

CDMA2000



CDMA2000 is a technology, which is being deployed to meet the requirements of the IMT-2000 3G global wireless communications system.

One of the benefits of the CDMA2000 systems is to increase data rates to/from the mobile device. To enable the testing of mobile devices supporting these higher data rates, the 3GPP2 organization developed a TDSO (Test Data Service Option) – Service Option 32.

Service Option 32 allows the mobile to operate in a special mode, which enables supplemental channels at fixed rates with a frame error rate reporting mechanism.

This application note provides the basic concept of TDSO Service Option 32 and how the 43xx utilizes this service option to test both receiver and transmitter performance when a supplemental channel is enabled.

Basic Concept of TDSO

TDSO provides for the generation of an arbitrary (pre-selected or random) data source for transport over forward and reverse traffic channels while following an arbitrary (preselected or random) transmission frame activity. The test is performed at a fixed data rate.

The mobile station and the base station generate TDSO data frames for the configured and allocated traffic channels. The content of each frame is generated by a selectable byte pattern or by employing a hybrid approach consisting of pseudo-randomly generated data together with a circular buffer.

The frame generation processes are synchronized between the mobile station and the base station. This permits the receiving station to reproduce the transmitted frames and compare them to the received frames. The test equipment counts the number of various frame types that were transmitted on a particular traffic channel. The test equipment also counts the number of various frame types received on the traffic channel according to the information provided by the multiplex sublayer and the result of the comparison between the frame received and the locally generated replica. Frame error and bit error statistics can be calculated from these counts.

TDSO Service Option 32 and Supplemental Channel Setup

To perform any testing with a supplemental channel, the Willtek 43xx Service Option must be set to 32. This may be achieved by setting up the initial channel conditions. This may be accomplished by pressing the "System Setup" softkey, followed by the "CDMA" softkey. This will place the 43xx in the screen shown below in Figure 1. Press the "Service Config" softkey to set up radio configuration and service option.

Setup Initial Service		Channel Type
Channel Type	CDMA	Band
Channel	0384	Channel
Frame Offset	00 (0.00 ms)	Frame Offset
Traffic Code	16	Traffic Code
Radio Config	F3-R3	Service Config
Service Option	32	
		Return

Figure 1 – CDMA Traffic Channel Setup

After pressing the above key sequences, the screen shown in Figure 2 will be displayed. The Radio Configuration must be set to "F3-R3" to allow the service option to be set to 32. Both the Radio Configuration and CDMA2000 Service Option Configuration may be set by pressing the corresponding softkeys shown in Figure 2.

Setup Initial Service		
Cdma2000		
Radio Config	F3-R3	Radio Config
Service Option	32	Cdma2000 Serv Opt
(Test Data Service Option)		
F-SCH:	16X 153.6 kbps	SCH Setup
	Conv. Encoder	
	PRBS Pattern	
R-SCH:	16X 153.6 kbps	
	Conv. Encoder	

CdmaOne		CdmaOne Serv Opt
Service Option	2	
(Loopback, 9600 rate set)		
		Return

Figure 2 – RC and Service Option Configuration

Once the proper radio configuration is selected and the Service Option is set to 32, the forward supplemental data rate, Encoder type, Reverse supplemental channel state, data rate and encoder type must be selected. This may be accomplished by pressing "SCH Setup" softkey in the user screen in Figure 2. The screen shown in Figure 3 will be displayed allowing the supplemental channel to be configured according to user test requirement.

Setup Initial Service		Default Setup
F-SCH Data Rate	16X 153.6 kbps	F-SCH Data Rate
F-SCH Enc. Type	Conv.	F-SCH Enc. Type
F-SCH Pattern	PRBS 0x01	F-SCH Pattern

R-SCH On/Off	ON	R-SCH On/Off
R-SCH Data Rate	16X 153.6 kbps	R-SCH Data Rate
R-SCH Enc. Type	Conv.	R-SCH Enc. Type
		Return

Figure 3 – Forward & Reverse Supplemental Channel Setup

FER Measurements in TDSO mode

Once the Service Option and Supplemental channels have been configured properly, the user must "Page" the mobile device to establish a traffic channel with fundamental and supplemental channels enabled. A mobile-originated call will not guarantee that the call will be established utilizing Service Option 32. Once the call is established, the user may perform receiver sensitivity or dynamic range test by performing Frame Error Rate (FER) measurements. This may be accomplished by pressing the "FER" softkey. The 43xx FER is shown in Figure 4. There are three (3) sections to this screen: Previous test results (top section), current test results (middle section) and test configuration (lower section).

Previous Test results:

This section displays the frame information, which was reported by the mobile. This information is then compared against user-defined limits and a pass/fail status indication is provided.

Current results:

This section displays the status of the current test. This is the number of frames transmitted, the number of frame errors reported, the mobile device and the calculated FER, based on the previous two parameters.

Test Configuration

This section displays the test configuration parameters, which will have a direct impact on the FER rate test or correlate to the IS-98D test specification. These test parameters may be modified by pressing the "Rx Quality Setup" softkey. The Rx Quality Setup screen is shown in Figure 5.

CDMA Rx Quality (TDS0)		Messages
FER 0.0000 %		Channel Setup
Status: Passed w/ Confidence		Loopback / Voice
Calculated Confidence 99.40%		Pause / Resume
Frame Errors	0	Transmit Tests
Good Frames	1024	Rx Qual Setup
Blank Frames	0	AWGN On/Off
Frames Transmitted	1024	Summary

Current Test FER 0.0000 %		
Frame Errors	0	
Frames Transmitted	1024	

F-SCH Ec/Ior	-13.6 dB	
F-SCH Ec/Io	-13.6 dB	
Maximum FER Limit	0.5 %	
F-SCH Data Rate	153600	
PN	0	Base Pwr -70.0
Channel	384	Radio Cfg F3-R3
Traffic	24	

Figure 4 – FER Screen

CDMA Rx Quality Setup (TDS0)		Default Setup
Maximum Frames	8192	Maximum Frames
Maximum FER Limit	0.5 %	Maximum FER Limit
Confidence Level	95.0 %	Confidence Level

F-SCH Ec/Ior	-13.6	F-SCH Level
F-SCH Ec/Io	-13.6 dB	AWGN On/Off
PN	0	Base Pwr -70.0
Channel	384	Radio Cfg F3-R3
Traffic	24	
		Return

Figure 5 – Rx Quality Setup (TDS0)

Code Domain Power Measurements of Supplemental Channel

To measure the code domain power of a supplemental channel, the user must "Page" the mobile device to establish a traffic channel with fundamental and supplemental channels enabled. Prior to this step, the service option and supplemental channels should be configured as shown in Figure 3. The reverse supplemental channel must be enabled. Once, the mobile is on a call the user may get to the code domain screen by pressing the "Transmitter Test" softkey and then the "Code Domain" softkey. The 43xx will now be displaying the screen shown in Figure 6.

Code Domain Power		Setup
Q	Code I	Waveform Qual
0	0	0.9935
8		Power 0.5dBm
4		Pilot Error
12		Freq 0.00kHz
2		Time -477 ns
10		Cursor Data
6		Walsh Code 0
14		I-ch: -11.2 dB
1		Q-ch: -38.9 dB
9		Walsh Code
5		
13		
3		
11		
7		
15		
PN	0	Base Pwr -70.0
Channel	384	Radio Cfg F3-R3
Traffic	24	
		Return

Figure 6 – Code Domain Power Screen

Channel	Walsh Function	Data Rates	I or Q	Walsh Codes
R-PICH	W ₀ ³²	NA	I	0
R-DCCH	W ₈ ¹⁶	NA	I	8
R-SCH2	W ₆ ⁸	NA	I	6, 14
	W ₂ ⁴			2, 10, 6, 14
R-FCH	W ₄ ¹⁶	NA	Q	4
R-EACH or				
R-CCCH	W ₂ ⁸	NA	Q	2, 10
R-SCH1	W ₂ ⁴	19.2 kbps	Q	2
R-SCH1	W ₂ ⁴	38.4 kbps	Q	2, 10
R-SCH1	W ₂ ⁴	76.8 kbps	Q	2, 10, 6, 14
R-SCH1	W ₁ ⁴	153.6 kbps	Q	1, 9, 5, 13, 3, 11, 7, 15

Table 1 – Code Domain Channel Definitions

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