Instruction Manual
for
Ku-band 16W BUC
[NJT8319 series]

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General Caution

1. NJRC strives to produce reliable and high quality microwave components. NJRC's microwave components are intended for specific applications and require proper maintenance and handling. To enhance the performance and service of NJRC's microwave components, the devices, machinery or equipment into which they are integrated should undergo preventative maintenance and inspection at regularly scheduled intervals. Failure to properly maintain equipment and machinery incorporating these products can result in catastrophic system failures.

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5. The products listed in the catalog and specification sheets may not be appropriate for use in certain equipment where reliability is critical or where the products may be subjected to extreme conditions. You should consult our sales office or sales representatives before using the products in any of the following types of equipment.
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   * Equipment Used in the Deep Sea
   * Power Generator Control Equipment (nuclear, steam, hydraulic)
   * Life Maintenance Medical Equipment
   * Fire Alarm/Intruder Detector
   * Vehicle Control Equipment (automobile, airplane, railroad, ship, etc.)
   * Various Safety Equipment

General Caution (continued)

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About This Instruction Manual

This instruction manual describes Ku-band 16W BUCs (Model No.: NJT8319 series) herein referred to as "the Unit".

This instruction manual provides information and instructions for installation and operation of the Unit.

This instruction manual is intended for use by trained field installers or system engineers responsible for satellite networks.

Updated instruction manual may be available from NJRC's sales group mcsales@njr.co.jp.

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1. Introduction

This instruction manual is for Ku-band 16W BUCs (Model No.: NJT8319 series) .

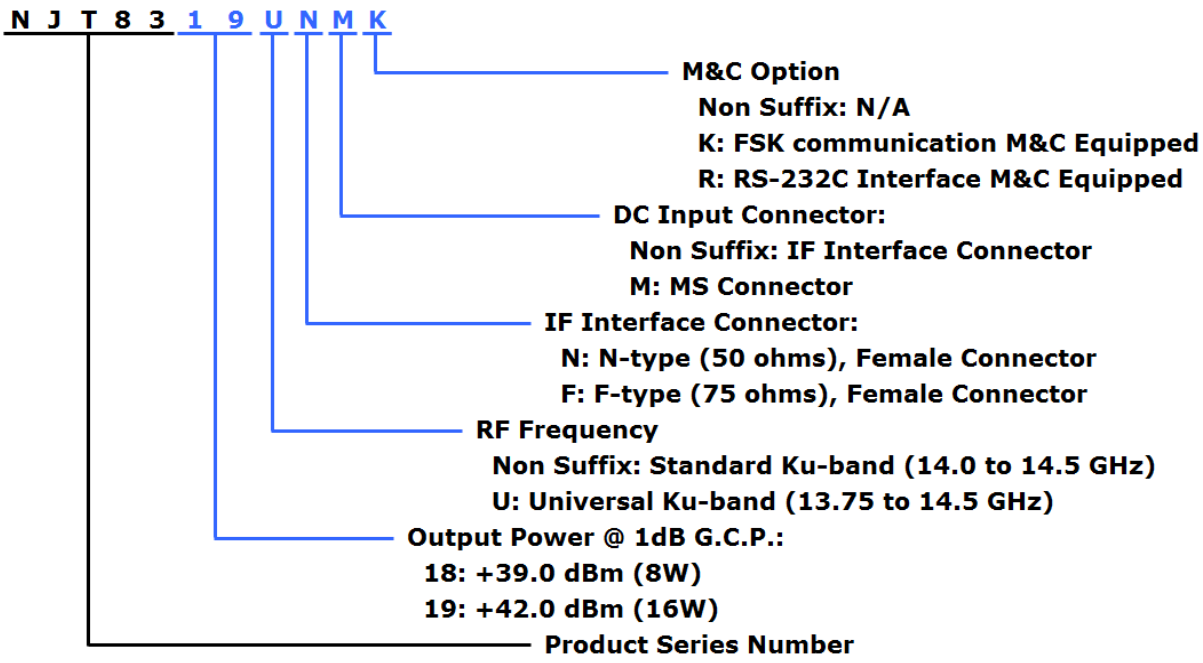
The Unit receives a reference signal (10 MHz) and an IF signal (L-Band: 950 to 1,450 MHz or 950 to 1,700 MHz) input and transmits an RF signal (Standard Ku-band: 14.0 to 14.5 GHz or Universal Ku-band: 13.75 to 14.5 GHz) output.

The Unit comes in a single, weatherized housing rated for outdoor use. The Unit has either an N-Type or a F-type female connector input, a WR75 waveguide with grooved flange output, and optional MS connector for DC power input. The Unit is operated by +48 V DC power (Range: +36 to +60 V) input.

The Unit has the function of Monitor and Control which is complied with FSK communication and RS-232C interfaces

The Unit has the following line-up:

Model No.	RF Frequency	Local Frequency	IF Frequency	Output Power @ P1dB	IF Connector	Port for Voltage Input	Power Supply	M&C Option
NJT8319N	14.0 to 14.5GHz (Standard Ku-band)	13.05 GHz	950 to 1,450 MHz	16W Linear (+42dBm min.)	N-type	Same as IF Connector	+36 to +60 V DC Power	N/A
NJT8319F					F-type			
NJT8319NM					N-type	MS Connector (Separate Port)		
NJT8319FM					F-type			
NJT8319NK					N-type	Same as IF Connector		FSK Communication M&C
NJT8319FK					F-type			
NJT8319NMK					N-type	MS Connector (Separate Port)		
NJT8319FMK					F-type			
NJT8319NMR					N-type			RS-232C Interface M&C
NJT8319FMR					F-type			
NJT8319UN	13.75 to 14.5GHz (Universal Ku-band)	12.80 GHz	950 to 1,700 MHz		N-type	Same as IF Connector		N/A
NJT8319UF					F-type			
NJT8319UNM					N-type	MS Connector (Separate Port)		
NJT8319UFM					F-type			
NJT8319UNK					N-type	Same as IF Connector		FSK Communication M&C
NJT8319UFK					F-type			
NJT8319UNMK					N-type	MS Connector (Separate Port)		
NJT8319UFMK					F-type			
NJT8319UNMR					N-type			RS-232C Interface M&C
NJT8319UFMR					F-type			

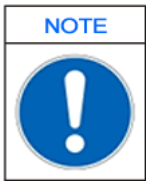


2. Safety Instructions

Use the following safety guidelines to help protect the Unit from potential damage and to help ensure your own personal safety.

DANGER, WARNING, CAUTION, and NOTE Statements

DANGER, WARNING, CAUTION, and NOTE statements are used throughout this instruction manual to emphasize important and critical information. You must read these statements to help ensure safety and to prevent product damage. The statement are defined below.

Statement	Symbol	Description
DANGER		DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING		WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION		CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. CAUTION may also be used to indicate other unsafe practices or risks of property damage.
NOTE		NOTE is used to notify of installation, operation, or maintenance information that is important, but not hazard-related.

Symbol	Description
	GENERIC HAZARD
	ELECTRIC HAZARD
	HOT SURFACE
	MOVING PARTS

When installing the Unit, observe the following safety guidelines.

2.1. Safety Statements

1. Opening / Removing

DO NOT dismantle this product.
Dismantlement may cause malfunction and electric shock.

2. Input Voltage

Only input a voltage within the range indicated in specified voltage.
DO operate at the input voltage of +36 to +60 V DC power.

3. RF Radiation

A radiation hazard exists if the BUC is operated with its RF signal output unterminated.
DO NOT operate the BUC without a load or termination attached to the RF signal output.

4. High Temperatures

DO NOT touch the body, especially fins, during operating the Unit.
High touch temperatures may exist, depending on load conditions.

5. Fan

DO NOT insert your finger into the fan to avoid injury.

DO NOT insert any objects into the fan. Keep any objects away from the fan.
Incorrect usage may cause injury to self or others.

6. Input Level

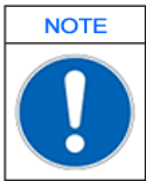
DO NOT input an IF signal over the range of +13 dBm maximum and a reference signal within the range of -5 to +5 dBm.

7. Operating Temperature.

Operate the Unit within the ambient temperature range of -40 to +75 degree C, but the performance guarantee temperature range is -40 to +55 degree C.

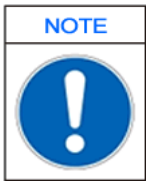
2.2. Instruction Statements

1. Mounting



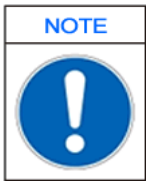
DO NOT block the fins and air flow.
Normally the Unit should be mounted with fan face down.

2. Connector



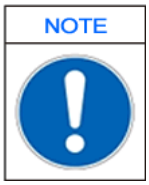
When attaching cable, DO tighten as connector with following torque:
N-type connector, 0.68 to 1.13 N・m
F-type connector, 0.39 to 0.49 N・m

3. Weatherproof



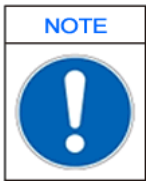
The Unit is mounted outdoors must be adequately weatherproofed.
Ensure the waveguide joints are properly sealed with the supplied o-ring (gasket). Use self-amalgamating tape to seal connectors and cable entry points from the connector to the

4. Fan



The fan has its lifetime. The fan is to be replaced with a new one at appropriate interval.
The recommendation interval of replacement is five years.

5. Warranty



Opening or removing any component (e.g. label, and screws) without fan equipments or sealed area will immediately void the warranty.

3. Packing List

The Unit is shipped in a single shipping container with the following content:

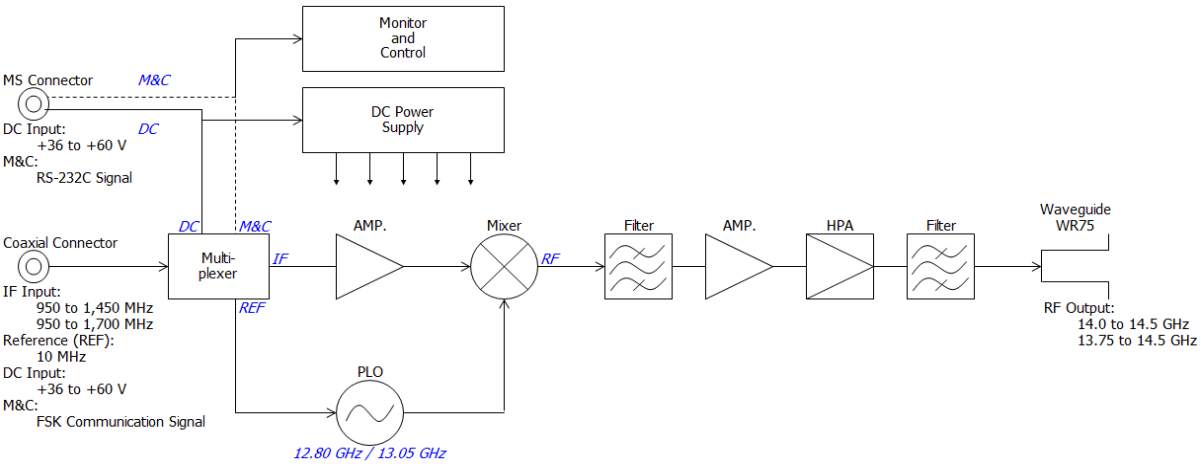
No.	Qty	Description
1.	1 unit	BUC: NJT8319N NJT8319F NJT8319NM NJT8319FM NJT8319NK NJT8319FK NJT8319NMK NJT8319FMK NJT8319NMR NJT8319FMR NJT8319UN NJT8319UF NJT8319UNM NJT8319UFM NJT8319UNK NJT8319UFK NJT8319UNMK NJT8319UFMK NJT8319UNMR OR NJT8319UFMR
2.	1 set	Accessory: Qty(4), Hexagon Socket Head Bolt (M4x10) Qty(1), Hexagon Wrench Key (M4) Qty(2), Phillips-head Screw (M6x10) Qty(1), O-ring
3.	1 sheet	Date sheet
4.	(1 pc)	Mating MS Connector: Part Number: PT06E-14-12S (470) ** MS connector is enclosed in the shipping container the only MS Connector models*

4. Overview

The Unit transmits an RF signal (Universal Ku-band: 13.75 to 14.5 GHz / Standard Ku-band: 14.0 to 14.5 GHz) output with up to 16W (+42 dBm) linear.

The unique features are

- High Temperature Operating:
  - * Operation Guarantee Temperature Range: -40 to +75 degree C
- RF Frequency Line-up:
  - * Universal Ku-band: 13.75 to 14.5 GHz
  - * Standard Ku-band: 14.0 to 14.5 GHz
- High Efficiency & Low Distortion.
  - * P1dB: +42 dBm min. over temperature
  - * IM3: -28 dBc @ Pout = +39 dBm
  - * Power Consumption: 160 W typ.
- Monitor & Control Line-up
  - * FSK Communication M&C
  - * RS-232C Interface Serial M&C
- Smaller Size & Lighter Weight
  - * Dimension: 180 (L) x 130 (W) x 80 (H) mm
  - * Weight: 2.4 kg
- LED Indicator
- RoHS Compliance

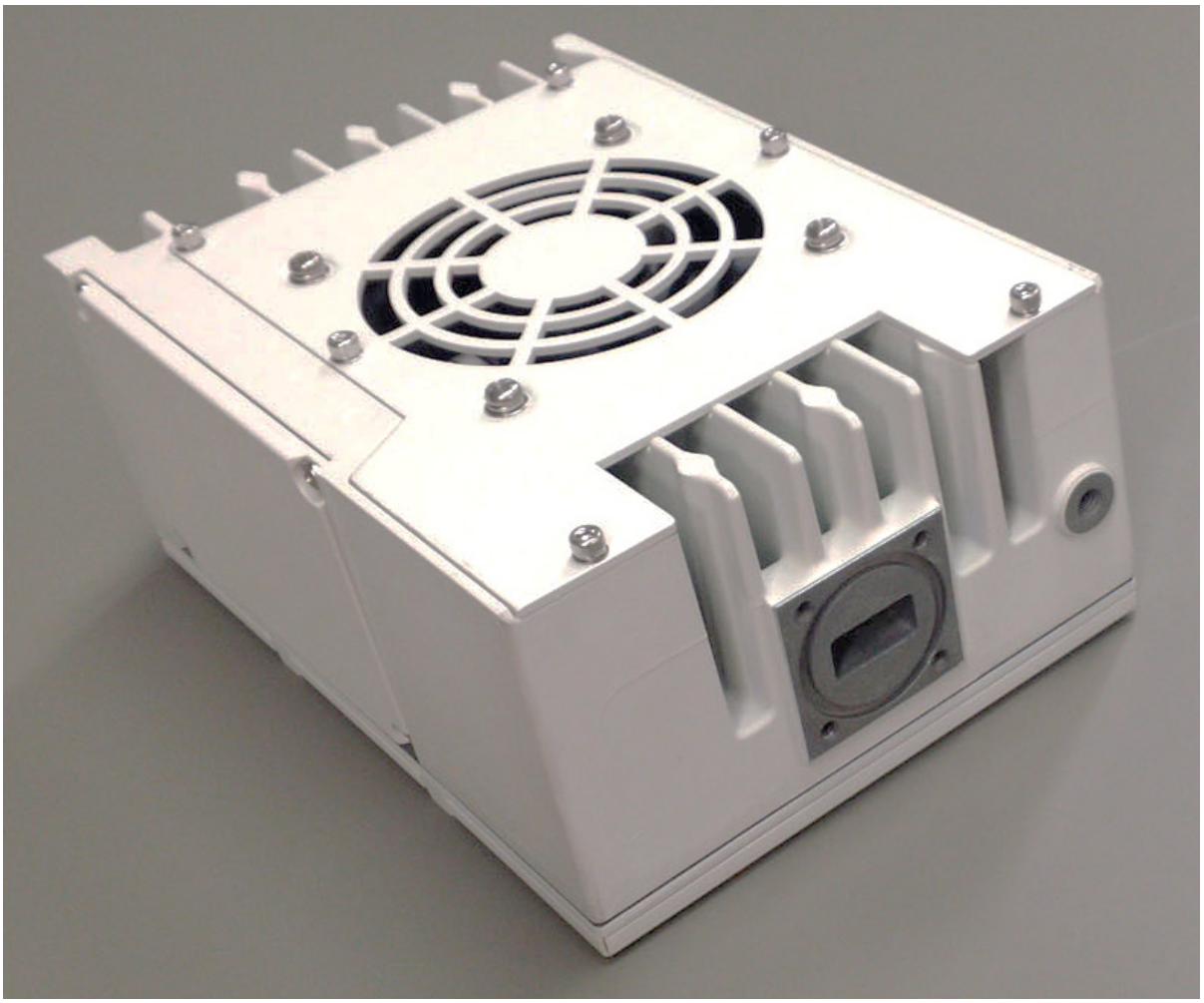


Block Diagram

5. Physical Description

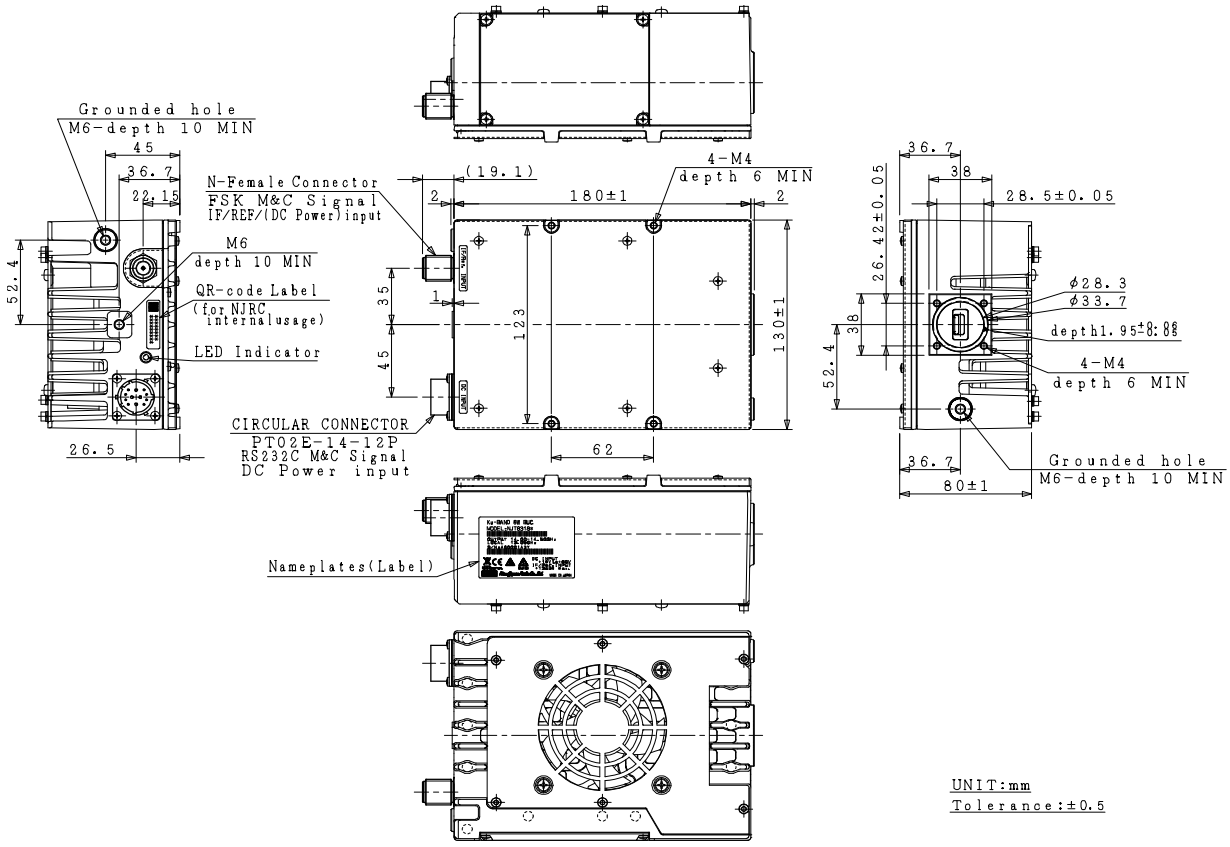
This section describes appearance and outline for the Unit.

5.1. Appearance



Overall Picture

5.2. Outline Drawing



5.3. Description of Connectors, and LEDs

<table>
<tr><th>Item</th><th>Description</th><th>Purpose</th></tr>
<tr><td rowspan="4">N-type
or
F-type
Female
Connector</td><td>IF Signal Input</td><td>The Unit receives an IF signal (950 to 1,450 MHz or 950 to 1,700 MHz) via this connector.</td></tr>
<tr><td>Reference Signal Input</td><td>The Unit receives a reference signal (10 MHz) via this connector.</td></tr>
<tr><td>FSK Communication M&C Signal</td><td>FSK Communication M&C models are only equipped.
The Unit receives / transmits the M&C signal with the FSK modulation via this connector.</td></tr>
<tr><td>DC Power Input *1</td><td>The Unit is required to supply +36 to +60 V DC power via this connector.</td></tr>
<tr><td rowspan="3">Circular Connector (MS Connector)</td><td>DC Power Input *1</td><td>MS Connector models are only
The Unit is required to supply +36 to +60 V DC power via Pin# J and K in this connector.</td></tr>
<tr><td>RS-232C Interface M&C Signal</td><td>RS-232C Interface M&C models are only equipped.
The Unit receives / transmits the M&C signal with the RS-232C interface Pin# G, H and K in this connector.</td></tr>
<tr><td colspan="2">Connector Information
Part No.: PT02E-14-12P (025)
Mating connector: PT06E-14-12S (470)
Assignment:
 

Pin A: N.C.
Pin B: N.C.
Pin C: N.C.
Pin D: N.C.
Pin E: N.C.
Pin F: N.C.
Pin G: RS-232C TxD*
Pin H: RS-232C RxD*
Pin J: DC Power (+) / Prime
Pin K: DC Power (-) / Return;
GND COMMON (RS-232C)
Pin L: N.C.
Pin M: N.C.
* Pin G: RS-232C TxD and Pin H: RS-232C RxD are available for only RS-232C Interface M&C models.
* Do not connect the pins for N.C. and not using pins with the cable wires.</td></tr>
</table>

Item	Description	Purpose
WR-75	RF Output	The Unit transmits an RF signal (14.0 to 14.5 GHz or 13.75 to 14.5 GHz) via this waveguide.
LED Indicator	Local Unlock Alarm	GREEN: L.O. locked RED: L.O. unlocked (or no reference signal)
Grounded Hole	M6 hole	Common chassis ground

*1: MS Connector models are available to apply DC voltage via Circular Connector (MS Connector) or N-/F-type Female Connector.

DO NOT apply DC voltage via both Circular Connector (MS Connector) and N-/F-type Female Connector.
If DC voltage is applied on both connectors, it may damage the unit or the unit may not operate properly.

6. Installing

This section describes basic installation for the Unit.

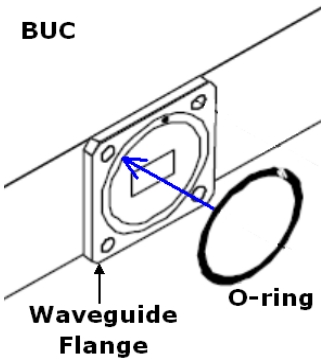
6.1. Mounting Configuration

The Unit can be mounted in the feed horn of the satellite antenna.

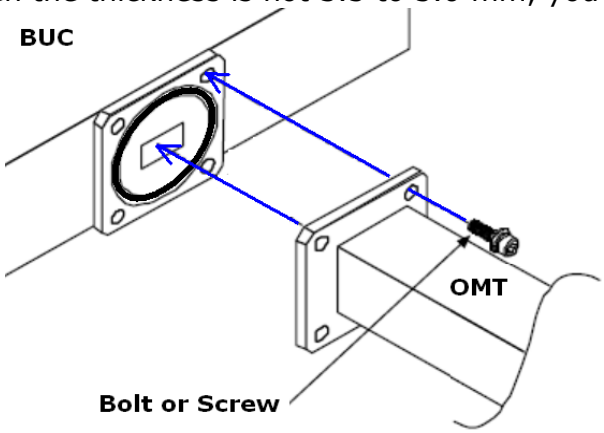
6.1.1. Guidelines for Attachment of OMT

When attaching the OMT or the filter, you should follow the following steps:

Step 1: Verify that the o-ring groove on the waveguide flange of the Unit is clean. Insert the enclosed o-ring (gasket) the groove as shown.



Step 2: Secure the OMT or the filter to the Unit using the supplied enclosed bolts with 1.15 to 1.4 N･m torque as shown, when the thickness of the flange of the OMT or the filter is 3.5 to 5.0 mm.
When the thickness is not 3.5 to 5.0 mm, you should prepare



6.1.2. Guidelines for Mounting

When mounting on the OMT or the filter, you should follow the following cautions:

- DO NOT block the fins and air flow.
- Normally the Unit should be mounted with fan face down.

6.2. Connecting System

The Unit is connected two cables:

- Coaxial Cable
- Power Cable
- Wire for Common Chassis Ground / Earthing
- M&C Signal Cable

6.2.1. Connecting Coaxial Cable

The Unit receives an IF signal and a reference signal via coaxial cable from modem, is required to supply +36 to +60 V DC power , receives an FSK communication M&C signal.

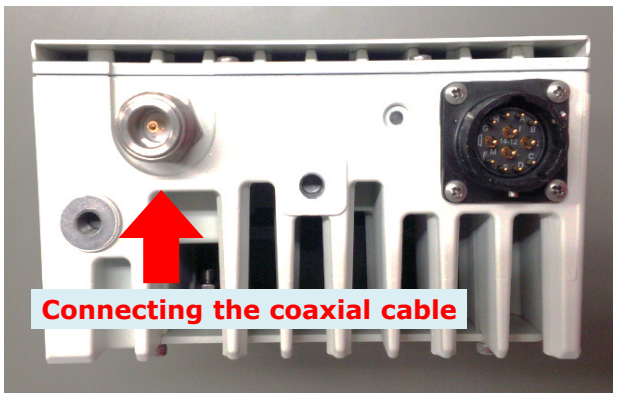
Connecting the coaxial cable is proceeded with the following steps:

Step 1: Connect the coaxial cable with N-type or F-type male connectors to the coaxial connector equipped with the Unit under following torque:
N-type connector, 0.68 to 1.13 N･m
F-type Connector, 0.39 to 0.49 N･m

Step 2: Use self-amalgamating tape to seal connector and cable entry points from the connector to the cable sheath.

Only input a voltage within the range indicated in specified voltage.
DO operate at the input voltage of +36 to +60 V DC power at the coaxial connector on the Unit.

DO NOT input an IF signal over the range of +13 dBm maximum and a reference signal within the range of -5 to +5 dBm.



6.2.2. Connecting Power Cable

The Unit is required to supply +36 to +60 V DC power via power cable from modem or a DC power supply unit with the exception of only IF connecter supplied models.

Connecting the power cable is proceeded with the following steps:

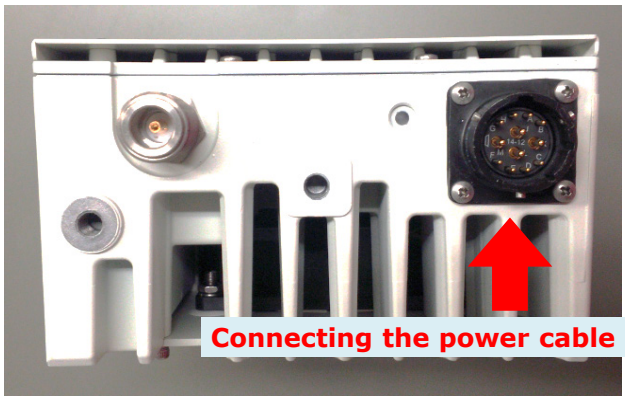
Step 1: Assemble the power cable and the supplied MS mating connector with the following assignment:
Pin J: Prime (+48 V DC Power)
Pin K: Prime Return
* *Do not connect the pins for N.C. and not using pins with the cable wires.*

Step 2: Connect the power cable above to MS connector equipped with a bayonet locked status.

Step 3: Use self-amalgamating tape to seal connector and cable entry points from the connector to the cable sheath.

Only input a voltage within the range indicated in specified voltage.
DO operate at the input voltage of +36 to 60 V DC power at the coaxial connector on the Unit.

DO NOT apply DC voltage via both MS Connector and N-/F-type Female Connector.
If DC voltage is applied on both connectors, it may damage the unit or the unit may not operate properly.

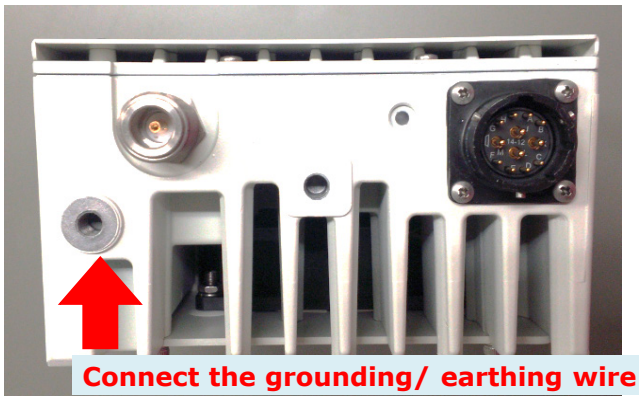


6.2.3. Wire for Common Chassis Ground / Earthing

The Unit can be had the chassis ground of the other equipment (e.g. antenna) in common or earthing.

Connecting the wire for common chassis ground / earthing is proceeded with the following steps:

Step 1: Connect the grounding/ earthing wire from ground on the other equipment or earthing point to the ground hole on connector or waveguide sides with M6 screw.



OR

6.2.4. Connecting M&C Signal Cable

The Unit is required to supply RS-232C interface signal via signal cable from modem or M&C equipment in case that it is RS-232C interface M&C models.

Connecting the M&C signal cable is proceeded with the following steps:

Step 1: Assemble the M&C signal cable and the supplied MS mating connector with the following assignment:

Pin G: RS-232C TxD
Pin H: RS-232C RxD
Pin K: GND COMMON (RS-232C)

* *Do not connect the pins for N.C. and not using pins with the cable wires.*

Step 2: Connect the M&C signal cable above to MS connector equipped with a bayonet locked status.

Step 3: Use self-amalgamating tape to seal connector and cable entry points from the connector to the cable sheath.

7. GUI of Monitor and Control

This Section describes the NJR's Graphical User Interface (GUI) of Monitor and Control.

The NJR's GUI is available for the RS-232C Interface M&C models.

The GUI uses the BUC-EP001 software which can be downloaded from the following NJR's website.

- Website: http://mc.njr.co.jp/eng/products/vsat/ku-buc/8w_2.html
  Please download a zip file of the GUI software and decompress this

7.1. Setup

7.1.1. Connecting the RS-232C Interface

Connecting the the RS-232C Interface is proceeded with the following

Step 1: Assemble the cable and the supplied MS mating connector with the following assignment:
Pin G: RS-232C TxD
Pin H: RS-232C RxD
Pin K: GND COMMON (RS-232C)

Step 2: Connect the MS connector and the COM port of user's PC with the above cable.

7.1.2. COM Port Setting

Set the serial communication property of your PC as follows.
Baud rate: 9600
Data bit: 8
Parity: none
Stop bit: 1
Flow control: none

7.1.3. Installing the GUI Software

The GUI Software can be installed by Setup.exe in the downloaded zip file. The details of Installing the GUI software are mentioned in the user manual which is stored in Manual.htm in the downloaded zip file.

7.2. Starting and Operating

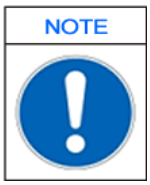
The details of starting and operating the GUI software are mentioned in the user manual which is stored in Manual.htm in decompressed folder.

8. Maintenance

This Section describes basic maintenance for the Unit.

8.1. Fan Field Replacement

The Unit is Forced Air by fan for cooling.



The fan has its lifetime. The fan is to be replaced with a new one at appropriate interval.
The recommendation interval of replacement is five years.

The fan of the Unit stop and does not operate normally, you need to replace a new fan by yourself in field. And the fan is to be replaced with a new one at five years interval.

Contact to us by phone, fax, or email, when a new fan for replacement is needed.

- Telephone: +81-49-278-1270
- Fax: +81-49-278-1234
- Email: mcsales@njr.co.jp

9. Specifications

The Unit is in compliance with the following specifications:

9.1. Electrical Specifications

No.	Item	Specifications
1.	Output Frequency Range <Universal Ku-band> <Standard Ku-band>	 13.75 to 14.5 GHz 14.0 to 14.5 GHz
2.	Input Frequency Range <Universal Ku-band> <Standard Ku-band>	 950 to 1,700 MHz 950 to 1,450 MHz
3.	Maximum IF Input Level (without damage)	+13 dBm max.
4.	Conversion Type	Single, fixed L.O.
5.	L.O. Frequency <Universal Ku-band> <Standard Ku-band>	 12.80 GHz 13.05 GHz
6.	Frequency Sense	Positive
7.	Output Power @ 1dB G.C.P.	+42 dBm min. over temperature
8.	Linear Gain	68 dB nom., 62 dB min.
9.	IM3	-28 dBc typ., -24 dBc max. @ total power <= +42 dBm - 3 dB
10.	Requirement for External Reference [Frequency] [Input Power] [Phase Noise]	 10 MHz (sine-wave) -5 to +5 dBm @ Input port -125 dBc/Hz max. @ 100 Hz -135 dBc/Hz max. @ 1 kHz -140 dBc/Hz max. @ 10 kHz
11.	L.O. Phase Noise	-60 dBc/Hz max. @ 100 Hz -70 dBc/Hz max. @ 1 kHz -80 dBc/Hz max. @ 10 kHz -90 dBc/Hz max. @ 100 kHz -100 dBc/Hz max. @ 1MHz
12.	Input Impedance <N-type Model> <F-type Model>	 50 ohms nom. 75 ohms nom.
13.	Input VSWR	2 : 1 max.
14.	Output VSWR	2 : 1 max.
15.	Output Load VSWR for Non Damage	2 : 1 max.

No.	Item	Specifications
16.	DC Power Requirement [Voltage Range] [Power Consumption]	 +48 VDC (+36 to +60 VDC) 140 W typ. @ No IF signal 160W typ., 180 W max. @ Pout = +42 dBm
17.	Mute	Shut off the HPA in case of L.O. unlocked
18.	LED Indicator	GREEN: L.O. locked RED: L.O. unlocked (or no 10 MHz reference signal)
19.	Monitor and Control	
	<FSK Communication M&C> [Interface] [Functions] [Performance	 650kHz FSK Signal on IF Connector Monitor: Tx Output Power / Temperature / Tx Status / Alarm (Over temperature *2 / L.O. unlock) / Step Attenuator Control: Transmit On/Off / Step Attenuator Tx Output Power: Detector Range: 15 dB (up to P1dB) Reading Accuracy: +/- 1.0 dB Step Attenuator: Attenuator Range: 0 to 15.5 dB Attenuator Step: 0.5 dB ** Details are mentioned on Appendix of "Monitor & Control Specifications for FSK Communications Interface".*

No.	Item	Specifications
19.	Monitor and Control	
	<RS-232C Interface M&C> [Interface] [Functions] [Performance	 RS-232C Interface on MS connector Monitor: Tx Output Power / Temperature / Tx Status / Alarm (Over temperature *2 / L.O. unlock) / Step Attenuator Control: Transmit On/Off / Step Attenuator Tx Output Power: Detector Range: 15 dB (up to P1dB) Reading Accuracy: +/- 1.0 dB Step Attenuator: Attenuator Range: 0 to 15.5 dB Attenuator Step: 0.5 dB ** Details are mentioned on Appendix of "Monitor & Control Specifications for RS-232C Interface".*

*2: Regardless of cooling fan status, the unit will operate until status of over temperature which turn out at internal temperature of around 120 °C, and the Mute and Alarm will function at status of over temperature.

9.2. Mechanical Specifications:

No.	Item	Specifications
1.	Input Interface [IF Connector] [DC Input *3]	 N-type or F-type, female connector IF / Ref. / FSK M&C Signal (/ DC) Input IF Connector or MS Connector - MS connector - Part No.: PT02E-14-12P (025) Mating connector: PT06E-14-12S (470) Assignment:  **Pin A: N.C.** **Pin B: N.C.** **Pin C: N.C.** **Pin D: N.C.** **Pin E: N.C.** **Pin F: N.C.** **Pin G: RS-232C TxD*** **Pin H: RS-232C RxD*** **Pin J: DC Power (+) / Prime** **Pin K: DC Power (-) / Return; GND COMMON (RS-232C)** **Pin L: N.C.** **Pin M: N.C.** * *Pin G: RS-232C TxD and Pin H: RS-232C RxD are available for only RS-232C Interface M&C models.* * *Do not connect the pins for N.C. and not using pins with the cable wires.*
2.	Output Interface	Waveguide, WR75 with Grooved Flange
3.	Cooling	Forced-air-cooled
4.	Dimension & Housing without Interface Connector (L) (W) (H)	 180 mm [7.09"] 130 mm [5.12"] 80 mm [3.15"]
5.	Weight	2.4 kg [5.3 lbs]

*3: MS Connector models are available to apply DC voltage via MS Connector or N-/F-type Female Connector.

DO NOT apply DC voltage via both MS Connector and N-/F-type Female Connector.
If DC voltage is applied on both connectors, it may damage the unit or the unit may not operate properly.

9.3. Environmental Specification:

No.	Item	Specifications
1.	Temperature Range (ambient) [Operating] [Storage]	 Operation Guarantee: -40 to +75 °C Performance Guarantee: -40 to +55 °C -40 to +75 °C
2.	Humidity	0 to 100 %
3.	Altitude	15,000 feet (4,572 m)
4.	Vibration	5 G [49.03 m/s^2] (3 axis, 50 Hz to 2 kHz) 1 mm p-p (3 axis, 5 to 50 Hz)
5.	Shock	30 G [294.20 m/s^2] (3 axis)
6.	Dustproof / Waterproof	IP67 (IEC 60529)
7.	Regulatory Compliance	CE / EMC Directive (2004/108/EC)
8.	Comply with RoHS (Restricting the use of Hazardous Substances) directives	

Appendix)

Monitor & Control Specifications for FSK Communications Interface

Rev. 3.0
June 14 2013

1. FSK Communications Specifications

(1) Transmitter

a. Frequency	650 kHz +/-5%
b. FSK deviation	+/- 60 kHz Nominal (+60 kHz mark)
c. Deviation tolerance	+/- 50 kHz minimum ; +/-70 kHz maximum
d. Output Level	-5 to –15 dBm
e. Output impedance	50 Ohm
f. Start Tone	710 kHz
g. Start Tone Time	10 ms minimum

(2) Receiver

a. Locking range	+/- 32.5 kHz
b. Input impedance	50 Ohm
c. Input Sensitivity	-15 dBm

(3) Transmission Protocol

a. Operation Mode	Legacy-Binary
b. Transfer Rate	9600 bit/s
c. Data Format	1 start bit, 8 data bits, 1 stop bit No Parity

ST	D0	D1	D2	D3	D4	D5	D6	D7	SP

←――― Transmit

(The least significant bit (LSB) is sent first.)

- ST: Start bit (Status "L")
- D0: Data(LSB)
- ---
- D7: Data(MSB)
- SP: Stop bit (Status "H")

d. Maximum Response Time	50 ms
e. Massage Rate	1 every 20 ms

2. Packet Format

(1) Byte Configuration

a. Data Packet Length: 7 Bytes

b. Byte Configuration

Byte	Command (IDU to BUC)	Response (BUC to IDU)
1st	BUC Address (*1)	BUC Address (*2)
2nd	Command	Data Byte 1
3rd	Data Byte 1	Data Byte 2
4th	Data Byte 2	Data Byte 3
5th	Data Byte 3	Data Byte 4
6th	Data Byte 4	Data Byte 5
7th	Check Sum (*3)	Check Sum (*3)

*1: Initial setting of a BUC address is 0x01.
*2: Responder address is shifted left by 4 bits.
*3: Algebraic sum of bytes 1 through 6.
Spare bytes are always filled with 0xAA (10101010).

Appendix)

3. Command & Response Message Structure

The last state of the BUC condition is stored to inside memory, so when the BUC is re-turned DC power on again, the state is reproduced last condition.

(1) Command Message Structure (IDU to BUC)

a. Request Status 1

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Request Status 1	0x01
3	Data Byte 1	Not used	0xAA
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

b. Set Transmit On/Off State

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Tx On/Off	0x02
3	Data Byte 1	Tx Control	Off:0x00/On:0x01
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

c. Change BUC Address (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Change Address	0x03
3	Data Byte 1	New Address	0x01 to 0x0F
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

This command is not applicabe (N/A) in this version.

d. Set Carrier Frequency (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Set Carrier Frequency	0x04
3	Data Byte 1	Carrier Frequency	MSbyte
4	Data Byte 2	Carrier Frequency	LSbyte
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

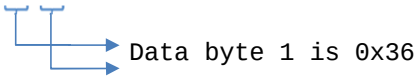
This command is not applicabe (N/A) in this version.

Data Field Definition

Carrier Frequency	Unsigned integer in MHz

ex).

14000 MHz : 36 B0 (Convert into a hexadecimal number)



Appendix)

e. Set Attenuator

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Set Attenuator	0x05
3	Data Byte 1	Attenuator Selection 1 or 2	Att.1 0x01 Att.2 0x02 *1
4	Data Byte 2	Setting Att. in 10dB digit	0x00 or 0x01 *2
5	Data Byte 3	Setting Att. in 1dB digit	0x00 to 0x09 *2
6	Data Byte 4	Setting Att. bit in 0.5dB digit	0x00 or 0x05 *2
7	Checksum	Algebraic sum of bytes 1 - 6	

*1 Att.1 is available, Att.2 is not avalable.
*2 Dynamic range and step size of the step attenuator: 15.5dB in 0.5dB step
ex) 12.5dB : Data byte 2 is 0x01
Data byte 3 is 0x02
Data byte 4 is 0x05

f. Request Status 2

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Request Status 2	0x06
3	Data Byte 1	Attenuator Selection 1 or 2	Att.1 0x01 Att.2 0x02
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

(2) Response Message Structure (BUC to IDU)

a. Request Status 1

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Level Byte 1	MSbyte of Tx Output Power	***1**
3	Level Byte 2	LSbyte of Tx Output Power	***1**
4	Temperature	Temperature in deg. C	***2**
5	Status Byte 1	Bit 0: Temperature Out-of-Range	1:Fail , 0:Normal
		Bit 1: PLL Out-of-Lock	1:Fail , 0:Normal
		Bit 2: Checksum Error	1:Error , 0:Normal
		Bit 3: Tx Status	1:Tx On , 0:Tx Off
		Bits 4 thru 7: BUC Power Class	0x1 to 0xA ***3**
6	Status Byte 2	Bits 0 - 3: Not used	Fixed 0xA
		Bits 4 - 7: Software Version	0x0 to 0xF
7	Checksum	Algebraic sum of bytes 1 - 6	

***1** Data Field Definition
Output power is the number which changed hexadecimal data into the decimal number and was divided by 100.
ex).

Output Power Data		Output Power
Data byte 1 is 0x10 Data byte 2 is 0x36	0x1036 →	+41.50 dBm

***2** Data Field Definition
Temperature data is -128 deg.C to +127 deg.C in two's complement.
(1 deg.C step).
ex).
When BUC Temperature is -40C, Temperature data is

***3** BUC Power Class

Value	0x1	0x2	0x3	0x4	0x5	0x6	0x7	0x8	0x9	0xA
Power	2W	4W	5W	8W	10w	16W	20W	25W	40W	60W

Appendix)

b. Set Transmit

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Tx On/Off	0x02
3	Data Byte 1	Tx Control	Off:0x00/On:0x01
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

c. Change BUC Address (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Change Address	0x03
3	Data Byte 1	New Address	0x01 to 0x0F
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

This command is not applicabe (N/A) in this version.

d. Set Carrier Frequency (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Set Carrier Frequency	0x04
3	Data Byte 1	Carrier Frequency	MSbyte
4	Data Byte 2	Carrier Frequency	LSbyte
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

This command is not applicabe (N/A) in this version.

e. Set Attenuator

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Set Attenuator	0x05
3	Data Byte 1	Attenuator Selection 1or 2	Att.1 0x01 Att.2 0x02
4	Data Byte 2	Set Att. bit in 10 dB digit	0x00 or 0x01
5	Data Byte 3	Set Att. bit in 1 dB digit	0x00 to 0x09
6	Data Byte 4	Set Att. bit in 0.5 dB digit	0x00 or 0x05
7	Checksum	Algebraic sum of bytes 1 - 6	

f. Request Status 2

Byte	Name	Description	Value
1	Address	Address of BUC	0x10 (to 0xF0)
2	Command	Request Status 2	0x08
3	Data Byte 1	Attenuator Selection 1or 2	Att.1 0x01 Att.2 0x02
4	Data Byte 2	Set Att. bit in 10 dB digit	0x00 or 0x01
5	Data Byte 3	Set Att. bit in 1 dB digit	0x00 to 0x09
6	Data Byte 4	Set Att. bit in 0.5 dB digit	0x00 or 0x05
7	Checksum	Algebraic sum of bytes 1 - 6	

Appendix)

Monitor & Control Specifications for RS-232C Interface

Rev. 2.3
July 25 2013

1. RS-232C Link Specificatons

(1) Transmission Protocol

a. Operation Mode: Binary

b. Transfer Rate: 9600 bit/s

c. Data Format: 1 start bit, 8 data bits, 1 stop bit
No Parity

ST	D0	D1	D2	D3	D4	D5	D6		D7	SP

⟵ Transmit

(The least significant bit (LSB) is sent first.)

ST: Start bit
D0: Data(LSB)

D7: Data(MSB)
SP: Stop bit

2. Packet Format

(1) Byte Configuration

a. Data Packet Length: 7 Bytes

b. Byte Configuration

Byte	Command (IDU to BUC)	Response (BUC to IDU)
1st	BUC Address (*1)	BUC Address (*2)
2nd	Command	Data Byte 1
3rd	Data Byte 1	Data Byte 2
4th	Data Byte 2	Data Byte 3
5th	Data Byte 3	Data Byte 4
6th	Data Byte 4	Data Byte 5
7th	Check Sum (*3)	Check Sum (*3)

*1: Initial setting of a BUC address is 0x01.
*2: Responder address is shifted left by 4 bits.
*3: Algebraic sum of bytes 1 through 6.
Spare bytes are always filled with 0xAA (10101010).

Appendix)

3. Command & Response Message Structure

The last state of the BUC condition is stored to inside memory, so when the BUC is re-turned DC power on again, the state is reproduced last condition.

(1) Command Message Structure (IDU to BUC)

a. Request Status 1

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Request Status 1	0x01
3	Data Byte 1	Not used	0xAA
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

b. Set Transmit On/Off State

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Tx On/Off	0x02
3	Data Byte 1	Tx Control	Off:0x00/On:0x01
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

c. Change BUC Address (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Change Address	0x03
3	Data Byte 1	New Address	0x01 to 0x0F
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

This command is not applicabe (N/A) in this version.

d. Set Carrier Frequency (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Set Carrier Frequency	0x04
3	Data Byte 1	Carrier Frequency	MSbyte
4	Data Byte 2	Carrier Frequency	LSbyte
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

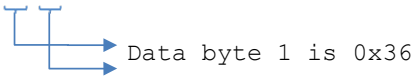
This command is not applicabe (N/A) in this version.

Data Field Definition

Carrier Frequency	Unsigned integer in MHz

ex).

14000 MHz : 36 B0 (Convert into a hexadecimal number)



Appendix)

e. Set Attenuator

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Set Attenuator	0x05
3	Data Byte 1	Attenuator Selection 1 or 2	Att.1 0x01 Att.2 0x02 *1
4	Data Byte 2	Setting Att. in 10dB digit	0x00 or 0x01 *2
5	Data Byte 3	Setting Att. in 1dB digit	0x00 to 0x09 *2
6	Data Byte 4	Setting Att. bit in 0.5dB digit	0x00 or 0x05 *2
7	Checksum	Algebraic sum of bytes 1 - 6	

*1 Att.1 is available, Att.2 is not avalable.

*2 Dynamic range and step size of the step attenuator: 15.5dB in 0.5dB step

ex) 12.5dB : Data byte 2 is 0x01
Data byte 3 is 0x02
Data byte 4 is 0x05

f. Request Status 2

Byte	Name	Description	Value
1	Address	Address of BUC	0x01 (to 0x0F)
2	Command	Request Status 2	0x06
3	Data Byte 1	Attenuator Selection 1 or 2	Att.1 0x01 Att.2 0x02
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

(2) Response Message Structure (BUC to IDU)

a. Request Status 1

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Level Byte 1	MSbyte of Tx Output Power	***1**
3	Level Byte 2	LSbyte of Tx Output Power	***1**
4	Temperature	Temperature in deg. C	***2**
5	Status Byte 1	Bit 0: Temperature Out-of-Range	1:Fail , 0:Normal
		Bit 1: PLL Out-of-Lock	1:Fail , 0:Normal
		Bit 2: Checksum Error	1:Error , 0:Normal
		Bit 3: Tx Status	1:Tx On , 0:Tx Off
		Bits 4 thru 7: BUC Power Class	0x1 to 0xA ***3**
6	Status Byte 2	Bits 0 - 3: Not used	Fixed 0xA
		Bits 4 - 7: Software Version	0x0 to 0xF
7	Checksum	Algebraic sum of bytes 1 - 6	

***1** Data Field Definition

Output power is the number which changed hexadecimal data into the decimal number and was divided by 100.

ex).

Output Power Data (Data byte 1 is 0x10, Data byte 2 is 0x36) 0x1036 → Output Power +41.50 dBm

***2** Data Field Definition

Temperature data is -128 deg.C to +127 deg.C in two's complement. (1 deg.C step).

ex).

When BUC Temperature is -40C, Temperature data is

***3** BUC Power Class

Value	0x1	0x2	0x3	0x4	0x5	0x6	0x7	0x8	0x9	0xA
Power	2W	4W	5W	8W	10w	16W	20W	25W	40W	60W

Appendix)

b. Set Transmit

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Tx On/Off	0x02
3	Data Byte 1	Tx Control	Off:0x00/On:0x01
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

c. Change BUC Address (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Change Address	0x03
3	Data Byte 1	New Address	0x01 to 0x0F
4	Data Byte 2	Not used	0xAA
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

This command is not applicabe (N/A) in this version.

d. Set Carrier Frequency (N/A)

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Set Carrier Frequency	0x04
3	Data Byte 1	Carrier Frequency	MSbyte
4	Data Byte 2	Carrier Frequency	LSbyte
5	Data Byte 3	Not used	0xAA
6	Data Byte 4	Not used	0xAA
7	Checksum	Algebraic sum of bytes 1 - 6	

This command is not applicabe (N/A) in this version.

e. Set Attenuator

Byte	Name	Description	Value
1	Address	Address of BUC shifted left by 4	0x10 (to 0xF0)
2	Command	Set Attenuator	0x05
3	Data Byte 1	Attenuator Selection 1or 2	Att.1 0x01 Att.2 0x02
4	Data Byte 2	Set Att. bit in 10 dB digit	0x00 or 0x01
5	Data Byte 3	Set Att. bit in 1 dB digit	0x00 to 0x09
6	Data Byte 4	Set Att. bit in 0.5 dB digit	0x00 or 0x05
7	Checksum	Algebraic sum of bytes 1 - 6	

f. Request Status 2

Byte	Name	Description	Value
1	Address	Address of BUC	0x10 (to 0xF0)
2	Command	Request Status 2	0x08
3	Data Byte 1	Attenuator Selection 1or 2	Att.1 0x01 Att.2 0x02
4	Data Byte 2	Set Att. bit in 10 dB digit	0x00 or 0x01
5	Data Byte 3	Set Att. bit in 1 dB digit	0x00 to 0x09
6	Data Byte 4	Set Att. bit in 0.5 dB digit	0x00 or 0x05
7	Checksum	Algebraic sum of bytes 1 - 6	