MX370107A
Fading IQproducer™
Operation Manual

Fifth 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), or MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe). Please also refer to either of these documents before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W2995AE-5.0

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

These indicate that the marked part should be recycled.

MX370107A
Fading IQproducer™
Operation Manual

7 September 2007 (First Edition)
23 October 2012 (Fifth Edition)

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

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- 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.
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- This warranty does not cover damage to this software caused by Acts of God, natural disasters, and misuse or mishandling by the customer.

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   iv) If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.
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- 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.

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

1. Product Model

Software: MX370107A Fading IQproducer™

2. Applied Directive and Standards

When the MX370107A Fading IQproducer™ is installed in the MG3710A/MG3740A, the applied directive and standards of this software conform to those of the MG3710A/MG3740A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX370107A 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

1. Product Model

Software: MX370107A Fading IQproducer™

2. Applied Directive and Standards

When the MX370107A Fading IQproducer™ is installed in the MG3710A, the applied directive and standards of this software conform to those of the MG3710A main frame.

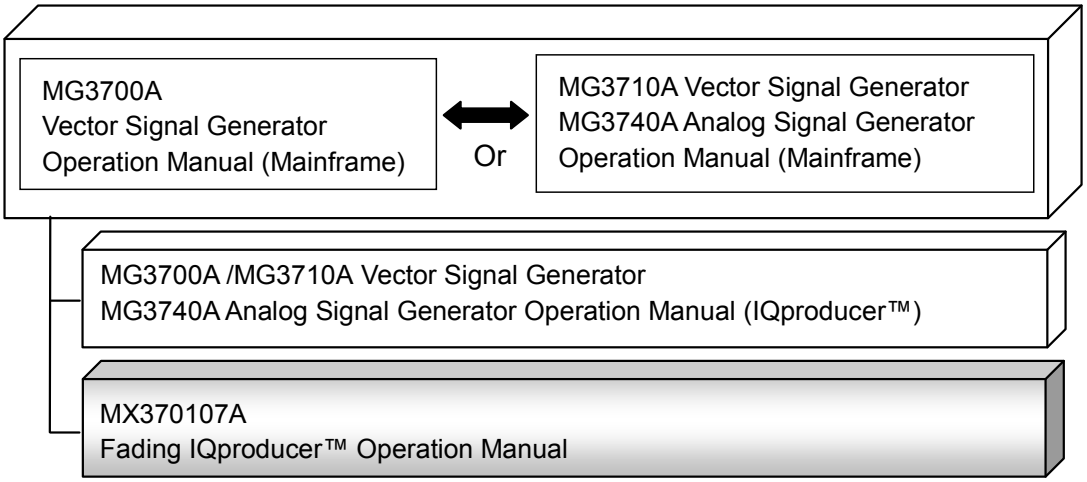
PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX370107A can be used with.

About This Manual

■Associated Documents

The operation manual configuration of the MX370107A Fading IQproducer™ is shown below.

■If using MG3700A, MG3710A or MG3740A:



- 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.

- Fading IQproducer™ Operation Manual (This document)

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

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IV.

Chapter 1 Overview

This chapter provides an overview of the MX370107A Fading IQproducer™.

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1.1 Product overview

MX370107A Fading IQproducer™ (hereinafter referred to as "this software") is software used to read waveform patterns and generate fading-processed waveform patterns.

This software requires either of the following environment:

- MG3710A Vector Signal Generator
- MG3740A Analog Signal Generator
- Personal computer (hereinafter, "PC")

This software generates waveform patterns that support the specifications of fading 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 or MG3740A Analog Signal Generator (collectively referred to as "mainframe", or "this equipment").

With the MX370107A, fading processing of each channel, correlation matrix calculation, and AWGN addition can be performed as shown in the dotted rectangle in the operation flow of Fig. 1.1-1. ASCII format files created using simulation software in addition to waveform pattern files created using IQproducer™ can be specified for IQ data files to be input.

This software can also simulate the propagation environment between transmission and reception antennas. A configuration example when using a 2 × 2 MIMO configuration with this software is shown in Fig. 1.1-2. In this example, this software performs fading processing for the waveform pattern files that correspond to the signals transmitted from each of the transmission antennas, and outputs the fading-processed waveform pattern files from two MG3700A/MG3710A/MG3740A units, simulating the propagation environment between transmission and reception antennas in 2 × 2 MIMO. Refer to Chapter 3 "Detailed Description of Functions" for details on this software, and refer to Appendix C "Connecting Multiple MG3700A/10A/40A Units" for how to synchronize two or more MG3700A/MG3710A/MG3740A units.

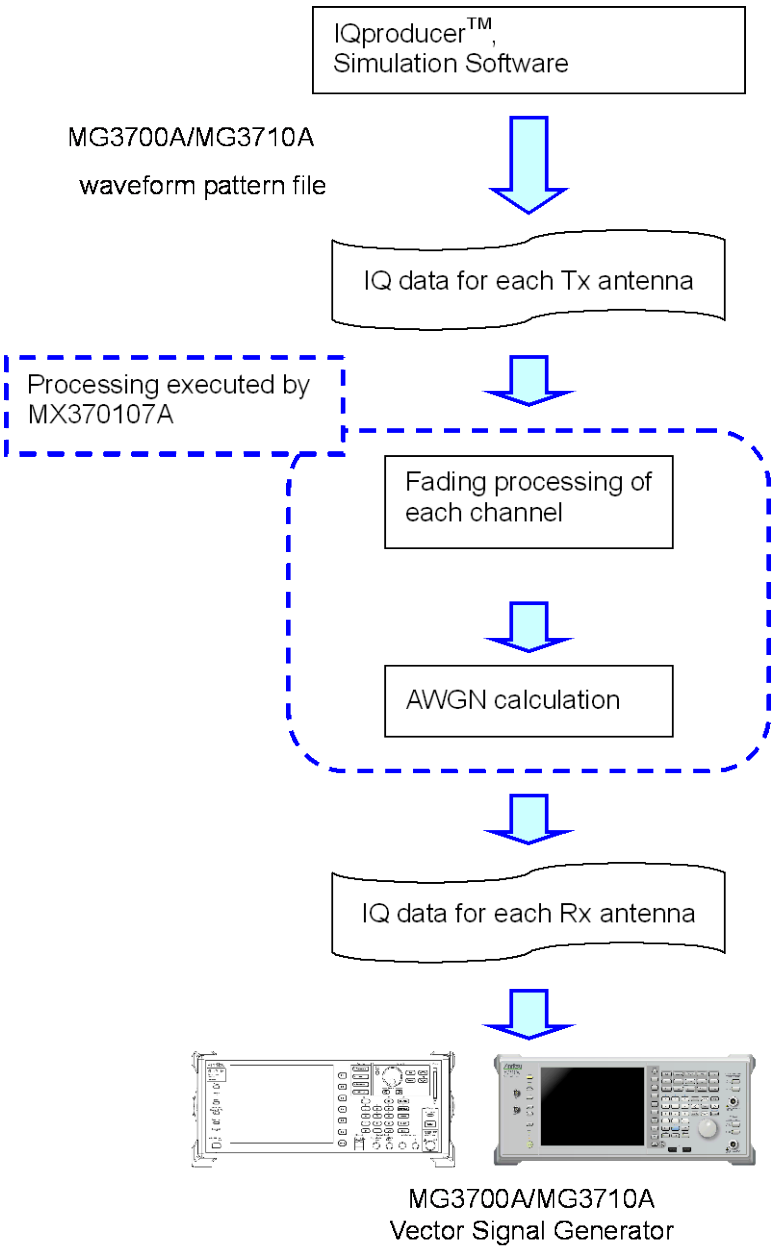

Fig. 1.1-1 Fading processing flow

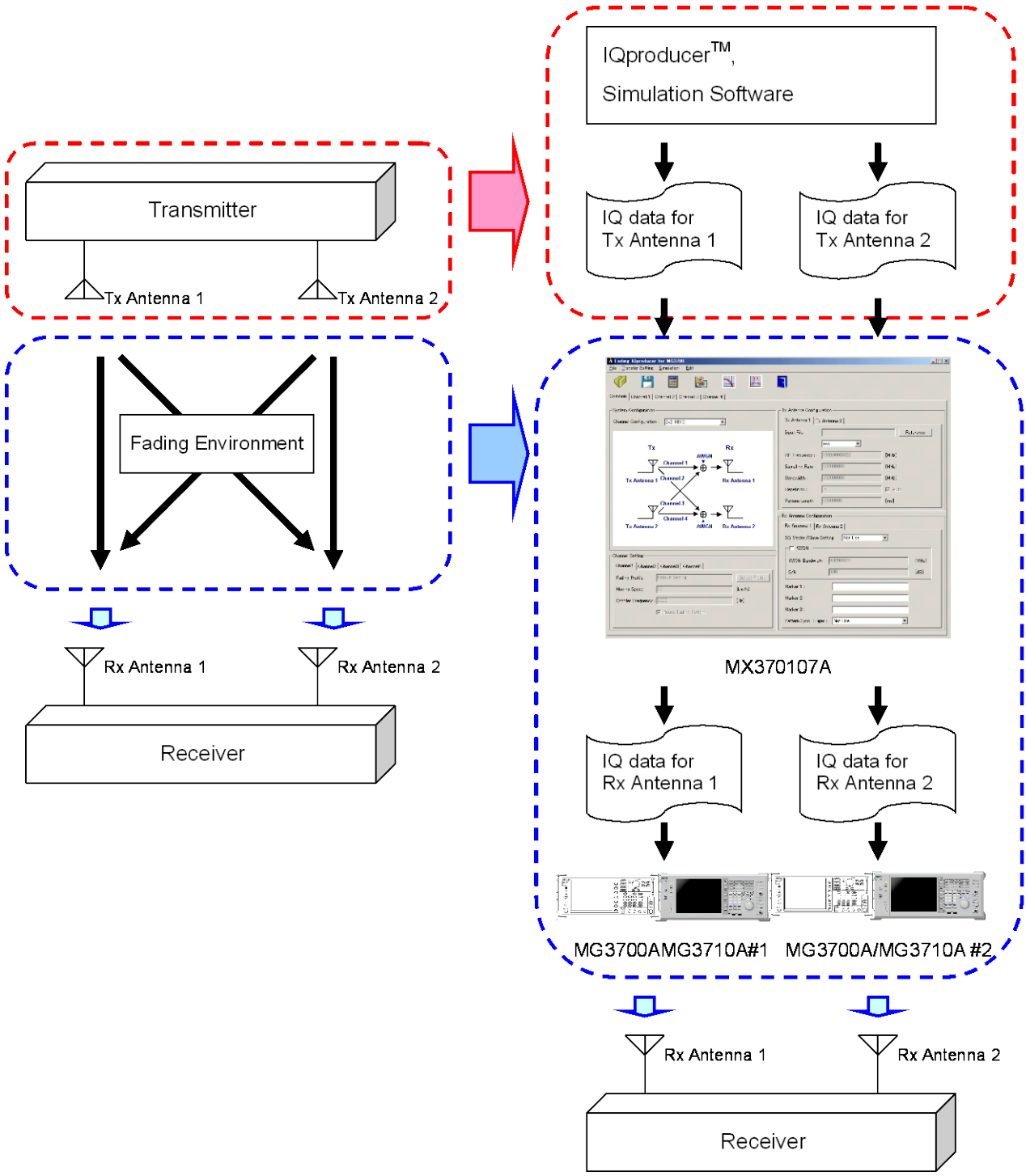

Fig. 1.1-2 2 × 2 MIMO configuration example

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
Software name	MX370107A		
Maximum Size of Waveform Patterns	256 M sample 512 M sample*1	64 M sample 128 M sample*3 256 M sample*4 512 M sample*5 1024 M sample*6	64 M sample 128 M sample*3 256 M sample*4 512 M sample*5
Transmission method of Waveform Patterns	LAN, CompactFlash Card	External device such as LAN, USB memory*2	External device such as LAN, USB memory*2
Installation of this software to this equipment	N/A	Possible	Possible

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

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

*5: 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)

*6: The ARB memory expansion 1024M sample (optional) must be installed into the MG3710A to use waveform patterns of maximum 1024 M samples.

■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, see Section 4.5 “File Conversion on Convert Screen” in the MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™).

Chapter 2 Preparation

This chapter describes the operating environment for this software.

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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. 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™

Refer to section 2 “Installation/Uninstallation” in the MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™).

■Installing/Uninstalling IQproducer™ license file

For how to install license file to MG3700A/MG3710A, 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, 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”

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 PC

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

<Procedure>

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

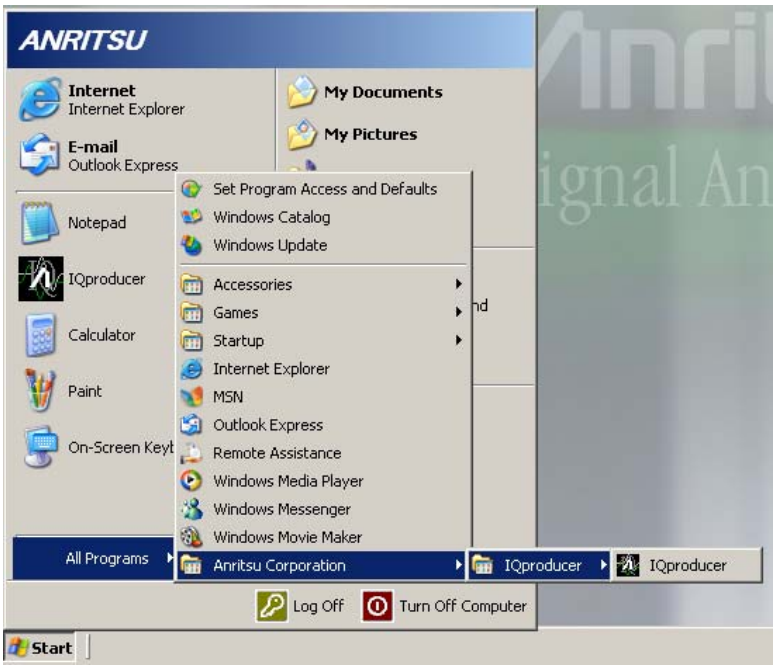

Figure 2.3.1-1 Program selection screen

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

   This **Select instrument** screen is used to select either MG3700A, MG3710A or MG3740A. This following explanation assumes that you have selected **MG3700**.

Figure 2.3.1-2 Select Instrument Screen

Notes:

1. This software does not support MS269xA and MS2830A.
2. 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™.

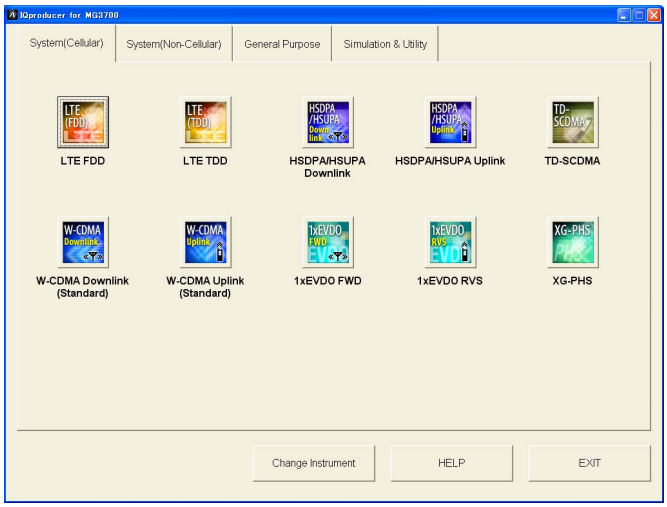

Figure 2.3.1-3 Common Platform Screen

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

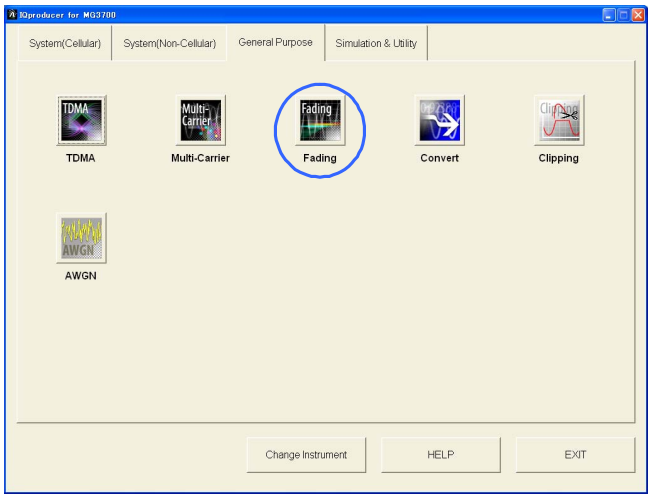

Figure 2.3.1-4 General Purpose Selection Screen

5. Click **Fading** 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/MG3740A

Start this software using the following procedure.

<Procedure>

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

Note:

The common platform screen does not appear when pressing IQpro if Option 020/120 are not installed in the MG3740A.

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

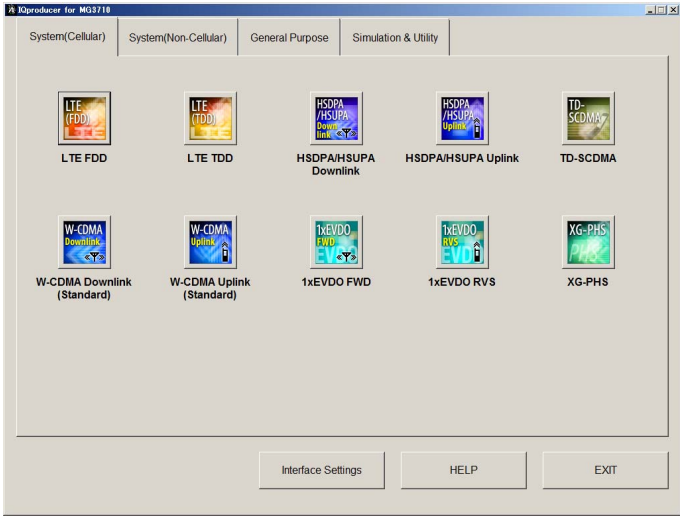

Figure 2.3.2-1 Common Platform Screen

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

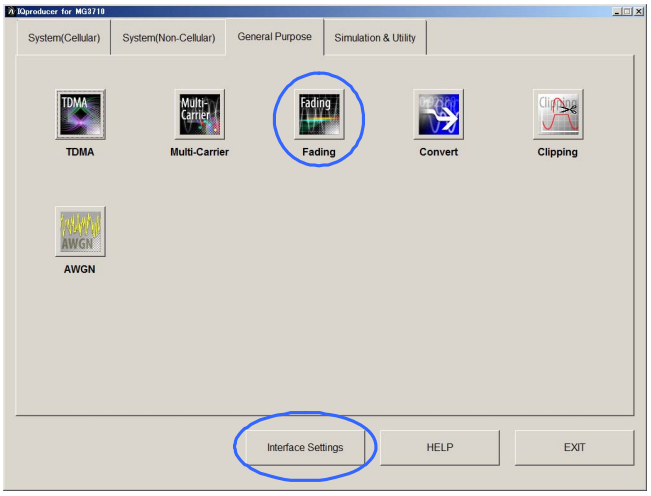

Figure 2.3.2-2 General Purpose Selection Screen

3. Click **Fading** 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.

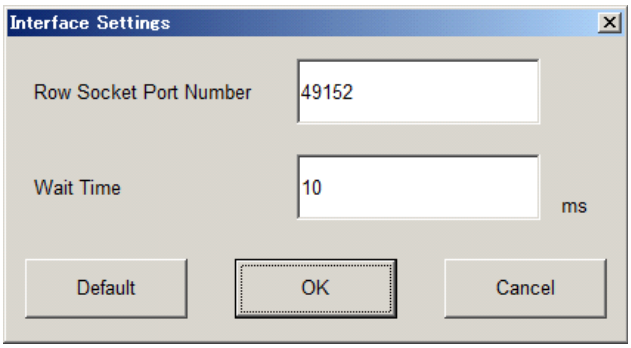

Figure 2.3.2-3 Interface Settings Dialog Box

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.

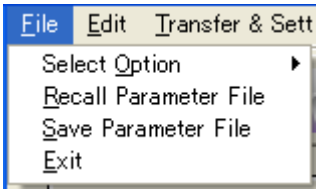

Figure 2.3.3-1 Exiting Software

The operation of the three screen buttons is explained below.

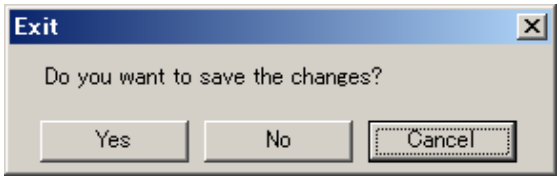

Figure 2.3.3-2 Exit Confirmation Window

- **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.

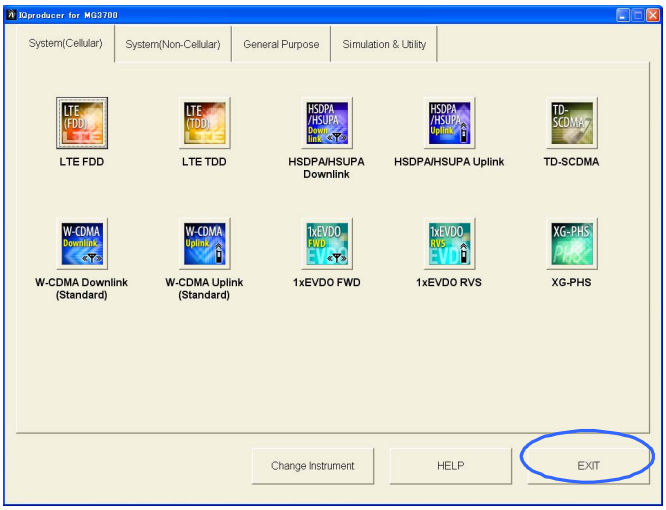

Figure 2.3.3-3 Exiting IQproducer™

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 functions are described as notes in each item.

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3.1 Screen Details

3.1.1 Main screen

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

Figure 3.1.1-1 shows the main screen of this software. The main screen consists of the menu, toolbar, Common tab window, Channel tab window, Birth-Death Propagation tab window, Moving Propagation tab window, and High Speed Train tab window. The number and type of tabs to be displayed differ depending on the settings on the Common tab window. For details on each of the tab windows, refer to the corresponding sections.

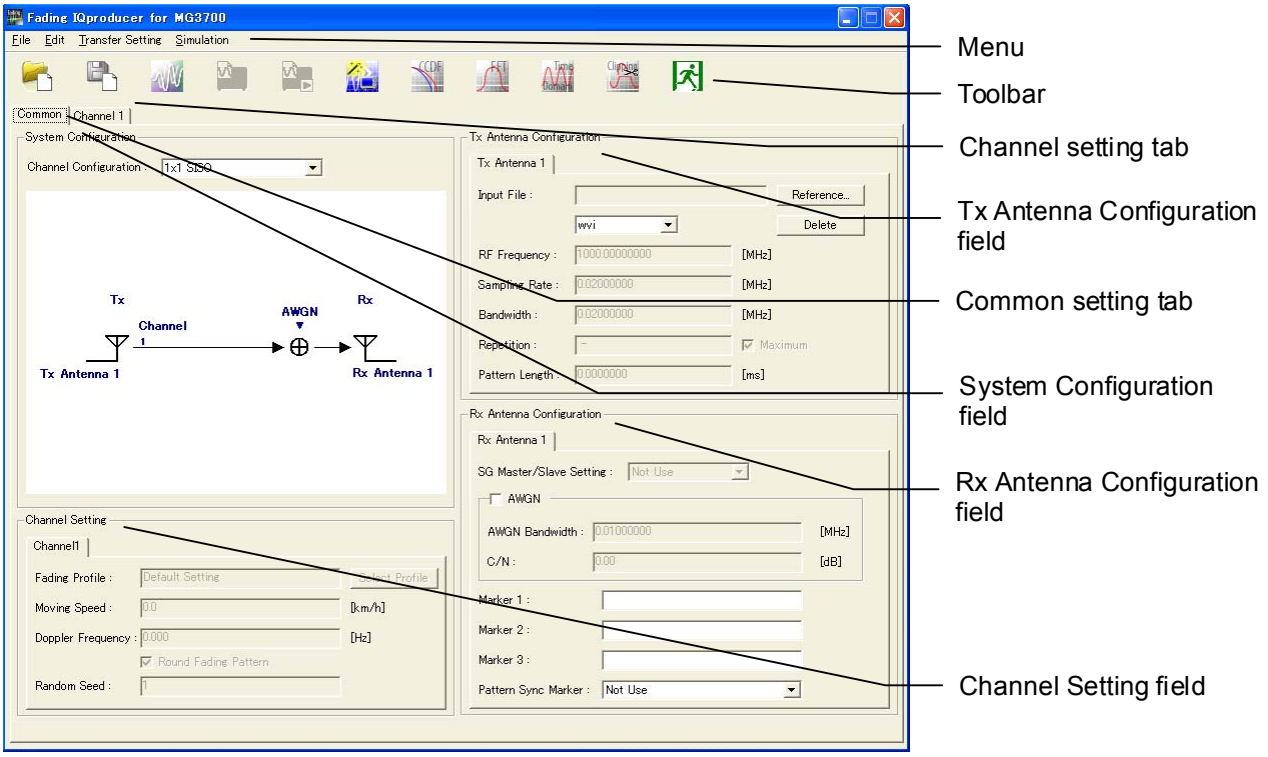

Figure 3.1.1-1 Main screen

Screen transition

Figure 3.1.1-2 shows screen transition of this software. For details on each of the screens, refer to the sections shown below the corresponding screen.

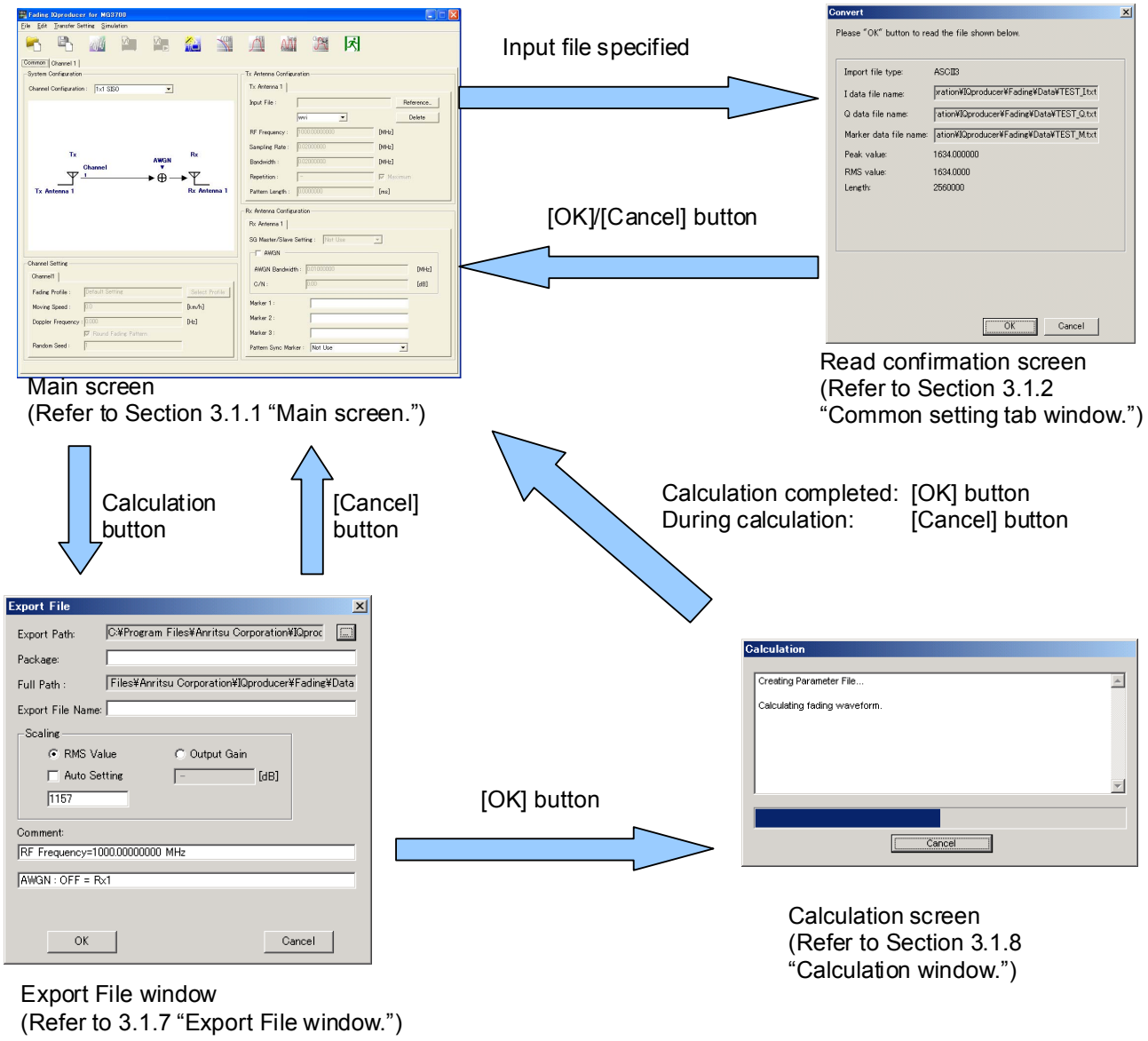

Figure 3.1.1-2 Overview of screen transition

■ The **[File]** menu contains the following items.

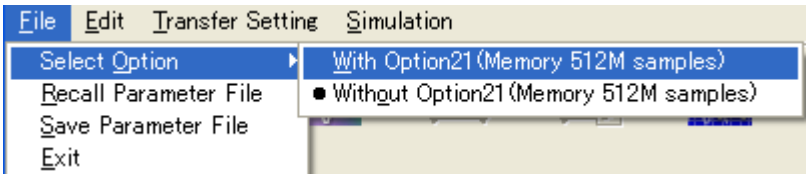

Figure 3.1.1-3 Screen when File is selected

- **Select Option**

  ■ When using MG3700A

  Select whether the ARB memory expansion option 256Msamples is installed. Selecting **With Option21 (Memory 512M 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 when **Without Option21 (Memory 512M samples)** is selected. Select either according to the presence of ARB memory expansion option.

Table 3.1.1-1 Available Options for MG3700A

Items	ARB Memory Expansion
With Option21 (Memory 512M samples)	1 GB x 2 memory
Without Option21 (Memory 512M samples):	512 MB × 2 Memories

  ■ 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 75
Memory 256M samples × 2	Option 45 and Option 48 or Option 75 and Option 78
Memory 1024M samples*	Option46 or Option 76
Memory 1024M samples × 2*	Option 46 and Option 48 or 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 (With Option48, 78)	128M samples
Memory 256M samples	256M samples
Memory 256M samples × 2 (With Option48, 78)	512M samples
Memory 1024M samples*	1024M samples
Memory 1024M samples × 2* (With Option48, 78)	1024M samples

*: Does not support MG3740A.

- **Recall Parameter File**
  Loads the parameter files saved by the [Save Parameter File] menu. When the parameter file is loaded, the settings when it was loaded are recovered.

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

- **Exit**
  Exits from this software.

■ The **[Edit]** menu contains the following items.

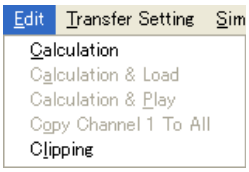

Figure 3.1.1-4 Screen when Edit is selected

- **Calculation**

  Generates a waveform pattern.

- **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.

- **Copy Channel 1 To All**

  Copies the Channel 1 settings to all other channels.

- **Clipping**

  Displays the Clipping screen. In this screen, the generated waveform patterns can be clipped and filtered.

■ The **[Transfer Setting]** menu contains the following item.

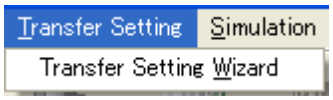

Figure 3.1.1-5 Screen when Transfer Setting is selected

- **Transfer Setting Wizard**

  Displays the Transfer Setting Wizard screen. In this screen, a series of operations including connection between PC and the MG3700A/MG3710A/MG3740A, waveform pattern transfer to the MG3700A/MG3710A/MG3740A internal hard disk, and waveform pattern loading from the hard disk to an arbitrary waveform memory are performed.

■ The [Simulation] menu contains the following items.

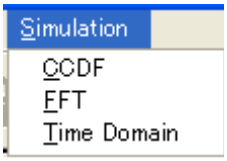

Figure 3.1.1-6 Screen when Simulation is selected

- **CCDF**

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

- **FFT**

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

- **Time Domain**

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

■ The Tool buttons contains the following items.

Note:

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.

3.1.2 Common tab window

The Common tab window is shown in Figure 3.1.2-1. The Common tab window consists of the System Configuration, Tx Antenna Configuration, Channel Setting, and Rx Antenna Configuration fields.

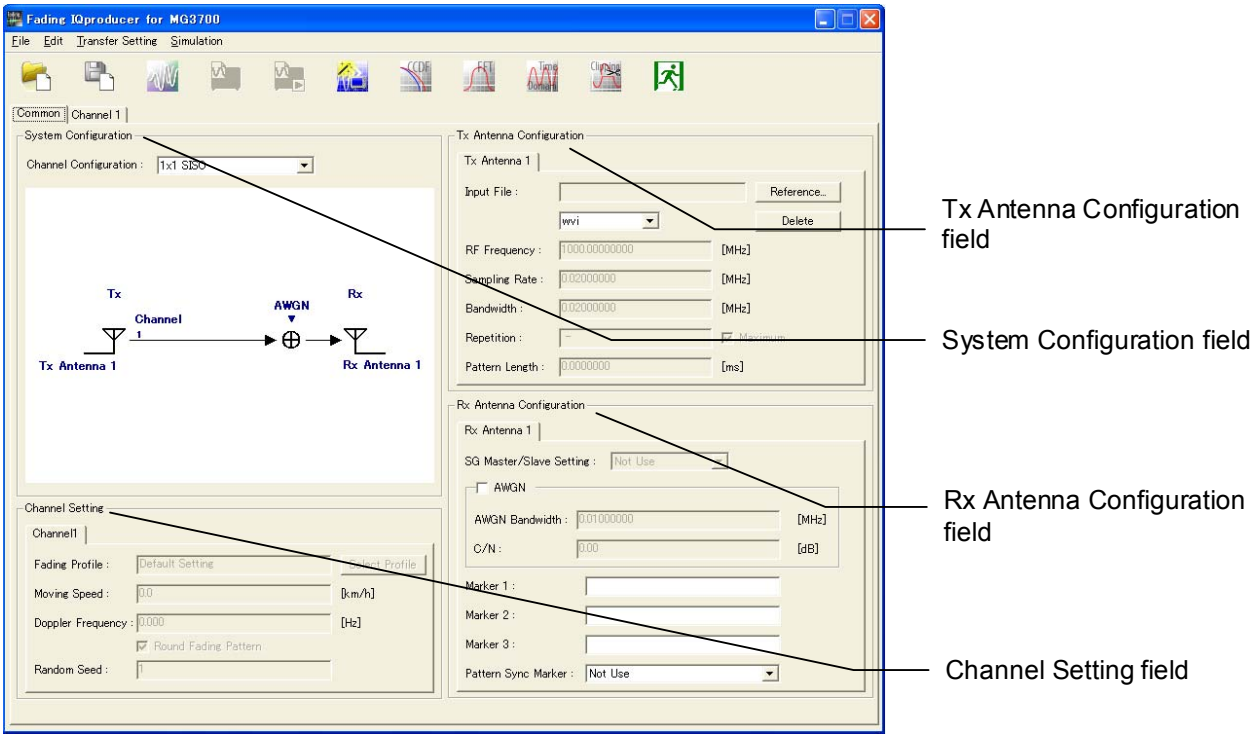

Figure 3.1.2-1 Common tab window

3.1.2.1 Tab configuration

The tabs to be displayed differ depending on the Channel Configuration and Fading Profile settings on the Common tab window. Table 3.1.2.1-1 shows the correspondence between the Channel Configuration and Fading Profile settings and the tabs to be displayed.

Table 3.1.2.1-1 Settings on Common tab window and displayed tabs

Channel Configuration	Fading Profile	Tab Displayed
1 × 1 SISO	Moving Propagation	Moving Propagation setting tab
	Birth-Death Propagation	Birth-Death Propagation setting tab
	High Speed Train	High Speed Train setting tab
	Other than the above	Channel 1 setting tab
1 × 2 SIMO	Arbitrary	Channel 1 and Channel 2 setting tabs
1 × 3 SIMO	Arbitrary	Channel 1 to Channel 3 setting tabs
1 × 4 SIMO	Arbitrary	Channel 1 to Channel 4 setting tabs
2 × 1 MISO	Arbitrary	Channel 1 and Channel 2 setting tabs
2 × 2 MIMO	Arbitrary	Channel 1 to Channel 4 setting tabs
2 × 3 MIMO	Arbitrary	Channel 1 to Channel 6 setting tabs
2 × 4 MIMO	Arbitrary	Channel 1 to Channel 8 setting tabs
3 × 1 MISO	Arbitrary	Channel 1 to Channel 3 setting tabs
3 × 2 MIMO	Arbitrary	Channel 1 to Channel 6 setting tabs
3 × 3 MIMO	Arbitrary	Channel 1 to Channel 9 setting tabs
3 × 4 MIMO	Arbitrary	Channel 1 to Channel 12 setting tabs
4 × 1 MISO	Arbitrary	Channel 1 to Channel 4 setting tabs
4 × 2 MIMO	Arbitrary	Channel 1 to Channel 8 setting tabs
4 × 3 MIMO	Arbitrary	Channel 1 to Channel 12 setting tabs
4 × 4 MIMO	Arbitrary	Channel 1 to Channel 16 setting tabs

The number of tabs displayed in the Tx Antenna Configuration and Rx Antenna Configuration fields also changes depending on the Channel Configuration setting. Table 3.1.2.1-2 shows the correspondence between the Channel Configuration setting and the tabs to be displayed in the Tx Antenna Configuration and Rx Antenna Configuration fields.

Table 3.1.2.1-2 Tabs displayed in Tx Antenna Configuration and Rx Antenna Configuration fields

Channel Configuration	Tx Antenna Configuration	Rx Antenna Configuration
1 × 1 SISO	Tx Antenna 1	Rx Antenna 1
1 × 2 SIMO	Tx Antenna 1	Rx Antenna 1 and Rx Antenna 2
1 × 3 SIMO	Tx Antenna 1	Rx Antenna 1 to Rx Antenna 3
1 × 4 SIMO	Tx Antenna 1	Rx Antenna 1 to Rx Antenna 4
2 × 1 MISO	Tx Antenna 1 and Tx Antenna 2	Rx Antenna 1
2 × 2 MIMO	Tx Antenna 1 and Tx Antenna 2	Rx Antenna 1 and Rx Antenna 2
2 × 3 MIMO	Tx Antenna 1 and Tx Antenna 2	Rx Antenna 1 to Rx Antenna 3
2 × 4 MIMO	Tx Antenna 1 and Tx Antenna 2	Rx Antenna 1 to Rx Antenna 4
3 × 1 MIMO	Tx Antenna 1 to Tx Antenna 3	Rx Antenna 1
3 × 2 MIMO	Tx Antenna 1 to Tx Antenna 3	Rx Antenna 1 and Rx Antenna 2
3 × 3 MIMO	Tx Antenna 1 to Tx Antenna 3	Rx Antenna 1 to Rx Antenna 3
3 × 4 MIMO	Tx Antenna 1 to Tx Antenna 3	Rx Antenna 1 to Rx Antenna 4
4 × 1 MISO	Tx Antenna 1 to Tx Antenna 4	Rx Antenna 1
4 × 2 MIMO	Tx Antenna 1 to Tx Antenna 4	Rx Antenna 1 and Rx Antenna 2
4 × 3 MIMO	Tx Antenna 1 to Tx Antenna 4	Rx Antenna 1 to Rx Antenna 3
4 × 4 MIMO	Tx Antenna 1 to Tx Antenna 4	Rx Antenna 1 to Rx Antenna 4

3.1.2.2 Common parameters

This section describes the parameters provided in the Common tab window.

System Configuration field

Channel Configuration

[Overview] Sets the number of I/O antennas.

[Default] 1 × 1 SISO

[Setting range] 1 × 1 SISO, 1 × 2 SIMO, 1 × 3 SIMO, 1 × 4 SIMO, 2 × 1 MISO, 2 × 2 MIMO, 2 × 3 MIMO, 2 × 4 MIMO, 3 × 1 MISO, 3 × 2 MIMO, 3 × 3 MIMO, 3 × 4 MIMO, 4 × 1 MISO, 4 × 2 MIMO, 4 × 3 MIMO, 4 × 4 MIMO

Channel configurations 1 × 1 SISO to 4 × 4 MIMO can be selected in Channel Configuration. Each channel configuration is described below.

(1 × 1 SISO)
Communication is performed using a single antenna at each of the transmission and reception stations in this configuration.
Figure 3.1.2.2-1 is displayed when 1 × 1 SISO is selected in Channel Configuration.

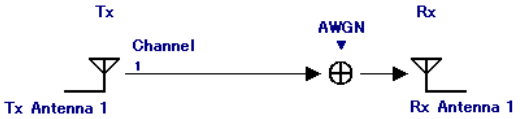

Figure 3.1.2.2-1 1 × 1 SISO configuration

(1 × 2 SIMO)
Communication is performed using a single antenna at the transmission station and two antennas at the reception station in this configuration.
Figure 3.1.2.2-2 is displayed when 1 × 2 SIMO is selected in Channel Configuration. In this case, two waveform patterns corresponding to the two Rx antenna modulation signals are generated.

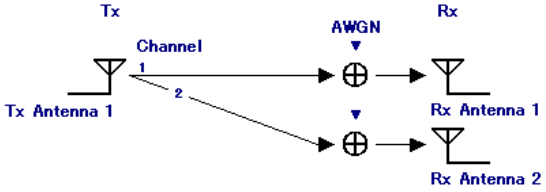

Figure 3.1.2.2-2 1 × 2 SIMO configuration

(1 × 3 SIMO)
Communication is performed using a single antenna at the transmission station and three antennas at the reception station in this configuration. Figure 3.1.2.2-3 is displayed when 1 × 3 SIMO is selected in Channel Configuration. In this case, three waveform patterns corresponding to the three Rx antenna modulation signals are generated.

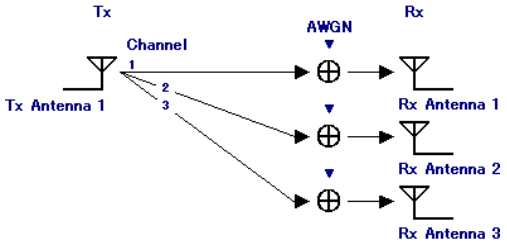

Figure 3.1.2.2-3 1 × 3 SIMO configuration

(1 × 4 SIMO)
Communication is performed using a single antenna at the transmission station and four antennas at the reception station in this configuration. Figure 3.1.2.2-4 is displayed when 1 × 4 SIMO is selected in Channel Configuration. In this case, four waveform patterns corresponding to the four Rx antenna modulation signals are generated.

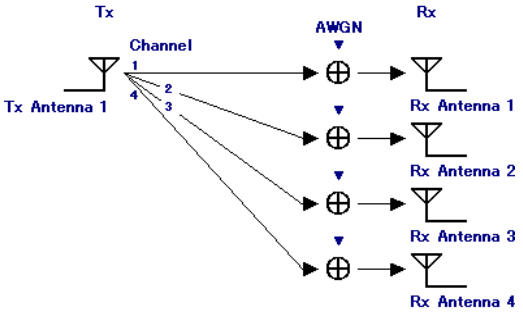

Figure 3.1.2.2-4 1 × 4 SIMO configuration

(2 × 1 MISO)
Communication is performed using two antennas at the transmission station and a single antenna at the reception station in this configuration.
Figure 3.1.2.2-5 is displayed when 2 × 1 MISO is selected in Channel Configuration.

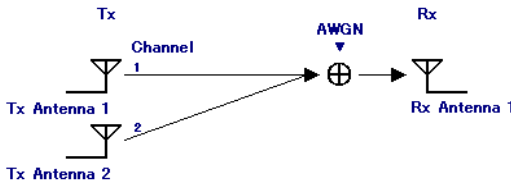

Figure 3.1.2.2-5 2 × 1 MISO configuration

(2 × 2 MIMO)
Communication is performed using two antennas at each of the transmission and reception stations in this configuration.
Figure 3.1.2.2-6 is displayed when 2 × 2 MIMO is selected in Channel Configuration. In this case, two waveform patterns corresponding to the two Rx antenna modulation signals are generated.

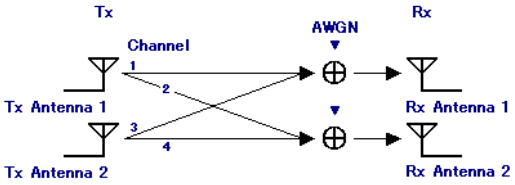

Figure 3.1.2.2-6 2 × 2 MIMO configuration

(2 × 3 MIMO)
Communication is performed using two antennas at the transmission station and three antennas at the reception station in this configuration.
Figure 3.1.2.2-7 is displayed when 2 × 3 MIMO is selected in Channel Configuration. In this case, three waveform patterns corresponding to the three Rx antenna modulation signals are generated.

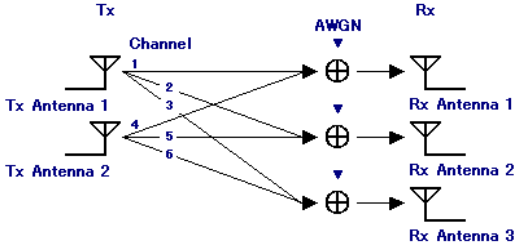

Figure 3.1.2.2-7 2 × 3 MIMO configuration

(2 × 4 MIMO)
Communication is performed using two antennas at the transmission station and four antennas at the reception station in this configuration.
Figure 3.1.2.2-8 is displayed when 2 × 4 MIMO is selected in Channel Configuration. In this case, four waveform patterns corresponding to the four Rx antenna modulation signals are generated.

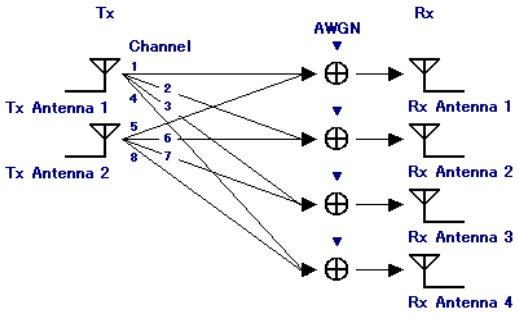

Figure 3.1.2.2-8 2 × 4 MIMO configuration

(3 × 1 MISO)
Communication is performed using three antennas at the transmission station and a single antenna at the reception station in this configuration.
Figure 3.1.2.2-9 is displayed when 3 × 1 MISO is selected in Channel Configuration.

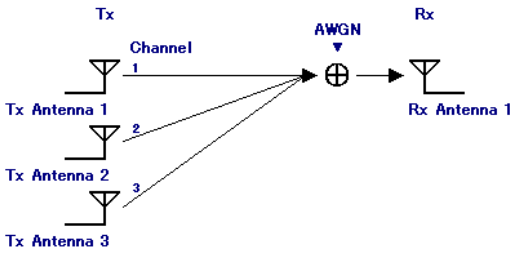

Figure 3.1.2.2-9 3 × 1 MISO configuration

(3 × 2 MIMO)
Communication is performed using three antennas at the transmission station and two antennas at the reception station in this configuration.
Figure 3.1.2.2-10 is displayed when 3 × 2 MIMO is selected in Channel Configuration. In this case, two waveform patterns corresponding to the two Rx antenna modulation signals are generated.

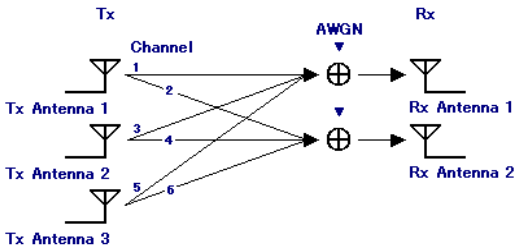

Figure 3.1.2.2-10 3 × 2 MIMO configuration

(3 × 3 MIMO)
Communication is performed using three antennas at each of the transmission and reception stations in this configuration.
Figure 3.1.2.2-11 is displayed when 3 × 3 MIMO is selected in Channel Configuration. In this case, three waveform patterns corresponding to the three Rx antenna modulation signals are generated.

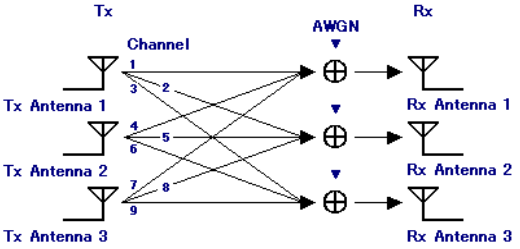

Figure 3.1.2.2-11 3 × 3 MIMO configuration

(3 × 4 MIMO)
Communication is performed using three antennas at the transmission station and four antennas at the reception station in this configuration.
Figure 3.1.2.2-12 is displayed when 3 × 4 MIMO is selected in Channel Configuration. In this case, four waveform patterns corresponding to the four Rx antenna modulation signals are generated.

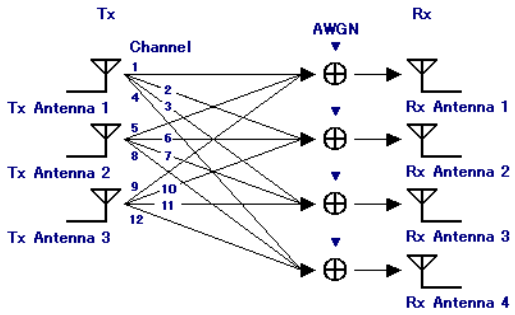

Figure 3.1.2.2-12 3 × 4 MIMO configuration

(4 × 1 MISO)
Communication is performed using four antennas at the transmission station and a single antenna at the reception station in this configuration.
Figure 3.1.2.2-13 is displayed when 4 × 1 MISO is selected in Channel Configuration.

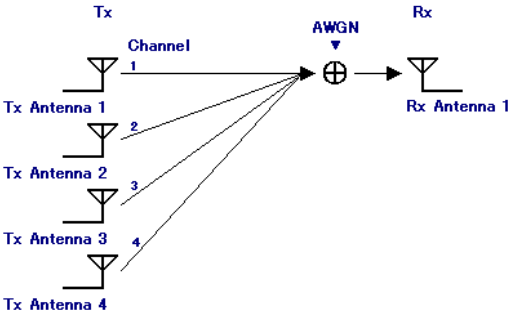

Figure 3.1.2.2-13 4 × 1 MISO configuration

(4 × 2 MIMO)
Communication is performed using four antennas at the transmission station and two antennas at the reception station in this configuration. Figure 3.1.2.2-14 is displayed when 4 × 2 MIMO is selected in Channel Configuration. In this case, two waveform patterns corresponding to the two Rx antenna modulation signals are generated.

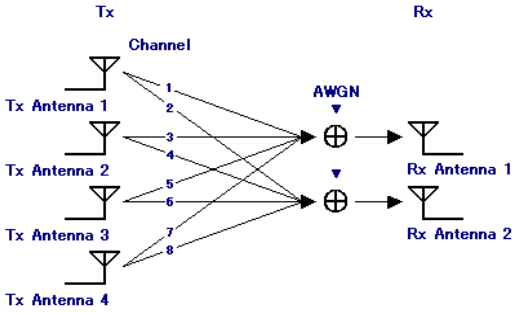

Figure 3.1.2.2-14 4 × 2 MIMO configuration

(4 × 3 MIMO)
Communication is performed using four antennas at the transmission station and three antennas at the reception station in this configuration. Figure 3.1.2.2-15 is displayed when 4 × 3 MIMO is selected in Channel Configuration. In this case, three waveform patterns corresponding to the three Rx antenna modulation signals are generated.

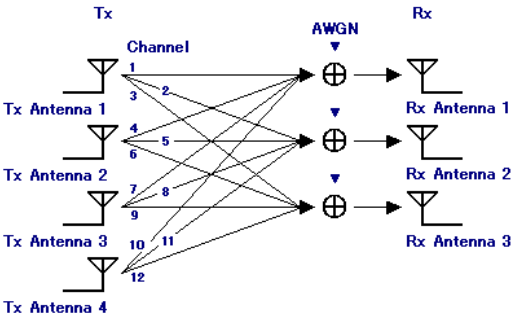

Figure 3.1.2.2-15 4 × 3 MIMO configuration

(4 × 4 MIMO)
Communication is performed using four antennas at each of the transmission and reception stations.
Figure 3.1.2.2-16 is displayed when 4 × 4 MIMO is selected in Channel Configuration. In this case, four waveform patterns corresponding to the four Rx antenna modulation signals are generated.

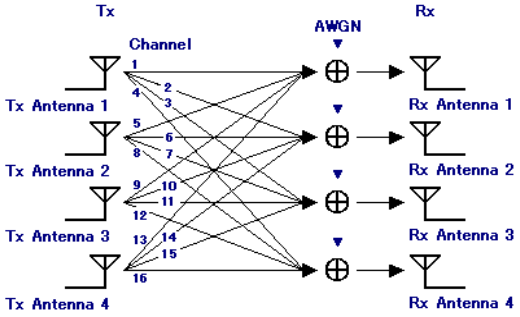

Figure 3.1.2.2-16 4 × 4 MIMO configuration

Tx Antenna Configuration field

Input waveform pattern settings can be configured in the Tx Antenna Configuration field (see Figure 3.1.2.2-17).

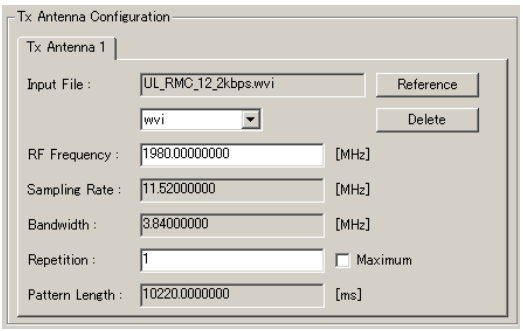

Figure 3.1.2.2-17 Tx Antenna Configuration field

Input File

[Overview] Selects a waveform pattern file to be input.

[Setting range] Display only

[Remarks] Figure 3.1.2.2-18 is displayed when a waveform pattern file is selected.

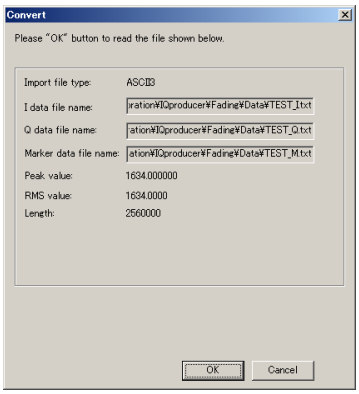

Figure 3.1.2.2-18 Reading confirmation window (when an ASCII3 is selected)

The Peak value, RMS value, and the number of samples of the specified input waveform pattern file can be confirmed on this window.
Clicking the **[OK]** button sets the waveform pattern, and clicking the **[Cancel]** button cancels the setting.

Input File (file type selection)

[Overview] Sets the type of the file to be input.

[Default] wvi

[Setting range] wvi, ASCII1, ASCII2, ASCII3

[Remarks] Refer to Section 4.5.6 “Input file format” in the MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™) for details on the file types.

RF Frequency

[Overview] Sets the center frequency.

[Default] 10000.00000000

[Unit] MHz

[Setting range] 0.25000000 to 6000.00000000
Setting resolution: 0.00000001

[Remarks] The set value applies to Tx Antenna 1 to Tx Antenna 4. The Doppler frequency is recalculated when the RF Frequency setting is changed.

Sampling Rate

[Overview] Sets and displays the sampling rate.

[Default] 0.02000000

[Unit] MHz

[Setting range] Display only (when a wvi file is selected)
0.02000000 to 160.00000000 (Except for MG3740A)
(when an ASCII1, ASCII2, or ASCII3 file is selected)
0.02000000 to 8.00000000 (MG3740A)
(when an ASCII1, ASCII2, or ASCII3 file is selected)
Display resolution: 0.00000001

[Remarks] When a wvi file is selected in Input File, the sampling rate of the selected wvi file is displayed and cannot be edited.

Bandwidth

[Overview] Sets and displays the bandwidth.

[Default] 0.02000000

[Unit] MHz

[Setting range] Display only (when a wvi file is selected)
0.02000000 to Sampling Rate (when an ASCII1, ASCII2, or ASCII3 file is selected)
Setting resolution: 0.00000001

[Remarks] When a wvi file is selected in Input File, the sampling rate of the selected wvi file is displayed and cannot be edited.

Repetition

[Overview] Sets the number of repetition for the waveform pattern.

[Default] See Remarks.

[Setting range] Maximum, or the range from the default value to the maximum value of memory capacity

[Remarks] The default value is the minimum number of repetitions in which data points of the waveform pattern number are 1000 samples or more.
When Maximum is set, the waveform pattern is repeated continuously until the maximum value of memory capacity is reached.

Pattern length

[Overview] Displays the waveform pattern length after generation.

[Unit] ms

[Setting range] Display only
Display resolution: 0.0000001

Channel Setting field

The fading profile, moving speed, and Doppler frequency can be set for each channel in the Channel Setting field (see Figure 3.1.2.2-19).

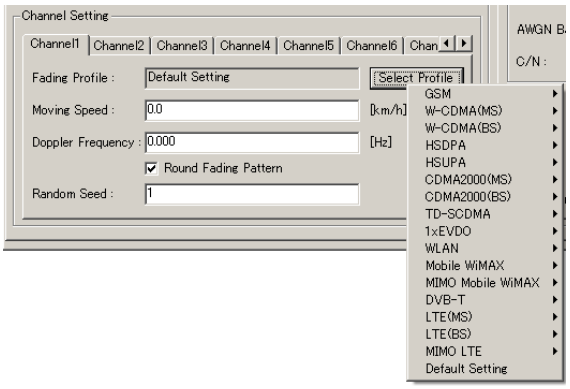

Figure 3.1.2.2-19 Channel Setting field

Fading Profile

[Overview] Displays the fading profile.

[Default] Default Setting

[Remarks] Click the **[Select Profile]** button to display the profile list, and select a system to set the corresponding parameters. Refer to Appendix B for details.
The channel settings are restored to their initial values when Default Setting is selected.

Moving Speed

[Overview] Sets the moving speed.

[Default] 0.0

[Unit] km/h

[Setting range] 0.0 to 5000.0
Setting resolution: 0.1

Doppler Frequency

[Overview] Sets the Doppler frequency.

[Default] 0.000

[Unit] Hz

[Setting range] The smaller value between 0.000 to (Sampling Rate)/2 and the value calculated by the following equation is set.

$$5000 \times \frac{1000}{3600} \times \frac{\text{RF Frequency}}{c}$$

c: Speed of light (299,792,458 m/s)
Setting resolution: 0.001

Round Fading Pattern

[Overview] Selects whether to make the start and end of fading-processed waveform patterns consecutive.

[Default] Select

[Setting range] Select/clear

[Remarks] The start and end of fading-processed waveform patterns are consecutive when the check box is selected. The waveform patterns may not be consecutive if the Doppler frequency is low. Settings may also affect processing time.

Random Seed

[Overview] Sets a random seed used for fading processing.

[Default] 1 (Channel1), 2 (Channel2), …, 16 (Channel16)

[Setting range] 1 to 255
Setting resolution: 1

[Remarks] Changing the random seed changes the fading inclination of the waveform pattern to be generated.

Rx Antenna Configuration field

Items of an output waveform pattern file can be set in the Rx Antenna Configuration field (see Figure 3.1.2.2-20).

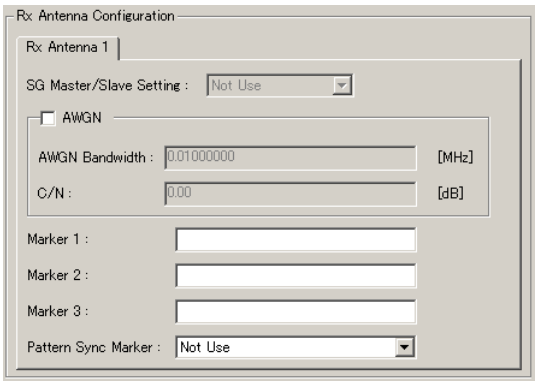

Figure 3.1.2.2-20 Rx Antenna Configuration field

SG Master/Slave Setting

[Overview] Specifies master or slave when multiple SG units are connected in the SIMO or MIMO configuration.

[Default] Not Use

[Setting range] Not Use, Master, Slave (Slave1 to Slave3)

[Remarks] Refer to Appendix C for how to connect multiple SG units.

AWGN

[Overview] Sets AWGN On or Off.

[Default] Cleared (Off)

[Setting range] Select/clear

[Remarks] AWGN addition is enabled when the check box is selected.

AWGN Bandwidth

[Overview] Sets the bandwidth of AWGN.

[Default] 0.01000000

[Unit] MHz

[Setting range] 0.01000000 to (Sampling Rate)/2
Setting resolution: 0.00000001

C/N

[Overview] Sets the C/N.

[Default] 0.00

[Unit] dB

[Setting range] –40.00 to +40.00
Setting resolution: 0.01

Marker 1 to Marker 3

[Overview] Sets the marker name.

[Setting range] Up to 31 one-byte alphanumeric characters.

Pattern Sync Marker

[Overview] Sets the marker to output the Pattern Sync Marker.

[Default] Not Use

[Setting range] Not Use, Marker1, Marker2, Marker3

[Remarks] Refer to Section 3.5 “Marker Output” for details.

3.1.3 Channel tab window

Figure 3.1.3-1 shows the Channel tab window.

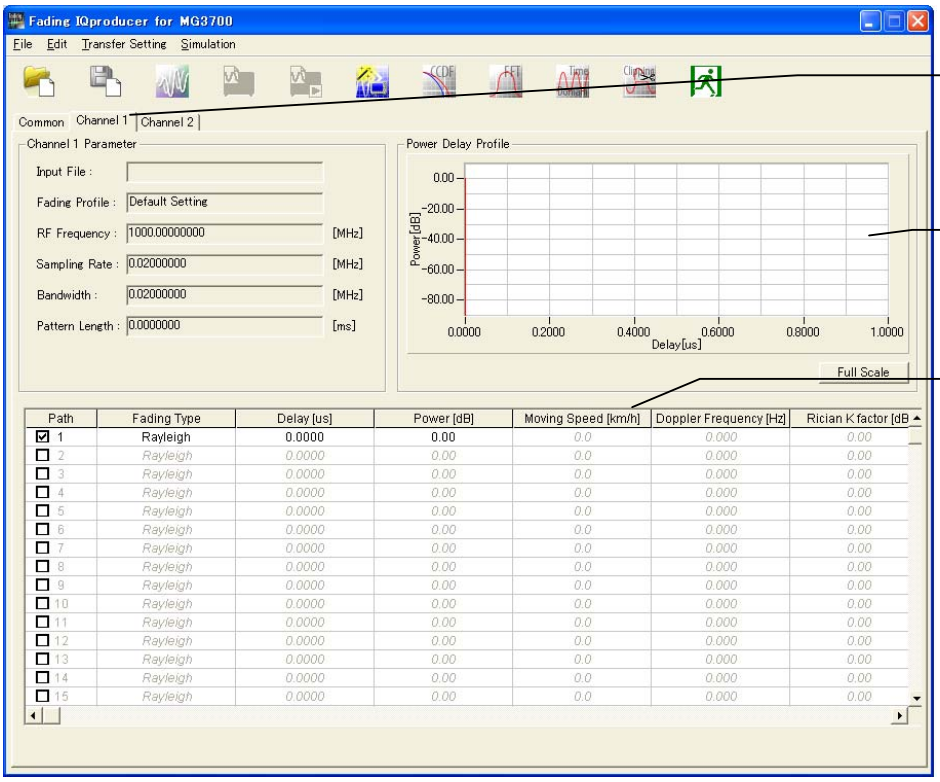

Figure 3.1.3-1 Channel tab window

This section describes the parameters on the Channel tab window.

Channel n Parameter fields (n = 1 to 16)

The Tx Antenna settings corresponding to Channel n (n = 1 to 16) are displayed in the Channel n Parameter field (see Figure 3.1.3-2).

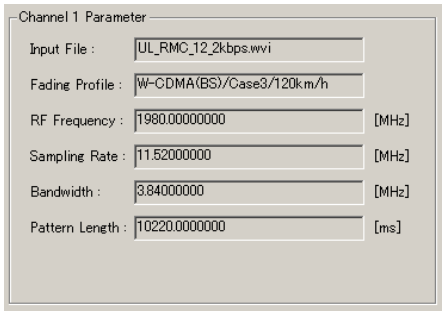

Figure 3.1.3-2 Channel n Parameter field

Input File

[Overview] Displays the currently selected input file.

[Setting range] Display only

[Remarks] The parameter of the corresponding Tx Antenna is displayed.

Fading Profile

[Overview] Displays the currently selected fading profile.

[Setting range] Display only

[Remarks] The parameter of the corresponding Tx Antenna is displayed.

RF Frequency

[Overview] Displays the center frequency.

[Setting range] Display only

[Remarks] The parameter of the corresponding Tx Antenna is displayed.

Sampling Rate

[Overview] Displays the sampling rate.

[Setting range] Display only

[Remarks] The parameter of the corresponding Tx Antenna is displayed.

Bandwidth

[Overview] Displays the bandwidth of the waveform pattern.

[Setting range] Display only

[Remarks] The parameter of the corresponding Tx Antenna is displayed.

Pattern Length

[Overview] Displays the waveform pattern length.

[Setting range] Display only

[Remarks] The parameter of the corresponding Tx Antenna is displayed.

Path (1 to 20)

Path

[Overview] Sets the path number display to On or Off.

[Default] Cleared (Off)

[Setting range] Select/clear

[Remarks] The Path parameters become enabled when the corresponding check box is selected.

Fading Type

[Overview] Sets the type of single path fading.

[Default] Rayleigh

[Setting range] Rayleigh, Rice, Constant

[Remarks]

- Rayleigh
  Environment in which multiple scattering waves arrive.
  Reception level changes in accordance with the Rayleigh distribution.
- Rice
  Environment in which multiple scattering waves and direct waves arrive.
  Reception level changes in accordance with the Rice distribution.
- Constant
  Reception level does not change with time.

Delay

[Overview] Sets the delay.

[Default] 0.0000

[Unit] μs

[Setting range] 0.0000 to 2000.0000
Setting resolution: 0.0001

Power

[Overview] Sets the path power.

[Default] 0.00

[Unit] dB

[Setting range] –80.00 to 0.00
Setting resolution: 0.01

Rician K factor

[Overview] Sets the power ratio between direct waves and scattering waves.

[Default] 0.00

[Unit] dB

[Setting range] –40.00 to 40.00
Setting resolution: 0.01

[Remarks] Can be set when Fading Type is Rice.

Angle of Arrival

[Overview] Sets the arrival angle of direct waves.

[Default] 0.0

[Unit] deg

[Setting range] 0.0 to 180.0
Setting resolution: 0.1

[Remarks] Can be set when Fading Type is Rice.

Phase Shift

[Overview] Sets the phase shift.

[Default] 0.0

[Unit] deg

[Setting range] 0.0 to 359.9
Setting resolution: 0.1

Spectrum Shape

[Overview] Sets the shape of the Doppler spectrum.

[Default] Classical 6 dB

[Setting range] Classical 3 dB, Classical 6 dB, Flat, and Rounded

[Details of parameter]

Figure 3.1.3-3 shows each of the spectrum shapes.

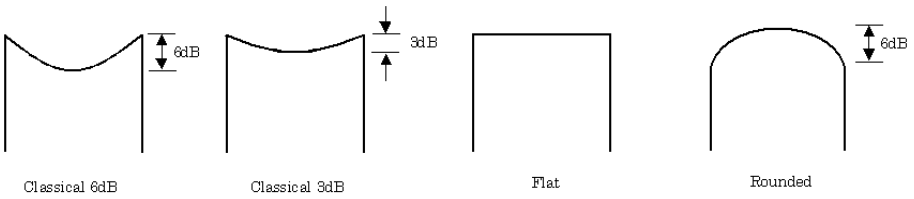

Figure 3.1.3-3 Doppler spectrum shapes

[Remarks] Cannot be set when Constant is selected for Fading Type.

Correlation Setting

[Overview] Selects the correlation matrix setting method.

[Default] Not Use

[Setting range] Edit, Not Use, path number set in Edit.

[Remarks] Enabled when a waveform data file is selected in Input File.
When a path number is selected, the settings of the selected path will apply. Note, however, that no path number can be selected in the case of the 1 × 1 SISO configuration.

Correlation Coefficients (Correlation matrix setting window)

[Overview] Sets the correlation coefficients.

[Default] 0.00000

[Setting range] –1.00000 – j1.00000 to 1.00000 + j1.00000
Only the elements on the upper-right of the diagonal components can be edited.

[Remarks] The setting resolution is 0.00001 for both real and imaginary parts.

Correlation Matrix

When **Edit** is selected in Correlation Setting, the correlation matrix setting window shown in Figure 3.1.3-4 is displayed (an example when Channel Configuration = 2 × 2 MIMO) and settings for all valid paths can be set.
With the diagonal components of the Correlation Matrix as the border, the bottom left element is automatically set so that the upper right and bottom left elements form a complex conjugation.

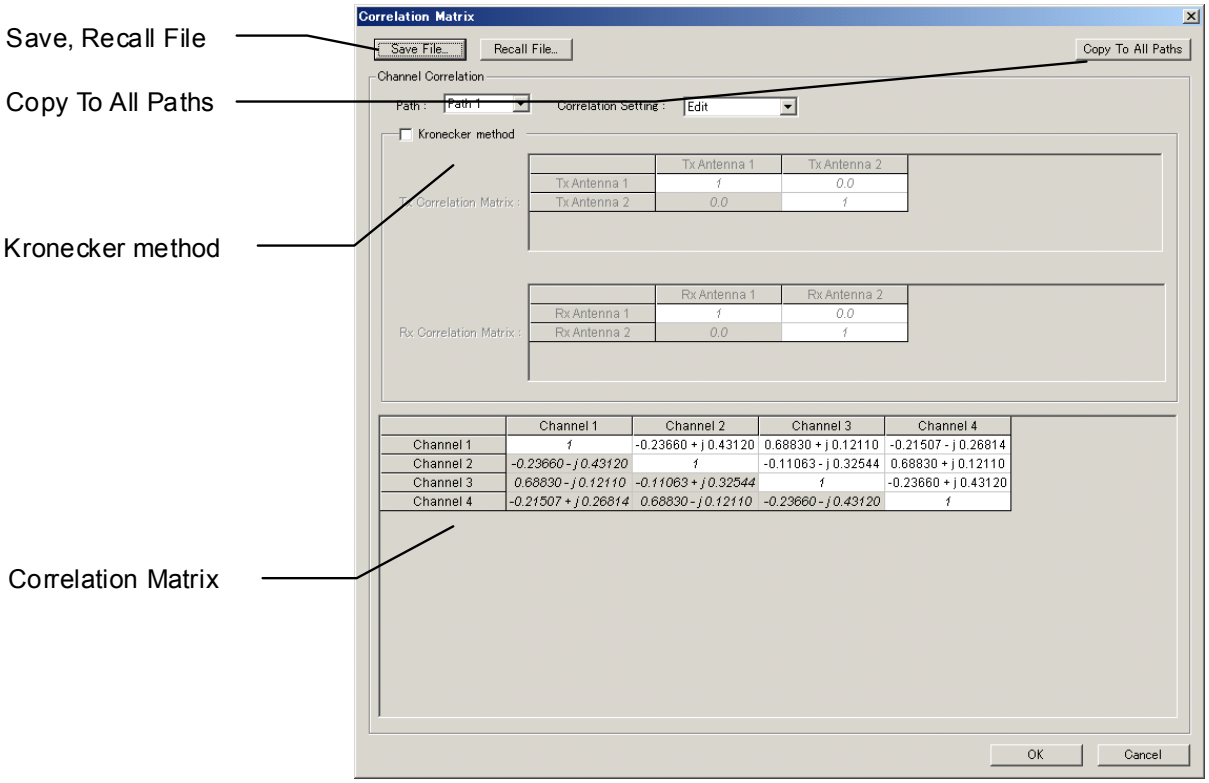

Figure 3.1.3-4 Correlation Matrix setting window (2 × 2 MIMO configuration)

The element count of the matrix depends on the system configuration; the correspondence between the system configuration and the displayed element count is shown in Table 3.1.3-1.

Table 3.1.3-1 Correspondence between system configuration and displayed element count

System Configuration	Displayed Element Count
1 × 2 SIMO, 2 × 1 MISO	2 × 2 matrix
1 × 3 SIMO, 3 × 1 MISO	3 × 3 matrix
1 × 4 SIMO, 4 × 1 MISO , 2 × 2 MIMO	4 × 4 matrix
2 × 3 MIMO, 3 × 2 MIMO	6 × 6 matrix
2 × 4 MIMO, 4 × 2 MIMO	8 × 8 matrix
3 × 3 MIMO	9 × 9 matrix
3 × 4 MIMO, 4 × 3 MIMO	12 × 12 matrix
4 × 4 MIMO	16 × 16 matrix

When a matrix element is selected in the Correlation Matrix setting window, the Input Complex Data window shown in Figure 3.1.3-5 is displayed and numeric values can be input.

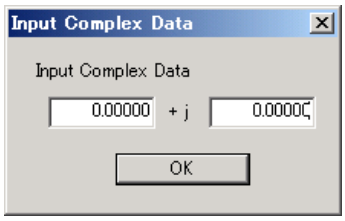

Figure 3.1.3-5 Input Complex Data window

Kronecker Method

[Overview] Sets Kronecker Method to On or Off.

[Default] Cleared (Off)

[Setting range] Select/clear

[Remarks] The Kronecker product of Tx Correlation Matrix and Rx Correlation Matrix is displayed in the correlation matrix when this checkbox is selected.

Click the **[Save File…]** button to save the Correlation Matrix parameters of a valid path into a CSV file.
Click the **[Recall File…]** button to load a CSV file and set Correlation Matrix parameters.
Click the **[Copy To All Paths]** button to copy the parameters of the set path to all other valid paths.

Power Delay Profile graph

In the Power Delay Profile graph, the horizontal and vertical axes are Delay and Power, respectively, and the valid paths are displayed. All paths can be displayed by clicking the **[Full Scale]** button.

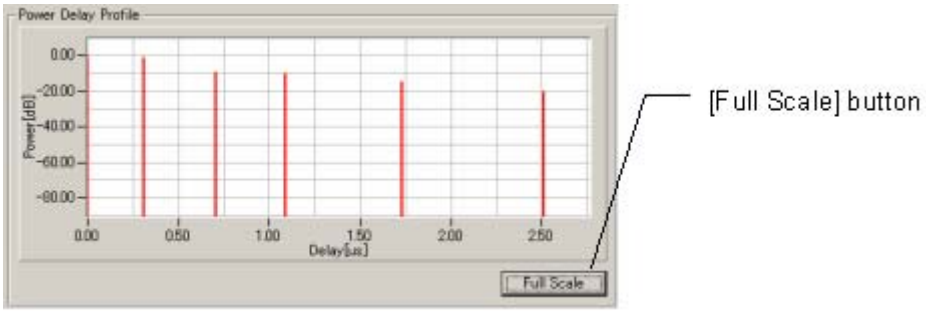

Figure 3.1.3-6 Power Delay Profile graph

As shown in Figure 3.1.3-7, a part of the graph can be enlarged by dragging the mouse to select the area.

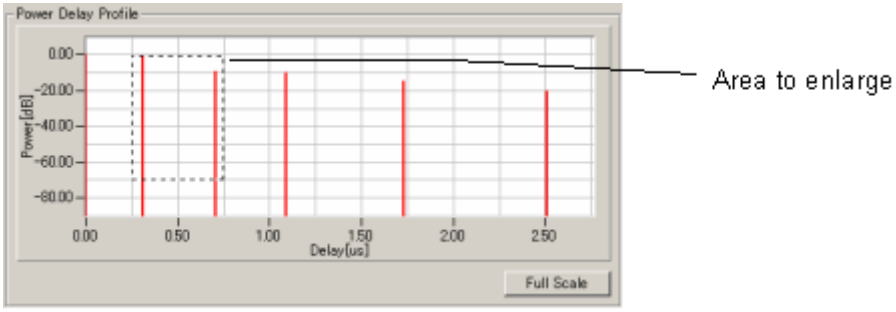

Figure 3.1.3-7 Selecting area to enlarge

Figure 3.1.3-8 shows the graph after it is enlarged.

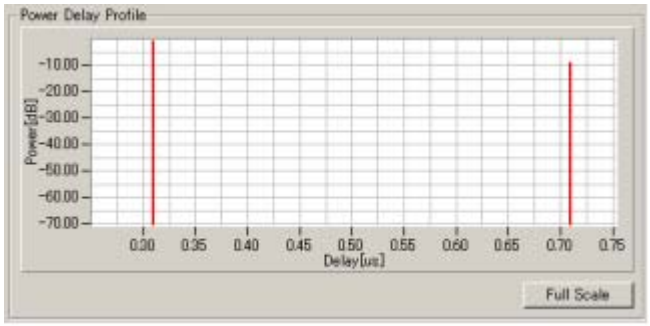

Figure 3.1.3-8 Enlarged area

3.1.4 Moving Propagation tab window

The Moving Propagation tab window is displayed when System Configuration is 1 × 1 SISO and Fading Profile is Moving Propagation. In moving propagation, the delay of Path2 to Path1 changes accordingly with the following equation.

$$\Delta t = B + \frac{A}{2}\left(1 + \sin\left(\omega \cdot t\right)\right)$$

Figure 3.1.4-1 shows the Moving Propagation tab window.

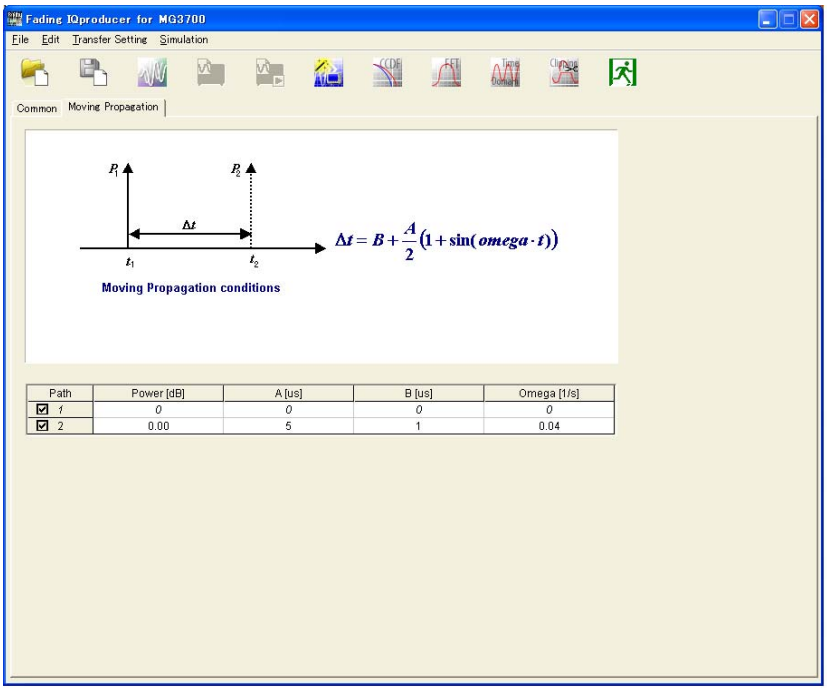

Figure 3.1.4-1 Moving Propagation tab window

This section describes the parameters in the Moving Propagation tab window.
The initial values for Path1 are all fixed to 0.

Power

[Overview] Sets the power of Path2.

[Default] 0.00

[Unit] dB

[Setting range] –80.00 to 0.00
Setting resolution: 0.01

A (Offset)

[Overview] Sets the offset for Path2.

[Default] 5

[Unit] μs

[Setting range] 0 to 500
Setting resolution: 1

B (Variation)

[Overview] Sets amount of change in delay for Path2.

[Default] 1

[Unit] μs

[Setting range] 0 to 500
Setting resolution: 1

Omega

[Overview] Sets Omega.

[Default] 0.04

[Unit] Hz

[Setting range] 0.00 to 1.00
Setting resolution: 0.01

3.1.5 Birth-Death Propagation tab window

The Birth-Death Propagation tab window is displayed when System Configuration is 1 × 1 SISO and Fading Profile is Birth-Death Propagation. At Birth-Death Propagation, delay of two paths switches randomly.

Figure 3.1.5-1 shows the Birth-Death Propagation tab window.

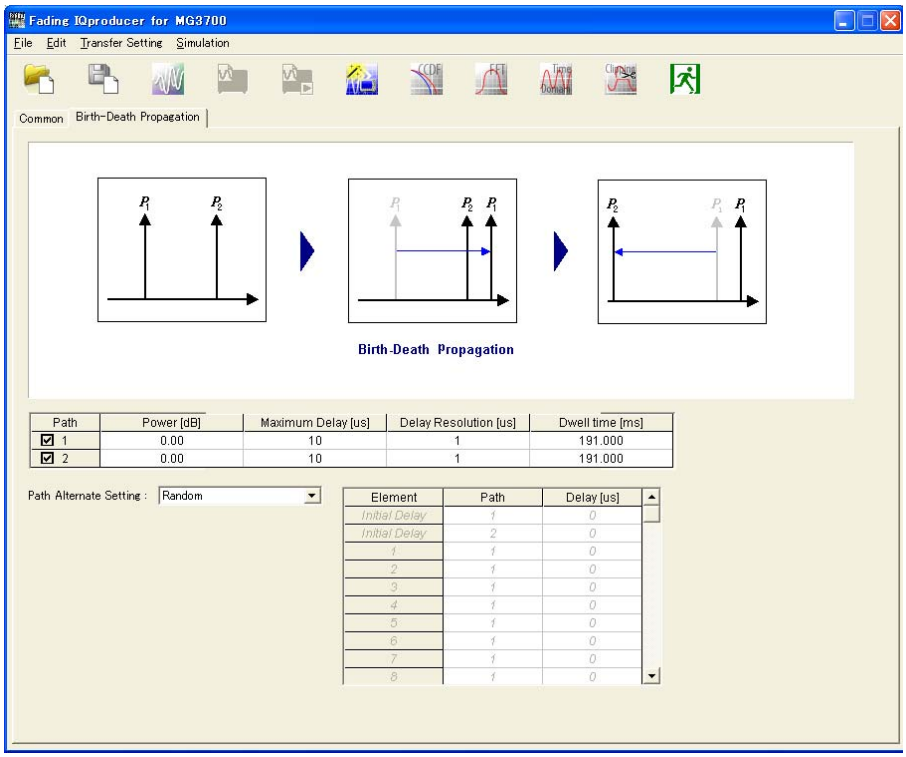

Figure 3.1.5-1 Birth-Death Propagation tab window

This section describes the parameters in the Birth-Death Propagation tab window.

Power

[Overview] Sets the path power.

[Default] 0.00

[Unit] dB

[Setting range] –80.00 to 0.00
Setting resolution: 0.01

Maximum Delay

[Overview] Sets the maximum delay.

[Default] 10

[Unit] μs

[Setting range] 1 to 400
Setting resolution: Delay Resolution

[Remarks] The same value applies to Path1 and Path2. When Delay Resolution is changed, the maximum delay is rounded to an integer multiple of Delay Resolution.

Delay Resolution

[Overview] Sets the delay resolution.

[Default] 1

[Unit] μs

[Setting range] 1 to Maximum Delay
Setting resolution: 1

[Remarks] The same value applies to Path1 and Path2. When Maximum Delay is changed to a value lower than the setting value of Delay Resolution, the setting value of Delay Resolution is set to the same value as Maximum Delay.

Dwell time

[Overview] Sets the dwell time.

[Default] 191.000

[Unit] ms

[Setting range] 0.001 to 200.000
Setting resolution: 0.001
(Note that the set value is rounded according to the sampling rate.)

[Remarks] The same value applies to Path1 and Path2.

Path Alternate Setting

[Overview]	Sets the path alternate setting.
[Default]	Random
[Setting range]	Random, Sequence
[Remarks]	When Random is set, Path1 and Path2 alternate randomly. When Sequence is set, the path to be alternated and the delay can be set.

Path

[Overview]	Sets the path to be alternated.
[Default]	1
[Setting range]	1, 2, Termination
[Remarks]	Enabled when Sequence is selected in Path Alternate Setting.

Delay

[Overview]	Sets the delay of the path.
[Default]	μs
[Setting range]	0 to Maximum Delay Setting resolution: Delay Resolution
[Remarks]	Enabled when Sequence is selected in Path Alternate Setting and the preceding Element is not set to Termination.

3.1.6 High Speed Train tab window

The High Speed Train tab window is displayed when System Configuration is set to 1 × 1 SISO and Fading Profile is set to High Speed Train.
In the case of High Speed Train for W-CDMA (BS), Scenario1 to Scenario3 can be selected. Scenario1 and Scenario3 are non-fading channels and Scenario2 is a Rice fading channel for Path1. Scenario 1 and Scenario 2 can be set for LTE (BS).

Figs. 3.1.6-1 to 3.1.6-3 show the High Speed Train tab windows for W-CDMA (BS), and Figure 3.1.6-4 shows the High Speed Train tab window for W-CDMA (MS).

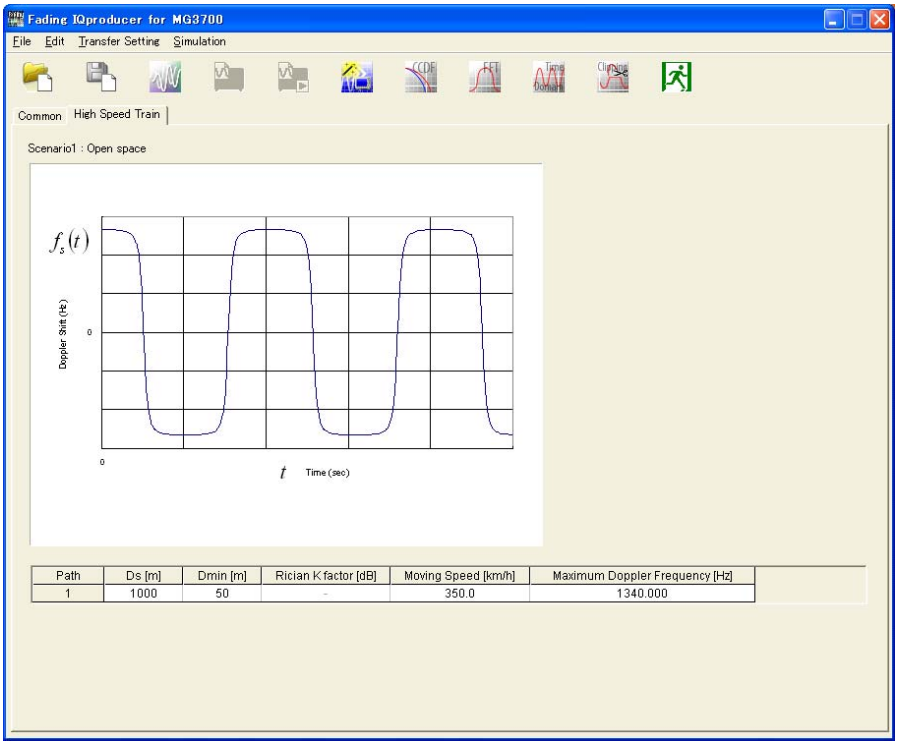

Figure 3.1.6-1 High Speed Train tab window (Scenario1)

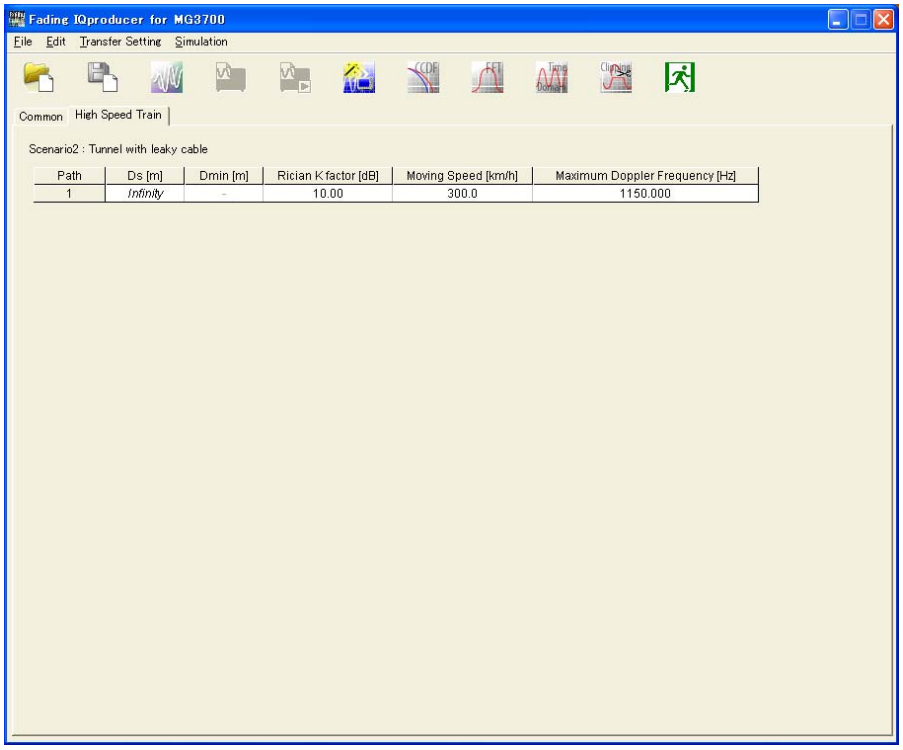

Figure 3.1.6-2 High Speed Train tab window (Scenario2)

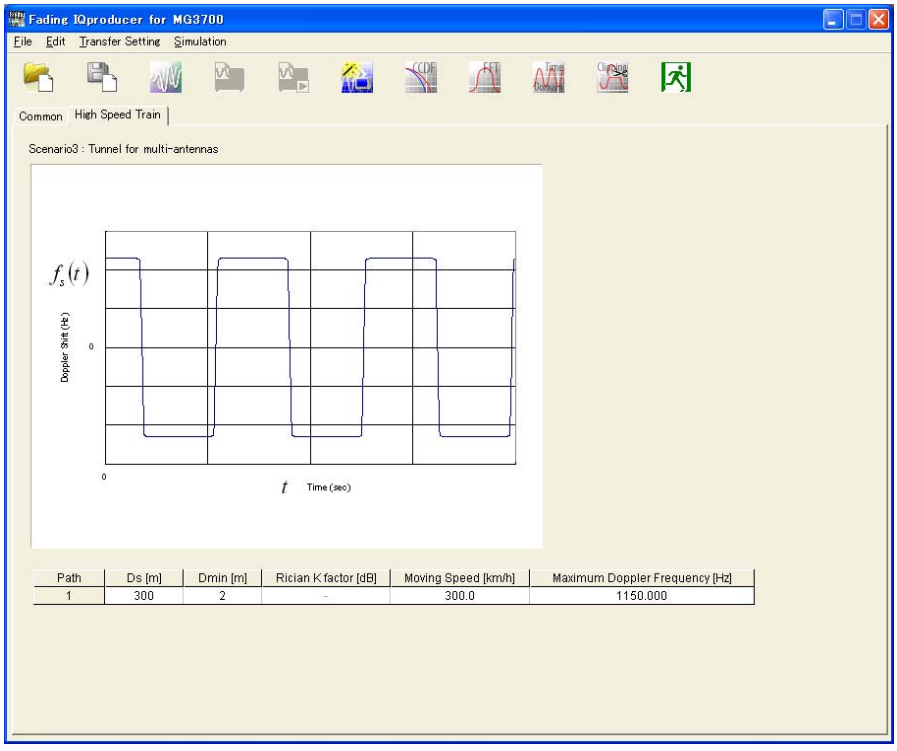

Figure 3.1.6-3 High Speed Train tab window (Scenario3)

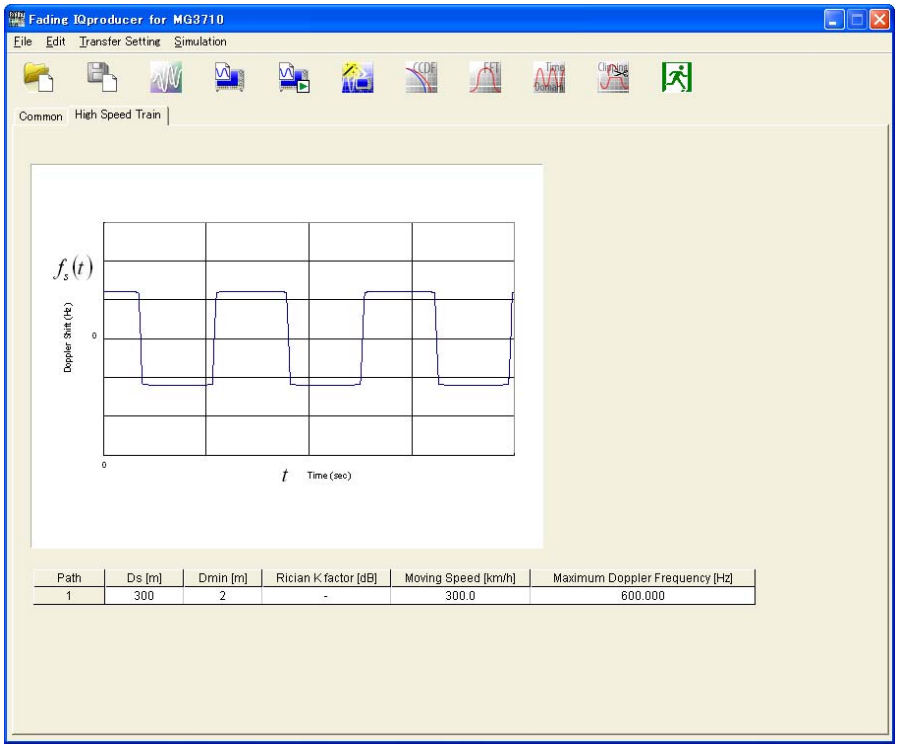

Figure 3.1.6-4 High Speed Train tab window (W-CDMA (MS))

This section describes the parameters on the High Speed Train tab window.

Ds

[Overview] Sets (the default value of the distance between BS and train) × 2.

[Default] 1000 (Scenario1), Infinity (Scenario2), 300 (Scenario3, W-CDMA(MS), and LTE(MS))

[Unit] m

[Setting range] 0 to 2000
Setting resolution: 1

Dmin

[Overview] Sets the distance between BS and rail.

[Default] 50 (Scenario1), 2 (Scenario3, W-CDMA(MS), and LTE(MS)), invalid (Scenario2)

[Unit] m

[Setting range] 1 to 100
Setting resolution: 1

Rician K factor

[Overview] Sets the ratio between direct waves and scattering waves.

[Default] 10.00

[Unit] dB

[Setting range] −40.00 to 40.00
Setting resolution: 0.01

Moving Speed

[Overview] Sets the moving speed.

[Default] 350.0 (Scenario1), 300.0 (Scenario2, Scenario3, W-CDMA(MS), and LTE(MS))

[Unit] km/h

[Setting range] 0.0 to 5000.0
Setting resolution: 0.1

Maximum Doppler Frequency

[Overview] Sets the maximum Doppler frequency.

[Default] 1340 (Scenario1), 1150 (Scenario2 and Scenario3), 600 (W-CDMA(MS)), 750(LTE(MS))

[Unit] Hz

[Setting range] 0.000 to 2000.000
Setting resolution: 0.001

3.1.7 Export File window

This section describes the Export File window.

The Export File window is used to set the package name, file name, comment, etc., of the waveform pattern. The Export File window is displayed when **[Calculation]** is selected from the **[Edit]** menu or the  button is clicked. The number of waveform patterns to be generated changes depending on the Channel Configuration setting. Table 3.1.7-1 shows the correspondence between the Channel Configuration setting and the number of waveform patterns to be generated.

Table 3.1.7-1 Correspondence between Channel Configuration setting and number of waveform patterns

Channel Configuration Setting	Number of Waveform Patterns
1 × 1 SISO	1
1 × 2 SIMO	2
1 × 3 SIMO	3
1 × 4 SIMO	4
2 × 1 MISO	1
2 × 2 MIMO	2
2 × 3 MIMO	3
2 × 4 MIMO	4
3 × 1 MISO	1
3 × 2 MIMO	2
3 × 3 MIMO	3
3 × 4 MIMO	4
4 × 1 MISO	1
4 × 2 MIMO	2
4 × 3 MIMO	3
4 × 4 MIMO	4

When one to four waveform patterns are generated, the waveform pattern names corresponding to Rx Antenna1 to Rx Antenna4 have "_1", "_2", "_3", and "_4" suffixed, respectively, to the specified export file name.

Figs. 3.1.7-1 to 3.1.7-4 show an example where the number of waveform patterns to be generated is one to four, respectively. In the Comment field, the RF frequency value and AWGN setting are initially displayed in the first and second text boxes, respectively.

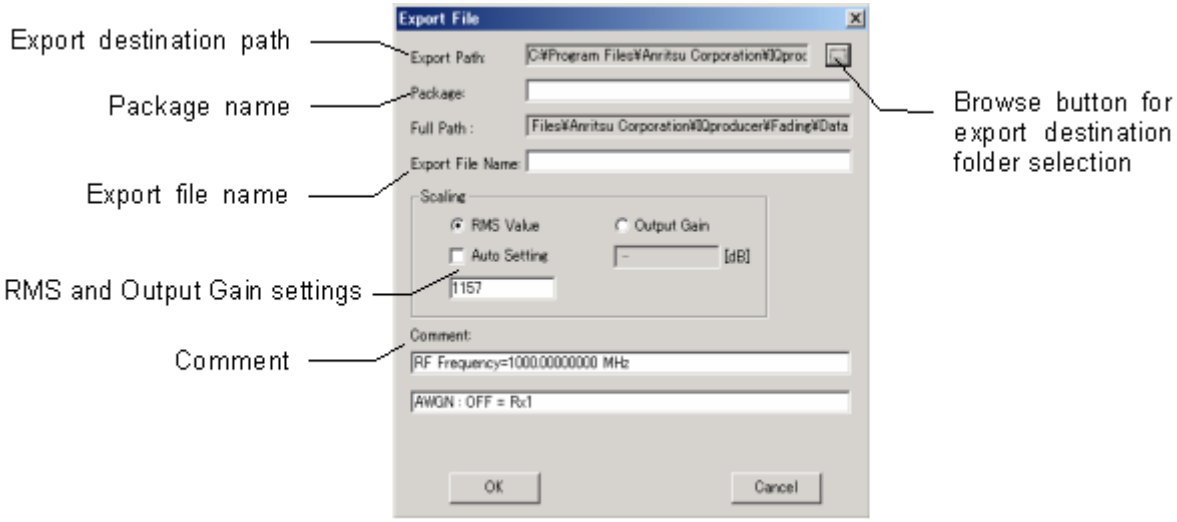

Figure 3.1.7-1 Export File window (when generating one waveform pattern)

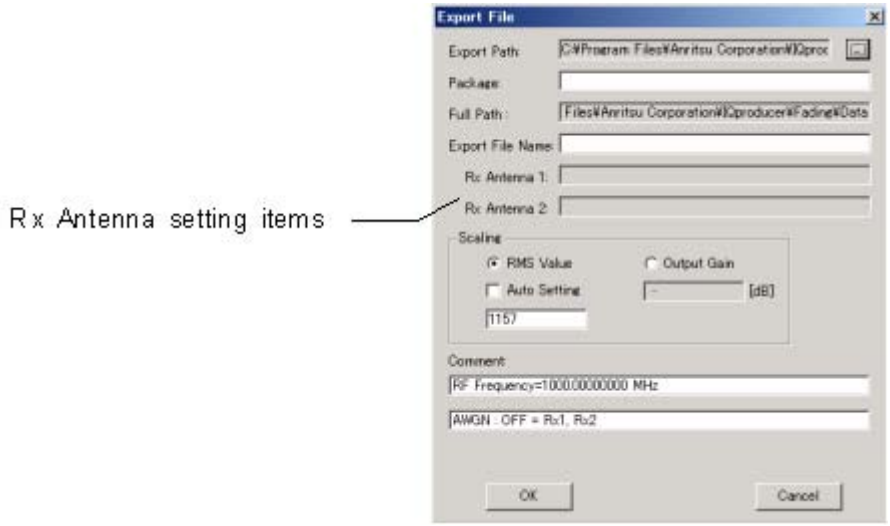

Figure 3.1.7-2 Export File window (when generating two waveform patterns)

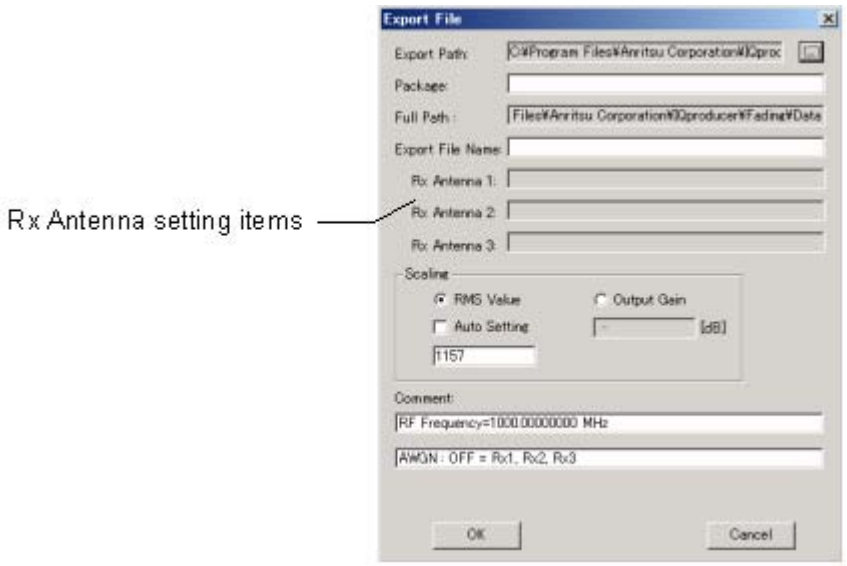

Figure 3.1.7-3 Export File window (when generating three waveform patterns)

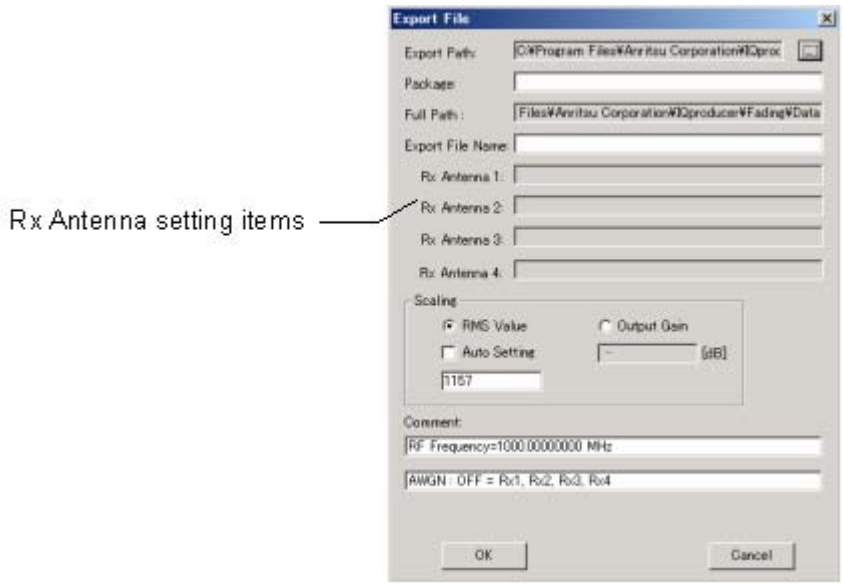

Figure 3.1.7-4 Export File window (when generating four waveform patterns)

The Scaling setting is used to set the level of the generated waveform pattern.

When RMS Value is selected, the waveform pattern amplitude is normalized so that the output waveform pattern has the specified RMS value.

Conversely, when Output Gain is selected, the gain of the output data corresponding to the input data can be set (+0.0 to –10.0 dB). The output power is found by summing the powers on the assumption that there is no correlation for each channel and path.

RMS Value

[Overview] Sets the RMS value.

[Default] 1157

[Setting range] 1 to 1634
Setting resolution: 1

[Remarks] In addition to manual setting, the RMS value can also be set automatically by selecting the Auto Setting check box. When the Auto Setting check box is selected to enable the automatic RMS value setting function, the RMS value is automatically adjusted and set so that the peak of the generated waveform pattern is not clipped. When the RMS value is 1 or less, however, clipping is performed setting the RMS value to 1.

Auto Setting

[Overview] Selects the automatic RMS value setting On/Off.

[Default] When selected:

[Setting range] Select/clear

[Remarks] The RMS value is automatically set when the check box is selected.

Output Gain

[Overview] Sets the output gain.

[Default] 0.0

[Unite] dB

[Setting range] 0.0 to −10.0
Setting resolution: 0.1

[Remarks] At Output Gain, processing is performed so the average level of the output data after fading processing matches the average level of the input data. (However, this assumes there is no correlation with each path and channel.)
The coefficient used at this time is displayed as Gain Offset in **Comment** of the MG3700A/MG3710A/MG3740A setting screen (Figure 3.1.7-5). Actually, the next step adjusts the output level of the waveform data output from the SG according to the Output Gain setting.

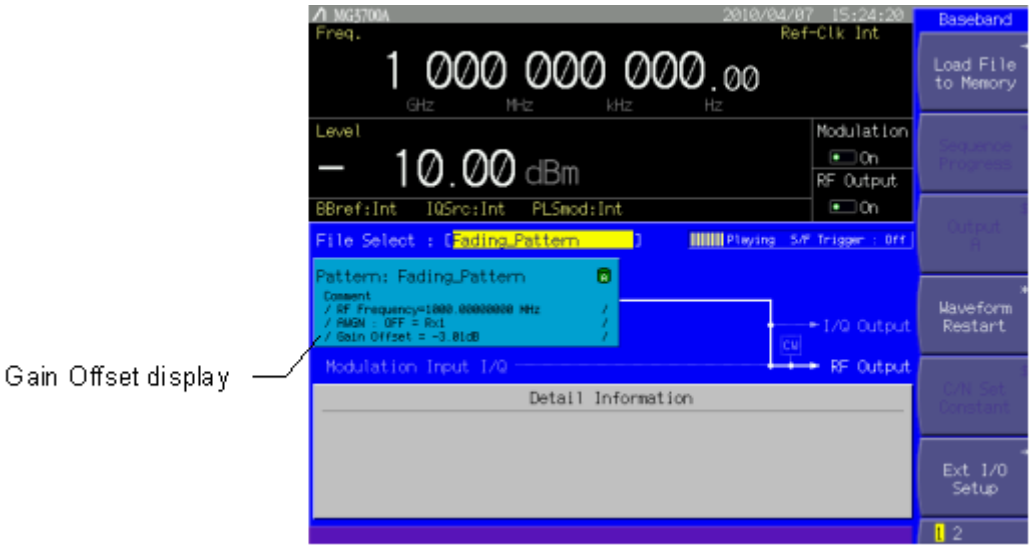

Figure 3.1.7-5 Gain Offset display

When the browse button for export destination folder selection is clicked, the folder selection window shown in Figure 3.1.7-6 is displayed. Select the export destination folder here.

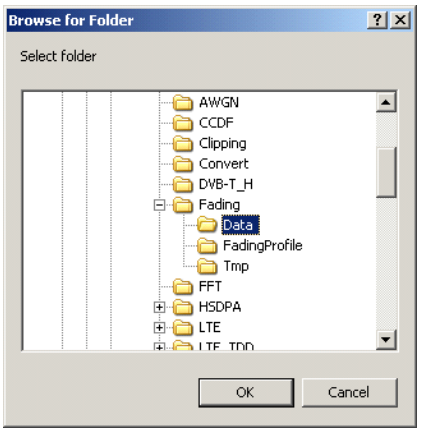

Figure 3.1.7-6 Export destination folder selection window

If an export destination folder is not selected, the generated waveform pattern will be saved in the following folder:

X:\IQproducer\Fading\Data
(X:\IQproducer is the folder in which IQproducer™ is installed)

One-byte alphanumeric characters and the symbols shown below can be used for the package name and file name:

! % & ( ) + = ` { } _ - ^ @ [ ]

The characters entered in the comment are displayed in the comment field on the MG3700A screen. The comment field may be left blank.

Clicking the **[OK]** button starts waveform pattern generation. Note that all items other than comment must be set.

3.1.8 Calculation window

Clicking **Calculation & Load**, **Calculation & Play**, or the **OK** button on the Export File window will start the waveform generation.

The Calculation window shown in Figure 3.1.8-1 is displayed when the waveform pattern generation is started.

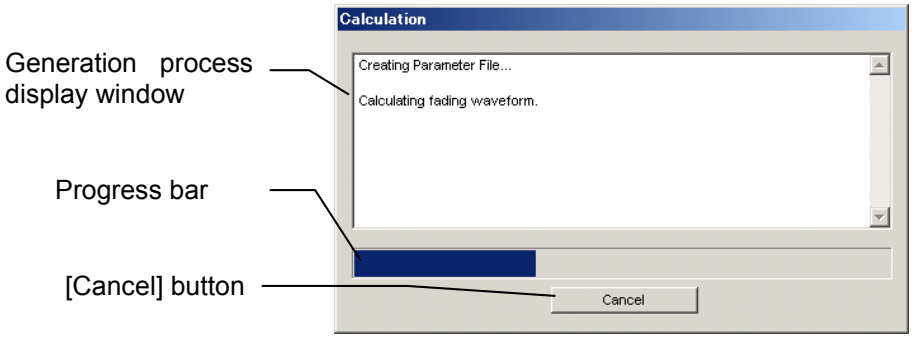

Figure 3.1.8-1 Calculation window (during waveform generation)

Waveform pattern generation can be cancelled by clicking the **[Cancel]** button. Cancelling closes the Calculation window and returns to the main screen.
When the waveform pattern generation is completed, "Calculation Completed" is displayed and the **[Cancel]** button changes to the **[OK]** button.

When the generation is complete, you can return to the setting screen by clicking the **OK** button. After waveform generation, two files with .wvi and .wvd extension are output.

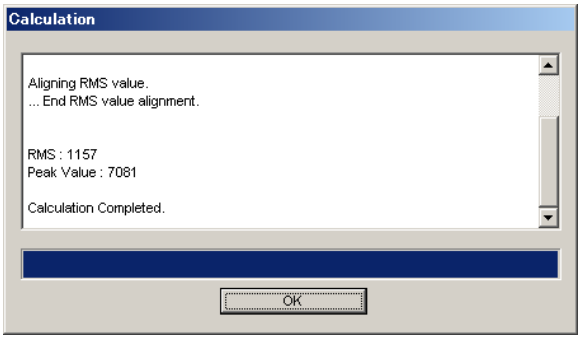

Figure 3.1.8-2 Calculation window (when waveform generation is completed)

At this time, the RMS value, peak value, whether clipping was done, and if so, the sample count, of the generated waveform pattern are displayed.

Note:

When using this software on MG3710A/MG3740A and selecting **Calculation & Load** or **Calculation & Play**, the waveform generation ends without displaying the above screen.

When multiple waveform patterns are generated, the window shown in Figure 3.1.8-3 is displayed at the completion of the waveform pattern generation. In this window, Level Offset shows the level ratio of signal generators (two signal generators in this example). Set the output level of the signal generators to these values when using multiple signal generators. The signal generator output levels are adjusted according to the RMS power of the generated waveform pattern.

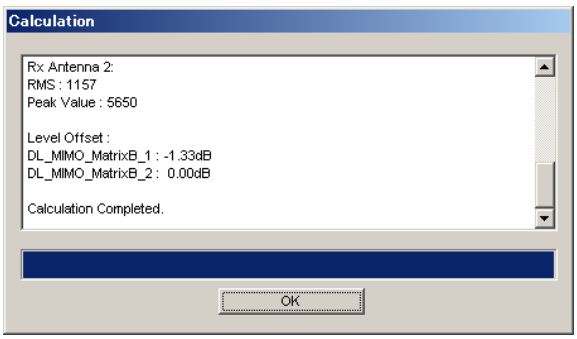

Figure 3.1.8-3 Calculation window with Level Offset display

3.1.9 Calculation & Load

Note:

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

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

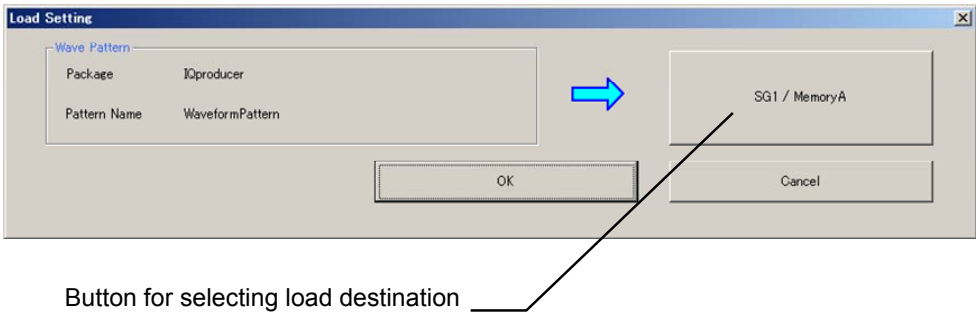

Figure 3.1.9-1 Load Setting Screen

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

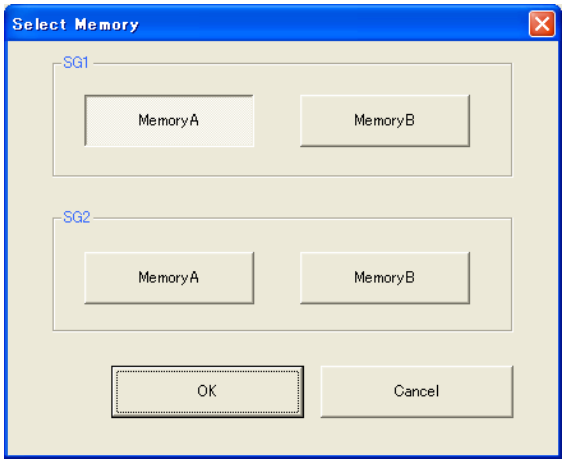

Figure 3.1.9-2 Select Memory Screen

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.

3.1.10 Calculation & Play

Note:

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

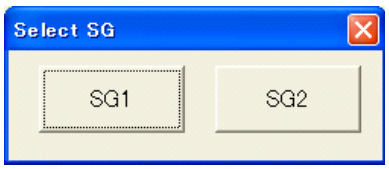

Figure 3.1.10-1 Select SG Screen

3.2 Saving/Reading Parameters

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

3.2.1 Saving a parameter file

When running on PC

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

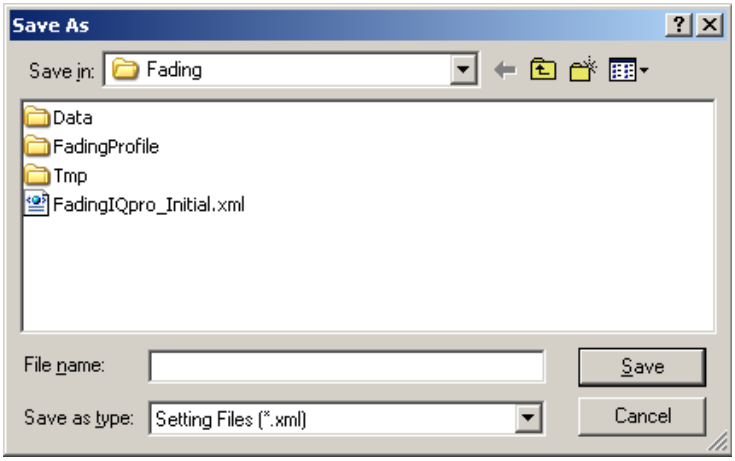

Figure 3.2.1-1 Parameter file saving screen

2. Enter a file name in the **[File name]** text box, and click **[Save]** to save the parameter file.
   If the parameter file saving destination is not changed in **[Save in]**, the parameter file will be saved in the following destination:
   X:\IQproducer\Fading*Entered file name*.xml
   (X:\IQproducer is the folder in which IQproducer™ is installed)

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.

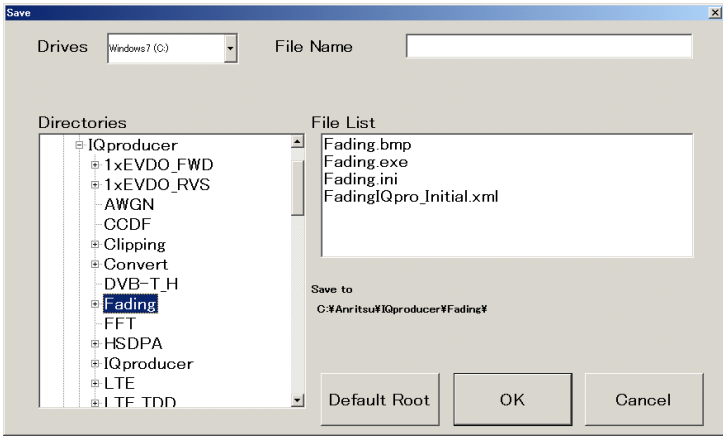

Figure 3.2.1-2 Parameter file saving screen (MG3710A/MG3740A)

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.

3.2.2 Reading a parameter file

When running on PC

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

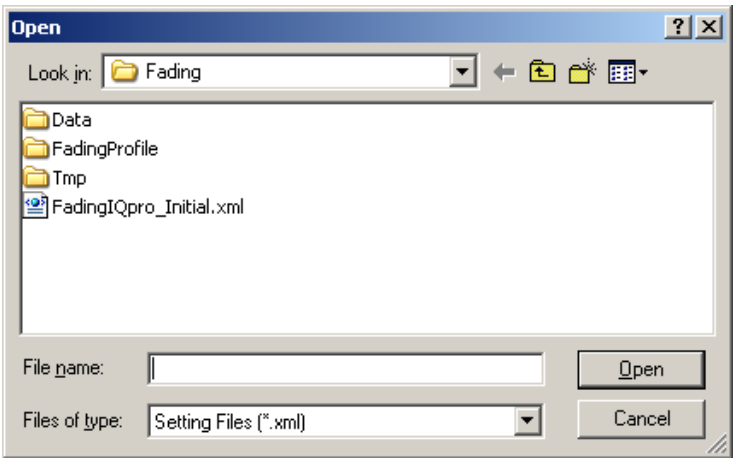

Figure 3.2.2-1 Parameter file reading screen

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

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.

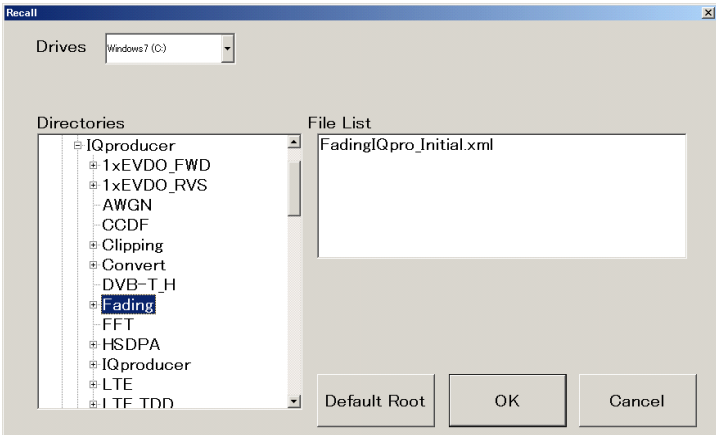

Figure 3.2.2-2 Parameter file reading screen (MG3710A/MG3740A)

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.

3.3 Waveform Pattern Generation Procedure

This section describes how to generate a waveform pattern, using the Fading waveform pattern as an example.

3.3.1 1 × 1 SISO waveform generation

How to generate a Multi Path waveform pattern for W-CDMA BS measurement reception is described below, using the MG3700A standard waveform pattern UL_RMC_12.2kbps as an example.

<Procedure>

1. Start this software.
2. Set Common parameters.
   (1) Setting in System Configuration field

   Select "1 × 1 SISO" from the Channel Configuration list box.

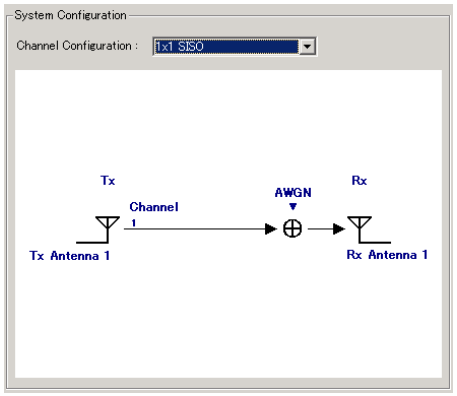

Figure 3.3.1-1 System Configuration (1 × 1 SISO)

   (2) Setting in Tx Antenna Configuration field

   Select "wvi" from the list box, and then click the **[Reference]** button to select a waveform pattern file to be input.

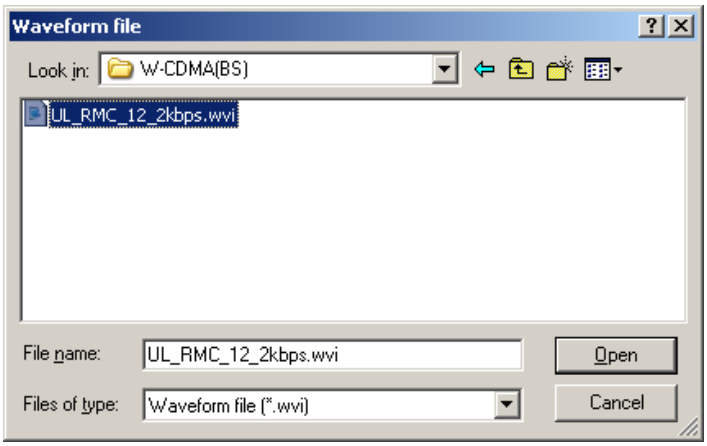

Figure 3.3.1-2 Waveform pattern file selection window (1 × 1 SISO)

Next, set “1980 MHz” for RF Frequency and “1” for Repetition. Figure 3.3.1-3 shows the screen after setting.

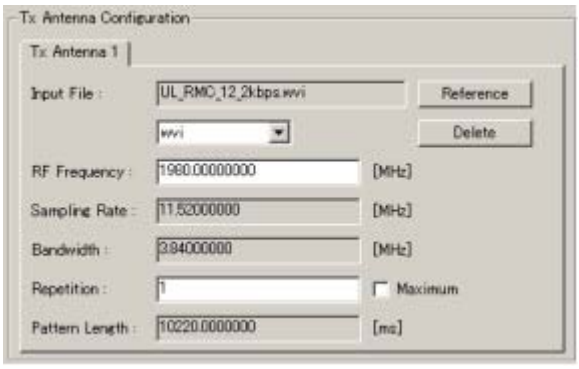

Figure 3.3.1-3 Settings in Tx Antenna Configuration field

(3) Setting in Channel Setting field

Click the **[Select Profile]** button and select the fading profile “W-CDMA(BS)/Case3/120km/h.”

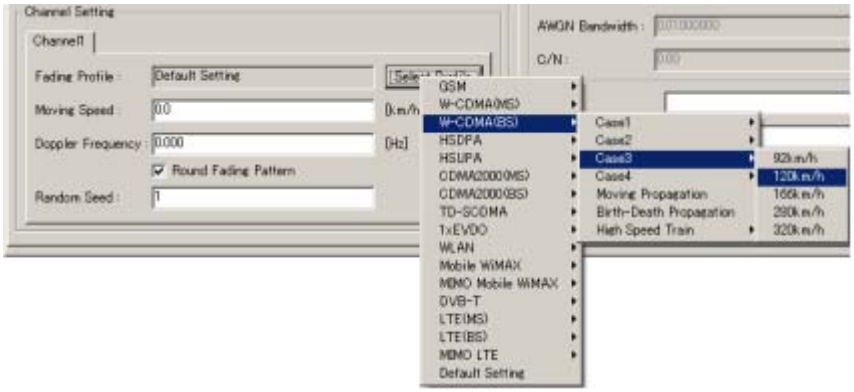

Figure 3.3.1-4 Selecting fading profile

Figure 3.3.1-5 shows the screen after the profile is selected.

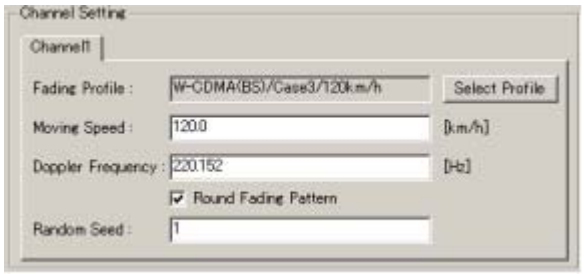

Figure 3.3.1-5 Settings in Channel Setting field

(4) Setting in Rx Antenna Configuration field

Configure the settings as shown in Figure 3.3.1-6.

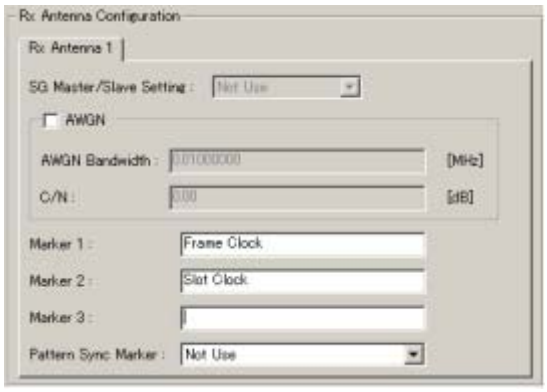

Figure 3.3.1-6 Settings in Rx Antenna Configuration field

(5) Setting in Channel 1 Parameter field

Confirm that the settings configured in the Channel Setting field are displayed in the Channel 1 Parameter field on the Channel 1 tab window.

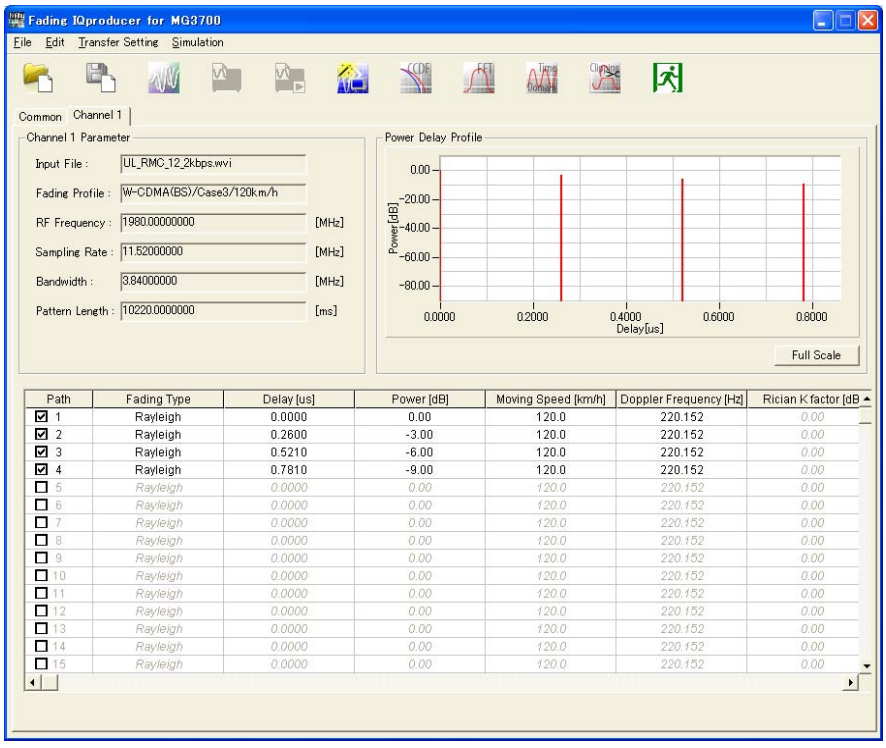

Figure 3.3.1-7 Channel parameter setting screen (1 × 1 SISO)

3. Confirm that the parameters are correctly set.

   Table 3.3.1-1 shows the parameters and their settings in this example.

Table 3.3.1-1 W-CDMA (BS) parameter settings

Parameter	Setting
System Configuration	
Channel Configuration	1 × 1 SISO
Tx Antenna Configuration	
Input File	UL_RMC_12_2kbps.wvi
RF Frequency	1980 MHz
Sampling Rate	11.52 MHz
Bandwidth	3.84 MHz
Repetition	1
Pattern Length	10220.0 ms
Channel Setting	
Fading Profile	W-CDMA(BS)/Case3/120km/h
Moving Speed	120 km/h
Doppler Frequency	220.152 Hz
Round Fading Pattern	Selected
Random Seed	1 (Default)
Rx Antenna Configuration	
AWGN	Cleared

4. Start calculation to generate the waveform.

   Select **[Calculation]** from the **[Edit]** menu or click the  button to display the Export File window shown in Figure 3.3.1-8. Set the package name and export file name, and then click the **[OK]** button. Calculation is started and the waveform is generated.

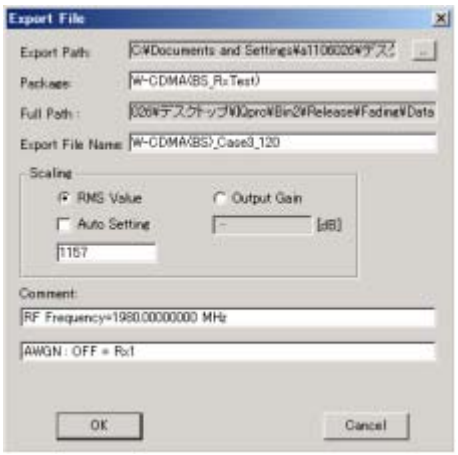

Figure 3.3.1-8 Export File window

5. Figure 3.3.1-9 shows the spectrum of the generated waveform data.

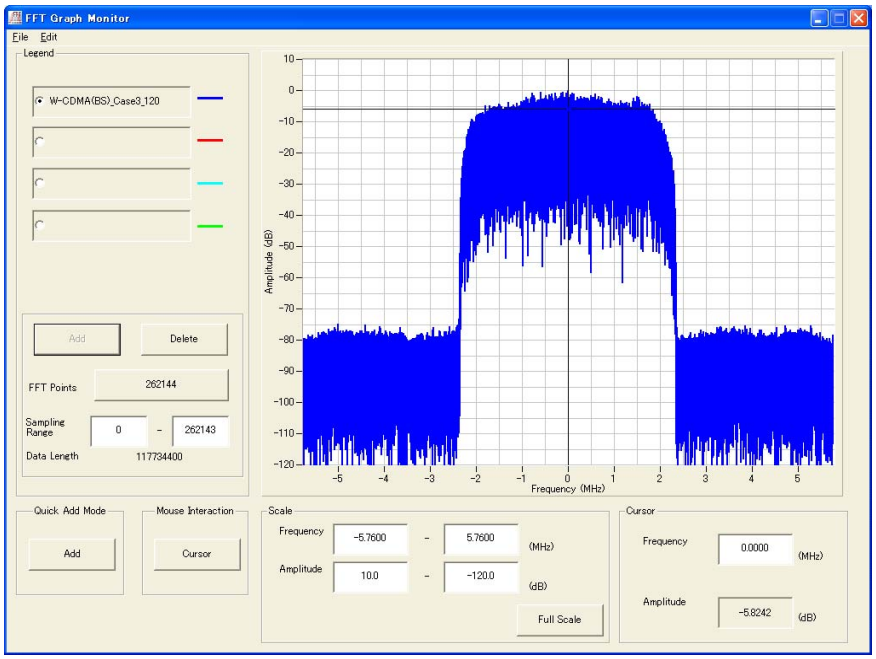

Figure 3.3.1-9 Spectrum (W-CDMA Case3 120km/h)

3.3.2 Moving Propagation waveform generation

How to generate a Moving Propagation waveform pattern for W-CDMA BS measurement reception is described below, using the MG3700A standard waveform pattern UL_RMC_12.2kbps as an example.

<Procedure>

1. Start this software.
2. Set Common parameters.
   (1) Setting in System Configuration field

   Select "1 × 1 SISO" from the Channel Configuration list box.

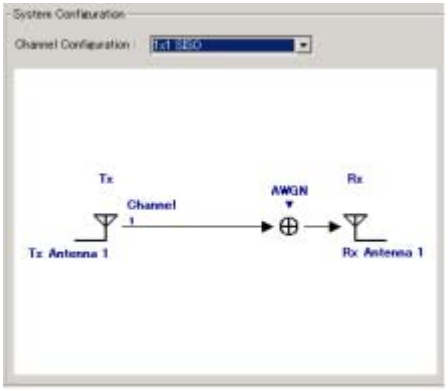

Figure 3.3.2-1 System Configuration (1 × 1 SISO)

   (2) Setting in Tx Antenna Configuration field

   Select "wvi" from the list box, and then click the **[Reference]** button to select a waveform pattern file to be input.

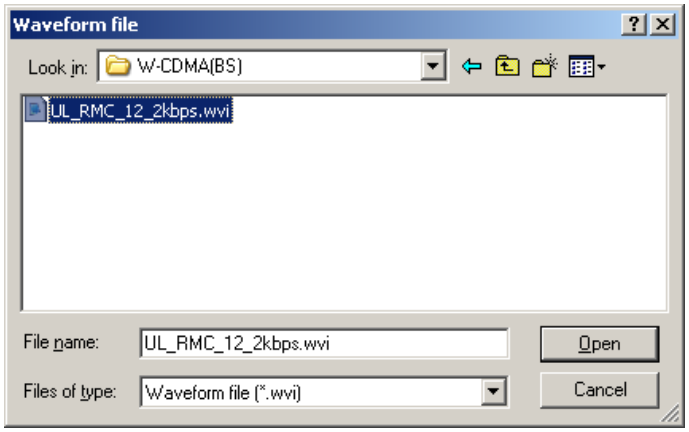

Figure 3.3.2-2 Waveform pattern selection window

Next, set “1980 MHz” for RF Frequency and “1” for Repetition. Figure 3.3.2-3 shows the screen after setting.

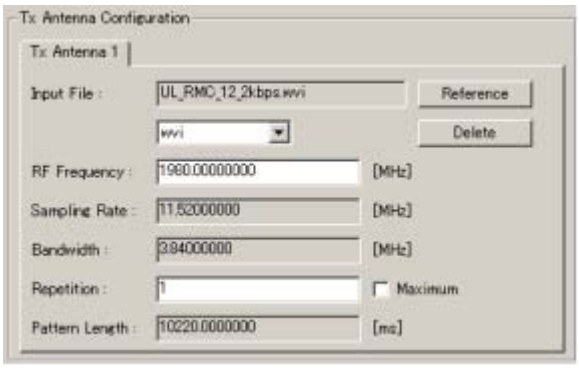

Figure 3.3.2-3 Settings in Tx Antenna Configuration field

(3) Setting in Channel Setting field

Click the **[Select Profile]** button and select the fading profile “W-CDMA(BS)/Moving Propagation.”

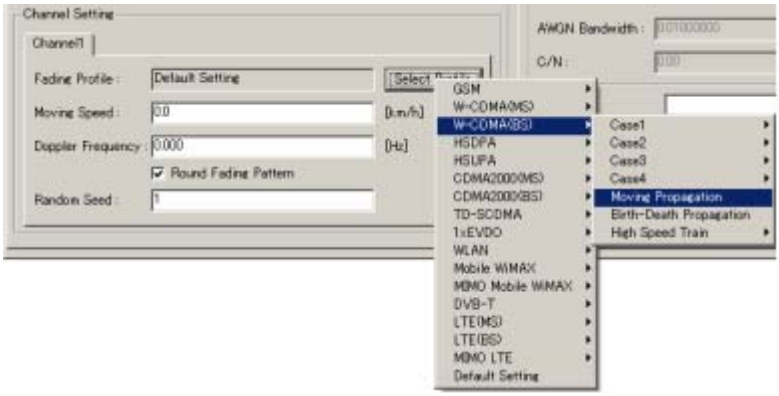

Figure 3.3.2-4 Selecting fading profile

Figure 3.3.2-5 shows the screen after the profile is selected.

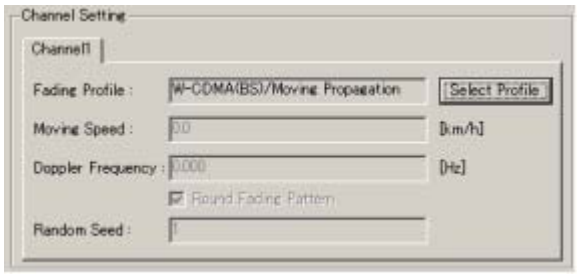

Figure 3.3.2-5 Settings in Channel Setting field (Moving Propagation)

(4) Setting in Rx Antenna Configuration field

Configure the settings as shown in Figure 3.3.2-6.

Figure 3.3.2-6 Settings in Rx Antenna Configuration field

3. Set Path parameters on the Moving Propagation tab window.

Set the Path parameters as shown in Table 3.3.2-1.

Table 3.3.2-1 Path parameter settings (Moving Propagation)

Path	Power [dB]	A [μs]	B [μs]	Omega [Hz]
0	0	0	0	0
1	0.00	5	1	0.04

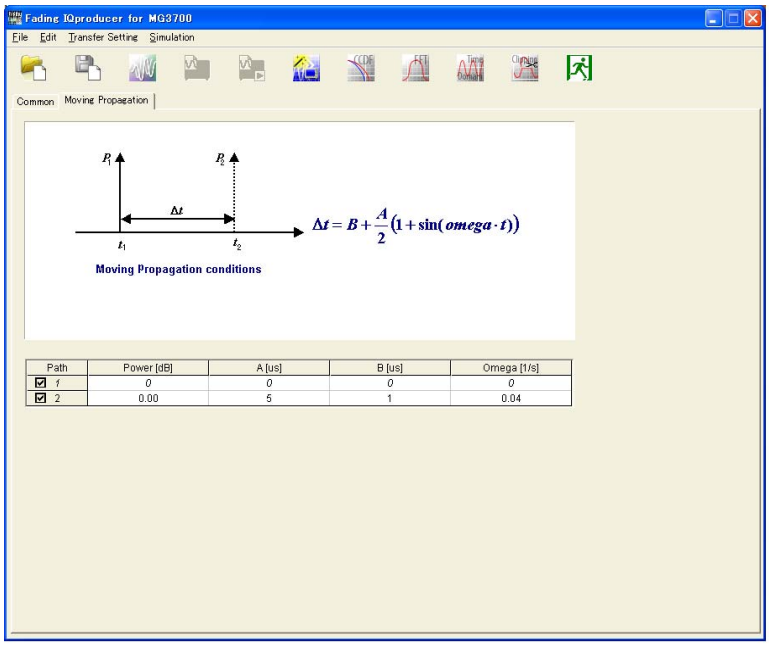

Figure 3.3.2-7 Moving Propagation tab window

4. Confirm that the parameters are correctly set.

   Table 3.3.2-2 shows the parameters and their setting in this example.

Table 3.3.2-2 W-CDMA (BS) Moving Propagation parameter settings

Parameter	Setting
System Configuration	
Channel Configuration	1 × 1 SISO
Tx Antenna Configuration	
Input File	UL_RMC_12_2kbps.wvi
RF Frequency	1980 MHz
Sampling Rate	11.52 MHz
Bandwidth	3.84 MHz
Repetition	1
Pattern Length	10220.0 ms
Channel Setting	
Fading Profile	W-CDMA(BS)/Moving Propagation
Rx Antenna Configuration	
AWGN	Cleared

5. Start calculation to generate the waveform.

   Select **[Calculation]** from the **[Edit]** menu or click the  button to display the Export File window shown in Figure 3.3.2-8. Set the package name and export file name, and then click the **[OK]** button. Calculation is started and the waveform is generated.

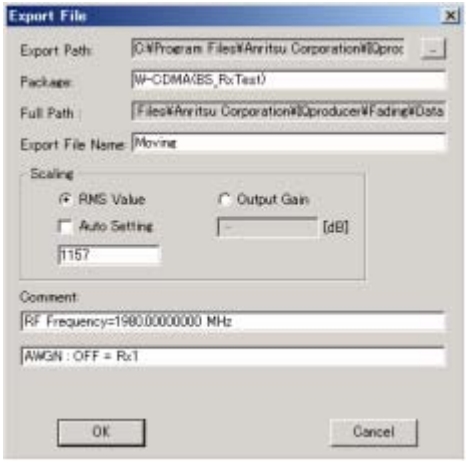

Figure 3.3.2-8 Export File window

6. Spectrum

Figure 3.3.2-9 shows an FFT graph of the generated waveform data.

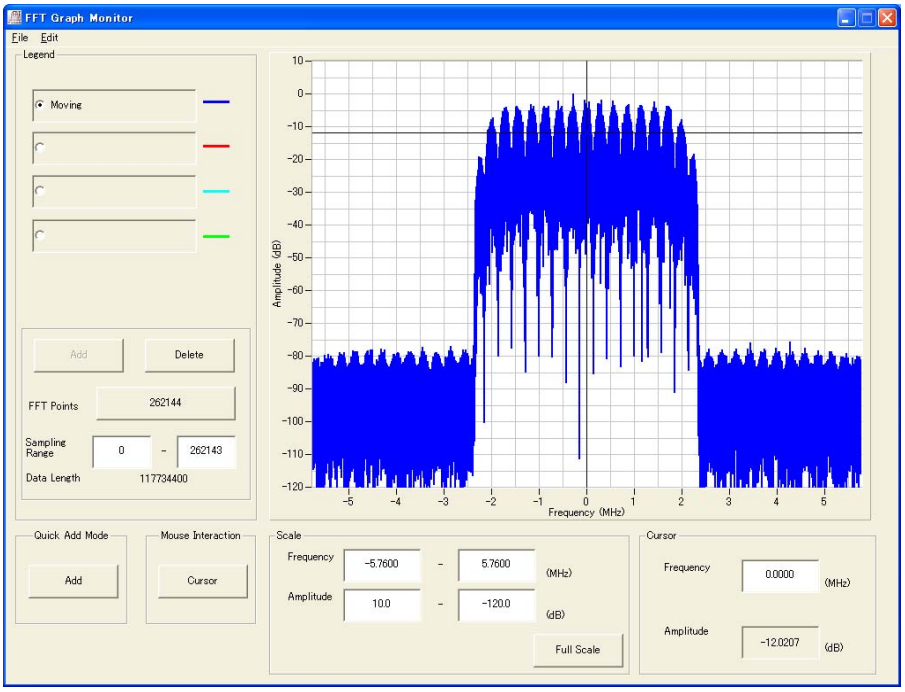

Figure 3.3.2-9 Spectrum (Moving Propagation)

3.3.3 Birth-Death Propagation waveform generation

How to generate a Birth-Death Propagation waveform pattern for W-CDMA BS measurement reception is described below, using the MG3700A standard waveform pattern UL_RMC_12.2kbps as an example.

<Procedure>

1. Start this software.
2. Set Common parameters.
   (1) Setting in System Configuration field

   Select "1 × 1 SISO" from the Channel Configuration list box.

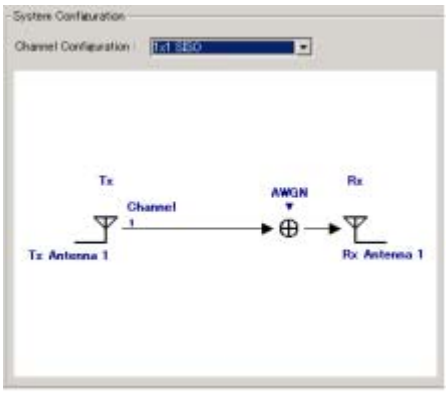

Figure 3.3.3-1 System Configuration (1 × 1 SISO)

   (2) Setting in Tx Antenna Configuration field

   Select "wvi" from the list box, and then click the **[Reference]** button to select a waveform pattern file to be input.

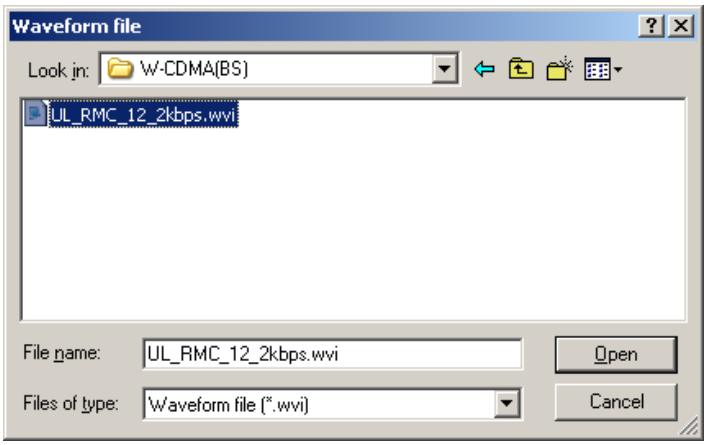

Figure 3.3.3-2 Waveform pattern selection window

Next, set “1980 MHz” for RF Frequency and “1” for Repetition. Figure 3.3.3-3 shows the screen after setting.

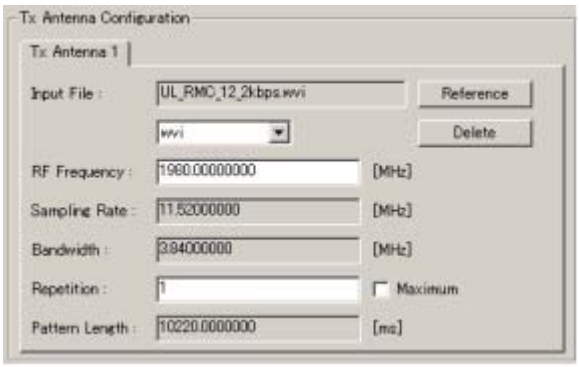

Figure 3.3.3-3 Settings in Tx Antenna Configuration field

(3) Setting in Channel Setting field

Click the **[Select Profile]** button and select the fading profile “W-CDMA(BS)/Birth Death Propagation.”

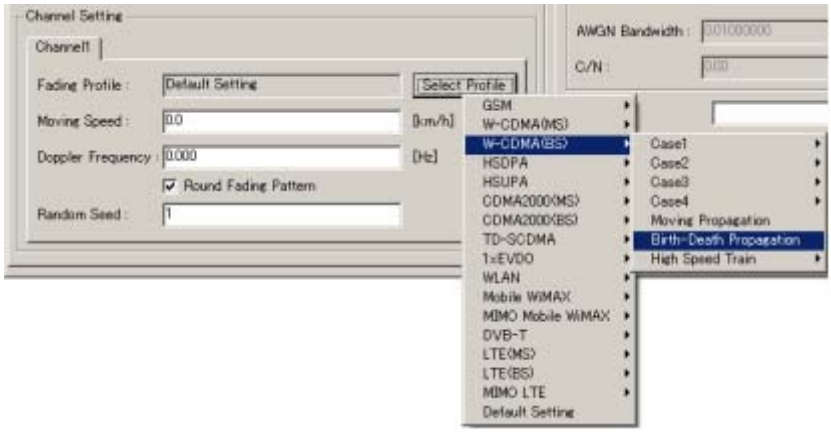

Figure 3.3.3-4 Selecting fading profile

Figure 3.3.3-5 shows the screen after the profile is selected.

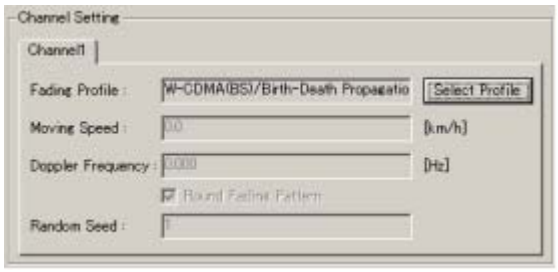

Figure 3.3.3-5 Settings in Channel Setting field (Birth-Death Propagation)

(4) Setting in Rx Antenna Configuration field

Configure the settings as shown in Figure 3.3.3-6.

Figure 3.3.3-6 Settings in Rx Antenna Configuration field

3. Set Path parameters on the Birth Death Propagation tab window.

Set the Path parameters as shown in Table 3.3.3-1.

Table 3.3.3-1 Path parameter settings (Birth-Death Propagation)

Path	Power [dB]	Minimum Delay [μs]	Delay Resolution [μs]	Dwell time [ms]
0	0.00	10	1	191.000
1	0.00	10	1	191.000

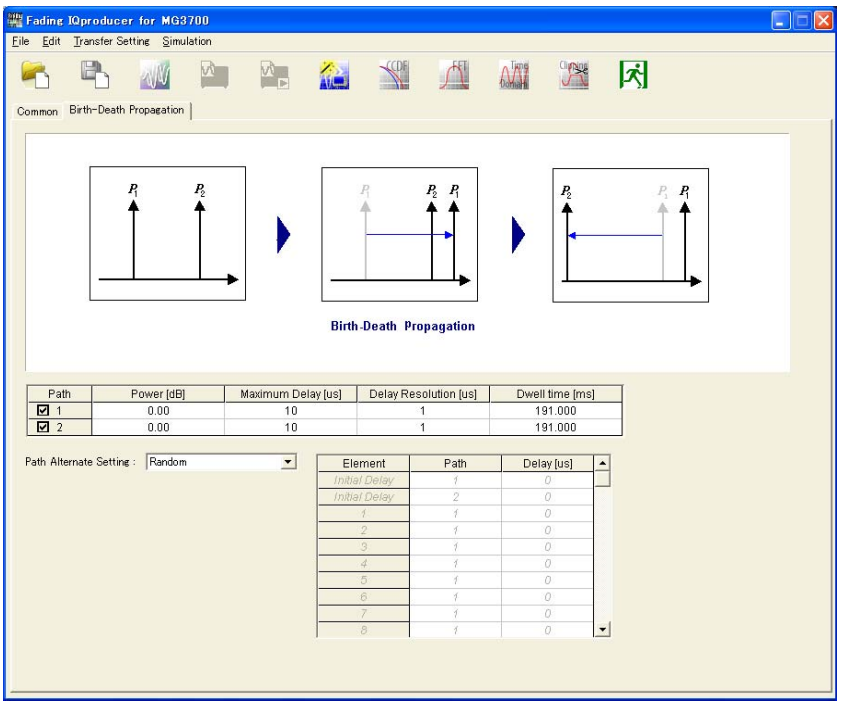

Figure 3.3.3-7 Birth-Death Propagation tab window

In this example, the waveform pattern generation procedure when Random is selected for Path Alternate Setting is provided below.
The path delay changes randomly when Random is selected for Path Alternate Setting, while the path can be alternated in a desired pattern when Sequence is selected.

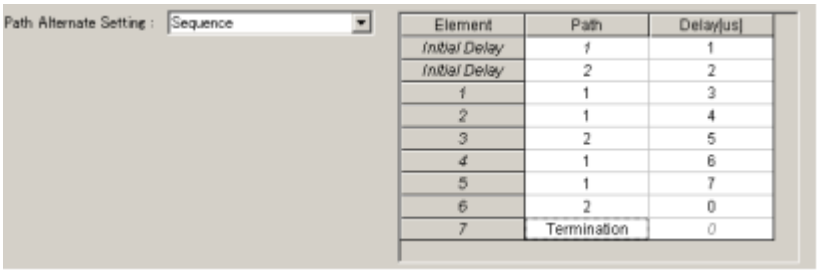

Figure 3.3.3-8 Example when Sequence is selected

4. Confirm that the parameters are correctly set.

   Table 3.3.3-2 shows the parameters and their setting in this example.

Table 3.3.3-2 W-CDMA (BS) Birth-Death Propagation parameter settings

Parameter	Setting
System Configuration	
Channel Configuration	1 × 1 SISO
Tx Antenna Configuration	
Input File	UL_RMC_12_2kbps.wvi
RF Frequency	1980 MHz
Sampling Rate	11.52 MHz
Bandwidth	3.84 MHz
Repetition	1
Pattern Length	10220.0 ms
Channel Setting	
Fading Profile	W-CDMA(BS)/Birth-Death Propagation
Rx Antenna Configuration	
AWGN	Cleared

5. Start calculation to generate the waveform.

   Select **[Calculation]** from the **[Edit]** menu or click the  button to display the Export File window shown in Figure 3.3.3-9. Set the package name and export file name, and then click the **[OK]** button. Calculation is started and the waveform is generated.

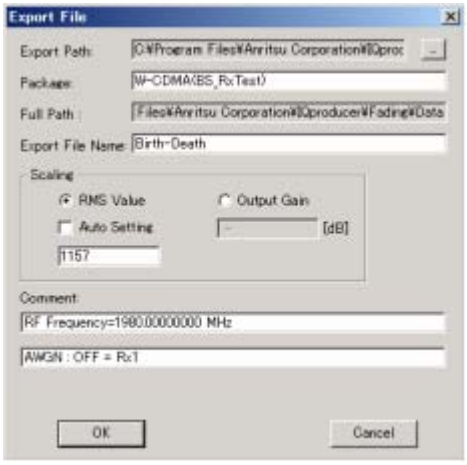

Figure 3.3.3-9 Export File window

6. Spectrum

   Figure 3.3.3-10 shows the spectrum of the generated waveform data.

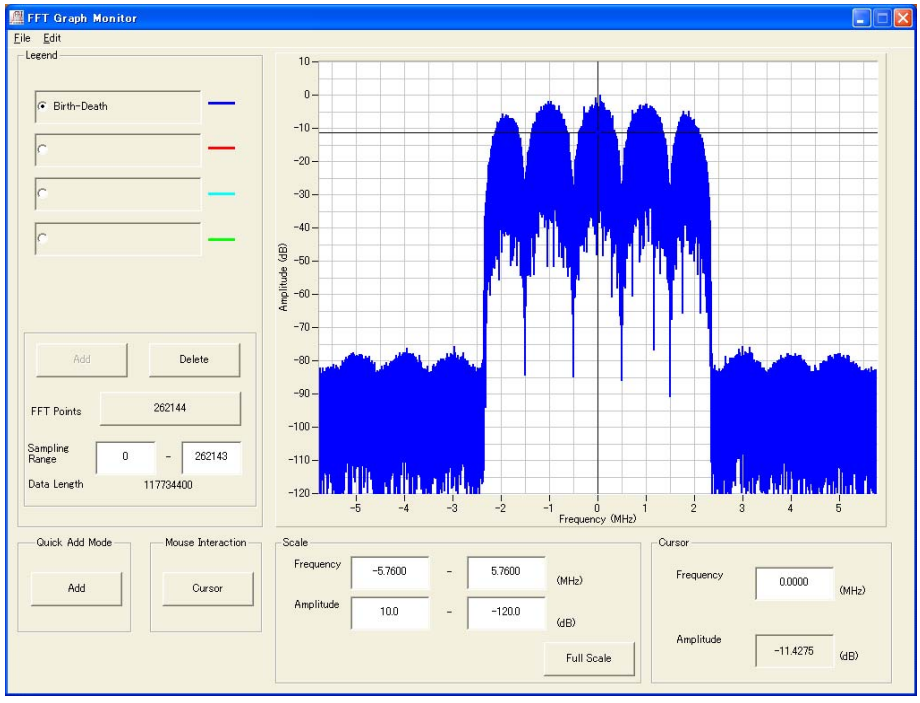

Figure 3.3.3-10 Spectrum (Birth-Death Propagation)

3.3.4 High Speed Train waveform generation

How to generate a High Speed Train waveform pattern for W-CDMA BS measurement reception is described below, using the MG3700A standard waveform pattern UL_RMC_12.2kbps as an example.

<Procedure>

1. Start this software.
2. Set Common parameters.
   (1) Setting in System Configuration field

   Select **1 × 1 SISO** from the Channel Configuration list box.

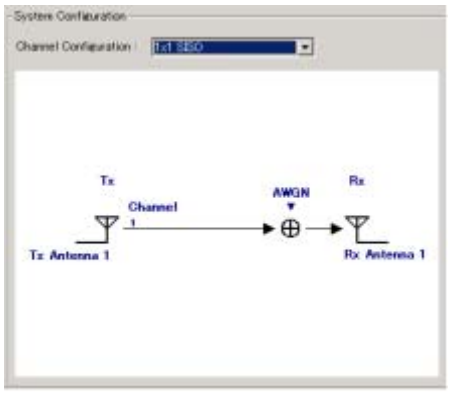

Figure 3.3.4-1 System Configuration (1 × 1 SISO)

   (2) Setting in Tx Antenna Configuration field

   Select the input file (wvi).

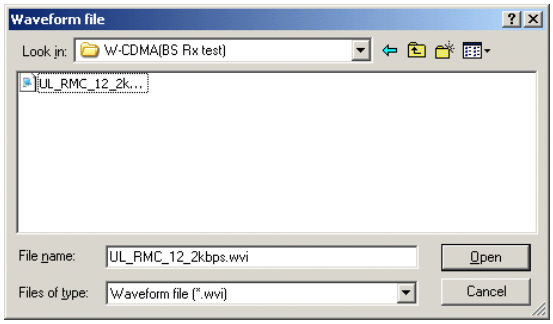

Figure 3.3.4-2 Waveform pattern file selection window

Next, set 1980 MHz for RF Frequency and "1" for Repetition. Figure 3.3.4-3 shows the screen after setting.

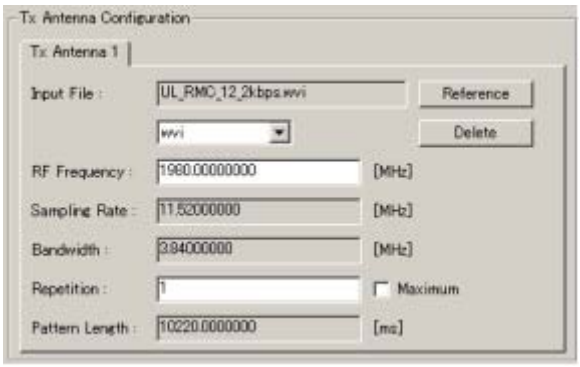

Figure 3.3.4-3 Tx Antenna Configuration

(3) Setting in Channel Setting field

Click the **Select Profile** and select the fading profile "W-CDMA(BS)/High Speed Train/Scenario1."

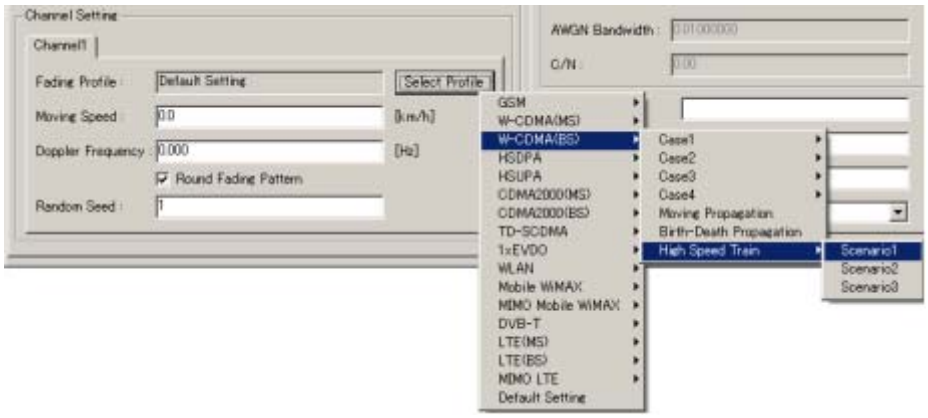

Figure 3.3.4-4 Selecting fading profile

Figure 3.3.4-5 shows the screen after the profile is selected.

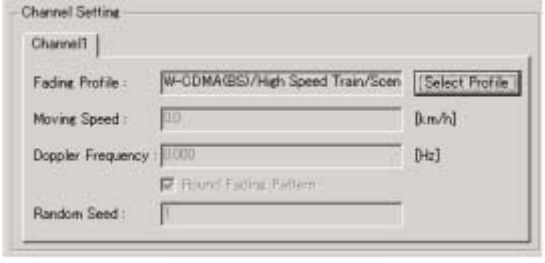

Figure 3.3.4-5 Settings in Channel Setting field (High Speed Train)

(4) Setting in Rx Antenna Configuration field

Configure the settings as shown in Figure 3.3.4-6.

Figure 3.3.4-6 Settings in Rx Antenna Configuration field

3. Set Path parameters on the High Speed Train tab window.

Set the Path parameters as shown in Table 3.3.4-1.

Table 3.3.4-1 Path parameter settings (High Speed Train)

Ds [m]	Dmin [m]	Rician K factor [dB]	Moving Speed [km/h]	Maximum Doppler Frequency [Hz]
1000	50	–	350.0	1340.000

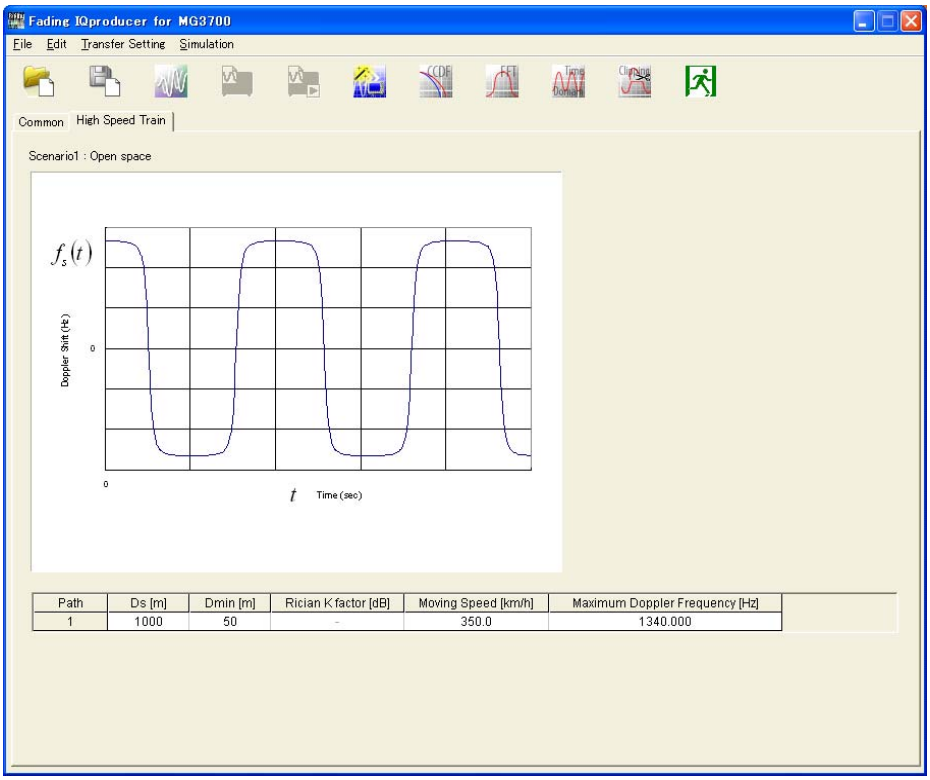

Figure 3.3.4-7 High Speed Train tab window (Scenario1)

4. Confirm that the parameters are correctly set.

   Table 3.3.4-2 shows the parameters and their setting in this example.

Table 3.3.4-2 W-CDMA(BS)/High Speed Train/Scenario1 parameter settings

Parameter	Setting
System Configuration	
Channel Configuration	1 × 1 SISO
Tx Antenna Configuration	
Input File	UL_RMC_12_2kbps.wvi
RF Frequency	1980 MHz
Sampling Rate	11.52 MHz
Bandwidth	3.84 MHz
Repetition	1
Pattern Length	10220.0 ms
Channel Setting	
Fading Profile	W-CDMA(BS)/High Speed Train/Scenario1
Rx Antenna Configuration	
AWGN	Cleared

5. Start calculation to generate the waveform.

   Select **[Calculation]** from the **[Edit]** menu or click the  button to display the Export File window shown in Figure 3.3.4-8. Set the package name and export file name, and then click the **[OK]** button. Calculation is started and the waveform is generated.

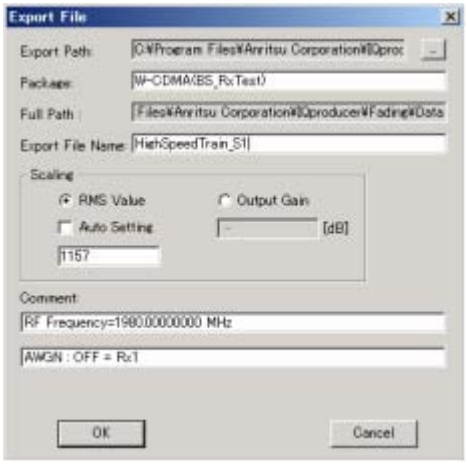

Figure 3.3.4-8 Export File window

7. Spectrum

Figure 3.3.4-9 shows the spectra of the generated waveform data.

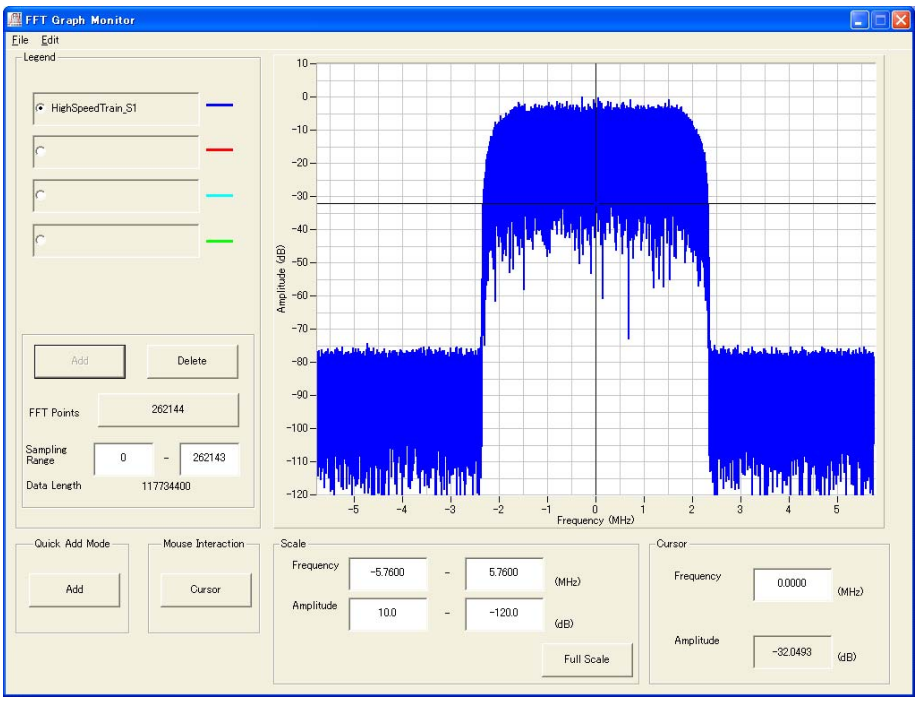

Figure 3.3.4-9 Spectrum (High Speed Train (Scenario1))

3.3.5 2 × 2 MIMO waveform generation

How to generate a 2 × 2 MIMO waveform pattern is described below, using the Mobile WiMAX waveform pattern as an example.
In the example, "DL_MIMO_MatrixB_1.wvi" is created as the waveform pattern corresponding to Tx Antenna1, and "DL_MIMO_MatrixB_2.wvi" as the waveform pattern corresponding to Tx Antenna2.

<Procedure>

1. Start this software.
2. Set Common parameters.
   (1) Setting in System Configuration field

   Select "2 × 2 MIMO" from the Channel Configuration list box.

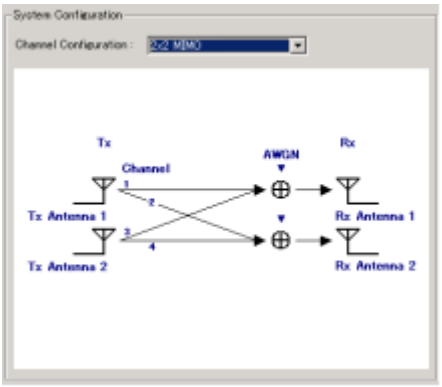

Figure 3.3.5-1 System Configuration (2 × 2 MIMO)

   (2) Setting for Tx Antenna 1 and Tx Antenna 2 in Tx Antenna Configuration field

   Select "wvi" from the list box, and then click the **[Reference]** button to select a waveform pattern file to be input.

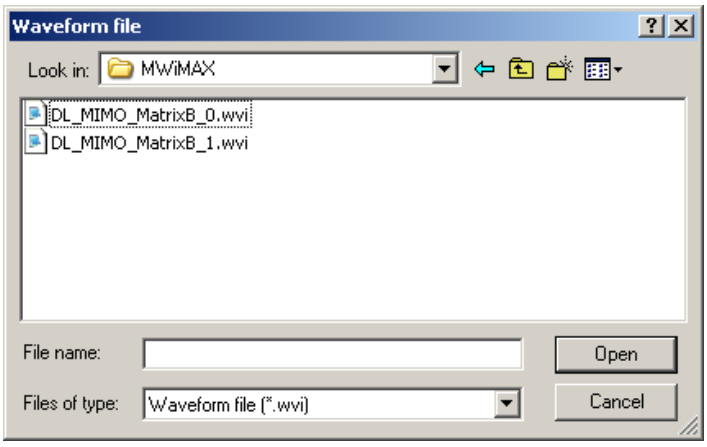

Figure 3.3.5-2 Waveform pattern file selection window (2 × 2 MIMO)

Next, set “2400 MHz” for RF Frequency and “1” for Repetition on the Tx Antenna 1 tab window and the Tx Antenna 2 tab window. Figs. 3.3.5-3 and 3.3.5-4 show the screen after setting.

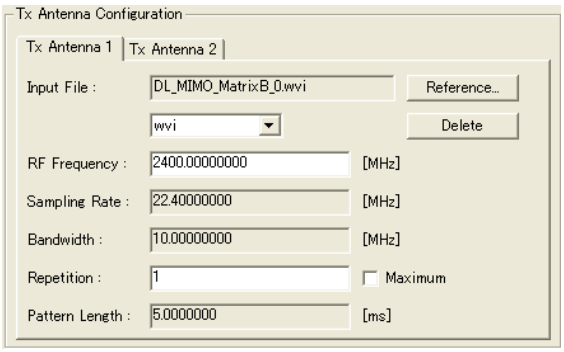

Figure 3.3.5-3 Settings on Tx Antenna 1 tab window

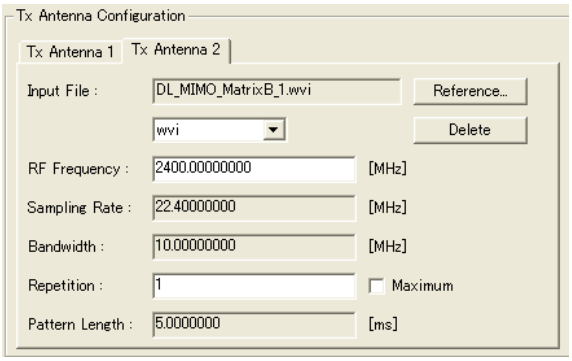

Figure 3.3.5-4 Settings on Tx Antenna 2 tab window

(3) Settings in Channel Setting field

Configure the settings for Channel 1 to Channel 4. On each Channel tab window, click the **[Select Profile]** button and select the fading profile “MIMO Mobile WiMAX/2x2 MIMO/ITU Vehicular A/Medium Correlation.”

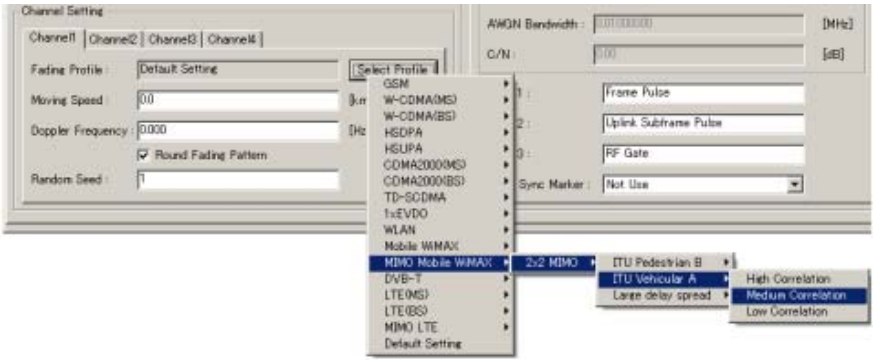

Figure 3.3.5-5 Setting in Channel Setting field

Figure 3.3.5-6 shows the Channel1 tab window after the profile is selected as an example.

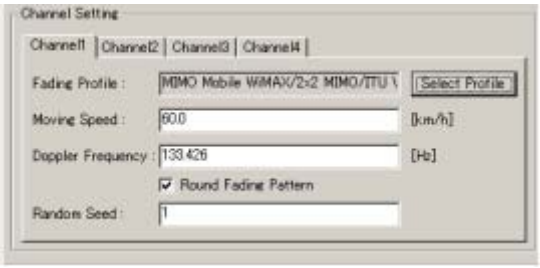

Figure 3.3.5-6 Settings on Channel1 tab window

(4) Setting for Rx Antenna 1 and Rx Antenna 2 in Rx Antenna Configuration field

Configure the settings as shown in Figs. 3.3.5-7 and 3.3.5-8.

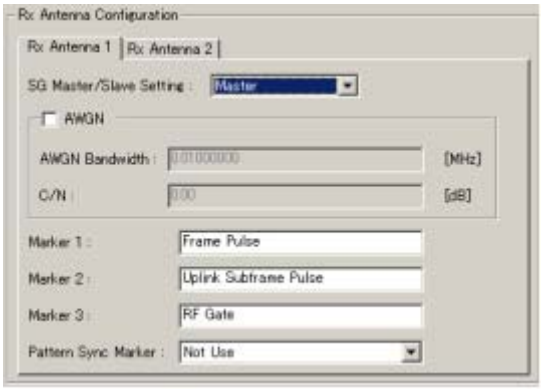

Figure 3.3.5-7 Settings on Rx Antenna1 tab window

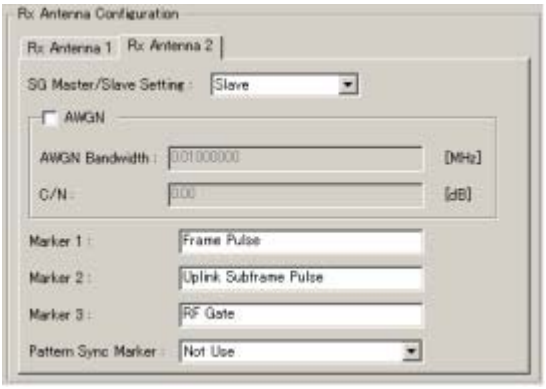

Figure 3.3.5-8 Settings on Rx Antenna2 tab window

(5) Setting in Channel n parameter field (n = 1 to 4)

Confirm that the settings configured in the Channel Setting field are displayed in the Channel Parameter field on each Channel tab window.

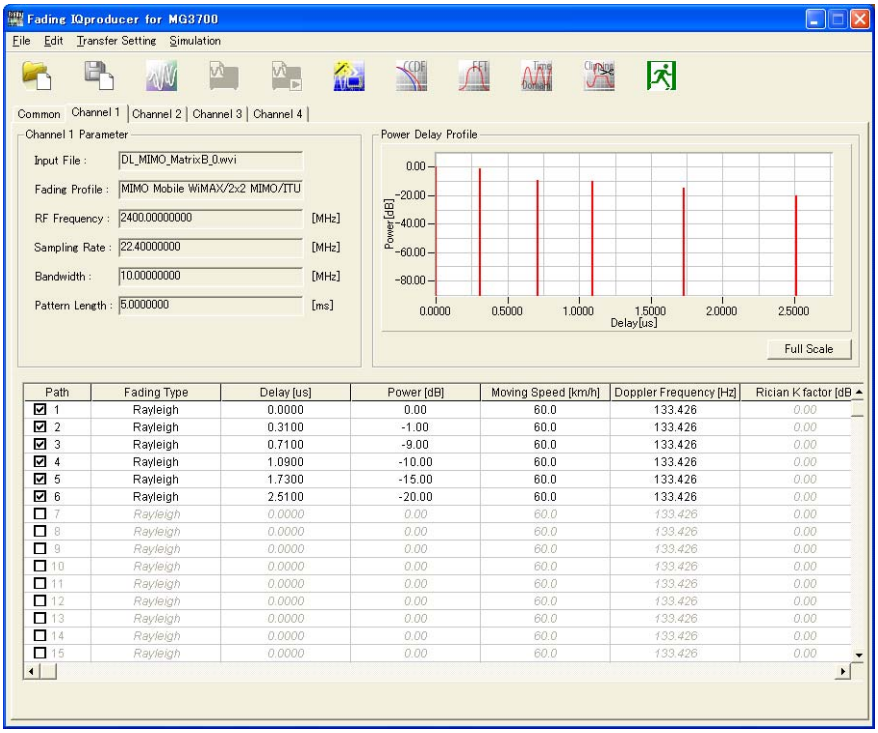

Figure 3.3.5-9 Channel parameter setting screen (2 × 2 MIMO)

Select Correlation Setting of Path1, select Edit to display the Correlation matrix setting window, and then configure the settings. The configured settings commonly apply to Channels 1 to 4.

Figure 3.3.5-10 shows the Correlation Matrix setting window after setting.

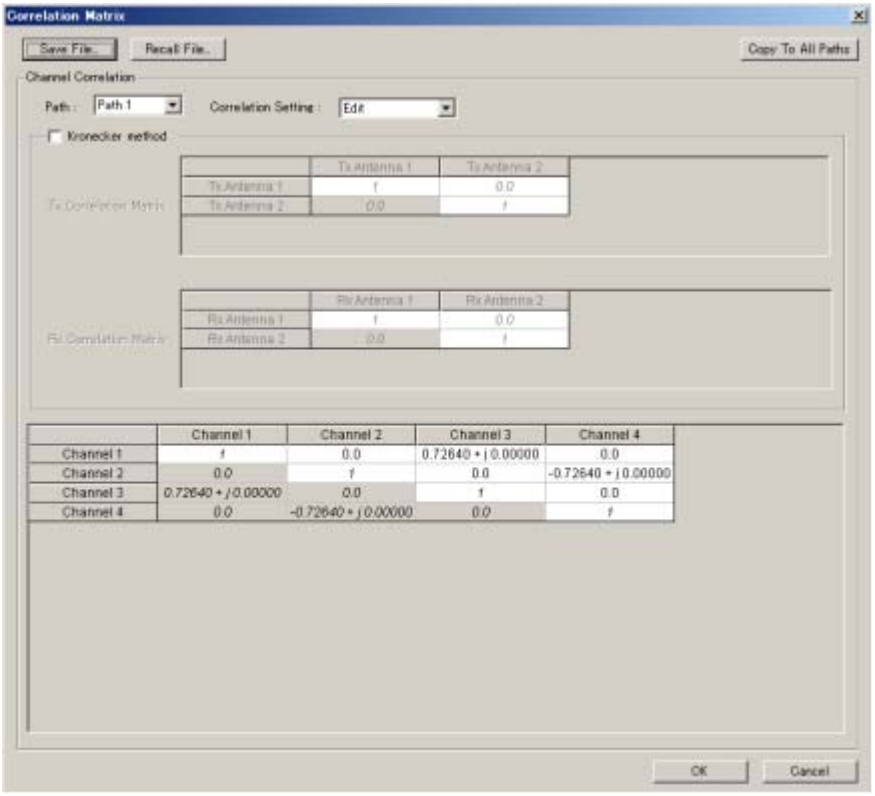

Figure 3.3.5-10 Correlation Matrix setting window (Path Correlation Matrix)

3. Confirm that the parameters are correctly set.

   Table 3.3.5-1 shows the parameters and their setting in this example.

Table 3.3.5-1 Mobile WiMAX parameter settings

Parameter	Setting
System Configuration	
Channel Configuration	2 × 2 MIMO
Tx Antenna Configuration (Tx Antenna1 and Tx Antenna2)	
Input File (Tx Antenna1)	DL_MIMO_MatrixB_1.wvi
Input File (Tx Antenna2)	DL_MIMO_MatrixB_2.wvi
RF Frequency	2400 MHz
Sampling Rate	22.4 MHz
Bandwidth	10 MHz
Repetition	1
Pattern Length	5 ms
Channel Setting (Channel 1 to Channel 4)	
Fading Profile	MIMO Mobile WiMAX/2x2 MIMO/ITU Vehicular A/Medium Correlation
Moving Speed	60 km/h
Doppler Frequency	133.426 Hz
Round Fading Pattern	Selected
Random Seed	Initial value
Rx Antenna Configuration (Rx Antenna1 and Rx Antenna2)	
AWGN	OFF
Channel (1 to 4) setting	
Spectrum Shape	Classical 6 dB
Correlation Setting (Path 1 to Path 6) (Medium correlation)	

	Channel1	Channel2	Channel3	Channel4
Channel1	1	0.0	0.7264	0.0
Channel2	0.0	1	0.0	–0.7264
Channel3	0.7264	0.0	1	0.0
Channel4	0.0	–0.7264	0.0	1

4. Start calculation to generate the waveform.

   Select **[Calculation]** from the **[Edit]** menu or click the  button to display the Export File window shown in Figure 3.3.5-11. Set the package name and export file name, and then click the **[OK]** button. Calculation is started and the waveform is generated.

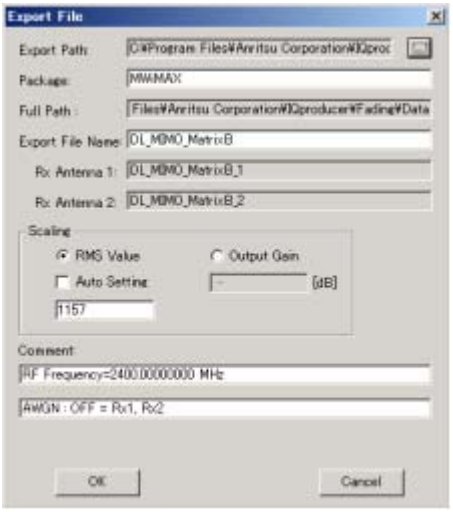

Figure 3.3.5-11 Export File window

When the waveform generation is completed, the window shown in Figure 3.3.5-12 is displayed. In this window, Level Offset shows the level ratio of two signal generators. Set the output level of the signal generators to these values when using two signal generators.

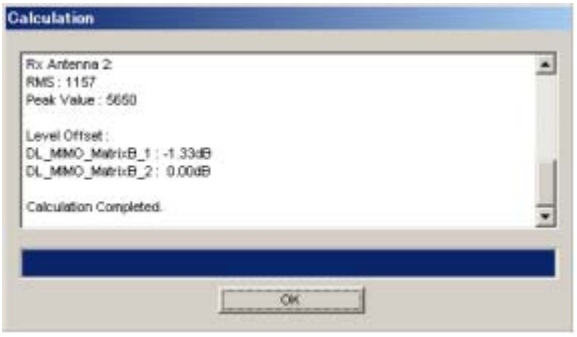

Figure 3.3.5-12 Window when waveform generation is completed

5. Figs. 3.3.5-13 and 3.3.5-14 show the spectra of the generated waveform data, for Rx Antenna1 and Rx Antenna2, respectively.

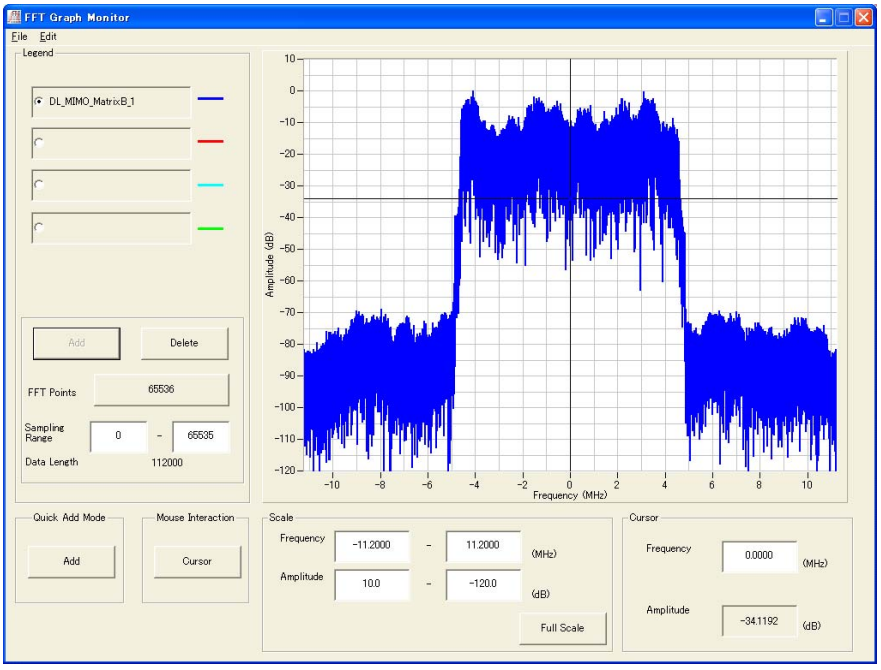

Figure 3.3.5-13 Spectrum (Rx Antenna 1)

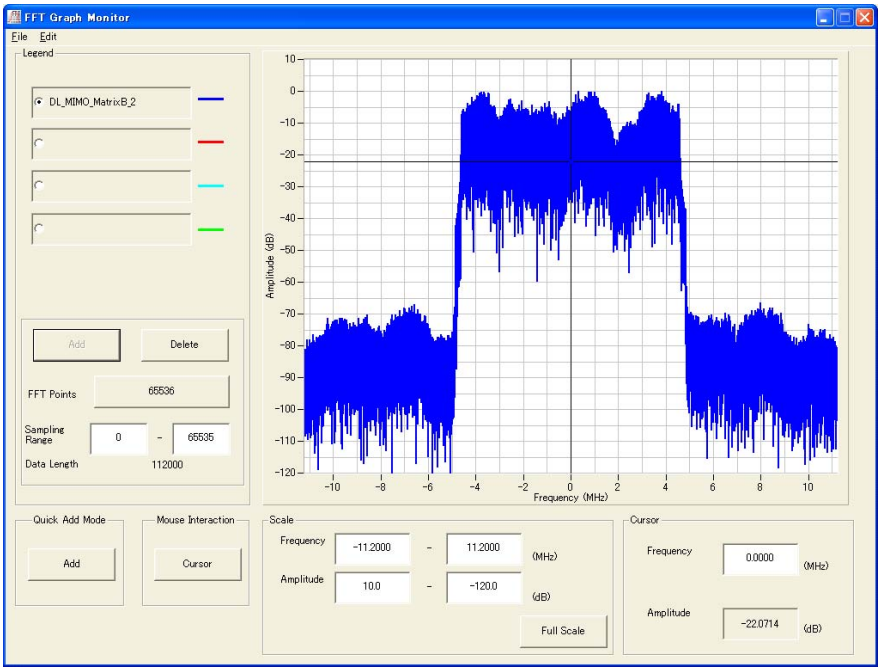

Figure 3.3.5-14 Spectrum (Rx Antenna 2)

3.4 Displaying Graph

The generated waveform pattern can be displayed in a CCDF or FFT graph by using this software. Refer to Sections 4.3 “CCDF Graph Display” and 4.4 “FFT Graph Display” in the MG3700A/MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (IQproducer™) for details on displaying graphs.

Displaying CCDF graph

1. Generate a Fading waveform pattern by executing “Calculation.”
2. Select **[CCDF]** from the **[Simulation]** menu or click the  tool button. The CCDF Graph Monitor screen shown in Figure 3.4-1 is displayed with the trace of the generated waveform pattern.

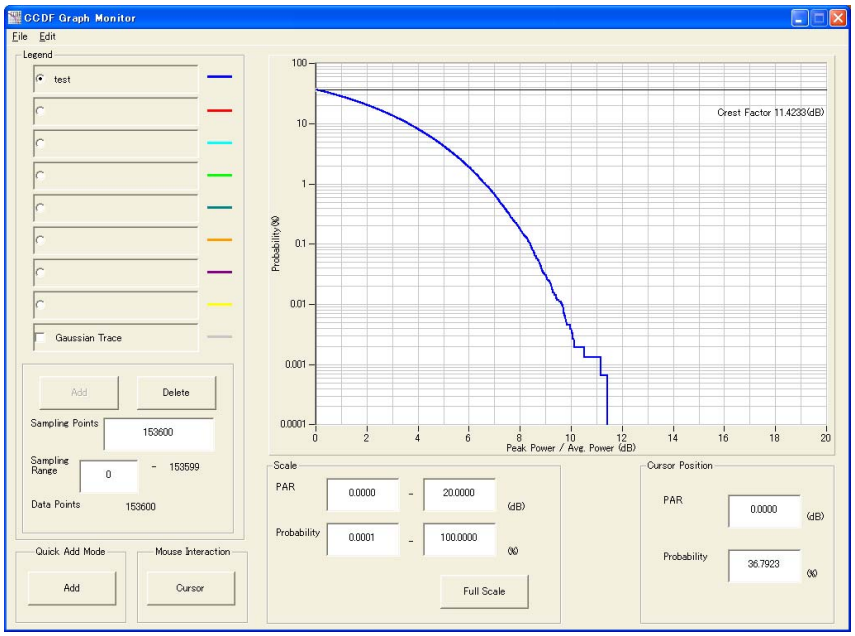

Figure 3.4-1 CCDF Graph Monitor screen

When a waveform pattern is generated by changing parameters and executing “Calculation” while other traces are displayed in the CCDF 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:

A CCDF graph and an FFT graph cannot be generated at the same time. When both graphs are to be displayed, complete one graph generation before generating the other graph.

■ 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 Monitor screen.
2. Select **[CCDF]** from the **[Simulation]** menu or click the  tool button. The trace of the waveform pattern newly generated is additionally displayed in the CCDF Graph Monitor 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 Monitor screen.
2. Select **[CCDF]** from the **[Simulation]** menu or click the  tool button. The confirmation message shown in Figure 3.4-2 below appears:

Figure 3.4-2 Confirmation message

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

Displaying FFT graph

1. Generate a Fading waveform pattern by executing “Calculation”.
2. Select **[FFT]** from the **[Simulation]** menu or click the  tool button. The FFT Graph Monitor screen shown in Figure 3.4-3 is displayed with the trace of the generated waveform pattern.

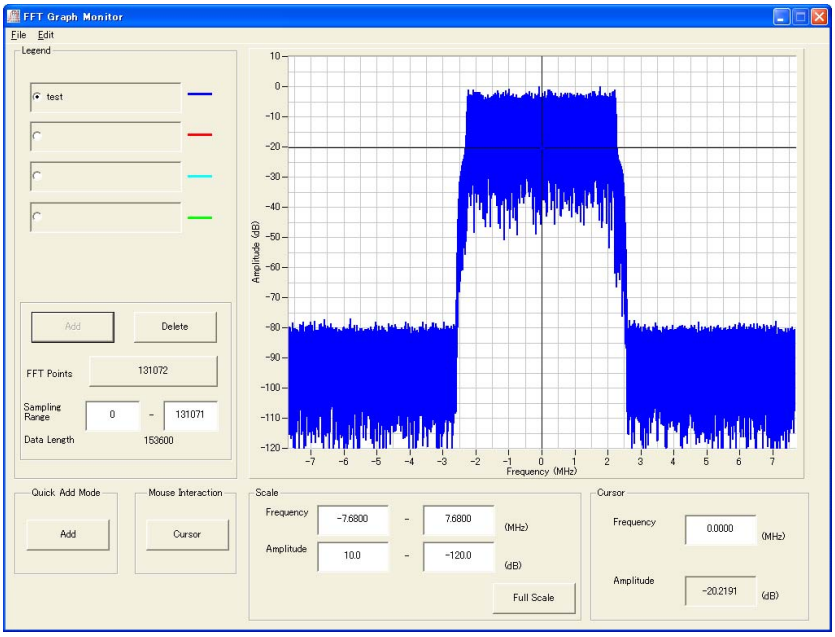

Figure 3.4-3 FFT Graph Monitor screen

When a waveform pattern is generated by changing parameters and executing “Calculation” while other traces are displayed in the FFT 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:

A CCDF graph and an FFT graph cannot be generated at the same time. When both graphs are to be displayed, complete one graph generation before generating the other graph.

■ 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 Monitor 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 Monitor 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 Monitor screen.
2. Select **[FFT]** from the **[Simulation]** menu or click the  tool button. The confirmation message shown in Figure 3.4-4 below appears:

Figure 3.4-4 Confirmation message

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

3.5 Marker Output

This software sets the marker as follows.

- 1 × 1 SISO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern.

- 1 × 2 SIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to Rx Antenna1 and Rx Antenna2 waveform patterns.

- 1 × 3 SIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to Rx Antenna1 to Rx Antenna3 waveform patterns.

- 1 × 4 SIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to Rx Antenna1 to Rx Antenna4 waveform patterns.

- 2 × 1 MISO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern.

- 2 × 2 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern.

- 2 × 3 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 and Rx Antenna3 waveform patterns.

- 2 × 4 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 and Rx Antenna2 waveform patterns, and the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna3 and Rx Antenna4 waveform patterns.

- 3 × 1 MISO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern.

- 3 × 2 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern.

- 3 × 3 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna3 is output to the Rx Antenna3 waveform pattern.

- 3 × 4 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna3 is output to the Rx Antenna3 and Rx Antenna4 waveform patterns.

- 4 × 1 MISO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern.

- 4 × 2 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern.

- 4 × 3 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna3 is output to the Rx Antenna3 waveform pattern.

- 4 × 4 MIMO configuration
  The marker signal of the waveform pattern set for Tx Antenna1 is output to the Rx Antenna1 waveform pattern, the marker signal of the waveform pattern set for Tx Antenna2 is output to the Rx Antenna2 waveform pattern, the marker signal of the waveform pattern set for Tx Antenna3 is output to the Rx Antenna3 waveform pattern, and the marker signal of the waveform pattern set for Tx Antenna4 is output to the Rx Antenna4 waveform pattern.

For the marker set in Pattern Sync Marker on the Marker Setting window, the marker signal is overwritten and output to the head of the waveform pattern as shown in Figure 3.5-1.

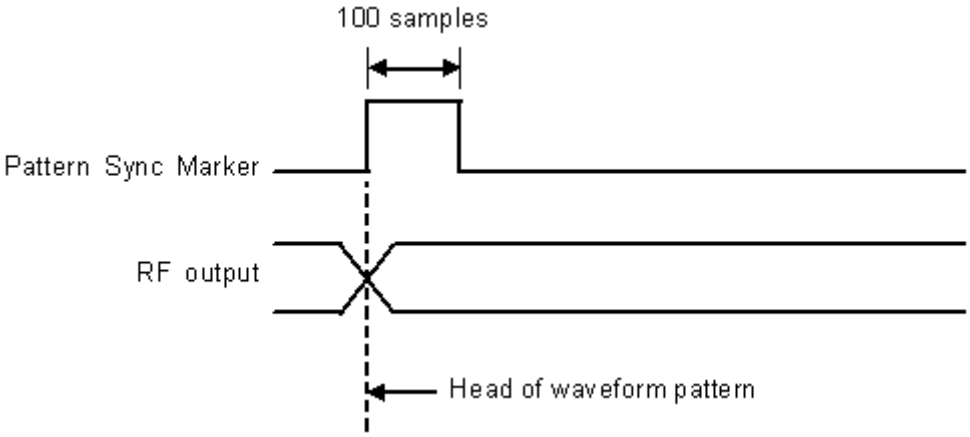

Figure 3.5-1 Pattern Sync Marker signal and RF output

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 4-2
4.1.1 Transferring waveform pattern to internal hard disk 4-2
4.1.2 Loading to Waveform Memory 4-4
4.1.3 Selecting Waveform Pattern..... 4-5

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/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 MG3740A Analog Signal GeneratorOperation 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)”.

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 GeneratorOperation 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™

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/MG3740A 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™

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™).

Appendix A Error Messages

A list of error messages is shown below. In this list, *x*, n_1, and n_2 indicate a numeric value, and *s* indicates a character string.

Table A-1 Error messages

Error Message	Description
The Setting value is out of range.("*s* = *x*(n_1 – n_2)")	The value of *x* set in parameter *s* is out of the setting range between n_1 and n_2.
Cannot write file	Data cannot be written to the file.
Cannot read file	The file cannot be read.
Cannot open file.	The file cannot be opend.
Cannot write file("*s*").	Data cannot be written to file *s*.
Input File is not found("*s*").	File *s* cannot be found.
Invalid file format.	The file format is invalid.
Invalid file format. (*s*)	The format of file *s* is invalid.
Input Package Name.	Input a package name.
Input Export File Name.	Input an export file name.
Input File is not selected.	An input file has not been selected.
Cannot calculate because all paths are disable in some channels.	Calculation cannot be done because there is a channel with all its paths disabled.
Wrong pattern license.	The license for the waveform pattern selected is invalid.
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.
Sampling Rate is mismatch.	The sampling rate of the waveform pattern set in Tx Antenna do not match.
Data Points is mismatch.	The number of data points of the waveform pattern set in Tx Antenna do not match.
Spectrum is mismatch.	The waveform spectrum set in Tx Antenna does not match.
This pattern cannot use. Because "Internal FIR" is used.	Calculation cannot be done because "Internal FIR" is used in the selected pattern file.
The number of samples is over 256M samples.	The waveform pattern size after generation is over 256 Msamples.
The number of samples is over 512M samples.	The waveform pattern size after generation is over 512 M samples.
Not enough hard disk space.	—

A list of warning messages is shown below.

Table A-2 Warning messages

Warning Message	Description
Input waveform pattern include some licensed patterns.	A waveform pattern that requires a license has been selected.
Clipping was done.	The clipping has been completed.
n_1 samples were clipped.	n_1 sample(s) have been clipped.
If you change Input File Format, the file information currently opened will be discarded. Are you sure to change Input File Format?	Current information will be lost if the input file format is changed. Are you sure you want to change the input file format?

Appendix B Fading Profile Details

Table B-1 GSM [1]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Rural Area 6 tap (Moving Speed = 130 km/h Rician K factor = 6.89 dB Angle of Arrival = 45 deg)	1	Rice	0.0	0.0
	2	Rayleigh	0.1	–4.0
	3	Rayleigh	0.2	–8.0
	4	Rayleigh	0.3	–12.0
	5	Rayleigh	0.4	–16.0
	6	Rayleigh	0.5	–20.0
Rural Area 4 tap (Moving Speed = 130 km/h Rician K factor = 8.26 dB Angle of Arrival = 45 deg)	1	Rice	0.0	0.0
	2	Rayleigh	0.2	–2.0
	3	Rayleigh	0.4	–10.0
	4	Rayleigh	0.6	–20.0
Hilly Terrain 12 tap-1 (Moving Speed 100 = km/h)	1	Rayleigh	0.0	–10.0
	2	Rayleigh	0.1	–8.0
	3	Rayleigh	0.3	–6.0
	4	Rayleigh	0.5	–4.0
	5	Rayleigh	0.7	0.0
	6	Rayleigh	1.0	0.0
	7	Rayleigh	1.3	–4.0
	8	Rayleigh	15.0	–8.0
	9	Rayleigh	15.2	–9.0
	10	Rayleigh	15.7	–10.0
	11	Rayleigh	17.2	–12.0
	12	Rayleigh	20.0	–14.0
Hilly Terrain 12 tap-2 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	–10.0
	2	Rayleigh	0.2	–8.0
	3	Rayleigh	0.4	–6.0
	4	Rayleigh	0.6	–4.0
	5	Rayleigh	0.8	0.0
	6	Rayleigh	2.0	0.0
	7	Rayleigh	2.4	–4.0
	8	Rayleigh	15.0	–8.0
	9	Rayleigh	15.2	–9.0
	10	Rayleigh	15.8	–10.0
	11	Rayleigh	17.2	–12.0
	12	Rayleigh	20.0	–14.0
Hilly Terrain 6 tap-1 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.1	–1.5
	3	Rayleigh	0.3	–4.5
	4	Rayleigh	0.5	–7.5
	5	Rayleigh	15.0	–8.0
	6	Rayleigh	17.2	–17.7

Table B-1 GSM [1] (Cont'd)

Fading Profile	Path	Type	Delay [us]	Power [dB]
Hilly Terrain 6 tap-2 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.2	–2.0
	3	Rayleigh	0.4	–4.0
	4	Rayleigh	0.6	–7.0
	5	Rayleigh	15.0	–6.0
	6	Rayleigh	17.2	–12.0
Urban Area 12 tap-1 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	–4.0
	2	Rayleigh	0.1	–3.0
	3	Rayleigh	0.3	0.0
	4	Rayleigh	0.5	–2.6
	5	Rayleigh	0.8	–3.0
	6	Rayleigh	1.1	–5.0
	7	Rayleigh	1.3	–7.0
	8	Rayleigh	1.7	–5.0
	9	Rayleigh	2.3	–6.5
	10	Rayleigh	3.1	–8.6
	11	Rayleigh	3.2	–11.0
	12	Rayleigh	5.0	–10.0
Urban Area 12 tap-2 (Moving Speed = 100 km)	1	Rayleigh	0.0	–4.0
	2	Rayleigh	0.2	–3.0
	3	Rayleigh	0.4	0.0
	4	Rayleigh	0.6	–2.0
	5	Rayleigh	0.8	–3.0
	6	Rayleigh	1.2	–5.0
	7	Rayleigh	1.4	–7.0
	8	Rayleigh	1.8	–5.0
	9	Rayleigh	2.4	–6.0
	10	Rayleigh	3.0	–9.0
	11	Rayleigh	3.2	–11.0
	12	Rayleigh	5.0	–10.0
Urban Area 6 tap-1 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	–3.0
	2	Rayleigh	0.2	0.0
	3	Rayleigh	0.5	–2.0
	4	Rayleigh	1.6	–6.0
	5	Rayleigh	2.3	–8.0
	6	Rayleigh	5.0	–10.0
Urban Area 6 tap-2 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	–3.0
	2	Rayleigh	0.2	0.0
	3	Rayleigh	0.6	–2.0
	4	Rayleigh	1.6	–6.0
	5	Rayleigh	2.4	–8.0
	6	Rayleigh	5.0	–10.0

Table B-1 GSM [1] (Cont'd)

Fading Profile	Path	Type	Delay [us]	Power [dB]
Equalization Test 6 tap (Moving Speed = 100 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	3.2	0.0
	3	Rayleigh	6.4	0.0
	4	Rayleigh	9.6	0.0
	5	Rayleigh	12.8	0.0
	6	Rayleigh	16.0	0.0
Typical small cell 2 tap (Moving Speed = 5 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.4	0.0

Table B-2 W-CDMA (MS) [2]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case 1 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
Case 2 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	0.0
	3	Rayleigh	20	0.0
Case 3 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h) 166 km/h (Moving Speed = 166 km/h) 282 km/h (Moving Speed = 282 km/h) 320 km/h (Moving Speed = 320 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Case 4 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	0.0
Case 5 38 km/h (Moving Speed = 38 km/h) 50 km/h (Moving Speed = 50 km/h) 69 km/h (Moving Speed = 69 km/h) 118 km/h (Moving Speed = 118 km/h) 133 km/h (Moving Speed = 133 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
Case 6 192 km/h (Moving Speed = 192 km/h) 250 km/h (Moving Speed = 250 km/h) 345 km/h (Moving Speed = 345 km/h) 583 km/h (Moving Speed = 583 km/h) 688 km/h (Moving Speed = 688 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Moving propagation Birth-Death propagation High Speed Train	Refer to Sections 3.1.4 “Moving Propagation tab window,” 3.1.5 “Birth-Death Propagation tab window,” and 3.1.6 “High Speed Train tab window.”			

Table B-3 W-CDMA (BS) [3]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case1 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
Case2 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	0.0
	3	Rayleigh	20	0.0
Case3 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h) 166 km/h (Moving Speed = 166 km/h) 280 km/h (Moving Speed = 280 km/h) 320 km/h (Moving Speed = 320 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Case4 192 km/h (Moving Speed = 192 km/h) 250 km/h (Moving Speed = 250 km/h) 345 km/h (Moving Speed = 345 km/h) 583 km/h (Moving Speed = 583 km/h) 668 km/h (Moving Speed = 668 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.260	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Moving propagation Birth-Death propagation High Speed Train	Refer to Sections 3.1.4 “Moving Propagation tab window,” 3.1.5 “Birth-Death Propagation tab window,” and 3.1.6 “High Speed Train tab window.”			

Table B-4 HSDPA [2]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case1 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
Case2 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	0.0
	3	Rayleigh	20	0.0
Case3 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h) 166 km/h (Moving Speed = 166 km/h) 282 km/h (Moving Speed = 282 km/h) 320 km/h (Moving Speed = 320 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Case4 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	0.0
Case5 38 km/h (Moving Speed = 38 km/h) 50 km/h (Moving Speed = 50 km/h) 69 km/h (Moving Speed = 69 km/h) 118 km/h (Moving Speed = 118 km/h) 133 km/h (Moving Speed = 133 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
Case6 192 km/h (Moving Speed = 192 km/h) 250 km/h (Moving Speed = 250 km/h) 345 km/h (Moving Speed = 345 km/h) 583 km/h (Moving Speed = 583 km/h) 688 km/h (Moving Speed = 688 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Case8 23 km/h (Moving Speed = 23 km/h) 30 km/h (Moving Speed = 30 km/h) 41 km/h (Moving Speed = 41 km/h) 71 km/h (Moving Speed = 71 km/h) 80 km/h (Moving Speed = 80 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
ITU Pedestrian A 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.11	–9.7
	3	Rayleigh	0.19	–19.2
	4	Rayleigh	0.41	–22.8

Table B-4 HSDPA [2] (Continued)

Fading Profile	Path	Type	Delay [us]	Power [dB]
ITU Pedestrian B 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.2	–0.9
	3	Rayleigh	0.8	–4.9
	4	Rayleigh	1.2	–8.0
	5	Rayleigh	2.3	–7.8
	6	Rayleigh	3.7	–23.9
ITU Vehicular A 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 23 km/h (Moving Speed = 23 km/h) 30 km/h (Moving Speed = 30 km/h) 41 km/h (Moving Speed = 41 km/h) 71 km/h (Moving Speed = 71 km/h) 80 km/h (Moving Speed = 80 km/h) 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h) 166 km/h (Moving Speed = 166 km/h) 282 km/h (Moving Speed = 282 km/h) 320 km/h (Moving Speed = 320 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.31	–1.0
	3	Rayleigh	0.71	–9.0
	4	Rayleigh	1.09	–10.0
	5	Rayleigh	1.73	–15.0
	6	Rayleigh	2.51	–20.0

Table B-5 HSUPA [3]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case1 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	–10.0
Case2 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.976	0.0
	3	Rayleigh	20	0.0
Case3 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h) 166 km/h (Moving Speed = 166 km/h) 280 km/h (Moving Speed = 280 km/h) 320 km/h (Moving Speed = 320 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
Case4 192 km/h (Moving Speed = 192 km/h) 250 km/h (Moving Speed = 250 km/h) 345 km/h (Moving Speed = 345 km/h) 583 km/h (Moving Speed = 583 km/h) 668 km/h (Moving Speed = 668 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.26	–3.0
	3	Rayleigh	0.521	–6.0
	4	Rayleigh	0.781	–9.0
ITU Pedestrian A 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.11	–9.7
	3	Rayleigh	0.19	–19.2
	4	Rayleigh	0.41	–22.8
ITU Pedestrian B 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h) 4.1 km/h (Moving Speed = 4.1 km/h) 7 km/h (Moving Speed = 7 km/h) 8 km/h (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.2	–0.9
	3	Rayleigh	0.8	–4.9
	4	Rayleigh	1.2	–8.0
	5	Rayleigh	2.3	–7.8
	6	Rayleigh	3.7	–23.9
ITU Vehicular A 23 km/h (Moving Speed = 23 km/h) 30 km/h (Moving Speed = 30 km/h) 41 km/h (Moving Speed = 41 km/h) 71 km/h (Moving Speed = 71 km/h) 80 km/h (Moving Speed = 80 km/h) 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h) 166 km/h (Moving Speed = 166 km/h) 282 km/h (Moving Speed = 282 km/h) 320 km/h (Moving Speed = 320 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.31	–1.0
	3	Rayleigh	0.71	–9.0
	4	Rayleigh	1.09	–10.0
	5	Rayleigh	1.73	–15.0
	6	Rayleigh	2.51	–20.0

Table B-6 CDMA2000 (MS) [4]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case 1 (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
Case 2 14 km/h (Moving Speed = 14 km/h) 30 km/h (Moving Speed = 30 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
Case 3 (Moving Speed = 30 km/h)	1	Rayleigh	0.0	0.0
Case 4 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
	3	Rayleigh	14.5	–3.0
Case 5 (Moving Speed = 0 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
Case 6 (Moving Speed = 3 km/h)	1	Rayleigh	0.0	0.0

Table B-7 CDMA2000 (BS) [5]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case 1 (Moving Speed = 3 km/h)	1	Rayleigh	0.0	0.0
Case 2 (Moving Speed = 8 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
Case 3 (Moving Speed = 30 km/h)	1	Rayleigh	0.0	0.0
Case 4 (Moving Speed = 100 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
	3	Rayleigh	14.5	–3.0

Table B-8 TD-SCDMA [6]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Case 1 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.928	–10.0
Case 2 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.928	0.0
	3	Rayleigh	12.0	0.0
Case 3 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.781	–3.0
	3	Rayleigh	1.563	–6.0
	4	Rayleigh	2.344	–9.0
ITU Pedestrian A 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.11	–9.7
	3	Rayleigh	0.19	–19.2
	4	Rayleigh	0.41	–22.8
ITU Pedestrian B 2.3 km/h (Moving Speed = 2.3 km/h) 3 km/h (Moving Speed = 3 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.2	–0.9
	3	Rayleigh	0.8	–4.9
	4	Rayleigh	1.2	–8.0
	5	Rayleigh	2.3	–7.8
	6	Rayleigh	3.7	–23.9
ITU Vehicular A 23 km/h (Moving Speed = 23 km/h) 30 km/h (Moving Speed = 30 km/h) 92 km/h (Moving Speed = 92 km/h) 120 km/h (Moving Speed = 120 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.31	–1.0
	3	Rayleigh	0.71	–9.0
	4	Rayleigh	1.09	–10.0
	5	Rayleigh	1.73	–15.0
	6	Rayleigh	2.51	–20.0

Table B-9 1xEVDO [7]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Configuration 1 8 km/h (Moving Speed = 8 km/h) 15 km/h (Moving Speed = 15 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
Configuration 2 3 km/h (Moving Speed = 3 km/h) 6 km/h (Moving Speed = 6 km/h)	1	Rayleigh	0.0	0.0
Configuration 3 30 km/h (Moving Speed = 30 km/h) 58 km/h (Moving Speed = 58 km/h)	1	Rayleigh	0.0	0.0
Configuration 4 100 km/h (Moving Speed = 100 km/h) 192 km/h (Moving Speed = 192 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	0.0
	3	Rayleigh	14.5	–3.0
Configuration 5 (Moving Speed = 0 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	2.0	–0.0

Table B-10 WLAN [8]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Model A (Moving Speed = 10.8 km/h)	1	Rayleigh	0.000	0.0
	2	Rayleigh	0.010	–0.9
	3	Rayleigh	0.020	–1.7
	4	Rayleigh	0.030	–2.6
	5	Rayleigh	0.040	–3.5
	6	Rayleigh	0.050	–4.3
	7	Rayleigh	0.060	–5.2
	8	Rayleigh	0.070	–6.1
	9	Rayleigh	0.080	–6.9
	10	Rayleigh	0.090	–7.8
	11	Rayleigh	0.110	–4.7
	12	Rayleigh	0.140	–7.3
	13	Rayleigh	0.170	–9.9
	14	Rayleigh	0.200	–12.5
	15	Rayleigh	0.240	–13.7
	16	Rayleigh	0.290	–18.0
	17	Rayleigh	0.340	–22.4
	18	Rayleigh	0.390	–26.7
Model B (Moving Speed = 10.8 km/h)	1	Rayleigh	0.000	–2.6
	2	Rayleigh	0.010	–3.0
	3	Rayleigh	0.020	–3.5
	4	Rayleigh	0.030	–3.9
	5	Rayleigh	0.050	0.0
	6	Rayleigh	0.080	–1.3
	7	Rayleigh	0.110	–2.6
	8	Rayleigh	0.140	–3.9
	9	Rayleigh	0.180	–3.4
	10	Rayleigh	0.230	–5.6
	11	Rayleigh	0.280	–7.7
	12	Rayleigh	0.330	–9.9
	13	Rayleigh	0.380	–12.1
	14	Rayleigh	0.430	–14.3
	15	Rayleigh	0.490	–15.4
	16	Rayleigh	0.560	–18.4
	17	Rayleigh	0.640	–20.7
	18	Rayleigh	0.730	–24.6

Table B-10 WLAN [8] (Cont'd)

Fading Profile	Path	Type	Delay [us]	Power [dB]
Model C (Moving Speed = 10.8 km/h)	1	Rayleigh	0.000	–3.3
	2	Rayleigh	0.010	–3.6
	3	Rayleigh	0.020	–3.9
	4	Rayleigh	0.030	–4.2
	5	Rayleigh	0.050	0.0
	6	Rayleigh	0.080	–0.9
	7	Rayleigh	0.110	–1.7
	8	Rayleigh	0.140	–2.6
	9	Rayleigh	0.180	–1.5
	10	Rayleigh	0.230	–3.0
	11	Rayleigh	0.280	–4.4
	12	Rayleigh	0.330	–5.9
	13	Rayleigh	0.400	–5.3
	14	Rayleigh	0.490	–7.9
	15	Rayleigh	0.600	–9.4
	16	Rayleigh	0.730	–13.2
	17	Rayleigh	0.880	–16.3
	18	Rayleigh	1.050	–21.2
Model D (Moving Speed = 10.8 km/h)	1	Rayleigh	0.000	0.0
	2	Rayleigh	0.010	–10.0
	3	Rayleigh	0.020	–10.3
	4	Rayleigh	0.030	–10.6
	5	Rayleigh	0.050	–6.4
	6	Rayleigh	0.080	–7.2
	7	Rayleigh	0.110	–8.1
	8	Rayleigh	0.140	–9.0
	9	Rayleigh	0.180	–7.9
	10	Rayleigh	0.230	–9.4
	11	Rayleigh	0.280	–10.8
	12	Rayleigh	0.330	–12.3
	13	Rayleigh	0.400	–11.7
	14	Rayleigh	0.490	–14.3
	15	Rayleigh	0.600	–15.8
	16	Rayleigh	0.730	–19.6
	17	Rayleigh	0.880	–22.7
	18	Rayleigh	1.050	–27.6

Table B-10 WLAN [8] (Cont'd)

Fading Profile	Path	Type	Delay [us]	Power [dB]
Model E (Moving Speed = 10.8 km/h)	1	Rayleigh	0.000	–4.9
	2	Rayleigh	0.010	–5.1
	3	Rayleigh	0.020	–5.2
	4	Rayleigh	0.040	–0.8
	5	Rayleigh	0.070	–1.3
	6	Rayleigh	0.100	–1.9
	7	Rayleigh	0.140	–0.3
	8	Rayleigh	0.190	–1.2
	9	Rayleigh	0.240	–2.1
	10	Rayleigh	0.320	0.0
	11	Rayleigh	0.430	–1.9
	12	Rayleigh	0.560	–2.8
	13	Rayleigh	0.710	–5.4
	14	Rayleigh	0.880	–7.3
	15	Rayleigh	1.070	–10.6
	16	Rayleigh	1.280	–13.4
	17	Rayleigh	1.510	–17.4
	18	Rayleigh	1.760	–20.9

Table B-11 Mobile WiMAX [9]

Fading Profile	Path	Type	Delay [us]	Power [dB]
ITU Pedestrian B (Moving Speed 3 = km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.2	–0.9
	3	Rayleigh	0.8	–4.9
	4	Rayleigh	1.2	–8.0
	5	Rayleigh	2.3	–7.8
	6	Rayleigh	3.7	–23.9
ITU Vehicular A (Moving Speed = 60 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.31	–1.0
	3	Rayleigh	0.71	–9.0
	4	Rayleigh	1.09	–10.0
	5	Rayleigh	1.73	–15.0
	6	Rayleigh	2.51	–20.0
Large delay spread channel (Moving Speed = 120 km/h)	1	Rayleigh	0.0	0.0
	2	Rayleigh	0.31	–1.0
	3	Rayleigh	0.71	–9.0
	4	Rayleigh	1.09	–10.0
	5	Rayleigh	1.73	–15.0
	6	Rayleigh	10.0	–20.0

Table B-12 2 × 2 MIMO Mobile WiMAX [9]

Correlation Matrix (2 × 2 MIMO) ITU Pedestrian B 3km/h					
High correlation	Path 1	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.1468 + 0.4156i	0.0303 + 0.7064i	–0.298 – 0.09111i
	Channel 2	–0.1468 – 0.4156i	1.00000	0.28913 – 0.11629i	0.0303 + 0.7064i
	Channel 3	0.0303 – 0.7064i	0.28913 + 0.11629i	1.00000	–0.1468 + 0.4156i
	Channel 4	–0.29803 + 0.09111i	0.0303 – 0.7064i	–0.1468 – 0.4156i	1.00000
	Path 2	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.4467 + 0.4227i	–0.4007 – 0.6073i	0.4357 + 0.10191i
	Channel 2	–0.4467 – 0.4227i	1.00000	–0.07771 – 0.44066i	–0.4007 – 0.6073i
	Channel 3	–0.4007 + 0.6073i	–0.07771 – 0.44066i	1.00000	–0.4467 + 0.4227i
	Channel 4	0.4357 – 0.10191i	–0.4007 + 0.6073i	–0.4467 – 0.4227i	1.00000
	Path 3	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.2906 + 0.4347i	–0.6664 + 0.262i	0.07976 – 0.36582i
	Channel 2	–0.2906 – 0.4347i	1.00000	0.30755 + 0.21355i	–0.6664 + 0.262i
	Channel 3	–0.6664 – 0.262i	0.30755 – 0.21355i	1.00000	–0.2906 + 0.4347i
	Channel 4	0.07976 + 0.36582i	–0.6664 – 0.262i	–0.2906 – 0.4347i	1.00000
	Path 4	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.4273 + 0.4259i	–0.6522 + 0.2088i	0.18976 – 0.367i
	Channel 2	–0.4273 – 0.4259i	1.00000	0.36761 + 0.18855i	–0.6522 + 0.2088i
	Channel 3	–0.6522 – 0.2088i	0.36761 – 0.18855i	1.00000	–0.4273 + 0.4259i
	Channel 4	0.18976 + 0.367i	–0.6522 – 0.2088i	–0.4273 – 0.4259i	1.00000
	Path 5	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.7026 – 0.3395i	–0.5378 – 0.4866i	0.21266 + 0.52447i
	Channel 2	–0.7026 + 0.3395i	1.00000	0.54306 + 0.1593i	–0.5378 – 0.4866i
	Channel 3	–0.5378 + 0.4866i	0.54306 – 0.1593i	1.00000	–0.7026 – 0.3395i
	Channel 4	0.21266 – 0.52447i	–0.5378 + 0.4866i	–0.7026 + 0.3395i	1.00000
	Path 6	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.45 + 0.4222 i	–0.4564 – 0.5655i	0.44413 + 0.06178i
	Channel 2	–0.45 – 0.422i	1.00000	–0.03337 + 0.44717i	–0.4564 – 0.5655i
	Channel 3	–0.4564 + 0.5655i	–0.03337 – 0.44717i	1.00000	–0.45 + 0.4222i
	Channel 4	0.44413 – 0.06178i	–0.4564 + 0.5655i	–0.45 – 0.4222i	1.00000

Table B-12 2 × 2 MIMO Mobile WiMAX [9] (Cont'd)

Correlation Matrix (2 × 2 MIMO) ITU Pedestrian B 3km/h					
Medium correlation	Path 1 to Path 6	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	0.7264	0.00000
	Channel 2	0.00000	1.00000	0.00000	–0.7264
	Channel 3	0.7264	0.00000	1.00000	0.00000
	Channel 4	0.00000	–0.7264	0.00000	1.00000
Low correlation	Path 1	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	0.02201 + 0.51313i	0.00000
	Channel 2	0.00000	1.00000	0.0000	–0.02201 – 0.51313i
	Channel 3	0.02201 – 0.51313i	0.00000	1.00000	0.00000
	Channel 4	0.00000	–0.02201 + 0.51313i	0.00000	1.00000
	Path 2	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.0000	0.0000	–0.29107 – 0.44114i	0.0000
	Channel 2	0.0000	1.0000	0.0000	0.29107 + 0.44114i
	Channel 3	–0.29107 + 0.44114i	0.0000	1.0000	0.0000
	Channel 4	0.0000	0.29107 – 0.44114i	0.0000	1.0000
	Path 3	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	–0.48407 + 0.19032i	0.00000
	Channel 2	0.00000	1.00000	0.00000	0.48407 – 0.19032i
	Channel 3	–0.48407 – 0.19032i	0.00000	1.00000	0.00000
	Channel 4	0.00000	0.48407 + 0.19032i	0.00000	1.00000
	Path 4	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	–0.47376 + 0.15167i	0.00000
	Channel 2	0.00000	1.00000	0.00000	0.47376 – 0.15167i
	Channel 3	–0.47376 – 0.15167i	0.00000	1.00000	0.00000
	Channel 4	0.00000	0.47376 + 0.15167i	0.00000	1.00000
	Path 5	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	–0.39066 – 0.35347i	0.00000
	Channel 2	0.00000	1.00000	0.00000	0.39066 + 0.35347i
	Channel 3	–0.39066 + 0.35347i	0.00000	1.00000	0.00000
	Channel 4	0.00000	0.39066 – 0.35347i	0.00000	1.00000
	Path 6	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	–0.33153 – 0.41078i	0.00000
	Channel 2	0.00000	1.00000	0.00000	0.33153 + 0.41078i
	Channel 3	–0.33153 + 0.41078i	0.00000	1.00000	0.00000
	Channel 4	0.00000	0.33153 – 0.41078i	0.00000	1.00000

Table B-12 2 × 2 MIMO Mobile WiMAX [9] (Cont'd)

Correlation Matrix (2 × 2 MIMO) ITU Vehicular A 60km/h, Large delay spread channel					
High correlation	Path 1	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.2366 + 0.4312i	0.6883 + 0.1211i	–0.21507 – 0.26814i
	Channel 2	–0.2366 – 0.4312i	1.00000	–0.11063 – 0.32544i	0.6883 + 0.1211i
	Channel 3	0.6883 – 0.1211i	–0.11063 + 0.32544i	1.00000	–0.2366 + 0.4312i
	Channel 4	–0.21507 + 0.26814i	0.6883 – 0.1211i	–0.2366 – 0.4312i	1.00000
	Path 2	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.1388 + 0.2343i	–0.3508 – 0.5926i	0.09016 + 0.16445i
	Channel 2	0.1388 – 0.2343i	1.00000	–0.1875 – 0.00006i	–0.3508 – 0.5926i
	Channel 3	–0.3508 + 0.5926i	–0.18754 + 0.00006i	1.00000	0.1388 + 0.2343i
	Channel 4	0.09016 + 0.16445i	–0.3508 + 0.5926i	0.1388 – 0.2343i	1.00000
	Path 3	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.6443 + 0.365i	0.3884 – 0.5604i	–0.0457 + 0.50283i
	Channel 2	–0.6443 – 0.365i	1.00000	–0.45479 + 0.2193i	0.3884 – 0.5604i
	Channel 3	0.3884 + 0.5604i	–0.45479 – 0.2193i	1.00000	–0.6443 + 0.365i
	Channel 4	–0.0457 – 0.50283i	0.3884 + 0.5604i	–0.6443 – 0.365i	1.00000
	Path 4	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.362 + 0.4331i	0.1899 + 0.6795i	–0.36304 – 0.16373i
	Channel 2	–0.362 – 0.4331i	1.00000	0.22555 – 0.32823i	0.1899 + 0.6795i
	Channel 3	0.1899 – 0.6795i	0.22555 + 0.32823i	1.00000	–0.362 + 0.4331i
	Channel 4	–0.36304 + 0.16373i	0.1899 – 0.6795i	–0.362 – 0.4331i	1.00000
	Path 5	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.7074 + 0.3372i	–0.3933 – 0.565i	0.46874 + 0.26706i
	Channel 2	–0.7074 – 0.3372i	1.00000	0.0877 + 0.5323i	–0.3933 – 0.565i
	Channel 3	–0.3933 + 0.565i	0.0877 – 0.5323i	1.00000	–0.7074 + 0.3372i
	Channel 4	0.46874 – 0.26706i	–0.3933 + 0.565i	–0.7074 – 0.3372i	1.00000
	Path 6	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	–0.4405 + 0.4238i	–0.4383 – 0.58i	0.43888 + 0.06974i
	Channel 2	–0.4405 – 0.4238i	1.00000	–0.05273 + 0.44124i	–0.4383 – 0.58i
	Channel 3	–0.4383 + 0.58i	–0.05273 – 0.44124i	1.00000	–0.4405 + 0.4238i
	Channel 4	0.43888 – 0.06974i	–0.4383 + 0.58i	–0.4405 – 0.4238i	1.00000

Table B-12 2 × 2 MIMO Mobile WiMAX (Cont'd)

Correlation Matrix (2 × 2 MIMO) ITU Vehicular A 60km/h, Large delay spread channel					
Medium correlation	Path 1 to Path 6	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	0.7264	0.00000
	Channel 2	0.00000	1.00000	0.00000	–0.7264
	Channel 3	0.7264	0.00000	1.00000	0.00000
	Channel 4	0.00000	–0.7264	0.00000	1.00000
Low correlation	Path 1	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	0.49998 + 0.08797i	0.00000
	Channel 2	0.00000	1.00000	0.00000	–0.49998 – 0.08797i
	Channel 3	0.49998 – 0.08797i	0.00000	1.00000	0.00000
	Channel 4	0.00000	–0.49998 + 0.08797i	0.00000	1.00000
	Path 2	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	–0.25482 – 0.43046i	0.00000
	Channel 2	0.00000	1.00000	0.00000	0.25482 + 0.43046i
	Channel 3	–0.25482 + 0.43046i	0.00000	1.00000	0.00000
	Channel 4	0.00000	0.25482 – 0.43046i	0.00000	1.00000
	Path 3	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	0.28213 – 0.40707i	0.00000
	Channel 2	0.00000	1.00000	0.00000	–0.28213 + 0.40707i
	Channel 3	0.28213 + 0.40707i	0.00000	1.00000	0.00000
	Channel 4	0.00000	–0.28213 – 0.40707i	0.00000	1.00000
	Path 4	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.0000	0.0000	0.13794 + 0.49359i	0.0000
	Channel 2	0.0000	1.0000	0.0000	–0.13794 – 0.49359i
	Channel 3	0.13794 – 0.49359i	0.0000	1.0000	0.0000
	Channel 4	0.0000	–0.13794 + 0.49359i	0.0000	1.0000
	Path 5	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.00000	0.00000	–0.28569 – 0.41042i	0.00000
	Channel 2	0.00000	1.00000	0.00000	0.28569 + 0.41042i
	Channel 3	–0.28569 + 0.41042i	0.00000	1.00000	0.00000
	Channel 4	0.00000	0.28569 – 0.41042i	0.00000	1.00000
	Path 6	Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.0000	0.0000	–0.31838 – 0.42131i	0.0000
	Channel 2	0.0000	1.0000	0.0000	0.31838 + 0.42131i
	Channel 3	–0.31838 + 0.42131i	0.0000	1.0000	0.0000
	Channel 4	0.0000	0.31838 – 0.42131i	0.0000	1.0000

Table B-13 DVB-T [10]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Typical Urban (TU6)	1	Rayleigh	0.0	–3.0
	2	Rayleigh	0.2	0.0
	3	Rayleigh	0.5	–2.0
	4	Rayleigh	1.6	–6.0
	5	Rayleigh	2.3	–8.0
	6	Rayleigh	5.0	–10.0
Typical Rural Area (RA6)	1	Rice	0.0	0.0
	2	Rayleigh	0.1	–4.0
	3	Rayleigh	0.2	–8.0
	4	Rayleigh	0.3	–12.0
	5	Rayleigh	0.4	–16.0
	6	Rayleigh	0.5	–20.0

Table B-14 LTE (MS)(BS) [11] [12]

Fading Profile	Path	Type	Delay [us]	Power [dB]
Extended Pedestrian A (EPA)	1	Rayleigh	0.00	0.0
	2	Rayleigh	0.03	–1.0
	3	Rayleigh	0.07	–2.0
	4	Rayleigh	0.09	–3.0
	5	Rayleigh	0.11	–8.0
	6	Rayleigh	0.19	–17.2
	7	Rayleigh	0.41	–20.8
Extended Vehicular A (EVA)	1	Rayleigh	0.00	0.0
	2	Rayleigh	0.03	–1.5
	3	Rayleigh	0.15	–1.4
	4	Rayleigh	0.31	–3.6
	5	Rayleigh	0.37	–0.6
	6	Rayleigh	0.71	–9.1
	7	Rayleigh	1.09	–7.0
	8	Rayleigh	1.73	–12.0
	9	Rayleigh	2.51	–16.9
Extended Typical Urban	1	Rayleigh	0.00	–1.0
	2	Rayleigh	0.05	–1.0
	3	Rayleigh	0.12	–1.0
	4	Rayleigh	0.20	0.0
	5	Rayleigh	0.23	0.0
	6	Rayleigh	0.50	0.0
	7	Rayleigh	1.6	–3.0
	8	Rayleigh	2.3	–5.0
	9	Rayleigh	5.0	–7.0
High Speed Train	Refer to 3.1.6 “High Speed Train tab window.”			

Table B-15 2 × 2 MIMO LTE [11] [12]

Correlation Matrix(1x2 SIMO)			
R_high		Channel 1	Channel 2
	Channel 1	1.0	0.9
	Channel 2	0.9	1.0
R_low		Channel 1	Channel 2
	Channel 1	1.0	0.0
	Channel 2	0.0	1.0

Table B-15 2 × 2 MIMO LTE [11] [12] (Cont'd)

Correlation Matrix (2 × 2 MIMO)					
R_high		Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.0	0.9	0.9	0.81
	Channel 2	0.9	1.0	0.81	0.9
	Channel 3	0.9	0.81	1.0	0.9
	Channel 4	0.81	0.9	0.9	1.0
R_medium		Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.0	0.9	0.3	0.27
	Channel 2	0.9	1.0	0.27	0.3
	Channel 3	0.3	0.27	1.0	0.9
	Channel 4	0.27	0.3	0.9	1.0
R_low		Channel 1	Channel 2	Channel 3	Channel 4
	Channel 1	1.0	0.0	0.0	0.0
	Channel 2	0.0	1.0	0.0	0.0
	Channel 3	0.0	0.0	1.0	0.0
	Channel 4	0.0	0.0	0.0	1.0

Table B-15 MIMO LTE [11][12] (Cont'd)

Correlation Matrix(4x2 MIMO)									
R_ high		Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	Ch1	1	0.8999	0.9883	0.8894	0.9542	0.8587	0.8999	0.8099
	Ch2	0.8999	1	0.8894	0.9883	0.8587	0.9542	0.8099	0.8999
	Ch3	0.9883	0.8894	1	0.8999	0.9883	0.8894	0.9542	0.8587
	Ch4	0.8894	0.9883	0.8999	1	0.8894	0.9883	0.8587	0.9542
	Ch5	0.9542	0.8587	0.9883	0.8894	1	0.8999	0.9883	0.8894
	Ch6	0.8587	0.9542	0.8894	0.9883	0.8999	1	0.8894	0.9883
	Ch7	0.8999	0.8099	0.9542	0.8587	0.9883	0.8894	1	0.8999
	Ch8	0.8099	0.8999	0.8587	0.9542	0.8894	0.9883	0.8999	1
R_me dium		Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	Ch1	1	0.9	0.8748	0.7873	0.5856	0.5271	0.3	0.27
	Ch2	0.9	1	0.7873	0.8748	0.5271	0.5856	0.27	0.3
	Ch3	0.8748	0.7873	1	0.9	0.8748	0.7873	0.5856	0.5271
	Ch4	0.7873	0.8748	0.9	1	0.7873	0.8748	0.5271	0.5856
	Ch5	0.5856	0.5271	0.8748	0.7873	1	0.9	0.8748	0.7873
	Ch6	0.5271	0.5856	0.7873	0.8748	0.9	1	0.7873	0.8748
	Ch7	0.3	0.27	0.5856	0.5271	0.8748	0.7873	1	0.9
	Ch8	0.27	0.3	0.5271	0.5856	0.7873	0.8748	0.9	1
R_low		Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	Ch1	1	0	0	0	0	0	0	0
	Ch2	0	1	0	0	0	0	0	0
	Ch3	0	0	1	0	0	0	0	0
	Ch4	0	0	0	1	0	0	0	0
	Ch5	0	0	0	0	1	0	0	0
	Ch6	0	0	0	0	0	1	0	0
	Ch7	0	0	0	0	0	0	1	0
	Ch8	0	0	0	0	0	0	0	1

Table B-15 MIMO LTE [11][12] (Cont'd)

Correlation Matrix(4x4 MIMO)									
R_ high		Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	Ch1	1	0.9882	0.9541	0.8999	0.9882	0.9767	0.943	0.8894
	Ch2	0.9882	1	0.9882	0.9541	0.9767	0.9882	0.9767	0.943
	Ch3	0.9541	0.9882	1	0.9882	0.943	0.9767	0.9882	0.9767
	Ch4	0.8999	0.9541	0.9882	1	0.8894	0.943	0.9767	0.9882
	Ch5	0.9882	0.9767	0.943	0.8894	1	0.9882	0.9541	0.8999
	Ch6	0.9767	0.9882	0.9767	0.943	0.9882	1	0.9882	0.9541
	Ch7	0.943	0.9767	0.9882	0.9767	0.9541	0.9882	1	0.9882
	Ch8	0.8894	0.943	0.9767	0.9882	0.8999	0.9541	0.9882	1
	Ch9	0.9541	0.943	0.9105	0.8587	0.9882	0.8999	0.9541	0.9882
	Ch10	0.943	0.9541	0.943	0.9105	0.9767	0.9882	0.9767	0.943
	Ch11	0.9105	0.943	0.9541	0.943	0.943	0.9767	0.9882	0.9767
	Ch12	0.8587	0.9105	0.943	0.9541	0.8894	0.943	0.9767	0.9882
	Ch13	0.8999	0.8894	0.8587	0.8099	0.9541	0.943	0.9105	0.8587
	Ch14	0.8894	0.8999	0.8894	0.8587	0.943	0.9541	0.943	0.9105
	Ch15	0.8587	0.8894	0.8999	0.8894	0.9105	0.943	0.9541	0.943
	Ch16	0.8099	0.8587	0.8894	0.8999	0.8587	0.9105	0.943	0.9541
		Ch9	Ch10	Ch11	Ch12	Ch13	Ch14	Ch15	Ch16
	Ch1	0.9541	0.943	0.9105	0.8587	0.8999	0.8894	0.8587	0.8099
	Ch2	0.943	0.9541	0.943	0.9105	0.8894	0.8999	0.8894	0.8587
	Ch3	0.9105	0.943	0.9541	0.943	0.8587	0.8894	0.8999	0.8894
	Ch4	0.8587	0.9105	0.943	0.9541	0.8099	0.8587	0.8894	0.8999
	Ch5	0.9882	0.9767	0.943	0.8894	0.9541	0.943	0.9105	0.8587
	Ch6	0.8999	0.9882	0.9767	0.943	0.943	0.9541	0.943	0.9105
	Ch7	0.9541	0.9767	0.9882	0.9767	0.9105	0.943	0.9541	0.943
	Ch8	0.9882	0.943	0.9767	0.9882	0.8587	0.9105	0.943	0.9541
	Ch9	1	0.9882	0.9541	0.8999	0.9882	0.9767	0.943	0.8894
	Ch10	0.9882	1	0.9882	0.9541	0.9767	0.9882	0.9767	0.943
	Ch11	0.9541	0.9882	1	0.9882	0.943	0.9767	0.9882	0.9767
	Ch12	0.8999	0.9541	0.9882	1	0.8894	0.943	0.9767	0.9882
	Ch13	0.9882	0.9767	0.943	0.8894	1	0.9882	0.9541	0.8999
	Ch14	0.9767	0.9882	0.9767	0.943	0.9882	1	0.9882	0.9541
	Ch15	0.943	0.9767	0.9882	0.9767	0.9541	0.9882	1	0.9882
	Ch16	0.8894	0.943	0.9767	0.9882	0.8999	0.9541	0.9882	1

Table B-15 MIMO LTE [11][12] (Cont'd)

Correlation Matrix(4x4 MIMO)									
R_medium		Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	Ch1	1	0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872
	Ch2	0.9882	1	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347
	Ch3	0.9541	0.9882	1	0.9882	0.8347	0.8645	0.8747	0.8645
	Ch4	0.8999	0.9541	0.9882	1	0.7872	0.8347	0.8645	0.8747
	Ch5	0.8747	0.8645	0.8347	0.7872	1	0.9882	0.9541	0.8999
	Ch6	0.8645	0.8747	0.8645	0.8347	0.9882	1	0.9882	0.9541
	Ch7	0.8347	0.8645	0.8747	0.8645	0.9541	0.9882	1	0.9882
	Ch8	0.7872	0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1
	Ch9	0.5855	0.5787	0.5588	0.527	0.8747	0.8645	0.8347	0.7872
	Ch10	0.5787	0.5855	0.5787	0.5588	0.8645	0.8747	0.8645	0.8347
	Ch11	0.5588	0.5787	0.5855	0.5787	0.8347	0.8645	0.8747	0.8645
	Ch12	0.527	0.5588	0.5787	0.5855	0.7872	0.8347	0.8645	0.8747
	Ch13	0.3	0.2965	0.2862	0.27	0.5855	0.5787	0.5588	0.527
	Ch14	0.2965	0.3	0.2965	0.2862	0.5787	0.5855	0.5787	0.5588
	Ch15	0.2862	0.2965	0.3	0.2965	0.5588	0.5787	0.5855	0.5787
	Ch16	0.27	0.2862	0.2965	0.3	0.527	0.5588	0.5787	0.5855
		Ch9	Ch10	Ch11	Ch12	Ch13	Ch14	Ch15	Ch16
	Ch1	0.5855	0.5787	0.5588	0.527	0.3	0.2965	0.2862	0.27
	Ch2	0.5787	0.5855	0.5787	0.5588	0.2965	0.3	0.2965	0.2862
	Ch3	0.5588	0.5787	0.5855	0.5787	0.2862	0.2965	0.3	0.2965
	Ch4	0.527	0.5588	0.5787	0.5855	0.27	0.2862	0.2965	0.3
	Ch5	0.8747	0.8645	0.8347	0.7872	0.5855	0.5787	0.5588	0.527
	Ch6	0.8645	0.8747	0.8645	0.8347	0.5787	0.5855	0.5787	0.5588
	Ch7	0.8347	0.8645	0.8747	0.8645	0.5588	0.5787	0.5855	0.5787
	Ch8	0.7872	0.8347	0.8645	0.8747	0.527	0.5588	0.5787	0.5855
	Ch9	1	0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872
	Ch10	0.9882	1	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347
	Ch11	0.9541	0.9882	1	0.9882	0.8347	0.8645	0.8747	0.8645
	Ch12	0.8999	0.9541	0.9882	1	0.7872	0.8347	0.8645	0.8747
	Ch13	0.8747	0.8645	0.8347	0.7872	1	0.9882	0.9541	0.8999
	Ch14	0.8645	0.8747	0.8645	0.8347	0.9882	1	0.9882	0.9541
	Ch15	0.8347	0.8645	0.8747	0.8645	0.9541	0.9882	1	0.9882
	Ch16	0.7872	0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1

Table B-15 MIMO LTE [11][12] (Cont'd)

Correlation Matrix(4x4 MIMO)									
R_ low		Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	Ch1	1	0	0	0	0	0	0	0
	Ch2	0	1	0	0	0	0	0	0
	Ch3	0	0	1	0	0	0	0	0
	Ch4	0	0	0	1	0	0	0	0
	Ch5	0	0	0	0	1	0	0	0
	Ch6	0	0	0	0	0	1	0	0
	Ch7	0	0	0	0	0	0	1	0
	Ch8	0	0	0	0	0	0	0	1
	Ch9	0	0	0	0	0	0	0	0
	Ch10	0	0	0	0	0	0	0	0
	Ch11	0	0	0	0	0	0	0	0
	Ch12	0	0	0	0	0	0	0	0
	Ch13	0	0	0	0	0	0	0	0
	Ch15	0	0	0	0	0	0	0	0
	Ch16	0	0	0	0	0	0	0	0
		Ch9	Ch10	Ch11	Ch12	Ch13	Ch14	Ch15	Ch16
	Ch1	0	0	0	0	0	0	0	0
	Ch2	0	0	0	0	0	0	0	0
	Ch3	0	0	0	0	0	0	0	0
	Ch4	0	0	0	0	0	0	0	0
	Ch5	0	0	0	0	0	0	0	0
	Ch6	0	0	0	0	0	0	0	0
	Ch7	0	0	0	0	0	0	0	0
	Ch8	0	0	0	0	0	0	0	0
	Ch9	1	0	0	0	0	0	0	0
	Ch10	0	1	0	0	0	0	0	0
	Ch11	0	0	1	0	0	0	0	0
	Ch12	0	0	0	1	0	0	0	0
	Ch13	0	0	0	0	1	0	0	0
	Ch14	0	0	0	0	0	1	0	0
	Ch15	0	0	0	0	0	0	1	0
	Ch16	0	0	0	0	0	0	0	1

Reference

[1] 3GPP TS 45.005 V7.9.0 (2007-02) Annex C

[2] 3GPP TS34.121 V8.1.0 (2007-12) Annex D

[3] 3GPP TS25.141 V8.2.0 (2008-03) Annex D

[4] 3GPP2 C.S0011-C v2.0

[5] 3GPP2 C.S0010-C v2.0

[6] 3GPP TS 25.102 V7.7.0 (2007-06) Annex B

[7] 3GPP2 C.S0032-A v1.0

[8] "Channel model for HiperLAN/2 in different indoor scenarios," ETSI EP BRAN 3ERI085B, March 1998.

[9] WiMAX Forum Mobile RCT-Wave2 (2007-12)

[10] ETSI TR 101 290 V1.2.1 (2001-05)

[11] 3GPP TR 36.803 V1.0.0 (2007-12)

[12] 3GPP TR 36.804 V1.0.0 (2007-11)

[13] IEC 60489-6 Ed.3.0:1999

Appendix C Connecting Multiple MG3700A/10A/40A Units

A different RF signal must be separately input to two Rx antenna input connectors to implement a 2 × 2 MIMO configuration.

There are two ways to synchronize signals when connecting multiple MG3700A, MG3710A or MG3740A units. One is to use an external Start/Frame Trigger, the other is to use one MG3700A/MG3710A/MG3740A unit as Master and a second MG3700A/MG3710A/MG3740A unit as Slave.

C.1 Connecting Multiple MG3700As

Using external Start/Frame Trigger

In this method, signals are synchronized by supplying an external Start/Frame Trigger to multiple MG3700A units. . Fig. C.1-1 shows a connection diagram.

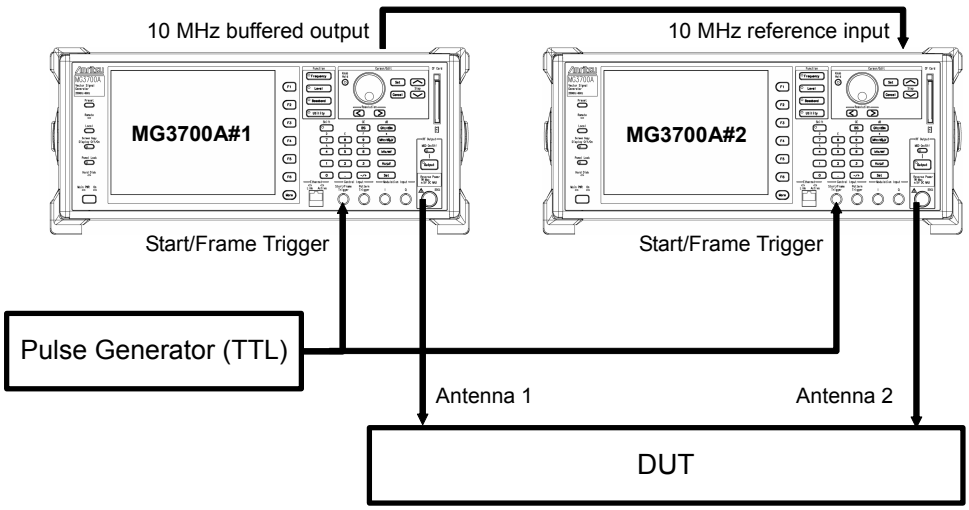

Figure C.1-1 Multiple MG3700A connection (external Start/Frame Trigger)

Synchronizing baseband signals

Input a TTL-level pulse signal to the Start/Frame Trigger connector on the MG3700A #1 as well as the MG3700A #2.
Next, configure the settings as follows for these two MG3700A units.

Start/Frame Trigger:
Trigger = ON
Mode = Start

Synchronization between baseband signals is established within one sampling clock of the waveform pattern with Delay = 0 (excluding an external cable delay error). . Fig. C-2 shows the synchronization relationship of the two signal generators. . Sampling clock *a* is determined by the sampling rate of the waveform pattern that is generated.

When the sampling rate is 20 MHz or lower:

a = sampling rate $\times 2^n$ (n is a value where 80M ≤ a < 160M)

When the sampling rate is higher than 20 MHz:

a = sampling rate

Note that the delay adjustment resolution changes, depending on the sampling rate. Refer to the following for details.

- MG3700A Vector Signal Generator Operation Manual (Mainframe) 3.5.3 “Setting up external input/output”

The MG3700A waits for the trigger to be input once the Waveform Restart function key is pressed. . Input the trigger after both of the MG3700A units are in this state.

Synchronizing RF signals

The RF frequencies of the two MG3700A units are synchronized using a 10 MHz reference clock.

Modify the Phase Adjust setting of either unit when changing the phase relation of the RF signal.

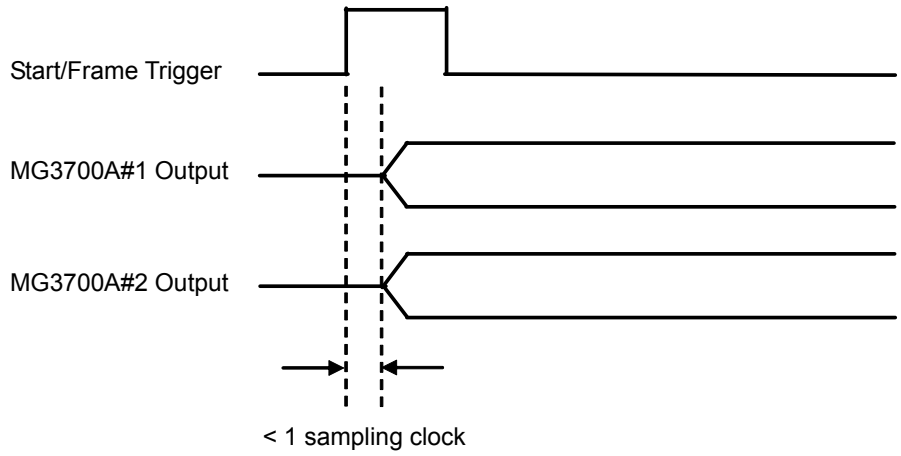

Figure C.1-2 Synchronization-baseband signals when using external Start/Frame Trigger

Using Master/Slave

In this method, signals are synchronized by sending a Start/Frame Trigger from the Master to Slave, where MG3700A#1 is the Master and MG3700A#2 is the Slave. Master and Slave must be set when generating waveforms, before the waveform patterns can be used, because the waveform pattern that is output from the MG3700A set as the Slave side produces a one frame lag to the Master side when Delay = 0. For the MX370107A on the Master side, set SG Master/Slave Setting to Master and select Pattern Sync Marker from Marker 1 to Marker 3, as shown in Fig. C-3. For the Slave side, SG Master/Slave Setting is automatically set to Slave.

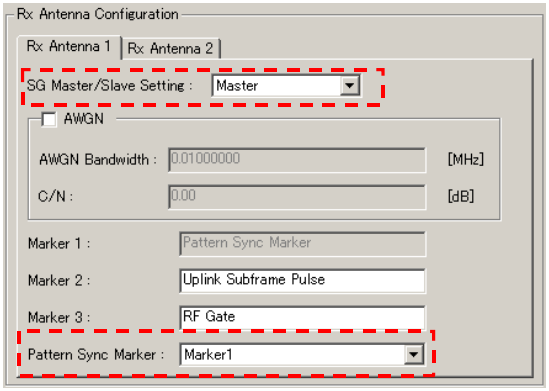

Figure C.1-3 Setting example of Master side

Fig. C.1-4 shows the connection, and Fig. C.1-5 shows the synchronization relationship of the two signal generators. Compared to the method using an external Start/Frame Trigger, the synchronization error between the Master output and Pattern Sync Marker is greater when using Master/Slave. Refer to the following manual(s) for details on the operation when the Start/Frame trigger is input.

- MG3700A Vector Signal Generator Operation Manual (Mainframe) 3.5.4 “To output the signal in synchronization with the external trigger signal.”

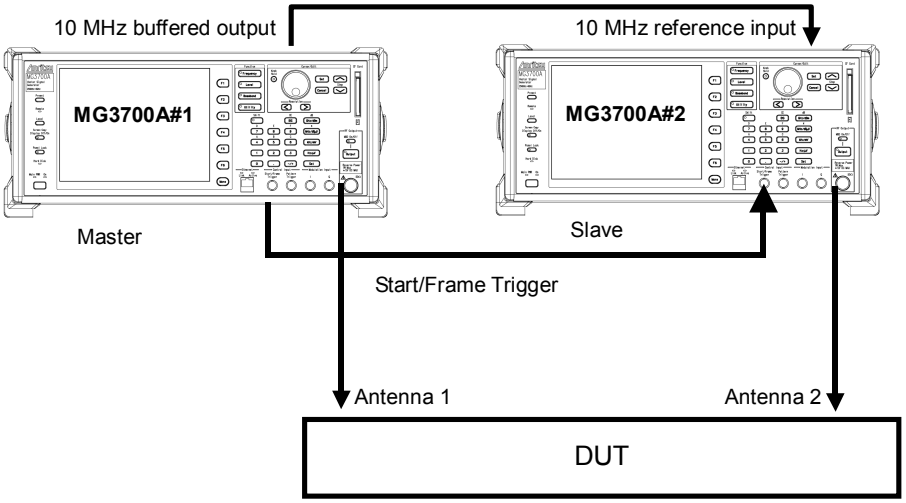

Figure C.1-4 Multiple MG3700A connection (Master/Slave)

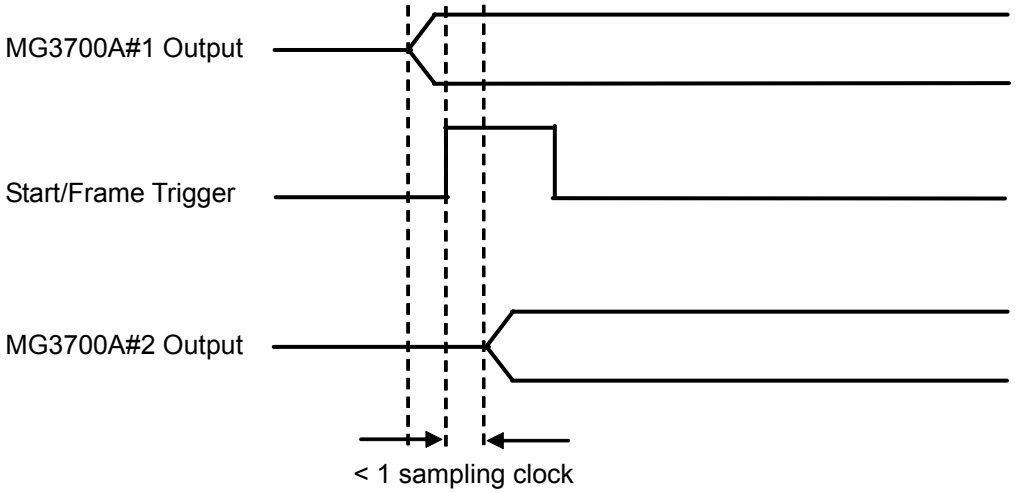

Figure C.1-5 Synchronization relationship of baseband signals when using Master/Slave

C.2 Connecting Multiple MG3710A/MG3740As

Using external Start/Frame Trigger

In this method, signals are synchronized by supplying an external Start/Frame Trigger to multiple MG3710A units. Fig. C.2-1 shows a connection diagram.

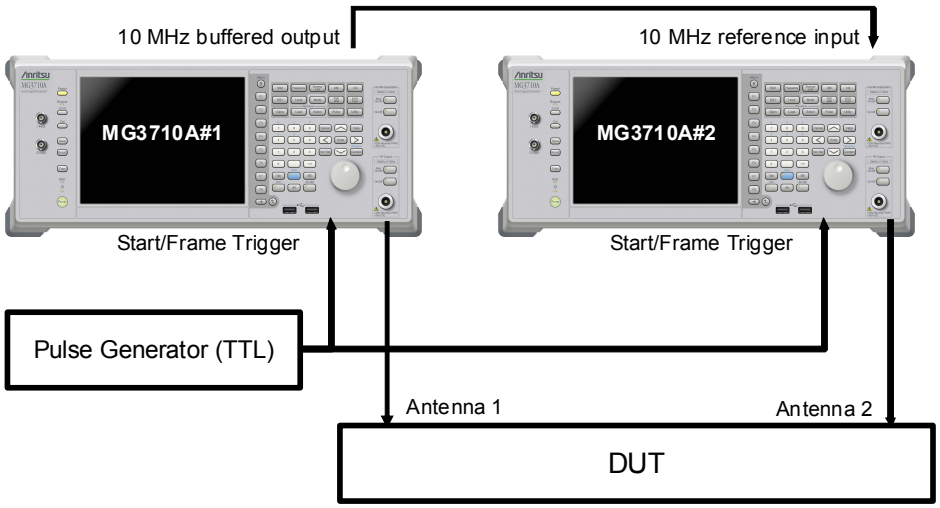

Figure C.2-1 Multiple MG3710A connection (external Start/Frame Trigger)

Synchronizing baseband signals

Input a TTL-level pulse signal to the Start/Frame Trigger connector on the MG3710A #1 as well as the MG3710A #2.
Next, configure the settings as follows for these two MG3710A units.

Start/Frame Trigger:
Trigger = ON
Mode = Start

Synchronization between baseband signals is established within one sampling clock of the waveform pattern with Delay = 0 (excluding an external cable delay error). Fig. C.2-2 shows the synchronization relationship of the two signal generators.

Note that the delay adjustment resolution changes, depending on the sampling rate. Refer to the following manual(s) for details.

- MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)
  7.3.8 “Start/Frame Trigger”

The MG3710A waits for the trigger to be input once the Waveform Restart function key is pressed. Input the trigger after both of the MG3710A units are in this state.

Synchronizing RF signals

The RF frequencies of the two MG3710A units are synchronized using a 10 MHz reference clock.

Modify the Phase Adjust setting of either unit when changing the phase relation of the RF signal.

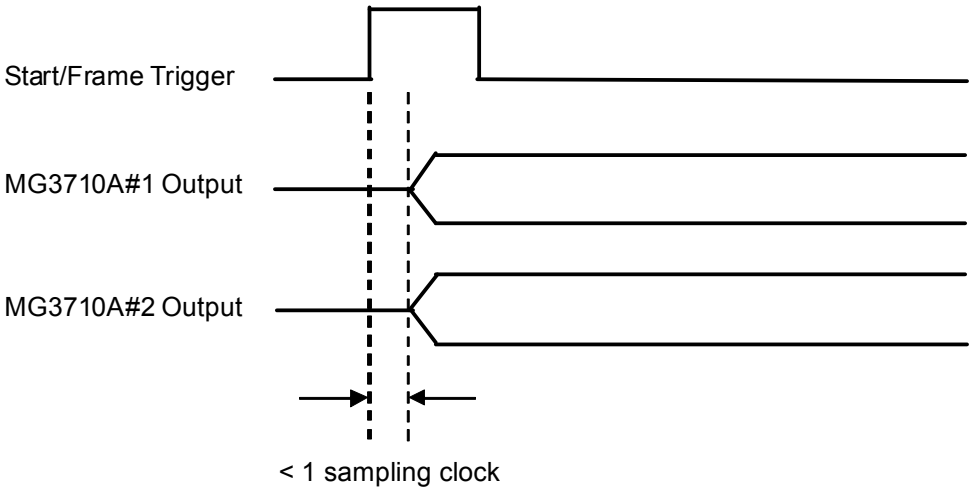

Figure C.2-2 Synchronization-baseband signals when using external Start/Frame Trigger

Using Master/Slave

In this method, signals are synchronized by sending a Start/Frame Trigger from the Master to Slave, where MG3710A#1 is the Master and MG3710A#2 is the Slave. Master and Slave must be set when generating waveforms, before the waveform patterns can be used, because the waveform pattern that is output from the MG3710A set as the Slave side produces a one frame lag to the Master side when Delay = 0. For the MX370107A on the Master side, set SG Master/Slave Setting to Master and select Pattern Sync Marker from Marker 1 to Marker 3, as shown in Fig. C.2-3. For the Slave side, SG Master/Slave Setting is automatically set to Slave.

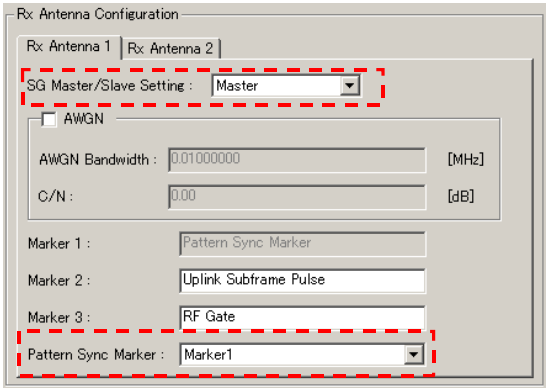

Figure C.2-3 Setting example of Master side

Fig. C.2-4 shows the connection, and Fig. C.2-5 shows the synchronization relationship of the two signal generators. Compared to the method using an external Start/Frame Trigger, the synchronization error between the Master output and Pattern Sync Marker is greater when using Master/Slave.

Refer to the following manual(s) for details on the operation when the Start/Frame trigger is input.

- MG3710A Vector Signal Generator MG3740A Analog Signal Generator Operation Manual (Mainframe)
  7.3.8 “Start/Frame Trigger”

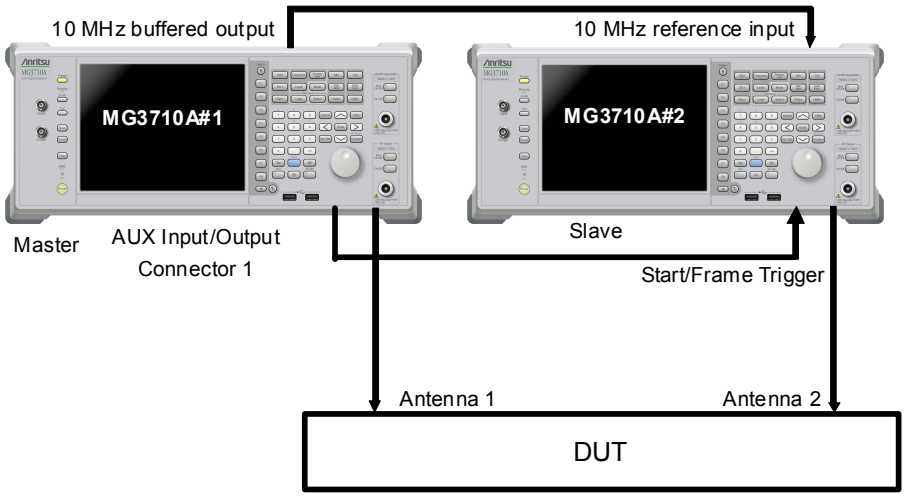

Figure C.2-4 Multiple MG3710A connection (Master/Slave)

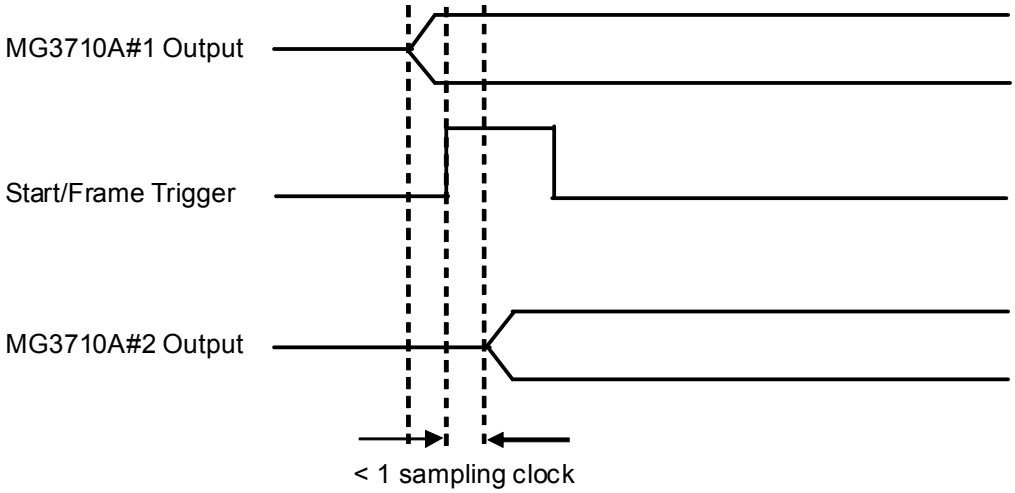

Figure C.2-5 Synchronization relationship of baseband signals when using Master/Slave

Appendix D Fading Characteristic Examples

This appendix provides two fading characteristic examples, the Doppler spectrum and an accumulated probability distribution/level crossing rate, as the verification results of the waveform data generated by this software.

D.1 Doppler Spectrum D-2
D.2 Accumulated Probability Distribution/
Level Crossing Rate D-6

D.1 Doppler Spectrum

Figs. D.1-1 to D.1-8 show examples of the spectrum when the Doppler spectrum is changed with the fading type Rayleigh and Rice.

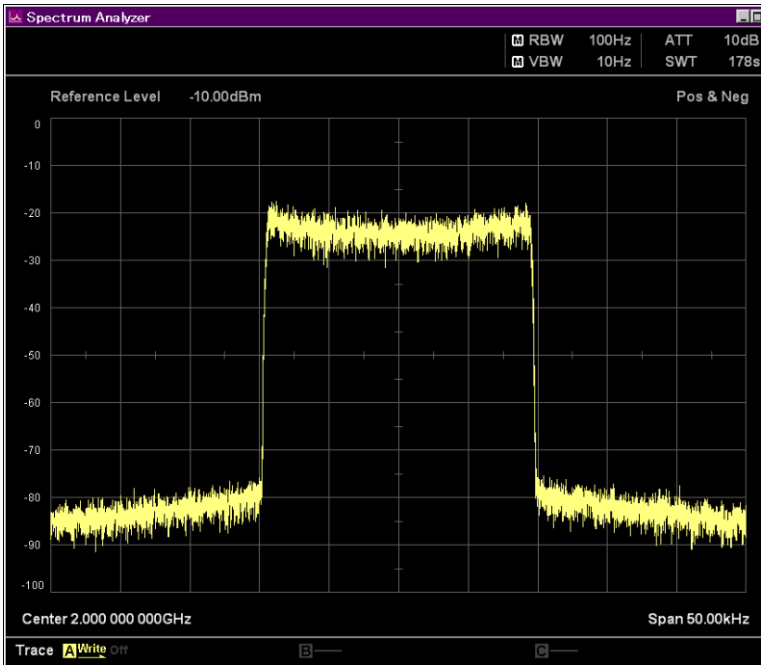

Figure D.1-1 Rayleigh with Classical 3 dB

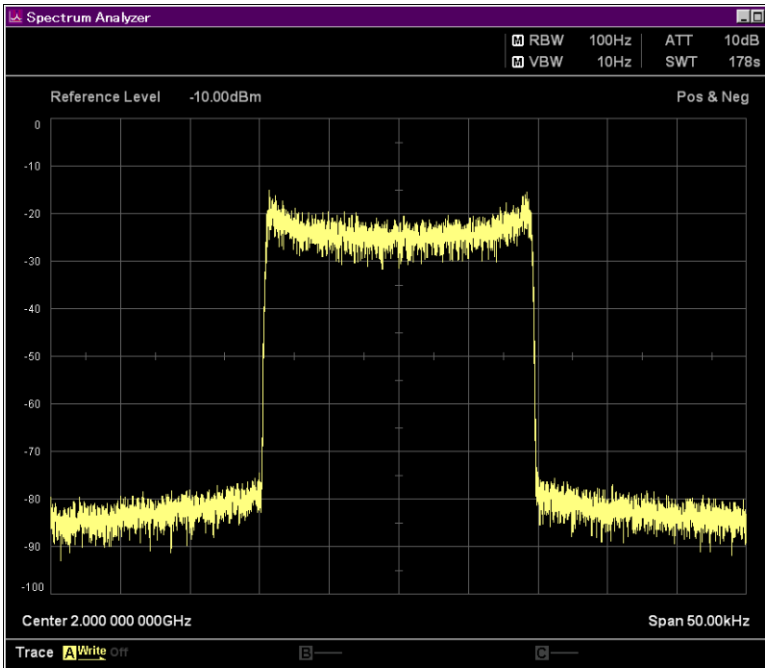

Figure D.1-2 Rayleigh with Classical 6 dB

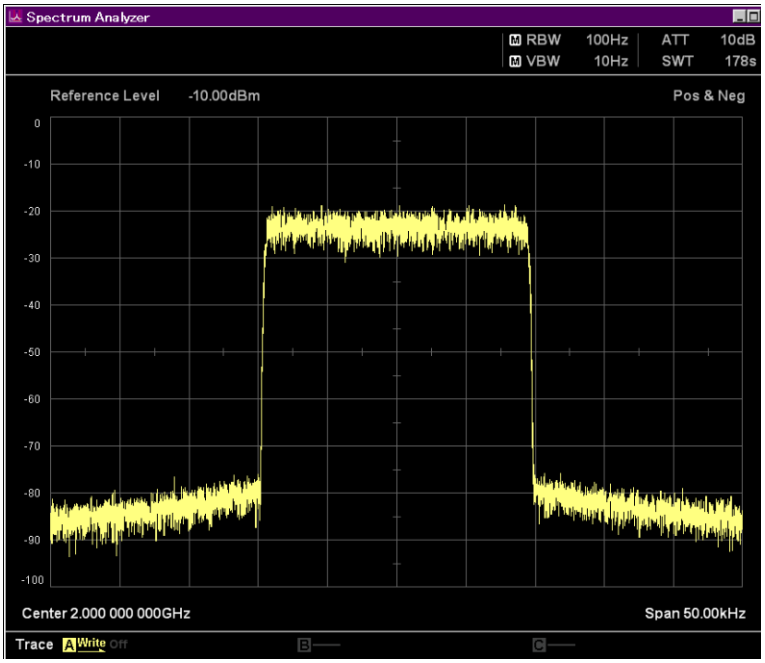

Figure D.1-3 Rayleigh with Flat

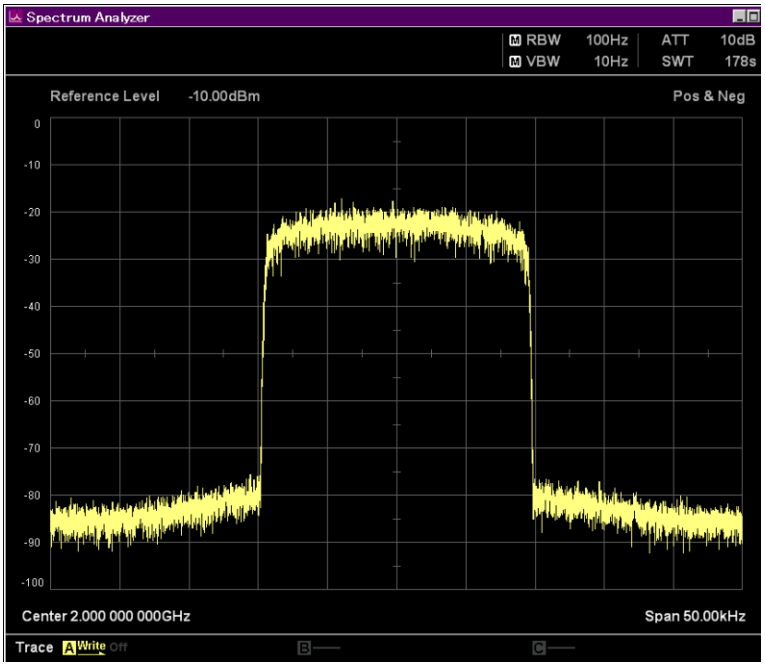

Figure D.1-4 Rayleigh with Rounded

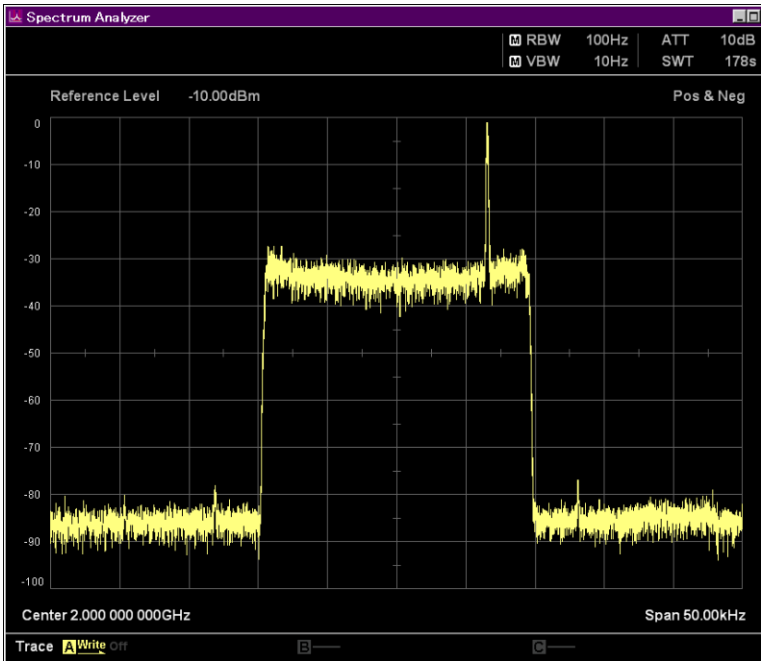

Figure D.1-5 Rice with Classical 3 dB

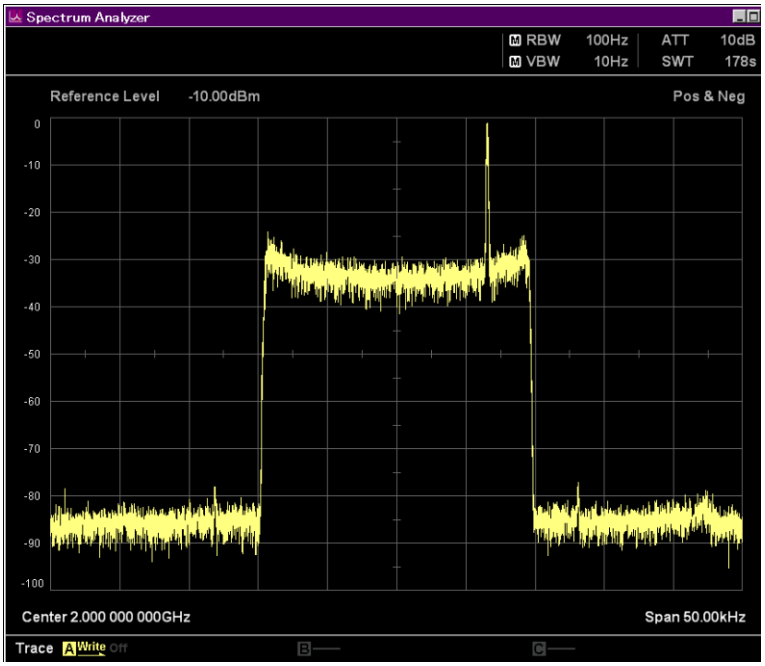

Figure D.1-6 Rice with Classical 6 dB

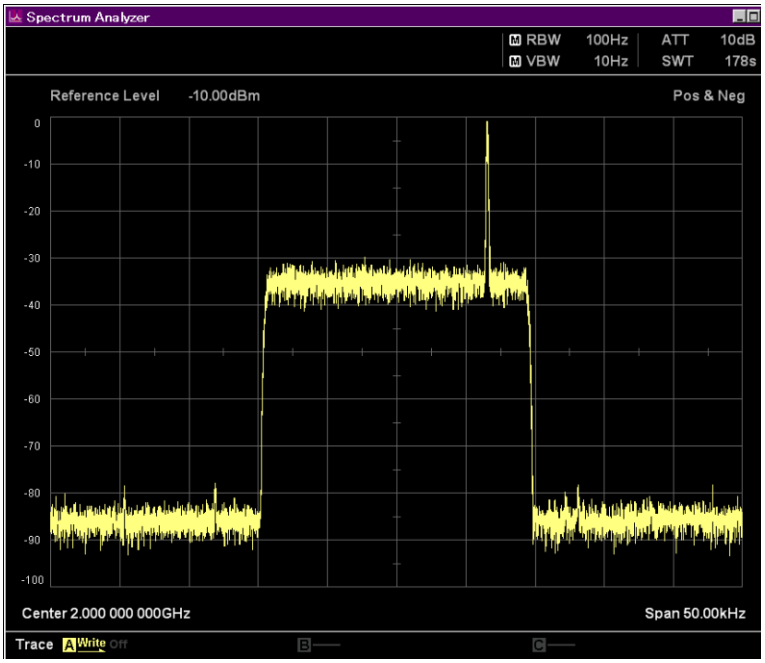

Figure D.1-7 Rice with Flat

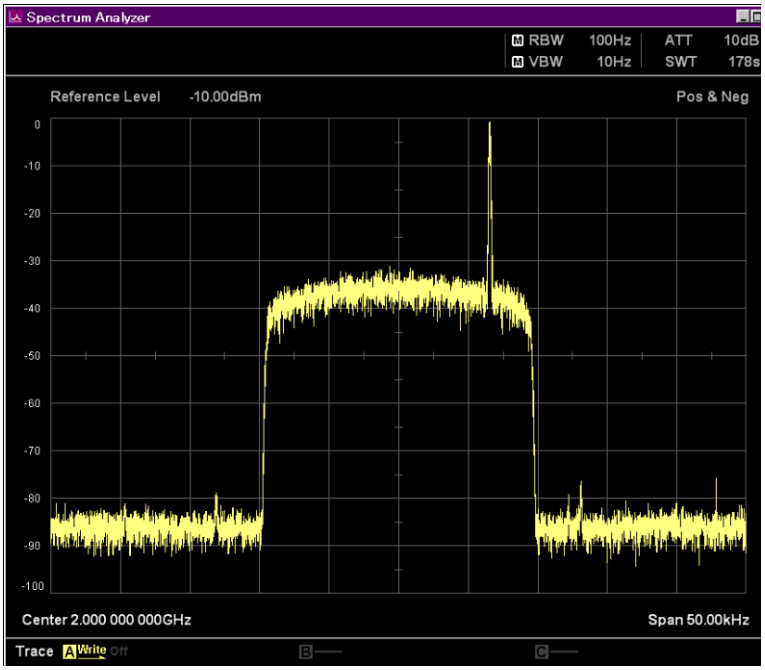

Figure D.1-8 Rice with Rounded

D.2 Accumulated Probability Distribution/ Level Crossing Rate

This section describes a calculation example of an accumulated probability distribution/level crossing rate when a fading processing is performed by the MX370107A on a tone signal waveform pattern with the same sampling frequency and length as the MG3700A or MG3710A standard waveform pattern UL_RMC_12_2kbps.
The setting values of the parameters are as shown in table D.2-1.

Table D.2-1 Accumulated probability distribution/ level crossing rate calculation parameters

System Configuration	
Channel Configuration	1 × 1 SISO
Tx Antenna Configuration (Tx Antenna 1)	
RF Frequency	2000.00000000 MHz
Sampling Rate	11.52 MHz
Repetition	1
Pattern Length	10220 ms
Channel Setting (Channel 1)	
Moving Speed	2.3, 50, 120, 250, 583 km/h
Doppler Frequency	4.262, 92.657, 222.376, 463.283, 1080.377 Hz
Round Fading Pattern	Clear
Random Seed	1
Rx Antenna Configuration (Rx Antenna 1)	
AWGN	Clear

Reference

[1] IEC 60489-6, Annex C (1999)

At Moving Speed = 2.3 km/h

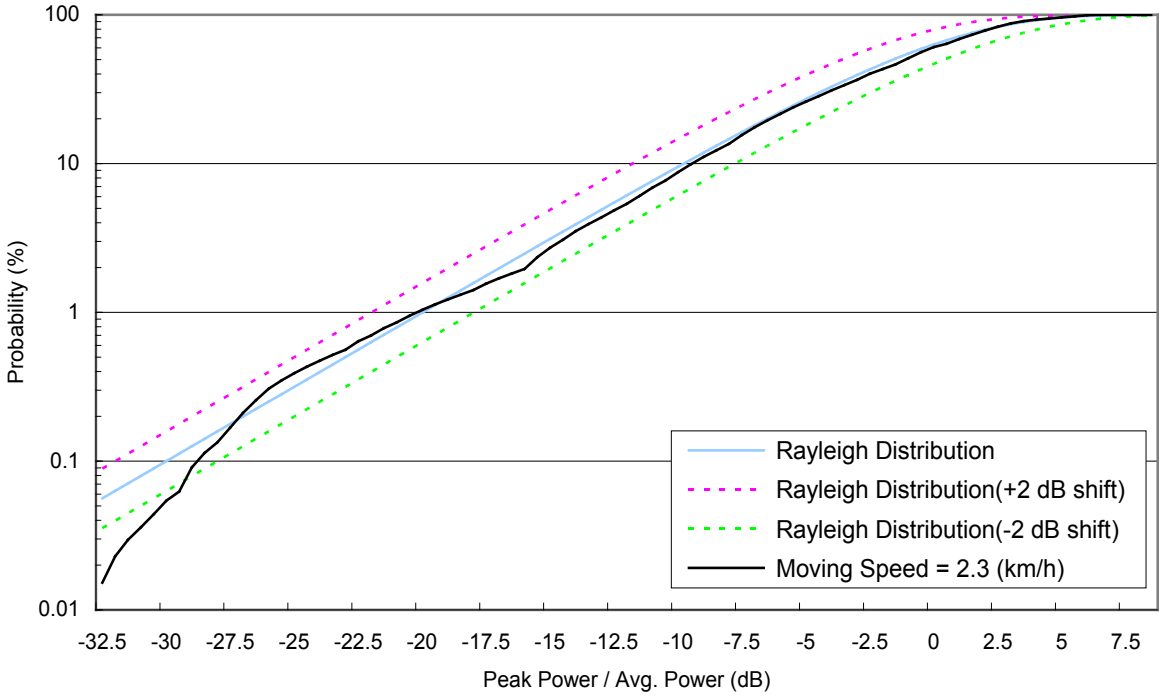

Figure D.2-1 Accumulated probability distribution (Moving Speed = 2.3 km/h)

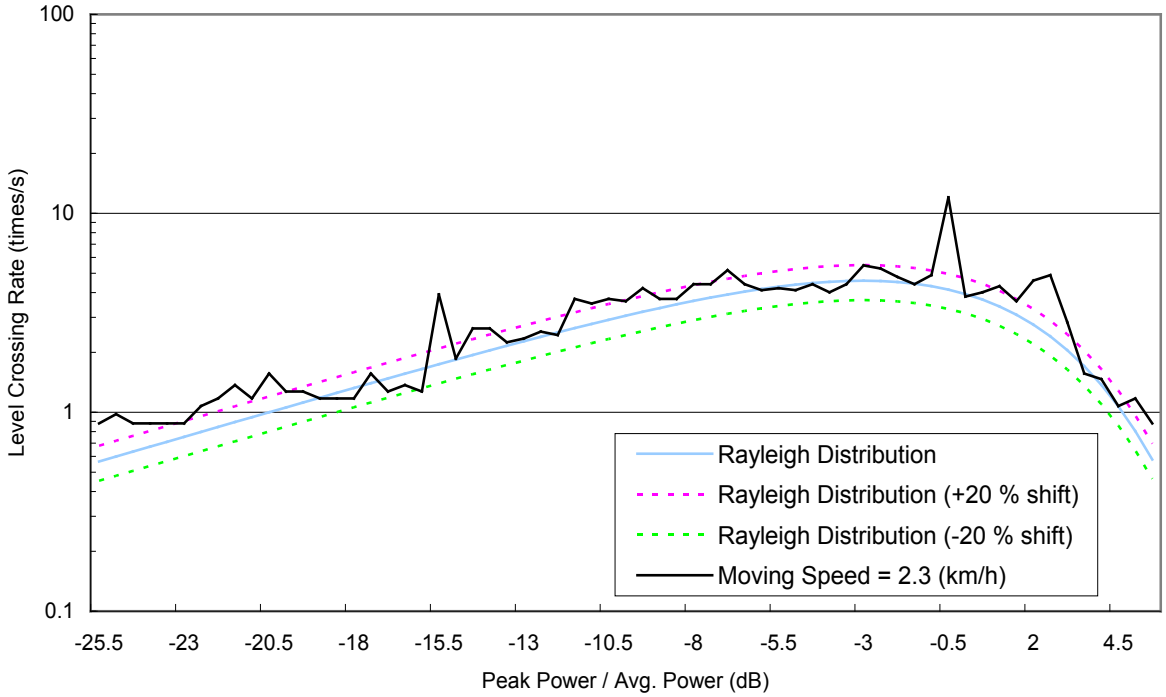

Figure D.2-2 Level crossing rate (Moving Speed = 2.3 km/h)

At Moving Speed = 50 km/h

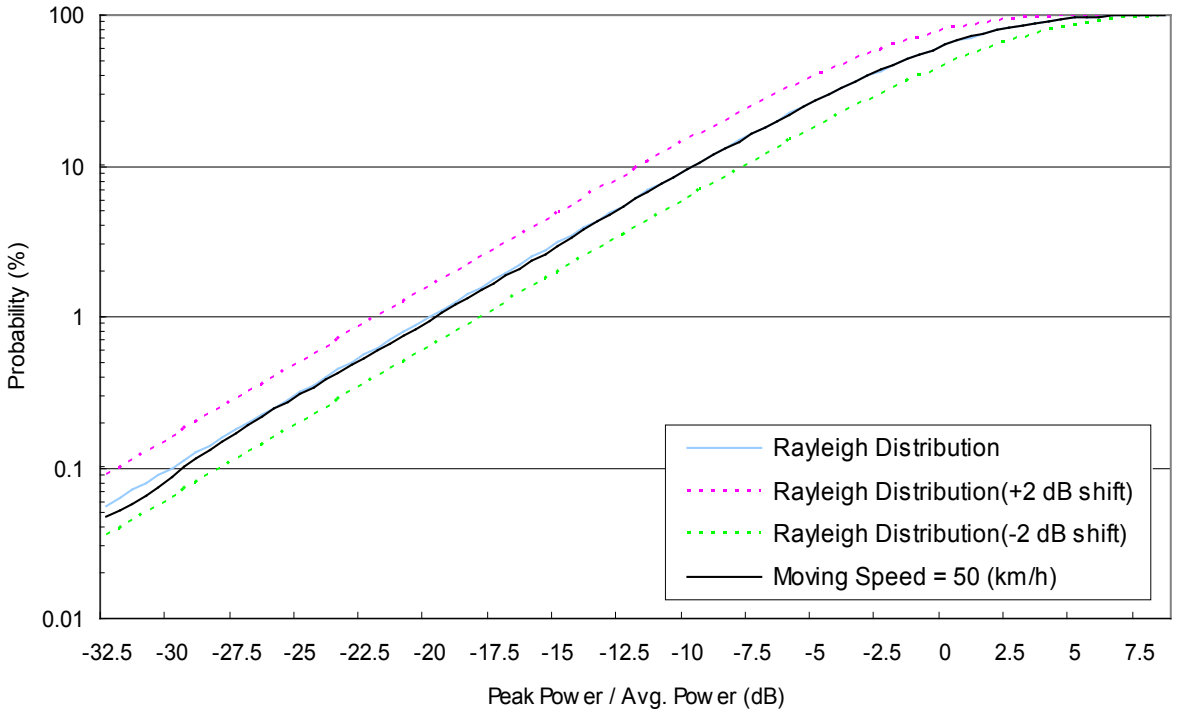

Figure D.2-3 Accumulated probability distribution (Moving Speed = 50 km/h)

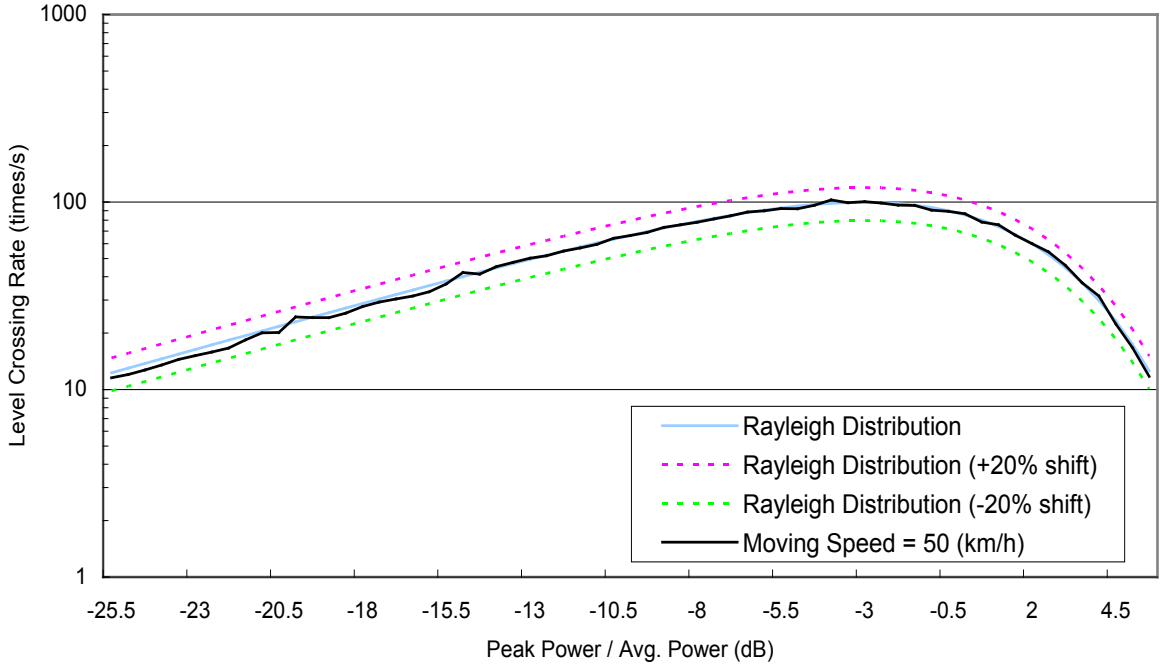

Figure D.2-4 Level crossing rate (Moving Speed = 50 km/h)

At Moving Speed = 120 km/h

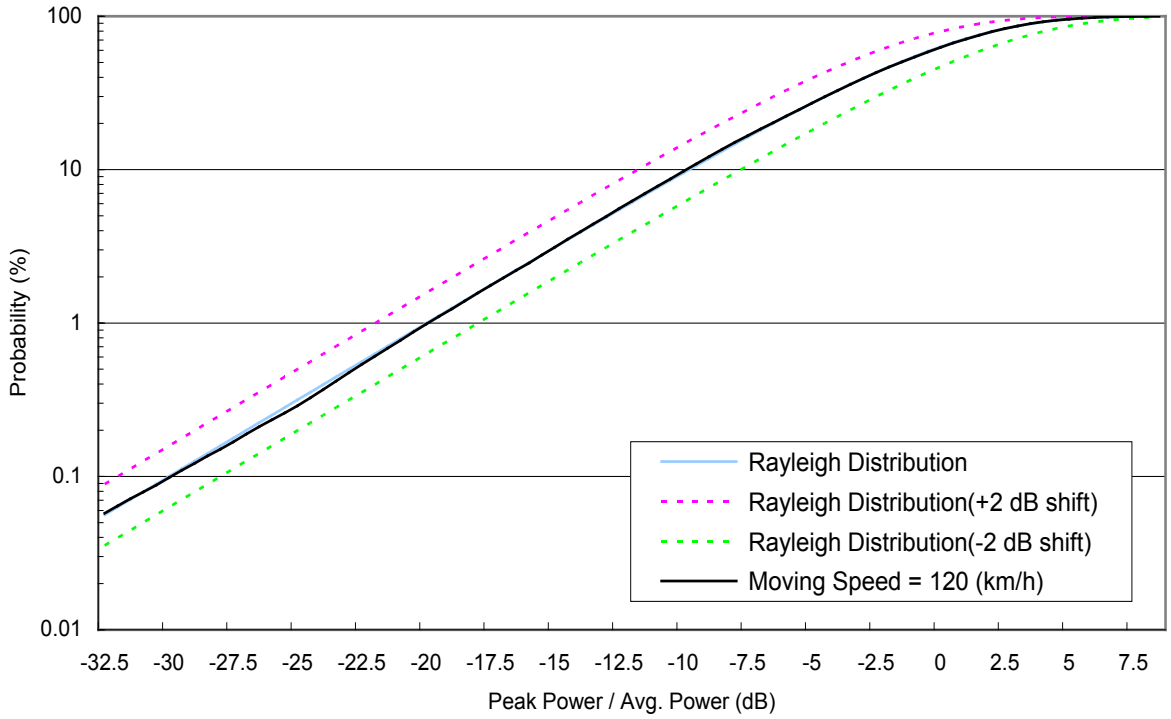

Figure D.2-5 Accumulated probability distribution (Moving Speed = 120 km/h)

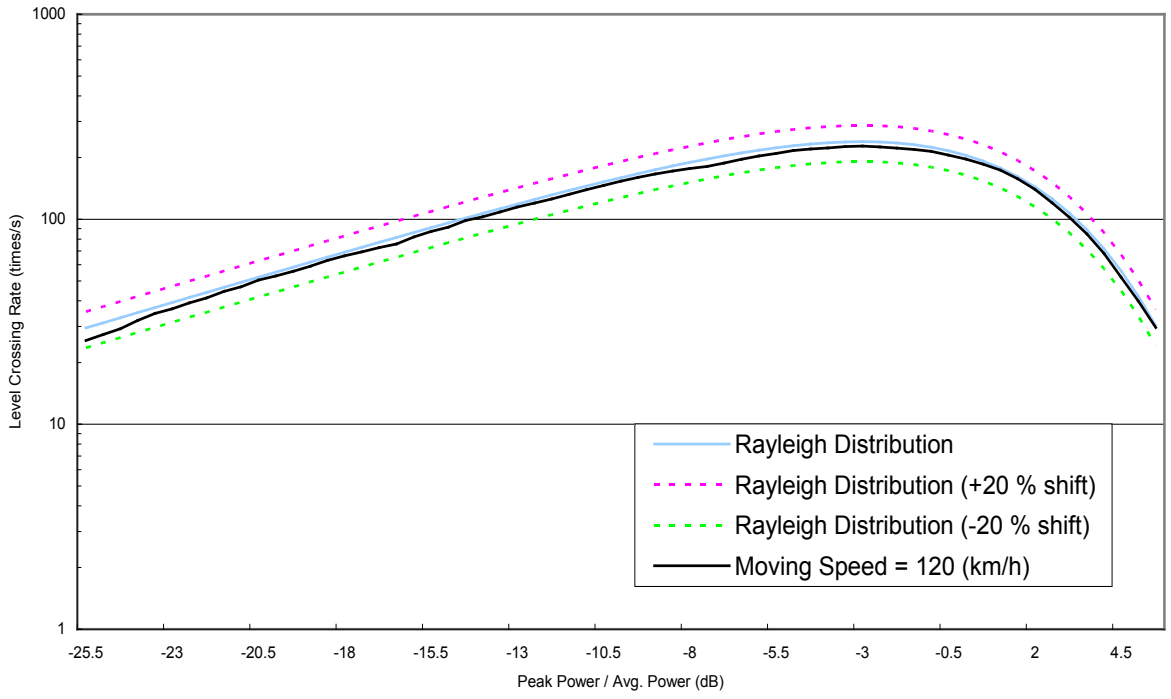

Figure D.2-6 Level crossing rate (Moving Speed = 120 km/h)

At Moving Speed = 250 km/h

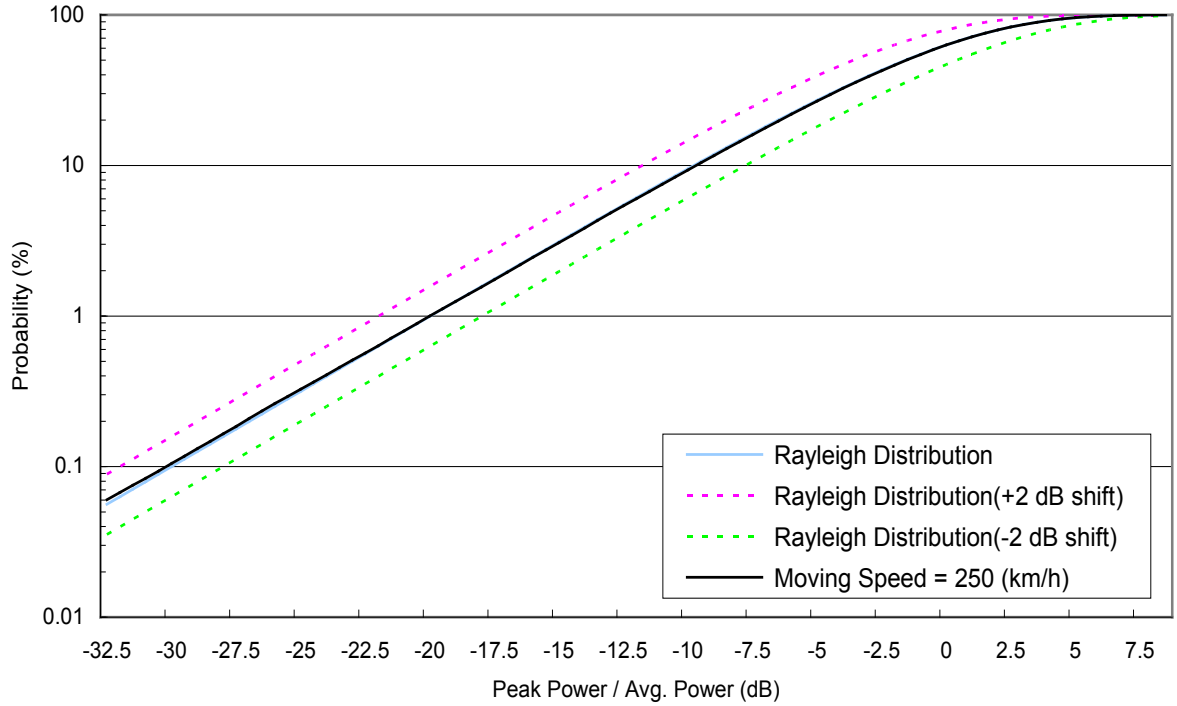

Figure D.2-7 Accumulated probability distribution (Moving Speed = 250 km/h)

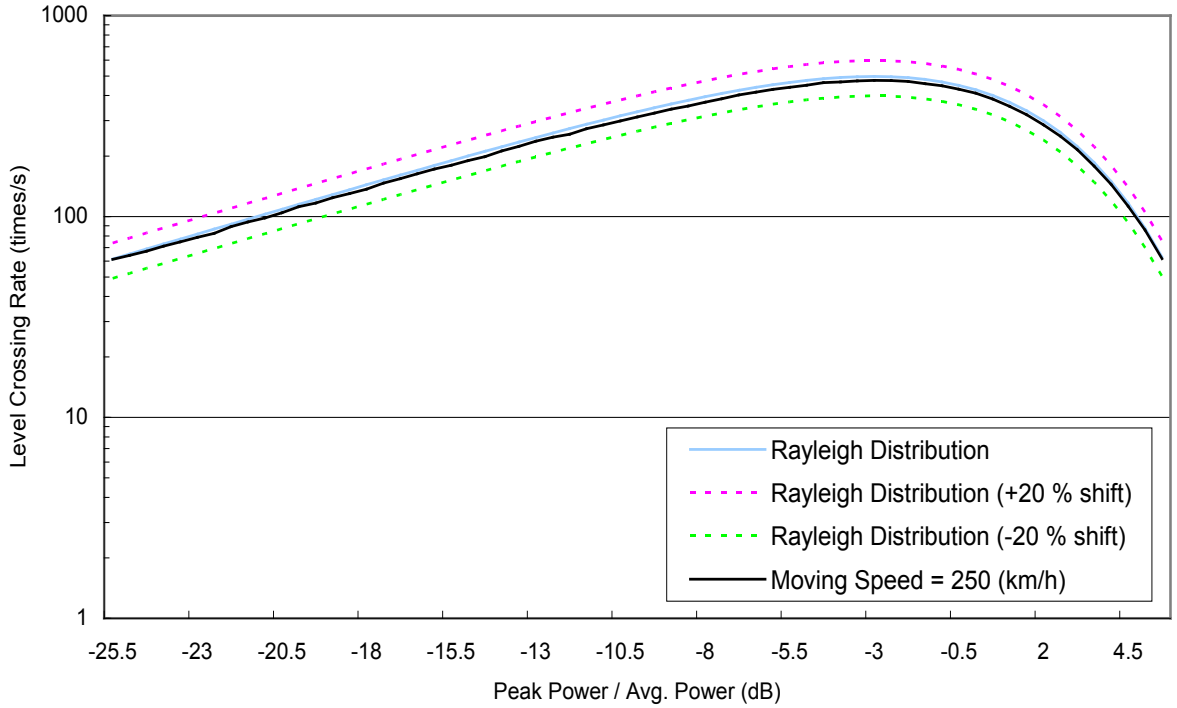

Figure D.2-8 Level crossing rate (Moving Speed = 250 km/h)

At Moving Speed = 583 km/h

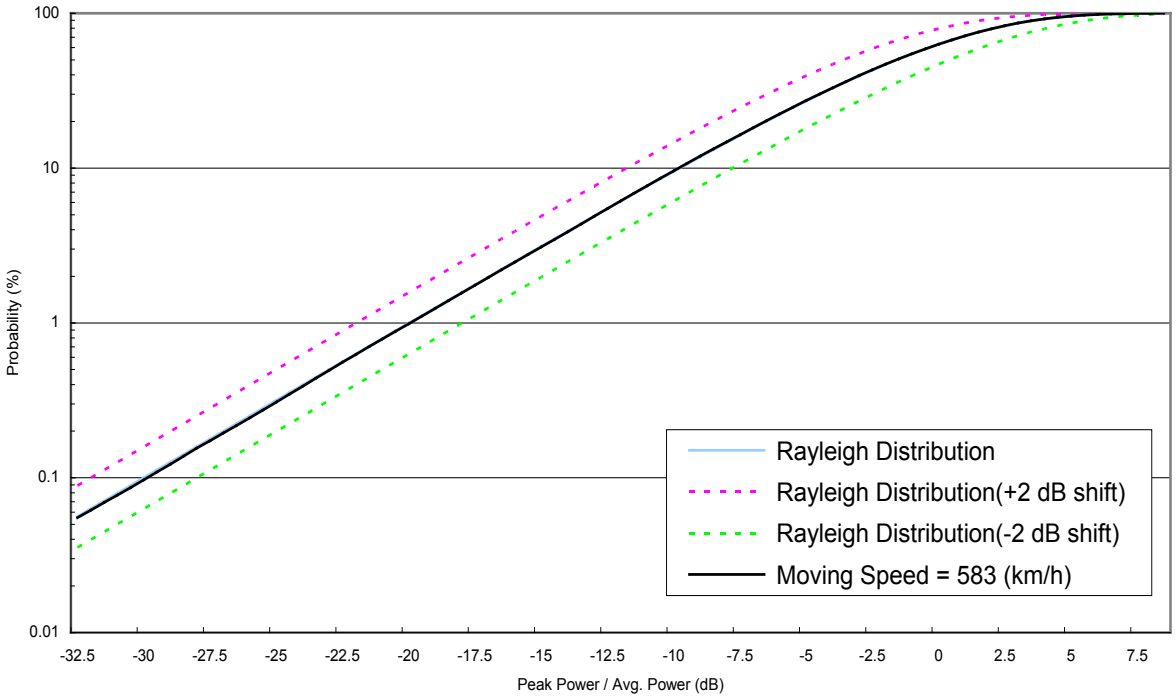

Figure D.2-9 Accumulated probability distribution (Moving Speed = 583 km/h)

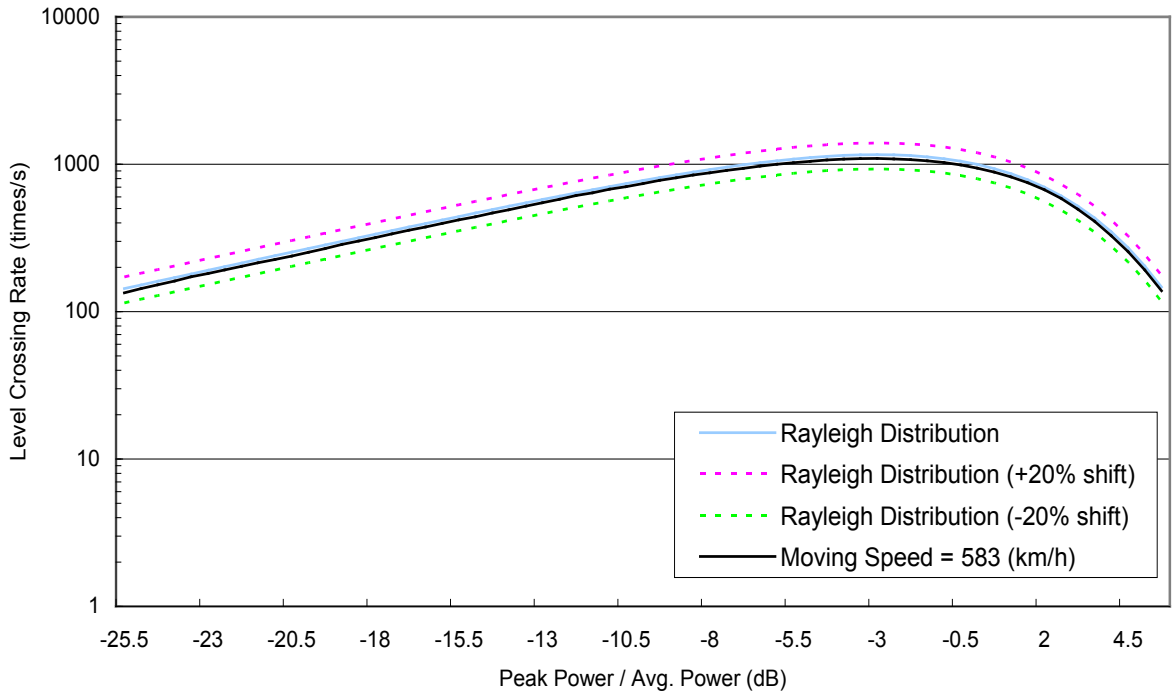

Figure D.2-10 Level crossing rate (Moving Speed = 583 km/h)

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