TD 92358GB

Repair Manual

Second Line Repair

914D Pocket Receiver

2005-11-25/ Ver. B

Contents

1 Exploded View and Spare Parts List

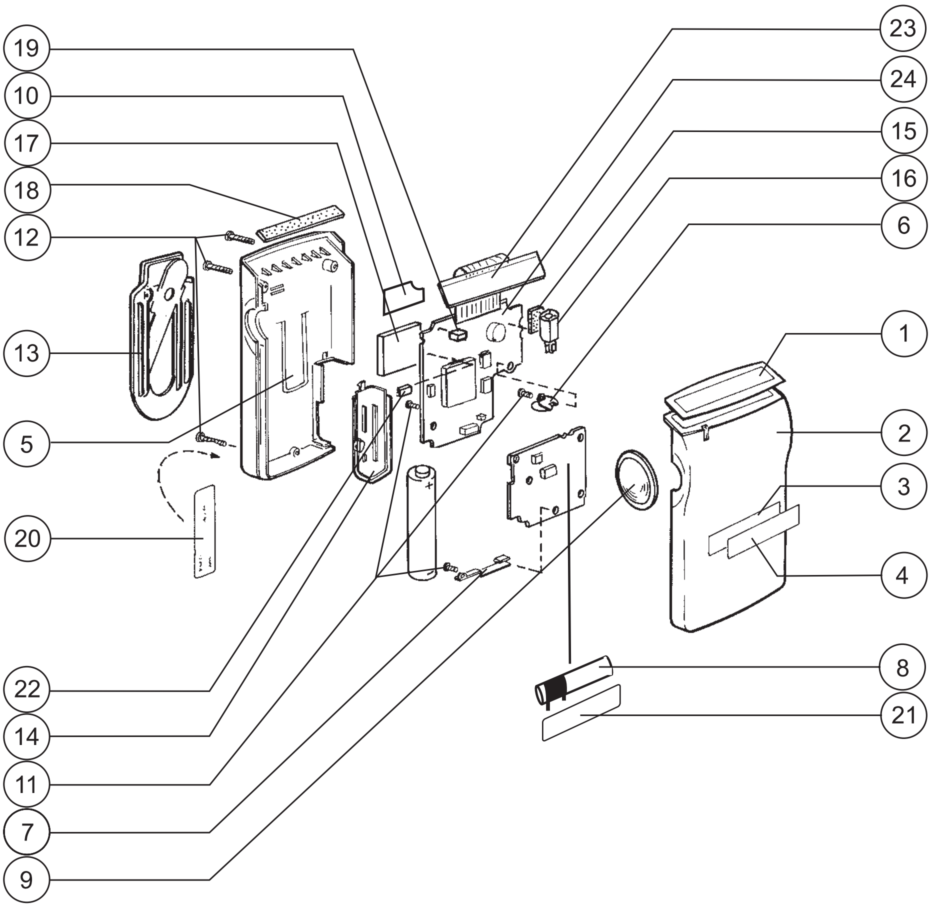


Figure 1. Exploded view 914D.

	Description	H/U 914D Ice White	H/U 914D Steel Grey
1	Display window 914D	R280875	R280875
2	Cover front including light guide	R281455	R281451
3	Tape for IR-glass	R490427	R490427
4	IR-glass "Ascom"	R280877	R280877
5	Cover rear	R281456	R281452
6	Battery connection (+)	R230787	R230787
7	Battery connection (-)	R230783	R230783
8	Antenna (only for HF-receivers)	R060216	R060216
9	Push button Black	R281459	R281459
10	Dust protect. loudspeaker	R490533	R490533
11	Screw p-type 1.7X3X0.9X4 black (3pcs)	R300283	R300283
12	Screw p-type 1.7X3.5X0.9X11 (3pcs)	R300403	R300403
13	Clips	R281458	R281454
14	Battery cover complete (incl. safety lock)	R281457	R281453
15	Tape vib.motor	R490303	R490303

16	Motor AT-M08-0040	R490304	R490304
17	Audio transducer MWT-01A	R150048	R150048
18	Tape display support	R490332	R490332
19	LED red CL-200HR-C	R090112	R090112
20	Label mobile 900 (please add label information separately)	R250219	R250219
21	Tape antenna 914D	R490462	R490462
22	Push button switch SKQLLC	R170289	R170289
23	Display Module 914D	R090154	R090154
24	Tape display module 914D	R490528	R490528

2 Circuit Description

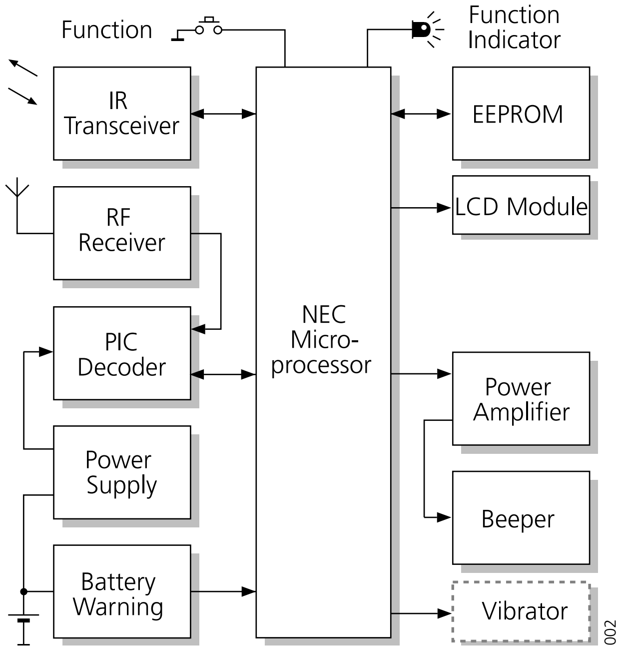


Figure 2. General contents of 914D.

2.1 General Description

U/H914D is a pocket paging receiver used in the teleCOURIER 900 paging system. There are two basic versions: H914D for the HF band 25 to 50 MHz, and U914D for the UHF band 415 to 485 MHz.

Pagings are indicated using sound, an LED, and a vibrator (optional). Display messages are presented on a 12-digit LCD. A screensaver function is included to ensure a longer battery life.

The user controls the function of the pocket unit with a single pushbutton.

The pager consists of three main parts: receiver circuit board, processor circuit board, and display module.

It is possible to upgrade the software of the PIC- and NEC-processor via the Programming Adapter for 914D.

Receiver Circuit Board

Consists of an RF receiver, IR transceiver, and battery warning circuit.

Processor Circuit Board

Consists of a microprocessor, decoder, power supply, and an EEPROM. The decoder decodes the baseband signal from the RF receiver and also controls battery saving. A watchdog circuit in the decoder checks the function of the microprocessor.

Decoder function is determined by parameters that are stored in a separate EEPROM. The parameters are transferred to the decoder by the processor. The processor stores parameters in the decoder and reads decoded data from it via a serial bus.

The power supply consists of a single LR03 (AAA) or IBP1 battery and a voltage converter. The processor controls the beeper, LED, and vibrator.

LCD Module

The COS-type LCD consists of a 12-digit, 5 x 7 dot matrix window and communicates with the processor via a serial interface bus connector.

2.2 Detailed Description

Refer to drawings 10604, 10614, and 10822.

HF Receiver

The HF receiver is a single IF, superheterodyne receiver with an intermediate frequency of 455 kHz.

The receiver is turned on by the signal RXEN.

The antenna is a ferrite loop antenna, tuned by C200. The RF signal from the antenna is amplified in the amplifier TR201/TR200. The amplifier is tuned by L201. Test point TPTR200 is used to measure the DC current through the transistors.

The local oscillator and mixer are in IC200. The frequency is set with L202. Test point TPIC200 is used to measure the DC current in IC200.

The IF signal is filtered in FL200 and fed to the IF circuit. Test point TPIF is used to measure the conversion gain of the frontend.

IC200 also contains an op-amplifier, a detector, comparator, quick-start circuit, voltage regulator, and battery warning test circuit. IF signal is demodulated by ceramic discriminator X201. The baseband output signal from the detector is filtered between TPAF and TPLP, and fed to the comparator. The demodulated data is fed to the decoder via pin CODE on J200.

To compensate for duty cycle variations when the radio is turned on the quick-start circuit supplies a fast charge to capacitor C210. The quick-start signal comes from the decoder via pin QS on J200.

The voltage regulator supplies 1.0 V to stabilise the operating point on the transistors. The battery warning signal (LOBATT) goes high when battery voltage drops below about 1.15 V. Test point TPV10 is used to measure the regulated supply.

UHF Receiver

The UHF receiver is a single IF, superheterodyne receiver. The RF path is partly balanced and the local oscillator operates on the RF frequency divided by two. The intermediate frequency is 455 kHz.

The receiver is turned on by the signal RXEN.

The antenna is a metal wire loop antenna, tuned by C302. Except for the tuning components mentioned below the frequency bands are determined by several components listed on the schematic diagram. RF signal from the antenna is amplified in cascaded amplifiers TR301/TR351. The amplifiers are tuned by C303 and C353, respectively. Test points TP1 and TP2 are used to measure the DC current through each transistor.

The local oscillator is a standard Butler with a third order overtone crystal. The frequency is set with C326. Test point TP7 is used to measure the DC current through transistor TR303.

The local oscillator signal is fed to frequency tripler TR304 which is tuned by C346. Output from this stage is the RF frequency divided by 2. Test point TP8 is used to measure the DC current through the transistor.

Mixer TR302/352 is a balanced overtone type. LO signal is fed common mode and the RF is fed differential mode. At the output of TR351 the RF signal is converted from single-ended to differential by L303/L353. To eliminate noise in the mixer, all frequencies except the RF channel are differentially short circuited on the mixer input by a parallel resonant circuit consisting of L302, L352, C311, and C339. The IF is extracted differentially on the collectors of TR302/TR352. Test point TP3 is used to measure the DC current through the transistors.

The IF signal is buffered in TR305, filtered in FL300, and fed to the IF circuit. Test point TP4 is used to measure the DC current through the transistor, and test point TP6 is used to measure the conversion gain of the frontend.

The IF circuit, IC300, consists of two op-amplifiers, a detector, comparator, quick-start circuit, voltage regulator, and battery warning test circuit. IF signal is demodulated by ceramic discriminator X302. The baseband output signal from the detector is filtered between TP10 and TP11, and fed to the comparator. The demodulated data is fed to the decoder via pin CODE on J300.

To compensate for duty cycle variations when the radio is turned on the quick-start circuit supplies a fast charge to capacitor C331. The quick-start signal comes from the decoder via pin QS on J300. Test point TP9 is used to measure the DC current through IC300.

The voltage regulator supplies 1.0 V and is temperature compensated to stabilise the operating point on the transistors. The battery warning signal (LOBATT) goes high when battery voltage drops below about 1.15 V. Test point TP12 is used to measure the regulated supply.

IR Transceiver

The IR transceiver is used to communicate with the central unit when the pocket unit is placed in the storage rack. The IR transceiver has the designation IC201 in HF versions of the pocket receiver and IC301 in UHF versions.

Processor Circuit Board

IC100 is a microprocessor with flash option onchip RAM and ROM. It controls the function of the different parts of the receiver.

It is possible to upgrade the software of the PIC- and NEC-processor via the Programming Adapter for 914D.

Parameters determining the function of the receiver are stored in EEPROM IC102. By changing these parameters it is possible to adapt the pager for a specific installation. Power is supplied via TR100. The processor opens TR100 by pulling pin 34 low.
It use pins 28, 29, 32, and 50 to read and write parameters in the EEPROM.

Beeper LS500 is connected to a balanced bridge power amplifier consisting of TR500, TR501, TR502 and TR504. TR505/TR506 invert the phase of the signal for the right half of the bridge. The tone signal appears at pin 45 of IC100. The volume is determined by pins 30 and 31 of IC100. The logic levels of these outputs are converted to a voltage level on the emitter of TR507. This voltage determines the maximum peak-to-peak voltage applied to LS500 and thus the volume.

The function switch is connected to pin 26 of the processor.

LED100 is connected via R117 to pin 44.

Vibrator V101 (optional) is driven by TR101 when
pin 46 of IC100 is pulled high. At power-up the processor uses pin 43 to check if a vibrator is mounted.

A test load is connected by TR102 to check battery condition. This is done by the processor by applying a high level to pin 47. The low battery detector on the receiver unit is connected to pin 33 of IC100. When the RF receiver is on, a high level on this pin indicates low battery voltage.

A communication sequence is started when the pager is placed in a storage rack. The pager and the storage rack communicate via IR. The IR transceiver is located on the receiver unit. Data to be transmitted via IR appears on pin 35 of IC100. Received data is fed via TR103 to pin 15. The logic level on pin 15 is normally high when the receiver is not in a storage rack (no IR detected). When the receiver is in the storage rack the level should be low (IR detected).

The processor based PIC-decoder IC101 is used to control battery saving and decode received code. One of the programmed functions is built-in address decoding. It also includes a timer and watchdog circuit. Various decoder functions such as battery saving period and decision rules are determined by parameters that are stored in the decoder by the processor.

The watchdog circuit is used to check processor function. The decoder starts the receiver by pulling pin 13 high. At the same time a pulse appears on pin 12. This pulse provides a faster start of the receiver. Received code is fed from the receiver to pin 16 of IC101.

When valid data is received, the decoder pulls IC101 pin 10 high. The pin "Data Enabled" is fed to IC100 pin 17 and starts the processor. Data is sent via asynchron uart interface to NEC (IC100 pin 26 and 27, IC101 pin 8 and 9).

An internal timer in IC101 applies a pulse to pin 2 once every minute. The processor uses this pulse to increment its internal real-time clock and for other similar functions. The timer is controlled by an external 32 kHz clock from IC100 pin 18 to IC101 pin 13.

If the processor fails to respond when a valid code has been detected by IC101, the watchdog circuit is activated. The decoder then applies a low pulse to pin 10. This forces pin 12 on IC100 low to restart the processor. The watchdog circuit is also activated if the processor fails to respond to the timer pulse from the decoder.

Internal timing of processor IC100 is provided by resonator X101 connected to pins 7 and 8. Oscillation appears only when the processor is activated for example by the decoder or by the function switch.

LCD Module

The display unit is a custom made chip-on-stick (COS) package containing LCD, controller/driver, serial connector and ZIF contact. The LCD window has a 12-digit, 5 x 7 dot matrix, plus two fixed symbols (warning and message). The LCD Module communicates with the processor via a serial interface bus connector. Orientation and character table are the same as in 912T, character table 1, and are variable parameters that are selected in the EEPROM.

Screensaver

A screensaver function is included to ensure a longer battery life. The screensaver function is pre-programmed and shuts the display off after a pre-set time. To activate the display again, press the button. An incoming message turns the screensaver off automatically. After reading the message it is important to press the button to return to ID mode. By this, the screensaver function is reactivated.

Power Supply

Power is supplied by a single IEC LR03 (AAA) or IBP1 battery. Some circuits are powered directly from the battery and others via a voltage converter. The voltage converter consists of IC103, L102, and D100A/B. The voltage converter output is maintained at about 3.0 V.

When replacing the battery there is a delay, R124 and C101, for about 7-8 seconds before the voltage converter starts.

3 Tuning and Alignment

3.1 H914D

3.1.1 Reference Drawings

Electrical Schematics

H912RX	10604

Component layouts

H912RX top	60305 (PCB 40344)
H912RX bottom	60305 (PCB 40344)

3.1.2 General

This document describes two alternate procedures, 3.1.4 *Preferred Procedure using RF Communications Test Set* on page 7, which is recommended and 3.1.5 *Alternate Procedure using Signal Generator and Oscilloscope* on page 11.

Alignment components referred to in the procedures are shown in the figure 3 on page 8, figure 5 on page 9 and figure 9 on page 11.

Note: All steps, except test pagings, are to be performed in an ESD-shielded environment.

3.1.3 Test Equipment

Alignment Kit	MAE-912H, consisting of:
Test Fixture	MAB-H912 (including antenna)
Selector Box	MSB-912
Test Cable	25-pin D-sub cable
Power Cable	5-pin DIN
Power Supply 12V	Mascot battery eliminator type 8513
6 dB Attenuator	(BNC)Tateco AT52 or equivalent
RF Communications Test Set	HP 8920A or equivalent

If an RF Communications Test Set is not available, the following three items can be used instead:

Signal Generator	Phase locked, 100kHz- 500 MHz
	Frequency accuracy: ±100Hz
	Amplitude: –110 to +6 dBm
	Frequency modulation: 1 kHz
	sine/square, 1,5/2,5 kHz deviation
Oscilloscope	Preferably with memory function and frequency counter
Frequency Counter	Accuracy ± 0.5% at IF (455 kHz)

3.1.4 Preferred Procedure using RF Communications Test Set

Note: The following description is directly applicable for an HP 8920 RF Communications Test Set. If another Test Set is used the settings must be equivalent.

Test Setup

1 Connect the test equipment as shown in figure 3.

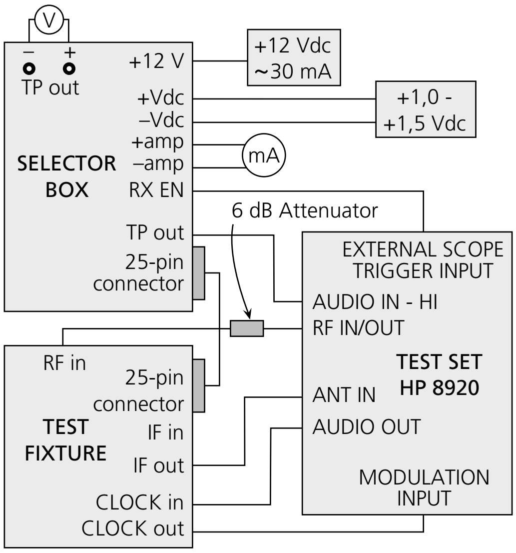


Figure 3. Recommended equipment setup using RF Communication Test Set.

2 Slide the receiver into the test fixture and pull the lever to connect the test pins to the test points.

Current consumption

3 Set the RX supply to the selector box to1,4 Vdc, set the RXEN switch to **On** and check that current consumption is 1,27 ± 0,10 mA.

4 Set RXEN switch to **Off** and check that current consumption is < 30 µA.

Battery warning

5 With RX supply at 1,4 Vdc, set the RXEN switch to **On** and press the battery warning button on the selector box. The LED should light.

6 Set RX supply to 1,07 Vdc and press the battery warning button. The LED should remain off.

RF Adjustment

7 On HP 8920 test set:
Set to **Spectrum Analyzer** mode with center frequency 455 kHz, span 50 kHz and Ref Level = 0 dBm. Use ANT input.
Select RF Generator under **Controls**. TRACK mode with offset = channel frequency –455 kHz and amplitude = –50 dBm.
Port = RF Out.
Channel frequency is marked on the cassette and on crystal X300.
Average 2 or 4 times is allowed to simplify reading of display (under **Controls/ Auxiliary**).

8 With RXEN set to **On** and IF control set to **Out**, adjust L202 until the oscillator starts, see figure 4

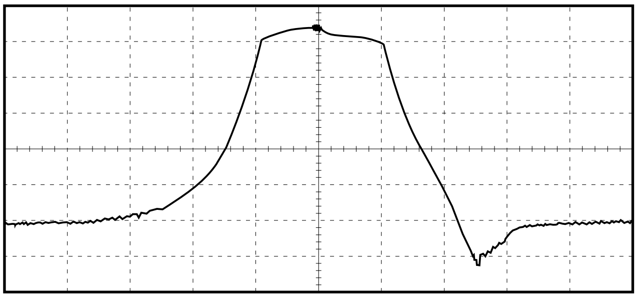


Figure 4. RF adjustment.

9 Adjust L202, L201, and C200 for max gain within passband (455 kHz ± 4 kHz), see figure 5.

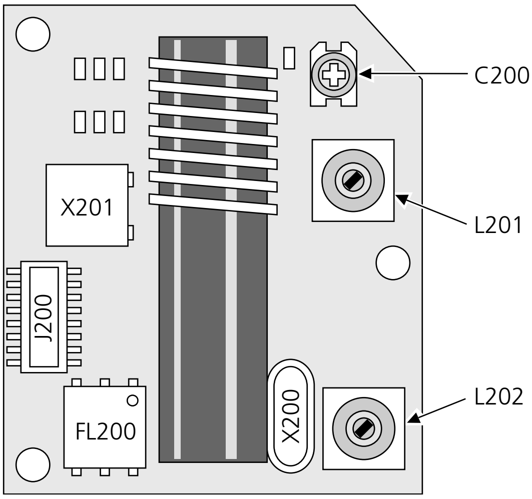


Figure 5. H912RX top showing alignment points.

10 Check the following:

Level at 455 kHz:	–13 dBm min
Ripple within passband:	5 dB max
Suppression at 435 and 475 kHz compared to level at 455kHz:	45 dB min

FM Detector

11 **On HP 8920 test set:**
Press **Preset** button and select **RFgen**.
Set RF Generator to channel frequency, amplitude = –50 dBm.
Set AFgen1TO = OFF and AFgen2TO = Audio Out with amplitude = 1,0V.
Set ModinTO = FM with deviation 1,5 kHz/Vpeak.
Under **Encoder** set AFgen2Freq = 585 Hz and square wave.
Under **AF ANL** set AFanlIN = AudioIN and Scope To = Filters.
Test set to **Scope** mode with vert = 50 mV/div, VertOffset = –1 and time = 1 ms/div.
Under Main = Trigger select external(TTL), CONT/Single, NORM and POS/NEG.

12 With the test point switch on the selector box set to **TPLP** and RXEN switch set to **pulse** check that the signal is as in figure 6. Amplitude 75 to 125 mVp-p.

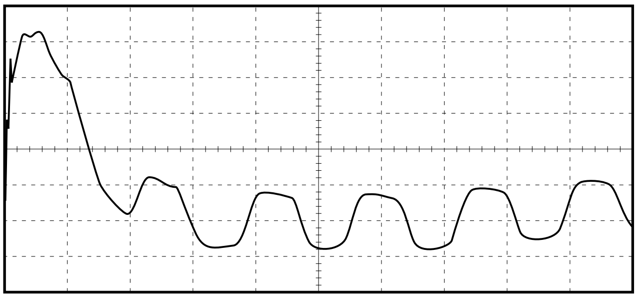


Figure 6. FM detector.

CODE signal and start time

13 HP 8920 test set:
As above but Scope To = Input and vert = 200 mV/div, VertOffset = –2,00 on the **Scope**.

14 Set the test point switch on the selector box to **TPCODE** and set the RXEN switch to **pulse**.

15 Check that the signal is as in figure 7, i.e. a square wave with 50% duty cycle, > 0,85 Vp-p, at 3 ms after start.

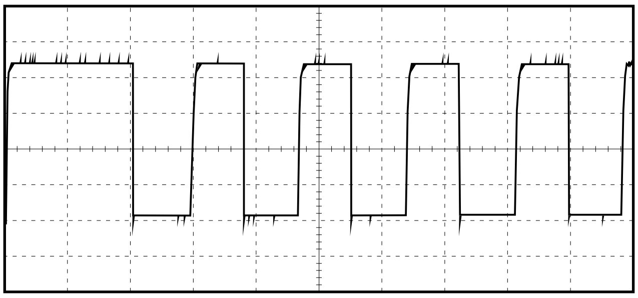


Figure 7. Code signal and start time.

Check of IR Link

16 HP 8920 test set:
As above but vert = 500 mV/div and VertOffset = –2,50 on the **Scope**.

17 Set the test point switch on the selector box to **TPIRDET** and check that the signal is as in figure 8. Amplitude > 2,5 Vp-p.

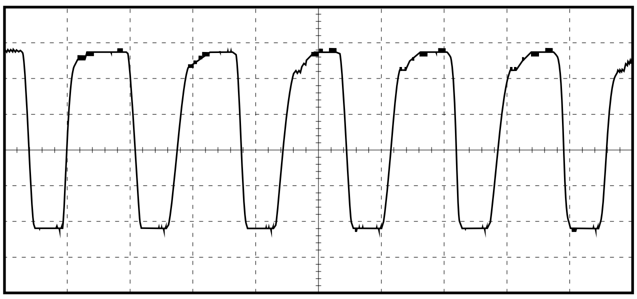


Figure 8. IR link.

Test Paging

18 Test pagings are to be made on completely assembled pagers. See *Appendix B*.

3.1.5 Alternate Procedure using Signal Generator and Oscilloscope

Test Setup

1 Connect the test equipment as shown in figure 9.

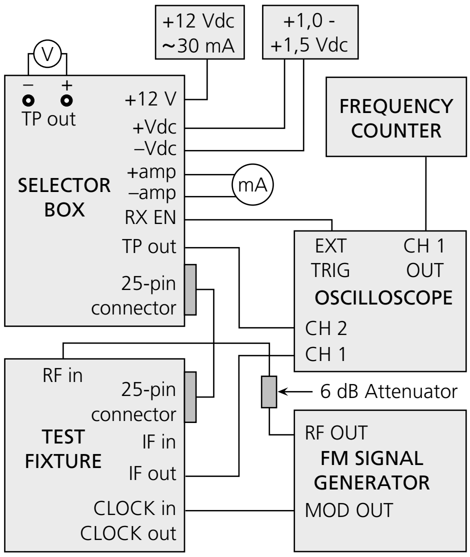


Figure 9. Equipment for alternate setup using Signal Generator and Oscilloscope.

2 Slide the receiver into the test fixture and pull the lever to connect the test pins to the test points.

Current consumption

3 Set the RX supply to the selector box to1,4 Vdc, set the RXEN switch to **On** and check that current consumption is 1,27 ± 0,10 mA.

4 Set RXEN switch to **Off** and check that current consumption is < 30 µA.

Battery warning

5 With RX supply at 1,4 Vdc, set the RXEN switch to **On** and press the battery warning button on the selector box. The LED should light.

6 Set RX supply to 1,07 Vdc and press the battery warning button. The LED should remain off.

RF adjustment

7 Set signal generator RF to channel frequency marked on the cassette and on crystal X300. Amplitude –50 dBm. Modulation is not required. Set the oscilloscope to 1 µs/div and 100 mV/div.

8 With RXEN set to **On** and IF control set to **Out**, adjust L202 until the oscillator starts, as indicated by an increased amplitude on the oscilloscope.

9 Adjust L202 for max amplitude and IF 455 ± 1,5 kHz, see figure 10.

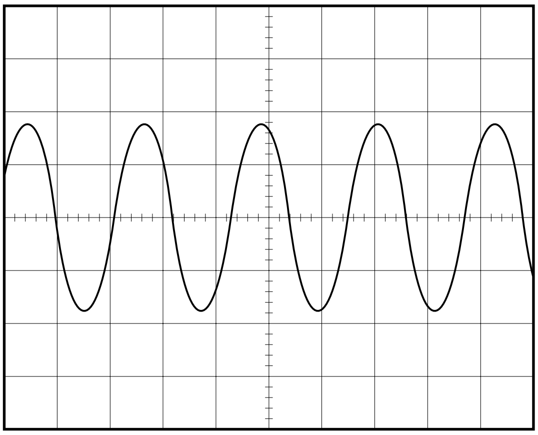


Figure 10. RF adjustment.

10 Adjust L201 and C200 for max gain.

FM detector

11 Connect the oscilloscope to **TP out** on the selector box. Set the test point switch to **TPLP** and RXEN switch in **on** position.

12 Set the signal generator to FM, 1,5 kHz deviation.
Check the demodulated signal.The waveform should be as in figure 11, with an amplitude of 50 - 100 mVp-p.

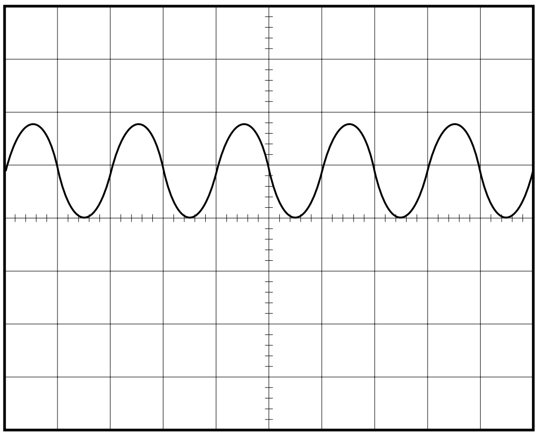


Figure 11. FM detector.

CODE signal

13 Set the test point switch on the selector box to **TPCODE** and set the RXEN switch to **on** position.

14 Set the signal generator to FM, 1,5 kHz deviation.
Check that the CODE signal is as in figure 12, i.e. a square wave with amplitude > 0.85 Vp-p.

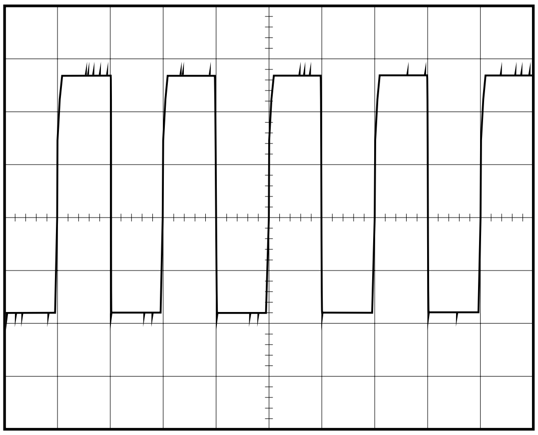


Figure 12. Code signal.

Start time

15 To perform check of start time an oscilloscope with memory function is neccessary, externally triggered with RXEN signal from the selector box.
Set test point switch to **TPCODE**.
Connect modulation output from the signal generator to **Clock in** on the test fixture. Set RXEN switch to **pulse** .

16 Set the signal generator to FM, 1,5 kHz deviation.
Check that the CODE signal is as in figure 13, i.e. a square wave with 50% duty cycle after < 3 ms.

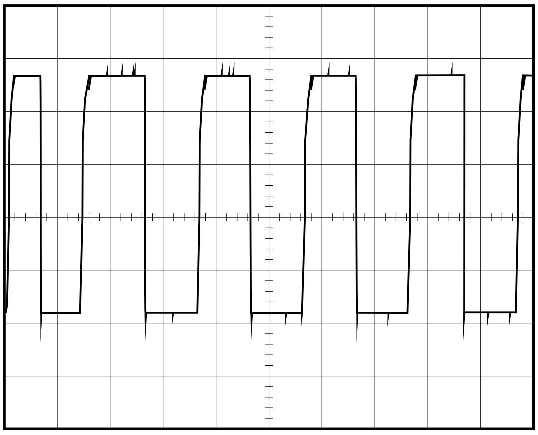


Figure 13. Start time.

Check of IR link

17 Set the test point switch to position **TPIRDET**.
Connect a 1 kHz square wave or modulation output from the signal generator with amplitude 1 Vpeak to **Clock In** on the test fixture.

18 Check that the waveform is approximately as in figure 14. Amplitude > 2,5 Vp-p.

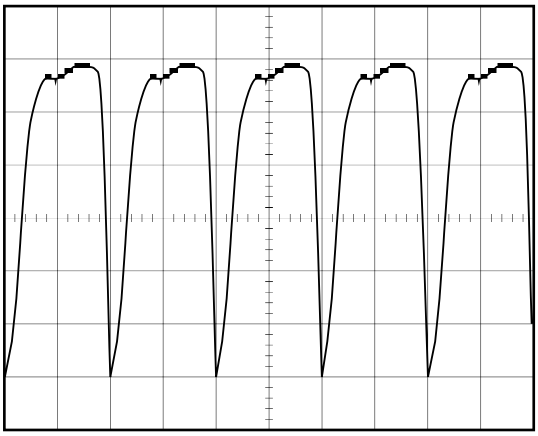


Figure 14. IR link, 1kHz sine wave to ***Clock in****.*

Test paging

Test pagings are to be made on completely assembled pagers. See Appendix B: *H914D and H912T Sensitivity Test* on page 25.

3.2 U914D

3.2.1 Reference Drawings

Electrical Schematics

U912RX	10614

Component layouts

U912RX top	60322 (PCB 40360)
U912RX bottom	60322 (PCB 40360)

3.2.2 General

This document describes two alternate procedures, 3.2.4 *Preferred Procedure using RF Communications Test Set* on page 16, which is recommended and 3.2.5 *Alternate Procedure using Signal Generator and Oscilloscope* on page 20.

Alignment components referred to in the procedures are shown in the figure 15 on page 15, figure 5 on page 9 and figure 9 on page 11.

Note: All steps, except test pagings, are to be performed in an ESD-shielded environment and with the receiver circuit board inserted in the alignment insert, which slides into the test fixture.

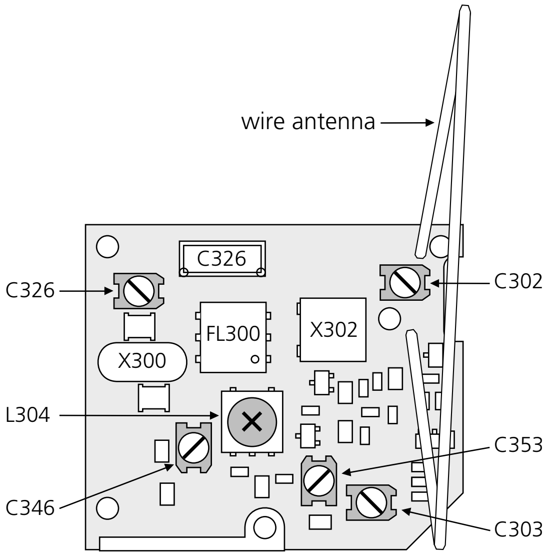


Figure 15. U912RXD showing alignment components.

3.2.3 Test Equipment

Alignment Kit	MAE-912U, consisting of:
Test Fixture	MAB-U912 (including antenna)
Selector Box	MSB-912
Test Cable	25-pin D-sub cable
Power Cable	5-pin DIN
Power Supply 12V	Mascot battery eliminator type 8513
Alignment Insert	MAI-U912D
6 dB Attenuator	(BNC)Tateco AT52 or equivalent
RF Communications Test Set	HP 8920A or equivalent

If an RF Communications Test Set is not available, the following three items can be used instead:

Signal Generator	Phase locked, 100kHz- 500 MHz
	Frequency accuracy: ±100Hz
	Amplitude: –110 to +6 dBm
	Frequency modulation: 1 kHz
	sine/square, 1,5/2,5 kHz deviation
Oscilloscope	Preferably with memory function and frequency counter
Frequency Counter	Accuracy ± 0.5% at IF (455 kHz)

3.2.4 Preferred Procedure using RF Communications Test Set

Note: The following description is directly applicable for an HP 8920 RF Communications Test Set. If another Test Set is used the settings must be equivalent.

Test Setup

1 Connect the test equipment as shown in figure 16.

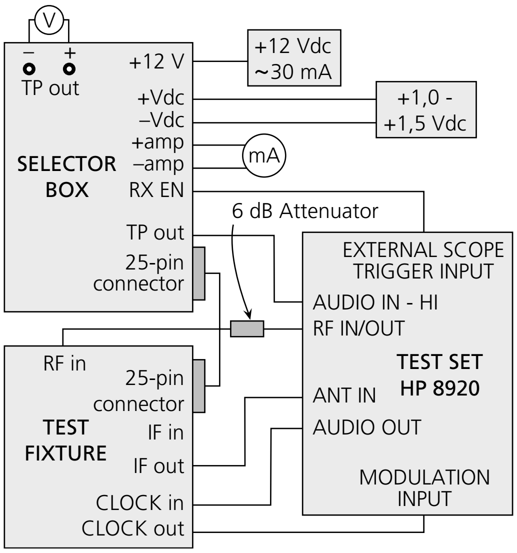


Figure 16. Recommended equipment setup using RF Communication Test Set.

2 Insert the receiver circuit board into the alignment insert as in figure 17 on page 17, then slide the insert into the test fixture and pull the lever to connect the test pins to the test points.

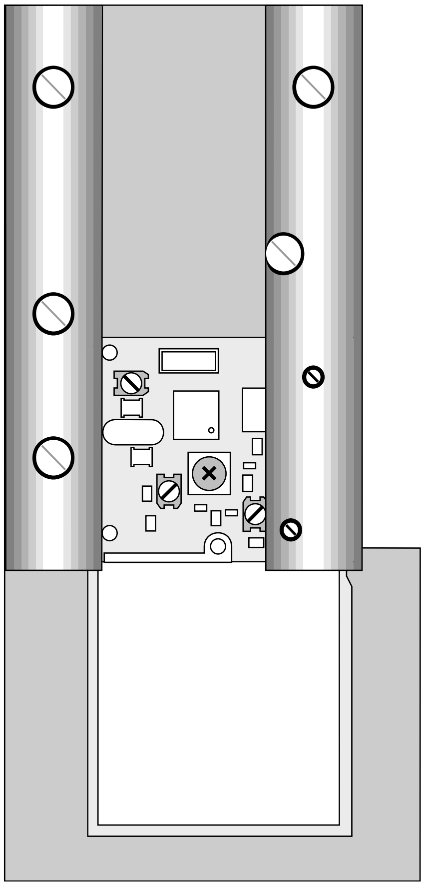


Figure 17. U912RXD placed in the alignment insert MAI-U912D.

Current consumption

3 Set the RX supply to the selector box to1,4 Vdc, set the RXEN switch to **On** and check that current consumption is 2,75 ± 0,40 mA.

4 Set RXEN switch to **Off** and check that current consumption is < 12 µA.

Battery warning

5 With RX supply at 1,4 Vdc, set the RXEN switch to **On** and press the battery warning button on the selector box. The LED should light.

6 Set RX supply to 1,07 Vdc and press the battery warning button. The LED should remain off.

RF Adjustment

7 On HP 8920 test set:
Set to **Spectrum Analyzer** mode with center frequency 455 kHz, span 50 kHz and Ref Level = -20 dBm. Use ANT input.
Select RF Generator under **Controls**. TRACK mode with offset = channel frequency –455 kHz and amplitude = –45 dBm.
Channel frequency is marked on the cassette and on crystal X300.
Average 2 or 4 times is allowed to simplify reading of display (under **Controls/ Auxiliary**).

8 With RXEN set to **On** and IF control set to **Out**, adjust trim capacitors C302, C303, C353 and C346 to mid-position. Adjust C326 until the oscillator starts, see figure 18 and below

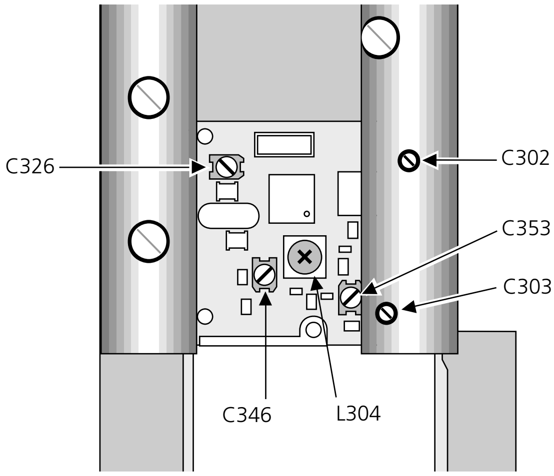


Figure 18. RF adjustment. U912RXD in alignment insert showing alignment points.

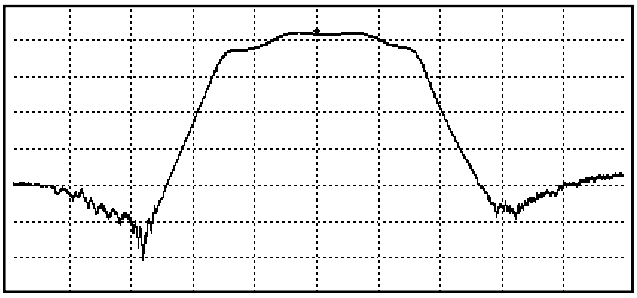


Figure 19. RF adjustment.

9 Adjust L304 for max gain and min ripple within passband (455 kHz ± 4 kHz). Readjust C326 for max gain. Adjust C346 for max gain.

10 Adjust C302, C303 and C353 for max gain. Repeat until no further improvement is obtained. The different trim capacitors affect each other.

11 Check the following:

Level at 455 kHz:	–40 dBm min
Ripple within passband:	5 dB max
Suppression at 435 and 475 kHz compared to level at 455kHz:	45 dB min

FM Detector

Note: For PCBs older than 40360M, see Appendix E: *FM Detector & CODE signal and start time for all PCBs on the UHF band with No. 40360M and older* on page 30.

12 **On HP 8920 test set:**
Press **Preset** button and select **RFgen**.
Set RF Generator to channel frequency, amplitude = –45 dBm.
Set AFgen1TO = OFF and AFgen2TO = Audio Out with amplitude = 1,0V.
Set ModinTO = FM with deviation 1,5 kHz/Vpeak.

Under **Encoder** set AFgen2Freq = 585 Hz and square wave.
Under **AF ANL** set AFanlIN = AudioIN and Scope To = Filters.

Filter > 20 Hz HPF.
Test set to **Scope** mode with vert = 50 mV/div, VertOffset = –3,5 and time = 1 ms/div.
Under Main = Trigger select external(TTL), CONT/Single, NORM and POS/NEG.

13 With the test point switch on the selector box set to **TP11** and RXEN switch set to **pulse** check that the signal is as in figure 30. Amplitude 40 to 60 mVp-p.

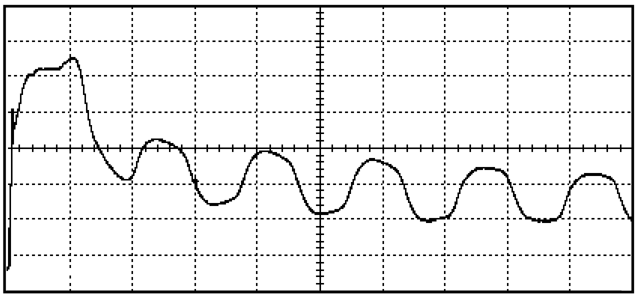


Figure 20. FM detector.

CODE signal and start time

Note: For PCBs older than 40360M, see Appendix E: *FM Detector & CODE signal and start time for all PCBs on the UHF band with No. 40360M and older* on page 30.

14 **HP 8920 test set:**
As above but Scope To = Input and vert = 200 mV/div, VertOffset = –3,50 on the **Scope**.

15 Set the test point switch on the selector box to **TP18** and set the RXEN switch to **pulse**.

16 Check that the signal is as in figure 21, i.e. a square wave with 50% duty cycle, > 0,85 Vp-p, at 3 ms after start.

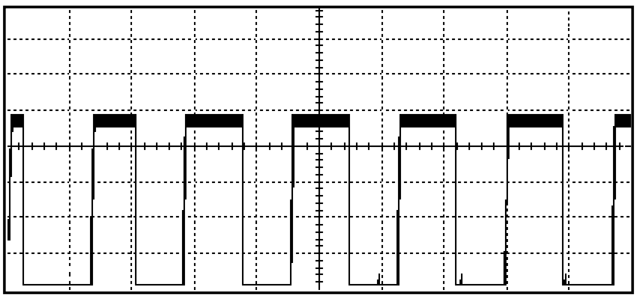


Figure 21. Code signal and start time.

Check of IR Link

17 **HP 8920 test set:**
As above but vert = 500 mV/div and VertOffset = –3,00 on the **Scope**.

18 Set the test point switch on the selector box to **TP17** and check that the signal is as in figure 22. Amplitude > 2,5 Vp-p.

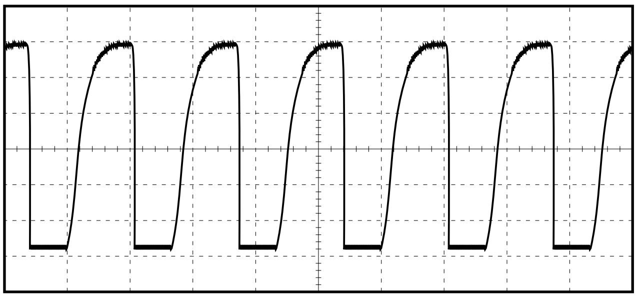


Figure 22. IR link.

Test Paging

19 Test pagings are to be made on completely assembled pagers. See Appendix D: *U914D Sensitivity Test* on page 28.

3.2.5 Alternate Procedure using Signal Generator and Oscilloscope

Test Setup

1 Connect the test equipment as shown in figure 23.

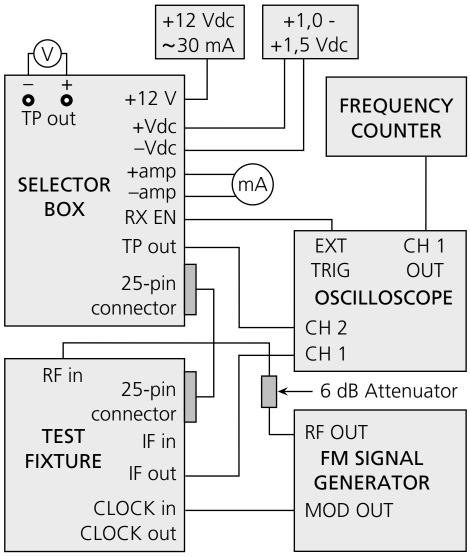


Figure 23. Equipment for alternate setup using Signal Generator and Oscilloscope.

2 Insert the receiver circuit board into the alignment insert as shown in figure 17, then slide the insert into the test fixture and pull the lever to connect the test pins to the test points.

Current consumption

3 Set the RX supply to the selector box to1,4 Vdc, set the RXEN switch to **On** and check that current consumption is 2,75 ± 0,25 mA.

4 Set RXEN switch to **Off** and check that current consumption is < 12 µA.

Battery warning

5 With RX supply at 1,4 Vdc, set the RXEN switch to **On** and press the battery warning button on the selector box. The LED should light.

6 Set RX supply to 1,07 Vdc and press the battery warning button. The LED should remain off.

RF adjustment

7 Set signal generator RF to channel frequency marked on the cassette and on crystal X300. Amplitude –40 dBm. Modulation is not required. Set the oscilloscope to 1 µs/div and 5 mV/div.

8 With RXEN set to **On** and IF control set to **Out**, adjust trim capacitors C302, C303,C353, and C346 to mid-position. Adjust C326 until the oscillator starts, as indicated by an increased amplitude on the oscilloscope.

9 Adjust L304 for max amplitude on the oscilloscope.
Readjust C326 for max amplitude and IF 455 ± 1,5 kHz *(filter the IF signal to aid in accurate measurement of frequency).* Adjust C346 for max amplitude. See figure 24.

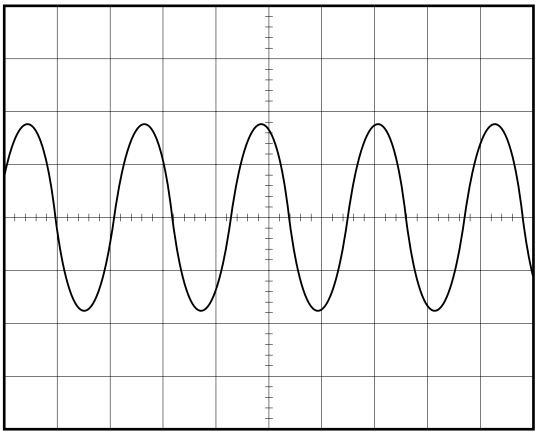


Figure 24. RF adjustment.

10 Adjust C302, C303, and C353 for max gain, see figure 25 below. Repeat until no further improvement is obtained. The different trim capacitors affect each other.

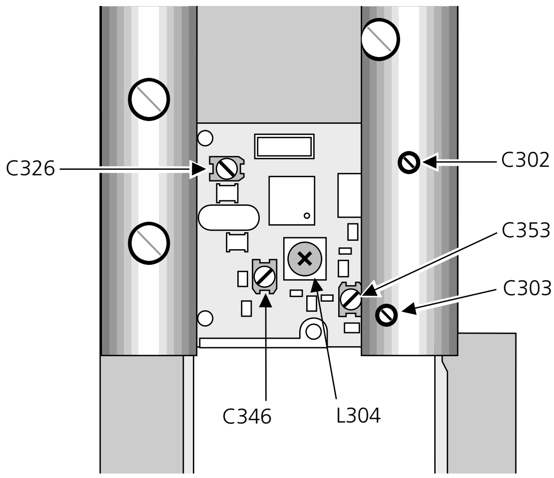


Figure 25. U912RXD in alignment insert showing alignment points.

FM detector

11 Connect the oscilloscope to **TP out** on the selector box. Set the test point switch to **TP11** and RXEN switch in **on** position.

12 Set the signal generator to FM, 2,5 kHz deviation.
Check the demodulated signal.The waveform should be as in figure 26, with an amplitude of 75 - 125 mVp-p

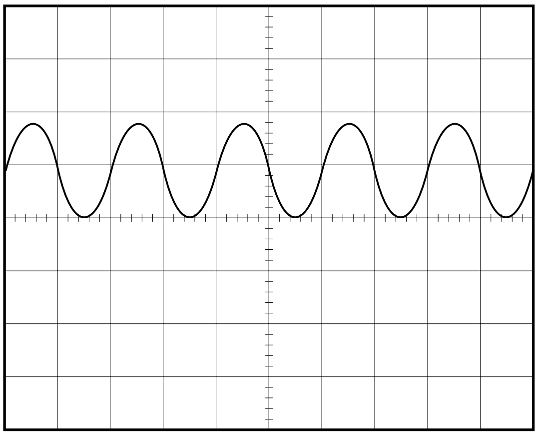


Figure 26. FM detector.

CODE signal

13 Set the test point switch on the selector box to **TP18** and set the RXEN switch to **on** position.

14 Set the signal generator to FM, 2,5 kHz deviation.
Check that the CODE signal is as in figure 27, i.e. a square wave with amplitude > 0.85 Vp-p.

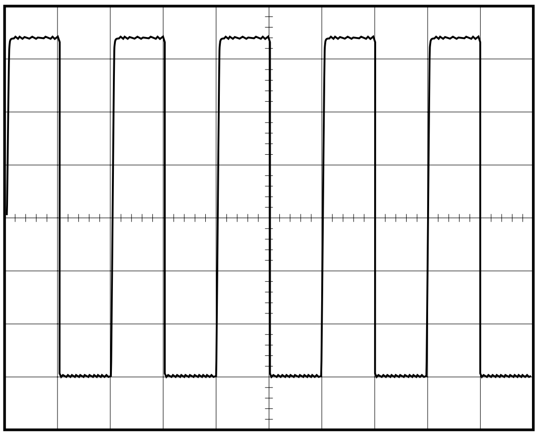


Figure 27. Code signal.

Start time

15 To perform check of start time an oscilloscope with memory function is neccessary, externally triggered with RXEN signal from the selector box.
Set test point switch to **TP18**.
Connect modulation output from the signal generator to **Clock in** on the test fixture. Set RXEN switch to **pulse** .

16 Set the signal generator to FM, 2,5 kHz deviation.
Check that the CODE signal is as in figure 28, i.e. a square wave with 50% duty cycle after < 3 ms.

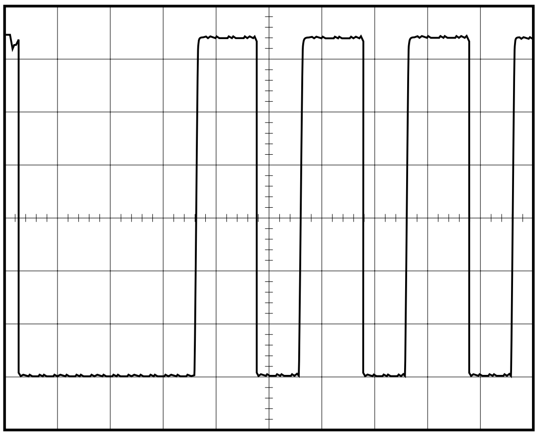


Figure 28. Start time.

Check of IR link

17 Set the test point switch to position **TP17**.
Connect a 1 kHz square wave or modulation output from the signal generator with amplitude 1 Vpeak to **Clock In** on the test fixture.

18 Check that the waveform is approximately as in figure 29. Amplitude > 2,5 Vp-p.

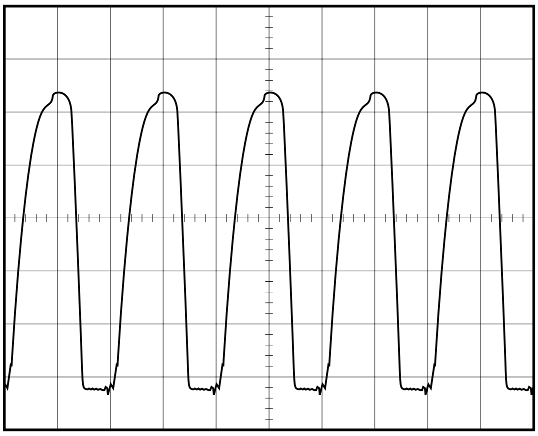


*Figure 29. IR llink, 1kHz sine wave to **Clock in**.*

Test paging

Test pagings are to be made on completely assembled pagers. See Appendix D: *U914D Sensitivity Test* on page 28.

Appendix A: H914D & H912T Testpoint Description

With the test point switch test points can be selected and measured at the **TP out** output on the selector box. The test points are decribed below in the order they appear on the test point switch.

All “Expected values” are approximately and may vary about ±20 mV.

Testpoint	Description
TPLP	Filtered output from FM detector.
TPCODE	Output from comparator that converts detected signal to CODE signal.
TPIRDET	Output from IR sensor.
TPTR200	DC voltage level at collector of second stage in the front-end amplifier. Expected value: 970 mV.
TPIF	Filtered IF-signal.
TPAF	Output from FM detector..
TPIC200	DC voltage level at VCC input to the FM circuit (IC200). Approximately equal to battery level. Expected value: 1250–1500 mV.
TPV10	DC voltage level of regulated supply (V10). Expected value: 1000 mV.

Appendix B: H914D and H912T Sensitivity Test

General

Perform this test to see if a H914D/H912T pocket receiver needs alignment. An accurate test requires a shielded environment. Without shielding the test must be modified and becomes basically a function test.

Test Equipment

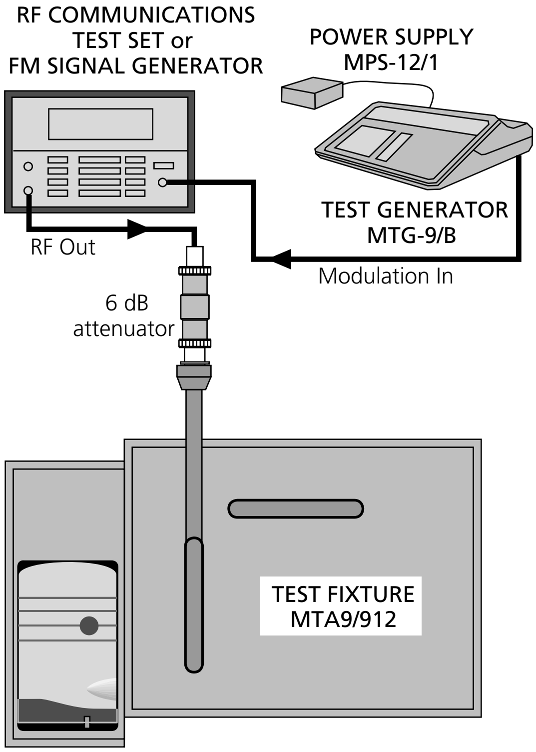
Test Generator	Tateco MTG-9/B
Power supply	MPS-12/1
Test fixture	MTA9/912
6 dB Attenuator (BNC)	Tateco AT52 or equivalent
RF Communications Test Set	HP 8920A or equivalent

If an RF Communications Test Set is not available, the following can be used instead:

Signal Generator	Phase locked, 100 kHz - 500 MHz
	Frequency accurancy: ± 100 Hz
	Amplitude: –110 to +6 dBm
	Frequency modulation: 1 kHz
	sine/square, 1,5/2,5 kHz deviation

Procedure

1 Connect the test equipment as shown in the figure below. Place the receiver into the cavity in test fixture MTA9/912 as shown.



Equipment setup for sensitivity test.

2 *If HP 8920 test set is used:*
Press **Preset** button and select **Rfgen**.
Set **RFgen Freq** = channel frequency and **Amplitude** according to table below.
Set **AFgen1 To** = off and **ModIn To** = FM (/Vpk), 1,50 kHz.

If other test equipment is used:
Set signal generator RF to channel frequency with amplitude according to table below.

3 Connect MTG-9/B to modulation input and initiate pagings.
Check that the receiver responds according to table below.

Environment	RF Amplitude	Receiver responds to least
Shielded	-85 dBm	4 out of 5 pagings
Unshielded	-73 dBm	9 out of 10 pagings

Appendix C: U914D Testpoint Description

With the test point switch test points can be selected and measured at the **TP out** output on the selector box. The test points are decribed below in the order they appear on the test point switch.

All “Expected values” are approximately and may vary about ±20 mV.

Testpoint	Description
TP11	Filtered output from FM detector.
TP18	Output from comparator that converts detected signal to CODE signal.
TP17	Output from IR sensor.
TP1	DC voltage level at collector of first stage in the front-end amplifier. Expected value: 830 mV.
TP2	DC voltage level at collector of second stage in the front-end amplifier. Expected value: 830 mV.
TP3	DC voltage level at mixer stage. Expected value: 720 mV.
TP4	DC voltage level at IF buffer stage. Expected value: 600 mV.
TP7	DC voltage level at oscillator collector. Expected value: 830 mV.
TP9	DC voltage level at VCC input to the FM circuit (IC300). Approximately equal to battery level. Expected value: 1250-1450 mV.
TP12	DC voltage level at regulated supply (V10). Expected value: 1040 mV.

Appendix D: U914D Sensitivity Test

General

Perform this test to see if an U914D pocket receiver needs alignment. An accurate test requires a shielded environment. Without shielding the test must be modified and becomes basically a function test.

Test Equipment

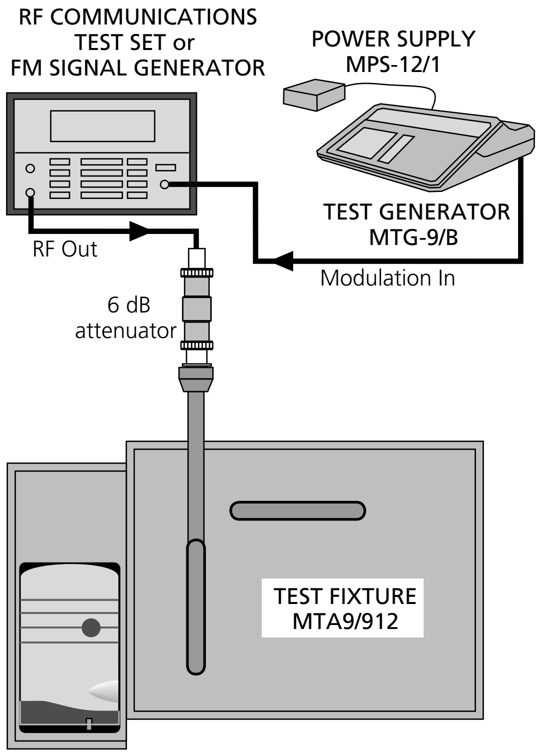
Test Generator	Tateco MTG-9/B
Power supply	MPS-12/1
Test fixture	MTA9/912
6 dB Attenuator (BNC)	Tateco AT52 or equivalent
RF Communications Test Set	HP 8920A or equivalent

If an RF Communications Test Set is not available, the following can be used instead:

Signal Generator	Phase locked, 100 kHz - 500 MHz
	Frequency accurancy: ± 100 Hz
	Amplitude: –110 to +6 dBm
	Frequency modulation: 1 kHz
	sine/square, 1,5/2,5 kHz deviation

Procedure

1 Connect the test equipment as shown in the figure below. Place the receiver into the cavity in test fixture MTA9/912 as shown.



Equipment setup for sensitivity test.

2 *If HP 8920 test set is used:*
Press **Preset** button and select **Rfgen**.
Set **RFgen Freq** = channel frequency and **Amplitude** according to table below.
Set **AFgen1 To** = off and **ModIn To** = FM (/Vpk), 2,50 kHz.

If other test equipment is used:
Set signal generator RF to channel frequency with amplitude according to table below.

3 Connect MTG-9/B to modulation input and initiate pagings.
Check that the receiver responds according to table below.

Environment	RF Amplitude	Receiver responds to least
Shielded	-78 dBm	4 out of 5 pagings
Unshielded	-68 dBm	9 out of 10 pagings

Appendix E: FM Detector & CODE signal and start time for all PCBs on the UHF band with No. 40360M and older

The following

FM Detector

4 On HP 8920 test set:
Press **Preset** button and select **RFgen**.
Set RF Generator to channel frequency, amplitude = –45 dBm.
Set AFgen1TO = OFF and AFgen2TO = Audio Out with amplitude = 1,0V.
Set ModinTO = FM with deviation 1,5 kHz/Vpeak.
Under **Encoder** set AFgen2Freq = 585 Hz and square wave.
Under **AF ANL** set AFanlIN = AudioIN and Scope To = Filters.
Test set to **Scope** mode with vert = 50 mV/div, VertOffset = –1 and time = 1 ms/div.
Under Main = Trigger select external(TTL), CONT/Single, NORM and POS/NEG.

5 With the test point switch on the selector box set to **TP11** and RXEN switch set to **pulse** check that the signal is as in figure 30. Amplitude 75 to 125 mVp-p.

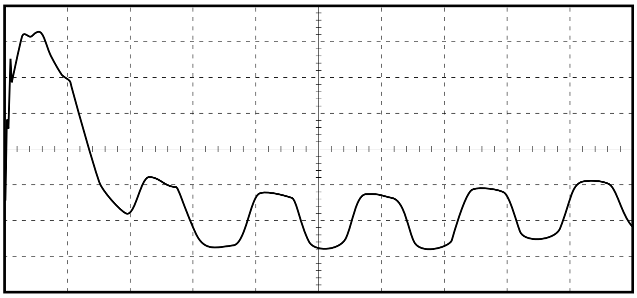


Figure 30. FM detector.

CODE signal and start time

6 HP 8920 test set:
As above but Scope To = Input and vert = 200 mV/div, VertOffset = –3,50 on the **Scope**.

7 Set the test point switch on the selector box to **TP18** and set the RXEN switch to **pulse**.

8 Check that the signal is as in figure 21, i.e. a square wave with 50% duty cycle, > 0,85 Vp-p, at 3 ms after start.

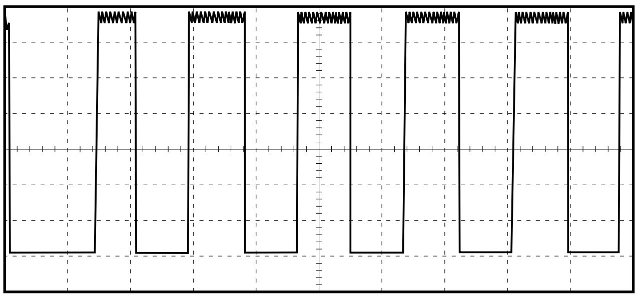


Figure 31. Code signal and start time.