Application Note

Anritsu

W-CDMA Test

MG3700A
Vector Signal Generator

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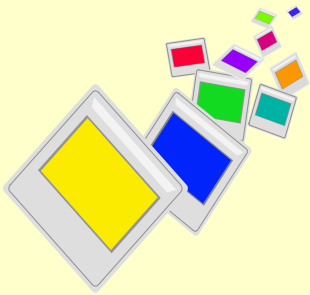
February 2007
(4.00)

Contents



UTRA/FDD Frequency Bands

Operating Band	Band Title	Bandwidth [MHz]	Uplink [MHz]	Downlink [MHz]	
VII	2600	2 × 70	2500 – 2570	2620 – 2690	New
I	2100	2 × 60	1920 – 1980	2110 – 2170	UMTS core band
II	1900	2 × 60	1850 – 1910	1930 – 1990	PCS band in USA
IV	1700/2100	2 × 45	1710 – 1755	2110 – 2155	3G band in USA
III	1800	2 × 75	1710 – 1785	1805 – 1880	EU, Asia, Brazil
IX	1700	2 × 35	1750 – 1785	1845 – 1880	Japan
VIII	900	2 × 35	880 – 915	925 – 960	EU, Asia
V	850	2 × 25	824 – 849	869 – 894	USA, Asia
VI	800	2 × 10	830 – 840	875 – 885	Japan

HSPA Standardization in 3GPP

- HSDPA (High-speed Downlink Packet Access) was standardized in 3GPP Release 5.
  - » The downlink peak data rate will increase to 3.6 Mbps, 7.2 Mbps and potentially beyond 10 Mbps.
  - » HS-DSCH
    - – HARQ for downlink
    - – Fast BTS downlink scheduling
    - – Shorter downlink TTI
    - – Higher order and adaptive modulation
- HSUPA (High-speed Uplink Packet Access) was standardized in 3GPP Release 6.
  - » The uplink peak data rate will increase to 1 to 2 Mbps and 3 to 4 Mbps.
  - » E-DCH
    - – HARQ for uplink
    - – Fast BTS uplink scheduling
    - – Shorter uplink TTI

HSDPA UE Capabilities (Categories)

- 3GPP TS 25.306 specifies UE capabilities for HS-DSCH categories.

Category	Maximum Number of HS-PDSCH Codes	Minimum Inter-TTI Interval	Maximum Number of Transport Channel Bits per HS-DSCH TTI	Achievable Maximum Data Rate [Mbps]
1	5	3	7298	1.2
2	5	3	7298	1.2
3	5	2	7298	1.8
4	5	2	7298	1.8
5	5	1	7298	3.6
6	5	1	7298	3.6
7	10	1	14411	7.2
8	10	1	14411	7.2
9	15	1	20251	10.2
10	15	1	27952	14.4
11	5	2	3630	0.9
12	5	1	3630	1.8

  - Category 1 to 10 support 16QAM and QPSK. Category 11 and 12 support QPSK only.

HSUPA UE Capabilities (Categories)

- 3GPP TS 25.306 specifies UE capabilities for E-DCH categories.

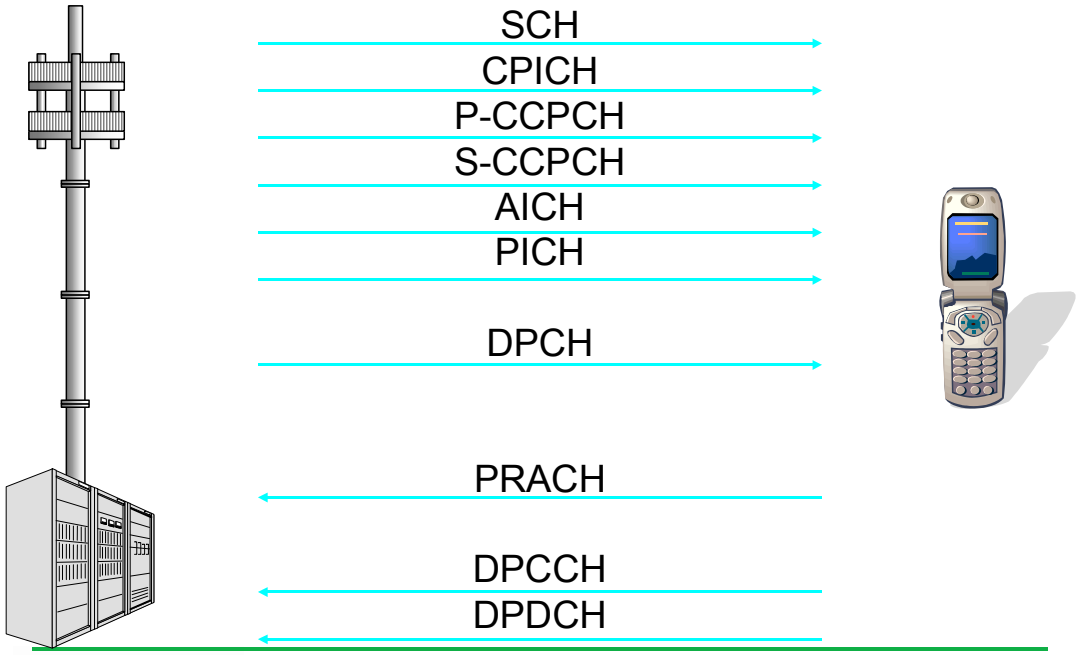
Category	Maximum Number of E-DPDCH Codes, Minimum SF	Support for 10 and 2 ms TTI	Maximum Data Rate with 10 ms TTI [Mbps]	Maximum Data Rate with 2 ms TTI [Mbps]
1	1 × SF4	10 ms	0.7	-
2	2 × SF4	10 ms and 2 ms	1.4	1.3
3	2 × SF4	10 ms	1.4	-
4	2 × SF2	10 ms and 2 ms	2	2.8
5	2 × SF2	10 ms	2	-
6	2 × SF2 + 2 × SF4	10 ms and 2 ms	2	5.7

  - All categories support 10 ms TTI.

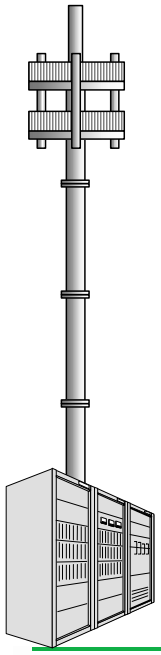
Mapping of Transport Channels onto Physical Channels

	Transport Channels	Physical Channels	
	– DCH	– DPDCH	Dedicated Physical Data Channel
		– DPCCH	Dedicated Physical Control Channel
		– F-DPCH	Fractional Dedicated Physical Channel
HSUPA	– E-DCH	– E-DPDCH	E-DCH Dedicated Physical Data Channel
		– E-DPCCH	E-DCH Dedicated Physical Control Channel
		– E-AGCH	E-DCH Absolute Grant Channel
		– E-RGCH	E-DCH Relative Grant Channel
		– E-HICH	E-DCH Hybrid ARQ Indicator Channel
	– RACH	– PRACH	Physical Random Access Channel
		– CPICH	Common Pilot Channel
	– BCH	– P-CCPCH	Primary Common Control Physical Channel
	– FACH	– S-CCPCH	Secondary Common Control Physical Channel
	– PCH	– SCH	Synchronization Channel
		– AICH	Acquisition Indicator Channel
		– PICH	Paging Indicator Channel
		– MICH	MBMS Notification Indicator Channel
HSDPA	– HS-DSCH	– HS-PDSCH	High Speed Physical Downlink Shared Channel
		– HS-SCCH	HS-DSCH-related Shared Control Channel
		– HS-DPCCH	Dedicated Physical Control Channel (uplink) for HS-DSCH

Basic Physical Channels



HSDPA Physical Channels

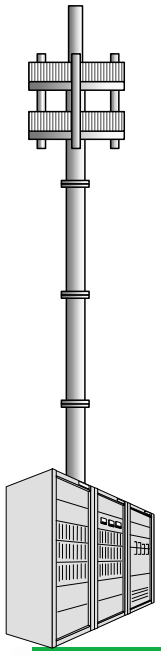


HS-SCCH
HS-PDSCH

HS-DPCCH

(DPCCH)
(DPDCH)

HSUPA Physical Channels



E-HICH/E-RGCH
E-AGCH

E-DPCCH
E-DPDCH

(DPCCH)
(DPDCH)

Downlink Physical Channels

- Common Channels
  - *SCH* is an un-encoded channel that is broadcast over the entire cell. *SCH* allows UEs to acquire the cell. *SCH* exists only at the physical layer.
  - *CPICH* is a channel that exists only at the physical layer. Its function is to assist the UE in channel estimation for dedicated or common physical channels. *CPICH* is scrambled with the cell-specific primary scrambling code.
  - *P-CCPCH* and *S-CCPCH* are common physical channels intended for carrying system and cell information and messages for UEs when a dedicated channel is not in place for communication.
  - *PICH* is a channel that exists only at the physical layer. It is used to notify UEs of outstanding paging messages on the Paging Channel (PCH). It saves UE battery power.

Downlink Physical Channels

- Common Channels
  - *AICH* is a channel that exists only at the physical layer. *AICH* sends status indicators on the downlink, reflecting the state (busy or idle) of the Random Access Channel (RACH). This allows UEs to verify the state of the access channel before transmission, which helps to minimize collisions.
  - *HS-PDSCH* is a shared channel across all users requesting HSDPA specific high-speed packet data services. Each cell may support one or more *HS-PDSCH*s. Sharing of the *HS-PDSCH* is based on Time-Division Multiplexing (TDM) across multiple users.
  - *HS-SCCH* is a control channel associated with the *HS-PDSCH*. *HS-SCCH* conveys the *HS-PDSCH* allocation information including the user identity, the number of spreading factors, and modulation scheme.

Downlink Physical Channels

- Common Channels
  - *E-AGCH* is used for transmitting the absolute value of the BTS scheduler decision informing the UE about the relative transmission power it may use for data channel transmission (*E-DPDCH*), effectively telling the UE the maximum transmission data rate it may use.

Downlink Physical Channels

- Dedicated Channels
  - *DPDCH* and *DPCCH* are the dedicated physical channels targeted to transport information between the network and the UE using a dedicated link on the physical channel. They are both time multiplexed and carried on the *DPCH*.
  - *E-RGCH* is used for transmitting single set-up/down scheduling commands that affect the relative transmission power the UE may use for data channel transmission (*E-DPDCH*), effectively adjusting the uplink data rate up/down.
  - *E-HICH* is used for transmitting positive and negative acknowledgements for uplink packet transmission.
  - *F-DPCH* is basically a stripped-down version of DPCH that handles the power control. Only the TPC field is kept when comparing *F-DPCH* with DPCH. *F-DPCH* is used in cases that DCH causes too much overhead and consumes too much code space when accepting a large number of users using a low data rate service, like VoIP.

Uplink Physical Channels

- Common Channels
  - » *PRACH* is shared by UEs. It is used for initial access of the system.
- Dedicated Channels
  - » *DPDCH* and *DPCCH* are separated due to potential audio interference that may be caused in the UE, such as a mobile phone.
  - » *HS-DPCCH* carries the feedback signalling related to downlink HS-DSCH (incoming packets). The HS-DSCH-related feedback signalling consists of Hybrid-ARQ Acknowledgement (HARQ-ACK) and Channel-Quality Indication (CQI).
  - » *E-DPDCH* is used for transmitting E-DCH transport channel processing from the UE to the BS.
  - » *E-DPCCH* is used for transmitting control information about *E-DPDCH* transmission from the UE to the BS.

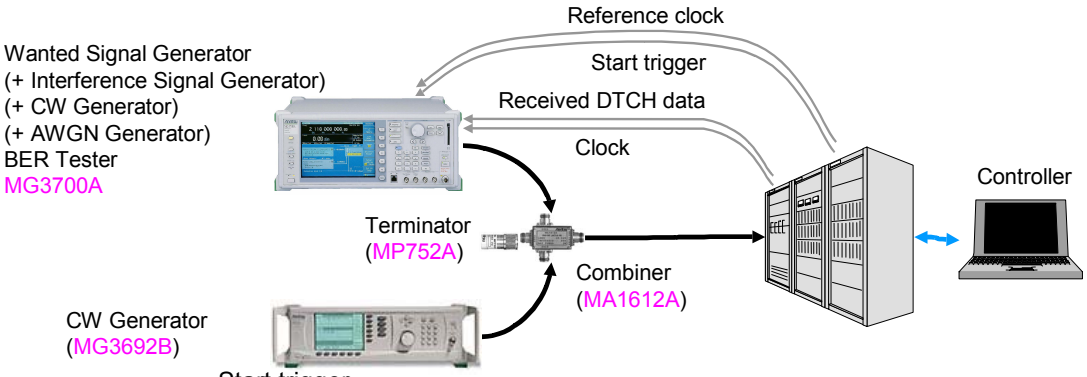
BS Test

3GPP TS 25.141 (Release 7)
6 Transmitter
7 Receiver
8 Performance requirement

	Test	Wanted Signal Generator with BERT	Interference Signal Generator	CW Generator	AWGN Generator	Others
6.4 6.4.2 6.4.3	Output power dynamics Power control steps Power control dynamic range	MG3700A				Code Domain Analyzer
6.6	Transmit intermodulation		MG3700A			Spectrum Analyzer Circulator
7.2	Reference sensitivity level	MG3700A				
7.3	Dynamic range				*	
7.4	Adjacent Channel Selectivity (ACS)		*			
7.5	Blocking characteristics		*	MG3692B 20 GHz or MG3642A 2.08 GHz		MA1612A 3 GHz Combiner
7.6	Intermodulation characteristics		*			
7.8	Verification of the internal BER calculation					
8.2	Demodulation in static propagation conditions				*	
8.3	Demodulation of DCH in multipath fading conditions				MG3700A	MA1612A 3 GHz Combiner Fading Simulator
8.4	Demodulation of DCH in moving propagation conditions					
8.5	Demodulation of DCH in birth/death propagation conditions					
8.6	Verification of the internal BLER calculation					
8.11 8.11.1 8.11.3	Performance of signaling detection for HS-DPCCH ACK false alarm in static propagation conditions ACK mis-detection in static propagation conditions				*	
8.12	Demodulation of E-DPDCH in multipath fading conditions				MG3700A	MA1612A 3 GHz Combiner Fading Simulator
8.13	Performance of signaling detection for E-DPCCH in multipath fading conditions					

*: MG3700A for wanted signal generator generates two signals with interference signal, CW or AWGN.

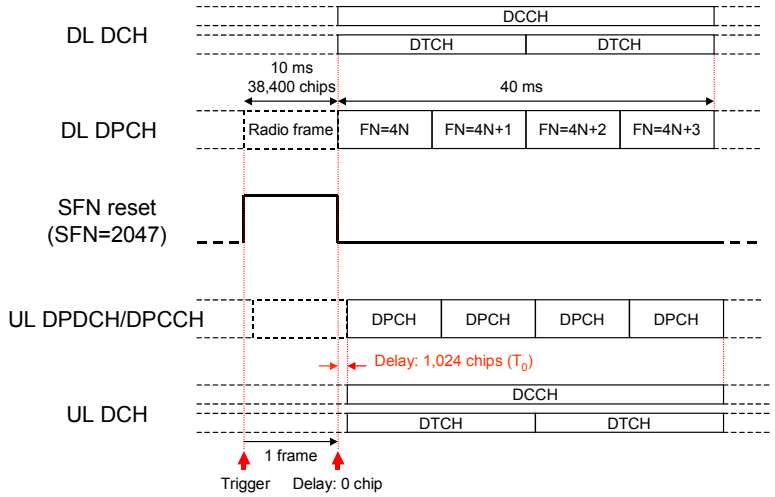
Receiver Test Connection Example



- Start trigger
  - Front panel [Start/Frame Trigger] Input
    - 40 ms × n clock
      e.g. SFN reset timing of Downlink BCH (4096 frame × 10 ms)
- Reference clock
  Use only one.
  - Rear panel [Baseband Ref Clock] Input
    - 3.84 MHz, 2 × 3.84 MHz (7.68 MHz), 4 × 3.84 MHz (15.36 MHz)
  - Rear panel [10MHz/5MHz Ref] Input
- Controller
  - Makes receivable state for UL RMC by FTM (Factory Test Mode) control
  - Reports internal BER/BLER calculation for received DTCH

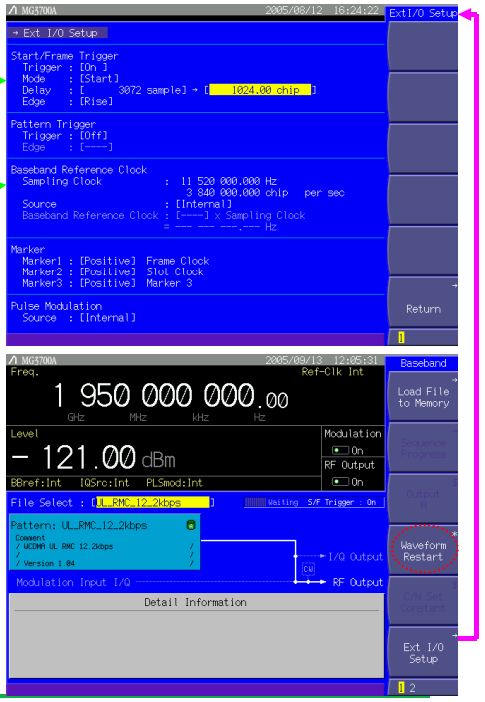
Timing Synchronization Setup Example

- Start trigger delay
  - » Set the timing at which the BS can receive UL RMC.

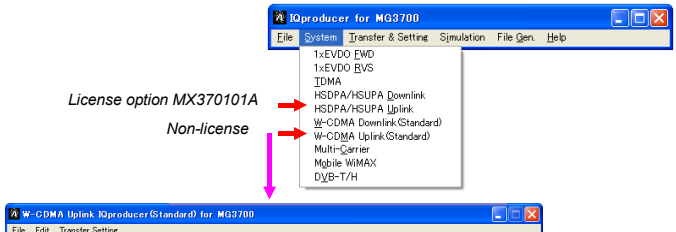


Timing Synchronization Setup Example

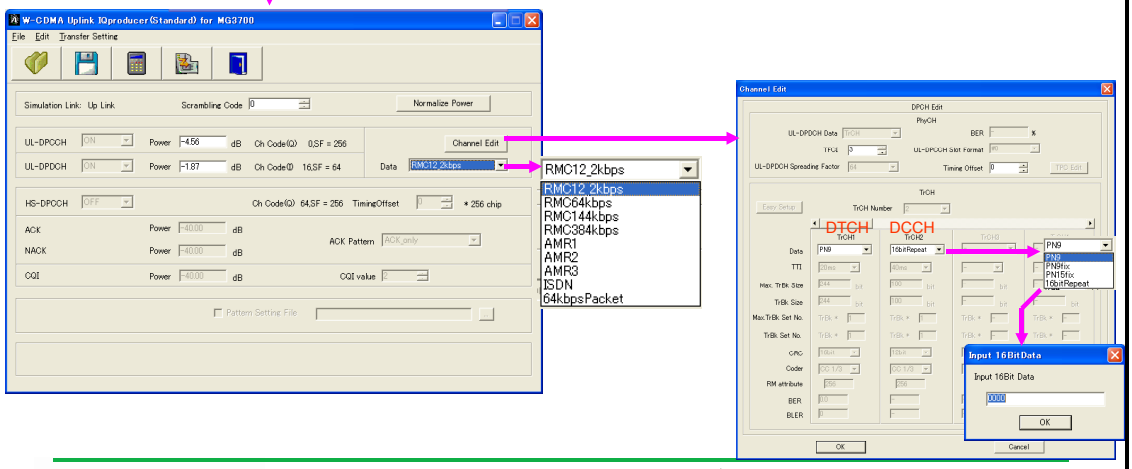
- Setting external start trigger
  - » Captures/ Synchronizes trigger once only
- Reference clock
  - » [Baseband Ref Clock] Input usage case
    - – Source: [External]
    - – Baseband Reference Clock:
      - [1],[1/2],[1/4],[1/8],[1/16] ×
  - » [10MHz/5MHz Ref] Input usage case
    - – Source: [Internal]
- Trigger recapture/ synchronization



Wanted Signal Setup
HSPA or Limited W-CDMA IQproducer

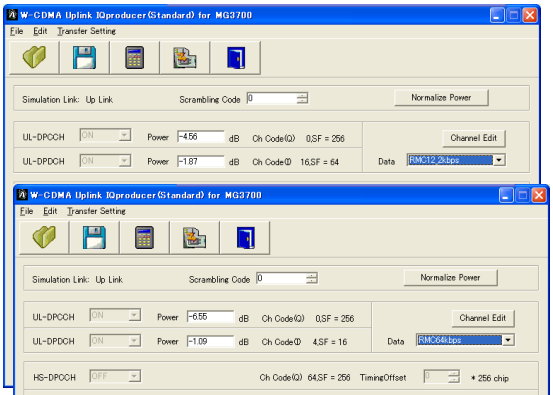


- Created sample rate
  - – 3 × Oversampling

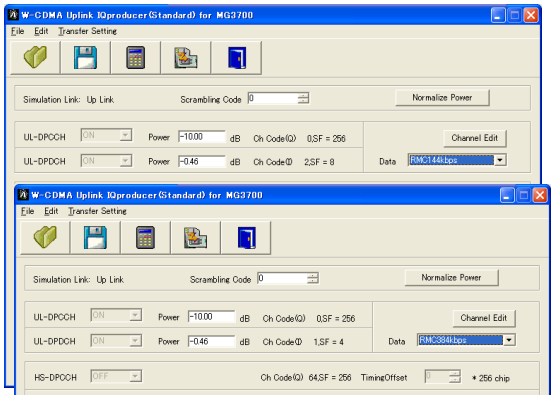


Wanted Signal Setup
HSPA or Limited W-CDMA IQproducer

- UL RMC 12.2 kbps



- UL RMC 144 kbps

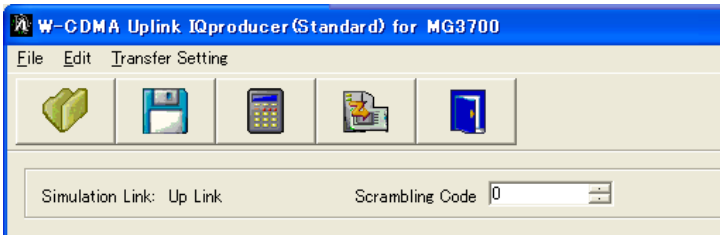


- UL RMC 64 kbps

- UL RMC 384 kbps

Scrambling Code Synchronization
Setup Example

- Scrambling code
  - » BS identifies UE by scrambling code allocated to each UE.
  - » 38,400 chips (10 ms) segments
    - – Created from 25-bit long Gold sequences
  - » Applies HPSK modulation to scrambling (spreading)
- Set the initial condition $x_n(23) \sim x_n(0)$ receivable by BS.
  - – 0 ~ 16,777,215

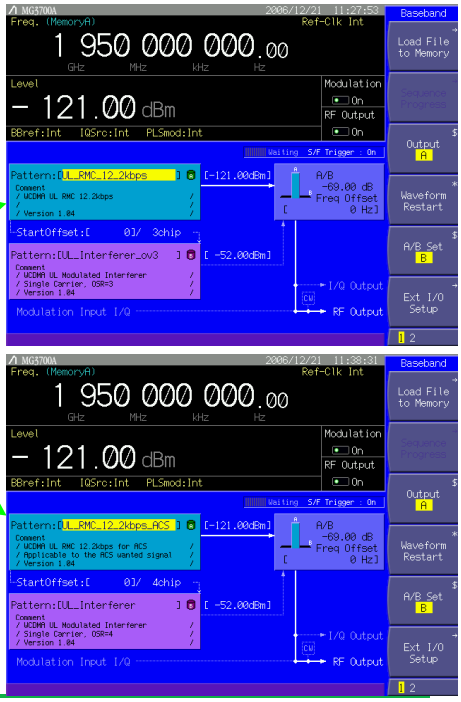


Wanted Signal Setup Example

Test
- Receiver

- UL RMC 12.2 kbps
  - Scrambling Code 0_H
    - » For mixing interference signal
      - 3 × Oversampling
        - Frequency offset ≤ 34.944 MHz
      - 4 × Oversampling
        - Frequency offset ≤ 47.232 MHz

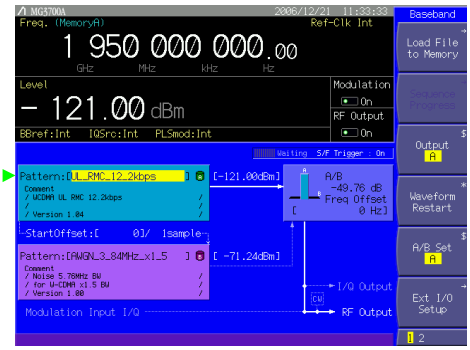
Both signal patterns are the same.



Wanted Signal Setup Example

Test
- Dynamic range
- Performance requirements

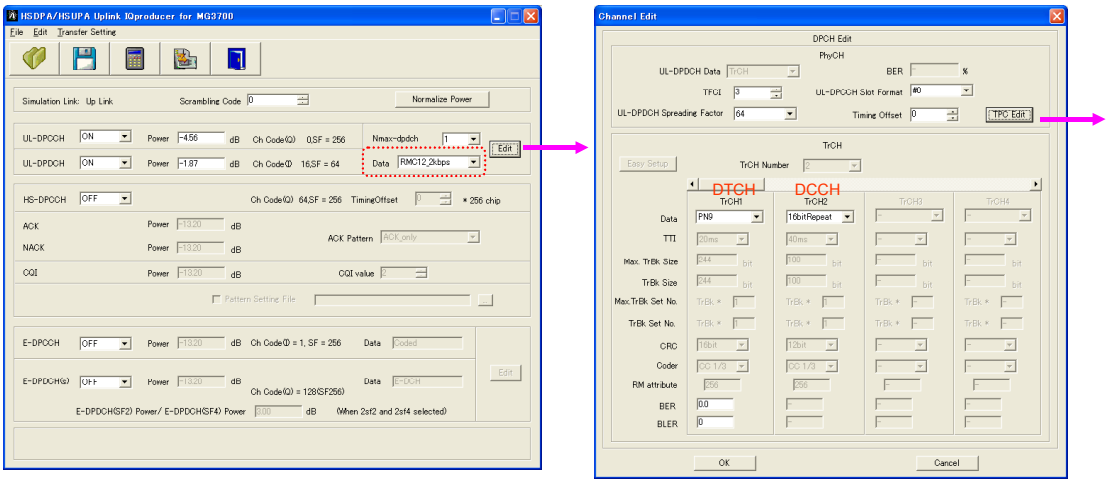
- UL RMC 12.2 kbps
- UL RMC 64 kbps
- UL RMC 144 kbps
- UL RMC 384 kbps
  - Scrambling Code 0_H
    - » For mixing AWGN
      - 3 × Oversampling



Wanted Signal Setup HSPA IQproducer

Test
- Power control steps
- Power control dynamic range

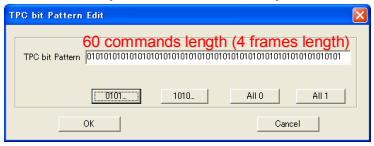
- UL RMC 12.2 kbps



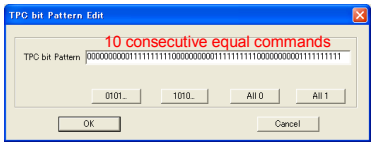
Wanted Signal Setup HSPA IQproducer

» Set TPC command for inner loop power control.
- Power control steps
  - Transmitter power control step tolerance

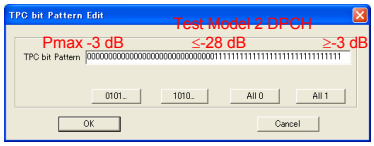
TPC Bit Pattern N_{TPC} = 2	Transmitter power control command
11	1 Up
00	0 Down



  - Transmitter aggregated power control step range

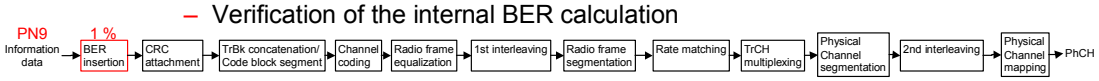


- Power control dynamic range

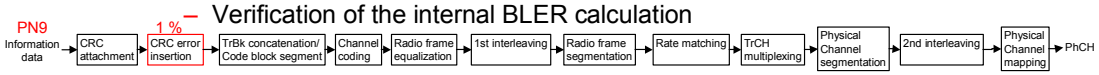


Wanted Signal Setup HSPA IQproducer

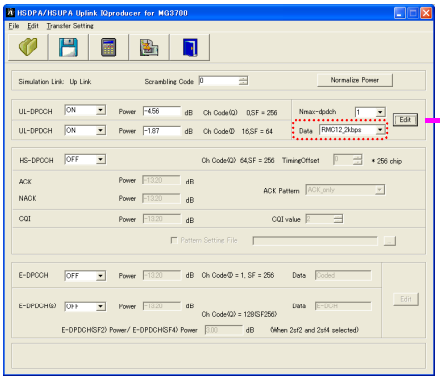
Test
- Verification of the internal BER calculation

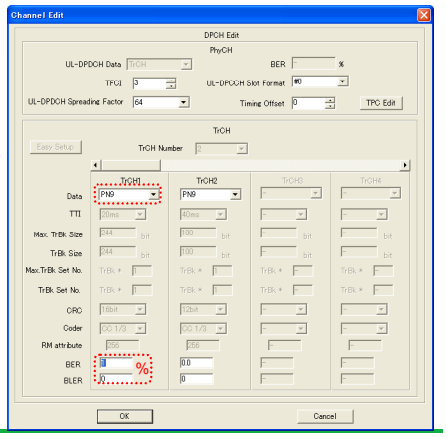


- Verification of the internal BLER calculation



- UL RMC 12.2 kbps

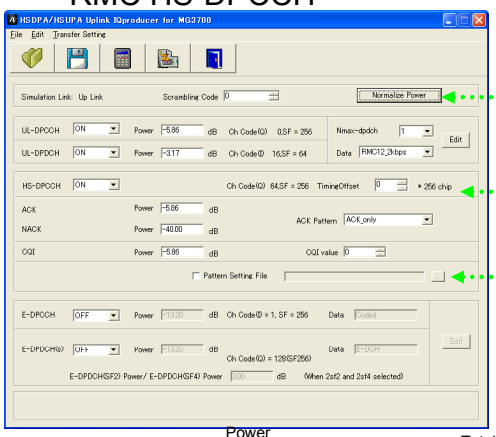




Wanted Signal Setup HSPA IQproducer

Test
- ACK mis-detection in static propagation conditions

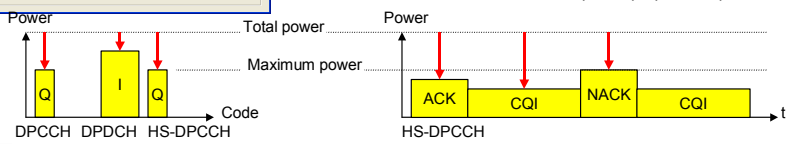
- RMC HS-DPCCH



- Each power ratio normalized automatically from total power

For example		Normalize
– DPCCH:	-4.56 dB	>> -5.86 dB
– DPDCH:	-1.87 dB	>> -3.17 dB
– HS-DPCCH (ACK):	-4.56 dB	>> -5.86 dB
– HS-DPCCH (CQI):	-4.56 dB	>> -5.86 dB

- Resolution 1 symbol (bit)
- Custom-designed pattern file for HS-DPCCH up to 2,048 radio frames
- Supports separate editing of power of HARQ-ACK (ACK), (NACK) and CQI

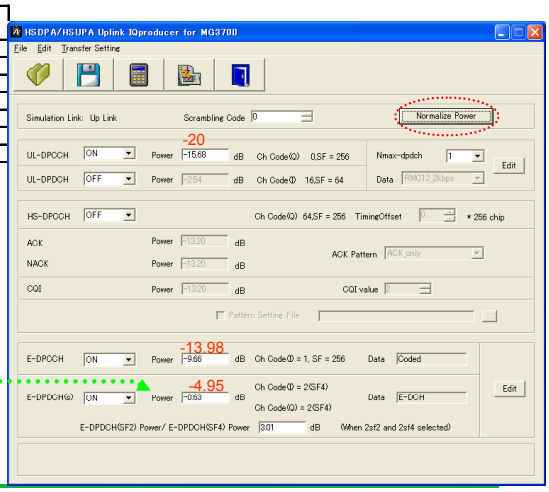


Wanted Signal Setup HSPA IQproducer

Test
- Demodulation of E-DPDCH in multipath fading conditions
- Performance of signaling detection for E-DPCCH in multipath fading conditions

- E-DPDCH FRC

Fixed Ref Channel	TTI [ms]	N_{INF}	SF_1	SF_2	SF_3	SF_4	N_{BIN}	Coding rate	Max inf bit rate [kbps]
FRC1	2	2706	4	4	0	0	3840	0.705	1353.0
FRC2	2	5412	2	2	0	0	7680	0.705	2706.0
FRC3	2	8100	2	2	4	4	11520	0.703	4050.0
FRC4	10	5076	4	0	0	0	9600	0.529	507.6
FRC5	10	9780	4	4	0	0	19200	0.509	978.0
FRC6	10	19278	2	2	0	0	38400	0.502	1927.8
FRC7	10	690	16	0	0	0	2400	0.288	69.0



Total E-DPDCHs power
* 3GPP standard shows E-DPDCH/DPCCH power ratio for single E-DPDCH.

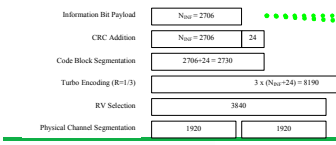
E-DPDCH/DPCCH power ratio: 12.04 dB
E-DPDCHs power = -20 + 12.04 + 10 log (2 codes) = -4.95

Wanted Signal Setup HSPA IQproducer

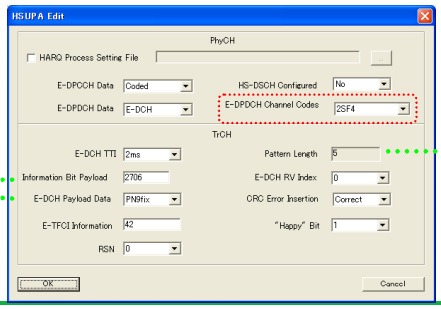
- The following information is transmitted by E-DPCCH.
  - Retransmission sequence number (RSN): xrsn (2 bits)
    - RSN informs the HARQ sequence number of the transport block currently being sent on E-DPDCHs. The initial transmission of a transport block is sent with RSN = 0, the first with RSN = 1, the second with RSN = 2, and all subsequent transmissions with RSN = 3.
  - E-TFCI: xtfci (7 bits)
    - E-TFCI, the E-DCH transport format combination indicator, indicates the transport format being transmitted simultaneously on E-DPDCHs, and tells the BS the transport block size coded on the E-DPDCH. From this information, the BS can derive how many E-DPDCHs are transmitted in parallel and what SF is used.
  - "Happy" bit: xh (1 bit)
    - The "Happy" bit indicates whether the UE is satisfied with the current data rate (or relative power allowed to be used for E-DPDCHs) or whether it could use higher power allocation.

RSN Value	N_{sys} / $N_{e,data,j}$ <1/2 E-DCH RV Index	1/2 ≤ N_{sys} / $N_{e,data,j}$ E-DCH RV Index
0	0	0
1	2	3
2	0	2
3	[⌊TTIN/N_{ARQ}⌋ **mod** 2] x 2	⌊TTIN/N_{ARQ}⌋ **mod** 4

"Happy" bit	$x_{h,1}$
Happy	1
Not happy	0



2 codes E-DPDCHs



TTI period

Transport Block Size

3GPP TS 25.321 Annex B.2 2 ms TTI

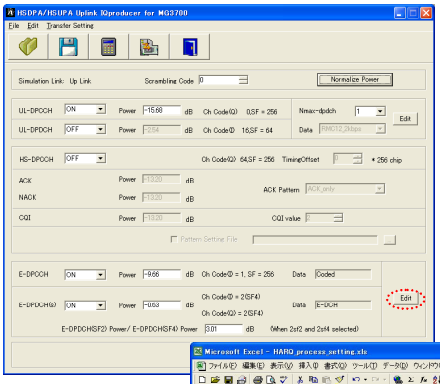
E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	43	2724	86	7252
1	186	44	2742	87	7288
2	204	45	3042	88	7428
3	354	46	3060	89	7464
4	372	47	3078	90	7764
5	522	48	3298	91	7800
6	540	49	3316	92	7908
7	674	50	3334	93	7944
8	690	51	3378	94	8100
9	708	52	3396	95	8136
10	726	53	3414	96	8436
11	858	54	3732	97	8472
12	876	55	3750	98	8564
13	1026	56	3972	99	8600
14	1044	57	3990	100	8772
15	1062	58	4068	101	8808
16	1194	59	4086	102	9108
17	1212	60	4404	103	9144
18	1330	61	4422	104	9220
19	1348	62	4628	105	9256
20	1362	63	4646	106	9444
21	1380	64	4740	107	9480
22	1398	65	4758	108	9780
23	1530	66	5076	109	9816
24	1548	67	5094	110	9876
25	1698	68	5284	111	9912
26	1716	69	5302	112	10116
27	1734	70	5412	113	10152
28	1866	71	5430	114	10452
29	1884	72	5748	115	10488
30	1986	73	5766	116	10532
31	2004	74	5940	117	10568
32	2022	75	5958	118	10788
33	2034	76	6084	119	10824
34	2052	77	6102	120	11124
35	2070	78	6420	121	11178
36	2370	79	6438	122	11188
37	2388	80	6596	123	11242
38	2406	81	6614	124	11460
39	2642	82	6756	125	11478
40	2660	83	6774		
41	2678	84	7092		
42	2706	85	7110		

3GPP TS 25.321 Annex B.4 10 ms TTI

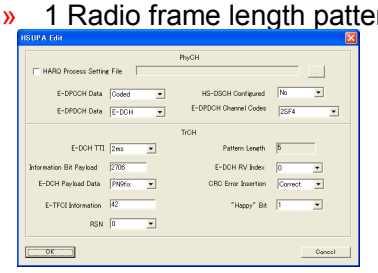
E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	41	5076	82	11850
1	186	42	5094	83	12132
2	204	43	5412	84	12186
3	354	44	5430	85	12468
4	372	45	5748	86	12522
5	522	46	5766	87	12804
6	540	47	6084	88	12858
7	690	48	6102	89	13140
8	708	49	6420	90	13194
9	858	50	6438	91	13476
10	876	51	6756	92	13530
11	1026	52	6774	93	13812
12	1044	53	7092	94	13866
13	1194	54	7110	95	14148
14	1212	55	7428	96	14202
15	1362	56	7464	97	14484
16	1380	57	7764	98	14556
17	1530	58	7800	99	14820
18	1548	59	8100	100	14892
19	1698	60	8136	101	15156
20	1716	61	8436	102	15228
21	1866	62	8472	103	15492
22	1884	63	8772	104	15564
23	2034	64	8808	105	15828
24	2052	65	9108	106	15900
25	2370	66	9144	107	16164
26	2388	67	9444	108	16236
27	2706	68	9480	109	16500
28	2724	69	9780	110	16572
29	3042	70	9816	111	17172
30	3060	71	10116	112	17244
31	3378	72	10152	113	17844
32	3396	73	10452	114	17916
33	3732	74	10488	115	18516
34	3750	75	10788	116	18606
35	4068	76	10824	117	19188
36	4086	77	11124	118	19278
37	4404	78	11178	119	19860
38	4422	79	11460	120	19950
39	4740	80	11514		
40	4758	81	11796		

Wanted Signal Setup HSPA IQproducer

- FRC1

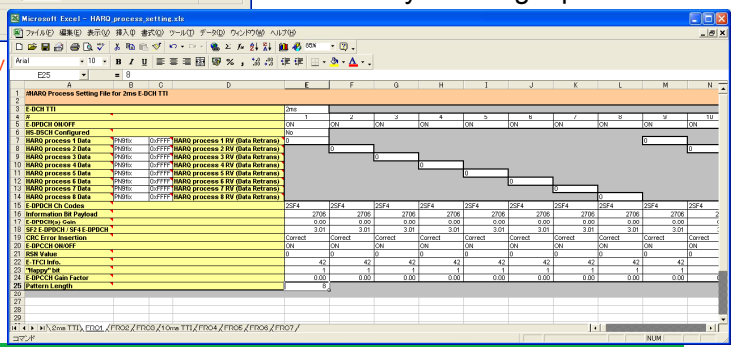


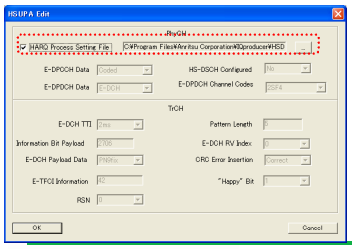
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

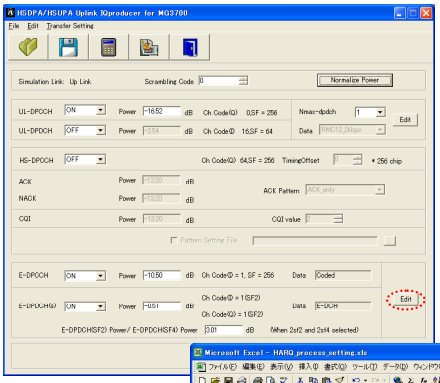
Save as CSV



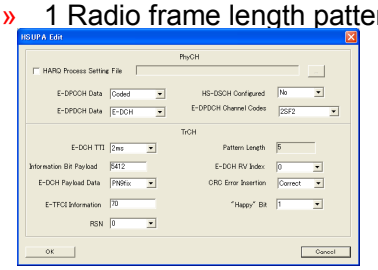


Wanted Signal Setup HSPA IQproducer

- FRC2

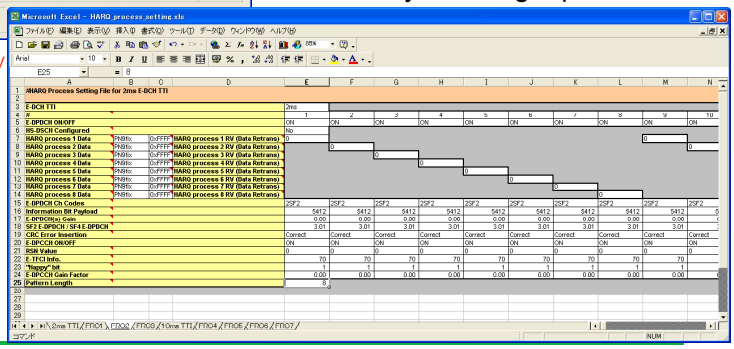


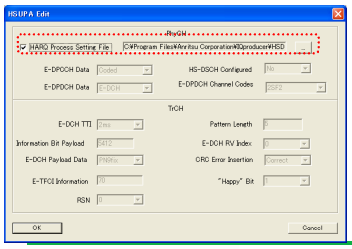
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

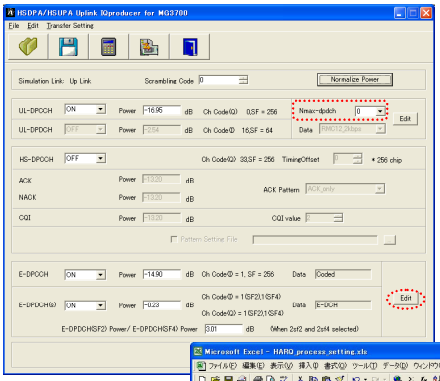
Save as CSV



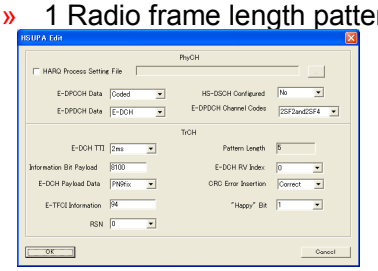


Wanted Signal Setup HSPA IQproducer

- FRC3

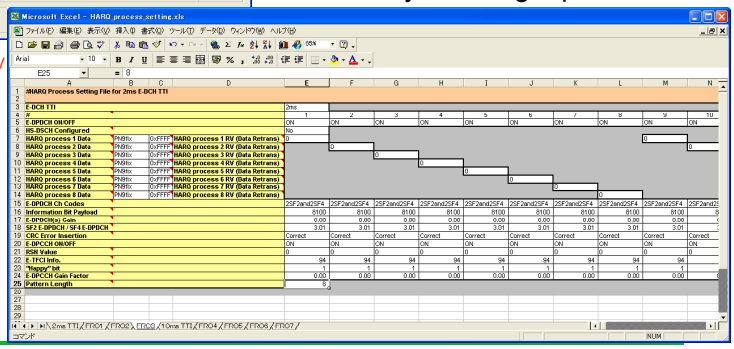


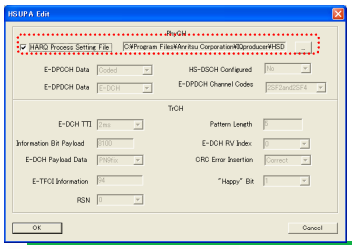
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

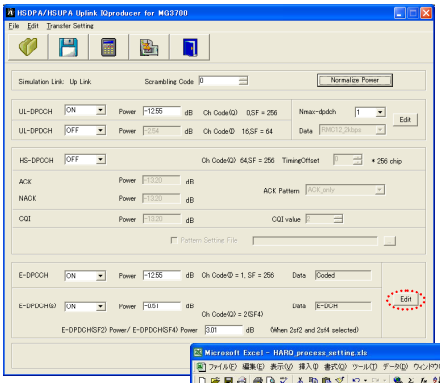
Save as CSV



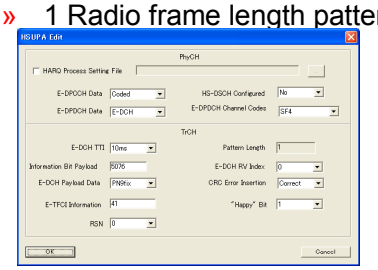


Wanted Signal Setup HSPA IQproducer

- FRC4

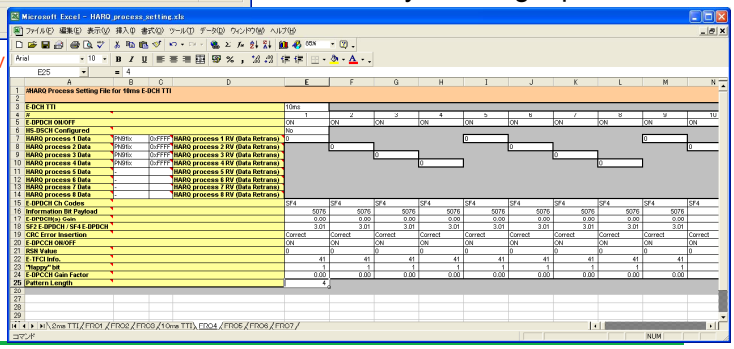


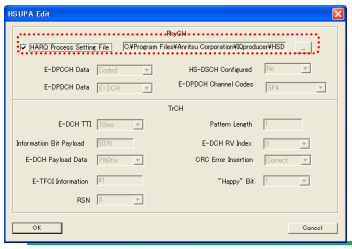
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

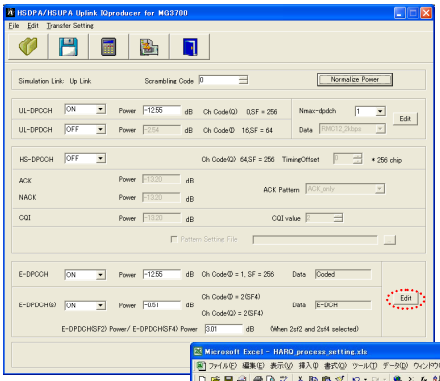
Save as CSV



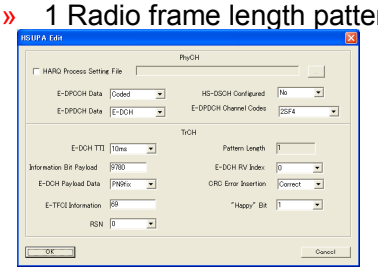


Wanted Signal Setup HSPA IQproducer

- FRC5

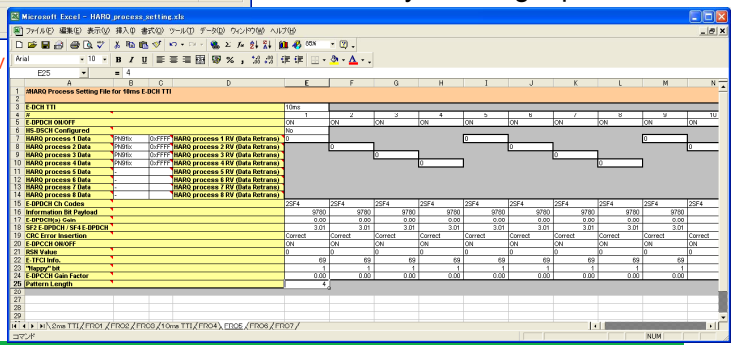


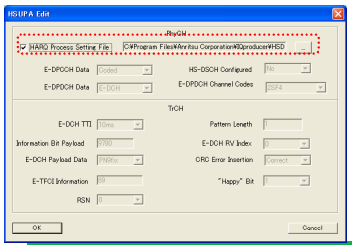
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

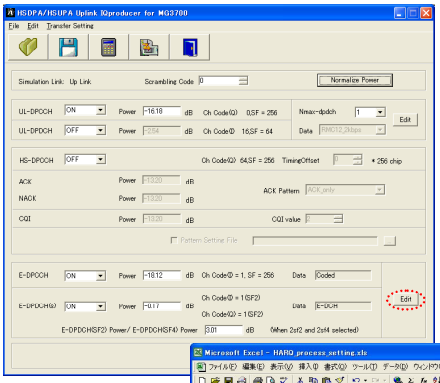
Save as CSV



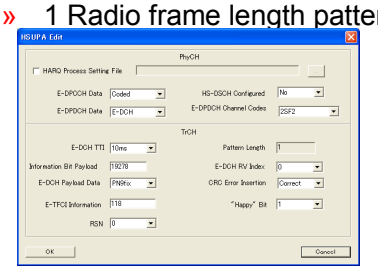


Wanted Signal Setup HSPA IQproducer

- FRC6

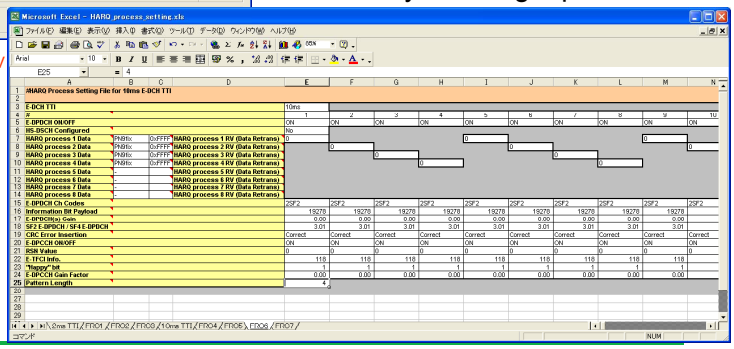


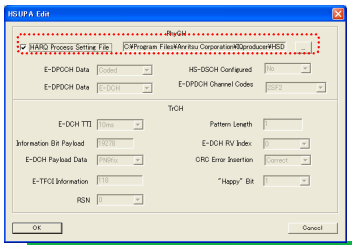
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

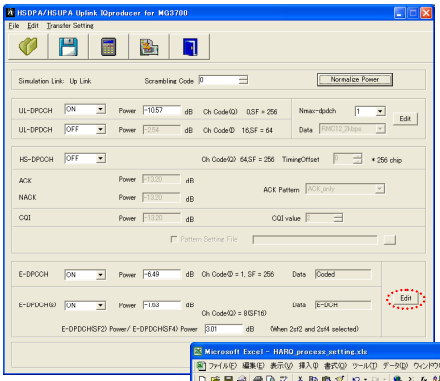
Save as CSV



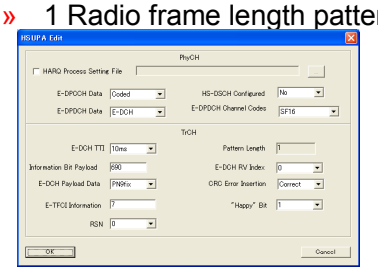


Wanted Signal Setup HSPA IQproducer

- FRC7

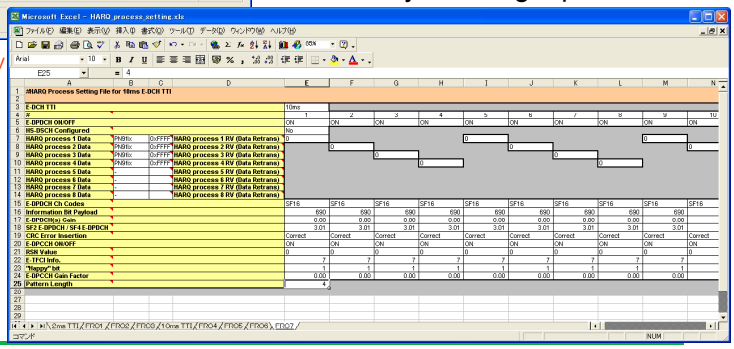


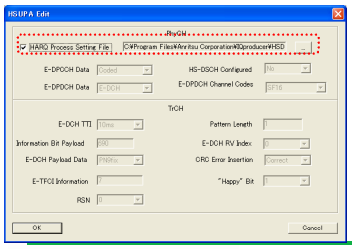
» 1 Radio frame length pattern



» Arbitrary TTI length pattern

Save as CSV





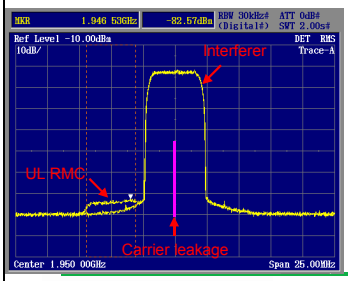
Wanted Signal + Interference Signal Setup Example

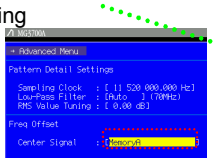
Test
- ACS
- Blocking characteristics
- Intermodulation characteristics

- UL RMC 12.2 kbps
  +
- UL Interferer

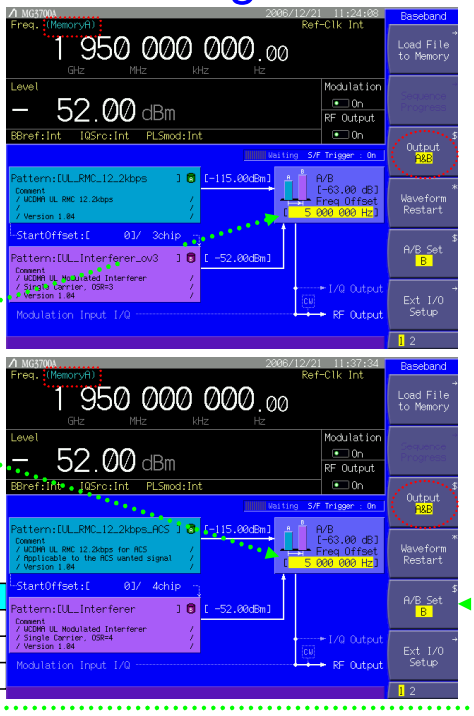
ACS: 5 MHz offset
Blocking: ≥ 10 MHz offset
Intermodulation: 20 MHz offset

» Set frequency offset.
- -34.944 ~ +34.944 MHz
  - 3 × Oversampling
- -47.232 ~ +47.232 MHz
  - 4 × Oversampling



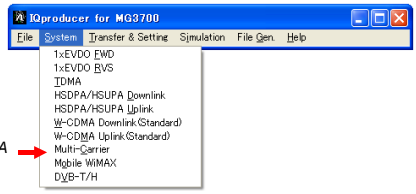


A/B Set	A level	B level	RF level
A	Variable	Static	Coupled
B	Static	Variable	Coupled
Constant	Variable	Variable	Static



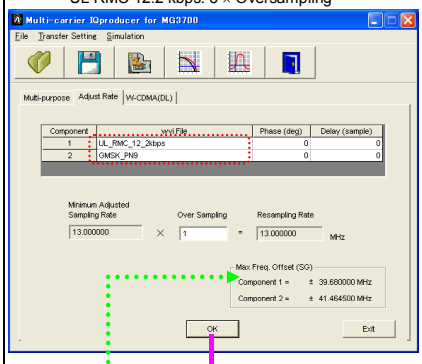
Wanted Signal + GMSK Interference Signal Setup Example

Test
- Blocking characteristics
- Intermodulation characteristics

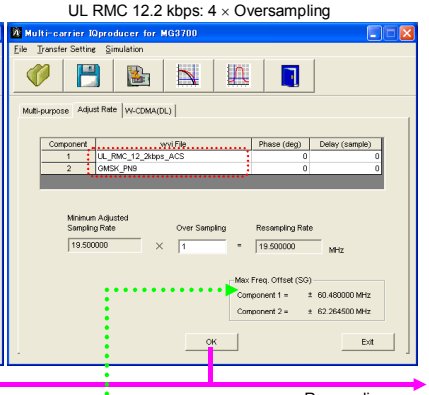


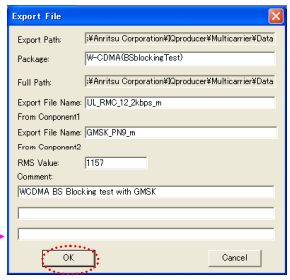
License option MX370104A

UL RMC 12.2 kbps: 3 × Oversampling



UL RMC 12.2 kbps: 4 × Oversampling





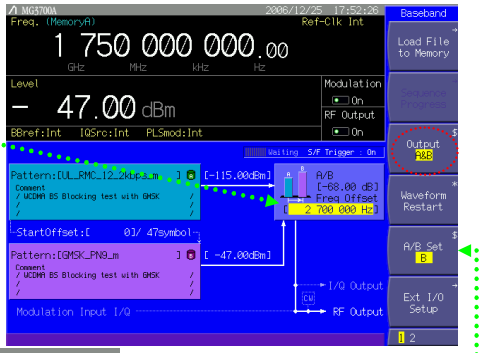
Available frequency offset between wanted signal and GMSK interference signal

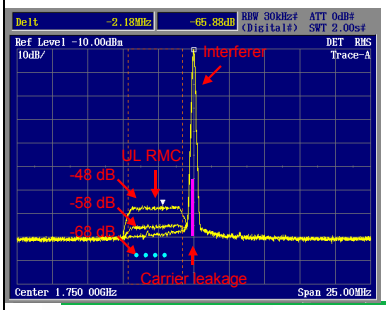
Resampling

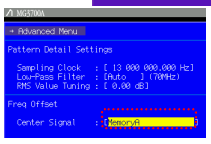
Requires about 1 day to complete, depending on the PC specifications

Wanted Signal + GMSK Interference Signal Setup Example

- UL RMC 12.2 kbps
  +
- GMSK Interferer Blocking: ≥ 2.7 MHz offset Intermodulation: 5.9 MHz offset
  - » Set frequency offset.
    - – -39.68 ~ +39.68 MHz
      - Based on 3 × Oversampling
    - – -60.48 ~ +60.48 MHz
      - Based on 4 × Oversampling







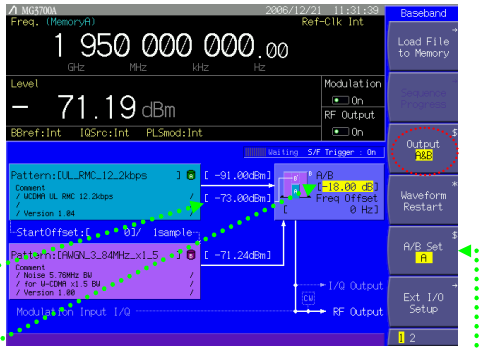
A/B Set	A level	B level	RF level
A	Variable	Static	Coupled
B	Static	Variable	Coupled
Constant	Variable	Variable	Static

S/N:
-70.1 dB/3.84 MHz (-91.2 dB/30 kHz) * 2.7 MHz offset
-73.1 dB/3.84 MHz (-94.2 dB/30 kHz) * 5.9 MHz offset
SSB phase noise:
-136 dBc/Hz typ. * 2.7 MHz offset
-139 dBc/Hz typ. * 5.9 MHz offset

Wanted Signal + AWGN Setup Example

Test
- – Dynamic range
- – Demodulation in static propagation conditions

- UL RMC 12.2 kbps
- UL RMC 64 kbps
- UL RMC 144 kbps
- UL RMC 384 kbps
  +
- AWGN
  - » Ioc [dBm/3.84MHz]
  - » Wanted signal level/AWGN [dB]
    = $10\log_{10}(R_b/3.84\times10^6) + E_b/N_o$
    - – R_b bps ↓↓
      12.2 k: -24.98
      64 k: -17.78
      144 k: -14.26
      384 k: -10
    - – E_b/N_o is specified in test requirements.



A/B Set	A level	B level	RF level
A	Variable	Static	Coupled
B	Static	Variable	Coupled
Constant	Variable	Variable	Static

Wanted Signal Parameters

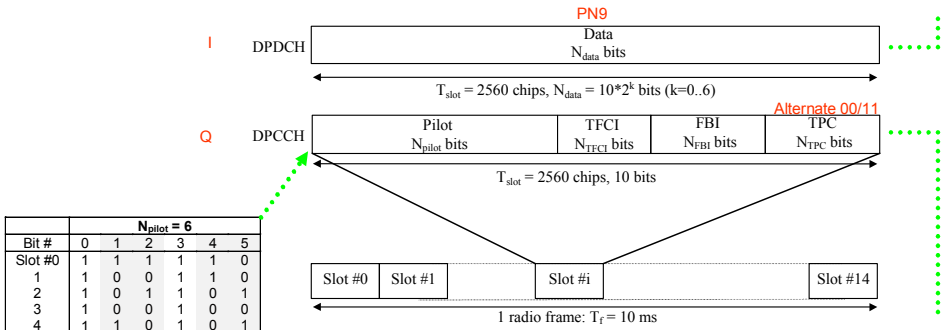
- UL RMC

Parameter	Setting Value
Scrambling Code	0_H
DTCH Information Data	PN9
DCCH information Data	All 0
Over sampling rate	3 (4 only for UL_RMC_12_2kbps_ACS)
Marker 1	Frame Clock
Marker 2	Slot Clock
Marker 3	–
AWGN addition (Note)	Enable (disable only for UL_RMC_12_2kbps_ACS)
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2+Q^2}$ = 320 mV

Parameter		DCH for DTCH / DCH for DCCH					Unit
DPDCH	Information bit rate	12,2/2,4	64/2,4	144/2,4	384/2,4	2048/2,4	kbps
	Physical channel	60/15	240/15	480/15	960/15	960/15	kbps
	Spreading factor	64	16	8	4	4	
	Repetition rate	22/22	19/19	8/9	-18/-17	-7/-7	%
	Interleaving	20	40	40	40	80	ms
	Number of DPDCHs	1	1	1	1	6	
DPCCH	Dedicated pilot	6					bit/slot
	Power control	2					bit/slot
	TFCI	2					bit/slot
	FBI	0 / 2					bit/slot
	Spreading factor	256					
Power ratio of DPCCH/DPDCH		-2,69	-5,46	-9,54	-9,54	-9,54	dB
Amplitude ratio of DPCCH/DPDCH		0,7333	0,5333	0,3333	0,3333	03333	
Note: Combination of TFCI bit of 0 bit/slot and FBI bit of 2 bit /slot is applied in test of Site Selection Diversity Transmission specified in 8.10.							

DPDCH/DPCCH Structure of UL RMC

	Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
	0	15	15	256	150	10	10
	1	30	30	128	300	20	20
12.2 kbps	2	60	60	64	600	40	40
	3	120	120	32	1200	80	80
64 kbps	4	240	240	16	2400	160	160
144 kbps	5	480	480	8	4800	320	320
384 kbps	6	960	960	4	9600	640	640



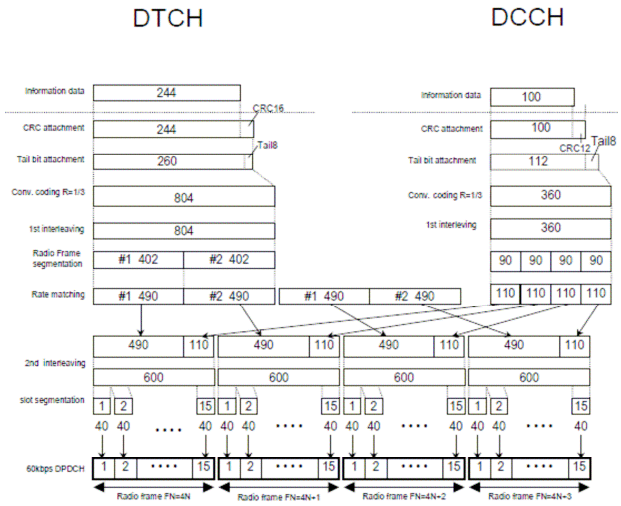
	N_{pilot} = 6					
Bit #	0	1	2	3	4	5
Slot #0	1	1	1	1	1	0
1	1	0	0	1	1	0
2	1	0	1	1	0	1
3	1	0	0	1	0	0
4	1	1	0	1	0	1
5	1	1	1	1	1	0
6	1	1	1	1	0	0
7	1	1	0	1	0	0
8	1	0	1	1	1	0
9	1	1	1	1	1	1
10	1	0	1	1	0	1
11	1	1	0	1	1	1
12	1	1	0	1	0	0
13	1	0	0	1	1	1
14	1	0	0	1	1	1

Slot Form at #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
0	15	15	256	150	10	6	2	2	0	15
0A	15	15	256	150	10	5	2	3	0	10-14
0B	15	15	256	150	10	4	2	4	0	8-9
1	15	15	256	150	10	8	2	0	0	8-15
2	15	15	256	150	10	5	2	2	1	15
2A	15	15	256	150	10	4	2	3	1	10-14
2B	15	15	256	150	10	3	2	4	1	8-9
3	15	15	256	150	10	7	2	0	1	8-15

Wanted Signal Parameters

- UL RMC 12.2 kbps

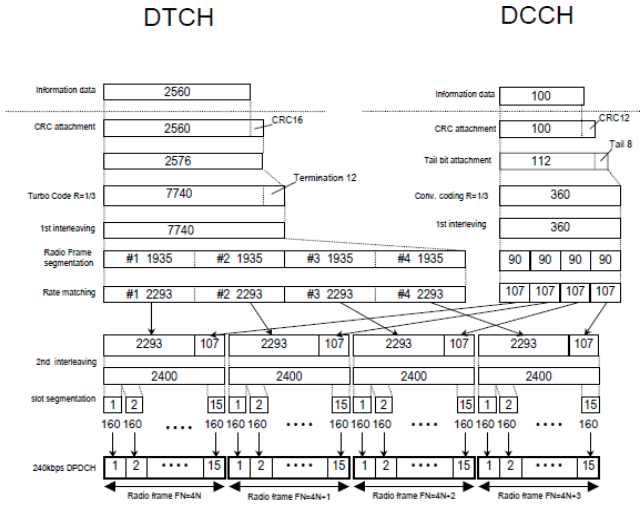
Parameter	Level	Unit
Information bit rate	12.2	kbps
DPCH	60	kbps
Power control	Off	
TFCI	On	
Repetition	22	%



Wanted Signal Parameters

- UL RMC 64 kbps

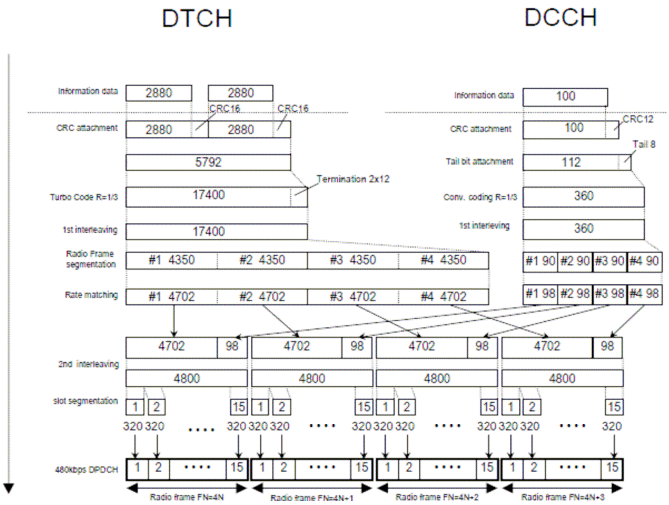
Parameter	Level	Unit
Information bit rate	64	kbps
DPCH	240	kbps
Power control	Off	
TFCI	On	
Repetition	19	%



Wanted Signal Parameters

- UL RMC 144 kbps

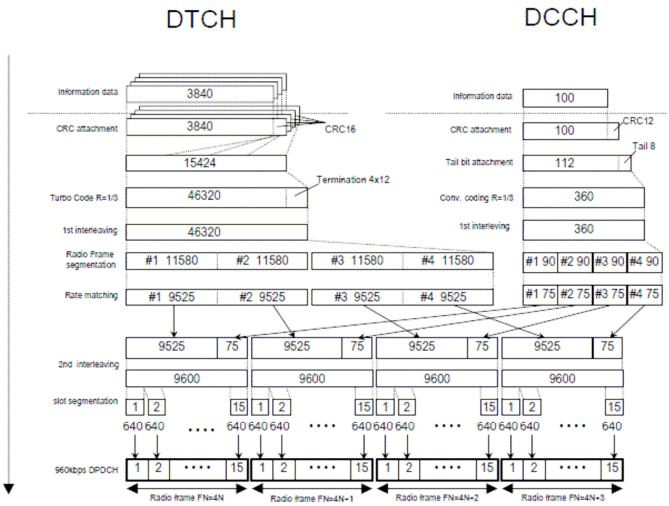
Parameter	Level	Unit
Information bit rate	144	kbps
DPCH	480	kbps
Power control	Off	
TFCI	On	
Repetition	8	%



Wanted Signal Parameters

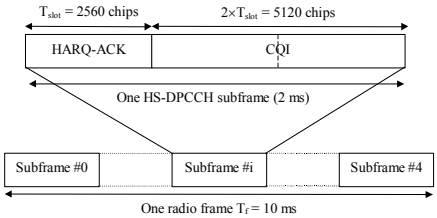
- UL RMC 384 kbps

Parameter	Level	Unit
Information bit rate	384	kbps
DPCH	960	kbps
Power control	Off	
TFCI	On	
Puncturing	18	%



Wanted Signal Parameters

- RMC HS-DPCCH



Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Subframe	Bits/ Slot	Transmitted slots per Subframe
0	15	15	256	30	10	3

Same as UL RMC 12.2 kbps

Parameter				Unit
DPDCH	DTCH	Information bit rate	12.2	kbps
		Physical channel	60	kbps
		Repetition rate	22	%
	DCCH	Information bit rate	2.4	kbps
		Physical channel	15	kbps
		Repetition rate	22	%
	Spreading factor		64	
	Interleaving		20	ms
	Number of DPDCHs		1	
DPCCH	Dedicated pilot		6	Bits/slot
	Power control		2	Bits/slot
	TFCI		2	Bits/slot
	Spreading factor		256	
Power ratio of DPCCH/DPDCH			-2.69	dB
Amplitude ratio of DPCCH/DPDCH			0.7333	
Closed loop power control			OFF	
Repetition factor of ACK/NACK			1	
HS-DPCCH power offset to DPCCH			0	dB
HS-DPCCH timing offset to DPCCH			0	symbol

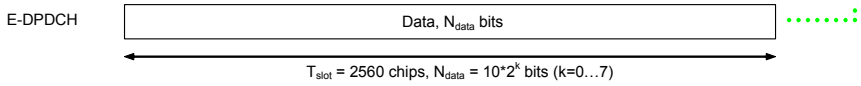
CQI mapping table for UE categories 1 to 6.

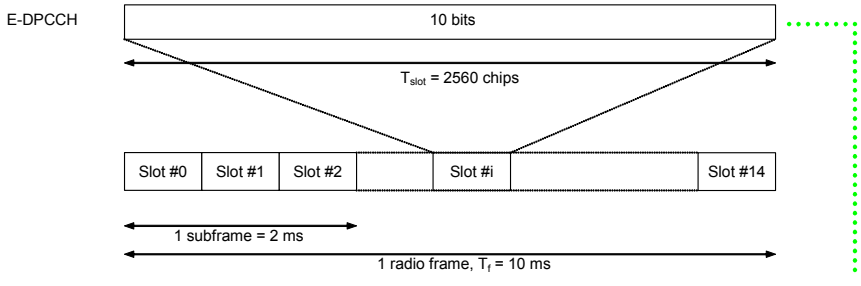
CQI value	Transport Block Size	Number of HS-PDSCH	Modulation	Reference power adjustment Δ	N_{IR}	X_{RV}
0	N/A	Out of range				
1	137	1	QPSK	0	9600	0
2	173	1	QPSK	0		
3	233	1	QPSK	0		
4	317	1	QPSK	0		
5	377	1	QPSK	0		
6	461	1	QPSK	0		
7	650	2	QPSK	0		
8	792	2	QPSK	0		
9	931	2	QPSK	0		
10	1262	3	QPSK	0		
11	1483	3	QPSK	0		
12	1742	3	QPSK	0		
13	2279	4	QPSK	0		
14	2583	4	QPSK	0		
15	3319	5	QPSK	0		
16	3565	5	16-QAM	0		
17	4189	5	16-QAM	0		
18	4664	5	16-QAM	0		
19	5287	5	16-QAM	0		
20	5887	5	16-QAM	0		
21	6554	5	16-QAM	0		
22	7168	5	16-QAM	0		
23	7168	5	16-QAM	-1		
24	7168	5	16-QAM	-2		
25	7168	5	16-QAM	-3		
26	7168	5	16-QAM	-4		
27	7168	5	16-QAM	-5		
28	7168	5	16-QAM	-6		
29	7168	5	16-QAM	-7		
30	7168	5	16-QAM	-8		

Wanted Signal Parameters

- E-DPDCH FRC (UL HSUPA)

Slot Format #i	Channel Bit Rate (kbps)	SF	Bits/ Frame	Bits/ Subframe	Bits/Slot N_{data}
0	15	256	150	30	10
1	30	128	300	60	20
2	60	64	600	120	40
3	120	32	1200	240	80
4	240	16	2400	480	160
5	480	8	4800	960	320
6	960	4	9600	1920	640
7	1920	2	19200	3840	1280



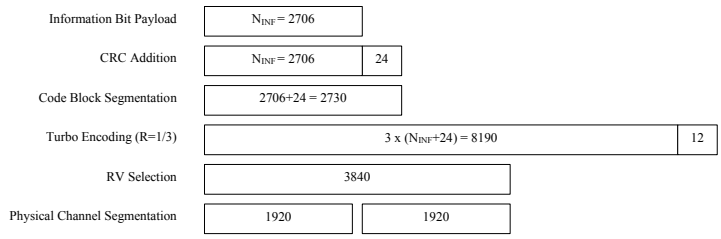


Slot Format #i	Channel Bit Rate (kbps)	SF	Bits/ Frame	Bits/ Subframe	Bits/Slot N_{data}
0	15	256	150	30	10

Wanted Signal Parameters

- E-DPDCH FRC1

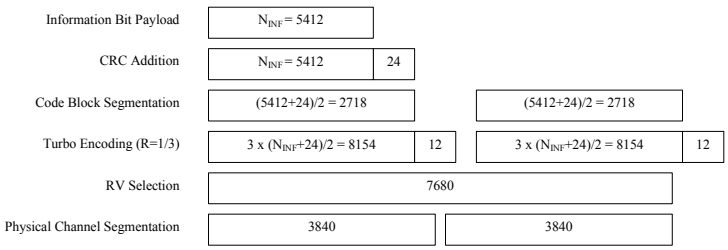
Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	1353.0
TTI	ms	2
Number of HARQ Processes	Processes	8
Information Bit Payload (N_{INF})	Bits	2706
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	3840
Coding Rate (N_{INF}/ N_{BIN})		0.705
Physical Channel Codes	SF for each physical channel	{4,4}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 8.94 Non-diversity: 12.04 Diversity: 2.05 Non-diversity: 6.02 E-DPDCH /DPCCH power ratio is calculated for a single E-DPDCH.
E-DPCCH missed detection testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 8.94 Non-diversity: 12.04 Diversity: -1.94 Non-diversity: 0.00



Wanted Signal Parameters

- E-DPDCH FRC2

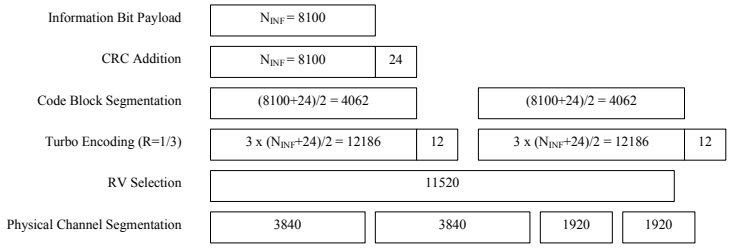
Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	2706.0
TTI	ms	2
Number of HARQ Processes	Processes	8
Information Bit Payload (N_{INF})	Bits	5412
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	7680
Coding Rate (N_{INF}/ N_{BIN})		0.705
Physical Channel Codes	SF for each physical channel	{2,2}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 9.92 Non-diversity: 13.00 Diversity: 4.08 Non-diversity: 6.02 E-DPDCH /DPCCH power ratio is calculated for a single E-DPDCH.



Wanted Signal Parameters

- E-DPDCH FRC3

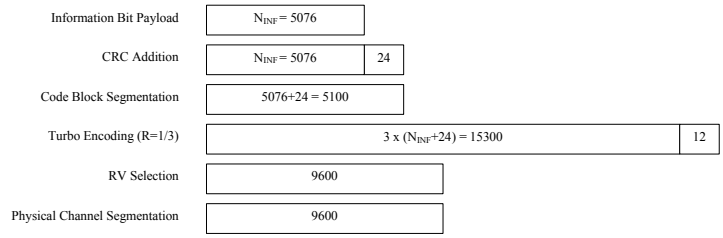
Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	4050.0
TTI	ms	2
Number of HARQ Processes	Processes	8
Information Bit Payload (N_{INF})	Bits	8100
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	11520
Coding Rate (N_{INF}/ N_{BIN})		0.703
Physical Channel Codes	SF for each physical channel	{2,2,4,4}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 6.02 Non-diversity: 8.94 Diversity: 0.0 Non-diversity: 2.05 E-DPDCH/DPCCH power ratio is calculated for a single E-DPDCH with SF 4. The power of an E-DPDCH with SF2 is twice that of an E-DPDCH with SF4.



Wanted Signal Parameters

- E-DPDCH FRC4

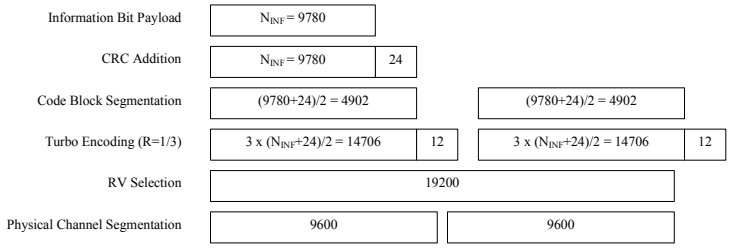
Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	507.6
TTI	ms	10
Number of HARQ Processes	Processes	4
Information Bit Payload (N_{INF})	Bits	5076
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	9600
Coding Rate (N_{INF}/ N_{BIN})		0.529
Physical Channel Codes	SF for each physical channel	{4}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 8.94 Non-diversity: 12.04 Diversity: -1.94 Non-diversity: 0.0
E-DPCCH missed detection testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 8.94 Non-diversity: 12.04 Diversity: -7.96 Non-diversity: -5.46



Wanted Signal Parameters

- E-DPDCH FRC5

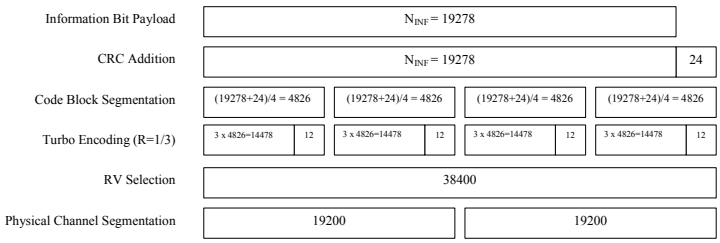
Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	978.0
TTI	ms	10
Number of HARQ Processes	Processes	4
Information Bit Payload (N_{INF})	Bits	9780
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	19200
Coding Rate (N_{INF}/ N_{BIN})		0.509
Physical Channel Codes	SF for each physical channel	{4,4}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 8.94 Non-diversity: 12.04 Diversity: -1.94 Non-diversity: 0.0 E-DPDCH /DPCCH power ratio is calculated for a single E-DPDCH.



Wanted Signal Parameters

- E-DPDCH FRC6

Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	1927.8
TTI	ms	10
Number of HARQ Processes	Processes	4
Information Bit Payload (N_{INF})	Bits	19278
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	38400
Coding Rate (N_{INF}/ N_{BIN})		0.502
Physical Channel Codes	SF for each physical channel	{2,2}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 9.92 Non-diversity: 13.00 Diversity: -5.46 Non-diversity: -1.94 E-DPDCH /DPCCH power ratio is calculated for a single E-DPDCH.



Wanted Signal Parameters

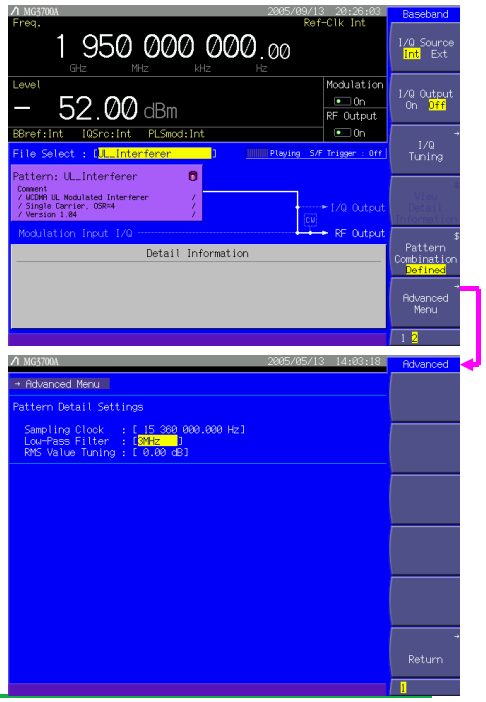
- E-DPDCH FRC7

Parameter	Unit	Value
Maximum. Inf. Bit Rate	kbps	69.0
TTI	ms	10
Number of HARQ Processes	Processes	4
Information Bit Payload (N_{INF})	Bits	690
Binary Channel Bits per TTI (N_{BIN}) (3840 / SF x TTI sum for all channels)	Bits	2400
Coding Rate (N_{INF}/ N_{BIN})		0.288
Physical Channel Codes	SF for each physical channel	{16}
E-DPDCH testing: E-DPDCH/DPCCH power ratio E-DPCCH/DPCCH power ratio	 dB dB dB dB	 Diversity: 6.02 Non-diversity: 8.94 Diversity: 0.0 Non-diversity: 4.08

Information Bit Payload	N_{INF} = 690	
CRC Addition	N_{INF} = 690	24
Code Block Segmentation	690+24 = 714	
Turbo Encoding (R=1/3)	3 x (N_{INF}+24) = 2142	12
RV Selection	2400	
Physical Channel Segmentation	2400	

Just Interference Signal Setup Example

- UL Interferer



» Set LPF to 3 MHz.
  – To improve ACLR

Interference Signal Parameters

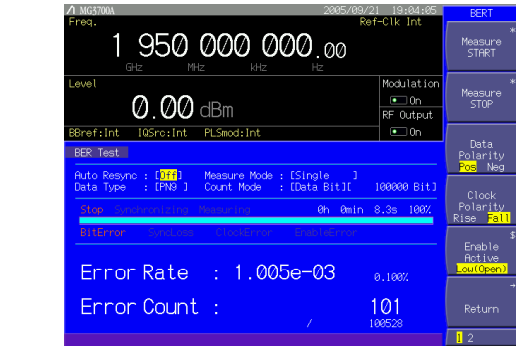
- UL Interferer

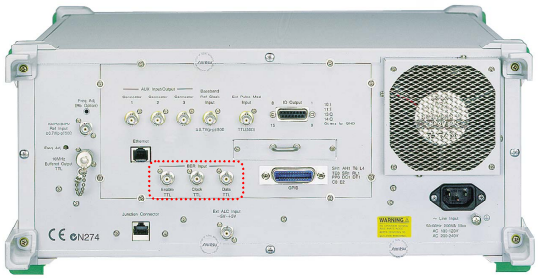
Parameter	Setting Value
Scrambling Code	1st
DTCH Information Data	PN9
DCCH Information Data	All 0
Over sampling rate	4, 3 (UL_Interferer_ov3)
Marker 1	Frame Clock
Marker 2	Slot Clock
Marker 3	–
AWGN addition	Disable
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2 + Q^2}$ = 320 mV

Channel	Bit Rate	Spreading Factor	Channelization Code	Relative Power
DPDCH	240 kbps	16	4	0 dB
DPCCH	15 kbps	256	0	-5.46 dB

BER Test Setup Example

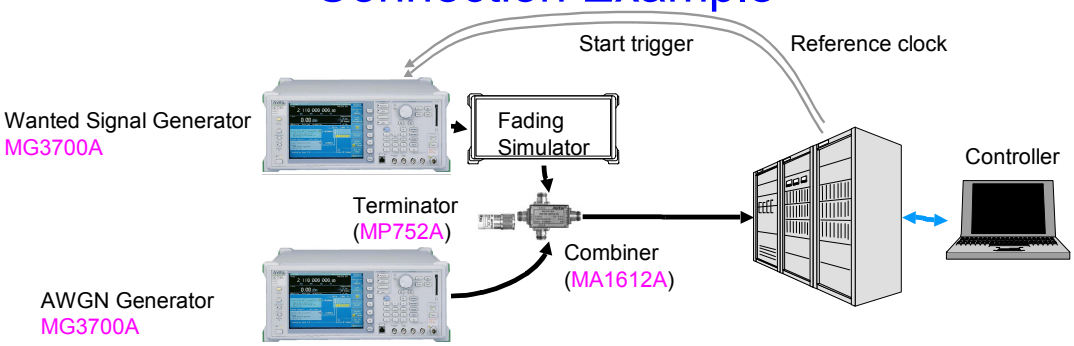
- Received DTCH data
  - » PN9
- Clock
  - » Rise
    - Data
    - Clock
  - » Fall
    - Data
    - Clock





- Measuring bit/time
- Automatic re-synchronization
  - » On
    - – Sync Loss detected
  - » Off
    - – Sync Loss ignored

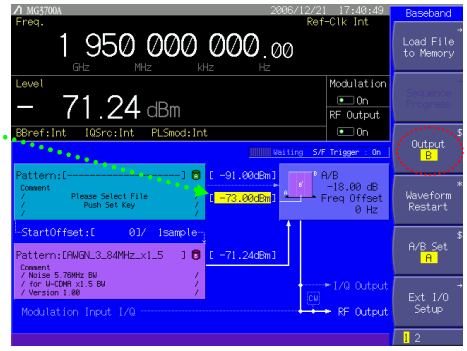
Test in Multipath Fading Conditions Connection Example



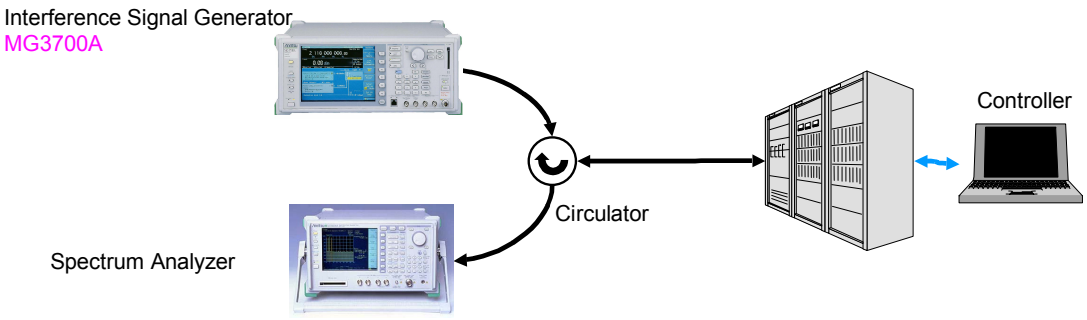
- Start trigger
  - Front panel [Start/Frame Trigger] Input
    - 40 ms × n clock
      e.g. SFN reset timing of Downlink BCH (4096 frame × 10 ms)
- Reference clock
  Use only one.
  - Rear panel [Baseband Ref Clock] Input
    - 3.84 MHz, 2 × 3.84 MHz (7.68 MHz), 4 × 3.84 MHz (15.36 MHz)
  - Rear panel [10MHz/5MHz Ref] Input
- Controller
  - Makes receivable state for UL RMC by FTM (Factory Test Mode) control
  - Reports internal BLER calculation for received DTCH

AWGN Setup Example

- AWGN
  - » Ioc [dBm/3.84MHz]
  - » Wanted signal level/AWGN [dB]
    = $10\log_{10}(R_b/3.84\times10^6) + E_b/N_o$
    - R_b bps ↓↓
      12.2 k: -24.98
      64 k: -17.78
      144 k: -14.26
      384 k: -10
    - E_b/N_o is specified in test requirements.
  - » Wanted signal level/AWGN [dB]
    = E_c/N_o
    - E_c/N_o is specified in test requirements.



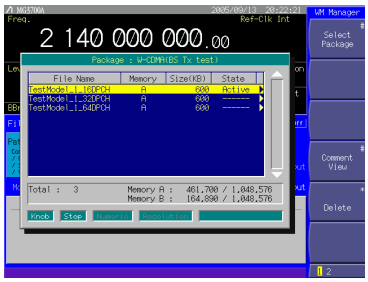
Transmit Intermodulation Test Connection Example



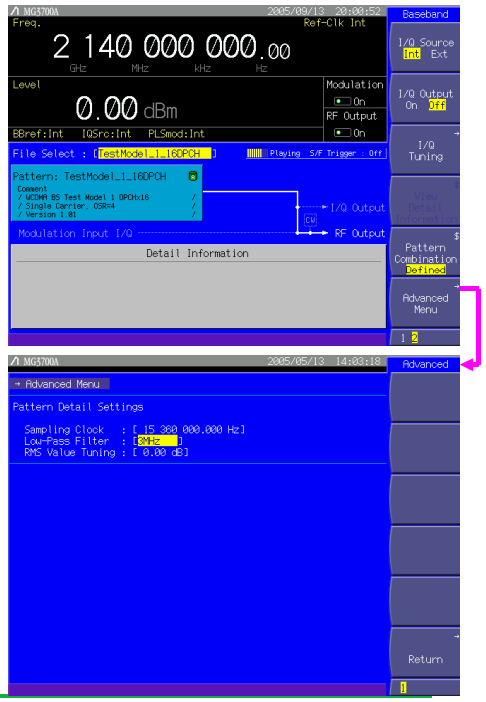
- Controller
  - Makes maximum transmitting power state by FTM (Factory Test Mode) control

Interference Signal Setup Example

- Test Model 1
  - » Select any one of:



  - » Set LPF to 3 MHz
    - To improve ACLR



UE Test

3GPP	TS 25.101 (Release 7)	TS 34.121 (Release 7)
6	Transmitter	5 Transmitter
7	Receiver	6 Receiver

	Test	Wanted Signal Generator with BERT	Interference Signal Generator	CW Generator	AWGN Generator	Others
6.4 6.4.2 6.4.3	Output power dynamics Inner loop power control in the uplink Minimum output power	MG3700A				Timeslot Power Meter Circulator
6.7	Transmit intermodulation			MG3700A		Spectrum Analyzer Circulator
7.3	Reference sensitivity level	MG3700A				
7.4 7.4.1 7.4.2	Maximum input level DPCH HS-PDSCH for 16QAM					
7.5	Adjacent Channel Selectivity (ACS)		*			
7.6 7.6.1	Blocking characteristics In-band blocking		*			
7.6.2	Out of-band blocking			MG3692B 20 GHz		MA1612A 3 GHz Combiner
7.6.3	Narrow band blocking		*			
7.7	Spurious response			MG3692B 20 GHz		MA1612A 3 GHz Combiner
7.8	Intermodulation characteristics		*			

*: MG3700A for wanted signal generator generates two signals with interference signal or CW, provided that P-CCPCH has *limited* SFN 11 bits count (0 ~ 510).

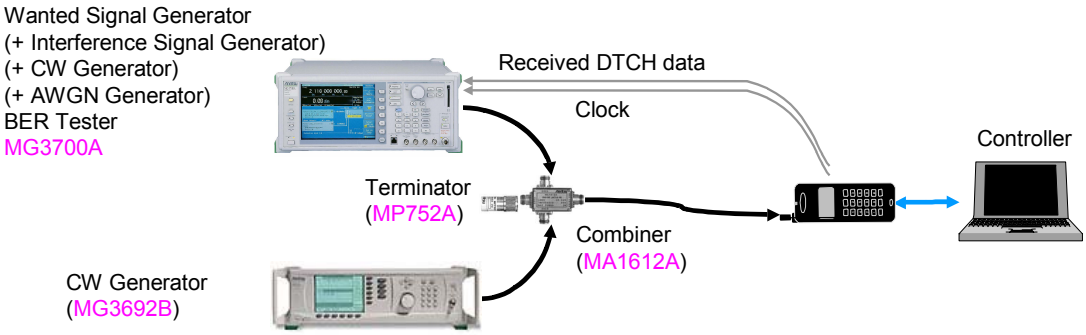
UE Test

3GPP	TS 25.101 (Release 7)	TS 34.121 (Release 7)
8	Performance requirement	7 Performance requirements
9	Performance requirement (HSDPA)	9 Performance requirements for HSDPA

	Test	Wanted Signal Generator with BERT	Interference Signal Generator	CW Generator	AWGN Generator	Others
8.2 8.2.3	Demodulation in static propagation conditions Demodulation of Dedicated Channel (DCH)	MG3700A			*	
8.3	Demodulation of DCH in multi-path fading propagation conditions				MG3700A	MA1612A 3 GHz Combiner Fading simulator
8.4	Demodulation of DCH in moving propagation conditions					
8.5	Demodulation of DCH in birth-death fading propagation conditions					
8.10	Blind transport format detection (BTFD) Test 1 ~ 3 Test 4 ~ 6				*	
9.2 9.2.1	Demodulation of HS-DSCH (FRC) Single Link Performance				MG3700A	MA1612A 3 GHz Combiner Fading simulator
9.3 9.3.1 9.3.1.1	Reporting of Channel Quality Indicator (CQI) Single Link Performance AWGN propagation conditions				*	
9.4 9.4.1	HS-SCCH Detection Performance Single Link Performance				MG3700A	MA1612A 3 GHz Combiner Fading simulator

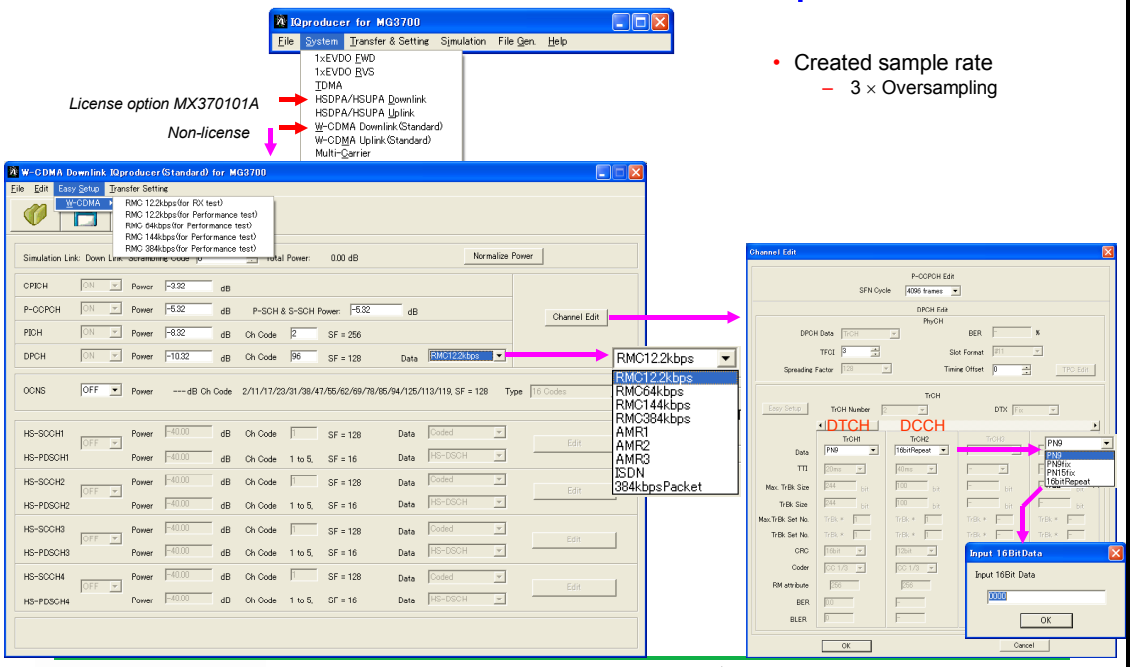
*: MG3700A for wanted signal generator generates two signals with AWGN, provided that P-CCPCH has *limited* SFN 11 bits count (0 ~ 510).

Receiver Test Connection Example



- Controller
  - Makes receivable state for DL RMC by FTM (Factory Test Mode) control
  - Reports internal BLER calculation for received DTCH and CQI for HSDPA

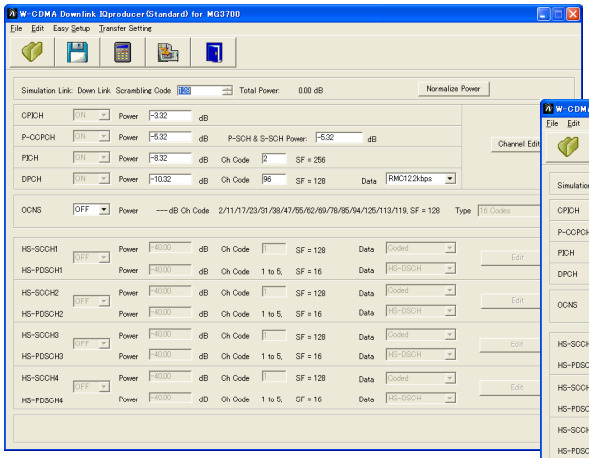
Wanted Signal Setup
HSPA or Limited W-CDMA IQproducer



- Created sample rate
  - 3 × Oversampling

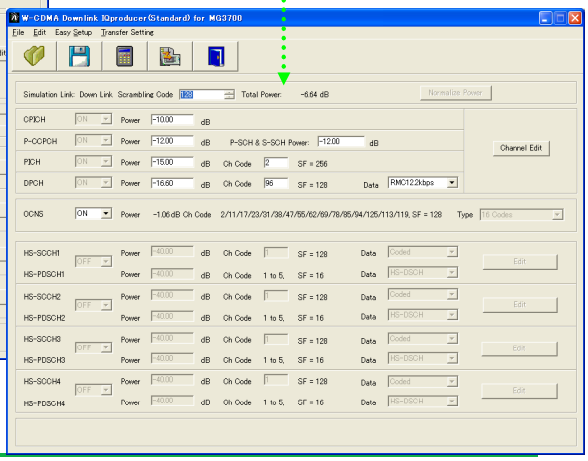
Wanted Signal Setup
HSPA or Limited W-CDMA IQproducer

- UL RMC 12.2 kbps
  Test
  - Receiver



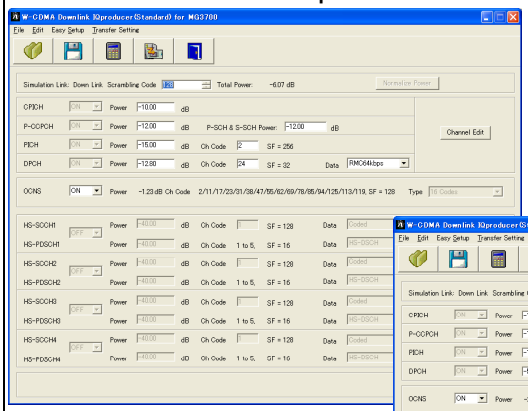
- UL RMC 12.2 kbps
  Test
  - Maximum input level (DPCH)
  - Performance requirements
    - OCNS multiplexing

Total Power without OCNS getting the residual power

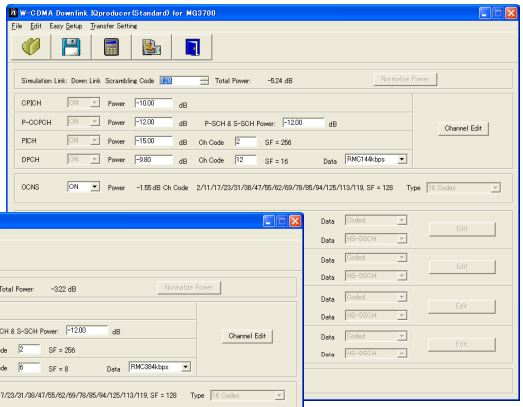


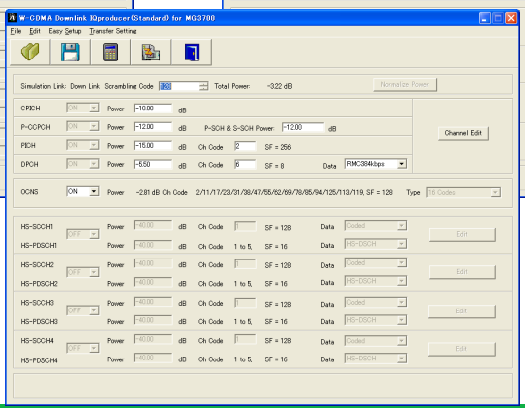
Wanted Signal Setup
HSPA or Limited W-CDMA IQproducer

- UL RMC 64 kbps



- UL RMC 144 kbps





- UL RMC 384 kbps

Scrambling Code Synchronization Setup Example

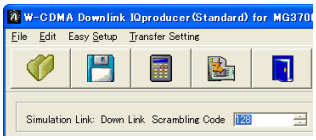
- Scrambling code
  - » UE identifies sector by scrambling code allocated to each sector.
  - » 38,400 chips (10 ms) segments
    - – Created from 18-bit long Gold sequences
  - » Applies QPSK modulation to scrambling (spreading)
- Set scrambling code receivable by UE.
  - » 0 ~ 8,191 (5 bits "0" + 13 bits length)
    - – Primary scrambling code: 16 × i
    - – Secondary scrambling code: 16 × i + (1~15)
      - i= 0 ~ 511: 8 × j + k
        - – j= 0 ~ 63: 64 Scrambling code group
        - – k= 0 ~ 7: 8 Primary scrambling code

80_H i= 8: J= 1, k= 0

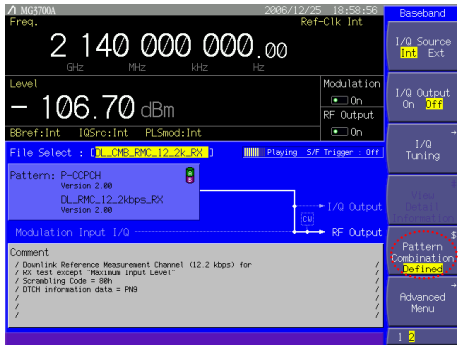
Wanted Signal Setup Example

Test
- – Receiver
  excluding
  Maximum input level

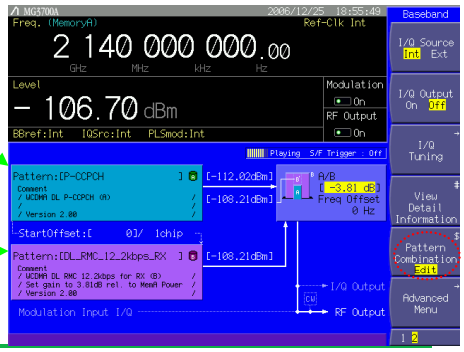
- DL RMC 12.2 kbps
  - – Scrambling Code 80_H



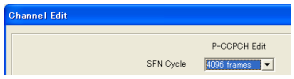
Combination file



Nested signal pattern files



  - » P-CCPCH
    - – 4096 frames with *full* SFN
      11 bits count (0 ~ 2047)

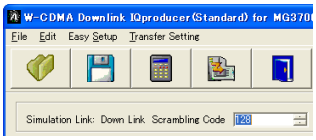


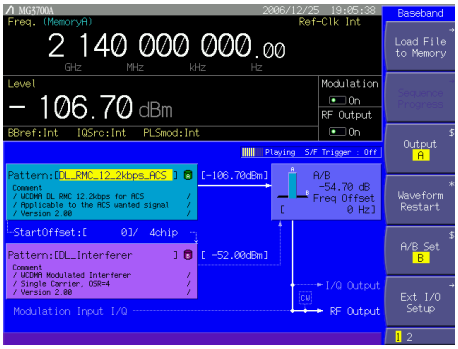
  - » Others
    - – CPICH, SCH, PICH, DPCH

Wanted Signal Setup Example

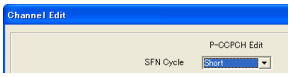
Test
– Receiver
excluding
Maximum input level

- DL RMC 12.2 kbps
  – Scrambling Code 80_H





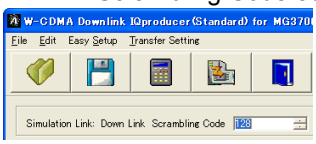
» For mixing interference signal
  – 1022 frames with *limited*
  SFN 11 bits count (0 ~ 510)



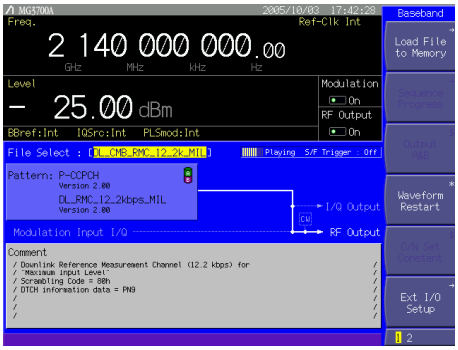
Wanted Signal Setup Example

Test
– Maximum input level
(DPCH)
  – OCNS multiplexing

- DL RMC 12.2 kbps
  – Scrambling Code 80_H



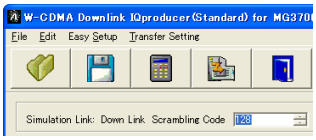
Combination file



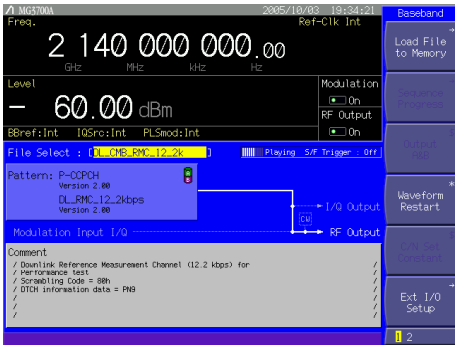
Wanted Signal Setup Example

Test
- Performance requirements
  - OCNS multiplexing

- DL RMC 12.2 kbps
- DL RMC 64 kbps
- DL RMC 144 kbps
- DL RMC 384 kbps
  - Scrambling Code 80_H



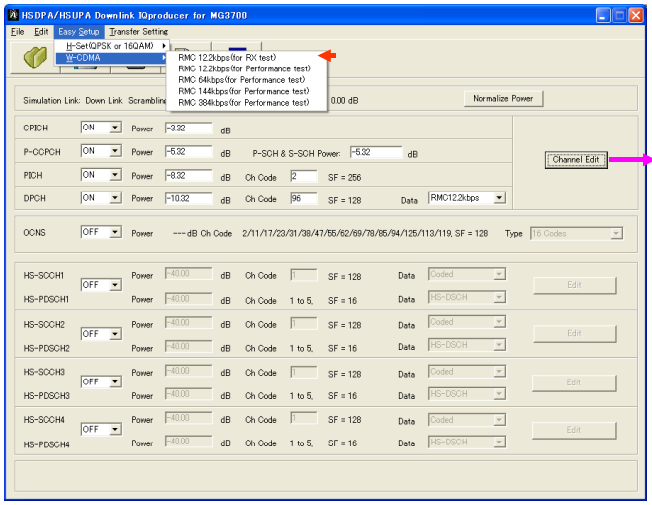
Combination file

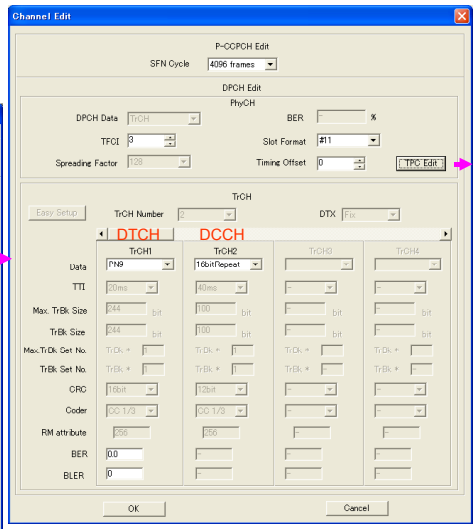


Wanted Signal Setup HSPA IQproducer

Test
- Inner loop power control in the uplink
- Minimum output power

- DL RMC 12.2 kbps

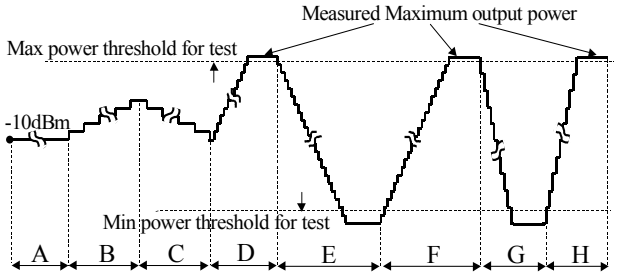




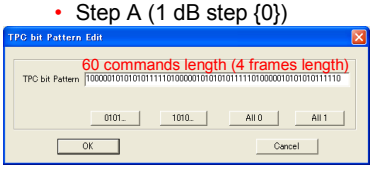
Wanted Signal Setup HSPA IQproducer

» Set TPC command for inner loop power control.
  – Inner loop power control in the uplink

TPC Bit Pattern			Transmitter power control command
N_{TPC} = 2	N_{TPC} = 4	N_{TPC} = 8	
11	1111	11111111	1 Up
00	0000	00000000	0 Down

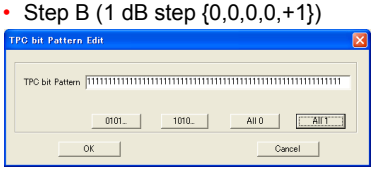


• Step A (1 dB step {0})



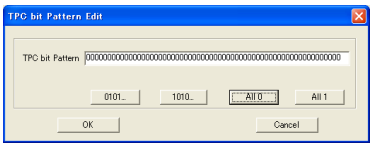
10000010101010111110100000101010111110100000101010111110

• Step B (1 dB step {0,0,0,0,+1})

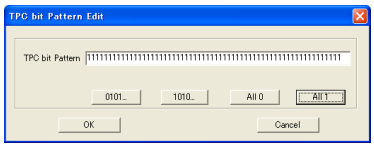


Wanted Signal Setup HSPA IQproducer

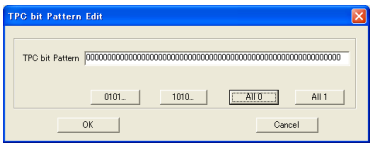
• Step C (1 dB step {0,0,0,0,-1})



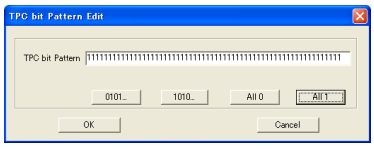
• Step D (1 dB step {+1})



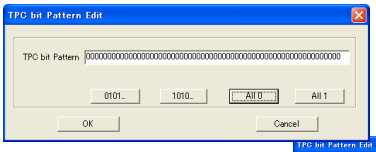
• Step E (1 dB step {-1})



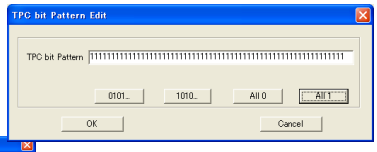
• Step F (1 dB step {+1})



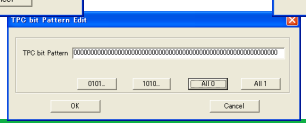
• Step G (2 dB step {-1})



• Step H (2 dB step {+1})



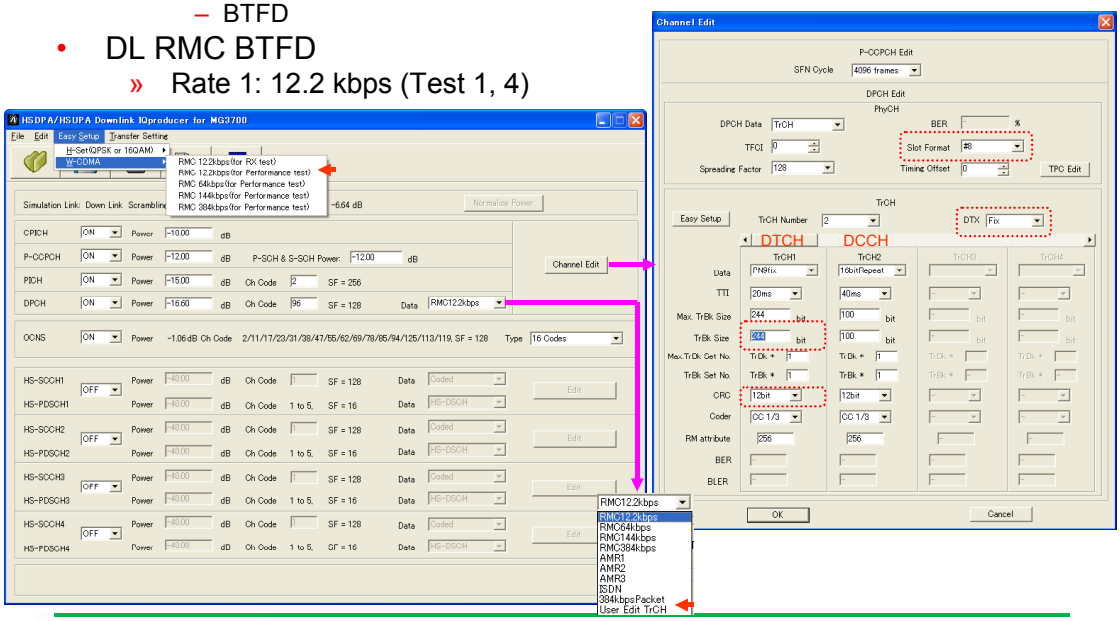
– Minimum output power



Wanted Signal Setup HSPA IQproducer

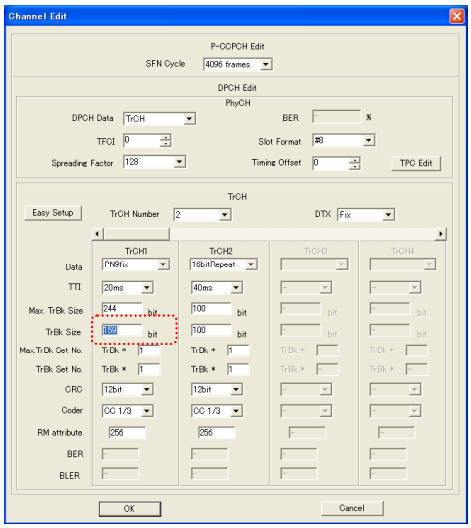
Test
- BTFD

- DL RMC BTFD
  - » Rate 1: 12.2 kbps (Test 1, 4)

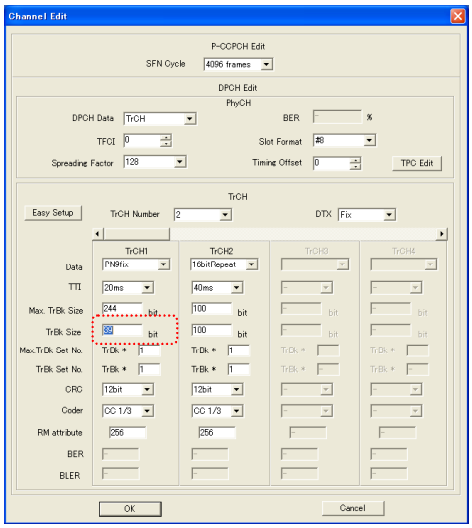


Wanted Signal Setup HSPA IQproducer

- » Rate 2: 7.95 kbps (Test 2, 5)



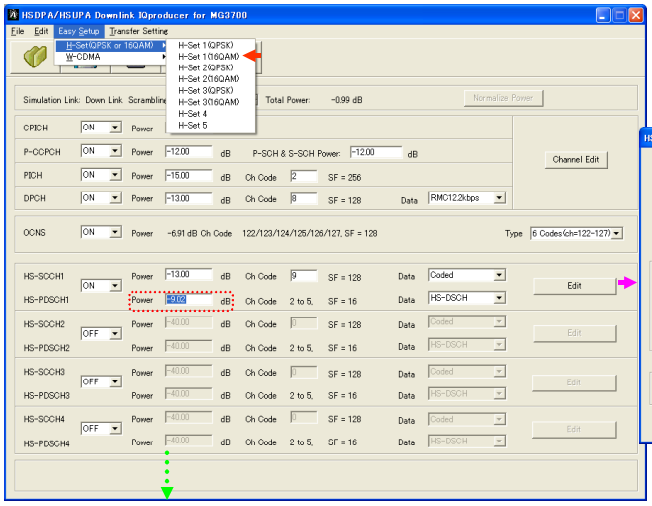
- » Rate 3: 1.95 kbps (Test 3, 6)

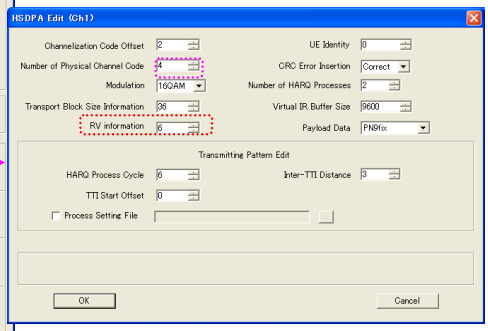


Wanted Signal Setup HSPA IQproducer

Test
- Maximum input level (HS-PDSCH for 16QAM)

- DL FRC H-Set 1 (16QAM)





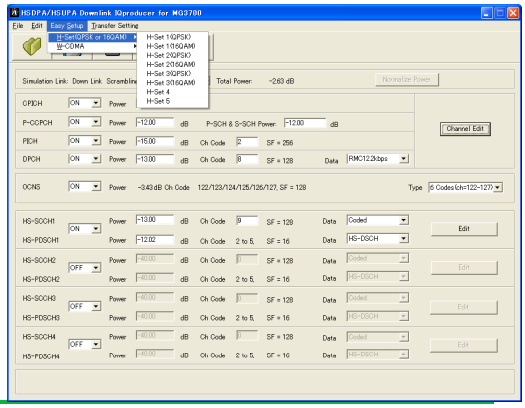
HS-PDSCH power/code
* 3GPP standard shows HS-PDSCH Ec/Ior for total multi-code power.

HS-PDSCH Ec/Ior: -3 dB
HS-PDSCH power/code = -3 + 10 log (1/4 codes) = -9.02

Wanted Signal Setup HSPA IQproducer

Test
- Demodulation of HS-DSCH (FRC)

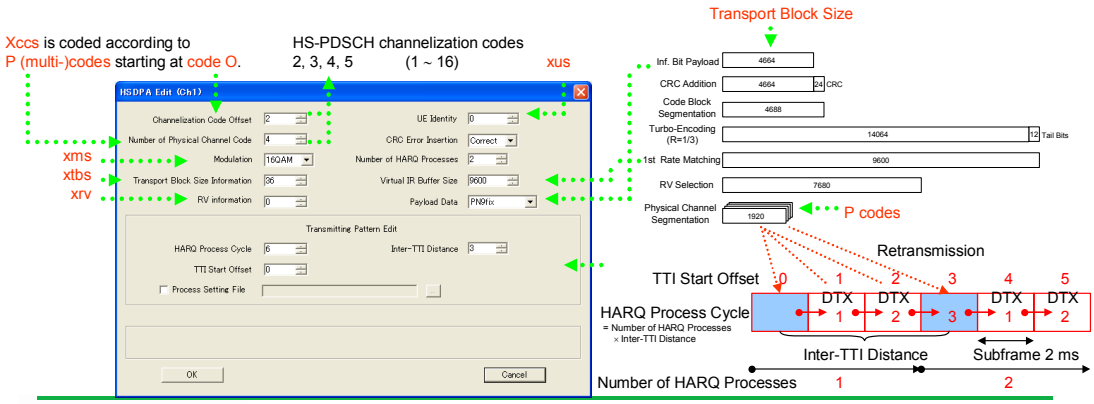
- DL FRC H-Set 1 (QPSK, 16QAM)
- DL FRC H-Set 2 (QPSK, 16QAM)
- DL FRC H-Set 3 (QPSK, 16QAM)
- DL FRC H-Set 4 (QPSK)
- DL FRC H-Set 5 (QPSK)
- DL FRC H-Set 6 (QPSK, 16QAM)



HS-PDSCH Ec/Ior: -6 dB
HS-PDSCH power/code = -6 + 10 log (1/4 codes) = -12.02

Wanted Signal Setup HSPA IQproducer

- The following information is transmitted by HS-SCCH.
  - Channelization-code-set information: xccs (7 bits)
  - Modulation scheme information: xms (1 bit)
  - Transport-block size information: xtbs (6 bits)
  - Hybrid-ARQ process information: xhap (3 bits)
  - Redundancy and constellation version: xrv (3 bits)
  - New data indicator: xnd (1 bit)
  - UE identity: xue (16 bits)



Transport Block Size

- Transport block size
  = L(kt): Next slide
  - kt = ki + k0,i = 154
    36 118
    xtbs

P (multi-)codes

3GPP TS 25.321 Table 9.2.3.1

Combination i	Modulation scheme	Number of channelization codes	k0,i
0	QPSK	1	1
1		2	40
2		3	63
3		4	79
4		5	92
5		6	102
6		7	111
7		8	118
8		9	125
9		10	131
10		11	136
11		12	141
12		13	145
13		14	150
14		15	153
15	16QAM	1	40
16		2	79
17		3	102
18		4	118
19		5	131
20		6	141
21		7	150
22		8	157
23		9	164
24		10	169
25		11	175
26		12	180
27		13	184
28		14	188
29		15	192

Transport Block Size

kt L(kt)

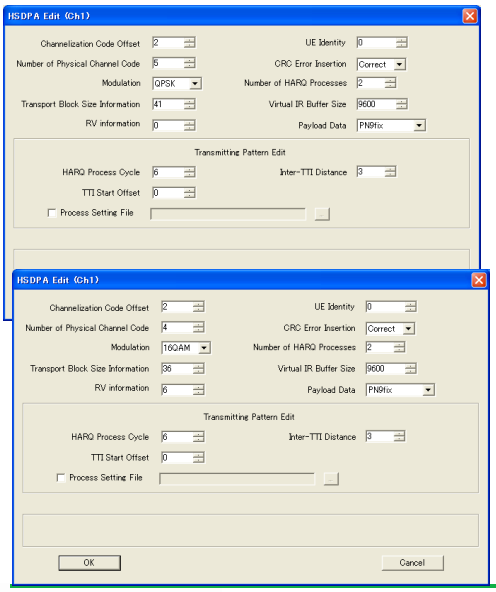
3GPP TS 25.321 Annex A

Index	TB Size	Index	TB Size	Index	TB Size	Index	TB Size	Index	TB Size	Index	TB Size	Index	TB Size	Index	TB Size
1	137	33	521	65	947	97	1681	129	2981	161	5287	193	9377	225	16630
2	149	34	533	66	964	98	1711	130	3035	162	5382	194	9546	226	16931
3	161	35	545	67	982	99	1742	131	3090	163	5480	195	9719	227	17237
4	173	36	557	68	1000	100	1773	132	3145	164	5579	196	9894	228	17548
5	185	37	569	69	1018	101	1805	133	3202	165	5680	197	10073	229	17865
6	197	38	581	70	1036	102	1838	134	3260	166	5782	198	10255	230	18188
7	209	39	593	71	1055	103	1871	135	3319	167	5887	199	10440	231	18517
8	221	40	605	72	1074	104	1905	136	3379	168	5993	200	10629	232	18851
9	233	41	616	73	1093	105	1939	137	3440	169	6101	201	10821	233	19192
10	245	42	627	74	1113	106	1974	138	3502	170	6211	202	11017	234	19538
11	257	43	639	75	1133	107	2010	139	3565	171	6324	203	11216	235	19891
12	269	44	650	76	1154	108	2046	140	3630	172	6438	204	11418	236	20251
13	281	45	662	77	1175	109	2083	141	3695	173	6554	205	11625	237	20617
14	293	46	674	78	1196	110	2121	142	3762	174	6673	206	11835	238	20989
15	305	47	686	79	1217	111	2159	143	3830	175	6793	207	12048	239	21368
16	317	48	699	80	1239	112	2198	144	3899	176	6916	208	12266	240	21754
17	329	49	711	81	1262	113	2238	145	3970	177	7041	209	12488	241	22147
18	341	50	724	82	1285	114	2279	146	4042	178	7168	210	12713	242	22548
19	353	51	737	83	1308	115	2320	147	4115	179	7298	211	12943	243	22955
20	365	52	751	84	1331	116	2362	148	4189	180	7430	212	13177	244	23370
21	377	53	764	85	1356	117	2404	149	4265	181	7564	213	13415	245	23792
22	389	54	778	86	1380	118	2448	150	4342	182	7700	214	13657	246	24222
23	401	55	792	87	1405	119	2492	151	4420	183	7840	215	13904	247	24659
24	413	56	806	88	1430	120	2537	152	4500	184	7981	216	14155	248	25105
25	425	57	821	89	1456	121	2583	153	4581	185	8125	217	14411	249	25558
26	437	58	836	90	1483	122	2630	154	4664	186	8272	218	14671	250	26020
27	449	59	851	91	1509	123	2677	155	4748	187	8422	219	14936	251	26490
28	461	60	866	92	1537	124	2726	156	4834	188	8574	220	15206	252	26969
29	473	61	882	93	1564	125	2775	157	4921	189	8729	221	15481	253	27456
30	485	62	898	94	1593	126	2825	158	5010	190	8886	222	15761	254	27952
31	497	63	914	95	1621	127	2876	159	5101	191	9047	223	16045		
32	509	64	931	96	1651	128	2928	160	5193	192	9210	224	16335		

Wanted Signal Setup HSPA IQproducer

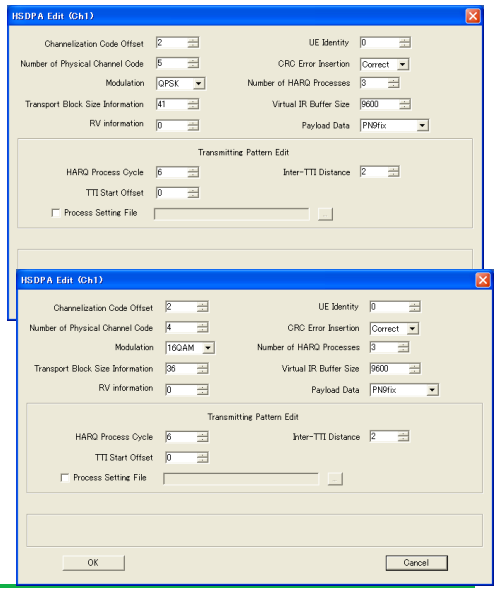
- H-Set 1

Default setting



- H-Set 2

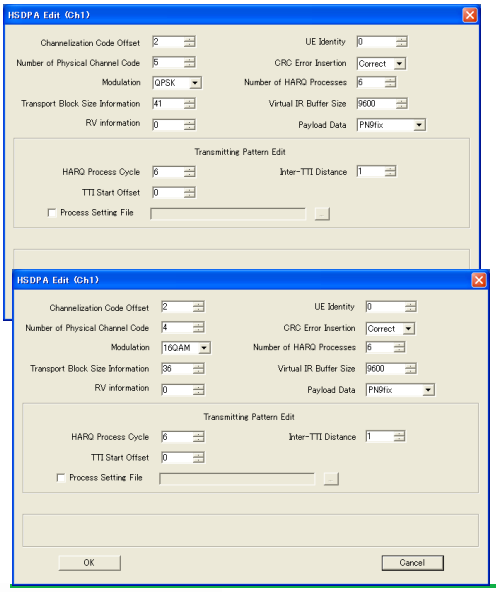
Default setting



Wanted Signal Setup HSPA IQproducer

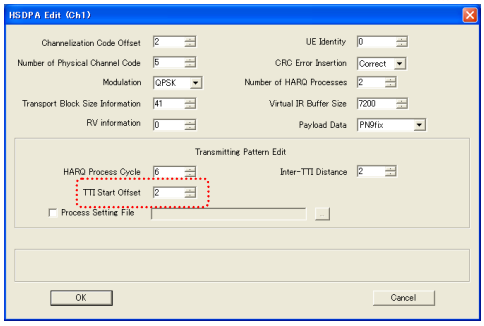
- H-Set 3

Default setting



- H-Set 4

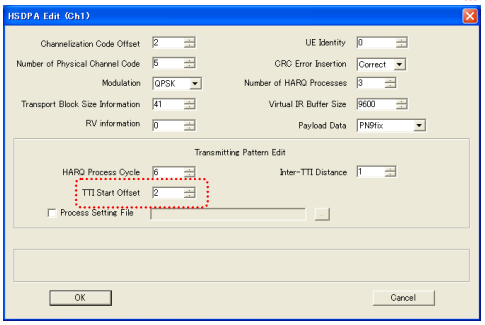
Default setting excluding



Wanted Signal Setup HSPA IQproducer

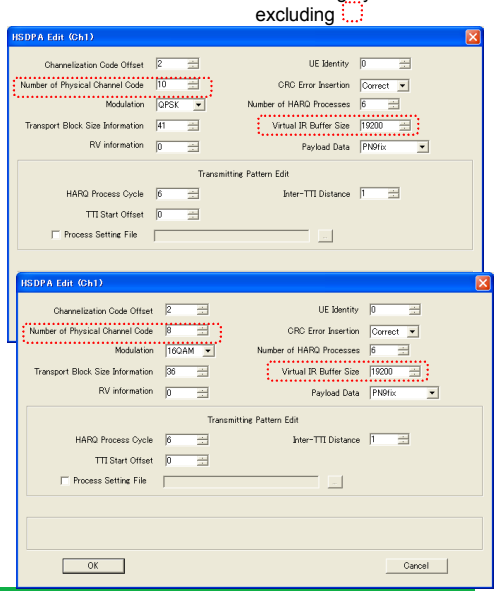
- H-Set 5

Default setting excluding



- H-Set 6

Default setting by H-Set 3 excluding



Wanted Signal HS-SCCH Parameters

H-Set 1	Q	P	S	K											16	Q	A	M										
Channelization-code-set information (xccs,7 bits)	41			41			41			41					31			31			31			31				
Modulation scheme information (xms,1 bit)	0			0			0			0					1			1			1			1				
Transport-block size information (xtbs,6 bits)	29			29			29			29					24			24			24			24				
Hybrid-ARQ process information (xhap,3 bits)	0			1			0			1					0			1			0			1				
Redundancy and constellation version (xrv,3 bits)	0			0			0			0					0			0			0			0				
New data indicator (xnd,1 bit)	0			0			1			1					0			1			1			1				
UE identity (xue,16 bits)	0			0			0			0					0			0			0			0				
H-Set 2	**Q**	**P**	**S**	**K**											**16**	**Q**	**A**	**M**										
Channelization-code-set information (xccs,7 bits)	41		41		41		41		41						31		31		31		31		31		31			
Modulation scheme information (xms,1 bit)	0		0		0		0		0						1		1		1		1		1		1			
Transport-block size information (xtbs,6 bits)	29		29		29		29		29						24		24		24		24		24		24			
Hybrid-ARQ process information (xhap,3 bits)	0		1		2		0		1		2				0		1		2		0		1		2			
Redundancy and constellation version (xrv,3 bits)	0		0		0		0		0		0				0		0		0		0		0		0			
New data indicator (xnd,1 bit)	0		0		0		1		1		1				0		0		0		1		1		1			
UE identity (xue,16 bits)	0		0		0		0		0		0				0		0		0		0		0		0			
H-Set 3	**Q**	**P**	**S**	**K**											**16**	**Q**	**A**	**M**										
Channelization-code-set information (xccs,7 bits)	41	41	41	41	41	41	41	41	41	41	41	41			31	31	31	31	31	31	31	31	31	31	31	31		
Modulation scheme information (xms,1 bit)	0	0	0	0	0	0	0	0	0	0	0	0			1	1	1	1	1	1	1	1	1	1	1	1		
Transport-block size information (xtbs,6 bits)	29	29	29	29	29	29	29	29	29	29	29	29			24	24	24	24	24	24	24	24	24	24	24	24		
Hybrid-ARQ process information (xhap,3 bits)	0	1	2	3	4	5	0	1	2	3	4	5			0	1	2	3	4	5	0	1	2	3	4	5		
Redundancy and constellation version (xrv,3 bits)	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0		
New data indicator (xnd,1 bit)	0	0	0	0	0	0	1	1	1	1	1	1			0	0	0	0	0	0	1	1	1	1	1	1		
UE identity (xue,16 bits)	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0		
H-Set 4	**Q**	**P**	**S**	**K**																								
Channelization-code-set information (xccs,7 bits)			41		41				41		41																	
Modulation scheme information (xms,1 bit)			0		0				0		0																	
Transport-block size information (xtbs,6 bits)			29		29				29		29																	
Hybrid-ARQ process information (xhap,3 bits)			0		1				0		1																	
Redundancy and constellation version (xrv,3 bits)			0		0				0		0																	
New data indicator (xnd,1 bit)			0		0				1		1																	
UE identity (xue,16 bits)			0		0				0		0																	
H-Set 5	**Q**	**P**	**S**	**K**																								
Channelization-code-set information (xccs,7 bits)			41	41	41				41	41	41																	
Modulation scheme information (xms,1 bit)			0	0	0				0	0	0																	
Transport-block size information (xtbs,6 bits)			29	29	29				29	29	29																	
Hybrid-ARQ process information (xhap,3 bits)			0	1	2				0	1	2																	
Redundancy and constellation version (xrv,3 bits)			0	0	0				0	0	0																	
New data indicator (xnd,1 bit)			0	0	0				1	1	1																	
UE identity (xue,16 bits)			0	0	0				0	0	0																	
H-Set 6	**Q**	**P**	**S**	**K**											**16**	**Q**	**A**	**M**										
Channelization-code-set information (xccs,7 bits)	5E	5E	5E	5E	5E	5E	5E	5E	5E	5E	5E	5E			7E	7E	7E	7E	7E	7E	7E	7E	7E	7E	7E	7E		
Modulation scheme information (xms,1 bit)	0	0	0	0	0	0	0	0	0	0	0	0			1	1	1	1	1	1	1	1	1	1	1	1		
Transport-block size information (xtbs,6 bits)	29	29	29	29	29	29	29	29	29	29	29	29			24	24	24	24	24	24	24	24	24	24	24	24		
Hybrid-ARQ process information (xhap,3 bits)	0	1	2	3	4	5	0	1	2	3	4	5			0	1	2	3	4	5	0	1	2	3	4	5		
Redundancy and constellation version (xrv,3 bits)	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0		
New data indicator (xnd,1 bit)	0	0	0	0	0	0	1	1	1	1	1	1			0	0	0	0	0	0	1	1	1	1	1	1		
UE identity (xue,16 bits)	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0		

* Unit [HEX]
* 12 subframes (TTI) length/pattern
* RV: Any fixed value
  (Maximum number of HARQ transmission: 1)

* DTX subframe

Wanted Signal Setup HSPA IQproducer

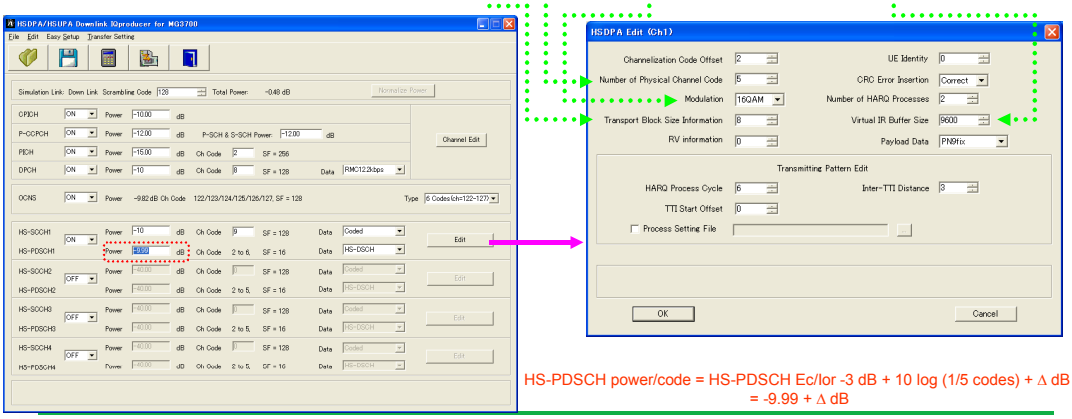
Test
– Reporting of CQI

- DL HSDPA

3GPP TS 25.214 Table 7

UE categories	CQI value	Transport Block Size	Number of HS-PDSCH	Modulation	Reference power Adjustment Δ dB	N_{IR}	X_{RV}
1 ~ 6	16	3565	5	16QAM	0	9600	0
7 ~ 8	16	3565	5	16QAM	0	19200	0
9	16	3565	5	16QAM	0	28800	0
10	16	3565	5	16QAM	0	28800	0
11 ~ 12	16	3319	5	QPSK	-1	4800	0

ki
8
43



HS-PDSCH power/code = HS-PDSCH Ec/Ior -3 dB + 10 log (1/5 codes) + Δ dB
= -9.99 + Δ dB

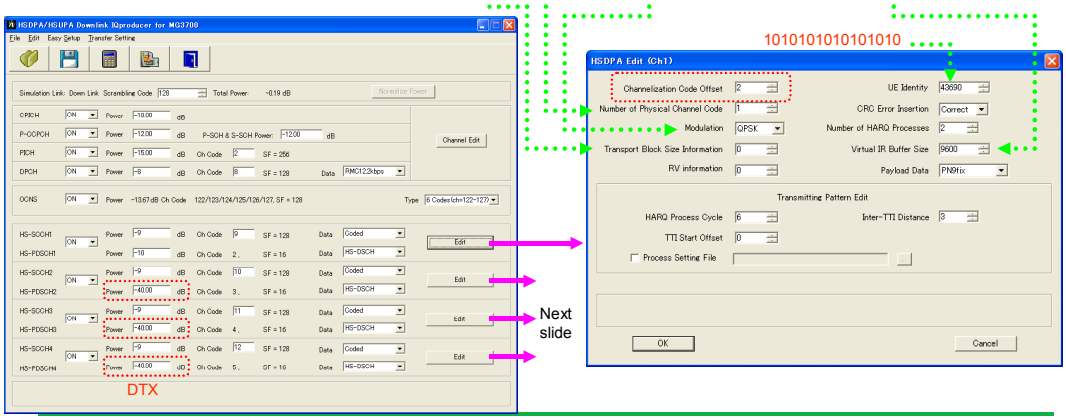
Wanted Signal Setup HSPA IQproducer

Test
- HS-SCCH Detection Performance

- DL HSDPA

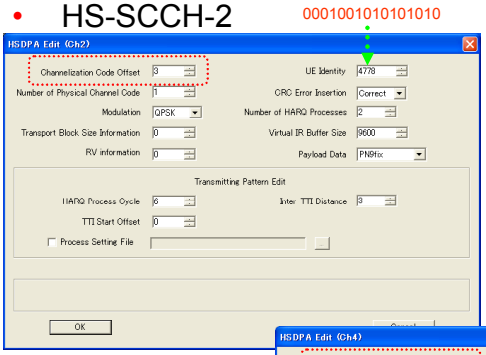
3GPP TS 25.214 Table 7

UE categories	CQI value	Transport Block Size	Number of HS-PDSCH	Modulation	Reference power Adjustment Δ dB	N_{IR}	X_{RV}
1 ~ 6	1	137	1	QPSK	0	9600	0
7 ~ 8	1	137	1	QPSK	0	19200	0
9	1	137	1	QPSK	0	28800	0
10	1	137	1	QPSK	0	28800	0
11 ~ 12	1	137	1	QPSK	0	4800	0

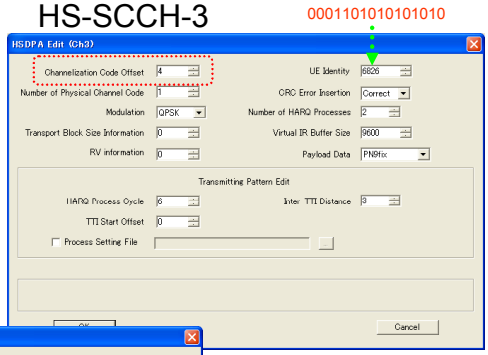


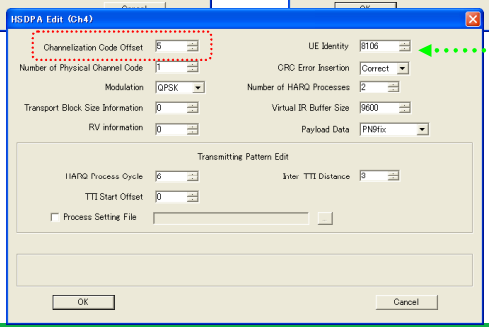
Wanted Signal Setup HSPA IQproducer

- HS-SCCH-2



- HS-SCCH-3





- HS-SCCH-4

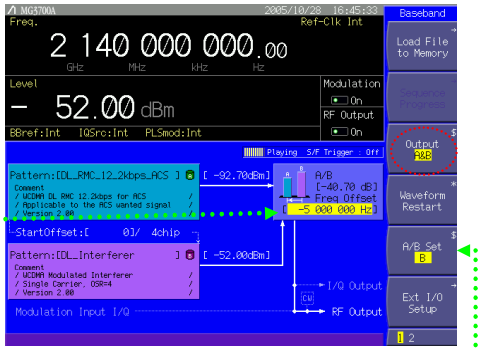
Wanted Signal + Interference Signal Setup Example

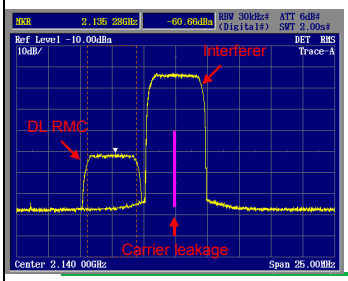
Test
- ACS
- Blocking characteristics
- Intermodulation characteristics

- DL RMC 12.2 kbps
  +
- DL interferer

ACS: 5 MHz offset
Blocking: ≥ 10 MHz offset
Intermodulation: 20 MHz offset

» Set frequency offset.
- -34.944 ~ +34.944 MHz
  - 3 × Oversampling
- -47.232 ~ +47.232 MHz
  - 4 × Oversampling

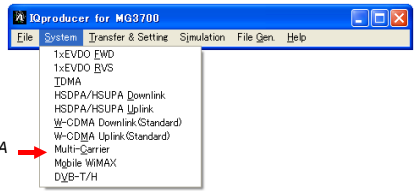




A/B Set	A level	B level	RF level
A	Variable	Static	Coupled
B	Static	Variable	Coupled
Constant	Variable	Variable	Static

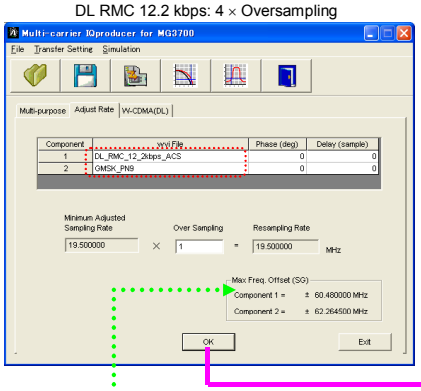
Wanted Signal + GMSK Interference Signal Setup Example

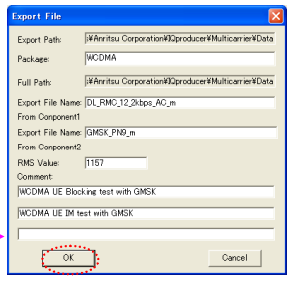
Test
- Blocking characteristics
- Intermodulation characteristics



License option MX370104A

DL RMC 12.2 kbps: 4 × Oversampling





Available frequency offset between wanted signal and GMSK interference signal

Resampling

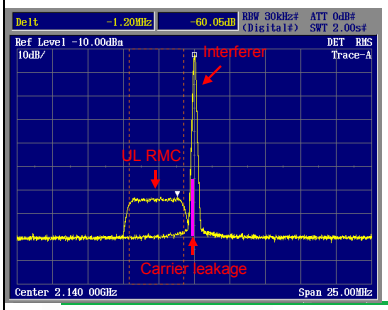
Requires about 1 day to complete, depending on the PC specifications

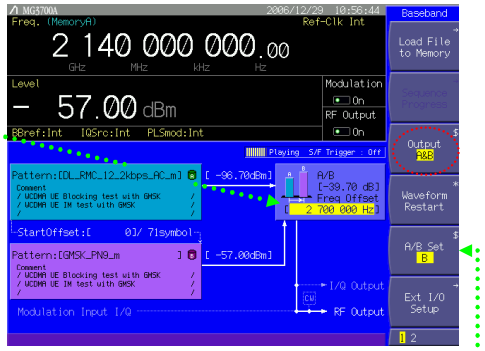
Wanted Signal + GMSK Interference Signal Setup Example

- DL RMC 12.2 kbps
  +
- GMSK Interferer

Blocking: ≥ 2.7 MHz offset
Intermodulation: 5.9 or 6 MHz offset

  - » Set frequency offset.
    - – -39.68 ~ +39.68 MHz
      - Based on 3 × Oversampling
    - – -60.48 ~ +60.48 MHz
      - Based on 4 × Oversampling



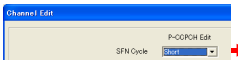


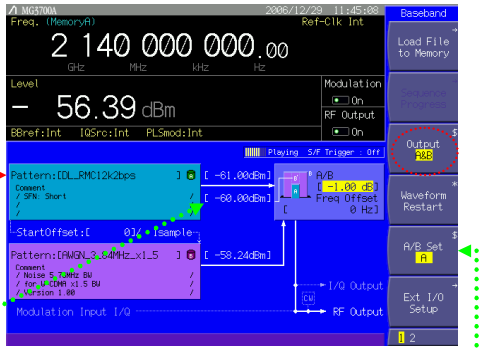
A/B Set	A level	B level	RF level
A	Variable	Static	Coupled
B	Static	Variable	Coupled
Constant	Variable	Variable	Static

Wanted Signal + AWGN Setup Example

Test
- – Demodulation of DCH
- – BTFD
- – Reporting of CQI

- DL RMC 12.2 kbps
- DL RMC 64 kbps
- DL RMC 144 kbps
- DL RMC 384 kbps
- DL RMC BTFD
- DL HSDPA
  +
- AWGN
  - » Ioc [dBm/3.84MHz]





A/B Set	A level	B level	RF level
A	Variable	Static	Coupled
B	Static	Variable	Coupled
Constant	Variable	Variable	Static

Wanted Signal Parameters

- DL RMC

Parameter	Setting Value
Scrambling Code	80_H
DTCH Information Data	PN9
DCCH Information Data	All 0
SFN count	4096
Over sampling rate	4
Ch Code (P-CPICH)	0
Ch Code (P-CCPCH)	1
Ch Code (PICH)	16
Ch Code (DPCH for DL_RMC_12.2kbps)	96
Ch Code (DPCH for DL_RMC_12.2kbps_RX)	96
Ch Code (DPCH for DL_RMC_12.2kbps_MIL)	96
Ch Code (DPCH for DL_RMC_64kbps)	24
Ch Code (DPCH for DL_RMC_144kbps)	12
Ch Code (DPCH for DL_RMC_384kbps)	6
Ch Code (DPCH for DL_AMR_TFCSx)	96
Ch Code (DPCH for DL_ISDN)	24
Ch Code (DPCH for DL_384kbps_Packet)	6
OCNS	See Table 3.1.4-2.
Marker 1	TTI Pulse
Marker 2	–
Marker 3	–
AWGN addition	Disable
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2+Q^2} = 320$ mV

» Receiver test

excluding

Maximum input level

Physical Channel	Power ratio
P-CPICH	P-CPICH_Ec / DPCH_Ec = 7 dB
P-CCPCH	P-CCPCH_Ec / DPCH_Ec = 5 dB
SCH	SCH_Ec / DPCH_Ec = 5 dB
PICH	PICH_Ec / DPCH_Ec = 2 dB
DPCH	Test dependent power

» Performance requirements

including

Maximum input level

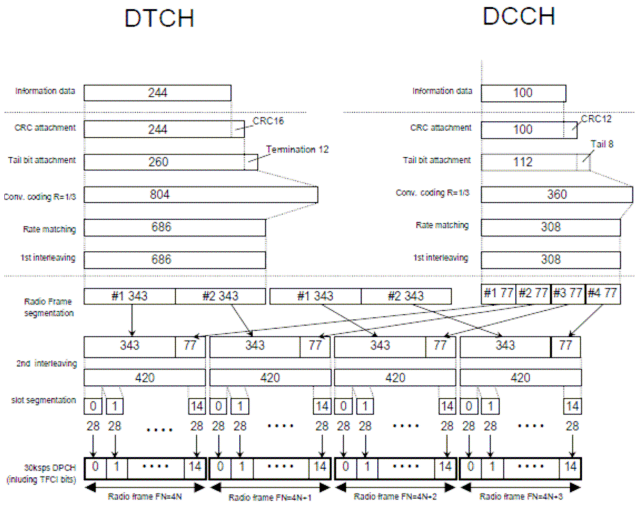
Physical Channel	Power ratio	NOTE
P-CPICH	P-CPICH_Ec/Ior = -10 dB	Use of P-CPICH or S-CPICH as phase reference is specified for each requirement and is also set by higher layer signalling.
S-CPICH	S-CPICH_Ec/Ior = -10 dB	When S-CPICH is the phase reference in a test condition, the phase of S-CPICH shall be 180 degrees offset from the phase of P-CPICH. When S-CPICH is not the phase reference, it is not transmitted.
P-CCPCH	P-CCPCH_Ec/Ior = -12 dB	When BCH performance is tested the P-CCPCH_Ec/Ior is test dependent
SCH	SCH_Ec/Ior = -12 dB	This power shall be divided equally between Primary and Secondary Synchronous channels
PICH	PICH_Ec/Ior = -15 dB	
DPCH	Test dependent power	When S-CPICH is the phase reference in a test condition, the phase of DPCH shall be 180 degrees offset from the phase of P-CPICH. When BCH performance is tested the DPCH is not transmitted.
OCNS	Necessary power so that total transmit power spectral density of Node B (Ior) adds to one[1]	OCNS interference consists of 16 dedicated data channels as specified in table C.6.

Wanted Signal Parameters

- DL RMC 12.2 kbps

Parameter	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	244	100
Transport Block Set Size	244	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Convolution Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12
Position of TrCH in radio frame	fixed	fixed

Parameter	Unit	Level
Information bit rate	kbps	12.2
DPCH	ksps	30
Slot Format #i	-	11
TFCI	-	On
Power offsets PO1, PO2 and PO3	dB	0
Puncturing	%	14.7

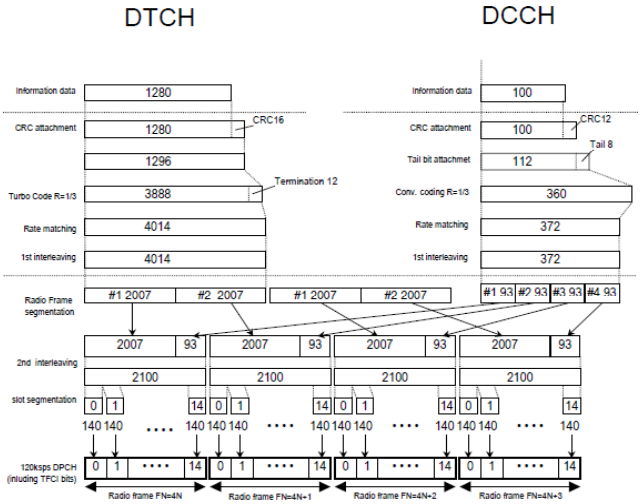


Wanted Signal Parameters

- DL RMC 64 kbps

Parameter	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	1280	100
Transport Block Set Size	1280	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Turbo Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12
Position of TrCH in radio frame	fixed	fixed

Parameter	Unit	Level
Information bit rate	kbps	64
DPCH	ksps	120
Slot Format #i	-	13
TFCI	-	On
Power offsets PO1, PO2 and PO3	dB	0
Repetition	%	2.9

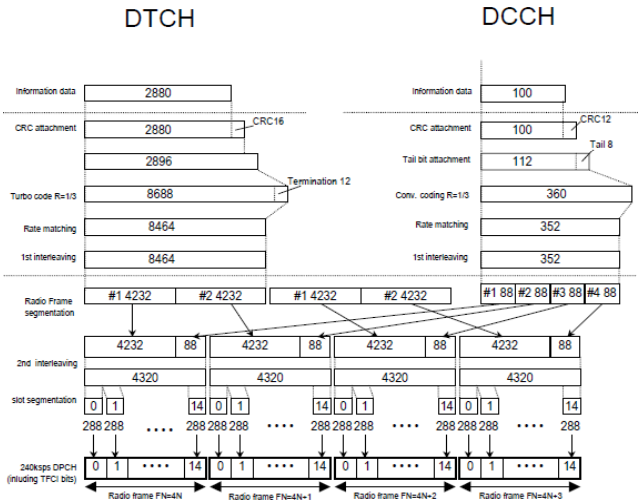


Wanted Signal Parameters

- DL RMC 144 kbps

Parameter	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	2880	100
Transport Block Set Size	2880	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Turbo Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12
Position of TrCH in radio frame	fixed	fixed

Parameter	Unit	Level
Information bit rate	kbps	144
DPCH	ksps	240
Slot Format #i	-	14
TFCI	-	On
Power offsets PO1, PO2 and PO3	dB	0
Puncturing	%	2.7

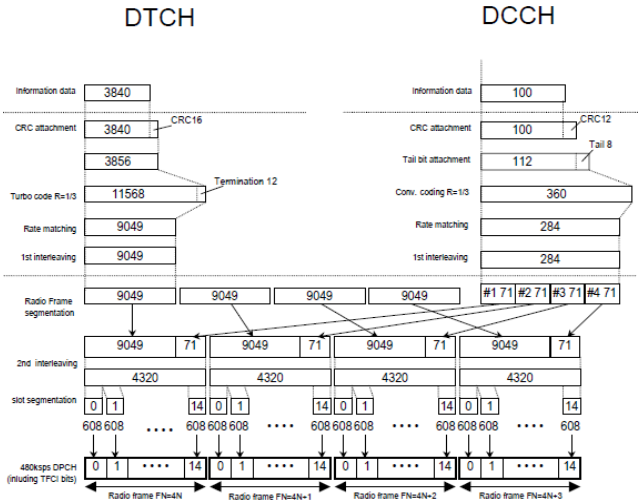


Wanted Signal Parameters

- DL RMC 384 kbps

Parameter	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	3840	100
Transport Block Set Size	3840	100
Transmission Time Interval	10 ms	40 ms
Type of Error Protection	Turbo Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12
Position of TrCH in radio frame	fixed	Fixed

Parameter	Unit	Level
Information bit rate	kbps	384
DPCH	ksps	480
Slot Format # i	-	15
TFCI		On
Power offsets PO1, PO2 and PO3	dB	0
Puncturing	%	22



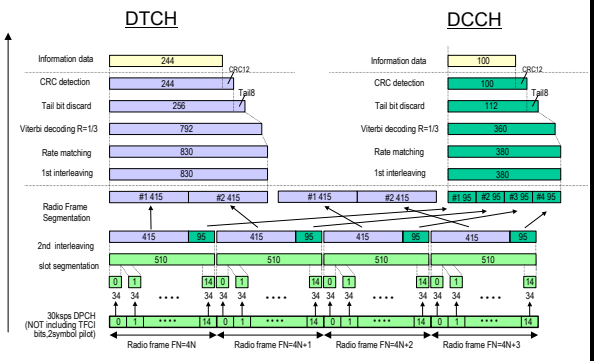
Wanted Signal Parameters

- DL RMC BTFD

Parameter	DTCH			DCCH
	Rate 1	Rate 2	Rate 3	
Transport Channel Number	1			2
Transport Block Size	244	159	39	100
Transport Block Set Size	244	159	39	100
Transmission Time Interval	20 ms			40 ms
Type of Error Protection	Convolution Coding			Convolution Coding
Coding Rate	1/3			1/3
Rate Matching attribute	256			256
Size of CRC	12			12
Position of TrCH in radio frame	fixed			fixed

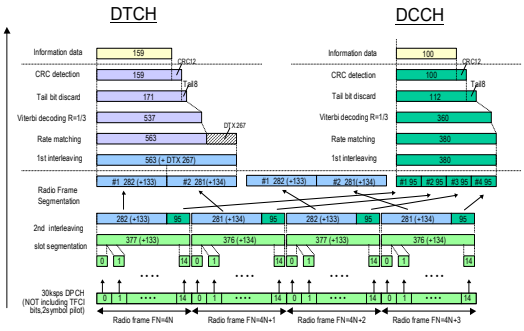
Parameter	Unit	Rate 1	Rate 2	Rate 3
Information bit rate	kbps	12.2	7.95	1.95
DPCH	ksps	30		
Slot Format # i	-	8		
TFCI	-	Off		
Power offsets PO1, PO2 and PO3	dB	0		
Repetition	%	5		

» Rate 1: 12.2 kbps (Test 1, 4)

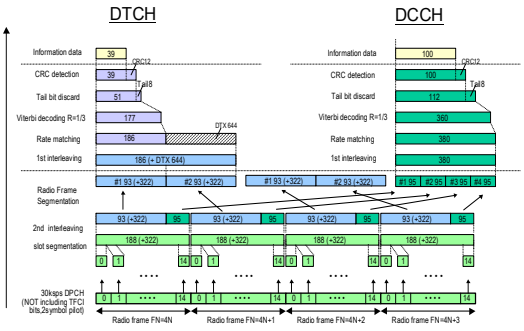


Wanted Signal Parameters

» Rate 2: 7.95 kbps (Test 2, 5)



» Rate 3: 1.95 kbps (Test 3, 6)



Wanted Signal Parameters

- DL HSDPA

Physical Channel	Parameter	Value	Note
P-CPICH	P-CPICH_Ec/Ior	-10dB	
P-CCPCH	P-CCPCH_Ec/Ior	-12dB	Mean power level is shared with SCH.
SCH	SCH_Ec/Ior	-12dB	Mean power level is shared with P-CCPCH – SCH includes P- and S-SCH, with power split between both. P-SCH code is S_dl,0 as per TS25.213 S-SCH pattern is scrambling code group 0
PICH	PICH_Ec/Ior	-15dB	
DPCH	DPCH_Ec/Ior	Test-specific	12.2 kbps DL reference measurement channel as defined in Annex A.3.1
HS-SCCH-1	HS-SCCH_Ec/Ior	Test-specific	Specifies fraction of Node-B radiated power transmitted when TTI is active (i.e. due to minimum inter-TTI interval).
HS-SCCH-2	HS-SCCH_Ec/Ior	DTX'd	No signalling scheduled, or power radiated, on this HS-SCCH, but signalled to the UE as present.
HS-SCCH-3	HS-SCCH_Ec/Ior	DTX'd	As HS-SCCH-2.
HS-SCCH-4	HS-SCCH_Ec/Ior	DTX'd	As HS-SCCH-2.
HS-PDSCH	HS-PDSCH_Ec/Ior	Test-specific	.
OCNS		Necessary power so that total transmit power spectral density of Node B (Ior) adds to one	OCNS interference consists of 6 dedicated data channels as specified in table C.13.

- DL HSDPA HS-SCCH Detection Performance

Parameter	Units	Value	Comment
CPICH *Ec/Ior*	dB	-10	
P-CCPCH *Ec/Ior*	dB	-12	Mean power level is shared with SCH.
SCH *Ec/Ior*	dB	-12	Mean power level is shared with P-CCPCH – SCH includes P- and S-SCH, with power split between both. P-SCH code is S_dl,0 as per TS25.213 S-SCH pattern is scrambling code group 0
PICH *Ec/Ior*	dB	-15	
HS-PDSCH-1 *Ec/Ior*	dB	-10	HS-PDSCH associated with HS-SCCH-1. The HS-PDSCH shall be transmitted continuously with constant power.
HS-PDSCH-2 *Ec/Ior*	dB	DTX	HS-PDSCH associated with HS-SCCH-2
HS-PDSCH-3 *Ec/Ior*	dB	DTX	HS-PDSCH associated with HS-SCCH-3
HS-PDSCH-4 *Ec/Ior*	dB	DTX	HS-PDSCH associated with HS-SCCH-4
DPCH *Ec/Ior*	dB	-8	12.2 kbps DL reference measurement channel as defined in Annex A.3.1
HS-SCCH-1 *Ec/Ior*	dB	Test Specific	All HS-SCCH's allocated equal *Ec/Ior*. Specifies *Ec/Ior* when TTI is active.
HS-SCCH-2 *Ec/Ior*	dB		
HS-SCCH-3 *Ec/Ior*	dB		
HS-SCCH-4 *Ec/Ior*	dB		
OCNS *Ec/Ior*	dB	Necessary power so that total transmit power spectral density of Node B (Ior) adds to one (Note 1)	1. Balance of power *Ior* of the Node-B is assigned to OCNS. 2. OCNS interference consists of 6 dedicated data channels as specified in table C.13.

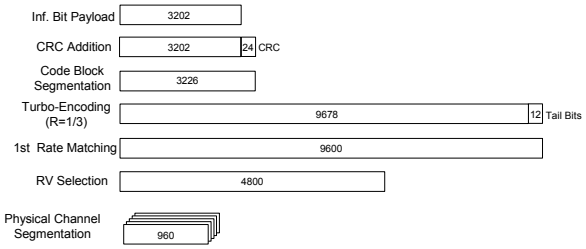
Wanted Signal Parameters

- DL FRC H-Set 1

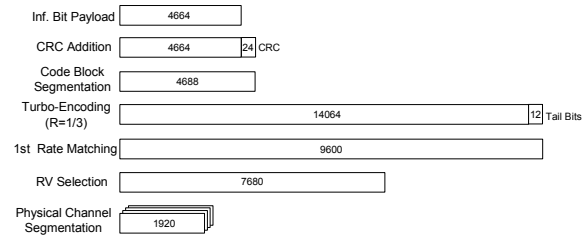
Parameter	Unit	Value	
Nominal Avg. Inf. Bit Rate	kbps	534	777
Inter-TTI Distance	TTI's	3	3
Number of HARQ Processes	Processes	2	2
Information Bit Payload (N_{INF})	Bits	3202	4664
Number Code Blocks	Blocks	1	1
Binary Channel Bits Per TTI	Bits	4800	7680
Total Available SML's in UE	SML's	19200	19200
Number of SML's per HARQ Proc.	SML's	9600	9600
Coding Rate		0.67	0.61
Number of Physical Channel Codes	Codes	5	4
Modulation		QPSK	16QAM

Note: The HS-DSCH shall be transmitted continuously with constant power but only every third TTI shall be allocated to the UE under test.

» QPSK



» 16QAM



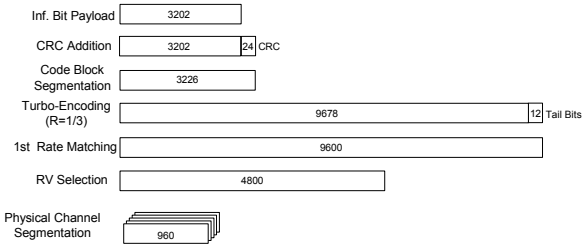
Wanted Signal Parameters

- DL FRC H-Set 2

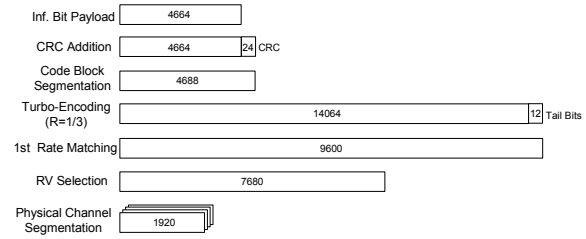
Parameter	Unit	Value	
Nominal Avg. Inf. Bit Rate	kbps	801	1166
Inter-TTI Distance	TTI's	2	2
Number of HARQ Processes	Processes	3	3
Information Bit Payload (N_{INF})	Bits	3202	4664
Number Code Blocks	Blocks	1	1
Binary Channel Bits Per TTI	Bits	4800	7680
Total Available SML's in UE	SML's	28800	28800
Number of SML's per HARQ Proc.	SML's	9600	9600
Coding Rate		0.67	0.61
Number of Physical Channel Codes	Codes	5	4
Modulation		QPSK	16QAM

Note: The HS-DSCH shall be transmitted continuously with constant power but only every second TTI shall be allocated to the UE under test.

» QPSK



» 16QAM

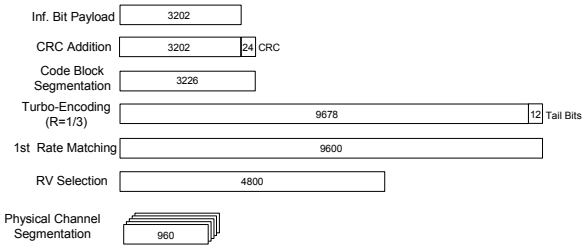


Wanted Signal Parameters

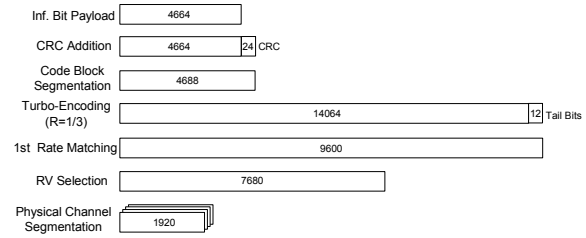
- DL FRC H-Set 3

Parameter	Unit	Value	
Nominal Avg. Inf. Bit Rate	kbps	1601	2332
Inter-TTI Distance	TTI's	1	1
Number of HARQ Processes	Processes	6	6
Information Bit Payload (N_{INF})	Bits	3202	4664
Number Code Blocks	Blocks	1	1
Binary Channel Bits Per TTI	Bits	4800	7680
Total Available SML's,in UE	SML's	57600	57600
Number of SML's per HARQ Proc.	SML's	9600	9600
Coding Rate		0.67	0.61
Number of Physical Channel Codes	Codes	5	4
Modulation		QPSK	16QAM

» QPSK



» 16QAM

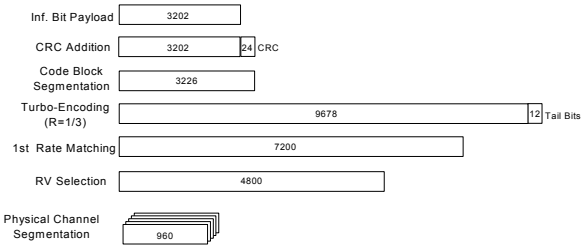


Wanted Signal Parameters

- DL FRC H-Set 4

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	534
Inter-TTI Distance	TTI's	2
Number of HARQ Processes	Processes	2
Information Bit Payload (N_{INF})	Bits	3202
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	4800
Total Available SML's in UE	SML's	14400
Number of SML's per HARQ Proc.	SML's	7200
Coding Rate		0.67
Number of Physical Channel Codes	Codes	5
Modulation		QPSK
Note: This FRC is used to verify the minimum inter-TTI distance for UE category 11. The HS-PDSCH shall be transmitted continuously with constant power. The six sub-frame HS-SCCH signalling pattern shall repeat as follows: …OOXOXOOOXOXO…, where 'X' marks TTI in which HS-SCCH uses the identity of the UE under test and 'O' marks TTI, in which HS-SCCH uses a different identity.		

» QPSK

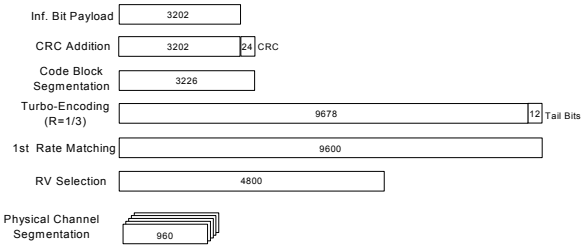


Wanted Signal Parameters

- DL FRC H-Set 5

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	801
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	3
Information Bit Payload (N_{INF})	Bits	3202
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	4800
Total Available SML's in UE	SML's	28800
Number of SML's per HARQ Proc.	SML's	9600
Coding Rate		0.67
Number of Physical Channel Codes	Codes	5
Modulation		QPSK
Note: This FRC is used to verify the minimum inter-TTI distance for UE category 12. The HS-PDSCH shall be transmitted continuously with constant power. The six sub-frame HS-SCCH signalling pattern shall repeat as follows: …OOXXXOOOXXXO…, where 'X' marks TTI in which HS-SCCH uses the identity of the UE under test and 'O' marks TTI, in which HS-SCCH uses a different identity.		

» QPSK

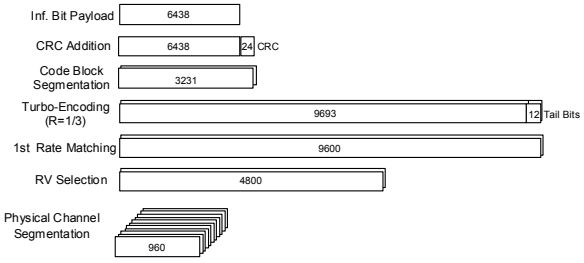


Wanted Signal Parameters

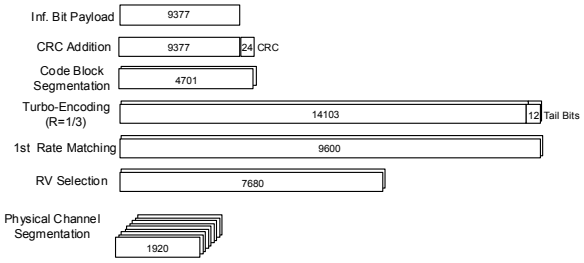
- DL FRC H-Set 6

Parameter	Unit	Value	
Nominal Avg. Inf. Bit Rate	kbps	3219	4689
Inter-TTI Distance	TTI's	1	1
Number of HARQ Processes	Processes	6	6
Information Bit Payload (N_{INF})	Bits	6438	9377
Number Code Blocks	Blocks	2	2
Binary Channel Bits Per TTI	Bits	9600	15360
Total Available SML's in UE	SML's	115200	115200
Number of SML's per HARQ Proc.	SML's	19200	19200
Coding Rate		0.67	0.61
Number of Physical Channel Codes	Codes	10	8
Modulation		QPSK	16QAM

» QPSK



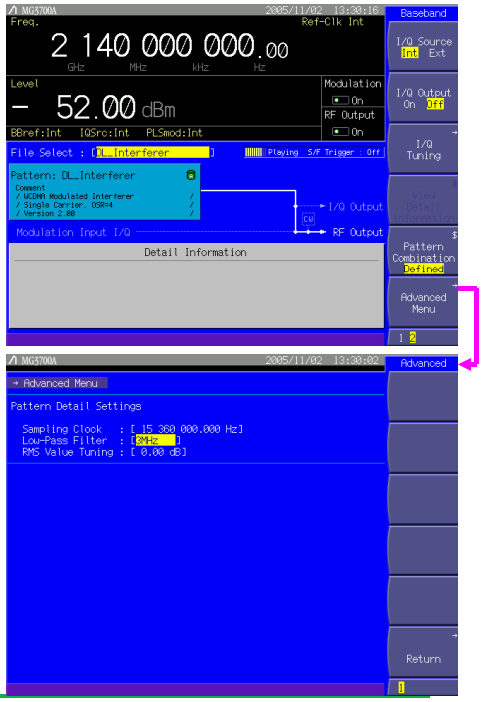
» 16QAM



Just Interference Signal Setup Example

- DL Interferer

» Set LPF to 3 MHz.
  – To improve ACLR



Interference Signal Parameters

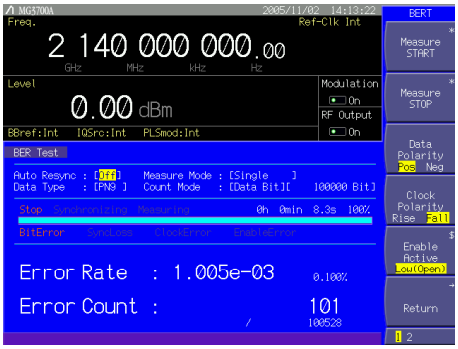
- DL Interferer

Parameter	Setting Value
Scrambling Code	0H
Over sampling rate	4, 3 (DL_Interferer_ov3)
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2+Q^2} = 320$ mV

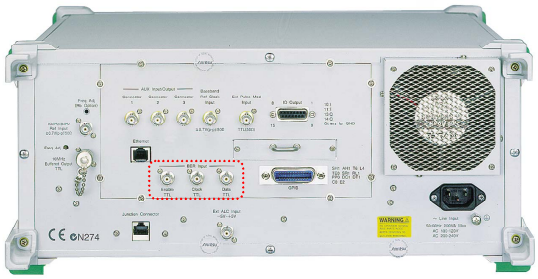
Channel Type	Spreading Factor	Channelization Code	Timing offset ($x256T_{chip}$)	Power	NOTE
P-CCPCH	256	1	0	P-CCPCH_Ec/Ior = -10 dB	
SCH	256	-	0	SCH_Ec/Ior = -10 dB	The SCH power shall be divided equally between Primary and Secondary Synchronous channels
P-CPICH	256	0	0	P-CPICH_Ec/Ior = -10 dB	
PICH	256	16	16	PICH_Ec/Ior = -15 dB	
OCNS	See table C.6			Necessary power so that total transmit power spectral density of Node B (Ior) adds to one	OCNS interference consists of the dedicated data channels. as specified in Table C.6.

BER Test Setup Example

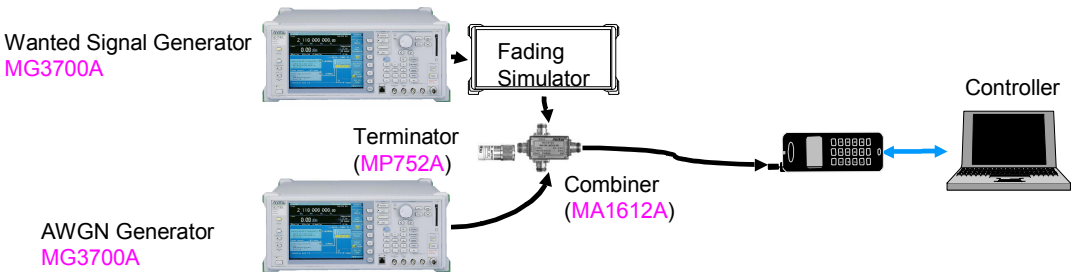
- Received DTCH data
  - » PN9
- Clock
  - » Rise
    - Data
    - Clock
  - » Fall
    - Data
    - Clock



- Measuring bit/time
- Automatic re-synchronization
  - » On
    - – Sync Loss detected
  - » Off
    - – Sync Loss ignored



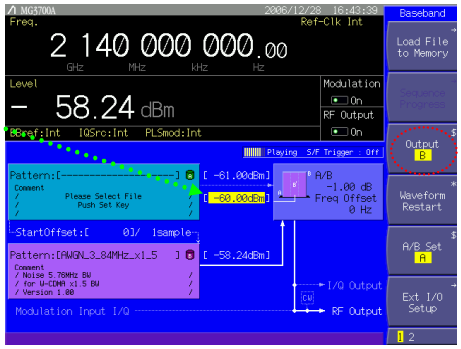
Demodulation of DCH in Multipath Fading Conditions Test Connection Example



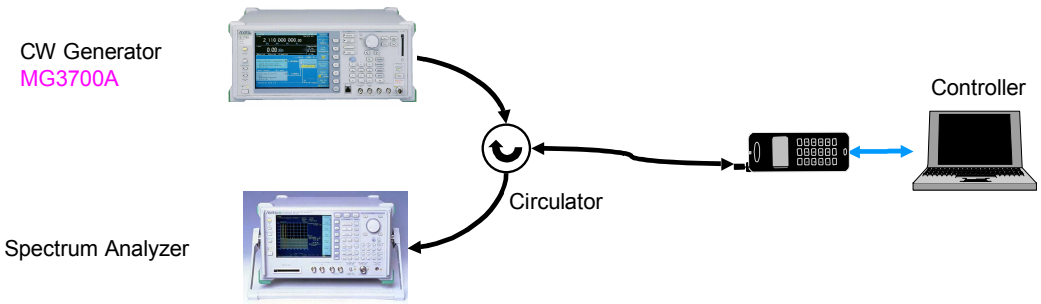
- – Controller
  - Makes receivable state for DL RMC by FTM (Factory Test Mode) control
  - Reports internal BLER calculation for received DTCH

AWGN Setup Example

- AWGN
  - » Ioc [dBm/3.84MHz]



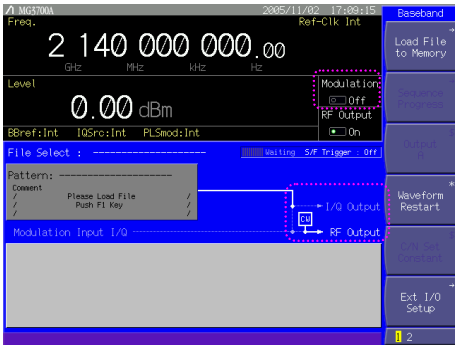
Transmit Intermodulation Test Connection Example



- Controller
  - Makes maximum transmitting power state by FTM (Factory Test Mode) control

Interference CW Signal　Setup Example

- Modulation Off

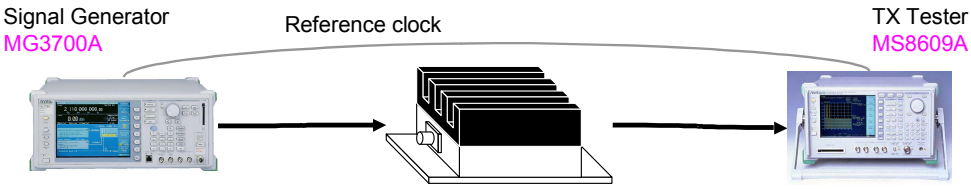


Repeater Test

3GPP　TS 25.143 (Release 7)

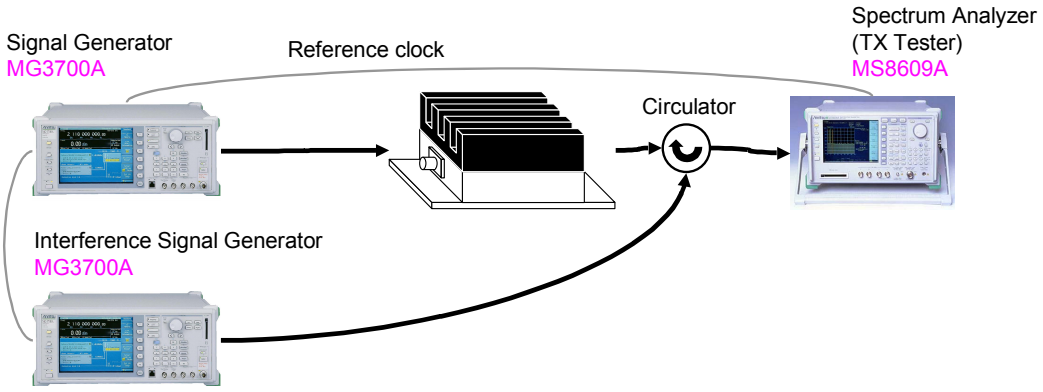
	Test	Signal Generator	Interference Signal Generator	Others
6	Output power	MG3700A		Power Meter
7	Frequency stability			Frequency Counter
8	Out of band gain			Spectrum Analyzer
9	Unwanted emission			Spectrum Analyzer
10	Modulation accuracy			Signal Analyzer
11	Input intermodulation			Spectrum Analyzer
12	Output intermodulation		MG3700A	Spectrum Analyzer Circulator
13	Adjacent Channel Rejection Ratio (ACRR)			Spectrum Analyzer

Basic Tests Connection Example



- Output power
  - » Maximum output power
- Frequency stability
- Out of band gain
- Unwanted emission
  - » Spectrum emission mask
  - » Spurious emissions
- Modulation accuracy
  - » EVM
  - » PCDE
- Input intermodulation
  - » 2-tone intermodulation

Output Intermodulation Test Connection Example

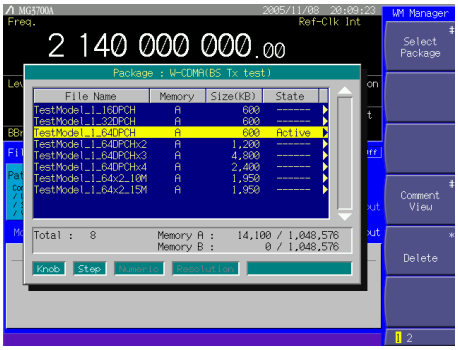


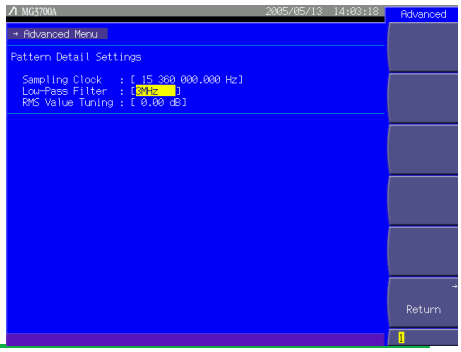
Downlink Signal Setup Example

Test
- Output power
- Frequency stability
- Out of band gain
- Unwanted emission
- EVM
- Output intermodulation
- ACRR

- Test Model 1
  - Single carrier
  - Multi-carrier

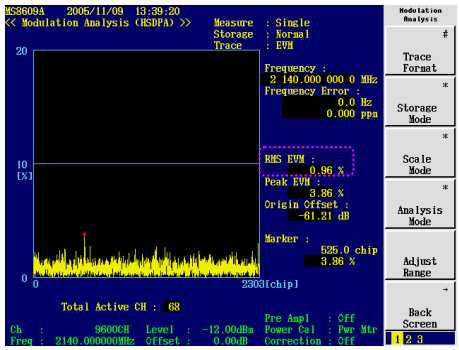
» Set the LPF correctly.
» Tune the RMS value correctly.
- To improve ACRR, EVM for
  - Out of band gain
  - Unwanted emission
  - EVM
  - Output intermodulation
  - ACRR



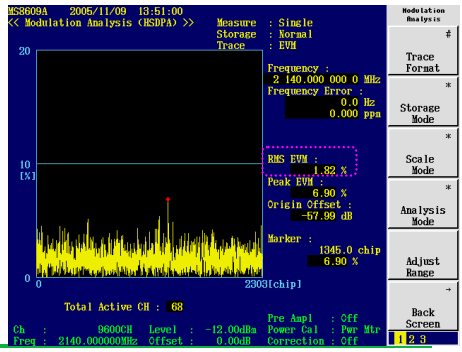


Effect of EVM on LPF Setting

- Test Model 1 64 DPCH
  - Single carrier



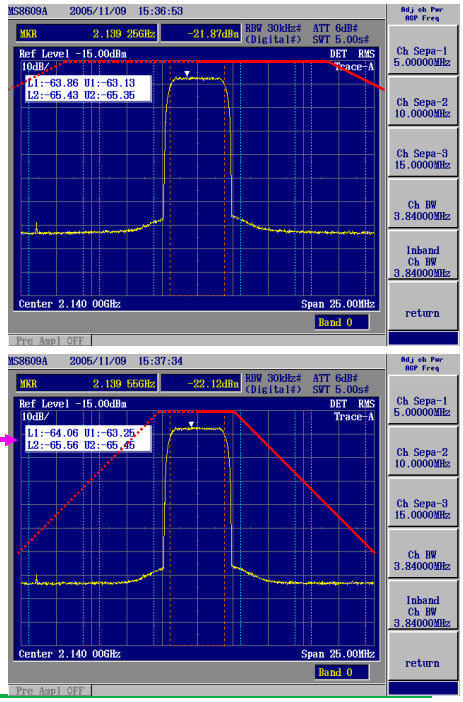
» When LPF changed from Auto (10 MHz) to 3 MHz



Effect of ACRR on LPF Setting

- Test Model 1 64 DPCH
  - Single carrier

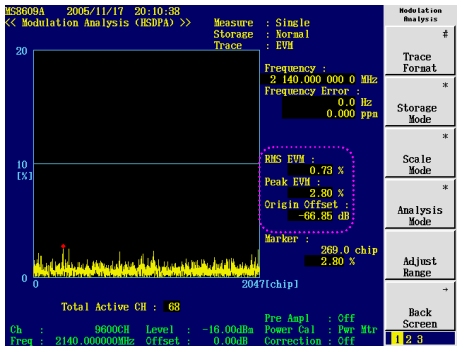
LPF curve image



» When LPF changed from Auto (10 MHz) to 3 MHz

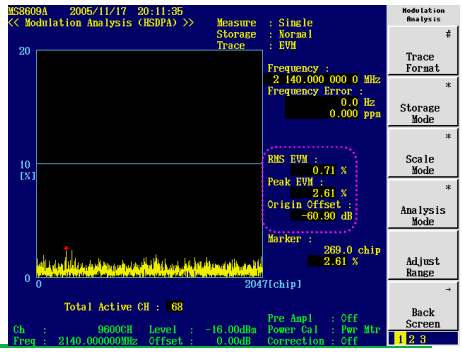
Effect of EVM on RMS Value Setting

- Test Model 1 64 DPCH
  - Single carrier



» When RMS value changed from 0 dB to -4 dB
  - Output level -4 dBm

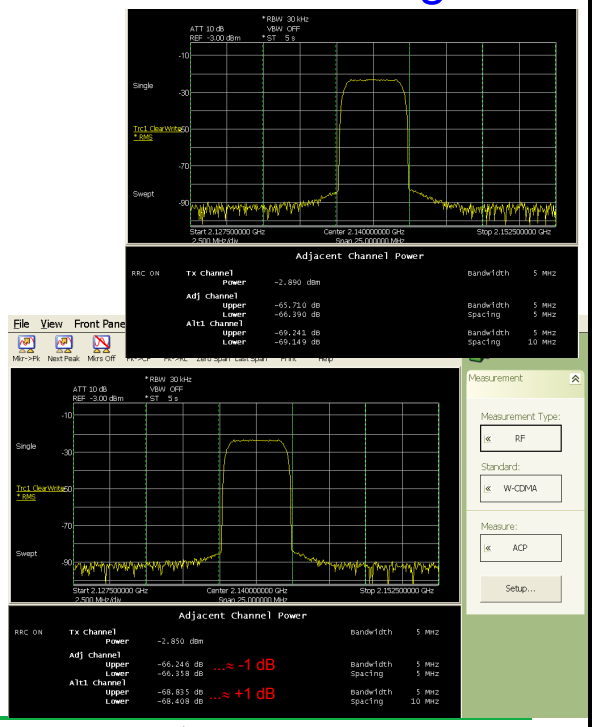
  - Trade-off between Peak EVM and Origin offset
    - Origin offset quantified Carrier leakage



Effect of ACRR on RMS Value Setting

- Test Model 1 64 DPCH
  - Single carrier

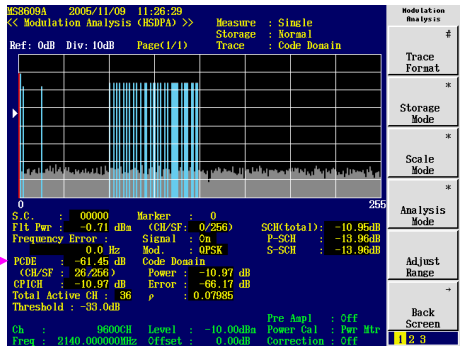
» When RMS value changed from 0 dB to -1 dB
  - Output level -2 dBm

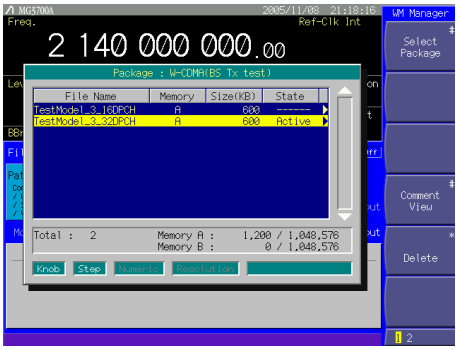


Downlink Signal Setup Example

Test
- PCDE

- Test Model 3





Downlink Signal Parameters

- Test Model 1

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256T_{chip})
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
S-CCPCH containing PCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 in total	see table 6.2	see table 6.2	see table 6.2

Code	Timing offset (x256T_{chip})	Level settings (dB) (16 codes)	Level settings (dB) (32 codes)	Level settings (dB) (64 codes)
2	86	-10	-13	-16
11	134	-12	-13	-16
17	52	-12	-14	-16
23	45	-14	-15	-17
31	143	-11	-17	-18
38	112	-13	-14	-20
47	59	-17	-16	-16
55	23	-16	-18	-17
62	1	-13	-16	-16
69	88	-15	-19	-19
78	30	-14	-17	-22
85	18	-18	-15	-20
94	30	-19	-17	-16
102	61	-17	-22	-17
113	128	-15	-20	-19
119	143	-9	-24	-21
7	83		-20	-19
13	25		-18	-21
20	103		-14	-18
27	97		-14	-20
35	56		-16	-24
41	104		-19	-24
51	51		-18	-22
58	26		-17	-21
64	137		-22	-18
74	65		-19	-20
82	37		-19	-17
88	125		-16	-18
97	149		-18	-19
108	123		-15	-23
117	83		-17	-22
125	5		-12	-21
4	91			-17
9	7			-18
12	32			-20
14	21			-17
19	29			-19
22	59			-21
26	22			-19
28	138			-23
34	31			-22
36	17			-19
40	9			-24
44	69			-23
49	49			-22
53	20			-19
56	57			-22
61	121			-21
63	127			-18
66	114			-19
71	100			-22
76	76			-21
80	141			-19
84	82			-21
87	64			-19
91	149			-21
95	87			-20
99	98			-25
105	46			-25
110	37			-25
116	87			-24
118	149			-22
122	85			-20
126	69			-15

Downlink Signal Parameters

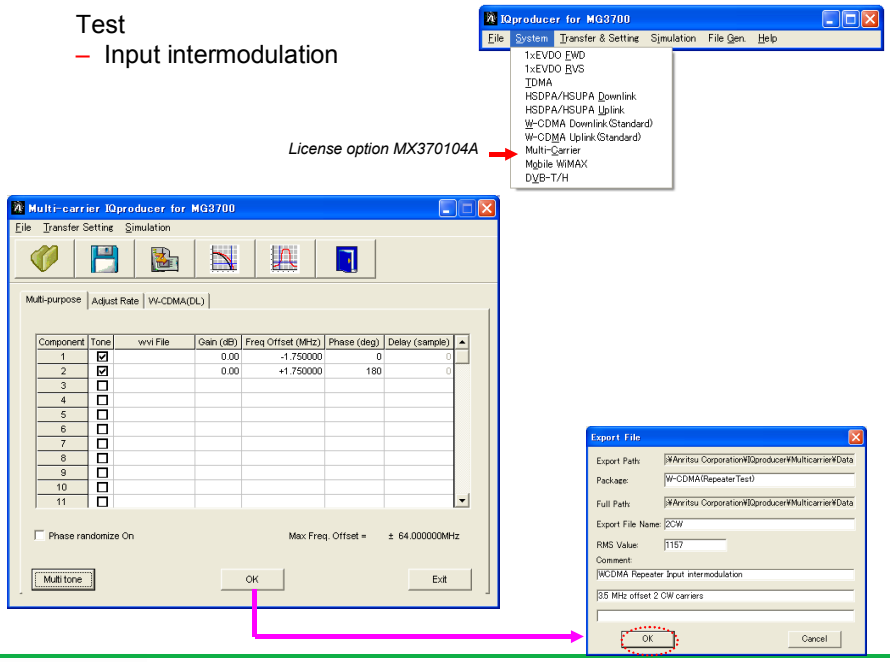
- Test Model 3

Type	Number of Channels	Fraction of Power (%) 16/32	Level settings (dB) 16/32	Channelization Code	Timing offset (x256T_{chip})
P-CCPCH+SCH	1	12,6/7,9	-9 / -11	1	0
Primary CPICH	1	12,6/7,9	-9 / -11	0	0
PICH	1	5/1.6	-13/-18	16	120
S-CCPCH containing PCH (SF=256)	1	5/1.6	-13/-18	3	0
DPCH (SF=256)	16/32	63,7/80,4 in total	see table 6.5	see table 6.5	see table 6.5

Code	T_{offset}	Level settings (dB) (16 codes)	Level settings dB) (32 codes)
64	86	-14	-16
69	134	-14	-16
74	52	-14	-16
78	45	-14	-16
83	143	-14	-16
89	112	-14	-16
93	59	-14	-16
96	23	-14	-16
100	1	-14	-16
105	88	-14	-16
109	30	-14	-16
111	18	-14	-16
115	30	-14	-16
118	61	-14	-16
122	128	-14	-16
125	143	-14	-16
67	83		-16
71	25		-16
76	103		-16
81	97		-16
86	56		-16
90	104		-16
95	51		-16
98	26		-16
103	137		-16
108	65		-16
110	37		-16
112	125		-16
117	149		-16
119	123		-16
123	83		-16
126	5		-16

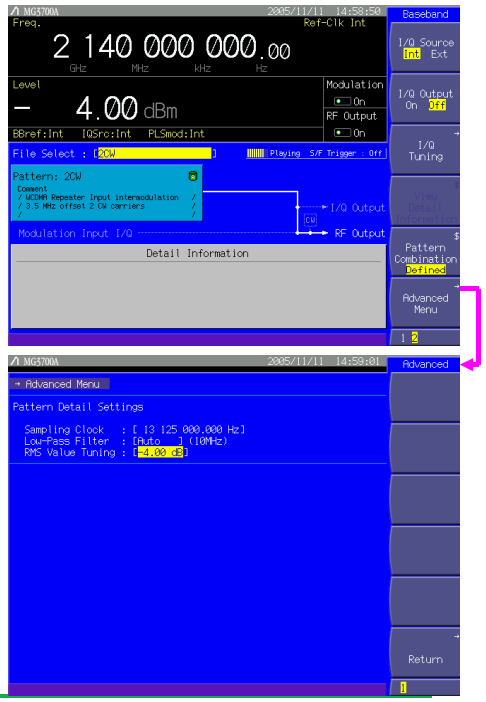
2-tone Signal Setup Example

Test
- Input intermodulation



2-tone Signal Setup Example

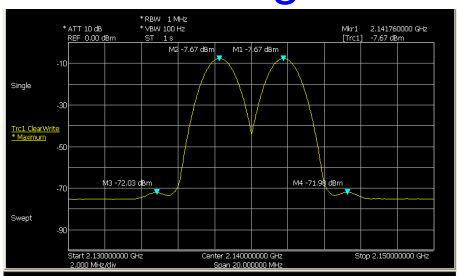
- Two CW carriers with 3.5 MHz offset



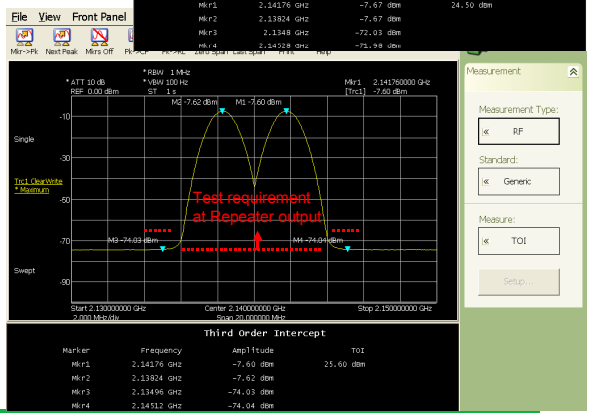
- » Set the LPF correctly.
- » Tune the RMS value correctly.
  - To improve IMD

Effect of IMD on RMS Value Setting

- Two CW carriers with 3.5 MHz offset
  - RBW 1 MHz

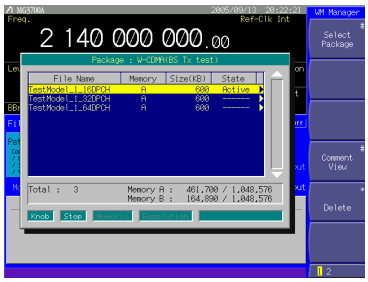


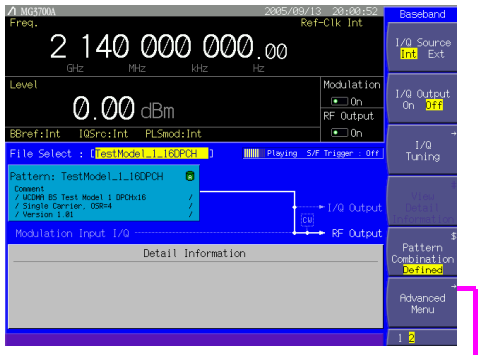
» When RMS value changed from 0 dB to -4 dB
  - Output level -4 dBm

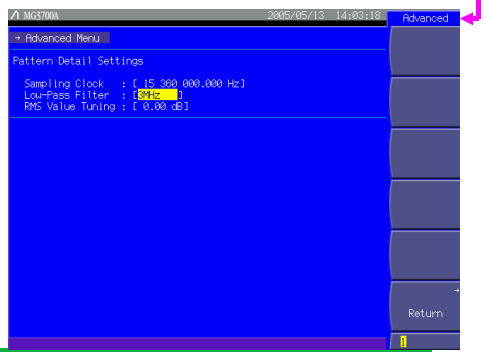


Interference Signal Setup Example

- Test Model 1
  - » Select any one of:



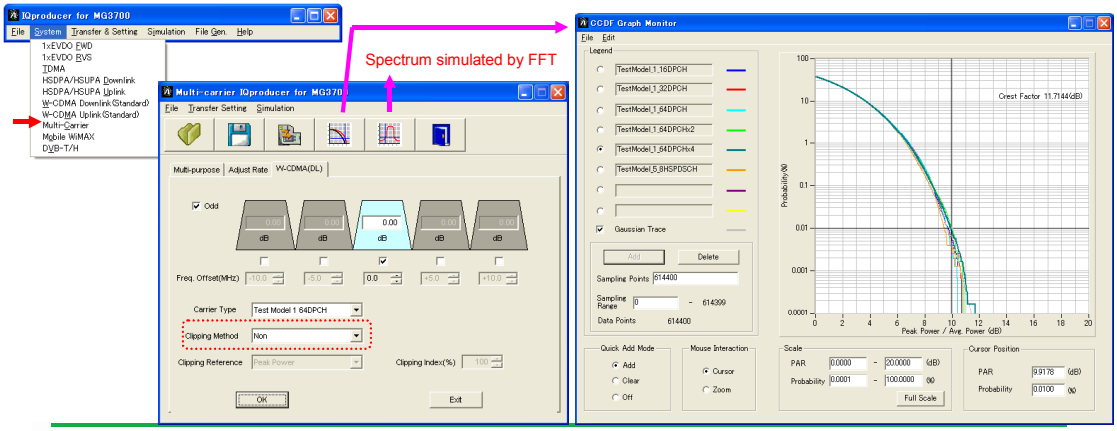




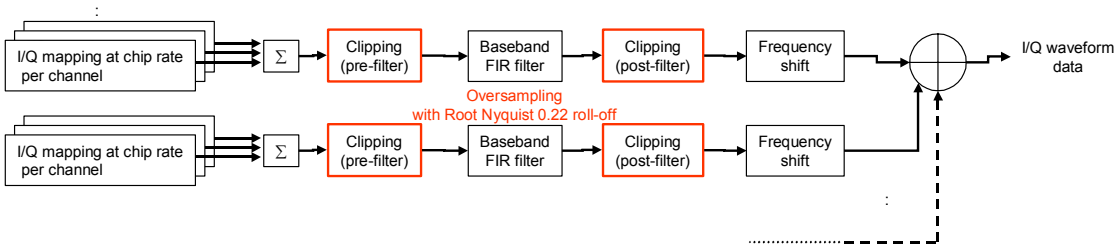
» Set LPF to 3 MHz.
  - To improve ACLR

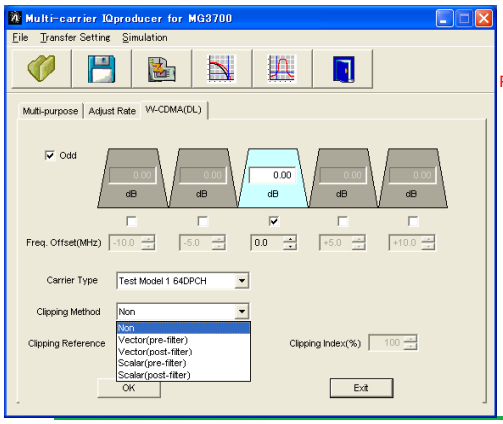
Peak Clipping Technique

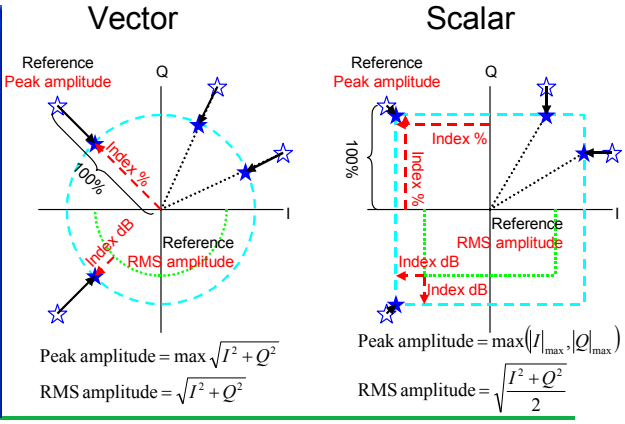
- Standard Test Model 1 patterns are I/Q waveforms without peak clipping.
  - » EVM gives best performance.
- Peak clipping affects the spectral regrowth and EVM because of changing CCDF curves.
  - » It can improve the spectral regrowth.



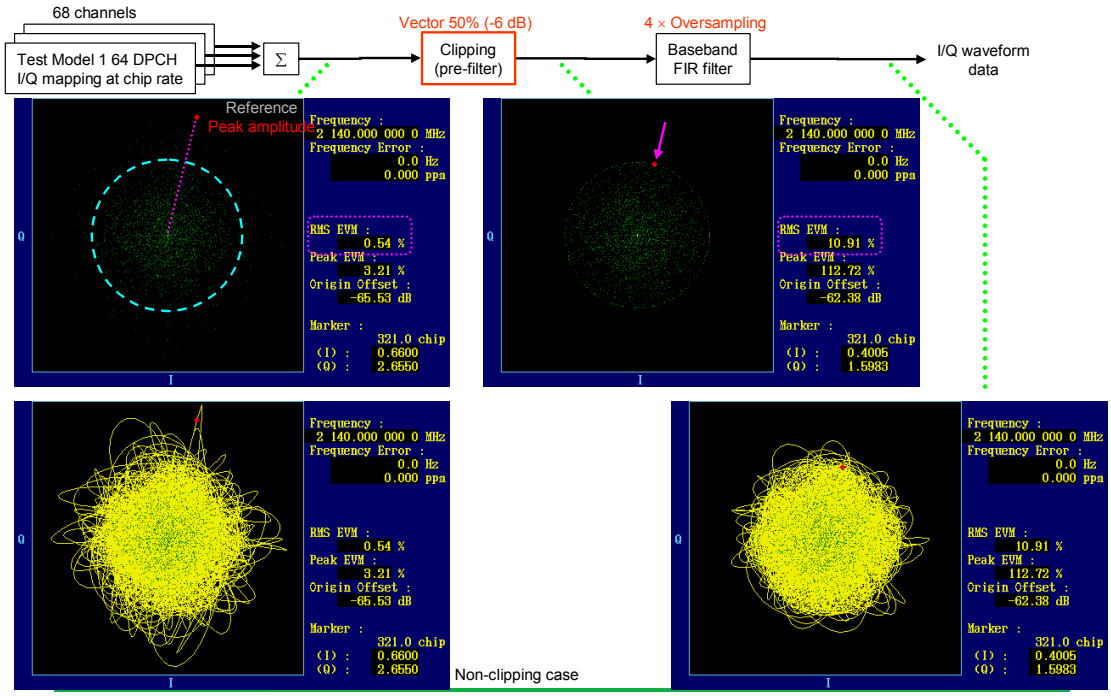
Peak Clipping Type



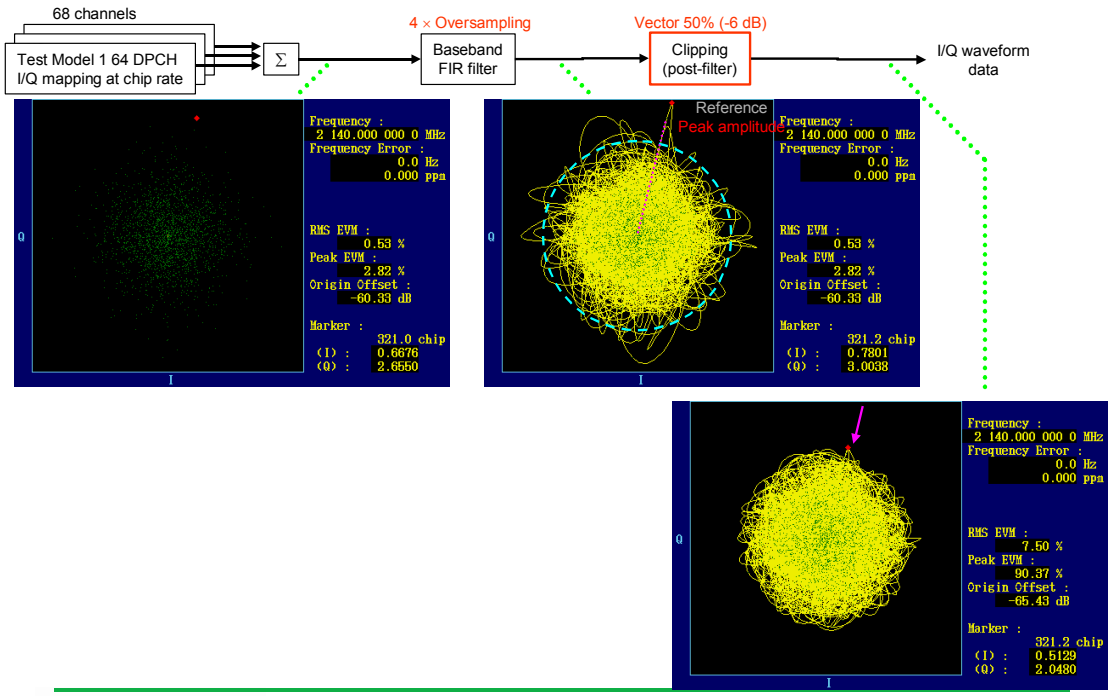




Peak Clipping Modeling

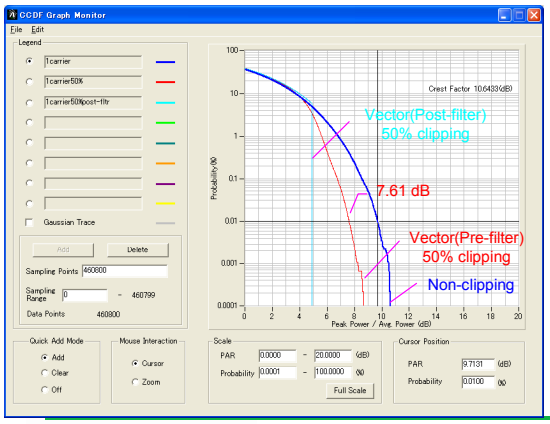


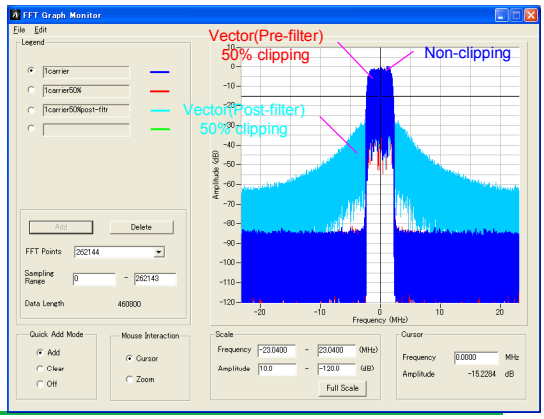
Peak Clipping Modeling



Effect of CCDF & Spectrum on Peak Clipping

- Pre-filter clipping can improve spectral regrowth because of lower PAR. It is a trade-off with EVM.
- Post-filter clipping can simulate spectral regrowth of nonlinear devices.

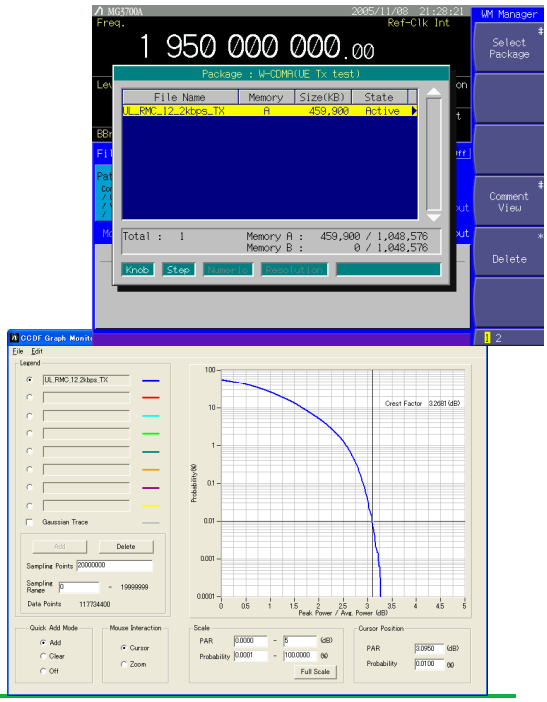




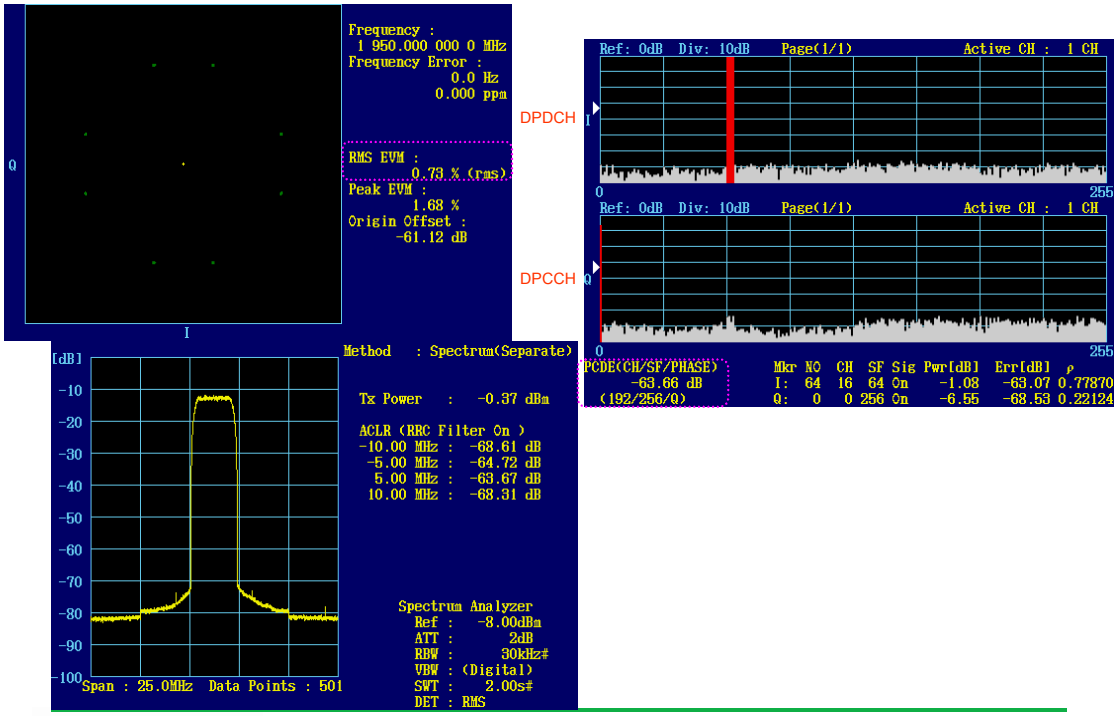
Uplink Signal Setup Example

Test
- Output power
- Frequency stability
- Out of band gain
- Unwanted emission
- EVM
- PCDE
- ACRR

- UL RMC 12.2 kbps



UL RMC 12.2 kbps EVM, PCDE, ACRR

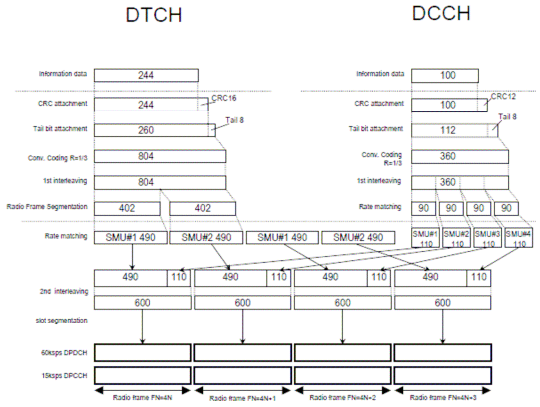


Uplink Signal Parameters

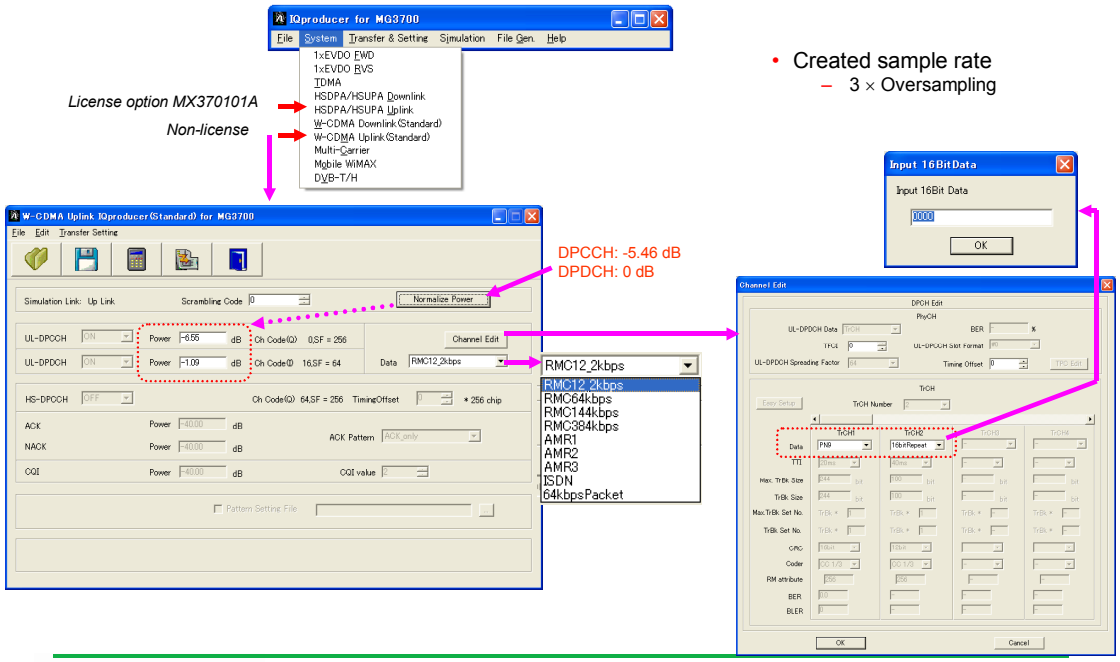
- UL RMC 12.2 kbps

Parameters	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	244	100
Transport Block Set Size	244	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Convolution Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12

Parameter	Unit	Level
Information bit rate	kbps	12.2
DPDCH	kbps	60
DPCCH	kbps	15
DPCCH Slot Format #i	-	0
DPCCH/DPDCH power ratio	dB	-5.46
TFCI	-	On
Repetition	%	23
NOTE: Slot Format #2 is used for closed loop tests in subclause 8.6.2. Slot Format #2 and #5 are used for site selection diversity transmission tests in subclause 8.6.3		



UL RMC 12.2 kbps Same setup
HSPA or Limited W-CDMA IQproducer



Additional Information

- DL Test Models for BS Transmitter Test 143
  - Explore 3GPP TS 25.141 subclause 6.1.1
- UL RMC for UE Transmitter Test 154
  - Explore 3GPP TS 34.121
- Number of Created Frames 171
  - Extract from operation manual for MX370101A HSPA IQproducer
- Transmitter/Receiver Requirements for HSPA UE 174
  - Refer to chapter 11 in the following reference book.
    - Principal parts of UE transmitter and receiver requirements with emphasis on new aspects introduced using HSDPA/HSUPA

Reference
- H.Holma and A.Toskala (eds) (2006), *HSDPA/HSUPA for UMTS*, John Wiley & Sons, Chichester, UK

DL Test Models for BS Transmitter Test

- Test Model 1

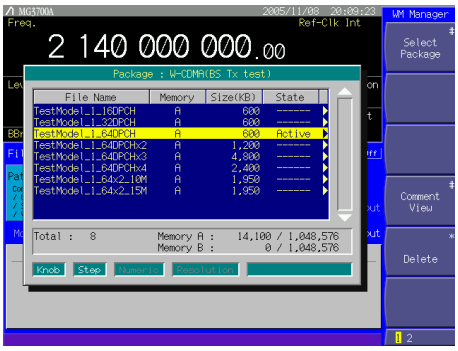
  Test
  - OBW
  - Spectrum emission mask
  - ACLR
  - Spurious emissions
  - Transmit intermodulation
  - Maximum output power
  - Total power dynamic range
  - Frequency error
  - EVM

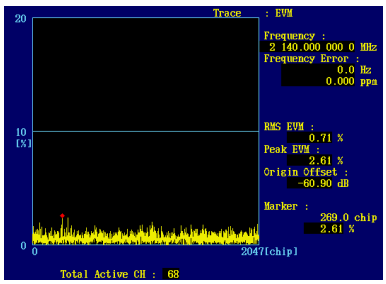
Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset ($x256T_{chip}$)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
S-CCPCH containing PCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 in total	see table 6.2	see table 6.2	see table 6.2

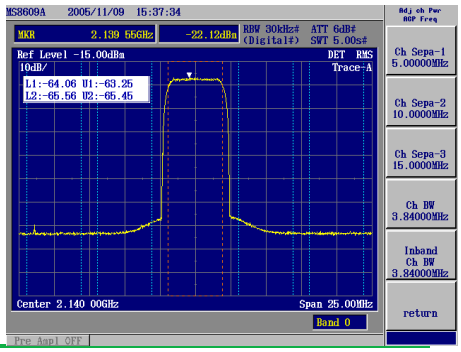
Code	Timing offset ($x256T_{chip}$)	Level settings (dB) (16 codes)	Level settings (dB) (32 codes)	Level settings (dB) (64 codes)
2	86	-10	-13	-16
11	134	-12	-13	-16
17	52	-12	-14	-16
23	45	-14	-15	-17
31	143	-11	-17	-18
38	112	-13	-14	-20
47	59	-17	-16	-16
55	23	-16	-18	-17
62	1	-13	-16	-16
69	88	-15	-19	-19
78	30	-14	-17	-22
85	18	-18	-15	-20
94	30	-19	-17	-16
102	61	-17	-22	-17
113	128	-15	-20	-19
119	143	-9	-24	-21
7	83		-20	-19
13	25		-18	-21
20	103		-14	-18
27	97		-14	-20
35	56		-16	-24
41	104		-19	-24
51	51		-18	-22
58	26		-17	-21
64	137		-22	-18
74	65		-19	-20
82	37		-19	-17
88	125		-16	-18
97	149		-18	-19
108	123		-15	-23
117	83		-17	-22
125	5		-12	-21
4	91			-17
9	7			-18
12	32			-20
14	21			-17
19	29			-19
22	59			-21
26	22			-19
28	138			-23
34	31			-22
36	17			-19
40	9			-24
44	69			-23
49	49			-22
53	20			-19
56	57			-22
61	121			-21
63	127			-18
66	114			-19
71	100			-22
76	76			-21
80	141			-19
84	82			-21
87	64			-19
91	149			-21
95	87			-20
99	98			-25
105	46			-25
110	37			-25
116	87			-24
118	149			-22
122	85			-20
126	69			-15

Test Model 1 for BS Transmitter Test

» For more information about EVM, ACLR and Peak clipping, see Downlink Signal parts in Repeater Test.





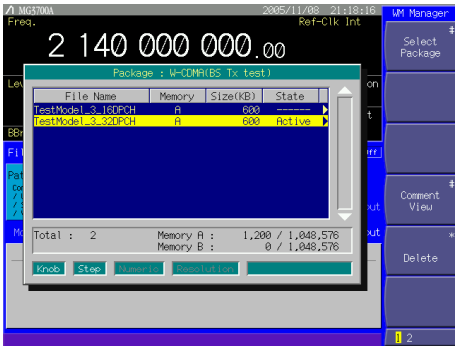


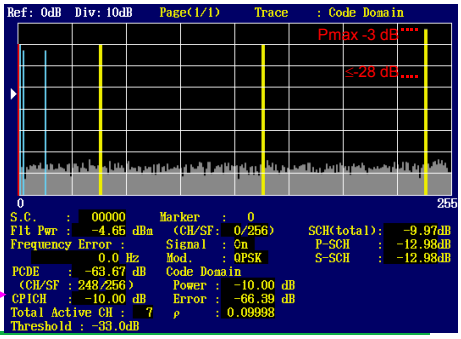
DL Test Models for BS Transmitter Test

- Test Model 2

  Test
  - Output power dynamics
  - CPICH power accuracy

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset ($x256T_{chip}$)
P-CCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
S-CCPCH containing PCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 x 10,1 x 50	2 x –10, 1 x –3	24, 72, 120	1, 7, 2





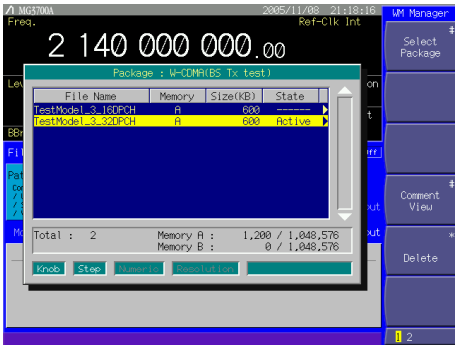
DL Test Models for BS Transmitter Test

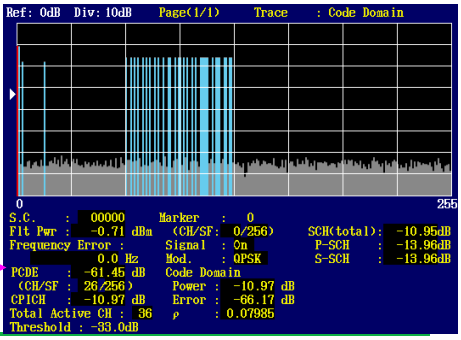
- Test Model 3

  Test
  - Peak code domain error

Type	Number of Channels	Fraction of Power (%) 16/32	Level settings (dB) 16/32	Channelization Code	Timing offset ($x256T_{chip}$)
P-CCPCH+SCH	1	12,6/7,9	-9 / -11	1	0
Primary CPICH	1	12,6/7,9	-9 / -11	0	0
PICH	1	5/1.6	-13/-18	16	120
S-CCPCH containing PCH (SF=256)	1	5/1.6	-13/-18	3	0
DPCH (SF=256)	16/32	63,7/80,4 in total	see table 6.5	see table 6.5	see table 6.5

Code	T_{offset}	Level settings (dB) (16 codes)	Level settings dB) (32 codes)
64	86	-14	-16
69	134	-14	-16
74	52	-14	-16
78	45	-14	-16
83	143	-14	-16
89	112	-14	-16
93	59	-14	-16
96	23	-14	-16
100	1	-14	-16
105	88	-14	-16
109	30	-14	-16
111	18	-14	-16
115	30	-14	-16
118	61	-14	-16
122	128	-14	-16
125	143	-14	-16
67	83		-16
71	25		-16
76	103		-16
81	97		-16
86	56		-16
90	104		-16
95	51		-16
98	26		-16
103	137		-16
108	65		-16
110	37		-16
112	125		-16
117	149		-16
119	123		-16
123	83		-16
126	5		-16



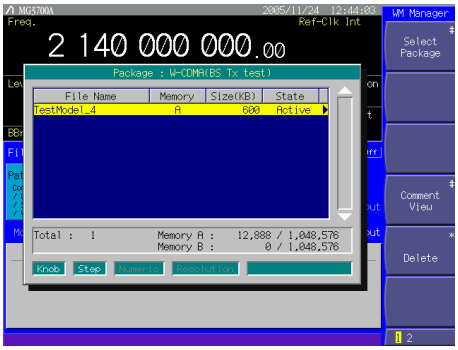


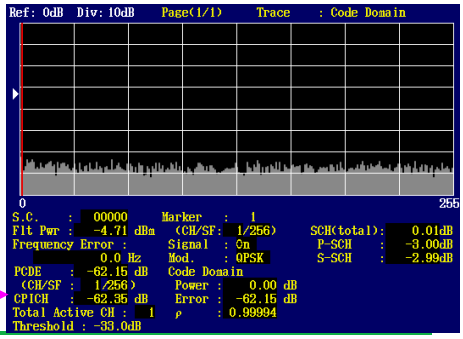
DL Test Models for BS Transmitter Test

- Test Model 4
  Test
  - EVM (at Pmax –18 dB)
  - Total power dynamic range (at Pmax –18 dB)
  - Frequency error (at Pmax –18 dB)

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset
PCCPCH+SCH when Primary CPICH is disabled	1	1.6	-18	1	0
PCCPCH+SCH when Primary CPICH is enabled	1	0.8	-21	1	0
Primary CPICH[1]	1	0.8	-21	0	0

Note 1: The CPICH channel is optional.

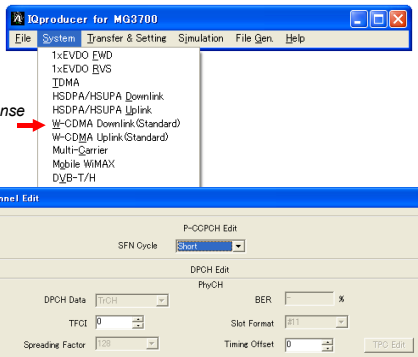




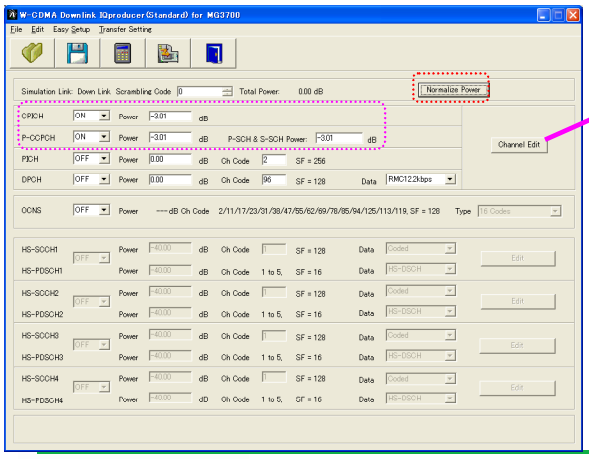
Test Model 4 for BS Transmitter Test

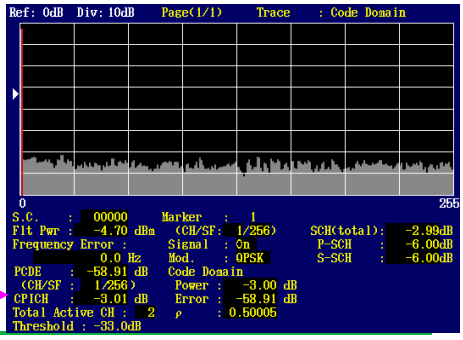
Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset
PCCPCH+SCH when Primary CPICH is disabled	1	1.6	-18	1	0
PCCPCH+SCH when Primary CPICH is enabled	1	0.8	-21	1	0
Primary CPICH[1]	1	0.8	-21	0	0

Note 1: The CPICH channel is optional.



Non-license





DL Test Models for BS Transmitter Test

- Test Model 5
  Test
  – EVM for HSDPA

Type	Number of Channels	Fraction of Power (%)	Level setting (dB)	Channelization Code	Timing offset (x256T$_{chip}$)
P-CCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
S-CCPCH containing PCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=128)	30/14/6(*)	14/14.2/14.4 in total	see table 6.b	see table 6.b	see table 6.b
HS-SCCH	2	4 in total	see table 6.c	see table 6.c	see table 6.c
HS-PDSCH (16QAM)	8/4/2(*)	63.6/63.4/63.2 in total	see table 6.d	see table 6.d	see table 6.d

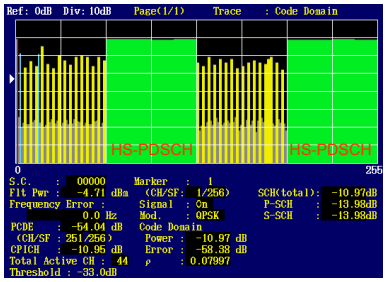
Note *: 2 HS-PDSCH shall be taken together with 6 DPCH, 4 HS-PDSCH shall be taken with 14 DPCH, and 8 HS-PDSCH shall be taken together with 30 DPCH.

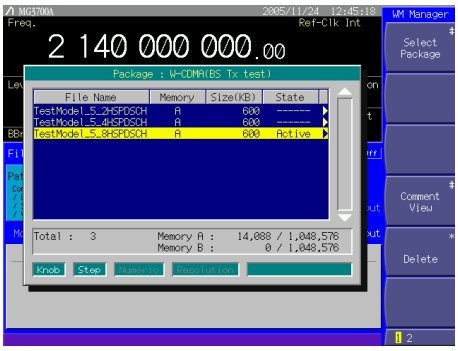
Code (SF=128)	Timing offset (x256T$_{chip}$)	Level settings (dB) (30 codes)	Level settings (dB) (14 codes)	Level settings (dB) (6 codes)
15	86	-20	-17	-17
23	134	-20	-19	-15
68	52	-21	-19	-15
76	45	-22	-20	-18
82	143	-24	-18	-16
90	112	-21	-20	-17
5	59	-23	-25	
11	23	-25	-23	
17	1	-23	-20	
27	88	-26	-22	
64	30	-24	-21	
72	18	-22	-22	
86	30	-24	-19	
94	61	-28	-20	
3	128	-27		
7	143	-26		
13	83	-27		
19	25	-25		
21	103	-21		
25	97	-21		
31	56	-23		
66	104	-26		
70	51	-25		
74	26	-24		
78	137	-27		
80	65	-26		
84	37	-23		
88	125	-25		
89	149	-22		
92	123	-24		

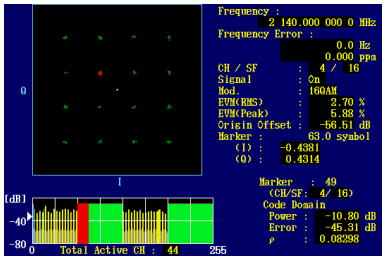
Code (SF=128)	Timing offset (x256T$_{chip}$)	Level settings (dB)
9	0	-15
29	0	-21

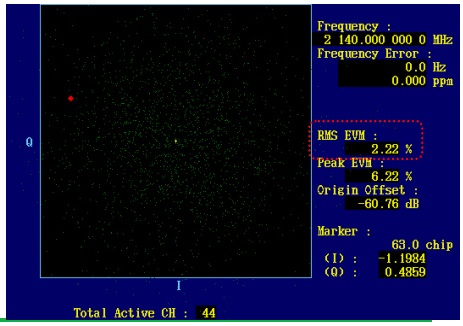
Code (SF=16)	Timing offset (x256T$_{chip}$)	Level settings (dB) (8 codes)	Level settings (dB) (4 codes)	Level settings (dB) (2 codes)
4	0	-11	-8	-5
5	0	-11	-8	
6	0	-11		
7	0	-11		
12	0	-11	-8	-5
13	0	-11	-8	
14	0	-11		
15	0	-11		

Test Model 5 for BS Transmitter Test

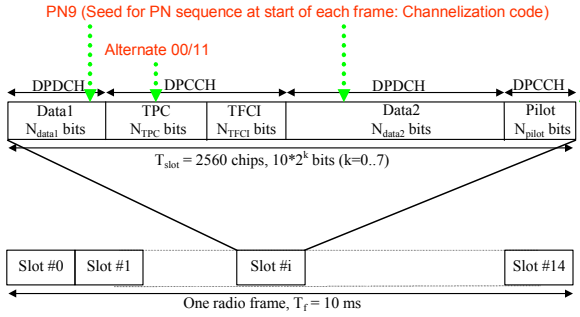








DPCH Structure of DL Test Models

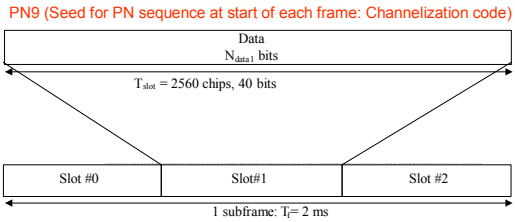


	Npilot = 8			
Symbol #	0	1	2	3
Slot #0	11	11	11	10
1	11	00	11	10
2	11	01	11	01
3	11	00	11	00
4	11	10	11	01
5	11	11	11	10
6	11	11	11	00
7	11	10	11	00
8	11	01	11	10
9	11	11	11	11
10	11	01	11	01
11	11	10	11	11
12	11	10	11	00
13	11	00	11	11
14	11	00	11	11

	Slot Format #I	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/Frame			Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot		
					DPDCH	DPCCH	TOT		NData1	Ndata2	NTFCI	NTPC	Npilot
Test Model 1, 2, 5	10	60	30	128	450	150	600	40	6	24	0	2	8
3	6	30	15	256	150	150	300	20	2	8	0	2	8

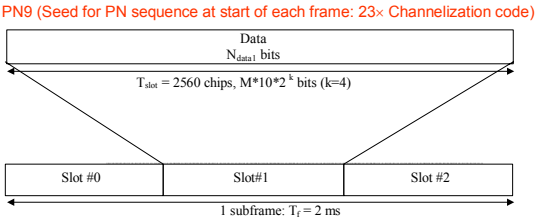
HS-SCCH, HS-PDSCH Structure of DL Test Model 5

- HS-SCCH



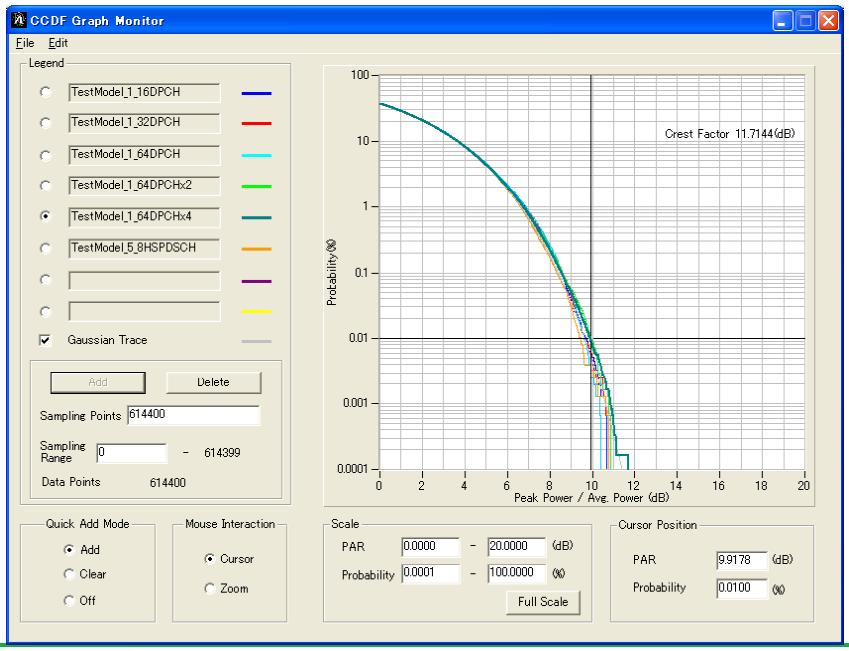
1 frame: 10 ms = 5× 2 ms

- HS-PDSCH



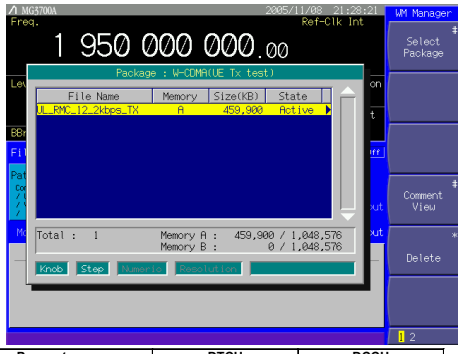
Slot format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ HS-DSCH subframe	Bits/ Slot	Ndata
0(QPSK)	480	240	16	960	320	320
1(16QAM)	960	240	16	1920	640	640

DL Test Models for BS Transmitter Test
CCDF Simulation



UL RMC for UE Transmitter Test

- UL RMC 12.2 kbps
  Test
  - Maximum output power
  - Frequency error
  - OBW
  - Spectrum emission mask
  - ACLR
  - Spurious emissions
  - Transmit intermodulation
  - EVM
  - PCDE

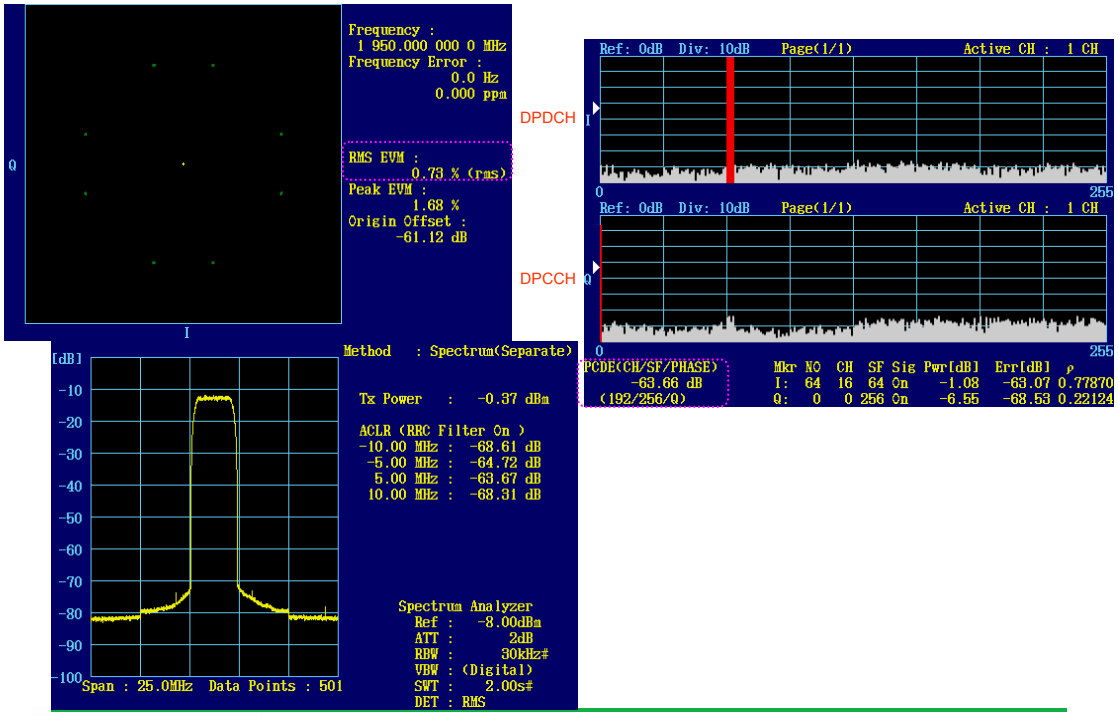


Type of User Information	User bit rate	DL DPCH symbol rate	UL DPCH bit rate	Remarks
12.2 kbps reference measurement channel	12.2 kbps	30 ksps	60 kbps	Standard Test

Parameters	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	244	100
Transport Block Set Size	244	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Convolution Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12

Parameter	Unit	Level
Information bit rate	kbps	12.2
DPDCH	kbps	60
DPCCH	kbps	15
DPCCH Slot Format #i	-	0
DPCCH/DPDCH power ratio	dB	-5.46
TFCI	-	On
Repetition	%	23
NOTE: Slot Format #2 is used for closed loop tests in subclause 8.6.2. Slot Format #2 and #5 are used for site selection diversity transmission tests in subclause 8.6.3		

UL RMC 12.2 kbps for UE Transmitter Test



UL RMC for UE Transmitter Test

- UL RMC HSDPA HS-DPCCH
  Test with HS-DPCCH
  - Maximum output power
  - Spectrum emission mask
  - ACLR
  - EVM

UL RMC 12.2 kbps

Parameter	Level	Unit
Information bit rate	12.2	kbps
DPDCH	60	kbps
DPCCH	15	kbps
DPCCH Slot Format #i	0	-
DPCCH/DPDCH power ratio	-5.46	dB
TFCI	On	-
Repetition	23	%
NOTE: Slot Format #2 is used for closed loop tests in clause 7.6.2. Slot Format #2 and #5 are used for site selection diversity transmission tests in subclause 7.6.3.		

DPCCH DPDCH DPCCH DPDCH HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c , and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

*CM: Cubic Metric based on UE transmit channel configuration $0 \le CM \le 3.5$

*MPR: UE Maximum Power Reduction for nominal maximum output power $max(CM-1, 0)$

UL RMC for UE Transmitter Test

- UL RMC HSUPA E-DCH
  - Test with HS-DPCCH and E-DCH
    - Maximum output power
    - Spectrum emission mask
    - ACLR
    - EVM

Layer 1	TrCH type	E-DCH
	TTI	10ms (alt. 2ms) (NOTE)
	Coding type	TC
	CRC, bit	24
NOTE:	The support of 2ms TTI depends on the UE category	

UE E-DPDCH Physical Layer category	Number of processes	TTI	Max Data Rate
1	4	10 ms	0.7296 Mbps
2	4	10 ms	1.4592 Mbps
2	8	2 ms	1.4595 Mbps
3	4	10 ms	1.4592 Mbps
4	4	10 ms	2.0 Mbps
4	8	2 ms	2.9185 Mbps
5	4	10 ms	2.0 Mbps
6	4	10 ms	2.0 Mbps
6	8	2 ms	5.76 Mbps

DPCCH DPDCH DPCCH DPDCH HS-DPCCH E-DPCCH E-DPDCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	65
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	94
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	70
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	80

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

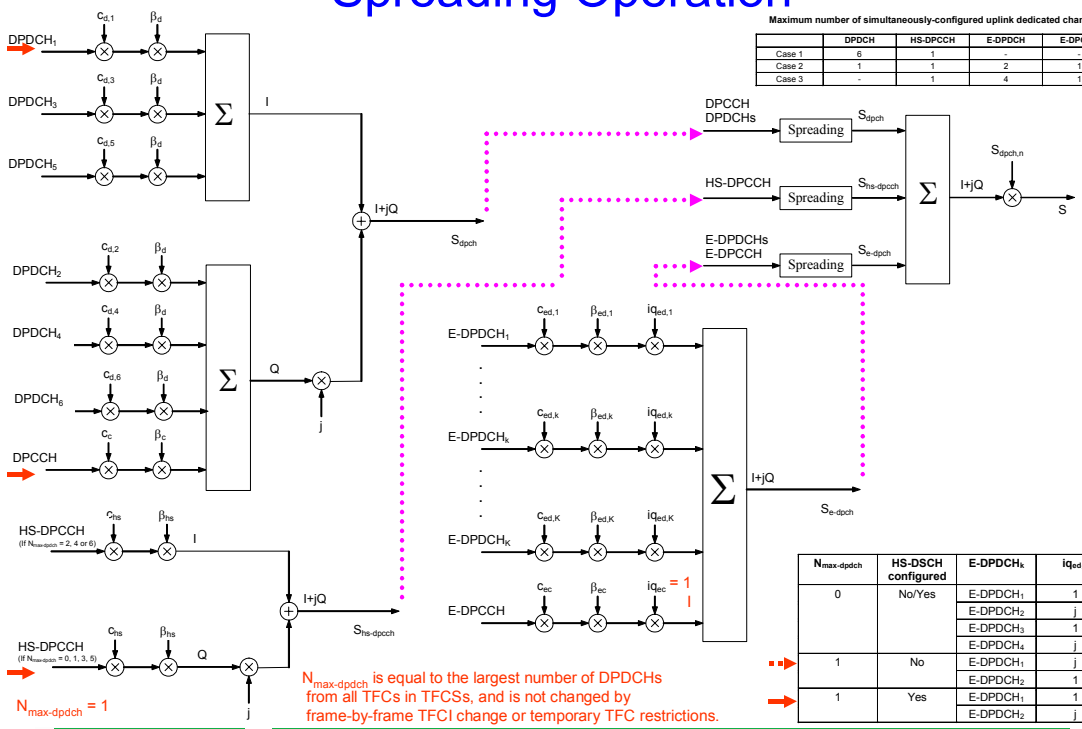
*CM: Cubic Metric based on UE transmit channel configuration $0 \le CM \le 3.5$

*MPR: UE Maximum Power Reduction for nominal maximum output power $max(CM-1, 0)$

Spreading Operation

Maximum number of simultaneously-configured uplink dedicated channels

	DPDCH	HS-DPCCH	E-DPDCH	E-DPCCH
Case 1	6	1	-	-
Case 2	1	1	2	1
Case 3	-	1	4	1

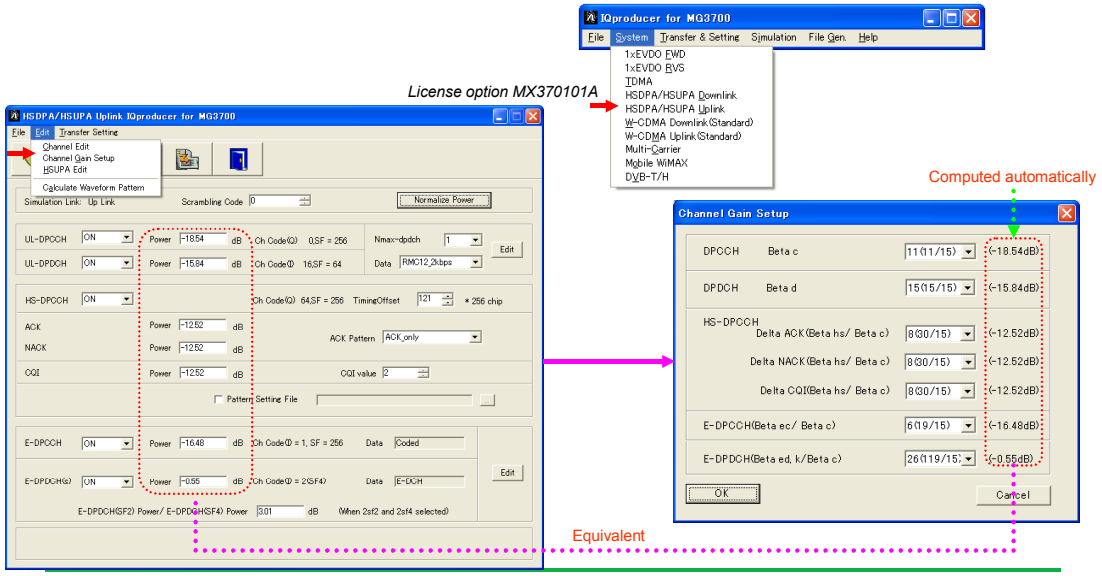


$N_{max-dpdch}$	HS-DSCH configured	$E\text{-}DPDCH_k$	$iq_{ed,k}$
0	No/Yes	E-DPDCH1	1
		E-DPDCH2	j
		E-DPDCH3	1
		E-DPDCH4	j
1	No	E-DPDCH1	j Q
		E-DPDCH2	1 I
1	Yes	E-DPDCH1	1 I
		E-DPDCH2	j Q

$N_{max-dpdch}$ is equal to the largest number of DPDCHs from all TFCs in TFCSs, and is not changed by frame-by-frame TFCI change or temporary TFC restrictions.

Gain Factor β

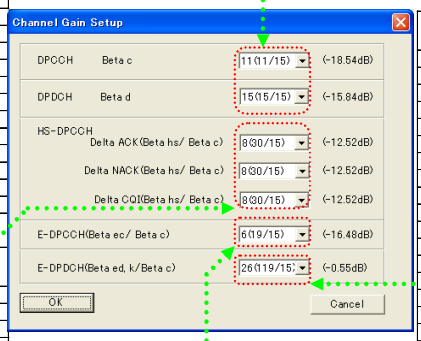
- Spread signals are weighted by gain factors β.
- The $\beta_{\square}$ are derived from quantized amplitude ratios $\beta_{\square}/\beta_c$.



Gain Factor β

Signalled values for β_c and β_d	Quantized amplitude ratios β_c and β_d
15	1.0
14	14/15
13	13/15
12	12/15
11	11/15
10	10/15
9	9/15
8	8/15
7	7/15
6	6/15
5	5/15
4	4/15
3	3/15
2	2/15
1	1/15
0	Switch off

Signalled values for Δ_{ACK}, Δ_{NACK} and Δ_{CQI}	Quantized amplitude ratios $A_{hs} = \beta_{hs}/\beta_c$
8	30/15
7	24/15
6	19/15
5	15/15
4	12/15
3	9/15
2	8/15
1	6/15
0	5/15

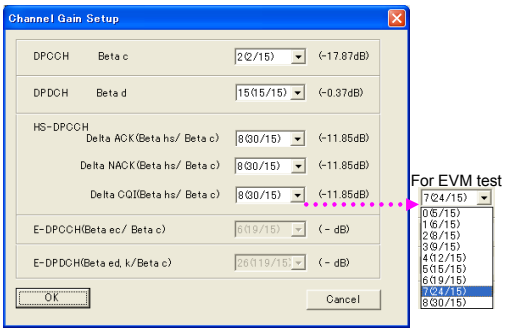


Signalled values for $\Delta_{E\text{-}DPCCH}$	Quantized amplitude ratios $A_{ec} = \beta_{ec}/\beta_c$
8	30/15
7	24/15
6	19/15
5	15/15
4	12/15
3	9/15
2	8/15
1	6/15
0	5/15

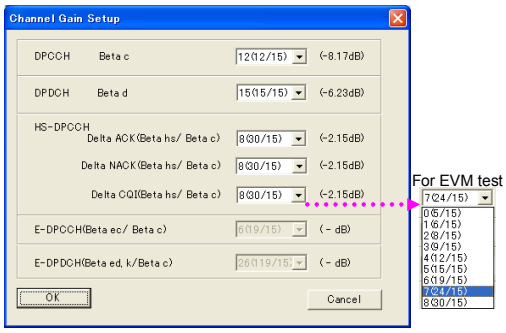
Signalled values for $\Delta_{E\text{-}DPCCH}$	Quantized amplitude ratios $A_{ed} = \beta_{ed}/\beta_c$
29	168/15
28	150/15
27	134/15
26	119/15
25	106/15
24	95/15
23	84/15
22	75/15
21	67/15
20	60/15
19	53/15
18	47/15
17	42/15
16	38/15
15	34/15
14	30/15
13	27/15
12	24/15
11	21/15
10	19/15
9	17/15
8	15/15
7	13/15
6	12/15
5	11/15
4	9/15
3	8/15
2	7/15
1	6/15
0	5/15

UL RMC HSDPA Quantized Amplitude Ratio

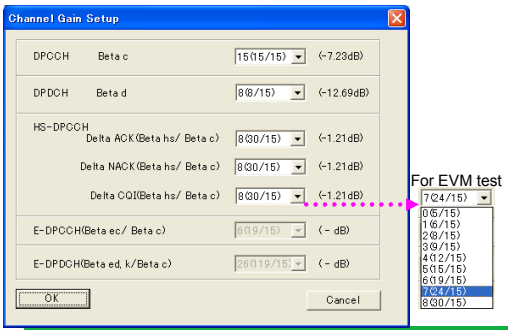
Sub-test 1



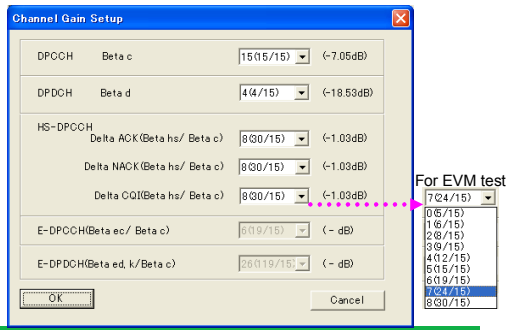
Sub-test 2



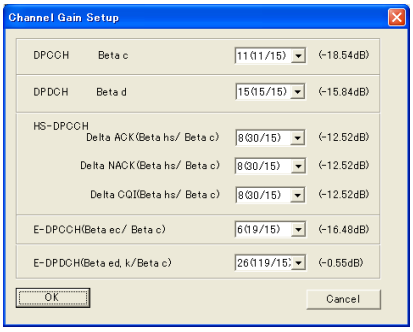
Sub-test 3

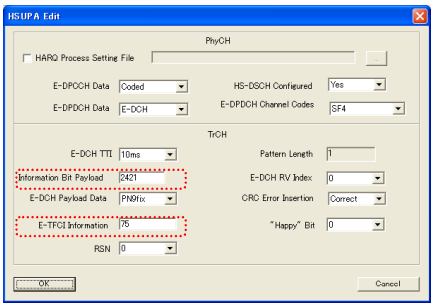


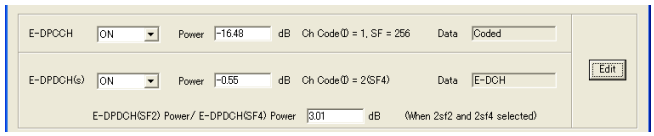
Sub-test 4



UL RMC HSUPA Sub-test 1



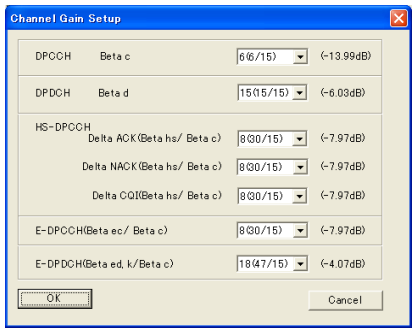


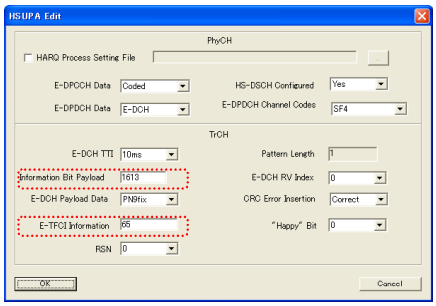


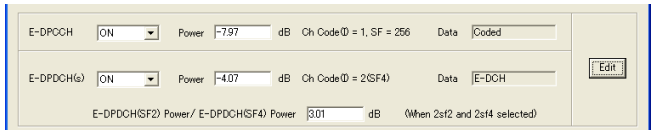
3GPP TS 25.321 Annex B.3

E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	30	389	60	1316	90	4452	120	15051
1	120	31	405	61	1371	91	4636	121	15675
2	124	32	422	62	1428	92	4828	122	16325
3	130	33	440	63	1487	93	5029	123	17001
4	135	34	458	64	1549	94	5237	124	17706
5	141	35	477	65	1613	95	5454	125	18440
6	147	36	497	66	1680	96	5680	126	19204
7	153	37	517	67	1749	97	5915	127	20000
8	159	38	539	68	1822	98	6161		
9	166	39	561	69	1897	99	6416		
10	172	40	584	70	1976	100	6682		
11	180	41	608	71	2058	101	6959		
12	187	42	634	72	2143	102	7247		
13	195	43	660	73	2232	103	7547		
14	203	44	687	74	2325	104	7860		
15	211	45	716	75	2421	105	8186		
16	220	46	745	76	2521	106	8525		
17	229	47	776	77	2626	107	8878		
18	239	48	809	78	2735	108	9246		
19	249	49	842	79	2848	109	9629		
20	259	50	877	80	2966	110	10028		
21	270	51	913	81	3089	111	10444		
22	281	52	951	82	3217	112	10877		
23	293	53	991	83	3350	113	11328		
24	305	54	1032	84	3489	114	11797		
25	317	55	1074	85	3634	115	12286		
26	331	56	1119	86	3784	116	12795		
27	344	57	1165	87	3941	117	13325		
28	359	58	1214	88	4105	118	13877		
29	374	59	1264	89	4275	119	14453		

UL RMC HSUPA Sub-test 2





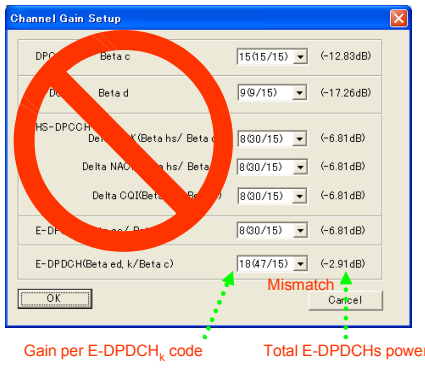


3GPP TS 25.321 Annex B.3

E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	30	389	60	1316	90	4452	120	15051
1	120	31	405	61	1371	91	4636	121	15675
2	124	32	422	62	1428	92	4828	122	16325
3	130	33	440	63	1487	93	5029	123	17001
4	135	34	458	64	1549	94	5237	124	17706
5	141	35	477	65	1613	95	5454	125	18440
6	147	36	497	66	1680	96	5680	126	19204
7	153	37	517	67	1749	97	5915	127	20000
8	159	38	539	68	1822	98	6161		
9	166	39	561	69	1897	99	6416		
10	172	40	584	70	1976	100	6682		
11	180	41	608	71	2058	101	6959		
12	187	42	634	72	2143	102	7247		
13	195	43	660	73	2232	103	7547		
14	203	44	687	74	2325	104	7860		
15	211	45	716	75	2421	105	8186		
16	220	46	745	76	2521	106	8525		
17	229	47	776	77	2626	107	8878		
18	239	48	809	78	2735	108	9246		
19	249	49	842	79	2848	109	9629		
20	259	50	877	80	2966	110	10028		
21	270	51	913	81	3089	111	10444		
22	281	52	951	82	3217	112	10877		
23	293	53	991	83	3350	113	11328		
24	305	54	1032	84	3489	114	11797		
25	317	55	1074	85	3634	115	12286		
26	331	56	1119	86	3784	116	12795		
27	344	57	1165	87	3941	117	13325		
28	359	58	1214	88	4105	118	13877		
29	374	59	1264	89	4275	119	14453		

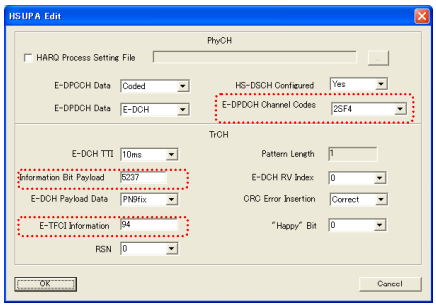
UL RMC HSUPA Sub-test 3

Not available to E-DPDCH multi-code



Gain per E-DPDCH$_k$ code

Total E-DPDCHs power

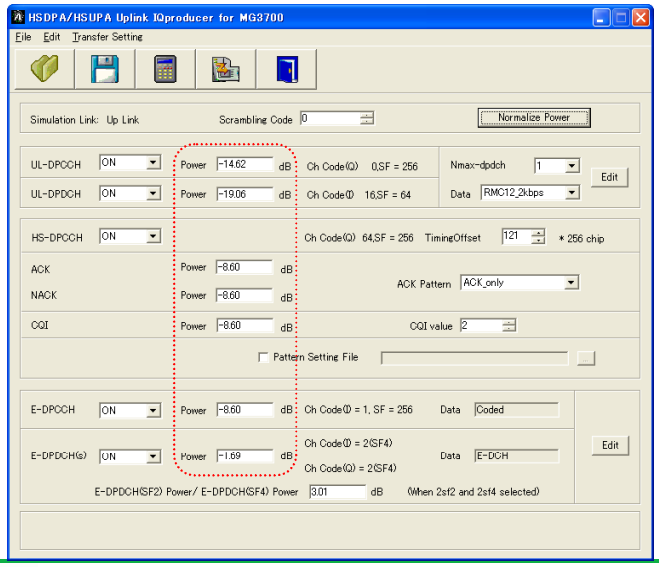


3GPP TS 25.321 Annex B.3

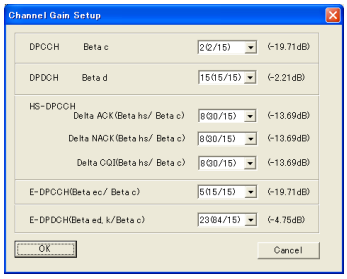
E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	30	389	60	1316	90	4452	120	15051
1	120	31	405	61	1371	91	4636	121	15675
2	124	32	422	62	1428	92	4828	122	16325
3	130	33	440	63	1487	93	5029	123	17001
4	135	34	458	64	1549	94	5237	124	17706
5	141	35	477	65	1613	95	5454	125	18440
6	147	36	497	66	1680	96	5680	126	19204
7	153	37	517	67	1749	97	5915	127	20000
8	159	38	539	68	1822	98	6161		
9	166	39	561	69	1897	99	6416		
10	172	40	584	70	1976	100	6682		
11	180	41	608	71	2058	101	6959		
12	187	42	634	72	2143	102	7247		
13	195	43	660	73	2232	103	7547		
14	203	44	687	74	2325	104	7860		
15	211	45	716	75	2421	105	8186		
16	220	46	745	76	2521	106	8525		
17	229	47	776	77	2626	107	8878		
18	239	48	809	78	2735	108	9246		
19	249	49	842	79	2848	109	9629		
20	259	50	877	80	2966	110	10028		
21	270	51	913	81	3089	111	10444		
22	281	52	951	82	3217	112	10877		
23	293	53	991	83	3350	113	11328		
24	305	54	1032	84	3489	114	11797		
25	317	55	1074	85	3634	115	12286		
26	331	56	1119	86	3784	116	12795		
27	344	57	1165	87	3941	117	13325		
28	359	58	1214	88	4105	118	13877		
29	374	59	1264	89	4275	119	14453		

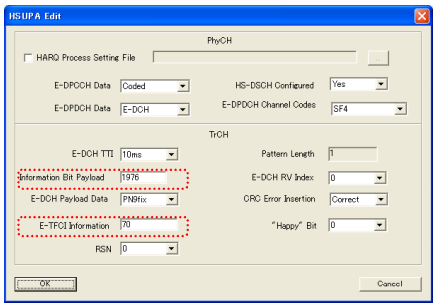
UL RMC HSUPA Sub-test 3

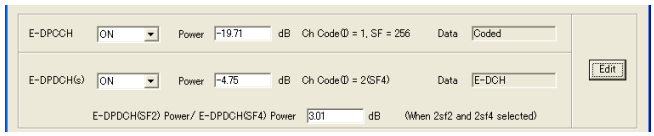
- Setting calculated channel powers



UL RMC HSUPA Sub-test 4



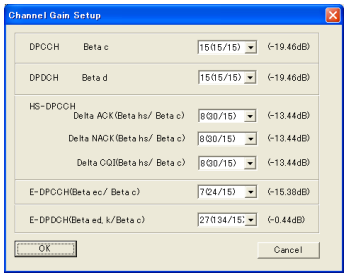


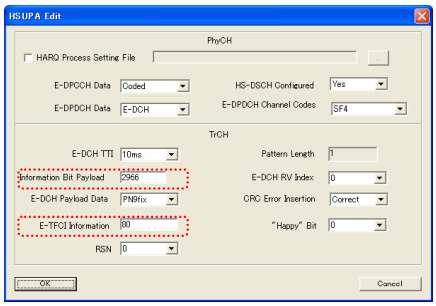


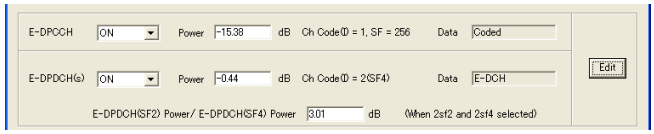
3GPP TS 25.321 Annex B.3

E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	30	389	60	1316	90	4452	120	15051
1	120	31	405	61	1371	91	4636	121	15675
2	124	32	422	62	1428	92	4828	122	16325
3	130	33	440	63	1487	93	5029	123	17001
4	135	34	458	64	1549	94	5237	124	17706
5	141	35	477	65	1613	95	5454	125	18440
6	147	36	497	66	1680	96	5680	126	19204
7	153	37	517	67	1749	97	5915	127	20000
8	159	38	539	68	1822	98	6161		
9	166	39	561	69	1897	99	6416		
10	172	40	584	70	1976	100	6682		
11	180	41	608	71	2058	101	6959		
12	187	42	634	72	2143	102	7247		
13	195	43	660	73	2232	103	7547		
14	203	44	687	74	2325	104	7860		
15	211	45	716	75	2421	105	8186		
16	220	46	745	76	2521	106	8525		
17	229	47	776	77	2626	107	8878		
18	239	48	809	78	2735	108	9246		
19	249	49	842	79	2848	109	9629		
20	259	50	877	80	2966	110	10028		
21	270	51	913	81	3089	111	10444		
22	281	52	951	82	3217	112	10877		
23	293	53	991	83	3350	113	11328		
24	305	54	1032	84	3489	114	11797		
25	317	55	1074	85	3634	115	12286		
26	331	56	1119	86	3784	116	12795		
27	344	57	1165	87	3941	117	13325		
28	359	58	1214	88	4105	118	13877		
29	374	59	1264	89	4275	119	14453		

UL RMC HSUPA Sub-test 5



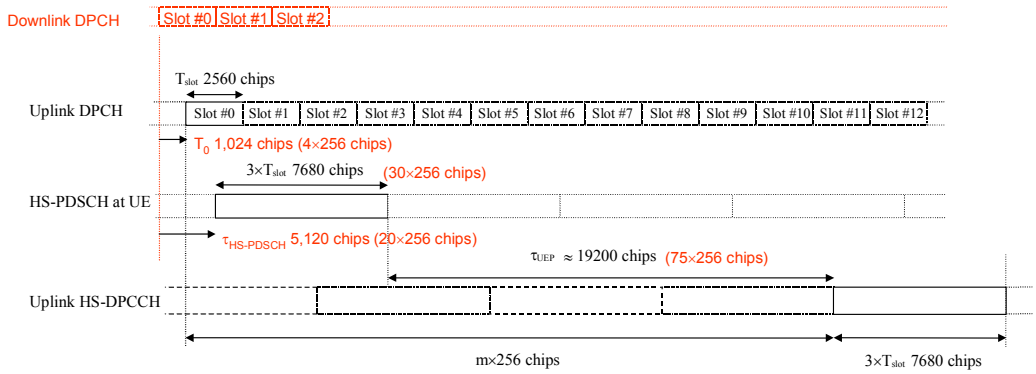




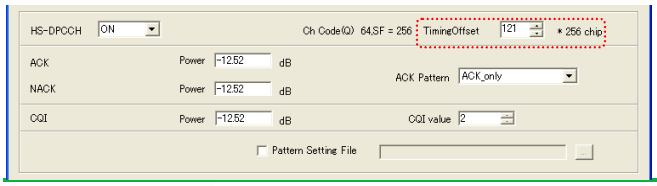
3GPP TS 25.321 Annex B.3

E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)	E-TFCI	TB Size (bits)
0	18	30	389	60	1316	90	4452	120	15051
1	120	31	405	61	1371	91	4636	121	15675
2	124	32	422	62	1428	92	4828	122	16325
3	130	33	440	63	1487	93	5029	123	17001
4	135	34	458	64	1549	94	5237	124	17706
5	141	35	477	65	1613	95	5454	125	18440
6	147	36	497	66	1680	96	5680	126	19204
7	153	37	517	67	1749	97	5915	127	20000
8	159	38	539	68	1822	98	6161		
9	166	39	561	69	1897	99	6416		
10	172	40	584	70	1976	100	6682		
11	180	41	608	71	2058	101	6959		
12	187	42	634	72	2143	102	7247		
13	195	43	660	73	2232	103	7547		
14	203	44	687	74	2325	104	7860		
15	211	45	716	75	2421	105	8186		
16	220	46	745	76	2521	106	8525		
17	229	47	776	77	2626	107	8878		
18	239	48	809	78	2735	108	9246		
19	249	49	842	79	2848	109	9629		
20	259	50	877	80	2966	110	10028		
21	270	51	913	81	3089	111	10444		
22	281	52	951	82	3217	112	10877		
23	293	53	991	83	3350	113	11328		
24	305	54	1032	84	3489	114	11797		
25	317	55	1074	85	3634	115	12286		
26	331	56	1119	86	3784	116	12795		
27	344	57	1165	87	3941	117	13325		
28	359	58	1214	88	4105	118	13877		
29	374	59	1264	89	4275	119	14453		

HS-PDSCH Timing

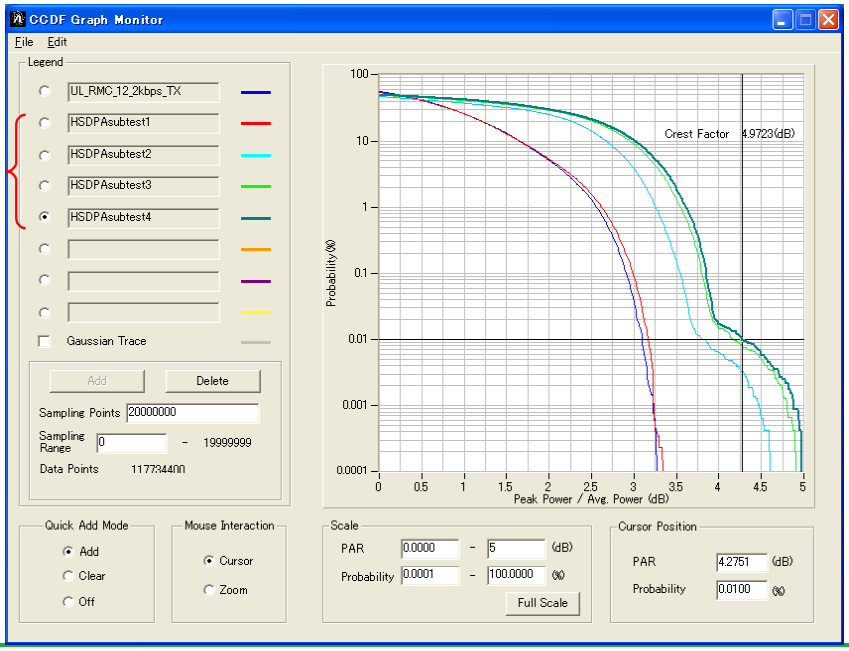


$m = (T_{TX\_diff}/256) + 101$ T_{TX_diff} = 0, 256, ..., 38144 chips



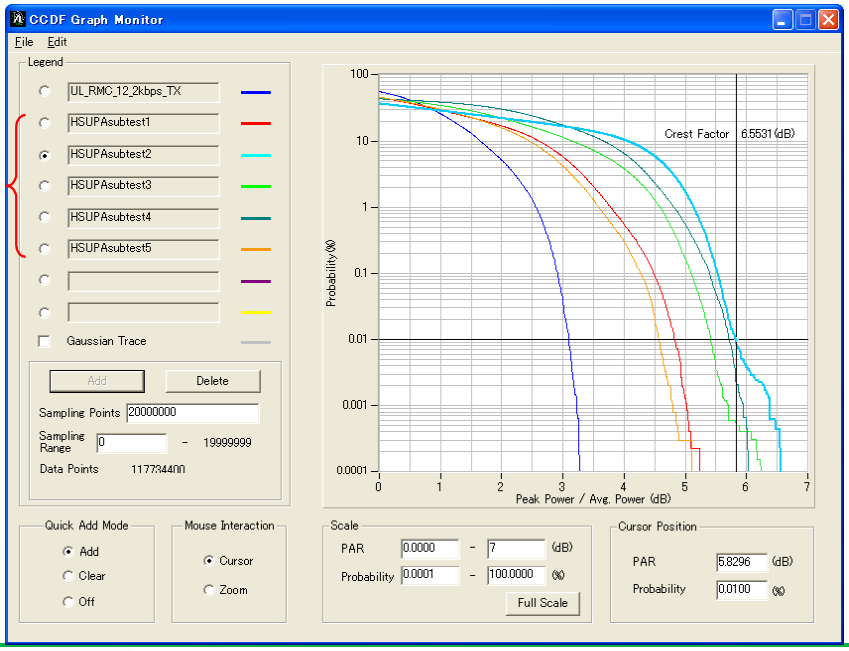
UL RMC for UE Transmitter Test
CCDF Simulation

RMC HSDPA



UL RMC for UE Transmitter Test
CCDF Simulation

RMC HSUPA



Number of created frames

The MG3700A has two arbitrary waveform memories from which different waveform patterns can be output separately. It is possible to add two signals, such as a desired signal + AWGN, using the baseband for output as one RF signal.
When using memories A and B individually as normal, the memory length may be insufficient for handling a waveform pattern with a long period that is used in a receiver test. A long-period waveform pattern may be caused as a result of the settings for SFN included in BCH, or the settings for HARQ Process Cycle when [PN9] is selected for the DCH data type. This problem can be resolved by using the capacities of both memories A and B to generate a waveform pattern. This is supported by switching memories A and B alternately as shown in Fig. B-1. Note that it is not possible to add two signals such as AWGN and interference signals in this case.
If the data length is still insufficient using the above memory configuration, use the function to execute filtering processing using the FIR filter of the hardware incorporated in the MG3700A as shown in Fig. B-2. If a filtered waveform pattern at data generation exceeds the total capacity of memories A and B, this hardware filtering function is used to generate the waveform pattern automatically.
However, waveform patterns used in this configuration cannot be used for interference signals because the number of FIR filter taps is less than the normal waveform pattern. In this case, it is also not possible to add two signals, such as AWGN and interference signals.

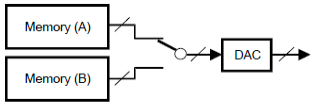


Fig. B-1 Pattern using FIR filter

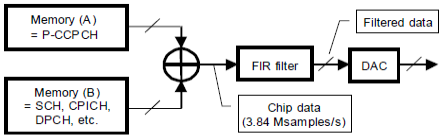


Fig. B-2 Block diagram with FIR filter used

Table B-1 Maximum number of generatable frames for each condition

ARB Memory Expansion Option	FIR Filter	Used Memory	Max. No. of Frames	Addition of AWGN and Interference Signal
Installed	Unused	A or B	2330	Enabled
		A and B	4660	Disabled
	Used	A and B	A: 27962 B: 6990	Disabled
Not installed	Unused	A or B	1165	Enabled
		A and B	2330	Disabled
	Used	A and B	A: 13981 B: 3495	Disabled

Number of downlink frames

- When SFN Cycle set to Short, and when number of frames after calculation does not exceed maximum number of frames for unused FIR filter

Frames =

(Least common multiple of HARQ Process Cycle of HSDPA 1 to 4 set to ON (or Frame Number of Process Setting File of HARQ that is ON)) × (•"511" if any Data set to PN9
•"1" if no Data set to PN9) ÷ (•"5" if any HS-PDSCH items for which Process Setting File checkbox selected and [1] is multiple of 5
•Otherwise, "1") × (•Least common multiple for maximum TTI of TrCH and 2 if DPCH Data is TrCH
•Otherwise, "2")

[1] [2] [3] [4]

- When SFN Cycle set to 4096 frames, or when number of frames obtained above exceeds maximum number of frames for unused FIR filter

Frames for P-CCPCH in Memory A =

(•"4096" if SFN Cycle set to 4096 frames
•"2" if SFN Cycle set to Short and all of HS-PDSCH 1 to 4 set to OFF
•Least common multiple for maximum TTI of TrCH and 2 if SFN Cycle set to Short, any HS-PDSCH set to ON, and DPCH Data set to TrCH
•"2" if SFN Cycle set to Short, any HS-PDSCH set to ON, and DPCH Data not set to TrCH)

Frames for other channels in Memory B =

(Least common multiple of HARQ Process Cycle of HSDPA 1 to 4 set to ON (or Frame Number of Process Setting File of HARQ that is ON)) × (•"511" if any Data set to PN9
•"1" if no Data set to PN9) ÷ (•"5" if any HS-PDSCH items for which Process Setting File checkbox selected and [1] is multiple of 5
•Otherwise, "1") × (•Least common multiple for maximum TTI of TrCH and 2 if DPCH Data is TrCH
•Otherwise, "2")

[1] [2] [3] [4]

Number of uplink frames

- When number of frames after calculation does not exceed the maximum number of frames for unused FIR filter

Frames =

LCM [•"Pattern Cycle/5" if Pattern Setting File checkbox selected while HS-DPCCH is ON, and Pattern Cycle is a multiple of 5 •"Pattern Cycle" if Pattern Setting File checkbox is selected while HS-DPCCH is ON, and Pattern Cycle is not multiple of 5 •"3" if alt_ACK_NACK_DTX selected while HS-DPCCH is ON •Otherwise, "1" , •"511" if any Data set to PN9 among valid Data Type •Otherwise, "1" , •"Maximum TTI among TrCHs set to ON" if UL-DPDCH is ON and DPCH Data is TrCH •Otherwise, "1" , •"Pattern Length" if HARQ process setting file selected •Otherwise, "1"]

- When number of frames obtained above exceeds maximum number of frames for unused FIR filter

Frames for DPDCH/DPCCH in Memory A =

LCM [•"511" if UL-DPDCH or UL-DPCCH is ON, and any Data for UL-DPDCH/UL-DPCCH set to PN9 •Otherwise, "1" , •"Maximum TTI among TrCHs set to ON" if UL-DPDCH is ON and DPCH Data is TrCH •Otherwise, "1"]

Frames for HS-DPCCH/E-DPDCH/E-EPCCH in Memory B =

LCM [•"Pattern Cycle/5" if Pattern Setting File checkbox selected while HS-DPCCH is ON, and Pattern Cycle is multiple of 5 •"Pattern Cycle" if Pattern Setting File checkbox selected while HS-DPCCH is ON, and Pattern Cycle is not multiple of 5 •"3" if alt_ACK_NACK_DTX selected while HS-DPCCH is ON •Otherwise, "1" , •"511" if E-DPDCH or E-DPCCH is ON, and any Data for E-DPDCH or UL-DPCCH set to PN9 •Otherwise, "1"]

- *LCM*( ) = Least common multiple for values in parentheses

Transmitter Requirements for HSPA UE

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

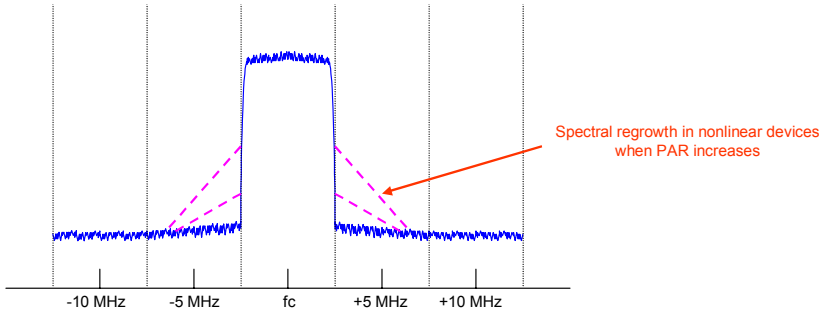
Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-3.7	+21	+2.7/-2.7
2	+22	+3.7/-3.7	+19	+4.7/-2.7
3	+23	+2.7/-3.7	+20	+3.7/-2.7
4	+22	+3.7/-3.7	+19	+4.7/-2.7
5	+24	+1.7/-3.7	+21	+2.7/-2.7

- Output Power
  - HSDPA and HSUPA introduces a new uplink channels HS-DPCCH, E-DPCCH, E-DPDCH.
  - They is transmitted in parallel with DPDCH/DPCCH generating a multicode transmission. Multicode transmission requires higher linearity for UE transmitter RF parts due to the PAR increase. The 3GPP specifications allow the UE to reduce the maximum output power for time slots when HS-DPCCH or E-DPDCH/E-DPCCH is transmitted.
  - The term 'cubic metric' (CM) is introduced as a measure for allowed power reduction. The specifications allow reduction of the maximum output power when the CM is increased due to use of parallel code channels over the reference CM value of 1 (CM=1 for β_c/β_d=12/15, β_{hs}/β_c=24/15). Thus, maximum power reduction (MPR) is calculated against the CM value of 1, and the maximum CM value is 3.5, equal to the maximum allowed -2 dB power reduction.
    - CM is defined rounding upwards in 0.5 steps as:

    CM = CEIL { [20 * log10 $((v\_norm^3)_{rms})$ – 20 * log10 $((v\_norm\_ref^3)_{rms})$] / k, 0.5 }
      - Where 'k' is 1.85 when channelization codes are taken only from the lower half of the code tree, otherwise 'k' is 1.56, with 'v_norm' representing the normalized voltage waveform of the input signal and 'v_norm_ref' representing the normalized voltage waveform of the reference signal (12.2 kbps AMR speech).

Transmitter Requirements for HSPA UE

- Adjacent Channel Leakage Power Ratio (ACLR)
  - ACLR specifies the amount of power allowed to leak into adjacent carriers. It is the ratio of the RRC filtered mean power centered on the assigned channel frequency to the RRC filtered mean power centered on an adjacent channel frequency.
  - If no reduction in power was allowed as PAR increases, it would be difficult to maintain ACLR performance.

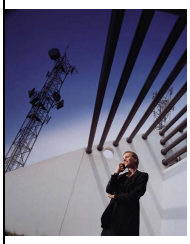


Transmitter Requirements for HSPA UE

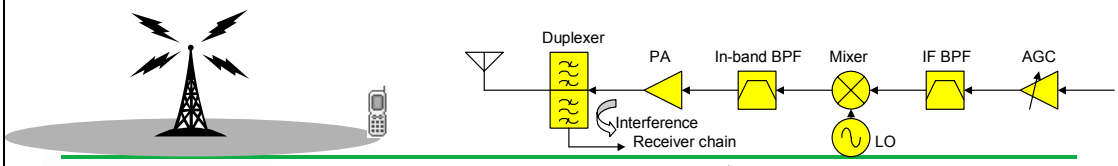
- Transmit Modulation
  - Transmit modulation requirements do not have specific HSDPA-related additions, but with HSUPA there are now similar issues to those of BS EVM, which specifies how much a particular BS transmitter chain leaks power between downlink channelization codes. This has been made tighter for BSs using HSDPA due to the introduction of 16QAM.
  - New modulation was not introduced in the uplink with HSUPA, so HPSK is still being used. EVM with multicode transmission specifies how much power leaks from one code to the other due to transmitter phase inaccuracy even if the code channels remain orthogonal in an ideal channel.
  - The DPCCH power level with SF256 is far below the power level of SF4 or SF2 of the E-DPDCH. The smaller SF makes interference between parallel E-DPDCHs more critical, because the processing gain is small and does not help in suppressing interference. Existing EVM requirements are valid also for HSUPA transmission.

Receiver Requirements for HSPA UE

- Sensitivity



  - The sensitivity test is performed with the UE transmitter at full power (21 dBm or 24 dBm), as would most likely be the case at the edge of cell coverage. This allows for leakage of transmitter power to the receiver band. The sensitivity test is defined only for the 12.2 kbps voice reference test channel.
    - There are no HSDPA-specific or HSUPA-specific tests related to receiver sensitivity.
  - To achieve the required performance in the test case, quite large attenuation is required between the transmitter and receiver. The signal sent to the duplex filter in the UE is a higher power than the actual output power, due to attenuation by the duplex filter itself. Separation between transmitter and receiver must be achieved with both available duplex filter separation and band pass filters in the transmitter chain.
    - Note the example transmitter shown in the figure using intermediate frequency in the transmitter section is only one of many possible solutions.



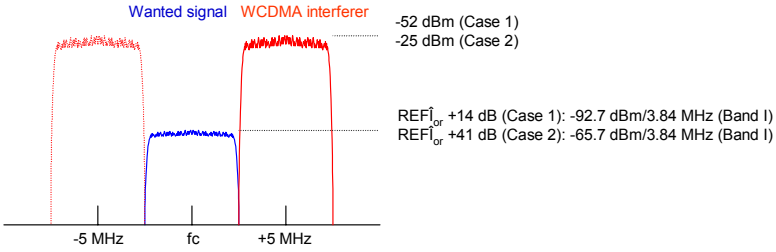
Receiver Requirements for HSPA UE

- Maximum Input Level

  - Introduction of 16QAM makes it necessary to preserve more accurate phase and amplitude information throughout the receiver chain. Otherwise, 16QAM performance is severely degraded. To avoid this, a specific test case tests UE performance at the maximum input signal. This corresponds to when the UE is close to the BS in an area using 16QAM. The test case measures throughput to ensure proper HSDPA receiver chain operation at maximum input level. This makes the test case applicable to all devices supporting 16QAM. All UEs in Categories 1 to 10 can use this test case to validate tolerance to high input signal levels. Additionally, there is a separate test case using QPSK-only to test UE Categories 11 and 12.
  - The HSDPA test case requires a throughput of 700 kbps with four codes and transmission in every third TTI. For reference, the maximum throughput with four codes and every third TTI is 960 kbps.

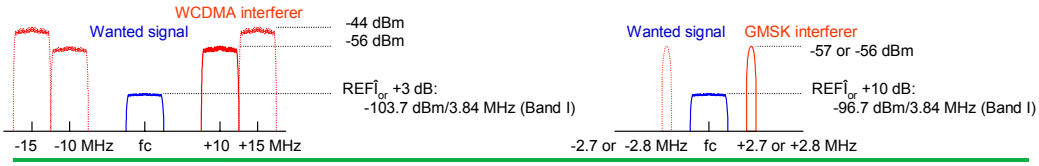
Receiver Requirements for HSPA UE

- Adjacent Channel Selectivity (ACS)
  - ACS verifies how much higher the power level of the adjacent carrier can be while the UE can still operate at its current frequency. The 3GPP specifications require an ACS of 33 dB. In UE design, ACS is obtained by the channel filter and baseband digital filtering.



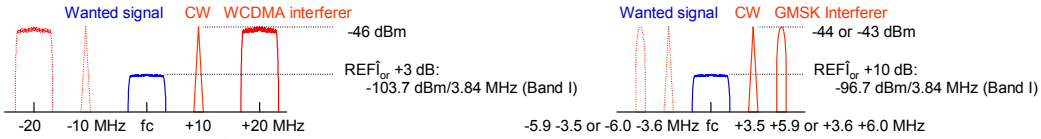
Receiver Requirements for HSPA UE

- Blocking
  - In-band blocking verifies how high signal levels from carriers must be for the UE to receive signals in the same frequency band. There are requirements for different frequency offsets of 10 and 15 MHz. The 5 MHz offset case is covered by the ACS test.
  - Narrow band blocking is another set of requirements covering situations in which a 2G narrowband system has been deployed in the same frequency band. The requirement is valid for UMTS 850, UMTS 1800, or UMTS 1900. The test signal is a GMSK-modulated signal with a central frequency that is either 2.7 or 2.8 MHz from the WCDMA central frequency.
  - If GSM and WCDMA BSs are co-located, the signals received at the UE are on the same level, avoiding blocking problems. The blocking requirement is only relevant when GSM and WCDMA are deployed without coordinated, such as by different operators using different sites.



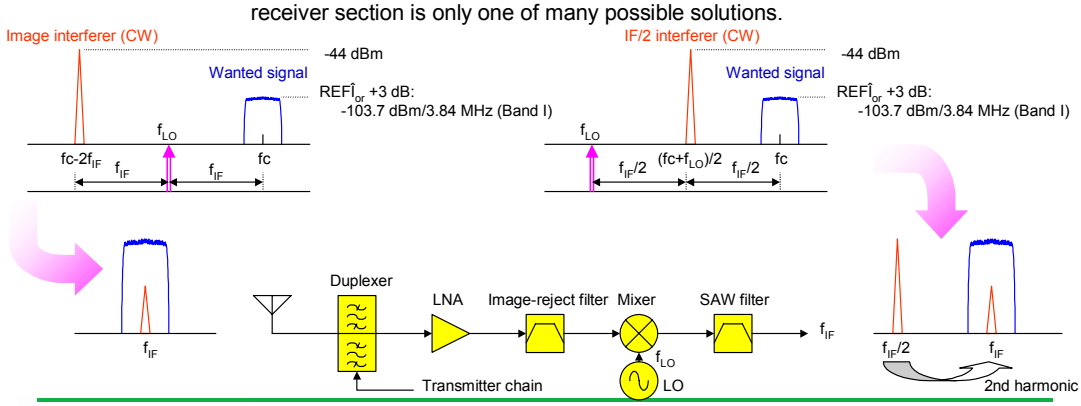
Receiver Requirements for HSPA UE

- Intermodulation
  - Intermodulation verifies the UE receiver tolerance of third-order intermodulation product generated by two high-power signals that are 10 MHz and 20 MHz apart. This requirement is to maintain performance in the case where several systems co-exist in the area. The test signal that is 10 MHz apart is a narrowband continuous wave signal while one that is 20 MHz apart is a wideband signal.
  - Additionally, there is a narrow band intermodulation test case for bands where deployment with narrowband systems is most likely. In this additional case, there are two narrowband signals with continuous wave signals that are 3.5 or 3.6 MHz apart and GMSK-modulated signals that are 5.9 or 6.0 MHz apart.



Receiver Requirements for HSPA UE

- Spurious Response
  - Spurious Response verifies the tolerance to high-level interference signals without undue degradation of receiver sensitivity. The interference frequencies that the receiver may respond to are typically an image frequency and an IF/2 (Half-IF) frequency.
  - The image-reject filter upstream of the mixer rejects the image signal and IF/2 signal.
    - Note the example receiver shown in the figure using intermediate frequency in the receiver section is only one of many possible solutions.



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