Application Note

Transmit FLO Signals

Vector Signal Generator for Receiver Tests
MS269xA-020

Introduction

This paper discusses how to obtain waveform IQ samples and convert IQ samples to MS269xA Vector Signal Generator (VSG) waveform format. It is directed at engineers who test Forward Link Only (FLO) receivers.

When performing tests defined in *Minimum Performance Specification for Terrestrial Mobile Multimedia* Multicast FLO devices (TIA-1102), testing with a full-fledged FLO transmitter is costly and often impractical. An attractive alternative is to transmit the FLO signal using a Vector Signal Generator such as the MS29xA-020, the VSG option for the MS269xA.

The MS269xA is a one-box tester that includes (standard) a swept mode Spectrum Analyzer, an FFT mode Vector Signal Analyzer (VSA), and the optional Vector Signal Generator. It can be used as a general purpose RF measurement instrument. Also, several software applications are available for measuring various 2G, 3G and 4G wireless technologies.

FLO waveform IQ samples are available to FLO Forum members via the FLO Forum Website. These IQ sample files can be converted into waveform files for the Anritsu MS269xA-020 Vector Signal Generator. They can also be converted into waveform files for the Anritsu MG3700 Vector Signal Generator.

IQ Sample Filename	Reference Document
FLOXIQ016.txt	FLO™ Test Waveform: FLOTXIQ016, Physical Layer Content Description 80-T2082-1 Rev. A
FLOXIQ017.txt	FLO™ Test Waveform: FLOTXIQ017, Physical Layer Content Description 80-T2083-1 Rev. A
FLOXIQ018.txt	FLO™ Test Waveform: FLOTXIQ018, Physical Layer Content Description 80-T2084-1 Rev. A
FLOXIQ019.txt	FLO™ Test Waveform: FLOTXIQ019, Physical Layer Content Description 80-T2085-1 Rev. A
FLOXIQ021.txt	FLO™ Test Waveform: FLOTXIQ021, Physical Layer Content Description 80-T2086-1 Rev. A
-	FLO™ Test Waveform Usage for FLO MPS Testing 80-T2087-1 Rev. A

FIGURE 1.

FLO Waveform IQ Sample files.

1. **OBTAIN THE WAVEFORM IQ SAMPLES.**
   A. Visit the FLO Forum website: http://www.floforum.org/.
   B. Login as a member and go to: http://www.floforum.org/private/IQ_Samples.html.

2. **CONVERT IQ SAMPLES TO MS269XA-020 VSG WAVEFORM FORMAT.** The IQ sample files are in a text format, which must be converted to another format in order to play on the MS269xA-020 VSG. The conversion process has two steps: (*See A and B.)*
   A. Convert the .txt file to ascii1 format using the PatternConverter tool provided by Anritsu. The tool is comprised of two files:
      - PatternConverter.ext
      - PatternConverter.bat

      The following example illustrates how to convert the file FLOTXIQ016.txt. The same method can be used to convert the other IQ sample files.
      1) Copy the IQ sample file FLOTXIQ016.txt to a USB memory stick.
      2) Create a temporary directory on the MS269xA, C:\temp\.
      3) Copy PatternCoverter.bat and PatternConverter.exe to C:\temp\.
      4) Copy the IQ sample file, FLOXIQ016.txt file to C:\temp\.

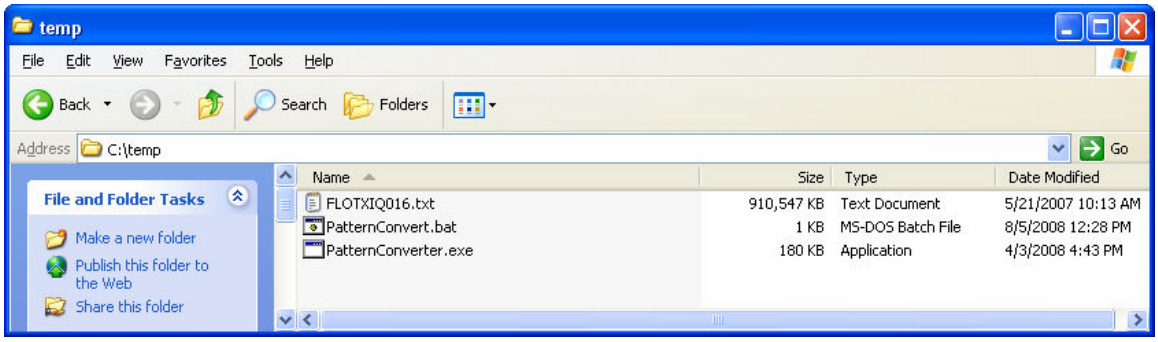

FIGURE 2.

Files needed for pattern conversion.

5) Edit PatternConverter.exe to specify the source path and file (c:\temp\FLOTXIQ016.txt) and output filename (FLOTXIQ016_ascii1.txt). Then save and close the .bat file.

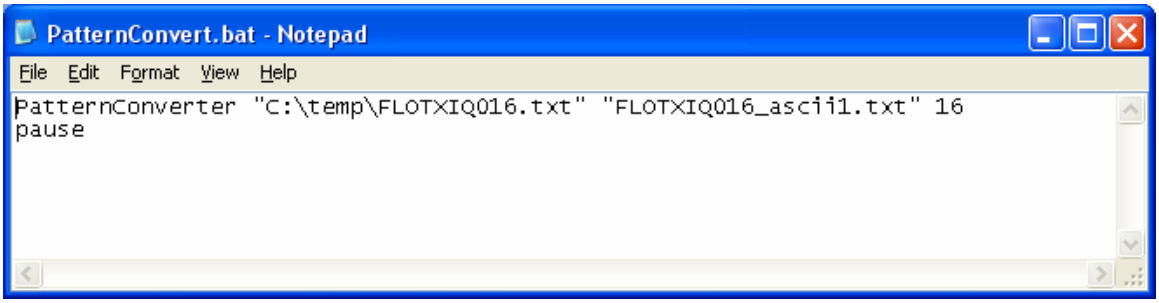

FIGURE 3.

PaternConvert.bat file.

NOTE: Several IQ sample files can be converted sequentially by modifying the .bat file as shown.

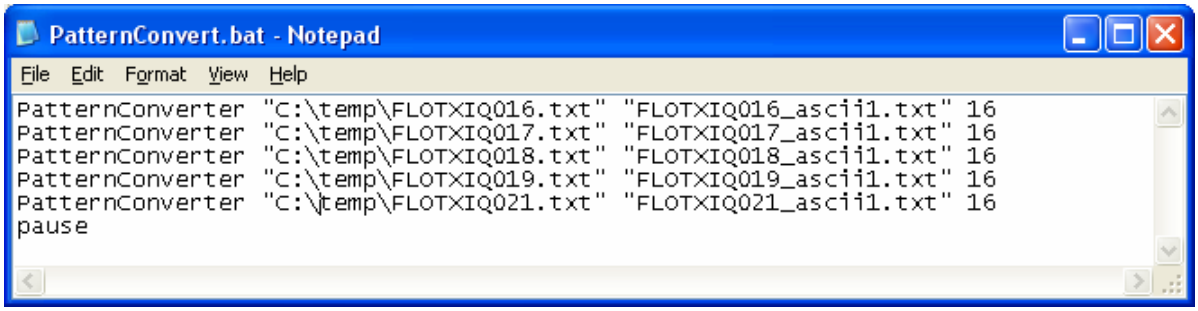

FIGURE 4.

PaternConvert.bat file for multiple waveforms.

6) Execute (double click) PatternConverter.exe.

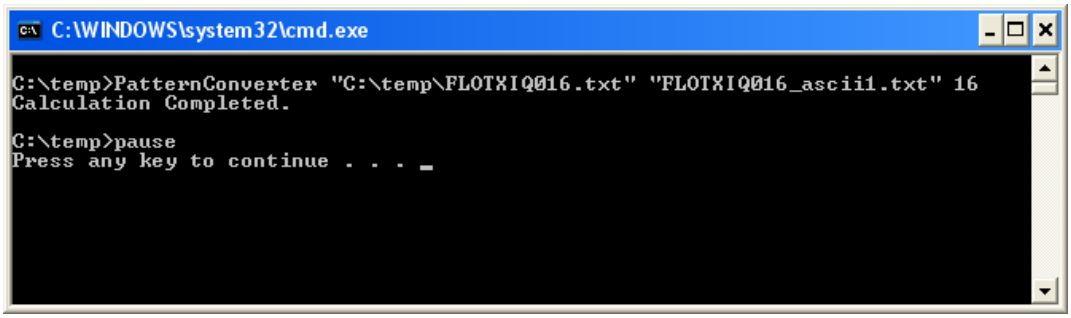

FIGURE 5.

Execution of PatternConverter.exe.

7) The output file FLOXIQ016_ascii1.txt will be generated in the C:\temp\ folder. This file is an ascii type-1 text file which will be used as the input in step B.

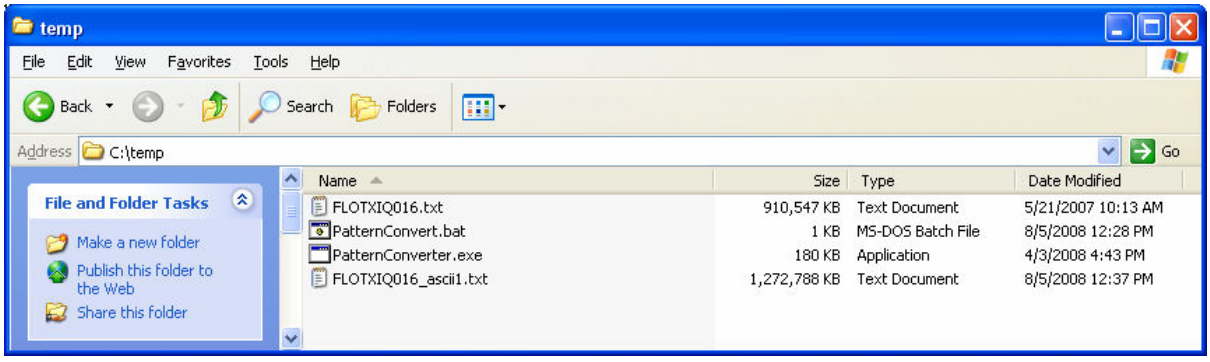

FIGURE 6.

Output of PatternConverter.exe.

B. Convert the ascii1 file to MS269xA VSG format using Anritsu IQ Producer.
   1) Open IQ Producer and select MS269x.

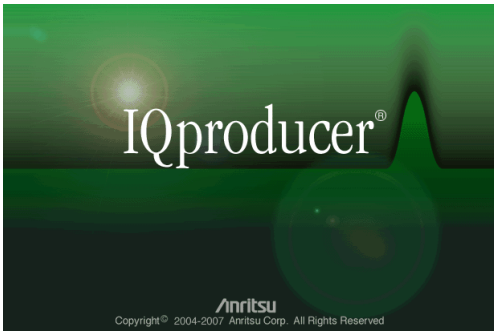

FIGURE 7.

IQ Producer startup screen.

FIGURE 8.

Instrument selection prompt.

2) Open the Convert function menu.

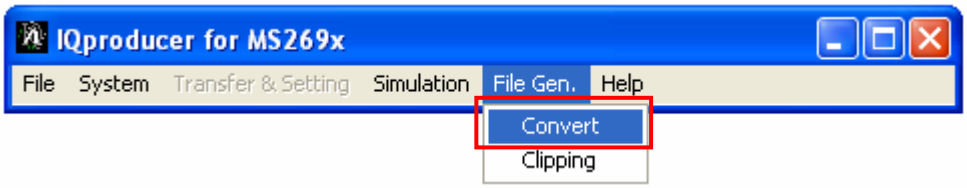

FIGURE 9.

Start the Convert function.

3) Load the Reference signal, FLOTXIQ016_ascii1.txt.
4) Enter the sampling rate. In the case of FLOTXIQ016, which has 6 MHz bandwidth, the sampling rate should be 11.1 MHz. Enter a Package Name such as FL0_MS269xA, or accept the default package name “Convert_IQproducer.” This package name is essentially a folder name that will contain the VSG waveform.

FLO Signal Bandwidth	Sampling Rate
5 MHz	9.25 MHz
6 MHz	11.1 MHz
7 MHz	12.95 MHz
8 MHz	14.8 MHz

FIGURE 10.

Sampling rate for FLO Bandwidths.

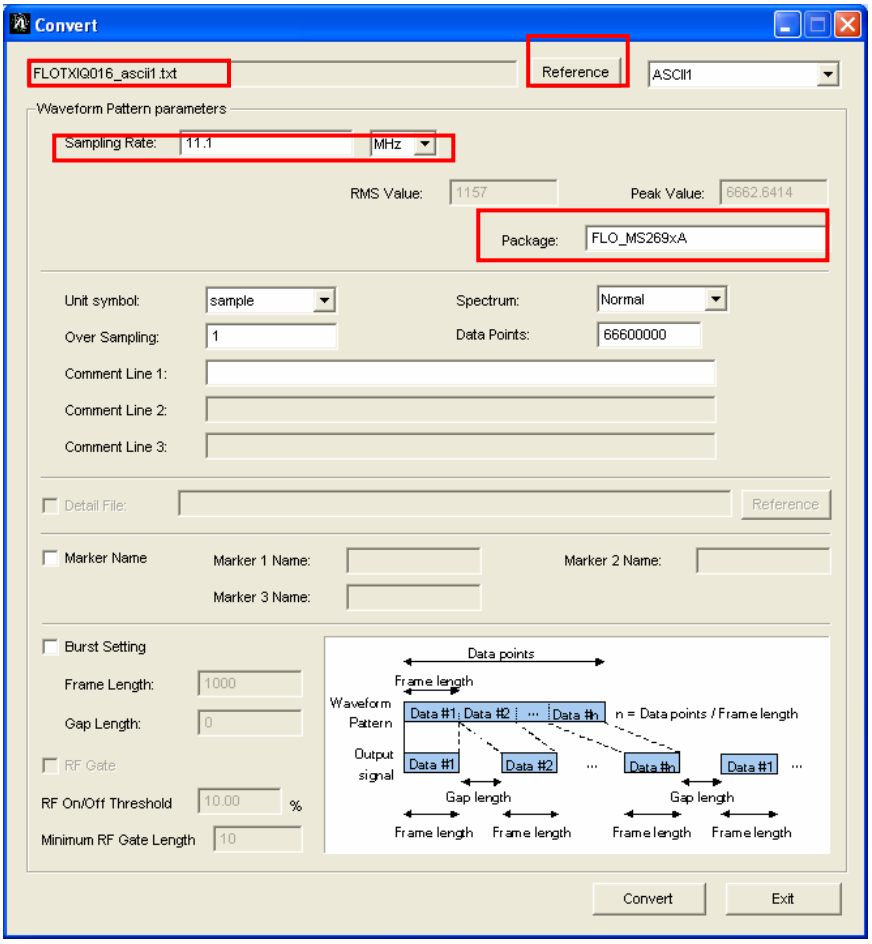

FIGURE 11.

The Convert menu.

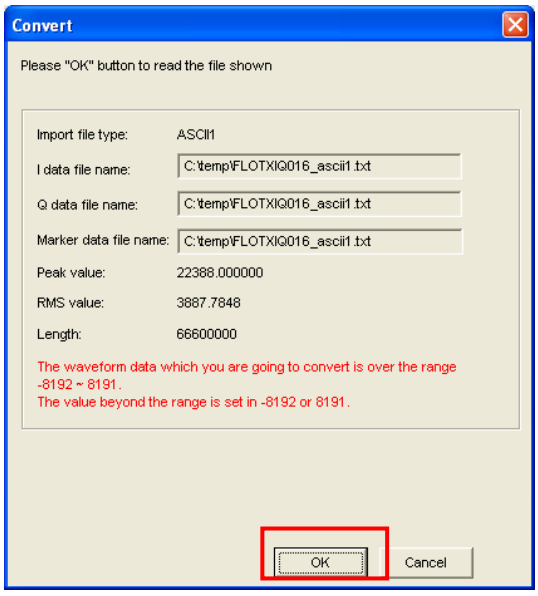

FIGURE 12.

Load the Reference Signal.

NOTE: The MS269xA-020 VSG has 14-bit DACs, which can accommodate signed integers in the range 8192…8191. The FLO IQ sample files are signed 16-bit integers in the range -32768…32767. These samples are scaled by IQ Producer to fit within the signed 14-bit range. When this kind of scaling is performed, a message is displayed on the IQ Producer Convert screen.

5) Click the Convert button, enter an output filename, then click OK. Two output files will be written: FLOTXIQ016.wvi and FLOTXIQ016.wvd.

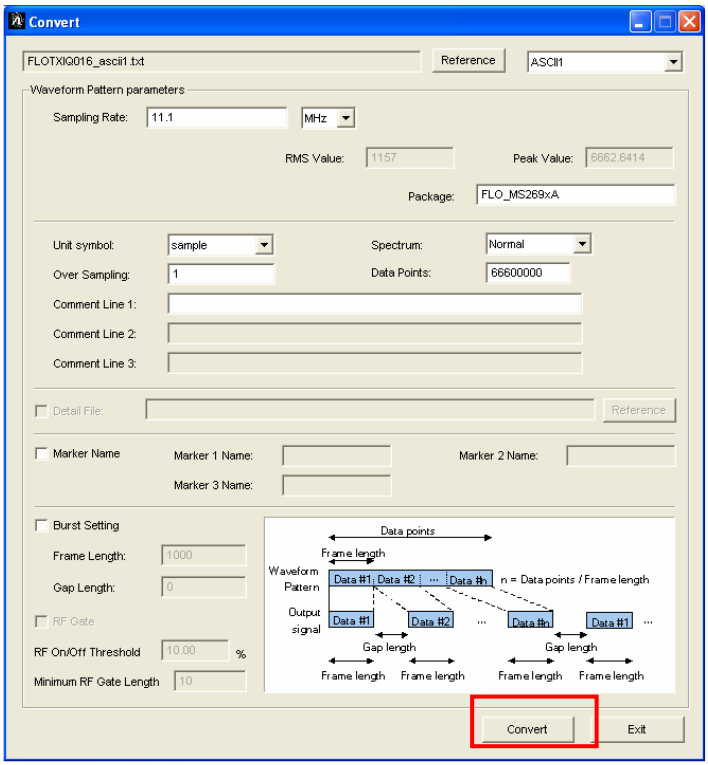

FIGURE 13.

The Convert Menu.

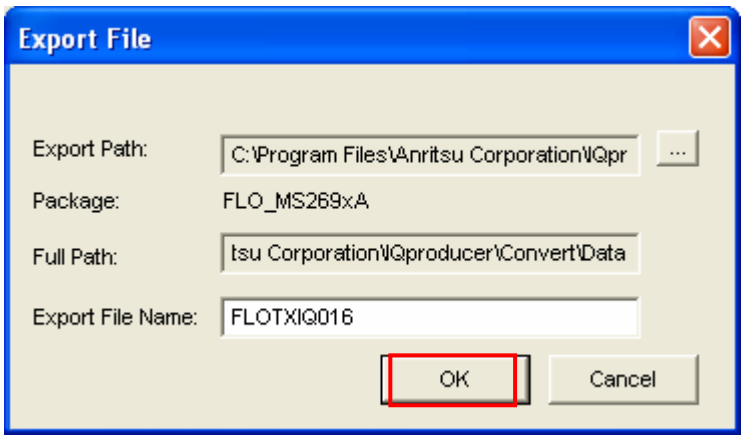

FIGURE 14.

Name of output file.

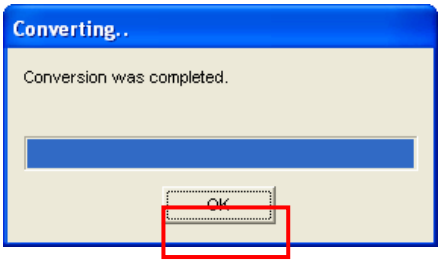

FIGURE 15.

Complete the conversion.

NOTE: The .wvi file contains useful information about the waveform. It can be read with a text editor. The .wvd file is the actual data file that will play on the MS269xA-020 VSG. Waveform files for the MS269xA-020 VSG are not compatible with the Anritsu MG3700 VSG. However, IQ Producer can also be used to create waveform files for the MG3700 VSG with the same procedure (when this instrument is chosen as the target instrument at the beginning of Step B).

3. **LOAD WAVEFORM FILE.** The VSG can play only a pattern that is loaded from the Hard Disk to the VSG memory (1GB).

   NOTE: Regarding VSG usage: Throughout the document the convention used is [Hard Button] or (Soft Button).

   - [Application Switch] → (Signal Generator).
   - (Load Pattern.)
   - Current Package: FLO_MS269xA.
   - Pattern: FLOTXIQ016.

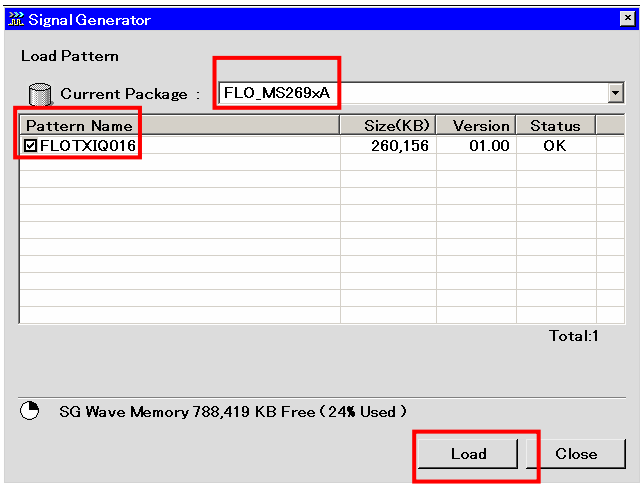

FIGURE 16.

Choose the waveform to load.

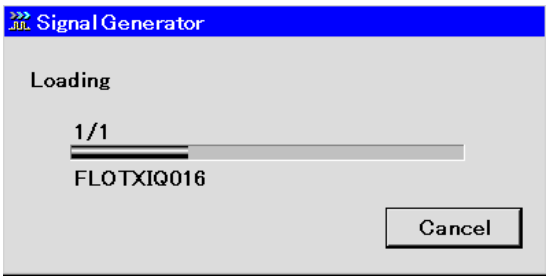

FIGURE 17.

Waveform is loading.

4. **SELECT WAVEFORM FILE.** The VSG outputs the pattern that is currently selected.
   - (Select Pattern.)
   - Current Package: FLO_MS269xA.
   - Pattern: FLOTXIQ016.
   - This is a FLO waveform with 6 MHz bandwidth.

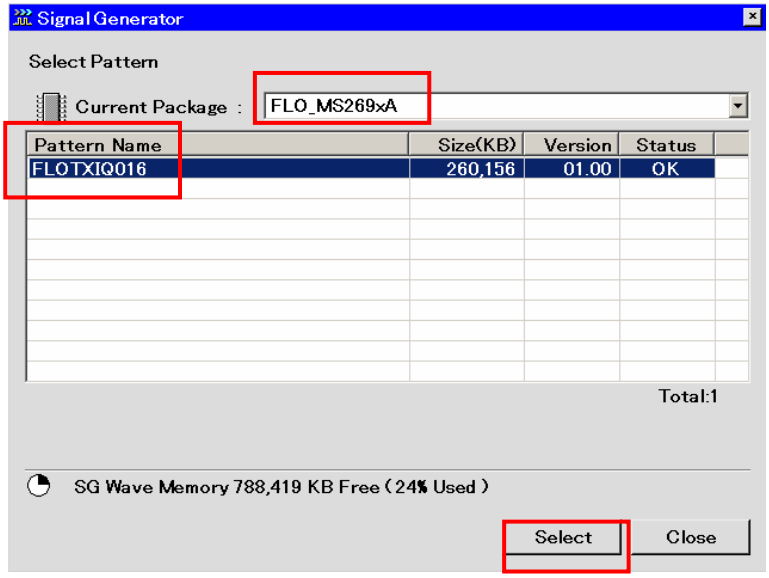

FIGURE 18.

Select the waveform to play.

5. **SET FREQUENCY AND AMPLITUDE.**

FIGURE 19.

VSG screen.

   - [Frequency]: 728 MHz.
   - [Amplitude]: -10 dBm.
   - A relatively high signal amplitude is chosen to give a high SNR.
   - (Modulation): ON.
   - (SG Output): ON.

6. **TRIGGER OFF 1PPS.** The master timing signal for the FLO system is a 1 PPS (pulse per second) signal. This corresponds to the time length of a Superframe. In order to synchronize the VSG with the DUT receiver, it may be desirable to trigger the VSG off a 1 PPS master signal. From Signal Generator menu:
   - (Page 2.)
   - (Ext IO Setup.) → S/F Trigger Setup.
   - Select Trigger ON.
   - Choose Source: Ext Trigger, Mode: Start Trigger
   - Delay: 0 sample.

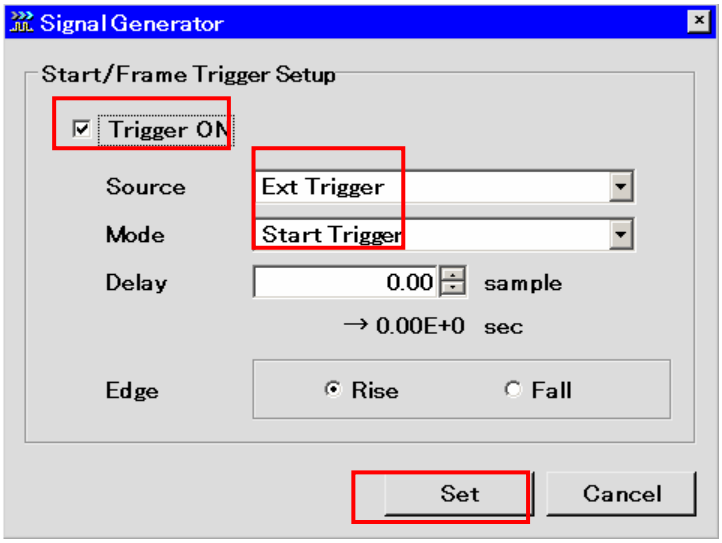

FIGURE 20.

Trigger setup menu.

7. **USE EXT 10 MHZ REFERENCE.** The DUT's that received EVM may be improved by providing a common 10 MHz reference to the VSG and DUT receiver. The MS269xA will automatically detect the presence of an external 10 MHz reference, and perform frequency alignment. Alternately, the reference signal of the MS269xA can be fixed to internal and used as a reference signal source for the DUT or other instruments.
   - [System Config] → (System Settings).
   - Select "Fixed to Internal."

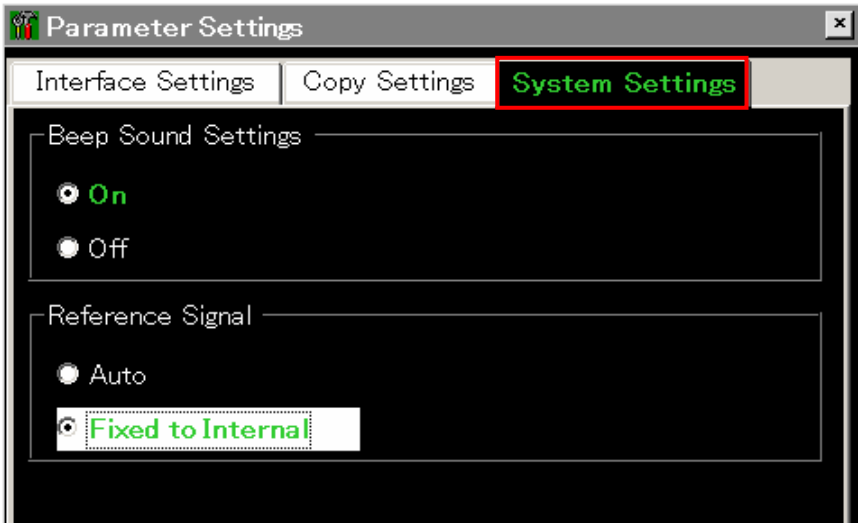

FIGURE 21.

Reference Signal selection menu.

- Example of VSG FLO measurement: The waveform FLOTXIQ016.wvd was played on the MS269xA-020 Vector Signal Generator and measured on the MS269xA Vector Signal Analyzer (VSA).

8. **SET VSA.**
   - Center Frequency: 728 MHz
   - Span: 10 MHz, to accommodate the 6 MHz FLO bandwidth.
   - Amplitude: -10 dBm.
   - Analysis Time: 10ms.

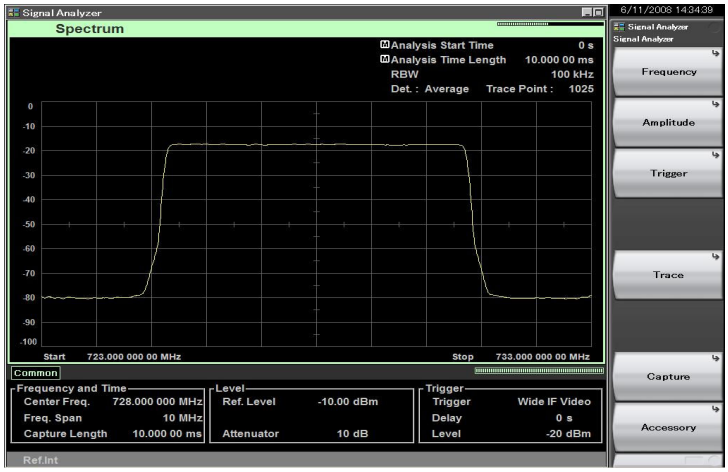

FIGURE 22.

VSA screen during FLO signal measurement.

Conclusion

This paper discussed how to obtain waveform IQ samples and convert IQ samples to MS269xA Vector Signal Generator (VSG) waveform format. It was directed at engineers who test Forward Link Only (FLO) devices, such as cell phones, that receive full-broadcast wireless TV signals.

FLO waveform IQ samples are available to FLO Forum members via the FLO Forum Website. These IQ sample files can be converted into waveform files for the Anritsu MS269xA-020 Vector Signal Generator. The IQ samples can also be converted into waveform files for the Anritsu MG3700 Vector Signal Generator.

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