elenos group
DEDICATED RELIABLE CREATIVE

Elenos Group
World Broadcast

Developments in state-of-the-art FM transmission

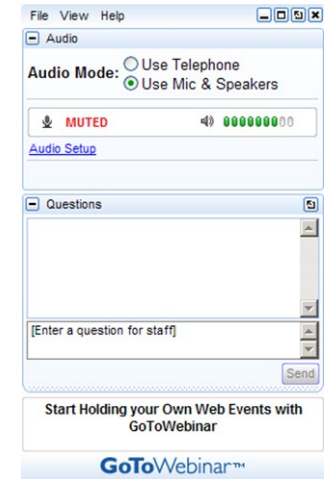
Innovation lives here

Webinar Schedule

- RF amplifier design innovations
- Efficiency innovations
- Power supply innovation
- Direct-to-channel FM digital exciter innovation
- Robustness innovation
- Remote control innovation
- The future is digital!
- Your questions

Your host:
Chuck Kelly
VP Market Development

Type any questions you may have at any time in the GoToWebinar interface.

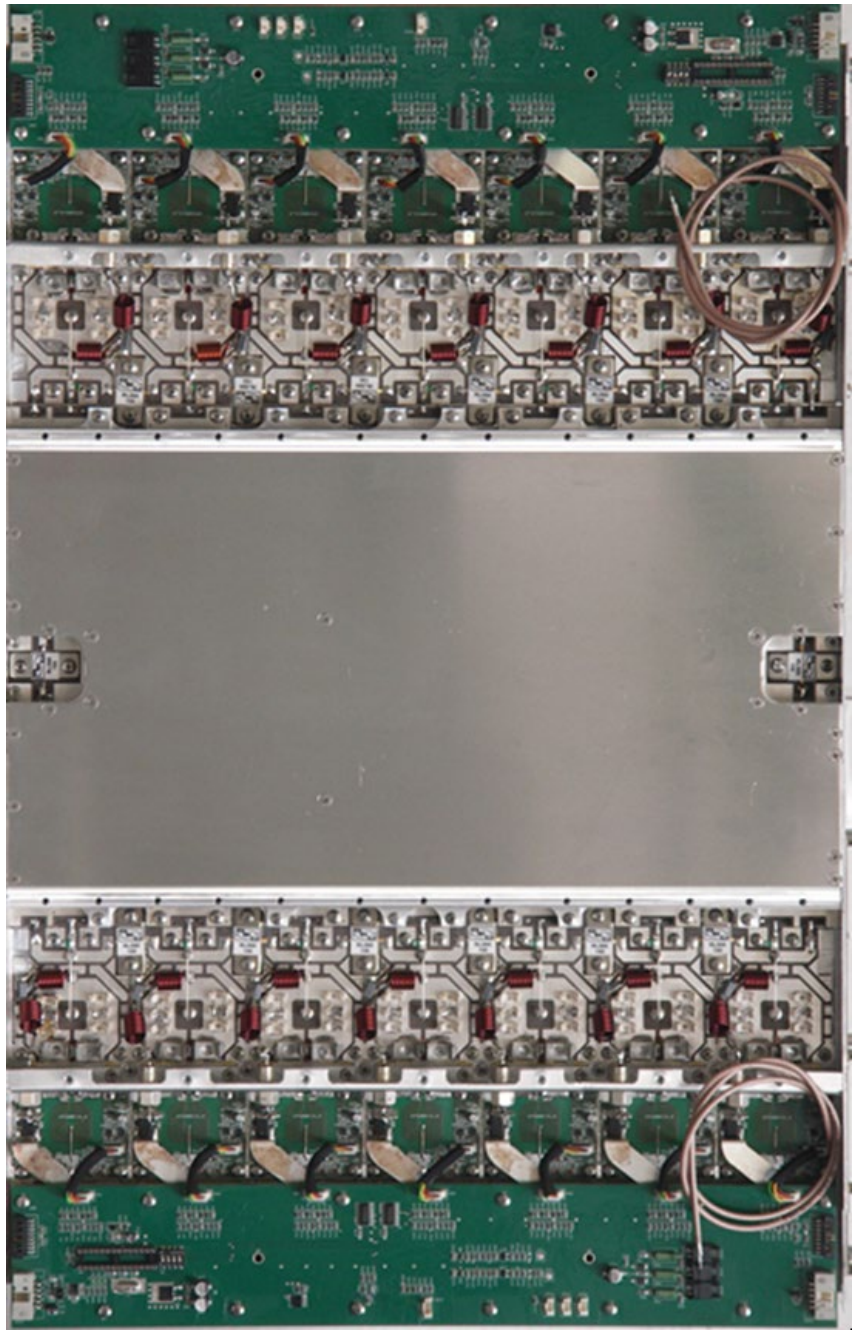


Remember, watching this webinar qualifies for ½ credit towards SBE certification under Category 1.

Indium Series: RF Innovation

Using stripline and microstrip design techniques results in:

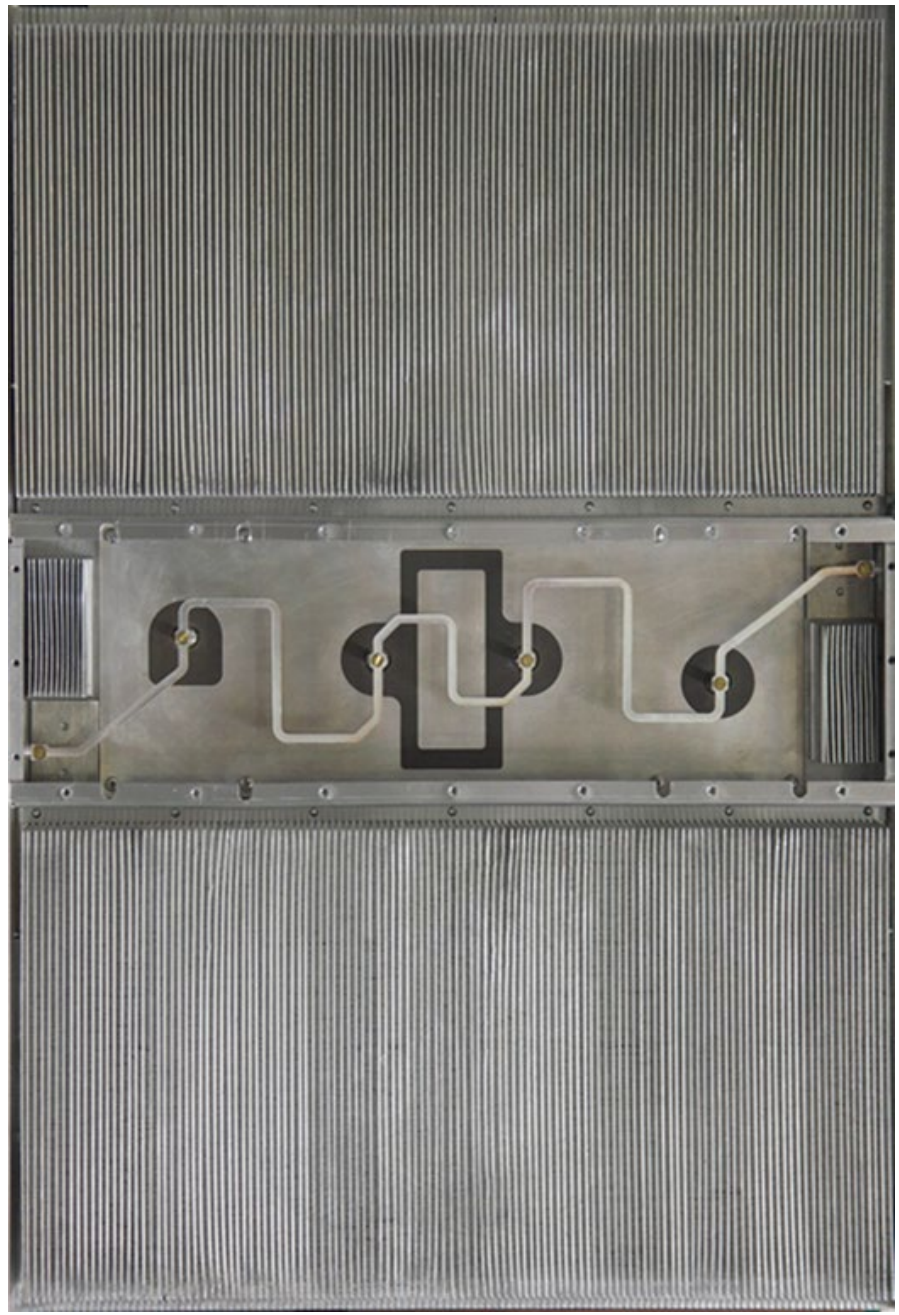
- Clean design for easy troubleshooting and service
- Repeatability and precision in manufacturing
- Stable performance and reduced in-cabinet RFI
- Maximum efficiency



Indium Series: RF Innovation

Precision thermal modelling in the design of the cooling system provides:

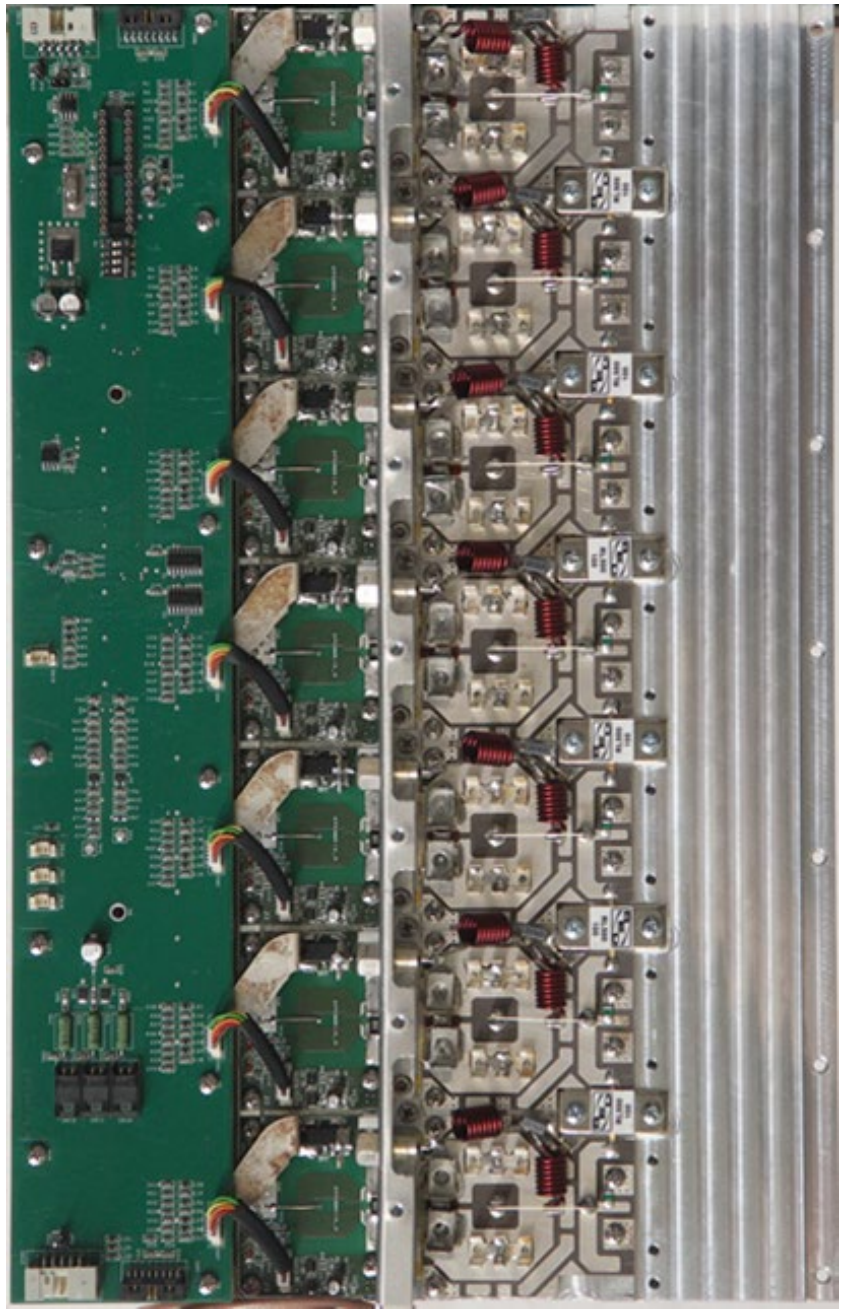
- Ideal component cooling with minimum heat sink size and weight
- Optimized fan speeds under all conditions for quiet, clean operation
- The ability to stay on the air under real-world conditions
- Longer PA device life due to reduced metal migration



Indium Series: RF Innovation

Class F PA design improves efficiency and reliability:

- The latest LDMOS devices for maximum efficiency
- Reduces the footprint of the amplifier
- Reduces the heat to be dissipated, keeping the devices cool, resulting in long life



Indium Series: RF Innovation

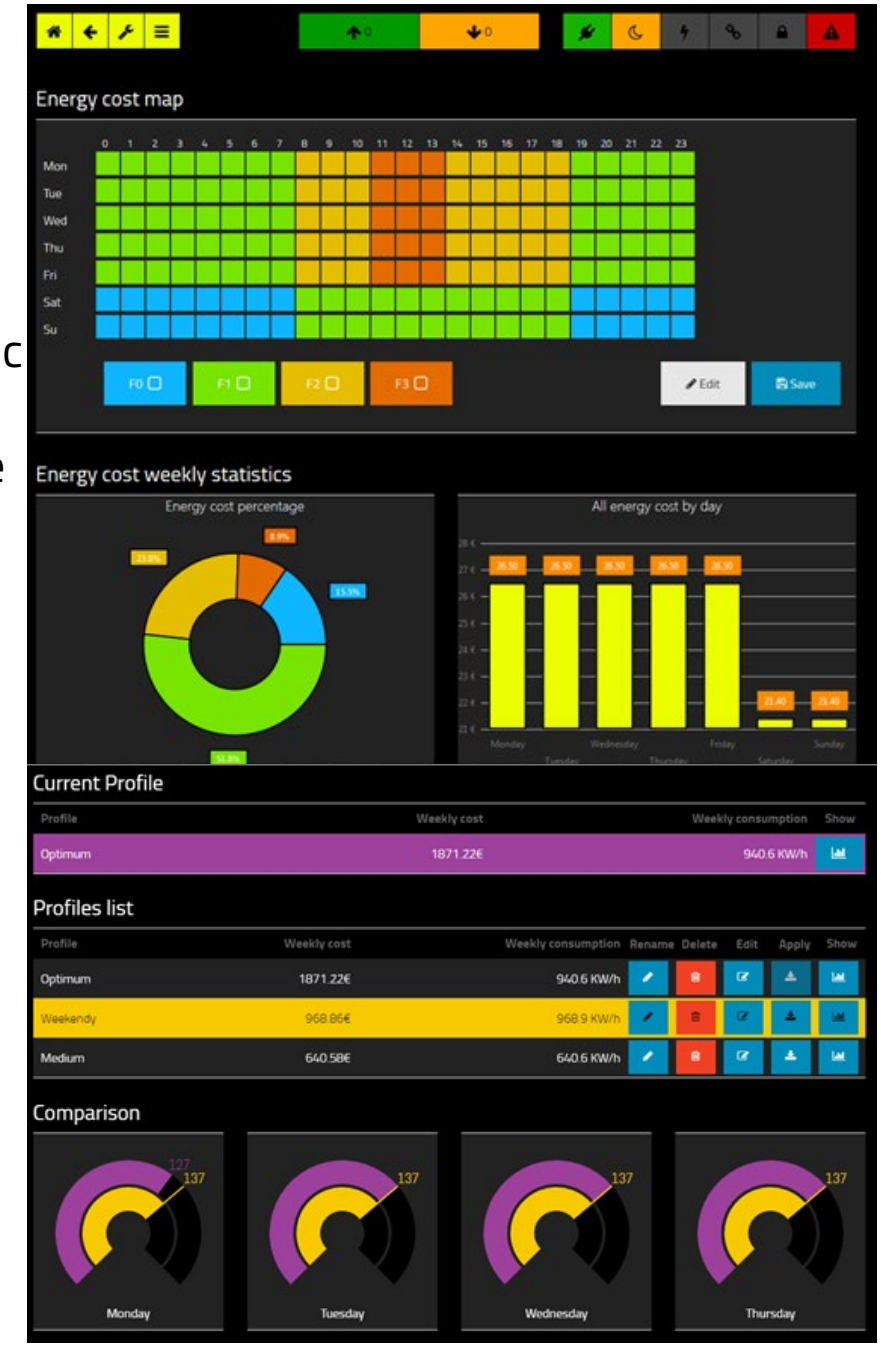
Precision design and carefully milled combiners offer:

- Repeatable performance
- Protection against physical or electronic shocks
- Reduced losses for improved efficiency

Reduction of Energy Costs

The Indium family includes a unique power level scheduler:

- Allows the automatic reduction of power at specific hours and days
- Based on listenership coverage needs and variable power company daypart costs
- Calculates savings automatically allowing intelligent business decisions to be made
- Amount of power reduction may be limited by government regulations



Power Supply Design

Most other manufacturers use an off-the-shelf power supply:

- These are often designed for computer clean room environments
- They are sealed and not user-repairable
- Schematic diagrams are not available
- The replacement of an inexpensive component requires the replacement of the entire unit.

Indium Series: Power Supply Innovation

Elenos designed our own power supplies:

- Designed for real-world transmitter room environments (less-than-perfect AC and harsh physical conditions)
- Optimized for the specific physical design of the transmitter
- Allows dynamic voltage control by the transmitter
- User serviceable!

Indium Series: Power Supply Innovation

The Indium remote control can monitor:

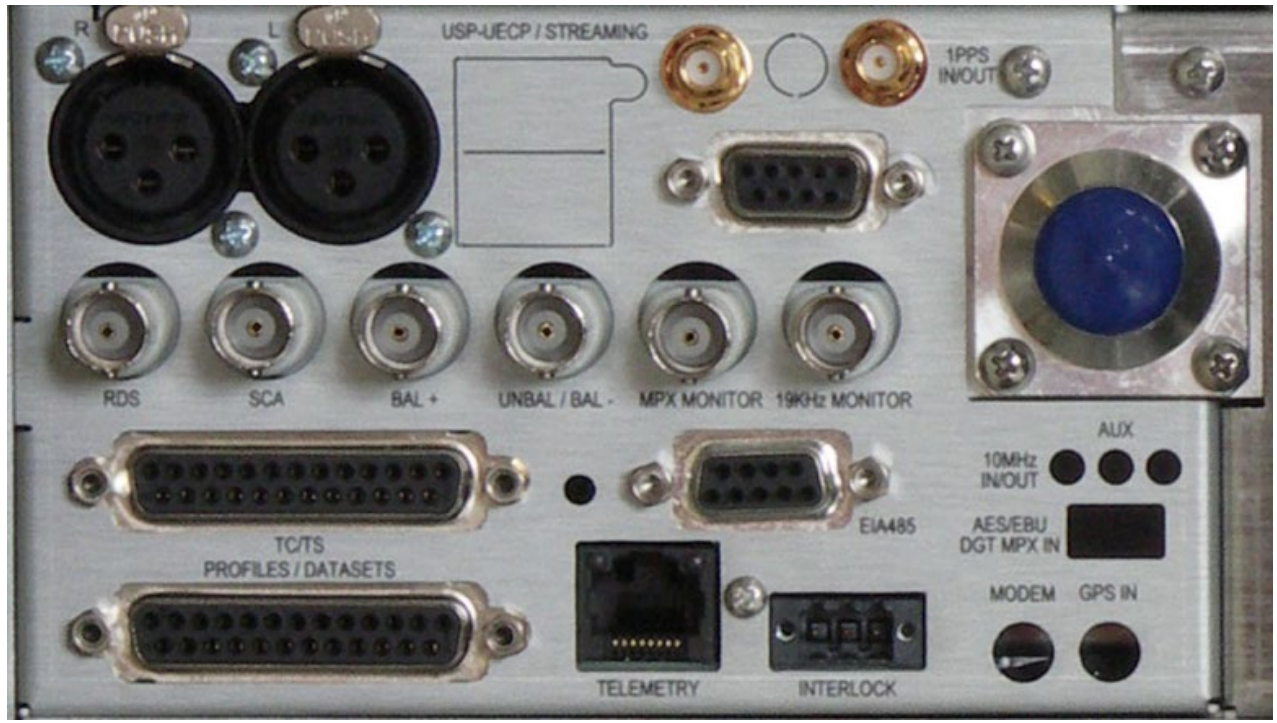
- Output current
- Output voltage
- Mains voltage
- Input overvoltage
- Temperatures
- Data communication errors
- Internal failures
- Each supply addressable

* Depending on model

Direct-to-channel digital exciter

A fully digital exciter that offers:

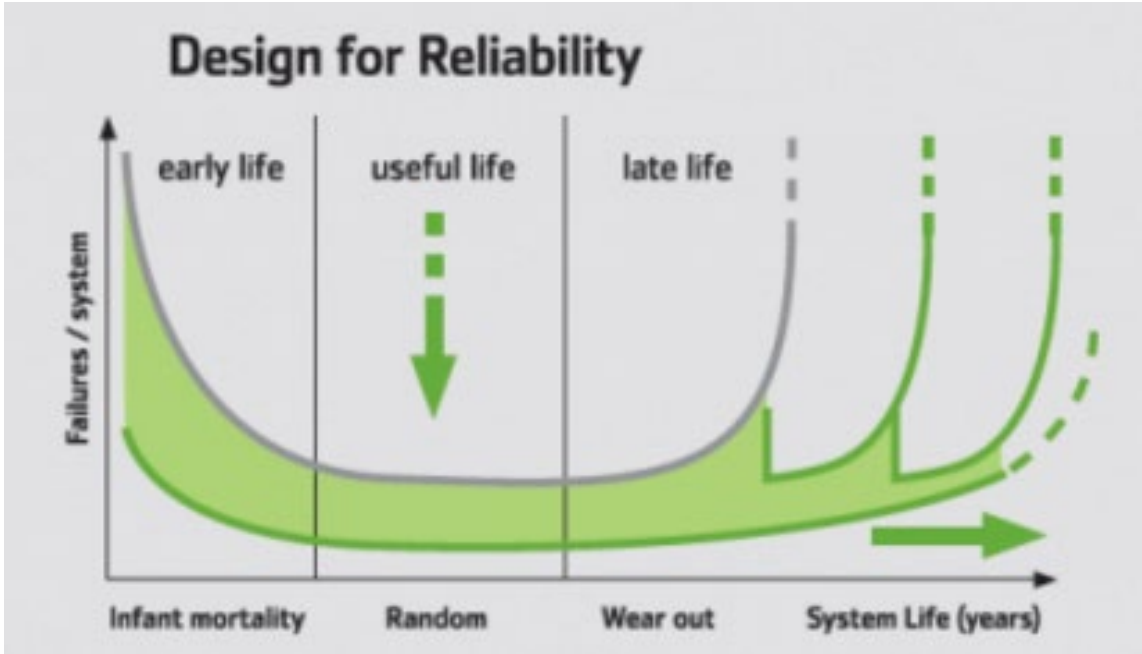
- Truly transparent, industry leading audio performance
- A wide variety of auto switching inputs, balanced analog L+R, AES/EBU, analog MPX, and MPX over AES
- SFN capability with 10MHz and 1pps inputs
- Shoutcast / Icecast streaming inputs



Indium Series: Designed for long life and robustness

All the fancy features and outstanding performance are worthless if the transmitter is unreliable, so how does Elenos assure the reliability and long life of its products?

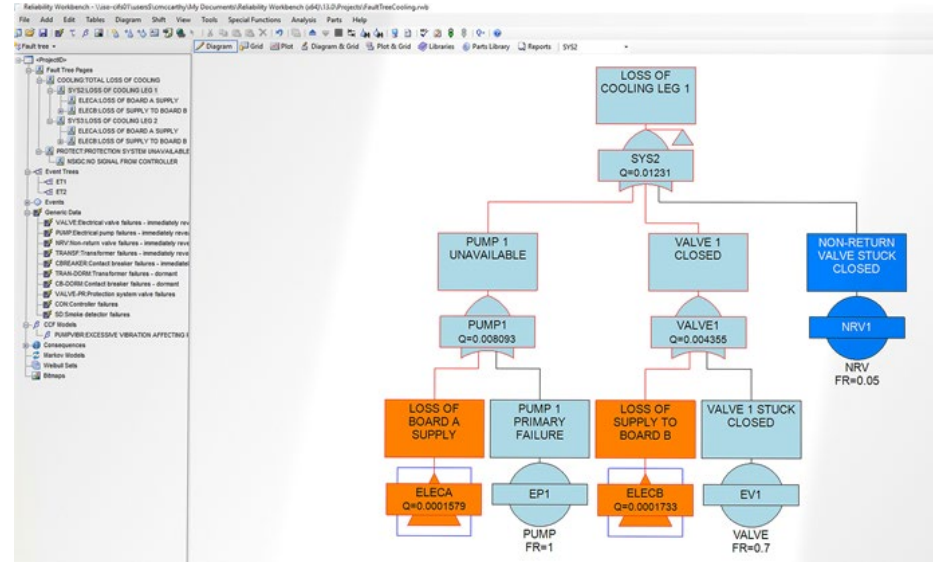
- Design headroom – assuring that every component is well within the maximum limits both by extensive design modelling and testing
- Adherence to tough industry standards for MTBF calculation
- Thermal camera measurement
- External MTBF evaluation consultant used
- MTBF design target: 30 to 60 years



Indium Series: Designed for long life and robustness

Ultra-high reliability must be designed-in from the beginning, and requires extensive design tools and analysis. Verified by external MTBF consultant. The "Isograph Reliability Workbench" is used which provides:

- Fault tree analysis
- FMECA/FMEDA/FMEA analysis
- RBD analysis
- Failure rate prediction
- Markov analysis
- Weibull analysis



Failure Rates.rwb-repx (read only)

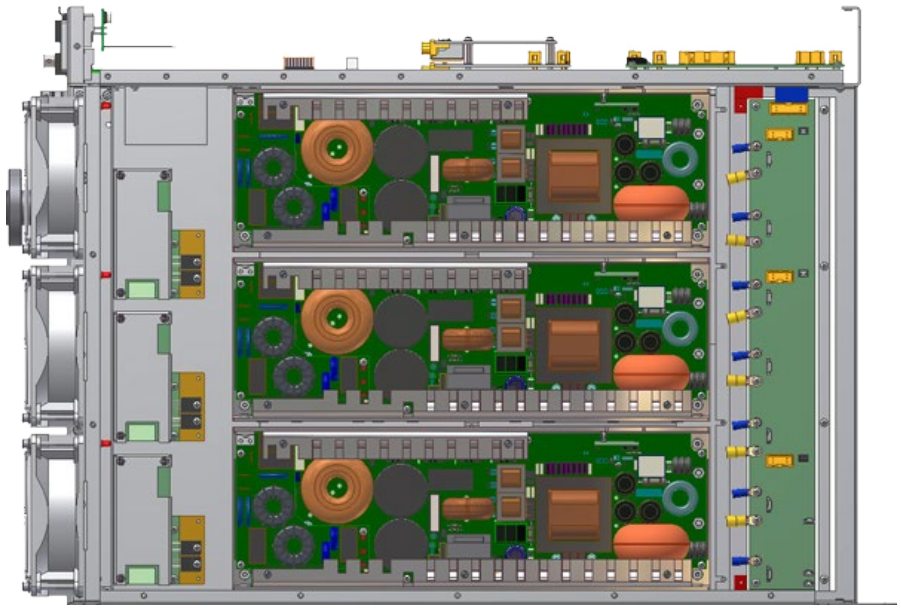
RWB V13.0

Failure Rates

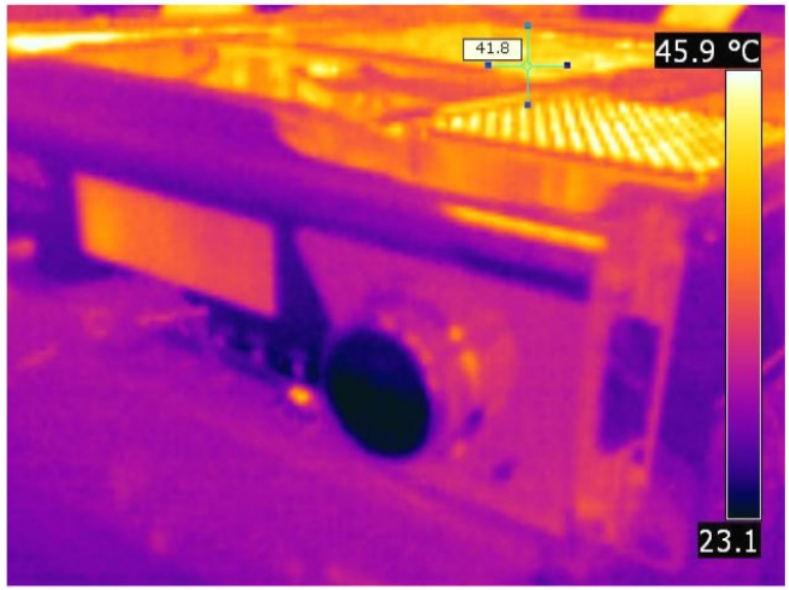
<ProjectID>

Part number	Reference ID	Category	Failure rate	N	N x failure rate	Contribution (%)
0805 COG	C3-C5	MIL-CR	0.006496	3	0.01949	1.967
0805 COG	C1, C20-32	MIL-CR	0.006496	14	0.09095	1.367
1		MIL-BK	0.9935	1	0.9935	6.846
11		MIL-BK	5.441	1	5.441	37.49
12		MIL-BK	8.077	1	8.077	55.66
121		MIL-BK	6.692	1	6.692	82.85
122		MIL-BK	1.385	1	1.385	17.15
19982B	C2	MIL-CR	0.01335	1	0.01335	0.2006
2164	RAM1-16	MIL-MM	0.03576	16	0.5722	8.601
2164	DISPLAY RAMS 1-24	MIL-MM	0.03258	24	0.782	57.6
28086F	C3	MIL-CR	0.01589	1	0.01589	0.2389
2N4403	T1-4	MIL-LB	0.004355	4	0.01742	1.283
2N4403	T1-7	MIL-LB	0.004355	7	0.03049	0.4583
4017A	IC1-5	MIL-DI	0.04266	5	0.2133	3.926
4017A	IC1-4	MIL-DI	0.04266	4	0.1706	2.565
4610X101-40338G	RN1	MIL-RS	0.005945	1	0.005945	0.4379

Indium Series: Designed for long life and robustness



Careful evaluation of thermal cycling stress which has been shown to be responsible for many long-term failures



Thermal imaging cameras are used to isolate and correct hotspots before the first units are sold

The Elenos LifeExtender: A safety net

The real world is a harsh place.

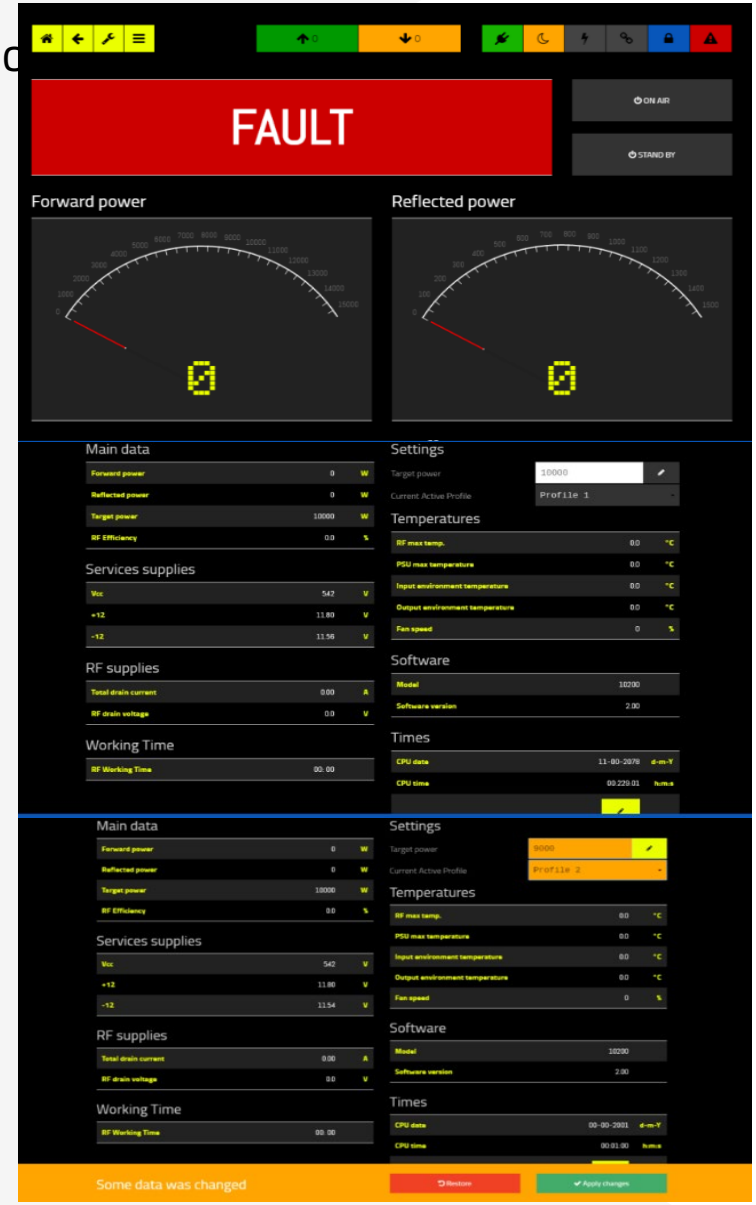
- Extreme AC voltage fluctuations and surges
- Both high and low temperatures
- High dust and dirt environments

LifeExtender monitors and controls every aspect of transmitter operation from temperatures, voltages and currents, to fan speeds and reflected power and takes action to protect the transmitter and keep you on the air

Remote Control: More than just a pretty screen

Let's face it, nobody lives at the transmitter site anymore, so effective and accessible remote control is essential:

- Works through the Web (no flash)
- Supports advanced SNMP
- You can even communicate via SMS (optional 3G/4G modem)
- Displays hundreds of parameters
- Logs an unlimited number of events
- Sends alerts

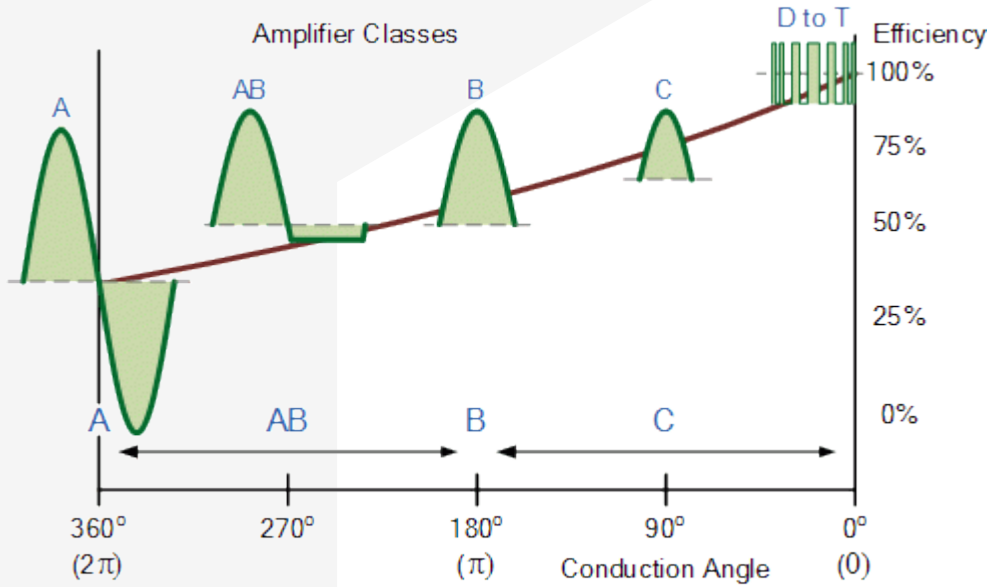


The future is digital

- We live in a digital world, and radio is as well
- Broadcast Electronics makes a full line of digital ready transmitters
- Elenos is developing digital ready high efficiency FM transmitters
- The ProTelevision RF Supercomputer is the most advanced digital exciter in the world

Class F – high efficiency

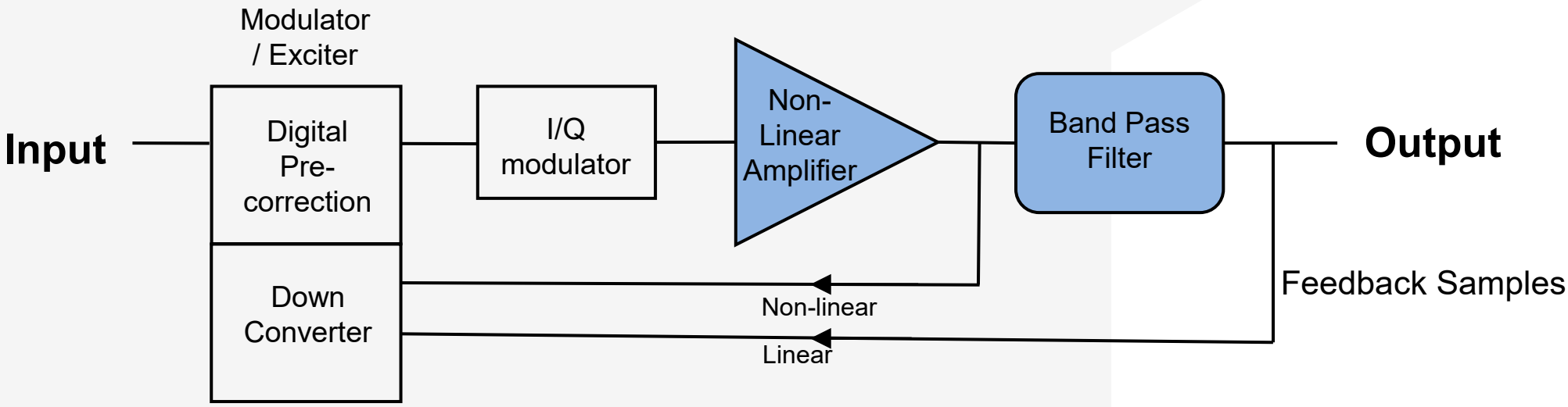
- Reduced conduction angle provides increased DC to RF efficiency.
- Class-F amplifiers boost both efficiency and output by using harmonic resonators in the output network to shape the output waveform into a square wave.



- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)

Class-F graphic credit Electronic-Tutorials.ws

What makes our solution unique: Advanced Adaptive Pre-correction



- Most manufacturers implement only non-linear pre-correction, but we include both linear and non-linear feedback to correct for more types of distortion in the PA and output networks and combiners.
- In addition, the new BE solution provides correction for memory effect, a sophisticated form of distortion. Our correction can significantly improve both efficiency and MER while staying within the spectral mask.

What makes our solution unique: ATSC-3 A/324 STL protocol

- The Advanced Television Systems Committee has developed a standard IP interface protocol for the STL function for ATSC 3 installations. It has a number of important features which are valuable to HD Radio installations:
  - Configurable to carry multiple audio and data streams.
  - Includes provisions for precise timing both for SFN applications and to minimize dynamic changes in the analog / digital timing.
  - End to end IP security provisions to minimize the chance of having the STL hacked.
  - Allows for redundancy of the content.
- As ProTelevision is already implementing this standard in our ATSC-3 modulator, it is being implemented as well in the HD Radio exciter.

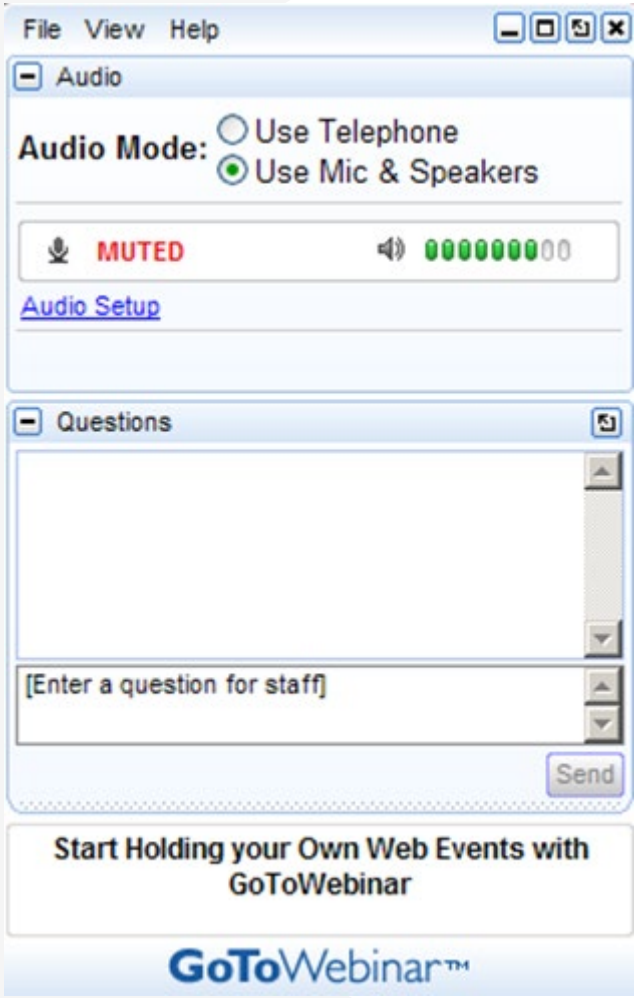
The RF Supercomputer

- A programmable hard real-time processor
- A programmable Linux real-time, multi-threaded processor
- A programmable DSP
- A large programmable FPGA
- One integrated board of programmable power
- 16-layer printed circuit board with 2200+ part
- RF out from 30MHz to 760MHz in 1Hz steps
- Four Ethernet ports with individual MAC addresses
- Build-in GNSS (optional: GPS, Glonass, Galileo & BeiDou)
- Single supply voltage (5 to 50 V)
- Totally software defined with remote firmware upgrade
- Onboard webserver control / monitoring (no FLASH Or Java)
- 3 different levels of Reference Oscillator (holdover duration)
- Supports: DVB-T/H/T2, ATSC legacy/3.0, ISDB-T/Tbb, Analog PAL/NTSC, DAB/TDMB/DAB+, HD Radio and DRM)

It’s time for your questions

Look for the Questions tab on the GoToWebinar interface

- Enter your question
- We’ll answer live or, if time doesn’t permit, we’ll answer you after the webinar via email
- Thanks for your questions and feedback - they help us keep these webinars relevant.



Thank You

We know how valuable your time is, and we are honored that you chose to spend time with us.

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For further information, contact:

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