Via Satellite's

Tech Focus REPORT

MITEQ

Technology Advances Equal Innovative Earth Station Designs

MITEQ's Cardcage Fiber Optic Link

Advances in key technology areas such as RF amplifier performance, embedded digital control and fiber optics have resulted in new product families from MITEQ and MCL, Inc. High performance Tri- and Quad-band block up and downconverters, RF fiber optic Links, redundant slope control amplifier systems, integrated block upconverters (BUC) and high power amplifiers (HPA) provide new, economical alternatives to earth station designers.

Access Intelligence

As the commercial and military satellite communications industries matured throughout the past few decades, there has been an almost single continuous concentration: the constant need to use earth station equipment that offers the highest performance and reliability while being cost effective throughout the long term operation of the system.

Teleports are continually evolving and upgrading hardware. Earth station equipment a decade ago were three or four rack units (RU) (1.75") in height. As time progressed, upgrades became necessary. Such equipment was replaced with 2 and 1 RU units. As those units now become obsolete, they too will need replacement.

System upgrades to stations have to "shoe horn" in new equipment in pre-existing racks. Today, new platforms are taking into account future requirements. The new MITEQ 1/3 rack and cardcage design platforms, for example, provide the necessary solution to such hardware issues.

Currently, fiber optic transmit and receive modules and block up and downconverters are offered in these configurations. Redundant protection modules and other subsystems, however, are in development to augment these products.

There is also a major increase in the need for transportable satellite communications hardware. The broadcasting, SNG and DSNG markets, as well as military end users all need transportable and reconfigurable communications equipment.

MITEQ and MCL products provide these market segments with key advantages. Both companies offer a unique solution for the military satcom marketplace.

The MCL MT4500 Traveling Wave Tube Amplifiers (TWTA) and the MITEQ Tri/Quad-band block converter products provide a switchable C-, X-, Ku- and Ka-band RF subsystem that allows the operator the most flexibility while maintaining the requirement for transportability, reliability and performance under severe working environments. MITEQ offers these units with an integrated L-band synthesized converter, thus making it able to support any IF frequency whether it's 70, 140 or L-band.

From The Field To The Station

The dawn of the military requirement for Tri-band satcom hardware found its way into the commercial sector through the broadcasting, SNG and DSNG community. Satellite trucks and flyaway terminals that operate selectively at either C- or Ku-band with a minimum

MCL's MT4500 Tri/Quad band TWTA

of reconfiguration, is one obvious result of the military to commercial product crossover.

As satellite earth stations have grown, they require more land. Antennas are being located further away from existing equipment shelters. MITEQ's FOL products provide alternatives to traditional approaches in these instances as well. The company developed Low Noise Amplifiers (LNA) and redundant LNA systems that have integrated RF fiber optic transmitters. Now the distance between the LNA and the downconverter can run as high as many kilometers and eliminates coax loss and impacts on dynamic range. Fiber links provide better isolation, in terms of lighting, EMI and signal security than copper mediums provide. Eavesdropping on fiber without detection is nearly impossible. The RF, IF or L-band fiber optic systems are also integrated into the inputs of the MCL outdoor TWTA products. This allows the same advantages of the downlink to the transmit side. Other advances in Ku- and Ka-band LNA design employ spot cooling critical devices. This yields superior G/T performance while minimizing power requirements.

Use of Coarse Wavelength Division Multiplexing (CWDM) in the MITEQ fiber optic products can allow multiple RF, IF or other signals to be carried on a single medium. MITEQ currently offers products that support up to a 20 nm signal spacing between adjacent carriers on a single fiber. This is advantageous to customers because it allows all signals traveling along the same fiber to remain phase coherent. MITEQ's ability to integrate the RF, optical and associated subsystems into a single package allows for better control of operating parameters and increased product reliability.

In addition, advances in digital technology and embedded systems control have brought interesting and unique solutions to the earth station equipment arena. MITEQ and MCL have developed a control system that allows the HPA to be controlled by the MITEQ converter.

A decade ago, MITEQ developed the first DSP approach to provide enhanced automatic frequency correction for INMARSAT earth stations. This technology has now found its way into applications.

The Future Of Earth Station Hardware

Constant evolution in digital technology and improvements in FPGA technology vs. ASICs are helping to shape the future designs of earth station hardware. ASICs have always been and continue to be intensive to implement. High performance FPGAs offer less upfront costs and allow for ease of design transportability between differing design platforms.

Applications range from digital AFC, frequency correction, frequency detection, automatic adjustment of signal equalizers and signal traffic monitoring.

There is also a trend to put more equipment close to the antennas, which sometimes means having it mounted

outdoors. This requires that there is better control and monitoring of the equipment, even in a single earth station making that equipment now located in a "remote" location.

MITEQ and MCL offer embedded Ethernet interfaces that allow the equipment operator to access the control and monitoring through the use of a Web page. Users can operate the equipment controls from any location that offers Internet access.

Along with all of the issues (water, temperature, lightning, solar loading) associated with mounting equipment outdoors, there are changes in the signal runs between structures of an earth station. In an effort to minimize signal run issues, satellite modems with L-band interfaces are being introduced in the market.

Likewise, there is an increase in RF links being converted to run on L-band frequency. Higher IF frequency and longer runs, however, require that outdoor mounted BUCs, DNBs and outdoor HPAs to need new support equipment. MITEQ is offering a 1:N L-band slope and amplitude redundant amplifier system to meet this type of requirement.

In the last few years, signal compression technology has enabled operators to digitize and compress an analog signal into much smaller bandwidths and has improved dramatically the quality and reliability. An analog signal that used to occupy 36+ MHz of satellite bandwidth is now routinely sent in a few megahertz with virtually the same signal quality when decoded at the receiving sites. The impact of this is a tremendous savings in satellite bandwidth costs.

With the increase demand for digital communications, the requirements for high performance, low signal degradation and distortion has also increased. Phase noise, overall system linearity, group delay and extended dynamic range are increasingly important as the demand for higher system data throughput grows. MITEQ's technology base allows for advances in this area. Using 1/f noise cancellation techniques and HBT- based active devices, lower phase noise performance of the equipment is provided.

HBT based amplifiers placed at the critical points of the RF/IF chain result in superior intermodulation distortion performance. Higher output 1 dB compression points in the LNA and the converters allow for extended dynamic range performance. This is very important as more carriers are packed onto transponders.

MITEQ's Tri/Quad band block converter

Another important product area impacted by the current trends in Ground-based earth station designs is the category of high power amplifiers utilized to boost the signal strength of the information media to a sufficient level to illuminate the satellite. There are considerable advances in satellite communication technology that are affecting the implementation of HPAs into earth station designs.

Increasingly, the satellites launched in the last few years have significantly more powerful transponders, which translates into lower transmitted power levels from the transmitting sites on the ground. This transponder power improvement has opened the way for Solid State Amplifiers (SSPA) as the transmitting source for an earth station. As a result, SSPA products have been exhibiting a steady improvement in both power level outputs and reliability that might not have been encouraged with less powerful satellite transponders.

The Future Of Transmission Competition

As the communication marketplace continues to mature, more satellite earth station operators have entered this competition for customers and an increasing fiber-optic network poses a credible alternative to customers seeking signal deliveries from point A to point B. Therefore, the level of acceptable costing for customers has been decreasing. This puts pressure on operators to lower their costs in any possible fashion.

One way that this cost reduction has been achieved is through combining the functions of past equipment into one assembly, lowering equipment costs.

Again, advances in technology, and conceptual thinking for earth stations, have promoted the introduction of higher operating frequencies for earth station designs. The past few years have seen Ka-band satellites associated earth stations emerge to offer competitive signal distribution solutions to customers. The concept of "Diversity Sites" has made this frequency band attractive to customers.

MITEQ and MCL have been delivering Ka-band equipment for many of these key projects worldwide.

HPA technology, like the other technologies associated with satellite communications, are evolving primarily as a response to the "Cost Pressure" defined above. HPA vendors offer options now that eliminate or allow the use of lower cost peripherals to lower the equipment acquisition costs for an operator.

An example of one of the options is the "L-band Input Interface" for HPAs that allow the elimination of the previously required upconverter assembly, saving thousands of dollars. Also, working closely with the critical HPA vendors, there is constant scrutiny of component costs associated with the manufacture of HPAs.

This partnering of HPA manufacturer and component supplier has led to more closely aligned thinking between the two groups, opening the way for better exchange of information on the future requirements, along with improved technology for HPA assemblies.

In an era where the creative engineering of convergent technologies plays an increasing importance in the development of Earth Station equipment, MITEQ and MCL seem poised on the brink of another wave of technology and innovative product development to answer the demands of the satellite communications community.

Good thing this technology is on our side!

TRI- AND QUAD-BAND OUTDOOR BLOCK CONVERTERS

Features:

- C-, X-, Ku-, and Ka-bands
- Small weather resistant enclosure
- Ethernet (10/100Base-T), RS422/485 remote control
- Output signal monitor port
- 30 dB gain control
- Automatic 5/10 MHz internal/ external reference selection
- Low phase noise
- LNA power provided on both RF center conductor (tri-band) and separate connection with current detection (downconverter)
- High frequency stability
- Summary alarm
- AC power supply (CE Mark)

MT4500 MULTI-BAND ANTENNA MOUNT TWT POWER AMPLIFIER

Ka-Band RF Module
27–31 GHz or
V-Band RF Module
36–51 GHz
available

Tri-Band
RF Module &
Power Supply
5.85–14.50 GHz

Features:

- 5 to 51 GHz coverage in discrete bands
- RF deck change less than 10 minutes
- Modular design power supply plus plug-in RF decks
- Reduced overall weight on multi-band systems
- Cost-effective depot logistics
- Flexible, transportable and rugged
- Diagnostic port for maintenance log
- Quiet, efficient thermal design

MITEQ & MCL, unique solutions from a single source!

MITEQ

100 Davids Drive, Hauppauge, NY 11788
(631) 436-7400 FAX: (631) 436-7431
www.miteq.com

MCL INC
A MITEQ COMPANY

501 S. Woodcreek Road, Bolingbrook, IL 60440-4999
(630) 759-9500 FAX: (630) 759-5018
www.mcl.com