

▶ strictly confidential

Attracting Tomorrow

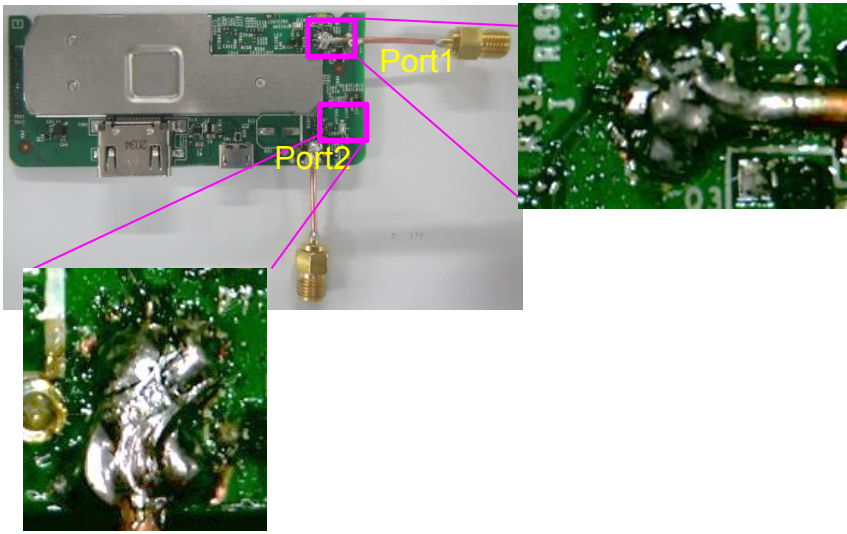


TDK Antenna Measurement

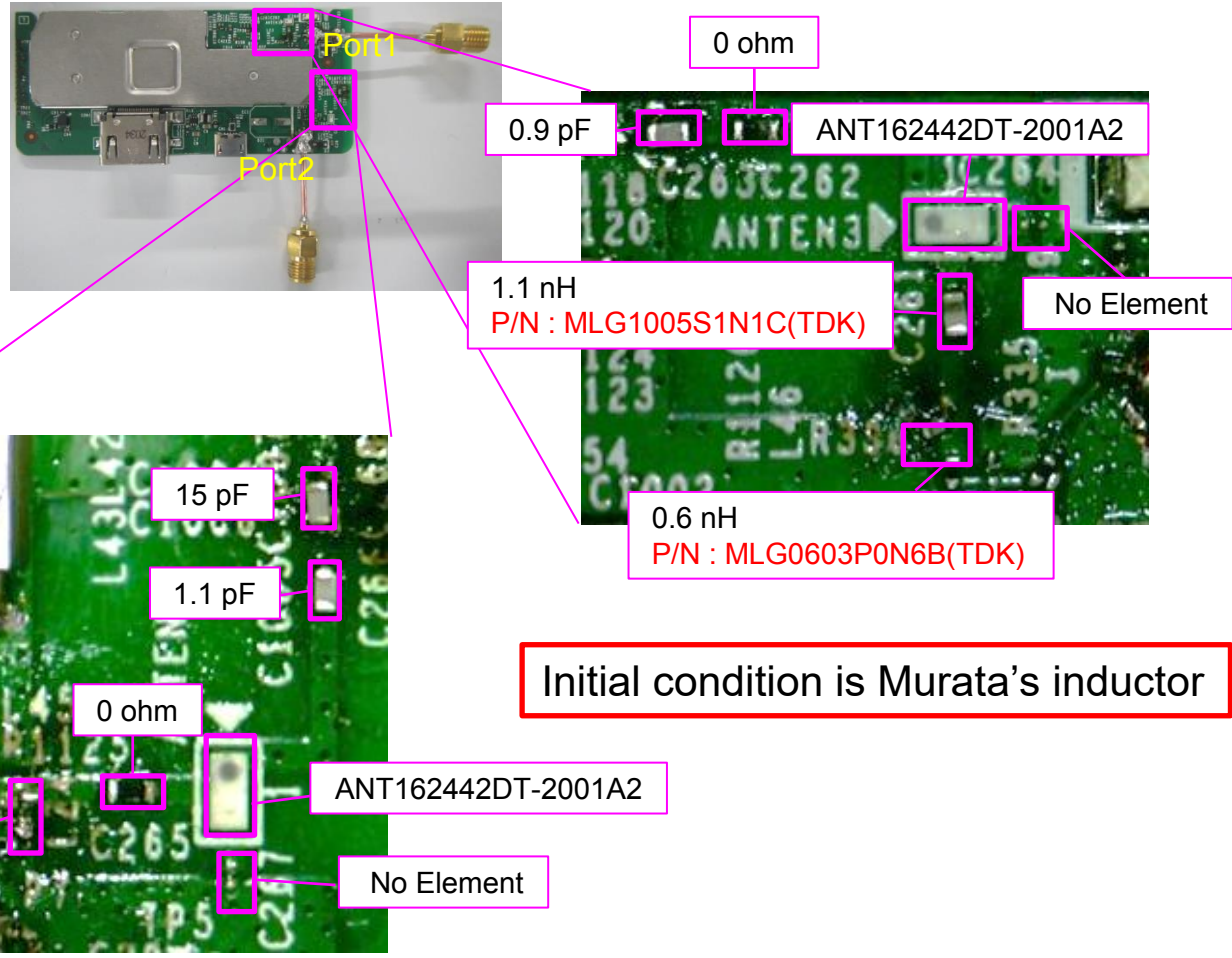
Measurement Setup

▶ MEASUREMENT SETUP

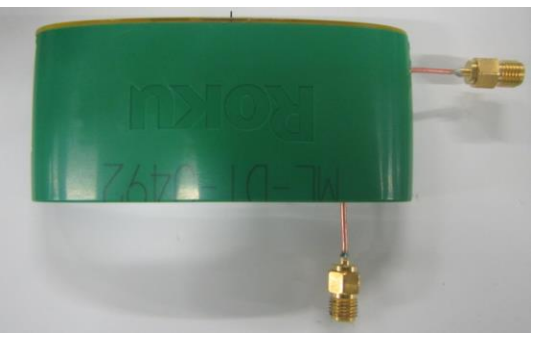
Cable setup



Element value



Measurement setup

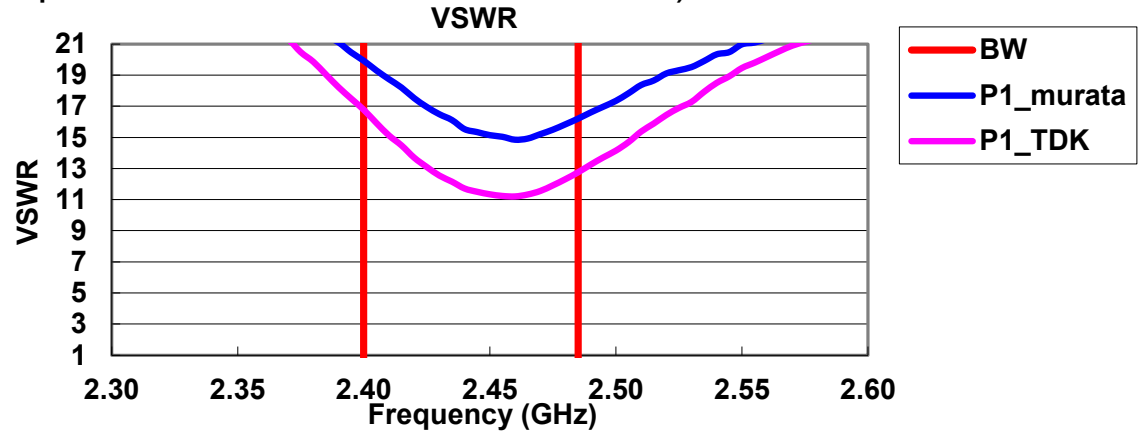


Initial condition is Murata's inductor

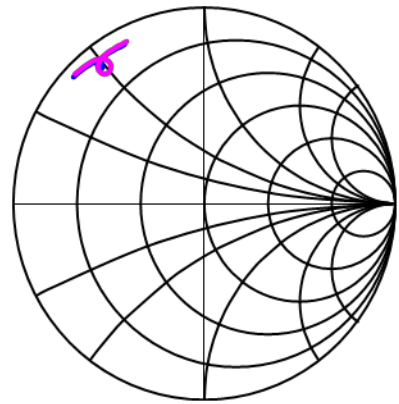
Measurement Results

▶ VSWR & Efficiency

(Comparison between TDK and Murata)



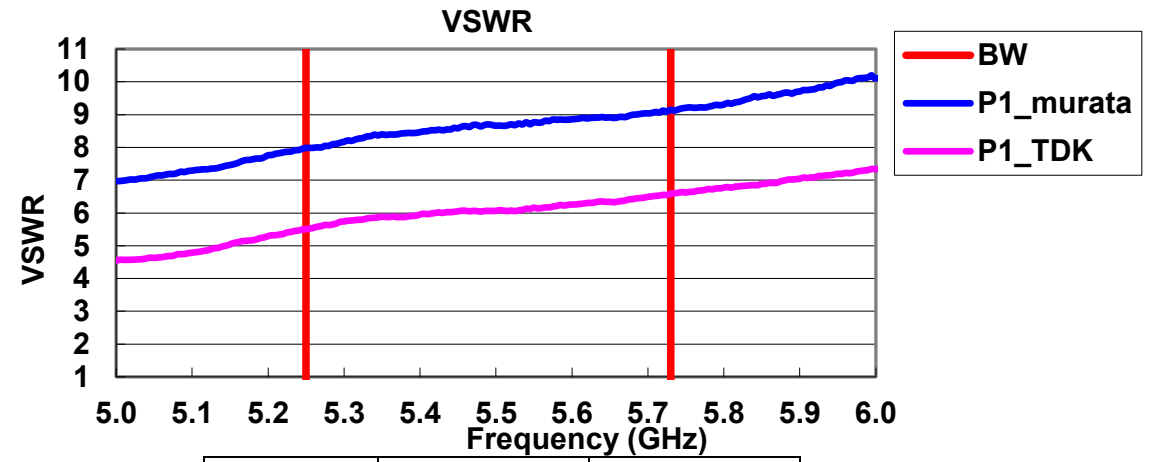
Frequency[GHz]	P1_murata			P1_TDK		
	2.4	2.442	2.485	2.4	2.442	2.485
VSWR	19.92	15.52	16.20	16.77	11.71	12.75



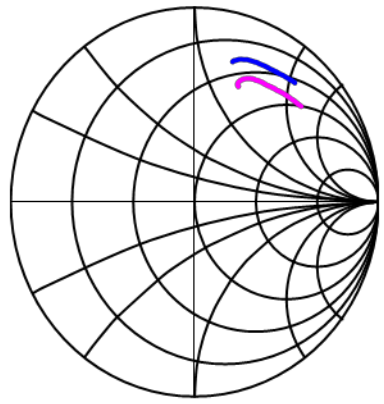
Smith Chart

— P1_murata
— P1_TDK

2.0 GHz – 3.0 GHz



Frequency[GHz]	P1_murata			P1_TDK		
	5.25	5.5	5.73	5.25	5.5	5.73
VSWR	7.99	8.66	9.14	5.51	6.06	6.58



Smith Chart

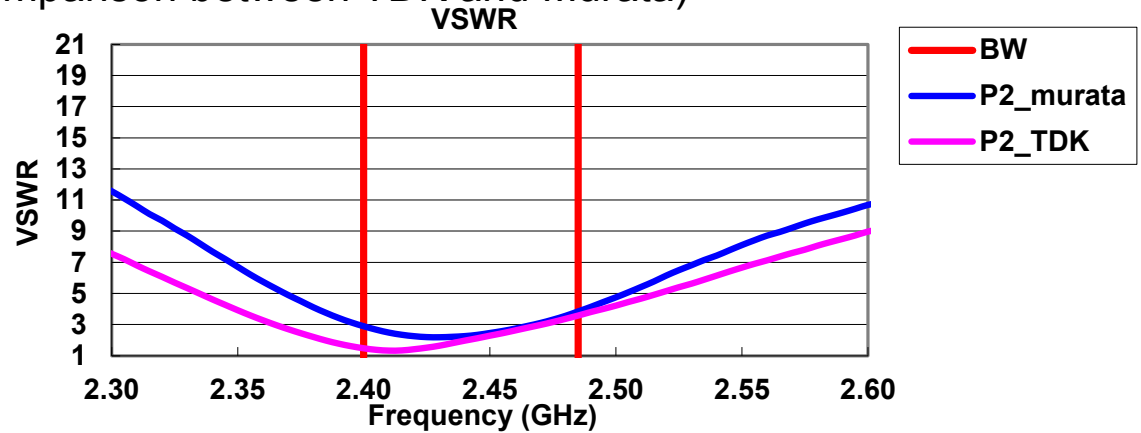
— P1_murata
— P1_TDK

5.0 GHz – 6.0 GHz

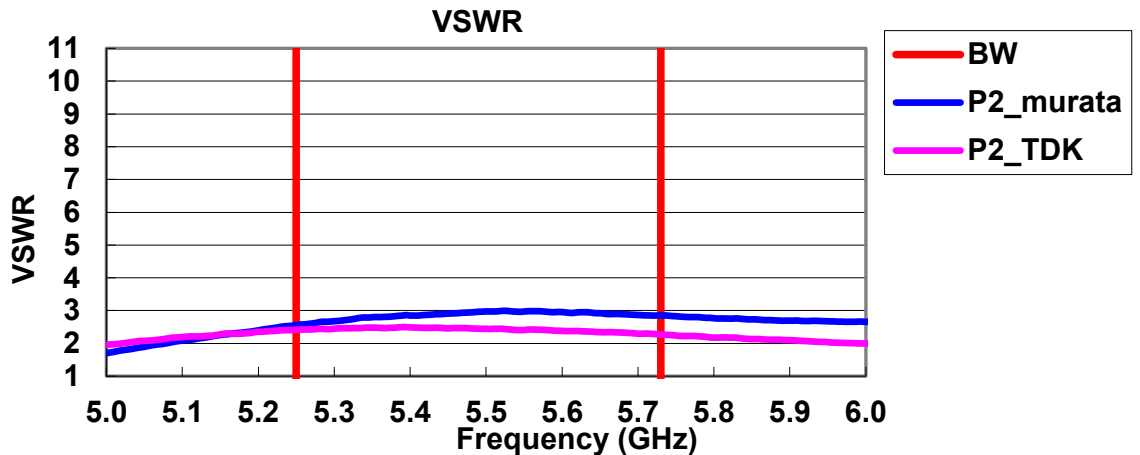
Measurement Results

▶ VSWR & Efficiency

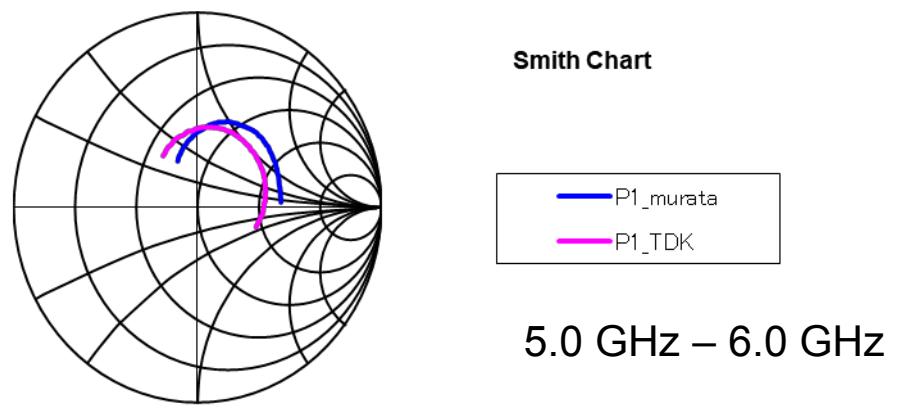
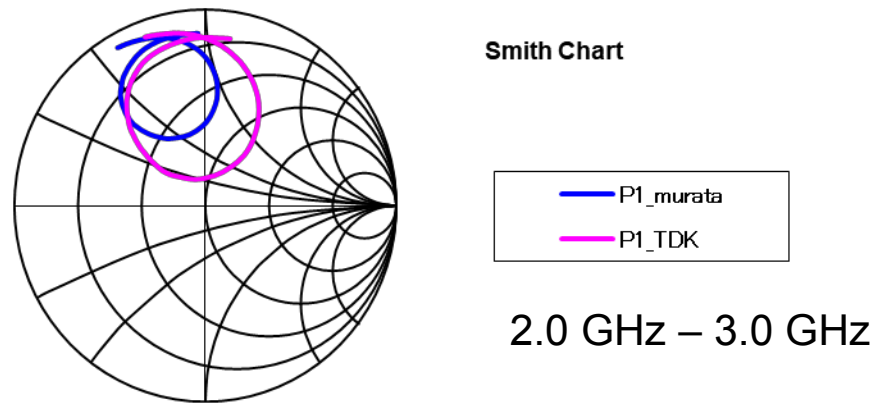
(Comparison between TDK and Murata)



Frequency[GHz]	P2_murata			P2_TDK		
	2.4	2.442	2.485	2.4	2.442	2.485
VSWR	2.88	2.25	3.83	1.47	1.96	3.57



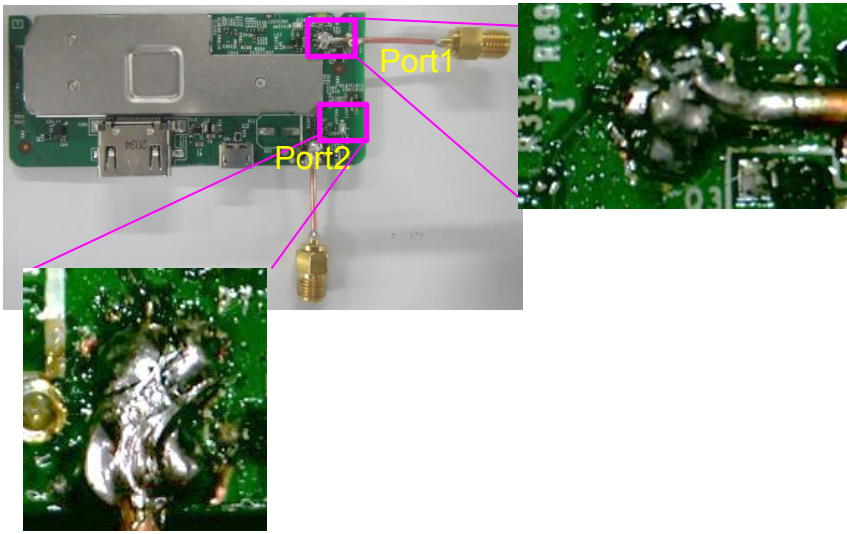
Frequency[GHz]	P2_murata			P2_TDK		
	5.25	5.5	5.73	5.25	5.5	5.73
VSWR	2.56	2.98	2.86	2.42	2.45	2.27



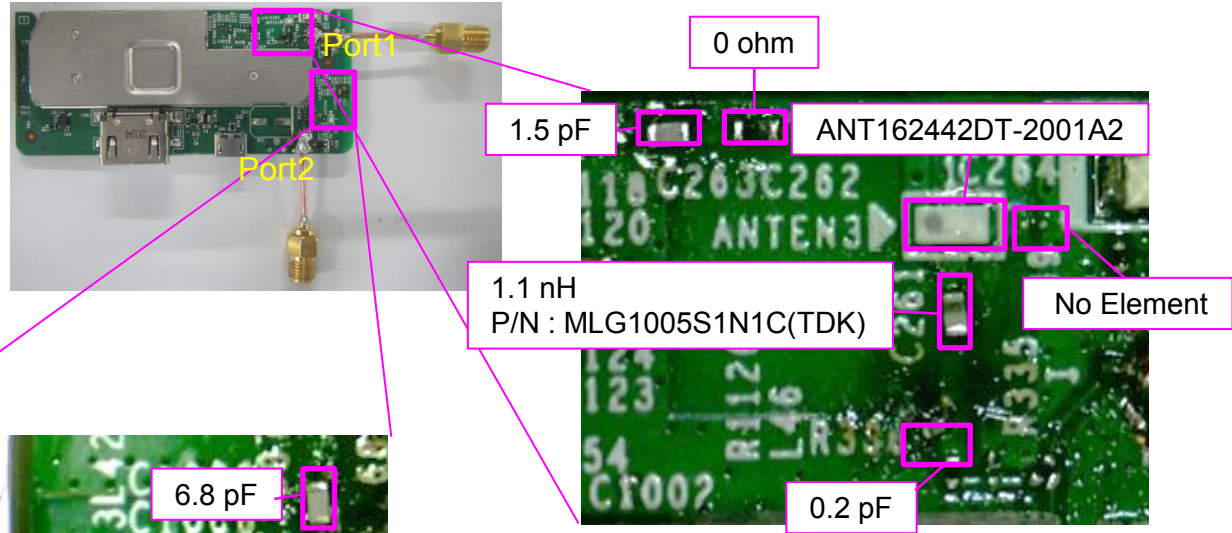
Measurement Setup

▶ MEASUREMENT SETUP

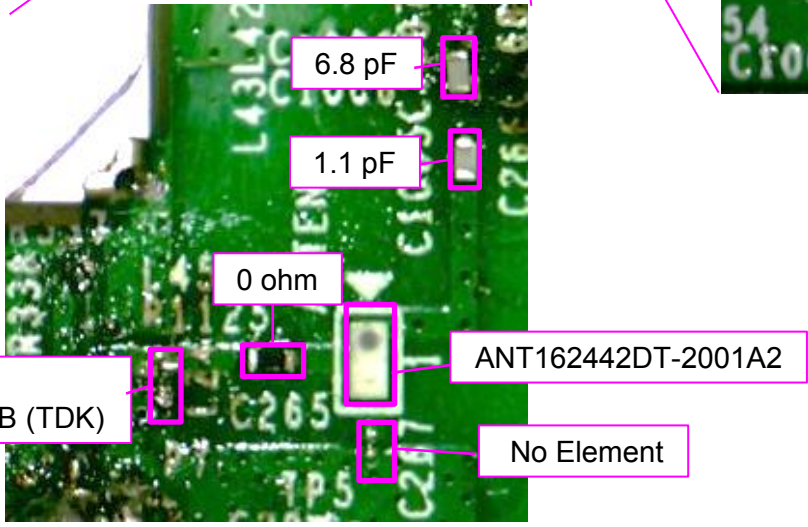
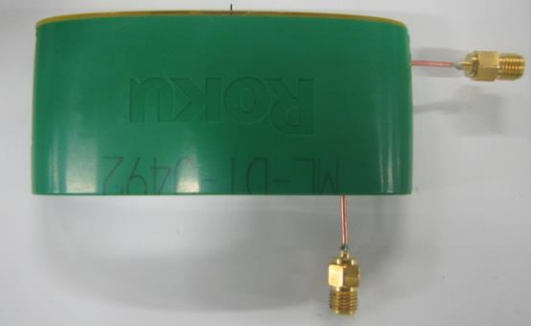
Cable setup



Element value after tuning

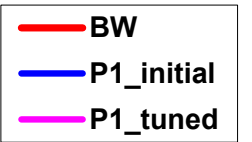
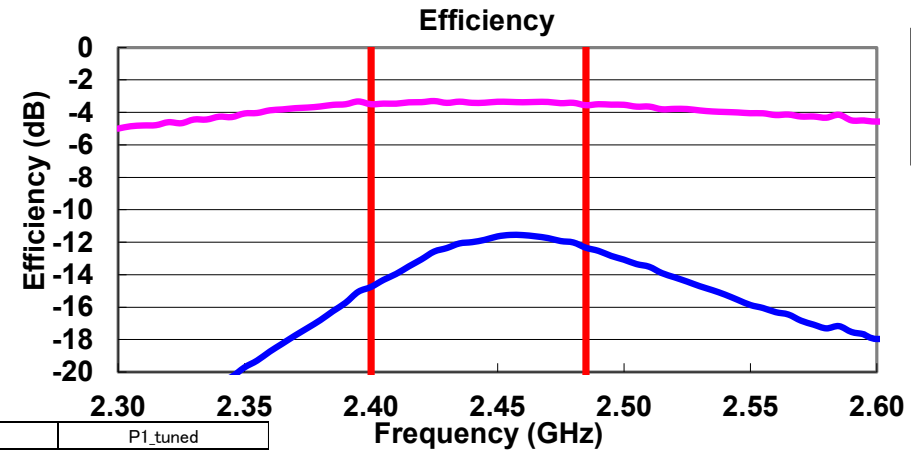
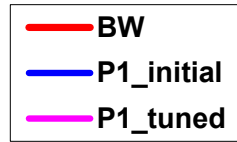
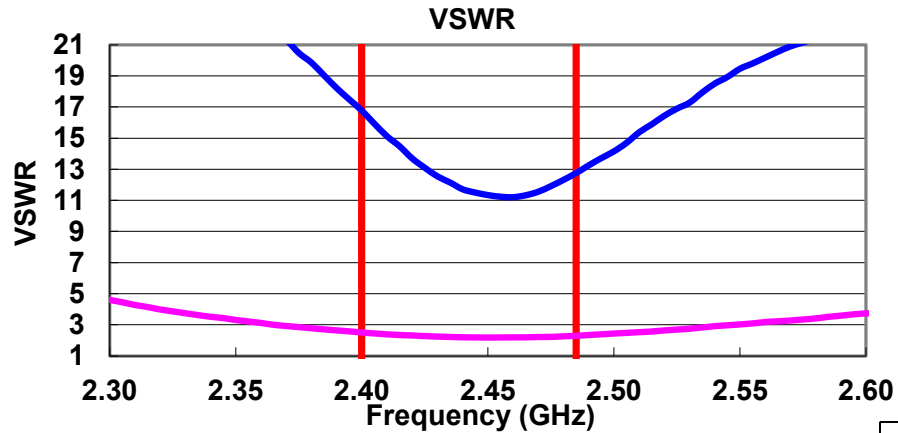


Measurement setup

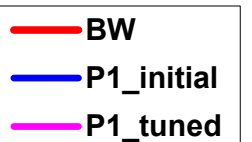
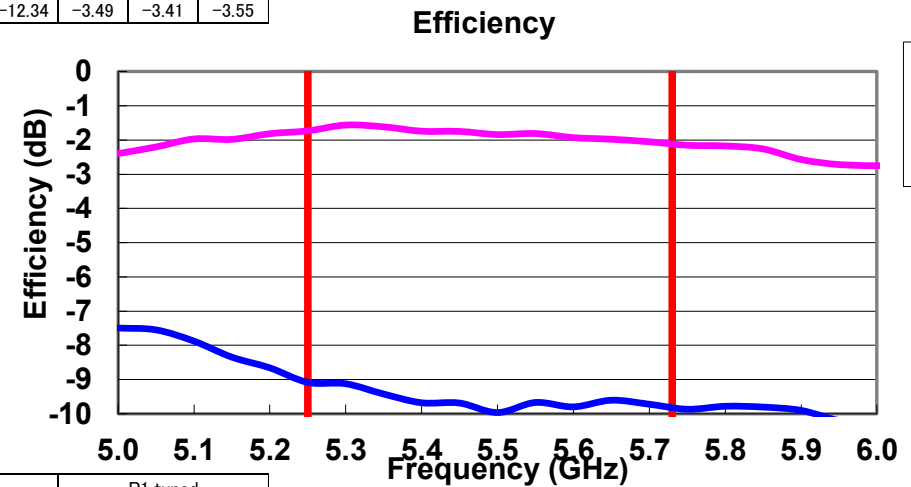
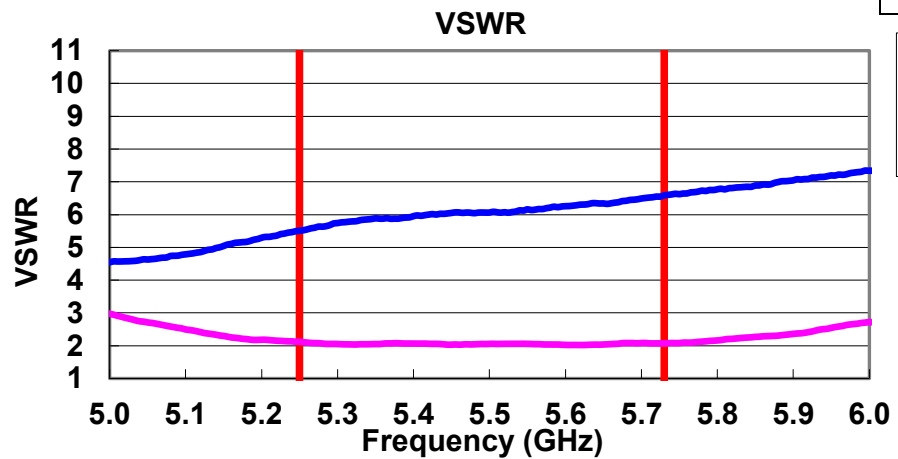


Measurement Results

▶ VSWR & Efficiency



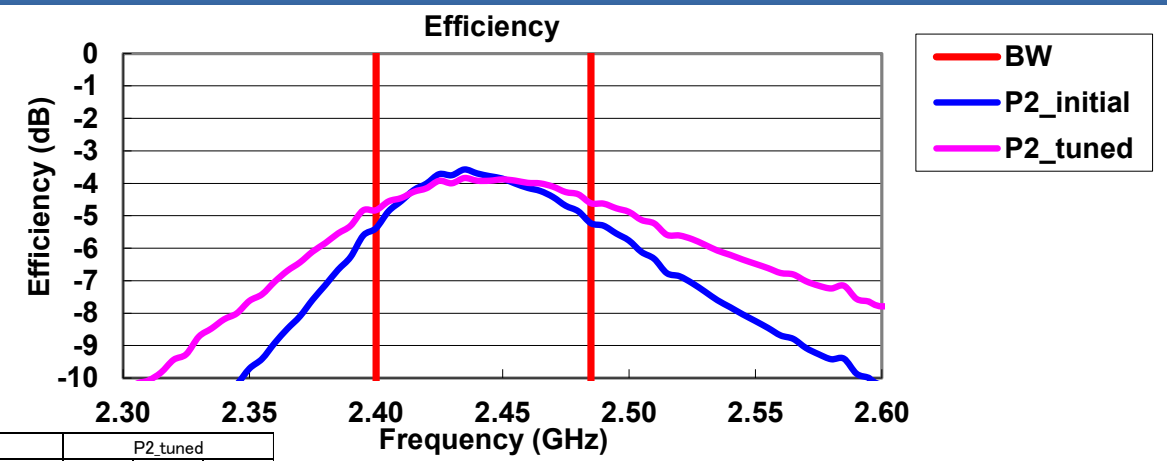
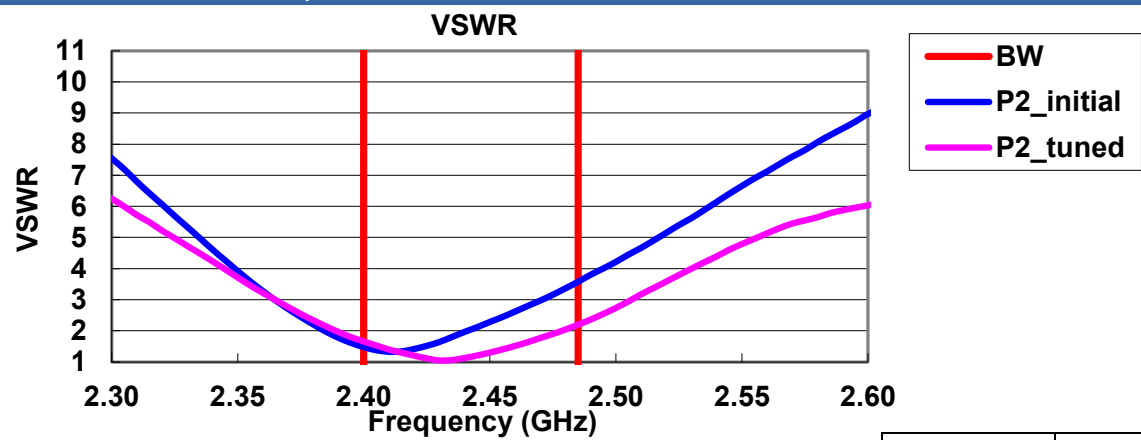
	P1_initial			P1_tuned		
Frequency[GHz]	2.4	2.442	2.485	2.4	2.442	2.485
VSWR	16.77	11.71	12.75	2.49	2.19	2.28
Efficiency[dB]	-14.76	-12.00	-12.34	-3.49	-3.41	-3.55



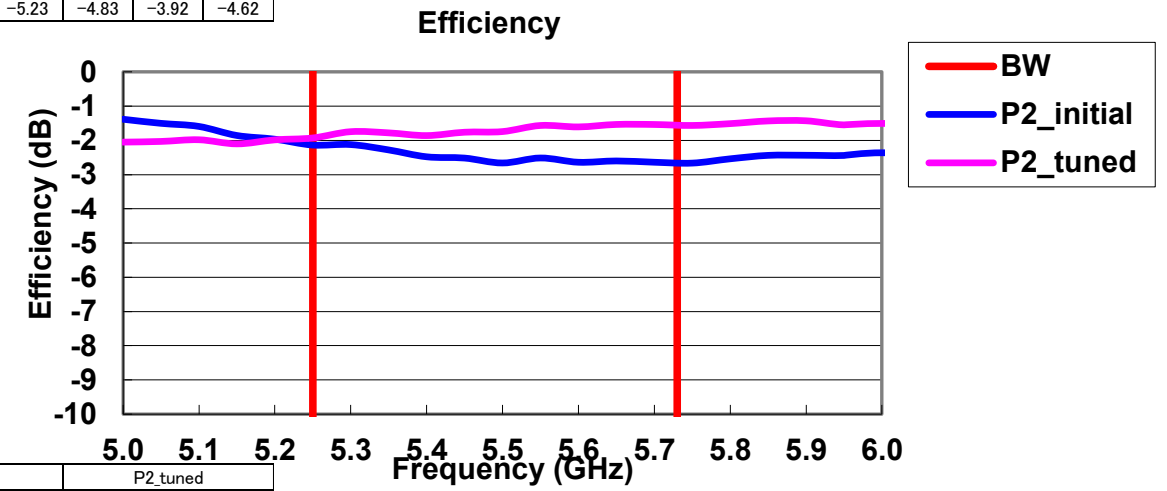
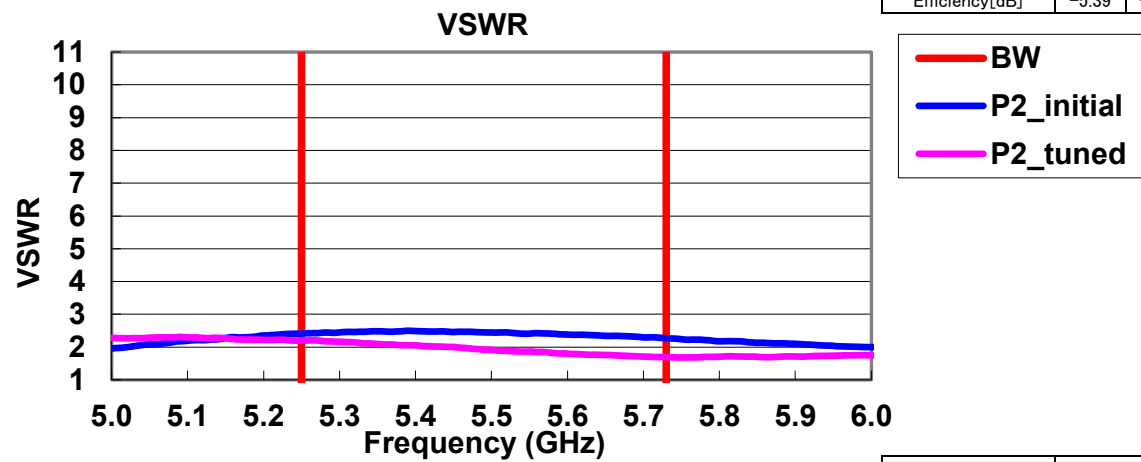
	P1_initial			P1_tuned		
Frequency[GHz]	5.25	5.5	5.73	5.25	5.5	5.73
VSWR	5.51	6.06	6.58	2.12	2.06	2.07
Efficiency[dB]	-9.09	-9.97	-9.72	-1.73	-1.84	-2.05

Measurement Results

▶ VSWR & Efficiency



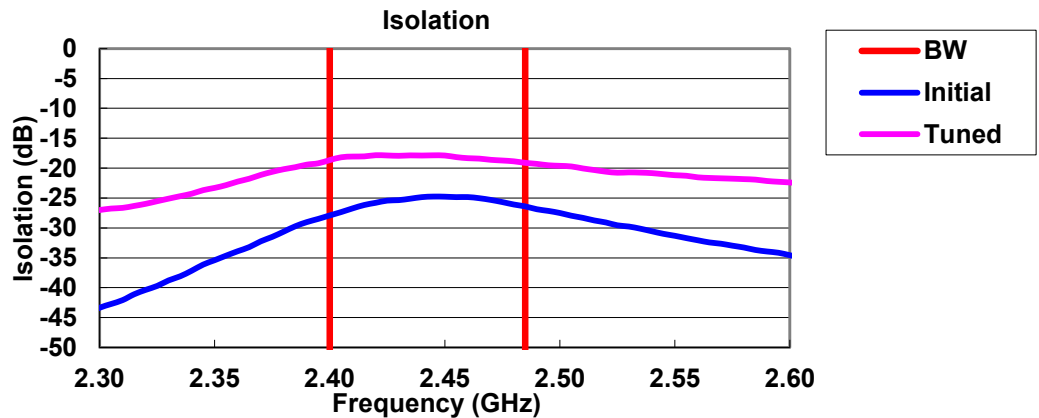
Frequency[GHz]	P2_initial			P2_tuned		
	2.4	2.442	2.485	2.4	2.442	2.485
VSWR	1.47	1.96	3.57	1.66	1.13	2.20
Efficiency[dB]	-5.39	-3.70	-5.23	-4.83	-3.92	-4.62



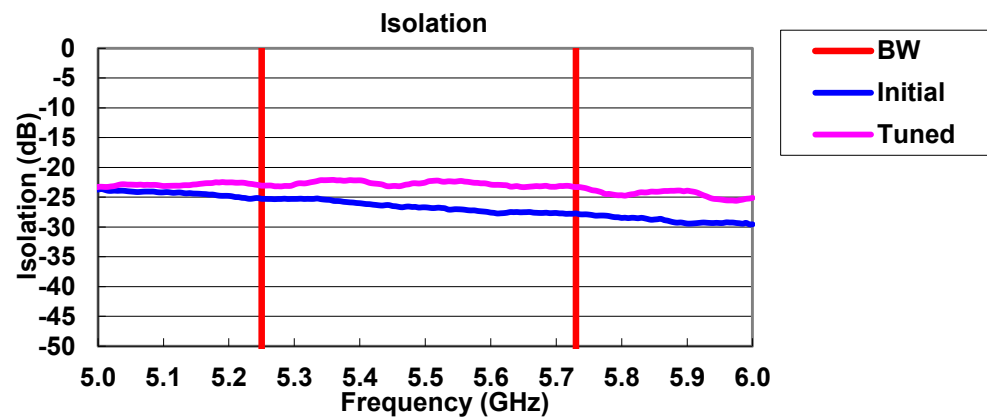
Frequency[GHz]	P2_initial			P2_tuned		
	5.25	5.5	5.73	5.25	5.5	5.73
VSWR	2.42	2.45	2.27	2.20	1.91	1.70
Efficiency[dB]	-2.13	-2.66	-2.63	-1.93	-1.74	-1.54

Measurement Results

► Isolation



Frequency[GHz]	Initial			Tuned		
	2.4	2.442	2.485	2.4	2.442	2.485
Isolation[dB]	-27.91	-24.85	-26.41	-18.66	-17.90	-19.12



Frequency[GHz]	Initial			Tuned		
	5.25	5.5	5.73	5.25	5.5	5.73
Isolation[dB]	-25.26	-26.68	-27.70	-23.06	-22.54	-23.30

Comments

- ◆ We measured the antenna before & after matching.
- ◆ Please see page5 of this report to know the suitable element value.

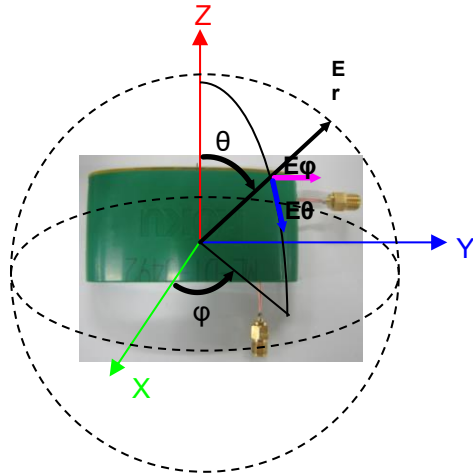
Now “antenna simulation tool” is published on TDK Web site. Please give it a try.

- Selection Guide <https://product.tdk.com/info/en/products/rf/rf/antenna/technote/selection-guide.html>
- Instant Simulator <https://product.tdk.com/en/search/rf/rf/antenna/simulation>
- Design Guide <https://product.tdk.com/info/en/products/rf/rf/antenna/technote/designnote.html>
- HFSS model https://product.tdk.com/info/en/technicalsupport/tvcl/ansys_hfss/antenna/index.html

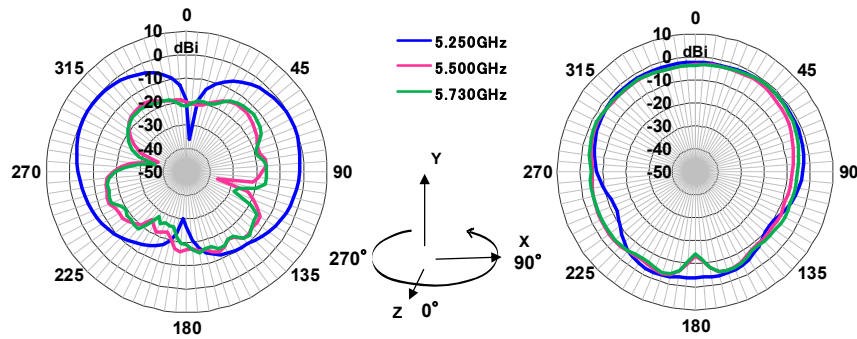
Radiation Pattern

Radiation Pattern (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE



Horizontal Polarization

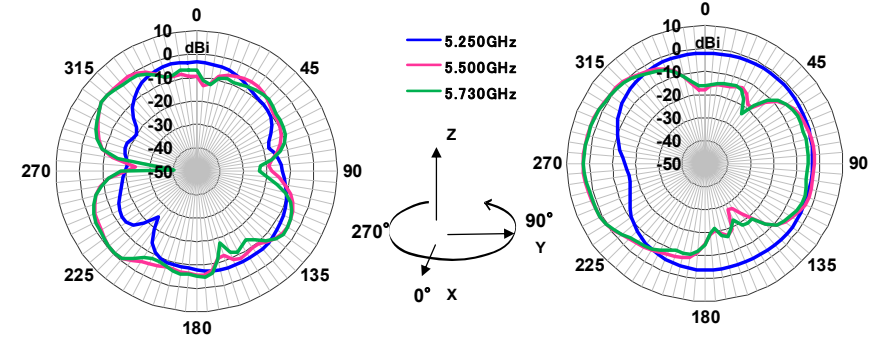
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-4.4	-16.8	-17.0
Maximum[dBi]	-0.2	-12.3	-11.8
Minimum[dBi]	-36.0	-37.4	-35.9

Vertical Polarization

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.59	-4.45	-3.96
Maximum[dBi]	-1.18	-2.16	-1.15
Minimum[dBi]	-12.10	-13.18	-14.43

P1_tuned

X-Y PLANE



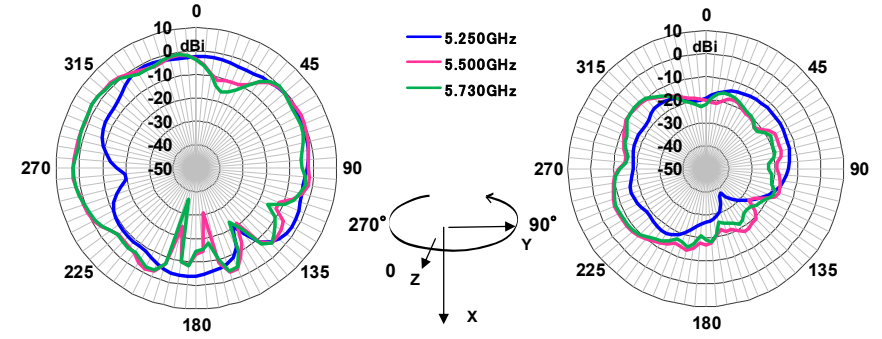
Horizontal Polarization

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-8.4	-5.2	-5.5
Maximum[dBi]	-2.9	0.3	0.3
Minimum[dBi]	-24.7	-23.8	-40.2

Vertical Polarization

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.7	-2.6	-3.2
Maximum[dBi]	-1.2	3.0	2.7
Minimum[dBi]	-16.6	-27.6	-23.0

Y-Z PLANE



Horizontal Polarization

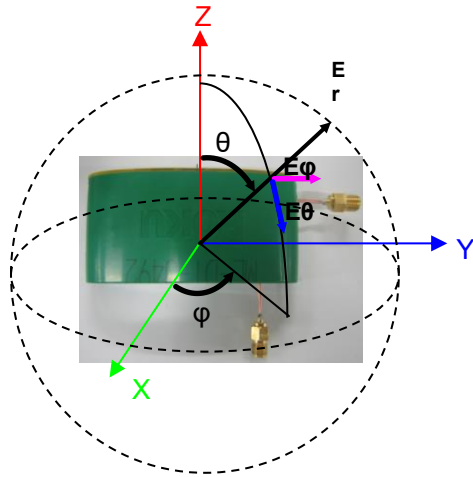
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-4.1	-1.9	-2.4
Maximum[dBi]	-0.6	2.8	2.6
Minimum[dBi]	-20.8	-30.7	-36.3

Vertical Polarization

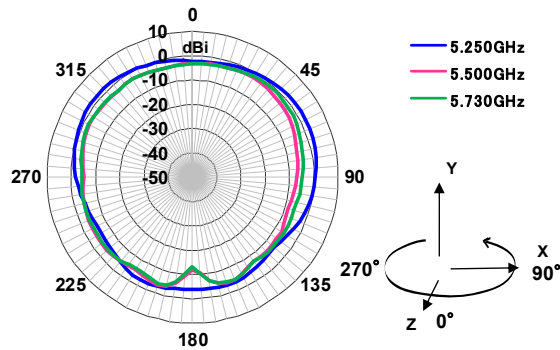
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-16.5	-13.3	-14.0
Maximum[dBi]	-12.2	-7.2	-7.7
Minimum[dBi]	-37.8	-26.8	-26.1

Total Power (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE

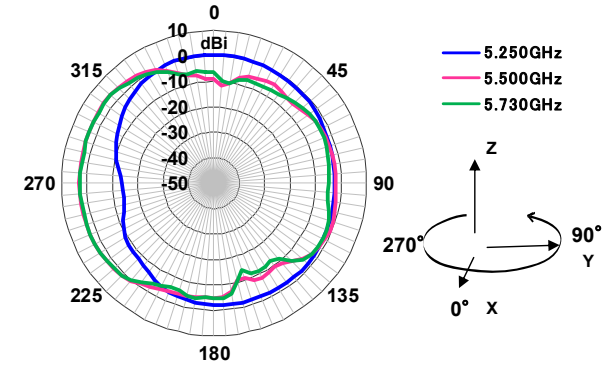


Total Power

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-1.0	-4.2	-3.8
Maximum[dBi]	2.3	-1.9	-0.9
Minimum[dBi]	-6.0	-11.7	-13.1

P1_tuned

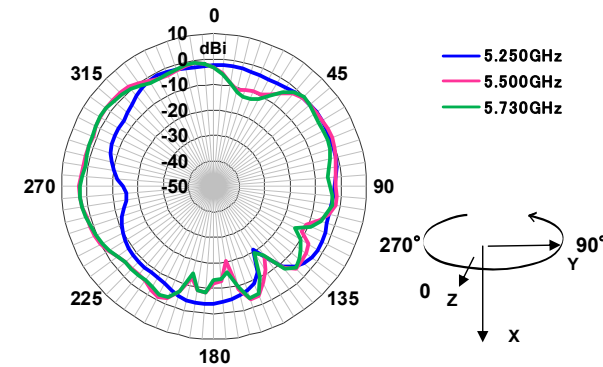
X-Y PLANE



Total Power

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-2.4	-0.7	-1.2
Maximum[dBi]	0.6	3.6	3.4
Minimum[dBi]	-14.1	-11.5	-14.2

Y-Z PLANE

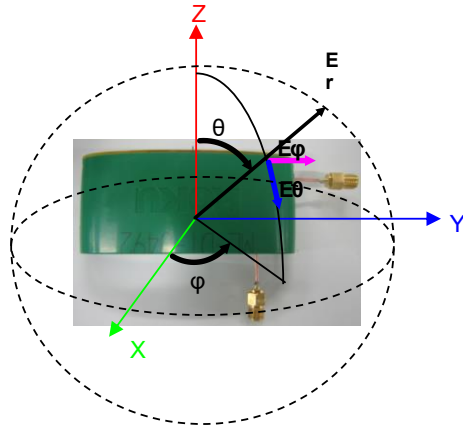


Total Power

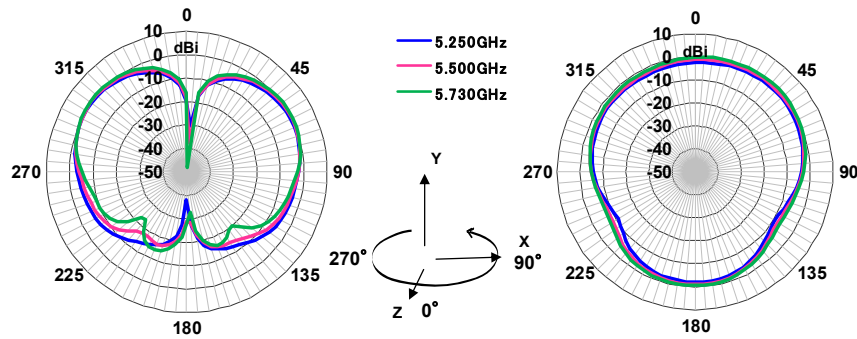
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.8	-1.6	-2.1
Maximum[dBi]	-0.3	3.0	2.8
Minimum[dBi]	-20.7	-20.3	-19.4

Radiation Pattern (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE



Horizontal Polarization

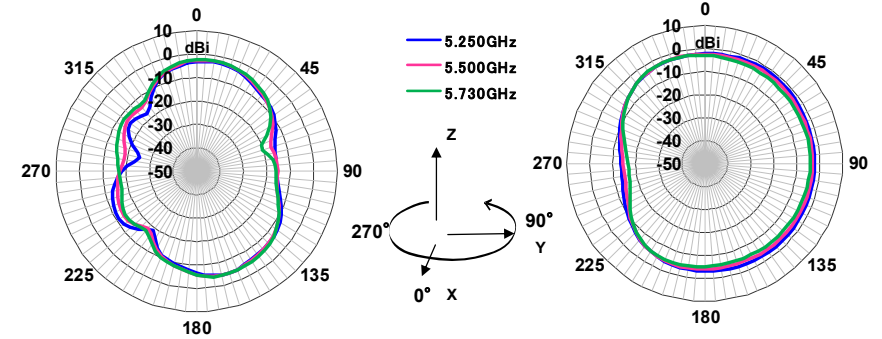
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-4.2	-4.1	-3.9
Maximum[dBi]	0.1	0.6	1.0
Minimum[dBi]	-38.0	-37.3	-47.9

Vertical Polarization

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.34	-2.40	-1.68
Maximum[dBi]	-0.51	0.41	1.28
Minimum[dBi]	-10.82	-8.70	-7.67

P2_tuned

X-Y PLANE



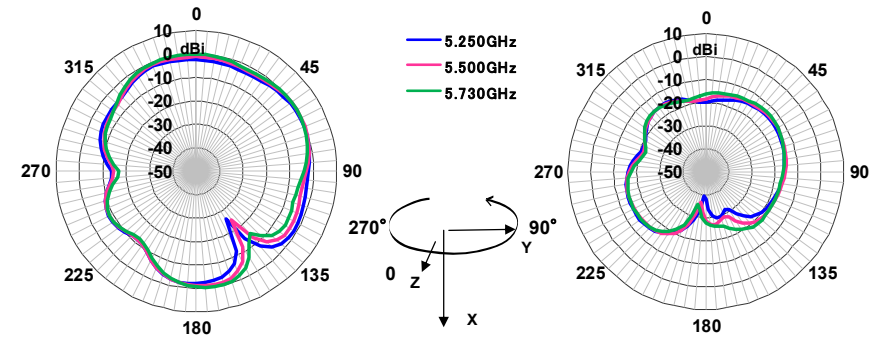
Horizontal Polarization

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-8.2	-8.0	-7.7
Maximum[dBi]	-2.8	-2.4	-2.2
Minimum[dBi]	-25.2	-18.8	-20.5

Vertical Polarization

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.5	-4.2	-5.1
Maximum[dBi]	-1.4	-2.3	-2.4
Minimum[dBi]	-13.6	-14.8	-16.8

Y-Z PLANE



Horizontal Polarization

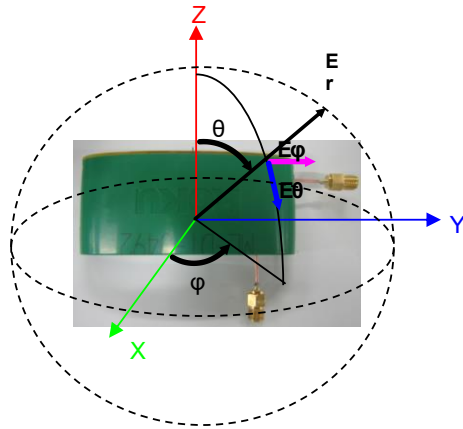
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.6	-3.3	-3.1
Maximum[dBi]	-0.2	0.4	0.2
Minimum[dBi]	-26.1	-24.4	-16.8

Vertical Polarization

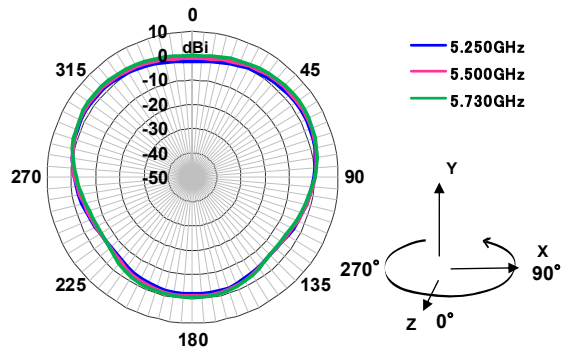
	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-17.1	-16.8	-16.6
Maximum[dBi]	-13.9	-13.2	-12.7
Minimum[dBi]	-39.2	-36.5	-35.4

Total Power (5GHz Band)

PRODUCT ORIENTATIONS



X-Z PLANE

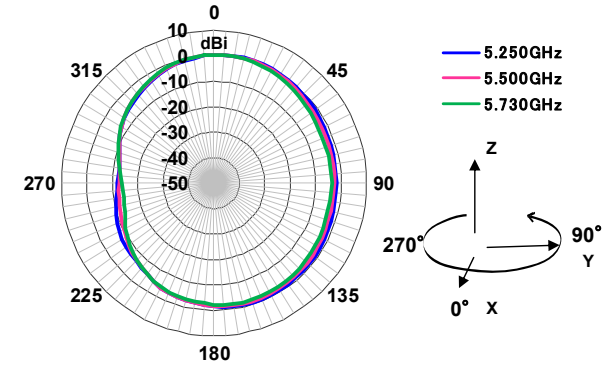


Total Power

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-0.7	-0.1	0.4
Maximum[dBi]	2.5	3.3	3.9
Minimum[dBi]	-6.0	-5.7	-5.9

P2_tuned

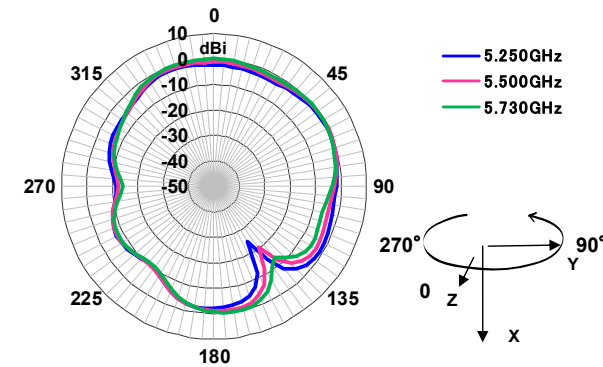
X-Y PLANE



Total Power

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-2.3	-2.7	-3.2
Maximum[dBi]	0.7	0.6	0.4
Minimum[dBi]	-12.5	-12.7	-14.1

Y-Z PLANE



Total Power

	5.250GHz	5.500GHz	5.730GHz
Average[dBi]	-3.4	-3.1	-2.9
Maximum[dBi]	0.0	0.5	0.4
Minimum[dBi]	-24.8	-20.4	-14.1

