

**Appendix-Calibration Certificate for Test Equipment
For Above 40GHz:**

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer Keysight	N9030A	MY55330160	Feb. 07, 2020	Feb. 06, 2021
*OXE89 Horn Antenna (33~55GHz) QuinStar	QWH-UCRR00	924200002	Jan. 20, 2020	Jan. 19, 2022
*Conical Horn Antenna (50~75GHz) Keysight	WR15CH- Conical	WR15CH_001	Jan. 20, 2020	Jan. 19, 2022
*Conical Horn Antenna (75~110GHz) Keysight	WR10CH- Conical	WR10CH_001	Jan. 20, 2020	Jan. 19, 2022
*Conical Horn Antenna (110~170GHz) Keysight	WR6.5CH- Conical	WR6.5CH_001	Jan. 20, 2020	Jan. 19, 2022
*Conical Horn Antenna (140~220GHz) Keysight	WR5.1CH- Conical	WR5.1CH_001	Dec. 09, 2019	Dec. 08, 2021
*Conical Horn Antenna (220~330GHz) Keysight	WR3.4DH- Diagonal	WR3.4DH_001	Dec. 09, 2019	Dec. 08, 2021
N9029AV15-DC9 - 50-75 GHz VDI Standard Downconverter with 9VDC supply Keysight	SA Extension WR15	SAX 381	CoC	CoC
N9029AV10-DC9 - 75-110 GHz VDI Standard Downconverter with 9VDC supply Keysight	SA Extension WR10	SAX 378	CoC	CoC
N9029AV06-DC9 - 110-170 GHz VDI Standard Downconverter with 9VDC supply Keysight	SA Extension WR6.5	SAX 377	CoC	CoC
*N9029AV05-DC9 - 140-220 GHz VDI Standard Downconverter with 9VDC supply Keysight	SA Extension WR5.1	SAX 375	Dec. 09, 2019	Dec. 08, 2021
*N9029AV03-DC9 - 220-330 GHz VDI Standard Downconverter with 9VDC supply Keysight	SA Extension	SAX 376	Dec. 09, 2019	Dec. 08, 2021
Millimeter-Wave Signal Generator Frequency Extension Module (50~75 GHz) Keysight	E8257DV15	SGX 050	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (75~110 GHz) Keysight	E8257DV10	SGX 069	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (110~170 GHz) Keysight	E8257DV06- DC9	SGX 223	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (140~220 GHz)	VDIWR5.1SGX	PSGX 007	CoC	CoC
PSG analog signal generator Keysight	E8257D	MY53401987	Jun. 17, 2020	Jun. 16, 2021
Antenna Tower & Turn Table CT	NA	NA	NA	NA
*Power Meter VDI	PM5	431V	Dec. 09, 2019	Dec. 08, 2021

工服 NO. 20-02-BCC-060-01L

財團法人台灣電子檢驗中心



收件日期: Feb.06,2020

校正報告

Receipt Date

CALIBRATION REPORT

發行日期: Feb.11,2020

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Report Issue Date

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顧客名稱 香港商立德國際商品試驗有限公司桃園分公司

Customer

顧客地址 新竹縣芎林鄉上山村文德路206巷49號

Address

供校儀器 ITEM CALIBRATED

儀器名稱: PXA Signal Analyzer

Nomenclature

製造商: KEYSIGHT

Manufacturer

型別: N9030A

Model No.

識別號碼: MY55330160

ID. No.

上述儀器經本實驗室校正，結果如內文。未經本實驗室書面許可，不得部份複製本報告，完整複製則不在此限。

The above instruments were calibrated by the laboratory and please refer to the content for the calibration results. This report may not be reproduced in part without the written permission of the laboratory, except for full reproduction.

校正資料: ☒ 僅量測 ☐ 調整

Calibration Information Calibration Only Adjusted

實際環境: 溫度: 22 °C 相對濕度: 48 %

Actual Environments Temperature Relative Humidity

環境管制條件: 溫度: (23 ± 2) °C, 相對濕度: (50 ± 10) %

Environmental Conditions

校正日期: Feb.07,2020

Calibration Date

建議再校日期: Feb.06,2021 註: 建議再校日期為應顧客要求列入。

Recommended Recalibration Date Note: The recommended recalibration date is agreed by the customer.

校正地點: 財團法人台灣電子檢驗中心校正實驗室

Laboratory Location

- 實驗室名稱地址: ☒ 1. 校正實驗室 33383 桃園市龜山區文明路29巷8號 TEL:+886-3-3280026
Laboratory Name and Address 2. 新竹校正實驗室 30075 新竹市科學園區園區二路47號205室 TEL:+886-3-5798806
3. 台中校正實驗室 40766 台中市西屯區福中二街8號2樓之2 TEL:+886-4-23584899
4. 台南校正實驗室 70248 台南市南區新和二路5號 TEL:+886-6-2925787#50,51

財團法人台灣電子檢驗中心特此證明報告內記載之受校儀器已與下方標準做過比較校正，用以校正之標準器可追溯至中華民國國家度量衡標準實驗室，美國標準及技術研究院，或其它國家之度量衡國家標準。本中心的校正服務均符合ISO/IEC 17025 之規定。

ETC hereby certifies that the equipment noted herein has been compared with the below listed standards. The Standards used to perform this calibration are traceable to NML/ROC,NIST/USA or other countries. The calibration services from ETC are capable of performing services in compliance with the requirements of ISO/IEC 17025.

財團法人台灣電子檢驗中心
ELECTRONICS TESTING CENTER,
TAIWAN



實驗室主管
Laboratory Head



報告簽署人
Signature



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使用校正依據 CALIBRATION PROCEDURE USED

1. 「頻譜(信號)分析儀校正程序書」, B00-CD-142, 5th Edition。
2. 「測試接收機/信號(頻譜)分析儀校正程序書」, B00-CD-376, 5th Edition。

使用標準器及附配件 STANDARD AND ACCESSORIES USED

儀器名稱【廠牌/型號】 Nomenclature【Mfg./Model No.】	【識別號碼】 【ID. No.】	校正單位(認可編號) Cal. Source(ACRED Code)	報告號碼 Cal. Report No.	校正日期 Date Cal.	有效日期 Due Date
RF Step Attenuator 【R/S RSG】 【13050122-001】		R&S(DAKS D-K-15195-01-01)	D-K-15195-01-01 2018-03	2018/03/08	2021/09/07
EPM Series Power Meter 【HP E4419B】 【13050609-001】		NML(TAF N0688)	U190100A	2019/07/24	2021/01/23
Swept Signal Generator 【AGILENT 83650B】 【13051703-001】		ETC(TAF 0025)	19-06-BAC-512-16L	2019/07/12	2020/07/11
Signal Generator 【R&S/SMB100A】 【13051715-001】		R&S(DAKS D-K-15195-01-01)	532388	2019/11/26	2023/05/25
Power Sensor 【AGILENT 8482A】 【13053506-001】		KEYSIGHT(ANAB AC-1498)	1-11911589522-1	2019/11/14	2022/05/13
Power Sensor 【AGILENT 8487A】 【13053508-003】		KEYSIGHT(ANAB AC-1498)	1-12179698623-1	2020/01/15	2022/07/14
Universal Counter 【HP 53132A】 【13060804-001】		ETC(TAF 0025)	19-12-BAC-630-02L	2020/01/03	2020/07/02

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Test Description	Actual Value	Expanded Uncertainty
1. Freq. Readout Accuracy and Freq. Count Marker Accuracy:		
(a) Freq. Readout Accuracy		
(a.1) 1.5 GHz Center Freq.		
1 MHz SPAN	1.500000 GHz	1.2×10^{-6}
10 MHz SPAN	1.500000 GHz	1.2×10^{-5}
20 MHz SPAN	1.500000 GHz	1.2×10^{-5}
50 MHz SPAN	1.500000 GHz	1.2×10^{-5}
100 MHz SPAN	1.500000 GHz	1.2×10^{-4}
1 GHz SPAN	1.499 GHz	1.2×10^{-3}
(a.2) 4.0 GHz Center Freq.		
1 MHz SPAN	4.000000 GHz	1.2×10^{-6}
10 MHz SPAN	4.000000 GHz	1.2×10^{-5}
20 MHz SPAN	4.000000 GHz	1.2×10^{-5}
50 MHz SPAN	4.000000 GHz	1.2×10^{-5}
100 MHz SPAN	4.000000 GHz	1.2×10^{-4}
1 GHz SPAN	3.999 GHz	1.2×10^{-3}
(a.3) 9.0 GHz Center Freq.		
1 MHz SPAN	9.000000 GHz	1.2×10^{-5}
10 MHz SPAN	9.000000 GHz	1.2×10^{-5}
20 MHz SPAN	9.000000 GHz	1.2×10^{-5}
50 MHz SPAN	9.000000 GHz	1.2×10^{-4}
100 MHz SPAN	9.000000 GHz	1.2×10^{-3}
1 GHz SPAN	8.999 GHz	1.2×10^{-6}
(a.4) 16.0 GHz Center Freq.		
1 MHz SPAN	16.000000 GHz	1.2×10^{-5}
10 MHz SPAN	16.000000 GHz	1.2×10^{-5}
20 MHz SPAN	16.000000 GHz	1.2×10^{-4}
50 MHz SPAN	16.000000 GHz	1.2×10^{-3}
100 MHz SPAN	16.000000 GHz	1.2×10^{-6}
1 GHz SPAN	15.999 GHz	1.2×10^{-5}

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Test Description	Actual Value	Expanded Uncertainty
1. Freq. Readout Accuracy and Freq. Count Marker Accuracy: (@ Continued):		
(a)Freq. Readout Accuracy		
(a.5)21.0 GHz Center Freq.		
1 MHz SPAN	21.000000 GHz	1.2×10^{-6}
10 MHz SPAN	21.000000 GHz	1.2×10^{-5}
20 MHz SPAN	21.000000 GHz	1.2×10^{-5}
50 MHz SPAN	21.000000 GHz	1.2×10^{-5}
100 MHz SPAN	21.000000 GHz	1.2×10^{-4}
1 GHz SPAN	20.999 GHz	1.2×10^{-3}
(a.6)29.0 GHz Center Freq.		
1 MHz SPAN	29.000000 GHz	1.2×10^{-6}
10 MHz SPAN	29.000000 GHz	1.2×10^{-5}
20 MHz SPAN	29.000000 GHz	1.2×10^{-5}
50 MHz SPAN	29.000000 GHz	1.2×10^{-5}
100 MHz SPAN	29.000000 GHz	1.2×10^{-4}
1 GHz SPAN	29.000 GHz	1.2×10^{-3}
(a.7)35.0 GHz Center Freq.		
1 MHz SPAN	35.000000 GHz	1.2×10^{-5}
10 MHz SPAN	35.000000 GHz	1.2×10^{-5}
20 MHz SPAN	35.000000 GHz	1.2×10^{-5}
50 MHz SPAN	35.000000 GHz	1.2×10^{-4}
100 MHz SPAN	35.000000 GHz	1.2×10^{-3}
1 GHz SPAN	34.999 GHz	1.2×10^{-6}
(b)Freq. Count Marker Accuracy:		
1.5 GHz Center Freq.	1.500000000 GHz	5.0×10^{-8}
4.0 GHz Center Freq.	4.000000000 GHz	5.0×10^{-8}
9.0 GHz Center Freq.	9.000000000 GHz	5.0×10^{-8}
16.0 GHz Center Freq.	16.00000000 GHz	5.0×10^{-8}
21.0 GHz Center Freq.	21.00000000 GHz	5.0×10^{-8}
29.0 GHz Center Freq.	29.00000000 GHz	5.0×10^{-8}
35.0 GHz Center Freq.	35.00000000 GHz	5.0×10^{-8}

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Test Description	Actual Value	Expanded Uncertainty
2. Freq. Span Accuracy:		
1 kHz Span	0.00 %	0.15 %
2 kHz Span	0.00 %	0.15 %
5 kHz Span	0.00 %	0.15 %
10 kHz Span	0.00 %	0.15 %
20 kHz Span	0.00 %	0.15 %
50 kHz Span	0.00 %	0.15 %
100 kHz Span	0.00 %	0.15 %
200 kHz Span	0.00 %	0.15 %
500 kHz Span	0.00 %	0.15 %
1 MHz Span	0.00 %	0.15 %
2 MHz Span	0.00 %	0.15 %
5 MHz Span	0.00 %	0.15 %
10 MHz Span	0.00 %	0.15 %
20 MHz Span	0.00 %	0.15 %
50 MHz Span	0.00 %	0.15 %
100 MHz Span	0.00 %	0.15 %
200 MHz Span	0.00 %	0.15 %
500 MHz Span	0.00 %	0.15 %
1 GHz Span	0.00 %	0.15 %
2 GHz Span	0.00 %	0.15 %

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Test Description	Actual Value	Expanded Uncertainty
3. Image, Multiple, and Out-of-Band Response:		
(a)2 GHz Center Freq.		
2021.4 MHz	-98.33 dBc	1.4 dB
2621.4 MHz	-98.26 dBc	0.96 dB
2321.4 MHz	-99.44 dBc	0.98 dB
2600.0 MHz	-98.96 dBc	1.1 dB
7910.7 MHz	-98.73 dBc	1.1 dB
9821.4 MHz	-98.19 dBc	1.2 dB
(b)4 GHz Center Freq.		
4021.4 MHz	-94.12 dBc	0.95 dB
4621.4 MHz	-95.40 dBc	0.90 dB
4321.4 MHz	-95.47 dBc	0.91 dB
4600.0 MHz	-95.44 dBc	0.97 dB
8310.7 MHz	-95.55 dBc	0.90 dB
8932.1 MHz	-95.71 dBc	1.2 dB
(c)9 GHz Center Freq.		
9021.4 MHz	-93.89 dBc	0.83 dB
9621.4 MHz	-94.86 dBc	1.2 dB
9321.4 MHz	-94.31 dBc	1.2 dB
9600.0 MHz	-95.14 dBc	1.4 dB
18310.7 MHz	-94.69 dBc	0.91 dB
18932.1 MHz	-94.37 dBc	0.92 dB
(d)15 GHz Center Freq.		
15021.400 MHz	-94.38 dBc	1.1 dB
15621.400 MHz	-95.97 dBc	1.2 dB
22655.350 MHz	-96.45 dBc	0.94 dB
23276.750 MHz	-95.17 dBc	1.4 dB
7344.650 MHz	-95.27 dBc	1.4 dB
7966.050 MHz	-94.05 dBc	1.1 dB
(e)20 GHz Center Freq.		
20021.400 MHz	-93.26 dBc	1.4 dB
20621.400 MHz	-92.46 dBc	1.0 dB
15543.725 MHz	-92.38 dBc	1.6 dB
25699.075 MHz	-92.78 dBc	1.1 dB
9844.650 MHz	-93.01 dBc	0.93 dB
10466.050 MHz	-93.03 dBc	1.4 dB

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3. Image, Multiple, and Out-of-Band Response(Continued):		
(f)29 GHz Center Freq.		
28378.600 MHz	-90.40 dBc	1.2 dB
28978.600 MHz	-90.42 dBc	1.3 dB
24450.925 MHz	-91.56 dBc	1.2 dB
28700.000 MHz	-89.50 dBc	1.2 dB
16455.350 MHz	-89.62 dBc	1.3 dB
35272.325 MHz	-89.77 dBc	1.3 dB
(g)35 GHz Center Freq.		
35021.400 MHz	-88.59 dBc	1.5 dB
35621.400 MHz	-87.58 dBc	1.4 dB
33093.725 MHz	-88.64 dBc	1.4 dB
35321.400 MHz	-88.49 dBc	1.3 dB
8744.538 MHz	-88.45 dBc	1.3 dB
15544.650 MHz	-88.55 dBc	1.3 dB
4. Frequency accuracy:	10.0000002 MHz	3.5×10^{-8}
5. IF bandwidth level accuracy Check:		
100 Hz	0.00 dB	0.32 dB
300 Hz	0.00 dB	0.32 dB
1 kHz	0.00 dB	0.32 dB
3 kHz	0.00 dB	0.32 dB
10 kHz	0.00 dB(Ref.)	----
30 kHz	0.00 dB	0.32 dB
100 kHz	0.00 dB	0.32 dB
300 kHz	0.00 dB	0.32 dB
1 MHz	0.00 dB	0.32 dB
3 MHz	0.01 dB	0.32 dB

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Test Description	Actual Value	Expanded Uncertainty
6. IF bandwidth (3 dB) Check:		
Bandwidth		
100 Hz	100.1 Hz	4.4 %
300 Hz	300.0 Hz	4.4 %
1 kHz	1.000 kHz	4.4 %
3 kHz	3.000 kHz	4.4 %
10 kHz	10.00 kHz	4.4 %
30 kHz	30.08 kHz	4.4 %
100 kHz	100.1 kHz	4.4 %
300 kHz	300.7 kHz	4.4 %
1 MHz	998.0 kHz	4.4 %
3 MHz	2.987 MHz	4.4 %
7. IF Bandwidths (3 dB)		
Shape factor Check:		
100 Hz	3.80	6.1 %
300 Hz	4.34	6.1 %
1 kHz	4.37	6.1 %
3 kHz	4.04	6.1 %
10 kHz	4.17	6.1 %
30 kHz	4.27	6.1 %
100 kHz	4.13	6.1 %
300 kHz	4.08	6.1 %
1 MHz	4.04	6.1 %
3 MHz	4.02	6.1 %

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Test Description	Actual Value	Expanded Uncertainty
8. Noise Display Check :		
9 kHz	-146.1 dBm	0.76 dB
100 kHz	-148.2 dBm	0.76 dB
999 kHz	-148.4 dBm	0.76 dB
10.99 MHz	-150.3 dBm	0.76 dB
19.99 MHz	-155.1 dBm	0.76 dB
49.99 MHz	-155.5 dBm	0.76 dB
99.99 MHz	-158.4 dBm	0.76 dB
199.9 MHz	-157.3 dBm	0.76 dB
499.9 MHz	-155.6 dBm	0.76 dB
999.9 MHz	-152.6 dBm	0.76 dB
1499 MHz	-152.1 dBm	0.88 dB
1999 MHz	-151.7 dBm	0.88 dB
2499 MHz	-150.9 dBm	0.88 dB
2999 MHz	-150.3 dBm	0.88 dB
3099 MHz	-148.9 dBm	0.88 dB
3499 MHz	-147.4 dBm	0.88 dB
3999 MHz	-148.2 dBm	0.88 dB
4499 MHz	-149.0 dBm	0.88 dB
4999 MHz	-148.4 dBm	0.88 dB
5499 MHz	-148.1 dBm	0.88 dB
5999 MHz	-147.3 dBm	0.88 dB
6499 MHz	-146.5 dBm	0.88 dB
6999 MHz	-146.9 dBm	0.88 dB
7999 MHz	-147.3 dBm	0.88 dB
8999 MHz	-146.8 dBm	0.88 dB
9999 MHz	-147.1 dBm	0.88 dB
10999 MHz	-144.6 dBm	0.88 dB
11999 MHz	-147.1 dBm	0.88 dB
12999 MHz	-146.0 dBm	0.88 dB
13999 MHz	-145.7 dBm	0.88 dB
14999 MHz	-144.8 dBm	0.88 dB
15999 MHz	-144.2 dBm	0.88 dB
16999 MHz	-143.7 dBm	0.88 dB

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Test Description	Actual Value	Expanded Uncertainty
8. Noise Display Check (@ Continued):		
17999 MHz	-144.1 dBm	0.88 dB
18999 MHz	-145.3 dBm	0.88 dB
19999 MHz	-146.1 dBm	0.88 dB
20999 MHz	-147.2 dBm	0.88 dB
21999 MHz	-146.9 dBm	0.88 dB
22999 MHz	-147.1 dBm	0.88 dB
23999 MHz	-146.9 dBm	0.88 dB
24999 MHz	-146.1 dBm	0.88 dB
25999 MHz	-145.4 dBm	0.88 dB
26999 MHz	-145.7 dBm	0.88 dB
27999 MHz	-145.8 dBm	0.88 dB
28999 MHz	-144.6 dBm	0.88 dB
29999 MHz	-145.3 dBm	0.88 dB
30999 MHz	-143.1 dBm	0.88 dB
31999 MHz	-146.3 dBm	0.88 dB
32999 MHz	-147.0 dBm	0.88 dB
33999 MHz	-146.5 dBm	0.88 dB
34999 MHz	-146.8 dBm	0.88 dB
35999 MHz	-145.3 dBm	0.88 dB
36999 MHz	-143.4 dBm	0.88 dB
37999 MHz	-142.7 dBm	0.88 dB
38999 MHz	-141.2 dBm	0.88 dB
39999 MHz	-139.2 dBm	0.88 dB

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Test Description	Actual Value	Expanded Uncertainty
9. Frequency response Check:		
RF Attenuation 10 dB		
100 kHz	0.12 dB	0.66 dB
1 MHz	0.11 dB	0.66 dB
10 MHz	0.08 dB	0.66 dB
50 MHz	0.13 dB	0.66 dB
100 MHz	0.13 dB	0.66 dB
200 MHz	0.12 dB	0.66 dB
300 MHz	0.13 dB	0.66 dB
400 MHz	0.14 dB	0.66 dB
500 MHz	0.17 dB	0.66 dB
600 MHz	0.12 dB	0.66 dB
700 MHz	0.13 dB	0.66 dB
800 MHz	0.15 dB	0.66 dB
900 MHz	0.17 dB	0.66 dB
1000 MHz	0.19 dB	0.66 dB
1500 MHz	0.21 dB	0.66 dB
2000 MHz	0.22 dB	0.66 dB
2500 MHz	0.21 dB	0.66 dB
2990 MHz	0.23 dB	0.66 dB
3010 MHz	0.20 dB	0.70 dB
3500 MHz	0.20 dB	0.70 dB
4000 MHz	-0.22 dB	0.70 dB
4500 MHz	-0.49 dB	0.70 dB
5000 MHz	-0.65 dB	0.70 dB
5500 MHz	-0.41 dB	0.70 dB
6000 MHz	-0.31 dB	0.70 dB
6500 MHz	-0.28 dB	0.70 dB
6990 MHz	-0.23 dB	0.70 dB
7100 MHz	-0.22 dB	0.70 dB
8000 MHz	-0.24 dB	0.70 dB
9000 MHz	-0.32 dB	0.70 dB
10000 MHz	-0.39 dB	0.70 dB
11000 MHz	-0.42 dB	0.70 dB
12000 MHz	-0.51 dB	0.70 dB
13000 MHz	-0.60 dB	0.70 dB

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Test Description	Actual Value	Expanded Uncertainty
9. Frequency response Check(@ Continued):		
RF Attenuation 10 dB		
13500 MHz	-0.71 dB	0.70 dB
14000 MHz	-0.58 dB	0.70 dB
15000 MHz	-0.43 dB	0.70 dB
16000 MHz	-0.51 dB	0.70 dB
17000 MHz	-0.55 dB	0.70 dB
18000 MHz	-0.53 dB	0.70 dB
19000 MHz	-0.57 dB	0.98 dB
20000 MHz	-0.56 dB	0.98 dB
21000 MHz	-0.52 dB	0.98 dB
22000 MHz	-0.41 dB	0.98 dB
23000 MHz	-0.52 dB	0.98 dB
24000 MHz	-0.59 dB	0.98 dB
25000 MHz	-0.63 dB	0.98 dB
26000 MHz	0.59 dB	0.98 dB
27000 MHz	-0.57 dB	1.3 dB
28000 MHz	-0.49 dB	1.3 dB
29000 MHz	-0.53 dB	1.3 dB
29900 MHz	-0.51 dB	1.3 dB
31000 MHz	-0.52 dB	1.3 dB
32000 MHz	-0.42 dB	1.3 dB
33000 MHz	-0.53 dB	1.3 dB
34000 MHz	-0.58 dB	1.3 dB
35000 MHz	-0.60 dB	1.3 dB
36000 MHz	-0.52 dB	1.3 dB
37000 MHz	-0.69 dB	1.3 dB
38000 MHz	-0.88 dB	1.3 dB
39000 MHz	-0.96 dB	1.3 dB
39999 MHz	-1.11 dB	1.3 dB
42990 MHz	-1.45 dB	1.3 dB
44000 MHz	-0.43 dB	1.3 dB
45000 MHz	-0.13 dB	1.3 dB
46000 MHz	0.14 dB	1.3 dB
47000 MHz	0.12 dB	1.3 dB
48000 MHz	0.10 dB	1.3 dB
49000 MHz	0.24 dB	1.3 dB
49999 MHz	0.00 dB	1.3 dB

校正報告

財團法人台灣電子檢驗中心

工 服NO. 20-02-BCC-060-01L

CALIBRATION REPORT

ELECTRONICS TESTING
CENTER, TAIWAN

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Test Description	Actual Value	Expanded Uncertainty
9. Frequency response Check(@ Continued):		
RF Attenuation 20 dB		
100 kHz	0.11 dB	0.64 dB
1 MHz	0.12 dB	0.64 dB
10 MHz	0.09 dB	0.64 dB
50 MHz	0.08 dB	0.64 dB
100 MHz	0.07 dB	0.64 dB
200 MHz	0.05 dB	0.64 dB
300 MHz	0.06 dB	0.64 dB
400 MHz	0.09 dB	0.64 dB
500 MHz	0.08 dB	0.64 dB
600 MHz	0.06 dB	0.64 dB
700 MHz	0.05 dB	0.64 dB
800 MHz	0.06 dB	0.64 dB
900 MHz	0.08 dB	0.64 dB
1000 MHz	0.11 dB	0.64 dB
1500 MHz	0.14 dB	0.64 dB
2000 MHz	0.16 dB	0.64 dB
2500 MHz	0.19 dB	0.64 dB
2990 MHz	0.22 dB	0.64 dB
Frequency response Check (@ Continued):		
RF Attenuation 40 dB		
100 kHz	0.11 dB	0.62 dB
1 MHz	0.12 dB	0.62 dB
10 MHz	0.09 dB	0.62 dB
50 MHz	0.08 dB	0.62 dB
100 MHz	0.07 dB	0.62 dB
200 MHz	0.08 dB	0.62 dB
300 MHz	0.09 dB	0.62 dB
400 MHz	0.11 dB	0.62 dB
500 MHz	0.13 dB	0.62 dB
600 MHz	0.11 dB	0.62 dB
700 MHz	0.09 dB	0.62 dB
800 MHz	0.08 dB	0.62 dB
900 MHz	0.09 dB	0.62 dB
1000 MHz	0.12 dB	0.62 dB
1500 MHz	0.14 dB	0.62 dB
2000 MHz	0.16 dB	0.62 dB
2500 MHz	0.19 dB	0.62 dB
2990 MHz	0.22 dB	0.64 dB

校正報告

財團法人台灣電子檢驗中心

工 服NO. 20-02-BCC-060-01L

CALIBRATION REPORT

ELECTRONICS TESTING
CENTER, TAIWAN

Page 14 of 16

Test Description	Actual Value	Expanded Uncertainty
10. Display linearity Check:		
RBW 300 Hz		
10 dB	9.99 dB	0.64 dB
12 dB	7.99 dB	0.64 dB
14 dB	5.98 dB	0.64 dB
16 dB	3.98 dB	0.64 dB
18 dB	1.97 dB	0.64 dB
20 dB	0.00 dB(Ref.)	-----
22 dB	-2.00 dB	0.64 dB
24 dB	-4.00 dB	0.64 dB
26 dB	-6.00 dB	0.64 dB
28 dB	-8.01 dB	0.64 dB
30 dB	-10.00 dB	0.64 dB
32 dB	-12.01 dB	0.64 dB
34 dB	-14.01 dB	0.64 dB
36 dB	-16.02 dB	0.64 dB
38 dB	-18.03 dB	0.64 dB
40 dB	-20.00 dB	0.64 dB
42 dB	-21.99 dB	0.64 dB
44 dB	-23.98 dB	0.64 dB
46 dB	-25.98 dB	0.64 dB
48 dB	-27.99 dB	0.64 dB
50 dB	-30.00 dB	0.64 dB
52 dB	-31.99 dB	0.64 dB
54 dB	-33.98 dB	0.64 dB
56 dB	-35.99 dB	0.64 dB
58 dB	-38.00 dB	0.64 dB
60 dB	-39.97 dB	0.64 dB
65 dB	-44.98 dB	0.64 dB
70 dB	-49.99 dB	0.64 dB
75 dB	-54.99 dB	0.64 dB
80 dB	-59.98 dB	0.64 dB
85 dB	-64.98 dB	0.64 dB
90 dB	-69.97 dB	0.64 dB
95 dB	-74.96 dB	0.64 dB
100 dB	-79.94 dB	0.64 dB

校正報告

財團法人台灣電子檢驗中心

工 服NO. 20-02-BCC-060-01L

CALIBRATION REPORT

ELECTRONICS TESTING
CENTER, TAIWAN

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Test Description	Actual Value	Expanded Uncertainty
10. Display linearity Check		
RBW 300 kHz:		
10 dB	9.99 dB	0.64 dB
12 dB	7.99 dB	0.64 dB
14 dB	5.98 dB	0.64 dB
16 dB	3.97 dB	0.64 dB
18 dB	1.96 dB	0.64 dB
20 dB	0.00 dB(Ref.)	
22 dB	-2.00 dB	0.64 dB
24 dB	-4.01 dB	0.64 dB
26 dB	-6.02 dB	0.64 dB
28 dB	-8.03 dB	0.64 dB
30 dB	-10.01 dB	0.64 dB
32 dB	-12.01 dB	0.64 dB
34 dB	-14.00 dB	0.64 dB
36 dB	-16.01 dB	0.64 dB
38 dB	-18.02 dB	0.64 dB
40 dB	-20.00 dB	0.64 dB
42 dB	-21.99 dB	0.64 dB
44 dB	-23.98 dB	0.64 dB
46 dB	-25.98 dB	0.64 dB
48 dB	-27.99 dB	0.64 dB
50 dB	-29.99 dB	0.64 dB
52 dB	-31.98 dB	0.64 dB
54 dB	-33.98 dB	0.64 dB
56 dB	-35.99 dB	0.64 dB
58 dB	-38.01 dB	0.64 dB
60 dB	-40.01 dB	0.64 dB
65 dB	-44.98 dB	0.64 dB
70 dB	-49.99 dB	0.64 dB
75 dB	-55.01 dB	0.64 dB
80 dB	-60.02 dB	0.64 dB

校正報告

財團法人台灣電子檢驗中心

工 服NO. 20-02-BCC-060-01L

CALIBRATION REPORT

ELECTRONICS TESTING
CENTER, TAIWAN

Page 16 of 16

Test Description	Actual Value	Expanded Uncertainty
11. Attenuator accuracy Check:		
0 dB	-9.98 dB	0.38 dB
10 dB	0.00 dB(Ref.)	-----
20 dB	10.00 dB	0.38 dB
30 dB	20.01 dB	0.38 dB
40 dB	30.00 dB	0.38 dB
50 dB	40.00 dB	0.38 dB
60 dB	50.01 dB	0.38 dB
70 dB	60.04 dB	0.38 dB
12. Reference level		
switching accuracy		
Reference level Check:		
0 dBm	10.00 dB	0.36 dB
-10 dBm	0.00 dB(Ref.)	-----
-20 dBm	-10.00 dB	0.36 dB
-30 dBm	-20.00 dB	0.36 dB
-40 dBm	-30.01 dB	0.36 dB
-50 dBm	-40.01 dB	0.36 dB
-11 dBm	-1.00 dB	0.36 dB
-12 dBm	-2.00 dB	0.36 dB
-13 dBm	-3.00 dB	0.36 dB
-14 dBm	-4.00 dB	0.36 dB
-15 dBm	-5.00 dB	0.36 dB
-16 dBm	-6.00 dB	0.36 dB
-17 dBm	-7.00 dB	0.36 dB
-18 dBm	-8.00 dB	0.36 dB
-19 dBm	-9.00 dB	0.36 dB

說明:

- 本校正報告內的項次1、2、6、7相對擴充不確定度評估與評估表示係依據「ISO Guide 98-3 量測不確定度表示方式指引」，相對擴充不確定度 $U = ku_c$ 其中 u_c 為相對組合標準不確定度， $k = 2.0$ ，為信賴水準 95 %之涵蓋因子。
本校正報告內的項次3、4、5、8、9、10、11、12擴充不確定度與評估表示係依據「ISO Guide 98-3 量測不確定度表示方式指引」，擴充不確定度 $U = ku_c$ 其中 u_c 為組合標準不確定度， $k = 2.0$ ，為信賴水準 95 %之涵蓋因子。
- 參考ANSI C63.2及CISPR 16-1-1相關規範。

Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



Calibration certificate

ISO 17025
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 5.0065 of 09.01.2015

Certificate number 04-20 Date when calibrated 20.01.20 Page 1 of 2

Item calibrated Conical Horn Antenna QWH-UCRR00 # 924200002

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 8.2-16

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

Authorising
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/ Technical manager Date of issue 20.01.20

Calibration Certificate

Certificate number **04-20**

Page **2** of **2**

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
E4418B/ N8486AR	Power meter	US39251390/ MY52270003	19 November 2020	2978-43	RF Power
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency
G4-161	Signal generator	3	10 July 2020	22-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-11B	Measuring horn antenna	08051	23 September 2021	2370-43	Gain
P6-133	Measuring horn antenna	15005	23 September 2021	2374-43	Gain

Calibration conditions

Temperature: 21.8 °C.

Humidity: 37.0 %.

Pressure: 100.0 kPa.

Calibration results are given in the measurement report # 04-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	33 – 55 GHz	Corresponds
2	Antenna Gain	21* dBi	Corresponds (Table 1)
3	Antenna Factor	43 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.5 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration

/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 5.0065

Address: 6, P. Brovki str., Minsk
220013, Belarus

Phone/Fax: +375 17 2938496



Technical Manager

January 20, 2020

MEASUREMENT REPORT # 04-20

January 20, 2020

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Conical Horn Antenna QWH-UCRR00 # 924200002
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 09.12.2019 to 20.01.2020

MEASUREMENT CONDITIONS

Temperature: 21.8 °C	Humidity: 37 %	Pressure: 100.0 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
E4418B/ N8486AR	Power meter	US39251390/ MY52270003	19 November 2020	2978-43	RF Power
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency
G4-161	Signal generator	3	10 July 2020	22-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-11B	Measuring horn antenna	08051	23 September 2021	2370-43	Gain
P6-133	Measuring horn antenna	15005	23 September 2021	2374-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 2 m.

Table 1

Frequency, GHz	33	44	55
Power density of electromagnetic field, W/m ²	0.022	0.057	0.049
Maximum level of measured power, dBm	-20.0	-16.4	-17.2
Gain, dBi	18.4	20.3	21.3
Expanded uncertainty, dB	2.5	2.5	2.5
Antenna Factor, dB/m	42.2	42.8	42.9

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager




This Measurement report issued in duplicate and sent to:

1. Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
 2. Calibration Laboratory of Microwave Measuring Equipment
- Duplication of Measurement report (complete or partial) must be authorized by the laboratory.

Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



Calibration certificate

ISO 17025
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 5.0065 of 09.01.2015

Certificate number 01-20 Date when calibrated 20.01.20 Page 1 of 2

Item
calibrated Conical Horn Antenna WR15CH_001

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of
calibration GOST 20271.1, MK KL 8.2-16

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

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/ Technical manager Date of issue 20.01.20

Calibration Certificate

Certificate number **01-20**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power Frequency
G4-161	Signal generator	3	10 July 2020	22-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-134	Measuring horn antenna	14002	23 September 2021	2372-43	Gain

Calibration conditions

Temperature: 21.8 °C.
Humidity: 37.0 %.
Pressure: 100.0 kPa.

Calibration results are given in the measurement report # 01-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	50 – 75 GHz	Corresponds
2	Antenna Gain	21* dBi	Corresponds (Table 1)
3	Antenna Factor	46 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.8 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration

/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 5.0065

Address: 6, P. Brovki str., Minsk
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MEASUREMENT REPORT # 01-20

January 20, 2020

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Conical Horn Antenna WR15CH_001
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 09.12.2019 to 20.01.2020

MEASUREMENT CONDITIONS

Temperature: 21.8 °C	Humidity: 37 %	Pressure: 100.0 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power Frequency
G4-161	Signal generator	3	10 July 2020	22-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-134	Measuring horn antenna	14002	23 September 2021	2372-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 1 m.

Table 1

Frequency, GHz	50	55	65	75
Power density of electromagnetic field, W/m ²	0.15	0.18	0.23	0.26
Maximum level of measured power, dBm	-15.0	-14.7	-14.2	-14.2
Gain, dBi	18.7	19.0	20.0	20.5
Expanded uncertainty, dB	2.8	2.8	2.8	2.8
Antenna Factor, dB/m	45.6	46.1	46.5	47.2

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager



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Calibration certificate

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Accreditation certificate No. № BY/112 5.0065 of 09.01.2015

Certificate number 02-20 Date when calibrated 20.01.20 Page 1 of 2

Item calibrated Conical Horn Antenna WR10CH_001

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 8.2-16

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/ Technical manager Date of issue 20.01.20

Calibration Certificate

Certificate number **02-20**

Page **2** of **2**

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power Frequency
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain

Calibration conditions

Temperature: 21.8 °C.

Humidity: 37.0 %.

Pressure: 100.0 kPa.

Calibration results are given in the measurement report # 02-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	75 – 110 GHz	Corresponds
2	Antenna Gain	21* dBi	Corresponds (Table 1)
3	Antenna Factor	49 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 2.8 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
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No. BY/112 5.0065

Address: 6, P. Brovki str., Minsk
220013, Belarus

Phone/Fax: +375 17 2938496



MEASUREMENT REPORT # 02-20

January 20, 2020

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Conical Horn Antenna WR10CH_001
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 09.12.2019 to 20.01.2020

MEASUREMENT CONDITIONS

Temperature: 21.8 °C	Humidity: 37 %	Pressure: 100.0 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
G4-186	Signal generator	5	10 July 2020	23-19	RF Power Frequency
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 0.8 m.

Table 1

Frequency, GHz	75	92.5	110
Power density of electromagnetic field, W/m ²	0.20	0.29	0.37
Maximum level of measured power, dBm	-16.2	-15.5	-15.1
Gain, dBi	19.9	20.6	21.5
Expanded uncertainty, dB	2.8	2.8	2.8
Antenna Factor, dB/m	47.9	49.0	49.6

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager




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Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



Calibration certificate

ISO 17025
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 5.0065 of 09.01.2015

Certificate number 03-20 Date when calibrated 20.01.20 Page 1 of 2

Item calibrated Conical Horn Antenna WR6.5CH_001

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 8.2-16

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/ Technical manager Date of issue 20.01.20

Calibration Certificate

Certificate number **03-20**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
02	Frequency multiplier	02	23 January 2020	02-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain

Calibration conditions

Temperature: 21.8 °C.

Humidity: 37.0 %.

Pressure: 100.0 kPa.

Calibration results are given in the measurement report # 03-20

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	110 – 170 GHz	Corresponds
2	Antenna Gain	21* dBi	Corresponds (Table 1)
3	Antenna Factor	53 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 3.5 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Signature of the person who has performed calibration

/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 5.0065

Address: 6, P. Brovki str., Minsk
220013, Belarus

Phone/Fax: +375 17 2938496



Technical Manager

January 20, 2020

MEASUREMENT REPORT # 03-20

January 20, 2020

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Conical Horn Antenna WR6.5CH_001
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 09.12.2019 to 20.01.2020

MEASUREMENT CONDITIONS

Temperature: 21.8 °C	Humidity: 37 %	Pressure: 100.0 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M3-75	Power meter	002189	12 March 2021	06-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
02	Frequency multiplier	02	23 January 2020	02-19	RF Power Frequency
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-31A	Measuring horn antenna	35864	23 September 2021	2368-43	Gain
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 0.6 m.

Table 1

Frequency, GHz	110	140	170
Power density of electromagnetic field, W/m ²	0.70	0.67	1.0
Maximum level of measured power, dBm	-14.8	-15.6	-14.7
Gain, dBi	19.0	20.5	21.3
Expanded uncertainty, dB	2.8	3.0	3.5
Antenna Factor, dB/m	52.0	52.7	53.5

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager




This Measurement report issued in duplicate and sent to:

1. Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1,
Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.

2. Calibration Laboratory of Microwave Measuring Equipment

Duplication of Measurement report (complete or partial) must be authorized by the laboratory.

Calibration Laboratory of Microwave Measuring Equipment
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Calibration certificate

ISO 17025
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Accreditation certificate No. № BY/112 02.5.0.0065 of 09.01.2015

Certificate number 73-19 Date when calibrated 09.12.19 Page 1 of 2

Item calibrated Conical Horn Antenna WR5.1CH_001

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 8.2-16

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

Authorising
signature



/ Technical manager Date of issue 09.12.19

Calibration Certificate

Certificate number **73-19**

Page **2** of **2**

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
M 523	Reference power meter	162	20 December 2019	21/7/2/13	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-32	Measuring horn antenna	115671	18 May 2020	405-43	Gain

Calibration conditions

Temperature: 21.7 °C.

Humidity: 42.0 %.

Pressure: 100.2 kPa.

Calibration results are given in the measurement report # 73-19

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	140 – 220 GHz	Corresponds
2	Antenna Gain	21* dBi	Corresponds (Table 1)
3	Antenna Factor	54 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 3.0 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 02.5.0.0065

Address: 6, P. Brovki str., Minsk

220013, Belarus

Phone/Fax: +375 17 2938496



Technical Manager

December 9, 2019

MEASUREMENT REPORT # 73-19

December 9, 2019

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Conical Horn Antenna WR5.1CH_001
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 29.11.2019 to 09.12.2019

MEASUREMENT CONDITIONS

Temperature: 21.7 °C	Humidity: 42 %	Pressure: 100.2 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
M 523	Reference power meter	162	20 December 2019	21/7/2/13	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-32	Measuring horn antenna	115671	23 September 2021	2369-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 0.50 m.

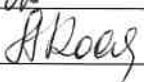
Table 1

Frequency, GHz	140	180	220
Power density of electromagnetic field, W/m ²	0.969	0.145	0.114
Maximum level of measured power, dBm	-16.12	-24.51	-26.55
Gain, dBi	18.4	20.4	21.2
Expanded uncertainty, dB	2.2	2.4	3.0
Antenna Factor, dB/m	54.8	54.3	55.9

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager

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Accreditation certificate No. № BY/112 02.5.0.0065 of 09.01.2015

Certificate number 75-19 Date when calibrated 09.12.19 Page 1 of 2

Item calibrated Diagonal Horn Antenna WR3.4DH_001

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 8.2-16

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

Authorising
signature



/ Technical manager Date of issue 09.12.19

Calibration Certificate

Certificate number **75-19**

Page 2 of 2

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
03	Frequency multiplier	03	23 January 2020	03-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-137	Measuring horn antenna	15001	18 May 2020	406-43	Gain

Calibration conditions

Temperature: 21.7 °C.

Humidity: 42.0 %.

Pressure: 100.2 kPa.

Calibration results are given in the measurement report # 75-19

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	220 – 330 GHz	Corresponds
2	Antenna Gain	21* dBi	Corresponds (Table 1)
3	Antenna Factor	55 dB/m	Corresponds (Table 1)

* – Expanded uncertainty of measurements 3.5 dB.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 02.5.0.0065

Address: 6, P. Brovki str., Minsk

220013, Belarus

Phone/Fax: +375 17 2938496



MEASUREMENT REPORT # 75-19

December 9, 2019

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Diagonal Horn Antenna WR3.4DH_001
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 29.11.2019 to 09.12.2019

MEASUREMENT CONDITIONS

Temperature: 21.7 °C	Humidity: 42 %	Pressure: 100.2 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power Frequency
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
03	Frequency multiplier	03	23 January 2020	03-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
P6-137	Measuring horn antenna	15001	23 September 2021	2373-43	Gain

MEASUREMENT RESULTS

Distance between tested and generating antenna 0.50 m.

Table 1

Frequency, GHz	220	275	330
Power density of electromagnetic field, W/m ²	0.331	0.395	0.446
Maximum level of measured power, dBm	-21.36	-21.10	-21.34
Gain, dBi	21.7	23.1	23.9
Expanded uncertainty, dB	3.0	3.5	3.5
Antenna Factor, dB/m	55.3	55.8	56.6

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager



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Calibration certificate

ISO 17025
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 02.5.0.0065 of 09.01.2015

Certificate number 72-19 Date when calibrated 09.12.19 Page 1 of 2

Item
calibrated

Spectrum Analyzer Extension Module SAX 375 (N9029AV05)
US53250017

Customer

Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of
calibration

GOST 20271.1, MK KL 8.2-16

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Authorising
signature



/ Technical manager Date of issue 09.12.19

Calibration Certificate

Certificate number **72-19**

Page **2** of **2**

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
M 523	Reference power meter	162	20 December 2019	21/7/2/13	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency
E4407B	Spectrum analyzer	MY45110807	03 September 2020	2166-43	RF Power AC Voltage Frequency
LDPW-162-212	Diplexer – isolation of input and output signals	01504	22 November 2020	04-18	Attenuation

Calibration conditions

Temperature: 21.7 °C.

Humidity: 42.0 %.

Pressure: 100.2 kPa.

Calibration results are given in the measurement report # 72-19

#	Parameter	Specifications required	Specifications tested and measured
1	RF Frequency Band	140 – 220 GHz	Corresponds
2	Multiplication Factor	24	Corresponds
3	Low Freq. LO Input Power (Typical / Damage)	10 dBm ± 3dB / 20 dBm	Corresponds
4	LO Input Standard Frequency Range	5.83 – 9.17 GHz	Corresponds
5	RF Power Limits: Compression / Damage	-10 / 0 dBm	Corresponds
6	Typical SSB Conversion Loss (configuration “B”)	-2* dB	Corresponds (Table 1)
7	Typical SSB Conversion Loss (configuration “A”)	12** dB	Corresponds (Table 1)
8	IF Output Standard Frequency Range	16 kHz – 2.5 GHz	Corresponds

* – Expanded uncertainty of measurements 3.0 dB (IF Frequency 400 MHz).

** – Expanded uncertainty of measurements 3.5 dB (IF Frequency 400 MHz).

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 02.5.0.0065

Address: 6, P. Brovki str., Minsk

220013, Belarus

Phone/Fax: +375 17 2938496



MEASUREMENT REPORT # 72-19

December 9, 2019

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Spectrum Analyzer Extension Module SAX 375 (N9029AV05) # US53250017
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 29.11.2019 to 09.12.2019

MEASUREMENT CONDITIONS

Temperature: 21.7 °C	Humidity: 42 %	Pressure: 100.2 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
M 523	Reference power meter	162	20 December 2019	21/7/2/13	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency
E4407B	Spectrum analyzer	MY45110807	03 September 2020	2166-43	RF Power AC Voltage Frequency
LDPW-162-212	Diplexer – isolation of input and output signals	01504	22 November 2020	04-18	Attenuation

MEASUREMENT RESULTS

SSB conversion loss RF to IF port for an LO input power of 10 dBm in Standard LO Frequency operation. IF power measured from “IF Output” port with IF frequency fixed at 400 MHz.

Table 1

RF frequency, GHz		140	180	220
RF input power, dBm		-20.0	-20.0	-20.0
LO frequency, MHz		5 850	7 516	9 183
LO input power, dBm		10.0	10.0	10.0
IF frequency, MHz		400.0		
Configuration B: Block Down-Conversion (Low Frequency LO Input)	IF measured level, dBm	-21.9	-18.7	-18.6
	Conversion loss, dB	1.9	-1.3	-1.4
	Expanded uncertainty, dB	3.0	3.0	3.0
Configuration A: Spectrum Analyzer Extension	IF measured level, dBm	-32.0	-32.6	-32.9
	Conversion loss, dB	12.0	12.6	12.9
	Expanded uncertainty, dB	3.5	3.5	3.5

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager



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1. Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
2. Calibration Laboratory of Microwave Measuring Equipment

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Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



Calibration certificate

ISO 17025
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Accreditation certificate No. № BY/112 02.5.0.0065 of 09.01.2015

Certificate number 74-19 Date when calibrated 09.12.19 Page 1 of 2

Item calibrated Spectrum Analyzer Extension Module SAX 376 (N9029AV03)
US53250019

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 8.2-16

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Authorising
signature



/ Technical manager Date of issue 09.12.19

Calibration Certificate

Certificate number **74-19**

Page **2** of **2**

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
03	Frequency multiplier	03	23 January 2020	03-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency
E4407B	Spectrum analyzer	MY45110807	03 September 2020	2166-43	RF Power AC Voltage Frequency
LDPW-162-212	Diplexer – isolation of input and output signals	01504	22 November 2020	04-18	Attenuation

Calibration conditions

Temperature: 21.7 °C.

Humidity: 42.0 %.

Pressure: 100.2 kPa.

Calibration results are given in the measurement report # 74-19

#	Parameter	Specifications required	Specifications tested and measured
1	RF Frequency Band	220 - 330 GHz	Corresponds
2	Multiplication Factor	48	Corresponds
3	Low Freq. LO Input Power (Typical / Damage)	10 dBm $\pm$ 3dB / 20 dBm	Corresponds
4	LO Input Standard Frequency Range	4.59 – 6.78 GHz	Corresponds
5	RF Power Limits: Compression / Damage	-20 / -10 dBm	Corresponds
6	Typical SSB Conversion Loss (configuration "B")	1* dB	Corresponds (Table 1)
7	Typical SSB Conversion Loss (configuration "A")	2** dB	Corresponds (Table 1)
8	IF Output Standard Frequency Range	16 kHz – 2.5 GHz	Corresponds

* – Expanded uncertainty of measurements 3.0 dB (IF Frequency 400 MHz).

** – Expanded uncertainty of measurements 3.5 dB (IF Frequency 400 MHz).

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration



/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 02.5.0.0065

Address: 6, P. Brovki str., Minsk

220013, Belarus

Phone/Fax: +375 17 2938496



December 9, 2019

MEASUREMENT REPORT # 74-19

December 9, 2019

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	Spectrum Analyzer Extension Module SAX 376 (N9029AV03) # US53250019
Method of calibration:	GOST 20271.1, MK KL 8.2-16
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 29.11.2019 to 09.12.2019

MEASUREMENT CONDITIONS

Temperature: 21.7 °C	Humidity: 42 %	Pressure: 100.2 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
03	Frequency multiplier	03	23 January 2020	03-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency
E4407B	Spectrum analyzer	MY45110807	03 September 2020	2166-43	RF Power AC Voltage Frequency
LDPW-162-212	Diplexer – isolation of input and output signals	01504	22 November 2020	04-18	Attenuation

MEASUREMENT RESULTS

SSB conversion loss RF to IF port for an LO input power of 10 dBm in Standard LO Frequency operation. IF power measured from “IF Output” port with IF frequency fixed at 400 MHz.

Table 1

RF frequency, GHz		220	275	330
RF input power, dBm		-25.0	-25.0	-25.0
LO frequency, MHz		4 592	5 738	6 779
LO input power, dBm		10.0	10.0	10.0
IF frequency, MHz		400.0		
Configuration B: Block Down-Conversion (Low Frequency LO Input)	IF measured level, dBm	-25.9	-24.8	-26.8
	Conversion loss, dB	0.9	0.2	1.8
	Expanded uncertainty, dB	3.0	3.0	3.0
Configuration A: Spectrum Analyzer Extension	IF measured level, dBm	-30.4	-26.0	-29.2
	Conversion loss, dB	5.4	1.0	4.2
	Expanded uncertainty, dB	3.5	3.5	3.5

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager



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2. Calibration Laboratory of Microwave Measuring Equipment

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工服 NO. 20-06-BCC-176-02L

財團法人台灣電子檢驗中心



收件日期: Jun.11,2020

校正報告

CALIBRATION REPORT

Receipt Date

發行日期: Jun.20,2020

ELECTRONICS TESTING CENTER, TAIWAN

Report Issue Date

Page 1 of 6

顧客名稱 香港商立德國際商品試驗有限公司桃園分公司

Customer

顧客地址 新竹市科學園區力行一路1號E-2

Address

供校儀器 ITEM CALIBRATED

儀器名稱: PSG Analog Signal Generator

Nomenclature

製造商: KEYSIGHT

Manufacturer

型別: E8257D

Model No.

識別號碼: MY53401987

ID. No.

上述儀器經本實驗室校正，結果如內文。未經本實驗室書面許可，不得部份複製本報告，完整複製則不在此限。

The above instruments were calibrated by the laboratory and please refer to the content for the calibration results. This report may not be reproduced in part without the written permission of the laboratory, except for full reproduction.

校正資料: ☒ 僅量測 ☐ 調整

Calibration Information Calibration Only Adjusted

環境狀態: 環境溫度: (23 ± 2) °C, 相對濕度: (50 ± 10) %

Environmental Conditions

校正日期: Jun.17,2020

Calibration Date

建議再校日期: Jun.16,2021

註: 建議再校日期為應顧客要求列入。

Recommended Recalibration Date

Note: The recommended recalibration date is agreed by the customer.

校正地點: 財團法人台灣電子檢驗中心校正實驗室

Laboratory Location

實驗室名稱地址: ☒ 1. 校正實驗室 33383 桃園市龜山區文明路29巷8號 TEL:+886-3-3280026

Laboratory Name and 2. 新竹校正實驗室 30075 新竹市科學園區區區二路47號205室 TEL:+886-3-5798806

Address 3. 台中校正實驗室 40766 台中市西屯區福中二街8號2樓之2 TEL:+886-4-23584899

4. 台南校正實驗室 70248 台南市南區新和二路5號 TEL:+886-6-2925787#50,51

財團法人台灣電子檢驗中心特此證明報告內記載之受校儀器已與下方標準做過比較校正，用以校正之標準器可追溯至中華民國國家度量衡標準實驗室，美國標準及技術研究院，或其它國家之度量衡國家標準。本中心的校正服務均符合ISO/IEC 17025之規定。

ETC hereby certifies that the equipment noted herein has been compared with the below listed standards. The Standards used to perform this calibration are traceable to NML/ROC,NIST/USA or other countries. The calibration services from ETC are capable of performing services in compliance with the requirements of ISO/IEC 17025.

財團法人台灣電子檢驗中心

ELECTRONICS TESTING CENTER,
TAIWAN

實驗室主管

Laboratory Head

報告簽署人

Signature



使用校正依據 CALIBRATION PROCEDURE USED

1. 「信號產生器校正程序書」，B00-CD-369，4th Edition。

使用標準器及附配件 STANDARD AND ACCESSORIES USED

儀器名稱【廠牌/型號】 Nomenclature【Mfg./Model No.】	校正單位(認可編號) Cal. Source(ACRED Code)	報告號碼 Cal. Report No.	校正日期 Date Cal.	有效日期 Due Date
EPM Series Power Meter 【HP E4419B】 【13050609-001】	NML(TAF N0688)	U190100A	2019/07/24	2021/01/23
Avg Power Sensor 【AGILENT E9304A】 【13053522-001】	KEYSIGHT(ANAB AC-1498)	1-11911589470-1	2019/11/15	2022/05/14
Power Sensor 【R&S/NRP-Z56】 【13053525-001】	R&S(DAKKS D-K-15195-01-00)	0260/D-K-15195-01-00	2017/09/11	2021/03/10
Measuring Receiver 【R&S FSMR】 【13054413-001】	R&S(DAKKS D-K-15195-01-00)	438369/D-K-15195-01-01	2017/11/16	2021/05/15
Universal Counter 【HP 53132A】 【13060804-001】	ETC(TAF 0025)	19-12-BAC-630-02L	2020/01/03	2020/07/02
Frequency Counter 【AGILENT 53152A】 【13060808-001】	KEYSIGHT(ANAB AC-1498)	1-11246338304-1	2019/05/09	2022/11/08

校正報告

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工 服NO.20-06-BCC-176-02L

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1. Frequency Accuracy Check:

Reading	Standard	Expanded Uncertainty
250.0000 kHz	249.99998990 kHz	1.0×10^{-9}
1.000000 MHz	99.999996117 kHz	8.8×10^{-10}
10.000000 MHz	9.999995995 MHz	8.2×10^{-10}
100.000000 MHz	99.999995977 MHz	8.1×10^{-10}
200.000000 MHz	199.99999195 MHz	8.1×10^{-10}
500.000000 MHz	499.99997987 MHz	8.1×10^{-10}
1.000000000 GHz	999.99995975 MHz	8.1×10^{-10}
2.000000000 GHz	1.9999999195 GHz	8.1×10^{-10}
5.000000000 GHz	4.999999799 GHz	8.2×10^{-10}
10.000000000 GHz	9.999999598 GHz	8.1×10^{-10}
20.000000000 GHz	19.999999195 GHz	8.1×10^{-10}
30.000000000 GHz	29.999998794 GHz	8.1×10^{-10}
40.000000000 GHz	39.999998397 GHz	8.1×10^{-10}
46.000000000 GHz	45.999998196 GHz	8.1×10^{-10}

2. Output Level And Frequency Response Accuracy Check:

Test Freq.	Setting(dBm)	Measured(dBm)	Expanded Uncertainty(dB)
250.0000 kHz	0.00	0.06	0.10
1.000000 MHz	0.00	-0.03	0.10
10.000000 MHz	0.00	-0.05	0.10
100.000000 MHz	0.00	-0.05	0.10
200.000000 MHz	0.00	-0.04	0.09
500.000000 MHz	0.00	-0.02	0.11
1.000000000 GHz	0.00	-0.05	0.09
2.000000000 GHz	0.00	0.01	0.15
3.000000000 GHz	0.00	-0.03	0.21
4.000000000 GHz	0.00	-0.00	0.27
5.000000000 GHz	0.00	-0.01	0.15
6.000000000 GHz	0.00	-0.02	0.11
7.000000000 GHz	0.00	-0.02	0.12
8.000000000 GHz	0.00	-0.04	0.11
9.000000000 GHz	0.00	-0.03	0.11
10.000000000 GHz	0.00	-0.04	0.11
11.000000000 GHz	0.00	-0.04	0.16
12.000000000 GHz	0.00	-0.06	0.16
13.000000000 GHz	0.00	0.01	0.16
14.000000000 GHz	0.00	-0.11	0.16
15.000000000 GHz	0.00	-0.07	0.16
16.000000000 GHz	0.00	-0.04	0.16
17.000000000 GHz	0.00	-0.07	0.16
18.000000000 GHz	0.00	-0.23	0.16

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2. Output Level And Frequency Response Accuracy Check: (Continued)

Test Freq.	Setting(dBm)	Measured(dBm)	Expanded Uncertainty(dB)
19.000000000 GHz	0.00	-0.37	0.16
20.000000000 GHz	0.00	-0.61	0.16
21.000000000 GHz	0.00	-0.24	0.18
22.000000000 GHz	0.00	-0.10	0.18
23.000000000 GHz	0.00	-0.06	0.18
24.000000000 GHz	0.00	-0.08	0.18
25.000000000 GHz	0.00	-0.10	0.18
26.000000000 GHz	0.00	-0.06	0.18
27.000000000 GHz	0.00	-0.10	0.18
28.000000000 GHz	0.00	-0.08	0.18
29.000000000 GHz	0.00	-0.11	0.18
30.000000000 GHz	0.00	-0.25	0.18
31.000000000 GHz	0.00	-0.06	0.21
32.000000000 GHz	0.00	-0.02	0.21
33.000000000 GHz	0.00	-0.15	0.21
34.000000000 GHz	0.00	0.03	0.21
35.000000000 GHz	0.00	0.02	0.21
36.000000000 GHz	0.00	-0.06	0.21
37.000000000 GHz	0.00	0.02	0.22
38.000000000 GHz	0.00	0.01	0.22
39.000000000 GHz	0.00	-0.10	0.21
40.000000000 GHz	0.00	0.08	0.21
41.000000000 GHz	0.00	0.07	0.38
42.000000000 GHz	0.00	-0.19	0.38
43.000000000 GHz	0.00	-0.31	0.38
44.000000000 GHz	0.00	-0.14	0.38
45.000000000 GHz	0.00	-0.15	0.38
46.000000000 GHz	0.00	-0.35	0.38
47.000000000 GHz	0.00	-0.34	0.38
48.000000000 GHz	0.00	-0.24	0.38
49.000000000 GHz	0.00	-0.40	0.38
50.000000000 GHz	0.00	-0.36	0.38
100.000000 MHz	10.00	9.98	0.62
100.000000 MHz	-10.00	-10.05	0.62
100.000000 MHz	-20.00	-20.07	0.62
100.000000 MHz	-30.00	-30.12	0.62
100.000000 MHz	-40.00	-40.12	0.62
100.000000 MHz	-50.00	-50.09	0.62
100.000000 MHz	-60.00	-60.09	0.62
100.000000 MHz	-70.00	-70.10	0.62
100.000000 MHz	-80.00	-80.10	0.62
100.000000 MHz	-90.00	-90.11	0.62

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2. Output Level And Frequency Response Accuracy Check: (Continued)

Test Freq.	Setting(dBm)	Measured(dBm)	Expanded Uncertainty(dB)
100.000000 MHz	-100.00	-100.11	0.62
1.000000000 GHz	10.00	10.01	0.62
1.000000000 GHz	-10.00	-10.10	0.62
1.000000000 GHz	-20.00	-20.12	0.62
1.000000000 GHz	-30.00	-30.16	0.62
1.000000000 GHz	-40.00	-40.16	0.62
1.000000000 GHz	-50.00	-50.13	0.62
1.000000000 GHz	-60.00	-60.12	0.62
1.000000000 GHz	-70.00	-70.13	0.62
1.000000000 GHz	-80.00	-80.10	0.62
1.000000000 GHz	-90.00	-90.11	0.62
1.000000000 GHz	-100.00	-100.11	0.62
10.000000000 GHz	10.00	9.98	0.65
10.000000000 GHz	-10.00	-10.01	0.65
10.000000000 GHz	-20.00	-20.03	0.65
10.000000000 GHz	-30.00	-30.04	0.65
10.000000000 GHz	-40.00	-40.04	0.65
10.000000000 GHz	-50.00	-50.13	0.65
10.000000000 GHz	-60.00	-60.13	0.65
10.000000000 GHz	-70.00	-70.11	0.65
10.000000000 GHz	-80.00	-80.13	0.65
10.000000000 GHz	-90.00	-90.17	0.65
10.000000000 GHz	-100.00	-100.24	0.65
20.000000000 GHz	10.00	9.37	0.68
20.000000000 GHz	-10.00	-10.61	0.68
20.000000000 GHz	-20.00	-20.59	0.68
20.000000000 GHz	-30.00	-30.72	0.68
20.000000000 GHz	-40.00	-40.71	0.68
20.000000000 GHz	-50.00	-50.99	0.68
20.000000000 GHz	-60.00	-60.99	0.68
20.000000000 GHz	-70.00	-71.00	0.68
20.000000000 GHz	-80.00	-81.01	0.68
20.000000000 GHz	-90.00	-91.00	0.68
20.000000000 GHz	-100.00	-101.04	0.68

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財團法人台灣電子檢驗中心

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3. Harmonic Distortion Measurement Check:

Test Freq.	Harmonic(dBc)	Expanded Uncertainty(dB)
250.0000 kHz	-31.2	0.69
1.00000 MHz	-34.4	0.69
10.0000 MHz	-39.7	0.69
100.0000 MHz	-66.7	0.69
500.0000 MHz	-37.2	0.69
1.000000000 GHz	-39.0	0.69
5.000000000 GHz	-54.5	1.3
10.000000000 GHz	-67.6	1.9
20.000000000 GHz	-65.5	1.9

4. 10 MHz Ref. Out. Frequency Accuracy Check:

Reading(MHz)	Standard(MHz)	Expanded Uncertainty
10	9.9999995953	8.7×10^{-10}

說明:

- 項次1、4校正報告內的相對擴充不確定度評估與表示是依據「ISO Guide 98-3量測不確定度表示方式指引」，相對擴充不確定度 $U = ku_c$ ，其中 u_c 為相對組合標準不確定度， $k = 2.0$ ，為信賴水準約95 %之涵蓋因子。
- 項次2、3校正報告內的擴充不確定度評估與表示是依據「ISO Guide 98-3量測不確定度表示方式指引」，擴充不確定度 $U = ku_c$ ，其中 u_c 為組合標準不確定度， $k = 2.0$ ，為信賴水準約95 %之涵蓋因子。

Calibration Laboratory of Microwave Measuring Equipment
of MWMLab



Calibration certificate

ISO 17025
ACCREDITED LABORATORY



Accreditation certificate No. № BY/112 02.5.0.0065 of 09.01.2015

Certificate number 71-19 Date when calibrated 09.12.19 Page 1 of 2

Item calibrated VDI Power Meter PM5 # 431V

Customer Bureau Veritas Group Consumer Products Services Division, Taiwan
Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300,
Taiwan, R.O.C.

Method of calibration GOST 20271.1, MK KL 04.3-2014

All measurements are traceable to the SI units which are realized by national measurement standards of NMI and state standards of RF. Conversion loss measurements above 178 GHz are to confirm operation functionality and traceable only to MWMLab standards and OML. This certificate shall not be reproduced, except in full. Any publication extracts from the calibration certificate requires written permission of the issuing calibration laboratory of microwave measuring equipment.

Authorising
signature



/ Technical manager Date of issue 09.12.19

Calibration Certificate

Certificate number **71-19**

Page **2** of **2**

Calibration is performed by using

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
M 523	Reference power meter	162	20 December 2019	21/7/2/13	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
03	Frequency multiplier	03	23 January 2020	03-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency

Calibration conditions

Temperature: 21.7 °C.
Humidity: 42.0 %.
Pressure: 100.2 kPa.

Calibration results are given in the measurement report # 71-19

#	Parameter	Specifications required	Specifications tested and measured
1	Frequency range	110 – 330 GHz	Corresponds
2	Waveguide	WR-10	Corresponds
3	Input Loss	0.15 – 0.30 dB	Corresponds (Table 1)
4	Typical RF accuracy	5* %	Corresponds (Table 1)

Expanded uncertainty of measurements: * – 15 %.

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Signature of the person who has performed calibration

/ Engineer

**Calibration Laboratory of
Microwave Measuring Equipment**

Accreditation certificate

No. BY/112 02.5.0.0065

Address: 6, P. Brovki str., Minsk
220013, Belarus

Phone/Fax: +375 17 2938496



Technical Manager

December 9, 2019

MEASUREMENT REPORT # 71-19

December 9, 2019

Customer:	Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
Item calibrated:	VDI Power Meter PM5 # 431V
Method of calibration:	GOST 20271.1, MK KL 04.3-2014
Number of samples:	One
Delivery date of the sample:	29.11.2019
Date of calibration:	From 29.11.2019 to 09.12.2019

MEASUREMENT CONDITIONS

Temperature: 21.7 °C	Humidity: 42 %	Pressure: 100.2 kPa
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MEASUREMENT EQUIPMENT

Model	Model Description	Equipment ID	Cal Due Date	Certificate Number	Trace Value
M 514	Reference power meter	165	22 December 2019	21/7/2/17	RF Power
M 523	Reference power meter	162	20 December 2019	21/7/2/13	RF Power
02	Frequency multiplier	02	23 January 2020	02-19	RF Power
03	Frequency multiplier	03	23 January 2020	03-19	RF Power
RG4-14	Signal generator	22	10 July 2020	24-19	RF Power
V7-34	Universal voltmeter	0067787	27 September 2020	1994-42	DC Voltage
RCH3-72	Frequency meter	931200	13 September 2020	2261-43	Frequency
MG3694C	Signal generator	133805	21 August 2020	2066-43	RF Power Frequency

MEASUREMENT RESULTS

Table 1

Frequency, GHz	110	220	330
Reference power, dBm	1.000	1.000	1.000
Measured power, dBm	0.981	0.962	0.940
Power measurement error, %	1.8	4	6
Expanded uncertainty, %	7.2	10	15

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported 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 %. This probability corresponds to a coverage factor of $k=2$ for a normal distribution.

Engineer

Quality Manager




This Measurement report issued in duplicate and sent to:

1. Bureau Veritas Group Consumer Products Services Division, Taiwan Branch E-2, No.1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan, R.O.C.
2. Calibration Laboratory of Microwave Measuring Equipment

Duplication of Measurement report (complete or partial) must be authorized by the laboratory.