



Utilizing CMTS Features and Commands for RF Troubleshooting

Cable Access Business Unit

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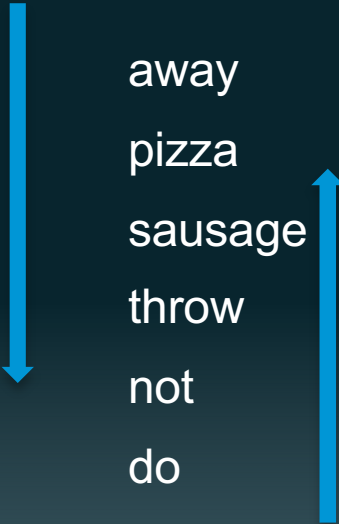
10/19/16

Agenda

- Understanding MER (SNR) and CNR
- Correctable and Uncorrectable FEC
- Ping vs DOCSIS Ping
- T3 & T4 Timeouts
- Flaplist - Modem Diagnostics Log (MDL)
- Cisco Broadband Troubleshooter (CBT) Ver 3.5
- Modem Levels and Ranging
- Proactive Network Maintenance (PNM)
- Full Bandwidth Capture (FBC) - DS Spectrum

Troubleshooting 101

Seven Layer OSI model

- | | | |
|--------------------|---------|---------|
| • 7 = Application | all | away |
| • 6 = Presentation | people | pizza |
| • 5 = Session | seem | sausage |
| • 4 = Transport | to | throw |
| • 3 = Network | need | not |
| • 2 = Data | data | do |
| • 1 = Physical | packets | please |
- 

- **Start at layer 1 !!!!!**

Understanding MER (SNR) and CNR

Modulation Error Ratio (MER)

- Same as Signal-to-Noise Ratio (SNR)
 - Demodulated signal from US chip (brcm in most cases)
- After ingress cancellation and pre-eq
 - Max reading = 36.12 dB
 - SCH1 fixed limitation on 3G60 and now max = 42 dB
- Only based on symbol rate
 - .8 times ch width (ie $6.4 \text{ MHz} * .8 = 5.12 \text{ Msym/s}$)
- `Sh cab modu, sh cab modu cx/y/z up n`
- `Sh contr`
- `Sh cab hop thres`
- `Sh cab modem phy & remote-query`
- `Scm ver`
- `Scm wide phy`

Show Cable Modulation

- 10k#show cable modulation 224

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	Scrmb seed	Max B	Guard time	Last CW	Scrmb	Pre offst	Pre Type	RS
					BYTE	BYTE		siz	size	short				
224	request	16qam	36	no	0x0	0x10	0x152	0	22	no	yes	0	qpsk1	no
224	initial	16qam	96	no	0x5	0x22	0x152	0	48	no	yes	0	qpsk1	no
224	station	16qam	96	no	0x5	0x22	0x152	0	48	no	yes	0	qpsk1	no
224	a-short	64qam	64	no	0x6	0x4C	0x152	6	22	yes	yes	0	qpsk1	yes
224	a-long	64qam	64	no	0x9	0xE8	0x152	0	22	yes	yes	0	qpsk1	yes
224	a-ugs	64qam	64	no	0x9	0xE8	0x152	0	22	yes	yes	0	qpsk1	no

- 10k#show cable modulation c7/1/0 upstream 0

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	Scrmb seed	Max B	Guard time	Last CW	Scrmb	Pre offst	Pre Type	RS
					BYTE	BYTE		siz	size	short				
224	request	16qam	36	no	0x0	0x10	0x152	0	22	no	yes	396	qpsk1	no
224	initial	16qam	384	no	0x5	0x22	0x152	0	48	no	yes	6	qpsk1	no
224	station	16qam	384	no	0x5	0x22	0x152	0	48	no	yes	6	qpsk1	no
224	a-short	64qam	64	no	0x6	0x4C	0x152	6	22	yes	yes	396	qpsk1	yes
224	a-long	64qam	64	no	0x9	0xE8	0x152	0	22	yes	yes	396	qpsk1	yes
224	a-ugs	64qam	64	no	0x9	0xE8	0x152	36	22	yes	yes	396	qpsk1	no

Show Controller

- 10k#show controller | in SNR|Cable.*Up
Cable7/1/0 Upstream 0 is up
US phy MER(SNR)_estimate for good packets - 38.9437 dB
Cable7/1/0 Upstream 1 is up
US phy MER(SNR)_estimate for good packets - 38.5114 dB
Cable7/1/0 Upstream 2 is up
US phy MER(SNR)_estimate for good packets - 38.9437 dB
Cable7/1/0 Upstream 3 is up
US phy MER(SNR)_estimate for good packets - 38.2657 dB
Cable7/1/0 Upstream 4 is up
US phy MER(SNR)_estimate for good packets - 37.5800 dB
Cable7/1/0 Upstream 5 is up
US phy MER(SNR)_estimate for good packets - 29.5564 dB
Cable7/1/0 Upstream 6 is up
US phy MER(SNR)_estimate for good packets - 37.3285 dB
Cable7/1/0 Upstream 7 is up
US phy MER(SNR)_estimate for good packets - 36.8782 dB
Cable7/1/1 Upstream 0 is up
US phy MER(SNR)_estimate for good packets - 39.4850 dB
Cable7/1/1 Upstream 1 is up
US phy MER(SNR)_estimate for good packets - 39.6762 dB
Cable7/1/1 Upstream 2 is up
US phy MER(SNR)_estimate for good packets - 39.1894 dB
Cable7/1/1 Upstream 3 is up
US phy MER(SNR)_estimate for good packets - 31.4474 dB

Show Cable Hop <Cx/y/z> <Threshold>

- 10k#show cable hop c7/1/0

Upstream Port	Port Status	Poll Rate (ms)	Missed Poll Count	Min Poll Sample	Missed Poll Pcnt	Hop Thres Pcnt	Hop Period (sec)	Corr FEC Erro	Uncorr FEC Errors
Cable7/1/0/U0	15.000 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0
Cable7/1/0/U1	21.400 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0
Cable7/1/0/U2	27.800 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0
Cable7/1/0/U3	34.200 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0
Cable7/1/0/U4	40.600 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0
Cable7/1/0/U5	47.000 MHz	319	* * *	set to fixed freq	* * *	* * *		15	2
Cable7/1/0/U6	53.400 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0
Cable7/1/0/U7	59.800 MHz	319	* * *	set to fixed freq	* * *	* * *		0	0

- Clear cab hop to reset all counters
- 10k#sh cab hop 7/1/0 threshold

Upstream Port	SNR (dB)			CNR (dB)			CorrFEC%		UncorrFEC%		MissedSM%	
	Val	Thre1	Thre2	Val	Thre1	Thre2	Pcnt	Thre	Pcnt	Thre	Pcnt	Thre
Ca7/1/0/U0	38	24	19	45	25	13	0	0	0	1	---	---
Ca7/1/0/U1	38	24	19	42	25	13	0	0	0	1	---	---
Ca7/1/0/U2	37	24	19	51	25	13	0	0	0	1	---	---
Ca7/1/0/U3	38	24	19	53	25	13	0	0	0	1	---	---
Ca7/1/0/U4	37	24	19	43	25	13	0	0	0	1	---	---
Ca7/1/0/U5	30	24	19	55	25	13	0	0	0	1	---	---
Ca7/1/0/U6	37	24	19	55	25	13	0	0	0	1	---	---
Ca7/1/0/U7	37	24	19	55	25	13	0	0	0	1	---	---

Show Cable Signal-Quality

- 10k#show cable signal-quality c7/1/0 mer

I/F	Received MER (dB)	Received MER Samples
Cable7/1/0/U0	38.7	10
Cable7/1/0/U1	38.9	10
Cable7/1/0/U2	38.4	10
Cable7/1/0/U3	38.3	10
Cable7/1/0/U4	37.3	10
Cable7/1/0/U5	29.2	10
Cable7/1/0/U6	37.7	10
Cable7/1/0/U7	36.7	10

- Note:** Be careful in lab with limited CMs as it could take a while to get 10 samples and get an updated MER reading
 - If SM every 20 sec (no linecard HA configured) & only 5 CMs, we actually send SM every 5 sec because only 5 CMs, but would get 5 samples from 5 CMs in 5 sec & next 5 sample at next 5 sec interval leading to 10 secs between MER updates
 - If D3.0 CM, then T4 multiplier could have negative affect on time also

Show Cable Modem Phy

- 10k#show cable modem 0018.689c.14ac phy

MAC Address	I/F	Sid	USPwr (dBmV)	USMER (SNR)	Timing Offset	DSPwr (dBmV)	DSMER (SNR)	Mode	DOCSIS Prov
0018.689c.14ac	C7/1/4/U1	231	32.70	27.25	1486	-3.60	34.90	atdma	1.1

- DS info not displayed unless remote-query configured and working properly
- US Tx level not reported unless remote-query working or:
 - CM in US bonding mode

- 10k#scm c7/1/0 phy

MAC Address	I/F	Sid	USPwr (dBmV)	USMER (SNR)	Timing Offset	DSPwr (dBmV)	DSMER (SNR)	Mode	DOCSIS Prov
0018.689c.1b12	C7/1/0/U1	33	41.70	38.86	1493	-1.10	38.80	atdma	1.1
1859.3353.0b1e	C7/1/0/U0	57	38.00	39.07	1508	0.30	45.50	atdma*	1.1
1859.3353.0b1e	C7/1/0/U1	57	38.75	39.08	1494	0.30	45.50	atdma*	1.1
1859.3353.0b1e	C7/1/0/U2	57	37.75	36.64	1508	0.30	45.50	atdma*	1.1
1859.3353.0b1e	C7/1/0/U3	57	38.00	36.72	1508	0.30	45.50	atdma*	1.1

- * indicates US bonded mode and notice mac address listed 4 times

Show Cable Modem Remote-Query

- 10k#show cable modem remote-query

Remote Query Polling State : Active

IP address	MAC address	S/N Ratio	US Power	DS Power	Tx Time Offset	SNMP Request
10.10.0.112	1859.3353.0b10	44.8	39.5	0.2	1489	YES
10.10.0.83	0018.689c.1a16	42.3	40.7	-1.5	9076	YES
10.10.0.111	1859.3353.0b00	46.5	39.3	0.0	1486	YES

- **Note:** Can't see CMs on certain interfaces, updates can take long time, time offsets misleading
- CSCtn83905 - cable modem remote-query doesn't report any info for ipv6 CMs
- CSCum81956 - add remote-query feature IPv6 support
- Need snmp-server manager and remote query commands configured
- Can get update with scm x.x.x remote update "community"

SCM “mac address” Verbose

- 10k#scm 68ee.9631.b27b verbose

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..... •
Extended Upstream Transmit Power      : 0dB
Multi-Transmit Channel Mode           : Y
Number of US in UBG                   : 8
Upstream Channel                      : US0      US1      US2      US3
Ranging Status                        : sta      sta      sta      sta
Upstream SNR (dB)                     : 39.3     37.0     38.30    37.82
Upstream Data SNR (dB)                : --      --      --      --
Received Power (dBmV)                 : 0.50     0.50     0.50     0.50
Reported Transmit Power (dBmV)        : 39.50    39.50    39.50    39.50
Peak Transmit Power (dBmV)            : 48.00    48.00    48.00    48.00
Phy Max Power (dBmV)                  : 48.00    48.00    48.00    48.00
Minimum Transmit Power (dBmV)         : 23.00    23.00    23.00    23.00
Timing Offset (97.6 ns)               : 1767     1768     1767     1767
Initial Timing Offset                 : 1767     1511     1511     1511
Rng Timing Adj Moving Avg(0.381 ns) : 0         0         0         0
Rng Timing Adj Lt Moving Avg          : 0         0         0         0
Rng Timing Adj Minimum                : 0         0         0         0
Rng Timing Adj Maximum                : 256      65792    65536    65536
Pre-EQ Good                           : 546      542      542      541
Pre-EQ Scaled                         : 0         0         0         0
Pre-EQ Impulse                        : 0         0         0         0
Pre-EQ Direct Loads                   : 0         0         0         0
Good Codewords rx                     : 916      701      707      714
Corrected Codewords rx                : 0         0         0         0
Uncorrectable Codewords rx            : 0         0         0         0
Phy Operating Mode                    : atdma*   atdma*   atdma*   atdma*
Upstream Channel                      : US4      US5      US6      US7
Ranging Status                        : sta      sta      sta      sta
Upstream SNR (dB)                     : 36.53    37.75    37.98    38.2
```

SCM Wideband Channel & RF-Status

- 10k#show cable modem wideband channel

MAC Address	IP Address	I/F	MAC State	DSxUS	Primary WB
1859.3353.0b1e	10.10.0.32	C7/1/0/UB	w-online(pt)	8x4	Wi3/3/2:3
1859.3353.0b10	10.10.0.112	C7/1/0/UB	w-online(pt)	8x4	Wi3/3/2:2
1859.3353.0a5c	10.10.0.11	C7/1/0/UB	w-online(pt)	8x4	Wi3/3/2:4
1859.3353.095e	10.10.0.16	C7/1/0/UB	w-online(pt)	8x4	Wi3/3/2:2
68ee.9631.b27b	10.10.1.250	C7/1/0/UB	w-online(pt)	24x8	Wi3/3/2:1

- 10k#show interface wideband-Cable 3/3/2:1 rf-status

Resource	RF	Status

3/3/2	0	UP
	1	UP
	2	UP
	3	UP
	4	UP
	5	UP
	6	UP
	7	UP

SCM Wideband Phy & Partial-Service

- 10k#scm wideband phy

MAC Address	IP Address	I/F	MAC State	Chan Desc	Frq (MHZ)	SNR (db)	Pwr (dBmV)
1859.3353.0b1e	10.10.0.32	C7/1/0/UB	w-online(pt)	dsPri	183	45.40	0.20
				dsSec	165	N/A	N/A
				dsSec	171	N/A	N/A
				dsSec	177	N/A	N/A
				us0	15	39.03	38.00
				us1	21	38.36	38.75
				us2	27	38.02	37.75
				us3	34	37.84	38.00

- CSCum43392 - Missing decimal places for US freqs in SCM wide phy command
- CSCun75629 - DSPwr missing in show cable modem wide phy

- 10k#scm partial-service

MAC Address	IP Address	I/F State	MAC State	DSxUS	Impaired DS	Impaired US
54d4.6ffb.2e1b	40.4.58.23	C7/1/0/p	p-online(pt)	2x2	Mo1/3/0:1 Mo1/3/0:2	0,1
54d4.6ffb.2f6b	40.4.58.16	C7/1/0/p	p-online(pt)	2x2	Mo1/3/0:1 Mo1/3/0:2	0,1
4458.2945.2a78	40.4.58.21	C7/1/0/p	p-online(pt)	2x2	Mo1/3/0:1 Mo1/3/0:2	0,1

Carrier-to-Noise Ratio (CNR)

- Amplitude of signal (carrier) to amplitude of noise
 - Before US chip demodulates it
 - Also called CNiR for Carrier-to-Noise and Ingress Ratio
- Before ingress cancellation
- Highest reading of ~ 55 dB
- Show controller
 - With spectrum groups
- `sh cab signal-quality cx/y/z cmts`
- `Sh cab hop threshold`
- `Sh cab hop history`
- `Sh cab modem "mac" cnr`

Show Cable Signal-Quality

- 10k#show cable signal-quality c7/1/0 cmts

I/F	CNiR (dB)	Expected Received Signal Power (dBmV)
Cable7/1/0/U0	45.0	0.0
Cable7/1/0/U1	43.0	0.0
Cable7/1/0/U2	51.0	0.0
Cable7/1/0/U3	54.0	0.0
Cable7/1/0/U4	45.0	0.0
Cable7/1/0/U5	53.0	0.0
Cable7/1/0/U6	55.0	0.0
Cable7/1/0/U7	55.0	0.0

- Note:** CniR is based on configured US ch level minus noise floor reading
 - Not based on actual CM Rx level at CMTS US port

Show Cable Hop <Cx/y/z> <Threshold>

- 10k#show cable hop c7/1/0

Upstream Port	Port Status	Poll Rate	Missed Poll	Min Poll	Missed Poll	Hop Thres	Hop Period	Corr FEC Errors	Uncorr FEC Errors
		(ms)	Count	Sample	Pcnt	Pcnt	(sec)		
Cable7/1/0/U0	15.000 MHz	319	* * *	set to	fixed frequency	* * *		0	0
Cable7/1/0/U1	21.400 MHz	319	* * *	set to	fixed frequency	* * *		0	0
Cable7/1/0/U2	27.800 MHz	319	* * *	set to	fixed frequency	* * *		0	0
Cable7/1/0/U3	34.200 MHz	319	* * *	set to	fixed frequency	* * *		0	0
Cable7/1/0/U4	40.600 MHz	319	* * *	set to	fixed frequency	* * *		0	0
Cable7/1/0/U5	47.000 MHz	319	* * *	set to	fixed frequency	* * *		15	2
Cable7/1/0/U6	53.400 MHz	319	* * *	set to	fixed frequency	* * *		0	0
Cable7/1/0/U7	59.800 MHz	319	* * *	set to	fixed frequency	* * *		0	0

- Clear cable hop to reset all counters

- 10k#sh cab hop 7/1/0 thres

Upstream Port	SNR (dB)			CNR (dB)			CorrFEC%		UncorrFEC%		MissedSM%	
	Val	Thre1	Thre2	Val	Thre1	Thre2	Pcnt	Thre	Pcnt	Thre	Pcnt	Thre
Ca7/1/0/U0	38	24	19	45	25	13	0	0	0	1	---	---
Ca7/1/0/U1	38	24	19	42	25	13	0	0	0	1	---	---
Ca7/1/0/U2	37	24	19	51	25	13	0	0	0	1	---	---
Ca7/1/0/U3	38	24	19	53	25	13	0	0	0	1	---	---
Ca7/1/0/U4	37	24	19	43	25	13	0	0	0	1	---	---
Ca7/1/0/U5	30	24	19	55	25	13	0	0	0	1	---	---
Ca7/1/0/U6	37	24	19	55	25	13	0	0	0	1	---	---
Ca7/1/0/U7	37	24	19	55	25	13	0	0	0	1	---	---

- Note:** If CNiR much worse than SNR; could be cosmetic, narrow ingress, adjacent carrier overlap, isolation and “bleed-over from another US fiber node

Show Cable Hop <Cx/y/z> <History>

- Can use 3-level dynamic modulation for self-healing and tracking purposes

- `cBR8#sh cab hop upstream-cable 2/0/0 us-channel 0 history`

F = Frequency Hop, M = Modulation Change, C = Channel Width Change

Upstream Channel	Action Time	Chg Code	Chg From	Chg To	Action Reason
UC2/0/0:U0	Oct 18 17:28:57	M	223	224	SNR 38>=28 UnCFEC 0<=1
	Oct 18 17:28:42	M	224	223	Test command enforced
	Oct 17 18:01:12	C	1.6	6.4	Configuration changed

Show Cable Modem “mac|ip” <cnr>

- 10k#scm 0018.689c.1ce0 cnr

MAC Address	IP Address	I/F	MAC State	Prim Sid	ExPwr (dBmv)	RxPwr (dBmv)	cnr (dB)
0018.689c.1ce0	10.10.0.54	C7/1/0/U1	online (pt)	43	0.0	0.50	> 40

- 10k#scm 0018.689c.14ac cnr

MAC Address	IP Address	I/F	MAC State	Prim Sid	ExPwr (dBmv)	RxPwr (dBmv)	cnr (dB)
0018.689c.14ac	10.10.0.239	C7/1/4/U1	online (pt)	231	0.0	-0.50	26

- 10k#scm 68ee.9631.b27b cnr

MAC Address	IP Address	I/F	MAC State	Prim Sid	ExPwr (dBmv)	RxPwr (dBmv)	cnr (dB)
68ee.9631.b27b	10.10.1.250	C7/1/0/U0	w-online (pt)	267	0.0	0.50	35
68ee.9631.b27b	10.10.1.250	C7/1/0/U1	w-online (pt)	267	0.0	0.50	37
68ee.9631.b27b	10.10.1.250	C7/1/0/U2	w-online (pt)	267	0.0	0.50	> 40
68ee.9631.b27b	10.10.1.250	C7/1/0/U3	w-online (pt)	267	0.0	0.50	> 40
68ee.9631.b27b	10.10.1.250	C7/1/0/U4	w-online (pt)	267	0.0	0.50	36
68ee.9631.b27b	10.10.1.250	C7/1/0/U5	w-online (pt)	267	0.0	0.00	> 40
68ee.9631.b27b	10.10.1.250	C7/1/0/U6	w-online (pt)	267	0.0	0.00	> 40
68ee.9631.b27b	10.10.1.250	C7/1/0/U7	w-online (pt)	267	0.0	-1.00	> 40

- **Note:** CniR is based on actual CM Rx level minus noise floor reading

Correctable and Uncorrectable FEC

Forward Error Correction (FEC)

- Modulation profile bursts with FEC
- Corrected vs Uncorrected codewords
- `Sh cab hop`
- `Sh cab hop thres`
- `Sh inter`
- `Sh cab modem "mac" ver`

Show Cable Modulation

- 10k#sh cab modu c7/1/0 up 0

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	Scrmb seed	Max B	Guard time	Last CW	Scrmb	Pre offst	Pre Type	RS
					BYTE	BYTE		siz	size	short				
224	request	16qam	36	no	0x0	0x10	0x152	0	22	no	yes	396	qpsk1	no
224	initial	16qam	384	no	0x5	0x22	0x152	0	48	no	yes	6	qpsk1	no
224	station	16qam	384	no	0x5	0x22	0x152	0	48	no	yes	6	qpsk1	no
224	a-short	64qam	64	no	0x6	0x4C	0x152	6	22	yes	yes	396	qpsk1	yes
224	a-long	64qam	64	no	0x9	0xE8	0x152	0	22	yes	yes	396	qpsk1	yes
224	a-ugs	64qam	64	no	0x9	0xE8	0x152	36	22	yes	yes	396	qpsk1	no

- IM and SM burst used during registration
 - IM (init(r1)) can have collisions and create uncorr FEC
 - SM = init(r2), unicast and “keepalive” maintenance every 15-20 sec
- Overhead = $2 \cdot T / (2 \cdot T + \text{codeword})$
 - Example: a-long burst = $2 \cdot 9 / (2 \cdot 9 + 232) = 18/250 = 7.2\%$

Show Cable Hop <Cx/y/z> <Threshold>

- 10k#show cable hop c7/1/0

Upstream Port	Port Status	Poll Rate (ms)	Missed Poll Count	Min Poll Sample	Missed Poll Pcnt	Hop Thres Pcnt	Hop Period (sec)	Corr FEC Errors	Uncorr FEC Errors
Cable7/1/0/U0	15.000 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0
Cable7/1/0/U1	21.400 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0
Cable7/1/0/U2	27.800 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0
Cable7/1/0/U3	34.200 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0
Cable7/1/0/U4	40.600 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0
Cable7/1/0/U5	47.000 MHz	319	* * *	set to fixed frequency	* * *	* * *		15	2
Cable7/1/0/U6	53.400 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0
Cable7/1/0/U7	59.800 MHz	319	* * *	set to fixed frequency	* * *	* * *		0	0

- Clear cab hop to reset all counters

- 10k#sh cab hop 7/1/0 thres

Upstream Port	SNR(dB)			CNR(dB)			CorrFEC%		UncorrFEC%		MissedSM%	
	Val	Thre1	Thre2	Val	Thre1	Thre2	Pcnt	Thre	Pcnt	Thre	Pcnt	Thre
Ca7/1/0/U0	38	24	19	45	25	13	0	0	0	1	---	---
Ca7/1/0/U1	38	24	19	42	25	13	0	0	0	1	---	---
Ca7/1/0/U2	37	24	19	51	25	13	0	0	0	1	---	---
Ca7/1/0/U3	38	24	19	53	25	13	0	0	0	1	---	---
Ca7/1/0/U4	37	24	19	43	25	13	0	0	0	1	---	---
Ca7/1/0/U5	30	24	19	55	25	13	0	0	0	1	---	---
Ca7/1/0/U6	37	24	19	55	25	13	0	0	0	1	---	---
Ca7/1/0/U7	37	24	19	55	25	13	0	0	0	1	---	---

SCM “mac address” Verbose

- 10k#scm 68ee.9631.b27b ver

```

.....
Extended Upstream Transmit Power      : 0dB
Multi-Transmit Channel Mode           : Y
Number of US in UBG                   : 8
Upstream Channel                      : US0      US1      US2      US3
Ranging Status                        : sta      sta      sta      sta
Upstream SNR (dB)                     : 39.3     37.0     38.30    37.82
Upstream Data SNR (dB)                : --      --      --      --
Received Power (dBmV)                 : 0.50     0.50     0.50     0.50
Reported Transmit Power (dBmV)        : 39.50    39.50    39.50    39.50
Peak Transmit Power (dBmV)            : 48.00    48.00    48.00    48.00
Phy Max Power (dBmV)                  : 48.00    48.00    48.00    48.00
Minimum Transmit Power (dBmV)         : 23.00    23.00    23.00    23.00
Timing Offset (97.6 ns)               : 1767     1768     1767     1767
Initial Timing Offset                 : 1767     1511     1511     1511
Rng Timing Adj Moving Avg(0.381 ns)  : 0         0         0         0
Rng Timing Adj Lt Moving Avg          : 0         0         0         0
Rng Timing Adj Minimum                : 0         0         0         0
Rng Timing Adj Maximum                : 256      65792    65536    65536
Pre-EQ Good                           : 546      542      542      541
Pre-EQ Scaled                         : 0         0         0         0
Pre-EQ Impulse                        : 0         0         0         0
Pre-EQ Direct Loads                   : 0         0         0         0
Good Codewords rx                     : 916      701      707      714
Corrected Codewords rx                : 0         0         0         0
Uncorrectable Codewords rx            : 0         0         0         0
Phy Operating Mode                    : atdma*   atdma*   atdma*   atdma*
Upstream Channel                      : US4      US5      US6      US7
Ranging Status                        : sta      sta      sta      sta
Upstream SNR (dB)                     : 36.53    37.75    37.98    38.2

```


Impairment Increase vs Reporting

	CNR	MER(SNR)	Corr FEC	Uncorr FEC
AWGN	Bad	Bad	Bad	Eventually Bad
CW Carrier	Bad	Ok	Ok	Ok
Impulse Noise	Bad	Ok	Ok	Bad
Group Delay / Micro-Reflections	Ok	Bad	Bad	Eventually Bad
Laser Clipping				
No traffic	Ok, ish	Ok	----	----
Distorted traffic		Bad	Bad	Eventually Bad

- Ingress cancellation will cancel some CPD
- CPD resembles AWGN when all DSs are digital

sh cab card X/0 us-phy ch fec-sum

- cbr#show cable card 2/0 us-phy channel fec-summa

No us-phy since it's Remote PHY!

- cbr#show cable card 1/0 us-phy channel fec-summa

Corrected-FEC

PCH/LCH	Mg:0	Mg:1	Mg:2	Mg:3	Mg:4	Mg:5	Mg:6	Mg:7
0/0	0	0	0	220	0	0	0	0
0/1	0	0	0	0	0	0	0	0
1/0	0	0	0	36	0	0	0	0
1/1	0	0	0	0	0	0	0	0
2/0	0	0	0	2	0	0	0	0
2/1	0	0	0	0	0	0	0	0
3/0	0	0	0	15352	0	0	0	0
3/1	0	0	0	0	0	0	0	0
4/0	0	0	0	0	0	0	0	0
4/1	0	0	0	0	0	0	0	0
5/0	0	0	0	0	0	0	0	0
5/1	0	0	0	0	0	0	0	0
6/0	0	0	0	0	0	0	0	0
6/1	0	0	0	0	0	0	0	0
7/0	0	0	0	0	0	0	0	0
7/1	0	0	0	0	0	0	0	0
8/0	0	0	0	0	0	0	0	0
8/1	0	0	0	0	0	0	0	0
9/0	0	0	0	0	0	0	0	0
9/1	0	0	0	0	0	0	0	0
10/0	0	0	0	0	0	0	0	0
10/1	0	0	0	0	0	0	0	0
11/0	0	0	0	0	0	0	0	0
11/1	0	0	0	0	0	0	0	0

sh cab card X/0 us-phy ch fec-sum (cont)

Uncorrected-FEC

PCH/LCH	Mg:0	Mg:1	Mg:2	Mg:3	Mg:4	Mg:5	Mg:6	Mg:7
0/0	0	0	0	0	0	0	0	0
0/1	0	0	0	0	0	0	0	0
1/0	0	0	0	1	0	0	0	0
1/1	0	0	0	0	0	0	0	0
2/0	0	0	0	13	0	0	0	0
2/1	0	0	0	0	0	0	0	0
3/0	0	0	0	527416	0	0	0	0
3/1	0	0	0	0	0	0	0	0
4/0	0	0	0	0	0	0	0	0
4/1	0	0	0	0	0	0	0	0
5/0	0	0	0	0	0	0	0	0
5/1	0	0	0	0	0	0	0	0
6/0	0	0	0	0	0	0	0	0
6/1	0	0	0	0	0	0	0	0
7/0	0	0	0	0	0	0	0	0
7/1	0	0	0	0	0	0	0	0
8/0	0	0	0	0	0	0	0	0
8/1	0	0	0	0	0	0	0	0
9/0	0	0	0	0	0	0	0	0
9/1	0	0	0	0	0	0	0	0
10/0	0	0	0	0	0	0	0	0
10/1	0	0	0	0	0	0	0	0
11/0	0	0	0	0	0	0	0	0
11/1	0	0	0	0	0	0	0	0

The numbers shown above in each Logical channels are summary of IUC5, IUC6, IUC9, IUC10, and IUC11 Cached Corrected-FEC / Uncorrected-FEC counters

Ping vs DOCSIS Ping

Ping and DOCSIS Ping

- Ping is layer 3 communication and will be short, long, a-short, or a-long burst settings depending on packet size
 - Ping “ip address”
 - Extended ping also good to use
 - Can change source, frame size, amount, ...
- DOCSIS ping is layer 1 to CM using SM burst
 - Can use mac address or IP address
 - Ping docsis
 - Verbose also available
- Good/bad difference between both pings could be mod profile settings
- CSCuh41631 - Ping DOCSIS and reporting while CM doing USCB
 - **Note:** Ping DOCSIS seems to send all pings to first US it ranged on; can verify with ping docsis ver and/or look and scm ver & time offsets

Ping

- 10k#ping 10.10.1.250

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.10.1.250, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 8/9/12 ms

- 10k#ping

Protocol [ip]:

Target IP address: 10.10.1.250

Repeat count [5]: 100

Datagram size [100]: 1500

Timeout in seconds [2]: 1

Extended commands [n]:

Sweep range of sizes [n]:

Type escape sequence to abort.

Sending 100, 1500-byte ICMP Echos to 10.10.1.250, timeout is 1 seconds:

!!

!!

Success rate is 100 percent (100/100), round-trip min/avg/max = 8/12/104 ms

Ping Docsis

- 10k#ping docsis ?

```
A.B.C.D      Modem IP address
H.H.H        Modem MAC address
X:X:X:X::X   IPv6 address of this modem
name         Domain name
```

- 10k#ping docsis 68ee.9631.b27b ?

```
repeat      Number of maintenance intervals to queue
verbose     Line-by-line output
<cr>
```

- 10k#ping docsis 68ee.9631.b27b repeat 10 verbose

Queueing 10 MAC-layer station maintenance intervals, timeout is 25 msec:

```
Reply from 68ee.9631.b27b: 16 upstream, 46 ms, tadj=0, padj=0.50, fadj=26
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=68
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=14
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=9
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=36
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=0
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=14
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=31
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=12
Reply from 68ee.9631.b27b: 16 upstream, 50 ms, tadj=0, padj=0.50, fadj=0
```

Success rate is 100 percent (10/10)

T3 and T4 Timeouts

Modem Timers

- Station maintenance = 3-way handshake
 - CMTS to CM every 20 sec (15 for HA)
 - Assumes at least 20 modems on mac domain
 - Used for US levels, time offsets, US freq adjustment and pre-eq
- T4 Timer
 - 30 sec “keepalive”
 - Understand T4 multiplier for US bonding
 - Typically DS issues and modem reboots
- T3 Timer
 - 200 msec range response
 - Last 2 parts of 3-way handshake
 - US issues like noise and/or timing
 - 16 in a row would drop DS synch and then get T4
 - Flaplist “misses” can be similar to T3 timeouts

Flaplist

Flaplist

- Cisco feature
- D3.0 incorporated and called Modem Diagnostics Log (MDL)
- US issues
 - Power
 - Noise
 - Timing
- Based on Station Maintenance (SM) burst
 - Mod profile affects
- “Misses” can be correlated with T3 timeouts
- `Sh cab flap-list <wb-rf>`
 - Sorting, clearing, thresholds

Show Cable Flap-list

- 10k#sh cab flap c7/1/0 ?
sort-flap Sort by flap count
sort-time Sort by last flap time
upstream Upstream port
wb-rf wideband RF resiliency
| Output modifiers
<cr>

- 10k#sh cab flap c7/1/0 up 0 ?
sort-flap Sort by flap count
sort-time Sort by last flap time
| Output modifiers
<cr>

- 10k#sh cab flap c7/1/0 up 0 sort-time

MAC Address	Upstream	Ins	Hit	Miss	CRC	P-Adj	Flap	Time
68ee.9631.b27b	C7/1/0/UB	***	No data	available	***			Feb 17 08:56:45
0018.689c.1b7e	C7/1/0/U0	0	12245	72	0	770	771	Feb 12 16:55:07

- CSCuh41637 - Flap-List Reporting while Modem Doing USCB
- CSCul59043 - D3.0 CMs Flap-list counters

Show Cable Flap-list wb-rf

- D3.0 DS Flaplist
- Percent column can be used to verify partial mode/resiliency feature

10k#sh cab flap-list wb-rf

MDD		QAM/FEC						
RF		Timeout	Recover	Failure	Recover	Flaps	CM	Percent
-----		-----	-----	-----	-----	-----	-----	-----
3/3/2	8	3	3	4	4	4	5	40
	9	3	3	4	2	4	5	40
7/1/0	16	113	113	5	4	4	15	26
	17	6753	6753	6	6	5	15	26
	18	651	651	5	5	4	14	28
	19	34165	34165	15	13	20	14	28
	20	18112	18112	9	8	6	14	28
	21	0	0	4	4	4	14	28
	23	3	3	4	3	0	14	0
7/1/1	10	10	10	22	20	0	13	0
7/1/2	10	1	1	0	0	0	12	0

Time Offsets Could be too Aggressive

- Flaplist based on Mod profile, specifically SM burst settings
- Interfaces may show CMs with many misses in flaplist, especially if using US interleave in mod profile leading to US bonding partial mode

• 10k#sh cab modu c7/1/0 up 0

Mod	IUC	Type	Pre len	Diff enco	FEC T	FEC k	Scramb seed	Max B	Guard time	Last CW	Scramb	Pre offst	Pre Type	RS
					BYTE	BYTE		siz	size	short				
224	request	16qam	36	no	0x0	0x10	0x152	0	22	no	yes	396	qpsk1	no
224	initial	16qam	384	no	0x5	0x22	0x152	0	48	no	yes	6	qpsk1	no
224	station	16qam	384	no	0x5	0x22	0x152	0	48	no	yes	6	qpsk1	no
224	a-short	64qam	64	no	0x6	0x4C	0x152	6	22	yes	yes	396	qpsk1	yes
224	a-long	64qam	64	no	0x9	0xE8	0x152	0	22	yes	yes	396	qpsk1	yes
224	a-ugs	64qam	64	no	0x9	0xE8	0x152	36	22	yes	yes	396	qpsk1	no

Aggressive Time Offsets

- Make sure dynamic map advance is > ~ 2500

- 10k#sh contr | in Dyn|Cable.*Up

```
Cable7/1/0 Upstream 0 is up
  Map Advance (Dynamic) : 2127 usecs
```

```
Cable7/1/0 Upstream 1 is up
  Map Advance (Dynamic) : 2127 usecs
```

```
Cable7/1/0 Upstream 2 is up
  Map Advance (Dynamic) : 2127 usecs
```

```
Cable7/1/0 Upstream 3 is up
  Map Advance (Dynamic) : 2152 usecs
```

- 10k#sh cab flap c7/1/4

MAC Address	Upstream	Ins	Hit	Miss	CRC	P-Adj	Flap	Time
1859.334e.851a	C7/1/4/UB	0	10	36	0	0	1	Nov 17 16:42:53
1859.3353.0b0a	C7/1/4/UB	0	10	13	0	!0	1	Nov 17 16:42:38
1859.334e.859c	C7/1/4/UB	0	11	8	0	!0	1	Nov 17 16:42:38
1859.3353.0aea	C7/1/4/UB	0	11	8	0	!0	1	Nov 17 16:42:36
1859.334e.86b6	C7/1/4/UB	0	11	8	0	0	1	Nov 17 16:42:34
1859.3353.09ca	C7/1/4/UB	0	11	10	0	!0	1	Nov 17 16:42:30

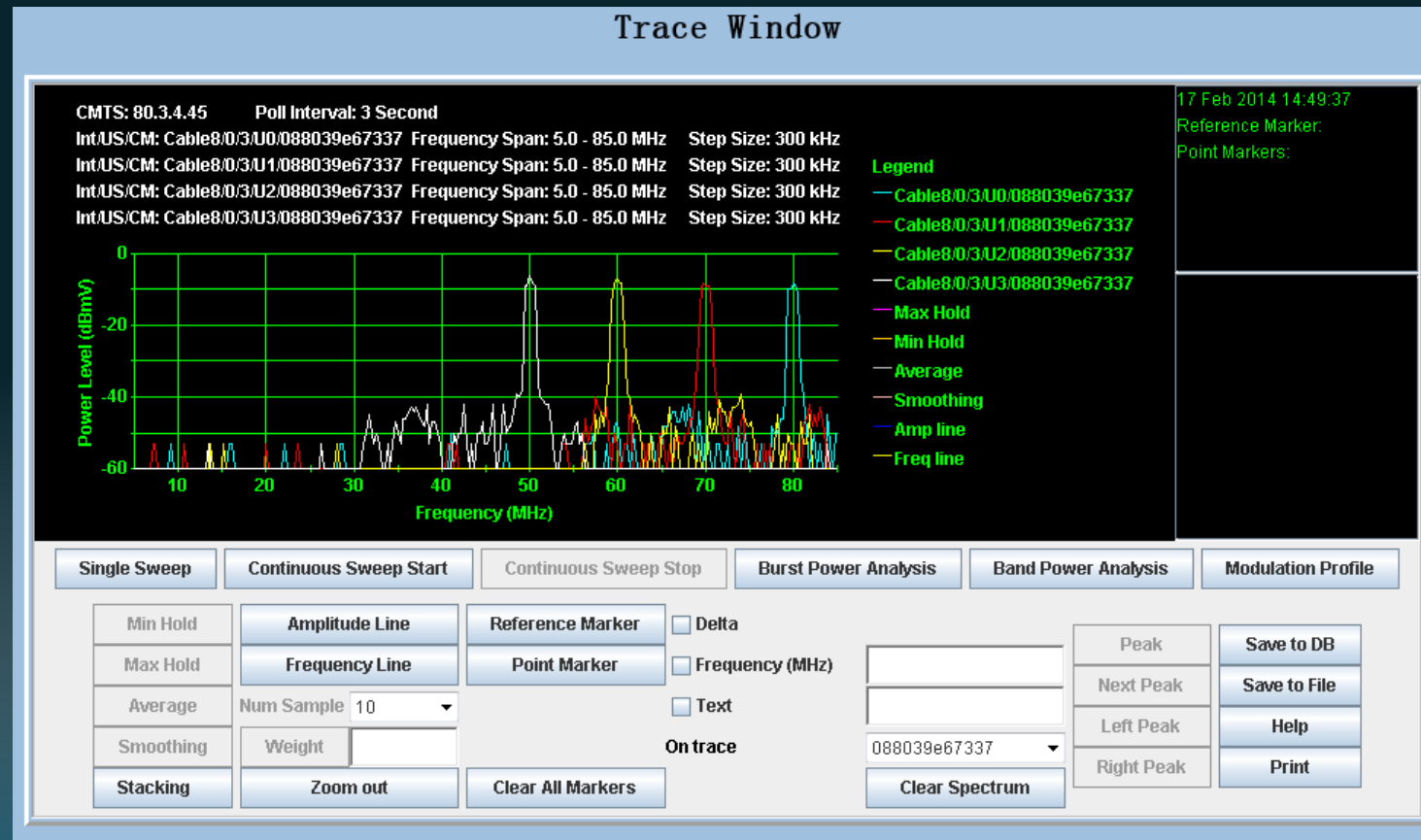
- The hit-to-miss ratio should be closer to (10 or 5) to 1!!

Cisco Broadband Troubleshooter (CBT)

CBT

- Free demo, but Ver 3.3 and only supports 28U and 5x20 cards
- Ver 3.4 added 20x20 support
- Ver 3.5 is latest
 - Supports 3G60, 5-85 MHz, and 4 US ch bonding
 - Need new version to support 8-ch US bonding, which is supported in SCH1
- US spectrum analysis obtained via snmp right from US chip
 - Requires read/write snmp string since docsis ping done in background
- Can see individual modem bursts
- Can identify overlapping chs
- Can even identify headend potential isolation issues
- CMTS has; `sh cab spectrum-analysis cx/y/z up n`
- **Note:** No CBT roadmap, replaced by CMTS dashboard & PNM

CBT Trace Window



Show Cable Spectrum

```
• 10k#sh cab spectrum-analysis
  c7/1/0 upstream 0
Spectrum Analysis Measurements for
Cable7/1/0 : Upstream 0
Channel Center Frequency: 15000000 Hz
Frequency Span: 6400000 Hz
Number of Bins: 257
Bin Spacing: 25000 Hz
Resolution Bandwidth: 42750 Hz
Amplitude Data:
  Bin   1: -60.00 dBmV
  Bin   2: -56.00 dBmV
  Bin   3: -60.00 dBmV
  Bin   4: -49.00 dBmV
  Bin   5: -53.00 dBmV
  Bin   6: -60.00 dBmV
  Bin   7: -45.00 dBmV
  Bin   8: -44.00 dBmV
  Bin   9: -46.00 dBmV
  Bin  10: -37.00 dBmV
  Bin  11: -38.00 dBmV
  Bin  12: -37.00 dBmV
  Bin  13: -40.00 dBmV
  Bin  14: -34.00 dBmV
  Bin  15: -31.00 dBmV
  Bin  16: -31.00 dBmV
  Bin  17: -27.00 dBmV
  Bin  18: -32.00 dBmV
  Bin  19: -35.00 dBmV
  Bin  20: -33.00 dBmV
  Bin  21: -29.00 dBmV
  Bin  22: -24.00 dBmV
  Bin  23: -26.00 dBmV
  Bin  24: -24.00 dBmV
  Bin  25: -23.00 dBmV
  Bin  26: -21.00 dBmV
  Bin  27: -29.00 dBmV
  Bin  28: -23.00 dBmV
  Bin  29: -26.00 dBmV
  Bin  30: -23.00 dBmV
  Bin  31: -24.00 dBmV
  Bin  32: -23.00 dBmV
  Bin  33: -17.00 dBmV
  Bin  34: -19.00 dBmV
  Bin  35: -16.00 dBmV
  Bin  36: -22.00 dBmV
  Bin  37: -23.00 dBmV
  Bin  38: -29.00 dBmV
  Bin  39: -17.00 dBmV
  Bin  40: -19.00 dBmV
  Bin  41: -20.00 dBmV
  Bin  42: -26.00 dBmV
  Bin  43: -21.00 dBmV
  Bin  44: -19.00 dBmV
  Bin  45: -21.00 dBmV
  Bin  46: -20.00 dBmV
  Bin  47: -21.00 dBmV
  Bin  48: -21.00 dBmV
  Bin  49: -21.00 dBmV
  Bin  50: -22.00 dBmV
  Bin  51: -26.00 dBmV
  Bin  52: -23.00 dBmV
  Bin  53: -26.00 dBmV
  Bin  54: -25.00 dBmV
  Bin  55: -26.00 dBmV
  Bin  56: -15.00 dBmV
  Bin  57: -24.00 dBmV
  Bin  58: -23.00 dBmV
  Bin  59: -19.00 dBmV
  Bin  60: -22.00 dBmV
  Bin  61: -22.00 dBmV
  Bin  62: -24.00 dBmV
  Bin  63: -18.00 dBmV
  Bin  64: -18.00 dBmV
  Bin  65: -19.00 dBmV
  Bin  66: -24.00 dBmV
  Bin  67: -22.00 dBmV
  Bin  68: -23.00 dBmV
  Bin  69: -23.00 dBmV
  Bin  70: -21.00 dBmV
  Bin  71: -21.00 dBmV
  Bin  72: -17.00 dBmV
  Bin  73: -17.00 dBmV
  Bin  74: -18.00 dBmV
  Bin  75: -25.00 dBmV
  Bin  76: -20.00 dBmV
  Bin  77: -22.00 dBmV
  Bin  78: -24.00 dBmV
  Bin  79: -24.00 dBmV
  Bin  80: -19.00 dBmV
```

Show Cable Fiber-node Spectrum

Fiber Node No.	Upstream Port	Physical Port	Frequency (MHz)	Spectrum Group No.
1	Cable7/1/0 U0	0	15.000 [6.4]	No
1	Cable7/1/0 U1	0	21.400 [6.4]	No
1	Cable7/1/0 U2	0	27.800 [6.4]	No
1	Cable7/1/0 U3	0	34.200 [6.4]	No
1	Cable7/1/0 U4	0	40.600 [6.4]	No
1	Cable7/1/0 U5	0	47.000 [6.4]	No
1	Cable7/1/0 U6	0	53.400 [6.4]	No
1	Cable7/1/0 U7	0	59.800 [6.4]	No
2	Cable7/1/1 U0.0	2	15.000 [6.4]	No
2	Cable7/1/1 U1.0	2	21.400 [6.4]	No

Modem Levels and Ranging

Optimum US and DS Levels

- Spec says DS Tx levels from CMTS/e-qam dependent on number of chs (qams) per port
- Spec says DS Rx levels at CM +15 to -15 dBmV
 - Best is +5 to -5 dBmV
 - Scm phy
- Spec says US Rx level config at CMTS dependent on US ch width
- Spec says US Tx levels from CM dependent on US modulation
 - Also dependent on number of USs used for bonding
 - Could be multiple single-ch BGs
 - ECN allows potential 61 dBmV per ch, dependent on CM and ver
 - Typical 3 dB more

10K with 3G SPA & 3G60 Linecard

- 10k#sh contr c7/1/0 down

```
NB DS Mo3/3/2:0, STATE: UP
  Frequency 117.0000 MHz 256-QAM,  ANNEX B, R/S Interleave I=32, J=4
  Network Delay 150 (usec)
  Bandwidth (Kbps): 300,  Load Percent: 0
  Channel ID: 217, US MAP: 0x00FF
  Total modems: 2, modems active : 2, total DS flows: 5
NB DS Mo3/3/2:1, STATE: UP
  Frequency 123.0000 MHz 256-QAM,  ANNEX B, R/S Interleave I=32, J=4
NB DS Mo3/3/2:2, STATE: UP
  Frequency 129.0000 MHz 256-QAM,  ANNEX B, R/S Interleave I=32, J=4
NB DS Mo3/3/2:3, STATE: UP
  Frequency 135.0000 MHz 256-QAM,  ANNEX B, R/S Interleave I=32, J=4
NB DS Mo3/3/2:4, STATE: UP
  Frequency 141.0000 MHz 256-QAM,  ANNEX B, R/S Interleave I=32, J=4
```

- 10k#sh contr modular-Cable 3/3/2 all

```
SPA IP address = 10.33.2.1          SPA MAC Addr = 0021.A0FB.8935

QAM      MOD      ANNEX      TKB Interval      Rate adjust      State
48        QAM 256  Annex B        145                27                Enabled
49        QAM 256  Annex B        145                27                Enabled
50        QAM 256  Annex B        145                27                Enabled
```

RFGW-10 with DS-384, Port 7/1

- RFGW-10#sh contr qam-red 7/1 down
RF Port7/1 is enabled
Max carrier density on this port set to 24

Valid rf-power range: 33.0 dBmV to 45.0 dBmV
Default RF Power value: 39.0 dBmV

RF Power configured on Qam channels:

Qam interface current-rf-power

x-----x-----

Qam-red7/1.1	43.0 dBmV
Qam-red7/1.2	43.0 dBmV
Qam-red7/1.3	43.0 dBmV
Qam-red7/1.4	43.0 dBmV
Qam-red7/1.5	43.0 dBmV
Qam-red7/1.6	43.0 dBmV
Qam-red7/1.7	43.0 dBmV
Qam-red7/1.8	43.0 dBmV
Qam-red7/1.9	43.0 dBmV
Qam-red7/1.10	43.0 dBmV
Qam-red7/1.11	43.0 dBmV
Qam-red7/1.12	43.0 dBmV
Qam-red7/1.13	43.0 dBmV
Qam-red7/1.14	43.0 dBmV
Qam-red7/1.15	43.0 dBmV
Qam-red7/1.16	43.0 dBmV
Qam-red7/1.17	43.0 dBmV
Qam-red7/1.18	43.0 dBmV

.....

Start Frequency: 111000000Hz

Frequency in use carrier_id lane_id block_id

x-----	x-----	x-----	x-----
117000000hz	001	1	1 Qam-red7/1.1
123000000hz	002	1	1 Qam-red7/1.2
129000000hz	003	1	1 Qam-red7/1.3
135000000hz	004	1	1 Qam-red7/1.4
141000000hz	005	1	1 Qam-red7/1.5
147000000hz	006	1	1 Qam-red7/1.6
153000000hz	007	1	1 Qam-red7/1.7
159000000hz	008	1	1 Qam-red7/1.8
165000000hz	009	1	2 Qam-red7/1.9
171000000hz	010	1	2 Qam-red7/1.10
177000000hz	011	1	2 Qam-red7/1.11
183000000hz	012	1	2 Qam-red7/1.12
189000000hz	013	1	2 Qam-red7/1.13
195000000hz	014	1	2 Qam-red7/1.14
201000000hz	015	1	2 Qam-red7/1.15
207000000hz	016	1	2 Qam-red7/1.16
213000000hz	017	1	3 Qam-red7/1.17

RFGW-10 with DS-384, Port 1.1

- RFGW-10#sh contr qam-red 7/1.1 down
Qam-red 7/1.1 Downstream is up
Annex B, Power: 43.0 dBmV
Frequency: 117000000 Hz, lane: 1, block: 1
Modulation: 256QAM, TSID: 711, QAM IDB_State: UP
Bandwidth Used: 3231056 bps
Bandwidth Total: 38810700 bps
Transport Mode: QAM_MODE_MPT Qam Owner: REMOTE
Qam License: Exists
Interleave Level: 2, FEC I: 32 FEC J: 4

10K with 3G60 Linecard

- 10k#sh contr c7/1/1 down

NB DS Mo7/1/0:8, STATE: UP

Frequency 165.0000 MHz 256-QAM, ANNEX B, R/S Interleave I=32, J=4

Network Delay 150 (usec)

Bandwidth (Kbps): 300, Load Percent: 0

Channel ID: 81, US MAP: 0x000F

Total modems: 7, modems active : 6, total DS flows: 8

NB DS Mo7/1/0:9, STATE: UP

Frequency 171.0000 MHz 256-QAM, ANNEX B, R/S Interleave I=32, J=4

NB DS Mo7/1/0:10, STATE: UP

- 10k#sh contr modular-Cable 7/1/0 rf-channel 8

Ctrl	Chan	Frequency	Mod	Annex	IP Address	MAC Address	DEPI Remote ID
0	8	165000000	256	B	10.71.0.2	30e4.db0c.2a3f	1074332036

RFGW-10 with DS-384, Port 7/2

- RFGW-10#sh contr qam-red 7/2 down

RF Port7/2 is enabled

Max carrier density on this port set to 24

Valid rf-power range: 33.0 dBmV to 45.0 dBmV

Default RF Power value: 39.0 dBmV

RF Power configured on Qam channels:

Qam interface current-rf-power

x-----x-----

Qam-red7/2.1	43.0 dBmV
Qam-red7/2.2	43.0 dBmV
Qam-red7/2.3	43.0 dBmV
Qam-red7/2.4	43.0 dBmV
Qam-red7/2.5	43.0 dBmV
Qam-red7/2.6	43.0 dBmV
Qam-red7/2.7	43.0 dBmV
Qam-red7/2.8	43.0 dBmV
Qam-red7/2.9	39.0 dBmV
.	
.	
.	

Start Frequency: 55000000Hz

Frequency in use	carrier_id	lane_id	block_id
------------------	------------	---------	----------

x-----x-----x-----x-----

165000000hz	025	1	3	Qam-red7/2.1
171000000hz	026	1	3	Qam-red7/2.2
177000000hz	027	1	3	Qam-red7/2.3
183000000hz	028	1	3	Qam-red7/2.4
189000000hz	029	1	3	Qam-red7/2.5
195000000hz	030	1	3	Qam-red7/2.6
201000000hz	031	1	3	Qam-red7/2.7
207000000hz	032	1	4	Qam-red7/2.8

RFGW-10 with DS-384, Port 2.1

- RFGW-10#sh contr qam-red 7/2.1 down
Qam-red 7/2.1 Downstream is up
Annex B, Power: 43.0 dBmV
Frequency: 165000000 Hz, lane: 1, block: 3
Modulation: 256QAM, TSID: 721, QAM IDB_State: UP
Bandwidth Used: 1757880 bps
Bandwidth Total: 38810700 bps
Transport Mode: QAM_MODE_MPT Qam Owner: REMOTE
Qam License: Exists
Interleave Level: 2, FEC I: 32 FEC J: 4

Partial Mode & Wideband CM Distribution

- Scm <mac> wide rcs ver
- Scm cm-status, scm partial-mode, scm partial-service
- Scm resiliency, show cable resiliency
- Scm wide ch, scm wide registered-traditional
- Sh cab mac-domain cx/y/z rcc

• Sh cab upstream service-flow summary

Interface		Static US Service Flow						Dynamic US Service						
Flow Description		Total	PRI	BE	UGS	UGS-AD	RTPS	N-RTPS	BE	UGS	UGS-AD	RTPS	N-RTPS	
C6/0/0/UB1	17	17	0	0	0	0	17	0	0	0	0	0	0	Cell-1
C6/0/0/UB2	17	17	0	0	0	0	17	0	0	0	0	0	0	Cell-2
C6/0/0/U0	8	4	4	0	0	0	4	0	0	0	0	0	0	N/A

• Sh cab modem tcs summ

Interface	Cable Modem							
	Total	Reg	Oper	Unreg	Offline	Wideband	TCS	USCB
C5/0/0/U0-1	32	32	32	0	0	32	768	1
C5/0/0/U2-3	94	94	94	0	0	94	3072	2
C5/0/0/U4-5	32	32	32	0	0	32	12288	3
C5/0/0/U6-7	50	50	50	0	0	50	49152	4

DBS Allocations

- sh contr modular-Cable 7/1/0 mapping rf-channel

Ctrlr	RF channel	MC BW %	MC Rem. Ratio	WB channel	WB BW %	WB Rem. Ratio
7/1/0	0	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	1	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	2	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	3	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	4	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	5	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	6	30	1	7/1/0:1	1	1
				7/1/0:9	1	1
7/1/0	7	30	1	7/1/0:1	1	1
				7/1/0:9	1	1

- sh hw-module bay 3/3/0 mapping rf-channel

US Ranging

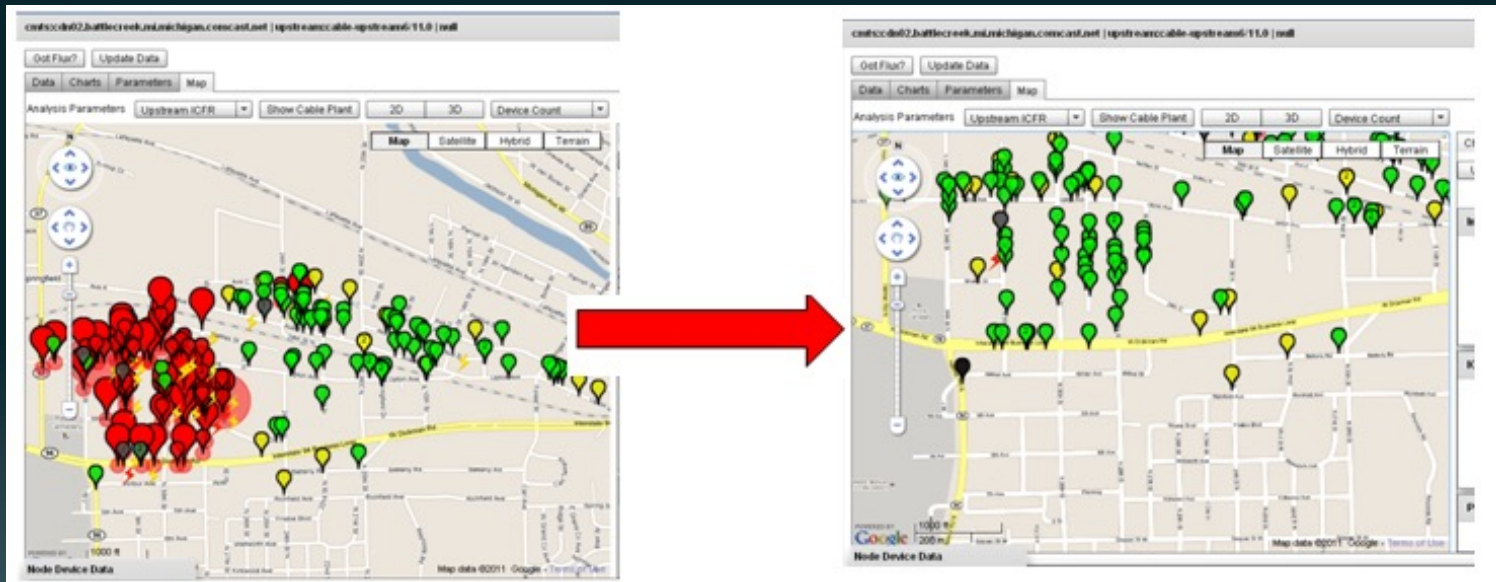
- `Init(r1)` = IM burst
- `Inti(r2)` = SM burst also used every 15-20 sec
- `Init(rc)` = Range complete
- CMTS settings
 - Power-level, power-adjust threshold, power-adjust continue
- D3.0 ranges on each one individually
 - Reports level back to CMTS even without remote-query configured
- CMTS T4 multiplier defaults to $(15 \text{ or } 20) * \# \text{ of USs in BG}$
 - Modem T4 = $30 * \# \text{ of USs in BG}$

Proactive Network Maintenance (PNM)

Quantifying Pre-EQ Operation

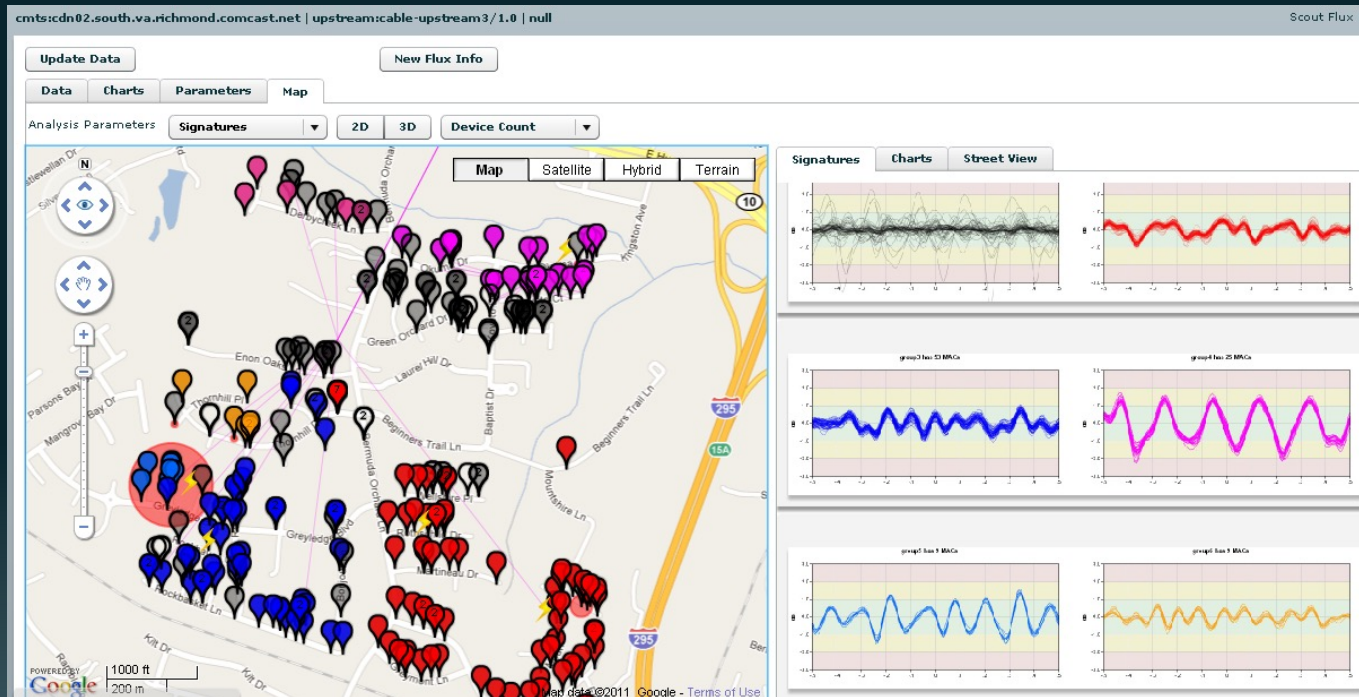
- Pre-equalization allows CM to pre-distort US signal for group delay, micro-reflections, in-ch tilt and impairments
 - Cab up n equalization-coefficient - not on by default
 - Scm phy loses effectiveness of per-CM MER when pre-eq used
- Cablelabs created Proactive Network Maintenance (PNM)
 - Query modems for their pre-eq tap information
 - Allows troubleshooting of US issues
 - Allows identification of trouble locations in RF plant

Comcast Scout Flux Examples



This was caused by a radial crack in the trunk cable

Scout Flux Examples (cont)



- Signature match/grouping illustrates physical boundaries of effects of several different impedance mismatches
- Any one of these could be point of ingress, CPD or causing ISI & EQ problems
- Often manifest as intermittent service problems

Full Bandwidth Capture (FBC) - DS Spectrum

Broadcom FBC

- DS spectrum analysis at CM
 - Brcms 3183 and 3184 chipsets
 - Cisco products =
- Requires snmp gui & html5 (Google Chrome?)
 - Note: direct connect pc can access via 192.168.100.1:8080
- Can identify off-air ingress
 - 4G = long term evolution (LTE) mobile phone ~700-900 MHz
 - Digital TV broadcasters
 - fcc.gov website lists freqs assigned in specific cities
- Can identify noise floor and impulse noise
- Can identify overlapping chs

Thank you.

