Application Notes

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Introduction

Corning Gilbert provides **push-on interconnect solutions** that are designed for blind mating and electrical performance when fully mated or mechanical misaligned. The push-on interface features ease of mating along with a high reliability electro-mechanical connection. This enables high density system flexibility while maintaining functionality from DC to 65 GHz.

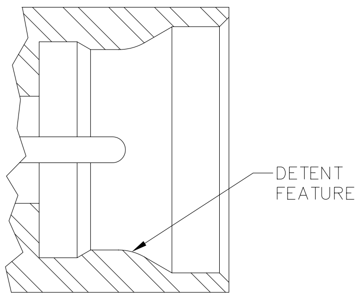

Figure 1 - Full Detent

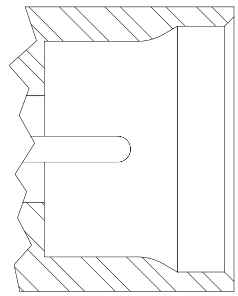

Figure 2 - Smooth Bore

Detent features are provided to retain the push-on connectors in the mated condition. Different levels of engage and disengage forces are accomplished by the stepped feature on the inside of the Shroud housing. Figure 1 shows the Full Detent interface which provides the highest mating forces and is recommended for use with cable connectors. Limited Detent interfaces are also available with reduced engage and disengage forces. Figure 2 shows the Smooth Bore interface which has the lowest mating forces (no stepped detent feature).

Module to module and board to board applications typically use a three connector system. One Blind-Mate Interconnect (BMI also know as a bullet) is mated between a Full Detent and a Smooth Bore Shroud. The Full Detent interface retains the BMI yet allows radial misalignment. The Smooth Bore interface allows misalignment in both radial and axial orientations.

Mechanical misalignment is the result of multiple component systems and the associated positional tolerances. **Axial misalignment** is the offset distance between the Shroud and BMI reference planes. For most connectors, coplanar reference planes provide the best electrical performance. Corning Gilbert can design connectors for optimal performance with a preset amount of axial misalignment. This enables good electrical performance with movement in both axial directions. **Radial misalignment** is the distance between the centerlines of the mated Shroud connectors. This is also know as gimballing and is a directly related to the BMI length.

Figure 3 shows the BMI axially misaligned with an offset distance between the Shroud and BMI reference planes. The fully mated condition (no offset) is ideal for best electrical performance on most connectors.

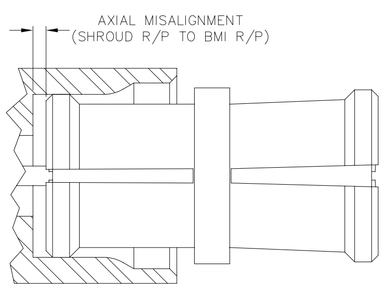

Figure 3 - Axial Misalignment

Figure 4 shows the BMI mated between two (2) connectors that are radially misaligned from centerline to centerline. The amount of radial misalignment is dependent upon the length and angle of the BMI. The GPO standard angle of 3° is mainly a function of the allowable connector housing movement.

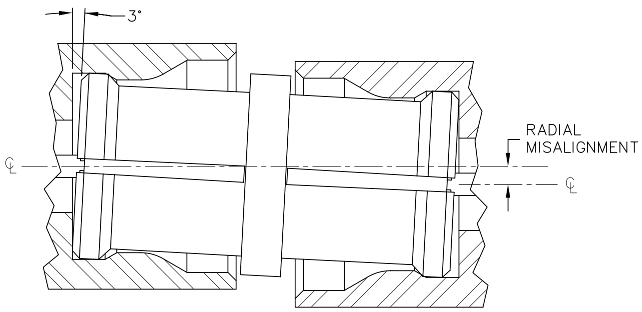

Figure 4 - Radial Misalignment

Various configurations are available such as Blind-Mate Interconnects, printed circuit board connectors, cable connectors, and hermetic panel connectors. The GPO connectors are also functionally compliant with the SMP interface of MIL-PRF-31031. Performance and reliability make Corning Gilbert the push-on connector of choice.

1.0 Materials and Finishes

Tables 1A, 1B, and 1C show the standard materials and finishes used to manufacture Corning Gilbert push-on connectors. This includes various configurations across all of the product families (GPO, GPPO, G3PO, G4PO, and SGMS).

Table 1A - Metal Materials

Material	Specification
BeCu (Beryllium Copper)	ASTM B 196 and/or ASTM B 197
Brass	ASTM B 36, B121, B16, B16M
Stainless Steel (303)	ASTM A484/ A582 or A555/581
Iron-Nickel-Cobalt	ASTM F-15

Table 1B - Metal Finishes

Finish	Specification
Gold (75u in. Typ)	ASTM-B488 Type 1, Class 1.25
Nickel (100u in. Typ)	SAE AMS-QQ-N-290

Table 1C - Dielectric Materials

Material	Specification
Virgin PTFE Fluorocarbon	ASTM D 1710 and ASTM D 1457
Polyamide-Imide	ASTM D5204 Group 2 Class 1
Glass	Corning 7070 or Equivalent

The characteristics of the above materials enable the standard Storage and Operating Temperature Range of -65 °C to +165 °C.

2.0 GPO

2.1 GPO Detents – Full, Limited, and Smooth Bore

Table 2 shows the available GPO detents, typical engage / disengage forces, and mating cycles.

Table 2 - GPO Detent Forces and Mating Cycles

Detent	GPO		
	Engage*	Disengage*	Cycles (Min)
Full	7.0	9.0	100
Limited	5.0	7.0	500
Smooth Bore	3.0	0.5	1000

* The engage / disengage force values (shown in pounds) are typical and based upon actual data.

2.2 GPO Axial Misalignment

Figure 5 shows the GPO VSWR electrical performance versus frequency and axial misalignment.

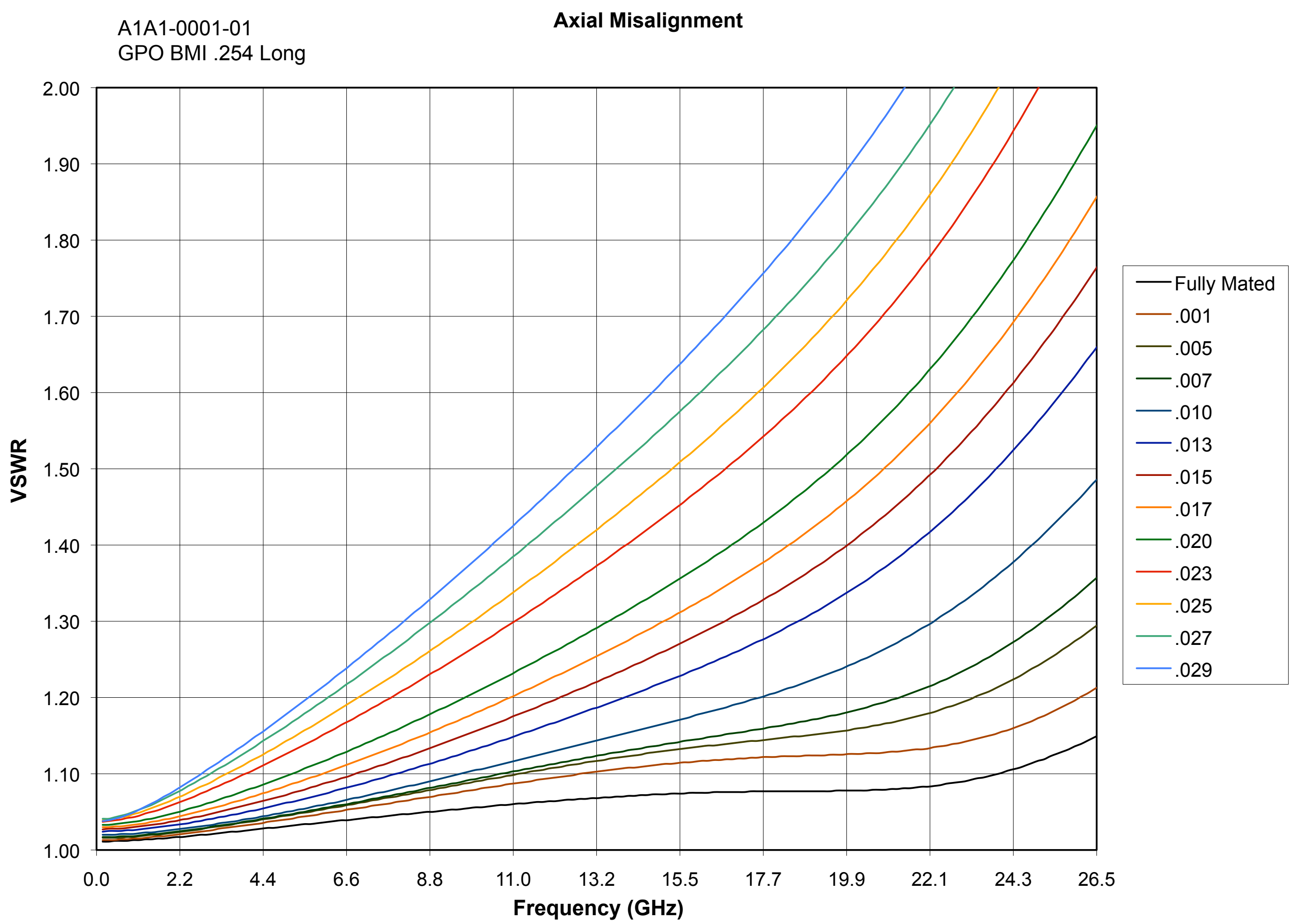

Figure 5 - GPO Axial Misalignment Performance

2.3 GPO Radial Misalignment

Figure 6 shows the GPO VSWR electrical performance versus frequency and radial misalignment.

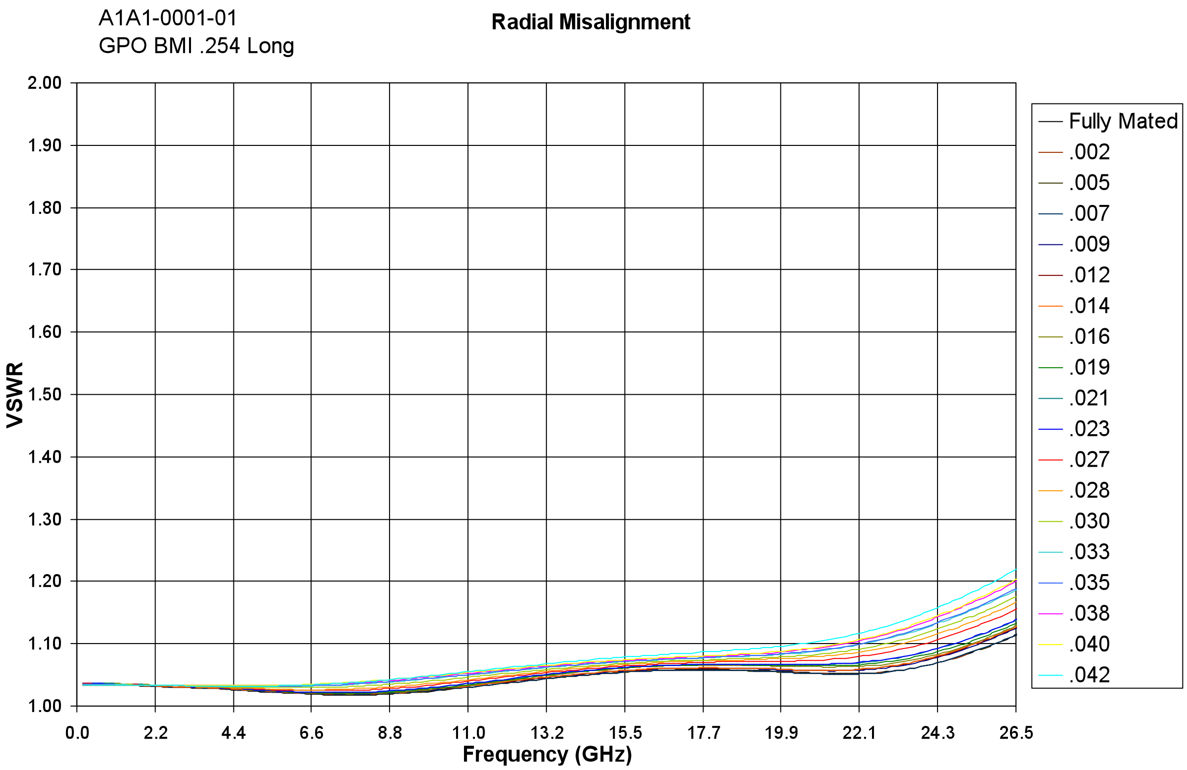

Figure 6 - GPO Radial Misalignment Performance

2.4 GPO VSWR and Insertion Loss

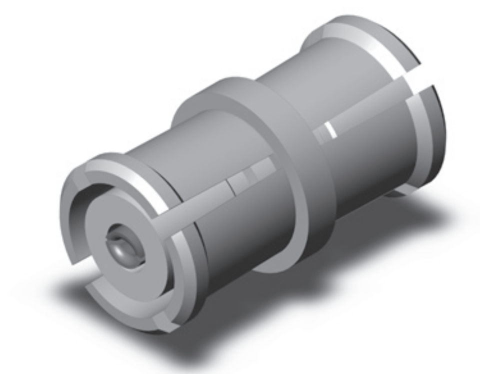

Figure 7 - GPO BMI A1A1-0001-01

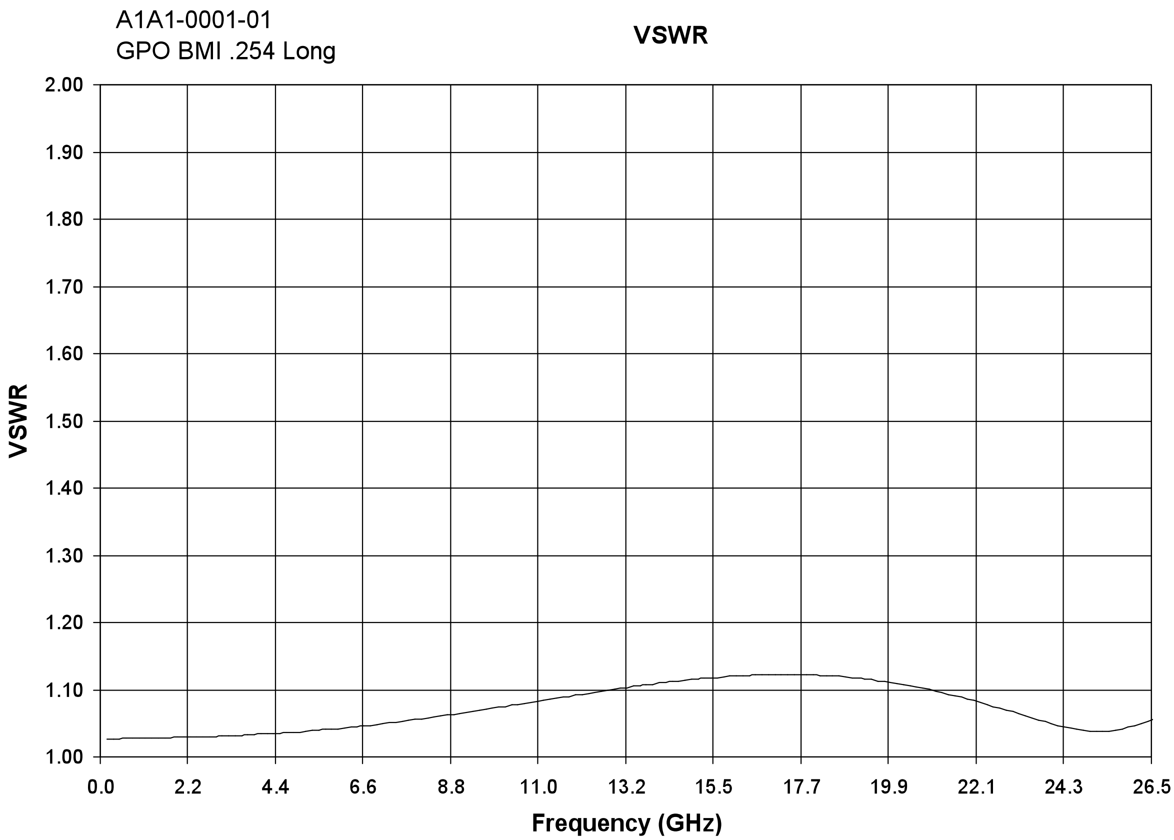

Figure 7A - GPO BMI VSWR Performance

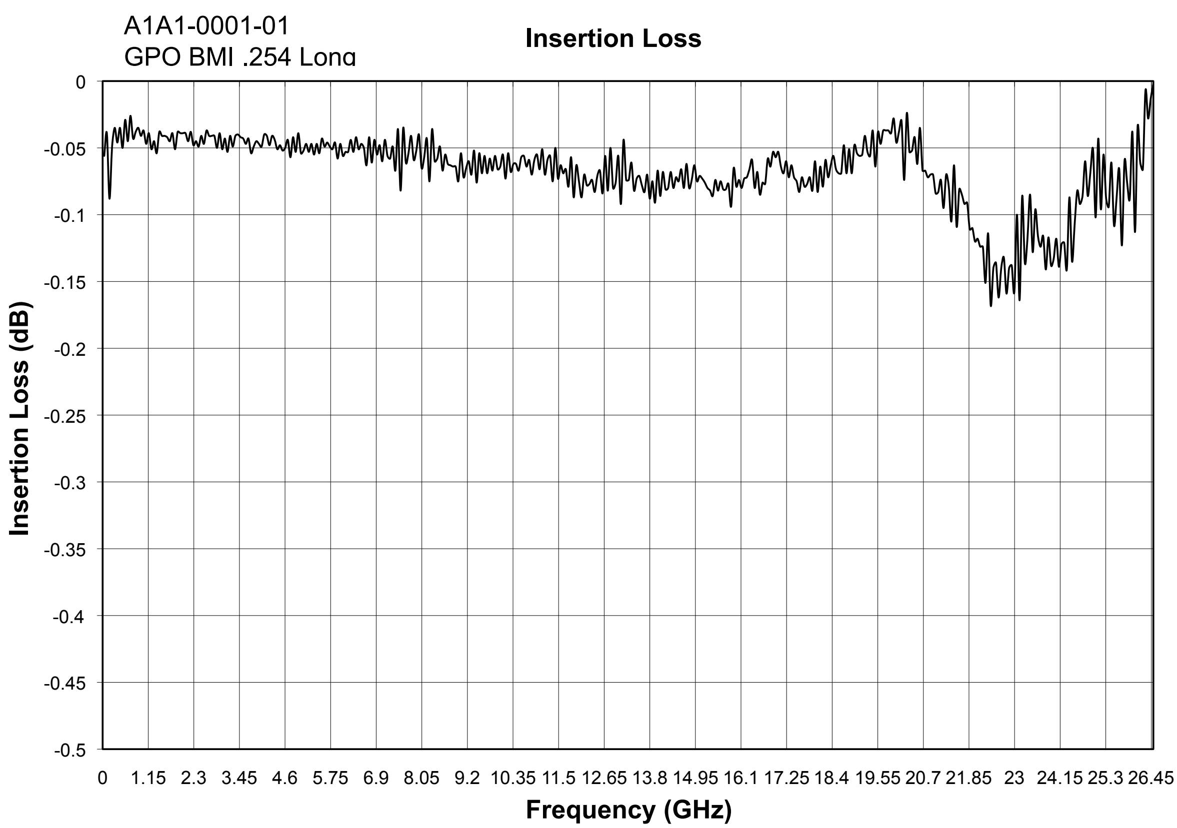

Figure 7B - GPO BMI Insertion Loss Performance

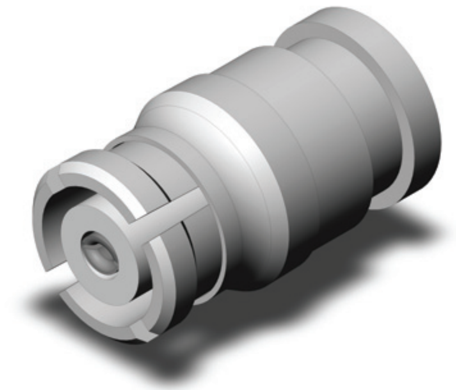

Figure 8 - GPO Cable Connector 0119-925-1

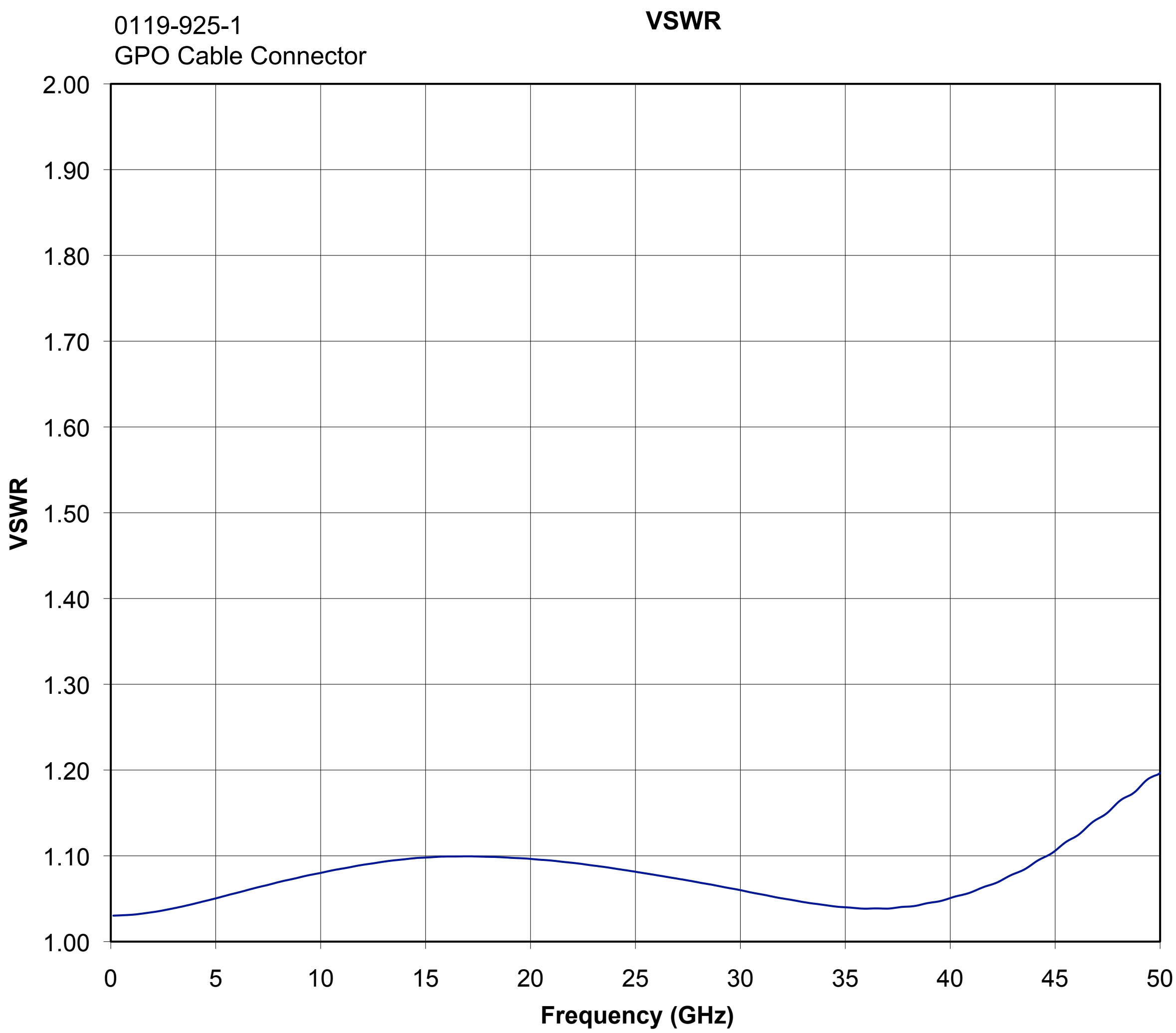

Figure 8A - GPO Cable Connector VSWR Performance

3.0 GPPO

3.1 GPPO Detents – Full and Smooth Bore

Table 3 shows the available GPPO detents, typical engage / disengage forces, and mating cycles.

Table 3 - GPPO Detent Forces and Mating Cycles

Detent	GPPO		
	Engage*	Disengage*	Cycles (Min)
Full	4.5	6.5	100
Smooth Bore	2.5	1.5	500

* The engage / disengage force values (shown in pounds) are typical and based upon actual data.

3.2 GPPO Axial Misalignment

Figure 9 shows the GPPO VSWR electrical performance versus frequency and axial misalignment.

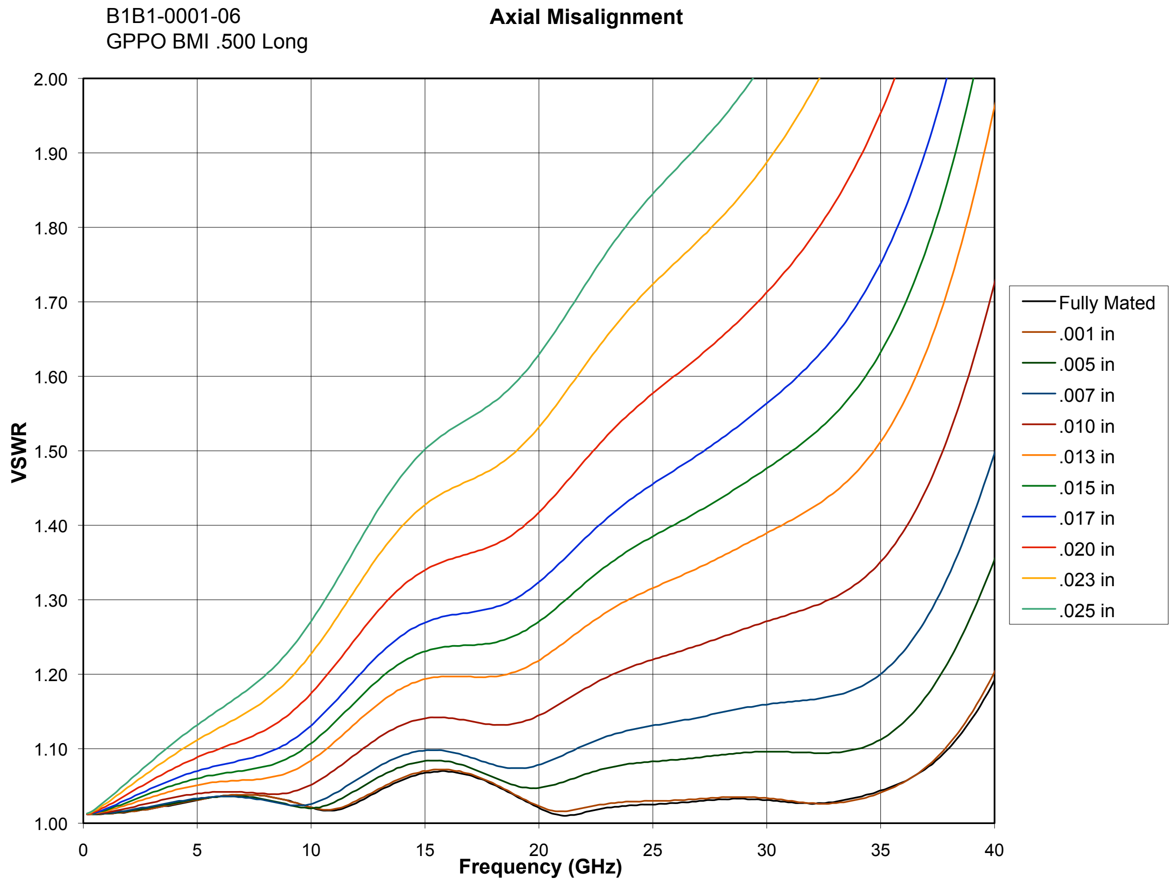

Figure 9 - GPPO Axial Misalignment Performance

3.3 GPPO Radial Misalignment

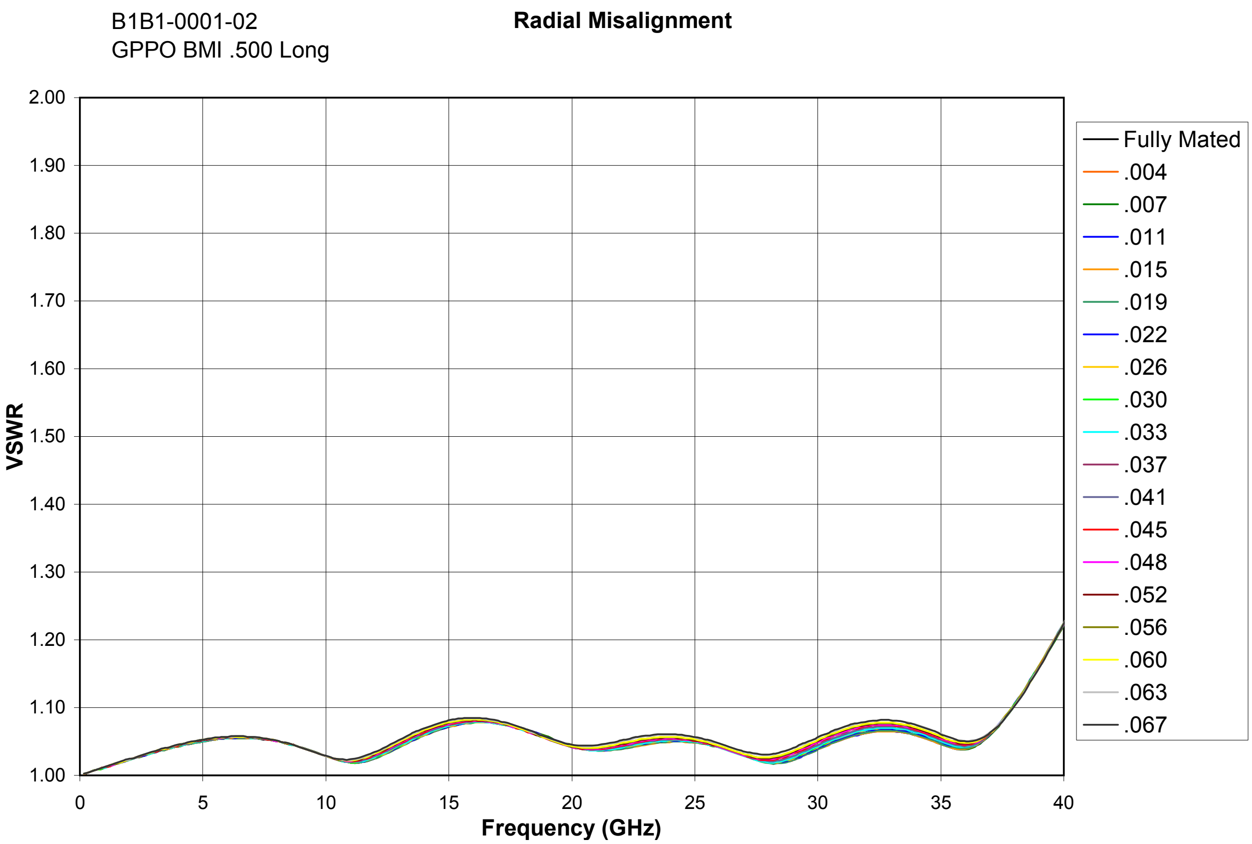

Figure 10 - GPPO Radial Misalignment Performance

3.4 GPPO VSWR and Insertion Loss

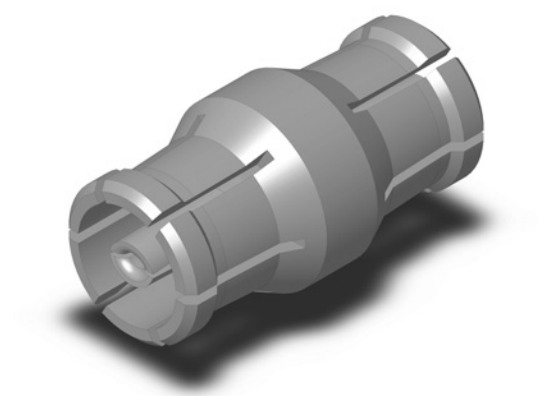

Figure 11 - GPPO BMI B1B1-0001-01

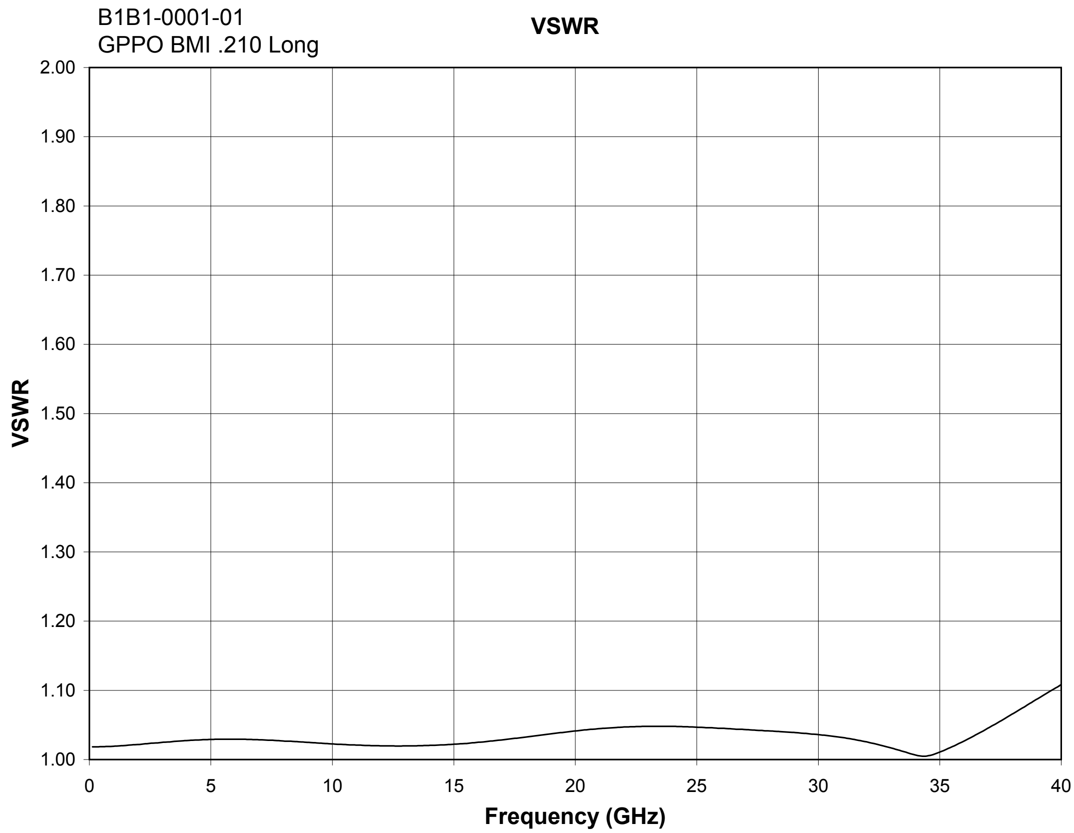

Figure 11A - GPPO BMI VSWR Performance

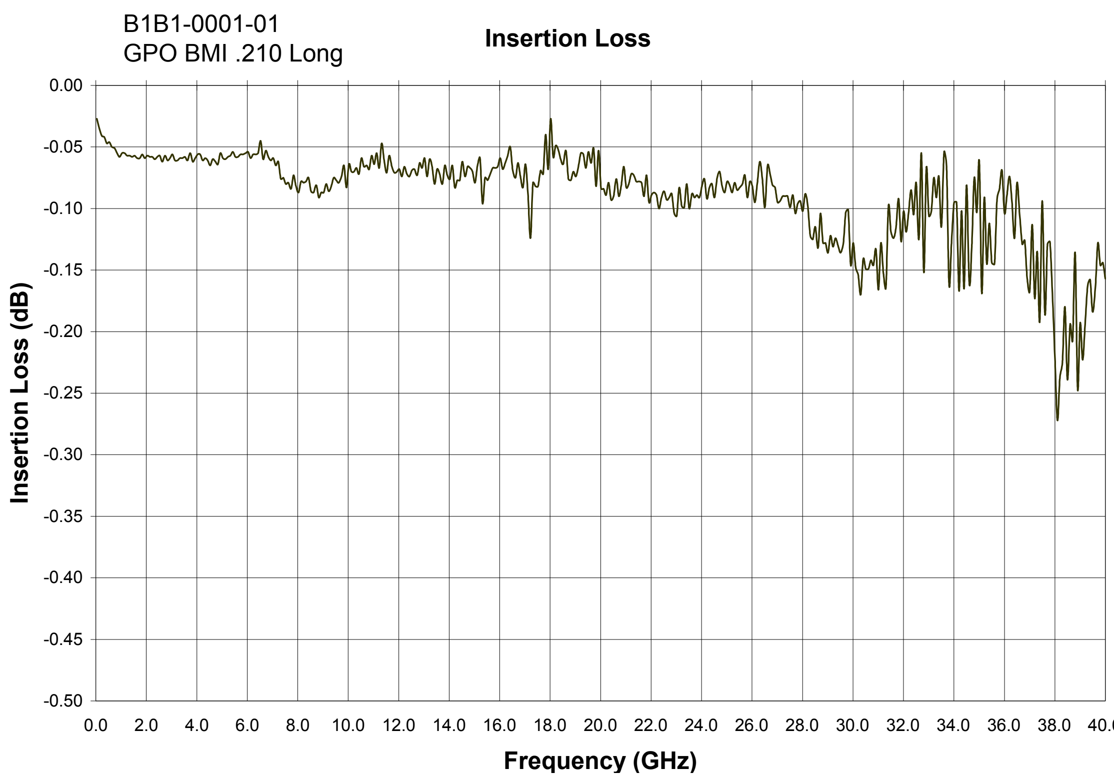

Figure 11B - GPPO BMI Insertion Loss Performance

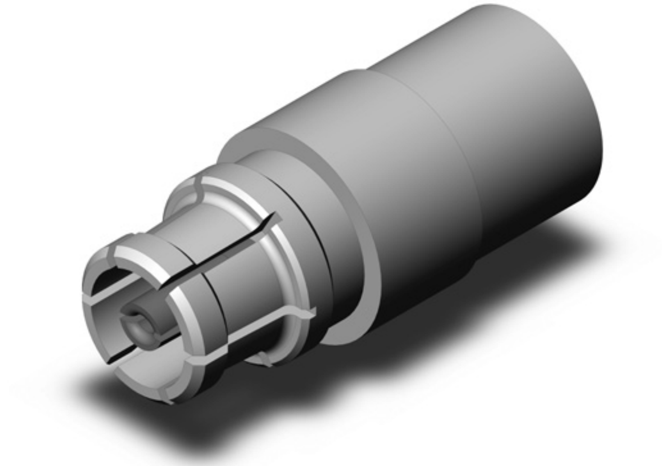

Figure 12 - GPPO Cable Connector B014-D11-01

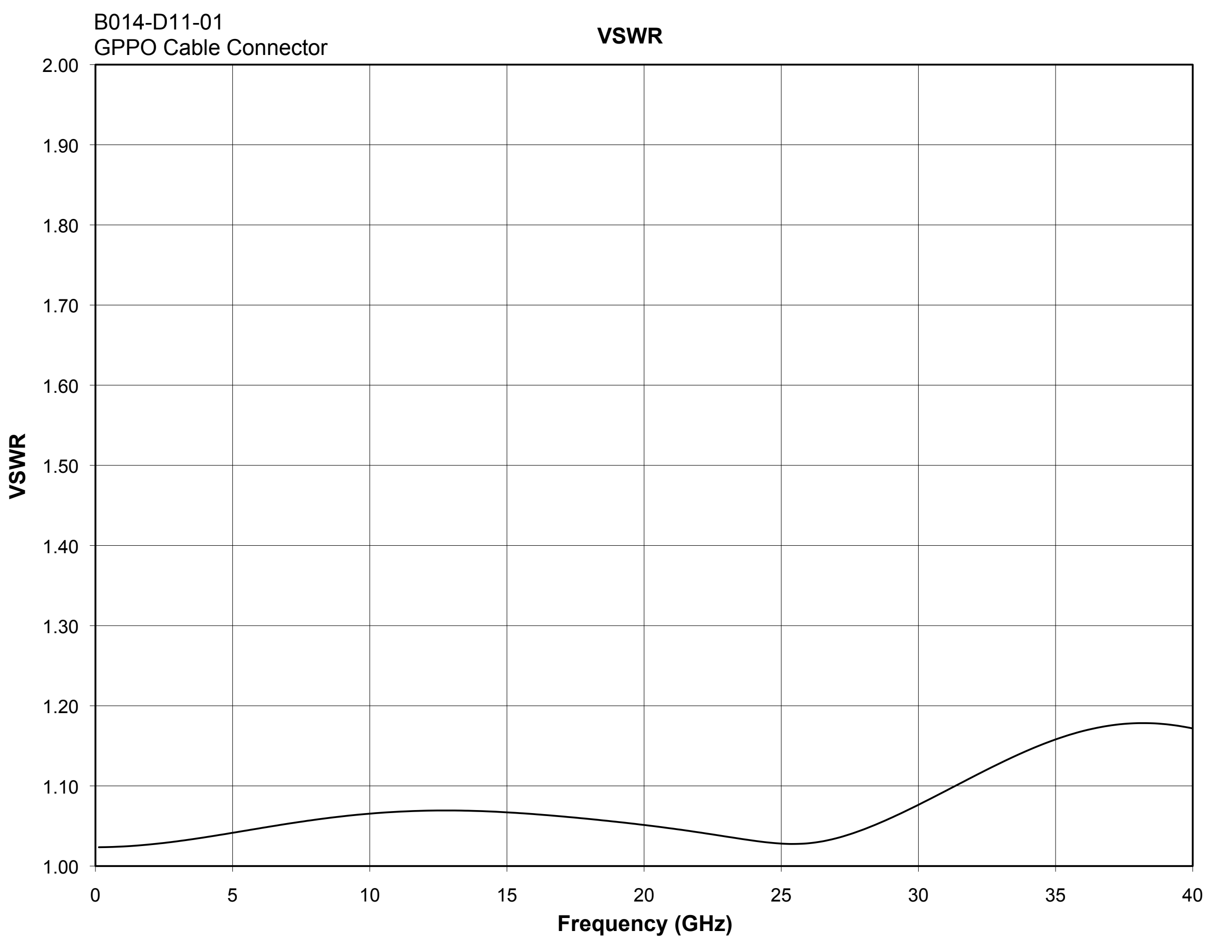

Figure 12A - GPPO Cable Connector VSWR Performance

4.0 G3PO

4.1 G3PO Detents – Full and Smooth Bore

Table 4 shows the available G3PO detents, typical engage / disengage forces, and mating cycles.

Table 4 – G3PO Detent Forces and Mating Cycles

Detent	G3PO		
	Engage*	Disengage*	Cycles (Min)
Full	2.5	4.5	100
Smooth Bore	1.2	1.0	500

* The engage / disengage force values (shown in pounds) are typical and based upon actual data.

4.2 G3PO Axial Misalignment

Figure 13 shows the G3PO VSWR electrical performance versus frequency and axial misalignment.

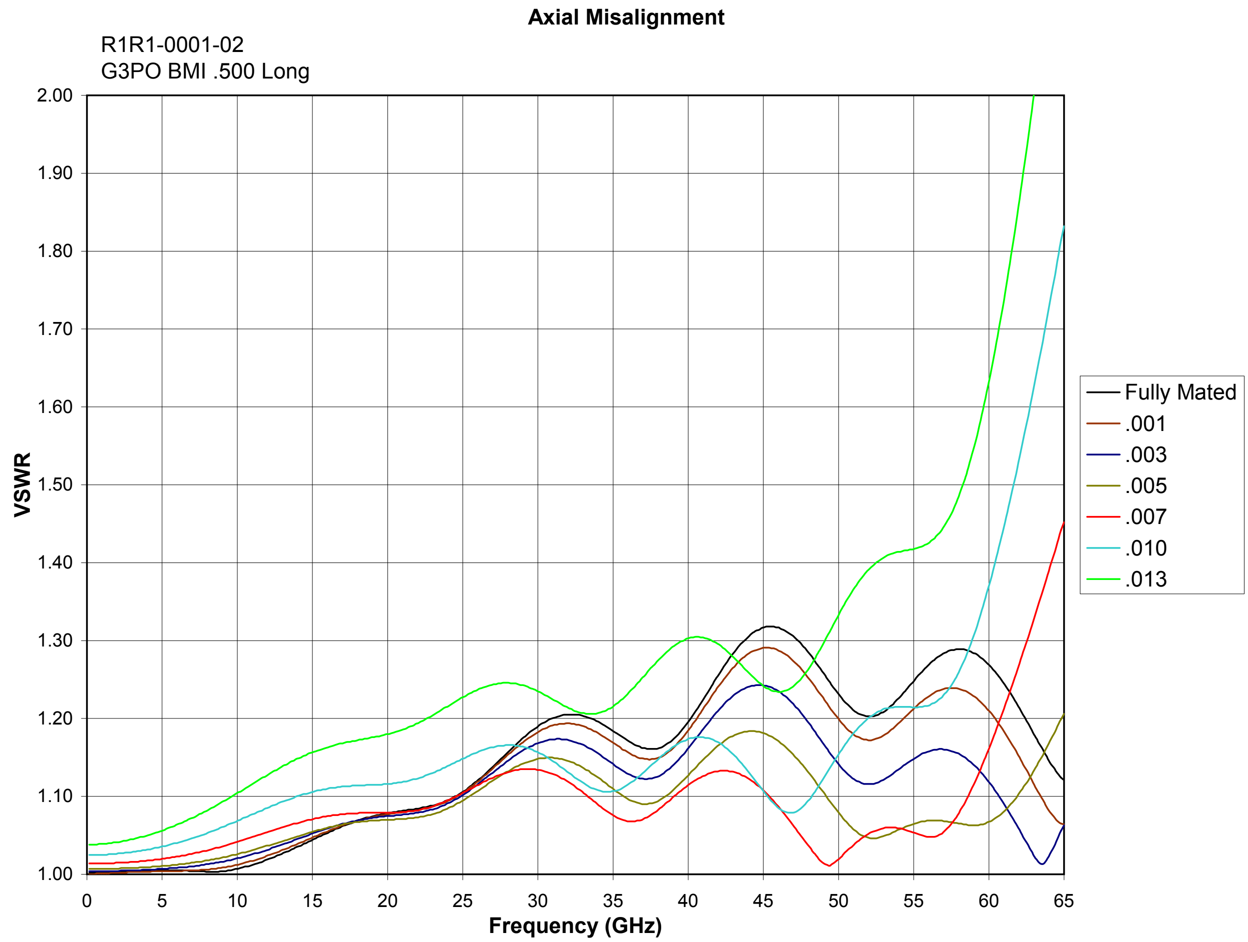

Figure 13 – G3PO Axial Misalignment Performance

4.3 G3PO Radial Misalignment

Figure 14 shows the G3PO VSWR electrical performance versus frequency and radial misalignment.

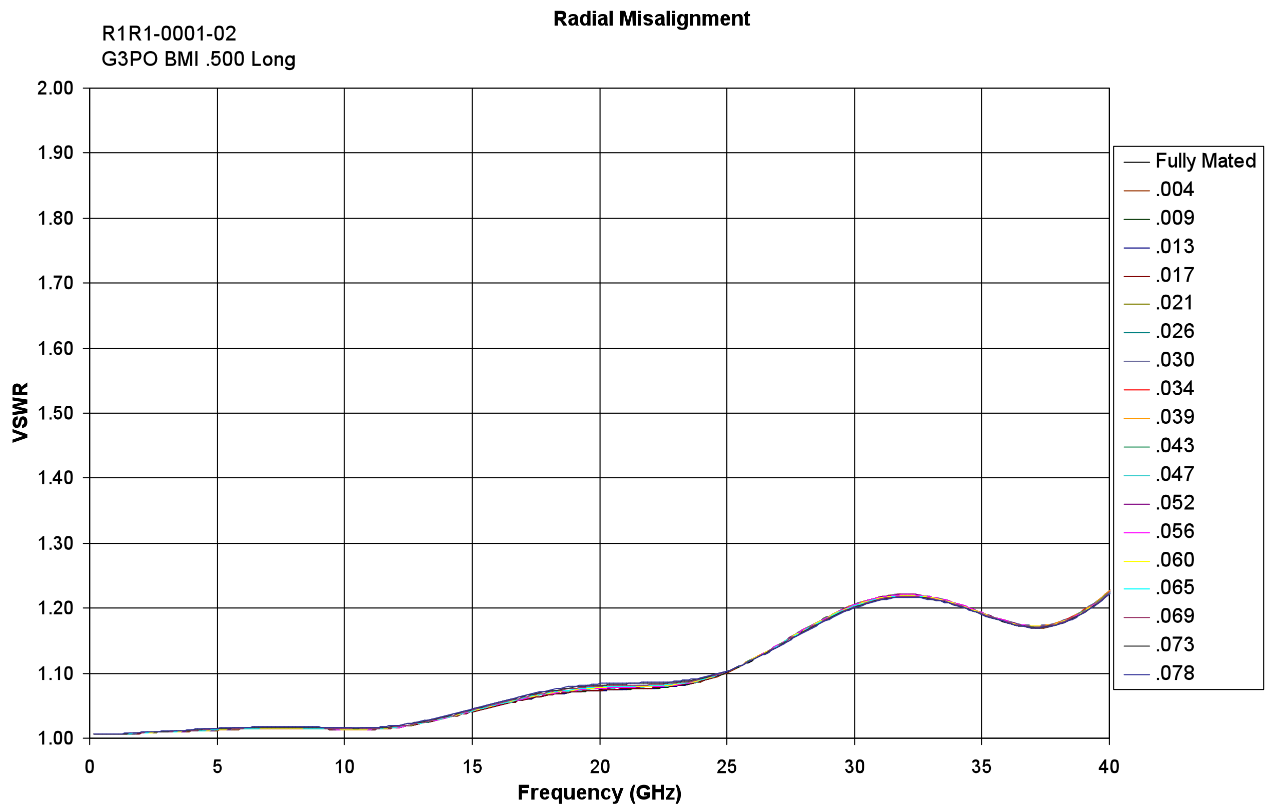

Figure 14 – G3PO Radial Misalignment Performance

4.4 G3PO VSWR and Insertion Loss

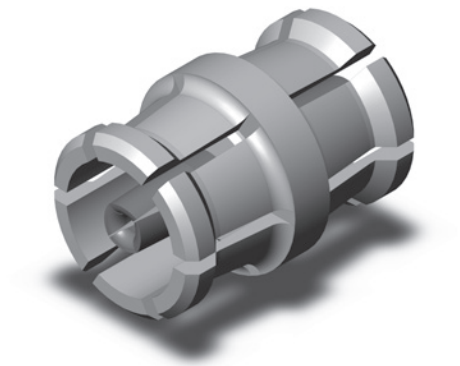

Figure 15 – G3PO BMI R1R1-0001-01

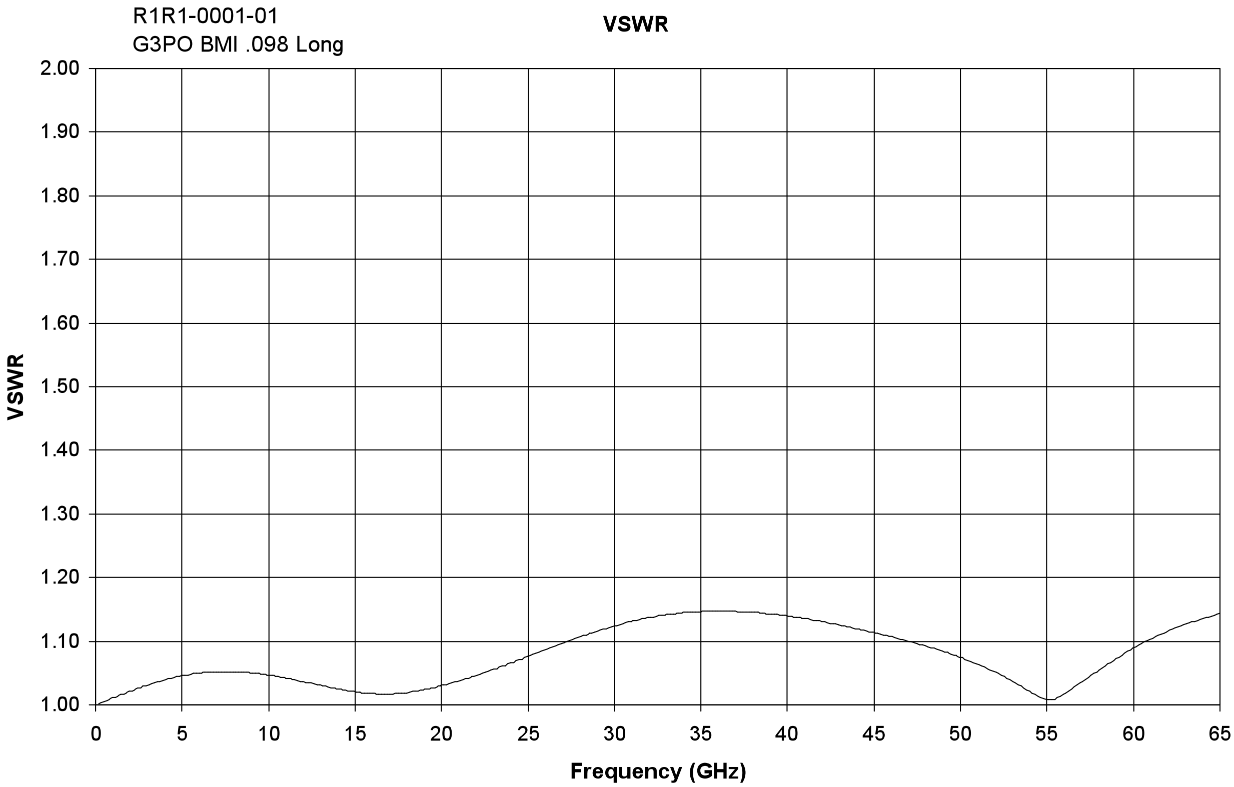

Figure 15A – G3PO BMI VSWR Performance

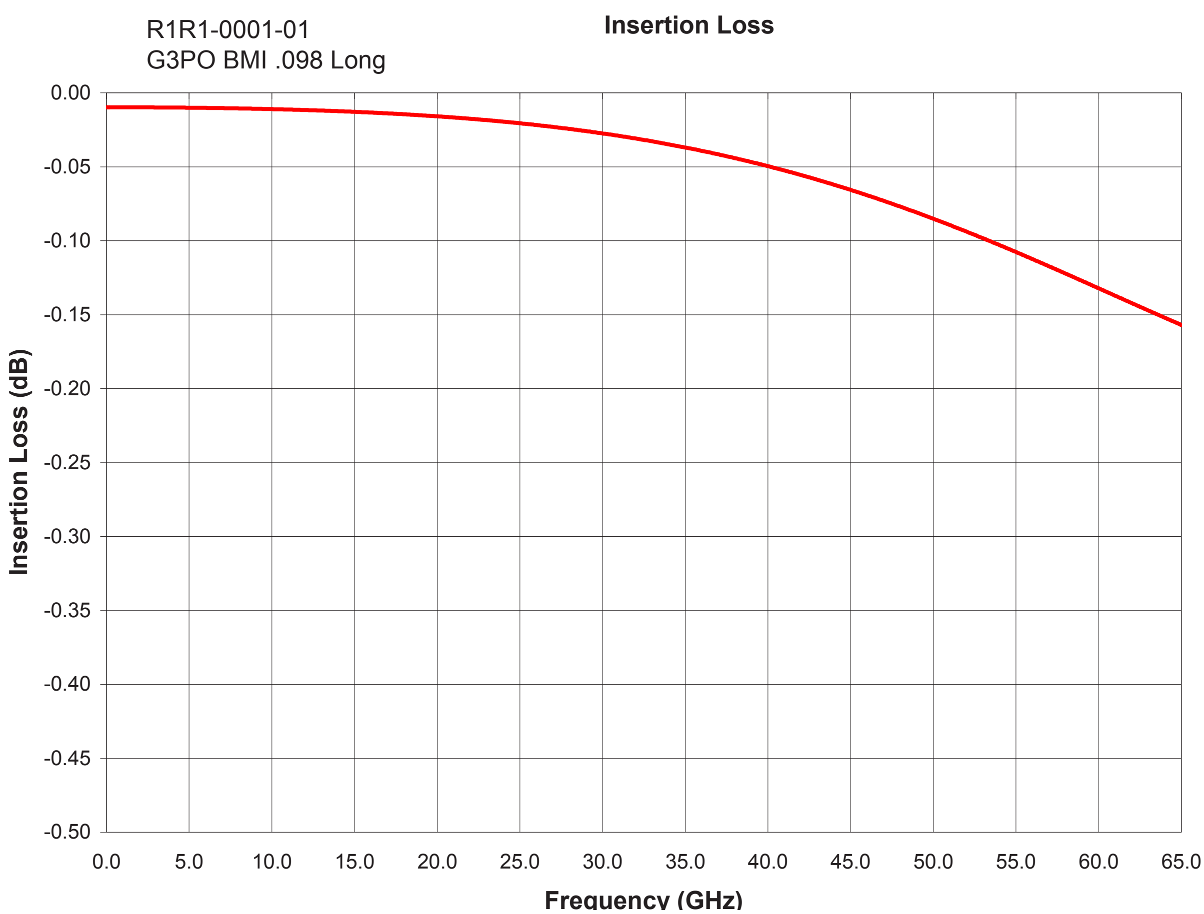

Figure 15B – G3PO BMI Insertion Loss Performance

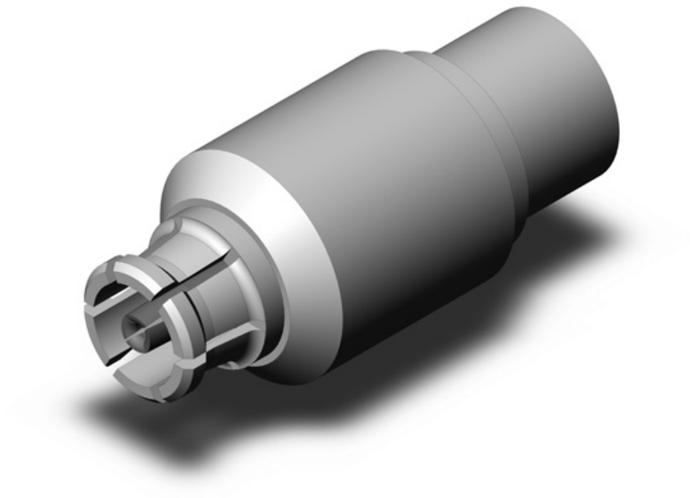

Figure 16 – G3PO Cable Connector R014-B11-01

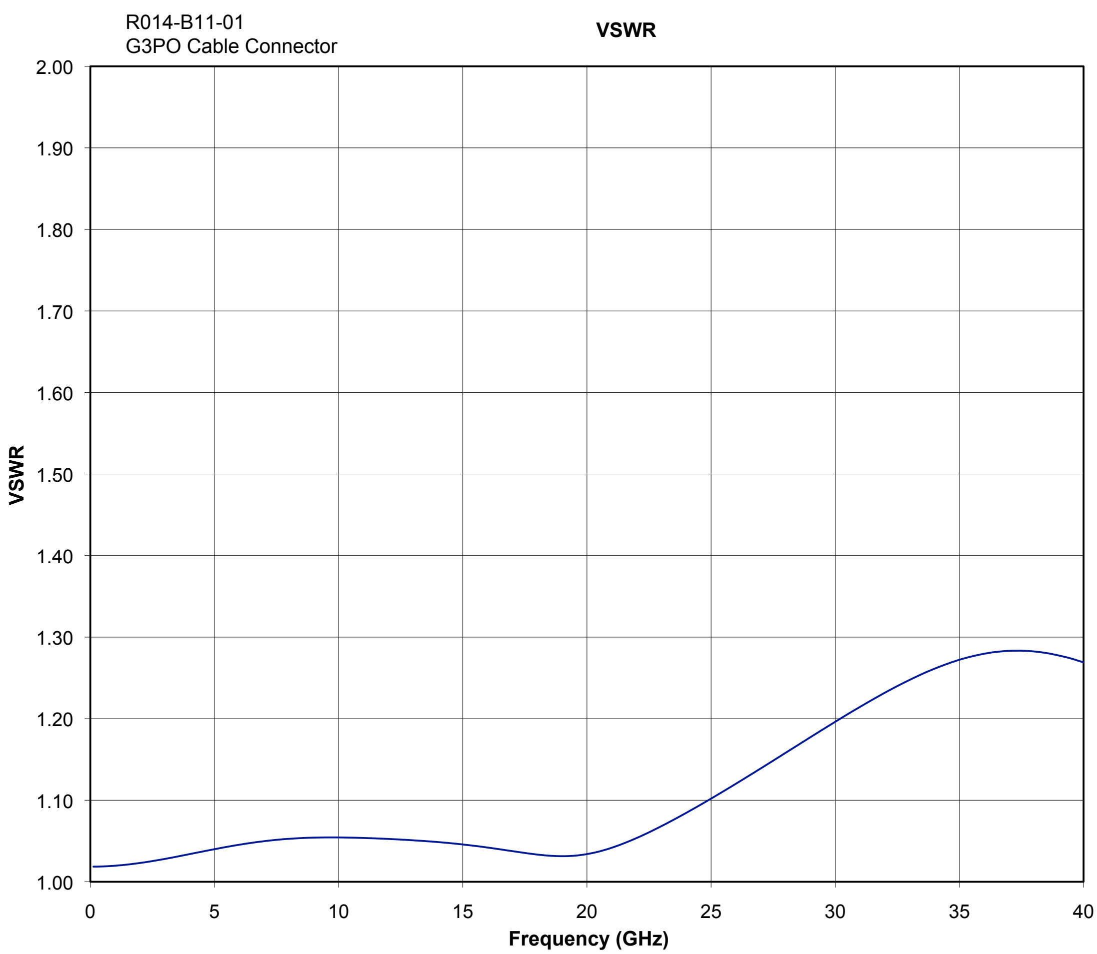

Figure 16A – G3PO Cable Connector VSWR Performance

5.0 G4PO

5.1 G4PO Detents – Full and Smooth Bore

Table 5 shows the available G4PO detents, typical engage / disengage forces, and mating cycles.

Table 5 – G4PO Detent Forces and Mating Cycles

Detent	G4PO		
	Engage*	Disengage*	Cycles (Min)
Full	.65	2.2	100
Smooth Bore	.20	.15	500

* The engage / disengage force values (shown in pounds) are typical and based upon actual data.

5.2 G4PO VSWR

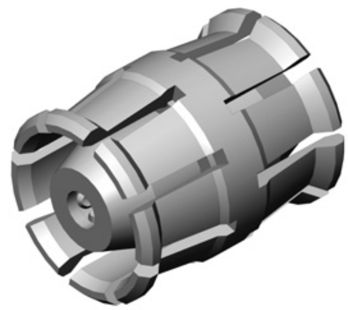

Figure 17 – G4PO BMI S1S1-0001-01

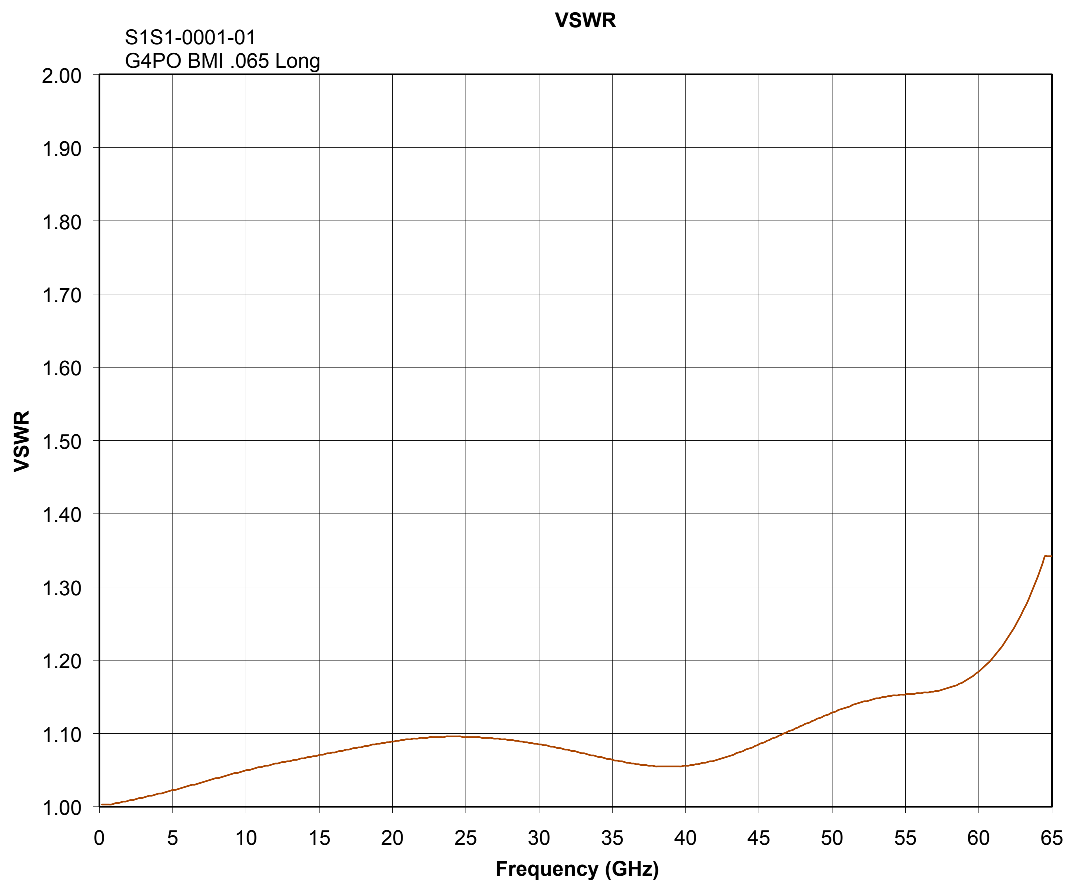

Figure 17A – G4PO BMI VSWR Performance

6.0 SGMS

6.1 SGMS Detents – Full and Smooth Bore

Table 6 shows the available SGMS detents, typical engage / disengage forces, and mating cycles.

Table 6 – SGMS Detent Forces and Mating Cycles

Detent	SGMS		
	Engage*	Disengage*	Cycles (Min)
Limited	4.5	6.0	100
Smooth Bore	3.0	1.5	5000

* The engage / disengage force values (shown in pounds) are typical and based upon actual data.

6.2 SGMS Axial Misalignment

Figure 18 shows the SGMS VSWR electrical performance versus frequency and axial misalignment.

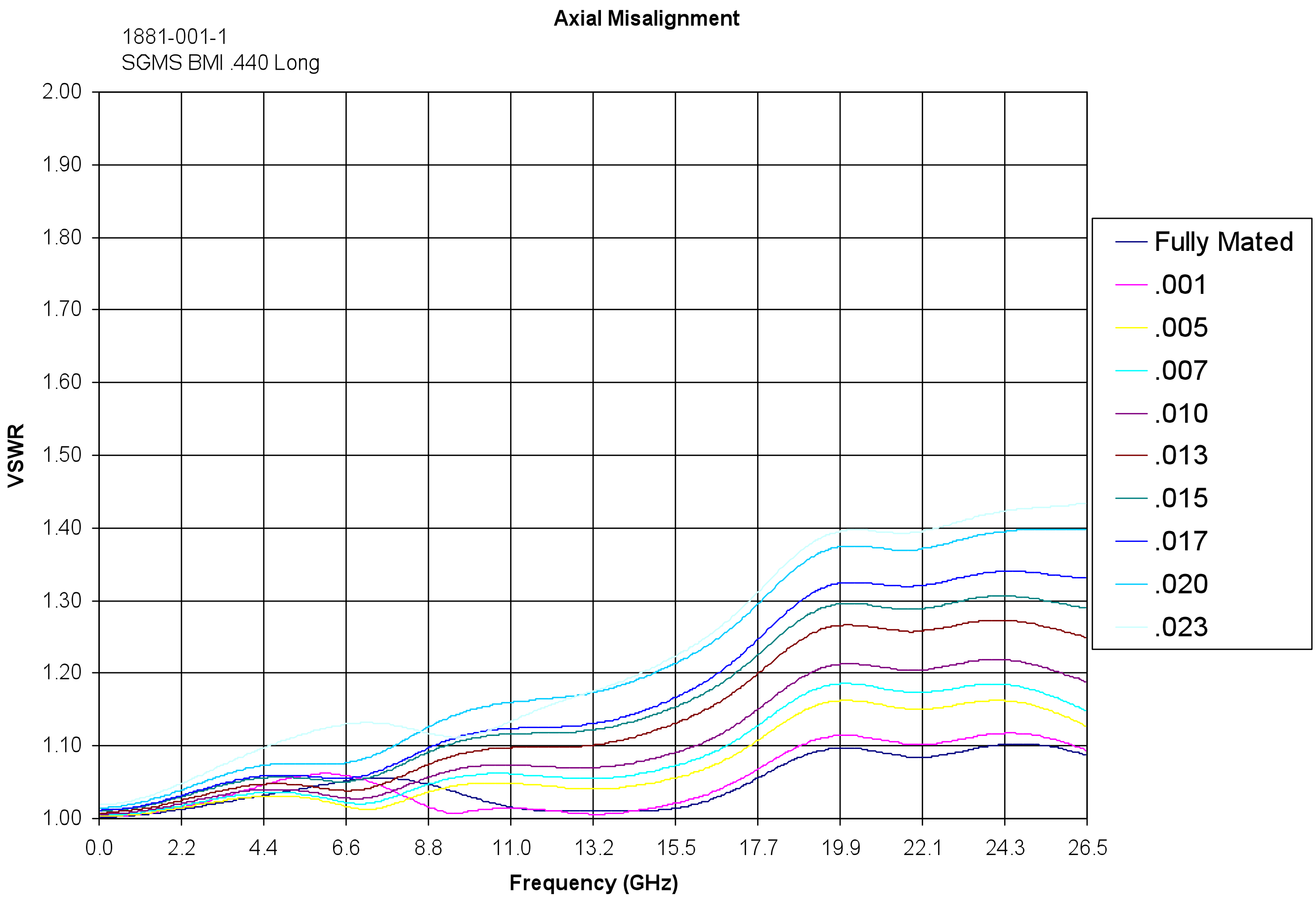

Figure 18 – SGMS Axial Misalignment Performance

6.3 SGMS Radial Misalignment

Figure 19 shows the SGMS VSWR electrical performance versus frequency and radial misalignment.

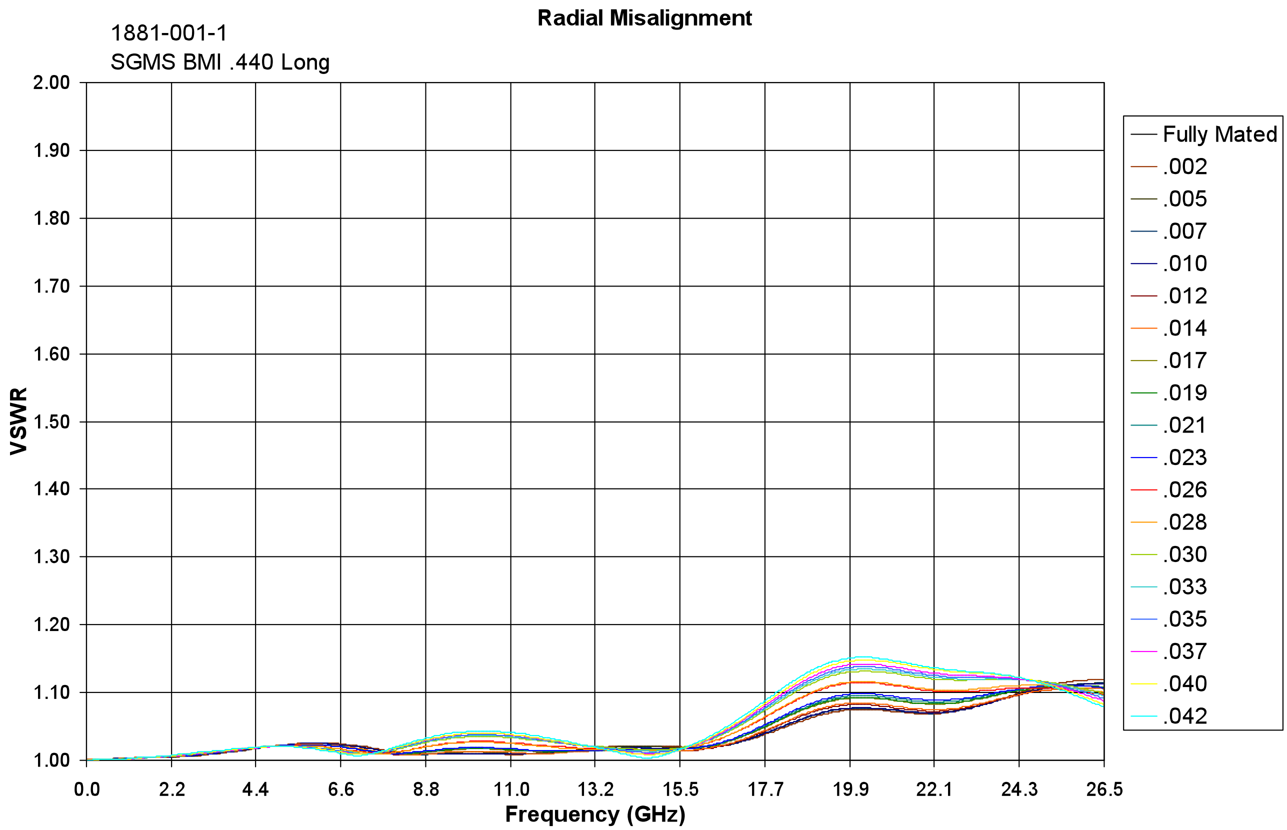

Figure 19 – SGMS Radial Misalignment Performance

6.4 SGMS VSWR and Insertion Loss

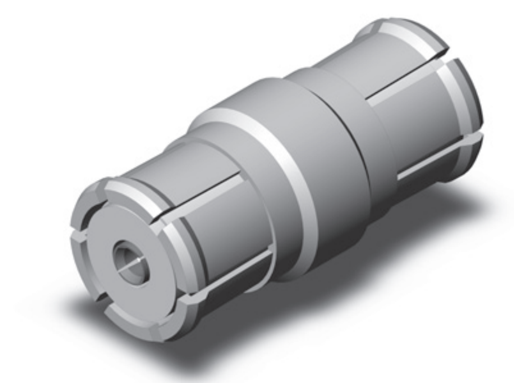

Figure 20 – SGMS BMI 1881-001-1

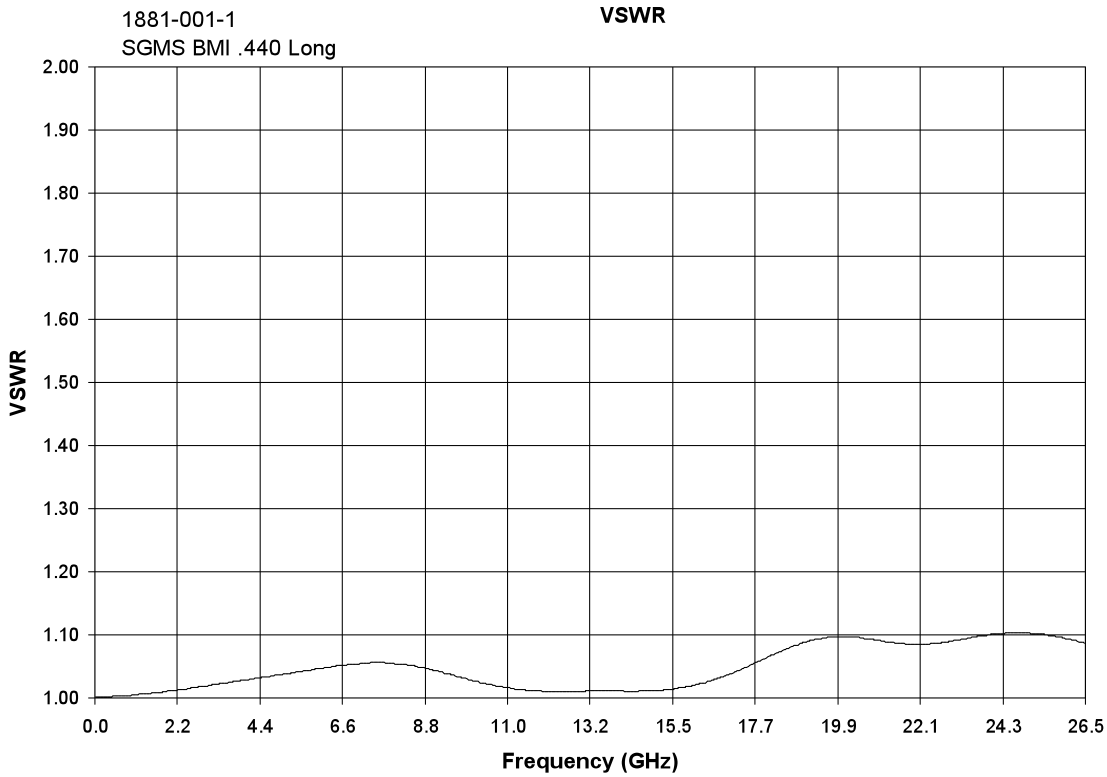

Figure 20A – SGMS BMI VSWR Performance

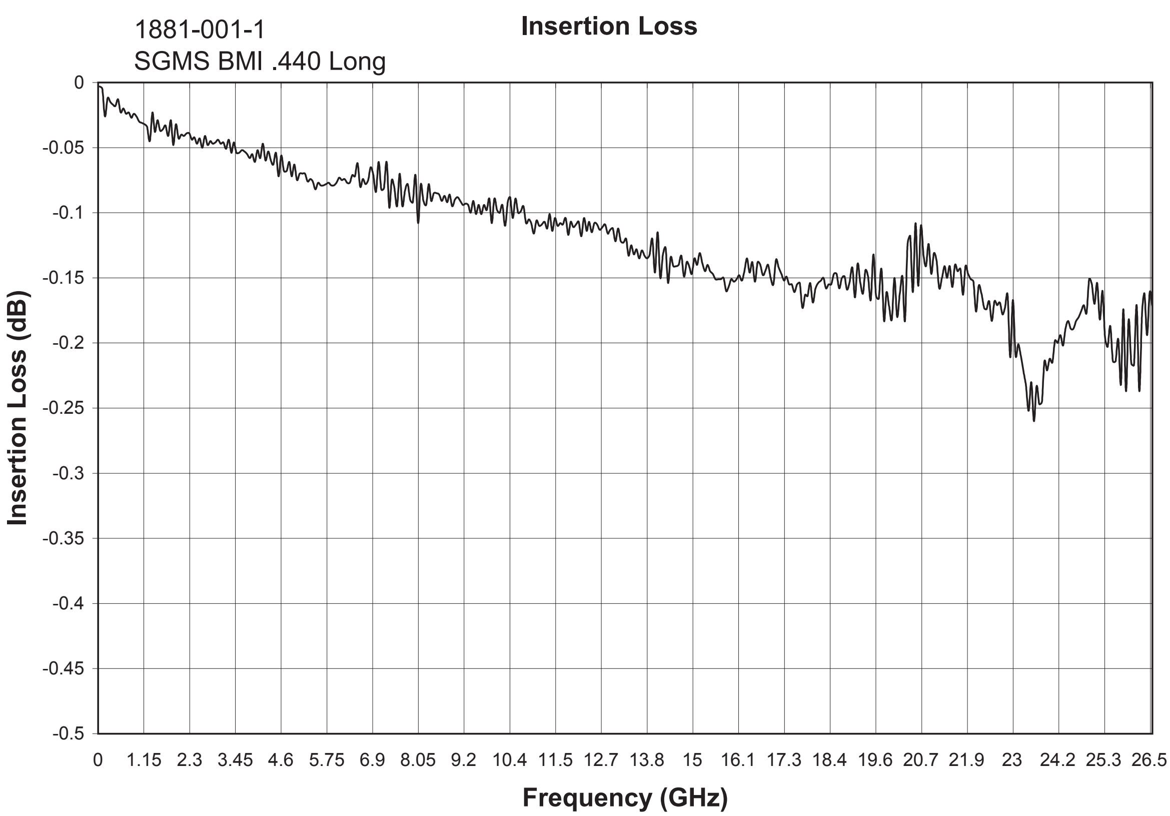

Figure 20B – SGMS BMI Insertion Loss Performance

7.0 Electrical – GPO, GPPO, G3PO, G4PO, and SGMS

7.1 General Electrical Specifications

Table 7 – GPO, GPPO, G3PO, G4PO, and SGMS General Electrical Specifications

Parameter	GPO	GPPO	G3PO	G4PO	SGMS
Dielectric Withstanding Voltage (DWV)	500 Vrms	325 Vrms	250 Vrms	250 Vrms	1500 Vrms
Insulation Resistance (IR)	5000 MOhms @ 500 VDC	5000 MOhms @ 500 VDC	3500 MOhms @ 100 VDC	3500 MOhms @ 100 VDC	5000 MOhms @500 VDC
RF High Pot. @ 5 MHz	325 Vrms	200 Vrms	150 Vrms	150 Vrms	500 Vrms
Corona Level @ 70,000 ft	190 Vrms	125 Vrms	100 Vrms	100 Vrms	250 Vrms
Center Conductor Contact Resistance	6.0 mOhms max	6.0 mOhms max	6.0 mOhms max	6.0 mOhms max	6.0 mOhms max

7.2 Average Power Handling

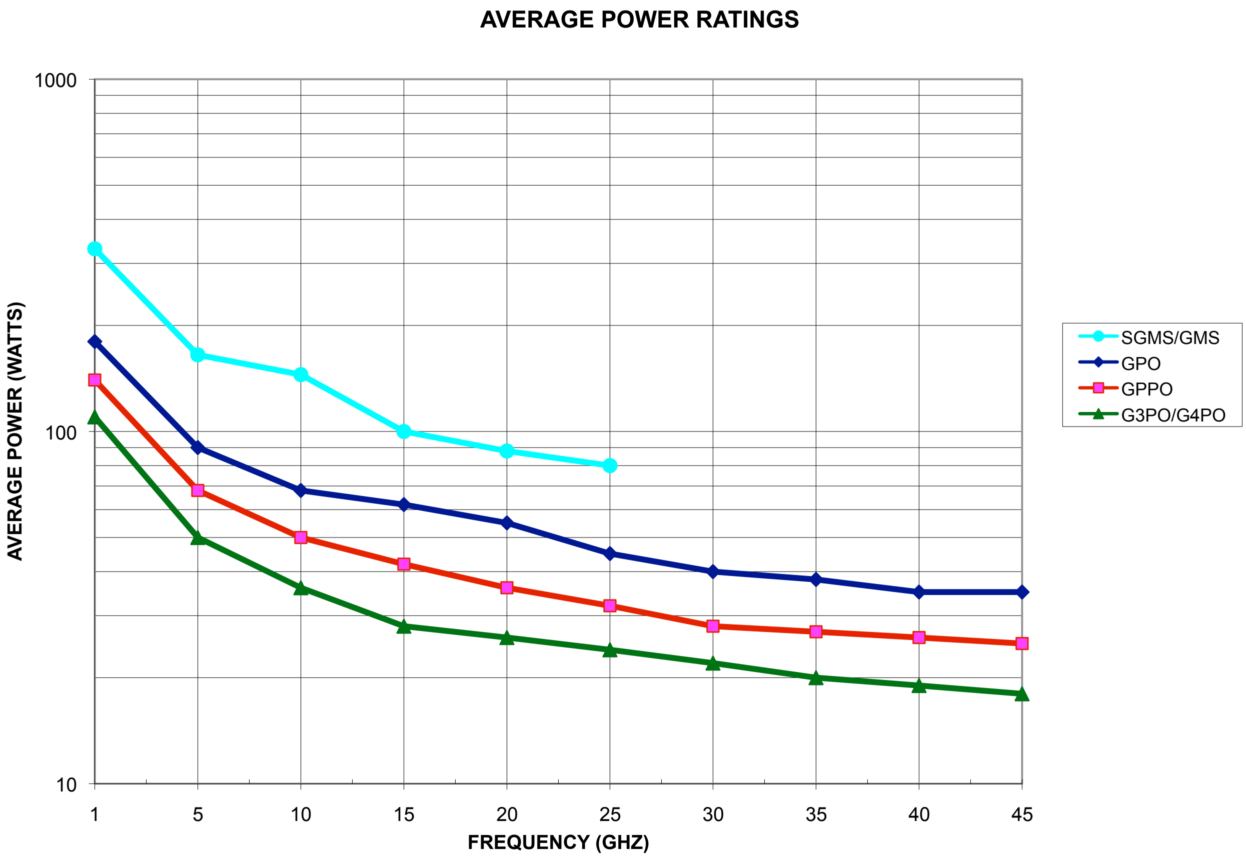

Figure 21 - GPO, GPPO, G3PO, G4PO, and SGMS Average Power Handling

7.3 Temperature and Altitude De-rating

Table 8 – Typical Temperature and Altitude De-rating Factors

TEMP DEG C	DERATING FACTOR
0	1.2
40	1.0
80	0.8
120	0.6
160	0.4
200	0.2
240	0.05

ALTITUDE X 1000'	DERATING FACTOR
0	1.0
20	0.8
30	0.7
40	0.6
50	0.5
60	0.4
70	0.3

7.4 VSWR De-rating

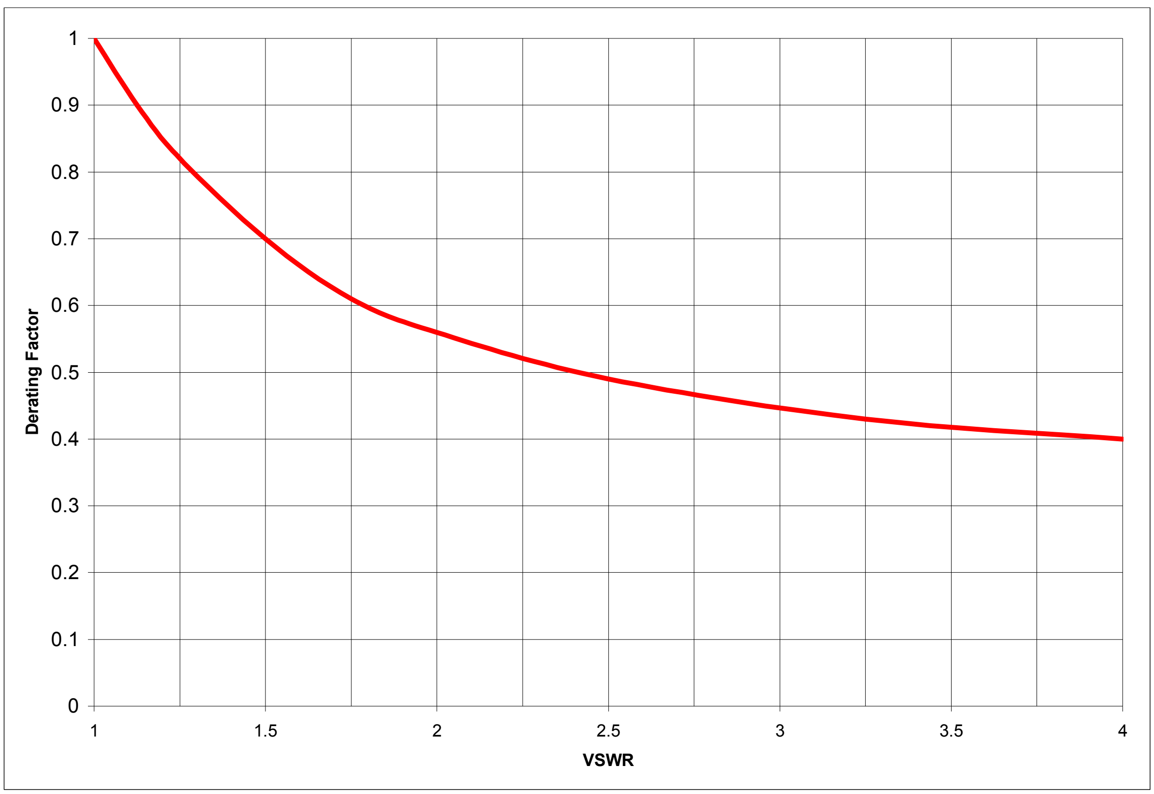

Figure 22 – Typical VSWR De-rating Factors

8.0 Board-to-Board Tolerance Analysis

8.1 GPO Tolerance Analysis

Figure 23 shows a typical GPO Board–to–Board tolerance analysis using a surface mount configuration. The BMI Length and associated Gap are dependent on the **Board–to–Board spacing, Shroud Reference Plane (R/P), and Solder Thickness**.

Determine the Shroud R/P to Shroud R/P spacing as follows:

.4545	±	.005	Board–to–Board
-.091	±	.003	Shroud R/P
-.091	±	.003	Shroud R/P
-.002	±	.001	Solder Thickness
-.002	±	.001	Solder Thickness
.2685	±	.013	**Shroud R/P to R/P**

The **minimum Shroud R/P to R/P** spacing is therefore .2685 - .013 = .2555. This dimension is also the maximum BMI Length. This ensures that the BMI doesn't bottom out between the Shroud Reference Planes. The nominal BMI Length is the minimum R/P to R/P spacing minus the BMI Length tolerance (.0015). The **nominal BMI Length** is therefore .2555 - .0015 = .254.

Next, determine the Gap between the Smooth Bore Shroud R/P and the BMI as follows:

.2685	±	.013	Shroud R/P to Shroud R/P
-.254	±	.0015	BMI Length
.0145	±	.0145	**Gap**

The tolerance analysis shows that the BMI can be flush (.0145 - .0145) to .029 (.0145 + .0145) away from the Smooth Bore Shroud R/P. The Gap tolerance should be minimized whenever possible to ensure optimal electrical performance.

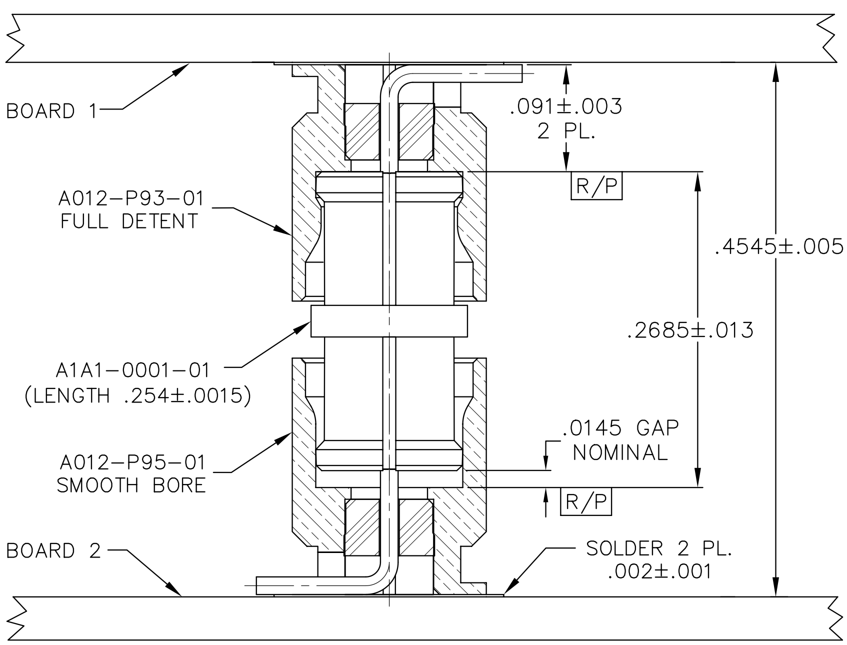

Figure 23 – GPO Board–to–Board Tolerance Analysis

8.2 GPO Minimum Tolerance Analysis

Figure 24 shows the minimum GPO Board–to–Board tolerance analysis using a surface mount configuration. The BMI Length and associated Gap are dependent on the **Board–to–Board spacing, Shroud Reference Plane (R/P), and Solder Thickness**.

Determine the Shroud R/P to Shroud R/P spacing as follows:

.258	±	.005	Board–to–Board
-.010	±	.001	Shroud R/P
-.010	±	.001	Shroud R/P
-.002	±	.001	Solder Thickness
-.002	±	.001	Solder Thickness
.234	±	.009	**Shroud R/P to R/P**

The **minimum Shroud R/P to R/P** spacing is therefore .234 - .009 = .225. This dimension is also the maximum BMI Length. This ensures that the BMI doesn't bottom out between the Shroud Reference Planes. The nominal BMI Length is the minimum R/P to R/P spacing minus the BMI Length tolerance (.001). The nominal BMI Length is therefore .225 - .001 = .224.
Next, determine the Gap between the Smooth Bore Shroud R/P and the BMI as follows:

.234	±	.009	Shroud R/P to Shroud R/P
-.224	±	.001	BMI Length
.010	±	.010	Gap

The tolerance analysis shows that the BMI can be flush (.010 - .010) to .020 (.010 + .010) away from the Smooth Bore Shroud R/P. The Gap tolerance should be minimized whenever possible to ensure optimal electrical performance.

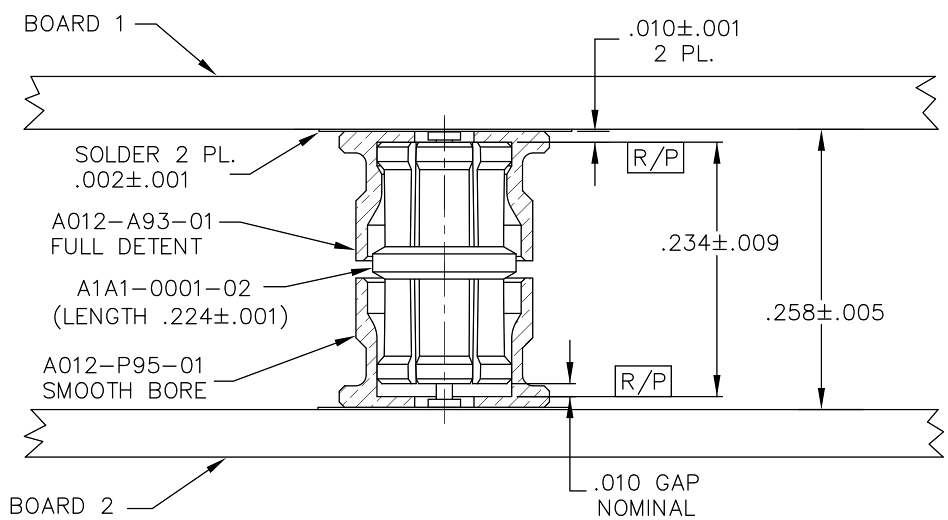

Figure 24 – GPO Minimum Board–to–Board Tolerance Analysis

8.3 GPPO Tolerance Analysis

Figure 25 shows a typical GPPO Board–to–Board tolerance analysis using a surface mount configuration. The BMI Length and associated Gap are dependent on the **Board–to–Board spacing, Shroud Reference Plane (R/P), and Solder Thickness.**

Determine the Shroud R/P to Shroud R/P spacing as follows:

.360	±	.005	Board–to–Board
-.067	±	.002	Shroud R/P
-.067	±	.002	Shroud R/P
-.002	±	.001	Solder Thickness
-.002	±	.001	Solder Thickness
.222	±	.011	**Shroud R/P to R/P**

The **minimum Shroud R/P to R/P** spacing is therefore .222 - .011 = .211. This dimension is also the maximum BMI Length. This ensures that the BMI doesn't bottom out between the Shroud Reference Planes. The nominal BMI Length is the minimum R/P to R/P spacing minus the BMI Length tolerance (.001). The **nominal BMI Length** is therefore .211 - .001 = .210.

Next, determine the Gap between the Smooth Bore Shroud R/P and the BMI as follows:

.222	±	.011	Shroud R/P to Shroud R/P
-.210	±	.001	BMI Length
.012	±	.012	**Gap**

The tolerance analysis shows that the BMI can be flush (.012 - .012) to .024 (.012 + .012) away from the Smooth Bore Shroud R/P. The Gap tolerance should be minimized whenever possible to ensure optimal electrical performance.

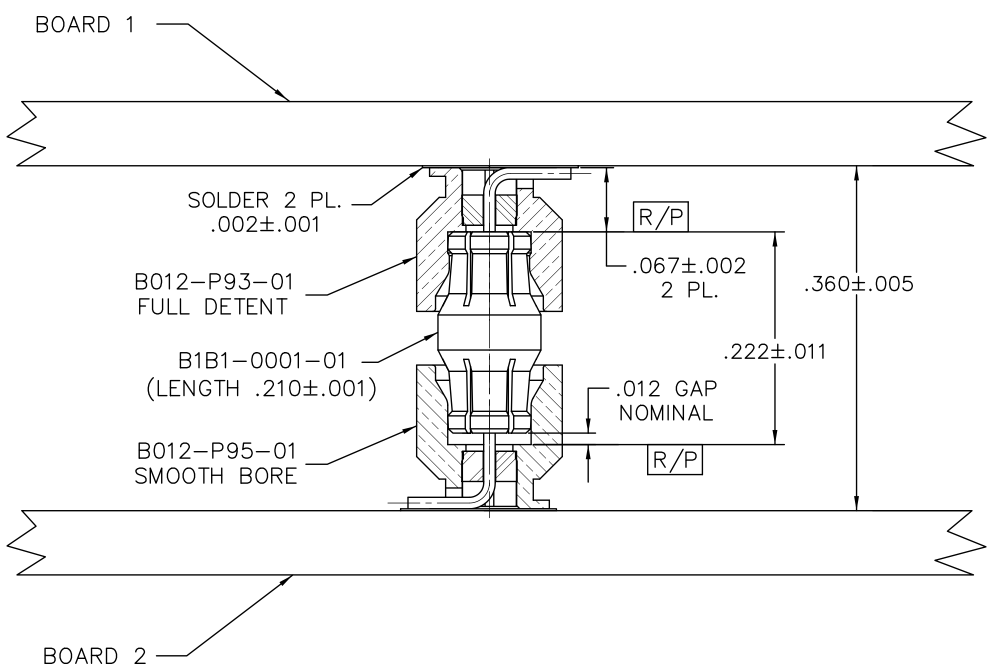

Figure 25 – GPPO Board–to–Board Tolerance Analysis

8.4 GPPO Minimum Tolerance Analysis

Figure 26 shows the minimum GPPO Board–to–Board tolerance analysis using a surface mount configuration. The BMI Length and associated Gap are dependent on the **Board–to–Board spacing, Shroud Reference Plane (R/P), and Solder Thickness**.

Determine the Shroud R/P to Shroud R/P spacing as follows:

.196	±	.005	Board–to–Board
-.008	±	.001	Shroud R/P
-.008	±	.001	Shroud R/P
-.002	±	.001	Solder Thickness
-.002	±	.001	Solder Thickness
.176	±	.009	**Shroud R/P to R/P**

The **minimum Shroud R/P to R/P** spacing is therefore .176 - .009 = .167. This dimension is also the maximum BMI Length. This ensures that the BMI doesn't bottom out between the Shroud Reference Planes. The nominal BMI Length is the minimum R/P to R/P spacing minus the BMI Length tolerance (.001). The **nominal BMI Length** is therefore .167 - .001 = .166.

Next, determine the Gap between the Smooth Bore Shroud R/P and the BMI as follows:

.176	±	.009	Shroud R/P to Shroud R/P
-.166	±	.001	BMI Length
.010	±	.010	**Gap**

The tolerance analysis shows that the BMI can be flush (.010 - .010) to .020 (.010 + .010) away from the Smooth Bore Shroud R/P. The Gap tolerance should be minimized whenever possible to ensure optimal electrical performance.

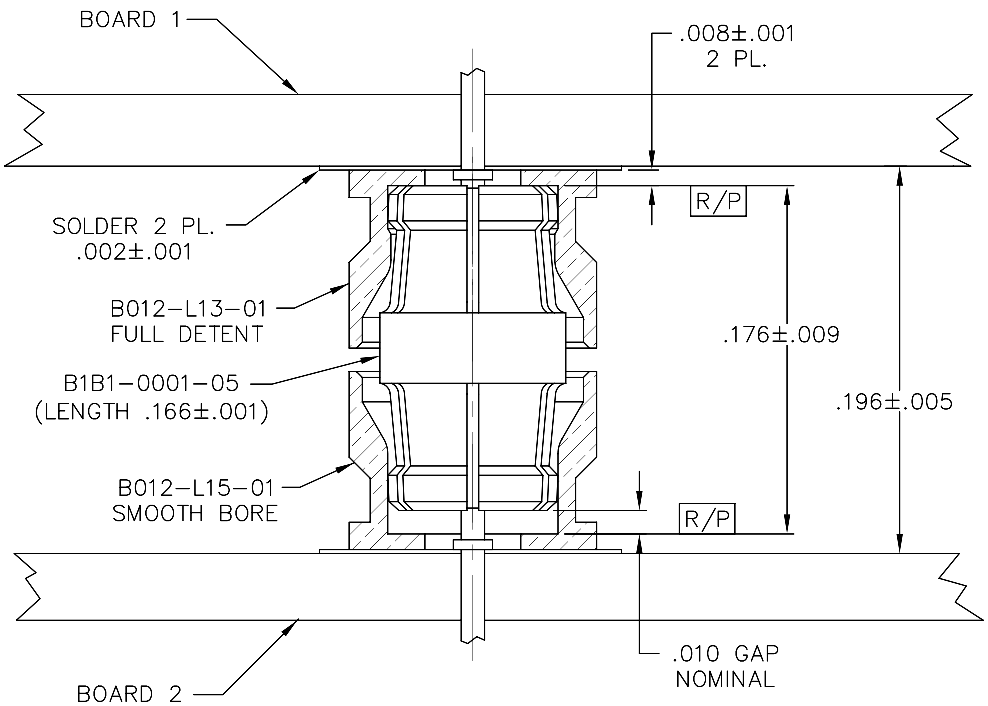

Figure 26 – GPPO Minimum Board–to–Board Tolerance Analysis

8.5 G3PO Tolerance Analysis

Figure 27 shows a typical G3PO Board–to–Board tolerance analysis using a surface mount configuration. The BMI Length and associated Gap are dependent on the **Board–to–Board spacing, Shroud Reference Plane (R/P), and Solder Thickness**.

Determine the Shroud R/P to Shroud R/P spacing as follows:

.1485	±	.002	Board–to–Board
-.020	±	.001	Shroud R/P
-.020	±	.001	Shroud R/P
-.002	±	.001	Solder Thickness
-.002	±	.001	Solder Thickness
.1045	±	.006	**Shroud R/P to R/P**

The **minimum Shroud R/P to R/P** spacing is therefore .1045 - .006 = .0985. This dimension is also the maximum BMI Length. This ensures that the BMI doesn't bottom out between the Shroud Reference Planes. The nominal BMI Length is the minimum R/P to R/P spacing minus the BMI Length tolerance (.0005). The **nominal BMI Length** is therefore .0985 - .0005 = .098.

Next, determine the Gap between the Smooth Bore Shroud R/P and the BMI as follows:

.1045	±	.006	Shroud R/P to Shroud R/P
-.098	±	.0005	BMI Length
.0065	±	.0065	**Gap**

The tolerance analysis shows that the BMI can be flush (.0065 - .0065) to .013 (.0065 + .0065) away from the Smooth Bore Shroud R/P. The Gap tolerance should be minimized whenever possible to ensure optimal electrical performance.

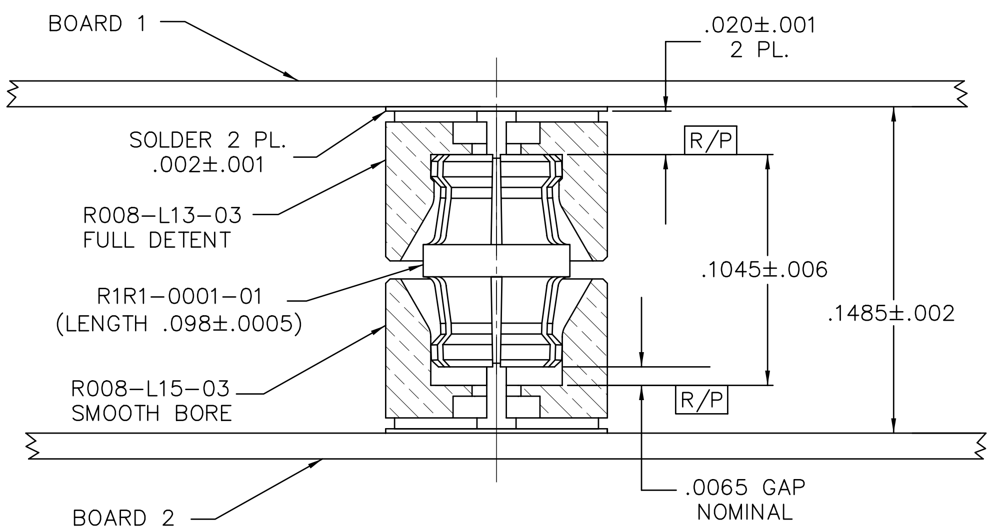

Figure 27 – G3PO Board–to–Board Tolerance Analysis

Please contact Applications Engineering to confirgure the G3PO minimum board-to-board spacing of .120".

8.6 G4PO Tolerance Analysis

Figure 28 shows a typical G4PO Board–to–Board tolerance analysis using a surface mount configuration. The BMI Length and associated Gap are dependent on the **Board–to–Board spacing, Shroud Reference Plane (R/P), and Solder Thickness**.

Determine the Shroud R/P to Shroud R/P spacing as follows:

.122	± .0015	Board–to–Board
-.0235	± .001	Shroud R/P
-.0235	± .001	Shroud R/P
-.002	± .001	Solder Thickness
-.002	± .001	Solder Thickness
.071	± .0055	**Shroud R/P to R/P**

The **minimum Shroud R/P to R/P** spacing is therefore .071 - .0055 = .0655. This dimension is also the maximum BMI Length. This ensures that the BMI doesn't bottom out between the Shroud Reference Planes. The nominal BMI Length is the minimum R/P to R/P spacing minus the BMI Length tolerance (.0005). The **nominal BMI Length** is therefore .0655 - .0005 = .065.

Next, determine the Gap between the Smooth Bore Shroud R/P and the BMI as follows:

.071	± .0055	Shroud R/P to Shroud R/P
-.065	± .0005	BMI Length
.006	± .006	**Gap**

The tolerance analysis shows that the BMI can be flush (.006 - .006) to .012 (.006 + .006) away from the Smooth Bore Shroud R/P. The Gap tolerance should be minimized whenever possible to ensure optimal electrical performance.

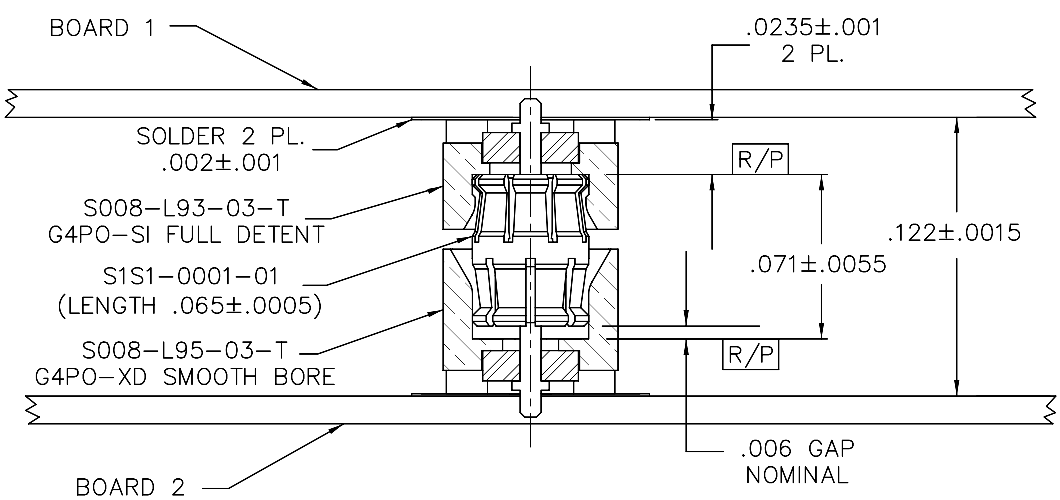

Figure 28 – G4PO Board–to–Board Tolerance Analysis

Please contact Applications Engineering to confirgure the G4PO minimum board-to-board spacing of .090".