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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: <u>http://www.floforum.org/</u>.
- B. Login as a member and go to: <u>http://www.floforum.org/private/IQ_Samples.html</u>.
- 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\.

📛 temp			
<u>File Edit Vi</u> ew F <u>a</u> vorites <u>T</u> ools <u>H</u> elp			
🔇 Back 🔹 🕥 - 🏂 🔎 Search 🎼 Folders 🔠 -			
Address C:\temp			💌 🋃 Go
Name 🔺	Size	Туре	Date Modified
File and Folder Tasks Image: Constraint of the second	910,547 КВ 1 КВ 180 КВ	Text Document MS-DOS Batch File Application	5/21/2007 10:13 AM 8/5/2008 12:28 PM 4/3/2008 4:43 PM
Share this folder	100		>

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.

PatternConvert.bat - Notepad		×
<u>File E</u> dit F <u>o</u> rmat <u>V</u> iew <u>H</u> elp		
PatternConverter "C:\temp\FLOTXIQ016.txt" "FLOTXIQ016_ascii1.txt" 16 PatternConverter "C:\temp\FLOTXIQ017.txt" "FLOTXIQ017_ascii1.txt" 16 PatternConverter "C:\temp\FLOTXIQ018.txt" "FLOTXIQ018_ascii1.txt" 16 PatternConverter "C:\temp\FLOTXIQ019.txt" "FLOTXIQ019_ascii1.txt" 16 PatternConverter "C:\temp\FLOTXIQ021.txt" "FLOTXIQ021_ascii1.txt" 16 pause		~
		\mathbf{v}
	>	

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.

Select instrument
Select instrument MG3700 MS269x Dopt show this window part time

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.

Convert				_	
FLOTXIQ016_ascii1.txt			Refere	nce ASCI1	•
-Waveform Pattern paramet	ers				
Sampling Rate: 11.	1	MHz 💌			
		RMS Value: 115	57	Peak Value:	6662.6414
			Package:	FLO_MS269×A	
Unit symbol:	sample 💌	Spe	ectrum:	Normal	•
Over Sampling:	1	Dat	a Points:	66600000	
Comment Line 1:					
Comment Line 2:					1
Comment Line 3:					
Detail File:					Reference
Marker Name	Marker 1 Name:		Mai	rker 2 Name:	
	Marker 3 Name:	, 	j	,	
Eurst Setting		D	ata points		
Frame Length:	1000	Frame length			
Gap Length:		Pattern Data #1: Da	ita #2 ··· Data	th = Data points	/Framelength
🔲 RF Gate		Output signal	Data #2	··· Data #n	Data #1
RF On/Off Threshold	10.00 %	Gap I	ength 4	Gaple	ngth I IIII
Minimum RF Gate Length	10	Frame length	Frame length	Frame length	Framelength
				Convert	E×it

FIGURE 11.

The Convert menu.

loto filo nomo:	CitempiELOTXIO016 ascii1 txt	
la nie name:		
ata file name:	CitempiFLOTXIQ016_ascii1.txt	
rker data file name:	C:temp/FLOTXIQ016_ascii1.txt	
ak value:	22388.000000	
VIS value:	3887.7848	
ngth:	66600000	
ta file name: C:ttemp/FLOTX/Q016_ascirl.txt ata file name: C:ttemp/FLOTX/Q016_ascirl.txt ker data file name: C:ttemp/FLOTX/Q016_ascirl.txt k value: 22388.000000 S value: 3887.7848 igth: 66600000 : waveform data which you are going to convert is over the range 92 ~ 8191. : value beyond the range is set in -8192 or 8191.		

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.

Convert					
FLOTXIQ016_ascii1.txt			Refer	ence ASCII	•
Waveform Pattern para	meters				
Sampling Rate:	11.1	MHz 💌			
ounpung roto.		min2 -			
		RMS Value:	1157	Peak Value:	6662.6414
			Раскаде:	1-CO_W3208XA	
Unit symbol:	sample	-	Spectrum:	Normal	-
Over Sampling:	1	_	Data Points:	66600000	_
Commont Line 4:				1	
Comment Line 1:					-
Comment Line 2:					_
Comment Line 3:					
Detail File:					Reference
🦳 Marker Name	Marker 1 Name:		M	arker 2 Name:	
	Marker 3 Name:				
E Burst Setting			Data points	_	
Frame Length:	1000	Franele	gth	-	
Gap Length:	0	Waveform Data #	1; Data #2 … Data	a #h n = Data points	/Frame length
E pro i	,	Output			
Kr Gatë		signal Data #	Uata #2	[Data #n]	Data #1
RF On/Off Threshold	10.00 %	-	⇒ap length ♦ 4 >	Gaple ≁——●	ngan ✦──→
Minimum RF Gate Leng	th 10	Frame le	ngth Framelength	Framelength	Frame length
				-	

FIGURE 13.

The Convert Menu.

Export File		
Export Path:	C: Program Files Anritsu Corporation VQpr	
Package:	FLO_MS269xA	
Full Path:	tsu CorporationVQproducer\Convert\Data	
Export File Name:	FLOTXIQ016	
	OK	el 🔤

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] \rightarrow (Signal Generator).
- (Load Pattern.)
- Current Package: FLO_MS269xA.
- Pattern: FLOTXIQ016.

Signal Generator			
Pattern Name	Size(KB)	Version	Status
	260,156	01.00	OK
,			Total:1
SG Wave Memory 788 419 KB Free (2	4%/Used/)		
,, ,,			-
		Load	Close

FIGURE 16.

Choose the waveform to load.

🔀 Signal Generator	
Loading	
1/1	
FLOTXIQ016	
	Cancel



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.

Signal Generator				×
Select Pattern	_			
Current Package : FLO_MS269xA				•
Pattern Name	Size(KB)	Version	Status	
FLOTXIQ016	260,156	01.00	ОК	
			Total:1	
SG Wave Memory 788,419 KB Free (24	% Used)			
	_			1
		Select	Close	

FIGURE 18.

Select the waveform to play.

5. SET FREQUENCY AND AMPLITUDE.

322	III FLOTXIQ016					_
ě	Frequency				Amplitude	
¢ ° SG		728	000	000.00 нг	- 10.00 dBm	

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.

🗱 Signal Generator 🔀 🔀							
Start/Frame Trigg	er Setup						
Source	Ext Trigger						
Mode	Start Trigger						
Delay	Delay $0.00 \div$ sample $\rightarrow 0.00E+0$ sec						
Edge	⊂ Rise ⊂ Fall						
	Set Cancel						

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] \rightarrow (System Settings).
 - Select "Fixed to Internal."

📅 Parameter Settings								
Interface Settings	Copy Settings	System Settings						
-Beep Sound Settings								
© On	© On							
● Off								
Reference Signal								
Auto								
• 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.





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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