

I/Q Modulation Generator AMIQ / Signal Generator SMIQ

HiperLAN/2 signals with OFDM Simulation Software WinIQOFDM



Photo 43528/3

FIG 1 With Signal Generator SMIQ (top) and I/Q Modulation Generator AMIQ even long HiperLAN/2 test sequences can be generated without any problems

HiperLAN/2 and IEEE 802.11a, the new standards for wireless LAN, use OFDM modulation, which has proved itself also in digital broadcasting systems (DAB, DVB-T). With OFDM Simulation Software WinIQOFDM for generators AMIQ and SMIQ (FIG 1), Rohde & Schwarz meets the increasing demand for units that generate such signals.

HiperLAN/2 at a glance

HiperLAN/2 standard uses OFDM signals (orthogonal frequency-division multiplex) for wireless LAN. Several mobile terminals communicate with one base station. HiperLAN/2 signals consist of 64 carriers, 52 of which are modulated and transmit data and reference signals, so-called pilots. While the pilots are always BPSK-modulated, the remaining carriers used can alternatively be QPSK-, 16QAM- or 64QAM-modulated. An OFDM symbol contains a period of the total signal generated by all 64 carriers and is preceded by a guard interval. Calculation is based on inverse Fourier transform.

In terms of time, HiperLAN/2 signals are divided into MAC frames (media access control), which in turn are divided into bursts. A burst consists of a pream-

ble and a sequence of OFDM symbols, which are all modulated according to the same scheme. A HiperLAN/2 frame comprises the uplink and downlink signals (TDD) for all simultaneously active mobile terminals (TDMA).

WinIQOFDM, option K15 for generators AMIQ and SMIQ, is optimized for the simple and fast definition and generation of such complex signals (FIG 2).

OFDM signals in three steps

OFDM signals are generated in three steps. First, WinIQOFDM computes the raw signal, which is then loaded into Simulation Software WinIQSIM™ [1]* via TCP/IP as an external signal for further processing. WinIQSIM™ includes baseband filtering and optional channel

▶ distortion. The two programs communicate with each other automatically without any action on the part of the user.

Via the IEC/IEEE bus, the signal model finally reaches I/Q Modulation Generator AMIQ [2] or Signal Generator SMIQ [3], where it is physically generated. There are three possibilities (FIG 3). AMIQ is used for signal generation in the baseband (1). The generation of RF signals requires the use of SMIQ; it can either be connected as a pure I/Q modulator after an AMIQ (2) or be used as a stand-alone RF signal generator with option SMIQ.B60 (arbitrary

waveform generator). Which of the last two possibilities is used depends mainly on the length of the signal to be generated. The SMIQ.B60's memory can store HiperLAN/2 signals up to a length of six MAC frames. The memory of AMIQ02 and 03 holds 52 MAC frames, and that of AMIQ04 up to 209 frames.

User-friendly editing mode and preset symbol structures

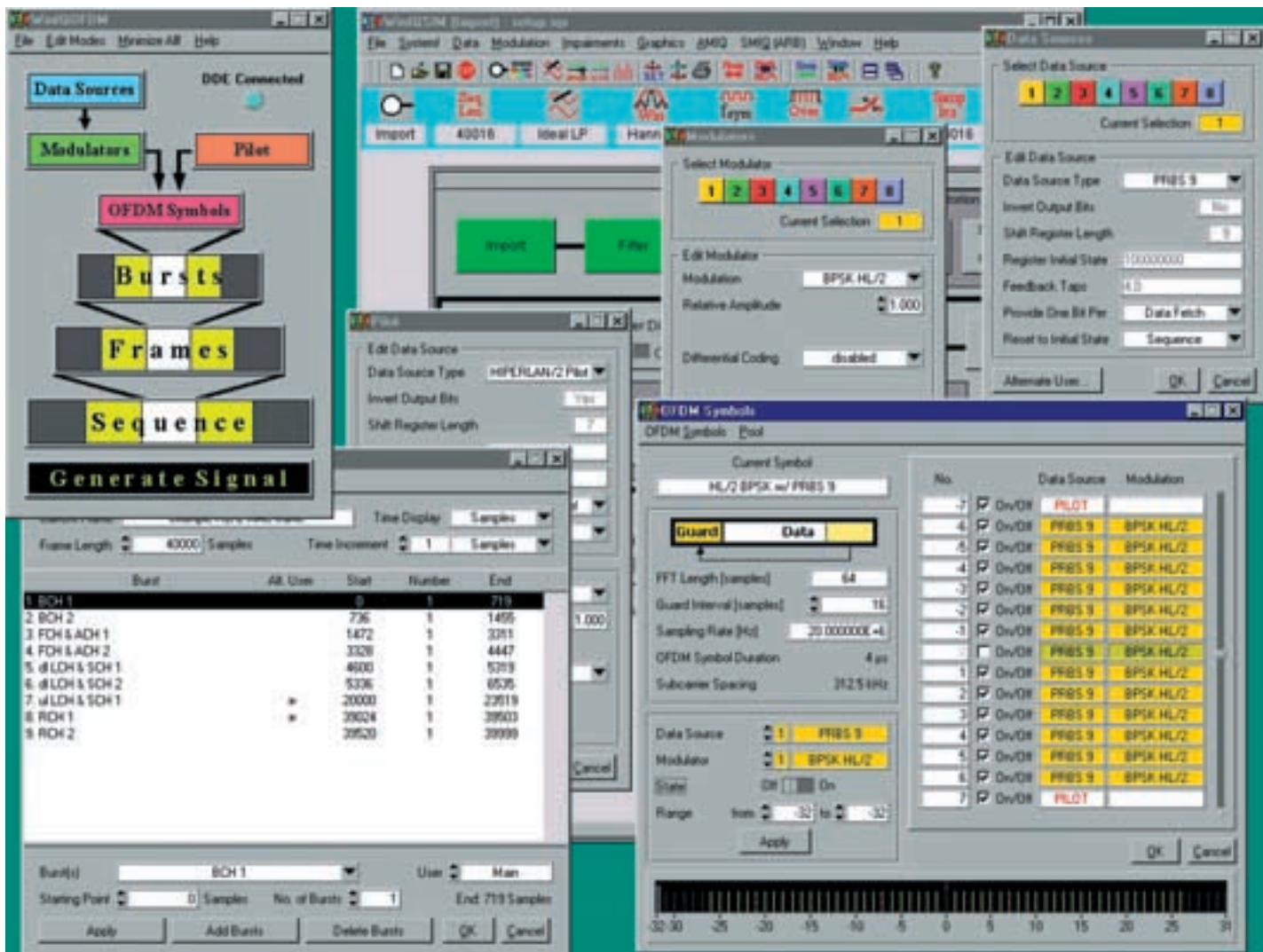
WinIQOFDM is designed as a general synthesis program for OFDM signals. For fast and simple generation of

HiperLAN/2 signals, the software comes with a special, clearly arranged editing mode. All symbol structures possible in HiperLAN/2 are preset, and sample setups considerably facilitate further program configuration. The desired HiperLAN/2 signal is generated with just a few mouse clicks.

OFDM symbol level

WinIQOFDM generates all symbol structures defined in HiperLAN/2 including the pilots. All four modulation modes BPSK, QPSK, 16QAM and 64QAM are

FIG 2 OFDM Simulation Software WinIQOFDM, a PC program to generate HiperLAN/2 signals



available. Useful data may consist of PRBS data and user-defined patterns as well as data read from ASCII files. Moreover, there are eight data sources available that can be freely allocated. The optional short guard mode (short guard intervals) is also supported.

TDMA framing

WinIQOFDM can also generate the time structure of any HiperLAN/2 signal. In HiperLAN/2 systems the length and sequence of bursts within the frames are dynamically defined during operation; as a result, there is an overwhelming variety of possible MAC frame structures. WinIQOFDM provides a hierarchy of bursts and frames that is user-configurable and easily edited, so the user can generate any desired MAC frame without difficulties. All necessary burst preambles are available. A model setup that can be adapted to requirements is also supplied so that untrained users can easily familiarize.

Multi-user scenarios with alternate user

Since TDD and TDMA are used within one HiperLAN/2 MAC frame, it is often necessary to simulate more than one signal simultaneously: one that is actually received by a DUT and analyzed, and another signal that represents all other active terminals and is not considered any further.

WinIQOFDM can simultaneously simulate the signals of two independent terminals with no need for redundant settings. Each burst within a frame can be assigned to one of the two terminals.

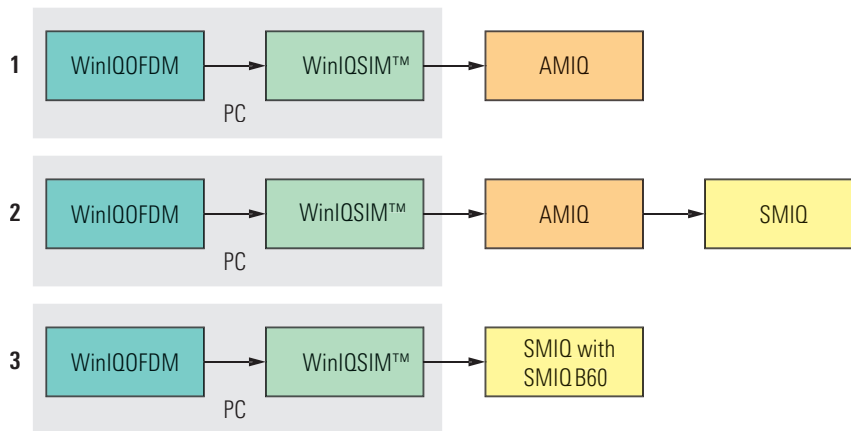


FIG 3 Generation of OFDM signals: (1) in the baseband, (2) in the RF band with AMIQ and SMIQ and (3) in the RF band with SMIQB60

IEEE 802.11a

WinIQOFDM of course allows straightforward generation of signals to IEEE 802.11a standard. Its physical layer is very similar to HiperLAN/2, the frame structure is much less complex however. Here a frame is not divided into bursts, but simply consists of a preamble and a variable number of OFDM symbols the structure of which is the same as with HiperLAN/2. The frame preamble for IEEE 802.11a is supplied as a file.

Conclusion: complex signals with a few mouse clicks

WinIQOFDM is an easy-to-operate software. Together with AMIQ or SMIQB60 it allows generation of all signals occurring in HiperLAN/2 systems. Thanks to the "alternate user", the generation of multi-user signals is particularly convenient. WinIQOFDM is not restricted to HiperLAN/2, so even test signals not complying with any standard can be computed. WinIQSIM™ handles baseband filtering and channel simulation, the user does not have to get accustomed to a new program. In AMIQ and SMIQ, two proven and powerful signal sources with sufficient bandwidth and

memory depth are available, so that even long test sequences can be generated.

The software runs under Windows™ 95 / 98 / NT / 2000.

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* WinIQSIM is a program to simulate various mobile radio signals and is supplied with AMIQ and SMIQ generators with option B60 (arbitrary waveform generator).

REFERENCES

- [1] I/Q Simulation Software WinIQSIM – New approaches in calculating complex I/Q signals. News from Rohde & Schwarz (1998) No. 159, pp 13–15
- [2] I/Q Modulation Generator AMIQ – New models 03 and 04 as well as digital I/Q output option. News from Rohde & Schwarz (2000) No. 166, pp 22–23
- [3] Signal Generator SMIQ: Fit for 3G with new options. News from Rohde & Schwarz (2000) No. 166, pp 10–12

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