Rt qnhgt c vlqp'qh'Hkdgt 'Ugpuqt 'Vgej pqnqi {" vj t qwi j 'E quv'T gf wevkqp.'Rcenci kpi .'cpf " F c w 'Cpc n{ vleu

Uwf gpu'cpf 'RF Hu'qh'Mgxkp'R0'Ej gpøu'I tqwr " F gr ctvo gpv'qh'Grgevtkecn'cpf 'Eqo r wgt'Gpi kpggtkpi ." Wpkxgtukv{ ''qh'Rkwudwti j

Go ckn<<u>r ge; B r kw0gf w</u>

Kp'èqmc dqt c vkqp 'y kyj <</th>ÉKP NÉP GVNÉQTP NÉEqtpkpi 'KpeÉNWP C 'Kppqxc vkqpÉO KVTÉO cp {





Hkdgt 'Ugpuqtu'cu'wdks wkwqwu'ugpuqt 'vgej pqrqi {

"' Tgf weg'equv'qh'igpulpi 'hdgt u'δ'Ugpuqt 'Hcdt lecvlqpu

- "'' Hwm{ ''gzr mk/'vgngeqo 'hkdgtu0
- <u>— Ftcy/vqy gt"errtqcej</u>
- "'' Tgf weg'equv'qh'igpuqt 'kpvgt t qi c vqt u
 - " Hwm{ "gzr mk/'vgngeqo "i gct"cpf "cwqpqo qwu'f tkxkpi "vgej pqmi {
 - "' Ckf gf 'd { 'my /equv'ugpukpi 'hkdgtu
- "' F gxgnpr 't gcf {/wp/wug'r cenci kpi 'upnwkqpu'hqt '32M'wp'3222M cr r decwlqpu
- "' Gzrnqtg'þgy 'crrnlæcvlqpu'dg{ qpf 'qknli cu<P wenget 'Gpgt i { '*F knvt kdwvgf " Ugpuqt u+

₩ 't 'y 'O



Tggn/wq/tggn/qkn/ko o gtukqp'hkdgt 'y tkskpi 'ugvwr

'Heuv'epf 'eqpvlpwqwu'hedt leevlqp'wr 'vq'3mo 'hldgt u '' Rqkpv/d{/r qlpv'y t kslpi '*pqv'r j cug'o cun#H<hgzklng '' J ki j /V'twedng'f kwt kdwwgf 'ugpuqt u'('r qlpv'ugpuqt 'ette{ ''Crrnleedng'hqt 'y lf g'ette{ 'qh'qrvleenhldgt u '' J ki j /V'twedng'tguvgf 'ev'; 22E '' Uerrj kt g'epf 'tklee

Type II: FBG Array







"'' Uvcpf ctf 'vgrgeqo 'hkdgt '6'vj t qwi j 'eqc vkpi

- "'' Qpg/uj qv'WX'r j cug'o cum'y t kdpi
- "'' 32/mo 'eqpvlpwqwu'ugpulpi 'hdgt 'hcdt lecvlqp'r quuldrg
- "'' Ftcy/wygt'htgg

yt O

"'' Ugpulpi 'Hdgt 'equv'¢ &206/ &302 'r gt 'b gygt '*eqo r gylskap< &32/5210 +





Rj cug'O cum'Qpg/Uj qv'Hcdtkecvkqpu

n17



Tggn/vq/Tggn/Hcdtkecvkqpu





A STREET OF STREET

- "" Korngo gpvkpi "fgpqkug" cniqtkyjo
- "" Rqnctl cvkqp'f kxgtukv{ "tgf weg'kpvgttqi cvkqp'hgpi yi 'htqo '622/o 'vq'¢322'o
- $\label{eq:constraint} \ensuremath{\textit{``''}} Ur cvkcn't guqnwkqp <3/\mu \ .''Vgo \ r \ gtcwtg <3E+$
- " O qf g/j qr r kpi "qpn{ "ecwug"uo cm'cf f kkqpcn'gttqtu'*ecp"dg"cxgtci gf "qw+



Vgo rgtcwtg<Tc{ngki j 'Gpj cpegf 'Hkdgt



Uvtckp<'Tc{ngki j 'Gpj cpegf 'Hkdgtu

#



Uvt clp<Rt kwlpg'Hldgt u





 $# \quad (7)k')$



K



FU

5 cm



[™]ÁF kuvt kdwgf 'Nquu'O gcuwt go gpvu<'TKC [™]ÁUr cvkcn't guqnwkqp<'4/eo [™]ÁEqtpkpi ''cnvo kpvo /f qr gf 'Hkdgt



O # ') ° o ') '7 'o '' 'k



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and the second		P		
4				
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	EqpxgpvkqpcriHkdgt" Ugpukpi 'Uej go gu	Qr vlecnVt cpueglszgt u
Qr decriUqwt egu'T gs wlt go gpv		
Qr væcnEqj gt gpeg	322"o gvgt"\q"42"mo	Pqv'tgswktgf"qt"wr"vq"3"o
QrvlecnY cxgrgpi vj 'Vwpplpi	32/po "qt"o qtg	Pq'tgswktgf ''qt''wr ''vq''206/po '' *cej kgxcdng''yj tqwi j ''ewttgpv''wpkpi +
Equv	& .222/&42.222	<i>8</i> 42/ <i>8</i> 472
O qf wnc wlqp 'T gs wlt go gp vu		
Pggf'fgfkecvgf'o qfwncvqt	[gu	PQ"6'Cntgcf {"dwknv/kp#
O qf wn: wqp'Ur ggf	62/472'OJ	32I J /47''I J
Equv	>&7.222	Kpvgi tcvgf 'y kj 'Vtcpuegkxgtu
P gw qt nikpvgi t c vcdng	Рq	[gu

FCU'Dcugf 'PRU'5 5''Uej go g











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Kp'Eqmcdqtcvkqp'y kj 'Rtqh0[qwpi dmqqf 'cv'Rkw<<u>{qwpi dmqf B r kw0gf w</u>



Y cxgrgpi y 'wpkpi 'uvkej kpi

I cu/egmly cxgngpi y "tghgtgpeg

`7"*8`*@











- J ki j /ur ggf 'kpvgttqi cvkqp'r quukdng J gygtqi gpgqwu'o wnk/eqtg'ctej kygewtgu/HRI C- 'FUR
- Tcr kf 'ugpuqt'f cvc'f go qf wrcvkqp'xkc'F UR
- Uvcvke''y cxgrgpi y ''xctkcvkqp''dgwgt''y cp''O'4ro





L

'7"*8*@



Ko'Eqmcdqtcvkqp'y kj 'Rtqh0Dclcl'cv'Rkw<<u>pdclclB r kv0gf w</u>

5 Xj UbWX DUV U[]b[HYVX b]ei Y

Tcrkf 'cpf 'intcki j whaty ctf 'igpuqt'f grm{ o gpvu

''Uo ctv'\crgu ''O g\critic f k\ksg'\o cp\v\rcev\vt kpi 'I mul'ugcncp\vu

What cupple 'Cffkkxg'O cpwhcewatkpi <'wr ''y '622E

Uo ctv'O gvcn'Eqo r qpgpw"

Smart Tapes

Vtwg''Uttckp''Htgg''Ugpuqtu

DUW_U[]b[.'Hfi Y'GHfU]b!: fYY'A i `H]d`YI UV`Y'GYbgcfg

O wn/kr ngz c d ng'Vt wg'U/t c kp'Ht gg'Ugpuqt u

V'Ecnldt cvlqp<99M'vq'822M

'Ykfg'igngevkqp'qhiügcn:pv'öcvgtk:nk-'in:uu'cpf'egtcokeu 'VGE'qhi`n:uu'igcn:pv'ë'7rro1E'ődgvyggp'ikklec'hkdgt'cpf'ögvcn0 'Jgtogvkecndqpfkpi'qp'ögvcni'ő'Eqortguuksg'iwtckp 'Tcrkf'rtqeguu'rquukdng

J grkwo 'Ngcm'Vguv'T guwwu

DUV_U[Y". `A YHJ` 5 XX]h]j Y`A Ubi ZM'i f]b[

What cupple'CO 'Ugpuqt 'Go dgf f kpi

Rqy f gt/dgf 'CO 'Ugpuqt 'Go dgf f kpi

Ugpuqt 'Hwugf 'CO 'Rt qeguugu

- "'' Gpcdng'in ctv'eqo r qpgpu
- "'' Rt qxlf g'liggf dcemi'liqt 'CO 'r t qegudpi 'qr vlo k c vlqp
- "'' Kortqxg'igpuqt'rgthqtocpeg

*Kp"eqmcdqtcvkqp"y kj "Rtqh0Cndgtv"Vq"qh"Rkw<<u>cmlgtwqB r kwQf w</u>+

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J ki j /V'Hkdgt 'Ugpuqtu'hqt 'J {ft qi gp'Crrnlecvkqpu

- : $22^{q}E$ 'f kuvt kdwygf 'J ₄''cpf ''V''o gcuwt go gpvu
- 3/eo "V"ugpukpi "ur cvkcn"t guqnwkqp
- "" 5/eo "j {ftqi gp"ugpukpi "ur cvkcn"tguqnvvkqpu
 - 8/0 "kpvgttqi cvkqp"ngpi yi "kp"j ctuj "gpxktqpo gpvu
 - J 4"UQHE"cpf"Y cuvg"r ncuvke"i cukhkecvkqp"r tqeguu
- '' Kợ 'êqnc dqt c vkqp 'ý ký 'P GVN

$Rf/f\,qr\,gf$ 'O gvcn'Qzkf g''Rqtqwu'O cvgtkcnu'Gpcdngf 'J $_4$ 'Ugpuqtu'Qrgtcvgf''cv': 22E

RtqlgevⁱQdlgevⁱxgu

- " Ecp'hkdgt'ugpuqtu'uwtxkxg'cpf 'hwpevkqp'kp'gzvtgog'j ctuj 'kp/rkrg'eqpfkkqpuA
 - " V{rgu"qh'hkdgtuA
 - " Ugpuqt "hcdtkecvkqp"r tqeguuguA
 - "' $V{r g'' qh'' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' ugpuqtu A' 6'Tc {rgki j/gpj cpegf 'f kuvt kd wgf '' 1 gpj cpegf 'f kuvt kd wgf '' 1 gpj cpegf 'f kuvt kd wgf '' 1 gpj cpegf '' f kuvt kd wgf '' 1 gpj cpegf '' 1 gpj$
 - "" Ugpuqt 'f tkhu'cpf 'o kki cvkqp'uej go guA
- " J qy 'ugxgtg'ku'tcfkcvkqp'eqpvco kpcvkqp'hqt'hkdgt'ugpuqtu'*Rquukdng'j qv'ugpuqt" tgrncego gpvu+0
- " Wug'hkdgt 'ugpuqtu'cu'c'o gcp'vq'gpcdrg'Eqpfkkkqp/Dcugf 'Oqpkkqtkpi 'hqt'PG' U{uvgou

Sample	Fiber Type	Single-mode Fiber	Laser
#	& Vendor	Specifications	Enhancement
1, 2	SMF28e+,	NA=0.14, Ge-doped core	Yes
3	Corning		No
4, 5	Super RadHard,	$\geq 0.41~wt\%$ and 1.2 $wt\%$	Yes
6	Draka	fluorine doped in core and cladding	No
7	RRSMFB,	Fluorine-doped silica core	Yes
	Fujikura	and cladding, chlorine	
		concentration of core \geq	
		lppm	

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"ÁO KVT "Vguuk"782E "vq"872E. "vqvcn" hcuv" pgwtqp" hnvz" 606 32⁴³" p leo ⁴" Rgt" [gct

Kt cf kcvkqp'Ghigevu'qhiF kwt kdwvgf 'Hkdgt 'Ugpuqt u

$\hat{O}_{c}[|\hat{C}_{a}] \hat{A} \hat{O}_{v}$

UOH4: g- 'hkdgt Qpg'eqghhekgpv.''409' 'gttqt'hqt''cm'mecvkqpu

0	Heating Cycle #	Location	Temperature Coefficient C _T (GHz/°C)	R-square
	1st (Non-irradiated)		-1.519±0.040	0.997
	2nd (Non-irradiated)		-1.607±0.035	0.998
	1 st (Day 1, Under Radiation)	at TC4	-1.573±0.005	0.999
	Radiation	at TC5	-1.641±0.007	0.999
	2 nd (Day 3, Under Radiation)	at TC4	-1.620±0.009	0.999
	Radiation	at TC5	-1.676±0.013	0.997
	3 rd (Day 19, Under Radiation)	at TC4	-1.536±0.007	0.999
	reaction	at TC5	-1.616±0.009	0.998
• U	Aggregated Linear Fit	at TC4&5	-1.604 ± 0.004	0.998

Uwrgt 'Tcf J ctf 'hdgt Qpg"eqghhekgpv."406' "gttqt"hqt"cmhqecvkqpu

Heating Cycle#	Location	Temperature Coefficient C _T (GHz/°C)	R-square
1st (Non-irradiated)		-1.498±0.023	0.999
2nd (Non-irradiated)		-1.555±0.032	0.998
1 st (Day 1, Under Radiation)	at TC4	-1.540±0.006	0.999
	at TC5	-1.577±0.006	0.999
2 nd (Day 3, Under Radiation)	at TC4	-1.578±0.007	0.999
	at TC5	-1.613±0.011	0.998
3 rd (Day 19, Under Radiation)	at TC4	-1.530±0.005	0.999
	at TC5	-1.596±0.010	0.998
Aggregated Linear Fit	at TC4&5	-1.567±0.003	0.998

TTUO HD'hdgt Qpg"eqghhekgpv."407' "gttqt"hqt"cm/mecvkqpu

Heating Cycle#	Location	Temperature Coefficient C _T (GHz/°C)	R-square
1st (Non-irradiated)		-1.489±0.018	0.999
2nd (Non-irradiated)		-1.534±0.033	0.998
1 st (Day 1, Under Radiation)	at TC4	-1.554±0.008	0.998
, and the second s	at TC5	-1.643±0.010	0.997
2 nd (Day 3, Under Radiation)	at TC4	-1.568±0.003	0.999
,	at TC5	-1.617 ± 0.004	0.999
3 rd (Day 19, Under Radiation)	at TC4	-1.550±0.005	0.999
	at TC5	-1.595±0.004	0.999
Aggregated Linear Fit	at TC4&5	-1.588±0.003	0.999

Qpg'eqghhelgpv'ecp'dg'wgf *¢407' 'gt t qt 'hqt 'c miqec vkqpu 'hcuv'pgwvt qp 'hwz 'xct kcvkqp '¢: ' '+

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- O kwi cvkqp'Uvt cvgi {<
- Ukpi ng''Vj gto qeqwr ng''cu''õi qnf ''uvcpf ctf ö''VE6

NUVO "pgwtcn"pgw qtm"cr r n{ "vq"y g"hdgt"ugpuqt"cv"VE6"mecvkqp<j ctpguu"vgo r qtcn"mpqy ngf i g

nPP 'pgwtcn'pgwy qtmu'r cuu'mpqy ngf i g'vq'qyj gt'hkdgt''ugpuqtu'mqecvgf 'kp'f khgtgpv'ur cvkcn'r qukskqp Cduqnwvg''gttqt''y kyj kp'6E

V^{]^\æv`\^Á\\[4^A (AT Q/ÁÜ^•^æ&@Ü^æ&(\ÁÔ[\^

- " Ki'ku'r quukdrg'vq'tgf weg'equv'qh'ugpukpi 'hkdgtu'd{" 32'vko gu0
- " Ki'ku'r quukdrg''vq'tgf weg'equv'qh'ugpuqt''kpvgttqi cvqtu''d{" 32''vko gu0
 - " Pqv'y g'dguv'r gthqto cpeg'dw'i qqf "gpqwi j 0
- " Gzrcpf "crrnlecdkrkv{ "qh"hkdgt "ugpuqtu
- " Uecng/wr 'f gr m{o gpwl'hqt "gpgti { 'kphtcuxt wewt gu

Vj cpm{ qw

