BWT Reach Analysis

N5BF/6

2012 October 6

Reach

- EIRP determined by equipment (ant output)
- MDS determined by equipment and noise (seen by ant)
  - MDS can be improved by averaging, 20+ dB
  - Averaging is limited by dynamics
    - Relative motion modeling error
    - Duration
    - Clock(s)
- Noise ultimately limited by sky / environment
- "Reach" = EIRP – MDS (dB)
  - Space loss for Zitzelberger path
  - Power subtended plus reflection coefficient plus space loss for radar path

BWT Goals

- Reach Space Radio targets, DIY
- Efforts that improve Reach
  - Algorithmic
  - Hardware
  - Antennas
  - Operations
    - http://cbduncan.duncanheights.com/HamRadio/Dsp10/Dsp10.html
- (Originally conceived as “Challenge Chart”)
  - (Doesn’t measure the right thing)
  - (See Implications)

Table not Graph

Case	EIRP	mds 2.3		Reach 2.3	R 10Ks	R Year	
				0.0	21.8	39.3	rev averaging improvement
N5BF 2006	49.9	-166.9		216.8	238.6	256.1	3+3=6 dB ground refl. Gain?
N5BF 2009	61.3	-182.9		244.2	266.1	283.5	144 with amp and preamp
N5BF 2011	47.5	-166.8		214.3	236.1	253.5	1296, 8 dB medium gain yagi
N5BF 23 dish	67.0	-190.0		257.0	278.8	296.2	
W5UN KW	91.9	-200.0		291.9	313.7	331.1	
Goldstone Radar L	129.2	-215.6		344.8	366.6	384.1	Mankind's best reach.

Case	SL			
Self moon 144	187.3			187.3
Self Venus 144	236.0			236.0
Self Titan 144	256.0			256.0

Case	subtends	Refl	SL			
EME 144	46.9	11.5	187.3	245.8		251.5-253.5
EME 1296	46.9	10.0	206.4	263.3		http://k7xc.tripod.com/id19.html
EVE 144	84.7	10.0	236.0	330.7		says 6-10 dB libration improvement happer
EVE 1296	84.7	4.5	255.1	344.3		(AMSAT Paper)
ISS 144	100.0	5.0	135.6	240.6	but only have a few minutes	
Meteor 144	221.6	5.0	137.2	363.8	rock only and only have a few seconds, must depend on a lot of trail	
NEO 144	166.4	5.0	236.0	407.4	km dia.	
Titan 144	118.7	5.0	256.0	379.7		

Conclusions

- Working self across solar system within Reach
  - Confirmed by deep space hearsat types
- Moon, ISS, meteors Reachable
  - As has been known for 60+ years
- Everything else for radar is 80 – 150 dB down
  - As the solar system radar guys know
  - Goldstone Radar is only ~100 dB better than N5BF
- Hz-level and longer averaging
  - Only helps make station smaller
  - Does not Reach more distant destinations ☹
  - Because they are so very far away

Implications

- Joe Taylor has already made the breakthroughs
  - Still want to replicate for self education
  - Still hope for incremental insight - improvement
- Stuff I want to do still enabled by SDRs
  - See 2006 AMSAT paper
  - Still want to be I/Q processing expert
  - Still want to build SW/HW to Reach Specific Goals

Specific Goals

- EME self, EME QSOs in JT and PUA modes
- Meteor 6
- WSPR 40
- Radio Jove, et al
- AO-7 Doppler Tracking and OD
- Software is still next
  - Back to the Arduino
- Az/El still needed on some “farm”
- Watch out for “better” I/Q radios