



Test Report No.: <i>Prüfbericht-Nr.:</i>		JP24F10P 003	Order No.: <i>Auftrags-Nr.:</i>	150294071	Page 1 of 60 <i>Seite 1 von 60</i>
Client Reference No.: <i>Kunden-Referenz-Nr.:</i>		N/A	Order Date: <i>Auftragsdatum:</i>	2024-04-05	
Client: <i>Auftraggeber:</i>		Nisshinbo Micro Devices Inc. 1-1, Fukuoka 2-Chome Fujimino City Saitama, 356-8510 Japan			
Test Item: <i>Prüfgegenstand:</i>		K-Band Doppler Sensor Module (Movement Sensor)			
Identification / Type No.: <i>Bezeichnung / Typ-Nr.:</i>		NJR4267F3C1	Serial No.: <i>Serien-Nr.:</i>	Sample1	
Order Content: <i>Auftrags-Inhalt:</i>		Wireless Testing			
Test Specification: <i>Prüfgrundlage:</i>		FCC 47 CFR Part 15, Subpart C, Section 15.245 RSS-210 (Issue 10): 2019+Amendment 1:2020			
Date of Sample Receipt: <i>Wareneingangsdatum:</i>		2024-05-29			
Test Sample No.: <i>Prüfmuster-Nr.:</i>		A003730986-001,A003731025-001,-002,-003,-004			
Testing Period: <i>Prüfzeitraum:</i>		2024-06-07 to 2024-06-12			
Place of Testing: <i>Ort der Prüfung:</i>		Yokohama EMC Laboratory			
Testing Laboratory: <i>Prüflaboratorium:</i>		TÜV Rheinland Japan Ltd.			
Test Result*: <i>Prüfergebnis*:</i>		Pass			
compiled by: <i>zusammengestellt von:</i>		authorized by: <i>genehmigt von:</i>			
Date: 2024-08-05 <i>Datum:</i>		Issue Date: 2024-08-05 <i>Ausstellungsdatum:</i>		Pin Zhang	
Position / Stellung:		Position / Stellung:		Authorizer	
Other / Sonstiges:		Note: This test report JP24F10P 003 replaces the original test report JP24F10P 002.			
Condition of the test item at delivery: <i>Zustand des Prüfgegenstandes bei Anlieferung:</i>		Test item complete and undamaged <i>Prüfmuster vollständig und unbeschädigt</i>			
* Legend: <i>* Legende:</i>		P(ass) = passed a.m. test specification(s) <i>P(ass) = entspricht o.g. Prüfgrundlage(n)</i>			
		F(ail) = failed a.m. test specification(s) <i>F(ail) = entspricht nicht o.g. Prüfgrundlage(n)</i>			
		N/A = not applicable <i>N/A = nicht anwendbar</i>			
		N/T = not tested <i>N/T = nicht getestet</i>			
This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark. <i>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</i>					

Revisions

Report No.	Issue date	Changes / Remarks
JP24F10P 001	2024-06-27	Original document
JP24F10P 002	2024-07-25	Corrections of table 5 and 6 in the section 5.4.
JP24F10P 003	2024-08-05	Corrections of typos in the section 3.2, 5.2, 5.6.

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.

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1. General Remarks

1.1 Test Specifications

Table 1: Test Summary

Test	Specifications	Result
Radio: FCC 47 CFR Part 15, Subpart C, Section 15.245 RSS-210 (Issue 10): 2019+Amendment 1:2020 RSS-Gen (Issue 5): 2018+Amendment 1:2019+Amendment 2:2021 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 RSS-Gen §8.10, §8.11 and RSS-210 §7.3	See the section 5.3.	Pass
Field Strength of Fundamental FCC §15.245(b) and RSS-210 §Annex F, Table F1	2500mV/m (127.9dBuV/m) at 3m measurement distance	Pass
20dB Bandwidth §15.215(c)	20dB bandwidth shall be contained within the designated frequency band.	Pass
99% Bandwidth RSS-Gen §6.7 and RSS-210 §7.3	-/-	For. Ref.
Duty Cycle	-/-	For. Ref.
Radiated Spurious Emissions of Transmitter FCC §15.209 and §15.245(b) (i) and (ii) RSS-210 §§Annex F, Table F1 and RSS-Gen §8.9, 8.10	9kHz - 100GHz 2 nd and 3 rd Harmonics: 7.5mV/m (77.5dBuV/m) at 3m distance	Pass
Conducted Emission on AC Power Ports of Transmitter FCC §15.207(a) RSS-Gen §8.8	150kHz - 30MHz	Pass

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 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 accredited by A2LA (member of ILAC) under certificate number 5056.02 according to ISO/IEC 17025:2017 for RSS-210, RSS-Gen and ANSI C63.10 standards.

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

The test facility is recognized by Innovation, Science and Economic Development Canada (ISED) as Wireless Device Testing Laboratory under the Wireless Lab Company Number 3466B and CAB Identifier JP0011.

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 Conducted Emission (CE)							
Path Loss Correction Factors for CE	-	-	-	RF-0597	1 year	2024-01-30	2025-01-30
Conducted Emission Measurement Software	Toyo Corporation	EP9/CE	Ver. 4.2.010	RF-0810	N/A	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	1 year	2024-03-22	2025-03-22
LISN	Rohde & Schwarz	ENV216	100276	RF-0016	1 year	2024-05-21	2025-05-21
LISN	Rohde & Schwarz	ENV216	101958	RF-0708	1 year	2024-05-21	2025-05-21
For Radiated Spurious Emission (RE Below 40GHz)							
Path Loss Correction Factors for RE below 1GHz	-	-	-	RF-0596	1 year	2024-01-30	2025-01-30
Path Loss Correction Factors for RE above 1GHz	-	-	-	RF-0995	1 year	2023-12-04	2024-12-04

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Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
Radiated Emission Measurement Software (below 30MHz)	Toyo Corporation	EP5/ME	Ver. 5.2.10	RF-0172	N/A	N/A	N/A
Radiated Emission Measurement Software (above 30MHz)	Toyo Corporation	EP7/RE	VER. 8.0.90	RF-0026	N/A	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	1 year	2024-03-22	2025-03-22
EMI Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	1 year	2023-09-11	2024-09-11
EMI Receiver	Rohde & Schwarz	ESW 26	101316	RF-0812	1 year	2024-05-29	2025-05-29
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	2023-07-25	2024-07-25
Biconical Antenna, 30-200MHz	Schwarzbeck	BBA9106-VHBB912	00235-00963	RF-0784	1 year	2024-03-04	2025-03-04
5dB Attenuator	Pasternack	PE7047-5	-	RF-0732	1 year	2024-03-05	2025-03-05
Log-Periodic Antenna, 300-1000MHz	Schwarzbeck	UHALP 9108 A1	UHALP 9108-A 0845	RF-0287	1 year	2024-03-04	2025-03-04
3dB Attenuator	Pasternack	PE7047-3	-	RF-0733	1 year	2024-03-05	2025-03-05
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	1 year	2023-12-27	2024-12-27
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
Preamplifier, 0-50GHz	NEXTEM	RFA-1050000-40	RFA-1905-01	RF-1140	1 year	2024-03-19	2025-03-19
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	2023-11-10	2024-11-10
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, 26.5 -40GHz (RX)	Toyo Corporation	HAP26-40N	00000007	RF-0069	1 year	2024-05-01	2025-05-01
Preamplifier, 18-40GHz	Toyo Corporation	TPA1840-60	B3208602 009-053	RF-0861	1 year	2024-03-19	2025-03-19
20dB Attenuator	Huber & Suhner	6610_SK-50-1/199_NE	-/-	RF-0887	1 year	2024-03-19	2025-03-19
10dB Attenuator	Huber & Suhner	6610_SK-50-1/199_NE	-/-	RF-0885	1 year	2024-03-19	2025-03-19

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
10dB Attenuator	Huber & Suhner	6610_SK-50-1/199_NE	-/-	RF-0886	1 year	2024-03-19	2025-03-19
For Radiated Spurious Emission (RE above 40GHz)							
Spectrum Analyzer	KEYSIGHT	E9041A	US57220181	G1825220	1 year	2023-07-20	2024-07-20
Spectrum Analyzer	Rohde & Schwarz	FSW85	FSW85	RF-1039	1 year	2023-09-19	2024-09-19
Horn Antenna 40-60GHz (RX)	Custom Microwave Inc.	HO19R	-	BT-8334	1 year	2023-08-08	2024-08-08
LNA 40-50GHz	ERAVANT	SBL-4036033080-1919	20101-01	RF-1061	1 year	2023-08-10	2024-08-10
Horn Antenna 50-75GHz (RX)	Custom Microwave Inc.	HO15R	-/-	G1810345	1 year	2023-08-09	2024-08-09
LNA 50-75GHz	AT Microwave	AT-LNA-5075-3804T	MCDE02	RF-0972	1 year	2023-08-16	2024-08-16
Horn Antenna 75-110GHz (RX)	Custom Microwave Inc.	HO10R	-	BT-8338	1 year	2023-08-09	2024-08-09
LNA 75G-110GHz	SAGE Millimeter, Inc.	SBL75311420401010E1	13352-01	G1810348	1 year	2023-08-17	2024-08-17
Constant Voltage Constant Frequency Stabilizers and Power Accessories							
True RMS Multimeter	Fluke	87V	16110176	RF-0414	1 year	2023-07-05	2024-07-05
True RMS Multimeter	Fluke	289	18590262	PV2-082	1 year	2023-12-06	2024-12-06

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	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)
Radiated Emission above 1GHz	1 - 6GHz	±5.15dB
	6 - 18GHz	±5.09dB
	18 - 40GHz	±5.18dB
Radiated Emission above 40GHz	40-110GHz	±5.88dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is K-band movement sensor module based on the Doppler Effect. Although the module incorporates transmitter and receiver, they can only be operated simultaneously.

3.2 Ratings and System Details

Rated voltage:	DC 3.8-5.8V
Input current:	90mA
Protection class:	III
Test voltage:	DC 5.0V (for EUT) AC 120V (for AC Adapter) (*)
Test frequency:	60Hz (for AC Adapter) (*)

24GHz Field Disturbance Sensor

Fundamental Field Strength:	108.22dBμV/m @3m, Average
Antenna gain:	+13.57dBi
Antenna type:	Patch antenna (printed on PCB)
Antenna mounting type:	Internal
Frequency range:	24.075 - 24.175GHz
Nominal frequency:	24.089 – 24.161GHz
Modulation type:	No modulation

Signal spreading:	-/- (No wireless data transmission capability)
Transmit speed:	-/- (No wireless data transmission capability)
Number of channels:	10
Channel spacing:	8MHz

FCC classification:	FDS
ISED classification:	Other
Emission designator:	N0N

Note:

(*) One off-the-shelf AC Adapter was used.

3.3 Noise Generating and Noise Suppressing Parts

The highest frequency generated or used by the EUT is 24.161GHz for fundamental component as intentional radiator portion.

3.4 Submitted Documents and Information

Following documents have been submitted by the client:

Instruction for the testing

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 15.245.

The test methodology used is based on the requirements of RSS-Gen, sections 3.2 and RSS-210.

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 at the lowest frequency (24.089GHz) with the specified Duty Cycle.
- B. Transmitting at the middle frequency (24.129GHz) with the specified Duty Cycle.
- C. Transmitting at the highest frequency (24.161GHz) with the specified Duty Cycle.

Note: As the EUT can transmit at 100% Duty Cycle (CW mode) in the normal operation, measurements were performed at this setting, according to ANSI C63.10:2020 clause 5.11.

4.3 Physical Configuration for Testing

The EUT was tested on a stand-alone basis (only attached to the test jig) 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

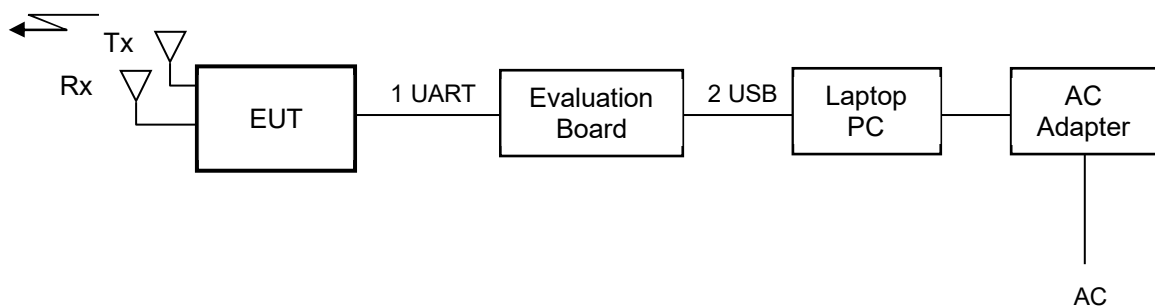
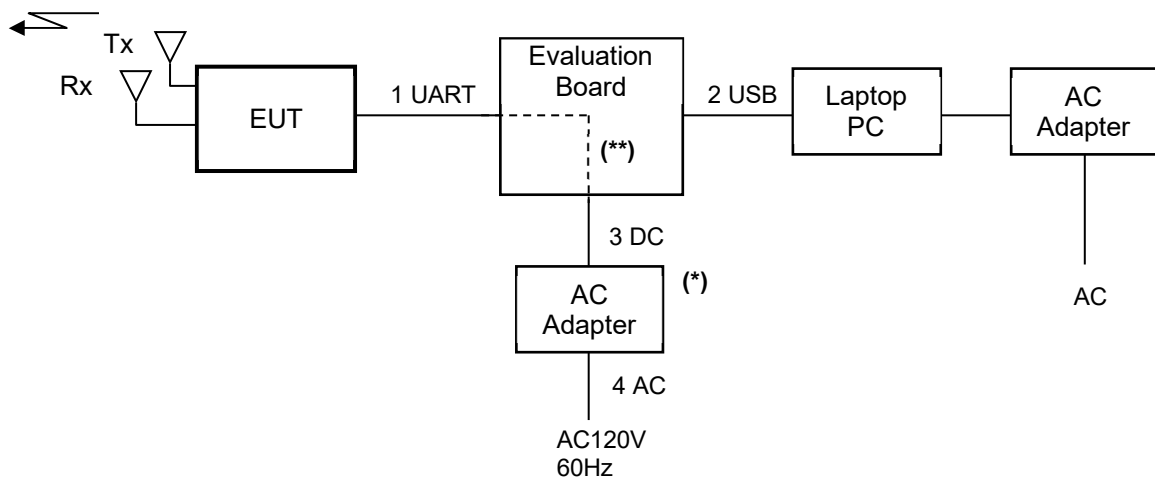


Figure 2: Block Diagram for AC Power Line Conducted Emission of Transmitter



Note: (*) Off-the-shelf AC Adapter was used. See the section 4.5 for details.

(**) No.3 DC power cable is only passing through the Evaluation Board. DC power cable connects directly to EUT.

Table 4: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	UART Cable with DC power	3m, un-shielded	Signal port
2.	USB Cable	1m, un-shielded	Signal port
3.	DC Input	1.2m, un-shielded	DC Input power port
4.	AC Input	1m, un-shielded	AC input power 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: NJR4267x1 Controller.exe version 1.1 by Nisshinbo Micro Devices Inc. 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:

- Product: Laptop PC
Manufacturer: Lenovo
Model: ThinkPad L560
Rated Voltage: DC 20V
Input Current: 2.5A
Protection Class: III
Serial Number: MP-180XOS 17/05
- Product: AC Adapter for Laptop PC
Manufacturer: Lenovo
Model: ADLX45NCC2A
Rated Voltage: AC 100-240V
Input Current: 1.3A
Frequency: 50-60Hz
Rated Voltage: DC 20V
Output Current: 2.25A
Protection Class: II
Serial Number: 8SSA10E75794C1SG8BP0L5H REV:1

3. Product: AC adapter for EUT
Manufacturer: UNIFIVE
Model: UNI318-0530
Rated Voltage: AC 100-240V
Input Current: 0.4A
Frequency: 50/60Hz
Output Voltage: DC 5.0V
Output Current: 3.0A
Protection Class: II
Serial Number: L12-043880
4. Product: Evaluation Board
Manufacturer: Nisshinbo Micro Devices Inc.
Model: AE-FT231X
Rated Voltage: DC 5.0V
Protection Class: III
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 a patch antenna permanently attached on the printed circuit board. Hence it complies with the antenna requirements.

5.3 Restricted Bands of Operation

RESULT:

Pass

Requirements:

FCC §15.205 and RSS-Gen §8.10 and RSS-210 §7.3

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

RSS-210 §7.3

Only spurious emissions are permitted in any of the TV bands of 54-72MHz, 76-88MHz, 174-216MHz, 470-608MHz and 614-806MHz.

Verdict:

The Operation frequency range of the EUT is 24.075 - 24.175GHz as Field Disturbance Sensor, only spurious emissions may be found in the restricted bands below 100GHz. Hence the EUT complies with the restricted frequency band requirement.

5.4 Field Strength of Fundamental

RESULT:

Pass

Date of testing: 2024-06-10

Ambient temperature: 22°C

Relative humidity: 59%

Atmospheric pressure: 1006hPa

Requirements:

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

FCC §15.245(b) and RSS-210 Annex F

The field strength of fundamental shall not exceed the level specified in 15.245(b).

The field strength of fundamental shall not exceed the level specified in RSS-210 Annex F, Table F1.

Test procedure:

ANSI C63.10-2020 §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 = 3MHz, VBW = 10MHz, peak detector with max hold for Peak;
- RBW = 3MHz, VBW = 10MHz, linear average detector with max hold for Average.

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

In the taken spectra in this section, the Yellow trace corresponds to the peak measurement. The Green trace corresponds to the average measurement.

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Table 5: Field Strength of Fundamental, Average Data

Mode	Frequency [GHz]	EUT / Ant. Orient.	Reading Level AV [dBμV]	Factor [dB/m]	Average Level [dBμV/m]	Average Limit [dBμV/m]	Margin [dB]
A	24090.278	X/V	98.45	9.70	108.15	127.90	19.75
B	24129.522	X/V	98.52	9.70	108.22	127.90	19.68
C	24164.572	X/V	98.48	9.70	108.18	127.90	19.72

Note: Average limit in dBμV/m is calculated as follows: Average limit = $20 \times \log_{10} (2500000 \mu\text{V/m})$.

Average Level was calculated by the following formula;

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

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

Table 6: Field Strength of Fundamental, Peak Data

Mode	Frequency [GHz]	EUT / Ant. Orient.	Reading Level PK [dBμV]	Factor [dB/m]	Peak Level [dBμV/m]	Peak Limit [dBμV/m]	Margin [dB]
A	24091.530	X/V	98.81	9.70	108.51	147.90	39.39
B	24130.698	X/V	98.80	9.70	108.50	147.90	39.40
C	26164.324	X/V	98.68	9.70	108.38	147.90	39.52

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

Figure 3: Field Strength of Fundamental, Spectral Diagram, Mode A

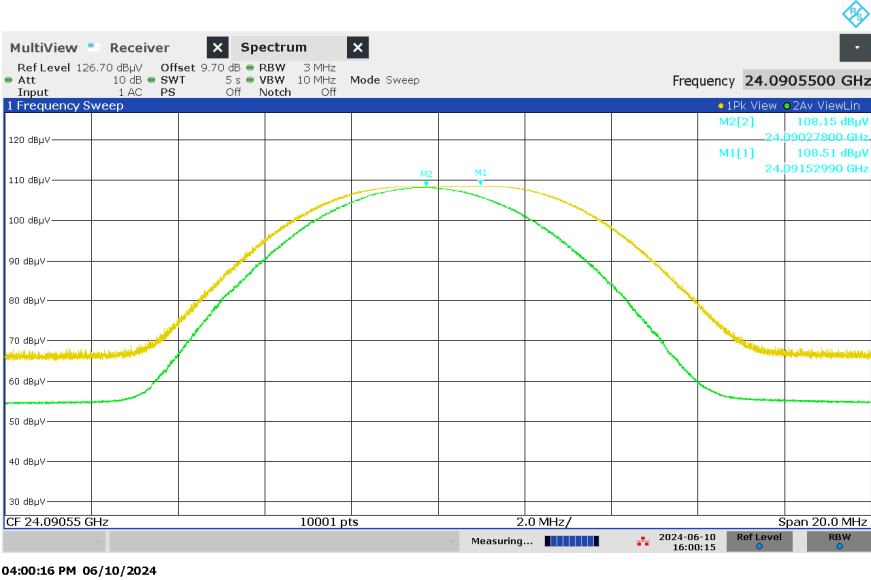


Figure 4: Field Strength of Fundamental, Spectral Diagram, Mode B

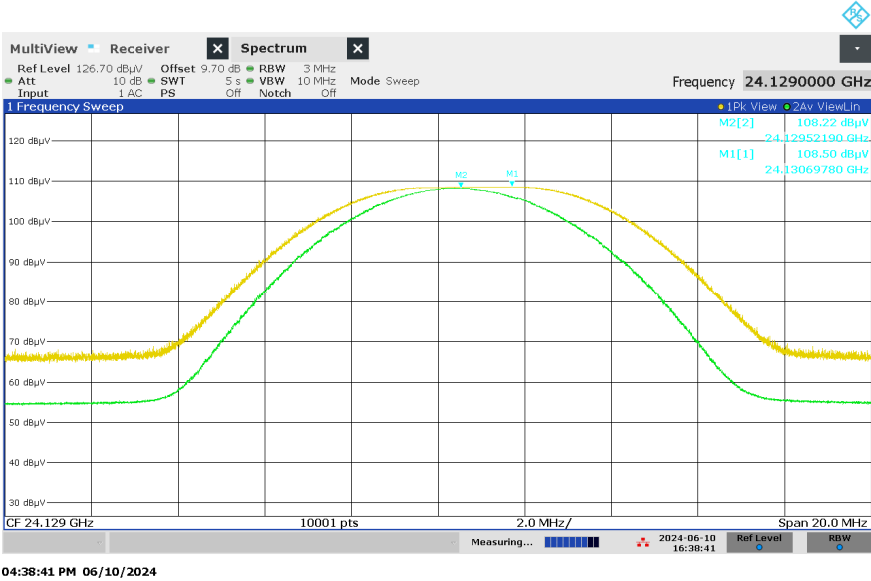


Figure 5: Field Strength of Fundamental, Spectral Diagram, Mode C



05:02:59 PM 06/10/2024

5.5 20dB Bandwidth

RESULT:

Pass

Date of testing: 2024-06-10

Ambient temperature: 22°C

Relative humidity: 59%

Atmospheric pressure: 1006hPa

Requirements:

FCC §15.215(c) and §15.245

The 20dB bandwidth of the emission shall be contained within the frequency band (24.075 - 24.175GHz) 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.

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.

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Table 7: 20dB Bandwidth Edge Frequencies

Mode	20dB Bandwidth Edge Side	Edge Frequency [GHz]	Limit [GHz]	Margin [MHz]
A	Lower side	24.0881042	24.075	13.104
	Higher side	24.0902830	24.175	84.717
C	Lower side	24.1637870	24.075	88.787
	Higher side	24.1660098	24.175	8.990

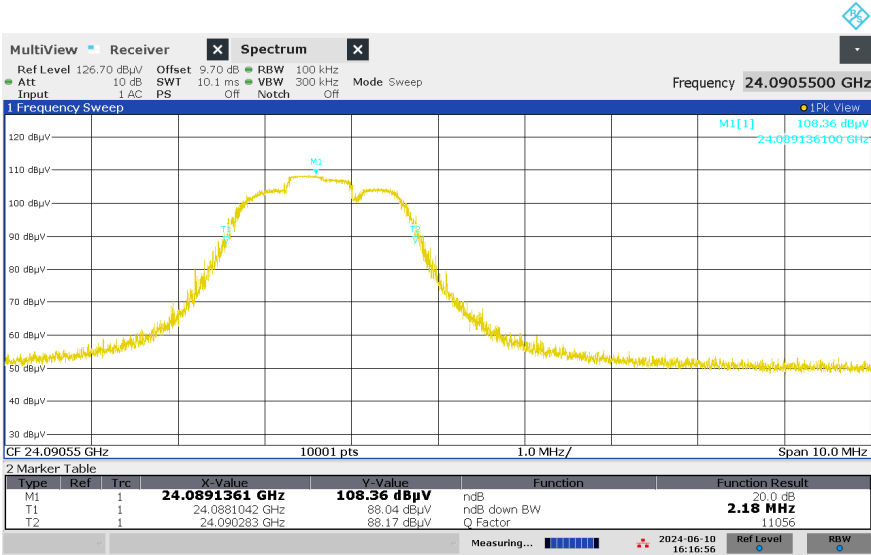
Note: Lower side of the Lowest Ch and Higher side of the Highest Ch were measured.

Table 8: 20dB Bandwidth

Mode	20dB Bandwidth [MHz]	RBW [kHz]	Ratio	Remark
A	2.17880	100	4.60%	
B	2.26380	100	4.40%	
C	2.22280	100	4.50%	

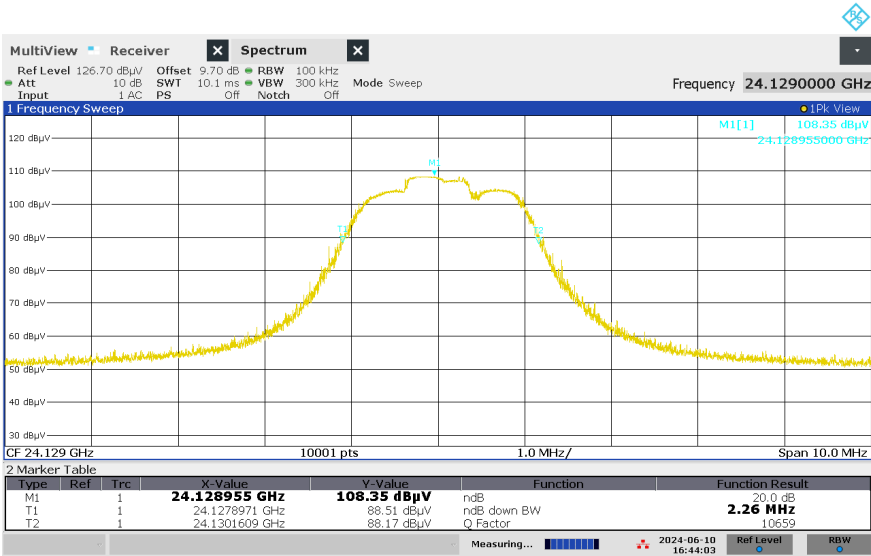
Note: Ratio was calculated in order to confirm its RBW setting at each measurement (i.e. 1% to 5%).

Figure 6: 20dB Bandwidth, Mode A



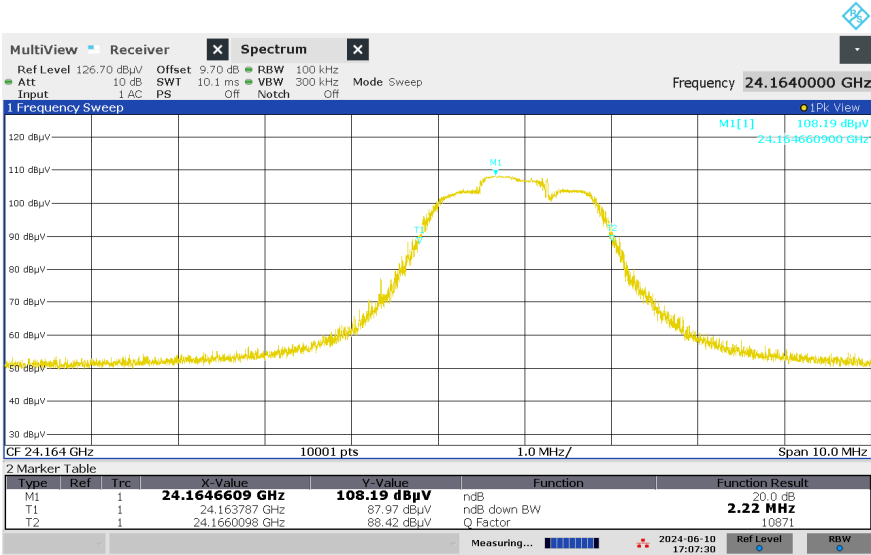
04:16:56 PM 06/10/2024

Figure 7: 20dB Bandwidth, Mode B



04:44:04 PM 06/10/2024

Figure 8: 20dB Bandwidth, Mode C



05:07:30 PM 06/10/2024

5.6 99% Bandwidth

RESULT:

For. Ref.

Date of testing: 2024-06-10

Ambient temperature: 22°C

Relative humidity: 59%

Atmospheric pressure: 1006hPa

RSS-Gen §6.7 and §8.11 and RSS-210 §7.3

The 99% bandwidth shall be reported and shall lie entirely outside the restricted bands and the prohibited TV bands of 54-72MHz, 76-88MHz, 174-216MHz, 470-608MHz and 614-806MHz, unless otherwise indicated.

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.

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

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

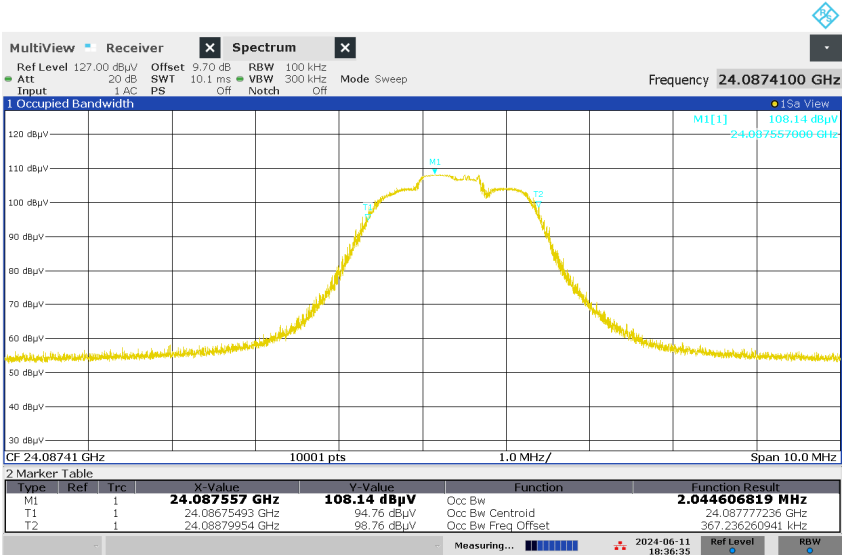
Markers were placed at the lowest and highest intersections of the trace by 99% OBW function to obtain the value of the emission bandwidth.

Table 9: 99% Bandwidth

Mode	99% Bandwidth [MHz]	RBW [kHz]	Ratio	Remark
A	2.044606819	100	4.90%	Widest 99 OBW
B	2.024827645	100	4.90%	
C	2.006160007	100	5.00%	

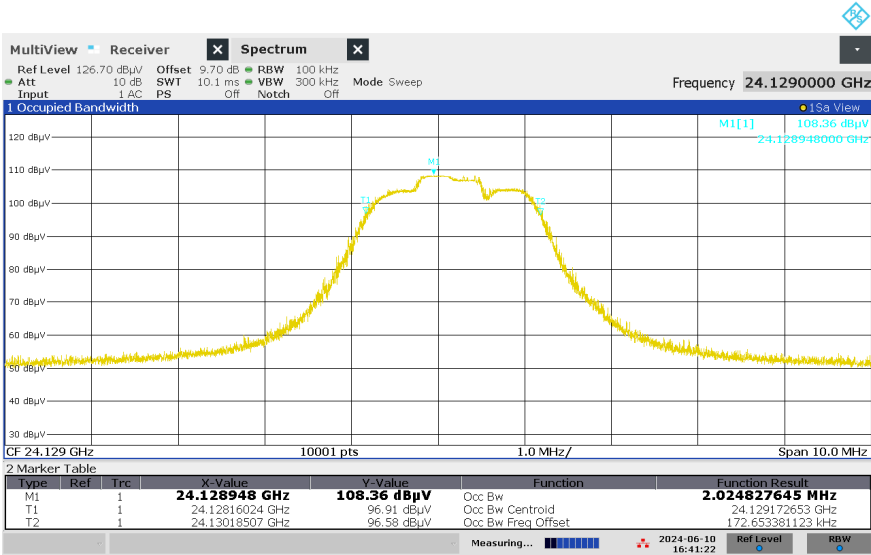
Note: Ratio was calculated in order to confirm its RBW setting at each measurement (i.e. 1% to 5%). Gray shading data is the widest 99% OBW in this test report.

Figure 9: 99% Bandwidth, Mode A



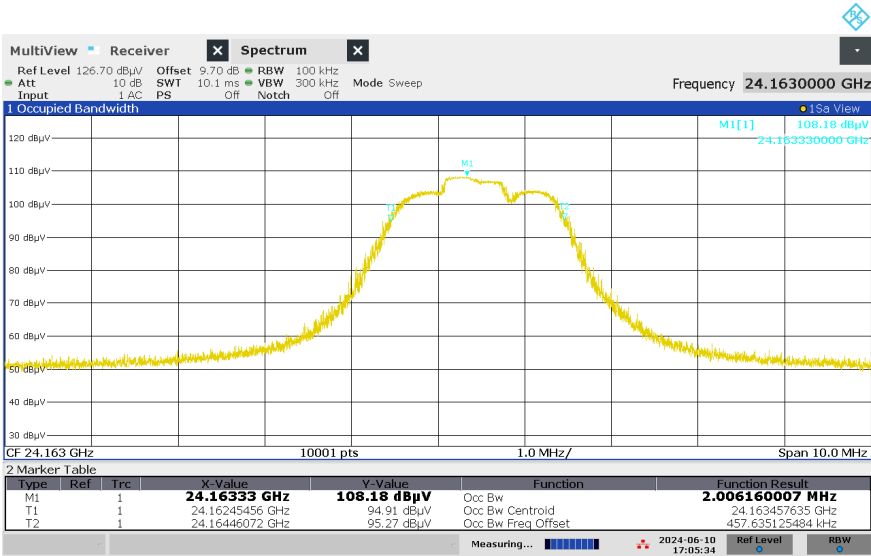
06:36:35 PM 06/11/2024

Figure 10: 99% Bandwidth, Mode B



04:41:23 PM 06/10/2024

Figure 11: 99% Bandwidth, Mode C



05:05:35 PM 06/10/2024

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5.7 Duty Cycle

RESULT:

For. Ref.

Date of testing: 2024-06-12

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1006hPa

Requirements:

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

Test procedure:

ANSI C63.10-2020 §7.5 and KDB 558074 D01.

Note:

As the EUT operates at 100% duty cycle setting, this test item confirms the continuous transmission state of the EUT at mode A, B, C.

Table 10: Duty Cycle at 100% duty cycle

Mode	Conf.	Duty Cycle Setting [%]	On-Time [ms]	Period [ms]	Duty Cycle [%]	DCCF [dB]
A	1	100	100.0	100.0	100	0
B	1	100	100.0	100.0	100	0
C	1	100	100.0	100.0	100	0

Note: Duty Cycle Correction Factor (DCCF)
DCCF = 20 x Log₁₀ (1/duty cycle)
DCCF is not applied in this test report.

Figure 12: Duty Cycle, Mode A at 100% duty cycle

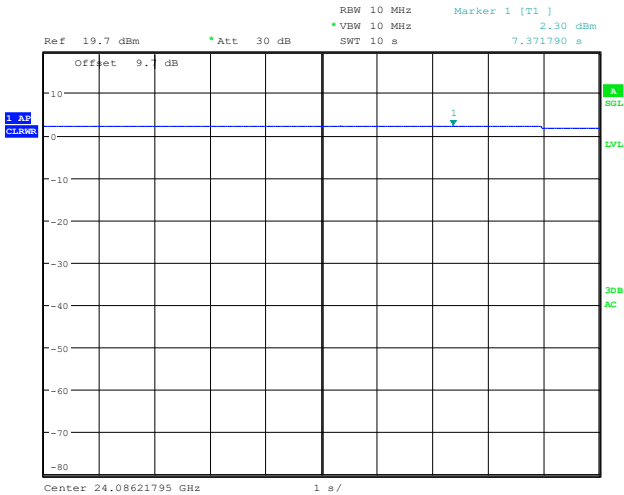
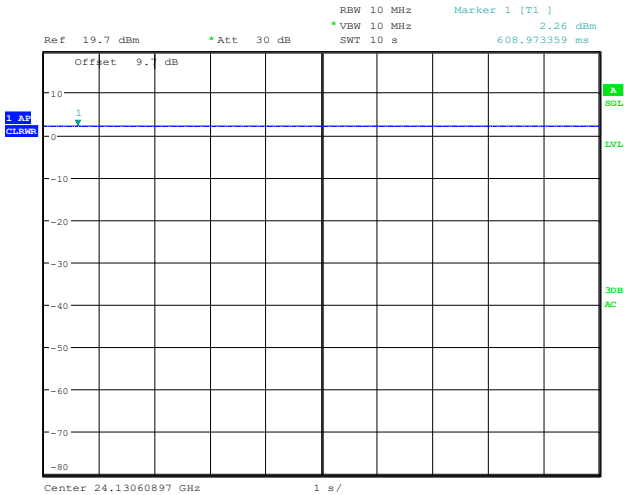
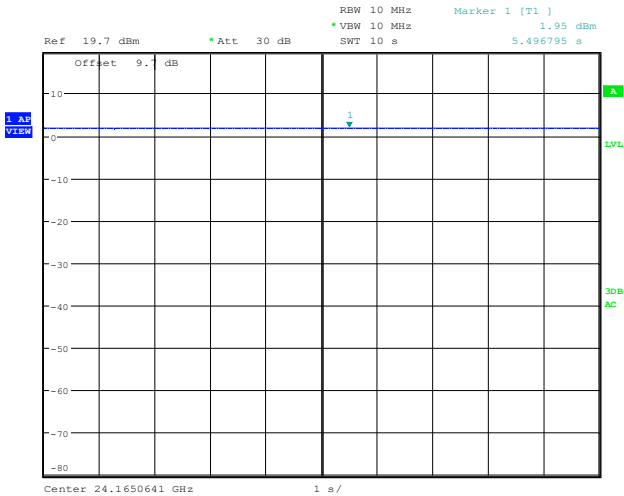


Figure 13: Duty Cycle, Mode B at 100% duty cycle



Date: 12.JUN.2024 16:20:59

Figure 14: Duty Cycle, Mode C at 100% duty cycle



Date: 12.JUN.2024 16:03:04

5.8 Radiated Spurious Emissions of Transmitter

RESULT:

Pass

Date of testing: 2024-06-07, 2024-06-10, 2024-06-11

Ambient temperature: 24, 22, 22°C

Relative humidity: 55, 59, 64%

Atmospheric pressure: 1014, 1006, 1007hPa

Frequency range: 9kHz - 100GHz

Measurement distance: 3m below 30MHz

3m 30MHz - 1GHz, 1GHz - 40GHz

1.2m 40GHz - 75GHz

0.6m 75GHz - 100GHz

Kind of test site: Semi Anechoic Chamber

Requirements:

FCC §15.205, §15.209, §15.245, RSS-Gen §8.9 and §8.10 and RSS-210 Annex F

Radiated emissions which fall in the restricted bands, as defined in FCC §15.205(a) and RSS-Gen §8.10 (table 7), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen §8.9 (tables 5 and 6).

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 and RSS-Gen §6.13 and 8.1

The EUT was placed on a non-conductive table. The table height was 0.8m 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 from 9kHz to 40GHz and 1.2m or 0.6m above 40GHz.

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.

For emissions between 30MHz and 1GHz, measurements were performed with a receiver operating in the CISPR quasi-peak detection mode. The receiver's 6dB bandwidth was 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 was found in the range from 9kHz to 30MHz at 3m measurement distance and also above 75GHz at 0.6m measurement distance.

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Table 11: Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Height [cm]	Angle [°]
43.478	X/V	55.9	-24.0	31.9	40.0	8.1	100	202
83.810	X/V	61.7	-25.4	36.3	40.0	(*) 3.7	105	163
83.862	X/H	50.3	-25.4	24.9	40.0	15.1	185	233
119.994	X/V	40.1	-22.9	17.2	43.5	26.3	100	181
120.020	X/H	37.9	-22.9	15.0	43.5	28.5	157	88
168.000	X/H	45.9	-20.6	25.3	43.5	18.2	121	90
323.307	X/H	39.8	-20.1	19.7	46.0	26.3	100	271
587.301	X/V	35.9	-14.1	21.8	46.0	24.2	183	206

Note: Level QP = Reading QP + Factor

(*) 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.

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Table 12: Radiated Emission, Average Data, 1GHz - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7815.173	X/H	41.2	-2.0	39.2	54.0	14.8	158	183
7833.951	X/V	41.2	-1.9	39.3	54.0	14.7	144	354
15008.230	X/H	38.1	-6.3	31.8	54.0	22.2	188	234
15240.336	X/V	38.9	-5.6	33.3	54.0	20.7	192	155
18675.618	X/V	45.1	-11.7	33.4	54.0	20.6	100	190
19996.778	X/H	42.7	-10.0	32.7	54.0	21.3	182	330
20479.504	X/V	42.2	-9.7	32.5	54.0	21.5	120	184
26300.292	X/H	45.9	-11.3	34.6	54.0	19.4	162	276
39135.728	X/V	59.3	-24.3	35.0	54.0	19.0	185	314
38987.448	X/H	59.2	-24.8	34.4	54.0	19.6	158	138

Note: Level AV = Reading AV + Factor

Table 13: Radiated Emission, Peak Data, 1GHz - 40GHz, Horizontal and Vertical Antenna Orientations, Mode A

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
7815.173	X/H	54.0	-2.0	52.1	74.0	21.9	158	183
7833.951	X/V	54.2	-1.9	52.4	74.0	21.6	144	354
15008.230	X/H	51.5	-6.3	45.2	74.0	28.8	188	234
15240.336	X/V	51.8	-5.6	46.2	74.0	27.8	192	155
18675.618	X/V	54.4	-11.7	42.7	74.0	31.3	100	190
19996.778	X/H	53.6	-10.0	43.6	74.0	30.4	182	330
20479.504	X/V	52.0	-9.7	42.3	74.0	31.7	120	184
26300.292	X/H	55.5	-11.3	44.2	74.0	29.8	162	276
39135.728	X/V	73.5	-24.3	49.2	74.0	24.8	185	314
38987.448	X/H	73.0	-24.8	48.2	74.0	25.8	158	138

Note: Level PK = Reading PK + Factor

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

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]
48172.3	Z/V	53.80	15.61	1.2	-7.96	61.46	77.5	16.04
48172.8	Z/H	35.87	15.61	1.2	-7.96	43.53	77.5	33.97
48177.8	Y/H	46.64	15.61	1.2	-7.96	54.30	77.5	23.20
48178.3	X/H	52.22	15.61	1.2	-7.96	59.88	77.5	17.62
48178.8	Y/V	51.82	15.61	1.2	-7.96	59.48	77.5	18.02
48180.8	X/V	43.63	15.61	1.2	-7.96	51.29	77.5	26.21
62018.0	Z/V	39.98	21.25	1.2	-7.96	53.27	54.0	(*) 0.73
62027.0	Y/V	37.95	21.25	1.2	-7.96	51.24	54.0	(*) 2.76
62027.0	X/H	37.65	21.25	1.2	-7.96	50.94	54.0	(*) 3.06
62029.0	Y/H	36.82	21.25	1.2	-7.96	50.11	54.0	(*) 3.89
72263.0	Z/V	43.25	21.36	1.2	-7.96	56.66	77.5	20.84
72264.0	Z/H	36.96	21.36	1.2	-7.96	50.37	77.5	27.13
72272.0	Y/H	39.50	21.36	1.2	-7.96	52.91	77.5	24.59
72273.0	Y/V	41.91	21.36	1.2	-7.96	55.32	77.5	22.18
72274.0	X/V	35.74	21.36	1.2	-7.96	49.15	77.5	28.35
72277.0	X/H	40.93	21.36	1.2	-7.96	54.34	77.5	23.16

Note: Distance Conversion Factor (DCF) was applied for each measurement point.

$$DCF = 20 \times \log_{10} (D/3.0) \text{ [dB]}$$

$$\text{Level AV} = \text{Reading AV} + \text{Factor} + \text{DCF}$$

(*) 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.

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

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

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]
48171.8	Z/V	54.27	15.61	1.2	-7.96	61.93	97.5	35.57
48173.8	Z/H	40.03	15.61	1.2	-7.96	47.69	97.5	49.81
48177.8	X/H	52.88	15.61	1.2	-7.96	60.54	97.5	36.96
48178.8	Y/V	52.58	15.61	1.2	-7.96	60.24	97.5	37.26
48180.3	Y/H	48.06	15.61	1.2	-7.96	55.72	97.5	41.78
48180.8	X/V	45.37	15.61	1.2	-7.96	53.03	97.5	44.47
62019.0	Z/V	41.12	21.25	1.2	-7.96	54.41	74.0	19.59
62025.0	Y/V	37.65	21.25	1.2	-7.96	50.94	74.0	23.06
62026.0	X/H	38.51	21.25	1.2	-7.96	51.80	74.0	22.20
62029.0	Y/H	37.56	21.25	1.2	-7.96	50.85	74.0	23.15
72263.0	Z/V	44.92	21.36	1.2	-7.96	58.33	97.5	39.17
72264.0	Z/H	38.76	21.36	1.2	-7.96	52.17	97.5	45.33
72272.0	X/V	37.94	21.36	1.2	-7.96	51.35	97.5	46.15
72272.0	X/H	42.84	21.36	1.2	-7.96	56.25	97.5	41.25
72273.0	Y/V	43.22	21.36	1.2	-7.96	56.63	97.5	40.87
72275.0	Y/H	41.48	21.36	1.2	-7.96	54.89	97.5	42.61

Note: Distance Conversion Factor (DCF) was applied for each measurement point.

$$DCF = 20 \times \log_{10} (D/3.0) \text{ [dB]}$$

$$\text{Level PK} = \text{Reading PK} + \text{Factor} + \text{DCF}$$

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Table 16: Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode B

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Height [cm]	Angle [°]
43.511	X/H	42.1	-24.0	18.1	40.0	21.9	384	238
44.639	X/V	56.5	-24.2	32.3	40.0	7.7	100	179
79.268	X/V	59.2	-25.5	33.7	40.0	6.3	100	191
83.802	X/V	60.8	-25.4	35.4	40.0	(*) 4.6	100	159
83.925	X/H	49.5	-25.4	24.1	40.0	15.9	199	234
168.001	X/H	45.3	-20.6	24.7	43.5	18.8	199	92
622.783	X/H	36.2	-14.0	22.2	46.0	23.8	155	36
759.992	X/V	33.9	-12.9	21.0	46.0	25.0	194	72

Note: Level QP = Reading QP + Factor

(*) 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.

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Table 17: Radiated Emission, Average Data, 1GHz - 40GHz, Horizontal and Vertical Antenna Orientations, Mode B

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7280.487	X/H	41.7	-2.5	39.2	54.0	14.8	135	311
7737.980	X/V	41.3	-2.4	38.9	54.0	15.1	166	88
11168.437	X/V	38.3	-5.5	32.8	54.0	21.2	161	103
15790.803	X/H	38.3	-4.8	33.5	54.0	20.5	179	201
18571.692	X/H	45.3	-11.8	33.5	54.0	20.5	146	317
18655.798	X/V	45.2	-11.7	33.5	54.0	20.5	154	156
38860.904	X/V	59.8	-25.3	34.5	54.0	19.5	175	267
38963.464	X/H	59.6	-24.8	34.8	54.0	19.2	183	50

Note: Level AV = Reading AV + Factor

Table 18: Radiated Emission, Peak Data, 1GHz - 40GHz, Horizontal and Vertical Antenna Orientations, Mode B

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
7280.487	X/H	55.0	-2.5	52.5	74.0	21.5	135	311
7737.980	X/V	54.0	-2.4	51.7	74.0	22.3	166	88
11168.437	X/V	51.5	-5.5	45.9	74.0	28.1	161	103
15790.803	X/H	51.4	-4.8	46.6	74.0	27.4	179	201
18571.692	X/H	54.6	-11.8	42.8	74.0	31.2	146	317
18655.798	X/V	54.9	-11.7	43.2	74.0	30.8	154	156
38860.904	X/V	74.6	-25.3	49.3	74.0	24.7	175	267
38963.464	X/H	73.6	-24.8	48.8	74.0	25.2	183	50

Note: Level PK = Reading PK + Factor

Table 19: Radiated Emission, Average Data, 40GHz - 100GHz, Horizontal and Vertical Antenna Orientations, Mode B

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]
48259.5	Z/H	36.04	15.61	1.2	-7.96	43.70	77.5	33.80
48261.3	X/H	53.22	15.61	1.2	-7.96	60.88	77.5	16.62
48261.3	Z/V	53.36	15.61	1.2	-7.96	61.02	77.5	16.48
48261.8	Y/H	45.97	15.61	1.2	-7.96	53.63	77.5	23.87
48263.8	X/V	40.35	15.61	1.2	-7.96	48.01	77.5	29.49
48265.3	Y/V	52.27	15.61	1.2	-7.96	59.93	77.5	17.57
62135.0	Y/H	34.60	21.25	1.2	-7.96	47.89	54.0	6.11
62137.0	Z/V	37.68	21.25	1.2	-7.96	50.97	54.0	(*) 3.03
62142.0	X/H	37.52	21.25	1.2	-7.96	50.81	54.0	(*) 3.19
62145.0	Y/V	36.82	21.25	1.2	-7.96	50.11	54.0	(*) 3.89
72381.0	Y/H	37.44	21.36	1.2	-7.96	50.85	77.5	26.65
72382.0	Z/V	40.64	21.36	1.2	-7.96	54.05	77.5	23.45
72385.0	X/H	40.08	21.36	1.2	-7.96	53.49	77.5	24.01
72387.0	X/V	34.51	21.36	1.2	-7.96	47.92	77.5	29.58
72389.0	Z/H	36.21	21.36	1.2	-7.96	49.62	77.5	27.88
72389.0	Y/V	39.52	21.36	1.2	-7.96	52.93	77.5	24.57

Note: Distance Conversion Factor (DCF) was applied for each measurement point.

$$\text{DCF} = 20 \times \log_{10} (D/3.0) \text{ [dB]}$$

$$\text{Level AV} = \text{Reading AV} + \text{Factor} + \text{DCF}$$

(*) 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.

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Table 20: Radiated Emission, Peak Data, 40GHz - 100GHz, Horizontal and Vertical Antenna Orientations, Mode B

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]
48258.2	Z/H	38.84	15.61	1.2	-7.96	46.50	97.5	51.00
48261.3	X/H	53.73	15.61	1.2	-7.96	61.39	97.5	36.11
48261.3	Y/V	53.08	15.61	1.2	-7.96	60.74	97.5	36.76
48261.3	Z/V	54.28	15.61	1.2	-7.96	61.94	97.5	35.56
48262.3	Y/H	47.47	15.61	1.2	-7.96	55.13	97.5	42.37
48263.8	X/V	43.28	15.61	1.2	-7.96	50.94	97.5	46.56
62137.0	Z/V	38.22	21.25	1.2	-7.96	51.51	74.0	22.49
62138.0	Y/H	36.35	21.25	1.2	-7.96	49.64	74.0	24.36
62143.0	Y/V	37.24	21.25	1.2	-7.96	50.53	74.0	23.47
62144.0	X/H	37.83	21.25	1.2	-7.96	51.12	74.0	22.88
72382.0	Z/V	42.31	21.36	1.2	-7.96	55.72	97.5	41.78
72384.0	Y/H	39.39	21.36	1.2	-7.96	52.80	97.5	44.70
72386.0	X/H	41.79	21.36	1.2	-7.96	55.20	97.5	42.30
72387.0	Z/H	37.66	21.36	1.2	-7.96	51.07	97.5	46.43
72387.0	X/V	36.22	21.36	1.2	-7.96	49.63	97.5	47.87
72389.0	Y/V	41.30	21.36	1.2	-7.96	54.71	97.5	42.79

Note: Distance Conversion Factor (DCF) was applied for each measurement point.

$$DCF = 20 \times \log_{10} (D/3.0) \text{ [dB]}$$

$$\text{Level PK} = \text{Reading PK} + \text{Factor} + \text{DCF}$$

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Table 21: Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode C

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Height [cm]	Angle [°]
43.465	X/V	56.9	-24.0	32.9	40.0	7.1	100	187
48.040	X/H	39.8	-24.6	15.2	40.0	24.8	400	236
74.701	X/V	58.7	-25.4	33.3	40.0	6.7	110	176
83.830	X/V	60.2	-25.4	34.8	40.0	(*) 5.2	100	182
83.877	X/H	49.2	-25.4	23.8	40.0	16.2	188	237
167.997	X/H	45.8	-20.6	25.2	43.5	18.3	204	94
323.103	X/H	39.7	-20.1	19.6	46.0	26.4	100	282
431.153	X/V	39.8	-17.0	22.8	46.0	23.2	260	359

Note: Level QP = Reading QP + Factor

(*) 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.

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Table 22: Radiated Emission, Average Data, 1GHz - 40GHz, Horizontal and Vertical Antenna Orientations, Mode C

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7832.938	X/V	39.7	-1.9	37.8	54.0	16.2	169	246
7891.578	X/H	39.7	-1.7	38.0	54.0	16.0	170	331
15268.084	X/H	38.5	-5.6	32.9	54.0	21.1	146	183
15254.977	X/V	38.6	-5.6	33.0	54.0	21.0	159	356
26115.362	X/H	45.4	-11.2	34.2	54.0	19.8	142	87
26249.554	X/V	46.0	-11.3	34.7	54.0	19.3	133	189
39837.224	X/V	58.0	-23.1	34.9	54.0	19.1	136	13
38402.316	X/H	60.5	-26.8	33.7	54.0	20.3	107	124

Note: Level AV = Reading AV + Factor

Table 23: Radiated Emission, Peak Data, 1GHz - 40GHz, Horizontal and Vertical Antenna Orientations, Mode C

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
7832.938	X/V	54.4	-1.9	52.6	74.0	21.4	169	246
7891.578	X/H	54.0	-1.7	52.3	74.0	21.7	170	331
15268.084	X/H	52.0	-5.6	46.4	74.0	27.6	146	183
15254.977	X/V	51.8	-5.6	46.2	74.0	27.8	159	356
26115.362	X/H	55.0	-11.2	43.7	74.0	30.3	142	87
26249.554	X/V	55.2	-11.3	43.9	74.0	30.1	133	189
39837.224	X/V	72.3	-23.1	49.2	74.0	24.8	136	13
38402.316	X/H	74.6	-26.8	47.7	74.0	26.3	107	124

Note: Level PK = Reading PK + Factor

Table 24: Radiated Emission, Average Data, 40GHz - 100GHz, Horizontal and Vertical Antenna Orientations, Mode C

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBμV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]
48325.3	Y/H	47.23	15.61	1.2	-7.96	54.89	77.5	22.61
48325.3	Z/H	39.52	15.61	1.2	-7.96	47.18	77.5	30.32
48326.8	Z/V	51.04	15.61	1.2	-7.96	58.70	77.5	18.80
48327.8	Y/V	51.79	15.61	1.2	-7.96	59.45	77.5	18.05
48328.8	X/V	46.58	15.61	1.2	-7.96	54.24	77.5	23.26
48330.3	X/H	52.79	15.61	1.2	-7.96	60.45	77.5	17.05
62230.0	Z/V	36.58	21.25	1.2	-7.96	49.87	54.0	(*) 4.13
62230.0	X/H	36.22	21.25	1.2	-7.96	49.51	54.0	(*) 4.49
62236.0	Y/H	35.37	21.25	1.2	-7.96	48.66	54.0	(*) 5.34
62264.0	Y/V	33.02	21.25	1.2	-7.96	46.31	54.0	7.69
72475.0	Z/H	34.99	21.36	1.2	-7.96	48.40	77.5	29.10
72477.0	Y/V	40.78	21.36	1.2	-7.96	54.19	77.5	23.31
72479.0	X/H	39.85	21.36	1.2	-7.96	53.26	77.5	24.24
72480.0	X/V	34.68	21.36	1.2	-7.96	48.09	77.5	29.41
72481.0	Z/V	40.24	21.36	1.2	-7.96	53.65	77.5	23.85
72483.0	Y/H	38.34	21.36	1.2	-7.96	51.75	77.5	25.75

Note: Distance Conversion Factor (DCF) was applied for each measurement point.

$$DCF = 20 \times \log_{10} (D/3.0) \text{ [dB]}$$

$$\text{Level AV} = \text{Reading AV} + \text{Factor} + \text{DCF}$$

(*) 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.

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Table 25: Radiated Emission, Peak Data, 40GHz - 100GHz, Horizontal and Vertical Antenna Orientations, Mode C

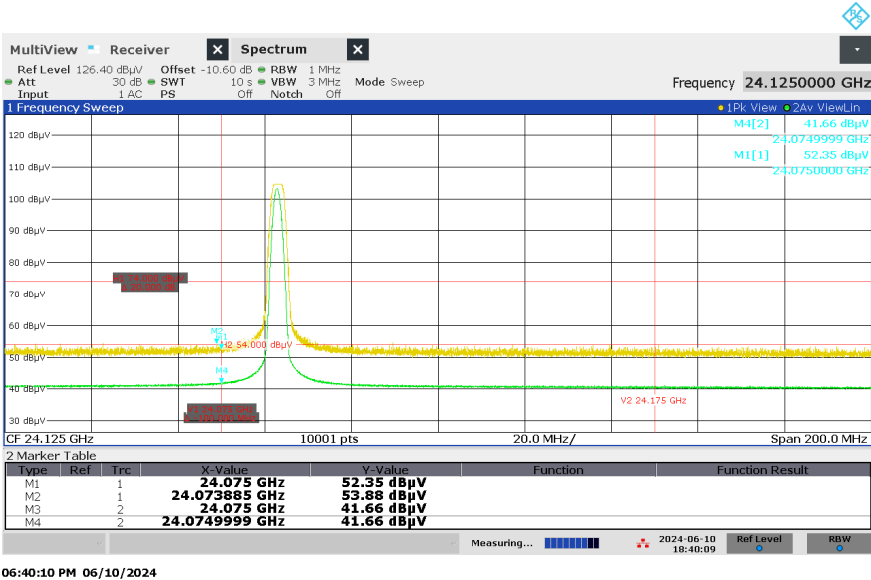
Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBμV]	Factor [dB(1/m)]	D [m]	DCF [dB]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]
48325.3	Y/V	52.68	15.61	1.2	-7.96	60.34	97.5	37.16
48327.3	Z/V	51.59	15.61	1.2	-7.96	59.25	97.5	38.25
48328.3	Y/H	48.02	15.61	1.2	-7.96	55.68	97.5	41.82
48328.8	X/V	48.02	15.61	1.2	-7.96	55.68	97.5	41.82
48329.8	Z/H	41.44	15.61	1.2	-7.96	49.10	97.5	48.40
48330.3	X/H	53.48	15.61	1.2	-7.96	61.14	97.5	36.36
62233.0	Z/V	37.88	21.25	1.2	-7.96	51.17	74.0	22.83
62234.0	Y/V	36.89	21.25	1.2	-7.96	50.18	74.0	23.82
62235.0	X/H	37.32	21.25	1.2	-7.96	50.61	74.0	23.39
62241.0	Y/H	37.68	21.25	1.2	-7.96	50.97	74.0	23.03
72476.0	Y/V	41.08	21.36	1.2	-7.96	54.49	97.5	43.01
72477.0	X/V	35.59	21.36	1.2	-7.96	49.00	97.5	48.50
72478.0	Z/V	41.91	21.36	1.2	-7.96	55.32	97.5	42.18
72478.0	Z/H	36.29	21.36	1.2	-7.96	49.70	97.5	47.80
72479.0	X/H	41.43	21.36	1.2	-7.96	54.84	97.5	42.66
72483.0	Y/H	40.27	21.36	1.2	-7.96	53.68	97.5	43.82

Note: Distance Conversion Factor (DCF) was applied for each measurement point.

$$DCF = 20 \times \log_{10} (D/3.0) \text{ [dB]}$$

$$\text{Level PK} = \text{Reading PK} + \text{Factor} + \text{DCF}$$

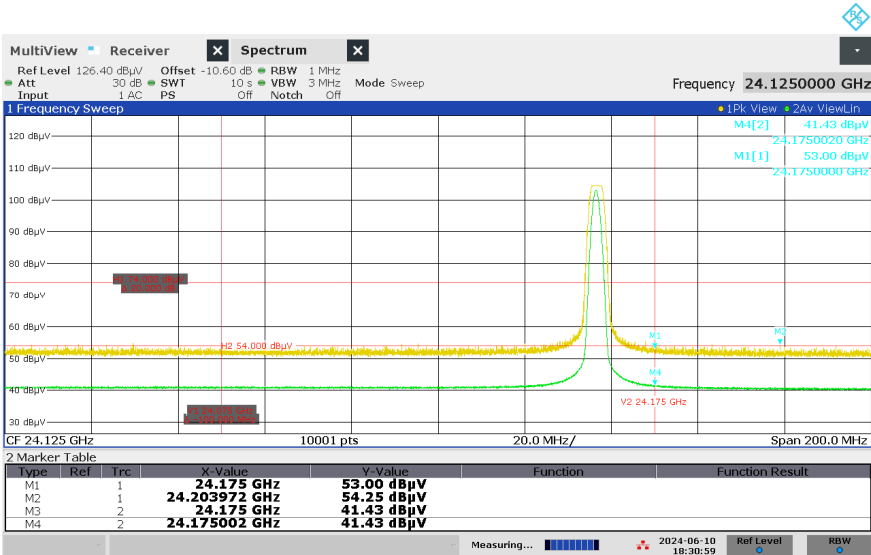
Figure 15: Radiated Emissions at Band Edge, Spectral Diagram, Mode A



06:40:10 PM 06/10/2024

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 16: Radiated Emissions at Band Edge, Spectral Diagram, Mode C



06:31:00 PM 06/10/2024

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:

Pass

Date of testing: 2024-06-12

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1006hPa

Frequency range: 0.15 - 30MHz

Kind of test site: Shielded Room

Requirements:

FCC §15.207 and RSS-Gen §8.8

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).

Test procedure:

ANSI C63.10-2020 §6.2 and RSS-Gen §8.1

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 adapter of the EUT 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.

Final measurements were performed at the all operation modes A, B and C.

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

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Table 26: 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]
0.153	L1	26.6	8.9	10.0	36.6	18.9	65.8	55.8	29.2	36.9
0.167	N	24.9	7.2	10.0	34.9	17.2	65.1	55.1	30.2	37.9
0.326	N	28.7	16.3	10.0	38.7	26.3	59.6	49.6	20.9	23.3
0.327	L1	28.3	15.9	10.1	38.4	26.0	59.5	49.5	21.1	23.5
20.120	L1	25.4	19.8	11.0	36.4	30.8	60.0	50.0	23.6	19.2
20.600	N	25.5	19.6	11.1	36.6	30.7	60.0	50.0	23.4	19.3
20.639	N	25.7	19.8	11.1	36.8	30.9	60.0	50.0	23.2	19.1
20.719	L1	26.4	20.5	11.1	37.5	31.6	60.0	50.0	22.5	18.4
20.799	N	25.3	19.3	11.1	36.4	30.4	60.0	50.0	23.6	19.6
20.921	N	24.3	17.1	11.1	35.4	28.2	60.0	50.0	24.6	21.8
21.079	L1	25.3	19.6	11.1	36.4	30.7	60.0	50.0	23.6	19.3
26.960	L1	25.6	17.9	11.3	36.9	29.2	60.0	50.0	23.1	20.8

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

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

Table 27: 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]
0.153	N	26.8	8.9	10.0	36.8	18.9	65.9	55.9	29.1	37.0
0.153	L1	26.5	8.9	10.0	36.5	18.9	65.8	55.8	29.3	36.9
0.324	L1	27.7	15.1	10.0	37.7	25.1	59.6	49.6	21.9	24.5
0.326	N	29.0	16.5	10.0	39.0	26.5	59.6	49.6	20.6	23.1
0.657	L1	14.0	2.6	10.2	24.2	12.8	56.0	46.0	31.8	33.2
1.060	N	11.1	1.1	10.1	21.2	11.2	56.0	46.0	34.8	34.8
4.220	N	9.0	-0.1	10.2	19.2	10.1	56.0	46.0	36.8	35.9
4.794	L1	11.4	0.8	10.2	21.6	11.0	56.0	46.0	34.4	35.0
15.560	N	20.5	15.4	10.8	31.3	26.2	60.0	50.0	28.7	23.8
15.561	L1	20.5	15.4	10.8	31.3	26.2	60.0	50.0	28.7	23.8
20.641	N	25.3	19.5	11.1	36.4	30.6	60.0	50.0	23.6	19.4
20.719	L1	26.2	20.4	11.1	37.3	31.5	60.0	50.0	22.7	18.5
26.960	N	24.9	17.3	11.3	36.2	28.6	60.0	50.0	23.8	21.4
27.000	L1	25.6	18.3	11.3	36.9	29.6	60.0	50.0	23.1	20.4

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

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Table 28: AC Power Line Conducted Emission, 0.15 - 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Mode C

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]
0.153	L1	26.5	8.8	10.0	36.5	18.8	65.9	55.9	29.4	37.1
0.154	N	26.5	8.6	10.0	36.5	18.6	65.8	55.8	29.3	37.2
0.190	L1	22.8	8.5	10.1	32.9	18.6	64.0	54.0	31.1	35.4
0.299	N	24.5	11.4	10.0	34.5	21.4	60.3	50.3	25.8	28.9
0.324	L1	27.9	15.3	10.0	37.9	25.3	59.6	49.6	21.7	24.3
1.157	N	9.5	-0.7	10.1	19.6	9.4	56.0	46.0	36.4	36.6
3.128	N	7.5	0.1	10.1	17.6	10.2	56.0	46.0	38.4	35.8
4.568	L1	10.5	1.0	10.2	20.7	11.2	56.0	46.0	35.3	34.8
4.638	N	9.0	0.6	10.2	19.2	10.8	56.0	46.0	36.8	35.2
15.560	L1	20.7	15.7	10.8	31.5	26.5	60.0	50.0	28.5	23.5
16.119	N	20.5	14.9	10.8	31.3	25.7	60.0	50.0	28.7	24.3
20.520	N	25.4	18.9	11.0	36.4	29.9	60.0	50.0	23.6	20.1
20.842	L1	25.2	18.5	11.1	36.3	29.6	60.0	50.0	23.7	20.4
26.159	L1	25.0	17.9	11.3	36.3	29.2	60.0	50.0	23.7	20.8
26.960	N	24.7	17.1	11.3	36.0	28.4	60.0	50.0	24.0	21.6

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

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