MULTICARRIER "ReFlex 50" PAGING ON – FREQUENCY RADIO REPEATER Model # OFR-P300F

Operation, Installation and Service Manual

Preliminary

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1 Introduction

1.1 What Is an OFR?

An OFR, or On Frequency Repeater, is a radio repeater that simultaneously receives and transmits a single narrowband radio channel on exactly the same frequency. The OFR-P300F is specifically designed for use with a narrowband PCS channel at 940.225 used with ReFlex 50 paging signals. It provides up to 125 dB of linear RF gain and can support up to 4 carriers within its 50 kHz channel assignment. This repeater offers significant adjacent channel rejection approaching that of normal narrowband radio receivers, unlike competitive wideband booster amplifiers.

The OFR accomplishes its repeater function without store and forward circuitry, or expensive conventional simulcasting techniques. The fact that the same frequency is retransmitted by an OFR means that additional frequency allocations are not required in situations where an existing radio coverage pattern needs to be extended. The most common OFR applications are the extension of above-ground signals into buildings, tunnels, vehicles or the extension of radio coverage patterns into outdoor shaded areas such as deep valleys.

From an applications standpoint, an OFR is very similar to a regular two-way radio repeater. OFRs can be combined using regular two-way radio multicoupling or duplexing equipment and have input and output signal characteristics to those of regular transmitters and receivers. The one special consideration in OFR systems is that of input to output antenna isolation. This must be carefully engineered for each installation.

Standard OFRs are designed for indoor use only and are intended for mounting in a standard EIA 19 inch rack. Modular design of OFR circuitry allows for easy servicing, stocking of spares, adaptability and upgradeability.

1.2 Manual Information

This manual is applicable to OFR model OFR-P300F which operates on 900 MHz band frequencies under FCC Part 24 rules for narrowband PCS systems. It has been written to instruct the user in installation, operation and service of this model of OFR. Maintenance and servicing is assumed to be conducted by technically trained personnel already familiar with two-way radio equipment using instruments commonly found in two way radio repair shops.

The internal circuitry and construction methods used in the manufacture of OFRs should be completely familiar to the average radio technician, so no special service or maintenance problems should be encountered.

Successful operation of an OFR in any installation depends upon sound system design. Service personnel should be aware that most problems experienced with OFR systems are due to failures or inadequacies in equipment outside the OFR. The scope of this manual is generally limited to the OFR circuitry itself, no attempt is made to thoroughly discuss all aspects of system or applications design. Kaval Telecom would be pleased to discuss the engineering aspects of OFR installations and can undertake overall OFR system design and installation.

Please contact Kaval Telecom at the address below to obtain further information, order parts, arrange for factory service.

Kaval Telecom Inc.

Product Service

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Markham, Ontario, Canada

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Tel: (905) 940-1400

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NOTE: This preliminary version of the manual does not include all line drawings that will be included in the final edition. However, all operational instructions and descriptions are accurate and complete. The purpose of this preliminary version is to provide information required for FCC certification.

1.3 Warranty

This section not included in preliminary version

1.4 Proprietary Notice

2 Specifications

The following table consolidates the product specifications for reference only.

SPECIFICATION	OFR-P300F
Operating Frequency*	940.225 MHz
Channel Spacing*	50 kHz
Bandwidth (1dB)	36 kHz
Primary Power Indicator	Green LED
Received Signal Indicator	Green LED
Transmit Indicator	Yellow LED
Loss of AC Power Alarm	Open Fault Relay Contact
Output RF Power Failure Alarm (due to 3 dB drop in RF output power or excessive reverse RF power)	Red Fault LED and Open Fault Relay
RF Frequency Stability	Tracks Input Signal ±10 Hz
Adjacent Channel Selectivity*	IF rejection +/- 50 kHz from band center = 30 dBc IF rejection at +/- 100 kHz from band center = 50 dBc
Composite RF Output Power* (Total of all carriers)	30 dBm +/- 1dB
Total Transit Delay*	< 80 µs
Transmitter Attack Time (1dB) *	< 3 ms
Transmitter Release Time*	10 ms-3 sec +/- 0.25 sec max (adjustable)
Output Power Adjustment Range	+20 to +30 dBm
Variation of maximum Output Power over Input Level Range	+/- 1 dB
Minimum Input Signal*	-70 dBm
Input Dynamic Range*	≤ -70 dBm to ≥ –40 dBm
Input Trigger Level Hysteresis	0-20 dB (Programmable)
RF Gain (Not Adjustable directly) *	Maximum 100 dB (-70 in and +30 out) (Must relate to total power of all carriers)
Duty Cycle	Continuous
Conducted RF Spurious Output*	< -20 dBm
Input / Output Impedance*	50 Ohms
Primary Power*	80-264 VAC 47-63 Hz

3 Installation

3.1 Mechanical Installation

Install OFR into EIA 19" rack using 4 screws provided. Ensure that no cables or other equipment rest on top of OFR and place excessive downward force at rear of unit.

Ensure that airflow around the rear panel heatsink is unobstructed. In high duty cycle installations, it is recommended that one rack unit of clear space be left both above and below the OFR. If several units are installed in the same rack, an external fan blowing air past the heatsinks is recommended.

The OFR is intended for indoor use only, in an environment suitable for electronic equipment. Do not expose to excess humidity

3.2 Interconnection

NOTE: Labeled Photo or Diagram of rear panel to be added

3.2.1 RF Output Connector

Connect to the transmit antenna system. This output has a nominal impedance of 50 Ohms. Although the OFR has reverse power protection, do not operate the OFR without an antenna or dummy load connected. Do not touch the exposed center pin of the output RF connector while an OFR is in operation. RF burns may result.

Double shielded or solid wall cables are recommended for all RF connections to the OFR. Systems operating with gains greater than 70 dB should be connected using Andrews foam Heliax or similar solid wall cables. Avoid allowing the input and output RF cables to touch or come closer than 12 inches of each other.

Always use cables properly terminated by a male type N connector. Do not use adapters at the OFR terminals to convert to other connector types.

Ensure that cables to not impart excessive stress to the OFR interface connectors.

3.2.2 RF Input Connector

This terminal, with a nominal impedance of 50 Ohms is connected to the receive antenna system. The same recommendations regarding cable types and routing as in the above section apply.

3.2.3 Power Connection

Connect to 90 to 264 VAC, 47 to 63 Hz.

3.2.4 Fuse

Always replace with same type and rating as listed on rear panel.

3.2.5 Test Interface Terminal

This interface connector allows access to certain diagnostic signals. In field installations, only the fault and ground terminals are normally used. A relay closure with 1A current rating occurs between the FLT and GND terminals when a fault condition is sensed. The GND terminal is internally connected to the OFR chassis ground.

3.3 Setup

Kaval recommends that you read sections 4 and 5 of this manual before installing a unit. The following step by step procedure is for a basic OFR installation with most commonly used user settings. It is assumed that the OFR is receiving a signal from a fixed base station. Your requirements may vary. Contact Kaval Telecom Customer Service for any additional assistance that may be necessary in unusual installations.

This procedure assumes that the OFR to be installed is in factory-new condition and that operating parameters are in the default state. If the OFR has been previously in service, it may be necessary to set user functions to suitable startup states. Recommended startup states are listed below:

Table 1 OFR Initial Installation Settings

RX Threshold:	-20 dBm
TX Power:	+30 dBm
Hang Time	0
TX Defeat	YES
AutoAGC	NO
AGC Margin	15 dB
AGC Limit	OFF (Minimum)
AGC Hysteresis	6 dB (use 15 dB for mobile pickup)
Test Oscillator ON	NO

One can safely verify these settings are in effect before installation by terminating the OFR RF ports with 50 Ohm loads and using the front panel controls to make the settings conform to those above.

Before installation, it is recommended that the performance of the antenna systems be verified and that the desired signal to be repeated is available at the RF input cable at a level within the dynamic range of the OFR.

1. Install OFR in equipment rack.

2. Connect the OFR RF input and output signal cables to their respective antenna systems.

3. Observe and record the front panel signal strength reading. It is advisable to compare this signal reading with expected levels predicted in the OFR system design.

4. Press the menu button to call up the receive threshold setting function.

5. Adjust the receive threshold to a level 6 dB below the previously recorded receive signal level

6. Press the menu button again to call up the transmit power adjustment function. Select the desired power level if required.

7. Press the menu button to call up the hang time setting function. Set the hang time, if necessary, to the time delay specified in the system design. The range of entries is zero to thirty, each step corresponding to a 100 ms increment up to 3 seconds.

8. Press the menu several times to call up the AGC limit setting function. Set the AGC limit to a signal level 15 dB below the previously recorded received signal level.

9. Press the menu button several time to call up the TX Defeat function. Use scroll buttons to select the NO option. The OFR will now energize.

10. Press the menu button until the signal strength reading is again seen. Verify that this level has not increased significantly as a result of the OFR keying on. A large upward jump in signal strength may indicate system self-oscillation. In such case, defeat transmitter and investigate antenna system and cables for unexpected isolation problems.

11. Verify that the Power, RX and TX LEDs are illuminated and that the Fault LED is not on.

12. You OFR is now in service.