

# CDMA2000 Test

MG3700A  
Vector Signal Generator

# Application Note ~ CDMA2000 Test ~

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# MG3700A

## Vector Signal Generator



April 2006  
(2.00)

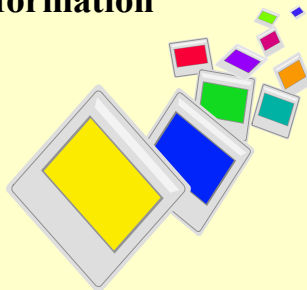
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# Band Class

3GPP2 C.S0057-A

- Band Class 0 (800 MHz Band)**

System Designator	Band Subclass	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
A	0	824.025-835.005	869.025-880.005
		844.995-846.495	889.995-891.495
	1	824.025-835.005	869.025-880.005
B	0	844.995-848.985	889.995-893.985
		824.025-829.995	869.025-874.995
	3	815.025-829.995	860.025-874.995
	1	835.005-844.995	880.005-889.995

- Band Class 1 (1900 MHz Band)**

Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	1850-1865	1930-1945
D	1865-1870	1945-1950
E	1870-1885	1950-1965
F	1885-1890	1965-1970
G	1890-1895	1970-1975
H	1895-1910	1975-1990

- Band Class 2 (TACS Band)**

Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	872.0125-879.9875	917.0125-924.9875
	890.0125-897.4875	935.0125-942.4875
	905.0125-908.9875	950.0125-953.9875
B	880.0125-887.9875	925.0125-932.9875
	897.5125-904.9875	942.5125-949.9875
	909.0125-914.9875	954.0125-959.9875

- Band Class 3 (JTACS Band)**

System Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	887.0125-888.9875	832.0125-833.9875
	893.0125-896.0000	838.0125-843.0000
	898.0125-900.9875	843.0125-845.9875
	915.0125-924.9875	860.0125-869.9875
B	Not specified	Not specified

- Band Class 4 (Korean PCS Band)**

Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	1750-1760	1840-1850
B	1760-1770	1850-1860
C	1770-1780	1860-1870

- Band Class 5 (450 MHz Band)**

Block Designator	Band Subclass	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
A	0	452.500-457.475	462.500-467.475
B	1	452.000-456.475	462.000-466.475
C	2	450.000-454.800	460.000-464.800
D	3	411.675-415.850	421.675-425.850
E	4	415.500-419.975	425.500-429.975
F	5	479.000-483.480	489.000-493.480
G	6	455.230-459.990	465.230-469.990
H	7	451.310-455.730	461.310-465.730
I	8	451.325-455.725	461.325-465.725
J	9	455.250-459.975	465.250-469.975
K	10	479.000-483.475	489.000-493.475

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# Band Class

- Band Class 6 (2-GHz Band)**

CDMA Channel Validity	CDMA Channel Number	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
Not Valid	0-24	1920.000-1921.200	2110.000-2111.200
Valid	25-1175	1921.250-1978.750	2111.250-2168.750
Not Valid	1176-1499	1978.800-1979.950	2168.800-2169.950

- Band Class 7 (700 MHz Band)**

Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	776-777	746-747
C	777-782	747-752
D	782-792	752-762
B	792-794	762-764

- Band Class 8 (1800 MHz Band)**

CDMA Channel Validity	CDMA Channel Number	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
Not Valid	0-24	1710.000-1711.200	1805.000-1806.200
Valid	25-1475	1711.250-1783.750	1806.250-1878.750
Not Valid	1476-1499	1783.800-1784.950	1878.800-1879.950

- Band Class 9 (900 MHz Band)**

CDMA Channel Validity	CDMA Channel Number	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
Not Valid	0-24	880.000-881.200	925.000-926.200
Valid	25-675	881.250-913.750	926.250-958.750
Not Valid	676-699	913.800-914.950	958.800-959.950

- Band Class 10 (Secondary-800 MHz Band)**

System Designator	Band Subclass	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
A	0	806.000-810.975	851.000-855.975
B	1	811.000-815.975	856.000-860.975
C	2	816.000-820.975	861.000-865.975
D	3	821.000-823.975	866.000-868.975
E	4	896.000-900.975	935.000-939.975

- Band Class 11 (400 MHz European PAMR Band)**

Block Designator	Band Subclass	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
A	0	452.500-457.475	462.500-467.475
B	1	452.000-456.475	462.000-466.475
C	2	450.000-454.800	460.000-464.800
D	3	411.675-415.850	421.675-425.850
E	4	415.500-419.975	425.500-429.975
F	5	Not specified	Not specified
G	6	Not specified	Not specified
H	7	Not specified	Not specified
I	8	451.325-455.725	461.325-465.725
J	9	455.250-459.975	465.250-469.975
K	10	479.000-483.475	489.000-493.475

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# Band Class

- Band Class 12 (800 MHz PAMR Band)**

Block Designator	Band Subclass	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
A	0	870.0125-875.9875	915.0125-920.9875
B	1	871.5125-874.4875	916.5125-919.4875
C	2	870.0125-875.9875	915.0125-920.9875

- Band Class 14 (US PCS 1.9-GHz Band)**

Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	1850-1865	1930-1945
D	1865-1870	1945-1950
B	1870-1885	1950-1965
E	1885-1890	1965-1970
F	1890-1895	1970-1975
C	1895-1910	1975-1990
G	1910-1915	1990-1995

- Band Class 13 (2.5-GHz IMT-2000 Extension Band)**

Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	2500-2505	2620-2625
B	2505-2510	2625-2630
C	2510-2515	2630-2635
D	2515-2520	2635-2640
E	2520-2525	2640-2645
F	2525-2530	2645-2650
G	2530-2535	2650-2655
H	2535-2540	2655-2660
I	2540-2545	2660-2665
J	2545-2550	2665-2670
K	2550-2555	2670-2675
L	2555-2560	2675-2680
M	2560-2565	2680-2685
N	2565-2570	2685-2690

- Band Class 15 (AWS Band)**

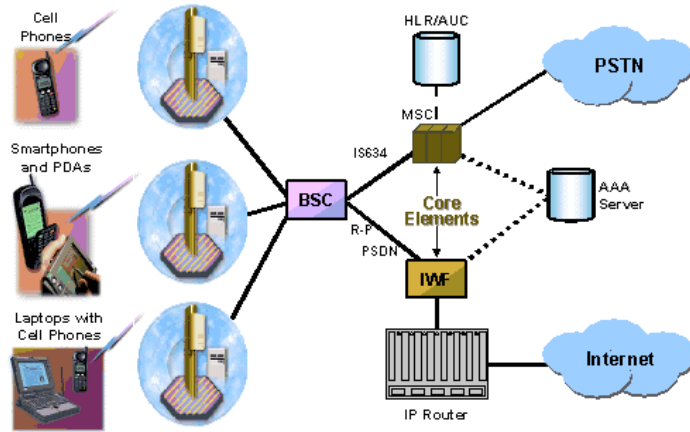
Block Designator	Transmit Frequency Band (MHz)	
	Mobile Station	Base Station
A	1710-1720	2110-2120
B	1720-1730	2120-2130
C	1730-1735	2130-2135
D	1735-1740	2135-2140
E	1740-1745	2140-2145
F	1745-1755	2145-2155

# Band Group

- Band Group 800**
  - » Band Class 0 (800 MHz Band)
  - » Band Class 2 (TACS Band)
  - » Band Class 3 (JTACS Band)
  - » Band Class 7 (700 MHz Band)
  - » Band Class 9 (900 MHz Band)
  - » Band Class 10 (Secondary 800 MHz Band)
  - » Band Class 12 (800 MHz PAMR Band)
- Band Group 1900**
  - » Band Class 1 (1900 MHz Band)
  - » Band Class 4 (Korean PCS Band)
  - » Band Class 6 (2-GHz Band)
  - » Band Class 8 (1800 MHz Band)
  - » Band Class 14 (US PCS 1.9-GHz Band)
  - » Band Class 15 (AWS Band)
- Band Group 450**
  - » Band Class 5 (450 MHz Band)
  - » Band Class 11 (400 MHz European PAMR Band)

# CDMA2000 1X Physical Channel Basics

CDMA2000 1X doubles the voice capacity of cdmaOne systems and offers packet data speeds of 153 kbps (Release 0) and 307 kbps (Release 1) in a 1.25 MHz channel.



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# RC for Forward Traffic Channels

Radio Configuration	Associated Spreading Rate	Data Rates, Forward Error Correction, and General Characteristics
1	1	1200, 2400, 4800, and 9600 bps data rates with R = 1/2, BPSK pre-spreading symbols
2	1	1800, 3600, 7200, and 14400 bps data rates with R = 1/2, BPSK pre-spreading symbols
3	1	1200, 1350, 1500, 2400, 2700, 4800, 9600, 19200, 38400, 76800, and 153600 bps data rates with R = 1/4, QPSK pre-spreading symbols, TD allowed
4	1	1200, 1350, 1500, 2400, 2700, 4800, 9600, 19200, 38400, 76800, 153600, and 307200 bps data rates with R = 1/2, QPSK pre-spreading symbols, TD and CCHS allowed
5	1	1800, 3600, 7200, 14400, 28800, 57600, 115200, and 230400 bps data rates with R = 1/4, QPSK pre-spreading symbols, TD and CCHS allowed
6	3	1200, 1350, 1500, 2400, 2700, 4800, 9600, 19200, 38400, 76800, 153600, and 307200 bps data rates with R = 1/6, QPSK pre-spreading symbols
7	3	1200, 1350, 1500, 2400, 2700, 4800, 9600, 19200, 38400, 76800, 153600, 307200, and 614400 bps data rates with R = 1/3, QPSK pre-spreading symbols
8	3	1800, 3600, 7200, 14400, 28800, 57600, 115200, 230400, and 460800 bps data rates with R = 1/4 (20 ms) or 1/3 (5 ms), QPSK pre-spreading symbols
9	3	1800, 3600, 7200, 14400, 28800, 57600, 115200, 230400, 259200, 460800, 518400, and 1036800 bps data rates with R = 1/2 (20 ms) or 1/3 (5 ms), QPSK pre-spreading symbols
10	1	43200, 81600, 86400, 158400, 163200, 172800, 312000, 316800, 326400, 465600, 619200, 624000, 633600, 772800, 931200, 1238400, 1248000, 1545600, 1862400, 2476800, and 3091200 bps subpacket data rates with R = 1/5, QPSK, 8-PSK, or 16-QAM pre-spreading symbols (see Table 3.1.3.1.14.4-1)

Compatible with cdmaOne

Unsupported 3X

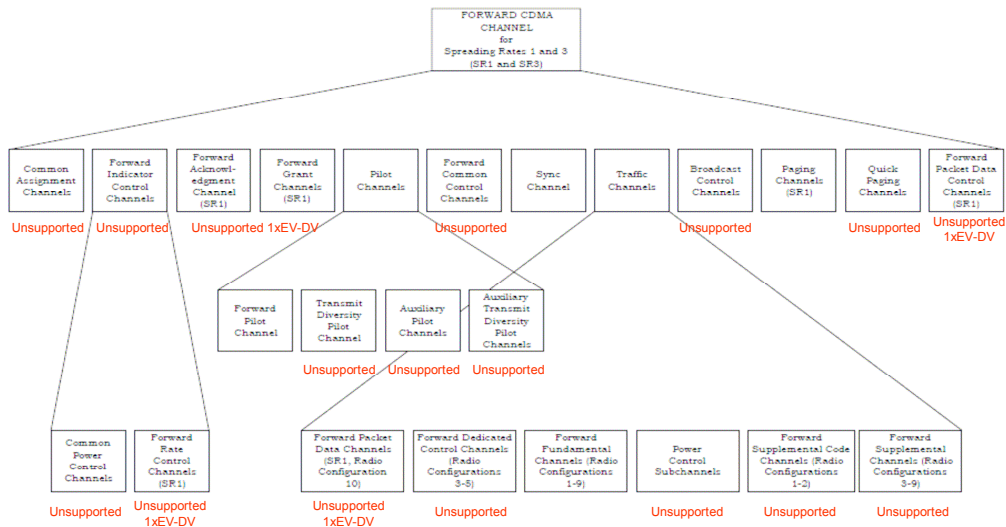
Unsupported 1xEV-DV

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# Forward Channels



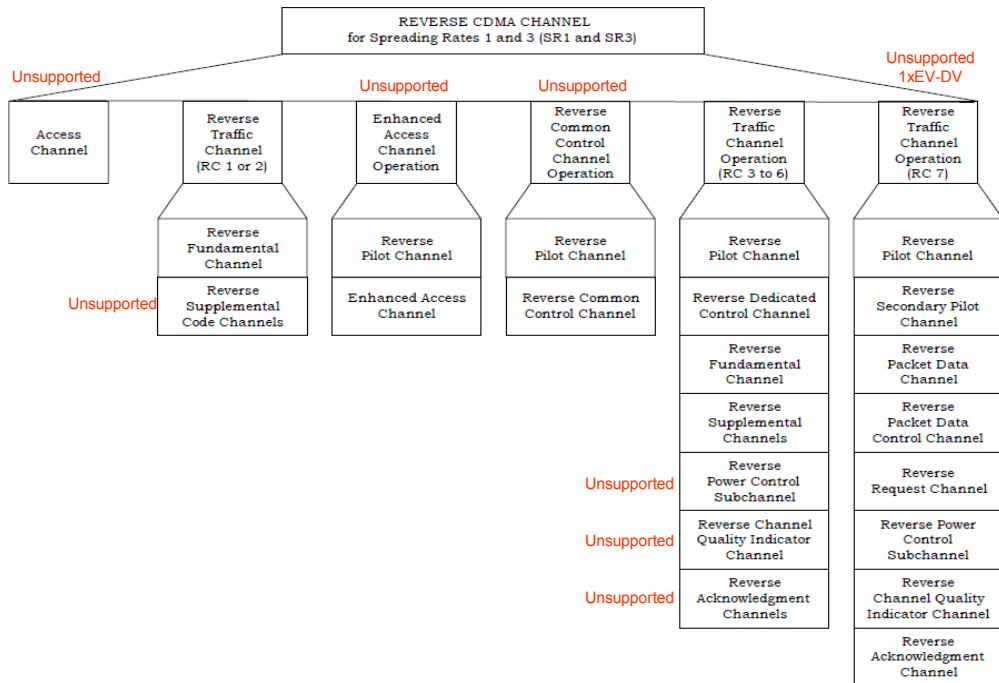
# Forward Physical Channels

- » *Forward Pilot Channel* is an unmodulated, direct-sequence spread-spectrum signal transmitted continuously by each BS. *Pilot Channel* allows an MS to acquire the timing of the Forward Channels, provides a phase reference for coherent demodulation, and provides a means for signal strength comparisons between BSs for determining when to handoff, and for forward link signal strength measurement.
- » *Sync Channel* is a code channel in the Forward Channels that transports the synchronization message to the MS.
- » *Paging Channel* is a code channel in the Forward Channels used for transmission of control information and pages from a BS to an MS.
- » *Forward Fundamental Channel* is a part of a *Forward Traffic Channel* that carries higher-level data. It can also carry power control information.
  - *Forward Traffic Channel* is one or more code channels used to transport user and signaling traffic from the BS to the MS.

# RC for Reverse Channels

Radio Config.	Associated Spreading Rate	Data Rates, Forward Error Correction, and General Characteristics	
1	1	1200, 2400, 4800, and 9600 bps data rates with $R = 1/3$ , 64-ary orthogonal modulation	Compatible with cdmaOne
2	1	1800, 3600, 7200, and 14400 bps data rates with $R = 1/2$ , 64-ary orthogonal modulation	
3	1	1200, 1350, 1500, 2400, 2700, 4800, 9600, 19200, 38400, 76800, and 153600 bps data rates with $R = 1/4$ , 307200 bps data rate with $R = 1/2$ , BPSK modulation with a pilot	Unsupported 3X
4	1	1800, 3600, 7200, 14400, 28800, 57600, 115200, and 230400 bps data rates with $R = 1/4$ , BPSK modulation with a pilot	
5	3	1200, 1350, 1500, 2400, 2700, 4800, 9600, 19200, 38400, 76800, and 153600 bps data rates with $R = 1/4$ , 307200 and 614400 bps data rate with $R = 1/3$ , BPSK modulation with a pilot	Unsupported 1xEV-DV
6	3	1800, 3600, 7200, 14400, 28800, 57600, 115200, 230400, and 460800 bps data rates with $R = 1/4$ , 1036800 bps data rate with $R = 1/2$ , BPSK modulation with a pilot	
7	1	19200, 40800, and 79200 bps subpacket data rates with $R = 1/5$ , BPSK modulation with a pilot; 156000, 309600, 463200, 616800, 924000, 1231200, and 1538400 bps subpacket data rates with $R = 1/5$ , QPSK modulation with one or two pilots; and 1845600 bps subpacket data rate with $R = 1/5$ , 8-PSK modulation with one or two pilots (see Table 2.1.3.1.1.4-1)	

# Reverse Channels

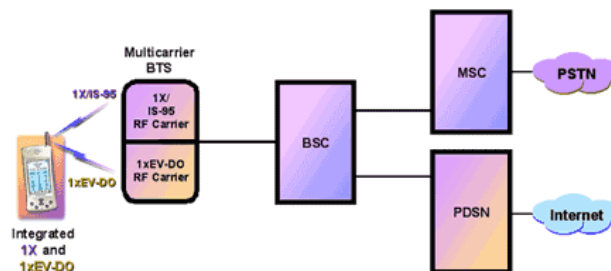


## Reverse Physical Channels

- » *Reverse Pilot Channel* is an unmodulated, direct-sequence spread-spectrum signal transmitted by an MS. It provides a phase reference for coherent demodulation and may provide a means for signal strength measurement.
- » *Reverse Dedicated Control Channel* is part of an RC 3 through 6 *Reverse Traffic Channel* used for transmission of higher-level data and control information from an MS to a BS.
- » *Reverse Fundamental Channel* is a part of an RC 1 through 6 *Reverse Traffic Channel* that carries higher-level data and control information from an MS to a BS.
- » *Reverse Supplemental Channel* is part of an RC 3 through 6 *Reverse Traffic Channel* that operates in conjunction with the *Reverse Fundamental Channel* or the *Reverse Dedicated Control Channel* in that *Reverse Traffic Channel* to provide higher data rate services, and on which higher-level data is transmitted.
  - *Reverse Traffic Channel* is one or more code channels used to transport user and signaling traffic from the MS to the BS.

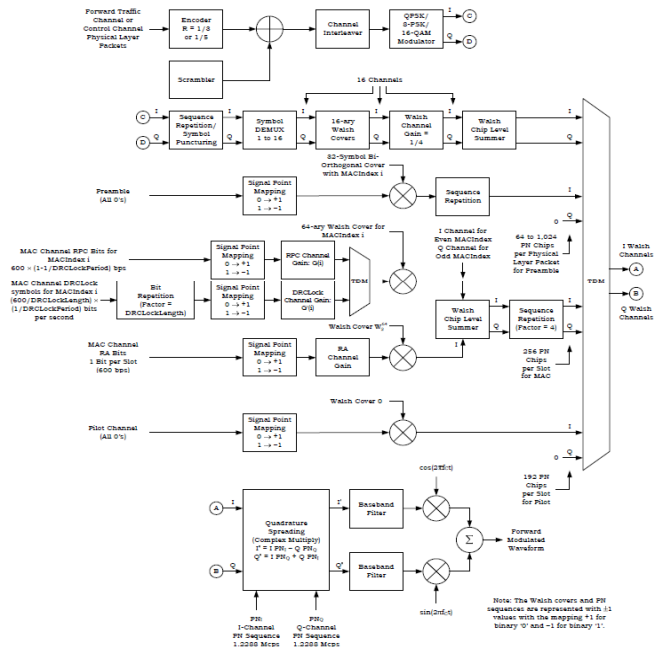
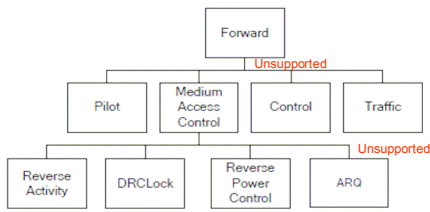
## CDMA2000 1xEV-DO Physical Channel Basics

- **Optimized for packet data services, CDMA2000 1xEV-DO Release 0 (subtype 0 physical layer) provides a peak data rate of 2.4 Mbps on the forward link and 153 kbps on the reverse link within a 1.25 MHz CDMA carrier. It leverages the existing suite of Internet Protocols (IP).**
- **CDMA2000 1xEV-DO Revision A (subtype 2 physical layer) provides a peak data rate of 1.8 Mbps on the reverse link and 3.1 Mbps on the forward link.**





# Structure of Forward Channels

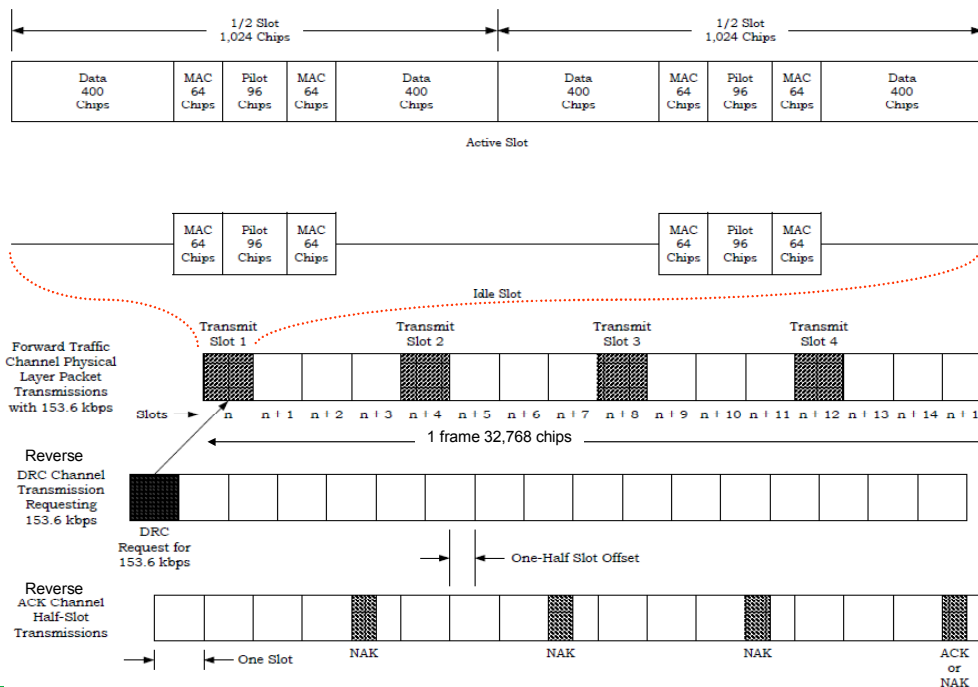


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# Forward Link Slot Structure



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## Modulation Parameters for Forward Traffic Channels and Control Channels

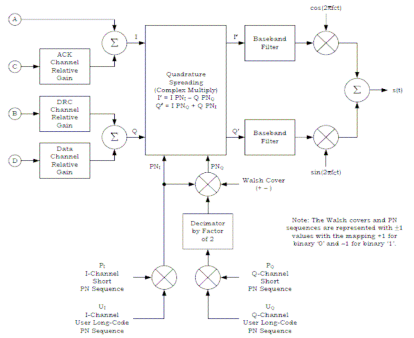
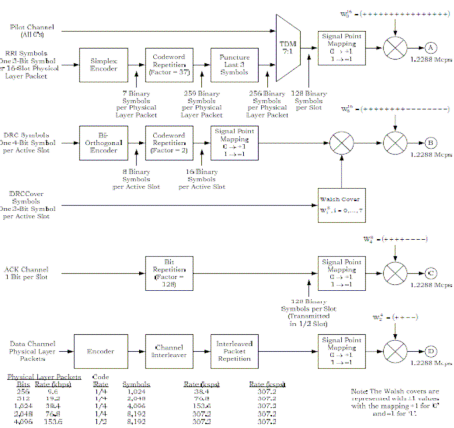
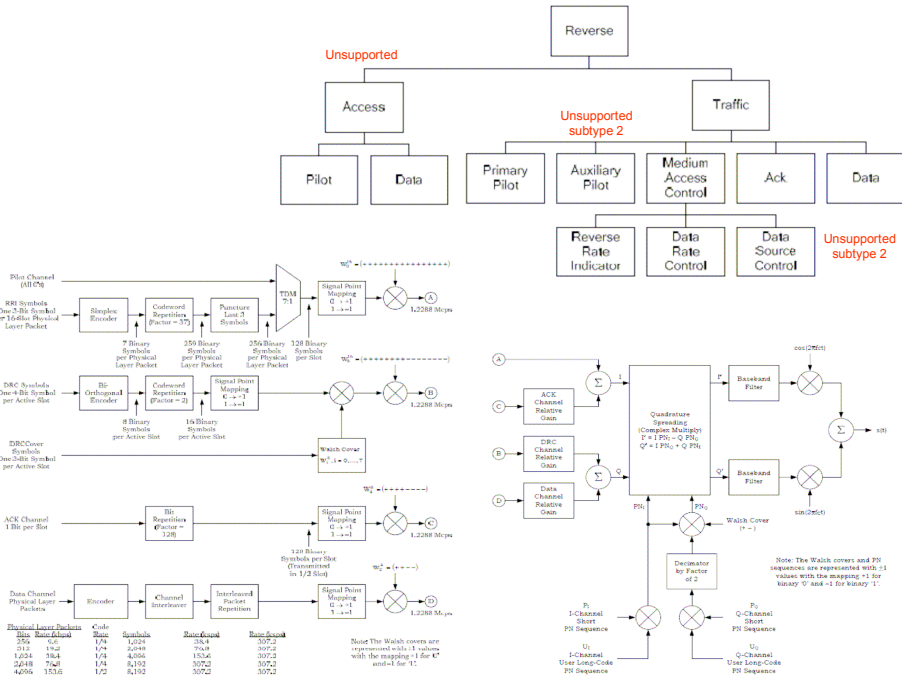
Data Rate (kbps)	Number of Values per Physical Layer Packet				
	Slots	Bits	Code Rate	Modulation Type	TDM Chips (Preamble, Pilot, MAC, Data)
38.4	16	1,024	1/5	QPSK	1,024 3,072 4,096 24,576
76.8	8	1,024	1/5	QPSK	512 1,536 2,048 12,288
153.6	4	1,024	1/5	QPSK	256 768 1,024 6,144
307.2	2	1,024	1/5	QPSK	128 384 512 3,072
614.4	1	1,024	1/3	QPSK	64 192 256 1,536

Data Rate (kbps)	Number of Values per Physical Layer Packet				
	Slots	Bits	Code Rate	Modulation Type	TDM Chips (Preamble, Pilot, MAC, Data)
307.2	4	2,048	1/3	QPSK	128 768 1,024 6,272
614.4	2	2,048	1/3	QPSK	64 384 512 3,136
1,228.8	1	2,048	1/3	QPSK	64 192 256 1,536
921.6	2	3,072	1/3	8-PSK	64 384 512 3,136
1,843.2	1	3,072	1/3	8-PSK	64 192 256 1,536
1,228.8	2	4,096	1/3	16-QAM	64 384 512 3,136
2,457.6	1	4,096	1/3	16-QAM	64 192 256 1,536

## Forward Physical Channels

- » *Forward Pilot Channel* is the part of the Forward Channels that carries the pilot.
- » *Forward MAC Reverse Activity (RA) Channel* is the part of the *Forward MAC Channel* that indicates activity level on the Reverse Channels.
- » *Forward MAC Reverse Power Control (RPC) Channel* is the part of the *Forward MAC Channel* that controls the power of the Reverse Channels for one particular AT.
- » *DRCLock Channel* is the part of the *Forward MAC Channel* that indicates to the AT whether or not the AN can receive the DRC sent by the AT.
- » *Forward Traffic Channel* is the part of the Forward Channels that carries information for a specific AT. It can be used as either a Dedicated Resource or a non-Dedicated Resource. Prior to successful AT authentication, it serves as a non-Dedicated Resource. Only after successful AT authentication can it be used as a Dedicated Resource for the specific AT.

# Structure of Reverse Channels



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# Modulation Parameters for Access Channel and Reverse Traffic Channel

Parameter	Data Rate (kbps)				
	9.6	19.2	38.4	76.8	153.6
Reverse Rate Index	1	2	3	4	5
Bits per Physical Layer Packet	256	512	1,024	2,048	4,096
Physical Layer Packet Duration (ms)	26.66...	26.66...	26.66...	26.66...	26.66...
Code Rate	1/4	1/4	1/4	1/4	1/2
Code Symbols per Physical Layer Packet	1,024	2,048	4,096	8,192	8,192
Code Symbol Rate (ksps)	38.4	76.8	153.6	307.2	307.2
Interleaved Packet Repeats	8	4	2	1	1
Modulation Symbol Rate (ksps)	307.2	307.2	307.2	307.2	307.2
Modulation Type	BPSK	BPSK	BPSK	BPSK	BPSK
PN Chips per Physical Layer Packet Bit	128	64	32	16	8

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## Reverse Physical Channels

- » *Reverse Traffic Pilot Channel* is the part of the *Reverse Traffic Channel* that carries the pilot.
- » *Reverse Traffic MAC Reverse Rate Indicator (RRI) Channel* is the part of the *Reverse Traffic Channel* that indicates the rate of the *Reverse Traffic Data Channel*.
- » *Reverse Traffic MAC Data Rate Control (DRC) Channel* is the part of the *Reverse Traffic Channel* that indicates the rate at which the AT can receive the *Forward Traffic Channel* and the sector from which the AT wishes to receive the *Forward Traffic Channel*.
- » *Reverse Traffic Ack Channel* is the part of the *Reverse Traffic Channel* that indicates the success or failure of the *Forward Traffic Channel* reception.
- » *Reverse Traffic Data Channel* is the part of the *Reverse Traffic Channel* that carries user data.

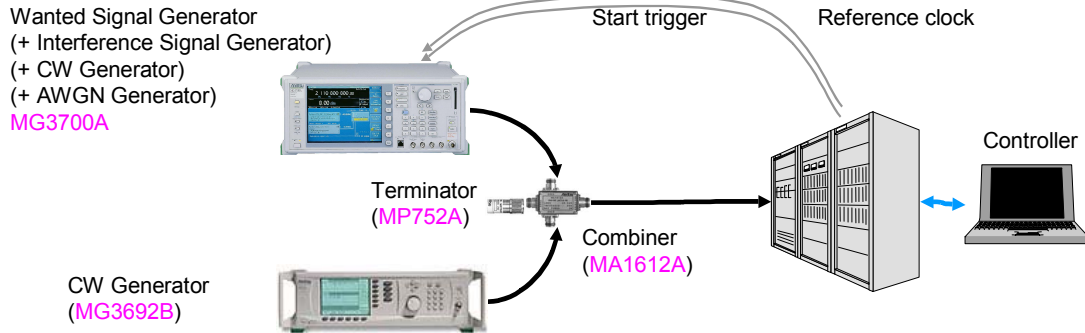
## 1X BS Tests

3GPP2 C.S0010-C v2.0  
3 Receiver  
4 Transmitter

Test		Wanted Signal Generator	Interference Signal Generator	CW Generator	AWGN Generator	Others	
3.6	Reverse Traffic Channel Demodulation Performance	MG3700A			*		
3.6.1	Performance in AWGN						
3.7.1	Receiver Sensitivity						
3.7.2	Receiver Dynamic Range				*		
3.7.3	Single Tone Desensitization				* or MG3642A 2.08 GHz		
3.7.4	Intermodulation Spurious Response Attenuation			* (for CW)	MG3692B 20 GHz or MG3642A 2.08 GHz		MA1612A 3 GHz Combiner
3.7.5	Adjacent Channel Selectivity (ACS) * Band Class 6 only			*			
3.7.6	Receiver Blocking * Band Class 6 only				MG3692B 20 GHz or MG3642A 2.08 GHz		
3.9	Received Signal Quality Indicator (RSQI)				*		
4.4.3	Inter-Base Station Transmitter Intermodulation		MG3700A			Spectrum Analyzer Circulator	

\*: 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
  - Apply only one.
    - 80 ms clock (Alignment of 20 ms frame clock and zero PN offset 26.67 ms clock: Short sequence rollover)
    - 2 s clock (Even second time mark)
- Reference clock
  - Apply only one.
    - Rear panel [Baseband Ref Clock] Input
      - 1.2288 MHz, 2 × 1.2288 MHz (2.4576 MHz), 4 × 1.2288 MHz (4.9152 MHz)
    - Rear panel [10 MHz/5 MHz Ref] Input
- Controller
  - Launches Reverse Traffic Channel in receivable state by FTM (Factory Test Mode) control
  - Reports Reverse Traffic Channel FER and RSQI

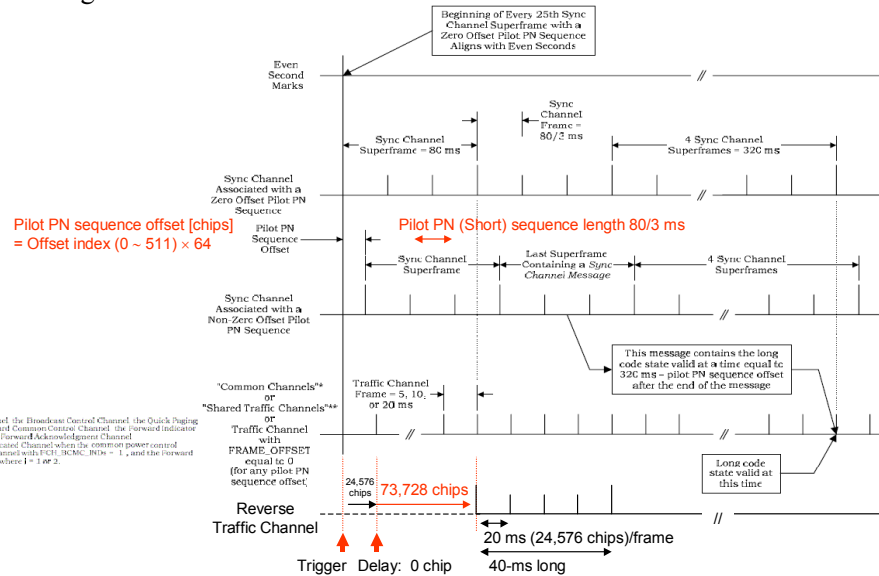
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# Timing Synchronization Setup Example

- Start Trigger Delay
  - » Sets timing at which BS can receive Reverse Traffic Channel



Note: \*Common Channels\* consists of the Paging Channel, the Broadcast Control Channel, the Quick Paging Channel, the Common Assignment Channel, the Forward Common Control Channel, the Forward Indication Channel, the Forward Grant Channel, and the Forward Acknowledgment Channel. \*\*Shared Traffic Channels\* consists of the Forward Dedicated Channel when the common power control subchannel is assigned, the Forward Fundamental Channel with FCH, BCCH, NBCH = 1, and the forward Supplemental Channel with SCH, BCCH, IND[1] = 1, where 1 = 1 or 2.

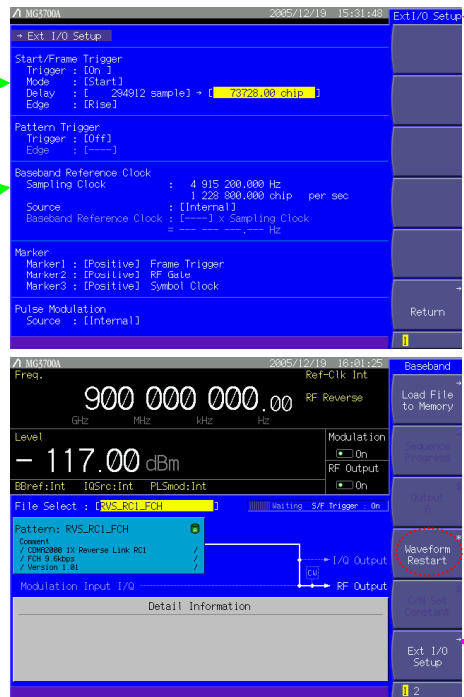
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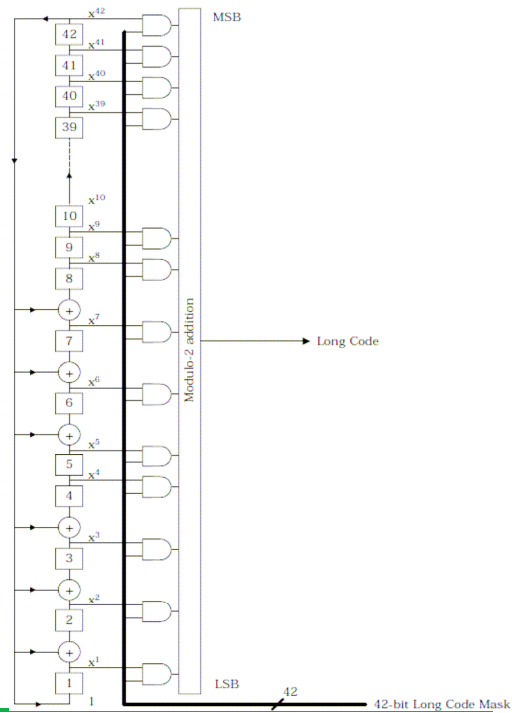
# Timing Synchronization Setup Example

- **Setting External Start Trigger**
  - » Captures/synchronizes trigger once only
- **Reference Clock:**
  - » [Baseband Reference Clock] Input Applicable case
    - Source: External]
    - Baseband Reference Clock:
      - [1], [1/2], [1/4], [1/8], [1/16] ×
  - » [10 MHz/5 MHz Ref] Input Applicable case
    - Source: [Internal]
- **Trigger Recapture/ Synchronization**



# Long Code Synchronization

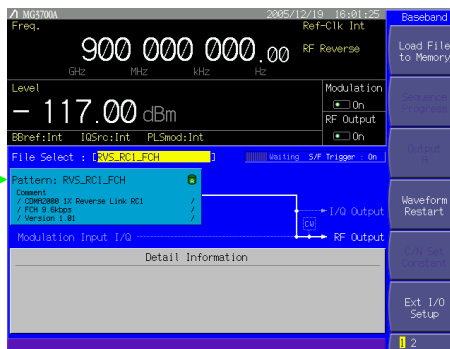
- **Long Code**
  - » 42-bit PN sequence
    - Generated from 42-bit Long Code Mask
  - » Applies O-QPSK or HPSK modulation to scrambling
    - HPSK: QPSK modulation and  $\pi/2$ BPSK modulation alternate per chip timing.
      - Crest factor lowered without shifting phase by  $180^\circ$
- **Set Long Code Mask to BS.**
  - » 000 0000 0000<sub>H</sub>



## Wanted Signal Setup Example

- Test
- Receiver
  - **Reverse Traffic Channel**
    - FCH TM 1 or 3 or DCCH TM 3

Test Mode	Forward Traffic Channel Radio Configuration	Reverse Traffic Channel Radio Configuration
1	1	1
2	2	2
3	3	3
4	4	3
5	5	4
6	6	5
7	7	5
8	8	6
9	9	6
10a	10	3
10b	10	7



Unsupported 3X

Unsupported 1xEV-DV

Note: Test Mode 10b is not applicable to this standard and is included for information only. Test Mode 10b will be applicable in the next revision of this Standard.

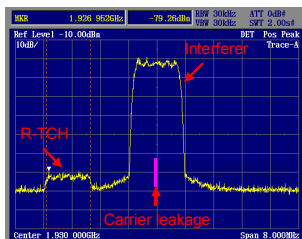
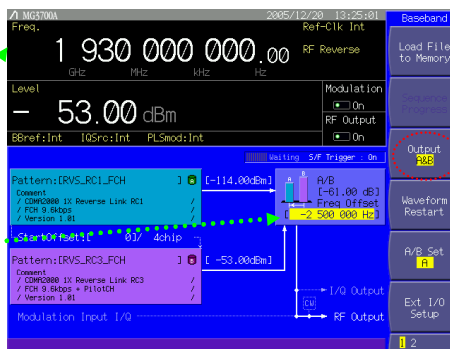
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MG3700A-E-F-8

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## Wanted Signal + Interference Signal Setup Example

- Test
- ACS
    - Applies to Band Class 6 only
  - **Reverse Traffic Channel**
    - FCH TM 1
    - FCH TM 3 or DCCH TM 3
  - +
  - **Reverse Interferer** 2.5 MHz offset
    - Full rate RC 3
- » Set Frequency Offset.
- -62.2 ~ +62.2 MHz
- » Set to shift Frequency.
- Center frequency is interferer.



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

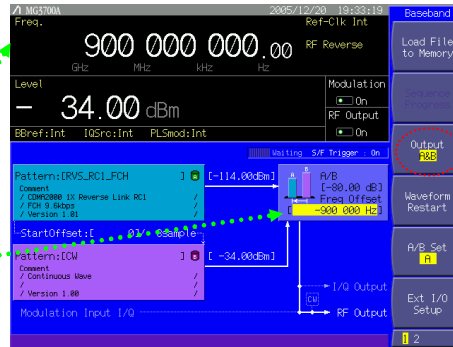
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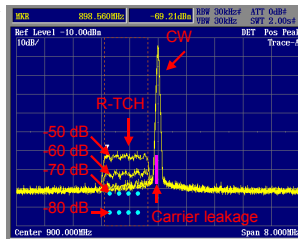
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# Wanted Signal + CW Setup Example

- Test
- Single Tone Desensitization
    - CW/R-TCH ≤ 80 dB
  - Intermodulation Spurious Response Attenuation
- **Reverse Traffic Channel**
    - FCH TM 1
    - FCH TM 3 or DCCH TM 3
- +
- **CW**
    - Single Tone: 750 kHz ~ 1.25 MHz offset
    - Intermodulation: ≥ 1.7 MHz offset
- » Set Frequency Offset.
    - -62.2 ~ +62.2 MHz
  - » Set to shift Frequency.
    - Center frequency is CW.



S/N:  
 -69.1 dB/1.23 MHz (-85.2 dB/30 kHz) \* 750 kHz ~ 900 kHz offset  
 -72.1 dB/1.23 MHz (-88.2 dB/30 kHz) \* 1.7 MHz offset  
 SSB Phase noise:  
 -130 dBc/Hz typ. \* 750 kHz ~ 900 kHz offset  
 -133 dBc/Hz typ. \* 1.7 MHz offset



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

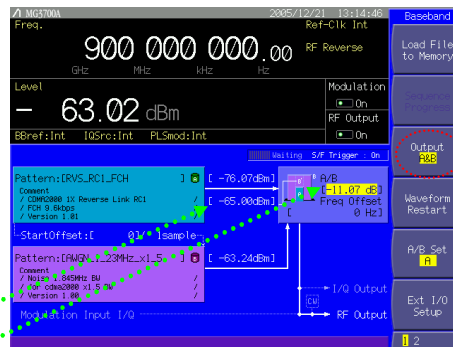
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# Wanted Signal + AWGN Setup Example

- Test
- Reverse Traffic Channel Demodulation Performance
  - Receiver Dynamic range
  - RSQI
- **Reverse Traffic Channel**
    - FCH TM 1
    - FCH TM 2
    - FCH TM 3 or DCCH TM 3
    - SCH TM 3 with Convolutional Coding
    - FCH TM 5
- +
- **AWGN**
    - »  $I_{oc}$  [dBm/1.23 MHz]
    - $\hat{I}_{or}/I_{oc}$  [dB]
- $$= 10 \log_{10} (R_b / 1,228,800) + E_b/N_0$$
- $R_b$  bps ↓↓
  - 9.6 k: -21.07
  - 14.4 k: -19.31
  - $E_b/N_0$  specified by test requirements



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

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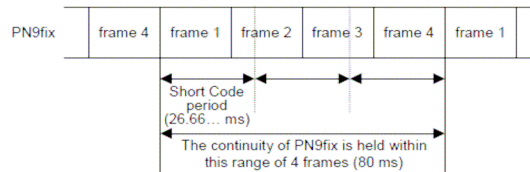
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# Wanted Signal Parameters

- Reverse Traffic Channel

Marker Signal	Output Data
Marker 1	Frame Clock
Marker 2	RF Gate
Marker 3	Symbol Clock
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2 + Q^2} = 320 \text{ mV}$
AWGN addition (Note)	Enable

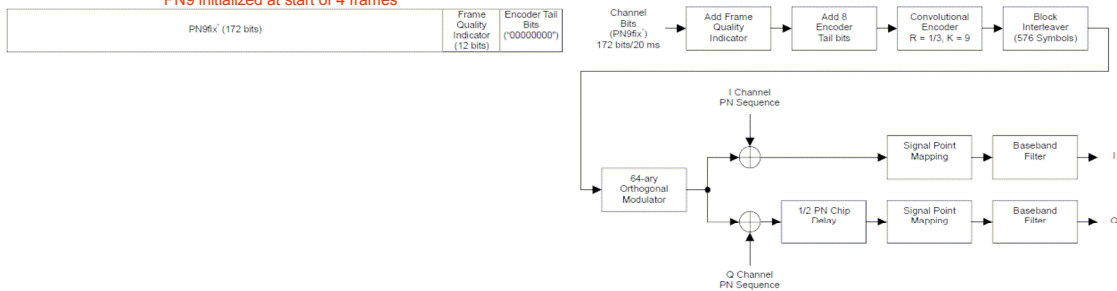


# Wanted Signal Parameters

- RC1 R-FCH

	Data Rate	Data
R-FCH	9.6 kbps	PN9fix*

PN9 initialized at start of 4 frames

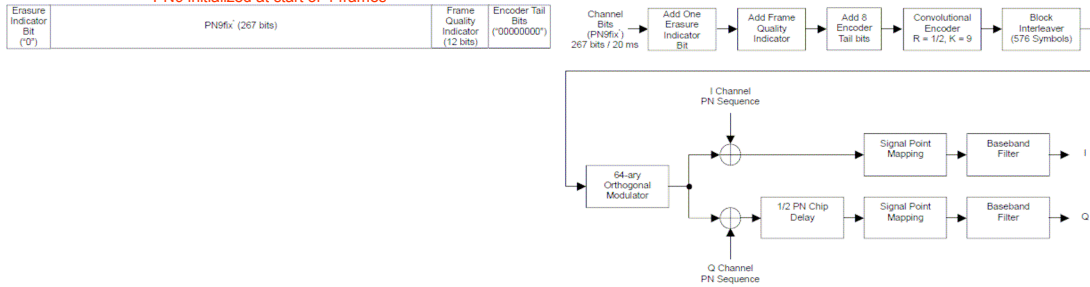


# Wanted Signal Parameters

- RC2 R-FCH**

	Data Rate	Data
R-FCH	14.4 kbps	PN9fix*

PN9 initialized at start of 4 frames



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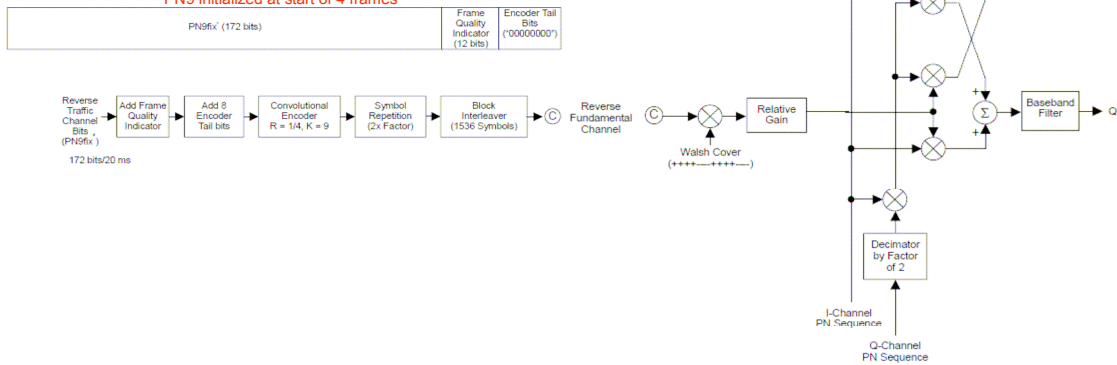
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# Wanted Signal Parameters

- RC3 R-FCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-5.278 dB	N/A	All "0"
R-FCH	4	-1.528 dB	9.6 kbps	PN9fix*

PN9 initialized at start of 4 frames



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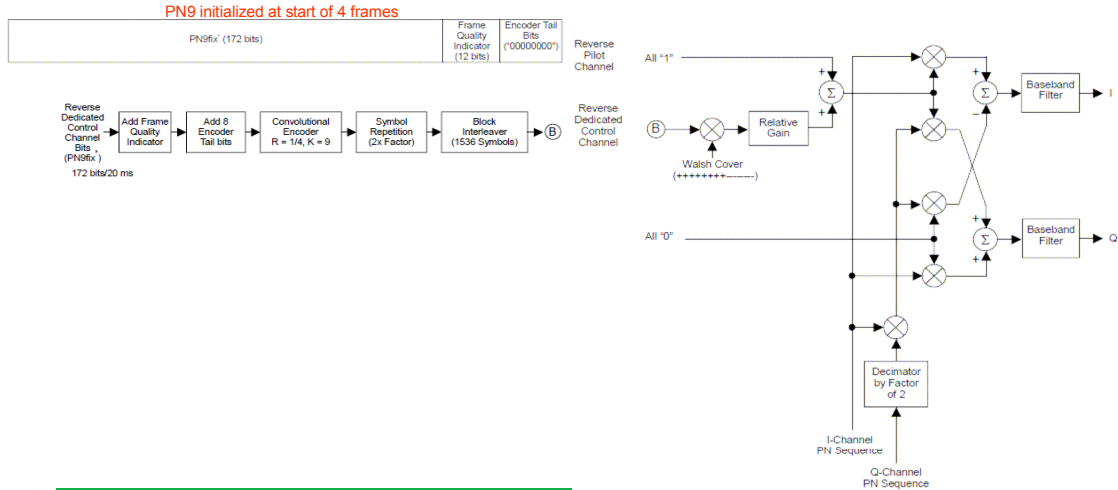
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# Wanted Signal Parameters

- RC3 R-DCCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-5.278 dB	N/A	All "0"
R-DCCH	8	-1.528 dB	9.6 kbps	PN9fix*



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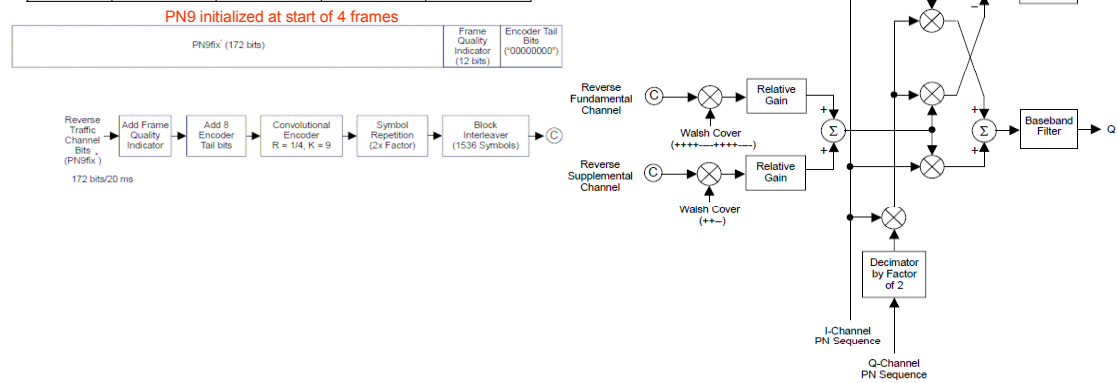
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# Wanted Signal Parameters

- RC3 R-SCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-7.5912 dB	N/A	All "0"
R-FCH	4	-3.8412 dB	9.6 kbps	PN9fix*
R-SCH	2	-3.8412 dB	9.6 kbps	PN9fix*



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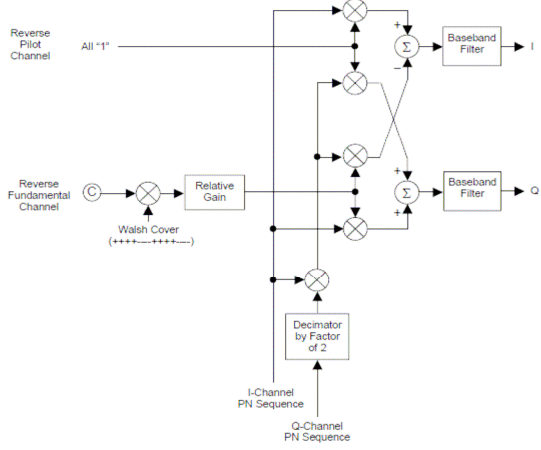
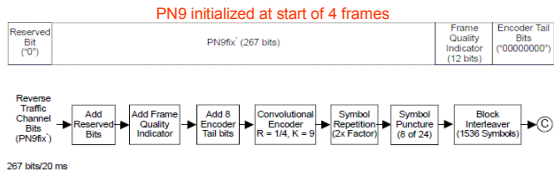
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# Wanted Signal Parameters

- RC4 R-FCH**

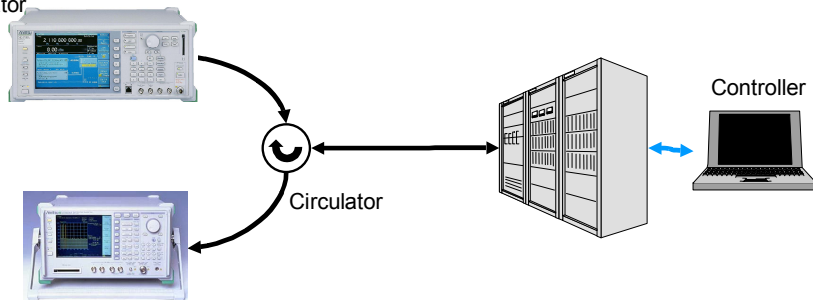
	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-5.278 dB	N/A	All "0"
R-FCH	4	-1.528 dB	14.4 kbps	PN9fix*



# Inter-Base Station Transmitter Intermodulation Test Connection Example

Interference Signal Generator  
MG3700A

Spectrum Analyzer

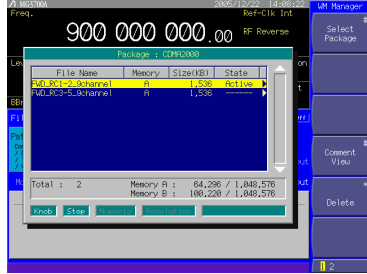


— Controller

- Launches in maximum transmitting power state by FTM (Factory Test Mode) control

# Interference Signal Setup Example

- Forward RC 1 ~ 5 Test Model
  - » Select any one of:



Channel Type	Number of Channels	Fraction of Power (linear)	Fraction of Power (dB)	Comments
Forward Pilot	1	0.2000	-7.0	Code channel W <sub>64</sub> <sup>64</sup>
Sync	1	0.0471	-13.3	Code channel W <sub>32</sub> <sup>64</sup> , always 1/3 rate
Paging	1	0.1882	-7.5	Code channel W <sub>64</sub> <sup>64</sup> , full rate only
Traffic	M	0.5547/M	-2.48 - 10 log(M)	Variable code channel assignments: full rate only

For the Total Power (4.3.1) and Co-channel Spurious Emission tests (4.4.1), M shall be the lesser of 37 or the maximum number of Fundamental Traffic Channels supported by the base station for the radio configuration under test.  
For all other tests, M shall be 6.

- » Set LPF to 1 MHz.
  - Improves ACLR



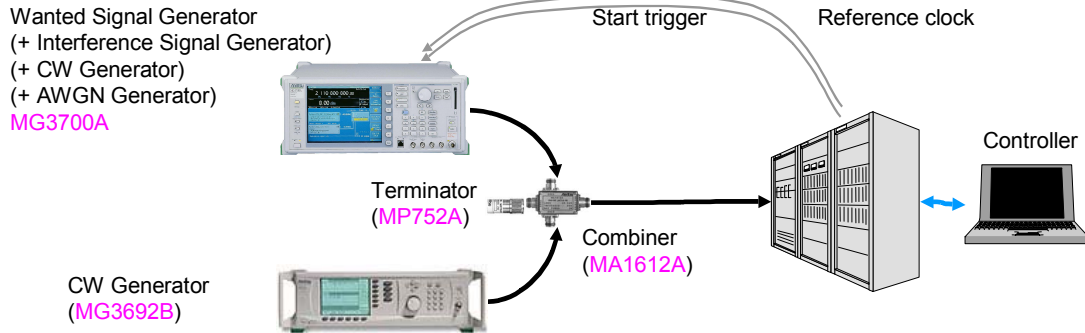
# 1xEV-DO AN Tests

3GPP2 C.S0032-A v1.0  
3 Receiver  
4 Transmitter

Test	Wanted Signal Generator	Interference Signal Generator	CW Generator	AWGN Generator	Others		
3.3.1 Data Channel Demodulation Performance	MG3700A	* (for CW)	* or MG3642A 2.08 GHz	*			
3.3.2 DRC Channel Demodulation Performance *DRC non-gated transmission							
3.3.3 ACK Channel Demodulation Performance (Case 1: AWGN, without closed loop power control)							
3.4.1 Receiver Sensitivity							
3.4.2 Receiver Dynamic Range							
3.4.3 Single Tone Desensitization							
3.4.4 Intermodulation Spurious Response Attenuation						MG3692B 20 GHz or MG3642A 2.08 GHz	MA1612A 3 GHz Combiner
3.4.5 Adjacent Channel Selectivity (ACS) * Band Class 6 only							
3.4.6 Receiver Blocking Characteristics * Band Class 6 only							
3.6 Received Signal Quality Indicator (RSQI)							
4.4.3 Inter-Sector Transmitter Intermodulation		MG3700A			Spectrum Analyzer Circulator		

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

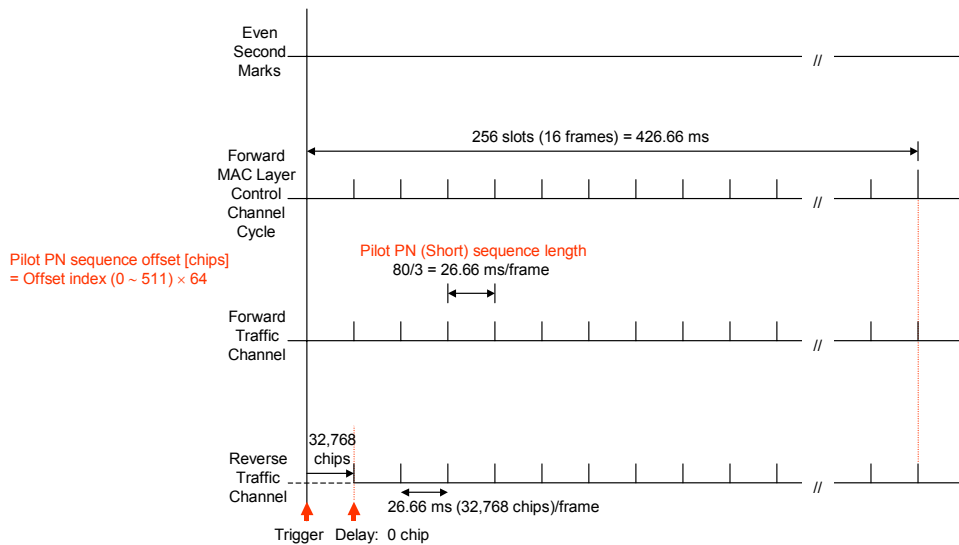
# Receiver Test Connection Example



- Start trigger
  - Front panel [Start/Frame Trigger] Input
    - Apply only one.
      - 26.66 ms clock (Short sequence roll-over)
      - 426.66 ms clock (Control Channel Cycle)
      - 2 s clock (Even second time mark)
- Reference clock
  - Apply only one.
    - Rear panel [Baseband Ref Clock] Input
      - 1.2288 MHz,  $2 \times 1.2288$  MHz (2.4576 MHz),  $4 \times 1.2288$  MHz (4.9152 MHz)
    - Rear panel [10 MHz/5 MHz Ref] Input
- Controller
  - Launches Reverse Traffic Channel in receivable state by FTM (Factory Test Mode) control
  - Reports Reverse Traffic Channel PER and RSQI

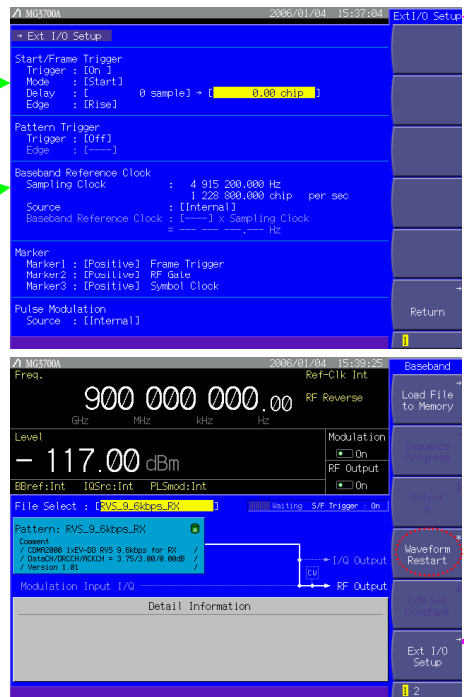
# Timing Synchronization Setup Example

- Start Trigger Delay
  - » Sets timing at which AN can receive Reverse Traffic Channel



# Timing Synchronization Setup Example

- **Setting External Start Trigger**
  - » Captures/synchronizes trigger once only
- **Reference Clock:**
  - » [Baseband Reference Clock] Input Applicable case
    - Source: [External]
    - Baseband Reference Clock:
      - [1], [1/2], [1/4], [1/8], [1/16] ×
  - » [10 MHz/5 MHz Ref] Input Applicable case
    - Source: Internal]
- **Trigger Recapture/ Synchronization**



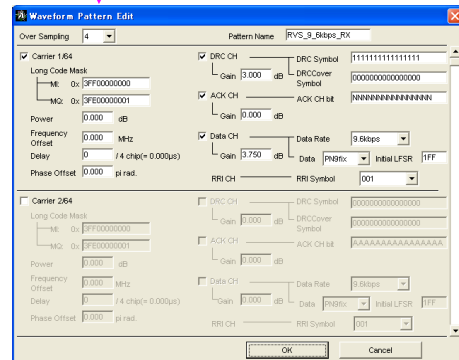
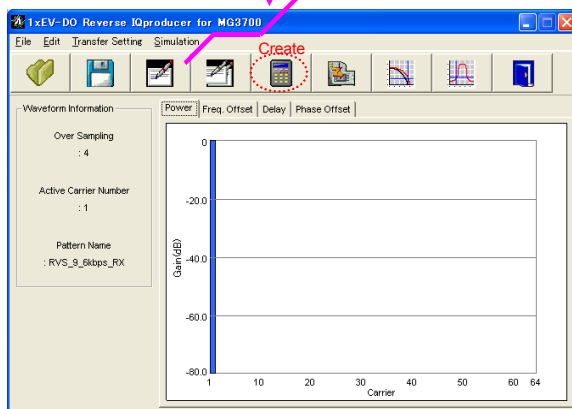
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MG3700A-E-F-8

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# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- License option MX370103A
- Created sample rate
  - 4, 8, 16× Over Sampling
- Can create up to 64 carriers for load test



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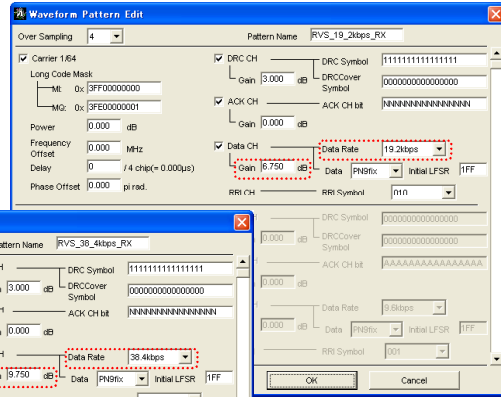
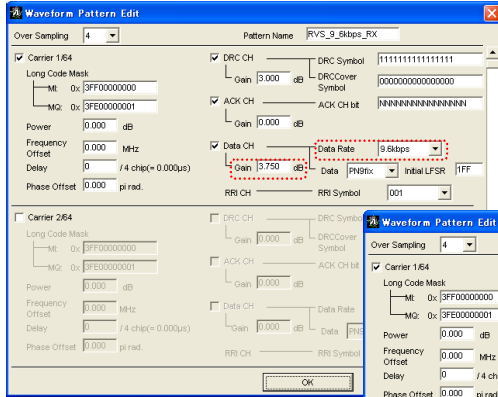
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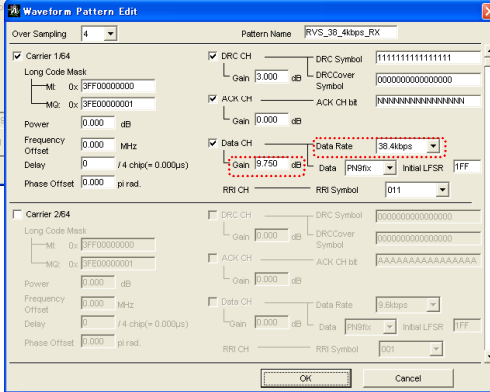
# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- Reverse 9.6 kbps

- Reverse 19.2 kbps



- Reverse 38.4 kbps



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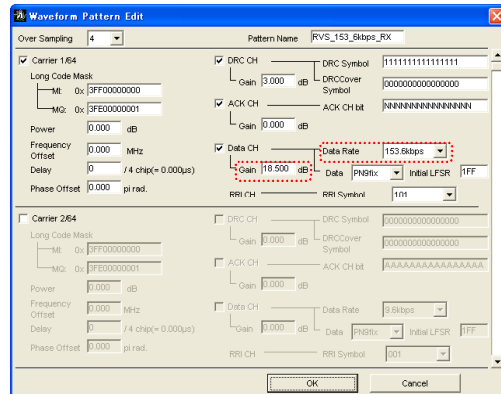
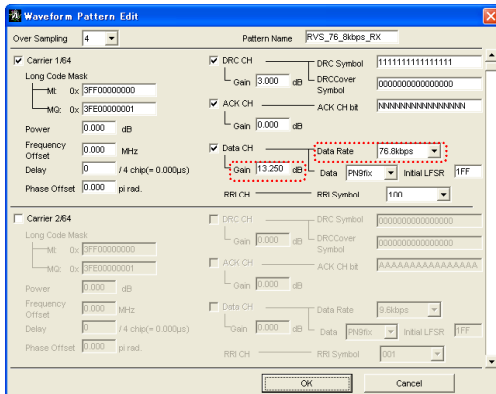
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# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- Reverse 76.8 kbps

- Reverse 153.6 kbps



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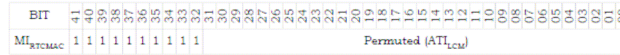
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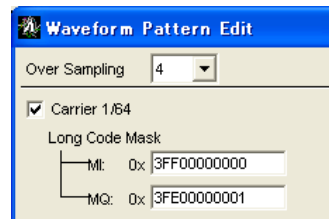
# Long Code Synchronization Setup Example

- **Long Code**
  - » 42-bit  $MI_{RTCMAC}$



- » 42-bit  $MQ_{RTCMAC}$ 
  - Derived from  $MI_{RTCMAC}$ 
    - $MQ_{RTCMAC}[k] = MI_{RTCMAC}[k-1]$ , for  $k = 1, \dots, 41$
    - $MQ_{RTCMAC}[0] = MI_{RTCMAC}[0] \oplus MI_{RTCMAC}[1] \oplus MI_{RTCMAC}[2] \oplus MI_{RTCMAC}[4] \oplus MI_{RTCMAC}[5] \oplus MI_{RTCMAC}[6] \oplus MI_{RTCMAC}[9] \oplus MI_{RTCMAC}[15] \oplus MI_{RTCMAC}[17] \oplus MI_{RTCMAC}[18] \oplus MI_{RTCMAC}[20] \oplus MI_{RTCMAC}[24] \oplus MI_{RTCMAC}[25] \oplus MI_{RTCMAC}[26] \oplus MI_{RTCMAC}[32] \oplus MI_{RTCMAC}[34] \oplus MI_{RTCMAC}[41]$

- **Set Long Code Mask receivable by AN**
  - $MI_{RTCMAC}, MQ_{RTCMAC}: 0 \sim 3FF\ FFFF\ FFFF_H$ 
    - $MQ_{RTCMAC}$  is calculated and set automatically.



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# Wanted Signal Setup Example

Test  
- Receiver

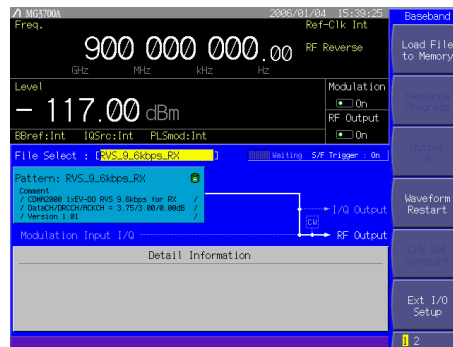
- **Reverse Traffic Channel**

Channel Gain	Default value (dB)
DRCChannelGain	3 dB
ACKChannelGain	0 dB
DSCChannelGain	-9 dB
RRChannelGain (Subtype 2 only)	-6 dB
Data_Channel_Gain	see next table
AuxPilotGain	12 dB below Data_Channel_Gain (if applicable)

Unsupported subtype 2

Unsupported subtype 2

Data Rate (kbps)	DataChannelGain (dB)	Default Data_Channel_Gain (dB)
9.6	3.75 + DataOffsetNom + DataOffset9k6	3.75
19.2	6.75 + DataOffsetNom + DataOffset19k2	6.75
38.4	9.75 + DataOffsetNom + DataOffset38k4	9.75
76.8	13.25 + DataOffsetNom + DataOffset76k8	13.25
153.6	18.50 + DataOffsetNom + DataOffset153k6	18.50



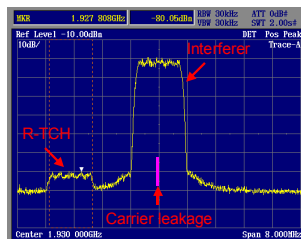
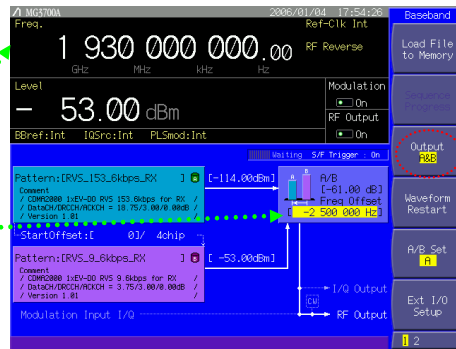
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# Wanted Signal + Interference Signal Setup Example

- Test
- ACS
    - Applies to Band Class 6 only
  - **Reverse Traffic Channel**
    - 153.6 kbps
  - +
    - **Reverse Interferer**
      - HRPD signal
      - » Set Frequency Offset.
        - -62.2 ~ +62.2 MHz
        - » Set to shift Frequency.
          - Center frequency is interferer.



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

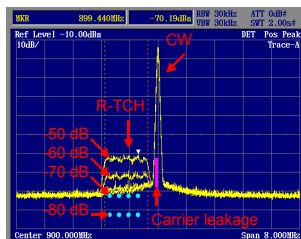
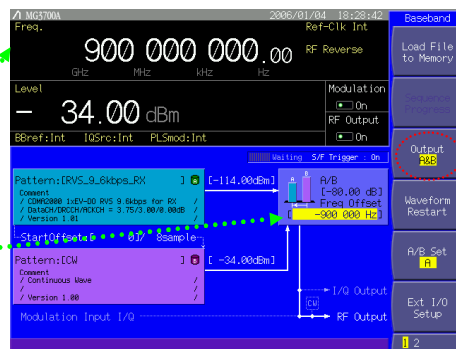
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# Wanted Signal + CW Setup Example

- Test
- Single Tone Desensitization
    - CW/R-TCH ≤ 80 dB
  - Intermodulation Spurious Response Attenuation
  - **Reverse Traffic Channel**
    - 9.6 kbps
  - +
    - **CW**
      - Single Tone: 750 kHz ~ 1.25 MHz offset
      - Intermodulation: ≥ 1.7 MHz offset
      - » Set Frequency Offset.
        - -62.2 ~ +62.2 MHz
        - » Set to shift Frequency.
          - Center frequency is CW.



S/N:  
 -69.1 dB/1.23 MHz (-85.2 dB/30 kHz) \* 750 kHz ~ 900 kHz offset  
 -72.1 dB/1.23 MHz (-88.2 dB/30 kHz) \* 1.7 MHz offset  
 SSB Phase noise:  
 -130 dBc/Hz typ. \* 750 kHz ~ 900 kHz offset  
 -133 dBc/Hz typ. \* 1.7 MHz offset

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

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# Wanted Signal + AWGN Setup Example

- Test
- Data Channel Demodulation Performance (Case 1)
  - Receiver Dynamic range
  - RSQI

- **Reverse Traffic Channel**

- 9.6 kbps
- 19.2 kbps
- 38.4 kbps
- 76.8 kbps
- 153.6 kbps

- **AWGN**

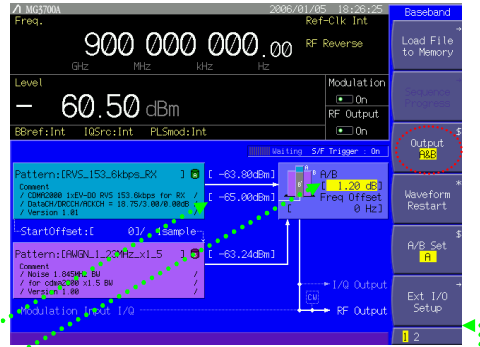
- »  $I_{oc}$  [dBm/1.23 MHz]
- $\hat{I}_{or/I_{oc}}$  [dB]

$$= 10\log_{10}(R_b/1,228,800) + 10\log_{10}((1+DRC^*/2+Data^*/Data^*) + Data E_b/N_t)$$

$R_b$ , kbps	$\hat{I}_{or/I_{oc}}$ [dB]	$DRC^*$	$Data^*$
9.6 k :	-21.07	3.93	
19.2 k :	-18.06	2.4	
38.4 k :	-15.05	1.37	
76.8 k :	-12.04	0.66	
153.6 k :	-9.03	0.21	

- Data  $E_b/N_t$  is specified by test requirements.

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

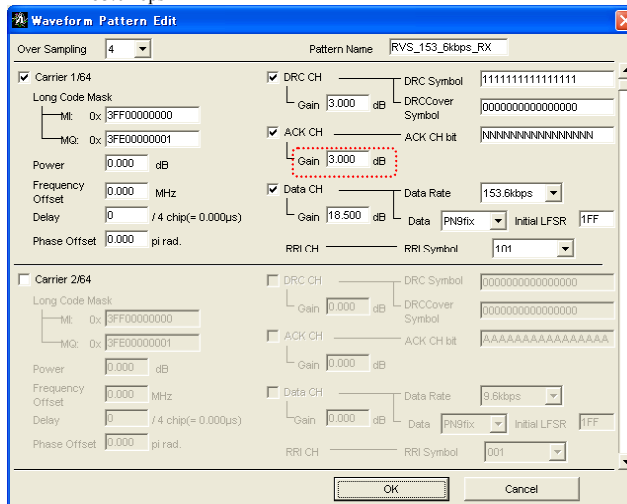


# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- Test
- DRC Channel Demodulation Performance (Case 1)
    - DRC non-gated transmission (DRCLength 1 slot: Test 1, 2)

- **Reverse Traffic Channel**

- 153.6 kbps



# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

Test

- ACK Channel Demodulation Performance (Case 1)

- **Reverse Traffic Channel**

- 153.6 kbps

For P(NAK/ACK), P(no ACK/ACK)

For P(ACK/NAK), P(no NAK/NAK)

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MG3700A-E-F-8

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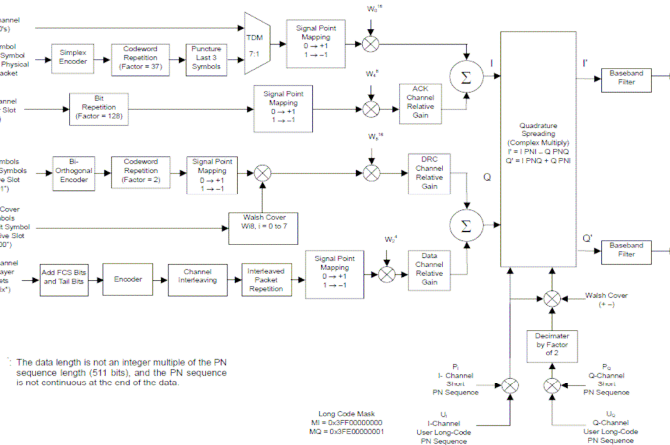
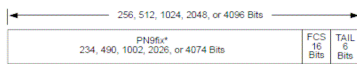
**Anritsu**

# Wanted Signal Parameters

- **Reverse Traffic Channel**

Marker Signal	Output Data
Marker 1	Frame Clock
Marker 2	RF Gate
Marker 3	Symbol Clock
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2 + Q^2} = 320 \text{ mV}$
AWGN addition (Note)	Enable

Data Rate (kbps)	RRI Symbol	DRC Value	DRC Cover	ACK Channel Bit
9.6	001	0x01	$W_0^8$	0
19.2	010	0x01	$W_0^8$	0
38.4	011	0x01	$W_0^8$	0
76.8	100	0x01	$W_0^8$	0
153.6	101	0x01	$W_0^8$	0



The data length is not an integer multiple of the PN sequence length (511 bits), and the PN sequence is not continuous at the end of the data.

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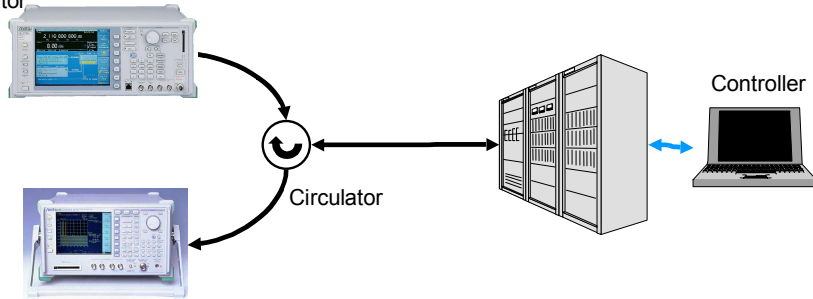
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# Inter-Sector Transmitter Intermodulation Test Connection Example

Interference Signal Generator  
MG3700A

Spectrum Analyzer



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

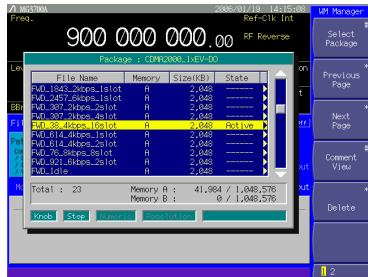
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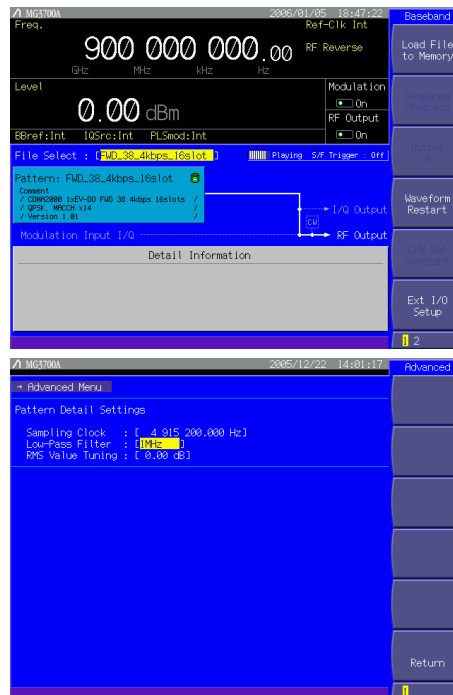
# Interference Signal Setup Example

- Forward Idle/Active slots
  - » Select any one of:



- Case 1, 2: Idle slots
- Case 3, 4: Active slots

- » Set LPF to 1 MHz.
  - Improves ACLR



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# 1xEV-DO AT Tests

3GPP2 C.S0033-A v1.0  
3 Receiver

Test	Wanted Signal Generator	Interference Signal Generator	CW Generator	AWGN Generator	Others	
3.2.1 Demodulation of Forward Traffic Channel in AWGN	MG3700A			*		
3.3.1 Receiver Sensitivity and Dynamic Range						
3.3.2 Single Tone Desensitization				*		
3.3.3 Intermodulation Spurious Response Attenuation			*(for CW)	MG3692B 20 GHz or MG3642A 2.08 GHz		MA1612A 3 GHz Combiner
3.3.4 Adjacent Channel Selectivity (ACS) * Band Class 6 only			*			
3.3.5 Receiver Blocking Characteristics			*(for In-Band) or MG3692B 20 GHz			

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

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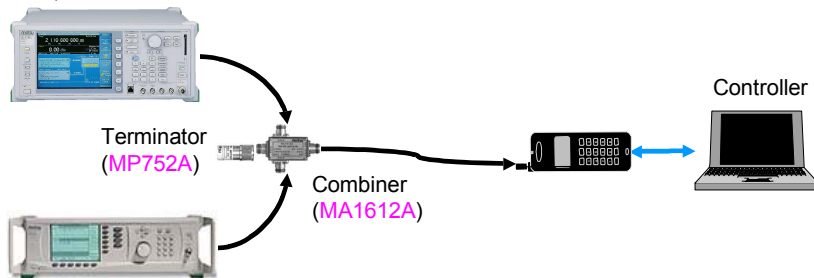
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## Receiver Test Connection Example

Wanted Signal Generator  
(+ Interference Signal Generator)  
(+ CW Generator)  
(+ AWGN Generator)  
MG3700A

CW Generator  
(MG3692B)



- Controller
  - Launches Forward Traffic Channel in receivable state by FTM (Factory Test Mode) control
  - Reports Forward Traffic Channel PER

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# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

License option MX370103A

Created sample rate  
- 4, 8, 16x Over Sampling

RA Bit, RPC Bit: Random every slot

TCH Data: PN15 initialized each packet

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The screenshot shows the MG3700 IQproducer interface. The 'System' menu is open, showing options like '1xEVDO EVD', '1xEVDO EVS', 'IOMA', 'HSDPA Downlink', 'HSDPA Uplink', 'W-CDMA Downlink (Standard)', 'W-CDMA Uplink (Standard)', and 'Multi-carrier'. The 'Carrier 3' parameters are visible, including 'Data Rate' (2487 kbps), 'TCH Data' (PN15), and 'RPC/RA CH Parameters' table. The 'Carrier 3' parameters table shows MAC Index 4 to 14 with RA Bit and RPC Bit settings. The 'Carrier 3' parameters table is as follows:

MAC Index	RA Bit	RPC Bit	CH Power	CH Power	CH Power
4	514	1524	2534	4544	5843
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- Forward 38.4 kbps  
- 16 slots/packet, QPSK
- Forward 76.8 kbps  
- 8 slots/packet, QPSK
- Forward 153.3 kbps  
- 4 slots/packet, QPSK
- Forward 307.2 kbps  
- 2 slots/packet, QPSK

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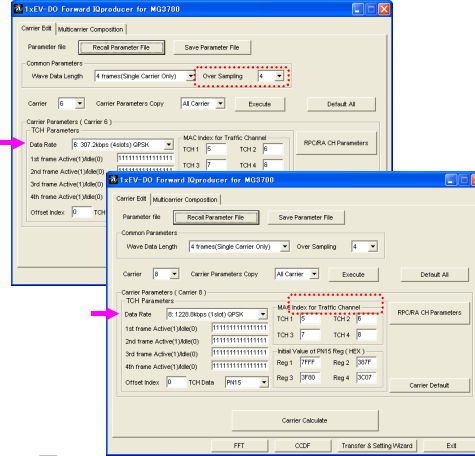
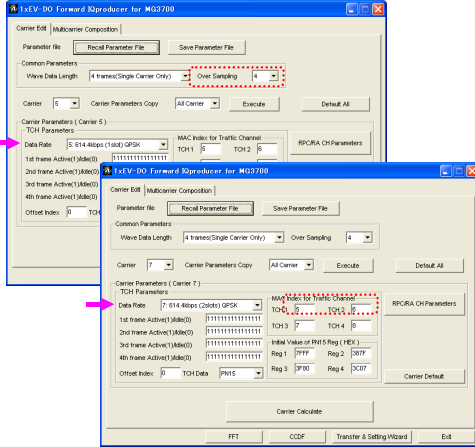
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The screenshot shows the MG3700 IQproducer interface with four carrier parameter windows open. The 'Carrier 1' parameters are: Data Rate 38.4 kbps, TCH Data PN15. The 'Carrier 2' parameters are: Data Rate 76.8 kbps, TCH Data PN15. The 'Carrier 3' parameters are: Data Rate 153.3 kbps, TCH Data PN15. The 'Carrier 4' parameters are: Data Rate 307.2 kbps, TCH Data PN15.

# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- **Forward 614.4 kbps**  
- 1 slot/packet, QPSK

- **Forward 307.2 kbps**  
- 4 slots/packet, QPSK



- **Forward 614.4 kbps**  
- 2 slots/packet, QPSK

- **Forward 1,228.8 kbps**  
- 1 slot/packet, QPSK

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MG3700A-E-F-8

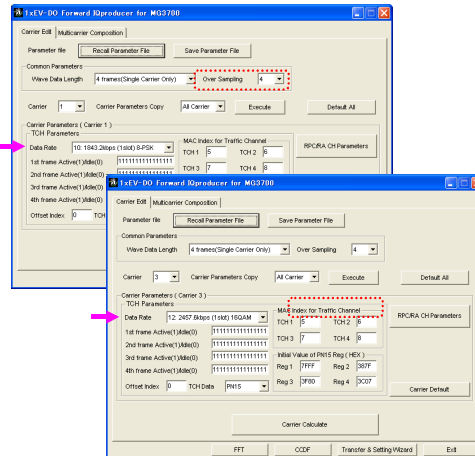
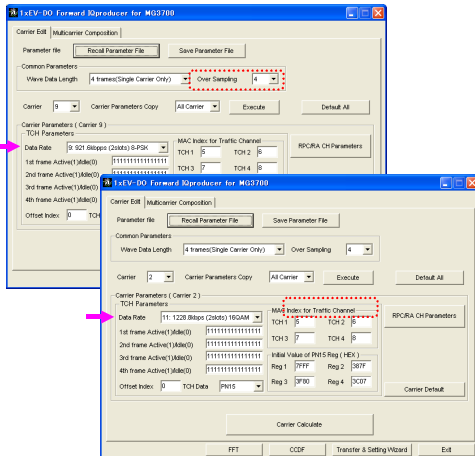
Slide 61

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# Wanted Signal Setup CDMA2000 1xEV-DO IQproducer

- **Forward 921.6 kbps**  
- 2 slots/packet, 8PSK

- **Forward 1,843.2 kbps**  
- 1 slot/packet, 8PSK



- **Forward 1,228.8 kbps**  
- 2 slots/packet, 16QAM

- **Forward 2,457.6 kbps**  
- 1 slot/packet, 16QAM

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MG3700A-E-F-8

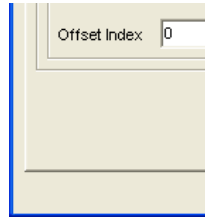
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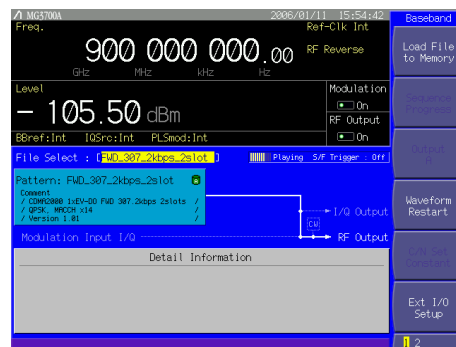
## Pilot PN Sequence Synchronization Setup Example

- **Pilot PN sequence**
  - » 32,768 PN chips (26.66 ms) length
    - Generated from linear feedback shift-register sequence of 15-bits length
  - » Applies to quadrature spreading
- **Set the offset index receivable by AT.**
  - » 0 ~ 511
    - Pilot PN sequence offset [chips] = Offset index × 64 chips



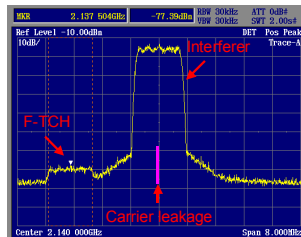
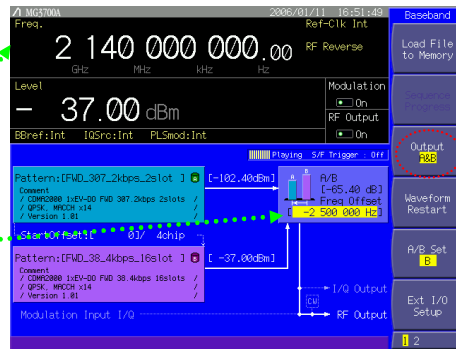
## Wanted Signal Setup Example

- Test
  - Receiver
- **Forward Traffic Channel**
  - 307.2 kbps, 2 slots/packet, QPSK
  - 2,457.6 kbps, 1 slot/packet, 16QAM
  - \* Dynamic range Test 3 only
- All TDM bursts transmitted at equal power



# Wanted Signal + Interference Signal Setup Example

- Test
- ACS
    - Applies to Band Class 6 only
  - **Forward Traffic Channel**
    - 307.2 kbps, 2 slots/packet, QPSK
  - +
    - **Forward Interferer** 2.5 MHz offset
      - HRPD or CDMA signal
- » Set Frequency Offset.
- -62.2 ~ +62.2 MHz
- » Set to shift Frequency.
- Center frequency is interferer.



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

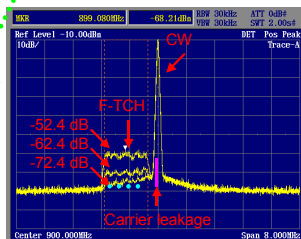
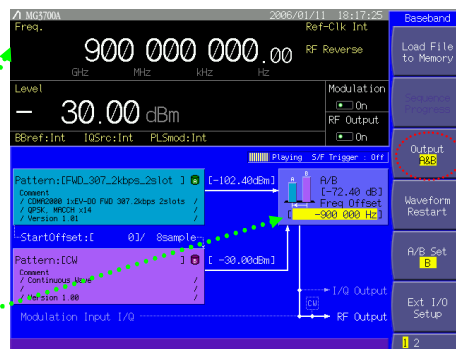
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MG3700A-E-F-8

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# Wanted Signal + CW Setup Example

- Test
- Single Tone Desensitization
  - Intermodulation Spurious Response Attenuation
  - Receiver Blocking Characteristics (In-band: Test 1 to 4)
- **Forward Traffic Channel**
  - 307.2 kbps, 2 slots/packet, QPSK
- +
  - **CW** Single Tone: 900 kHz, 1.25 MHz offset
    - Intermodulation:  $\geq 1.7$  MHz offset
    - Blocking: 5 MHz, 7.5 MHz offset
- » Set Frequency Offset.
- -62.2 ~ +62.2 MHz
- » Set to shift Frequency.
- Center frequency is CW.



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

S/N:

- 69.1 dB/1.23 MHz (-85.2 dB/30 kHz) \* 900 kHz offset
- 72.1 dB/1.23 MHz (-88.2 dB/30 kHz) \* 1.7 MHz offset

SSB Phase noise:

- 130 dBc/Hz typ. \* 900 kHz offset
- 133 dBc/Hz typ. \* 1.7 MHz offset

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# Wanted Signal + AWGN Setup Example

Test

- Demodulation of Forward Traffic Channel in AWGN

## Forward Traffic Channel

- 2,457.6 kbps, 1 slot/packet, 16QAM
- 1,228.8 kbps, 2 slots/packet, 16QAM
- 1,843.2 kbps, 1 slot/packet, 8PSK
- 921.6 kbps, 2 slots/packet, 8PSK
- 1,228.8 kbps, 1 slot/packet, QPSK
- 614.4 kbps, 2 slots/packet, QPSK
- 307.2 kbps, 4 slots/packet, QPSK
- 614.4 kbps, 1 slot/packet, QPSK
- 307.2 kbps, 2 slots/packet, QPSK
- 153.6 kbps, 4 slots/packet, QPSK
- 76.8 kbps, 8 slots/packet, QPSK
- 38.4 kbps, 16 slots/packet, QPSK

## AWGN

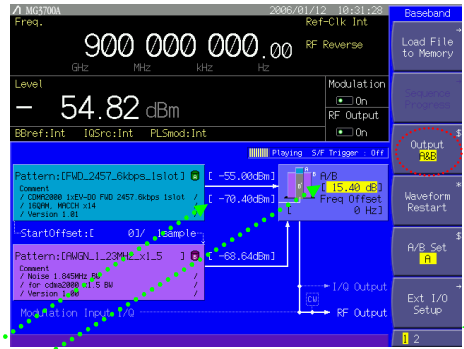
» Ioc [dBm/1.23 MHz]

- Ior/Ioc [dB]

$$= -10\log_{10}(\text{Traffic\_Chip\_Bit})$$

+ Traffic  $E_b/N_0$

\*Traffic\_Chip\_Bit is number of PN chips per Forward Traffic Channel bit.



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

Data Rate (kbps)	Slots	Traffic_Chip_Bit
38.4	16	24
76.8	8	12
153.6	4	6
307.2	2	3
614.4	1	3/2
307.2	4	49/16
614.4	2	49/32
1,228.8	1	3/4
921.6	2	49/48
1,843.2	1	1/2
1,228.8	2	49/64
2,457.6	1	3/8

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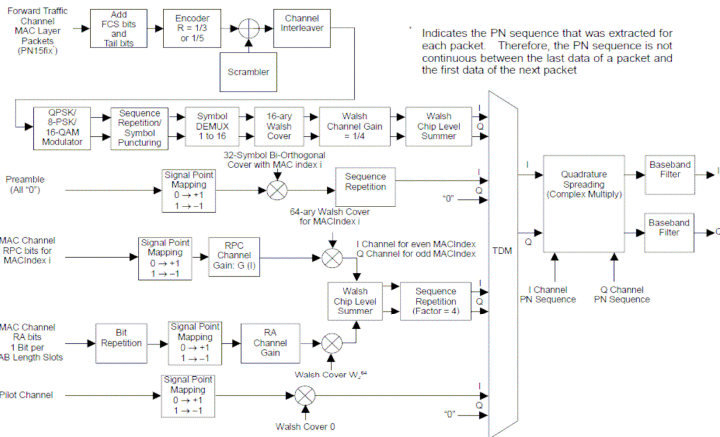
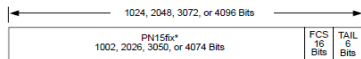
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# Wanted Signal Parameters

## Forward Traffic Channel

Marker Signal	Output Data
Marker 1	Frame Clock
Marker 2	RF Gate
Marker 3	Symbol Clock
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2 + Q^2} = 320 \text{ mV}$
AWGN addition (Note)	Enable



Indicates the PN sequence that was extracted for each packet. Therefore, the PN sequence is not continuous between the last data of a packet and the first data of the next packet

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# Wanted Signal Parameters

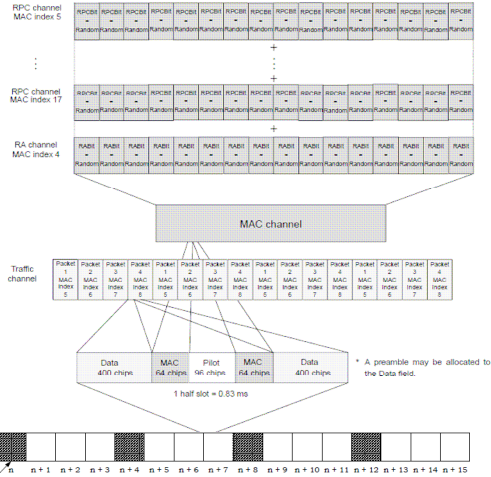
- **Forward MAC Channel**
  - » The encoder output is scrambled to randomize the data prior to modulation. MACIndex is specified in part of the initial state in the scrambler with a 17-tap linear feedback shift register.

MACIndex	MAC Channel Use	Preamble Use
0 and 1	Not Used	Not Used
2	Not Used	76.8 kbps Control Channel
3	Not Used	38.4 kbps Control Channel
4	RA Channel	Not Used
5-6	Available for RPC Channel and DRCLock Channel Transmissions	Available for Forward Traffic Channel if Broadcast is not transmitted. <i>no</i>
6-63	Available for RPC Channel and DRCLock Channel Transmissions	Available for Forward Traffic Channel Transmissions



MAC Index	RABit	RPCBit
4 (RA Channel), 5-17 (RPC Channel)	Random	Random

Every slot



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# Repeater Tests

3GPP2 C.S0051-0 v1.0  
2 Input ports  
3 Output ports

Test	CDMA Signal Generator	Interference Signal Generator	Others
2.1			Network Analyzer
2.2			NF (Network) Analyzer
2.3		* (for CW)	Spectrum Analyzer
2.4			Spectrum Analyzer
3.1	MG3700A		Frequency Counter
3.2			Signal Analyzer
3.3			Network Analyzer
3.4			Spectrum Analyzer
3.5	MG3700A	MG3700A	Spectrum Analyzer
3.6			Circulator
3.7			Spectrum Analyzer
3.7			Signal Analyzer

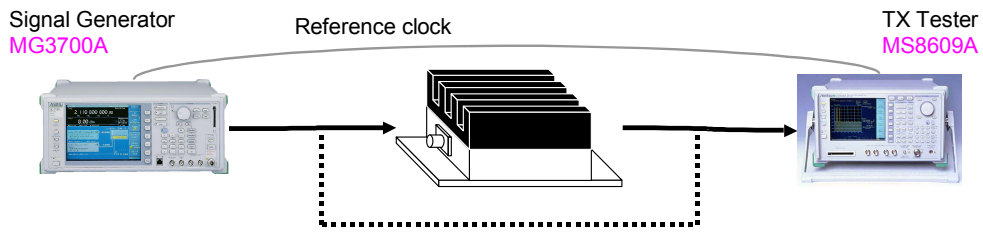
\*: MG3700A for signal generator generates two signals with CW.

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## Basic Test Connection Example



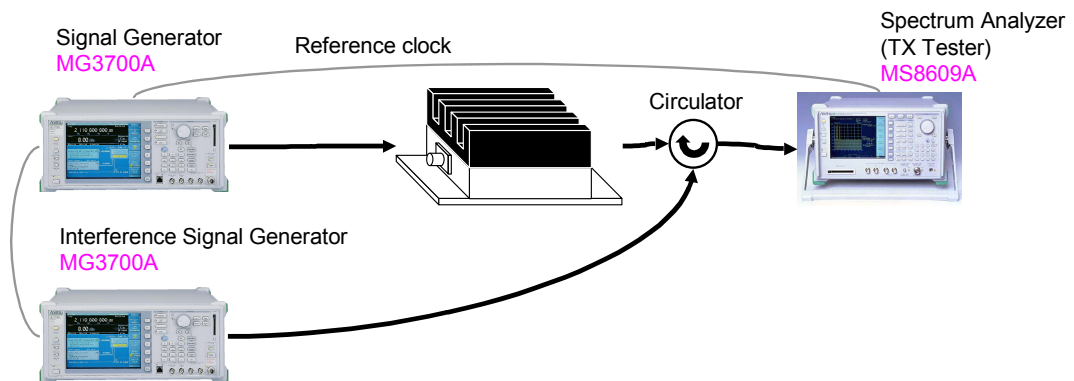
- **Single tone desensitization**
  - **Input intermodulation**
- **Frequency tolerance**
  - **Waveform quality**
  - **Output power, Linearity and Overload**
  - **Out-of-band and Spurious emissions**
  - **Repeater delay**

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## Output Intermodulation Test Connection Example



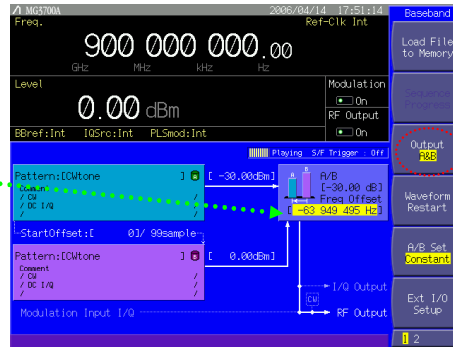
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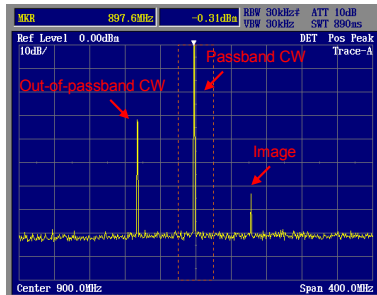
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# Passband CW + Out-of-Passband CW Setup Example

- Test
  - Single Tone Desensitization
- **Passband CW**
- +
  - **Out-of-passband CW**
    - » Set Frequency Offset.
    - -63 ~ +63 MHz



Measure mean power of the output passband CW signal.



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# 2-tone Signal Setup Example Multi-carrier IQproducer

- Test
  - Input intermodulation

License option MX370104A

Component	Tone	wvl File	Gain (dB)	Freq Offset (MHz)	Phase (deg)	Delay (sample)
1	<input checked="" type="checkbox"/>		0.00	-0.450000	0	0
2	<input checked="" type="checkbox"/>		0.00	+0.450000	0	0
3	<input type="checkbox"/>					
4	<input type="checkbox"/>					
5	<input type="checkbox"/>					
6	<input type="checkbox"/>					
7	<input type="checkbox"/>					
8	<input type="checkbox"/>					
9	<input type="checkbox"/>					
10	<input type="checkbox"/>					
11	<input type="checkbox"/>					

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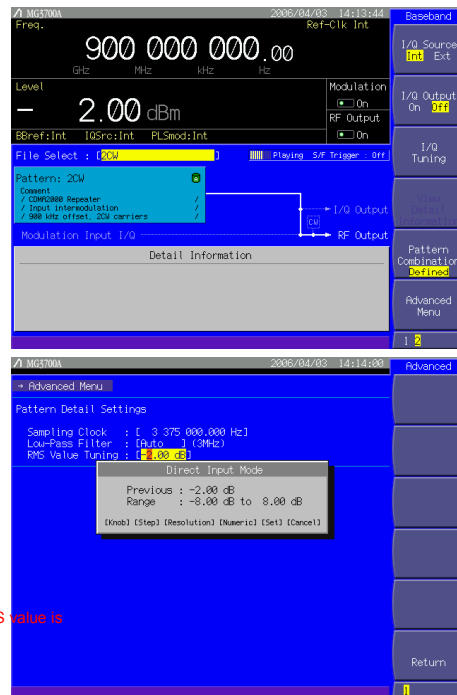
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## 2-tone Signal Setup Example

- Two CW carriers with 900 kHz offset

- » Set the LPF correctly.
- » Tune the RMS value correctly.
  - Improves IMD

The MG3700A PA drive level will increase if the output level exceeds 0 dBm at a mechanical attenuator or -4 dBm at an electronic attenuator when the RMS value is set to 1157.



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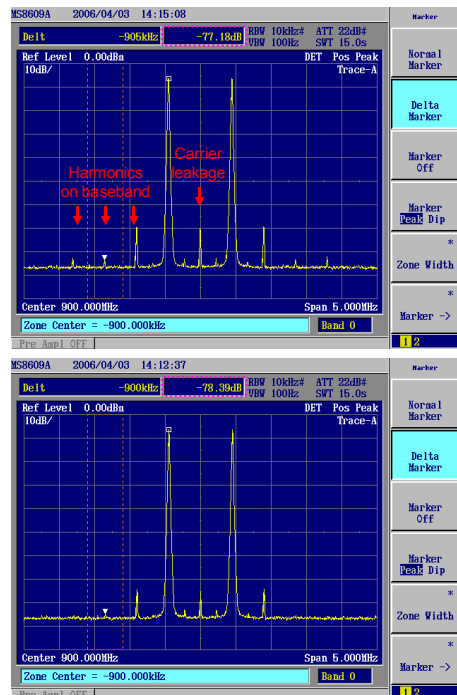
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## Effect of IMD on RMS Value Setting

- Two CW carriers with 900 kHz offset

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



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# CDMA Signal Setup Example

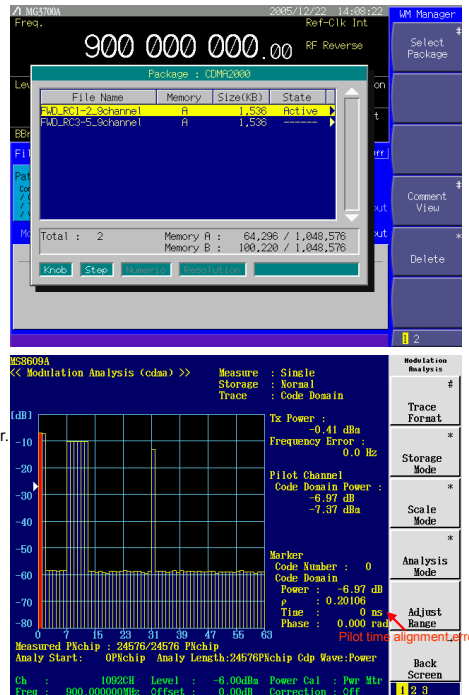
- Test
- Frequency tolerance
  - Waveform quality ( $\rho$ )
  - Output power, Linearity and Overload
    - Also multi-carrier
  - Output intermodulation
    - Including Interference signal
  - Out-of-band and Spurious emissions
    - Also multi-carrier
  - Repeater delay

- **Forward RC 1 ~ 5**

This is used for both the Forward link and Reverse link signal path directions of the repeater.

Channel Type	Number of Channels (1)	Fraction of Power (linear)	Fraction of Power (dB)	Comments
Forward Pilot	1	0.2000	-7.0	Code channel $W_0^{64}$
Sync	1	0.0171	13.3	Code channel $W_2^{64}$ ; always 1/8 rate
Paging	1	0.1882	-7.3	Code channel $W_1^{64}$ ; full rate only
Traffic	$M$	$0.5647/M$	$-2.48 - 10 \cdot \log(M)$	Variable code channel assignments; full rate only

(1) For the Output Power and Linearity Test (3.4) and Conducted Spurious Emissions tests (3.6.3),  $M$  shall be 37. For all other tests,  $M$  shall be 6.



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# CDMA Signal Setup Example

- » Set the LPF correctly.
- » Tune the RMS value correctly.
  - Improves Spurious,  $\rho$
  - \* More information in MG3700A Product Introduction



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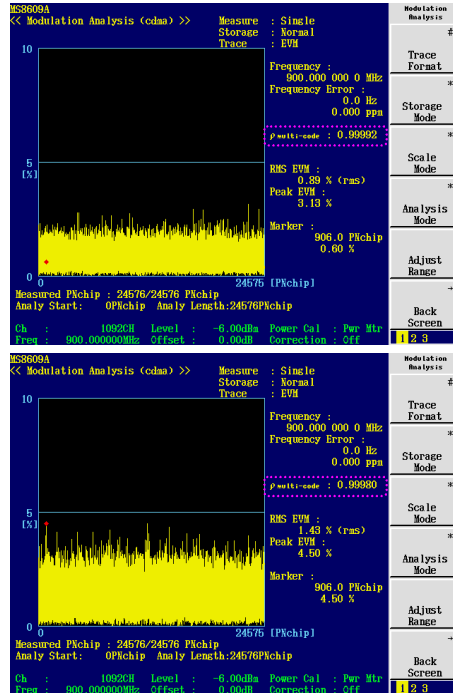
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# Effect of $\rho$ on LPF Setting

- RC 1, 2 F-FCH  $\times 6$



- » When LPF changed from Auto (3 MHz) to 1 MHz

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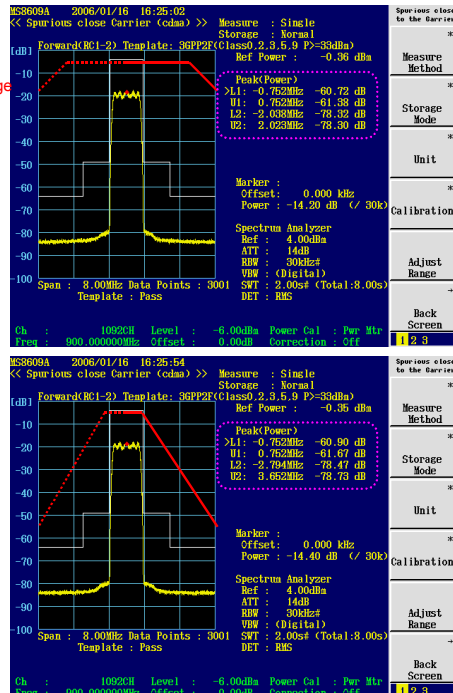
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# Effect of Spurious on LPF Setting

- RC 1, 2 F-FCH  $\times 6$

LPF Curve image



- » When LPF changed from Auto (3 MHz) to 1 MHz

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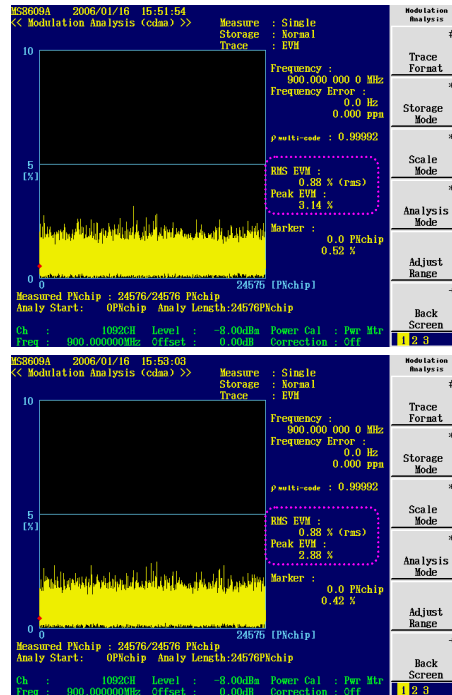
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## Effect of $\rho$ on RMS Value Setting

- RC 1, 2 F-FCH  $\times 6$

- » When RMS value changed from 0 dB to -2 dB
  - Output level -2 dBm
  - Trade-off between Peak EVM and Origin offset
    - Origin offset is quantified carrier leakage



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MG3700A-E-F-8

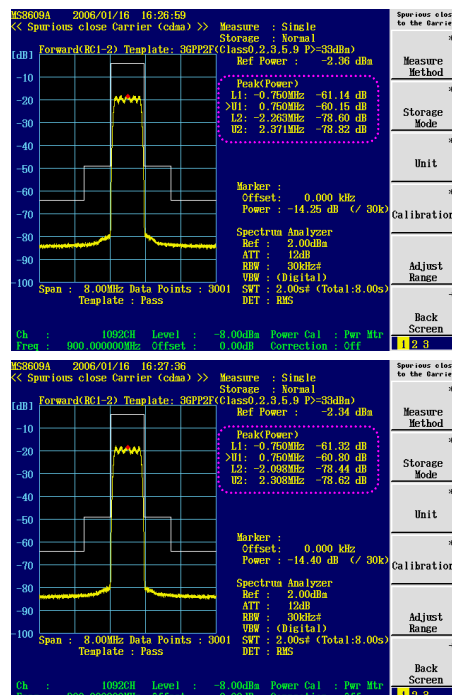
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## Effect of Spurious on RMS Value Setting

- RC 1, 2 F-FCH  $\times 6$

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



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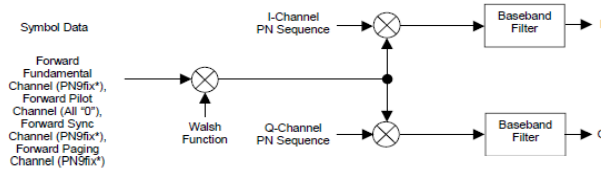
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# CDMA Signal Parameters

- Forward Test Model RC 1, 2

	Walsh Code	Code Power	Symbol Rate	Symbol Data
F-PICH	0	-7.0 dB	N/A	All "0"
F-SyncCH	32	-13.3 dB	4.8 ksp/s	PN9fix*
PagingCH	1	-7.3 dB	19.2 ksp/s	PN9fix*
F-FCH x 6	8 to 13	-10.3 dB	19.2 ksp/s	PN9fix*

PN9 initialized at start of 4 frames



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MG3700A-E-F-8

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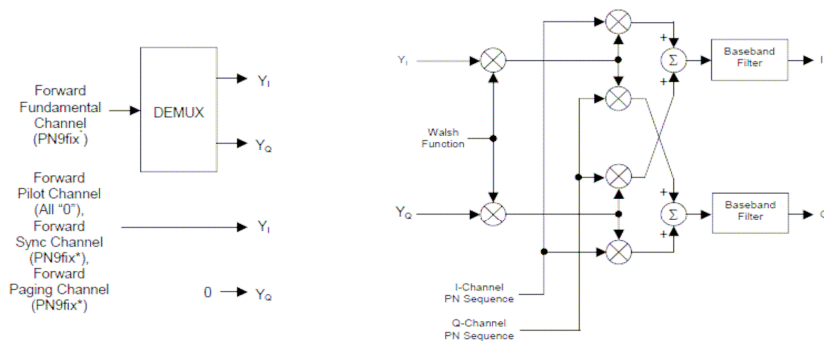
Anritsu

# CDMA Signal Parameters

- Forward Test Model RC 3, 4, 5

	Walsh Code	Code Power	Symbol Rate	Symbol Data
F-PICH	0	-7.0 dB	N/A	All "0"
F-SyncCH	32	-13.3 dB	4.8 ksp/s	PN9fix*
PagingCH	1	-7.3 dB	19.2 ksp/s	PN9fix*
F-FCH x 6	8 to 13	-10.3 dB	38.4 ksp/s	PN9fix*

PN9 initialized at start of 4 frames

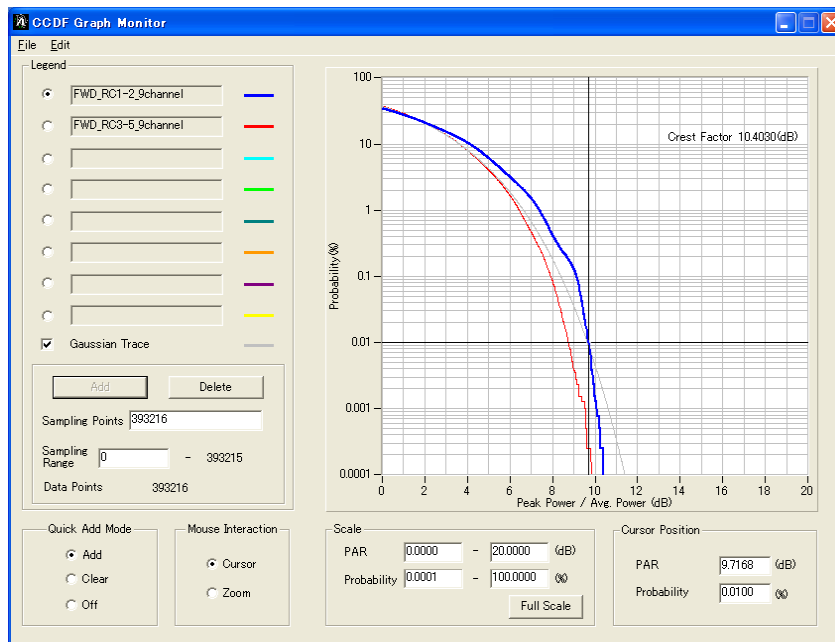


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# CDMA Signal CCDF Simulation



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## Additional Information

- **Forward Test Model for 1X BS Transmitter Test**
  - Explore 3GPP2 C.S0010-C section 6.5.2 **87**
- **Reverse Traffic Channel for 1X MS Transmitter Test**
  - Explore 3GPP2 C.S0011-C **96**
- **Forward Traffic Channel for 1xEV-DO AN Transmitter Test**
  - Explore 3GPP2 C.S0032-A **111**
- **Reverse Traffic Channel for 1xEV-DO AT Transmitter Test**
  - Explore 3GPP2 C.S0033-A **122**



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# Forward Test Model for 1X BS Transmitter Test

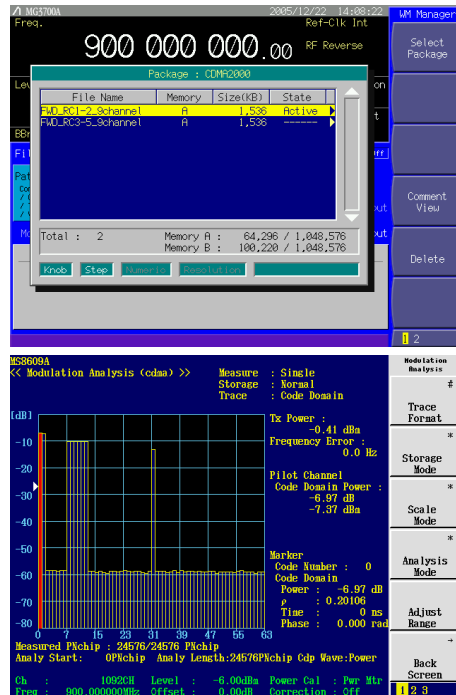
## Test

- Frequency Tolerance
- Waveform Quality ( $\rho$ )
- Total Power
- Code Domain Power
- Conducted Spurious Emissions
- Inter-BS Transmitter Intermodulation
- OBW
  - Applies to Band Class 3 and 6 only

Channel Type	Number of Channels	Fraction of Power (linear)	Fraction of Power (dB)	Comments
Forward Pilot	1	0.2000	-7.0	Code channel $W_0^{64}$
Sync	1	0.0471	-13.3	Code channel $W_{32}^{64}$ ; always 1/8 rate
Paging	1	0.1882	-7.3	Code channel $W_1^{64}$ ; full rate only
Traffic	M	0.5647/M	-2.48 - 10 log(M)	Variable code channel assignments; full rate only

For the Total Power (4.3.1) and Conducted Spurious Emissions tests (4.4.1), M shall be the lesser of 37 or the maximum number of Fundamental Traffic Channels supported by the base station for the radio configuration under test.

For all other tests, M shall be 6.



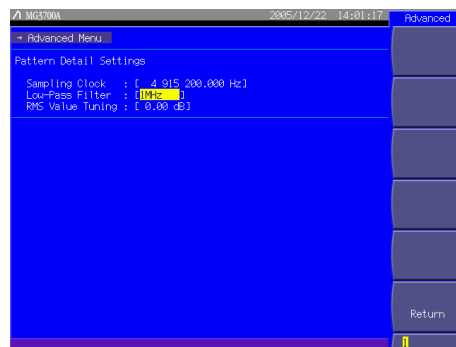
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# Forward Test Model for 1X BS Transmitter Test

- » Set the LPF correctly.
- » Tune the RMS value correctly
  - Improves Spurious,  $\rho$
  - \* More information in MG3700A Product Introduction



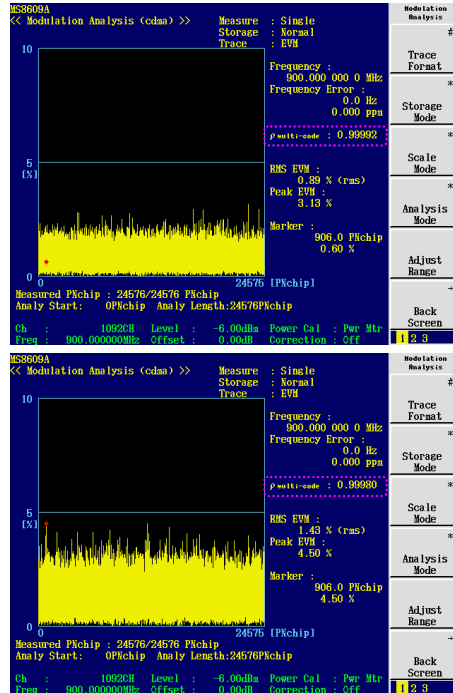
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## Effect of $\rho$ on LPF Setting

- RC 1, 2 F-FCH  $\times 6$



- » When LPF changed from Auto (3 MHz) to 1 MHz

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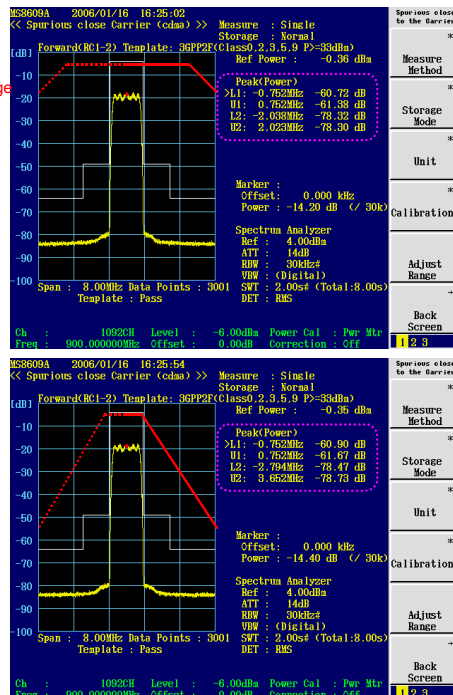
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## Effect of Spurious on LPF Setting

- RC 1, 2 F-FCH  $\times 6$

LPF Curve image



- » When LPF changed from Auto (3 MHz) to 1 MHz

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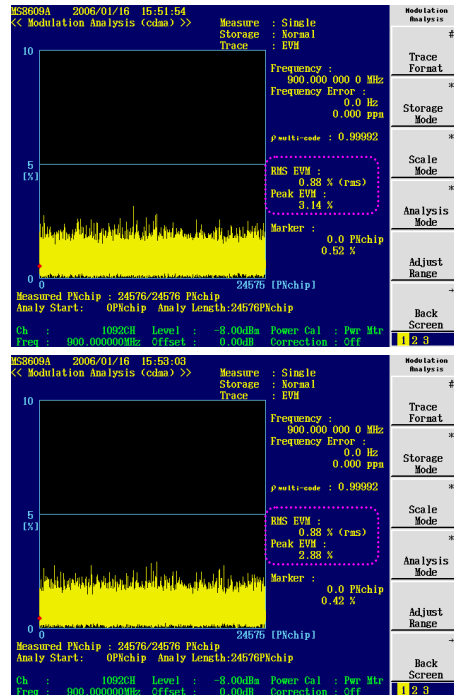
Slide 90

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## Effect of $\rho$ on RMS Value Setting

- RC 1, 2 F-FCH  $\times 6$

- » When RMS value changed from 0 dB to -2 dB
  - Output level -2 dBm
  - Trade-off between Peak EVM and Origin offset
    - Origin offset is quantified carrier leakage



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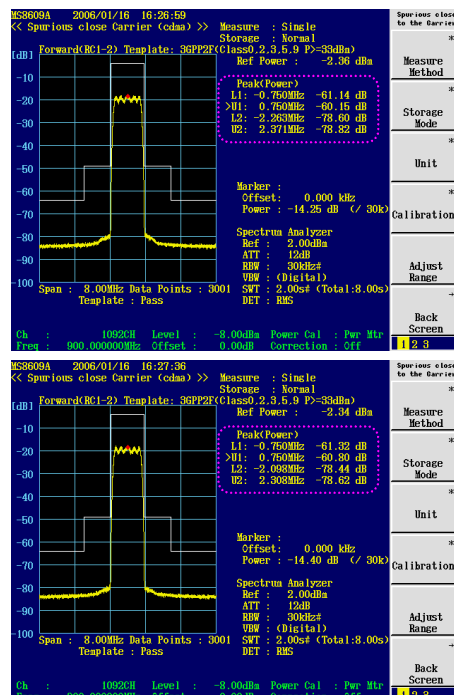
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## Effect of Spurious on RMS Value Setting

- RC 1, 2 F-FCH  $\times 6$

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



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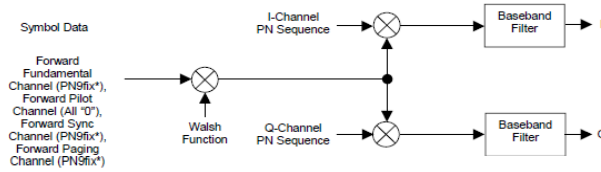
Anritsu

# Forward Signal Parameters

- Forward Test Model RC 1, 2

	Walsh Code	Code Power	Symbol Rate	Symbol Data
F-PICH	0	-7.0 dB	N/A	All "0"
F-SyncCH	32	-13.3 dB	4.8 ksp/s	PN9fix*
PagingCH	1	-7.3 dB	19.2 ksp/s	PN9fix*
F-FCH x 6	8 to 13	-10.3 dB	19.2 ksp/s	PN9fix*

PN9 initialized at start of 4 frames



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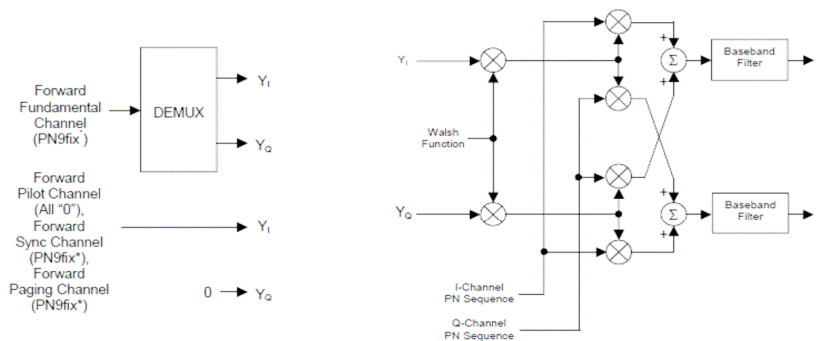
Anritsu

# Forward Signal Parameters

- Forward Test Model RC 3, 4, 5

	Walsh Code	Code Power	Symbol Rate	Symbol Data
F-PICH	0	-7.0 dB	N/A	All "0"
F-SyncCH	32	-13.3 dB	4.8 ksp/s	PN9fix*
PagingCH	1	-7.3 dB	19.2 ksp/s	PN9fix*
F-FCH x 6	8 to 13	-10.3 dB	38.4 ksp/s	PN9fix*

PN9 initialized at start of 4 frames



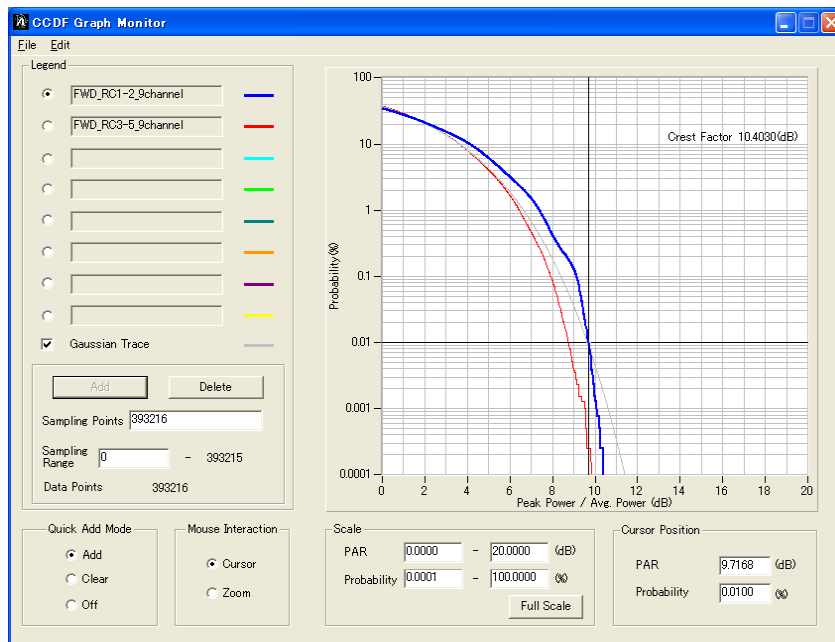
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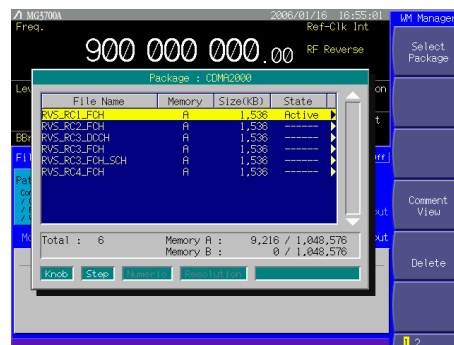
# Forward Test Model for 1X BS Transmitter Test CCDF Simulation



# Reverse Traffic Channel for 1X MS Transmitter Test

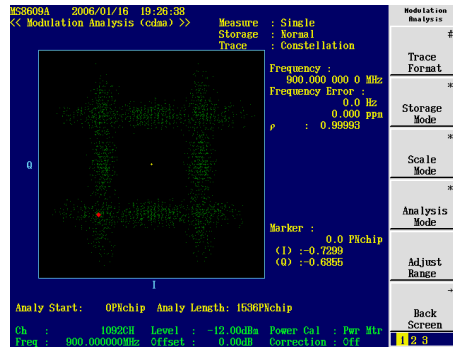
## Test

- Frequency Accuracy
- Waveform Quality ( $\rho$ )
- Code Domain Power
- Maximum RF Output Power
- Conducted Spurious Emissions
- OBW
  - Applies to Band Class 3 and 6 only

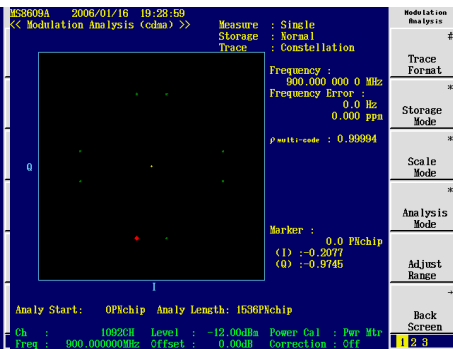
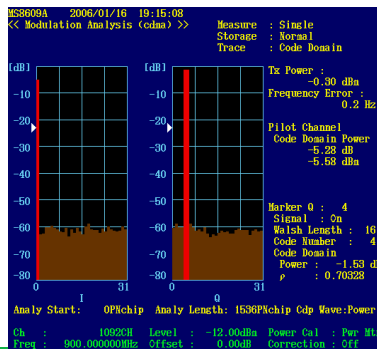


# Reverse Traffic Channel for 1X MS Transmitter Test

- RC 1, 2 R-FCH
  - » O-QPSK



- RC 3, 4 R-FCH
  - » HPSK



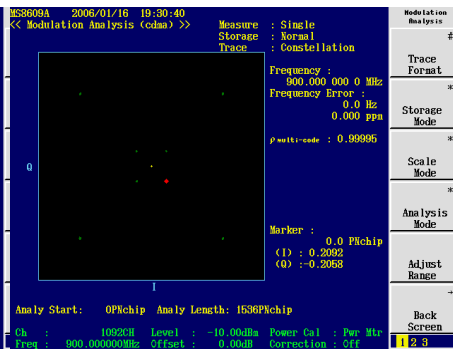
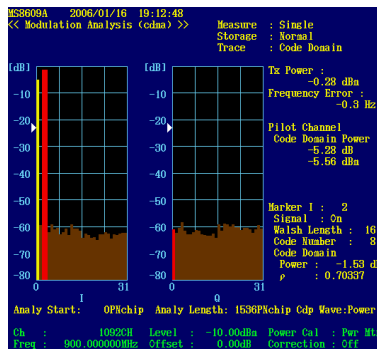
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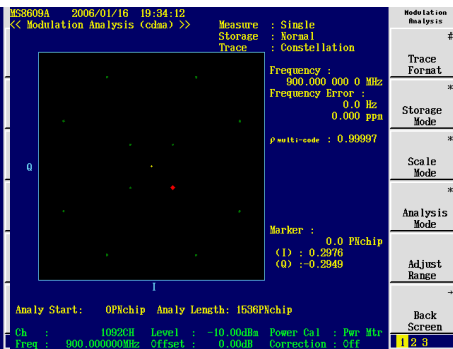
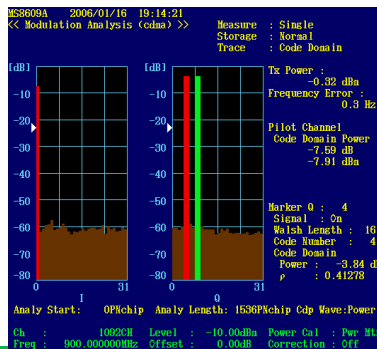
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# Reverse Traffic Channel for 1X MS Transmitter Test

- RC3 R-DCCH
  - » HPSK



- RC3 R-SCH
  - » HPSK



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## Reverse Traffic Channel for 1X MS Transmitter Test

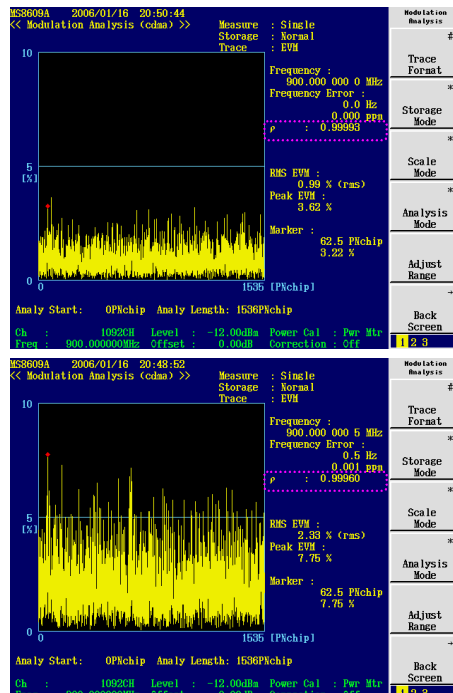
- » Set the LPF correctly.
  - » Tune the RMS value correctly.
    - Improves Spurious,  $\rho$
- \* More information in MG3700A Product Introduction



## Effect of $\rho$ on LPF Setting

- RC 1, 2 R-FCH

- » When LPF changed from Auto (3 MHz) to 1 MHz

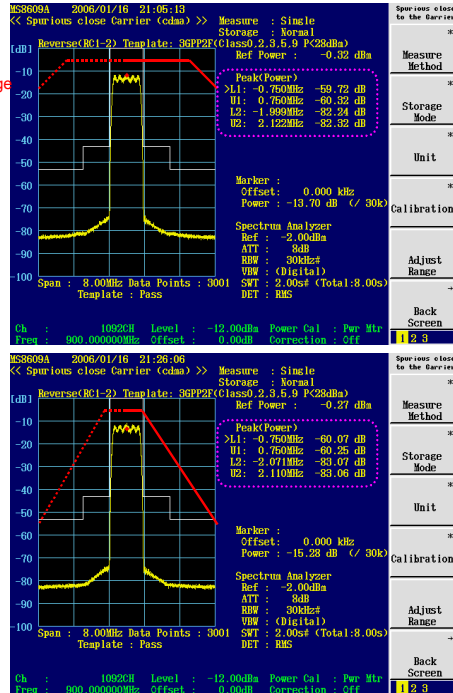


# Effect of Spurious on LPF Setting

- RC 1, 2 R-FCH

LPF Curve image

- » When LPF changed from Auto (3 MHz) to 1 MHz



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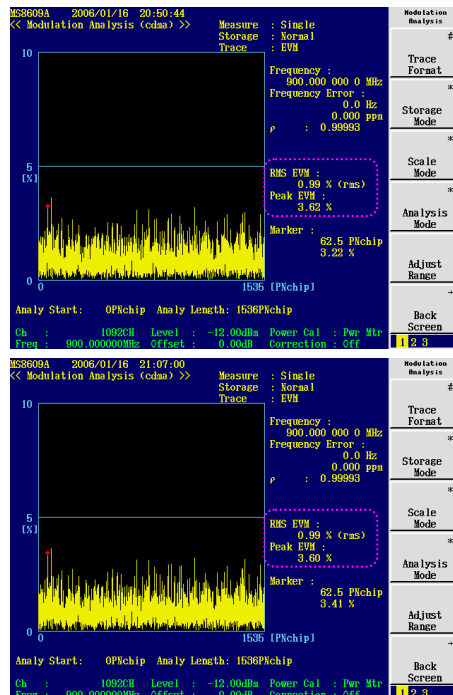
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# Effect of $\rho$ on RMS Value Setting

- RC 1, 2 R-FCH

- » When RMS value changed from 0 dB to +2 dB

- Output level 0 dBm
- Trade-off between Peak EVM and Origin offset
  - Origin offset is quantified carrier leakage



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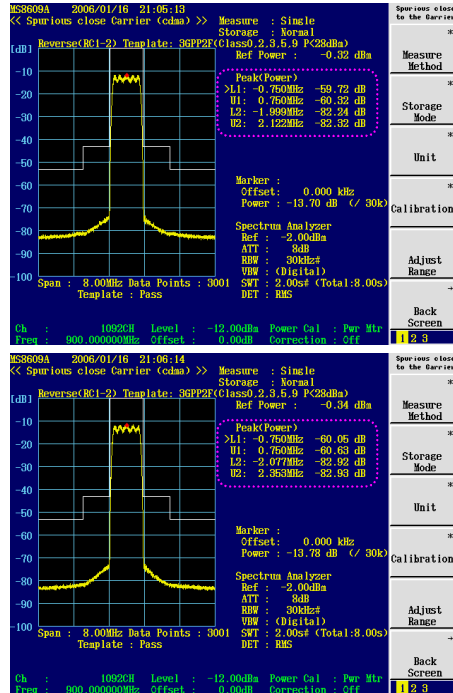
Slide 102

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# Effect of Spurious on RMS Value Setting

- RC 1, 2 R-FCH

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

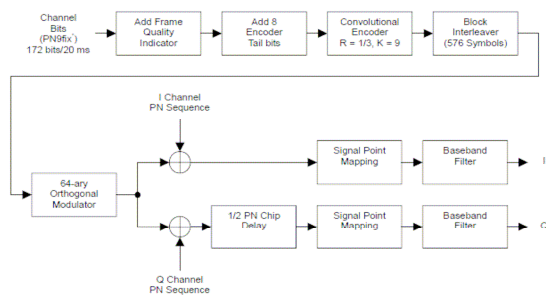


# Reverse Signal Parameters

- RC1 R-FCH

	Data Rate	Data
R-FCH	9.6 kbps	PN9fix*

PN9 initialized at start of 4 frames

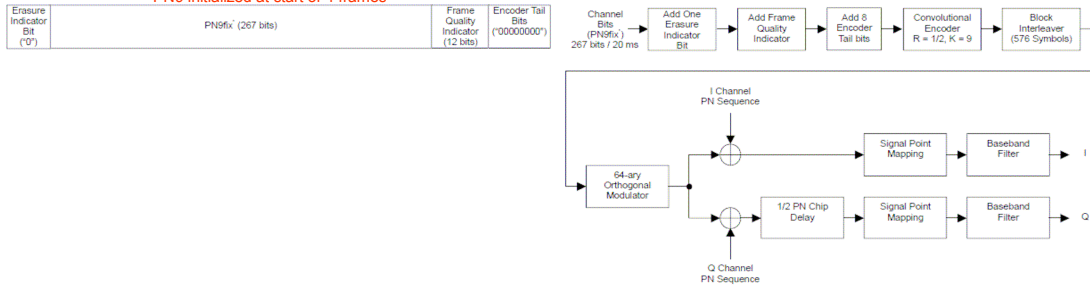


# Reverse Signal Parameters

- RC2 R-FCH**

	Data Rate	Data
R-FCH	14.4 kbps	PN9fix*

PN9 initialized at start of 4 frames

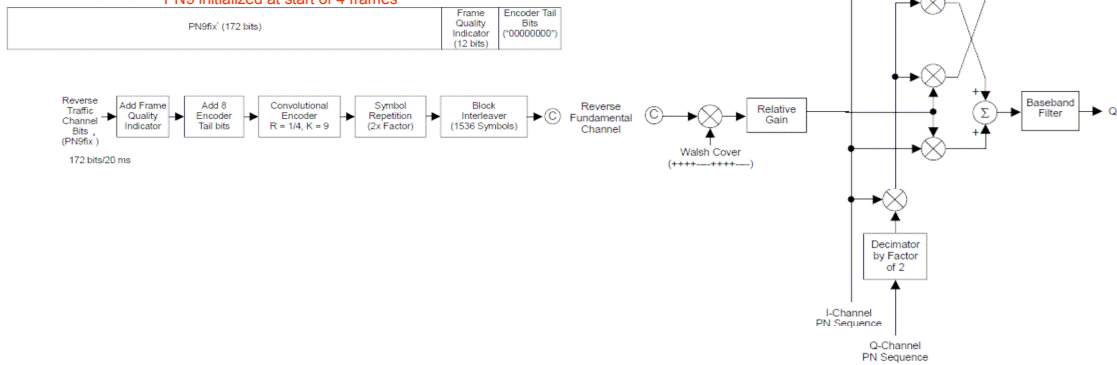


# Reverse Signal Parameters

- RC3 R-FCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-5.278 dB	N/A	All "0"
R-FCH	4	-1.528 dB	9.6 kbps	PN9fix*

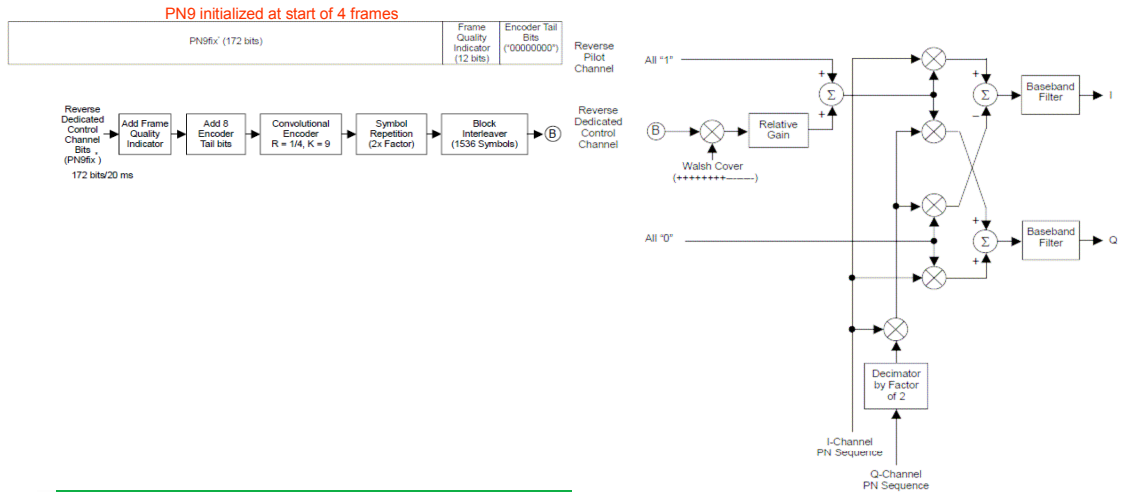
PN9 initialized at start of 4 frames



# Reverse Signal Parameters

- RC3 R-DCCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-5.278 dB	N/A	All "0"
R-DCCH	8	-1.528 dB	9.6 kbps	PN9fix*



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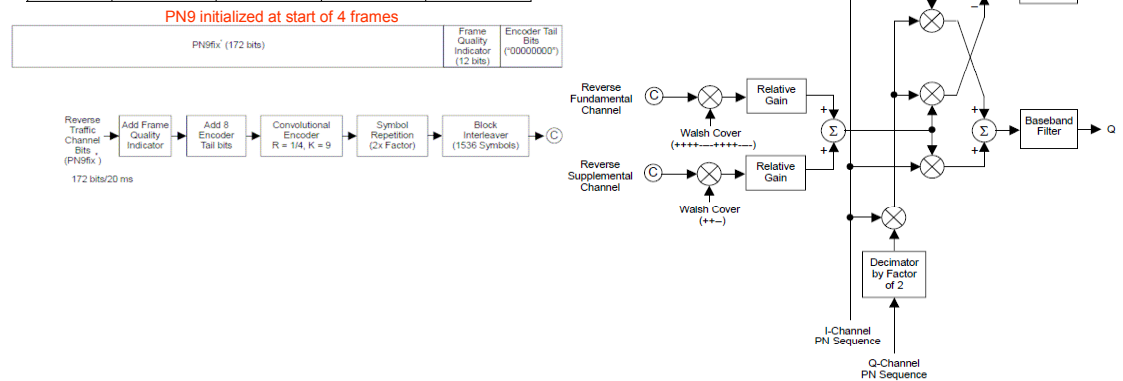
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# Reverse Signal Parameters

- RC3 R-SCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-7.5912 dB	N/A	All "0"
R-FCH	4	-3.8412 dB	9.6 kbps	PN9fix*
R-SCH	2	-3.8412 dB	9.6 kbps	PN9fix*



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MG3700A-E-F-8

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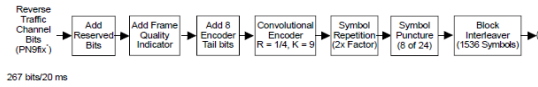


# Reverse Signal Parameters

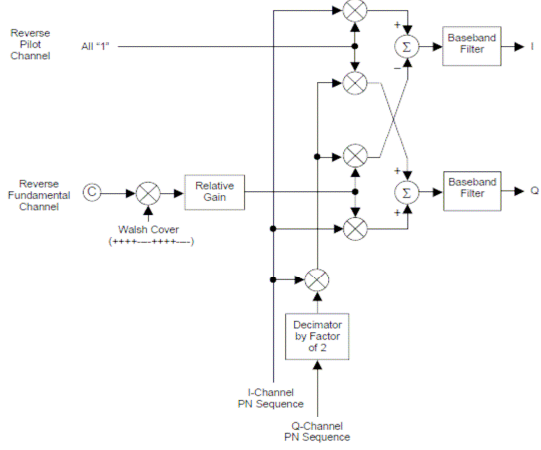
- RC4 R-FCH**

	Walsh Code	Code Power	Data Rate	Data
R-PICH	0	-5.278 dB	N/A	All "0"
R-FCH	4	-1.528 dB	14.4 kbps	PN9fix*

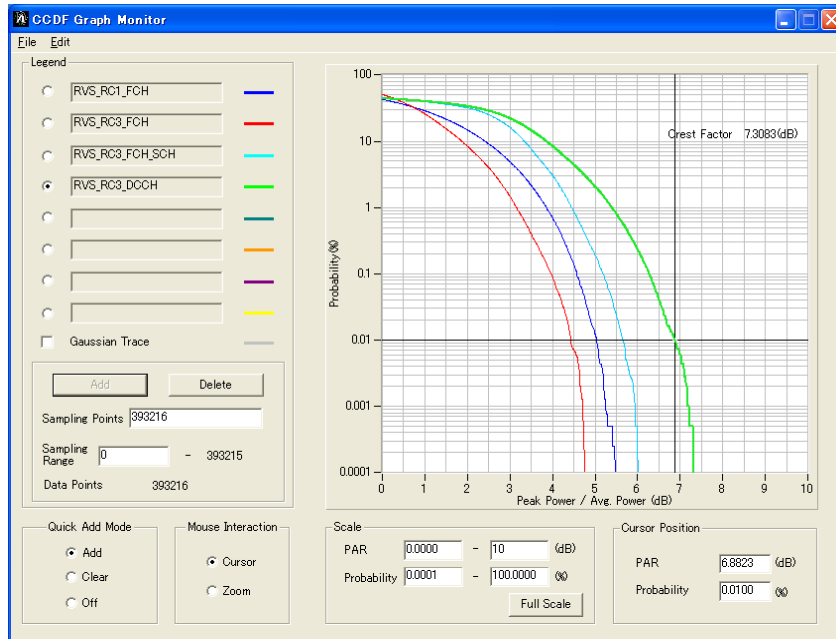
PN9 initialized at start of 4 frames



267 bits/20 ms



# Reverse Traffic Channel for 1X MS Transmitter Test CCDF Simulation

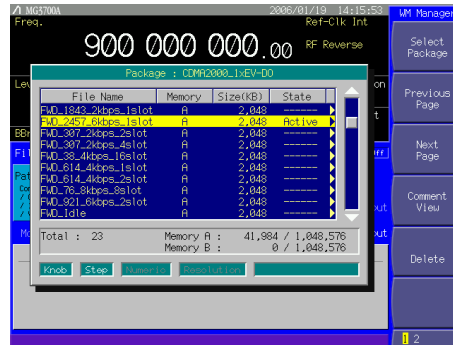




# Forward Traffic Channel for 1xEV-DO AN Transmitter Test

## Test

- Frequency Tolerance
- Waveform Quality (r)
  - Active slot
- Total Power
  - 614.4 kbps, 1 slot/packet, QPSK
- Pilot/MAC Channel Power
  - Idle slot
- Code Domain Power
  - 614.4 kbps, 1 slot/packet, QPSK
- Conducted Spurious Emissions
  - 2,457.6 kbps, 1 slot/packet, 16QAM
  - Idle slot
- Inter-Sector Transmitter Intermodulation
  - Active slot
  - Idle slot
- OBW
  - Active slot
    - Applies to Band Class 3 and 6 only

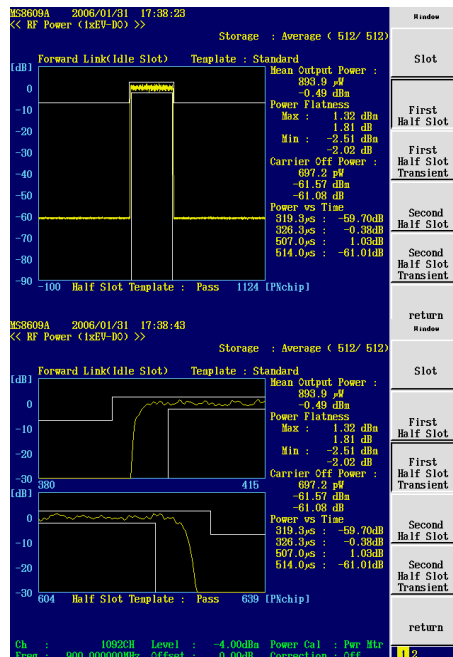
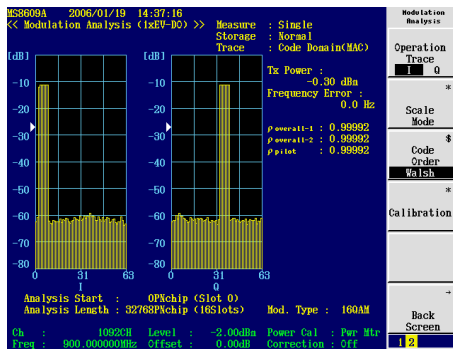


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# Forward Traffic Channel for 1xEV-DO AN Transmitter Test



Idle slot

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# Forward Traffic Channel for 1xEV-DO AN Transmitter Test

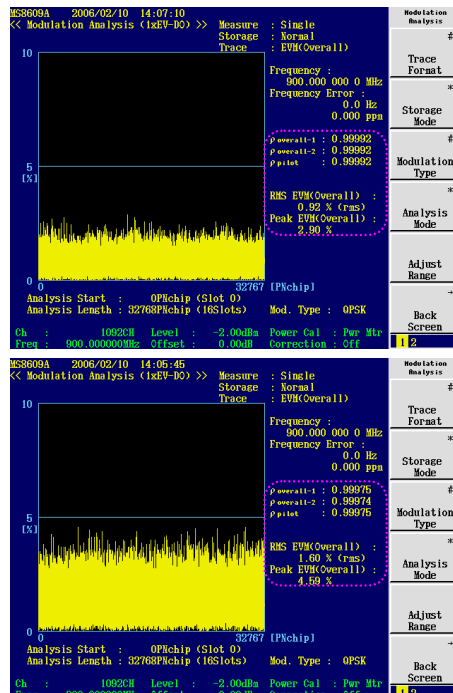
- » Set LPF correctly.
  - » Tune RMS value correctly.
    - Improves Spurious, r
- \* More information in MG3700A Product Introduction



# Effect of r on LPF Setting

- Forward Traffic Channel
  - 614.4 kbps, 1 slot/packet, QPSK

- » When LPF changed from Auto (3 MHz) to 1 MHz



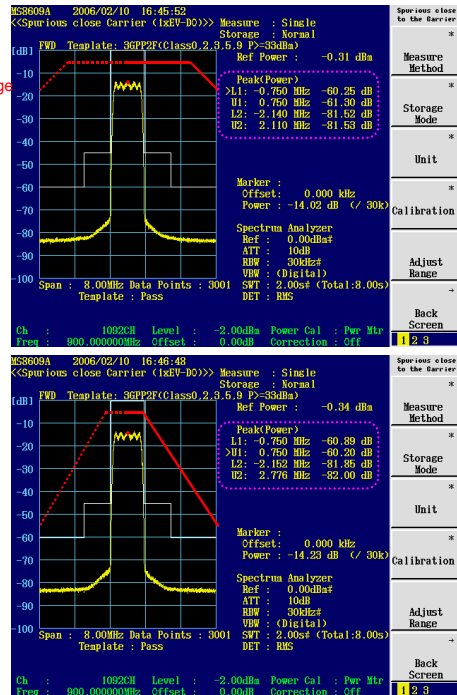
## Effect of Spurious on LPF Setting

- **Forward Traffic Channel**

- 2,457.6 kbps, 1 slot/packet, 16QAM

LPF Curve image

- » When LPF changed from Auto (3 MHz) to 1 MHz



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## Effect of r on RMS Value Setting

- **Forward Traffic Channel**

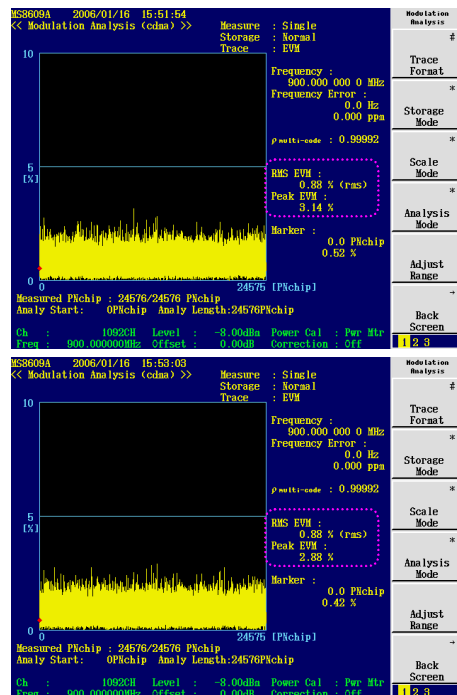
- 614.4 kbps, 1 slot/packet, QPSK

- » When RMS value changed from 0 dB to -2 dB

- Output level -2 dBm

- Trade-off between Peak EVM and Origin offset

- Origin offset is quantified carrier leakage



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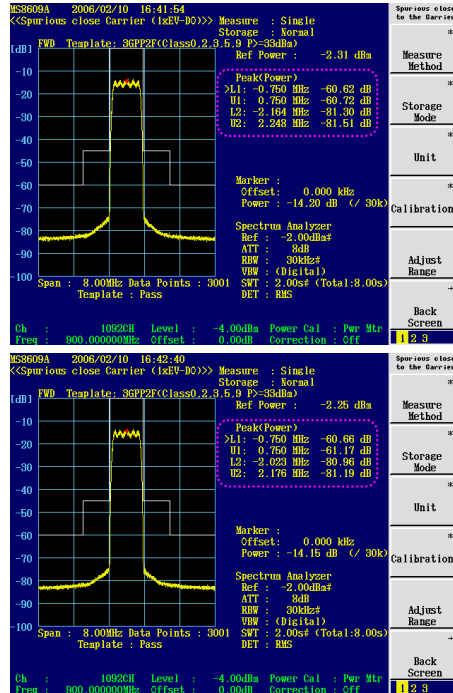
Slide 116

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# Effect of Spurious on RMS Value Setting

- **Forward Traffic Channel**
  - 2,457.6 kbps, 1 slot/packet, 16QAM

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

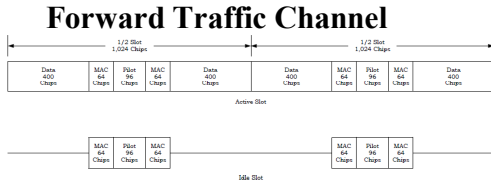


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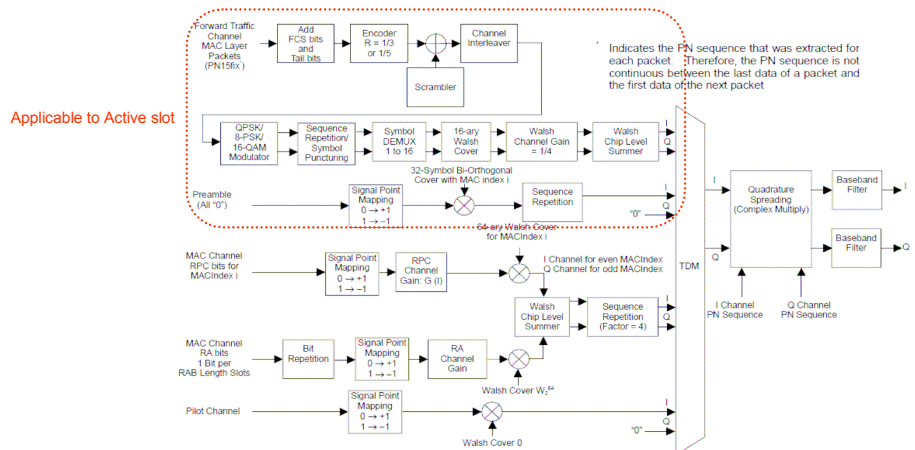
Slide 117

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# Forward Signal Parameters



Marker Signal	Output Data
Marker 1	Frame Clock
Marker 2	RF Gate
Marker 3	Symbol Clock
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2 + Q^2} = 320 \text{ mV}$
AWGN addition (Note)	Enable



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# Forward Signal Parameters

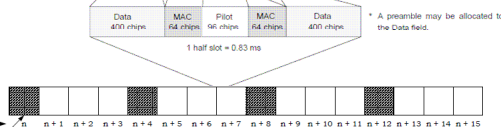
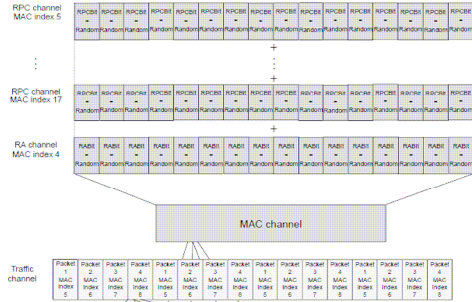
- Forward MAC Channel**
  - » The encoder output is scrambled to randomize the data prior to modulation. MACIndex is specified in part of the initial state in the scrambler with a 17-tap linear feedback shift register.

MACIndex	MAC Channel Use	Preamble Use
0 and 1	Not Used	Not Used
2	Not Used	76.8 kbps Control Channel
3	Not Used	38.4 kbps Control Channel
4	RA Channel	Not Used
5-17	Available for RPC Channel and DRCLock Channel Transmissions	Available for Forward Traffic Channel <u>if Broadcast is not notated</u> <del>Transmissions</del>
6-63	Available for RPC Channel and DRCLock Channel Transmissions	Available for Forward Traffic Channel Transmissions



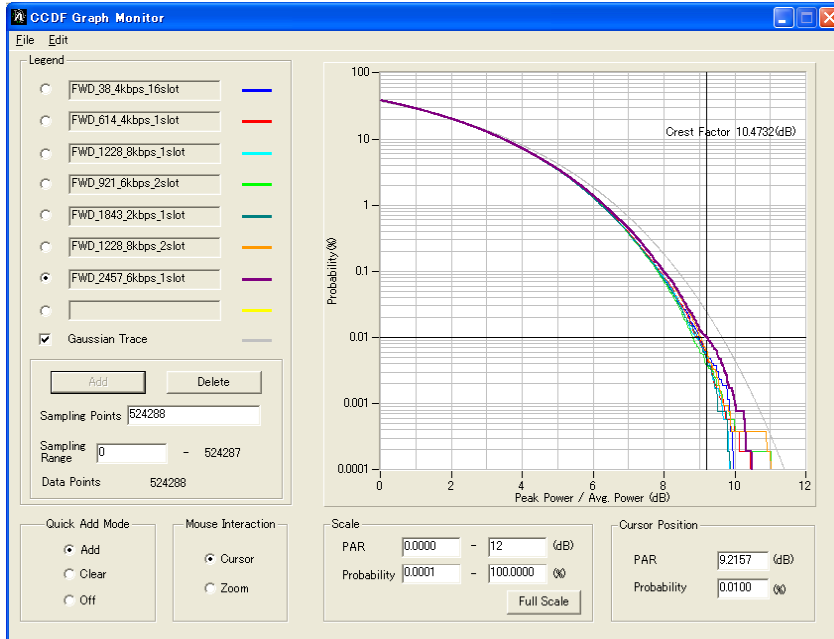
MAC Index	RABit	RPCBit
4 (RA Channel), 5-17 (RPC Channel)	Random	Random

Every slot



# Forward Traffic Channel for 1xEV-DO AN Transmitter Test CCDF Simulation

- QPSK
- QPSK
- QPSK
- 8PSK
- 8PSK
- 16QAM
- 16QAM



# Forward Multi-carrier for 1xEV-DO AN Transmitter Test

License option MX370103A

• Can create up to 9 carriers

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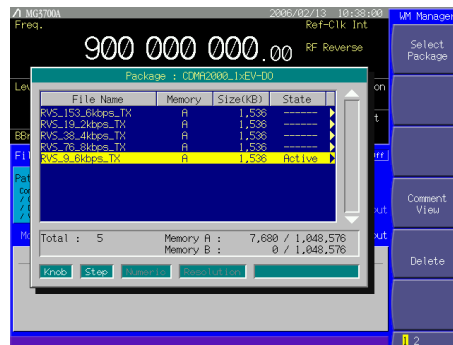
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# Reverse Traffic Channel for 1xEV-DO AT Transmitter Test

## Test

- Frequency Accuracy
  - 9.6 kbps
- Waveform Quality (r)
  - 9.6 kbps
- Maximum RF Output Power
  - 153.6 kbps
- Code Domain Power
  - 9.6 kbps
  - 19.2 kbps
  - 38.4 kbps
  - 76.8 kbps
  - 153.6 kbps
- Conducted Spurious Emissions
  - 153.6 kbps
- OBW
  - 9.6 kbps
  - Applies to Band Class 3 and 6 only



Field	Value (Decimal)
DRCLength	0 (1 slot)
DRCChannelGain	6 (3 dB)
ACKChannelGain	6 (3 dB)

Rate (kbps)	DataChannelGain (dB)
9.6	3.75
19.2	6.75
38.4	9.75
76.8	13.25
153.6	18.50

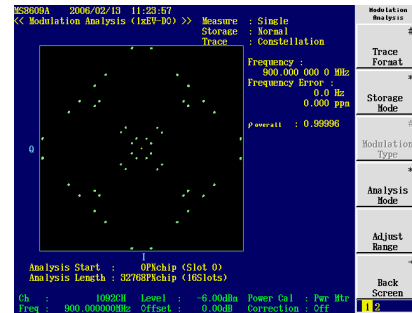
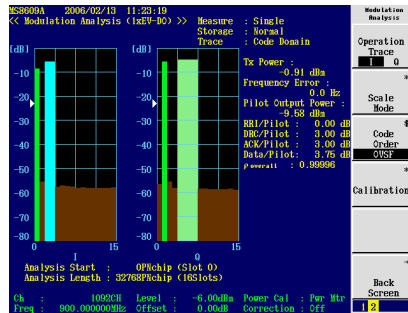
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MG3700A-E-F-8

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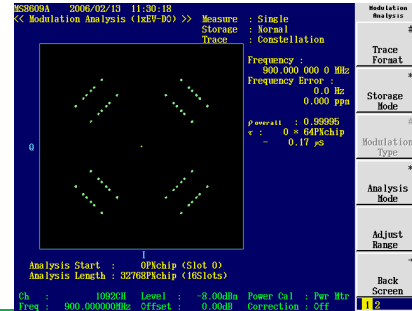
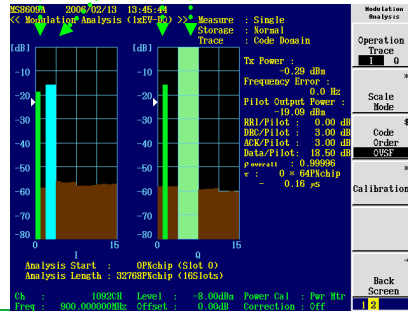
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# Reverse Traffic Channel for 1xEV-DO AT Transmitter Test

- 9.6 kbps



- 153.6 kbps Pilot+RRI ACK DRC Data



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# Reverse Traffic Channel for 1xEV-DO AT Transmitter Test

- » Set the LPF correctly.
- » Tune the RMS value correctly.
  - Improves Spurious, r
  - \* More information in MG3700A Product Introduction



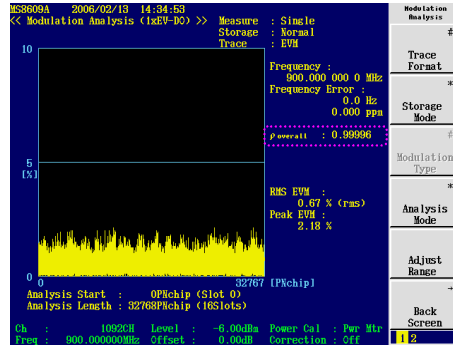
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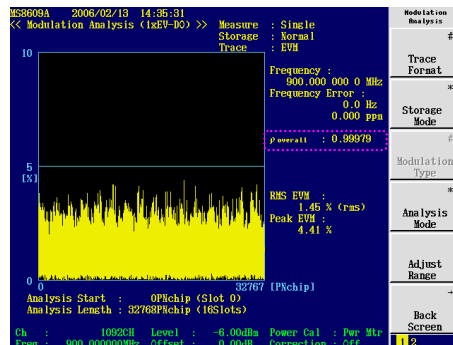
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# Effect of r on LPF Setting

- Reverse Traffic Channel
  - 9.6 kbps



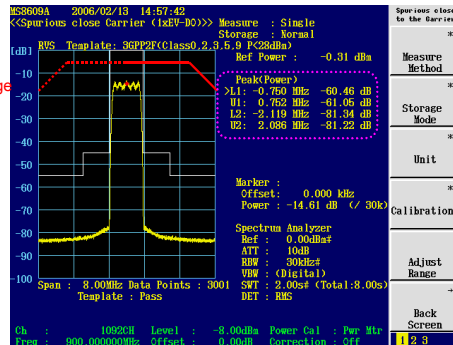
- » When LPF changed from Auto (3 MHz) to 1 MHz



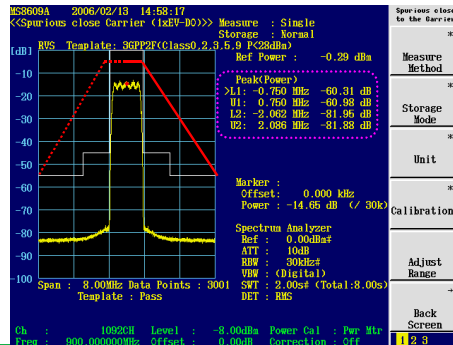
# Effect of Spurious on LPF Setting

- Reverse Traffic Channel
  - 153.6 kbps

LPF Curve image



- » When LPF changed from Auto (3 MHz) to 1 MHz

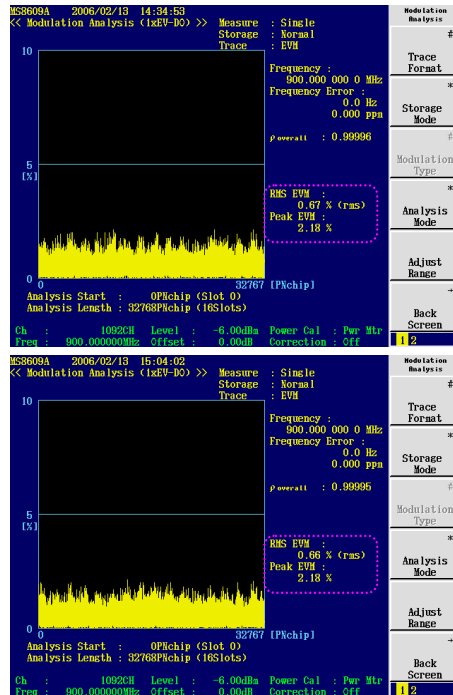




## Effect of r on RMS Value Setting

- Reverse Traffic Channel
  - 9.6 kbps

- » When RMS value changed from 0 dB to +2 dB
  - Output level 0 dBm
  - Trade-off between Peak EVM and Origin offset
    - Origin offset is quantified carrier leakage



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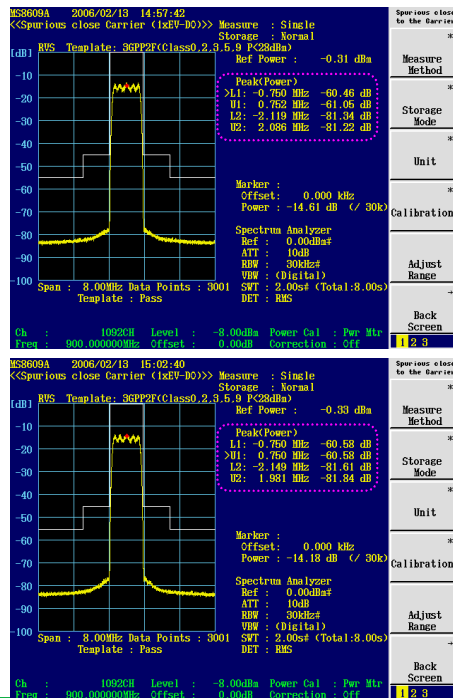
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## Effect of Spurious on RMS Value Setting

- Reverse Traffic Channel
  - 153.6 kbps

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



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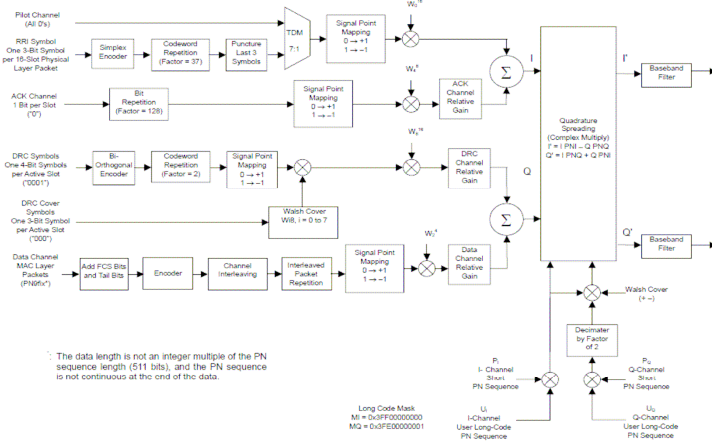
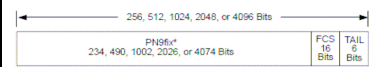
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# Reverse Signal Parameters

- Reverse Traffic Channel

Marker Signal	Output Data
Marker 1	Frame Clock
Marker 2	RF Gate
Marker 3	Symbol Clock
RMS for single phase of IQ	1157
IQ output level	$\sqrt{I^2 + Q^2} = 320 \text{ mV}$
AWGN addition (Note)	Enable

Data Rate (kbps)	RRI Symbol	DRC Value	DRC Cover	ACK Channel Bit
9.6	001	0x01	$W_0^8$	0
19.2	010	0x01	$W_0^8$	0
38.4	011	0x01	$W_0^8$	0
76.8	100	0x01	$W_0^8$	0
153.6	101	0x01	$W_0^8$	0

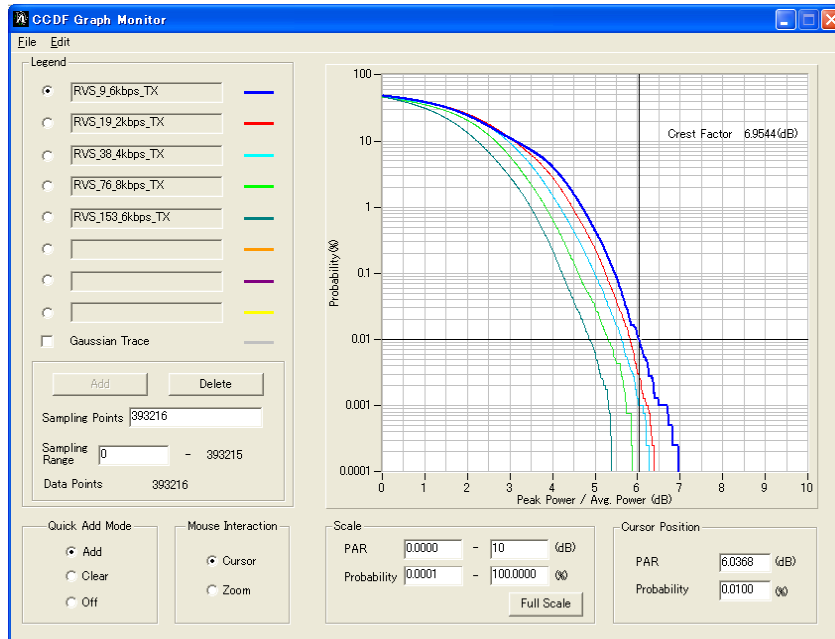


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# Reverse Traffic Channel for 1xEV-DO AT Transmitter Test CCDF Simulation



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