MX368011A
PDC Software
Operation Manual

Third Edition

To ensure that the equipment is used safely, read the "For Safety" in the MG3681A Digital Modulation Signal Generator Operation Manual first.
Keep this manual with the equipment.

ANRITSU CORPORATION

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MX368011A
PDC Software
Operation Manual

10 January 2001 (First Edition)
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CE

1. Product Name/Model Name

Product Name: PDC Software
Model Name: MX368011A

2. Applied Directive

EMC: Council Directive 89/336/EEC
LVD: Council Directive 73/23/EEC

3. Applied Standards

When the MX368011A is installed in the MG3681A, the applied standard conforms to the standards of MG3681A.

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C-tick marking

1. Product Name/Model Name

Product Name: PDC Software
Model Name: MX368011A

2. Applied Standards

When the MX368011A is installed in the MG3681A, the applied standard conforms to the standards of MG3681A.

About This Manual

This Operation Manual describes overview, sample measurement and remote control of the MX368011A PDC Software.

MX368011A PDC Software is a system software installed in the MG3681A Digital Modulation Signal Generator loaded with the MU368010A TDMA Modulation Unit.

The "MG3681A Digital Modulation Signal Generator Main Unit Operation Manual" is optionally available. Refer to the manual in addition to this Operation Manual.

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IV.

Section 1 Overview

This section explains product overview and configuration of the standard accessories of the MX368011A PDC Software.

1.1 Product Overview

MX368011A PDC Software is a system software installed in the MU368010A TDMA Modulation Unit.

To use the PDC software, the MG3680 series Digital Modulation Signal Generator (main frame) should be mounted with the TDMA Modulation Unit.

Installing the PDC software in this unit makes it possible to output the PDC modulation signal for the Japanese digital cellular system.

1.2 Product Configuration

The standard configuration of MX368011A is shown in the table below. When unpacking it, verify that all of these items are included. If there are any missing or damaged items found, please contact Anritsu or our representative.

Item	Model	Name	Quantity	Remarks
Main unit	MX368011A	PDC Software	1	Applicable system: PDC (Provided with a compact flash card or ATA flash memory card)
Accessories	—	PC card adapter	(1)	Provided only with compact flash card
	W1836AE	Operation Manual	1	

1.3 Handling the Memory Card

This unit employs a memory card as the external memory medium for data and programs.

Handling of the memory card is described below.

1.3.1 Notes on handling the memory card

Do not wipe the memory card using alcohol or other chemicals. It may cause panel peeling or result in injury, etc.

Do not bend or drop the memory card, nor apply strong shock to it.

Do not place heavy objects on the memory card or apply strong shock to it by putting it into your seat pocket.

Do not apply water on the memory card or expose it to direct sunlight.

Do not disassemble the memory card or insert metal objects such as clips into the terminal.

1.3.2 Storing the memory card

When not using the memory card, store it in the provided case. Store it in a place at temperatures of 4 to 53°C and humidity of 8 to 90% (without condensation).

Avoid storing in a place where:

- It is very dusty or humid
- It is near to magnetized objects
- It may be exposed to direct sunlight
- It is near a heat source

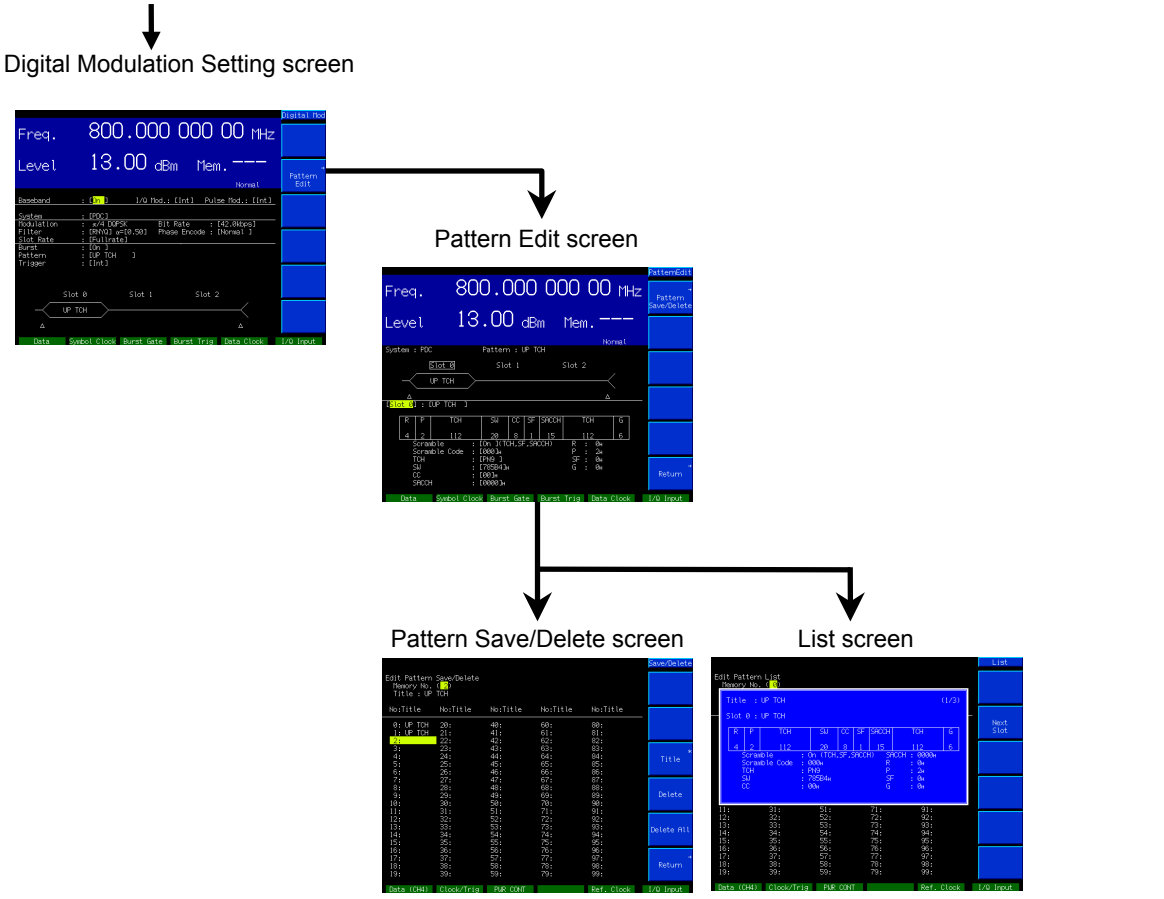
Section 2 Operation Overview

This section explains basic screens, output method of I/Q signal and input/output method of auxiliary signal when MU368010A TDMA Modulation Unit, that installed with MX368011A TDMA Software, is mounted on this unit.

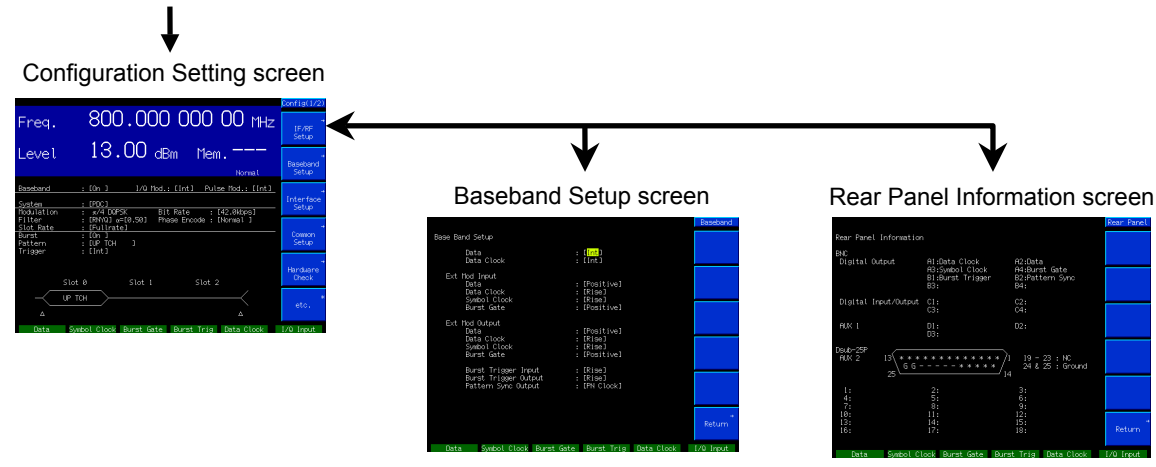
2.1 Diagram of Screen Transition

The transition of the screens is as follows.

Press the [Digital Mod] main function key.



Press the [Config] main function key.

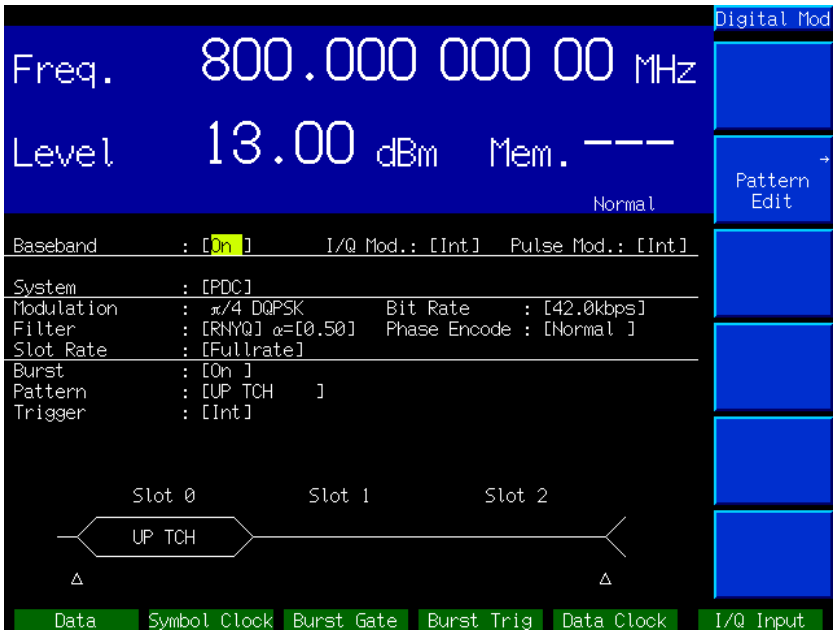


2.2 Setting the Modulation Parameters

2.2.1 Setting on the Main screen

Pressing the [Digital Mod] key lights a lamp and displays the Main screen. Basic parameters for digital modulation can be set on this screen. Setting contents for the Main screen are described below.

The triangle mark (△) in the figure below indicates burst trigger signal timing for the frame.



[1] Baseband

Selects On/Off for I/Q signal output.

[2] I/Q Mod.

Selects I/Q signal source for quadurature modulation. Select "Int" to set the I/Q signal source to an internal one (using MX368011A), or "Ext" to set it to external input.

Default value: Int

[3] Pulse Mod.

Sets the controller signal for pulse modulator of the MG3680 series main unit.

Int: Selects the controller signal for TDMA modulation unit. When [9] Burst is set to On, the pulse modulator operates according to the burst timing. When Burst is set to Off, the pulse modulator is fixed to On.

Normally set this item to Int.

Ext: The pulse modulator operates with external input signals regardless of modulation setting. The external signal inputs to the Pulse Input Connector on the front of this unit.

Off: The pulse modulator is fixed to On.

[4] System

Selects the communication system. When the PDC system is selected, modulation method (Modulation), roll-off rate (α) and bit rate (Bit Rate) are set as follows:

Communication system	Modulation method	Roll-off rate α	Bit rate
PDC	π/4 DQPSK	$\alpha = 0.5$	42.0 kbps

To select the PDC system, first select "TDMA" and then select "PDC".

[5] Bit Rate

Set the bit rate in the range of 37.8 to 46.2 kbps. When "PDC" is selected for [4] System, it is set to 42.0 kbps as default.

[6] Phase Encode

Selects Phase Encode function from "Normal" and "Inverse". See "2.6 Phase Encode Function" for details.

[7] Slot Rate

Select between "Full rate" and "Half rate". Select "Half rate" when using this unit as a PDC_H system for MG3680 series.

[8] Filter

Sets the type of baseband filter.
Select between Root-Nyquist [RNYQ] and Nyquist [NYQ].
Roll-off rate can be set in the range of 0.4 to 0.6. When "PDC" is selected for "[4] System", it is set to 0.50 as default.
Default value: RNYQ

[9] Burst

Sets the burst function to On/Off.

[10] Pattern

Selects the internal modulation data pattern. (This item cannot be set when "Data" in the Baseband Setup screen is set to "Ext".)

When the burst function is set to On:

Standard internal modulation data for the PDC system (see Section 3 "Function Details") or patterns saved in the internal modulation pattern memory can be set.

When the burst function is set to Off:

PN9, PN15 or repetition 4-bit (0000 to 1111) can be set.

[11] Trigger

When the burst function is set to On, the signal source of the burst trigger is set. Set to "Int" for the internal signal source or "Ext" for an external input.

Int: Outputs burst wave synchronous with the burst trigger signal generated in the modulation unit.

Ext: Outputs burst wave synchronous with the trigger signal inputted from the Burst Trig Input connector. When no trigger signal is inputted, no burst wave is outputted.

2.2.2 Using memory function

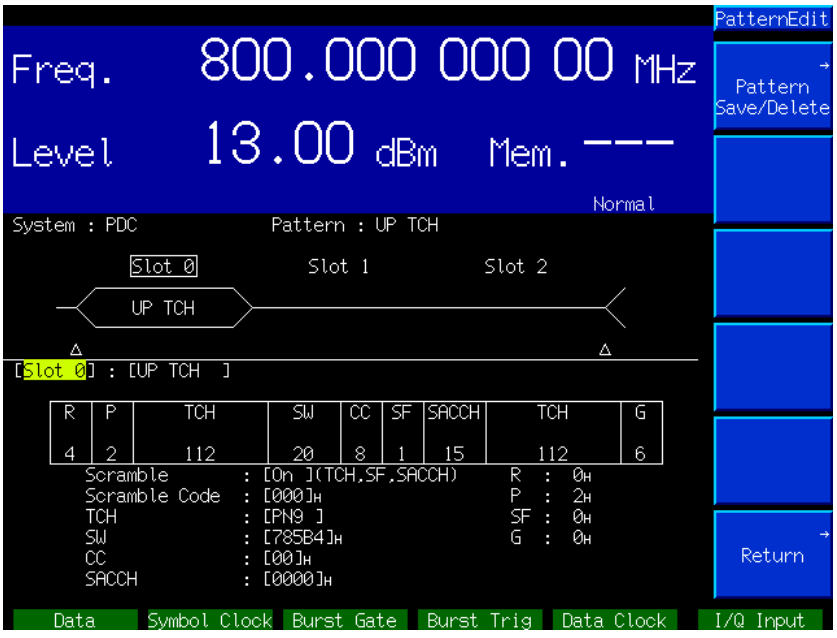
Saving the modulation data (Save)

The memory function of this unit can save up to 100 items of modulation data set in the Pattern Edit screen. Title (up to eight alphanumeric characters and symbols) can be added to the data. The procedure for saving the modulation data is described below.

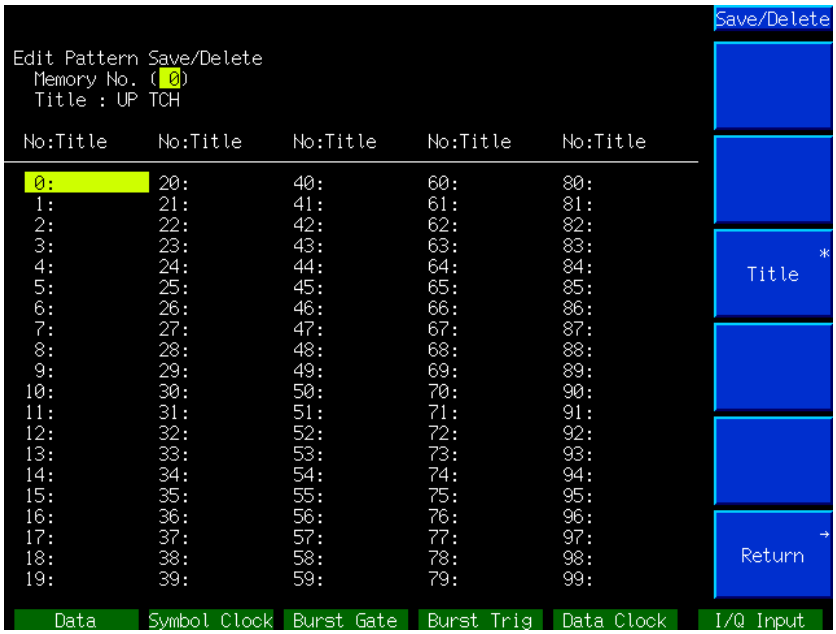
* The saving area for the modulation data is shared with TDMA communication systems. It may be therefore impossible to save items 100 in the memory for the modulation data when a large amount of data for other system is saved.

Sample operation: Save currently set modulation data in memory No. 1 with the title "ABCDEF".

[1] Set the modulation data on the screen for digital modulation parameter setting and then press F2 (Pattern Edit) to display the Pattern Edit screen.

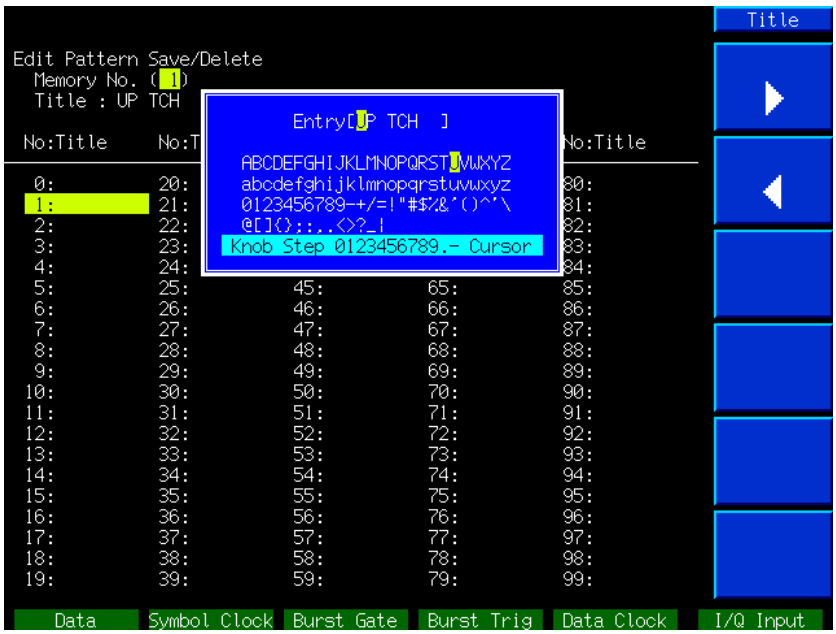


[2] On the Pattern Edit screen, press F1 (Pattern Save/Delete) to display the Pattern Save/Delete screen. The smallest No. that has nothing saved for it appears in "Memory No." at the upper left of the screen.



[3] Move the inverse cursor for memory No. to memory No. 1 using cursor keys. "1" also appears on "Memory No." at the upper left of the screen.

[4] Press F3 (Title) to display the screen for title input.



[5] Move the inverse cursor for characters to "A" using cursor keys. "A" also appears on "Entry" inverse cursor.

[6] Press F1 (▷) to move the inverse cursor in "Entry" to the right. Move the cursor for characters to "B" to input "B" to the inverse cursor position for "Entry".

[7] Repeat Step [6] to input "ABCDEF" in "Entry", then press Set. The title for memory No. 1 is then set to "ABCDEF". Press Set once more to save the modulation data for memory No. 1 and return to the Main screen.

[8] The inversed cursors for memory No. and characters can also be moved using the rotary knob or step keys.

[9] To overwrite the modulation data on memory No. already being used, the confirmation window (Yes/No) appears when the memory No. is specified. Select "Yes" and then press Set to overwrite and save data.

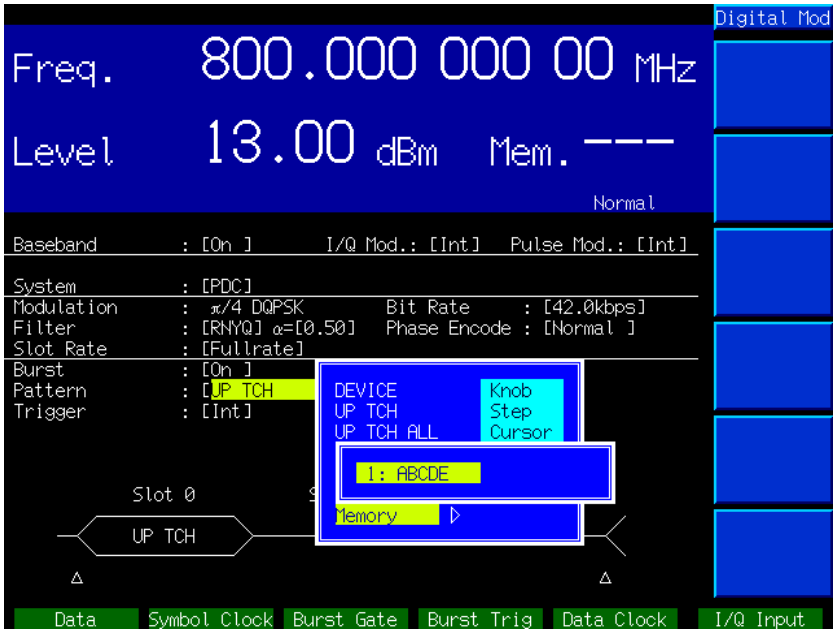
Recalling the modulation data (Recall)

The memory function of this unit can recall the modulation data memory saved in the Pattern Edit screen. The data recalling procedure for the modulation data is shown below.

Sample operation: The title "ABCDEF" and memory No. 1 where the modulation data is saved are recalled.

[1] From the screen for digital modulation parameter setting, open the pattern setting window. When internal modulation data is saved in memory, "Memory ▷" is displayed.

[2] Select the memory and then press Set to open another small window.



[3] Pressing Set to select the pattern closes the two windows and recalls the selected data. To close the small window only, press Cancel.

When 10 or more memories are available, switch the saved memory display by pressing F1 (Previous Page) and F2 (Next Page).

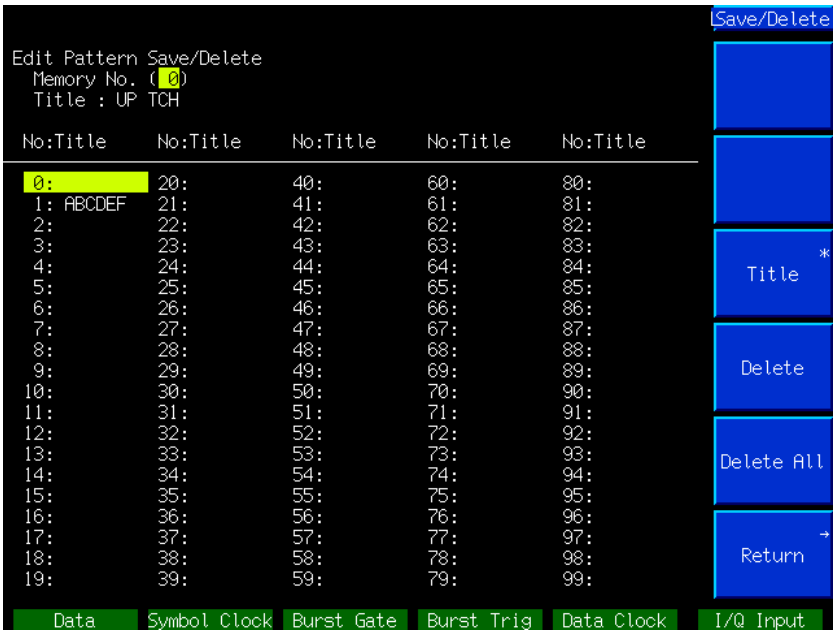
Deleting the internal modulation data (Delete)

The memory function of this unit can delete the modulation data saved in the Pattern Edit screen. The data deleting procedure for the modulation data is shown below.

Sample operation: Delete the data saved in the memory No. 1.

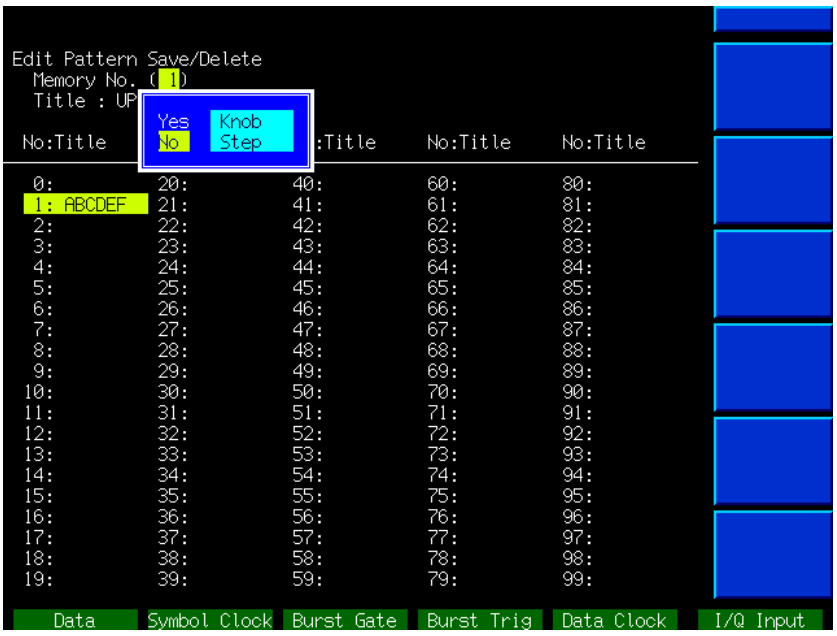
[1] On the screen for the digital modulation parameter setting, press F2 (Pattern Edit).

[2] Pressing F1 (Pattern Save/Delete) displays the Pattern Save/Display screen.



[3] Move the inversed cursor to memory No. 1 using cursor keys. "1" also appears on "Memory No." at the upper left of the screen.

[4] Pressing F2 (Delete) displays a Yes/No window to confirm delete operation.



[5] Select "Yes" and then press Set. The Yes/No window disappears and data saved in the memory No. 1 is deleted.

The inversed cursor for memory No. can also be moved using the rotary knob or step keys.

Note:

Selecting F5 (Delete All) in the Pattern Save/Display screen deletes all memory data on the screen.

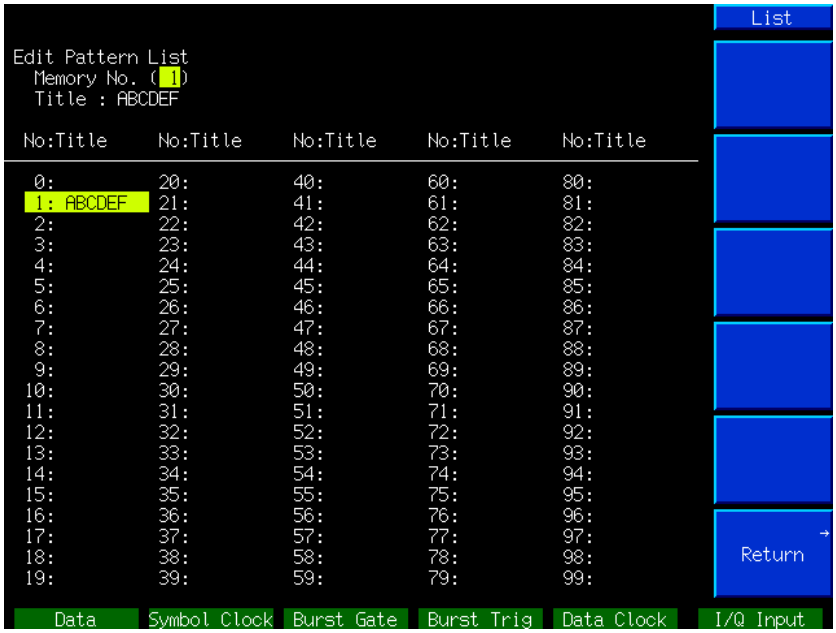
Checking the saved internal modulation data (List)

The memory function of MX368011A enables the display of the modulation data list saved from the Pattern Edit screen to check them. The checking procedure for the saved modulation data is shown below.

Sample operation: Check the modulation data saved on memory No. 1.

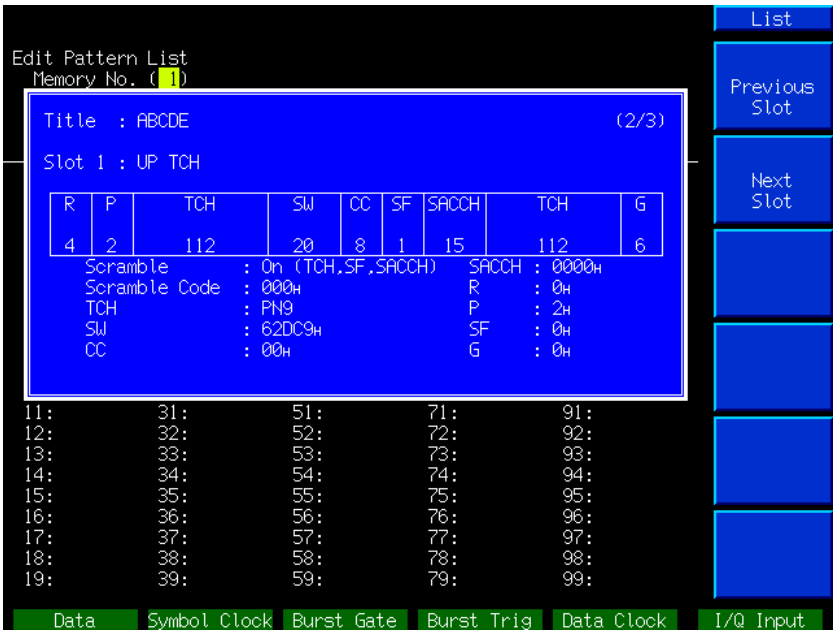
[1] Pressing F2 (Pattern Edit) in the screen for digital modulation parameter setting displays the Pattern Edit screen.

[2] Pressing F2 (Pattern List) displays the Pattern List screen.



[3] Move the inverse cursor to memory No. 1.

[4] Pressing Set displays the setting window for the modulation data saved in memory No. 1 by one slot. Press F1 (Previous Slot) and F2 (Next Slot) to display the desired slot.



[5] When the checking is completed, press Cancel to close the setting window.

2.3 Setting the Symbol Adjust Function

In π/4DQPSK modulation such as PDC, a modulation symbol consists of 2 bits. The synchronization status of the symbol therefore becomes unstable when inputting external data or data clock.

The Symbol Adjust function defines the synchronization status of the symbol. It consists of the "automatic synchronization function" and the "synchronization status change function".

Automatic synchronization function

This function synchronizes the external symbol clock inputted and the internal symbol when the setting allows symbol clock input. When a relevant symbol clock is inputted, the "Symbol Adjust" display from the function key disappears. At the same time, the internal symbol synchronization of this unit is adapted to the input symbol clock.

Synchronization status change function

When the setting allows symbol clock input and no external symbol clock is inputted, "Symbol Adjust" is displayed on the function key. Pressing F1 (Symbol Adjust) in the screen for the digital modulation parameter setting changes the synchronization status of the symbol. Pressing F1 again restores the synchronization status of the symbol.

Status in which the Symbol Adjust function is enabled

Setting on the Baseband Setup screen		Symbol Adjust function
Data Clock	Data	
Int	Int	Disabled
Int	Ext	Enabled
Ext	Int	Enabled
Ext	Ext	Enabled

Disabled: Symbol clock cannot be inputted. The Symbol Adjust key cannot be used.

Enabled: When a symbol clock is inputted, the unit operates in synchronization with it.
When no symbol clock is inputted, the synchronization status of the symbol becomes unstable. In this case, the synchronization status of the symbol can be changed by pressing the Symbol Adjust key.

2.4 Outputting I/Q Signal

Signal output from I/Q signal output on the front panel can be set to On/Off by setting baseband to On/Off. This also sets the auxiliary signal on the rear panel to On/Off.

2.4.1 Output level

The setting range of I/Q signal output level when PDC system is selected is shown in the table below.

When the optional "MG3681A-11: Expansion I/Q Signal Output" is loaded, the output level can be changed to 80 to 120% of that in the table.

Refer to "3.4 Setting the Baseband Signal Output" in the Operation Manual for MG3681A (main unit) for the setting procedures.

I/Q level	Output impedance
500 mV (rms)	50 Ω

Definition of the I/Q signal output level

For the terminal voltage when pattern is set to "PN9": value for $\sqrt{I^2 + Q^2}$

Terminal impedance: 50 Ω

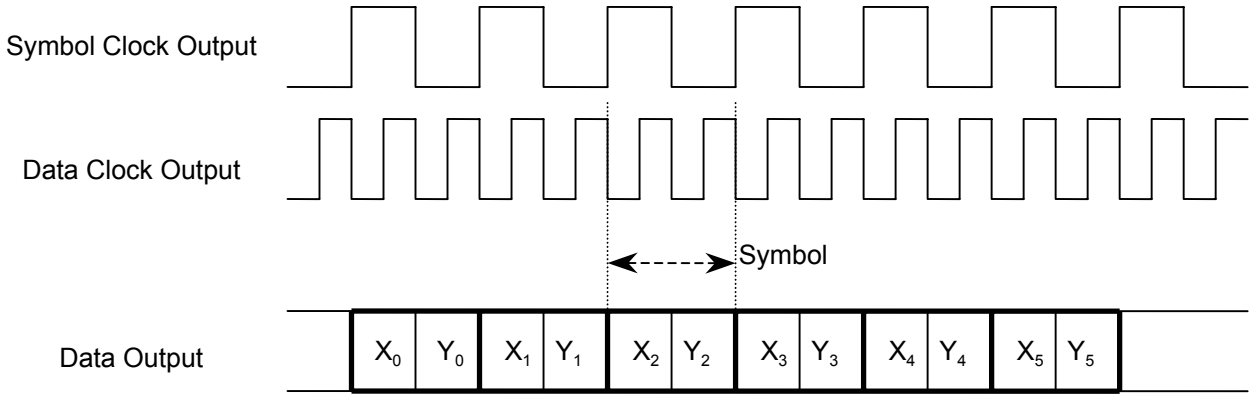
2.5 Inputting/Outputting Auxiliary Signal

2.5.1 Outputting auxiliary signal

Details on auxiliary (controller) signal output from the rear of this unit is described below.

Data, Data Clock and Symbol Clock signals

Output timing for Data, Data Clock and Symbol Clock signals are shown in the figure below. Polarity is indicated as Positive and Rise in the figure.



A Symbol consisting of X_n and Y_n where X_n indicates preceding data.

Pattern Sync signal

The Pattern Sync Output signal differs depending on On/Off status of the burst function.

When the burst function is set to On

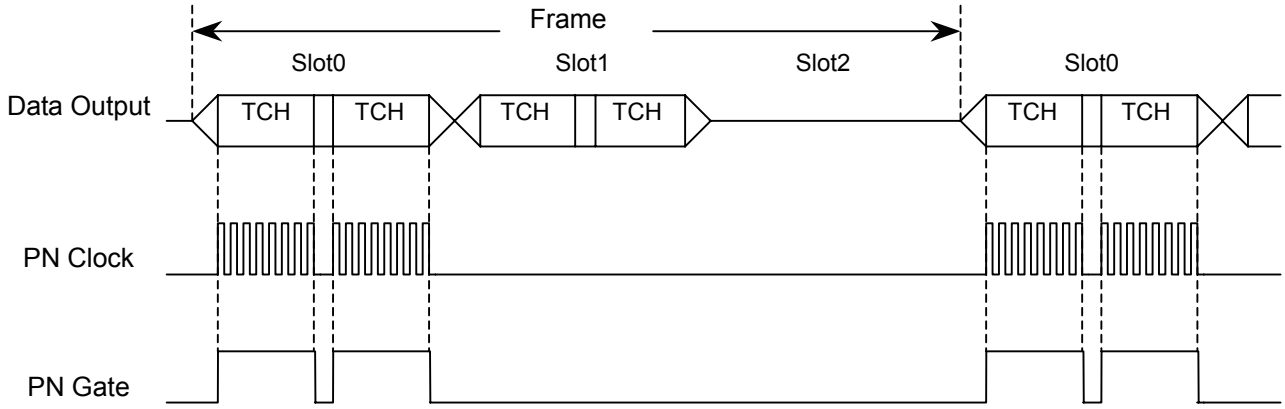
The Pattern Sync Output signal is a controller signal that is synchronous to the frame.

When PN Clock is selected:

Outputs the clock in the pseudo random pattern of the first output slot in the frame.

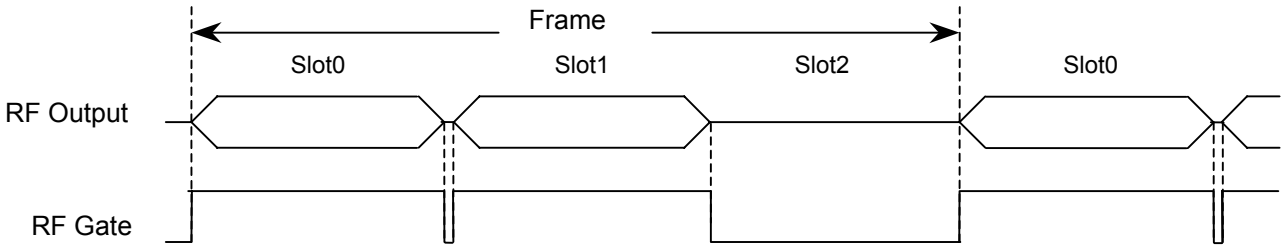
When PN Gate is selected:

Outputs the gate signal in the pseudo random pattern of the first output slot in the frame.

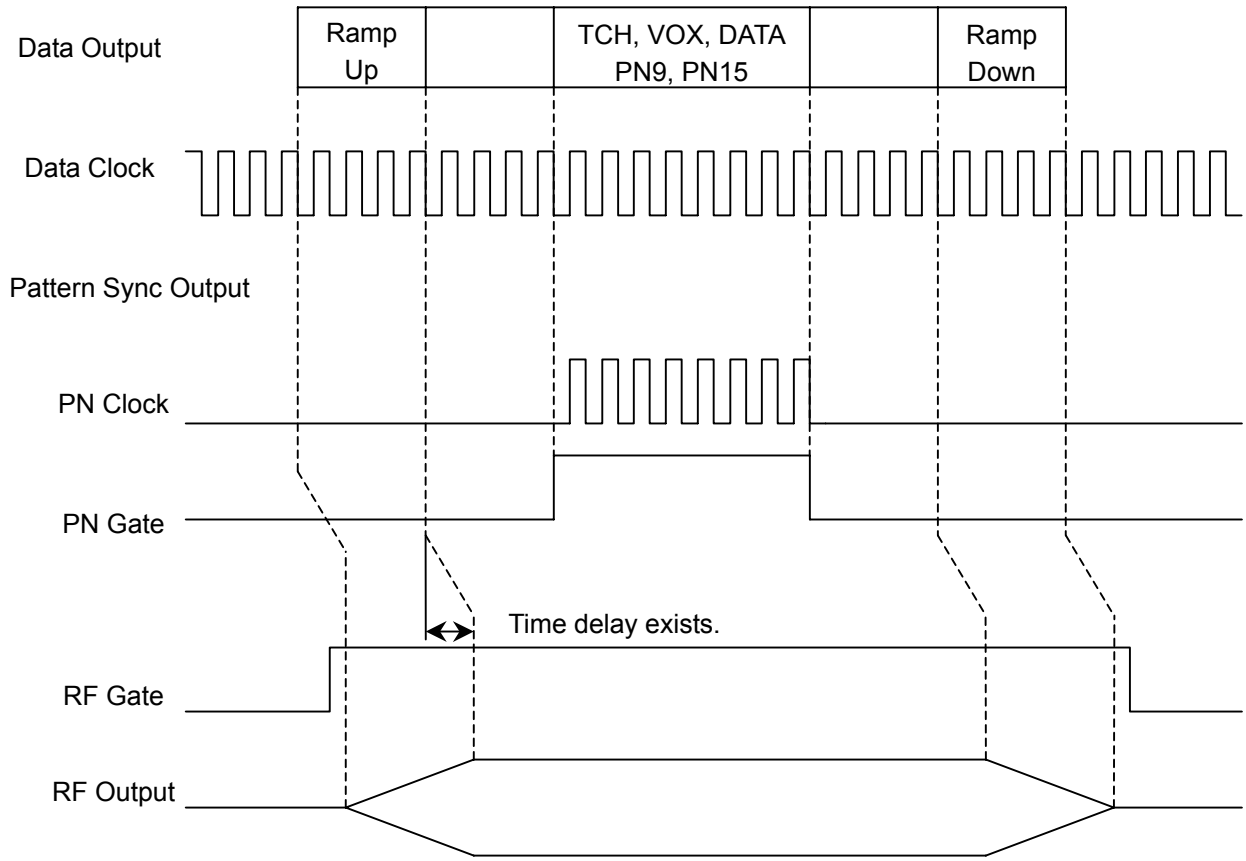


When RF Gate is selected:

Outputs the controller signal of the internal pulse modulator for the main unit.



Slot details are shown in the figure below. The slot format in the figure is a sample for description and differs from that of the actual system.

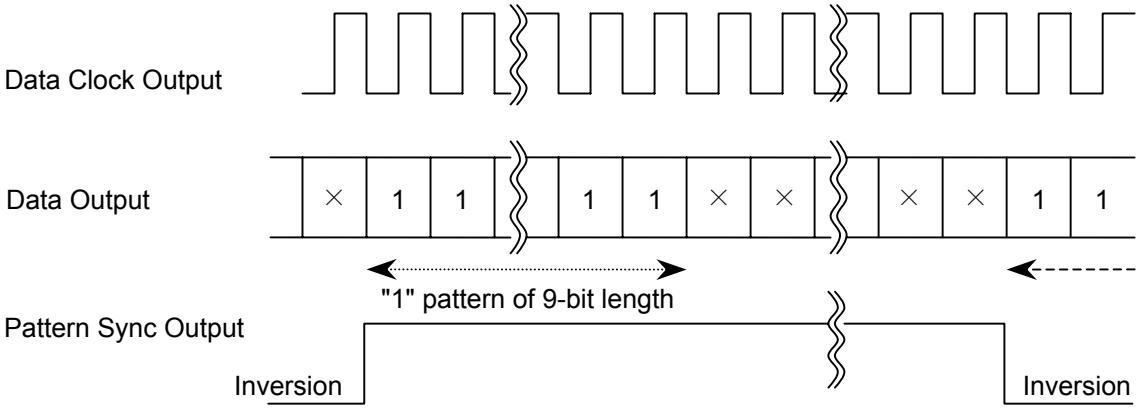


When the burst function is set to Off

Pattern Sync Output signal is a signal that is synchronous to the output pattern.

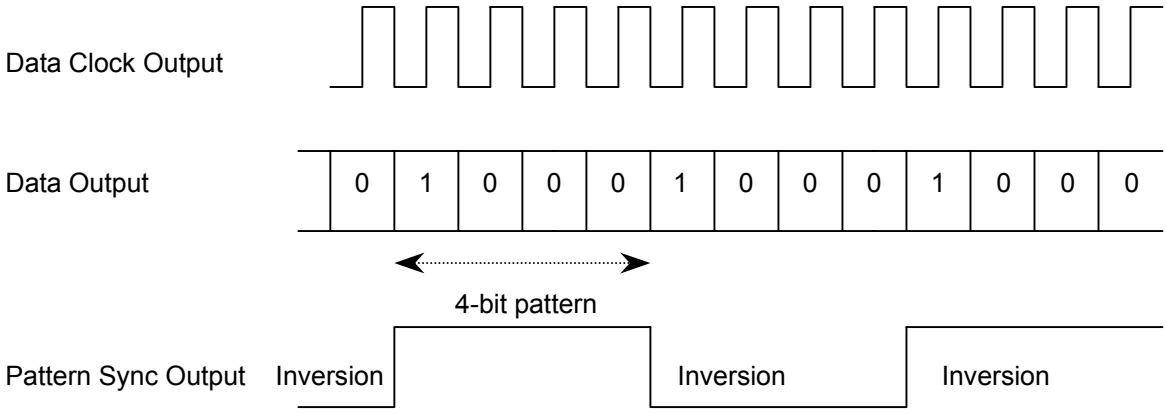
When PN pattern is selected:

Outputs "1" of 9-bit length when PN9 is selected, or outputs inversed signals at the beginning of the continuous pattern of "0" of 15-bit length when PN15 is selected. The output signal when PN9 is selected is shown in the figure below.



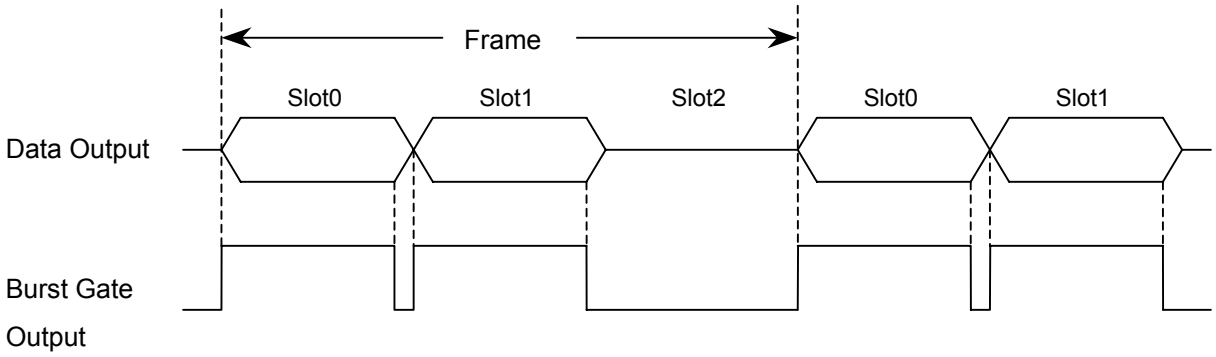
When 4-bit pattern is selected:

When 4-bit pattern is selected: Outputs the signal inverses at the beginning of the 4-bit pattern. The output signal when the 4-bit pattern is set to "1000" is shown in the figure below.

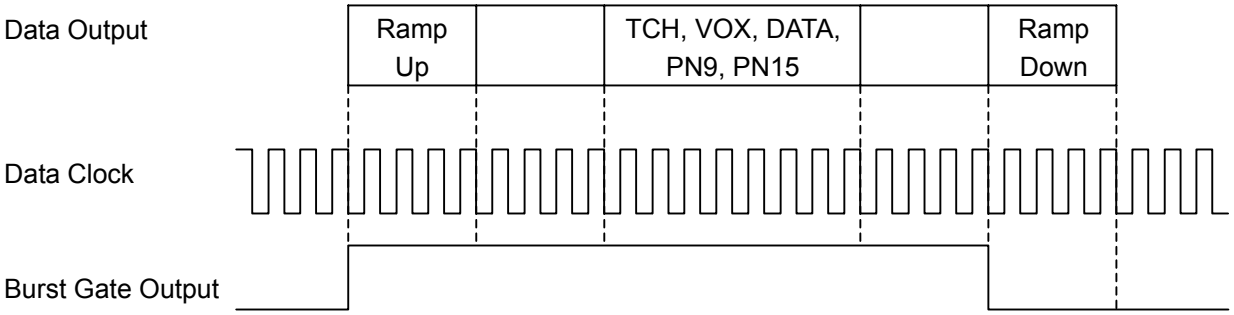


Burst Gate signal

Outputs a signal corresponding to the output slot when modulating with the burst function set to On and based on the internal pattern.



Slot details are shown in the figure below. The slot format in the figure is a sample for description and differs from that of the actual system.

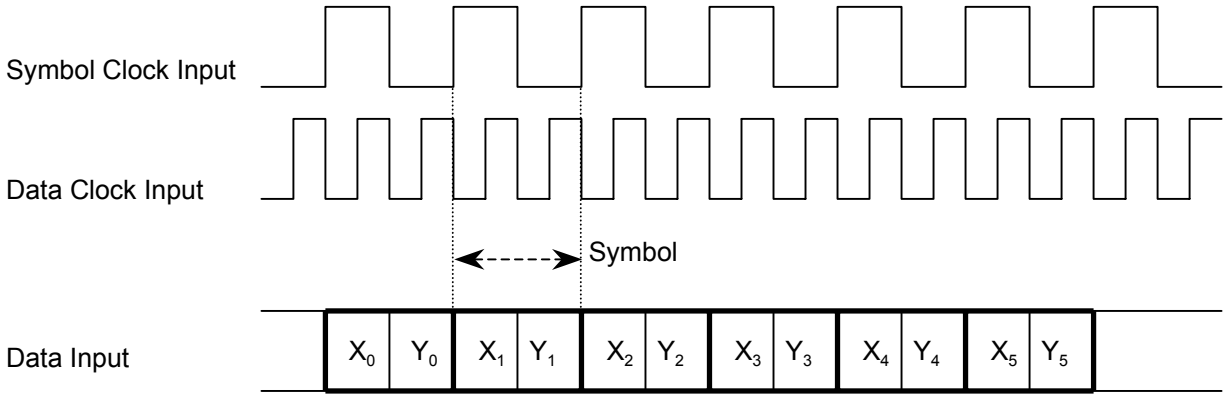


2.5.2 Inputting auxiliary signal

Details on auxiliary (controller) signal input to the front connector of this unit are described below.

Data, Data Clock and Symbol Clock signals

Input timing for Data, Data Clock and Symbol Clock signals are shown in the figure below. Polarity is indicated as Positive and Rise in the figure.

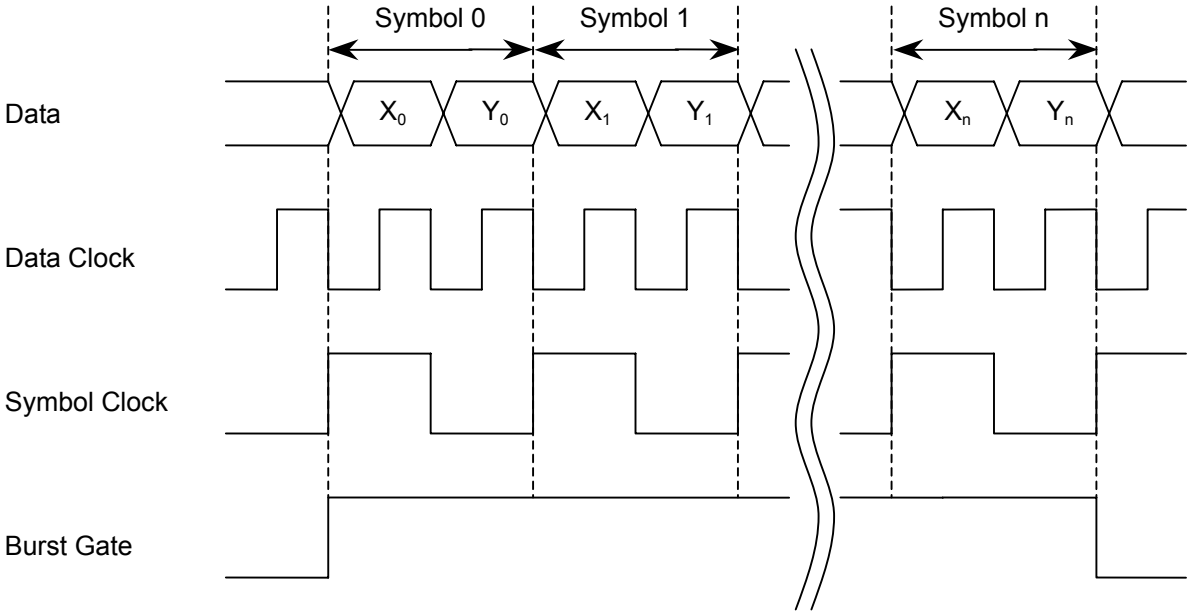


A Symbol consisting of X_n and Y_n where X_n indicates preceding data. When inputting one or two of the signals above, align the timing to the output signal of the signal that is not input.

Burst Gate signal

The Burst Gate signal can be input when the burst function is set to On and using external data input. Input the signal with the same timing to data to generate an RF burst signal equivalent to the burst signal generated using an internal pattern. (Prevents spectrum from degrading by adding a smooth inclination to its rising and falling edges.)

Input timing for Data, Data Clock and Symbol Clock signals are shown in the figure below.



$n \geq 13$

Note:

The corresponding symbol for the rising edge of power are 0 and 1, while n+1 and n+2 correspond to the falling edge.

Therefore, the range of the symbol that can be modulated at the receiver is symbol 2 to symbol n.

2.6 Phase Encode Function

This function inverts the phase change direction for the modulation data while changing the differential coding rule for π/4DQPSK modulation. This function enables up/down inversion of the modulation wave spectrum with the transmission wave frequency as the center.

The differential coding rule is shown below.

Differential coding rule for π/4DQPSK modulation

XY	Phase change△ϕ [rad]	
	Normal	Inverse
11	–3π/4	3π/4
01	3π/4	–3π/4
00	π/4	–π/4
10	–π/4	π/4

Note:

X and Y indicates symbols consisting of 2 bits where X indicates the preceding bit.

2.7 Auxiliary Signal I/O Connector

The I/O connector for the auxiliary signal does not show each signal name on the panel because it is used commonly with different communication system software. The auxiliary signal I/O terminals for the PDC system is shown below.

Front panel

The signal names for the BNC connector on the front panel are shown in the table below. They are also indicated at the bottom of the LCD display.

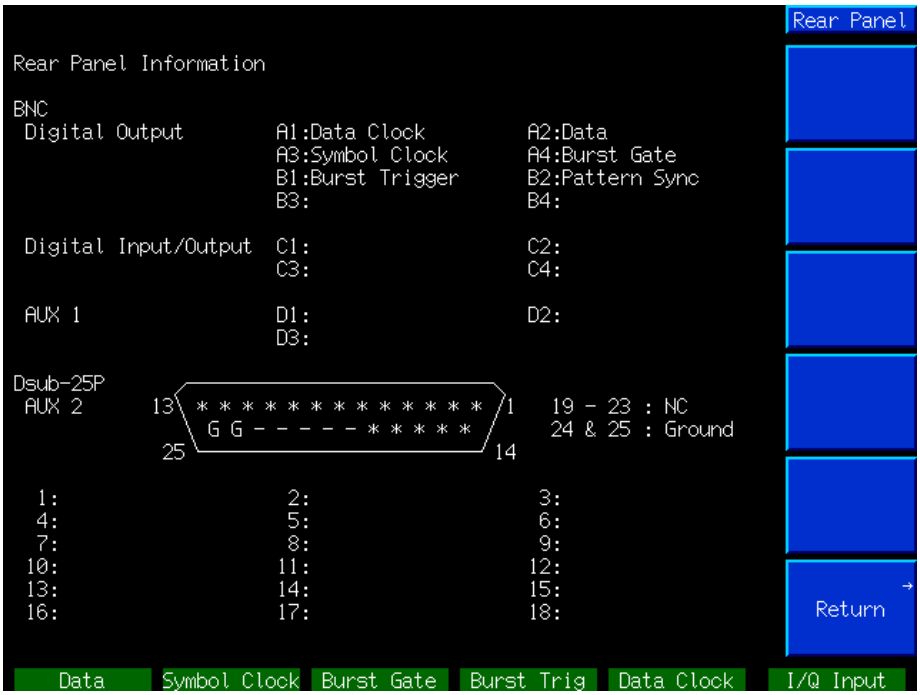
Connector Name	Auxiliary Signal Name
Digital Input 1	Data Input
Digital Input 2	Symbol Clock Input
Digital Input 3	Burst Gate Input
Digital Input 4	Burst Trigger Input
Digital Input 5	Data Clock Input

Rear panel

The signal names for the BNC connector on the rear panel are shown in the table below. They are also displayed on the Rear Panel Information screen.

Connector Name	Auxiliary Signal Name
A1	Data Clock Output
A2	Data Output
A3	Symbol Clock Output
A4	Burst Gate Output
B1	Burst Trigger Output
B2	Pattern Sync Output

To display the Rear Panel Information screen, press the Config main function key and then press F5 (Hardware Check) and F4 (Rear Panel Information) in this order.



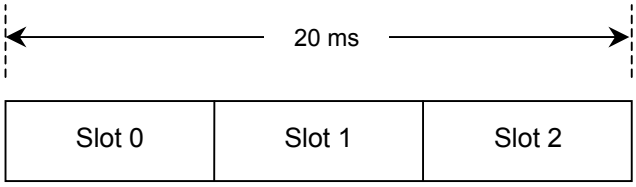
Section 3 Operation Details

This section describes details on PDC system operation, generated patterns and the trigger function.

3.1 Frame Configuration

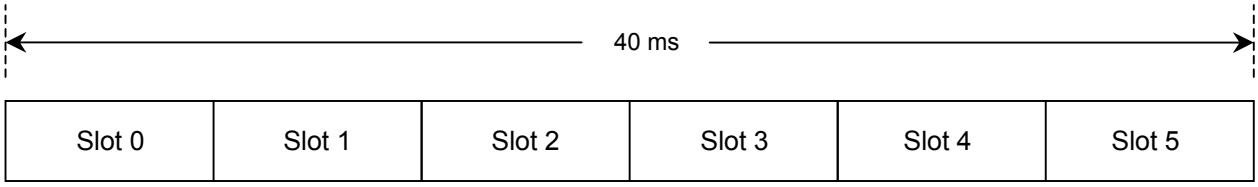
Full rate

PDC system consists of three slots of TDMA frame, the period for data generation. However, the PN9/PN15 pseudo random pattern of each slot is independent at each slot while possessing continuity.



Half rate

The PDC system consists of six slots of TDMA frame, the period for data generation. However, the PN9/PN15-layer pseudo random pattern of each slot is independent in each slot while possessing continuity.



3.2 Slot Configuration

There are four types of slots for device evaluation, up- and down-traffic channels and VOX control.

3.2.1 Device evaluation (DEVICE)

R	PN	G
4	270	6

R : Guard period for burst transient response.. 0_H (4 bits)

PN : Pseudo random pattern..... PN9 pseudo random pattern independent by each slot (PN pattern has continuity at the same slot)

G : Burst transient response guard ..... 0_H (6 bits)

[Setting parameter]

- PN : PN9 or PN15 random pattern

3.2.2 Up-Traffic channel (UP TCH)

R	P	TCH	SW	CC	SF	SACCH	TCH	G
4	2	112	20	8	1	15	112	6

R : Guard period for burst transient response.....0_H (4 bits)

P : Preamble.....2_H (2 bits)

TCH : For user information transfer .....PN9 pseudo random pattern independent by each slot (PN pattern has continuity at TCH of the same slot)

SW : Synchronization word .....Slot 0 = $785B4_H$ (20 bits)
Slot 1 = $62DC9_H$ (20 bits)
Slot 2 = $7E28A_H$ (20 bits)

CC : Color code .....00_H (8 bits)

SF : Still flag.....0_H (1 bit)

SACCH : Slow additional control channel .....0000_H (15 bits)

G : Guard period for burst transient response.....0_H (6 bits)

Scrambling function (TCH,SF,SACCH): .....On

Scramble code : .....000_H (9 bits)

[Setting parameter]

- CC : 00_H to FF_H (8 bits)
- SACCH : 0000_H to $7FFF_H$ (15 bits)
- TCH : PN9 or PN15 pseudo random pattern
- SW : 00000_H to $FFFF_H$ (20 bits)
- Scrambling function : On/Off
- Scramble code : 000_H to $1FF_H$ (9 bits)

3.2.3 Down-Traffic channel (DOWN TCH)

R	P	TCH	SW	CC	SF	SACCH	TCH
4	2	112	20	8	1	15	112

R : Guard period for burst transient response .... 0_H (4 bits)
P : Preamble ..... 2_H (2 bits)
TCH : For user information transfer ..... PN9 pseudo random pattern independent by each slot (PN pattern has continuity at TCH of the same slot)
SW : Synchronization word ..... Slot 0 = $87A4B_H$ (20 bits)
Slot 1 = $9D236_H$ (20 bits)
Slot 2 = $81D75_H$ (20 bits)
CC : Color code ..... 00_H (8 bits)
SF : Still flag ..... 0_H (1 bit)
SACCH : Slow additional control channel ..... 000000_H (21 bits)
Scrambling function (TCH,SF,SACCH): ..... On
Scramble code : ..... 000_H (9 bits)

[Setting parameter]

- CC : 00_H to FF_H (8 bits)
- SACCH : 000000_H to $7FFFFF_H$ (21 bits)
- TCH : PN9 or PN15 pseudo random pattern
- SW : 00000_H to $FFFF_H$ (20 bits)
- Scrambling function : On/Off
- Scramble code : 000_H to $1FF_H$ (9 bits)

3.2.4 VOX control (UP VOX)

G	R	P	SW	CC	SF	SACCH	G
108	4	6	20	8	1	15	118

R : Guard period for burst transient response.....0_H (4 bits)
G : Guard period for burst transient response.....0_H (118 bits)
P : Preamble.....26_H (6 bits)
SW : Synchronization word .....Slot 0 = $785B4_H$ (20 bits)
Slot 1 = $62DC9_H$ (20 bits)
Slot 2 = $7E28A_H$ (20 bits)
CC : Color code .....00_H (8 bits)
SF : Still flag.....0_H (1 bit)
SACCH : Slow additional control channel .....0000_H (15 bits)
Scrambling function (TCH,SF,SACCH): .....On
Scramble code : .....000_H (9 bits)
[Setting parameter]
- CC : 00_H to FF_H (8 bits)
- SACCH : 0000_H to $7FFF_H$ (15 bits)
- SW : 00000_H to $FFFF_H$ (20 bits)
- Scrambling function : On/Off
- Scramble code : 000_H to $1FF_H$ (9 bits)

3.3 Standard Internal Modulation Data (Full rate)

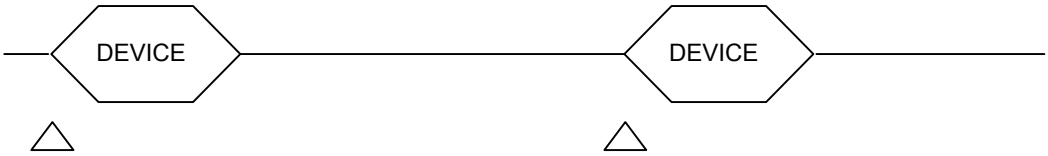
The PDC system has six standard internal modulation data for each of the full and half rate. Select the standard internal modulation data at the item "Pattern" in the screen for the digital modulation parameter setting. This sub-section describes full rate while the next sub-section describes half rate.

Note:

The triangle mark (ρ) in the figures below indicates the burst trigger position.
It is impossible to set all of slot 0 to 2 to Off.

3.3.1 DEVICE

RF output when slot 0 is applied for the device evaluation slot.



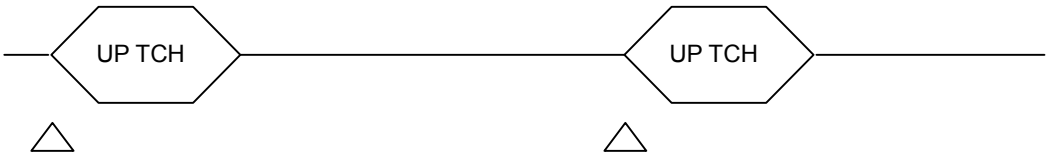
[Setting parameter]

- Slot

Sets slots 1 and 2 to DEVICE or Off.

3.3.2 UP TCH

RF output when slot 0 is applied for the up-traffic channel.



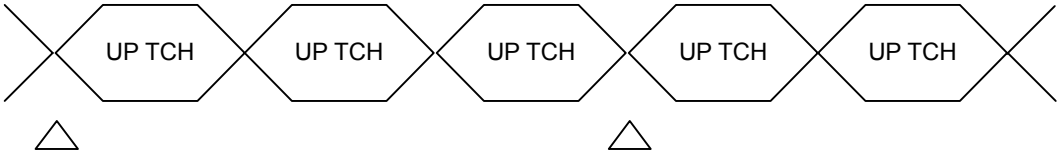
[Setting parameter]

- Slot

Sets the slot 0 to UP TCH or OFF and slots 1 and 2 to one of UP TCH, VOX or Off.

3.3.3 UP TCH ALL

RF output when all of slot 0 to 2 are applied for the up-traffic channel.



[Setting parameter]

- Slot

Sets the slots 0 to 2 to UP TCH, VOX or Off.

3.3.4 UP VOX

RF output when slot 0 is applied for VOX control.

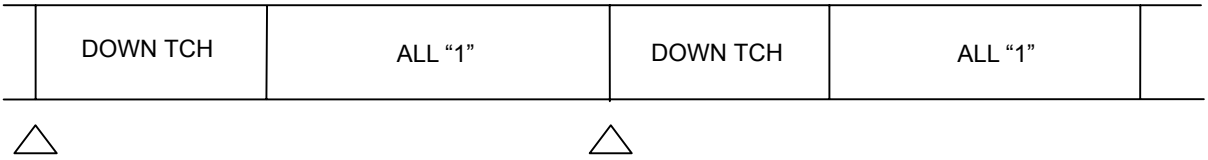
[Setting parameter]

- Slot

Sets slot 0 to UP TCH or VOX and slots 1 and 2 to UP TCH, VOX or Off.

3.3.5 DOWN TCH (DN TCH)

RF output when slot 0 is applied for down-traffic channel. RF output is the continuous wave.



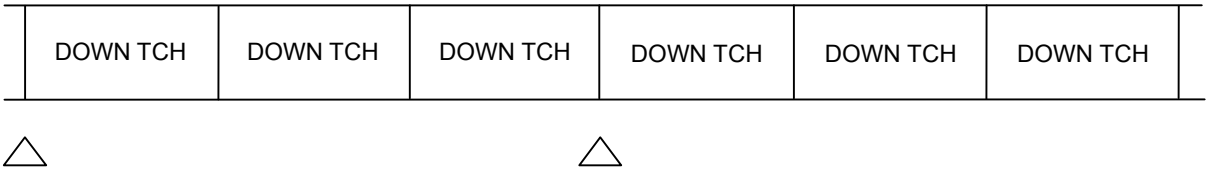
[Setting parameter]

- Slot

Sets the slots 1 and 2 to DOWN TCH or Off.
(Off slot outputs ALL "1".)

3.3.6 DOWN TCH ALL (DN TCH ALL)

RF output when all of slot 0 to 2 are applied for down-traffic channel. RF output is the continuous wave.



[Setting parameter]

- Slot

Sets the slots 0 to 2 to DOWN TCH or Off.
(Off slot outputs ALL "1".)

3.4 Standard Internal Modulation Data (Half rate)

3.4.1 DEVICE

RF output when slot 0 is applied for the device evaluation slot.

[Setting parameter]

- Slot

Sets slots 0 to 5 to DEVICE or Off.

3.4.2 UP TCH

RF output when slot 0 is applied for the up-traffic channel.

[Setting parameter]

- Slot

Sets the slot 0 to UP TCH or OFF and slots 1 to 5 to one of UP TCH, VOX or Off.

3.4.3 UP TCH ALL

RF output when all of slot 0 to 5 are applied for the up-traffic channel.

[Setting parameter]

- Slot

Sets the slots 0 to 5 to one of UP TCH, VOX or Off.

3.4.4 UP VOX

RF output when slot 0 is applied for VOX control.

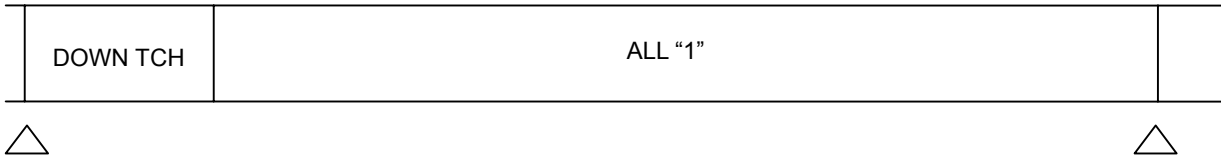
[Setting parameter]

- Slot

Sets slot 0 to UP TCH or VOX and slots 1 to 5 to UP TCH, VOX or Off.

3.4.5 DOWN TCH (DN TCH)

RF output when slot 0 is applied for down-traffic channel. RF output is the continuous wave.



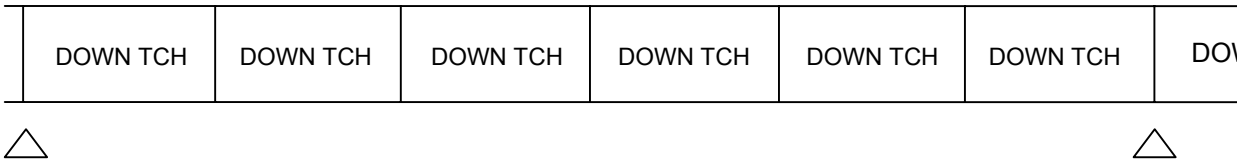
[Setting parameter]

- Slot

Sets the slots 1 to 5 to DOWN TCH or Off.
(Off slot outputs ALL "1".)

3.4.6 DOWN TCH ALL (DN TCH ALL)

RF output when all of slot 0 to 5 are applied for down-traffic channel. RF output is the continuous wave.



[Setting parameter]

- Slot

Sets the slots 0 to 5 to DOWN TCH or Off.
(Off slot outputs ALL "1".)

3.5 Trigger Function

When the burst function is set to on, there are two trigger functions for burst wave generation; the internal trigger operation and external trigger operation.

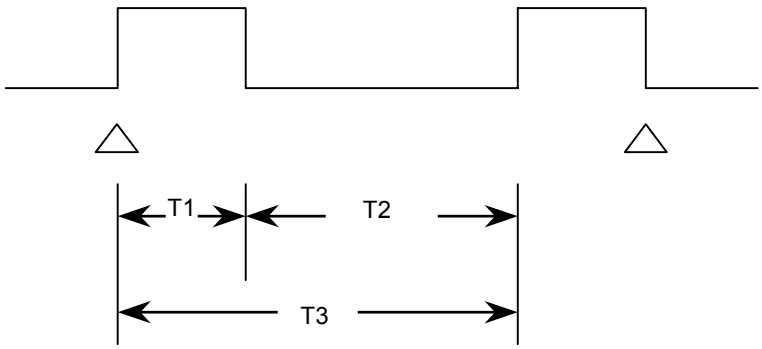
3.5.1 Internal trigger operation

This operation generates burst wave while synchronizing with the internal trigger signal. The internal trigger signal is outputted from the Burst Trig Output connector on the rear panel. The trigger signal is generated at the frame repetition period. The period for PDC system is 20 ms for full rate or 40 ms for half rate.

3.5.2 External trigger operation

This operation generates burst wave while synchronizing with the external trigger signal inputted. External trigger signal is inputted from the Burst Trig Input connector on the front panel.

(1) Input conditions for an external trigger signal
Input level: TTL level
Polarity: Rising or falling edges can be selected
Waveform: Waveform of the rising edge is shown in the figure below.



T1 : 0.1 µs or more
T2 : 0.1 µs or more
T3 : Burst repetition period (frame period) ± one symbol
Rising/falling time : 100 ns or less

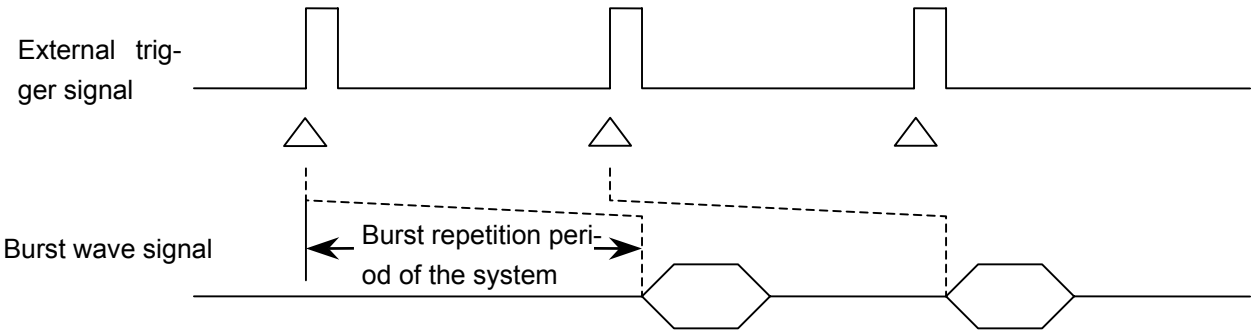
Point:

Ringing of the trigger signal waveform may cause malfunctioning.

In this case, insert a dumping resistor into the output edge of the trigger signal to weaken the waveform.

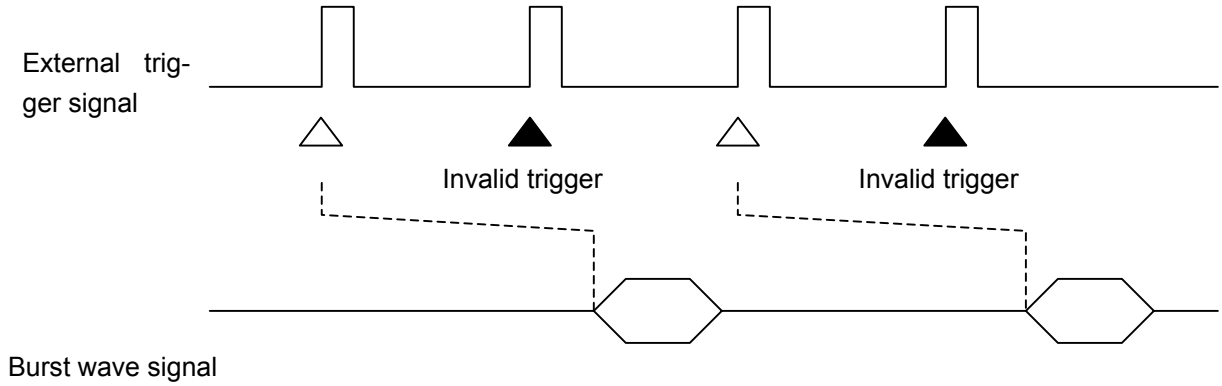
(2) Relationship between external trigger input signal and burst wave output

The burst signal is outputted one burst repetition period behind the external trigger input signal.



Note:

When the external trigger input signal repetition period is lower than the input condition in (1), the trigger signal is masked, invalid triggers are generated as shown below and the burst wave corresponding to the trigger signal cannot be obtained.

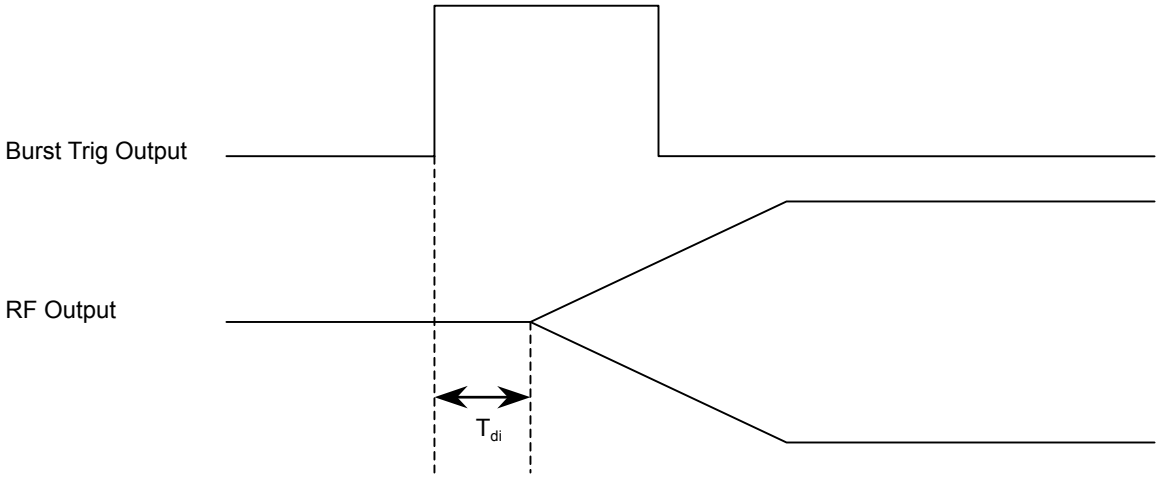


3.5.3 Output timing for burst trigger and RF signals

Care must be taken for the output timing of the burst trigger and output signal when synchronizing this unit with other equipment using its burst trigger signal. Output timing for the trigger and RF signals are shown in the figure below.

When using an internal trigger signal

Output timing for the RF signal when synchronizing this unit with other equipment using its Burst Trig Output signal (rear panel) is shown in the figure below.



T_{di}: The internal trigger signal is the delay time for burst signal output, the time from the trigger signal to the rising edge of the first slot of the frame.

Relationship between PDC system and delay time T_{di}

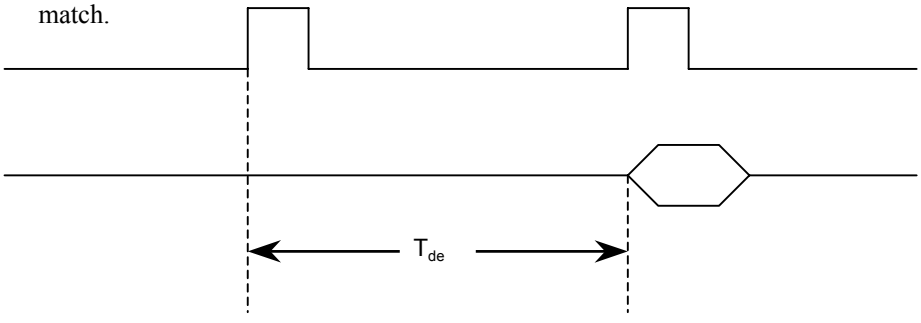
PDC: 46.1 μs (typical value: not a standard)

Note:

The value for T_{di} includes errors caused by individual differences in the equipment. It is an equipment-specific value, not including jitter.

When using an external trigger signal

The output timing for the RF signal when synchronizing this unit with other equipment using its Burst Trig Input signal (front panel) is shown in the figure below. The RF signal is outputted one frame period (T_{de}) behind when the trigger signal is inputted. When the trigger signal of frame period according to the communication system is inputted, the output timing for the second trigger signal and the RF signal match.



T_{de}: The external trigger signal is the delay time for burst signal output, the time from the trigger signal to the rising edge of the first slot of the frame.

When using an external trigger signal, the value of T_{de} varies according to the measure to synchronize the MG3681A (main unit) and the equipment generating trigger signal. The value of T_{de} for each synchronizing measure is shown below.

T_{de} = Frame period of the communication system + T_{di} ± synchronization error (1/16 symbol)

T_{de} : Delay time when connected using trigger signal

T_{di} : Delay time when using internal trigger signal

Synchronization error: Jitter of ± 1/16 symbol range is generated because this unit and the external trigger signal generator are not synchronized.

Note:

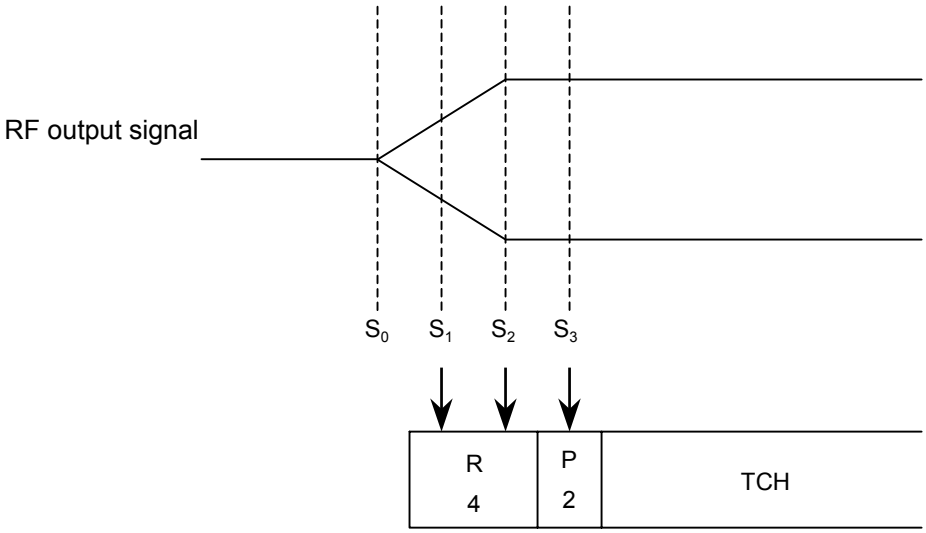
Jitter is not generated when this unit and the external trigger signal generator are synchronized using a 10/13-MHz reference signal. However, it is not constant in the range of 1/16 symbol of the synchronization error.

Relationship between PDC system and delay time T_{de}

T_{de} = 20 ms + (46.1 ± 2.98) μs (typical value: not a standard)

3.5.4 Relationship between RF signal and symbol determination point

The relationship between the RF signal and symbol determination point in the PDC system is shown in the figure below. The symbol determination point for the modulation data corresponding to the RF signal of Slot 0 of up-transmission channel is shown as an example.



S1 : The first symbol point after the phase change corresponding to the lamp bit for the burst transient response

S2 : The second symbol point after the phase change corresponding to the lamp bit for the burst transient response

S_3 : The symbol point after the phase change corresponding to the pre-amble (Symbol movement corresponding to the pre-amble data is equivalent to the movement to S_2 and S_3.)

The delay time from the burst trigger signal to the rising edge of the RF output is the time from the burst trigger signal to S_0. See "3.5.3 Output timing for burst trigger and RF signals" for details.

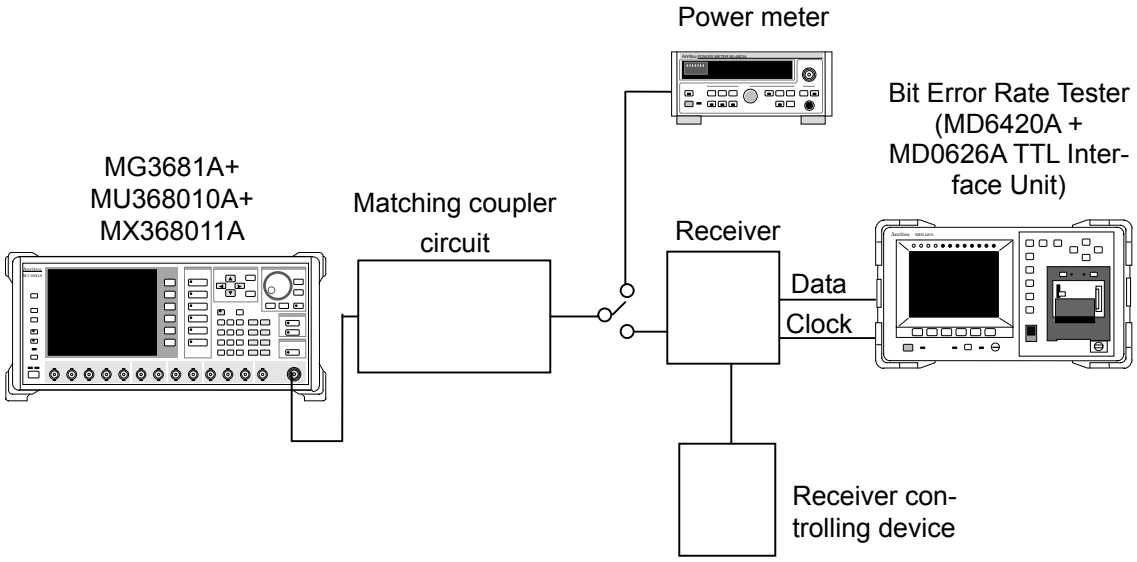
Section 4 Measurement

This section describes measurement for the bit error rate of the receiver and evaluation measurement for modulator and demodulator, with sample measurement using the PDC system.

4.1 Measurement for the Bit Error Rate of the Receiver

This sub-section describes measurement for the bit error rate of the receiver when using the PDC system. Here we describe receivers that can be set to reception mode by an external controller without using call processing. The Anritsu MD6420A Data Transmission Analyzer is used as the bit error measuring device in the example below.

(1) Setup



(2) Measurement procedure

[1] Set frequency and output level of this unit to desired value.

[2] Set the modulation method of this unit to "PDC".

[3] Set the modulation pattern of this unit to one that can be received by the receiver such as "DN TCH".

[4] Connect the RF output of this unit to the power meter via matching coupler circuit. Adjust the output level of this unit so that the sensitivity test level can be obtained at the power meter.

[5] Switch the output of the matching coupler circuit to the receiver.

[6] Set the receiver to reception mode using the receiver controlling device.

[7] Connect the demodulated data output and data clock of the receiver to the signal error rate measuring device.

[8] Connect the data and clock from the receiver to RD (Data) and RT (Clock) of the MD0626A (TTL Interface Unit) inserted into the rear panel of the MD6420A (bit error rate tester), respectively.

[9] Set the reception timing for the MD6420A as follows.

- RT (INV) mode when sampling data at the rising edge of the clock
- RT mode when sampling data at the falling edge of the clock

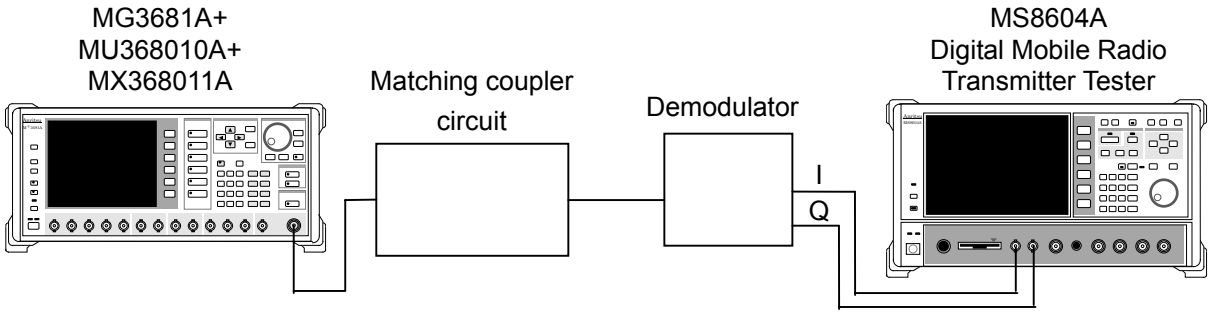
[10] Set the modulation pattern of the MD6420A to $2^9 - 1$ (PN9). However, the receiver outputs data only for the TCH part of the transmission channel.

[11] Press MEAS of the MD6420A (bit error rate tester) to start the bit error rate measurement.

4.2 Evaluation Measurement for Quadurature Demodulator

This sub-section describes the evaluation measurement for the quadurature demodulator when using the PDC system. The Anritsu MS8604A Digital Mobile Radio Transmitter Tester is used in this example to evaluate the I/Q signal of the demodulator. (Option 03: I/Q Input Function is required to use the MS8604A.)

(1) Setup



(2) Measurement procedure

[1] Set frequency and output level of this unit to desired value.

[2] Set the modulation method of this unit to "PDC".

[3] Set the modulation pattern of this unit to the PN9 pseudo random pattern.

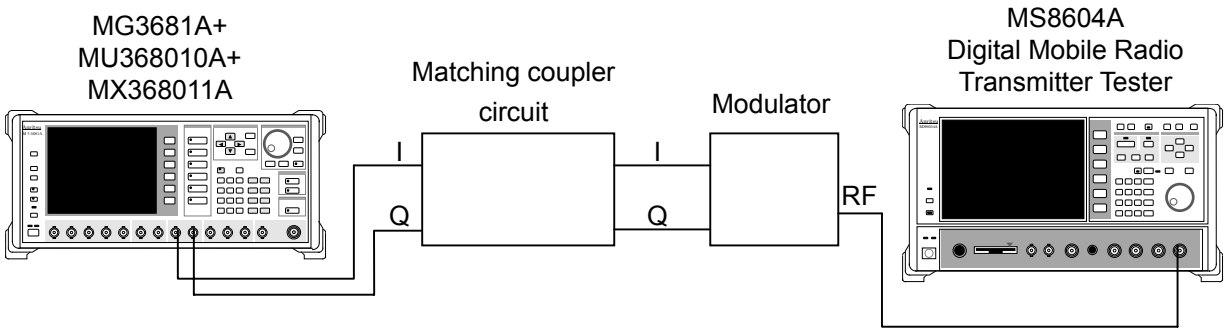
[4] Set the MS8604A (Digital Mobile Radio Transmitter Tester) to enable receiving the modulation method and pattern set in Steps [2] and [3].

[5] Measure the modulation accuracy using the MS8604A to evaluate the demodulator. (Refer to the MS8604A Operation Manual for the operating method of the MS8604A.)

4.3 Evaluation Measurement for Modulator

This sub-section describes the evaluation measurement for the modulator when using the PDC system. The Anritsu MS8604A Digital Mobile Radio Transmitter Tester is used in this example to evaluate the modulation signal of the modulator.

(1) Setup



(2) Measurement procedure

[1] Set the I/Q signal output level of this unit to the proper level for the modulator and matching coupler circuit.

[2] Set the modulation method of this unit to "PDC".

[3] Set the modulation pattern of this unit to PN9 pseudo random pattern.

[4] Set the MS8604A (Digital Mobile Radio Transmitter Tester) to enable receiving the modulation method and pattern set in Steps [2] and [3].

[5] Measure the modulation accuracy using the MS8604A to evaluate the modulator. (Refer to the MS8604A Operation Manual for the operating method of the MS8604A.)

Section 5 Remote Control

This section describes the details of the GPIB and RS-232C device messages in the form of functional lists and alphabetical order, in case that the MU368010A TDMA Modulation Unit installed with the MX368011A PDC Software is mounted to the MG3681A Digital Modulation Signal Generator.

Refer to "Section 4 Remote Control" in the "MG3681A Main Unit Operation Manual" for descriptions on other remote controls.

5.1 Device Message List by Function

Command message and query message

The header field of the command message is represented by uppercase alphanumeric characters as a reserved word. The header field of the query message ends with "?". The argument section of the command message and the query message can contain multiple arguments delimited by a separator ",". Argument types are explained below:

[1] Uppercase characters : reserved word

[2] Numeric : reserved word

[3] Lowercase characters in the argument section :

f (Frequency) : numeric data (NR1, NR2, NR3)

Suffix code : GHZ, GZ, MHz, MZ, kHz, KZ, HZ,
In case of no unit, HZ is applied.

l (Level) (Relative value) : numeric data (NR1, NR2, NR3 types)

Suffix code : DB
In case of no unit, DB is applied.

n (integer without unit) : numeric data (NR1 type)

r (real number without unit) : numeric data (NR2 type)

h (hexadecimal without unit) : numeric data (hexadecimal)

s (string) : alphanumeric enclosed in " " or ' '.

Response message

This is a responding message returned to the external controller when the query message is received, which is represented by the form of "response header field + response data section". By delimiting the response data section by a separator ",", it may contain multiple response data. Response data types are explained below:

[1] Uppercase characters : reserved word

[2] Numeric : reserved word

[3] Lowercase characters in the argument section :

f (Frequency) : numeric data (NR1 type)
Suffix code : HZ

l (Level) (Relative form) : numeric data (NR2 type)
Suffix code : DB

n (integer without unit) : numeric data (NR1 type)

r (real number without unit) : numeric data (NR2 type)

h (hexadecimal without unit) : numeric data (hexadecimal)

Note:

When the header is set to Off, the header of the response message and the suffix code of the numeric data are not output. For On/Off setting of the header, refer to the separate volume "MG3681A Operation Manual".

Device message list

< Common >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
I/Q Source Internal	MODE INT IQSRC INT	MODE? IQSRC?	MODE INT IQSRC INT
I/Q Source External	MODE EXT IQSRC EXT	MODE? IQSRC?	MODE EXT IQSRC EXT
I/Q Modulation Off	MODE OFF IQSRC OFF	MODE? IQSRC?	MODE OFF IQSRC OFF
System PDC (Full rate)	SYS PDC	SYS?	SYS PDC
System PDC (Half rate)	SYS PDC_H	SYS?	SYS PDC_H
Baseband ON	BASEBAND ON	BASEBAND?	BASEBAND ON
Baseband OFF	BASEBAND OFF	BASEBAND?	BASEBAND OFF
Pulse Mod. ON (External)	PMO ON	PMO?	PMO ON
Pulse Mod. OFF	PMO OFF	PMO?	PMO OFF
Pulse Mod. ON (Internal)	PMO INT	PMO?	PMO INT
Pulse Mod. ON (External)	PMO EXT	PMO?	PMO EXT
Digital	DIGITAL	–	DIGITAL

< Modulation >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Bit Rate	BITRATE r r :37.8 to 46.2	BITRATE?	BITRATE r
(Baseband) Filter Mode RNYQ	NYQ R	NYQ?	NYQ R
(Baseband) Filter Mode NYQ	NYQ N	NYQ?	NYQ N
Filter Roll Off Ratio	FILTROLL r r :0.40 to 0.60	FILTROLL?	FILTROLL r
Phase Encode Normal	DPE NORM	DPE?	DPE NORM
Phase Encode Inverse	DPE INVS	DPE?	DPE INVS
Burst On	BST ON	BST?	BST ON
Burst Off FILTER SPEC	BST OFF	BST?	BST OFF
Pattern 0000 to 1111 (Arbitrary4 bits)	PAT n n :0000 to 1111	PAT?	PAT n
Pattern Device	PAT DEV	PAT?	PAT DEV
Pattern UP TCH	PAT UPT	PAT?	PAT UPT
Pattern UP TCH All	PAT UPTA	PAT?	PAT UPTA
Pattern UP Vox	PAT UPUX	PAT?	PAT UPUX
Pattern DN TCH	PAT DNT	PAT?	PAT DNT
Pattern DN TCH All	PAT DNTA	PAT?	PAT DNTA
Pattern SPM Number (0 to 99)	PAT MEM n MEM n: MEM 00 to MEM 99	PAT?	PAT MEM n
Burst Trigger Internal	BTG INT	BTG?	BTG INT
Burst Trigger External	BTG EXT	BTG?	BTG EXT
Symbol Adjust	SAD	–	–

< Pattern Edit >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Pattern Edit	DIGBURST	–	DIGBURST
Slot Number	SLOTNO n n :0 to 5	SLOTNO?	SLOTNO n n :0 to 5
PN for each slot	PN PN9 PN PN15	PN?	PN PN9 PN PN15
Data selection for each slot	SLOT ON SLOT OFF SLOT UPT SLOT VOX	SLOT?	SLOT ON SLOT OFF SLOT UPT SLOT VOX
Color code for each slot	CC h h :00 to FF	CC?	CC h
SACCH for each slot	SACCH h h :0000 to 7FFF	SACCH?	SACCH h
Synchronization word (SW) for each slot	SW h h :00000 to FFFFF	SW?	SW h
TCH for each slot	TCH PN9 TCH PN15	TCH?	TCH PN9 TCH PN15
Scramble selection for each slot	SCBL ON SCBL OFF	SCBL?	SCBL ON SCBL OFF
Scramble code for each slot	SCBLC h h :000 to 1FF	SCBLC?	SCBLC h

< SPM Save/Delete >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Pattern Save	DIGSAVE	–	DIGSAVE
Burst Pattern Memory Save	BSAV n[,s] n :0 to 99 s :“Title”	–	–

< SPM List >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Pattern List	DIGLIST	–	–

< Baseband Setup: Common >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Baseband: Data Internal	MID INT	MID?	MID INT
Baseband: Data External	MID EXT	MID?	MID EXT
Baseband: Data Clock Internal	MIC INT	MIC?	MID INT
Baseband: Data Clock External	MIC EXT	MIC?	MIC EXT

< Baseband Setup: Ext. Mod. Input >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Data Input Input Positive	EID POS	EID?	EID POS
Data Input Input Negative	EID NEG	EID?	EID NEG
Data Clock Input Rise	EIC RISE	EIC?	EIC RISE
Data Clock Input Fall	EIC FALL	EIC?	EIC FALL
Symbol Clock Input Rise	EIS RISE	EIS?	EIS RISE
Symbol Clock Input Fall	EIS FALL	EIS?	EIS FALL
Burst Gate Input Positive	EIB POS	EIB?	EIB POS
Burst Gate Input Negative	EIB NEG	EIB?	EIB NEG

< Baseband Setup: Ext. Mod. Output >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Data Output Positive	EOD POS	EOD?	EOD POS
Data Output Negative	EOD NEG	EOD?	EOD NEG
Data Clock Output Rise	EOC RISE	EOC?	EOC RISE
Data Clock Output Fall	EOC FALL	EOC?	EOC FALL
Symbol Clock Output Rise	EOS RISE	EOS?	EOS RISE
Symbol Clock Output Fall	EOS FALL	EOS?	EOS FALL
Burst Gate Output Positive	EOB POS	EOB?	EOB POS
Burst Gate Output Negative	EOB NEG	EOB?	EOB NEG

< Baseband Setup: Others >

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Burst Trigger Input Rise	BTI RISE	BTI?	BTI RISE
Burst Trigger Input Fall	BTI FALL	BTI?	BTI FALL
Burst Trigger Output Rise	BTO RISE	BTO?	BTO RISE
Burst Trigger Output Fall	BTO FALL	BTO?	BTO FALL
Pattern Sync Output Mode	PSYNC PNCLK PSYNC PNCLK PSYNC RFGAT	PSYNC?	PSYNC PNCLK PSYNC PNCLK PSYNC RFGAT

5.2 Device Message Details in Alphabetical Order

< Example >

FREQ Frequency

Function Set the frequency.

Command message FREQ f

A space is required between the command message and f

Value to input

Description of a value to input

Value of f

–2.99975 to 3GHZ	: –2.99975 to 3 GHz
–2999.75 to 3000MHZ	: –2999.75 to 3000 MHz
–2999750 to 3000000KHZ	: –2999750 to 3000000 kHz
–2999750000.00 to 3000000000HZ	: –2999750000.00 to 3000000000 Hz

Query message FREQ?

Response message FREQ f

Application example FREQ 123MHZ

BASEBAND

Baseband

Function	Sets On/Off for the baseband I/Q output.
Command message	BASEBAND a
Query message	BASEBAND?
Response message	BASEBAND a
Value of a	ON : Baseband On
	OFF : Baseband Off
Application example	BASEBAND ON

BIT RATE

Bit Rate

Function	Sets data transmission speed for modulation.
Command message	BITRATE r
Value of r	37.8 to 46.2 : Bit rate (37.8 kbps to 46.2 kbps)
Query message	BITRATE?
Response message	BITRATE r
Application example	BITRATE 42.1

B

BSAV

Burst Pattern Memory Save

Function Saves the internal modulation data on memory

Command message BSAV n[,s]

Value of n 0 to 99 : Pattern memory number

Value of s Character string within 8 characters enclosed with double quotation marks (" ") or single quotation marks (' ').
When this value is omitted, the data is saved with the currently set title.
If this value exceeds 8 characters, the first 8 characters are used as the title.

Application example BSAV 5, "TEST01"

BST

Burst

Function Sets On/Off for burst function.

Command message BST a

Query message BST?

Response message BST a

Value of a ON : Burst On
OFF : Burst Off

Application example BST ON

BTG

Burst Trigger

Function	Sets the burst trigger signal to internal generation or external input.
Command message	BTG a
Query message	BTG?
Response message	BTG a
Value of a	INT : Internal (Internal generation) EXT : External (External input)
Application example	BTG INT

BTI

Burst Trigger Input

Function	Sets polarity for the burst trigger input.
Command message	BTI a
Query message	BTI?
Response message	BTI a
Value of a	RISE : Rise (Rising) FALL : Fall (Falling)
Application example	BTI RISE

B

BTO

Burst Trigger Output

Function Sets polarity for the burst trigger output.

Command message BTO a

Query message BTI?

Response message BTO a

Value of a

RISE : Rise (Rising)

FALL : Fall (Falling)

Application example

```
BTI RISE
```

CC

Color Code

Function	Sets color code data for each slot.
Command message	CC h
Query message	CC?
Response message	CC h
Value of n	h: 00 to FF (Color code)
Application example	CC 1F
Restrictions	Cannot be set when the internal modulation data is DEVICE, or Burst is set to Off.

D

DIGBURST

Pattern Edit Screen

Function Moves to the Pattern Edit screen.

Command message DIGBURST

Response message DIGBURST

Application example DIGBURST

Restrictions Screen movement is not necessary when remotely changing parameters in the internal burst data generation screen.

DIGITAL

Digital Modulation

Function Moves to the top screen for digital modulation.

Command message DIGITAL

Response message DIGITAL

Application example DIGITAL

DIGLIST

Pattern List Screen

Function	Moves to the Pattern List screen.
Command message	DIGLIST
Response message	DIGLIST
Application example	DIGLIST

DIGSAVE

Pattern Save Screen

Function	Moves to the Pattern Save screen.
Command message	DIGSAVE
Response message	DIGSAVE
Application example	DIGSAVE
Restrictions	Screen movement is not necessary when remotely changing parameters in the internal burst data generation screen.

D

DPE

Phase Encode

Function Sets Normal/Inverse for Phase Encode.

Command message DPE a

Query message DPE?

Response message DPE a

Value of a

NORM : Normal

INVS : Inverse

Application example DPE NORM

EIB

Burst Gate Input

Function	Sets polarity for data clock input.
Command message	EIB a
Query message	EIB?
Response message	EIB a
Value of a	POS : Positive (Positive logic) NEG : Negative (Negative logic)
Application example	EIB NEG

EIC

Data Clock Input

Function	Sets polarity for data clock input.
Command message	EIC a
Query message	EIC?
Response message	EIC a
Value of a	RISE : Rise (Rising) FALL : Fall (Falling)
Application example	EIC RISE

E

EID

Data Input

Function Sets polarity for data input.

Command message EID a

Query message EID?

Response message EID a

Value of a

POS	: Positive (Positive logic)
NEG	: Negative (Negative logic)

Application example EID NEG

EIS

Symbol Clock Input

Function Sets polarity for symbol clock input.

Command message EIS a

Query message EIS?

Response message EIS a

Value of a

RISE	: Rise (Rising)
FALL	: Fall (Falling)

Application example EIS RISE

EOB

Burst Gate Output

Function Sets polarity for burst gate output.

Command message EOB a

Query message EOB?

Response message EOB a

Value of a

POS : Positive (Positive logic)

NEG : Negative (Negative logic)

Application example EOB POS

EOC

Data Clock Output

Function Sets polarity for data clock output.

Command message EOC a

Query message EOC?

Response message EOC a

Value of a

RISE : Rise (Rising)

FALL : Fall (Falling)

Application example EOC FALL

E

EOD

Data Output

Function Sets polarity for data output.

Command message EOD a

Query message EOD?

Response message EOD a

Value of a

POS : Positive (Positive logic)

NEG : Negative (Negative logic)

Application example

```
EOD POS
```

EOS

Symbol Clock Output

Function Sets polarity for symbol clock output.

Command message EOS a

Query message EOS?

Response message EOS a

Value of a

RISE : Rise (Rising)

FALL : Fall (Falling)

Application example

```
EOS FALL
```

FILTROLL

Filter Roll Off Ratio

Function	Sets the baseband filter factor.
Command message	FILTROLL r
Query message	FILTROLL?
Response message	FILTROLL r
Value of r	r : 0.40 to 0.60 (roll-off ratio α)
Application example	FILTROLL 0.40

I

IQSRC

I/Q Modulation Source

Function Sets signal source for I/Q modulation.

Command message IQSRC a

Query message IQSRC?

Response message IQSRC a

Value of a

INT	: Internal (Internal modulation unit)
EXT	: External (External input)
OFF	: I/Q modulation Off (only pulse modulation can be performed)

Application example IQSRC INT

MIC

Data Clock

Function Sets data clock signal to internal generation or external input.

Command message MIC a

Query message MIC?

Response message MIC a

Value of a

INT : Internal

EXT : External

MID

Data

Function Sets data signal to internal generation or external input.

Command message MID a

Query message MID?

Response message MID a

Value of a

INT : Internal

EXT : External

Application example MID INT

M

MODE

I/Q Modulation Mode

Function Sets signal source for I/Q modulation.

Command message MODE a

Query message MODE?

Response message MODE a

Value of a

INT	: Internal (Internal modulation unit)
EXT	: External (External input)
OFF	: I/Q modulation Off (only pulse modulation can be performed)

Application example MODE INT

NYQ

Baseband Filter Mode

Function	Sets the type of baseband filter.
Command message	NYQ a
Query message	NYQ?
Response message	NYQ a
Value of a	N : Nyquist filter R : Root Nyquist filter
Application example	NYQ N

P

PAT

Pattern

Function Sets the pattern.

Command message PAT a

Query message PAT?

Response message PAT a

Value of a

When Burst Off:

PN9	: PN9 pseudo random pattern
PN15	: PN15 pseudo random pattern
0000 to 1111	: 4-bit binary pattern

When Burst On:

DEV	: DEVICE
UPT	: UP TCH
UPTA	: UP TCH ALL
UPVX	: UP VOX
DNT	: DOWN TCH
DNTA	: DOWN TCH ALL
MEM00 to MEM99	: Contents of the pattern memory for the specified number (00 to 99).

Application example PAT PN9

PMO

Pulse Modulation

Function Sets Internal/External and On/Off for pulse modulation.

Command message PMO a

Query message PMO?

Response message PMO a

Value of a

INT	: Internal (generated by the modulation unit)
EXT	: External (external input)
ON	: External (external input)
OFF	: Off (always generates signal)

Application example PMO INT

PN

PN Pattern Select

Function Sets PN for each slot.

Command message PN a

Query message PN?

Response message PN a

Value of a

PN9 : PN9 pseudo random pattern

PN15 : PN15 pseudo random pattern

Application example PN PN9

PSYNC

Pattern Sync Output Mode

Function Sets the output mode for pattern synchronization signal.

Command message PSYNC a

Query message PSYNC?

Response message PSYNC a

Value of a

PNCLK : Outputs PN clock at TCH Field

PNGAT : Outputs Gate Signal of TCH Field

RFGAT : Outputs Gate Signal of entire RF output slot

Application example PSYNC RFGAT

S

SACCH

Slow Associated Control Channel

Function Sets SACCH data for each slot.

Command message SACCH h

Query message SACCH?

Response message SACCH h

Value of h 0000 to 7FFF : SACCH data (hexadecimal)

Application example SACCH 1F9AB

Restrictions This command is enabled only when the internal modulation data is not DEVICE, and data selection is set to UP TCH or UP VOX.

SAD

Symbol Adjust

Function Executes Symbol Adjust function.

Command message SAD

Response message –

Application example SAD

Restrictions This command is enabled when the Symbol Adjust key is displayed.

SCBL

Scramble

Function	Sets scramble for each slot to ON/OFF.
Command message	SCBL a
Query message	SCBL?
Response message	SCBL a
Value of a	ON : Scramble On
	OFF : Scramble Off
Application example	SCBL ON

SCBLC

Scramble Code

Function	Sets Scramble Code for each slot.
Command message	SCBLC h
Query message	SCBLC?
Response message	SCBLC h
Value of h	00000 to FFFFF : Scramble code (hexadecimal)
Application example	SCBLC 1248C

S

SLOT

Slot

Function	Sets each slot to ON/OFF.
Command message	SLOT a
Query message	SLOT?
Response message	SLOT a
Value of a	ON : Slot On
	OFF : Slot Off
	UPT : Slot On at Uplink TCH
	UVX : Slot On at Uplink VOX
Application example	SLOT OFF

SLOTNO

Slot Number

Function	Sets the slot number.
Command message	SLOTNO n
Query message	SLOTNO?
Response message	SLOTNO n
Value of n	0 to 5 : Slot number
Application example	SLOTNO 5
Restrictions	Slot number 3 to 5 cannot be used when Slot rate is set to Full rate.

SYS

System

Function	Selects communication system.
Command message	SYS a
Query message	SYS?
Response message	SYS a
Value of a	PDC : PDC (Full rate) PDC_H : PDC (Half rate)
Application example	SYS PDC

SW

Synchronization Word

Function	Sets synchronization word (SW) for each slot.
Command message	SW h
Query message	SW?
Response message	SW h
Value of h	00000 to FFFFF : Synchronization word data (hexadecimal)
Application example	SW 1248F
Restrictions	Cannot be set when the internal modulation data is DEVICE, or Slot is set to Off.

T

TCH

Traffic Channel

Function Sets the contents of TCH data for each slot.

Command message TCH a

Query message TCH?

Response message TCH a

Value of a

PN9 : PN9 pseudo random pattern

PN15 : PN15 pseudo random pattern

Application example

```
TCH PN9
```

Restrictions This command is enabled only when the TCH is selected.

Section 6 Performance Test

This section describes required measuring equipment, setup method, calibration and performance test procedures to check if the PDC software and TDMA modulation unit conform to the specification.

6.1 Performance Test

Conduct a performance test to verify that the PDC software and TDMA modulation unit conform to the standard.
Conduct the test at the acceptance inspection, periodical inspection and after repairs to verify the performance of the MX368011A.
If the test indicates that the performance standards are not fulfilled, please contact the Anritsu service division.

Test items for the performance test of the PDC system are shown below.

- Modulation accuracy for I/Q signal
- Modulation accuracy for RF output
- Modulation pattern
- On/Off ratio of burst wave

For items deemed important, a performance test should be performed periodically as preventive maintenance. It is recommended to conduct the test once or twice a year.

Record the measurement result for the performance test by using "Appendix C Performance Test Result Sheet."

⚠ CAUTION

Warm up this unit and other devices used for more than 30 minutes before the performance test for stable operation of them. To obtain the best measurement accuracy, perform the test under room temperature with a stable AC power supply voltage, and avoid too much noise, vibration, dust or humidity.

6.2 Devices used for Performance Test

The devices used for a performance test of PDC system are shown below.

Performance Test Item	Recommended Device	Anritsu Product Model
Output level accuracy	Power meter	ML4803A
	Power sensor	MA4601A
Modulation accuracy for I/Q signal	Digital mobile radio transmitter tester	MS8604A Option 03, 11
Modulation accuracy for RF output	Digital mobile radio transmitter tester	MS8604A Option 11
Modulation pattern	Bit error rate tester	MD6420A, MD0626A TTL interface unit
On/Off ratio of burst wave	Spectrum analyzer	MS2683A

6.3 Output Level Accuracy

(1) Test standard

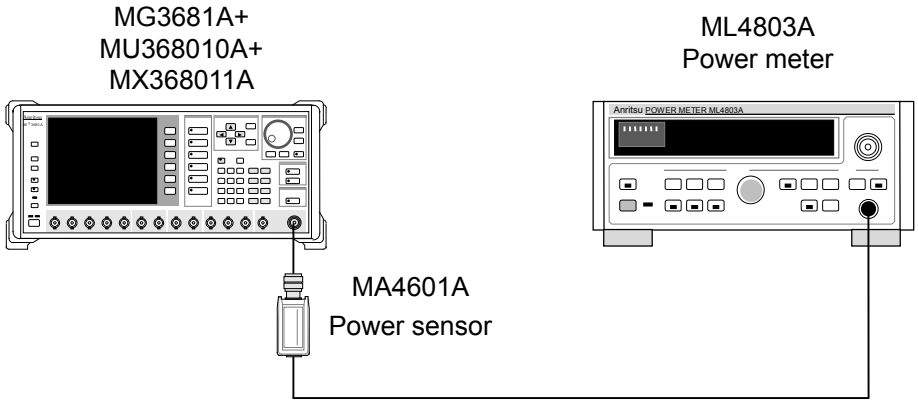
Level difference between CW and modulation: ..... within ±0.6 dB

(2) Measuring devices for test

Power meter: ML4803A

Power sensor: MA4601A

(3) Setup



(4) Test Procedure

[1] Set the communication system of this unit to "PDC".

[2] Press the [Preset] key of this unit and then set the parameter below.

Baseband : On

[3] Set RF Output of this unit to Off.

[4] Perform zero-point adjustment and sensitivity calibration of the power meter.

[5] Set the output level of this unit to the desired value.

[6] Set the frequency of this unit to the desired value.

[7] Set the sensor calibration factor of the power meter and then measure the output level of this unit.

[8] Press the [Preset] key of this unit and then set the parameter below.

Baseband : On

Digital Modulation : On

[9] Repeat Steps [3] to [7].

[10] Obtain the level difference from the results of Step [7] (CW) and [9] (when modulating).

6.4 Modulation Accuracy for I/Q Signal

(1) Test standard

When Expansion I/Q Signal Output option (MG3681A-11) is not installed:

≤1.6% (rms) (during continuous modulation with modulation pattern PN9)

≤1.7% (rms) (during burst modulation with modulation pattern UP TCH)

When Expansion I/Q Signal Output option is not installed:

≤3.0% (rms) (during continuous modulation with modulation pattern PN9)

≤3.0% (rms) (during burst modulation with modulation pattern UP TCH)

(2) Measuring devices for test

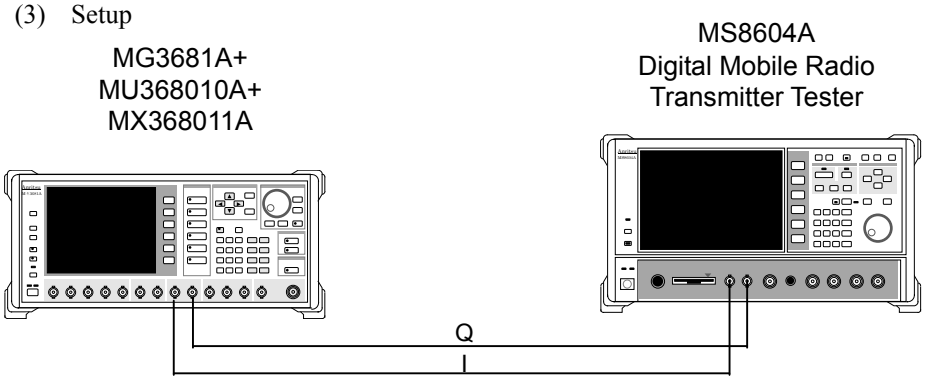
- Digital mobile radio transmitter tester MS8604A

  Required options of MS8604A for measurement

  Option 03: IQ input (required to analyze I/Q signal)

  Option 11: PDC software (required to analyze PDC signal)

(3) Setup



(4) Test procedure

[1] Set the communication system of this unit to "PDC".

[2] Press the [Preset] key of this unit and then set the parameter below.

Baseband : On

[3] Set MS8604A to be able to receive the modulation method and pattern set in Steps [1] and [2].

[4] Measure the modulation accuracy using MS8604A to measure the I/Q signal.

[5] Set the parameter below for this unit.

Burst	: On
Pattern	: UP TCH

[6] Set MS8604A to be able to receive the modulation pattern set in Step [5].

[7] Measure the modulation accuracy using MS8604A to measure the I/Q signal. (Refer to the MS8604A Operation Manual for its operation.)

6.5 Modulation Accuracy for RF Output

Check the modulation accuracy for the RF modulation signal output.

(1) Test standard

At 10 MHz to 2.1 GHz

1.8% (rms) (output level: ≤+5 dBm, continuous modulation with modulation pattern PN9)

1.8% (rms) (output level: ≤+5 dBm, burst modulation with modulation pattern UP TCH)

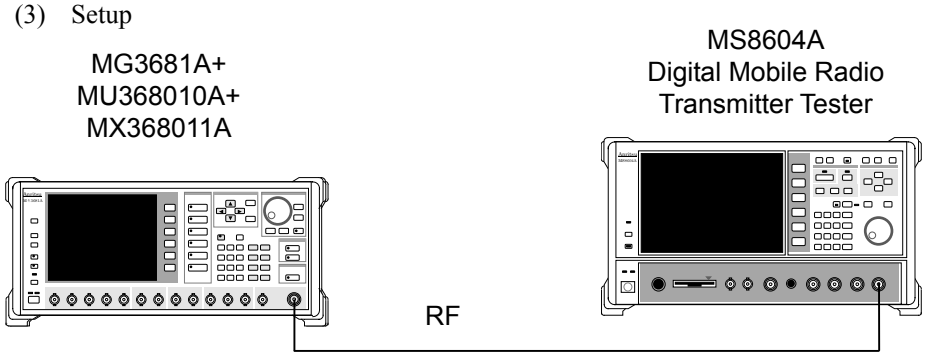
(2) Measuring devices for test

- Digital mobile radio transmitter tester MS8604A

  Required options of MS8604A for measurement

  Option 11: PDC software (required to analyze the PDC signal)

(3) Setup



(4) Test procedure

[1] Set the communication system of this unit to "PDC".

[2] Press the [Preset] key of this unit and then set the parameter below.

Baseband	: On
Digital Mod	: On
RF output level	: −10 dBm

[3] Set RF frequency of this unit to the desired measuring frequency.

[4] Set MS8604A to be able to receive the parameters set in Steps [2] and [3].

[5] Measure the modulation accuracy for RF modulation signal using MS8604A.

[6] Set the parameter below for this unit.

Burst	: On
Pattern	: UP TCH

[7] Set MS8604A to be able to receive the modulation pattern set in Step [6].

[8] Measure the modulation accuracy for RF modulation signal using MS8604A. (Refer to the MS8604A Operation Manual.)

6.6 Modulation Pattern

Check the modulation pattern.

(1) Test standard

PN9 pseudo random pattern

.....When the burst function is set to Off

PN9 pseudo random pattern on the slot

.....When the burst function is set to On

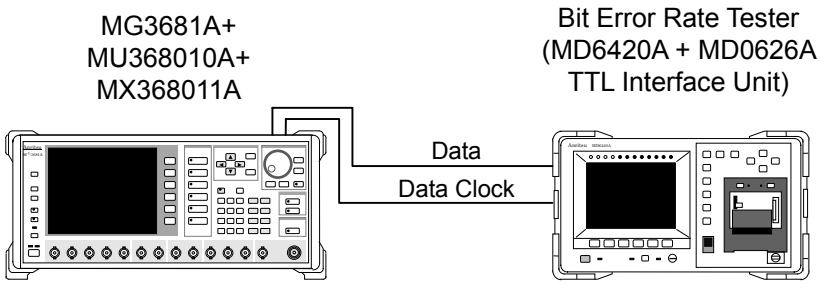
(2) Measuring devices for test

- Data transmission analyzer MD6420A

  Required options of MD6420A for measurement

  MD0626A: TTL interface unit

(3) Setup



(4) Test procedure

Procedure for output level frequency characteristics test is described below.

[1] Set the communication system of this unit to "PDC".

[2] Press the [Preset] key of this unit and then set the parameter below.

Baseband : On

[3] Connect Data output and Data Clock output of this unit to the code error rate measuring device. (Connect Data and Clock to RD (DATA) and RD (CLOCK) , respectively, of the MD0626A TTL interface unit inserted into the rear panel of the MD6420A.)

[4] Set reception timing of MD6420A to RT (INV) mode.

[5] Set modulation pattern of MD6420A to 2^9-1 (PN9) mode.

[6] Press the MEAS key of MD6420A to measure the code error rate.

[7] Set the parameter below for this unit.

Burst : On
Pattern : UP TCH

[8] Connect Pattern Sync output of SG to Clock input of the MD6420A.

[9] Set the signal output for Pattern Sync to PN Clock in the Baseband Set Up screen.

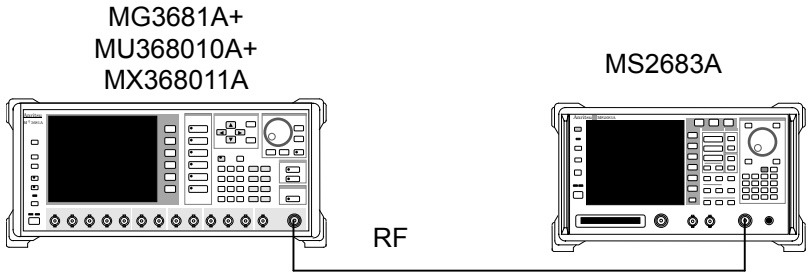
[10] Press the MEAS key of MD6420A to measure the code error rate. (Refer to the MD6420A Operation Manual for its operation.)

6.7 On/Off Ratio of Burst Wave

(1) Test standard
At 10 MHz to 2.1 GHz
≥65 dB at 5 dBm output

(2) Measuring devices for test
Spectrum analyzer MS2683A

(3) Setup



(4) Test procedure

[1] Set the communication system of this unit to "PDC".

[2] Press the [Preset] key of this unit and then set the parameter below.

Baseband	: On
Digital Mod.	: On
Burst	: On
RF output level	: +5 dBm

[3] Set RF frequency of this unit to the desired measuring frequency.

[4] Press the [Preset] key of the MS2683A and then set the parameter below. (Refer to the MS2683A Operation Manual for its operation.)

Ref Level	: +10 dBm
SPAN	: 0 Hz
RBW	: 30 kHz
VBW	: 30 kHz
Time Span	: 50 ms
Trig Source	: Video
Trig Level	: –30 dB

[5] Set RF frequency of MS2683A to that set in Step [3].

[6] Press the [Time] key of the MS2683A and then set the parameter below.

Detection : Average
Storage : Average
Average Count : 100

Observe the On/Off ratio for the output level at the time domain to measure the maximum and minimum level differences of the burst wave.

Appendix A Standards

(When installed to the MU368010A mounted to the MG3680 series)

<table>
<tr><td colspan="2">Applicable system</td><td>PDC</td></tr>
<tr><td colspan="2">Modulation method</td><td>π/4DQPSK</td></tr>
<tr><td colspan="2">Transmission speed</td><td>Variable range: 37.8 to 46.2 kbps (standard: 42.0 kbps), resolution: 0.1 kbps
Accuracy: Depends on the accuracy of the reference signal source for the MG3680 series main unit.</td></tr>
<tr><td colspan="2">Baseband filter</td><td>Nyquist and root-nyquist, roll-off rate α: 0.40 to 0.60, resolution: 0.01</td></tr>
<tr><td rowspan="2">Modulation data</td><td>Continuous modulation</td><td>PN9/PN15 pseudo random pattern or repeated pattern of 4-bit data</td></tr>
<tr><td>Burst modulation</td><td>Can output RCR STD27B-conformed data pattern
Frame configuration
1) Full rate: Consists of three slots (Slots 0 to 2), frame period: 20 ms
<table>
<tr><td>Slot 0</td><td>Slot 1</td><td>Slot 2</td></tr>
</table>
2) Half rate: Consists of six slots (Slots 0 to 5), frame period: 40 ms
<table>
<tr><td>Slot 0</td><td>Slot 1</td><td>Slot 2</td><td>Slot 3</td><td>Slot 4</td><td>Slot 5</td></tr>
</table>
Slot configuration
1) For device evaluation (DEVICE)
<table>
<tr><td>R
4</td><td>PN
270</td><td>G
6</td></tr>
</table>
PN: PN9 or PN15
2) Up-Traffic channel (UP TCH)
<table>
<tr><td>R
4</td><td>P
2</td><td>TCH
112</td><td>SW
20</td><td>CC
8</td><td>SF
1</td><td>SACCH
15</td><td>TCH
112</td><td>G
6</td></tr>
</table>
TCH: PN9 or PN15
SW: 00000 to FFFFF
CC: 00 to FF
SACCH: 0000 to 7FFF
3) Down-Traffic channel (DOWN TCH)
<table>
<tr><td>R
4</td><td>P
2</td><td>TCH
112</td><td>SW
20</td><td>CC
8</td><td>SF
1</td><td>SACCH
21</td><td>TCH
112</td></tr>
</table>
TCH: PN9 or PN15
SW: 00000 to FFFFF
CC: 00 to FF
SACCH: 000000 to 1FFFFF
4) VOX control (VOX)
<table>
<tr><td>G
108</td><td>R
4</td><td>P
6</td><td>SW
20</td><td>CC
8</td><td>SF
1</td><td>SACCH
15</td><td>G
118</td></tr>
</table>
SW: 00000 to FFFFF
CC: 00 to FF
SACCH: 0000 to 7FFF
Scramble function
On/Off of the scramble function and scramble code can be set.
Slot for which the scramble function can be set: UP TCH, DOWN TCH, VOX
scramble code: 000 to 1FF</td></tr>
</table>

Auxiliary signal	**Input signal**	Data Clock: Clock input corresponding to the transmission speed (input range: ±1% of the set transmission speed) Data: Data input synchronized with Data Clock Symbol Clock: Clock input for the symbol definition synchronized with Data Clock Burst Gate: Gate signal input for On/Off definition of burst signal Burst Trig: Trigger signal input synchronized with frame
	Output signal	Data Clock: Clock output corresponding to the transmission speed Data: Data output synchronized with Data Clock Symbol Clock: Clock output for the symbol definition synchronized with Data Clock Burst Gate: Gate signal output for On/Off definition of burst signal Burst Trig: Trigger signal output synchronized with frame Pattern Sync.: Signal output synchronized with PN9, PN15 or 4-bit pattern (during continuous modulation) On/Off signal output of gate or clock of TCH section, or RF signal (during burst modulation)
I/Q signal	**Vector accuracy**	When the MG3681A-11 additional function of I/Q output is not mounted ≤1.6% (rms) (continuous modulation, pattern: PN9) ≤1.7% (rms) (burst modulation, pattern: UP TCH) When the MG3681A-11 additional function of I/Q output is mounted ≤3.0% (rms) (continuous modulation, pattern: PN9) ≤3.0% (rms) (burst modulation, pattern: UP TCH) (Transmission speed: 42.00 kbps, baseband filter: root-nyquist $\alpha = 0.5$)
	Output level	$\sqrt{I^2 + Q^2}$ = 500 mV (rms) (Transmission speed: 42.0 kbps, baseband filter: root-nyquist $\alpha = 0.5$, continuous modulation, pattern: PN9)
RF signal	**Frequency range**	10 to 2100 MHz
	Output level range	–143 to +13 dBm
	Level accuracy	±0.6 dB of the level for CW (output level: ≤+5 dBm)
	Vector accuracy	≤1.8% (rms) (continuous modulation, pattern: PN9) ≤1.8% (rms) (burst modulation, pattern: UP TCH) (Transmission speed: 42.0 kbps, baseband filter: root-nyquist $\alpha = 0.5$, continuous modulation, pattern: PN9, output level: ≤+5 dBm)
	Carrier leak	≤–30 dBc (Transmission speed: 42.0 kbps, baseband filter: root-nyquist $\alpha = 0.5$, continuous modulation, pattern: "0000", ambient temperature: 18 to 35°C)
	Image rejection	≤–40 dBc (Transmission speed: 42.0 kbps, baseband filter: root-nyquist $\alpha = 0.5$, continuous modulation, pattern: "0000")
	Adjacent channel power leakage	≤–64 dBc/21 kHz (50 kHz offset) ≤–68 dBc/21 kHz (100 kHz offset) (Output level: 5 dBm, frequency: 810 to 958 MHz, 1429 to 1501 MHz, transmission speed: 42.0 kbps, baseband filter: root-nyquist $\alpha = 0.5$, continuous modulation, pattern: PN9) (Excluding performance loss due to spurious generated by the MG3681A main unit)
	Ratio of On/Off burst	≥65 dB (Output level: +5 dBm)
Firmware backup area to be used		TDMA: 280 kbyte, FPGA: 256 kbyte

Appendix B Default Value List

Settings	Default Value
Main screen for digital modulation	
Bit Rate	42.00 kbps
Filter	RNYQ, $\alpha = 0.50$
Phase Encode	Normal
Slot Rate	Full Rate
Burst	Off
Pattern	PN9

Settings	Default Value
Baseband Setup screen	
Data	Int
Data Clock	Int
Ext Mod Input	
Data	Positive
Data Clock	Rise
Symbol Clock	Rise
Burst Gate	Positive
Ext Mod Output	
Data	Positive
Data Clock	Rise
Symbol Clock	Rise
Burst Gate	Positive
Burst Trigger Input	Rise
Burst Trigger Output	Rise
Pattern Sync Output	PN Clock

Appendix C Performance Test Result Sheet

Test Location: _____ Report No. _____

Date _____

Person in charge of test _____

Model MG3681A Digital Modulation SG +
MU368010A TDMA Modulation Unit +
MX368011A PDC Software

Serial No. _____ Ambient temperature _____ °C

Power _____ Hz Relative humidity _____ %

Remarks:

Output level accuracy (Section 6.3)

Setting Frequency	Result	Maximum specification value
10 MHz		±0.6 dB
50 MHz		
100 MHz		
300 MHz		
500 MHz		
800 MHz		
1000 MHz		
1300 MHz		
1500 MHz		
1800 MHz		
2000 MHz		
2100 MHz		

Modulation accuracy for I/Q signal (Section 6.4)

Setting	Result	Maximum specification value
Burst Off		1.6% (rms) (3.0% (rms) When Option 11 installed.)
Burst On		1.7% (rms) (3.0% (rms) When Option 11 installed.)

Modulation accuracy for RF signal (Section 6.5)

Setting Frequency	Result	Maximum specification value
10 MHz		1.8 % (rms), Continuous wave 1.8 % (rms), Burst wave
50 MHz		
100 MHz		
300 MHz		
500 MHz		
800 MHz		
1000 MHz		
1300 MHz		
1500 MHz		
1800 MHz		
2000 MHz		
2100 MHz		

Modulation pattern (Section 6.6)

Setting	Result
Burst Off	☐ OK ☐ NG
Burst On	☐ OK ☐ NG

On/Off ratio of burst wave (Section 6.7)

Setting Frequency	Result	Maximum specification value
10 MHz		≥65 dB
50 MHz		
100 MHz		
300 MHz		
500 MHz		
800 MHz		
1000 MHz		
1300 MHz		
1500 MHz		
1800 MHz		
2000 MHz		
2100 MHz		

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