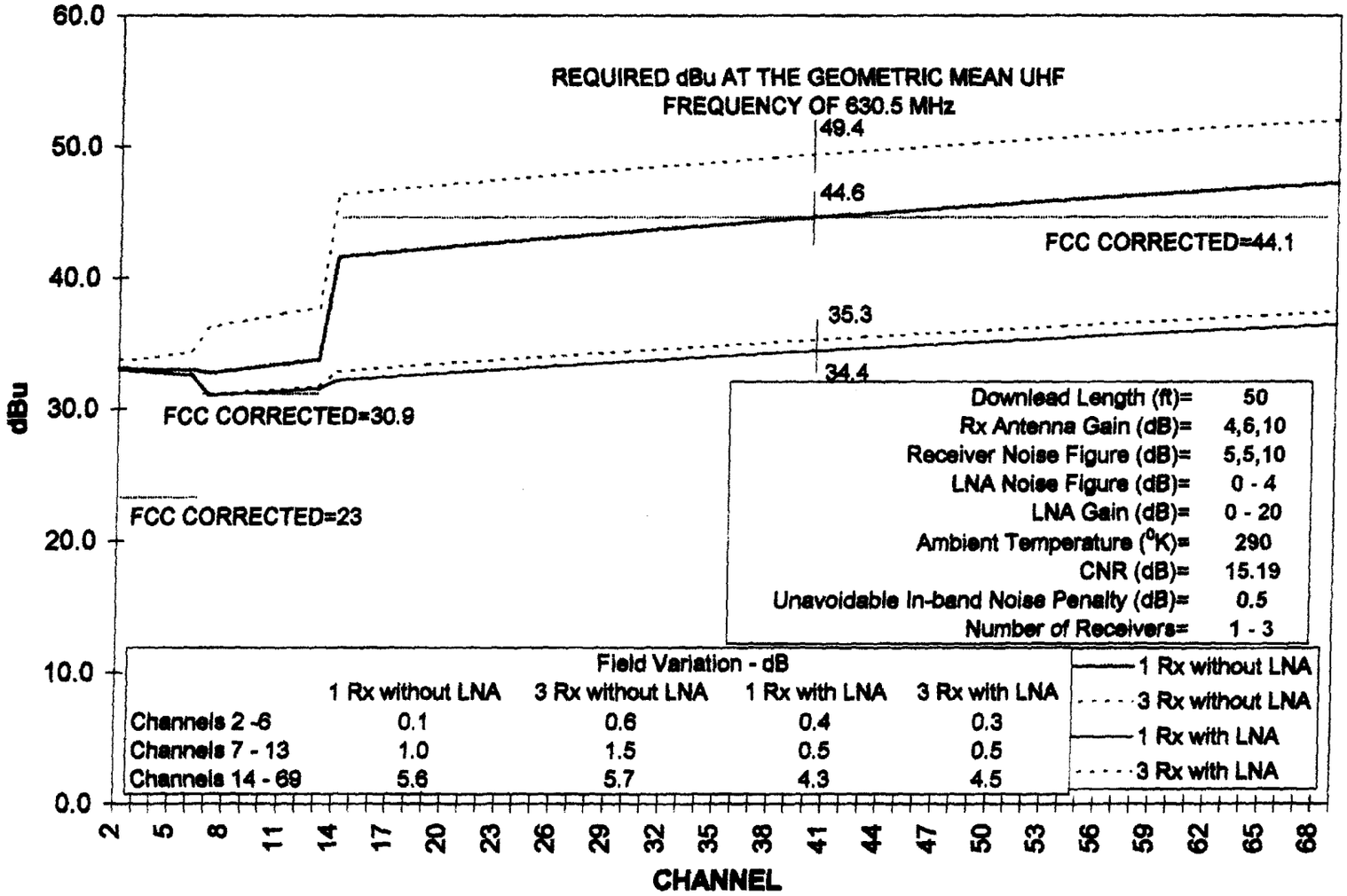
- Use one propagation model for both power and interference determination. The usage of two different models, one for power determination and one for interference determination, does not add engineering credibility to the final Allotment Table.
- Modify the single-carrier Longley-Rice propagation model to account for wide-band signals. In addition to the conventional attenuation, HDTV signals will undergo an additional attenuation resulting from spectral distortion of the 6 MHz channel upon terrain diffraction.
- Limit the ERP for 10 years or until enough field data is available on signal availability, interference and fading statistics.
- Replace the receive antenna in the planning factors with a "smart antenna" with on/off UHF-LNA capability.
- Use channel-specific planning factors in the UHF range.
- Define the Effective Radio-Horizon as the first of two UHF contours with planning factors not including LNA.
- Define the second of two UHF contours with planning factors including LNA.
- Assign measurable values to HDTV contours. Better yet, assign values that are measurable and can serve as service predictors. Neither field strength nor total power are useful predictors of service.

O. Bendov
November 8, 1996

Figure 1: CHANNEL-SPECIFIC EFFECTIVE FIELD STRENGTH for MAXIMUM SKY TEMPERATURE



Field Variation - dB	1 Rx without LNA	3 Rx without LNA	1 Rx with LNA	3 Rx with LNA
Channels 2 -6	0.1	0.6	0.4	0.3
Channels 7 - 13	1.0	1.5	0.5	0.5
Channels 14 - 69	5.6	5.7	4.3	4.5

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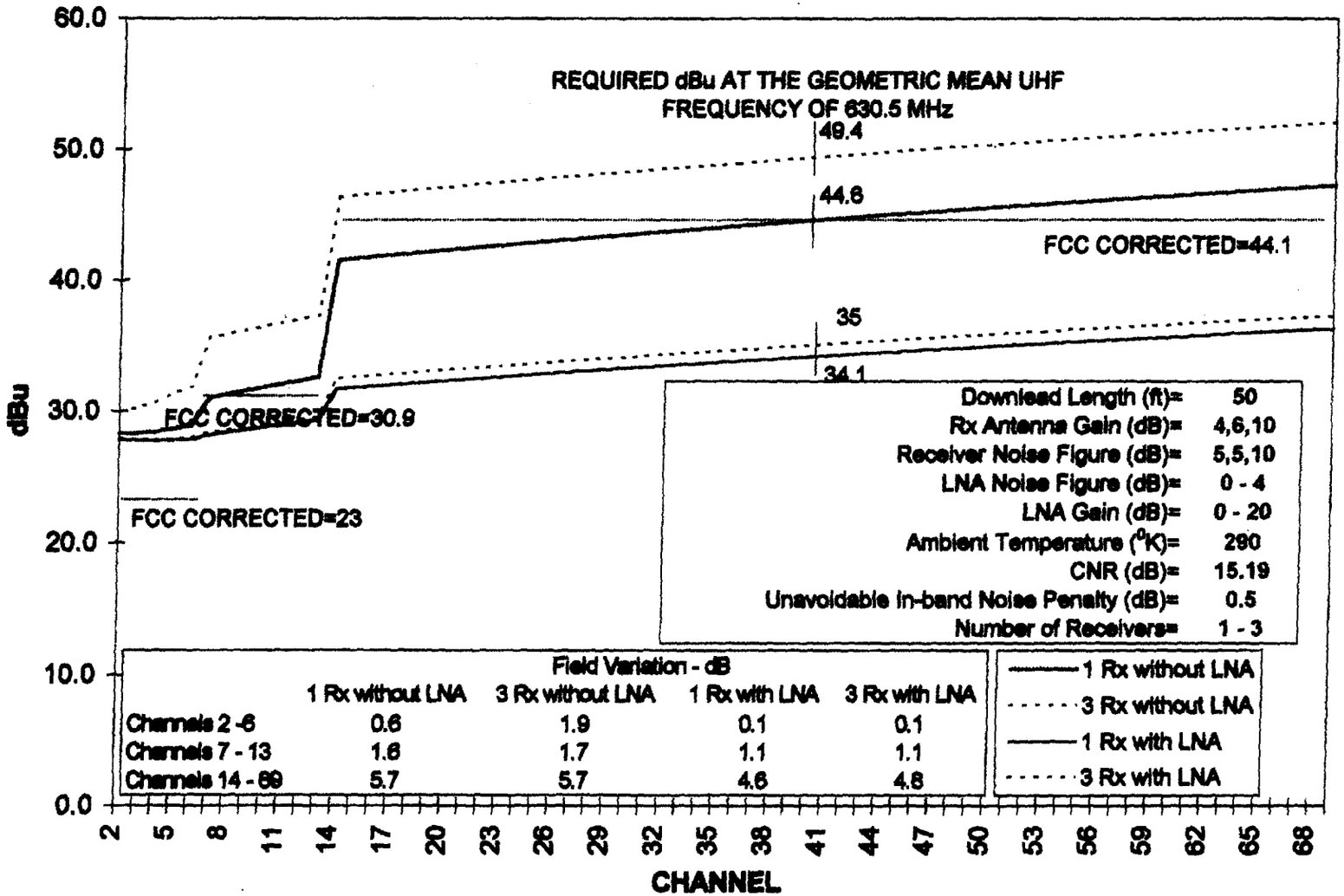
Figure2: CHANNEL-SPECIFIC EFFECTIVE FIELD STRENGTH for AVERAGE SKY TEMPERATURE



Downlead Length (ft)=	50
Rx Antenna Gain (dB)=	4,6,10
Receiver Noise Figure (dB)=	5,5,10
LNA Noise Figure (dB)=	0 - 4
LNA Gain (dB)=	0 - 20
Ambient Temperature (^{0}K)=	290
CNR (dB)=	15.19
Unavoidable In-band Noise Penalty (dB)=	0.5
Number of Receivers=	1 - 3

	Field Variation - dB			
	1 Rx without LNA	3 Rx without LNA	1 Rx with LNA	3 Rx with LNA
Channels 2 -6	0.6	1.9	0.1	0.1
Channels 7 - 13	1.6	1.7	1.1	1.1
Channels 14 - 69	5.7	5.7	4.6	4.8

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Figure 3: DESIRED/UNDESIRED LEVEL OF COLLOCATED ADJACENT CHANNELS
ASSUMING IDENTICAL Tx ANTENNAS AND A SINGLE GROUND REFLECTION

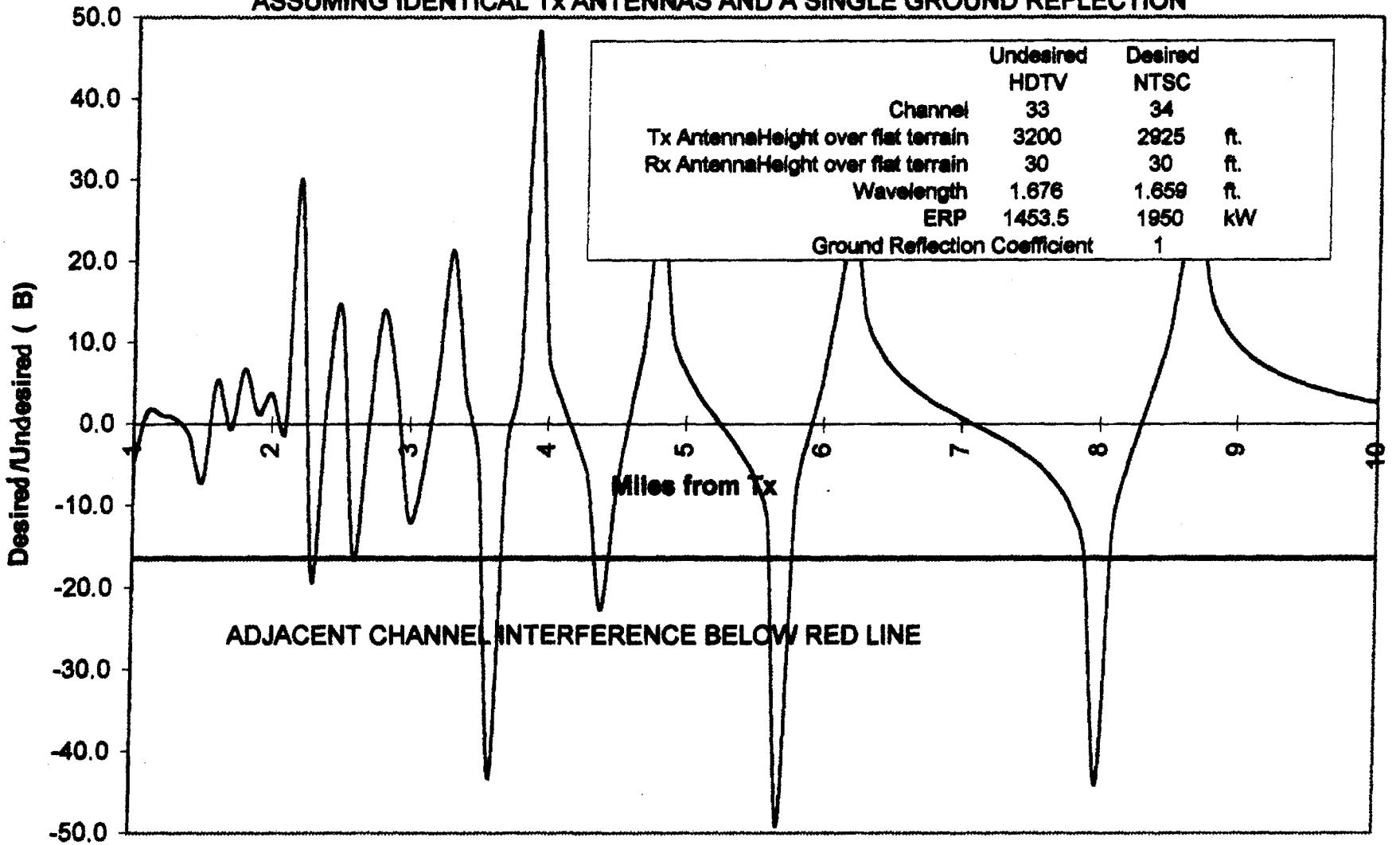

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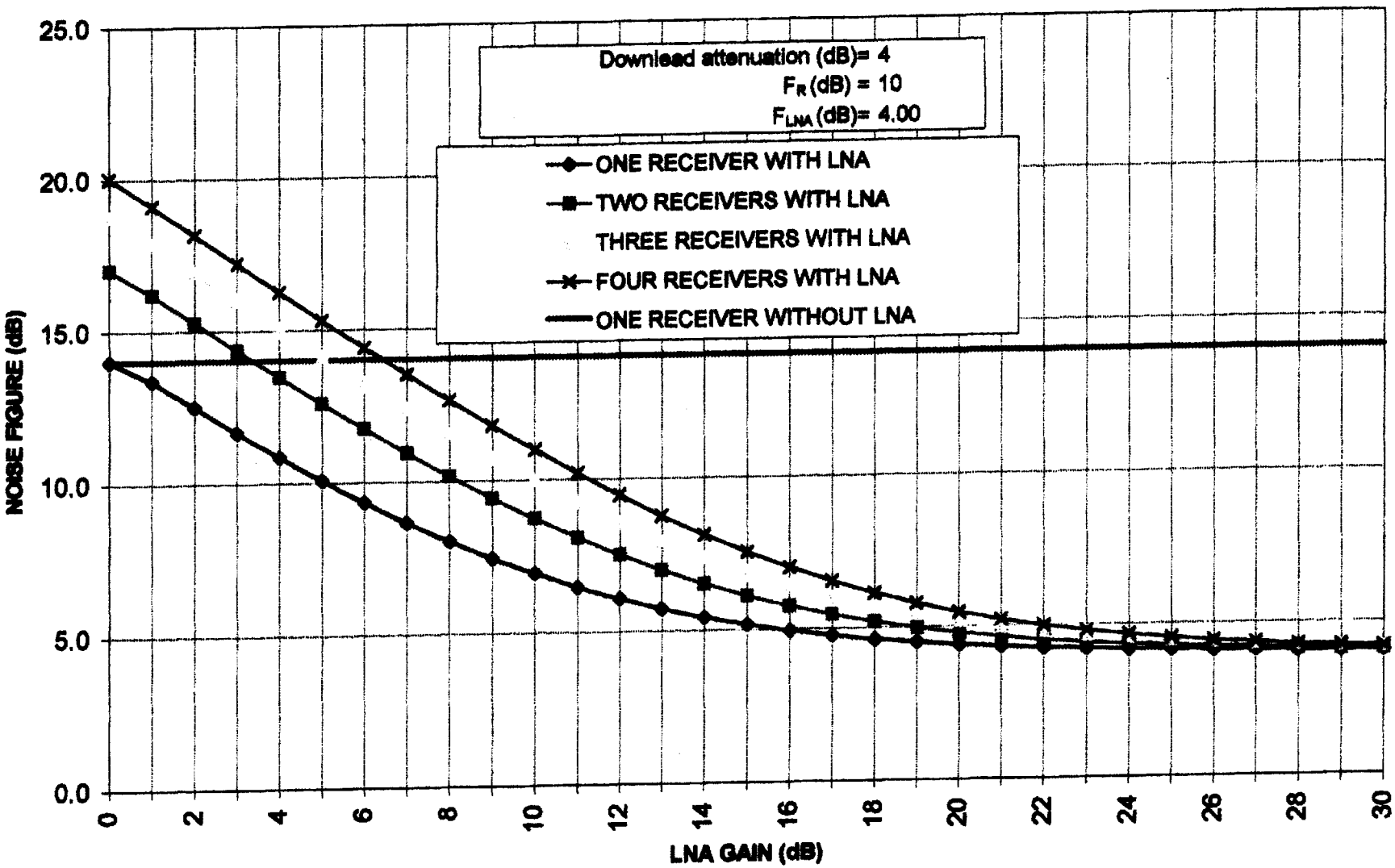
Figure 4: SYSTEM NOISE FIGURE



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MATHEMATICAL APPENDIX

A. ACATS* Receiver Model

$$P_a = \frac{V^2}{Z} = P_i \frac{1.64 G_R \lambda^2}{4\pi} = \frac{E_i^2}{120\pi} \frac{1.64 G_R \lambda^2}{4\pi} = \frac{31.1 E_i^2 G_R}{f_{MHz}^2}$$ Narrow - band transmission assumed

$$CNR = \frac{P_a}{N_t F_r \eta_D} \qquad L = -Log\eta_D \quad \eta_D = \text{Downlead efficiency} \qquad N_t = kTB = -136.2\ dBw\ @T = 290^0 K$$

$$E_i(dBu) = CNR(dB) + K_f + F_r(dB) + N_t(dBw) + L(dB) - G_R\ (\text{dB})$$

$$P_a(dbm) = E_i(dBu) + G_R(dB) - K_f + 30$$

$$K_f = 20Logf_{MHz} + 120 - 10Log31.1$$

B. Correct Receiver Model

$$P_a = \frac{V^2}{Z} = P_i \frac{1.64 G_R \lambda^2}{4\pi} = \frac{E_i^2}{120\pi} \frac{1.64 G_R \lambda^2}{4\pi} = \frac{31.1 E_i^2 G_R}{f_{MHz}^2}$$ Narrow - band transmission assumed

$$CNR = \frac{P_a}{N} \qquad N = kB\left[T_A + (F-1)T_0\right] = N_t\left[\frac{T_A}{T_0} + F - 1\right]$$

$$F = F_{LNA} + N\frac{F_R - \eta_D / N}{\eta_D G_{LNA}}$$ Up to N receivers; Optional LNA at the antenna

$F = System\ Noise\ Figure$

$T_A = Antenna\ Temperature \approx .5T_0 + .5T_S$

$T_0 = Ambient\ LNA\ and\ Downlead\ Temperature$

$T_S = Max\ Sky\ Temperature \qquad Log(T_S / 800) \approx 5.7 - 2.35Logf_{MHz}$

$< T_S >= Average\ Sky\ Temperature \qquad Log(T_S / 300) \approx 5.8 - 2.48Logf_{MHz}$

$$E_i(dBu) = CNR(dB) + K_f + N - G_R\ (\text{dB}) + p(dB)$$

$p = Unavoidable\ In - band\ noise\ penalty$

$$P_a(dbm) = E_i(dBu) + G_R(dB) - K_f + 30$$

$$K_f = 20Logf_{MHz} + 120 - 10Log31.1$$

* Advisory Committee on Advanced Television Service for the Federal Communications Commission