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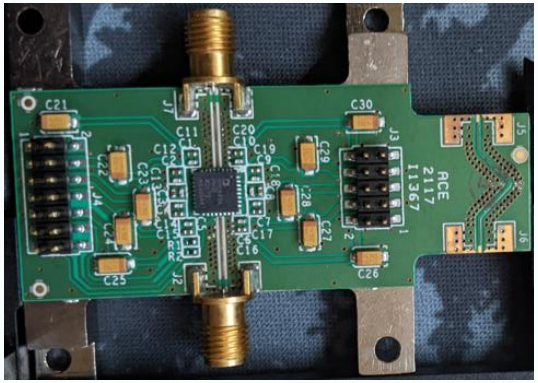
Ka band SSPA Specifications



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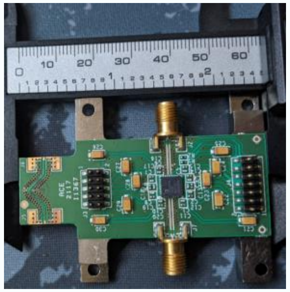
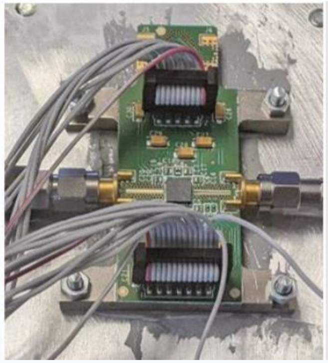
AstroComm Ka-band SSPA

- ✓ AstroComm has produced its first Ka-band SSPA prototype in May 2023.



- ✓ This unit has been thoroughly tested and characterized



- ✓ Following slides provide the detailed specifications

- ❖ AstroComm's nominal plan is to qualify this SSPA for a NASA Class D Mission equivalence
- ❖ Space Qualification to specific Customer Environmental Requirements will be performed as needed

Ka-band SSPA Specifications (1 of 5)

Parameter	Definition	Value
Operating Frequency	Operational Frequency band	24-29 GHz
(Forward) Small Signal Gain	Ratio of output power to input power, specified in the small-signal linear gain region, with a signal applied at the input. G (dB) = 10 $\log_{10}$ G.	20.5 dB
DC Efficiency	Ratio of the output power delivered to the load to the DC power applied to the amplifier.	50%+
Power Added Efficiency (PAE)	PAE is a metric for rating the efficiency of a power amplifier that takes into account the effect of the gain of the amplifier PAE=(RFP_{out} - RFP_{in})/P_{DC}	35-50%
Output Power	The output power from the amplifier, at a particular load impedance, at the 1 dB compression point.	33 dBM (avg) 1.5 W
Noise Factor/Noise Figure	The Noise Factor (F) is the ratio of signal-to-noise power ratio at an amplifier's input to the signal-to-noise power ratio at the output. Noise Figure NF = 10 $\log_{10}$F in dB	Noise Figure 4.5 dB
Harmonics	Harmonic output (typically second and third) with respect to the fundamental or main carrier signal in dBc at a set power output.	3^{rd} : 39 dBc
Impedance, Input and Output	Impedance at the operating regime of the power amplifier.	50 Ohms input & output
DC Power Supply Voltage	This is applied power supply voltage to the RFPA	5.5 V DC

Ka-band SSPA Specifications (2 of 5)

Parameter	Definition	Value
DC Power Supply Current	Current required for the correct operation of the RFPA	1300 mA
Spurious Signal Power	Introduced by the amplifier, non-signal related. Defined at a level relative to the fundamental signal and levels of minus 70dBc are typical for a good amplifier design. Quoted at a set output power level.	-70dBc
Input and output VSWR	Voltage standing wave ratio defined as ratio of the highest amplitude wave and the lowest amplitude wave.	1.58
Maximum input power	The maximum input power that can be applied to the RFPA inputs	20 dBm
Stability	Stability of an RFPA is an indication of how immune it is to self-oscillation, so that it does not generate a signal at its output without an applied input.	Unconditionally stable
Input and output connectors	SMA, BNC etc	SMA/2.4mm
Return Loss (RL)	Ratio of reflected power to incident power at the RF port, expressed as RL = -20 log |p|, where p is voltage reflection coefficient	10 – 12 dB
Isolation/Reverse Gain	Output power that leaks to the input	-55 dB @27 GHz

Ka-band SSPA Specifications (3 of 5)

Parameter	Definition	Value
Gain flatness	The variation of an amplifier's gain characteristic over the full frequency response range, at a given temperature (± dB). The value is obtained by taking the difference between maximum and minimum gain, and dividing it by 2	1.5 dB
Linearity and the 1dB Compression Point	1 dB compression point defines the output level at which the amplifier's gain is 1 dB less than the small signal gain, or is compressed by 1 dB (P1dB). Below this point the relationship between the input power and the output power is linear. As the amplifier approaches and exceeds the 1 dB compression point the performance of the amplifier is no longer linear. The output power of an amplifier cannot increase indefinitely and when an increase input power generates no discernible increase in output power, the amplifier is said to be saturated, and by definition the output is not proportional to the input signal. This point is often referred to as Psat or P3dB	33 dBm
Two tone third order intercept point	Two-Tone Third-order intercept point is a measure of third-order products generated by two equal-amplitude signals arriving simultaneously at the input of a device such as an amplifier. If F1 and F2 are the frequencies of the two signals arriving at the input, the amplifier generates intermodulation products at its output due to inherent non-linearity, in the form ± mxF1 ± nxF2 where m and n are positive integers which can assume any value from 1 to infinity	37.5 dBm

Ka-band SSPA Specifications (4 of 5)

Parameter	Definition	Value
Directivity	Active Directivity is defined as the difference between isolation and forward gain in dB. It is an indication of the isolation of the source from the load, or how much the load impedance affects the input impedance and the source impedance affects the output impedance. The higher the active directivity (in dB), the better the isolation	75 dB
Dynamic Range	Dynamic range (SFDR) is the power range over which an amplifier provides useful linear operation, with the lower limit dependent on the noise figure (and/or spurious levels) and the upper level a function of the 1 dB compression point.	80.5 dB
SSPA Mass		150 g
SSPA Size	width x length x height	45mm x 80mm x 15mm
Enclosure	Optional specification but may be required in some cases	RF shielding
Cooling	As needed (forced air, TEC, etc)	Forced Air
Ambient Temperature	Temperature range across which SSPA can operate	-40°C to 85°C
Storage Temperature	Temperature range across which SSPA can be stored without subsequent degradation in performance	-65C to 120°C

Ka-band SSPA Specifications (5 of 5)

Parameter	Definition	Value
AM – AM Conversion	AM to AM conversion is the measure of AM-AM distortion (nonlinear) in the RFPA. These are undesired amplitude changes due to temperature as well as power supply variations and multipath fading of the RF signal. This type of distortion is more severe in amplitude modulated signals such as QAM, AM etc. Unit of AM – AM conversion is dB/dB. It can also affect the constellation of QPSK signal.	TBD
AM – PM Conversion	AM-to-PM conversion measures the amount of undesired phase deviation (PM) that is caused by amplitude variations (AM) of the system. For example, unwanted phase deviation (PM) in a communications system can be caused by: Unintentional amplitude variations (AM) · Power supply ripple, Thermal drift, Multi-path fading Intentional modulation of signal amplitude · QAM, Burst modulation AM-to-PM conversion is usually defined as the change in output phase for a 1-dB increment in the power-sweep applied to the amplifier's input (i.e. at the 1 dB gain compression point). It is expressed in degrees-per-dB (°/dB). An Ideal amplifier would have no interaction between its phase response and the power level of the input signal	<0.1 Deg/dB