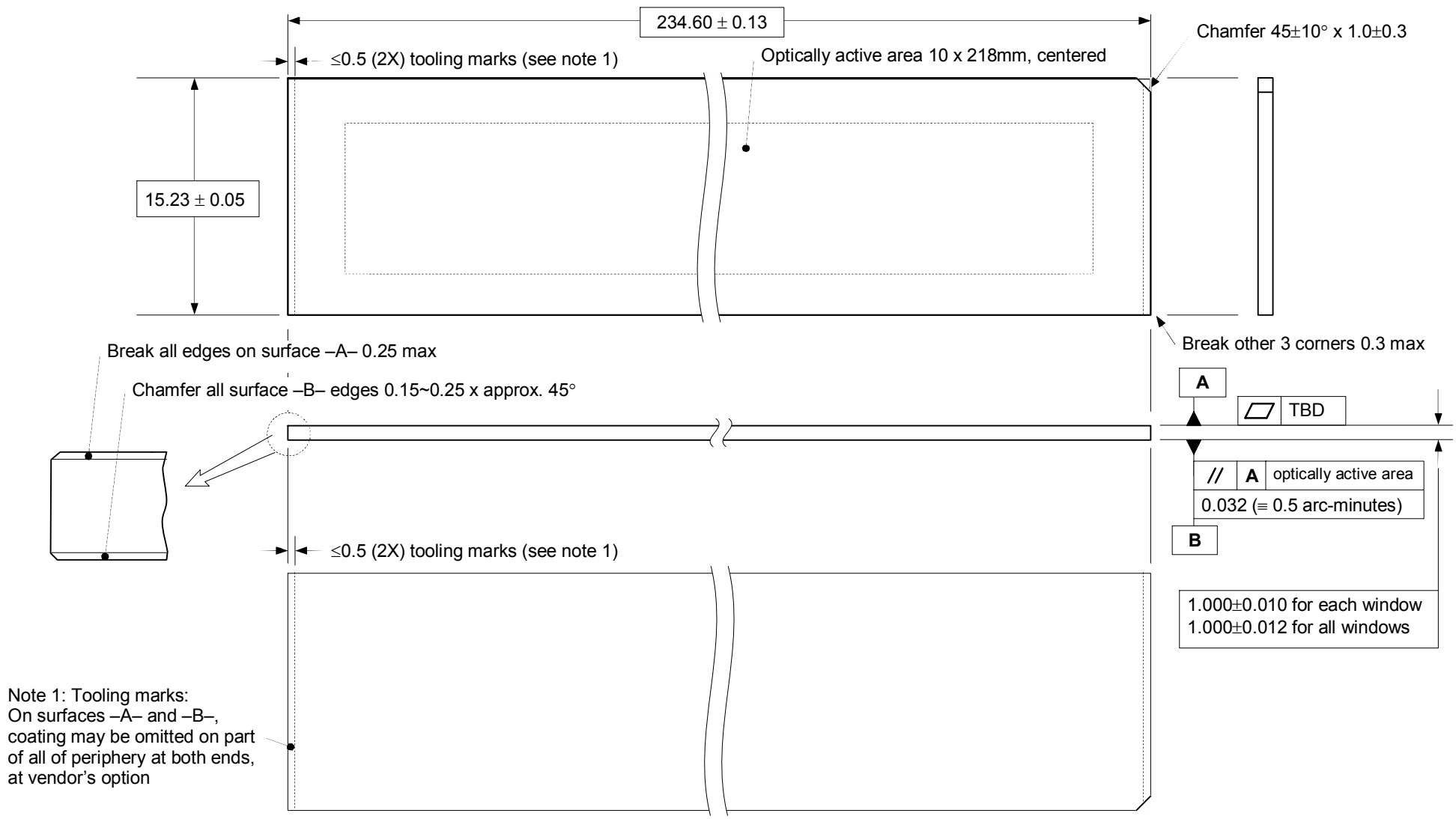

(Interpret drawing per ANSI Y14.5 1994. Not to scale. Dimensions in mm. Tolerances unless otherwise specified: X.X±0.1, X.XX±0.025)

Chief Ray Orientation

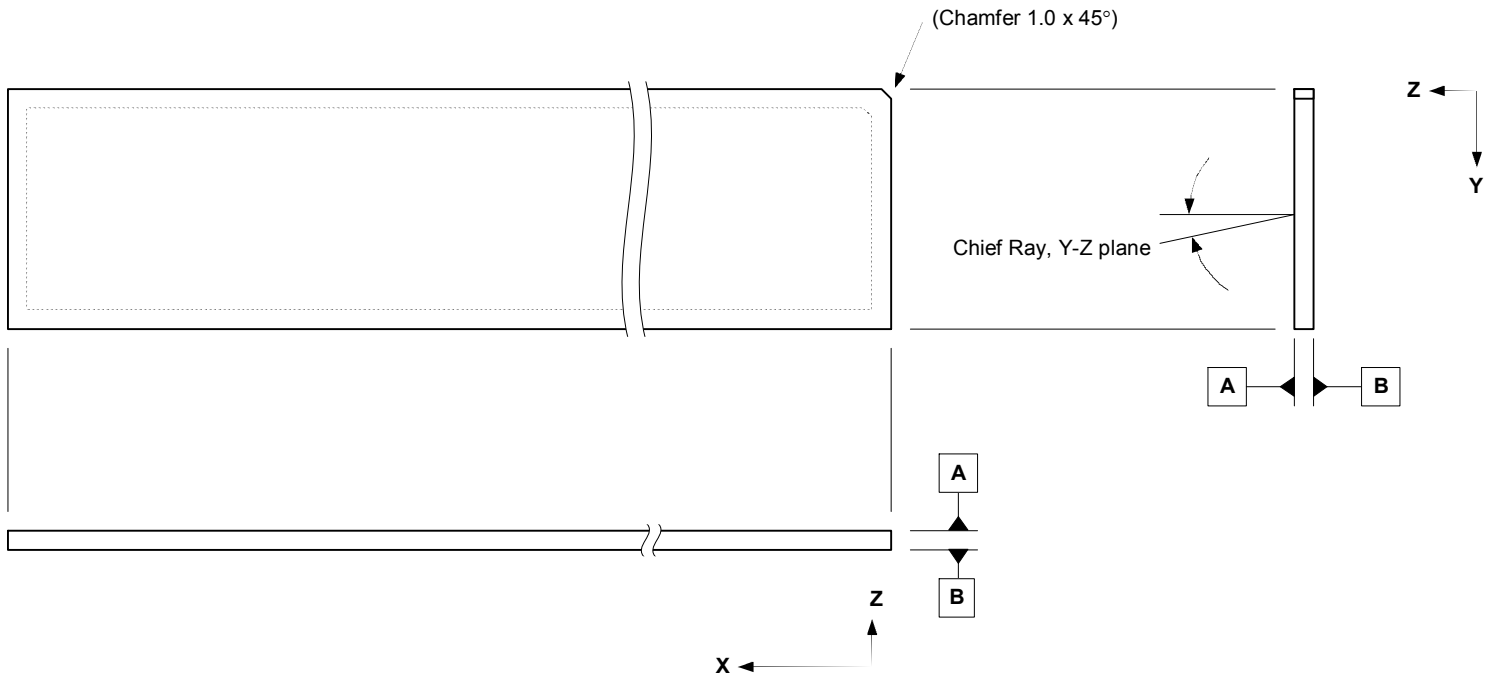

Table 1: Color Filter Spectral Performance

Parameter / Filter name	Symbol		**MS1**	**MS2**	**MS3**	**MS4**	**PAN-1**	**PAN-2**	Units
Color		=	Blue	Green	Red	NIR	Vis~NIR	Vis~NIR	---
Spectral range of attenuation (at λ<bandpass)		≥	350~427	350~494	350~598	350~722	350~427	350~427	nm
Spectral Bandpass @ 50% T_{MAX}	BP	≥	450 – 520	520 – 600	630 – 690	760 – 900	450 – 900	450 – 900	nm
Spectral range of attenuation (at λ>bandpass)		≥	546–1200	630–1200	724–1200	945–1200	945–1200	945–1200	nm
Bandpass center wavelength	λ_C	=	485 (+/-1%)	560 (+/-1%)	660 (+/-1%)	830 (+/-1%)	675 (+/-1%)	675 (+/-1%)	nm
Bandwidth	FWHM	≥	70	80	60	140	450	450	nm
Average Transmittance within bandpass	T_{AVG}(BP)	≥	80%	80%	80%	80%	80%	80%	%
Max. transmission at any λ within bandpass	T_{MAX}(BP)	>	80%	80%	80%	80%	80%	80%	%
(T_{MAX} – T_{MIN}) within passband	ΔT(BP)	≥	10%	10%	10%	10%	10%	10%	% pp
Blocking (transmission at any wavelength λ) for all λ in spectral ranges of attenuation		≤	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	% T_{MAX}
Cut-on slope @ lower BP edge = $\lvert(\lambda 80\% - \lambda 5\%)/ \lambda_C\rvert$		≤	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	%
Cut-off slope @ upper BP edge = $\lvert(\lambda 80\% - \lambda 5\%)/ \lambda_C\rvert$		≤	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	%
Angle of incidence, chief ray, Y-Z plane		=	5.5	9.6	10.8	12.2	7.0	8.4	°
Angle of incidence, half-cone angle, Y-Z plane		=	2.6	2.6	2.6	2.6	2.6	2.6	°

1. **Window Substrate:**

Material: Schott "Borofloat 33", or vendor may recommend a different glass type; subject to approval by Fairchild Imaging. Key requirements:

- CTE(+20°C) = 3.9±1.0ppm/°C (to match AIN ceramic).
- Index of refraction and dispersion to be approved by Fairchild Imaging.

Internal Transmission: $T(\lambda)>99.5\%$ for all λ, $425nm \leq \lambda \leq 925nm$, at 1.0mm thickness

Bubbles: $\leq 0.03mm^2$ / $100cm^3$ Glass, class B0

Homogeneity: ≤2.0E-6: group H3

Schlieren class: A (per MIL-G-174B)

Birefringence: ≤4nm / cm

Scratch / Dig: C – B per MIL-F-48616 within optically active area

Surface impurities (incl. coating) in optically active area: 5/20x0.01 according to ISO 10110
Scratches are not allowed along the detector line in optically active area

Wedge: Surfaces –A– and –B– parallel to ≤0.5 arc-minute within optically active area

Transmitted wavefront within optically active area

- Transmitted wavefront error ≤0.6μm peak-to-valley. This value excludes the power term (Focus).
- Transmitted wavefront power ≤2.0μm peak-to-valley.

Thickness uniformity within optically active area

- Within any one single window: ≤10μm (0.0004 inch),
- All windows ≤ 12μm (0.0005 inch)

Edge Chipouts:

- Max. chipout width (measured perpendicular to edge): 0.5mm
- Max. chipout length (measured parallel to edge): 2.25mm
- Total length of edge chipouts: <5% of total peripheral length of each face

2. **Color Filter Coating(s):**
   Color filter coating stacks may be on both surfaces –A– and –B–, at vendor's option.
   Spectral performance and angle of incidence per Table 1

   Coating uniformity: <0.5%.

   Surface quality (Scratch / Dig) within optically active area shall be C-B or better[1] per MIL-C-48497

   Surface impurities (incl. coating) in optically active area: 5/20x0.01 according to ISO 10110
   Scratches are not allowed along the detector line in optically active area

   - Note: ISO 10110 equivalent would be 3/3(1)

3. **Anti-Reflection Coating (ARC):**
   ARC is applied to surfaces –A– and –B– as part of the color filter multilayer coatings.

   ARC single-surface transmission: $T(\lambda) \geq 99.5\%$ for all λ, $450nm < \lambda < 900nm$, for all AOI $0° \leq \phi \leq \pm 13°$

   Surface quality (Scratch / Dig) within optically active area shall be C-B or better[1] per MIL-C-48497.

   Surface impurities (incl. coating) in optically active area: 5/20x0.01 according to ISO 10110
   Scratches are not allowed along the detector line in optically active area

4. **Outgassing**
   All materials must meet NASA outgassing specs: TML <1.0%, CVCM <0.1%.

5. **Resistance to Ionizing Radiation**
   Window substrate and coatings must not discolor or otherwise degrade after 15krad(Si) Co^{60} gamma-ray ionizing radiation. Transmission loss shall be <1% after after 15krad(Si) Co^{60} gamma-ray ionizing radiation.

[1] "C-B or better" scratch-dig per MIL-C-48497 ≡ (≤20μm wide scratches, ≤100μm diameter digs)

6. **Environmental Stress Screening:**

The window / filter must meet Table 1 performance specs between 0°C and +40°C.

All windows shall be ESS tested as follows:

- Temperature Cycle: 10 cycles. Each temp cycle is defined as varying the ambient temperature from –30°C to +70°C and back to -30°C with 15 minute dwell times at the temperature extremes, $\leq |\pm 2$°C/minute$|$ slew rates, air atmosphere at 1 atm. absolute pressure, non-condensing.

- The coating shall show no evidence of pitting, peeling, crazing, cracking or blistering after exposure to 49±5°C and ≥80% relative humidity (non-condensing) for ≥24 hours.

Optical coatings shall be uniform and exhibit no evidence of deterioration (flaking, crazing, cracking, peeling or blistering) or blemishes, strains, pinholes in excess of Dig Specification, peeling, or discoloration that affects the polarization performance of the filter, etc. that would cause non-conformance with the coating's specifications or the spectral performance.

7. **Durability tests on witness samples:**

Optical coatings shall be uniform and exhibit no evidence of deterioration (flaking, peeling, crazing, cracking, or blistering) or blemishes, strains etc. that would cause non-conformance with the coating's specifications or the spectral performance.

Optical coating shall meet the durability requirements of MIL-C-48497 "Durability Requirements for Single or Multilayer Interference Coatings", paragraphs

3.4.1.0 Environmental and physical durability
3.4.1.1 Adhesion ("scotch tape test")
3.4.1.2 Humidity
3.4.1.3 Moderate Abrasion
3.4.2 Thermal and cleaning durability
3.4.2.1 Temperature
3.4.2.2 Solubility and cleanability
3.4.3 Optical durability requirements
3.4.3.1 Water solubility
4.5 Test methods and procedures (including all subparagraphs)

without loss of spectral performance.

Coating shall exhibit no evidence of crazing, pinholes in excess of Dig Specification, peeling or discoloration that affects the polarization performance of the filter.

Coating durability testing to be performed on witness samples.

8. **Quality Assurance Tests & Deliverables:**

Traceability:

- Each window shall have a unique serial number, permanently marked.
- All measured data shall be traceable to window serial number.
- Supply manufacturing lot no. and date for each optical coating layer.
- All windows and witness samples must be traceable to manufacturing lot no. and date for each optical coating layer.

Color Filter Transmission & Blocking Performance Verification:

- Measure color filter transmission and blocking at ≤5nm intervals over the range 350nm≤λ≤1200nm, at AOI=0° and AOI=(chief ray Y-Z plane angle specified in Table 1). If both AOIs cannot be measured on test coupons, then at the vendor's option, measure at one AOI and compute performance at the other AOI from measured AOI data and measured layer thickness and index of refraction data.
- Deliverables: Measured data, test coupons

ARC Performance Verification: (if applicable)

- Measure ARC reflectance at ≤5nm intervals over the range 350nm≤λ≤1200nm, at AOI=0° and AOI=15°. (If both AOIs cannot be measured on test coupons, then at the vendor's option, measure at one AOI and compute ARC reflectance at the other AOI from measured AOI data and measured layer thickness and index of refraction data.)
- Deliverables: Measured data, test coupons

Transmitted Wavefront Error, Parallelism, Flatness, & Wedge Verification:

- Deliverables: interferometer fringe images, and other data for
  - Transmitted Wavefront Error (power and focus terms)
  - Parallelism & Flatness

Other mechanical measurements

- For each delivered part, measure and report:
  - Length, Width & Thickness
  - Bevel dimensions (both –A- and –B-)

Resistance to Ionizing Radiation Verification

- Deliverables: test data

Environmental Screening Test Verification

- Deliverables:
  - Temp vs. time graph from temp cycle test
  - temp and humidity vs. time graph from temp+humidity test.

Coating Durability and Environmental Qualification Test Verification

- Deliverables: Test coupons, test data, results

Certificate of Compliance

- Deliverable: Certificate of Compliance