NASA Electronic Parts and Packaging Radiation Effects Summary Database on Commercially Available Optical Fiber September 18, 2009

NASA GSFC Code 562 Photonics Group

Radiation Effects Data on Commercially Available Optical Fiber: Database Summary [2009 Update]

Executive Summary:

The following data represents a continuing research effort to maintain a clear and comprehensive tool for the radiation effects community; more specifically, those groups developing fiber optic technology operating in radiation sensitive environments. Taking into consideration the vendor restructuring of the optical telecom industry over the past several years and the present state of the technology sector as whole, the need arose to revisit and update the original database compilation work by M. Ott in 2002.[21] This survey focuses entirely on available right now Commercial-Off-The-Shelf (COTS) products and does not take into account any custom fabricated optical fibers for specific one-time applications.

Over the past nine years, fiber optic manufacturing companies, have been bought, sold, or are no longer in operation. Often during these situations, manufacturing methods, procedures, and key personnel change. For these reasons, attention is required for industry changes and technology trends not only to update this database, but discover new and better performing technologies for future mission applications.

As new products enter the market the only way to perform this trade study and assess the risk of considering products for flight missions is to have new data available. This database provides an up-to-date summary of new products as well as existing products with a comprehensive look at new radiation data published by the community over the past 8 years.

M. Ott "Radiation Effects Data on Commercially Available Optical Fiber: Database Summary," Nuclear Science and Radiation Effects Conference, Phoenix, Arizona, NSREC 2002, Data Workshop Proceedings, July, pp.24-31.

Criteria for Inclusion

- Optical fiber types included are currently available by the vendor.
- The publication/references are required to identify a part number that can be used when obtaining the product from the vendor.
- Publications included are available in the public domain.
- The references included provide data in a way that allowed for inclusion in a quantifiable table format.

How to Use this Database

1. Using the *Fiber Description Summary Table* identify the optical fiber product of interest. The details of each fiber type are in the last column labeled "Description". The fiber type descriptions and radiation effects data tables are divided into three categories; Multimode, Singlemode and Speciality Fiber.
2. Make note of the fiber ID number located in the first column of each description data table.
3. Use the ID number to locate the radiation effects data on the *Radiation Effects Data Summary* tables following the descriptions of each fiber category type.
4. Pertinent details of testing parameters are located in the columns of each *Radiation Effects Data Summary Table.* The reference number to which the data summary was gathered is located in the "Ref#" column.
5. The reference can be located on the last slide with the number corresponding to the reference number identified in the *Radiation Effects Data Summary Table*.
6. The Data Summary tables show the test parameters and conditions as identified by the references. Wavelength, dose rate, total dose, temperature, radiation induced attenuation and details as to whether the data was taken from a model or graph are included.
7. For greater explanation of the testing details please refer to the associated reference.

Units Discussion

- Dose rate units are expressed in rads per second.
- Multimode and some specialty optical fiber attenuation is expressed in units of dB/meter. Typically in cases of space flight applications, less than 30 meters is used for instrumentation and communication systems.
- Single mode optical fiber attenuation is expressed in units of dB/kilometer.
- Although specialty fiber attenuation is expressed with respect to meters, for fiber amplifier applications, the gain media is not typically meters in length. Additionally these fibers if tested unpumped will show a great deal more degradation than pumped.

MULTIMODE FIBER DESCRIPTIONS SUMMARY TABLE

Fiber ID	Manufacturer	Part Number	Fiber Description	Ref#
MM-021002	Heraeus	SSU 1.2 107/00	Step Index; 104/125/250; 0.22na; High OH Low Cl; CCDR 1.2; 40m & 70m	[1]
MM-021003	Heraeus	STU 1.2 237/2000	Step Index; 104/125/250; 0.22na; High OH Low Cl; CCDR 1.2; 40m & 70m	[1]
MM-021004	Mitsubishi Rayon	STR100C-SY	Step Index; 100/150/300; Low OH; 40m & 70m	[1]
MM-021005	FORC	KS-4V	Step Index; 110/125/280; 0.6^2 OH	[1]
MM-022204	Fujikura Ltd.	G-series MM Fiber	F-doped OH free; 200/250; 20m Length	[2]
MM-022205	Mitsubishi	MF Fiber	F-doped OH free; 200/250; 20m Length	[2]
MM-031101	Polymicro	FVP300330370	300/330/370; 0.7m - 1.68m Length	[3]
MM-031102	Polymicro	FIP300330370	300/330/370; 1.68m - 2.06m Length	[3]
MM-031401	Polymicro	FIA200220500	200/220/500; Acrylate; W.L. Gore FON1173; 10m Length	[4]
MM-031402	Polymicro	FIA300330500	300/330/500; Acrylate; W.L.Gore FON1174; 10m Length	[4]
MM-051201	OFS	F14369	Graded Index; Polyimide; Hermetic; 0.20na; 20m Length	[5]
MM-051202	Corning	InfniCol Fiber 50/125	0.20na; Graded-Index; Acrylate; 20m Length	[5]
MM-060204	Nufern	GR50/125-23-HTA	50/125; Graded-Index; <10m Length; Rad-Hard	[6]
MM-060205	Nufern	GR62.5/125-27-HTA	62.5/125; Graded-Index; <10m Length; Rad-Hard	[6]
MM-060206	Nufern	GR100/140-24-HTA	100/140; Graded-Index; <10m Length; Rad-Hard	[6]
MM-060207	OFS	BF04431	62.5/125; Graded-Index; <10m Length; Rad-Hard	[6]
MM-060208	OFS	BF05444	100/140; Graded-Index; <10m Length; Rad-Hard	[6]
MM-061701	Nufern	GR 100/140-24-HTA	12-Fiber 100/140 Graded-Index; 6.35m; Rad-Hard; W.L.Gore FOA 8100/12/1	[7]
MM-071101	ThorLabs	BFL37-200	200/230; Low OH; 50m Length	[8]
MM-071102	ThorLabs	BFH37-200	200/230; High OH; 50m Length	[8]
MM-072101	Polymicro	FIA200220500	200/220/500; Acrylate; 0.22NA; W.L. Gore FON1173 10m Length	[9]
MM-072201	Polymicro	FIA400440580	400/440/500; Acrylate; 0.22NA; W.L. Gore FON1416; 9.5m Length	[10]
MM-090103	Draka	RadHard SMF	DRAKA Elite 50/125/242; 1km length	[11]
MM-090104	Draka	Super RadHard SMF	DRAKA Elite 50/125/242; 1km length	[11]
MM-090201	Nufern	FUD3731	300/330; 0.12NA; W.L. Gore FON1442 PEEK Jacket; 10m Length	[12]

SINGLEMODE FIBER DESCRIPTIONS SUMMARY TABLE

Fiber ID	Manufacturer	Part Number	Fiber Description	Ref#
SM-022301	Corning	SMF-28	Ge-Doped; 9/125/250	[13]
SM-022302	Lucent	AllWave	Ge-Doped; 9/125/250	[13]
SM-041101	Sumitumo	Z-Fiber	5km Coil; Pure Silica fiber	[14]
SM-041102	Corning	SMF-28	5km Coil; Ge-Doped; 9/125/250	[14]
SM-060201	Nufern	S1550-HTA	9/125/250	[6]
SM-060202	Nufern	R1310-HTA	9/125/250	[6]
SM-060203	Corning	SMF-28	9/125/250	[6]
SM-090101	Draka	RadHard SMF	DRAKA Elite 9/125/242; 1km length	[11]
SM-090102	Draka	Super RadHard SMF	DRAKA Elite 9/125/242; 1km length	[11]

SPECIALTY FIBER DESCRIPTIONS SUMMARY TABLE

Fiber ID	Manufacturer	Part Number	Fiber Description	Ref#
ER-010401	Lucent	HE980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer	[15]
ER-010402	Lucent	HP980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer	[15]
ER-010403	Lucent	MP980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer	[15]
ER-010404	Lucent	LP980 (amp)	Er Doped Fiber; 3m Length; Simple Multi-Layer	[15]
ER-010405	Lucent	HG980 (src)	Er Doped Fiber; 3m Length; Simple Multi-Layer	[15]
ER-022001	Corning	Puremode 1550C	EDFA system, pumped, Er Doped Fiber; 3 m gain media	[13]
ER-072502	Liekki	Er20-4/125	Er Doped Fiber; 3 m Length	[19-20]
ER-072503	Liekki	Er16-8/125	Er Doped Fiber; 3 m Length	[19-20]
ER-072504	Liekki	Er30-4/125	Er Doped Fiber; 3 m Length	[19-20]
ER-072505	Liekki	Er80-4/125	Er Doped Fiber; 3 m Length	[19-20]
ER-072506	Liekki	Er110-4/125	Er Doped Fiber; 3 m Length	[19-20]
PM-060209	Nufern	PM1550G-80	80um Fiber DIA; approx 3m; PM Fiber	[6]
PM-060210	Nufern	PM850G-80	80um Fiber DIA; approx 3m; PM Fiber	[6]
PM-060211	3M	FS-PM7621	80um Fiber DIA; approx 3m; PM Fiber	[6]
PM-060212	3M	FS-PM4611	80um Fiber DIA; approx 3m; PM Fiber	[6]
PM-060213	FiberCore	HB800	80um Fiber DIA; approx 3m; PM Fiber	[6]
YM-070102	Liekki	Yb1200-20/400DC	Yb-doped; Double Clad; 3m Length; 20/400	[17-20]
YM-070103	Liekki	Yb1200-30/250DC	Yb-doped; Double Clad; 3m Length; 30/250	[17-20]
YM-070104	Liekki	Yb1200-4/125	Yb-doped; 3m Length; 4/125	[17-20]
YM-070105	Liekki	Yb2000-6/125DC	Yb-doped; Double Clad; 3m Length; 6/125	[17-20]
EY-072001	Nufern	SM-EYSF	Er:Yb doped; 8.3/125/250; Double Clad Fiber; non-fluro acrylate coat; .208m	[14]
EY-072002	Nufern	SM-EYDF	Er:Yb doped; 8.3/123.5/254; Double Clad Fiber; 15m	[14]
EY-072501	OFS	Er/Yb PM DC	Er:Yb Co-doped; Double Clad PM Fiber; 3 m	[19-20]

MULTIMODE FIBER RADIATION EFFECTS SUMMARY TABLE

Fiber ID	λ(nm)	Dose Rate (Gamma)	Total Dose (Gamma)	Temp	Attenuation (dB/m)	Details	[Ref#]
MM-021002	829nm	125 rads/s	1M rads	25°C	0.013	Graph Data	[1]
	829nm	125 rads/s	300 krads	25°C	0.008	Graph Data	[1]
	829nm	125 rads/s	100 krads	25°C	0.0065	Graph Data	[1]
	829nm	125 rads/s	30 krads	25°C	0.005	Graph Data	[1]
MM-021003	829nm	125 rads/s	1M rads	25°C	0.2	Graph Data	[1]
	829nm	125 rads/s	300 krads	25°C	0.25	Graph Data	[1]
	829nm	125 rads/s	100 krads	25°C	0.29	Graph Data	[1]
	829nm	125 rads/s	30 krads	25°C	0.27	Graph Data	[1]
	1310nm	125 rads/s	1M rads	25°C	0.012	Graph Data	[1]
	1310nm	125 rads/s	300 krads	25°C	0.013	Graph Data	[1]
	1310nm	125 rads/s	100 krads	25°C	0.014	Graph Data	[1]
	1310nm	125 rads/s	30 krads	25°C	0.015	Graph Data	[1]
MM-021004	829nm	125 rads/s	1M rads	25°C	0.16	Graph Data	[1]
	829nm	125 rads/s	300 krads	25°C	0.08	Graph Data	[1]
	829nm	125 rads/s	100 krads	25°C	0.045	Graph Data	[1]
	829nm	125 rads/s	30 krads	25°C	0.029	Graph Data	[1]
	1310nm	125 rads/s	1M rads	25°C	0.01	Graph Data	[1]
	1310nm	125 rads/s	300 krads	25°C	0.005	Graph Data	[1]
	1310nm	125 rads/s	100 krads	25°C	0.004	Graph Data	[1]
	1310nm	125 rads/s	30 krads	25°C	0.003	Graph Data	[1]
MM-021005	829nm	125 rads/s	1M rads	25°C	0.65	Graph Data	[1]
	829nm	125 rads/s	300 krads	25°C	0.9	Graph Data	[1]
	829nm	125 rads/s	100 krads	25°C	1.00	Graph Data	[1]
	829nm	125 rads/s	30 krads	25°C	0.96	Graph Data	[1]
	1310nm	125 rads/s	1M rads	25°C	0.027	Graph Data	[1]
	1310nm	125 rads/s	300 krads	25°C	0.028	Graph Data	[1]
	1310nm	125 rads/s	100 krads	25°C	0.026	Graph Data	[1]
	1310nm	125 rads/s	30 krads	25°C	0.025	Graph Data	[1]
MM-022204	600-650nm	333 rads/s	190M rads	25°C	0.9	Reported Data	[2]
MM-022205	600-650nm	333 rads/s	190M rads	25°C	0.25	Reported Data	[2]

MULTIMODE FIBER RADIATION EFFECTS SUMMARY TABLE

Fiber ID	λ(nm)	(Gamma)	(Gamma)	Temp	Attenuation (dB/m)	Details	[Ref#]
MM-031101	380nm	80 rads/s	100M rads	25°C	10	Reported Data	[3]
	430-450nm	80 rads/s	100M rads	25°C	1.50-3.50	Reported Data	[3]
	630nm	80 rads/s	100M rads	25°C	< 5.50	Reported Data	[3]
MM-031102	380nm	80 rads/s	100M rads	25°C	10.00	Reported Data	[3]
	430-450nm	80 rads/s	100M rads	25°C	1.500-3.500	Reported Data	[3]
	630nm	80 rads/s	100M rads	25°C	< 5.500	Reported Data	[3]
MM-031401	850nm	0.19 rads/s	30 krads	-24.1°C	0.102	Reported Data	[4]
	850nm	0.38 rads/s	30 krads	-18.3°C	0.0892	Reported Data	[4]
MM-031402	850nm	0.19 rads/s	30 krads	-24.1°C	0.0917	Reported Data	[4]
	850nm	0.38 rads/s	30 krads	-18.3°C	0.0818	Reported Data	[4]
MM-051201	1064nm	10 rads/s	36 Mrads	45°C	0.14	Reported Data	[5]
MM-051202	1064nm	10 rads/s	36 Mrads	45°C	0.175	Reported Data	[5]
MM-060204	1300nm	2.16 rads/s	42 krad	25°C	0.004	Graph Data	[6]
	850 nm	2.16 rads/s	30 krad	25°C	0.083	Graph Data	[6]
MM-060205	1300nm	2.16 rads/s	42 krads	25°C	0.0041	Graph Data	[6]
	1300 nm	2.16 rads/s	50 krads	25°C	0.00484	Table Data	[6]
	850 nm	2.16 rads/s	42 krads	25°C	0.085	Graph Data	[6]
MM-060206	1300nm	2.16 rads/s	42 krads	25°C	0.048	Graph Data	[6]
	1300nm	2.16 rads/s	50 krads	25°C	0.0054	Reported Data	[6]
	850nm	2.16 rads/s	30 krads	25°C	0.085	Graph Data	[6]
MM-060207	1300nm	2.16 rads/s	50 krads	25°C	583.00	Reported Data	[6]
MM-060208	1300nm	2.16 rads/s	50 krads	25°C	21.00	Reported Data	[6]
MM-061701	850nm	0.2 rads/s	244krads	-33°C	2.30	Reported Data	[7]
	850nm	2.0 rads/s	2.44M rads	-21°C	2.10	Reported Data	[7]
	850nm	0.2 rads/s	244krads	25°C	2.00	Reported Data	[7]
	850nm	2.0 rads/s	2.44M rads	25°C	2.00	Reported Data	[7]
MM-071101	633nm	0.5 rads/s	9.5krads	25°C	0.06	Graph Data	[8]
	850nm	0.5 rads/s	9.5krads	25°C	0.003	Graph Data	[8]
MM-071102	633nm	0.5 rads/s	19.4krads	25°C	0.038	Graph Data	[8]
	850nm	0.5 rads/s	19.4krads	25°C	0.004	Graph Data	[8]
MM-072101	850nm	2.53 rads/s	3.51M rads	9.6°C	0.11	Graph Data	[9]
	850nm	2.53 rads/s	1M rads	9.6°C	0.09	Graph Data	[9]
	850nm	2.53 rads/s	300 krads	9.6°C	0.075	Graph Data	[9]
	850nm	2.53 rads/s	100 krads	9.6°C	0.065	Graph Data	[9]
	850nm	2.53 rads/s	30 krads	9.6°C	0.05	Graph Data	[9]
	850nm	0.3 rads/s	420 krads	25°C	0.0185	Graph Data	[9]
	850nm	0.3 rads/s	300 krads	25°C	0.018	Graph Data	[9]
	850nm	0.3 rads/s	100 krads	25°C	0.016	Graph Data	[9]
	850nm	0.3 rads/s	30 krads	25°C	0.015	Graph Data	[9]

MULTIMODE FIBER RADIATION EFFECTS SUMMARY TABLE

Fiber ID	λ(nm)	Dose Rate (Gamma)	Total Dose (Gamma)	Temp	Attenuation (dB/m)	Details	[Ref#]
MM-072201	532nm	0.01 rads/s	200 krads	25°C	0.044	Extrapolated	[10]
	532nm	0.01 rads/s	100 krads	25°C	0.028	Extrapolated	[10]
	532nm	0.01 rads/s	30 krads	25°C	0.015	Extrapolated	[10]
	532nm	0.01 rads/s	200 krads	-50°C	0.056	Extrapolated	[10]
	532nm	0.01 rads/s	100 krads	-50°C	0.035	Extrapolated	[10]
	532nm	0.01 rads/s	30 krads	-50°C	0.017	Extrapolated	[10]
MM-090103	850nm	12.5 rads/s	850 krads	22°C	0.20	Graph Data	[11]
	850nm	12.5 rads/s	300 krads	22°C	0.155	Graph Data	[11]
	850nm	12.5 rads/s	100 krads	22°C	0.10	Graph Data	[11]
	850nm	12.5 rads/s	30 krads	22°C	0.04	Graph Data	[11]
	1310nm	12.5 rads/s	850 krads	22°C	0.05	Graph Data	[11]
	1310nm	12.5 rads/s	300 krads	22°C	0.038	Graph Data	[11]
	1310nm	12.5 rads/s	100 krads	22°C	0.025	Graph Data	[11]
	1310nm	12.5 rads/s	30 krads	22°C	0.0051	Graph Data	[11]
MM-090104	850nm	12.5 rads/s	850 krads	22°C	0.079	Graph Data	[11]
	850nm	12.5 rads/s	300 krads	22°C	0.07	Graph Data	[11]
	850nm	12.5 rads/s	100 krads	22°C	0.065	Graph Data	[11]
	850nm	12.5 rads/s	30 krads	22°C	0.039	Graph Data	[11]
	1310nm	12.5 rads/s	850 krads	22°C	0.009	Graph Data	[11]
	1310nm	12.5 rads/s	300 krads	22°C	0.007	Graph Data	[11]
	1310nm	12.5 rads/s	100 krads	22°C	0.005	Graph Data	[11]
	1310nm	12.5 rads/s	30 krads	22°C	0.003	Graph Data	[11]
MM-090201	300-400nm	0.3 rads/s	130 krads	25°C	0.07	Graph Data	[12]
	300-400nm	0.3 rads/s	100 krads	25°C	0.068	Graph Data	[12]
	300-400nm	0.3 rads/s	30 krads	25°C	0.03	Graph Data	[12]
	300-400nm	0.3 rads/s	130 krads	-100°C	0.15	Graph Data	[12]
	300-400nm	0.3 rads/s	100 krads	-100°C	0.148	Graph Data	[12]
	300-400nm	0.3 rads/s	30 krads	-100°C	0.09	Graph Data	[12]

SINGLEMODE FIBER RADIATION EFFECTS SUMMARY TABLE

Fiber ID	λ(nm)	Dose Rate	Total Dose	Temp	Attenuation	Details	[Ref#]
SM-022301	1550nm	1 rads/s	300 krads	25°C	11 dB/km	Graph Data	[13]
SM-022302	1310nm	1.67 rads/s	300 krads	25°C	7 dB/km	Graph Data	[13]
	1310nm	.195 rads/s	105 krads	25°C	2.5 dB/km	Graph Data	[13]
	1310nm	.0167 rads/s	9 krads	25°C	< 1.0 dB/km	Graph Data	[13]
	1550nm	1.67 rads/s	300 krads	25°C	7.0 dB/km	Graph Data	[13]
	1550nm	.195 rads/s	105 krads	25°C	2.5 dB/km	Graph Data	[13]
	1550nm	.0167 rads/s	9 krads	25°C	< 0.5 dB/km	Graph Data	[13]
SM-041101	1510nm	0.6 rads/s	1M rads	50°C	4.5 dB/km	Extrapolated	[14]
SM-041102	1530nm	0.6 rads/s	1M rads	50°C	1.3 dB/km	Extrapolated	[14]
SM-060201	1550nm	2 rads/s	50 krads	25°C	1.0 dB/km	Graph Data	[6]
	1550nm	2 rads/s	30 krads	25°C	0.8 dB/km	Graph Data	[6]
SM-060202	1550nm	2 rads/s	50 krads	25°C	3.4 dB/km	Graph Data	[6]
	1550nm	2 rads/s	30 krads	25°C	2.3 dB/km	Graph Data	[6]
SM-060203	1550nm	2 rads/s	50 krads	25°C	6.3 dB/km	Graph Data	[6]
	1550nm	2 rads/s	30 krads	25°C	4.6 dB/km	Graph Data	[6]
SM-090101	1310nm	19.4 rads/s	850 krads	22°C	25 dB/km	Graph Data	[11]
	1310nm	19.4 rads/s	300 krads	22°C	21 dB/km	Graph Data	[11]
	1310nm	19.4 rads/s	100 krads	22°C	17 dB/km	Graph Data	[11]
	1310nm	19.4 rads/s	30 krads	22°C	5.1 dB/km	Graph Data	[11]
SM-090102	1310nm	19.4 rads/s	850 krads	22°C	4.0 dB/km	Graph Data	[11]
	1310nm	19.4 rads/s	300 krads	22°C	3.8 dB/km	Graph Data	[11]
	1310nm	19.4 rads/s	100 krads	22°C	2.5 dB/km	Graph Data	[11]
	1310nm	19.4 rads/s	30 krads	22°C	2.0 dB/km	Graph Data	[11]

SPECIALTY FIBER RADIATION EFFECTS SUMMARY TABLE

Fiber ID	λ(nm)	Dose Rate	Total Dose	Temp	Attenuation	Details	[Ref#]
ER-010401	980nm	1.4 rads/s	50 krads	25°C	0.65 dB/m	Reported Data	[12]
	1300nm	1.4 rads/s	50 krads	25°C	0.205 dB/m	Reported Data	[12]
	1550nm	1.4 rads/s	50 krads	25°C	0.125 dB/m	Reported Data	[12]
ER-010402	980nm	1.4 rads/s	50 krads	25°C	3.5 dB/m	Reported Data	[12]
	1300nm	1.4 rads/s	50 krads	25°C	1.0 dB/m	Reported Data	[12]
	1550nm	1.4 rads/s	50 krads	25°C	0.60 dB/m	Reported Data	[12]
ER-010403	980nm	1.4 rads/s	50 krads	25°C	1.65 dB/m	Reported Data	[12]
	1300nm	1.4 rads/s	50 krads	25°C	0.50 dB/m	Reported Data	[12]
	1550nm	1.4 rads/s	50 krads	25°C	0.345 dB/m	Reported Data	[12]
ER-010404	980nm	1.4 rads/s	50 krads	25°C	0.24 dB/m	Reported Data	[12]
	1300nm	1.4 rads/s	50 krads	25°C	Negligible	Reported Data/ 3m	[12]
	1550nm	1.4 rads/s	50 krads	25°C	Negligible	Reported Data/ 3m	[12]
ER-010405	980nm	1.4 rads/s	50 krads	25°C	0.60 dB/m	Reported Data	[12]
	1300nm	1.4 rads/s	50 krads	25°C	0.19 dB/m	Reported Data	[12]
	1550nm	1.4 rads/s	50 krads	25°C	Negligible	Reported Data/ 3m	[12]
ER-022001	1530nm	1.2 krads/min	38.4 krad	25°C	1.4 dB	Reported Data/ 3m	[16]
ER-072502	1100 nm	14.3 & 40 rad/s	10 krads	25°C	2.0 dB/m	Graph Data	[19,20]
			20 krads	25°C	3.9 dB/m	Graph Data	[19,20]
			30 krads	25°C	5.8 dB/m	Graph Data	[19,20]
ER-072503	1100 nm	14.3 & 40 rad/s	10 krads	25°C	2.22 dB/m	Graph Data	[19,20]
			20 krads	25°C	4.4 dB/m	Graph Data	[19,20]
			30 krads	25°C	6.6 dB/m	Graph Data	[19,20]
ER-072504	1100 nm	14.3 & 40 rad/s	10 krads	25°C	2.36 dB/m	Graph Data	[19,20]
			20 krads	25°C	4.7 dB/m	Graph Data	[19,20]
			30 krads	25°C	6.8 dB/m	Graph Data	[19,20]
ER-072505	1100 nm	14.3 & 40 rad/s	10 krads	25°C	3.0 dB/m	Graph Data	[19,20]
			20 krads	25°C	5.85 dB/m	Graph Data	[19,20]
			30 krads	25°C	8 dB/m	Graph Data	[19,20]
ER-072506	1100 nm	14.3 & 40 rad/s	10 krads	25°C	3.8 dB/m	Graph Data	[19,20]
			20 krads	25°C	7.0 dB/m	Graph Data	[19,20]
			30 krads	25°C	10 dB/m	Graph Data	[19,20]

SPECIALTY FIBER RADIATION EFFECTS SUMMARY TABLE

Fiber ID	λ(nm)	Dose Rate	Total Dose	Temp	Attenuation	Details	[Ref#]
PM-060209	1550nm	2 rads/s	50 krads	25°C	6.20 dB/m	Reported Data	[6]
PM-060210	1550nm	2 rads/s	50 krads	25°C	55 dB/m	Reported Data	[6]
PM-060211	1550nm	175 rads/s	5M rads	25°C	151 dB/m	Reported Data	[6]
PM-060212	820nm	0.2 rads/s	200 krads	25°C	170 dB/m	Reported Data	[6]
PM-060213	850nm	21.2 rads/s	10 krads	25°C	45.6 dB/m	Reported Data	[6]
YM-070102	1100 nm	14.3 & 40 rad/s	10 krads	25°C	1 dB/m	Graph Data	[17-20]
			20 krads	25°C	2.15 dB/m	Graph Data	[17-20]
			30 krads	25°C	2.95 dB/m	Graph Data	[17-20]
YM-070103	1100 nm	14.3 & 40 rad/s	10 krads	25°C	1.25 dB/m	Graph Data	[17-20]
			20 krads	25°C	2.22 dB/m	Graph Data	[17-20]
			30 krads	25°C	3.0 dB/m	Graph Data	[17-20]
YM-070104	1100 nm	14.3 & 40 rad/s	10 krads	25°C	1.5 dB/m	Graph Data	[17-20]
			20 krads	25°C	2.76 dB/m	Graph Data	[17-20]
			30 krads	25°C	3.82 dB/m	Graph Data	[17-20]
YM-070105	1100 nm	14.3 & 40 rad/s	10 krads	25°C	1.55 dB/m	Graph Data	[17-20]
			20 krads	25°C	2.98 dB/m	Graph Data	[17-20]
			30 krads	25°C	4.0 dB/m	Graph Data	[17-20]
EY-072501	1100 nm	14.3 & 40 rad/s	10 krads	25°C	0.22 dB/m	Graph Data	[19,20]
			20 krads	25°C	0.45 dB/m	Graph Data	[19,20]
			30 krads	25°C	0.71 dB/m	Graph Data	[19,20]
EY-072001	1535nm	4.5 rads/s	91krads	25°C	23 dB/m	Reported / 0.208 m	[14]
EY-072002	1537 nm	20 rad/s	10 krads	25°C	8.0 dB	Reported/ pumped	[14]
	1537 nm	10 rad/s	10 krads	25°C	5.1 dB	Reported/ 15 m	[14]

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