

APPENDIX 5
INSTRUCTION MANUAL

TWENTY (26) PAGE INSTRUCTION MANUAL
FOLLOWS THIS SHEET

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INSTRUCTION MANUAL
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APPENDIX 5

Instruction Manual

Multi-Carrier Power Amplifier System

JHU-1961

PCS1900

REV.2 1998.11

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Section 1

General Introduction

1.1 Introduction

This manual covers information and procedures for installation, operation, and maintenance of the JHU-1961 series **Multi-Carrier Power Amplifier (MCPA)** system.

1.2 Description

The JHU-1961 MCPA system consists of one to four MCPA modules, a supervisory control card (SC Card) and the sub-rack. The MCPA module is an ultra linear power amplifier constructed with the SAFF (Self Adjusting Feed-Forward) intermodulation distortion compensation circuitry. Each amplifier operates in any 20 MHz frequency band from 1930 MHz to 1990 MHz, and can produce 40 watts of power output with better than -63 dBc inter-modulation distortion (IMD). Such ultra-linearity makes the MCPA system able to operate under multi-carrier environment of digital modulation signals. This superior characteristic is appropriate for all access methods such as GSM, TDMA and CDMA. The MCPA system can provide 32 watts, 64 watts, 96 watts and 128 watts of RF power output at the output terminal of the rack according to the number of the MCPA modules. The higher power is obtained by combining plural MCPA modules. Primary power supply for the MCPA system is +21Vdc to +30Vdc, and converted to the appropriate DC voltage in each module. The distributed primary power can be turned on/off with a circuit breaker installed on the front panel of each module.

1.3 Model Information

(1) PCS MCPA Rack

AirNet Definition	JRC Part Number	Output Power /Sector
1x1 Rack Switchable Splitter/Combiner	JHU-1961A1	32/64/96/128
1x1 Rack 2 way Conventional Splitter/Combiner with Through Line	JHU-1961A12	32/64
1x1 Rack 3 way Conventional Splitter/Combiner with Through Line	JHU-1961A13	32/96
1x1 Rack 4 way Conventional Splitter/Combiner with Through Line	JHU-1961A14	32/128
2x2 Rack Switchable Splitter/Combiner	JHU-1961A2	32/64
4x4 Rack	JHU-1961A4	32

(2) PCS MCPA Module

Definition	JRC Part Number
PCS 40W Multi-Carrier-Amplifier for A, D Block	NAH-1961AD
PCS 40W Multi-Carrier-Amplifier for B, E Block	NAH-1961BE
PCS 40W Multi-Carrier-Amplifier for C, F Block	NAH-1961CF
PCS 40W Multi-Carrier-Amplifier for E Block	NAH-1961E

Note: NAH-1961 series of the PCS 40w MCPA modules covers 20MHz of operating bandwidth. Make sure the operating frequency or Block with Name Plate before the modules are used. The sticker, which indicates the operating block, is attached beside the D-Sub connector on the back of the module. The front panel does not show the operating frequency block.

(3) PCS MCPA Supervision and Control

Definition	JRC Part Number
Supervisory and Control card for JHU-1961 series of PCS MCPA System	NCE-7028

There is only one PCS MCPA Supervision and Control Card (SC Card) is installed in a rack. The SC cards are interchangeable. The card must be always installed in the rack or must not be pulled out during the operation, otherwise, the appropriate operation will not be guaranteed.

(4) PCS MCPA Systematic diagrams

The systematic diagrams of JHU-1961 series PCS MCPA systems are shown below.

Figure 1-1:JHU-1961A1

Figure 1-2:JHU-1961A2

Figure 1-3:JHU-1961A4

Figure 1-4:JHU-1961A12

Figure 1-5:JHU-1961A13

Figure 1-6:JHU-1961A14

1.4 Specification

The specifications for the MCPA system JHU-1961 are shown in Table 1-1.

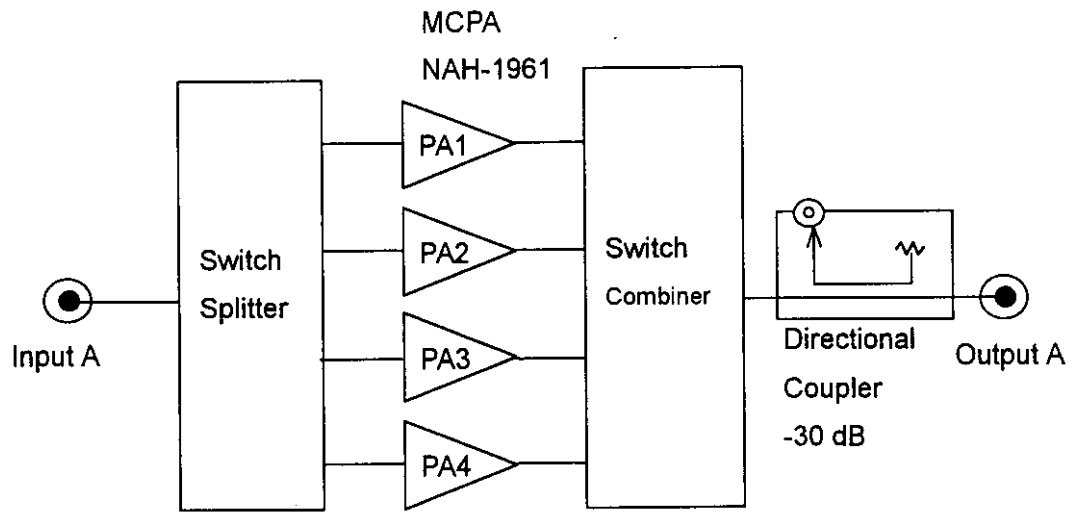


Fig 1-1 JHU-1961A1 1×1 Rack Switchable Splitter/Combiner

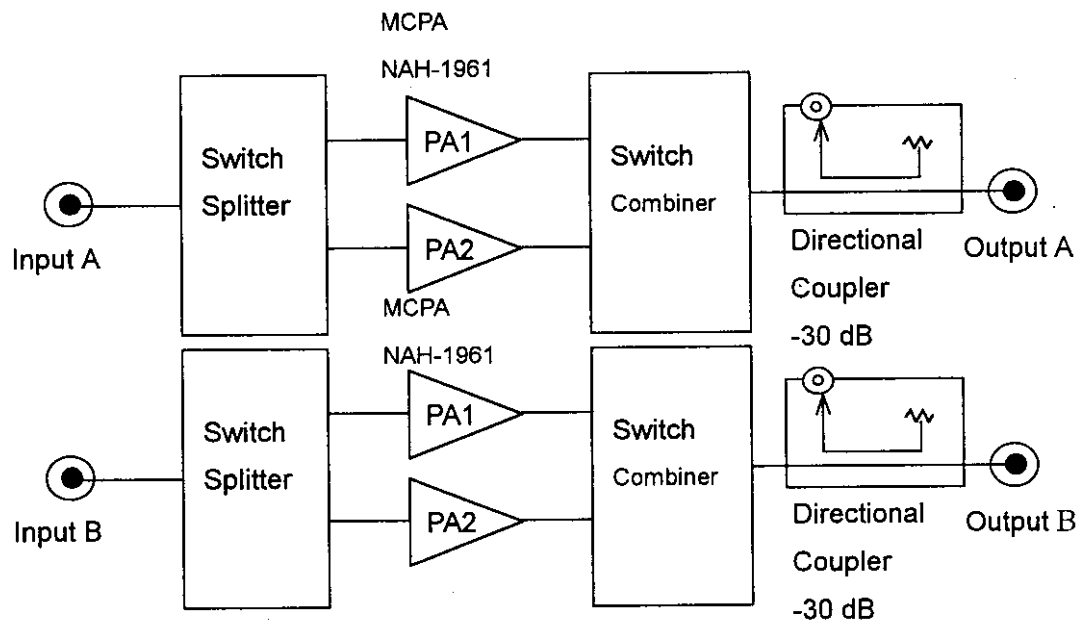


Fig 1-2 JHU-1961A2 2×2 Rack Switchable Splitter/Combiner

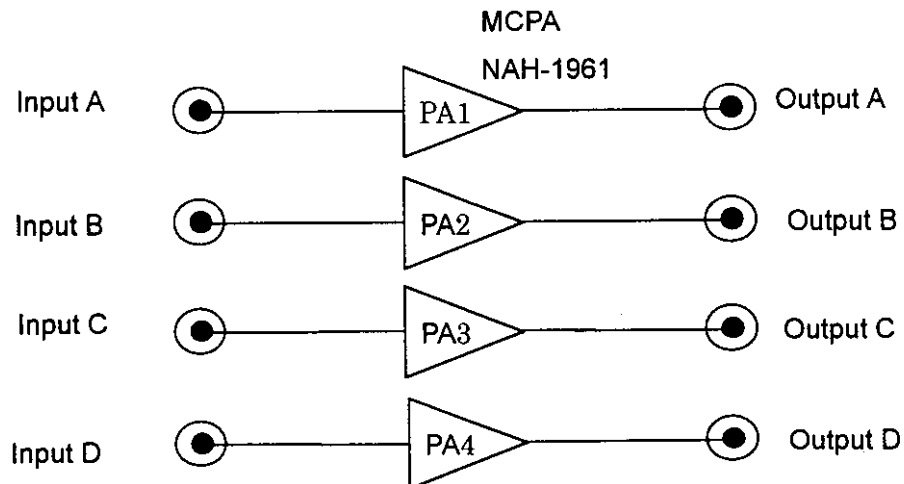


Fig 1-3 JHU-1961A4 4×4 Rack

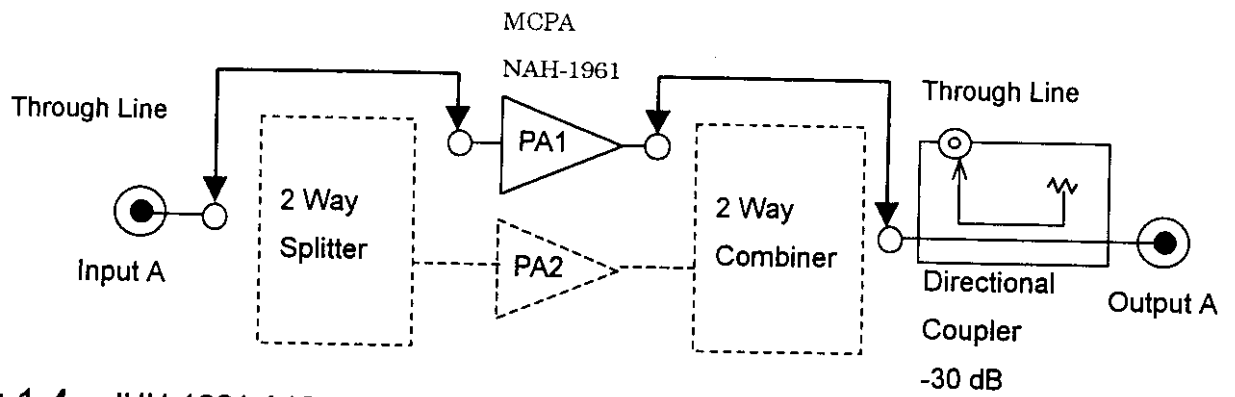


Fig 1-4 JHU-1961 A12 1×1 Rack
2 way Conventional Splitter/Combiner with Through Line

Note: When PA2 is not installed, 2 way splitter & combiner are bypassed with the through line.

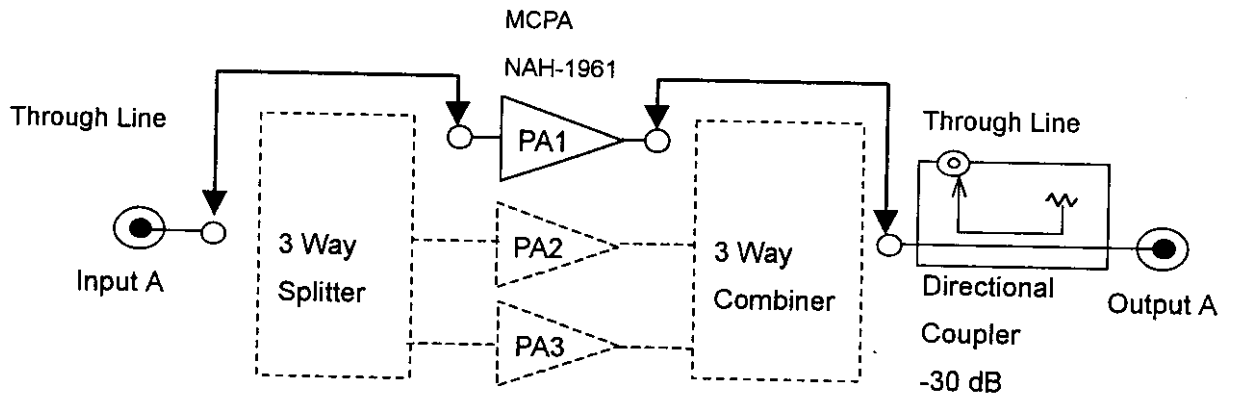


Fig 1-5 JHU-1961 A13 1×1 Rack
3way Conventional Splitter/Combiner with Through Line

Note: When PA2 and PA3 are not installed, 3 way splitter & combiner are bypassed with the through line.

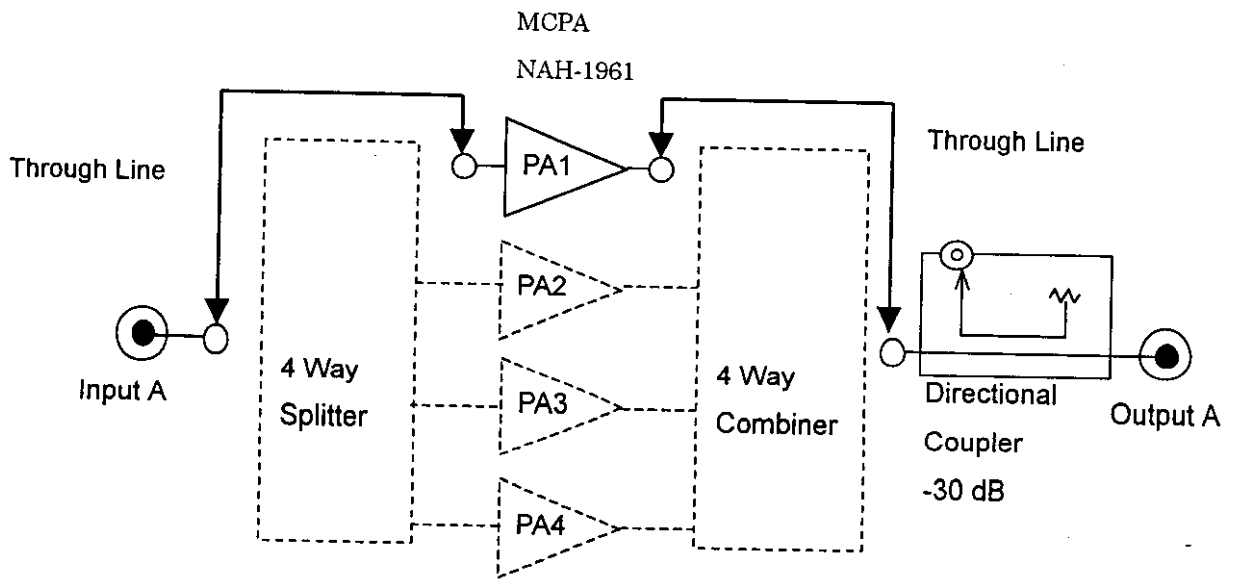


Fig 1-6 JHU-1961 A14 1×1 Rack
4way Conventional Splitter/Combiner with Through Line

Note: When PA2, PA3 and PA4 are not installed, 4 way splitter & combiner are bypassed with the through line.

Table 1-1 Specifications for the MCPA system JHU-1961

Transmitting Frequency Range within PCS band	1930MHz-1950MHz(NAH-1961AD used) 1950MHz-1970MHz(NAH-1961BE used) 1970MHz-1990MHz(NAH-1961CF used) 1965MHz-1970MHz(NAH-1961E used)
RF Gain	48.5dB +/-1.0dB (1x1 rack) 48.5dB +/-1.0dB (2x2 rack) 48.5dB +/-0.5dB (4x4 rack)
Total Output Power	128Watts(4 modules combined) 96Watts(3 modules combined) 64Watts(2 modules combined) 32Watts(1 module)
Passband Gain Flatness	Better than ± 0.5 dB across any 200kHz bandwidth within the TX band
Passband Phase Linearity	Better than ± 1 degree across any 200kHz bandwidth within the TX band
Gain Variation over Temperature	Better than ± 1.0 dB
Intermodulation Distortion	Better than -63dBc
Spurious	2 nd harmonics Less than +10dBm 3 rd and greater harmonics Less than -20dBm SFDR: Less than -36dBm
Input / Output Port Return Loss	Better than -15dB
Output Protection	Mismatch Protected
Monitor Coupling Level	-30dB \pm 1dB
DC Power Source	+21VDC to +30VDC
RF/DC Efficiency	Better than 4%
System Alarm	RS422 Serial Interface
Operating Temperature Range	0°C to +40°C (short term 0°C to +50°C)
Storage Temperature Range	-40°C to +65°C
Operating Humidity Range	10% to 80%
DC Power Input Connector	Terminal Block
Serial Interface Connector	Female 9-pin D-sub connector
RF Input Connector	SMA-type female
RF Output Connector	N-type female
Monitor Port Connector	SMA-type female
Dimensions	19"W 17.47"H 21.46"D

Section 2 Installation

CAUTION

1. "THIS EQUIPMENT IS DESIGNED FOR +21 to +30 Vdc POWER SUPPLY. THIS EQUIPMENT MUST BE CONNECTED ONLY POWER SUPPLY THAT COMPLY WITH THE REQUIREMENTS OF UL478, UL1012,UL1310, UL1270, UL1409, UL1410, UL813, UL1459, UL1419 OR UL1950. THIS POWER SUPPLY CABLE SHOULD BE PREPARED BY SYSTEM OPERATOR. THIS EQUIPMENT SHOULD BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE, ANSI/NFPA 70."
2. FOR INSTALLATION OF THE SUB-RACK, PREPARE A CABINET THAT IS COMPLETELY ENCLOSED WITH DURABLE WALL AND CAN WITHSTAND MORE THAN 80KG OF ITS WEIGHT.
3. TO AVOID TIPOVER OF CABINET, BE CAREFUL THE SUB-RACK ATTACHING POSITION IN THE CABINET.
4. TO AVOID HEATING TO THE SUB-RACK, DO NOT ATTACH ANY EQUIPMENT THAT MAY DISSIPATE PLENTY OF HEAT UNDER THE SUB-RACK.

2.1 Introduction

This section contains unpacking, inspection, installation instruction, power source, and Alarm interface for the JHU-1961 MCPA system. Prior to starting the equipment unpacking or installation, carefully read all sub-section item by item.

2.2 Unpacking and Inspection

As described in the previous section, the MCPA system consists of MCPA Module(s), an SC Card and a sub-rack. The SC Card is already installed in the sub rack, and packed in a wooden container along with MCPA module attaching screws packed in a plastic bag. While the MCPA module is packed in individual carton container, which is especially designed for anti-damage and easy packing. To remove the MCPA module from the carton container, carefully open the lid of the carton and carefully remove the shock absorber. If possible, retain its carton that can be reassembled in case the module must be returned to the

manufacturer.

After unpacking, visually check if the MCPA module is not damaged while transportation, especially the D-sub connector and its guide pins attached on the rear of the MCPA module are delicate. And confirm that the several sets of screw, washer and spring washer are in the plastic bag, which is attached on the top of sub rack.

2.3 Installation Instruction

WARNING

1. Do not remove any covers attached to the MCPA module.
If removed, its performance would not be guaranteed.
2. Carefully install the MCPA module into the slot of MCPA sub-rack.
D-sub connector attached on the back of the MCPA module, which connects with the rack, contains two push-on type RF connectors. These ones are delicate.

As shown in the Figure 2-1, the MCPA sub-rack has four slots for the MCPA modules. The first slot from the left corresponds to the MCPA module PA1, and the second one corresponds to the MCPA module PA2, and the third one to PA3, the fourth one to PA4. If four MCPAs are not installed, the empty slots are covered with blank panels.

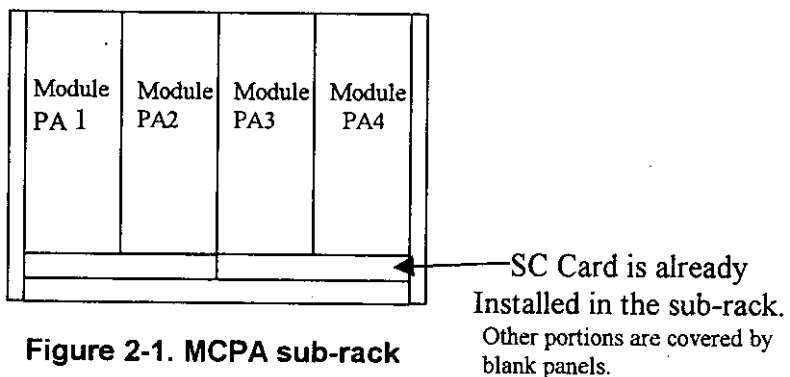


Figure 2-1. MCPA sub-rack

To install the MCPA system, proceed as follows;

- 2-3-1. Install sub-rack in the Lower Cabinet, and secure in place with eight screws.
- 2-3-2. Refer to Figure 2-2, 2-3 and 2-4 for the location of all input/output connectors.
- 2-3-3. Refer to Figure 2-6, 2-7, 2-8, 2-9, 2-10 and 2-11 schematic diagram for

the pin assignment.

2-3-4. Connect the antenna cable to the OUTPUT connector on the rear of the sub-rack.

2-3-5. Connect transceiver or exciter output to the INPUT connector on the rear of the sub-rack.

2-3-6. Connect proper DC voltage line(+ 21 Vdc to +30Vdc) and Ground to appropriate terminals on the sub-rack.

2-3-7. Carefully unpack each MCPA module from the carton.

2-3-8. Confirm that D-sub connector mounted on the rear of MCPA module is not accumulated with any dust.

2-3-9. Carefully install the MCPA module in the sub-rack, and secure in place with four screws. (* To install the MCPA module in the sub-rack quickly, firstly fit the lower edge to its corresponding slide attached in the sub-rack. And then, fit the upper edge.)

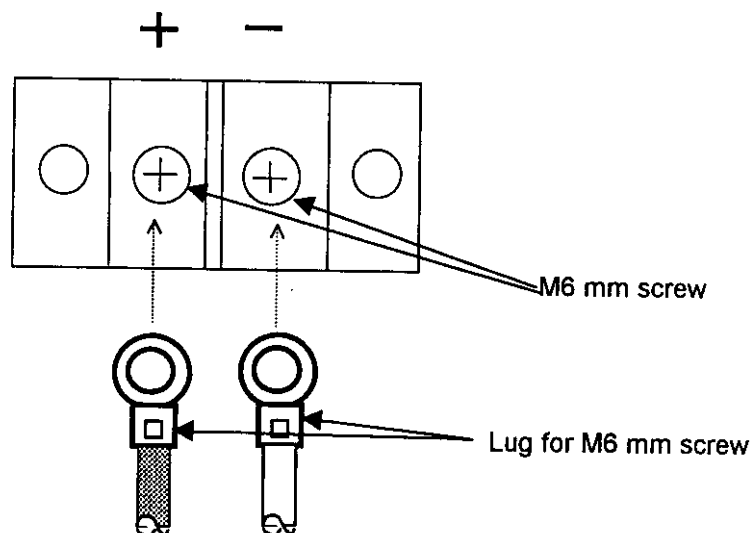
2-3-10. Before applying DC voltage to the sub-rack, check the connections around the D-sub connector if they are tight and correct.

2-3-11. Confirm that DC voltage is within +21 Vdc to +30 Vdc.

2.4 DC Power Cable Wiring

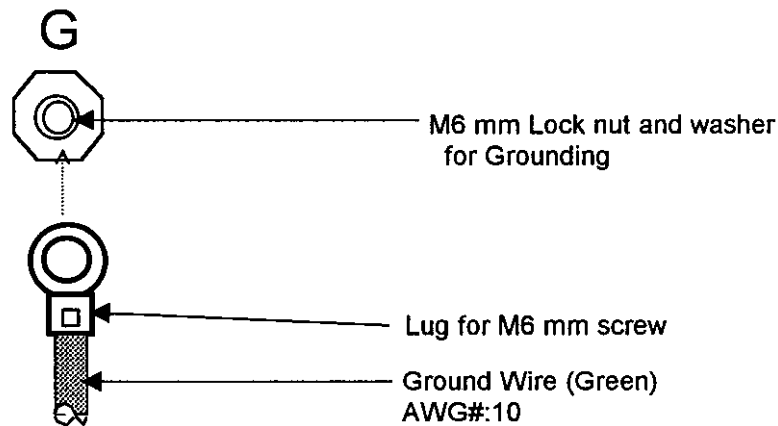
To generate nominal RF output power, this MCPA system consumes approximately 123 amperes maximum at +26Vdc when the nominal output power is generated. Therefore, to wire DC power cable with the MCPA system, use appropriate thick AWG # wire within safe current.

Since the DC power terminal provided on the rear of the MCPA system sub-rack is made from M6 mm screw, use a lug for M6 mm diameter screw or equivalent to attach the DC power cable to it. (see below)



2.5 Ground Wire Installation

Confirm a ground-wire attaching nut and a lock washer are mounted on the ground stud, which are located on the rear panel of the MCPA system sub-rack. Since this ground stud is made from M6 mm thread, provide a lug for M6 mm diameter screw or equivalent to attach the ground-wire to it securely. See below.



2.6 RF Coaxial Cable Installation

Refer to Figure 3-1 for the RF connectors location.

2.6.1 Input RF Cable Connection

Use appropriate RF cables for high frequency impedance matching .

Warning

Do not excessively screw the male SMA connector. Use the appropriate torque wrench. Excessive screwing results in breakage of the connector.

Recommended torque: 8kgf·cm

For RF input of the MCPA system, a female SMA connector is provided on the rear of the sub-rack. Prior to the connection of the input signal cable, check if the female SMA connector is not damaged. Then screw the male SMA with input cable firmly into the female SMA connector of the MCPA system using the appropriate torque wrench.

2.6.2 Output RF Cable Connection

For the RF output of the MCPA system, a female Type-N connector is provided on the rear of the sub-rack. Prior to the connection of the output signal cable, check if the female Type-N connector is not damaged. Then screw the male Type-N connector with antenna cable firmly into the female Type-N RF output connector of the MCPA system.

2.7 Alarms, Status, and Controls description

The status and alarm signals are provided via RS-422 serial interface and/or LED indicators. All amplifier modules in the sub-rack are monitored and controlled through a single RS-422 serial interface. JHU-1961 has up to four 9-pin D-sub miniature female type connector. These are used to monitor the individual MCPA module's operating condition and to activate the remote reset. The control circuitry has a watch-dog timer as an fail-safe mechanism to insure that failures of this circuitry are automatically cleared. The alarms, status, and control information are listed below.

2.7.1 Alarms and Status description

ALARM (LED) DESCRIPTION

ACT	ACT LED (Green) indicates when the RF output control is enabled and that the proper DC power level is applied. This status is sent through RS-422 as enable/disable of RF output.
FF	FF LED (Red) indicates when the MCPA module's feed-Forward correction system is failed. This alarm is sent through RS-422 too.
HPA	HPA LED (Red) indicates when the MCPA module's main amplifier is failed. This alarm is sent through RS-422 too.
OVER	OVER LED (Red) indicates that the transmit power of the MCPA module is in excess of the rated power. And the MCPA results in shutdown condition simultaneously with the alarm occurrence. This alarm is sent through RS-422 too. The resumption of the operation is performed by manual RESET button or remote RESET activation.
TEMP	TEMP LED (Red) indicates when the heat sink temperature of the MCPA module exceeds 80°C. Just then the MCPA results in shutdown condition simultaneously with the alarm occurrence. This alarm is sent through RS-422 too. The resumption of the operation is performed by manual RESET button or remote RESET activation.

- FAN FAN LED (Red) indicates when an air flow failure in the MCPA module is occurred. This alarm is also sent through RS-422.
- VSWR VSWR Alarm and Shutdown
 The VSWR LED (Red) turns on if the VSWR at the amplifiers output terminals exceeds approximately 5.5:1. The amplifier module results in shutdown condition simultaneously with the alarm occurrence. This alarm is also sent through RS-422. The resumption of the operation is performed by manual reset button or remote reset activation.
 Even if the VSWR comes back to the normal value, amplifiers maintain the shut-down state as long as two reset actions by software command and power-on will not be executed. When the reset action is required, antenna and RF cable's condition should be checked again by all means.

2.7.2 Controls description

CONTROL DESCRIPTION

- RESET RESET button is provided for the case, when the control operation and the alarm circuits are desired to be reset. A remote RESET is also implemented via RS-422 . And a remote reset terminal is provided in the 9-pin D-sub connector for RS-422 on the rack. See schematic diagram.
- RF Output Control This function enables or disables RF output of the MCPA module. Each MCPA module has its own control switch. This control is implemented via RS-422 and with the locking toggle switch on the rear of the sub-rack.
- O.V.P. Each MCPA module has over-voltage protection (O.V.P.) with shutdown before damage to the MCPA occurs. This condition is neither indicated nor sent through RS-422. However, the MCPA system automatically resume normal operation upon removal of the over-voltage condition without any control.

2.7.3 Serial Interface description

RS-422 DESCRIPTION

An RS-422 serial interface is implemented in this MCPA system. When this MCPA system is initially turned on or it encounters an interruption in power, the RS-422 RF output control comes up in the "output disabled" state. The serial communication network utilizes a single differential signal pair conforming to the RS-422 standard. The serial interface provides separate signal path for receiving and transmitting data. The connectors for the serial interface are standard DE-9 subminiature 9 pin female connectors with screw locks (#4-40). Signal pin assignments for serial interface in the MCPA system are shown in Table 2-1.

Table 2-1 Serial Interface Pin Assignments

Pin	Signal	Description
1	TX+	RS-422 Positive Output
2	TX-	RS-422 Negative Output
3	RX+	RS-422 Positive Input
4	RX-	RS-422 Negative Input
5	NC	No Connection
6	NC	No Connection
7	NC	No Connection
8	Reset	Serial Interface Reset (Low Active)
9	GND	Cable Shield

2.8 Outline Drawings

- (1) Fig. 2-2: NQZ-8625A1/ Outline Drawing for 1x1 Rack
- (2) Fig. 2-3: NQZ-8625A2/ Outline Drawing for 2x2 Rack
- (3) Fig. 2-4: NQZ-8625A4/ Outline Drawing for 4x4 Rack
- (4) Fig. 2-5: NAH-1961/ 40W PCS MCPA Module

2.9 Schematic Diagrams

- (1) Fig. 2-6: A1/1x1 Rack Switchable Splitter/Combiner
- (2) Fig. 2-7: A12/1x1 Rack 2 way Conventional Splitter/Combiner with Through Line
- (3) Fig. 2-8: A13/1x1 Rack 3 way Conventional Splitter/Combiner with Through Line
- (4) Fig. 2-9: A14/1x1 Rack 4 way Conventional Splitter/Combiner with Through Line
- (5) Fig. 2-10: A2/2x2 Rack Switchable Splitter/Combiner
- (6) Fig. 2-11: A4/4x4 Rack

Section 3

Operating Instructions

3.1 Introduction

This section contains operating instructions for the MCPA system JHU-1961.

3.2 Location of the system interface connectors and other connectors.

The MCPA system is designed for 19 inch rack mount. Almost all connectors of the MCPA system are mounted on the rear of the system rack, and are shown in Item 2.8 and are described in detail in Item 2.9.

3.3 Operation Procedures

WARNING

Before applying power, make sure that the input and output of the amplifier are properly terminated at 50 ohms. Do not operate the amplifier without a load attached. Excessive input power may damage the amplifier. " Warm-Up Period " is required before RF input signal is applied to the JHU-1961 Series of MCPA system.

1. Double check to ensure that all input and output cables are properly connected.
2. Confirm that all front panel switches are in the OFF position, and RF input is not applied.
3. Turn on power supply that provides proper DC voltage (+21Vdc to +30Vdc).
4. Confirm that the "Power" LED in the SC Card is lit.
5. Turn on each MCPA module power switch. And confirm that the "ACT" indicator is turned on.
6. "Warm-Up Period" is required before RF input signal is applied to the JHU-1961 Series of MCPA system. If the RF input signal is applied right after the power switch is turned on, the system could be damaged.
7. Slowly increase the RF input from lower level to appropriate input level that provides rated power output.
8. Do not exceed nominal output power at the OUTPUT terminal on the rack.

3.4 Power Splitter/Combiner

The JHU-1961 series of PCS MCPA system has six types of rack configuration as described in Item 1.3.

JHU-1961 A1 and A2 include Switchable Splitter and Combiner.

JHU-1961 A4 does not include Splitter and Combiner.

JHU-1961 A12, A13 and A14 have particular number of the MCPAs and all splitters and combines are designed so that each loss is optimized.

And through lines are installed in the three types of the rack to bypass the Splitter and combiner to use one unit of the MCPA.

The three types of the rack are assembled to use splitter and combiner when the racks are shipped. If only one module is installed in these three types of the rack, the splitter and combiner must be bypassed. The procedure is described below:

How to Bypass the Splitter and Combiner

The Racks are going to be shipped with particular configurations, such as two, three and four compositions. When the splitter and combiner are bypassed, the related co-axial cables are disconnected and reconnected as explained below. All drawings are the bottom views.

(1) Two Composition Type

The Rack is shipped in the composition of two amplifiers as shown in Fig. 3-1 and Fig. 3-2.

- a. Disconnect one end of the two cables marked 1 and 2.
- b. Connect the cable marked 1 to the connector marked 3.
- c. Connect the cable marked 2 to the connector marked 4.
- d. Disconnect one end of the two cables marked 5 and 6.
- e. Disconnect the N-type connector marked 7.
- f. Slide the combiner marked 8 and connect the connector marked 10 to the male connector which was connected to the combiner 8.
- g. Connect the marked 5 cable to the connector marked 9.
- h. The open end of the cable marked 6 can remain opened as it is.

(2) Three Composition Type

The Rack is shipped in the composition of three amplifiers as shown in Fig. 3-3 and Fig. 3-4.

- a. Disconnect one end of the two cables marked 1 and 2.
- b. Connect the cable marked 1 to the connector marked 3.
- c. Connect the cable marked 2 to the connector marked 4.
- d. Disconnect one end of the three cables marked 5, 6 and 7.
(The cable marked 6 is invisible in the drawing.)

- e. Disconnect the N-type connector marked 8.
- f. Slide the combiner marked 11 and connect the connector marked 9 to the male connector which was connected to the combiner 11.
- g. Connect the cable marked 7 to the connector marked 10.
- h. The open end of the cables marked 5 and 6 can remain opened as they are.

(3) Four Composition Type

The Rack is shipped in the composition of four amplifiers as shown in Fig. 3-5 and Fig. 3-6.

- a. Disconnect one end of the two cables marked 1 and 2.
- b. Connect the cable marked 1 to the connector marked 3.
- c. Connect the cable marked 2 to the connector marked 4.
- d. Disconnect one end of the four cables marked 5, 6, 7 and 8.
(The cable marked 6 and 8 are invisible in the drawing.)
- e. Disconnect the N-type connector marked 9.
- f. Slide the combiner marked 12 and connect the connector marked 10 to the male connector which was connected to the combiner 12.
- g. Connect the cable marked 7 to the connector marked 11.
- h. The open end of the cable marked 5, 6, and 7 can remain opened as they are.

3.5 VSWR of the Conventional Power Combiner

The conventional combiners are installed in the JHU-1961 series of the amplifier such as JHU-1961A12, JHU-1961A13 and JHU-1961A14.

When all MCPAs are normally operating in these racks, of-course, there is no problem. But, more than one modules are installed in the rack and the module(s) are not powered, or, if the module(s) are left in the rack while the alarm signal, which executes "shut-down" while the system is in operation, has been kept sent, the other module(s), which is (are) in the normal operation, will send "VSWR Alarm".

The reason is because,

If a module, the so-called "disable module" which is not in operation, is installed in the rack, the line impedance which is looked by the module, the so-called "enable module" which is in operation, looks like causing VSWR degradation because of a miss-matching in the combiner.

To avoid the above mentioned phenomena, the following things are required:

1. When only one module is operated in this type of the rack, the splitter and the combiner should be bypassed.
2. When more than one modules are combined and operated in this type of the rack, if the alarms (TEMP, OVER, VSWR), which cause "shut-down" come up in more than one modules, the particular module must be pulled out.
3. Do not put the module, which power switch is not turn on, into the rack.

Section 4

Principles of Operation

4.1 Introduction

This section provides functional descriptions of the JHU-1961 MCPA system.

4.2 JHU-1961 MCPA System

The MCPA system consists of a 19 inch sub-rack and one to four NAH-1961 plug-in MCPA modules. As shown in Figure 4-1, in the 1x1 sub-rack, four slots for the MCPA modules, the 4-way power splitter/combiner and associated components are provided. The so-called switchable splitter/combiner is installed in some model. This MCPA system is designed for parallel operation to achieve higher peak power output, and for good enough redundancy. The input signal is divided into equal power using a power splitter to input to each plug-in MCPA module. Having ultra linearity, each amplifier works within same power gain and same electrical phase. So the combined rated output power can be simply obtained by using power combiner.

A directional coupler is mounted behind the power combiner to monitor the Output signal. Each MCPA module has a serial interface (RS-485) separately to control the amplifier and to supervise a number of alarm signals with SC Card. The SC Card communicates with BTS through RS-422 interface. The serial interface connector (D-sub female connector) is provided on the rear of the sub-rack.

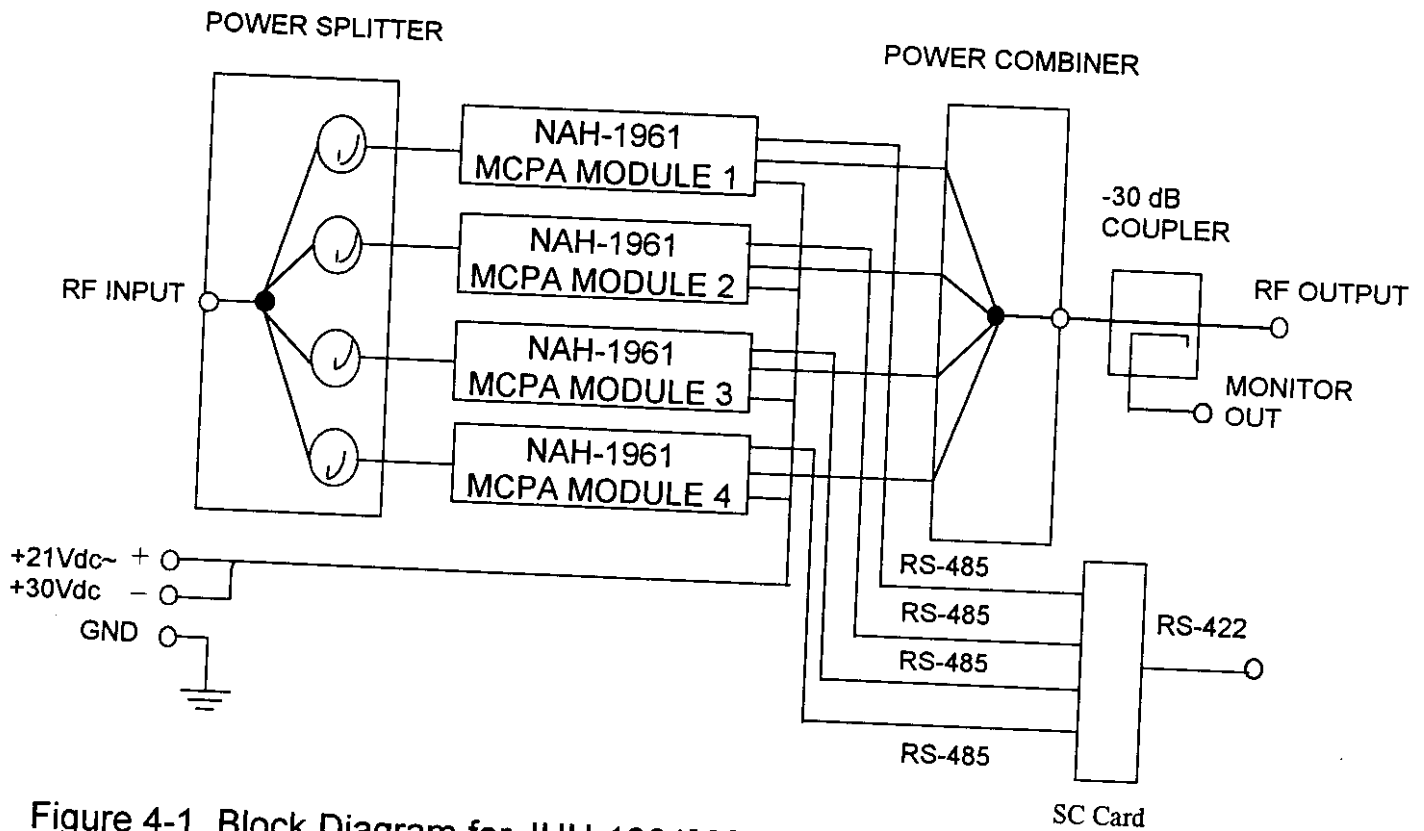


Figure 4-1. Block Diagram for JHU-1961MCPA System (1x1 Rack/128W type)

4.3 NAH-1961 MCPA Module

The MCPA module employs an unique feed forward IMD (Inter-Modulation Distortion) compensation technique, which is called SAFF (Self Adjusting Feed Forward) amplifier, and has an average power output of 40 watts with IMD suppressed to better than - 63 dBc.

In the MCPA module, there is an feed forward loop, which is operated with the SAFF control circuit so that maximum IMD suppression can be obtained under variety of environmental condition.

In addition, this MCPA has a number of alarming, controlling function and serial interface as described in section 2.7.

4.4 NCE-7028 Supervisory Control Card

(1) Installation

- a. No power switch is equipped in the SC card. As soon as the power is supplied to the rack, the SC card is in operation.
Two types of Fuse, which are for 1A and 3.2A, are used in the card. Make sure that two types are in the right place.
- b. Before the power is applied to the rack, make sure that;
 - two types of the fuse are installed in the SC card
 - the SC card is installed in the rack
 - the SC card is surely fixed by the screws

- c. The green lamp[Power] on the SC card indicates that suitable power is supplied to the rack.
- d. The DC power supply which outputs 21V to 30V should be used.

(2) Operation

- a. The SC card transfers the control signals from BTS to the individual MCPA modules. Also, the card supervises how each MCPA module is working and report to the BTS.
- b. The communication protocol between the card and modules is RS-485.
- c. The communication protocol between the card and BTS is RS-422. The connector for this communication is the so-called D-Sub 9 pins connector and it is installed on the back panel of the rack. Refer to Table 2-1 for the connection.
- d. Whenever the card is installed or removed, make sure that the power will not be applied to the rack.
- e. If the card is not installed, MCPA will not be operated.
- f. Since the card supervises Enable/Disable condition of the modules and controls switchable combiner, make sure by all means that the card is installed in the rack and the power must be applied. Otherwise, switchable splitter/combiner could be damaged.
- g. The operation status of the switchable splitter/combiner can be monitored by four LEDs on the front panel.
The green light indicates that its particular splitter/combiner slot is active when it is on.
If the green light is off, it indicates that its particular slot is not a part of the composition.
- h. Only when the communication between BTS and the card is not properly done, push the reset switch on the front panel. The hardware is coming to the reset condition
- i. One discrete TTL hard reset signal is provided to reset the serial interface. The reset signal is sent through the D-sub connector same as for RS-422. See schematic diagram.
- j. The MCPA rack provides forward and reverse power detection for each sector via an 8 bit digital word over the serial interface.
- k. While the module is in operation, do not pull out the fuse in the card by all means.

Section 5 MAINTENANCE

5.1 Introduction

This section describes periodic maintenance, field replaceable equipment, power output monitoring method, and spurious and IMD measurement procedures for the JHU-1961, MCPA system.

5.2 Periodic Maintenance

Periodic maintenance requirements are shown in Table 5-1.

CAUTION

**Do not touch DC power supply input terminal
and the FAN motors or they may cause serious physical injury.**

Table 5-1 Periodic Maintenance

ITEM	INTERVAL	ACTION
Air intake slit	30 days	Inspect and clean according to the explanation below.
Cables and Connectors Inspection	12 months	Inspect and confirm if signal and power cables are not frayed. Check RF connectors whether they are connected tight.

The air intake and outlet portion should be inspected every 30 days. If any dust and dirt are accumulated, the cooling efficiency may be decreased. Using compressed air, remove accumulated dust and dirt from them.

CAUTION

**Wear proper eye protection to avoid eye injury
when using compressed air.**

5.3 Field Replaceable Parts and Modules

The following parts and modules can be replaced in the field by a qualified technician.

1. NAH-1961 Multi Carrier Power Amplifier module
2. Cooling Fans
3. Fuses for SC Card : Type SMP-10, SMP-32

5.3.1 NAH-1961 Multi Carrier Power Amplifier Module

All NAH-1961 MCPA modules are pre-tested to assume minimal variances between modules. They are fully interchangeable and immediately usable without requiring retuning. To replace a MCPA module, proceed as follows:

1. Turn off the power switch on the front panel of the MCPA module.
2. Loosen four screws that fix the MCPA module to the sub-rack.
3. Pull module out of the sub-rack using handle on the front of the module.
4. Push the substitute module into the sub-rack slowly and carefully not to damage the D-sub connector on the back of the MCPA module.
5. Fasten four screws to secure the MCPA module to the sub-rack.
6. Turn on the power switch and confirm the green LED is lighted.

5.3.2 Cooling Fans

In NAH-1961 MCPA module, long life (20years) cooling fans are employed. So they have no need to replace. In case of an emergency, proceed as follows.

1. Remove finger guard panel on the front of the MCPA module.
2. Loosen two screws that fix fan motor to the MCPA module.
3. Disconnect fan power connector from amplifier module.
4. Install replacement fan motor in reverse order of steps 1 to 3 above.

5.3.3 Fuses

The fuses which are used in the rack are Type SMP-10 and SMP-32 which are Manufactured by Daito Communication Apparatus. When the fuse is replaced the applied power must be turned off. After the replacement is completed the power is applied to the rack. The nominal Fuse current level, which is shown on the panel must be kept by all means.

WARNING

- 1. Do not touch the blowing fan motors or they may cause serious physical injury.**
- 2. Do not restrict fan motors revolution or their life time may be reduced dramatically.**

5.4 Power Output Monitoring

The JHU-1961 series of the MCPA system other than Model JHU-1961A4 provide -30dB coupled monitor port of the final MCPA system output. It is used for measuring output signal waveform, IMD, and harmonics.

In-band and out-band coupled levels are shown in Figure 5-1 and Figure 5-2 respectively.

When monitoring the carrier signal output, the deviation of the coupling level is within 0.15dB in the assigned PCS band. So the in-band spurious and IMD level are measured exactly.

WARNING

- 1. Do not exceed the rated output power of the system. If exceeded, its performance would not be guaranteed.**
- 2. When measuring the system output power, using the power meter at the output port of the sub-rack is recommended for the accurate measuring.**

5.5 Measurement of spurious and IMD

When measuring the 2nd and greater order harmonics emitted from the MCPA system, compensate the discrepancy of the coupled level in accordance with Figure 5-2. Figure 5-2 shows the coupling level of the monitor coupler over 10GHz.

When measuring the IMD level emitted from the MCPA system, using the monitor port of the sub-rack allows accurate IMD measurement. However, for accurate IMD measurement, the spectrum analyzer having high dynamic range and low noise floor characteristics are required.

APPENDIX 6

TRANSMITTER ALIGNMENT

Factory Tune Up Procedure

1. MCPA Module NAH-1961

- 1-1. After checking all of the biasing voltages and function of individual circuit modules, the following adjustments shall be made:
- 1-2. To adjust the first loop (IMD detection loop), connect a spectrum analyzer to the output REF OUT located in the module A1.
- 1-3. Adjust the RV7 and RV8 so that the component of input signal is minimized at the outport (REF OUT).
- 1-4. To adjust the second loop (IMD suppression loop), apply rated multi-carrier input signal to the input port of the MCPA module.
- 1-5. Connect a spectrum analyzer to the monitor port (MON) located on the front panel of this MCPA module.
- 1-6. Adjust RV3 and RV4 attached in the module A2 so that the IMD components will be minimized.

TRANSMITTER TUNE-UP PROCEDURE
FCC ID: CKEJHU-1961

APPENDIX 7

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

The JHU-1961 MCPA functions as an amplifier only and has no frequency determining circuitry.

CIRCUITS AND DEVICES TO
STABILIZE FREQUENCY
FCC ID: CKEJHU-1961

APPENDIX 7

APPENDIX 8

CIRCUITS TO SUPPRESS SPURIOUS EMISSIONS

Circuitry to Suppress Spurious Emissions

1. Strip-line sections in conjunction with capacitors form a low -pass/band pass filtering between the RF amplifiers, combiner networks, and output port.
2. A notch filter is incorporated between power combiner and output terminal to pilot signal.

CIRCUITS TO SUPPRESS SPURIOUS
EMISSIONS
FCC ID: CKEJHU-1961

APPENDIX 8

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CERTIFICATION OF DATA

The technical data contained in this application has been taken under my supervision, is certified true and correct.

Yasushi Nakagawa

NAME: Yasushi Nakagawa

POSITION: Manager, Land Radio Communications
Engineering, Section II

DATE: October 23 1998