



cBR-8 US Channel MER(SNR) Algorithm



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MER Discussions

- Many variables affect US MER (also known as SNR)
 - MER totally different from CNR observed on spectrum analyzer
- MER is from preamble of station maintenance (SM) burst
 - If burst uses QPSK, preamble is QPSK0 pattern
 - If burst uses 16-QAM for SM, preamble pattern is QPSK1
 - ✓ This is 3 dB higher and could provide different results
- Old CMTS front-end was analog & could easily have amplifier in linecard contribute to MER(SNR)
- Not the case now where front-end is digital and tracks MER (SNR) based on sym rate of US ch
 - 6.4 MHz ATDMA is really 5.12 Msym/sec
- Padding on US port drops any external noise, but CM will Tx whatever needed to hit at 0, so, if there happens to be any noise on plant, extra pad will translate to better CNR & MER

MER Elaborated

- MER is after decoding by US chip
 - Other factors come into play like; ingress, grp delay, in-channel freq response, tilt, micro-reflections, etc.
 - ✓ Ingress cancellation & CM Pre-EQ should take care of these but if not, added padding can make poor return loss connections “appear” much better
- MER readings taken from every CM during their SM

- We average 10 samples/symbols for reporting

```
cbr8#sh cab signal-quality c2/0/15 mer
```

I/F (dB)	Received MER Samples	Received MER US Sharing	Device ID
Cable2/0/15/U0	42.04	1	0
Cable2/0/15/U0	42.04	1	1
Cable2/0/15/U0	38.12	1	2
Cable2/0/15/U0	-----	-----	3

- We can also now record data burst MER readings, but not very accurate if no data!

Fluctuating US MER Readings

- Power-adjust cont and power-adjust threshold affect Rx level, which can affect per-CM US MER & US ch avg
- Anything over 30 dB is more than good enough for 64-QAM
 - Would want to have higher/accurate readings for OFDMA
- Lack of granularity in MER readings when you get really good readings to begin with; CMTS can output following values:
 - error=1 SNR(db)=45.18db, error=2 SNR(db)=42.04db, error=3 SNR(db)=40.00db
 - error=4 SNR(db)=39.08db, error=5 SNR(db)=38.12db, error=6 SNR(db)=37.32db
 - error=7 SNR(db)=36.62db, error=8 SNR(db)=36.12db, error=9 SNR(db)=35.56db
 - error=10 SNR(db)=35.18db, error=11 SNR(db)=34.77db, error=12 SNR(db)=34.31db
 - error=13 SNR(db)=33.97db, error=14 SNR(db)=33.61db, error=16 SNR(db)=33.22db
 - error=17 SNR(db)=33.01db, error=18 SNR(db)=32.55db, error=19 SNR(db)=32.30db
 - error=21 SNR(db)=31.76db, error=23 SNR(db)=31.46db

T4 Multiplier Effect

- Because of T4 multiplier which is used during US bonding, it could be quite some time to get per-US, per-CM updates
- SM = 15 sec when doing linecard HA and single ch US
 - $2 \times 15 = 30$ sec for 2-ch US bonding
 - $4 \times 15 = 60$ sec for 4-ch US bonding
- If T4 multiplier is 4 because doing 4-ch US bonding, then actual CM Pre-EQ will not update for 60 sec
- Nature of HFC plants with grp delay along with micro-reflections, one could easily have fluctuation on MER on every reading before Pre-EQ reacquires
- Not getting Pre-EQ, US levels or time offsets for 60 sec could give unstable US ch MER for that time
- If grabbing per-CM US MER, it updates much quicker
 - Statically setting T4 multiplier to 2 may help stabilize per-CM MER because pre-eq would be “fixing” these potential issues

CLI to Get Per-CM MER

```
cBR8-R8825#show cable modem 34bd.faad.2afe phy
```

MAC Address	I/F	Sid	USPwr (dBmV)	USMER (SNR) (dB)	Timing Offset	DSPwr (dBmV)	DSMER (SNR) (dB)	Mode	DOCSIS Prov
34bd.faad.2afe	C1/0/0/U0	1	31.50	35.18	1802	0.00	-----	atdma*	1.1
34bd.faad.2afe	C1/0/0/U1	1	31.75	36.62	1802	0.00	-----	atdma*	1.1

```
cBR8-R8825#show cable modem 34bd.faad.2afe verbose | in Upstream SNR
```

Upstream SNR (dB)	:	36.12	36.62
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- OID: docsIfSigQSignalNoise

CLI to Get Per-US Channel MER

- On I-CMTS

```
cBR8-R8825#show cable signal-quality cable 1/0/0 upstream 0 mer
I/F          Received MER      Received MER
              (dB)          Samples
Cable1/0/0/U0  34.77            1
```

- On R-PHY

```
CST-CBR8-Amphenol#show cable signal-quality cable 8/0/1 upstream 1 mer
Load for five secs: 25%/4%; one minute: 20%; five minutes: 25%
Time source is NTP, 13:31:00.754 CST Mon Jun 10 2019
I/F          Received MER      Received MER      Device ID
              (dB)          Samples          US Sharing
Cable8/0/1/U1  40.64            10              0
Cable8/0/1/U1  -----          -----          1
Cable8/0/1/U1  -----          -----          2
Cable8/0/1/U1  -----          -----          3
Cable8/0/1/U1  -----          -----          4
Cable8/0/1/U1  -----          -----          5
Cable8/0/1/U1  -----          -----          6
Cable8/0/1/U1  -----          -----          7
```

For Your Reading Pleasure

- Feel free to download and pass to customers, some of it is dated, but mostly still relevant
 - Cisco Internal site
- http://stugots.cisco.com/rr/BNE-KnowledgeBase/Articles/CMTS_US_Monitoring_FEC_&_SNR.doc
- http://stugots.cisco.com/rr/BNE-KnowledgeBase/Articles/CM_Upstream_Ranging_4-22-17.doc
- http://stugots.cisco.com/rr/BNE-KnowledgeBase/Misc_PPTs/CMTS_&_RF_Troubleshooting_10-19-16.pptx
- http://stugots.cisco.com/rr/BNE-KnowledgeBase/Misc_PPTs/CMTS_&_CM_Impairment_Mitigation_Techniques_2-28-18.pptx