



S²MARTS Project: Frequency Selected Limiters Manufacturing Development
Request For Solutions (RFS) Question & Answer | Date: April 28, 2021

1. Question: What are the specifications for GGG Substrates? a. Diameter, orientation, flat and flat orientation, thickness, TTV, defect specification (dislocation/cm², other defects)

Answer: See below for commercially available wafer specifications. These would be the baseline minimum with the expectation they would be tailored to meet requirements of limiters and filter manufacturing needs:

Lattice parameter	12.383 Å ± 0.001 Å	
Edge	Rounding by beveling	
Flatness	≤ 6 μm over central 80% area	
TTV	≤ 6 μm over central 80% area	
Defects		Results to be provided
Dislocations	≤ 1 per cm ² over centered area covering 80% of the total surface	Maximum number on a piece of the lot
Other defects on epi face	≤ 10 over centered area covering 80% of the total surface	Maximum number on a piece of the lot
Surface finish	Etched	
Thickness	Standard thickness is 500 μm ± 50 μm Other thicknesses available on request	
Packaging	≤ 5 pieces Individual box > 5 pieces Collective box with 25 pieces maxi per box	

ORIENTATIONS AND DIMENSIONS DATA

ORIENTATIONS	DIAMETER	LARGE FLAT	SMALL FLAT
Epi face on (111) plan ± 0.1°	1" ± 0.005" (25.4 ± 0.127 mm)	0.40" ± 0.035" (10.16 ± 0.89 mm)	0.25" ± 0.035" (6.35 ± 0.89 mm)
Large flat perpendicular to [-110] direction ± 2°	2" ± 0.005" (50.8 ± 0.127 mm)	0.552" ± 0.035" (14.02 ± 0.89 mm)	0.394" ± 0.035" (10.00 ± 0.89 mm)

Small flat perpendicular to [-1-12] direction $\pm 2^\circ$	3" ± 0.005 " (76.2 ± 0.127 mm)	0.75" ± 0.04 " (19.05 ± 1.02 mm)	0.50" ± 0.04 " (12.70 ± 1.02 mm)
Epi face on (110) plan $\pm 0.1^\circ$	1" ± 0.005 " (25.4 ± 0.127 mm)	0.40" ± 0.035 " (10.16 ± 0.89 mm)	0.25" ± 0.035 " (6.35 ± 0.89 mm)
Large flat perpendicular to [-111] direction $\pm 2^\circ$			
Small flat perpendicular to [1-12] direction $\pm 2^\circ$	2" ± 0.005 " (50.8 ± 0.127 mm)	0.552" ± 0.035 " (14.02 ± 0.89 mm)	0.394" ± 0.035 " (10.00 ± 0.89 mm)
Epi face on (001) plan $\pm 0.1^\circ$	1" ± 0.005 " (25.4 ± 0.127 mm)	0.40" ± 0.035 " (10.16 ± 0.89 mm)	0.25" ± 0.035 " (6.35 ± 0.89 mm)
Large flat perpendicular to [010] direction $\pm 2^\circ$			
Small flat perpendicular to [-100] direction $\pm 2^\circ$	2" ± 0.005 " (50.8 ± 0.127 mm)	0.552" ± 0.035 " (14.02 ± 0.89 mm)	0.394" ± 0.035 " (10.00 ± 0.89 mm)
	3" ± 0.005 " (76.2 ± 0.127 mm)	0.75" ± 0.04 " (19.05 ± 1.02 mm)	0.50" ± 0.04 " (12.70 ± 1.02 mm)

2. Question: YIG Film specification: Is it free standing film or is it YIG on GGG; thickness of the film, quality specification, magnetic properties?

Answer: YIG on GGG. Expectation of the film is that thickness, quality and magnetic properties would be tailored to support specifications of limiters and filters.

3. Question: What is the expected volume? 2000 wafers/year: is that GGG, YIG on GGG and at what diameter?

Answer: We anticipate the GGG wafer target diameter would be 4" to increase cost efficiency of manufacturing for end product. However, if respondents are able to achieve the yield and cost goals using smaller diameters, then that may be proposed. The Government's initial expectation is the wafer manufacturing process is targeted to support end item limiter or filter but it is plausible to believe capability to make wafers could enable sales of the bare GGG wafer which would drive required/desired manufacturing volume to 2000 wafers a year or more.

4. Question: Can you confirm that the funding in Phase 1 includes and can be used for procurement of new equipment, existing equipment modifications and facility modifications?

Answer: Yes, as outlined in Phase 1 of the RFS and the project deliverables.



5. Question: How do you envision funding precious metals for crucibles?

Answer: It is up to the contractor to propose how to best utilize awarded funding to facilitate performance to the statement of work.

6. Question: Is the goal to have a single supplier for GGG/YIG and the FSL and AtF devices? Can the GGG/YIG supplier subcontract the device design and production?

Answer: The goal is to establish a minimum of one domestic (US) supplier with the rights to use processes established during the effort to other domestic suppliers. Any agreements shall address and be in compliance with 10 U.S.C. § 2371b eligibility criteria as further defined in the RFS.

7. Question: How many FSL and AtF devices are to be fabricated in Phase 3?

Answer: A minimum of one packaged device verifying the microwave FSL/AtF wafer/die processes are successful by meeting the requirements of the test plans/procedures delivered in Phase 2 and 3.

8. Question: Can you provide specifications for FSL and AtF?

Answer: Performance specifications are purposely not provided. This was done so the project is not directly connected to any specific platform/program. The respondent can show in their proposals the performance parameters and potential programs for use at the unclassified level.

9. Question: How do you envision this program working with specific FSL and AtF device fabrication?

Answer: Respondents can use existing packages leveraging off existing efforts, use COTS packages, or design, machine, and/or construct their own packages during the end-device fabrication portion of the program at an unclassified level.

10. Question: Can you confirm ITAR compliance is not required (Section 8.b page 10)

Answer: Confirmed. ITAR compliance is not required. However, if a respondent is leveraging an existing program where ITAR compliance is mandatory or is otherwise introducing ITAR controlled subject matter into the project, then the respondent will be required to self-impose ITAR.

11. Question: Will you consider a deadline extension of 2 weeks to 5/24/21 to allow time for respondents to incorporate government responses to the questions into respondent technical and cost proposals?

Answer: The Government is not considering an extension to the RFS.

12. Question: Would the government consider a Cost type contract instead of a Fixed Price?

Answer: The Government anticipates the award of firm-fixed priced order for this requirement.

13. Question: Would the government consider a ROM for Phase 3 until specifications for the FSL and AtF devices are provide.

Answer: The first phase will be Firm-Fixed Price (FFP). It is the Government's intent that all phases are provided on a FFP basis; however, FFP may not be possible at this time for all the phases, therefore, the out phases may be "estimated FFP". Responders are encouraged to provide their most competitive offer for all phases with the knowledge that the total project cost is a not to exceed (NTE) cost based on funding available.



14. Question: Could you clarify that the RFS is looking for: 1. GGG substrate (crystal) growth only? or 2.YIG film growth on GGG substrate only? or 3. both? By the way, for the total project funding of \$4.15 Million, how many awards the DoN intends to award: one or multiple?

Answer: The RFS is looking for both vertical integration of GGG substrates with YIG film growth with increasing yield and lower costs, then packaging and test of a FSL at the conclusion. The respondent can build their team to accomplish this; however, our intent is to make one award.

15. Question: Would frequency selective surfaces on RF windows, radomes, or conformal apertures be considered for this program or a complimentary program?

Answer: No. This effort is for the specific domestic (US) development capability for GGG/YIG.

16. Question: Is LPE the technique of choice for YIG growth on GGG?

Answer: LPE is anticipated but not mandated.