



## LINEARIZED CHANNEL AMPLIFIERS

The L3Harris Linearized Channel Amplifier (LCAMP) is a wideband TWT (Traveling Wave Tube) driver which operates in S-Band, C-Band, X-Band, Ku- Band or Ka-Band frequency ranges. The LCAMP consists of a channel amplifier assembly and a linearizer assembly which are mounted on a common baseplate. The RF output of the channel amplifier assembly is connected to the RF input of the linearizer assembly with an SMA coax cable.

The channel amplifier can operate in a fixed gain mode or an ALC mode. The unit has commandable gain and ALC levels. Pulse or serial command inputs are used to increase or decrease the gain in the fixed gain mode, increase or decrease the power in the ALC mode and select the mode of operation. An RF telemetry output monitor can be included which will provide a calibrated DC voltage to provide information on the output power level of the channel amplifier in the fixed gain mode. An RF telemetry input monitor can be included which will provide a calibrated DC voltage to provide information on the input power level of the channel amplifier in the ALC mode. The unit is constructed using thin film amplifier, attenuator, coupler/detector, microstrip bandpass filter and control circuits. The thin film modules are enclosed in a laser-sealed hermetic aluminum housing. The housing has two SMA RF connectors and a 15 pin Micro-D connector for DC/Command interface.

The linearizer acts as an amplitude and phase predistortion generator to extend the linear operating range of the TWTA. The unit is constructed using thin film amplifier, attenuator, equalizer, linearizer and control circuits. The thin film modules are enclosed in a laser-sealed hermetic aluminum housing. The housing has two SMA RF connectors and a 15 pin Micro-D connector for DC/Command interface. The housing may also include a second 15 pin Micro-D connector which can be used to externally fine tune the linearizer, after it has been sealed, to match the final TWTA data. If required, these adjustments can be made by adding established reliability resistors to this second 15 pin Micro-D connector.



### KEY FEATURES

- > S-, C-, X-, Ku- and Ka-Band Design
- > 6 dB Typical Gain Enhancement
- > 50 Degree Typical Phase Advance
- > Output Power Adjustment
- > Low Power Consumption
- > Lightweight

## SECTION 1: GENERAL REQUIREMENTS

Parameter	Units	S-Band Specification	C-Band Specification	X-Band Specification	Ku-Band Specification	Ka-Band Specification
Frequency Range	GHz	2.630 –2.655	3.7–4.2	7.25–7.75	500 MHz Bandwidth over 10.7 to 12.7	500 MHz Bandwidth over 18.3 to 20.2
Power Output Reference Level at Ambient ( $P_{out\_REF}$ )	—	+4.0	+3.0	+3.0	+3.0	+2.0
Channel Bandwidth	MHz	25	36	36	36	36
RF Input Power (FGM and ALC mode)	dBm	-40 to -13	-51 to -28	-58 to -27	-58 to -27	-53 to -26
Overdrive Capability, Input	dBm	0 Max	0 Max	0 Max	0 Max	0 Max
Maximum Output Power	dBm	+19	+19	+19	+19	+19
Input Return Loss	dB	18	18	18	18	18
Output Return Loss	dB	18	18	18	18	18
Source & Load VSWR for Stability		All phases of Open & Short	All phases of Open & Short	All phases of Open & Short	All phases of Open & Short	All phases of Open & Short
<b>Out-of-Band Rejection at Receive Frequencies</b>	dB	20 Min.	20 Min	40 Min (With external filter)	40 Min	40 Min
<b>In-Band Spurious Outputs</b>	—					
Within any 4 kHz band	dBc	75	75	75	75	75
Within any 1 MHz band	dBc	70	70	70	70	70
Caused by Power Supply Frequencies	dBc	55	55	55	55	55
<b>Out-of-Band Spurious Outputs (Except harmonics)</b>	—					
Within any 4 kHz Band	dBc	60	60	60	60	60
Group Delay Variation (Over channel BW)	nsec	1.0	0.2	2.0	0.2	0.2
Gain Flatness @ 10 dB IBO	dBp-p					
Over Channel Bandwidth		0.5	0.5	0.5	0.5	0.5
Over Operating Frequency Range		0.5	2.0	2.0	2.0	3.0
Gain Slope @ 10 dB IBO	dB/MHz	0.015	0.015	0.015	0.015	0.015
RF Susceptibility	dB <sub>i</sub>	-80	-80	-80	-80	-80
RF Connectors		SMA	SMA	SMA	SMA	SMA
DC Voltage	V	8.0	8.0	8.0	8.0	8.0
DC Power	W	3.0 Nom., 3.5 Max	3.0 Nom., 3.5 Max	3.5 Nom., 4.0 Max	3.5 Nom., 4.0 Max	4.0 Nom., 4.5 Max
Mass	g	200	200	260 (external filter)	200	200

## SECTION 2: FIXED GAIN MODE (FGM) REQUIREMENTS

Parameter	Units	S-Band Specification	C-Band Specification	X-Band Specification	Ku-Band Specification	Ka-Band Specification
Commandable Gain Control	dB	31 dB Min in 1.0±0.5 dB Steps	31 dB Min in 1.0±0.5 dB Steps	31 dB Min in 1.0±0.5 dB Steps	31 dB Min in 1.0±0.5 dB Steps	31 dB Min in 1.0±0.5 dB Steps
Noise Figure @ Max Gain	dB	7	7	7	7	7
Noise Figure @ Min Gain	dB	20	20	15	15	20
Output Power Compensation over Temperature	dB/°C	+0.5 dB Cold to Hot	+0.5 dB Cold to Hot	+0.5 dB Cold to Hot	+0.5 dB Cold to Hot	+0.5 dB Cold to Hot
<b>Input Dynamic Range Stability</b>	—					
Cold to Hot (More gain at Hot than Cold)	dB	+1.0	+1.0	+1.0	+1.0	+1.0
Over Life	dB	±0.7	±0.7	±0.7	±0.7	±0.7

## SECTION 3: AUTOMATIC LEVEL CONTROL (ALC) MODE REQUIREMENTS

Parameter	Units	S-Band Specification	C-Band Specification	X-Band Specification	Ku-Band Specification	Ka-Band Specification
ALC Commandable Output Level (measured at CAMP output)	dB	15 dB in 0.5±0.2 dB Steps	N/A	15 dB in 0.5±0.2 dB Steps	15 dB in 0.5±0.2 dB Steps	15 dB in 0.5±0.2 dB Steps
<b>Output Power Stability</b>						
@ Channel Center Frequency over Input Power Range	dBp-p	0.3	N/A	0.3	0.3	0.3
@ Any Fixed Drive Over Temp (Cold to Hot)	dBp-p	0.5	N/A	0.5	0.5	0.5
@ Max Power Variation due to Aging & Radiation (analysis)	dBp-p	0.5	N/A	0.5	0.5	0.5
ALC Time Constant (For a +1 dB Change in Input Power)	dBp-p	10–60	N/A	10–60	10–60	10–60

## SECTION 4 INTEGRATED LCAMP-TWTA REQUIREMENTS

Parameter	Unit	S-Band Specification	C-Band Specification	X-Band Specification	Ku-Band Specification	Ka-Band Specification
<b>Phase Shift LTWTA</b>	deg					
at Pin <sub>sat</sub> (0 dB IBO)		±20	±20	±20	±20	±20
at Pin <sub>sat</sub> -3 dB (3 dB IBO)		±15	±15	±15	±15	±15
at Pin <sub>sat</sub> -6 dB (6 dB IBO)		±9	±9	±9	±9	±9
at Pin <sub>sat</sub> -9 dB (9 dB IBO)		±5	±5	±5	±5	±5
at Pin <sub>sat</sub> -12 dB (12 dB IBO)		±3	±3	±3	±3	±3
at Pin <sub>sat</sub> -15 dB (15 dB IBO)		±2.5	±2.5	±2.5	±2.5	±2.5
at Pin <sub>sat</sub> < Pin <sub>sat</sub> -20 dB (20 dB IBO)		0.0 (reference)	0.0 (reference)	0.0 (reference)	0.0 (reference)	0.0 (reference)

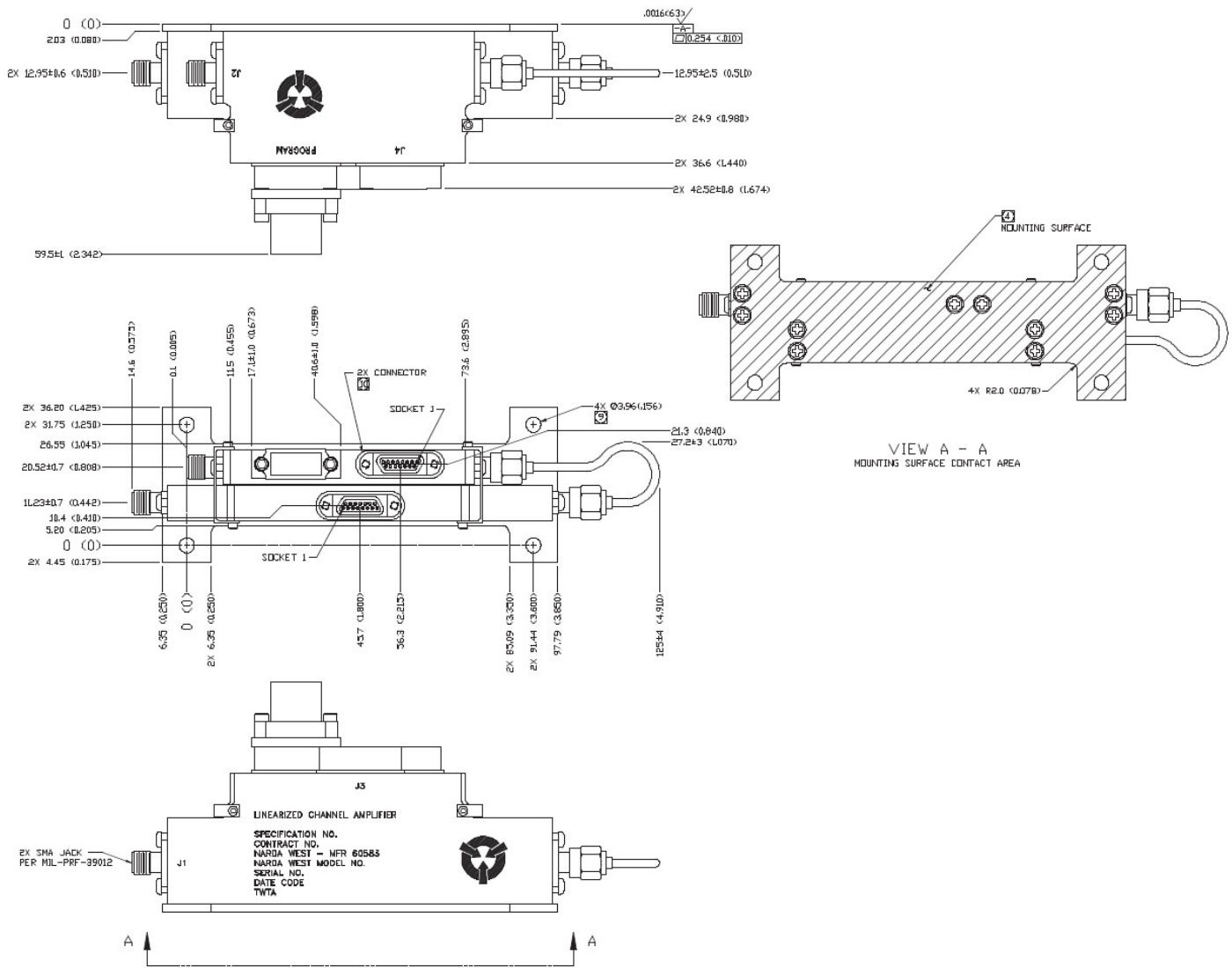
## SECTION 4 INTEGRATED LCAMP-TWTA REQUIREMENTS (CONTINUED)

Parameter	Unit	S-Band Specification	C-Band Specification	X-Band Specification	Ku-Band Specification	Ka-Band Specification
<b>AM/PM Conversion Coefficient LTWTA</b>	<b>deg/dB</b>					
at $P_{in\_sat}$ (0 dB IBO)		±4.5	±4.5	±4.5	±4.5	±4.5
at $P_{in\_sat}$ -3 dB (3 dB IBO)		±3.0	±3.0	±3.0	±3.0	±3.0
at $P_{in\_sat}$ -6 dB (6 dB IBO)		±2.5	±2.5	±2.5	±2.5	±2.5
at $P_{in\_sat}$ -9 dB (9 dB IBO)		±1.8	±1.8	±1.8	±1.8	±1.8
at $P_{in\_sat}$ -12 dB (12 dB IBO)		±1.2	±1.2	±1.2	±1.2	±1.2
at $P_{in\_sat}$ -15 dB (15 dB IBO)		±1.0	±1.0	±1.0	±1.0	±1.0
at $P_{in\_sat} < P_{in\_sat} - 20$ dB (20 dB IBO)		±0.5	±0.5	±0.5	±0.5	±0.5
<b>C/3IM Ratio (IBO is wrt single carrier <math>P_{in\_sat}</math>)</b>	<b>dBc</b>					
at $P_{in\_sat}$ -3 dB (3 dB IBO)		10	10	10	10	10
at $P_{in\_sat}$ -6 dB (6 dB IBO)		18	18	18	18	18
at $P_{in\_sat}$ -9 dB (9 dB IBO)		23	23	23	23	23
at $P_{in\_sat}$ -12 dB (12 dB IBO)		29	29	29	29	29
at $P_{in\_sat}$ -15 dB (15 dB IBO)		32	32	32	32	32
<b>NPR (IBO is wrt single carrier <math>P_{in\_sat}</math>)</b>	<b>dBc</b>					
at $P_{in\_sat}$ (0 dB IBO)		8	8	8	8	8
at $P_{in\_sat}$ -3 dB (3 dB IBO)		12	12	12	12	12
at $P_{in\_sat}$ -6 dB (6 dB IBO)		20	20	20	20	20
at $P_{in\_sat}$ -9 dB (9 dB IBO)		26	26	26	26	26
at $P_{in\_sat}$ -12 dB (12 dB IBO)		29	29	29	29	29
at $P_{in\_sat}$ -15 dB (15 dB IBO)		32	32	32	32	32

## SECTION 5: COMMAND AND TELEMETRY INTERFACE

Parameter	Unit	S-Band Specification	C-Band Specification	X-Band Specification	Ku-Band Specification	Ka-Band Specification
<b>Command Set</b>						
FGM/ALC Select		Pulse or Serial	Pulse or Serial	Pulse or Serial	Pulse or Serial	Pulse or Serial
GAIN/OUTPUT LEVEL ATTEN		Pulse or Serial	Pulse or Serial	Pulse or Serial	Pulse or Serial	Pulse or Serial
<b>Telemetry Set</b>						
FGM/ALC Status		Bi-Level	N/A	Bi-Level	Bi-Level	Bi-Level
GAIN/OUTPUT LEVEL STATE		Analog	N/A	Analog	Analog	Analog

# MECHANICAL OUTLINE



## Linearized Channel Amplifiers

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