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TECHNOLOGICAL DEVELOPMENTS FOR VGOS FROM IGN YEBES OBSERVATORY

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- Radiotelescopes
- Low Noise Amplifiers
- Broadband Feeds
- Receivers
 - Triband receiver
 - Phase Cal
 - Broadband receiver



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RADIOTELESCOPES



YEBES

- ✓ Quasi-Operational
- ✓ Triband S/X/Ka installed
- ✓ Already participating IVS sessions
- ✓ Broadband 2016

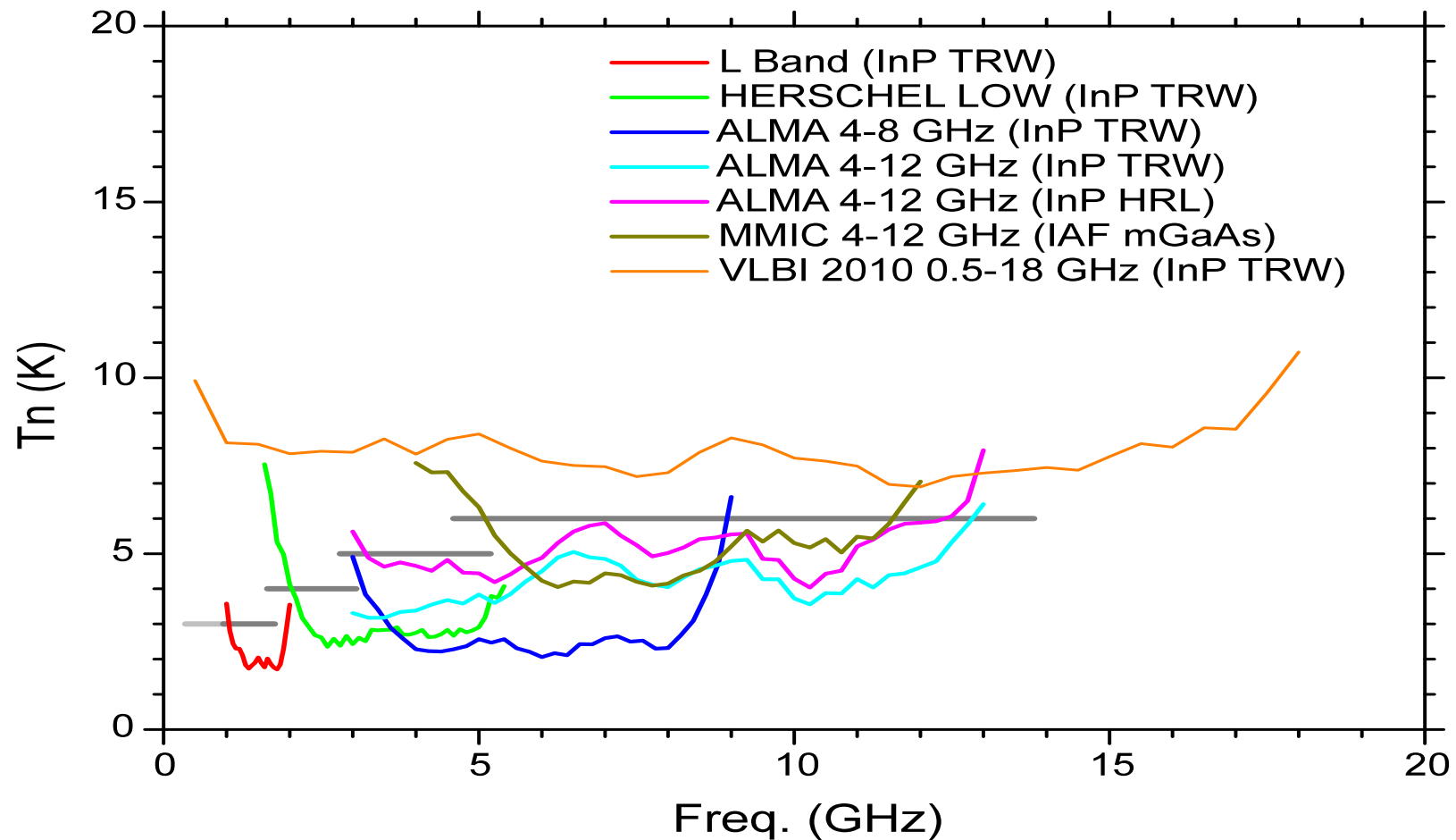


SANTA MARIA

- ✓ Not Operational until 2016
- ✓ Triband S/X/Ka first light receiver already built
- ✓ Broadband 2017

LOW NOISE AMPLIFIERS

Noise Temperature of various YEBES amplifiers ($T_{amb}=15K$)





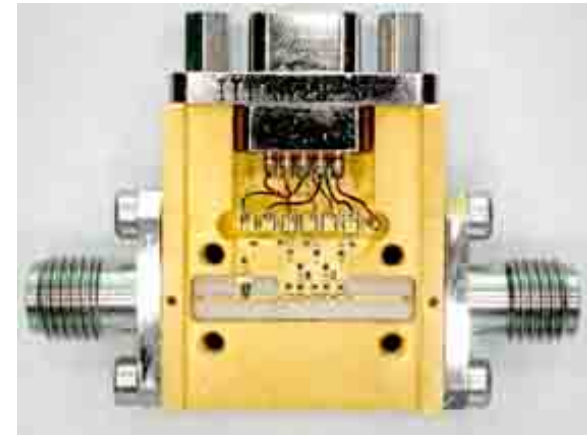
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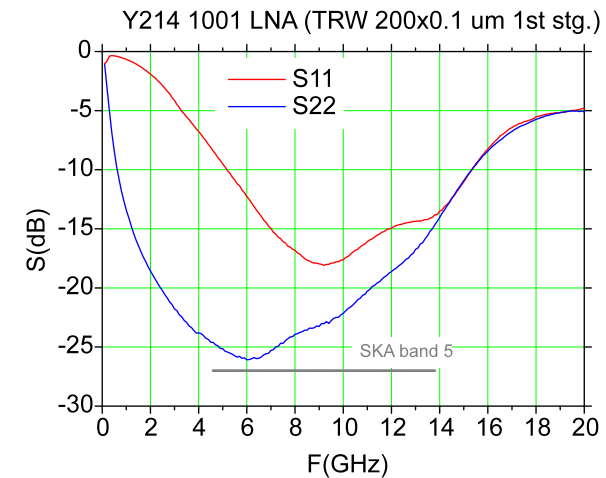
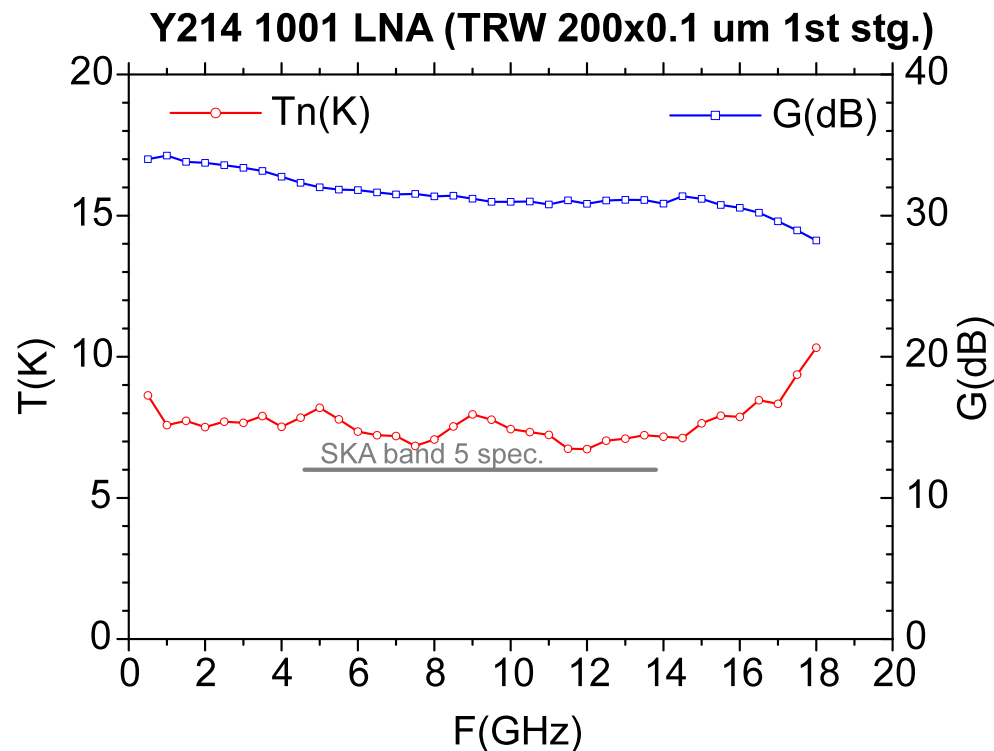
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Wide Band 2-14 GHz: Hybrid

- Discrete HEMT prototype
- 2-14 GHz
- TRW InP in 1st stg
- $T_n \sim 7.4$ K (avg. in band)
- NO ISOLATOR possible



Y214G-1001 1
(Dec 2013)





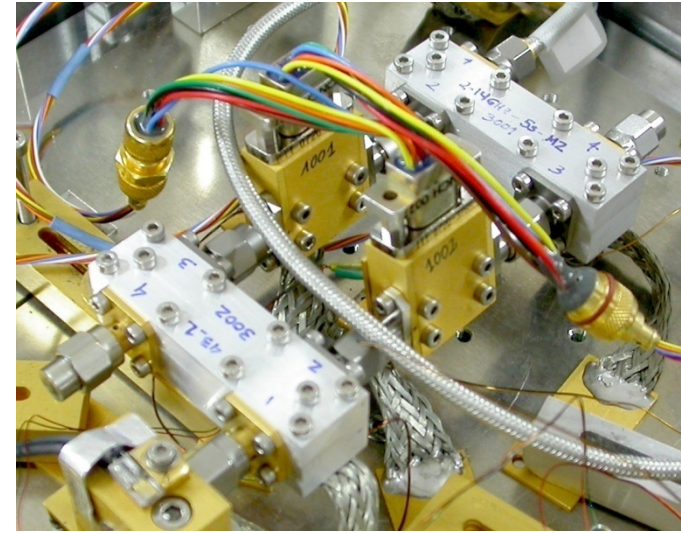
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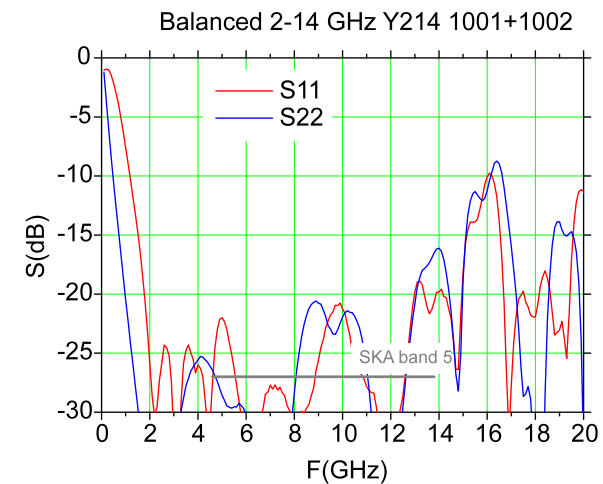
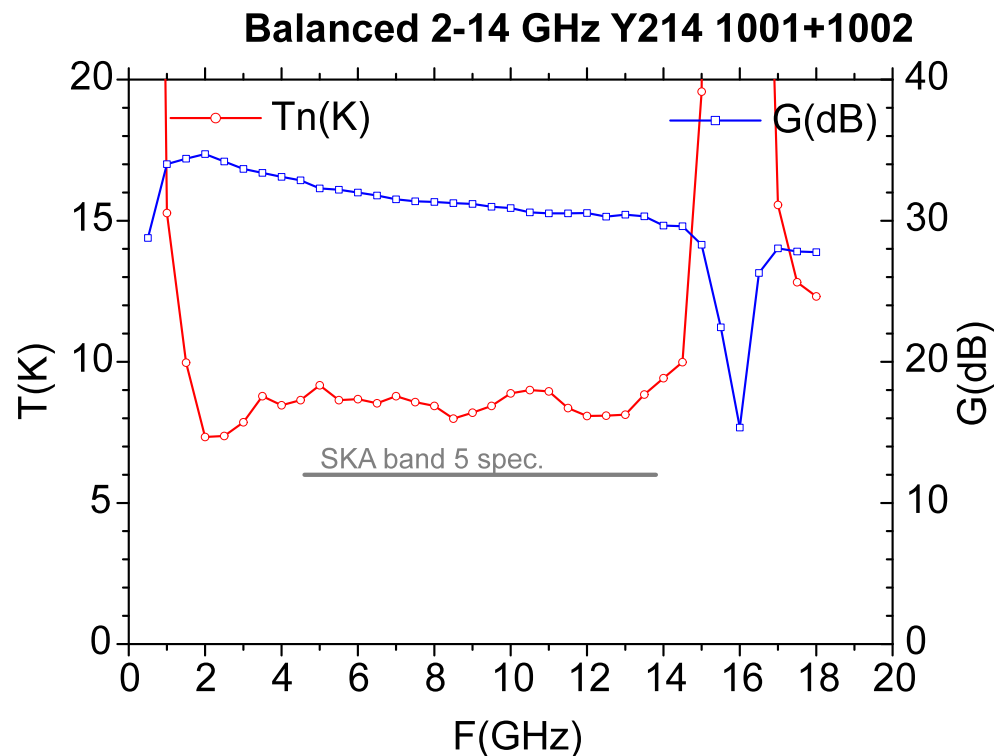
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Wide Band 2-14 GHz: Balanced

- Discrete HEMT prototype
- 2-14 GHz
- TRW InP in 1st stg
- $T_n \sim 8.4$ K (avg. in band)
- Balanced configuration



Y214G-1001+ 1002
(July 2014)





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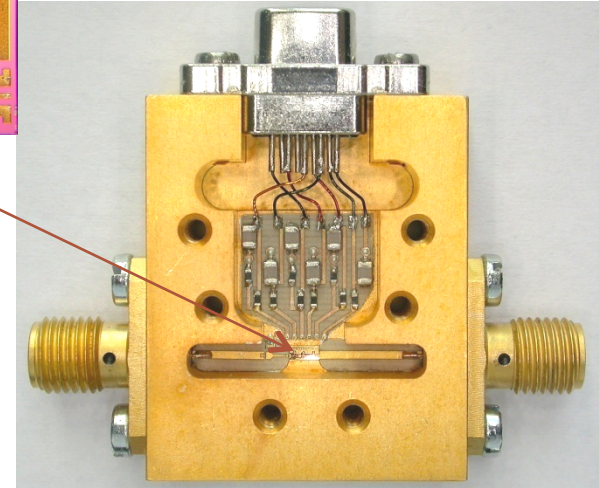
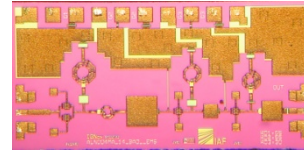
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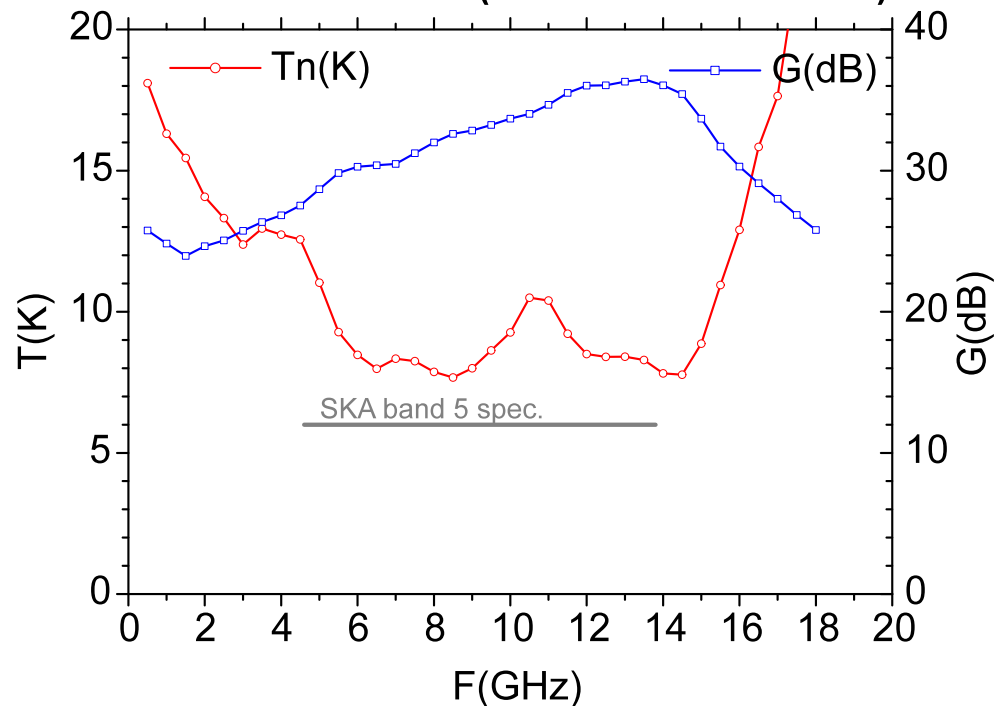
Wide Band 2-14 GHz: MMIC

MMIC IAF R760 2-14 GHz:

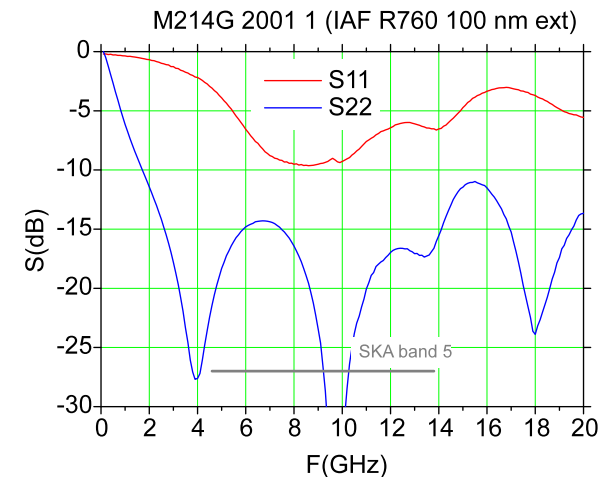
- First attempt, early prototype
- Designed for 2-14 GHz
- 100 nm process
- $T_n \sim 9.8$ K (avg. in band 2-14 GHz)
- Can not be optimally biased (osc.)
- Non compliant result yet but more versions to come



M214G 2001 1 (IAF R760 100 nm ext)



M214G-2001 1 (March 2015)





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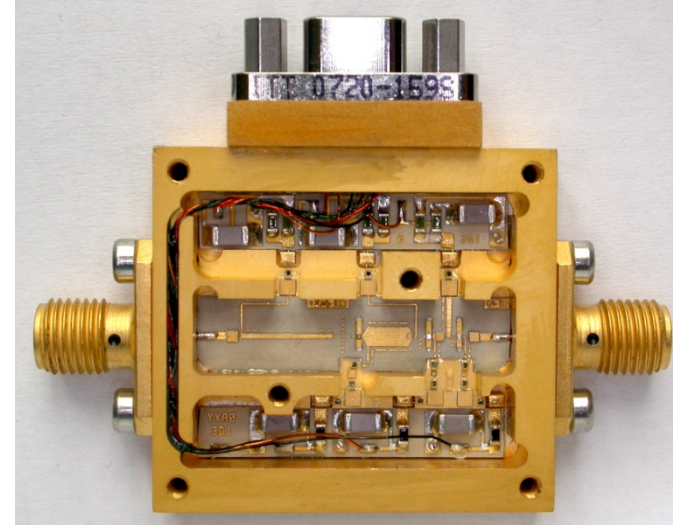
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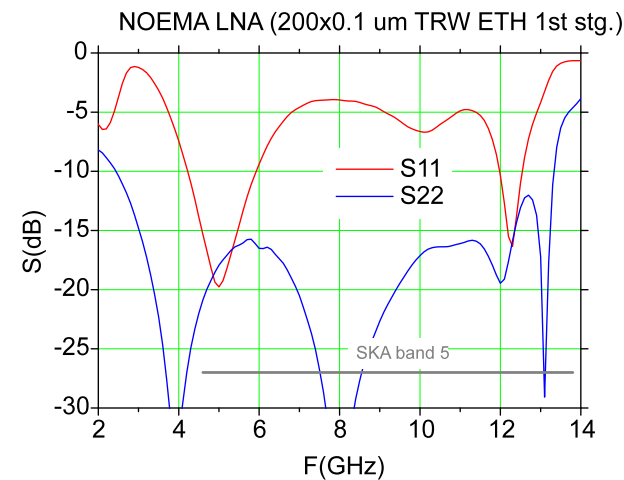
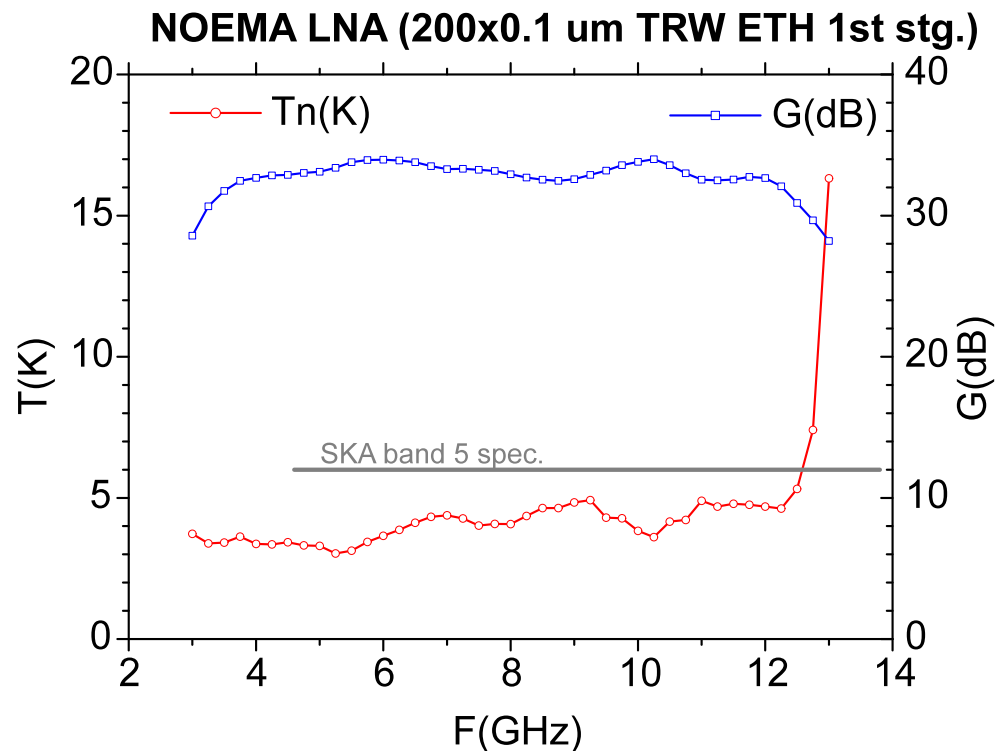
"Narrow" Band 4-12 GHz

Narrow band LNA to avoid RFI (low band):

- TRW InP in 1st stage (test)
- $T_n \sim 4.05$ K (avg. in band)
- ISOLATOR (PAMTECH) at input



YXA 1222 2
(Sep 2014)





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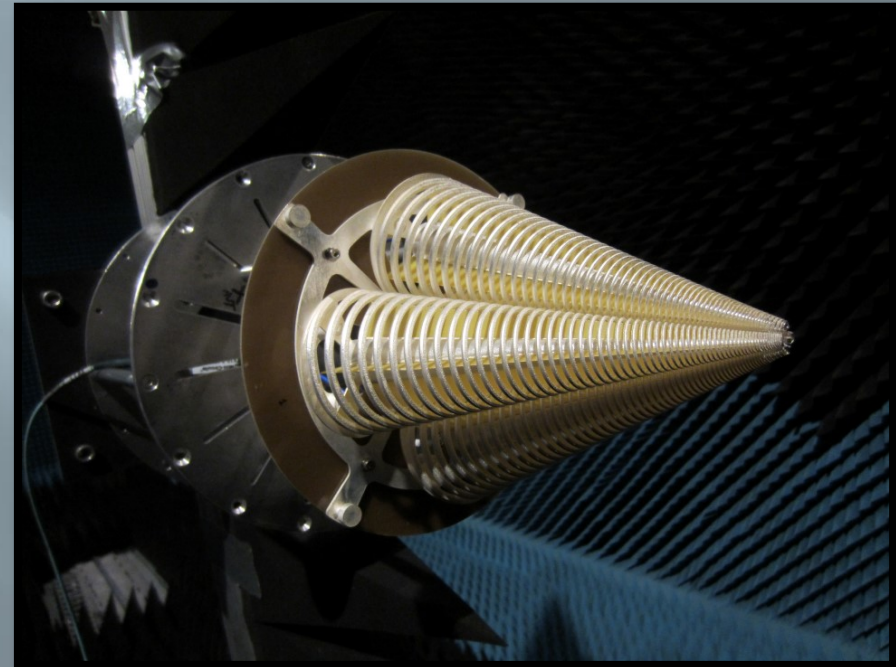
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BROAD BAND FEEDS

DYQSA

- Band: 2-14 GHz
- Dual circular polarization
- Gain < 10 dB
- Beamwidth (-16dB): 130°



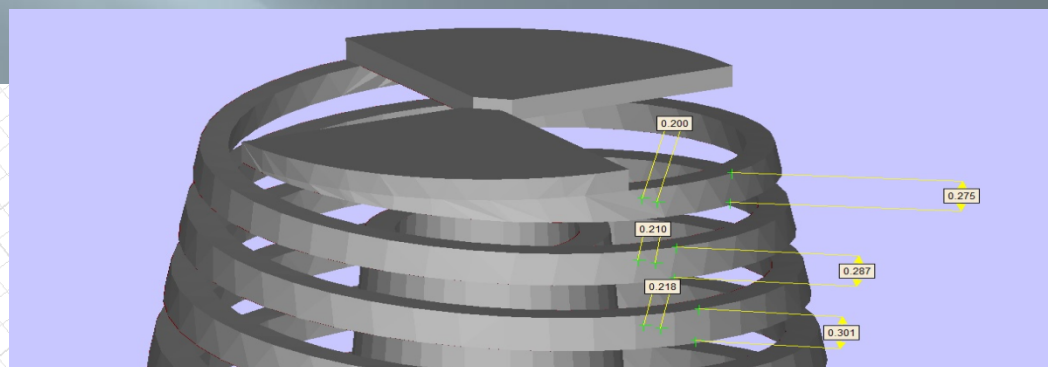
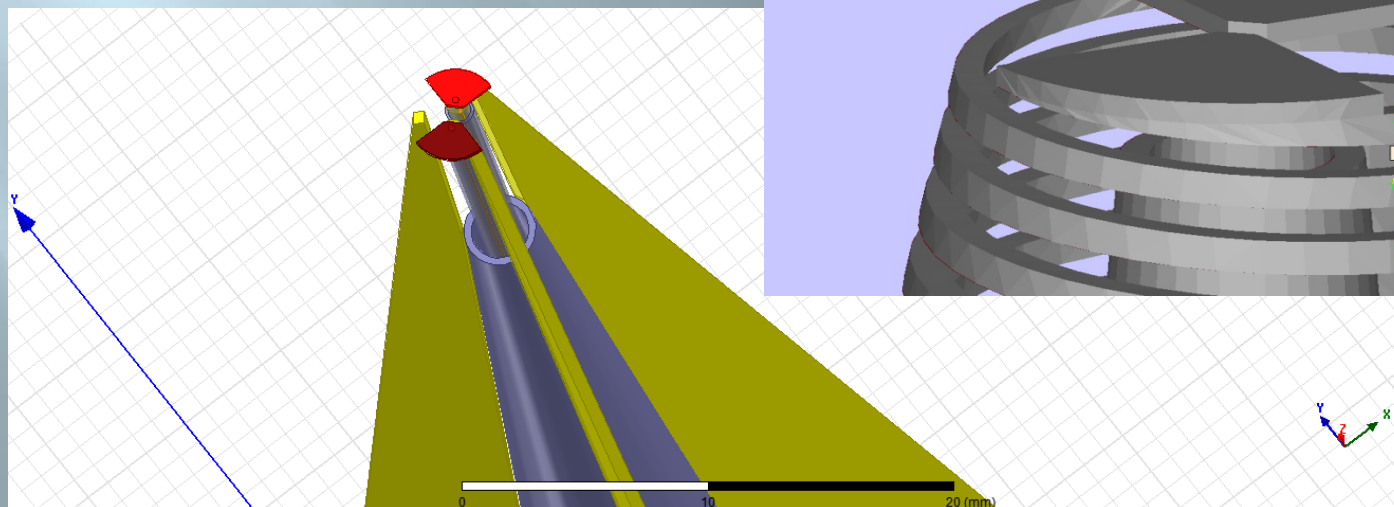
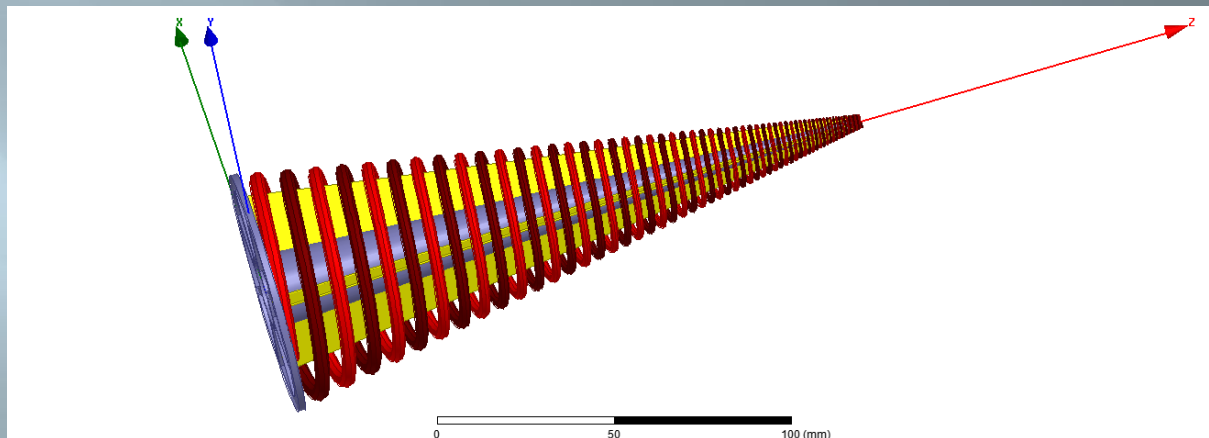
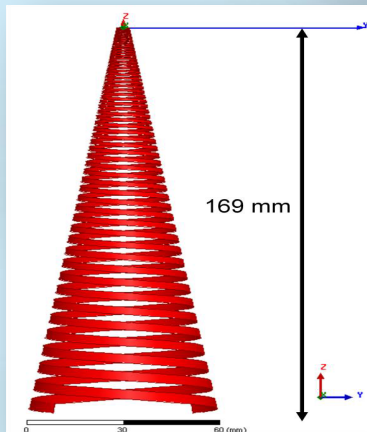


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Fabrication



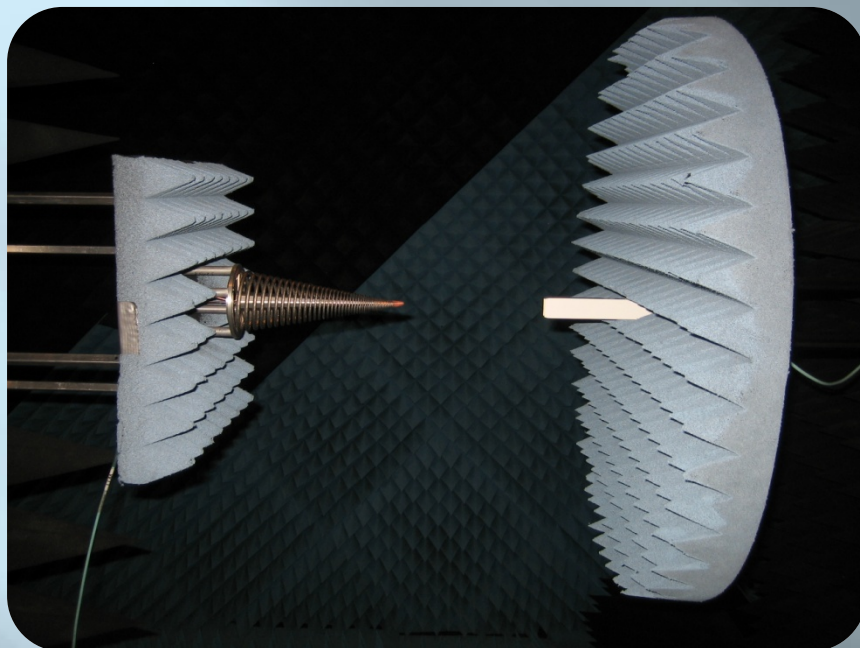


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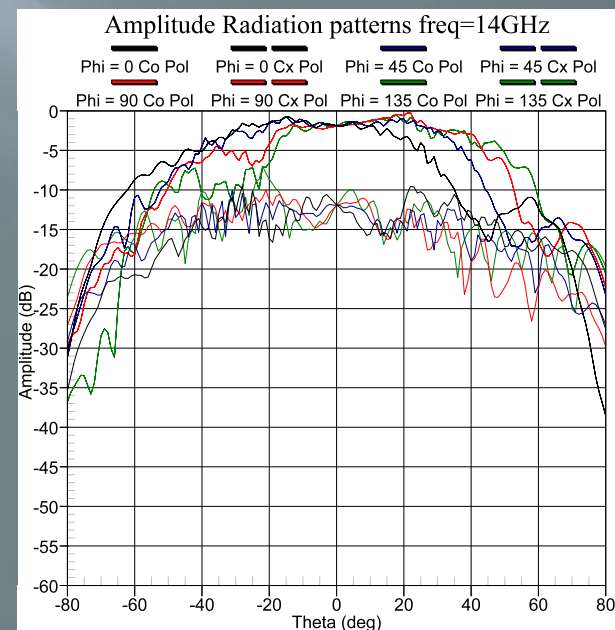
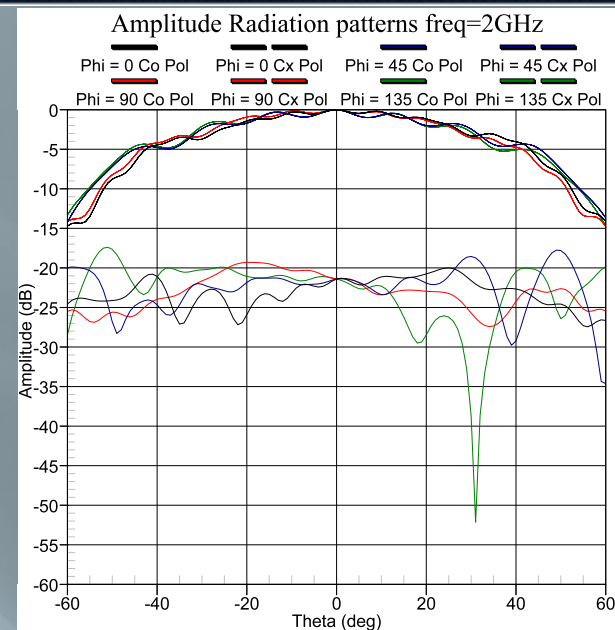
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FSP: Feed Single polarization



**Measurement setup in Yebes
Anechoic Chamber**





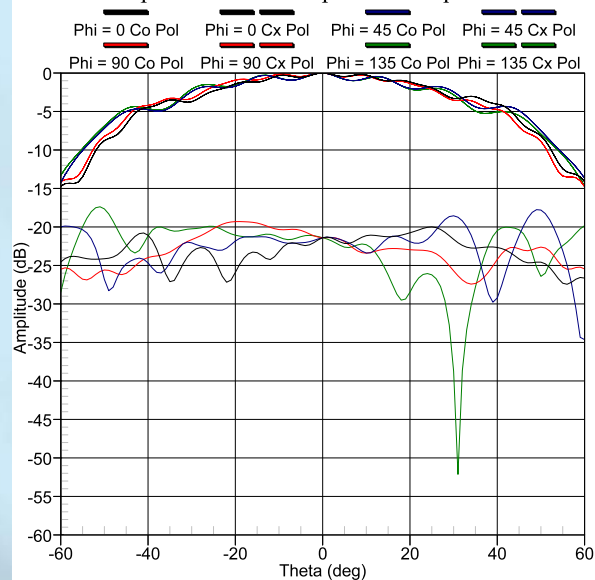
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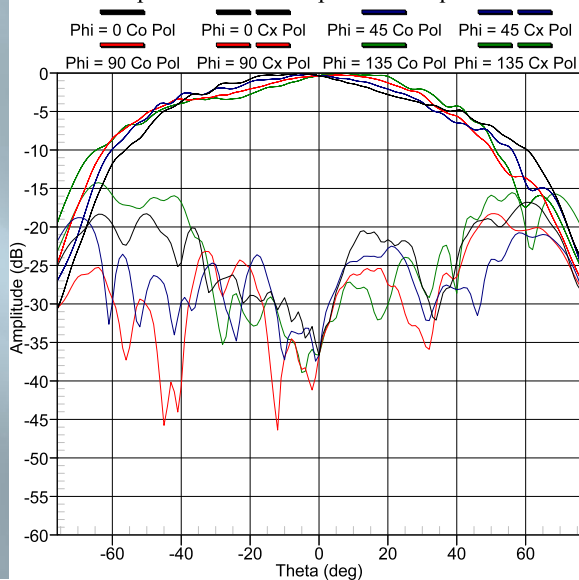
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FSP: Radiation Pattern

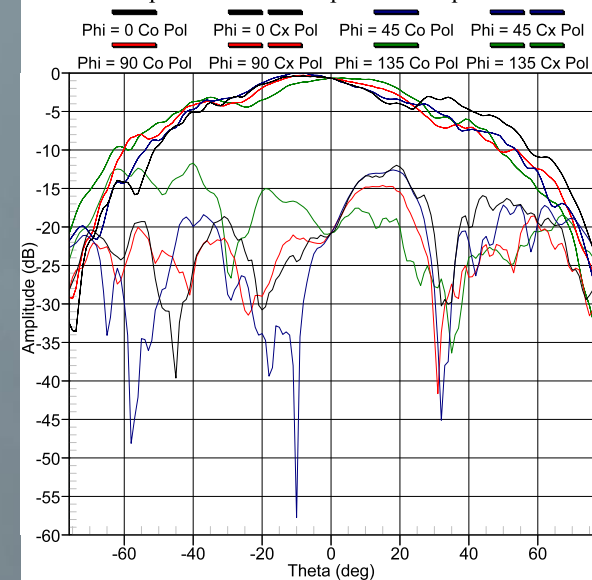
Amplitude Radiation patterns freq=2GHz



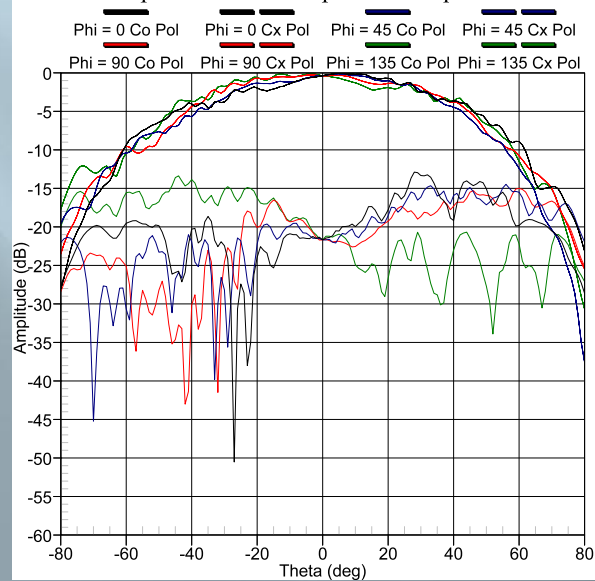
Amplitude Radiation patterns freq=5GHz



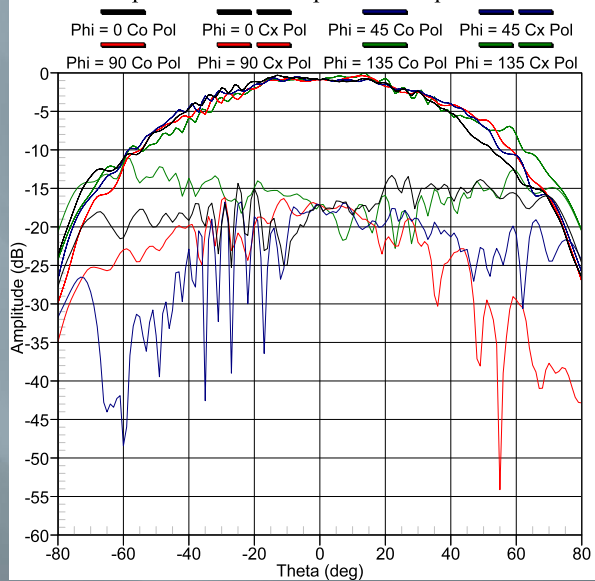
Amplitude Radiation patterns freq=7GHz



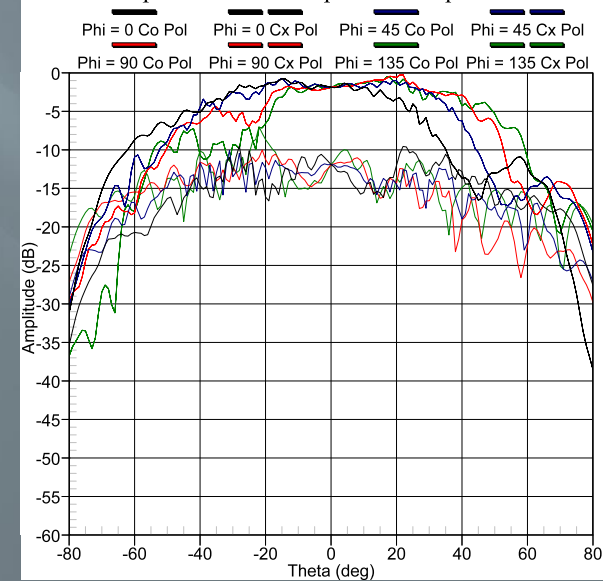
Amplitude Radiation patterns freq=9GHz



Amplitude Radiation patterns freq=11GHz



Amplitude Radiation patterns freq=14GHz





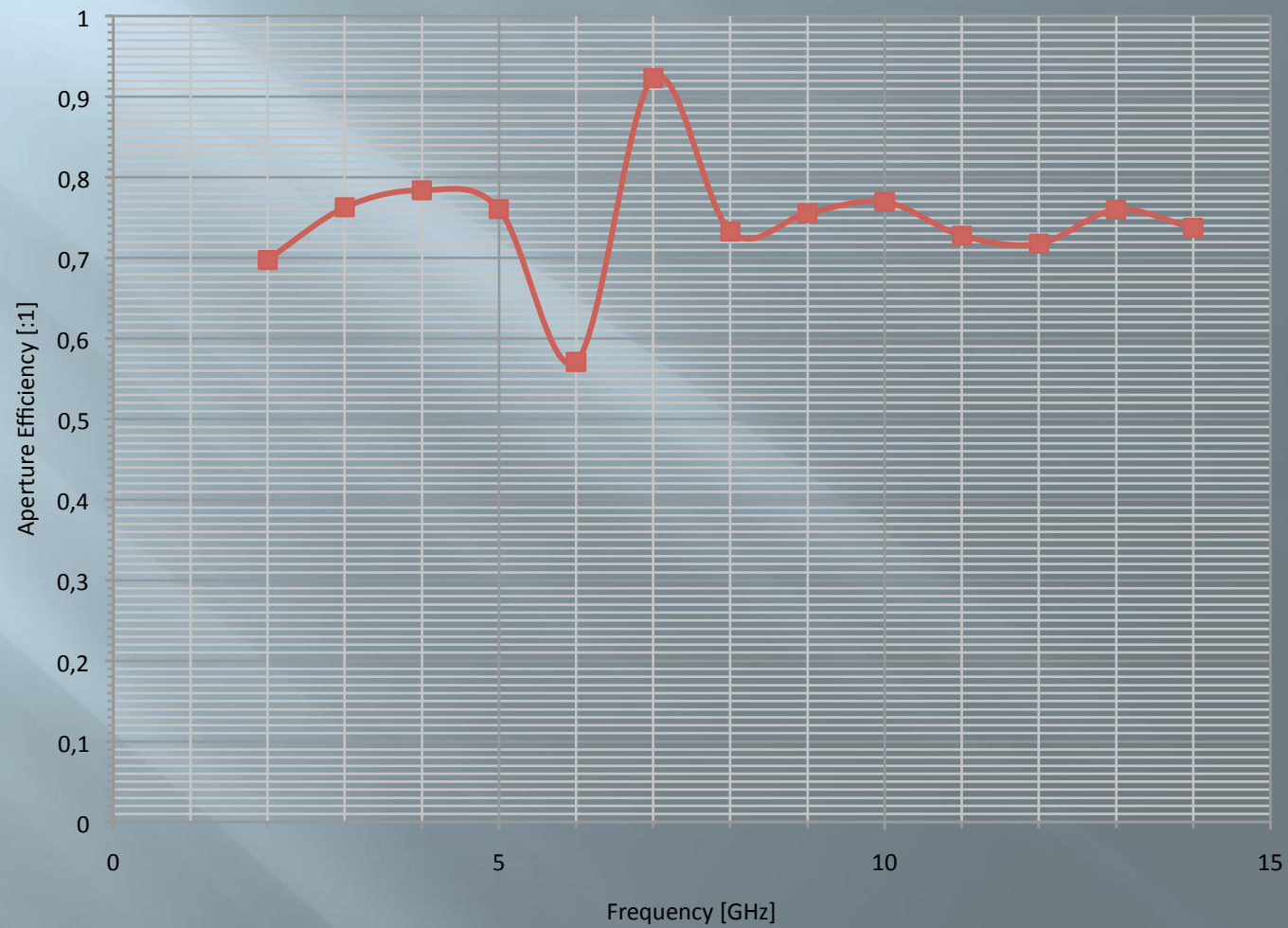
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FSP: Radiotelescope efficiency

Aperture Efficiency



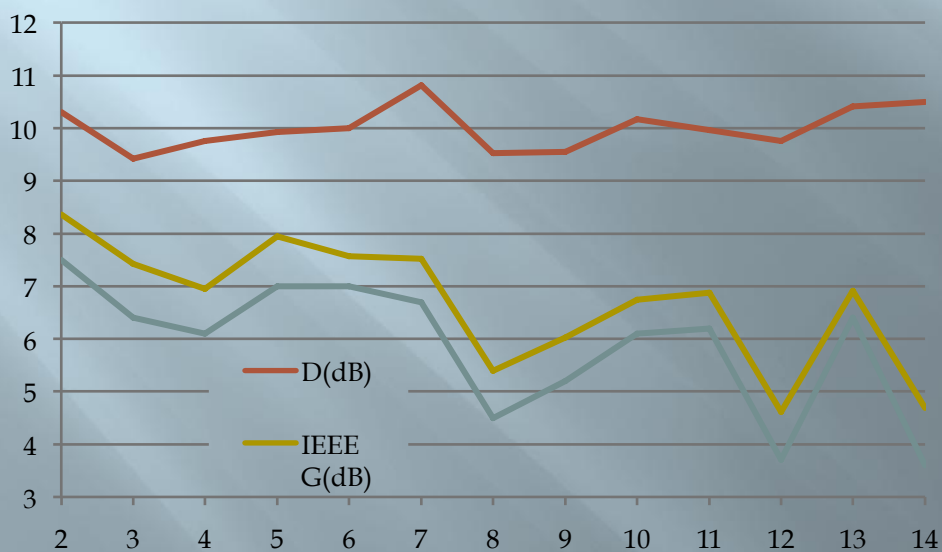
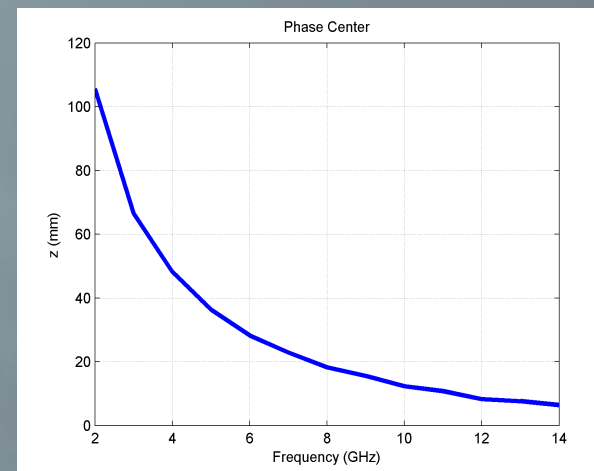
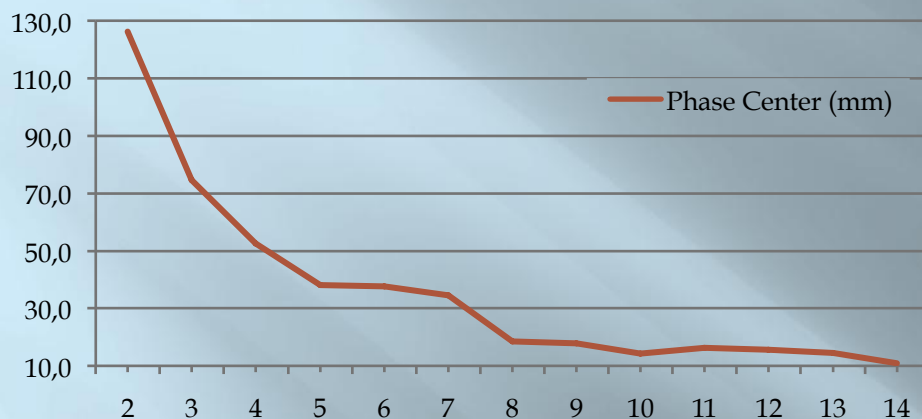


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FSP: Other parameters



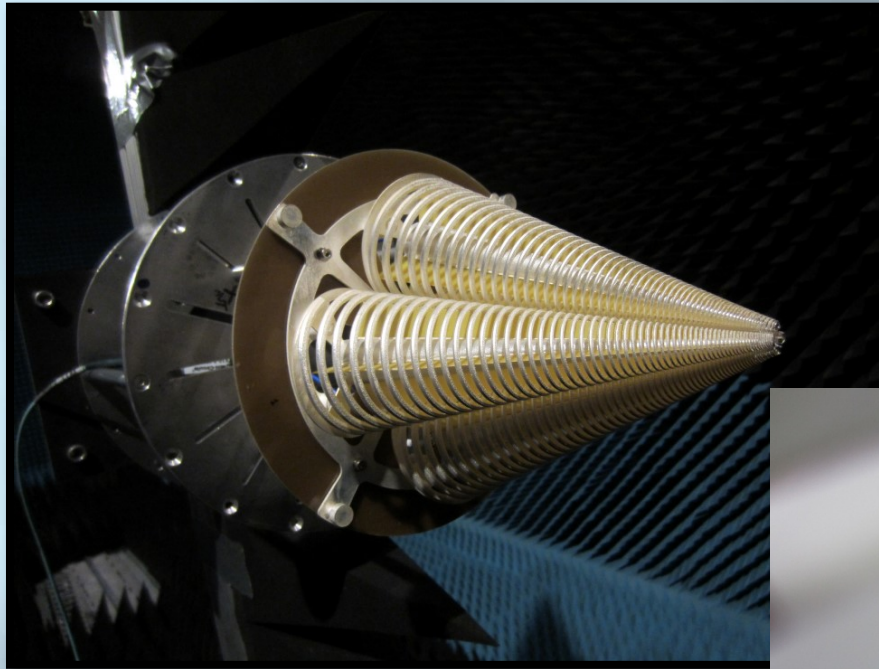


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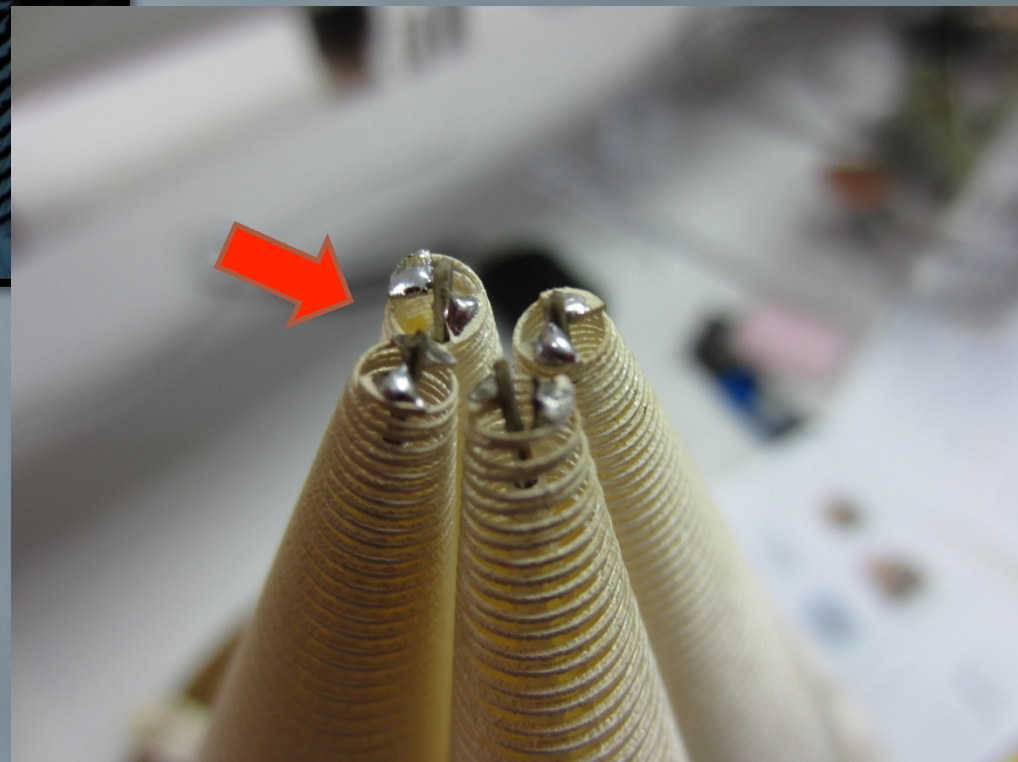
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FDP: Feed Double polarization



**4 elements
2
polarizations
(LHCP-RHCP)**





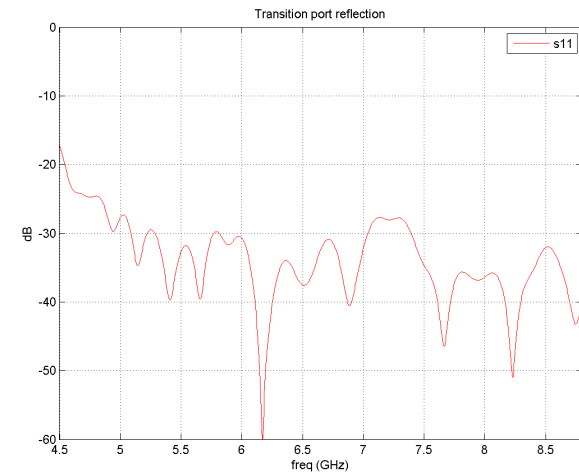
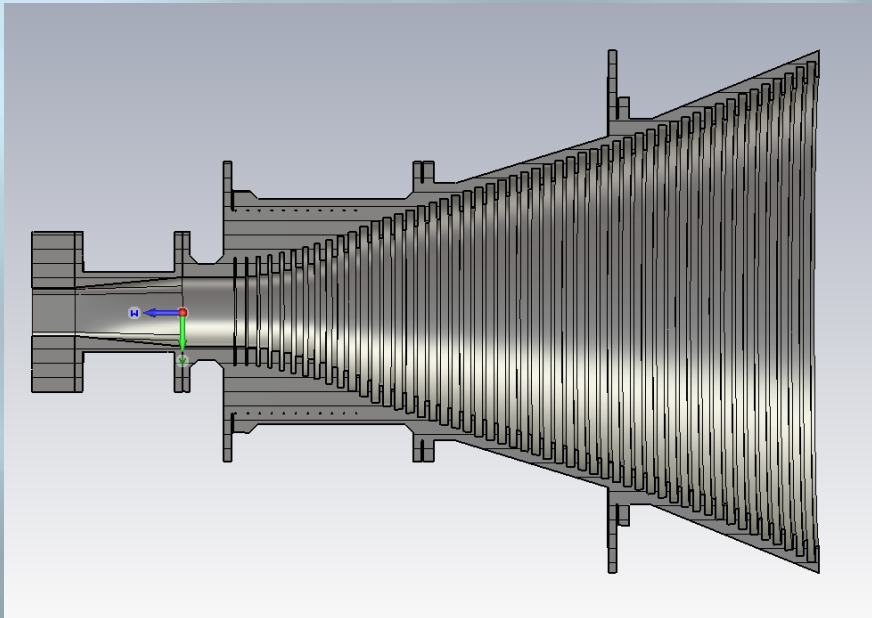
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Broad band corrugated horn

- Feed design to cover from 4.5GHz to 8.8GHz with a constant beamwidth (64% relative bandwidth)
- Optimised inner profiled corrugated horn



- Construction of an scaled model in frequency 3:1 (13.5 GHz to 26.4 GHz) to validate design

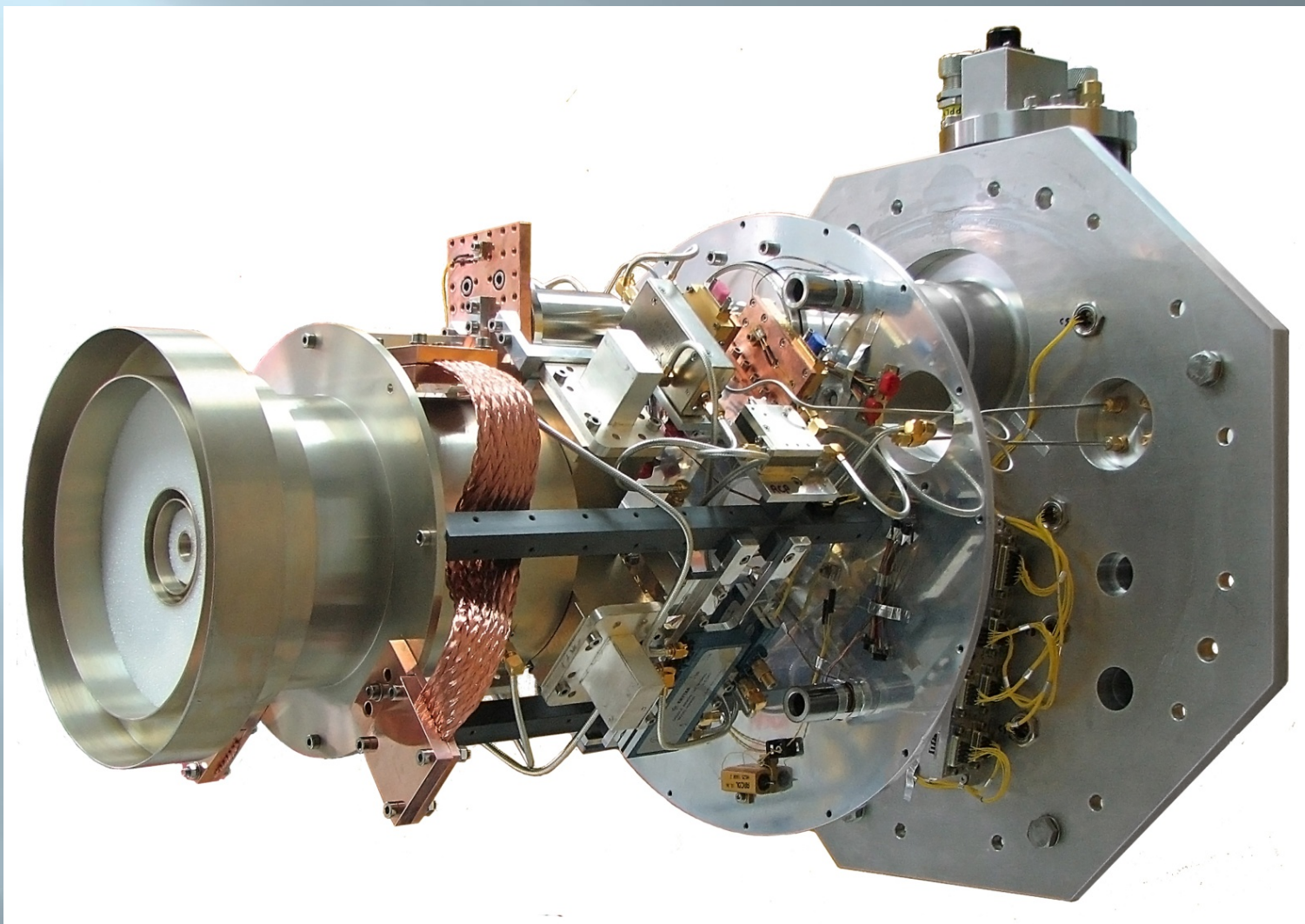


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RECEIVERS: Triband



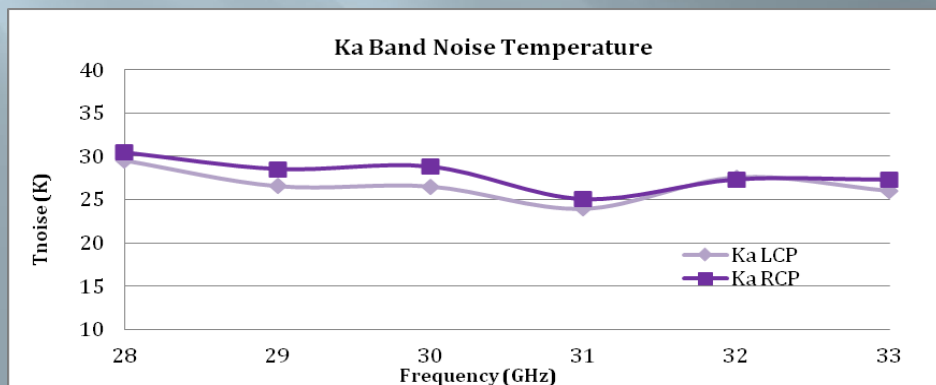
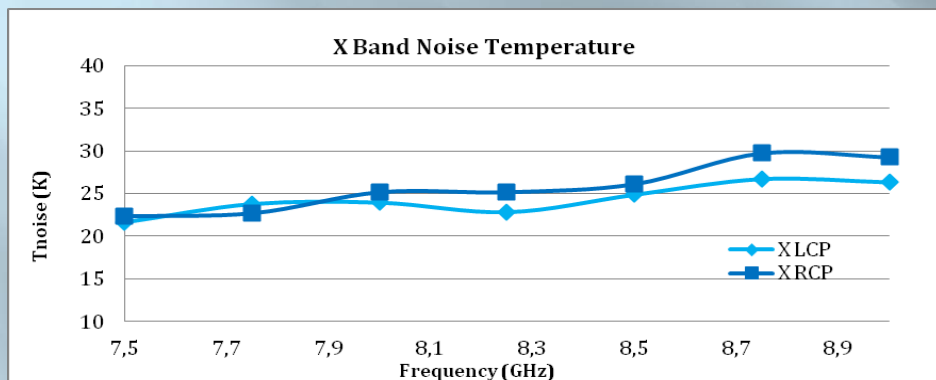
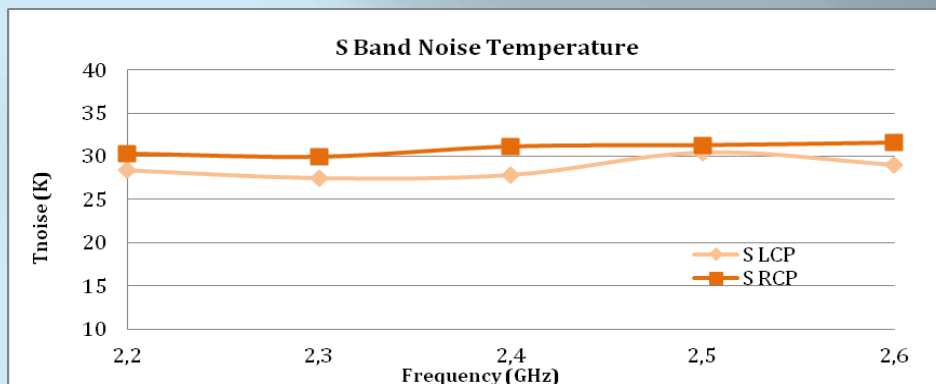


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Triband receiver:Performance



Frequency	S :2.2-2.6 GHz X:7.5-9.0 GHz Ka: 28-33 GHz
Taper	65° at -16 dB
Noise Temp.	< 30 K all bands
RF outputs	LCP&RCP

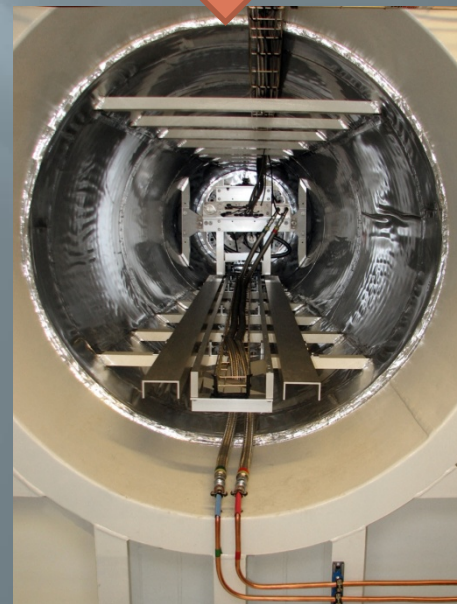
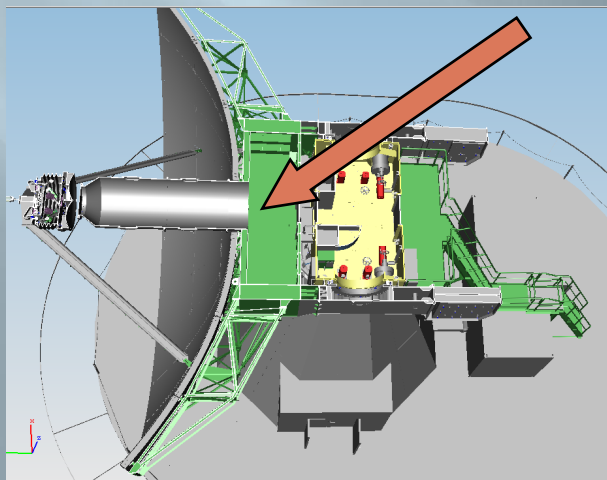
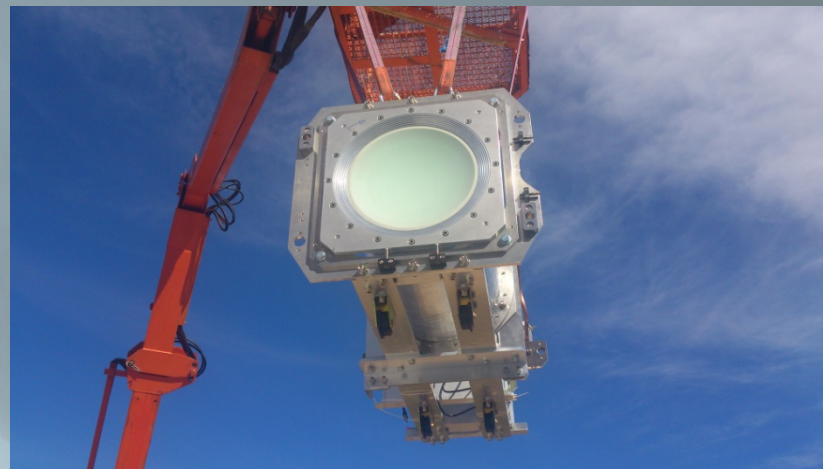
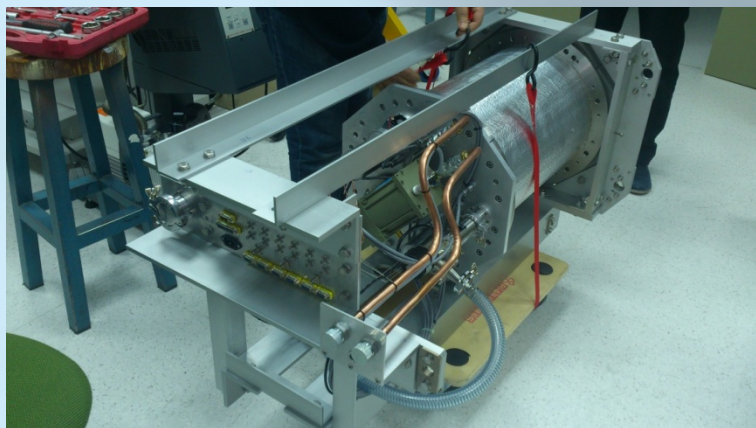


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Installation





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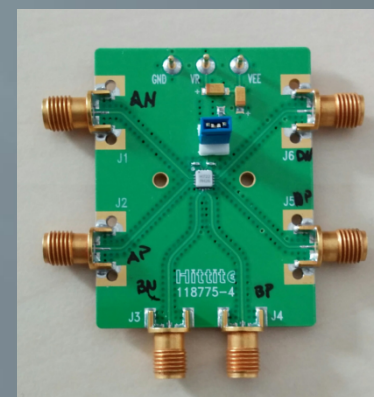
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Phase Cal

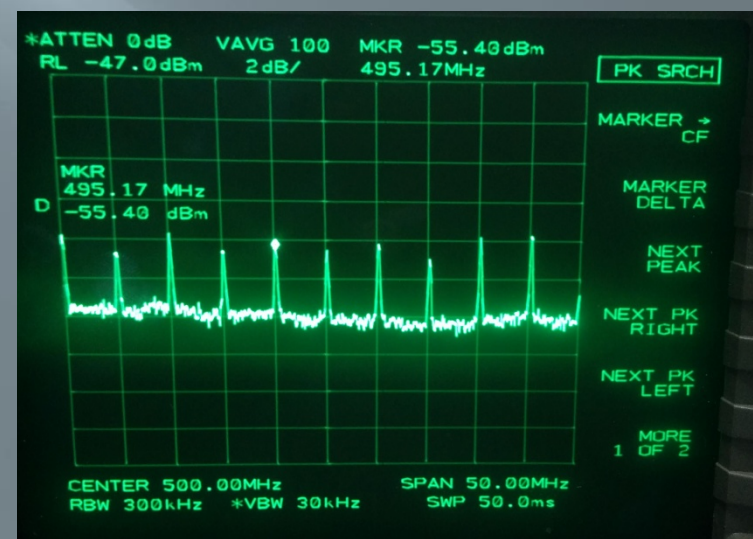
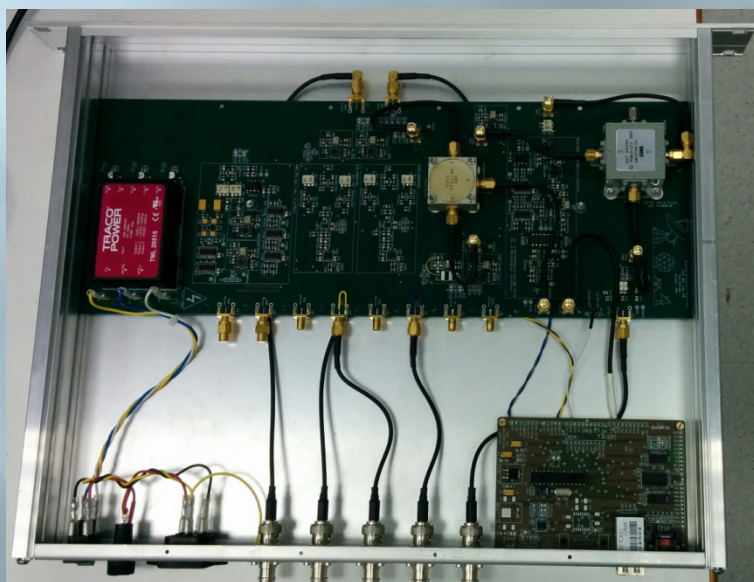
- 2 to 14 GHz
- Ka band pulses by mixing

ANTENNA UNIT

- Based on Hitite Ultrafast logic gates



GROUND UNIT





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Broadband receiver

