

Measurement Results

1. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
110.0	22.13	0.82	126.0	29.66	0.82
111.0	22.13	0.82	127.0	29.76	0.82
112.0	21.74	0.82	128.0	31.13	0.82
113.0	22.62	0.82	129.0	31.56	0.82
114.0	23.61	0.82	130.0	29.23	0.82
115.0	23.92	0.82	131.0	29.85	0.82
116.0	23.30	0.82	132.0	31.32	0.82
117.0	22.57	0.82	133.0	31.22	0.82
118.0	22.37	0.82	134.0	31.15	0.82
119.0	24.14	0.82	135.0	33.35	0.82
120.0	24.89	0.82	136.0	32.51	0.82
121.0	24.37	0.82	137.0	31.34	0.82
122.0	25.64	0.82	138.0	30.90	0.82
123.0	27.16	0.82	139.0	28.72	0.82
124.0	27.30	0.82	140.0	29.16	0.82
125.0	28.48	0.82	-	-	-

END.

Measurement Report

74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, Korea 17383
Tel :82-31-645-6900, www.hct.co.kr보고서번호(Report No) : IC-2024-057626
측 정 번 호(Measurement No) : C-2024-067795

페이지(page) : 1 of 3

1. 의뢰자 (Client)

- 기관명 (Name) : SPORTON INTERNATIONAL INC.
- 주소 (Address) : No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd., Guishan Dist., Taoyuan City 333, Taiwan, R.O.C.

2. 대상품목 (Measurement Item)

◇ HCT 등록번호 : 527291

- 기기명 (Description) : HARMONIC MIXER
- 제작회사 및 형식(Manufacturer and Model Name) : ROHDE & SCHWARZ / FS-Z220
- 기기번호 (Serial Number) : 101042

3. 측정일자 (Measurement date) : 2024.06.27

4. 측정환경 (Environment)

- 온도(Temperature) : (23.1 ± 0.3) °C - 습도(Humidity) : (49 ± 2) % R.H.

5. 측정방법 (Measurement method used)

This certifies that the above equipment was measured using the standard equipment below according to customer requirements.

측정에 사용한 표준장비 명세 (List of used standards/specifications)

기기명 (Description)	제작회사 / 형식 (Manufacturer and Model Name)	기기번호 (Serial Number)	차기교정예정일자 (The due date of next Calibration)	교정기관 (Calibration laboratory)
PSG ANALOG SIGNAL GENERATOR	AGILENT/E8257D	MY46130629	2025/06/12	HCT CO., LTD.
SIGNAL & SPECTRUM ANALYZER	ROHDE & SCHWARZ/FSW43	102337	2024/07/11	HCT CO., LTD.
ERICKSON POWER METER	VDI/PM5	394V	NCR	HCT CO., LTD.
WR-05 MULTIPLIER SOURCE MODULE	OML/S05MS-A	160419-1	NCR	HCT CO., LTD.

6. 측정결과 (Measurement result)

: 측정결과 참조 (Refer to attachment)

(주) 이 측정결과는 의뢰자가 제시한 시료 및 시료명에만 한정됩니다.

The messuremen results shown in this report refer only to the sample(s) measured unless otherwise stated.

확 인 (Affirmation)	작성자 (Tested by)	승인자 (Approved by)
	성명 (Name) : Seokhoon Kang	직위 (Title) 기술책임자(Technical Manager) 성명 (Name) Kwangchul Kim

이 성적서는 ILAC MRA 서명 기관인 KOLAS(Korea Laboratory Accreditation Scheme)와 A2LA (American Laboratory for Laboratory Accreditation)의 인정
과 무관합니다. This calibration certificate is Not an accredited report by KOLAS(Korea Laboratory Accreditation Scheme) and A2LA(American Association
for Laboratory Accreditation), a ILAC MRA signatory.

2024. 07. 17

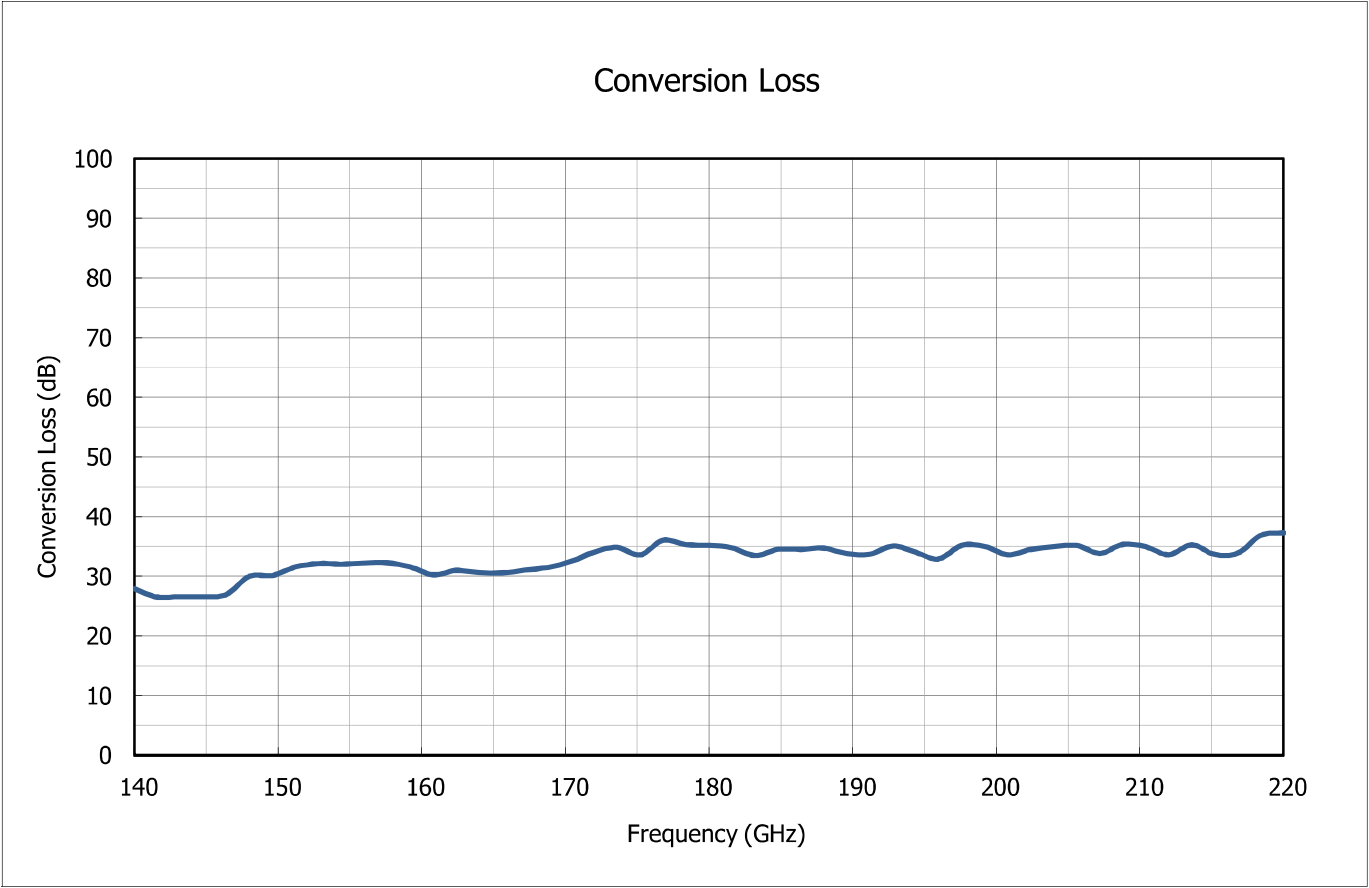
HCT

(주)에이치시티 대표이사
President, HCT Co., Ltd.

(주) 측정결과는 측정기의 정밀정확도에 영향을 미치는 요소(과부하, 온도, 습도 등)의 급격한 변화가 발생한 경우에는 무효가 됩니다. If any significant instability
or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

Measurement Results

1. Conversion Loss Graph



[Note]

1. Measurement Condition : RF = -30 dBm, Harmonic Order = 16, L.O. Level = 15.5 dBm, IF = 1 330 MHz, Bias Value = 0.00 mA

Measurement Results

1. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
140.00	27.89	0.89	181.60	34.79	0.89
141.60	26.48	0.89	183.20	33.48	0.89
143.20	26.57	0.89	184.80	34.51	0.89
144.80	26.57	0.89	186.40	34.52	0.89
146.40	26.91	0.89	188.00	34.72	0.89
148.00	29.94	0.89	189.60	33.82	0.89
149.60	30.10	0.89	191.20	33.72	0.89
151.20	31.53	0.89	192.80	35.08	0.89
152.80	32.12	0.89	194.40	33.99	0.89
154.40	32.02	0.89	196.00	32.90	0.89
156.00	32.21	0.89	197.60	35.20	0.89
157.60	32.26	0.89	199.20	34.97	0.89
159.20	31.54	0.89	200.80	33.62	0.89
160.80	30.23	0.89	202.40	34.50	0.89
162.40	30.97	0.89	204.00	34.98	0.89
164.00	30.57	0.89	205.60	35.16	0.89
165.60	30.55	0.89	207.20	33.84	0.89
167.20	31.00	0.89	208.80	35.35	0.89
168.80	31.48	0.89	210.40	34.95	0.89
170.40	32.48	0.89	212.00	33.62	0.89
172.00	34.05	0.89	213.60	35.25	0.89
173.60	34.85	0.89	215.20	33.66	0.89
175.20	33.57	0.89	216.80	33.88	0.89
176.80	36.03	0.89	218.40	36.85	0.89
178.40	35.30	0.89	220.00	37.27	0.89
180.00	35.18	0.89	-	-	-

END.

- Certificate No : IC-2024-057639
- Calibration No : C-2024-067808

page : 1 of 5

1. Client

- Name : SPORTON INTERNATIONAL INC.
- Address : No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd., Guishan Dist., Taoyuan City 333, Taiwan, R.O.C.

2. Calibration Subject

◇Registration No : 527313

- Description : ANTENNA
- Manufacturer and Model Name : QUINSTAR / QWH-UPRR00
- Serial Number : 1410300003

3. Date of Calibration

: 2024.06.27

4. Environment

- Temperature : (22.7 ± 0.1) °C - Humidity : (48 ± 2) % R.H.
- Location : Permanent Calibration Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea)

5. Traceability**Calibration method and/or brief description**

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-264-40707), (HCT-CS-264-40707), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

List of used standards/specifications

Description	Manufacturer / Model Name	Serial Number	The due date of next Calibration	Calibration laboratory
PNA SERIES NETWORK ANALYZER	AGILENT/E8363B	MY43030182	2025/06/18	HCT CO., LTD.
NETWORK ANALYZER	AGILENT/N5230C	MY49001853	2024/09/27	HCT CO., LTD.
TRANSMISSION/REFLECTION MODULE SET	OML/V15VNA2-T/R	200722-1	2024/10/18	HCT CO., LTD.
CALIBRATION KIT(2.4 mm)	KEYSIGHT/85056D	MY53400508	2025/02/28	KRISS
CALIBRATION KIT	Keysight Technologies/V11644A	MY46042094	2024/10/06	Keysight Technologies

6. Calibration result

: Refer to attachment

7. Measurement uncertainty

: Refer to attachment

(Confidence level about 95 %, $k = 2$)

affirmation	Measurements performed by	(signature)	Approved by	(signature)
	Name : Minhyeong Shin		Title Technical Cal. Manager Name Jaesang So	

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

2024. 06. 27

Accredited by KOLAS, Republic of KOREA **HCT Co., Ltd.**

(NOTE) If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

Calibration Results



Certificate No : IC-2024-057639

Calibration No : C-2024-067808

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1. Antenna Factor & Gain

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
40.00	39.9	22.4	43.70	40.4	22.6	47.40	41.0	22.8
40.10	39.9	22.3	43.80	40.4	22.6	47.50	41.0	22.8
40.20	40.0	22.3	43.90	40.5	22.6	47.60	41.0	22.8
40.30	40.0	22.3	44.00	40.5	22.6	47.70	41.1	22.7
40.40	40.1	22.3	44.10	40.6	22.5	47.80	41.1	22.7
40.50	40.1	22.3	44.20	40.7	22.5	47.90	41.1	22.7
40.60	40.1	22.3	44.30	40.7	22.4	48.00	41.2	22.7
40.70	40.1	22.3	44.40	40.8	22.4	48.10	41.2	22.7
40.80	40.1	22.3	44.50	40.8	22.4	48.20	41.2	22.7
40.90	40.1	22.3	44.60	40.8	22.4	48.30	41.2	22.7
41.00	40.1	22.4	44.70	40.8	22.4	48.40	41.2	22.7
41.10	40.1	22.4	44.80	40.8	22.4	48.50	41.2	22.8
41.20	40.1	22.4	44.90	40.8	22.5	48.60	41.1	22.8
41.30	40.1	22.4	45.00	40.7	22.6	48.70	41.1	22.9
41.40	40.1	22.4	45.10	40.7	22.6	48.80	41.1	22.9
41.50	40.2	22.4	45.20	40.7	22.7	48.90	41.1	22.9
41.60	40.2	22.4	45.30	40.6	22.7	49.00	41.1	22.9
41.70	40.2	22.4	45.40	40.6	22.7	49.10	41.1	22.9
41.80	40.2	22.4	45.50	40.7	22.7	49.20	41.2	22.9
41.90	40.2	22.4	45.60	40.7	22.7	49.30	41.2	22.9
42.00	40.2	22.4	45.70	40.7	22.7	49.40	41.3	22.8
42.10	40.2	22.5	45.80	40.8	22.6	49.50	41.3	22.8
42.20	40.3	22.5	45.90	40.9	22.6	49.60	41.4	22.7
42.30	40.3	22.5	46.00	41.0	22.5	49.70	41.4	22.7
42.40	40.3	22.5	46.10	41.0	22.5	49.80	41.5	22.7
42.50	40.3	22.5	46.20	41.1	22.5	49.90	41.5	22.7
42.60	40.4	22.4	46.30	41.1	22.4	50.00	41.5	22.8
42.70	40.4	22.4	46.40	41.1	22.5	50.10	41.4	22.8
42.80	40.5	22.4	46.50	41.1	22.5	50.20	41.4	22.8
42.90	40.5	22.4	46.60	41.0	22.5	50.30	41.4	22.8
43.00	40.5	22.4	46.70	41.0	22.6	50.40	41.4	22.9
43.10	40.5	22.4	46.80	41.0	22.7	50.50	41.4	22.9
43.20	40.5	22.4	46.90	40.9	22.7	50.60	41.4	22.9
43.30	40.5	22.4	47.00	40.9	22.8	50.70	41.4	22.9
43.40	40.5	22.5	47.10	40.9	22.8	50.80	41.4	22.9
43.50	40.5	22.5	47.20	40.9	22.8	50.90	41.4	22.9
43.60	40.4	22.6	47.30	40.9	22.8	51.00	41.5	22.9

Calibration Results



Certificate No : IC-2024-057639

Calibration No : C-2024-067808

page : 3 of 5

1. Antenna Factor & Gain (cont.)

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
51.10	41.5	22.9	54.10	41.9	22.9	57.10	42.6	22.7
51.20	41.6	22.8	54.20	41.9	23.0	57.20	42.6	22.7
51.30	41.6	22.8	54.30	41.9	23.0	57.30	42.6	22.8
51.40	41.7	22.8	54.40	41.9	23.0	57.40	42.6	22.8
51.50	41.7	22.7	54.50	42.0	23.0	57.50	42.6	22.8
51.60	41.8	22.7	54.60	42.0	22.9	57.60	42.6	22.9
51.70	41.8	22.7	54.70	42.1	22.9	57.70	42.6	22.9
51.80	41.8	22.7	54.80	42.2	22.8	57.80	42.6	22.9
51.90	41.8	22.8	54.90	42.2	22.8	57.90	42.6	22.9
52.00	41.7	22.8	55.00	42.3	22.7	58.00	42.6	22.9
52.10	41.7	22.8	55.10	42.3	22.7	58.10	42.6	22.9
52.20	41.7	22.9	55.20	42.4	22.7	58.20	42.7	22.9
52.30	41.7	22.9	55.30	42.4	22.7	58.30	42.7	22.8
52.40	41.7	22.9	55.40	42.4	22.7	58.40	42.8	22.8
52.50	41.7	22.9	55.50	42.4	22.8	58.50	42.8	22.7
52.60	41.7	22.9	55.60	42.3	22.8	58.60	42.9	22.7
52.70	41.7	22.9	55.70	42.3	22.8	58.70	42.9	22.7
52.80	41.8	22.9	55.80	42.3	22.8	58.80	43.0	22.6
52.90	41.8	22.9	55.90	42.3	22.8	58.90	43.0	22.6
53.00	41.8	22.9	56.00	42.3	22.9	59.00	43.0	22.6
53.10	41.9	22.8	56.10	42.3	22.9	59.10	43.0	22.7
53.20	42.0	22.8	56.20	42.3	22.9	59.20	42.9	22.7
53.30	42.0	22.7	56.30	42.4	22.9	59.30	42.9	22.8
53.40	42.1	22.7	56.40	42.4	22.9	59.40	42.8	22.9
53.50	42.1	22.7	56.50	42.4	22.9	59.50	42.7	23.0
53.60	42.2	22.7	56.60	42.5	22.8	59.60	42.7	23.1
53.70	42.1	22.7	56.70	42.5	22.8	59.70	42.6	23.1
53.80	42.1	22.7	56.80	42.6	22.8	59.80	42.6	23.1
53.90	42.1	22.8	56.90	42.6	22.7	59.90	42.6	23.2
54.00	42.0	22.9	57.00	42.6	22.7	60.00	42.6	23.2

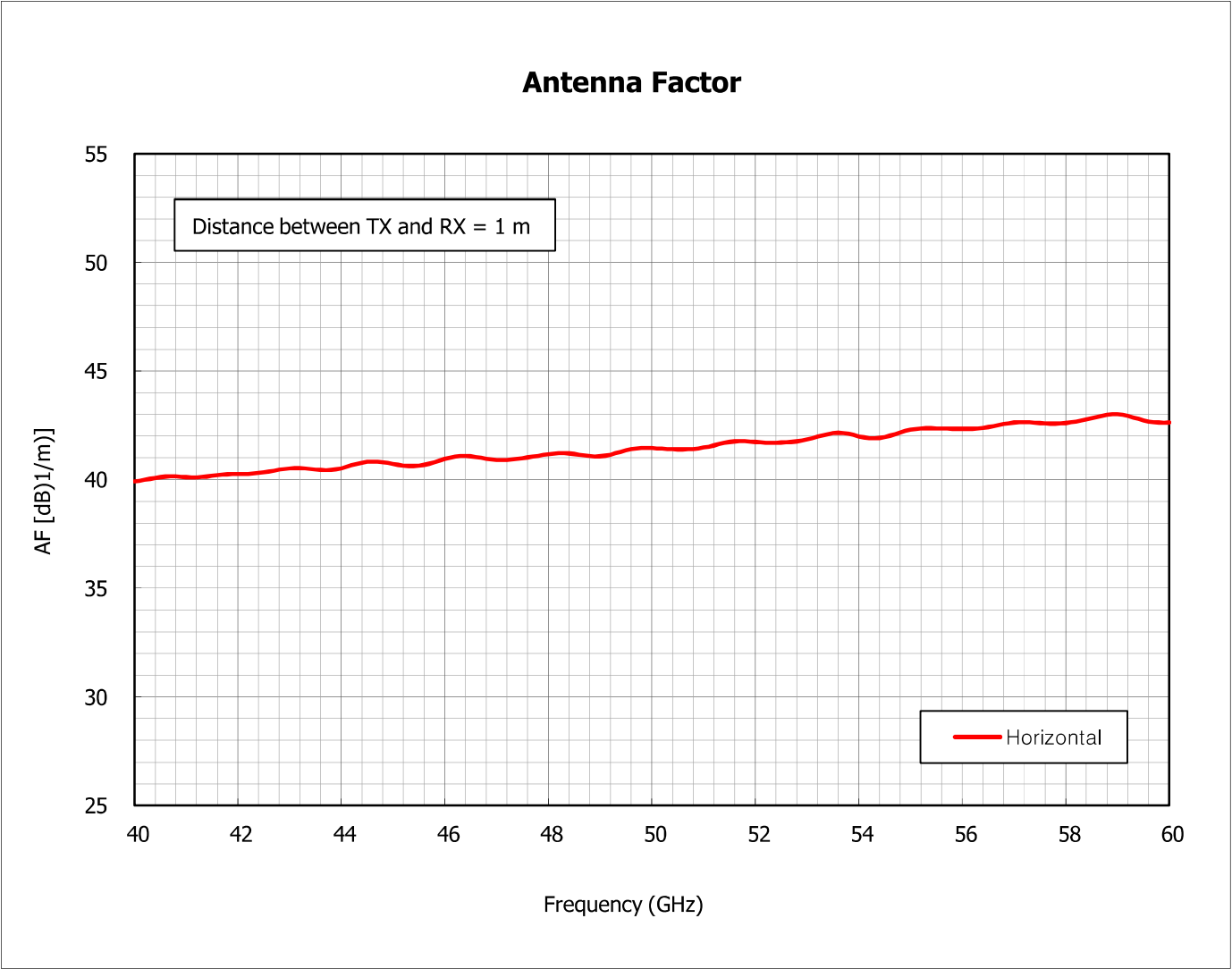
※ The measurement uncertainty of this result is 1.2 dB (Confidence level about 95 %, $k = 2$)

Calibration Results



Certificate No : IC-2024-057639
Calibration No : C-2024-067808

2. Antenna Factor Curve

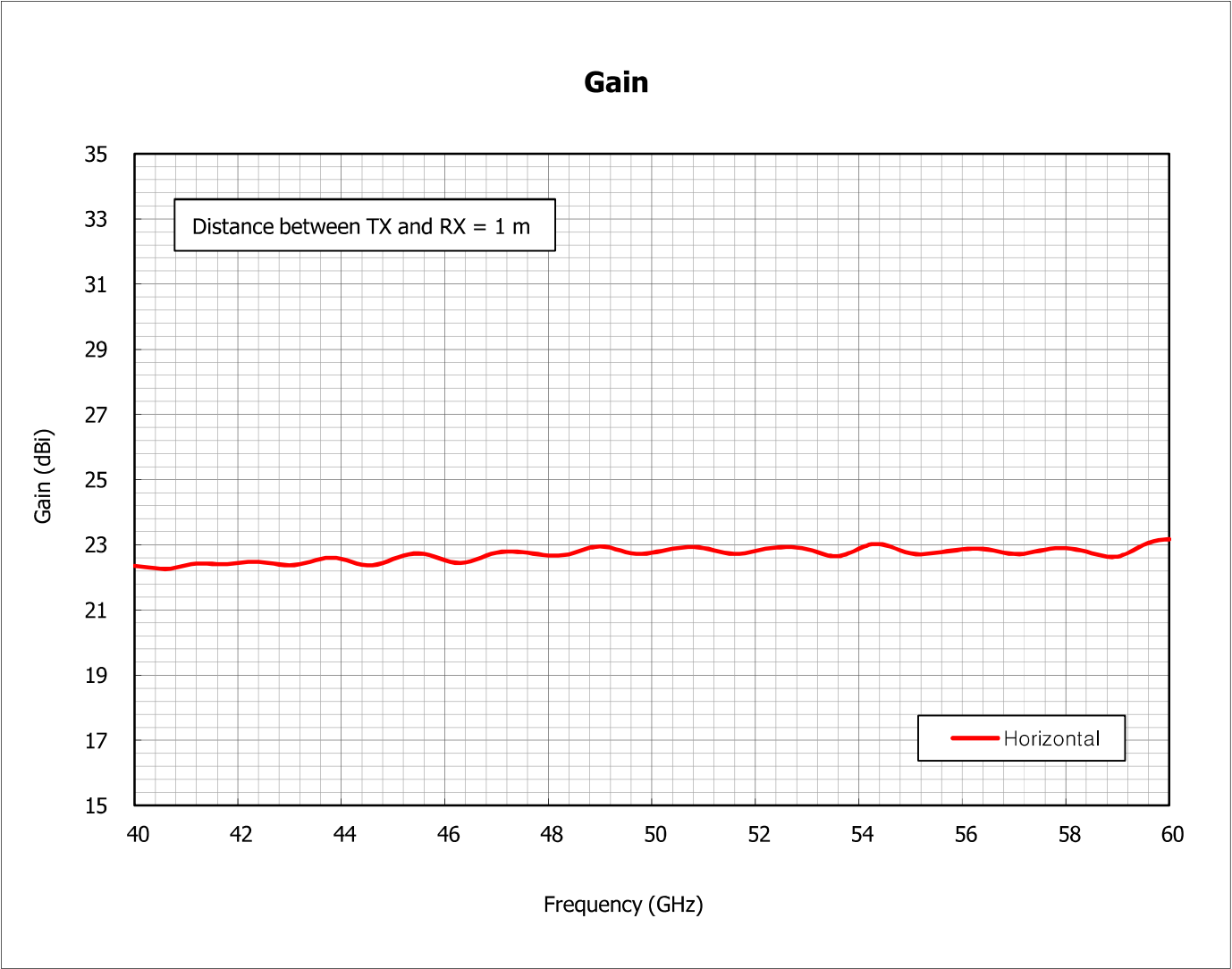


Calibration Results



Certificate No : IC-2024-057639
Calibration No : C-2024-067808

3. Gain Curve



END.

- Certificate No : IC-2024-057635
- Calibration No : C-2024-067804

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1. Client

- Name : SPORTON INTERNATIONAL INC.
- Address : No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd., Guishan Dist., Taoyuan City 333, Taiwan, R.O.C.

2. Calibration Subject

◇Registration No : 527309

- Description : ANTENNA
- Manufacturer and Model Name : QUINSTAR / QWH-EPRR00
- Serial Number : 1372000000

3. Date of Calibration

: 2024.06.27

4. Environment

- Temperature : (22.6 ± 0.1) °C - Humidity : (46 ± 2) % R.H.
- Location : Permanent Calibration Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea)

5. Traceability**Calibration method and/or brief description**

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-264-40707), (HCT-CS-264-40707), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

List of used standards/specifications

Description	Manufacturer / Model Name	Serial Number	The due date of next Calibration	Calibration laboratory
PNA SERIES NETWORK ANALYZER	AGILENT/E8363B	MY43030182	2025/06/18	HCT CO., LTD.
TRANSMISSION/REFLECTION MODULE SET	OML/V15VNA2-T/R	200722-1	2024/10/18	HCT CO., LTD.
TRANSMISSION/REFLECTION MODULE SET	OML/V10VNA2-T/R	200722-1	2024/10/18	HCT CO., LTD.
CALIBRATION KIT	Keysight Technologies/V11644A	MY46042094	2024/10/06	Keysight Technologies
CALIBRATION KIT	Keysight Technologies/W11644A	MY46042118	2024/10/08	Keysight Technologies

6. Calibration result

: Refer to attachment

7. Measurement uncertainty

: Refer to attachment

(Confidence level about 95 %, k = 2)

affirmation	Measurements performed by	(signature)	Approved by	(signature)
	Name : Minhyeong Shin		Title Technical Cal. Manager Name Jaesang So	

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

2024. 06. 27

Accredited by KOLAS, Republic of KOREA HCT Co., Ltd.



(NOTE) If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

Calibration Results



Certificate No : IC-2024-057635

Calibration No : C-2024-067804

page : 2 of 6

1. Antenna Factor & Gain

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
60.00	43.6	22.2	63.70	43.8	22.5	67.40	44.0	22.8
60.10	43.6	22.2	63.80	43.8	22.5	67.50	44.0	22.8
60.20	43.6	22.2	63.90	43.8	22.5	67.60	44.0	22.8
60.30	43.7	22.2	64.00	43.8	22.6	67.70	44.1	22.8
60.40	43.7	22.2	64.10	43.8	22.6	67.80	44.1	22.8
60.50	43.7	22.2	64.20	43.8	22.6	67.90	44.1	22.8
60.60	43.7	22.2	64.30	43.8	22.6	68.00	44.1	22.7
60.70	43.7	22.2	64.40	43.8	22.7	68.10	44.2	22.7
60.80	43.7	22.2	64.50	43.7	22.7	68.20	44.2	22.7
60.90	43.7	22.2	64.60	43.7	22.7	68.30	44.2	22.7
61.00	43.7	22.3	64.70	43.7	22.7	68.40	44.3	22.7
61.10	43.6	22.3	64.80	43.8	22.7	68.50	44.3	22.6
61.20	43.6	22.4	64.90	43.8	22.7	68.60	44.3	22.6
61.30	43.6	22.4	65.00	43.8	22.6	68.70	44.4	22.6
61.40	43.5	22.4	65.10	43.9	22.6	68.80	44.4	22.6
61.50	43.5	22.5	65.20	43.9	22.6	68.90	44.4	22.6
61.60	43.5	22.5	65.30	44.0	22.6	69.00	44.4	22.6
61.70	43.5	22.5	65.40	44.0	22.5	69.10	44.3	22.7
61.80	43.5	22.5	65.50	44.0	22.5	69.20	44.3	22.7
61.90	43.6	22.5	65.60	44.0	22.5	69.30	44.3	22.7
62.00	43.6	22.5	65.70	44.0	22.5	69.40	44.3	22.8
62.10	43.6	22.5	65.80	44.0	22.5	69.50	44.3	22.8
62.20	43.7	22.4	65.90	44.1	22.5	69.60	44.2	22.8
62.30	43.7	22.4	66.00	44.1	22.6	69.70	44.2	22.9
62.40	43.7	22.4	66.10	44.1	22.6	69.80	44.2	22.9
62.50	43.7	22.4	66.20	44.1	22.6	69.90	44.2	22.9
62.60	43.7	22.4	66.30	44.1	22.6	70.00	44.2	22.9
62.70	43.8	22.4	66.40	44.1	22.6	70.10	44.2	22.9
62.80	43.8	22.4	66.50	44.1	22.6	70.20	44.2	22.9
62.90	43.8	22.4	66.60	44.0	22.7	70.30	44.3	22.9
63.00	43.8	22.4	66.70	44.0	22.7	70.40	44.3	22.9
63.10	43.9	22.4	66.80	44.0	22.7	70.50	44.3	22.9
63.20	43.9	22.4	66.90	44.0	22.7	70.60	44.3	22.9
63.30	43.9	22.4	67.00	44.0	22.8	70.70	44.4	22.8
63.40	43.9	22.4	67.10	44.0	22.8	70.80	44.4	22.8
63.50	43.9	22.4	67.20	44.0	22.8	70.90	44.4	22.8
63.60	43.8	22.4	67.30	44.0	22.8	71.00	44.5	22.8

Calibration Results



Certificate No : IC-2024-057635

Calibration No : C-2024-067804

page : 3 of 6

1. Antenna Factor & Gain (cont.)

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
71.10	44.5	22.7	74.60	44.8	22.9	78.10	44.9	23.1
71.20	44.6	22.7	74.70	44.8	22.9	78.20	44.9	23.1
71.30	44.6	22.7	74.80	44.8	22.9	78.30	44.9	23.2
71.40	44.6	22.7	74.90	44.8	22.9	78.40	44.9	23.2
71.50	44.6	22.7	75.00	44.8	23.0	78.50	44.9	23.2
71.60	44.6	22.7	75.10	44.7	23.0	78.60	44.9	23.2
71.70	44.6	22.7	75.20	44.7	23.0	78.70	44.9	23.2
71.80	44.6	22.7	75.30	44.7	23.0	78.80	44.9	23.2
71.90	44.6	22.7	75.40	44.7	23.1	78.90	45.0	23.2
72.00	44.6	22.8	75.50	44.7	23.1	79.00	45.0	23.2
72.10	44.6	22.8	75.60	44.7	23.1	79.10	45.0	23.1
72.20	44.5	22.9	75.70	44.7	23.1	79.20	45.1	23.1
72.30	44.5	22.9	75.80	44.7	23.2	79.30	45.1	23.1
72.40	44.5	22.9	75.90	44.7	23.1	79.40	45.2	23.0
72.50	44.5	23.0	76.00	44.7	23.1	79.50	45.2	23.0
72.60	44.5	23.0	76.10	44.7	23.1	79.60	45.3	23.0
72.70	44.4	23.0	76.20	44.8	23.1	79.70	45.3	23.0
72.80	44.4	23.0	76.30	44.8	23.0	79.80	45.3	22.9
72.90	44.4	23.0	76.40	44.9	23.0	79.90	45.3	23.0
73.00	44.5	23.0	76.50	44.9	23.0	80.00	45.3	23.0
73.10	44.5	23.0	76.60	44.9	23.0	80.10	45.3	23.0
73.20	44.5	23.0	76.70	45.0	22.9	80.20	45.3	23.0
73.30	44.5	23.0	76.80	45.0	22.9	80.30	45.3	23.0
73.40	44.5	23.0	76.90	45.0	22.9	80.40	45.3	23.1
73.50	44.5	23.0	77.00	45.0	22.9	80.50	45.2	23.1
73.60	44.6	23.0	77.10	45.0	22.9	80.60	45.2	23.1
73.70	44.6	23.0	77.20	45.0	22.9	80.70	45.2	23.1
73.80	44.6	22.9	77.30	45.0	23.0	80.80	45.2	23.2
73.90	44.7	22.9	77.40	45.0	23.0	80.90	45.2	23.2
74.00	44.7	22.9	77.50	45.0	23.0	81.00	45.2	23.2
74.10	44.7	22.9	77.60	45.0	23.0	81.10	45.2	23.2
74.20	44.8	22.9	77.70	45.0	23.1	81.20	45.2	23.2
74.30	44.8	22.9	77.80	45.0	23.1	81.30	45.2	23.2
74.40	44.8	22.9	77.90	45.0	23.1	81.40	45.2	23.2
74.50	44.8	22.9	78.00	45.0	23.1	81.50	45.2	23.2

Calibration Results



Certificate No : IC-2024-057635

Calibration No : C-2024-067804

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1. Antenna Factor & Gain (cont.)

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
81.60	45.3	23.2	84.50	45.6	23.1	87.40	45.9	23.1
81.70	45.3	23.2	84.60	45.7	23.1	87.50	46.0	23.1
81.80	45.3	23.2	84.70	45.7	23.1	87.60	46.0	23.1
81.90	45.3	23.1	84.80	45.8	23.0	87.70	46.0	23.0
82.00	45.4	23.1	84.90	45.8	23.0	87.80	46.1	23.0
82.10	45.4	23.1	85.00	45.8	23.0	87.90	46.1	23.0
82.20	45.5	23.0	85.10	45.9	23.0	88.00	46.1	23.0
82.30	45.5	23.0	85.20	45.9	23.0	88.10	46.1	23.0
82.40	45.6	23.0	85.30	45.9	23.0	88.20	46.1	23.0
82.50	45.6	23.0	85.40	45.9	23.0	88.30	46.1	23.0
82.60	45.6	23.0	85.50	45.9	23.0	88.40	46.1	23.0
82.70	45.6	23.0	85.60	45.9	23.0	88.50	46.1	23.1
82.80	45.6	23.0	85.70	45.9	23.0	88.60	46.1	23.1
82.90	45.6	23.0	85.80	45.9	23.0	88.70	46.1	23.1
83.00	45.6	23.0	85.90	45.8	23.1	88.80	46.1	23.1
83.10	45.6	23.0	86.00	45.8	23.1	88.90	46.0	23.2
83.20	45.6	23.0	86.10	45.8	23.1	89.00	46.0	23.2
83.30	45.6	23.0	86.20	45.8	23.1	89.10	46.0	23.2
83.40	45.6	23.1	86.30	45.8	23.1	89.20	46.0	23.2
83.50	45.5	23.1	86.40	45.8	23.1	89.30	46.0	23.2
83.60	45.5	23.1	86.50	45.8	23.2	89.40	46.1	23.2
83.70	45.5	23.2	86.60	45.8	23.2	89.50	46.1	23.2
83.80	45.5	23.2	86.70	45.8	23.2	89.60	46.1	23.2
83.90	45.5	23.2	86.80	45.8	23.2	89.70	46.1	23.2
84.00	45.5	23.2	86.90	45.8	23.2	89.80	46.1	23.1
84.10	45.5	23.2	87.00	45.8	23.2	89.90	46.2	23.1
84.20	45.5	23.2	87.10	45.8	23.2	90.00	46.2	23.1
84.30	45.5	23.2	87.20	45.9	23.2	-	-	-
84.40	45.6	23.2	87.30	45.9	23.1	-	-	-

※ The measurement uncertainty of this result is 1.2 dB (Confidence level about 95 %, $k = 2$)

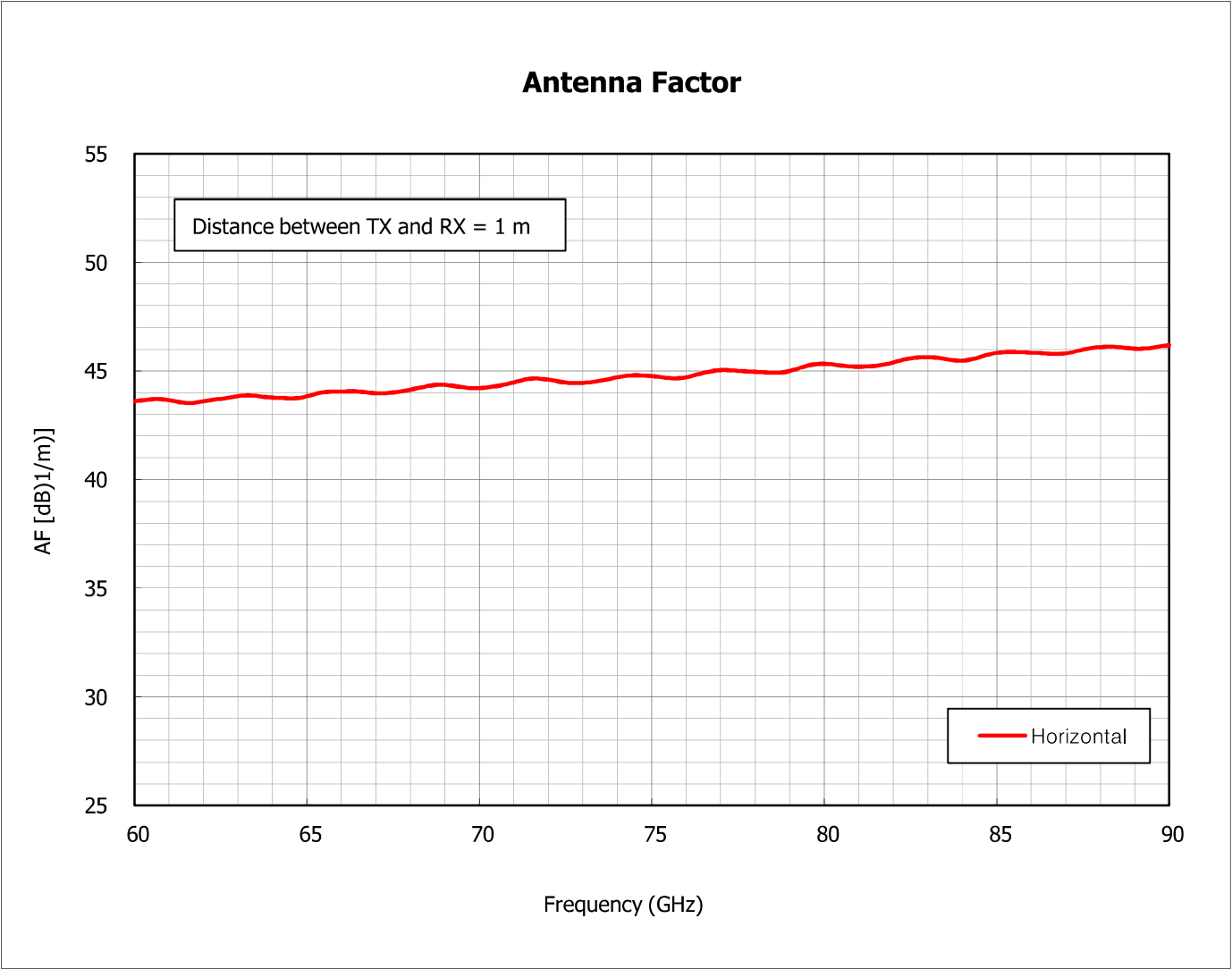
Calibration Results



Certificate No : IC-2024-057635
Calibration No : C-2024-067804

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2. Antenna Factor Curve

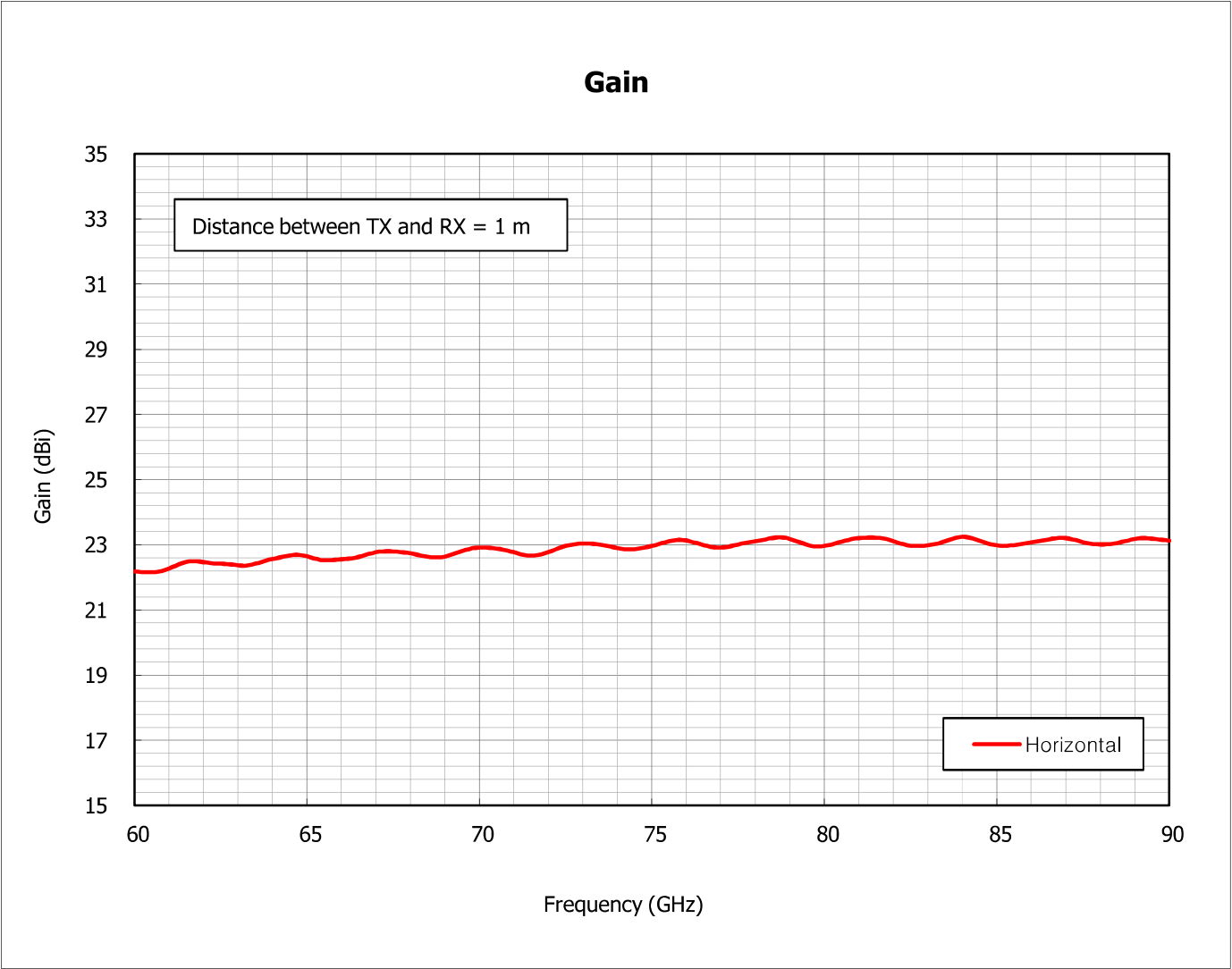


Calibration Results



Certificate No : IC-2024-057635
Calibration No : C-2024-067804

3. Gain Curve



END.

- Certificate No : IC-2024-057643
- Calibration No : C-2024-067812

page : 1 of 5

1. Client

- Name : SPORTON INTERNATIONAL INC.
- Address : No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd., Guishan Dist., Taoyuan City 333, Taiwan, R.O.C.

2. Calibration Subject

◇Registration No : 527323

- Description : ANTENNA
- Manufacturer and Model Name : QUINSTAR / QWH-FPRR00
- Serial Number : 1011500008

3. Date of Calibration

: 2024.06.27

4. Environment

- Temperature : (23.1 ± 0.3) °C - Humidity : (49 ± 2) % R.H.
- Location : Permanent Calibration Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea)

5. Traceability**Calibration method and/or brief description**

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-264-40707), (HCT-CS-264-40707), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

List of used standards/specifications

Description	Manufacturer / Model Name	Serial Number	The due date of next Calibration	Calibration laboratory
PNA SERIES NETWORK ANALYZER	AGILENT/E8363B	MY43030182	2025/06/18	HCT CO., LTD.
TRANSMISSION/REFLECTION MODULE SET	OML/V10VNA2-T/R	200722-1	2024/10/18	HCT CO., LTD.
CALIBRATION KIT	Keysight Technologies/W11644A	MY46042118	2024/10/08	Keysight Technologies

6. Calibration result

: Refer to attachment

7. Measurement uncertainty

: Refer to attachment

(Confidence level about 95 %, $k = 2$)

affirmation	Measurements performed by	(signature)	Approved by	(signature)
	Name : Minhyeong Shin		Title Technical Cal. Manager Name Jaesang So	

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

2024. 06. 27Accredited by KOLAS, Republic of KOREA **HCT Co., Ltd.**

(NOTE) If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

Calibration Results



Certificate No : IC-2024-057643

Calibration No : C-2024-067812

page : 2 of 5

1. Antenna Factor & Gain

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
90.00	47.1	22.2	93.70	47.2	22.5	97.40	47.4	22.6
90.10	47.1	22.2	93.80	47.2	22.5	97.50	47.4	22.6
90.20	47.1	22.2	93.90	47.2	22.5	97.60	47.4	22.6
90.30	47.1	22.2	94.00	47.2	22.5	97.70	47.5	22.6
90.40	47.1	22.2	94.10	47.2	22.5	97.80	47.5	22.6
90.50	47.1	22.3	94.20	47.2	22.5	97.90	47.5	22.6
90.60	47.1	22.3	94.30	47.2	22.5	98.00	47.5	22.6
90.70	47.1	22.3	94.40	47.2	22.5	98.10	47.5	22.6
90.80	47.1	22.3	94.50	47.2	22.5	98.20	47.5	22.6
90.90	47.1	22.3	94.60	47.2	22.5	98.30	47.5	22.6
91.00	47.1	22.3	94.70	47.3	22.5	98.40	47.5	22.6
91.10	47.0	22.4	94.80	47.3	22.5	98.50	47.5	22.6
91.20	47.0	22.4	94.90	47.3	22.5	98.60	47.5	22.6
91.30	47.0	22.4	95.00	47.3	22.5	98.70	47.5	22.6
91.40	47.1	22.4	95.10	47.3	22.5	98.80	47.5	22.6
91.50	47.1	22.4	95.20	47.3	22.5	98.90	47.6	22.6
91.60	47.1	22.4	95.30	47.3	22.5	99.00	47.6	22.5
91.70	47.1	22.3	95.40	47.3	22.5	99.10	47.6	22.5
91.80	47.2	22.3	95.50	47.3	22.5	99.20	47.6	22.5
91.90	47.2	22.3	95.60	47.3	22.5	99.30	47.6	22.5
92.00	47.2	22.3	95.70	47.4	22.5	99.40	47.6	22.6
92.10	47.2	22.3	95.80	47.4	22.5	99.50	47.6	22.6
92.20	47.2	22.4	95.90	47.4	22.5	99.60	47.6	22.6
92.30	47.2	22.4	96.00	47.4	22.5	99.70	47.6	22.6
92.40	47.1	22.4	96.10	47.4	22.5	99.80	47.6	22.6
92.50	47.1	22.4	96.20	47.4	22.5	99.90	47.6	22.6
92.60	47.2	22.4	96.30	47.4	22.5	100.00	47.6	22.6
92.70	47.2	22.4	96.40	47.4	22.5	100.10	47.6	22.6
92.80	47.2	22.4	96.50	47.4	22.5	100.20	47.6	22.6
92.90	47.2	22.4	96.60	47.4	22.5	100.30	47.6	22.6
93.00	47.2	22.4	96.70	47.4	22.5	100.40	47.6	22.6
93.10	47.2	22.4	96.80	47.4	22.5	100.50	47.6	22.7
93.20	47.2	22.4	96.90	47.4	22.5	100.60	47.6	22.7
93.30	47.2	22.4	97.00	47.4	22.6	100.70	47.6	22.7
93.40	47.2	22.4	97.10	47.4	22.6	100.80	47.6	22.7
93.50	47.2	22.4	97.20	47.4	22.6	100.90	47.6	22.7
93.60	47.2	22.5	97.30	47.4	22.6	101.00	47.6	22.7

Calibration Results



Certificate No : IC-2024-057643

Calibration No : C-2024-067812

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1. Antenna Factor & Gain (cont.)

Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)	Frequency (GHz)	AF [dB(1/m)]	Gain (dBi)
101.10	47.6	22.7	104.10	47.9	22.7	107.10	47.9	22.9
101.20	47.6	22.7	104.20	47.9	22.7	107.20	47.9	22.9
101.30	47.6	22.7	104.30	47.9	22.7	107.30	48.0	22.9
101.40	47.6	22.8	104.40	47.9	22.7	107.40	48.0	22.9
101.50	47.6	22.8	104.50	47.9	22.7	107.50	48.0	22.9
101.60	47.6	22.8	104.60	47.9	22.7	107.60	48.0	22.8
101.70	47.6	22.8	104.70	47.9	22.7	107.70	48.0	22.8
101.80	47.6	22.8	104.80	47.9	22.7	107.80	48.1	22.8
101.90	47.6	22.8	104.90	47.9	22.7	107.90	48.1	22.8
102.00	47.6	22.8	105.00	47.9	22.7	108.00	48.1	22.8
102.10	47.6	22.8	105.10	47.9	22.8	108.10	48.1	22.8
102.20	47.7	22.8	105.20	47.9	22.8	108.20	48.1	22.8
102.30	47.7	22.8	105.30	47.9	22.8	108.30	48.2	22.8
102.40	47.7	22.8	105.40	47.9	22.8	108.40	48.2	22.8
102.50	47.7	22.8	105.50	47.9	22.8	108.50	48.2	22.8
102.60	47.7	22.8	105.60	47.8	22.9	108.60	48.1	22.8
102.70	47.7	22.8	105.70	47.8	22.9	108.70	48.1	22.8
102.80	47.7	22.8	105.80	47.8	22.9	108.80	48.1	22.8
102.90	47.7	22.8	105.90	47.8	22.9	108.90	48.1	22.9
103.00	47.7	22.8	106.00	47.8	22.9	109.00	48.1	22.9
103.10	47.7	22.8	106.10	47.8	22.9	109.10	48.1	22.9
103.20	47.7	22.7	106.20	47.8	22.9	109.20	48.1	22.9
103.30	47.8	22.7	106.30	47.8	22.9	109.30	48.1	22.9
103.40	47.8	22.7	106.40	47.8	22.9	109.40	48.1	22.9
103.50	47.8	22.7	106.50	47.8	22.9	109.50	48.1	22.9
103.60	47.8	22.7	106.60	47.9	22.9	109.60	48.1	22.9
103.70	47.9	22.7	106.70	47.9	22.9	109.70	48.1	22.9
103.80	47.9	22.7	106.80	47.9	22.9	109.80	48.1	22.9
103.90	47.9	22.7	106.90	47.9	22.9	109.90	48.1	22.9
104.00	47.9	22.7	107.00	47.9	22.9	110.00	48.1	22.9

※ The measurement uncertainty of this result is 1.2 dB (Confidence level about 95 %, $k = 2$)

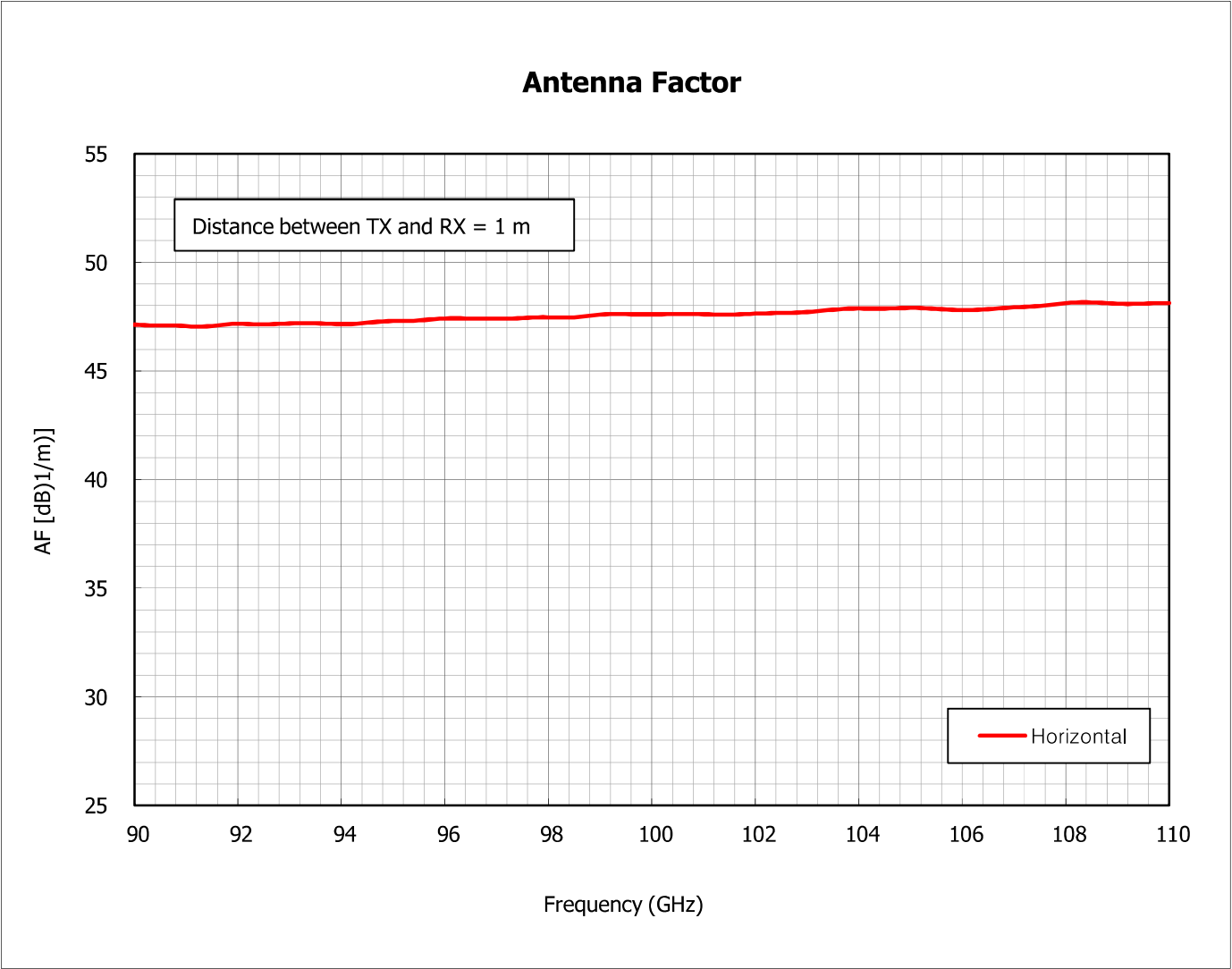
Calibration Results



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Calibration No : C-2024-067812

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2. Antenna Factor Curve

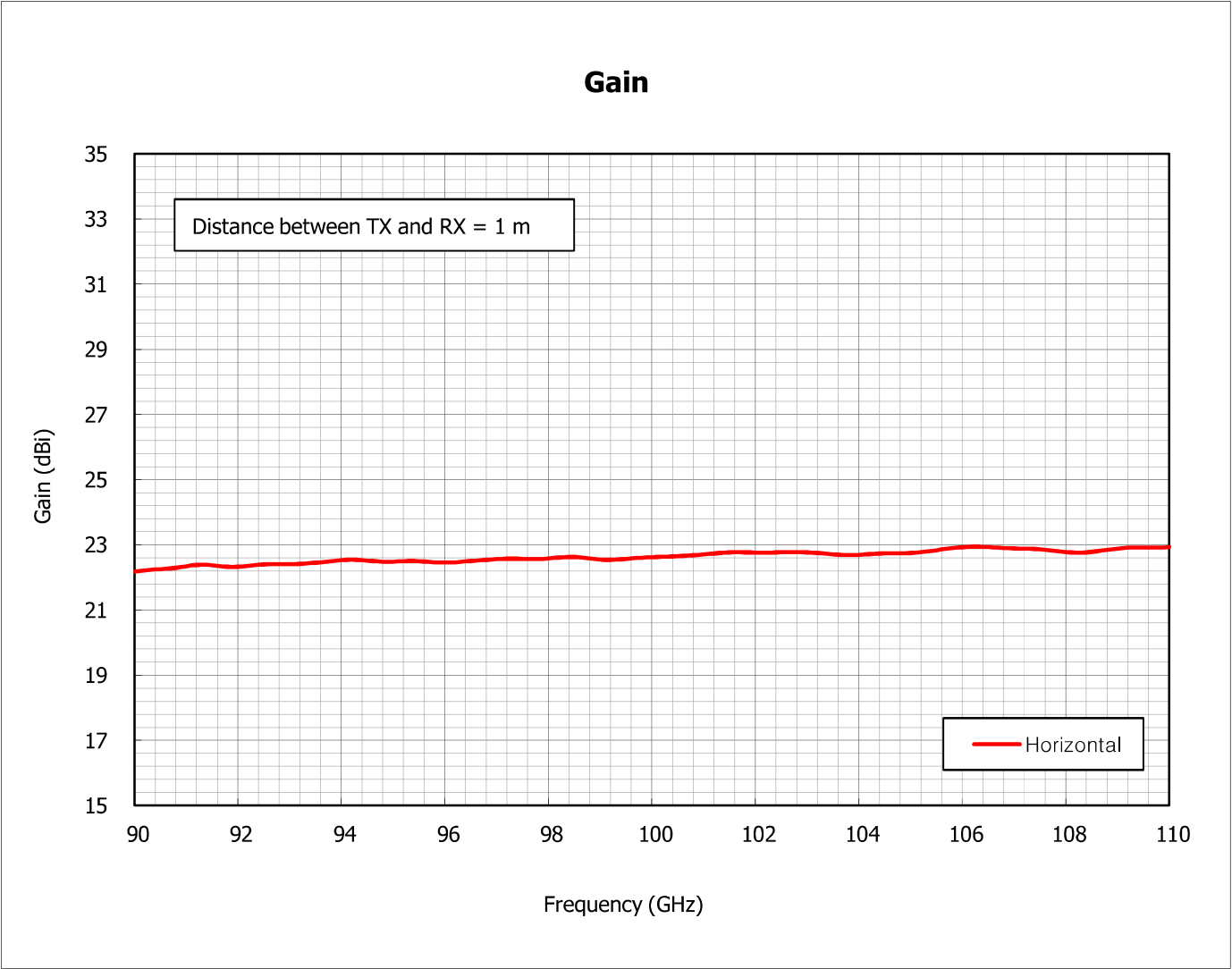


Calibration Results



Certificate No : IC-2024-057643
Calibration No : C-2024-067812

3. Gain Curve



END.