**Product Introduction** 



# GPS positioning pattern generation tool

MG3700A Vector Signal Generator The MG3700A Vector Signal Generator Product Introduction

# [Sample software] GPS positioning pattern generation tool



## **ANRITSU CORPORATION**

The Licensee acknowledges that the "Sample Software" is supplied "as is" by ANRITSU CORPORATION free of charge. ANRITSU CORPORATION does not either expressly or tacitly warrant that the "Sample Software" does not infringe any or all third party intellectual right relating to a patent, software or to any or all other property right. Moreover, ANRITSU CORPORATION shall not hold the Licensee harmless against any or all proceedings for infringement that may be instituted in respect of the use, modification and redistribution of the "Sample Software".

Discover What's Possible™

Slide 1



## [MG3700A] GPS Signal Generator

### MG3700A Vector Signal Generator outputs GPS position (map display)\*

\*: The GPS Waveform Creator sample software generates MG3700A waveform patterns in compliance with GPS standards using a PC. GPS parameters, such as position and time can be set.



- 1. Cold start the receiver. (Do not leave any previous data remaining.)
- 2. Check the receiver map display between each waveform pattern output.

Incitsu

Slide 2 MG3700A-E-L-12

## [MG3700A] Hardware Features

### Performance and functions

- Frequency Range 250 kHz to 6 GHz 250 kHz to 3 GHz (standard) 250 kHz to 6 GHz (option)
- Wide vector modulation bandwidth
   120 MHz (Internal base band generator)
   150 MHz (External IQ input)
- High level accuracy
   ±0.5 dB (Absolute level accuracy)
   ±0.2 dB typical (Linearity)
- Waveform addition function
   Two signals, such as wanted signal + interfering
   signal or wanted signal + AWGN, can be added
   and output.
- Built-in BERT Analyzer.
  - 1 kbps to 20 Mbps (standard) 100 bps to 120 Mbps (option)
- ♦40-GB hard disk built-in
- Large capacity baseband memory
   1 GB = 256M samples (standard)
  - 2 GB = 512M samples (option)
- ♦ High-speed waveform transmission over 100Base-TX LAN

The key MG3700A features are listed opposite.

In particular, the waveform addition function saves different patterns in the two built-in memories and outputs them simultaneously.

Useful for following tests:

- Wanted signal + Delayed signal
- Wanted signal + Interference signal
- ► Wanted signal + AWGN



## [MG3700A] Software Lineup

### Various communication systems supported

### Pre-installed Waveform Patterns:

W-CDMA/HSDPA, GSM/EDGE, PDC, PHS, CDMA2000 1x/1xEV-DO, AWGN, *Bluetooth*®, GPS, Digital Broadcast (ISDB-T/BS/CS/CATV), WLAN (IEEE802.11a/11b/11g)

### ♦ Optional Waveform Patterns:

- TD-SCDMA
- Public Radio System (RCR STD-39, ARIB STD-T61/T79/T86)

#### ◆IQproducer (\*: Software license is optional) Waveform generation software

- W-CDMA AWGN
- 3GPP LTE (FDD)\* HSDPA/HSUPA\*
- TDMA\* (PDC, PHS, ARIB, etc.)
- CDMA2000 1xEV-DO\* Multi-carrier\*
- Mobile WiMAX\* DVB-T/H\* Fading\*
- XG-PHS\* 3GPP LTE(TDD)\*

#### Sample software

- GPS positioning pattern generation tool

Since the MG3700A uses arbitrary waveform memory, signals can be output just by preparing waveform patterns.

Anritsu offers various waveform patterns with preset parameters.

Moreover, IQproducer with GUI supports easy generation of waveform patterns by setting parameters at a PC.



## [MG3700A] GPS Measurement Image

### Ex: Total Operation Test by MAP display (Receive & Display)

Overall operation checks are supported by using this software to generate waveform patterns for positioning using a PC and outputting them to the MG3700A.



### **Ex: Rx Sensitivity Test**

Outputting pre-installed patterns (free) from the MG3700A supports Rx sensitivity tests for GPS.



## [MG3700A] Memory Capacity and Signal Output Time

## GPS Positioning Waveform



The MG3700A has two ARB memories with the following capacities.

- 512 MB x 2 pc (Standard)
- 1 GB x 2 pc (MG3700A-011 Option) <<Recommended

We recommend increasing the size of the waveform pattern memory using the MG3700A-011 option.

### 1) Standard memory: About 174 sec

2) Optional memory: About 348 sec



- 1. Cold start the receiver. (Do not leave any previous data remaining.)
- 2. Check the map display of the receiver while outputting the waveform pattern once.
- 3. Press F4 (Waveform Restart) to restart (output from top) the waveform pattern.
  - (When restarting almost simultaneously with a receiver cold start, the output time can be used effectively.)

Discover What's Possible™



## Example: Rx Characteristics and Mutual Interference Evaluation of Multi-Functions



Most navigation systems and PC have digital terrestrial broadcasting as well as wireless LAN and Bluetooth. Each signal source must be tested to avoid interference between systems.

Slide 7 MG3700A-E-L-12



## **Example: Rx Characteristics Evaluation for Multi-Functions**



When a multi-system is installed, it can be used as a signal source for Rx characteristics tests.

Slide 8 MG3700A-E-L-12



## **Example: Mutual Interference Evaluation for Multi-Functions**

# Supports Various Communication Systems

- Built-in Waveform Pattern
- W-CDMA/HSDPA, GSM/EDGE, PDC, PHS
- CDMA2000 1x/1xEV-DO, AWGN
- Bluetooth, GPS
- Broadcasting (ISDB-T/BS/CS/CATV)
- Wireless LAN (IEEE802.11a/11b/11g)
- Optional Waveform Patterns (sold separately)
- TD-SCDMA
- Public Wireless System (RCR STD-39, ARIB STD-T61/T79/T86)
- Waveform Generating Software: IQproducer (\*: sold separately)
- W-CDMA, AWGN
- HSDPA/HSUPA\*, TDMA\*(PDC, PHS, ARIB)
- CDMA2000 1xEV-DO\*
- Multi-carrier\*, Mobile WiMAX\*, DVB-T/H\*
- Sample Software
- GPS waveform creator

The MG3700 outputs signals of various communication systems, such as the main mobile signals, WLAN signals and Bluetooth, as standard.

## Multi-SG for Interference signal



Discover What's Possible™

Slide 9 MG3700A-E-L-12



# Introduction to GPS positioning pattern generation tool

Slide 10



## **GPS tool** ~Configuration~

The GPS tool is configured using:



GPS positioning pattern generation tool

### [Waveform pattern generation flow]

- 1. Download navigation data from website.
- 2. Set parameters.
- 3. Generate waveform pattern by running execution file (transfer to MG3700A to use).

Discover What's Possible<sup>™</sup>

Slide 11



## **GPS tool** ~Configuration~

### Recommended configuration

MG3700A Vector Signal Generator

♦MG3700A-021 ARB Memory Expansion 512M sample

\*Opt-021 (ARB Memory Expansion 512M Sample) recommended

GPS positioning pattern generation tool (this software)

## GPS tool ~Operating Environment~

### Operating environment

**Requires following PC:** 

- **OS:** Windows 2000 Professional or Windows XP
- ♦ CPU: Pentium III 1 GHz or faster
- Memory: 512 MB
- Hard disk: >5 GB (required capacity depends on parameters)

Discover What's Possible™

Slide 12



## GPS tool ~How to Use (1)~

### Navigation data download

Download navigation data from a website.

1) Access the following site:

http://www.ngs.noaa.gov/CORS/standard1.shtml

- 2) Highlight "Global Navigation" in OPTION.
- 3) Set Year, Month and Day.

(Future dates cannot be downloaded.)

- 4) Click [Find Files] to download.
- 5) Unzip downloaded file.

Please choose SITE, OPTION and (if necessary) DATE sort by state or country code sort by city sort by site ID SITE OPTION D.' E Year AF Herat , AFHT RINEX Data ~ 2010 🗸 AF Kabul , AFKB Data Availability AG Aguascalientes, INEG Data Sheet Al Kandi , BJKA Coordinates (NAD83 & ITRF) Month<sup>\*</sup> Al Nikki , BJNI Logfile (Site logs) AK Akhiok . AC13 Local Map January ~ Photo AK Anchorage . ANC2 AK Anchorage, TBON Time Series (60-day) Day\* AK Anchorage, TSEA Time Series (longterm) AK Anchorage , UAAG 1 🔽 AK Anchorage WAAS 1, ZAN1 Non Site Specific AK Annette Island , AIS5 Global Navigation or AK Annette Island , AIS6 IGS Ephemeris (precise, rapid or ultra-rapid) AK Barrow , BRW1 NGS Rapio hemeris AK Barrow . SG27 Enter Day of AK Bethel, BET1 AK Biorka IsaInd , BIS6 Year (e.g. 2, 93, AK Biorka Island, BIS5 365) AK Buckland , AC07 2. Select here. AK Cape Hinchinbrook , CHI5 This will AK Cape Hinchinbrook , CHI6 override the AK Central, CENA Find Files AK Cold Bay , BAY5 Month and Day Y AK Cold Bay , BAY6 boxes if selected! 4. Start download.

3. Set date.

Slide 13 MG3700A-E-L-12

## GPS tool ~How to Use (2) 1/2~

### Parameter setting

Set parameters using the parameter file (GpsParam.ini).

### <Procedure>

- 1. Open the parameter file (GpsParam.ini) with a text editor.
- 2. Set the following parameters.

### 3. Save and close the file after setting.

Note: If a parameter location and file name are changed, the software will not operate correctly.

Discover What's Possible™



## GPS tool ~How to Use (2) 2/2~

### Parameter setting range

Parameter	Setting range	
Latitude (degrees)	–90.000000 to +90.000000 South latitudes are negative	
Longitude (degrees)	-180.000000 to +180.000000 West longitudes are negative	
Altitude (m)	–1000 to +1000 m	
Time (hh:mm:ss)	00:00:00 to 23:59:59	
Number of satellites	4 to 8	
Replay time (s)	6 s (1 sub-frame) to 174 s (29 sub-frame) w/o Opt-021 6 s (1 sub-frame) to 348 s (58 sub-frame) w/ Opt-021	



## GPS tool ~How to Use (3)~

### Start waveform generation

Start waveform generation after setting parameters. <Procedure>

- Check that the following files are in the same folder: Execution file (gen\_gps\_signal.exe) Parameter file (GpsParam.ini) Navigation data file (see Slide 6)
- 2. Double click [gen\_gps\_signal.exe]. The DOS command prompt screen opens (see opposite) and waveform generation starts.
- 3. When waveform pattern generation is completed, [Press return key.] is displayed on the DOS command prompt screen. Press the [<u>Return</u>] key to complete.
- 4. Check that the waveform pattern (wvi/wvd) is generated.
- 5. Transfer the waveform pattern from the PC to the MG3700A to use.

#### ex C:¥Documents and Settings¥a1199001¥デスクトップ¥GPSネタ¥ナビツール¥soft¥

Satellite ID: 2 -Calculating Doppler Shift... -Calculating Code Phase... -Doppler Shift: 1217.797392

Satellite ID: 4 -Calculating Doppler Shift... -Calculating Code Phase... -Doppler Shift: -1208.885611

Satellite ID: 7 -Calculating Doppler Shift... -Calculating Code Phase... -Doppler Shift: 726.252373

Satellite ID: 8 -Calculating Doppler Shift... -Calculating Code Phase... -Doppler Shift: 3109.225899

Generating GPS Wavefile... 100.0%

Press Return Key

#### Discover What's Possible™

Slide 16 MG3700A-E-L-12

## GPS tool ~How to Use (4)~

Downloading waveform pattern to MG3700A

Download the waveform generated by the PC to the MG3700A hard disk.

<Procedure> Using a CF card

- 1. Copy the waveform pattern to the CF card. Put the waveform pattern in the <u>root</u> <u>directory</u>.
- 2. Insert the CF card into the MG3700A card slot.
- 3. Press the Baseband key, and then the F1 key (Load File to Memory).
- 4. Press the F3 key (File Copy CF to HDD) to read the CF card file data. Do not remove the CF card from the card slot.
- 5. The waveform pattern selection window and waveform files in the CF card are displayed. Use the rotary knob or Up/Down keys to select the waveform files to copy, and press the Set key to confirm.

Select [\*\*\* ALL Install \*\*\*] to copy all waveforms in the CF card to the internal hard disk.

Note: Read the following pdf for the procedure using a LAN.

MG3700A\_Connection to LAN\_J.pdf

Discover What's Possible™

Slide 17



## GPS tool ~How to Use (5)~

### Loading waveform pattern into memory

Load waveform patterns from the MG3700A hard disk into memory.

<Procedure>

- 1. Press the Baseband key, and then F1 key (Load File to Memory).
- 2. Press the F1 key (Select Package) to display the package selection window. Use the rotary knob or Up/Down keys to select the GPS package and press the Set key.
- 3. The waveform file selection window and waveform files in the selected package are displayed. Use the rotary knob or UP/Down keys to select the waveform file to load into memory and press the Set key to confirm. Select [\*\*\* ALL Load \*\*\*] to load all waveforms in the package into memory.





## GPS tool ~How to Use (6)~

### Selecting waveform pattern

Select a waveform pattern in the MG3700A waveform memory.

<Procedure>

- 1. Press the **Baseband key** and move the cursor to **File Select** using the rotary knob or Up/Down keys.
- 2. Press the Set key to display the package selection window. Select the GPS package using the rotary knob or Up/Down keys, and press the Set key.
- 3. The waveform file selection window and waveform files in the selected package are displayed. Use the rotary knob or Up/Down keys to select the waveform file to output, and press the Set key to confirm.

**Usage Notes** 

- 1. Cold start the receiver. (Do not leave any previous data remaining.)
- 2. Check the map display of the receiver while outputting the waveform pattern once.
- 3. Press F4 (Waveform Restart) to restart (output from top) the waveform pattern.
  - (When restarting almost simultaneously with a receiver cold start, the output time can be used effectively.)

Discover What's Possible™

Slide 19



## GPS tool ~How to Use (7)~

### Setting frequency and amplitude

<Procedure>

1. Press the Frequency key and push the ten-keys.

### 1.57542 GHz

(GPS frequency is fixed value)

2. Press the Amplitude key and push the ten-keys.

## Ex.) -100 dBm

(Adjust it by the sensitivity level of the receiver)



## GPS tool ~Supplement~

### Search landmark latitude and longitude

A landmark latitude and longitude can be searched on the internet using Google's geocoding (http://www.geocoding.jp/), etc.

When using geocoding, input the name or address of a landmark into the input box and click the search button to display the latitude and longitude.



Slide 21 MG3700A-E-L-12



## **Detailed Information**

### MG3700A operation

See the MG3700A Vector Signal Generator instruction manual (main frame) [W2495AW].

### IQproducer operation

See the MG3700A Vector Signal Generator instruction manual (IQproducer) [W2496AW].

## **Operating Precautions**

The MG3700A is a Vector Signal Generator with arbitrary waveform memory (ARB). The waveform pattern replay time depends on the memory capacity (Slide 12). When outputting a waveform pattern, the pattern is output to the end and then repeated over from the start. In the case of GPS, it is assumed that the receive status is cut at the receiver side to return the time data and satellite position data. When confirming receive using the MG3700, set as follows:

1. Cold-start the receiver. (Do not leave any previous data remaining.)

2. Check the map display of the receiver while outputting the waveform pattern once.



# Appendix

# Introduction of Standard Waveform Pattern for GPS Rx Sensitivity Test

Slide 23



### GPS Waveform Patterns

Pattern Name	Data Overview		
	This is TLM, HOW and Default Navigation Data, which formatted		
SYNC_ADJ <sup>*1</sup>	on the GSP specification <sup>*2</sup> subframe configuration base. One		
	cycle is composed from 6 subframes.		
TLM	This is TLM, HOW and Default Navigation Data, which formatted		
	on the GSP specification <sup>*2</sup> subframe configuration base.		
ΔΛΡΙΤΥ	This Word format is compiled with the GSP specification <sup>*2</sup> .		
	1Word is composed from 24 bit PN9 data and 6bit parity bit.		
	This Word format is compiled with GPS specification <sup>*2</sup> . 1 Word		
TLM_PARITY	is composed from 24 bit NAV data (1 frame cycle) and 6 bit		
	parity bit.		
PN9	This is PN9 continuous data without subframe format.		

\*1: Since SYNC\_ADJ is used with DATA0, DATA1 and DATA10, you need to select file. Press the MG3700A baseband key, and set the Pattern Combination in Defined, and select a file.

\*2: GLOBAL POSITIONING SYSTEM STANDARD POSITIONING SERVICE SIGNAL SPECIFICATION

Note: At least four satellites must be received for evaluating GPS module devices. However, four waveform patterns are not supported for evaluation of the GPS measuring function, because the number of satellite numbers is fixed to "1". These waveform patterns can be used for validating performance, evaluating TRx characteristics and synchronizing adjustment of the mobile with the evaluated module device.



## Appendix: Introduction of GPS Pattern for MG3700A 2/3

### • GPS Waveform Pattern Frame Format





## Appendix: Introduction of GPS Pattern for MG3700A 3/3

### Usage of GPS Waveform Pattern

Waveform	Usage	Measurement	Remark
SYNC_ADJ	Synchronization	For synchronization	Adjusts mobile with GPS by
	adjustment of	adjustment to GPS*3	synchronizing to MT8820A 2-second
	CDMA2000 system	(For synchronization to	cycle trigger, and by outputting GPS
	UE	2PPS signal)	signal
TLM	Rx Sensitivity	Px lovel measurement	Satellite number and C/N information are
	measurement,	Rx level measurement,	obtained at operation check using
	Operation check		controller*4
TLM_PARITY	Rx Sensitivity	Rx level measurement,	Satellite number and C/N information are
	measurement,	Rx data detection	obtained at operation check using
	Operation check	with Default Navi Data	controller*4
PARITY	Rx Characteristics	Parity detection,	Validates parity check function by using
			waveform that has data and parity
		BER Measurement	format*4
PN9	<b>By Characteristics</b>	BER Measurement	IMeasures BER by using continuous wave
			that doesn't have packet format*4

\*3: The RF subframe output timing is within 10 ns with respect to external start trigger input (diagram opposite)

\*4: The special test mode, which checks GPS performance, is required for mobile function.



Diagram SYNC\_ADJ output timing



Slide 26

# **Ordering information**

	Name	Remarks		
lainframe —				
3700A	Vector Signal Generator			
standard				
essories —				
17F	Power cord, 2.6 m	1 pc		
76 I	LAN Straight cable	1 pc, 10 cm, For back-panel U link connection		
(	Compact Flash	1 pc		
54 (	Compact Flash Adapter	1 pc, PCMCIA Adapter		
42	MG3700A CD-ROM	1 pc, includes MG3700A Operation Manual, IQproducer Operation Manual, Standard		
		Waveform Pattern Operation Manual, IQproducer Software		
Options —				
3700A-002 I	Mechanical Attenuator	Replaces standard electronic attenuator with mechanical attenuator. increases output power from +13 to +19 dBm; improves Ajacent Channel Power by 1 to 2 dB		
3700A-011	Upper Frequency 6 GHz	Expands standard frequency range from "250 kHz to 3 GHz" to "250 kHz to 6 GHz".		
3700A-021	ARB Memory Upgrade 512 M sample	Expands standard ARB memory size from 128 Msamples/channel x 2 to 256 Msamples/channel x 2. Recommended for video because one 12-s video file requires 256Msa		
3700A-031 I	High Speed BER Test Function	Replaces standard buit-in BER; recommended for R&D because supports threshold adjuctment function and higher error rates		
Optional access	sories —			
51D I	Ethernet Cable (Shield Type)	Crossover 3 m; required when connecting PC (IQproducer) and MG3700A directly. Can use straight cable for connection via hub.		
77	IQ Output Conversion Adapter	Required when evaluating using IQ output (Balance); converts MG3700A IQ output D-Sub connectior to BNC.		
— Sample Softwares —				
nple	GPS positioning pattern generation tool	Required when generating GPS waveform pattern usinfg PC. The user can obtain this software from the software download site.		
	ainframe — 700A andard ssories — 7F 5 4 2 btions — 700A-002 700A-002 700A-011 700A-021 700A-031 btional access ID 7 mple Softwa ble	ainframe —         700A       Vector Signal Generator         andard       ssories —         7F       Power cord, 2.6 m         S       LAN Straight cable         Compact Flash       Compact Flash Adapter         A       MG3700A CD-ROM         Dtions —       Mechanical Attenuator         700A-002       Mechanical Attenuator         700A-011       Upper Frequency 6 GHz         700A-021       ARB Memory Upgrade 512 M sample         700A-031       High Speed BER Test Function         Ditional accessories —       ID         ID       Ethernet Cable (Shield Type)         IQ Output Conversion Adapter         Imple Softwares —       GPS positioning pattern generation tool		

Discover What's Possible™



### Note

Slide 28



# <u>/inritsu</u>

#### United States

Anritsu Company 1155 East Collins Blvd., Suite 100, Richardson, TX 75081, U.S.A. Toll Free: 1-800-267-4878 Phone: +1-972-644-1777 Fax: +1-972-671-1877

#### Canada

Anritsu Electronics Ltd. 700 Silver Seven Road, Suite 120, Kanata, Ontario K2V 1C3, Canada Phone: +1-613-591-2003 Fax: +1-613-591-1006

#### • Brazil

Anritsu Eletrônica Ltda. Praça Amadeu Amaral, 27 - 1 Andar 01327-010 - Bela Vista - São Paulo - SP - Brazil Phone: +55-11-3283-2511 Fax: +55-11-3288-6940

#### Mexico

Anritsu Company, S.A. de C.V. Av. Ejército Nacional No. 579 Piso 9, Col. Granada 11520 México, D.F., México Phone: +52-55-1101-2370 Fax: +52-55-5254-3147

#### United Kingdom

Anritsu EMEA Ltd. 200 Capability Green, Luton, Bedfordshire, LU1 3LU, U.K. Phone: +44-1582-433200 Fax: +44-1582-731303

#### France

Anritsu S.A. 12 avenue du Québec, Bâtiment Iris 1- Silic 612, 91140 VILLEBON SUR YVETTE, France Phone: +33-1-60-92-15-50 Fax: +33-1-60-46-10-65

#### • Germany

Anritsu GmbH Nemetschek Haus, Konrad-Zuse-Platz 1 81829 München, Germany Phone: +49-89-442308-0 Fax: +49-89-442308-55

#### • Italy

Anritsu S.r.I. Via Elio Vittorini 129, 00144 Roma, Italy Phone: +39-6-509-9711 Fax: +39-6-502-2425

#### Sweden Anritsu AB

Annisu AD Borgarfjordsgatan 13A, 164 40 KISTA, Sweden Phone: +46-8-534-707-00 Fax: +46-8-534-707-30

#### • Finland

Anritsu AB Teknobulevardi 3-5, FI-01530 VANTAA, Finland Phone: +358-20-741-8100 Fax: +358-20-741-8111

#### Denmark

Anritsu A/S (Service Assurance) Anritsu AB (Test & Measurement) Kay Fiskers Plads 9, 2300 Copenhagen S, Denmark Phone: +45-7211-2200 Fax: +45-7211-2210

#### • Russia

#### Anritsu EMEA Ltd. Representation Office in Russia

Tverskaya str. 16/2, bld. 1, 7th floor. Russia, 125009, Moscow Phone: +7-495-363-1694 Fax: +7-495-935-8962

#### • United Arab Emirates Anritsu EMEA Ltd.

Dubai Liaison Office P O Box 500413 - Dubai Internet City Al Thuraya Building, Tower 1, Suit 701, 7th Floor Dubai, United Arab Emirates Phone: +971-4-3670352 Fax: +971-4-3688460

#### • India

#### Anritsu India Private Limited

2nd & 3rd Floor, #837/1, Binnamangla 1st Stage, Indiranagar, 100ft Road, Bangalore - 560038, India Phone: +91-80-4058-1300 Fax: +91-80-4058-1301

#### Specifications are subject to change without notice.

#### Singapore

Anritsu Pte. Ltd. 60 Alexandra Terrace, #02-08, The Comtech (Lobby A) Singapore 118502 Phone: +65-6282-2400 Fax: +65-6282-2400

#### • P.R. China (Shanghai)

Anritsu (China) Co., Ltd. Room 1715, Tower A CITY CENTER of Shanghai, No.100 Zunyi Road, Chang Ning District, Shanghai 200051, P.R. China Phone: +86-21-6237-0898 Fax: +86-21-6237-0899

#### • P.R. China (Hong Kong)

Anritsu Company Ltd. Unit 1006-7, 10/F., Greenfield Tower, Concordia Plaza, No. 1 Science Museum Road, Tsim Sha Tsui East, Kowloon, Hong Kong, P.R. China Phone: +852-2301-4980 Fax: +852-2301-3545

#### Japan

Anritsu Corporation 8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016 Japan Phone: +81-46-296-1221 Fax: +81-46-296-1238

Korea

#### Anritsu Corporation, Ltd.

502, 5FL H-Square N B/D, 681 Sampyeong-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400 Korea Phone: +82-31-696-7750 Fax: +82-31-696-7751

#### Australia

Anritsu Pty. Ltd. Unit 21/270 Fentree Gully Road, Notting Hill, Victoria 3168, Australia Phone: +61-3.9558-8177 Fax: +61-3-9558-8255

#### Taiwan

Anritsu Company Inc. 7F, No. 316, Sec. 1, NeiHu Rd., Taipei 114, Taiwan Phone: +886-2-8751-1816 Fax: +886-2-8751-1817

