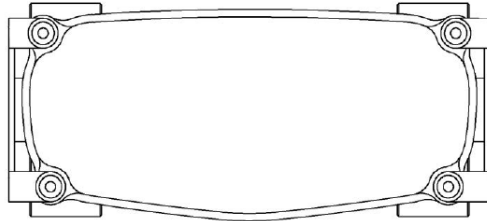
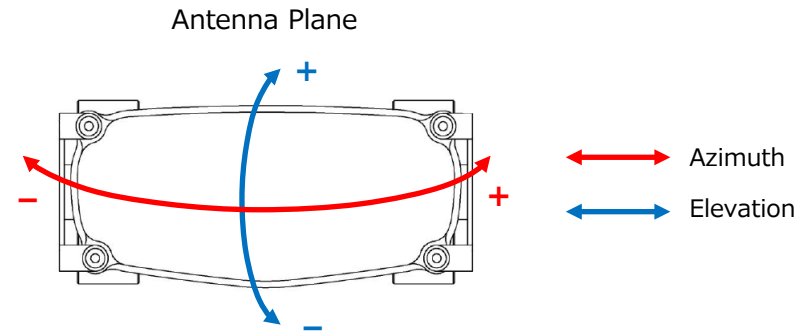


Sensor Unit Antenna Gain measurement result

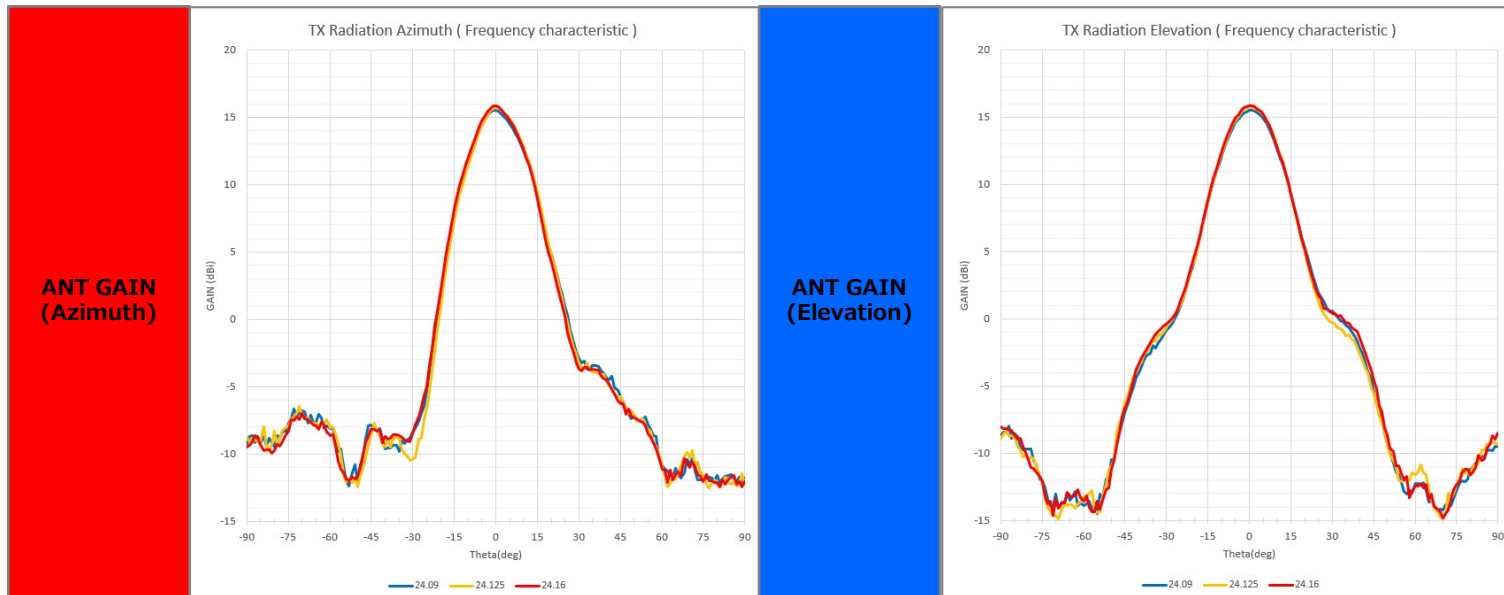
Antenna Type : Patch array Antenna (36 Elements)
Frequency Range Used : 24.09GHz ~ 24.16GHz (70MHz)



Antenna side front of the sensor unit



Antenna Gain Measurement Frequency : 24.09GHz (Low), 24.125GHz (Mid), 24.16GHz (Hi)



Antenna Gain : 15.84dBi (MAX) @24.16GHz
Half-Value Angle : 19 deg

Antenna Gain : 15.86dBi (MAX) @24.16GHz
Half-Value Angle : 19 deg



Sensor Unit Antenna Gain measurement result

TX Radiation Azimuth Frequency Characteristic

Measurement Frequency : 24.09GHz (Low)、24.125GHz (Mid)、 24.16GHz (High)

Frq	24.09	24.125	24.16	GHz
Peak	15.53	15.70	15.84	dB
Theta	0	0	0	deg

Azimuth

Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)		
	24.09 Level(dBi)	24.125 Level(dBi)	24.16 Level(dBi)		24.09 Level(dBi)	24.125 Level(dBi)	24.16 Level(dBi)		24.09 Level(dBi)	24.125 Level(dBi)	24.16 Level(dBi)		24.09 Level(dBi)	24.125 Level(dBi)	24.16 Level(dBi)		24.09 Level(dBi)	24.125 Level(dBi)	24.16 Level(dBi)		24.09 Level(dBi)	24.125 Level(dBi)	24.16 Level(dBi)
-90	-9.30	-8.74	-9.49	-59	-8.11	-7.96	-8.58	-28	-7.59	-8.90	-7.22	3	15.03	15.34	15.35	34	-3.76	-3.72	-3.76	65	-11.08	-11.89	-11.56
-89	-8.70	-9.10	-9.36	-58	-8.83	-8.50	-9.42	-27	-7.00	-8.82	-6.55	4	14.77	15.15	15.04	35	-3.45	-3.87	-3.73	66	-11.54	-11.36	-11.32
-88	-8.65	-8.81	-9.12	-57	-9.82	-9.29	-10.51	-26	-6.46	-7.47	-5.68	5	14.48	14.87	14.74	36	-3.45	-3.98	-3.77	67	-11.77	-10.84	-11.62
-87	-9.13	-8.98	-8.66	-56	-9.65	-10.03	-11.16	-25	-5.33	-6.58	-5.04	6	14.20	14.56	14.45	37	-3.52	-4.02	-3.75	68	-11.38	-10.23	-10.37
-86	-8.72	-9.09	-8.75	-55	-10.87	-11.53	-11.43	-24	-4.05	-5.42	-3.44	7	13.78	14.19	14.08	38	-3.86	-4.11	-4.25	69	-10.41	-9.87	-10.67
-85	-9.25	-9.18	-9.28	-54	-12.01	-12.13	-11.89	-23	-2.26	-3.86	-2.23	8	13.47	13.77	13.63	39	-4.00	-4.10	-4.42	70	-10.75	-10.25	-10.99
-84	-8.73	-7.96	-9.76	-53	-12.38	-11.83	-12.01	-22	-1.18	-2.38	-0.48	9	13.03	13.34	13.16	40	-4.34	-4.61	-4.47	71	-10.35	-9.74	-10.63
-83	-9.42	-9.45	-9.67	-52	-11.39	-12.15	-11.75	-21	0.23	-0.81	0.55	10	12.57	12.88	12.69	41	-4.47	-4.96	-4.83	72	-11.26	-10.88	-10.95
-82	-8.80	-9.73	-9.72	-51	-10.81	-11.81	-11.86	-20	1.77	0.96	2.23	11	12.02	12.29	12.01	42	-4.23	-5.05	-5.22	73	-11.93	-10.58	-11.56
-81	-9.15	-9.26	-9.93	-50	-12.06	-12.43	-11.69	-19	3.24	2.57	3.52	12	11.45	11.64	11.39	43	-5.09	-5.57	-5.54	74	-11.95	-11.34	-11.64
-80	-9.47	-8.28	-9.78	-49	-11.24	-11.59	-10.86	-18	4.61	3.90	4.90	13	10.85	10.98	10.64	44	-5.26	-5.76	-6.06	75	-11.93	-11.57	-12.08
-79	-8.62	-9.27	-9.32	-48	-10.17	-11.07	-10.05	-17	5.68	5.03	5.96	14	10.03	10.21	9.83	45	-5.72	-5.73	-6.26	76	-11.87	-12.27	-11.51
-78	-8.74	-8.84	-9.41	-47	-8.90	-10.28	-9.13	-16	6.94	6.25	7.03	15	9.16	9.51	8.91	46	-6.41	-6.14	-6.25	77	-11.75	-12.51	-11.96
-77	-8.35	-8.27	-9.10	-46	-7.88	-9.40	-8.68	-15	7.72	7.34	8.15	16	8.16	8.55	7.96	47	-6.77	-6.67	-7.03	78	-11.82	-12.22	-12.01
-76	-8.33	-8.01	-8.55	-45	-7.84	-8.56	-8.17	-14	8.68	8.33	9.09	17	7.22	7.60	6.94	48	-7.04	-6.99	-6.66	79	-12.00	-11.93	-12.15
-75	-7.73	-7.89	-8.33	-44	-8.17	-7.69	-8.16	-13	9.56	9.26	9.93	18	6.25	6.73	5.93	49	-7.40	-6.81	-7.18	80	-11.59	-12.24	-12.10
-74	-7.41	-7.41	-7.45	-43	-8.33	-8.38	-8.30	-12	10.39	10.07	10.77	19	5.47	5.68	5.08	50	-7.21	-7.08	-7.32	81	-12.13	-12.43	-12.43
-73	-6.69	-7.29	-7.49	-42	-8.10	-8.61	-8.25	-11	11.03	10.89	11.50	20	4.77	4.72	4.18	51	-7.44	-7.53	-7.39	82	-11.84	-12.17	-11.95
-72	-7.19	-6.97	-7.28	-41	-8.81	-9.28	-9.13	-10	11.67	11.48	12.02	21	4.04	4.00	3.44	52	-7.61	-7.60	-7.61	83	-11.64	-11.76	-12.25
-71	-6.99	-6.49	-7.46	-40	-9.59	-9.50	-8.72	-9	12.22	12.04	12.59	22	3.36	3.20	2.53	53	-7.37	-7.37	-7.66	84	-11.62	-12.14	-11.84
-70	-6.80	-7.08	-7.00	-39	-9.54	-8.91	-8.92	-8	12.74	12.71	13.16	23	2.46	2.32	1.75	54	-7.25	-7.93	-7.89	85	-11.53	-12.23	-11.75
-69	-6.84	-7.36	-7.37	-38	-9.55	-9.50	-8.85	-7	13.32	13.27	13.68	24	1.88	1.59	1.07	55	-7.86	-8.15	-8.52	86	-11.80	-12.06	-11.61
-68	-7.70	-7.31	-7.43	-37	-9.36	-8.93	-8.60	-6	13.93	13.86	14.25	25	0.95	0.53	0.26	56	-8.17	-8.33	-8.76	87	-12.05	-12.39	-12.26
-67	-7.12	-7.67	-7.66	-36	-9.36	-8.71	-8.54	-5	14.38	14.41	14.71	26	0.29	-0.23	-1.00	57	-8.63	-9.20	-9.14	88	-11.70	-12.19	-12.05
-66	-7.70	-7.69	-7.84	-35	-9.84	-8.92	-8.66	-4	14.88	14.88	15.11	27	-0.81	-1.13	-1.73	58	-8.73	-9.44	-9.61	89	-12.09	-11.49	-12.45
-65	-7.65	-7.69	-7.93	-34	-9.04	-9.66	-8.78	-3	15.17	15.21	15.44	28	-1.72	-2.11	-2.54	59	-10.21	-9.98	-10.20	90	-11.77	-12.31	-12.06
-64	-7.07	-7.94	-8.17	-33	-9.22	-10.03	-8.99	-2	15.39	15.52	15.64	29	-2.45	-2.55	-3.27	60	-10.86	-10.91	-11.14				
-63	-7.34	-7.90	-7.66	-32	-8.96	-10.14	-9.04	-1	15.51	15.63	15.83	30	-2.94	-3.30	-3.73	61	-11.14	-11.58	-11.21				
-62	-8.09	-7.79	-7.87	-31	-8.86	-10.46	-9.09	0	15.53	15.70	15.84	31	-3.21	-3.57	-3.80	62	-11.28	-12.47	-12.12				
-61	-7.91	-7.44	-8.34	-30	-8.39	-10.39	-8.47	1	15.42	15.67	15.76	32	-3.08	-3.68	-3.60	63	-11.60	-12.22	-11.18				
-60	-8.14	-8.07	-8.61	-29	-8.11	-10.25	-7.82	2	15.24	15.55	15.58	33	-3.69	-3.23	-3.54	64	-11.71	-11.57	-11.95				

TX Radiation Elevation Frequency Characteristic
Measurement Frequency : 24.09GHz (Low)、 24.125GHz (Mid)、 24.16GHz (High)

Elevation

Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)			Theta (deg)	Frequency(GHz)						
	24.09	24.125	24.16		24.09	24.125	24.16		24.09	24.125	24.16		24.09	24.125	24.16		24.09	24.125	24.16				
	Level(dBi)	Level(dBi)	Level(dBi)		Level(dBi)	Level(dBi)	Level(dBi)		Level(dBi)	Level(dBi)	Level(dBi)		Level(dBi)	Level(dBi)	Level(dBi)		Level(dBi)	Level(dBi)	Level(dBi)				
-90	-8.63	-8.92	-8.04	-59	-13.79	-13.15	-13.20	-28	-0.33	-0.07	0.03	3	15.33	15.57	15.61	34	-0.24	-0.84	-0.03	65	-13.66	-12.69	-13.42
-89	-8.43	-8.54	-8.15	-58	-13.59	-13.01	-14.04	-27	0.02	0.41	0.31	4	15.14	15.38	15.44	35	-0.49	-1.25	-0.25	66	-13.55	-13.41	-13.07
-88	-8.42	-8.36	-8.18	-57	-14.20	-12.80	-14.39	-26	0.46	0.63	0.74	5	14.86	15.12	15.18	36	-0.68	-1.18	-0.36	67	-13.88	-14.11	-13.96
-87	-7.97	-8.67	-8.23	-56	-13.68	-14.20	-14.38	-25	0.90	1.02	1.27	6	14.57	14.85	14.82	37	-1.03	-1.52	-0.65	68	-14.29	-14.29	-14.16
-86	-8.93	-8.69	-8.32	-55	-14.49	-14.44	-13.58	-24	1.41	1.53	1.82	7	14.17	14.45	14.49	38	-1.27	-1.69	-0.78	69	-14.15	-14.74	-14.35
-85	-8.50	-8.78	-8.64	-54	-13.06	-14.36	-14.14	-23	2.14	2.21	2.38	8	13.74	14.01	13.97	39	-1.65	-2.11	-0.94	70	-14.21	-14.87	-14.80
-84	-8.76	-9.50	-8.97	-53	-13.37	-13.29	-13.51	-22	2.81	2.72	3.10	9	13.26	13.53	13.40	40	-2.19	-2.66	-1.47	71	-13.81	-14.50	-14.50
-83	-9.51	-9.75	-8.90	-52	-11.94	-12.29	-12.69	-21	3.56	3.78	3.83	10	12.69	12.96	12.83	41	-2.60	-3.11	-1.99	72	-14.02	-13.00	-14.26
-82	-9.75	-10.26	-9.50	-51	-12.07	-11.18	-12.56	-20	4.28	4.29	4.71	11	12.09	12.27	12.24	42	-3.24	-3.62	-2.50	73	-13.91	-13.35	-13.45
-81	-9.69	-10.21	-9.98	-50	-10.46	-10.99	-11.18	-19	5.17	5.12	5.40	12	11.45	11.69	11.56	43	-3.87	-4.01	-3.13	74	-13.37	-13.04	-12.74
-80	-9.72	-10.43	-10.45	-49	-10.48	-10.48	-10.57	-18	6.06	6.01	6.18	13	10.80	10.92	10.86	44	-4.52	-5.12	-3.83	75	-12.84	-12.45	-12.37
-79	-9.69	-10.26	-11.05	-48	-9.12	-8.49	-9.42	-17	6.88	6.88	7.12	14	10.06	10.13	10.16	45	-5.49	-5.60	-4.64	76	-12.19	-11.81	-12.04
-78	-10.57	-10.44	-11.15	-47	-8.52	-7.77	-8.49	-16	7.74	7.79	7.94	15	9.28	9.29	9.28	46	-6.30	-6.36	-5.18	77	-12.07	-11.13	-11.37
-77	-10.88	-10.96	-11.38	-46	-7.79	-7.22	-7.33	-15	8.63	8.66	8.78	16	8.55	8.50	8.50	47	-6.93	-7.27	-6.48	78	-12.10	-11.56	-11.22
-76	-11.92	-11.75	-11.74	-45	-7.00	-6.27	-6.74	-14	9.37	9.41	9.58	17	7.77	7.65	7.70	48	-7.40	-7.71	-6.90	79	-11.91	-11.19	-11.22
-75	-12.06	-12.22	-12.15	-44	-6.24	-5.65	-6.08	-13	10.14	10.17	10.39	18	6.95	6.72	6.87	49	-8.52	-8.34	-8.14	80	-11.22	-11.63	-11.58
-74	-12.56	-13.36	-13.17	-43	-5.58	-4.89	-5.30	-12	11.00	10.95	11.15	19	6.08	5.81	5.97	50	-9.32	-9.26	-8.66	81	-11.01	-10.93	-11.39
-73	-13.44	-14.10	-13.79	-42	-5.06	-4.31	-4.56	-11	11.53	11.69	11.85	20	5.24	4.91	5.12	51	-9.94	-10.17	-9.64	82	-10.76	-10.85	-11.04
-72	-13.90	-14.29	-13.59	-41	-4.33	-4.05	-3.79	-10	12.16	12.31	12.49	21	4.58	4.07	4.28	52	-10.77	-10.51	-9.90	83	-10.57	-10.72	-10.16
-71	-13.94	-14.69	-14.64	-40	-4.01	-3.42	-3.34	-9	12.74	12.88	13.07	22	3.89	3.27	3.54	53	-11.38	-10.98	-10.94	84	-10.24	-9.75	-10.56
-70	-13.06	-14.59	-13.47	-39	-3.59	-3.22	-2.92	-8	13.26	13.44	13.59	23	3.15	2.57	2.93	54	-11.59	-12.01	-10.91	85	-10.27	-9.78	-10.39
-69	-14.00	-14.90	-14.08	-38	-3.07	-2.60	-2.57	-7	13.72	13.94	14.08	24	2.53	1.91	2.25	55	-12.21	-12.11	-11.52	86	-9.82	-9.38	-9.63
-68	-13.65	-14.15	-13.67	-37	-2.73	-2.53	-2.22	-6	14.14	14.40	14.53	25	1.96	1.29	1.75	56	-12.82	-12.02	-11.99	87	-9.75	-9.27	-9.38
-67	-13.68	-13.82	-13.72	-36	-2.59	-1.97	-1.80	-5	14.61	14.75	14.92	26	1.65	0.75	1.50	57	-13.03	-12.07	-11.72	88	-9.81	-9.20	-8.72
-66	-12.96	-13.88	-12.88	-35	-1.99	-1.65	-1.43	-4	14.86	15.05	15.20	27	1.29	0.40	0.80	58	-12.70	-12.02	-13.30	89	-9.49	-9.23	-8.99
-65	-13.51	-13.77	-13.20	-34	-2.18	-1.66	-1.11	-3	15.09	15.36	15.49	28	0.76	0.03	0.69	59	-12.96	-11.44	-12.87	90	-9.46	-9.38	-8.48
-64	-13.21	-13.87	-13.24	-33	-1.79	-1.17	-0.94	-2	15.31	15.56	15.70	29	0.53	-0.20	0.55	60	-12.28	-11.62	-12.37				
-63	-12.87	-14.12	-13.13	-32	-1.52	-1.18	-0.74	-1	15.41	15.66	15.81	30	0.57	-0.30	0.40	61	-12.28	-11.39	-12.43				
-62	-13.88	-13.79	-12.72	-31	-1.17	-1.02	-0.53	0	15.53	15.75	15.86	31	0.33	-0.44	0.39	62	-12.37	-10.85	-12.27				
-61	-13.71	-13.65	-13.30	-30	-0.89	-0.69	-0.38	1	15.52	15.74	15.85	32	0.11	-0.70	0.21	63	-12.19	-11.46	-12.55				
-60	-13.89	-13.26	-13.54	-29	-0.66	-0.25	-0.32	2	15.42	15.68	15.81	33	-0.13	-0.75	0.22	64	12.75	-11.57	-12.35				

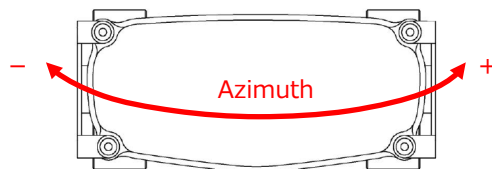
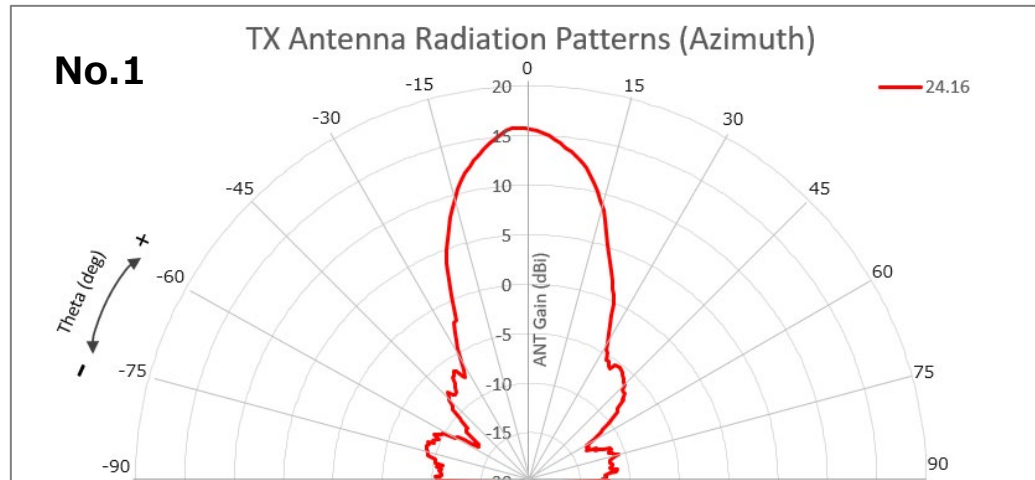
Sensor Unit Antenna Gain measurement result

【Measurement Environment】

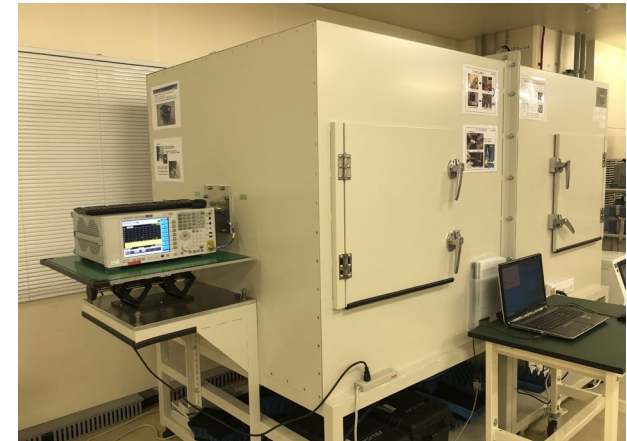
- Measurement Location : S-TAKAYA Electronics Industry Co.,LTD.
- Measurement Date:2023/05/30
- Mesurer: Radar Development Section Manabu Gakumi
- 2m Anechoic Box : MAB101 (24GHz ~ 81GHz)
S/N:171773 MicroWave Factory
- Signal Analyzer : N9010A (10Hz ~ 44GHz)
S/N:MY51440171 Calibration:2022/3/11 Keysight Technology
- Horn Antenna : MSGHWR42-20 (18GHz ~ 26.5GHz) Gain:20dBi
S/N:171775 MicroWave Factory

Frequency : @24.16 GHz

Antenna Gain : 15.84dBi (MAX)



Sensor Unit



2m Anechoic box



Horn Antenna

See **No.1** photo in another file (setup-photo.pdf) for setup.

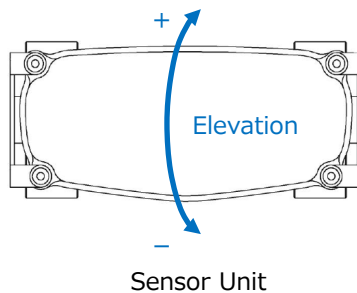
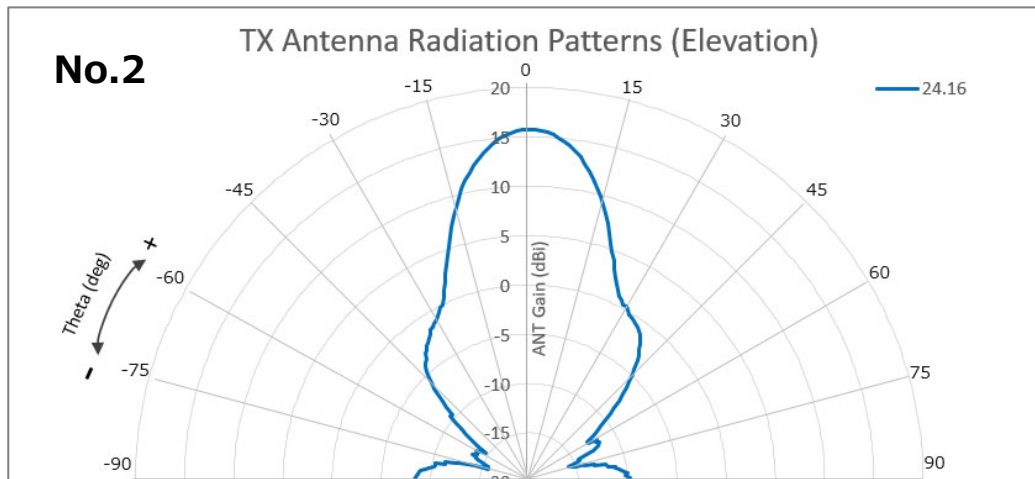
Sensor Unit Antenna Gain measurement result

【Measurement Environment】

- Measurement Location : S-TAKAYA Electronics Industry Co.,LTD.
- Measurement Date:2023/05/30
- Measurer: Radar Development Section Manabu Gakumi
- 2m Anechoic Box : MAB101 (24GHz ~ 81GHz)
S/N:171773 MicroWave Factory
- Signal Analyzer : N9010A (10Hz ~ 44GHz)
S/N:MY51440171 Calibration:2022/3/11 Keysight Technology
- Horn Antenna : MSGHWR42-20 (18GHz ~ 26.5GHz) Gain:20dBi
S/N:171775 MicroWave Factory

Frequency : @24.16 GHz

Antenna Gain : 15.86dBi (MAX)



2m Anechoic box



Horn Antenna

See **No.2** photo in another file (setup-photo.pdf) for setup.