

1 DMT
 2 DMT
 3a 3c

(discrete multi-tone, DMT)

가 가 ,
 kbps Mbps

xDSL(digital subscriber line)

xDSL HDSL(high-data-rate DSL), SDSL(single-line HDSL), ADSL(asymmetry DSL), UADSL(universal ADSL), VDSL(very-high-bit-rate DSL) , VDSL 300 1,500m

xDSL SCM(single-carrier modulation) CAP(carrierless AM/PM)
 QAM(quadrature amplitude modulation) MCM(multi-carrier modulation) DMT(discrete multi-tone)
 DMT 가

가
 (cyclic prefix) 가
 가

IFFT(inverse fast fourier transform) FFT(fast fourier transform)
 (near end cross-talk) (echo)

suffix) 가 , DMT (cyclic)
 (orthogonality) DMT

ic suffix) 가 ,
 DMT U2 가
 U2

U2

$(170, 270)$ $(110, 210)$ (200) (100)
 $(400, 500)$ (200) (100)
 $(400, 500)$ $(140, 240)$ (200) (100)
 $2N_{SC}$ L_{CS} N_{SC} , DMT L_{CP} (N_T) 1

$$N_T = L_{CP} + 2N_{SC} + L_{SC}$$

$(130, 230)$ $(OTxSampleCnt, RTxSampleCnt)$ $(120, 220)$
 $(OTxSampleCntAtU2, RTxSampleCntAtU2)$ $U2$ $(400, 500)$
 $(OTxSampleCnt, RTxSampleCnt)$ $(120, 220)$
 $U2$ $(400, 500)$ (OTx, RTx) 2

$$OTxSampleCntAtU2 = OTxSampleCnt - OTx$$

$RTxSampleCntAtU2 = RTxSampleCnt - RTx$
 $(150, 250)$ $(160, 260)$ $(ORxSampleCnt, RRxSampleCnt)$
 $(ORxSampleCntAtU2, RRxSampleCntAtU2)$ $U2$ $(400, 500)$ (40)
 $(ORxSampleCnt, RRxSampleCnt)$ $U2$ (40)
 $(120, 220)$ (ORx, RRx) 3

$$ORxSampleCntAtU2 = ORxSampleCnt + ORx$$

$RRxSampleCntAtU2 = RRxSampleCnt + RRx$
 DMT (initialization) 가
 (channel analysis exchange) (activation: handshake) (training)
 가 (SNR) (equalizer training) (bit loading)

3a 3c
 3a 3c
 1). (200) O-SIGNATURE (200) R-MSG1 (100) O-SIGNATURE (S30)
 (200) O-SIGNATURE (200) R-MSG1 (100) O-SIGNATURE (S302).
 (200) O-SIGNATURE (200) O-SIGNATURE (211) O-SIG
 (200) O-SIGNATURE (200) O-SIGNATURE $(RTxSampleCnt) N_T + TA_0 + RTx +$
 (500) O-SIGNATURE $(RTxSampleCntAtU2)$
 (200) O-SIGNATURE RRx R-MSG1 (10)
 $(RTxSampleCnt)가 0$ (S304).
 (500) R-MSG1 $U2-R$ (500) $가 0$ $U2-R$
 $가 TA_0$ (100) $U2-O$ (400)
 (100) $() OTxSampleCnt - ORx - OTx$ (S305).
 $R-MSG1$ (S306) $R-MSG1$ O

-UPDATE TxSampleCnt)가 0 (S307). O-UPDATE R-MSG1 (O
 O-UPDATE
 4

$$TA = \frac{(TA_0 + \Delta) \bmod N_T}{2}$$

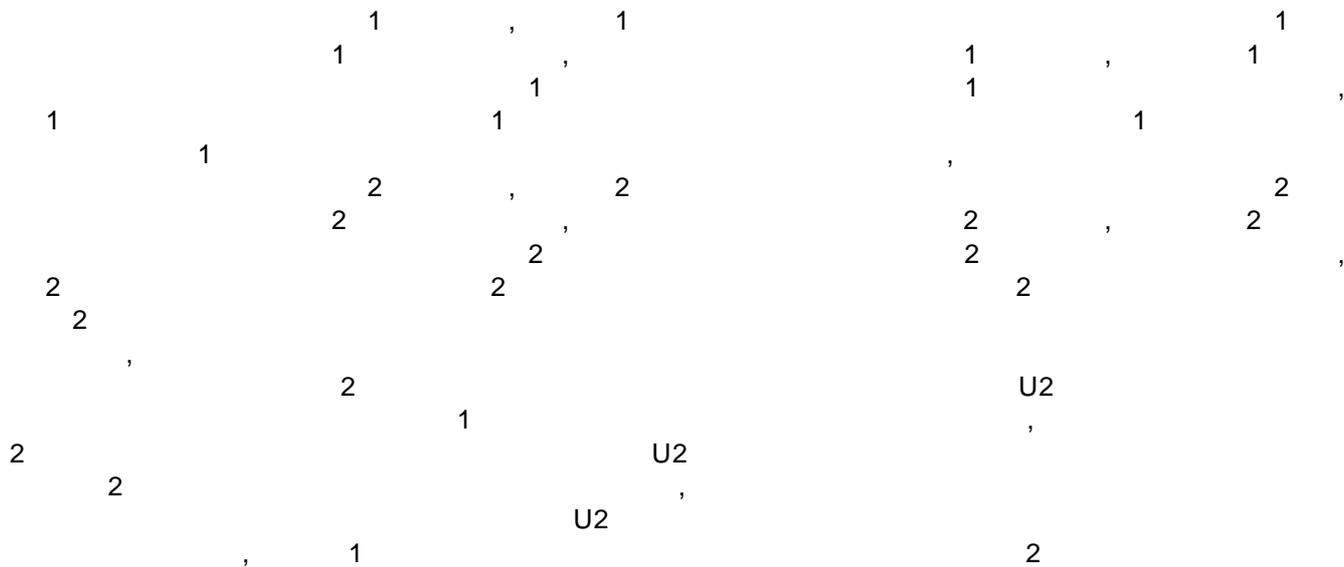
, TA , TA₀ , N_T , mod modulo

(200) O-UPDATE TA (S308).
 R-ACK (RTxSampleCnt) 0 (100)
 (S309). R-ACK R-IDLE (S310).
 R-IDLE (OTxSampleCnt) 0 (OTxSampleCnt)가 N_T - (TA -)
 +TA₀ -TA L_{CS} -(TA₀ -TA) L_{CP}
 (RTxSampleCnt)가 0 (S311). (200)
 -TA L_{CS} -(TA₀ -TA) L_{CP} +TA₀
 (100)
 가

가 U2

(57)

1.



(discrete multi-tone)

2.



3.

$$TA = \frac{(TA_0 + \Delta) \bmod N_T}{2}$$

(, TA₀ , mod modulo) , TA₀ , N_T

$$OTxSampleCnt - \Delta_{ORx} - \Delta_{OTx}$$

(, OTxSampleCnt U2 , ORx , OTx U2)

4.

가 ,
 U2 ,
 1 , 가 ,
 가 2 ,
 3 , 1 , 2
 2 , 가 U2 4 ,
 2 5

5.

4 ,
 5 ((+ 1 1 + - 2 2)) ,
 (- 1 1 + - 2 2)

6.

4 5 ,
 2 U2 U2

7.

$$TA = \frac{(TA_0 + \Delta) \bmod N_T}{2}$$

(, TA₀ , mod modulo) , TA₀ , N_T

