

Application Note AN6004

APVSG Permanent Data Storage SD

Purpose

The SD Card is an option for APVSG devices to be utilized as a permanent data storage. This application note focuses on the utilization of this storage to load waveform files to and from the SD card. The waveform files are typically employed for modulating the carrier frequency on the device.

Table of Contents

Introduction.....	2
Modulation with SD Card File.....	3
Load Files with the APVSG GUI	3
SCPI Commands for Loading Files	3
SCPI Example.....	3
Manage Files on SD Card.....	4
Store Waveform.....	4
Delete File	4
Fetch Information	4
Permanent Storage	4
Further Documentation	5

Introduction

The APVSG can be optionally configured to have an external SD card slot. Please consult with your AnaPico representative to order a device that includes this option. The inserted SD card then functions as a permanent data storage of the device. This enables the user to upload IQ data files directly from the SD card to the signal generator. The waveforms on the APVSG are then available to be replayed like any other segment on the device.

Additionally, there are possibilities for the user to store, delete and list files from the permanent data storage.

The following pages briefly introduce and explain the available functionality with SD cards and provide some short examples of their applications.

The most important SCPI commands for memory segments are:

BB:ARbitrary:WAVeform:DATA [<segment ID>] <file name>

Upload the data of a qid file from the SD card to the device. Set the segment ID of the waveform to <segment ID>.

BB:ARbitrary:WAVeform:FILE <file name>, <data>

Store the block data <data> on the SD card with a given <file name>.

BB:ARbitrary:WAVeform:FILE:DELeTe <file name>

Delete a specific file from the SD card.

BB:ARbitrary:WAVeform:FILE:FREE?

Display how many bytes of free storage are left on the SD card.

BB:ARbitrary:WAVeform:FILE:LIST?

Return a list with the names of the files on the SD card.

All SCPI commands related to memory segmentation are listed and described at the end of this Application Note in section *SCPI Command Overview*.

Further associated documentation is:

- Programmer's Manual [1]
with a description of all SCPI commands
- APVSG Datasheet [2]
with specifications on the APVSG devices.
- AN6001 [3]
Application Note on the AnaPico IQ file format.
- AN6003 [4]
Application Note on the Internal Memory, Segments and Sequences.

Modulation with SD Card File

The SD card is a permanent data storage for waveforms. The waveforms are stored as IQ data files in the qid file format. For detailed information on the qid file format, please consult AN6001 [3]. The APVSG supports the transferal of IQ data from the SD card to the internal memory of the device.

The internal APVSG memory structures IQ modulation data in samples and segments. For an overview and explanation on this memory structure, read AN6003 [4]. The process of uploading IQ data from the SD card to the internal memory follows the same underlying principle as sending any IQ modulation segment to the device. Once uploaded, the IQ data can be replayed and set as the IQ modulation source, exactly like any other segment.

Load Files with the APVSG GUI

The following steps are required to replay a waveform that is stored on the SD card with the APVSG GUI.

1. Insert the SD card in the appropriate slot of the APVSG.
2. Power up the signal generator.
3. Find the SD card option in the RF Modulation part of the GUI.
4. List the content of the permanent data storage.
5. Select and upload the desired waveform.
6. Enable the IQ modulation as well as the RF output to see the modulated carrier at the RF out.

SCPI Commands for Loading Files

There is a SCPI command that allows the user to choose a qid file on the SD card and transfer its IQ modulation data to the internal memory of the device, while specifying a segment ID for this newly stored data. The SCPI command is

BB:ARbitrary:WAVEform:DATA [<segment ID>] <file name>

With the following properties.

- Upload IQ modulation data from file <file name> on the SD card storage.
- The IQ data is stored in the device's internal memory with <segment ID>.
- <segment ID> is an optional parameter. If it is omitted, the data is stored with ID 0.
- The <file name> denotes a qid file on the SD card from which IQ data is uploaded.
- <file name> is a string in quotation marks that does NOT include the file ending (.qid)

SCPI Example

The following SCPI command sequence shows how to replay IQ modulation data from the permanent SD card storage. In this example, file *iq_data.qid* is loaded and replayed.

SOUR:SEL 1	Sets the source to channel 1
BB:ARB:WAV:DATA 2, "iq_data"	Send data of <i>iq_data.qid</i> to memory with segment ID 1
FREQ 50e6	Sets initial RF output frequency to 50 MHz
BB:ARB:WSEG:SOUR INT	Set the segment selection to internal
BB:ARB:WSEG 2	Select segment with ID 3
BB:ARB:WSEG?	Expected answer: 2 (ID of selected segment)
BB:ARB:WSEG:COUN?	Expected answer: 1 (number of stored segments)
BB:ARB:WAV:STAT ON	Enable the IQ modulation with memory data
OUTP:STAT ON	Enables the RF output

Manage Files on SD Card

Store Waveform

The SD card can also be written to. Storing a waveform simply requires the user to send the qid file content as block data with the following SCPI command.

BB:ARbitrary:WAVeform:FILE <file name>, <data>

Please consider the following guidelines:

- <file name> is a string in quotation marks that includes the file ending qid (e.g. "myfile.qid").
- <data> must be sent as block data.
- The sent IQ modulation data <data> will be stored on the SD card with <file name>.
- At this point, the device can only store qid data files on the SD card. For further information on this IQ data file format, please consult the corresponding Application Note [3].

Delete File

The SCPI command below deletes a file on the SD card, with <file name> being a string in quotation marks that includes the file ending. The file name needs to exactly match a file on the SD card for this command to succeed.

BB:ARbitrary:WAVeform:FILE:DElete <file name>

Fetch Information

There are two kinds of information the user can obtain from an inserted SD card. On the one hand, the amount of free storage space can be reported and on the other hand, a list of all available files on the SD card can be acquired.

BB:ARbitrary:WAVeform:FILE:FREE?

Reports the free storage space on the SD card in bytes.

BB:ARbitrary:WAVeform:FILE:LIST?

Returns a comma separated list of strings that represent the names of all the files on the SD card.

Permanent Storage

The SD card option is built to be utilized as a permanent data storage, not an exchangeable storage. To this end, the following rules should be followed to ensure correct operation of this permanent data storage.

- Insert the SD card to its dedicated slot before powering up the device.
- Do not remove or insert the SD card while the APVSG is running.
- Only remove the SD card when the device is turned off.

Further Documentation

- [1] AnaPico Programmer's Manual for Signal Generators
<https://www.anapico.com/downloads/manuals/>
Includes description of all SCPI commands.
- [2] APVSG Datasheet
<https://www.anapico.com/downloads/brochures-and-data-sheets/>
Specifications of APVSG devices
- [3] AN6001 APVSG - AnaPico IQ File Format
<https://www.anapico.com/downloads/application-notes-and-videos/>
Includes information on the IQ data file formats and their applications.
- [4] AN6003 APVSG – Memory Segmentation
<https://www.anapico.com/downloads/application-notes-and-videos/>
Includes explanation and examples for Samples, Segments and Sequences.