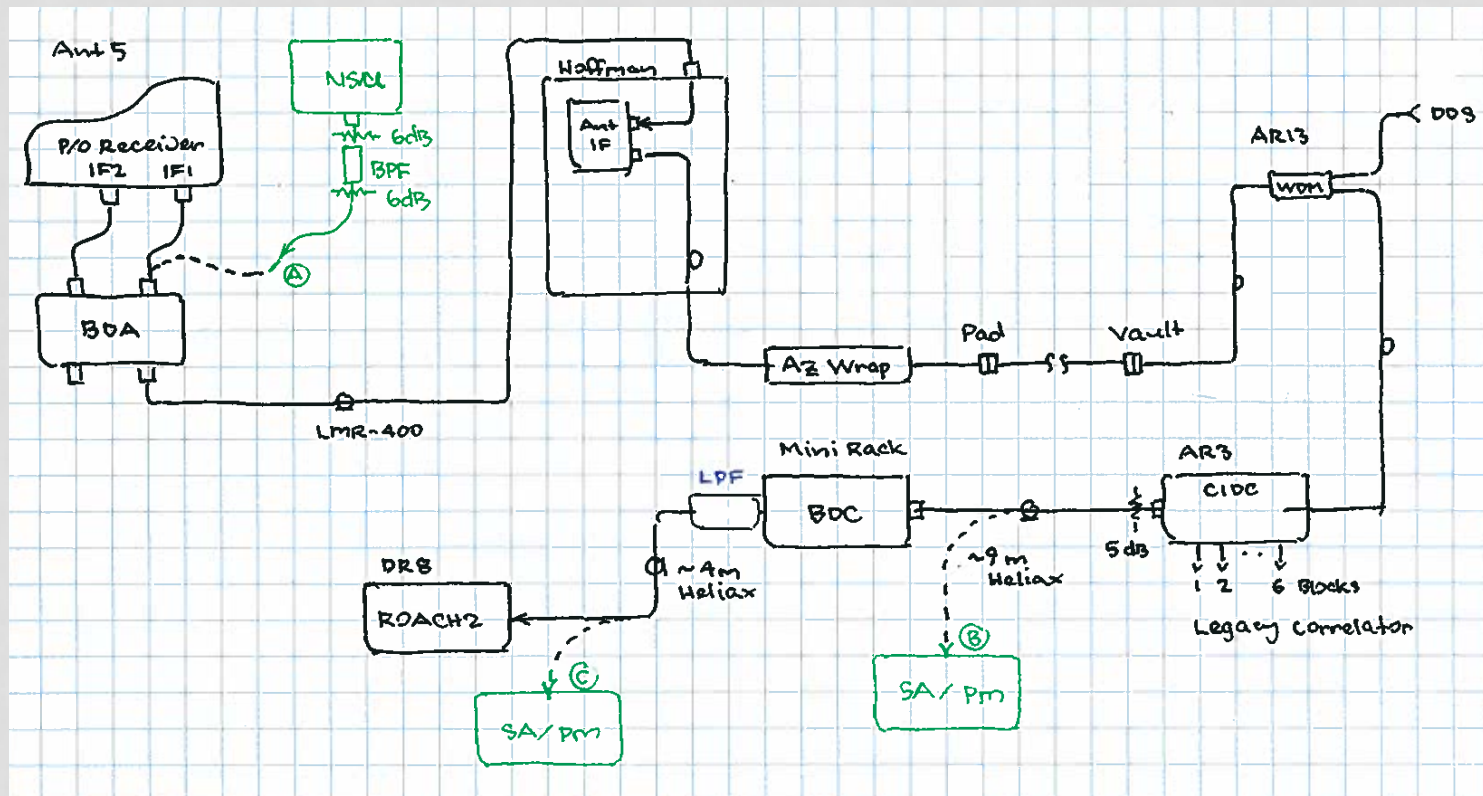


ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Artificial Noise Source Unit (NSU) was used in the antenna
 - K&L, model 11ED10-9125/U2250-O/O, 8.0 – 10.25 GHz BPF was used to band limit the NSU signal
 - Power and spectral measurements were taken using a power meter and spectrum analyzer at points A, B, and C in the diagram below
 - No additional cables were introduced to take measurements, i.e., actual interconnect cables were used to connect to the power meter (PM, Agilent E4418A meter, E4412A sensor) and spectrum analyzer (SA, E4407B)



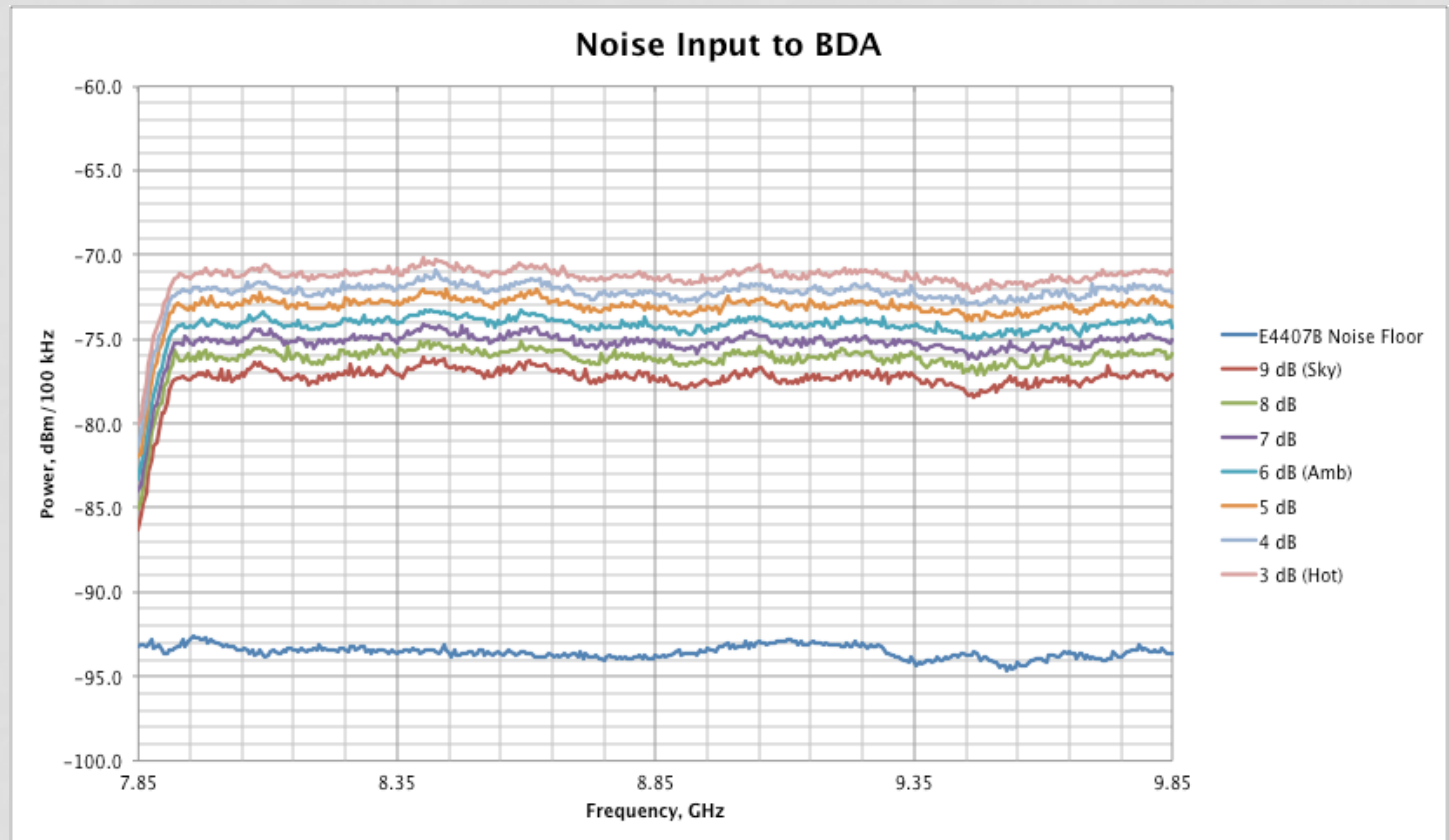
ANTENNA 5 WIDEBAND IF CHARACTERIZATION

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Simulated Condition	8-10 GHz Input to BDA (end of 1-m test cable)						8-10 GHz Input to BDC (end of 9-m Heliac)					0-2 GHz Input to ROACH2 (end of 4-m Heliac)					
	No pad added to PM		7.85-9.85 GHz		Monitor		No pad added to PM		23 dB pad added to PM		7.85-9.85 GHz		No pad added to PM		23 dB pad added to PM		0.00-2.00 GHz
	NSU Attn	Meas'd Input	"Sky"	E4407B	Pwr"		Meas'd Input	"Sky"	Power	"Sky"	E4407B	Meas'd Input	"Sky"	Power	"Sky"	E4407B	
-	(dB)	(dBm)	(dB)	CSV file	(V)	(dBm)	(dB)	(dBm)	(dB)	CSV file	(dBm)	(dB)	(dBm)	(dB)	CSV file		
A	No Noise	69	< 70	> 70	713	0.03	-25.00	14.30	-48.00	13.75	722	-35.75	26.63	-58.40	25.80	746	
B	Sky	9	-32.58	0.00	720	1.06	-10.70	0.00	-34.25	0.00	729	-9.12	0.00	-32.60	0.00	745	
C		8	-31.45	1.13	719	1.33	-9.57	1.13	-33.20	1.05	728	-8.00	1.12	-31.60	1.00	744	
D		7	-30.51	2.07	718	1.62	-8.60	2.10	-32.30	1.95	727	-7.00	2.12	-30.60	2.00	743	
E	Ambient	6	-29.49	3.09	717	1.98	-7.55	3.15	-31.30	2.95	726	-5.94	3.18	-29.65	2.95	742	
F		5	-28.49	4.09	716	2.40	-6.52	4.18	-30.35	724.00	725	-4.93	4.19	-28.70	3.90	741	
G		4	-27.53	5.05	715	2.89	-5.52	5.18	-29.40	4.85	724	-3.97	5.15	-27.80	4.80	740	
H	Hot	3	-26.47	6.11	714	3.49	-4.45	6.25	-28.40	5.85	723	-2.95	6.17	-26.85	5.75	739	

- Power meter was used to characterize power for columns 3, 7, and 12 above and correspond to locations A, B, and C in the previous figure
 - We discovered that the Agilent E4412A (S/N US37183623) power sensor produces different linearity values at different input power ranges (-33 to -27 dBm in antenna, -11 to -4 dBm at BDC input, and -9 to -3 dBm at ROACH2 input).
 - Used a 23 dB pad in front of the power sensor when measuring power at location B and C to make comparable power level measurements
 - Y-factor at BDC input (after C1DC + cable): 3.09 → 2.95 dB (0.14 dB delta), 6.11 → 5.85 dB (0.26 dB delta)
 - Y-factor at ROACH2 input (after 4-m cable): 3.09 → 2.95 dB (0.14 dB delta), 6.11 → 5.75 dB (0.36 dB delta)

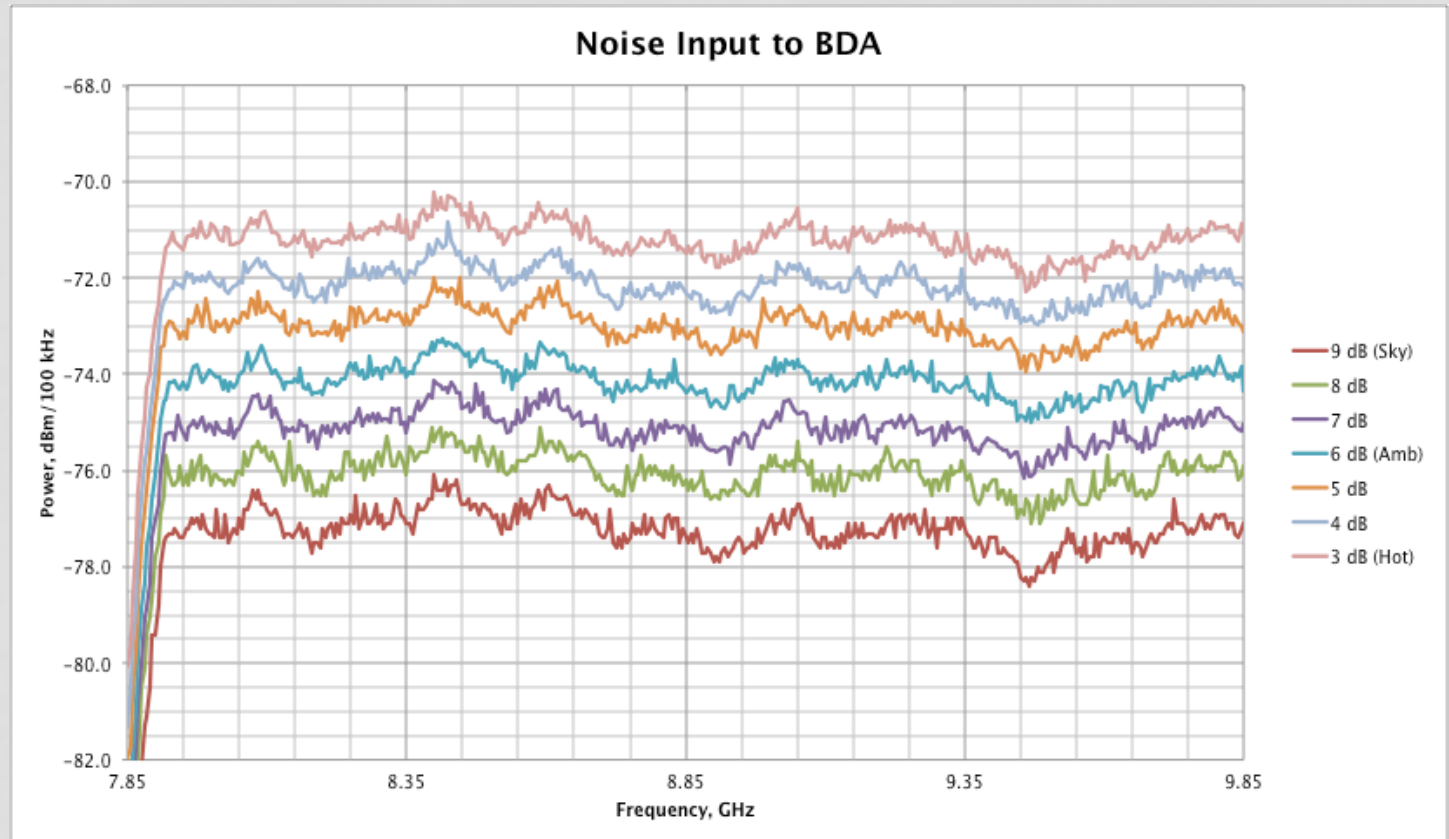
ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Noise power spectral density from Noisewave, model NW18H-MI, at attenuation settings 3 through 9 dB
 - Sky power was set to -32.58 dBm
 - In hindsight, we should have set this level 6 dB lower because we were only sending 2 GHz of noise through an 8 GHz wide channel ($10 \cdot \log[2/8] = -6$ dB)



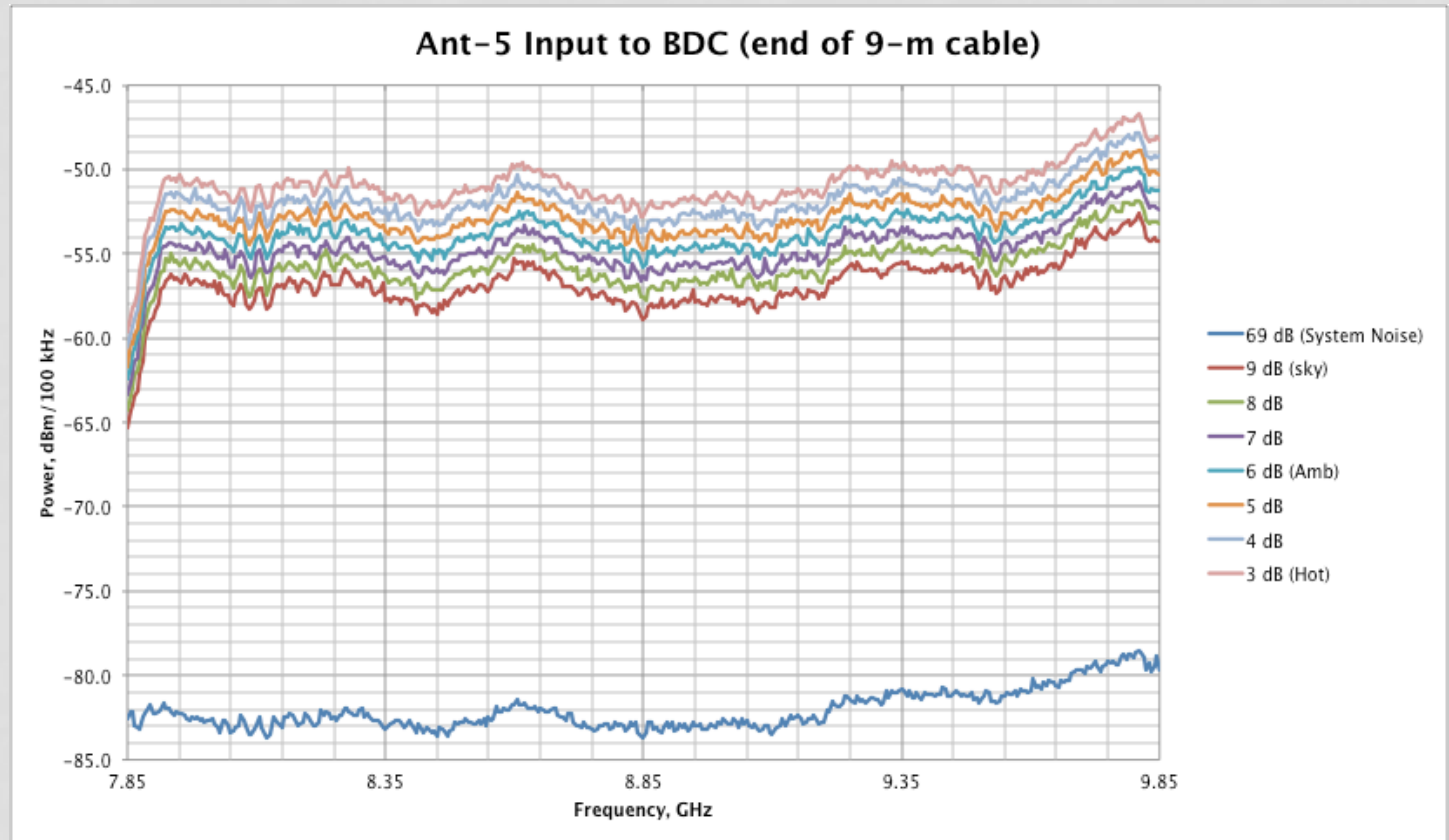
ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Note the well behaved input noise spectra from the noise source
 - Pass band of filtered noise is 8.00 – 10.25 GHz



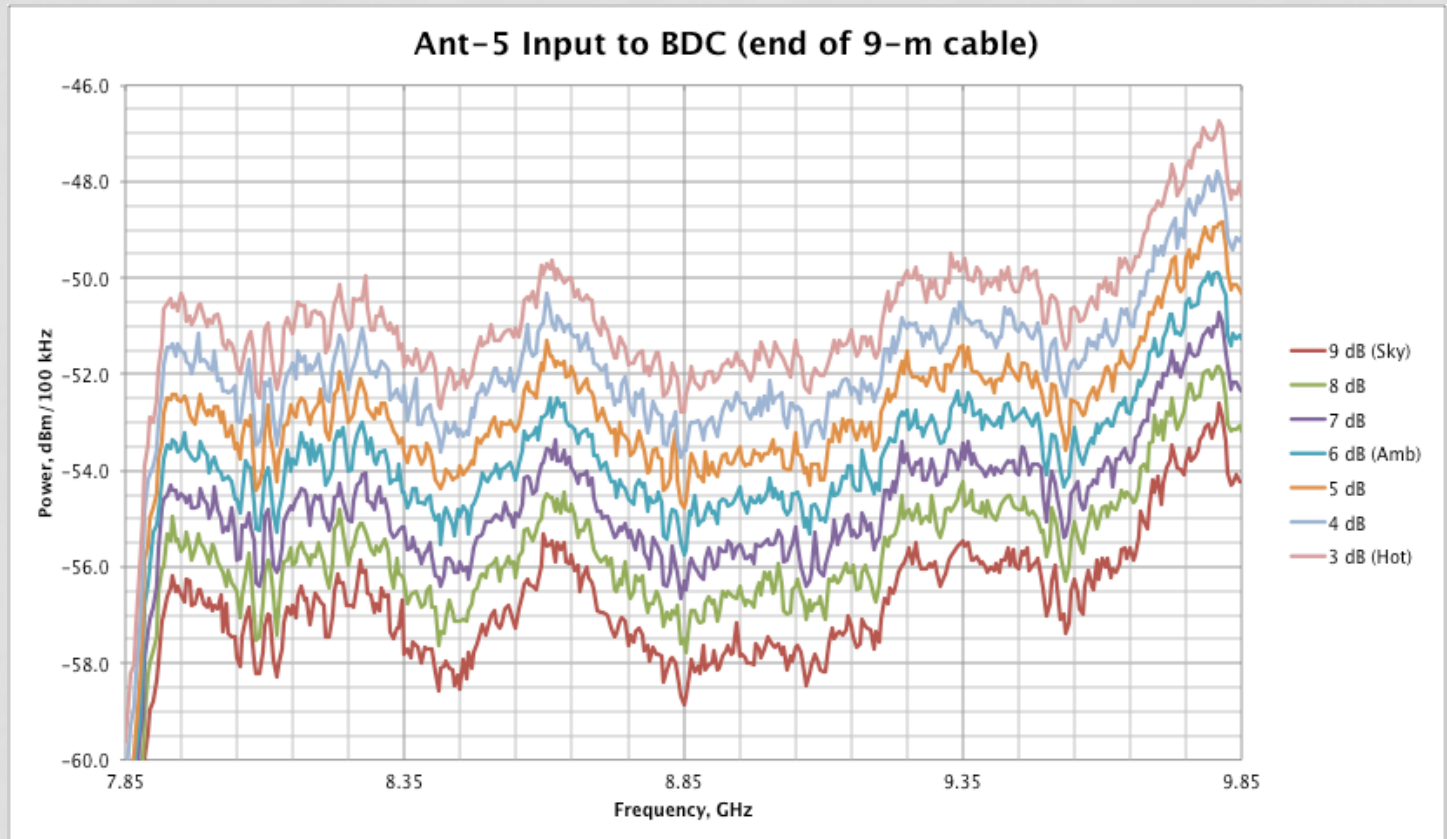
ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Input spectra to BDC (after C1DC and 9-m Heliax cable)
 - Note sky to noise floor ratio of approximately 24 dB at mid-band
 - This translates to ~18 dB taking into account the 2 GHz band limited signal



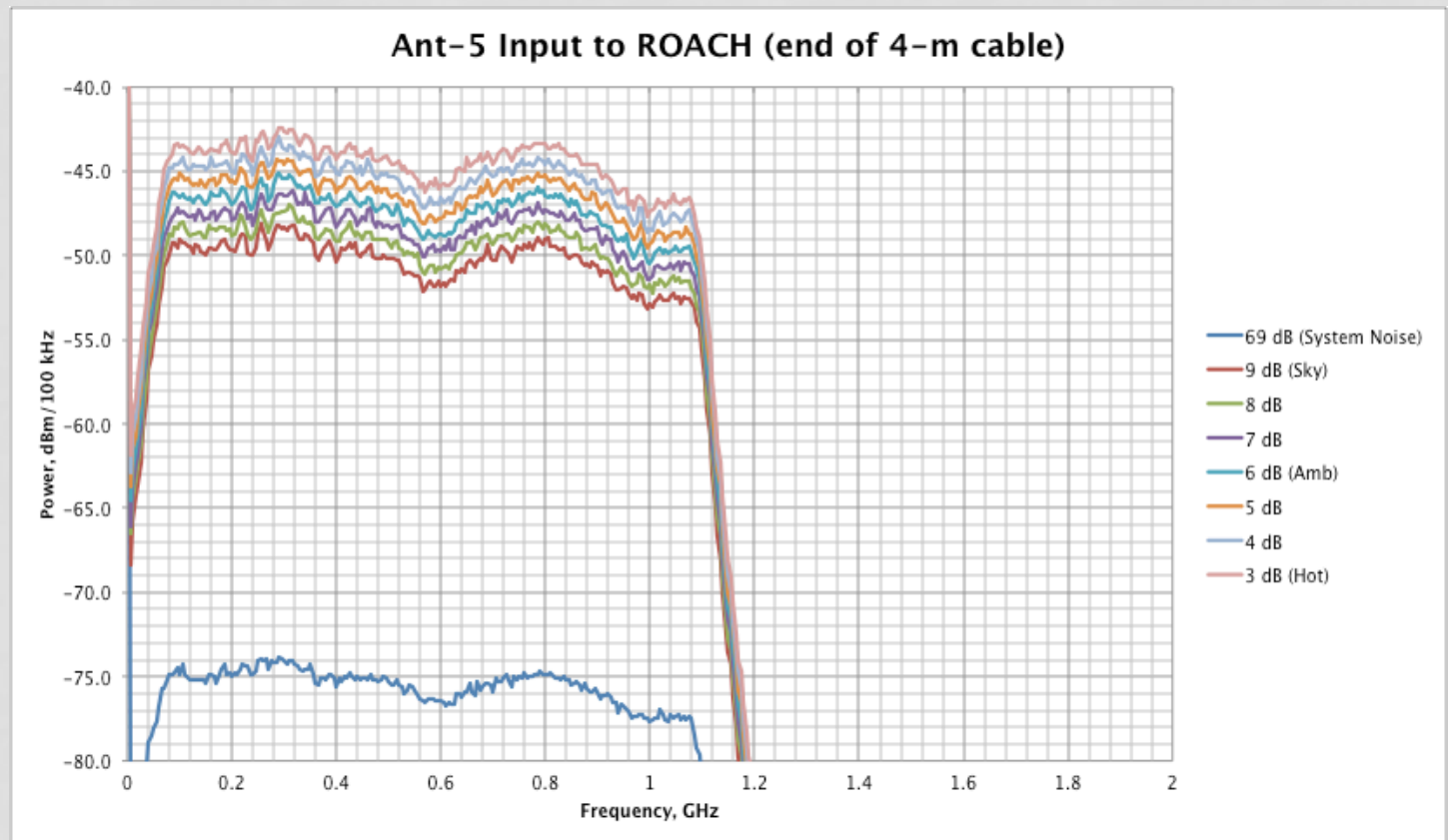
ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Close-in view of noise spectra after Antenna-IF, fiber link, C1DC, and 9-meter cable
 - Fast moving ripple near 8.1 GHz has a ripple amplitude of 1 dBpp and frequency of ~33 MHz → 3.8 m (~12 foot) cable
 - Could be related to cable between BDA and Hoffman box in antenna → we should find the cause and fix it



ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Input spectra to ROACH2 (after BDC and 4-m Heliax cable)
 - Note sky to noise floor ratio of approximately 24 dB at mid-band and is similar to the input ratio
 - Here again the actual SNR should be approximately 6 dB lower than shown here because of the narrower input noise bandwidth



ANTENNA 5 WIDEBAND IF CHARACTERIZATION

- Close-in view of noise spectra after Antenna-IF, fiber link, C1DC, 9-meter cable, BDC, 1 GHz LPF, and 4-meter cable
 - Note the fast roll-off at approximately 1.1 GHz due to the addition of the LPF to control aliasing for our current sample clock of 1144.0 MHz

