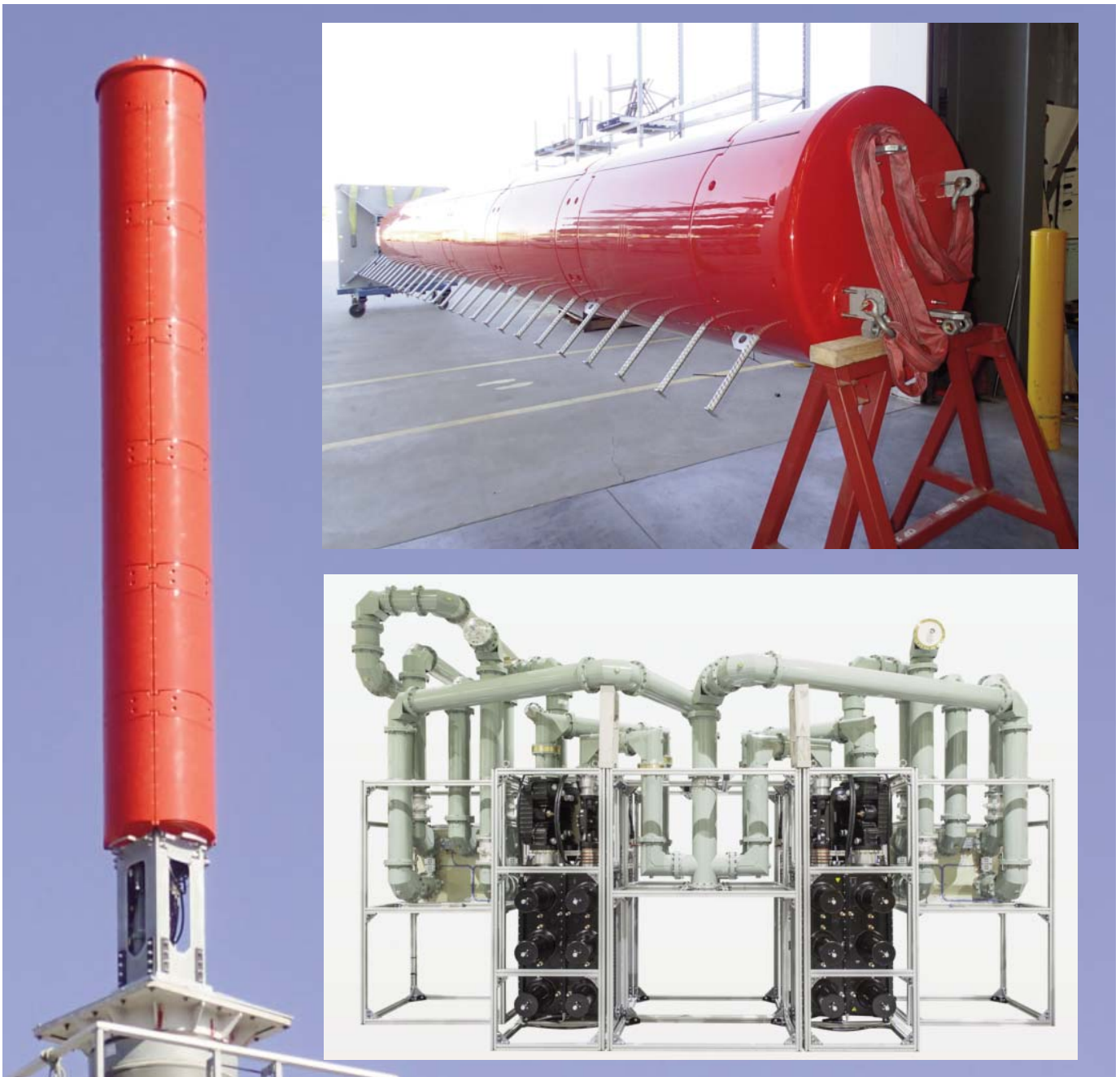




RFS Prepares for US DTV Repack – Are you ready?

Written by Timo Brouwer, Vice President, Broadcast and Defense, RFS

March 2016





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➔ Introduction

With the Federal Communications Commission's (FCC) broadcast television spectrum incentive auction process now defined, the challenges facing the North American Broadcasters to transition to new channels in the allotted timeframe are significant.

A substantial issue will be the capacity of the supply chain to meet the demand for new equipment to support the transition, especially in antennas. Slot radiator pylon antennas have been dominant in the North American market, either tower top or side mounted for years. A majority of the current installed base is of this type, with the balance being broadband panel-array type antennas.

RFS, a leading global manufacturer of passive RF systems, has recognized the need for a much higher demand for both types of antennas than US suppliers can meet and has invested heavily in preparation for the transition period, commencing in 2016. Using its global engineering and manufacturing capabilities (in Australia, US, UK, Germany, Shanghai and Brazil) RFS has increased engineering and production capabilities at the **Meriden CT manufacturing facility** to ensure it can meet the significant market demand.



2015 RFS broadband slot antenna installed on Sutro Tower San Francisco. Photos courtesy of S. Merrill Weiss and Sutro Tower.



During installation, the crew raises the antenna carefully past the tower outriggers and guys.



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RFS antennas are installed across the USA, many in iconic locations such as on the One World Trade Center New York, above, Sutro Tower, San Francisco, Sears Tower, John Hancock Building Chicago and more.



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➔ A tradition of innovation

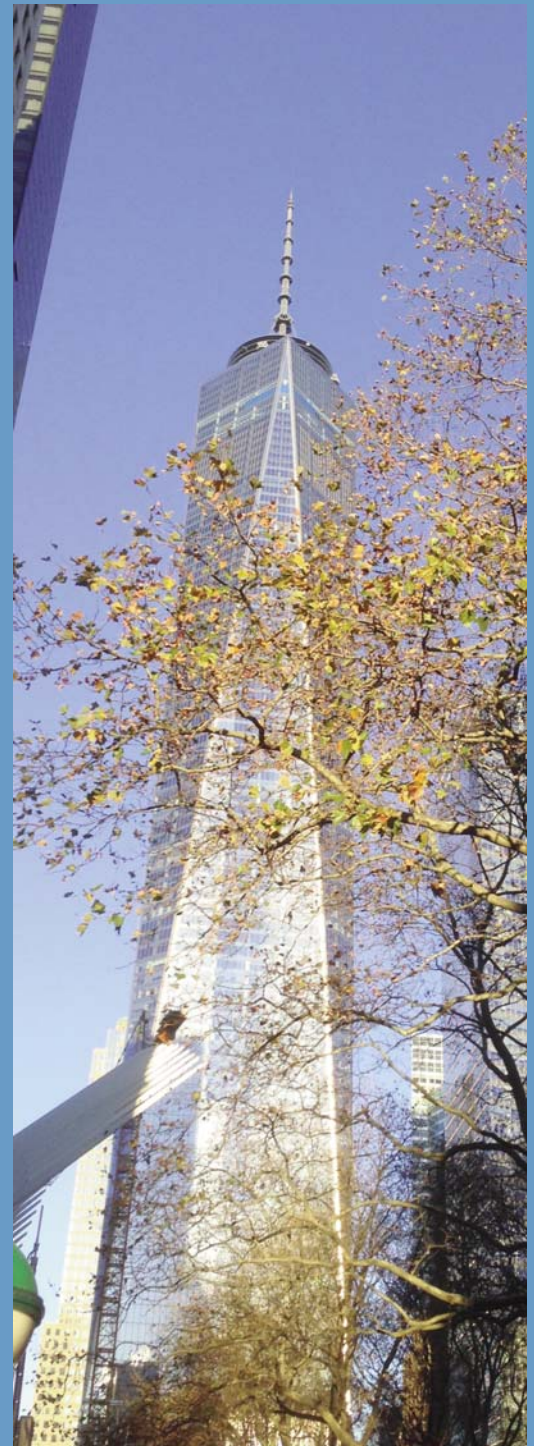
For more than a century, RFS has been at the forefront of the broadcast communication industry through its unwavering commitment to research design and development of the world's most advanced technology in the field. Dedicated R&D teams, and a privileged partnership with Bell Labs, are at the heart of the many breakthroughs ensuring the company enjoys a worldwide reputation for continuous innovation.

RFS' solutions are the result of ongoing investments in R&D and close working relationships with customers, which ensure that all products are designed to meet the demanding needs of network infrastructure today and the emerging communications requirements of tomorrow.

RFS innovations result in cost-effective, state-of-the-art solutions that are based on the company's unrivaled knowledge of wireless broadcast and its clear vision of customer needs.

RFS has a long list of firsts demonstrating this commitment to innovation:

- First variable polarized full broadband antenna array, as installed at One World Trade in New York City, covering the entire UHF spectrum;
- First tunable broadband filter at power levels above 50 kW, ensuring flexibility for future channel changes as deployed at Cedar Hills outside Dallas, Texas for NBC
- BCAT™ filter tuning software, allowing customers to easily and quickly retune their filters and combiners
- Wideband couplers in both coaxial and waveguide technology up to 320 kW.



First variable polarized full broadband antenna UHF array, as installed at the top of the spire at One World Trade in New York City. Also supplied is a VHF antenna array.



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➔ A guarantee of quality

From design to manufacture, ISO 9001 and ISO 14001 certification standards and LEAN manufacturing methods encompass all aspects of RFS' business worldwide. Every product RFS ships has stood up to the most stringent technical, environmental and quality control tests, continuously meeting and surpassing the expectations of a long list of broadcasters, government agencies, wireless carriers, and transportation and utility operators.

RFS pays attention to every detail in product design and manufacture to ensure this quality is "built-in" to everything it does:

- RFS uses the most state-of-the-arts design tools, including Ansys HFSS suite, CST MW-Studio, Aurorasat Spark3D, Keysight ADS, and AWR MW-Office during engineering phases of development.
- Products are **power and voltage tested** in-house using RFS' UHF High Power UHF DTV, VHF DTV and VHF FM transmitters.
- Internally developed custom test equipment, such as low-pressure chambers for peak power testing, and resonant ring for average power testing are part of the investment in development systems RFS has made.
- Prior to production, careful materials analysis is conducted, ensuring highest quality materials are tested and selected. Environmental considerations are routine in the product life cycle. Carbon foot-printing has accelerated elimination of wasteful processes from manufacturing - RFS adheres willingly to a number of international conventions including WEEE on waste and recycling, RoHS on reducing the use of hazardous substances, and the United Nations Global Compact to avoid the use of conflict minerals .
- **Accelerated Life Testing** during the prototyping stage, ensures RFS designs perform optimally across a wide range of environmental conditions. Acceptance Test Plans are an integrated element of RFS' delivery commitment, ensuring customers can witness and sign-off on the system prior to site delivery. As a result of this rigorous approach RFS can guarantee the performance of its specifications.



A crane has lifted the PEPL low wind load antenna onto the RFS tower in preparation for testing



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➔ The total portfolio

RFS is the only manufacturer that offers a truly flexible and end-end portfolio of passive RF solutions, including:

- Single-channel pylon slot antennas with a range of patterns and power levels;
- Broadband slot antennas (SBB);
- Full broadband UHF and VHF panel antennas for all power levels;
- Other discrete broadband antennas for temporary or standby operation;
- Fully tunable filters up to 100kW
- Fully tunable multi-channel combiners with adjacent channel combining capability up to 320kW;
- A range of switching solutions;
- Transmission line (air cable to 9-inch and rigid line), accessories and connectors; and
- Installation supervision of its product portfolio.

➔ World class engineering capability

RFS' broadcast engineering teams are located in Meriden CT, USA as well as Melbourne, Australia, UK and Hannover, Germany. RFS employs more than 40 engineers in broadcast. Many are recognized experts in the field with excellent tertiary and post-graduate qualifications and years of practical industry experience. RFS boasts one of the world's most capable RF engineering teams in the broadcast industry.

RFS' engineering capability is the core of its value proposition to customers and the reason for its **2009 Emmy** awarded for services to the broadcast industry. This award recognized the importance of adjacent channel combining which has enabled sharing of infrastructure by many broadcasters at the same site.

RFS consistently delivers new innovation ahead of the rest, such as a complete range of tunable filters and combiners, full broadband **variable polarization** panel antennas.



High power coupler



High power filter



High power combiner module



Emmy awarded to RFS for adjacent channel combining



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With global engineering capability RFS offers customers “follow the sun” engineering support, to ensure critical deadlines can be met. Engineering issues can be solved on demand.

The **Meriden, CT factory** has been expanded to include antenna manufacturing and assembly. RFS is ready to meet the needs of the US market. Manufacturing, assembly and testing capacity for pylon antennas, broadband arrays and filter/combiner RF systems have been implemented since late 2013.

➔ **Pride in People**

Nick Wymant, the Chief Technology Officer, Broadcast, at Radio Frequency Systems (RFS), leads the research and development team responsible for design and introduction of new products. His experience in the **US manufacturing** environment started in 2000 when he was Director of Engineering for the North American Broadcast Division. During that time, his design team was responsible for products manufactured into the US market including panel arrays and slot antennas.

Nick previously managed the digital switch over projects first hand in the UK and Australia and the Australian UHF frequency repack. He has been located in country each time and his experience with high profile, high pressure projects will be very valuable to customers now transitioning in the US. Nick is currently located in Meriden CT which demonstrates his and RFS’s commitment to the important US market. His engineering design team is part of the global engineering service of RFS.

Scott Martin joined RFS recently as new Director of Broadcast Sales in North America bringing extensive experience in broadcast RF and antenna, transmission line and filter/combiner sales. RFS is without equal in delivering innovation and application to broadcast solutions. RFS antenna, combiner and filter specialists, test engineers and technicians have state-of-art facilities and equipment, and the tools needed to model and manufacture a solution for any site.



RFS, Meriden CT



Nick Wymant



Scott Martin



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➔ A process that delivers excellence

RFS has rigorous design, production and test procedures and is keenly aware of every requirement for product quality and customer satisfaction. Electrical (RF impedance) testing of components and assemblies occurs at many points in the production cycle. UHF panels are tested indoors in an anechoic chamber while dipole antennas are measured on an outdoor test area. Product developments are tested using **in-house test transmitters**. Where necessary, components are power tested to prove power and voltage handling capability. Following top level assembly, panel antennas are pattern tested in azimuth using a test range with a turntable capable of rotating antennas weighing up to 11000 pounds (5 tonnes) and 46 feet (14 meters) in height. Smaller antennas and components are tested on a range with full azimuth over elevation positioner. Testing confirms that when operational, the antenna will deliver an excellent result for every customer. The production test lab uses NATA accredited network analyzers and Ecal calibration sets to verify that all equipment produced in an RFS broadcast facility meets the customer specified requirements. Products designed, manufactured and performance tested are tracked by unique serial number. Products are shipped with a set of as built drawings and measured test results in an installation manual.

At RFS, the communion of excellent facilities, excellent processes, and excellent people, produces excellent products. Excellence is expected.

Great equipment on site makes the world of difference when developing new products. RFS has UHF and FM test transmitters vital to proof of performance in product development. A recently acquired VHF test transmitter completes the transmitter testing suite.



RFS FM test transmitter and low pressure chamber



RFS UHF test transmitter



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➤ RFS technology leadership

With any technology change, RFS has been thirsty for involvement. FM radio, UHF and VHF television cemented RFS as an innovator and preferred supplier in the 1950's, and RFS has been actively pursuing leadership roles since.

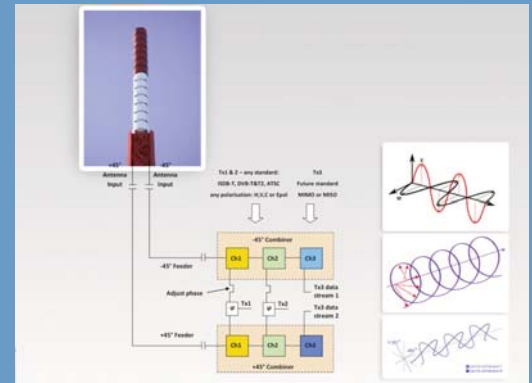
Broadcast products need to be built tough to survive a reasonable service life: often sites are in exceedingly harsh environments – cyclonic, frozen, marine, earthquake-prone. Initially, broadcast success occurred in Australia off the back of imported failures. Australian broadcasters called for a reliable, locally made product for the challenging Australian climate and RFS Australia was ready with a portfolio of strongly utilitarian, functional broadcast products.

Soon enough, broadcast panel arrays were being exported widely across Asia. In 1996, RFS Australia was bold and offered a US broadcaster delivery of a demonstration antenna to show the advantages of shared infrastructure.

The result was a twenty-four panel design on three sides and 8 levels of a square 500mm column, the first UHF antenna to broadcast a digital television (DTV) signal for the US. The Australian design was assembled in the existing RFS US Cablewave factory and trucked to Washington DC where it was installed as a working demonstration of a shared horizontally polarized UHF antenna. Positive feedback led to orders and the establishment of an assembly and test facility in Meriden Connecticut.

Twenty years on, RFS thought leaders have continued to lead. Most recently they inspired variable polarization (VPT) in a range of RFS products now appearing on towers and in transmitter rooms across the globe.

RFS is first with VPT. VPT is evident in the panels, power distribution networks, and right through to the antenna inputs.



RFS systems using variable polarization technology (VPT) secures the future for every broadcaster. It accommodates mobile receivers using MIMO or MISO technology and future DTV broadcast standards such as ATSC 3.0.



One module of the low wind load, multi-channel, master antenna destined for Cedar Hills TX is prepared for despatch following pattern tests.



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➔ Innovative Solutions

Enabling multiple polarization types in the same antenna ensures a highly flexible, and future-proof product which is unique in broadcast. VPT improves data rate, increases signal saturation and minimizes fading. It improves the noise margin for mobile receivers and allows **MIMO or MISO technology** which may be required for future DTV broadcast standards (such as ATSC 3.0). A wide variety of polarization ratios are possible using RFS products. Not only is the One World Trade Center master antenna expected to operate multiple digital channels at extremely high powers, each of the 4 or 5 broadcasters that join together to share the infrastructure will transmit a unique polarization ratio on every channel.

Best of all, any changes to the ratio occur in the building and not on the tower. They are managed by the station broadcaster and without impacting other broadcasters who share the facilities.

Similarly at Cedar Hills site in Texas, the tower owner will partner with NBC and others on a 14-level panel master antenna which features dual input low wind load panels. Inside, the dual output internal plant combines two channels using an economical VPT RF switch system with mask filter and phase differential. This equipment employs high power filters, couplers and RF switching. The phasing layout addresses unique station requirements and will be suspended from the roof leaving more than enough space on the floor for the filters, couplers and switches.



RF system for NBC Dallas Texas



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➔ Why RFS?

No two networks are the same. Radio Frequency Systems (RFS) offers the widest possible range of options.

In broadcast, RFS is the market leader. When it comes to solutions, RFS provides all components of the RF system from the output of the transmitter to the antenna, and offers supervision services for installation. This provides a single point of accountability, end-to-end, a fully integrated solution and a complete system warranty.

Serious about services

Customers know they can count on RFS for comprehensive logistical capabilities, flawless execution and outstanding technical skills and support. The company's dedicated shipment coordinators, hotline staff and on-site engineers go well beyond mere technology, striving to offer tailored solutions to meet even the most complex site engineering and delivery challenges. RFS' value-added services match the exact needs of business partners large and small.

Ever-present quality guarantee

From design to manufacture, ISO 9001 and ISO 14001 certification standards encompass all aspects of RFS' business worldwide. Every product RFS ships has stood up to the most stringent technical, environmental and quality control tests, continuously meeting and surpassing the expectations of a long list of broadcasters, wireless carriers, transportation and utility operators.

RFS backs every product bearing its name with a quality guarantee that is unrivaled in the market.

A tradition of innovation

For over a century, RFS has been at the forefront in wireless communication design and manufacture. Dedicated R&D teams who enjoy a privileged partnership with Bell Labs, continue to bring advanced technologies to an increasingly mobile and wireless world.

RFS is at the frontier of wireless technology innovation, sustaining the boldest ventures to enhance the way people communicate and live.

A truly global company

With on-the-ground personnel in more than 20 countries and on every continent, RFS always delivers on its commitments, providing a comprehensive range of premium products, systems and services.

Its clients benefit from all the advantages of a global supplier, while relying on dedicated support from RFS' local engineering, manufacturing and shipping teams.

RFS' products, systems and personnel can be found in every corner of the planet. As a global group, RFS is committed to upholding the most stringent environmental, health and safety standards, and seeks to integrate green initiatives in every aspect of its business.



Dave Boreham, RFS installation supervisor,
Sutro Tower 2015, courtesy S Merrill Weiss



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➔ Conclusion

RFS is ready for the US DTV repack with the science, the engineering, the technology and the experience to deliver excellence across the product range. RFS solutions are innovative and acknowledged by peers as being at the forefront in the field of broadcast. By choosing RFS to provide design and manufacture, in one supplier you can get a total solution that is fully flexible, future-proof and state-of-art and including every component after the transmitter output. At Radio Frequency Systems, the customer is at the heart of everything we do. RFS is ready to help you with a solution, now.

➔ About RFS

Radio Frequency Systems (RFS) is a global designer and manufacturer of cable, antenna and tower systems, plus active and passive RF conditioning modules, providing total-package solutions for wireless infrastructure.

RFS serves OEMs, distributors, system integrators, operators and installers in the broadcast, HF, wireless communications, land-mobile and microwave market sectors.

As an ISO compliant organization with manufacturing and customer service facilities that span the globe, RFS offers cutting-edge engineering capabilities, superior field support and innovative product design. RFS is a leader in wireless infrastructure.

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