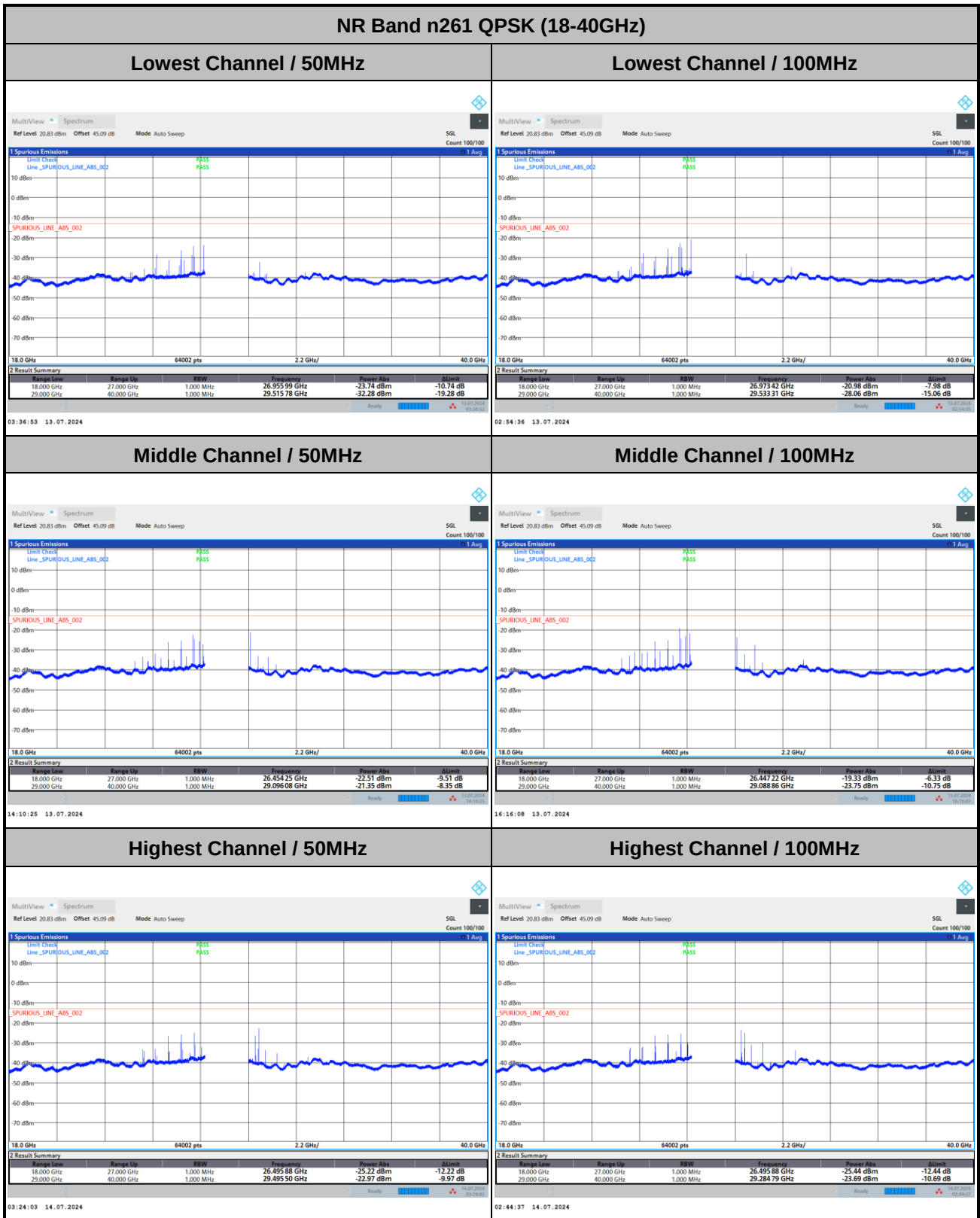




Spurious emission between 18GHz to 40GHz worst case plot is reported as following.

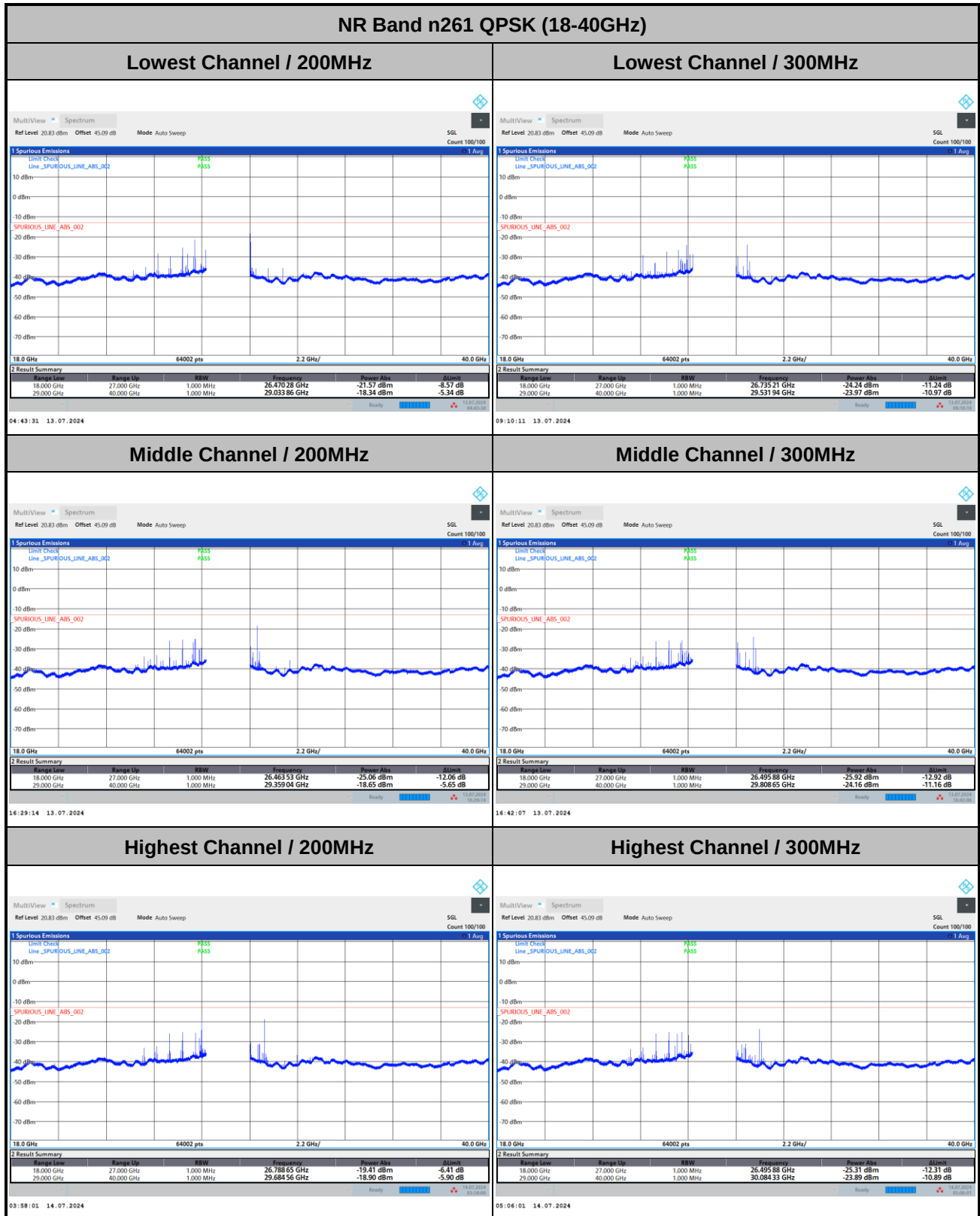
DFT-s-OFDM Module 1



Remark: In band and out of band frequencies are omitted.



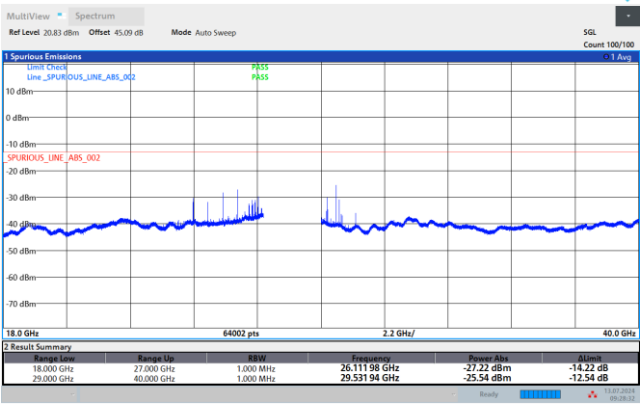
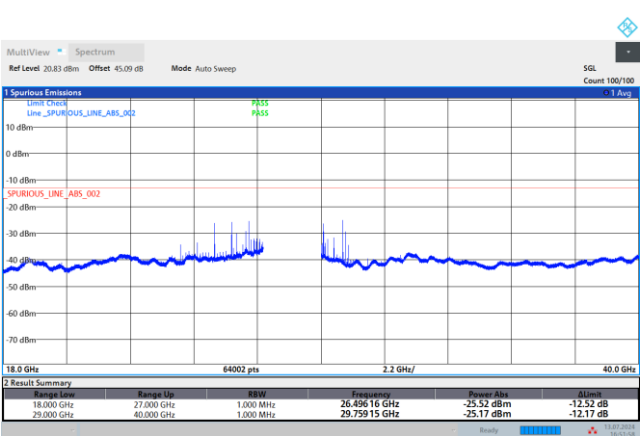
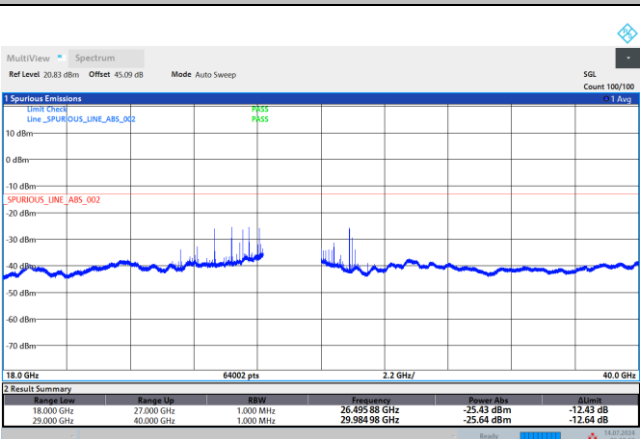
DFT-s-OFDM Module 1



Remark: In band and out of band frequencies are omitted.



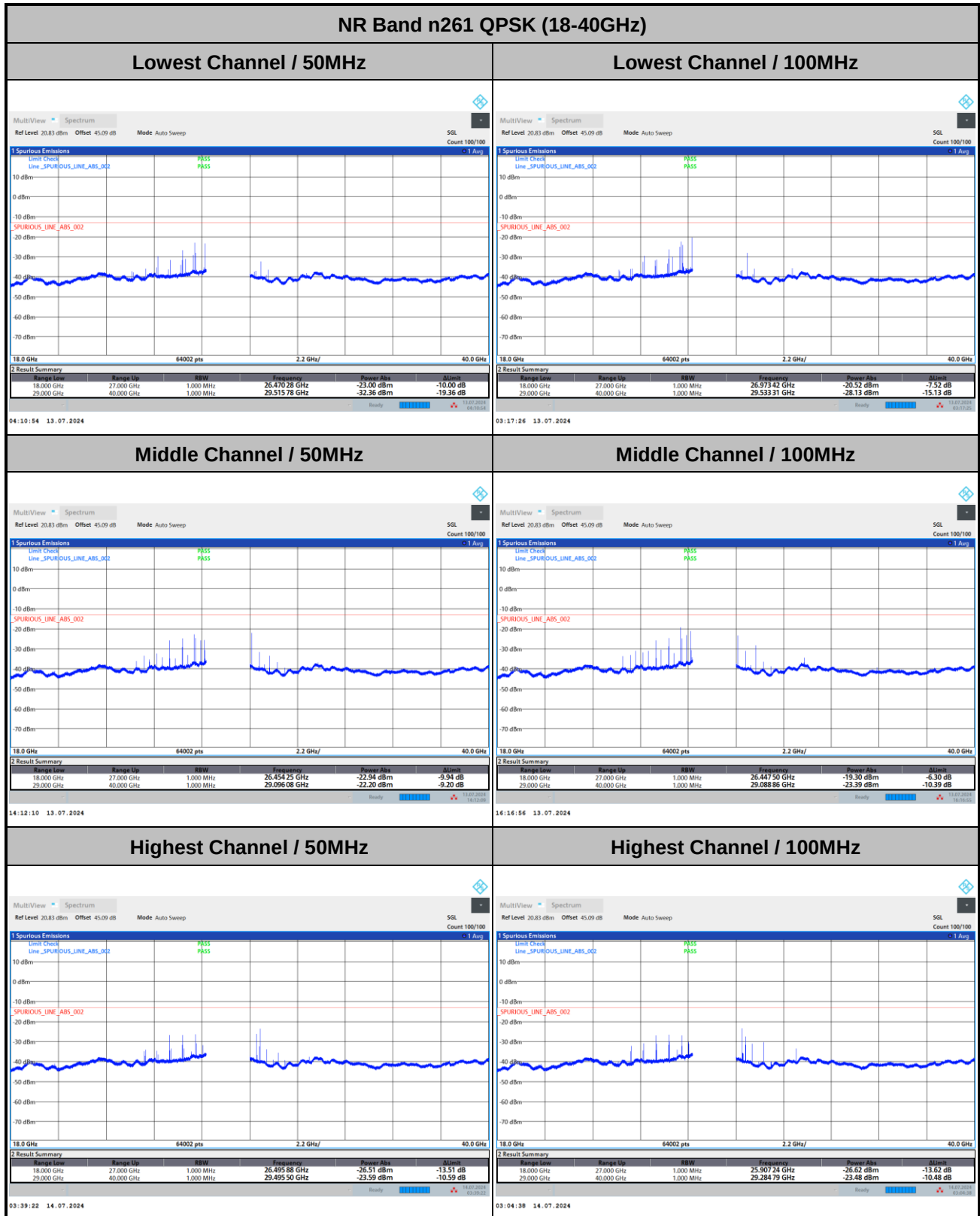
DFT-s-OFDM Module 1

NR Band n261 QPSK (18-40GHz)																			
Lowest Channel / 400MHz																			
 MultiView Spectrum Ref Level 20.83 dBm Offset 45.09 dB Mode Auto Sweep SGL Count 100/100 1 Spurious Emissions Line Check Line_SPURIOUS_LINE_ABS_002 PASS PASS 18.0 GHz 40.0 GHz 64002 pts 2.2 GHz/ <table><tr><th>Range Low</th><th>Range Up</th><th>RBW</th><th>Frequency</th><th>Power Abs</th><th>Attenu</th></tr><tr><td>18,000 GHz</td><td>27,000 GHz</td><td>1,000 MHz</td><td>26,111 98 GHz</td><td>-27,22 dBm</td><td>-14,22 dB</td></tr><tr><td>29,000 GHz</td><td>40,000 GHz</td><td>1,000 MHz</td><td>29,531 94 GHz</td><td>-25,54 dBm</td><td>-12,54 dB</td></tr></table> 09:28:33 13.07.2024	Range Low	Range Up	RBW	Frequency	Power Abs	Attenu	18,000 GHz	27,000 GHz	1,000 MHz	26,111 98 GHz	-27,22 dBm	-14,22 dB	29,000 GHz	40,000 GHz	1,000 MHz	29,531 94 GHz	-25,54 dBm	-12,54 dB	intentionally blank
Range Low	Range Up	RBW	Frequency	Power Abs	Attenu														
18,000 GHz	27,000 GHz	1,000 MHz	26,111 98 GHz	-27,22 dBm	-14,22 dB														
29,000 GHz	40,000 GHz	1,000 MHz	29,531 94 GHz	-25,54 dBm	-12,54 dB														
Middle Channel / 400MHz																			
 MultiView Spectrum Ref Level 20.83 dBm Offset 45.09 dB Mode Auto Sweep SGL Count 100/100 1 Spurious Emissions Line Check Line_SPURIOUS_LINE_ABS_002 PASS PASS 18.0 GHz 40.0 GHz 64002 pts 2.2 GHz/ <table><tr><th>Range Low</th><th>Range Up</th><th>RBW</th><th>Frequency</th><th>Power Abs</th><th>Attenu</th></tr><tr><td>18,000 GHz</td><td>27,000 GHz</td><td>1,000 MHz</td><td>26,496 16 GHz</td><td>-25,52 dBm</td><td>-12,52 dB</td></tr><tr><td>29,000 GHz</td><td>40,000 GHz</td><td>1,000 MHz</td><td>29,759 15 GHz</td><td>-25,17 dBm</td><td>-12,17 dB</td></tr></table> 16:51:58 13.07.2024	Range Low	Range Up	RBW	Frequency	Power Abs	Attenu	18,000 GHz	27,000 GHz	1,000 MHz	26,496 16 GHz	-25,52 dBm	-12,52 dB	29,000 GHz	40,000 GHz	1,000 MHz	29,759 15 GHz	-25,17 dBm	-12,17 dB	intentionally blank
Range Low	Range Up	RBW	Frequency	Power Abs	Attenu														
18,000 GHz	27,000 GHz	1,000 MHz	26,496 16 GHz	-25,52 dBm	-12,52 dB														
29,000 GHz	40,000 GHz	1,000 MHz	29,759 15 GHz	-25,17 dBm	-12,17 dB														
Highest Channel / 400MHz																			
 MultiView Spectrum Ref Level 20.83 dBm Offset 45.09 dB Mode Auto Sweep SGL Count 100/100 1 Spurious Emissions Line Check Line_SPURIOUS_LINE_ABS_002 PASS PASS 18.0 GHz 40.0 GHz 64002 pts 2.2 GHz/ <table><tr><th>Range Low</th><th>Range Up</th><th>RBW</th><th>Frequency</th><th>Power Abs</th><th>Attenu</th></tr><tr><td>18,000 GHz</td><td>27,000 GHz</td><td>1,000 MHz</td><td>26,495 88 GHz</td><td>-25,43 dBm</td><td>-12,43 dB</td></tr><tr><td>29,000 GHz</td><td>40,000 GHz</td><td>1,000 MHz</td><td>29,984 98 GHz</td><td>-25,64 dBm</td><td>-12,64 dB</td></tr></table> 06:18:52 14.07.2024	Range Low	Range Up	RBW	Frequency	Power Abs	Attenu	18,000 GHz	27,000 GHz	1,000 MHz	26,495 88 GHz	-25,43 dBm	-12,43 dB	29,000 GHz	40,000 GHz	1,000 MHz	29,984 98 GHz	-25,64 dBm	-12,64 dB	intentionally blank
Range Low	Range Up	RBW	Frequency	Power Abs	Attenu														
18,000 GHz	27,000 GHz	1,000 MHz	26,495 88 GHz	-25,43 dBm	-12,43 dB														
29,000 GHz	40,000 GHz	1,000 MHz	29,984 98 GHz	-25,64 dBm	-12,64 dB														

Remark: In band and out of band frequencies are omitted.



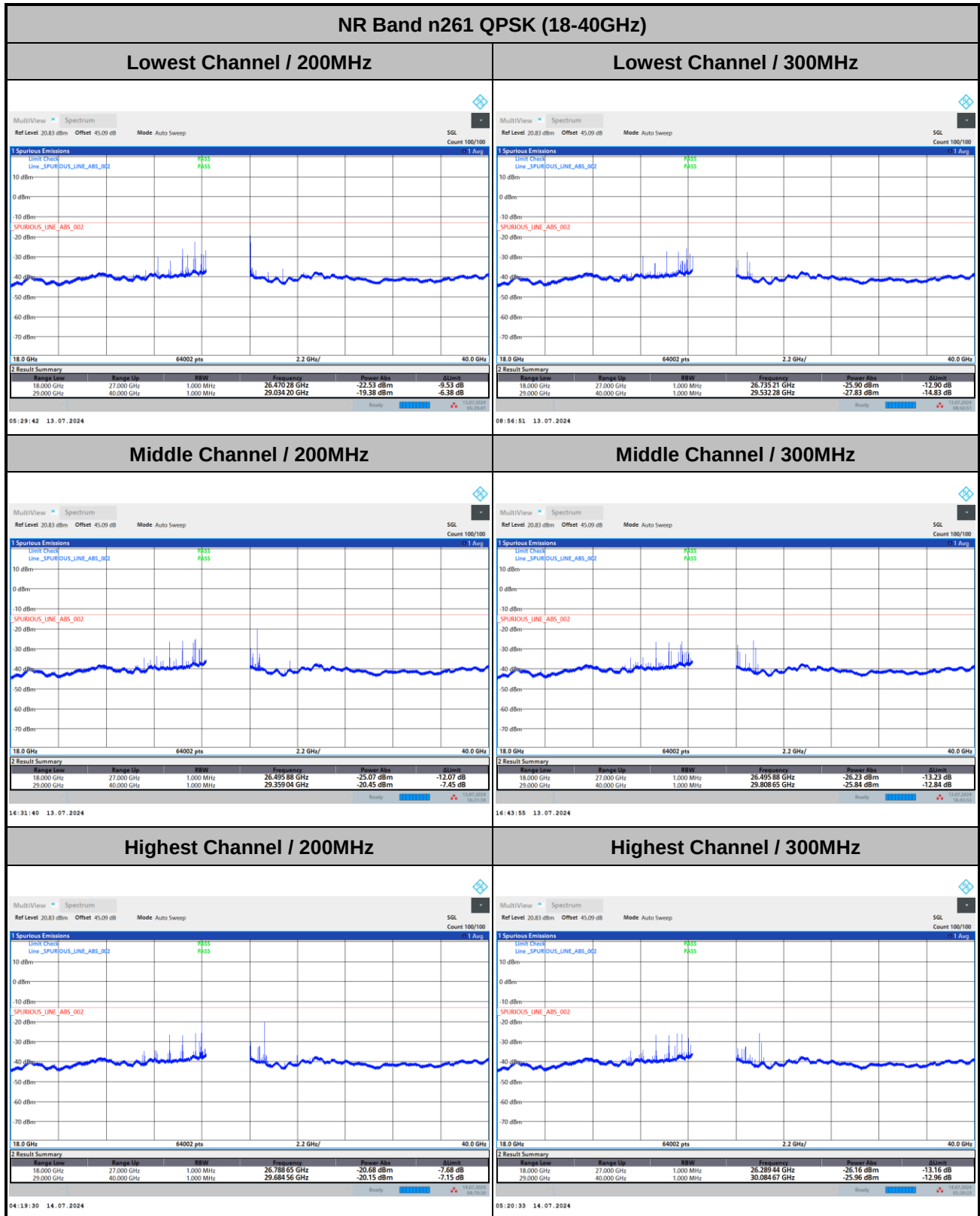
CP-OFDM Module 1



Remark: In band and out of band frequencies are omitted.



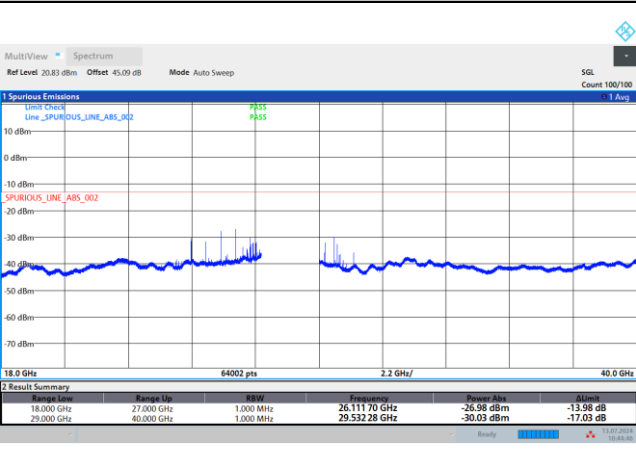
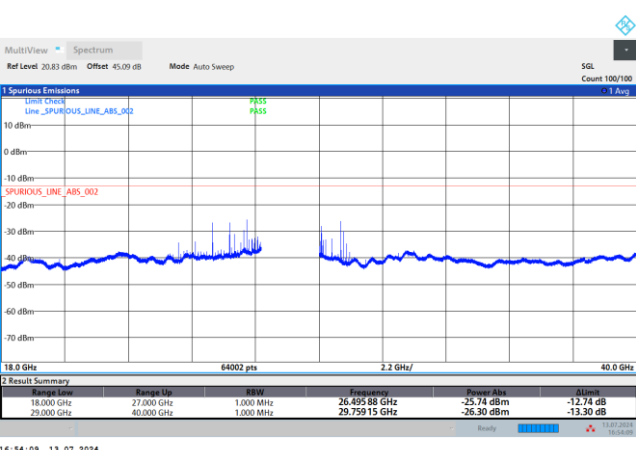
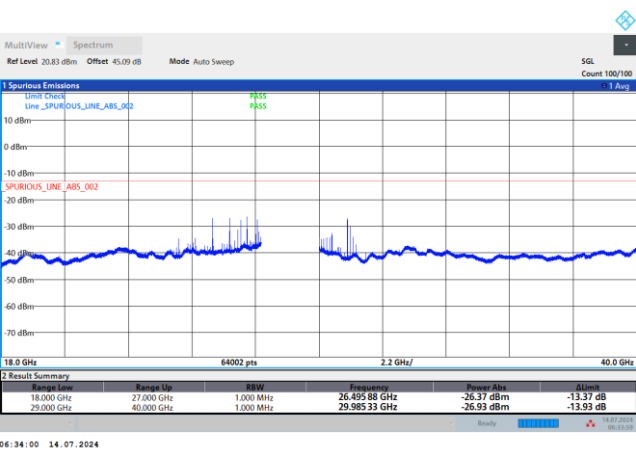
CP-OFDM Module 1



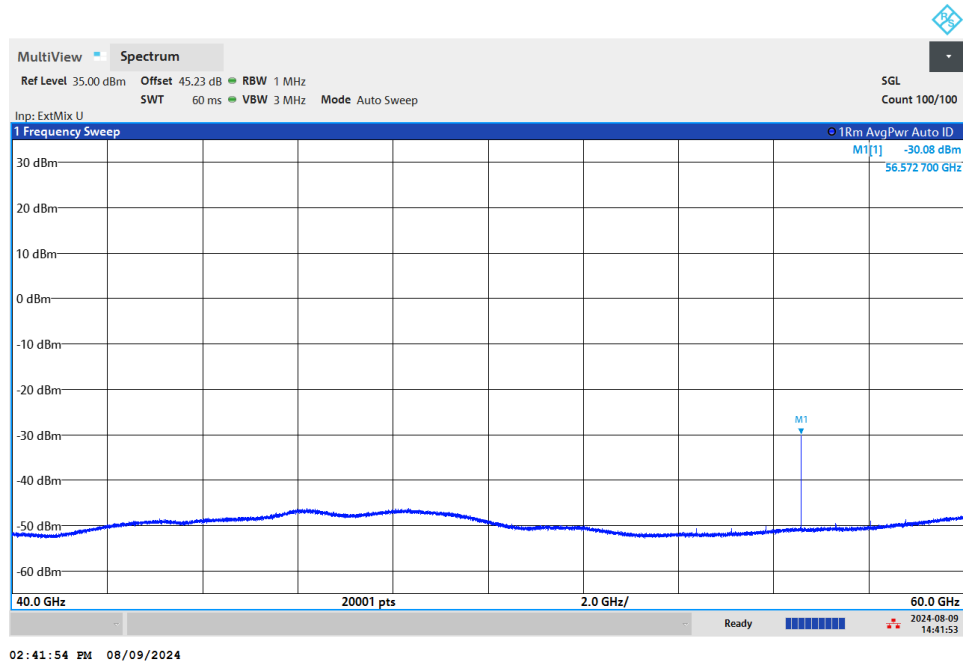
Remark: In band and out of band frequencies are omitted.



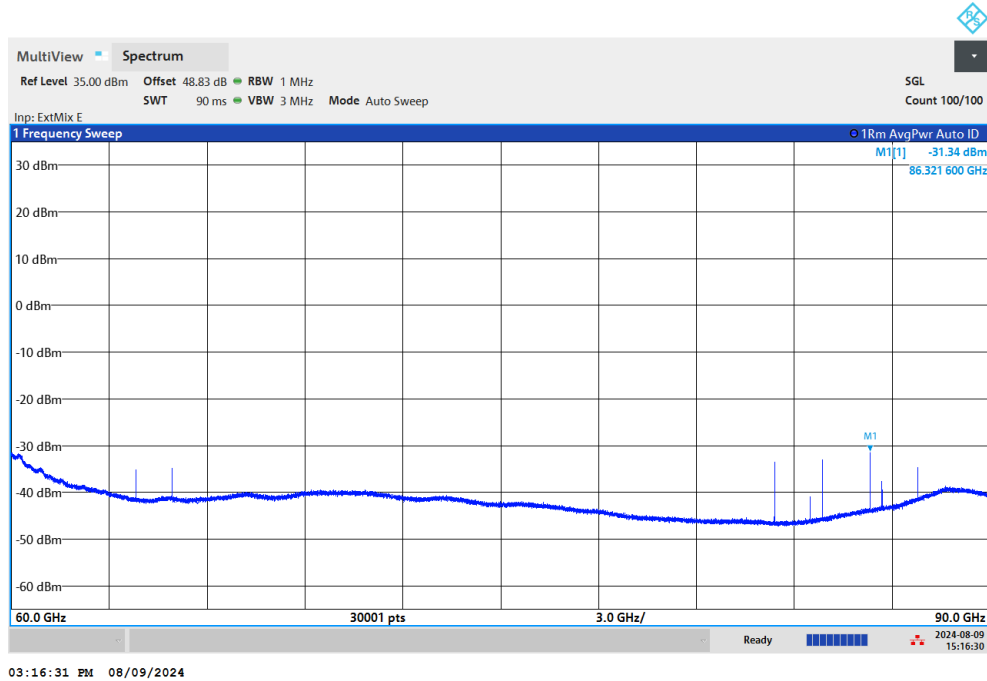
CP-OFDM Module 1

NR Band n261 QPSK (18-40GHz)	
Lowest Channel / 400MHz	
 intentionally blank	
Middle Channel / 400MHz	
 intentionally blank	
Highest Channel / 400MHz	
 intentionally blank	

Remark: In band and out of band frequencies are omitted.

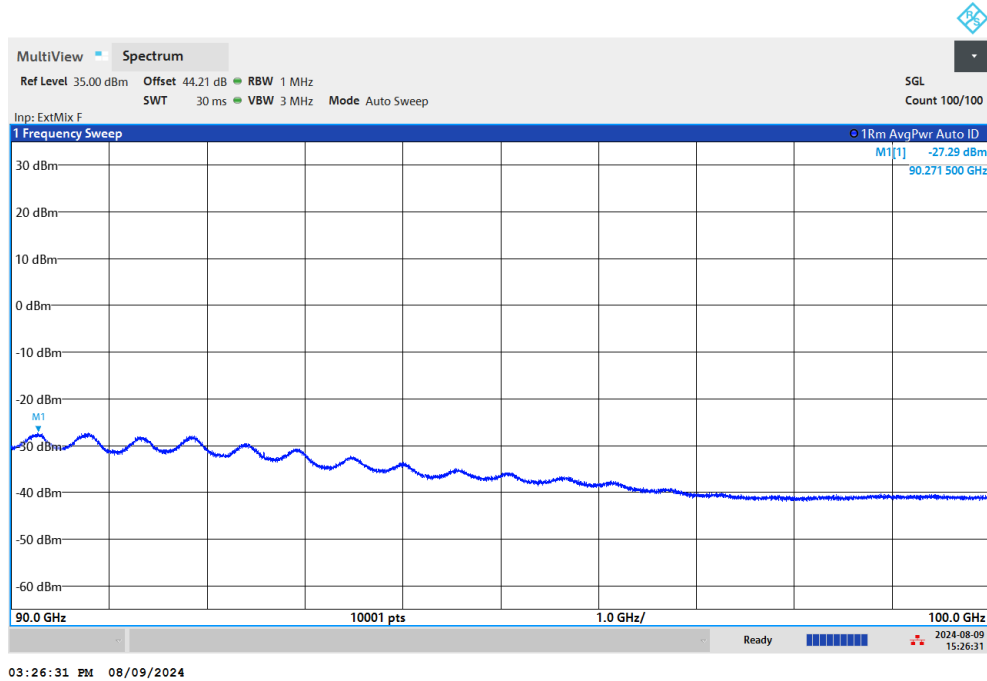
NR Band n261
(40GHz-60GHz)


$$\begin{aligned} \text{Offset} &= \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8 \\ &= 42.6 + 0.43 + 107 + 20\log(1) - 104.8 = 45.23(\text{dB}) \end{aligned}$$

NR Band n261
(60GHz-90GHz)


$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$

$$= 46.2 + 0.43 + 107 + 20\log(1) - 104.8 = 48.83 \text{ (dB)}$$

NR Band n261
(90GHz-100GHz)


$$\text{Offset} = \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$$

$$= 47.6 + 0.43 + 107 + 20\log(0.5) - 104.8 = 44.21 \text{ (dB)}$$

Frequency Stability

Test Conditions		NR Band n261 / Middle Channel			Limit
Temperature (°C)	Voltage (Volt)	CW tone			Note 2.
		Frequency (GHz)	Deviation (kHz)	Deviation (ppm)	Result
50	Normal Voltage	27.9248132	132.900	4.759	Pass
40	Normal Voltage	27.9248062	139.900	5.010	
30	Normal Voltage	27.9248412	104.900	3.756	
20(Ref.)	Normal Voltage	27.9249461	0.000	0.000	
10	Normal Voltage	27.9248212	124.900	4.473	
0	Normal Voltage	27.9247992	146.900	5.261	
-10	Normal Voltage	27.9248262	119.900	4.294	
-20	Normal Voltage	27.9248432	102.900	3.685	
-30	Normal Voltage	27.9248741	72.000	2.578	
20	Maximum Voltage	27.9249271	19.000	0.680	
20	Normal Voltage	27.9249341	12.000	0.430	
20	Battery End Point	27.9249201	26.000	0.931	

Note:

1. Normal Voltage = 56 V. ; Battery End Point (BEP) = 47.6 V. ; Maximum Voltage = 64.4 V.
2. The frequency fundamental emissions stay within the operation band.



Appendix B. R&S Mixer and Horn Antenna Calibration Reports



CALIBRATION CERTIFICATE



Kalibrierschein

Certificate Number
Zertifikatsnummer

0001A300718726

General Data	
Item Gegenstand	FS-Z60 HARMONIC MIXER 40-60GHZ
Manufacturer Hersteller	ROHDE & SCHWARZ
Type Typ	FS-Z60
Material Number Materialnummer	1048.0171.02
Serial Number Seriennummer	100986
Order Number Bestellnummer	Q786007
Asset Number Inventarnummer	
Customer Auftraggeber	Sporton International Inc. 6F., Sec. 1, Hsin Tai Wu Rd 106 221 New Taipei City TW
Performance	
Place and Date of Calibration Ort und Datum der Kalibrierung	87700 Memmingen, Rohde-und-Schwarz-Str. 1 2023-10-31
Statement of Compliance (Incoming) Konformitätsaussage (Anlieferung)	All measured values are within the data sheet specifications.
Statement of Compliance (Outgoing) Konformitätsaussage (Auslieferung)	All measured values are within the data sheet specifications.
Customers due Interval Kalibrierintervall des Kunden	
Extent of Calibration Document Umfang des Kalibrierdokuments	3 Pages Certificate 6 Pages Outgoing Results 6 Pages Incoming Results
Date of Issue Ausstellungsdatum	Approval of the certificate by Freigabe des Kalibrierscheins durch
2023-11-08	Dr. Gerhard Rösel Johannes Negele
Laboratory management Labormanagement	Person responsible Bearbeiter

Calibration Mark Kalibrierzeichen

300718726
D-K- 15195-01-00
2023-10

Member of Deutscher Kalibrierdienst
Mitglied im Deutschen Kalibrierdienst



This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI). The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates. The user is obliged to have the object recalibrated at appropriate intervals. This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates with the full name of the approval responsible person are valid without signature.

Dieser Kalibrierschein dokumentiert die metrologische Rückführbarkeit auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European cooperation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich. Dieser Kalibrierschein darf nur vollständig weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine sind bei Nennung des für die Freigabe Verantwortlichen in Klarschrift auch ohne Unterschrift gültig.



Material No 1048.0171.02 **Serial No** 100986 **Certificate** 0001A300718726
Page 2/3 **Number**

Calibration Procedure

The measuring object is an RF harmonic mixer, which converts an RF signal at one frequency into a signal at another frequency (here: IF). The conversion loss was measured using a vector network analyzer. The RF output power as well as the IF input power of the corresponding ports of the VNA were traced back to a power sensor. The conversion loss is defined as the ratio of the power at the IF frequency to the power at the RF frequency with a given LO power. (IF: Intermediate frequency; LO: Local Oscillator)
 The traceability is represented in the table Working Standards used.

Working Standards used

Item	Type	Serial Number	Calibration Certificate Number	Cal. Due
Therm.Power Sensor DC-40GHz	NRP-Z55	130179	0001A300682928	2025-01-31
Thermal Power Sensor	NRP67T	100977	0001A300658977	2025-07-31
Vector Network Analyzer 4 Port	ZVA67	101100	0001A300698540	2024-05-31

Remarks

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Material No 1048.0171.02 **Serial No** 100986 **Certificate** 0001A300718726
Page 3/3 **Number**

Environmental Conditions			
Ambient Temperature	(23 ± 1) °C	Relative Humidity	20%-70%

Comments on Measurement Results
The reported results apply only to those items specifically listed on this calibration certificate and have been tested for compliance with the specifications. The associated uncertainty of measurement has been taken into account if not otherwise stated. The non-binary decision rule with guard band is used according to ILAC G8:09/2019 'Guidelines on Decision Rules and Statements of Conformity'. Pass is normally not marked. Conditional Pass is marked with UGB1, Conditional Fail with UGB2 and Fail with Fail. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %. It is consistent with the EA-4/02 M:2022. In addition to the calibration results, the calibration certificate includes functional measurements that might have an influence on the measurement uncertainty of the calibration results. The functional measurement results are marked and are not intended to be used to support the further dissemination of metrological traceability. They are intended to verify the requirements on the measurement object according to manufacturer specifications and technical standards.

Outgoing Results

Designation:	HARMONIC MIXER
Type:	FS-Z60
Material No.:	1048.0171.02
Serial No.:	100986
Certificate No.:	0001A300718726
Referring to Test Documentation:	5038.8581.01-PB-02.00

Test Department:	3MM-P
Name:	see certificate
Date:	2023-10-31



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1.1 Conversion Loss (IF = 404.4 MHz) 4

1.2 Conversion Loss (IF = 729 MHz) 5

1.3 Conversion Loss (IF = 1330 MHz) 6

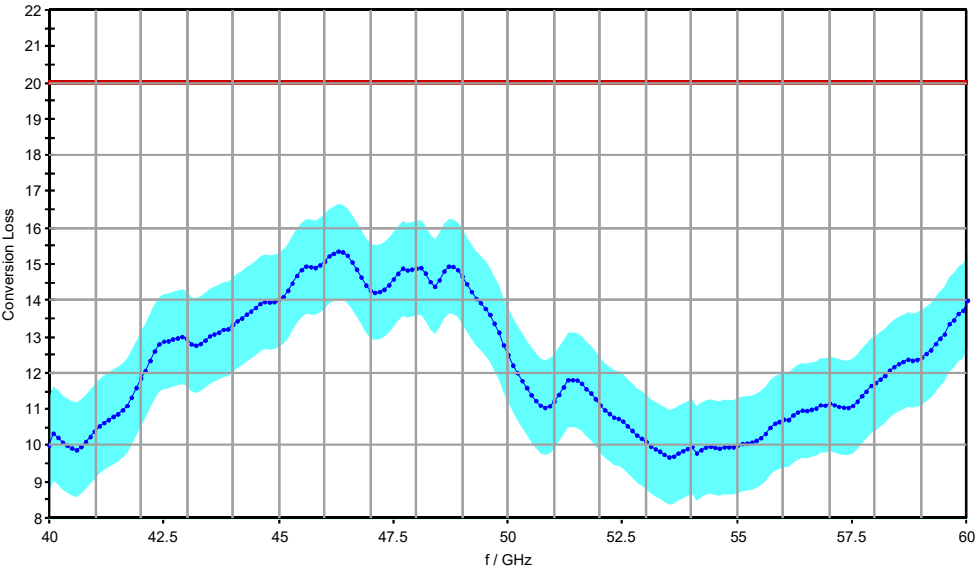
1.4 Continuity response within 1 GHz 6

Software used for measurement			
Item	Type	Version	Remark
Suite	Setup	V12.37.04	Test Management Software G5
Test Program (7012.8706.00_)	Component	V01.05	

1. Conversion Loss (4. Harmonic)

1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 4. Harmonic

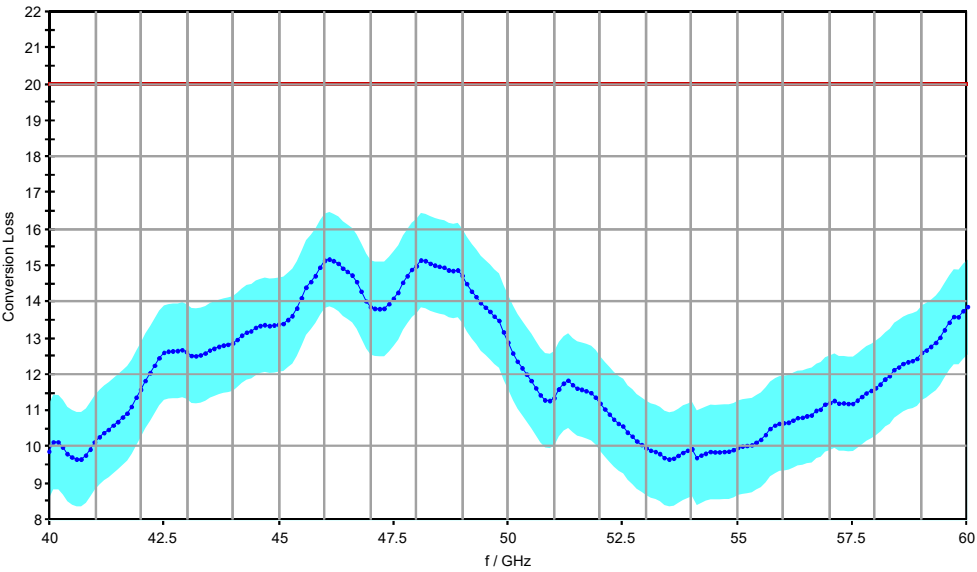


Conversion Loss (IF = 404.4 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
40.0	10.0	±1.3
41.0	10.4	±1.3
42.0	11.9	±1.3
43.0	13.0	±1.3
44.0	13.3	±1.3
45.0	14.0	±1.3
46.0	15.1	±1.3
47.0	14.3	±1.3
48.0	14.9	±1.3
49.0	14.7	±1.3
50.0	12.5	±1.3
51.0	11.2	±1.3
52.0	11.1	±1.3
53.0	10.1	±1.3
54.0	10.0	±1.3
55.0	10.0	±1.3
56.0	10.7	±1.3
57.0	11.2	±1.3
58.0	11.7	±1.3
59.0	12.5	±1.3
60.0	14.0	±1.3

1.2 Conversion Loss (IF = 729 MHz)

IF = 729 MHz, 4. Harmonic

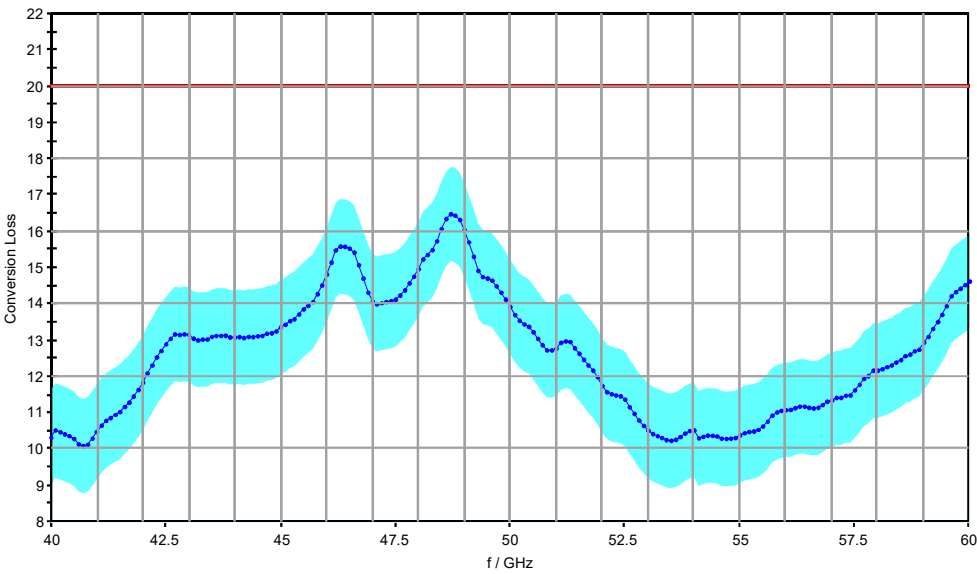


Conversion Loss (IF = 729 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
40.0	9.9	±1.3
41.0	10.2	±1.3
42.0	11.6	±1.3
43.0	12.6	±1.3
44.0	12.9	±1.3
45.0	13.4	±1.3
46.0	15.1	±1.3
47.0	13.9	±1.3
48.0	15.0	±1.3
49.0	14.7	±1.3
50.0	12.9	±1.3
51.0	11.4	±1.3
52.0	11.2	±1.3
53.0	10.0	±1.3
54.0	10.0	±1.3
55.0	10.0	±1.3
56.0	10.7	±1.3
57.0	11.2	±1.3
58.0	11.6	±1.3
59.0	12.6	±1.3
60.0	13.9	±1.3

1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 4. Harmonic



Conversion Loss (IF = 1330 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
40.0	10.3	±1.3
41.0	10.5	±1.3
42.0	11.9	±1.3
43.0	13.2	±1.3
44.0	13.1	±1.3
45.0	13.4	±1.3
46.0	14.8	±1.3
47.0	14.1	±1.3
48.0	15.0	±1.3
49.0	16.1	±1.3
50.0	13.9	±1.3
51.0	12.8	±1.3
52.0	11.8	±1.3
53.0	10.5	±1.3
54.0	10.5	±1.3
55.0	10.4	±1.3
56.0	11.1	±1.3
57.0	11.4	±1.3
58.0	12.2	±1.3
59.0	13.0	±1.3
60.0	14.6	±1.3

1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 4. Harmonic

	DUL /dB	Continuity /dB
max. at IF = 404.4 MHz:	6.0	2.37
max. at IF = 729 MHz:	6.0	2.19
max. at IF = 1330 MHz:	6.0	2.19

Incoming Results

Designation:	HARMONIC MIXER
Type:	FS-Z60
Material No.:	1048.0171.02
Serial No.:	100986
Certificate No.:	0001A300718726
Referring to Test Documentation:	5038.8581.01-PB-02.00

Test Department:	3MM-P
Name:	see certificate
Date:	2023-10-31



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Incoming Results

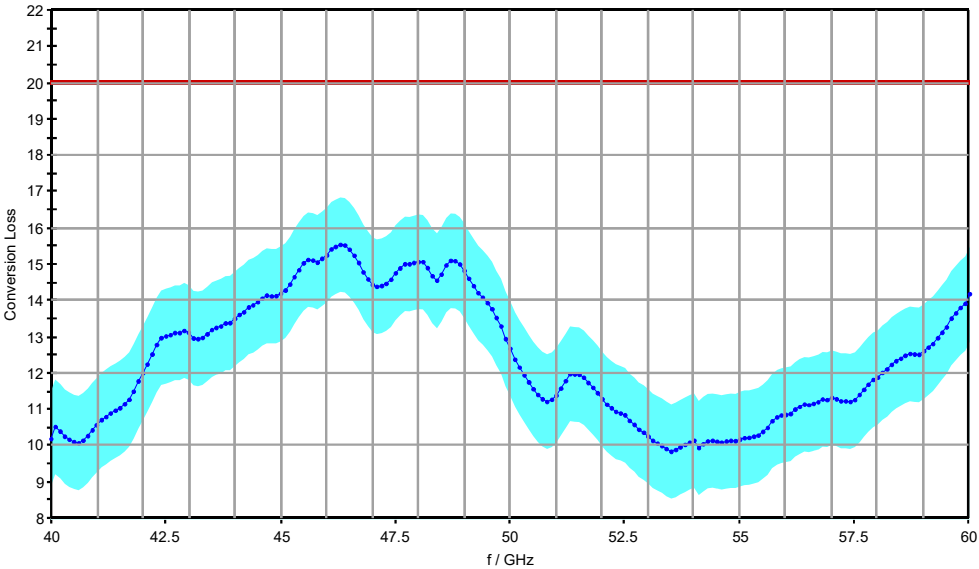
Software used for measurement			
Item	Type	Version	Remark
Suite	Setup	V12.37.04	Test Management Software G5
Test Program (7012.8706.00_)	Component	V01.05	

Incoming Results

1. Conversion Loss (4. Harmonic)

1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 4. Harmonic



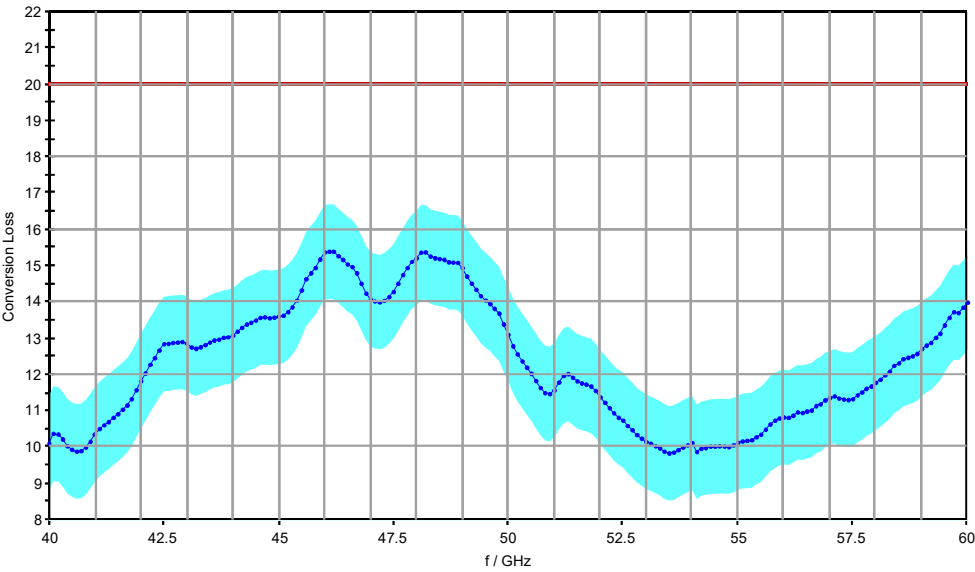
Conversion Loss (IF = 404.4 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
40.0	10.2	±1.3
41.0	10.6	±1.3
42.0	12.0	±1.3
43.0	13.1	±1.3
44.0	13.5	±1.3
45.0	14.2	±1.3
46.0	15.3	±1.3
47.0	14.4	±1.3
48.0	15.1	±1.3
49.0	14.8	±1.3
50.0	12.7	±1.3
51.0	11.4	±1.3
52.0	11.3	±1.3
53.0	10.3	±1.3
54.0	10.2	±1.3
55.0	10.2	±1.3
56.0	10.9	±1.3
57.0	11.3	±1.3
58.0	11.9	±1.3
59.0	12.6	±1.3
60.0	14.2	±1.3

Incoming Results

1.2 Conversion Loss (IF = 729 MHz)

IF = 729 MHz, 4. Harmonic



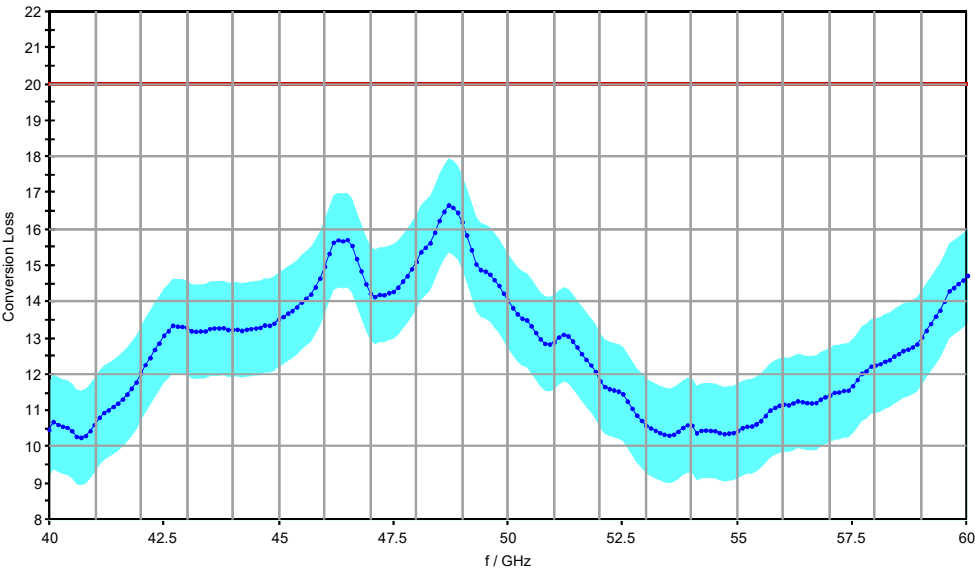
Conversion Loss (IF = 729 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
40.0	10.1	±1.3
41.0	10.4	±1.3
42.0	11.8	±1.3
43.0	12.9	±1.3
44.0	13.1	±1.3
45.0	13.6	±1.3
46.0	15.4	±1.3
47.0	14.1	±1.3
48.0	15.2	±1.3
49.0	14.9	±1.3
50.0	13.1	±1.3
51.0	11.6	±1.3
52.0	11.4	±1.3
53.0	10.2	±1.3
54.0	10.1	±1.3
55.0	10.1	±1.3
56.0	10.8	±1.3
57.0	11.4	±1.3
58.0	11.8	±1.3
59.0	12.7	±1.3
60.0	14.0	±1.3

Incoming Results

1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 4. Harmonic



Conversion Loss (IF = 1330 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
40.0	10.5	±1.3
41.0	10.6	±1.3
42.0	12.1	±1.3
43.0	13.3	±1.3
44.0	13.2	±1.3
45.0	13.5	±1.3
46.0	15.0	±1.3
47.0	14.2	±1.3
48.0	15.1	±1.3
49.0	16.2	±1.3
50.0	14.0	±1.3
51.0	12.9	±1.3
52.0	11.8	±1.3
53.0	10.6	±1.3
54.0	10.6	±1.3
55.0	10.5	±1.3
56.0	11.2	±1.3
57.0	11.4	±1.3
58.0	12.3	±1.3
59.0	13.0	±1.3
60.0	14.7	±1.3

1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 4. Harmonic

	DUL /dB	Continuity /dB
max. at IF = 404.4 MHz:	6.0	2.35
max. at IF = 729 MHz:	6.0	2.18
max. at IF = 1330 MHz:	6.0	2.22

Incoming Results



CALIBRATION CERTIFICATE



Kalibrierschein

Certificate Number
Zertifikatsnummer

0001A300718729

General Data	
Item Gegenstand	FS-Z90 HARMONIC MIXER 60-90GHZ
Manufacturer Hersteller	ROHDE & SCHWARZ
Type Typ	FS-Z90
Material Number Materialnummer	1048.0371.02
Serial Number Seriennummer	101811
Order Number Bestellnummer	Q786007
Asset Number Inventarnummer	
Customer Auftraggeber	Sporton International Inc. 6F., Sec. 1, Hsin Tai Wu Rd 106 221 New Taipei City TW
Performance	
Place and Date of Calibration Ort und Datum der Kalibrierung	87700 Memmingen, Rohde-und-Schwarz-Str. 1 2023-10-31
Statement of Compliance (Incoming) Konformitätsaussage (Anlieferung)	All measured values are within the data sheet specifications.
Statement of Compliance (Outgoing) Konformitätsaussage (Auslieferung)	All measured values are within the data sheet specifications.
Customers due Interval Kalibrierintervall des Kunden	
Extent of Calibration Document Umfang des Kalibrierdokuments	3 Pages Certificate 7 Pages Outgoing Results 7 Pages Incoming Results
Date of Issue Ausstellungsdatum	Approval of the certificate by Freigabe des Kalibrierscheins durch
2023-11-08	Dr. Gerhard Rösel Johannes Negele
 Laboratory management Labormanagement Person responsible Bearbeiter	

Calibration Mark Kalibrierzeichen

300718729
D-K- 15195-01-00
2023-10

Member of Deutscher Kalibrierdienst
Mitglied im Deutschen Kalibrierdienst



This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI). The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates. The user is obliged to have the object recalibrated at appropriate intervals. This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates with the full name of the approval responsible person are valid without signature.

Dieser Kalibrierschein dokumentiert die metrologische Rückführbarkeit auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European cooperation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich. Dieser Kalibrierschein darf nur vollständig weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine sind bei Nennung des für die Freigabe Verantwortlichen in Klarschrift auch ohne Unterschrift gültig.



Material No

1048.0371.02

Serial No

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Certificate

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Number

Calibration Procedure
The measuring object is an RF harmonic mixer, which converts an RF signal at one frequency into a signal at another frequency (here: IF). The conversion loss was measured using a vector network analyzer. The RF output power as well as the IF input power of the corresponding ports of the VNA were traced back to a power sensor. The conversion loss is defined as the ratio of the power at the IF frequency to the power at the RF frequency with a given LO power. (IF: Intermediate frequency; LO: Local Oscillator) The traceability is represented in the table Working Standards used.

Working Standards used				
Item	Type	Serial Number	Calibration Certificate Number	Cal. Due
Therm.Power Sensor DC-40GHz	NRP-Z55	130179	0001A300682928	2025-01-31
Thermal Waveguide Power Sensor	NRP90TWG	910001	20A1129129	2026-04-30
Vector Network Analyzer 4 Port	ZVA67	101100	0001A300698540	2024-05-31

Remarks



Material No 1048.0371.02 **Serial No** 101811 **Certificate** 0001A300718729
Page 3/3 **Number**

Environmental Conditions			
Ambient Temperature	(23 ± 1) °C	Relative Humidity	20%-70%

Comments on Measurement Results
The reported results apply only to those items specifically listed on this calibration certificate and have been tested for compliance with the specifications. The associated uncertainty of measurement has been taken into account if not otherwise stated. The non-binary decision rule with guard band is used according to ILAC G8:09/2019 'Guidelines on Decision Rules and Statements of Conformity'. Pass is normally not marked. Conditional Pass is marked with UGB1, Conditional Fail with UGB2 and Fail with Fail. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %. It is consistent with the EA-4/02 M:2022. In addition to the calibration results, the calibration certificate includes functional measurements that might have an influence on the measurement uncertainty of the calibration results. The functional measurement results are marked and are not intended to be used to support the further dissemination of metrological traceability. They are intended to verify the requirements on the measurement object according to manufacturer specifications and technical standards.

Outgoing Results

Designation:	HARMONIC MIXER
Type:	FS-Z90
Material No.:	1048.0371.02
Serial No.:	101811
Certificate No.:	0001A300718729
Referring to Test Documentation:	5038.8323.01-PB-02.00

Test Department:	3MM-P
Name:	see certificate
Date:	2023-10-31



The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
{g}	Verification of specified requirements, non-accredited measurements. Technical operations that consist of the determination of one or more characteristics to a specified procedure (formerly {f}).
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Symmetrical Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	A compliance statement may be possible where a confidence level of less than 95 % is acceptable.
UGB2	A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.
DU	Datasheet Uncertainty

Explanation of charts

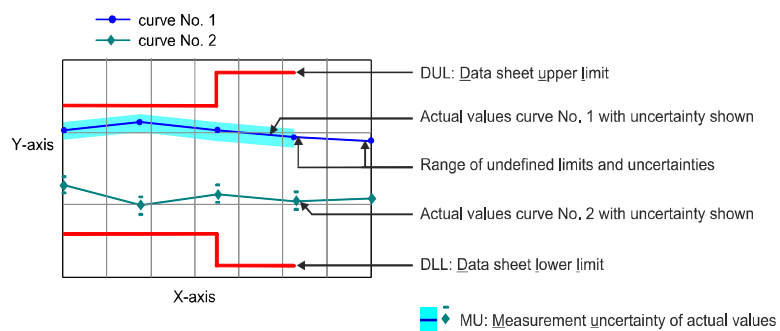


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 1.2 Conversion Loss (IF = 729 MHz) 6

 1.3 Conversion Loss (IF = 1330 MHz) 7

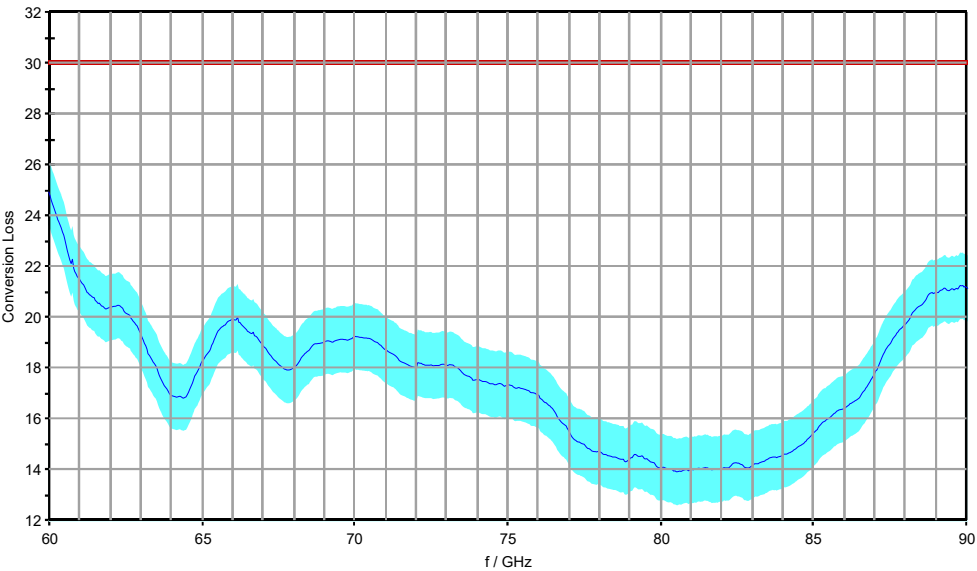
 1.4 Continuity response within 1 GHz 7

Software used for measurement			
Item	Type	Version	Remark
Suite	Setup	V12.37.04	Test Management Software G5
Test Program (7012.8706.00_)	Component	V01.05	

1. Conversion Loss (6. Harmonic)

1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 6. Harmonic

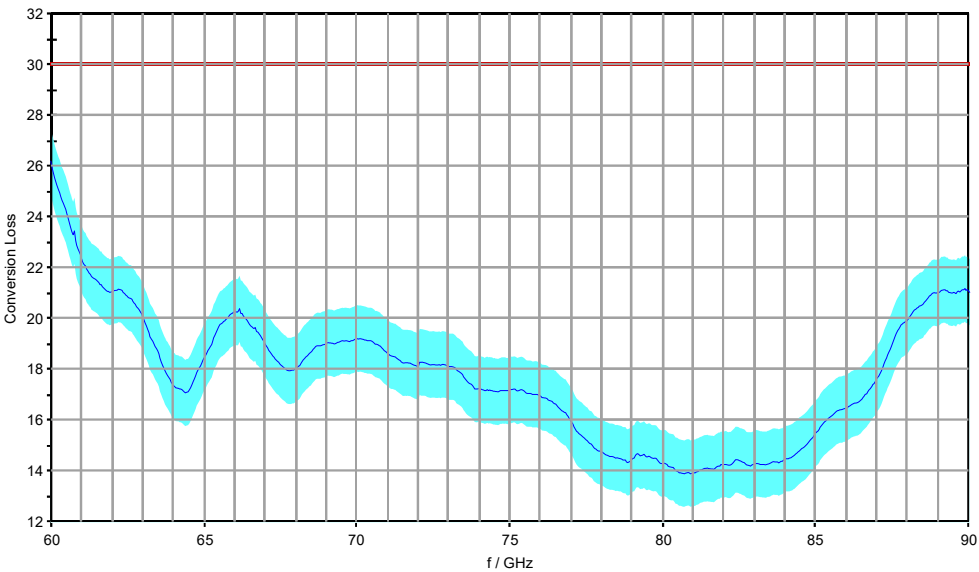


Conversion Loss (IF = 404.4 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
60.0	24.9	±1.3
61.0	21.5	±1.3
62.0	20.4	±1.3
63.0	19.4	±1.3
64.0	16.9	±1.3
65.0	18.3	±1.3
66.0	19.9	±1.3
67.0	18.9	±1.3
68.0	18.0	±1.3
69.0	19.1	±1.3
70.0	19.3	±1.3
71.0	18.7	±1.3
72.0	18.0	±1.3
73.0	18.1	±1.3
74.0	17.6	±1.3
75.0	17.4	±1.3
76.0	16.9	±1.3
77.0	15.5	±1.3
78.0	14.7	±1.3
79.0	14.5	±1.3
80.0	14.1	±1.3
81.0	14.0	±1.3
82.0	14.1	±1.3
83.0	14.2	±1.3
84.0	14.6	±1.3
85.0	15.5	±1.3
86.0	16.5	±1.3
87.0	17.9	±1.3
88.0	19.8	±1.3
89.0	21.0	±1.3
90.0	21.1	±1.3

1.2 Conversion Loss (IF = 729 MHz)

IF = 729 MHz, 6. Harmonic

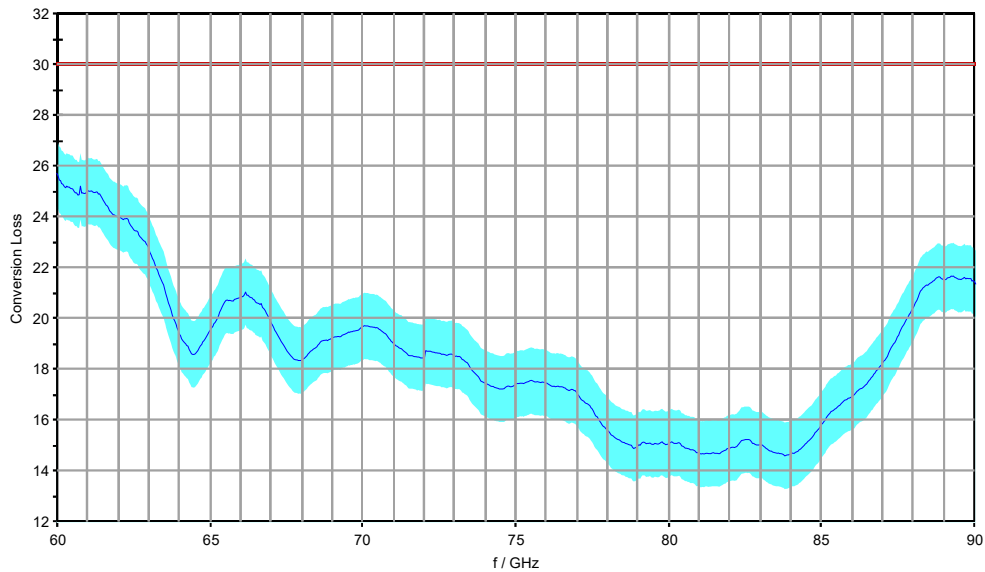


Conversion Loss (IF = 729 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
60.0	26.2	±1.3
61.0	22.4	±1.3
62.0	21.1	±1.3
63.0	20.1	±1.3
64.0	17.4	±1.3
65.0	18.5	±1.3
66.0	20.3	±1.3
67.0	19.0	±1.3
68.0	18.0	±1.3
69.0	19.0	±1.3
70.0	19.2	±1.3
71.0	18.6	±1.3
72.0	18.1	±1.3
73.0	18.1	±1.3
74.0	17.3	±1.3
75.0	17.2	±1.3
76.0	17.0	±1.3
77.0	15.9	±1.3
78.0	14.8	±1.3
79.0	14.5	±1.3
80.0	14.3	±1.3
81.0	14.0	±1.3
82.0	14.3	±1.3
83.0	14.3	±1.3
84.0	14.5	±1.3
85.0	15.5	±1.3
86.0	16.5	±1.3
87.0	17.7	±1.3
88.0	20.0	±1.3
89.0	21.0	±1.3
90.0	21.0	±1.3

1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 6. Harmonic



Conversion Loss (IF = 1330 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
60.0	25.7	±1.3
61.0	25.0	±1.3
62.0	24.0	±1.3
63.0	22.8	±1.3
64.0	19.4	±1.3
65.0	19.5	±1.3
66.0	20.9	±1.3
67.0	19.8	±1.3
68.0	18.4	±1.3
69.0	19.3	±1.3
70.0	19.7	±1.3
71.0	19.0	±1.3
72.0	18.5	±1.3
73.0	18.5	±1.3
74.0	17.5	±1.3
75.0	17.5	±1.3
76.0	17.5	±1.3
77.0	17.0	±1.3
78.0	15.6	±1.3
79.0	15.1	±1.3
80.0	15.1	±1.3
81.0	14.7	±1.3
82.0	15.0	±1.3
83.0	15.1	±1.3
84.0	14.7	±1.3
85.0	15.9	±1.3
86.0	17.0	±1.3
87.0	18.3	±1.3
88.0	20.5	±1.3
89.0	21.5	±1.3
90.0	21.4	±1.3

1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 6. Harmonic

	DUL /dB	Continuity /dB
max. at IF = 404.4 MHz:	6.0	3.42
max. at IF = 729 MHz:	6.0	3.82
max. at IF = 1330 MHz:	6.0	3.35

Incoming Results

Designation:	HARMONIC MIXER
Type:	FS-Z90
Material No.:	1048.0371.02
Serial No.:	101811
Certificate No.:	0001A300718729
Referring to Test Documentation:	5038.8323.01-PB-02.00

Test Department:	3MM-P
Name:	see certificate
Date:	2023-10-31



The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
{g}	Verification of specified requirements, non-accredited measurements. Technical operations that consist of the determination of one or more characteristics to a specified procedure (formerly {f}).
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Symmetrical Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
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UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	A compliance statement may be possible where a confidence level of less than 95 % is acceptable.
UGB2	A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.
DU	Datasheet Uncertainty

Explanation of charts

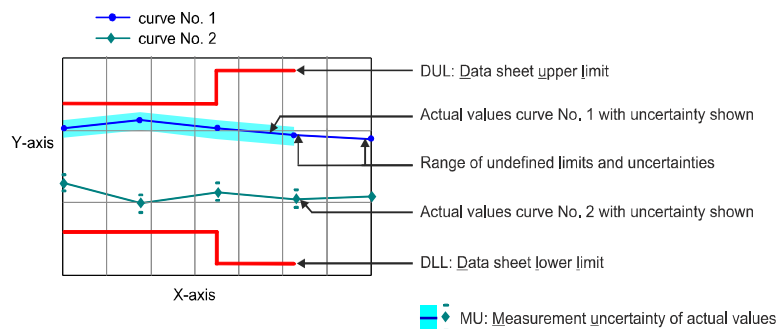


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Incoming Results

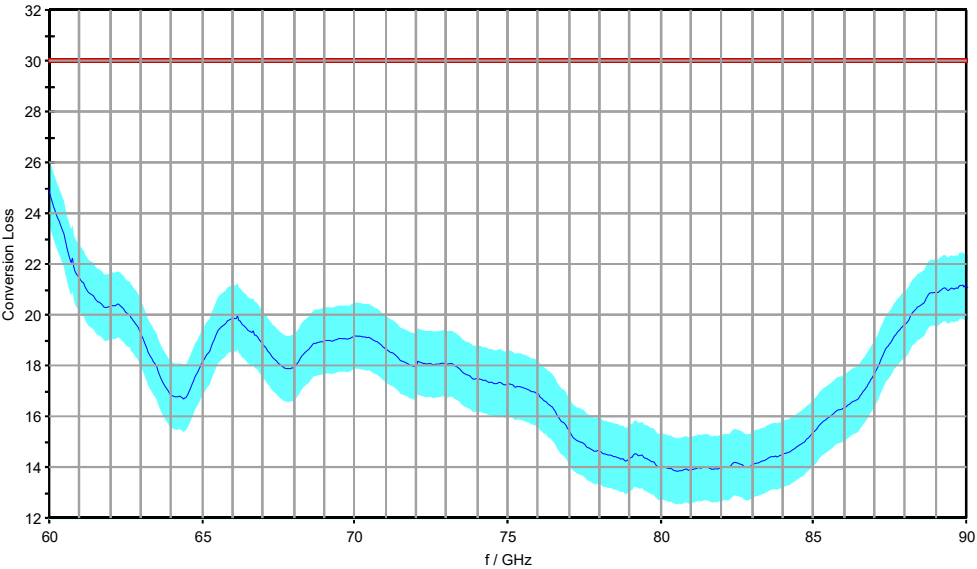
Software used for measurement			
Item	Type	Version	Remark
Suite	Setup	V12.37.04	Test Management Software G5
Test Program (7012.8706.00_)	Component	V01.05	

Incoming Results

1. Conversion Loss (6. Harmonic)

1.1 Conversion Loss (IF = 404.4 MHz)

IF = 404.4 MHz, 6. Harmonic



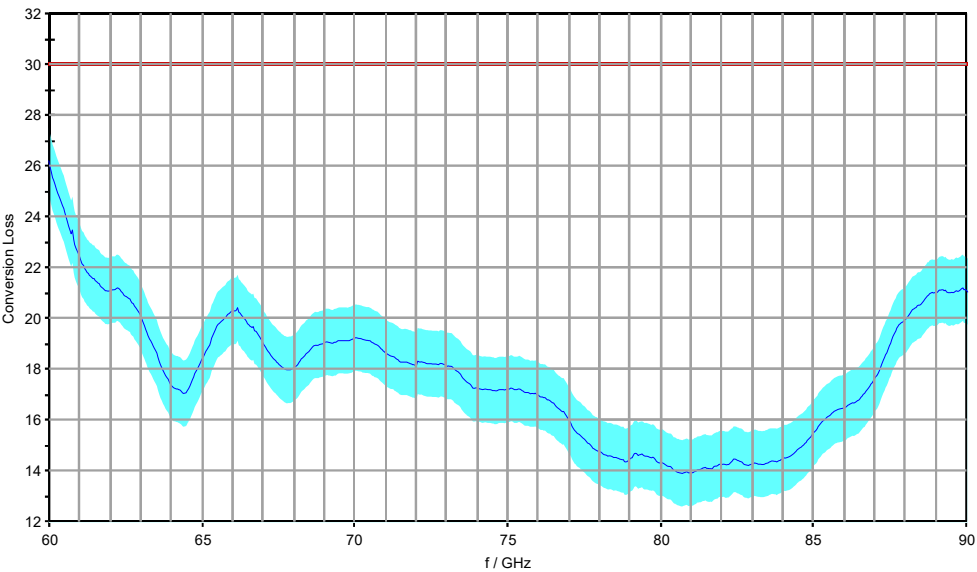
Conversion Loss (IF = 404.4 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
60.0	24.9	±1.3
61.0	21.5	±1.3
62.0	20.4	±1.3
63.0	19.3	±1.3
64.0	16.9	±1.3
65.0	18.2	±1.3
66.0	19.9	±1.3
67.0	18.8	±1.3
68.0	18.0	±1.3
69.0	19.0	±1.3
70.0	19.2	±1.3
71.0	18.7	±1.3
72.0	18.0	±1.3
73.0	18.1	±1.3
74.0	17.5	±1.3
75.0	17.3	±1.3
76.0	16.9	±1.3
77.0	15.4	±1.3
78.0	14.7	±1.3
79.0	14.4	±1.3
80.0	14.1	±1.3
81.0	14.0	±1.3
82.0	14.0	±1.3
83.0	14.2	±1.3
84.0	14.6	±1.3
85.0	15.5	±1.3
86.0	16.4	±1.3
87.0	17.8	±1.3
88.0	19.7	±1.3
89.0	20.9	±1.3
90.0	21.1	±1.3

Incoming Results

1.2 Conversion Loss (IF = 729 MHz)

IF = 729 MHz, 6. Harmonic



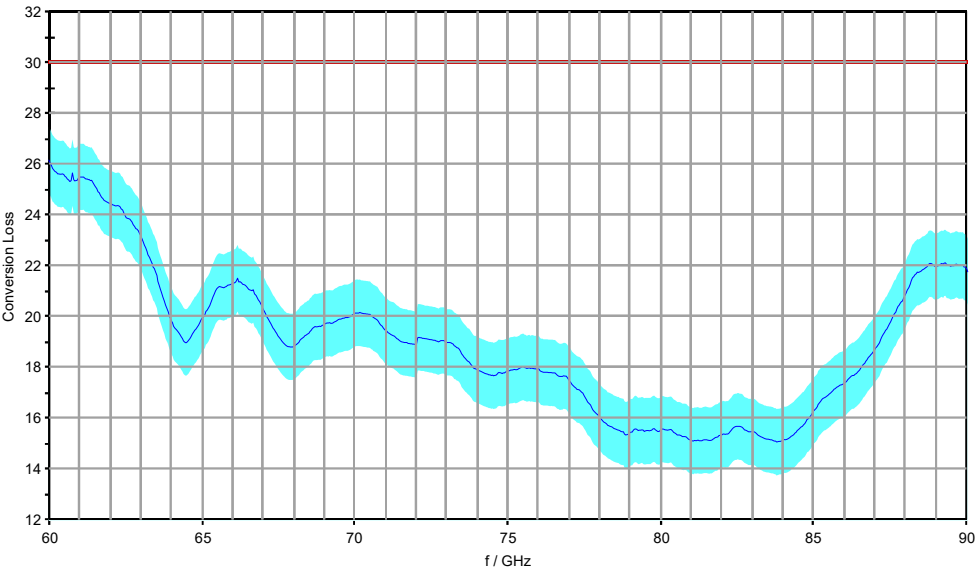
Conversion Loss (IF = 729 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
60.0	26.2	±1.3
61.0	22.5	±1.3
62.0	21.1	±1.3
63.0	20.1	±1.3
64.0	17.4	±1.3
65.0	18.4	±1.3
66.0	20.3	±1.3
67.0	19.0	±1.3
68.0	18.1	±1.3
69.0	19.1	±1.3
70.0	19.3	±1.3
71.0	18.7	±1.3
72.0	18.2	±1.3
73.0	18.2	±1.3
74.0	17.3	±1.3
75.0	17.3	±1.3
76.0	17.0	±1.3
77.0	16.0	±1.3
78.0	14.8	±1.3
79.0	14.5	±1.3
80.0	14.4	±1.3
81.0	14.0	±1.3
82.0	14.3	±1.3
83.0	14.3	±1.3
84.0	14.5	±1.3
85.0	15.6	±1.3
86.0	16.5	±1.3
87.0	17.7	±1.3
88.0	20.0	±1.3
89.0	21.0	±1.3
90.0	21.1	±1.3

Incoming Results

1.3 Conversion Loss (IF = 1330 MHz)

IF = 1330 MHz, 6. Harmonic



Conversion Loss (IF = 1330 MHz)

Frequency /GHz	Conversion Loss /dB	Uncertainty /dB
60.0	26.2	±1.3
61.0	25.5	±1.3
62.0	24.5	±1.3
63.0	23.2	±1.3
64.0	19.9	±1.3
65.0	19.9	±1.3
66.0	21.3	±1.3
67.0	20.3	±1.3
68.0	18.8	±1.3
69.0	19.7	±1.3
70.0	20.1	±1.3
71.0	19.5	±1.3
72.0	18.9	±1.3
73.0	19.0	±1.3
74.0	17.9	±1.3
75.0	17.9	±1.3
76.0	18.0	±1.3
77.0	17.5	±1.3
78.0	16.0	±1.3
79.0	15.5	±1.3
80.0	15.6	±1.3
81.0	15.1	±1.3
82.0	15.4	±1.3
83.0	15.5	±1.3
84.0	15.2	±1.3
85.0	16.3	±1.3
86.0	17.4	±1.3
87.0	18.8	±1.3
88.0	20.9	±1.3
89.0	22.0	±1.3
90.0	21.8	±1.3

1.4 Continuity response within 1 GHz

Continuity response within any 1 GHz Band, 6. Harmonic

	DUL /dB	Continuity /dB
max. at IF = 404.4 MHz:	6.0	3.46
max. at IF = 729 MHz:	6.0	3.75
max. at IF = 1330 MHz:	6.0	3.34

Incoming Results



Calibration Certificate

Kalibrierschein

Certificate Number 24-0140-101128-03

Zertifikatsnummer

Unit Data

Item
Gegenstand **Harmonic Mixer, 90 GHz to 140 GHz**

Manufacturer
Hersteller **RPG Radiometer physics GmbH**

Type
Typ **RPG FS-Z140**

Material Number
Materialnummer **3622.0708.02** Serial Number
Seriennummer **101128**

Asset Number
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor $k = 2$). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

Order Data

Customer
Auftraggeber **Sporton International Inc.
6F., Sec. 1, Hsin Tai Wu Rd 106
Xizhi Dist.
221 New Taipei City
Taiwan**

Order Number
Bestellnummer **8800047909**

Date of Receipt
Eingangsdatum **2023-10-27**

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung

Meckenheim, 2023-11-03

Scope of Calibration
Umfang der Kalibrierung

Standard Calibration

Statement of Compliance
(Incoming)
Konformitätsaussage
(Anlieferung)

All measured values are within the data sheet specifications.

Statement of Compliance
(Outgoing)
Konformitätsaussage
(Auslieferung)

All measured values are within the data sheet specifications.

Extend of Calibration Documents
Umfang des Kalibrierdokuments

**2 pages Calibration Certificate
4 pages Outgoing Results
3 pages Incoming Results**

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte lagen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Werteintervall (Erweiterte Messunsicherheit mit $k = 2$). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

RPG Radiometer physics GmbH; Meckenheim

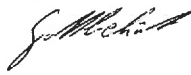
Date of Issue
Ausstellungsdatum

2023-11-06

Head of Laboratory
Laborleitung


Emons

Person Responsible
Bearbeiter


Gottbehüt

Page (Seite) 1/2
Vers2010-05-05/
RPG2014-02-28

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %
Relative LuftfeuchteAmbient Temperature
Umgebungstemperatur(23 ⁺⁷₋₃) °CWorking standards used (having a significant effect on the accuracy)
Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)

Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA40	100103	0001A300715526	2026-10-04
Powersensor	R&S® NRP-Z55	140093	0001-300700427	2025-06-06

UGB1 A compliance statement may be possible where a confidence level of less than 95 % is acceptable.
Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

UGB2 A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.
Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.

Notes
Anmerkungen

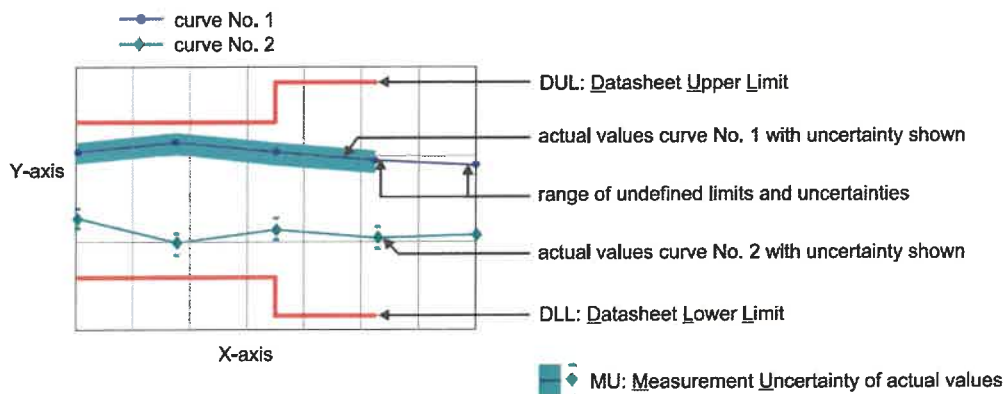
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

Outgoing Results

The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

Explanation of charts

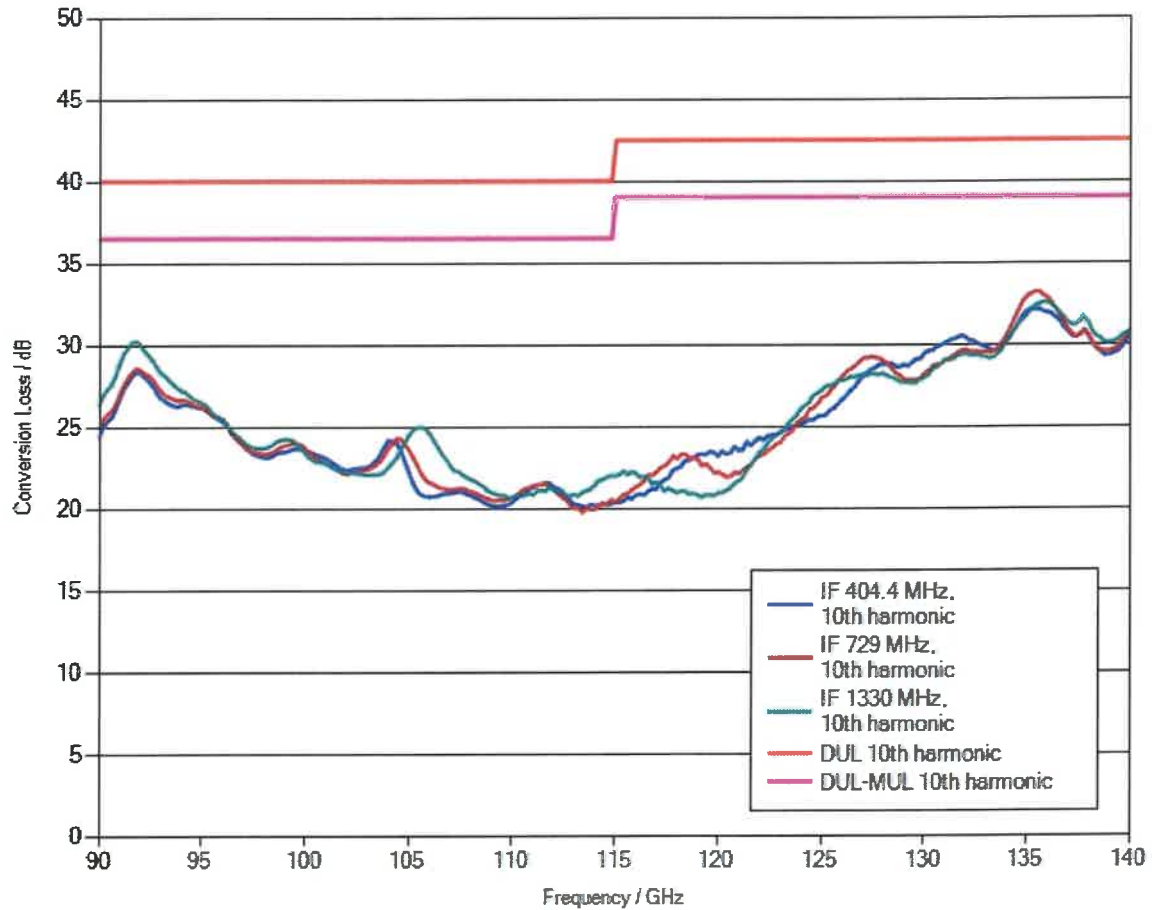


Software used for measurement**Item Type**Measurement Studio Professional Edition
MixerCertification**Version**2013
7_15**Remark**

1.1 Conversion loss

LO level +14 dBm nominal
Bias 0 A

Measurement uncertainty: 3.5 dB



Note: Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the “paper clip” symbol to display the file.

The file has been renamed for safety reasons.

When downloading the file onto your PC, please delete the “.file” extension and unzip the data.

1.2 Frequency response within 1 GHz

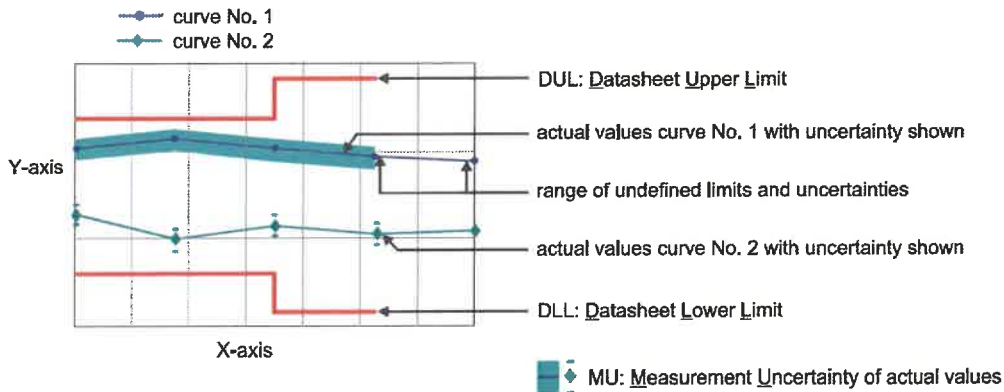
	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 10th harmonic	6 dB	2.49 dB	PASS
IF = 729 MHz, 10th harmonic	6 dB	2.09 dB	PASS
IF = 1330 MHz, 10th harmonic	6 dB	2.24 dB	PASS

1 Incoming Results

The following abbreviations may be used in this document

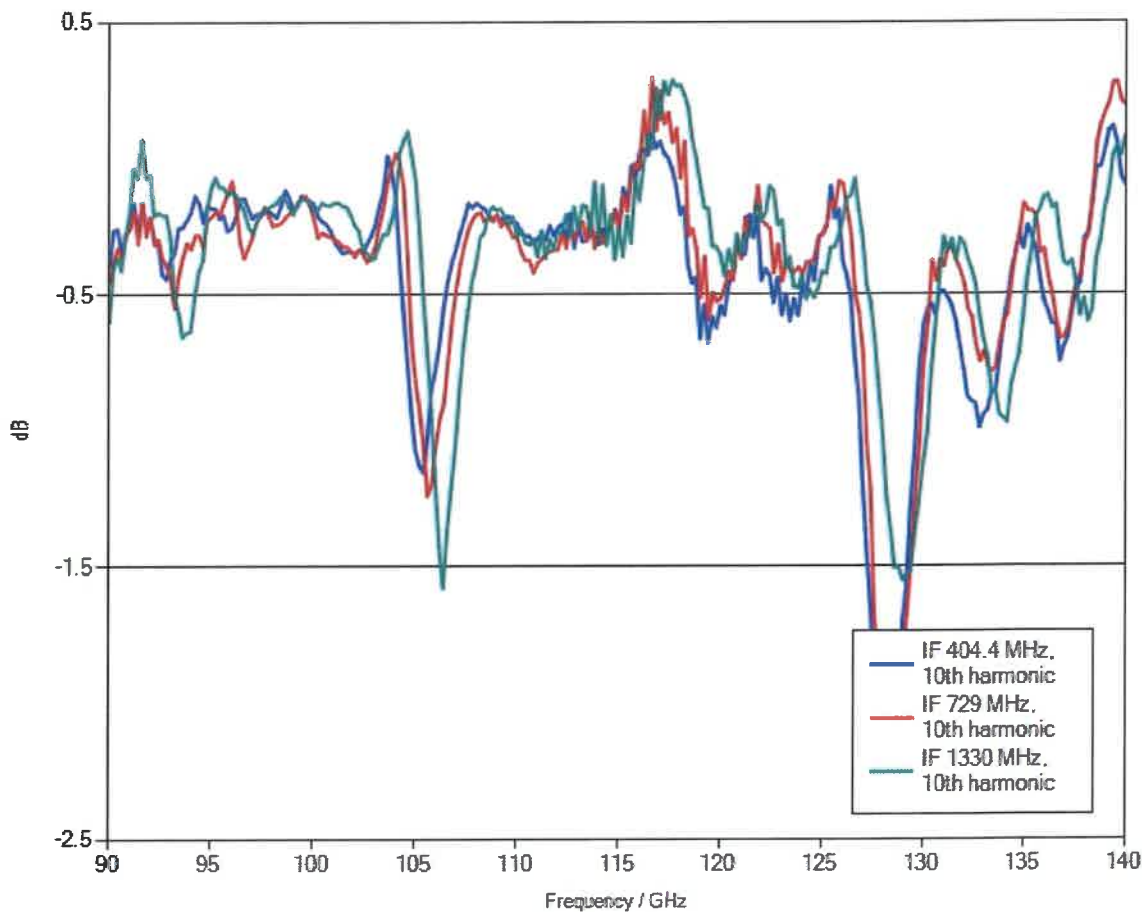
{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
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MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

Explanation of charts



Software used for measurement		
Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_15	

1.1 Deviation between actual and previous conversion loss



Incoming Report



Calibration Certificate

Kalibrierschein

Certificate Number **24-0220-101014-03**

Zertifikatsnummer

Unit Data

Item
Gegenstand **Harmonic Mixer, 140 GHz to 220 GHz**

Manufacturer
Hersteller **RPG Radiometer physics GmbH**

Type
Typ **RPG FS-Z220**

Material Number
Materialnummer **3593.3250.02** Serial Number
Seriennummer **101014**

Asset Number
Inventarnummer

This calibration certificate documents, that the named item is tested and measured against defined specifications. Measurement results are located usually in the corresponding interval with a probability of approx. 95% (coverage factor $k = 2$). Calibration is performed with test equipment and standards directly or indirectly traceable by means of approved calibration techniques to the PTB/DKD or other national/international standards, which realize the physical units of measurement according to the International System of Units (SI). In all cases where no standards are available, measurements are referenced to standards of the R&S laboratories. Principles and methods of calibration correspond with EN ISO/IEC 17025. This calibration certificate may not be reproduced other than in full. Calibration certificates without signatures are not valid. The user is obliged to have the object recalibrated at appropriate intervals.

Order Data

Customer
Auftraggeber **Sporton International Inc.
6F., Sec. 1, Hsin Tai Wu Rd 106
Xizhi Dist.
221 New Taipei City
Taiwan**

Order Number
Bestellnummer **8800047911**

Date of Receipt
Eingangsdatum **2023-10-27**

Dieser Kalibrierschein dokumentiert, dass der genannte Gegenstand nach festgelegten Vorgaben geprüft und gemessen wurde. Die Messwerte liegen im Regelfall mit einer Wahrscheinlichkeit von annähernd 95% im zugeordneten Werteintervall (Erweiterte Messunsicherheit mit $k = 2$). Die Kalibrierung erfolgte mit Messmitteln und Normalen, die direkt oder indirekt durch Ableitung mittels anerkannter Kalibriertechniken rückgeführt sind auf Normale der PTB/DKD oder anderer nationaler/internationaler Standards zur Darstellung der physikalischen Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI). Wenn keine Normale existieren, erfolgt die Rückführung auf Bezugsnormale der R&S-Laboratorien. Grundsätze und Verfahren der Kalibrierung beziehen sich auf EN ISO/IEC 17025. Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Kalibrierscheine ohne Unterschriften sind ungültig. Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

Performance

Place and Date of Calibration
Ort und Datum der Kalibrierung

Meckenheim, 2023-11-06

Scope of Calibration
Umfang der Kalibrierung

Standard Calibration

Statement of Compliance
(Incoming)
Konformitätsaussage
(Anlieferung)

All measured values are within the data sheet specifications.

Statement of Compliance
(Outgoing)
Konformitätsaussage
(Auslieferung)

All measured values are within the data sheet specifications.

Extend of Calibration Documents
Umfang des Kalibrierdokuments

**2 pages Calibration Certificate
4 pages Outgoing Results
3 pages Incoming Results**

RPG Radiometer physics GmbH; Meckenheim

Date of Issue
Ausstellungsdatum

2023-11-06

Head of Laboratory
Laborleitung

Emons

Person Responsible
Bearbeiter

Gottbehüt

Page (Seite) 1/2
Vers2010-05-05/
RPG2014-02-28

Calibration Method
Kalibrieranweisung

RPG-PAQA-TN-2014-002

Relative Humidity 20 % - 80 %
Relative LuftfeuchteAmbient Temperature
Umgebungstemperatur(23 ⁺⁷₋₃) °CWorking standards used (having a significant effect on the accuracy)
Verwendete Gebrauchsnormale (mit signifikantem Einfluss auf die Genauigkeit)

Item Gegenstand	Type Typ	Serial Number Seriennummer	Calibration Certificate Number Kalibrierscheinnummer	Cal. Due Kalibr. bis
Vector Network Analyzer	R&S® ZVA40	100103	0001A300715526	2026-10-04
Powersensor	R&S® NRP-Z55	140093	0001-300700427	2025-06-06

UGB1 A compliance statement may be possible where a confidence level of less than 95 % is acceptable.
Die Bestätigung der Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

UGB2 A non-compliance statement may be possible where a confidence level of less than 95 % is acceptable.
Die Bestätigung der Nicht-Konformität ist möglich, sofern ein Grad des Vertrauens von weniger als 95 % akzeptabel ist.

Ref.: ILAC-G8:03/2009 'Guidelines on the Reporting of Compliance with Specification'.

Notes
Anmerkungen

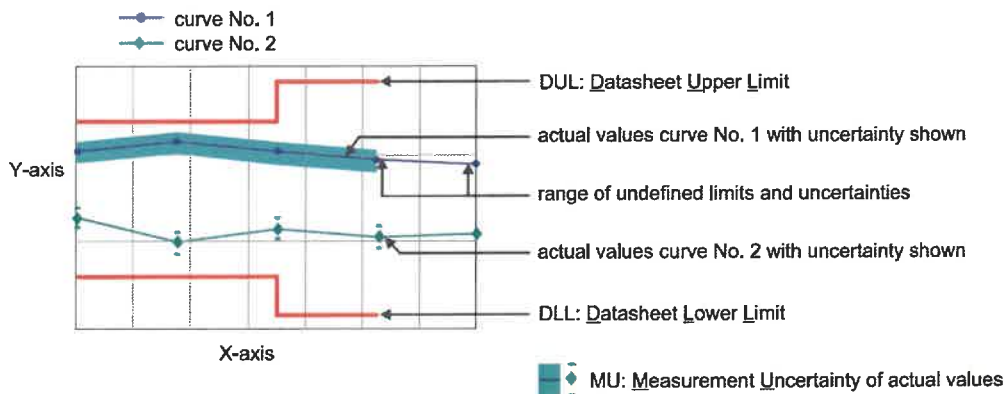
If the new product is stored under the climate conditions as specified in the data sheet upon delivery, the product's accuracy is not significantly affected within 12 month after its calibration in our factory. In this case, the recommended calibration interval starts on the date when the product is actually put into operation.

Outgoing Results

The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
{e}	The measurement uncertainty is taken into account when setting the measuring system.
DL or DT	Data Limit for symmetrical tolerance limits
DLL	Datasheet Lower Limit
DUL	Datasheet Upper Limit
MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

Explanation of charts

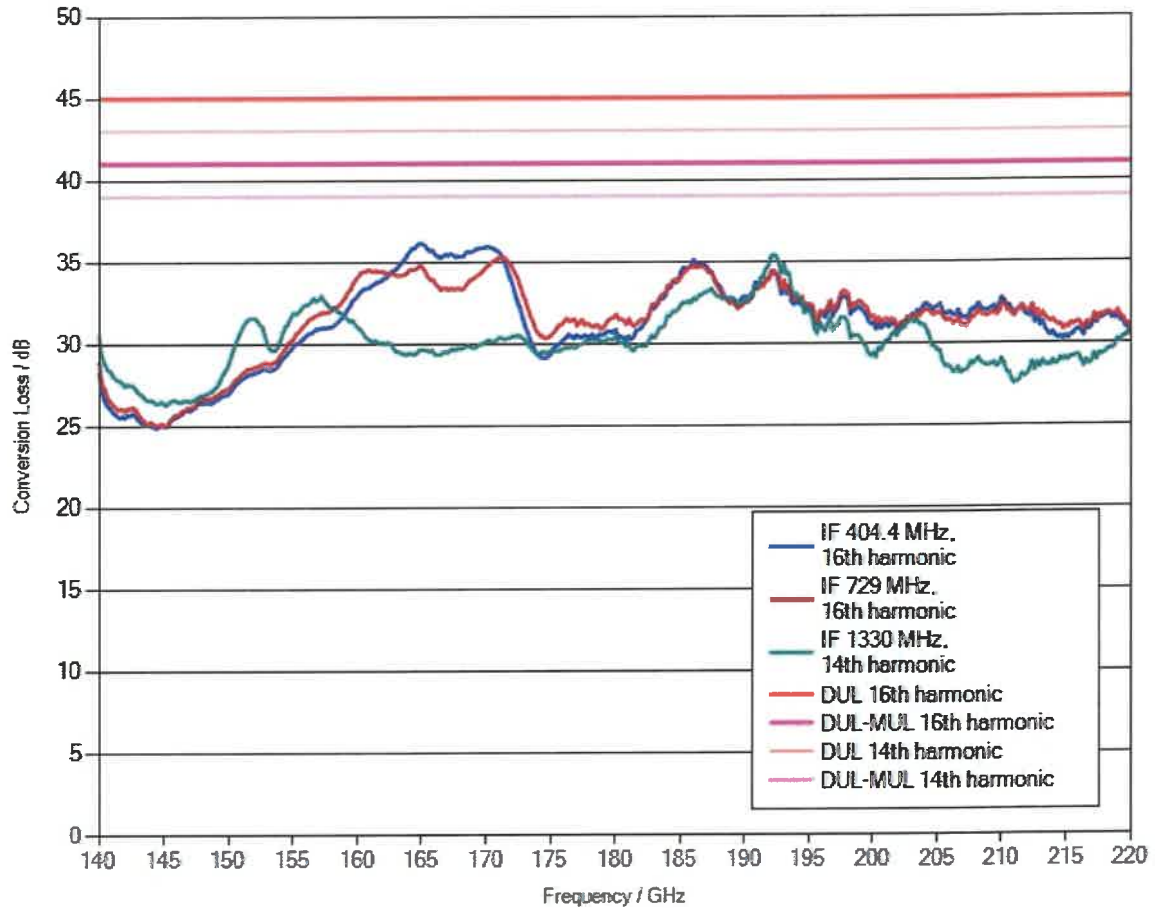


Software used for measurement**Item Type**Measurement Studio Professional Edition
MixerCertification**Version**2013
7_15**Remark**

1.1 Conversion loss

LO level +13 dBm nominal
Bias 0 A

Measurement uncertainty: 4 dB



Note: Numeric calibration data can be found attached to the PDF file of the calibration certificate. Click the “paper clip” symbol to display the file.

The file has been renamed for safety reasons.
When downloading the file onto your PC, please delete the “.file” extension and unzip the data.

1.2 Frequency response within 1 GHz

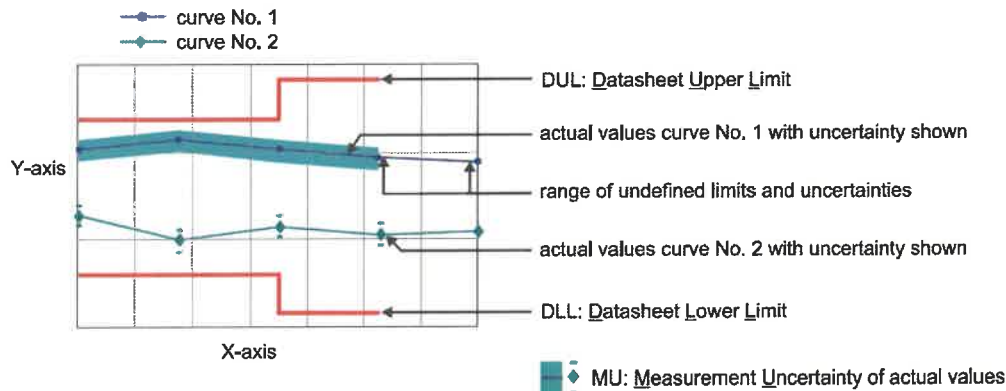
	DUL	Actual (worst case)	Evaluation
IF = 404.4 MHz, 16th harmonic	6 dB	2.61 dB	PASS
IF = 729 MHz, 16th harmonic	6 dB	2.54 dB	PASS
IF = 1330 MHz, 14th harmonic	6 dB	2.39 dB	PASS

1 Incoming Results

The following abbreviations may be used in this document

{a}	No measurement uncertainty stated because the errors always add together. So it is sure that a measurement result evaluated as "PASS" is pass.
{b}	The measurement uncertainty depends on the measurement result. The stated measurement uncertainty is valid for the close area around the specification. Measurement results outside the close area have a higher measurement uncertainty but are within the specification.
{c}	Functional test, therefore no measurement uncertainty is stated.
{d}	Typical value, refer to performance test.
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DL or DT	Data Limit for symmetrical tolerance limits
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MU	Measurement Uncertainty
MLL or MLV	Measurement Uncertainty Lower Value
MUL or MUV	Measurement Uncertainty Upper Value
Nom.	Nominal Value
Dev.	Deviation
MErr.	Measurement Error
Act.	Actual Value
UGB	Uncertainty Guard Band: Measuring uncertainty violates the data (spec.) limit.
UGB1	Measurement results marked as UGB1 show conformity with a probability of >50 % and <95 %.
UGB2	Measurement results marked as UGB2 show non-conformity with a probability of >50 % and <95 %.
DU	Datasheet Uncertainty

Explanation of charts



Material Number 3593.3250.02

Serial Number 101014

Certificate Number 24-0220-101014-03

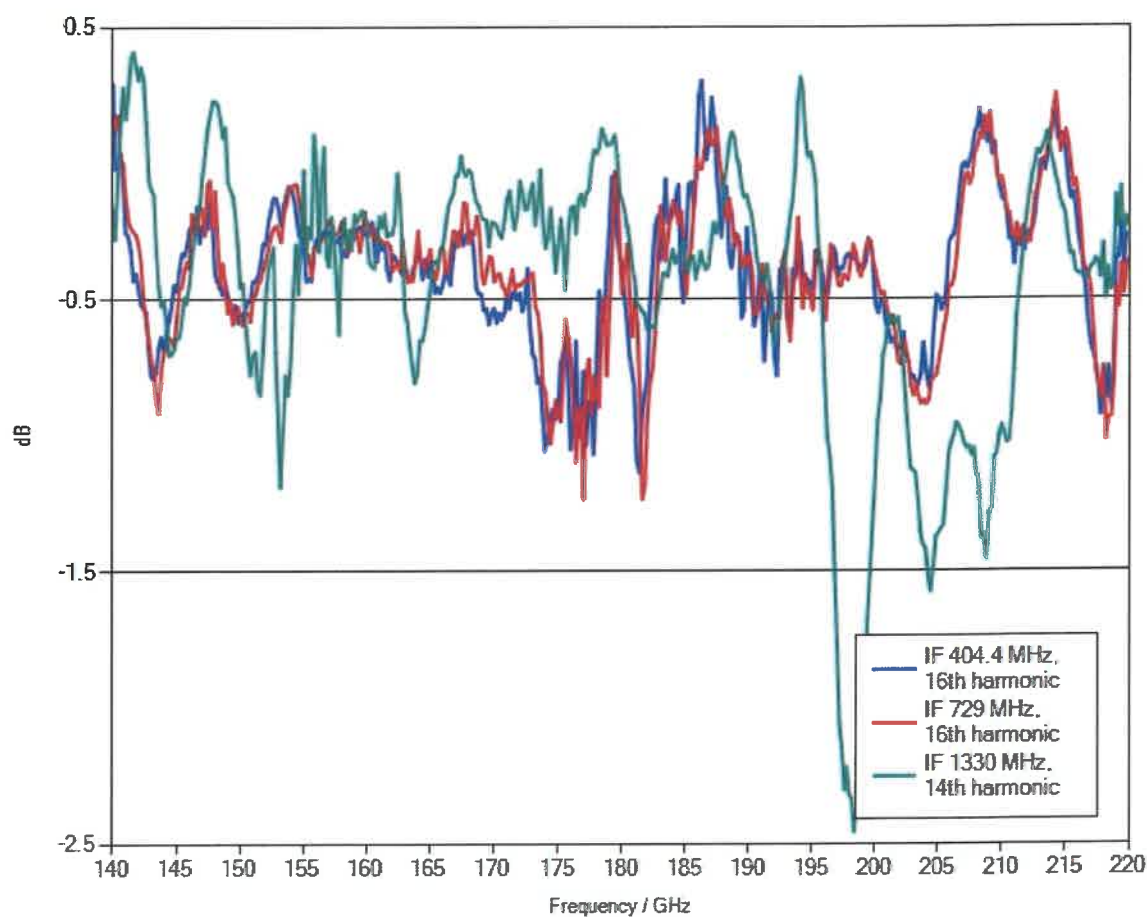
(Incoming)

Software used for measurement

Item Type	Version	Remark
Measurement Studio Professional Edition	2013	
MixerCertification	7_15	

Incoming Report

1.1 Deviation between actual and previous conversion loss



Incoming Report

- 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

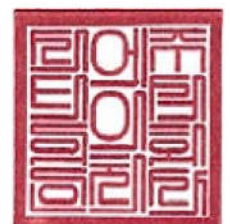
(Confidence level about 95 %, k = 2)

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

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)
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

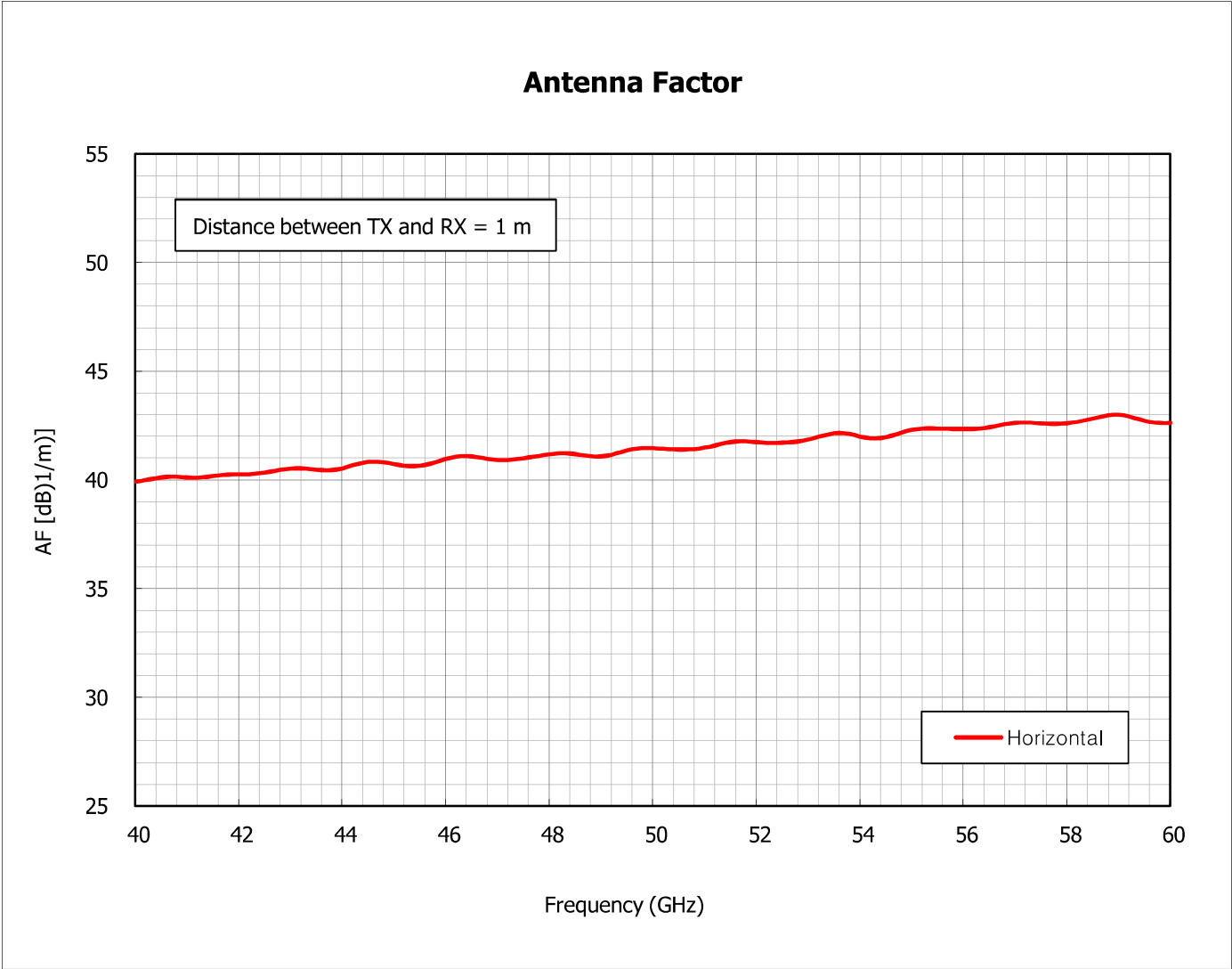
※ The measurement uncertainty of this result is 1.2 dB (Confidence level about 95 %, $k = 2$)

Calibration Results



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

2. Antenna Factor Curve

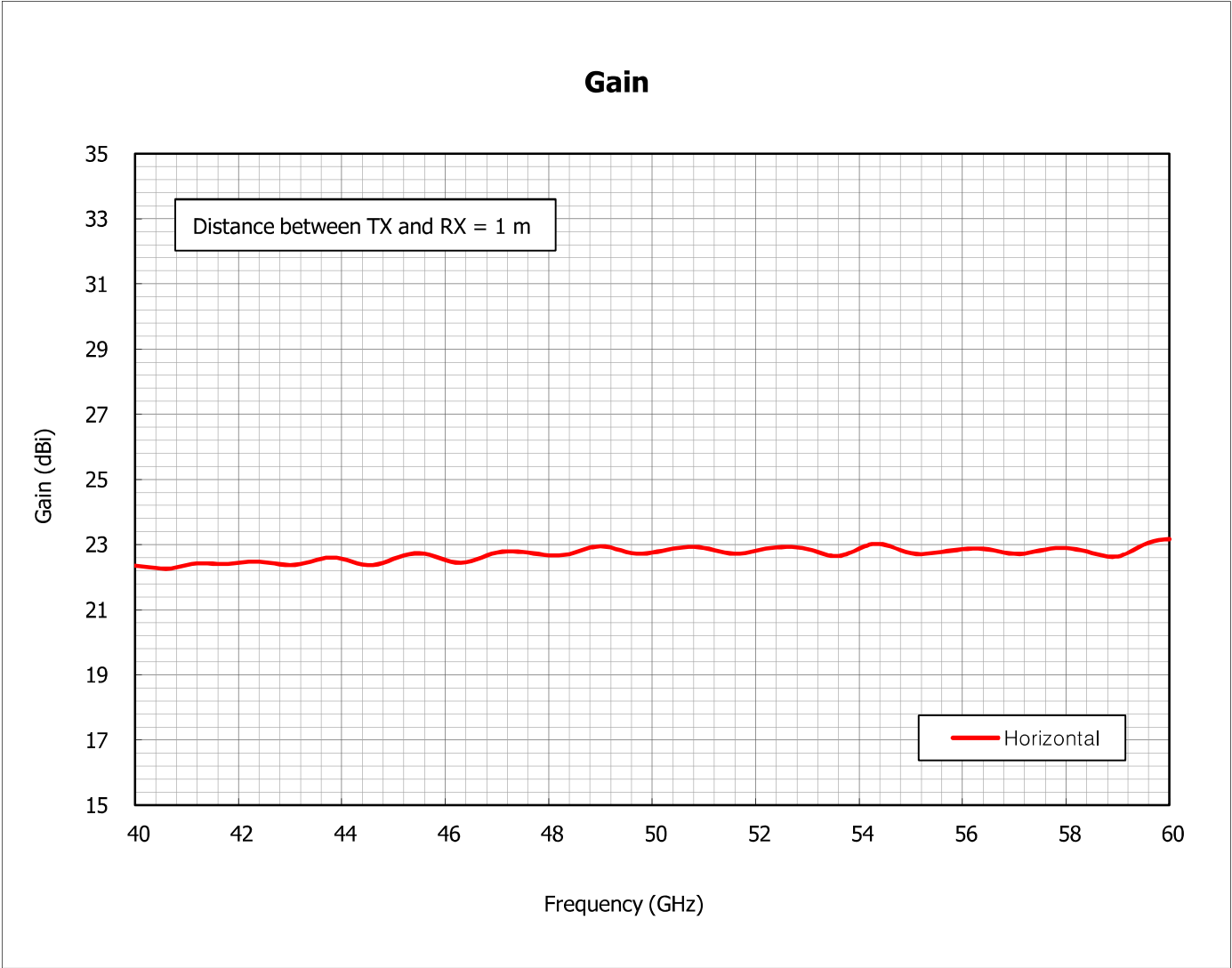


Calibration Results



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

3. Gain Curve



END.

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

page : 1 of 6

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 $\pm$ 0.1) °C - Humidity : (46 $\pm$ 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

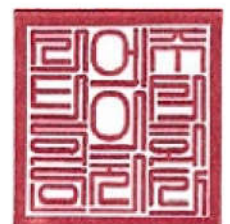
(Confidence level about 95 %, $k = 2$)

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.