

FCC Measurement/Technical Report on Rational WA112

FCC ID: contains XMR2023EG916QGL
(cellular) and
contains XO2-SPB611 (WLAN/BT)

IC: –

Test Report Reference: MDE_AVNET_2403_FCC_03

Test Laboratory:

7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany



Deutsche
Akkreditierungsstelle
D-PL-12140-01-00

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

7layers GmbH

Borsigstraße 11
40880 Ratingen, Germany
T +49 (0) 2102 749 0
F +49 (0) 2102 749 350

Geschäftsführer/
Managing Directors:
Jörg-Timm Kilisch
Bernhard Retka

Registergericht/registered:
Düsseldorf HRB 75554
USt-Id.-Nr./VAT-No. DE203159652
Steuer-Nr./TAX-No. 147/5869/0385

a Bureau Veritas
Group Company

www.7layers.com

Commerzbank AG Account No. 303 016 000 Bank Code 300 400 00 IBAN DE81 3004 0000 0303 0160 00 Swift Code COBADEFF

Table of Contents

1	Applied Standards and Test Summary	3
1.1	Applied Standards	3
1.2	Measurement Summary	4
2	Revision History / Signatures	4
3	Administrative Data	5
3.1	Testing Laboratory	5
3.2	Project Data	5
3.3	Applicant Data	5
3.4	Manufacturer Data	5
4	Test object Data	6
4.1	General EUT Description	6
4.2	EUT Main components	7
4.3	Ancillary Equipment	7
4.4	Auxiliary Equipment	7
4.5	EUT Setups	7
4.6	Operating Modes / Test Channels	8
4.7	Product labelling	8
5	Test Results	9
5.1	Peak Power Output (FHSS)	9
6	Test Equipment	13
6.1	Test Equipment Hardware	13
6.2	Test Equipment Software	13
7	Measurement Uncertainties	14
8	Photo Report	14
9	Annex: Software Version sample ae02	15

1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization

Certification for an Intentional Radiator.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15 (10-1-24 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz

Note:

The tests were selected and performed with reference to the FCC OET KDB "Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules, 558074 D01 15.247 Meas Guidance v05r02, 2019-04-02".

ANSI C63.10-2020 + Cor. 1-2023 + C63.10a-2024 + Errata to C63.10a-2024 is applied.

1.2 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 15

§ 15.247 (b) (1) (2)

Subpart C §15.247

Peak Power Output

The measurement was performed according to ANSI C63.10, chapter 7.8.5

Final Result

OP-Mode

Radio Technology, Operating Frequency, Measurement method

Setup

Date

FCC

Bluetooth BDR, low, conducted	S05_AE02	2025-11-18	Passed
Bluetooth EDR 2, low, conducted	S05_AE02	2025-11-18	Passed
Bluetooth EDR 3, low, conducted	S05_AE02	2025-11-18	Passed

N/A: Not applicable

N/P: Not performed

2 REVISION HISTORY / SIGNATURES

Report version control			
Version	Release date	Change Description	Version validity
initial	2025-11-24	--	valid
--	--	--	--

COMMENT:

This test report does not contain all tests which are applicable to the EUT. The EUT includes a pre-certified module, RF output power is re-tested on selected frequencies for a C2PC where the highest values have been reported for the unlicensed module.

Please refer to the test report of the module referenced by: MDE_HDW_2303_FCC_01.



(responsible for accreditation scope)
Dipl.-Ing. Daniel Gall



(responsible for testing and report)
Dipl.-Ing. Andreas Petz



7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

3 ADMINISTRATIVE DATA

3.1 TESTING LABORATORY

Company Name: 7layers GmbH
Address: Borsigstr. 11
40880 Ratingen
Germany

The test facility is accredited by the following accreditation organisation:

Laboratory accreditation no: DAkKS D-PL-12140-01-00
FCC Designation Number: DE0015
FCC Test Firm Registration: 929146
ISED CAB Identifier DE0007; ISED#: 3699A

Responsible for accreditation scope: Dipl.-Ing. Daniel Gall
Report Template Version: 2025-10-17

3.2 PROJECT DATA

Responsible for testing and report: Dipl.-Ing. Andreas Petz
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2025-11-24
Testing Period: 2025-11-18

3.3 APPLICANT DATA

Company Name: Tria Technologies GmbH
Address: Industriestr. 16
76297 Stutensee
Germany
Contact Person: Martin Schneider

3.4 MANUFACTURER DATA

Company Name: please see Applicant Data

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Device with WLAN / Bluetooth and cellular transceivers for controlling professional kitchen devices																							
Product name	Rational WA112																							
Type	–																							
Declared EUT data by the supplier																								
Power Supply Type	DC																							
Nominal Voltage / Frequency	12.0 V / –																							
General Description	The device is designed for use in professional kitchen devices. Exchange of data is possible by using a cellular network link or WLAN / Bluetooth (BT) / Bluetooth Low Energy (BLE) / LAN / RS485 connections to other devices.																							
Ports	<table><tr><td>Name:</td><td>Cable:</td><td>Length:</td></tr><tr><td>DC input</td><td>AWG 22, 2-wire, unshielded</td><td>1.2 m</td></tr><tr><td>LAN 1</td><td>8-wire, CAT5e, shielded</td><td>2.0 m</td></tr><tr><td>USB 1</td><td>4-wire, USB 3.0</td><td>not connected</td></tr><tr><td>Audio</td><td>2-wire, AWG 24, unshielded</td><td>not connected</td></tr><tr><td>RS485</td><td>9-wire, DB9, shielded</td><td>not connected</td></tr><tr><td>External Antenna</td><td>Coaxial 50 Ω, shielded</td><td>0.0 m</td></tr></table> Notes: Above, the length of the connected cable under test is given, not the specified (max.) length (defined by the applicant).			Name:	Cable:	Length:	DC input	AWG 22, 2-wire, unshielded	1.2 m	LAN 1	8-wire, CAT5e, shielded	2.0 m	USB 1	4-wire, USB 3.0	not connected	Audio	2-wire, AWG 24, unshielded	not connected	RS485	9-wire, DB9, shielded	not connected	External Antenna	Coaxial 50 Ω, shielded	0.0 m
Name:	Cable:	Length:																						
DC input	AWG 22, 2-wire, unshielded	1.2 m																						
LAN 1	8-wire, CAT5e, shielded	2.0 m																						
USB 1	4-wire, USB 3.0	not connected																						
Audio	2-wire, AWG 24, unshielded	not connected																						
RS485	9-wire, DB9, shielded	not connected																						
External Antenna	Coaxial 50 Ω, shielded	0.0 m																						
Antenna / Gain	External / 4.8 dBi																							
Tested data rates	<table><tr><td><u>Mode:</u></td><td><u>Data rate:</u></td></tr><tr><td>BT:</td><td>1 / 2 / 3 Mbps</td></tr><tr><td>BLE:</td><td>1 / 2 Mbps</td></tr><tr><td>WLAN b:</td><td>1 Mbps</td></tr><tr><td>WLAN g:</td><td>54 Mbps</td></tr><tr><td>WLAN n:</td><td>MCS7</td></tr><tr><td>WLAN ax:</td><td>MCS9</td></tr></table>			<u>Mode:</u>	<u>Data rate:</u>	BT:	1 / 2 / 3 Mbps	BLE:	1 / 2 Mbps	WLAN b:	1 Mbps	WLAN g:	54 Mbps	WLAN n:	MCS7	WLAN ax:	MCS9							
<u>Mode:</u>	<u>Data rate:</u>																							
BT:	1 / 2 / 3 Mbps																							
BLE:	1 / 2 Mbps																							
WLAN b:	1 Mbps																							
WLAN g:	54 Mbps																							
WLAN n:	MCS7																							
WLAN ax:	MCS9																							
Tested at power settings	<table><tr><td><u>Mode:</u></td><td><u>Power setting:</u></td></tr><tr><td>BT:</td><td>4</td></tr><tr><td>BLE:</td><td>4</td></tr><tr><td>WLAN b:</td><td>14</td></tr><tr><td>WLAN g / n20:</td><td>12</td></tr><tr><td>WLAN n40:</td><td>11</td></tr><tr><td>WLAN ax20 / ax40:</td><td>6</td></tr></table>			<u>Mode:</u>	<u>Power setting:</u>	BT:	4	BLE:	4	WLAN b:	14	WLAN g / n20:	12	WLAN n40:	11	WLAN ax20 / ax40:	6							
<u>Mode:</u>	<u>Power setting:</u>																							
BT:	4																							
BLE:	4																							
WLAN b:	14																							
WLAN g / n20:	12																							
WLAN n40:	11																							
WLAN ax20 / ax40:	6																							
Special software used for testing	labtool-611 (to generate synthetic test modes)																							

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
ae02	DE1183057ae02	Sample for conducted tests
Sample Parameter	Value	
Serial No.	F251901559	
HW Version	DV3	
SW Version	please refer to the annex	
Comment	The sample is tested as "stand-alone" PCB without housing and auxiliaries.	

NOTE: The short description is used to simplify the identification of the EUT in this test report.

4.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, OUT Code)	Description
–	–	–

4.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, HW, SW, S/N)	Description
–	–	–

4.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
S05_AE02	ae02	setup for conducted tests

4.6 OPERATING MODES / TEST CHANNELS

This chapter describes the operating modes of the EUTs used for testing (grey shading = not used).

BT Test Channels:

Channel:

Frequency [MHz]

2.4 GHz ISM 2400 - 2483.5 MHz		
low	mid	high
0	39	78
2402	2441	2480

4.7 PRODUCT LABELLING

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 PEAK POWER OUTPUT (FHSS)

Standard **FCC Part 15 Subpart C**

The test was performed according to:

ANSI C63.10, chapter 7.8.5

5.1.1 TEST DESCRIPTION

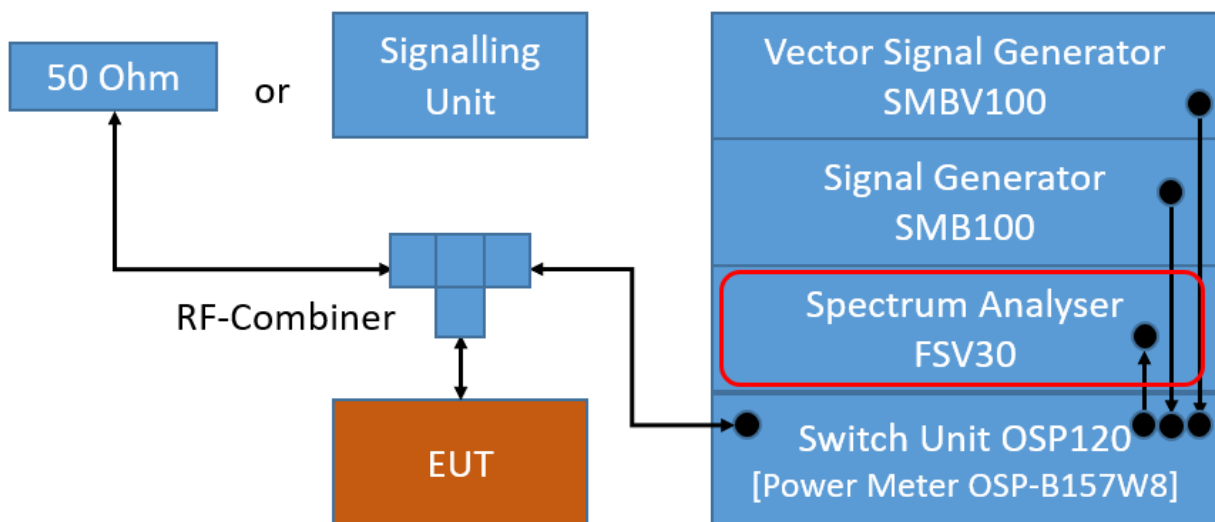
FHSS EQUIPMENT:

The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power. The reference level of the spectrum analyser was set higher than the output power of the EUT.

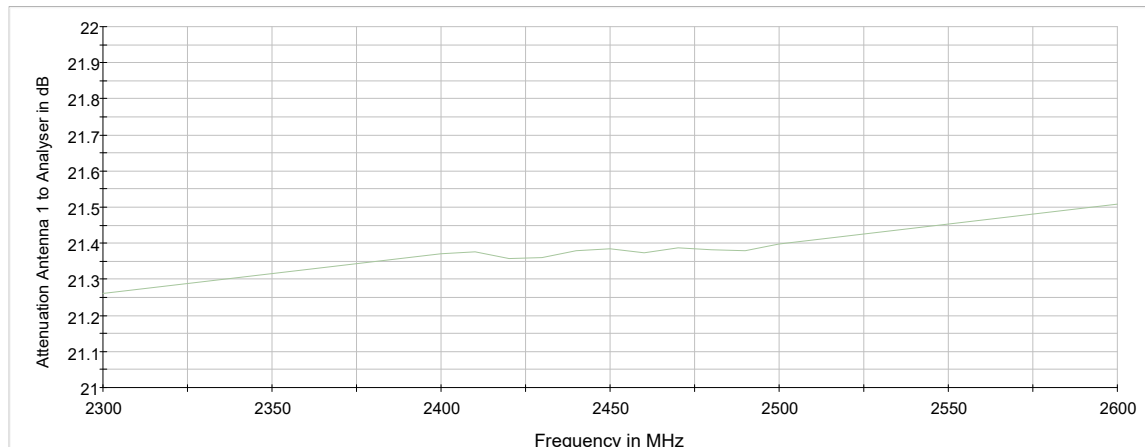
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyser settings:

- Resolution Bandwidth (RBW): ≥ 20 dB BW
- Video Bandwidth (VBW): ≥ 3 times RBW
- Trace: Maxhold
- Sweeps: Till stable (min. 300, max. 15000)
- Sweptime: Auto
- Detector: Peak



TS8997; Output Power



Attenuation Output power

5.1.2 TEST REQUIREMENTS / LIMITS

DTS devices:

FCC Part 15, Subpart C, §15.247 (b) (3)

For systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1 watt.

==> Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

Frequency Hopping Systems:

FCC Part 15, Subpart C, §15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

FCC Part 15, Subpart C, §15.247 (b) (2)

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Used conversion factor: Limit (dBm) = $10 \log (\text{Limit (W)}/1\text{mW})$

5.1.3 TEST PROTOCOL

Ambient temperature: 24 °C
Air Pressure: 1014 hPa
Humidity: 41 %

BT BDR, GFSK (1-DH5)

Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]	E.I.R.P [dBm]
2.4 GHz ISM	0	2402	2.4	21.0	18.6	7.2

BT EDR 2, DQPSK (2-DH5)

Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]	E.I.R.P [dBm]
2.4 GHz ISM	0	2402	0.6	21.0	20.4	5.4

BT EDR 3, 8-DPSK (3-DH5)

Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]	E.I.R.P [dBm]
2.4 GHz ISM	0	2402	0.9	21.0	20.1	5.7

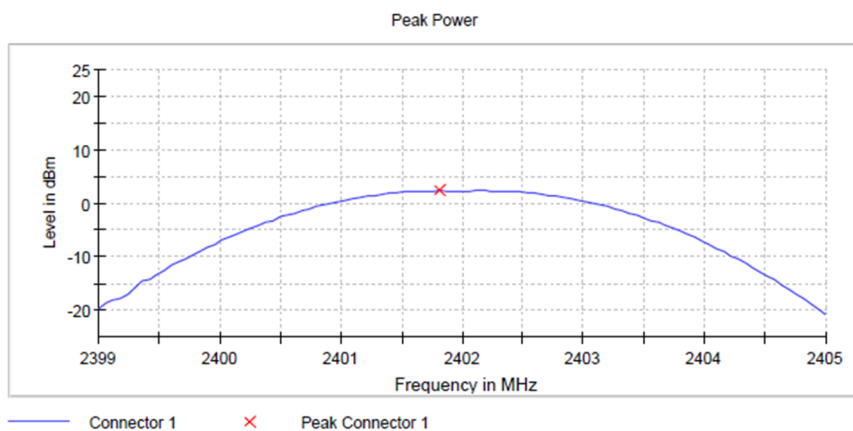
Remark: Please see next sub-clause for the measurement plot.

5.1.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = Bluetooth BDR, Operating Frequency = low

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	2.4	21.0	PASS



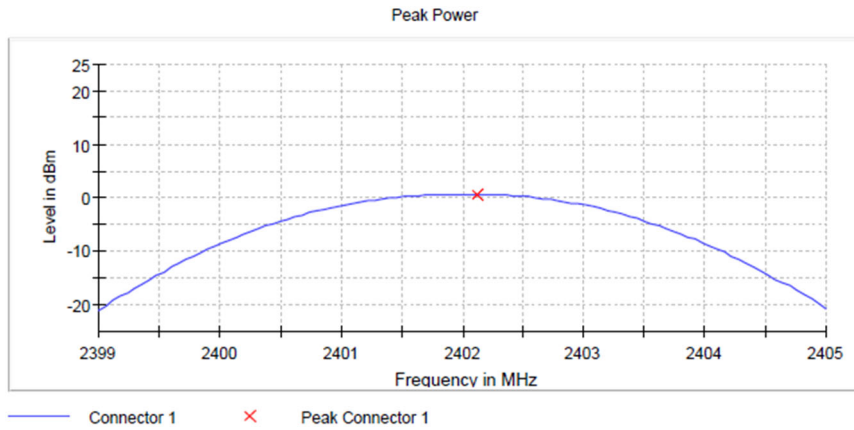
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.39900 GHz	2.39900 GHz
Stop Frequency	2.40500 GHz	2.40500 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.000 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 dB	0.50 dB

Radio Technology = Bluetooth EDR 2, Operating Frequency = low

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	0.6	21.0	PASS



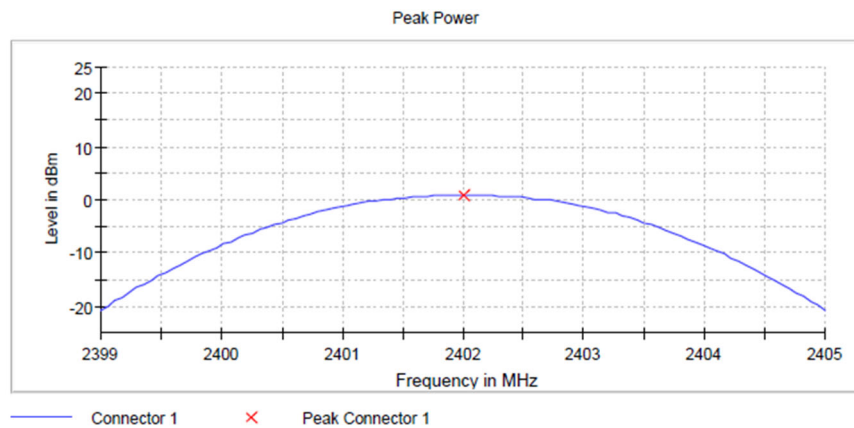
Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.39900 GHz	2.39900 GHz
Stop Frequency	2.40500 GHz	2.40500 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.100 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.07 dB	0.50 dB

Radio Technology = Bluetooth EDR 3, Operating Frequency = low

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	0.9	21.0	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.39900 GHz	2.39900 GHz
Stop Frequency	2.40500 GHz	2.40500 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.100 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.14 dB	0.50 dB

5.1.5 TEST EQUIPMENT USED

- R&S TS8997

6 TEST EQUIPMENT

6.1 TEST EQUIPMENT HARDWARE

- 1 R&S TS8997
2.4 and 5 GHz Bands Conducted Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
1.2	EX520	Digital Multimeter 12	Extech Instruments Corp	05157876	2024-12	2026-12
1.3	Opus10 THI (8152.00N)	T/H Logger 01	Lufft Mess- und Regeltechnik GmbH	5809	2023-12	2025-12
1.4	Opus10 THI (8152.00)	T/H Logger 14	Lufft Mess- und Regeltechnik GmbH	13993	2023-12	2025-12
1.5	HMP2020	Programmable Power Supply	Rohde & Schwarz GmbH & Co. KG	101992	N/A	N/A
1.6	FSW26	Signal- & Spectrum-Analyzer	Rohde & Schwarz GmbH & Co. KG	104459	2025-06	2027-06
1.7	OSP120	Contains Power Meter and Switching Unit OSP-B157W8 PLUS	Rohde & Schwarz	101158	2024-08	2027-08
1.8	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100451	2025-07	2027-07

The calibration interval is the time interval between "Last Calibration" and "Calibration Due"

6.2 TEST EQUIPMENT SOFTWARE

TS 8997
WMS32 Measurement Software Version 11.70.00 + Hotfix 01

7 MEASUREMENT UNCERTAINTIES

Test Case	Parameter	Uncertainty
Conducted Output Power	Power	± 2.2 dB

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) $k = 1.96$. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	on pass mark	within pass mark	Passed
4	above pass mark	within pass mark	Failed
5	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so-called shared risk principle.

8 PHOTO REPORT

Please see separate photo report.

9 ANNEX: SOFTWARE VERSION SAMPLE AE02

MSC-LDK LOL99_20240805_V1_14_0-7-gf066e6a built on Wed May 14 01:16:17 PM UTC 2025 by @docker
NXP i.MX Release Distro 6.6-scarthgap \n \l

LAYER meta-arm=mickledore-6.1.36-2.1.0-LOL99_20240731_V1_13_0-367-g58268ddc
LAYER meta-freescale-distro=mickledore-6.1.36-2.1.0-LOL99_20240731_V1_13_0-10-gb9d6a5d
LAYER meta-freescale=mickledore-6.1.36-2.1.0-LOL99_20240731_V1_13_0-383-gc4ef717d
LAYER meta-imx=e06f8574e9
LAYER meta-marvell-labtool=ed9c966-dirty
LAYER meta-msc-arm-extensions=LOL99_20240731_V1_13_0-20-g285d820
LAYER meta-msc-ldk-core=LOL99_20240805_V1_14_0-19-gd141a04
LAYER meta-msc-ldk-core-recipes=LOL99_20240805_V1_14_0-33-gc0a49ba
LAYER meta-msc-ldk-distro=68801c2
LAYER meta-msc-ldk-hwtests=LOL99_20240805_V1_14_0-8-gff226e5
LAYER meta-msc-ldk-hwtests-recipes=LOL99_20240805_V1_14_0-41-ge5d31f9
LAYER meta-msc-ldk-mscio=LOL99_20240805_V1_14_0-8-gaec2227
LAYER meta-openembedded=initial-29996-g4a7bb77f7
LAYER meta-qt5=mickledore-LOL99_20240731_V1_13_0-46-geb82841
LAYER meta-rat-wall2=4c81972
LAYER meta-secure-core-windriver=adbcl9
LAYER meta-spb611-sdio-uart=c09a44a
LAYER msc-ldk-bsp-recipes=2038944-dirty
LAYER yocto=4.3_M1-3727-g59c3a90cf4

*****END OF TEST REPORT*****