

Partial EN 300 328 RF Test Report

Report No.: RE180620D13

Test Model: Calliope Mini

Received Date: Jun. 20, 2018

Test Date: Jul. 23, 2018

Issued Date: Sep. 27, 2018

Applicant: Calliope gGmbH

Address: Raumerstraße 11; 10437 Berlin

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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(R.O.C.)



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Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Summary of Test Results	5
2.1 Test Instruments	6
2.2 Measurement Uncertainty	7
2.3 Maximum Measurement Uncertainty	7
2.4 Modification Record	7
3 General Information	8
3.1 General Description of EUT	8
3.2 Description of Test Modes	9
3.2.1 Test Mode Applicability and Tested Channel Detail	10
3.3 Description of Support Units	11
3.3.1 Configuration of System under Test	11
3.4 General Description of Applied Standards	11
4 Test Procedure and Results	12
Transmitter Parameters	12
4.1.1 Test Results	12
Receiver Parameters	13
4.2 Receiver Spurious Radiation	13
4.2.1 Limit of Receiver Spurious Radiation	13
4.2.2 Test Procedure	13
4.2.3 Deviation from Test Standard	13
4.2.4 Test Setup	13
4.2.5 Test Results	14
5 Photographs of the Test Configuration	15
Appendix - Information on the Testing Laboratories	16

Release Control Record

Issue No.	Description	Date Issued
RE180620D13	Original release.	Sep. 27, 2018

1 Certificate of Conformity

Product: Calliope Mini
Brand: Calliope gGmbh
Test Model: Calliope Mini
Sample Status: Engineering Sample
Applicant: Calliope gGmbH
Test Date: Jul. 23, 2018
Standards: EN 300 328 V2.1.1 (2016-11)
Test Item: Transmitter Unwanted Emissions in the Spurious Domain (Clause 4.3.2.9)
Receiver Spurious Emissions (Clause 4.3.2.10)

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Jessica Cheng , **Date:** Sep. 27, 2018
Jessica Cheng / Senior Specialist

Approved by : Rex Lai , **Date:** Sep. 27, 2018
Rex Lai / Associate Technical Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V2.1.1		
Clause	Test Parameter	Results
	Transmitter Parameters	
4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	Pass
	Receiver Parameters	
4.3.2.10	Receiver Spurious Emissions	Pass

- Note: 1. This report is supplementary report.
2. Only test item of Spurious Emissions tests were performed for this report. Other testing data please refer to other report.

2.1 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2944A10505	Feb. 22, 2018	Feb. 21, 2019
HP Preamplifier	8449B	3008A01886	Feb. 22, 2018	Feb. 21, 2019
HP Preamplifier	8449B	3008A01887	Feb. 22, 2018	Feb. 21, 2019
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2018	Feb. 20, 2019
ROHDE & SCHWARZ Spectrum Analyzer	FSP 40	100036	Jun. 5, 2018	Jun. 4, 2019
ROHDE & SCHWARZ Spectrum Analyzer	FSV 40	101042	Sep. 29, 2017	Sep. 28, 2018
ROHDE & SCHWARZ Signal Generator	SMR 40	100231	Jun. 27, 2018	Jun. 26, 2019
Tektronix Oscilloscope	TDS1012	C019167	Jan. 8, 2018	Jan. 7, 2019
KEYSIGHT MXG Vector Signal Generator	N5182B	MY53052658	May 24, 2018	May 23, 2019
Schwarzbeck Antenna	VULB9168	139	Nov. 29, 2017	Nov. 28, 2018
EMCO Horn Antenna	3117	00034127	Dec. 1, 2017	Nov. 30, 2018
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 1, 2017	Nov. 30, 2018
Temperature & Humidity Chamber	MHU-225AU	920409	May 25, 2018	May 24, 2019
ADT. Controll	ADT100	0301	NA	NA
ADT. Turn Table	TT100	0301	NA	NA
ADT. Tower	AT100	0301	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
TIMES RF cable With 10dB PAD	LMR-600	CABLE-RF-01	Mar. 16, 2018	Mar. 15, 2019
SUHNER RF cable With 10dB PAD	SF 104	CABLE-RF-01	Aug. 14, 2017	Aug. 13, 2018
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	Jun. 4, 2018	Jun. 3, 2019
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260		
ROHDE & SCHWARZ Wireless Connection Tester	CMW270	101075	Jan. 31, 2018	Jan. 30, 2019
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
Highpass filter SUHNER	11SH10-7000/T18000-O/OP	SN 4	NA	NA

- NOTE:**
1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 3. The test was performed in Chia Pau RF Chamber.

2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 1.132 \times 10^{-4} \%$
RF output power, conducted	± 1.371 dB
Power Spectral Density, conducted	± 1.371 dB
All emissions, radiated	± 3.294 dB
Temperature	± 0.23 °C
Supply voltages	± 0.3 %
Time	± 2.53 %

2.3 Maximum Measurement Uncertainty

For the test methods, according to EN 300 328 standard, the measurement uncertainty figures shall be calculated in accordance with ETR 100 028-1 [4] and shall correspond to an expansion factor (coverage factor) $k = 1,96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	± 5 %
RF output power, conducted	$\pm 1,5$ dB
Power Spectral Density, conducted	± 3 dB
All emissions, radiated	± 6 dB
Temperature	± 1 °C
Supply voltages	± 3 %
Time	± 5 %

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Calliope Mini
Brand	Corsair
Test Model	Calliope Mini
Status of EUT	Engineering sample
Nominal Voltage	3Vdc from Battery holder, 5Vdc from from USB interface
Normal Testing Voltage	5Vdc
Temperature Operating Range	-25~75°C
Modulation Type	GFSK
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Antenna Type	Inverted F antenna with 3.3dBi gain
Antenna Connector	N/A
Accessory Device	Battery holder
Data Cable Supplied	USB cable (0.15m)

Note:

1. The EUT with Bluetooth technology.

2. The EUT was pre-tested with the following modes:

- ✧ EUT Operating + power from Notebook
- ✧ EUT Operating + power from Battery holder

The worst emission level was found when the EUT tested under **EUT Operating + power from Notebook.**

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

40 channels are provided to this EUT:

Channel	FREQ. (MHz)	Channel	FREQ. (MHz)	Channel	FREQ. (MHz)	Channel	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to		Description
	SE< 1G	SE≥ 1G	
-	√	√	EUT Operating + power from Notebook

Where **SE<1G**: Spurious Emissions below 1GHz
SE≥1G: Spurious Emissions above 1GHz

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Unwanted Emissions in the Spurious Domain Test (Below 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0	GFSK	1

Unwanted Emissions in the Spurious Domain Test (above 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 39	GFSK	1

Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
SE<1G	29 deg. C, 77% RH	230Vac, 50Hz(System)	Ian Chang
SE≥1G	29 deg. C, 77% RH	230Vac, 50Hz(System)	Ian Chang

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

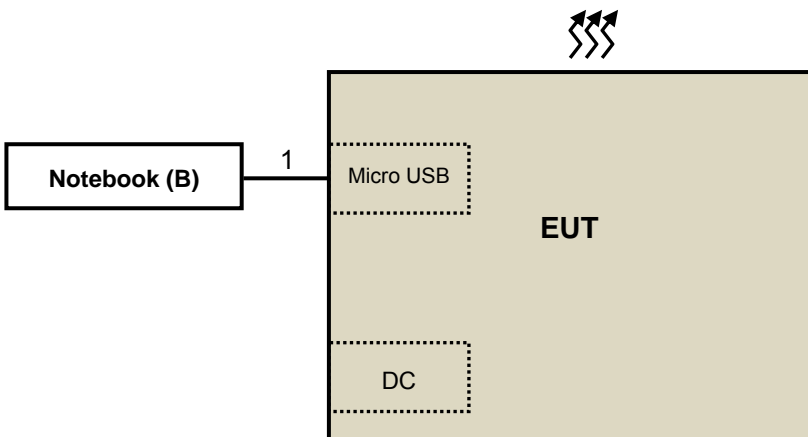
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook PC	Lenovo	80WG	YD01YRC9	FCC DoC Approved	Provided by Lab

Note: All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	0.15	Y	0	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 300 328 V2.1.1 (2016-11)

All test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

Transmitter Parameters

4.1.1 Test Results

BELOW 1GHz WORST-CASE DATA

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
48.07	H	-73.14	-54.00	-19.14
49.28	V	-65.86	-54.00	-11.86
105.42	V	-74.30	-54.00	-20.30
105.54	H	-64.58	-54.00	-10.58
157.56	V	-71.47	-36.00	-35.47
157.80	H	-73.44	-36.00	-37.44
236.37	H	-79.89	-36.00	-43.89
237.09	V	-75.78	-36.00	-39.78
277.11	V	-78.88	-36.00	-42.88
279.65	H	-75.32	-36.00	-39.32
413.63	V	-78.24	-36.00	-42.24
541.19	V	-75.32	-54.00	-21.32
600.00	H	-74.14	-54.00	-20.14
702.45	H	-76.72	-54.00	-22.72

ABOVE 1GHz DATA

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4803.79	H	-42.56	-30.00	-12.56
	4804.18	V	-48.34	-30.00	-18.34
39	4959.65	H	-46.20	-30.00	-16.20
	4959.81	V	-50.82	-30.00	-20.82

Receiver Parameters

4.2 Receiver Spurious Radiation

4.2.1 Limit of Receiver Spurious Radiation

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz ~ 1 GHz	-57dBm	100kHz
1 GHz ~ 12.75 GHz	-47dBm	1MHz

4.2.2 Test Procedure

Refer to chapter 5.4.10 of EN 300 328 V2.1.1.

Measurement Method	
<input type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u></p> <p>The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p>	
<p><u>Conducted measurement (For equipment with multiple transmit chains):</u></p> <p><input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.</p> <p><input type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log(N)$ (number of active transmit chains)</p>	

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The measurement was performed at normal environmental conditions only. Controlling software has been activated to set the EUT on specific status.

4.2.5 Test Results

RX BELOW 1GHz WORST-CASE DATA

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
35.70	H	-71.05	-57.00	-14.05
49.16	V	-66.19	-57.00	-9.19
105.30	V	-73.90	-57.00	-16.90
105.66	H	-64.09	-57.00	-7.09
156.34	H	-72.41	-57.00	-15.41
157.68	V	-71.15	-57.00	-14.15
236.61	V	-75.08	-57.00	-18.08
237.09	H	-77.97	-57.00	-20.97
278.20	H	-75.11	-57.00	-18.11
278.32	V	-78.04	-57.00	-21.04
440.19	V	-78.75	-57.00	-21.75
534.64	V	-74.47	-57.00	-17.47
600.00	H	-73.29	-57.00	-16.29
713.97	V	-68.25	-57.00	-11.25

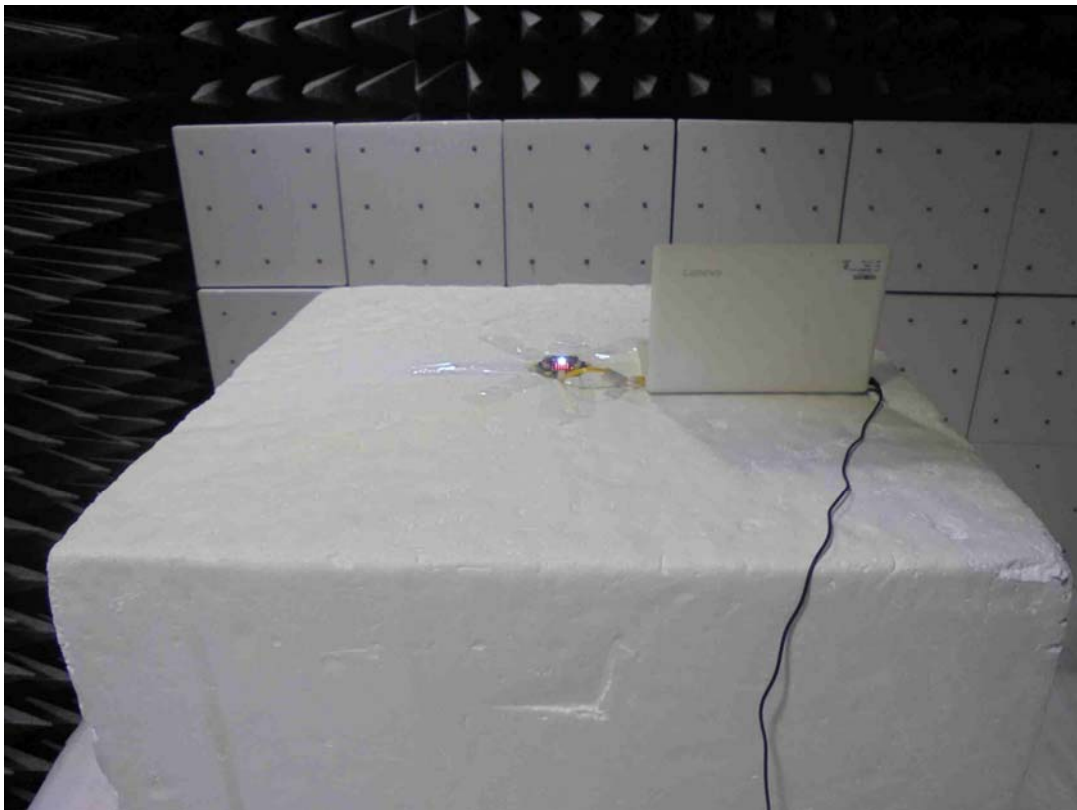
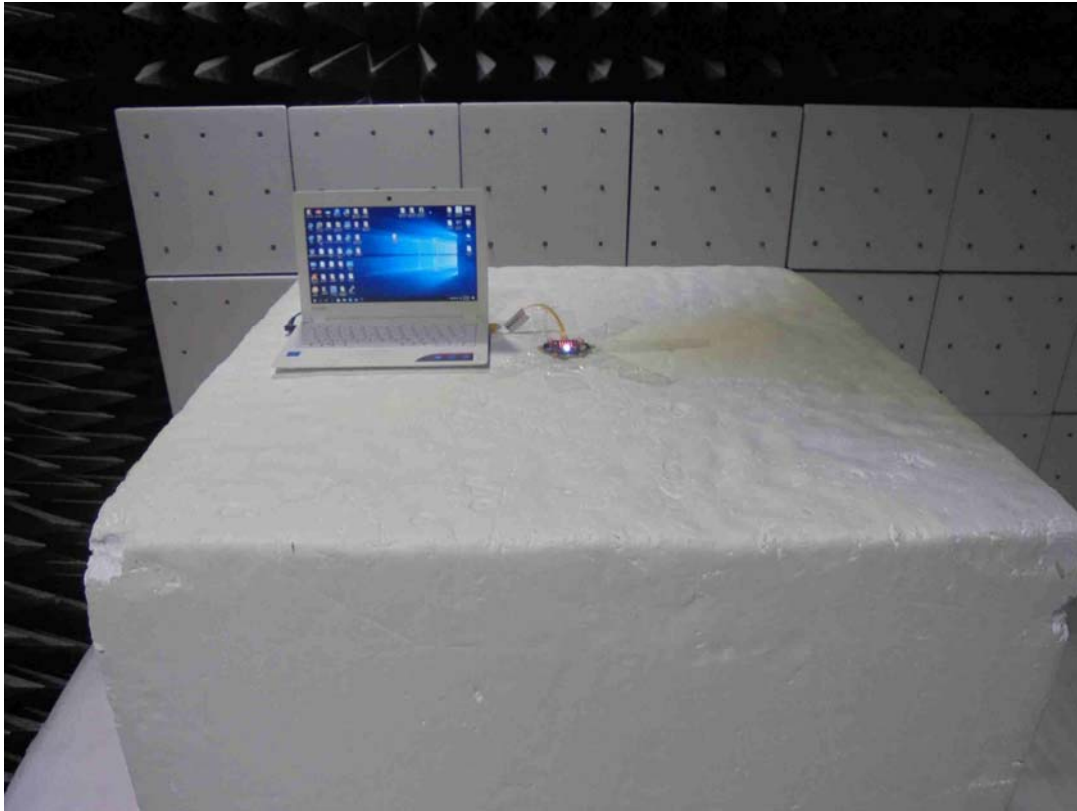
RX ABOVE 1GHz DATA

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	2747.29	H	-58.55	-47.00	-11.55
	2747.31	V	-60.63	-47.00	-13.63
39	2836.48	H	-56.86	-47.00	-9.86
	2836.52	V	-63.21	-47.00	-16.21

5 Photographs of the Test Configuration

TX / RX SPURIOUS EMISSION TEST



Appendix - Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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