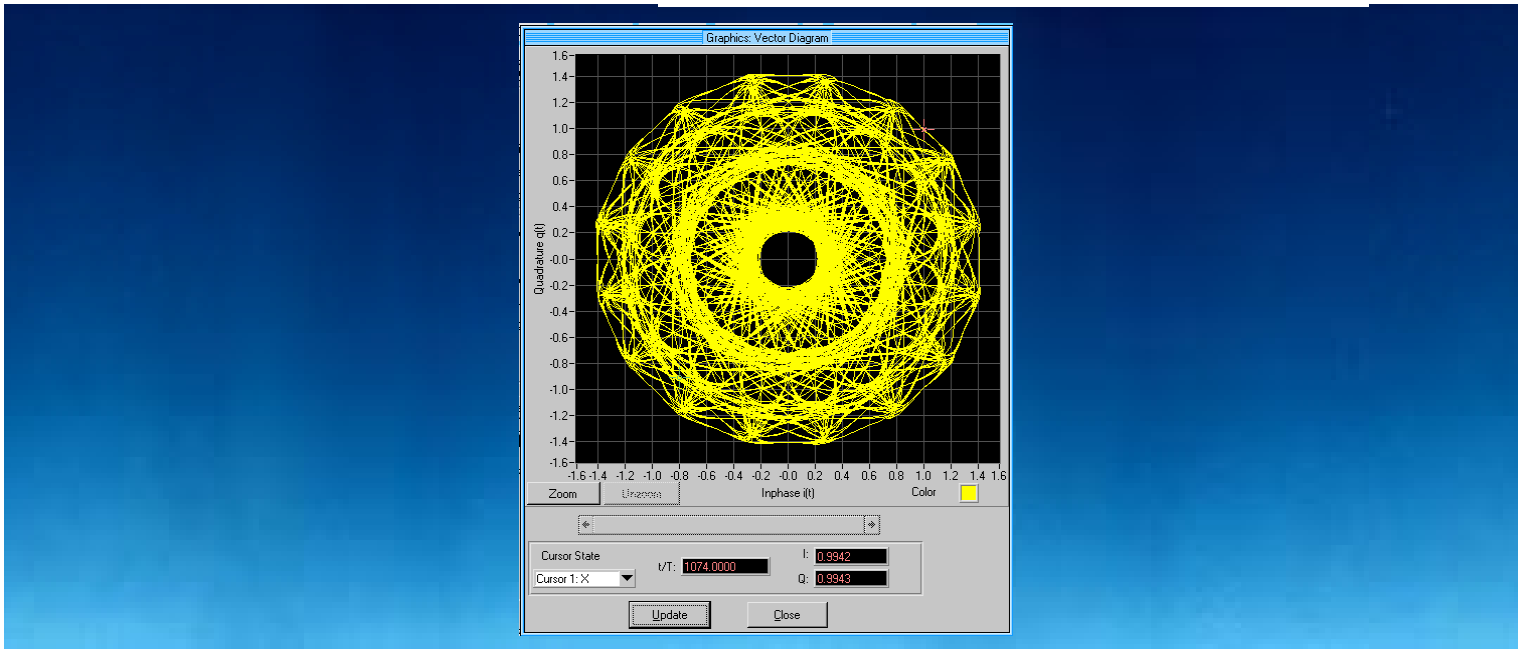


Products: AMIQ / WinIQSIM, SMIQ

# Creating alternating GSM / EDGE signals with **AMIQ** and **WinIQSIM**

## Application Note

The I/Q modulation generator AMIQ with software WinIQSIM has the capabilities to generate test signals for EDGE. This application note gives some insight into these capabilities and how to use them.

ROHDE&SCHWARZ

Subject to change – Dr. René Desquiotz, Andreas Pauly 12.98 - Application Note 1GP37_0E

# Contents



# 1 Overview

Third-generation wireless systems will have to meet demands for data transmission speed far higher than those in use today. While W-CDMA is tipped to become the future air interface for wideband wireless services, technical and economic reasons speak for an evolutionary development strategy, starting from the most established standard today, GSM. The next step from GSM towards systems of the next generation is Enhanced Data Rates for GSM Evolution (EDGE).

The I/Q modulation generator AMIQ with software WinIQSIM[1] has the capabilities already to generate test signals for EDGE. This application note gives some insight into these capabilities and how to use them.

# 2 Structure of GSM / EDGE alternating signals

The basic concept of EDGE is to provide higher data rate transmission per radio timeslot than with GMSK, the current modulation of the GSM standard. As EDGE uses the same TDMA (Time Division Multiple Access) frame structure, logical channel and 200 kHz carrier bandwidth as today's GSM network, EDGE timeslots can be inserted into a GSM TDMA signal without changing the TDMA structure.

The combination of EDGE and standard GSM structure in a radio channel is not yet completely specified. As a result, the signal structure shown in the following sections can only be an example to demonstrate that AMIQ / WinIQSIM provides all the necessary features for creating all kinds of combinations with GSM and EDGE structures.

The signal to be created is a TDMA sequence built of alterning EDGE and GSM timeslots, as shown in Fig. 1.


Fig. 1: Structure of a signal containing alternating EDGE and GSM timeslots.

[1] WinIQSIM Version 2.20 or higher required.

# 3 Guide to constructing GSM / EDGE signals

The rough scheme for signal construction is:

1. Create the standard GSM signal (with power-up in even timeslots)
2. Create the EDGE signal (with power-up in odd timeslots)
3. Add the signals in the **`multi carrier mixed signal`** system of WinIQSIM

## Create the standard GSM part of the signal

Load the WinIQSIM setting GSM_SLO1.IQS from the folder \EXAMPLES in your WinIQSIM folder. This is a setup to create a bursted GSM signal. We will modify the settings to obtain the GSM signal required for the GSM/EDGE composite.

Open the **`modulation settings`** panel and change the **oversampling** to 8. The other parameters remain unchanged.

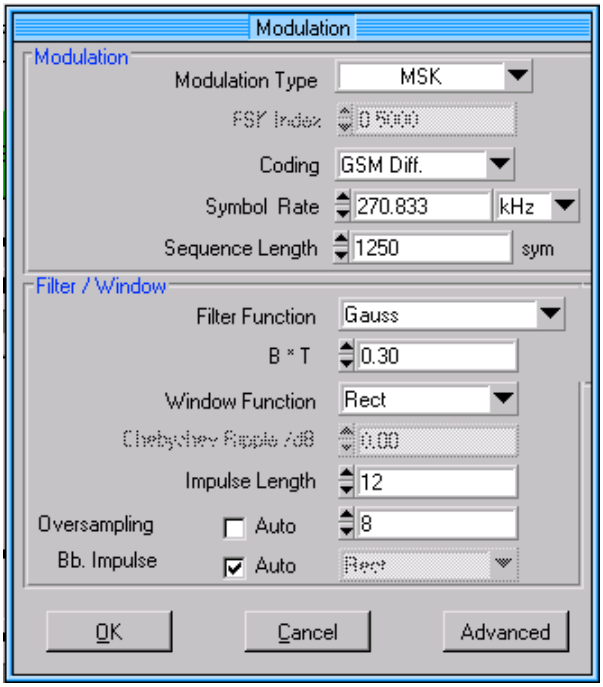


Fig. 2: Modulation settings for the GSM signal.

Open the WinIQSIM **`data editor`** and load the file GSM_TSC1.DED from the folder \EXAMPLES in your WinIQSIM folder. The slot pool of this file provides all the required GSM timeslots. Build a frame as shown in Fig. 3.

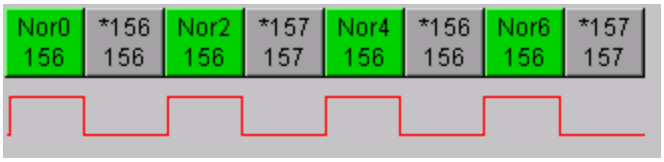


Fig. 3: Frame for the GSM signal.

The even timeslots are occupied with the GSM slots according to the standard [2]. The **Nor0** timeslot is shown as an example in Fig. 4. The odd timeslots are filled with dummy slots where power is down.


Fig. 4: Nor0 timeslot for the GSM standard.

**Calculate and save the sequence** as GSM_GMSK.DBI. Also save the **data editor settings** as GSM_GMSK.DED for further use.

Now open the **`Graphics --> Settings...`** panel and choose **r(t), phi(t)**. Calculate the signal by clicking on the **plot graph** button.

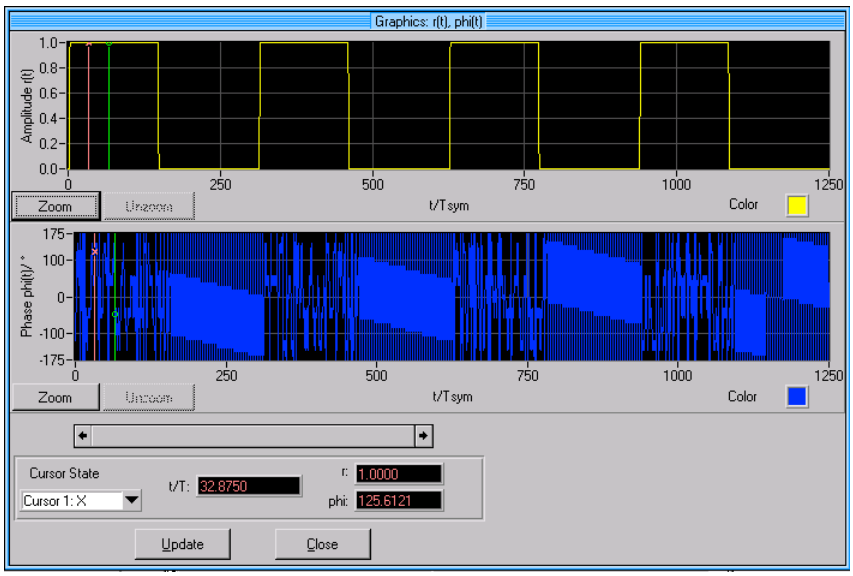


Fig. 5: Magnitude and phase of the GSM component as functions of time, as shown by WinIQSIM graphics.

Save the signal in .IBN format (with **`save for add / Multi Carrier Mixed Signal...`**) as GSM_GMSK.IBN. Save your settings as GSM_GMSK.IQS.

## Create the EDGE part of the signal

For the EDGE component again we use an example provided with WinIQSIM as the starting point.

Load the WinIQSIM setting EDGE.IQS from the folder \EXAMPLES in your WinIQSIM folder. The **`modulation settings`** need not to be changed this time.

[2] The slot numbers in GSM frame start at zero, not at one.

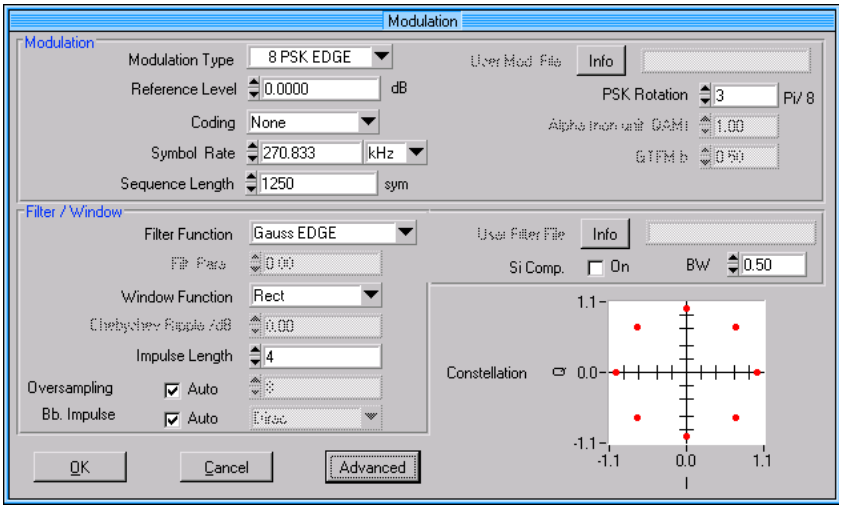


Fig. 6: Modulation settings for the EDGE signal.

Open the **`data editor`** and load the file EDGE.DED from the folder \EXAMPLES in your WinIQSIM folder. Call up the **frame** menu and build a frame as shown in Fig. 7. This time the odd timeslots are filled with usable data, the even ones contain dummy slots with power down.

If some of the normal slots are missing in the slot library, they can be built out of the slots **N468** and **N471** by just inserting the appropriate TS data fields in the **slot** menu of the **`data editor`** (see Fig. 8).

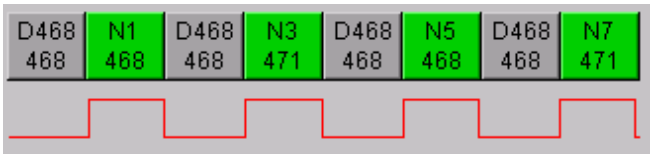


Fig. 7: Frame and powerramping for the EDGE part of the signal.

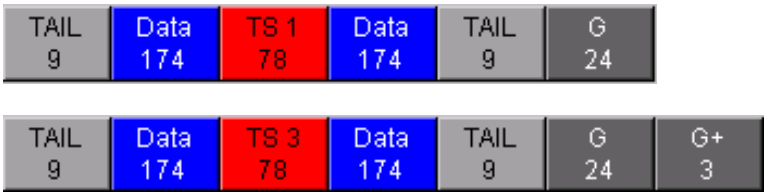


Fig. 8: Structure of the EDGE Normal Slots N1 and N3. Replace the TS 1 (TS 3) by TS 5 (TS 7) to get N5 (N7) slot.

Symbol rate and slot duration in EDGE are the same as in GSM. However, one symbol contains three bits in EDGE as the modulation type is now 8PSK. Therefore the EDGE timeslots contain 468 and 471 bits, the GSM slots 156 and 157 bits.

**Calculate and save the sequence** as GSM_EDGE.DBI. Also save the **data editor settings** as GSM_EDGE.DED for further use.

Open the **`Graphics --> Settings...`** panel and choose **r(t), phi(t)** and calculate the signal by clicking on the **plot graph** button.

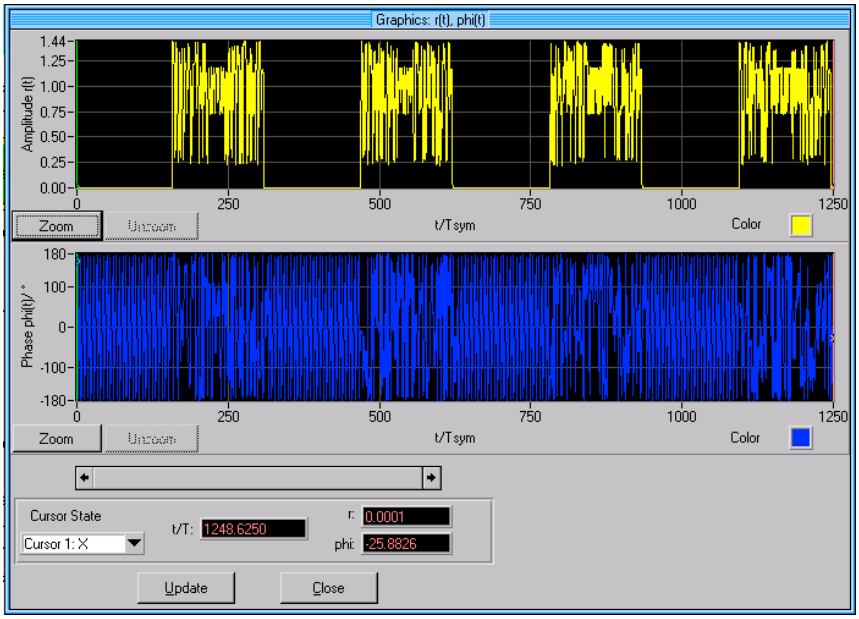


Fig. 9: Magnitude and phase of the EDGE component as functions of time.

Again save the signal in .IBN format (GSM_EDGE.IBN) and the WinIQSIM settings (GSM_EDGE.IQS).

## Create the GSM / EDGE mixed signal

As we have prepared the signals to mix in a way that they have the same sample rates and numbers of samples there arise no problems with resampling. So this is a straightforward procedure now.

Choose **`file --> new...`** and select **`multi carrier mixed signal`** system. Open the **`carrier settings`** panel and set the parameters as shown in Fig. 10. Do not forget to confirm your channel definitions - especially the chosen .IBN files - with the **accept** button.

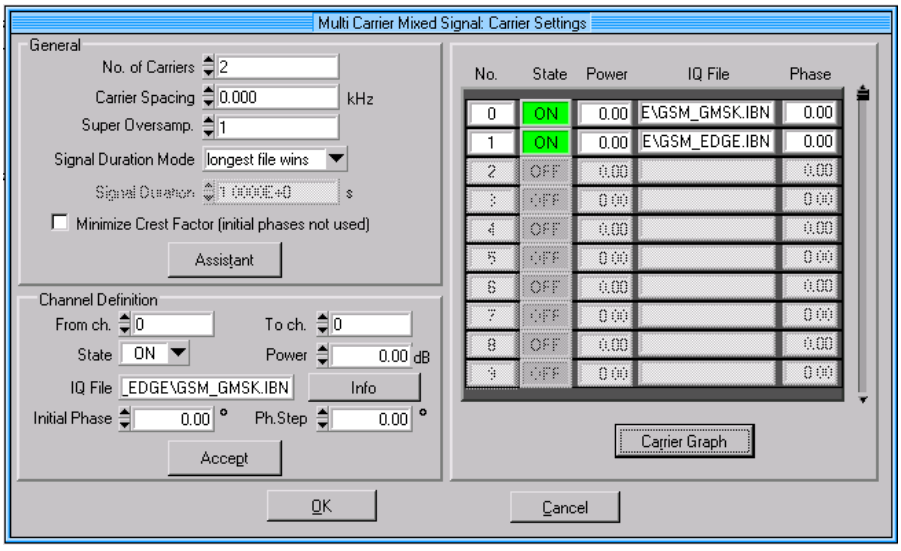


Fig. 10: Carrier settings for the combined GSM / EDGE signal.

Calculate the signal and **view r(t), phi(t)** which should look like as shown in Fig. 11.

Transmit the waveform to AMIQ - do not forget to save your WinIQSIM settings.

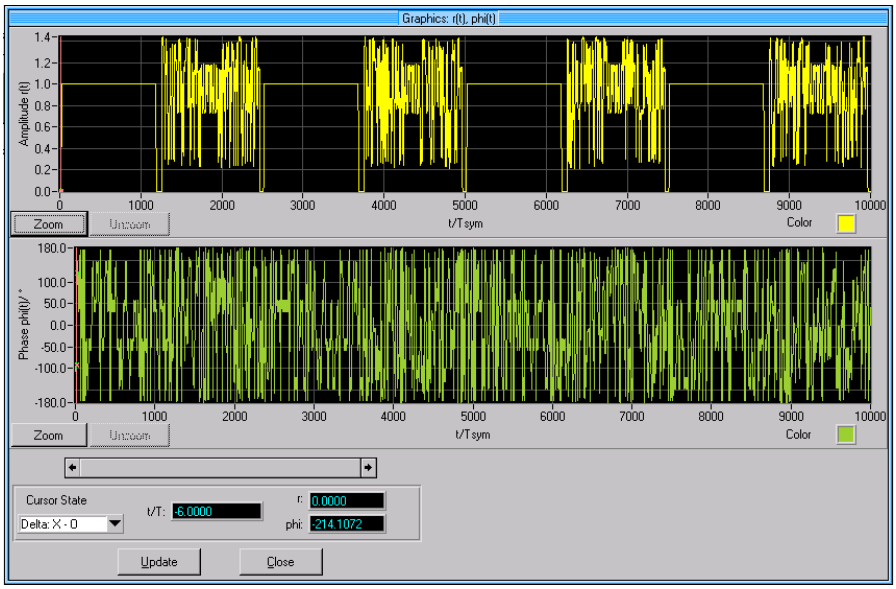


Fig. 11: Magnitude and phase of the combined GSM / EDGE signal as functions of time.

# 4 Connect the Computer and the Instruments

For the setup see Fig. 12. The AMIQ I and Q outputs are connected with the I and Q inputs of the SMIQ signal generator. SMIQ is operated in mode VECTOR MOD.

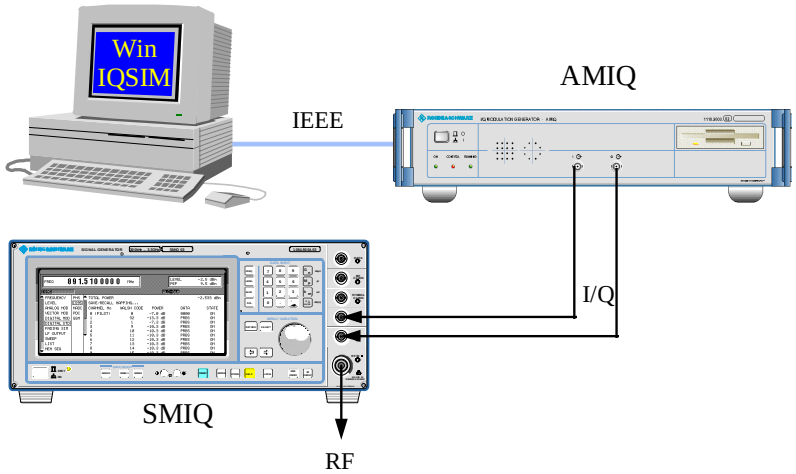


Fig. 12: Setup for calculating waveforms and controlling AMIQ via WinIQSIM.

The parameters are set and the signals are calculated using WinIQSIM running on the PC. The calculated waveform is then transmitted to the

AMIQ RAM or harddisk via the GPIB connection. The waveform can also be stored on the PC harddisk and transmitted later.

The AMIQ hardware is also controlled by WinIQSIM via the GPIB connection - including selecting waveforms stored on the AMIQ harddisk. Alternatively, this hardware control via GPIB can also be performed by the SMIQ signal generator instead of WinIQSIM on the PC, in which case the PC is only required for waveform calculation.

# 5 Literature

I/Q Modulation Generator AMIQ, Operating Manual, Rohde & Schwarz, 1998

Software WinIQSIM for Calculating I/Q Signals for I/Q Modulation Generator AMIQ, Software Manual, Rohde & Schwarz, 1998

# 6 Contents of the file archive

The archive EDGE_GSM.EXE delivered with this application note contains the WinIQSIM files for the example described above.

| | |
|---|---|
| GSM_PART.IQS | WinIQSIM settings for the GSM component. |
| GSM_PART.DED | Data editor settings for the GSM component. |
| GSM_PART.DBI | Data sequence for the GSM component |
| EDG_PART.IQS | WinIQSIM settings for the EDGE component. |
| EDG_PART.DED | Data editor settings for the EDGE component. |
| EDG_PART.DBI | Data sequence for the EDGE component |
| GSM_PART.IBN | GSM component in .IBN format |
| EDG_PART.IBN | EDGE component in .IBN format |
| GSM_EDGE.IQS | WinIQSIM settings for the mixed signal setup |
| GSM_EDGE.WV | Waveform file for GSM / EDGE alternating signal |

# 7 Ordering information

| | | |
|---|---|---|
| **I/Q Modulation Generator** | | |
| AMIQ / WinIQSIM | | 1110.2003.02 |
| **Vector Signal Generator:** | | |
| SMIQ02B | 300 kHz to 2.2 GHz | 1125.5555.02 |
| SMIQ03B | 300 kHz to 3.3 GHz | 1125.5555.03 |

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