ICOM®

INSTRUCTION MANUAL

VHF FM REPEATER

IC–FR3100

UHF FM REPEATER

IC–FR4100

Icom Inc.

IMPORTANT

READ THIS INSTRUCTION MANUAL CAREFULLY before attempting to operate the repeater.

SAVE THIS INSTRUCTION MANUAL– This manual contains important safety and operating instructions for the IC-FR3100/FR4100 series.

EXPLICIT DEFINITIONS

WORD	DEFINITION
⚠ **WARNING**	Personal injury, fire hazard or electric shock may occur.
CAUTION	Equipment damage may occur.
NOTE	If disregarded, inconvenience only. No risk of personal injury, fire or electric shock.

PRECAUTION

⚠ **WARNING HIGH VOLTAGE! NEVER** attach an antenna or internal antenna connector during transmission. This may result in an electrical shock or burn.

⚠ **WARNING HIGH VOLTAGE! NEVER** install the antenna in any place that a person can touch the antenna easily during transmission. This may result in an electrical shock or burn.

⚠ **NEVER** apply AC to the [BATTERY] terminals on the repeater rear panel. This could cause a fire or damage the repeater.

⚠ **NEVER** apply more than 16 V DC, such as a 24 V battery, to the [BATTERY] terminals on the repeater rear panel. This could cause a fire or damage the repeater.

⚠ **NEVER** let metal, wire or other objects touch any internal part or connectors on the rear panel of the repeater. This may result in an electric shock.

⚠ **NEVER** expose the repeater to rain, snow or any liquids.

AVOID using or placing the repeater in areas with temperatures below –25°C or above +55°C.

AVOID placing the repeater in excessively dusty environments or in direct sunlight.

AVOID putting anything on top of the repeater. This will obstruct heat dissipation.

Place the repeater in a secure place to avoid inadvertent use by children.

BE CAREFUL! The heatsink will become hot when operating the repeater continuously for long periods.

BE CAREFUL! If a linear amplifier is connected, set the repeater's RF output power to less than the linear amplifier's maximum input level, otherwise, the linear amplifier will be damaged.

Use Icom microphones only (optional). Other manufacturer's microphones have different pin assignments, and connection to the IC-FR3100/FR4100 series may damage the repeater.

CAUTION: This repeater is intended for use as a fixed base station with the antenna located outdoors on the rooftop or on an antenna tower.

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FORWARD

Thank you for purchasing this Icom product. The IC-FR3100/FR4100 VHF/UHF FM REPEATER is designed and built with Icom's state of the art technology and craftsmanship. With proper care, this product should provide you years of trouble-free operation.

We want to take a couple of moments of your time to thank you for making the IC-FR3100/FR4100 your repeater of choice, and hope you agree with Icom's philosophy of "technology first." Many hours of research and development went into the design of the IC-FR3100/FR4100 series.

◇ *FEATURES*

❍ *25 W continuous full duty cycle operation*

This repeater looks as good as it performs. A rugged heatsink, large cooling fans and a high performance power module provide the repeater with a stable 25 W at full duty cycle operation.

❍ *Automatic battery backup system*

A built-in backup system supports automatic switching to an external power supply (13.2 V DC) if the AC power supply fails.

❍ *Multiple CTCSS & DTCS tone memories with multiple memory channels*

Up to 16 CTCSS/DTCS tones (TX/RX tones respectively) can be programmed in a channel. This feature allows you to share a channel with multiple user groups. You can also give priority/exclusive use to a specified group simply by programming different tones to another memory channel. Ideal for many different applications.

❍ *Built-in 2-Tone, 5-Tone, DTMF encoder & decoder*

Multiple signaling systems are equipped as standard. These systems are fully compatible with Icom F-series radios.

❍ *Telephone interconnect capability*

❍ *DTMF remote control capability*

You can control the repeater from a remote location over the air or over a phone line with DTMF.

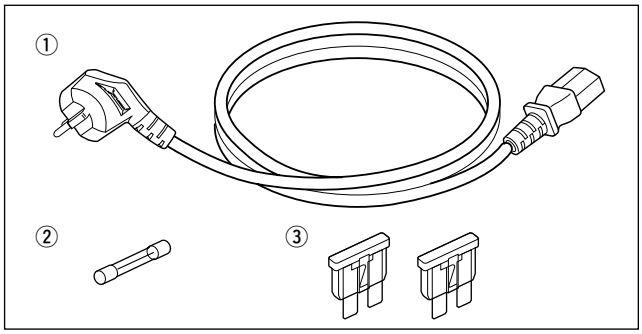
❍ *Other features*

- PC programmable
- Wall or 19 inch rack mount (optional MB-77/MB-78)
- Optional Voice Scrambler Unit (UT-109 #01/UT-110 #01) for base operating mode

SUPPLIED ACCESSORIES

The following accessories are supplied with the IC-FR3100/FR4100 series

① AC power cable (OPC-492) 1
② Spare fuse (FGB 1 A) 1
③ Spare fuses (ATC 20) 2



EXPLICIT DEFINITIONS

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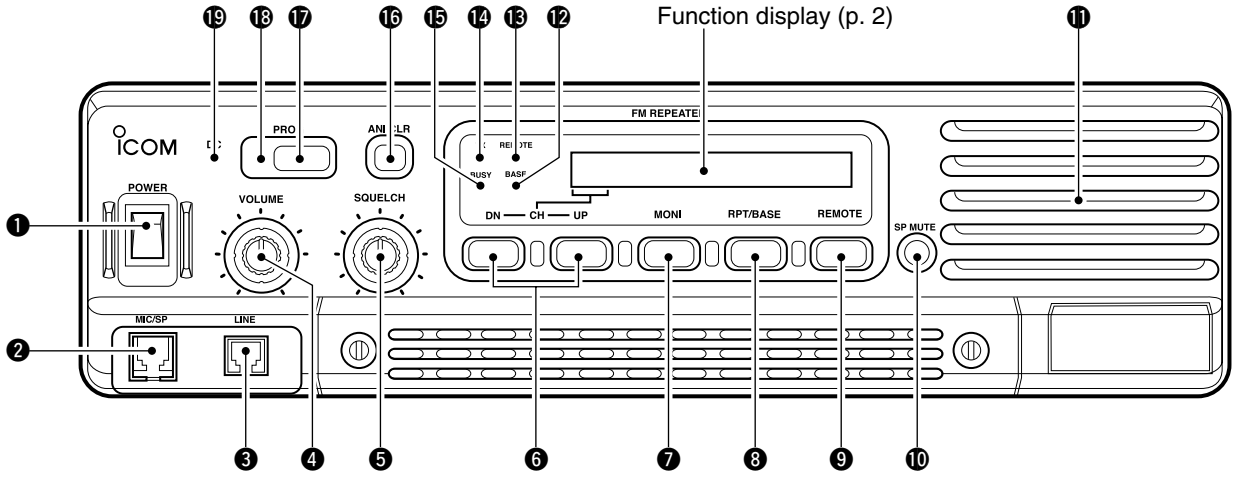
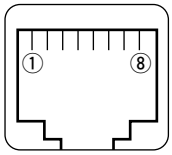
1 PANEL DESCRIPTION

■ Front panel



❶ POWER SWITCH [POWER]
Toggle to turn the repeater power ON or OFF.

❷ MICROPHONE/SPEAKER CONNECTOR [MIC/SP]
This 8-pin modular jack accepts the optional microphone.



① +9 V DC output (Max. 10 mA)
② I/O port for PC programming
③ NC
④ M PTT (Input port for TX control)
⑤ Microphone ground
⑥ Microphone input
⑦ Ground
⑧ M MONI (Input port for monitor control)

❸ LINE CONNECTOR [LINE]
This 4-pin modular jack allows connection of a 2 wire system telephone cable.
• See p. 7 for line connector information.

❹ VOLUME CONTROL [VOLUME] (p. 12)
Adjusts the audio output level.

❺ SQUELCH CONTROL [SQUELCH]
➥While in base operating mode, adjusts the squelch threshold level. (p. 12)
➥While in repeater operating mode, this knob is not activated.

❻ CHANNEL SELECT SWITCHES [DN/UP]
Push either switch to select the operating channel.

❼ MONITOR SWITCH [MONI]
➥Push to monitor the operating frequency.

❽ MODE SELECT SWITCH [RPT/BASE]
Toggles the repeater or base operating mode when pushed.
• When setting up a repeater system using IC-FR3100/FR4100 only, select a repeater operating mode.
• When using IC-FR3100/FR4100 as a full (or half) duplex transceiver, or setting up a repeater system connecting an external controller, select a base operating mode.

❾ REMOTE CONTROL SWITCH [REMOTE]
Toggle to activate or inactivate the remote control operation when pushed.

❿ AF MUTE CONTROL [SP MUTE]
Mutes the audio output.

⓫ INTERNAL SPEAKER
Monitors received signals.

⓬ BASE OPERATING MODE INDICATOR
Lights green while in base operating mode.

⓭ REMOTE CONTROL MODE INDICATOR
Lights green while in remote control operation mode.

⓮ TRANSMIT INDICATOR
Lights red while transmitting.

⓯ BUSY INDICATOR
Lights green while receiving a signal or when the noise squelch is open.

⓰ ANI CLEAR SWITCH [ANI CLR]
Push for 1 sec. to clear the received ANI ID indication on the display and return to the original indication.

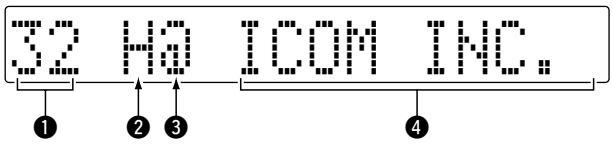
NOTE: This switches' function is not available for some versions.

⓱ DEALER-PROGRAMMABLE SWITCH [PROG]
Toggles the pre-programmed function ON or OFF when pushed.

⓲ PROGRAMMED FUNCTION INDICATOR
Lights green while the pre-programmed function is activated.

⓳ DC INDICATOR
Lights green during DC operation.

◇Function display



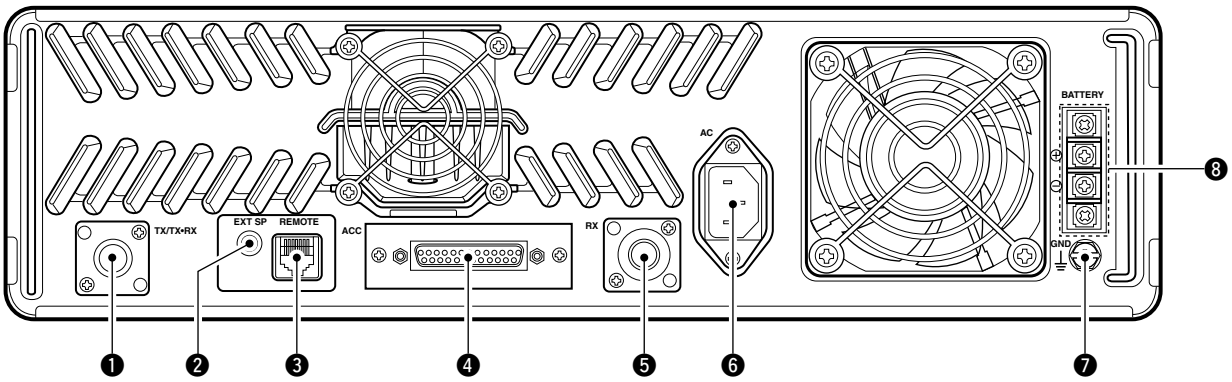
❶ MEMORY CHANNEL INDICATOR
Shows the selected memory channel.

❷ TRANSMIT POWER INDICATOR
Shows the output power level.

❸ AUDIBLE INDICATOR
"@" appears during audible condition, disappears during inaudible condition. (During audible condition, the audio mute is cancelled.)

❹ ALPHANUMERIC INDICATORS
Shows a variety of text or code information.

■ Rear panel



❶ TRANSMIT ANTENNA CONNECTOR [TX/TX•RX]
➥ Connects a transmit antenna (impedance: 50 Ω) and outputs transmit signals.
➥ When installing an optional internal duplexer (supplied by a third party), this connects the transmit/receive to an antenna.

❷ EXTERNAL SPEAKER CONNECTOR [EXT SP]
Accepts a 4 Ω external speaker.

❸ REMOTE CONNECTOR [REMOTE]
Connects to the remote controller.
• See p. 3 for remote connector information.

❹ ACCESSORY CONNECTOR [ACC]
Connects to the remote controller.
• See pgs. 3, 4 for accessory connector information.

❺ RECEIVE ANTENNA CONNECTOR [RX]
➥ Connects a receive antenna (impedance: 50 Ω) and inputs received signals.
➥ When installing an internal duplexer (supplied by third party), do not use this connector.

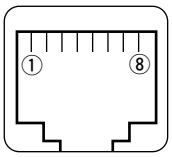
❻ AC POWER SOCKET [AC]
Connects the supplied AC power cable to a domestic AC outlet.

❼ GROUND TERMINAL [GND]
Ground the repeater through this terminal to prevent electric shocks, TVI, BCI and other problems.

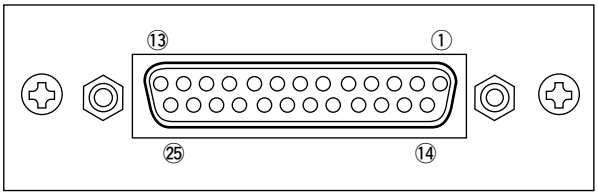
❽ DC POWER INPUT TERMINALS [BATTERY]
Connects the 12 V storage battery for the repeater backup when the AC power is interrupted. These terminals are also used for DC power operation.

CAUTION: NEVER short the (+) line of the DC power cable to the repeater's chassis when connecting a DC power cable to the [BATTERY] terminals. Otherwise there is danger of electric shock and/or equipment damage.

◇ Remote connector

	Pin No.	Pin Name	Description	Specification
	1	–PTT	Input terminals to transmit the repeater in relation to the external equipment. An opto-isolator is provided to facilitate PTT signals.	High voltage=PTT ON (transmits) Hi-Z=PTT OFF
	2	+PTT		
	3	–AFOUT	Output terminal for AF signals from the AF detector circuit via the bandpass filter. Output level is fixed, regardless of [AF] control.	Output impedance: 600 Ω
	4	+AFOUT		
	5	–EXTMOD	Input terminal for the modulation circuit.	Input impedance: 600 Ω
	6	+EXTMOD		
	7	–BUSY	Output terminal for squelch condition (Open/Close). An opto-isolator is provided to facilitate BUSY signals.	Open collector=BUSY OFF 0 V=BUSY ON (Squelch is opened)
	8	+BUSY		

◇ Accessory connector



Pin No.	Pin Name	Description	Specification
1	BUSY OUT	Output terminal for busy signal.	Open collector=OFF, 0 V=ON
2	COAXIAL SW	Output terminal for coaxial switching (antenna switching) signal.	Open collector=OFF 0 V=ON
3	M/S IN	Input terminal for master/slave signal.	+5 V pull up, Active=L
4	D1	Input terminal for selecting memory channel.	+5 V pull up, Active=L
5	D3	Input terminal for selecting memory channel.	+5 V pull up, Active=L
6	EXT RPT/BASE	Input terminal for repeater/base operating mode switching signal.	+5 V pull up Active=L
7	EXT MONI	Input terminal for monitor function.	+5 V pull up, Active=L
8	EXT DTCS	Input terminal for continuous tone (CTCSS/DTCS) signal.	Input impedance: 100 kΩ (approx.)
9	EXTMOD IN B	Input terminal for the modulation signals applied to input of the splutter filter circuit.	Input impedance: 600 Ω (approx.)
10	EXTMOD IN A	Input terminal for the modulation signal applied to input of the pre-emphasis circuit via the bandpass filter.	Input impedance: 600 Ω (approx.)
11	AF OUT	Output terminal for AF signals from the AF detector circuit via the bandpass filter. Output level is fixed, regardless of [AF] control.	Output impedance: 1 kΩ (approx.)
12	DISC OUT	Output terminal for AF signals from the AF detector circuit. Output level is fixed, regardless of [AF] control.	Output impedance: 1 kΩ (approx.)
13	+15V	Output terminal for +15V DC while in AC operation. (While in DC operation, same as input DC.)	Output current: Less than 1 A
14	TX OUT	Output terminal for transmission state.	Open collector=OFF, 0 V=ON

Accessory connector (continued)

Pin No.	Pin Name	Description	Specification
15	M/S OUT	Output terminal for master/slave signal.	Open collector=OFF, 0V=ON
16	D0	Input terminal for selecting memory channel.	+5 V pull up, Active=L
17	D2	Input terminal for selecting memory channel.	+5 V pull up, Active=L
18	D4	Input terminal for selecting memory channel.	+5 V pull up, Active=L
19	EXT PTT	Input terminal for PTT signal.	+5 V pull up, Active=L
20	RSSI	Output terminal for RSSI (Received Signal Strength Indicator) signal.	Output impedance: 1 kΩ (approx.)
21–24	AGND	Analog ground	
25	DC GND	Ground for +15 V DC	

• Pin 4, pin 5, pins 16–18 select one of the 32 pre-programmed memory channels. (see table below)
[0]: Hi-Z, [1]: 0 V (D0–D4: +5 V pull up)

Channel	D4 (pin 18)	D3 (pin 5)	D2 (pin 17)	D1 (pin 4)	D0 (pin16)	Channel	D4 (pin 18)	D3 (pin 5)	D2 (pin 17)	D1 (pin 4)	D0 (pin16)
1	0	0	0	0	0	17	1	0	0	0	0
2	0	0	0	0	1	18	1	0	0	0	1
3	0	0	0	1	0	19	1	0	0	1	0
4	0	0	0	1	1	20	1	0	0	1	1
5	0	0	1	0	0	21	1	0	1	0	0
6	0	0	1	0	1	22	1	0	1	0	1
7	0	0	1	1	0	23	1	0	1	1	0
8	0	0	1	1	1	24	1	0	1	1	1
9	0	1	0	0	0	25	1	1	0	0	0
10	0	1	0	0	1	26	1	1	0	0	1
11	0	1	0	1	0	27	1	1	0	1	0
12	0	1	0	1	1	28	1	1	0	1	1
13	0	1	1	0	0	29	1	1	1	0	0
14	0	1	1	0	1	30	1	1	1	0	1
15	0	1	1	1	0	31	1	1	1	1	0
16	0	1	1	1	1	32	1	1	1	1	1

2 INSTALLATION AND CONNECTIONS

■ Unpacking

After unpacking, immediately report any damage to the delivering carrier or dealer. Keep the shipping cartons.

For a description and a diagram of accessory equipment included with the IC-FR3100/FR4100 series, see 'Supplied Accessories' on p. ii of this manual.

■ Selecting a location

Select a location for the repeater that allows adequate air circulation, free from extreme heat, cold, or vibrations, and away from TV sets, TV antenna elements, radios and other electromagnetic sources.

■ Antenna connection

For radio communications, the antenna is of critical importance, along with output power and sensitivity. Selecting antenna(s), such as a well-matched 50 Ω antenna, and feedline. 1.5:1 or better of Voltage Standing Wave Ratio (VSWR) is recommended for the desired band. Of course, the transmission line should be a coaxial cable.

CAUTION: Protect the repeater from lightning by using a lightning arrestor.

NOTE: There are many publications covering proper antennas and their installation. Check with your local dealer for more information and recommendations.

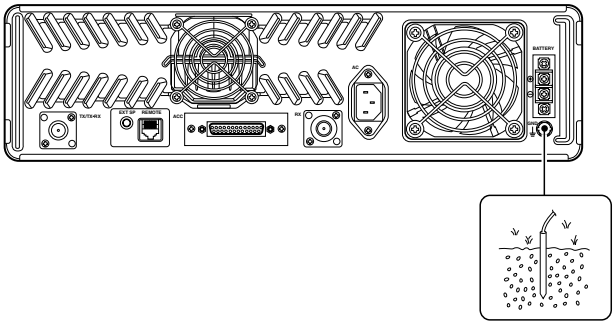
■ Duplexer

A duplexer is separately required when only one antenna is used for both transmitting and receiving. Select a duplexer according to the transmitting and receiving frequencies. Ask your Dealer for details.

■ Grounding

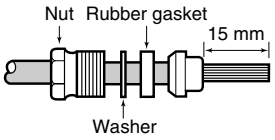
To prevent electrical shock, television interference (TVI), broadcast interference (BCI) and other problems, ground the transceiver through the [GND] terminal on the rear panel.

For best results, connect a heavy gauge wire or strap to a long earth-sunk copper rod. Make the distance between the [GND] terminal and ground as short as possible.

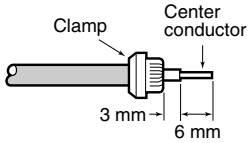


⚠**WARNING: NEVER** connect the [GND] terminal to a gas or electric pipe, since the connection could cause an explosion or electric shock.

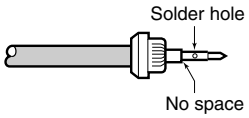
TYPE-N CONNECTOR INSTALLATION EXAMPLE

① 

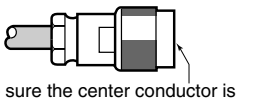
Slide the nut, flat washer, rubber gasket and clamp over the coaxial cable, then cut the end of the cable evenly.

② 

Strip the cable and fold the braid back over the clamp.

③ 

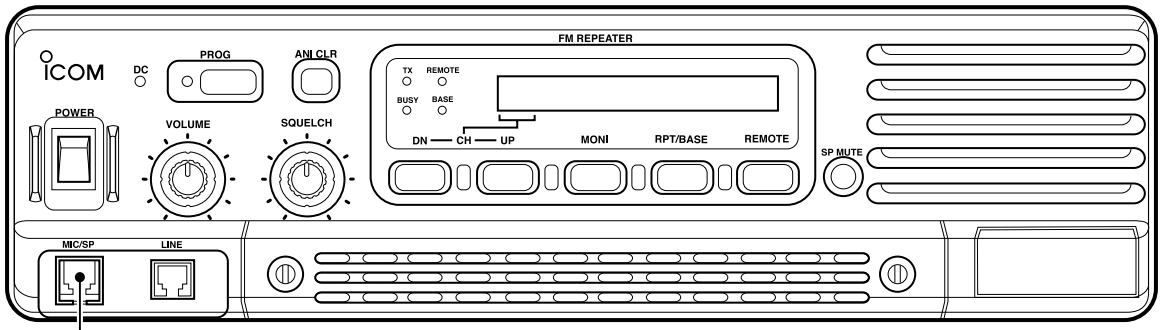
Soft solder the center conductor. Install the center conductor pin and solder it.

④ 

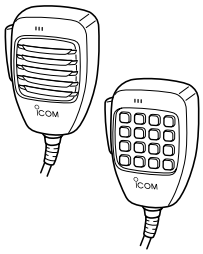
Carefully slide the plug body into place aligning the center conductor pin on the cable. Tighten the nut onto the plug body.

30 mm ≈ 9/8 in 10 mm ≈ 3/8 in 1–2 mm ≈ 1/16 in

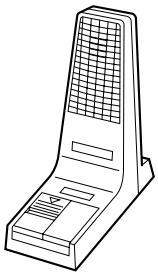
■ Required connections



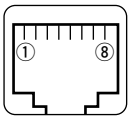
HM-100N/TN HAND MICROPHONE (optional)



SM-25 DESKTOP MICROPHONE (optional)



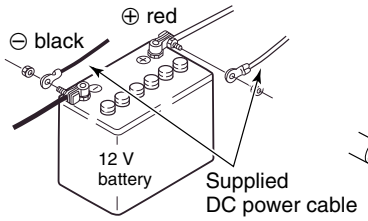
MICROPHONE CONNECTOR (Front panel view)

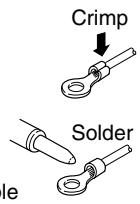


① +9 V DC output (Max. 10 mA)
② I/O port for PC programming
③ NC
④ M PTT (Input port for TX control)
⑤ Microphone ground
⑥ Microphone input
⑦ Ground
⑧ M MONI (Input port for monitor control)

CAUTION: DO NOT short pin 1 to ground as this can damage the internal 9 V regulator. DC voltage is applied to pin 1 for microphone operation. Take care when using a non-Icom microphone.

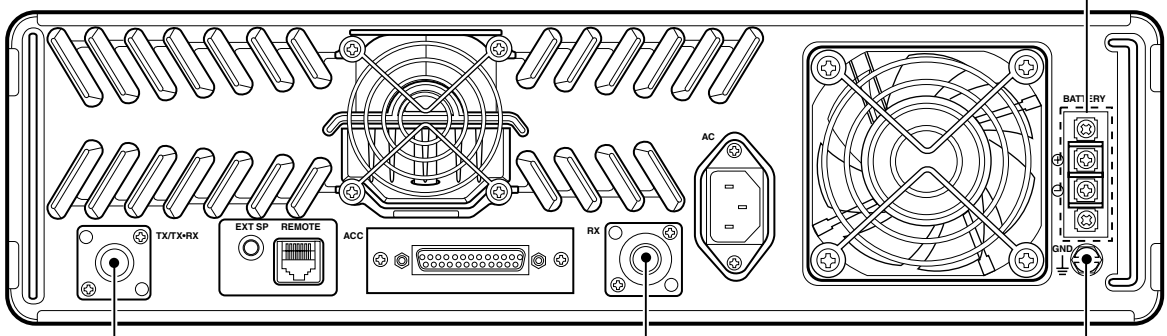
[DC POWER INPUT TERMINAL] (p. 8)





Make sure the back up battery is correctly connected. Use a cable with following current capacity. Solder or clamp the cable lug when connecting the power cable to the backup battery to prevent voltage drops.

Power cable current capacity: 20 A or more

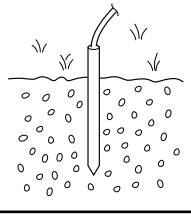


[TX(TX•RX) ANT] (p. 5)

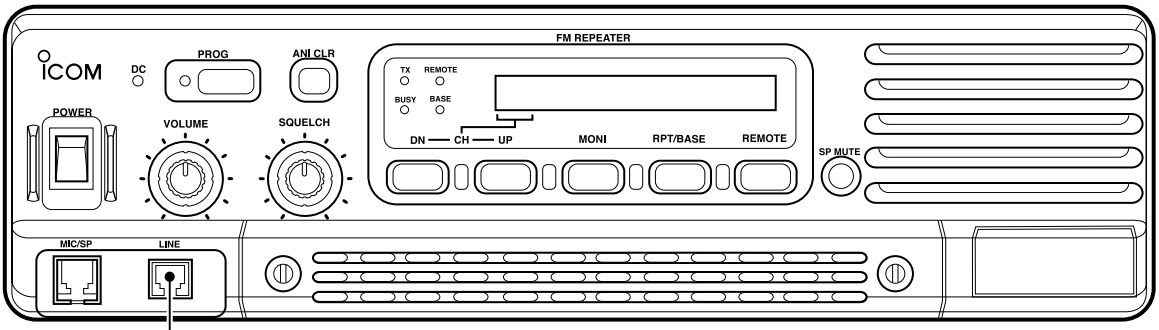
TX•RX antenna required for installing an internal duplexer.

[RX ANT] (p. 5)

GROUND (p. 5)

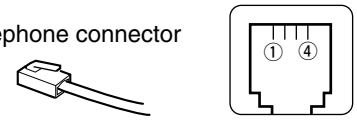


■ Advanced connections



LINE CONNECTOR (Front panel view)

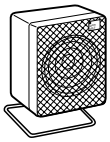
to telephone connector



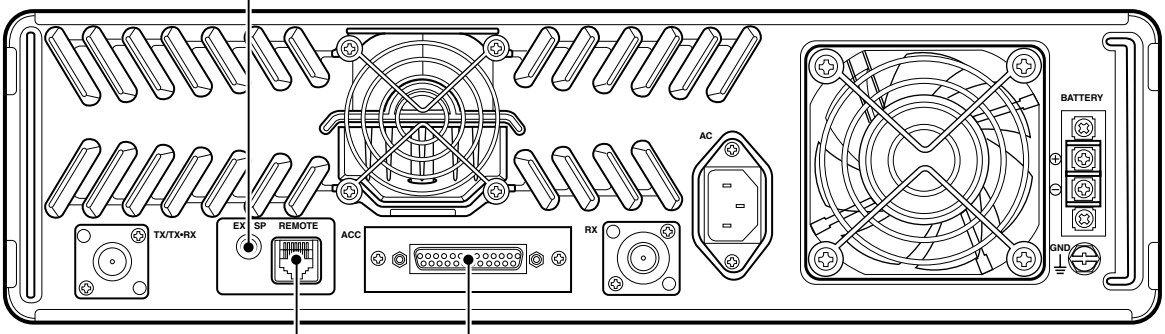
① NC (No connection)
② L1 input/output
③ L2 input/output
④ NC (No connection)

Telephone connector type is different for some countries.

EXTERNAL SPEAKER



Use a 4 Ω speaker.



[REMOTE] (p. 3)
Used for external equipment control.

ACC CONNECTOR (pgs. 3, 4)
Used for external equipment control.

■ Power

Make sure the [POWER] switch is turned OFF when connecting an AC power cable and a backup battery (emergency power supply).

The IC-FR3100/FR4100 series can operate with an AC or DC power supply. If AC power is interrupted when operating the repeater with an AC power supply, power is automatically provided to the [BATTERY] terminals.

NOTE: When repeatedly to turning the repeater ON and OFF quickly, the repeater may not turn ON. In this case turn OFF the power switch and wait for a while, then turning power ON again.

◇ In AC operation

- The [DC] indicator turns OFF.
- Use the supplied AC power cable for connection to a domestic AC outlet.
- Extension cords should not be used unless absolutely necessary. Using improper extension cords could result in fire risk.
- Usually the battery is continuously charged with a small amount of current from an AC power supply through the regulator circuit in the repeater. Discharging is therefore prevented even if the battery is not used for a long time.

◇ In DC operation

CAUTION: Voltages greater than 16 V DC will damage the repeater. Check the source voltage before connecting the power cable.

- The [DC] indicator lights up green.
- **DO NOT** place the backup battery on or near the repeater. Lead-acid batteries should be placed at least 5 m away from the repeater. Use a heavy duty cable to make the connection and be sure both the positive (red) and negative (black) terminals are correctly connected.
- Connect cables to the battery in the following order. Connect the DC power cable to the repeater first, then the positive (red) terminal and negative (black) terminal to the battery to prevent an electric shock.
- After the battery is connected and the [POWER] switch is ON, the repeater continuously supplies approx. 1 A for charging the battery. If the repeater stops functioning while connected to the battery, disconnect the battery, recharge it, then connect the battery to continue operation after the battery is charged. During repeater transmission, approx. 15 A of battery power is consumed.

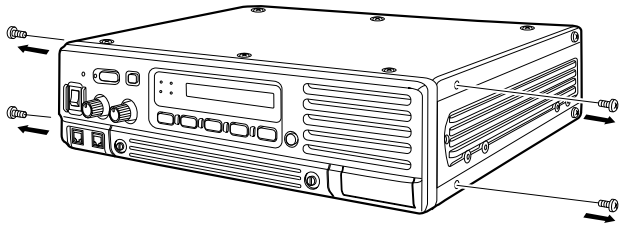
■ Mounting the repeater

◇ Using the optional MB-78

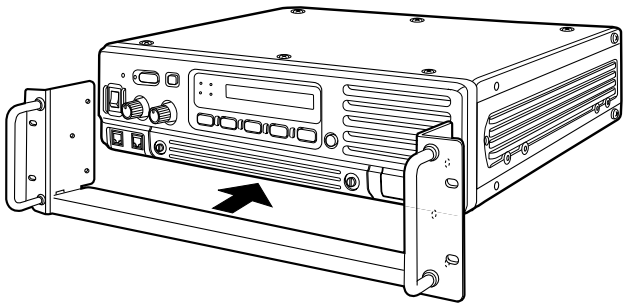
An optional MB-78 19 INCH RACK MOUNT BRACKET is available for mounting the repeater into a 19 inch rack. The MB-78 can install the repeater's bottom side and top side.

• Bottom side installation

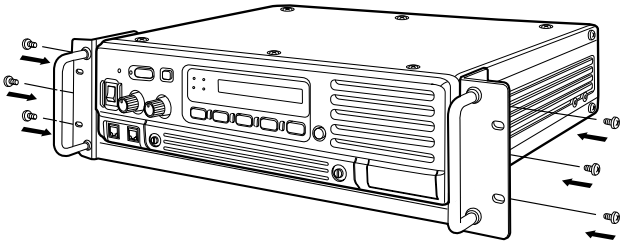
① Remove the 2 screws (M4 × 8) from both sides of the side panel (front-end).



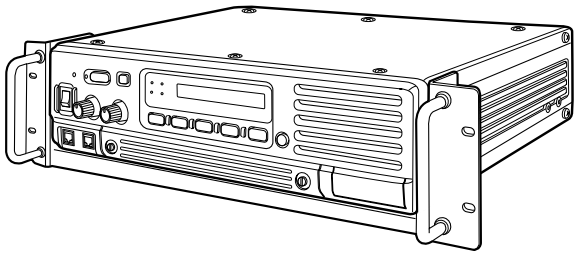
② Attach the MB-78 to the bottom side of the repeater.



③ Tighten the supplied screws (M4 × 8) and the 2 screws removed in step ① to each side. (6 screws in total)

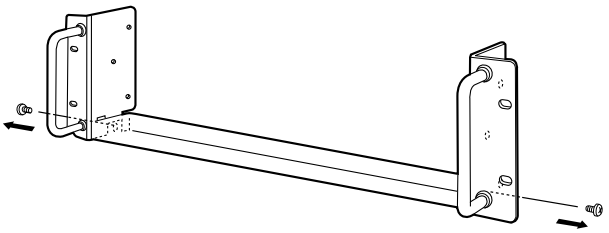


④ The completed bottom side installation should look like this.

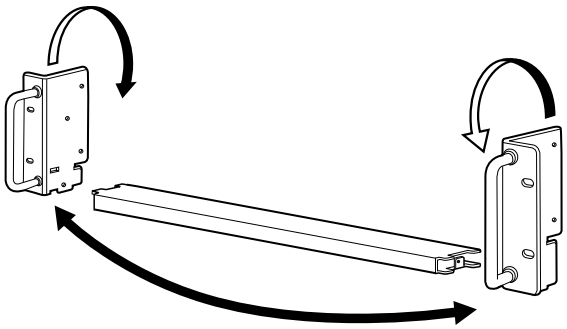


• Top side installation

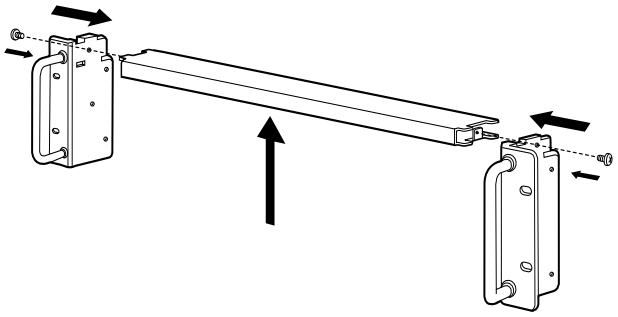
① Remove the screws (M4 × 8) from both sides of the MB-78.



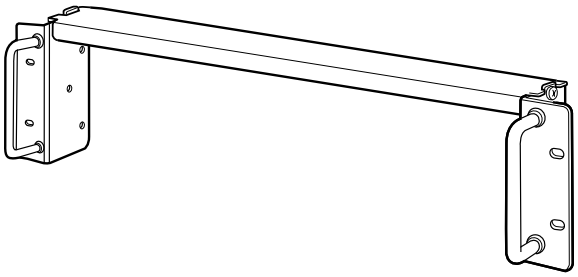
② Remove the handles from the bottom bar. And turn the handles upside down, then replace the handles right side and left side.



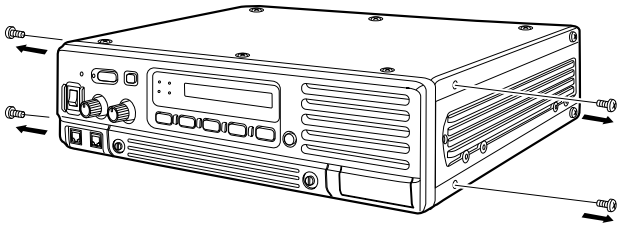
③ Attach the handles to the bar, then tighten the screws.



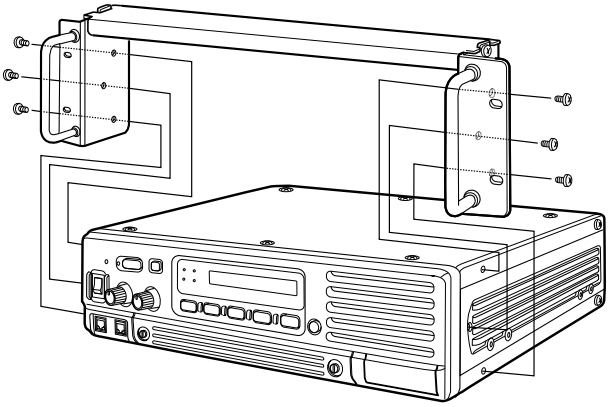
④ The completed MB-78 should look like this.



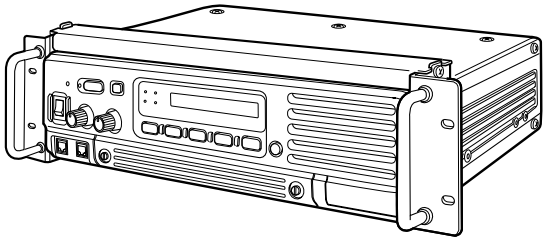
⑤ Remove the 2 screws (M4 × 8) from both sides of the side panel (front-end).



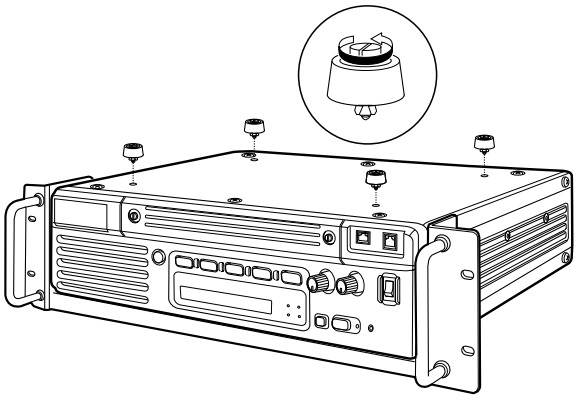
⑥ Attach the MB-78 to the top side of the repeater. Then tighten the supplied screws (M4 × 8) and 2 screws removed from each side of the repeater. (6 screws in total)



⑦ The top side installation should look like this.



⑧ Turn the repeater upside down, and remove the 4 legs before mounting into the 19 inch rack.



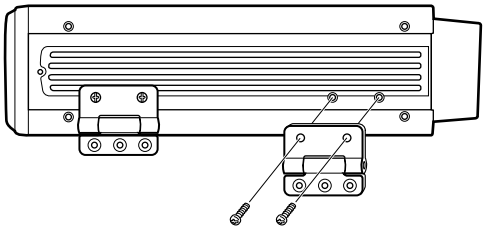
◇ Using the optional MB-77

An optional MB-77 WALL MOUNT BRACKET is available for mounting the repeater to a flat surface.

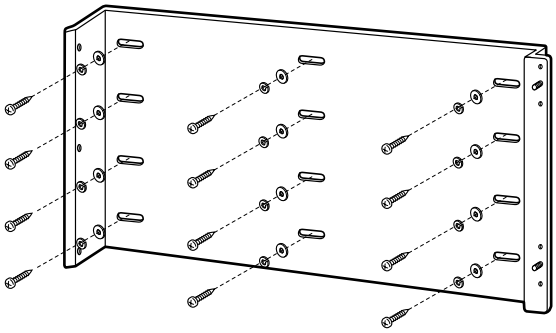
⚠**WARNING: NEVER** mount the repeater on the MB-77 by yourself. At least two people are required to mount the repeater since it weights approx. 12 kg.

•Mount the MB-77 securely with the 12 supplied screws (M6 × 30) to a surface which is more than 50 mm thick and can support more than 20 kg (44 lb). The unit must be mounted on a flat hard surface only.

① Attach the hinges on the right side of the repeater as shown below.
② Tighten the 2 supplied screws (M5 × 12) for each hinge.

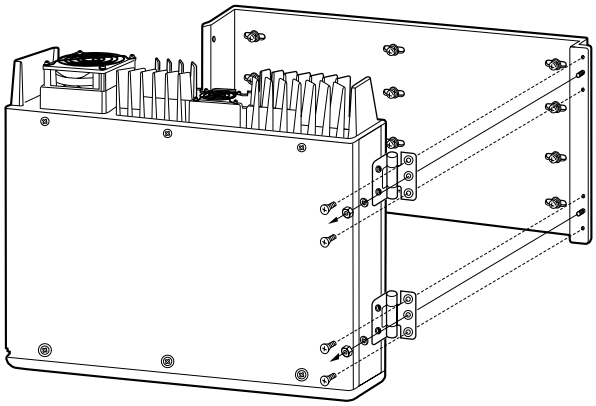


③ Put the MB-77 on the wall (or wherever you plan to mount the repeater).
④ Tighten the 12 supplied screws (M6 × 30) using flat washers and spring washers.

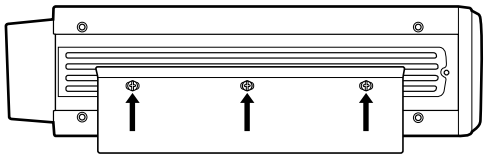


NOTE: Mount this way so that the repeater's front panel will be facing dawn.

⑤ Attach the hinges with the repeater to the MB-77 and tighten the 4 supplied screws (M5 × 10) and 2 nuts (with spring washer).

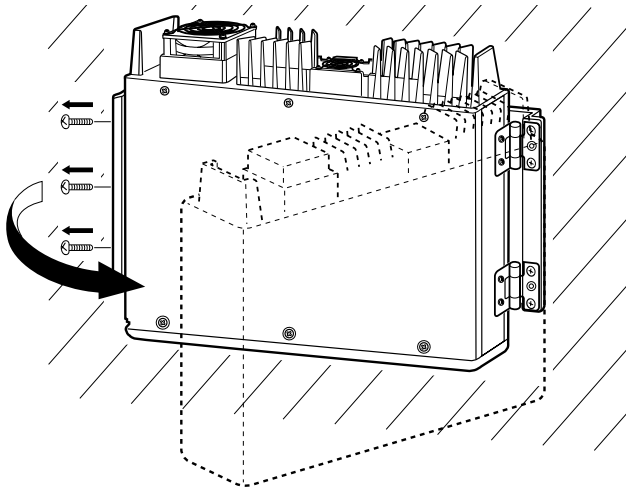


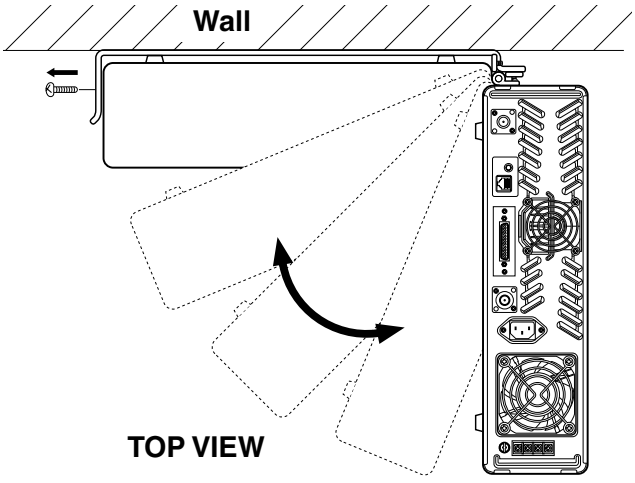
⑥ Tighten the 3 supplied screws (M5 × 12) to the other side.



• Accessing the internal area of the repeater when mounted on the MB-77

① Remove the 3 screws (M5 × 12) on the left side of the MB-77 when the repeater's front panel is facing dawn.
② Pull the left side of the repeater.
③ Remove the screws and open the bottom cover or top cover of the repeater, then set the repeater up.
④ Return the top or bottom cover of the repeater and MB-77 to their original positions.





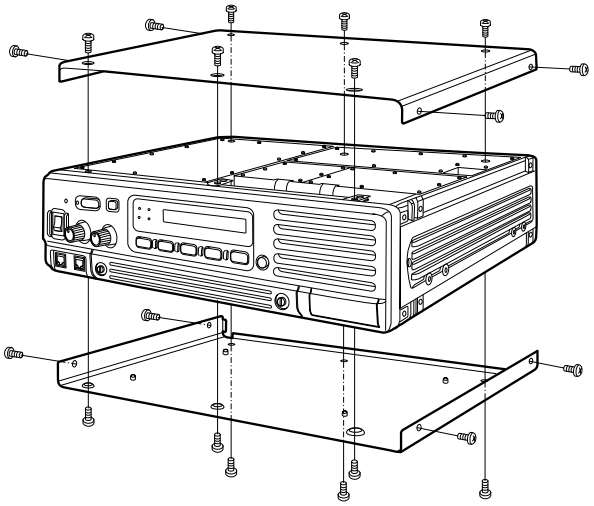
3 OPTIONAL UNIT INSTALLATION

■ Opening the repeater's case

Follow the case and cover opening procedures shown here when an optional unit is installed or when adjusting the internal units, etc.

CAUTION: DISCONNECT the AC power cable and/or DC power cable from the repeater. Otherwise, there is danger of electric shock and/or equipment damage.

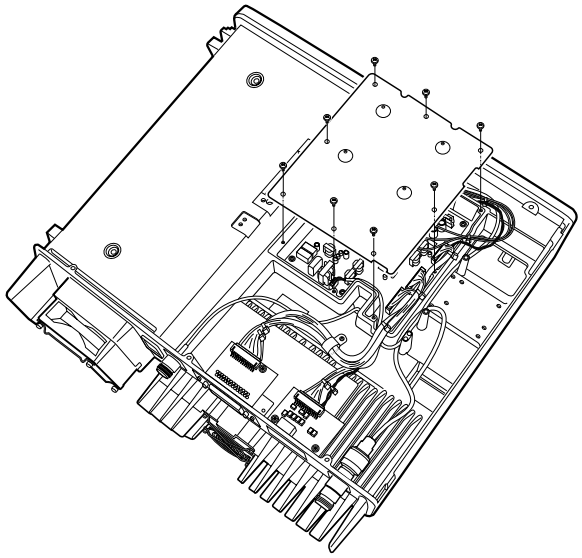
① Remove 6 screws from the top of the repeater and 4 screws from the sides, then lift up the top cover.
② Turn the repeater upside down.
③ Remove 6 screws from the bottom of the repeater, and 4 screws from the sides, then lift up the bottom cover.



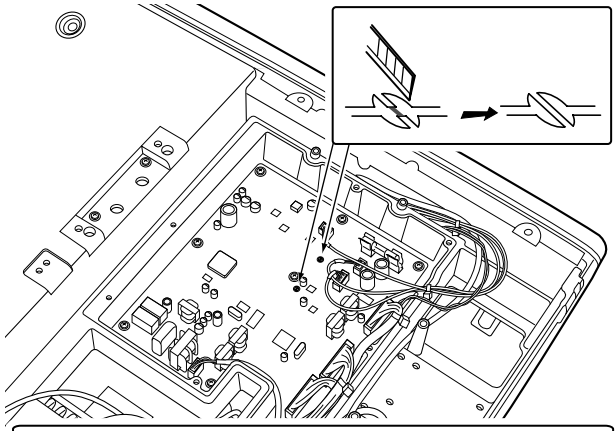
■ Voice scrambler unit installation

The UT-109 (#01)/UT-110 (#01) provide high performance private communication for base operating mode. In order to receive or send scrambled transmissions, the UT-109 (#01)/UT-110 (#01) must be installed to activate the scrambler function.

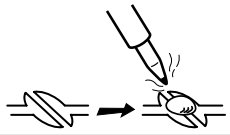
① Remove the top and bottom covers as shown above.
② Remove 8 screws from the LOGIC shielding plate, then remove the plate.



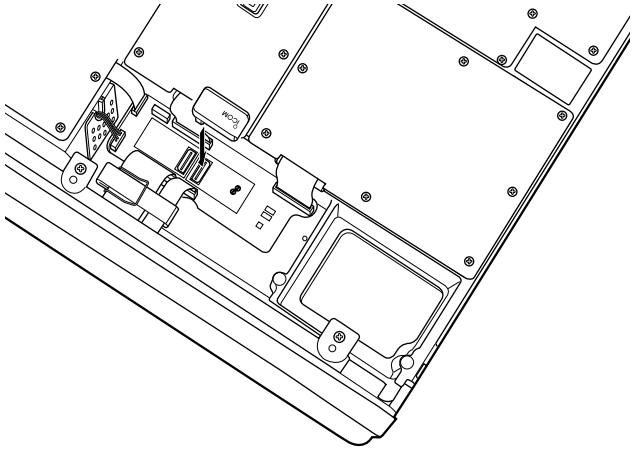
③ Cut the pattern on the PCB at the RX AF circuit (CP1) and TX mic circuit (CP2) on the LOGIC unit as shown at right.



NOTE: Be sure to re-solder above disconnected points, otherwise no TX modulation or AF output is available when you remove the scrambler unit.



④ Turn the repeater upside down, then install the scrambler unit as shown below.



⑤ Return the LOGIC shielding plate, top and bottom covers to their original positions.

■ Turning power ON

① Push [POWER] to turn the power ON.
② If the repeater is programmed for a power on password by an Icom Dealer, input the digit codes directly.
- The keys in the table below can be used for password input.
- The repeater detects numbers in the same block as

KEY	[DN]	[UP]	[MONI]	[RPT/BASE]	[REMOTE]
NUMBER	0 5	1 6	2 7	3 8	4 9

identical. Therefore “01234” and “56789” are the same.

③ When the “PASSWORD” indication does not clear after inputting 4 digits, the input code number may be incorrect. Turn power off and start over in this case.

■ Receiving and transmitting

◇ Receiving

① Push [POWER] to turn the power ON.
② Set the audio and squelch levels.
- ➥ Rotate [SQUELCH] fully counterclockwise in advance.
- ➥ Rotate [VOLUME] to adjust the audio output level.
- ➥ Rotate [SQUELCH] clockwise until the noise disappears.

③ Push [UP] or [DN] to select the desired channel.
- When receiving a signal, BUSY indicator turns ON and audio is emitted from the speaker.
- Further adjustment of [VOLUME] to a comfortable listening level may be necessary at this point.

◇ Transmitting

① Take the microphone off hook.
② Wait for the channel to become clear.
③ Push and hold [PTT] to transmit, then speak into the microphone at your normal voice level.
④ Release [PTT] to receive.

IMPORTANT:
To maximize the readability of the transmitted signal:
(1) Pause briefly after pushing [PTT].
(2) Hold the microphone 2.5 to 5 cm from your mouth, then speak into the microphone at a normal voice level.

5 MAINTENANCE

■ Troubleshooting

The following chart is designed to help correct problems which are not equipment malfunctions.

If you are unable to locate the cause of a problem or solve it through the use of this chart, contact the nearest Icom Dealer or Service Center.

PROBLEM	POSSIBLE CAUSE	SOLUTION	REF.
Power does not come on when [POWER] switch is ON.	<DC operation> • DC power cable is improperly connected. <AC/DC common> • Fuse is blown.	• Re-connect the DC power cable correctly. • Check the cause, then replace the fuse with a spare one. (Fuses are installed in the internal REG unit and LOGIC unit.)	p. 6 p. 14
No sounds from the speaker.	• Volume level is too low. • The squelch is closed. • The audio mute function is activated. • A selective call or squelch function is activated such as 2/5 tone call or tone squelch. • While in base operating mode, the repeater is in the transmitting condition.	• Rotate [VOLUME] clockwise to obtain a suitable listening level. • While in base operating mode, rotate [SQUELCH] counterclockwise to open the squelch. • Push [SP MUTE] to turn the audio mute function OFF • Turn the appropriate function OFF. • Push [PTT] on the microphone to receive or check the PTT line of an external unit, if connected.	p. 12 p. 12 p. 1 – –
Sensitivity is low and only strong signals are audible.	• Antenna feedline or the antenna connector has a poor contact or has short-circuited.	• Check and re-connect (or replace if necessary), the antenna feedline or antenna connector.	p. 5
Received signal cannot be understood.	• Optional voice scrambler is turned OFF. • Scrambler code is not set correctly.	• Turn the optional voice scrambler ON. • Reset the scrambler code.	– –
Output power is too low.	• Output power is set to Low.	• Push channel selector to select the high power operating channel.	p. 1
No contact possible with another station.	• The other station is using tone squelch. • While in base operating mode, the repeater is set to duplex.	• Turn the tone squelch function ON. • Set the repeater to simplex, when the other transceiver is set to simplex.	– –

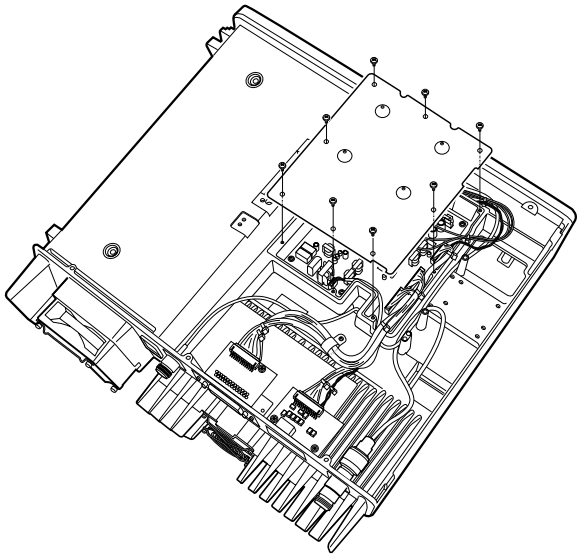
■ Fuse replacement

If a fuse blows or the repeater stops functioning, try to find the source of the problem, and replace the damaged fuse with a new, rated fuse.

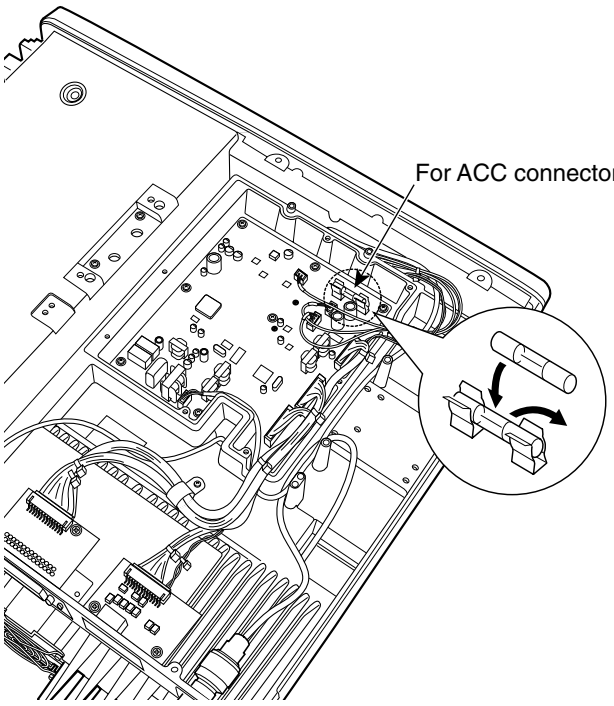
⚠**WARNING: DISCONNECT** the AC power cable and/or DC power cable from the repeater. Otherwise, there is danger of electric shock and/or equipment damage.

◇ LOGIC unit

① Remove the bottom cover as shown on p. 11.
② Remove 8 screws from the LOGIC shielding plate, then remove the plate.



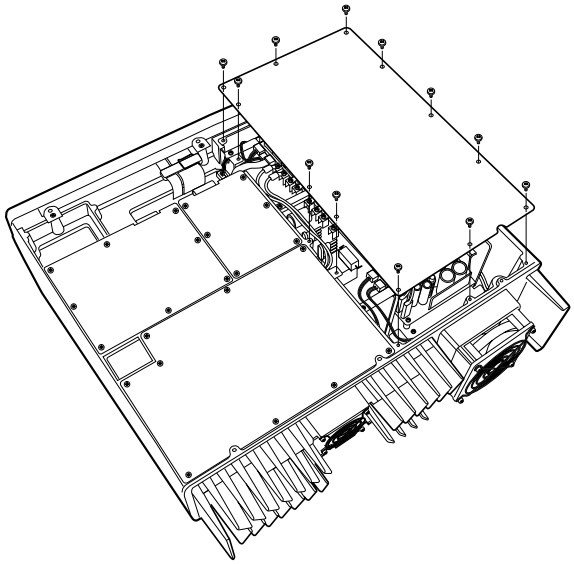
③ Replace the circuitry fuse as shown below.



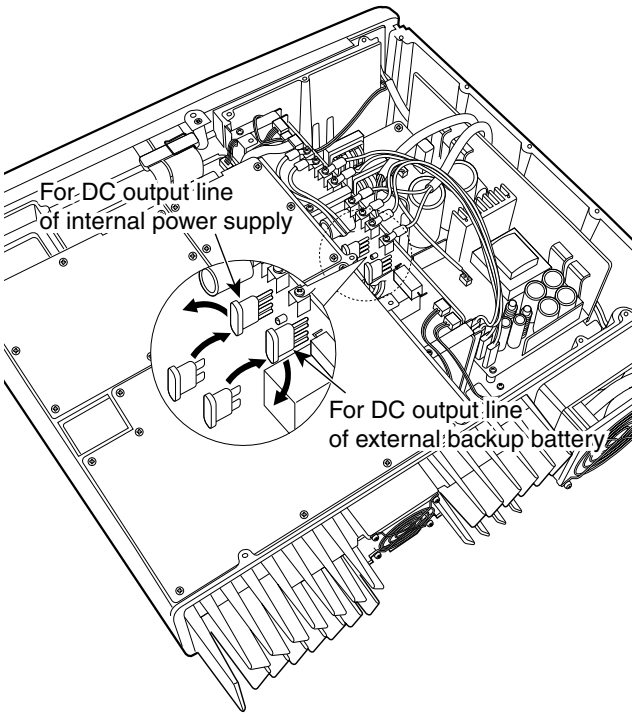
④ Return the LOGIC shielding plate and bottom cover.

◇ REG unit

① Remove the top cover as shown on p. 11.
② Remove the 12 screws from the REG shielding plate, then remove the plate.



③ Replace the circuitry fuse as shown below.



④ Return the REG shielding plate and top cover.

6 SPECIFICATIONS AND OPTIONS

■ Specifications

Specifications are measured in accordance with EN 300 086.

◇IC-FR3100

General

- Frequency coverage : 150.000–174.000 MHz
- Channel spacing : 12.5/25.0 kHz (Narrow/Wide)
  12.5/20.0 kHz (Narrow/Middle)
- PLL channel step : 5.0, 6.25 kHz
- Frequency stability : ±1.0 kHz
- Number of channels : Max. 32 channel
- Antenna connector : Type-N×2 (50 Ω)
- Operating temp. range : –25°C to +55°C
- Power supply voltage : 220–240 V AC (50/60 Hz)
  13.2 V DC (negative ground)
- Current drain (at 13.2 V) : TX high (25 W) 10.0 A
  Max. audio 2.0 A
  Stand-by 1.0 A
- Dimensions : 410(W)×110(H)×360(D) mm
  (Projections not included)
- Weight (approx.) : 12 kg

Transmitter

- RF output power : 25 W
- Modulation system : Variable reactance frequency modulation system
- Max. frequency deviation : ±5.0 kHz (Wide),
  ±4.0 kHz (Middle),
  ±2.5 kHz (Narrow)
- Spurious emissions : Less than 0.25 µW
- Adjacent channel power : More than 70 dB
  (Wide, Middle),
  More than 60 dB (Narrow)
- Intermodulation attenuation : More than 40 dB
- Audio harmonic distortion : 3.0% typical
  (at 1 kHz, 40% deviation)
- Microphone impedance : 600 Ω (8-pin modular)

Receiver

- Receive system : Double conversion superheterodyne system
- Sensitivity (20 dB SINAD) : 0 dBµV (EMF) typical
- Intermediate frequencies : 1st; 31.65 MHz, 2nd; 455 kHz
- Adjacent channel selectivity : More than 70 dB
  (Wide, Middle),
  More than 60 dB (Narrow)
- Spurious response : More than 70 dB
- Intermodulation : More than 70 dB
- Audio output power : 2.5 W typical at 10% distortion with a 4 Ω load
- External speaker connector : 2-conductor 3.5 (d) mm (⅛") 4 Ω

◇IC-FR4100

General

- Frequency coverage : 400.000–430.000 MHz
  (Depends on version) 450.000–480.000 MHz
- Channel spacing : 12.5/25.0 kHz (Narrow/Wide)
  12.5/20.0 kHz (Narrow/Middle)
- PLL channel step : 5.0, 6.25 kHz
- Frequency stability : ±1.0 kHz
- Number of channels : Max. 32 channel
- Antenna connector : Type-N×2 (50 Ω)
- Operating temp. range : –25°C to +55°C
- Power supply voltage : 220–240 V AC (50/60 Hz)
  13.2 V DC (negative ground)
- Current drain (at 13.2 V) : TX high (25 W) 12.0 A
  Max. audio 2.0 A
  Stand-by 1.0 A
- Dimensions : 410(W)×110(H)×360(D) mm
  (Projections not included)
- Weight (approx.) : 12 kg

All stated specifications are subject to change without notice or obligation.

Transmitter

- RF output power : 25 W
- Modulation system : Variable reactance frequency modulation system
- Max. frequency deviation : ±5.0 kHz (Wide), ±4.0 kHz (Middle), ±2.5 kHz (Narrow)
- Spurious emissions : Less than 0.25 µW (≤1 GHz) Less than 1 µW (>1 GHz)
- Adjacent channel power : More than 70 dB (Wide, Middle), More than 60 dB (Narrow)
- Intermodulation attenuation : More than 40 dB
- Audio harmonic distortion : 3.0% typical (at 1 kHz, 40% deviation)
- Microphone impedance : 600 Ω (8-pin modular)

Receiver

- Receive system : Double conversion superheterodyne system
- Sensitivity (20 dB SINAD) : 0 dBµV (EMF) typical
- Intermediate frequencies : 1st; 70.0 MHz, 2nd; 455 kHz
- Adjacent channel selectivity : More than 70 dB (Wide, Middle), More than 60 dB (Narrow)
- Spurious response : More than 70 dB
- Intermodulation : More than 70 dB
- Audio output power : 2.5 W typical at 10% distortion with a 4 Ω load
- External speaker connector : 2-conductor 3.5 (d) mm (⅛") 4 Ω

■ Options

• MB-77 WALL MOUNT BRACKET (p. 10)
For mounting the repeater to a wall.

• MB-78 19 INCH RACK MOUNT BRACKET (pgs. 9, 10)
For mounting the repeater into a 19 inch rack.

• HM-100N HAND MICROPHONE

• HM-100TN DTMF MICROPHONE
Hand microphone with a DTMF keypad.

• SM-25 DESKTOP MICROPHONE

• UT-109 (#01) VOICE SCRAMBLER UNIT (p. 11)
Non-rolling type (max. 32 codes).

• UT-110 (#01) VOICE SCRAMBLER UNIT (p. 11)
Rolling type (max. 1020 codes).

The scrambler systems of the UT-109 and UT-110 are not compatible with each other.

8 ABOUT CE

INSTALLATION NOTES

• Compliance of base station transmitter installations with EN50385

The installation of this equipment and it's associated antenna should be made in such a manner as to respect the EC recommended electromagnetic (EM) field exposure limits. (1999/519/EC)

In order not to exceed these exposure limits it is necessary to determine the 'Compliance Boundary,' that means the volume within which the EM field radiated by the transmitter/antenna installation may exceed the 1999/519/EC limits. You will then need to ensure that members of the general public do not have access within this area. The actual Compliance Boundary for this repeater will be totally dependant on the antenna, feeder, RF amplifier and other passive or active devices used in the installation.

The RF output power of this repeater is 25 watts.

The figures contained in this guide are based on the recommended limits for the general public and are obtained by 'worst case' numerical analysis. For a definitive evaluation of any given installation, measurements should be made with an EM field meter and a broadband calibrated probe.

• Installation

The antenna should be installed as high as possible for maximum efficiency and minimum EM field at ground-level. The evaluation of radiated field should take into account any additional RF amplifiers used, any loss in the antenna feeder cable and the gain of the antenna used as well as its polar radiation pattern.

If there are any objects or structures larger than half a wavelength close to the antenna, or within the clearance distances specified, then these can cause reflections which will have an effect on the overall radiation pattern.

For any installation you need to consider 'height clearance' (i.e. the height above any place where persons may have access) and 'front clearance' (i.e. the distance in front of the antenna where the radiated field may exceed the recommended limits). Normally with an antenna installed on a reasonably high mast or tower, there will not be any access point directly in front but care should be exercised when there are other buildings higher than the antenna within the vicinity.

• Installation with a vertical type antenna at VHF-UHF

You need to consider the distances between the antenna and any point where persons may have access. Allowing an average height of 1.8 m for a person in the vicinity of the antenna the clearance distances can be evaluated as follows. For the antenna a forward gain of 1.6 and downward gain of unity has been assumed.

Power	EIRP	Distance	Height clearance	Front clearance
1 watt	1.6 watts	0.32 m	2.1 m	0.4 m
10 watts	16 watts	1 m	2.8 m	1.3 m
25 watts	40 watts	1.6 m	3.4 m	2 m
100 watts	160 watts	3.2 m	5 m	4 m
1 kW	1600 watts	10 m	12 m	13 m

• Installation with a yagi or directive type antenna

Exposure distance assumes that the predominant radiation pattern is forwards and that radiation vertically downwards is at unity gain (sidelobe suppression is equal to main lobe gain). This is true of almost every gain antenna today. Exposed persons are assumed to be beneath the antenna array and have a typical height of 1.8 m.

The figures assume the worst case emission of constant carrier.

RF power	**Clearance heights by frequency band**			
Watts	10–2 m	70 cm	23 cm	13 cm and above
1	2.1 m	2 m	2 m	2 m
10	2.8 m	2.7 m	2.5 m	2.3 m
25	3.4 m	3.3 m	2.7 m	2.5 m
100	5 m	4.7 m	3.6 m	3.2 m
1000	12 m	11.5 m	7.3 m	6.3 m

EIRP	**Forward clearance, EIRP by frequency band**			
Watts	10–2 m	70 cm	23 cm	13 cm and above
100	2 m	2 m	1.1 m	0.7 m
1000	6.5 m	6 m	3.5 m	3 m
10,000	20 m	18 m	11 m	7 m
100,000	65 m	60 m	35 m	29 m

• Typical installation example

A UHF base station transmitter is to be installed on the roof of an office.

The transmit power is 25 watts, there is 20 m of RG-213 coaxial cable and the antenna is vertically polarised dipole.

The specification of the RG-213 cable gives a loss of 1.5 dB/10 m. There will be 3 dB loss for the 20 m length used.

The RF power at the antenna input will be 12.5 watts.

The dipole antenna has a forward gain of 0 dBd or 1.6, giving an EIRP of 20 watts.

Referring to the table above for VHF/UHF vertical antennas, this gives a front clearance distance of approx. 1.5 m and a height clearance of 3 m.

The antenna installation needs to ensure that the lowest part of the antenna is at least 3 m above any point where the general public may gain access and that they cannot pass within 1.5 m in front of the antenna.

If there is no general public access to the roof in question then the antenna could be mounted on a short stub mast. If there is such access to the roof then the antenna could be mounted on top of a short mast of 3.2 m high. The mast position should be such that the antenna can radiate clearly i.e. no other object or structure is within 1.5 m (preferably more).

It should be relatively easy to fulfil all these recommendations.

If for any reason such minimum distances are impossible to guarantee then some type of access control fence or barrier around the antenna installation should be provided.

Should a Yagi type antenna be used then you will have to obtain a 3 dimensional polar plot of the radiation characteristic from the manufacturer and evaluate the clearance distances in both vertical and horizontal planes.

• Operating Notes

All of the above comments on RF safety assume that the radio is transmitting continuously in a constant carrier mode such as FM or RTTY etc.

The RF exposure limits recommended by the EC are based on the mean power averaged over a 6 minute period.

Therefore if the total transmit time during any 6 minute period is reduced, then the installation will be even further within the recommended limits.

Similarly, not all operating modes are constant carrier. AM type modes all have a lower mean power level. Use of SSB or CW will reduce exposure by approximately 70% for this reason.

CE Versions of the IC-FR3100/FR4100 which display the “CE” symbol on the serial number seal, comply with the essential requirements of the European Radio and Telecommunication Terminal Directive 1999/5/EC.

This warning symbol indicates that this equipment operates in non-harmonised frequency bands and/or may be subject to licensing conditions in the country of use. Be sure to check that you have the correct version of this radio or the correct programming of this radio, to comply with national licensing requirement.

Network Compatibility Notice
Icom IC-FR3100/IC-FR4100 PSTN Interface

Scope

This Network Compatibility Notice contains national requirements for proper operation of telecommunications equipment within specific countries and is based on the ETSI document "A guide to the application of TBR21," EG201 121 V1.1.3 (02-2002). This notice applies to all IC-FR3100/IC-FR4100 that are marked CE0168.

This product has been tested in accordance with TBR21 for pan-European single terminal connection to the Public Switched Telephone Network (PSTN). However, due to differences between the individual PSTNs provided in different countries, TBR21 does not, of itself, give an unconditional assurance of successful operation on every PSTN network termination point.

In the event of problems you should contact your equipment supplier in the first instance.

Network Compatibility

In accordance with the requirements of EG201 121, no national network compatibility issues have been identified for the following countries:

Austria	Belgium	Denmark	Finland
France	Germany	Greece	Iceland
Ireland	Italy	Luxemburg	Netherlands
Portugal	Sweden	Switzerland	United Kingdom

Icom is providing the following information to demonstrate telecommunications conformity for the IC-FR3100/IC-FR4100 PSTN interface to the Common Technical Regulation 21 (CTR21) and EG201 121.

Using the IC-FR3100/IC-FR4100 PSTN interface connection in Germany

A filter (see annex) will be required for any analogue line that has subscriber metering pulses.

Note: *These subscriber metering pulses may or may not be present on analogue lines in Germany. The subscriber may request that metering pulses be placed on the line, or can have them removed, by calling the German network provider. Normally metering pulses are not provided unless specifically requested by the subscriber at the time of installation.*

Using the IC-FR3100/IC-FR4100 PSTN interface connection in Switzerland

A filter (see annex) will be required as all Swiss analogue lines are using subscriber metering pulses.

Annex

Suitable filters for use in conjunction with analogue lines carrying subscriber metering pulses are available from many sources.

Currently available types include:

Tax Impulse Filter (CGTIF) from Connect Globally
Metering Pulse Filter (FIL0811602) from TeleAdapt
Billing Tone Filter (14B5109, 5123 etc) from Lexmark

ICOM

DECLARATION OF CONFORMITY

We Icom Inc. Japan
1-1-32, Kaminami, Hirano-ku
Osaka 547-0003, Japan

CE0168!

Declare on our sole responsibility that this equipment complies with the essential requirements of the Radio and Telecommunications Terminal Equipment Directive, 1999/5/EC, and that any applicable Essential Test Suite measurements have been performed.

Kind of equipment: **VHF REPEATER**

Type-designation: **IC-FR3100**

150–174 MHz 12.5 kHz/ 25 kHz
150–174 MHz 12.5 kHz/ 20 kHz

Version (where applicable):

This compliance is based on conformity with the following harmonised standards, specifications or documents:

i) EN 301 489-1 v1.3.1 (September 2001)
ii) EN 301 489-5 (August 2000)
iii) EN 60950 (August 1992 +A11)
iv) EN 300 086-2 (March 2001)
v) EN 300 219-2 (March 2001)
vi) EN 300 113-2 (March 2001)
vii) TBR 21 (January 1998)
viii) EN50385 (2002)

Düsseldorf 23rd May 2003
Place and date of issue

Icom (Europe) GmbH
Himmelgeister straße 100
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Authorized representative name

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General Manager

Signature

Icom Inc.

ICOM

DECLARATION OF CONFORMITY

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Osaka 547-0003, Japan

CE0168!

Declare on our sole responsibility that this equipment complies with the essential requirements of the Radio and Telecommunications Terminal Equipment Directive, 1999/5/EC, and that any applicable Essential Test Suite measurements have been performed.

Kind of equipment: **UHF REPEATER**

Type-designation: **IC-FR4100**

450–480 MHz 12.5 kHz/ 25 kHz
450–480 MHz 12.5 kHz/ 20 kHz

Version (where applicable):

This compliance is based on conformity with the following harmonised standards, specifications or documents:

i) EN 301 489-1 v1.3.1 (September 2001)
ii) EN 301 489-5 (August 2000)
iii) EN 60950 (August 1992 +A11)
iv) EN 300 086-2 (March 2001)
v) EN 300 219-2 (March 2001)
vi) EN 300 113-2 (March 2001)
vii) TBR 21 (January 1998)
viii) EN50385 (2002)

Düsseldorf 27th June 2003
Place and date of issue

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Signature

Icom Inc.

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