Test Report – Products
Prüfbericht – Produkte

VLAC Lab Accreditation VLAC-017

TÜVRheinland®

Test Report No.: *Prüfbericht-Nr.:*	**JP25EM5I 001**	**Order No.:** *Auftrags-Nr.:*	**150313482**	**Page 1 of 43** *Seite 1 von 43*
Client Reference No.: *Kunden-Referenz-Nr.:*	TOTUV-20240607	**Order Date:** *Auftragsdatum:*	2025-06-04	
Client: *Auftraggeber:*	Nextorage Corporation Kawasaki-eki-mae Tower Riverk 9F 12-1, Ekimaehoncho, Kawasaki-ku Kawasaki City, Kanagawa 210-0007 Japan			
Test Item: *Prüfgegenstand:*	Multi-functional SSD with security			
Identification / Type No.: *Bezeichnung / Typ-Nr.:*	NX-PFS1PRO1TB	**Serial No.:** *Serien-Nr.:*	Refer to section 4.3	
Order Content: *Auftrags-Inhalt:*	Wireless Testing			
Test Specification: *Prüfgrundlage:*	FCC 47 CFR Part 15, Subpart C, Section 15.225			

Date of Sample Receipt: *Wareneingangsdatum:*	2025-06-23
Test Sample No.: *Prüfmuster-Nr.:*	A004028115-001
Testing Period: *Prüfzeitraum:*	2025-06-23 to 2025-07-18
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: 2025-08-06 *Datum:*	Hidetoshi Sasaki	**Issue Date:** 2025-08-06 *Ausstellungsdatum:*	Pin Zhang
Position / *Stellung:*	Project Engineer	**Position** / *Stellung:*	Authorizer

Other / *Sonstiges:*

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
JP25EM5I 001	2025-08-06	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 15.225 ANSI C63.10-2020		
Supply Voltage Requirements FCC §15.31(e)	See section 5.1.	Pass
Antenna Requirements FCC §15.203	See section 5.2.	Pass
Restricted Bands of Operation FCC §15.205	See section 5.3.	Pass
Field Strength of Fundamental (In-Band Emission) FCC §15.225(a)(b)(c)	84.0dBuV/m within the band 13.553-13.567MHz 50.5dBuV/m within the bands 13.410-13.553MHz and 13.567-13.710MHz 40.5dBuV/m within the bands 13.110-13.410MHz and 13.710-14.010MHz	Pass
20dB Bandwidth §15.215(c)	20dB bandwidth shall be contained within the designated frequency band.	Pass
Duty Cycle	-/-	For. Ref.
Radiated Spurious Emissions of Transmitter (Out-Band Emission) §15.225(d) and FCC §15.209	9kHz - 1GHz §15.209(a) General Limits	Pass
Frequency Stability §15.225(e)	Frequency tolerance: ±0.01% Temperature variation: -20 to +50°C Voltage variation: See section 5.8.	Pass
Conducted Emission on AC Power Ports of Transmitter FCC §15.207(a)	150kHz - 30MHz	Pass

1.2 Test Report Purpose

The purpose of this test report is to show compliance of the **EUT** (**E**quipment **U**nder **T**est) 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 test facility is accredited by VLAC (member of ILAC) under accreditation number VLAC-017-1 according to ISO/IEC 17025:2017.

The test facility is recognized by the Federal Communications Commission (FCC) as Accredited Testing Laboratory under designation number JP0017.

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)							
Path Loss Correction Factors for RE below 1GHz	-/-	-/-	-/-	RF-0596	1 year	2025-01-29	2026-01-29
RE Meas. Software	Toyo Corporation	ES10/RE-AJ	0600-0179-80	RF-1263	N/A	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESW 44	103396	RF-1250	1 year	2025-05-22	2026-05-22
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	N/A	N/A	N/A
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	1 year	2024-07-24	2025-07-24
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB 9168	9168-475	RF-0462	1 year	2025-05-26	2026-05-26
5dB Attenuator	Pasternack	PE7047-5	-/-	RF-0731	1 year	2025-05-30	2026-05-30
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	1 year	2024-12-24	2025-12-24
For Power Port Conducted Emission (CE)							
Path Loss Correction Factors for CE	-/-	-/-	-/-	RF-0597	1 year	2025-01-29	2026-01-29
CE Measurement Software	Toyo Corporation	ES10/CE-AJ	0700-0183-35	RF-1262	N/A	N/A	N/A
EMI Receiver ESW 44	Rohde & Schwarz	ESW 44	103396	RF-1250	1 year	2025-05-22	2026-05-22
LISN	Rohde & Schwarz	ENV216	101958	RF-0708	1 year	2025-05-21	2026-05-21

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
Frequency Stability							
Temperature Chamber	Voetsch	VT 4018	58566025 090010	BT-8012	1 year	2024-07-02	2025-07-02
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	1 year	2024-07-24	2025-07-24
EMI Receiver EPL1000	Rohde & Schwarz	EPL1000	100969	RF-1249	1 year	2025-05-23	2026-05-23
DC Power Supply	Agilent	E3646A	MY503500 07	RF-0412	N/A	N/A	N/A
Constant Voltage Constant Frequency Stabilizers and Power Accessories							
CVCF (10m Chamber)	NF Corporation	ES2000U	9067307	RF-0212	1 year	2025-03-10	2026-03-10
CVCF Booster (10m Chamber)	NF Corporation	ES2000B	9074408	RF-0213	1 year	2025-03-10	2026-03-10
CVCF (Shielded Room)	NF Corporation	ES2000S	9075612	RF-0210	1 year	2025-03-10	2026-03-10
CVCF Booster (Shielded Room)	NF Corporation	ES2000B	9074403	RF-0211	1 year	2025-03-10	2026-03-10
True RMS Multimeter	Fluke	87V	97680450	RF-0282	1 year	2025-04-08	2026-04-08

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 Power Ports	9 - 150kHz	±3.79dB
	150kHz - 30MHz	±3.31dB
Magnetic Field Strength	9kHz - 30MHz	±4.79dB
Radiated Emission up to 1GHz	30MHz - 1GHz (3m Distance)	±6.01dB (Vertical) ±4.91dB (Horizontal)
	30MHz - 1GHz (10m Distance)	±4.95dB (Vertical) ±4.94dB (Horizontal)

3. General Product Information

3.1 Product Function and Intended Use

The **EUT** NX-PFS1PRO1TB is an external SSD (**S**olid **S**tate **D**rive) with some security features. It supports USB 3.2 Gen 2×2 (20Gbps) interface and USB PD (**P**ower **D**elivery) interface by pass-through to a PC or a tablet.

Un-lock functions by 13.56MHz RF-ID wireless or by 2.4GHz wireless LAN are implemented for the device.

Four types of SSD capacities are available for the product line of NX-PFS1PRO. They are 8TB, 4TB, 2TB and 1TB.

13.56MHz RF-ID portion is fully identical among the models NX-PFS1PRO1TB, NX-PFS1PRO2TB, NX-PFS1PRO4TB and NX-PFS1PRO8TB. See the submitted exhibits for more details.

3.2 Ratings and System Details

13.56MHz RF-ID

Radio Standard:	MIFARE: ISO/IEC 14443 (Type A) Felica: ISO/IEC 18092 (Type F)
Frequency range:	13.110-14.010 MHz
Nominal frequency:	13.56MHz
Modulation type:	MIFARE: ASK 100% Felica: ASK 10%
Fundamental Field Strength:	MIFARE: 55.3dBµV/m at 3m measurement distance Felica: 54.8dBµV/m at 3m measurement distance
Antenna type:	Loop Antenna
Antenna mounting type:	PCB Pattern
Signal spreading:	N/A
Transmit speed:	MIFARE: 106kbps Felica: 212kbps
Number of channels:	1
FCC classification:	DXX
Rated voltage and frequency:	DC 5V (by USB Bus-powered) DC 20V (by USB Power Delivery)
Input power:	100W Maximum
Protection class:	III

Test voltage and frequency:	DC 5V by USB bus-powered from host PC AC 120V, 60Hz for AC Adapter of the host PC

For Frequency Stability Test:

Low test voltage:	DC 4.75V
High test voltage:	DC 5.5V

Note: As per USB specifications, its voltage range is from DC 4.75V to DC 5.5V, therefore, the minimum and maximum allowable voltage range was applied.

3.3 Noise Generating and Noise Suppressing Parts

The highest frequency generated or used by the EUT is 5GHz by USB 3.2 Gen 2×2 data transfer rate (20Gbps).

3.4 Submitted Documents and Information

Following documents have been submitted by the client:

- Product Description (Multi-Function SSD for compliance)
- Table for test samples

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 15.225.

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. Tx mode: EUT continuously transmits 13.56MHz modulated signals (ASK 100% for MIFARE).

B. Tx mode: EUT continuously transmits 13.56MHz modulated signals (ASK 10% for Felica).

C. Tx mode: EUT continuously transmits 13.56MHz un-modulated signals.

Note:
As per section 5.10.7 of ANSI C63.10, each representative passive tag (i.e. RF-ID card) was used. As the EUT is RF-ID reader that interacts with a passive tag, the EUT was tested “with each representative card” and “without the card”.
The card was set at the minimum separation distance (i.e. contact without a gap) from the surface of EUT during testing.

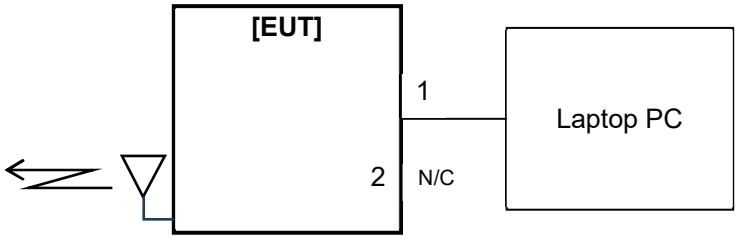
4.3 Physical Configuration for Testing

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.

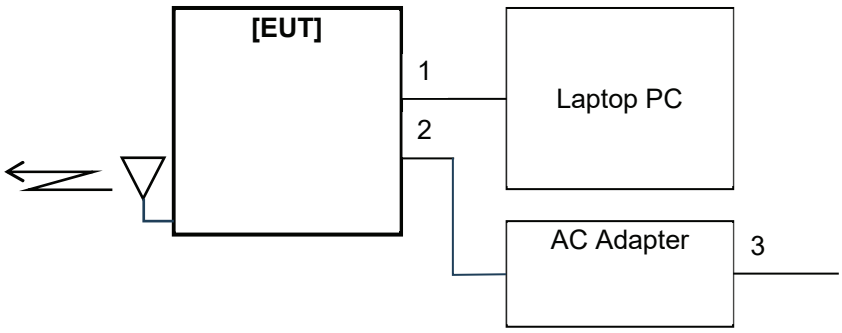
Figure 1: Block Diagram for Radiated Emission of Transmitter

USB Bus-powered



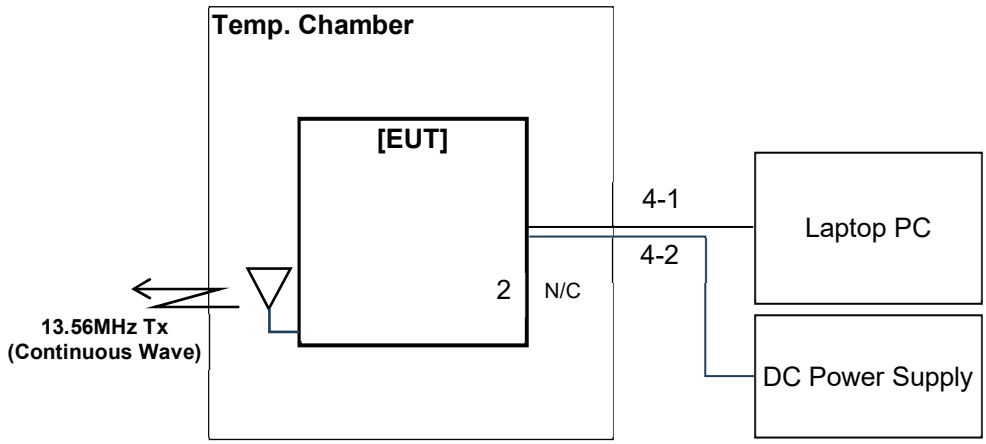
Note: A RF-ID card was set on the surface of the EUT, when this card was used.

USB Pass-through



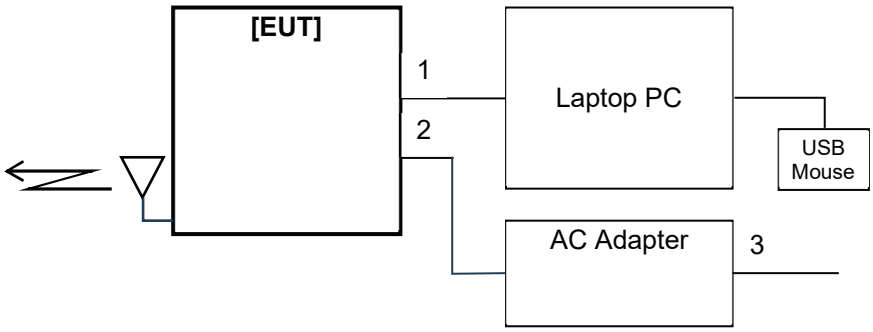
Note:
The 13.56MHz Tx can be powered via USB bus-powered. Further, USB pass-throguh was considered for the radiated spurious emission measurements in order to identify the worst case emission.
A RF-ID card was set on the surface of the EUT, when this card was used.

Figure 2: Block Diagram for Frequency Stability



Note: DC power supply was used for voltage variation testing.

Figure 3: Block Diagram for AC Power Line Conducted Emission of Transmitter



Note: As per the Q5 in the KDB publication 174176 D01 Line Conducted FAQ v01r01, a suitable dummy load replaced a loop coil antenna of the EUT and was a termination used in place of the antenna, which has the same electrical properties as the intended antenna without radiated emissions.

Table 4: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	USB 3.2 Gen 2×2 (20Gbps)	0.5m or 2.0m, shielded	DC Output Power and Signal Port
2.	USB PD	1.8m, shielded	DC Input Power Port
3.	AC Cable	0.9m, un-shielded	AC Mains Power Port
4.	USB Cable **(*)**	1.0m, shielded	DC Output Power and Signal Port

Note: **(*)** For testing purposes, DC power line of this USB cable was connected from a DC power supply to EUT at frequency stability testing.

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

Table 5: Serial Number of test samples

Test Item	Serial Number	Remark
Radiated Emission of Transmitter	SP1ADVT0029	For Mode A
	SP1ADVT0034	For Mode B
	SP1ADVT0006	For Mode A with RF-ID card
Frequency Stability	SP1ADVT0005	Transmitted Continuous Wave
AC Power Line Conducted Emission of Transmitter	SP1ADVT0059	Tx antenna was replaced by a dummy load for the measurements.
	SP1ADVT0007	

Note: Each test sample supports relevant test mode by its pre-installed firmware.

4.4 Test Software

The EUT(s) were provided by the manufacturer with suitable internal firmware to allow operation in all the required modes.

For Mode A and B

Firmware used for testing: NFC_compliance_test_ASK100/10, version Fri Jun 27 2025 by Nextorage Corporation.

For Mode C

Firmware used for testing: NFC_compliance_test_no_mod, version Fri Jun 27 2025 by Nextorage Corporation.

Each firmware was running on each 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: Laptop Computer (RF-1322)
   Manufacturer: Lenovo
   Model: ThinkPad E14 Gen6
   Rated Voltage: DC 20V
   Input Current: 3.25A
   Protection Class: III
   Serial Number: PF-55WAD5

2. Product: AC Adaptor (RF-1322)
   Manufacturer: Lenovo
   Model: ADLX65YCC2E
   Rated Voltage: AC 100V-240V
   Input Current: 1.8A
   Frequency: 50-60Hz
   Protection Class: II
   Serial Number: 8SGX21J75552C1TJ

3. Product: USB Mouse (RF-0567)
   Manufacturer: Microsoft
   Model: Comfort Mouse 4500
   Rated Voltage: DC 5V
   Protection Class: III
   Serial Number: 02205-523-3377582-11310

4. Product: RF-ID Card (MIFARE)
   Manufacturer: M-acs
   Model: MiA001
   Serial Number: 86658059

5. Product: RF-ID Card (Felica)
   Manufacturer: M-acs
   Model: Fe-001
   Serial Number: Un-specified

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 antenna permanently attached on a printed circuit board. 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 13.110-14.010 MHz as 13.56MHz RF-ID, only spurious emissions may be found in the restricted bands below 1GHz. Hence the EUT complies with the restricted frequency band requirement.

5.4 Field Strength of Fundamental

RESULT: **Pass**

Date of testing: 2025-06-27

Ambient temperature: 25°C
Relative humidity: 66%
Atmospheric pressure: 1002hPa

Requirements:

Measurement distance: 3m
Kind of test site: Semi Anechoic Chamber

Requirements:

FCC §15.225(a)(b)(c)

The field strength of fundamental shall not exceed the level specified in 15.225(a)(b)(c).

Test procedure:

ANSI C63.10-2020 §6.3 and §6.6

The EUT was placed on a non-conductive table raised 80cm above the ground plane for the fundamental measurements. Measurements were made at 3m distance. The EUT was rotated 360° in order to determine the emission's maximum level.

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

Measurements were performed with a test receiver operating in the CISPR quasi-peak detection mode with a 6dB bandwidth set to 9kHz.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. The field strength values taken at 3m measurement distance were recalculated for a 30m distance using with the factor of 40dB/decade according to FCC 15.31(f).

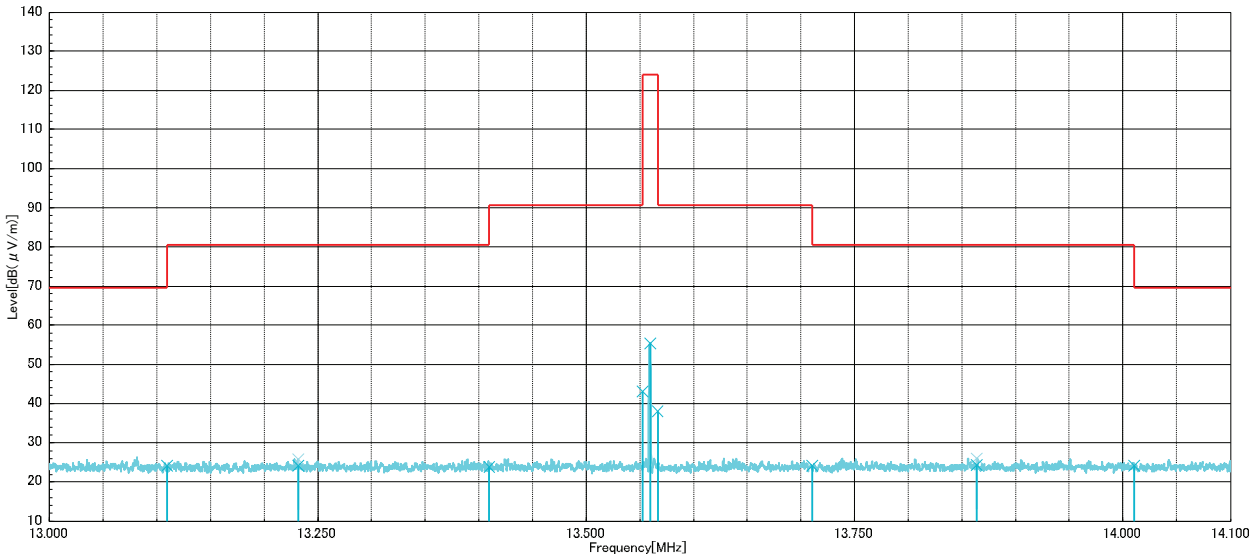
The final measurements were performed without a card in this test item, after prechecks which state the highest fundamental emission was observed.

Table 6: Field Strength of Fundamental, Mode A without Card

Frequency [MHz]	EUT / Antenna Orientation	Reading QP at 3m [dBuV]	Factor [dB(1/m)]	Level QP at 3m [dBuV/m]	Level QP at 30m [dBuV/m]	Limit QP at 30m [dBuV/m]	Margin QP [dB]	Angle [°]
13.110	Z/V	4.4	19.7	24.1	-15.9	29.5	45.4	0
13.232	Z/V	4.3	19.7	24.0	-16.0	40.5	56.5	0
13.410	Z/V	4.2	19.7	23.9	-16.1	40.5	56.6	0
13.553	Z/V	23.4	19.7	43.1	3.1	50.5	47.4	0
13.559	Z/V	35.6	19.7	**55.3**	15.3	84.0	68.7	0
13.567	Z/V	18.2	19.7	37.9	-2.1	50.5	52.6	0
13.710	Z/V	4.3	19.7	24.0	-16.0	40.5	56.5	0
13.864	Z/V	4.6	19.7	24.3	-15.7	40.5	56.2	0
14.010	Z/V	4.4	19.7	24.1	-15.9	29.5	45.4	0

Note: Level QP at 3m = Reading QP at 3m + Factor
Level QP at 30m = Level QP at 3m - distance extrapolation factor per one decade
Distance extrapolation factor = 40dB/decade
Margin QP = Limit QP at 3m – Level QP at 3m
Gray shading data shows the highest E-field strength of the fundamental in this test report.

Figure 4: Field Strength of Fundamental, Spectral Diagram, Mode A without Card



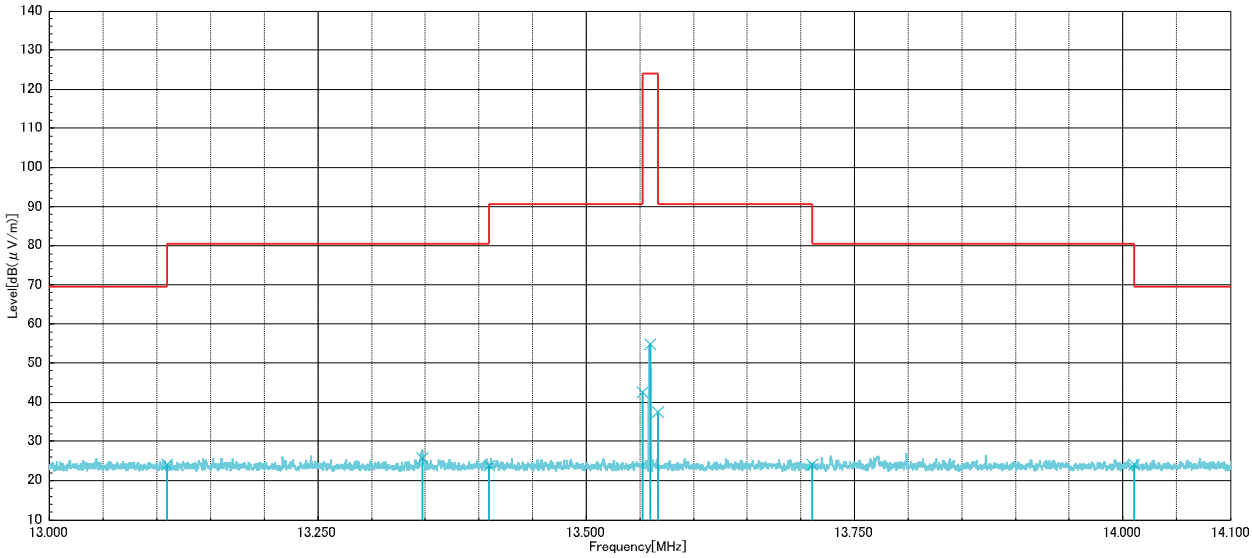
Note: This spectral diagram with peak detector is given for reference purposes only.
Measurement distance: 3m (limit is adjusted from 30m to 3m with 40dB distance correction factor)

Table 7: Field Strength of Fundamental, Mode B without Card

Frequency [MHz]	EUT / Antenna Orientation	Reading QP at 3m [dBuV]	Factor [dB(1/m)]	Level QP at 3m [dBuV/m]	Level QP at 30m [dBuV/m]	Limit QP at 30m [dBuV/m]	Margin QP [dB]	Angle [°]
13.110	Z/V	4.3	19.7	24.0	-16.0	29.5	45.5	0
13.347	Z/V	6.0	19.7	25.7	-14.3	40.5	54.8	0
13.410	Z/V	4.2	19.7	23.9	-16.1	40.5	56.6	0
13.553	Z/V	22.9	19.7	42.6	2.6	50.5	47.9	0
13.559	Z/V	35.1	19.7	54.8	14.8	84.0	69.2	0
13.567	Z/V	17.7	19.7	37.4	-2.6	50.5	53.1	0
13.710	Z/V	4.5	19.7	24.2	-15.8	40.5	56.3	0
14.010	Z/V	4.5	19.7	24.2	-15.8	29.5	45.3	0
14.270	Z/V	4.6	19.7	24.3	-15.7	29.5	45.2	0

Note: Level QP at 3m = Reading QP at 3m + Factor
Level QP at 30m = Level QP at 3m - distance extrapolation factor per one decade
Distance extrapolation factor = 40dB/decade
Margin QP = Limit QP at 3m – Level QP at 3m

Figure 5: Field Strength of Fundamental, Spectral Diagram, Mode B without Card



Note: This spectral diagram with peak detector is given for reference purposes only.
Measurement distance: 3m (limit is adjusted from 30m to 3m with 40dB distance correction factor)

5.5 20dB Bandwidth

RESULT: **Pass**

Date of testing: 2025-06-27

Ambient temperature: 25°C
Relative humidity: 66%
Atmospheric pressure: 1002hPa

Requirements:

FCC §15.215(c)

The 20dB bandwidth of the emission shall be contained within the frequency band (13.110-14.010 MHz) 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 80cm above the ground plane in a semi-anechoic chamber.

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

- RBW = 1kHz, VBW = 3kHz, 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.

The final measurements were performed without a card in this test item, after prechecks were conducted with and without the card.

Table 8: 20dB Bandwidth Edge Frequencies without Card

Mode	20dB Bandwidth Edge Side	Edge Frequency [MHz]	Limit [MHz]	Margin [MHz]
A	Lower side	13.558033297	13.11	0.448033297
	Higher side	13.560701527	14.01	0.449298473
B	Lower side	13.558033797	13.11	0.448033797
	Higher side	13.560757527	14.01	0.449242473

Note: Lower side of the Lowest Ch and Higher side of the Highest Ch were measured.

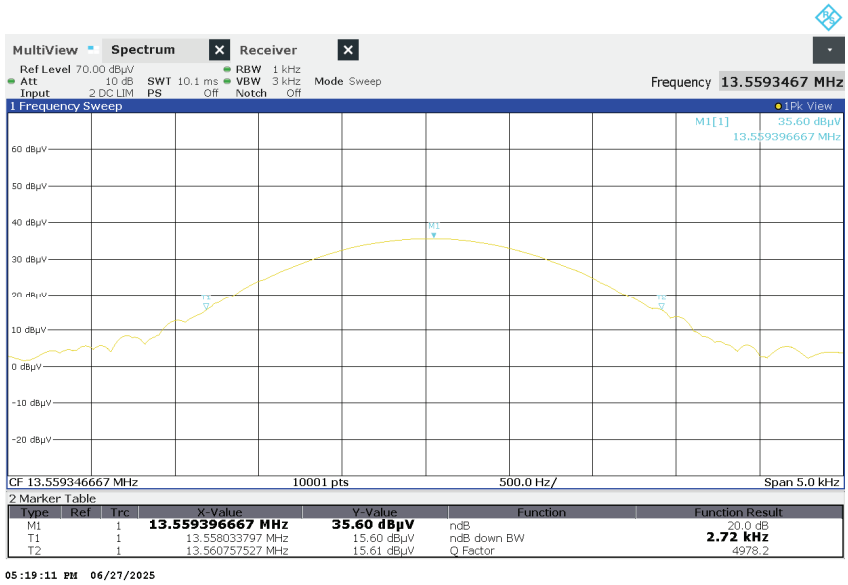
Table 9: 20dB Bandwidth

Mode	20dB Bandwidth [kHz]	RBW [Hz]	Remark
A	2.668230	1000	without Card
B	2.723730	1000	without Card

Note:
As the observed fundamental signal is CW-like signal from 13.553 to 13.567kHz, therefore, RBW was set to 1kHz. The presentation material (title: TCB Sharing of FCC KDBs and ISED emails as of 2021-10-19) slides from 15 to 19 were referred for this measurement.

Figure 6: 20dB Bandwidth, Mode A

Figure 7: 20dB Bandwidth, Mode B



5.6 Duty Cycle

RESULT: **For. Ref.**

Date of testing: 2025-06-27

Ambient temperature: 25°C
Relative humidity: 66%
Atmospheric pressure: 1002hPa

Requirements:

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

Test procedure:

ANSI C63.10-2020 §7.5 as reference

The EUT was placed on non-conductive table raised 80cm above the ground plane in a semi-anechoic chamber.

The duty cycle was measured with a loop antenna connected to a spectrum analyzer with the following settings:

- RBW = 200Hz, VBW = 200Hz, peak detector with Max Hold

Sweep time was adjusted to obtain 100ms time window of a pulse train, including blanking intervals as per the §15.35(c).

Note:

No duty cycle correction was applied in this test report.

Table 10: Duty Cycle

Mode	Duty Cycle Setting [%]	On-Time [ms]	Period [ms]	Duty Cycle [%]
A	100	100	100	100
B	100	100	100	100

Figure 8: Duty Cycle, Mode A

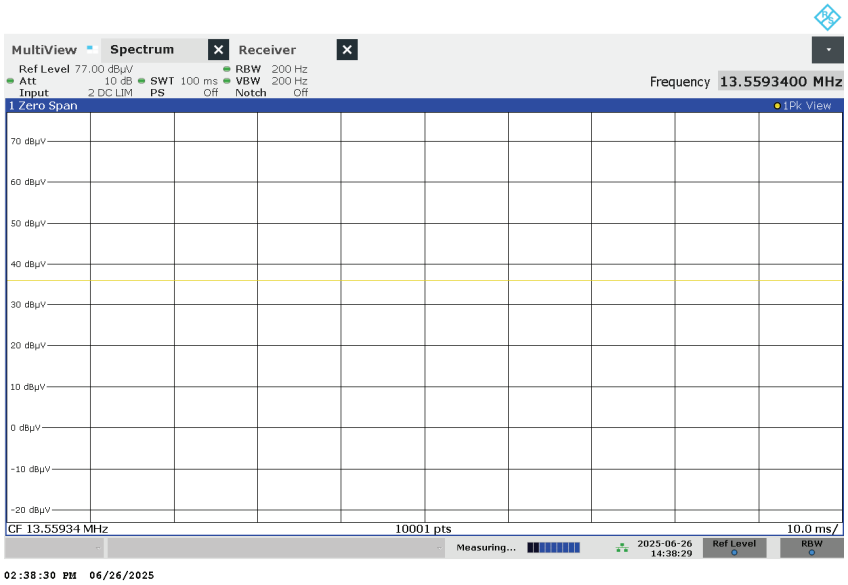
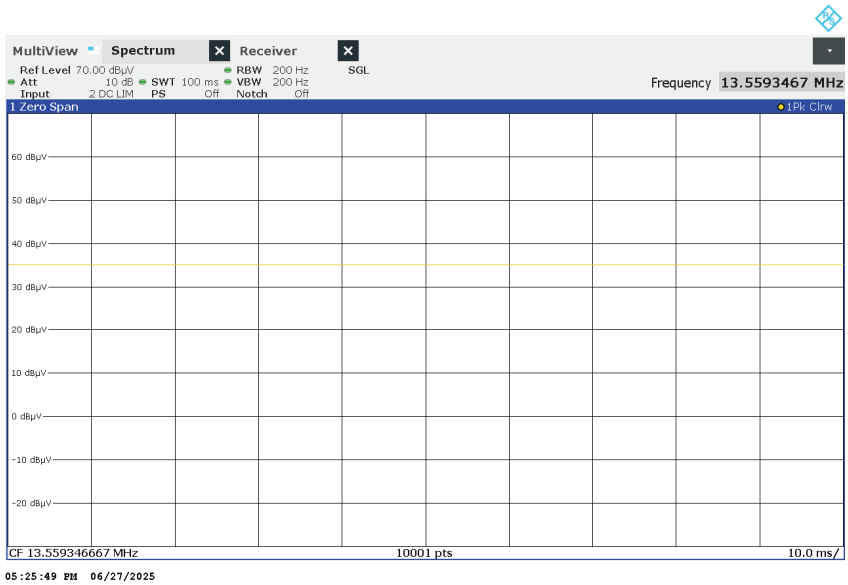


Figure 9: Duty Cycle, Mode B



5.7 Radiated Spurious Emissions of Transmitter

RESULT: **Pass**

Date of testing:	2025-06-26, 2025-06-27, 2025-07-18
Ambient temperature:	24, 25, 25°C
Relative humidity:	65, 66, 64%
Atmospheric pressure:	1005, 1002, 1014hPa
Frequency range:	9kHz - 1GHz (except 13.11 - 14.01MHz)
Measurement distance:	3m below 30MHz 3m 30MHz - 1GHz
Kind of test site:	Semi Anechoic Chamber

Requirements:

FCC §15.225 (d), §15.205, §15.209

Emission radiated outside the band 13.110-14.010MHz must comply with the radiated emission limits specified in FCC 15.209 (a).

Test procedure:

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

The EUT was placed on a non-conductive table. The table height was 0.8m for measurements below 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 and Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to 1GHz.

For emissions between 9kHz to 30MHz, measurements were performed with a receiver operating in the CISPR quasi-peak detection mode. The receiver's 6dB bandwidth was set to 9kHz above 150kHz and to 200Hz below 150kHz, respectively.

At each frequency selected for final measurement, the EUT was rotated 360° in order to determine the emission's maximum level. Measurements were taken using both vertical antenna and ground parallel polarizations.

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

At each frequency selected for final measurement, 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.

Final radiated emission measurements were made at 3m distance from 9kHz to 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.

Table 11: Radiated Emission, Quasi Peak Data, 9kHz - 30MHz, Vertical Antenna Orientations, Mode A without Card

Freq. [MHz]	EUT / Ant. Orient.	Reading [dBµV]	Factor [dB(1/m)]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Angle [°]
27.128	X/V	4.5	20.1	24.6	69.5	44.9	92

Note: Level QP/AV = Reading QP/AV + Factor

Table 12: Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A without Card

Freq. [MHz]	EUT / Ant. Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
40.681	Z/V	43.9	-21.5	22.4	40.0	17.6	100	52
42.146	Z/V	44.8	-21.4	23.4	40.0	16.6	100	0
108.483	Z/H	48.6	-24.0	24.6	43.5	18.9	245	99
311.873	Z/H	44.9	-18.3	26.6	46.0	19.4	100	22
478.200	Z/V	38.6	-13.3	25.3	46.0	20.7	181	239
527.210	Z/V	38.1	-12.3	25.8	46.0	20.2	102	142
527.358	Z/H	40.0	-12.3	27.7	46.0	18.3	181	319
600.820	Z/H	34.9	-10.4	24.5	46.0	21.5	400	349
600.900	Z/V	34.2	-10.4	23.8	46.0	22.2	181	47

Note: Level QP = Reading QP + Factor

Table 13: Radiated Emission, Quasi Peak Data, 9kHz - 30MHz, Vertical Antenna Orientations, Mode B without Card

Freq. [MHz]	EUT / Ant. Orient.	Reading [dBµV]	Factor [dB(1/m)]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Angle [°]
20.735	Z/V	4.4	20.0	24.4	69.5	45.1	302
27.118	Z/V	4.8	20.1	24.9	69.5	44.6	302

Note: Level QP/AV = Reading QP/AV + Factor

Table 14: Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode B without Card

Freq. [MHz]	EUT / Ant. Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
38.473	Z/V	36.0	-21.6	14.4	40.0	25.6	100	356
40.685	Z/V	45.7	-21.5	24.2	40.0	15.8	100	44
42.522	Z/V	45.8	-21.4	24.4	40.0	15.6	100	8
108.483	Z/H	48.6	-24.0	24.6	43.5	18.9	246	96
171.672	Z/V	43.9	-20.7	23.2	43.5	20.3	100	267
311.872	Z/H	44.8	-18.3	26.5	46.0	19.5	100	24
527.188	Z/V	38.7	-12.3	26.4	46.0	19.6	100	141
600.706	Z/V	36.4	-10.4	26.0	46.0	20.0	100	209

Note: Level QP = Reading QP + Factor

Table 15: Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A with Card

Freq. [MHz]	EUT / Ant. Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
31.706	Z/V	37.9	-21.9	16.0	40.0	24.0	135	331
40.684	Z/V	53.7	-21.5	32.2	40.0	7.8	100	273
48.791	Z/V	47.0	-21.0	26.0	40.0	14.0	100	299
49.885	Z/V	46.8	-20.9	25.9	40.0	14.1	100	283
77.560	Z/V	47.3	-24.6	22.7	40.0	17.3	100	150
147.198	Z/H	45.7	-20.4	25.3	43.5	18.2	206.5	81
149.158	Z/V	45.6	-20.3	25.3	43.5	18.2	100	105
404.647	Z/V	41.1	-15.5	25.6	46.0	20.4	192.4	274

Note: Level QP = Reading QP + Factor, dB(uV/m) = 20 × Log_{10}(uV/m)

Gray shading data shows the highest Radiated Emission observed in this test report.

5.8 Frequency Stability

RESULT: **Pass**

Date of testing:	2025-07-02
Ambient temperature:	25°C
Relative humidity:	53%
Atmospheric pressure:	1013hPa
Kind of test site:	Temperature Chamber

Requirements:

FCC §15.225(e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20°C to +50°C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C. For hand-held device with internal battery, voltage variation measurement shall be repeated at the battery's operating end-point voltage declared by the manufacturer.

Test procedure:

ANSI C63.10-2020 §6.8

The EUT was placed inside a temperature chamber and was configured to produce an unmodulated carrier for mode C.

The carrier frequency was measured with a loop antenna connected to a spectrum analyzer. Measurements were performed from +50°C down to -20°C for every 10°C.

For each temperature step, the measurements started after the temperature was sufficiently stabilized and were performed at start-up of the EUT, and then after two, five and ten minutes, respectively.

The EUT was turned off during temperature changes.

The carrier frequency measurement was performed at a temperature of 20°C for a voltage variation. As per USB specifications, its voltage was varied from DC 4.75V to DC 5.5V, instead of ± 15% of the nominal input voltage.

Table 16: Frequency Stability at 50°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559380	-0.00457	± 0.01	Pass
2	13.56	13.559378	**-0.00459**	± 0.01	Pass
5	13.56	13.559379	-0.00458	± 0.01	Pass
10	13.56	13.559383	-0.00455	± 0.01	Pass

Note: Gray shading data shows the highest deviation of the frequency offset in this test item.

Table 17: Frequency Stability at 40°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559391	-0.00449	± 0.01	Pass
2	13.56	13.559386	-0.00453	± 0.01	Pass
5	13.56	13.559383	-0.00455	± 0.01	Pass
10	13.56	13.559381	-0.00456	± 0.01	Pass

Table 18: Frequency Stability at 30°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559418	-0.00429	± 0.01	Pass
2	13.56	13.559410	-0.00435	± 0.01	Pass
5	13.56	13.559404	-0.00440	± 0.01	Pass
10	13.56	13.559398	-0.00444	± 0.01	Pass

Table 19: Frequency Stability at 20°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559412	-0.00434	± 0.01	Pass
2	13.56	13.559412	-0.00434	± 0.01	Pass
5	13.56	13.559411	-0.00434	± 0.01	Pass
10	13.56	13.559411	-0.00434	± 0.01	Pass

Table 20: Frequency Stability at 10°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559475	-0.00387	± 0.01	Pass
2	13.56	13.559469	-0.00392	± 0.01	Pass
5	13.56	13.559463	-0.00396	± 0.01	Pass
10	13.56	13.559455	-0.00402	± 0.01	Pass

Table 21: Frequency Stability at 0°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559492	-0.00375	± 0.01	Pass
2	13.56	13.559488	-0.00378	± 0.01	Pass
5	13.56	13.559484	-0.00381	± 0.01	Pass
10	13.56	13.559479	-0.00384	± 0.01	Pass

Table 22: Frequency Stability at -10°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559492	-0.00375	± 0.01	Pass
2	13.56	13.559493	-0.00374	± 0.01	Pass
5	13.56	13.559493	-0.00374	± 0.01	Pass
10	13.56	13.559492	-0.00375	± 0.01	Pass

Table 23: Frequency Stability at -20°C, DC 5V, Mode C

Elapsed Time [min]	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
Start-up	13.56	13.559465	-0.00395	± 0.01	Pass
2	13.56	13.559477	-0.00386	± 0.01	Pass
5	13.56	13.559483	-0.00381	± 0.01	Pass
10	13.56	13.559489	-0.00377	± 0.01	Pass

Table 24: Frequency Stability with Supply Voltage at 20°C, Mode C

Supply Voltage	Center Frequency [MHz]	Measured Frequency [MHz]	Deviation [%]	Limit [%]	Result
DC 4.75V	13.56	13.559413	-0.00433	± 0.01	Pass
DC 5V	13.56	13.559411	-0.00434	± 0.01	Pass
DC 5.5V	13.56	13.559412	-0.00434	± 0.01	Pass

Note: As per USB specifications, its voltage was varied from DC 4.75V to DC 5.5V, instead of ± 15% of the nominal input voltage.

5.9 AC Power Line Conducted Emission of Transmitter

RESULT: **Pass**

Date of testing:	2025-06-30
Ambient temperature:	25°C
Relative humidity:	68%
Atmospheric pressure:	1009hPa
Frequency range:	0.15 - 30MHz
Kind of test site:	Shielded Room

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).

Test procedure:

ANSI C63.10-2020 §6.2

The EUT was placed on an wooden table raised 80cm above the reference ground plane. A vertical conducting plane of the screened room was located 40cm to the rear of the EUT. The AC input port of the AC Adapter was connected to a Line Impedance Stabilization Network (LISN).

The physical arrangement of the test system and associated cabling was varied to determine the effect on the EUT's emissions in amplitude and frequency in order to ensure that maximum emission amplitudes were attained.

The measurements were performed with a measurement receiver operating in the CISPR quasi-peak and average detection modes. The receiver’s 6dB bandwidth was set to 9kHz.

In accordance with the Q5 in the KDB publication 174176 D01 v01r01, a suitable dummy load replaced an antenna of the EUT and was a termination used in place of the antenna, which has the same electrical properties as the intended antenna without radiated emissions. Therefore, the final measurements were performed at the modes A and B without card.

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

Table 25: AC Power Line Conducted Emission, 0.15 - 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Mode A

Freq. [MHz]	Phase	Reading QP [dBµV]	Reading AV [dBµV]	Factor [dB]	Level QP [dBµV]	Level AV [dBµV]	Limit QP [dBµV]	Limit AV [dBµV]	Margin QP [dB]	Margin AV [dB]
0.1635	N	42.5	26.7	9.9	52.4	36.6	65.3	55.3	12.9	18.7
0.5415	N	24.1	18.7	10.1	34.2	28.8	56.0	46.0	21.8	17.2
2.3100	N	16.9	9.8	9.9	26.8	19.7	56.0	46.0	29.2	26.3
3.8918	N	23.4	9.2	9.9	33.3	19.1	56.0	46.0	22.7	26.9
11.7060	N	25.6	18.7	10.1	35.7	28.8	60.0	50.0	24.3	21.2
24.0855	N	11.1	4.7	10.3	21.4	15.0	60.0	50.0	38.6	35.0
0.1590	L1	42.9	26.8	9.9	52.8	36.7	65.5	55.5	**12.7**	18.8
0.5415	L1	25.0	19.9	10.1	35.1	30.0	56.0	46.0	20.9	16.0
1.7970	L1	17.1	10.3	9.9	27.0	20.2	56.0	46.0	29.0	25.8
3.8243	L1	23.5	10.7	9.9	33.4	20.6	56.0	46.0	22.6	25.4
11.6790	L1	26.2	19.5	10.1	36.3	29.6	60.0	50.0	23.7	20.4
29.1930	L1	11.1	4.6	10.3	21.4	14.9	60.0	50.0	38.6	35.1

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

Gray shading data shows the highest deviation of the frequency offset in this test item.

Table 26: AC Power Line Conducted Emission, 0.15 - 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Mode B

Freq. [MHz]	Phase	Reading QP [dBµV]	Reading AV [dBµV]	Factor [dB]	Level QP [dBµV]	Level AV [dBµV]	Limit QP [dBµV]	Limit AV [dBµV]	Margin QP [dB]	Margin AV [dB]
0.1500	N	39.6	20.6	9.8	49.4	30.4	66.0	56.0	16.6	25.6
0.5325	N	22.7	17.1	10.1	32.8	27.2	56.0	46.0	23.2	18.8
1.9118	N	14.4	8.4	9.9	24.3	18.3	56.0	46.0	31.7	27.7
3.7658	N	19.8	7.3	9.9	29.7	17.2	56.0	46.0	26.3	28.8
11.4270	N	22.4	14.3	10.1	32.5	24.4	60.0	50.0	27.5	25.6
24.0878	N	9.8	3.5	10.3	20.1	13.8	60.0	50.0	39.9	36.2
0.1500	L1	39.3	20.6	9.9	49.2	30.5	66.0	56.0	16.8	25.5
0.5370	L1	24.6	18.9	10.1	34.7	29.0	56.0	46.0	21.3	17.0
1.6238	L1	14.9	8.6	9.9	24.8	18.5	56.0	46.0	31.2	27.5
3.7028	L1	19.4	8.3	9.9	29.3	18.2	56.0	46.0	26.7	27.8
11.4428	L1	22.1	14.8	10.1	32.2	24.9	60.0	50.0	27.8	25.1
24.0855	L1	9.2	2.8	10.3	19.5	13.1	60.0	50.0	40.5	36.9

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

7. List of Tables

8. List of Figures

9. List of Photographs

– End of test report –