# MX370102A/MX269902A
# TDMA IQproducer<sup>TM</sup>
# Operation Manual

## 10th Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided within the MG3700A Vector Signal Generator Operation Manual (Mainframe), MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe), MS2690A/MS2691A/ MS2692A Signal Analyzer Operation Manual (Mainframe Operation), or MS2830A Signal Analyzer Operation Manual (Mainframe Operation). Please also refer to either of these documents before using the equipment.**
- **Keep this manual with the equipment.**

# ANRITSU CORPORATION

# Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information.   Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment.   Some or all of the following symbols may be used on all Anritsu equipment.   In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

## Symbols used in manual

| | |
|---|---|
| ⚠ **DANGER** | This indicates a very dangerous procedure that could result in serious injury or death if not performed properly. |
| ⚠ **WARNING** | This indicates a hazardous procedure that could result in serious injury or death if not performed properly. |
| ⚠ **CAUTION** | This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken. |

## Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions.   Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation.   The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution.   The obligatory operation is indicated symbolically in or near the circle.

This indicates a warning or caution.   The contents are indicated symbolically in or near the triangle.

This indicates a note.   The contents are described in the box.

These indicate that the marked part should be recycled.

MX370102A/MX269902A
TDMA IQproducer<sup>TM</sup>
Operation Manual

25   April        2007 (First Edition)
22   March       2016 (10th Edition)

# Equipment Certificate

Anritsu Corporation guarantees that this equipment was inspected at shipment and meets the published specifications.

# Anritsu Warranty

- During the warranty period, Anritsu Corporation will repair or exchange this software free-of-charge if it proves defective when used as described in the operation manual.
- The warranty period is 6 months from the purchase date.
- The warranty period after repair or exchange will remain 6 months from the original purchase date, or 30 days from the date of repair or exchange, depending on whichever is longer.
- This warranty does not cover damage to this software caused by Acts of God, natural disasters, and misuse or mishandling by the customer.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

# Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

# Software End-User License Agreement (EULA)

Please read this Software End-User License Agreement (hereafter this EULA) carefully before using (includes executing, copying, registering, etc.) this software (includes programs, databases, scenarios, etc., used to operate, set, etc., Anritsu electronic equipment). By reading this EULA and using this software, you are agreeing to be bound by the terms of its contents and Anritsu Corporation (hereafter Anritsu) hereby grants you the right to use this Software with the Anritsu-specified equipment (hereafter Equipment) for the purposes set out in this EULA.

## 1. Grant of License and Limitations

1. Regardless of whether this Software was purchased from or provided free-of-charge by Anritsu, you agree not to rent, lease, lend, or otherwise distribute this Software to third parties and further agree not to disassemble, recompile, reverse engineer, modify, or create derivative works of this Software.
2. You may make one copy of this Software for backup purposes only.
3. You are not permitted to reverse engineer this software.
4. This EULA allows you to install one copy of this Software on one piece of Equipment.

## 2. Disclaimers

To the extent not prohibited by law, in no event shall Anritsu be liable for personal injury, or any incidental, special, indirect or consequential damages whatsoever, including, without limitation, damages for loss of profits, loss of data, business interruption or any other commercial damages or losses, arising out of or related to your use or inability to use this Software.

## 3. Limitation of Liability

a. If a fault (bug) is discovered in this Software, preventing operation as described in the operation manual or specifications whether or not the customer uses this software as described in the manual, Anritsu shall at its own discretion, fix the bug, or exchange the software, or suggest a workaround, free-of-charge. However, notwithstanding the above, the following items shall be excluded from repair and warranty.

   i) If this Software is deemed to be used for purposes not described in the operation manual or specifications.
   ii) If this Software is used in conjunction with other non-Anritsu-approved software.
   iii) Recovery of lost or damaged data.
   iv) If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.
   v) For any other reasons out of Anritsu's direct control and responsibility, such as but not limited to, natural disasters, software virus infections, etc.

b. Expenses incurred for transport, hotel, daily allowance, etc., for on-site repairs by Anritsu engineers necessitated by the above faults shall be borne by you.

c. The warranty period for faults listed in article 3a above covered by this EULA shall be either 6 months from the date of purchase of this Software or 30 days after the date of repair, whichever is longer.

### 4. Export Restrictions

You may not use or otherwise export or re-export directly or indirectly this Software except as authorized by Japanese and United States law. In particular, this software may not be exported or re-exported (a) into any Japanese or US embargoed countries or (b) to anyone on the Japanese or US Treasury Department's list of Specially Designated Nationals or the US Department of Commerce Denied Persons List or Entity List. By using this Software, you warrant that you are not located in any such country or on any such list. You also agree that you will not use this Software for any purposes prohibited by Japanese and US law, including, without limitation, the development, design and manufacture or production of missiles or nuclear, chemical or biological weapons of mass destruction.

### 5. Termination

Anritsu shall deem this EULA terminated if you violate any conditions described herein. This EULA shall also be terminated if the conditions herein cannot be continued for any good reason, such as violation of copyrights, patents, or other laws and ordinances.

### 6. Reparations

If Anritsu suffers any loss, financial or otherwise, due to your violation of the terms of this EULA, Anritsu shall have the right to seek proportional damages from you.

### 7. Responsibility after Termination

Upon termination of this EULA in accordance with item 5, you shall cease all use of this Software immediately and shall as directed by Anritsu either destroy or return this Software and any backup copies, full or partial, to Anritsu.

### 8. Dispute Resolution

If matters of dispute or items not covered by this EULA arise, they shall be resolved by negotiations in good faith between you and Anritsu.

### 9. Court of Jurisdiction

This EULA shall be interpreted in accordance with Japanese law and any disputes that cannot be resolved by negotiation described in Article 8 shall be settled by the Japanese courts.

# Cautions against computer virus infection

- Copying files and data

  Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.

  All other required files should be transferred by means of USB or CompactFlash media after undergoing a thorough virus check.

- Adding software

  Do not download or install software that has not been specifically recommended or licensed by Anritsu.

- Network connections

  Ensure that the network has sufficient anti-virus security protection in place.

## Protection Against Computer Virus Infections

Prior to the software installation

Before installing this software or any other software recommended or approved by Anritsu, run a virus scan on your computer, including removable media (e.g. USB memory stick and CF memory card) you want to connect to your computer.

When using this software and connecting with the measuring instrument
- Copying files and data
  On your computer, do not save any copies other than the following:
  - Files and data provided by Anritsu
  - Files created by this software
  - Files specified in this document
  Before copying these files and/or data, run a virus scan, including removable media (e.g. USB memory stick and CF memory card).
- Connecting to network
  Connect your computer to the network that provides adequate protection against computer viruses.

## Cautions on Proper Operation of Software

This software may not operate normally if any of the following operations are performed on your computer:
- Simultaneously running any software other than that recommended or approved by Anritsu
- Closing the lid (Laptop computer)
- Turning on the screen saver function
- Turning on the battery-power saving function (Laptop computer)

For how to turn off the functions, refer to the operation manual that came with your computer.

# CE Conformity Marking

Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

## CE marking

$$C \in$$

## 1. Product Model

Software:   MX370102A/MX269902A TDMA IQproducer[TM]

## 2. Applied Directive and Standards

When the MX370102A/MX269902A TDMA IQproducer[TM] is installed in the MG3710A, MS2690A/MS2691A/MS2692A, or MS2830A, the applied directive and standards of this software conform to those of the MG3710A, MS2690A/MS2691A/MS2692A, or MS2830A main frame.

PS:   About main frame
Please contact Anritsu for the latest information on the main frame types that MX370102A/MX269902A can be used with.

# C-tick Conformity Marking

Anritsu affixes the C-tick mark on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

## C-tick marking

CN274

## 1. Product Model

Software: MX370102A/MX269902A TDMA IQproducer™

## 2. Applied Directive and Standards

When the MX370102A/MX269902A TDMA IQproducer™ is installed in the MG3710A, MS2690A/MS2691A/MS2692A, or MS2830A, the applied directive and standards of this software conform to those of the MG3710A, MS2690A/MS2691A/MS2692A, or MS2830A main frame.
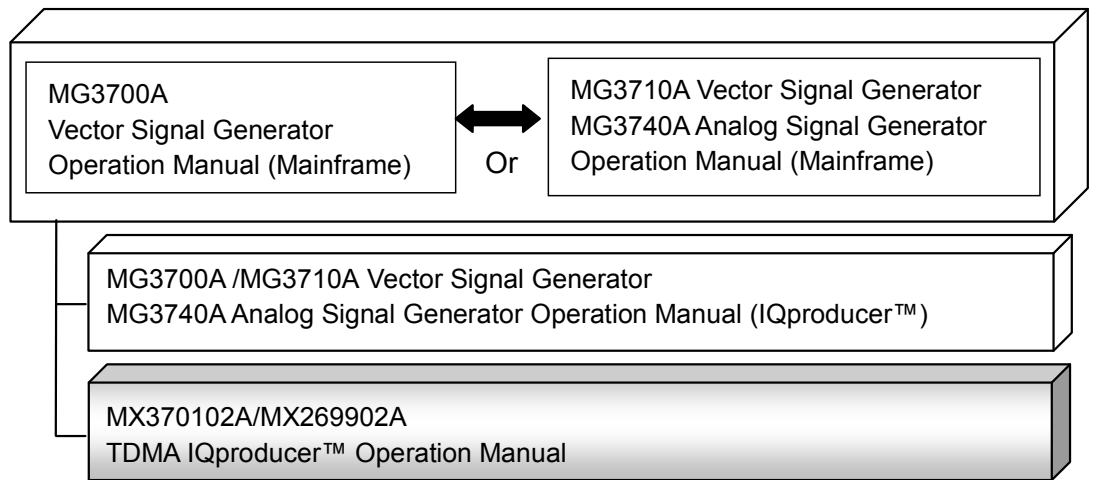
PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX370102A/MX269902A can be used with.

# About This Manual

## ■ Associated Documents

The operation manual configuration of the MX370102A/MX269902A TDMA IQproducer™ is shown below.

## ■ If using MG3700A, MG3710A or MG3740A:

MG3700A
Vector Signal Generator
Operation Manual (Mainframe)

Or

MG3710A Vector Signal Generator
MG3740A Analog Signal Generator
Operation Manual (Mainframe)

MG3700A /MG3710A Vector Signal Generator
MG3740A Analog Signal Generator Operation Manual (IQproducer™)

MX370102A/MX269902A
TDMA IQproducer™ Operation Manual

● MG3700A Vector Signal Generator Operation Manual (Mainframe)

This describes basic operations, maintenance procedure, and remote functions of the MG3700A Vector Signal Generator.

↕ Or

● MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)

This describes basic operations, maintenance procedure, and remote functions of the MG3710A Vector Signal Generator and the MG3740A Analog Signal Generator.
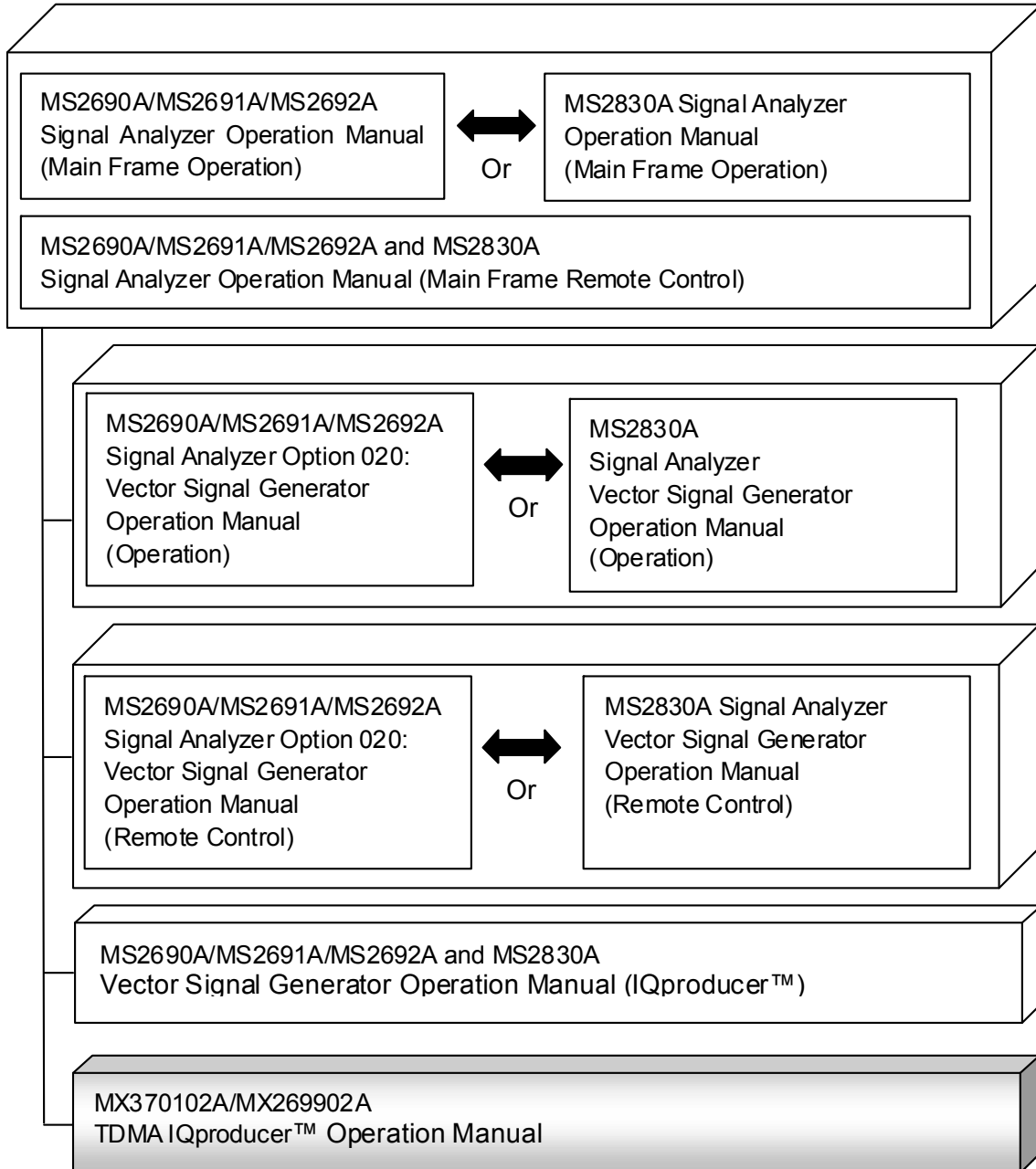
● MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™)

This describes the functions and how to use the IQproducer, which is Windows software for the Vector Signal Generator and the Analog Signal Generator.

● TDMA IQproducer™ Operation Manual (This document)

This describes basic operations and functions of the TDMA IQproducer™.

MS2690A/MS2691A/MS2692A
Signal Analyzer Operation Manual
(Main Frame Operation)

↔

Or

MS2830A Signal Analyzer
Operation Manual
(Main Frame Operation)

MS2690A/MS2691A/MS2692A and MS2830A
Signal Analyzer Operation Manual (Main Frame Remote Control)

MS2690A/MS2691A/MS2692A
Signal Analyzer Option 020:
Vector Signal Generator
Operation Manual
(Operation)

↔

Or

MS2830A
Signal Analyzer
Vector Signal Generator
Operation Manual
(Operation)

MS2690A/MS2691A/MS2692A
Signal Analyzer Option 020:
Vector Signal Generator
Operation Manual
(Remote Control)

↔

Or

MS2830A Signal Analyzer
Vector Signal Generator
Operation Manual
(Remote Control)

MS2690A/MS2691A/MS2692A and MS2830A
Vector Signal Generator Operation Manual (IQproducer™)

MX370102A/MX269902A
TDMA IQproducer™ Operation Manual

- MS2690A/MS2691A/MS2692A Signal Analyzer Operation Manual (Mainframe, Operation)

This describes basic operations, maintenance procedure, common functions and common remote functions of the MS2690A/MS2691A/MS2692A.

**Or**

- MS2830A Signal Analyzer Operation Manual (Mainframe, Operation)

This describes basic operations, maintenance procedure, common functions and common remote functions of the MS2830A.

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- MS2690A/MS2691A/MS2692A and MS2830A Signal Analyzer Operation Manual (Mainframe, Remote Control)

These describe basic operations, maintenance procedure, common functions and common remote functions of the MS2690A/MS2691A/MS2692A or MS2830A.

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- MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual, Operation

This describes the functions and how to use the Vector Signal Generator option.

**Or**

- MS2830A Vector Signal Generator Operation Manual, Operation

This describes the functions and how to use the Vector Signal Generator option.

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- MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual, Remote Control

This describes how to remotely control the Vector Signal Generator option.

**Or**

- MS2830A Vector Signal Generator Operation Manual, Remote Control

This describes how to remotely control the Vector Signal Generator option.

------------------------------------------------------------------------------------------------

- MS2690A/MS2691A/MS2692A and MS2830A Vector Signal Generator Operation Manual (IQproducer™)

This describes the functions and how to use the IQproducer, which is Windows software for the Vector Signal Generator option.

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- TDMA IQproducer™ Operation Manual (This document)

This describes basic operations and functions of the TDMA IQproducer™.

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*VI.*

This chapter provides an overview of the MX370102A/MX269902A TDMA IQproducer™.

**1**

# 1.1  Product overview

MX370102A/MX269902A TDMA IQproducer™ (hereinafter referred to as "this software") is software used to generate waveform patterns conforming to the TDMA specifications.

This software requires either of the following environment:

- MG3710A Vector Signal Generator
- MG3740A Analog Signal Generator
- MS2690A/MS2691A/MS2692A or MS2830A Signal Analyzer with Vector Signal Generator option mounted
- Personal computer (hereinafter, "PC")

This software generates waveform patterns that support the specifications of TDMA with various characteristics. This is made possible by the editing/customizing of parameters according to its use.

A waveform pattern created by this software can be output using an RF signal after being downloaded into the MG3700A Vector Signal Generator , MG3710A Vector Signal Generator, MG3740A Analog Signal Generator or an MS2690A/MS2691A/MS2692A or MS2830A Signal Analyzer with Vector Signal Generator option installed (collectively referred to as "mainframe", or "this equipment").

# 1.2  Product Composition

The following table lists the model name and specifications of this software according to the equipment.

**Table 1.2-1    Restrictions**

| Mainframe\\Restrictions | MG3700A | MG3710A MG3740A | MS2690A MS2691A MS2692A | MS2830A |
|---|---|---|---|---|
| Software name | MX370102A | | MX269902A | |
| Maximum Size of Waveform Patterns | 256 M sample 512 M sample*1 | 64 M sample 128 M sample*5 256 M sample*6 512 M sample*7 | 256 M sample | 64 M sample 256 M sample*4 |
| Transmission method of Waveform Patterns | LAN, CompactFlash Card | External device such as LAN, USB memory*2 | USB Memory and other external device*2 | USB Memory and other external device*2 |
| Installation of this software to this equipment | N/A | Possible | Possible*3 | Possible*3 |

*1:  The ARB memory expansion 512M sample (optional) must be installed into the MG3700A to use waveform patterns that exceed 256 M samples.

*2:  Transferring waveform patterns is not required if the waveform patterns are created on the equipment using this software.

*3:  Although this software can be installed and run in the MS2690A/MS2691A/MS2692A or MS2830A, the measurement functions of the MS2690A/MS2691A/MS2692A or MS2830A are not guaranteed while this software runs.

*4:  The ARB memory expansion 256M sample (optional) must be installed into the Vector Signal Generator option to use waveform patterns that exceed 64 M samples.

*5:  The Combination of Baseband Signal (optional) must be installed into the MG3710A/MG3740A to use waveform patterns of maximum 128 M samples.

*6:  The ARB memory expansion 256M sample (optional) must be installed into the MG3710A/MG3740A to use waveform patterns of maximum 256 M samples.

*7:   To use waveform patterns of maximum 512 M samples, either of the
following must be installed:

MG3710A

- ARB memory expansion 1024 M sample (optional)
- ARB memory expansion 256 M (optional) and Combination of
  Baseband Signal (optional)

MG3740A

- ARB memory expansion 256 M (optional) and Combination of
  Baseband Signal (optional)

■  Notes on waveform pattern conversion

The waveform patterns generated with this software varies according to
the main unit type. If using the waveform pattern to the different main
unit, you need to convert the waveform pattern.

For details about how to convert a waveform pattern, refer to each one of
the following manuals.

- MG3700A/MG3710A Vector Signal Generator MG3740A Analog
  Signal Generator Operation Manual (IQproducer™)
  4.5 "File Conversion on Convert Screen"
- MS2690A/MS2691A/MS2692A and MS2830A Vector Signal Generator
  Operation Manual (IQproducer™)
  4.5 "File Conversion on Convert Screen"

This chapter describes the operating environment for the MX370102A/MX269902A.

**2**

Preparation

# 2.1 Operating Environment

The following environment is required for operating this software.

(1) PC that meets the following conditions

| OS | Windows XP/Windows Vista/Windows 7 |
|---|---|
| CPU | Pentium III 1 GHz equivalent or faster |
| Memory | 512 MB or more |
| Hard disk space | 5 GB or more free space in the drive where this software is to be installed.<br>The free hard disk space necessary to create waveform pattern varies depending on the waveform pattern size. The free disk space of 27 GB or greater is required to create four maximum (512 Msample) waveform patterns. |

(2) If viewing on PC, displays with a resolution of 1024 × 768 pixels are best viewed using a small font setting.

## 2.2 Installation/Uninstallation

This software is included in the IQproducer™ installer. It is automatically installed by installing the IQproducer™ that is supplied with this equipment or this software. When using a waveform pattern created using this software in the equipment, the license file must be installed in advance.

■ Installing/Uninstalling IQproducer™

For how to install and uninstall IQproducer™, refer to each of the following manuals:

- MG3700A/ MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™)
  Chapter 2 "Installation"
- MS2690A/MS2691A/MS2692A and MS2830A Vector Signal Generator Operation Manual (IQproducer™)
  Chapter 2 "Installation"

■ Installing/Uninstalling IQproducer™ license file

For how to install license file to MG3700A/MG3710A/MG3740A, refer to the following manual:

- MG3700A/ MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™)
  5.1 "Installing License File"

For how to uninstall license file from MG3700A/MG3710A/MG3740A, refer to each one of the following manuals:

- MG3700A Vector Signal Generator Operation Manual (Mainframe)
  3.10.10 "Install"
- MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)
  9.4.4 "Install"

Refer to the following manual for details of how to install/uninstall license file to MS2690A/MS2691A/MS2692A or MS2830A with Vector Signal Generator option.

- MS2690A/MS2691A/MS2692A and MS2830A Vector Signal Generator Operation Manual (IQproducer™)
  2.2 "Installation/Uninstallation"

**2**

Preparation

# 2.3   Starting up and exiting the software

This section explains how to start and stop this software.

***Note:***

> The following explanation assumes the use of Windows XP. The
> screen image may differ slightly if not using Windows XP.

## 2.3.1   Starting Software: When installed on other than MG3710A

Start this software using the following procedure.
The example assumes that it is a PC operation.

&lt;Procedure&gt;

1.   Click **Start** on the task bar, and point to **All Programs**. Next, point to
     **Anritsu Corporation**, point to **IQproducer**, and then click
     **IQproducer.**

2.   When IQproducer™ starts, the **Select instrument** screen is
     displayed.

     On the **Select instrument** screen, select the model of the main unit
     that uses the waveform patterns created by IQproducer™.

***Notes:***

- The software does not support MG3740A.

- To hide this screen and to start with the selected mainframe's
  screen from the next time, select the Don't show this window
  next time check box.

3. The common platform screen is displayed when **OK** is clicked in the **Select instrument** screen.

   The common platform screen is a screen used to select each function of the IQproducer™.
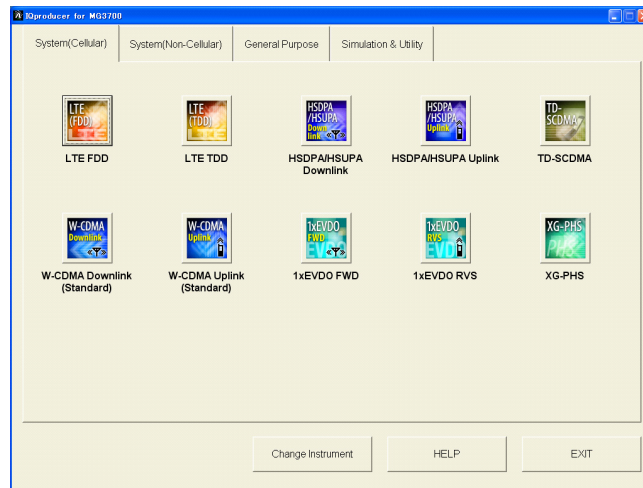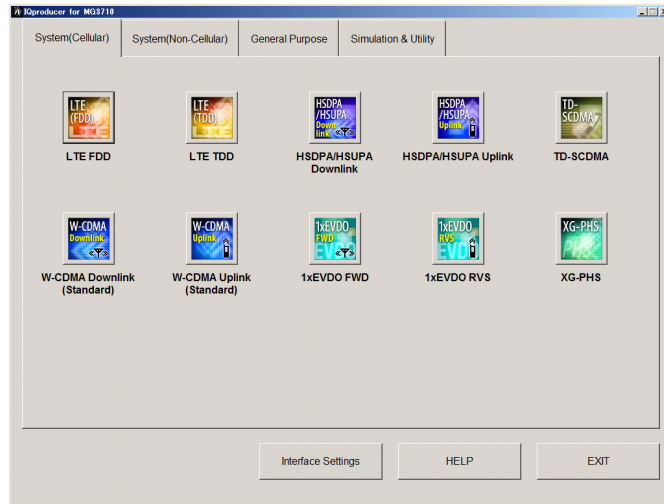


**Figure 2.3.1-1　Common Platform Screen**

4. Click the **General Purpose** tab on the common platform screen, to show the **General Purpose** selection screen that supports each telecommunication system.
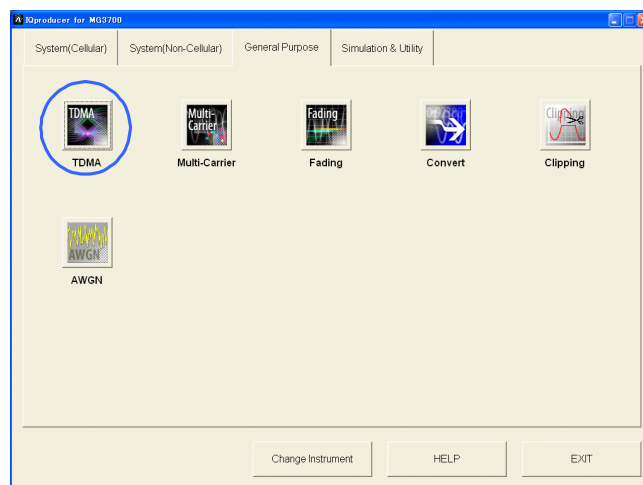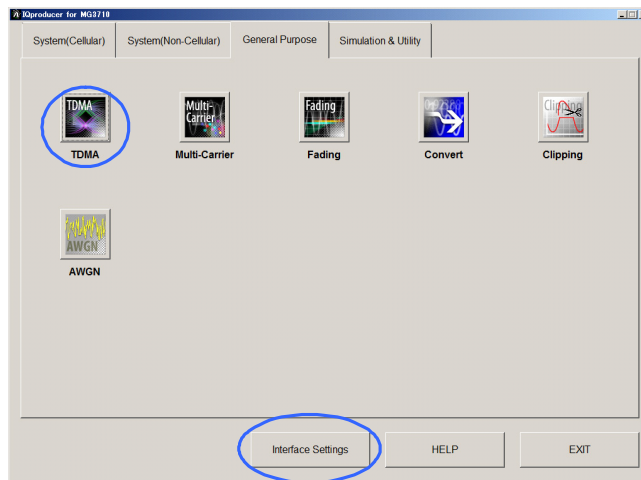


**Figure 2.3.1-2　General Purpose Selection Tab**

5. Click **TDMA** to display the main screen. For details of the main screen, refer to Chapter 3 "Detailed Description of Functions".

*Note:*

   If **Change Instrument** is clicked, the **Select instrument** screen will appear each time the software is loaded.

## 2.3.2　Starting Software: When installed on MG3710A

Start this software using the following procedure.

&lt;Procedure&gt;

1.　Press ⌈ IQpro ⌋ on the MG3710A/MG3740A front panel to display the common platform screen.

The common platform screen is a screen used to select each function of the IQproducer™.



**Figure 2.3.2-1　Common Platform Screen**

2.　Click the General Purpose tab on the common platform screen, to show the General Purpose selection screen that supports each telecommunication system.



**Figure 2.3.2-2　General Purpose Selection Tab**

3. Click TDMA to display the main screen. For details of the main screen, refer to Chapter 3 "Detailed Description of Functions".

***Note:***

When this software is installed on MG3710A/MG3740A, **Change Instrument** displays instead of **Interface Settings**. Clicking **Interface Settings** displays the Interface Setting dialog box.
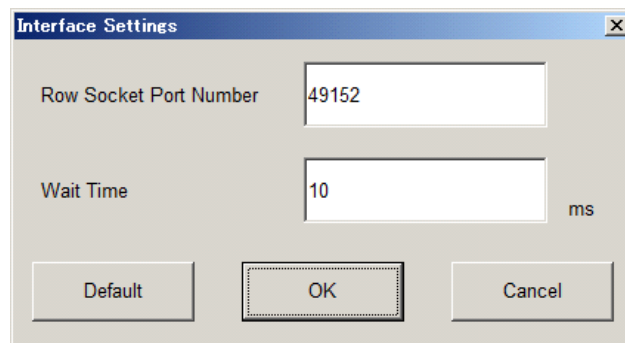


**Figure 2.3.2-3 Interface Settings Dialog Box**

Here, you can configure interface-related settings of IQproducer and MG3710A/MG3740A. To return to factory defaults, click **Default**.

- Row Socket Port Number

 Sets Row Socket port number. Set the same value as that for MG3710A/MG3740A.

- Wait Time

 Sets the wait time between commands.

## 2.3.3 Exiting Software

Stop this software using the following procedure.

■ When exiting only this software

To exit only this software without closing the Common Platform screen, or other IQproducer™ tools, do one of these below:

- Click the Exit button (  ) on the tool bar.
- Select Exit from the File menu.
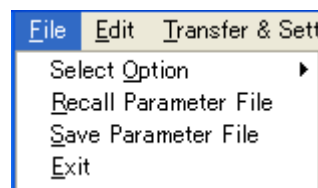- Click the  button on the upper right screen.



**Figure 2.3.3-1 Exiting Software**

**2**

*Preparation*

The operation of the three screen buttons is explained below.
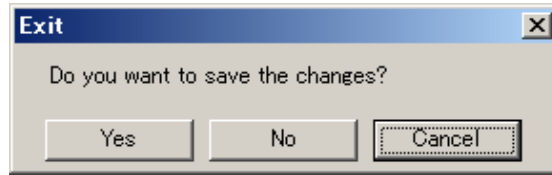


**Figure 2.3.3-2   Exit Confirmation Window**

- **Yes**           Saves current parameters to file and stops this software.
- **No**            Stops this software without saving current parameters to file.
- **Cancel** or ⊠   Cancels the process and returns to the main screen.

When stopping this software using the **Yes** button, the saved parameters are read at the next start and reset for each parameter.

■ When exiting entire IQproducer™ application

To exit all tools of IQproducer™ that are running, select **Exit** on the Common Platform Screen. In this case, a dialog is displayed to confirm stopping of each running tool.
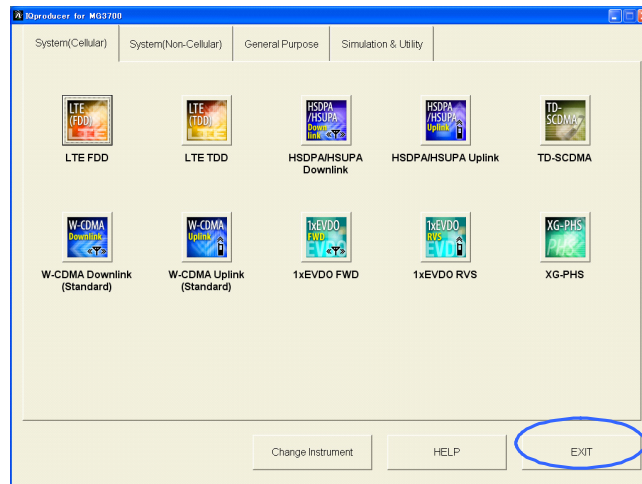


**Figure 2.3.3-3   Exiting IQproducer™**

# Chapter 3 Detailed Description of Functions

This chapter provides detailed descriptions of this software.

***Notes:***

- The examples and screens used throughout this chapter are based on the assumption that the IQproducer™ is activated with the MG3700A.

- The MG3710A, MG3740A, MS2690A/MS2691A/MS2692A, and MS2830A functions are described as notes in each item.

# 3.1   Screen Layout and Composition

## 3.1.1   Main screen

On common platform screen, click the **General Purpose** tab, and then click **TDMA** to display the main screen.
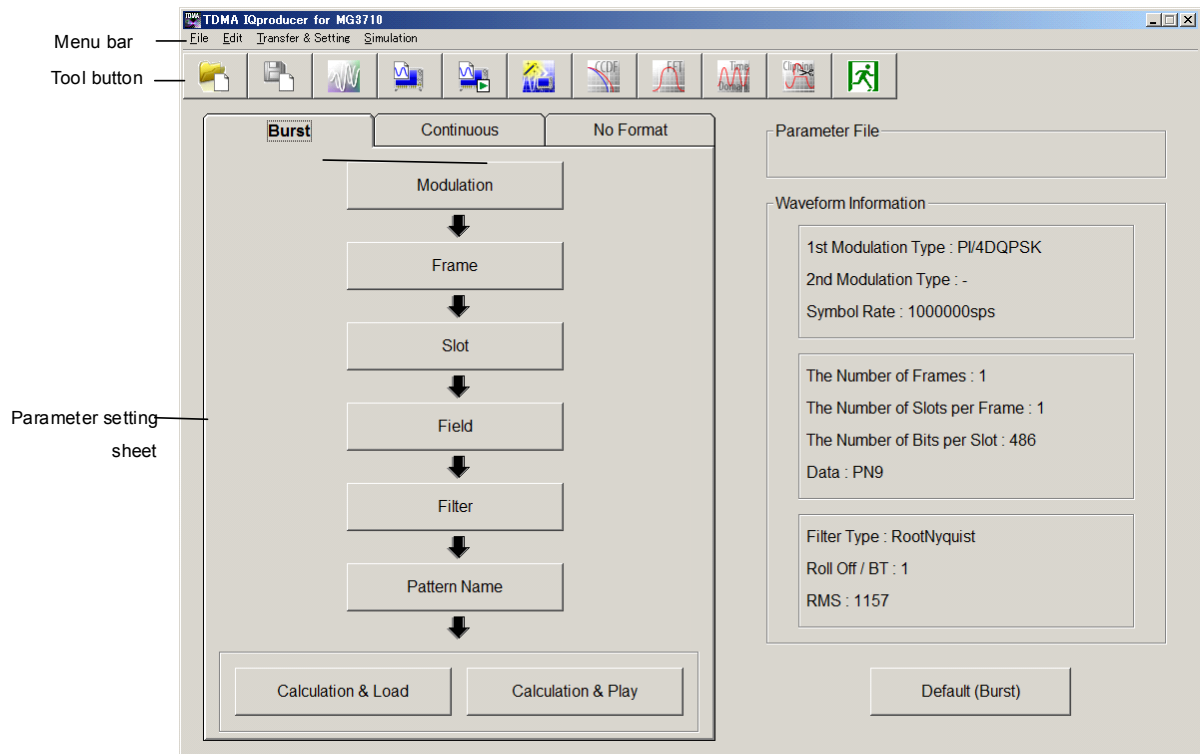


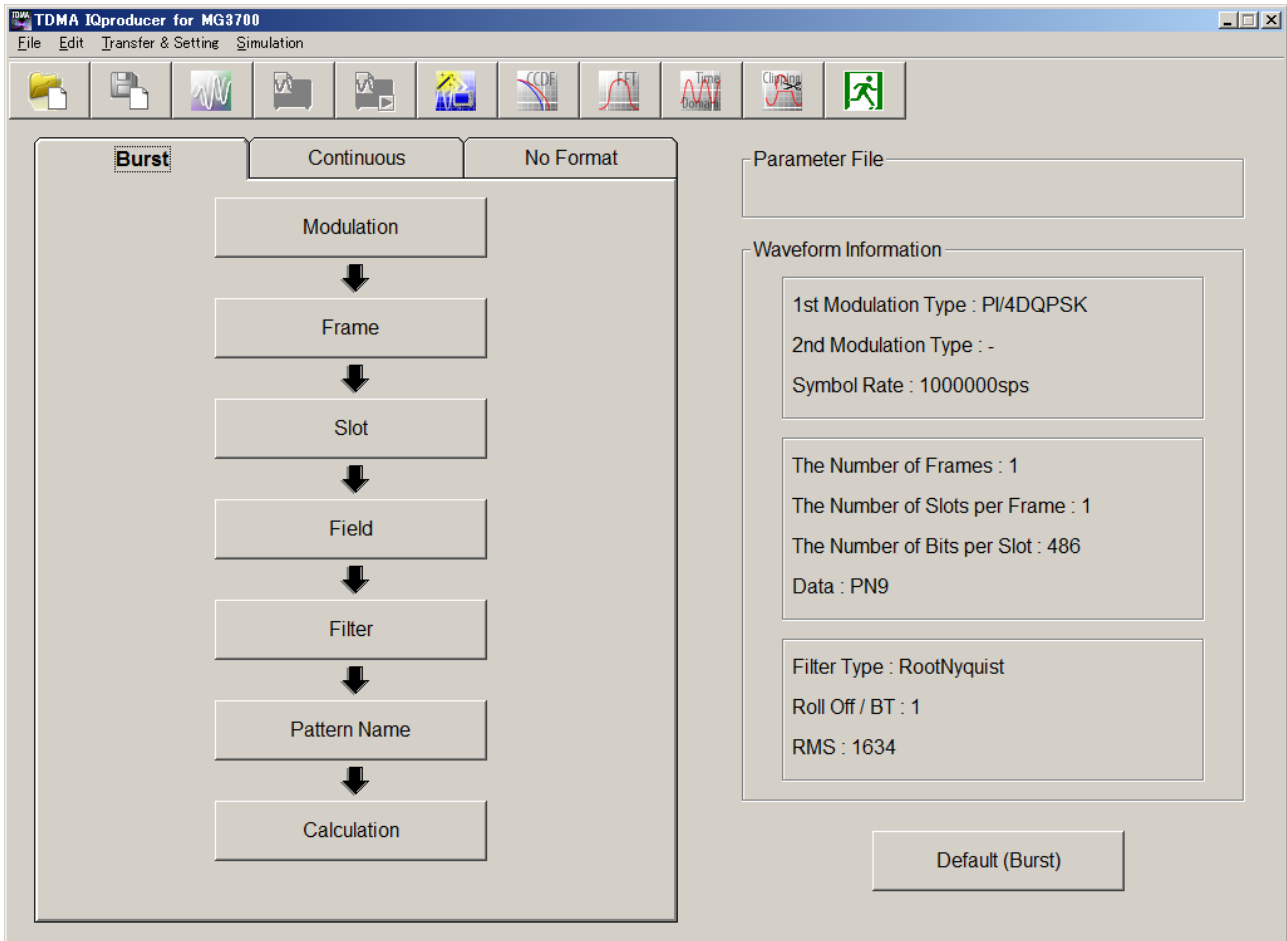**Figure 3.1.1-1    TDMA IQproducer Main Screen (When on MG3710 or MG3740)**

**Figure 3.1.1-2   TDMA IQproducer Main Screen (When on PC)**

■  **File** menu

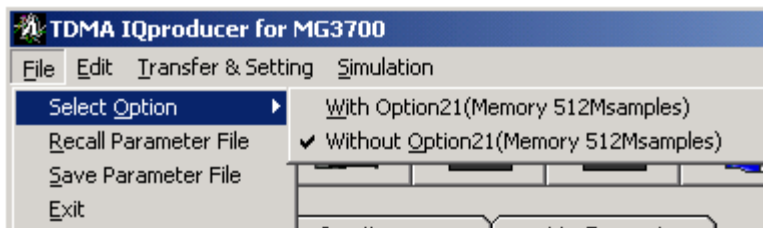The **File** menu contains the following items.



**Figure 3.1.1-3   File menu**

- **Select Option**

  ***Notes:***

  - This function is available only when **MG3700**, **MG3710**, MG3740 or **MS2830** is selected in the **Select instrument** screen.

  - ARB Memory Expansion (option) is not available for MS269xA. Only Memory 256M samples, 1 GB is available.

■ When using MG3700A or MS2830A

Select whether the ARB memory expansion option 256Msamples is installed. Selecting **With Option21 (Memory 512M samples)/With Option27 (Memory 256M samples)** supports creation of larger waveform patterns. If the ARB memory expansion option is not installed, the generated waveform pattern may not be able to be used. Waveform patterns cannot be created with a size greater than 256Msamples or 64M samples when **Without Option21 (Memory 512M samples)/Without Option27 (Memory 256M samples)** is selected. Select either according to the presence of ARB memory expansion option.

**Table 3.1.1-1   Available Options for MG3700A or MS2830A**

| Model | Items | ARB Memory Expansion |
|-------|-------|----------------------|
| MG3700A | With Option21 (Memory 512M samples) | 1 GB x 2 memory |
| | Without Option21 (Memory 512M samples): | 512 MB × 2 Memories |
| MS2830A | With Option27 (Memory 256M samples) | 1 GB |
| | Without Option27 (Memory 256M samples) | 256 MB |

■ When using MG3710A or MG3740A

The presence/absence of the ARB Memory Expansion (option) and Baseband Signal Combination Function (option) is selected. Selecting the ARB Memory Expansion (option) and the Baseband Signal Combination Function (option) generates a bigger waveform pattern, while selecting the Baseband Signal Combination Function (option) generates a waveform pattern. If an uninstalled option is selected, sometimes the created waveform pattern may not be usable.

Set the combination of installed options based on the following setting items.

**Table 3.1.1-2   Available Options for MG3710A or MG3740A**

| Items | Combinations of Options |
|---|---|
| Memory 64M samples | None |
| Memory 64M samples × 2 | Option48 and Option 78 |
| Memory 256M samples | Option45 or Option 78 |
| Memory 256M samples × 2 | Option 45 and Option 48<br>or<br>Option 75 and Option 78 |
| Memory 1024M samples* | Option46 or Option 76 |
| Memory 1024M samples × 2* | Option 46 and Option 48<br>or<br>Option 76 and Option 78 |

*:    Option 46 and Option 76 are not available for MG3740A and do not
      appear on the display.

The maximum size of the generated waveform pattern for each of
the setting items is shown below.

**Table 3.1.1-3   Waveform Pattern Maximum Size**

| Items | Maximum Size |
|---|---|
| Memory 64M samples | 64M samples |
| Memory 64M samples × 2<br>(With Option48, 78) | 128M samples |
| Memory 256M samples | 256M samples |
| Memory 256M samples × 2<br>(With Option48, 78) | 512M samples |
| Memory 1024M samples* | 512M samples |
| Memory 1024M samples × 2*<br>(With Option48, 78) | 512M samples |

*:    Does not support MG3740A.

- **Recall Parameter File**
  Loads the parameter files saved by Save Parameter File. Setting
  can be facilitated by using the loaded parameters.

- **Save Parameter File**
  Saves the setting parameters to a file.

- **Exit**
  Exits this Software.

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Detailed Description of Functions

■ **Edit** menu

The **Edit** menu contains the following item.



**Figure 3.1.1-4　Edit menu**

- **Calculation Waveform Pattern**

  Starts waveform pattern generation after parameter setting. This is the same operation with clicking the Calculation button on a parameter setting sheet.

- **Calculation & Load**

  *Note:*

  This function is available only when this software is used on MG3710A or MG3740A.

  After waveform generation is finished, the created waveform pattern is loaded into the MG3710A or MG3740A waveform memory.

- **Calculation & Play**

  *Note:*

  This function is available only when this software is used on MG3710A or MG3740A.

  After waveform generation is finished, the created waveform pattern is loaded and selected at the MG3710A or MG3740A waveform memory.

- **Clipping**

  Displays the Clipping setting screen. In this screen, clipping and filtering processing can be performed for a generated waveform pattern.

■ **Transfer Setting** Menu

The **Transfer Setting** menu contains the following item.



**Figure 3.1.1-5    Transfer Setting menu**

- Transfer & Setting Wizard
  *Note:*

  This function is available only when MG3700, MG3710 or MG3740 is selected in the **Select instrument** screen.

  Displays the Transfer Setting Wizard screen. Every operation ranging from connecting the PC and MG3700A, MG3710A or MG3740A and transferring the waveform pattern to the MG3700A, MG3710A or MG3740A, to loading the waveform pattern into the MG3700A, MG3710A or MG3740A ARB memory is performed at this screen.

■ **Simulation** menu

The **Simulation** menu contains the following items.



**Figure 3.1.1-6    Simulation menu**

- CCDF
  Displays the CCDF graph display screen. In this screen, the CCDF of the generated waveform pattern is displayed in a graph.

- FFT
  Displays the FFT graph display screen. In this screen, the FFT-processed spectrum of the generated waveform pattern is displayed in a graph.

- Time Domain
  Displays the Time Domain screen. In this screen, the time domain waveform of a generated waveform pattern is displayed in a graph.

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Detailed Description of Functions

■ Tool buttons

The following tool buttons are provided:

***Notes:***

- Transfer&Setting Wizard is available only when **MG3700, MG3710** or **MG3740** is selected in the **Select instrument** screen.

- Calculation & Load and Calculation & Play are available only when this software is used on MG3710A or MG3740A.

|  |  |
|---|---|
| | Recall Parameter File |
| | Save Parameter File |
| | Calculation |
| | Calculation & Load |
| | Calculation & Play |
| | Transfer & Setting Wizard |
| | CCDF |
| | FFT |
| | Time Domain |
| | Clipping |
| | Exit |

Clicking a tool button operates the same as the corresponding commands in the menu.

■ Parameter setting sheets
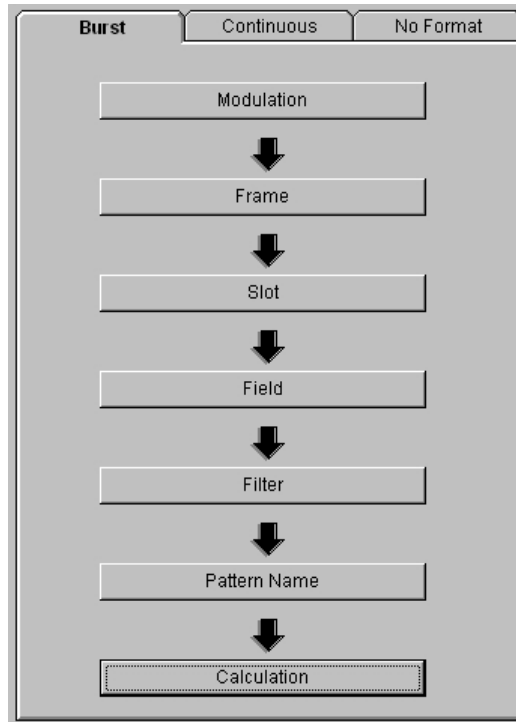


**Figure 3.1.1-7    Parameter setting sheets**

The parameter setting sheets are provided on the left of the TDMA main screen, consisting of three independent sheets: Burst, Continuous, and No Format. Each parameter setting sheet has setting item buttons. When one of these setting item buttons is clicked, the corresponding setting screen is displayed. Although the setting item buttons are placed sequentially from top down with arrows, it is not necessary to perform parameter settings in this order. Note, however, that some parameters have an effect on the subsequent parameters.

■ Parameter File display

Parameter File
PHS.prm

**Figure 3.1.1-8   Parameter File display**

When reading or saving a parameter file, the target file name is displayed in this area.

■ Waveform Information display

Waveform Information

1st Modulation Type : PI/4DQPSK
2nd Modulation Type : 16QAM
Symbol Rate : 192000sps

The Number of Frames : 511
The Number of Slots per Frame : 8
The Number of Bits per Slot : 434
Data : PN9

Filter Type : RootNyquist
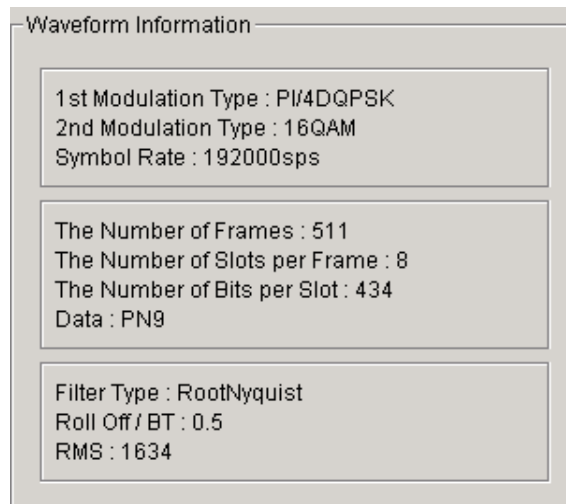Roll Off / BT : 0.5
RMS : 1634

**Figure 3.1.1-9   Waveform Information display**

The settings of the current parameter are displayed for each parameter setting sheet.
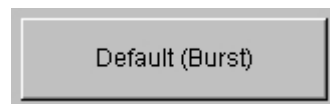
■ Initialization button

Default (Burst)

**Figure 3.1.1-10   Initialization button**

Clicking this button initializes the parameters on the selected parameter setting sheet.

## 3.1.2   Parameter setting sheet

There are three parameter setting sheets (Burst, Continuous, No Format) on the TDMA main screen, and each sheet is displayed by clicking the tab on the sheet. Each parameter setting sheet has five or seven setting item buttons, and when one of these buttons is clicked, the corresponding setting screen is displayed. Although the setting item buttons are placed sequentially from top down with arrows, it is not necessary to perform parameter settings in this order. Note, however, that some parameters have an effect on the subsequent parameters (refer to Section 3.1.2.8 "Re-setting by changing parameter").

The following setting item buttons are provided:
**[Modulation]**, **[Frame]**, **[Slot]**, **[Field]**, **[Data]**, **[Filter]**, **[Pattern Name]**, **[Calculation]**

The setting item buttons are different among parameter setting sheets. See the table below for what setting item buttons are provided in each parameter setting sheet.

**Table 3.1.2-1    Setting item buttons provided on each parameter setting sheet**

| Setting Item Buttons | Parameter Setting Sheets | | |
|:---:|:---:|:---:|:---:|
| | **Burst** | **Continuous** | **No Format** |
| Modulation | ✓ | ✓ | ✓ |
| Frame | ✓ | ✓ | – |
| Slot | ✓ | ✓ | – |
| Field | ✓ | ✓ | – |
| Data | – | – | ✓ |
| Filter | ✓ | ✓ | ✓ |
| Pattern Name | ✓ | ✓ | ✓ |
| Calculation | ✓ | ✓ | ✓ |

- Burst:        Used to generate a burst waveform with a slot format.
- Continuous: Used to generate a continuous waveform with a slot format.
- No Format:  Used to generate a continuous waveform without a slot format.

When running on MG3710A or MG3740A the **Calculation & Load**, **Calculation & Play buttons display** instead of the **Calculation** button.

The following sections show the setting screens corresponding to each setting item.

**3**

Detailed Description of Functions

## 3.1.2.1 Modulation

In the "Modulation" setting item, the modulation type, symbol rate, and oversampling rate can be set. The 2nd modulation type can be set only in the Burst parameter setting sheet, and the modulation type can be switched within one slot. Clicking the **[Modulation]** button on a parameter setting sheet displays the Modulation setting screen.

After setting the parameters, click the **[OK]** button on the screen to apply the current settings and close the Modulation setting screen. Clicking the **[Cancel]** button or ✕ button on the upper right of the screen closes the Modulation setting screen canceling the current settings.



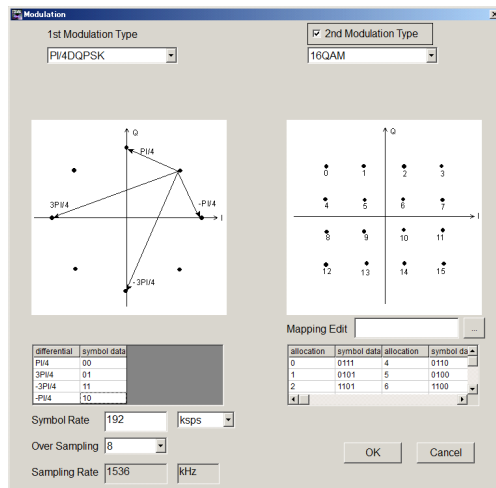**Figure 3.1.2.1-1 Modulation setting screen (When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A)**
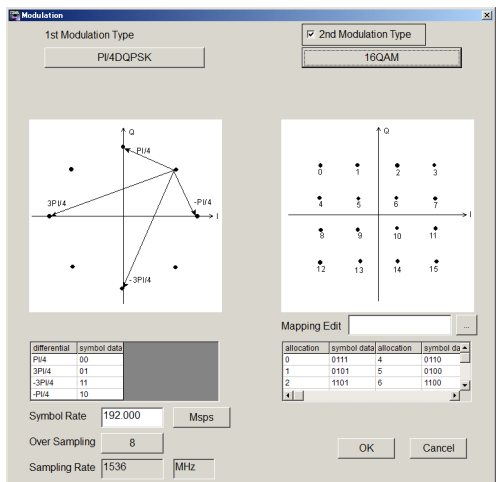


**Figure 3.1.2.1-2 Modulation setting screen（When running on MG3710A or MG3740A)**

The following parameters can be set in the Modulation setting screen.

Modulation Type (1st Modulation Type)

| | |
|---|---|
| [Overview] | Set the 1st modulation type. |
| [Default] | PI/4DQPSK |
| [Options] | BPSK, DBPSK, PI/2DBPSK, |
| | QPSK, O-QPSK, DQPSK, PI/4DQPSK, |
| | 8PSK, D8PSK, |
| | 16QAM, 32QAM, 64QAM, 256QAM, |
| | 2ASK, 4ASK, 2FSK, 4FSK |
| [Remarks] | Symbol points on the IQ plane for each modulation type are shown in the Modulation Type list box, and the decimal numbers corresponding to each symbol point are listed in the table in the lower part of the screen. (Similar figures and tables are provided in Appendix B for reference.) |

For modulation types 8PSK, D8PSK, 16QAM, 32QAM, 64QAM, and 256QAM, 4FSK, the decimal numbers corresponding to each symbol point can be changed by clicking the referential button [ ... ] under the IQ plane and selecting a user file for IQ mapping.   Refer to Appendix C "User File Format" for details on the user file.

For modulation types BPSK and QPSK, the symbol points can be rotated by 45° by selecting the check box [ □ 45-degree Rotation ]   under the Modulation Type list box.

When generating Continuous or No Format waveform at 2FSK and 4FSK, the phase may not be continuous between the first and last waveform data.

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Detailed Description of Functions

Modulation Type (2nd Modulation Type)

[Overview]        Set the 2nd modulation type.

[Default]          PI/4DQPSK

[Options]         BPSK, DBPSK, PI/2DBPSK,
QPSK, DQPSK, PI/4DQPSK, 8PSK, D8PSK,
16QAM, 32QAM, 64QAM, 256QAM

[Remarks]       The settings for the 2nd modulation type can be configured by selecting the check box ☐ 2nd Modulation Type . Note, however, that the 2nd modulation type cannot be set when 2ASK 4ASK, 2FSK, or 4FSK is set for the 1st modulation type. The decimal numbers corresponding to each symbol point are displayed in the same manner as for the 1st modulation type.

Symbol Rate, Modulation Index, Maximum Frequency deviation

The display changes according to the setting made for modulation type.

    Other than below:   Symbol Rate
    2ASK, 4ASK, 2FSK: Modulation Index
    4FSK:               Maximum Frequency deviation

Symbol Rate

[Overview]        Set the symbol rate.

[Default]          1 Msps

[Setting range]    1 ksps to 80 Msps      Except for MG3740A
                1 ksps to 4 Msps        MG3740A

[Resolution]      1 sps

Over Sampling

[Overview]        Set the oversampling rate.

[Default]          2

[Options]         2, 3, 4, 8, 16, 32

[Remarks]       The setting range varies depending on the modulation index when 2FSK is set for the modulation type.

Sampling Rate

[Overview]        Set the sampling rate.

[Default]          2 MHz

[Setting range]    20 kHz to 160 MHz    Except for MG3740A
                20 kHz to 8 MHz      MG3740A

[Remarks]       The value of *symbol rate × oversampling rate* is automatically set. When the Manchester code setting is enabled, however, the value of *symbol rate × oversampling rate × 2* is automatically set.

GSM

[Overview]    Enable/disable the automatic setting in accordance with GSM.

When 8PSK or 2FSK is set for the modulation type, the check box    ☐ GSM    appears under the Modulation Type list box. When this check box is selected, the automatic setting is performed in accordance with GSM. Note, however, that the 2nd modulation type cannot be set when the GSM check box is selected.

The setting values are as follows.

| | |
|---|---|
| Symbol data: | 8PSK symbol data (Refer to Appendix B) |
| Symbol rate: | 270.833 ksps |
| Oversampling rate: | 12 |
| Number of slots (see 3.1.2.2): | 8 slots |
| Ramp length (see 3.1.2.3) | 2 symbols × 2 |
| Guard length (see 3.1.2.3) | 4.25 symbols |
| Filter (see 3.1.2.6) | Specified Filter |

Modulation Index

[Overview]    Set the modulation index.
[Default]    1
[Setting range]    0.00 to 1.00 (for 2ASK, 4ASK), 0.20 to 10.00 (for 2FSK)
[Remarks]    The modulation index can be set in the text box that appears under the Modulation Type list box when 2ASK, 4ASK or 2FSK is set for the modulation type. When the modulation type is 2FSK, the setting range of the oversampling rate varies depending on the modulation index.

Manchester Code

[Overview]    Enable/disable Manchester code setting.

When 2ASK is set for the modulation type, the check box ☐ Manchester Code    appears under the Modulation Type list box. The Manchester code is selected when this check box is selected, and NRZ is selected when this check box is cleared. NRZ is always selected for modulation types other than 2ASK.

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Detailed Description of Functions

Maximum frequency deviation

[Overview]      This sets the maximum frequency deviation.

[Default]      945

[Setting range]      120 to 100000

[Remarks]      This is available only when 4FSK is selected for modulation; a text box appears below the Modulation Type list box.

Mapping Edit

Click the referential button on the right hand side of Mapping Edit. Here you can select user file.

Refer to Appendix C.1 "IQ Mapping User File Format" for details.

Keep Phase continuity

[Overview]      This function keeps the continuity of phase header and footer of waveform pattern.

[Remarks]      This is available when parameter setting sheet is Continuous, No Format, and when modulation method is 2FSK, 4FSK.

***Note:***

When the **Number of Frames** setting is set to **AUTO**, the number of frames to be generated differs depending on whether the Keep phase continuity check box is selected or not.

If selected, the number of frames is determined by the data frequency set for Data Field. This is because it is no longer necessary to repeat until the header and footer of waveform pattern matches, as previously.

If the check box is selected, offset to applied to the waveform pattern frequency. Its value is displayed as "Frequency Offset" as shown below.
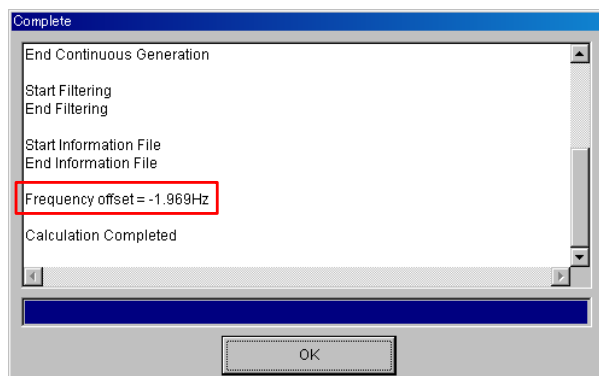


**Figure 3.1.2.1-3　Waveform Generation Screen**

## 3.1.2.2  Frame

In the "Frame" setting item, the number of frames, the number of slots per frame, and the transmission status of each slot (ON/OFF) can be set. This setting item is not provided in the No Format parameter setting sheet. Clicking the **[Frame]** button on the Burst or Continuous parameter setting sheet displays the Frame setting screen shown in Figure 3.1.2.2-1.

After setting the parameters, click the **[OK]** button on the screen to apply the current settings and close the Frame setting screen. Clicking the **[Cancel]** button or ✕ button on the upper right of the screen closes the Frame setting screen canceling the current settings.
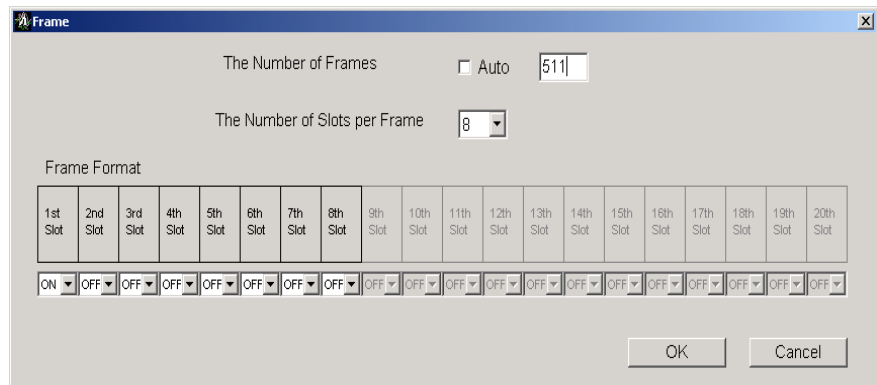


**Figure 3.1.2.2-1   Frame setting screen**

The following parameters can be set in the Frame setting screen.

The Number of Frames
[Overview]          Set the number of frames.
[Default]            1
[Setting range]    1 to 32767

[Remarks]     The number of frames is automatically set when the check box ☐ Auto is selected. On the Burst parameter setting sheet, the number of frames that retain the continuity of the continuous pattern set in the Data Field area (refer to Section 3.1.2.4 "Field" for details) is automatically set. When the continuous pattern is PN9, for example, the number of frames is automatically set to 511, retaining the PN9 continuity. On the Continuous parameter setting sheet, the number of frames that retains the phase continuity as well as the continuity of the continuous pattern is automatically set. But if the continuous pattern is set to "UserFile" when the check box ☐ Auto is selected, the number of frames is automatically set to 1 or a value that retains the phase continuity only. When the check box ☐ Auto is cleared, the number of frames can be set freely within the setting range. Note, however, the continuity of the continuous pattern and phase is not guaranteed in this event.

The Number of Slots per Frame

[Overview]        Set the number of slots per frame.
[Default]         1
[Setting range]   1 to 20
[Remarks]         The transmission status can be selected for the slots to be used (set by ON/OFF). It is prohibited to set all the slots to OFF. In the Continuous parameter setting sheet, an ALL1 signal is output for the transmission-OFF slots (slots for which the transmission status is set to OFF).
The signal output level when the transmission status is OFF is the same as that when the transmission status is ON.

### 3.1.2.3    Slot

The slot format can be set in the "Slot" setting item. This setting item is not provided in the No Format parameter setting sheet. The setting items for "Slot" in the Burst parameter setting sheet and that in the Continuous parameter setting sheet are different. Clicking the **[Slot]** button on the Burst or Continuous parameter setting sheet displays the Slot setting screen.

The slot format set here is commonly applied to all the transmission-ON slots. On slot can be divided into up to 24 fields. The number of bits and field type (Guard, Ramp, Fixed, Data, or CRC) can be set for each field. The fields for which the number of bits is set to 0 are recognized as nonexistent.

When the 2nd modulation type is set in the Burst parameter setting sheet, the setting range for the 1st modulation type is between the first and 12th fields, and that for the 2nd modulation type is between the 13th to 24th fields.

When the **[Apply]** button on the screen is clicked after setting the parameters, the Slot Format image on the upper of the Frame screen is modified according to the settings. Clicking the **[OK]** button applies the current settings and closes the Slot setting screen. Clicking the **[Cancel]** button or ☒ button on the upper right of the screen closes the Slot setting screen canceling the current settings.

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Detailed Description of Functions
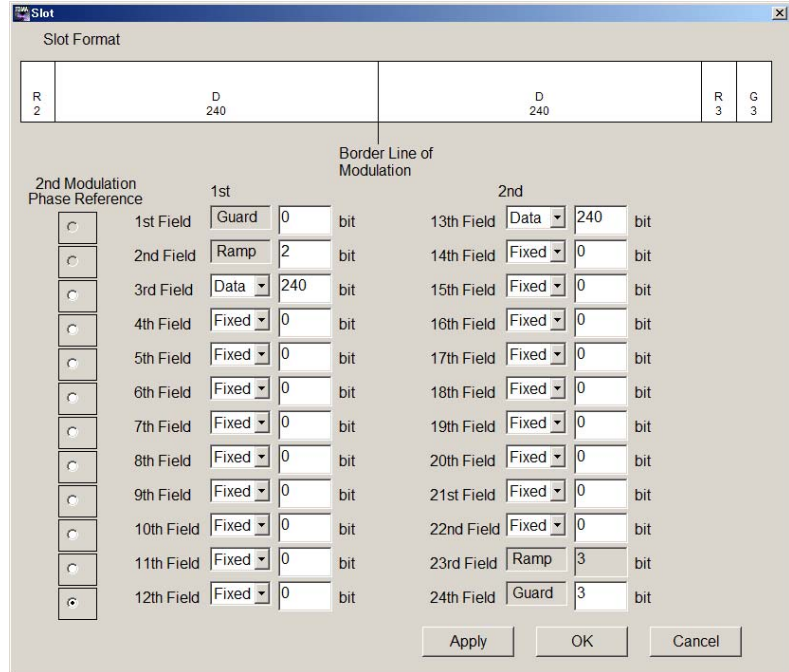
Setting items for Burst



**Figure 3.1.2.3-1    Slot setting screen for Burst (When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A)**
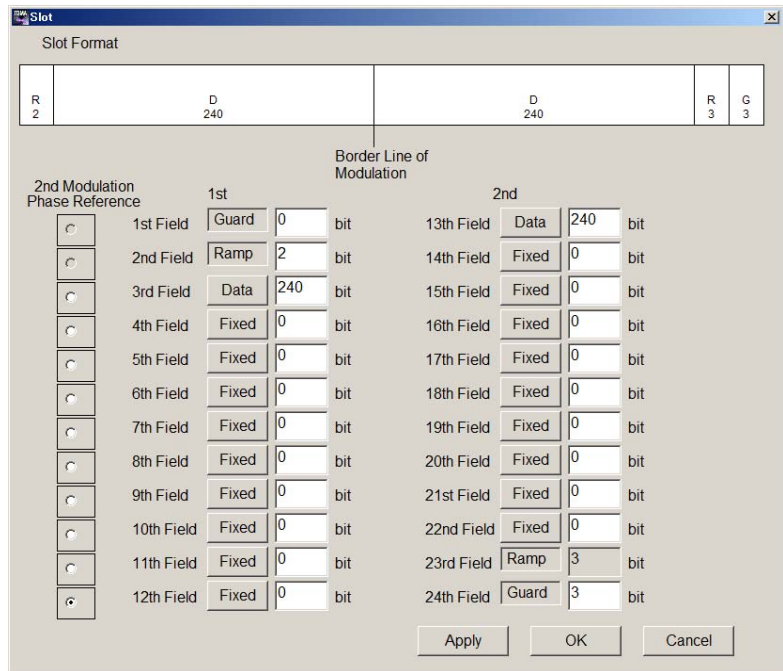


**Figure 3.1.2.3-2    Slot setting screen for Burst (When running on MG3710A or MG3740A)**

The following parameters can be set in the Slot setting screen for Burst.

Guard

[Overview]        Set the number of bits in the Guard field.

                    The Guard field is fixed to the first and 24th fields.

[Setting range]   The setting range for the number of bits is determined as follows according to the set modulation type.

**Table 3.1.2.3-1   Setting range for Guard**

| (1st/2nd) Modulation Type | Number of Bits in 1st Field | Number of Bits in 24th Field |
|---|---|---|
| BPSK, DBPSK, PI/2DBPSK, 2ASK, 2FSK | Integer number from 0 to 9960 | Integer number from 0 to 9960 |
| QPSK, O-QPSK, DQPSK, PI/4DQPSK, 4ASK, 4FSK | Multiples of 2 from 0 to 9960 | Multiples of 2 from 0 to 9960 |
| 8PSK, D8PSK | Multiples of 3 from 0 to 9960 | Multiples of 3 from 0 to 9960 |
| 16QAM | Multiples of 4 from 0 to 9960 | Multiples of 4 from 0 to 9960 |
| 32QAM | Multiples of 5 from 0 to 9960 | Multiples of 5 from 0 to 9960 |
| 64QAM | Multiples of 6 from 0 to 9960 | Multiples of 6 from 0 to 9960 |
| 256QAM | Multiples of 8 from 0 to 9960 | Multiples of 8 from 0 to 9960 |

Ramp

[Overview]        Set the number of bits in the Ramp field.

                    The Ramp field is fixed to the second and 23rd fields. The number of bits equivalent to the symbol length set in the second field is automatically set to the 23rd field.

[Setting range]   The setting range for the number of bits is determined as follows according to the set modulation type.

**Table 3.1.2.3-2   Setting range for Ramp**

| (1st/2nd) Modulation Type | Number of Bits |
|---|---|
| BPSK, DBPSK, PI/2DBPSK, 2ASK, 2FSK | Integer number from 1 to 16 |
| QPSK, O-QPSK, DQPSK, PI/4DQPSK, 4ASK, 4FSK | Multiples of 2 from 2 to 32 |
| 8PSK, D8PSK | Multiples of 3 from 3 to 48 |
| 16QAM | Multiples of 4 from 4 to 64 |
| 32QAM | Multiples of 5 from 5 to 80 |
| 64QAM | Multiples of 6 from 6 to 96 |
| 256QAM | Multiples of 8 from 8 to 128 |

**3**

Detailed Description of Functions

Slot

The following items are available:

Fixed

| | |
|---|---|
| [Overview] | Set the number of bits in the fixed data field. The fixed data field can be set to the 3rd through 22nd fields. |
| [Setting range] | An integer number from 0 to 128 |

Data

| | |
|---|---|
| [Overview] | Set the number of bits in the continuous pattern data field, such as a pseudo random pattern (PN9, PN15). The continuous pattern data field can be set to the 3rd through 22nd fields. |
| [Setting range] | An integer number from 0 to 1024 |

CRC

| | |
|---|---|
| [Overview] | Set the number of bits in the cyclic redundancy check (CRC) field. The CRC field can be set to the 4th through 22nd fields. |
| [Options] | 0, 8, 12, 16, 24, 32 |
| [Remarks] | The following generation polynomial expressions are used according to the set number of bits: |

$$8 \text{ bits:} \quad x^8 + x^7 + x^4 + x^3 + x + 1$$
$$12 \text{ bits:} \quad x^{12} + x^{11} + x^3 + x^2 + x + 1$$
$$16 \text{ bits:} \quad x^{16} + x^{12} + x^5 + 1$$
$$24 \text{ bits:} \quad x^{24} + x^{23} + x^6 + x^5 + x + 1$$
$$32 \text{ bits:} \quad x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$$

The total number of bits in the left fields of the CRC field (excluding Guard and Ramp fields) must be 1 or more. When setting two or more CRC fields, the total number of bits between the CRC field and the previous CRC field must be 1 or more. The CRC calculation area can be set in the Field setting screen (refer to Section 3.1.2.4 "Field" for details).

The total number of bits in the Fixed, Data, and CRC fields is restricted as follows according to the set modulation type. When the 2nd modulation type is set, the total number of bits for the 1st modulation type should be calculated from the third to 12th fields, and that for the 2nd modulation type should be calculated from the 13th to 22nd fields. Also, note that the total number of bits cannot be set to 0.

**Table 3.1.2.3-3   Restrictions on total number of bits for modulation type**

| (1st/2nd) Modulation Type | Total Number of Bits |
|---|---|
| BPSK, DBPSK, PI/2DBPSK, 2ASK, 2FSK | – |
| QPSK, O-QPSK, DQPSK, PI/4DQPSK, 4ASK, 4FSK | Multiples of 2 |
| 8PSK, D8PSK | Multiples of 3 |
| 16QAM | Multiples of 4 |
| 32QAM | Multiples of 5 |
| 64QAM | Multiples of 6 |
| 256QAM | Multiples of 8 |

2nd Modulation Phase Reference

[Overview]       Set the 0 phase reference symbol.
                The optional radio buttons are displayed for the third to 12th fields when the 2nd modulation type is set. When the 1st modulation mode is the differential modulation mode, the 2nd modulation is performed regarding the phase of the last symbol in the field with the selected optional radio button as 0.

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Detailed Description of Functions
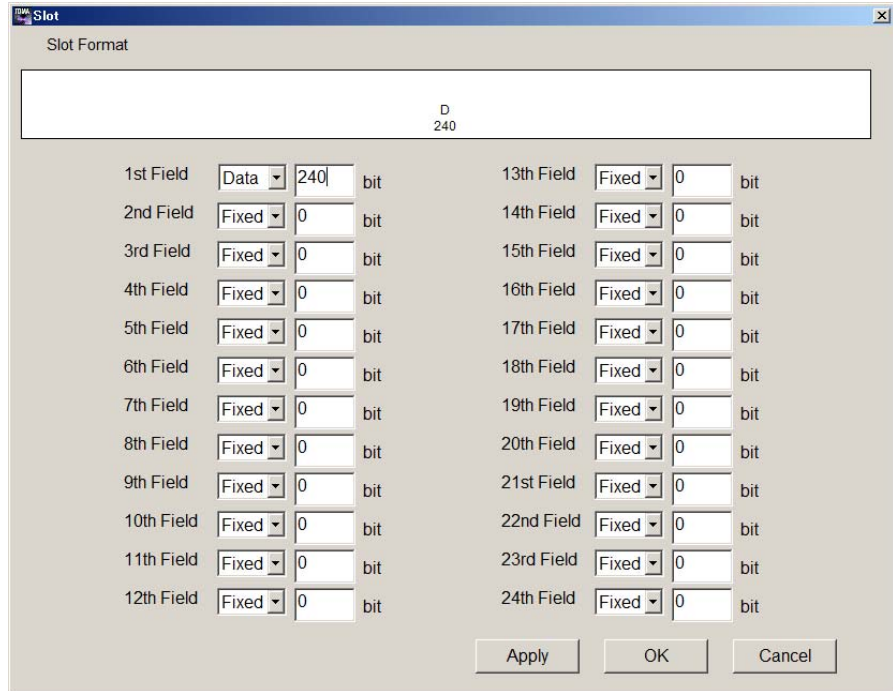
Setting items for Continuous



**Figure 3.1.2.3-3   Slot setting screen for Continuous (When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A)**
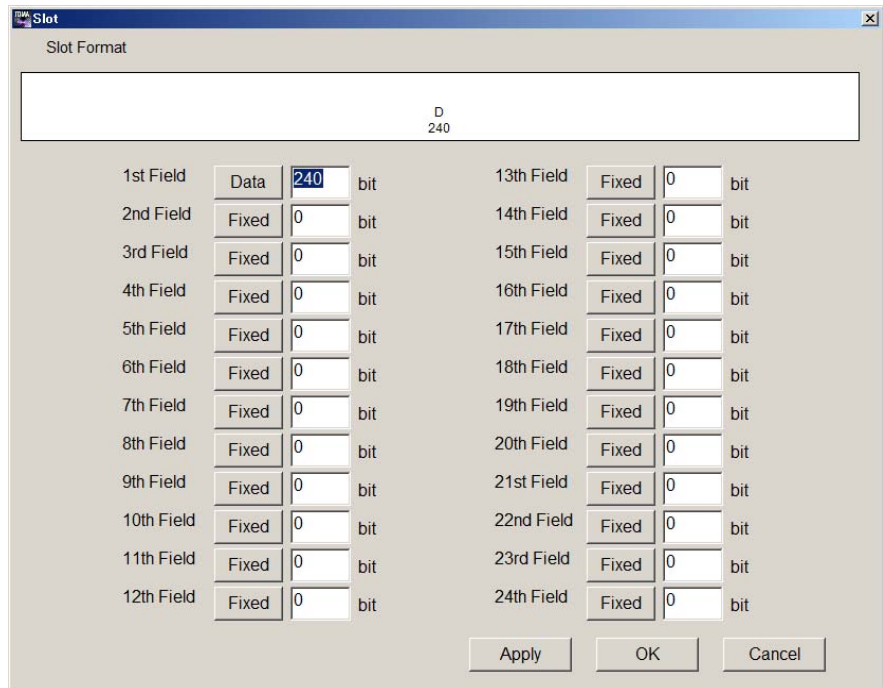


**Figure 3.1.2.3-4   Slot setting screen for Continuous (When running on MG3710A or MG3740A)**

The following parameters can be set in the Slot setting screen for Continuous.

Fixed

[Overview]       Set the number of bits in the fixed data field.
                 The fixed data field can be set to the first through 24th fields.

[Setting range]  An integer number from 0 to 128

Data

[Overview]       Set the number of bits in the continuous pattern data field, such as a pseudo random pattern (PN9, PN15). The continuous pattern data field can be set to the first through 24th fields.

[Setting range]  An integer number from 0 to 1024

CRC

[Overview]       Set the number of bits in the cyclic redundancy check (CRC) field.
                 The CRC field can be set to the 2nd through 24th fields.

[Options]        0, 8, 12, 16, 24, 32

[Remarks]        The following generation polynomial expressions are used according to the set number of bits:

   8 bits:  $x^8 + x^7 + x^4 + x^3 + x + 1$

   12 bits: $x^{12} + x^{11} + x^3 + x^2 + x + 1$

   16 bits: $x^{16} + x^{12} + x^5 + 1$

   24 bits: $x^{24} + x^{23} + x^6 + x^5 + x + 1$

   32 bits: $x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$

The total number of bits in the left fields of the CRC field must be 1 or more. When setting two or more CRC fields, the total number of bits between the CRC field and the previous CRC field must be 1 or more. The CRC calculation area can be set in the Field setting screen (refer to Section 3.1.2.4 "Field" for details).

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Detailed Description of Functions

The total number of bits is restricted as follows according to the set modulation type. Also, note that the total number of bits cannot be set to 0.

**Table 3.1.2.3-4   Restrictions on total number of bits**

| Modulation Type | Total Number of Bits |
|---|---|
| BPSK, DBPSK, PI/2DBPSK, 2ASK, 2FSK | – |
| QPSK, ,O-QPSK, DQPSK, PI/4DQPSK, 4ASK, 4FSK | Multiples of 2 |
| 8PSK, D8PSK | Multiples of 3 |
| 16QAM | Multiples of 4 |
| 32QAM | Multiples of 5 |
| 64QAM | Multiples of 6 |
| 256QAM | Multiples of 8 |

### 3.1.2.4    Field

In the "Field" setting item, the contents of each field in a transmission-ON slot can be set. This setting item is not provided in the No Format parameter setting sheet. Clicking the **[Field]** button on the Burst or Continuous parameter setting sheet displays the Field setting screen.

The slot format image is displayed on the upper of the Field setting screen, like in the Slot setting screen. Select a slot to be set from the Slot Format list box on the upper-left of the screen. The field numbers, field types, and the numbers of bits in each field are displayed in the middle of the screen. For Fixed fields and CRC fields, a text box is displayed on the right. For Data fields, their contents can be set in the Data Field area under the slot format image.
When "ALL" is selected from the Slot Format list box, the field settings on the Field screen commonly apply to all transmission slots.

After setting the parameters, click the **[OK]** button to apply the current settings and close the Field setting screen. Clicking the **[Cancel]** button or ☒ button on the upper right of the screen closes the Field setting screen canceling the current settings.
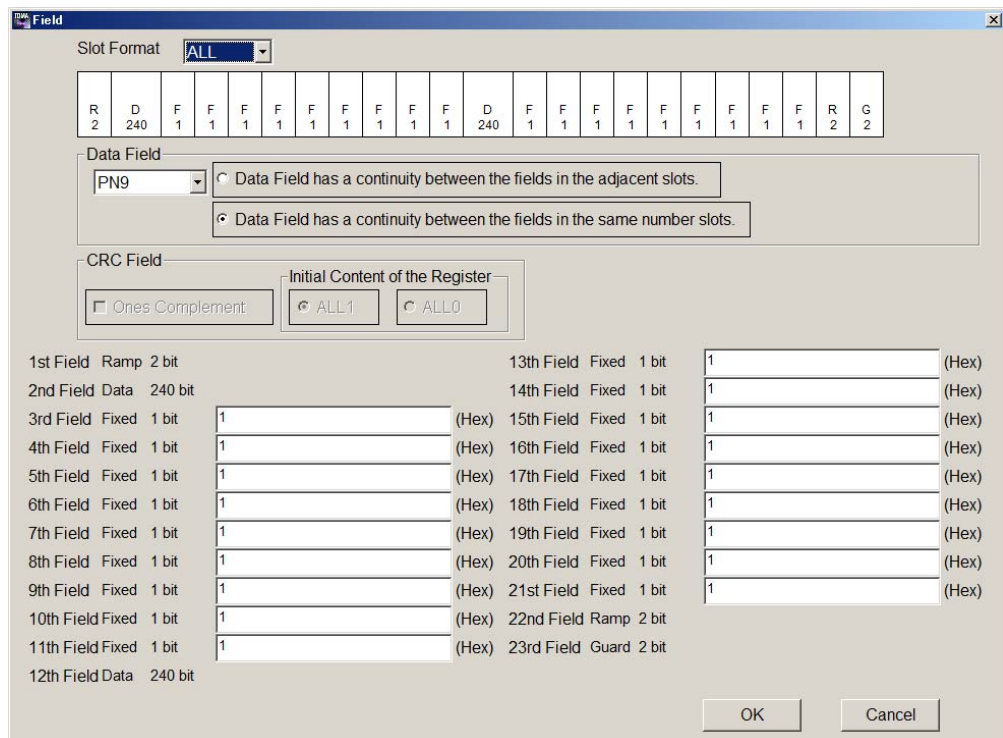


**Figure 3.1.2.4-1    Field setting screen (When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A)**
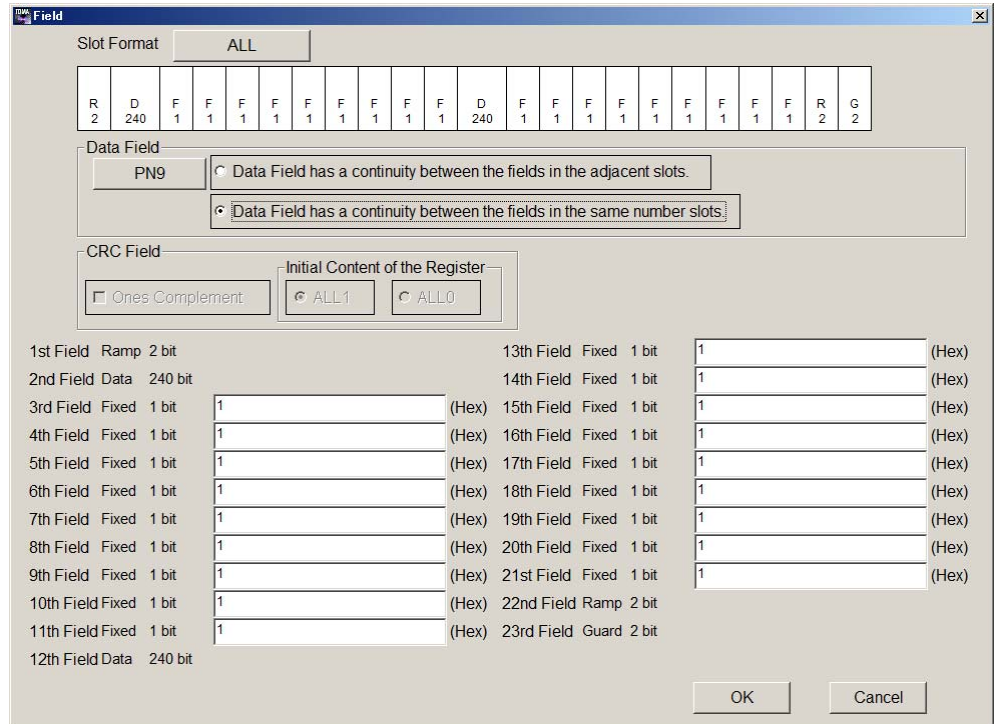
**Figure 3.1.2.4-2    Field setting screen (When running on MG3710A or MG3740A)**

The following parameters can be set in the Field setting screen.

Slot Format

The slot whose transmission setting is set to ON in 3.1.2.2 "Frame" can be selected.

| | |
|---|---|
| [Overview] | Select from the list box a slot whose field is to be set. |
| [Default] | ALL |
| [Setting range] | Slots whose transmission status is set to ON in the Frame setting screen (transmission-ON slots). |
| [Remarks] | When "ALL" is selected, the set field contents will be applied to all the transmission-ON slots. |

Fixed

| | |
|---|---|
| [Overview] | Set fixed data in the text box in hexadecimal. |
| [Default] | 1 |
| [Setting range] | 0 to the maximum value within the set number of bits (Ex. 0 to 1F when the set number of bits is 5) |

CRC

| | |
|---|---|
| [Overview] | Set a CRC calculation area in the text box by integer number. |
| [Default] | 1 |
| [Setting range] | 1 to the total number of bits in the left fields (excluding Guard and Ramp fields) of the CRC field. When there are two or more CRC fields, the maximum value for the second and subsequent CRC fields is the total number of bits between the CRC fields. |
| [Remarks] | The initial value of the CRC register can be set by using the radio buttons in Initial Content of the Register in the CRC Field area. All the initial values are set to 0 when the ALL0 radio button is selected, and are set to 1 when the ALL1 radio button is selected. |
| | The CRC Field area also provides the Ones Complement check box. When this check box is selected, the 1's complement of the register value after CRC calculation is used for the CRC field. When this check box is cleared, the register value after CRC calculation is used as is. |

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Data

[Overview]     Select a continuous pattern from the list box in the Data Field area.

When "16-bit Pattern" is selected, the 16-bit Pattern (Common) text box on the right in this area becomes enabled. Enter an arbitrary "16-bit Pattern" in this text box in hexadecimal. It is also possible to load a user file for setting.

[Default]      PN9

[Options]      PN9, PN15, 16-bit Pattern, ALL0, ALL1, UserFile

[Remarks]      When two or more Data fields exist in one slot, the continuity of the Data fields within the slot is retained. However, the continuity of the Data fields between different slots should be specified by the radio buttons on the right of the list box. When the radio button "Data Field has a continuity between the fields in the adjacent slots." is selected, the continuity of the Data fields is retained between the transmission-ON slots. In this event, if "16-bit Pattern" is selected for the continuous pattern, the value entered in the text box is commonly applied to all the transmission-ON slots. When the radio button "Data Field has a continuity between the fields in the same number slots." is selected, the continuity of the Data fields is retained between the transmission-ON slots having the same number in each frame. In this event, if "16-bit Pattern" is selected for the continuous pattern, an individual value can be set in the text box for each transmission-ON slot (see Figure 3.1.2.4-3).

When "UserFile" is selected in the Data Field list box, a screen for selecting a user file for continuous pattern is displayed, enabling to load a user-defined bit string other than the provided selection items. Refer to Appendix C "User File Format" for details on the user file.
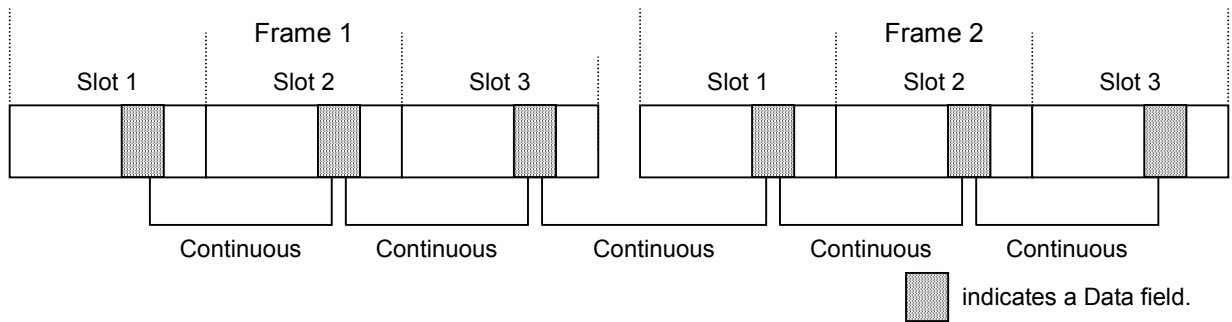
When "Data Field has a continuity between the fields in the adjacent slots." is selected
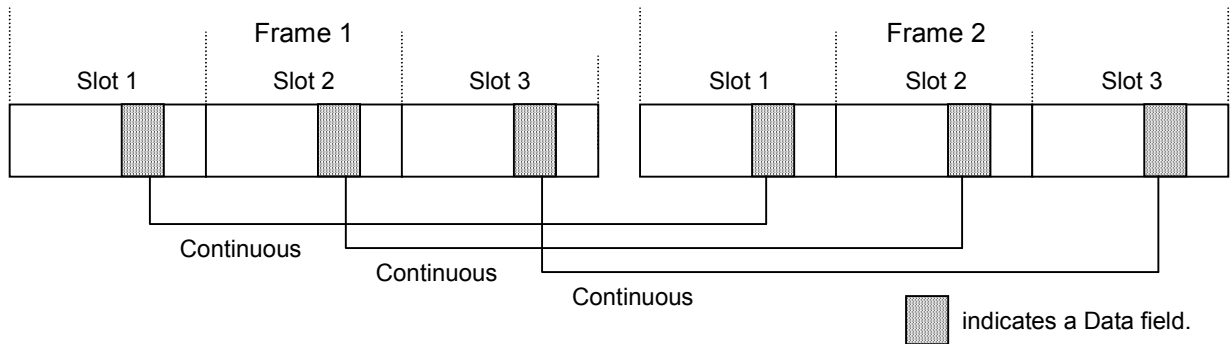


When "Data Field has a continuity between the fields in the same number slots." is selected

**Figure 3.1.2.4-3    Continuity of Data field when one frame contains three transmission-ON slots**

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## 3.1.2.5    Data

In the "Data" setting item, a continuous pattern such as a pseudo random pattern (PN9, PN15) can be set for a No Format waveform pattern. This setting item is not provided in the Burst and Continuous parameter setting sheets. Clicking the **[Data]** button on the No Frame parameter setting sheet displays the Data setting screen.

After setting the parameters, click the **[OK]** button to apply the current settings and close the Data setting screen. Clicking the **[Cancel]** button or ☒ button on the upper right of the screen closes the Data setting screen canceling the current settings.



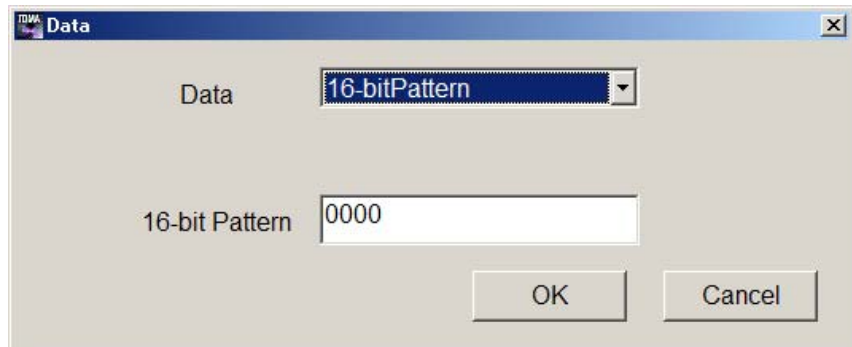**Figure 3.1.2.5-1    Data setting screen (When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A)**
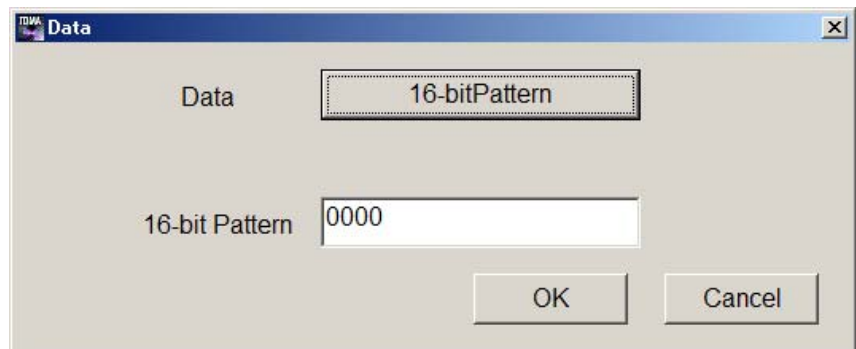


**Figure 3.1.2.5-2    Data setting screen (When running on MG3710A or MG3740A)**

The following parameter can be set in the Data setting screen.

Data

| | |
|---|---|
| [Overview] | Select a continuous pattern from the Data list box. When "16-bit Pattern" is selected, the 16-bit Pattern text box under the list box becomes enabled. Enter an arbitrary "16-bit Pattern" in this text box in hexadecimal. It is also possible to load a user file for setting. |
| [Default] | PN9 |
| [Options] | PN9, PN15, 16-bit Pattern, ALL0, ALL1, UserFile |
| [Remarks] | When "UserFile" is selected in the Data Field list box, a screen for selecting a user file for continuous pattern is displayed, enabling to load a user-defined bit string other than the provided selection items. Refer to Appendix C "User File Format" for details on the user file. |

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### 3.1.2.6　Filter

The "Filter" setting item is used for setting a filter. Clicking the **[Filter]** button on a parameter setting sheet displays the Filter setting screen.

After setting the parameters, click the **[OK]** button to apply the current settings and close the Filter setting screen. Clicking the **[Cancel]** button or ✕ button on the upper right of the screen closes the Filter setting screen canceling the current settings.
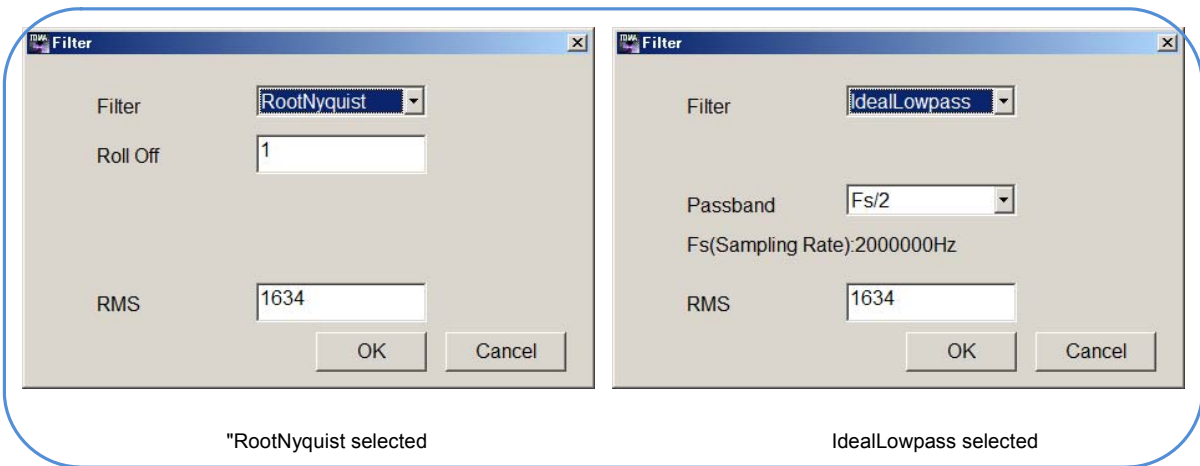


**Figure 3.1.2.6-1　Filter setting screen (When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A)**
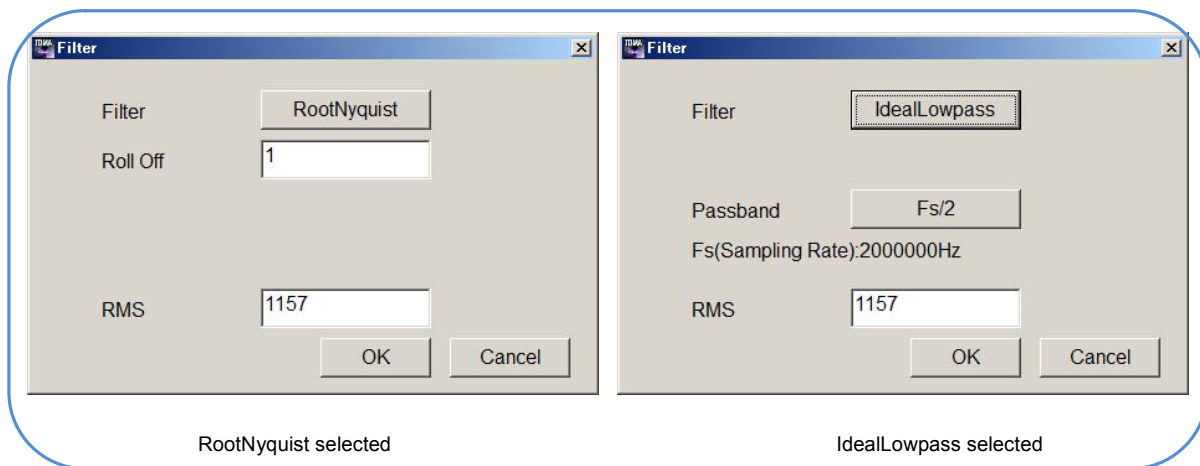


**Figure 3.1.2.6-2　Filter setting screen (When running on MG3710A or MG3740A)**

The following parameters can be set in the Filter setting screen.

Filter

[Overview]    Set the filter type.

[Default]    RootNyquist

[Options]    Nyquist, RootNyquist, Gaussian, Gaussian2, IdealLowpass, None, ARIB STD-T98, Half-sine, ARIB STD-T102Part1, User Defined Filter

[Remarks]    IdealLowpass is a rectangular filter.  It is not an ideal filter since the number of filter coefficients is limited. When the check box ☐ GSM has been selected in the Modulation setting screen to enable the GSM setting, Specified Filter is displayed and a filter that conforms to the GSM specifications is automatically set.
If 2FSK or 4FSK is specified for Modulation Type on the Modulation setting screen, symbols are filtered. ARIB STD-T98 and ARIB STD-T102Part1 can only be selected if 4FSK is specified for Modulation Type on the Modulation setting screen.
The ARIB STD-T98/T102 filter is specified for the four-frequency shift keying of the ARIB STD-T98/T102 standards and has the configuration shown in the following figure.
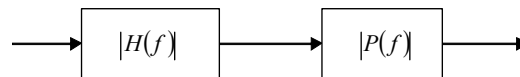


**Figure 3.1.2.6-3   ARIB STD-T98/102 filter composition**

Here, H(f) is the RootNyquist function, and P(f) is the sinc function (T98) or Gaussian function (T102).
Half-sine can only be selected if O-QPSK is specified for Modulation Type on the Modulation setting screen.
The impulse response is expressed as the formula below when the filter is set to Gaussian.

$$h(t) = \frac{\exp\left(\dfrac{-t^2}{2\delta^2 T^2}\right)}{\sqrt{(2\pi)}\,.\,\delta T} * rect\left(\frac{t}{T}\right)$$

It is under the condition below. (T is symbol cycle )

$$rect\left(\frac{t}{T}\right) = \frac{1}{T} \quad for |t| < \frac{T}{2}, \qquad rect\left(\frac{t}{T}\right) = 0 \quad otherwise$$

The impulse response is expressed as the formula below when the filter is set to Gaussian2.

$$h(t) = \frac{\exp\left(\dfrac{-t^2}{2\delta^2 T^2}\right)}{\sqrt{(2\pi)} \cdot \delta T}$$

Here δ is a constant expressed as the formula below.

$$\delta = \frac{\sqrt{\ln(2)}}{2\pi BT}$$

The following figure shows the comparison of amplitude characteristics between the filter types (Gaussian and Gaussian2).
(Horizontal axis: Frequency normalized to the symbol rate, BT = 0.5, Over Sampling = 8)

In comparison with Gaussian2, Gaussian has the narrower passband, and its amplitude becomes 0 at an integer multiples of the Symbol Rate frequency, due to the influence of rect(t/T).
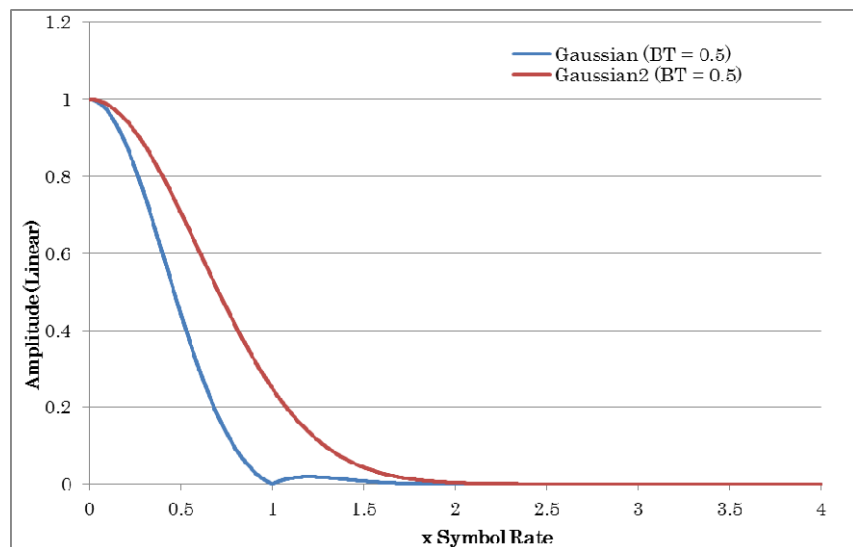


**Figure 3.1.2.6-4    Amplitude characteristics of Gaussian and Gaussian2 filters**

The user file format when the filter is set to User Defined Filter is as below.
-Each filter coefficient should be separated by return key in ASCII format. (Commas, spaces, and tabs are taken as errors.)
-There must be a FIR filter coefficient string expressed by time response (as real number).

-The filter coefficient tap number must be an odd number in the range from 1 to 1023.

Roll Off/BT

[Overview]        Set the roll-off rate for filter (when Nyquist or RootNyquist is set) or BT product (when Gaussian is set).

[Default]          1

[Setting range]    0.10 to 1.00

[Remarks]          This item is displayed and can be set only when Nyquist, RootNyquist, or Gaussian is set for the filter type.

Passband

[Overview]        Set the passband of filter.

[Default]          Fs/oversampling rate (Fs: Sampling rate)

[Options]          Fs/2, Fs/3, Fs/4, Fs/8, Fs/16, Fs/32

[Remarks]          The setting range varies depending on the oversampling rate.
                   This item is displayed and can be set only when IdealLowpass is set for the filter type.

RMS

[Overview]        Set the RMS value of waveform pattern.

[Default]          1634

[Setting range]    651 to 4104

[Remarks]          The RF output level accuracy of the mainframe is specified by an RMS value from 1157 to 1634.

**Note:**

When started up in MG3710, MG3740 or MS2830 mode, the initial value is 1157. RMS value is fixed to 1157 in MS269x mode.

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Detailed Description of Functions

## 3.1.2.7 Pattern Name

The "Pattern Name" setting item is used to set a waveform pattern file name. Clicking the **[Pattern Name]** button on a parameter setting sheet displays the Pattern Name setting screen shown in Figure 3.1.2.7-1.

After setting the parameters, click the **[OK]** button to apply the current settings and close the Pattern Name setting screen. Clicking the **[Cancel]** button or ✕ button on the upper right of the screen closes the Pattern Name setting screen canceling the current settings.
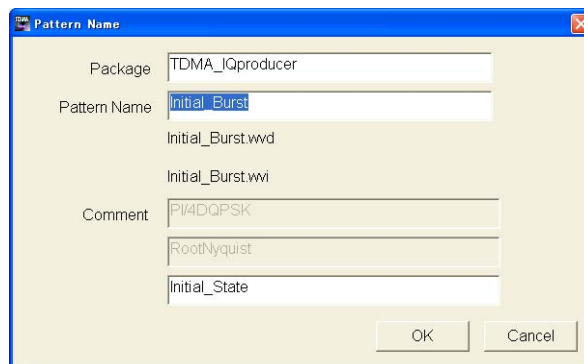


**Figure 3.1.2.7-1 Pattern Name setting screen**

The following parameters can be set in the Field setting screen.

Package
[Overview]          Enter the name of the package that saves waveform
                    patterns to be created.
[Default]           TDMA_IQproducer
[Setting range]     Within 31 characters, including alphanumeric and the
                    following symbols:
                    ! % & ( ) + = ` { } _ - ^ @ [ ]

Pattern Name
[Overview]          Enter a waveform pattern file name.
                    One waveform pattern consists of a waveform
                    information file with the extension ".wvi" and a
                    waveform data file with the extension ".wvd". These
                    file names are the same except for the extension.
[Default]           Initial_Burst/Initial_Continuous/Initial_NoFormat
[Setting range]     Within 20 characters, including alphanumeric and the
                    following symbols:
                    ! % & ( ) + = ` { } _ - ^ @ [ ]

Comment

[Overview]           Enter comments to be displayed on the screen.
                     The settings of Modulation Type and Over Sampling
                     are displayed in the first line, and the settings of Filter
                     Type are displayed in the second line.
                     A comment can be entered by a user in the third line
                     only. This line can be left blank.

[Default]            Initial_State

[Setting range]      Within 38 characters.

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## 3.1.2.8    Re-setting by changing parameter

Although it is not necessary to perform parameter settings in the order indicated by arrows (see Figure 3.1.1-7 "Parameter setting sheets"), some parameters have an effect on the subsequent parameters when they are set.

Automatic setting when Modulation Type is changed

The parameters on the Slot setting screen are automatically changed depending on the setting of "Modulation Type" in the Modulation setting screen. When "Modulation Type" is changed on the Modulation setting screen after setting the parameters on the Slot setting screen, therefore, be aware that the parameters on the Slot setting screen will be changed automatically. Tables 3.1.2.8-1 and 3.1.2.8-2 show the values automatically set after changing "Modulation Type."

**Table 3.1.2.8-1    Automatically set values (Burst)**

| Field | No. of Bits | Field Type |
|---|---|---|
| 1st | 0 | Guard |
| 2nd | Number of bits per symbol for the set modulation type | Ramp |
| 3rd | 240 | Data |
| 13th | 240 | Data |
| 23rd | Number of bits per symbol for the set modulation type | Ramp |
| 24th | Number of bits per symbol for the set modulation type | Guard |
| Other than the above | 0 | Fixed |

**Table 3.1.2.8-2    Automatically set values (Continuous)**

| Field | No. of Bits | Field Type |
|---|---|---|
| 1st | 240 | Data |
| Other than the above | 0 | Fixed |

Automatic setting due to change in Frame or Slot setting item

When the number of transmission-ON slots is increased or a transmission-OFF slot is changed to a transmission-ON slot in the Frame setting screen, all the values of Fixed and CRC fields in the Field setting screen are automatically set to "1" for the slots that are set/changed to transmission-ON.

This automatic setting operation also occurs when the slot format in the Slot setting screen is changed. Care must be taken, therefore, when changing the parameters on the Frame or Slot setting screen after the parameters on the Field setting screen have been set.

### 3.1.3   Calculation

The "Calculation" button is used to start waveform pattern generation after parameter setting is completed. Click the **[Calculation]** button on a parameter setting sheet to display the Export Path screen shown in Fig. 3.1.3 -1, and select the waveform pattern output destination on this screen.
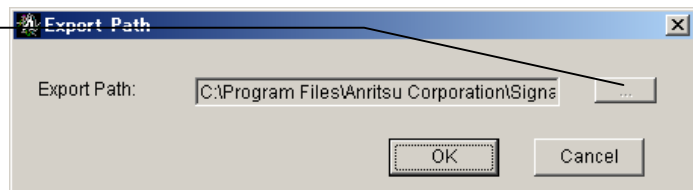
Output destination folder selection button



**Figure 3.1.3-1   Export Path screen for selecting waveform pattern output destination**

Clicking the output destination selection button displays the Browse for Folder screen shown in Figure 3.1.3-2. The output destination folder can be selected from this screen.
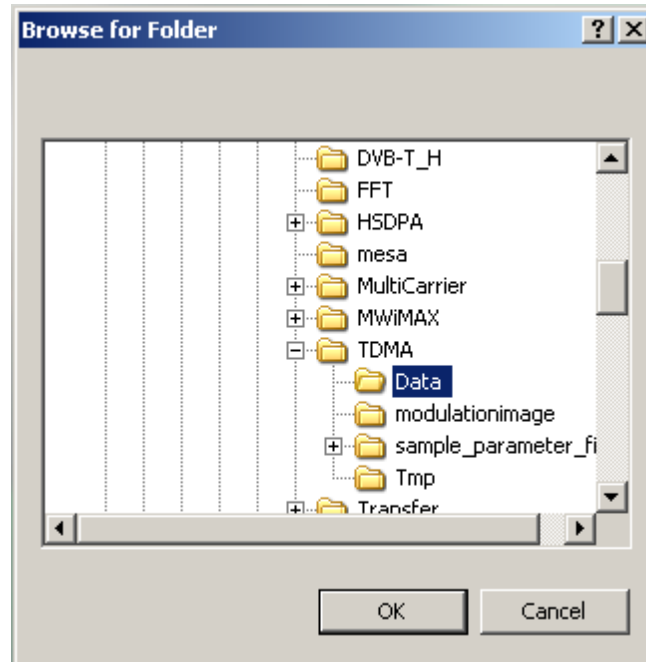


**Figure 3.1.3-2   Browse for Folder screen**

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Detailed Description of Functions

The default destination folder for waveform patterns in each instrument is shown in the table below.

**Table 3.1.3-1   Default export destination folder**

| Instrument | Operating environment | Export destination folder |
|---|---|---|
| **MG3700A** | —— | X:\IQproducer\TD-SCDMA\Data<br>(X:\ IQproducer is a folder where IQproducer is installed)<br>This can be changed. |
| **MG3710A** | **MG3710A** | C:\Anritsu\MG3710A\User Data \Waveform\"Package name"<br>This cannot be changed. |
| | **PC** | Same as MG3700A |
| **MS269xA, MS2830A** | **MS269xA MS2830A** | When Installed OS is Windows Embedded Standard 7.<br>C:\Anitsu\Signal Analyzer\System\Waveform<br>Other than above.<br>C:\Program Files\Anritsu Corporation \Signal Analyzer\System\Waveform\" Package name"<br>This cannot be changed. |
| | **PC** | Same as MG3700A |

After the output destination folder is specified, the Waveform Generation screen shown in Figure 3.1.3-3 is displayed, but if the waveform pattern sample size exceeds the upper limit of the memory, an error screen is displayed and the waveform is not generated. However, when the frame count is set to Auto at the Frame Parameter setting screen, if the waveform pattern sample size exceeds the above-described limit range, the waveform pattern is generated by reducing the frame count; when the directions indicate a Burst waveform, the frame count becomes 1 to generate a waveform. For a Continuous waveform, the waveform is generated with a continuous phase, but even in this case, the waveform is generated with a frame count of 1 if the sample count exceeds the limit range. Furthermore, for a waveform pattern with less than 1000 samples, the frame count is increased to generate the waveform as for a waveform pattern with 1000 or more samples. Table 3.1.3-1 shows the method for calculating the waveform pattern sample count.
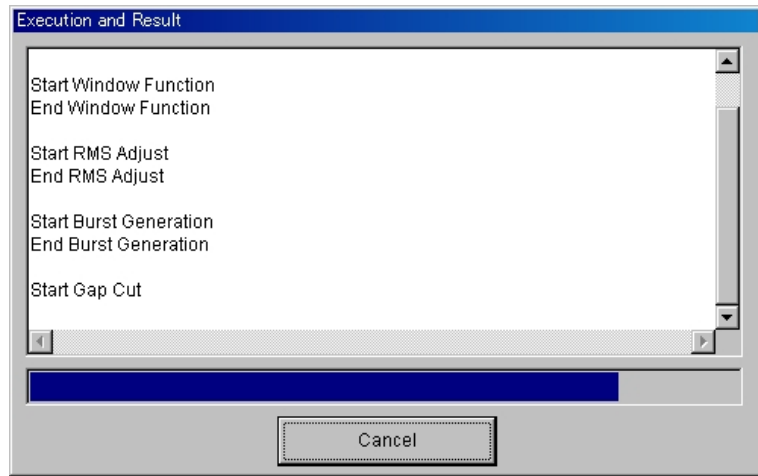
**Figure 3.1.3-3    Waveform generation screen (in progress)**

**Table 3.1.3-1 How to calculate the number of samples of waveform pattern**

For Burst: Symbol*Slot_ON*Frame*OSR [samples]

For Continuous: Symbol*Slot*Frame*OSR [samples]

where; Symbol: The number of symbols in a slot

Slot_ON: Number of the last transmission-ON slot in a frame

Slot: The number of slots in a frame

Frame: The number of frames

OSR: Oversampling rate

When waveform generation is completed, "Calculation Completed" is displayed on the screen as shown in Fig. 3.1.2-4, and the **[Cancel]** button changes to the **[OK]** button.

If the amplitude value of the waveform pattern is out of the range from –8192 to 8191, clipping is processed and "Clipping was done." is displayed on the screen. Clipping is a process to "clip" the part of the amplitude value that exceeds the limitation range. When clipping is processed, a waveform may be distorted, resulting in the degradation in the adjacent channel leakage power ratio and/or waveform quality.
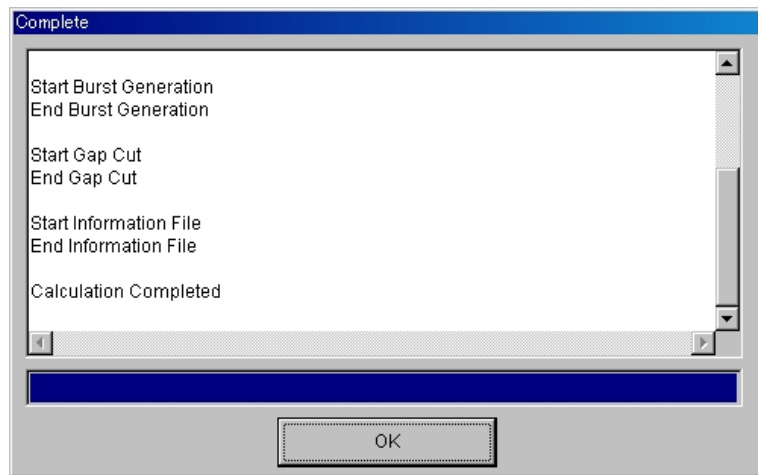


**Figure 3.1.3-4 Waveform generation screen (when calculation completed)**

When the **[Cancel]** button is clicked during waveform generation, the waveform generating operation is interrupted, the waveform generation screen is closed, and the TDMA main screen is displayed again. The waveform generating operation is also interrupted if the size of the intermediate file that is created during waveform generation exceeds 4 GB ("Can not read file" is displayed on the screen at this time). In this event, reduce the number of frames, for example, to complete the waveform generating operation.

When the **[OK]** button is clicked after waveform generation is completed, the waveform generation screen is closed and the TDMA main screen is displayed again.

## 3.1.4    Calculation & Load

*Note:*

> This function is available only when this software is used on MG3710A or MG3740A.

When **Calculation & Load** is selected, the Load Setting screen will display after waveform generation.
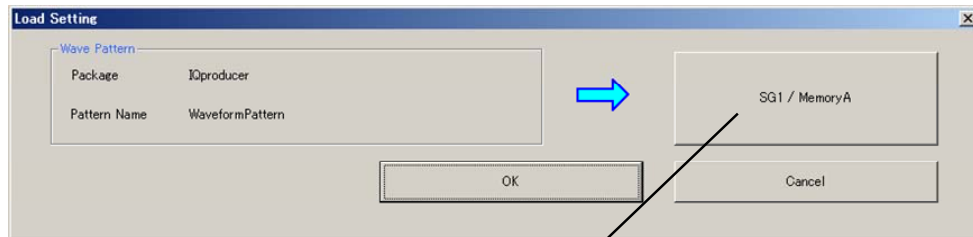


Button for selecting load destination _____

**Figure 3.1.4-1    Load Setting Screen**

The Select Memory screen will display after clicking the load destination in the Load Setting screen.
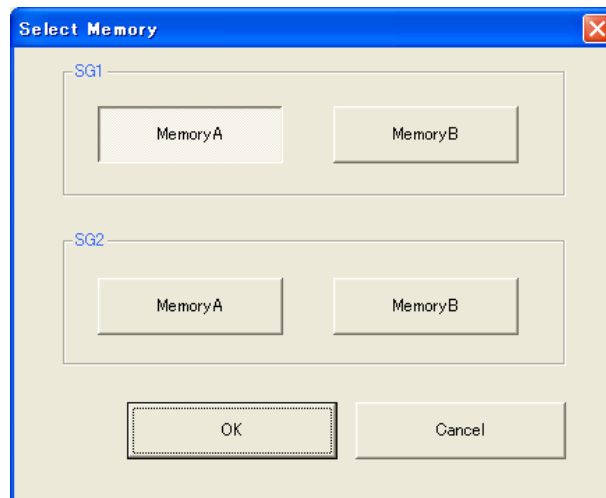


**Figure 3.1.4-2    Select Memory Screen**

After selecting the load destination of generated waveform in the Select Memory screen and clicking the **OK** button, the Load Setting screen will be shown again. Click the **OK** button in the Load Setting screen, and then the loading of waveform starts.

*Note:*

> To exit this screen without loading the waveform pattern, click the **Cancel** button in the Load Setting screen.

## 3.1.5   Calculation & Play

*Note:*

> This function is available only when this software is used on MG3710A or MG3740A.

When **Calculation & Play** is selected, after waveform creation is completed, the created waveform is loaded into memory, selected and output.

When the 2nd Vector Signal Generator (option) is installed, the Select SG screen is displayed before the start of waveform generation. This screen is used to select the signal generator for outputting the created waveform pattern.
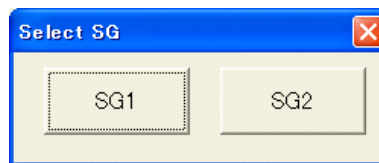


**Figure 3.1.5-1   Select SG Screen**

## 3.1.6 Saving/reading parameters

This numeric values and settings for each item can be saved in a parameter file by using this software.

■ Saving parameter file

When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A

1. Select **[Save Parameter File]** from the **[File]** menu or click the tool button to display the parameter file saving screen shown.
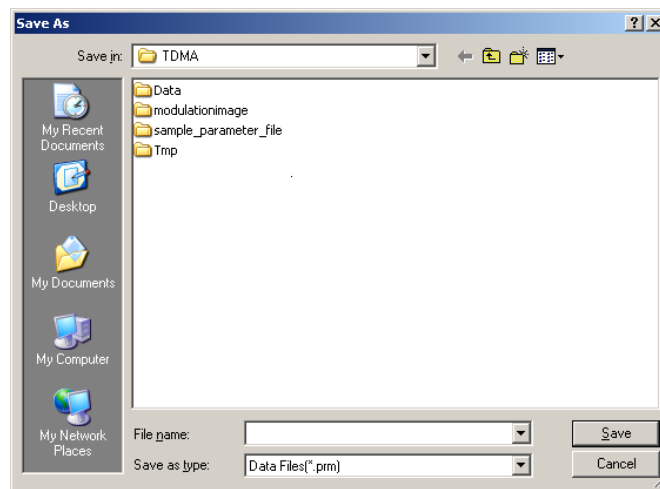


**Figure 3.1.6-1 Parameter file saving screen**

2. Enter a file name in the **[File name]** text box and click the **[Save]** button to save the parameter file.
   When the save destination is not changed in the **[Save in]** box, the parameter file is saved in the following directory with the entered file name:
   X:\IQproducer\TDMA\\*Entered file name*.prm
   ("X:\IQproducer" indicates the folder where the IQproducer™ is installed.)

**3**

Detailed Description of Functions

When running on MG3710A or MG3740A

1.  Click the**[Save Parameter File]** button in **[File]** menu or click the
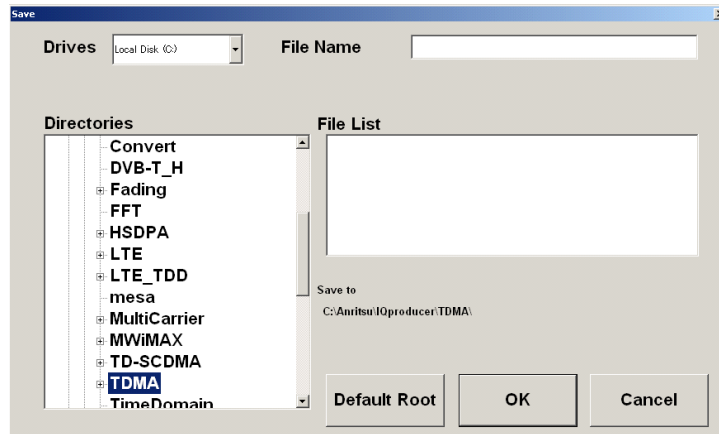    button to display the parameter file saving screen.



**Figure 3.1.6-2   Parameter file saving screen (MG3710A or MG3740A)**

2.  Select the folder to store the file in the **Directories** field, and then
    enter the name of the file using the **File Name** box. Click **OK** to save the
    parameter file. To initialize the setting in the **Directories** field, click the
    **Default Root** button.

■ Reading parameter file

When running on PC, MS2690A/MS2691A/MS2692A, or MS2830A.

1.  Select **[Recall Parameter File]** from the **[File]** menu or click the
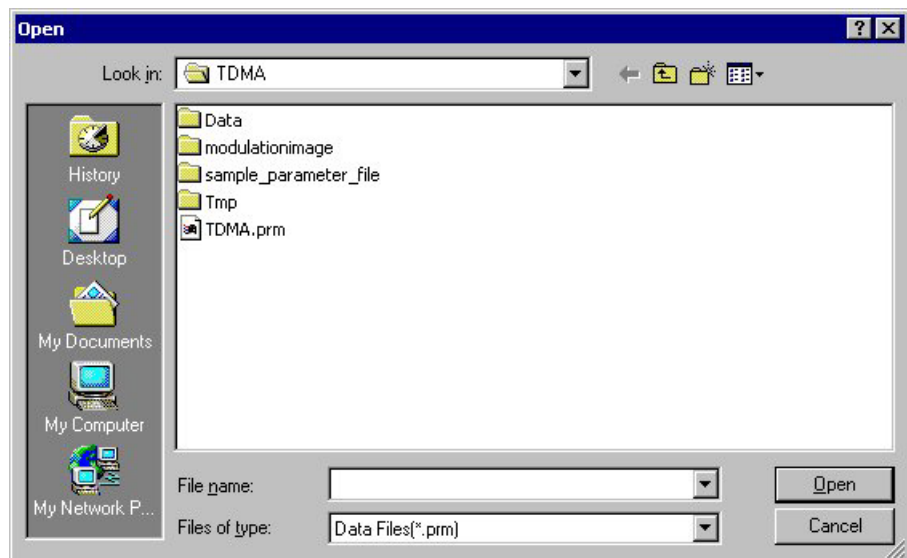    tool button to display the parameter file reading screen.



**Figure 3.1.6-3   Parameter file reading screen**

2. Select a parameter file to be read from the file list, and then click the **[Open]** button to read the selected parameter file.

3. The parameter files for creating PDC or PHS waveform patterns are stored in the following directories:

   X:\IQproducer\TDMA\sample_parameter_file\PDC
   X:\IQproducer\TDMA\sample_parameter_file\PHS
   ("X:\IQproducer" indicates the folder where the IQproducer™ is installed.)

   Read a parameter file and generate a waveform to create a waveform pattern similar to the standard waveform pattern.

When running on MG3710A or MG3740A.

1. Select **[Recall Parameter File]** from the **[File]** menu or click the tool button to display the parameter file reading screen.
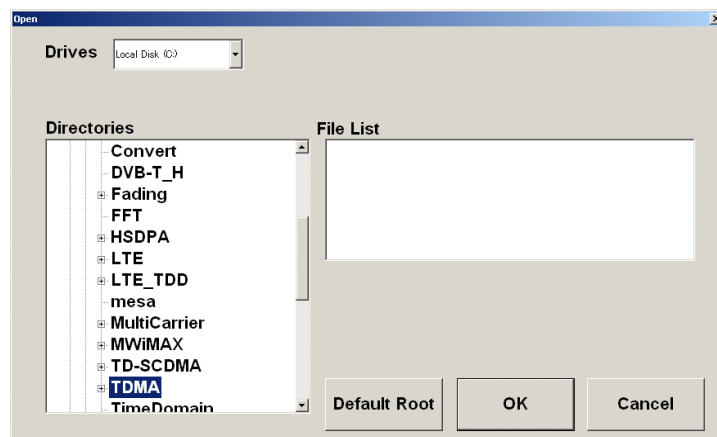


**Figure 3.1.6-4   Parameter file reading screen (MG3710A or MG3740A)**

2. Select the directory where the files to be loaded is stored in the **[Directories]** field. Click the desired file from the **[File List]**, and click **[OK]**. To initialize the setting in the **[Directories]** field, click the **[Default Root]** button.

## 3.1.7   Displaying graph

The generated waveform pattern can be displayed in a CCDF, FFT, or Time Domain graph by using this software. For details of each graph display, refer to each one of the following:

- MG3700A/3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™)
  4.3 "CCDF Graph Display", 4.4 "FFT Graph Display", 4.13 "Time Domain Graph Display"
- MS2690A/MS2691A/MS2692A or MS2830A Vector Signal Generator Operation Manual (IQproducer™)
  4.3 "CCDF Graph Display", 4.4 "FFT Graph Display", 4.9 "Time Domain Graph Display"

Displaying CCDF graph

1. Generate a TDMA waveform pattern by executing "Calculation."

2. Select **[CCDF]** from the **[Simulation]** menu or click the ⬛ tool button. The CCDF graph screen shown in Figure 3.1.7-1 is displayed with the trace of the generated waveform pattern.
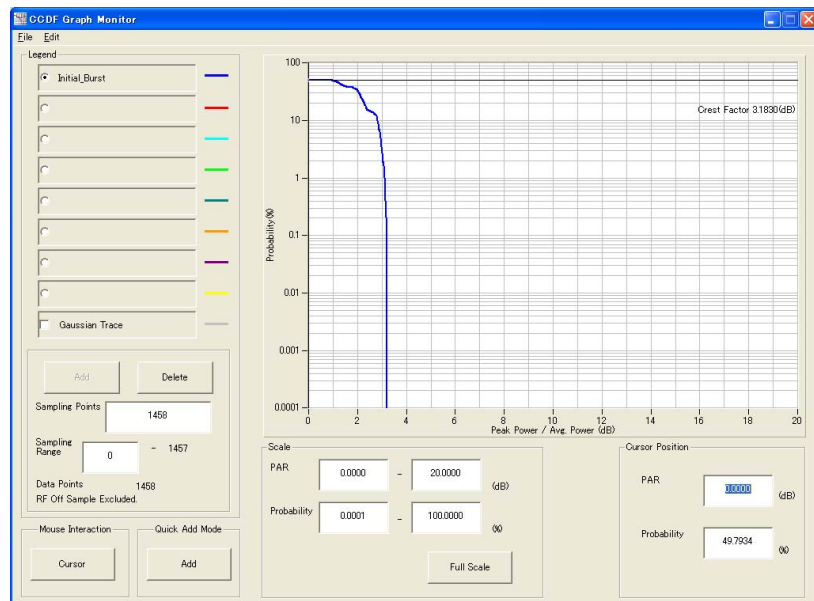


**Figure 3.1.7-1   CCDF graph screen**

When a waveform pattern is generated by changing parameters and executing "Calculation" while other traces are displayed in the CCDF graph screen, the trace of the waveform pattern newly generated can be displayed in either of the following two methods:

- Displaying the new trace in the same screen with the previous traces
- Deleting the previous traces to display the new trace

---

***Note:***

A CCDF graph and an FFT graph cannot be generated at the same time. When displaying a CCDF graph while an FFT graph is displayed, execute the CCDF graph generation after FFT graph generation is completed.

---

■ When displaying a new trace in the same screen with the previous traces:
1.  Set **[Add]** for **[Quick Add Mode]** on the lower-left of the CCDF graph screen.
2.  Select **[CCDF]** from the **[Simulation]** menu or click the 〔CCDF〕 tool button. The trace of the waveform pattern newly generated is additionally displayed in the CCDF graph screen.
    Up to eight traces can be displayed by repeating this procedure.

■ When deleting the previous traces to display a new trace:
1.  Set **[Clear]** for **[Quick Add Mode]** on the lower-left of the CCDF graph screen.
2.  Select **[CCDF]** from the **[Simulation]** menu or click the 〔CCDF〕 tool button. The confirmation message shown in Figure 3.1.7-2 below appears:



**Figure 3.1.7-2   Confirmation message**

Click the **[Yes]** button. The previous traces are deleted from the CCDF graph screen, and the trace of the waveform pattern newly generated is displayed.

**3**

Detailed Description of Functions

Displaying FFT graph

1.  Generate a TDMA waveform pattern by executing "Calculation."

2.  Select **[FFT]** from the **[Simulation]** menu or click the ⬜ tool button. The FFT graph screen shown in Figure 3.1.7-3 is displayed with the trace of the generated waveform pattern.
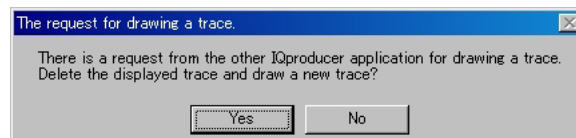


**Figure 3.1.7-3   FFT graph screen**

When a waveform pattern is generated by changing parameters and executing "Calculation" while other traces are displayed in the FFT graph screen, the trace of the waveform pattern newly generated can be displayed in either of the following two methods:

*   Displaying the new trace in the same screen with the previous traces
*   Deleting the previous traces to display the new trace

*Note:*

A CCDF graph and an FFT graph cannot be generated at the same time. When displaying an FFT graph while a CCDF graph is displayed, execute the FFT graph generation after CCDF graph generation is completed.

■ When displaying a new trace in the same screen with the previous traces:

1.  Set **[Add]** for **[Quick Add Mode]** on the lower-left of the FFT graph screen.

2.  Select **[FFT]** from the **[Simulation]** menu or click the ⬚ tool button. The trace of the waveform pattern newly generated is additionally displayed in the FFT graph screen.
    Up to four traces can be displayed by repeating this procedure.

■ When deleting the previous traces to display a new trace:

1.  Set **[Clear]** for **[Quick Add Mode]** on the lower-left of the FFT graph screen.

2.  Select **[FFT]** from the **[Simulation]** menu or click the ⬚ tool button. The confirmation message shown in Figure 3.1.7-4 below appears:
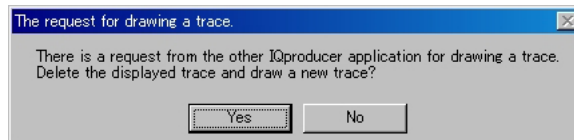


**Figure 3.1.7-4    Confirmation message**

Click the **[Yes]** button. The previous traces are deleted from the FFT graph screen, and the trace of the waveform pattern newly generated is displayed.

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Detailed Description of Functions

Displaying the Time Domain graph

1. Generate a waveform pattern by executing "Calculation".

2. When **Time Domain** is clicked in the **Simulation** menu or ⬛ is clicked, the Time Domain graph screen shown in Figure 3.1.7-5 is displayed, along with a trace of the generated waveform pattern.
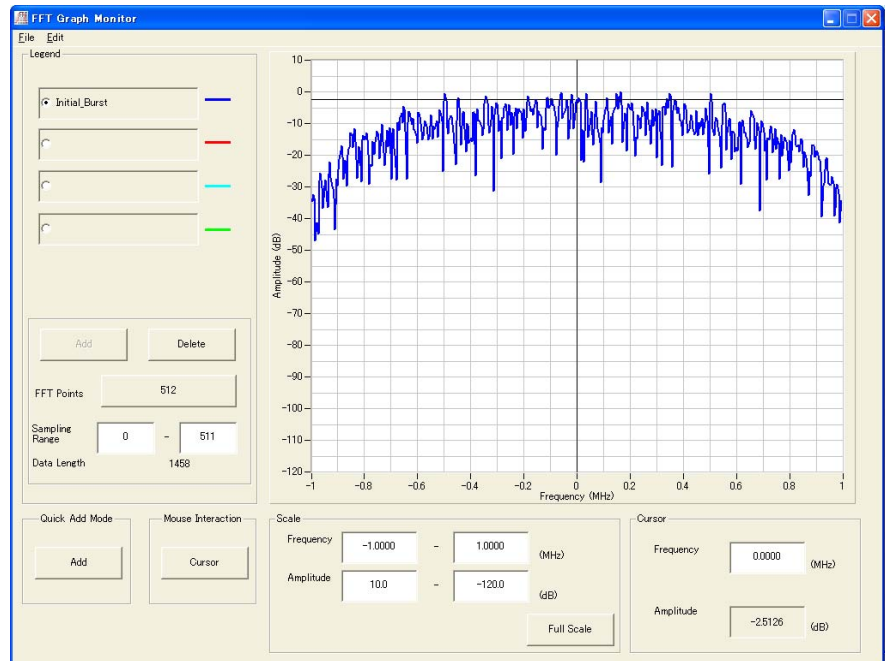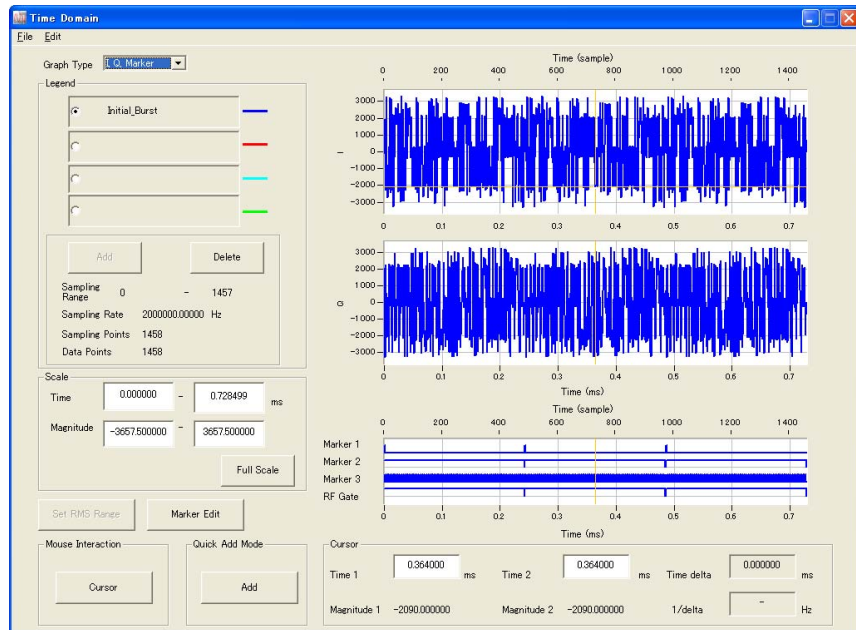


**Figure 3.1.7-5 Time Domain graph**

When a waveform pattern is generated by changing parameters and executing "Calculation" while other traces are displayed in the Time Domain Graph Monitor screen, the trace of the waveform pattern newly generated can be displayed in either of the following two methods:

- Displaying the new trace in the same screen as the previous traces
- Deleting the previous traces to display the new trace

*Note:*

> CCDF, FFT, and Time Domain graphs cannot be created simultaneously. To display all these graphs, complete creation of each graph and then create a separate graph.

■ Displaying the new trace in the same screen as the previous traces
1. Set **Add** for **Quick Add Mode** on the lower-left of the Time Domain Graph Monitor screen.
2. When **Time Domain** is clicked in the **Simulation** menu or ![icon] is clicked, a trace of the newly generated waveform pattern is added to the Time Domain graph screen.
Up to four traces can be displayed by repeating this procedure.

■ When deleting the previous traces to display a new trace:
1. Set **Clear** for **Quick Add Mode** on the lower-left of the Time Domain Graph Monitor screen.
2. When **Time Domain** is clicked in the **Simulation** menu or ![icon] is clicked, a message such as that shown in Figure 3.1.7-6 is displayed.
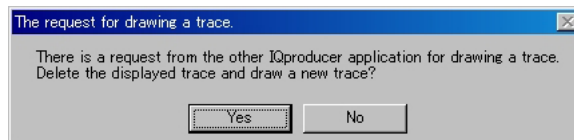


**Figure 3.1.7-6   Confirmation screen**

Click **Yes**. The previous traces are deleted, and the trace of the waveform pattern newly generated is displayed.

## 3.1.8   Auxiliary signal output

When a waveform pattern generated by the TDMA IQproducer™ is selected by the Vector Signal Generator, a marker signal synchronized with the RF signal is output from the AUX input/output connector on the rear panel as an auxiliary signal. Refer to the Vector Signal Generator Operation Manual (Operation) for details on the AUX input/output connector. Frame Trigger (Connector 1), RF Gate (Connector 2) and Symbol Clock (Connector 3) are output.

- Frame Trigger
  A pulse synchronized with the symbol at the beginning of the frame is output from Connector 1. The signal polarity can be changed by changing the polarity of Connector 1.

- RF Gate
  Indicates the RF output burst ON/OFF status of the Vector Signal Generator when a burst wave is used as the waveform pattern. Correspondence between the burst status and output signal status is shown below:
  Burst ON: High level
  Burst OFF: Low level
  (When Polarity for Marker 2 is set to Positive. When Polarity is set to Negative, the above correspondences are reversed.)

- Symbol Clock
  A symbol clock synchronized with the symbol is output from Marker 3. The signal polarity can be changed by changing the polarity of Marker 3.

# 3.2  Waveform Pattern Generation Procedure

This section provides the waveform pattern generation procedure, taking a PHS downlink waveform pattern as an example.

| R | SS | PR | UW | CI | SA | TCH | CRC | R | G |
|---|----|----|----|----|----|-----|-----|---|---|
| 4 | 2  | 6  | 16 | 4  | 16 | 160 | 16  | 4 | 12 |

| | | |
|---|---|---|
| R: | Ramp time for transient response | $0_H$ (4 bits) |
| SS: | Start symbol | $2_H$ (2 bits) |
| PR: | Preamble | $19_H$ (6 bits) |
| UW: | Sync word | Uplink line $E149_H$ (16 bits) |
| | | Downlink line $3D4C_H$ (16 bits) |
| CI: | Channel identification | $0_H$ (4 bits) |
| SA: | SACCH | $8000_H$ (16 bits) |
| TCH: | Information channel | PN9 pseudo random pattern |
| CRC: | Cyclic redundancy check code | CRC bit of CI, SA, TCH |
| G: | Guard time for transient response | $000_H$ (12 bits) |

**Figure 3.2-1    PHS Slot Format**

<Procedure>

1.    Click the tab of Burst parameter setting sheet.

2.    Click the **[Modulation]** button to display the Modulation setting screen.

3.    Set "Modulation Type" to PI/4DQPSK and "Symbol Rate" to 192 ksps. Then click the **[OK]** button to close the Modulation setting screen.

4.    Click the **[Frame]** button to display the Frame setting screen.

5.    Set "The Number of Frames" to 511 and "The Number of Slots per Frame" to 8. For the transmission status, set only the 1st Slot to ON. Then click the **[OK]** button to close the Frame setting screen.

6.    Click the **[Slot]** button to display the Slot setting screen.

7.    Set the parameters so that the slot format becomes as shown in Table 3.2-1. Then click the **[OK]** button to close the Slot setting screen.

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Detailed Description of Functions

**Table 3.2-1   Slot setting values**

| Field | No. of Bits | Field Type |
|---|---|---|
| 1st | 0 | Guard |
| 2nd | 4 | Ramp |
| 3rd | 2 | Fixed |
| 4th | 6 | Fixed |
| 5th | 16 | Fixed |
| 6th | 4 | Fixed |
| 7th | 16 | Fixed |
| 8th | 160 | Data |
| 9th | 16 | CRC |
| 23rd | 4 | Ramp |
| 24th | 12 | Guard |
| Other than the above | 0 | Fixed |

8.   Click the **[Field]** button to display the Field setting screen.

9.   Set each field as shown in Table 3.2-2. Then click the **[OK]** button to close the Field setting screen.

**Table 3.2-2   Field setting values**

| Field | Field Type | Setting Value |
|---|---|---|
| Data Field | – | PN9 |
| CRC Field | – | Clear Ones Complement check box and select ALL1 radio button for register initial value. |
| 1st | Ramp | – |
| 2nd | Fixed | 2 |
| 3rd | Fixed | 19 |
| 4th | Fixed | 3D4C |
| 5th | Fixed | 0 |
| 6th | Fixed | 8000 |
| 7th | Data | – |
| 8th | CRC | 180 |
| 9th | Ramp | – |
| 10th | Guard | – |
| Other than the above | Fixed | – |

10. Click the **[Filter]** button to display the Filter setting screen.

11. Set Root Nyquist for Filter Type, 0.5 for Roll Off and 1634 for RMS, and then click the **[OK]** button to close the Filter setting screen.

12. Click the **[Pattern Name]** button to display the Pattern Name setting screen.

13. Enter an output file name into the Pattern Name text box. Then click the **[OK]** button to close the Pattern Name setting screen.

14. Click the **[Calculation]** button to generate the waveform pattern.

**3**

Detailed Description of Functions

# Chapter 4 How to Use Waveform Patterns

The following operations are required to output a modulated signal from this equipment using the waveform pattern generated by this software:

- Transferring waveform pattern to internal hard disk
- Loading waveform patterns from the hard disk to the waveform memory
- Selecting a waveform pattern to be output from this equipment

This chapter explains the details of these operations.

# 4.1 For MG3700A, MG3710A or MG3740A

This section describes how to download a waveform pattern created for the MG3700A/MG3710A/MG3740A to the hard disk of the MG3700A/MG3710A/MG3740A and output the pattern.

## 4.1.1 Transferring waveform pattern to internal hard disk

The waveform pattern created with this software can be transferred to the internal hard disk in the following ways:

***Note:***

> This operation is not necessary if you are using MG3710A or MG3740A and have generated waveform patterns on MG3710A, MG3740A.

For MG3700A
- LAN
- CompactFlash Card

For MG3710A or MG3740A
- LAN
- External device such as USB Memory

■ Transferring from PC via LAN (MG3700A, MG3710A, MG3740A)
Two IQproducer™ tools can be used to transfer a waveform pattern to the MG3700A/MG3710A/MG3740A via a LAN.

- Transfer & Setting Wizard
  Start this wizard by clicking the **Transfer & Setting Wizard** button of this software or by selecting **Simulation & Utility** tab → **Transfer & Setting Wizard** from the IQproducer™ after creating a waveform pattern. For details, refer to Section 4.7 "File Transfer and Loading to Memory Using Transfer & Setting Wizard" in the *MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™)*.
  Transferring a waveform pattern to the internal hard disk of the MG3700A/MG3710A/MG3740A, loading the waveform from the hard disk to the waveform memory, and then outputting the waveform pattern can be done using this wizard.

● Transfer & Setting Panel
This function is loaded by selecting **Transfer & Setting Panel** in the
**Simulation & Utility** tab of the IQproducer™. For details, refer to
Section 5.2 "Transferring Waveform Pattern" in the
*MG3700A/MG3710A Vector Signal Generator MG3740A Analog
Signal Generator Operation Manual IQproducer™.*
Specify the folder that contains the waveform pattern to transfer to
the MG3700A/MG3710A/MG3740A in the PC-side tree of **Transfer &
Setting Panel**.

■ Transferring using a CF card (MG3700A)
Copy the waveform pattern (***.wvi and ***.wvd files) to be downloaded
to the MG3700A to the root directory of a CF card.

Insert the CF card into the card slot on the front panel of the MG3700A,
and then copy the file to the hard disk. For details about how to use a CF
card to transfer a waveform pattern, refer to (1) Loading waveform file in
memory in Section 3.5.2 of the *MG3700A Vector Signal Generator
Operation Manual (Mainframe)*.

■ Transferring via external device such as USB memory (MG3710A,
MG3740A)
For details about how to transfer a waveform pattern created using this
software to the hard disk of the MG3710A/MG3740A, refer to Section
7.3.6 "Copying external waveform pattern: Copy" in the *MG3710A Vector
Signal Generator MG3740A Analog Signal Generator Operation Manual
(Mainframe)*.

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How to Use Waveform Patterns

## 4.1.2   Loading to Waveform Memory

To output a modulated signal using a waveform pattern,   it is necessary to load the waveform pattern that was transferred to the internal hard disk of the MG3700A/MG3710A/MG3740A (described in Section 4.1.1 "Transferring waveform pattern to internal hard disk") to the waveform memory. A waveform pattern can be loaded into the waveform memory in the following two ways.

■ Configuring using the mainframe

A waveform pattern can be loaded into the waveform memory by using the instruction panel of the MG3700A/MG3710A/MG3740A or by using a remote command.

For operation using the front panel, refer below:

- Section 3.5.2 (1) "Loading waveform file in memory" in the *MG3700A Vector Signal Generator Operation Manual (Mainframe)*
- Section 7.3.4 "Loading waveform pattern: Load" in the *MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)*

For operation using remote commands, refer below:

- Chapter 4 "Remote Control" in the *MG3700A Vector Signal Generator Operation Manual (Mainframe)*
- Section 7.3.4 "Loading waveform pattern: Load" in the *MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)*

■ Using Transfer & Setting Panel of IQproducer<sup>TM</sup>

A waveform pattern can be loaded from the LAN-connected PC to the memory by using **Transfer & Setting Panel**, which can be opened from the **Simulation & Utility** tab. For details, refer to Section 4.6 "File Transfer and Loading to Memory Using Transfer & Setting Panel" in the *MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™).*

## 4.1.3 Selecting Waveform Pattern

Select a waveform pattern to use for modulation from the waveform patterns loaded into the waveform memory of the MG3700A/MG3710A according to Section 4.1.2 "Loading to waveform memory". A waveform pattern can be selected in the following two ways.

■ Configuring using the MG3700A/MG3710A/MG3740A

Waveform patterns to be used for modulation can be selected by operating the equipment panel or by using a remote command.

For operation using the front panel, refer below:

- Section 3.5.2 (4) "Outputting pattern loaded in Memory A for modulation in Edit mode" in the *MG3700A Vector Signal Generator Operation Manual (Mainframe)*
- Section 7.3.5 "Selecting output waveform pattern: Select" in the *MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)*

For operation using remote commands, refer below:

- Chapter 4 "Remote Control" in the *MG3700A Vector Signal Generator Operation Manual (Mainframe)*
- Section 7.3.5 "Selecting output waveform pattern: Select" in the *MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)*

■ Using Transfer & Setting Panel of IQproducer<sup>TM</sup>

A waveform pattern can be loaded from the LAN-connected PC to the memory, and also selected for modulation. This is done by using **Transfer & Setting Panel**, which can be opened from the **Simulation & Utility** tab. For details, refer to Section 4.6 "File Transfer and Loading to Memory Using Transfer & Setting Panel" in the *MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™)*.

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How to Use Waveform Patterns

# 4.2   For MS2690A/MS2691A/MS2692A or MS2830A

This section describes how to download a waveform pattern created for the MS2690A/MS2691A/MS2692A or MS2830A to the hard disk of the MS2690A/MS2691A/MS2692A or MS2830A and output the pattern.

## 4.2.1   Transferring waveform pattern to internal hard disk

For details about how to transfer a waveform pattern created using this software to the hard disk of the MS2690A/MS2691A/MS2692A or MS2830A, refer below:

- Section 2.4.4 "Copying waveform file(s) to hard disk" in the *MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual (Operation)*
- Section 2.4.4 "Copying waveform file(s) to hard disk" in the *MS2830A Signal Analyzer Vector Signal Generator Operation Manual (Operation)*

***Note:***

Transferring waveform patterns is not required if the patterns are created using this software.

## 4.2.2   Loading to Waveform Memory

In order to output a modulated signal using the waveform pattern, it is necessary to load the waveform patterns stored in the internal hard disk to the waveform memory.

■ Loading to Waveform Memory
Waveform patterns can be loaded to waveform memories by operating the panel or by using a remote command.

For operation using the front panel, refer below:

- Section 2.4.1 "Loading waveform file in memory" in the *MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual (Operation)*
- Section 2.4.1 "Loading waveform pattern(s) to memory" in the *MS2830A Signal Analyzer Vector Signal Generator Operation Manual (Operation)*

For operation using remote commands, refer below:

- MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual (Remote Control)
- MS2830A Signal Analyzer Vector Signal Generator Operation Manual (Remote Control)

## 4.2.3  Selecting Waveform Pattern

Select waveform patterns to be used for modulation from those loaded in the waveform memory as described in Section 4.2.1 "Transferring waveform pattern to internal hard disk" above.

■ Selecting waveform pattern

Waveform patterns to be used for modulation can be selected by operating the equipment panel or by using a remote command.

For operation using the front panel, refer below:

- Section 2.4.2 "Loading waveform file in memory" in the *MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual (Operation)*
- Section 2.4.2 "Loading waveform pattern(s) to memory" in the *MS2830A Signal Analyzer Vector Signal Generator Operation Manual (Operation)*

For operation using remote commands, refer below:

- MS2690A/MS2691A/MS2692A Signal Analyzer Option 020: Vector Signal Generator Operation Manual (Remote Control)
- MS2830A Signal Analyzer Vector Signal Generator Operation Manual (Remote Control)

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How to Use Waveform Patterns

# *Appendix*

**Appendix**

# *Appendix A   Error Messages*

A list of error messages is shown below. In an error message, $n_1$ and $n_2$ indicate a numeric value, and $s$ indicates a character string.

**Table A-1   Error messages**

| Error Message | Description |
|---|---|
| Can not open file | The file cannot be opened. |
| Can not open file ("$s$") | The file $s$ cannot be opened. |
| Can not read file | Reading from the file is disabled. |
| Can not write file | Writing to the file is disabled. |
| Directory not found ("$s$") | The folder $s$ cannot be found. |
| Disk full ("$s$") | The disk capacity becomes full while creating the file $s$. |
| Inadequacy: All Off | The statuses of all slots are OFF. |
| Inadequacy: Blank | The setting is left blank. |
| Inadequacy: CRC | The CRC setting is invalid. |
| Inadequacy: Invalid Value | The set numeric value is invalid. |
| Inadequacy: No Pattern Name | A pattern name is not entered. |
| Invalid file format | The file format is invalid. |
| Invalid file format ("$s$") | The format of the file $s$ is invalid. |
| Out of range: $s$ ($n_1 - n_2$) | The value of the parameter $s$ is out of the setting range from $n_1$ to $n_2$. |
| Out of range: The number of samples is over 256/512Msamples. | The number of samples of the waveform pattern to be generated exceeds 256/512 Msamples.<br><br>***Note:***<br>This message is available only when **MG3700** is selected in the Select instrument screen at startup. |
| Out of range: The number of samples is over 256Msamples. | The number of samples of the waveform pattern to be generated exceeds 256 Msamples.<br>***Note:***<br>This message is available only when **MS269x** or **MS2830** is selected in the Select instrument screen at startup. |
| Out of Range：Sampling Rate (kHz) (20-8000) | The sampling rate is out of the range of 20 to 8000 kHz. |
| Out of Range：Sampling Rate (MHz) (0.02-8) | The sampling rate is out of the range of 0.02 to 8 MHz. |
| The Waveform data file is not generated. | The waveform pattern data file is not generated. |
| There is no Fixed/Data/CRC field. | There are no Fixed/Data/CRC fields in the slot. |

**Table A-1   Error messages (Cont'd)**

| Error Message | Description |
|---|---|
| Total bit isn't a multiple of $n_1$. | The total number of bits in the slot is not a multiple of $n_1$. |
| Total bit of the first half of the slot isn't a multiple of $n_1$. | The total number of bits in the first half of the slot is not a multiple of $n_1$. |
| Total bit of the second half of the slot isn't a multiple of $n_1$. | The total number of bits in the second half of the slot is not a multiple of $n_1$. |
| Inadequacy:Maximum frequency deviation isn't a multiple of 3. | Maximum frequency deviation is not a multiple of 3. |
| Out of range : The number of FIR taps(1 – 1023) | The number of filter coefficient taps is out of the setting range from 1 to 1023. |
| Inadequacy : The number of FIR taps is not odd numbers | The number of filter coefficient taps is not an odd number. |

A list of warning messages is shown below.

**Table A-2   Warning messages**

| Warning Message | Description |
|---|---|
| All slots shall be the same content of fields. | The field settings will apply to all transmission slots. |
| Change the number of frames to 1? | Do you want to change the number of frames to 1? |
| Clipping was done. | Clipping has been executed. |
| Decrease the number of frames to keep only phase continuous? | Do you want to decrease the number of frames to keep only phases continuous? |
| Keep phase continuous? | Do you want to keep phases continuous? |
| There is a possibility that phase is not continuous. | Phase may not be continuous. |

# *Appendix B  Symbol Points for Each Modulation Type*

## B.1  BPSK
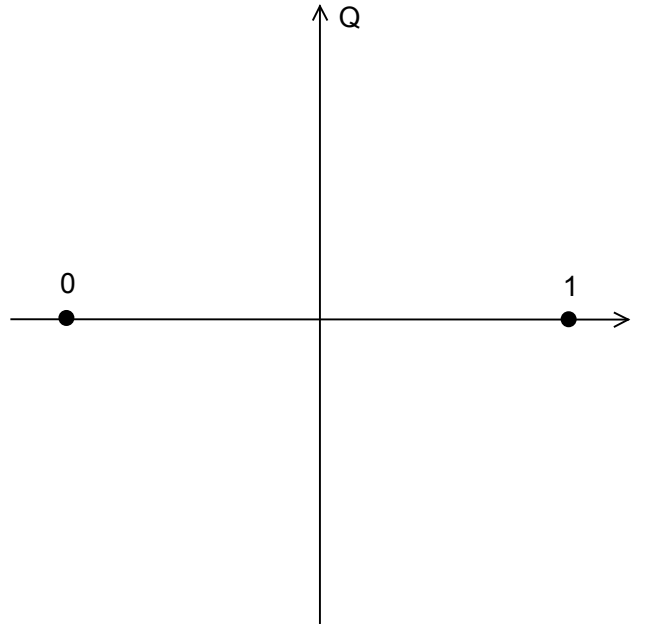


**Table B.1-1   BPSK**

| Allocation | Symbol Data |
|------------|-------------|
| 0          | 0           |
| 1          | 1           |
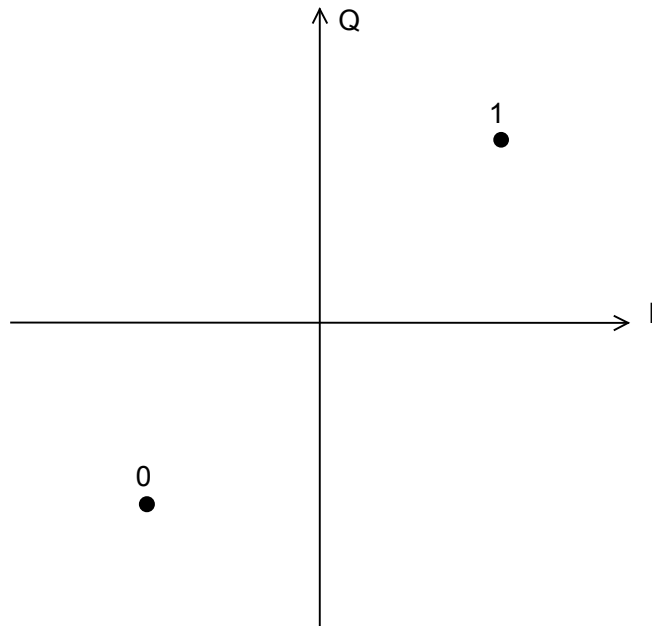
**Table B.1-2   BPSK (Rotated 45° counterclockwise)**

| Allocation | Symbol Data |
|---|---|
| 0 | 0 |
| 1 | 1 |

# B.2  DBPSK
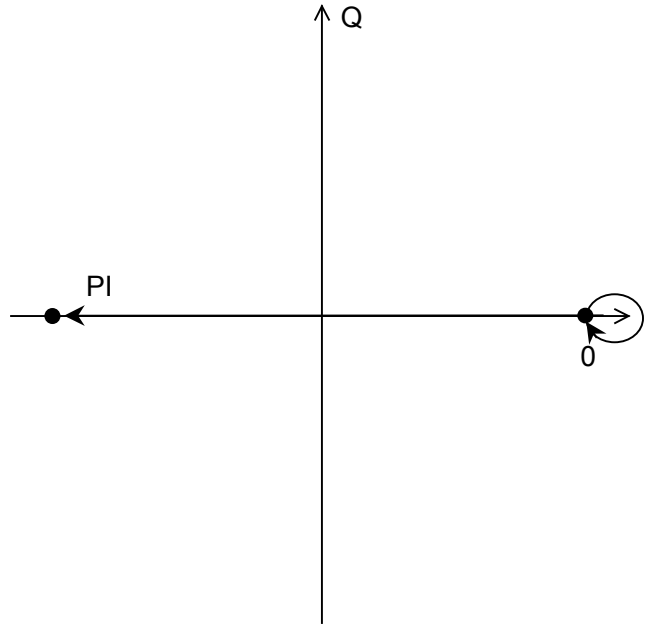


**Table B.2-1   DBPSK**

| Differential | Symbol Data |
|---|---|
| PI | 0 |
| 0 | 1 |

# B.3  PI/2DBPSK
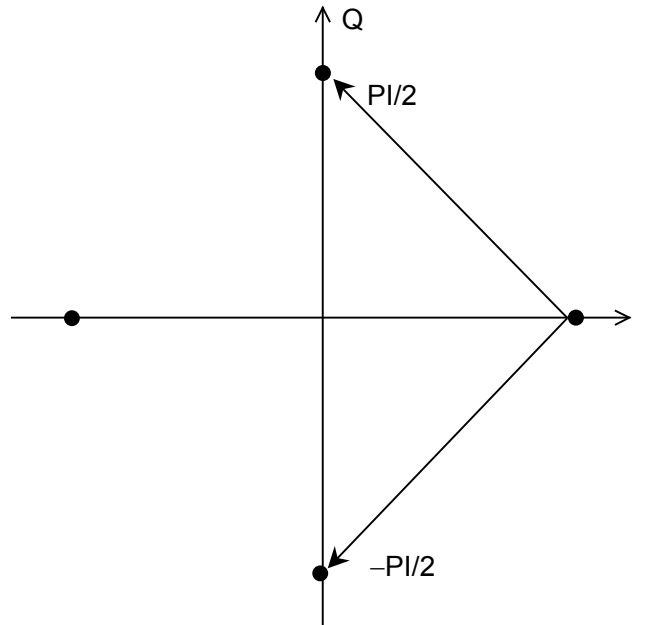


**Table B.3-1   PI/2DBPSK**

| Differential | Symbol Data |
|---|---|
| PI/2 | 0 |
| −PI/2 | 1 |

# B.4 QPSK
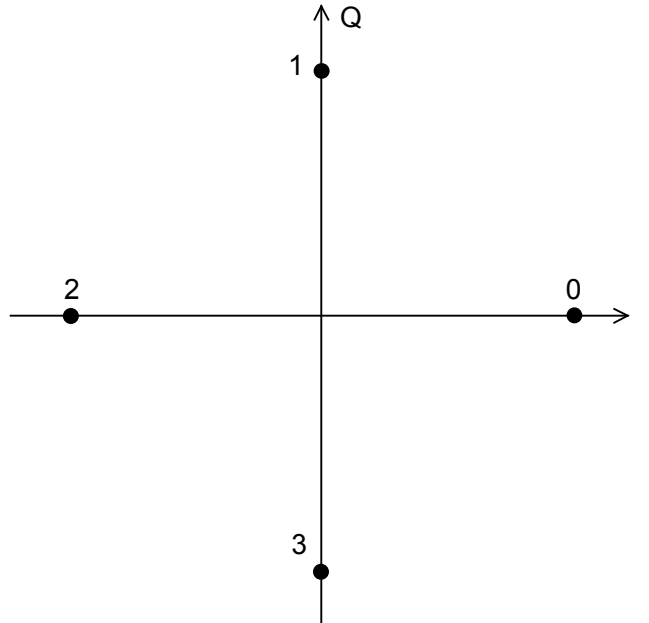


**Table B.4-1    QPSK**

| Allocation | Symbol Data |
|---|---|
| 0 | 11 |
| 1 | 01 |
| 2 | 00 |
| 3 | 10 |
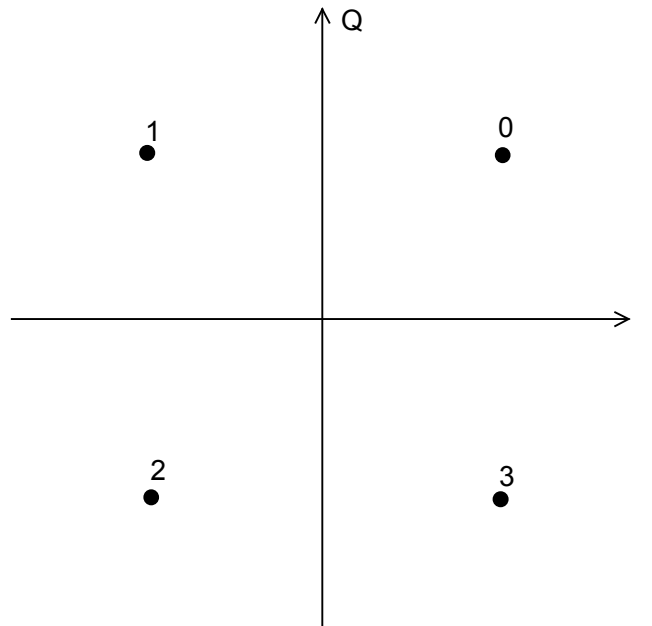
**Table B.4-2   QPSK (Rotated 45° counterclockwise)**

| Allocation | Symbol Data |
| --- | --- |
| 0 | 11 |
| 1 | 01 |
| 2 | 00 |
| 3 | 10 |

# B.5  O-QPSK
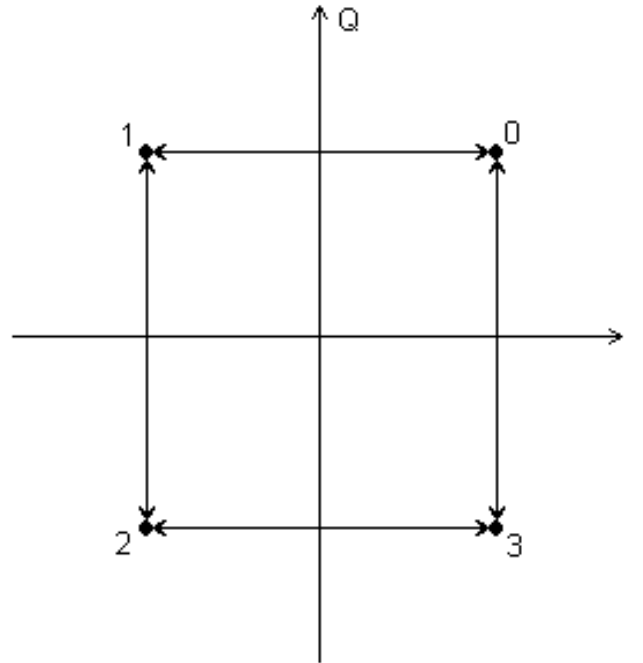


**Table B.5-1    QPSK**

| Allocation | Symbol Data |
|---|---|
| 0 | 11 |
| 1 | 01 |
| 2 | 00 |
| 3 | 10 |

# B.6  DQPSK
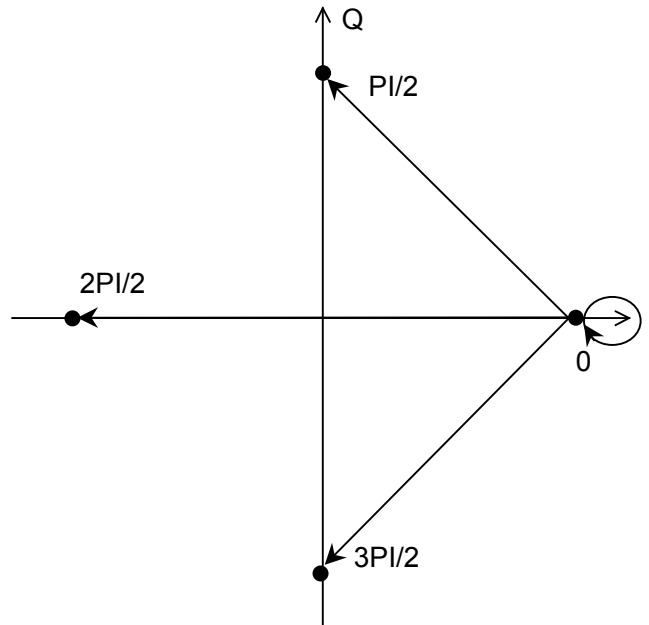


**Table B.6-1    DQPSK**

| Differential | Symbol Data |
|---|---|
| PI/2 | 00 |
| 2PI/2 | 01 |
| 3PI/2 | 10 |
| 0 | 11 |

# B.7 PI/4DQPSK
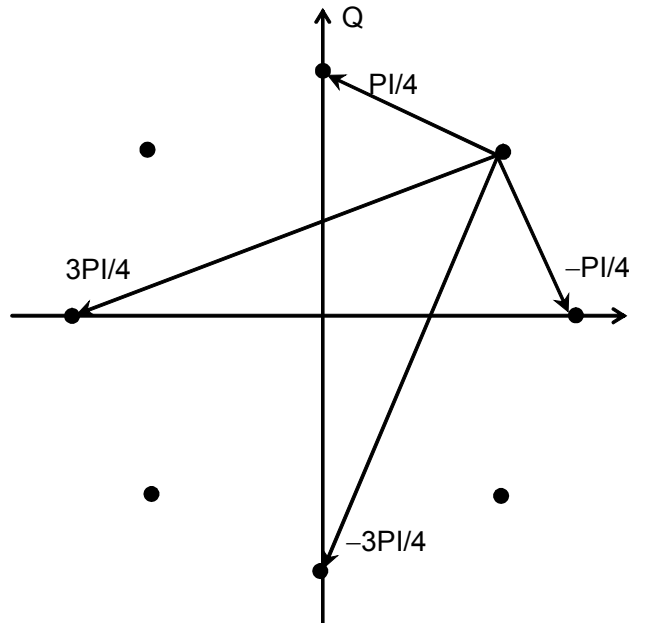


**Table B.7-1 PI/4DQPSK**

| Differential | Symbol Data |
|---|---|
| PI/4 | 00 |
| 3PI/4 | 01 |
| −3PI/4 | 10 |
| −PI/4 | 11 |

# B.8  8PSK
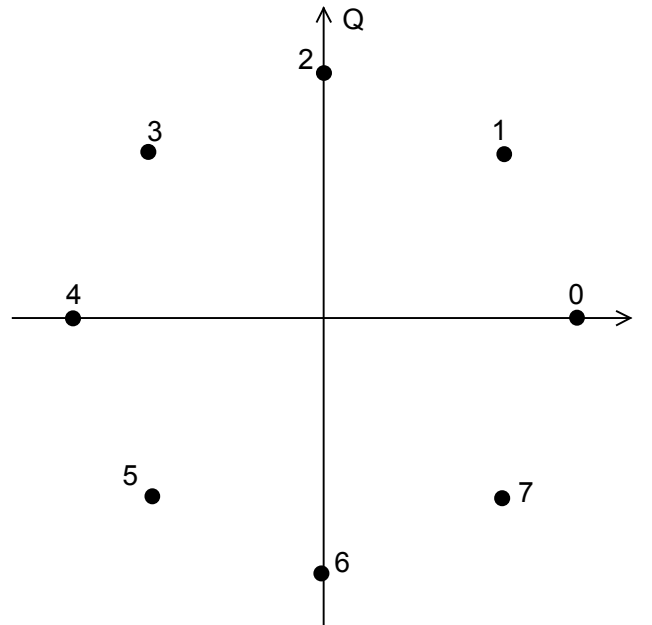


**Table B.8-1  8PSK**

| Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|
| 0 | 111 | 4 | 001 |
| 1 | 110 | 5 | 000 |
| 2 | 010 | 6 | 100 |
| 3 | 011 | 7 | 101 |

**Table B.8-2  8PSK (GSM)**

| Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|
| 0 | 111 | 4 | 001 |
| 1 | 011 | 5 | 101 |
| 2 | 010 | 6 | 100 |
| 3 | 000 | 7 | 110 |

# B.9  D8PSK
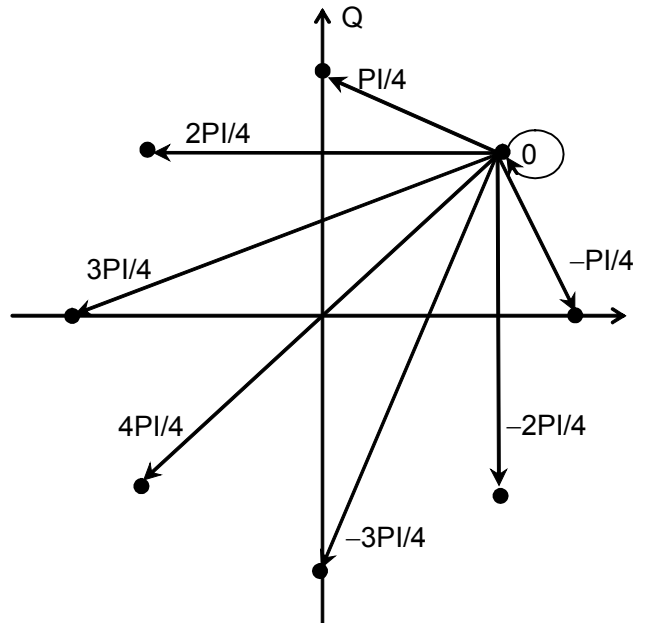


**Table B.9-1    D8PSK**

| Differential | Symbol Data | Differential | Symbol Data |
|---|---|---|---|
| PI/4 | 110 | −3PI/4 | 000 |
| 2PI/4 | 010 | −2PI/4 | 100 |
| 3PI/4 | 011 | −PI/4 | 101 |
| 4PI/4 | 001 | 0 | 111 |
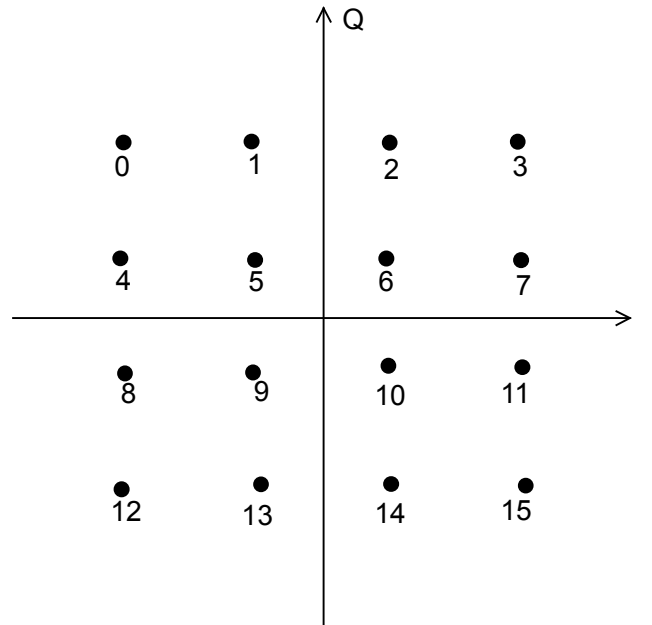
# B.10  16QAM



**Table B.10-1    16QAM**

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|---|---|---|---|
| 0 | 0111 | 4 | 0110 | 8 | 0010 | 12 | 0011 |
| 1 | 0101 | 5 | 0100 | 9 | 0000 | 13 | 0001 |
| 2 | 1101 | 6 | 1100 | 10 | 1000 | 14 | 1001 |
| 3 | 1111 | 7 | 1110 | 11 | 1010 | 15 | 1011 |

# B.11 32QAM
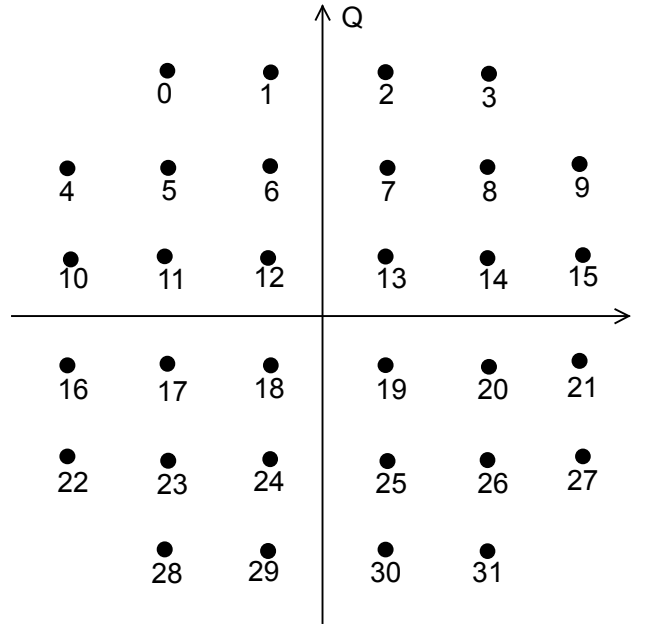


**Table B.11-1    32QAM**

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|---|---|---|---|
| 0 | 11101 | 8 | 00100 | 16 | 00110 | 24 | 01001 |
| 1 | 01010 | 9 | 10111 | 17 | 10011 | 25 | 11001 |
| 2 | 11010 | 10 | 01110 | 18 | 00000 | 26 | 01100 |
| 3 | 01101 | 11 | 11011 | 19 | 10000 | 27 | 11111 |
| 4 | 00111 | 12 | 01000 | 20 | 00011 | 28 | 10101 |
| 5 | 10100 | 13 | 11000 | 21 | 10110 | 29 | 00010 |
| 6 | 00001 | 14 | 01011 | 22 | 01111 | 30 | 10010 |
| 7 | 10001 | 15 | 11110 | 23 | 11100 | 31 | 00101 |

# B.12  64QAM

Q

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |
| 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 |
| 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |

I
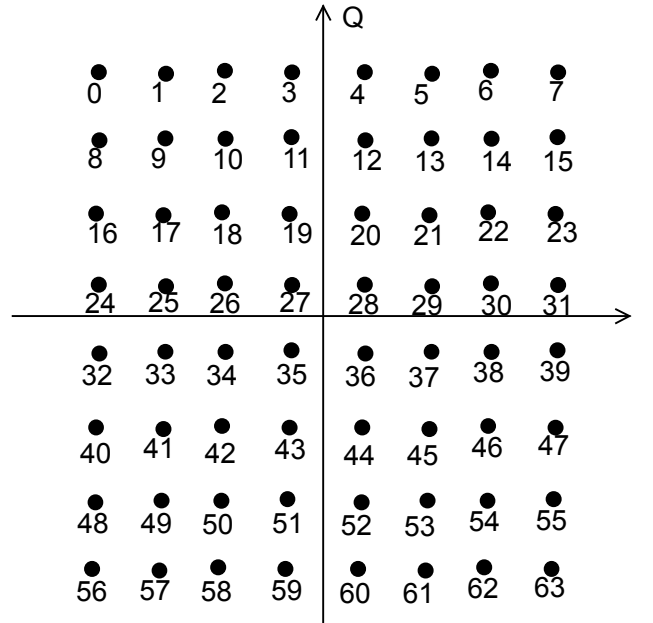
**Table B.12-1    64QAM**

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|---|---|---|---|
| 0 | 100010 | 16 | 100111 | 32 | 110111 | 48 | 110010 |
| 1 | 100000 | 17 | 100101 | 33 | 110101 | 49 | 110000 |
| 2 | 101000 | 18 | 101101 | 34 | 111101 | 50 | 111000 |
| 3 | 101010 | 19 | 101111 | 35 | 111111 | 51 | 111010 |
| 4 | 001000 | 20 | 001101 | 36 | 011101 | 52 | 011000 |
| 5 | 001010 | 21 | 001111 | 37 | 011111 | 53 | 011010 |
| 6 | 000010 | 22 | 000111 | 38 | 010111 | 54 | 010010 |
| 7 | 000000 | 23 | 000101 | 39 | 010101 | 55 | 010000 |
| 8 | 100011 | 24 | 100110 | 40 | 110110 | 56 | 110011 |
| 9 | 100001 | 25 | 100100 | 41 | 110100 | 57 | 110001 |
| 10 | 101001 | 26 | 101100 | 42 | 111100 | 58 | 111001 |
| 11 | 101011 | 27 | 101110 | 43 | 111110 | 59 | 111011 |
| 12 | 001001 | 28 | 001100 | 44 | 011100 | 60 | 011001 |
| 13 | 001011 | 29 | 001110 | 45 | 011110 | 61 | 011011 |
| 14 | 000011 | 30 | 000110 | 46 | 010110 | 62 | 010011 |
| 15 | 000001 | 31 | 000100 | 47 | 010100 | 63 | 010001 |

# B.13  256QAM
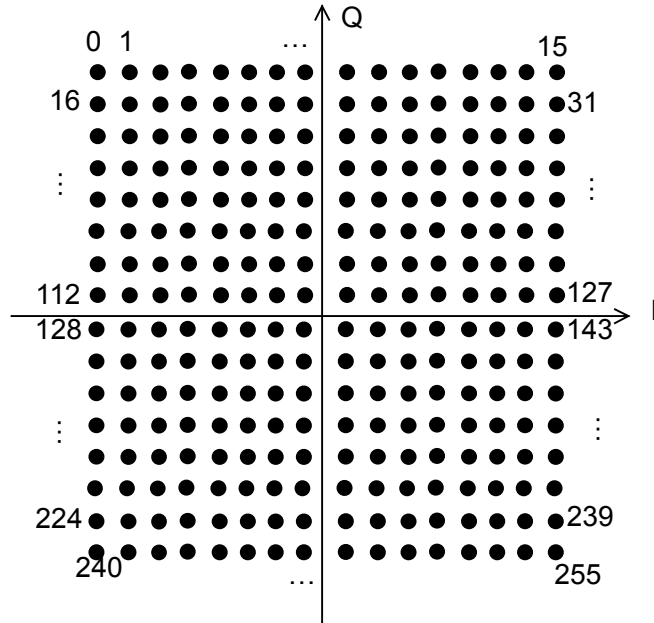


**Table B.13-1    256QAM**

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|---|---|---|---|
| 0 | 10001000 | 30 | 00000011 | 60 | 00001100 | 90 | 00111100 |
| 1 | 10001010 | 31 | 00000001 | 61 | 00001110 | 91 | 00111110 |
| 2 | 10000010 | 32 | 10001101 | 62 | 00000110 | 92 | 00011100 |
| 3 | 10000000 | 33 | 10001111 | 63 | 00000100 | 93 | 00011110 |
| 4 | 10100010 | 34 | 10000111 | 64 | 10011101 | 94 | 00010110 |
| 5 | 10100000 | 35 | 10000101 | 65 | 10011111 | 95 | 00010100 |
| 6 | 10101000 | 36 | 10100111 | 66 | 10010111 | 96 | 10011000 |
| 7 | 10101010 | 37 | 10100101 | 67 | 10010101 | 97 | 10011010 |
| 8 | 00100010 | 38 | 10101101 | 68 | 10110111 | 98 | 10010010 |
| 9 | 00100000 | 39 | 10101111 | 69 | 10110101 | 99 | 10010000 |
| 10 | 00101000 | 40 | 00100111 | 70 | 10111101 | 100 | 10110010 |
| 11 | 00101010 | 41 | 00100101 | 71 | 10111111 | 101 | 10110000 |
| 12 | 00001000 | 42 | 00101101 | 72 | 00110111 | 102 | 10111000 |
| 13 | 00001010 | 43 | 00101111 | 73 | 00110101 | 103 | 10111010 |
| 14 | 00000010 | 44 | 00001101 | 74 | 00111101 | 104 | 00110010 |
| 15 | 00000000 | 45 | 00001111 | 75 | 00111111 | 105 | 00110000 |
| 16 | 10001001 | 46 | 00000111 | 76 | 00011101 | 106 | 00111000 |
| 17 | 10001011 | 47 | 00000101 | 77 | 00011111 | 107 | 00111010 |
| 18 | 10000011 | 48 | 10001100 | 78 | 00010111 | 108 | 00011000 |
| 19 | 10000001 | 49 | 10001110 | 79 | 00010101 | 109 | 00011010 |
| 20 | 10100011 | 50 | 10000110 | 80 | 10011100 | 110 | 00010010 |
| 21 | 10100001 | 51 | 10000100 | 81 | 10011110 | 111 | 00010000 |
| 22 | 10101001 | 52 | 10100110 | 82 | 10010110 | 112 | 10011001 |
| 23 | 10101011 | 53 | 10100100 | 83 | 10010100 | 113 | 10011011 |
| 24 | 00100011 | 54 | 10101100 | 84 | 10110110 | 114 | 10010011 |
| 25 | 00100001 | 55 | 10101110 | 85 | 10110100 | 115 | 10010001 |
| 26 | 00101001 | 56 | 00100110 | 86 | 10111100 | 116 | 10110011 |
| 27 | 00101011 | 57 | 00100100 | 87 | 10111110 | 117 | 10110001 |
| 28 | 00001001 | 58 | 00101100 | 88 | 00110110 | 118 | 10111001 |
| 29 | 00001011 | 59 | 00101110 | 89 | 00110100 | 119 | 10111011 |

**Table B.13-1    256QAM (Cont'd)**

| Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data | Allocation | Symbol Data |
|---|---|---|---|---|---|---|---|
| 120 | 00110011 | 154 | 01111100 | 188 | 01011001 | 222 | 01000011 |
| 121 | 00110001 | 155 | 01111110 | 189 | 01011011 | 223 | 01000001 |
| 122 | 00111001 | 156 | 01011100 | 190 | 01010011 | 224 | 11001101 |
| 123 | 00111011 | 157 | 01011110 | 191 | 01010001 | 225 | 11001111 |
| 124 | 00011001 | 158 | 01010110 | 192 | 11001000 | 226 | 11000111 |
| 125 | 00011011 | 159 | 01010100 | 193 | 11001010 | 227 | 11000101 |
| 126 | 00010011 | 160 | 11011000 | 194 | 11000010 | 228 | 11100111 |
| 127 | 00010001 | 161 | 11011010 | 195 | 11000000 | 229 | 11100101 |
| 128 | 11011101 | 162 | 11010010 | 196 | 11100010 | 230 | 11101101 |
| 129 | 11011111 | 163 | 11010000 | 197 | 11100000 | 231 | 11101111 |
| 130 | 11010111 | 164 | 11110010 | 198 | 11101000 | 232 | 01100111 |
| 131 | 11010101 | 165 | 11110000 | 199 | 11101010 | 233 | 01100101 |
| 132 | 11110111 | 166 | 11111000 | 200 | 01100010 | 234 | 01101101 |
| 133 | 11110101 | 167 | 11111010 | 201 | 01100000 | 235 | 01101111 |
| 134 | 11111101 | 168 | 01110010 | 202 | 01101000 | 236 | 01001101 |
| 135 | 11111111 | 169 | 01110000 | 203 | 01101010 | 237 | 01001111 |
| 136 | 01110111 | 170 | 01111000 | 204 | 01001000 | 238 | 01000111 |
| 137 | 01110101 | 171 | 01111010 | 205 | 01001010 | 239 | 01000101 |
| 138 | 01111101 | 172 | 01011000 | 206 | 01000010 | 240 | 11001100 |
| 139 | 01111111 | 173 | 01011010 | 207 | 01000000 | 241 | 11001110 |
| 140 | 01011101 | 174 | 01010010 | 208 | 11001001 | 242 | 11000110 |
| 141 | 01011111 | 175 | 01010000 | 209 | 11001011 | 243 | 11000100 |
| 142 | 01010111 | 176 | 11011001 | 210 | 11000011 | 244 | 11100110 |
| 143 | 01010101 | 177 | 11011011 | 211 | 11000001 | 245 | 11100100 |
| 144 | 11011100 | 178 | 11010011 | 212 | 11100011 | 246 | 11101100 |
| 145 | 11011110 | 179 | 11010001 | 213 | 11100001 | 247 | 11101110 |
| 146 | 11010110 | 180 | 11110011 | 214 | 11101001 | 248 | 01100110 |
| 147 | 11010100 | 181 | 11110001 | 215 | 11101011 | 249 | 01100100 |
| 148 | 11110110 | 182 | 11111001 | 216 | 01100011 | 250 | 01101100 |
| 149 | 11110100 | 183 | 11111011 | 217 | 01100001 | 251 | 01101110 |
| 150 | 11111100 | 184 | 01110011 | 218 | 01101001 | 252 | 01001100 |
| 151 | 11111110 | 185 | 01110001 | 219 | 01101011 | 253 | 01001110 |
| 152 | 01110110 | 186 | 01111001 | 220 | 01001001 | 254 | 01000110 |
| 153 | 01110100 | 187 | 01111011 | 221 | 01001011 | 255 | 01000100 |

# B.14 2ASK
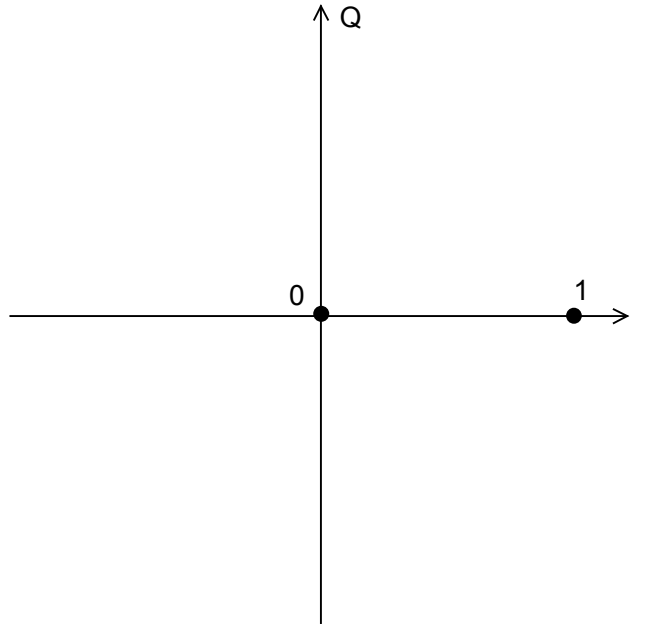


**Table B.14-1    2ASK**

| Allocation | Symbol Data |
|---|---|
| 0 | 0 |
| 1 | 1 |

# B.15 4ASK
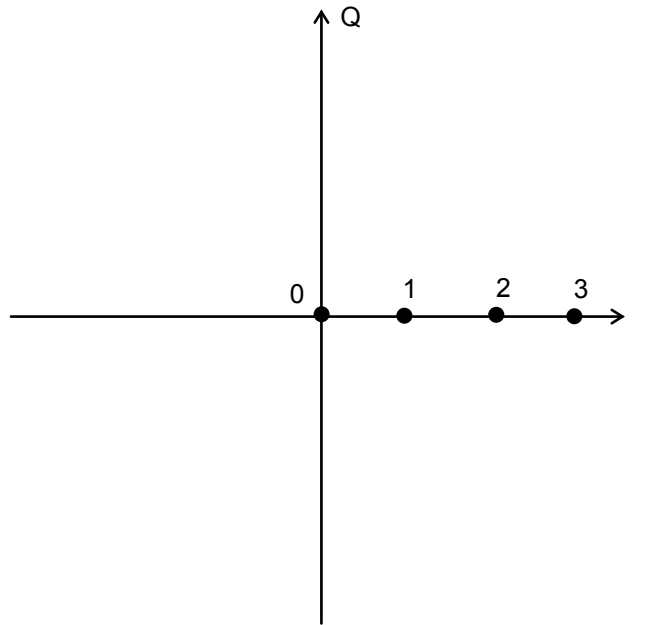


**Table B.15-1 4ASK**

| Allocation | Symbol Data |
|------------|-------------|
| 0 | 00 |
| 1 | 01 |
| 2 | 11 |
| 3 | 10 |

# B.16  2FSK



**Table B.16-1    FSK**

| Direction | Symbol Data |
|-----------|-------------|
| +         | 1           |
| −         | 0           |

# B.17  4FSK
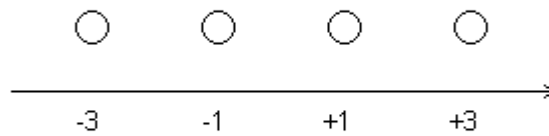


**Table B.17-1    4FSK (Maximum frequency deviation = 945 Hz)**

| Direction | Symbol Data | Deviation |
|-----------|-------------|-----------|
| $+3$ | 01 | 945 |
| $+1$ | 00 | 315 |
| $-1$ | 10 | $-315$ |
| $-3$ | 11 | $-945$ |

Deviation is calculated by the following:

$$Deviation = Direction \times \frac{Maximum\ frequency\ deviation}{3}$$

## C.1  IQ Mapping User File Format

Write binary numbers corresponding to symbol points shown in the figures in Appendix B in the order of numbers assigned for symbol points using text character 0 or 1 in one line per point. For D8PSK, write binary numbers corresponding to phase difference in the order of PI/4, 2PI/4, 3PI/4, 4PI/4, –3PI/4, –2PI/4, –PI/4 and 0 in one line per point.

Any extension can be used as long as the user file is a text file. A loading error occurs with a file in an invalid format. Shortage in binary numbers required for the modulation type or duplication of the same binary numbers also result in an error at loading.

1111

1110

1101

1100

1011

1010

1001

1000

0111

0110

0101

0100

0011

0010

0001

0000

**Figure C.1-1   Example of 16QAM IQ mapping user file**

When the user file shown in Fig. C.1-1 is loaded, symbol point allocation is as shown in Fig. C.1-2.
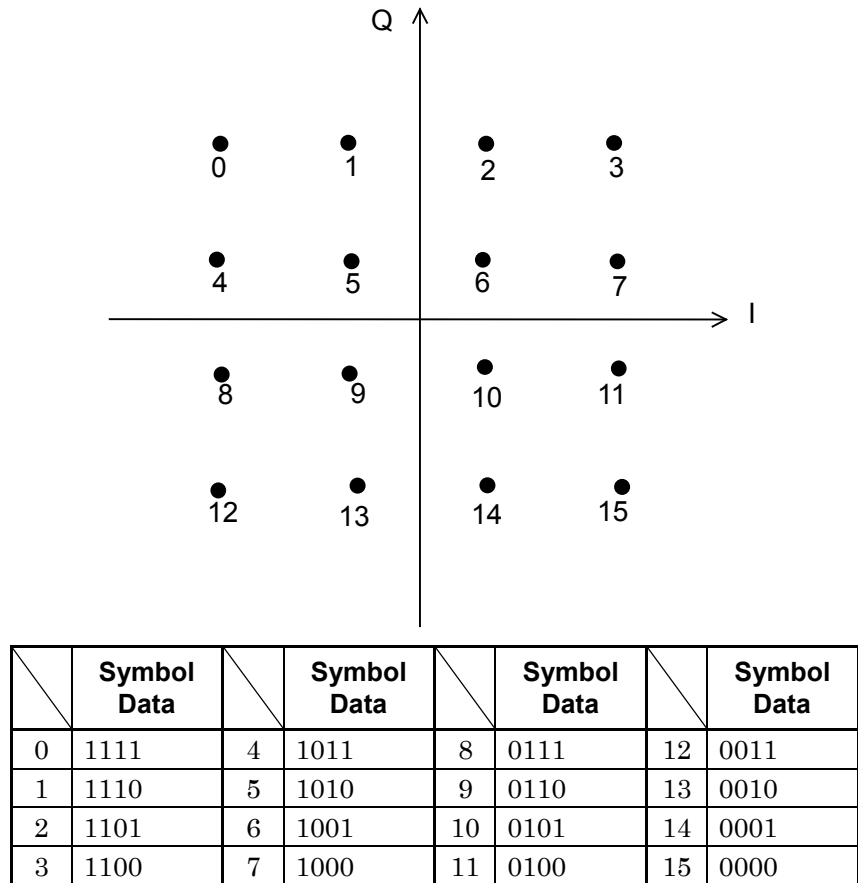


| | Symbol Data | | Symbol Data | | Symbol Data | | Symbol Data |
|---|---|---|---|---|---|---|---|
| 0 | 1111 | 4 | 1011 | 8 | 0111 | 12 | 0011 |
| 1 | 1110 | 5 | 1010 | 9 | 0110 | 13 | 0010 |
| 2 | 1101 | 6 | 1001 | 10 | 0101 | 14 | 0001 |
| 3 | 1100 | 7 | 1000 | 11 | 0100 | 15 | 0000 |

**Figure C.1-2   16QAM IQ mapping and symbol data table when the user file shown in Fig. C.1-1 is loaded**

# C.2  Continuous Pattern User File Format

Describe binary sequences before modulation. Only 0, 1 and line feed characters can be used and any comma or space causes loading error. Up to 9600000 bits can be loaded.

Example: PN9

```
111111111000001111011111000101110011001000001001010011101101000111100111110011011000101010010001110001101101010101110001001100010001000000000100001000110000100111001010101100001101111010011011100100010100001010110100111111011001001001011011111100100110101001100110000000011000110010100011010010101111111010001011000111010110010110011110001111101110100000110101101101110110000010110101111101010101000000010100101011110010111011100000011100111010010011110101110101000100100001100111000010111101101100110100001110111100000
```

The binary sequences are inserted into Data Field one by one starting from the top left. Refer to Fig. 5.1.2.4-3 in Section 5 for the continuity of Data Field for each Slot. When the total number of bits in the Data Field exceeds the number of binary number bits in the user file, the rest are inserted from the top of the user file again, as shown in Fig. C.2-1. When the checkbox ☐ Auto is selected for the Number of Frames in the Frame setting screen and the continuous pattern is set to "UserFile" in the Data Field area of the Field setting screen, the number of frames is automatically set to 1 or a value that retains the phase continuity only.
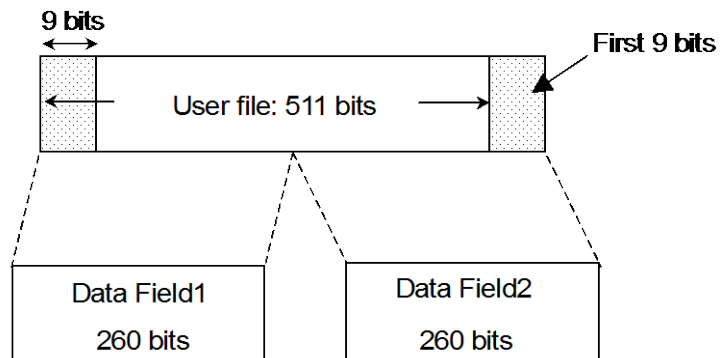


**Figure C.2-1    Insertion method to Data Field**

References are to page numbers.