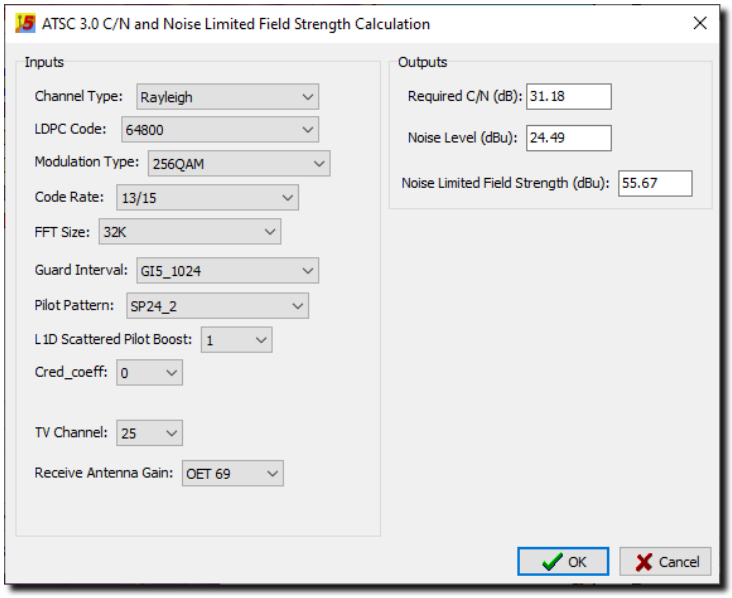
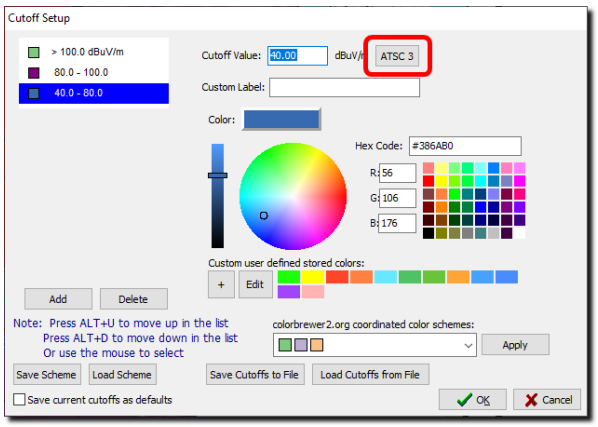
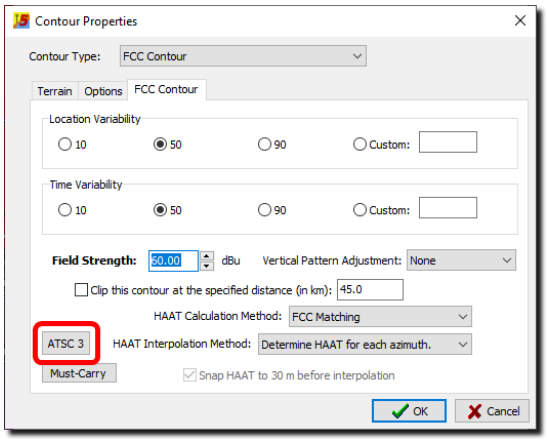
ATSC 3.0 C/N and Noise Limited Field Strength Calculation in Probe 5

This new Probe 5 feature will calculate the required C/N and noise limited field strength for various ModCod (modulation & code rate) and associated values selected for an ATSC 3.0 Physical Layer Pipe (PLP). The C/N calculation is performed as outlined in Annex B of of the ATSC A/327 recommended practice. As inputs are adjusted in the left hand side of the window the outputs on the right will be recalculated accordingly. Clicking the "OK" button to close this window will cause the noise limited field strength to be specified as the current field strength in the window the tool was accessed from.



To access this feature click the "ATSC 3" button that is located on either the cutoff list editing window or the FCC contour editing window, shown here:





Calculation Inputs:

Channel Type

AWGN - Additive White Gaussian Noise. A channel model where the only impairment to communication is a linear addition white noise with a constant spectral density and a Gaussian distribution of amplitude.

Rayleigh – A communication channel model that considers multipath and fading effects.

LDPC Codes

LPDC - Low-Density Parity Check

This is the inner forward error correction code.

Possible Values:

64800 bits – 64k Code (better performance)
16200 bits – 16k Code (less latency and memory)

Modulation Type

Modulation constellation used: QPSK, 16QAM, 64QAM, 256QAM,1024QAM, 2048QAM

Code Rate

The ATSC 3.0 standard supports the following 12 forward error correction convolutional coding rates:

2/15, 3/15, 4/15, 5/15, 6/15, 7/15, 8/15, 9/15, 10/15, 11/15, 12/15, 13/15

FFT Size

FFT (Fast Fourier Transform) sizes (8K, 16K and 32K) offer a choice of Doppler protection depending on the anticipated device mobility.

8K - 8192 point FFT size (mobile reception)
16K - 16384 point FFT size (mobile reception)
32K - 32768 point FFT size (high bit-rate fixed reception)

See Section 4.2.1 of ATSC A/327 for more information.

Guard Interval

The guard interval provides protection from time-delay based inter-symbol interference caused by multi-path propagation and multiple transmitted signals in a Single Frequency Network (SFN). The guard interval is not used directly in the C/N calculation, but only certain pilot patterns are available based on the FFT size and guard interval selected.

Pilot Pattern

The pilot pattern indicates the frequency separation of pilots and the length of the scattered pilot pattern.

See Section 4.2.3 of ATSC A/327 for more information and a description of the pilot pattern naming convention. Section 7.4.1 contains a table of recommended scattered pilot patterns for ATSC 3.0 mobile services.

L1D Scattered Pilot Boost

The pilot boost factor is a value from 0 to 4. Higher pilot boosting improves channel estimation accuracy at the expense of having a reduced data carrier power (thus requiring a higher SNR).

Cred_coeff

The carrier reduction coefficient ranges from 0 to 4. A smaller value of the carrier reduction coefficient corresponds with increased data capacity, while a larger carrier reduction coefficient can help mitigate severe adjacent channel interference.

Other Inputs

In order to calculate the noise limited field strength a number of other factors must be considered. The program is currently using the planning factors defined in the FCC's OET 69 document for this purpose. The frequency, by way of specifying the channel number, and receive antenna gain are options presented to the user. If "OET 69" is selected for the receive antenna gain then 4, 6, and 10 dBd are used for Low VHF, High VHF, and UHF. If custom is selected the user can supply their own value to be used for the antenna gain.

Links to Additional Information

ATSC 3.0 Standards: https://www.atsc.org/standards/atsc-3-0-standards/

ATSC 3.0 Recommended Practices: https://www.atsc.org/standards/atsc-3-0-recommended-practices/

Direct link to ATSC A/327:
https://www.atsc.org/wp-content/uploads/2018/10/A327-2018-Physical-Layer-RP.pdf

Direct link to ATSC A/322:
https://www.atsc.org/wp-content/uploads/2016/10/A322-2018-Physical-Layer-Protocol.pdf