passed via SYS AUDIO+/– on the CIB.

CIB transmit path

The CIB is an 8-wire bus that connects all the units in the system together:

- **SYS AUDIO+/–:** The audio is TDM balanced, as described on page 36, *Time division multiplex audio channels*.
- **SYS DATA+/–:** The data uses CAN protocol. This protocol has good error detection capabilities and performs well in high-noise environments. The data rate on the CIB is 125 kbps.
- **STBY:** Standby power is a 100 mA, 6 V DC continuous supply. This is used to backlight the ⏻ key at night.
- **A PROTECTED:** The Protected **A** rail is an unregulated supply that is used to supply power to all the units in the transceiver system. The maximum current that this can supply is 2 A. If very long runs of the CIB cabling are required, an external supply may be connected to the junction box to supply power locally.
- **PWR ON:** The power on line is used to switch the transceiver on when the line is grounded.
- **GND:** Ground is the supply return wire and is connected to the negative terminal of the battery.

RF unit transmit path

Audio Interface PCB

The audio from the junction box connects to the Audio Interface PCB. This PCB decodes the TDM audio to normal audio.

Application Processor PCB

The transmit audio is passed to the Application Processor PCB for compression, which converts the signal to a fixed level before passing to the RF/IF PCB.

RF/IF PCB

The audio is mixed with the local oscillator to produce double sideband. It is then filtered by a 2.5 kHz sideband filter centred on 455 kHz, so that only the wanted sideband is passed to the first 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 second mixer.

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

PA PCB

On the PA PCB, the signal is amplified then passed through the transmit/receive relay to the selected LPF.

The output from the LPF is passed via the VSWR detector to the RF output connector. From there it is connected by coaxial cable to the antenna.

Receive path

RF unit receive path

PA PCB

The receive signal from the antenna passes through a PA LPF to the transmit/receive relay. It is then passed to the receiver input on the RF/IF PCB.

RF/IF PCB

From the receiver input, the signal passes 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 44.545 MHz to produce an IF signal centred on 455 kHz.

The output from 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 signals.

Audio Interface PCB

The audio is passed to the Audio Interface PCB where it divides into two paths. One path is the unprocessed (raw) audio on one TDM channel. The other path is passed to the Application Processor PCB where the audio is enhanced (noise-reduced). This audio is then passed back to the Audio Interface PCB and becomes another TDM audio channel.

The audio is then passed to the junction box via the CIB.

Junction box receive path

The audio from the RF unit is decoded and either raw audio or noise-reduced audio (as selected by the user) is passed to the speaker.

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.

ALTERNATIVE TEXT

The reference oscillator (REF OSC) at 44.545 MHz is used as the second mixer LO. This 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 (USB) and 453.5 kHz (LSB) for the Tx MOD and Rx DEMOD circuits.

ALTERNATIVE TEXT

The reference oscillator at 14.848333 MHz is fed through a 44.5 MHz BPF to select the 3rd 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 (USB) and 453.5 kHz (LSB) for the Tx MOD and Rx DEMOD circuits.

Control and switching

Most functions of the transceiver are controlled by microprocessors.

A microprocessor in the handset reads the key strokes entered by the user. The keyed data is then passed to the junction box via the handset bus. The junction box sends data to the handset to update the display.

A microprocessor in the junction box transmits commands and data onto the CIB using the CAN protocol. The data rate on the bus is 125 kbps.

The RF unit receives the data, decodes it and then carries out the required function.

The RF unit contains five microprocessors located on four PCBs. Incoming data first goes to the main application microprocessor. This microprocessor then commands lower level microprocessors to carry out the required function.

Brief description (2011/2012 RF Unit)

This section contains the following topics:

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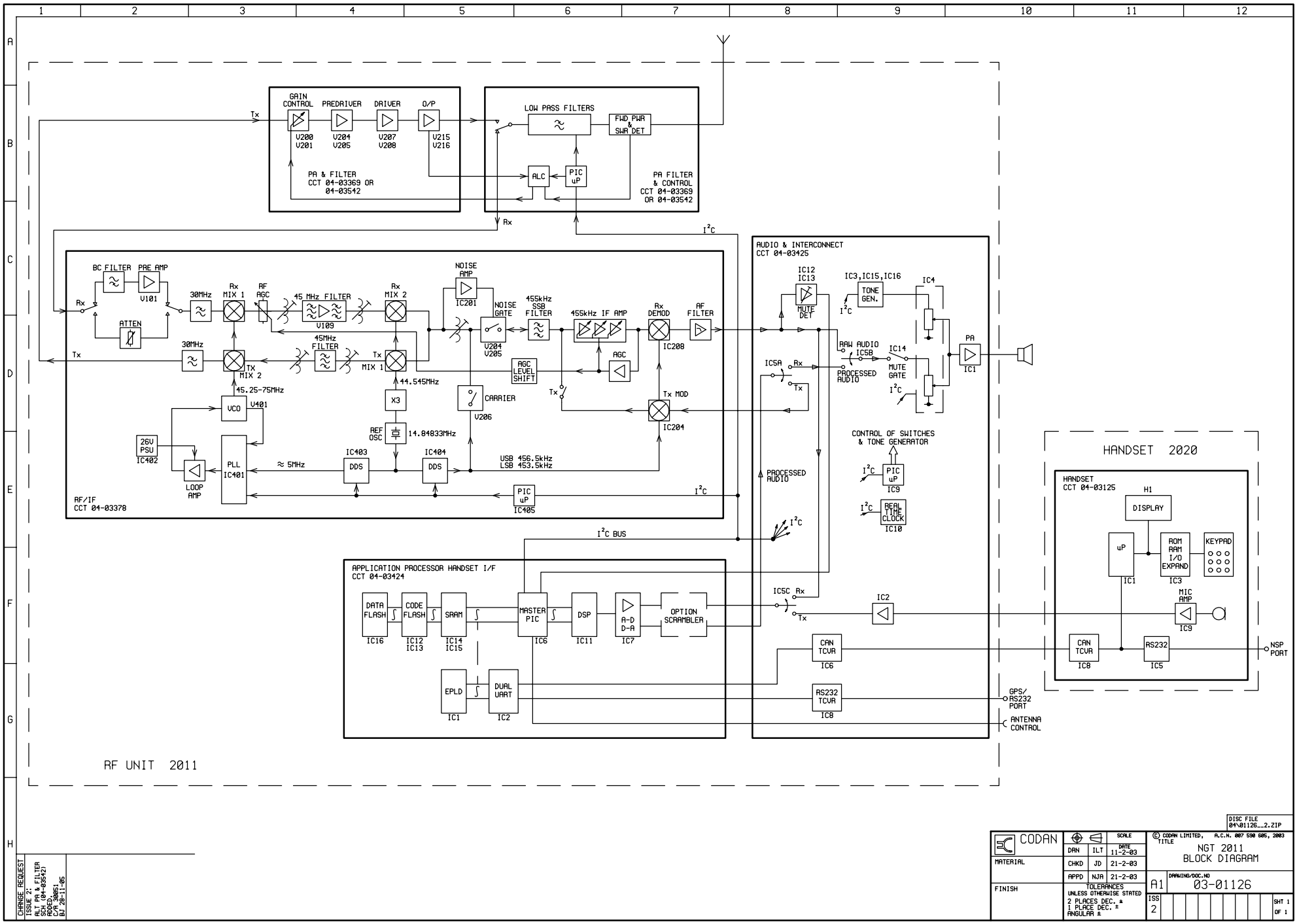


CHANGE REQUEST
ISSUE 2:
ALT PA & FILTER SCH (04-03542) ADDED
CVS 300S1
BJ 28-11-05

DISC FILE 04-01126...2.ZIP

CODAN

DRN	ILT	DATE 11-2-03
CHKD	JD	21-2-03
APPD	NJA	21-2-03

SCALE

MATERIAL

FINISH

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±
1 PLACE DEC. ±
ANGULAR ±

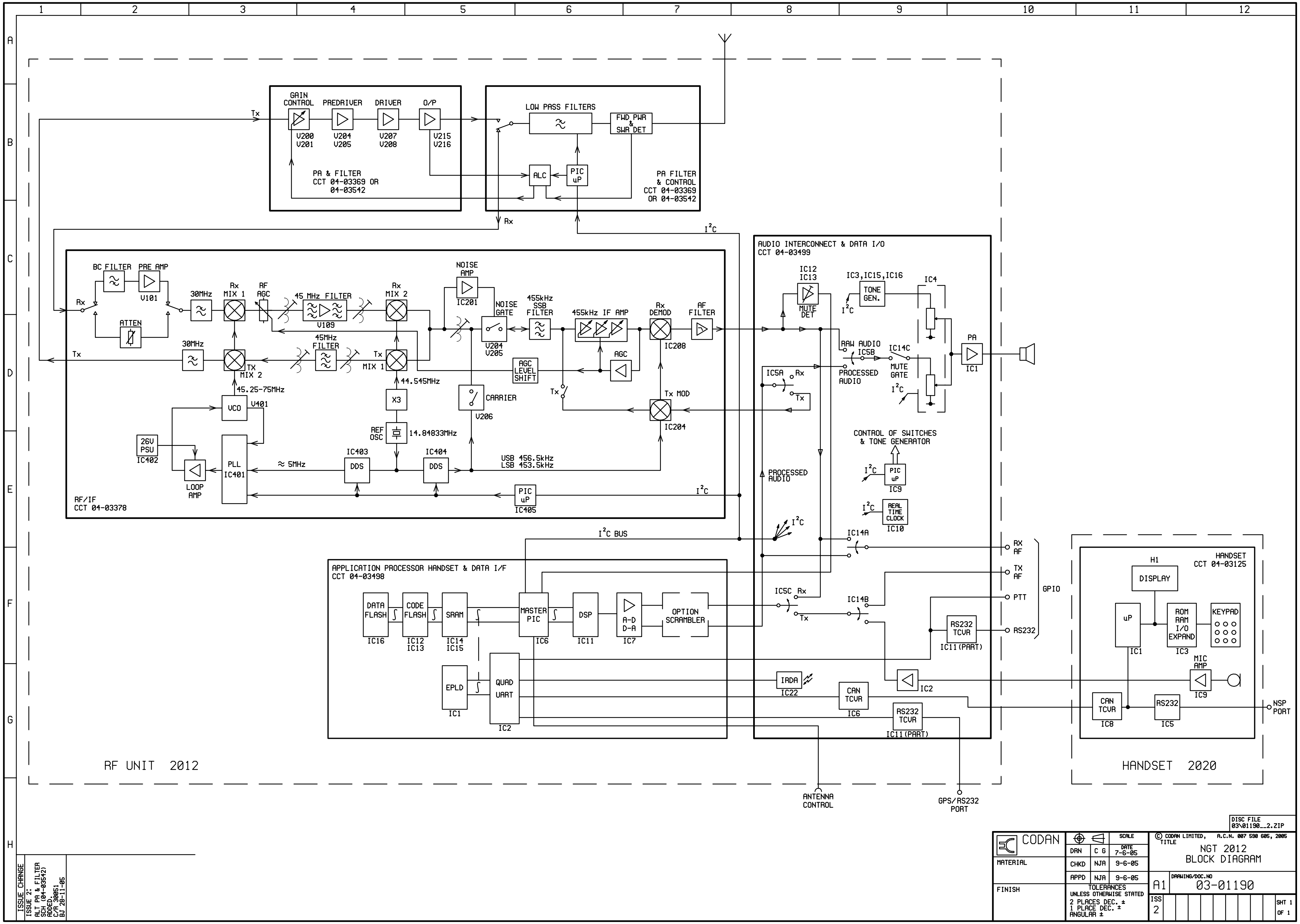
TITLE
NGT 2011
BLOCK DIAGRAM

A1

DRAWING/DOC.NO
03-01126

ISS 2

SHT 1 OF 1


GAIN CONTROL
PREDRIVER
DRIVER
O/P
Tx
V200 V201
V204 V205
V207 V208
V215 V216
PA & FILTER
CCT 04-03369 OR 04-03542
LOW PASS FILTERS
FWD PWR & SWR DET
ALC
PIC uP
PA FILTER & CONTROL
CCT 04-03369 OR 04-03542
Rx
I²C
BC FILTER
PRE AMP
V101
ATTEN
30MHz
Rx MIX 1
RF AGC
45 MHz FILTER
V109
Rx MIX 2
NOISE AMP
IC201
NOISE GATE
V204 V205
455kHz SSB FILTER
455kHz IF AMP
Rx DEMOD
IC208
AF FILTER
AGC
AGC LEVEL SHIFT
45MHz FILTER
Tx MIX 1
TX MIX 2
44.545MHz
45.25-75MHz
VCO
V401
X3
REF OSC
14.84833MHz
CARRIER
V206
Tx MOD
IC204
26V PSU
IC402
LOOP AMP
PLL IC401
≈ 5MHz
IC403 DDS
IC404 DDS
USB 456.5kHz
LSB 453.5kHz
PIC uP
IC405
RF/IF
CCT 04-03378
AUDIO INTERCONNECT & DATA I/O
CCT 04-03499
IC12 IC13
MUTE DET
IC3,IC15,IC16
TONE GEN.
IC4
PA
IC1
RAW AUDIO
IC5B
IC14C
PROCESSED AUDIO
MUTE GATE
IC5A
CONTROL OF SWITCHES & TONE GENERATOR
PIC uP
IC9
REAL TIME CLOCK
IC10
PROCESSED AUDIO
I²C BUS
IC14A
RX AF
TX AF
PTT
RS232
GPIO
IC5C
IC14B
RS232 TCVR
IC11(PART)
APPLICATION PROCESSOR HANDSET & DATA I/F
CCT 04-03498
DATA FLASH
IC16
CODE FLASH
IC12 IC13
SRAM
IC14 IC15
MASTER PIC
IC6
DSP
IC11
A-D D-A
IC7
OPTION SCRAMBLER
EPLD
IC1
QUAD UART
IC2
IRDA
IC22
CAN TCVR
IC6
RS232 TCVR
IC11(PART)
IC2
RF UNIT 2012
ANTENNA CONTROL
GPS/RS232 PORT
HANDSET
CCT 04-03125
H1
DISPLAY
uP
IC1
ROM RAM I/O EXPAND
IC3
KEYPAD
MIC AMP
IC9
CAN TCVR
IC8
RS232
IC5
NSP PORT
HANDSET 2020
DISC FILE
03\01190__2.ZIP
CODAN
© CODAN LIMITED, A.C.N. 007 590 605, 2005
TITLE
NGT 2012
BLOCK DIAGRAM
SCALE
DRN C G DATE 7-6-05
CHKD NJA 9-6-05
APPD NJA 9-6-05
MATERIAL
FINISH
TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±
1 PLACE DEC. ±
ANGULAR ±
A1
DRAWING/DOC.NO
03-01190
ISS 2
SHT 1 OF 1
ISSUE CHANGE
ISSUE 2:
ALT PA & FILTER
SCH (04-03542)
ADDED.
C/A 30051
BJ 28-11-05

General information

NOTE The information in this section should be read in conjunction with the appropriate block diagram for the RF unit. See below to determine which block diagram you should be viewing.

For RF unit type...	See...
2011	03-01126
2012	03-01190

The transceiver uses double conversion in both the Receive and Transmit modes. Only the 455 kHz sideband filter and the local oscillators VCO and REF OSC are common to both modes of operation.

The signal routing is determined by switching and control voltages according to the selected mode.

Transmit path

Handset transmit path

The microphone audio is amplified in the handset and passed to the RF unit via the handset and speaker connection cable.

RF unit transmit path

2011—Audio & Interconnect PCB

The audio from the microphone is buffered on the Audio & Interconnect PCB, then passed to the Application Processor Handset I/F 3 V PCB for compression to convert the signal to a fixed level. This signal is then returned to the Audio & Interconnect PCB where it is forwarded to the RF/IF PCB.

2012—Audio Interconnect & Data I/O PCB

The audio from the microphone is buffered on the Audio Interconnect & Data I/O PCB, then passed to the Application Processor Handset & Data I/F PCB for compression to convert the signal to a fixed level. This signal is then returned to the Audio Interconnect & Data I/O PCB where it is forwarded to the RF/IF PCB.

RF/IF PCB

The audio is mixed with the local oscillator to produce double sideband. It is then filtered by a 2.5 kHz sideband filter centred on 455 kHz, so that only the wanted sideband is passed to the first 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 second mixer.

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

PA PCB

On the PA PCB, the signal is amplified then passed through the transmit/receive relay to the selected LPF.

The output from the LPF is passed via the VSWR detector to the RF output connector. From there it is connected by coaxial cable to the antenna.

Receive path

RF unit receive path

PA PCB

The receive signal from the antenna passes through a PA LPF to the transmit/receive relay. It is then passed to the receiver input on the RF/IF PCB.

RF/IF PCB

From the receiver input, the signal passes via a selectable pre-amplifier 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 44.545 MHz to produce an IF signal centred on 455 kHz.

The output from 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.

2011—Audio & Interconnect PCB

The audio is passed to the Audio & Interconnect PCB where it divides into two paths. One path is the unprocessed (raw) audio. The other path is passed to the Application Processor Handset I/F 3 V PCB where the audio is enhanced (noise-reduced) before returning to the Audio & Interconnect PCB. The required audio path is switch-selected and passed to the audio amplifier, then to the speaker via the handset and speaker connection cable.

2012—Audio Interconnect & Data I/O PCB

The audio is passed to the Audio Interconnect & Data I/O PCB where it divides into two paths. One path is the unprocessed (raw) audio. The other path is passed to the Application Processor Handset & Data I/F PCB where the audio is enhanced (noise-reduced) before returning to the Audio Interconnect & Data I/O PCB. The required audio path is switch-selected and passed to the audio amplifier, then to the speaker via the handset and speaker connection cable.

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 3rd 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 (USB) and 453.5 kHz (LSB) for the Tx MOD and Rx DEMOD circuits.

Control and switching

Most functions of the transceiver are controlled by microprocessors.

A microprocessor in the handset reads the key strokes entered by the user. The keyed data is then passed to the RF unit via the differential handset bus. The RF unit sends data to the handset to update the display over the same bus.

The RF unit contains five microprocessors located on four PCBs. Incoming data first goes to the main application microprocessor. This microprocessor then commands lower level microprocessors to carry out the required function.

Interconnection diagrams and listed spares drawings

The drawings listed in this section are required during repair of an NGT series Transceiver.

Table 15: List of drawings

Title	Drawing number
Interconnection Diagram	
2010	04-03223
2030	04-03562
2011	04-03437
2012	04-03533
Handset—NGT Listed Spares	16-00111-001 (sheet 1)
Desktop Console—NGT Listed Spares	16-00111-002 (sheet 1)
Junction Box—NGT Listed Spares	16-00111-003 (sheet 1)
RF Unit—NGT Listed Spares	16-00111-004 (sheet 1)
	16-00111-004 (sheet 2)
RF Unit—NGT Listed Spares MS1253	16-00114 (sheet 1)
	16-00114 (sheet 2)

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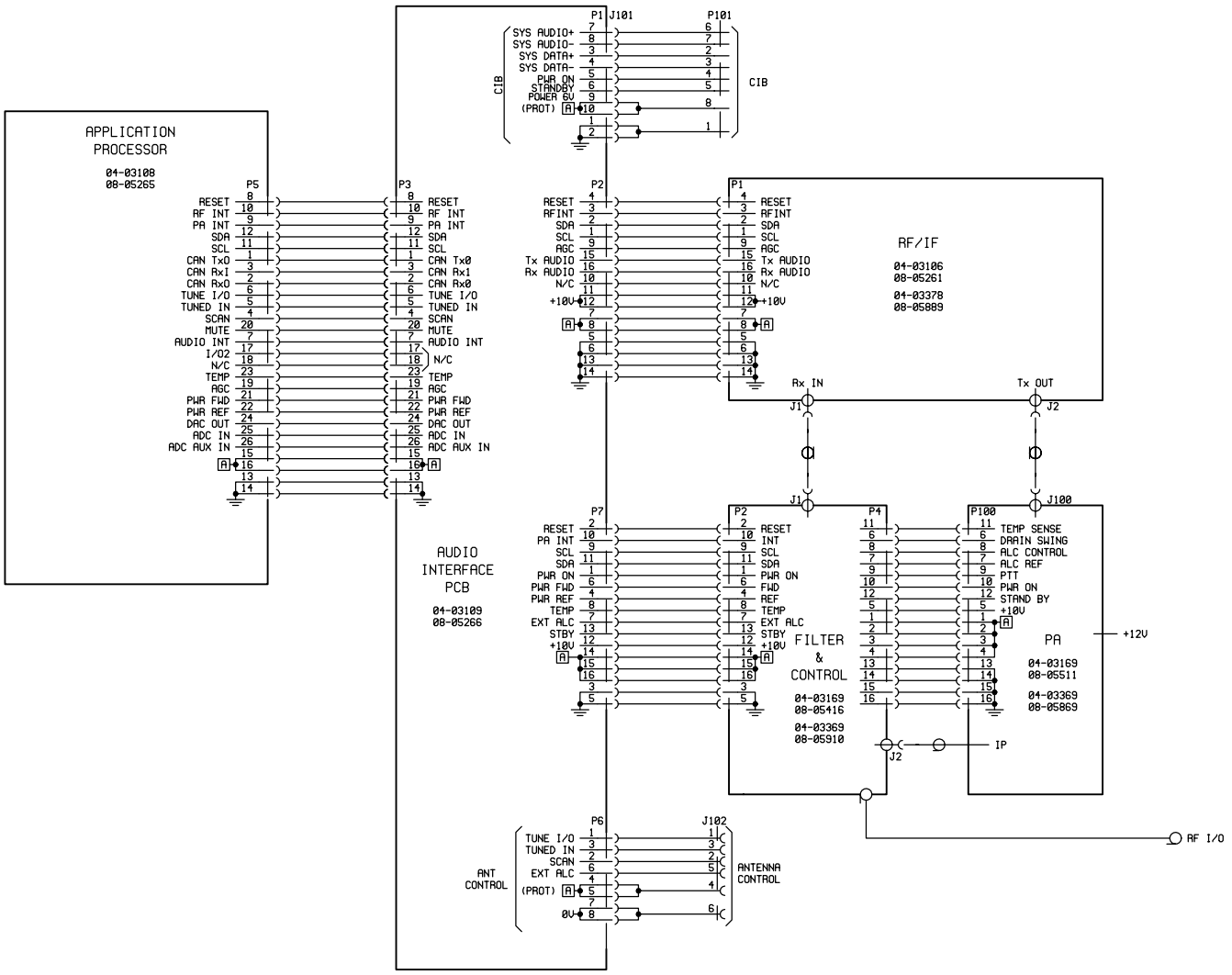


ISSUE CHANGE

ISSUE 2:
VARIOUS TEXT CHANGES.
C/A 26227
NJA 2-8-99

ISSUE 3
PA -08 WAS 08-05415-001
C/A 26926
26-04-01 NJA

ISSUE 4:
SCH & ASSY DETAILS FOR ALT. RF/IF, FILTER & CONTROL & PA ADDED.
C/A 27237
NJA 24-7-02

FILE NAME
04\03223_-4.*

CODAN

MATERIAL

FINISH

DRN	C G	DATE 14-5-98
CHKD	NJA	8-7-99
APPD	NJA	8-7-99

SCALE

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±
1 PLACE DEC. ±
ANGULAR ±

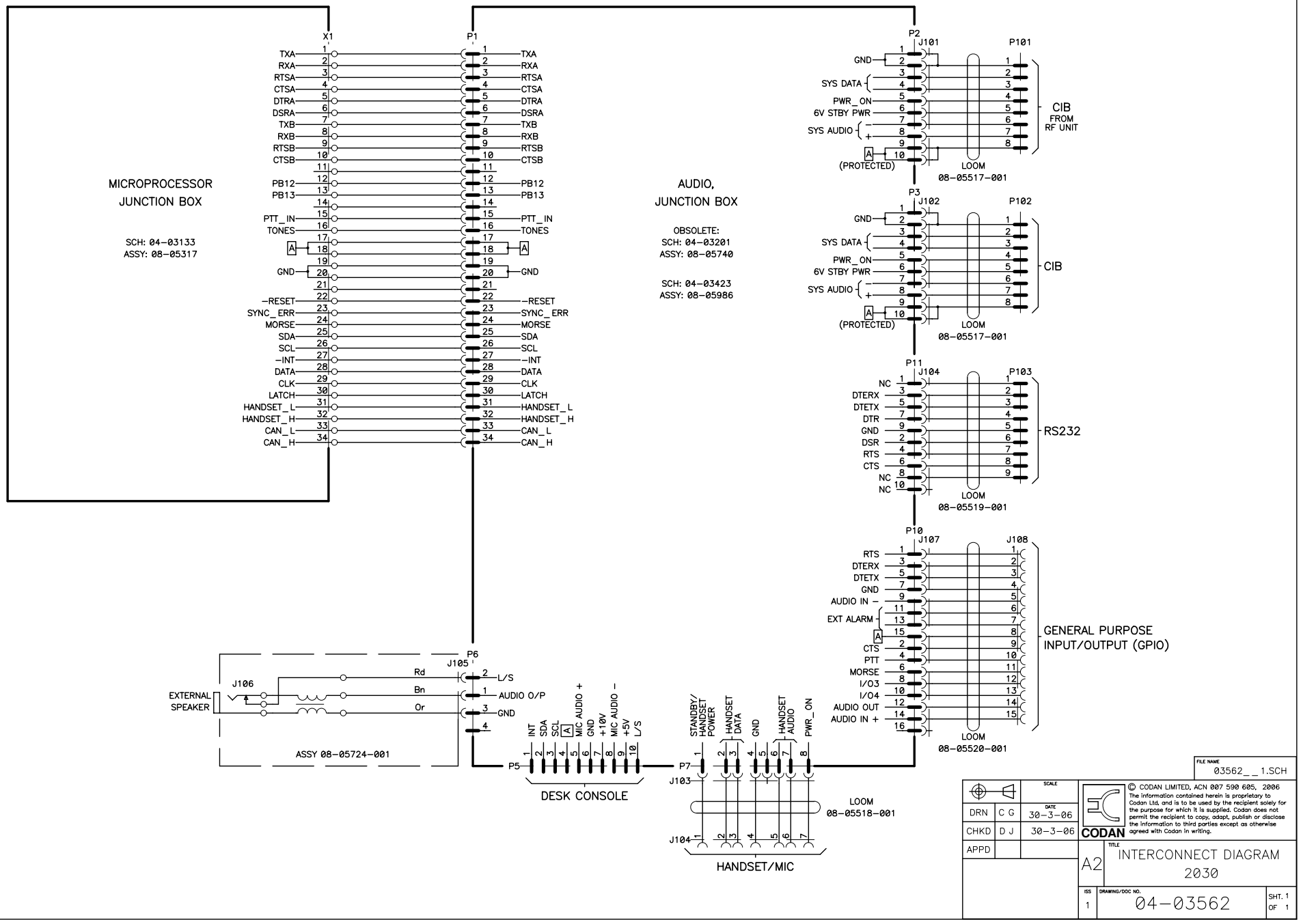
TITLE
2010 INTERCONNECTION DIAGRAM

A1

DRAWING/DOC.NO
04-03223

ISS 1 2 3 4

SHT 1 OF 1


MICROPROCESSOR
JUNCTION BOX
SCH: 04-03133
ASSY: 08-05317
X1
P1
TXA
RXA
RTSA
CTSA
DTRA
DSRA
TXB
RXB
RTSB
CTSB
PB12
PB13
PTT_IN
TONES
GND
-RESET
SYNC_ERR
MORSE
SDA
SCL
-INT
DATA
CLK
LATCH
HANDSET_L
HANDSET_H
CAN_L
CAN_H
AUDIO,
JUNCTION BOX
OBSOLETE:
SCH: 04-03201
ASSY: 08-05740
SCH: 04-03423
ASSY: 08-05986
P2
J101
P101
SYS DATA
PWR_ON
6V STBY PWR
SYS AUDIO
(PROTECTED)
LOOM
08-05517-001
CIB
FROM
RF UNIT
P3
J102
P102
CIB
P11
J104
P103
NC
DTERX
DTETX
DTR
DSR
RTS
CTS
RS232
08-05519-001
P10
J107
J108
AUDIO IN -
EXT ALARM
PTT
MORSE
I/O3
I/O4
AUDIO OUT
AUDIO IN +
GENERAL PURPOSE
INPUT/OUTPUT (GPIO)
08-05520-001
P6
J105
J106
EXTERNAL
SPEAKER
Rd
Bn
Or
L/S
AUDIO O/P
ASSY 08-05724-001
P5
INT
SDA
SCL
MIC AUDIO +
+10V
MIC AUDIO -
+5V
DESK CONSOLE
P7
J103
STANDBY/
HANDSET
POWER
HANDSET
DATA
HANDSET
AUDIO
PWR_ON
LOOM
08-05518-001
J104
HANDSET/MIC
FILE NAME
03562__1.SCH
SCALE
DRN
C G
DATE
30-3-06
CHKD
D J
30-3-06
APPD
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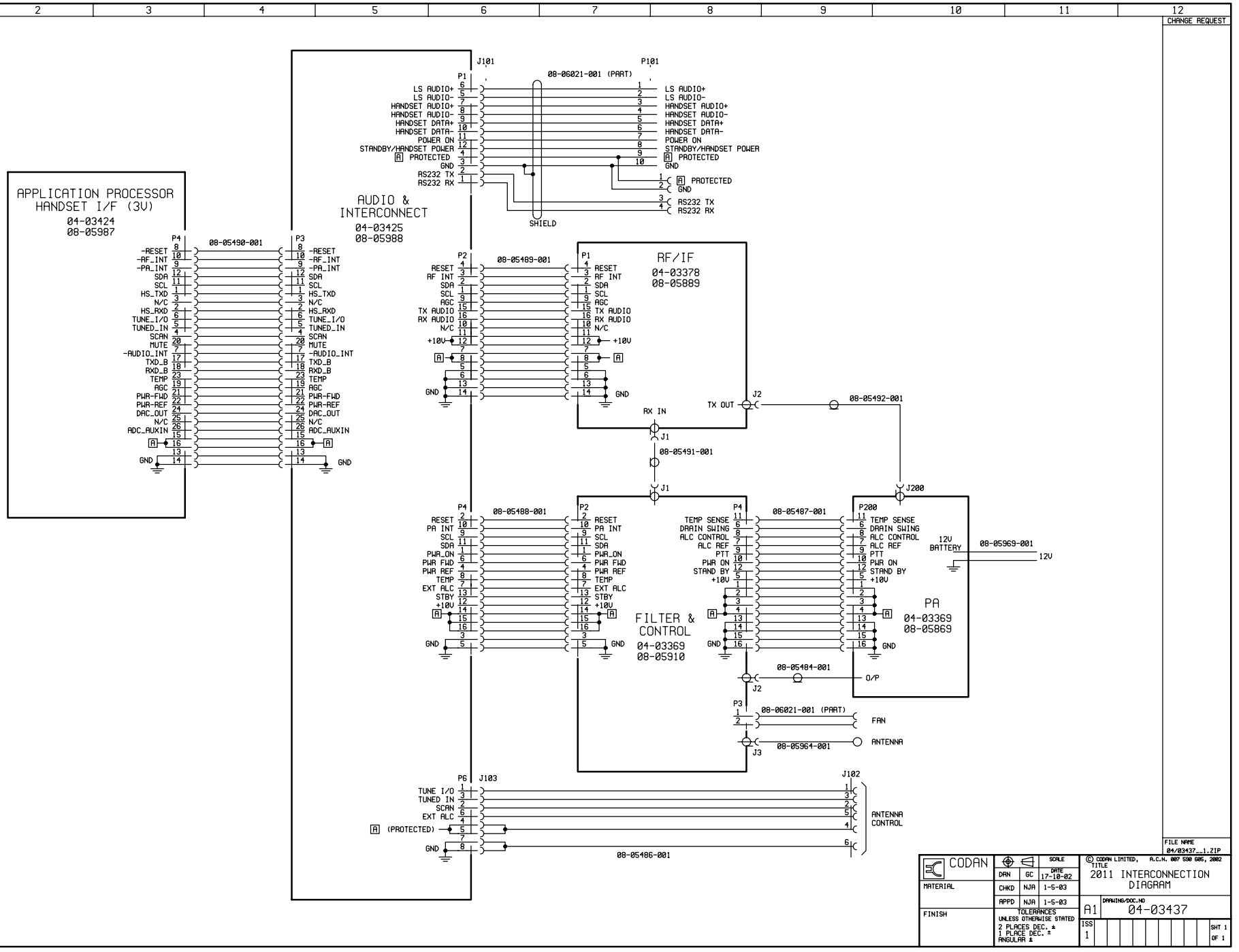
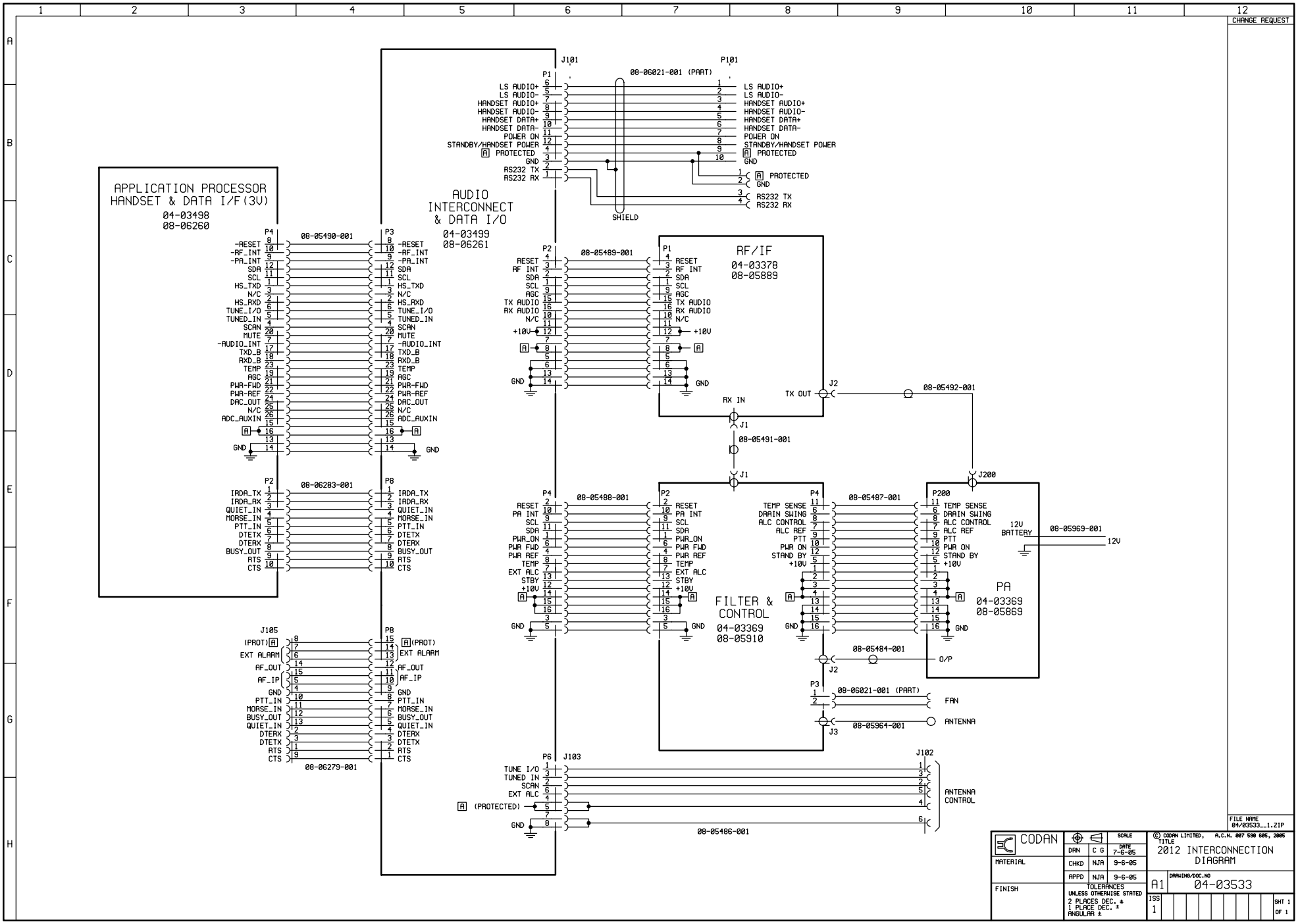
CODAN
A2
TITLE
INTERCONNECT DIAGRAM
2030
ISS
1
DRAWING/DOC NO.
04-03562
SHT. 1
OF 1


CHANGE REQUEST
APPLICATION PROCESSOR
HANDSET I/F (3V)
04-03424
08-05987
AUDIO &
INTERCONNECT
04-03425
08-05988
J101
P101
08-06021-001 (PART)
LS AUDIO+
LS AUDIO-
HANDSET AUDIO+
HANDSET AUDIO-
HANDSET DATA+
HANDSET DATA-
POWER ON
STANDBY/HANDSET POWER
PROTECTED
GND
RS232 TX
RS232 RX
SHIELD
08-05490-001
-RESET
-RF_INT
-PA_INT
SDA
SCL
HS_TXD
N/C
HS_RXD
TUNE_I/O
TUNED_IN
SCAN
MUTE
-AUDIO_INT
TXD_B
RXD_B
TEMP
AGC
PWR-FWD
PWR-REF
DAC_OUT
ADC_AUXIN
08-05489-001
RF/IF
04-03378
08-05889
RF INT
TX AUDIO
RX AUDIO
+10V
TX OUT
RX IN
J2
J1
08-05492-001
08-05491-001
08-05488-001
PA INT
PWR_ON
PWR FWD
PWR REF
EXT ALC
STBY
08-05487-001
TEMP SENSE
DRAIN SWING
ALC CONTROL
ALC REF
PTT
PWR ON
STAND BY
FILTER &
CONTROL
04-03369
08-05910
J200
P200
12V
BATTERY
08-05969-001
PA
04-03369
08-05869
08-05484-001
O/P
08-06021-001 (PART)
FAN
ANTENNA
08-05964-001
J3
P6
J103
J102
TUNE I/O
TUNED IN
SCAN
EXT ALC
(PROTECTED)
ANTENNA
CONTROL
08-05486-001
FILE NAME
04/03437__1.ZIP
CODAN
MATERIAL
FINISH
SCALE
DRN GC DATE 17-10-02
CHKD NJA 1-5-03
APPD NJA 1-5-03
TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±
1 PLACE DEC. ±
ANGULAR ±
© CODAN LIMITED, A.C.N. 007 590 605, 2002
TITLE
2011 INTERCONNECTION
DIAGRAM
A1
DRAWING/DOC.NO
04-03437
ISS 1
SHT 1 OF 1



CHANGE REQUEST

FILE NAME
04/03533__1.ZIP

CODAN

MATERIAL

FINISH

DRN	C G	DATE	7-6-05
CHKD	NJA		9-6-05
APPD	NJA		9-6-05

SCALE

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±
1 PLACE DEC. ±
ANGULAR ±

TITLE
2012 INTERCONNECTION DIAGRAM

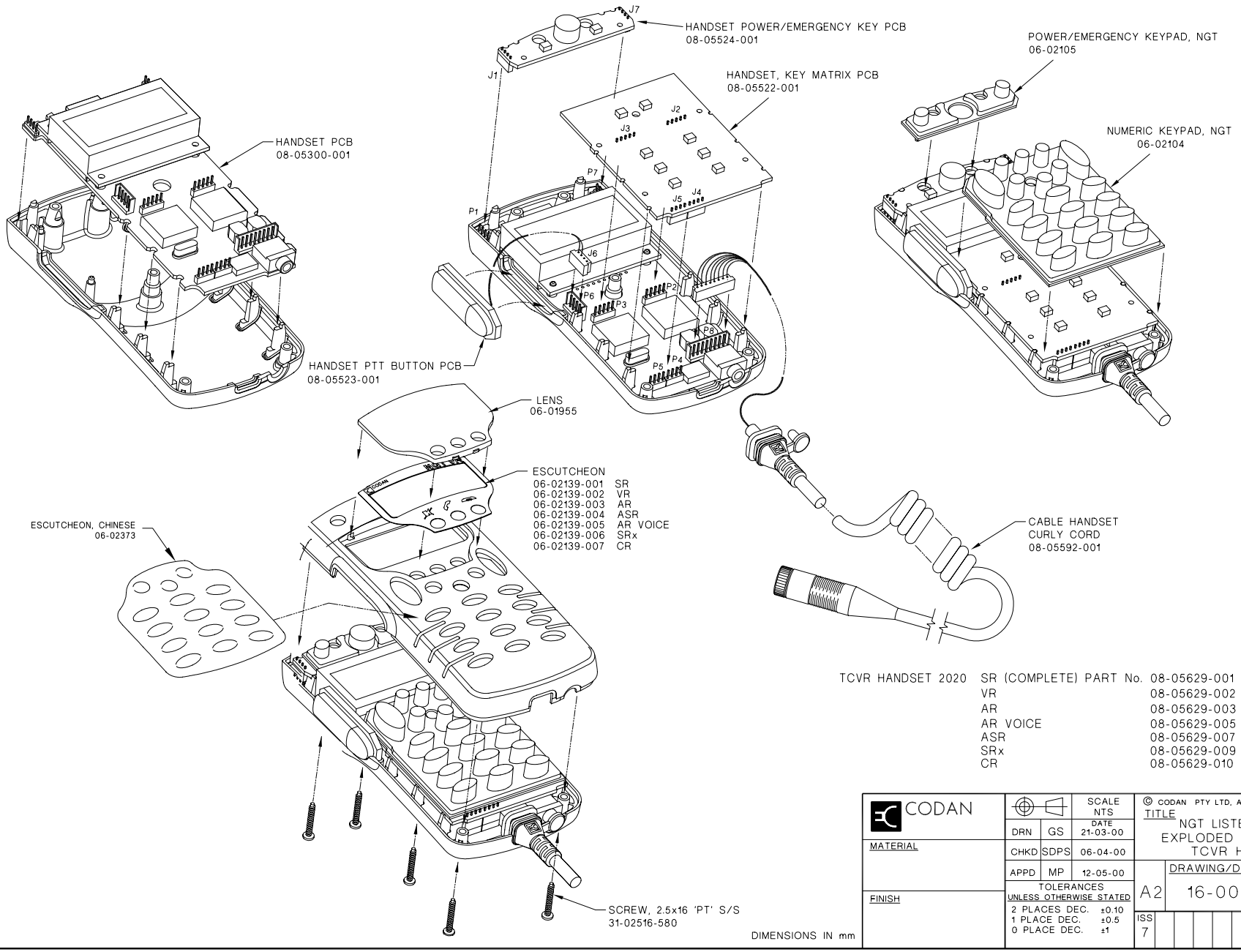
A1

DRAWING/DOC.NO
04-03533

ISS
1

SHT 1
OF 1

DO NOT SCALE



TCVR HANDSET 2020

SR (COMPLETE) PART No.		08-05629-001
VR		08-05629-002
AR		08-05629-003
AR VOICE		08-05629-005
ASR		08-05629-007
SRx		08-05629-009
CR		08-05629-010

DIMENSIONS IN mm

ISSUE 2
MINOR ALTERATIONS & CORRECTIONS, SHT 2 ADDED.
C/R 27162
22-2-02 CAM

ISSUE 3
KEYPAD DETAIL 06-01918 DELETED NUMERIC & PWR/EMERG KEYPADS ADDED
C/R 27341

ASSEMBLY CHANGED TO SHOW CLEAR LENS & ESCUTCHEON VARIANTS.
C/R 27389

ISSUE 4
SHT 2 REMOVED
C/R 27455
12-03-03 CAM

ISSUE 5
VARIANTS 5&7 ADDED
ESCUTCHEON ASR WAS VR MOBILE
C/R 27599
RML 13-10-03

ISSUE 6
SRx VARIANT ADDED
C/R 28471
RM 30-06-2005

ISSUE 7:
CR VARIANT ADDED.
CR ESCUTCHEON ADDED.
C/R 30211
D.Jones 15-3-06

FILE No.
16\00111X_M.DWG

CODAN

MATERIAL

FINISH

SCALE NTS

DRN	GS	DATE 21-03-00
CHKD	SDPS	06-04-00
APPD	MP	12-05-00

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

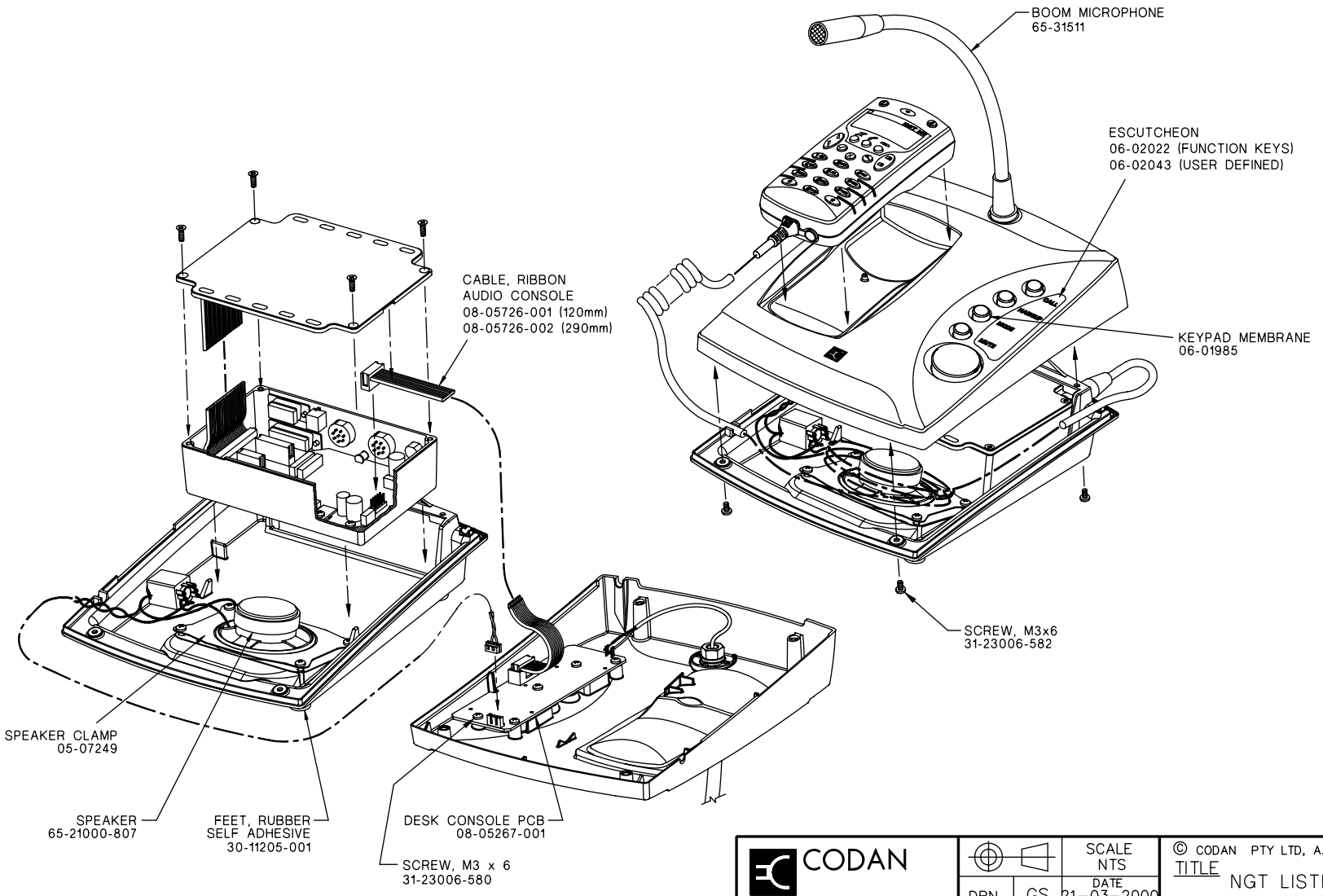
TITLE
NGT LISTED SPARES
EXPLODED PARTS VIEW
TCVR HANDSET

DRAWING/DOC NO.
A2 16-00111-001

ISS 7

SHT. 1 OF 1

DO NOT SCALE



DIMENSIONS IN mm

ISSUE B:
JB LID ATTACHING SCREWS ADDED
REF ALSO SH -003
C/R 26555
MP 10-05-00

ISSUE 2:
SPEAKER STOCK No. WAS 65-21000-805
PICTORIAL UPDATE TO SPEAKER
C/R
AJC 01-11-2001

ISSUE 3
MINOR CORRECTIONS & ALTERATIONS, SHT 2 ADDED.
C/R 27145
20-2-02 CAM

ISSUE 4
SHT 2 REMOVED.
C/R 27455
12-03-03 CAM

ISSUE 5
NOTE 1 DELETED
PCB SCREW DETAILS ADDED,
CONSOLE SCREWS WERE 31-23006-580
C/R 28471
RM 30-06-2005

FILE No.
16\00111XAL.DWG

CODAN

MATERIAL

FINISH

SCALE NTS

		DATE
DRN	GS	21-03-2000
CHKD	SDPS	06-04-2000
APPD	MP	12-05-2000

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
NGT LISTED SPARES
EXPLODED PARTS VIEW
DESK CONSOLE

A3

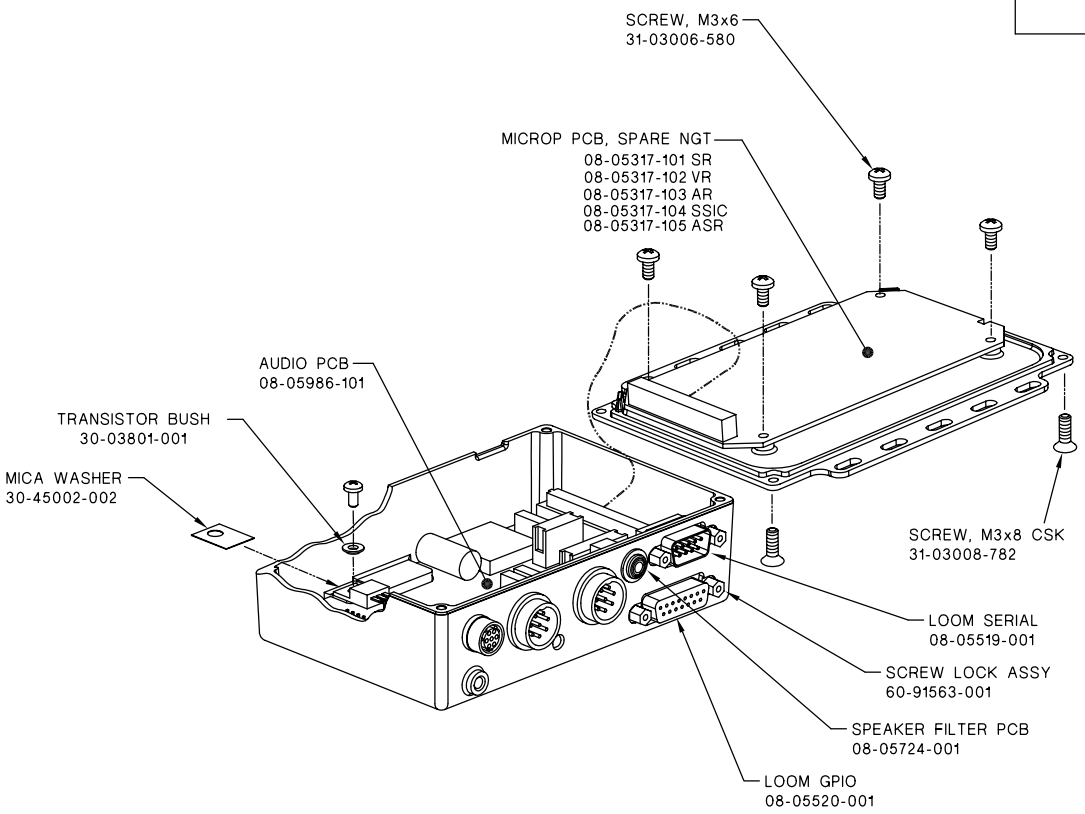
DRAWING/DOC NO.
16-00111-002

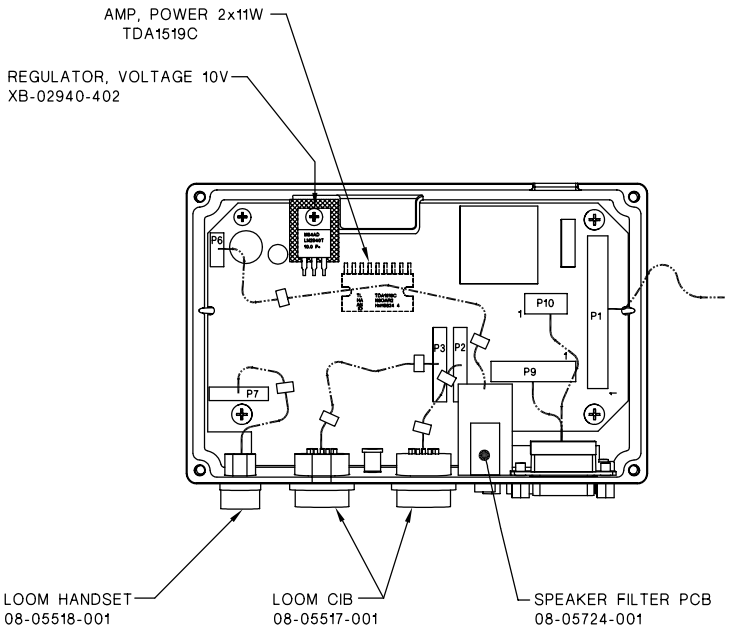
ISS 5

SHT. 1 OF 1

DO NOT SCALE

ISSUE 6:	ISSUE 4:	ISSUE 2:	ISSUE B:
AUDIO PCB WAS 08-05986-001 C/R 27934 KMWee 20-4-04	SSIC REFS 08-05317-104 & 08-05630-005 ADDED SHT 2 REMOVED. C/R 27455 12-03-03 CAM	MINOR ALTERATIONS & CORRECTIONS. SHT 2 ADDED. C/R 27162 22-2-02 CAM	MICA WASHER DETAILS ADDED JB LID ATTACHING SCREWS ADDED M3x6 SCREWS WERE M3x8 SCREW LOCK ASSY DETAILS ADDED REF ALSO SH -002 C/R 26555 MP 10-05-00
	ISSUE 5:	ISSUE 3:	
	ASR REFS 08-05317-105 & 08-05630-007 ADDED C/R 27599 RML 13-10-03	UPDATED TO REFLECT NEW AUDIO BOARD. C/R 27407 17-12-02 JD	





FILE No.
16\00111XAK.DWG

JUNCTION BOX 2030

SR (COMPLETE)	PART No.	08-05630-001
VR		08-05630-002
AR		08-05630-003
RCJB		08-05630-004
SSIC		08-05630-005
ASR		08-05630-007

DIMENSIONS IN mm

CODAN

MATERIAL

FINISH

		SCALE NTS
DRN	GS	DATE 31-03-00
CHKD	SDPS	06-04-00
APPD	MP	12-05-00

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

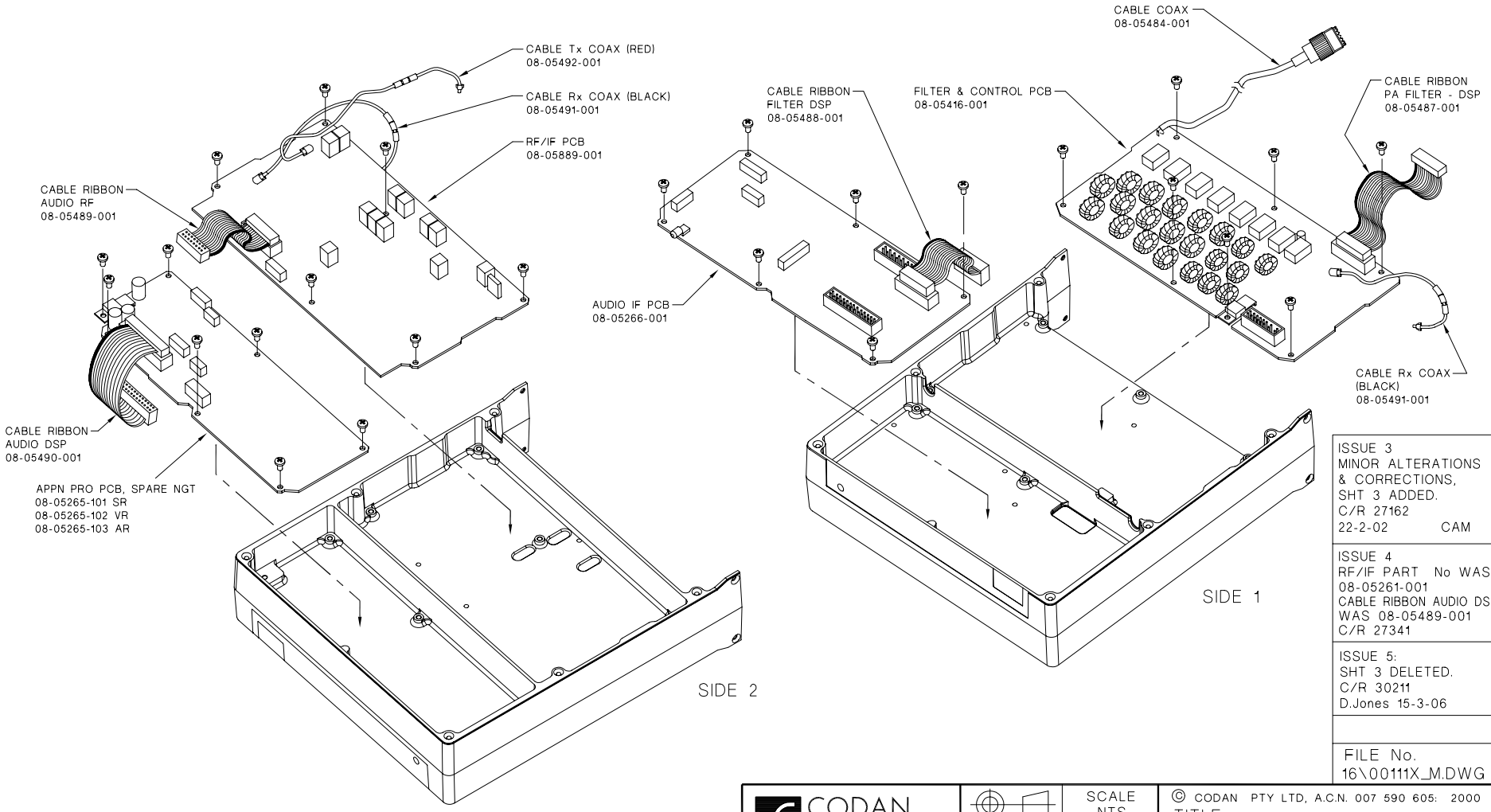
TITLE
NGT LISTED SPARES
LOCATION & IDENTIFICATION
JUNCTION BOX

A3 DRAWING/DOC NO. 16-00111-003

ISS 6

SHT. 1 OF 1

DO NOT SCALE



ISSUE 3 MINOR ALTERATIONS & CORRECTIONS, SHT 3 ADDED. C/R 27162 22-2-02 CAM
ISSUE 4 RF/IF PART No WAS 08-05261-001 CABLE RIBBON AUDIO DSP WAS 08-05489-001 C/R 27341
ISSUE 5: SHT 3 DELETED. C/R 30211 D.Jones 15-3-06
FILE No. 16\00111X_M.DWG

RF UNIT 2011 SR (COMPLETE) PART No. 08-05628-001
VR 08-05628-002
AR 08-05628-003

DIMENSIONS IN mm

CODAN

MATERIAL

FINISH

		SCALE NTS
DRN	GS	DATE 21-03-00
CHKD	SDPS	06-04-00
APPD	MP	12-05-00

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
NGT LISTED SPARES
EXPLODED PARTS VIEW
TCVR RF UNIT

A3

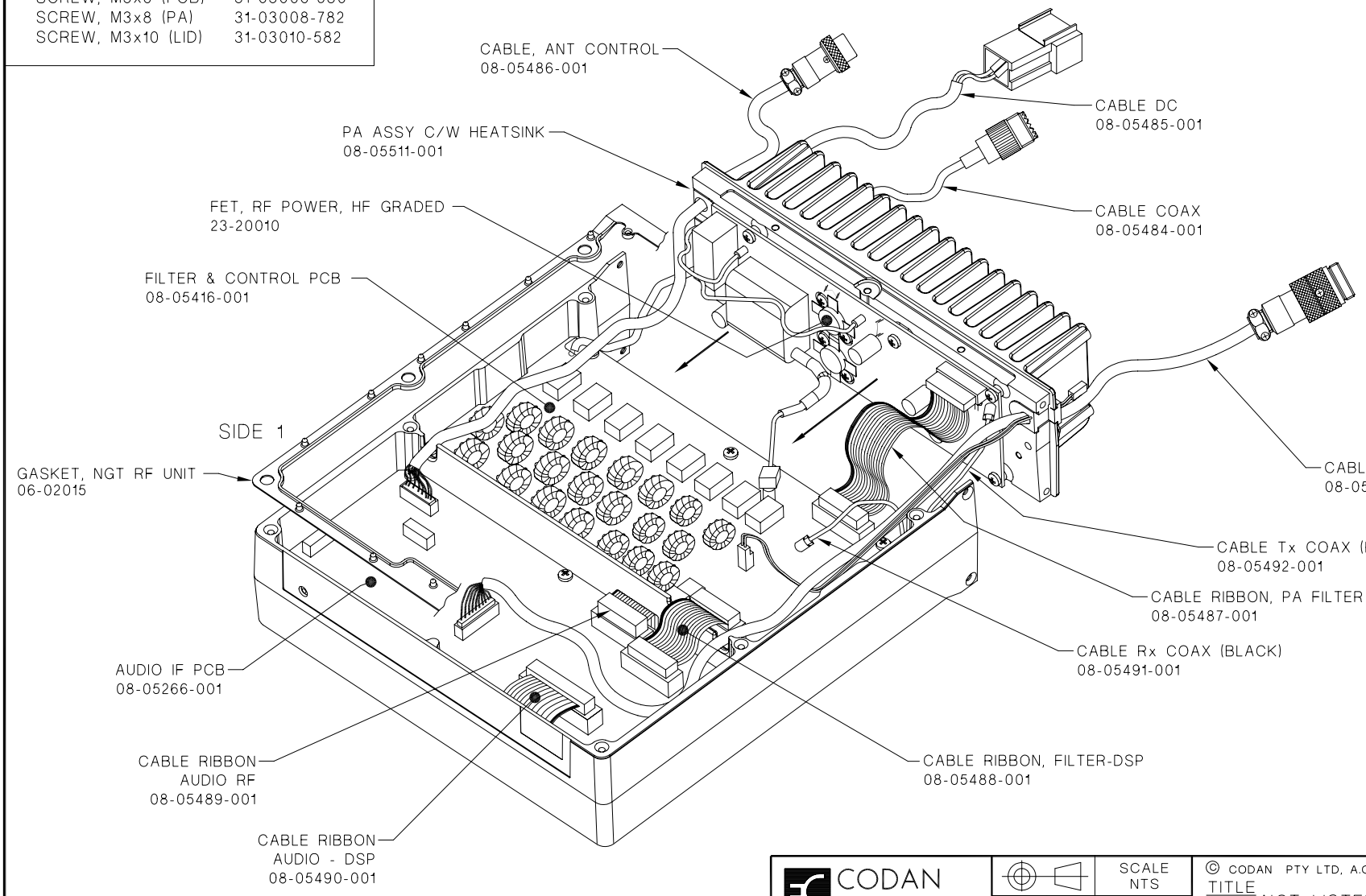
DRAWING/DOC NO.
16-00111-004

ISS 5

SHT. 1 OF 2

SCREW, M3x6 (PCB)	31-03006-580
SCREW, M3x8 (PA)	31-03008-782
SCREW, M3x10 (LID)	31-03010-582

DO NOT SCALE



ISSUE 2:
PCB DESCR "AUDIO IF PCB, 08-05266-001" WAS "APPN PRO PCB, 08-05265-101 SR, -102 VR, -103 AR"
C/R 26704
MP 29-08-2000

ISSUE 3
MINOR ALTERATIONS & CORRECTIONS.
SHT 3 ADDED.
C/R 27162
22-2-02 CAM

ISSUE 4
REFER TO SHEETS 1 & 3
C/R 27341

ISSUE 5:
SHT 3 DELETED.
C/R 30211
D.Jones 15-3-06

FILE No.
16\00111X_M.DWG

DIMENSIONS IN mm

CODAN

MATERIAL

FINISH

		SCALE NTS
DRN	GS	DATE 21-03-00
CHKD	SDPS	06-04-00
APPD	MP	12-05-00

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
NGT LISTED SPARES
EXPLODED PARTS VIEW
TCVR RF UNIT

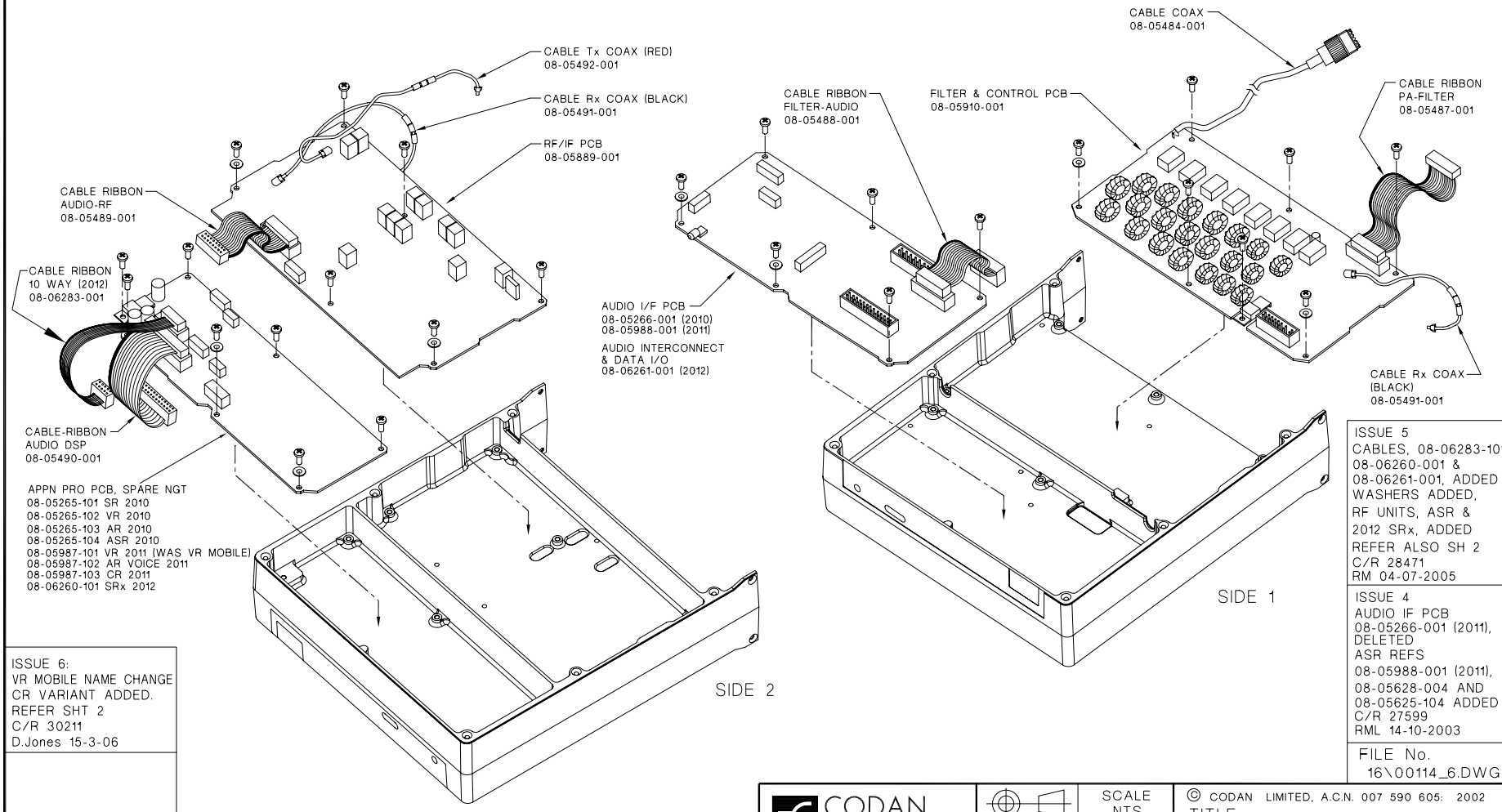
A3

DRAWING/DOC NO.
16-00111-004

ISS 5

SHT. 2 OF 2

DO NOT SCALE



ISSUE 5
CABLES, 08-06283-101, 08-06260-001 & 08-06261-001, ADDED
WASHERS ADDED,
RF UNITS, ASR & 2012 SRx, ADDED
REFER ALSO SH 2
C/R 28471
RM 04-07-2005

ISSUE 4
AUDIO IF PCB 08-05266-001 (2011), DELETED
ASR REFS 08-05988-001 (2011), 08-05628-004 AND 08-05625-104 ADDED
C/R 27599
RML 14-10-2003

FILE No.
16\00114_6.DWG

ISSUE 6:
VR MOBILE NAME CHANGE
CR VARIANT ADDED.
REFER SHT 2
C/R 30211
D.Jones 15-3-06

RF UNIT 2010	SR (COMPLETE) PART No.	08-05628-001
	VR	08-05628-002
	AR	08-05628-003
	ASR	08-05628-007
2011	VR (WAS VR MOBILE)	08-05628-004
	AR VOICE	08-05628-005
	CR	08-05628-010
2012	SRx	08-05628-009

CODAN

MATERIAL

FINISH

SCALE NTS

DRN	AP	DATE 02-07-02
CHKD	CAM	03-07-02
APPD	CAM	04-07-02

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
NGT LISTED SPARES
MS1253 RFU

A3

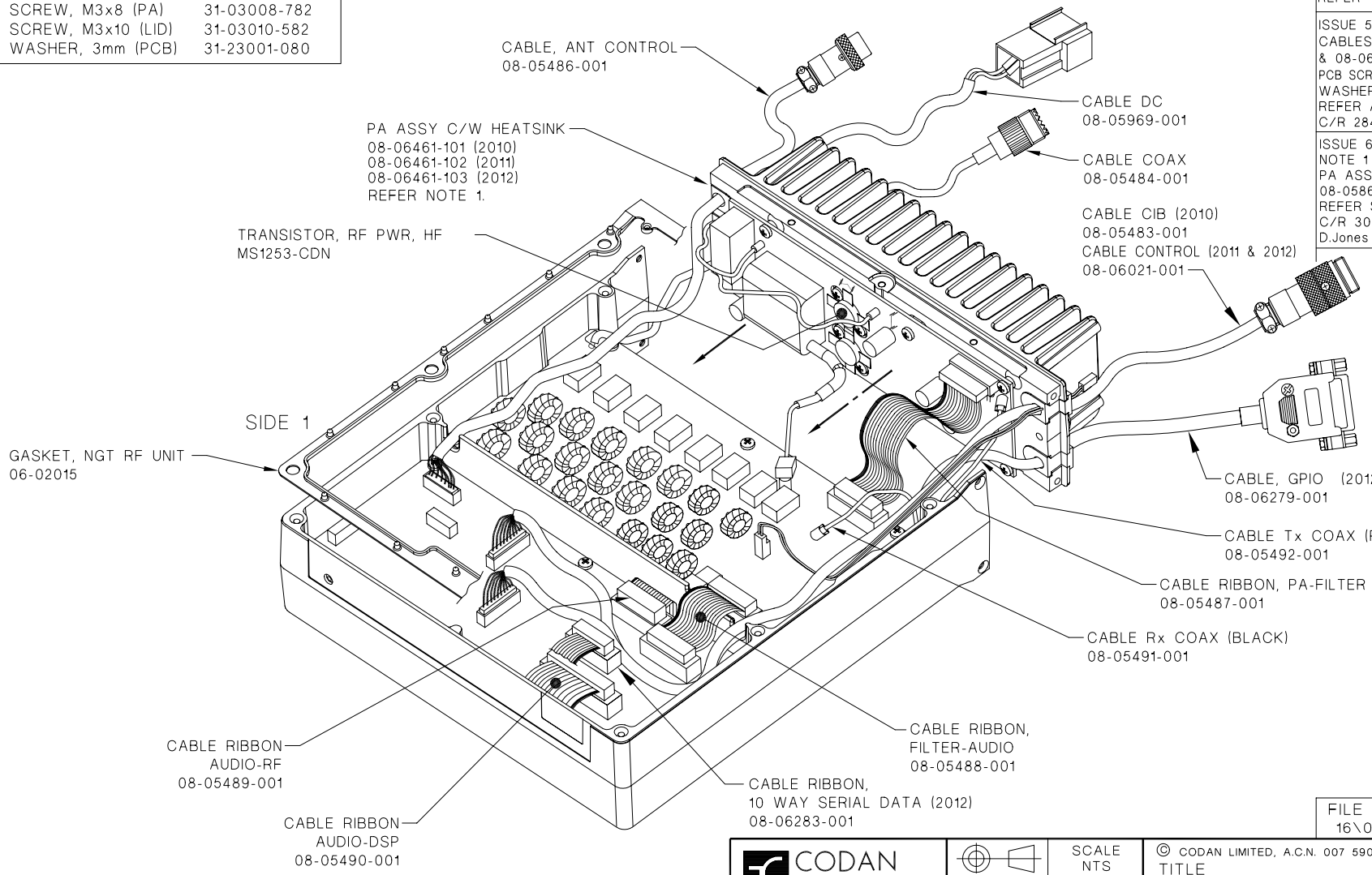
DRAWING/DOC NO.
16-00114

ISS 6

SHT. 1 OF 2

SCREW, M3x8 (PCB)	31-03008-580
SCREW, M3x8 (PA)	31-03008-782
SCREW, M3x10 (LID)	31-03010-582
WASHER, 3mm (PCB)	31-23001-080

DO NOT SCALE



ISSUE 4
REFER TO SH1

ISSUE 5
CABLES, 08-06279-001 & 08-06283-001,
PCB SCREWS WERE 6 LG,
WASHERS ADDED,
REFER ALSO SH 1
C/R 28471

ISSUE 6:
NOTE 1 ADDED.
PA ASSY ETC WAS 08-05869-XXX.
REFER SHT 1
C/R 30211
D.Jones 15-3-06

NOTES:
1. 08-06461-XXX REPLACES 08-05869-XXX.

DIMENSIONS IN mm

FILE No.
16\00114_6.DWG

CODAN

MATERIAL

FINISH

SCALE NTS

		DATE
DRN	AP	02-07-02
CHKD	CAM	03-07-02
APPD	CAM	04-07-02

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
NGT LISTED SPARES
MS1253 RFU

A3

DRAWING/DOC NO.
16-00114

ISS 6

SHT. 2 OF 2

This section contains the following topics:

NOTE

The functional description should be read in conjunction with the appropriate brief description (see page 33, *Brief description (2010 RF Unit with 2030 Junction Box)* or page 41, *Brief description (2011/2012 RF Unit)*).

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Figure 19: Handset PCB (08-05300-001)

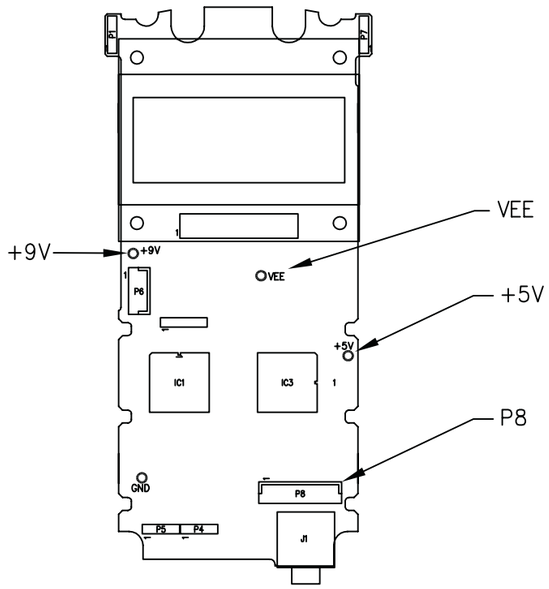

Figure 20: Audio PCB (08-05470-001)

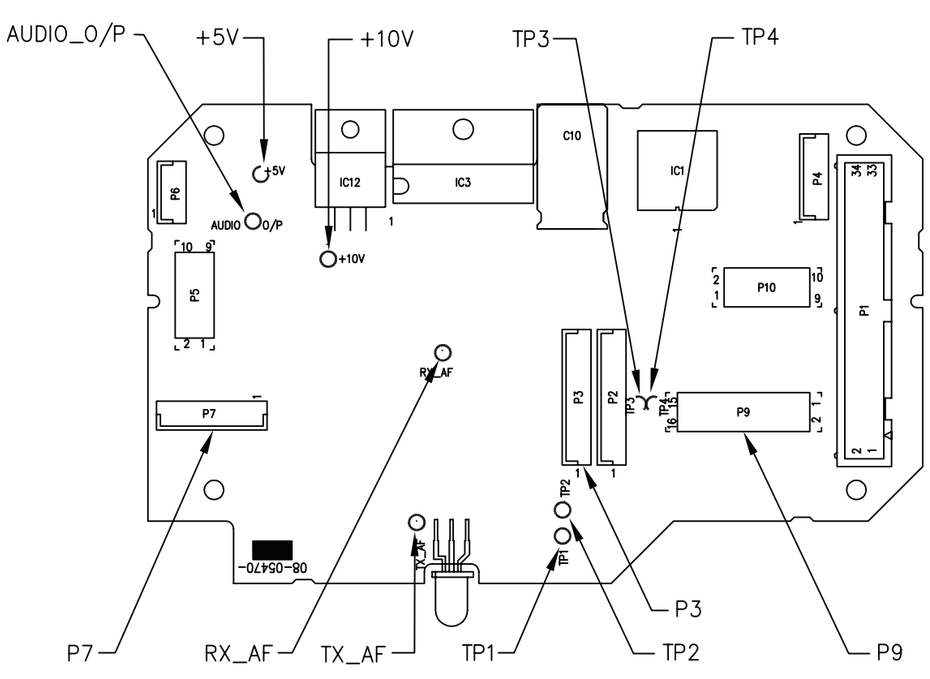

Figure 21: Audio PCB (08-05986-001)

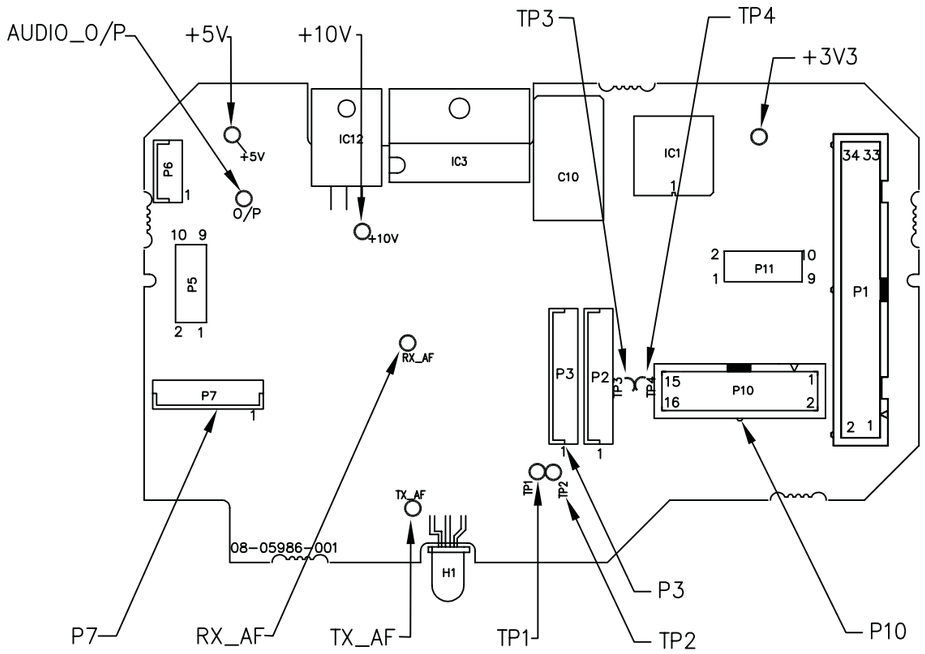

Figure 22: Microprocessor PCB (08-05317-001)

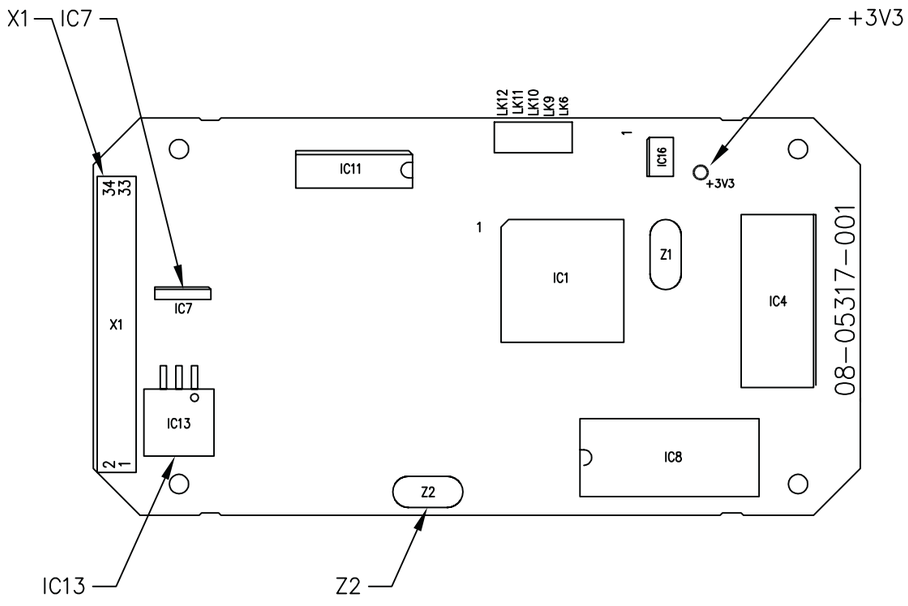

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Figure 23: Audio Interface PCB (08-05266-001)

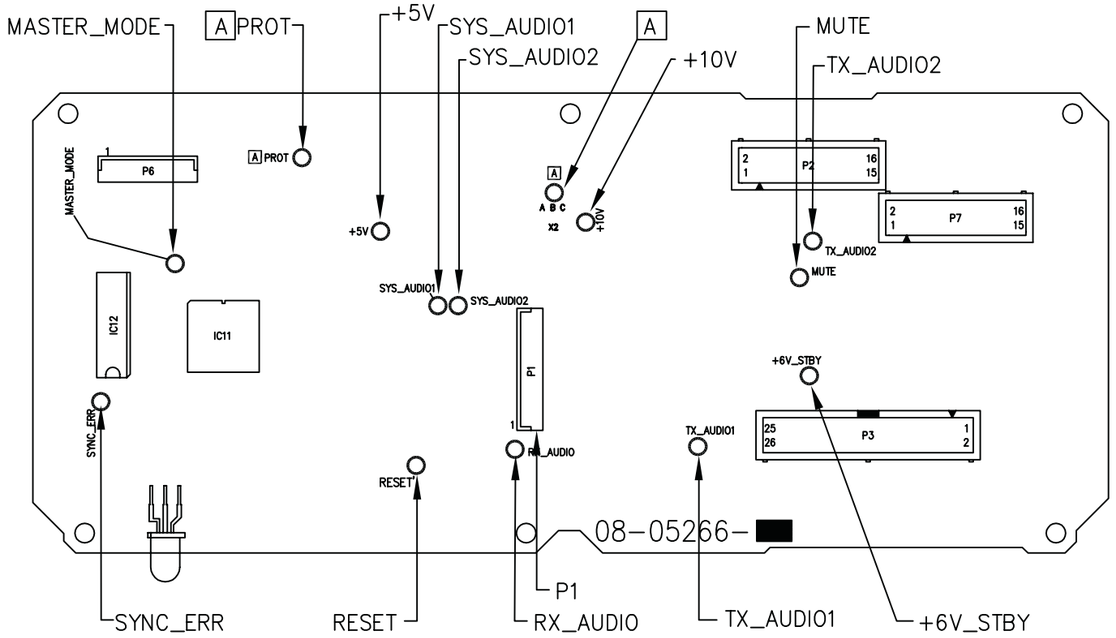

Figure 24: Audio & Interconnect PCB (08-05988-001)

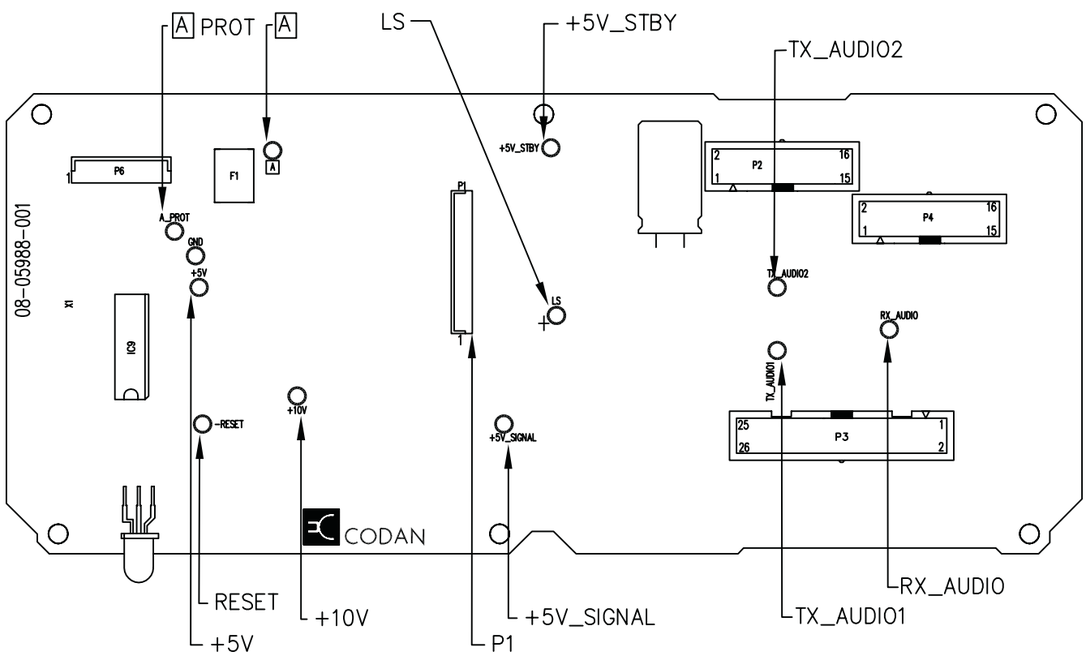

Figure 25: Audio Interconnect & Data I/O PCB (08-06261-001)

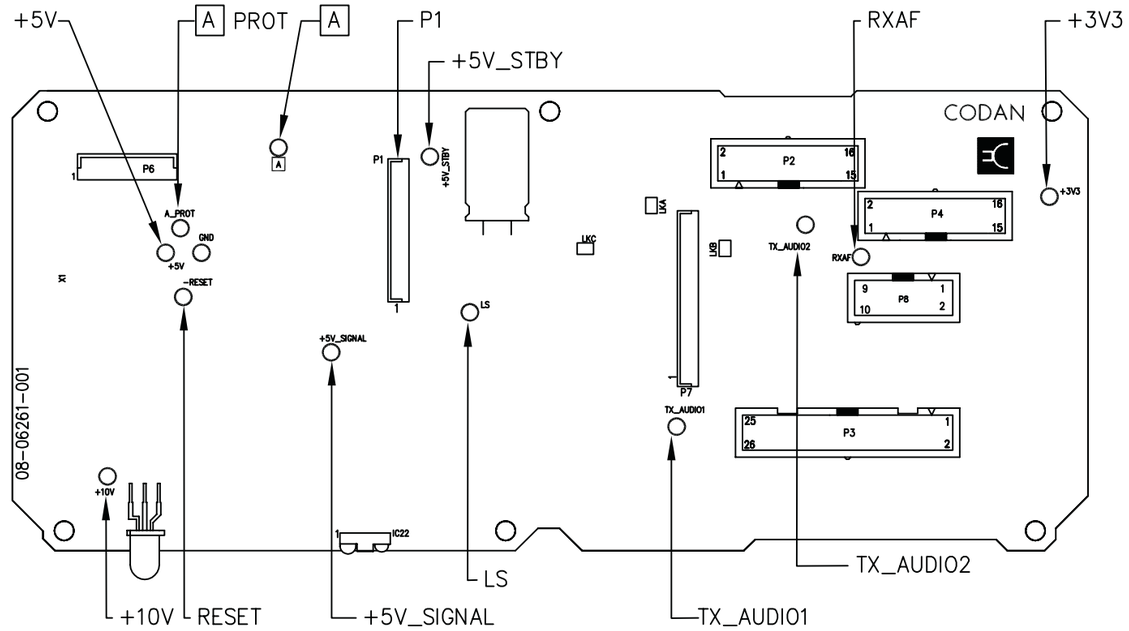

Figure 26: Application Processor PCB (08-05265-001)

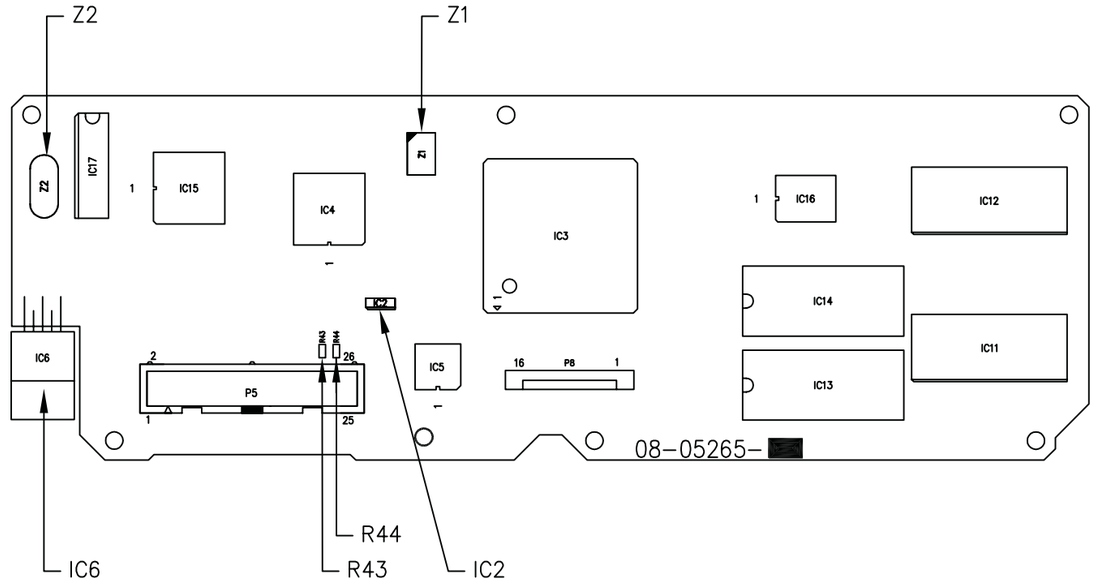

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Figure 27: Application Processor Handset I/F 3 V PCB (08-05987-001)

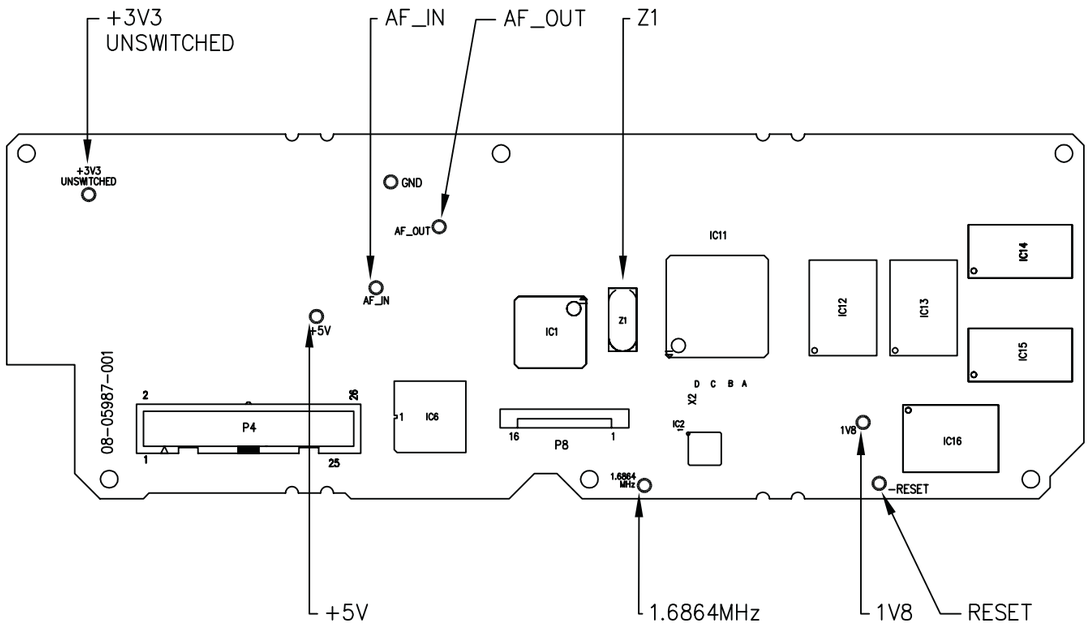

Figure 28: Application Processor Handset & Data I/F PCB (08-06260-001)

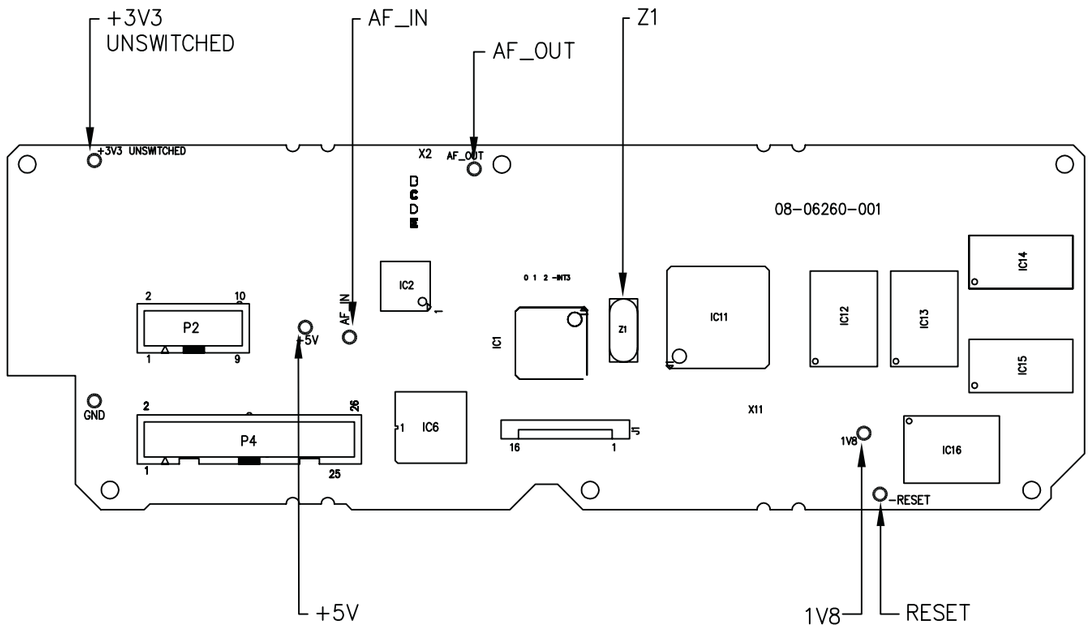

Figure 29: RF/IF PCB (08-05261-001)

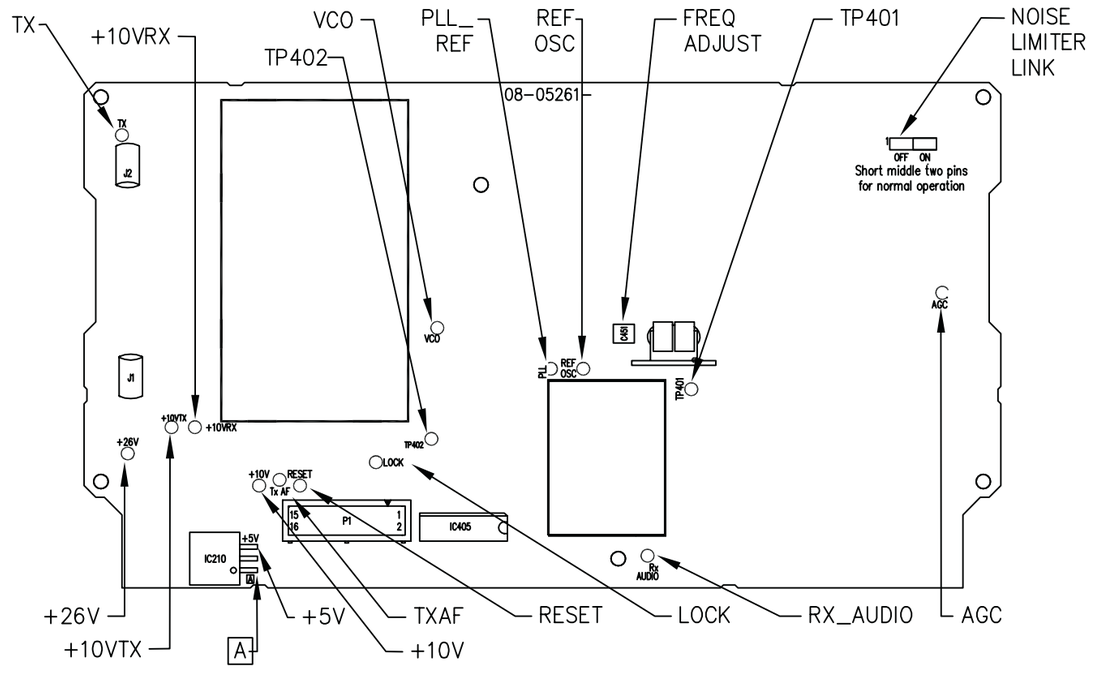

Figure 30: RF/IF PCB (08-05889-001)

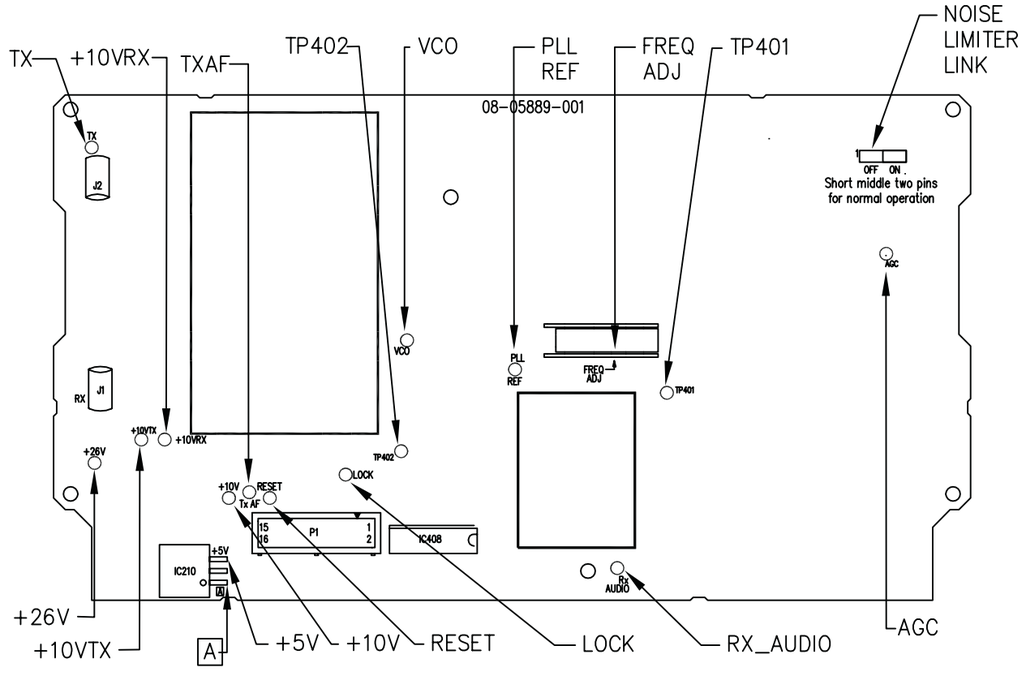

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Figure 31: PA PCB (08-05415-001)

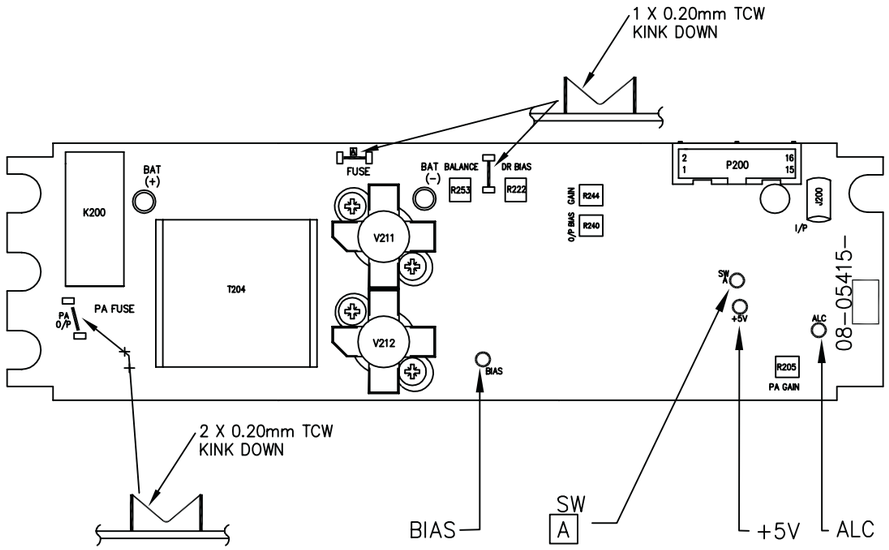

Figure 32: PA PCB (08-05511-001)

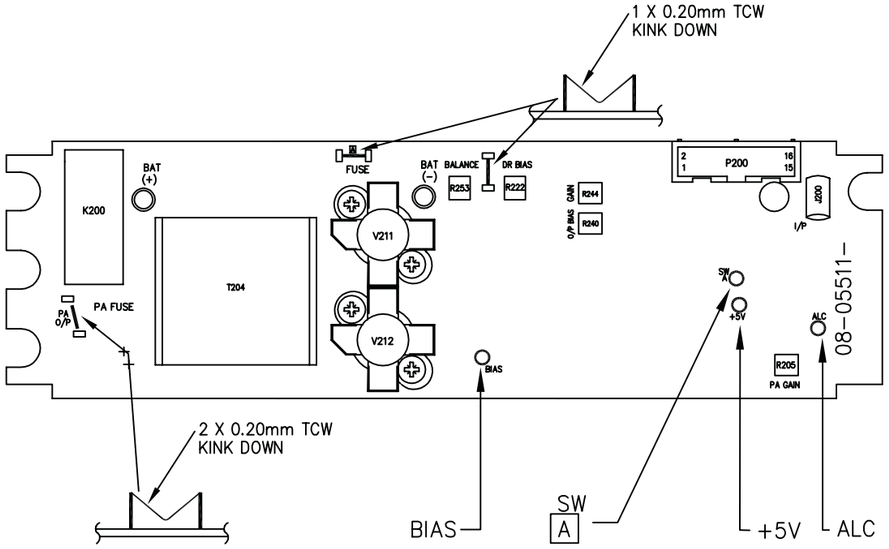

Figure 33: PA PCB (08-05869-001)

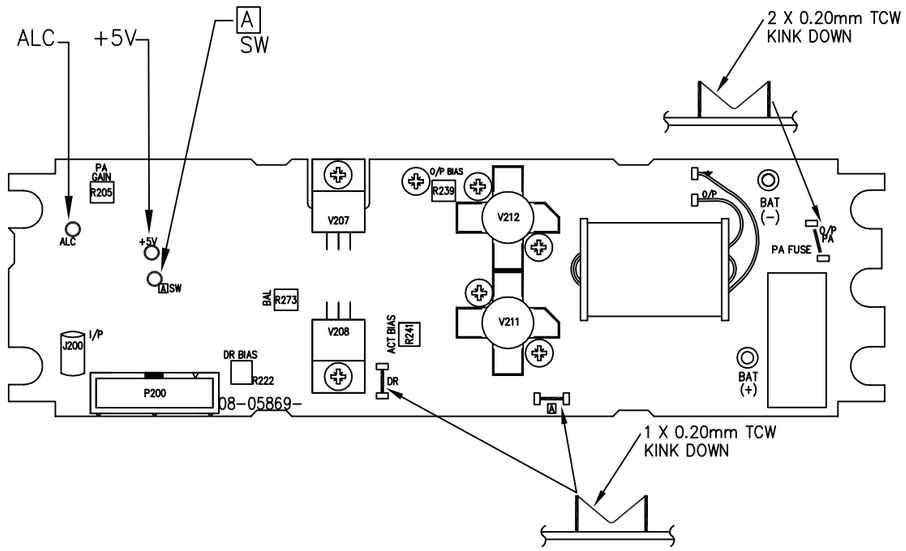

Figure 34: PA PCB (08-06461-001)

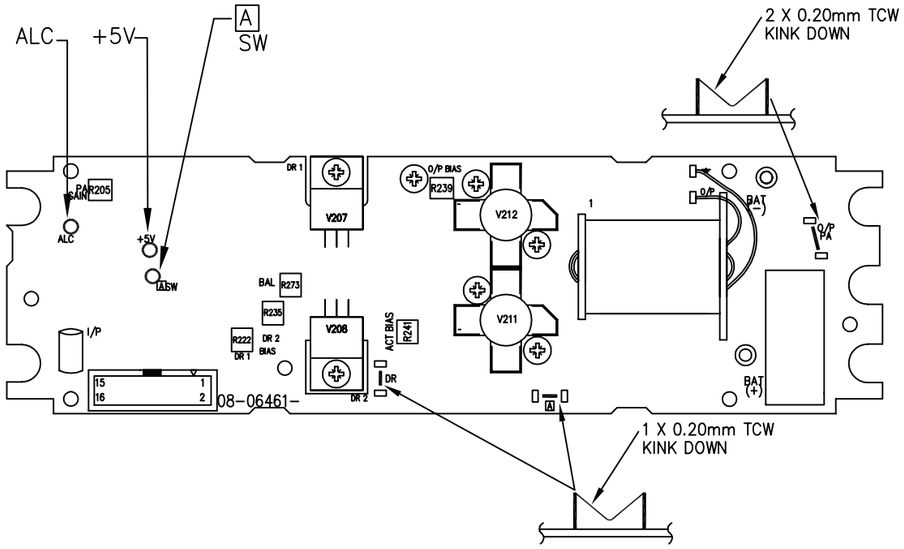

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Figure 35: Filter and Control PCB (08-05416-001)

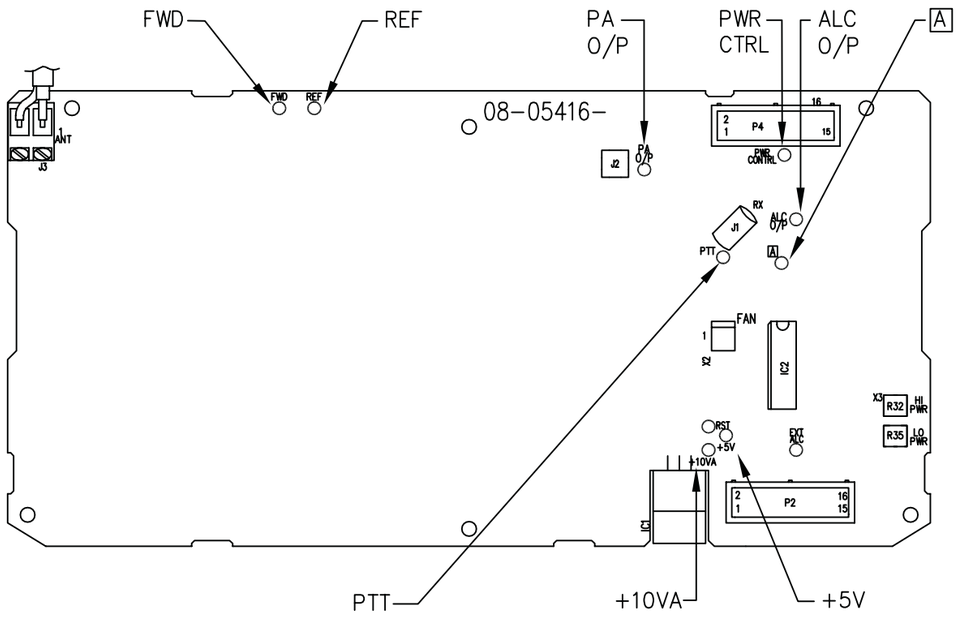
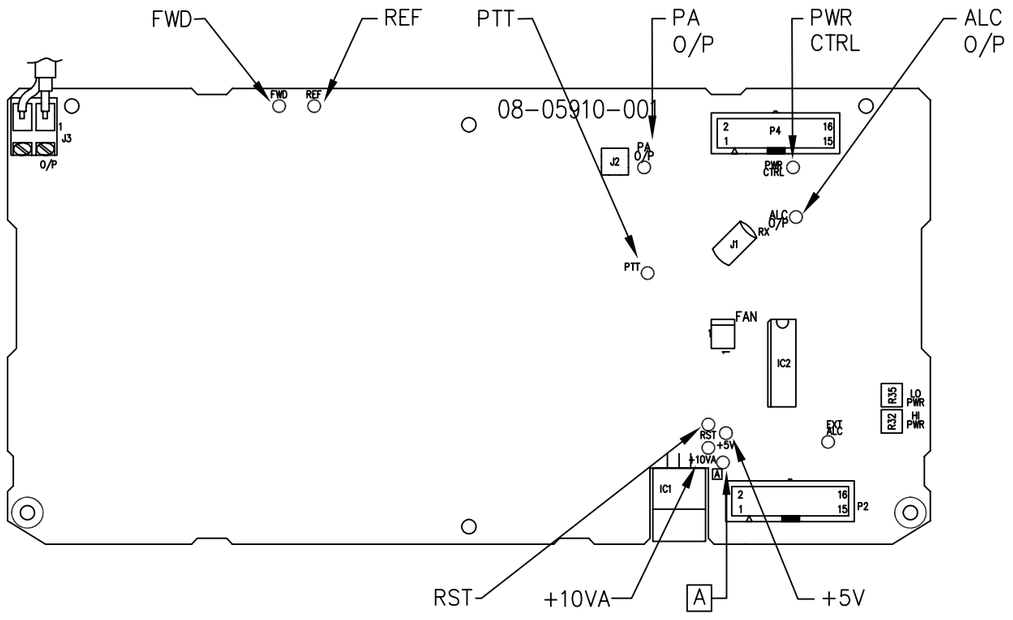


Figure 36: Filter and Control PCB (08-05910-001)



Handset

Handset PCB

The Handset PCB performs the following functions:

- interprets data from the Microprocessor PCB (junction box)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012) and displays it on the handset screen
- reads keypad entries and sends data to the Microprocessor PCB (junction box)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012)
- provides an RS232 port for programming
- provides some pre-amplification of microphone audio
- provides brightness and contrast adjustment for LCD

The Handset PCB contains:

- a microprocessor with ROM and RAM (IC1)
- an LCD and drivers (H1)
- a connection to the keypad matrix
- a programming port (J1)
- an I/O IC to drive the handset bus (IC8)
- a microphone amplifier (IC9)

For details on the Handset PCB, Codan part number	**See...**
08-05300-001	Table 16 on page 62 and Figure 19 on page 52

08-05300-001

CAUTION If this PCB is replaced, ensure that IC3 has the same (or later) firmware version as the original.

Table 16: Test points for the Handset PCB (08-05300-001)

Test point	Correct signal	Explanation
+5V	5.0 V	5 V supply rail regulated on-board. This supplies power for the display driver microcontroller, the display, the RS232 serial port driver and the handset data driver.
+9V	9.0 V	9 V nominal supply rail. Only present when the transceiver is switched on. This supplies the microphone pre-amp, display and handset backlighting, and the RS232 serial port driver.
VEE	–0.8 V to –2.4 V	LCD contrast control voltage. Typically, this measures –1.3 V, depending on the contrast setting. The negative voltage is generated by the RS232 driver IC.
Pin 1, P8	5.4 V 9.2 V	5.4 V when the transceiver is switched off. Power is supplied from the Audio PCB (junction box)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012). 9.2 V when the transceiver is switched on.
Pin 6 & 7, P8	500 mV p–p	Push-pull balanced amplified microphone audio.
Pin 8, P8	12.9 V 0.4 V	12.9 V when the transceiver is switched off. Power is supplied from the Audio PCB (junction box)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012). 0.4 V when the transceiver is switched on.

Junction box (used with 2010 RF Units only)

Audio PCB

The Audio PCB performs the following functions:

- provides amplification and volume control for speaker audio
- provides level control of beeps
- provides level control of morse tone
- provides level control of external Tx audio input (GPIO source)
- controls TDM audio sampling gates
- provides external port connections for Tx audio input, Rx audio output, PTT, and RS232 (GPIO port)
- provides external alarm relay contacts (GPIO port)
- provides connection point for desk console

The Audio PCB contains:

- an audio amplifier (IC3)
- digital volume control elements
- Rx and Tx audio active filters
- an EPLD to control the TDM switching

For details on the Audio PCB, Codan part number	**See...**
08-05470-001	Table 17 on page 64 and Figure 20 on page 52
08-05986-001	Table 18 on page 65 and Figure 21 on page 52

08-05470-001

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

Table 17: Test points for the Audio PCB (08-05470-001)

Test point	Correct signal	Explanation
+5V	5.0 V	5 V supply rail regulated on-board.
+10V	10.0 V	10 V supply rail regulated on-board.
Pin 9 & 10, P3	13.6 V	13.6 V supplied from the RF unit via the CIB cable.
Pin 1, P7	5.4 V 9.2 V	5.4 V when the transceiver is switched off. Power is supplied to the handset. 9.2 V when the transceiver is switched on.
TX_AF	1 V p–p audio	Filtered and level-controlled Tx audio prior to being multiplexed onto the CIB.
RX_AF	600 mV p–p audio	Filtered and level-controlled Rx audio before being applied to the volume control circuitry.
AUDIO_O/P	High level audio	Rx audio output as applied to the speaker. This can be as high as 12 V p–p at the onset of clipping, depending on the volume level.
Pin 12, P10	1 V p–p	Audio output to GPIO.
TP1 TP2	TDM audio	On the CRO, this waveform should appear as 5 V p–p amplitude (10 V p–p differential) 10 µs-wide sync pulses, followed by seven channels of sampled audio of approximately 1 V p–p (2 V p–p differential) amplitude. TDM slot 1 typically carries Rx audio, slot 2 carries enhanced Rx audio, and slot 3 carries Tx audio.
TP3 TP4	CAN DATA High CAN DATA Low	CAN digital serial data stream. CAN in the NGT operates at 125 kbps. CAN High and CAN Low form a differential pair. CAN High nominally measures 3.80 V with approx. 3 V amplitude low-going pulses, and CAN Low nominally measures 1.4 V with approx. 3 V amplitude high-going pulses.

08-05986-001

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

Table 18: Test points for the Audio PCB (08-05986-001)

Test point	Correct signal	Explanation
+3V3	3.3 V	3.3 V supply rail regulated on-board.
+5V	5.0 V	5 V supply rail regulated on-board.
+10V	10.0 V	10 V supply rail regulated on-board.
Pin 9 & 10, P3	13.6 V	13.6 V supplied from the RF unit via the CIB cable.
Pin 1, P7	5.4 V 9.2 V	5.4 V when the transceiver is switched off. Power is supplied to the handset. 9.2 V when the transceiver is switched on.
TX_AF	1 V p–p audio	Filtered and level-controlled Tx audio prior to being multiplexed onto the CIB.
RX_AF	1 V p–p audio	Filtered and level-controlled Rx audio before being applied to the volume control circuitry.
AUDIO_O/P	High level audio	Rx audio output as applied to the speaker. This can be as high as 12 V p–p at the onset of clipping, depending on the volume level.
Pin 12, P10	1 V p–p	Audio output to GPIO.
TP1 TP2	TDM audio	On the CRO, this waveform should appear as 5 V p–p amplitude (10 V p–p differential) 10 µs-wide sync pulses, followed by seven channels of sampled audio of approximately 1 V p–p (2 V p–p differential) amplitude. TDM slot 1 typically carries Rx audio, slot 2 carries enhanced Rx audio, and slot 3 carries Tx audio.
TP3 TP4	CAN DATA High CAN DATA Low	CAN digital serial data stream. CAN in the NGT operates at 125 kbps. CAN High and CAN Low form a differential pair. CAN High nominally measures 3.80 V with approx. 3 V amplitude low-going pulses, and CAN Low nominally measures 1.4 V with approx. 3 V amplitude high-going pulses.

Microprocessor PCB

The Microprocessor PCB performs the following functions:

- generates local speaker beeps and morse code tones when required
- sends and receives commands from the handset
- sends and receives commands from the RF unit via the CIB
- stores user data: Address List, Phone Link List, Keypad List, junction box control macros
- controls arbitration of the system audio bus

The Microprocessor PCB contains:

- a microprocessor (IC1)
- a static RAM (IC8)
- a program flash ROM (IC4)
- a CAN controller (IC11)
- a CAN I/O IC
- a UART and RS232 I/O driver IC
- a tone generator
- an I/O data driver for handset bus
- the TPE and Service mode links

For details on the Microprocessor PCB, Codan part number	**See...**
08-05317-001	Table 19 on page 67 and Figure 22 on page 52

08-05317-001

CAUTION If this PCB is replaced, ensure that IC4 has the same (or later) firmware version as the original.

Table 19: Test points for the Microprocessor PCB (08-05317-001)

Test point	Correct signal	Explanation
+3V3	3.3 V	3.3 V supply rail regulated on-board.
Pin 1, IC13	5.0 V	5 V supply rail regulated on-board.
Pin 17 & 18, X1	13.6 V	13.6 V supplied from the Audio PCB.
Pin 4, IC7	16 MHz square wave	Buffered version of the clock to the microprocessor IC1. Absence of this clock signal means IC1 is not running correctly.
Z2	3.6864 MHz	Clock for IC10.

RF unit

Audio Interface PCB (2010 RF Unit only)

The Audio Interface PCB performs the following functions:

- converts balanced CIB audio into single-ended Tx and Rx audio
- indicates to the Application Processor PCB to mute the audio output when an Rx signal is not present
- provides a mute detector circuit with logic level output for the Application Processor PCB
- converts balanced CIB data into single-ended TTL data stream
- provides routing of Tx audio to the RF/IF PCB
- decodes and encodes TDM system audio
- generates sync timing pulses for the TDM system audio
- provides power on/off function; switches volts to the power relay on the Filter and Control PCB
- provides battery-backed real time clock
- provides current-limited, overload-protected, battery DC supply to the CIB

The Audio Interface PCB contains:

- a PIC microprocessor (IC12)
- an EPLD (IC11)
- a CAN I/O IC
- TDM sampling gates
- a mute detector circuit
- a fuse that may be reset electronically (IC14)

For details on the Audio Interface PCB, Codan part number	**See...**
08-05266-001	Table 20 on page 69 and Figure 23 on page 54

08-05266-001

CAUTION If this PCB is replaced, ensure that IC11 and IC12 have the same (or later) firmware versions as the originals.

Table 20: Test points for the Audio Interface PCB (08-05266-001)

Test Point	Correct Signal	Explanation
+5V	5.0 V	5 V supply rail regulated on-board.
+10V	10.0 V	10 V supply rail regulated on-board.
A	13.6 V	13.6 V supplied from the Filter and Control PCB.
A PROT	13.6 V	Protected power supply voltage. It is supplied to the CIB and the antenna control cable. It is current limited and short-circuit protected.
Pin 5, P1	13 V 0.4 V	13 V when the transceiver is switched off. 0.4 V when the transceiver is switched on. Switched in the handset.
+6V_STBY	6.2 V	Standby power for the handset supplied via the CIB and the junction box.
RESET	5.0 V	Resets microprocessors when low.
RX_AUDIO	800 mV p–p	Rx audio supplied from the RF/IF PCB.
TX_AUDIO1	700 mV p–p	Tx audio supplied to the Application Processor PCB for digital enhancing.
TX_AUDIO2	1 V p–p	Digitally enhanced Tx audio supplied to the RF/IF PCB.
MUTE	 5 V 0 V	Mute detect. 5 V when a signal is present. 0 V when no signal is present.
SYNC_ERR	0 V	TDM audio synchronisation error status.
MASTER_MODE	5.0 V	TDM master indicator. This shows which RF unit is generating the TDM synchronisation pulses when multiple RF units are present on one bus. In the test configuration, this should be 5.0 V.
SYS_AUDIO1 SYS_AUDIO2	TDM audio	On the CRO, this waveform should appear as 5 V p–p amplitude (10 V p–p differential) 10 µs-wide sync pulses, followed by seven channels of sampled audio of approximately 1 V p–p (2 V p–p differential) amplitude. TDM slot 1 typically carries Rx audio, slot 2 carries enhanced Rx audio, and slot 3 carries Tx audio.

Audio & Interconnect PCB (2011 RF Unit only)

The Audio & Interconnect PCB performs the following functions:

- indicates to the Application Processor Handset I/F 3 V PCB to mute the audio output when an Rx signal is not present
- provides a mute detector circuit with logic level output for the Application Processor Handset I/F 3 V PCB
- provides routing of Tx audio to RF/IF PCB
- provides power on/off function; switches volts to the power relay on the Filter and Control PCB
- provides battery-backed real time clock
- provides amplification and volume control for the speaker audio
- provides level control of beeps
- provides level control of morse tone
- generates local speaker beeps and morse code tones when required
- sends and receives commands from the handset

The Audio & Interconnect PCB contains:

- a PIC microprocessor (IC9)
- a mute detector circuit
- an audio amplifier (IC1)
- digital volume control ICs

For details on the Audio & Interconnect PCB, Codan part number	**See...**
08-05988-001	Table 21 on page 71 and Figure 24 on page 54

08-05988-001

CAUTION If this PCB is replaced, ensure that IC9 has the same (or later) firmware version as the original.

Table 21: Test points for the Audio & Interconnect PCB (08-05988-001)

Test Point	Correct Signal	Explanation
+5V	5.0 V	5 V supply rail regulated on-board.
+10V	10.0 V	10 V supply rail regulated on-board.
A	13.6 V	13.6 V supplied from the Filter and Control PCB.
A PROT	13.6 V	Protected power supply voltage supplied to the antenna control cable. It is current limited and short-circuit protected.
Pin 11, P1	13 V 0.4 V	13 V when the transceiver is switched off. 0.4 V when the transceiver is switched on. Switched in the handset.
+5V_STBY	9.2 V on 5.4 V off	Standby power for the handset.
RESET	5.0 V	Resets microprocessors when low.
RX_AUDIO	800 mV p–p	Rx audio supplied from the RF/IF PCB.
TX_AUDIO1	700 mV p–p	Tx audio supplied to the Application Processor Handset I/F 3 V PCB for digital enhancing.
TX_AUDIO2	1 V p–p	Digitally enhanced Tx audio supplied to the RF/IF PCB.
+5V_SIGNAL	 5 V 0 V	Mute detect. 5 V when a signal is present. 0 V when no signal is present.
LS	High-level audio	Rx audio output as applied to the speaker. This can be as high as 12 V p–p at the onset of clipping, depending on the volume level.

Audio Interconnect & Data I/O PCB (2012 RF Unit only)

The Audio Interconnect & Data I/O PCB performs the following functions:

- indicates to the Application Processor Handset & Data I/F PCB to mute the audio output when an Rx signal is not present
- provides a mute detector circuit with logic level output for the Application Processor Handset & Data I/F PCB
- provides routing of Tx audio to the RF/IF PCB
- provides power on/off function; switches volts to power relay on the Filter and Control PCB
- provides battery-backed real time clock
- provides amplification and volume control for the speaker audio
- provides level control of beeps
- provides level control of morse tone
- generates local speaker beeps and morse code tones when required
- sends and receives commands from the handset
- GPIO interface

The Audio Interconnect & Data I/O PCB contains:

- a PIC microprocessor (IC9)
- a mute detector circuit
- an audio amplifier (IC1)
- digital volume control ICs

For details on the Audio Interconnect & Data I/O PCB, Codan part number	**See...**
08-06261-001	Table 22 on page 73 and Figure 25 on page 54

08-06261-001

CAUTION If this PCB is replaced, ensure that IC9 has the same (or later) firmware version as the original.

Table 22: Test points for the Audio Interconnect & Data I/O PCB (08-06261-001)

Test Point	Correct Signal	Explanation
+3V3	3.3 V	3.3 V supply rail regulated on-board.
+5V	5.0 V	5 V supply rail regulated on-board.
+10V	10.0 V	10 V supply rail regulated on-board.
A	13.6 V	13.6 V supplied from the Filter and Control PCB.
A PROT	13.6 V	Protected power supply voltage supplied to the antenna control cable. It is current limited and short-circuit protected.
Pin 11, P1	13 V 0.4 V	13 V when the transceiver is switched off. 0.4 V when the transceiver is switched on. Switched in the handset.
+5V_STBY	9.2 V On 5.4 V Off	Standby power for the handset.
RESET	5.0 V	Resets microprocessors when low.
RXAF	800 mV p–p	Rx audio supplied from the RF/IF PCB.
TX_AUDIO1	700 mV p–p	Tx audio supplied to the Application Processor Handset & Data I/F PCB for digital enhancing.
TX_AUDIO2	1 V p–p	Digitally enhanced Tx audio supplied to the RF/IF PCB.
+5V_SIGNAL	 5 V 0 V	Mute detect. 5 V when a signal is present. 0 V when no signal is present.
LS	High-level audio	Rx audio output as applied to the speaker. This can be as high as 12 V p–p at the onset of clipping, depending on the volume level.

Application Processor PCB (2010 RF Unit only)

The Application Processor PCB performs the following functions:

- implements transceiver functions and call systems
- generates and decodes ALE and Selcall tones
- stores channel and frequency data, modes, Network List, and some Control List entries
- stores operating code for the RF unit
- processes Rx audio (Easitalk)
- compresses Tx audio from the handset and junction box
- communicates with the junction box via the CIB
- provides serial data to the CAN I/O IC on the Audio Interface PCB
- broadcasts frequency and PTT information to the PIC microprocessors on the Filter and Control PCB and RF/IF PCB

The Application Processor PCB contains:

- a DSP (IC3) with associated flash ROM (IC11, IC12) and static RAM (IC13, IC14)
- an A/D and D/A converter (IC5)
- a CAN controller
- a master PIC (IC4)
- an EPLD (IC15)

For details on the Application Processor PCB, Codan part number	**See...**
08-05265-001	Table 23 on page 75 and Figure 26 on page 54

08-05265-001

CAUTION If this PCB is replaced, ensure that IC4, IC11, IC12, and IC15 have the same (or later) firmware versions as the originals.

Table 23: Test points for the Application Processor PCB (08-05265-001)

Test point	Correct signal	Explanation
Pin 4, IC6	5.0 V	5 V supply rail regulated on-board.
Pin 6, IC2	5.0 V	Resets microprocessors when low.
Pin 3, Z1	41.472 MHz	Clock for IC3.
Z2	16 MHz	Clock for IC17.
R43	1 V p–p Tx 800 mV p–p Rx	Audio before digital enhancement.
R44	1 V p–p Tx 800 mV p–p Rx	Audio after digital enhancement.

Application Processor Handset I/F 3 V PCB (2011 RF Unit only)

The Application Processor Handset I/F 3 V PCB performs the following functions:

- implements transceiver functions and call systems
- generates and decodes ALE and Selcall tones
- stores channel and frequency data, modes, Network List, and some Control List entries
- stores operating code for the RF unit
- processes Rx audio (Easitalk)
- compresses Tx audio from the handset
- broadcasts frequency and PTT information to the PIC microprocessors on the Filter and Control PCB and RF/IF PCB

The Application Processor Handset I/F 3 V PCB contains:

- a DSP (IC11) with associated flash ROM (IC12, IC13) and static RAM (IC14, IC15)
- an A/D and D/A converter (IC7)
- a master PIC (IC6)
- the TPE and Service mode links

For details on the Application Processor Handset I/F 3 V PCB, Codan part number	**See...**
08-05987-001	Table 24 on page 77 and Figure 27 on page 56

08-05987-001

CAUTION If this PCB is replaced, ensure that IC1, IC6, IC12, and IC13 have the same (or later) firmware versions as the originals.

Table 24: Test points for the Application Processor Handset I/F 3 V PCB (08-05987-001)

Test point	Correct signal	Explanation
1V8	1.8 V	1.8 V supply rail regulated on-board.
+3V3 UNSWITCHED	3.3 V	3.3 V supply rail regulated on-board.
+5V	5.0 V	5 V supply rail regulated on-board.
RESET	5.0 V	Resets microprocessors when low.
AF_IN	1 V p–p Tx 800 mV p–p Rx	Audio before digital enhancement.
AF_OUT	1 V p–p Tx 800 mV p–p Rx	Audio after digital enhancement.
1.6864MHz	1.6864 MHz	Clock for UART.
Z1	11.059 MHz	Clock for IC11.

Application Processor Handset & Data I/F PCB (2012 RF Unit only)

The Application Processor Handset & Data I/F PCB performs the following functions:

- implements transceiver functions and call systems
- generates and decodes ALE and Selcall tones
- stores channel and frequency data, modes, Network List, and some Control List entries
- stores operating code for the RF unit
- processes Rx audio (Easitalk)
- compresses Tx audio from the handset and
- broadcasts frequency and PTT information to PIC microprocessors on the Filter and Control PCB and RF/IF PCB

The Application Processor Handset & Data I/F PCB contains:

- a DSP (IC11) with associated flash ROM (IC12, IC13) and static RAM (IC14, IC15)
- an A/D and D/A converter (IC7)
- a master PIC (IC6)
- the TPE and Service mode links

For details on the Application Processor Handset & Data I/F PCB, Codan part number	**See...**
08-06260-001	Table 25 on page 79 and Figure 28 on page 56

08-06260-001

CAUTION If this PCB is replaced, ensure that IC1, IC6, IC12, and IC13 have the same (or later) firmware versions as the originals.

Table 25: Test points for the Application Processor Handset & Data I/F PCB (08-06260-001)

Test point	Correct signal	Explanation
1V8	1.8 V	1.8 V supply rail regulated on-board.
+3V3 UNSWITCHED	3.3 V	3.3 V supply rail regulated on-board.
+5V	5.0 V	5 V supply rail regulated on-board.
RESET	5.0 V	Resets microprocessors when low.
AF_IN	1 V p–p Tx 800 mV p–p Rx	Audio before digital enhancement.
AF_OUT	1 V p–p Tx 800 mV p–p Rx	Audio after digital enhancement.
Z1	11.059 MHz	Clock for IC11.

RF/IF PCB

The RF/IF PCB performs the following functions:

- demodulates RF input into a gain-controlled audio signal
- provides a low-level RF signal at the channel frequency modulated with the Tx audio
- filters out impulse noise on the receive signal
- provides the RF source for a tune signal
- switches between USB and LSB
- provides a REF OSC for the DDS, PLL and LO2 circuits
- interprets commands from the Application Processor PCB (2010)/Application Processor Handset I/F 3 V PCB (2011)/Application Processor Handset & Data I/F PCB (2012) via a PIC microprocessor

The RF/IF PCB contains:

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

For details on the RF/IF PCB, Codan part number	**See...**
08-05261-001	Table 26 on page 81 and Figure 29 on page 56
08-05889-001	Table 27 on page 82 and Figure 30 on page 56

08-05261-001

CAUTION If this PCB is replaced, ensure that IC405 has the same (or later) firmware version as the original.

Table 26: Test points for the RF/IF PCB (08-05261-001)

Test Point	Correct Signal	Explanation
+26V	26.0 V	Charge pump power supply for the VCO.
+10VTX	10.0 V	10 V rail for Tx path analog circuitry, which is switched on when the transceiver is in Tx.
+10VRX	10.0 V	10 V rail for Rx path analog circuitry, which is switched on when the transceiver is in Rx.
+10V	10.0 V	10 V rail input from the Audio Interface PCB (2010)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012).
A	13.6 V	13.6 V supplied from the Audio Interface PCB (2010)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012).
+5V	5.0 V	5 V supply rail regulated on-board.
TXAF	1 V p–p audio	Tx audio prior to being modulated.
RESET	5.0 V	Not used.
LOCK	0 V	PLL unlock indicator.
TP402	2 to 22 V	Control voltage to the VCO. Varies from 2 V at 1.6 MHz up to 22 V at 30 MHz.
VCO	45.25 to 75 MHz 10 Hz steps	VCO output frequency.
PLL_REF	5 MHz ± 6 kHz	PLL reference oscillator.
REF OSC	44.545 MHz	
RX_AUDIO	1 V p–p audio	Receive audio, prior to being processed by DSP.
TP401	456.5 kHz (USB) 453.5 kHz (LSB)	IF depending on whether upper sideband or lower sideband is demodulated.
TX	650 mV p–p Tx	Tx mixer output to the PA. Terminated with 50 Ω.
AGC	1 to 6.4 V	AGC control voltage. Nominally 6.4 V with no signal. The minimum voltage is approx. 1 V at maximum signal.

08-05889-001

CAUTION If this PCB is replaced, ensure that IC408 has the same (or later) firmware version as the original.

Table 27: Test points for the RF/IF PCB (08-05889-001)

Test Point	Correct Signal	Explanation
+26V	26.0 V	Charge pump power supply for the VCO.
+10VTX	10.0 V	10 V rail for Tx path analog circuitry, which is switched on when the transceiver is in Tx.
+10VRX	10.0 V	10 V rail for Rx path analog circuitry, which is switched on when the transceiver is in Rx.
+10V	10.0 V	10 V rail input from the Audio Interface PCB (2010)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012).
A	13.6 V	13.6 V supplied from the Audio Interface PCB (2010)/Audio & Interconnect PCB (2011)/Audio Interconnect & Data I/O PCB (2012).
+5V	5.0 V	5 V supply rail regulated on-board.
TXAF	1 V p–p audio	Tx audio prior to being modulated.
RESET	5.0 V	Not used.
LOCK	0 V	PLL unlock indicator.
TP402	2 to 22 V	Control voltage to the VCO. Varies from 2 V at 1.6 MHz up to 22 V at 30 MHz.
VCO	45.25 to 75 MHz 10 Hz steps	VCO output frequency.
PLL REF	5 MHz ± 6 kHz	PLL reference oscillator.
RX_AUDIO	800 mV p–p audio	Receive audio, prior to being processed by DSP.
TP401	456.5 kHz (USB) 453.5 kHz (LSB)	IF depending on whether upper sideband or lower sideband is demodulated.
TX	650 mV p–p Tx	Tx mixer output to the PA. Terminated with 50 Ω.
AGC	1 to 6.4 V	AGC control voltage. Nominally 6.4 V with no signal. The minimum voltage is approx. 1 V at maximum signal.

PA PCB

The PA PCB performs the following functions:

- amplifies the modulated Tx input signal to 100/125 W
- provides inputs to the ALC circuitry on the Filter and Control PCB
- adjusts output level depending on the control signal from the ALC generator on the Filter and Control PCB
- provides linear dynamic bias for the output transistors

The PA PCB contains:

- gain control circuitry
- a pre-driver
- a driver
- driver bias circuitry
- output transistors
- output bias circuitry
- a DC power relay

For details on the PA PCB, Codan part number	**See...**
08-05415-001	Table 28 on page 84 and Figure 31 on page 58
08-05511-001	Table 29 on page 84 and Figure 32 on page 58
08-05869-001	Table 30 on page 85 and Figure 33 on page 58
08-06461-001	Table 31 on page 85 and Figure 34 on page 58

08-05415-001

CAUTION If the output FETs are replaced, some adjustments must be made (see page 111, *Adjusting the PA*). Complete all adjustments within the section.

Table 28: Test points for the PA PCB (08-05415-001)

Test Point	Correct Signal	Explanation
BIAS	3 V nominal	Bias voltage on the gate of the output FET.
SW A	13.6 V nominal in Tx	**A** supply rail, which is switched on when the transceiver is in Tx.
+5V	5.0 V	5 V supply rail regulated on-board.
ALC	3 V nominal in Tx	ALC voltage applied to the PA gain-control stage.

08-05511-001

CAUTION If the output FETs are replaced, some adjustments must be made (see page 111, *Adjusting the PA*). Complete all adjustments within the section.

Table 29: Test points for the PA PCB (08-05511-001)

Test Point	Correct Signal	Explanation
BIAS	3 V nominal	Bias voltage on the gate of the output FET.
SW A	13.6 V nominal in Tx	**A** supply rail, which is switched on when the transceiver is in Tx.
+5V	5.0 V	5 V supply rail regulated on-board.
ALC	3 V nominal in Tx	ALC voltage applied to the PA gain-control stage.

08-05869-001

CAUTION If the output transistors are replaced, some adjustments must be made (see page 111, *Adjusting the PA*). Complete all adjustments within the section.

Table 30: Test points for the PA PCB (08-05869-001)

Test Point	Correct Signal	Explanation
A SW	13.6 V nominal in Tx	**A** supply rail which is switched on when the transceiver is in Tx.
+5V	5.0 V	5 V supply rail regulated on-board.
ALC	3 V nominal in Tx	ALC voltage applied to the PA gain-control stage.

08-06461-001

CAUTION If the output transistors are replaced, some adjustments must be made (see page 111, *Adjusting the PA*). Complete all adjustments within the section.

Table 31: Test points for the PA PCB (08-06461-001)

Test Point	Correct Signal	Explanation
A SW	13.6 V nominal in Tx	**A** supply rail which is switched on when the transceiver is in Tx.
+5V	5.0 V	5 V supply rail regulated on-board.
ALC	3 V nominal in Tx	ALC voltage applied to the PA gain-control stage.

Filter and Control PCB

The Filter and Control PCB performs the following functions:

- suppresses harmonics generated by the amplification process
- monitors SWR and FWD/REF power levels at the antenna connection and input to the ALC processor
- interprets and executes LPF selection and ALC circuit reference control data from the Application Processor PCB (2010)/Application Processor Handset I/F 3 V PCB (2011)/Application Processor Handset & Data I/F PCB (2012) via a PIC microprocessor
- outputs a gain control signal to control the output power of the PA

The Filter and Control PCB contains:

- seven low pass filters
- a PIC microprocessor (IC2)
- a power and SWR detector
- an ALC processor circuit

For details on the Filter and Control PCB, Codan part number	**See...**
08-05416-001	Table 32 on page 87 and Figure 35 on page 60
08-05910-001	Table 33 on page 88 and Figure 36 on page 60

08-05416-001

CAUTION If this PCB is replaced, ensure that IC2 has the same (or later) firmware version as the original.

Table 32: Test points for the Filter and Control PCB (08-05416-001)

Test Point	Correct Signal	Explanation
+5V	5.0 V	5 V supply rail regulated on-board.
+10VA	10.0 V	10 V supply rail regulated on-board.
A	13.6 V nominal (10.5 to 15 V allowable)	Switched power supply. Once the power relay (located on the PA PCB) has switched on, this should measure the supply voltage.
PTT	A rail (PTT off) 0 V nominal (PTT on)	PTT relay driver. This point is driven low when the transceiver goes into Tx.
FWD	21 V p–p	Forward transmitted power.
REF	Depends on load	Reflected power. This should measure approx. 0 V with a 50 Ω load.
ALC O/P	4.3 V nominal in Tx	ALC output to PA.
PWR CTRL	3.5 V nominal	PA output power control. This control voltage is responsible for controlling the output power as the frequency changes.
PA O/P	200 V p–p (100 W) 225 V p–p (125 W)	Unfiltered signal from the PA O/P transformer.

08-05910-001

CAUTION If this PCB is replaced, ensure that IC2 has the same (or later) firmware version as the original.

Table 33: Test points for the Filter and Control PCB (08-05910-001)

Test Point	Correct Signal	Explanation
+5V	5.0 V	5 V supply rail regulated on-board.
+10VA	10.0 V	10 V supply rail regulated on-board.
A	13.6 V nominal (10.5 to 15 V allowable)	Switched power supply. Once the power relay (located on the PA PCB) has switched on, this should measure the supply voltage.
PTT	A rail (PTT off) 0 V nominal (PTT on)	PTT relay driver. This point is driven low when the transceiver goes into Tx.
FWD	21 V p–p	Forward transmitted power.
REF	Depends on load	Reflected power. This should measure approx. 0 V with a 50 Ω load.
ALC O/P	4.3 V nominal in Tx	ALC output to PA.
PWR CTRL	3.5 V nominal	PA output power control. This control voltage is responsible for controlling the output power as the frequency changes.
PA O/P	200 V p–p (100 W) 225 V p–p (125 W)	Unfiltered signal from the PA O/P transformer.
RST	5.0 V	Resets the microprocessor.

Repair procedures, tests, and adjustments

This section contains the following topics:

Test equipment

Test equipment required

The following test equipment is required:

- a Codan 0208 Test Set
- an NGT test handset for use with 2011 and 2012 RF Units (see the *Transceiver Test Set 0208 Reference Manual* for the handset modification procedure)
- a 50 MHz oscilloscope with an external trigger capability
- a 10× oscilloscope probe with an input impedance of 10 MΩ and less than 20 pF
- a 50 Ω RF dummy load rated at a minimum of 100 W RMS
- an RF power meter covering the range of 1 MHz to 30 MHz rated for 100 W RMS
- an RF signal generator covering the range 400 kHz to 30 MHz, with a calibrated output of –130 dBm to 0 dBm from a source impedance of 50 Ω
- a 50 MHz frequency counter with a resolution of 1 Hz
- a regulated power supply of 13.6 V ±0.2 V at 20 A peak with current display
- a digital multimeter with a 10 MΩ input impedance
- an AC voltmeter with a range of 10 mV to 10 V with dB scale
- an RF spectrum analyser capable of measuring intermodulation (optional)
- a PC with serial COM port
- Codan NSP software (15-04128-EN)
- NGT programming cable (08-05123-001)

Test equipment configuration

Figure 37: Setup for 2010 RF Unit with 2030 Junction Box

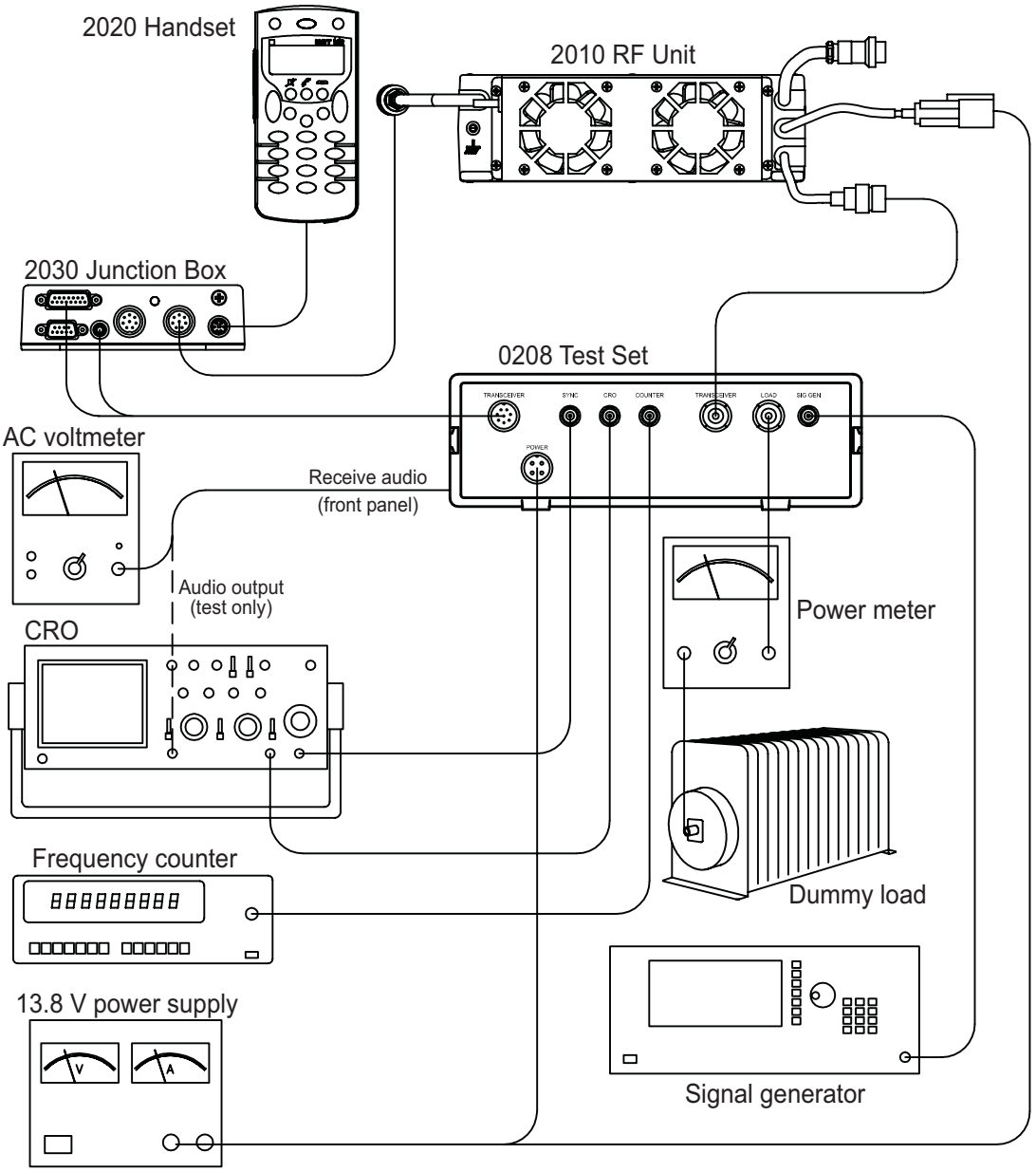
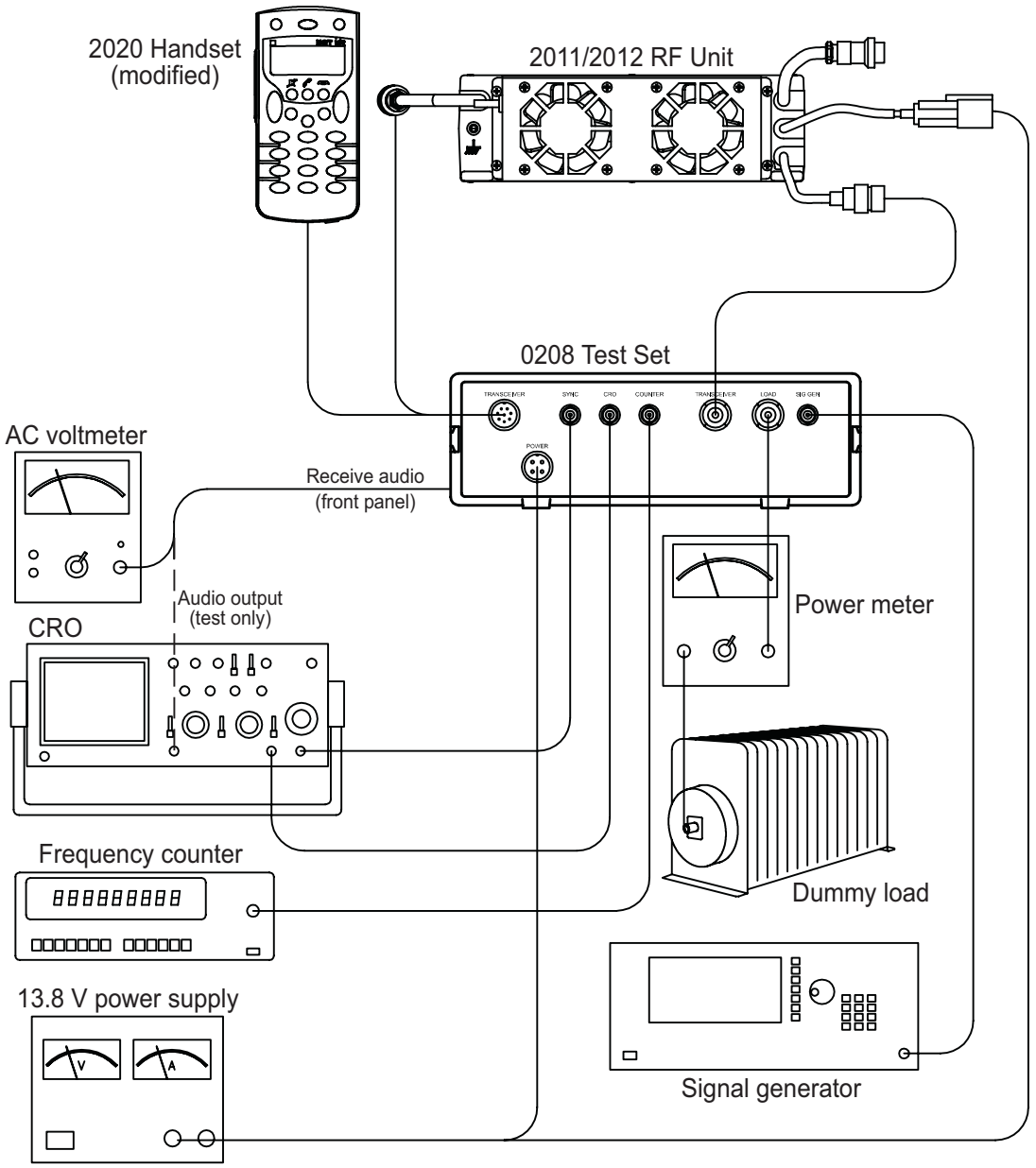


Figure 38: Setup for 2011/2012 RF Unit



Repair procedures and fault diagnosis

NOTE

The fault diagnosis and repair procedures assume that the transceiver is unoptioned. See page 145, *Options* to identify any hardware options. You should read the information provided with the options and adjust any tests accordingly.

General

The information in this section should be read in conjunction with the appropriate flow chart for the corresponding NGT series RF unit. See below to determine which flow chart you should view.

NOTE

All fault diagnosis should begin with the Repair flow chart (see Figure 45 on page 121).

For transceivers with:

RF Unit	Flow chart	See...
2010 with 2030 Junction Box	Repair flow chart	Figure 45 on page 121
	2010 Power On fault diagnosis flow chart	Figure 46 on page 123
	2010 Receive fault diagnosis flow chart	Figure 49 on page 129
	2010 Transmit fault diagnosis flow chart	Figure 52 on page 135
2011	Repair flow chart	Figure 45 on page 121
	2011 Power On fault diagnosis flow chart	Figure 47 on page 125
	2011 Receive fault diagnosis flow chart	Figure 50 on page 131
	2011 Transmit fault diagnosis flow chart	Figure 53 on page 137
2012	Repair flow chart	Figure 45 on page 121
	2012 Power On fault diagnosis flow chart	Figure 48 on page 127
	2012 Receive fault diagnosis flow chart	Figure 51 on page 133
	2012 Transmit fault diagnosis flow chart	Figure 54 on page 139

Mechanical inspection

Inspecting the transceiver for damage

To inspect the RF unit, junction box and handset:

- ❑ Check for:
  - physical damage (that is, crushed or distorted case and cables)
  - signs of water ingress
  - corrosion
- ❑ Check that:
  - the connectors are clear of foreign material
  - the pins on the connectors are straight and not distorted
- ❑ Remove all covers and shields.
- ❑ 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 If the covers are removed, ensure all screens are in place to provide shielding.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Operational tests

Setting up the test equipment

To set up the test equipment for the operational tests:

- ❑ Set up the test equipment as required.

For RF Unit	See...
2010	Figure 37 on page 91
2011/2012	Figure 38 on page 92

NOTE Do not connect the transceiver.

- ❑ Set the power supply to 13.6 V DC, then switch off the output.
- ❑ Switch off the output from the RF signal generator.
- ❑ Set up the 0208 Test Set as follows:

Balance	Centre position
Output level (coarse, left knob)	–20 dBV
Output level (fine, right knob)	Minimum
Speaker/Load	Speaker
Noise	Up position (noise is off)
PTT	Up position (PTT is off)

- ❑ Adjust the AC voltmeter to suit the audio level.
- ❑ Set the frequency counter to 10 samples/second.
- ❑ Adjust the power meter to suit 125 W PEP.
- ❑ Connect the transceiver to the test equipment.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the Power On test

To perform the Power On test:

- ❑ Switch on the output from the power supply.
- ❑ Press the ⏻ key on the handset.

Pass	Handset screen displays the Codan logo, then the home screen (typically the channel screen). Current drawn is < 2 A.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Examining the profile in the transceiver

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

To assess the profile for its suitability in testing:

- ❑ View the Channel List using the handset or NSP.

  There should be at least seven channels, one within each of the following ranges:

  - 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)
- ❑ Use NSP to load the profile from the transceiver, then save this profile to disk.
- ❑ Program the transceiver with a suitable test profile, if required.

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

- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the Handset test

To perform the Handset test:

- ❑ *Hold down* ⏻ and press **#**.

  The display prompts you to press a key. This message is displayed for approximately one second, then the handset test screen will flash at 2 Hz to ensure all pixels are functional.

  Pass All pixels on the screen flash at 2 Hz.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ 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.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Press ✕ to exit the Handset test.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Receive tests

Performing the Basic Receive test

To test if the transceiver can receive:

- ❑ Ensure Easitalk is switched off in the transceiver.
- ❑ Ensure the RF amp (Cfg RF Pre-Amp entry in the Control List) is switched off in the transceiver.
- ❑ Ensure Mute is switched off in the transceiver.
- ❑ Select any channel.
- ❑ Set the signal generator to 1.0 kHz above the SCF of the selected channel (USB) or 1.0 kHz below the SCF of the selected channel (LSB).
- ❑ Set the RF output level of the signal generator to –20 dBm.
- ❑ Switch on the RF output from the signal generator.
- ❑ Adjust the volume via the NGT handset to a comfortable level.

  Pass A tone is audible from the 0208.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).

- ❑ Switch off the RF output from the signal generator.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the Sensitivity test

To test the sensitivity of the transceiver to received signals:

- ❑ Switch on the RF amp (Cfg RF Pre-Amp entry in the Control List) in the transceiver.
- ❑ Select any channel.
- ❑ Adjust the volume via the NGT handset so that background noise is audible.
- ❑ Set the signal generator to 1.0 kHz above the SCF of the selected channel (USB) or 1.0 kHz below the SCF of the selected channel (LSB).
- ❑ Set the 0 dB reference on the AC voltmeter to the level of the background noise.
- ❑ Set the RF output level of the signal generator to –121 dBm.
- ❑ Switch on the RF output from the signal generator.

  Pass A reading on the AC voltmeter that is > 10 dB.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off the RF amp in the transceiver.
- ❑ Repeat the test, this time setting the RF output level of the signal generator to –103 dBm.
- ❑ Switch off the RF output from the signal generator.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the AGC test

To test the AGC of the transceiver:

- ❑ Switch on the RF amp (Cfg RF Pre-Amp entry in the Control List) in the transceiver.
- ❑ Select any channel.
- ❑ Set the signal generator to 1.0 kHz above the SCF of the selected channel (USB) or 1.0 kHz below the SCF of the selected channel (LSB).
- ❑ Set the RF output level of the signal generator to –13 dBm.
- ❑ Adjust the volume via the NGT handset so the tone is clearly audible.
- ❑ Set the 0 dB reference on the AC voltmeter to the level of the tone.
- ❑ Reduce the RF output level of the signal generator until the AC voltmeter reduces by 6 dB.

  Pass An RF output level from the signal generator that is < –99 dBm.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off the RF output from the signal generator.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the Audio Output test

To test the audio output from the transceiver:

- ❑ Replace the AC voltmeter with an oscilloscope.
- ❑ Adjust the oscilloscope to view a 1 kHz tone at 6 V p–p.
- ❑ Select any channel.
- ❑ Set the signal generator to 1.0 kHz above the SCF of the selected channel (USB) or 1.0 kHz below the SCF of the selected channel (LSB).
- ❑ Set the RF output level of the signal generator to –67 dBm.
- ❑ Switch on the RF output from the signal generator.

Pass	A tone is audible from the 0208.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off the speaker on the 0208.
- ❑ While viewing the tone on the oscilloscope, use the volume control on the NGT handset to increase the audio level.

Pass	A waveform that does not clip until reaching 5.5 V p–p.
NOTE	The receive audio output from the 0208 is half that of the speaker on the NGT, that is, the audio output from the NGT should not clip until reaching approximately 12 V p–p.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off the RF output from the signal generator.
- ❑ Switch on the speaker on the 0208.
- ❑ Replace the oscilloscope with an AC voltmeter.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the Selectivity test

To test the selectivity of the transceiver:

- ❑ Select any channel.
- ❑ Set the signal generator to 1.0 kHz above the SCF of the selected channel (USB) or 1.0 kHz below the SCF of the selected channel (LSB).
- ❑ Set the RF output level of the signal generator to –121 dBm.
- ❑ Switch on the RF output from the signal generator.
- ❑ Adjust the volume via the NGT handset so the tone is clearly audible.
- ❑ Set the 0 dB reference on the AC voltmeter to the level of the tone.
- ❑ Set the signal generator to 1.0 kHz *below* the SCF of the selected channel (USB) or 1.0 kHz *above* the SCF of the selected channel (LSB).
- ❑ Increase the RF output level of the signal generator to –55 dBm.

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

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Set the signal generator to 4.0 kHz above the SCF of the selected channel (USB) or 4.0 kHz below the SCF of the selected channel (LSB).

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

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off the RF output from the signal generator.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the Noise Limiter test

To test the noise limiter circuit in the transceiver:

- ❑ Select any channel.
- ❑ Set the signal generator to 1.0 kHz above the SCF of the selected channel (USB) or 1.0 kHz below the SCF of the selected channel (LSB).
- ❑ Set the RF output level of the signal generator to –115 dBm.
- ❑ Switch on the RF output from the signal generator.
- ❑ Adjust the volume via the NGT handset so the tone is clearly audible.
- ❑ Switch on the noise on the 0208.

Pass	A tone is audible over a faint buzzing from the 0208 speaker.
NOTE	The noise limiter may be switched off for comparison purposes. On the RF/IF PCB, short the ON/OFF 4-pin plug of the noise limiter.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off the RF output from the signal generator.
- ❑ Switch off the noise on the 0208.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Transmit tests

Performing the Basic Transmit test

To test if the transceiver can transmit:

- ❑ Select a frequency between 4 and 6 MHz.
- ❑ Ensure the power output from the NGT is set to high (if applicable), that is, Cfg Power Preference is set to **High** and Cfg Tx Power is set to **Maximum**.
- ❑ *Hold down* PTT on the handset, then whistle into the microphone on the handset.

Pass	For a 100 W variant, a reading on the RF power meter that is approximately 100 W. For a 125 W variant, a reading on the RF power meter that is approximately 125 W.
NOTE	Equivalent readings for power meters that do not have PEP and dB scales are listed in Table 34 on page 105 and Table 35 on page 105.

- ❑ Release PTT on the handset.
- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Setting the balance on the 0208

To set the balance on the 0208:

- ❑ Select the channel on the oscilloscope to which the **CRO** output of the 0208 is connected.
- ❑ Select any channel.
- ❑ Ensure the output level of the 0208 is set to a minimum.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power reaches a maximum.
- ❑ Adjust the oscilloscope to view the RF envelope.
- ❑ Adjust the balance control on the 0208 for zero cross-over on the oscilloscope.
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

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:

- ❑ Select a channel with a high frequency (ideally 30 MHz).
- ❑ Press **TUNE** on the handset.
- ❑ *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.

  NOTE — The RF/IF PCB 08-05261-001 has a stability of 1.5 ppm/year of age.

  The RF/IF PCB 08-05889-001 has a stability of 0.3 ppm/year of age.

- ❑ Release PTT on the handset.
- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the ALC test

To test the ALC of the transceiver:

- ❑ Select any channel.
- ❑ 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 stops increasing.

  This is the ALC threshold.

- ❑ Record the PEP (see page 141, *Test sheet for the NGT series 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 34 on page 105 and Table 35 on page 105.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).

- ❑ Reduce the output level on the 0208 until the RF power is 6 dB below the ALC threshold.
- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Disconnect the coaxial cable from the RF connector (ᛉ).
- ❑ Switch on PTT on the 0208.

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

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Reconnect the coaxial cable to the RF connector.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Performing the RF Output Power test

To test the RF output power of the transceiver:

- ❑ 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 NGT stops increasing, then increase the output level of the 0208 by 10 dB.

Pass	For a 100 W variant, a reading on the RF power meter that is between 89 and 112 W. For a 125 W variant, a reading on the RF power meter that is between 112 and 141 W.
NOTE	Equivalent readings for power meters without PEP and dB scales are listed in Table 34 on page 105 and Table 35 on page 105.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).

❑ For each band, adjust the output level of the 0208 until the RF output power of the NGT stops increasing, then increase the output level of the 0208 by 10 dB.

Pass — For a 100 W variant, a reading on the RF power meter that is between 89 and 112 W for all bands.

For a 125 W variant, a reading on the RF power meter that is between 112 and 141 W at 1.6 MHz, decreasing to between 79 and 126 W for all bands.

NOTE — Equivalent readings for power meters without PEP and dB scales are listed in Table 34 on page 105 and Table 35 on page 105.

❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).

Table 34: 100 W output power scale

PEP (W)	PEP (dBm)	Variation from 100 W (dB)	RMS responding meter (W)	Average responding meter W)	V p–p
79	49.0	–1.0	39.5	32	128
89	49.5	–0.5	44.5	36	189
100	50.0	0	50	40.5	200
112	50.5	+0.5	56	45	212
126	51.0	+1.0	63	51	224

Table 35: 125 W output power scale

PEP (W)	PEP (dBm)	Variation from 100 W (dB)	RMS responding meter (W)	Average responding meter (W)	V p–p
112	50.5	–0.5	56	45	212
125	51	0	62.5	50.6	224
141	51.5	+0.5	70.5	57	237

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 flow chart (see Figure 45 on page 121).

Performing the Intermodulation and Distortion test

NOTE This test may be performed using an oscilloscope or a spectrum analyser.

To test the intermodulation products and spurious signals using an oscilloscope:

- ❑ Select any channel.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the NGT stops increasing, then increase the output level of the 0208 by 10 dB.
- ❑ Analyse the RF envelope using Figure 39, Figure 40, Figure 41 on page 107, and Figure 42 on page 107.

  Pass The RF waveform envelope is acceptable.

Figure 39: Acceptable two-tone RF envelope

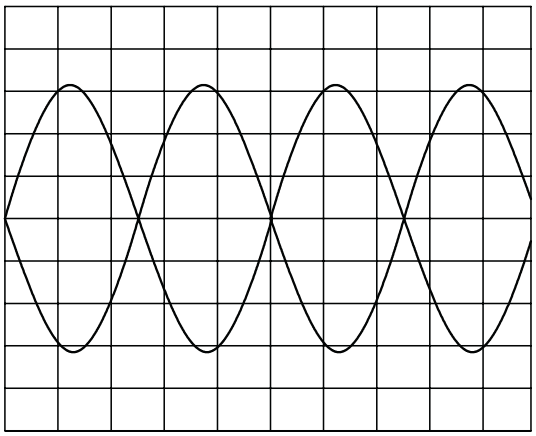


Figure 40: Defective two-tone RF envelope (typical overbias of PA)

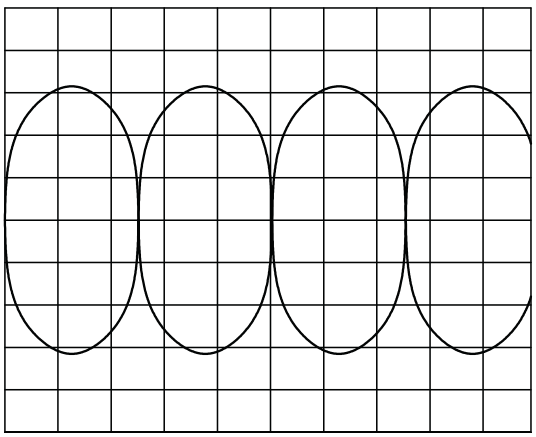


Figure 41: Defective two-tone RF envelope (typical underbias of PA)

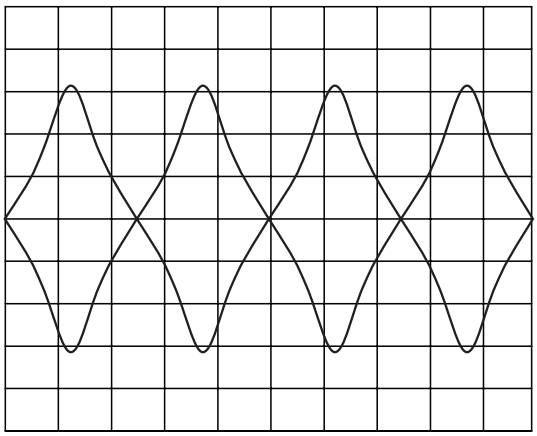
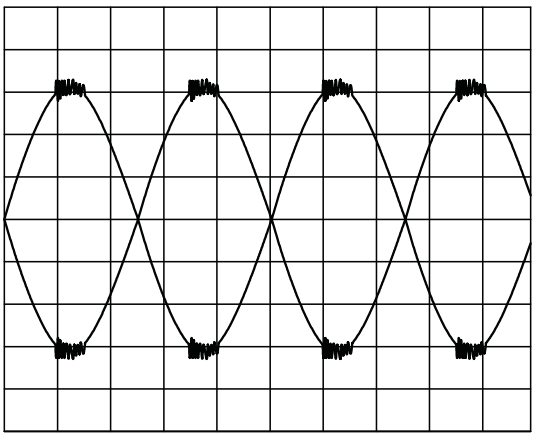


Figure 42: Defective two-tone RF envelope (typical spurious-related problems)



- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

To test the intermodulation products using a spectrum analyser:

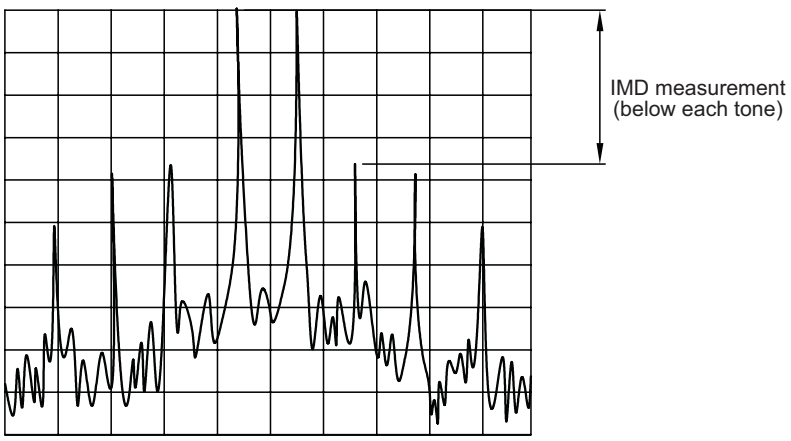
- ❑ Connect the spectrum analyser via a 47 kΩ resistor to the RF connector (ϒ) with the dummy load still connected.
- ❑ Select any channel.
- ❑ Set up the spectrum analyser as follows:

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 NGT stops increasing, then increase the output level of the 0208 by 10 dB.
- ❑ Analyse the display on the spectrum analyser using Figure 43.

Pass Intermodulation products are 26 dB down on all bands.

Figure 43: Intermodulation measurements using a spectrum analyser



- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

To check spurious transmissions and harmonics using a spectrum analyser:

- ❑ Select any channel.
- ❑ 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 NGT 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 RF unit.

- ❑ Record your results and actions (see page 141, *Test sheet for the NGT series Transceiver*).
- ❑ Switch off PTT on the 0208.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

Adjustments

Adjusting frequency

ALTERNATIVE TEXT RF/IF PCB (08-05261-001) (see Figure 29 on page 56)

All the channels are synthesised and locked to the 44.545 MHz reference crystal oscillator Z401.

To adjust the frequency:

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

- ❑ Select a channel with a high frequency (ideally 30 MHz).
- ❑ Press **TUNE** on the handset.
- ❑ *Hold down* PTT on the handset.
- ❑ Read the carrier frequency from the frequency counter.
- ❑ Adjust trimmer C451 (located on the RF/IF PCB) to a frequency within 3 Hz of the SCF.
- ❑ Release PTT on the handset.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121).

ALTERNATIVE TEXT RF/IF PCB (08-05889-001) (see Figure 30 on page 56)

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

To adjust the frequency:

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

- ❑ Select a channel with a high frequency (ideally 30 MHz).
- ❑ Press **TUNE** on the handset.
- ❑ *Hold down* PTT on the handset.
- ❑ Read the carrier frequency from the frequency counter.
- ❑ Adjust trimmer C7 (located on the RF/IF PCB) to a frequency within 3 Hz of the SCF.

NOTE

Links X1 and X2 on the oscillator PCB may be joined to lower the frequency if the trimmer does not have enough range.

Approximate link settings are:

- X1: 200 Hz
- X2: 400 Hz
- X1 + X2: 600 Hz

❑ Release PTT on the handset.

❑ Return to the Repair flow chart (see Figure 45 on page 121).

Adjusting the PA

NOTE

If the FET or output transistors are replaced, some adjustments must be made. Complete all adjustments within this section.

NOTE

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

NOTE

These adjustments assume that the transceiver is unoptioned. See page 145, *Options* to identify any hardware options. You should read the information provided with the options and make the adjustments accordingly.

Adjusting the driver bias

ALTERNATIVE TEXT PA PCB (08-05415-001) (see Figure 31 on page 58)

To adjust the driver bias:

❑ Ensure the transceiver is switched off and the DC supply is disconnected.

❑ Disconnect the exciter output from the PA by removing the connector from J2 (Tx coaxial) on the RF/IF PCB in the RF unit.

❑ Unsolder the link next to the DR (driver) BIAS control (DC supply to the driver transistors V207 to V212).

❑ Set a multimeter to DC 10 mA range and connect it in place of the removed link.

❑ Connect the DC supply, then switch on the transceiver.

❑ Select any transmit channel, then *hold down* PTT.

❑ Check that the driver current measures 4 mA ±1 mA.

❑ If the current is out of the specified limit stated above, change it by adjusting DR BIAS (R222).

❑ Switch off the transceiver, disconnect the multimeter, then replace the link with a length of tinned copper wire.

❑ Return to the Repair flow chart (see Figure 45 on page 121), if required.

ALTERNATIVE TEXT PA PCB (08-05869-001) (see Figure 33 on page 58)

To adjust the driver bias:

- ❑ Ensure the transceiver is switched off and the DC supply is disconnected.
- ❑ Disconnect the exciter output from the PA by removing the connector from J2 (Tx coaxial) on the RF/IF PCB in the RF unit.
- ❑ Unsolder the link labelled DR (DC supply to the driver transistors V207 and V208).
- ❑ Set a multimeter to DC 20 mA range and connect it in place of the removed link.
- ❑ Connect the DC supply, then switch on the transceiver.
- ❑ Select any transmit channel, then *hold down* PTT.
- ❑ Check that the driver current measures 13 mA ±2 mA.
- ❑ If the current is out of the specified limit stated above, change it by adjusting DR BIAS (R222).
- ❑ Switch off the transceiver, disconnect the multimeter, then replace the link with a length of tinned copper wire.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121), if required.

ALTERNATIVE TEXT PA PCB (08-06461-001) (see Figure 34 on page 58)

To adjust the driver bias:

- ❑ Ensure the transceiver is switched off and the DC supply is disconnected.
- ❑ Disconnect the exciter output from the PA by removing the connector from J2 (Tx coaxial) on the RF/IF PCB in the RF unit.
- ❑ Unsolder the link labelled DR (DC supply to the driver FETs V207 and V208).
- ❑ Set a multimeter to DC 200 mA range and connect it in place of the removed link.
- ❑ Connect the DC supply, then switch on the transceiver.
- ❑ Select any transmit channel, then *hold down* PTT.
- ❑ Check that the driver current measures 56 mA ±2 mA.
- ❑ If the current is out of the specified limit stated above, adjust any of the following:
  - R222 (DR BIAS 1) and R235 (DR BIAS 2) fully counterclockwise
  - R222 (DR BIAS 1) until the current measures 28 mA ±2 mA
  - R235 (DR BIAS 2) until the current measures 56 mA ±2 mA
- ❑ Switch off the transceiver, disconnect the multimeter, then replace the link with a length of tinned copper wire.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121), if required.

Adjusting the PA bias

ALTERNATIVE TEXT PA PCB (08-05415-001) (see Figure 31 on page 58)

To adjust the bias of the PA output FETs:

- ❑ Ensure the transceiver is switched off and the DC supply is disconnected.
- ❑ Disconnect the exciter output from the PA by removing the connector from J2 (Tx coaxial) on the RF/IF PCB in the RF unit.
- ❑ Unsolder the fuse PA O/P (F201) next to the power relay (DC supply to the output FETs V215 and V216).
- ❑ Set a multimeter to DC 10 A range and connect it in place of the removed fuse (positive near to relay).
- ❑ Connect the DC supply, then switch on the transceiver.
- ❑ Select any transmit channel, then *hold down* PTT.
- ❑ Check that the output FET current measures 4 A ±100 mA.

  If the current is out of the specified limit stated above, change it by adjusting the preset potentiometer PA BIAS (R240).
- ❑ Switch off the transceiver, disconnect the DC supply, then resolder the fuse PA O/P.

  If the fuse is broken, replace it with two strands (2 × 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.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121), if required.

ALTERNATIVE TEXT PA PCB (08-05869-001) (see Figure 33 on page 58) or PA PCB (08-06461-001) (see Figure 34 on page 58)

To adjust the bias of the PA output transistors:

- ❑ Ensure the transceiver is switched off and the DC supply is disconnected.
- ❑ Disconnect the exciter output from the PA by removing the connector from J2 (Tx coaxial) on the RF/IF PCB in the RF unit.
- ❑ Unsolder the fuse PA O/P (F201) next to the power relay (DC supply to the output transistors V211 and V212).
- ❑ Set a multimeter to DC 1 A range and connect it in place of the removed fuse (positive near to relay).
- ❑ Connect the DC supply, then switch on the transceiver.
- ❑ Select any transmit channel, then *hold down* PTT.

- ❑ Check that the output current measures:
  - 400 mA ±50 mA for 08-05869, or
  - 200 mA ±20 mA for 08-06461

  If the current is out of the specified limit stated above, change it by adjusting the preset potentiometer PA BIAS (R239)
- ❑ Switch off the transceiver, disconnect the DC supply, then resolder the fuse PA O/P.

  If the fuse is broken, replace it with two strands (2 × 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.
- ❑ Return to the Repair flow chart (see Figure 45 on page 121), if required.

Adjusting high output power

ALTERNATIVE TEXT Filter and Control PCB (08-05416-001) (see Figure 35 on page 60)

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.

Before adjusting the output power, you must check the state of links X2 and X3 on the Filter and Control PCB in the RF unit:

- X2 and X3 both open—required when setting the output power to 100 W PEP (this complies with the licensing regulations in Australia)
- X2 and X3 joined—required when setting the output power to 125 W PEP at low frequency, reducing to 100 W PEP at 30 MHz

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 NGT stops increasing, then increase the output level of the 0208 by 3 dB.
- ❑ Adjust HI PWR (R32) for the required output:
  - for 100 W PEP, X2 and X3 both open
  - for 125 W PEP, X2 and X3 joined

  NOTE Equivalent readings for power meters without PEP and dB scales are listed in Table 34 on page 105 and Table 35 on page 105.
- ❑ 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 flow chart (see Figure 45 on page 121), if required.

ALTERNATIVE TEXT Filter and Control PCB (08-05910-001) (see Figure 36 on page 60)

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 NGT stops increasing, then increase the output level of the 0208 by 3 dB.
- ❑ Adjust HI PWR (R32) for the required output.

NOTE Equivalent readings for power meters without PEP and dB scales are listed in Table 34 on page 105 and Table 35 on page 105.

- ❑ 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 flow chart (see Figure 45 on page 121), if required.

Adjusting low output power

ALTERNATIVE TEXT Filter and Control PCB (08-05416-001) (see Figure 35 on page 60) or Filter and Control PCB (08-05910-001) (see Figure 36 on page 60)

NOTE Before adjusting the low output power, set the high output power (see page 114, *Adjusting high output power*).

To adjust the low output power:

- ❑ Select any frequency between 4 and 6 MHz.
- ❑ Select low power (Cfg Power Preference entry in the Control List).
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the output level of the 0208 until the RF output power of the NGT stops increasing, then increase the output level of the 0208 by 3 dB.
- ❑ Adjust LO PWR (R35) for 12 W PEP (5 W on an average reading meter).
- ❑ 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.
- ❑ Re-select high power.

Adjusting the bias gain

ALTERNATIVE TEXT

PA PCB (08-05415-001) (see Figure 31 on page 58) or PA PCB (08-05511-001) (see Figure 32 on page 58)

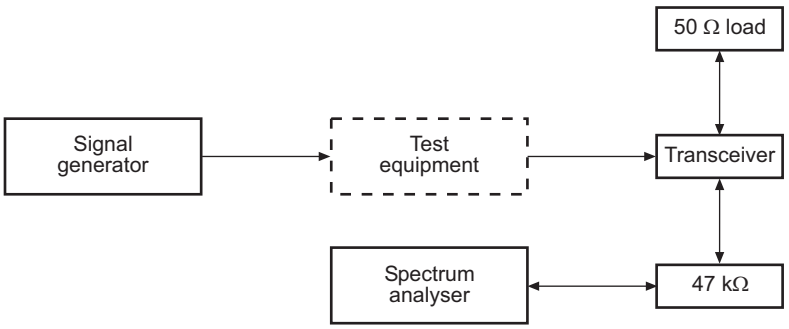
NOTE The bias gain must be set before any intermodulation adjustments are performed.

To adjust the bias gain:

- ❑ Connect a 50 Ω dummy load to the RF connector (♈) (see Figure 44).
- ❑ Connect a spectrum analyser via a 47 kΩ resistor to the RF connector (see Figure 44).

  This provides a low-level output for the spectrum analyser.

Figure 44: Setup for adjusting the bias gain



- ❑ Select a channel with a frequency of 24.9 MHz.
- ❑ Set up the spectrum analyser as follows:

Centre frequency	24.9 MHz
Frequency span	20 kHz (2 kHz per division)
Vertical level	10 dB per division
Video bandwidth	300 Hz
Sensitivity	Depends on the signal level applied to the spectrum analyser and will require adjustment when transmitting

- ❑ Switch on PTT on the 0208, then adjust the level of the two tones for compression.
- ❑ Adjust the two tones displayed on the spectrum analyser for equal amplitude by adjusting the balance control on the 0208.

- ❑ Adjust the sensitivity control on the spectrum analyser to set the two tones at the top of the screen.
- ❑ Adjust the GAIN potentiometer (R244) for a minimum intermodulation distortion level.
- ❑ Measure the intermodulation distortion levels relative to each tone.

  Add 6 dB to the reading if referenced to PEP.
- ❑ Switch off PTT on the 0208.

Adjusting the active bias

ALTERNATIVE TEXT

PA PCB (08-05869-001) (see Figure 33 on page 58) or PA PCB (08-06461-001) (see Figure 34 on page 58)

NOTE The active bias must be set before any intermodulation adjustments are performed.

To adjust the active bias:

- ❑ Connect setup as per the bias gain adjustment (see page 116, *Adjusting the bias gain*).
- ❑ 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 NGT stops increasing, then increase the output level of the 0208 by 3 dB.
- ❑ Starting from the fully-counterclockwise position, turn R241 slowly clockwise, while observing the two-tone waveform on the oscilloscope.
- ❑ Adjust R241 to the point at which the waveform begins to enlarge.
- ❑ Switch off PTT on the 0208.

Adjusting balance control

ALTERNATIVE TEXT

PA PCB (08-05415-001) (see Figure 31 on page 58) or PA PCB (08-05511-001) (see Figure 32 on page 58)

To adjust the balance control:

- ❑ Connect setup as per the bias gain adjustment (see page 116, *Adjusting the bias gain*).
- ❑ Select a channel with a frequency of 8.6 MHz.

- ❑ Set up the spectrum analyser as follows:

Centre frequency	10 MHz
Frequency span	20 MHz (2 MHz per division)
Vertical level	10 dB per division
Sensitivity	Depends on the signal level applied to the spectrum analyser and will require adjustment when transmitting

- ❑ Press **TUNE** on the handset.
- ❑ *Hold down* PTT on the handset.
- ❑ Adjust the sensitivity control on the spectrum analyser to set the tone at the top of the screen.
- ❑ Adjust the balance control (R253) for a minimum on 17.2 MHz.
- ❑ Check that the level of the 2nd harmonic (17.2 MHz) is below 60 dB.
- ❑ Release PTT on the handset.

ALTERNATIVE TEXT PA PCB (08-05869-001) (see Figure 33 on page 58) or PA PCB (08-06461-001) (see Figure 34 on page 58)

To adjust the balance control:

- ❑ Connect setup as per the bias gain adjustment (see page 116, *Adjusting the bias gain*).
- ❑ Select a channel with a frequency of 5.7 MHz.
- ❑ Set up the spectrum analyser as follows:

Centre frequency	11.4 MHz
Frequency span	20 kHz (2 kHz per division)
Vertical level	10 dB per division
Sensitivity	Depends on the signal level applied to the spectrum analyser and will require adjustment when transmitting

- ❑ Press **TUNE** on the handset.
- ❑ *Hold down* PTT on the handset.
- ❑ Adjust the balance control (R273) for a minimum on 11.4 MHz.
- ❑ Check that the level of the 2nd harmonic (11.4 MHz) is below 60 dB.
- ❑ Release PTT on the handset.

Adjusting the PA gain

ALTERNATIVE TEXT

RF/IF PCB (08-05261-001) (see Figure 29 on page 56) or RF/IF PCB (08-05889-001) (see Figure 30 on page 56), and PA PCB (08-05415-001) (see Figure 31 on page 58) or PA PCB (08-05511-001) (see Figure 32 on page 58) or PA PCB (08-05869-001) (see Figure 33 on page 58) or PA PCB (08-06461-001) (see Figure 34 on page 58)

To adjust the PA gain:

- ❑ Select any frequency between 4 and 6 MHz.
- ❑ Connect an oscilloscope to the TX test point (exciter output) on the RF/IF PCB in the RF unit (use connector J2 body as earth).
- ❑ Adjust the Balance on the 0208 fully clockwise.
- ❑ Switch on PTT on the 0208.
- ❑ Adjust the audio output level on the 0208 until the exciter output level is 225 mV p–p.
- ❑ Adjust the PA GAIN control (R205) on the PA PCB to give a 45 W output.
- ❑ Switch off PTT on the 0208.

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Figure 45: Repair flow chart

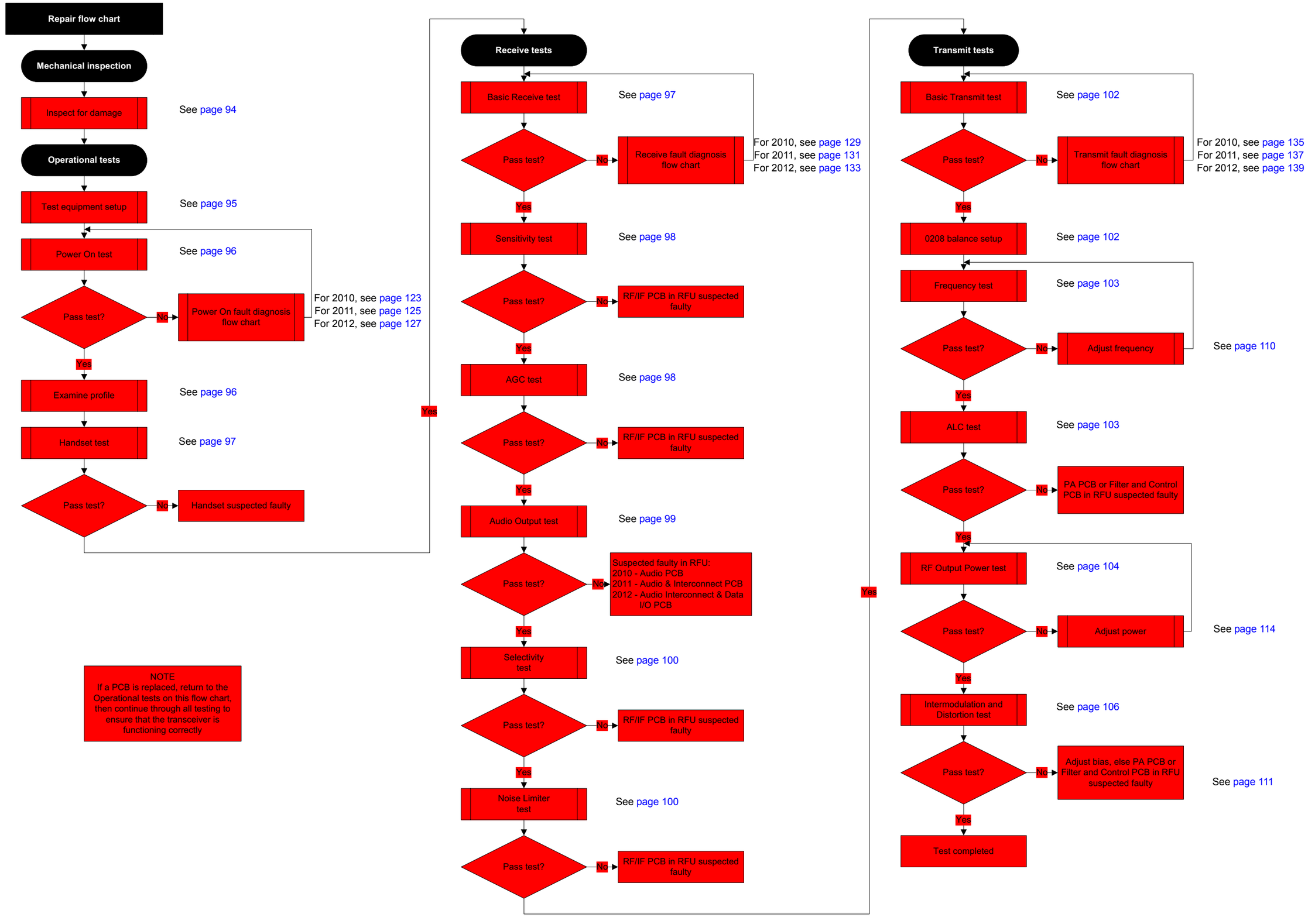

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Figure 46: 2010 Power On fault diagnosis flow chart

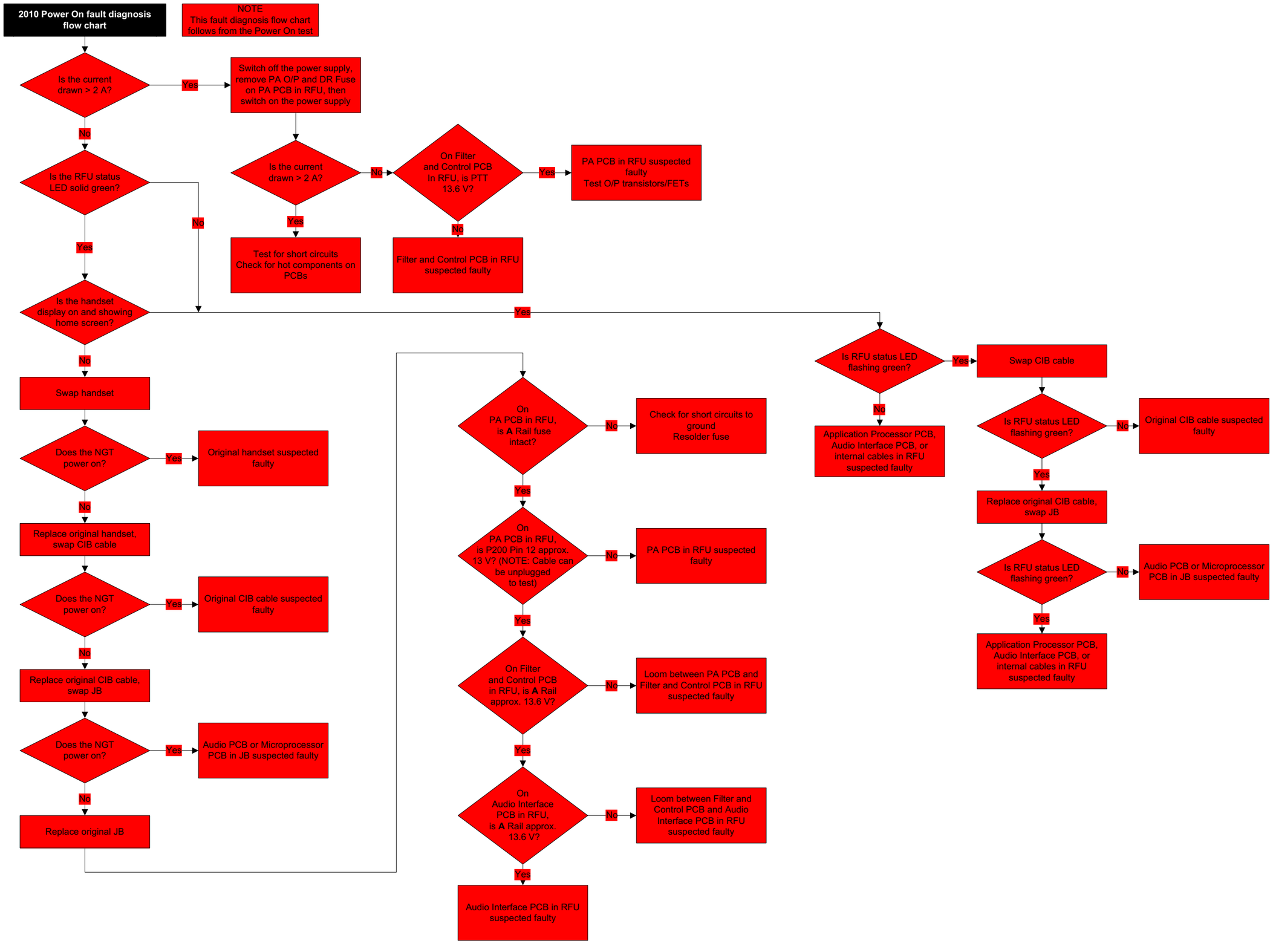

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Figure 47: 2011 Power On fault diagnosis flow chart

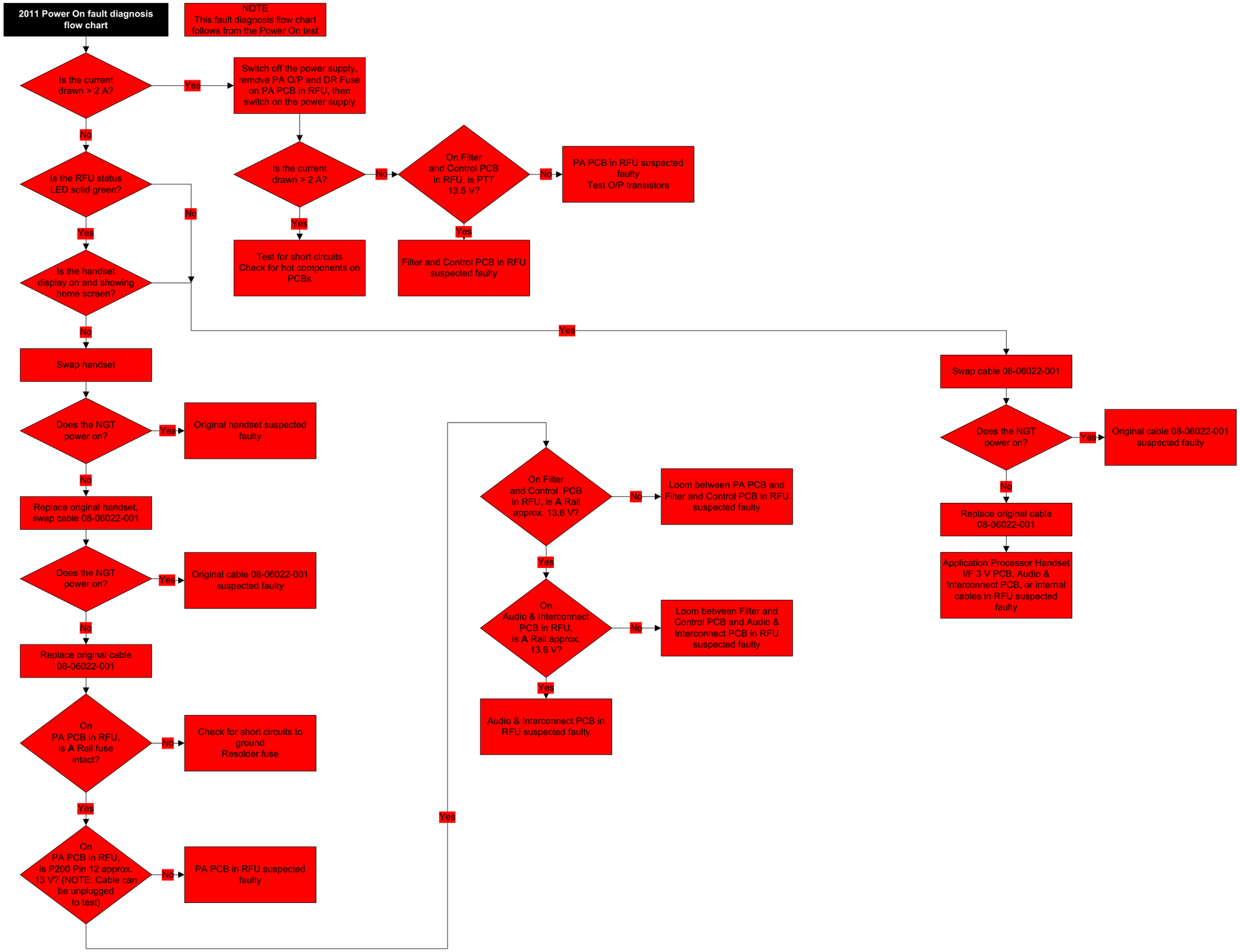

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Figure 48: 2012 Power On fault diagnosis flow chart

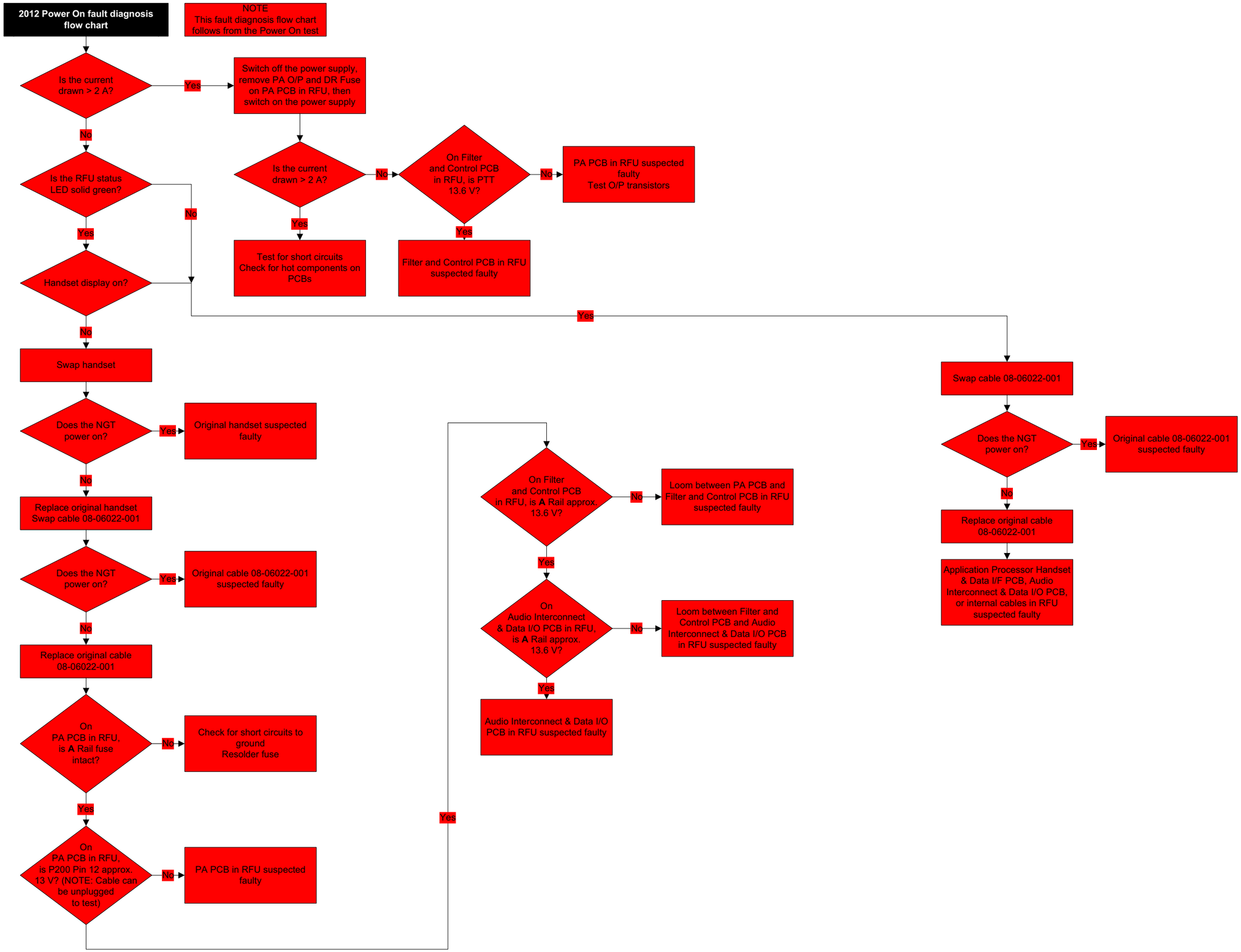

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Figure 49: 2010 Receive fault diagnosis flow chart

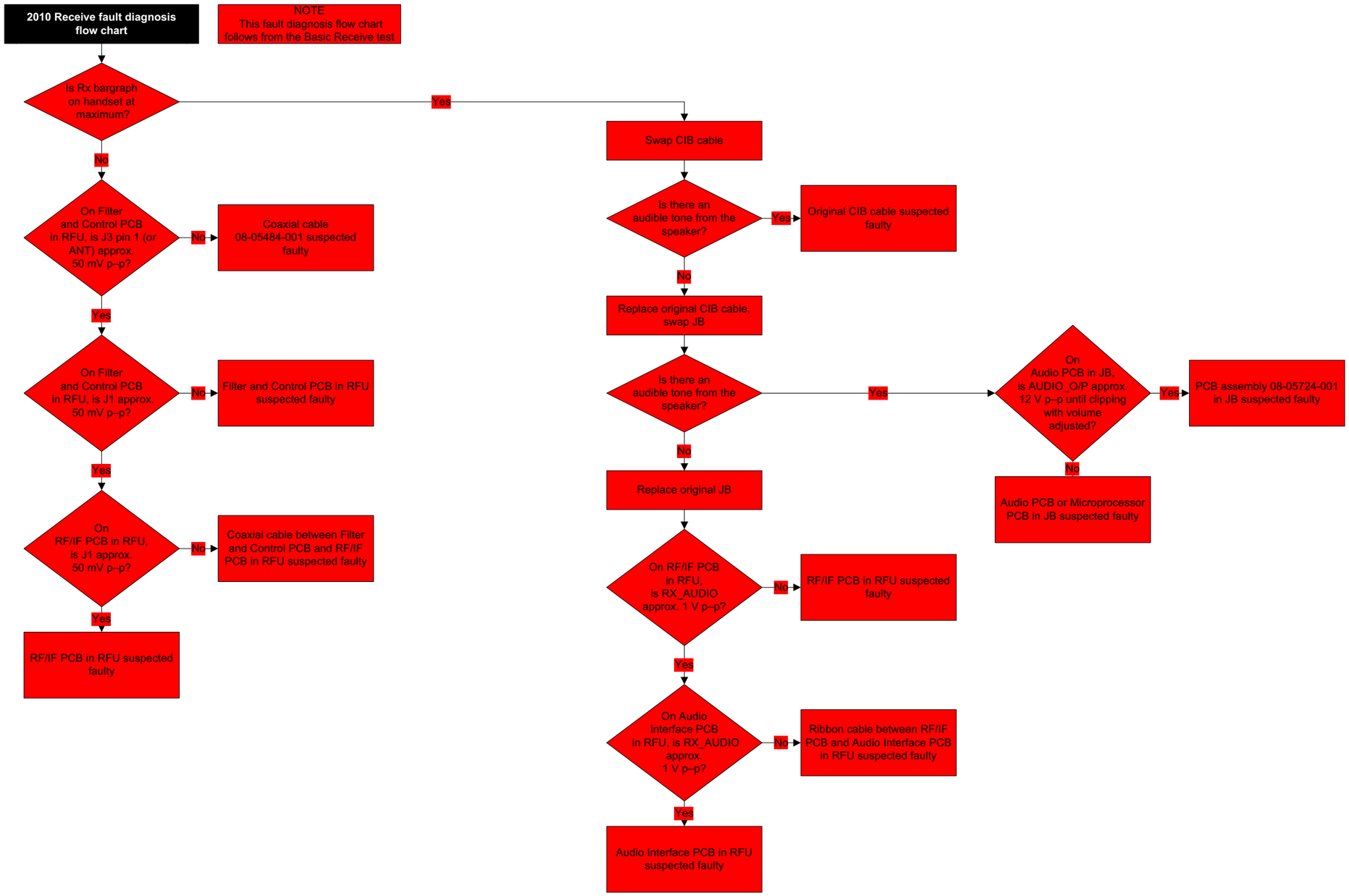

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Figure 50: 2011 Receive fault diagnosis flow chart

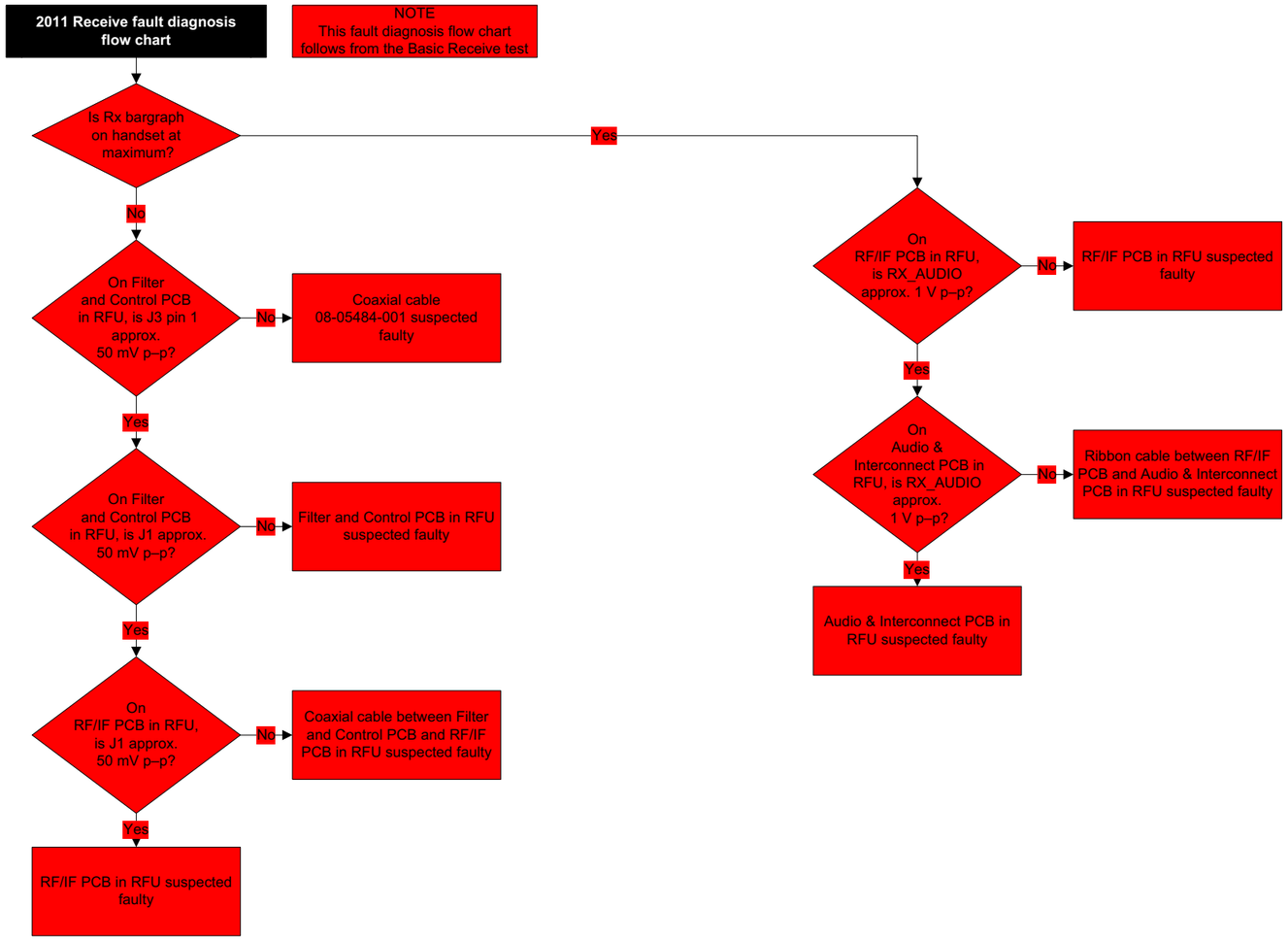

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Figure 51: 2012 Receive fault diagnosis flow chart

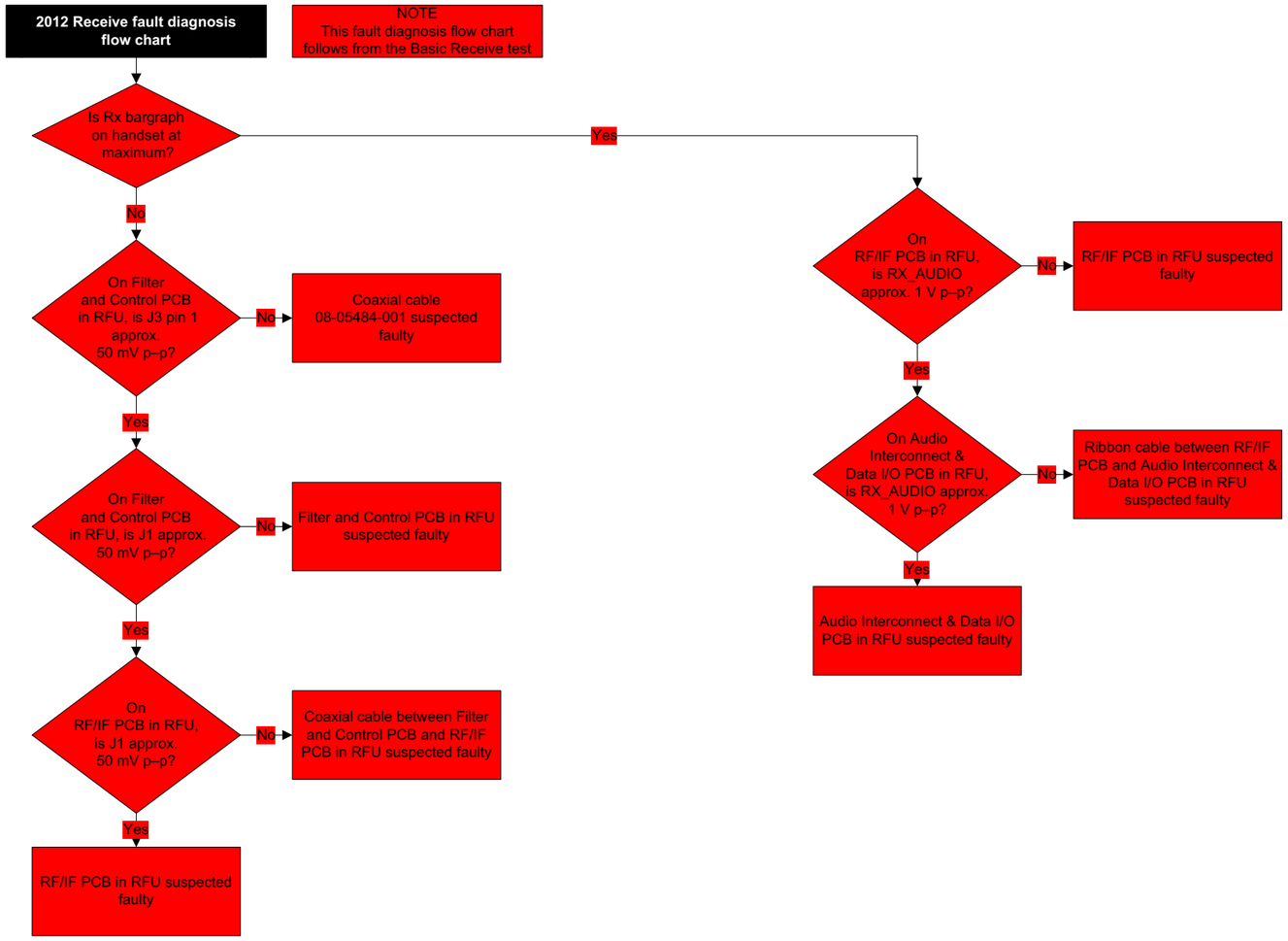

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Figure 52: 2010 Transmit fault diagnosis flow chart

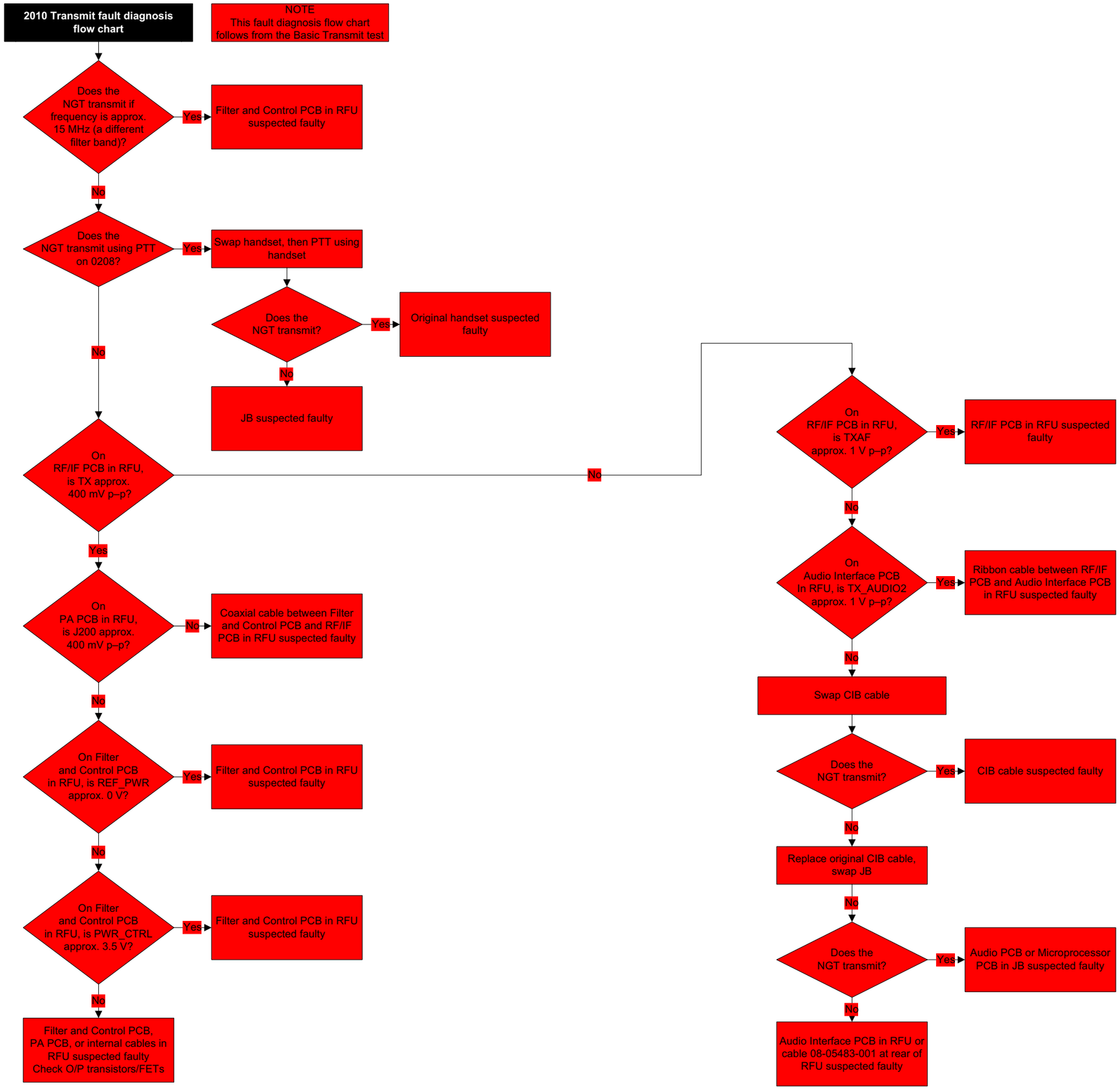

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Figure 53: 2011 Transmit fault diagnosis flow chart

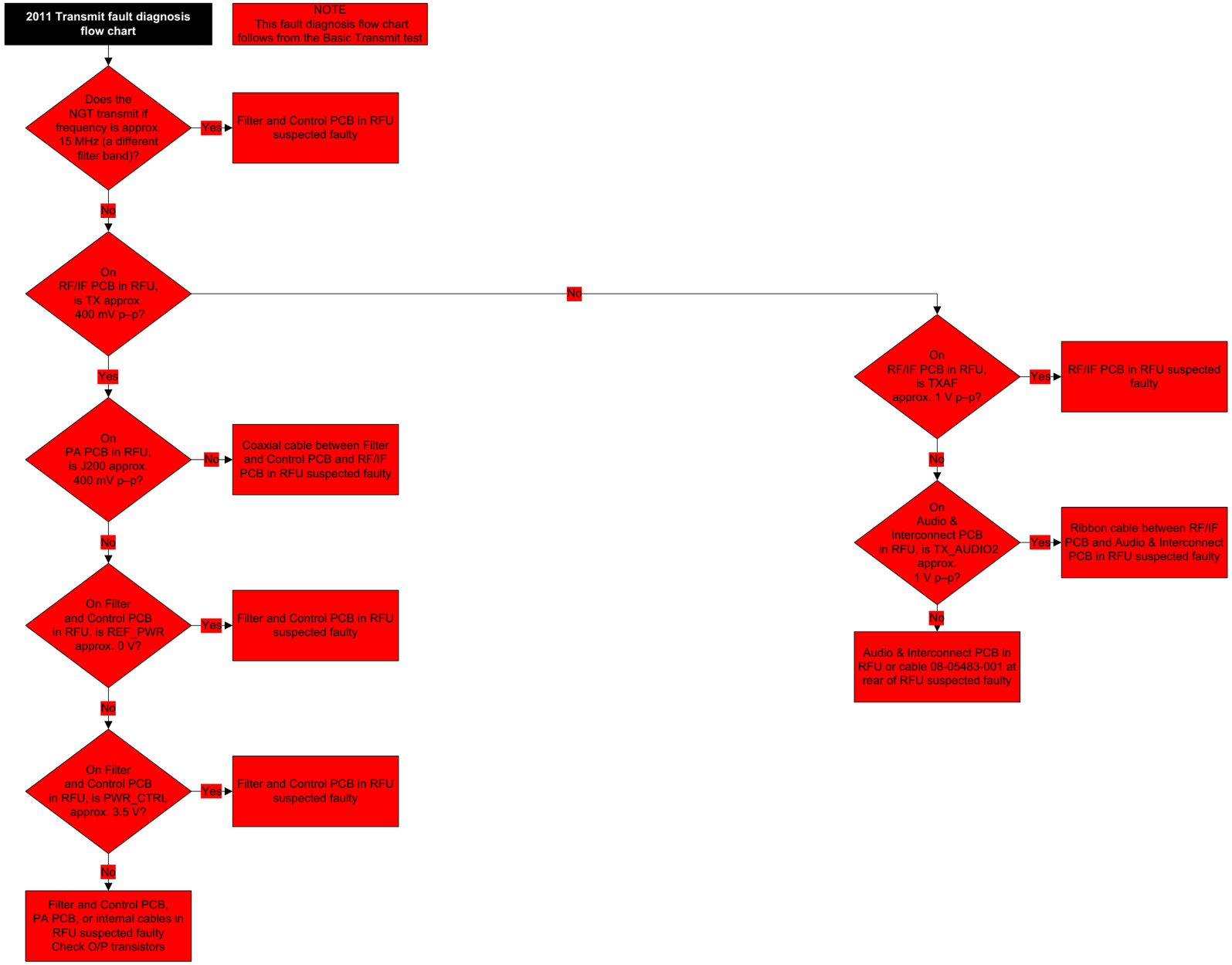

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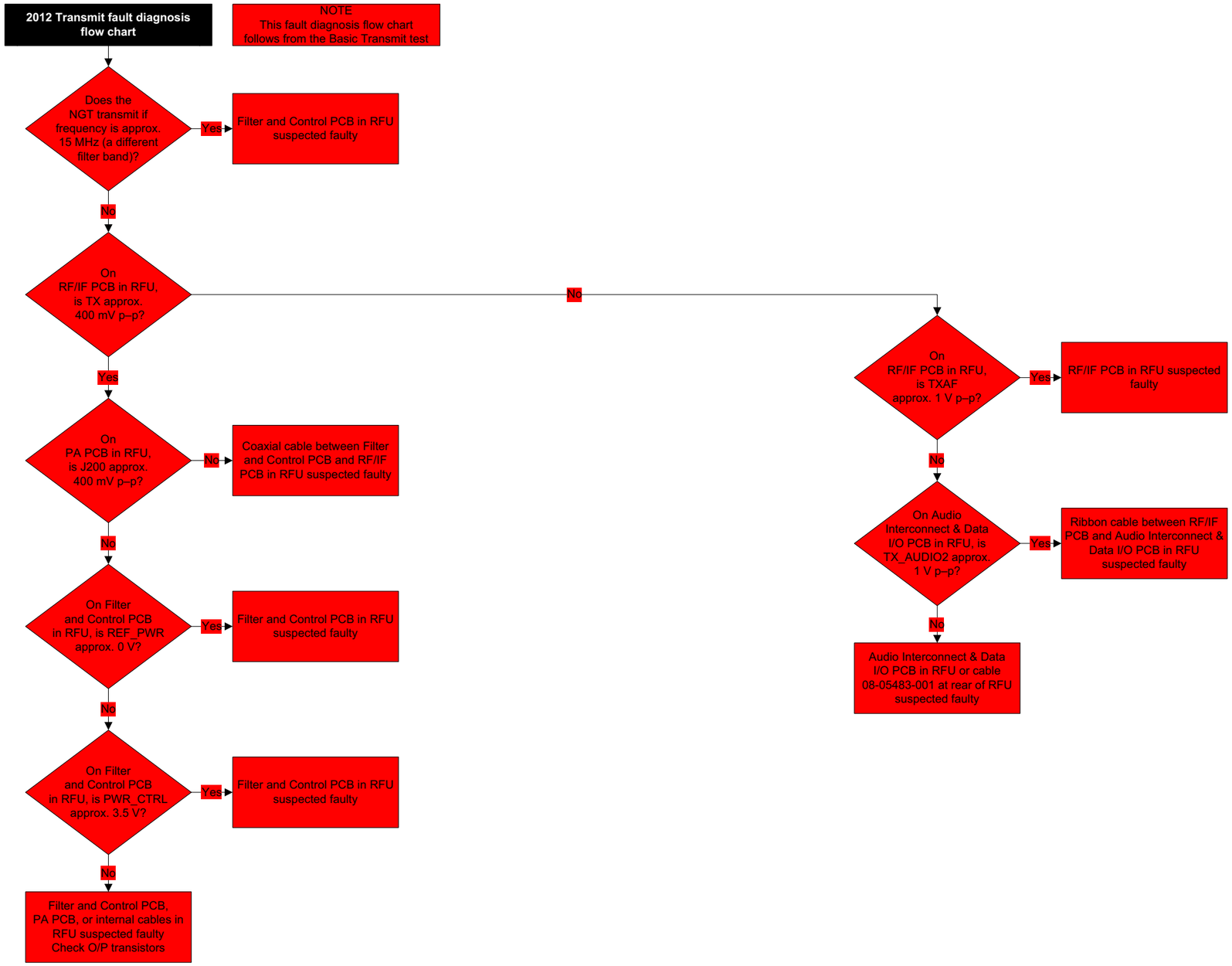
Figure 54: 2012 Transmit fault diagnosis flow chart



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Test sheet for the NGT series 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
2010 RF Unit		
2030 Junction Box		
2011 RF Unit		
2012 RF Unit		
2020 Handset		
Options fitted:		

Mechanical inspection

Inspect for...	Yes/No	Action
Physical damage		
Water ingress		
Corrosion		
Connector pins straight		
Plugs/sockets oriented correctly		
Cables positioned/clamped correctly		
PCBs/assemblies fixed securely		

Operational tests

Test	Criteria	Reading	Pass/Fail	Action
Power On	Handset displays Logo screen			
	Current drawn < 2 A			
User profile saved as:				
Handset	All pixels flash			
	Each key is displayed on screen when pressed			

Receive tests

Test	Criteria	Reading	Pass/Fail	Action
Basic Receive	Audible tone from 0208			
Sensitivity	RF amp on, RF output level –121 dBm, AC voltmeter reading > 10 dB			
	RF amp off, RF output level –103 dBm, AC voltmeter reading > 10 dB			
AGC	RF output level from signal generator < –99 dBm			
Audio Output	RF output level –67 dBm with audible tone from 0208			
	Waveform that does not clip until 5.5 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	Audible tone over faint buzz from 0208			

Transmit tests

Test	Criteria	Reading	Pass/Fail	Action
Basic Transmit	100 W variant: RF power meter reading approx. 100 W 125 W variant: RF power meter reading approx. 125 W			
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 @ 6 dB below ALC threshold (with load)			
	DC supply current reduced by 50% @ 6 dB below ALC threshold (without load)			
RF Output Power	100 W variant: RF power meter reading between 89 and 112 W for all bands 125 W variant: RF power meter reading between 112 and 141 W at 1.6 MHz, decreasing to between 79 and 126 W for all bands	4 to 6 MHz		
		Band 1		
		Band 2		
		Band 3		
		Band 4		
		Band 5		
		Band 6		
		Band 7		

Transmit tests (cont.)

Test	Criteria	Reading	Pass/Fail	Action
Intermodulation and Distortion	Oscilloscope waveform is acceptable		If Fail, what type?	
	Spectrum analyser: IMD products 26 dB down on all bands	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			

The drawings listed in this section are required for identifying a fitted option, then adjusting equipment after testing to ensure that the option is functional.

Table 36: Options

Title	Drawing number
Option, 100 W PEP for NGT	15-10502-001
Option, External ALC	15-10504-001 sheet 1 15-10504-001 sheet 2 15-10504-001 sheet 3
Option, 500 Hz Filter, NGT	15-10506-001
Option, NGT Voice Encryptor	15-10507-001
Option, 2700 Hz Filter, NGT	15-10514-001
Option, SC20-455 Encryptor	15-10523-001
Option, 3000 Hz Filter, NGT	15-10535-001

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ISSUE STATUS

ISSUE	DATE	CR NO.	DESCRIPTION OF CHANGE	SIGNED
1	19-3-01		Approved	NJA
2	5/12/02	27404	Update for filter and control PCB variants.	G. Bond

Fitting Instruction for Option 100W PEP for NGT

This sheet should be read together with the NGT's Filter and Control circuit diagram and assembly drawings found in the NGT Technical Service Manual.

1. Remove the NGT's top cover.
2. Locate and make modifications to the Filter and Control PCB as per the following table.

Filter and Control PCB 08-05416-001 & 08-05871-001	Filter and Control PCB 08-05910-001
Cut Links X2 & X3	Solder Link X2

3. Check O/P power is now 100W ±5W on a frequency below 10Mhz. (Adjust "Hi PWR" if required).
4. Replace Cover.

DO NOT SCALE

ISSUE 2:
SHT 2 ADDED
REF TO ASSY ADDED.
C/R 27307
T.Bolton 18-09-02

ISSUE 3:
SHT 3 ADDED.
ADDITIONAL NOTES
ADDED SHT 1 & 2.
C/R 27527
25-08-03 BHJ

ISSUE 4:
SHT 1, POINT 3:
REFERENCE TO ASSY
08-05614-001 DELETED
C/R 28567
27-6-05 RML

ISSUE 5:
SECT 4 REPLACED
BECAUSE ASSY
08-06461 ADDED.
C/R 30026
28-11-05 BHJ

3061/3062 AMPLIFIERS:

1. Remove top and bottom covers of RF unit

2. Either
   a. Ensure the NGT RF Unit Build Standard is Q or greater,
      ie the Barcode Reads XXXXXXXQXXX or greater
   Or
   b. Locate 'Application Processor' PCB
      i. Ensure 90-20590-001 (IC4) version >= 1.10
         Locate 'RF/IF' PCB
      ii. Ensure 90-20612-001 (IC408) version >= 2.01
         Locate 'Filter and Control' PCB
      iii. Ensure 90-20608-001 version >= 2.01

3. Locate 'Filter and Control' PCB
   a. Ensure assembly is 08-05910-001.
   b. Solder X1 link.

4. Locate 'Power Amplifier' PCB
   1. For assembly 08-05869
      a. Turn 'active bias' control fully anticlockwise (R241)
      b. Set 'driver bias' to 23mA ± 3mA (R222)
      c. Set 'output bias' to 650mA ± 50mA (R234)
   2. For assembly 08-06461
      a. Set 'output bias' to 300mA ± 20mA (R239)

5. Replace top and bottom covers of RF unit

6. Fit label 06-02160 to top cover of NGT near the heatsink fins

7. Turn on handset
   a. From the main menu select 'control'
   b. Select the 'devices' entry
   c. Select the 'rf unit' entry
   d. Select the 'software version' entry &
   e. Ensure DSP version >= 3.13
   f. Press the 'x' key repeatedly to return to the main menu
   g. From the main menu select 'control'
   h. Select the 'cfg auto tune mode' entry
   i. Select the 'amplifier only' menu
   j. Press the 'x' key repeatedly to return to the main menu

8. Ensure fan option F (15-10469) is fitted

FILE No.
15\10504__5.DWG

CODAN

MATERIAL

FINISH

SCALE 1:1

DRN	DJ	DATE 3-10-01
CHKD	NJA	6-11-01
APPD	AJC	19-07-02

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
OPTION, EXTERNAL ALC

A4

DRAWING/DOC NO.
15-10504-001

ISS 5

SHT. 1 OF 3

ISSUE 2: SHT 2 ADDED REF TO ASSY ADDED. C/R 27307 T.Bolton 18-09-02
ISSUE 3 REFER SHT 1.
ISSUE 4: REFER SHT 1. C/R 28567
ISSUE 5: REFER SHT 1. C/R 30026

TW500 & TW1000 AMPLIFIERS:

1. Remove top and bottom covers of RF unit

2. Locate 'Application Processor' PCB
   a. Ensure Master PIC version >= 1.10

3. Locate 'Filter and Control' PCB
   a. For assembly 08-05416-001 only
      i. Solder X1 link and cut X2 & X3 links
   b. For assembly 08-05910-001 only
      i. Solder X1 link
      ii. Check the power output on a frequency below
      iii. If power output >100W solder link X2
      iv. Check power output is now 100W PEP on same frequency as before

4. Replace top and bottom covers of RF unit

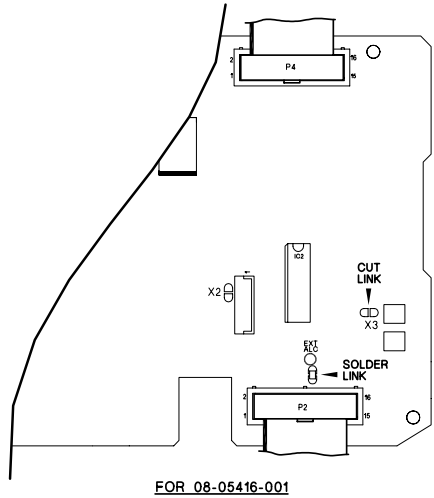
5. Turn on handset
   a. From the main menu select 'control'
   b. Select the 'devices' entry
   c. Select the 'rf unit' entry
   d. Select the 'software version' entry &
   e. Ensure DSP version >= 2.30
   f. Press the 'X' key repeatedly to return to the main menu
   g. From the main menu select 'Control'
   h. Select the 'Cfg Auto Tune Mode' entry
   i. Select the 'Amplifier Only' menu
   j. Press the 'X' key repeatedly to return to the main menu

6. Ensure fan option F (15-10469) is fitted

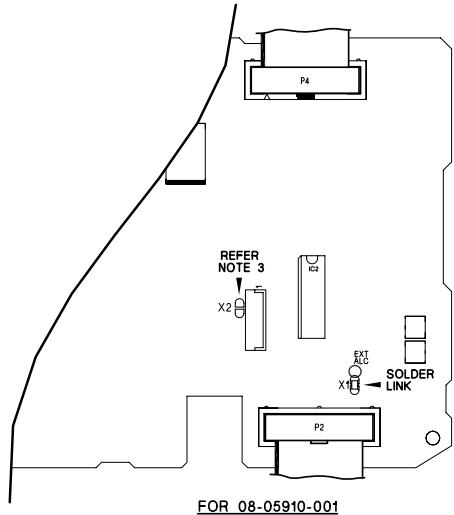
FILE No.
15\10504__5.DWG

CODAN		SCALE 1:1	© CODAN LIMITED, A.C.N. 007 590 605: 2001	
	DRN DJ	DATE 3-10-01	TITLE	OPTION, EXTERNAL ALC
MATERIAL	CHKD NJA	6-11-01		
	APPD AJC	19-07-02	DRAWING/DOC NO.	
	TOLERANCES UNLESS OTHERWISE STATED		A4	15-10504-001
FINISH	2 PLACES DEC. ±0.10 1 PLACE DEC. ±0.5 0 PLACE DEC. ±1		ISS 5	SHT. 2 OF 3

ISSUE 2: SHT 2 ADDED REF TO ASSY ADDED. C/R 27307 T.Bolton 18-09-02
ISSUE 3 REFER SHT 1.
ISSUE 4: REFER SHT 1. C/R 28567
ISSUE 5: REFER SHT 1. C/R 30026



FOR 08-05416-001



FOR 08-05910-001

FILE No.
15\10504__5.DWG

CODAN

MATERIAL

FINISH

		SCALE 1:1
DRN	DJ	DATE 3-10-01
CHKD	NJA	6-11-01
APPD	AJC	19-07-02

TOLERANCES
UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
OPTION, EXTERNAL ALC

A4

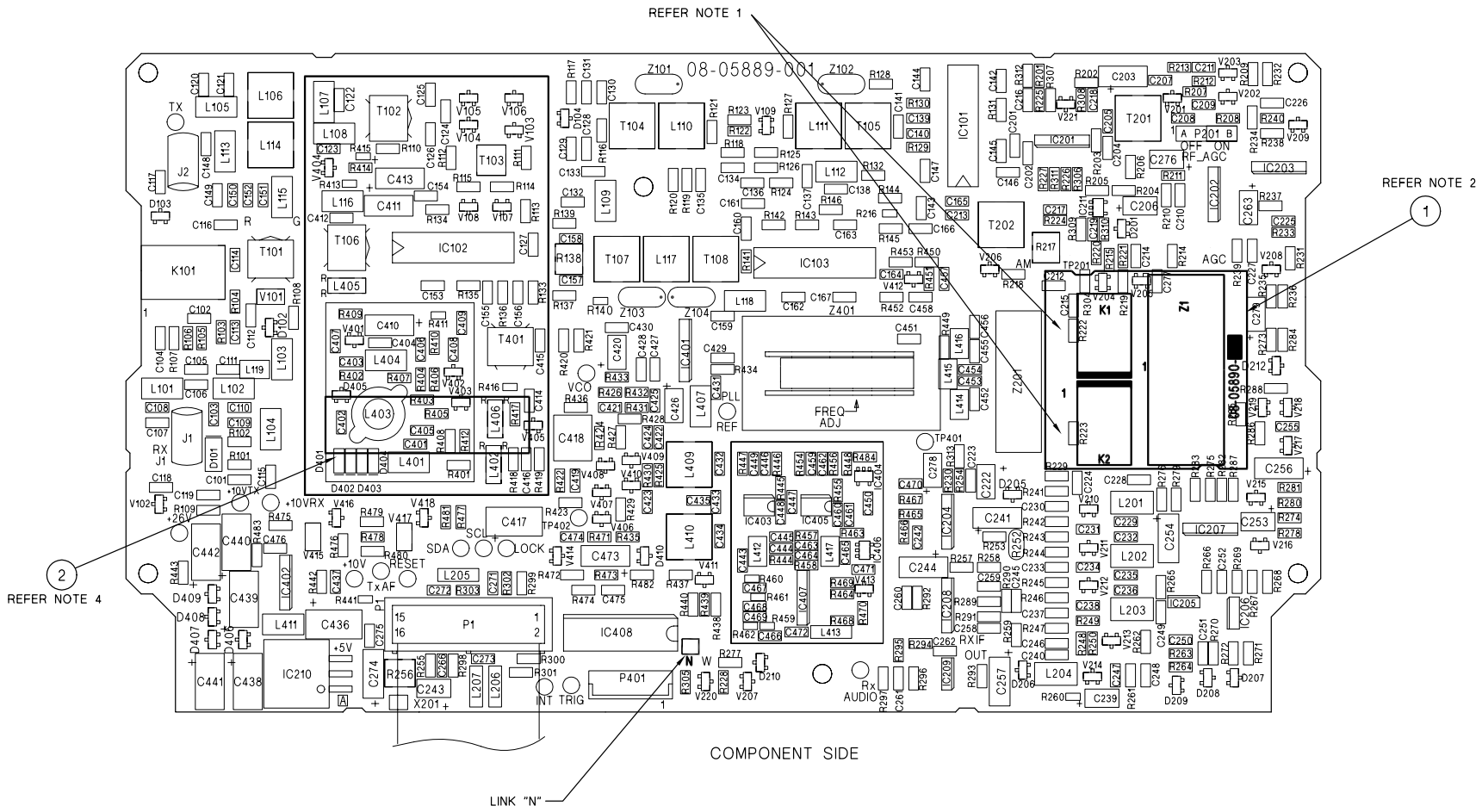
DRAWING/DOC NO.
15-10504-001

ISS 5

SHT. 3 OF 3

DO NOT SCALE

ISSUE 2:
LINK "N" ADDED.
NOTE 5 WAS 4, NOTE 4 WAS 3, NOTE 3 ADDED
NOTE 5 REFFERED TO NARROW FILTER.
C/R 27587
NJA 13-6-03



COMPONENT SIDE

NOTES:

1. REMOVE R222 & R223.
2. PLACE & SOLDER FILTER ASSEMBLY (ITEM 1).
3. SOLDER LINK "N".
4. PLACE SERIAL NUMBER LABEL (ITEM 2) NEAR THE PCB SERIAL NUMBER LABEL ON SHIELD.
5. ENABLE SECOND FILTER OPTION IN NSP.

REQUIRES 90-20612-001 VERSION 2.01, OR LATER.

DIMENSIONS IN mm

ASSY: 08-05889-001

FILE No. 15\10506__2.DWG

CODAN

MATERIAL

FINISH

SCALE 2:1

DRN	C G	DATE 14-2-02
CHKD	J.D	19-2-02
APPD	AJC	17-02-03

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC.
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

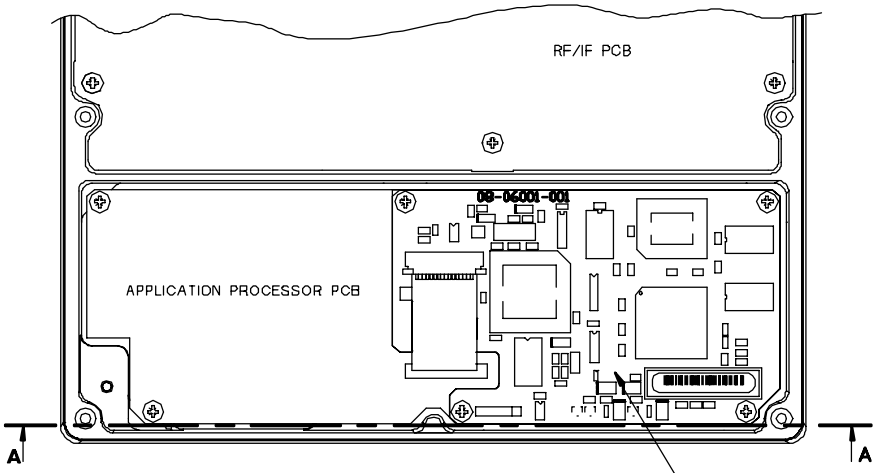
TITLE
OPTION
500Hz FILTER, NGT
FITTING INSTRUCTIONS

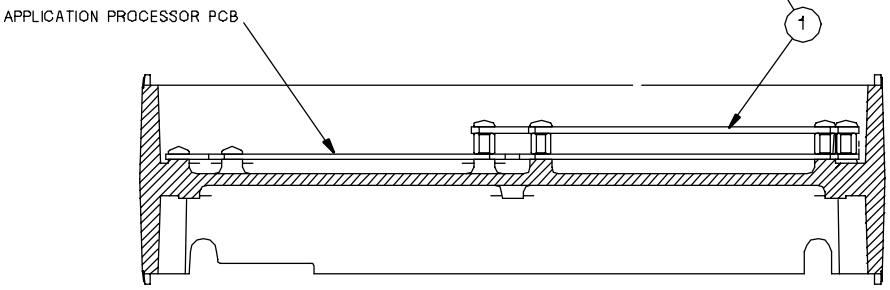
DRAWING/DOC NO.
A2 15-10506-001

ISS 2

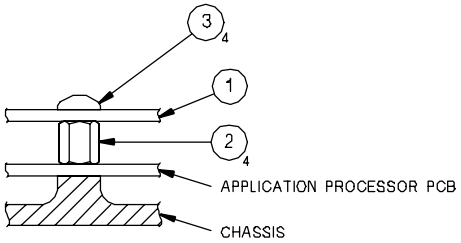
SHT. 1 OF 1

DO NOT SCALE





SECTION A-A



TYP MOUNTING DETAIL
4 PLACES

NOTES:

1. REMOVE AND DISCARD 4 TAPTITES HOLDING THE APPLICATION PROCESSOR IN PLACE. REPLACE WITH 4 x STUDDED SPACERS {ITEM 2}.
2. LOCATE ENCRYPTOR BOARD ONTO APPLICATION PROCESSOR BOARD. INSERT AND LATCH ENCRYPTOR INTERCONNECT CABLE.
3. SECURE ENCRYPTOR BOARD WITH 4 x MACHINE SCREWS {ITEM 3}.

FILE No.
15\10507__1.DWG

CODAN

MATERIAL

FINISH

DIMENSIONS IN mm

		SCALE 1:1
DRN	AML	DATE 19-06-02
CHKD	SSJ	20-06-02
APPD	AJC	21-10-02

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
NGT VOICE ENCRYPTOR INSTALLATION DETAIL

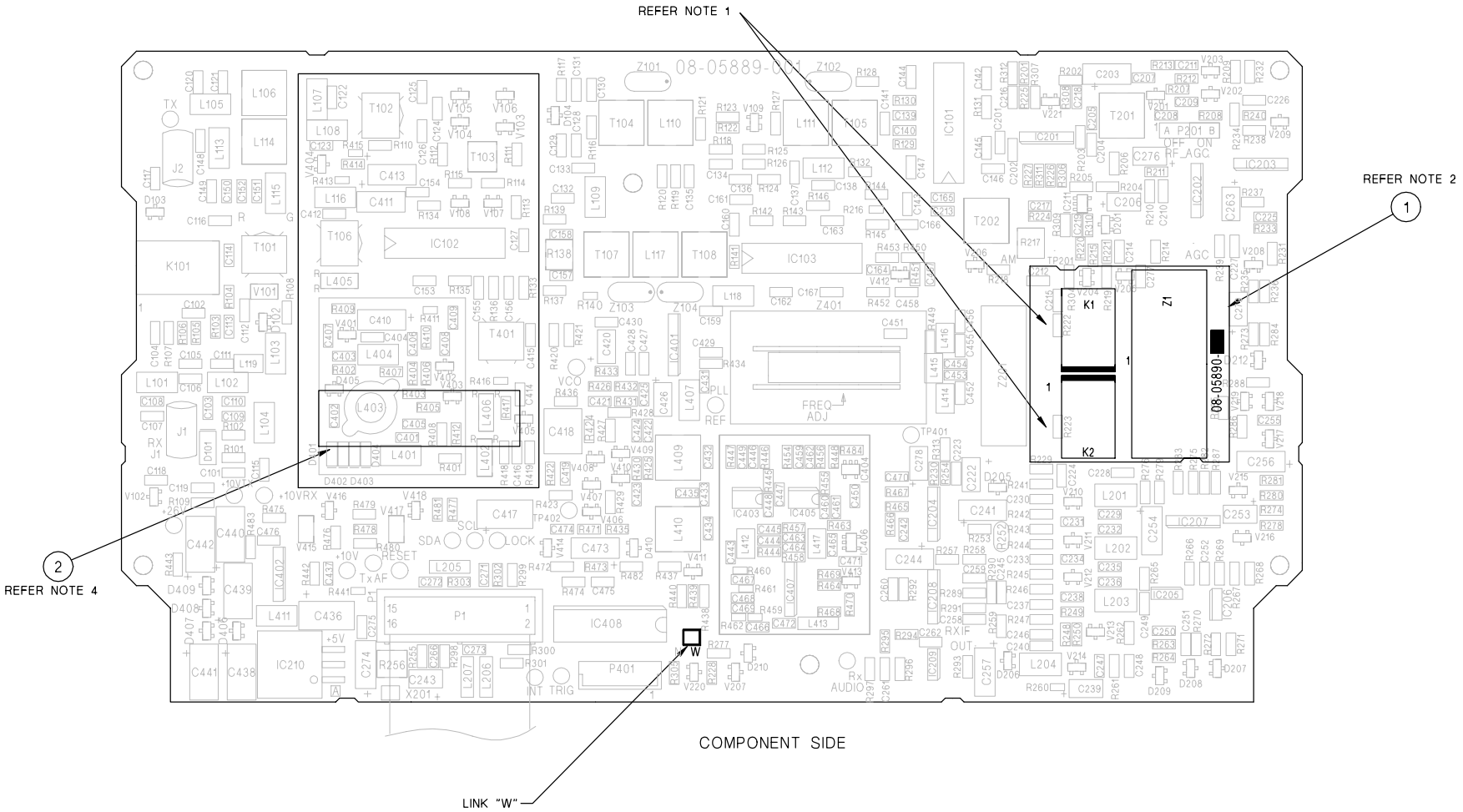
DRAWING/DOC NO.
A2 15-10507-001

ISS 1

SHT. 1 OF 1

DO NOT SCALE

ISSUE B:
LINK "W" ADDED.
NOTE 5 WAS 4, NOTE 4 WAS 3, NOTE 3 ADDED
NOTE 5 REFERRED TO WIDE FILTER.
C/R 27587
NJA 13-6-03



COMPONENT SIDE

NOTES:

1. REMOVE R222 & R223.
2. PLACE & SOLDER FILTER ASSEMBLY (ITEM 1).
3. SOLDER LINK "W".
4. PLACE SERIAL NUMBER LABEL (ITEM 2) NEAR THE PCB SERIAL NUMBER LABEL ON SHIELD.
5. ENABLE SECOND FILTER OPTION IN NSP.

REQUIRES 90-20612-001 VERSION 2.01, OR LATER.

DIMENSIONS IN mm

ASSY: 08-05889-001

FILE No.
15\10514__1.DWG

CODAN

MATERIAL

FINISH

SCALE		2:1
DRN	ILT	DATE 25-11-02
CHKD	NJA	25-11-02
APPD	AJC	04-07-03

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC.
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

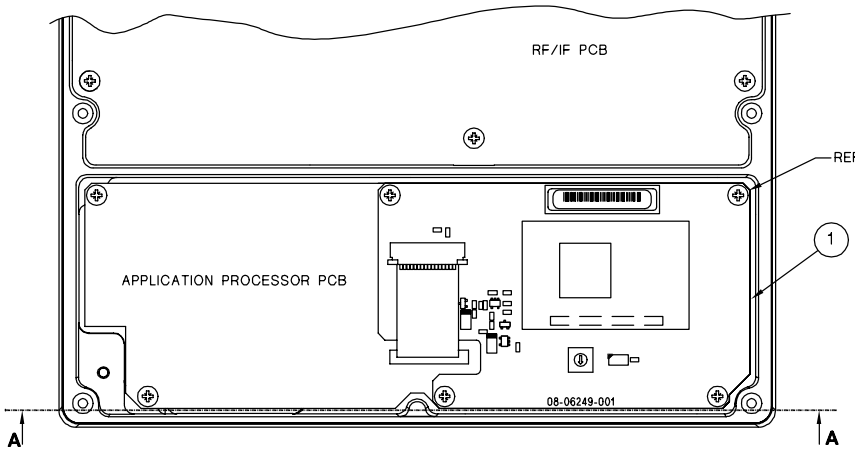
TITLE
OPTION
2700Hz FILTER, NGT
FITTING INSTRUCTIONS

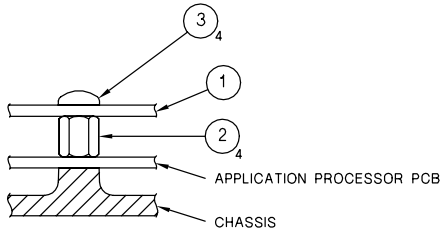
DRAWING/DOC NO.
A2 15-10514-001

ISS 1

SHT. 1 OF 1

DO NOT SCALE

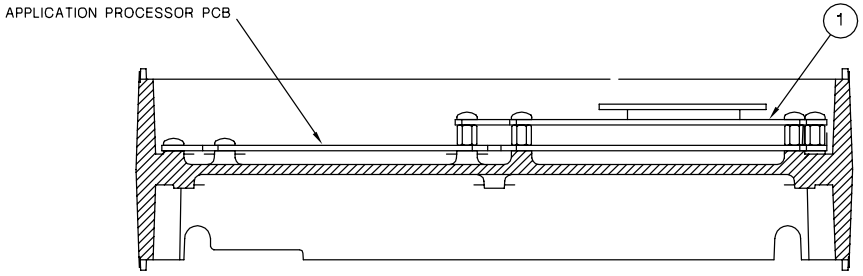




TYP MOUNTING DETAIL
4 PLACES

NOTES:

1. REMOVE AND DISCARD 4 TAPTITES HOLDING THE APPLICATION PROCESSOR IN PLACE, REPLACE WITH 4 x STUDDED SPACERS (ITEM 2).
2. LOCATE ENCRYPTOR BOARD ONTO APPLICATION PROCESSOR BOARD. INSERT AND LATCH ENCRYPTOR INTERCONNECT CABLE.
3. SECURE ENCRYPTOR BOARD WITH 4 x MACHINE SCREWS (ITEM 3).



SECTION A-A

DIMENSIONS IN mm

FILE No.
15\10523__1.DWG

CODAN

MATERIAL

FINISH

SCALE 1:1

DRN	C G	DATE 28-6-04
CHKD	SSJ	29-6-04
APPD	KMW	23-11-04

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC. ±0.10
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

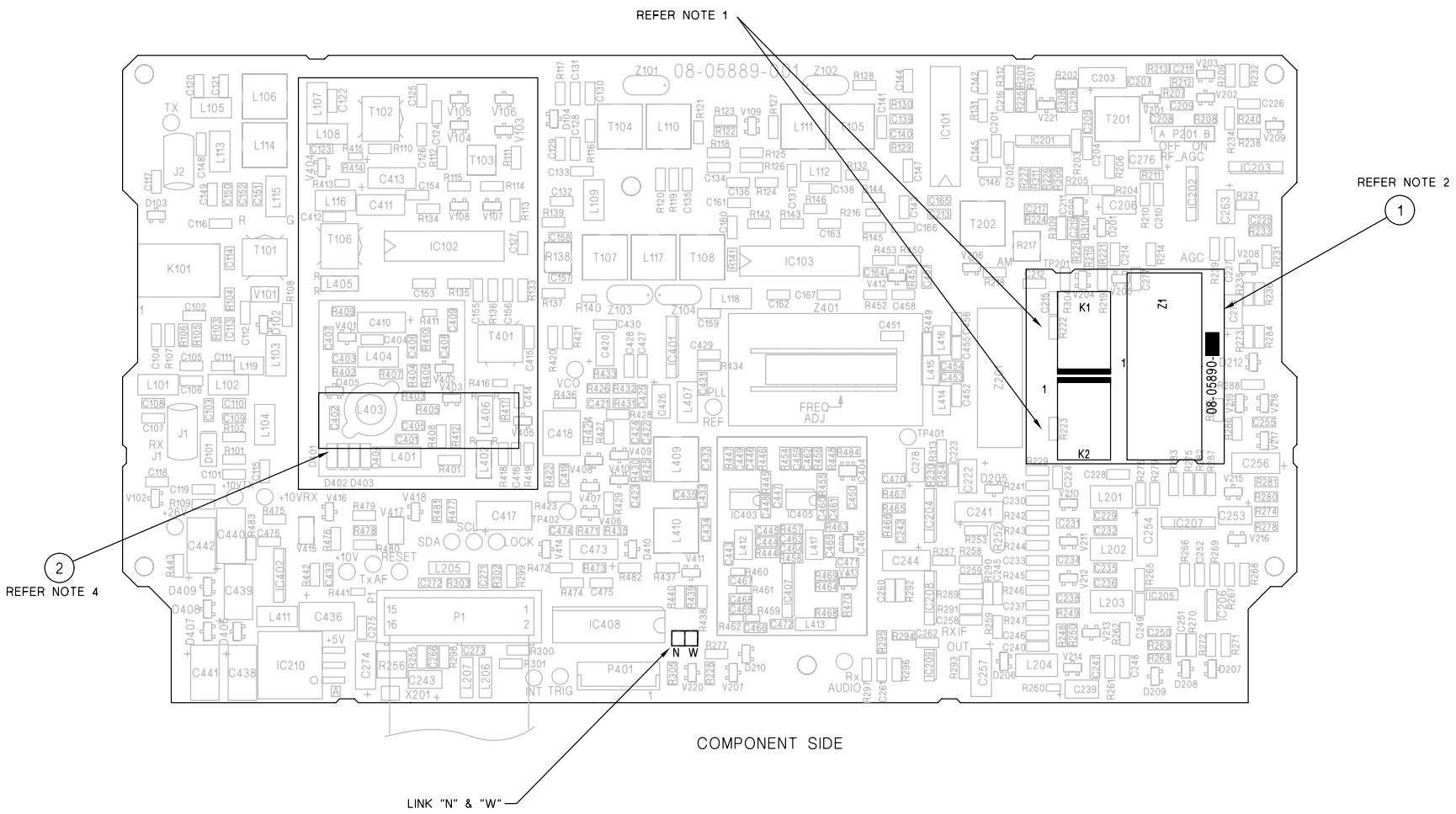
TRANSCRYPT SC20-455
ENCRYPTOR
INSTALLATION DETAIL

DRAWING/DOC NO.
A2 15-10523-001

ISS 1

SHT. 1 OF 1

DO NOT SCALE



NOTES:

1. REMOVE R222 & R223.
2. PLACE & SOLDER FILTER ASSEMBLY (ITEM 1).
3. SOLDER LINK "N" & "W".
4. PLACE SERIAL NUMBER LABEL (ITEM 2) NEAR THE PCB SERIAL NUMBER LABEL ON SHIELD.
5. ENABLE SECOND FILTER OPTION IN NSP.

REQUIRES 90-20612-001 VERSION 2.06, OR LATER.

DIMENSIONS IN mm

ASSY: 08-05889-001

FILE No. 15\10535__1.DWG

CODAN

MATERIAL

FINISH

SCALE 2:1

DRN	C G	DATE 27-7-05
CHKD	NJA	18-11-05
APPD		

TOLERANCES UNLESS OTHERWISE STATED
2 PLACES DEC.
1 PLACE DEC. ±0.5
0 PLACE DEC. ±1

TITLE
OPTION
3000Hz FILTER, NGT
FITTING INSTRUCTIONS

DRAWING/DOC NO.
A2 15-10535-001

ISS 1

SHT. 1 OF 1

Standards and icons

The following standards and icons are used in this guide:

This typeface	Means...
Italics	a cross-reference, text requiring emphasis
Bold	name of a connector, LED, label, rail, or setting

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
ALTERNATIVE TEXT	select the segment of text to read carefully—multiple assembly numbers exist for this activity
❑	a step to follow

Definitions

Acronyms and abbreviations

Acronym	Means...
A/D	analog to digital
A/F	audio frequency
AC	alternating current
AGC	automatic gain control
ALC	automatic level control
ALE	automatic link establishment
AM	amplitude modulation
BPF	band-pass filter
CALM	Codan automated link management
CAN	controller area network
CB	citizen band
CIB	Codan interconnect bus
CMOS	complementary metal oxide semiconductor
CRO	cathode-ray oscilloscope
CW	continuous wave, carrier wave
DC	direct current
DDS	direct digital synthesis
DSP	digital signal processor/processing
e.g.	exempli gratia, for example
EPLD	electronically programmable logic device
etc.	et cetera, and so forth
ETSI	European Telecommunications Standards Institute
EXT	external
FCC	Federal Communications Commission
FET	field-effect transistor
GND	ground
GPIO	general purpose input/output
HF	high frequency

Acronym	Means...
i.e.	id est, that is
I/O	input/output
IC	integrated circuit; Industry Canada
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IF	intermediate frequency
IMD	intermodulation distortion
JB	junction box
LCD	liquid crystal display
LED	light-emitting diode
LO	local oscillator
LPF	low-pass filter
LSB	lower sideband
M	morse
Modem	modulator-demodulator
N/C	not connected
NC	normally closed
NO	normally open
NSP	NGT system programmer
O/P	output
P	peak
PA	power amplifier
PA O/P	power amplifier output
PC	personal computer
PCB	printed circuit board
PD	potential difference
PEP	peak envelope power
PLL	phase locked loop
p–p	peak to peak
ppm	parts per million
PTT	press-to-talk
PWR	power
Q	quality factor

Acronym	Means...
R&TTE	radio and telecommunications terminal equipment
RAM	random access memory
REF OSC	reference oscillator
RF	radio frequency
RFU	RF unit
RMS	root mean square
ROM	read only memory
Rx	receive, receiver
Rx DEMOD	receive demodulator
SCF	suppressed carrier frequency
SINAD	(signal+noise+distortion)-to-(noise+distortion) ratio
sync	synchronised
TCW	tinned copper wire
TDM	time division multiplex
THD	total harmonic distortion
TPE	transmit program enable
TTL	transistor–transistor logic
Tx	transmit, transmitter
Tx MOD	transmit modulator
UART	universal asynchronous receiver/transmitter
USB	upper sideband
VCO	voltage-controlled oscillator
VSWR	voltage standing wave ratio

Glossary

Term	Means...
CAN protocol	A communication method that has good error detection capabilities and performs well in high noise environments.
channel	Frequencies programmed in the transceiver to transmit and receive signals on air.
coder/decoder	A device combining analog to digital and digital to analog converters.
data terminal equipment	An RS232-related term indicating a PC or terminal.
digital signal processor	A microprocessor-like device that is designed to process high volume digital data streams quickly.
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.
handset	A hand-held device that is used to control the functions of a transceiver. It consists of a microphone, PTT button, display and keypad.
junction box	The unit in a transceiver to which a handset, 2010 RF Unit, speaker and related devices are connected. The junction box receives the instructions that a user enters through the handset and sends these instruction to the relevant devices.
Master Bus mode	A CIB operating mode in which a CIB device, e.g. a 2010 RF Unit, supplies power and TDM audio synchronisation pulses to the bus.
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.
remote control junction box	A device that is used in a remote control system to interface with other equipment including a modem or a radio/telephone interconnect unit.
remote control NGT system	A fixed base station that consists of a control site and transceiver site. The control and transceiver sites communicate via a modem at each site. This enables the transceiver site to be located in an electrically quiet area for more reliable transmission with less noise interference.
RF unit	The unit in a transceiver that modulates audio signals onto radio frequencies that can be transmitted on air, and that demodulates the radio frequencies it receives into audio signals.

Term	Means...
Slave Bus mode	A CIB operating mode in which a CIB device, e.g. a junction box, sources its power supply and TDM audio synchronisation pulses from the bus.
throughput	Average data transfer rate between stations (this varies with different channel conditions).
transceiver	The unit that modulates audio signals onto radio frequencies that may be transmitted on air, and that demodulates the radio frequencies it receives into audio signals. A transceiver comprises an RF unit, handset, speaker, and appropriate connecting cables. Transceivers that use a 2010 RF Unit also include a 2030 Junction Box.
transceiver site	The location of the RF unit in a remote control NGT system. This site is selected to have low electrical noise and to provide good HF propagation.

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
Attenuation	decibel	dB
Current	ampere	A
Data rate	bits per second	bps
Frequency	hertz	Hz
Impedance	ohm	Ω
Length	metre (feet/inch)	m (ft/in)
Mass	gram	g
Noise temperature	kelvin	K
Power	watt	W
Power	decibels relative to 1 mW	dBm
Power ratio	decibel	dB
Pressure	pascal	Pa
Rate of data transfer	baud	baud
Temperature	degrees Celsius (Fahrenheit)	°C (°F)
Time	hour	h
Time	second	s
Voltage	volt	V
Weight	gram (pound)	g (lb)

Unit multipliers

Unit	Name	Multiplier
n	nano	0.000000001
µ	micro	0.000001
m	milli	0.001
d	deci	0.1
k	kilo	1000
M	mega	1000000
G	giga	1000000000

About this issue

This is the first issue of the NGT Transceiver System Repair Guide.

Associated documents

This guide is one of a series of publications related to the NGT series Transceiver. Other associated publications are:

- NGT Transceiver Getting Started Guide (Codan part number 15-04127-EN)
- NGT Transceiver Reference Manual (Codan part number 15-04126-EN)
- NGT *ASR* Transceiver Getting Started Guide (Codan part number 15-04137-EN)
- NGT *ASR* Transceiver Reference Manual (Codan part number 15-04138-EN)
- NGT *SRx* Transceiver Getting Started Guide (Codan part number 15-04140-EN)
- NGT *SRx* Transceiver Reference Manual (Codan part number 15-04141-EN)
- NGT *CR* Transceiver Getting Started Guide (Codan part number 15-04144-CH, Chinese version)
- NGT *CR* Transceiver Reference Manual (Codan part number 15-04145-EN)
- NGT System Programmer Help (Codan part number 15-04105-EN)
- Transceiver Test Set 0208 Reference Manual (Codan part number 15-04134-EN)
- NGT Transceiver System Technical Service Manual (Codan part number 15-02063-EN)
- Declaration of Conformity for the NGT *AR* Transceiver (Codan part number 19-40130)
- Declaration of Conformity for the NGT *SR* Transceiver (Codan part number 19-40121)
- Declaration of Conformity for the NGT *ASR* Transceiver (Codan part number 19-40131)
- Declaration of Conformity for the NGT *AR Voice* Transceiver (Codan part number 19-40123)
- Declaration of Conformity for the NGT *VR* Transceiver (Codan part number 19-40122)
- Declaration of Conformity for the NGT *SRx* Transceiver (Codan part number 19-40192)
- Declaration of Conformity for the NGT *CR* Transceiver (Codan part number 19-40424)
- Declaration of Conformity for the 3020 Transceiver Supply (Codan part number 19-40127)

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 37: 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)	*AR*, *SR*, *ASR*, *AR Voice*, *SRx*:	400	
	VR, *VR Mobile*:	20	
	CR:	100	
Frequency generation	All frequencies generated by synthesiser and DDS 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 (–22 to 140°F)	(08-05261)
	±0.3 ppm	–30 to +60°C (–22 to 140°F)	(08-05889)
Oven warm up time	60 seconds nominal		
Programming	Frequencies and options are programmed via the RS232 socket on the handset using NSP programming software and a PC		
	Channels may be entered from the handset by qualified personnel or (where authorised) by the operator		
Transmit/Receive switching	Using GPIO port on 2010 RF unit:	35 ms	
	Using GPIO port on 2012 RF unit:	15 ms	
RF input/output impedance	50 Ω nominal		
Supply voltage	13.6 V DC nominal, negative earth		
	Nominal operating range:	10.8 to 15 V	
	Functional range:	9 to 16 V (not specified)	
	Reverse polarity protected		

Table 37: General specifications (cont.)

Item	Specification	
Overvoltage protection	Shut down at 16 V DC nominal for duration of overvoltage	
Supply current	Transmit:	see Table 39 on page 160
	Receive:	
	2010 RF Unit:	no signal 1 A
	2011/2012 RF Unit:	no signal < 0.70 A
Environment	Ambient temperature:	–30 to +60°C (–22 to 140°F)
	Relative humidity:	95%
	Derate upper ambient temperature by 1°C (33.8°F) per 330 m (360 yd) above sea level	
Cooling	Convection or fan (Option F)	
Size	2010/2011/2012 RF Unit:	210 mm W × 270 mm D × 65 mm H (8.4 in W × 10.8 in D × 2.6 in H)
	2020 Handset:	65 mm W × 35 mm D × 130 mm H (2.6 in W × 1.4 in D × 5.2 in H)
	2030 Junction Box:	135 mm W × 106 mm D × 38 mm H (5.4 in W × 4.3 in D × 1.5 in H)
	Handset and speaker connector:	42 mm W × 55 mm D × 22 mm H 1.7 in W × 2.2 in D × 0.9 in H)
Weight	2010/2011/2012 RF Unit:	3.3 kg (7.3 lb)
	2020 Handset:	0.3 kg (0.7 lb)
	2030 Junction Box:	0.4 kg (0.9 lb)
Finish colour	Dark Grey	

Receiver

Table 38: Receiver specifications

Item	Specification
Type	Dual conversion, superheterodyne
IF frequencies	45 MHz and 455 kHz
Sensitivity	Frequency: 0.25 to 30 MHz — RF amp off: 1.5 [1.25] µV PD, –103 [–105] dBm Frequency: 1.6 to 30 MHz — RF amp on: 0.2 [0.12] µV PD, –121 [–125] dBm For 10 dB SINAD with greater than 50 mW audio output
Input protection	Will withstand 50 V p–p RF from a 50 W source
Selectivity	Greater than 65 [70] dB at –1 kHz and +4 kHz reference SCF USB Pass Band: –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) 60 [65] dB ±10 kHz 75 [80] dB ±50 kHz 90 [95] dB
Blocking	As for Desensitisation For frequencies > ±50 kHz > 95 dB
Image rejection	Better than 65 [70] dB
Spurious responses	Better than 70 [90] dB Self-generated signals > 0.15 mV PD: 4.999, 29.49 MHz
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 90 [92] dB above the wanted signal Third order intercept (unaffected by AGC): +30 [+33] dBm with RF amp off +10 [+13] 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 38: Receiver specifications (cont.)

Item	Specification
A/F response @ GPIO connector	Typical: –6 dB 300 to 2600 Hz
A/F response @ loudspeaker	Typical: –6 dB 300 to 2400 Hz
A/F power and A/F distortion	2.4 W into 8 Ω, 5% THD 4 W into 4 Ω, 5% THD 6 W into 2 Ω, 5% THD
Clarifier	±10 ppm (nominal) ±50 Hz below 5 MHz increasing to ±300 Hz at 30 MHz Clarifier is automatically reset to mid-frequency with channel change
Inband IMD	Better than 25 dB IMD with two 100 mV PD RF inputs
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 40 dB

Transmitter

Table 39: Transmitter specifications

Item	Specification
Power output for AUST & FCC	100 W PEP ±0.5 dB, 27 MHz CB 10 W PEP (Aust only)
Power output	125 W PEP reducing with frequency to 100 W PEP at 30 MHz ±1 dB CW or single tone: approximately 60% of PEP with average PEP control (average control disabled on handset PTT)
Duty cycle	100%: normal speech over full temperature range 100%: ARQ up to 30°C 25%: 16-tone continuous data mode (5 minutes on maximum) at ambient temperature up to 30°C 100%: all modes up to maximum ambient of 45°C with Option F
Supply current	Output power: 100/125 W Two-tone or CW: 9 to 17 A Average speech: 8 A for battery life calculations
Protection	Safe under all load conditions by limiting reflected power to 10 W PEP and limiting PA transistor collector voltage swing Thermal protection against excessive heatsink temperature

Table 39: Transmitter specifications (cont.)

Item	Specification		
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)		
Intermodulation (Two-tone test)	100 W:	26 [30] dB below each tone	32 [36] dB below PEP
	125 W:	26 [27] dB below each tone	32 [33] 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	Electret Condenser type		

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