JQA File No. : KL80230809
Issue Date : February 20, 2024

TEST REPORT

Applicant	:	Teijin Frontier Co., Ltd.
Address	:	NBF Comodio Shiodome 2-14-1, Higashishimbashi, Minato-ku, Tokyo 105-0021, Japan
Products	:	RecoHand
Model No.	:	M920SRW
Serial No.	:	00012 (Radiated sample), 00013 (Conducted sample)
Test Standard	:	CFR 47 FCC Rules and Regulations Part 15 Subpart C
FCC ID	:	2BEXRRHM920T001
Test Results	:	**Passed**
Date of Receipt	:	February 5, 2024
Date of Test	:	February 6 ~ 9, 2024

ilac-MRA VLAC Lab Accreditation
VLAC-001-2

Kosei Shibata
Deputy Director
Japan Quality Assurance Organization
Kitakansai Testing Center
Saito EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
- The contents for the equipment under test (EUT) such as identification information in clause 2 and 6 of this report were provided by the applicant. JQA is not responsible for the test results affected by the incorrect information.
- The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
- This test report shall not be reproduced except in full without the written approval of JQA.
- VLAC does not approve, certify or warrant the product by this test report.

REVISION HISTORY

File No.	Contents	Issue Date
KL80230809	Initial Issue	February 20, 2024

TABLE OF CONTENTS

1 Summary of Test Results

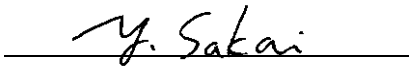
Applied Standard : CFR 47 FCC Rules and Regulations Part 15 – Radio Frequency Devices
Subpart C – Intentional Radiators

Item	FCC rules	Result	Note
Antenna Requirement	§15.203	Passed	1
99% Occupied Bandwidth	--	--	2
6 dB Emission Bandwidth	§15.247(a)(2)	Passed	
Power Spectral Density	§15.247(e)	Passed	
Maximum Conducted Output Power	§15.247(b)(3)	Passed	
Conducted Spurious Emission	§15.247(d)	Passed	
Radiated Spurious Emission	§15.205, §15.209 and §15.247(d)	Passed	
AC Powerline Conducted Emission	§15.207	Passed	
RF Exposure	§1.1310, §2.1091 and §15.247(i)	Passed	3

1) The EUT is designed to ensure that no antenna other than that furnished by the manufacturer shall be used. Information for antenna type is described in clause 2.
2) Reporting purposes only
3) Refer to test report KL80230810.

In the approval of test results,
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by
Yasuhisa Sakai / Project Manager



Tested by
Yuji Shintaku / Assistant Manager

2 Description of Equipment Under Test (EUT)

2.1 General Information

Manufacturer	Teijin Frontier Co., Ltd. NBF Comodio Shiodome 2-14-1, Higashishimbashi, Minato-ku, Tokyo 105-0021, Japan
Products	RecoHand
Model No.	M920SRW
Serial No.	00012 (Radiated sample), 00013 (Conducted sample)
Product Type	Mass Production
Date of Manufacture	October 19, 2023
Power Rating	3.3VDC
EUT Grounding	None
Modulation Technology	Digital transmission system (DTS)
Modulation Type	Bluetooth 5.1 +LE (GFSK)
Operating Frequency	2402.0 MHz (00CH) – 2480.0MHz (39CH)
Antenna Type	PCB Antenna
Antenna Gain	-1.61 dBi

2.2 Channel List

40 channels are provided for BLE.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	⋮	⋮
2	2406	⋮	⋮
⋮	⋮	37	2476
18	2438	38	2478
19	2440	39	2480

3 Test Location

Japan Quality Assurance Organization (JQA)
Kitakansai Testing Center Saito EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

4 Accreditation of Test Laboratory

JQA Kitakansai Testing Center Saito EMC Branch is accredited under ISO/IEC 17025 by the following accreditation bodies and the test facility is registered by the following bodies. If the accreditation logo does not appear on this cover, it is outside the scope of ISO/IEC 17025.

VLAC Accreditation No. : VLAC-001-2 (Expiry date : April 30, 2024)
A2LA Accreditation No. : 5498.01 (Expiry date : November 30, 2025)

VCCI Registration No. : A-0002 (Expiry date : April 30, 2024)
FCC Registration No. : JP5008 (Expiry date : April 30, 2024)
ISED Registration No. : JP0014 (Expiry date : November 30, 2025)
BSMI Registration No. : SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006 (Expiry date : September 14, 2025)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI. (Expiry date : February 22, 2025)

5 Measurement Uncertainty

Item	Frequency	Uncertainty (*U*)
Emission Bandwidth	--	± 0.9 %
Peak Output Power	--	± 0.9 dB
Conducted Emission (Antenna Port)	9 kHz – 1 GHz	± 1.4 dB
	1 GHz – 18 GHz	± 1.7 dB
	18 GHz – 40 GHz	± 2.3 dB
Radiated Emission	9 kHz – 30 MHz	± 3.0 dB
	30 MHz – 200 MHz	± 3.6 dB
	200 MHz – 1000 MHz	± 4.8 dB
	1 GHz – 6 GHz	± 4.7 dB
	6 GHz – 18 GHz	± 4.6 dB
	18 GHz – 40 GHz	± 5.1 dB
AC Powerline Conducted Emission	150 kHz – 30 MHz	± 2.6 dB

Determining compliance with the limits in this test report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty (MIU).
The reported expanded uncertainty of measurement, *U* is described with using the coverage factor k = 2, to give a level of confidence of approximately 95 %.

6 Setup of EUT

6.1 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.
A	RecoHand	Teijin Frontier Co., Ltd.	M920SRW	00012, 00013

The auxiliary equipment (AE) used for testing :

None

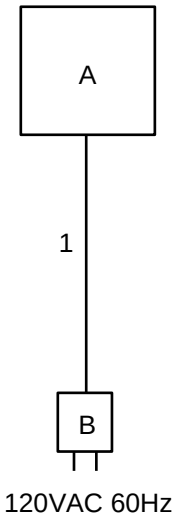
	Item	Manufacturer	Model No.	Serial No.
B	AC Adapter	Dongguan Yingju Power Co., Ltd.	YJC010W-0502000J	4219

Type of Cable:

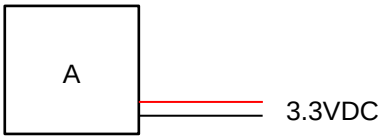
No.	Description	Identification (Manu. etc.)	Cable Shielded	Ferrite Core	Length (m)
1	USB Cable	--	Yes	No	1.5

6.2 Test Arrangement (Drawings)

Conducted Emission Tests



Other RF Tests



6.3 Operating Condition

Test Mode

The EUT is set with the test mode, the specification of the test mode is as followings.

Bluetooth Low Energy Mode (Bluetooth 5.1 +LE):
Transmitting frequency : 2402 MHz (00CH) – 2480 MHz (39CH)
Receiver frequency : 2402 MHz (00CH) – 2480 MHz (39CH)

The tests were performed in the following worst condition.

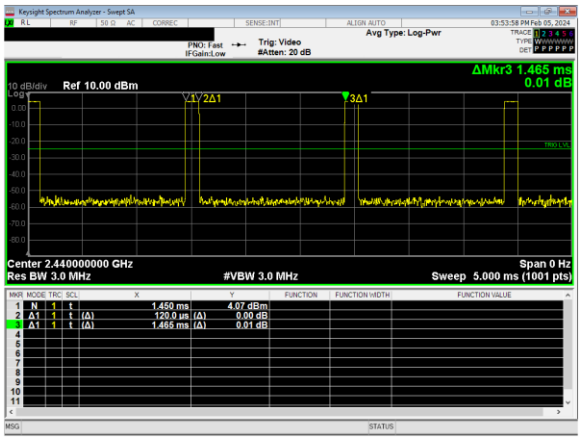
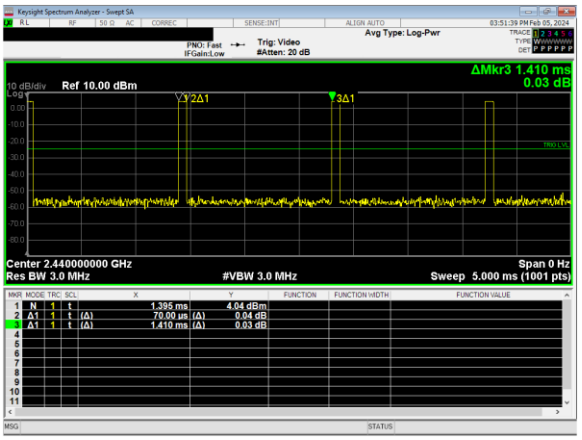
Mode	Data Rate (Worst)	Channel
BLE 1 Mbps	1 Mbps	0, 19, 39
BLE 2 Mbps	2 Mbps	0, 19, 39

The EUT with temporary antenna port was used in conducted measurement.

The tests were performed using the test program which status changed by the contact switches supplied by applicant.

6.4 Duty Cycle

Mode	On Time (msec.)	On+Off Time (msec.)	Duty Cycle (%)	Duty Factor (dB)	VBW [>1/T] (kHz)
BLE 1 Mbps	0.120	1.465	8.2	10.87	> 8.34
BLE 2 Mbps	0.070	1.410	5.0	13.04	> 14.29

BLE 1 Mbps	BLE 2 Mbps
	

7 Test Item

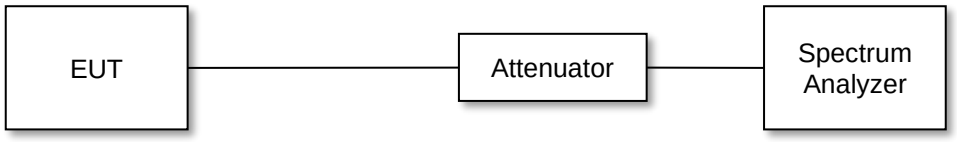
7.1 99% Occupied Bandwidth

7.1.1 Test Site and Instruments

Test Site : Shielded Room S3					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Spectrum Analyzer	N9010A	MY50420292 (A-12)	Agilent	2023/12/12	2024/12/11
RF Cable	SF102	14253/2 (C-52)	HUBER+SUHNER	2023/08/29	2024/08/28
Attenuator	54A-10	W5732 (D-30)	Weinschel	2023/05/26	2024/05/25
Thermo-Hygrometer	testo 608-H2	30050650 (F-71)	testo	2023/04/24	2024/04/23
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

7.1.2 Test Method and Test Setup (Diagrammatic illustration)

The EUT is connected to the measuring equipment via a suitable attenuator.
The test conditions and methods comply with the following test standards.
- ANSI C63.10-2020 +Cor.1-2023 clause 6.9.3



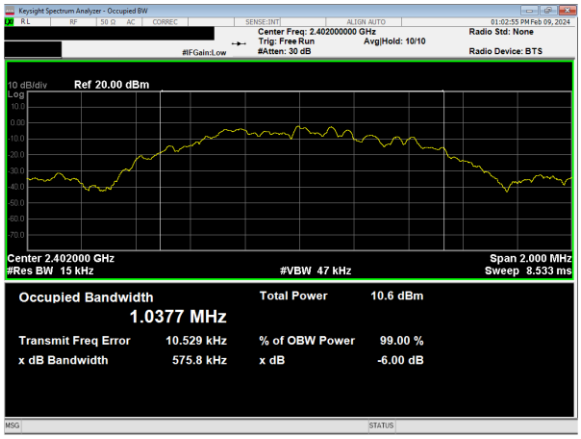
7.1.3 Test Data

Test Date: February 9, 2024
Temp.: 23 °C, RH: 38 %, Atm.: 1001 hPa

Mode	Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	Limits (MHz)
BLE 1 Mbps	0	2402	1.038	--
	19	2440	1.041	--
	39	2480	1.042	--
BLE 2 Mbps	0	2402	2.036	--
	19	2440	2.042	--
	39	2480	2.043	--

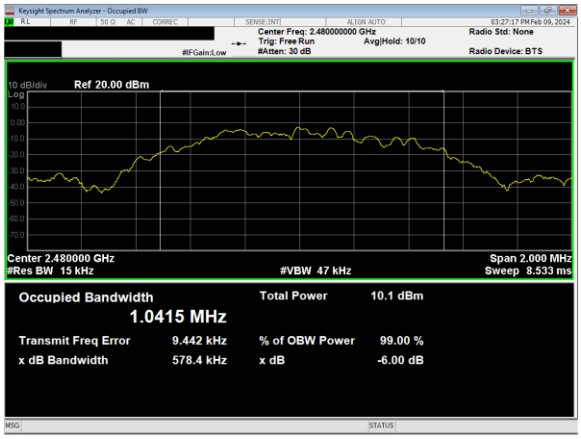
BLE 1 Mbps

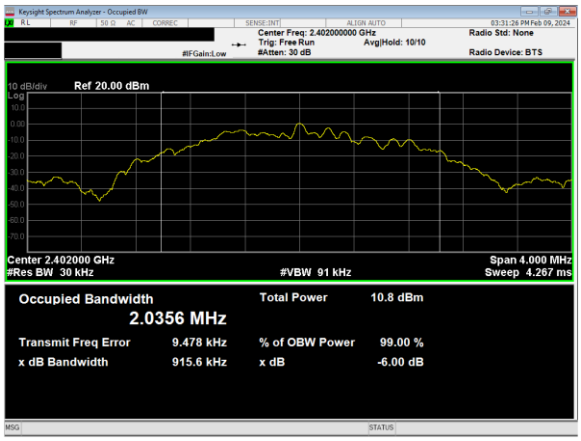
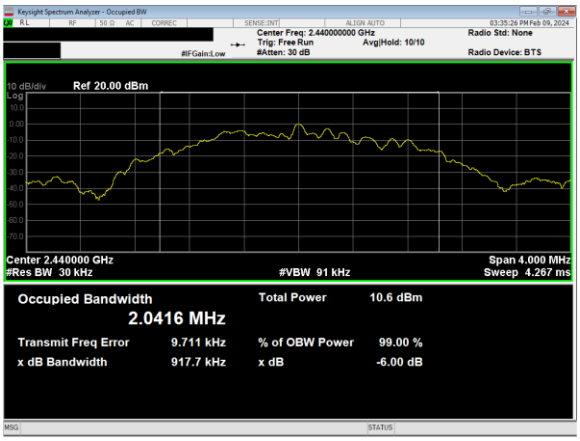
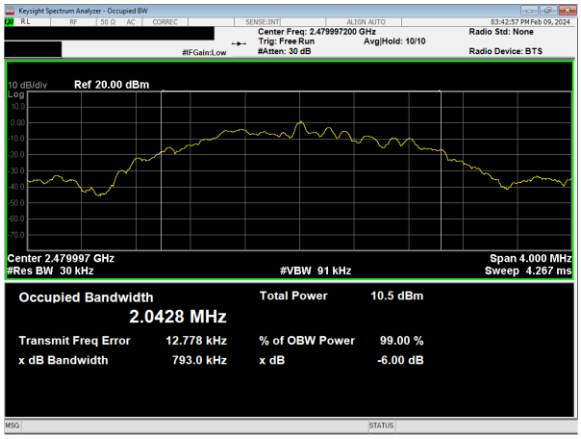
Channel 0 (2402 MHz)



Channel 19 (2440 MHz)

Channel 39 (2480 MHz)



BLE 2 Mbps	
Channel 0 (2402 MHz)	Channel 19 (2440 MHz)
	
Channel 39 (2480 MHz)	
	

7.2 6 dB Emission Bandwidth

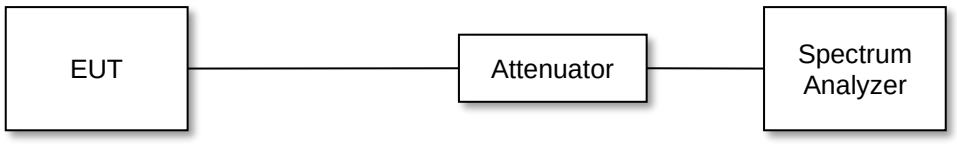
7.2.1 Test Site and Instruments

Test Site : Shielded Room S3					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Spectrum Analyzer	N9010A	MY50420292 (A-12)	Agilent	2023/12/12	2024/12/11
RF Cable	SF102	14253/2 (C-52)	HUBER+SUHNER	2023/08/29	2024/08/28
Attenuator	54A-10	W5732 (D-30)	Weinschel	2023/05/26	2024/05/25
Thermo-Hygrometer	testo 608-H2	30050650 (F-71)	testo	2023/04/24	2024/04/23
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

7.2.2 Test Method and Test Setup (Diagrammatic illustration)

The EUT is connected to the measuring equipment via a suitable attenuator.
The test conditions and methods comply with the following test standards.

- KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2020 +Cor.1-2023 clause 11.8



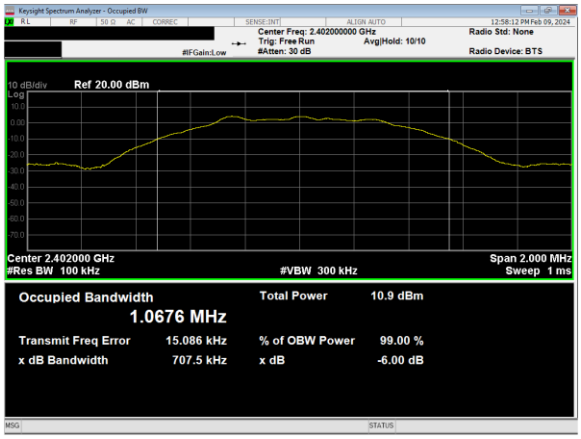
7.2.3 Test Data

Test Date: February 9, 2024
Temp.: 23 °C, RH: 38 %, Atm.: 1001 hPa

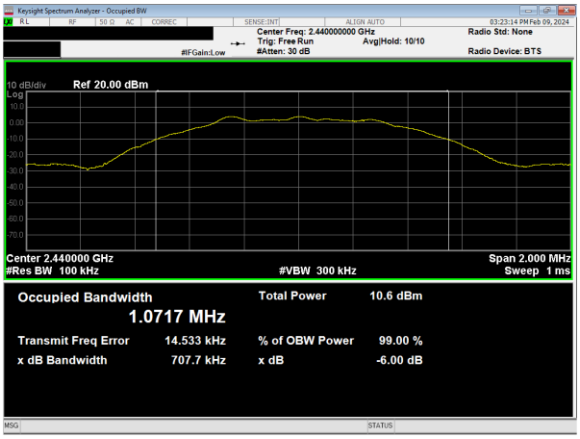
Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limits (MHz)
BLE 1 Mbps	0	2402	0.708	≥ 0.5
	19	2440	0.708	≥ 0.5
	39	2480	0.712	≥ 0.5
BLE 2 Mbps	0	2402	1.188	≥ 0.5
	19	2440	1.192	≥ 0.5
	39	2480	1.198	≥ 0.5

BLE 1 Mbps

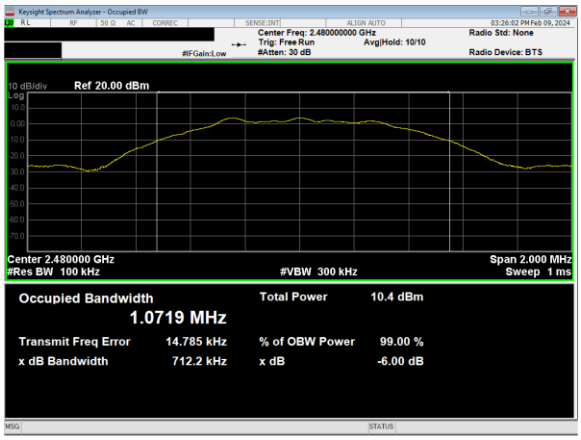
Channel 0 (2402 MHz)

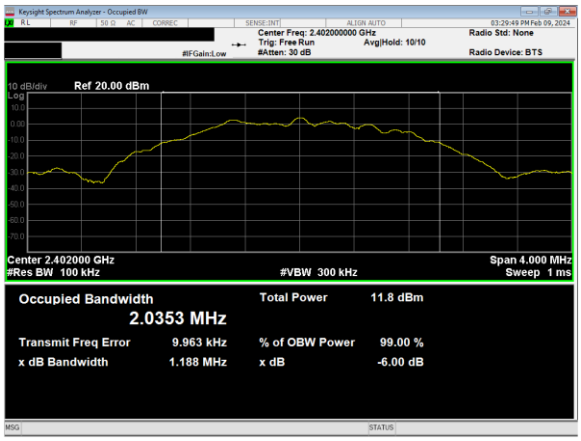
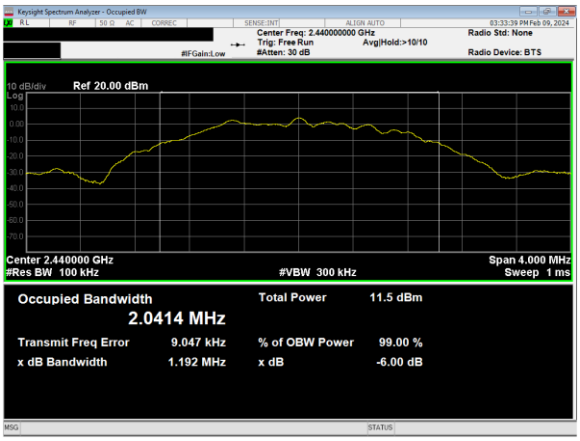
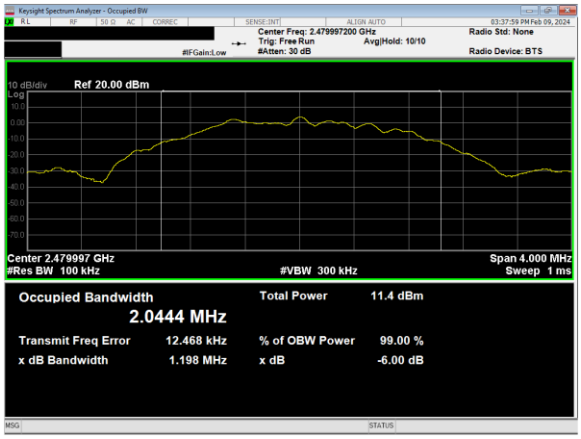


Channel 19 (2440 MHz)



Channel 39 (2480 MHz)



BLE 2 Mbps	
Channel 0 (2402 MHz)	Channel 19 (2440 MHz)
	
Channel 39 (2480 MHz)	
	

7.3 Power Spectral Density

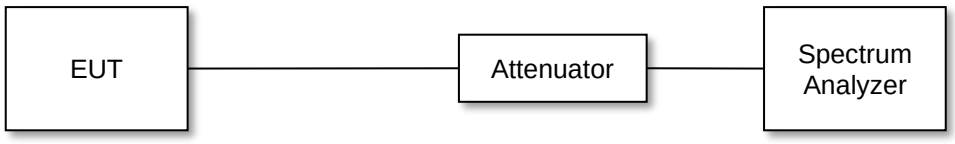
7.3.1 Test Site and Instruments

Test Site : Shielded Room S3					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Spectrum Analyzer	N9010A	MY50420292 (A-12)	Agilent	2023/12/12	2024/12/11
RF Cable	SF102	14253/2 (C-52)	HUBER+SUHNER	2023/08/29	2024/08/28
Attenuator	54A-10	W5732 (D-30)	Weinschel	2023/05/26	2024/05/25
Thermo-Hygrometer	testo 608-H2	30050650 (F-71)	testo	2023/04/24	2024/04/23
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

7.3.2 Test Method and Test Setup (Diagrammatic illustration)

The EUT is connected to the measuring equipment via a suitable attenuator.
The test conditions and methods comply with the following test standards.

- KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2020 +Cor.1-2023 clause 11.10



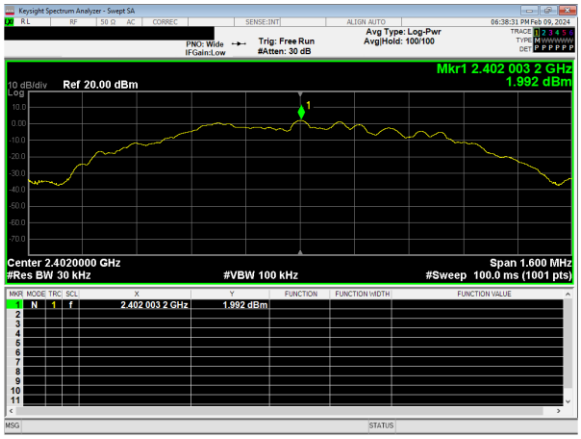
7.3.3 Test Data

Test Date: February 9, 2024
Temp.: 23 °C, RH: 38 %, Atm.: 1001 hPa

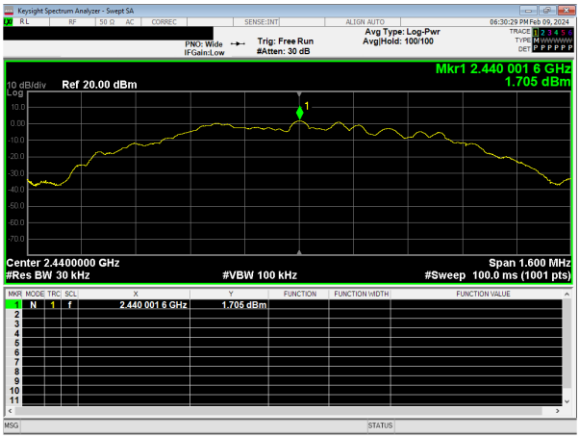
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/30kHz)	Limits (dBm/3kHz)
BLE 1 Mbps	0	2402	1.992	≤ 8.0
	19	2440	1.705	≤ 8.0
	39	2480	1.462	≤ 8.0
BLE 2 Mbps	0	2402	0.628	≤ 8.0
	19	2440	0.348	≤ 8.0
	39	2480	0.117	≤ 8.0

BLE 1 Mbps

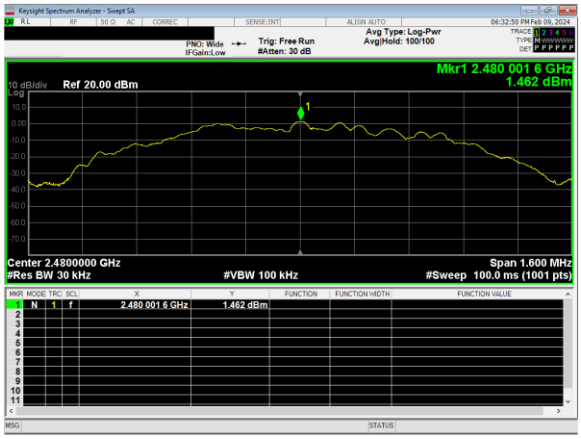
Channel 0 (2402 MHz)

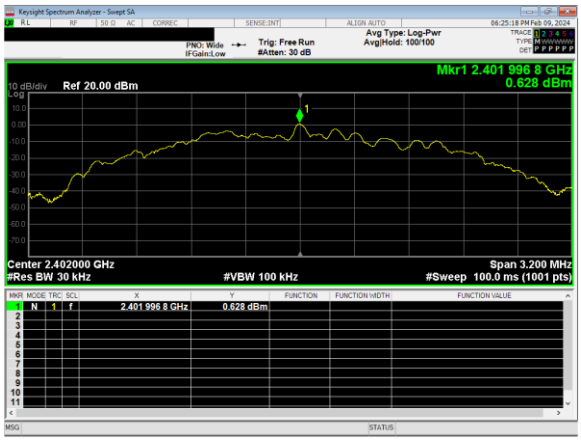
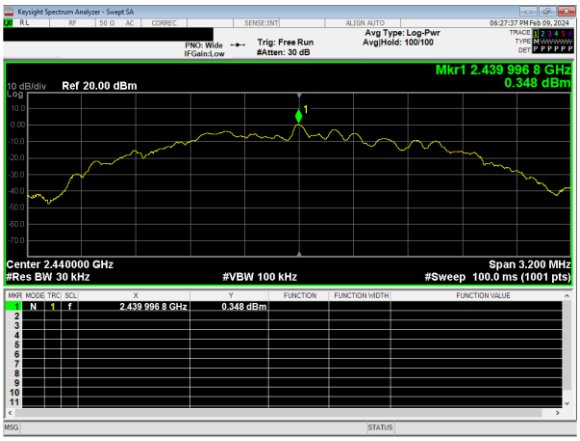
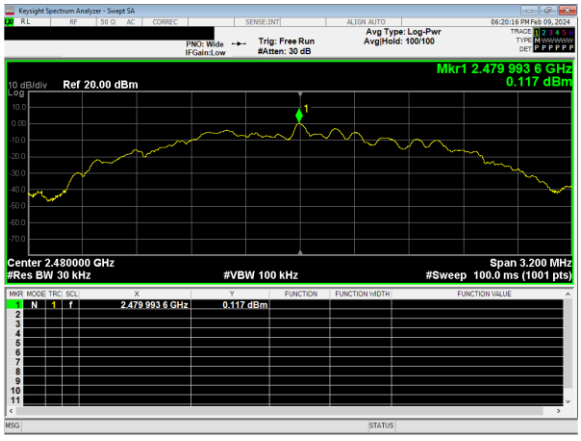


Channel 19 (2440 MHz)



Channel 39 (2480 MHz)



BLE 2 Mbps	
Channel 0 (2402 MHz)	Channel 19 (2440 MHz)
	
Channel 39 (2480 MHz)	
	

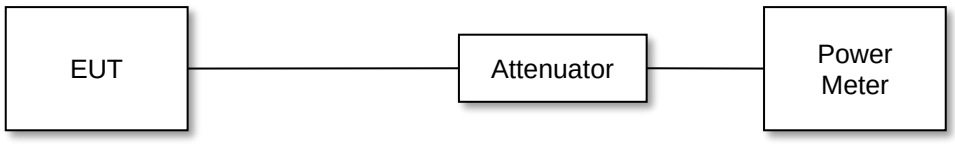
7.4 Maximum Conducted Output Power

7.4.1 Test Site and Instruments

Test Site : Shielded Room S3					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Power Meter	ML2495A	1423001 (B-16)	Anritsu	2023/08/14	2024/08/13
Power Sensor	MA2411B	1339136 (B-18)	Anritsu	2023/08/14	2024/08/13
Attenuator	54A-10	W5732 (D-30)	Weinschel	2023/05/26	2024/05/25
Thermo-Hygrometer	testo 608-H2	30050650 (F-71)	testo	2023/04/24	2024/04/23
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

7.4.2 Test Method and Test Setup (Diagrammatic illustration)

The EUT is connected to the measuring equipment via a suitable attenuator.
The test conditions and methods comply with the following test standards.
- KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2020 +Cor.1-2023 clause 11.9.1.2 (PKPM1) and 11.9.2.3.2 (AVGPM-G)



7.4.3 Test Data

Test Date: February 6, 2024
Temp.: 22 °C, RH: 39 %, Atm.: 1005 hPa

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limits (dBm)
BLE 1 Mbps	0	2402	4.456	≤ 30.0
	19	2440	4.238	≤ 30.0
	39	2480	3.944	≤ 30.0
BLE 2 Mbps	0	2402	4.464	≤ 30.0
	19	2440	4.232	≤ 30.0
	39	2480	3.960	≤ 30.0

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)	Limits (dBm)
BLE 1 Mbps	0	2402	4.434	--
	19	2440	4.208	--
	39	2480	3.925	--
BLE 2 Mbps	0	2402	4.438	--
	19	2440	4.205	--
	39	2480	3.927	--

7.5 Conducted Spurious Emission

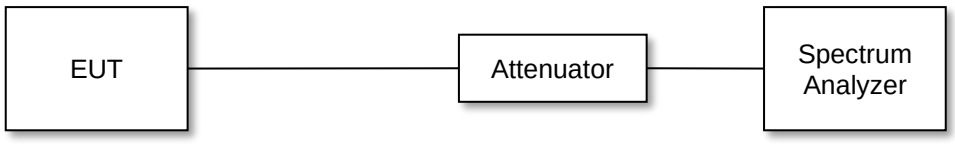
7.5.1 Test Site and Instruments

Test Site : Shielded Room S3					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Spectrum Analyzer	N9010A	MY50420292 (A-12)	Agilent	2023/12/12	2024/12/11
RF Cable	SF102	14253/2 (C-52)	HUBER+SUHNER	2023/08/29	2024/08/28
Attenuator	54A-10	W5732 (D-30)	Weinschel	2023/05/26	2024/05/25
Thermo-Hygrometer	testo 608-H2	30050650 (F-71)	testo	2023/04/24	2024/04/23
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

7.5.2 Test Method and Test Setup (Diagrammatic illustration)

The EUT is connected to the measuring equipment via a suitable attenuator.
The test conditions and methods comply with the following test standards.

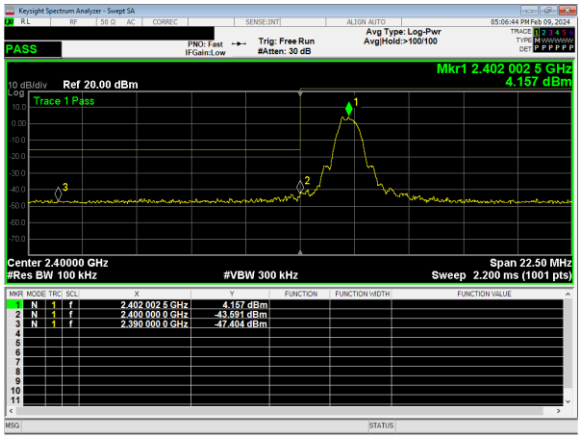
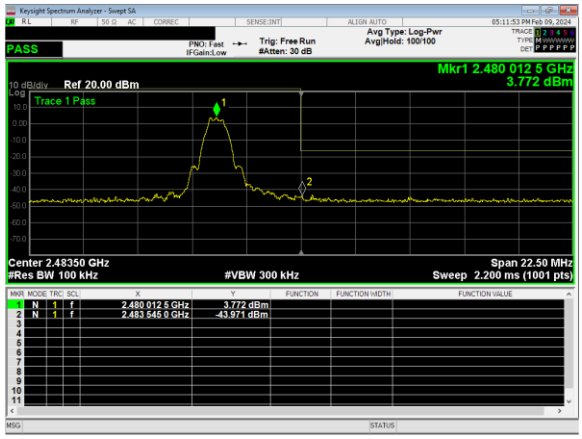
- KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2020 +Cor.1-2023 clause 11.11

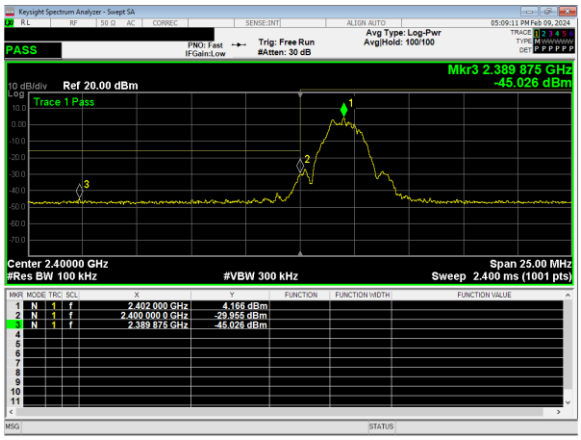
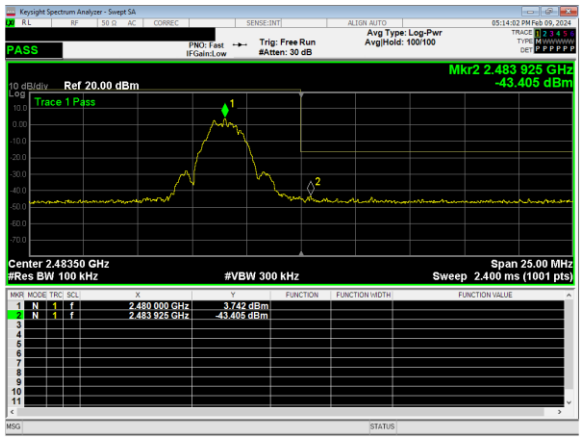


7.5.3 Test Data

7.5.3.1 Band-edge Emission

Test Date: February 9, 2024
Temp.: 23 °C, RH: 38 %, Atm.: 1001 hPa

BLE 1 Mbps	
Channel 0 (2402 MHz)	Channel 39 (2480 MHz)
	

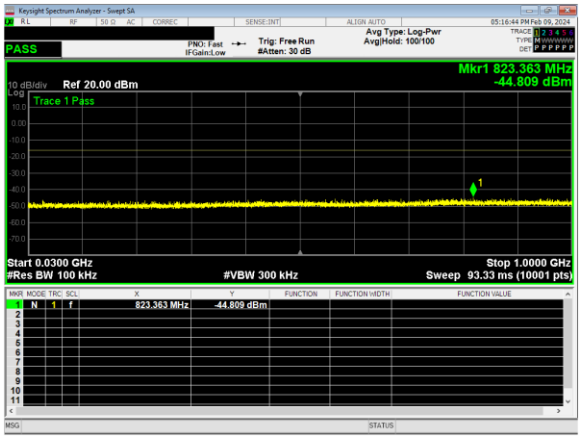
BLE 2 Mbps	
Channel 0 (2402 MHz)	Channel 39 (2480 MHz)
	

7.5.3.2 Conducted Spurious Emission

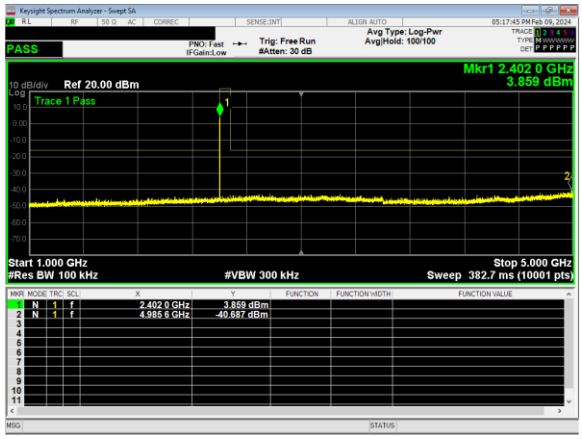
Test Date: August 10, 2023
Temp.: 25 °C, RH: 59 %, Atm.: 1003 hPa

BLE 1 Mbps – Channel 0 (2402 MHz)

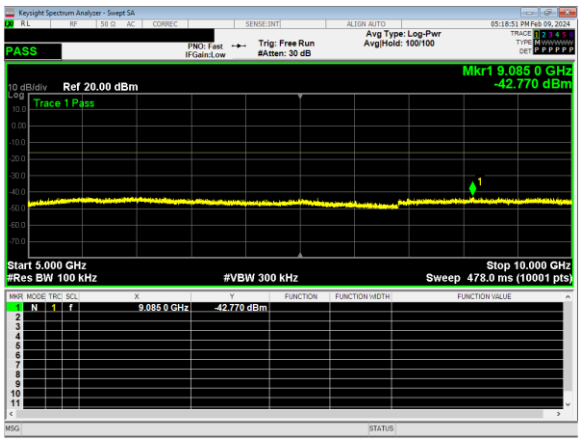
30 MHz – 1000 MHz



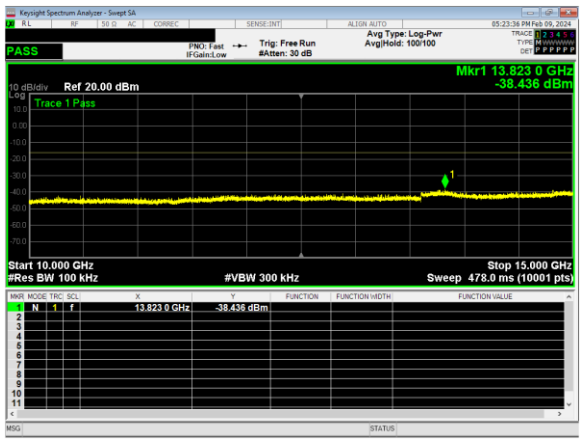
1 GHz – 5 GHz



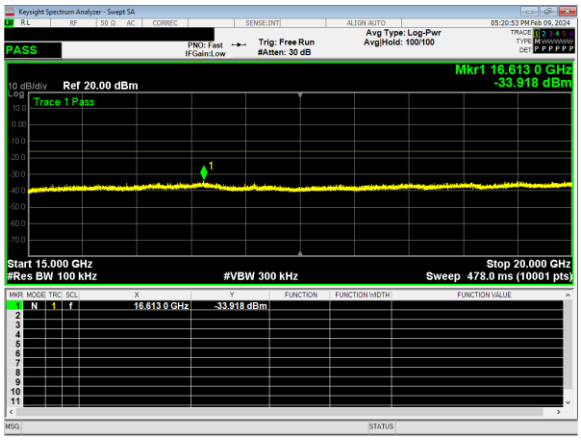
5 GHz – 10 GHz



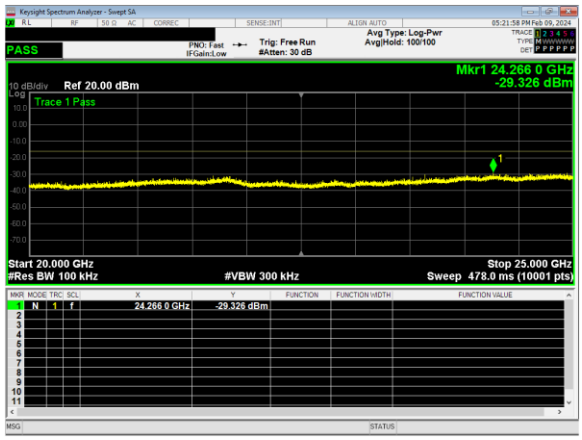
10 GHz – 15 GHz

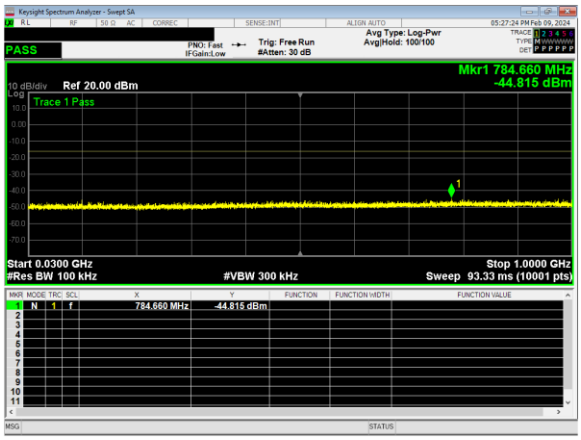
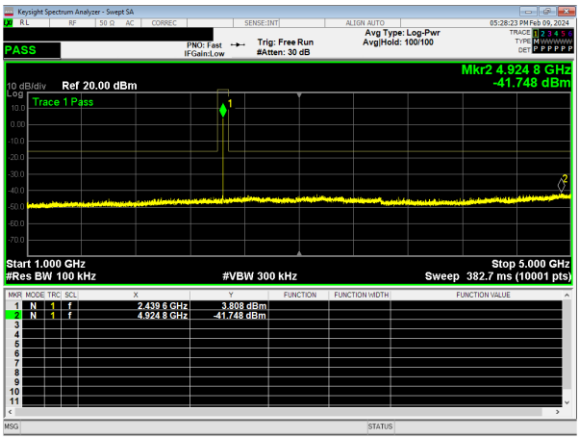
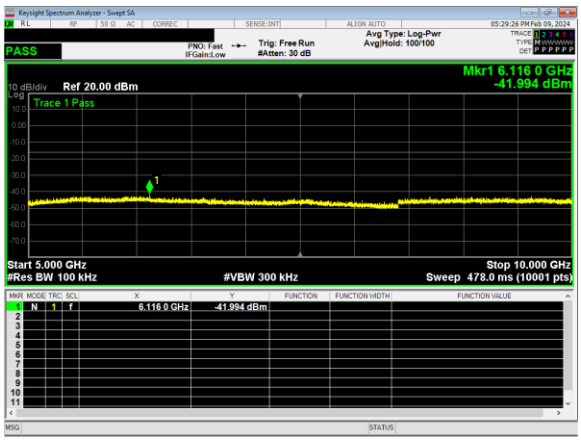
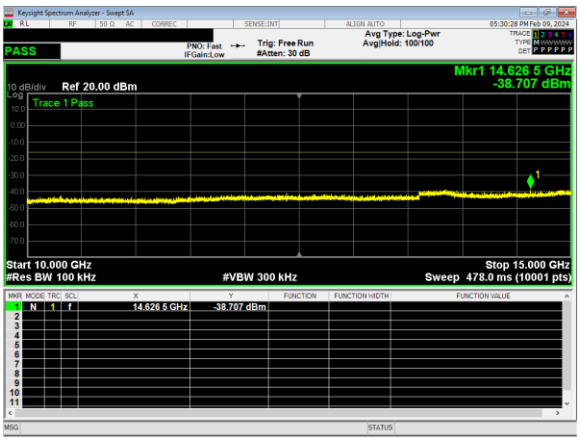
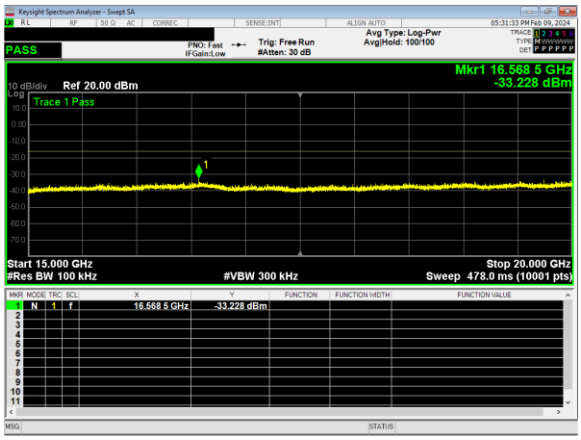
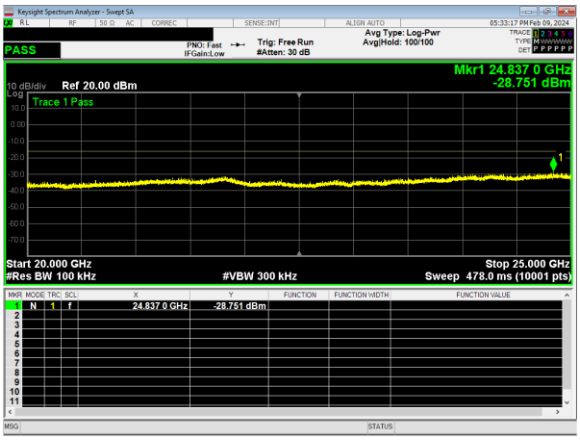


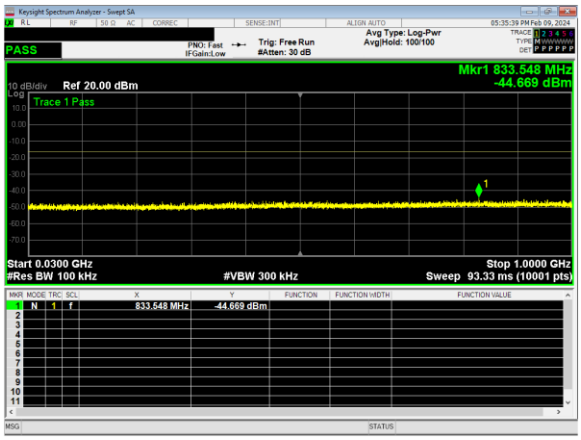
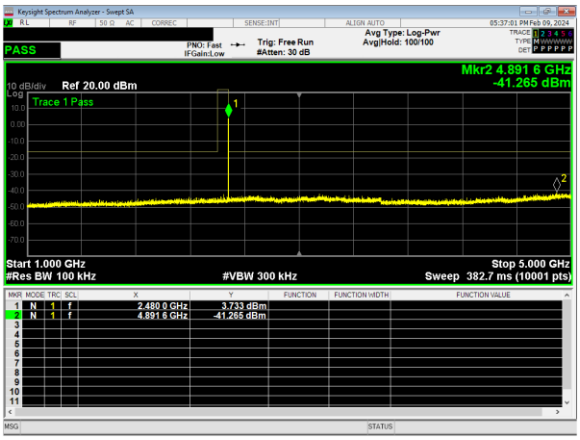
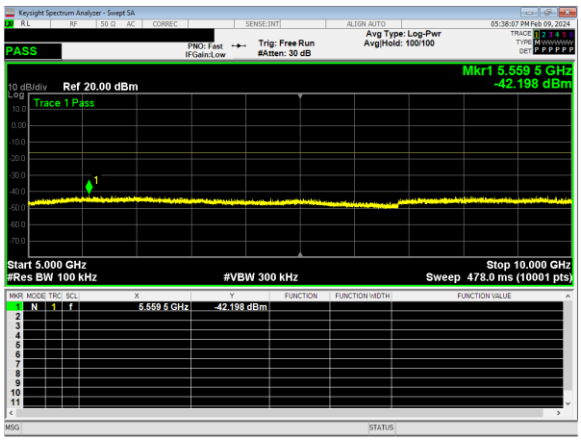
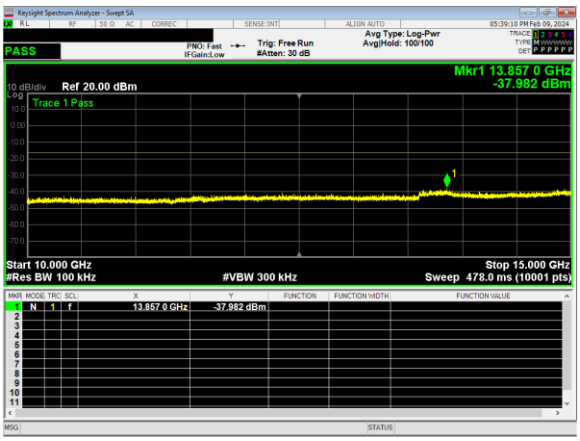
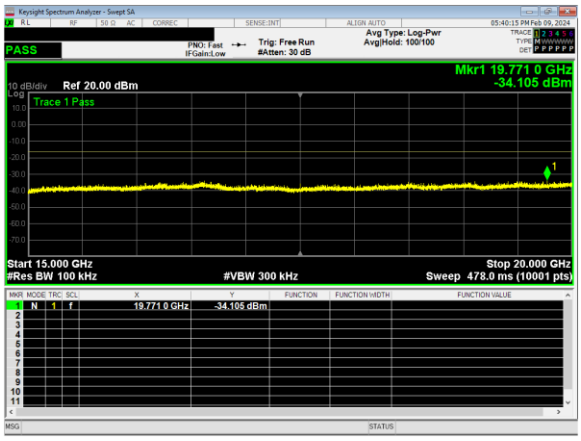
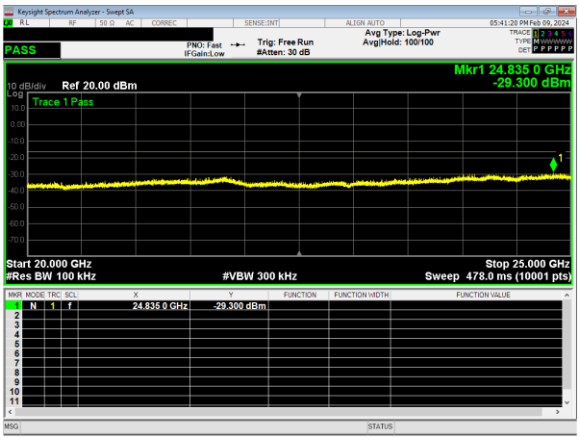
15 GHz – 20 GHz

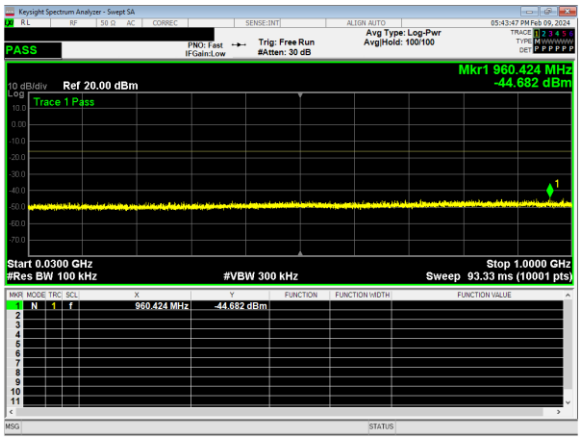
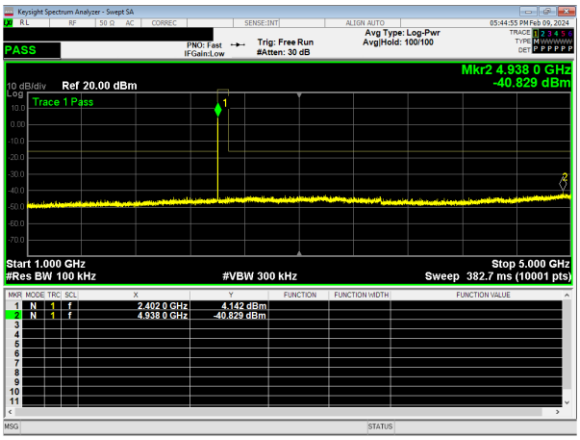
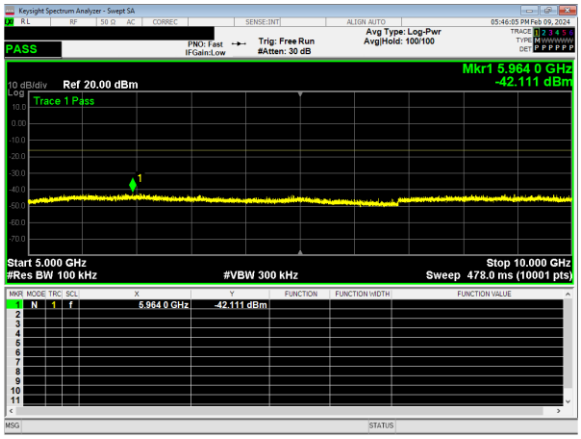
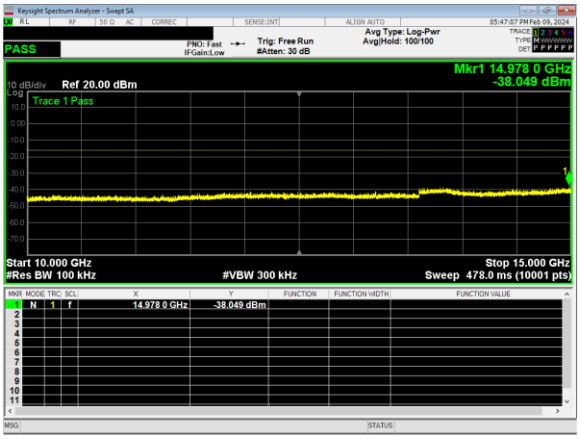
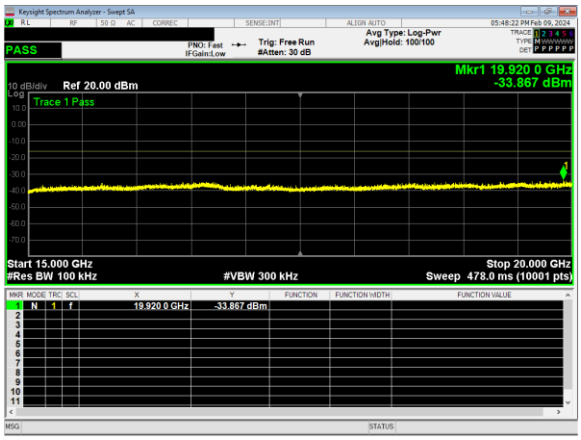
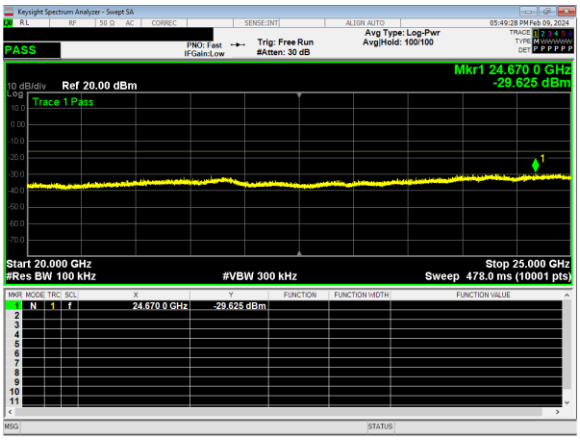


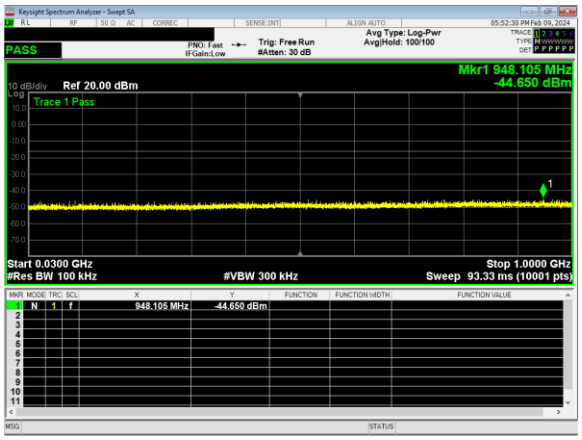
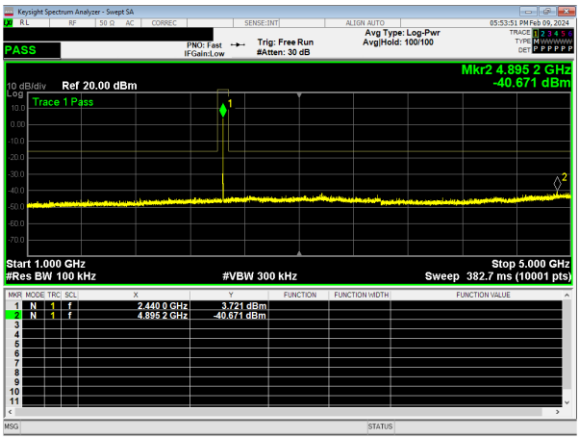
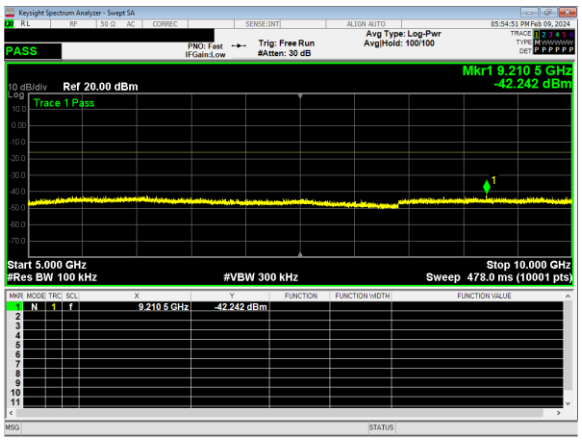
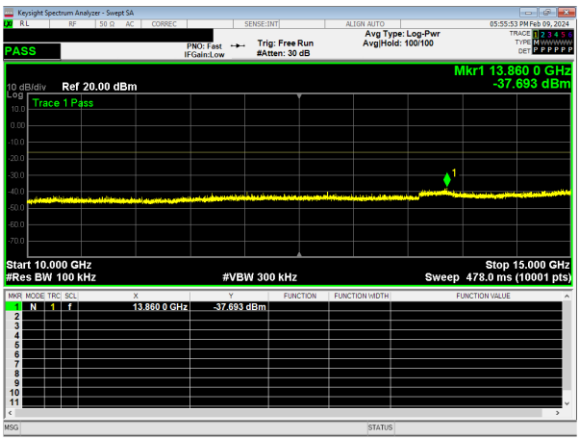
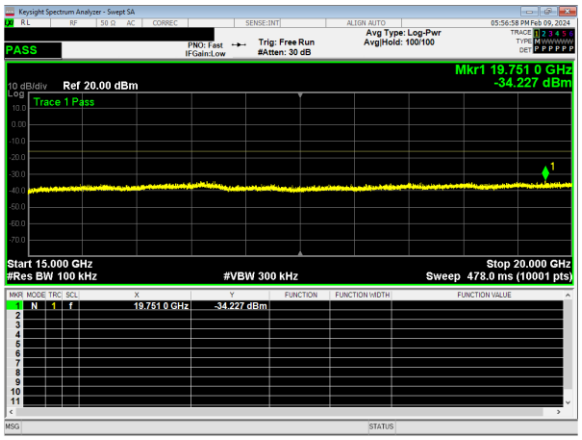
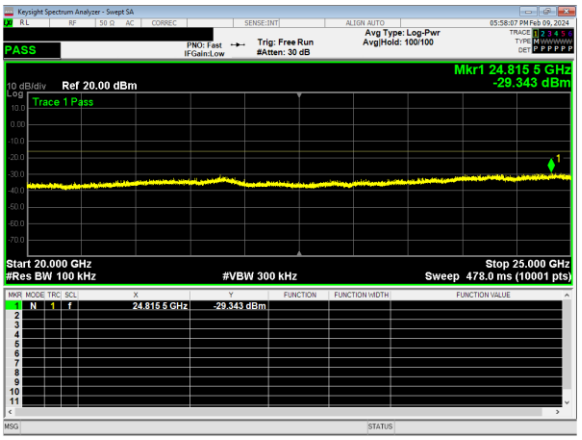
20 GHz – 25 GHz

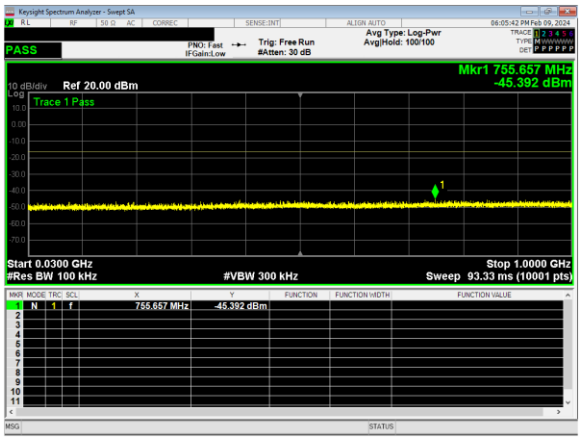
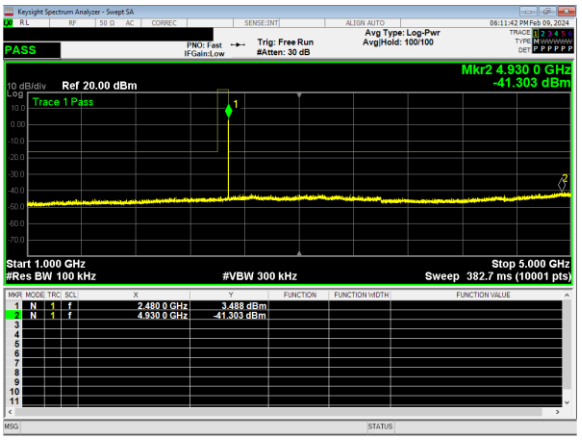
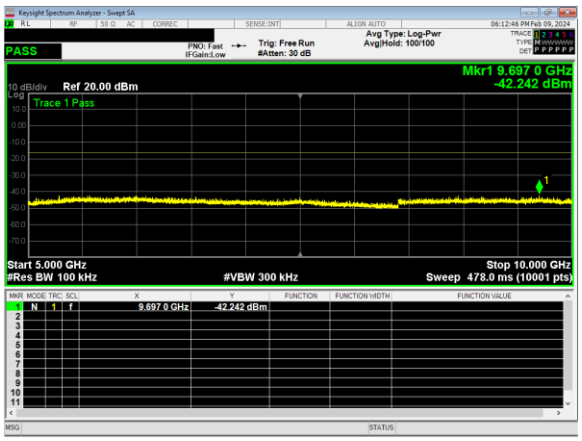
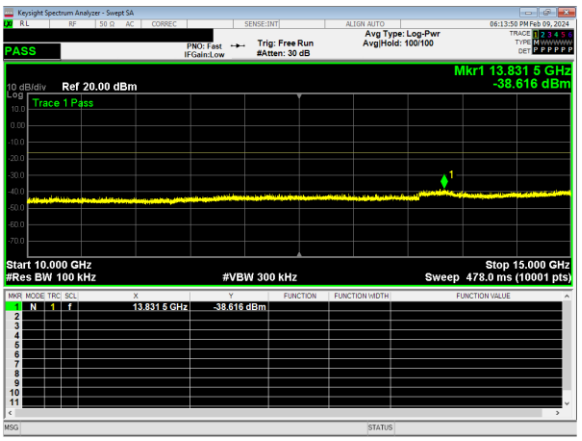
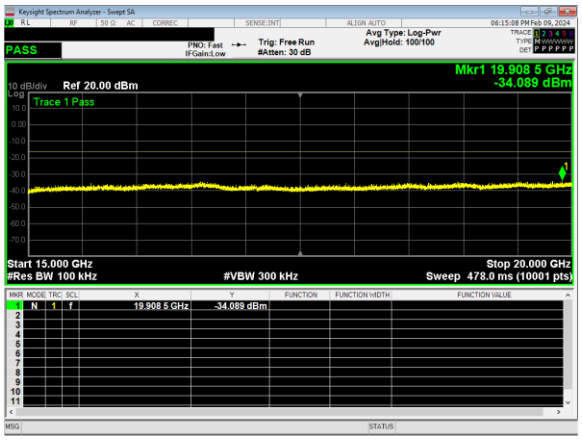
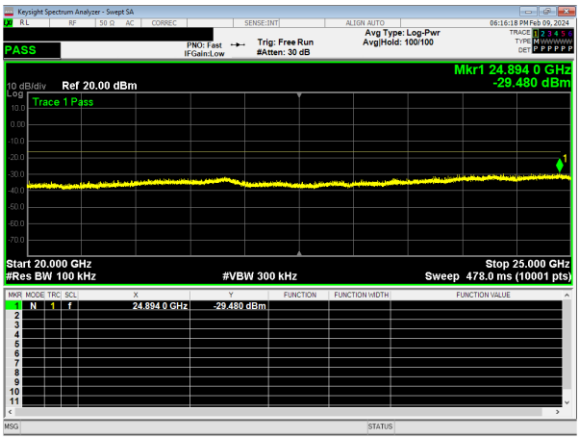


BLE 1 Mbps – Channel 19 (2440 MHz)	
30 MHz – 1000 MHz	1 GHz – 5 GHz
	
5 GHz – 10 GHz	10 GHz – 15 GHz
	
15 GHz – 20 GHz	20 GHz – 25 GHz
	

BLE 1 Mbps – Channel 39 (2480 MHz)	
30 MHz – 1000 MHz	1 GHz – 5 GHz
	
5 GHz – 10 GHz	10 GHz – 15 GHz
	
15 GHz – 20 GHz	20 GHz – 25 GHz
	

BLE 2 Mbps – Channel 0 (2402 MHz)	
30 MHz – 1000 MHz	1 GHz – 5 GHz
	
5 GHz – 10 GHz	10 GHz – 15 GHz
	
15 GHz – 20 GHz	20 GHz – 25 GHz
	

BLE 2 Mbps – Channel 19 (2440 MHz)	
30 MHz – 1000 MHz	1 GHz – 5 GHz
	
5 GHz – 10 GHz	10 GHz – 15 GHz
	
15 GHz – 20 GHz	20 GHz – 25 GHz
	

BLE 2 Mbps – Channel 39 (2480 MHz)	
30 MHz – 1000 MHz	1 GHz – 5 GHz
	
5 GHz – 10 GHz	10 GHz – 15 GHz
	
15 GHz – 20 GHz	20 GHz – 25 GHz
	

7.6 Radiated Spurious Emission

7.6.1 Test Site and Instruments

Test Site : Anechoic Chamber A2					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Test Receiver	ESR26	101680 (A-76)	Rohde & Schwarz	2024/01/29	2025/01/28
Pre-Amplifier	310N	304573 (A-17)	SONOMA	2023/11/07	2024/11/06
Pre-Amplifier	RP1826G-45H	RP140121-11 (A-53)	EMCS	2023/07/17	2024/07/16
Pre-Amplifier	BZR-01001800-201040-182323-HS	23804 (A-65)	B&Z	2024/02/07	2025/02/06
Loop Antenna	HFH2-Z2	872096/25 (C-2)	Rohde & Schwarz	2023/05/25	2024/05/24
Biconical Antenna	VHBB9124/BBA9106	01314 (C-85)	Schwarzbeck	2023/11/01	2024/10/31
Log-periodic Antenna	VULP9118B	871 (C-39)	Schwarzbeck	2023/11/01	2024/10/31
Double-Ridge Guide Horn Antenna	TR17206	73370006 (C-29)	ADVANTEST	2023/05/22	2024/05/21
Horn Antenna	91889-2	568 (C-41-2)	EATON	2023/05/23	2024/05/22
Horn Antenna	3160-09	9808-1117 (C-48)	EMCO	2023/07/17	2024/07/16
Horn Antenna	3160-08	9904-1099 (C-59)	EMCO	2023/05/23	2024/05/22
RF Cable	SF102E	6683/2E (C-70)	HUBER+SUHNER	2023/04/03	2024/04/02
RF Cable	SF102E	10055/2E (C-75)	HUBER+SUHNER	2023/04/03	2024/04/02
Band Rejection Filter	BRM50702	371 (D-121)	MICRO-TRONICS	2023/10/05	2024/10/04
EMC Software	EP5/RE	Ver.6.00.120	TOYO	--	--
RF Cable	RG213/U	--- (H-28)	HUBER+SUHNER	2023/05/25	2024/05/24
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2023/11/07	2024/11/06
Thermo-Hygrometer	testo 608-H2	30050646 (F-68)	testo	2023/06/09	2024/06/08
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

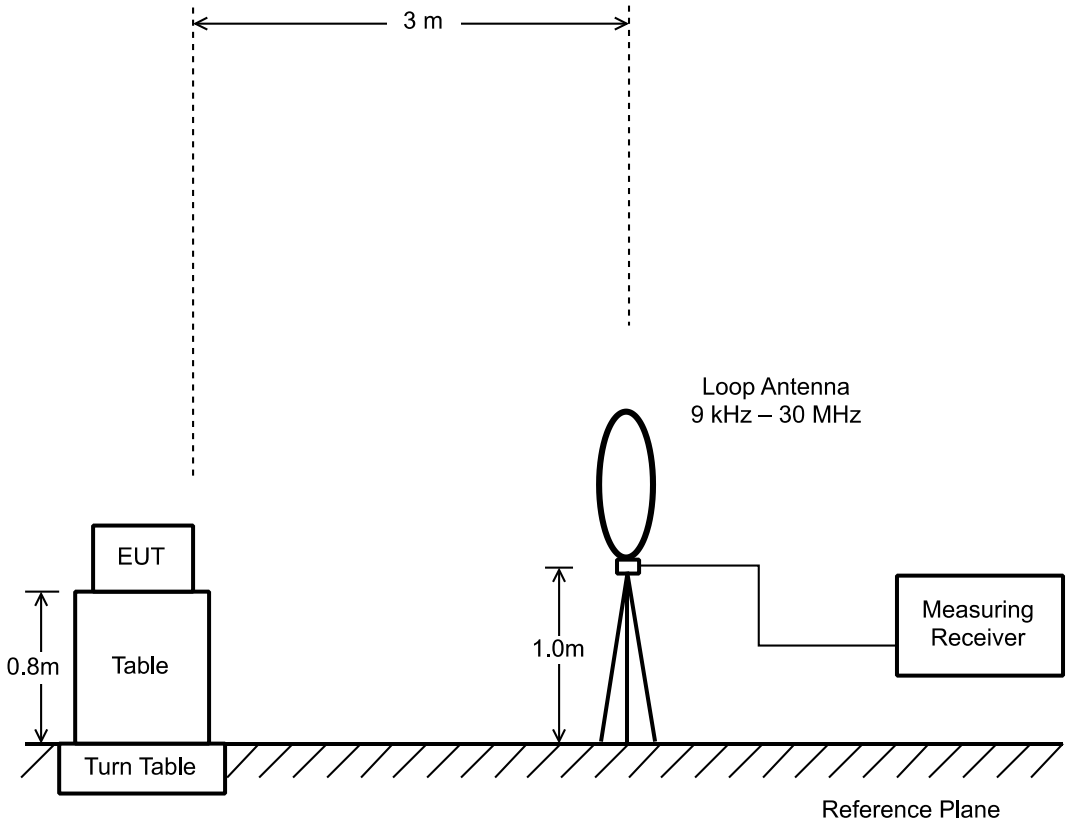
7.6.2 Test Method and Test Setup (Diagrammatic illustration)

The test conditions and methods comply with the following test standards.

- KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2020 +Cor.1-2023 clause 11.12

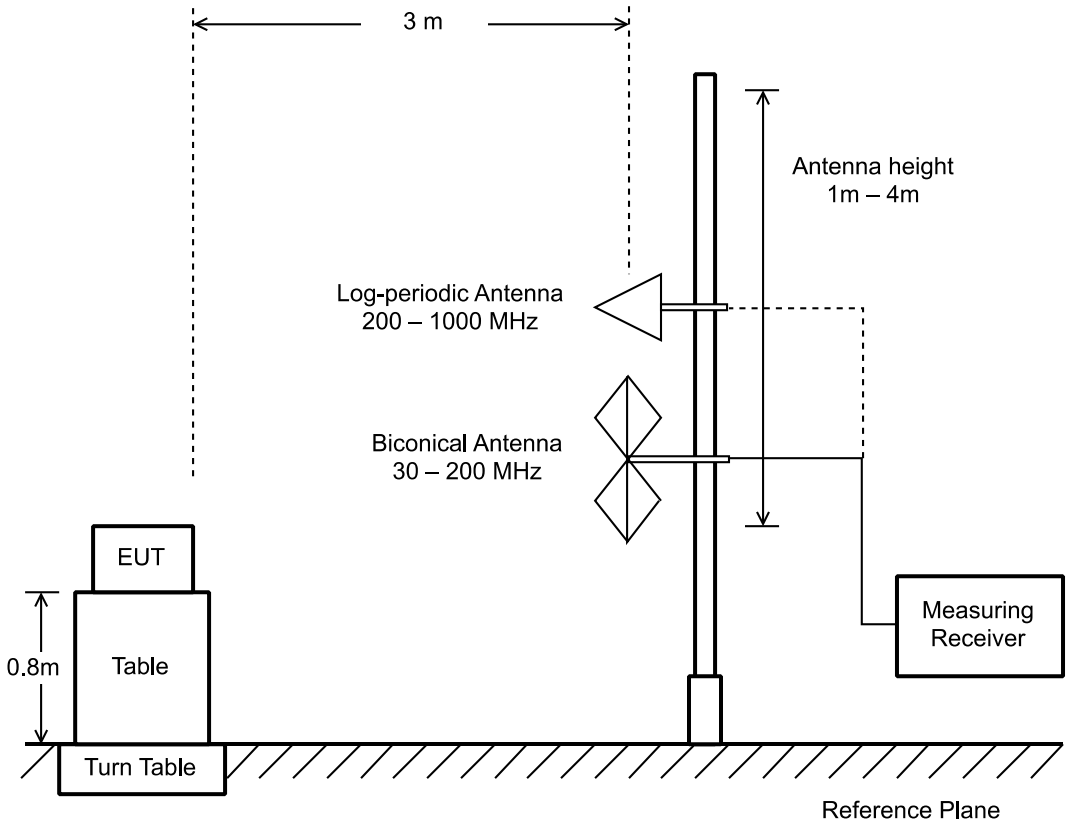
7.6.2.1 Radiated Spurious Emission 9 kHz – 30 MHz

The pre-scan measurements were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT. The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.
The measurement were performed about three antenna orientations (parallel, perpendicular, and ground-parallel).
According to KDB 414788, a used anechoic chamber were equivalent to those on an open fields site based on comparison measurements.
This configurations was used for formal measurements.
(Reference divisional instruction No. G703649)



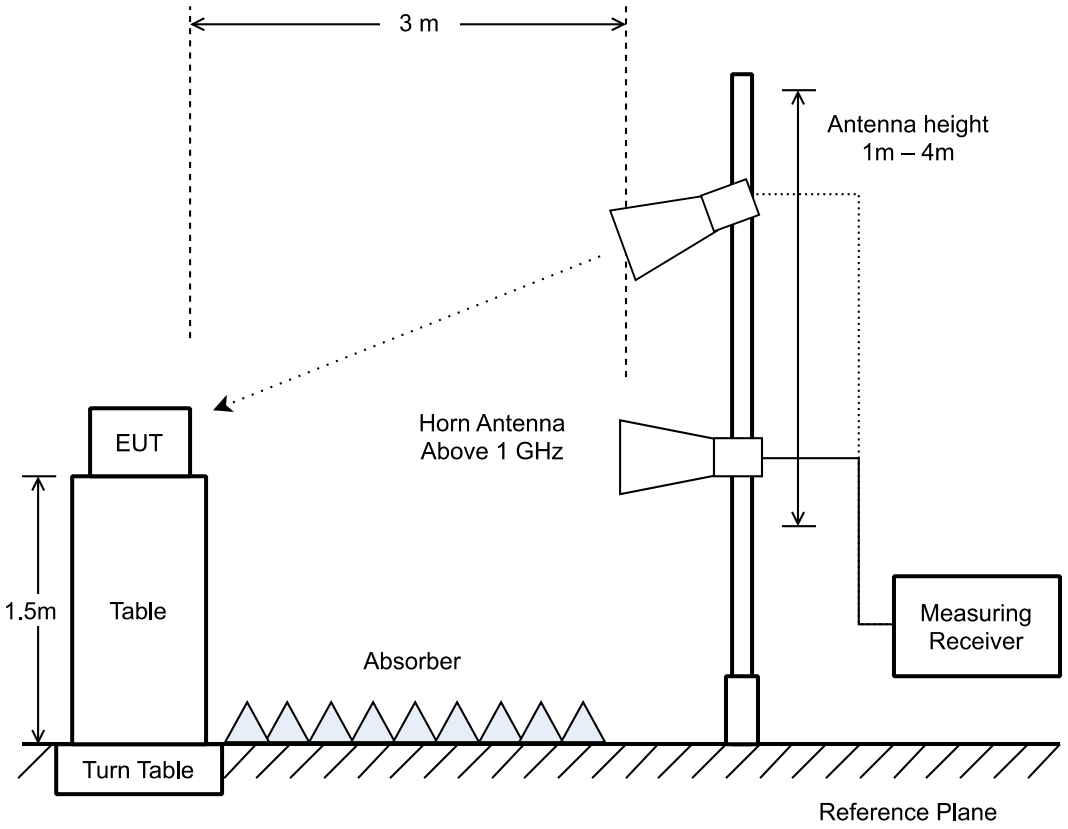
7.6.2.2 Radiated Spurious Emission 30 MHz – 1000 MHz

The pre-scan measurements were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT. The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for formal measurements.
(Reference divisional instruction No. G703649)



7.6.2.3 Radiated Spurious Emission above 1 GHz

The pre-scan measurements were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT. The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for formal measurements.
(Reference divisional instruction No. G703649)



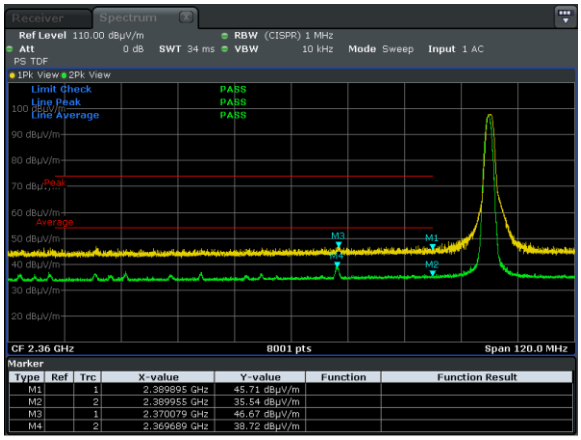
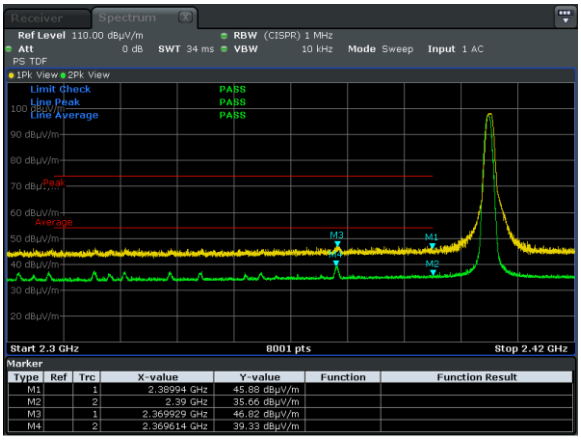
NOTE
When the EUT is manipulated through three different orientations (for example, X, Y and Z axis), the scan height upper range for the measurement antenna is limited to 2.5 m or 0.5 m above the top of the EUT.

7.6.3 Test Data

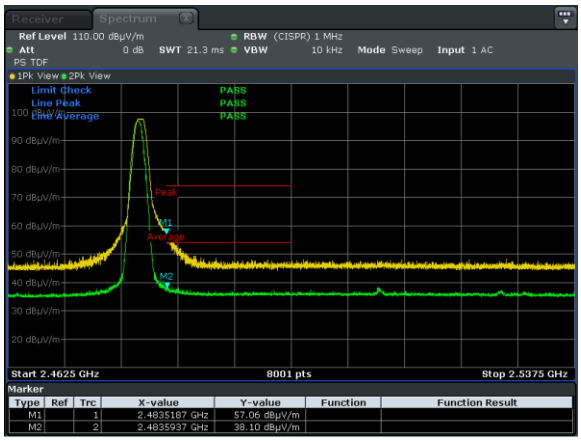
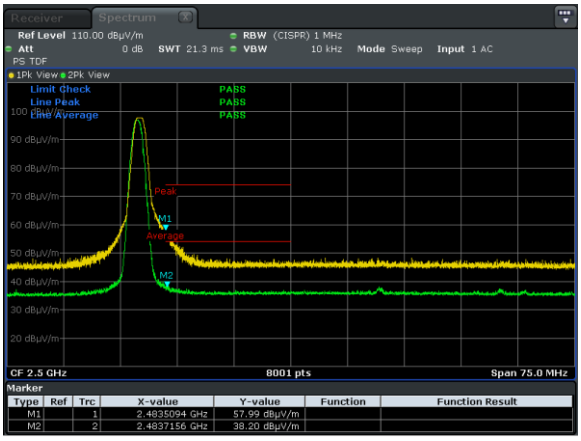
7.6.3.1 Band-edge Emission

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

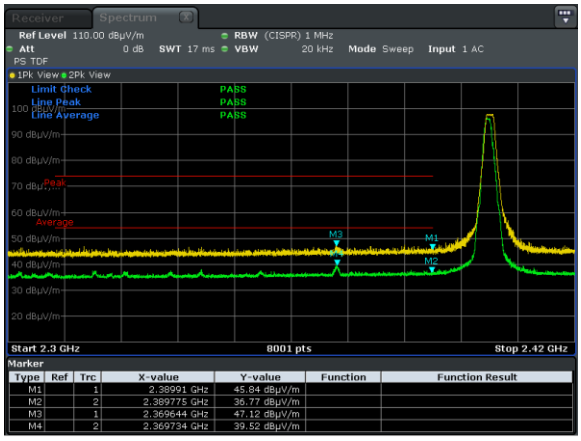
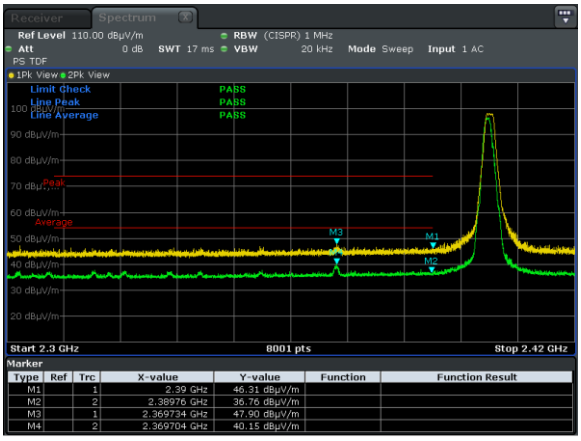
w/o Attachment

BLE 1 Mbps – Channel 0 (2402 MHz)	
Horizontal – Y axis	Vertical – Z axis
	

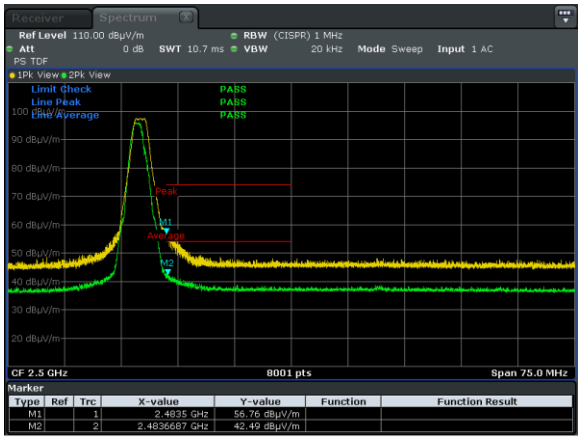
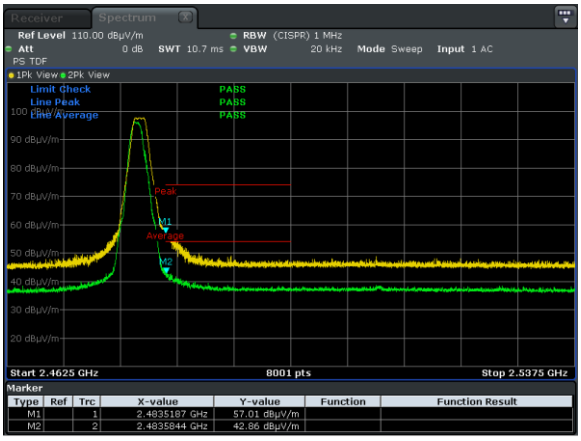
Peak detector is set to RBW 1 MHz and VBW 3 MHz.

BLE 1 Mbps – Channel 39 (2480 MHz)	
Horizontal – Y axis	Vertical – Z axis
	

Peak detector is set to RBW 1 MHz and VBW 3 MHz.

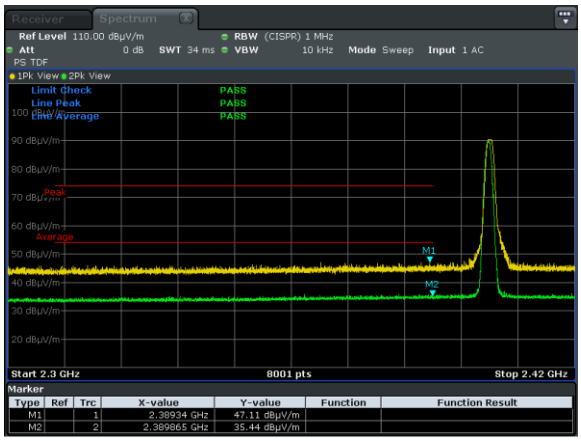
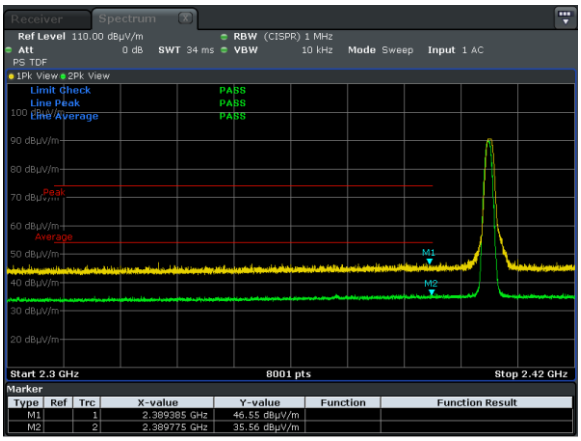
BLE 2 Mbps – Channel 0 (2402 MHz)	
Horizontal – Y axis	Vertical – Z axis
	

Peak detector is set to RBW 1 MHz and VBW 3 MHz.

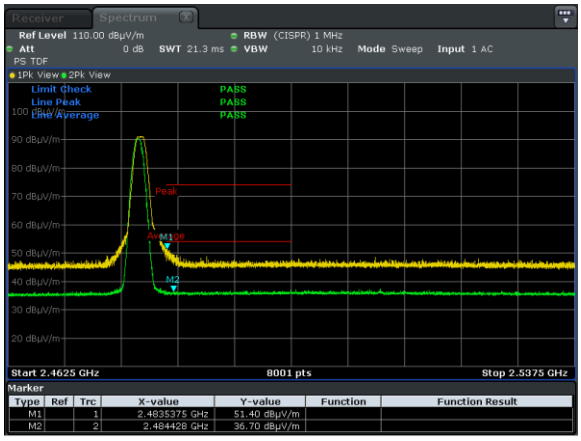
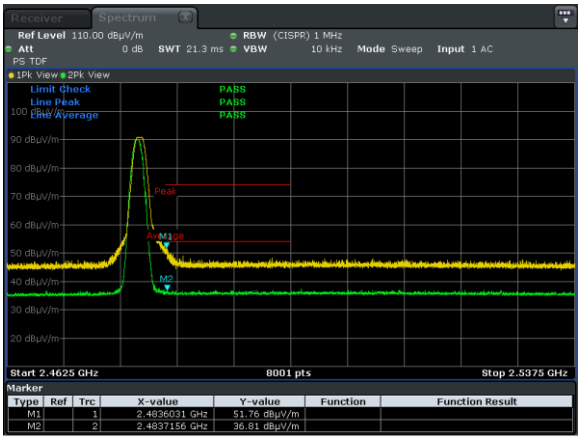
BLE 2 Mbps – Channel 39 (2480 MHz)	
Horizontal – Y axis	Vertical – Z axis
	

Peak detector is set to RBW 1 MHz and VBW 3 MHz.

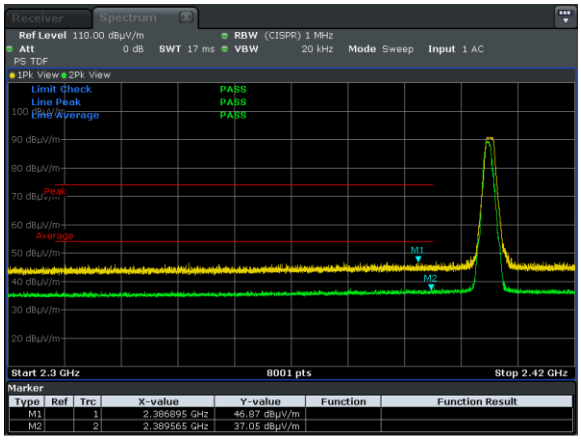
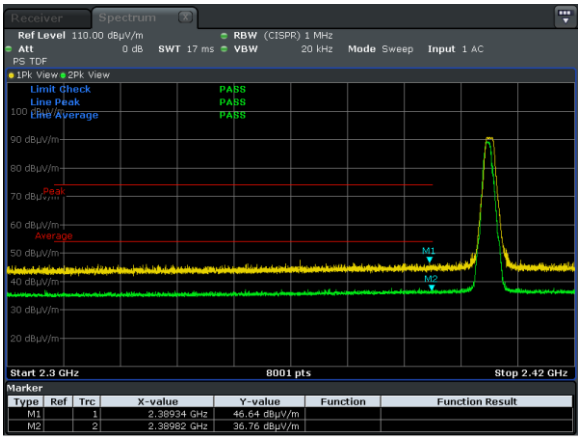
w/ Attachment

BLE 1 Mbps – Channel 0 (2402 MHz)	
Horizontal – Z axis	Vertical – Y axis
	

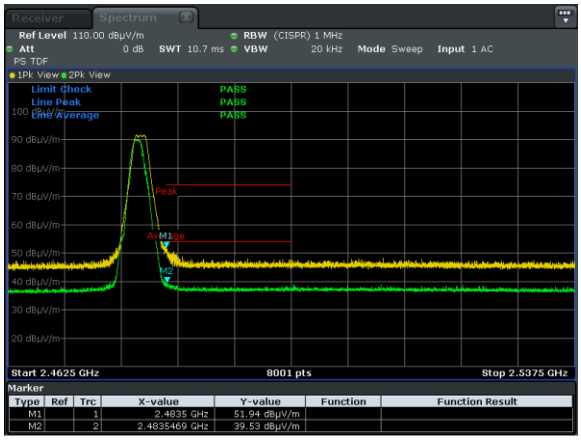
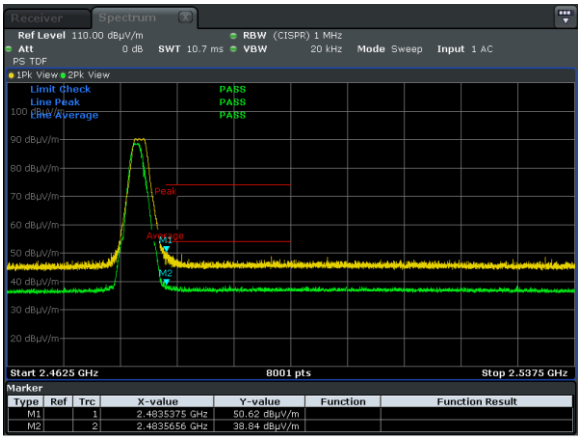
Peak detector is set to RBW 1 MHz and VBW 3 MHz.

BLE 1 Mbps – Channel 39 (2480 MHz)	
Horizontal – Z axis	Vertical – Y axis
	

Peak detector is set to RBW 1 MHz and VBW 3 MHz.

BLE 2 Mbps – Channel 0 (2402 MHz)	
Horizontal – Z axis	Vertical – Y axis
	

Peak detector is set to RBW 1 MHz and VBW 3 MHz.

BLE 2 Mbps – Channel 39 (2480 MHz)	
Horizontal – Z axis	Vertical – Y axis
	

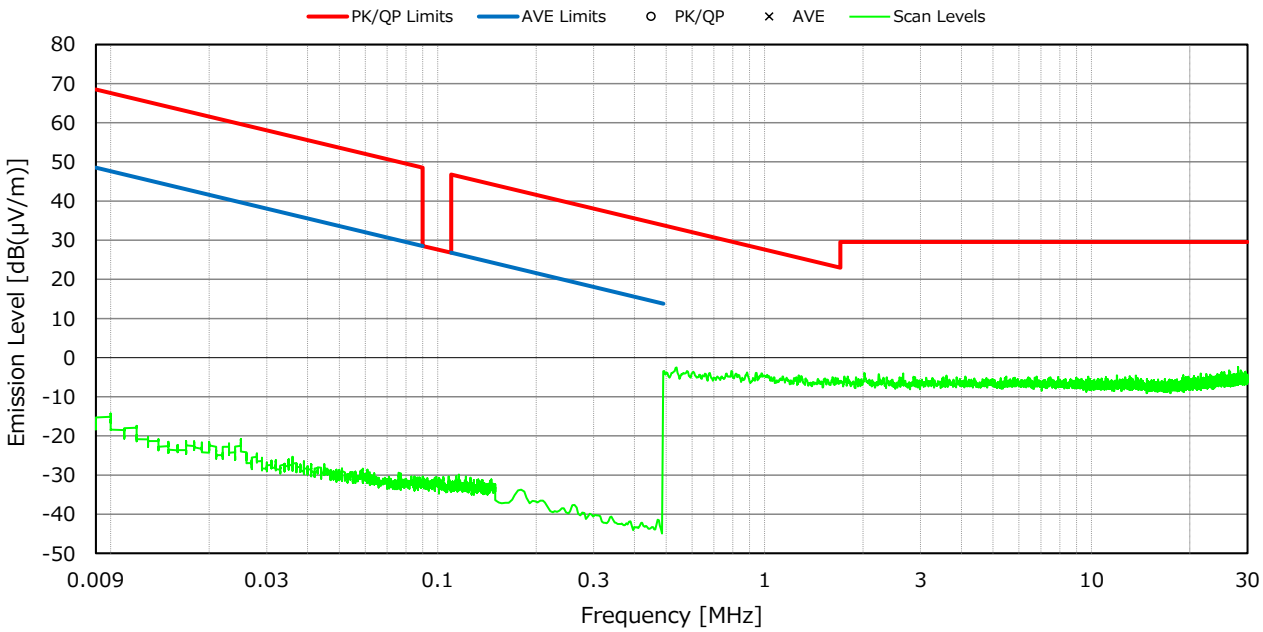
Peak detector is set to RBW 1 MHz and VBW 3 MHz.

7.6.3.2 Radiated Spurious Emission 9 kHz – 30 MHz

Mode of EUT : All modes have been investigated and the worst case mode has been listed.

Test voltage : 3.3VDC
Test condition : w/o Attachment
Antenna polarization : Perpendicular to measurement axis

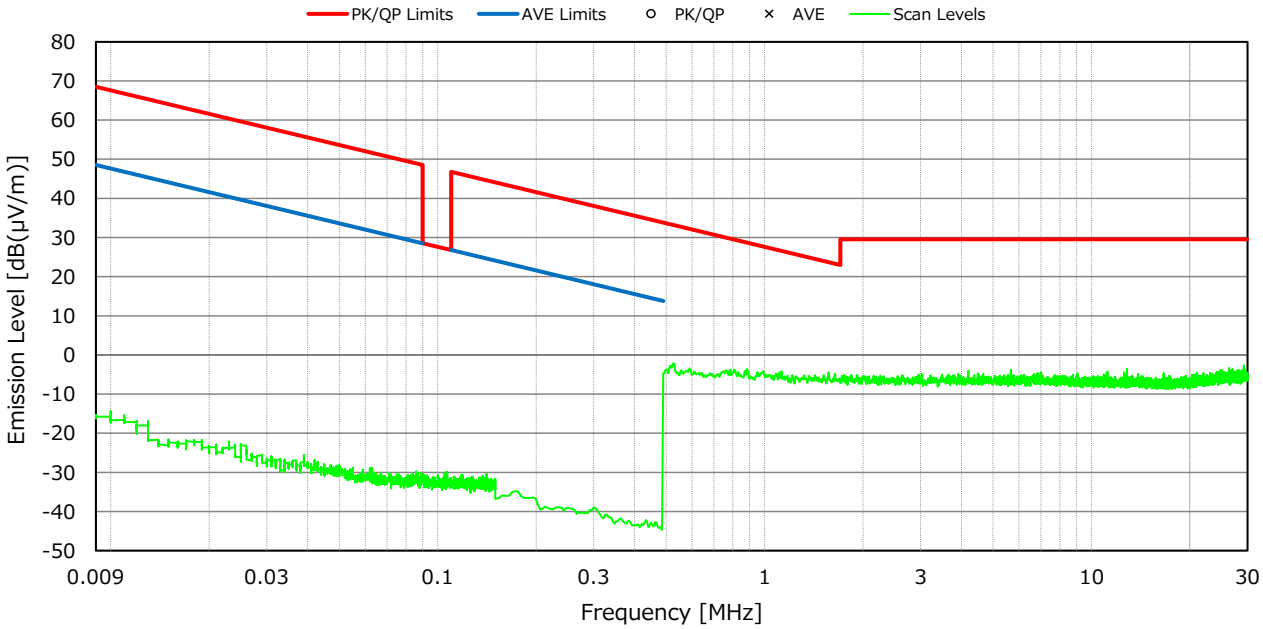
Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa



NOTES
1) Measurement Distance : 3 m (Specified Distance : 30 m)
2) The spectrum was checked from 9 kHz to 30 MHz.
3) PK/QP : Quasi-Peak detector, AVE : Average detector
4) Bandwidth : 200 Hz (9 kHz - 150 kHz), 9 kHz (150 kHz - 30 MHz)
5) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

Test voltage : 3.3VDC
Test condition : w/ Attachment
Antenna polarization : Perpendicular to measurement axis

Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa



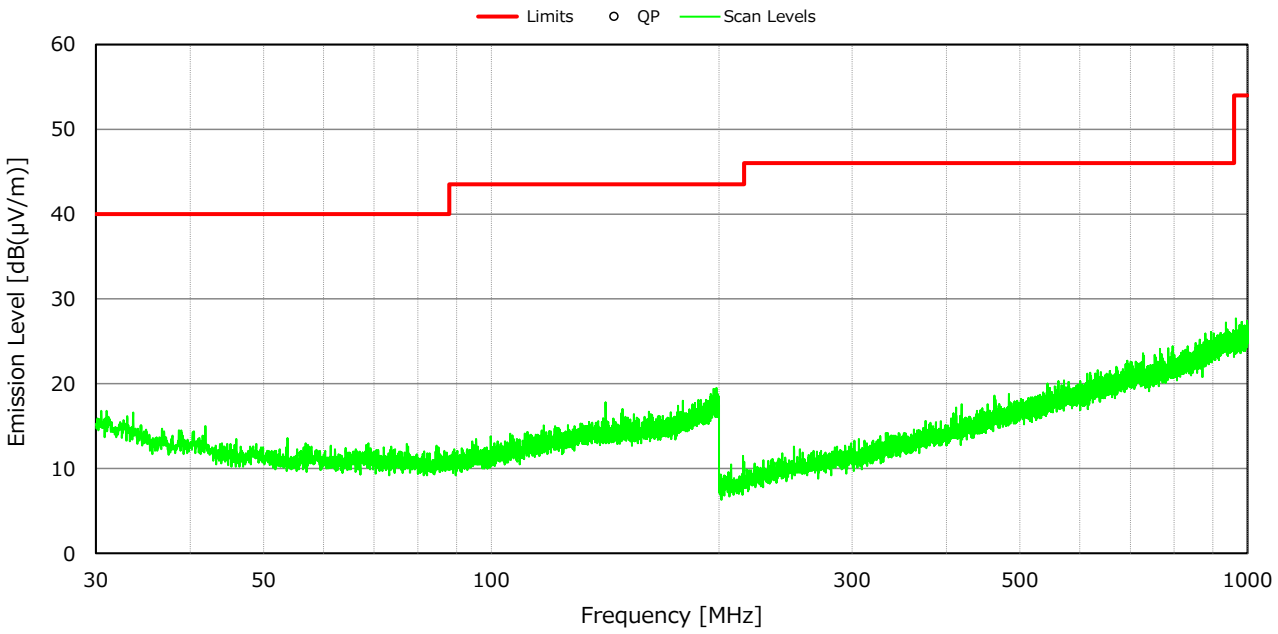
NOTES
1) Measurement Distance : 3 m (Specified Distance : 30 m)
2) The spectrum was checked from 9 kHz to 30 MHz.
3) PK/QP : Quasi-Peak detector, AVE : Average detector
4) Bandwidth : 200 Hz (9 kHz - 150 kHz), 9 kHz (150 kHz - 30 MHz)
5) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

7.6.3.3 Radiated Spurious Emission 30 MHz – 1000 MHz

Mode of EUT : All modes have been investigated and the worst case mode has been listed.

Test voltage : 3.3VDC
Test condition : w/o Attachment
Antenna polarization : Horizontal

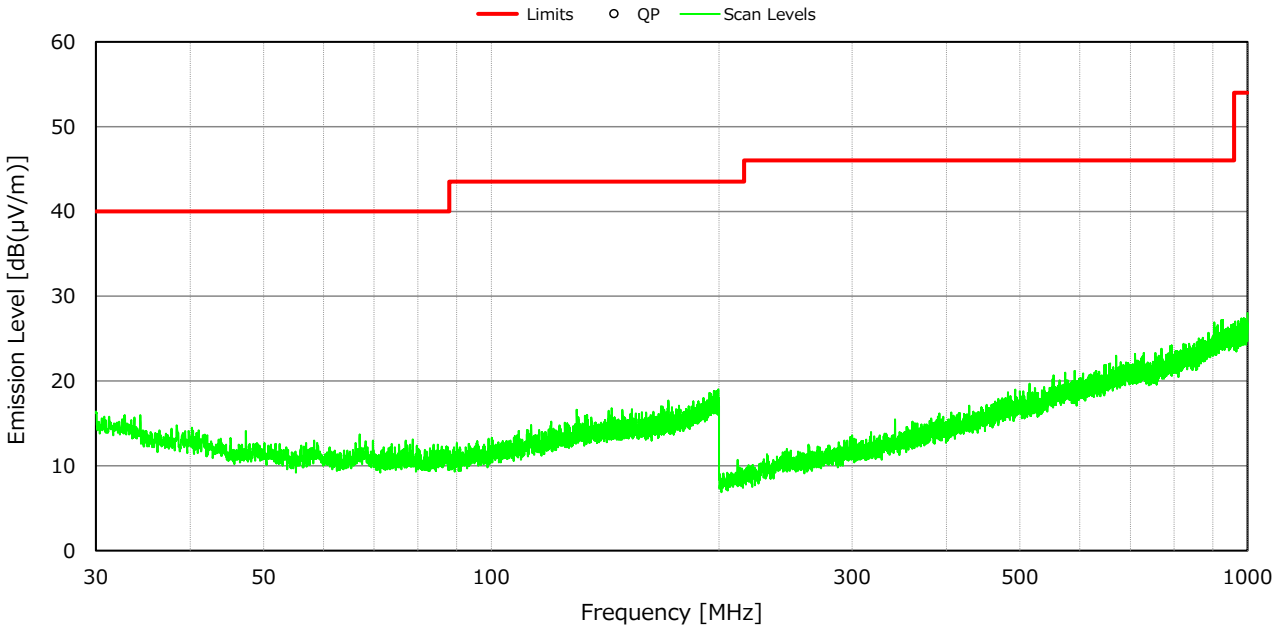
Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa



NOTES
1) Measurement Distance : 3 m
2) The spectrum was checked from 30 MHz to 1000 MHz.
3) QP : Quasi-Peak detector
4) Bandwidth : 120 kHz (30 MHz - 1000 MHz)
5) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

Test voltage : 3.3VDC
Test condition : w/o Attachment
Antenna polarization : Vertical

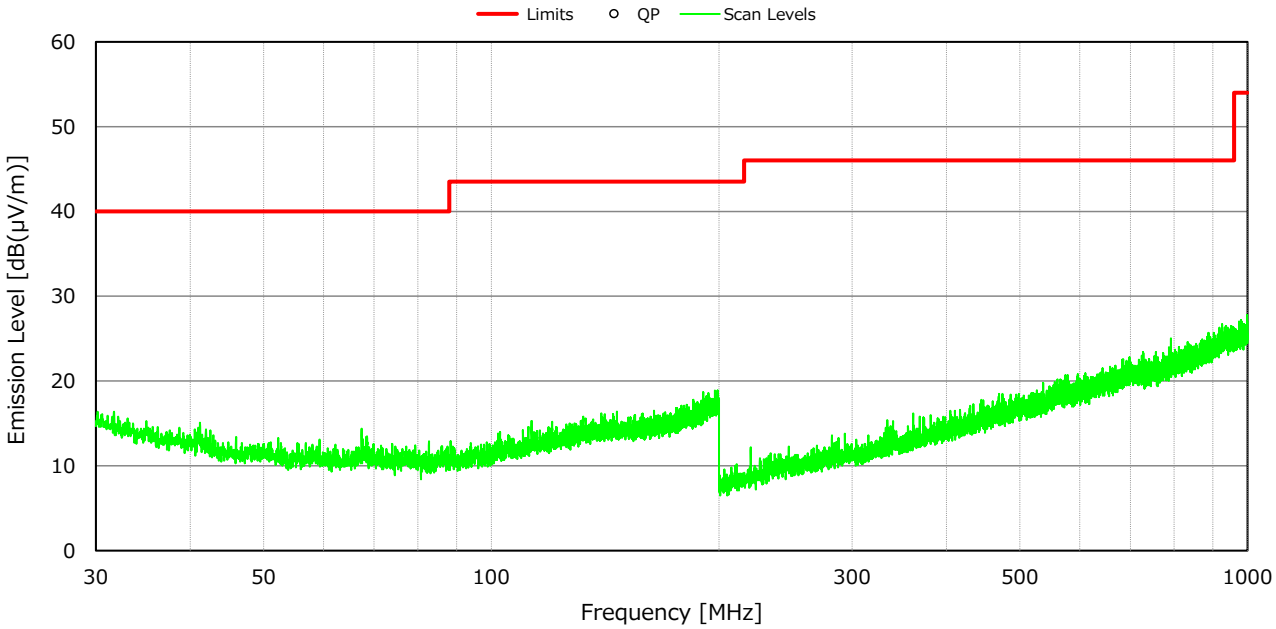
Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa



NOTES
1) Measurement Distance : 3 m
2) The spectrum was checked from 30 MHz to 1000 MHz.
3) QP : Quasi-Peak detector
4) Bandwidth : 120 kHz (30 MHz - 1000 MHz)
5) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

Test voltage : 3.3VDC
Test condition : w/ Attachment
Antenna polarization : Horizontal

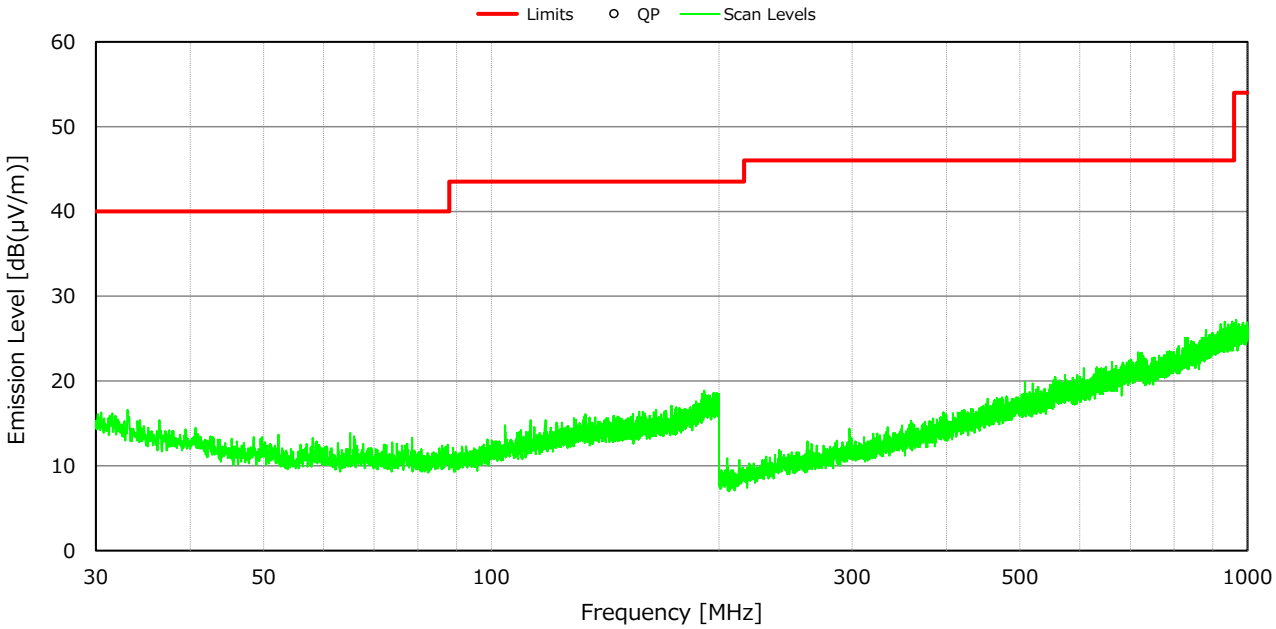
Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa



NOTES
1) Measurement Distance : 3 m
2) The spectrum was checked from 30 MHz to 1000 MHz.
3) QP : Quasi-Peak detector
4) Bandwidth : 120 kHz (30 MHz - 1000 MHz)
5) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

Test voltage : 3.3VDC
Test condition : w/ Attachment
Antenna polarization : Vertical

Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa



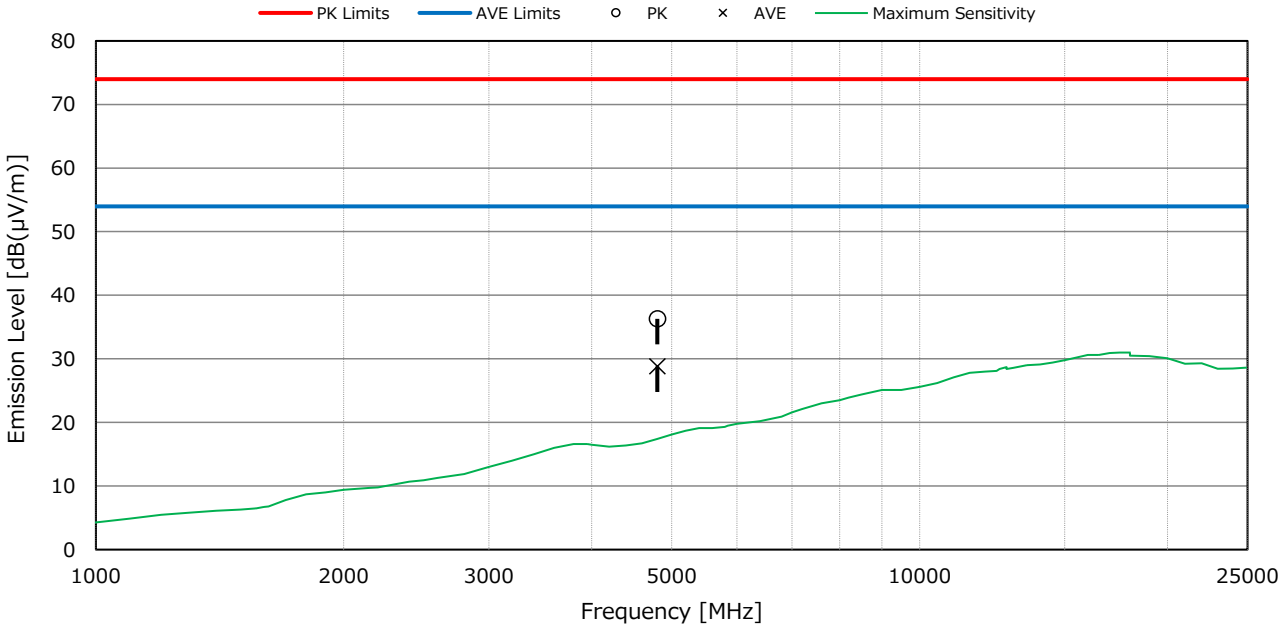
NOTES
1) Measurement Distance : 3 m
2) The spectrum was checked from 30 MHz to 1000 MHz.
3) QP : Quasi-Peak detector
4) Bandwidth : 120 kHz (30 MHz - 1000 MHz)
5) All emission levels were below the noise floor, or more than 15 dB below the applied limits.

7.6.3.4 Radiated Spurious Emission above 1 GHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 0ch (2402MHz) w/o Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	51.7	44.2	74.0	54.0	36.3	28.8	+ 37.7	+ 25.2	Y



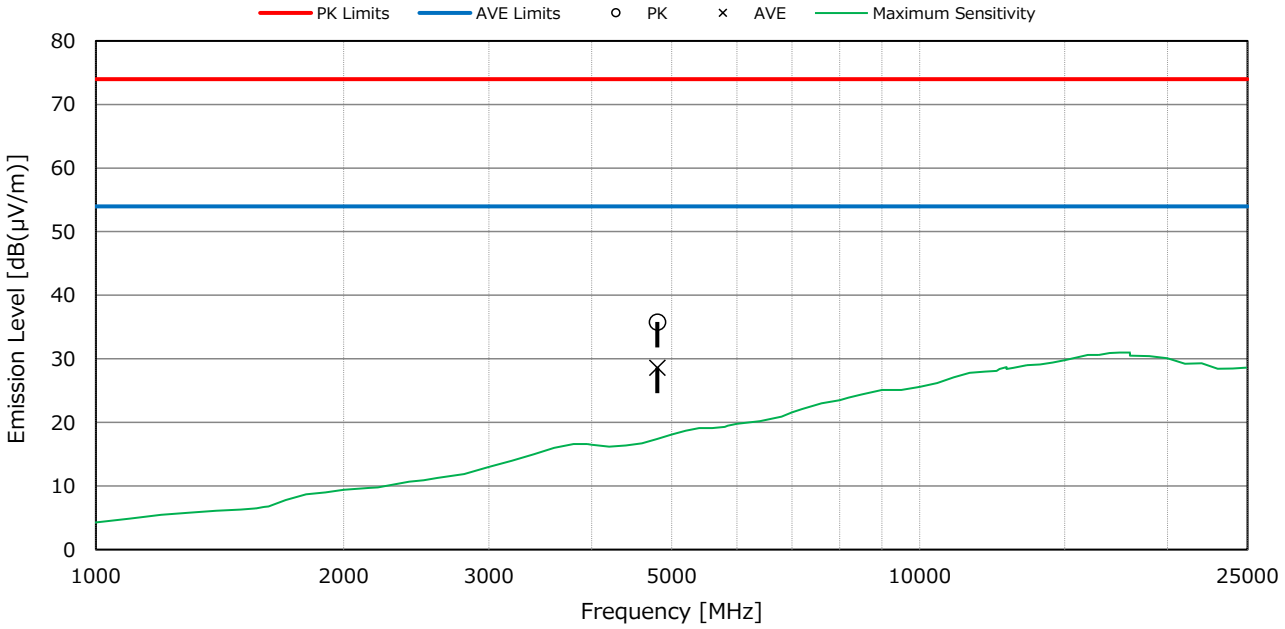
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 44.2 = 28.8 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 0ch (2402MHz) w/o Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	51.2	44.0	74.0	54.0	35.8	28.6	+ 38.2	+ 25.4	Z



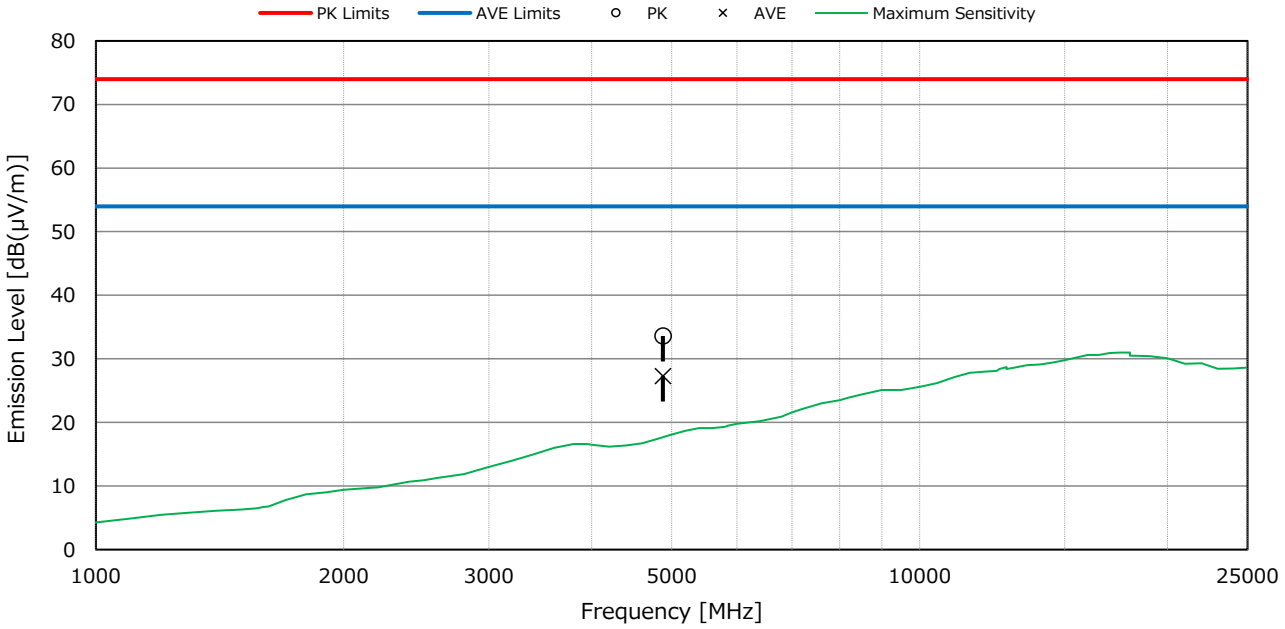
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 44.0 = 28.6 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 19ch (2440MHz) w/o Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.8	42.5	74.0	54.0	33.6	27.3	+ 40.4	+ 26.7	Y



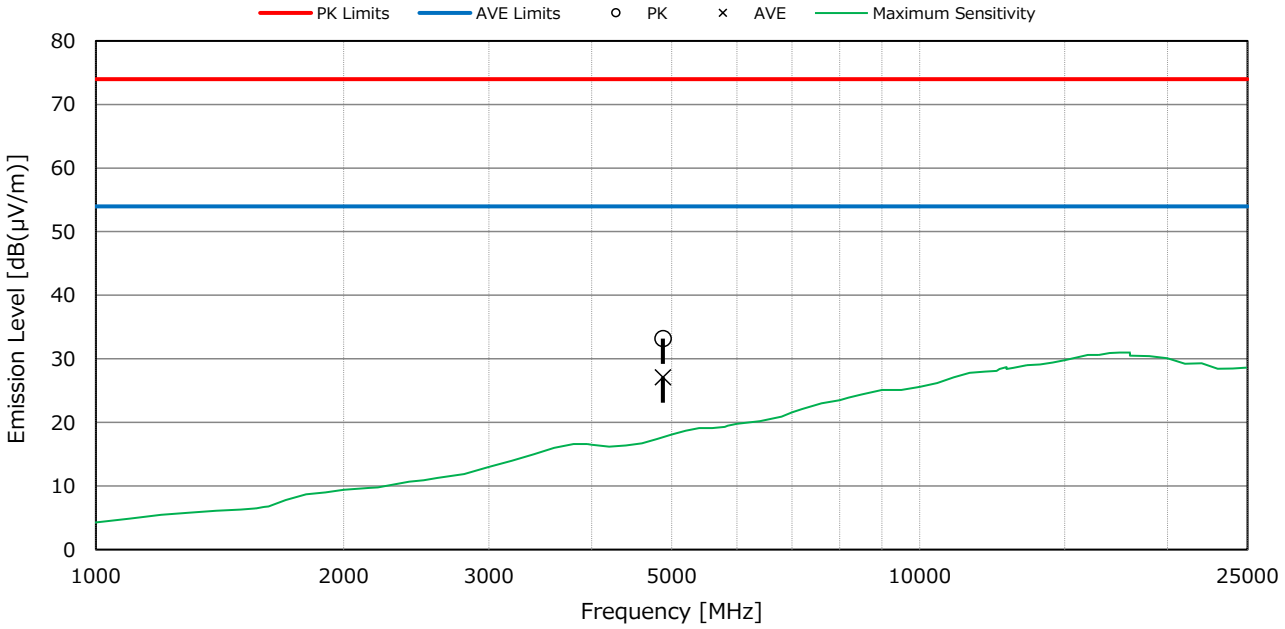
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 42.5 = 27.3 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 19ch (2440MHz) w/o Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.4	42.3	74.0	54.0	33.2	27.1	+ 40.8	+ 26.9	Z



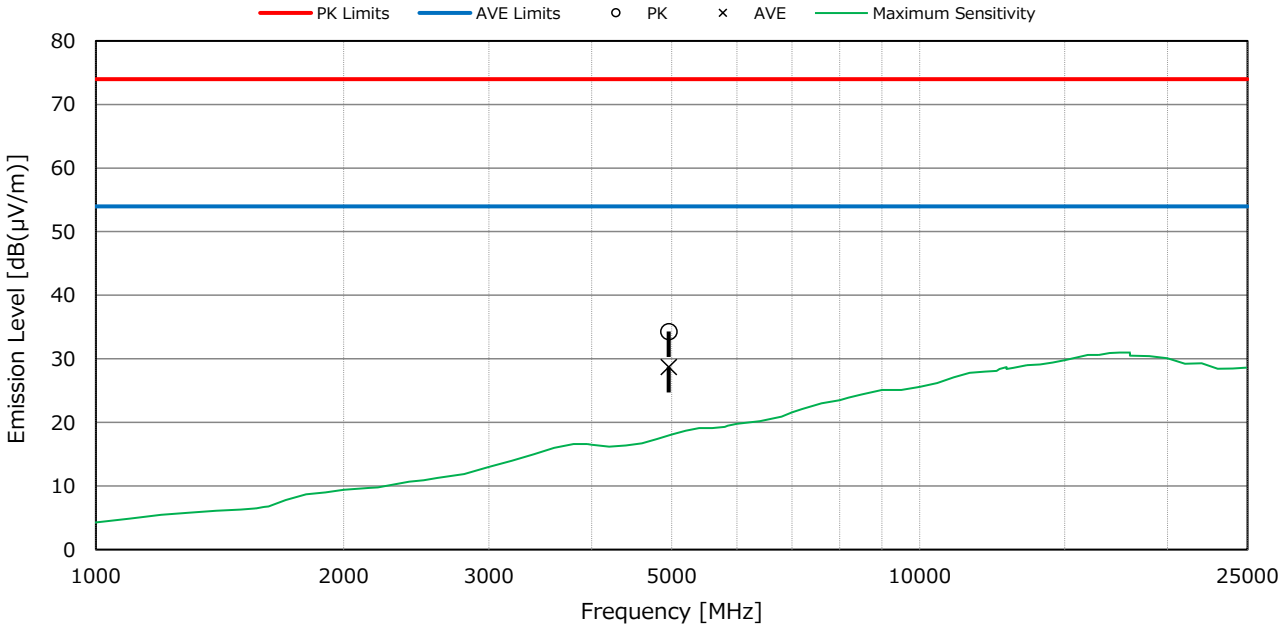
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 42.3 = 27.1 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 39ch (2480MHz) w/o Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	49.2	43.6	74.0	54.0	34.3	28.7	+ 39.7	+ 25.3	Y



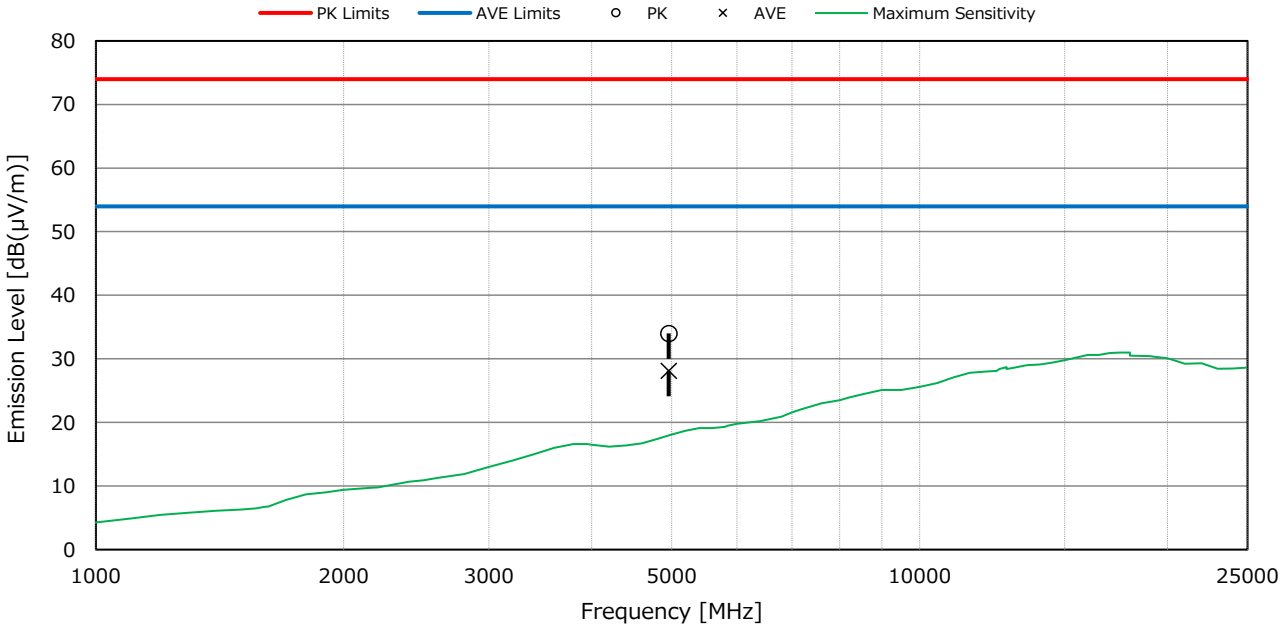
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 43.6 = 28.7 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 39ch (2480MHz) w/o Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	48.9	43.0	74.0	54.0	34.0	28.1	+ 40.0	+ 25.9	Z



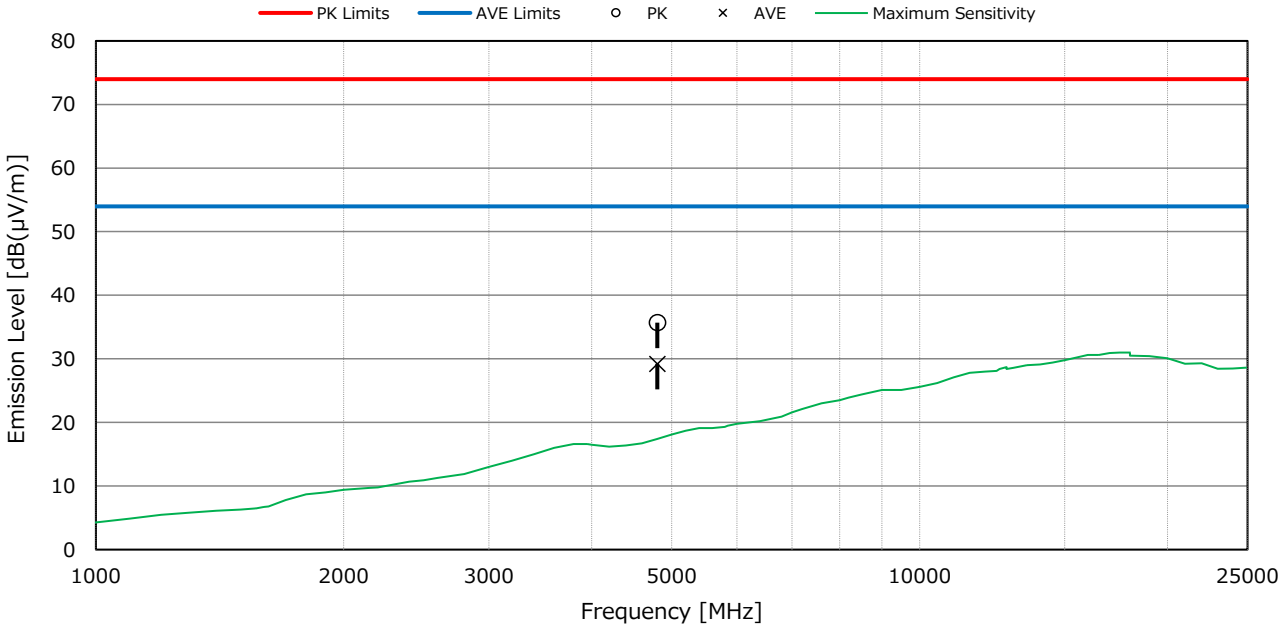
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 43.0 = 28.1 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 0ch (2402MHz) w/o Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	51.1	44.6	74.0	54.0	35.7	29.2	+ 38.3	+ 24.8	Y



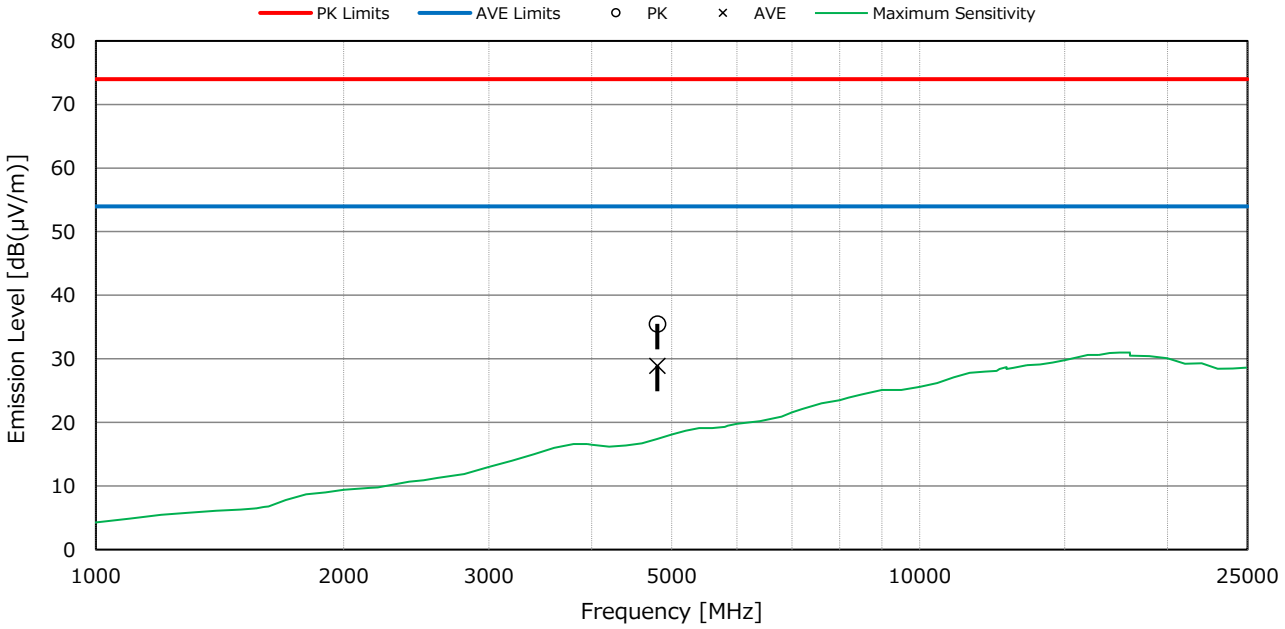
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 44.6 = 29.2 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 0ch (2402MHz) w/o Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	50.9	44.3	74.0	54.0	35.5	28.9	+ 38.5	+ 25.1	Z



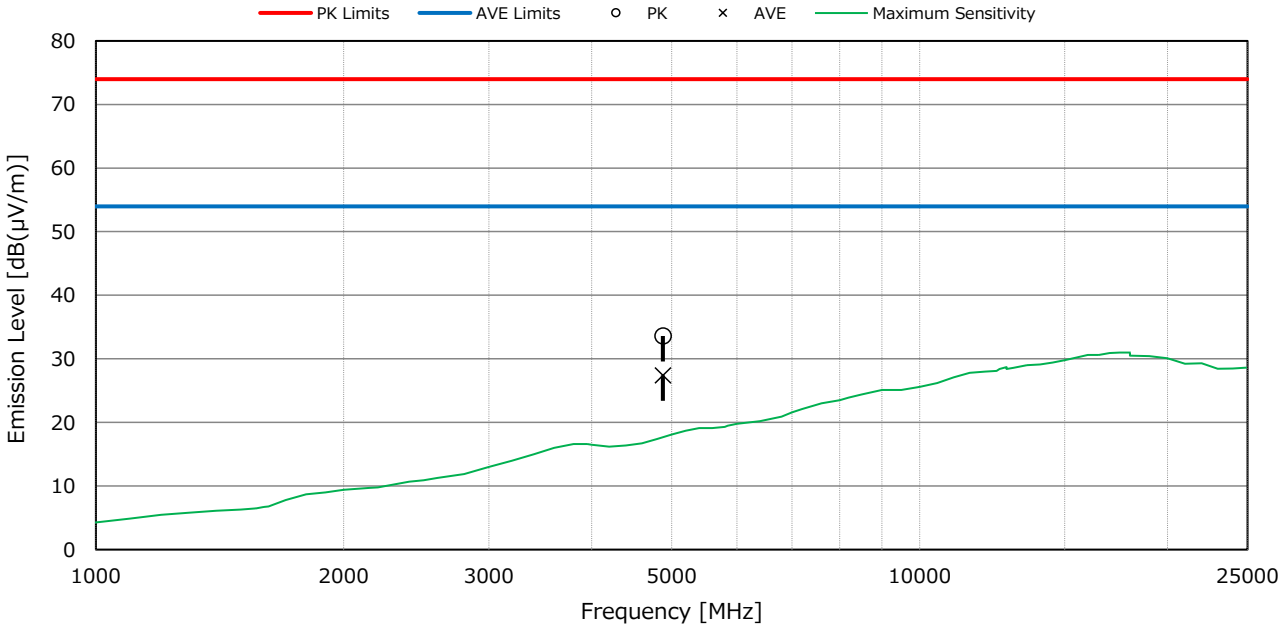
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 44.3 = 28.9 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 19ch (2440MHz) w/o Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.8	42.6	74.0	54.0	33.6	27.4	+ 40.4	+ 26.6	Y



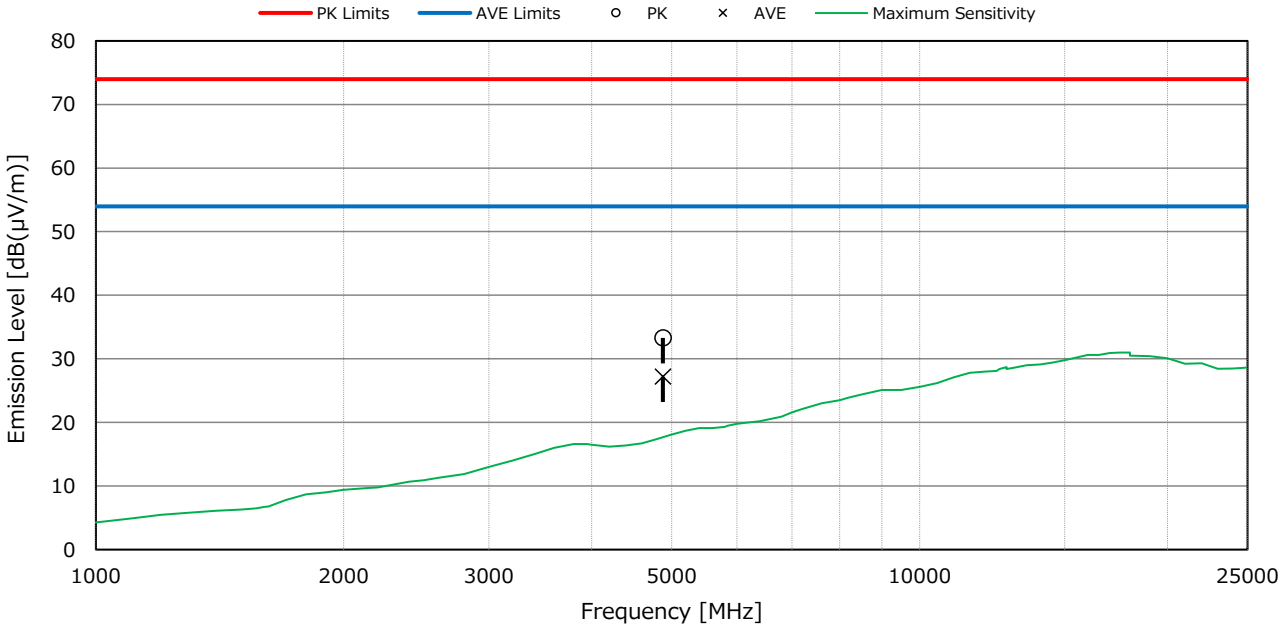
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 42.6 = 27.4 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 19ch (2440MHz) w/o Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.5	42.4	74.0	54.0	33.3	27.2	+ 40.7	+ 26.8	Z



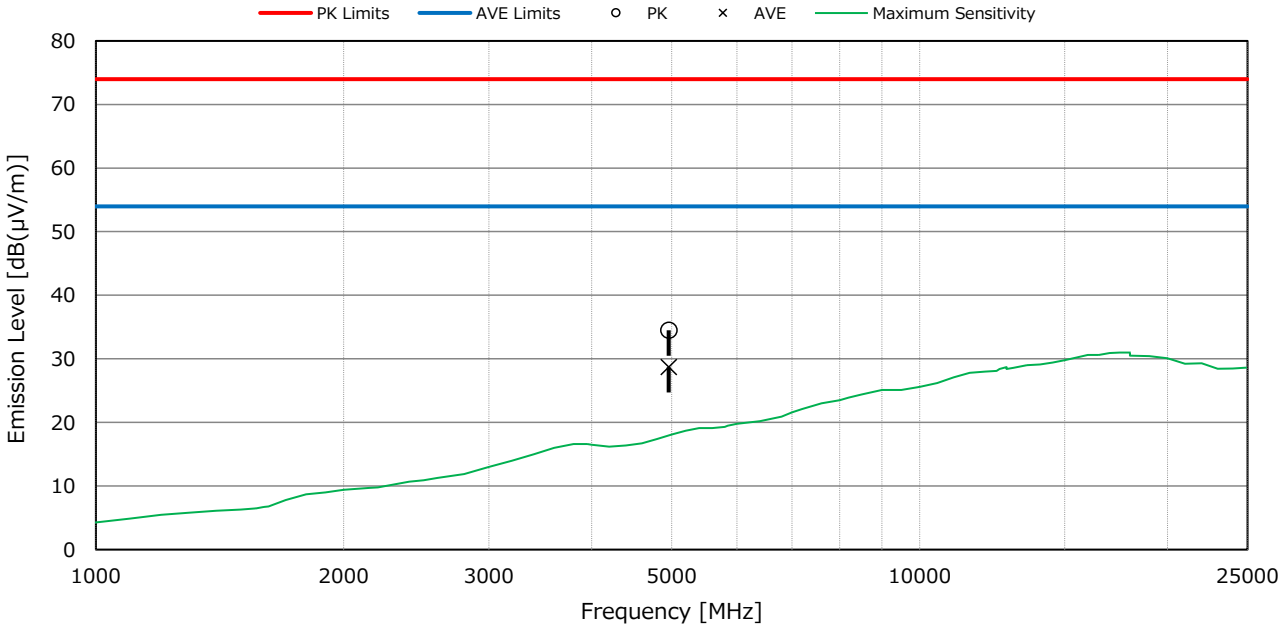
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 42.4 = 27.2 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 39ch (2480MHz) w/o Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	49.4	43.6	74.0	54.0	34.5	28.7	+ 39.5	+ 25.3	Y



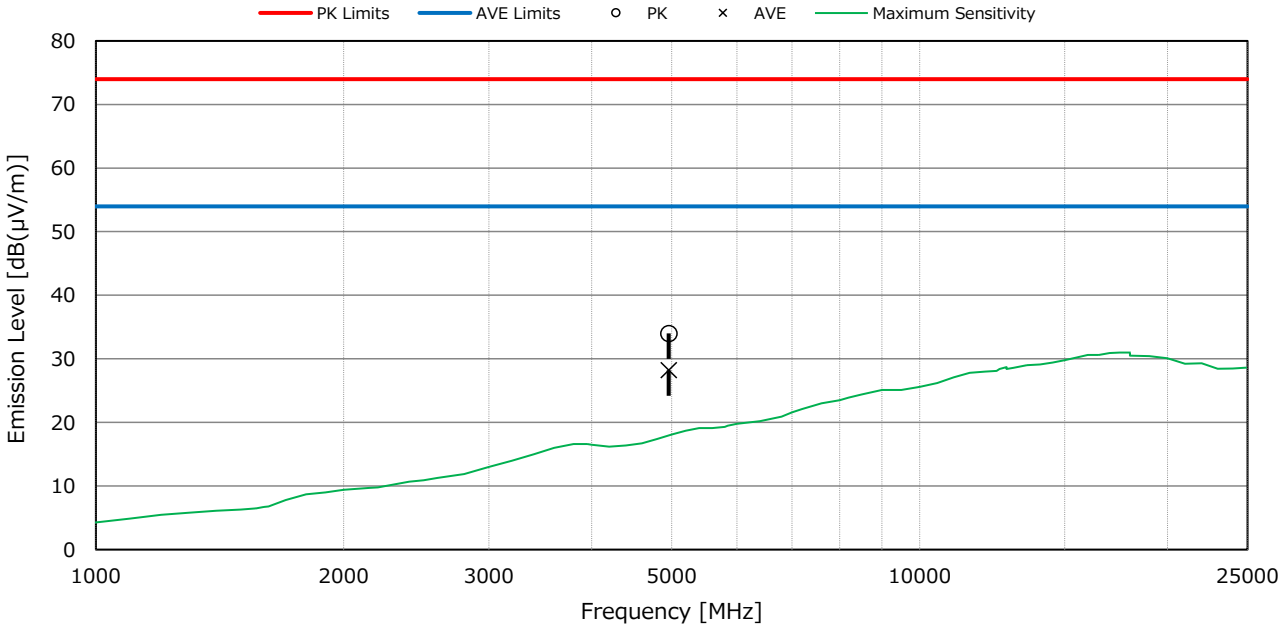
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 43.6 = 28.7 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 39ch (2480MHz) w/o Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	48.9	43.1	74.0	54.0	34.0	28.2	+ 40.0	+ 25.8	Z



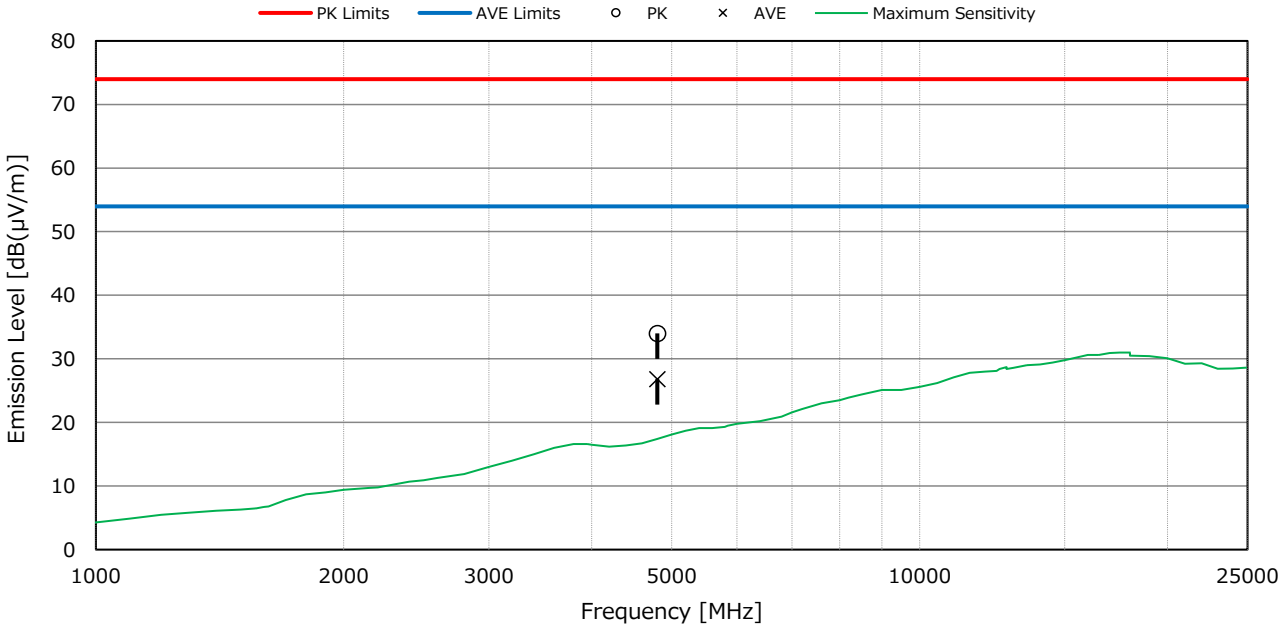
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 43.1 = 28.2 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 0ch (2402MHz) w/ Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	49.4	42.2	74.0	54.0	34.0	26.8	+ 40.0	+ 27.2	Z



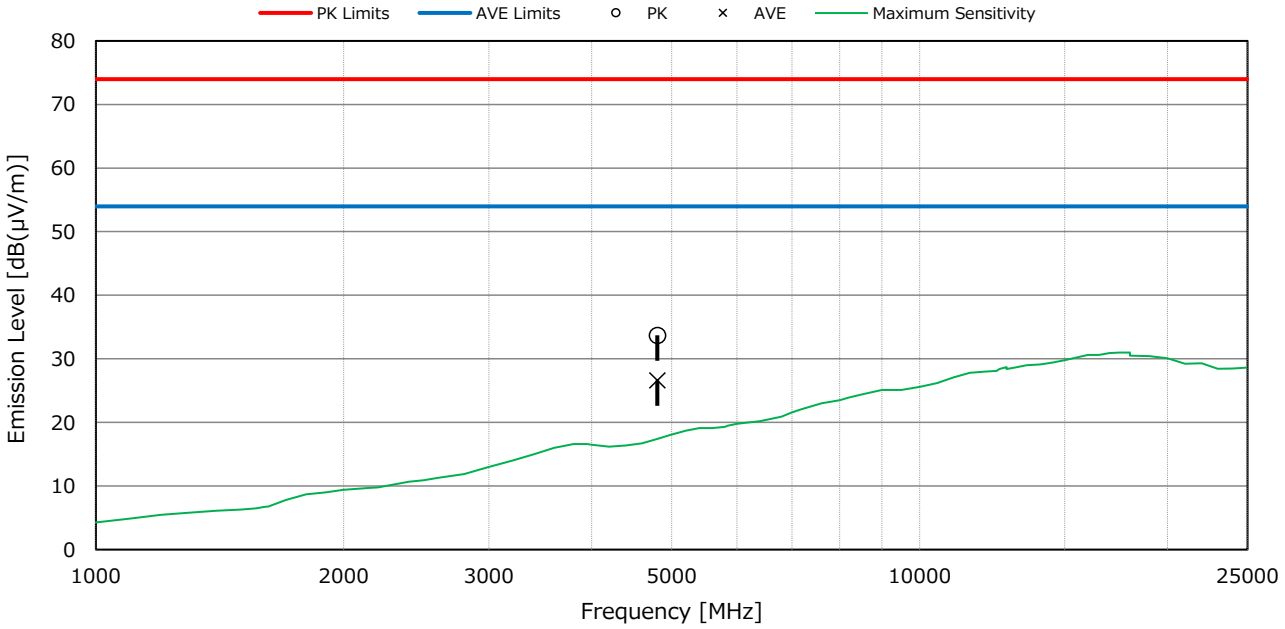
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 42.2 = 26.8 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 0ch (2402MHz) w/ Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	49.1	42.0	74.0	54.0	33.7	26.6	+ 40.3	+ 27.4	Y



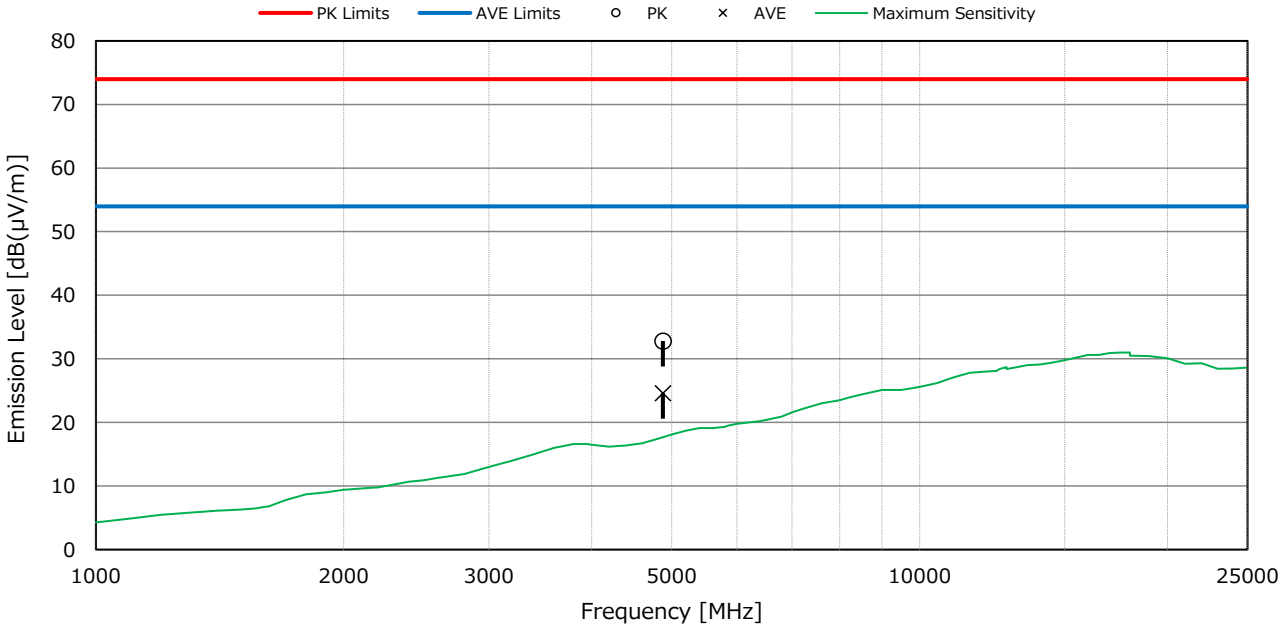
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 42.0 = 26.6 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 19ch (2440MHz) w/ Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.0	39.8	74.0	54.0	32.8	24.6	+ 41.2	+ 29.4	Z



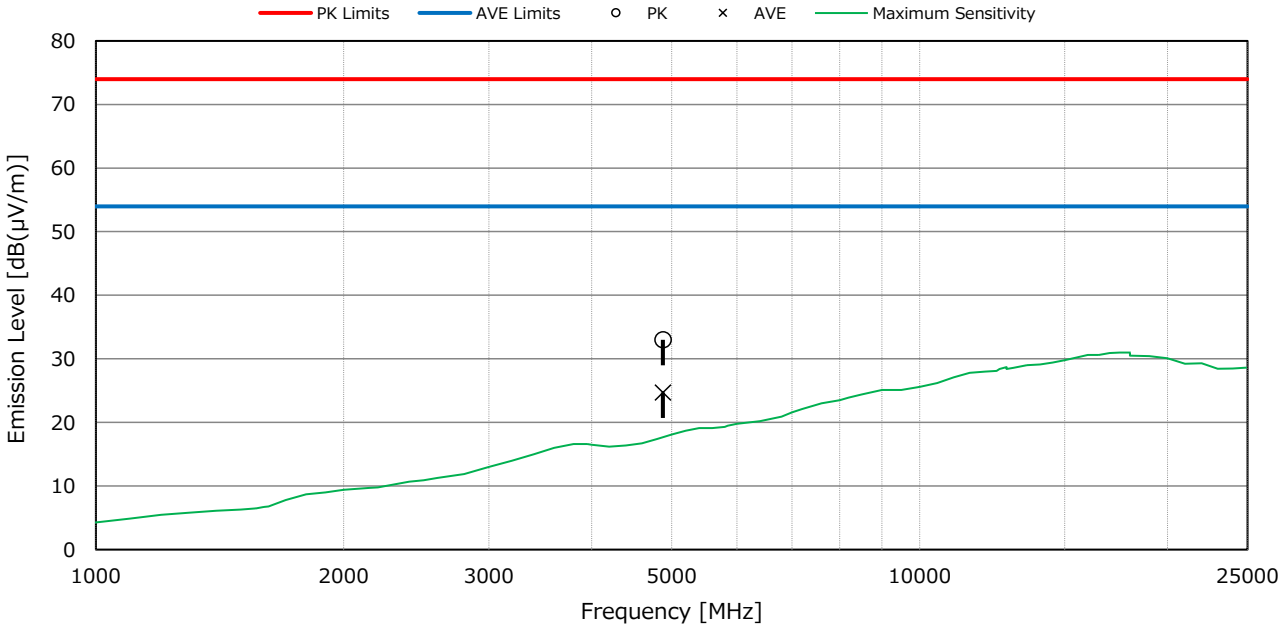
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 39.8 = 24.6 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 19ch (2440MHz) w/ Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.2	39.9	74.0	54.0	33.0	24.7	+ 41.0	+ 29.3	Y



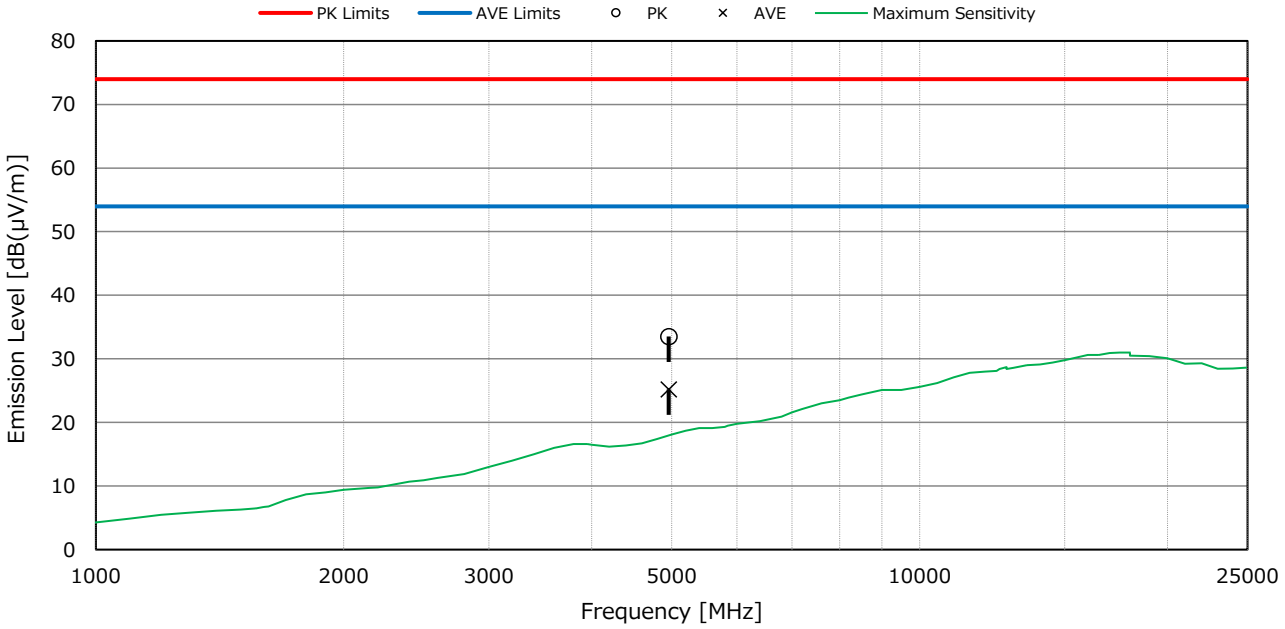
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 39.9 = 24.7 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 39ch (2480MHz) w/ Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	48.4	40.1	74.0	54.0	33.5	25.2	+ 40.5	+ 28.8	Z



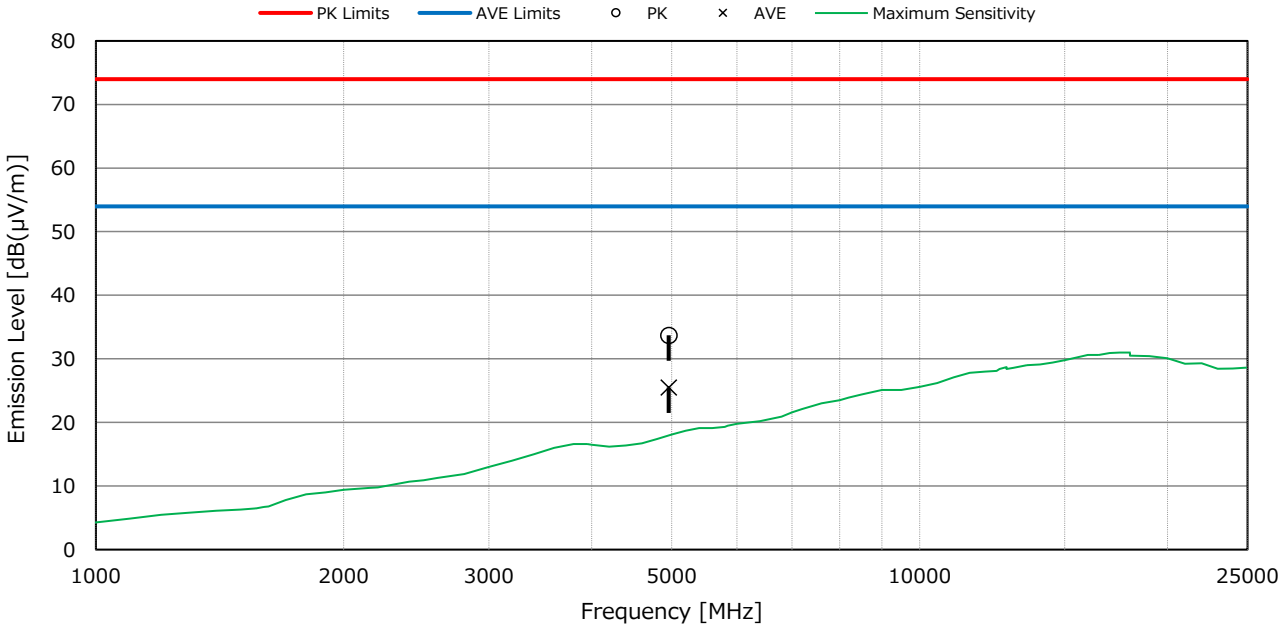
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 40.1 = 25.2 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 1 Mbps, 39ch (2480MHz) w/ Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	48.6	40.4	74.0	54.0	33.7	25.5	+ 40.3	+ 28.5	Y



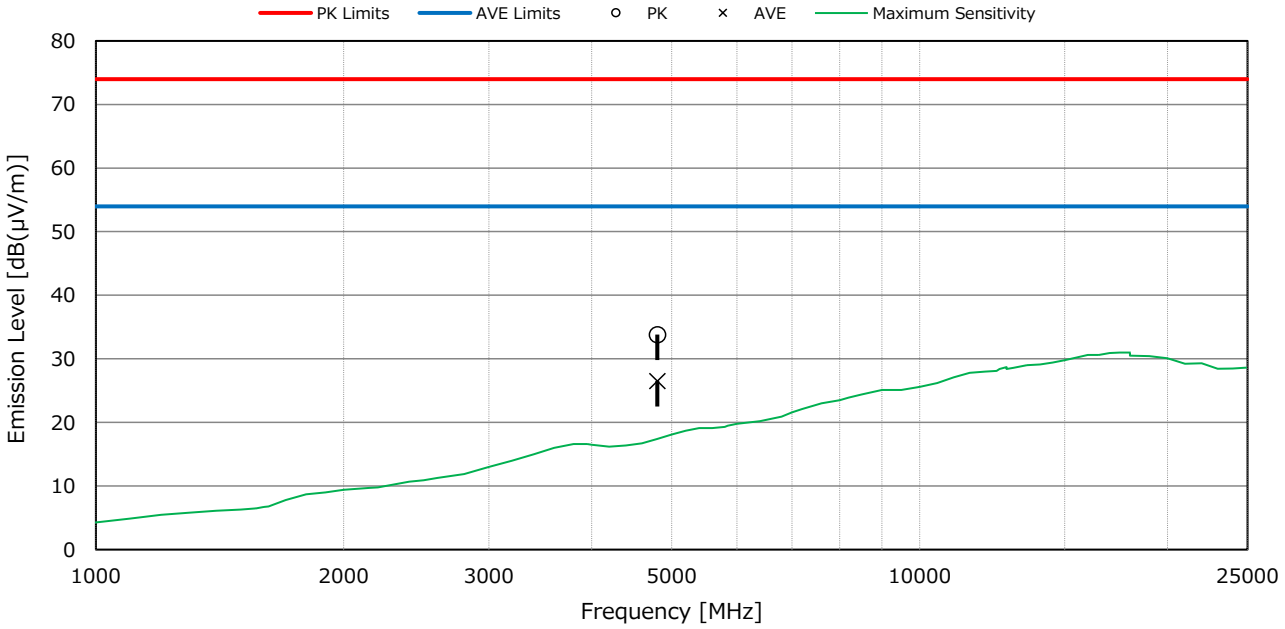
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 40.4 = 25.5 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 10 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 0ch (2402MHz) w/ Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency [MHz]	Factor [dB]	Readings [dB(μV)] PK	Readings [dB(μV)] AVE	Limits [dB(μV/m)] PK	Limits [dB(μV/m)] AVE	Results [dB(μV/m)] PK	Results [dB(μV/m)] AVE	Margin [dB] PK	Margin [dB] AVE	Remarks
4804.00	-15.4	49.2	41.9	74.0	54.0	33.8	26.5	+ 40.2	+ 27.5	Z



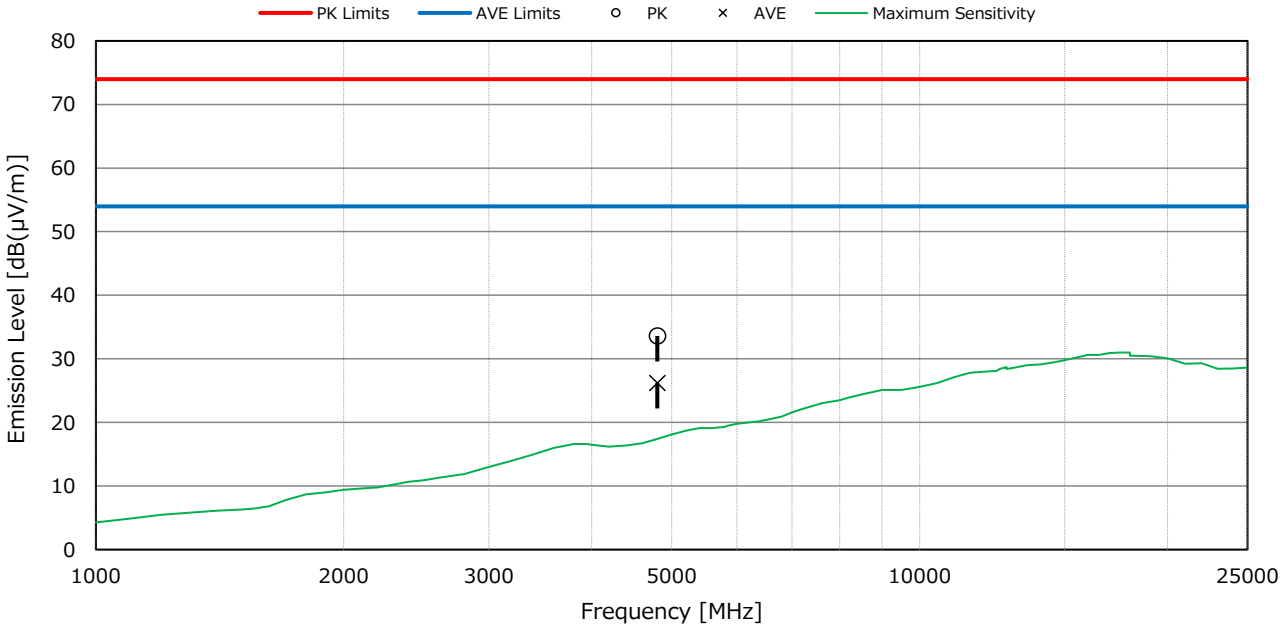
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 41.9 = 26.5 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 0ch (2402MHz) w/ Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4804.00	-15.4	49.0	41.6	74.0	54.0	33.6	26.2	+ 40.4	+ 27.8	Y



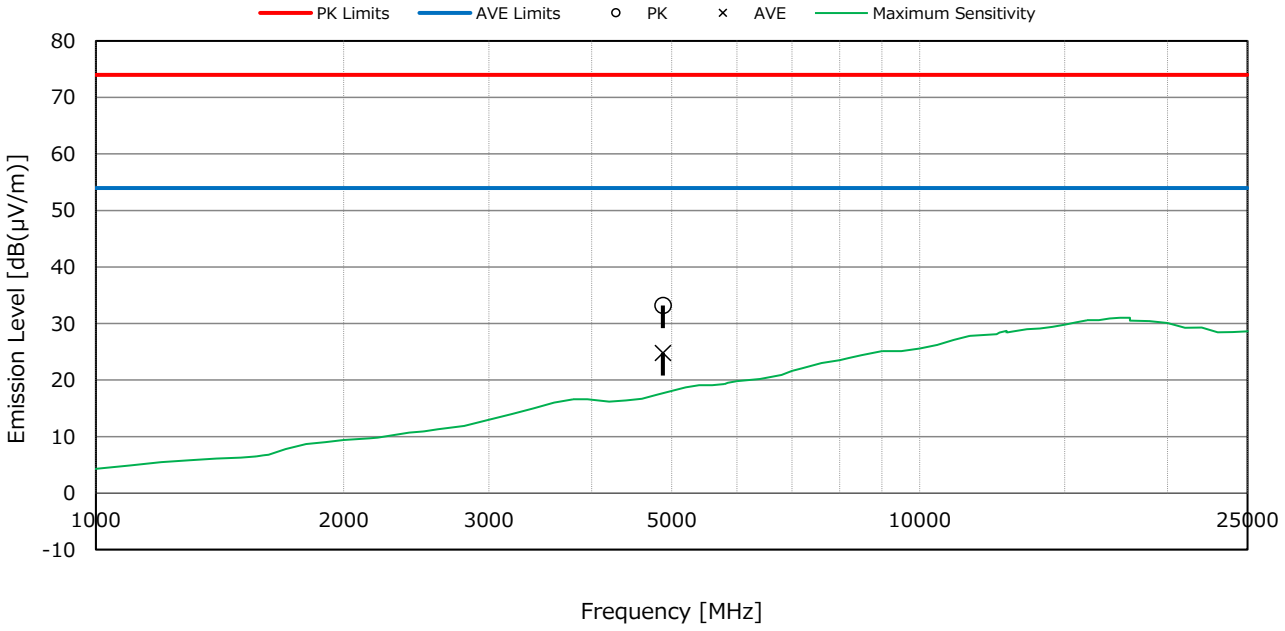
NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.4 + 41.6 = 26.2 dB(μV) at 4804.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 19ch (2440MHz) w/ Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.4	40.0	74.0	54.0	33.2	24.8	+ 40.8	+ 29.2	Z



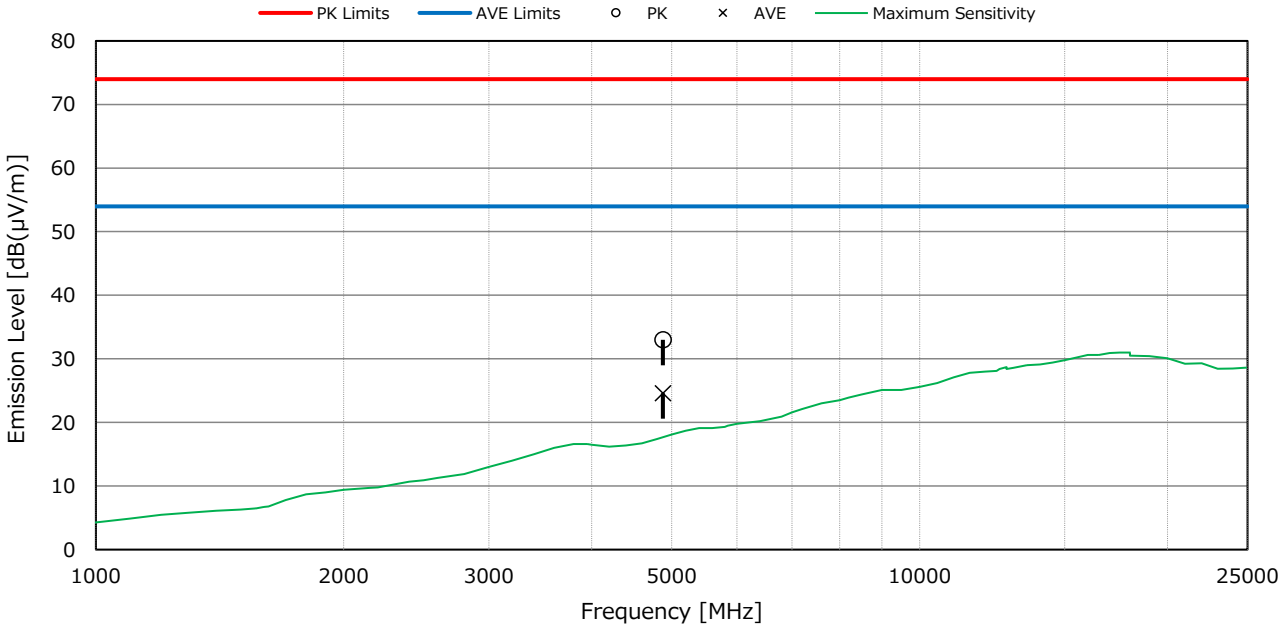
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 40.0 = 24.8 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 19ch (2440MHz) w/ Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4880.00	-15.2	48.2	39.8	74.0	54.0	33.0	24.6	+ 41.0	+ 29.4	Y



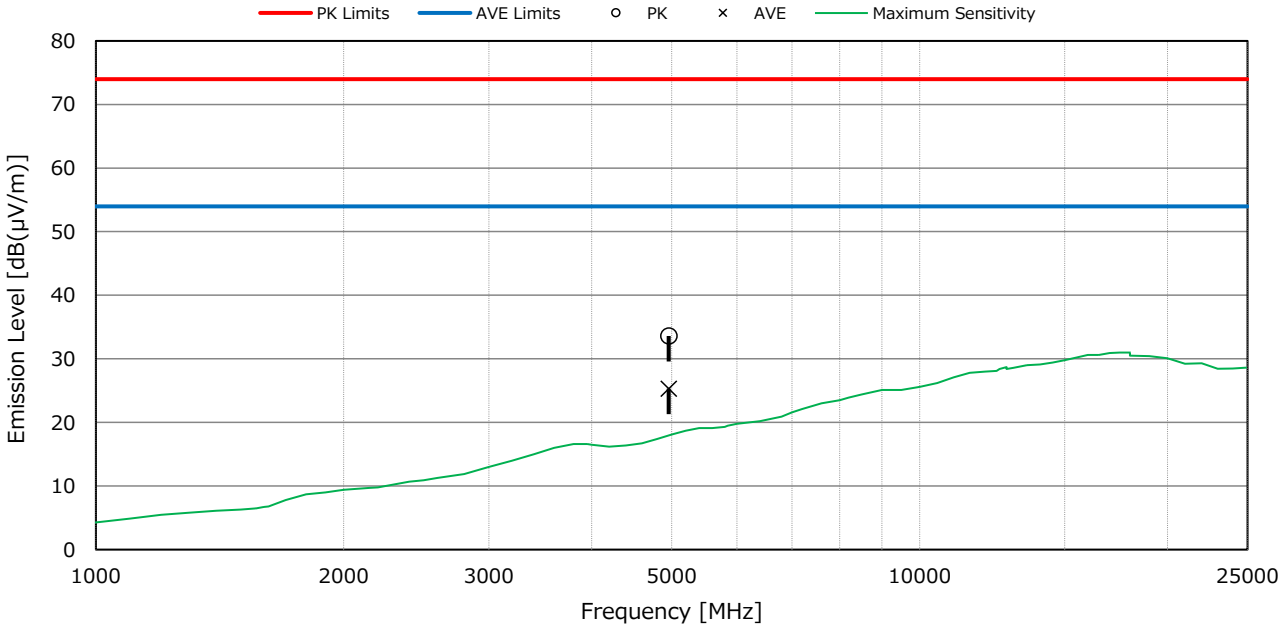
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -15.2 + 39.8 = 24.6 dB(μV) at 4880.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 39ch (2480MHz) w/ Attachment
Antenna polarization : Horizontal

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	48.5	40.2	74.0	54.0	33.6	25.3	+ 40.4	+ 28.7	Z



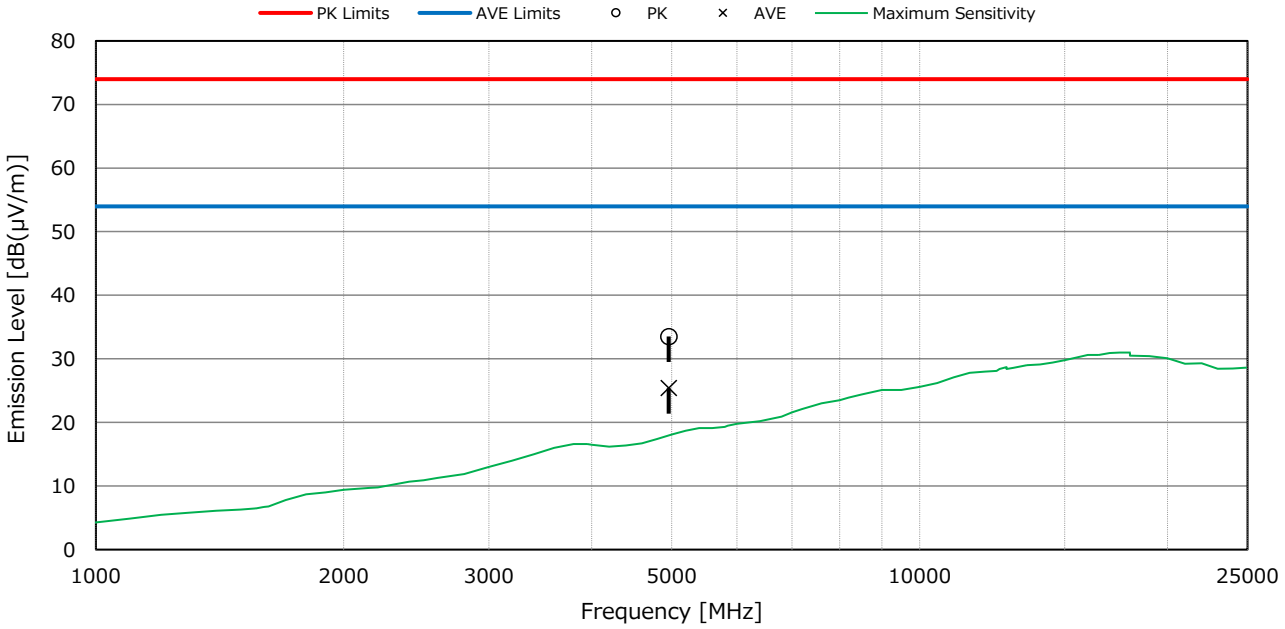
NOTES
1) Measurement Distance : 1 m （Specified Distance : 3 m）
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 40.2 = 25.3 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

Test voltage : 3.3VDC
Test condition : BLE 2 Mbps, 39ch (2480MHz) w/ Attachment
Antenna polarization : Vertical

Test Date: February 8, 2024
Temp.: 21 °C, RH: 40 %, Atm.: 1002 hPa

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin [dB]		Remarks
[MHz]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	
4960.00	-14.9	48.4	40.3	74.0	54.0	33.5	25.4	+ 40.5	+ 28.6	Y



NOTES
1) Measurement Distance : 1 m (Specified Distance : 3 m)
2) The spectrum was checked from 1 GHz to 25 GHz.
3) The factor includes the antenna factor, the pre-amplifier gain, the cable loss and the distance conversion.
4) Calculated result as the worst point shown on underline :
Factor + Reading (AVE) = -14.9 + 40.3 = 25.4 dB(μV) at 4960.00 MHz
5) PK : Peak detector, AVE : Average detector
6) Bandwidth : 1 MHz (1 GHz - 25 GHz)

Spectrum Analyzer Setting(s) :
Peak : RBW 1 MHz, VBW 3 MHz / Average : RBW 1 MHz, VBW 20 kHz

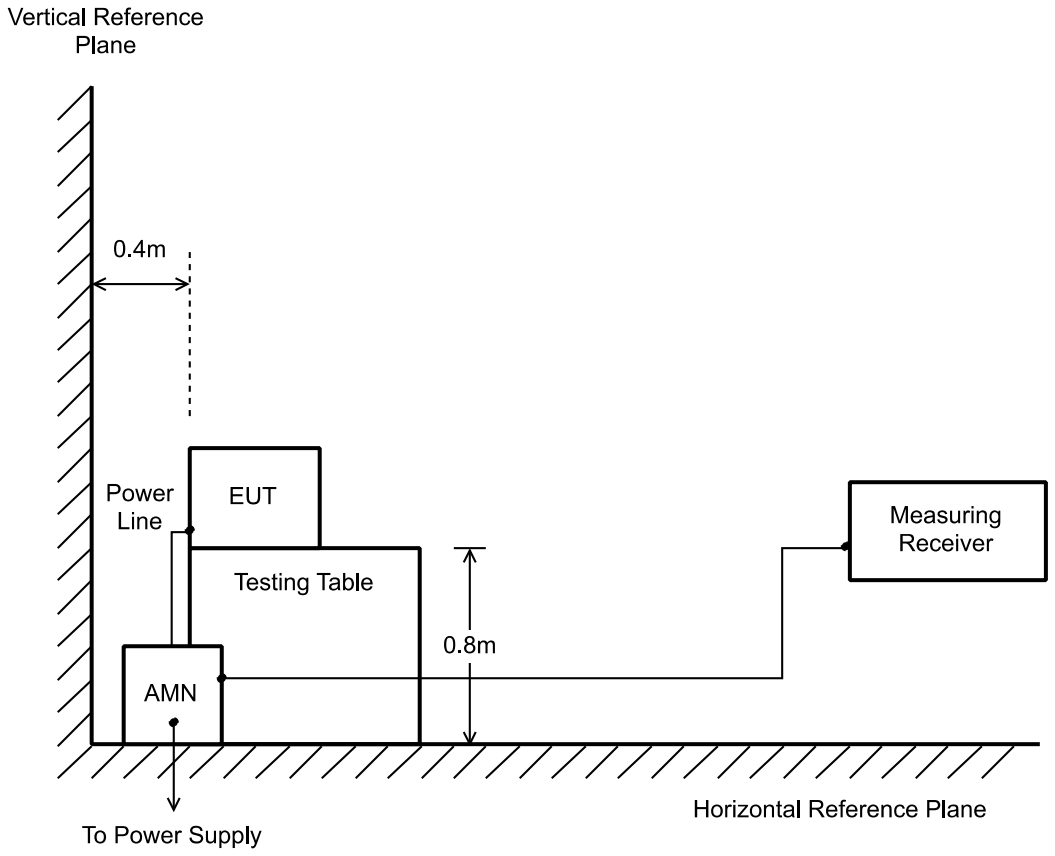
7.7 AC Powerline Conducted Emission

7.7.1 Test Site and Instruments

Test Site : Measurement Room M2					
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Last Cal.**	**Cal. Due**
Test Receiver	ESR26	101680 (A-76)	Rohde & Schwarz	2023/02/20	2024/02/19
AMN (main)	KNW-407FR	8-2019-1 (D-103)	Kyoritsu	2023/06/30	2024/06/29
EMC Software	EP9/CE	Ver.4.04.050	TOYO	--	--
RF Cable	RG223/U	--- (H-9)	HUBER+SUHNER	2023/11/07	2024/11/06
Thermo-Hygrometer	testo 608-H2	30050646 (F-68)	testo	2023/06/09	2024/06/08
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

7.7.2 Test Method and Test Setup (Diagrammatic illustration)

The pre-scan measurements were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT. The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for formal measurements.
(Reference divisional instruction No. G703649)



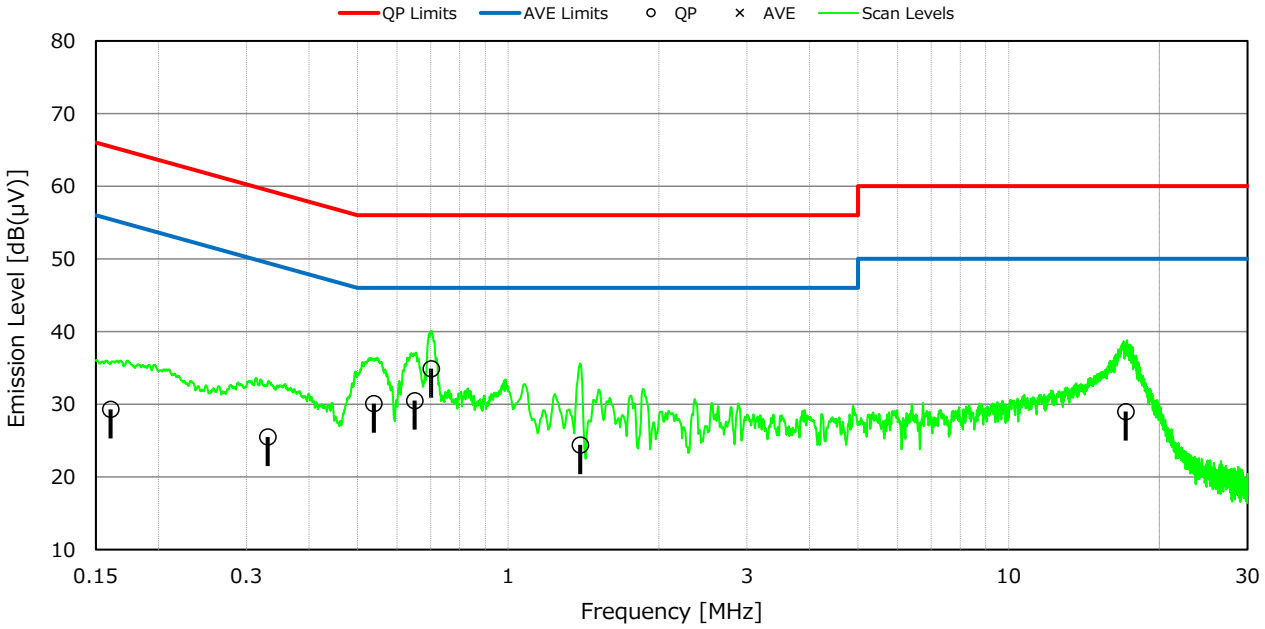
7.7.3 Test Data

Test voltage : 3.3VDC (AC Adapter 120VAC 60Hz)

Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa

Measured phase : VA

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV)]		Results [dB(μV)]		Margin [dB]		Remarks
[MHz]	[dB]	QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.1606	10.3	19.0	--	65.4	55.4	29.3	--	+ 36.1	--	-
0.3308	10.3	15.2	--	59.4	49.4	25.5	--	+ 33.9	--	-
0.5389	10.3	19.8	--	56.0	46.0	30.1	--	+ 25.9	--	-
0.6505	10.3	20.2	--	56.0	46.0	30.5	--	+ 25.5	--	-
0.7016	10.3	24.6	--	56.0	46.0	34.9	--	+ 21.1	--	-
1.3933	10.3	14.1	--	56.0	46.0	24.4	--	+ 31.6	--	-
17.1423	11.1	17.9	--	60.0	50.0	29.0	--	+ 31.0	--	-



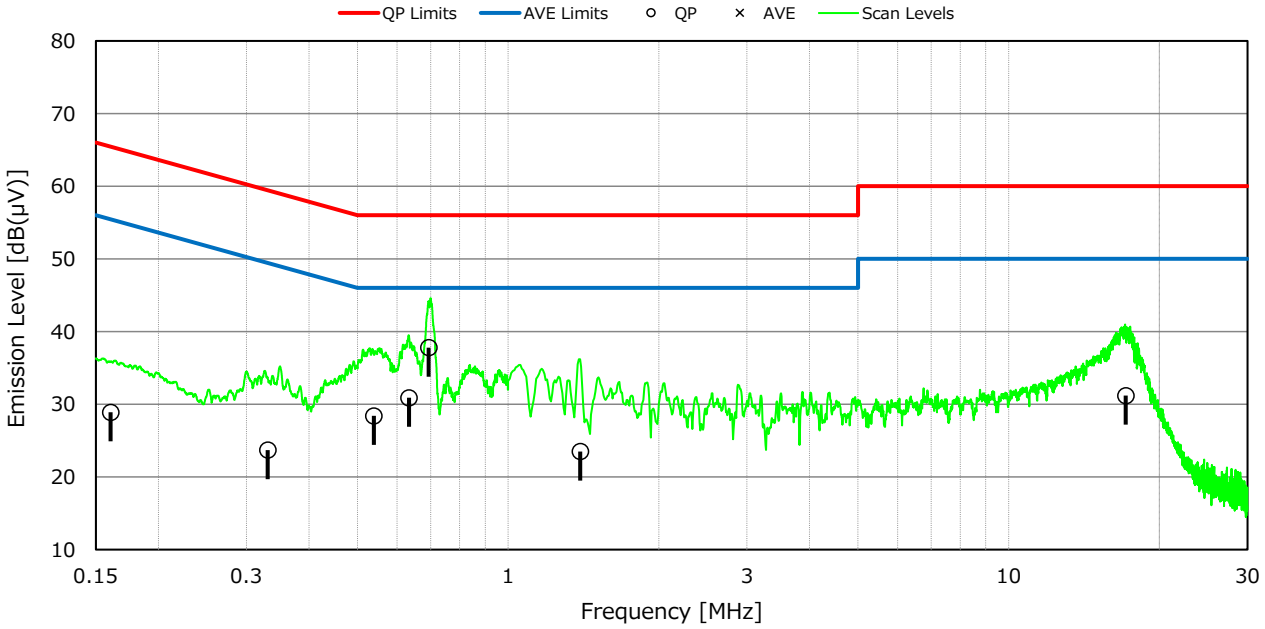
NOTES
1) The spectrum was checked from 150 kHz to 30 MHz.
2) The factor includes the AMN voltage division factor and the cable loss.
3) The symbol of "--" means "not applicable".
4) Calculated result as the worst point shown on underline :
   Factor + Reading (QP) = 10.3 + 24.6 = 34.9 dB(μV) at 0.7016 MHz
5) QP : Quasi-Peak detector, AVE : Average detector
6) Bandwidth : 9 kHz (150 kHz - 30 MHz)

Test voltage : 3.7VDC (AC Adapter 120VAC 60Hz)

Test Date: February 7, 2024
Temp.: 24 °C, RH: 40 %, Atm.: 998 hPa

Measured phase : VB

Frequency	Factor	Readings [dB(μV)]		Limits [dB(μV)]		Results [dB(μV)]		Margin [dB]		Remarks
[MHz]	[dB]	QP	AVE	QP	AVE	QP	AVE	QP	AVE	
0.1606	10.4	18.5	--	65.4	55.4	28.9	--	+ 36.5	--	-
0.3308	10.4	13.3	--	59.4	49.4	23.7	--	+ 35.7	--	-
0.5389	10.4	18.0	--	56.0	46.0	28.4	--	+ 27.6	--	-
0.6337	10.4	20.5	--	56.0	46.0	30.9	--	+ 25.1	--	-
0.6937	10.4	27.4	--	56.0	46.0	37.8	--	+ 18.2	--	-
1.3933	10.4	13.1	--	56.0	46.0	23.5	--	+ 32.5	--	-
17.1423	11.4	19.8	--	60.0	50.0	31.2	--	+ 28.8	--	-



NOTES
1) The spectrum was checked from 150 kHz to 30 MHz.
2) The factor includes the AMN voltage division factor and the cable loss.
3) The symbol of "--" means "not applicable".
4) Calculated result as the worst point shown on underline :
Factor + Reading (QP) = 10.4 + 27.4 = 37.8 dB(μV) at 0.6937 MHz
5) QP : Quasi-Peak detector, AVE : Average detector
6) Bandwidth : 9 kHz (150 kHz - 30 MHz)