



Test Report – Products
Prüfbericht – Produkte

Test Report No.: Prüfbericht-Nr.:	JP24S14A 001	Order No.: Auftrags-Nr.:	150295034	Page 1 of 68 Seite 1 von 68
Client Reference No.: Kunden-Referenz-Nr.:	N/A	Order Date: Auftragsdatum:	2024-05-08	
Client: Auftraggeber:	A&D Co Ltd 1-243 Asahi, Kitamoto-city, Saitama, 364-8585, Japan			
Test Item: Prüfgegenstand:	Digital Blood Pressure Monitor			
Identification / Type No.: Bezeichnung / Typ-Nr.:	UA-1040TBLE	Serial No.: Serien-Nr.:	See clause 4.3	
Order Content: Auftrags-Inhalt:	Wireless Testing			
Test Specification: Prüfgrundlage:	FCC 47 CFR Part 15, Subpart C, Section 15.247 RSS-247 (Issue 3): 2023			
Date of Sample Receipt: Wareneingangsdatum:	2024-05-24	N/A		
Test Sample No.: Prüfmuster-Nr.:	A003726935			
Testing Period: Prüfzeitraum:	2024-07-16 to 2024-08-06			
Place of Testing: Ort der Prüfung:	Yokohama EMC Laboratory			
Testing Laboratory: Prüflaboratorium:	TÜV Rheinland Japan Ltd.			
Test Result*: Prüfergebnis*:	Pass			
compiled by: zusammengestellt von:		authorized by: genehmigt von:		
Date: 2024-08-07 Datum:	Pin Zhang	Issue Date: 2024-08-07 Ausstellungsdatum:	Daisuke Watanuki	
Position / Stellung:	Test Engineer	Position / Stellung:	Authorizer	
Other / Sonstiges:				
Condition of the test item at delivery: Zustand des Prüfgegenstandes bei Anlieferung:		Test item complete and undamaged Prüfmuster vollständig und unbeschädigt		
* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
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. 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.				

V05

Revisions

Report No.	Issue date	Changes / Remarks
JP24S14A 001	2024-08-07	Original document

Remarks

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

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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 15.247 RSS-247 (Issue 3): 2023 RSS-Gen (Issue 5): 2018+Amendment 1:2019+Amendment 2:2021 ANSI C63.10-2020 KDB Publication No. 558074 D01 (v05r02): Guidance for Compliance Measurement on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operation under Section 15.247 of the FCC Rules		
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	See the section 5.3.	Pass
Maximum Peak Output Power FCC §15.247(b)(3) RSS-247 §5.4 d.	1W (30dBm) (Peak Conducted) 4W (36dBm) (Peak EIRP) for ISSED	Pass
6dB Bandwidth FCC §15.247(a)(2) and §15.215(c) RSS-247 §5.2 a.	Minimum 500kHz 6dB bandwidth shall be contained within the designated frequency band.	Pass
99% Bandwidth RSS-Gen §6.7	-/-	For. Ref.
Conducted Spurious Emissions FCC §15.247(d) RSS-247 §5.5	20dBc 30MHz - 25GHz (10 th Harmonics)	Pass
Peak Power Spectral Density FCC §15.247(e) RSS-247 §5.2 b.	8dBm in any 3kHz band	Pass
Radiated Spurious Emissions of Transmitter FCC §15.209 and §15.247(d) RSS-247 §5.5 and RSS-Gen §8.9, 8.10	9kHz - 25GHz	Pass

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Test	Specifications	Result
Conducted Emission on AC Power Ports of Transmitter FCC §15.207(a) and 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 FCC & ISSED rules listed in section 1.1 for original grant application.

1.3 Complementary Materials

None.

2. Test Sites

2.1 Test Facilities

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

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

The test facility is recognized by the Federal Communications Commission (FCC) as a Conformity Assessment Body under designation number JP0017 and test firm registration number 386498.

The test site is registered by Innovation, Science and Economic Development Canada (ISED) under OATS filing number 3466B-1.

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 Antenna Port Conducted Emission							
EMI Receiver	Rohde & Schwarz	ESW 26	101316	RF-0812	1 year	5/29/2024	5/29/2025
EMI Receiver	Rohde & Schwarz	ESW 44	101751	RF-0809	1 year	10/3/2023	10/3/2024
RF Power Meter	Agilent	N1911A	MY45101737	RF-0393	1 year	1/15/2024	1/15/2025
RF Peak Power Sensor	Agilent	N1921A	MY45242228	RF-0394	1 year	1/15/2024	1/15/2025
For Power Port and Telecommunication Port Conducted Emission (CE)							
Path Loss Correction Factors for CE	-	-	-	RF-0597	1 year	1/30/2024	1/30/2025
Conducted Emission Measurement Software	Toyo Corporation	EP9/CE	Ver. 4.2.010	RF-0810	N/A	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESW 26	101316	RF-0812	1 year	5/29/2024	5/29/2025
LISN	Rohde & Schwarz	ENV216	101958	RF-0708	1 year	5/21/2024	5/21/2025
For Radiated Emission (RE)							
Path Loss Correction Factors for RE below 1GHz	-	-	-	RF-0596	1 year	1/30/2024	1/30/2025

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Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
Path Loss Correction Factors for RE above 1GHz	-	-	-	RF-0995	1 year	12/4/2024	12/4/2025
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	3/22/2024	3/22/2025
EMI Receiver	Rohde & Schwarz	ESW 26	101316	RF-0812	1 year	5/29/2024	5/29/2025
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	N/A	N/A	N/A
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB 9168	9168-475	RF-0462	1 year	5/9/2024	5/9/2025
5dB Attenuator	Pasternack	PE7047-5	-	RF-0731	1 year	5/22/2024	5/22/2025
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	1 year	12/27/2023	12/27/2024
Band Pass Filter	Microwave Factory	MBP301	224969	RF-1015	1 year	3/19/2024	3/19/2025
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120 D	9120D-2280	RF-0845	1 year	3/8/2024	3/8/2025
MMW PreAmp 0-50GHz	NEXTEM	RFA-1050000-40	RFA-1905-01	RF-1140	1 year	3/19/2024	3/19/2025
Horn Antenna, 1-18GHz	Schwarzbeck	BBHA9120 D	9120D-2280	RF-0845	1 year	3/8/2024	3/8/2025
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	11/10/2023	11/10/2024
Horn Antenna with Preamplifier, 18-26.5GHz (RX)	Toyo Corporation	HAP18-26W	B2010482 210-125	RF-1096	1 year	11/10/2023	11/10/2024
Horn Antenna with Preamplifier, 26.5 -40GHz (RX)	Toyo Corporation	HAP26-40W	B3208602 210-126	RF-1097	1 year	11/10/2023	11/10/2024
Constant Voltage Constant Frequency Stabilizers and Power Accessories							
CVCF (3m Chamber)	NF Corporation	ES2000S	9075613	RF-0208	1 year	3/19/2024	3/19/2025
CVCF Booster (3m chamber)	NF Corporation	ES2000B	9072132	RF-0209	1 year	3/19/2024	3/19/2025
CVCF (Shielded Room)	NF Corporation	ES2000S	9075612	RF-0210	1 year	3/19/2024	3/19/2025
CVCF Booster (Shielded Room)	NF Corporation	ES2000B	9074403	RF-0211	1 year	3/19/2024	3/19/2025
CVCF (10m Chamber)	NF Corporation	ES2000U	9067307	RF-0212	1 year	3/19/2024	3/19/2025
CVCF Booster (10m Chamber)	NF Corporation	ES2000B	9074408	RF-0213	1 year	3/19/2024	3/19/2025
True RMS Multimeter	Fluke	87V	97680450	RF-0282	1 year	4/12/2024	4/12/2025

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	Uncertainty (k=2)
AC Power Line Conducted Emission	150kHz - 30MHz	±3.31dB
Antenna Port Conducted Emission	20Hz - 40GHz	±1.5dB
Radiated Emission	150kHz - 30MHz	±4.79dB
	30MHz - 1GHz (3m distance)	±6.01dB (Vertical) ±4.91dB (Horizontal)
	1 - 6GHz	±5.15dB
	6 - 18GHz	±5.09dB
	18 - 40GHz	±5.18dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a digital blood pressure monitor with BLE connectivity.

3.2 Ratings and System Details

1) EUT

System Input Voltage:	DC 6V (4 x 1.5V batteries or from AC adaptor)
Typical Nominal Voltage:	AC 120V for North America
Frequency:	50/60Hz
Protection Class:	III

Rated temperature:	+10 to +40°C
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Dimensions:	140mm x 118mm x 64mm
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Weight:	320g (excluding batteries)
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Test Voltage:	Refer to each test item.
Test Frequency:	Refer to each test item.

2) AC Adaptor for EUT

Manufacturer:	A & D Medical
Model:	TB-233
Typical Nominal Voltage:	AC 120V
Frequency:	60Hz
Input Current:	0.15A
Protection Class:	II

3) BLE Connectivity

Radio standard:	Bluetooth 5.1
Frequency range:	2402 – 2480MHz
Specified output power	1.37dBm (conducted peak power)
Antenna number:	1
Antenna gain:	-0.4dBi
Antenna type:	PCB pattern antenna
Antenna mounting type:	Internal

Modulation type: GFSK
Data rate: 1Mbps, 2Mbps
Channel spacing: 2MHz

3.3 Noise Generating and Noise Suppressing Parts

The highest frequency generated or used by the EUT is 2480MHz for radio portion and unspecified for digital interface.

3.4 Submitted Documents and Information

Following documents have been submitted by the client:

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

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

4. Test Setup and Operation Modes

4.1 Principle of Test Configuration Selection

Radio: The test methodology used is based on the requirements of 47 CFR Part 15, sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209 and 15.247.
The test methodology used is based on the requirements of RSS-Gen, sections 3.2 and RSS-247.

The test methods, which have been used, are based on ANSI C63.10 and KDB 558074 D01.

For details, see under each test item.

4.2 Operation Modes

The operation modes used for testing are:

- L. Transmitting at the lowest frequency Channel with 100% Duty Cycle.
- M. Transmitting at the middle frequency Channel with 100% Duty Cycle.
- H. Transmitting at the highest frequency Channel with 100% Duty Cycle.

Above modes are coupled with the following configurations:

Table 4: Setting of Test Frequencies

Radio	Mode L	Mode M	Mode H	Remark
BLE	2402MHz	2442MHz	2480MHz	

And the following configurations:

1. 1Mbps
2. 2Mbps

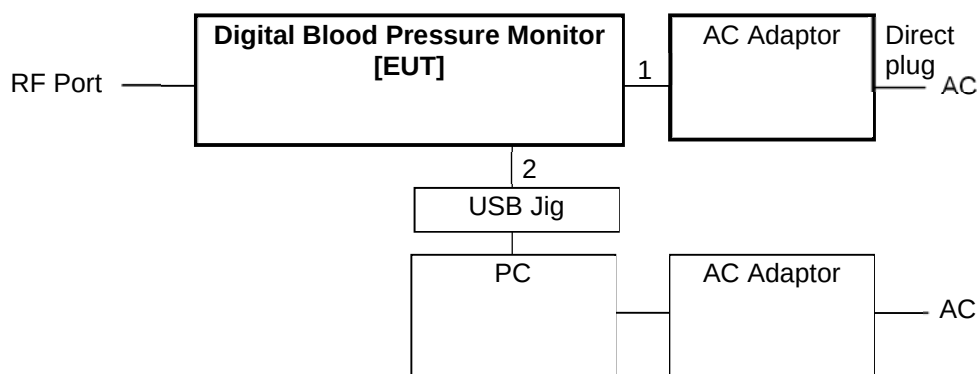
4.3 Physical Configuration for Testing

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

1) Conducted Radio Testing



2) Radiated Radio Testing

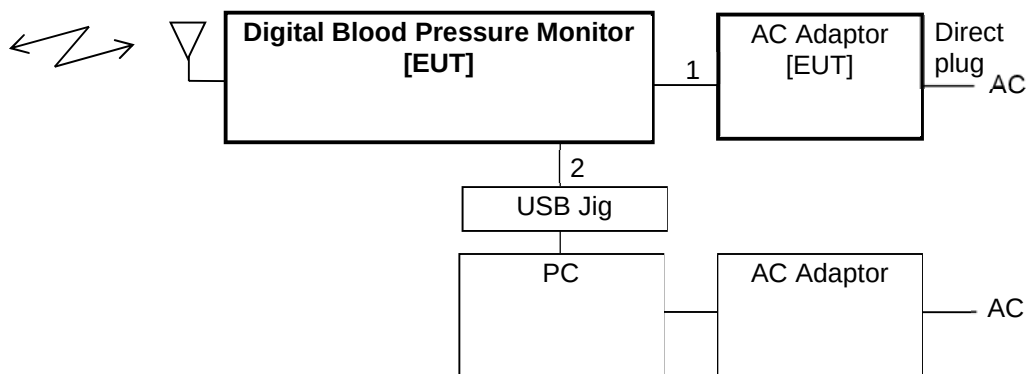


Table 5: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	DC Cable	1.3m, un-shielded	DC input power port
2.	Control Cable	0.2m, un-shielded	Signal port

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

Table 6: EUT Serial Numbers

Test Items	Serial Number
Conducted Radio Testing	(21)7240400018
Radiated Spurious Emissions of Transmitter	(21)7240400017
AC Power Line Conducted Emission of Transmitter	(21)7240400017

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:

Tera Term version 4.106 by Tera Term Project.

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.

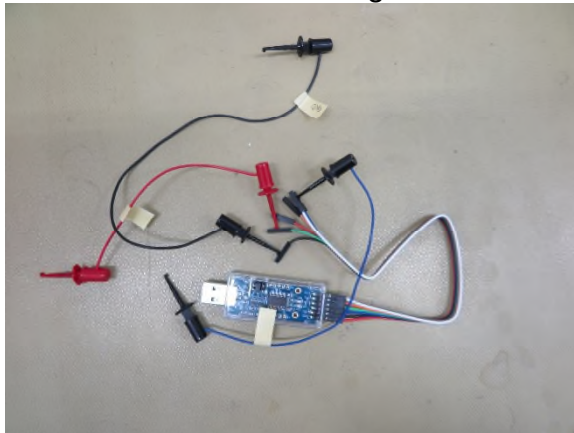
4.5 Special Accessories and Auxiliary Equipment

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

- Product: PC (Notebook)
Manufacturer: HP
Model: HP ProBook 650 G4
Rated Voltage: 19.5Vdc or 20Vdc
Input Current: 2.31A or 2.25A
Protection Class: I
Serial Number: JPH9029GYQ

2. Product: AC Adapter
Manufacturer: HP
Model: HSTNN-CA41
Rated Voltage: 100–240V
Input Current: 1.4A
Frequency: 50–60Hz
Protection Class: I
Serial Number: WFULP0CGC78RL4 0C

3. Product: USB Jig



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 a voltage regulator to supply the RF circuit. Hence it complies with the supply voltage requirements.

5.2 Antenna Requirements

RESULT:

Pass

Requirements:

FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

All antennas for use with the EUT must be listed in the application, including a test report.

Verdict:

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

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

5.3 Restricted Bands of Operation

RESULT:

Pass

Requirements:

FCC §15.205 and RSS-Gen §8.10

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

Verdict:

The Operation frequency range of the EUT is 2400 – 2483.5MHz, only spurious emissions may be found in the restricted bands below 25GHz. Hence the EUT complies with the restricted frequency band requirement.

5.4 Maximum Peak Output Power

RESULT:

Pass

Date of testing: 2024-07-16

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1011hPa

Requirements:

FCC §15.247(b)(3) and RSS-247 §5.4

For systems using digital modulation in the 2400 – 2483.5MHz band, the maximum peak output power is 1W (30dBm). The e.i.r.p. shall not exceed 4W (36dBm) for ISSED.

If transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Test procedure:

ANSI C63.10-2020 §11.9, KDB 558074 D01.

The maximum peak output power was measured at the antenna port with broadband peak power meter.

The readings of the measurements take into account the loss generated by all the involved cables.

Table 7: Maximum Peak Output Power, 1Mbps

Freq. [MHz]	Peak Output Power [dBm]	Peak Output Power Limit [dBm]	Peak Output Power Margin [dB]	Antenna Gain [dBi]	e.i.r.p. [dBm]	e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2402	1.34	30	28.66	-0.4	0.94	36	35.06
2442	1.33	30	28.67	-0.4	0.93	36	35.07
2480	1.25	30	28.75	-0.4	0.85	36	35.15

Note:

Cable (including temporary RF cable) and attenuator loss has been compensated for Peak Output Power

$\text{e.i.r.p. [dBm]} = \text{Peak Output Power [dBm]} + \text{Antenna Gain [dBi]}$

Table 8: Maximum Peak Output Power, 2Mbps

Freq. [MHz]	Peak Output Power [dBm]	Peak Output Power Limit [dBm]	Peak Output Power Margin [dB]	Antenna Gain [dBi]	e.i.r.p. [dBm]	e.i.r.p. Limit [dBm]	e.i.r.p. Margin [dB]
2402	1.37	30	28.63	-0.4	0.97	36	35.03
2442	1.33	30	28.67	-0.4	0.93	36	35.07
2480	1.26	30	28.74	-0.4	0.86	36	35.14

Note:

Cable (including temporary RF cable) and attenuator loss has been compensated for Peak Output Power

$\text{e.i.r.p. [dBm]} = \text{Peak Output Power [dBm]} + \text{Antenna Gain [dBi]}$

5.5 6dB Bandwidth

RESULT:

Pass

Date of testing: 2024-07-16

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1011hPa

Requirements:

FCC §15.215(c), §15.247(a)(2) and RSS-247 §5.2 a)

For system using digital modulation techniques in the 2400-2483.5MHz band, the 6dB bandwidth shall be at least 500kHz.

Additionally, for FCC, the 6dB bandwidth shall be contained within the frequency band designated in the rule section under which the equipment is operated.

Test procedure:

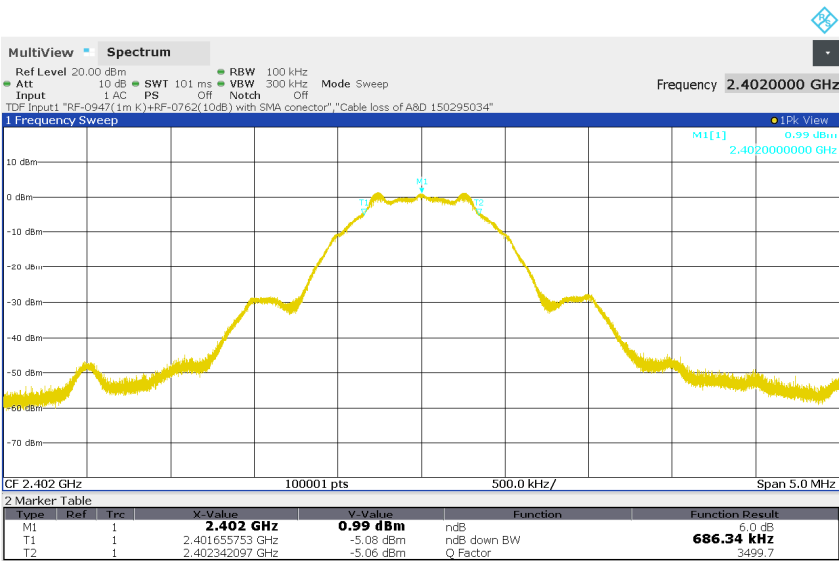
ANSI C63.10-2020 §11.8 and KDB 558074 D01.

The 6dB bandwidth was measured at the antenna port with a spectrum analyzer using a peak detector. The RBW was set to 100kHz and the VBW was set to 300kHz. Markers placed at the lowest and highest intersections of the trace with a 6dBc line were used to calculate the emission bandwidth.

Table 9: 6dB Bandwidth, BLE, 1Mbps

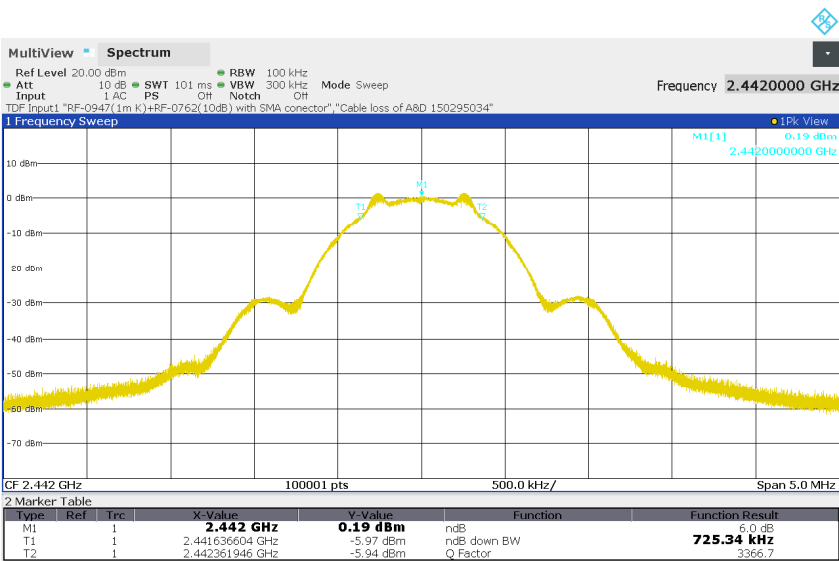
Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2402	0.686	>0.5
2442	0.725	>0.5
2480	0.725	>0.5

Figure 2: 6dB Bandwidth, BLE, Mode L (2402MHz), 1Mbps



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Figure 3: 6dB Bandwidth, BLE, Mode M (2442MHz), 1Mbps



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Figure 4: 6dB Bandwidth, BLE, Mode H (2480MHz), 1Mbps



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Table 10: 6dB Bandwidth, BLE, 2Mbps

Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2402	1.130	>0.5
2442	1.120	>0.5
2480	1.130	>0.5

Figure 5: 6dB Bandwidth, BLE, Mode L (2402MHz), 2Mbps



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Figure 6: 6dB Bandwidth, BLE, Mode M (2442MHz), 2Mbps



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Figure 7: 6dB Bandwidth, BLE, Mode H (2480MHz), 2Mbps



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5.6 99% Bandwidth

RESULT:

For. Ref.

Date of testing: 2024-07-16

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1011hPa

Requirements:

RSS-Gen §6.7

The 99% occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSS.

Test procedure:

ANSI C63.10-2020 §6.9.3

The 99% bandwidth was measured at the antenna port with a spectrum analyzer using with the following settings:

- RBW = 30kHz, VBW = 100kHz, Peak detector with Max Hold

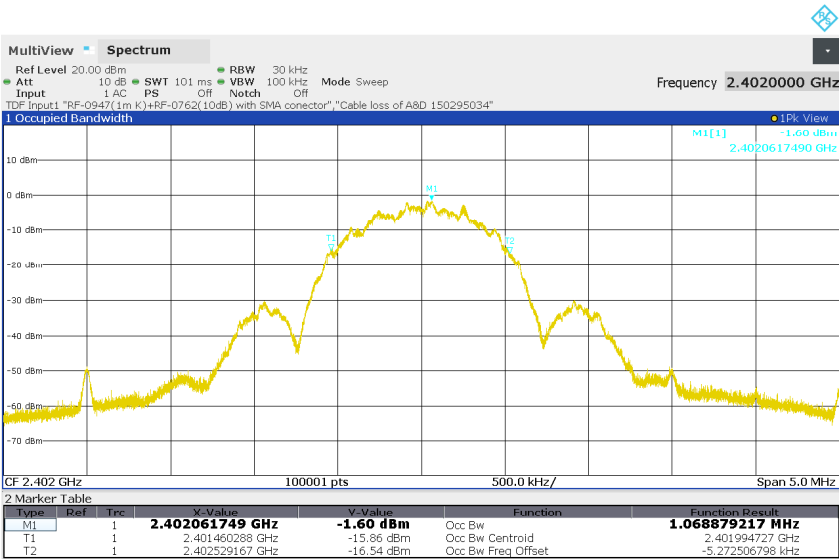
The RBW was set in the range from 1% to 5% of the observed OBW, VBW was set to at least three times of RBW.

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

Table 11: 99% Bandwidth, BLE, 1Mbps

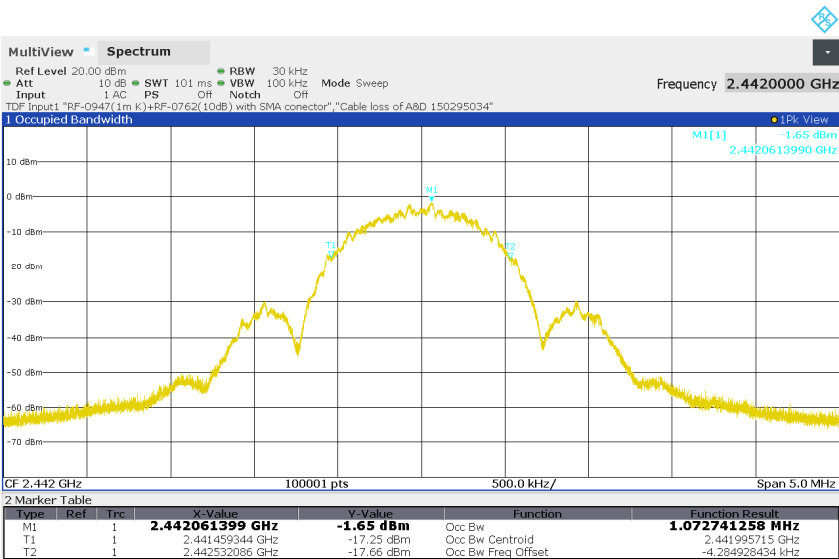
Operating Frequency [MHz]	99% Bandwidth [MHz]	Remarks
2402	1.069	
2442	1.073	Widest OBW for 1Mbps
2480	1.067	

Figure 8: 99% Bandwidth, BLE, Mode L (2402MHz), 1Mbps



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Figure 9: 99% Bandwidth, BLE, Mode M (2442MHz), 1Mbps



05:17:14 PM 07/16/2024

Figure 10: 99% Bandwidth, BLE, Mode H (2480MHz), 1Mbps

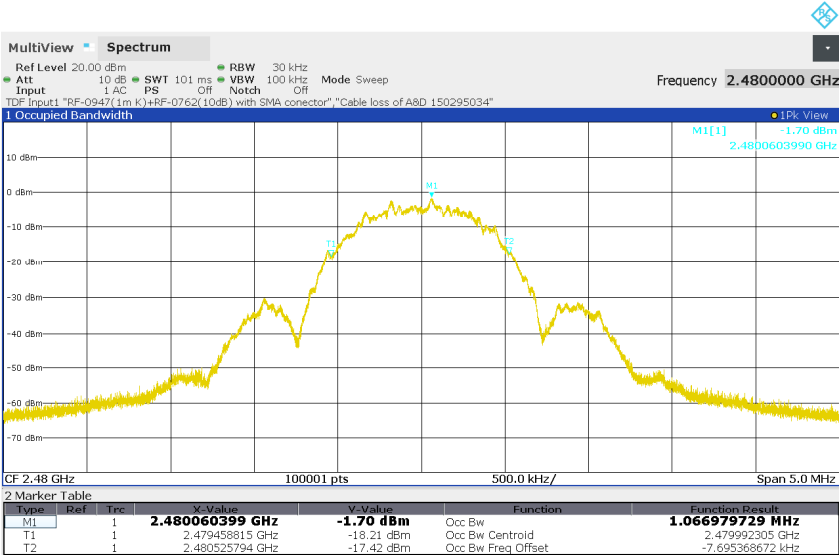


Table 12: 99% Bandwidth, BLE, 2Mbps

Operating Frequency [MHz]	99% Bandwidth [MHz]	Remarks
2402	2.106	
2442	2.100	
2480	2.138	Widest OBW for 2Mbps

Figure 11: 99% Bandwidth, BLE, Mode L (2402MHz), 2Mbps



Figure 12: 99% Bandwidth, BLE, Mode M (2442MHz), 2Mbps

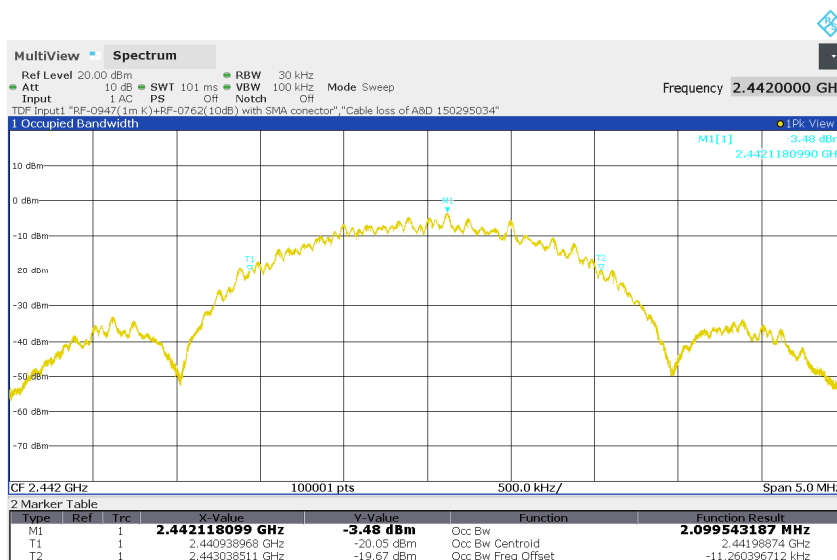


Figure 13: 99% Bandwidth, BLE, Mode H (2480MHz), 2Mbps



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5.7 Conducted Spurious Emissions

RESULT:

Pass

Date of testing: 2024-07-16

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1011hPa

Requirements:

FCC §15.247(d) and RSS-247 §5.5

In any 100kHz bandwidth outside the frequency band in which the intentional radiator is operating, the RF power shall be at least 20dBc below that of the maximum in-band 100kHz emission.

Test procedure:

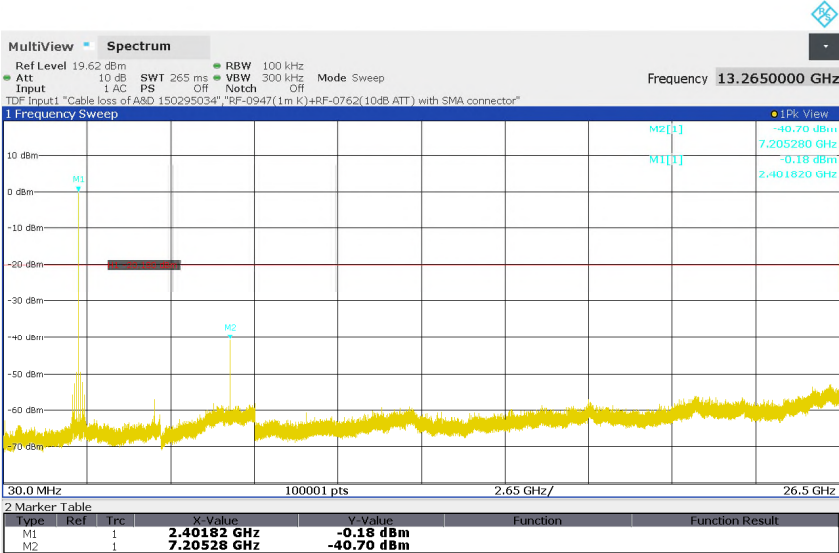
ANSI C63.10-2020 §6.7, §6.10 and KDB 558074 D01.

The conducted spurious emissions were measured at the antenna port with a spectrum analyzer using a peak detector. The RBW was set to 100kHz and the VBW was set to 300kHz. Measurements were performed from 30MHz to 25GHz (10th harmonics).

The readings of the measurements take into account the loss generated by all the involved cables.

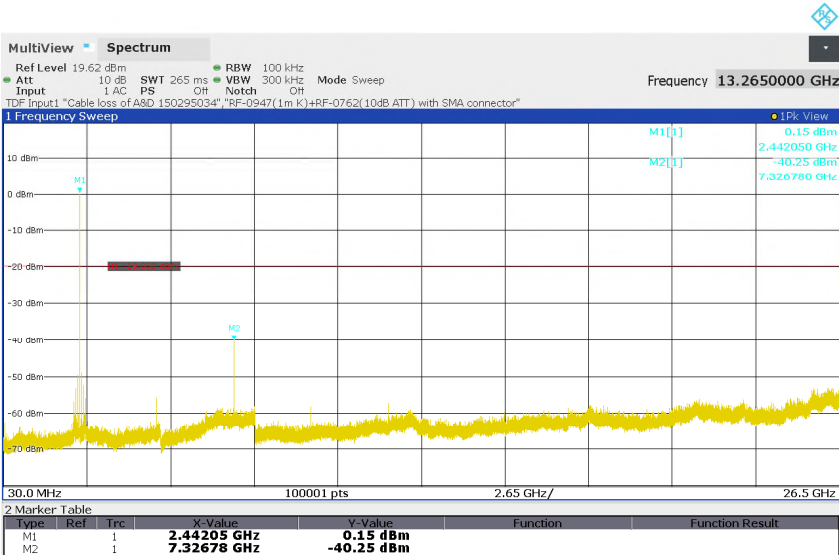
Authorized-band band-edge measurements (relative method) were performed by conducted, as per §6.10.4 of ANSI C63.10-2020.

Figure 14: Conducted Spurious Emissions, 30MHz - 25GHz, BLE, Mode L (2402MHz), 1Mbps



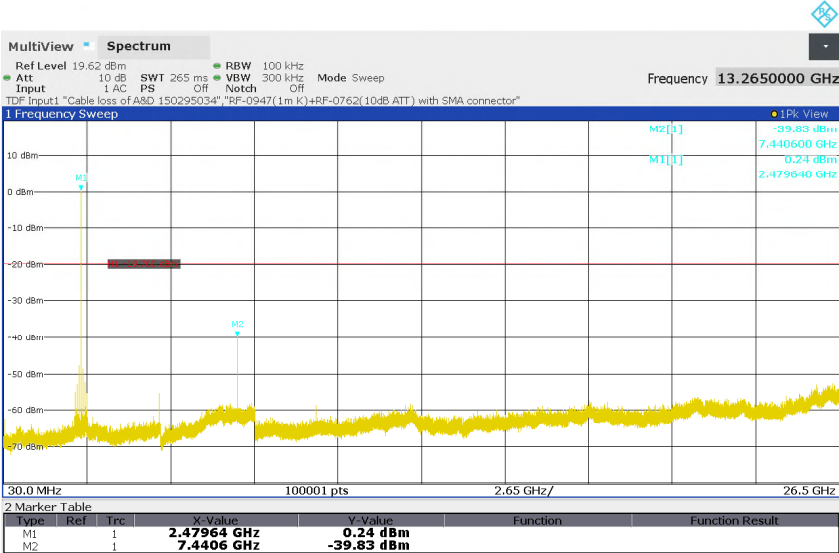
06:34:53 PM 07/24/2024

Figure 15: Conducted Spurious Emissions, 30MHz - 25GHz, BLE, Mode M (2442MHz), 1Mbps



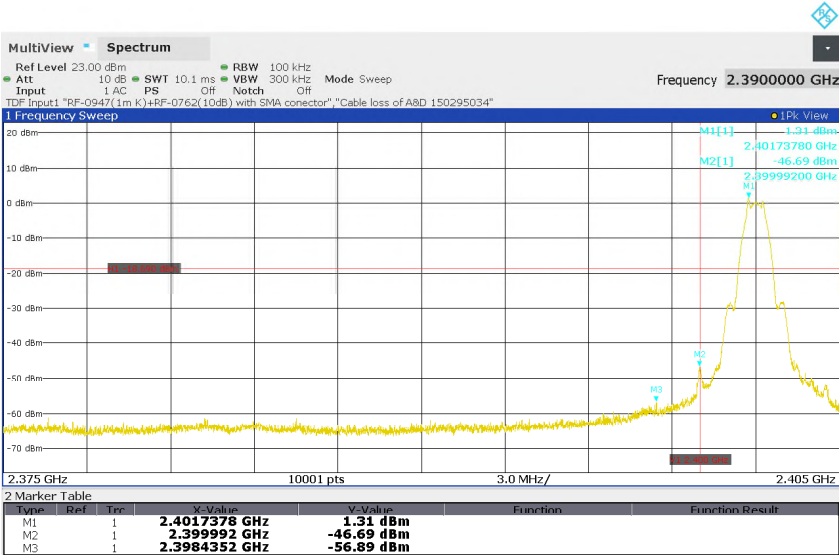
06:36:48 PM 07/24/2024

Figure 16: Conducted Spurious Emissions, 30MHz - 25GHz, BLE, Mode H (2480MHz), 1Mbps



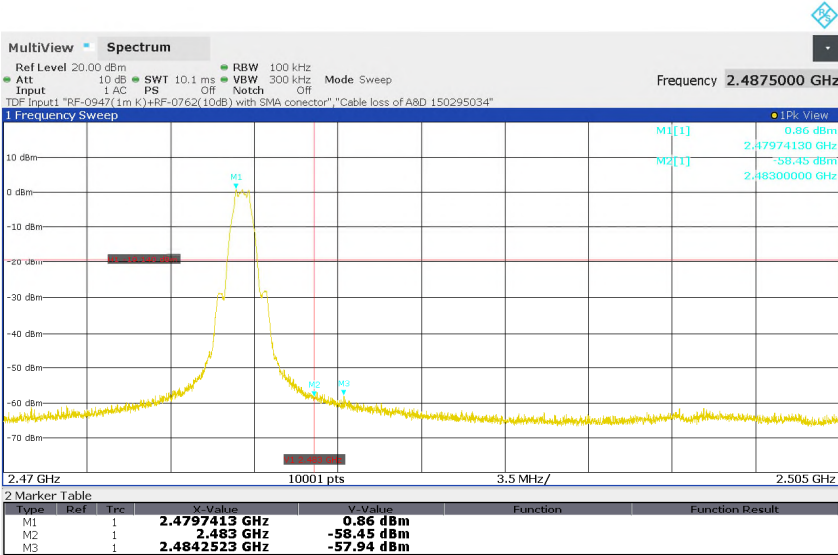
06:39:53 PM 07/24/2024

Figure 17: Authorized-band band-edge, BLE, Mode L (2402MHz), 1Mbps



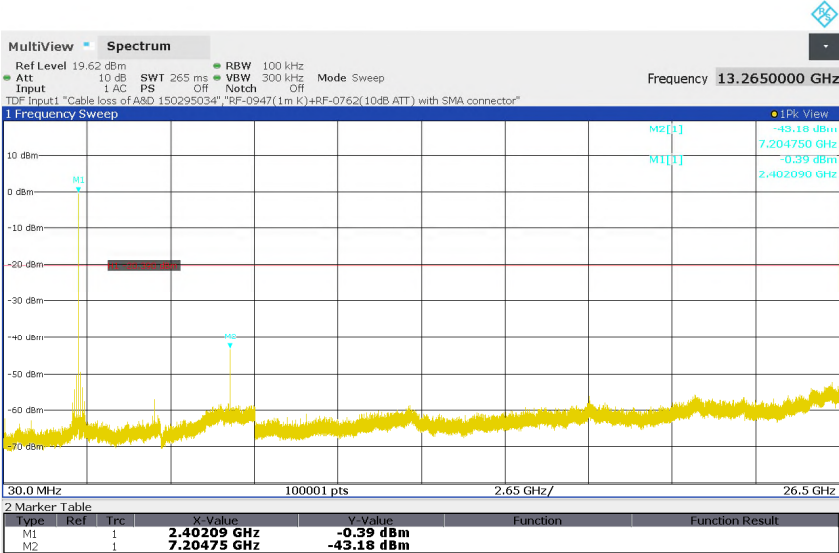
06:30:30 PM 07/16/2024

Figure 18: Authorized-band band-edge, BLE, Mode H (2480MHz), 1Mbps



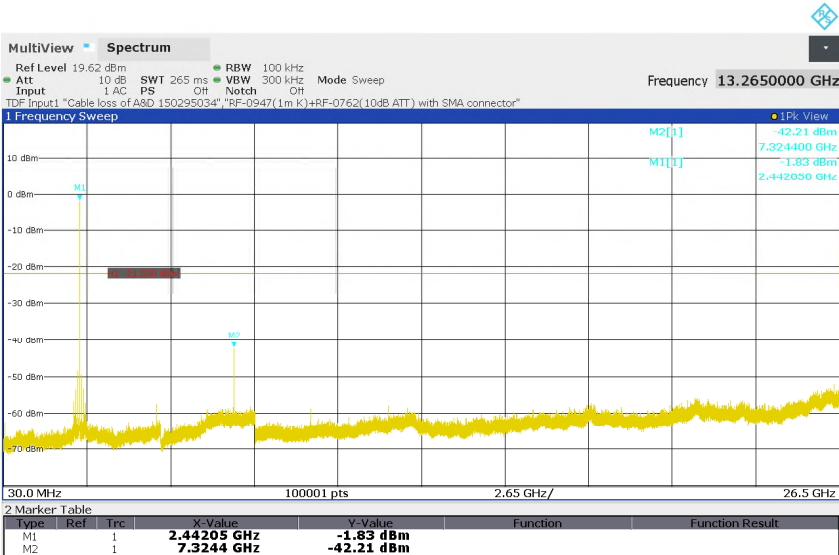
06:45:44 PM 07/16/2024

Figure 19: Conducted Spurious Emissions, 30MHz - 25GHz, BLE, Mode L (2402MHz), 2Mbps



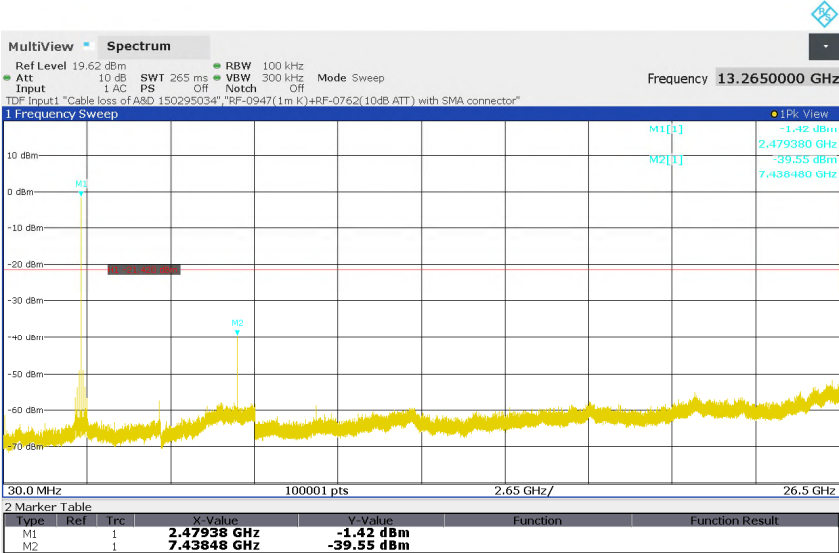
06:28:21 PM 07/24/2024

Figure 20: Conducted Spurious Emissions, 30MHz - 25GHz, BLE, Mode M (2442MHz), 2Mbps



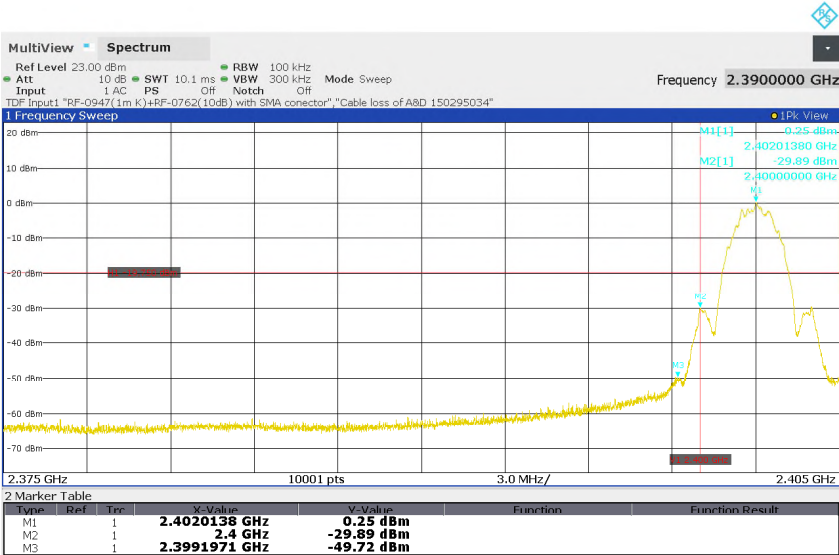
06:30:23 PM 07/24/2024

Figure 21: Conducted Spurious Emissions, 30MHz - 25GHz, BLE, Mode H (2480MHz), 2Mbps



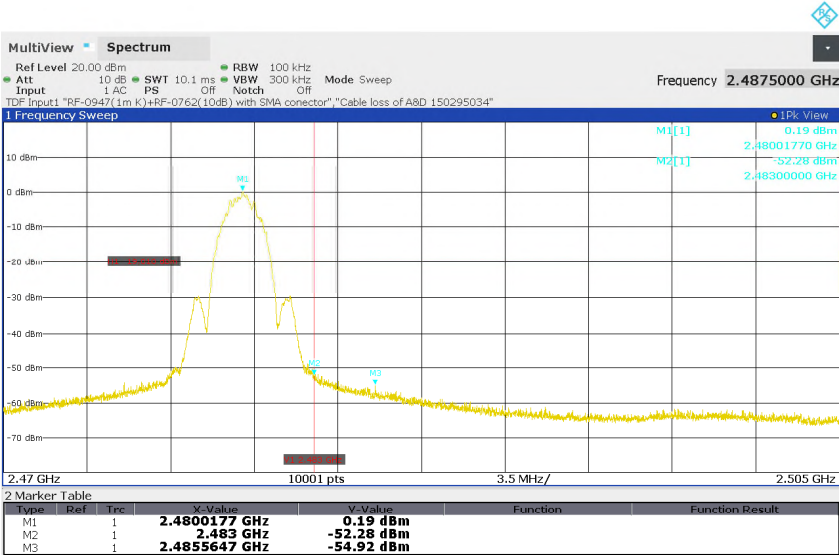
06:32:52 PM 07/24/2024

Figure 22: Authorized-band band-edge, BLE, Mode L (2402MHz), 2Mbps



06:36:43 PM 07/16/2024

Figure 23: Authorized-band band-edge, BLE, Mode H (2480MHz), 2Mbps



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5.8 Peak Power Spectral Density

RESULT:

Pass

Date of testing: 2024-07-16

Ambient temperature: 23°C

Relative humidity: 58%

Atmospheric pressure: 1011hPa

Requirements:

FCC §15.247(e) and RSS-247 §5.2(b)

For digitally modulated systems, the power spectral density (PSD) conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test procedure:

ANSI C63.10-2020 §11.10, KDB 558074 D01.

The peak power spectral density was measured at the antenna port with a spectrum analyzer using a peak detector with a RBW of 3kHz and a VBW of 10kHz.

The readings of the measurements take into account the loss generated by all the involved cables.

Table 13: Peak Power Spectral Density, BLE, 1Mbps

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2402	-11.72	8	19.72
2442	-12.91	8	20.91
2480	-11.81	8	19.81

Note:
Cable (including temporary RF cable) and attenuator loss has been compensated for Power Spectral Density

Figure 24: Power Spectral Density, BLE, Mode L (2402MHz), 1Mbps

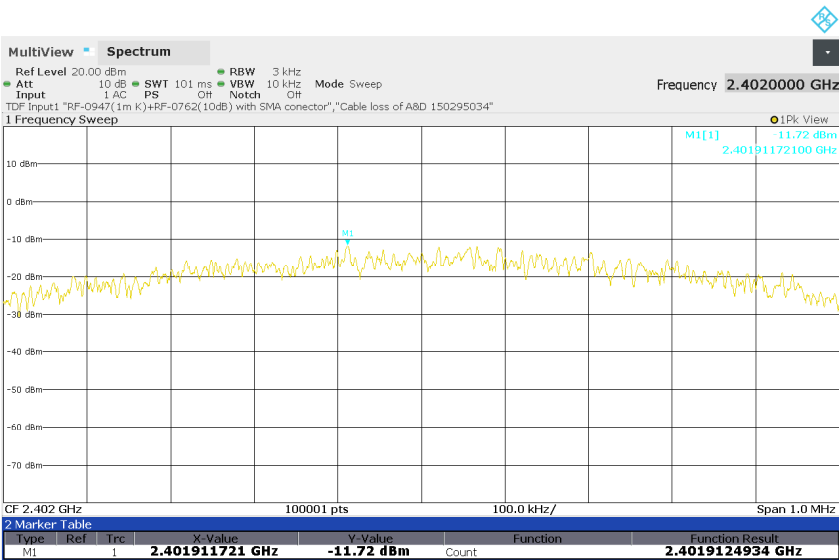


Figure 25: Power Spectral Density, BLE, Mode M (2442MHz), 1Mbps

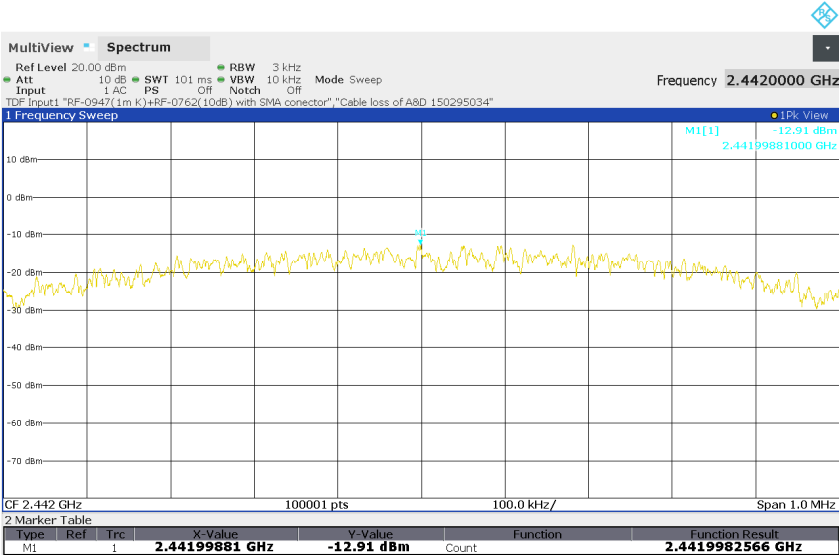


Figure 26: Power Spectral Density, BLE, Mode H (2480MHz), 1Mbps

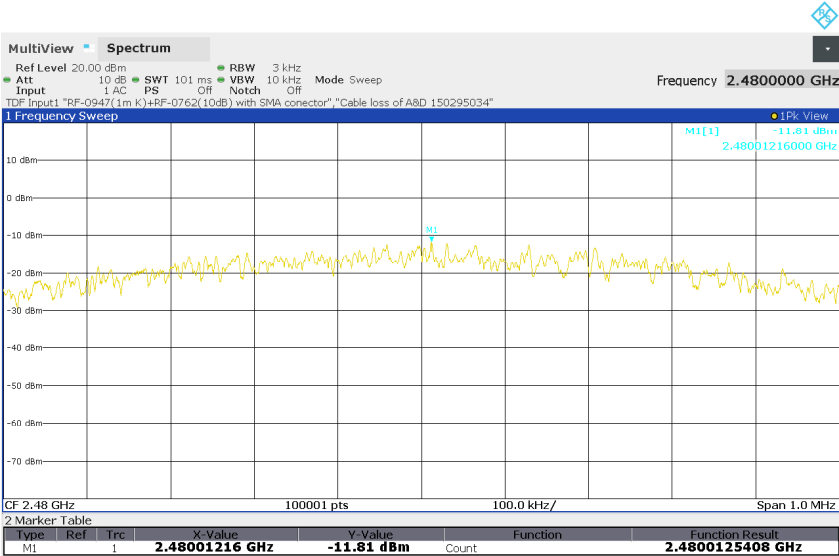


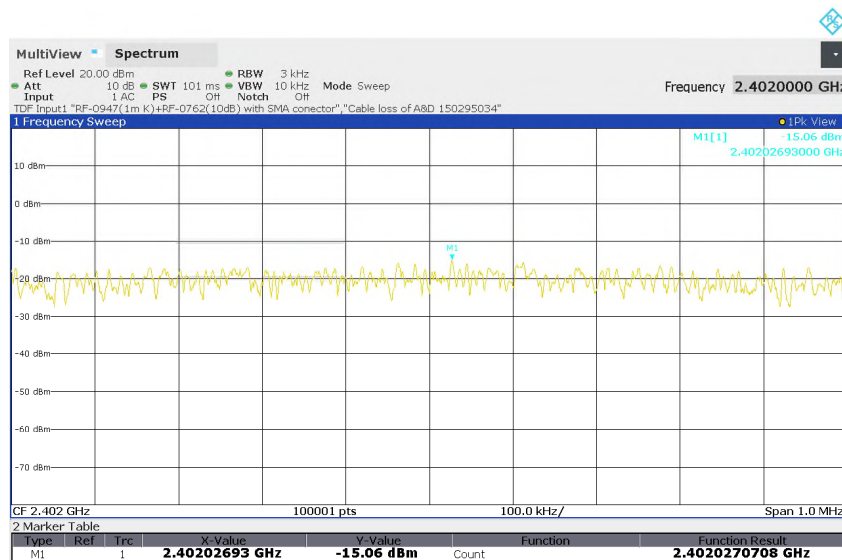
Table 14: Peak Power Spectral Density, BLE, 2Mbps

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2402	-15.06	8	23.06
2442	-14.94	8	22.94
2480	-15.56	8	23.56

Note:

Cable (including temporary RF cable) and attenuator loss has been compensated for Power Spectral Density

Figure 27: Power Spectral Density, BLE, Mode L (2402MHz), 2Mbps



05:33:50 PM 07/16/2024

Figure 28: Power Spectral Density, BLE, Mode M (2442MHz), 2Mbps

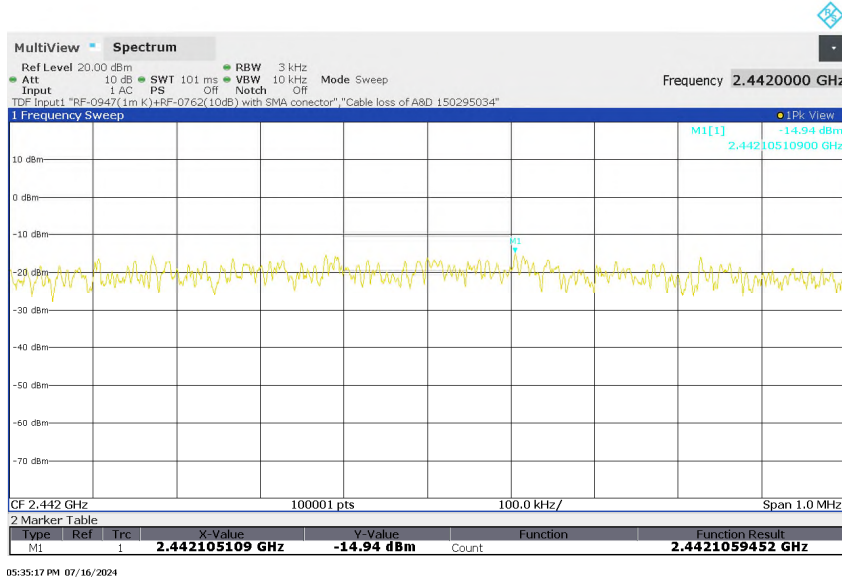
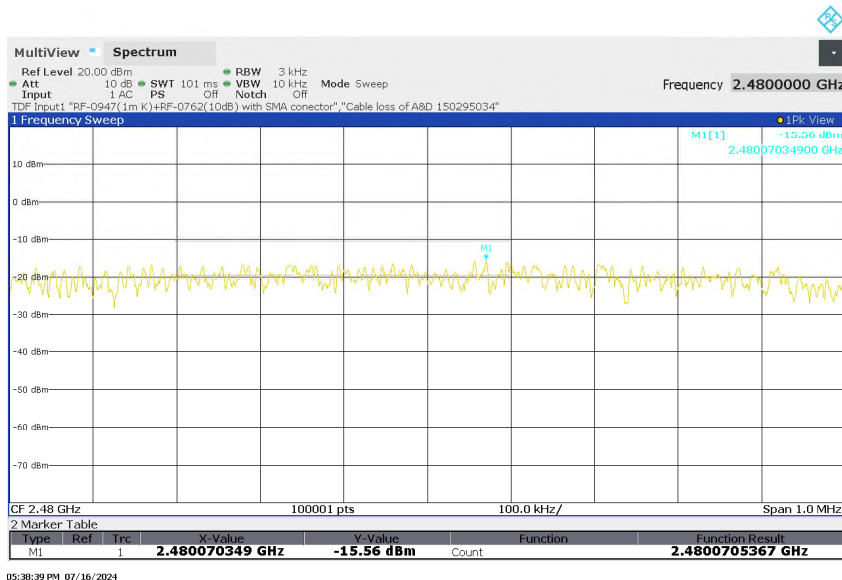


Figure 29: Power Spectral Density, BLE, Mode H (2480MHz), 2Mbps



5.9 Radiated Spurious Emissions of Transmitter

RESULT:

Pass

Date of testing: 2024-07-17, 2024-07-18, 2024-07-19,
2024-08-06

Ambient temperature: 23, 20, 20, 23°C

Relative humidity: 55, 58, 60, 55%

Atmospheric pressure: 1007, 1007, 1005, 1014hPa

Frequency range: 9kHz - 25GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

FCC §15.205, §15.209, §15.247(d) and RSS-247 §5.5, RSS-Gen §8.9, §8.10.

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

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC §15.209(a) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Test procedure:

ANSI C63.10-2020 §6.3, §6.4, §6.5, §6.6, §6.10 and KDB 558074 D01

The EUT was placed on a nonconductive turntable. 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 were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

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

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

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

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

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

Table 15: Radiated Emissions, Quasi Peak Data, 9kHz - 30MHz, BLE, 2402MHz, 1Mbps

Freq. [MHz]	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Angle [°]
0.02661	10.3	19.7	30.0	119.3	89.3	339.0
0.04599	4.0	19.7	23.7	114.4	90.7	253.0
0.06269	4.2	19.7	23.9	111.6	87.7	334.0
0.08003	-0.5	19.6	19.1	109.5	90.4	314.0
0.27101	23.4	19.5	42.9	99.0	56.1	156.0
0.87279	20.1	19.5	39.6	68.8	29.2	266.0
2.11043	7.2	19.5	26.7	69.5	42.8	130.0
8.84677	5.3	19.7	25.0	69.5	44.5	180.0

Note: Level QP = Reading QP + Factor

Table 16: Radiated Emissions, Quasi Peak Data, 9kHz - 30MHz, BLE, 2402MHz, 2Mbps

Freq. [MHz]	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Angle [°]
0.02563	9.3	19.7	29.0	119.6	90.6	343.0
0.04371	4.6	19.7	24.3	114.9	90.6	38.0
0.06308	26.5	19.7	46.2	111.6	65.4	34.0
0.08039	0.0	19.6	19.6	109.5	89.9	26.0
0.26974	24.5	19.5	44.0	99.1	55.1	156.0
0.87382	19.7	19.5	39.2	68.8	29.6	179.0
3.68434	5.6	19.6	25.2	69.5	44.3	185.0
25.33262	5.5	20.1	25.6	69.5	43.9	143.0

Note: Level QP = Reading QP + Factor

Table 17: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, BLE, 2402MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Height [cm]	Angle [°]
53.271	H	36.2	-21.0	15.2	40.0	24.8	400	251
54.278	V	46.3	-21.0	25.3	40.0	14.7	100	359
64.326	V	40.6	-21.8	18.8	40.0	21.2	101	256
144.687	V	42.1	-20.6	21.5	43.5	22.0	101	115
145.322	H	39.2	-20.5	18.7	43.5	24.8	228	100
167.450	H	33.2	-20.2	13.0	43.5	30.5	101	69
169.548	V	38.9	-20.3	18.6	43.5	24.9	100	27
319.999	H	38.4	-18.2	20.2	46.0	25.8	101	1

Note: Level QP = Reading QP + Factor

Table 18: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, BLE, 2402MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading QP [dBμV]	Factor [dB(1/m)]	Level QP [dBμV/m]	Limit [dBμV/m]	Margin QP [dB]	Height [cm]	Angle [°]
54.100	H	35.7	-21.0	14.7	40.0	25.3	397	260
55.300	V	46.7	-21.1	25.6	40.0	14.4	100	359
64.000	V	44.6	-21.8	22.8	40.0	17.2	100	305
146.289	H	36.5	-20.5	16.0	43.5	27.5	211	83
147.746	V	38.0	-20.4	17.6	43.5	25.9	100	331
158.628	V	36.1	-20.0	16.1	43.5	27.4	105	17
167.183	H	31.7	-20.2	11.5	43.5	32.0	166	92
315.096	H	33.5	-18.3	15.2	46.0	30.8	100	186

Note: Level QP = Reading QP + Factor

Table 19: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2402MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2273.997	H	61.8	-14.6	47.2	74.0	26.8	148	72
2337.950	V	59.1	-14.5	44.6	74.0	29.4	215	149
2338.001	H	65.1	-14.5	50.6	74.0	23.4	144	303
2465.990	H	61.9	-13.8	48.1	74.0	25.9	193	287
4823.393	V	56.3	-6.5	49.7	74.0	24.3	365	41
4826.707	H	55.7	-6.5	49.1	74.0	24.9	122	102
7205.974	V	58.4	0.9	59.3	74.0	14.7	214	331
7205.992	H	58.7	0.9	59.6	74.0	14.4	240	79
9608.829	H	49.4	-3.3	46.1	74.0	27.9	208	21
9608.854	V	49.8	-3.3	46.5	74.0	27.5	237	143
12011.099	H	48.5	0.7	49.2	74.0	24.8	133	85
12011.117	V	49.4	0.7	50.1	74.0	23.9	215	345
14413.309	V	47.0	0.7	47.7	74.0	26.3	349	177
14413.452	H	48.3	0.7	49.0	74.0	25.0	177	134
19199.506	V	51.4	-9.4	42.0	74.0	32.0	187	313
19235.448	H	51.1	-9.4	41.7	74.0	32.3	190	205
21604.850	H	49.0	-6.7	42.3	74.0	31.7	193	324
21654.904	V	48.6	-6.7	41.9	74.0	32.1	135	212

Note: Level PK = Reading PK + Factor

Table 20: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2402MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2273.997	H	54.7	-14.6	40.1	54.0	13.9	148	72
2337.950	V	49.3	-14.5	34.8	54.0	19.2	215	149
2338.001	H	60.8	-14.5	46.3	54.0	7.7	144	303
2465.990	H	55.0	-13.8	41.2	54.0	12.8	193	287
4823.393	V	42.0	-6.5	35.5	54.0	18.5	365	41
4826.707	H	42.1	-6.5	35.6	54.0	18.4	122	102
7205.974	V	49.0	0.9	49.9	54.0	4.1 (*)	214	331
7205.992	H	48.8	0.9	49.7	54.0	4.3 (*)	240	79
9608.829	H	36.6	-3.3	33.3	54.0	20.7	208	21
9608.854	V	36.6	-3.3	33.3	54.0	20.7	237	143
12011.099	H	34.8	0.7	35.5	54.0	18.5	133	85
12011.117	V	36.4	0.7	37.1	54.0	16.9	215	345
14413.309	V	32.4	0.7	33.1	54.0	20.9	349	177
14413.452	H	34.2	0.7	34.9	54.0	19.1	177	134
19199.506	V	36.2	-9.4	26.8	54.0	27.2	187	313
19235.448	H	36.3	-9.4	26.9	54.0	27.1	190	205
21604.850	H	34.2	-6.7	27.5	54.0	26.5	193	324
21654.904	V	34.2	-6.7	27.5	54.0	26.5	135	212

Note: Level AV = Reading AV + 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.

Table 21: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2442MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2313.989	H	62.7	-14.6	48.1	74.0	25.9	166	297
2377.982	V	60.1	-14.4	45.7	74.0	28.3	104	283
2378.008	H	65.1	-14.4	50.7	74.0	23.3	201	299
2505.998	H	59.7	-13.6	46.1	74.0	27.9	126	282
7325.977	H	57.4	1.1	58.5	74.0	15.5	204	77
7325.994	V	58.1	1.1	59.2	74.0	14.8	118	303
9768.784	H	50.4	-3.1	47.3	74.0	26.7	149	75
9768.789	V	49.5	-3.1	46.4	74.0	27.6	158	131
12211.109	V	49.0	-0.4	48.6	74.0	25.4	140	206
12211.132	H	48.1	-0.4	47.7	74.0	26.3	170	147
19534.082	H	50.4	-9.3	41.1	74.0	32.9	179	252
19604.528	V	49.5	-9.3	40.2	74.0	33.8	189	38

Note: Level PK = Reading PK + Factor

Table 22: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2442MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2313.989	H	57.0	-14.6	42.4	54.0	11.6	166	297
2377.982	V	53.1	-14.4	38.7	54.0	15.3	104	283
2378.008	H	61.3	-14.4	46.9	54.0	7.1	201	299
2505.998	H	51.5	-13.6	37.9	54.0	16.1	126	282
7325.977	H	47.3	1.1	48.4	54.0	5.6	204	77
7325.994	V	48.4	1.1	49.5	54.0	4.5 (*)	118	303
9768.784	H	37.3	-3.1	34.2	54.0	19.8	149	75
9768.789	V	36.5	-3.1	33.4	54.0	20.6	158	131
12211.109	V	35.6	-0.4	35.2	54.0	18.8	140	206
12211.132	H	33.6	-0.4	33.2	54.0	20.8	170	147
19534.082	H	35.9	-9.3	26.6	54.0	27.4	179	252
19604.528	V	34.9	-9.3	25.6	54.0	28.4	189	38

Note: Level AV = Reading AV + 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.

Table 23: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2480MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2352.000	H	63.2	-14.5	48.7	74.0	25.3	169	300
2416.002	V	60.5	-14.2	46.3	74.0	27.7	121	141
2416.005	H	63.9	-14.2	49.7	74.0	24.3	301	291
2543.994	H	59.8	-13.3	46.5	74.0	27.5	148	23
7440.019	V	58.6	0.3	58.9	74.0	15.1	186	152
7440.066	H	56.1	0.3	56.4	74.0	17.6	117	98
9920.833	V	49.1	-3.1	46.0	74.0	28.0	394	90
9920.851	H	49.4	-3.1	46.3	74.0	27.7	256	62
12401.145	H	48.5	-1.0	47.5	74.0	26.5	179	233
12401.157	V	48.5	-1.0	47.5	74.0	26.5	151	54
19819.088	H	49.7	-9.1	40.6	74.0	33.4	175	278
19851.506	V	50.2	-9.1	41.1	74.0	32.9	118	13

Note: Level PK = Reading PK + Factor

Table 24: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2480MHz, 1Mbps

Freq. [MHz]	Antenna Orient.	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2352.000	H	57.8	-14.5	43.3	54.0	10.7	169	300
2416.002	V	51.6	-14.2	37.4	54.0	16.6	121	141
2416.005	H	58.9	-14.2	44.7	54.0	9.3	301	291
2543.994	H	49.7	-13.3	36.4	54.0	17.6	148	23
7440.019	V	49.2	0.3	49.5	54.0	4.5 (*)	186	152
7440.066	H	45.2	0.3	45.5	54.0	8.5	117	98
9920.833	V	36.5	-3.1	33.4	54.0	20.6	394	90
9920.851	H	36.0	-3.1	32.9	54.0	21.1	256	62
12401.145	H	35.2	-1.0	34.2	54.0	19.8	179	233
12401.157	V	34.8	-1.0	33.8	54.0	20.2	151	54
19819.088	H	34.9	-9.1	25.8	54.0	28.2	175	278
19851.506	V	34.9	-9.1	25.8	54.0	28.2	118	13

Note: Level AV = Reading AV + 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.

Table 25: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2402MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading PK [dBμV]	Factor [dB(1/m)]	Level PK [dBμV/m]	Limit [dBμV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2274.003	H	62.0	-14.6	47.4	74.0	26.6	214	304
2337.997	H	65.2	-14.5	50.7	74.0	23.3	130	307
2338.014	V	59.5	-14.5	45.0	74.0	29.0	214	149
2465.991	H	60.4	-13.8	46.6	74.0	27.4	272	79
7207.112	V	59.9	0.9	60.8	74.0	13.2	100	191
7207.145	H	58.6	0.9	59.4	74.0	14.6	190	79
9609.719	V	49.3	-3.3	46.0	74.0	28.0	187	38
9609.744	H	49.1	-3.3	45.8	74.0	28.2	157	59
12012.260	V	48.6	0.7	49.3	74.0	24.7	185	350
12012.315	H	47.3	0.7	48.0	74.0	26.0	260	132
19194.450	V	50.3	-9.4	40.9	74.0	33.1	131	217
19219.904	H	50.9	-9.4	41.5	74.0	32.5	198	327

Note: Level PK = Reading PK + Factor

Table 26: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2402MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading AV [dBμV]	Factor [dB(1/m)]	Level AV [dBμV/m]	Limit [dBμV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2274.003	H	54.5	-14.6	39.9	54.0	14.1	214	304
2337.997	H	59.4	-14.5	44.9	54.0	9.1	130	307
2338.014	V	48.9	-14.5	34.4	54.0	19.6	214	149
2465.991	H	52.0	-13.8	38.2	54.0	15.8	272	79
7207.112	V	48.7	0.9	49.6	54.0	4.4 (*)	100	191
7207.145	H	47.3	0.9	48.2	54.0	5.8	190	79
9609.719	V	35.8	-3.3	32.5	54.0	21.5	187	38
9609.744	H	35.8	-3.3	32.5	54.0	21.5	157	59
12012.260	V	35.1	0.7	35.8	54.0	18.2	185	350
12012.315	H	33.0	0.7	33.7	54.0	20.3	260	132
19194.450	V	35.5	-9.4	26.1	54.0	27.9	131	217
19219.904	H	36.5	-9.4	27.1	54.0	26.9	198	327

Note: Level AV = Reading AV + 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.

Table 27: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2442MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2313.998	H	62.8	-14.6	48.2	74.0	25.8	214	308
2377.991	V	58.2	-14.4	43.8	74.0	30.2	177	127
2378.007	H	64.9	-14.4	50.5	74.0	23.5	204	299
2506.016	H	58.9	-13.6	45.3	74.0	28.7	293	10
7324.811	H	56.9	1.1	58.0	74.0	16.0	236	81
7324.826	V	58.2	1.1	59.3	74.0	14.7	304	153
9769.836	H	49.1	-3.1	46.0	74.0	28.0	159	81
9769.844	V	49.6	-3.1	46.5	74.0	27.5	133	44
12212.309	V	48.1	-0.4	47.7	74.0	26.3	142	170
12212.361	H	48.5	-0.4	48.1	74.0	25.9	394	250
19525.742	H	49.5	-9.3	40.2	74.0	33.8	193	112
19532.060	V	49.5	-9.3	40.2	74.0	33.8	130	97

Note: Level PK = Reading PK + Factor

Table 28: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2442MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2313.998	H	55.7	-14.6	41.1	54.0	12.9	214	308
2377.991	V	48.2	-14.4	33.8	54.0	20.2	177	127
2378.007	H	59.7	-14.4	45.3	54.0	8.7	204	299
2506.016	H	48.2	-13.6	34.6	54.0	19.4	293	10
7324.811	H	44.9	1.1	46.0	54.0	8.0	236	81
7324.826	V	46.7	1.1	47.8	54.0	6.2	304	153
9769.836	H	35.6	-3.1	32.5	54.0	21.5	159	81
9769.844	V	36.1	-3.1	33.0	54.0	21.0	133	44
12212.309	V	34.2	-0.4	33.8	54.0	20.2	142	170
12212.361	H	34.2	-0.4	33.8	54.0	20.2	394	250
19525.742	H	34.9	-9.3	25.6	54.0	28.4	193	112
19532.060	V	35.1	-9.3	25.8	54.0	28.2	130	97

Note: Level AV = Reading AV + Factor

Table 29: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2480MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2352.000	H	63.3	-14.5	48.8	74.0	25.2	180	304
2416.010	H	64.3	-14.2	50.1	74.0	23.9	235	287
2490.345	V	59.4	-13.7	45.7	74.0	28.3	303	44
2543.981	H	59.7	-13.3	46.4	74.0	27.6	220	285
7441.166	V	58.4	0.3	58.7	74.0	15.3	143	311
7441.189	H	56.9	0.3	57.2	74.0	16.8	122	99
9918.155	H	47.8	-3.1	44.7	74.0	29.3	100	186
9918.270	V	49.2	-3.1	46.1	74.0	27.9	131	130
12402.277	V	48.6	-1.0	47.6	74.0	26.4	370	44
12402.616	H	47.8	-1.0	46.8	74.0	27.2	268	108
19820.786	V	49.7	-9.1	40.6	74.0	33.4	116	41
19835.878	H	50.6	-9.1	41.5	74.0	32.5	189	155

Note: Level PK = Reading PK + Factor

Table 30: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE, 2480MHz, 2Mbps

Freq. [MHz]	Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2352.000	H	56.9	-14.5	42.4	54.0	11.6	180	304
2416.010	H	58.4	-14.2	44.2	54.0	9.8	235	287
2490.345	V	44.9	-13.7	31.2	54.0	22.8	303	44
2543.981	H	49.5	-13.3	36.2	54.0	17.8	220	285
7441.166	V	47.0	0.3	47.3	54.0	6.7	143	311
7441.189	H	44.2	0.3	44.5	54.0	9.5	122	99
9918.155	H	33.5	-3.1	30.4	54.0	23.6	100	186
9918.270	V	35.8	-3.1	32.7	54.0	21.3	131	130
12402.277	V	34.2	-1.0	33.2	54.0	20.8	370	44
12402.616	H	33.8	-1.0	32.8	54.0	21.2	268	108
19820.786	V	35.1	-9.1	26.0	54.0	28.0	116	41
19835.878	H	35.1	-9.1	26.0	54.0	28.0	189	155

Note: Level AV = Reading AV + Factor

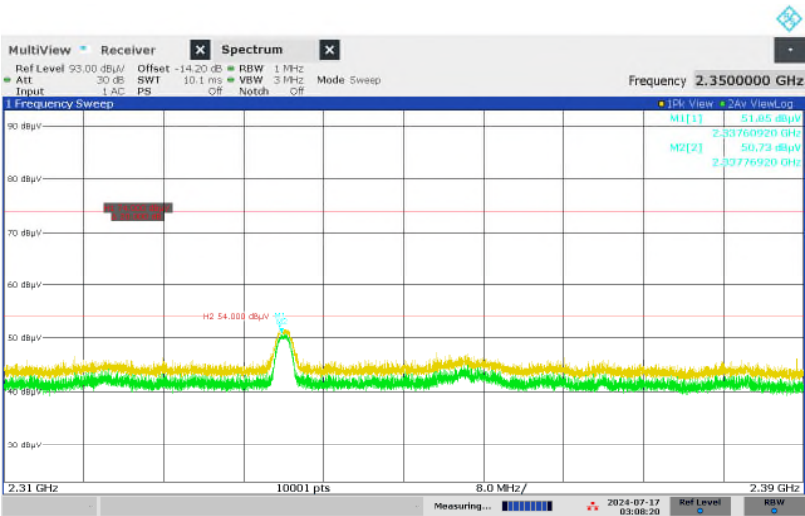
Table 31: Restricted-band Band-edge, BLE, 1Mbps

Operating Frequency [MHz]	Antenna Orient.	Level AV [dBµV/m]	Level PK [dBµV/m]	Limit AV [dBµV/m]	Limit PK [dBµV/m]	Margin AV [dB]	Margin PK [dB]
2402	H	50.73	51.85	54	74	3.27 (*)	22.15
2402	V	46.09	47.56	54	74	7.91	26.44
2480	H	46.61	48.04	54	74	7.39	25.96
2480	V	42.86	44.30	54	74	11.14	29.70

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
Average limit in dBµV/m is calculated as follows: Average limit = 20 x Log₁₀(500µV/m).
Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

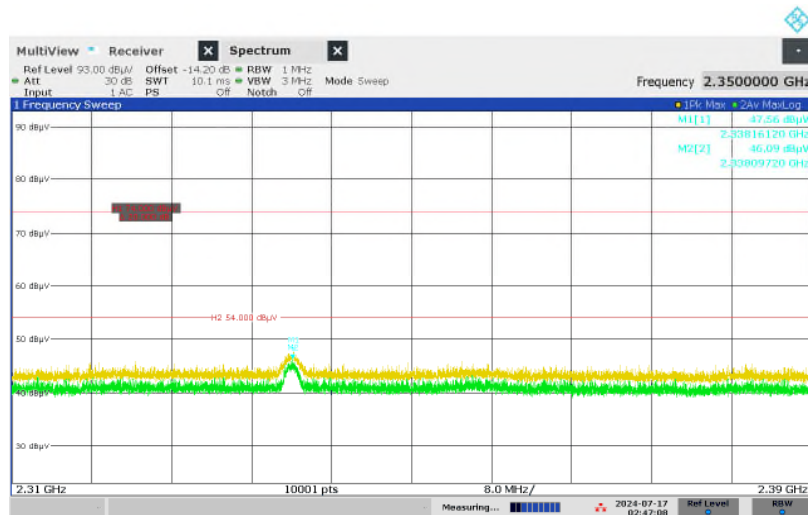
(*) The measured result is below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a high probability that the tested product complies with the specification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

Figure 30: Restricted-band Band-edge, Spectral Diagram, BLE, 2402MHz, Horizontal Antenna Orientation, 1Mbps



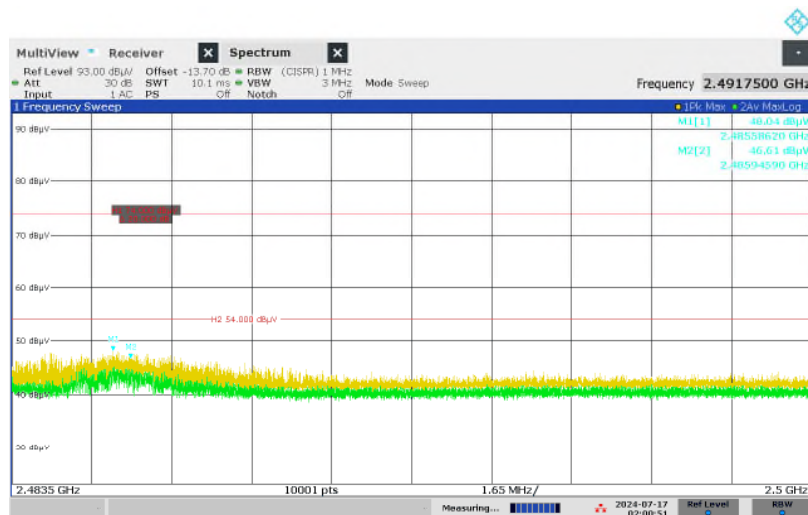
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Figure 31: Restricted-band Band-edge, Spectral Diagram, BLE, 2402MHz, Vertical Antenna Orientation, 1Mbps



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Figure 32: Restricted-band Band-edge, Spectral Diagram, BLE, 2480MHz, Horizontal Antenna Orientation, 1Mbps



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Figure 33: Restricted-band Band-edge, Spectral Diagram, BLE, 2480MHz, Vertical Antenna Orientation, 1Mbps

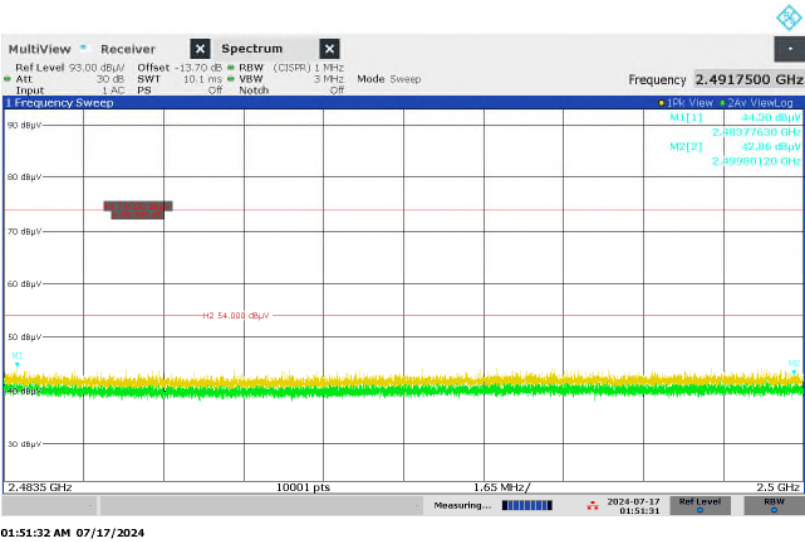


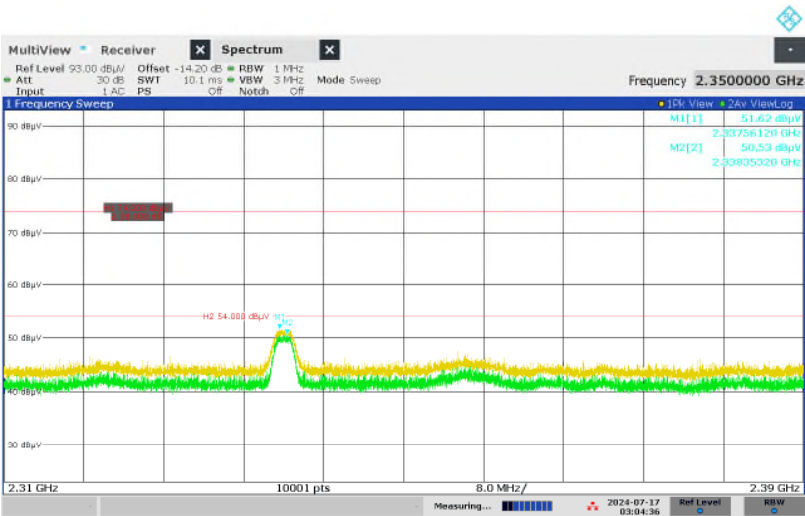
Table 32: Restricted-band Band-edge, BLE, 2Mbps

Operating Frequency [MHz]	Antenna Orient.	Level AV [dBµV/m]	Level PK [dBµV/m]	Limit AV [dBµV/m]	Limit PK [dBµV/m]	Margin AV [dB]	Margin PK [dB]
2402	H	50.53	51.62	54	74	3.47 (*)	22.38
2402	V	46.52	48.07	54	74	7.48	25.93
2480	H	47.75	49.06	54	74	6.25	24.94
2480	V	43.71	44.97	54	74	10.29	29.03

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
Average limit in dBµV/m is calculated as follows: Average limit = 20 x Log₁₀(500µV/m).
Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

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

Figure 34: Restricted-band Band-edge, Spectral Diagram, BLE, 2402MHz, Horizontal Antenna Orientation, 2Mbps



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Figure 35: Restricted-band Band-edge, Spectral Diagram, BLE, 2402MHz, Vertical Antenna Orientation, 2Mbps

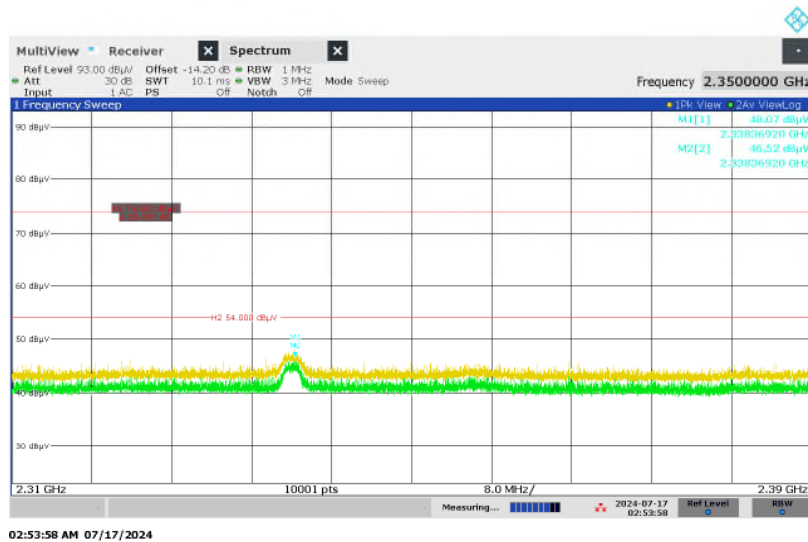


Figure 36: Restricted-band Band-edge, Spectral Diagram, BLE, 2480MHz, Horizontal Antenna Orientation, 2Mbps

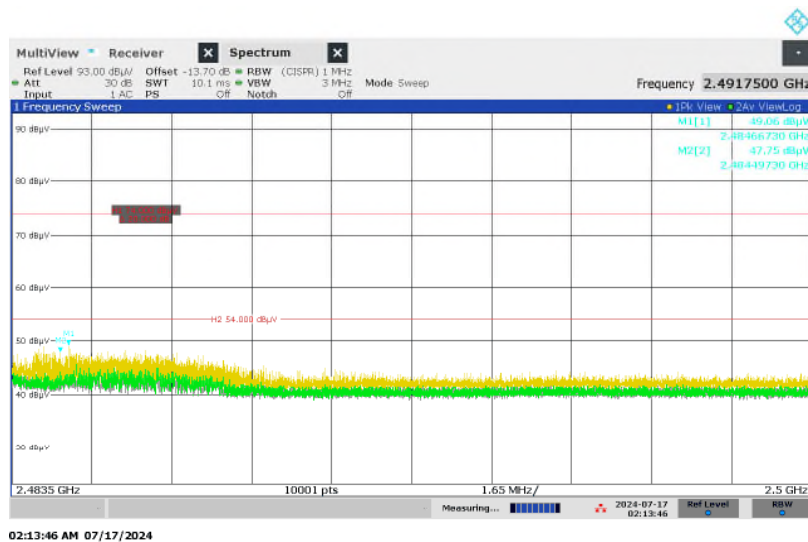
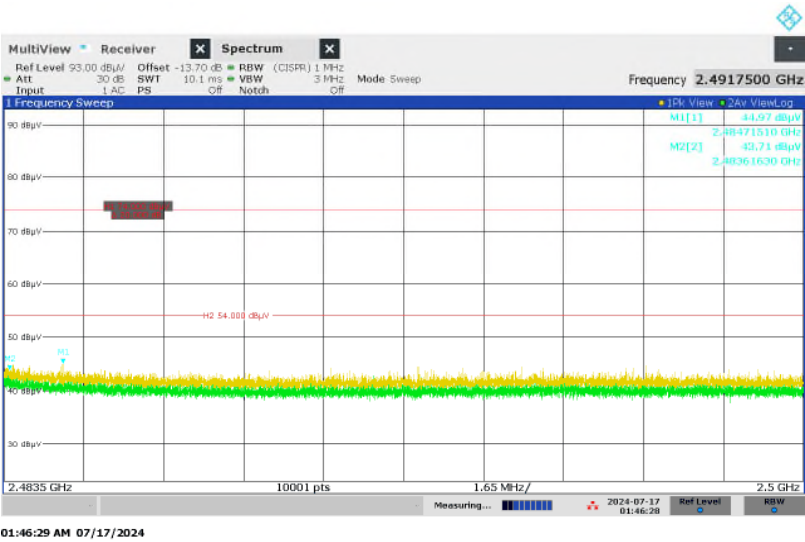


Figure 37: Restricted-band Band-edge, Spectral Diagram, BLE, 2480MHz, Vertical Antenna Orientation, 2Mbps



5.10 AC Power Line Conducted Emission of Transmitter

RESULT:

Pass

Date of testing: 2024-05-23

Ambient temperature: 24°C

Relative humidity: 56%

Atmospheric pressure: 1007hPa

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 input port 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.

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

Table 33: AC Power Line Conducted Emission, 0.15 - 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Original Wireless Communication Transmission

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]
0.27200	N	19.9	10.8	10.0	29.9	20.8	61.0	51.0	31.1	30.2
0.45800	N	32.8	27.2	10.2	43.0	37.4	56.7	46.7	13.7	9.3
0.47900	N	34.6	28.8	10.2	44.8	39.0	56.4	46.4	11.6	7.4
0.79800	N	20.9	12.8	10.1	31.0	22.9	56.0	46.0	25.0	23.1
1.06900	N	20.0	14.5	10.1	30.1	24.6	56.0	46.0	25.9	21.4
2.09300	N	17.5	10.1	10.0	27.5	20.1	56.0	46.0	28.5	25.9
8.63800	N	25.1	17.1	10.2	35.3	27.3	60.0	50.0	24.7	22.7
19.17300	N	22.9	9.9	10.7	33.6	20.6	60.0	50.0	26.4	29.4
0.27300	L1	20.9	11.5	10.0	30.9	21.5	61.0	51.0	30.1	29.5
0.45600	L1	33.0	27.1	10.2	43.2	37.3	56.8	46.8	13.6	9.5
0.48000	L1	34.8	29.5	10.2	45.0	39.7	56.3	46.3	11.3	6.6
0.76400	L1	21.8	14.6	10.1	31.9	24.7	56.0	46.0	24.1	21.3
1.06900	L1	21.1	15.3	10.1	31.2	25.4	56.0	46.0	24.8	20.6
2.09400	L1	18.6	11.2	10.0	28.6	21.2	56.0	46.0	27.4	24.8
8.76100	L1	25.7	17.3	10.3	36.0	27.6	60.0	50.0	24.0	22.4
19.14400	L1	23.2	10.4	10.7	33.9	21.1	60.0	50.0	26.1	28.9

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

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