

Test Report

Electromagnetic Compatibility (EMC)

HELEM2108000327-1



TESTS ACCORDING TO FCC PART 15 B AND ISED CANADA REQUIREMENTS

Equipment Under Test: Indoor air quality transmitter

Model: eGate-Kombi-LWUS-RHT-CO2-TVOC-Dust40-DP

Type: -

Manufacturer: Nokeval Oy
Rounionkatu 107
FI-37150, Nokia
Finland

Customer: Nokeval Oy
Rounionkatu 107
FI-37150, Nokia
Finland

FCC Rule Part: FCC CFR 47 Part 15 Subpart B, Class B
IC Rule Part: ICES-003 Issue 7, Class B

Date: 10 June 2022

Date: 10 June 2022

A handwritten signature in blue ink that appears to read "Henri Mäki".

A handwritten signature in blue ink that appears to read "R. Repo".

Issued by: Henri Mäki
Testing Engineer

Checked by: Rauno Repo
Senior EMC Specialist

Table of Contents**TABLE OF CONTENTS**

TABLE OF CONTENTS	2
GENERAL REMARKS	3
Disclaimer	3
RELEASE HISTORY	4
PRODUCT DESCRIPTION	5
Equipment Under Test (EUT)	5
General description	5
Samples and modifications	6
Ports and cables	6
Peripherals	6
TEST CONDITION	7
EUT Test Conditions During EMC-Testing	7
Operation modes	7
Emission Measurement Uncertainty	7
SUMMARY OF TESTING	8
EMISSION TESTS	9
Conducted Emissions In The Frequency Range 150 kHz – 30 MHz	9
Radiated Emissions In The Frequency Range 30 – 1000 MHz	11
TEST EQUIPMENT	13
Conducted Emissions	13
Radiated Emissions	13

GENERAL REMARKS**Disclaimer**

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	1 March 2022
1.1	Radiated Emissions test description updated on page 11.	10 June 2022

PRODUCT DESCRIPTION**Equipment Under Test (EUT)**

EUT information	
General Product Description	Indoor air quality transmitter
Trademark	eGate
Model	eGate-Kombi-LWUS-RHT-CO2-TVOC-Dust40-DP
Type	-
Serial number	N110553
Power input port type	DC (USB Micro-B)
Rated voltage	5 ± 0.5 V
Rated current	1 A max
Rated frequency	-
Rated power	-
EUT Highest operation freq.	32 MHz
Hardware Version (if any)	Motherboard AdaptB V1.0
Software Version (if any)	Product: V1.0 Radio: V1.1.03
Mechanical size of the EUT	Height: 87 mm Width: 75 mm Length: 95 mm
Parallel models	eGate-Kombi-LWUS-RHT eGate-Kombi-LWUS-RHT-DP eGate-Kombi-LWUS-RHT-Dust13 eGate-Kombi-LWUS-RHT-Dust40
Radio module or chip	Murata CMWX1ZZABZ-093

The EUT was tested as a tabletop unit.

General description

The equipment under test is an indoor air quality transmitter, which measures temperature, humidity, CO2, VOC, particles, and differential pressure. The equipment includes a LoRaWAN radio which operates in the 902.3-914.9 MHz band.

The differences between the parallel models:

Model	Measurements (besides temperature and humidity)				Height	Power supply
	CO2	VOC	Particles	Diff. press.		
-RHT-CO2-TVOC-Dust40-DP	X	X	X	X	87 mm	USB
-RHT					47 mm	USB/battery
-RHT-DP				X	47 mm	USB/battery
-RHT-Dust13 *)			X		67 mm	USB
-RHT-Dust40			X		87 mm	USB

*) Different dust sensor for particles

Samples and modifications

No.	Name	Description
1	Sample 1	Normal sample

Ports and cables

Port name and purpose	Connected from-to	Length	Type
AC mains input	AC mains to AC/DC power supply	-	L/N
Power *)	AC/DC power supply to EUT	1.5 m	USB Micro-B

*) The port can be used for maintenance with USB data, but in normal use it is used for power only

Peripherals

Peripheral	Description / Usage
AC/DC power supply	XP Power VEL05US050-EU-UB. Power supply to EUT

The peripherals were provided by the customer.

TEST CONDITION

EUT Test Conditions During EMC-Testing

Configuration of the EUT was made to correspond to the actual assembling conditions as far as possible. All sensors were enabled and the radio was turned off during the measurements. The input voltage to the peripheral AC/DC power supply was 120 V, 60 Hz.

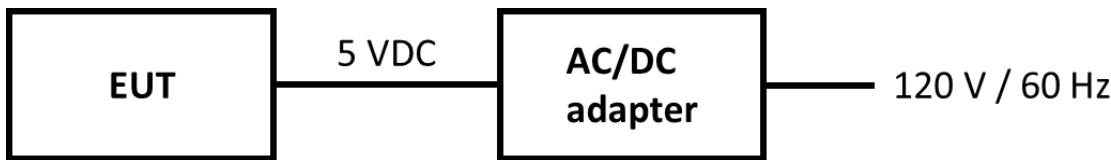


Figure 1: Test setup block diagram

Operation modes

During the tests the EUT was in the following operation modes:

Mode	Description
1	Power on, sensors enabled, radio off

Emission Measurement Uncertainty

The uncertainties comply with CISPR 16-4-2 ed.2 requirements ($U_{lab} < U_{cispr}$).

Summary of Testing**SUMMARY OF TESTING**

Test Specification	Description of Test	Result
47 CFR 15.107 / ICES-003 3.2.1	Conducted Emissions, Class B	PASS
47 CFR 15.109 / ICES 003 3.2.2	Radiated Emissions, Class B	PASS

Decision rule used for the emission tests are defined in standard CISPR 16-4-2 / EN 55016-4-2 clause 4.2

Test Facility

Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	<input type="checkbox"/> K10LAB, ISED Canada registration number: 8708A-1 <input checked="" type="checkbox"/> K5LAB, ISED Canada registration number: 8708A-2 <input type="checkbox"/> T10LAB

EMISSION TESTS**Conducted Emissions In The Frequency Range 150 kHz – 30 MHz**

Standard: ANSI C63.4-2014
Tested by: HEM
Date: 24 February 2022
Temperature: 23 °C
Humidity: 33 %RH
Barometric pressure: 996 mbar
Measurement uncertainty: ± 2.9 dB, level of confidence 95 % (k = 2)

FCC Rule: 15.107(a)

ICES-003: 3.2.1

Test Plan

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors from the phase(s) and neutral lines of the power supply cable.

The EUT was working as described in the section “EUT Test Conditions”.

Class B limits:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Conducted Emissions In The Frequency Range 150 kHz – 30 MHz

Test results

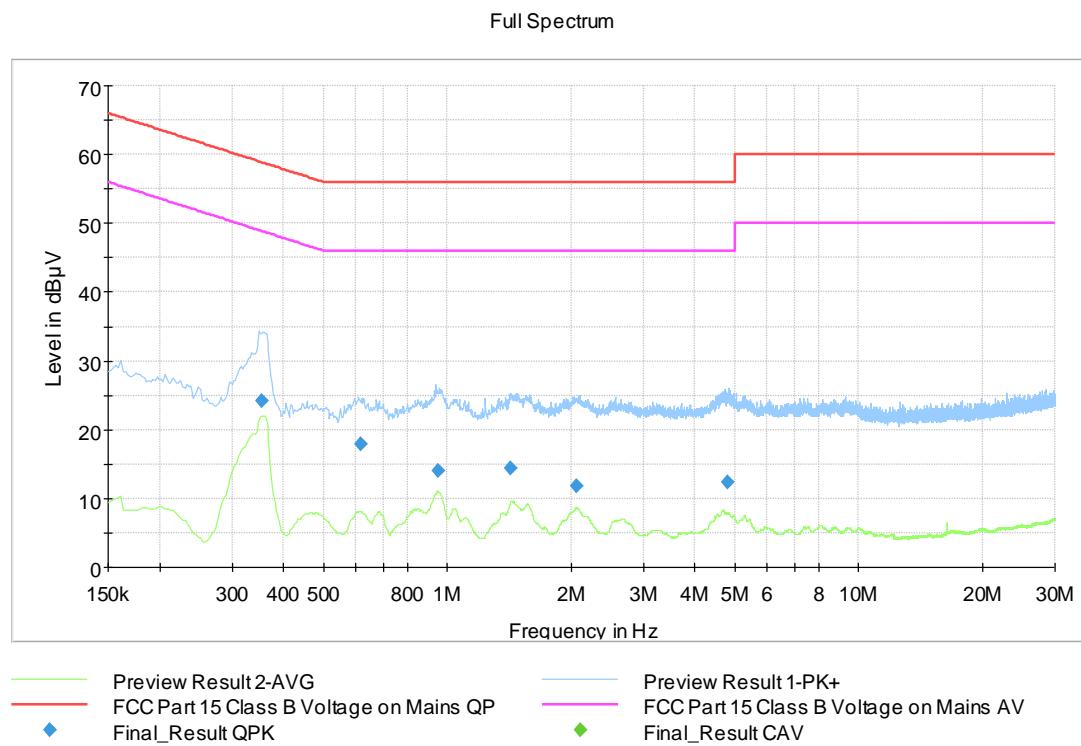


Figure 2: The measured curves with peak-detector and average detectors

Table 1: Final measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.353250	24.21	---	58.89	34.68	15 x 1000.0	9.000	L1	9.7
0.616000	17.99	---	56.00	38.01	15 x 1000.0	9.000	L1	9.7
0.950750	13.98	---	56.00	42.02	15 x 1000.0	9.000	L1	9.8
1.427500	14.42	---	56.00	41.58	15 x 1000.0	9.000	L1	9.9
2.062000	11.81	---	56.00	44.19	15 x 1000.0	9.000	L1	9.9
4.807750	12.32	---	56.00	43.68	15 x 1000.0	9.000	L1	10.0

Correction factor (dB) in the final result tables contains the sum of the transducers (cables + LISN).

QuasiPeak and CAverage values are the measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 30 – 1000 MHz

Standard: ANSI C63.4-2014
Tested by: HEM
Date: 24 February 2022
Temperature: 23 °C
Humidity: 33 %RH
Barometric pressure: 996 mbar
Measurement uncertainty: ± 4.9 dB (30 – 200 MHz) Level of confidence 95 % (k = 2).
 ± 4.1 dB (200 – 1 000 MHz)

FCC Rule: 15.109(a)**ICES-003: 3.2.2****Test plan**

The radiated emission measurements were done within a semi anechoic screened chamber. The EUT was placed on a table 0.8 m above the reflecting ground plane. The measurement distance was 3 meters. The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations. The supply voltage to the turntable was fed through the filter.

The EUT was working as described in the section “EUT Test Conditions”. The final measurements were performed in the worst-case EUT orientation.

Radiated measurement settings**Preliminary testing:**

Turntable movement: 30 ° step
Turntable position: 15 ° to 345 °
Antenna movement: 1.5 m step
Antenna height: 1.0 m to 4.0 m
Antenna polarization: Vertical and horizontal

Final testing:

Turntable movement: Continuous
Turntable position: ± 30 °
Antenna movement: Continuous
Antenna height: ± 1.50 m
Antenna polarization: Vertical and horizontal

Test results

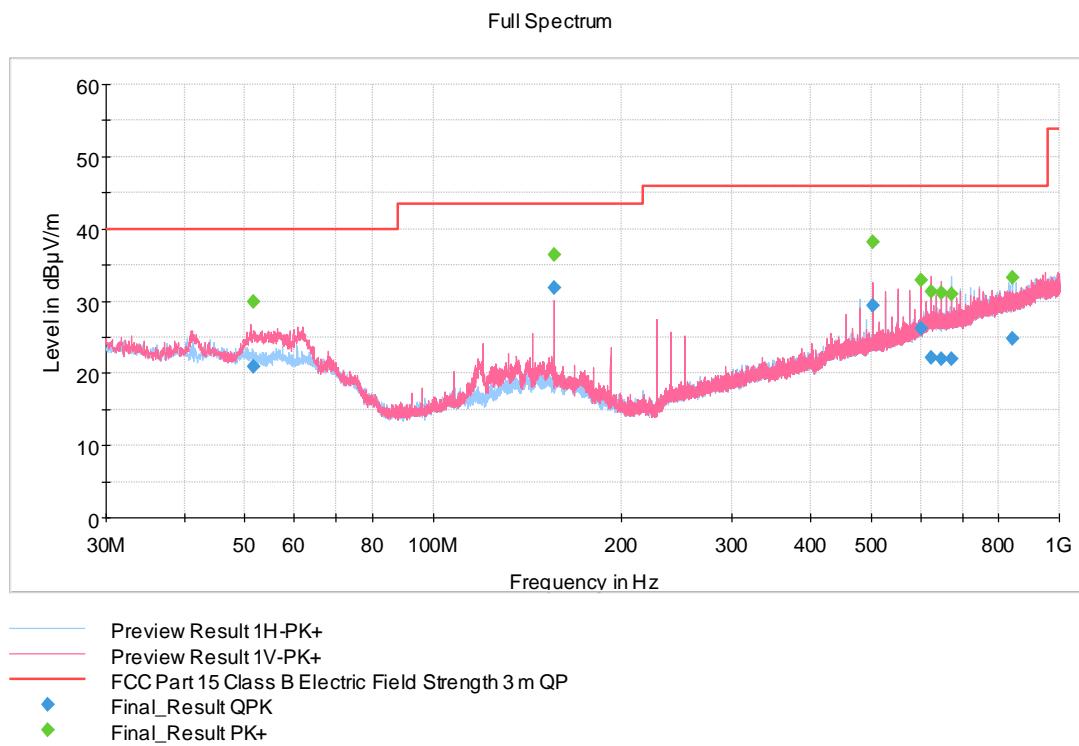


Figure 3: Measured curve with peak-detector

Table 2: Final quasi-peak measurement from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.520000	20.90	40.00	21.40	15 x 1000.0	120.000	236.0	V	319.0	17.8
156.260000	31.90	43.50	11.80	15 x 1000.0	120.000	108.0	V	117.0	18.6
504.320000	29.40	46.00	16.60	15 x 1000.0	120.000	165.0	V	105.0	24.6
600.000000	26.15	46.00	19.85	15 x 1000.0	120.000	187.0	V	332.0	26.8
624.440000	22.12	46.00	23.88	15 x 1000.0	120.000	193.0	V	285.0	27.5
647.800000	22.01	46.00	23.99	15 x 1000.0	120.000	129.0	V	323.0	27.5
672.560000	21.91	46.00	24.09	15 x 1000.0	120.000	235.0	H	355.0	27.7
840.310000	24.83	46.00	21.17	15 x 1000.0	120.000	400.0	H	59.0	30.3

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables).

QuasiPeak values are measured values corrected with the correction factor.

TEST EQUIPMENT**Conducted Emissions**

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv. 10679	2021-06-21	2022-06-21
LISN	ROHDE & SCHWARZ	ENV216	inv. 9611	2022-02-02	2023-02-02
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv. 7826	NCR	NCR
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv. 10517	2021-10-22	2022-10-22
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-

Radiated Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
ANTENNA	SCHWARZBECK	VULB 9168	inv. 8911	2020-11-04	2022-11-04
ANTENNA MAST	MATURO	TAM 4.0E	inv. 10181	NCR	NCR
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv. 10126	2022-02-23	2024-02-23
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv. 10679	2021-06-21	2022-06-21
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv. 10183	NCR	NCR
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv. 7826	NCR	NCR
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv. 10517	2021-10-22	2022-10-22
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
TURNTABLE	MATURO	DS430 UPGRADED	inv. 10182	NCR	NCR

NCR = No Calibration Required

END OF REPORT