Test Report – Products
Prüfbericht – Produkte

VLAC Lab Accreditation VLAC-017

TÜVRheinland®

Test Report No.: *Prüfbericht-Nr.:*	**JP25E48F 001**	**Order No.:** *Auftrags-Nr.:*	**150302505**	**Page 1 of 38** *Seite 1 von 38*
Client Reference No.: *Kunden-Referenz-Nr.:*	N/A	**Order Date:** *Auftragsdatum:*	2024-12-18	
Client: *Auftraggeber:*	MinebeaMitsumi Inc. 1-9-3, Higashi-shimbashi, Minato-ku, Tokyo, 105-0021, Japan			
Test Item: *Prüfgegenstand:*	Parking Sensor			
Identification / Type No.: *Bezeichnung / Typ-Nr.:*	NDPM006US	**Serial No.:** *Serien-Nr.:*	193	
Order Content: *Auftrags-Inhalt:*	Radio Testing			
Test Specification: *Prüfgrundlage:*	FCC 47 CFR Part 15, Subpart C, Section 15.249			

Date of Sample Receipt: *Wareneingangsdatum:*	2024-12-20, 2024-12-27
Test Sample No.: *Prüfmuster-Nr.:*	A003894557-001, A003898564-001
Testing Period: *Prüfzeitraum:*	2025-01-28 to 2025-02-04
Place of Testing: *Ort der Prüfung:*	Yokohama EMC Laboratory
Testing Laboratory: *Prüflaboratorium:*	TÜV Rheinland Japan Ltd.
Test Result*: *Prüfergebnis*:*	Pass

-/-

compiled by: *zusammengestellt von:*	Hidetoshi Sasaki	**authorized by:** *genehmigt von:*	P. Zhang
Date: 2025-02-17 *Datum:*	Hidetoshi Sasaki	**Issue Date:** 2025-02-17 *Ausstellungsdatum:*	Pin Zhang
Position / *Stellung:*	Project Engineer	**Position** / *Stellung:*	Authorizer

Other / *Sonstiges:*

This test report covers DXX (Low Power Communication Device Transmitter) portions of the EUT for the application.

Condition of the test item at delivery: *Zustand des Prüfgegenstandes bei Anlieferung:*	Test item complete and undamaged *Prüfmuster vollständig und unbeschädigt*

* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
** Legende:*	*P(ass) = entspricht o.g. Prüfgrundlage(n)*	*F(ail) = entspricht nicht o.g. Prüfgrundlage(n)*	*N/A = nicht anwendbar*	*N/T = nicht getestet*

Revisions

Report No.	Issue date	Changes / Remarks
JP25E48F 001	2025-02-17	Original document

Remarks

1	The equipment used during the specified testing period was calibrated according to the test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of the laboratory's management system.
2	Unless otherwise specified by the applied standard(s), the decision rule used in this test report for statements of conformity based on numerical measurement results is the "Zero Guard Band"/"Simple Acceptance" rule in accordance with ILAC G8:2019 and IEC Guide 115:2021. When the "Zero Guard Band" rule is applied, measurement uncertainty is not taken in account. For additional information on the risk resulting from the application of the "Zero Guard Band" decision rule, refer to ILAC G8:2019.

Contents

1. General Remarks

1.1 Test Specifications

Table 1: Test Summary

Test	Specifications	Result
Radio: FCC 47 CFR Part 15, Subpart C, Section 15.249 ANSI C63.10-2020		
Supply Voltage Requirements FCC §15.31(e)	See the section 5.1.	Pass
Antenna Requirements FCC §15.203	See the section 5.2.	Pass
Restricted Bands of Operation FCC §15.205	See the section 5.3.	Pass
20dB Bandwidth FCC §15.215 (c)	20dB bandwidth shall be contained within the designated frequency band.	Pass
99% Bandwidth	-/-	For. Ref.
Duty Cycle	-/-	For. Ref.
Field Strength of Fundamental FCC §15.249(a), (c) and (e)	250mV/m (107.9dBuV/m) at 3m distance	Pass
Radiated Spurious Emissions of Transmitter FCC §15.249(a), (c), (d) and (e), §15.205 and §15.209	9kHz - 100GHz 2nd and 3rd Harmonics: 2.5mV/m (67.9dBuV/m) at 3m distance	Pass
Conducted Emission on AC Power Ports of Transmitter FCC §15.207(a)	150kHz - 30MHz This test is not applicable, since the equipment is not intended to be connected to the AC mains network. (The equipment is battery operated only.)	N/A

1.2 Test Report Purpose

The purpose of this test report is to show compliance of the EUT (Equipment Under Test) with the requirements of the standards listed in section 1.1.

1.3 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland Japan Ltd. – Global Technology Assessment Center
4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The test facility is recognized by the Federal Communications Commission (FCC) as Accredited Testing Laboratory under Designation Number JP0017 and test firm registration number 386498.

The test facility is accredited by VLAC (member of ILAC) under number VLAC-017-1 according to ISO/IEC 17025:2017.

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
For Radiated Emission (RE below 40GHz)							
Path Loss Correction Factors for RE below 1GHz	-	-	-	RF-0596	1 year	2025-01-29	2026-01-29
Path Loss Correction Factors for RE above 1GHz	-	-	-	RF-0995	1 year	2024-12-03	2025-12-03
RE Meas. Software	Toyo Corporation	ES10/RE-AJ	0600-0179-80	RF-1263	N/A	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESW 26	101316	RF-0812	1 year	2024-05-29	2025-05-29
EMI Receiver	Rohde & Schwarz	ESW 44	101751	RF-0809	1 year	2024-09-27	2025-09-27
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	N/A	N/A	N/A
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB 9168	9168-475	RF-0462	1 year	2024-05-09	2025-05-09
5dB Attenuator	Pasternack	PE7047-5	-	RF-0731	1 year	2024-05-22	2025-05-22
20dB Attenuator	Aeroflex/Weinschel	1	BV2948	RF-0200	1 year	2024-04-03	2025-04-30
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	1 year	2024-12-24	2025-12-24

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
Band Pass Filter	Microwave Factory	MBP301	224969	RF-1015	1 year	2024-03-19	2025-03-19
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120 D	9120D-2280	RF-0845	1 year	2024-03-08	2025-03-08
PreAmp 0-50GHz	NEXTEM	RFA-1050000-40	RFA-1905-01	RF-1140	1 year	2024-12-03	2025-12-03
High Pass Filter (1GHz)	Wainwright Instruments	WHK1000-14SS-10W	1	RF-0550	1 year	2024-07-09	2025-07-09
Horn Antenna, 1-18GHz	Schwarzbeck	BBHA9120 D	9120D-2280	RF-0845	1 year	2024-03-08	2025-03-08
Horn Antenna with Preamplifier, 6-18GHz (RX)	Toyo Corporation	HAP06-18W	B1510452 210-123	RF-1095	N/A	N/A	N/A
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	G089	RF-1094	1 year	2024-11-14	2025-11-14
Horn Antenna with Preamplifier, 18-26.5GHz (RX)	Toyo Corporation	HAP18-26N	00000010	RF-0070	1 year	2024-05-01	2025-05-01
Horn Antenna with Preamplifier, 18-26.5GHz (RX)	Toyo Corporation	HAP18-26W	B2010482 210-125	RF-1096	1 year	2024-11-08	2025-11-08
10dB Attenuator	ZTS Technologies Co., Ltd	ZFA2K-40B-10A	1#	RF-1272	1 year	2024-09-24	2025-09-24
20dB Attenuator	ZTS Technologies Co., Ltd	ZFA2K-40B-10A	2#	RF-1273	1 year	2024-09-24	2025-09-24
Horn Antenna with Preamplifier, 26.5 -40GHz (RX)	Toyo Corporation	HAP26-40N	00000007	RF-0069	1 year	2024-05-01	2025-05-01
Horn Antenna with Preamplifier, 26.5 -40GHz (RX)	Toyo Corporation	HAP26-40W	B3208602 210-126	RF-1097	1 year	2024-11-08	2025-11-08
Preamplifier, 18-40GHz	Toyo Corporation	TPA1840-60	B3208602 009-053	RF-0861	1 year	2024-03-19	2025-03-19
For Radiated Emission (RE above 40GHz)							
Spectrum Analyzer	Rohde & Schwarz	FSW85	101545	RF-1039	1 year	2024-11-15	2025-11-15
Horn Antenna 40-60GHz (RX)	Custom Microwave Inc.	HO19R	-	BT-8334	1 year	2024-08-01	2025-08-01
Low Noise Amplifier (40-50GHz)	ERAVANT	SBL-4036033080-1919	20101-01	RF-1061	1 year	2024-08-14	2025-08-14
Horn Antenna 50-75GHz	Custom Microwave Inc.	HO15R	-	G1810345	1 year	2024-08-02	2025-08-02
Low Noise Amplifier (50-75GHz)	AT microwave	AT-LNA-5075-38041	MCDE02	RF-0972	1 year	2024-08-07	2025-08-07
Harmonic mixer 75GHz-110GHz	Rohde & Schwarz	FS-Z110	101655	RF-1035	1 year	2024-10-09	2025-10-09
Horn Antenna 75-110GHz (RX)	Custom Microwave Inc.	HO10R	-	BT-8338	1 year	2024-08-05	2025-08-05
WR-10 84GHz Highpass Filter	SAGE	SWF-84380340-10-H1	25077-01	RF-1136	1 year	2024-02-22	2025-02-22

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
Constant Voltage Constant Frequency Stabilizers and Power Accessories							
DC Power Supply	Hewlett Packard	6653A	3640A03102	RF-0004	N/A	N/A	N/A
Regulated DC Power Supply	Kikusui	PAN 35-30A	JD002143	RF-1113	N/A	N/A	N/A
True RMS Multimeter	Fluke	87V	97680445	RF-0281	1 year	2024-12-23	2025-12-23
True RMS Multimeter	Fluke	289	18590262	PV2-082	1 year	2024-12-23	2025-12-23

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025 has been confirmed before testing.

2.3 Measurement Uncertainty

Table 3: Measurement Uncertainty

Measurement Type	Frequency Range	Uncertainty (k=2)
Conducted Emission on RF Ports	30MHz-40GHz	±2.47dB
Magnetic Field Strength	9kHz - 30MHz	±4.79dB
Radiated Emission up to 1GHz	30MHz - 1GHz (3m Distance)	±6.01dB (Vertical) ±4.91dB (Horizontal)
Radiated Emission above 1GHz	1 - 6GHz	±5.15dB
	6 - 18GHz	±5.09dB
	18 - 40GHz	±5.18dB
	40 – 60GHz	±4.73dB
	60 – 75GHz	±4.91dB
	75 – 110GHz	±6.32dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (**E**quipment **U**nder **T**est) is a parking sensor utilizing 24.15GHz radio to detect parked car and communicate via Sub-GHz Radio Interface.

3.2 Ratings and System Details

Rated voltage and frequency:	DC 3.0-3.6V (8500mAh batteries)
Input power:	0.05W
Protection class:	III
Radio standard:	Non-specific SRD 24GHz
Fundamental Field Strength:	102.3dBµV/m @3m, Peak
Antenna gain:	+8.5dBi
Antenna type:	Patch Antenna
Antenna mounting type:	PCB Pattern
Frequency range:	24.05-24.25GHz
Nominal frequency:	24.15GHz
Modulation type:	No modulation
Channel Bandwidth:	100MHz
Number of channels:	1
Channel spacing:	N/A
FCC equipment class:	DXX (Part 15 Low Power Transceiver, Rx Verified)
Simultaneous transmission:	Implemented (See below Note.)

Note: One Sub-GHz transmitter is co-located in the EUT, see the test report JP25KRGU 001 for more details.

3.3 Noise Generating and Noise Suppressing Parts

The highest frequency generated or used by the EUT is 24.15GHz for radio portion and unspecified for digital interface.

3.4 Submitted Documents and Information

Following documents have been submitted by the client:

Following information provided in this test report has been submitted by the client:

- client name and address;
- EUT identification, ratings, system details, and description of product function and intended use;
- information related to noise generating and noise suppressing parts (if any).

4. Test Setup and Operation Modes

4.1 Principle of Test Configuration Selection

Radio: The test methodology used is based on the requirements of 47 CFR Part 15, sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209 and 15.249.

The test methods, which have been used, are based on ANSI C63.10. For details, see under each test item.

4.2 Operation Modes

The operation modes used for testing are:

A. Transmitting with 100% Duty Cycle.

Table 4: Setting of Radio Parameters

Radio	Power Setting	Remark
Non-specific SRD 24GHz	8dBm	

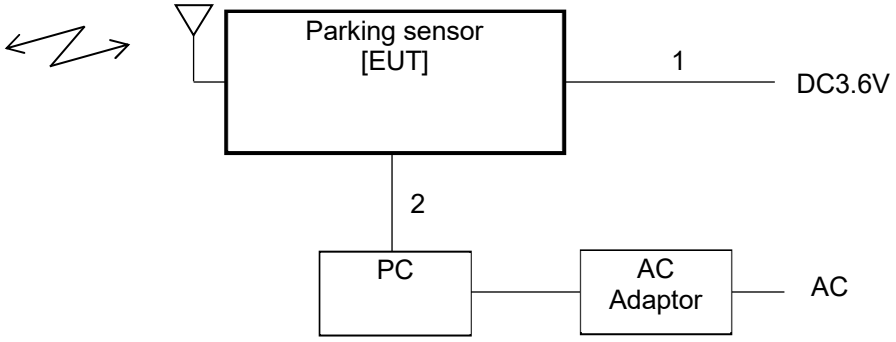
4.3 Physical Configuration for Testing

The EUT was tested on a stand-alone basis and the test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10.

Figure 1: Block Diagram

For Radiated testing



Note:
- DC power was supplied instead of batteries to maintain the constant output power.
- PC was disconnected from USB cable during the test.

Table 5: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	DC Input	0.7m, un-shielded	DC input power port
2.	USB	1.6m, shielded	Signal port

For more details, refer to section 6 “Photographs of the Test Setup”.

4.4 Test Software

The EUT was provided by the manufacturer with suitable internal software to allow operation in all the required modes.

Software used for testing: PKK GUI Embed version 1.3 by MinebeaMitsumi.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 4.2 as appropriate.

4.5 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

1. Product: PC (Notebook)
   Manufacturer: Lenovo
   Model: L590
   Rated Voltage: DC20V
   Input Current: 2.25A
   Protection Class: III
   Serial Number: PF-141MAG 19/09

2. Product: AC Adapter
   Manufacturer: Lenovo
   Model: ADLX45YCC2D
   Rated Voltage: 100–240V
   Input Current: 1.3A
   Frequency: 50–60Hz
   Protection Class: II
   Serial Number: 8SSA10R16869C1SG97CH5Y0

4.6 Countermeasures to achieve Compliance

No additional measures were employed to achieve compliance.

5. Test Results RADIO

5.1 Supply Voltage Requirements

RESULT: **Pass**

Requirements:

FCC §15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Verdict:

The EUT has an internal voltage regulator to supply the RF circuit. Hence it complies with the supply voltage requirements.

5.2 Antenna Requirements

RESULT: **Pass**

Requirements:

FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
All antennas for use with the EUT must be listed in the application, including a test report.

Verdict:

As per the guidance by KDB Publication No. 353028 D01, three ways can be used for a Part 15 Intentional radiator. a) Antenna permanently addached is applicable to the EUT.

The EUT has an internal antenna permanently attached on the printed circuit board which is not user accessible. Hence it complies with the antenna requirements.

5.3 Restricted Bands of Operation

RESULT: **Pass**

Requirements:

FCC §15.205

Only spurious emissions are permitted in any of the restricted frequency bands, unless otherwise specified.

Verdict:

The Operation frequency range of the EUT is 24.05-24.25GHz as Non-specific SRD 24GHz, only spurious emissions may be found in the restricted bands below 100GHz. Hence the EUT complies with the restricted frequency band requirement.

5.4 20dB Bandwidth

RESULT: **Pass**

Date of testing: 2025-01-31

Ambient temperature: 22°C
Relative humidity: 47%
Atmospheric pressure: 1015hPa

Test mode applied: A

Requirements:

FCC §15.215(c) and §15.249

The 20dB bandwidth of the emission shall be contained within the frequency band (24.00 – 24.25GHz) designated in the rule section under which the equipment is operated.

Test procedure:

ANSI C63.10-2020 §6.9.2

The EUT was placed on non-conductive table raised 1.5m above the ground plane in a semi-anechoic chamber. Test was conducted by the radiated measurement.

The 20dB bandwidth was measured with a horn antenna connected to a spectrum analyzer with the following settings:

- RBW = 100kHz, VBW = 300kHz, peak detector with Max Hold

Markers were placed at the lowest and highest intersections of the trace with a 20dBc line to obtain the value of the emission bandwidth.

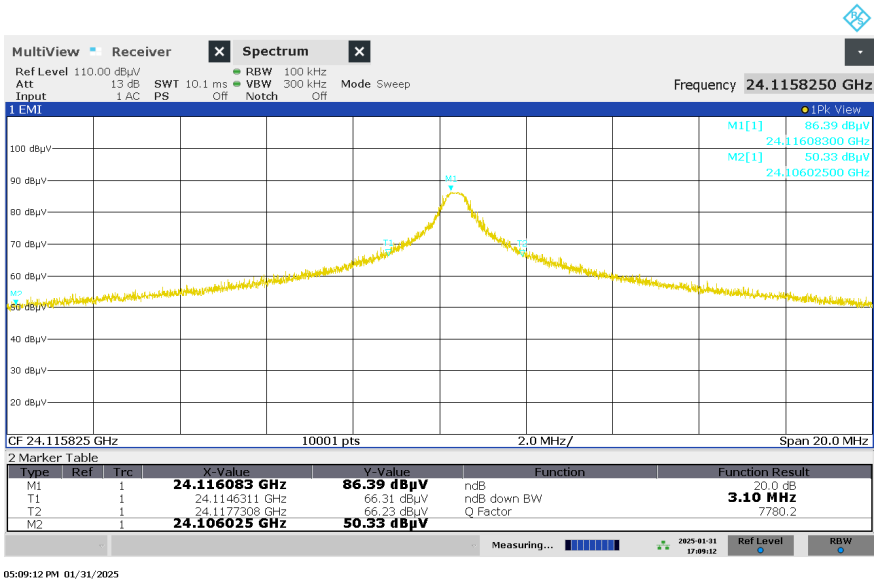
Table 6: 20dB Bandwidth Edge Frequencies

Operating Frequency [GHz]	20dB Bandwidth Edge Side	Edge Frequency [GHz]	Limit [GHz]	Margin [MHz]
24.15	Lower side	24.1146311	24.00	114.63
	Higher side	24.1177308	24.25	132.26

Table 7: 20dB Bandwidth

Operating Frequency [GHz]	20dB Bandwidth [MHz]	RBW [kHz]	Ratio	Remark
24.15	3.10	100	3.22%	

Figure 2: 20dB Bandwidth, Mode A



5.5 99% Bandwidth

RESULT: **For. Ref.**

Date of testing:	2025-01-31
Ambient temperature:	22°C
Relative humidity:	47%
Atmospheric pressure:	1015hPa
Test mode applied:	A

Test procedure:

ANSI C63.10-2020 §6.9.3

The EUT was placed on non-conductive table raised 1.5m above the ground plane in a semi-anechoic chamber. Test was conducted by the radiated measurement.

The 99% bandwidth was measured with a horn antenna connected to a spectrum analyzer with the following settings:

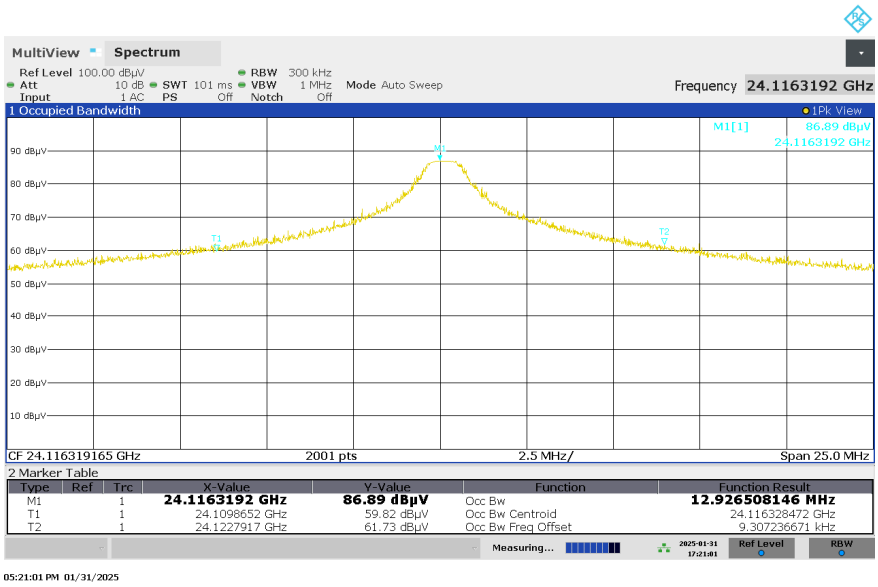
- RBW = 300kHz, VBW = 1MHz, Peak detector with Max-hold

The RBW was set in the range from 1% to 5% of the observed OBW, VBW was set to at least three times of RBW. Markers were placed at the lowest and highest intersections of the trace by 99% OBW function to obtain the value of the 99% emission bandwidth.

Table 8: 99% Bandwidth

Operating Frequency [GHz]	99% Bandwidth [MHz]	RBW [kHz]	Ratio	Remark
24.15	12.926508146	300	3.13%	

Figure 3: 99% Bandwidth, Mode A



5.6 Duty Cycle

RESULT: **For. Ref.**

Date of testing:	2025-01-31
Ambient temperature:	22°C
Relative humidity:	47%
Atmospheric pressure:	1015hPa
Test mode applied:	A

Requirements:

N/A, this test item was performed as reference.

Test procedure:

ANSI C63.10-2020 §7.5

Note:

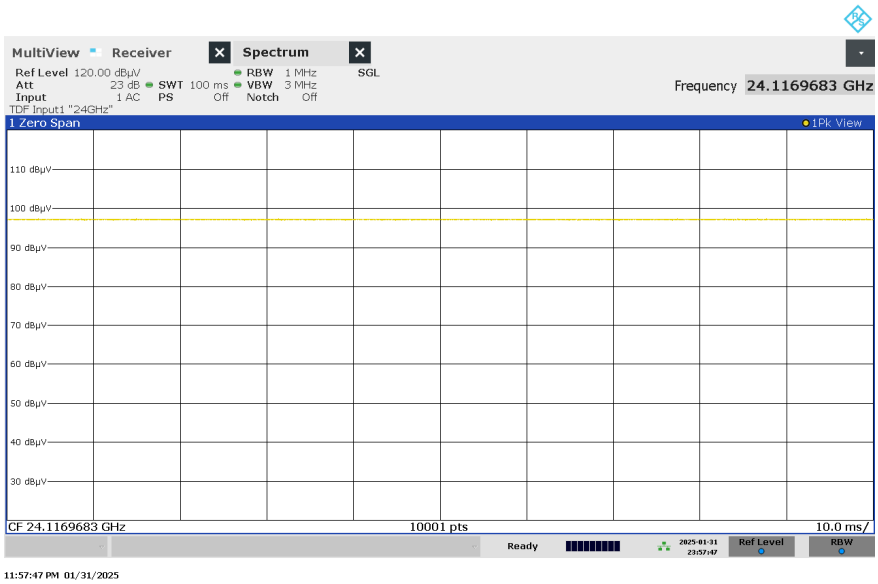
As the observed duty cycle achieved by the test modes was 100% for mode A, no duty cycle correction was made on this test report.

Table 9: Duty Cycle for Mode A

Operating Frequency [GHz]	On-Time [ms]	Period [ms]	Duty Cycle [%]
24.15	100	100	100

Note: These duty cycles show the continuous transmission during measurements at Mode A.

Figure 4: Duty Cycle, Mode A



5.7 Field Strength of Fundamental

RESULT: **Pass**

Date of testing:	2025-01-31
Ambient temperature:	22°C
Relative humidity:	47%
Atmospheric pressure:	1015hPa
Frequency range:	9kHz - 100GHz
Measurement distance:	3m
Kind of test site:	Semi Anechoic Chamber
Test mode applied:	A

Requirements:

FCC §15.249 (a), (c) and (e)

The field strength of fundamental shall not exceed the level specified in FCC 15.249 (a).

Test procedure:

ANSI C63.10 §6.3 and §6.6

The EUT was placed on a non-conductive table raised 1.5m above the ground plane for the fundamental measurements. Measurements were made at 3m distance. The EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level.

Measurements were taken using both horizontal and vertical antenna polarizations for the three EUT orientations (X, Y, Z) in order to specify the worst case condition.

Measurements were performed using a spectrum analyzer with a suitable span to encompass the maximum point of the fundamental and using the following settings;

- RBW = 1MHz, VBW = 3MHz, peak detector with max hold for Peak;
- RBW = 1MHz, VBW = 3MHz, average detector with max hold for Average.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 10: Field Strength of Fundamental, Peak Data

Mode	Frequency [MHz]	EUT / Ant. Orient.	Reading Level PK [dBµV]	Factor [dB/m]	Peak Level [dBµV/m]	Peak Limit [dBµV/m]	Margin [dB]
A	24116.025	Z/V	86.9	15.4	102.3	127.9	25.6

Note: Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

Peak Level was calculated by the following formula;

- Peak Level at 3m = Reading Level PK + Factor

Gray shading data shows the highest E-field strength of the fundamental in this test report.

Table 11: Field Strength of Fundamental, Average Data

Mode	Frequency [MHz]	EUT / Ant. Orient.	Reading Level AV [dBµV]	Factor [dB/m]	Average Level [dBµV/m]	Average Limit [dBµV/m]	Margin [dB]
A	24116.025	Z/V	86.2	15.4	101.6	108	6.4

Note: Average limit in dBµV/m is calculated as follows: Average limit = 20 × Log_{10} (250000uV/m).

Average Level was calculated by the following formula;

- Average Level at 3m = Reading Level AV + Factor

5.8 Radiated Spurious Emissions of Transmitter

RESULT: **Pass**

Date of testing:	2025-01-31, 2025-02-03, 2025-02-04
Ambient temperature:	22, 24, 24°C
Relative humidity:	47, 27, 30%
Atmospheric pressure:	1015, 1003, 1006hPa
Frequency range:	9kHz - 100GHz
Measurement distance:	3m below 40GHz 1.2m 40 - 75GHz 0.6m 75 - 100GHz
Kind of test site:	Semi Anechoic Chamber
Test mode applied:	A

Requirements:

FCC §15.205, §15.209, §15.249 (a), (c), (d) and (e)

Radiated emissions which fall in the restricted bands, as defined in FCC §15.205(a) must comply with the radiated emission limits specified in FCC §15.209(a).

Radiated emissions which is outside of the authorized band, shall be attenuated by at least 50dBc or to the general emission, whichever is the lesser attenuation.

Test procedure:

ANSI C63.10-2020 §6.3, §6.4, §6.5, §6.6, §6.10, 9

The EUT was placed on a nonconductive turntable. The table height was 80cm for measurements below 1GHz and 1.5m for measurements above 1GHz. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to 100GHz. Final radiated emission measurements were made at 3m distance below 40GHz and 1.0 or 0.6m above 40GHz.

At each frequency where a spurious emission was found, the EUT was rotated 360° in order to determine the emission's maximum level. For frequencies above 30MHz, the antenna was raised and lowered from 1 to 4m and measurements were taken using both horizontal and vertical antenna polarizations.

For emissions between 30MHz and 1GHz, measurements were performed with a test receiver operating in the CISPR quasi-peak detection mode with a 6dB bandwidth set to 120kHz.

For emissions above 1GHz, measurements were performed with a spectrum analyzer using the following settings: for peak field strength: RBW = 1MHz & VBW = 3MHz; for average field strength: RBW = 1MHz & VBW = 10Hz. Positive peak detector was applied.

Absorbers have been placed on the floor between the EUT and the measuring antenna for testing above 1GHz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Emissions other than those mentioned are small or not detectable.

No spurious emission other than the fundamental frequency was found in the range from 1GHz to 40GHz.

Table 12: Radiated Emissions, Quasi Peak Data, 9kHz - 30MHz, Mode A

Freq. [MHz]	EUT / Antenna Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Angle [°]
0.0149	Z/V	14.3	19.7	34.0	124.2	90.2	101
0.0369	Z/V	7.0	19.6	26.6	116.3	89.7	251
0.4884	Z/V	6.0	19.4	25.4	93.8	68.4	248
5.1794	Z/V	4.3	19.7	24.0	69.5	45.5	356
27.7108	Z/V	6.7	20.1	26.8	69.5	42.7	1
0.0119	Z/H	16.2	19.8	36.0	126.1	90.1	127
0.0585	Z/H	2.2	19.6	21.8	112.2	90.4	168
0.6656	Z/H	6.0	19.5	25.5	71.1	45.6	109
2.5887	Z/H	5.5	19.5	25.0	69.5	44.5	227
10.4072	Z/H	6.0	19.8	25.8	69.5	43.7	1

Note: Level QP = Reading QP + Factor

Table 13: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A

Freq. [MHz]	EUT / Antenna Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
31.416	Z/V	42.4	-21.9	20.5	40.0	19.5	100	206
57.088	Z/V	43.9	-21.2	22.7	40.0	17.3	100	171
67.687	Z/H	40.8	-22.4	18.4	40.0	21.6	108	359
89.997	Z/V	55.2	-26.4	28.8	43.5	14.7	120	313
90.000	Z/H	56.4	-26.4	30.0	43.5	13.5	149	126
291.177	Z/H	47.6	-19.0	28.6	46.0	17.4	102	295
291.802	Z/V	47.2	-19.0	28.2	46.0	17.8	119	179
674.966	Z/H	38.1	-9.8	28.3	46.0	17.7	119	225

Note: Level QP = Reading QP + Factor

Table 14: Radiated Emissions, Peak Data, 40 - 100GHz, Horizontal and Vertical Antenna Orientations, Mode A

Freq. [GHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]
48.229	X/V	46.9	15.6	1.2	-8.0	54.6	87.9	33.3
48.229	X/H	46.3	15.6	1.2	-8.0	53.9	87.9	34.0
48.229	Y/H	53.2	15.6	1.2	-8.0	60.8	87.9	27.1
48.229	Y/V	44.0	15.6	1.2	-8.0	51.7	87.9	36.2
48.228	Z/V	51.5	15.6	1.2	-8.0	59.2	87.9	28.7
48.228	Z/H	45.4	15.6	1.2	-8.0	53.1	87.9	34.8
72.343	Z/V	51.9	21.4	1.2	-8.0	65.3	87.9	22.6
72.349	Z/H	46.8	21.4	1.2	-8.0	60.2	87.9	27.7
72.343	Y/H	51.5	21.4	1.2	-8.0	64.9	87.9	23.0
72.342	Y/V	52.2	21.4	1.2	-8.0	65.7	87.9	22.3
72.343	X/V	51.5	21.4	1.2	-8.0	64.9	87.9	23.0
72.343	X/H	46.5	21.4	1.2	-8.0	59.9	87.9	28.0
74.050	X/H	50.9	27.3	1.2	-8.0	70.2	74.0	3.8 (*)

Note: Level PK = Reading PK + Factor + DCF (Distance Correction Factor)

DCF (Distance Correction Factor) = 20 × Log_{10} (D (m) / 3.0 (m))

(*) The measured result is below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a high probability that the tested product complies with the specification limit.

Table 15: Radiated Emissions, Average Data, 40 - 100GHz, Horizontal and Vertical Antenna Orientations, Mode A

Freq. [GHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]
48.229	X/V	41.8	15.6	1.2	-8.0	49.5	67.9	18.4
48.229	X/H	41.4	15.6	1.2	-8.0	49.1	67.9	18.8
48.229	Y/H	50.0	15.6	1.2	-8.0	57.6	67.9	10.3
48.229	Y/V	37.3	15.6	1.2	-8.0	45.0	67.9	22.9
48.229	Z/V	47.0	15.6	1.2	-8.0	54.6	67.9	13.3
48.229	Z/H	39.3	15.6	1.2	-8.0	46.9	67.9	21.0
72.463	Z/V	44.8	21.4	1.2	-8.0	58.2	67.9	9.7
72.343	Z/H	35.8	21.4	1.2	-8.0	49.2	67.9	18.7
72.343	Y/H	44.0	21.4	1.2	-8.0	57.4	67.9	10.5
72.343	Y/V	45.4	21.4	1.2	-8.0	58.8	67.9	9.1
72.343	X/V	41.2	21.4	1.2	-8.0	54.6	67.9	13.3
72.343	X/H	39.4	21.4	1.2	-8.0	52.8	67.9	15.1
71.472	X/H	39.4	19.9	1.2	-8.0	51.4	54.0	2.6 (*)

Note: Level AV = Reading AV + Factor + DCF (Distance Correction Factor)

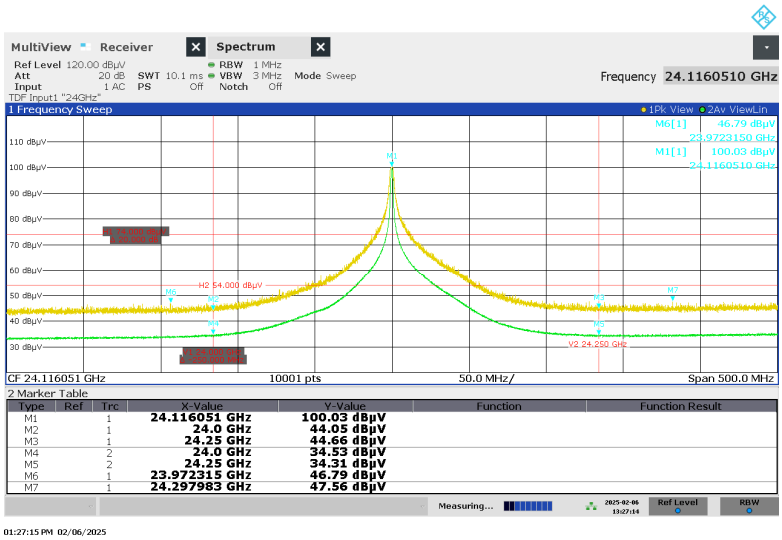
DCF (Distance Correction Factor) = 20 × Log_{10} (D (m) / 3.0 (m))

(*) The measured result is below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a high probability that the tested product complies with the specification limit.

Figure 5: Restricted-band Band-edge, Spectral Diagram, Mode A, Horizontal Antenna Orientation

Note: The upper trace shows the peak value and the lower trace shows the average value. Radiated emissions which is outside of the authorized band were attenuated below the general emission limits.

Figure 6: Restricted-band Band-edge, Spectral Diagram, Mode A, Vertical Antenna Orientation



Note: The upper trace shows the peak value and the lower trace shows the average value. Radiated emissions which is outside of the authorized band were attenuated below the general emission limits.

5.9 AC Power Line Conducted Emission of Transmitter

RESULT: **N/A**

Frequency range: 0.15 - 30MHz

Requirements:

FCC §15.207

The AC power line conducted emission on any frequency within the band 150kHz to 30MHz shall not exceed the limits specified in FCC §15.207(a) and RSS-Gen §8.8 (table 4).

Note:

This test item is not applicable for the EUT which only employes battery power for operation and which does not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

7. List of Tables

8. List of Figures

9. List of Photographs

– End of test report –