



Eyal Microwave Ltd.

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REVISIONS

REV	ECN NO.	DATE	NAME	SIGN

Specification For T/R Module with 2 Watt



Eyal Microwave LTD

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	DATE	NAME	SIGN	TITLE: SPECIFICATIONS FOR X BAND T/R MODULE		
MECH. ENG.	23/02/05	A.G		MODEL No: TR-2610-02 P/N: 9750261002		
LEC. ENG.	23/02/05	L.L				
QC. ENG.	23/02/05	M.C				
CONFIG ENG.						
PROJ. ENG.	23/02/05	L.L				
DRAFT					DWG NO:	
				SIZE: A	CAGE CODE:	SH 1 OF 12



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Scope

This specifications document defines the technical and mechanical for an X band transmit and receive module

1. Module Electrical Specifications

	Specifications	Notes
Frequency Range	9.45÷10.45 GHz	
Promoting Power Driver	2÷5 mW	
PRF	5÷35 KHz	
Duty Cycle	5% ÷ 40%	
Transmit/Receive Converting Time:	≤200ns	
Efficiency:	≥20%	

2. Transmission Channel

	Specifications	Notes
Output Power	≥2W @ 24°C ≥2W @ other temp. under 0dB Attenuation	@ 20% Efficiency @ 24° C
Output Power Flatness	≤ 0.5dB	@ any 30MHz Band
Output Power Flatness	≤ 1.25dB ≤ 1.0 dB design Goal	@ 1.0 GHz Band @ 24°C
Spurious	≤80dB	(±10MHz)
Phase Shift Disperse	±4° max	
Insertion Phase shift Var. within band insertion phase shift Variation	< 10% (variety with the frequency)	



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3. Receiving Channel

	Specifications	Notes
Gain	$\geq 22\text{dB} \pm 0.5\text{dB}$	$\pm 1.5\text{dB OT}$
Noise Figure	$\leq 3.0\text{dB @ } 24^\circ\text{C}$ $\leq 3.5\text{dB @ O. temperature range}$	
Attenuation	15.5 dB max.	
Attenuation Step	0.5dB	
Attenuation Accuracy	$\pm 0.7\text{dB max}$	
Phase Shift Disperse	$\pm 4^\circ \text{ max}$	
Insertion Phase shift Var. within band insertion phase shift Variation	$< 10\%$ (variety with the frequency)	

4. Insertion Phase Shift Variation

- **Between Transmission Channel and Receiving Channel**

The var. Margin between two channels	$< 10\%$ (variety with the freq.)	
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5. Phase Shifter:

	Specifications	Notes
4 Bits	22.5°	
	45°	
	90°	
	180°	
Phase-shifter accuracy	±4°	max
Phase building time:	≤100 nSec	

6. Attenuator:

	Specifications	Notes
Attenuation Range	15.5 dB	max
No of Bits	5	
Attenuation Step:	0.5dB	
Attenuation Accuracy	± 0.7 dB	max

7. In & Out Connectors

	Specifications	Notes
Input SMA (F)	VSWR≤1.5	
Output OSP (M)	VSWR≤1.5	



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8. Attenuator Control Signal @ 5 BIT

8.1. Comparison of Attenuator Control Signal & Attenuation

Attenuator Control Signal					Attenuation
CA0	CA1	CA2	CA3	CA4	
0	0	0	0	0	0dB
1	0	0	0	0	0.5 dB
0	1	0	0	0	1 dB
1	1	0	0	0	1.5 dB
0	0	1	0	0	2 dB
1	0	1	0	0	2.5 dB
0	1	1	0	0	3 dB
1	1	1	0	0	3.5 dB
0	0	0	1	0	4 dB
1	0	0	1	0	4.5 dB
0	1	0	1	0	5 dB
1	1	0	1	0	5.5 dB
0	0	1	1	0	6 dB
1	0	1	1	0	6.5 dB
0	1	1	1	0	7 dB
1	1	1	1	0	7.5 dB
0	0	0	0	1	8 dB
1	0	0	0	1	8.5 dB
0	1	0	0	1	9 dB
1	1	0	0	1	9.5 dB
0	0	1	0	1	10 dB
1	0	1	0	1	10.5 dB
0	1	1	0	1	11 dB
1	1	1	0	1	11.5 dB
0	0	0	1	1	12 dB
1	0	0	1	1	12.5 dB
0	1	0	1	1	13 dB
1	1	0	1	1	13.5 dB
0	0	1	1	1	14 dB
1	0	1	1	1	14.5 dB
0	1	1	1	1	15 dB
1	1	1	1	1	15.5 dB



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8.2. The Correspondence of Attenuator Control Signal in XS1

Port	Signal	Electric Spec.
XS1 : 1	CA0	Attenuator control signal port 1 (TTL)
XS1 : 3	CA1	Attenuator control signal port 2 (TTL)
XS1 : 5	CA2	Attenuator control signal port 3 (TTL)
XS1 : 7	CA3	Attenuator control signal port 4 (TTL)
XS1 : 9	CA4	Attenuator control signal port 5 (TTL)
XS1 : 11	CA GND	Attenuator control signal ground

9. Phase Shifter Control Signal : 4bit

9.1. Comparison of Phase Shifter Control Signal & Phase Shift Degree

Phase Shifter Control Signal				Degree
CP0	CP1	CP2	CP3	
0	0	0	0	0°
1	0	0	0	22.5°
0	1	0	0	45°
1	1	0	0	67.5°
0	0	1	0	90°
1	0	1	0	112.5°
0	1	1	0	135°
1	1	1	0	157.5°
0	0	0	1	180°
1	0	0	1	202.5°
0	1	0	1	225°
1	1	0	1	247.5°
0	0	1	1	270°
1	0	1	1	292.5°
0	1	1	1	315°
1	1	1	1	337.5°



9.2. The Corresponding of Phase Shifter Control Signal in XS1

Port	Signal	Electric Spec.
XS1 : 2	CP0	Phase shifter control signal port 1 (TTL)
XS1 : 4	CP1	Phase shifter control signal port 2 (TTL)
XS1 : 6	CP2	Phase shifter control signal port 3 (TTL)
XS1 : 8	CP3	Phase shifter control signal port 4 (TTL)
XS1 : 10	CP GND	Phase shifter control signal ground

10. Data Lock Signal

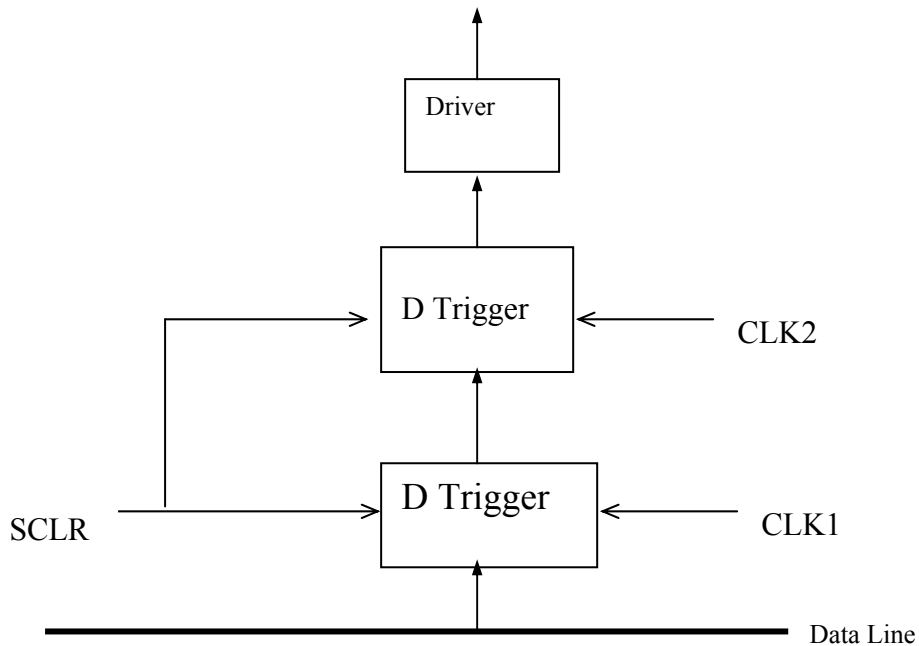
The T/R Module must include the D trigger (with reset function) that can handle 4+5 bits. (Suggestion: 54LS174)

Reset port (SCLR) : "0" is reset , set all D trigger as "0".

Reset port (SCLR) : "1": set data. The entire D trigger can set data.

Data control port CLK1 : Rise "↑": T/R Module receives data from the data line.

Data control port CLK2 : Rise "↑": T/R Module sends the data to the driver of phase shifter and attenuator





• **The Correspondence of Data Lock Signal in XS1**

port	signal	Electric spec.
XS1 : 14	SCLR	Reset signal (TTL)
XS1 : 16	CLK1	Data control signal 1 (TTL ↑)
XS1 : 18	CLK2	Data control signal 2 (TTL ↑)
XS1 : 20	CL GND	Data lock signal ground

11. T/R Switch Control Signal

T/R Switch control signal CT/R "1": T/R is under transmission state

T/R Switch control signal CT/R "0": T/R is under receiving state

• **The Correspondence of T/R Switch Control Signal in XS1**

Port	Signal	Electric Spec.
XS1 : 15	CT/R	T/R signal (TTL)
XS1 : 17	CL GND	T/R control signal ground

12. Power Modulate Pulse

Power modulates pulse "1": The transmission power is on.

Power modulates pulse "0": The receiving power is on.

• **The Correspondence of Power Modulate Pulse PT/R in XS1**

Port	Signal	Electric Spec.
XS1 : 21	PT/R	PT/R power control signal (TTL)
XS1 : 23	PT/RGND	PT/R modulate pulse ground



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13. Output Power

A failure signal will be received if the power drops below 30dBm ± 0.5 dB in transmit mode

- Power Detection:

Port	Signal	Electrical Specifications
XS1 : 30	Fault Signal (TTL)	... detector signal TTL
XS1 : 31	Fault Signal RTN	... detector signal RTN

14. The Correspondence of Power in XS1

Port	Electric Spec.
XS1:22	+15V
XS1:24	+15V
XS1:25	+15V RTN
XS1:27	+15V RTN
XS1:28	-15V
XS1:29	-15V RTN
XS1:30	Fault Signal (TTL)
XS1:31	Fault Signal RTN
XS1:32	
XS1:33	
XS1:34	
XS1:35	
XS1:36	
XS1:37	
XS1:38	
XS1:40	
XS1:39	
XS1:41	



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15. Environmental

	Specifications	Notes
Operating Temperature	-40°C to +60°C	
Storage Temperature	-45°C to +70°C	
Vibration:	5-8.57Hz, Equal Amplitude 8.5mm 8.57-200Hz, Equal Accretion 2.5g	TO Be Tested Only For 2 First Units
Shock:	≥15g, remain 11ms, Half sine wave	TO Be Tested Only For 2 First Units
Reliability	MTBF≥10000h	
Maintainability	MTTR≤0.5h	



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16. Outline Drawing

