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Digital Terrestrial Broadcasting (ISDB-T)
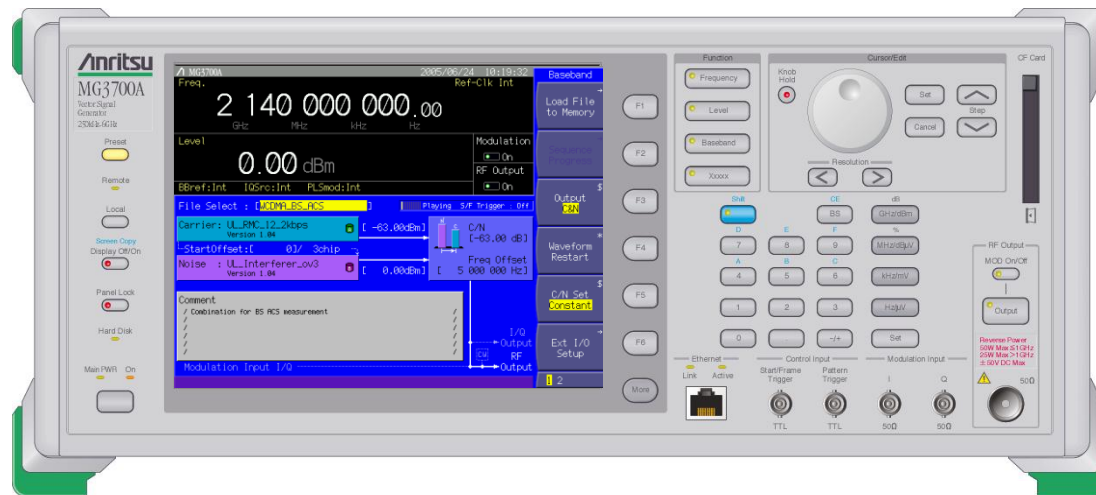
MG3700A
Vector Signal Generator

Digital Terrestrial Broadcasting (ISDB-T)

ANRITSU CORPORATION

Measurement Business Group Wireless Measurement Div.

MG3700A: For Generating Digital Terrestrial Broadcast Signals

The MG3700A Vector Signal Generator outputs **simple BER data** and **video waveforms** for **Digital Terrestrial Broadcasting (ISDB-T)**

*Video waveforms are provided separately. Please enquire about details separately.
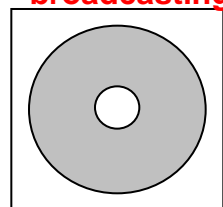
Key features of MG3700A

Frequency: 250 kHz to 3 GHz (Standard)
250 kHz to 6 GHz (Option)

Output Level (CW): −140 to +13 dBm (Standard)
−140 to +19 dBm (Option)

Level Accuracy: ±0.5 dBm
Waveform Combine Function: Two built-in ARB memories support simultaneous output of two signals using one unit.
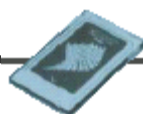
Waveform patterns for digital terrestrial broadcasting

PC

CF Card

or
100Base-TX LAN

MG3700A Vector Signal Generator

1. PC reads waveform pattern

2. Waveform data transferred to MG3700A

3. Waveform data selected and output

The waveform patterns must be installed on the MG3700A HDD only for the first time. Waveforms can then be read from the HDD.

Waveform output using MG3700A

◆Main Performance

- **Frequency Range 250 kHz to 6 GHz**
  250 kHz to 3 GHz (Standard)
  250 kHz to 6 GHz (Option)

- **Wideband Vector Modulation**
  120 MHz (using built-in baseband generator)
  150 MHz (using external IQ)

- **High Level Accuracy**
  Absolute: ±0.5 dB
  Linearity: ±0.2 dB typ.

- **Waveform Combine Function**
  Output two signals of different frequencies*
  at separate levels

- **Built-in BER Measurement**
  Input Bit Rate: 1 kbps to 20 Mbps (Standard)
  Input Bit Rate: 100 bps to 120Mbps (Option)

- **Built-in 40 GB HDD**

- **Max. 2 GB Arbitrary Waveform Memory**
  1 GB = 256 Msamples/ch (Standard)
  2 GB = 512 Msamples /ch (Option)

- **Waveform Transfer and Remote Control via 100Base-TX LAN**

- **Weight: ≤15 kg (without options)**

The MG3700A key features are listed opposite.

The waveform combine function saves a different signal in each built-in ARB memory and supports frequency offset, as well as output of two different video channels.

ch1 Video 1   **ch2 Video 2**
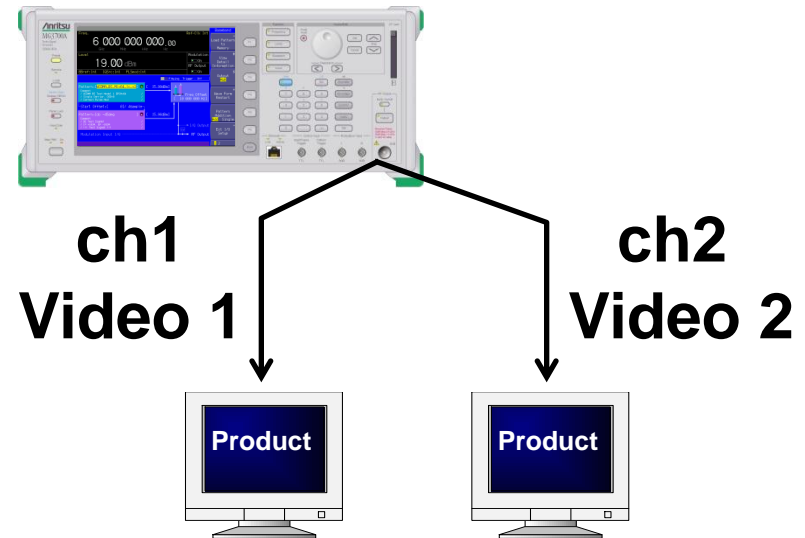
*The MG3700A has a modulation bandwidth of 120 MHz max.when using frequency offset. There is a limit due to sampling grade.

MG3700A: Software Lineup

♦ **The MG3700A Supports Various Communication Systems**

• **Built-in Waveform Patterns**
- 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 Generation Software: IQproducer (sold separately)**
- W-CDMA, - AWGN
- HSDPA/HSUPA, - TDMA (PDC, PHS, Public Wireless)
- CDMA2000 1xEV-DO, - Multi-carrier
- Mobile WiMAX, - DVB-T/H,

• **Arbitrary Waveform Generator**
ASCII system IQ data created using a general EDA tool can be converted and output as waveform pattern for the MG3700A. The quick and easy creation and measurement of waveform patterns increases the development efficiency of new communications systems.

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.

Note: Anritsu doesn't support continuous PN23 data, due to memory capacity.

◆ Standard Waveform Pattern for Digital Broadcast

Pattern Name	Parameter	Application
ISDBT_1layer_1ch	Mode: 3, GI: 1/8 A-Layer:13seg, 64QAM	Physical layer waveform pattern of ISDB-T for device evaluation.
ISDBT_2layer_1ch	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK B-Layer: 12seg, 64QAM	Physical layer waveform pattern of ISDB-T for device evaluation.
ISDBT_2layer_Movie	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK, CR = 2/3, TI = 2 B-Layer: 12seg, 64QAM, CR = 7/8, TI = 2	Waveform pattern for ISDB-T partial reception, mainlyused for evaluation of image and voice data of terminals. The waveform length is 40 frames.
ISDBT_2layer_Movie2	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK, CR = 2/3, TI = 4 B-Layer: 12seg, 64QAM, CR = 3/4, TI = 2	
ISDBT_2layer_Coded	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK, CR = 2/3, TI = 2 B-Layer: 12seg, 64QAM, CR = 7/8, TI = 2	Waveform pattern for ISDB-T partial reception, mainlyused for simple BER measurement. The waveform length is 4 frames.
ISDBT_QPSK_1_2	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK, CR = 1/2, TI = 0 B-Layer: 12seg, 64QAM, CR = 7/8, TI = 1	
ISDBT_QPSK_2_3	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK, CR = 2/3, TI = 0 B-Layer: 12seg, 64QAM, CR = 7/8, TI =1	
ISDBT_16QAM_1_2	Mode: 3, GI: 1/8 A-Layer: 1seg, 16QAM, CR = 1/2, TI = 0 B-Layer: 12seg, 64QAM, CR = 7/8, TI = 1	
ISDBT_QPSK_2_3_TI4	Mode: 3, GI: 1/8 A-Layer: 1seg, QPSK, CR = 2/3, TI = 4 B-Layer: 12seg, 64QAM, CR = 3/4, TI = 2	

Use: Each waveform pattern can be used for ISDB-T1/12 segment video/voice check, simple BER and interference.

Note: Due to its huge memory footprint, PN23 data cannot be used.

# MG3700A: Software Lineup (ISDB-T)

◆ Video Waveform Pattern for Digital Terrestrial Broadcasting

Usually, customers use their own video content to evaluate digital terrestrial broadcasts. Therefore, Anritsu offers a service to convert the customer's re-multiplexed TS data to MG3700A waveform pattern data. Along with TS data, the following setting information is required for conversion.

The cost (free/charged) and development terms depend on the number of waveform patterns. Enquire us for details.

[Setting Information]
– Mode
– GI
– Existence of emergency warning fragment
– Existence of Rx fragment parts
– Number of segments in each layer
– Modulation system in each layer
– Convolutional code rate in each layer
– Time interleave length in each layer

Customer → Re-multiplexed TS data + setting information → **Anritsu**

Anritsu → Video waveform pattern for digital terrestrial broadcasting (free/charged) → **Customer**
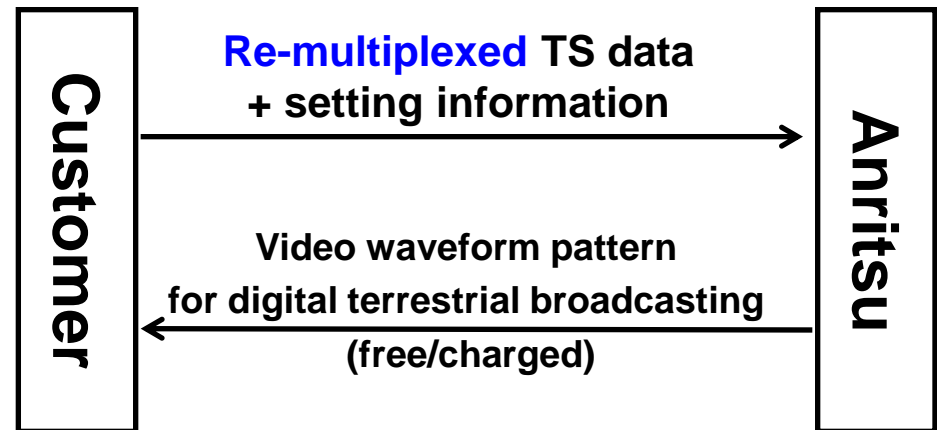
Anritsu also offers tools for generating ISDB-T waveform patterns. Please enquire for details.

MG3700A: Waveform Combine Function

◆ Waveform Combine Function (Standard Function)

The single MG3700A unit supports setting and output of different waveform patterns for 2 ARB memories.
It can also set level and frequency offset, supports output of different channels (frequency) with different animations.

[Ex. MG3700A Setting Screen]

One unit outputs two channel signals

6 MHz Offset
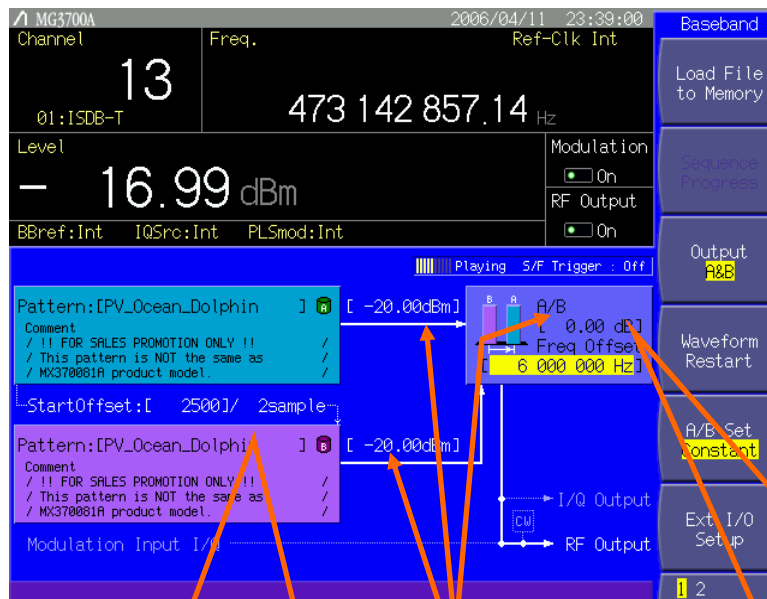
Two signals set simultaneously
Different signals set in memory A and B

Two waveforms set with different level and C/N

Frequency offset setting
Range depends on waveform pattern sampling rate*

*Example for 16.254 MHz sampling rate
Frequency Offset Setting Range
– 47.94 to + 47.94 MHz

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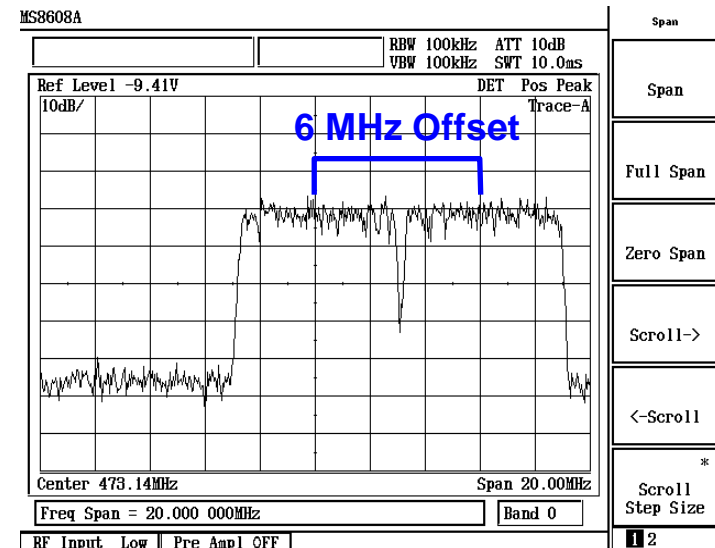
◆ Waveform for Video Evaluation

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.

The video run time when the option is installed and one side has 1 GB of memory is shown below.

1. 13 Segment Single Layer (13 Segment): About 16 s
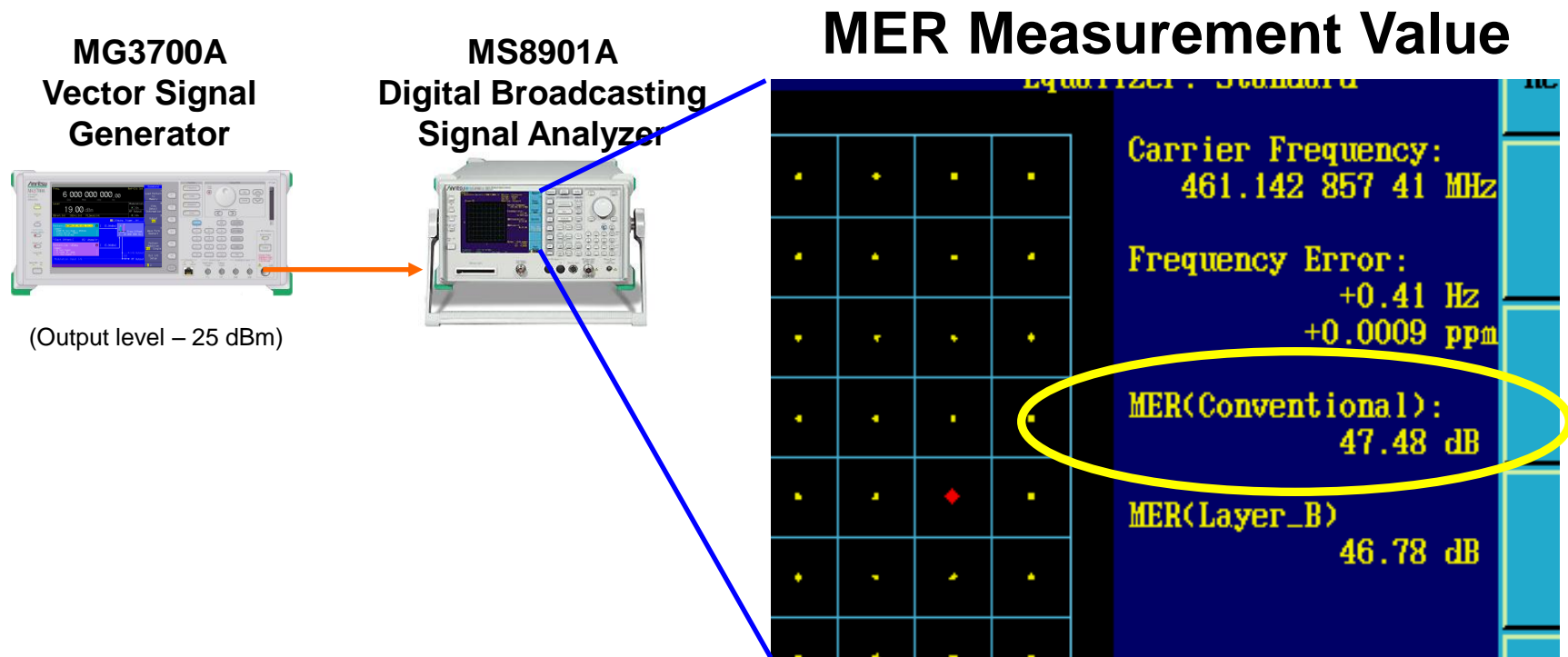
2. 13 Segment Layer Transmission (1, 12 Segment): About 16 s

Memory A: 1 GB	Memory B: 1 GB
Video 1 **Run Time: about 16 s**	**Video 2** **Run Time: about 16 s**

Image of 1. and 2. when 1 GB x 2 pcs
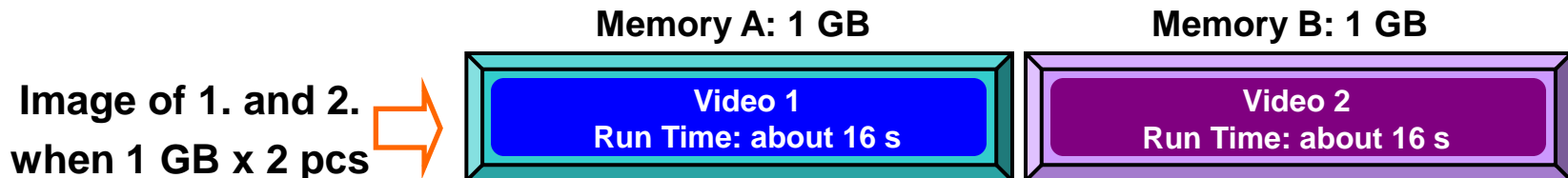
Note:
When the video run time is long, evaluation differences might occur between some scenes (contents). On the other hand, playing repeated short scenes permits evaluation in the same scene (content).

♦ MG3700A Output Signal MER Performance

**MG3700A
Vector Signal
Generator**

(Output level – 25 dBm)

**MS8901A
Digital Broadcasting
Signal Analyzer**

MER Measurement Value

Equalizer: Standard

Carrier Frequency:
461.142 857 41 MHz

Frequency Error:
+0.41 Hz
+0.0009 ppm

MER(Conventional):
47.48 dB

MER(Layer_B)
46.78 dB

MER: 47 dB approx.

Note: This is one measurement result and this performance is not guaranteed.
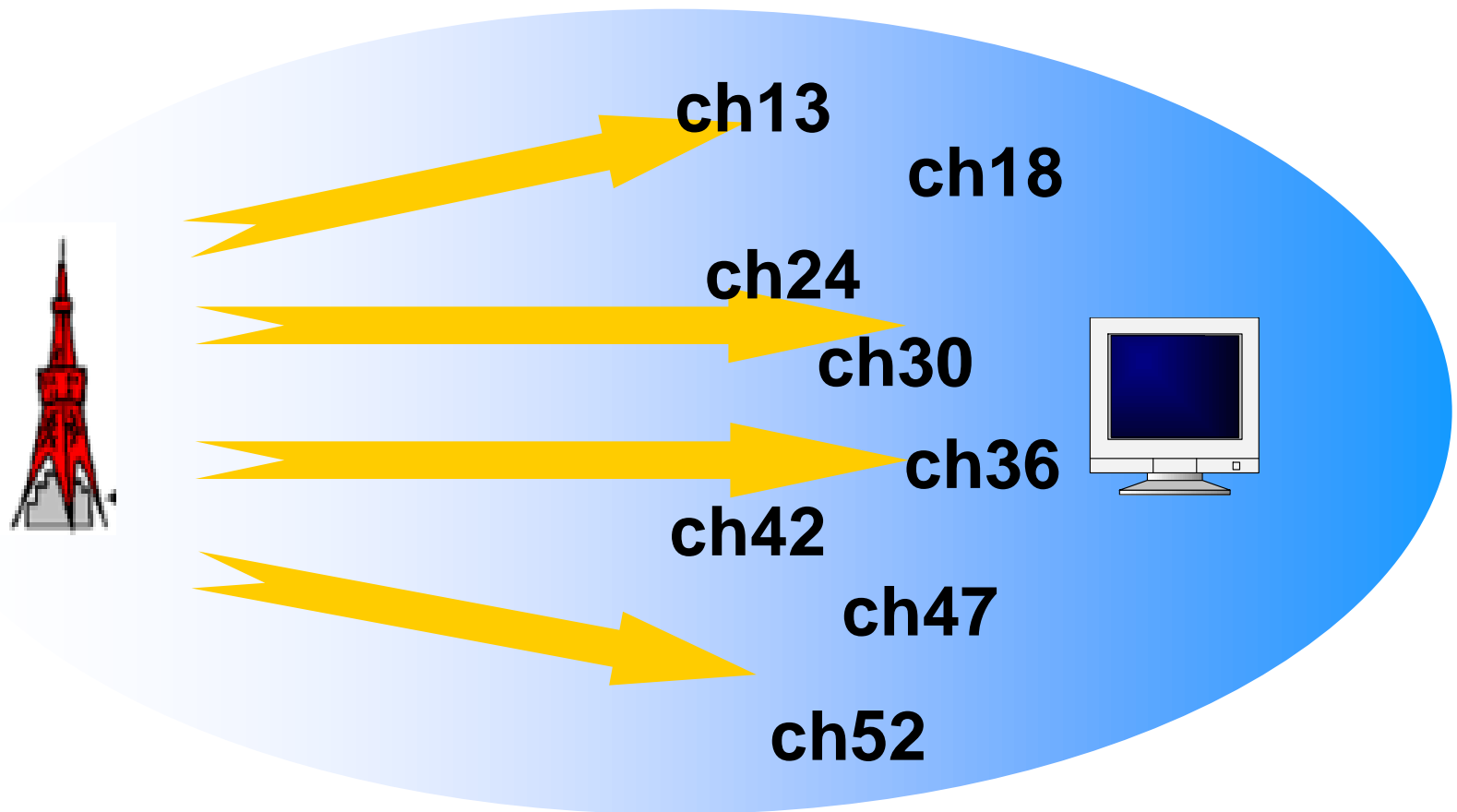
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Rx Performance Measurement

◆ Simple BER Measurement

Simple BER measured and displayed using signal analyzer

MS8901A

Device

Instrument

Waveform pattern for simple BER* output

(*Forward Error Correction count)

Simple BER* measured after demodulation

Simple BER measurement result received and displayed

◆ Video Measurement

***Waveform patterns provided separately for simple BER and video. Enquire for details.**

Video waveform pattern output

Video displayed on monitor
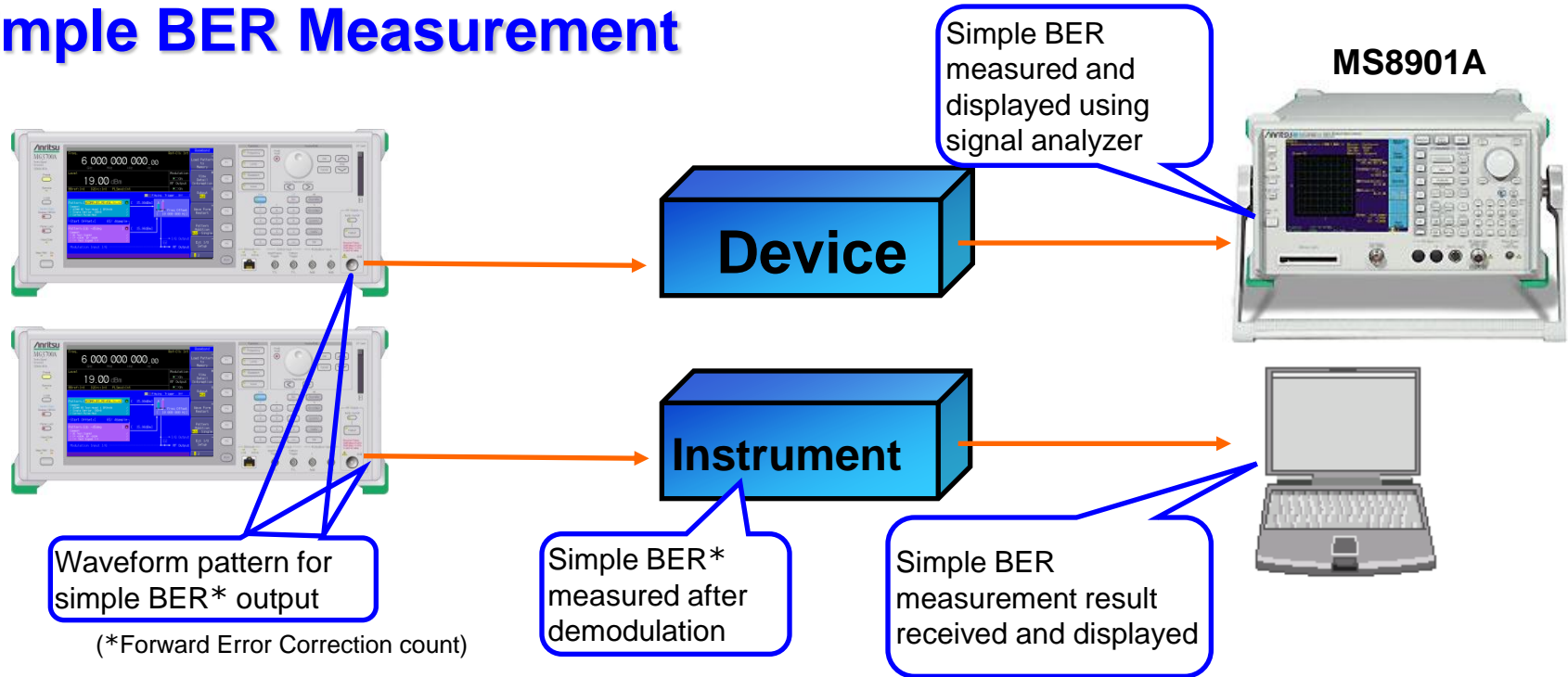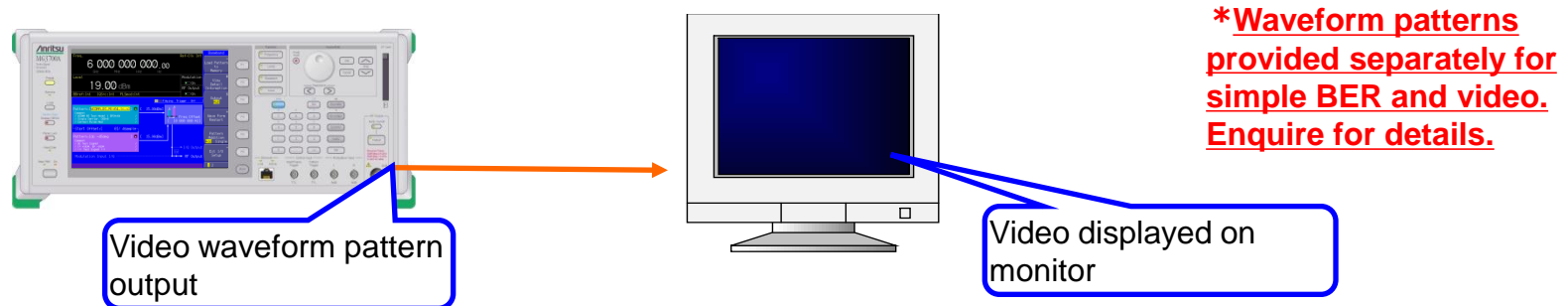
Example 1:
Rx Performance Evaluation on Production Line

Digital Terrestrial Broadcasting uses ch13 to 52 band.
The Rx performance for any frequency and monitor quality are checked at manufacturing.

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Point

SG SG SG SG SG SG SG SG

ch13 video 1 | ch18 video 2 | ch24 video 3 | ch30 video 4 | ch36 video 5 | ch42 video 6 | ch47 video 7 | ch52 video 8

Product Product Product Product Product Product Product Product

Example

ch13 video 1 | ch18 video 2 | ch24 video 3 | ch30 video 4 | ch36 video 5 | ch42 video 6 | ch47 video 7 | ch52 video 8

Product Product Product Product Product Product Product Product

Sometimes, the video quality is checked by changing video contents while switching channels as a production line evaluation point.

Usually, in such a case, one SG must be prepared for each channel because one SG can output only one channel and one video signal animation.
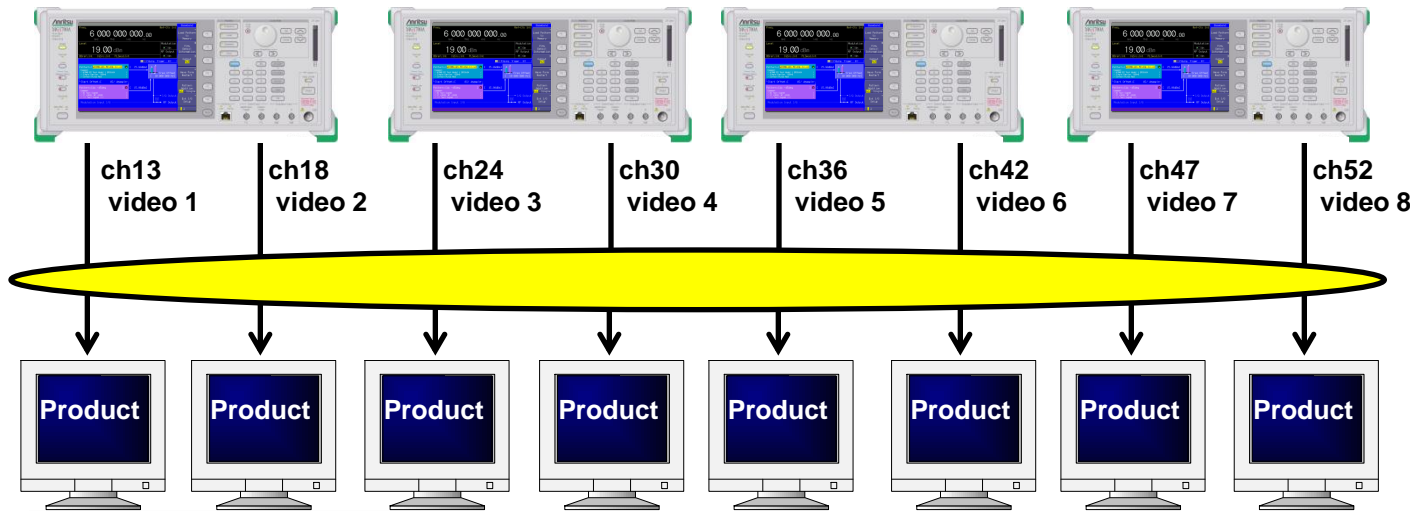
One MG3700A supports simultaneous output of two channels and two video signals*, cutting capital costs.

*Video played repeatedly in loops of 16 s approx.

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Slide 12

MG3700A-E-L-8

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Example 2: Interference Evaluation

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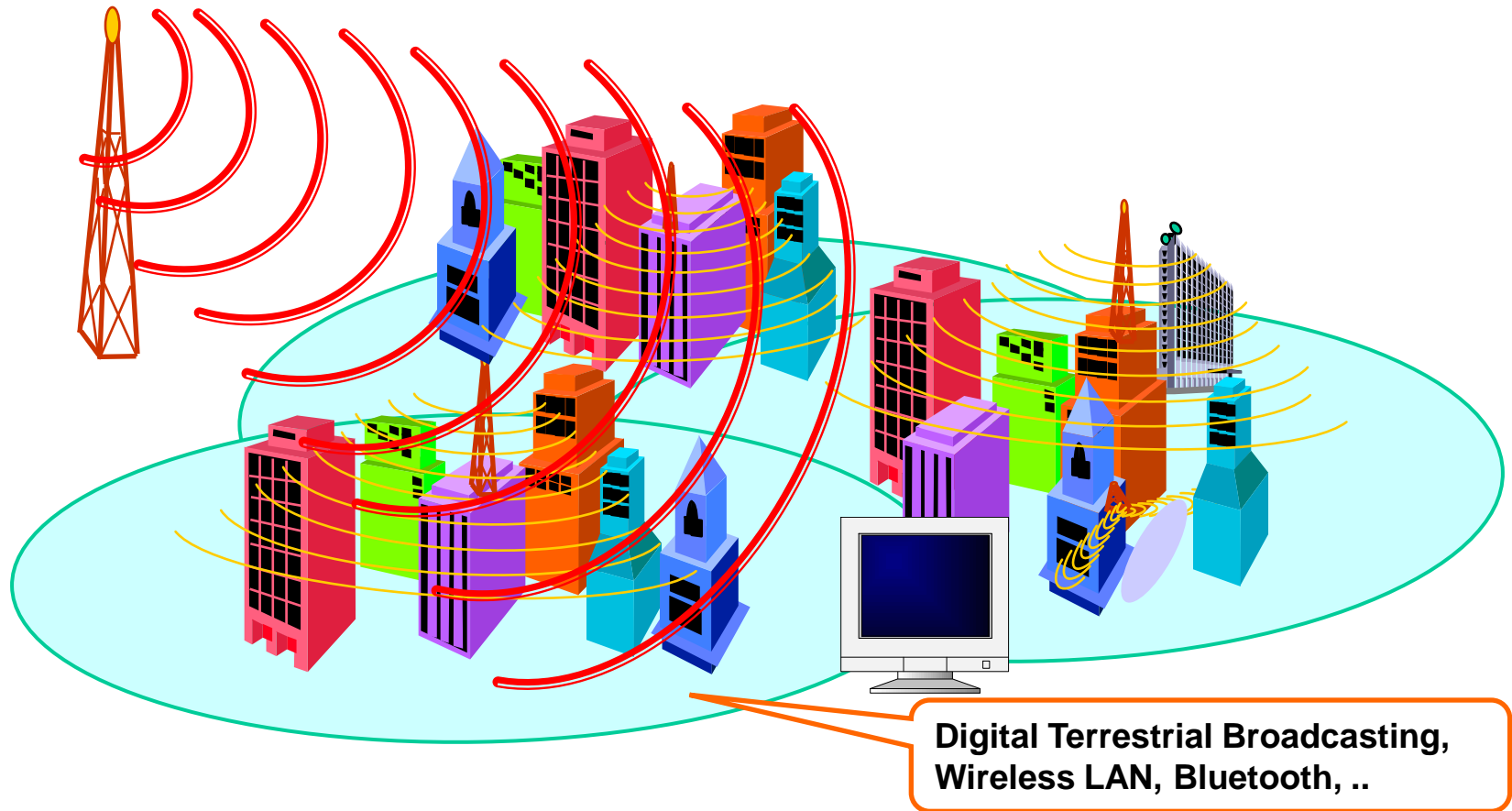
Most navigation systems and PC have digital terrestrial broadcasting as well as wireless LAN and Bluetooth. Each signal source must be tested to avoid the interference between systems.

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Example 2: Interference Evaluation

Point

♦ **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***

The MG3700 outputs signals of various communication systems, such as the main mobile signals, WLAN signals and Bluetooth, as standard. Therefore, it can be also used as an interference signal source for digital terrestrial broadcasting, when the product has multiple systems built-in. Moreover, the MG3700A will support future communication systems, just by adding software.

Interference

Digital Terrestrial Broadcasting

Product
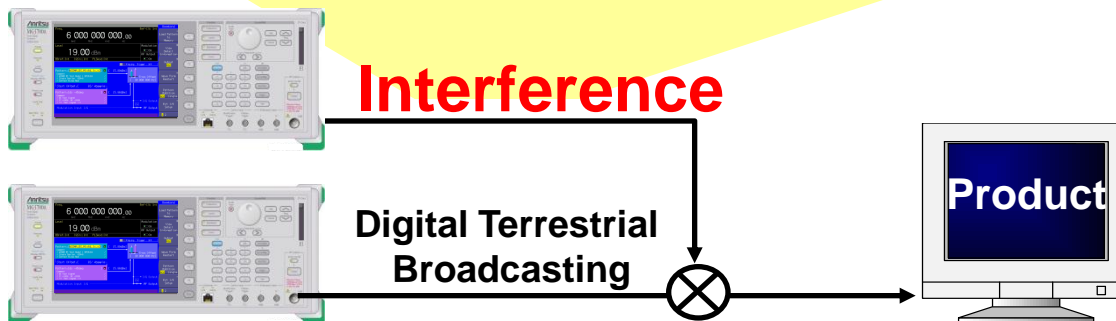
Example 3: Delayed Signal Interference Evaluation

In a real environment, interference can be caused by waveform signal delay. The occurrence of signal delay can be checked using the delay measurement profile shown below. Moreover, the effect can be tested by BER and MER.
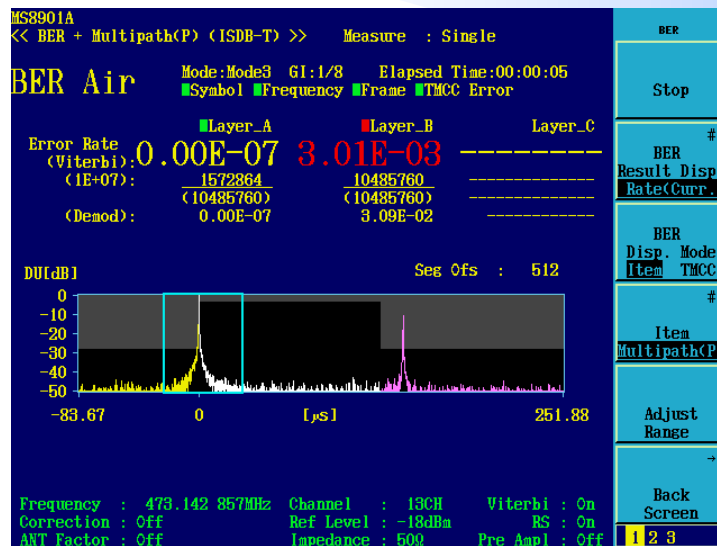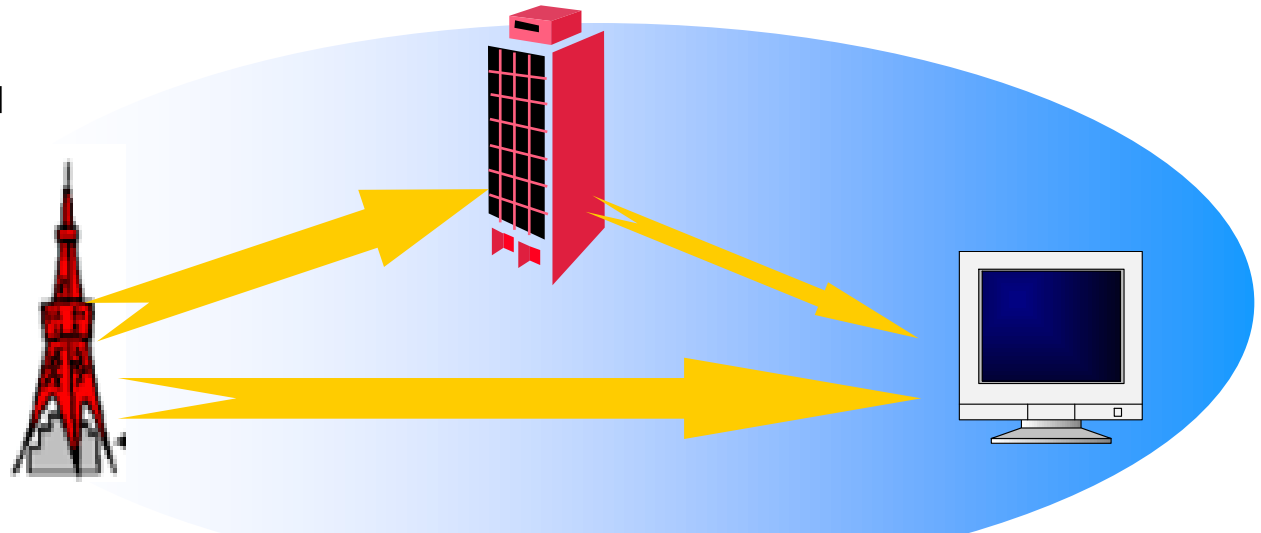
Delay Profile
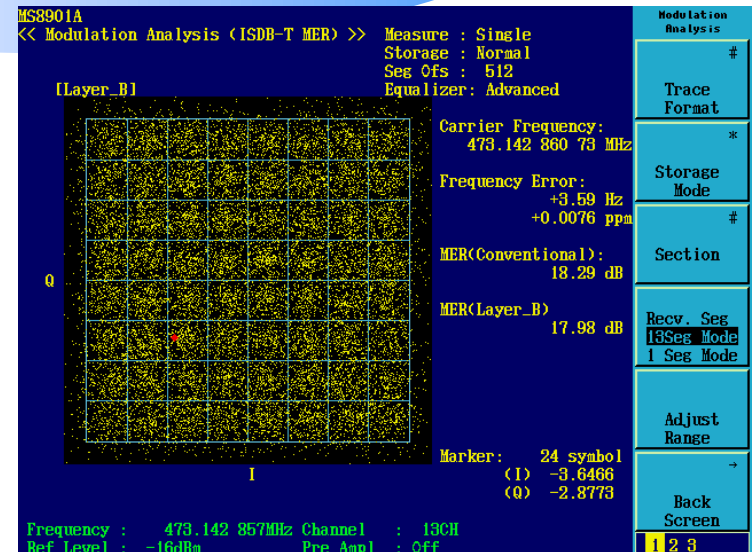
Constellation

[Ex. MS8901A Digital Broadcasting Signal Analyzer Screen]

Example 3: Delayed Signal Interference Evaluation

The MG3700A waveform combine function simulates evaluation of waveform delay (one waveform) by outputting the waveform patterns in memory A and B at different timings.
The different timing is set using "Start Offset" shown below.

[MG3700A Setting Example]

Setting same waveform pattern in memory A and B

C/N level setting

Delay setting

Wanted Signal

Delayed Signal

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Example 4: CN Margin Test
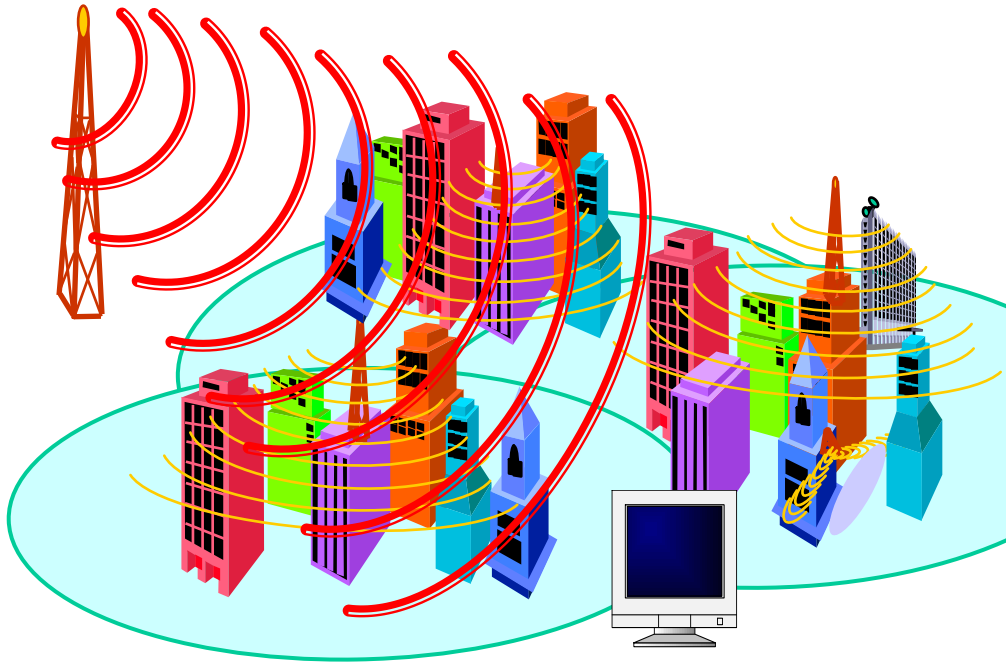
In a real environment, interference between signals may cause noise, causing deteriorated MER even when the Rx level is adequate (opposite figure.) Testing CN margin requires addition of white noise (AWGN) to the wanted wave and evaluation.

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The MG3700A waveform combine function supports evaluation of **CN margin** by setting the wanted signal in memory A, AWGN in memory B, and combining the waveform patterns.

IQproducer supports AWGN generation as a standard function.

Setting wanted waveform pattern (video) in memory A

Setting AWGN waveform pattern in memory B

C/N level setting

[Ex. MG3700A Setting Screen]

Example 5: Interference Test

Sometimes, an interference wave enters the Digital Terrestrial Signal band as shown in the screen on the right. However, it is impossible to check the interference by spectrum analysis and it must be checked using the Carrier vs. MER method shown in the bottom right figure. The specified MER dispersion can be checked in the constellation at the same time.
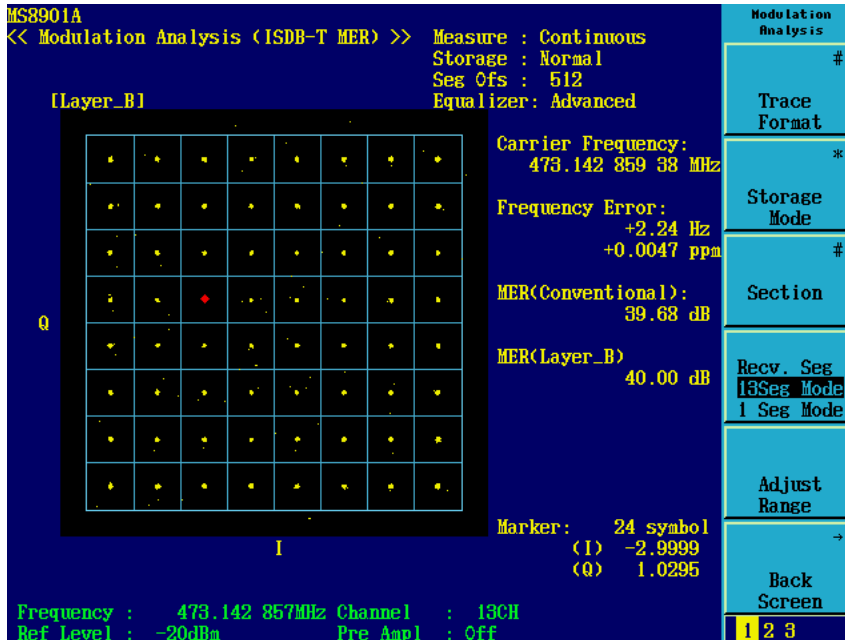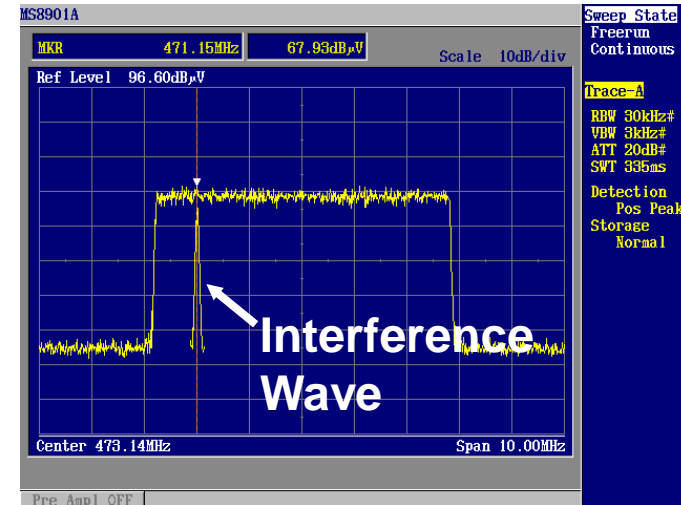
Constellation
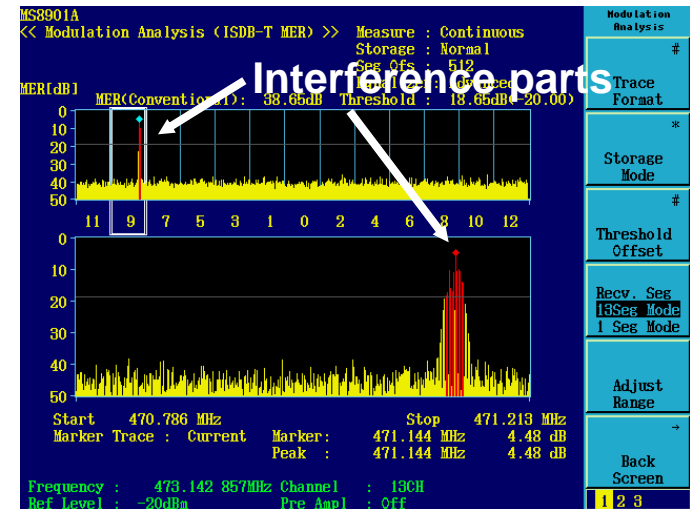
MER in each sub-carrier

[Ex. MS8901A Digital Broadcasting Signal Analyzer Screen]

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Example 5: Interference Test

Point

The MG3700A waveform combine function supports **simulated waveform interference tests** by setting the wanted wave in memory A the interference wave (CW) in memory B, and combining the waveforms.

Center offset frequency

Setting wanted waveform pattern (video) in memory A

Setting CW waveform pattern in memory B

C/N level setting

Offset frequency setting

[Ex. MG3700A Setting Screen]

Sometimes, actual digital terrestrial broadcasts use adjacent channels and the wanted carrier deterioration must be checked.

Deterioration? (MER/Simple BER)

ch13 ch14 ch15 ch16 ch17
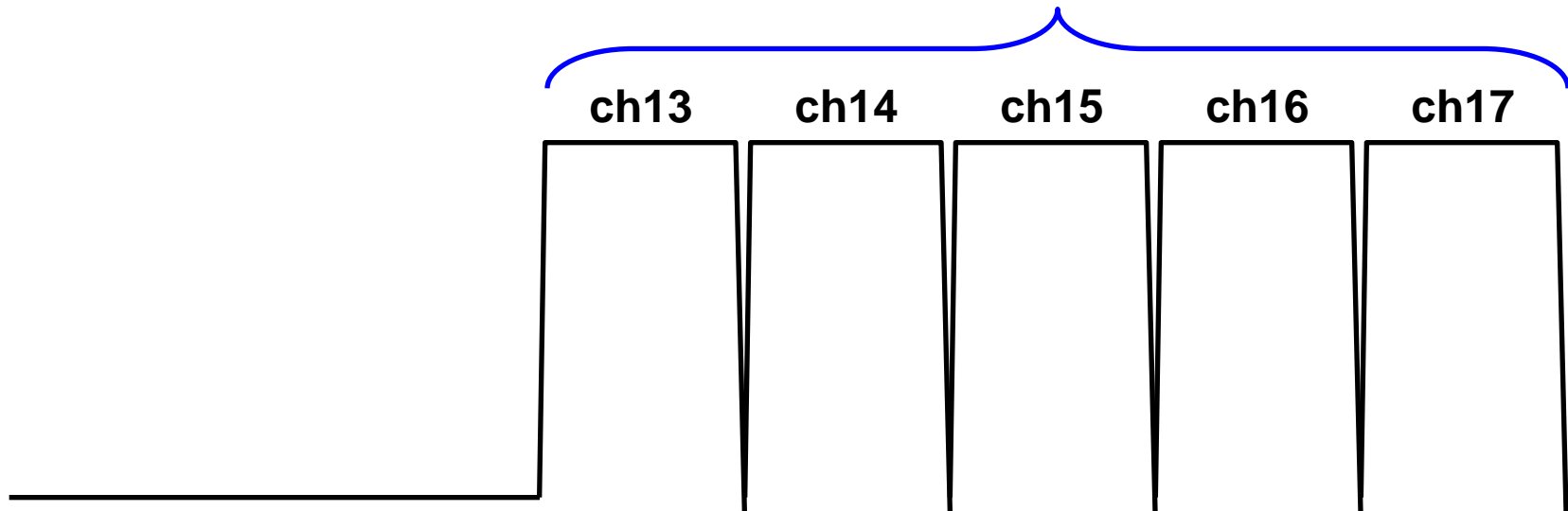
Example 6: Multi-signal Output

The MX370104A Multi-carrier IQproducer supports generation of up to 4 carrier signals as one waveform pattern. By using the waveform combine function, one unit can output eight **continuous** carrier signals by combining two waveform patterns with a 24 MHz offset.
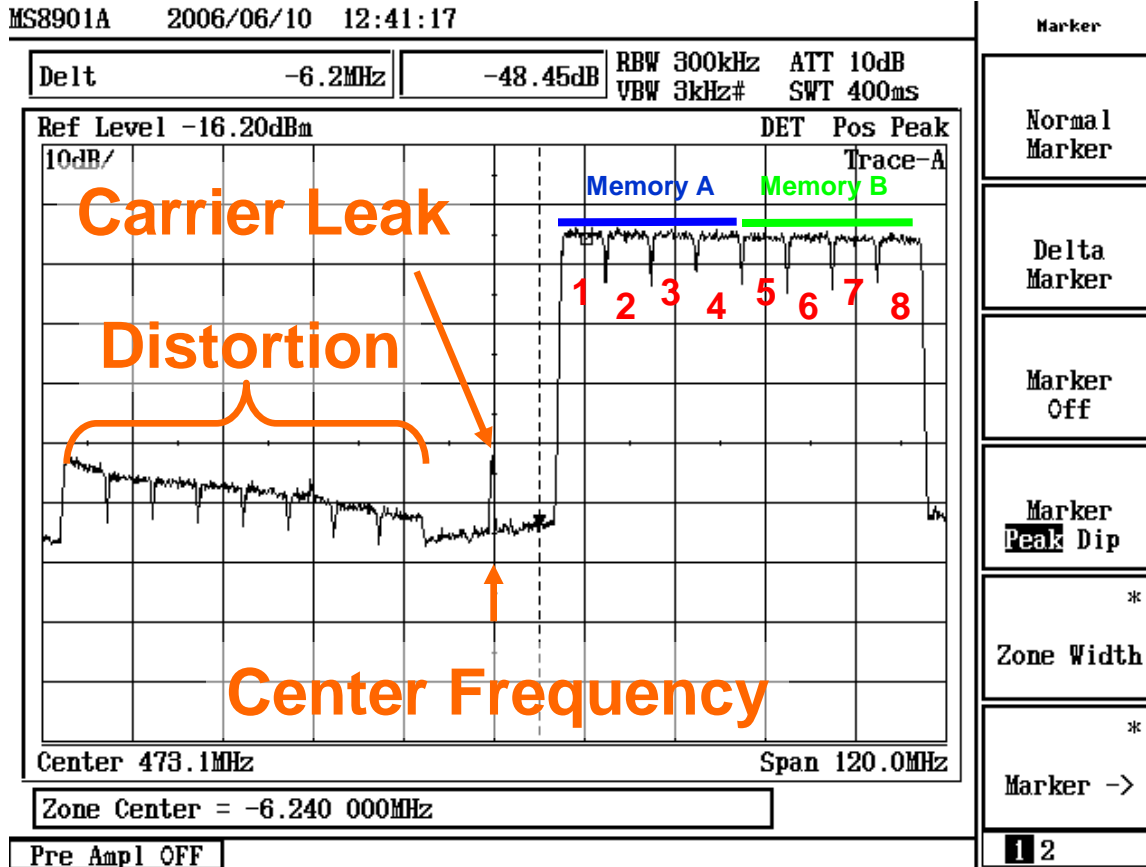
When checking the deterioration of each carrier, an offset is placed around the center frequency, so carrier leak and distortion do no impact the carrier.
In this case, the existence of carrier leak and distortion have no impact on measurement, because the carrier is being measured.

When measuring out-of-band noise, the carrier is centered symmetrically around the center frequency, so both distortions are hidden between the carriers and outside the band becomes flat.

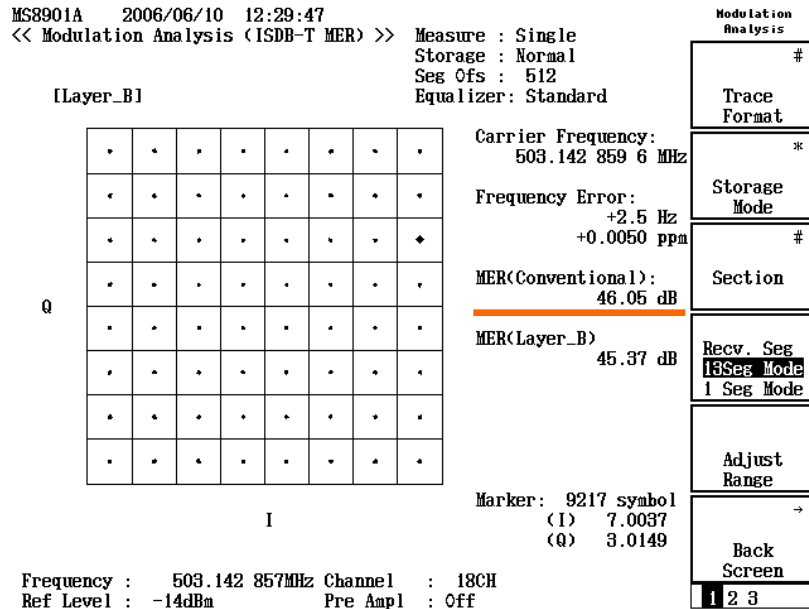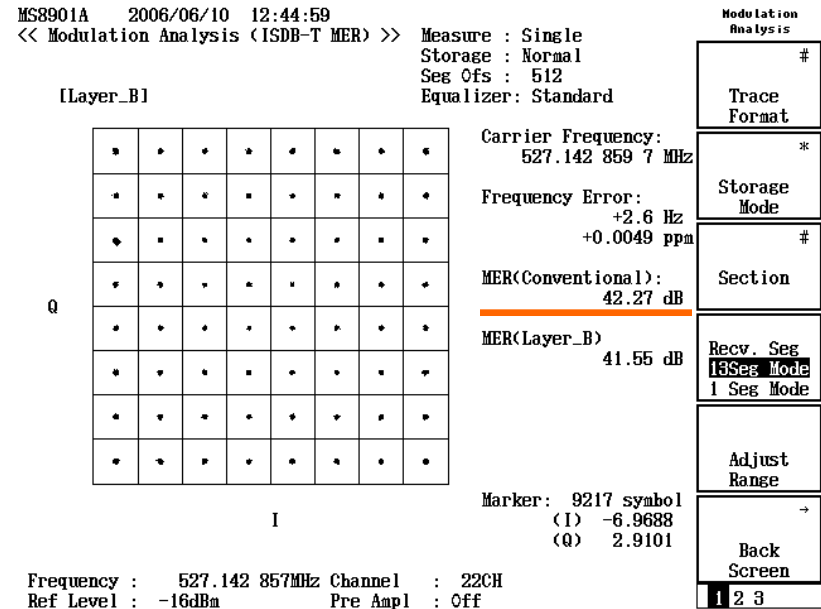|	Model/ Order No.	Name	Remarks
	— Mainframe —		
Mandatory	MG3700A	Vector Signal Generator	
	— Options —		
	MG3700A-002	Mechanical Attenuator	This option replaces standard Electronic Attenuator with Mechanical Attenuator. Output power becomes from +13dBm to +19dBm. Adjacent Channel Power is improved about 1 to 2dB.
	MG3700A-011	Upper Frequency 6 GHz	This option expands standard frequency range from "250 kHz to 3 GHz" to "250 kHz to 6 GHz".
Recommended	MG3700A-021	ARB Memory Upgrade 512 M sample	This option expands standard ARB memory size from 128 Msamples/channel x 2 to 256 Msamples/channel x 2. We recommend to expand the memory size of animation,because it requires 256Msa/one file for playing 16 seconds.
	MG3700A-031	High Speed BER Test Function	This option is replaced with standard buit-in BER. It's recommended for R&D , because it has threshold adjustment function, and supports higer error rate than standard function.
	— Softwares (License Key for IQproducer system) —		
Recommended	MX370104A	Multi-carrier IQproducer	It's required when generating multicarrier waveform pattern usinfg PC.
	— Optional accessories —		
	W2495AE	MG3700A operation manual	
	W2496AE	MG3700A IQproducer operation manual	
	W2539AE	MG3700A standard waveform pattern operation manual	
Recommended	W2505AE	MX370104A Multi-carrier IQproducer operation manual	The PDF manual is preserved in CD of this software. Please order this accessory when the booklet is necessary.
Recommended	J1261D	Ethernet Cable (Shield Type)	Cross 3 m, The cross cable is required when connecting PC（IQproducer）and the MG3700A directly. When it connected via Hub, you can use a straight cable too.
	Z0777	Standard waveform pattern upgrade kit	DVD set of pre-install wave form pattern of latest version
	G0141	HDD ASSY	Exchange HDD when built-in HDD break.
Recommended	J1277	IQ Output Conversion Adapter	This adapter is required when evaluating using IQ output (Balance), converts the MG3700A IQ output connecter D-Sub into BNC.

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Specifications are subject to change without notice.

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