

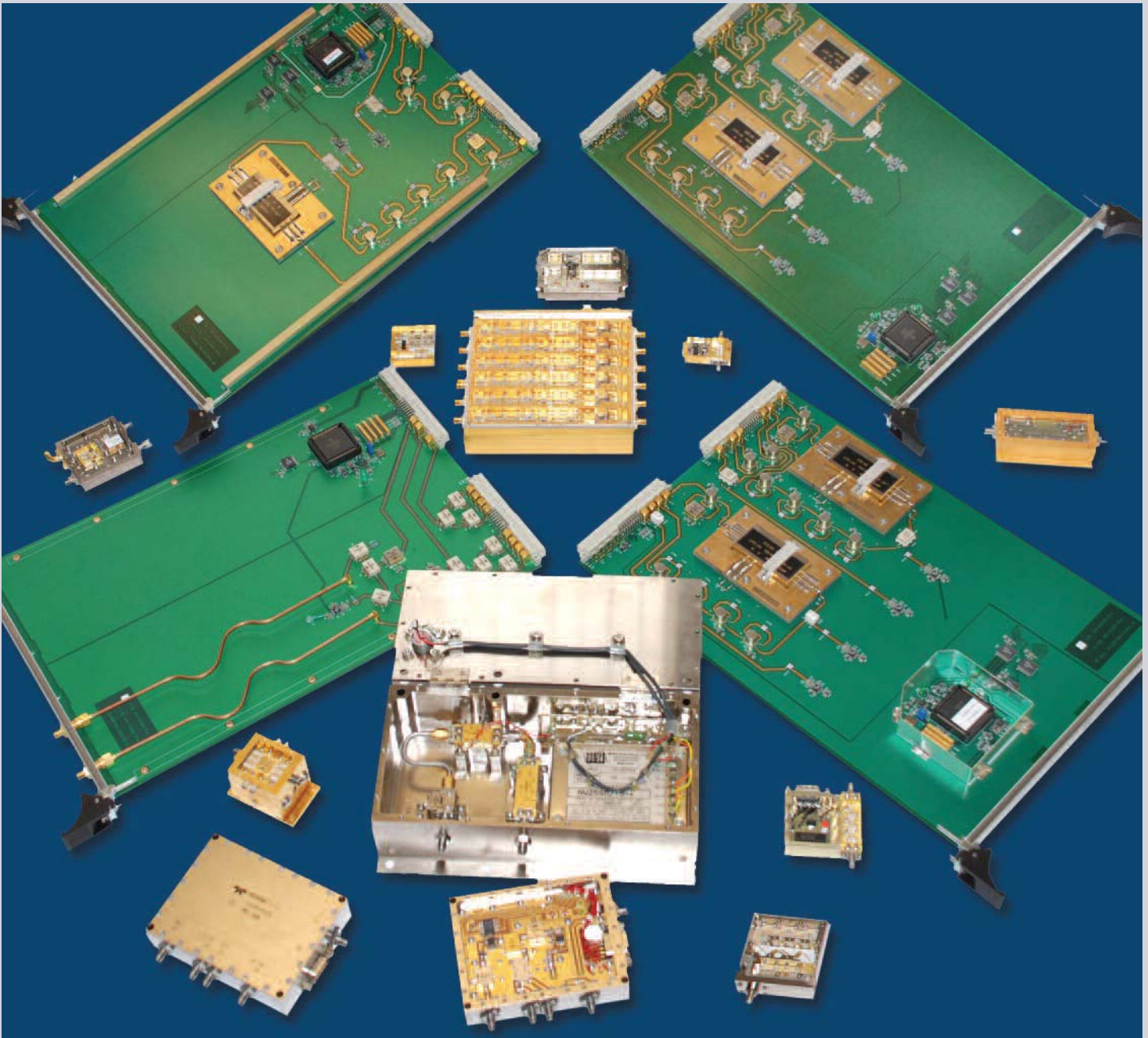
INTEGRATED ASSEMBLIES

TELEDYNE MICROWAVE SOLUTIONS



INTEGRATED ASSEMBLIES

FROM TELEDYNE MICROWAVE SOLUTIONS



Teledyne Microwave Solutions (TMS) offers full first-level integration capabilities, providing not just performance components but also subsystem solutions to help reduce program schedule and cost. Drawing on our broad component product line, TMS delivers customer-specified subsystems of analog and mixed analog-digital design, including hybrid, MMIC, and mixed hybrid-MMIC configurations. Designed to meet military or space applications, Teledyne Microwave Solutions integrations include I/Q demodulators, coupled detector assemblies, switched amplifier detector assemblies, and dual-band VCOs.

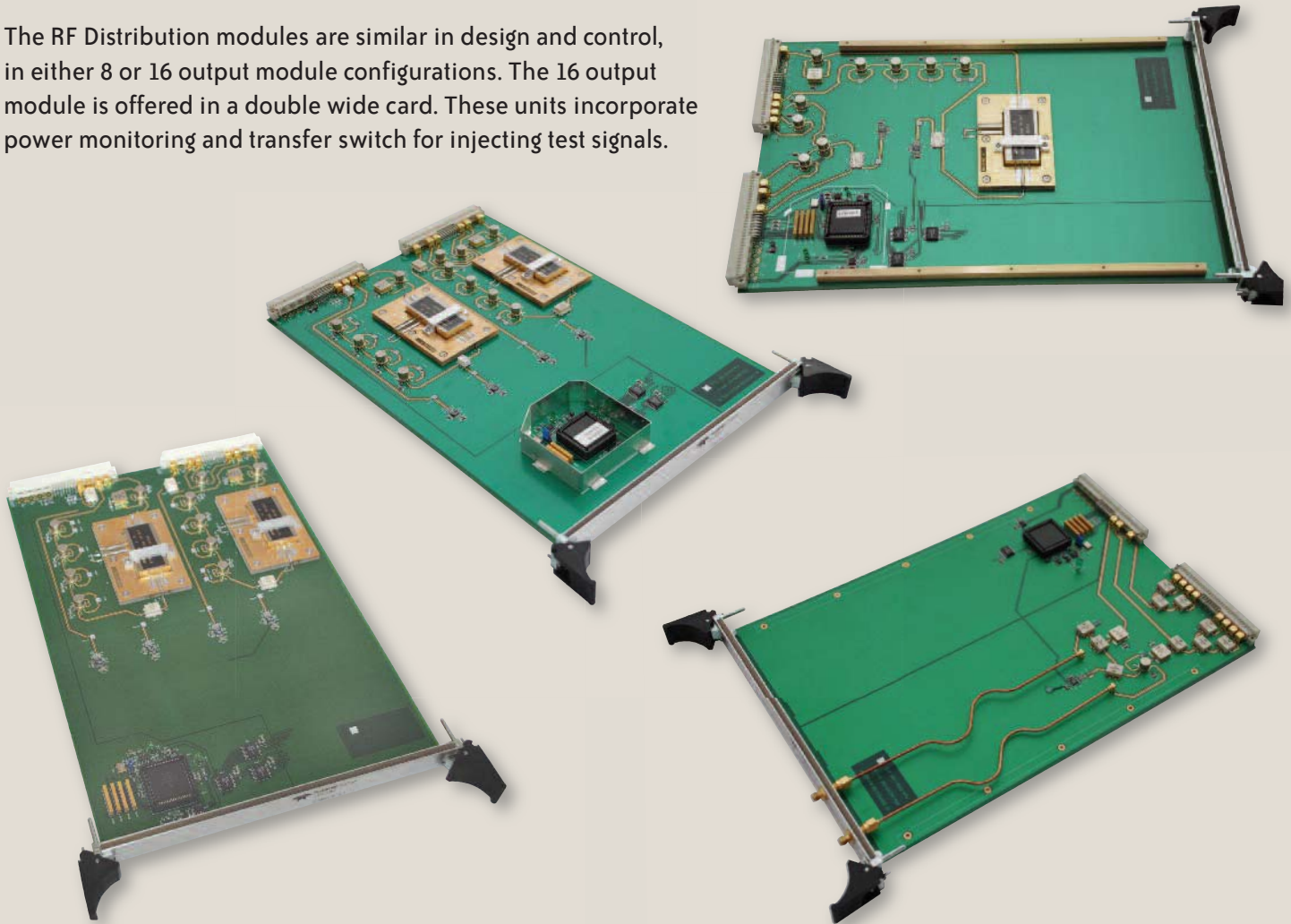
Our experienced component and subsystem engineering staffs work closely with the customer's design team. We can help identify and develop the correct integrated subassembly to complete the system requirements and reduce component interface difficulties.

VME Assemblies

Teledyne Microwave Solutions' RF protection and distribution modules cover 30-3000 MHz with on-board PIC controller circuitry.

The RF Protection modules operate in 6 sub-bands, protecting the system downstream from damaging high power inputs. Designed in 2- channel or 1-channel cards, the inputs handle up to 2 Watts CW while selecting-in attenuation to maintain operability under harsh signal environments. Also incorporated in the designs are power monitoring and transfer switches to select off-board signal conditioning.

The RF Distribution modules are similar in design and control, in either 8 or 16 output module configurations. The 16 output module is offered in a double wide card. These units incorporate power monitoring and transfer switch for injecting test signals.



Low Noise Dual Band VCO

This oscillator subassembly consists of two low noise oscillators covering 1.5 to 2.5 GHz, a power combiner, an amplifier, and a lowpass microstrip filter. TMS designed both oscillators for low phase noise and linear tuning. The output frequency bands are switched using standard TTL control.

- Frequency Output
1500 to 2500 MHz in two bands
 - +3 to +8 dBm Output Power
 - < 2 dB Output Power Fatness
 - Excellent Phase Noise
- | Offset | dBc/Hz |
|---------|--------|
| 10 kHz | -86 |
| 100 kHz | -114 |
| 1 MHz | -135 |
| 10 MHz | -158 |
| 100 MHz | -160 |



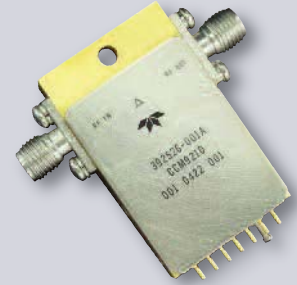
Switch Amplifier



One of many potential designs, Teledyne Microwave Solutions' switched amplifier covers 100 to 2000 MHz, 18 dB gain and phase matched to within ± 1.0 degree. The primary RF input and a secondary calibration signal input are switched, then amplified, and split to two outputs. Gain balance between any of the two outputs is ± 0.5 dB. Output power at 1dB compression is +14 dBm and input/output VSWR is 2.0:1 maximum.

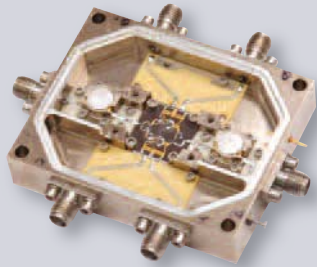
X Band Coupler with Dual Output Threshold Detector

The X Band coupler with dual output has an input power range of either -5 to $+10$ dBm, or $+5$ to $+20$ dBm. Covering 8.0 to 9.5 GHz, insertion loss is less than 1.0 dB and VSWR is 1.5:1. The coupler/detector has two external resistors providing independently settable threshold TTL outputs. The power flatness is ~ 0.4 dB and hysteresis is 0.1 dB. TMS can provide this function in other frequency ranges and input power ranges.



- 8 to 10 GHz Operational Frequency
- < 1.0 dB Insertion Loss
- Two Independently Settable (external resistor) Threshold Detector Outputs
- High Speed Threshold Detector Response (< 80 ns)

17 to 19 GHz QPSK Modulator

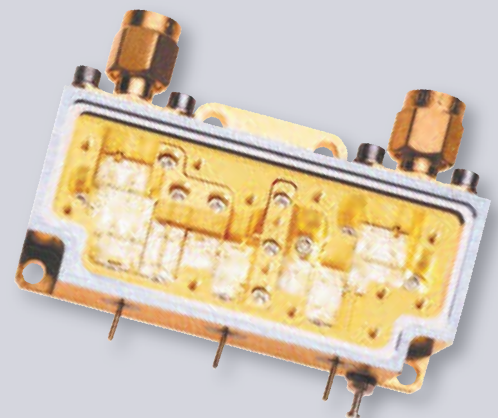


The CCM19001 is a Differential Drive Digital QPSK (Quadrature Phase Shift Keying) modulator operating from 17.0 to 19.0 GHz. The modulator utilizes differential drive digital inputs (180° apart) to drive both of the bi-phase modulators (mixers) integrated into the assembly. The modulator is a combination of a matched pair bi-phase modulators, which are in quadrature (90°) to each other. It is modulated by switching polarities of the DC voltage controls in 4 different logic states ("0,0", "0,1", "1,0" & "1,1") for 4 phase states. The QPSK modulator provides constant amplitude, 90° vector: 0 (ref.), 90° , 180° , 270° and operates across the -55° to 85° C temperature range.

C and Ku Band Gain Control Amplifiers

The Ku Gain Control Amplifier covers 10-13 GHz, 45 dB unattenuated small signal gain with 15 dB attenuation range. Typical gain flatness is ± 0.5 dB, +35 dBm third order intercept point, +22 dBm minimum 1-dB gain compression, and 3.5 dB unattenuated noise figure 4.5 dB at full attenuation. This is only one of a series of microwave controllable amplifiers currently in production.

- 10 to 13 GHz Frequency Band
- 45 dB Unattenuated Gain
- ± 0.5 dB Gain Flatness
- 3.5 dB Noise Figure (at unattenuated setting, 4.5 dB full attenuation)
- 15 dB Attenuation Range
- +22 dBm Output Power at 1dB Compression
- +35 dBm Third Order Intercept Point

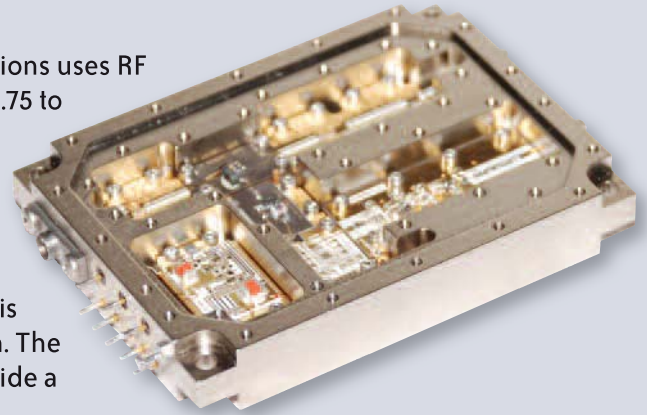


Broadband, High Signal-to-Signal Isolation Downconverter

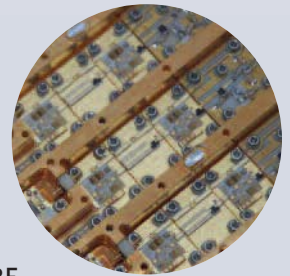
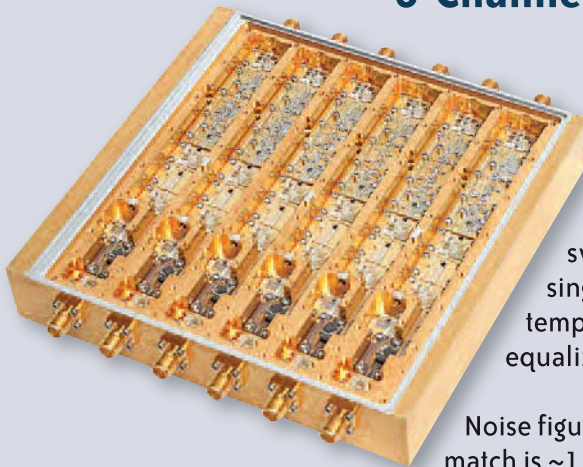
This broadband downconverter from Teledyne Microwave Solutions uses RF inputs from 1.85 to 9.35 GHz, converting to IF frequencies from 0.75 to 1.25 GHz using a customer provided local oscillator input.

Conversion gain is 10 dB nominal, typical noise figure is 7 dB, and the P1dB output is +6 dBm minimum.

An output filter centered at 1 GHz with a bandwidth of 500 MHz is designed into the IF chain, yielding high L to I and R to I isolation. The CCM9350 uses a 5 bit digital attenuator with a 0.5 dB LSB to provide a gain control range of 15.5 dB.



2 to 18 GHz Amplitude & Phase Matched 6-Channel Downconverter



This downconverter is a two-sided hermetically sealed six channel 2-to-18 GHz (RF and LO) downconverter with an IF of ~960 MHz, 25 dB RF-to-IF gain, and bandwidth of ~500 MHz. The model uses a single LO input at -6 dBm. Each identical channel integrates a range extension switch adding 20 dB range, and the six 2-18 GHz switches are controlled by a single TTL input. The IF chain includes amplification, phase adjustment, temperature compensation and a lumped element Band Pass Filter with equalizer.

Noise figure is ~13.5 dB and output IP3 is ~25 dBm. Channel-to-channel amplitude match is ~1.0 dB and channel-to-channel phase match is <math><20^\circ</math>.

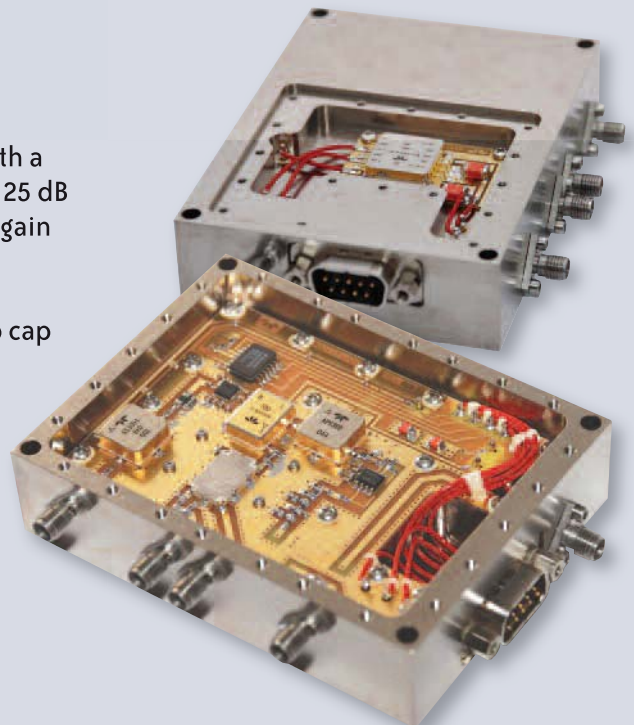
Flexible, Highly Linear Downconverter

This downconverter model converts a 1430 MHz signal to 30 MHz with a customer supplied 1400 MHz local oscillator. The conversion gain is 25 dB and with an integrated 4 bit digital attenuator with 1 dB LSB, a 15 dB gain adjustment range is achieved.

The noise figure is less than 6.5 dB, and includes an output limiter to cap saturated output power at 8.5 dBm maximum while still preserving high linearity. The two-tone intercept point is +27 dBm minimum.

TMS has incorporated a low-pass filter at the IF output to achieve high L to I isolation of 50 dB minimum. The L to R isolation is 50 dB minimum.

The frequency plan can be modified to accommodate specific customer's requirements.



SIGNAL PROCESSING LEGACY PARTS (TO 20 GHz)

Cascadable Amps
Cascaded Amps
VCOs
Mixers
Detectors
IQ Networks
Microwave Amps
Frequency Doublers
Power Dividers
Attenuators
Limiters
Switches

ANALOG AND MIXED ANALOG-DIGITAL DESIGNS:

Hybrid
MMIC
Mixed Hybrid-MMIC

SUBASSEMBLIES:

I/Q Demodulators
Coupled Detector Assemblies
Switched Amplifier Detector Assemblies
Dual Band VCOs
Downconverters
VME Assemblies

VALUE ADDED SOLUTIONS

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Device Related Services • Material Related Services • Documentation Related Services

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Electrical Test Capabilities
Microcircuit and Semiconductor Die Evaluation
Element Evaluation
Standard Hybrid Assembly
Die Services
Standard Hybrid Screening Flow
Packaging



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Information subject to change without notice.