Digital standards IS-95 and CDMA2000

Supplement to SMIQ, AMIQ and WinIQSIM

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The specifications in this supplement are valid for digital standards CDMA2000 and IS-95, which are enabled by options AMIQK12/SMIQK12 and AMIQK11/SMIQK11 of Arbitrary Waveform Generator AMIQ and/or Vector Signal Generator SMIQ. Waveforms generated by means of WinIQSIM™ can be loaded into Arbitrary Waveform Generators AMIQ or SMIQB60 (option for Vector Signal Generator SMIQ).

Digital standard IS-95

- **with AMIQ and option AMIQK11**
- **with SMIQ and options SMIQK11 and SMIQB60 (arbitrary waveform generator)**

IS-95	Simulation of CDMA signals to North American standard IS-95 A, available as software option AMIQK11 of AMIQ or software option SMIQK11 in conjunction with option SMIQB60 (arbitrary waveform generator of SMIQ)
General settings	
Chip rate Standard Range	 1.2288 Mcps AMIQ: 10 cps to 100 Mcps SMIQB60: 1 kcps to 40 Mcps
Link direction	forward link and reverse link
Sequence length	input in symbols (1536 symbols correspond to frame of 80 ms), max. length depending on oversampling AMIQ02 and AMIQ03 (for oversampling of 4): 1 to 10 frames AMIQ04 (for oversampling of 4): 1 to 40 frames SMIQB60 (for oversampling of 2 in WinIQSIM, and oversampling >4 in SMIQ due to hardware oversampling): 1 to 2 frames
Baseband filter Standard Other filters	 CDMA2000 1X (corresponds to IS-95 filter) same as with single carrier system
Clipping level	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering and reduces the crest factor. The range is 1 to 100 %.
Parameter for each base station	PN offset 0 to 511
Parameter for each code channel	state on/off, power, data, long code mask
Physical channels in forward link	
Pilot	
Paging	parameters: data, long code mask with PCN and pilot PN field
Sync	parameter: data
Traffic	parameters: data, long code mask with permuted ESN field
Physical channels in reverse link	
Access	parameters: data, long code mask with ACN, PCN, base ID and pilot PN field
Traffic	parameters: data, long code mask with permuted ESN field
Channel power	–40 dB to 0 dB
Modulation data	4 different data sources, 3 same as with single carrier system, another PRBS source with different start values for different code channels
Baseband filtering	same as with single carrier system (see AMIQ data sheet)
Simulation of impairments and transmission characteristics	same as with single carrier system (see AMIQ data sheet)
Smoothing	same as with single carrier system (see AMIQ data sheet)
Graphic output	same as with single carrier system (see AMIQ data sheet)

CCDF	Display of complementary cumulative distribution function of current signal. This function gives the probability of the magnitudes of complex IQ samples exceeding a predefined threshold. Together with the current CCDF, the CCDFs of any number of IS-95 signals last generated can be displayed to observe the effect of parameter changes. The crest factor of the signal can be seen in the CCDF.
ACP calculation	Calculation of adjacent-channel power in spectrum display (ACP up, low and ACP up 1st alt, low 1st alt)
IF signal generation	Modulation of calculated IQ signal to intermediate frequency in the range 0.01 MHz to 25 MHz (output to I channel of AMIQ)

Digital standard CDMA2000

- **with AMIQ and option AMIQK12**
- **with SMIQ and options SMIQK12 and SMIQB60 (arbitrary waveform generator)**

CDMA2000	Simulation of CDMA signals to North American standard IS-2000, available as software option AMIQK12 of AMIQ or software option SMIQK12 in conjunction with option SMIQB60 (arbitrary waveform generator of SMIQ)
General settings	
Chip rate Standard Range	 1.2288 Mcps (1X), 3.6864 Mcps (3X) AMIQ: 10 cps to 100 Mcps SMIQB60: 1 kcps to 40 Mcps
Carrier spacing Standard Variable	 1.25 MHz AMIQ: 0 to 10 MHz SMIQB60: 0 to 2 MHz
Modes	1X Direct Spread 3X Direct Spread 3X Multi Carrier (forward link only)
Link direction	forward link and reverse link
Sequence length	Input in frames of 80 ms, max. length depending on chip rate, mode and oversampling AMIQ02 and AMIQ03 (for oversampling of 4): 1 to 10 frames at 1.2288 Mcps (1X) 1 to 6 frames at 3.6864 Mcps (3X) Multi Carrier 1 to 3 frames at 3.6864 Mcps (3X) Direct Spread AMIQ04 (for oversampling of 4): 1 to 40 frames at 1.2288 Mcps (1X) 1 to 26 frames at 3.6864 Mcps (3X) Multi Carrier 1 to 13 frames at 3.6864 Mcps (3X) Direct Spread SMIQB60 (for oversampling of 2 in WinIQSIM, and oversampling >4 in SMIQ due to hardware oversampling): 1 to 2 frames at 1.2288 Mcps (1X) 1 frame at 3.6864 Mcps (3X) Multi Carrier 1 frame at 3.6864 Mcps (3X) Direct Spread
Baseband filter Standard Other filters	 CDMA2000 1X CDMA2000 3X Direct Spread same as with single carrier system
Code channels Forward link Reverse link	 4 base stations with max. 91 code channels each (depending on radio configuration) 4 mobile stations with max. 13 code channels each (depending on radio configuration)
Clipping level	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering and reduces the crest factor. The range is 1 to 100 %.

Parameters for each base station (BS)	
State	off/on
Radio configuration Chip rate 1.2288 Mcps (1X) Chip rate 3.6864 Mcps (3X)	 RC 1 to RC 5 RC 6 to RC 9
PN offset	0 to 511
Quasi-orthogonal Walsh sets	set 1 to set 3
Channel coding	All levels of channel coding provided by IS-2000 (eg frame quality indicator, convolutional encoder, symbol puncture and interleaver) are available. All combinations of frame lengths and data rates are supported. Four modes are available: – off: channel coding off – complete: complete channel coding on – without interleaving: channel coding on, but without interleaver – interleaving only: channel coding off, interleaver active only
Transmit diversity (OTD)	off / antenna 1 / antenna 2 If this function is active, the output signal for antenna 1 or antenna 2 can be generated as defined in the standard.
Use TPC for dynamic output power control	off/on If this function is active, the TPC pattern is used to vary the transmit power of the code channels versus time.
Output power control step	–10 dB to +10 dB
Parameters for each mobile station (MS)	
State	off/on
Radio configuration Chip rate 1.2288 Mcps (1X) Chip rate 3.6864 Mcps (3X)	 RC 1 to RC 4 RC 5 to RC 6
Channel coding	All levels of channel coding provided by IS-2000 (eg frame quality indicator, convolutional encoder, symbol puncture and interleaver) are available. All combinations of frame lengths and data rates are supported. Four modes are available: – off: channel coding off – complete: complete channel coding on – without interleaving: channel coding on, but without interleaver – interleaving only: channel coding off, interleaver active only
Use TPC for dynamic output power control	off/on If this function is active, the TPC pattern (selectable bit pattern, max. 16 bit long) is used to vary the transmit power of the code channels versus time.
Output power control step	–10 dB to +10 dB
Channel types	
Forward link	Special channels: – Forward Pilot (F-PICH) – Sync (F-SYNC) – Paging (F-PCH) – Transmit Diversity Pilot (F-TDPICH) – Auxiliary Pilot (F-APICH) – Auxiliary Transmit Diversity Pilot (F-ATDPCH) – Broadcast (F-BCH) – Quick Paging (F-QPCH) – Common Power Control (F-CPCCH) – Common Assignment (F-CACH) – Forward Common Control (F-CCCH) Traffic channels: – Forward Dedicated Control (F-DCCH) – Forward Fundamental (F-FCH) – Forward Supplemental (F-SCH)

Reverse link	Special channels: – Reverse Pilot (R-PICH) – Access (R-ACH) – Enhanced Access (R-EACH) – Reverse Common Control (R-CCCH) – Reverse Dedicated Control (R-DCCH) Traffic channels: – Reverse Fundamental (R-FCH) – Reverse Supplemental Code (R-SCCH) – Reverse Supplemental 1 (R-S1CH) – Reverse Supplemental 2 (R-S2CH)
Parameters for each forward link code channel, independently selectable	
State	off/on
Frame length	depending on channel type and radio configuration: 5 ms, 10 ms, 20 ms, 40 ms, 80 ms
Data rate	depending on channel type and radio configuration: 1.2 kbps to max. 1036.8 kbps
Walsh code	depending on channel type and radio configuration: 0 to max. 255
Quasi-orthogonal code	off/on
Long code mask	0 to 3FF FFFF FFFF hex
Power	–60 dB to 0 dB
Data	4 different data sources, 3 same as with Single Carrier system, another PRBS source with different start values for different code channels
TPC pattern	bit pattern (max. 16 bit long)
Parameters for each reverse link code channel, independently selectable	
State	off/on
Frame length	depending on channel type and radio configuration: 5 ms, 10 ms, 20 ms, 40 ms, 80 ms
Data rate	depending on channel type and radio configuration: 1.2 kbps to max. 1036.8 kbps
Long code mask	0 to 3FF FFFF FFFF hex
Power	–60 dB to 0 dB
Data	4 different data sources, 3 same as with single carrier system, another PRBS source with different start values for different code channels
Assistant functions to facilitate operation	
Parameterizable predefined settings (forward link only)	Generation of complex signal scenarios with parameterizable default settings. Selectable parameters: – use of special channels (F-PICH, F-SYNC, number of F-QPCHs) – number, frame length and data rate of data channels – crest factor: minimal/average/worst
Multichannel edit (forward link only)	Common configuration of data channels of BS channel table. Selectable parameters, partly with start value and step size: – range of data channels to be set – frame length – data rate – Walsh code with step width – state of quasi-orthogonal Walsh set – channel power with step size – data – TPC – state
Copy BS/MS	Adopting the configuration of a BS/MS for another BS/MS to define multi-BS/MS scenarios. Parameters: – source and destination of copying – Walsh code offset (forward link)

Graphic displays	
Domain conflicts (forward link only)	Display of domain conflicts (overlapping of code channels in code domain) in the lines concerned of the channel tables. The code domain occupied by the code channels involved in the conflict can also be displayed.
Code Domain (forward link only)	Display of code domain occupied by current BS. Domain areas in which conflicts occur are highlighted. The distribution of code channels in the code domain as well as channel powers are displayed.
Channel graph	Display of all active channels of a BS/MS versus the channel table index. The powers of the code channels are shown.
CCDF	Display of complementary cumulative distribution function of current signal. This function gives the probability of the magnitudes of complex IQ samples exceeding a predefined threshold. Together with the current CCDF, the CCDFs of any number of CDMA2000 signals last generated can be displayed to observe the effect of parameter changes. The crest factor of the signal can be seen in the CCDF.
Constellation diagram	Display of constellation diagram versus IQ samples of current CDMA signal. This diagram allows qualitative assessment of channel configuration, channel power ratios, and effect of selected Walsh codes.
ACP calculation	Calculation of adjacent-channel power in spectrum display (ACP up, low and ACP up 1st alt, low 1st alt)
IF signal generation	Modulation of calculated IQ signal to intermediate frequency in the range 0.01 MHz to 25 MHz (output to I channel of AMIQ)

Ordering information

Digital Standard IS-95 CDMA	**AMIQK11**	**1122.2003.02**
Digital Standard IS-95 CDMA (option SMIQB60 required)	**SMIQK11**	**1105.0287.02**
Digital Standard CDMA2000	**AMIQK12**	**1122.2503.02**
Digital Standard CDMA2000 (option SMIQB60 required)	**SMIQK12**	**1105.0435.02**

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