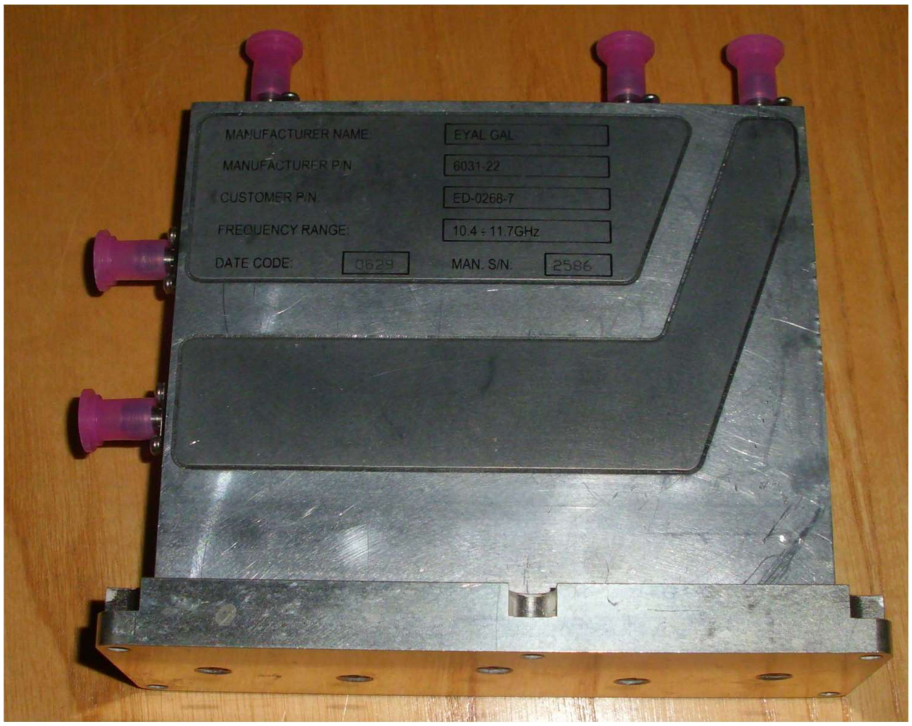
Eyal Gal Modules for 10 & 24GHz – Update

by G8CUB

My original articles on these modules in Scatterpoint is now several years old. In the intervening period, there have been periods when modules were unavailable, and others when new variants have come to light.

11GHz Module



Of the 6031 module for 10GHz, there are differences in module thickness, and derivation of transmit supply.
These 10.4 – 11.7GHz modules have a useful cut-off of the transmit response on the LF side and receive filtering is by the use of image rejection mixing / filtering.
The original modules looked at were -01 or -07 variants. These had the thicker bodies, and derived the transmit supply from the +12V.
More recent variants type -12 have the thinner bodies but still use the +12V for TX. The -22 variant has the thinner body, and takes the transmit supply from the +8V. Also the -22 types have come with test sheets showing the measured noise figure to be 1.3 to 1.6dB at 10.4GHz.

These must be first stage noise figures, as my measurements on the whole module vary between 2.3 & 3.3dB.

On the transmit side the unit is just a high gain amplifier. The 1dB compression point, measured now on quite a lot of modules, varies between 31.3 and 32.3dB, with the saturated output about 0.6dB higher. Although I have seen up to +33.5dBm.

-01 Module on the left, -22 module on the right

When using the -22 variant modules, the +8V supply needs a capability of at least 2.2A for maximum output, hence it is convenient to use a 3A regulator (78T08 or similar). This regulator needs to have sufficient heatsinking. Typical current on receive is 0.38A, while on transmit current is around 1.8A, peaking to 2.2A.
Also the -12V current requirement is less, around 70mA max. instead of 110mA. Current from the 12V supply is typically 20mA on receive, 780mA on transmit. Note that on 'transmit' i.e. TX un-muted, the receive side is still operational. The only module I have known to have a receive failure, is when the auxiliary antenna contact in the RX position was used to mute the module. Obviously the changeover period caused the problem, when using CW break-in. I have now used the TX aux. contact to control the mute line via a transistor.

Transmitter Report

Normal: PASS

Transmitter Type: 11G
CERAGON Serial No: EY-09867
CERAGON Part No: ED-0268-7
Tester Name: Alex

Vendor Code: 25
Vendor Serial No: 2874
Vendor Part No: 6031-22
Date: 09:01 Dec. 20 2006

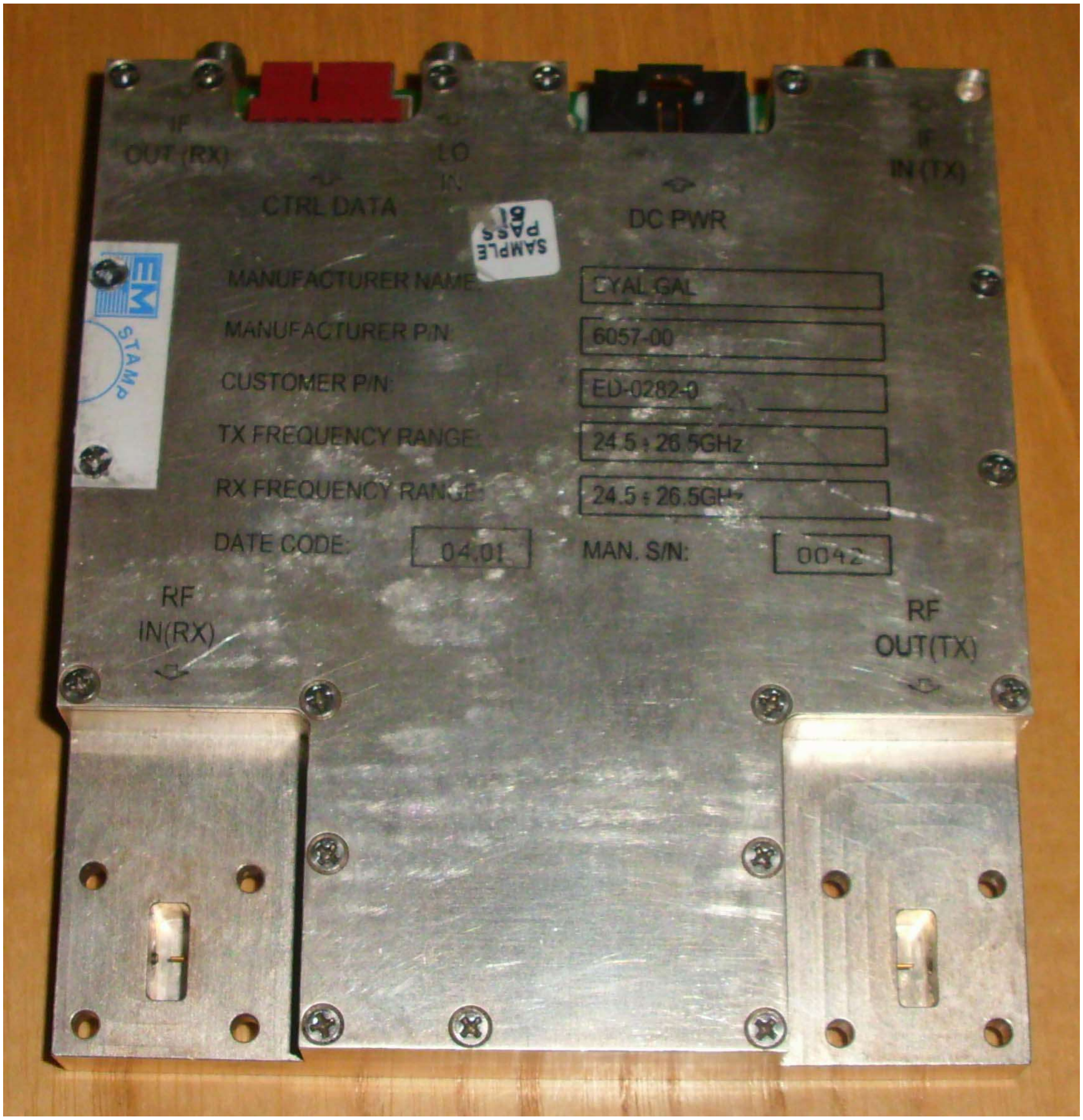
Temperature = 25°C

	Current	Pass			Units	Pass Value
DC Current: PASS					mA	
		PASS			mA	
8Volt	1780	PASS			mA	n < 2500 < 2500
-12Volt	60	PASS			mA	n < 150 < 150
12Volt	370	Pass			mA	n < 1800 < 1800
Tx Results: PASS	IF	Pass		Pass	Units	Pass Value
Nominal Gain: PASS						
Flatness: PASS		PASS				
IF Flatness (Max.)	0.61	PASS			dB	n < 1.2 < 1.2
Maximum Gain (Min. Val. Over Freq Range)	58.42				dB	L>48>46
					dBm	
Mute: PASS		PASS				
Mute Delta	76.71				dB	n > 70 > 70
Detector: PASS		PASS				
Detector Function Derevative	90.5	PASS			mV/dB	n > 40 > 40 Above 0dBm
Detector Flatness Derevative	0.33				dB/60MHz	n < 1 < 1dB/60MHz
Gain Control: PASS		PASS				
Control Derevative	84.28	PASS			mV/dB	n > 40 > 40 Above 33dB Gain
Minimum Gain (Max. Val. Over Freq Range)	22.5				dB	n < 33 < 33
Noise Figure: PASS						
Noise Figure Start-Center	6.2				dB	
Noise Figure Center-Stop	8.5				dB	
Noise Start-Center	-71.77	PASS			dBm	n < -63 < -63
Noise Center-Stop	-69.47	PASS			dBm	n < -63 < -63
IP3/IM5: PASS						
					dBm	
					dBm	
					dBm	
Normal IP3 Start	40.3	PASS			dBm	n > 38.5 > 38.5
Normal IP3 Center	40.7	PASS			dBm	n > 38.5 > 38.5
Normal IP3 Stop	41.3	PASS			dBm	n > 38.5 > 38.5
Normal Delta IM5 Start	74.7	PASS			dB	n > 58 > 58
Normal Delta IM5 Center	71.3	PASS			dB	n > 58 > 58
Normal Delta IM5 Stop	70.6	PASS			dB	n > 58 > 58
Rx Results: PASS	IF	Pass		Pass	Units	Pass Value
Flatness: PASS						
RF Flatness (Max.)			0.55	PASS	dB	n < 1.5 < 1.5
Maximum Gain (Min. Val. Over Freq Range)			21.91	PASS	dB	19.5 < Gain < 24
					mV/dB	
					dB	
Noise Figure: PASS						
Noise Figure Start			1.3	PASS	dB	n < 3.7 < 4
Noise Figure Center			1.4	PASS	dB	n < 3.7 < 4
Noise Figure Stop			1.4	PASS	dB	n < 3.7 < 4

*IF Start: 10400MHz, IF Center: 11050MHz, IF Stop: 11700MHz.

Version: 5.80, Calibration Date: 17:28 Dec. 07 2006.

11GHz module original data sheet: www.eyal-microwave.com/eyal-emi/09042006100536@6031-00.pdf



For 24GHz the original 6058 (21.2-23.6GHz) module I looked at, required an LO on the high side, together with additional TX filtering (when using a 70cm IF). Now there is availability of a 24.5-26.5GHz module. As with the 23GHz version these are a complete mixing system on transmit and receive, with LO at half frequency. Being designed for 26GHz allows an LO on the low side, and can be used with either no or minimal additional filtering. They do have some gain reduction at 24.05GHz. But, fortunately the waveguide connects directly into the front end amplifier via a short length of track, so the noise figure remains good. (my conservative system measurements show better than 4.5dB). They do cut-off rapidly after 24.0GHz though. After measuring a dozen units the RX gains varies between 20 and 27dB @ 24.048GHz. An advantage of this is that the image rejection on receive is >30dB.
While the unwanted product on transmit is <-40dBc, LO being around -32dBc. These measurements were made with an LO injection level of +9dBm.
They work well with the Elcom 11.2-12GHz synthesisers, just needing around 6dB of attenuation. The only disadvantage of using the Elcom, is they are limited to 3.333MHz steps. Therefore using a 70cm IF, the range is either 428-430MHz or 434.666-436.666MHz. A higher

IF is practical, but not significantly lower. After using the Elcom synths at 76 & 134GHz, I recommend using the internal 10MHz reference, unless you want to go GPS locked. It is rather good once set on frequency, with quick warm-up.

Transmit measurements show a 1dB compression of around 30.2dBm. The TX gain is high, with some units only requiring -28dBm for full output. Typical supply currents are -12V 120mA, +8V 680mA RX / 1.2A TX, +12V 20mA RX / 0.65A TX.

26GHz module original data sheet: www.eyal-microwave.com/eyal-emi/09042006100536@6031-00.pdf

I can supply Elcom synthesisers with loader boards and programmed PICs for 24GHz, but unfortunately 24GHz modules have at the moment all gone. However, I do have plenty of tested 10GHz modules.

A copy of the original article can be found on: www.rfdesign.co.uk