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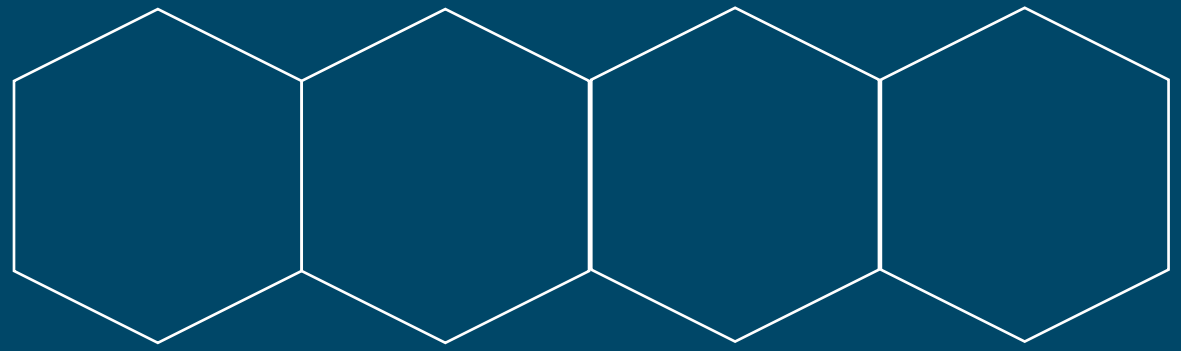
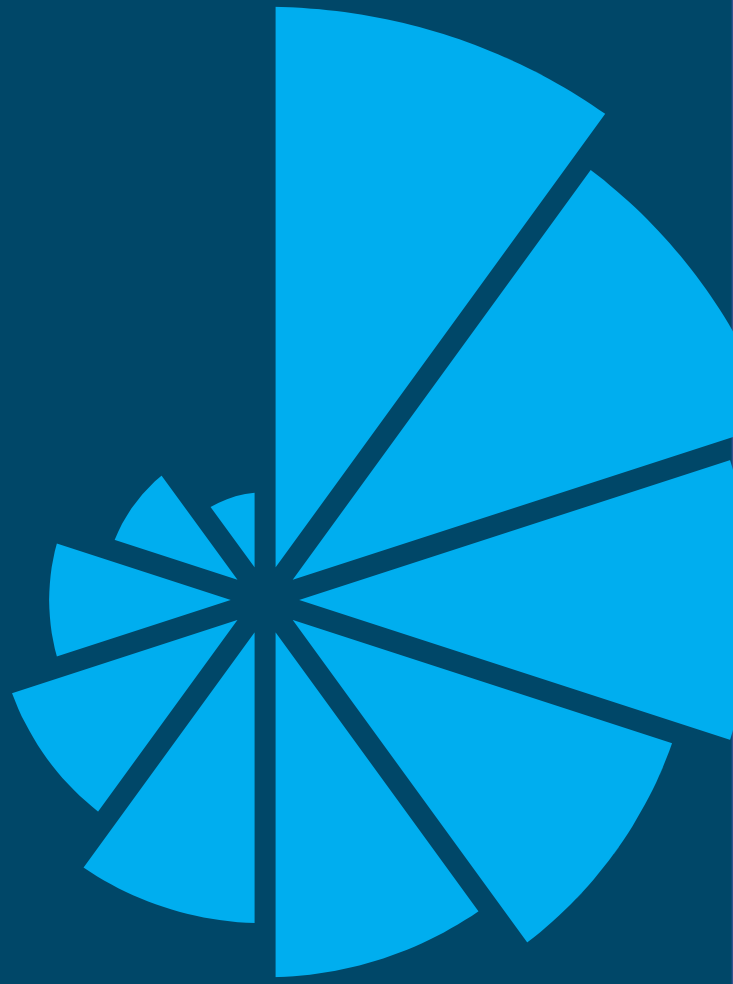
Elenos Group
World Broadcast



ELENOS BE itelco PRO TELEVISION

Developments in ATSC/ATSC 3.0 Elenos Group



Radio & TV
Broadcast Equipment
and solutions Worldwide

Version 1.5

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Webinar Schedule

1. Elenos Group
2. Product line
3. A New TV translator
4. The Exciter behind the Transmitter
5. The RF Amplifier
6. Specifications and Performance
7. Translators and ATSC 3.0
8. A closer looks at the Exciter
9. Summary and Q&A

Your host:
Chuck Kelly
VP Market Development

Special Guest:
Perry Priestley
COO / CSO Broadcast Electronics

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Elenos Group

Elenos

- Founded in **1977** in Ferrara, Italy

Itelco

- Broadcast began in **1962** in Orvieto, Italy

Broadcast Electronics

- Established in the USA in **1959**

PROTELEVISION TECHNOLOGIES

- Established in Denmark, over **50** years of experience

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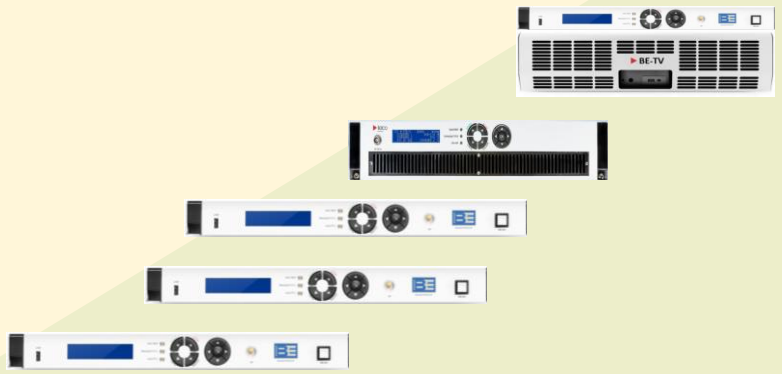
TV Transmitter Selection

Genesis Compact
VHF Band I
VHF Band III
UHF Band



1W 10W 100W 200W 600W

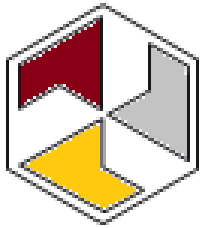
Genesis Elite
VHF Band III
UHF Band

1200W ⟷ 4800W

Genesis Aqua
VHF Band III
UHF Band

1200W ⟷ 12000W

NEW



Genesis Compact Transmitter Translator

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So what is the difference between a transmitter and translator?

- Typically a **transmitter** has an ASI, SMPTE310M or IP input directly from a TV studio
- A **translator** often has an RF input on a different channel
  - But also can have an ASI or IP too
  - Usually serves small and or rural areas, so ROI is important
  - Are often in more remote locations – difficult to access
    - Some can not be accessed for nearly 50% of the year
  - Large groups of translators are typical maintained by a single person, so reliability, consistency between products and simplicity is key

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Essential “must haves”

- **Future proof**: Multiple inputs options – Should have both ATSC1.0 and ATSC3.0 receivers, and both ATSC1.0 and ATSC3.0 modulation capability
- **Reliability**: derived from designed overhead
- **Redundancy:** with economics considered – even in the event of failure of major components, the equipment still transmits even at a lower level
- **Remote monitoring** of all major parts of the system

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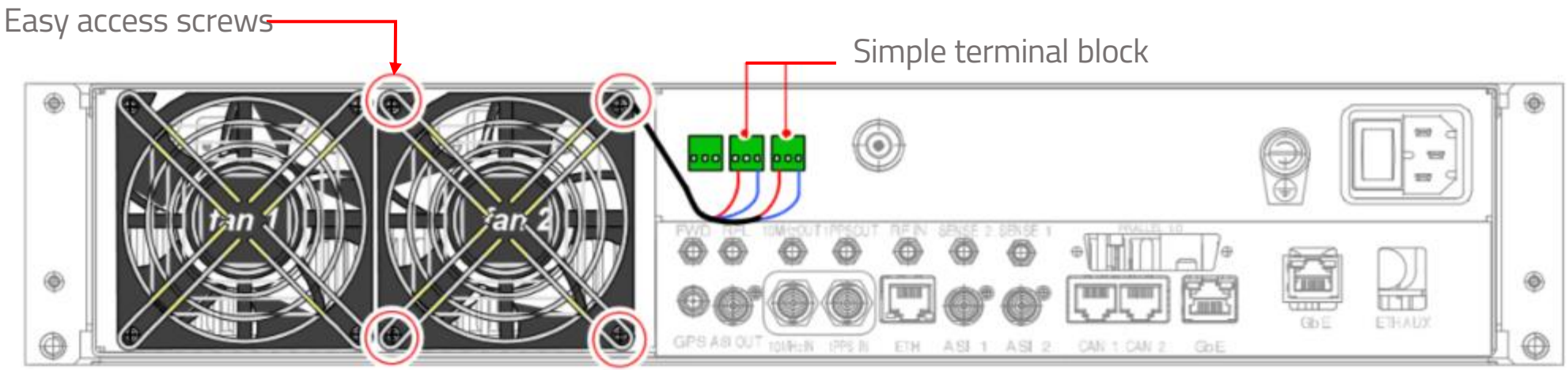
Essential “must haves”

- Should include dual fans
- Be able to operate even if one fan fails
- Be able to swap out a fan without switching off power and going off air
- Be able to swap fan in just five minutes with no special tools and not affecting the rest of the transmitter



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Essential “must haves”

- Same exciter for EVERY standard.. Analog, Digital and Radio!

ATSC

ATSC 3.0

DVB T

DVB T2

ISDB-T

ISDB-Tb

DAB
Digital Audio Broadcasting

DAB+
Digital Audio Broadcasting

And now….

HD Radio®
Digital AM & FM

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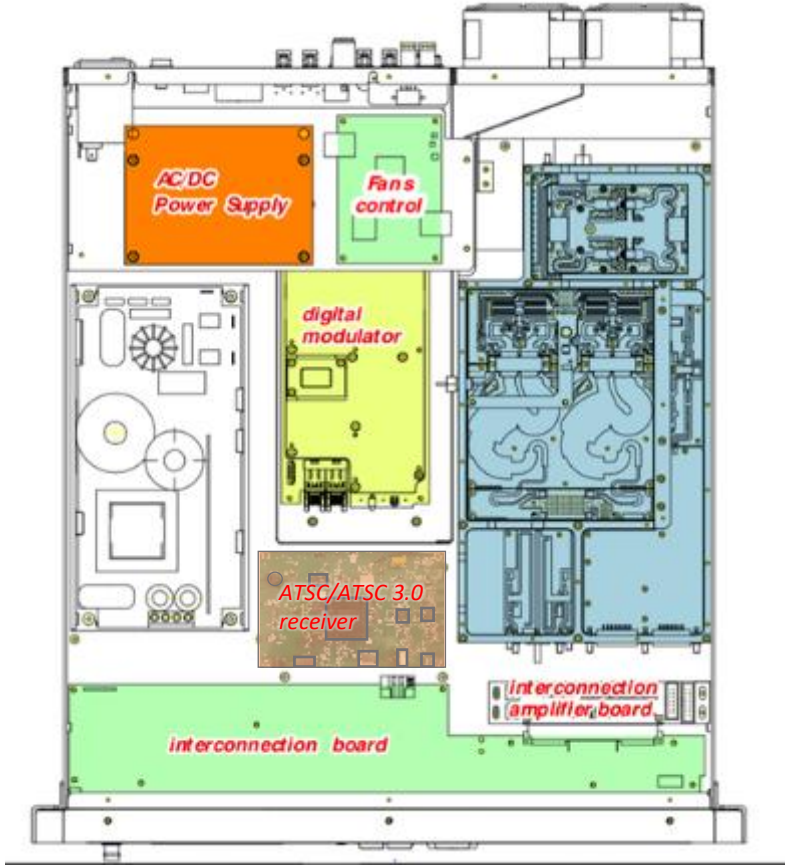
Essential “must haves”



- 50% power supply design headroom
- EMI filtering on AC mains input
- Self contained digital modulator
- Dual Doherty PA stages
- Independent control structure (Control still available even if control board fails)
- Internal ATSC & ATSC3.0 receiver

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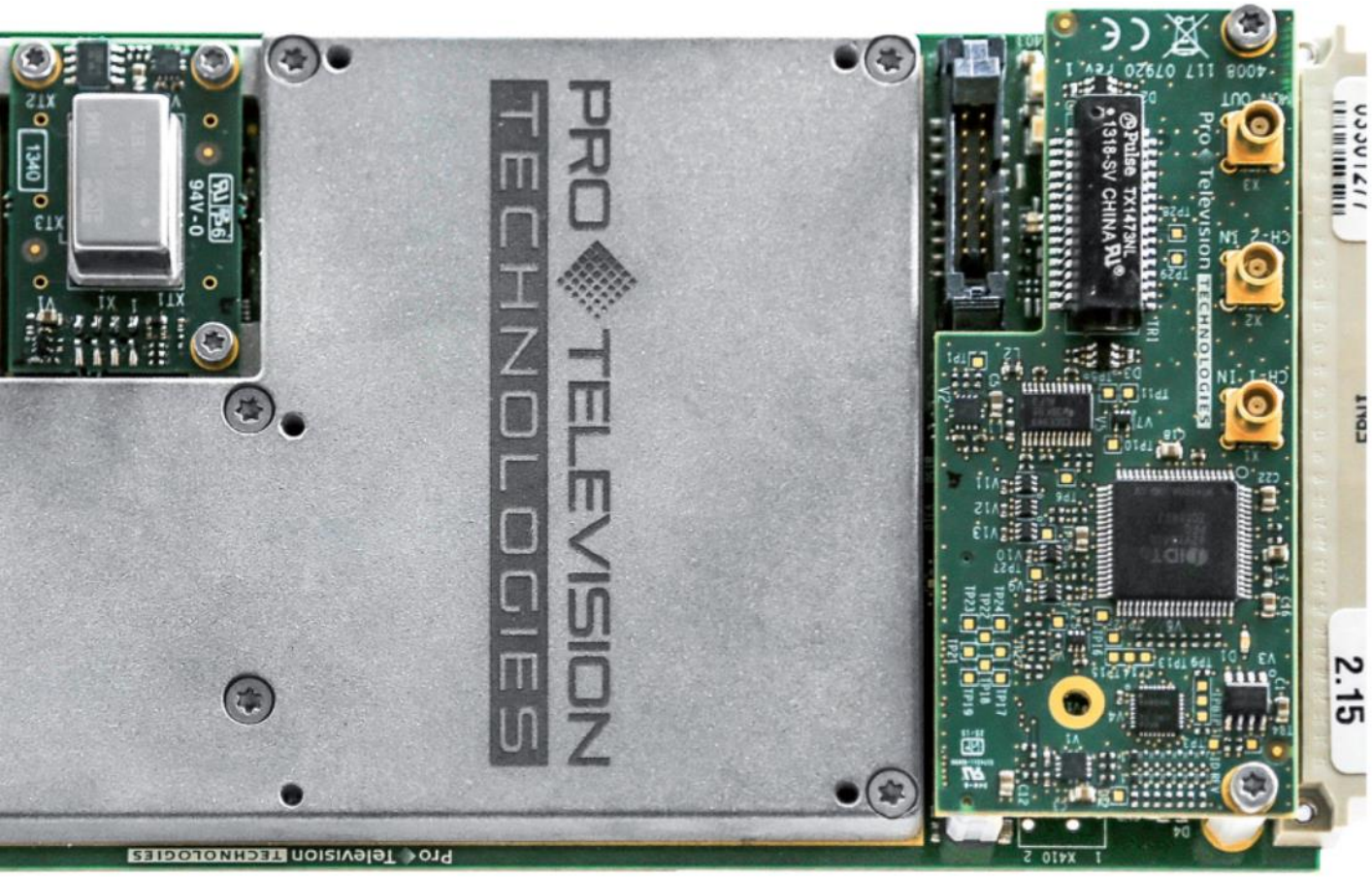
Essential “must haves”



- The exciter determines
  - Overall performance
  - Efficiency of the RF amplifier/system
  - Control and monitoring
  - Future capabilities

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Essential “must haves”

- Optimized pre-correction technology
- Crest Factor Reduction (CFR)
- Memory Effects Correction (MEC)
- Optimized waveform processing to increase amplifier efficiency
- Advanced algorithms for best MER/SNR, shoulders (IMD)

OPTI POWER®

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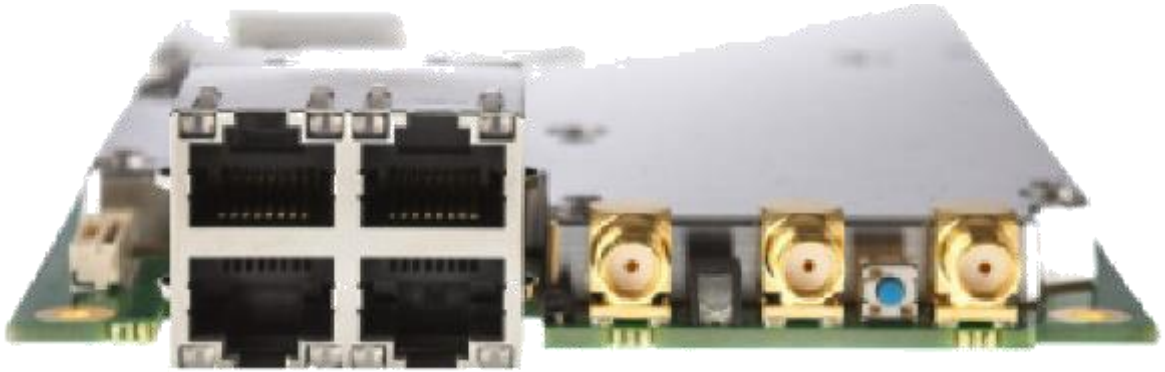
Essential “must haves”

Am I really ready for ATSC3.0 ?



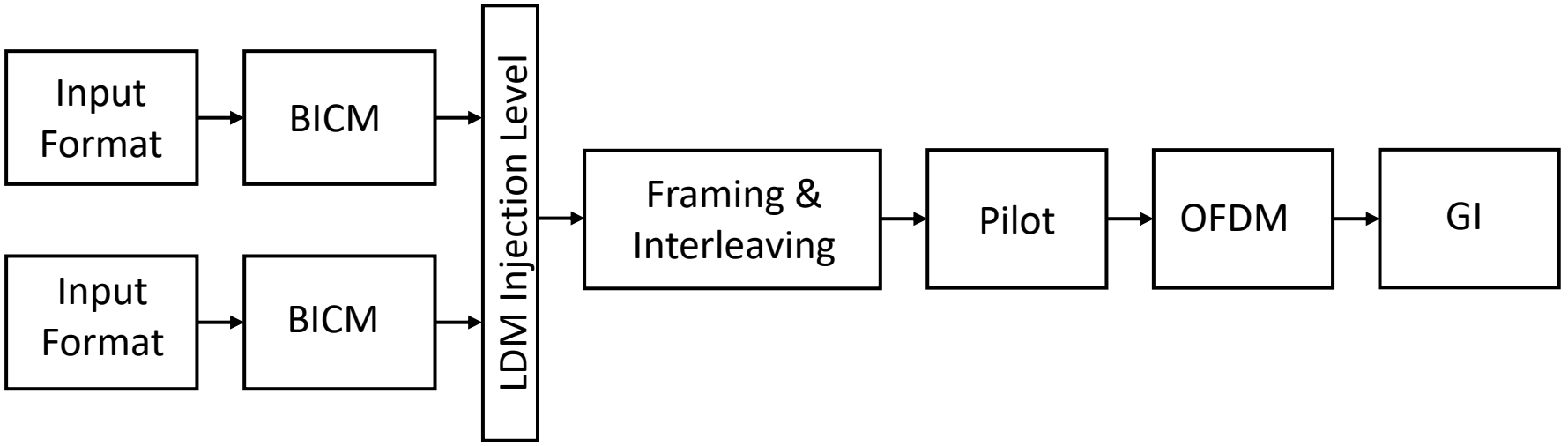
Do I need an IP input to my exciter?

- 4 x IP physical ports
- Each input with individual MAC address
- Gigabit capacity

Essential “must haves”

What is Layered Division Multiplex, and do I need it?

- LDM supports transmitting two signals over a single RF channel
- LDM is one of the major components ATSC3.0.
- LDM provides a tool to make flexible use of the spectrum for delivering simultaneous services to stationary and mobile services



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Essential “must haves”

- The **Scheduler** is the module that provides in-band control and signaling to the modulator/exciter
- Exciter is fed by an STL-ALP (Studio-Transmitter Link ATSC Link-layer Protocol
- When using the Multiple PLP (Physical Layer Pipes) feature to provide service-specific robustness, the Scheduler enables the modulator to generate the correct PLP data
- A scheduler can be purchased as a separate assembly, these can be expensive
- Having one included inside the exciter, is the perfect start for any station wishing to experiment with ATSC 3.0

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Essential “must haves”

- **Memory Error Correction** (MEC) algorithms improve SNR/MER by up to 3dB.
- Originally developed for the cell phone industry to improve coverage through improved SNR
- MEC can correct for memory effects and for simple AM to AM (non-linear) and AM to PM (linear) distortions. Wideband solid-state RF amplifiers have memory effects that change the shape of the nonlinearities with digital modulation data states and in particular with OFDM where larger PAPR these are exaggerated over standard ATSC
- MEC compensates for dynamic errors in the amplifiers due to a transistor thermal memory

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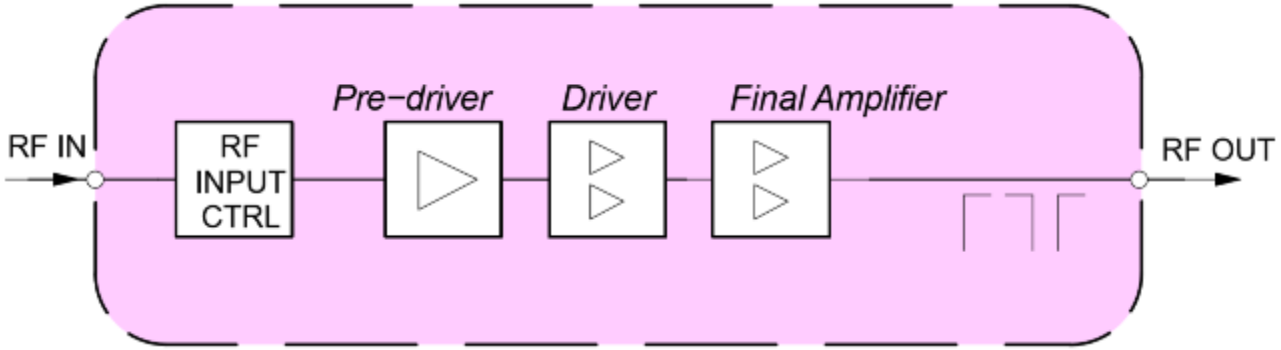
Essential “must haves”

Do I need crest factor reduction or PAPR protection?

- ATSC 3.0 typically has greater PAPR than ATSC by 2-3dB, meaning the peaks can be almost twice as high
- **Crest Factor Reduction** reduces the peaks of the amplified waveform at the same time allows for less “crushing” of the signal and the generation of odd order harmonics and IMD
- CFR reduces IMD at the cost (compromise) of MER/SNR
- CFR can only be applied if MER/SNR is high enough to be reduced; >36dB
- Another feature of CFR is that is “protects” sensitive amplifiers, antennas, transmission lines, etc from “spikes”

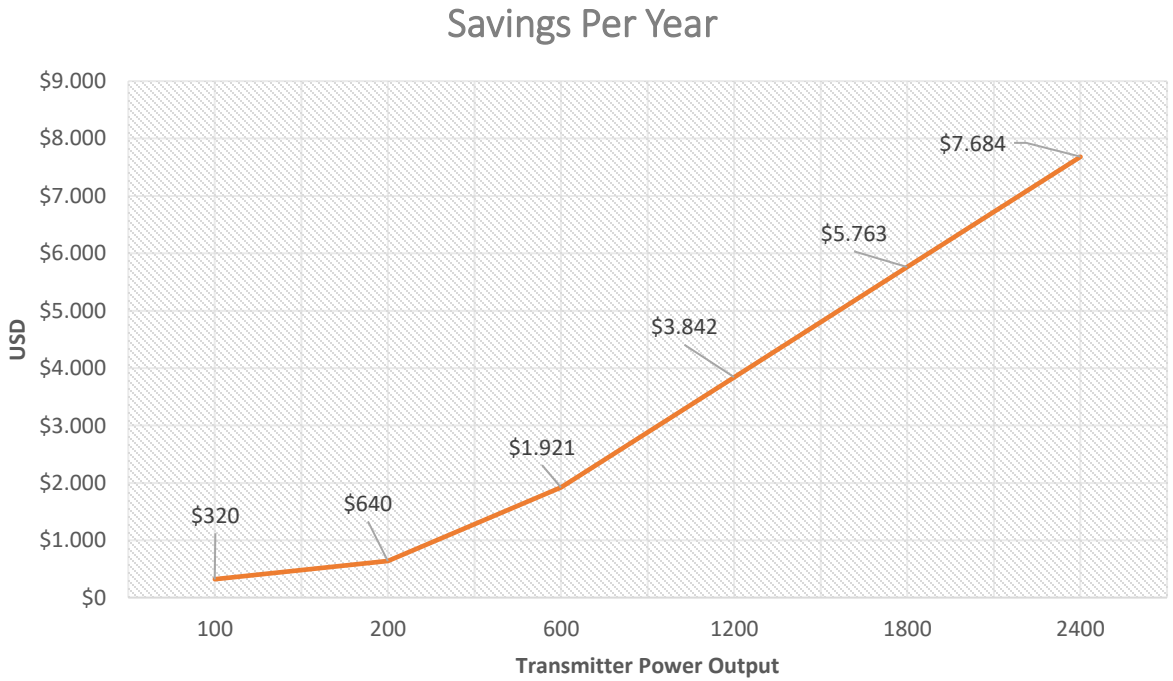
5. RF Amplifier



More “Essential Must haves”

Doherty Amplification

- Developed originally for AM radio
- Implemented by the semiconductor manufacturers (mainly for the cellular industry)
- Its objective to significantly improve efficiency in the Broadcast bands
- Works in both VHF and UHF



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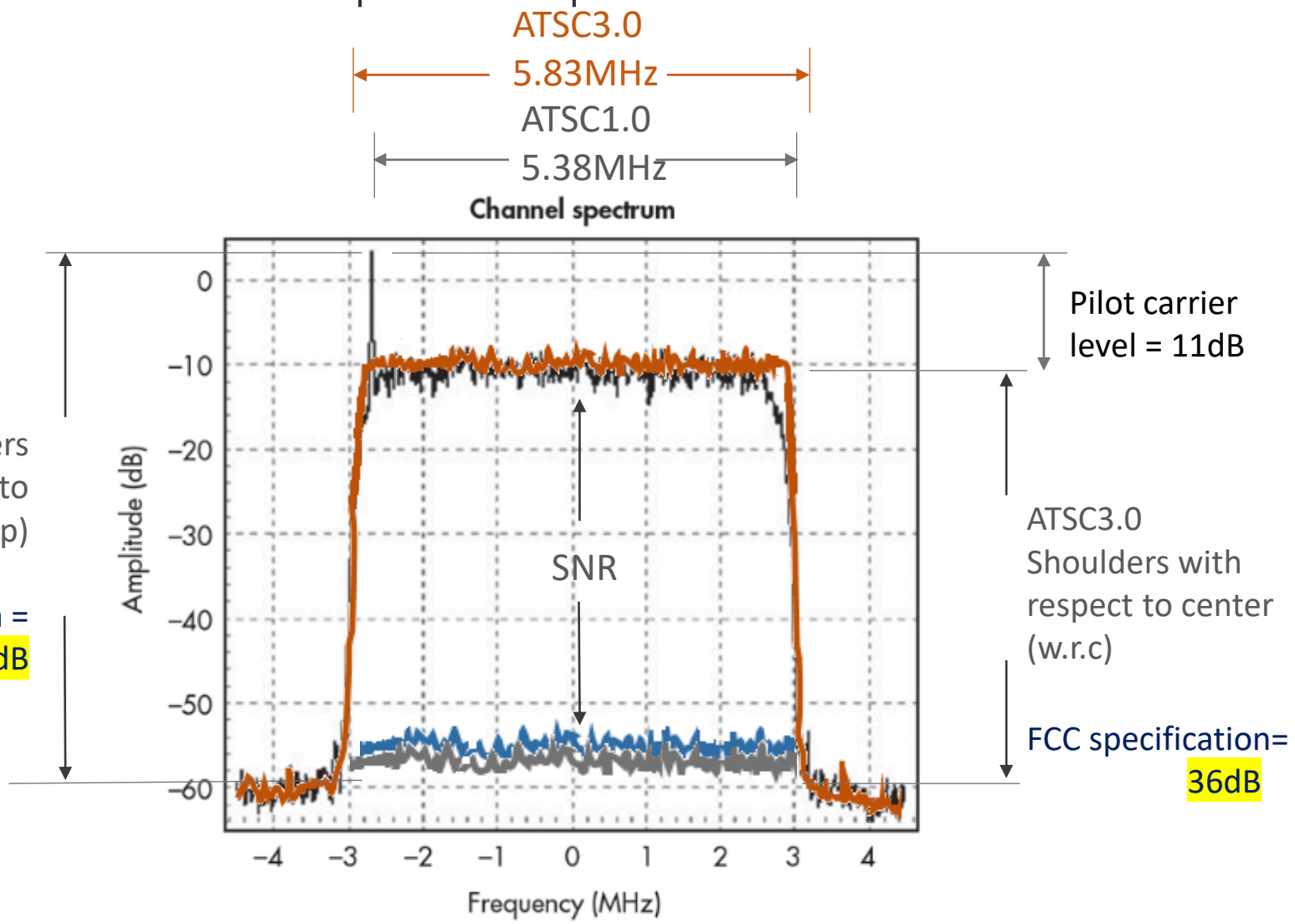
Are the RF specifications the same between ATSC and ATSC 3.0?

Shoulders will be referenced to center of carrier and not the peak of the pilot

What is the same?

- SNR/MER levels
- Out of band performance
- Power level



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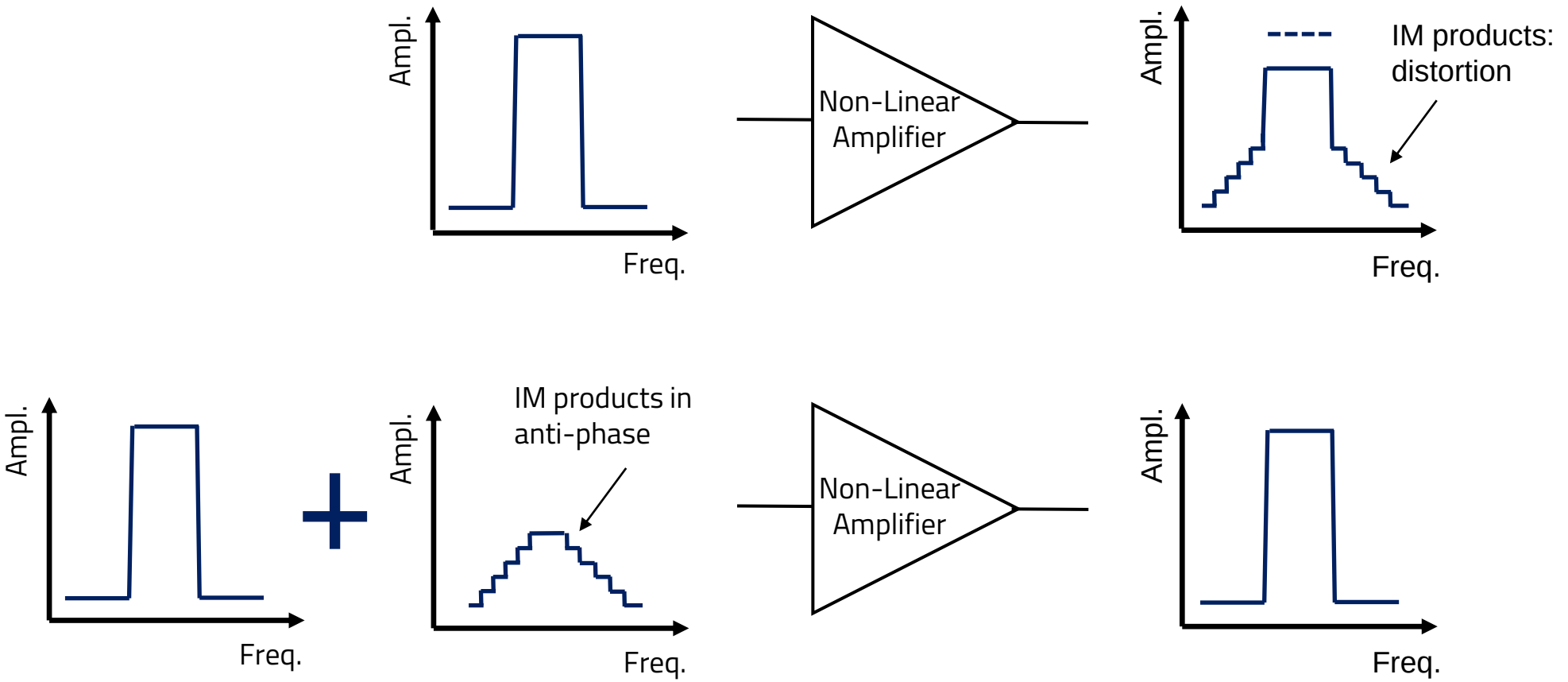
What is automatic and or adaptive linear and non-linear pre-correction?



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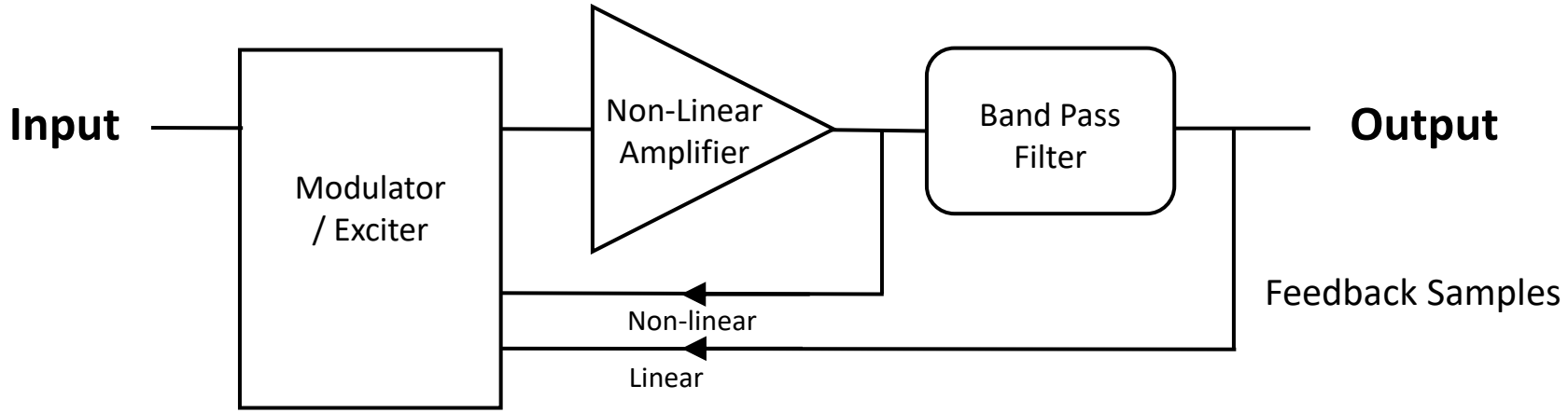

The Modulator / Exciter pre-distortion:

- Increases the peak-to-average power ratio of the signal input to the PA
  - Which is the “gain expansion” characteristic of the Exciter

- Increases the bandwidth of the signal that is input to the PA
  - Distortion components are added to the signal to cancel out the distortion of the PA

7. Translators and ATSC 3.0

How will a translator operate if all the local “main” stations are operating on ATSC 3.0 ?

- Currently all local stations receive either an NTSC or ATSC signal
- A translator needs to be able to receive the new ATSC 3.0 signal, decode then re-encode some or all programs, include all the appropriate PSIP data and then re-modulate and retransmit either in ATSC or ATSC 3.0
- If this is to be accomplished with an existing “standard” ATSC translator, an enormous investment would be required
  - ATSC 3.0 Receiver / Decoder
  - Encoder (MPEG 2 or HVEC)
  - For ATSC : PSIP generator
  - For ATSC 3.0 : Scheduler / Gateway

7. Translators and ATSC 3.0

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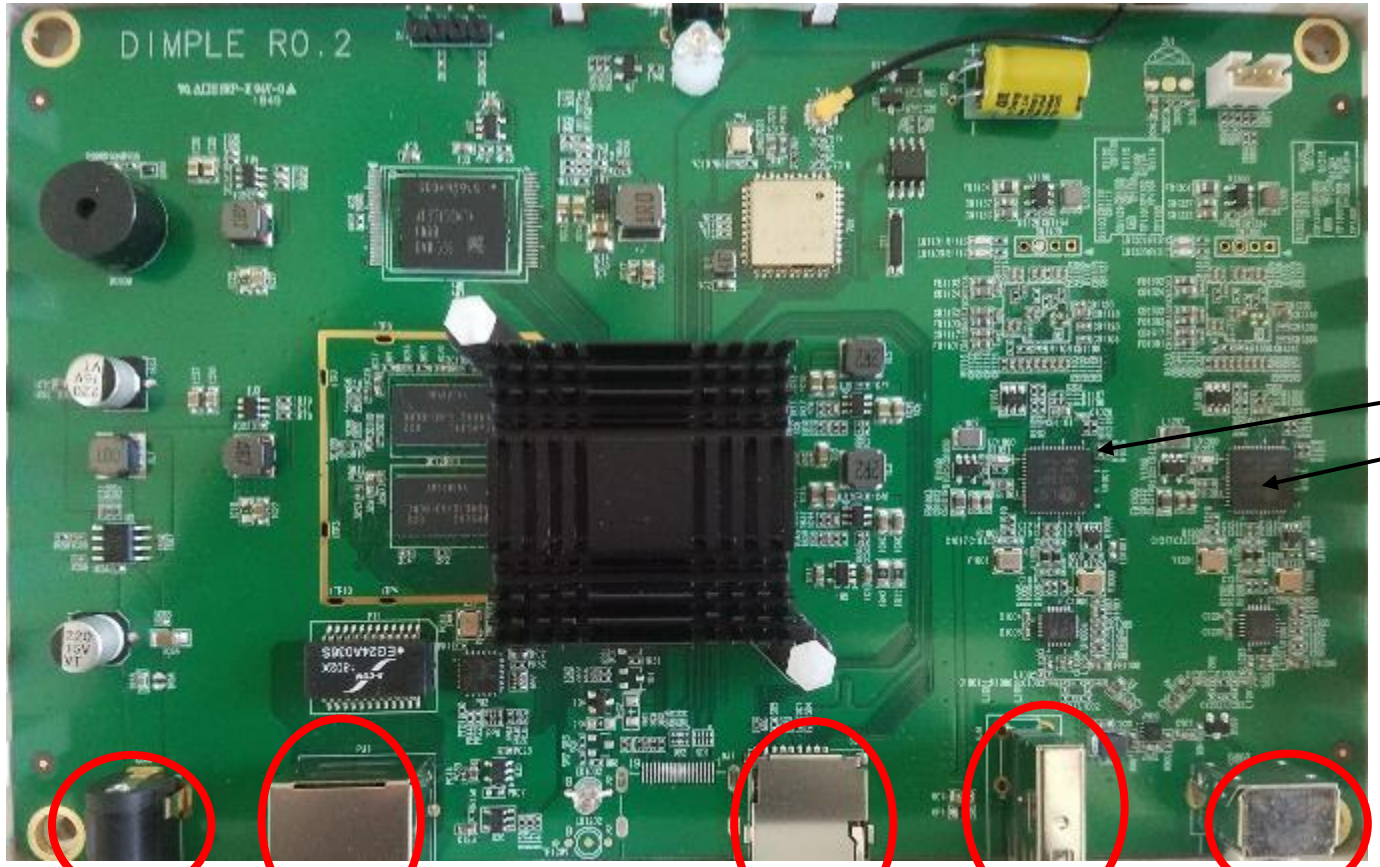
Translator receive module



Two RF reciever/ Demods

1. ATSC
2. ATSC 3.0

DC Input

Ethernet

SD Card

USB

RF Input

8. A closer look at the Exciter

8. A closer look at the Exciter

Standalone exciter

Connects to standard PC with standard Web page browser

GUI split into four main blocks

- System Schematic
- Three configuration panels
- Each BLOCK can be dragged and dropped into any configuration panel

8. A closer look at the Exciter

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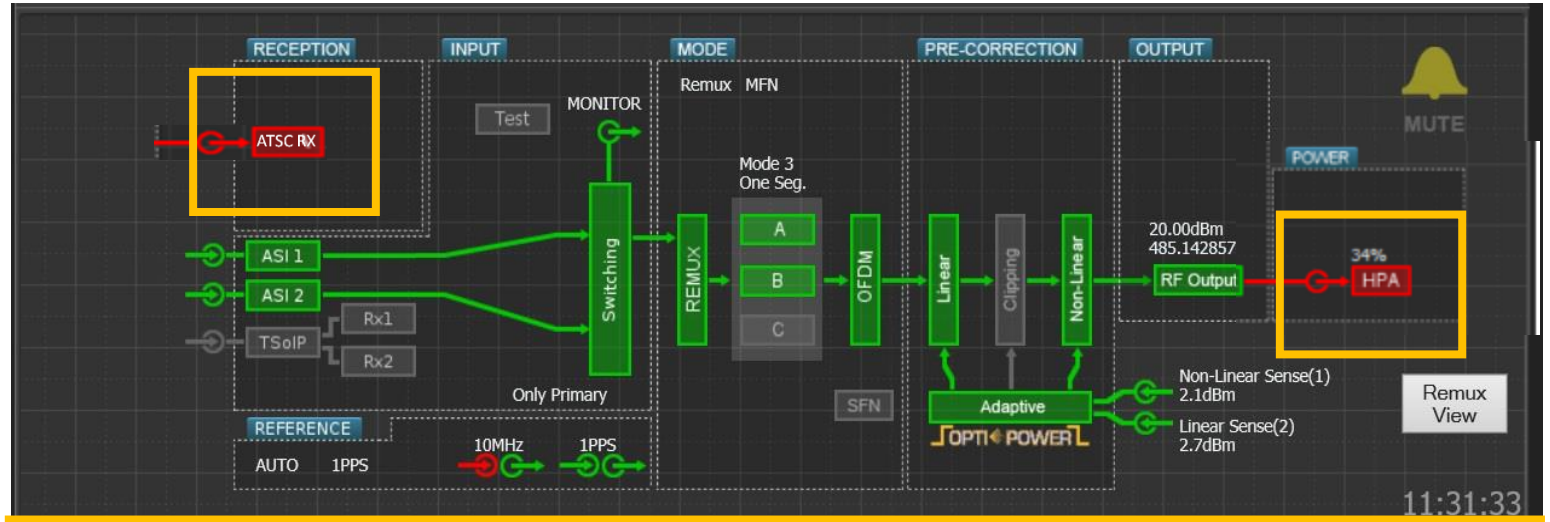
Transmitter / Translator

Drag and drop the HPA module we get the following information

- Operation Mode
- Transmitter ON/OFF
- Forward Power dBm / %
- Reflected power
- Total amplifier current
- Amplifier Heat sink Temp.
- External Interlock
- Power output OK
- Reflected power level OK



8. A closer look at the Exciter

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Now lets see it in action

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Essential must haves for a LPTV Transmitter / Translator

- Look for some redundancy – especially of moving parts
- Easy to maintain
- Key features; Doherty modulation, LDM, CFR, MEC, four IP inputs
- Insist on ATSC 3.0 modulator with Scheduler capabilities
- Look for an internal ATSC / ATSC 3.0 receiver
- Automatic linear and non-linear compensation
- Comprehensive remote control i.e. A GUI where you can control the exciter, receiver and the transmitter all from one place

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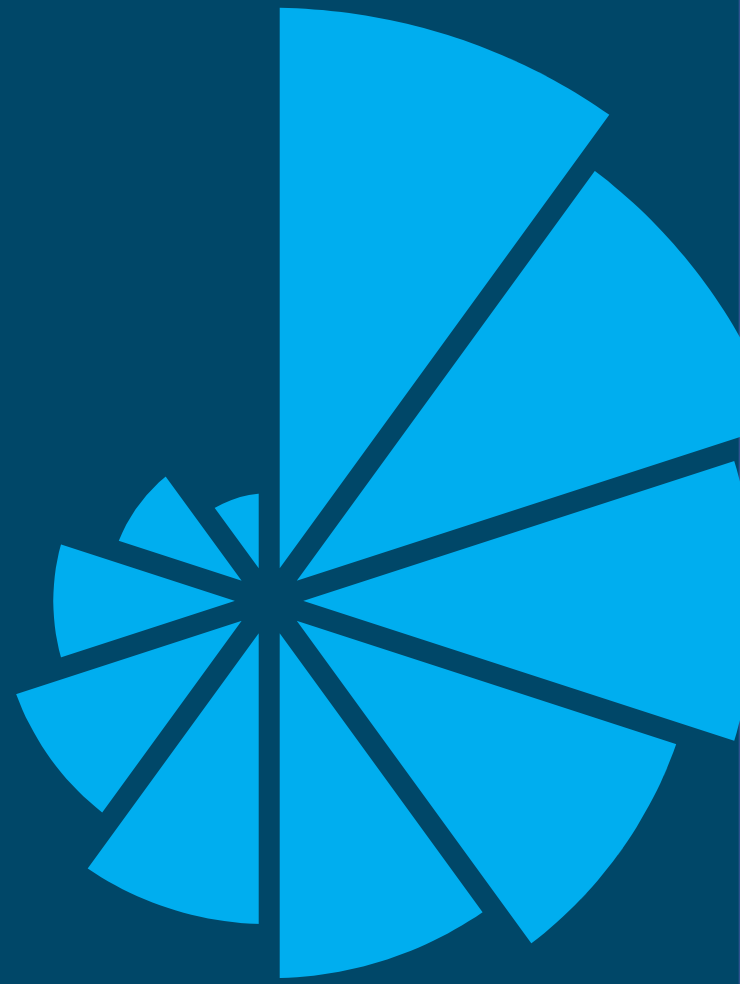
Questions?



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Thank You

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