Test Report No.: *Prüfbericht-Nr.:*	**JP252FBF 001**	**Order No.:** *Auftrags-Nr.:*	**150313233**	**Page 1 of 70** *Seite 1 von 70*
Client Reference No.: *Kunden-Referenz-Nr.:*	N/A	**Order Date:** *Auftragsdatum:*	2025-05-29	
Client: *Auftraggeber:*	MIZUNO CORPORATION 1-12-35 Nanko Kita, Suminoe-ku, Osaka, Japan			
Test Item: *Prüfgegenstand:*	Golf swing measurement system			
Identification / Type No.: *Bezeichnung / Typ-Nr.:*	SET OPTIMIZER	**Serial No.:** *Serien-Nr.:*	See clause 3.2	
Order Content: *Auftrags-Inhalt:*	Wireless Testing			
Test Specification: *Prüfgrundlage:*	FCC 47 CFR Part 15, Subpart C, Section 15.247 RSS-247 (Issue 4): 2025			

Date of Sample Receipt: *Wareneingangsdatum:*	2025-06-12	-/-
Test Sample No.: *Prüfmuster-Nr.:*	A004018785-001 to 003	
Testing Period: *Prüfzeitraum:*	2025-06-12 to 2025-06-30	
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: 2025-09-09 *Datum:*	Yoshifuru Fujiwara	**Issue Date:** 2025-09-09 *Ausstellungsdatum:*	Pin Zhang
Position / *Stellung:*	Project Engineer	**Position** / *Stellung:*	Authorizer

Other / *Sonstiges:*

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

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

Revisions

Report No.	Issue date	Changes / Remarks
JP252FBF 001	2025-09-09	Original document

Remarks

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

Contents

1. General Remarks

1.1 Test Specifications

Table 1: Test Summary

Test	Specifications	Result
Radio: FCC 47 CFR Part 15, Subpart C, Section 15.247 RSS-247 (Issue 4): 2025 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 §6.3.2	1W (30dBm) (Peak Conducted) 4W (36dBm) (Peak EIRP) for ISED	Pass
6dB Bandwidth FCC §15.247(a)(2) and §15.215(c) RSS-247 §6.3.1 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 §6.6	20dBc 30MHz - 25GHz (10th Harmonics)	Pass
Peak Power Spectral Density FCC §15.247(e) RSS-247 §6.3.1 b.	8dBm in any 3kHz band	Pass
Duty Cycle	-/-	For. Ref.

Test	Specifications	Result
Radiated Spurious Emissions of Transmitter FCC §15.209 and §15.247(d) RSS-247 §6.6 and RSS-Gen §8.9, 8.10	9kHz - 25GHz	Pass
Conducted Emission on AC Power Ports of Transmitter FCC §15.207(a) and RSS-Gen §8.8	150kHz - 30MHz The equipment is battery operated only. (The EUT is not intended to operate the BLE function while charging.)	N/A

Note: RSS-247 (Issue 4): 2025 is applied, since no technical difference is seen for the requirements on DTS device among the Issue 3 and 4.

1.2 Test Report Purpose

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

1.3 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

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

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

The test facility is 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	2025-06-10	2026-06-10
RF Cable	HAYASHI-REPIC	GL140SE	50112-01-01	RF-1243	1 year	2025-03-28	2026-03-28
For Radiated Emission (RE)							
Path Loss Correction Factors for RE below 1GHz	-	-	-	RF-0596	1 year	2025-01-29	2026-01-29
Path Loss Correction Factors for RE above 1GHz	-	-	-	RF-0995	1 year	2024-12-03	2025-12-03
RE Meas. Software	Toyo Corporation	ES10/RE-AJ	0600-0179-80	RF-1263	N/A	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESW 44	103396	RF-1250	1 year	2025-05-22	2026-05-22
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	N/A	N/A	N/A
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	1 year	2024-07-24	2025-07-24
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB 9168	9168-475	RF-0462	1 year	2025-05-26	2026-05-26

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
5dB Attenuator	Pasternack	PE7047-5	-	RF-0731	1 year	2025-05-30	2026-05-30
Low Noise Preamplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	1 year	2024-12-24	2025-12-24
Band Pass Filter	Microwave Factory	MBP301	224969	RF-1015	1 year	2025-03-14	2026-03-14
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120 D	9120D-2280	RF-0845	1 year	2025-03-07	2026-03-07
MMW PreAmp 0-50GHz	NEXTEM	RFA-1050000-40	RFA-1905-01	RF-1140	1 year	2024-12-03	2025-12-03
Horn Antenna, 1-18GHz	Schwarzbeck	BBHA9120 D	9120D-2280	RF-0845	1 year	2025-03-07	2026-03-07
Band Reject Filter, 1-8GHz	Nitsuki	NF-49BT	027	RF-0131	1 year	2024-12-03	2025-12-03
Horn Antenna with Preamplifier, 6-18GHz (RX)	Toyo Corporation	HAP06-18W	B1510452 210-123	RF-1095	N/A	N/A	N/A
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	G089	RF-1094	1 year	2024-11-14	2025-11-14
Horn Antenna with Preamplifier, 18-26.5GHz (RX)	Toyo Corporation	HAP18-26W	B2010482 210-125	RF-1096	1 year	2024-11-08	2025-11-08
Band Reject Filter, 2.4-2.5GHz	Micro-Tronics	BRM50702	G488	RF-0933	1 year	2024-09-19	2025-09-19
Constant Voltage Constant Frequency Stabilizers and Power Accessories							
CVCF (10m Chamber)	NF Corporation	ES2000U	9067307	RF-0212	1 year	2025-03-10	2026-03-10
CVCF Booster (10m Chamber)	NF Corporation	ES2000B	9074408	RF-0213	1 year	2025-03-10	2026-03-10
True RMS Multimeter	Fluke	87V	97680445	RF-0281	1 year	2024-12-23	2025-12-23
True RMS Multimeter	Fluke	87V	97680450	RF-0282	1 year	2025-04-08	2026-04-08

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

2.3 Measurement Uncertainty

Table 3: Measurement Uncertainty

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

3. General Product Information

3.1 Product Function and Intended Use

The EUT (**E**quipment **U**nder **T**est) is a golf swing measurement system that measures swing parameters and transfers data to a tablet via BLE.

3.2 Ratings and System Details

Rated voltage and frequency:	DC 3.7V (battery-powered)
Input current:	160mA
Protection class:	III
Test voltage and frequency:	Refer to each test item.
Radio standard:	Bluetooth Low Energy (BLE 1M-PHY, BLE 2M-PHY)
Peak conducted power::	-1.07dBm BLE 1M-PHY -1.06dBm BLE 2M-PHY
Frequency range:	2402 - 2480MHz
Antenna gain:	+1.6dBi
Antenna type:	PCB antenna (Chip antenna)
Antenna mounting type:	Internal
Modulation type:	GFSK
Transmit speed:	1Mbps BLE 1M-PHY 2Mbps BLE 2M-PHY
Number of channels:	40
Channel spacing:	2MHz
FCC classification:	DTS
ISED classification:	Bluetooth Device (DTS)
Simultaneous Tx:	Not implemented

Condition of EUT for Radiated Spurious Testing of Radio:
Engineering prototype (Serial No.: 54) (*)

Condition of EUT for Conducted Testing of Radio:
Engineering prototype (Serial No.: 31) (*)

Note: **(*)** Not for sale, this sample is equivalent to mass-produced items.

3.3 Noise Generating and Noise Suppressing Parts

The highest frequency generated or used by the EUT is 2480MHz for radio portion and 64MHz for digital interface portion.

3.4 Submitted Documents and Information

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 the highest available Duty Cycle.
M. Transmitting at the middle frequency Channel with the highest available Duty Cycle.
H. Transmitting at the highest frequency Channel with the highest available 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 1M-PHY	2402MHz	2442MHz	2480MHz	
BLE 2M-PHY	2402MHz	2442MHz	2480MHz	

Table 5: Setting of Radio Parameters

Radio	Power Setting	Data Rate	Data	Remark
BLE 1M-PHY	0dBm	1 Mbps	PRBS9	
BLE 2M-PHY	0dBm	2 Mbps	PRBS9	

Note: The worst conditions were determined based on the test result of Maximum Peak Output Power in the section 5.4.

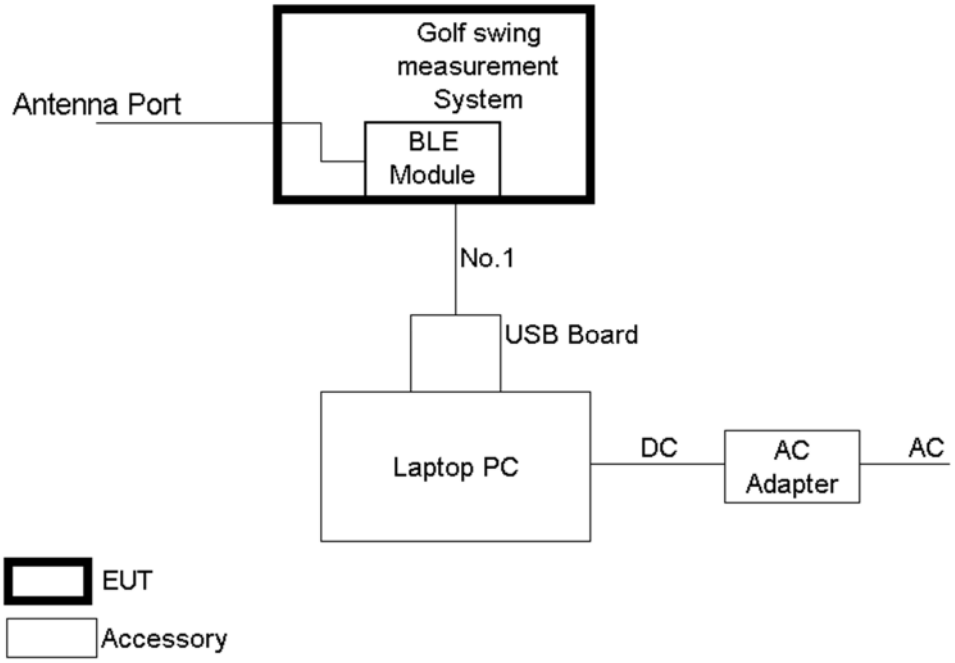
4.3 Physical Configuration for Testing

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

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

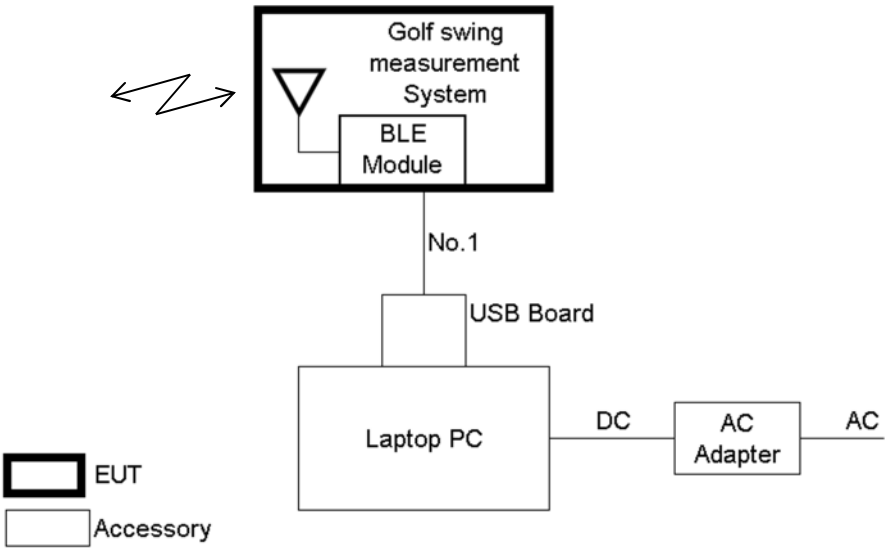
Figure 1: Block Diagram

1) Conducted Radio Testing



Note:
A new battery was used.

2) Radiated Radio Testing



Note:
A new battery was used.

Table 6: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	UART Cable	1.0m, un-shielded	Signal Port

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

4.4 Test Software

Software used for testing: Direct Test Mode version 2.4.2 by Nordic Semiconductor ASA. This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 4.2 as appropriate.

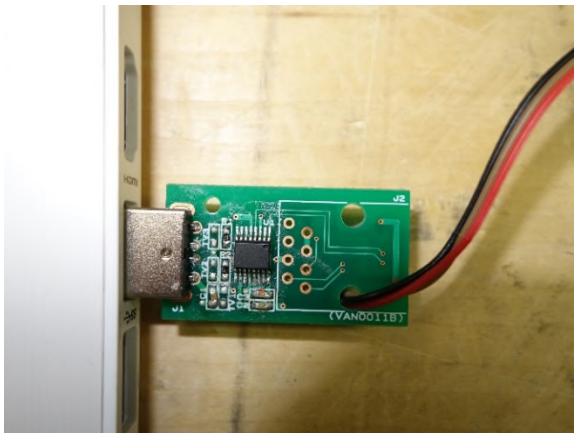
4.5 Special Accessories and Auxiliary Equipment

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

1. Product: PC
   Manufacturer: HP
   Model: 14s-fq0521AU
   Rated Voltage: DC 19.5V
   Input Current: 2.31A
   Protection Class: III
   Serial Number: 5CD235FX32

2. Product: AC Adapter (PC)
   Manufacturer: HP
   Model: TPN-LA15
   Rated Voltage: AC100-240V
   Input Current: 1.1A
   Frequency: 50-60Hz
   Protection Class: I
   Serial Number: WHHRE0A5RGMADQ

3. Product: Evaluation Boards



4.6 Countermeasures to achieve Compliance

No additional measures were employed to achieve compliance.

5. Test Results R A D I O

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 internal voltage regulators to supply the RF circuit. Hence it complies with the supply voltage requirements. A new battery was used.

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.

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 as Bluetooth Low Energy, 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: 2025-06-20

Ambient temperature: 25°C
Relative humidity: 65%
Atmospheric pressure: 1012hPa

Requirements:

FCC §15.247(b)(3) and RSS-247 §6.3.2

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 ISED.

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 a spectrum analyzer using a peak detector. The resolution bandwidth (RBW) was set to 3MHz and the video bandwidth (VBW) were set to 10MHz.

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

The measurement was performed at the each mode, BLE 1M-PHY and BLE 2M-PHY.

Table 7: Maximum Peak Output Power, BLE 1M-PHY

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	-1.45	30	31.45	1.6	0.15	36	35.85
2442	-1.07	30	31.07	1.6	0.53	36	35.47
2480	-1.12	30	31.12	1.6	0.48	36	35.52

Note:
Cable (including temporary RF cable) and attenuator loss has been compensated for Peak Output Power
e.i.r.p. [dBm] = Peak Output Power [dBm] + Antenna Gain [dBi]

Table 8: Maximum Peak Output Power, BLE 2M-PHY

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	-1.46	30	31.46	1.6	0.14	36	35.86
2442	-1.06	30	31.06	1.6	0.54	36	35.46
2480	-1.13	30	31.13	1.6	0.47	36	35.53

Note:
Cable (including temporary RF cable) and attenuator loss has been compensated for Peak Output Power
e.i.r.p. [dBm] = Peak Output Power [dBm] + Antenna Gain [dBi]

5.5 6dB Bandwidth

RESULT: **Pass**

Date of testing: 2025-06-20, 2025-06-30

Ambient temperature: 25, 25°C
Relative humidity: 65, 62%
Atmospheric pressure: 1012, 1010hPa

Requirements:

FCC §15.215(c), §15.247(a)(2) and RSS-247 §6.3.1 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 with max-hold. 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 1M-PHY

Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2402	0.694	>0.5
2442	0.694	>0.5
2480	0.694	>0.5

Figure 2: 6dB Bandwidth, BLE 1M-PHY, Mode L (2402MHz)

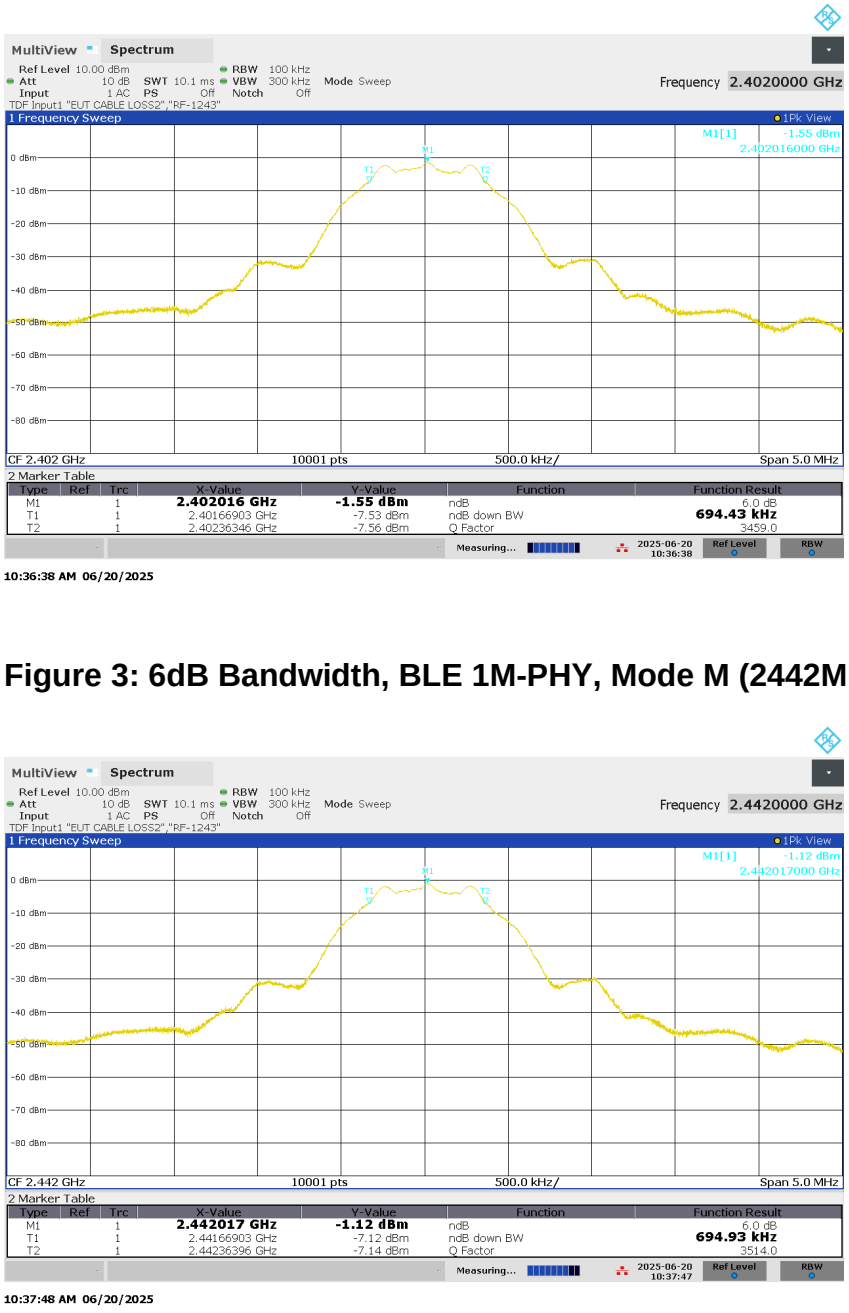


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Figure 3: 6dB Bandwidth, BLE 1M-PHY, Mode M (2442MHz)

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Figure 4: 6dB Bandwidth, BLE 1M-PHY, Mode H (2480MHz)

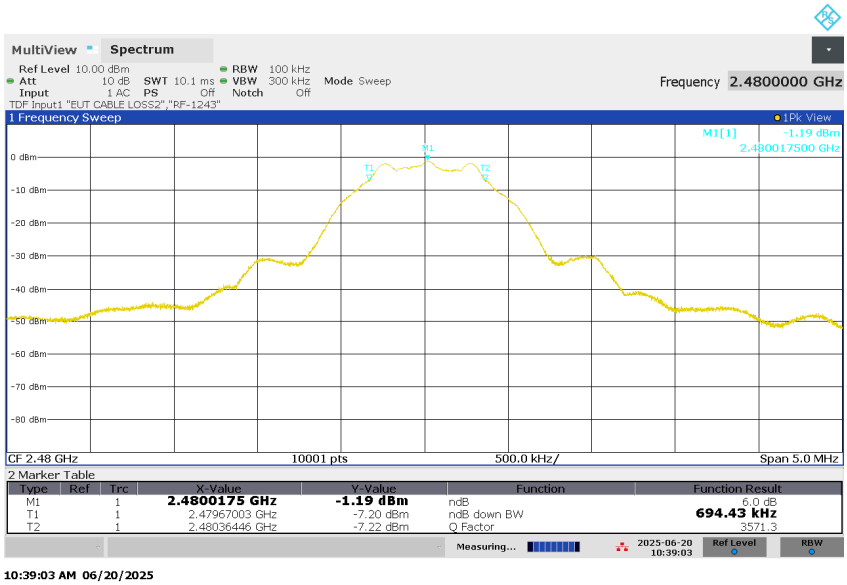

Table 10: 6dB Bandwidth, BLE 2M-PHY

Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2402	1.158	>0.5
2442	1.149	>0.5
2480	1.138	>0.5

Figure 5: 6dB Bandwidth, BLE 2M-PHY, Mode L (2402MHz)

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

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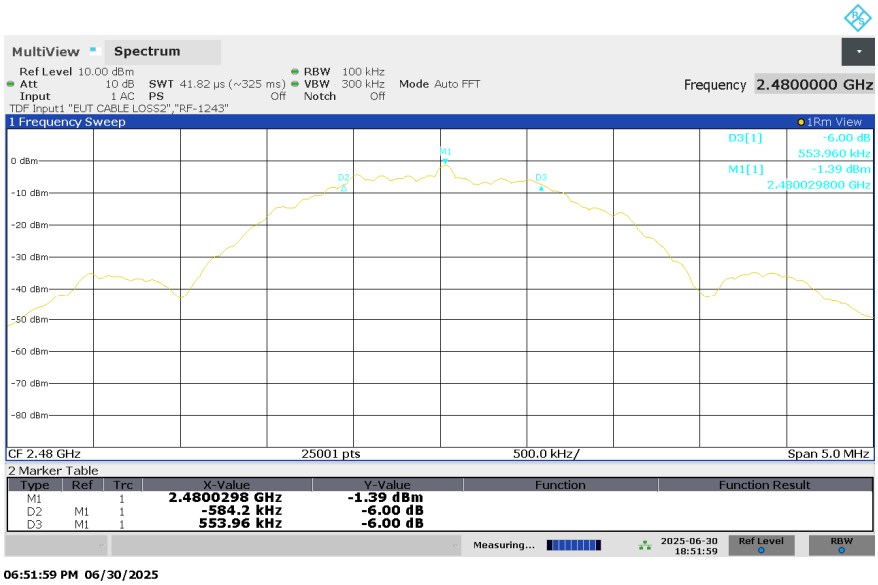
Figure 7: 6dB Bandwidth, BLE 2M-PHY, Mode H (2480MHz)



5.6 99% Bandwidth

RESULT: **For. Ref.**

Date of testing: 2025-06-20

Ambient temperature: 25°C
Relative humidity: 65%
Atmospheric pressure: 1012hPa

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 single sweep 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 1M-PHY

Operating Frequency [MHz]	99% Bandwidth [MHz]	Remarks
2402	1.0499	
2442	1.0540	Widest OBW for 1Mbps
2480	1.0538	

Figure 8: 99% Bandwidth, BLE 1M-PHY, Mode L (2402MHz)

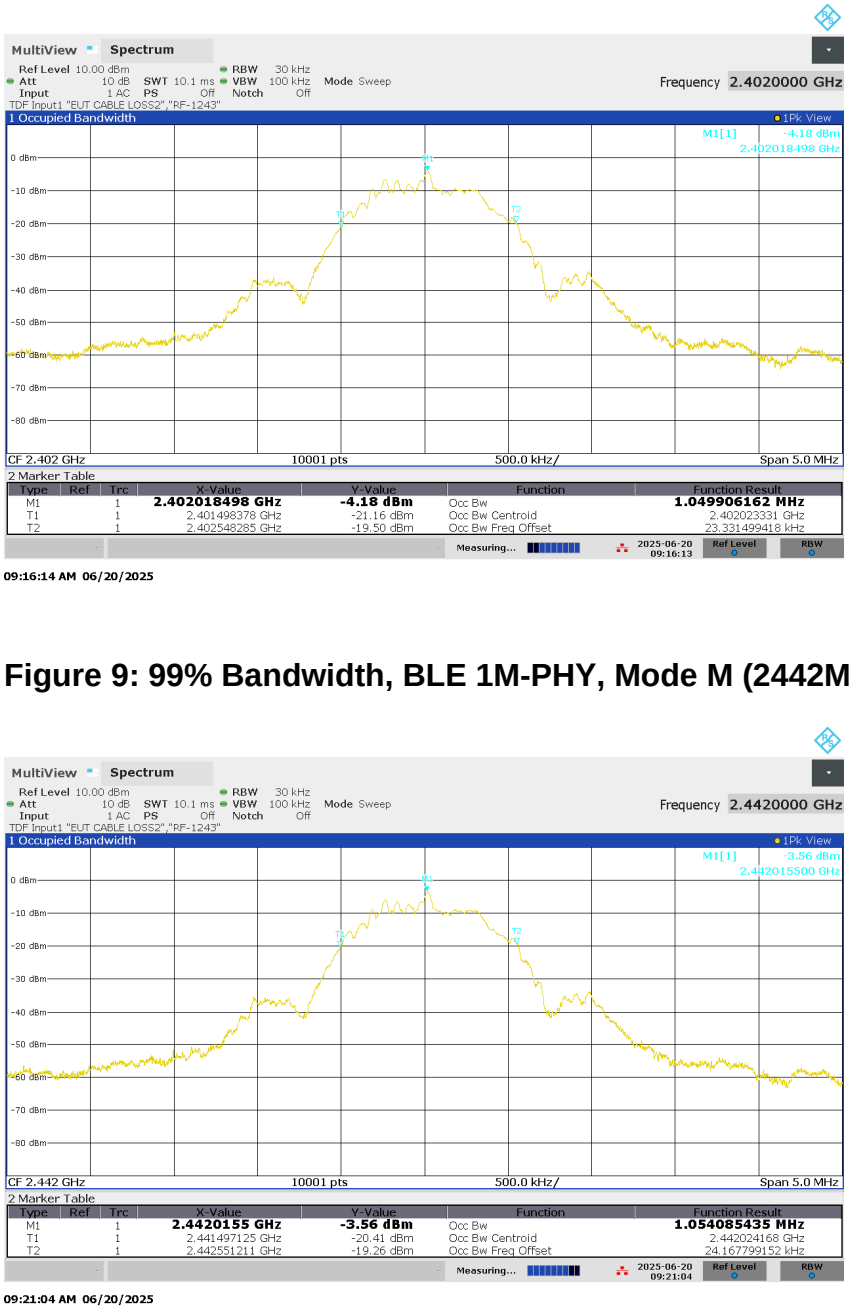


Figure 9: 99% Bandwidth, BLE 1M-PHY, Mode M (2442MHz)

Figure 10: 99% Bandwidth, BLE 1M-PHY, Mode H (2480MHz)

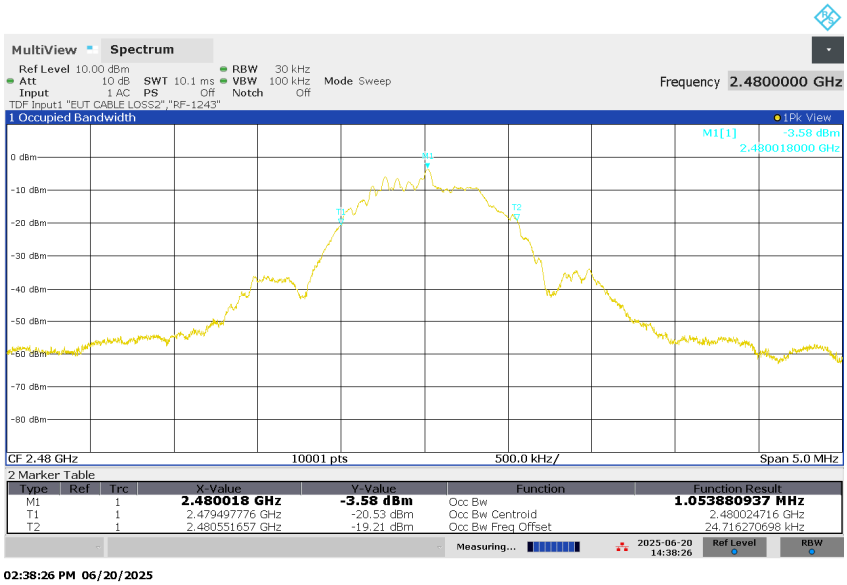


Table 12: 99% Bandwidth, BLE 2M-PHY

Operating Frequency [MHz]	99% Bandwidth [MHz]	Remarks
2402	2.0371	
2442	2.0417	
2480	2.0429	Widest OBW for 2Mbps

Figure 11: 99% Bandwidth, BLE 2M-PHY, Mode L (2402MHz)

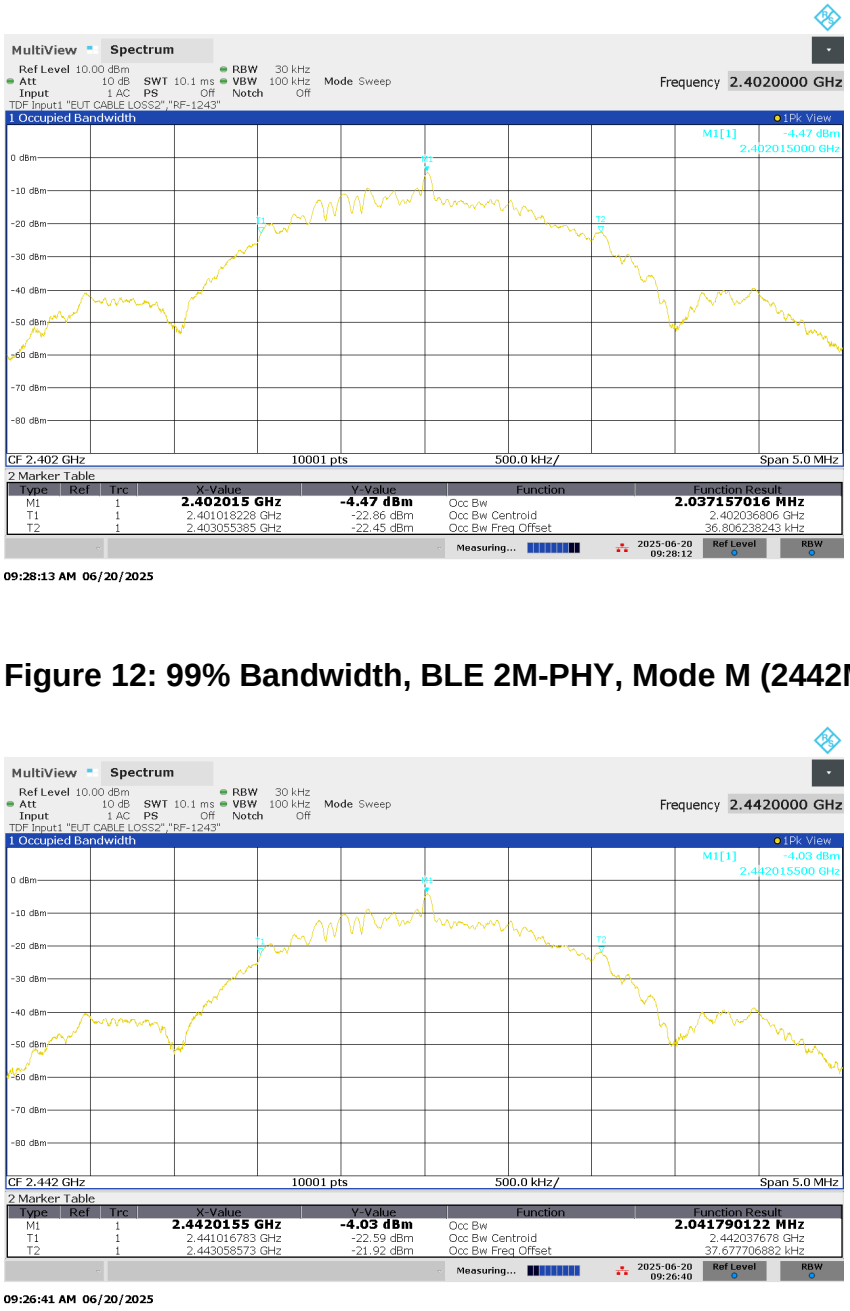
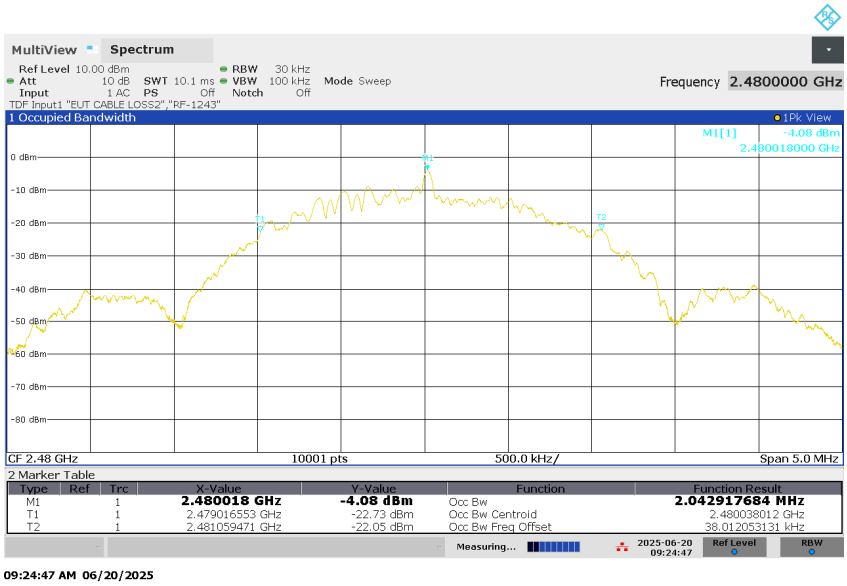


Figure 12: 99% Bandwidth, BLE 2M-PHY, Mode M (2442MHz)

Figure 13: 99% Bandwidth, BLE 2M-PHY, Mode C (2480MHz)



5.7 Conducted Spurious Emissions

RESULT: **Pass**

Date of testing: 2025-06-20

Ambient temperature: 25°C
Relative humidity: 65%
Atmospheric pressure: 1012hPa

Requirements:

FCC §15.247(d) and RSS-247 §6.6

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 (10^{th} 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 1M-PHY, Mode L (2402MHz)

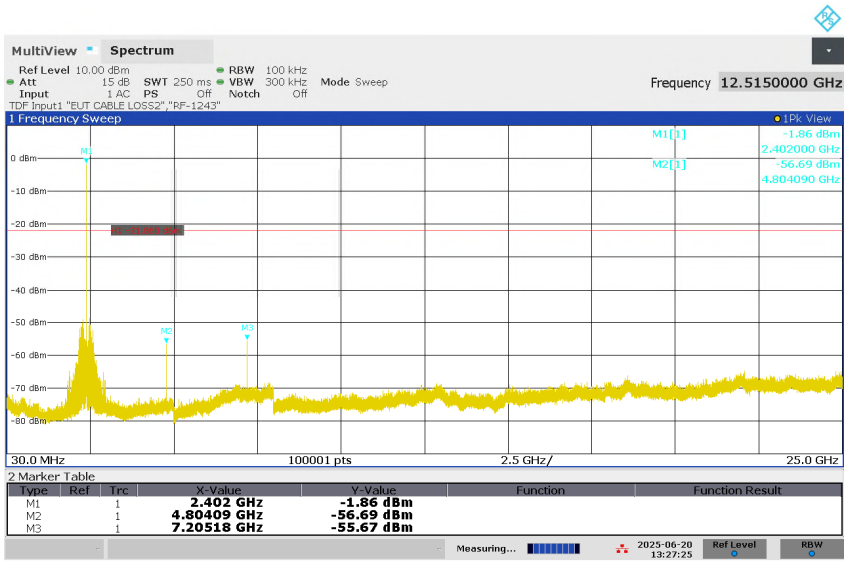


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Figure 15: Conducted Spurious Emissions, 30MHz - 25GHz, BLE 1M-PHY, Mode M (2442MHz)

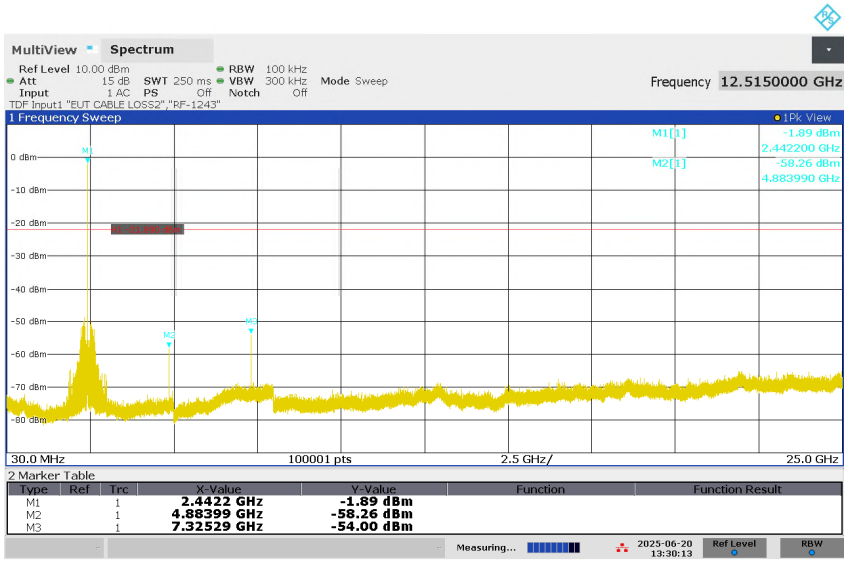

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Figure 16: Conducted Spurious Emissions, 30MHz - 25GHz, BLE 1M-PHY, Mode H (2480MHz)

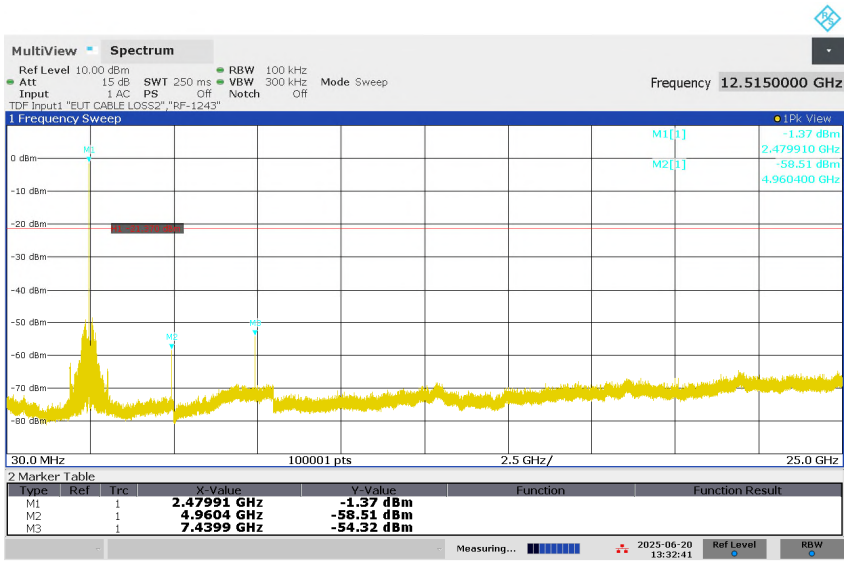

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Figure 17: Authorized-band band-edge, BLE 1M-PHY, Mode L (2402MHz), Horizontal

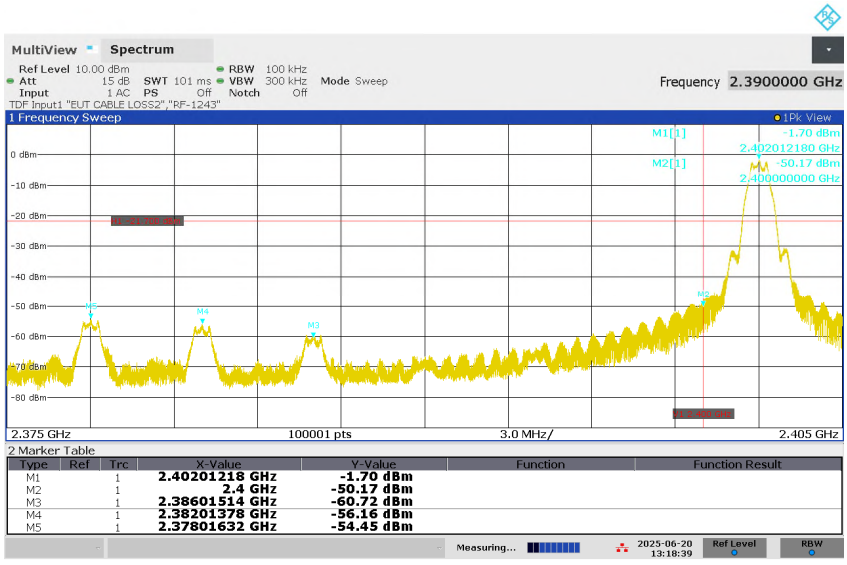

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Figure 18: Authorized-band band-edge, BLE 1M-PHY, Mode H (2480MHz)

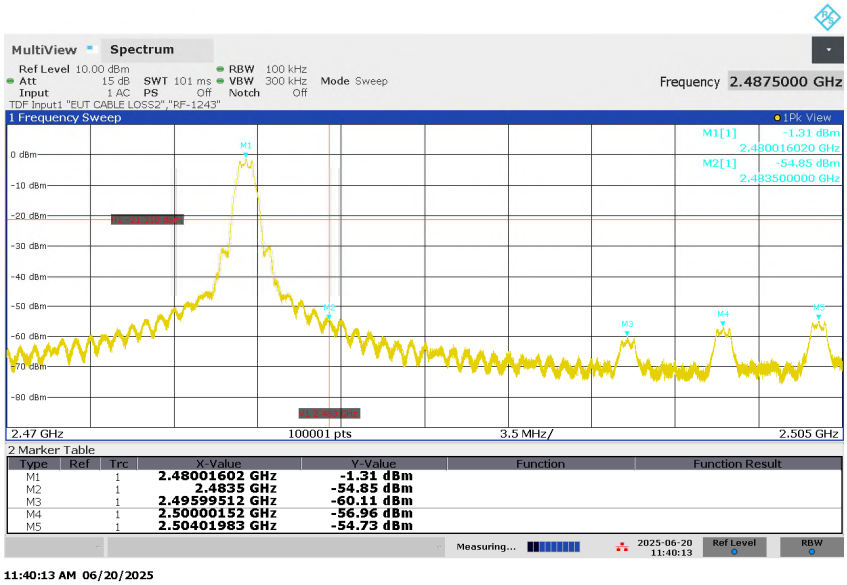

Figure 19: Conducted Spurious Emissions, 30MHz - 25GHz, BLE 2M-PHY, Mode L (2402MHz)

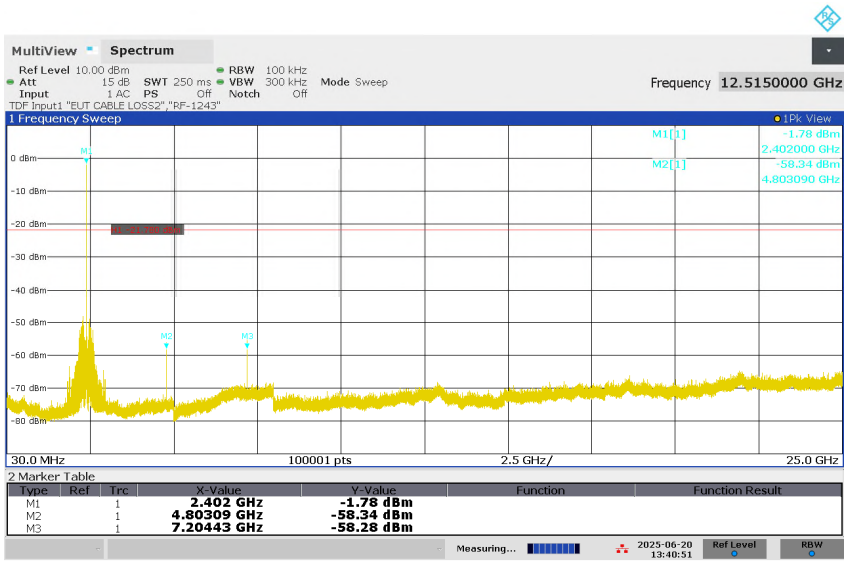

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Figure 20: Conducted Spurious Emissions, 30MHz - 25GHz, BLE 2M-PHY, Mode M (2442MHz)

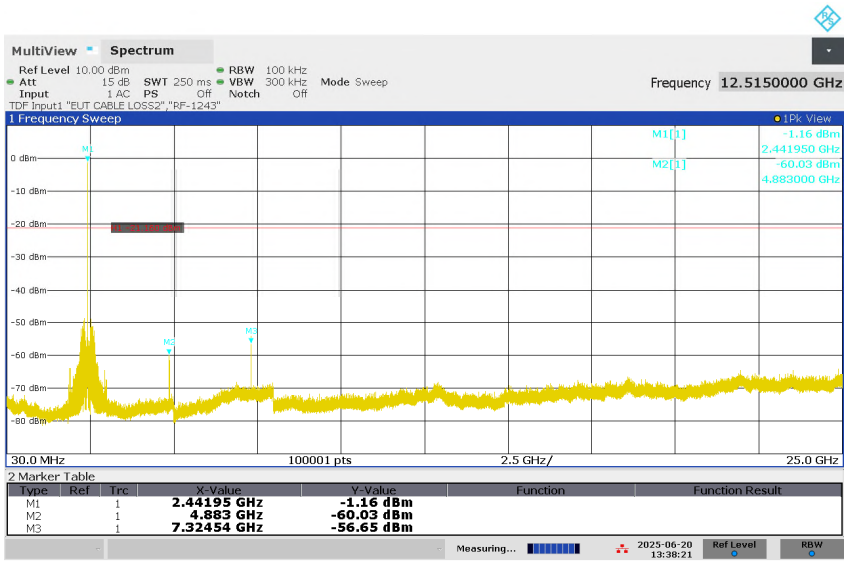

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Figure 21: Conducted Spurious Emissions, 30MHz - 25GHz, BLE 2M-PHY, Mode H (2480MHz)

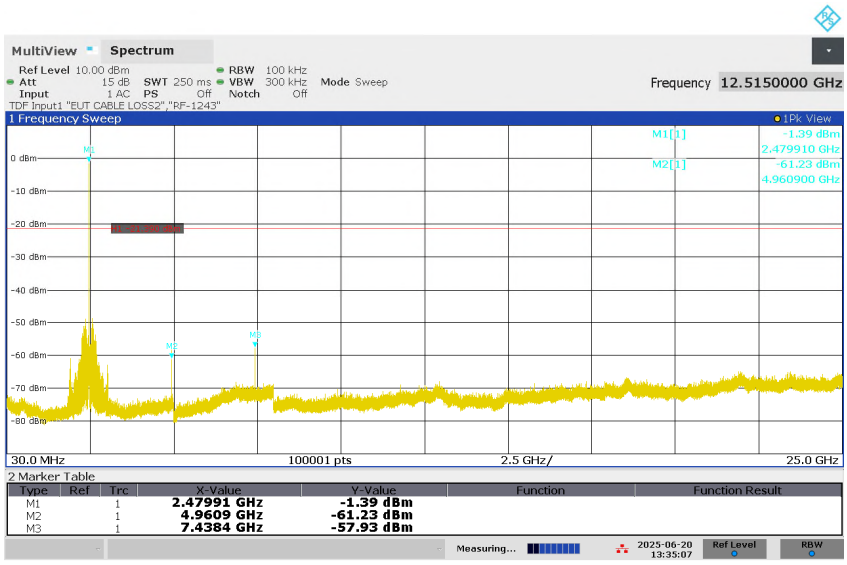

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Figure 22: Authorized-band band-edge, BLE 2M-PHY, Mode L (2402MHz)

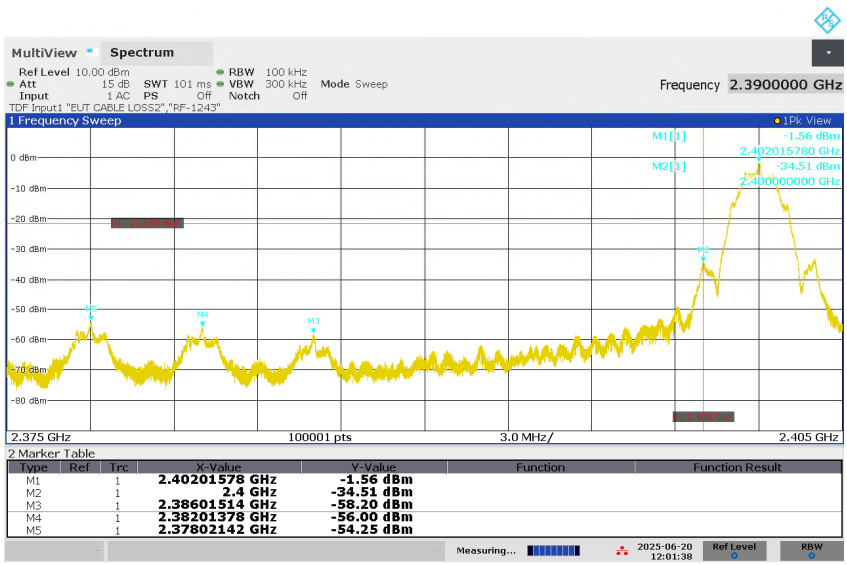

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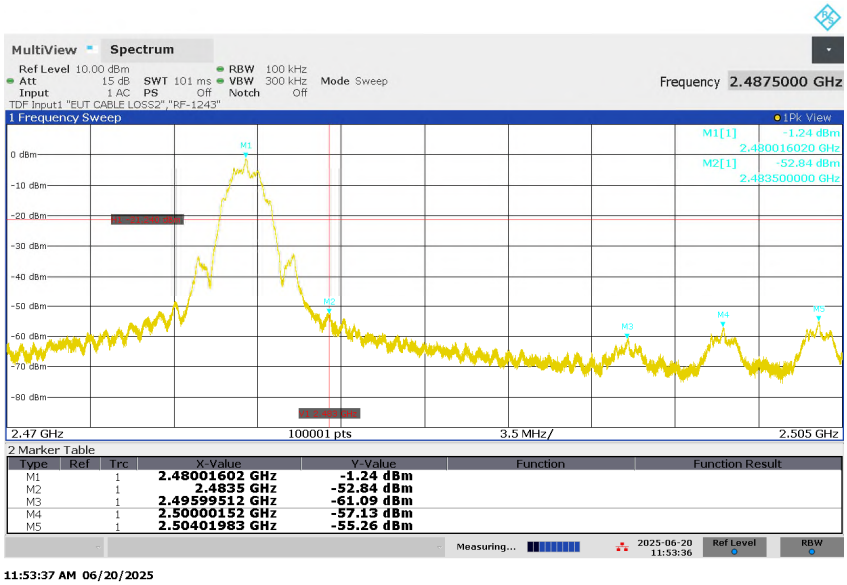
Figure 23: Authorized-band band-edge, BLE 2M-PHY, Mode H (2480MHz)



5.8 Peak Power Spectral Density

RESULT: **Pass**

Date of testing: 2025-06-20

Ambient temperature: 25°C
Relative humidity: 65%
Atmospheric pressure: 1012hPa

Requirements:

FCC §15.247(e) and RSS-247 §6.3.1 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 1M-PHY

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2402	-16.89	8	24.89
2442	-16.32	8	24.32
2480	-16.56	8	24.56

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

Figure 24: Power Spectral Density, BLE 1M-PHY, Mode L (2402MHz)

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

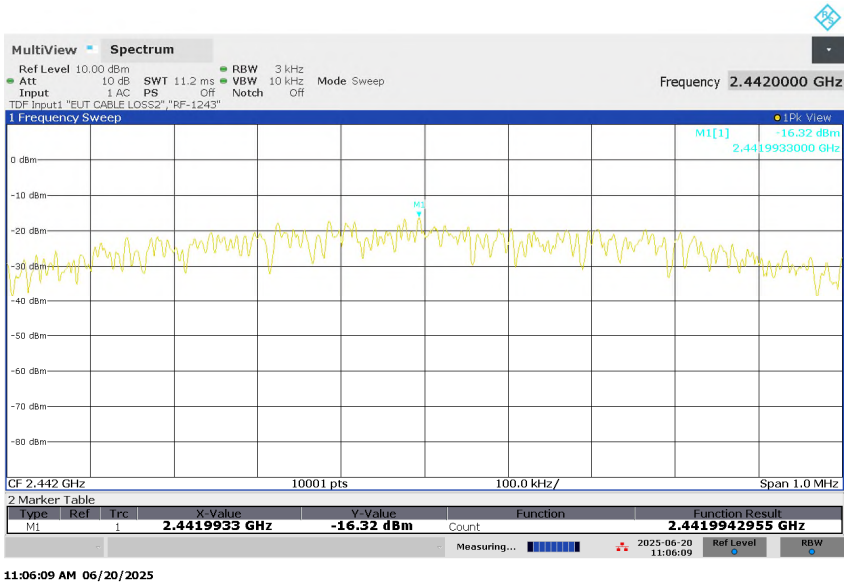


Figure 26: Power Spectral Density, BLE 1M-PHY, Mode H (2480MHz)

Table 14: Peak Power Spectral Density, BLE 2M-PHY

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2402	-19.55	8	27.55
2442	-19.01	8	27.01
2480	-19.11	8	27.11

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

Figure 27: Power Spectral Density, BLE 2M-PHY, Mode L (2402MHz)

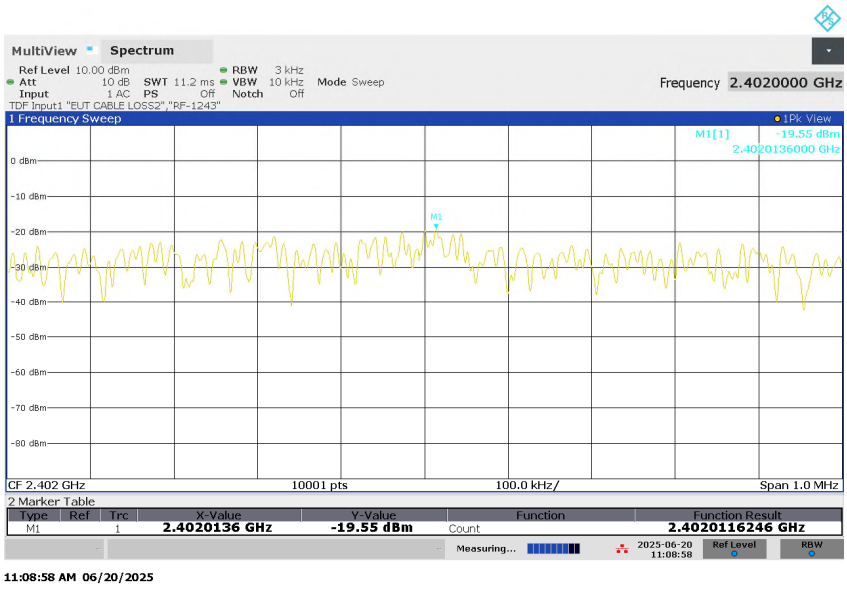


Figure 28: Power Spectral Density, BLE 2M-PHY, Mode M (2442MHz)

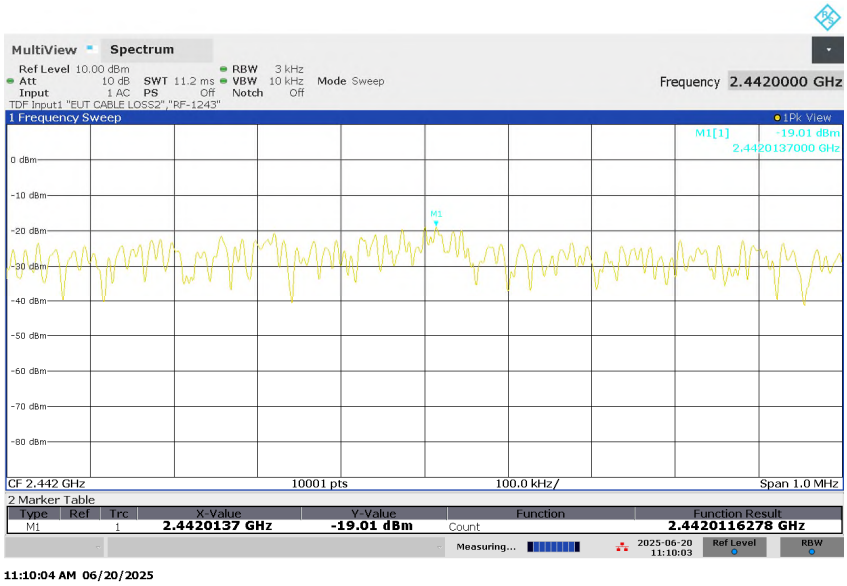


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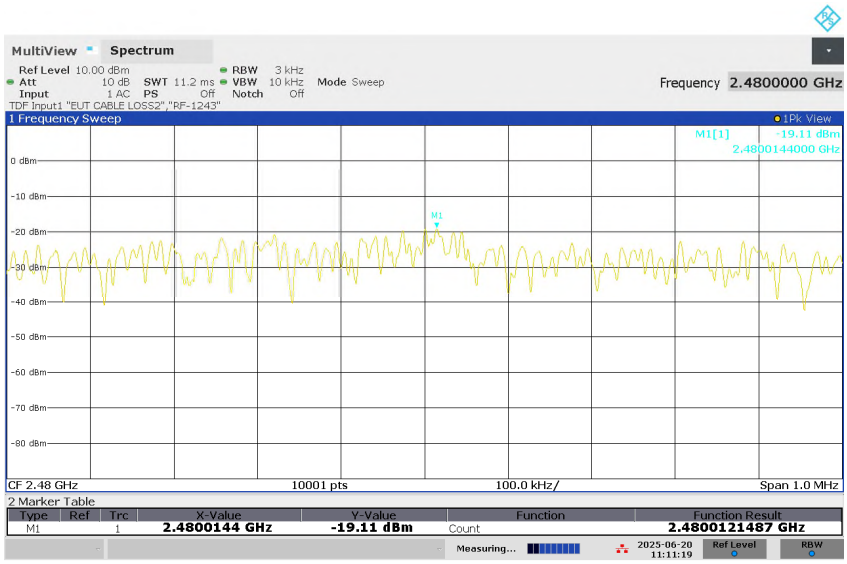
Figure 29: Power Spectral Density, BLE 2M-PHY, Mode H (2480MHz)



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5.9 Duty Cycle

RESULT: **For. Ref.**

Date of testing:	2025-06-20
Ambient temperature:	25°C
Relative humidity:	65%
Atmospheric pressure:	1012hPa

Requirements:

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

Test procedure:

ANSI C63.10-2020 §11.6, §7.5 and KDB 558074 D01**.**

Note:

For Bluetooth Low Energy, average levels were calculated with each peak level using with a Duty Cycle Correction Factor (DCCF) at radiated spurious emission measurements, as per the §7.5 and §11.3 of ANSI C63.10-2020.

DCCF is calculated by the following formula;

$DCCF = 20 \times \mathrm{Log}_{10}$ (Duty Cycle), where Duty Cycle is in dimensionless.

Table 15: Duty Cycle, Bluetooth Low Energy

Radio	Operating Freq. [MHz]	On-Time [us]	Period [us]	Duty Cycle [%]	DCCF [dB]
BLE 1M-PHY	2442	389.99	626.4	62.3	-4.1
BLE 2M-PHY	2442	203.62	627.3	32.4	-9.8

Note: DCCF = 20 x Log_{10} (Duty Cycle)

Figure 30: Duty Cycle, BLE 1M-PHY, Mode M (2442MHz)

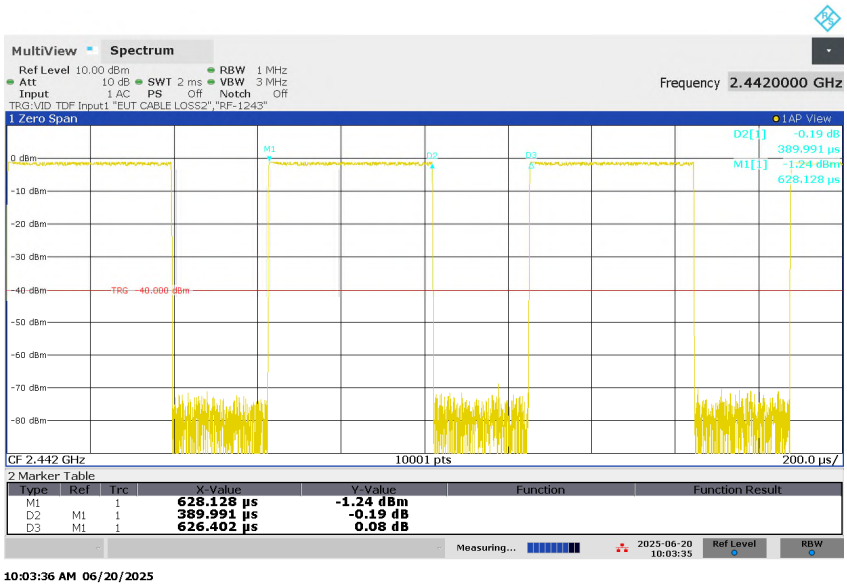

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Figure 31: Duty Cycle, BLE 2M-PHY, Mode M (2442MHz)

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5.10 Radiated Spurious Emissions of Transmitter

RESULT: **Pass**

Date of testing:	2025-06-12, 2025-06-17, 2025-06-18
Ambient temperature:	25, 23, 21°C
Relative humidity:	58, 65, 61%
Atmospheric pressure:	1009, 1003, 1007hPa
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 §6.6, 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 80cm for measurements below 1GHz and 1.5m for measurements above 1GHz. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling 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 in non-restricted frequency bands, 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.

For emissions above 1GHz in restricted frequency bands, Positive peak detector was applied. for peak field strength: RBW = 1MHz & VBW = 3MHz by positive peak detector. Average results were calculated with peak results and compensated by DCCF for frequencies related to the fundamental or its harmonics as per §11.12.5.2.2 ANSI C63.10-2020.

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.

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

Prechecks have been performed in the EUT Orientation X, Y, Z which orientation produces the highest emission level. Final measurement was performed for the worst case orientation only.

Table 16: Radiated Emissions, Quasi Peak Data, 9kHz - 30MHz, BLE 1M-PHY

Freq. [MHz]	EUT / Antenna Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Angle [°]
0.0188	Z/H	12.9	19.6	32.5	122.1	89.6	271
0.2713	Z/H	8.5	19.5	28.0	99.0	71.0	173
1.1149	Z/H	4.6	19.5	24.1	66.7	42.6	312
1.8248	Z/H	4.2	19.5	23.7	69.5	45.8	41
24.2875	Z/H	4.5	20.2	24.7	69.5	44.8	104
0.0188	Z/V	12.8	19.6	32.4	122.1	89.7	156
0.2708	Z/V	8.3	19.5	27.8	99.0	71.2	206
1.0973	Z/V	4.4	19.5	23.9	66.8	42.9	3
1.7987	Z/V	3.9	19.5	23.4	69.5	46.1	166
21.4262	Z/V	4.3	20.0	24.3	69.5	45.2	348

Note: Level QP = Reading QP + Factor
The above is the worst case condition, A margin exceeding 20 dB was observed.

Table 17: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2442MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
148.507	Z/H	36.7	-20.3	16.4	43.5	27.1	108	107
489.283	Z/H	29.2	-13.1	16.1	46.0	29.9	108	116
601.931	Z/H	29.3	-10.4	18.9	46.0	27.1	100	282
999.179	Z/H	29.9	-4.7	25.2	54.0	28.8	108	244
53.569	Z/V	32.1	-21.1	11.0	40.0	29.0	100	216
88.770	Z/V	37.4	-26.3	11.1	43.5	32.4	108	237
148.507	Z/V	33.0	-20.3	12.7	43.5	30.8	119	53
931.403	Z/V	31.0	-6.2	24.8	46.0	21.2	120	359

Note: Level QP = Reading QP + Factor
The above is the worst case condition, A margin exceeding 20 dB was observed.

Table 18: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2402MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2293.947	Z/H	59.9	-14.9	45.0	74.0	29.0	100	5
2510.029	Z/H	62.8	-13.9	48.9	74.0	25.1	146	5
7205.954	Z/H	56.3	0.6	56.9	74.0	17.1	400	100
7205.782	Z/V	55.5	0.6	56.1	74.0	17.9	100	333
14475.830	X/V	47.6	0.7	48.3	74.0	25.7	210	1
14637.860	X/H	45.9	0.6	46.5	74.0	27.5	222	1
17804.790	X/V	43.5	4.9	48.4	74.0	25.6	211	1
17959.561	X/H	43.2	4.8	48.0	74.0	26.0	212	1
21611.205	X/V	47.9	-7.0	40.9	74.0	33.1	401	359
24546.995	X/H	46.4	-5.7	40.7	74.0	33.3	401	1

Note: Level PK = Reading PK + Factor
The above is the worst case condition.

Table 19: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2402MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2293.947	Z/H	48.5	-14.9	33.6	54.0	20.4	100	5
2510.029	Z/H	51.7	-13.9	37.8	54.0	16.2	146	5
14637.860	X/H	32.0	0.6	32.6	54.0	21.4	222	1
17804.790	X/V	29.4	4.9	34.3	54.0	19.7	211	1
17959.561	X/H	29.1	4.8	33.9	54.0	20.1	212	1

Note: Level PK = Reading PK + Factor
The above is the worst case condition. Average results are measured with 10Hz of VBW.

Table 20: Radiated Emissions, Average Data Compensated with DCCF, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2402MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	DCCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7205.954	Z/H	56.3	0.6	-4.1	52.8	54.0	1.2 (*)	400	100
7205.782	Z/V	55.5	0.6	-4.1	52.0	54.0	2.0 (*)	100	333
14475.830	X/V	47.6	0.7	-4.1	44.2	54.0	9.8	210	1
21611.205	X/V	47.9	-7.0	-4.1	36.8	54.0	17.2	401	359
24546.995	X/H	46.4	-5.7	-4.1	36.6	54.0	17.4	401	1

Note: Level AV = Reading PK + Factor + DCCF
The DCCF was only applied to the spurious emissions of the BLE fundamental.

(*) 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 1M-PHY, 2442MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2334.000	Z/H	60.4	-14.8	45.6	74.0	28.4	400	350
2549.970	Z/H	60.8	-13.7	47.1	74.0	26.9	100	359
7325.733	Z/H	54.6	0.6	55.2	74.0	18.8	205	342
7325.869	Z/V	55.9	0.6	56.5	74.0	17.5	100	342
17946.610	Z/H	43.3	4.8	48.1	74.0	25.9	210	359
17998.240	Z/V	43.4	4.8	48.2	74.0	25.8	211	1
22637.685	Z/H	47.0	-6.2	40.8	74.0	33.2	401	359
24968.455	Z/V	46.0	-5.7	40.3	74.0	33.7	401	1

Note: Level PK = Reading PK + Factor

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

Freq. [MHz]	EUT / Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2334.000	Z/H	48.9	-14.8	34.1	54.0	19.9	400	350
2549.970	Z/H	49.7	-13.7	36.0	54.0	18.0	100	359
17946.610	Z/H	29.2	4.8	34.0	54.0	20.0	210	359
17998.240	Z/V	29.0	4.8	33.8	54.0	20.2	211	1
22637.685	Z/H	33.2	-6.2	27.0	54.0	27.0	401	359
24968.455	Z/V	32.1	-5.7	26.4	54.0	27.6	401	1

Note: Level PK = Reading PK + Factor
The above is the worst case condition. Average results are measured with 10Hz of VBW.

Table 23: Radiated Emissions, Average Data Compensated with DCCF, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2442MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	DCCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7325.733	Z/H	54.6	0.6	-4.1	51.1	54.0	2.9 (*)	205	342
7325.869	Z/V	55.9	0.6	-4.1	52.4	54.0	1.6 (*)	100	342

Note: Level AV = Reading PK + Factor + DCCF
The DCCF was only applied to the spurious emissions of the BLE fundamental.

(*) 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 24: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2480MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2391.993	Z/H	61.4	-14.7	46.7	74.0	27.3	103	7
2588.017	Z/H	59.5	-13.5	46.0	74.0	28.0	225	1
7439.984	Z/H	55.9	0.2	56.1	74.0	17.9	103	326
7439.701	Z/V	53.9	0.2	54.1	74.0	19.9	166	337
17334.390	Z/H	44.0	4.2	48.2	74.0	25.8	211	352
17133.660	Z/V	44.7	3.5	48.2	74.0	25.8	100	1
24865.805	Y/V	45.8	-5.6	40.2	74.0	33.8	401	1
24930.770	Y/H	46.5	-5.7	40.8	74.0	33.2	401	1

Note: Level PK = Reading PK + Factor

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

Freq. [MHz]	EUT / Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2391.993	Z/H	51.6	-14.7	36.9	54.0	17.1	103	7
2588.017	Z/H	48.0	-13.5	34.5	54.0	19.5	225	1
17334.390	Z/H	30.1	4.2	34.3	54.0	19.7	211	352
17133.660	Z/V	30.0	3.5	33.5	54.0	20.5	100	1
24865.805	Y/V	31.8	-5.6	26.2	54.0	27.8	401	1
24930.770	Y/H	32.3	-5.7	26.6	54.0	27.4	401	1

Note: Level PK = Reading PK + Factor
The above is the worst case condition. Average results are measured with 10Hz of VBW.

Table 26: Radiated Emissions, Average Data Compensated with DCCF, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 1M-PHY, 2480MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	DCCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7439.984	Z/H	55.9	0.2	-4.1	51.8	54.0	2.0 (*)	103	326
7439.701	Z/V	53.9	0.2	-4.1	49.9	54.0	4.0 (*)	166	337

Note: Level AV = Reading PK + Factor + DCCF
The DCCF was only applied to the spurious emissions of the BLE fundamental.

(*) 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: Restricted-band Band-edge, BLE 1M-PHY

Operating Frequency [MHz]	EUT / 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	Z/H	48.93	60.83	54	74	5.07 (*)	13.17
2402	Z/V	48.89	59.81	54	74	5.11 (*)	14.19
2480	Z/H	49.84	60.49	54	74	4.16 (*)	13.51
2480	Z/V	49.61	59.40	54	74	4.39 (*)	14.60

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 Log_{10}(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 32: Restricted-band Band-edge, Spectral Diagram, BLE 1M-PHY, 2402MHz, Horizontal Antenna Orientation

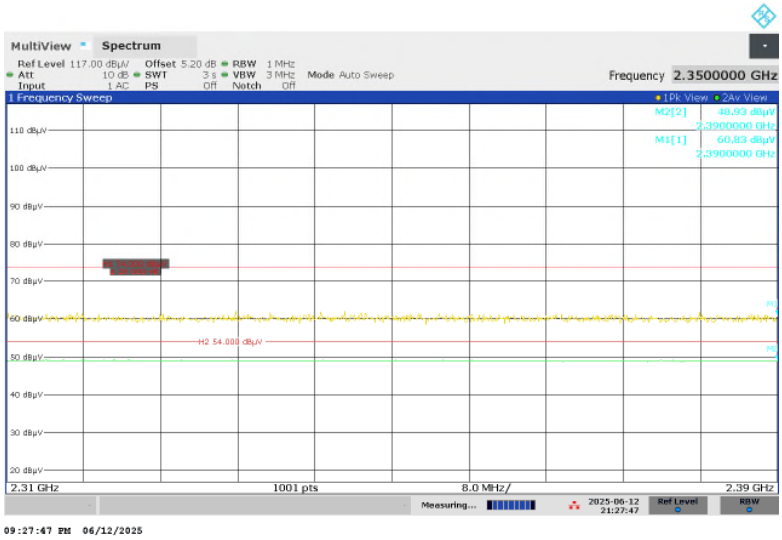


Figure 33: Restricted-band Band-edge, Spectral Diagram, BLE 1M-PHY, 2402MHz, Vertical Antenna Orientation

Figure 34: Restricted-band Band-edge, Spectral Diagram, BLE 1M-PHY, 2480MHz, Horizontal Antenna Orientation

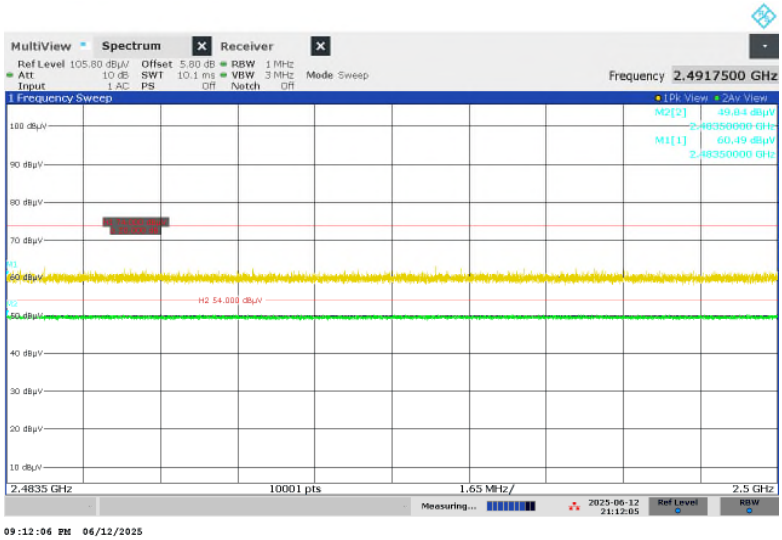


Figure 35: Restricted-band Band-edge, Spectral Diagram, BLE 1M-PHY, 2480MHz, Vertical Antenna Orientation

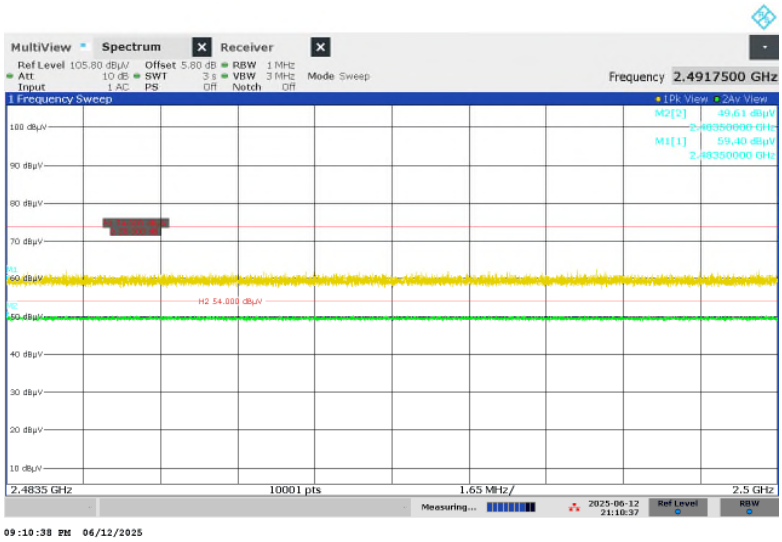


Table 28: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2402MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2319.953	Z/H	60.1	-14.9	45.2	74.0	28.8	400	10
2510.023	Z/H	61.7	-13.9	47.8	74.0	26.2	100	355
4804.563	Z/H	56.2	-7.1	49.1	74.0	24.9	205	67
7204.765	Z/H	54.3	0.6	54.9	74.0	19.1	100	196
4804.220	Z/V	55.9	-7.1	48.8	74.0	25.2	103	7
7205.003	Z/V	56.0	0.6	56.6	74.0	17.4	400	359
17853.090	Z/H	43.3	4.9	48.2	74.0	25.8	211	359
17723.550	Z/V	43.0	5.1	48.1	74.0	25.9	211	101
23338.230	X/H	46.3	-5.9	40.4	74.0	33.6	401	354
24930.745	X/V	46.7	-5.7	41.0	74.0	33.0	188	1

Note: Level PK = Reading PK + Factor

Table 29: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2402MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2319.953	Z/H	45.8	-14.9	30.9	54.0	23.1	400	10
2510.023	Z/H	47.1	-13.9	33.2	54.0	20.8	100	355
17853.090	Z/H	29.2	4.9	34.1	54.0	19.9	211	359
17723.550	Z/V	28.9	5.1	34.0	54.0	20.0	211	101
23338.230	X/H	32.6	-5.9	26.7	54.0	27.3	401	354
24930.745	X/V	32.4	-5.7	26.7	54.0	27.3	188	1

Note: Level PK = Reading PK + Factor
The above is the worst case condition. Average results are measured with 10Hz of VBW.

Table 30: Radiated Emissions, Average Data Compensated with DCCF, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2402MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	DCCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
4804.563	Z/H	56.2	-7.1	-9.8	39.3	24.9	14.7	205	67
7204.765	Z/H	54.3	0.6	-9.8	45.1	19.1	8.9	100	196
4804.220	Z/V	55.9	-7.1	-9.8	39.0	25.2	15.0	103	7
7205.003	Z/V	56.0	0.6	-9.8	46.8	17.4	7.2	400	359

Note: Level AV = Reading PK + Factor + DCCF
The DCCF was only applied to the spurious emissions of the BLE fundamental.

Table 31: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2442MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2529.969	Z/H	60.2	-13.8	46.4	74.0	27.6	145	359
7324.949	Z/H	57.9	0.6	58.5	74.0	15.5	109	208
7324.298	Z/V	54.0	0.6	54.6	74.0	19.4	400	238
17333.790	X/V	43.5	4.2	47.7	74.0	26.3	211	1
17403.010	X/H	43.5	4.5	48.0	74.0	26.0	211	359
24714.620	Y/H	45.9	-5.6	40.3	74.0	33.7	100	1
24930.775	Y/V	46.4	-5.7	40.7	74.0	33.3	401	1

Note: Level PK = Reading PK + Factor

Table 32: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2442MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2529.969	Z/H	46.2	-13.8	32.4	54.0	21.6	145	359
17333.790	X/V	30.0	4.2	34.2	54.0	19.8	211	1
17403.010	X/H	29.4	4.5	33.9	54.0	20.1	211	359
24714.620	Y/H	31.8	-5.6	26.2	54.0	27.8	100	1
24930.775	Y/V	32.3	-5.7	26.6	54.0	27.4	401	1

Note: Level PK = Reading PK + Factor
The above is the worst case condition. Average results are measured with 10Hz of VBW.

Table 33: Radiated Emissions, Average Data Compensated with DCCF, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2442MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	DCCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7324.949	Z/H	57.9	0.6	-9.8	48.7	54.0	5.3	109	208
7324.298	Z/V	54.0	0.6	-9.8	44.8	54.0	9.2	400	238

Note: Level AV = Reading PK + Factor + DCCF
The DCCF was only applied to the spurious emissions of the BLE fundamental.

Table 34: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2480MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2416.040	Z/H	59.4	-14.5	44.9	74.0	29.1	400	1
7441.282	Z/H	53.1	0.2	53.3	74.0	20.7	330	48
7440.558	Z/V	53.5	0.2	53.7	74.0	20.3	400	312
16047.600	Z/H	45.2	2.5	47.7	74.0	26.3	166	1
17946.380	Z/V	43.4	4.8	48.2	74.0	25.8	100	184
22717.850	X/H	47.3	-6.2	41.1	74.0	32.9	401	1
24545.480	X/V	46.6	-5.7	40.9	74.0	33.1	401	289

Note: Level PK = Reading PK + Factor

Table 35: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2480MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2416.040	Z/H	45.5	-14.5	31.0	54.0	23.0	400	1
16047.600	Z/H	31.1	2.5	33.6	54.0	20.4	166	1
17946.380	Z/V	29.2	4.8	34.0	54.0	20.0	100	184
22717.850	X/H	33.1	-6.2	26.9	54.0	27.1	401	1
24545.480	X/V	32.5	-5.7	26.8	54.0	27.2	401	289

Note: Level PK = Reading PK + Factor
The above is the worst case condition. Average results are measured with 10Hz of VBW.

Table 36: Radiated Emissions, Average Data Compensated with DCCF, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, BLE 2M-PHY, 2480MHz

Freq. [MHz]	EUT / Antenna Orient.	Reading PK [dBµV]	Factor [dB(1/m)]	DCCF [dB]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
7441.282	Z/H	53.1	0.2	-9.8	43.5	54.0	10.5	330	48
7440.558	Z/V	53.5	0.2	-9.8	43.9	54.0	10.1	400	312

Note: Level AV = Reading PK + Factor + DCCF
The DCCF was only applied to the spurious emissions of the BLE fundamental.

Table 37: Restricted-band Band-edge, BLE 2M-PHY

Operating Frequency [MHz]	EUT / 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	Z/H	48.99	60.21	54	74	5.01 (*)	13.79
2402	Z/V	49.04	60.41	54	74	5.96 (*)	13.59
2480	Z/H	49.30	60.30	54	74	4.70 (*)	13.70
2480	Z/V	49.36	60.12	54	74	4.64 (*)	13.88

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 Log_{10}(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 36: Restricted-band Band-edge, Spectral Diagram, BLE 2M-PHY, 2402MHz, Horizontal Antenna Orientation

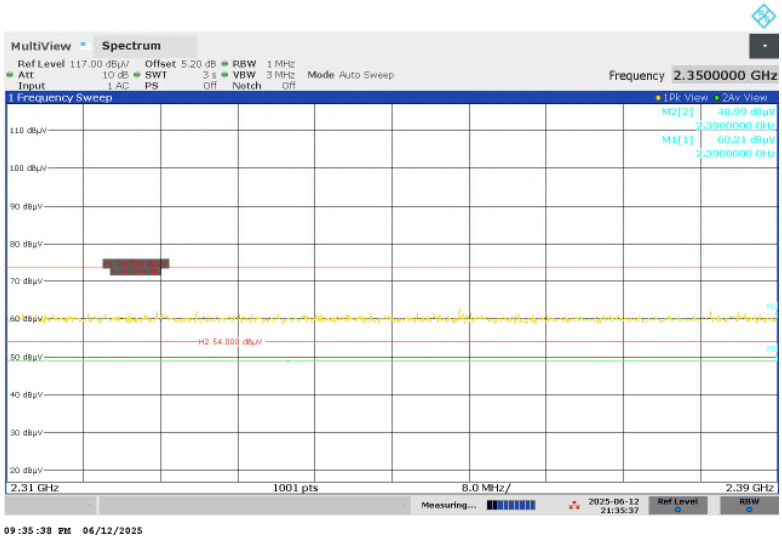


Figure 37: Restricted-band Band-edge, Spectral Diagram, BLE 2M-PHY, 2402MHz, Vertical Antenna Orientation

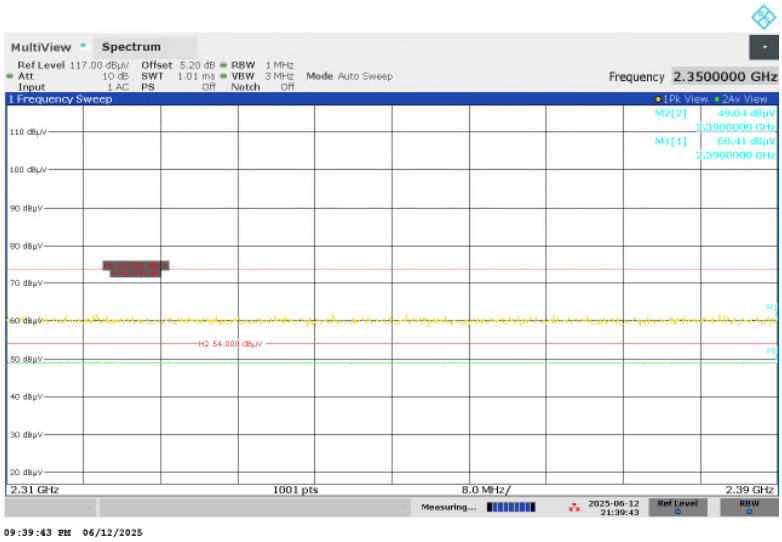


Figure 38: Restricted-band Band-edge, Spectral Diagram, BLE 2M-PHY, 2480MHz, Horizontal Antenna Orientation

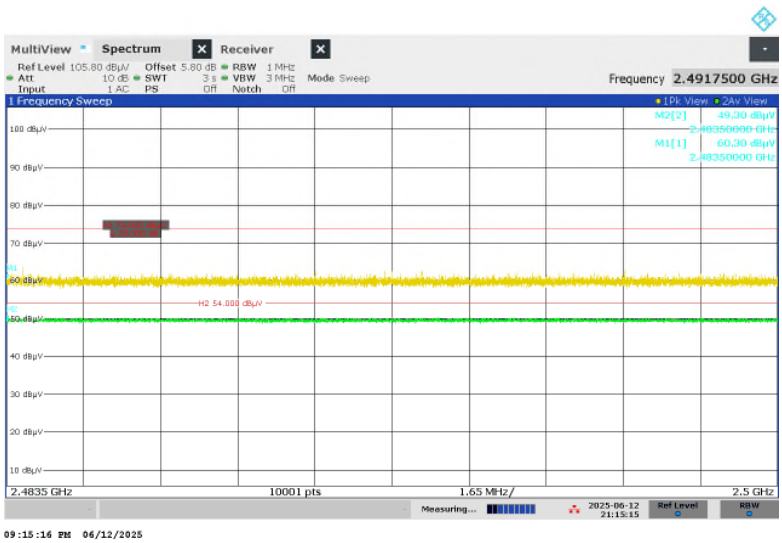
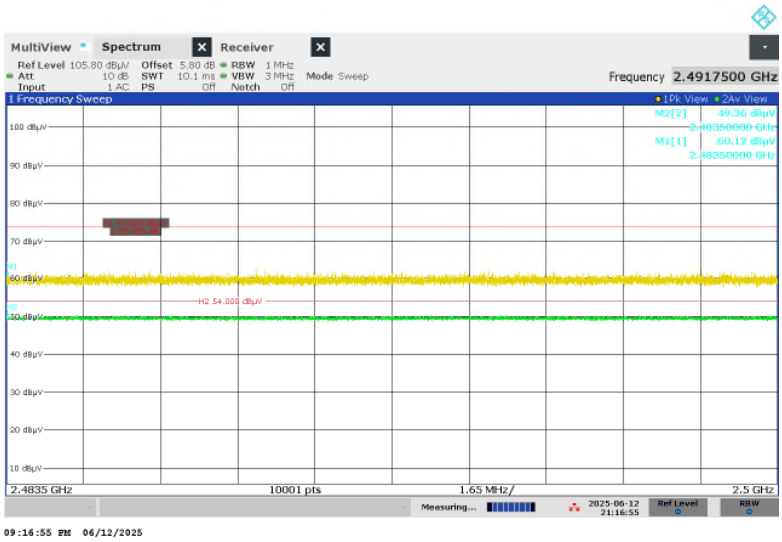


Figure 39: Restricted-band Band-edge, Spectral Diagram, BLE 2M-PHY, 2480MHz, Vertical Antenna Orientation



7. List of Tables

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– End of test report –