

FCC Measurement/Technical Report on

WLAN and Bluetooth Module

JODY-W5

FCC ID: XPYJODYW562
IC: 8595A-JODYW562

Test Report Reference: MDE_UBLOX_2317_FCC_05_rev02

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D-PL-12140-01-00

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Type of Authorization

Certification for an Intentional Radiator (Digital Device / Spread Spectrum).

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15 (10-1-23 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

Part 15, Subpart E – Unlicensed National Information Infrastructure Devices

§ 15.403 Definitions

§ 15.407 General technical requirements

Note:

The tests were selected and performed with reference to the FCC KDB "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02 General U-NII Test Procedures New Rules v02r01, 2017-12-14". and "GUIDELINES FOR COMPLIANCE TESTING OF UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) 5.9 GHz DEVICES UNDER PART 15, SUBPART E, 291074 D02 EMC Measurement v01, 2022-03-03".

ANSI C63.10-2020 is applied.

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for UNII / LE-LAN (e.g. WLAN 5 GHz) equipment from FCC and IC

UNII equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 5 & AMD 1 & AMD 2: 8.8
Occupied bandwidth	§ 15.403 (26 dB) / § 15.407 (e) (6 dB)	RSS-247 Issue 3: 6.2.1.1, 6.2.2.1, 6.2.3.1 (99%) RSS-247 Issue 3: 6.2.4.2 (6 dB) RSS-248 Issue 2: 4.4
Maximum conducted output power	§ 15.407 (a) (1) to (8), (11)	RSS-247 Issue 3: 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.2 RSS-248 Issue 2: 4.5
Maximum power spectral density	§ 15.407 (a) (1) to (8), (12)	RSS-247 Issue 3: 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.1 RSS-248 Issue 2: 4.5
Transmitter undesirable emissions; General Field Strength Limits, Restricted Bands, In-Band Emissions	§ 15.407 (b) § 15.209 (a)	RSS-Gen Issue 5: 6.13/8.9/8.10; RSS-247 Issue 3: 3.3/6.2 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.2 RSS-248 Issue 2: 4.6
Frequency stability	§ 15.407 (g)	RSS-Gen Issue 5: 6.11/8.11
Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)	§ 15.407 (h)	RSS-247 Issue 3: 6.2.2.1, 6.2.3.1, 6.3
Antenna requirement	§ 15.203 / 15.204 § 15.407 (a) (9)	RSS-Gen Issue 5 & AMD 1 & AMD 2: 8.3
Contention Based Protocol	§ 15.407 (d) (6)	RSS-248 Issue 2: 4.7
Receiver spurious emissions	-	-

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407

FCC §15.31, §15.407 (e)

6 dB Bandwidth

The measurement was performed according to ANSI C63.10,
chapter 6.9.2

Final Result

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	Date	FCC	IC
WLAN a, high, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN a, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN a, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 20 MHz, high, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 20 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 40 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 80 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 20 MHz, high, U-NII-4	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 20 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 40 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-12-12	Passed	Passed
WLAN n 20 MHz, high, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 20 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 40 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407

FCC §15.31, IC RSS 247 Ch. 6.2.x

99 % Bandwidth

The measurement was performed according to ANSI C63.10,
chapter 12.4.2 (6.9.3)

Final Result

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	Date	FCC	IC
WLAN a, high, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN a, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN a, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ac 20 MHz, high, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ac 20 MHz, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ac 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ac 40 MHz, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ac 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed

47 CFR CHAPTER I FCC PART 15
Subpart E §15.407

FCC §15.31, IC RSS 247 Ch. 6.2.x

99 % Bandwidth

The measurement was performed according to ANSI C63.10,
chapter 12.4.2 (6.9.3)

Final Result

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	Date	FCC	IC
WLAN ac 80 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ax 20 MHz, high, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ax 20 MHz, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ax 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ax 40 MHz, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ax 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN n 20 MHz, high, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN n 20 MHz, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN n 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN n 40 MHz, low, U-NII-4	S01_AD02	2025-04-02	N/A	Performed
WLAN n 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2025-04-02	N/A	Performed

47 CFR CHAPTER I FCC PART 15
Subpart E §15.407

FCC §15.31, §15.407 (a)(1)

Maximum Conducted Output Power

The measurement was performed according to ANSI C63.10,
chapter 12.3.3.2

Final Result

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	Date	FCC	IC
WLAN a, high, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN a, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN a, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 20 MHz, high, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 20 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 40 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ac 80 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 20 MHz, high, U-NII-4	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 20 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 40 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 40 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-12-12	Passed	Passed
WLAN n 20 MHz, high, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 20 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 20 MHz, straddle, U-NII-3 + U-NII-4	S01_AD02	2024-08-15	Passed	Passed
WLAN n 40 MHz, low, U-NII-4	S01_AD02	2024-08-15	Passed	Passed

47 CFR CHAPTER I FCC PART 15
FCC §15.31, §15.407 (a)(1)
Subpart E §15.407

Maximum Conducted Output Power

The measurement was performed according to ANSI C63.10,
chapter 12.3.3.2

Final Result
OP-Mode

Radio Technology, Operating Frequency,
Subband

Setup
Date
FCC
IC

WLAN n 40 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-08-15

Passed

Passed

47 CFR CHAPTER I FCC PART 15
FCC §15.31, §15.407 (a) (1),(5)
Subpart E §15.407

Peak Power Spectral Density

The measurement was performed according to ANSI C63.10,
chapter 12.5 (SA-3)

Final Result
OP-Mode

Radio Technology, Operating Frequency,
Subband

Setup
Date
FCC
IC

WLAN a, high, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN a, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN a, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ac 20 MHz, high, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN ac 20 MHz, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN ac 20 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ac 40 MHz, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN ac 40 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ac 80 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ax 20 MHz, high, U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ax 20 MHz, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN ax 20 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ax 40 MHz, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN ax 40 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN n 20 MHz, high, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN n 20 MHz, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN n 20 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

WLAN n 40 MHz, low, U-NII-4

S01_AD02

2024-08-15

Passed

Passed

WLAN n 40 MHz, straddle, U-NII-3 + U-NII-4

S01_AD02

2024-12-12

Passed

Passed

**47 CFR CHAPTER I FCC PART 15 Subpart E
§15.407**
**FCC §15.407 (b), (1),(2),(3),(4);
FCC §15.205, §15.209, §15.407 (b)
(5),(6)**

Undesirable Emissions; General Field Strength Limits

The measurement was performed according to ANSI C63.10, chapter
6.4, 6.5, 6.6.5

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Measurement range, Subband				
WLAN a, high, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-4 Remark: Radiated Measurement	S02_AC02	2024-11-05	Passed	Passed
WLAN a, high, 26GHz - 40GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, high, 30MHz - 1GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, high, 30MHz - 1GHz, U-NII-4 Remark: Radiated Measurement	S02_AC02	2024-11-12	Passed	Passed
WLAN a, high, 9kHz - 30MHz, U-NII-4 Remark: Radiated Measurement	S02_AC02	2024-11-07	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, low, 26GHz - 40GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, low, 30MHz - 1GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, straddle, 1GHz - 26GHz, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, straddle, 26GHz - 40GHz, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN a, straddle, 30MHz - 1GHz, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ac 20 MHz, high, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ac 20 MHz, low, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ac 20 MHz, straddle, 1GHz - 26GHz, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ac 40 MHz, low, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ac 40 MHz, straddle, 1GHz - 26GHz, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ac 80 MHz, straddle, 1GHz - 26GHz, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ax 20 MHz, high, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed
WLAN ax 20 MHz, high, 1GHz - 26GHz, U-NII-4 Remark: Radiated Measurement Harmonics only	S02_AC02	2024-11-05	Passed	Passed
WLAN ax 20 MHz, high, 30MHz - 1GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-05	Passed	Passed
WLAN ax 20 MHz, low, 1GHz - 26GHz, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-11-06	Passed	Passed

**47 CFR CHAPTER I FCC PART 15 Subpart E
§15.407**
**FCC §15.407 (b), (1),(2),(3),(4);
FCC §15.205, §15.209, §15.407 (b)
(5),(6)**

Undesirable Emissions; General Field Strength Limits

 The measurement was performed according to ANSI C63.10, chapter
6.4, 6.5, 6.6.5

Final Result
OP-Mode

 Radio Technology, Operating Frequency, Measurement
range, Subband

Setup
Date
FCC
IC

 WLAN ax 20 MHz, low, 30MHz - 1GHz, U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-05

Passed

Passed

 WLAN ax 20 MHz, straddle, 1GHz - 26GHz, U-NII-3 +
U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN ax 20 MHz, straddle, 30MHz - 1GHz, U-NII-3 +
U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-05

Passed

Passed

 WLAN ax 40 MHz, low, 1GHz - 26GHz, U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN ax 40 MHz, low, 1GHz - 26GHz, U-NII-4
Remark: Radiated Measurement Harmonics only

S02_AC02

2024-11-05

Passed

Passed

 WLAN ax 40 MHz, straddle, 1GHz - 26GHz, U-NII-3 +
U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN ax 80 MHz, straddle, 1GHz - 26GHz, U-NII-3 +
U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN n 20 MHz, low, 1GHz - 26GHz, U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN n 20 MHz, straddle, 1GHz - 26GHz, U-NII-3 +
U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN n 40 MHz, low, 1GHz - 26GHz, U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

 WLAN n 40 MHz, straddle, 1GHz - 26GHz, U-NII-3 +
U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-11-06

Passed

Passed

**47 CFR CHAPTER I FCC PART 15
Subpart E §15.407**
FCC §15.407 (b), (1),(2),(3),(4)

Band Edge

 The measurement was performed according to ANSI C63.10, chapter
6.6.5

Final Result
OP-Mode

 Radio Technology, Operating Frequency,
Subband

Setup
Date
FCC
IC

 WLAN a, straddle, U-NII-3 + U-NII-4
Remark: Conducted Measurement

S01_AD02

2025-03-24

Passed

Passed

 WLAN a, high, U-NII-4
Remark: Conducted Measurement

S01_AD02

2024-12-12

Passed

Passed

 WLAN a, high, U-NII-4
Remark: Radiated Measurement

S02_AC02

2024-12-13

Passed

Passed

47 CFR CHAPTER I FCC PART 15
Subpart E §15.407
FCC §15.407 (b), (1),(2),(3),(4)

Band Edge

The measurement was performed according to ANSI C63.10, chapter 6.6.5 **Final Result**

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Subband				
WLAN ac 20 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2025-03-24	Passed	Passed
WLAN ac 20 MHz, high, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-12-12	Passed	Passed
WLAN ac 40 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2025-03-24	Passed	Passed
WLAN ac 40 MHz, low, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-12-12	Passed	Passed
WLAN ac 80 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement, low BE	S01_AD02	2025-03-24	Passed	Passed
WLAN ac 80 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement, high BE	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 20 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2025-03-24	Passed	Passed
WLAN ax 20 MHz, high, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 20 MHz, high, U-NII-4 Remark: Radiated Measurement	S02_AC02	2024-12-13	Passed	Passed
WLAN ax 40 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2025-03-24	Passed	Passed
WLAN ax 40 MHz, low, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 40 MHz, low, U-NII-4 Remark: Radiated Measurement	S02_AC02	2024-12-13	Passed	Passed
WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement, low BE	S01_AD02	2025-03-24	Passed	Passed
WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement, high BE	S01_AD02	2024-12-12	Passed	Passed
WLAN ax 80 MHz, straddle, U-NII-3 + U-NII-4 Remark: Radiated Measurement	S02_AC02	2024-12-13	Passed	Passed
WLAN n 20 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2025-03-24	Passed	Passed
WLAN n 20 MHz, high, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-12-12	Passed	Passed
WLAN n 40 MHz, straddle, U-NII-3 + U-NII-4 Remark: Conducted Measurement	S01_AD02	2025-03-24	Passed	Passed
WLAN n 40 MHz, low, U-NII-4 Remark: Conducted Measurement	S01_AD02	2024-12-12	Passed	Passed

N/A: Not applicable

N/P: Not performed

2 REVISION HISTORY / SIGNATURES

Report version control			
Version	Release date	Change Description	Version validity
initial	2025-02-06	--	invalid
rev01	2025-04-30	HVIN added, changed 6GHz KDB reference to band 4 KDB reference, replaced 99% BW results, revised various descriptions, Added Band 4 IC limits to power density limit chapter, added lower BE to band edge test case	valid
rev02	2025-08-29	Added description of procedure for worst case data rate determination, removed unit from test power density for band 3.	valid

COMMENT: -



(responsible for accreditation scope)
Dipl.-Ing. Robert Machulec



(responsible for testing and report)
Dipl.-Ing. Daniel Gall



7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

3 ADMINISTRATIVE DATA

3.1 TESTING LABORATORY

Company Name: 7layers GmbH
Address: Borsigstr. 11
40880 Ratingen
Germany

The test facility is accredited by the following accreditation organisation:

Laboratory accreditation no: DAKKS D-PL-12140-01-00
FCC Designation Number: DE0015
FCC Test Firm Registration: 929146
ISED CAB Identifier: DE0007; ISED#: 3699A

Responsible for accreditation scope: Dipl.-Ing. Robert Machulec
Report Template Version: 2024-11-06

3.2 PROJECT DATA

Responsible for testing and report: Dipl.-Ing. Daniel Gall
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2025-08-29
Testing Period: 2024-08-15 to 2025-04-04

3.3 APPLICANT DATA

Company Name: u-blox AG
Address: Zürcherstrasse 68
8800 Thalwil
Switzerland
Contact Person: Filip Kruzela

3.4 MANUFACTURER DATA

Company Name: please see Applicant Data

Address:

Contact Person:

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	WLAN and Bluetooth Module																																																							
Product name	JODY-W5																																																							
Type	JODY-W562-00A (HVIN: M2-JODY-W562)																																																							
Declared EUT data by the supplier																																																								
Voltage Type	DC																																																							
Voltage Level	1.8 V + 3.3 V																																																							
Tested Modulation Type	OFDM																																																							
Specific product description	The EUT is a Bluetooth and WLAN module. It supports SISO Mode only. Supported WLAN modes are a, n, ac and ax with 20 MHz (mode a, n, ac, ax), 40 MHz (mode n, ac, ax) and 80 MHz (mode ac, ax) BW. The U-NII bands 1, 2A, 2C, 3 and 4 are supported.																																																							
Ports of the device	Enclosure Data DC Power Antenna The EUT is a module with solder pads for surface mounting, so no cables were connected to the EUT itself.																																																							
Antenna 1	External / 5.1 dBi (Radiated measurements were performed with 50 Ohm termination at the antenna ports)																																																							
Tested Datarates	WLAN a: 6 Mbit WLAN n: MCS 0 WLAN ac, ax: MCS 0																																																							
Special software used for testing	Labtool on computer board provided by applicant																																																							
Used output power	<table><tr><th colspan="5">5 GHz</th></tr><tr><th>Mode Ch.</th><th>165</th><th>169</th><th>173</th><th>177</th></tr><tr><td>A</td><td>-</td><td>18</td><td>18</td><td>18</td></tr><tr><td>N20 SISO</td><td>-</td><td>18</td><td>18</td><td>18</td></tr><tr><td>N40 SISO</td><td></td><td>18</td><td></td><td>18</td></tr><tr><td>Ac20 SISO</td><td>-</td><td>18</td><td>18</td><td>18</td></tr><tr><td>Ac40 SISO</td><td></td><td>18</td><td></td><td>18</td></tr><tr><td>Ac80 SISO</td><td></td><td></td><td>17</td><td></td></tr><tr><td>Ax20 SISO</td><td>-</td><td>18</td><td>18</td><td>12</td></tr><tr><td>Ax40 SISO</td><td></td><td>18</td><td></td><td>18</td></tr><tr><td>Ax80 SISO</td><td></td><td></td><td>17</td><td></td></tr></table>	5 GHz					Mode Ch.	165	169	173	177	A	-	18	18	18	N20 SISO	-	18	18	18	N40 SISO		18		18	Ac20 SISO	-	18	18	18	Ac40 SISO		18		18	Ac80 SISO			17		Ax20 SISO	-	18	18	12	Ax40 SISO		18		18	Ax80 SISO			17	
5 GHz																																																								
Mode Ch.	165	169	173	177																																																				
A	-	18	18	18																																																				
N20 SISO	-	18	18	18																																																				
N40 SISO		18		18																																																				
Ac20 SISO	-	18	18	18																																																				
Ac40 SISO		18		18																																																				
Ac80 SISO			17																																																					
Ax20 SISO	-	18	18	12																																																				
Ax40 SISO		18		18																																																				
Ax80 SISO			17																																																					

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT ac02	DE1015185ac02	Type JODY-W562-00A on M.2 KEY-E board
Sample Parameter	Value	
Serial No.	BU520BA36D796200200	
HW Version	3	
SW Version	v2.0.0.31-18.99.2.p66.20	
Comment		

Sample Name	Sample Code	Description
EUT ad02	DE1015185ad02	Type JODY-W562-00A on M.2 KEY-E board
Sample Parameter	Value	
Serial No.	BU520BA36D798100200	
HW Version	3	
SW Version	v2.0.0.31-18.99.2.p66.20	
Comment		

NOTE: The short description is used to simplify the identification of the EUT in this test report.

4.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

-	-	-
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4.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, HW, SW, S/N)	Description
AUX 01	UBLOX, JODY Carrier Board M.2 Adapter, REV. A, -, -	M.2 Adapter board
AUX 04	EDACPOWER ELEC., EA1045CR, -, -, -	AC Adapter
AUX 05	UBLOX, JODY-Carrier Board, Rev. D, -, 10000003369561020001	Jody Carrier Board
AUX 06	UBLOX, JODY-Carrier Board, Rev. D, -, 10000003369561002002	Jody Carrier Board
AUX 08	NXP, i.MX 8M MINI on 8MMINI-BB, REV A2, -, NT19150864	Computer Board

4.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
S01_AD02	EUT ad02, AUX 06, AUX 04, AUX 08, AUX 01,	Conducted Setup
S02_AC02	EUT ac02, AUX 01, AUX 05,	Radiated Setup

4.6 OPERATING MODES / TEST CHANNELS

This chapter describes the operating modes of the EUTs used for testing.

straddle channel	U-NII-Subband 4 5850 - 5895 MHz		Nom. BW
straddle	low	high	20 MHz
169	173	177	Ch.-No.
5845	5865	5885	MHz

straddle	low	high	40 MHz
167	175	-	Ch.-No.
5835	5875	-	MHz
straddle	low	high	80 MHz
171	-	-	Ch.-No.
5855	-	-	MHz

Duty Cycle was reused from the 5 GHz report MDE_UBLOX_2317_FCC_02 since the duty cycle of the tested mode is independent of the used channel.

Procedure for worst case data rate determination:

To determine worst case data rate, Power, Power Density and Band Edge were tested on channel 177 with one power setting at 20 MHz BW

Mode	Data Rate	Power [dBm]	Power Density [dBm/MHz]	Band Edge AV [dBm]
WLAN a	6 Mbps	18.6	7.3	-16.1
WLAN a	9 Mbps	18.5	7.2	-16.3
WLAN a	12 Mbps	18.4	7.1	-16.6
WLAN a	18 Mbps	18.5	7.1	-16.1
WLAN a	24 Mbps	18.5	7.1	-16.3
WLAN a	36 Mbps	18.5	7.0	-16.7
WLAN a	48 Mbps	18.5	7.0	-16.9
WLAN a	54 Mbps	18.5	7.1	-16.2
WLAN n20	MCS 0	18.4	6.8	-11.1
WLAN n20	MCS 1	18.4	6.7	-11.1
WLAN n20	MCS 2	18.4	6.7	-11.1
WLAN n20	MCS 3	18.4	6.7	-11.1
WLAN n20	MCS 4	18.4	6.7	-11.1
WLAN n20	MCS 5	18.4	6.8	-11.1
WLAN n20	MCS 6	18.4	6.8	-11.2
WLAN n20	MCS 7	18.4	6.7	-11.2
WLAN ac20	MCS 0	18.4	6.7	-11.1
WLAN ac20	MCS 1	18.3	6.7	-11.1
WLAN ac20	MCS 2	18.4	6.7	-11.2
WLAN ac20	MCS 3	18.4	6.8	-11.3
WLAN ac20	MCS 4	18.4	6.7	-11.1
WLAN ac20	MCS 5	18.4	6.7	-11.3
WLAN ac20	MCS 6	18.4	6.8	-11.1
WLAN ac20	MCS 7	18.4	6.8	-11.1
WLAN ac20	MCS 8	18.4	6.7	-11.4

For WLAN a 6 Mbps is worst case for all test cases. For WLAN n/ac 20 MHz all modes produce similar results (within +- 0.1 dB), so the lowest was chosen for all test cases.

4.7 PRODUCT LABELLING

4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 6 DB BANDWIDTH

Standard **FCC Part 15 Subpart E**

The test was performed according to:
 ANSI C63.10, chapter 12.5.1

5.1.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

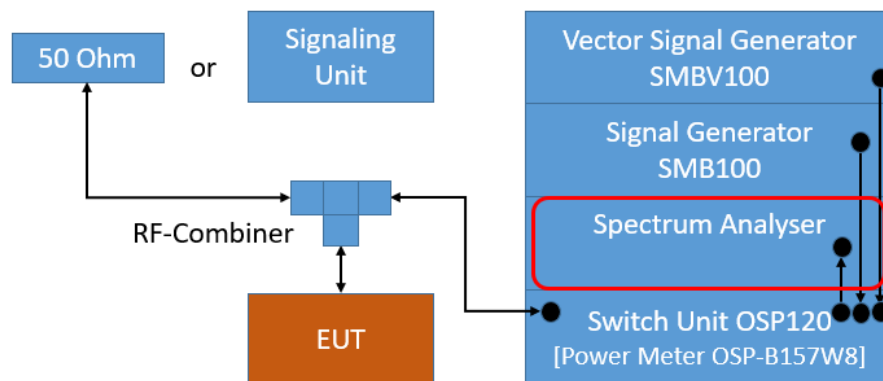
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produce the worst-case (smallest) emission bandwidth.

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Span: 30 / 60 / 120 MHz (for 20 / 40 / 80 MHz nominal bandwidth))
- Trace: Maxhold
- Sweeps: see example plots
- Sweep time: Auto
- Detector: Peak



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5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart E, §15.407 (e)

Within the 5.725-5.850 GHz and 5.850-5.895 GHz bands, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.1.3 TEST PROTOCOL

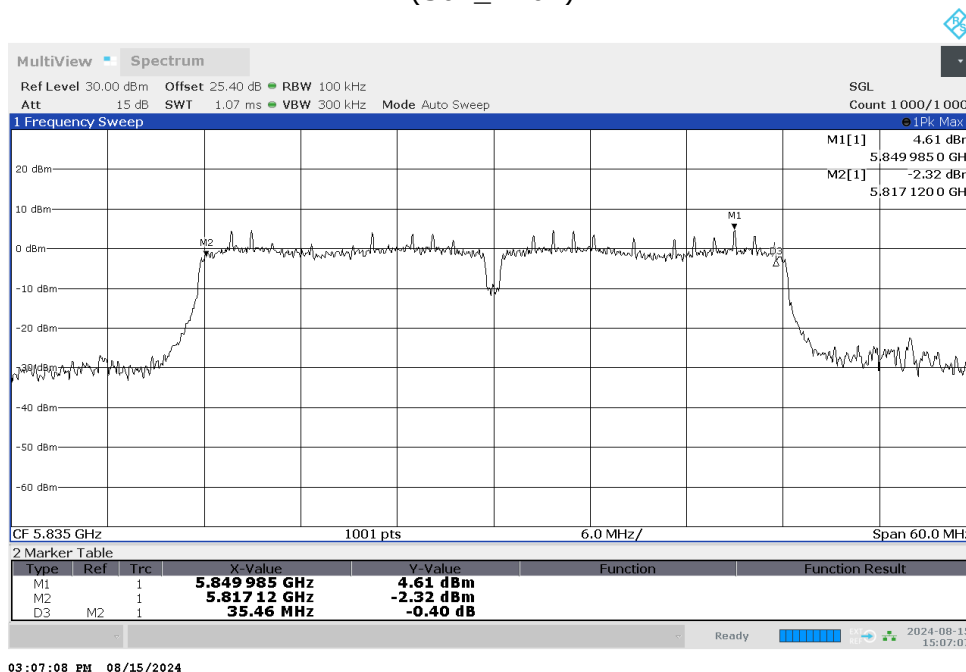
Ambient
 temperature: 23 - 26 °C
 Air Pressure: 1010 - 1024 hPa
 Humidity: 36 - 56 %

Radio Technology	Band	Operating Frequency	6 dB Bandwidth [MHz]	Limit [MHz]	Margin [MHz]
WLAN a	U-NII-3/4	straddle	13.2 / 3.2	0.5	2.70
WLAN a	U-NII-4	low	16.4	0.5	15.91
WLAN a	U-NII-4	high	16.4	0.5	15.91
WLAN n 20 MHz	U-NII-3/4	straddle	13.8 / 3.8	0.5	3.30
WLAN n 20 MHz	U-NII-4	low	17.1	0.5	16.60
WLAN n 20 MHz	U-NII-4	high	17.6	0.5	17.14
WLAN n 40 MHz	U-NII-3/4	straddle	33 / 2.8	0.5	2.30
WLAN n 40 MHz	U-NII-4	low	35.8	0.5	35.32
WLAN ac 20 MHz	U-NII-3/4	straddle	13.9 / 3.8	0.5	3.30
WLAN ac 20 MHz	U-NII-4	low	17.4	0.5	16.87
WLAN ac 20 MHz	U-NII-4	high	17.1	0.5	16.60
WLAN ac 40 MHz	U-NII-3/4	straddle	32.9 / 2.6	0.5	2.10
WLAN ac 40 MHz	U-NII-4	low	35.8	0.5	35.32
WLAN ax 20 MHz	U-NII-3/4	straddle	14.2 / 4.1	0.5	3.60
WLAN ax 20 MHz	U-NII-4	low	18.6	0.5	18.10
WLAN ax 20 MHz	U-NII-4	high	18.7	0.5	18.16
WLAN ax 40 MHz	U-NII-3/4	straddle	33.6 / 3.4	0.5	2.90
WLAN ax 40 MHz	U-NII-4	low	36.7	0.5	36.22
WLAN ax 80 MHz	U-NII-3/4	straddle	34.2 / 44	0.5	43.50

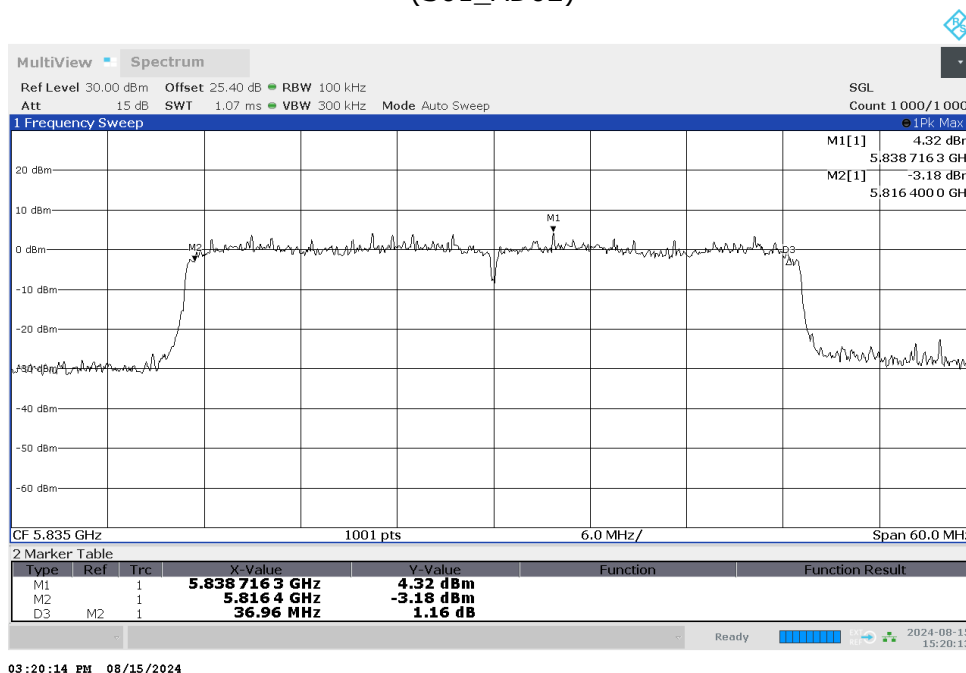
Remark: Please see next sub-clause for the measurement plot.

5.1.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

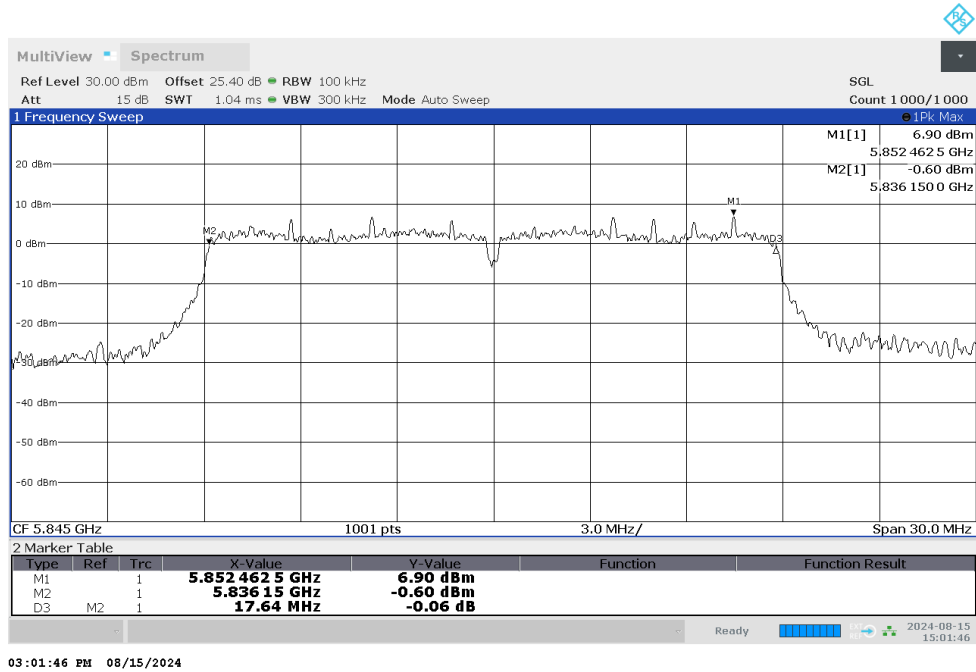
Radio Technology = WLAN ac 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4 (S01_AD02)



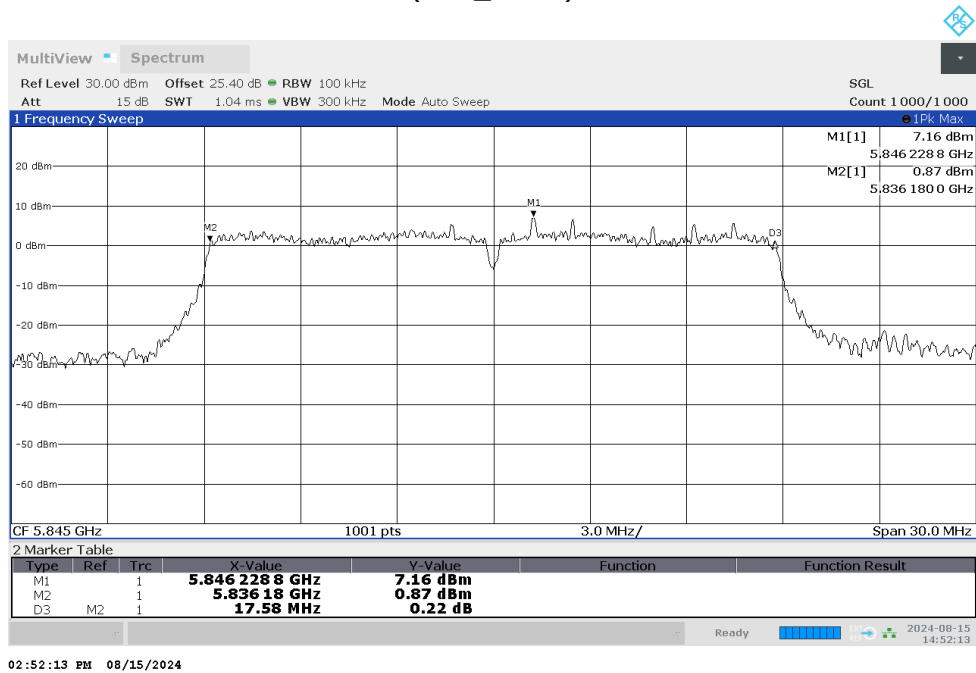
Radio Technology = WLAN ax 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4 (S01_AD02)



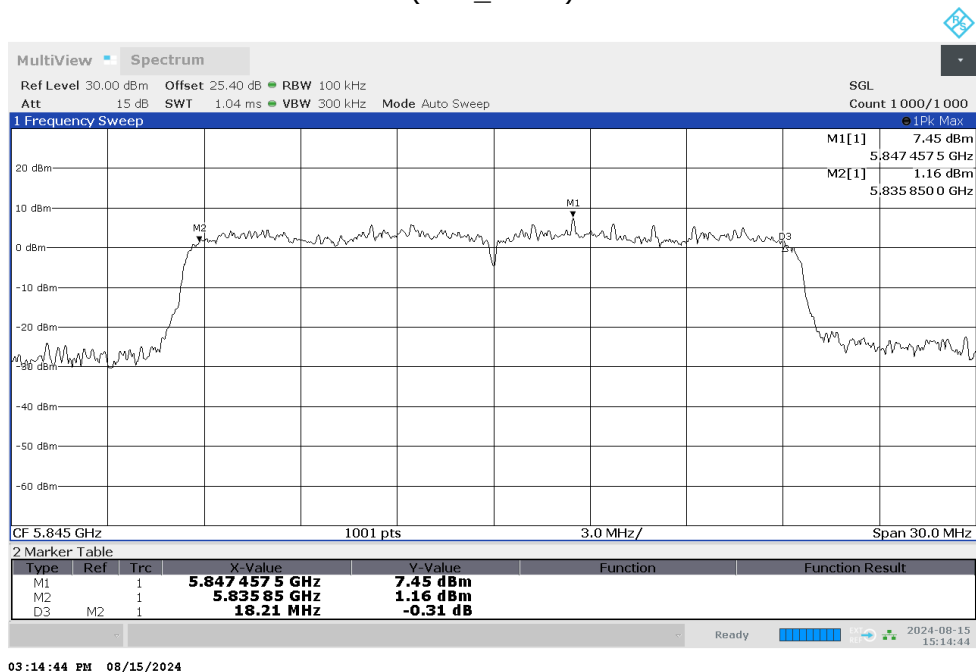
Radio Technology = WLAN ac 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



Radio Technology = WLAN n 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)

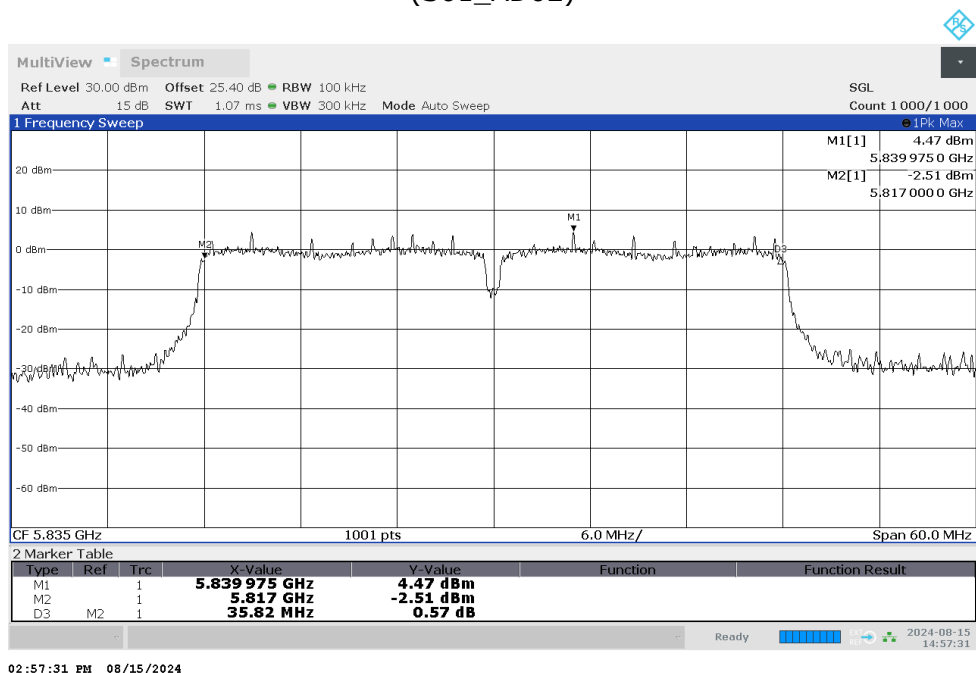


Radio Technology = WLAN ax 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



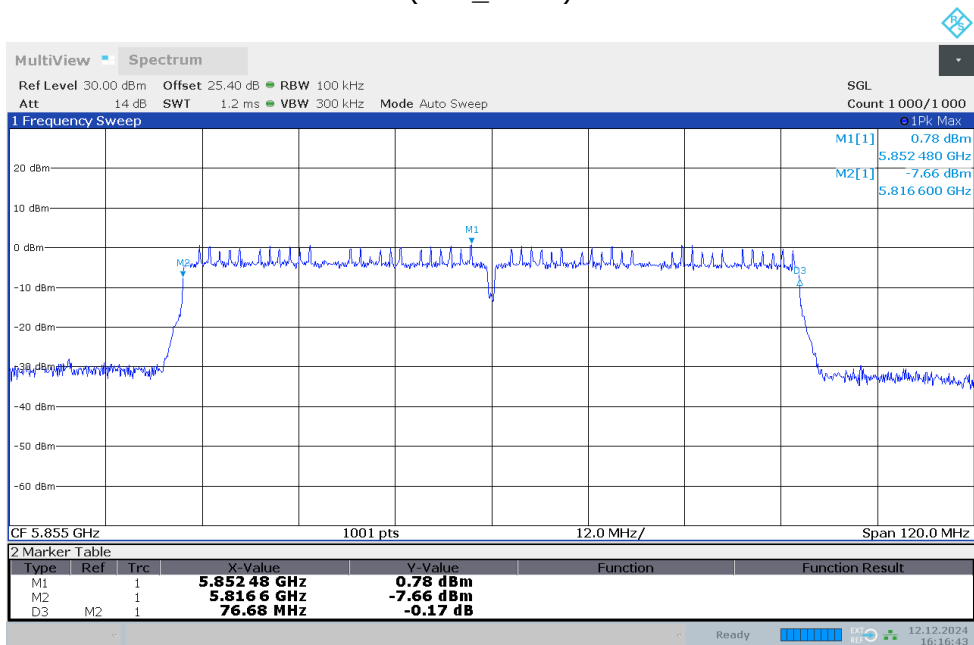
03:14:44 PM 08/15/2024

Radio Technology = WLAN n 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



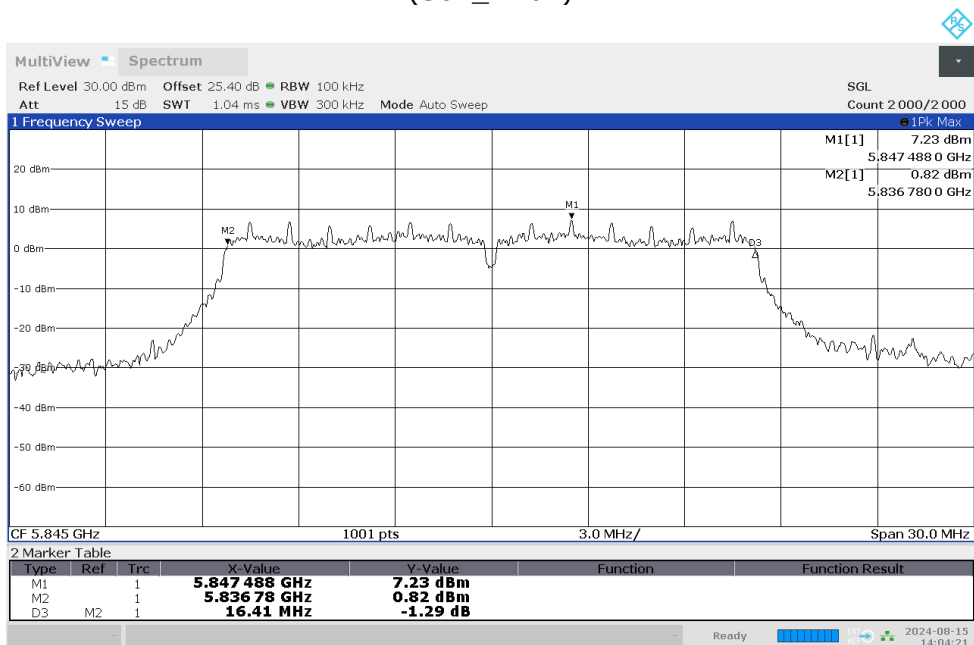
02:57:31 PM 08/15/2024

Radio Technology = WLAN ac 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



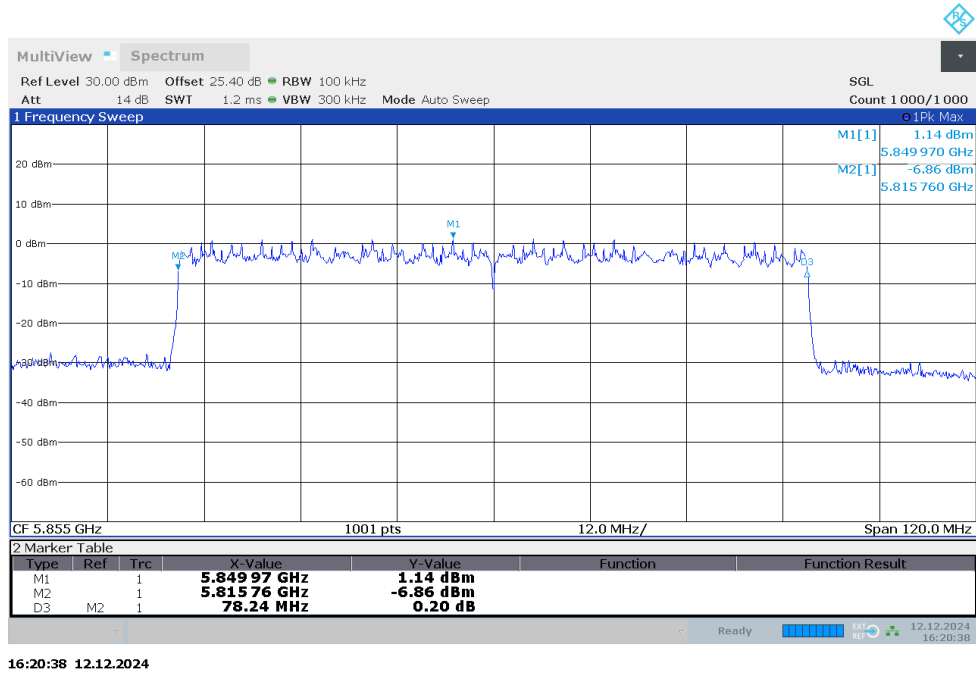
16:16:43 12.12.2024

Radio Technology = WLAN a, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4
(S01_AD02)



02:04:22 PM 08/15/2024

Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



16:20:38 12.12.2024

5.1.5 TEST EQUIPMENT USED

- R&S TS8997

5.2 99 % BANDWIDTH

Standard **FCC Part 15 Subpart E**

The test was performed according to:

ANSI C63.10, chapter 12.5.3 (6.9.3)

5.2.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

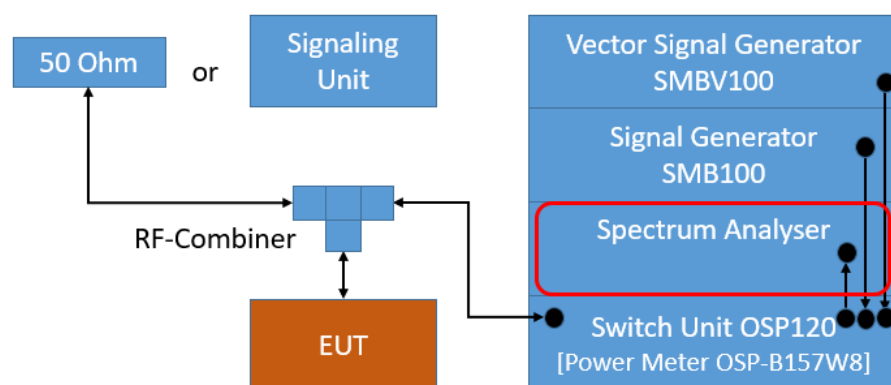
The results recorded were measured with the modulation which produce the worst-case (widest) emission bandwidth.

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): 1 to 5 % of the span
- Video Bandwidth (VBW): ≥ 3 times the RBW
- Span: 30 / 60 / 120 MHz (for 20 / 40 / 80 MHz nominal bandwidth)
- Trace: Maxhold
- Sweeps: see example plots
- Sweep time: Auto
- Detector: Peak

The 99 % measurement function of the spectrum analyser function was used to determine the 99 % bandwidth.



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5.2.2 TEST REQUIREMENTS / LIMITS

No applicable limit.

The test was performed to determine the limits for the "Maximum Conducted Output Power" and DFS test cases.

5.2.3 TEST PROTOCOL

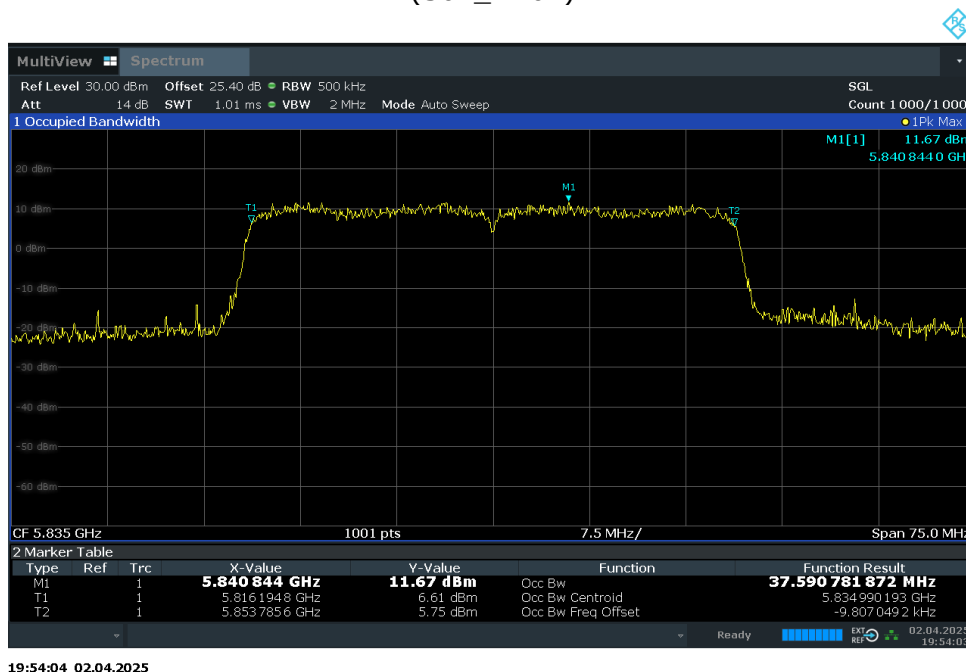
Ambient temperature: 23 - 26 °C
 Air Pressure: 1010 - 1024 hPa
 Humidity: 36 - 56 %

Radio Technology	Subband	Operating Frequency	99% Bandwidth [MHz]
WLAN a	U-NII-3/4	straddle	13.3 / 3.3
WLAN a	U-NII-4	low	16.6
WLAN a	U-NII-4	high	16.6
WLAN n 20 MHz	U-NII-3/4	straddle	13.8 / 3.8
WLAN n 20 MHz	U-NII-4	low	17.6
WLAN n 20 MHz	U-NII-4	high	17.6
WLAN n 40 MHz	U-NII-3/4	straddle	33.2 / 3.1
WLAN n 40 MHz	U-NII-4	low	36.4
WLAN ac 20 MHz	U-NII-3/4	straddle	13.8 / 3.8
WLAN ac 20 MHz	U-NII-4	low	17.6
WLAN ac 20 MHz	U-NII-4	high	17.7
WLAN ac 40 MHz	U-NII-3/4	straddle	33.2 / 3.2
WLAN ac 40 MHz	U-NII-4	low	36.4
WLAN ac 80 MHz	U-NII-3/4	straddle	33.3 / 43.2
WLAN ax 20 MHz	U-NII-3/4	straddle	14.4 / 4.4
WLAN ax 20 MHz	U-NII-4	low	18.8
WLAN ax 20 MHz	U-NII-4	high	18.8
WLAN ax 40 MHz	U-NII-3/4	straddle	33.8 / 3.8
WLAN ax 40 MHz	U-NII-4	low	37.6
WLAN ax 80 MHz	U-NII-3/4	straddle	34.0 / 43.7

Remark: Please see next sub-clause for the measurement plot.

5.2.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

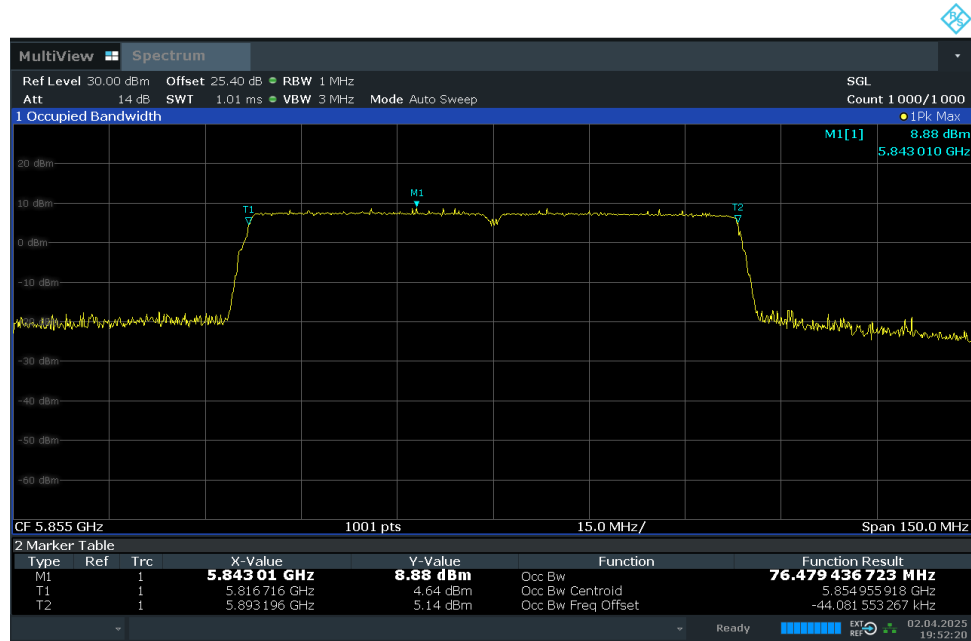
Radio Technology = WLAN ax 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4 (S01_AD02)



Radio Technology = WLAN ac 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4 (S01_AD02)

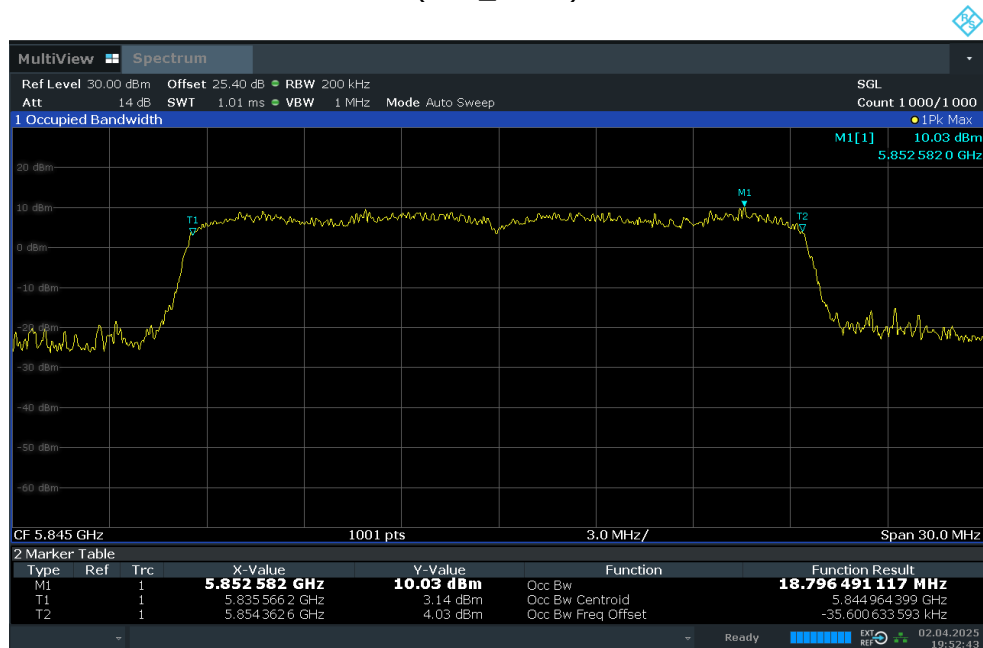


Radio Technology = WLAN ac 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



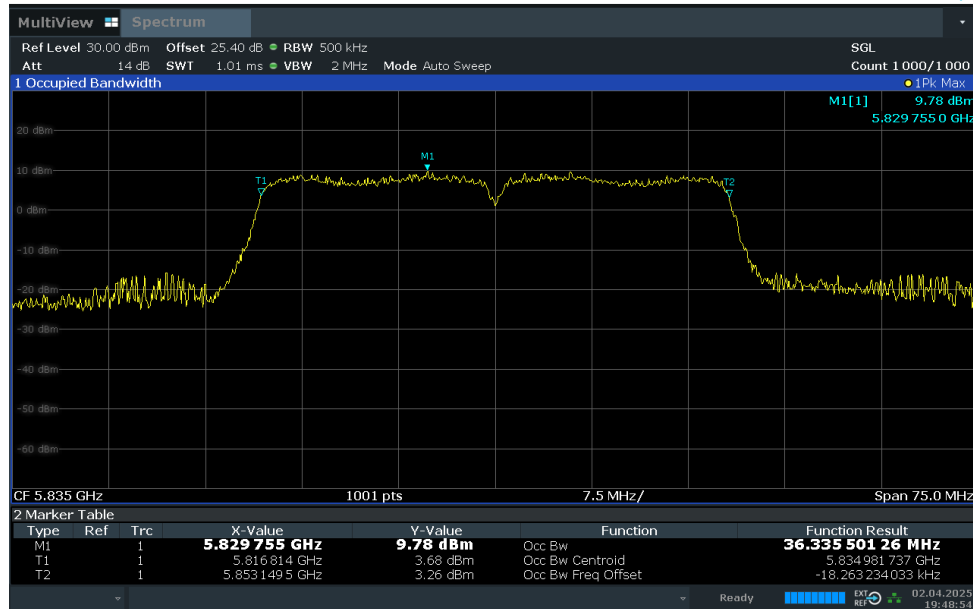
19:52:20 02.04.2025

Radio Technology = WLAN ax 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



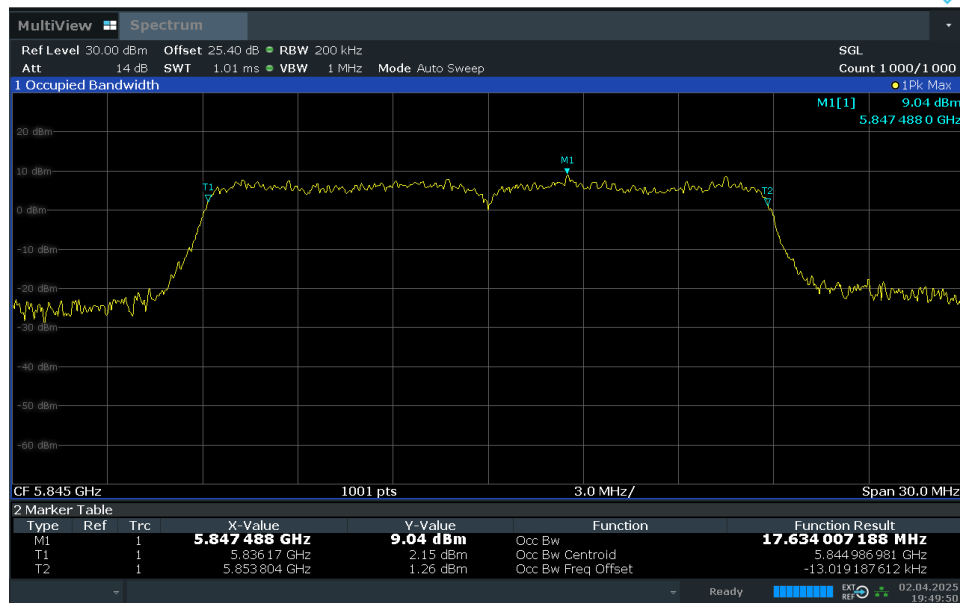
19:52:44 02.04.2025

Radio Technology = WLAN n 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



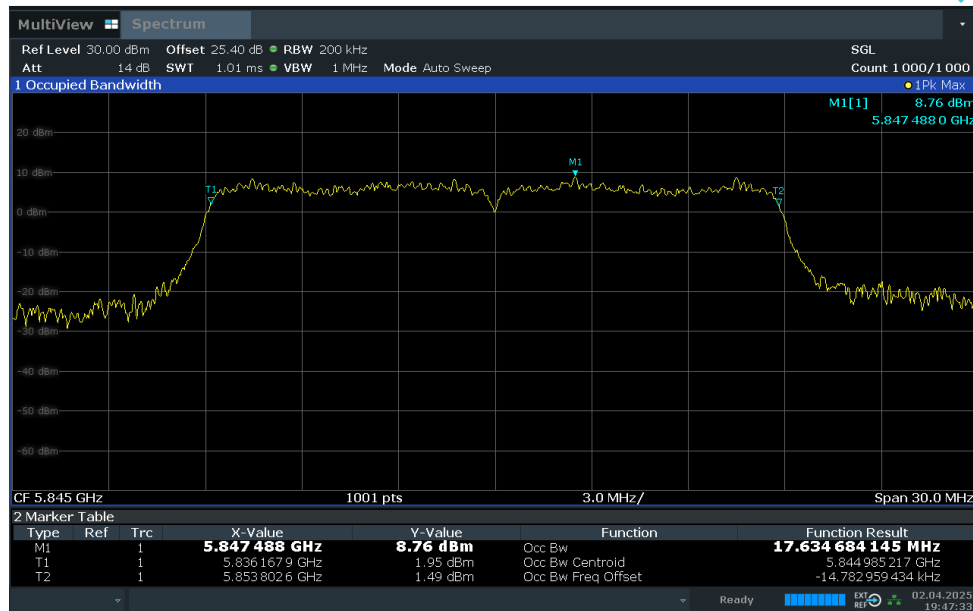
19:48:54 02.04.2025

Radio Technology = WLAN ac 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



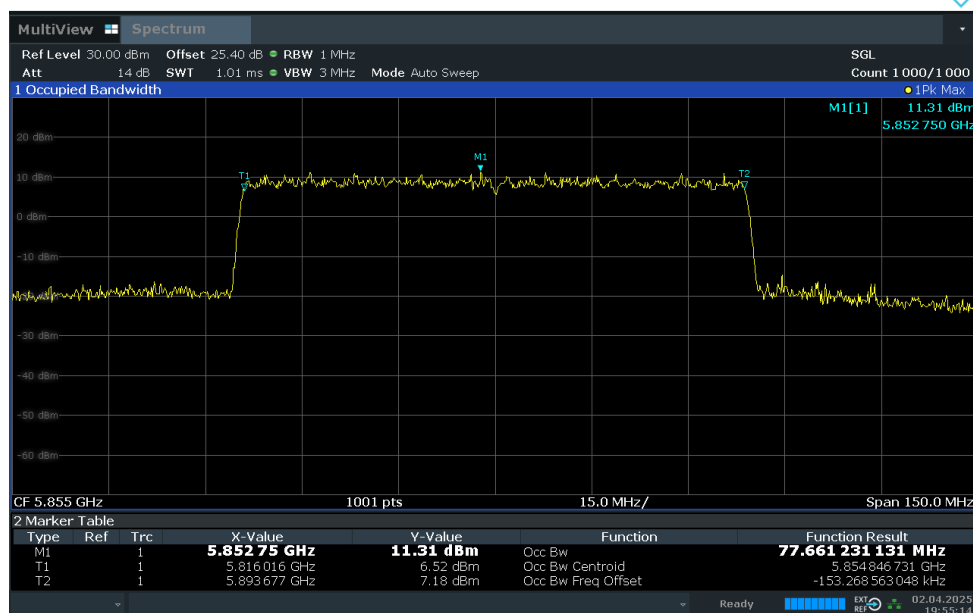
19:49:50 02.04.2025

Radio Technology = WLAN n 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



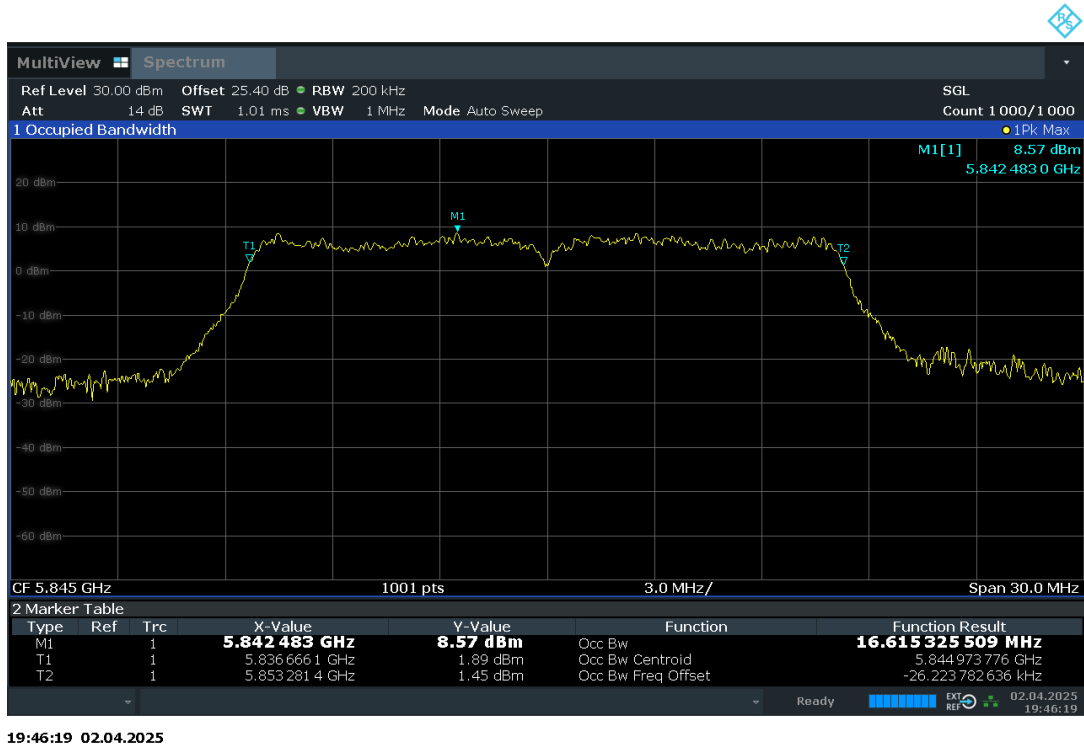
19:47:34 02.04.2025

Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



19:55:15 02.04.2025

Radio Technology = WLAN a, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4 (S01_AD02)



19:46:19 02.04.2025

5.2.5 TEST EQUIPMENT USED

- R&S TS8997

5.3 MAXIMUM CONDUCTED OUTPUT POWER

Standard **FCC Part 15 Subpart E**

The test was performed according to:

ANSI C63.10, chapter 12.4.3.2

5.3.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power

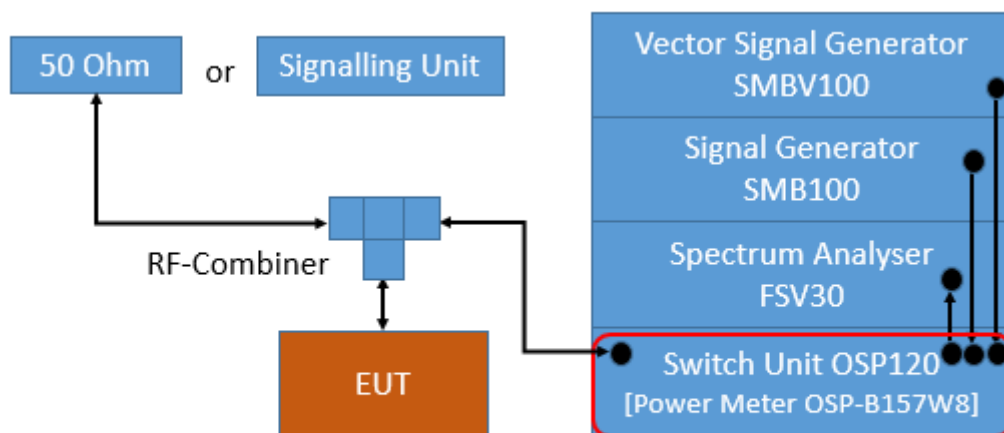
For U-NII bands 1, 2A, 2C, 3, 4:

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

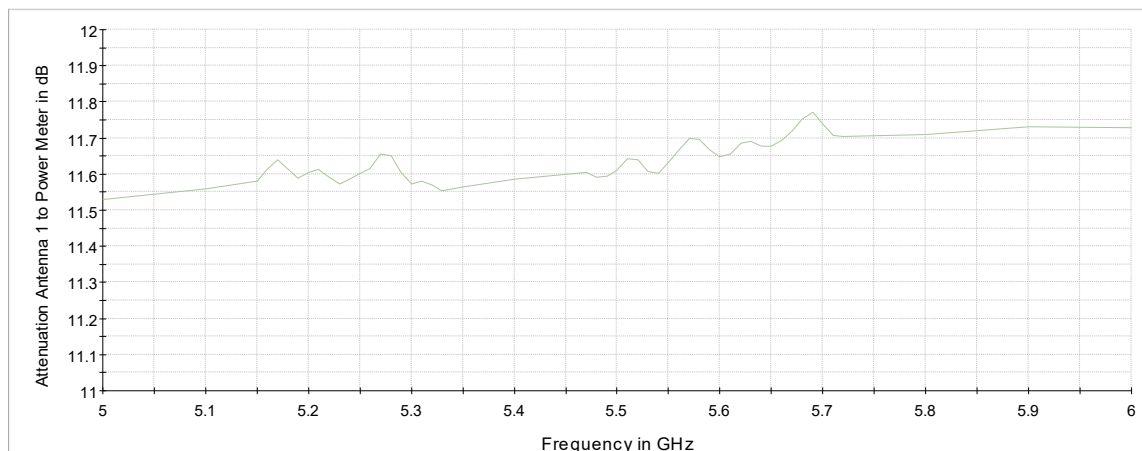
The OSP-B157W is a gated RF average power meter with a signal bandwidth > 300 MHz.

Note:

The measurement was performed according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method **PM-G**.



TS8997; Maximum Conducted Output Power



Attenuation of measurement path

5.3.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15, Subpart E, §15.407 (a) (3):

For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:

Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi. The antenna gain limitation is not applicable for fixed point-to-point devices.

For an indoor access point operating in the 5.850-5.895 GHz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm. Indoor access points operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 36 dBm.

For client devices operating under the control of an indoor access point in the 5.850-5.895 GHz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm. Client devices operating on a channel that spans the 5.725-5.850 GHz and 5.850-5.895 GHz bands must not exceed an e.i.r.p. of 30 dBm.

For a subordinate device operating under the control of an indoor access point in the 5.850-5.895 GHz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 36 dBm.

FCC Part 15, Subpart E, §15.407 (a) (11):

The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

B) IC

RSS-247, 6.2.4.1, Band 5725-5850 MHz:

Limits:

Maximum conducted Power: 1 W (30 dBm)

e.i.r.p.: 4 W (36 dBm)

RSS-247, 6.2.5.2, Band 5850-5925 MHz:

Limits:

For fixed outdoor access points, the maximum e.i.r.p. shall not exceed 4 W (36 dBm).

The maximum e.i.r.p. measured at any elevation angle greater than 30 degrees above the horizon, shall not exceed 125 mW (21 dBm) over the 5850-5895 MHz frequency band.

For fixed outdoor client devices, the maximum e.i.r.p. shall not exceed 1 W (30 dBm).

For indoor access points, the maximum e.i.r.p. shall not exceed 4 W (36 dBm).

For indoor subordinate devices, the maximum e.i.r.p. shall not exceed 4 W (36 dBm).

For indoor client devices, the maximum e.i.r.p. shall not exceed 1 W (30 dBm).

5.3.3 TEST PROTOCOL

Ambient
temperature: 23 - 26 °C
Air Pressure: 1010 - 1024 hPa
Humidity: 36 - 56 %

WLAN a-Mode; 20 MHz; 6 Mbit/s												
U-NII-band	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	169	5845	18.3	23.4	30.0	11.7	30.0	6.6	30.0	11.7	30.0	6.6
4	173	5865	18.1	23.2	N/A	-	30.0	6.8	N/A	-	30.0	6.8
	177	5885	17.9	23.0	N/A	-	30.0	7.0	N/A	-	30.0	7.0

WLAN n-Mode; 20 MHz; MCS 0; SISO												
U-NII-band	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	169	5845	18.2	23.3	30.0	11.8	30.0	6.7	30.0	11.8	30.0	6.7
4	173	5865	18.0	23.1	N/A	-	30.0	6.9	N/A	-	30.0	6.9
	177	5885	17.8	22.9	N/A	-	30.0	7.1	N/A	-	30.0	7.1

WLAN n-Mode; 40 MHz; MCS 0; SISO												
U-NII-band	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	167	5835	18.3	23.4	30.0	11.7	30.0	6.6	30.0	11.7	30.0	6.6
4	175	5875	17.9	23.0	N/A	-	30.0	7.0	N/A	-	30.0	7.0

WLAN ac-Mode; 20 MHz; MCS 0; SISO												
U-NII-Subband	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	169	5845	18.2	23.3	30.0	11.8	30.0	6.7	30.0	11.8	30.0	6.7
4	173	5865	18.0	23.1	N/A	-	30.0	6.9	N/A	-	30.0	6.9
	177	5885	17.8	22.9	N/A	-	30.0	7.1	N/A	-	30.0	7.1

WLAN ac-Mode; 40 MHz; MCS 0; SISO												
U-NII-Subband	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	167	5835	18.3	23.4	30.0	11.7	30.0	6.6	30.0	11.7	30.0	6.6
4	175	5875	17.8	22.9	N/A	-	30.0	7.1	N/A	-	30.0	7.1

WLAN ac-Mode; 80 MHz; MCS 0; SISO												
U-NII-Subband	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	171	5855	17.6	22.7	30.0	12.4	30.0	7.3	30.0	12.4	30.0	7.3

WLAN ax-Mode; 20 MHz; MCS 0; SISO												
U-NII-Subband	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	169	5845	18.4	23.5	30.0	11.6	30.0	6.5	30.0	11.6	30.0	6.5
4	173	5865	18.3	23.4	N/A	-	30.0	6.6	N/A	-	30.0	6.6
	177	5885	12.8	17.9	N/A	-	30.0	12.1	N/A	-	30.0	12.1

WLAN ax-Mode; 40 MHz; MCS 0; SISO												
U-NII-Subband	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	167	5835	18.6	23.7	30.0	11.4	30.0	6.3	30.0	11.4	30.0	6.3
4	175	5875	18.2	23.3	N/A	-	30.0	6.7	N/A	-	30.0	6.7

WLAN ax-Mode; 80 MHz; MCS 0; SISO												
U-NII-Subband	Ch. No.	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]
3+4	171	5855	18.0	23.1	30.0	12.0	30.0	6.9	30.0	12.0	30.0	6.9

Remark: None.

5.3.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Power Meter Measurement, no plots provided.

5.3.5 TEST EQUIPMENT USED

- R&S TS8997

5.4 PEAK POWER SPECTRAL DENSITY

Standard **FCC Part 15 Subpart E**

The test was performed according to:

ANSI C63.10, chapter 12.6 (SA-1)

5.4.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up in a shielded room to perform the Maximum Power Spectral Density measurements.

The results recorded were measured with the modulation which produces the worst-case (highest) output power.

For U-NII bands 1, 2A, 2C, 3:

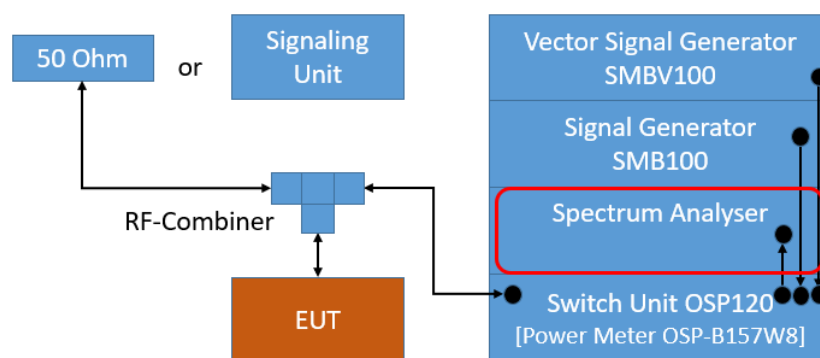
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

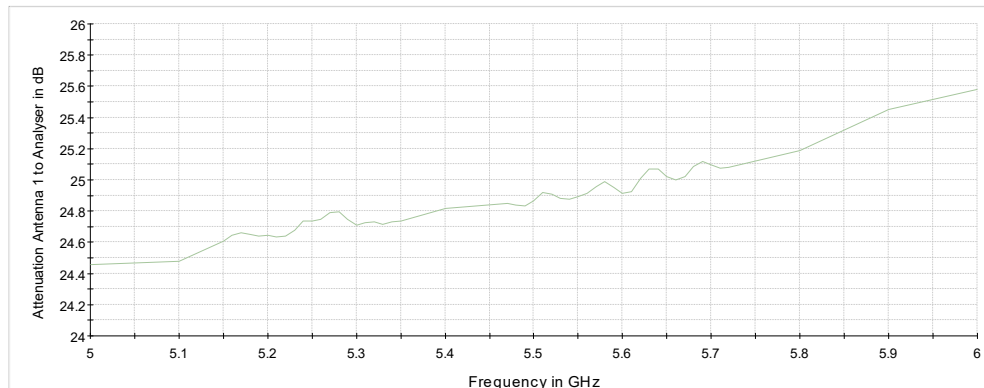
- Resolution Bandwidth (RBW): 1 MHz (for subband 3: 500 kHz)
- Video Bandwidth (VBW): 3 MHz (for subband 3: 2 MHz)
- Trace: Average (Power)
- Sweeps: see example plots
- Sweep time: Auto
- Detector: RMS
- Trigger: free run

Note:

The analyser settings are according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method **SA-1**.



TS8997



Attenuation of the measurement path

5.4.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15, Subpart E, §15.407 (a) (3)

For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:

Limit: 30 dBm/500 kHz.

For an indoor access point operating in the 5.850-5.895 GHz band:

Limit: 20 dBm/MHz e.i.r.p.

For client devices operating under the control of an indoor access point in the 5.850-5.895 GHz band:

Limit: 14 dBm/MHz e.i.r.p.

For a subordinate device operating under the control of an indoor access point in the 5.850-5.895 GHz band:

Limit: 20 dBm/MHz e.i.r.p.

B) IC

RSS-247, 6.2.4 (1), Band 5725-5850 MHz:

Limit: 30 dBm/500 kHz.

RSS-247, 6.2.5.2, Band 5850 – 5895 MHz:

For fixed outdoor access points: 23 dBm/MHz e.i.r.p.

For fixed outdoor client devices: 17 dBm/MHz e.i.r.p.

For indoor access points: 20 dBm/MHz e.i.r.p.

For indoor subordinate devices: 20 dBm/MHz e.i.r.p.

For indoor client devices: 14 dBm/MHz e.i.r.p.

5.4.3 TEST PROTOCOL

Ambient temperature: 23 - 26 °C
 Air Pressure: 1010 - 1024 hPa
 Humidity: 36 - 56 %

WLAN a-Mode; 20 MHz; 6 Mbit/s										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	169	5845	7.3	12.4	14 (E.I.R.P.)	1.6	30.0	22.7	14.0	1.6
4	173	5865	6.7	11.8	14 (E.I.R.P.)	2.2	N/A	-	14.0	2.2
	177	5885	6.6	11.7	14 (E.I.R.P.)	2.3	N/A	-	14.0	2.3

WLAN n-Mode; 20 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	169	5845	7.1	12.2	14 (E.I.R.P.)	1.8	30.0	22.9	14.0	1.8
4	173	5865	6.4	11.5	14 (E.I.R.P.)	2.5	N/A	-	14.0	2.5
	177	5885	6.3	11.4	14 (E.I.R.P.)	2.6	N/A	-	14.0	2.6

WLAN n-Mode; 40 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	167	5835	4.1	9.2	14 (E.I.R.P.)	4.8	30.0	25.9	14.0	4.8
4	175	5875	3.4	8.5	14 (E.I.R.P.)	5.5	N/A	-	14.0	5.5

WLAN ac-Mode; 20 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	169	5845	7.1	12.2	14 (E.I.R.P.)	1.8	30.0	22.9	14.0	1.8
4	173	5865	6.4	11.5	14 (E.I.R.P.)	2.5	N/A	-	14.0	2.5
	177	5885	6.2	11.3	14 (E.I.R.P.)	2.7	N/A	-	14.0	2.7

WLAN ac-Mode; 40 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	167	5835	4.1	9.2	14 (E.I.R.P.)	4.8	30.0	25.9	14.0	4.8
4	175	5875	3.4	8.5	14 (E.I.R.P.)	5.5	N/A	-	14.0	5.5

WLAN ac-Mode; 80 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	171	5855	-0.6	4.5	14 (E.I.R.P.)	9.5	30.0	30.6	14.0	9.5

WLAN ax-Mode; 20 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	169	5845	7.2	12.3	14 (E.I.R.P.)	1.7	30.0	22.8	14.0	1.7
4	173	5865	6.4	11.5	14 (E.I.R.P.)	2.5	N/A	-	14.0	2.5
	177	5885	1.3	6.4	14 (E.I.R.P.)	7.6	N/A	-	14.0	7.6

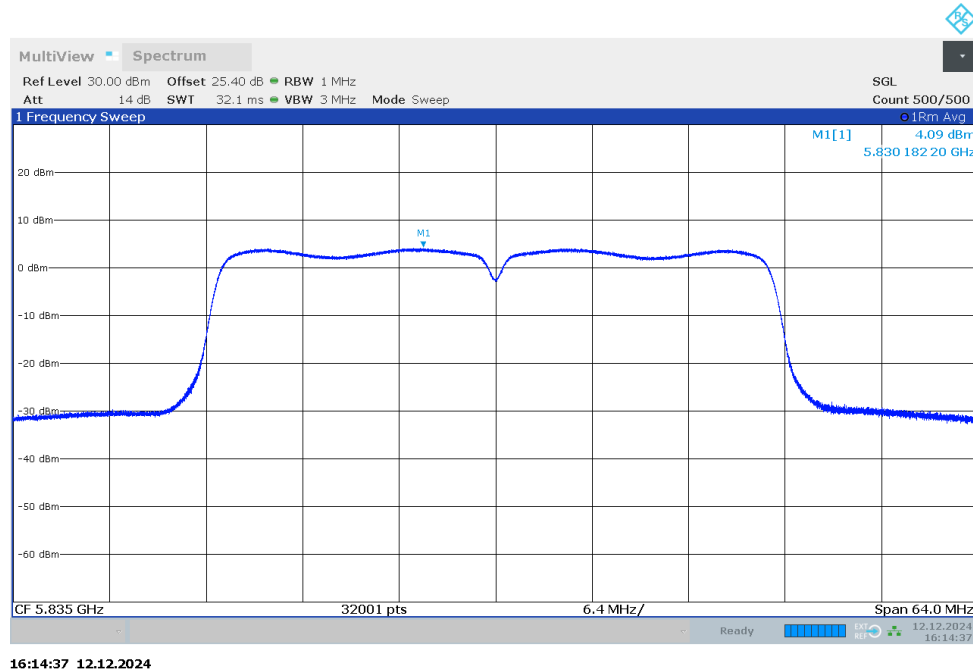
WLAN ax-Mode; 40 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	167	5835	4.3	9.4	14 (E.I.R.P.)	4.6	30.0	25.7	14.0	4.6
4	175	5875	3.5	8.6	14 (E.I.R.P.)	5.4	N/A	-	14.0	5.4

WLAN ax-Mode; 80 MHz; MCS 0; SISO										
U-NII-band	Ch. No.	Freq. [MHz]	MPSD [dBm/MHz]	E.I.R.P MPSD [dBm/MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]	Margin [dB]	ISED E.I.R.P limit [dBm/MHz]	Margin [dB]
3+4	171	5855	0.3	5.4	14 (E.I.R.P.)	8.6	30.0	29.7	14.0	8.6

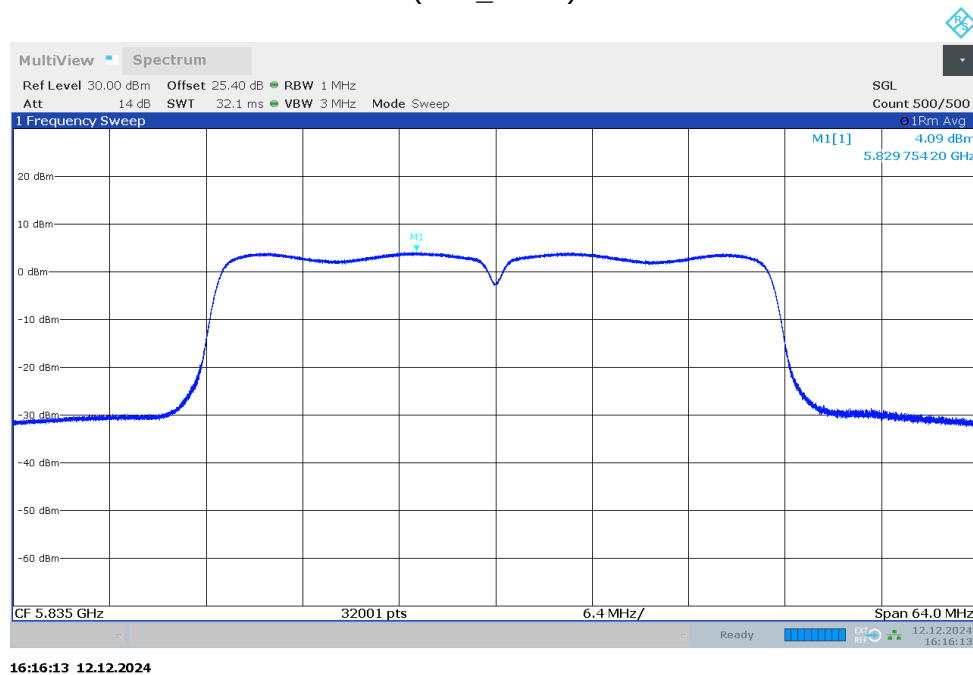
Remark: Straddle channels were measured with 1 MHz RBW. Passed results will also satisfy the dBm/500 kHz limit since 1 MHz is worse case.
For straddle channels the lowest limit of the bands 3 and 4 is given and compared to (worst case).
Please see next sub-clause for the measurement plot.

5.4.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

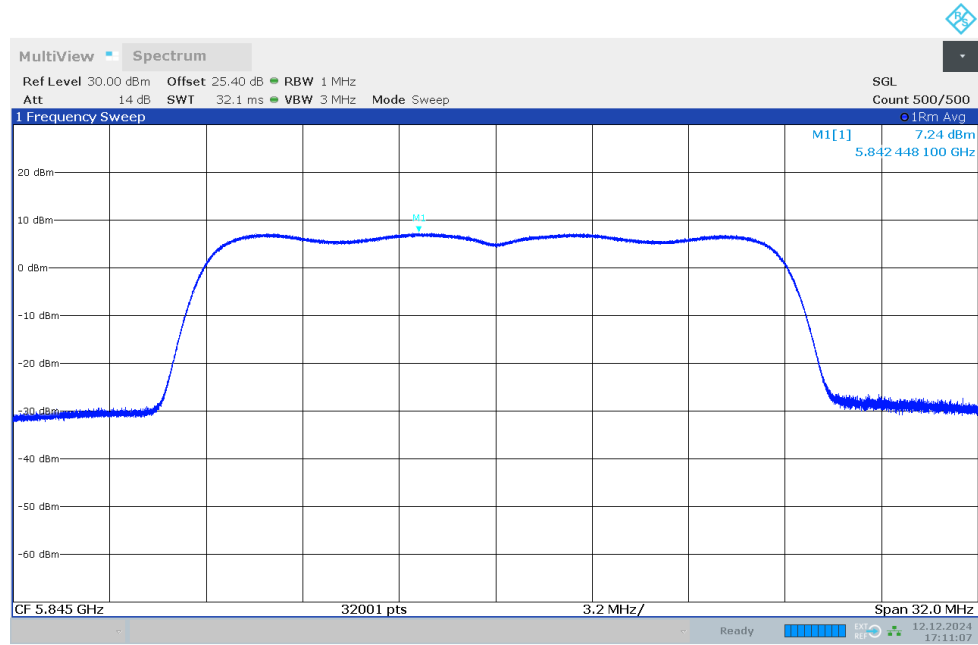
Radio Technology = WLAN n 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4
(S01_AD02)



Radio Technology = WLAN ac 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4
(S01_AD02)

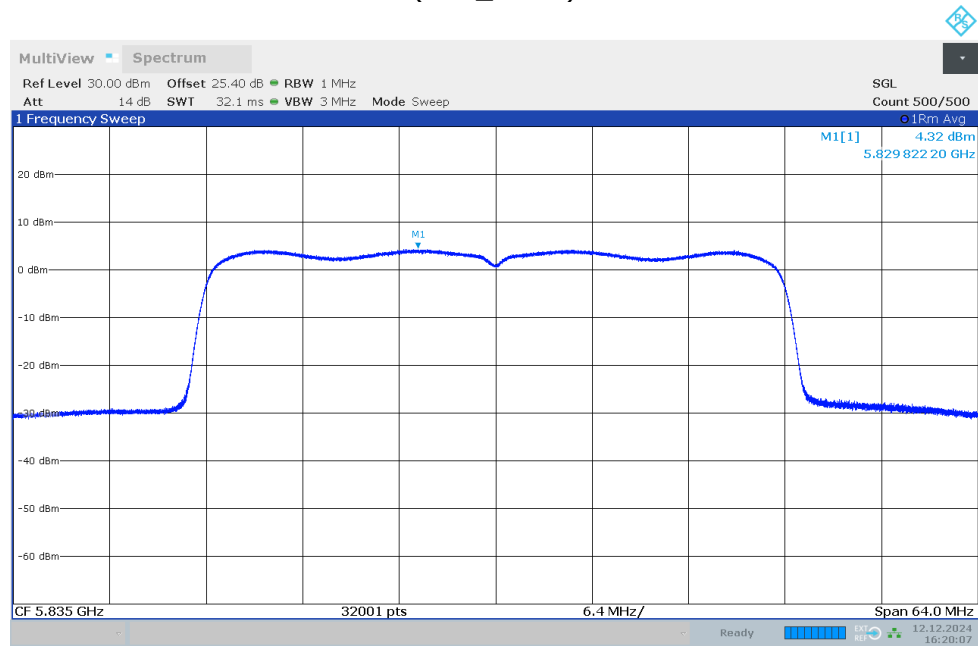


Radio Technology = WLAN ax 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4
(S01_AD02)



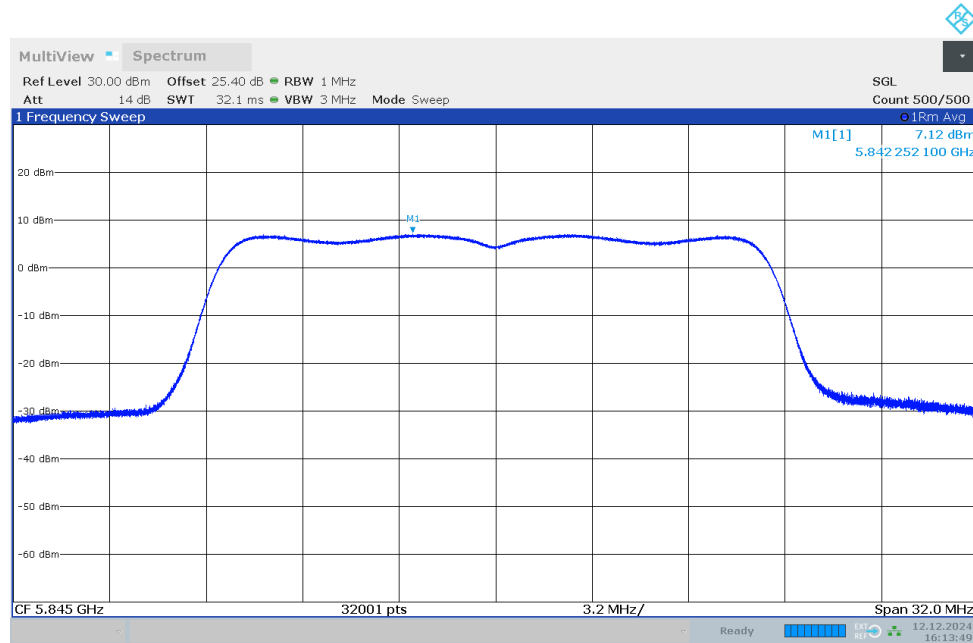
17:11:07 12.12.2024

Radio Technology = WLAN ax 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4
(S01_AD02)



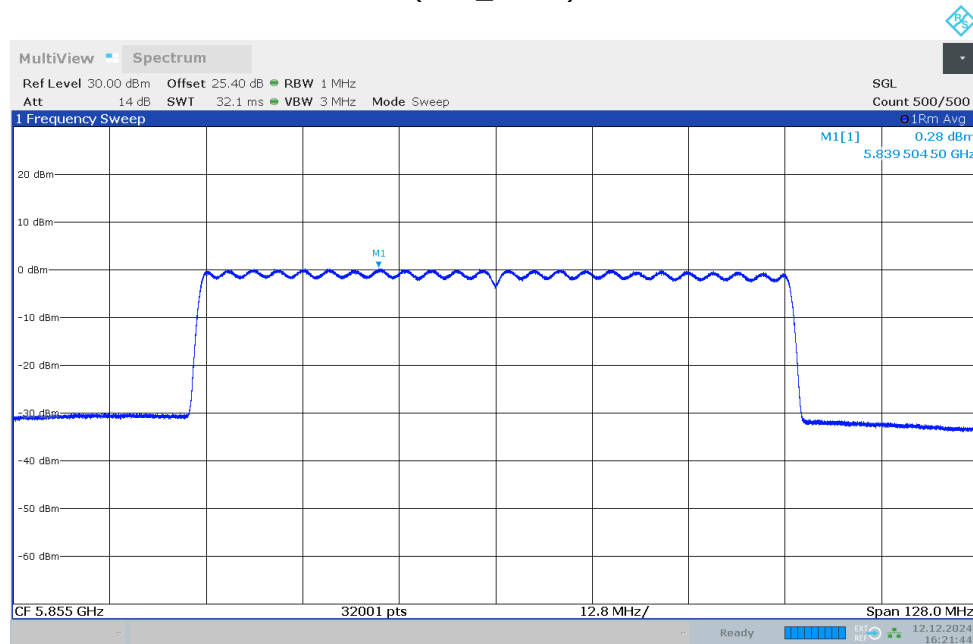
16:20:08 12.12.2024

Radio Technology = WLAN n 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



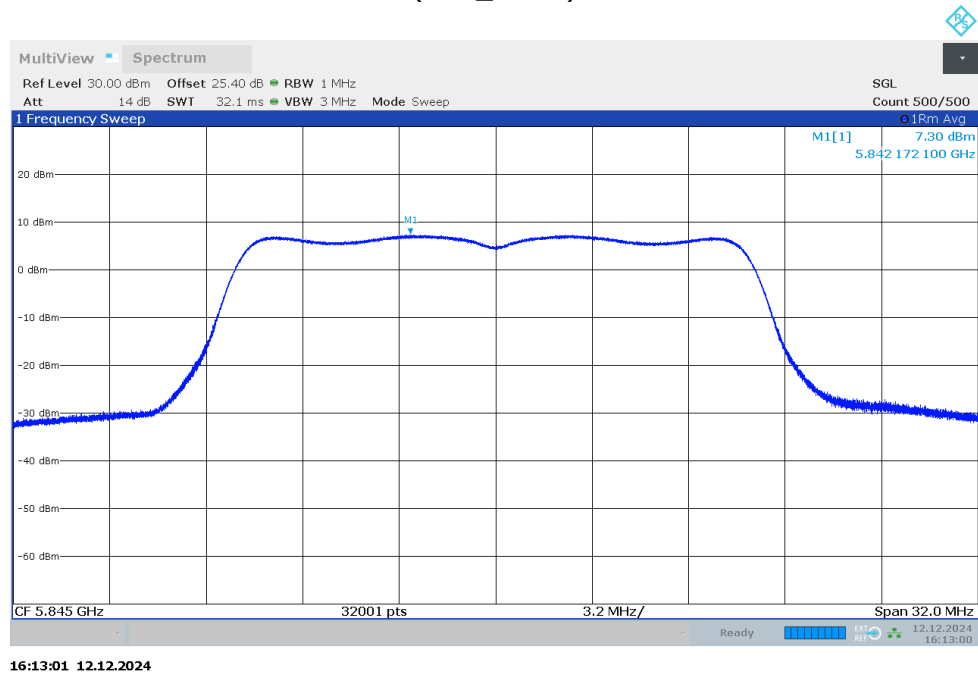
16:13:49 12.12.2024

Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)

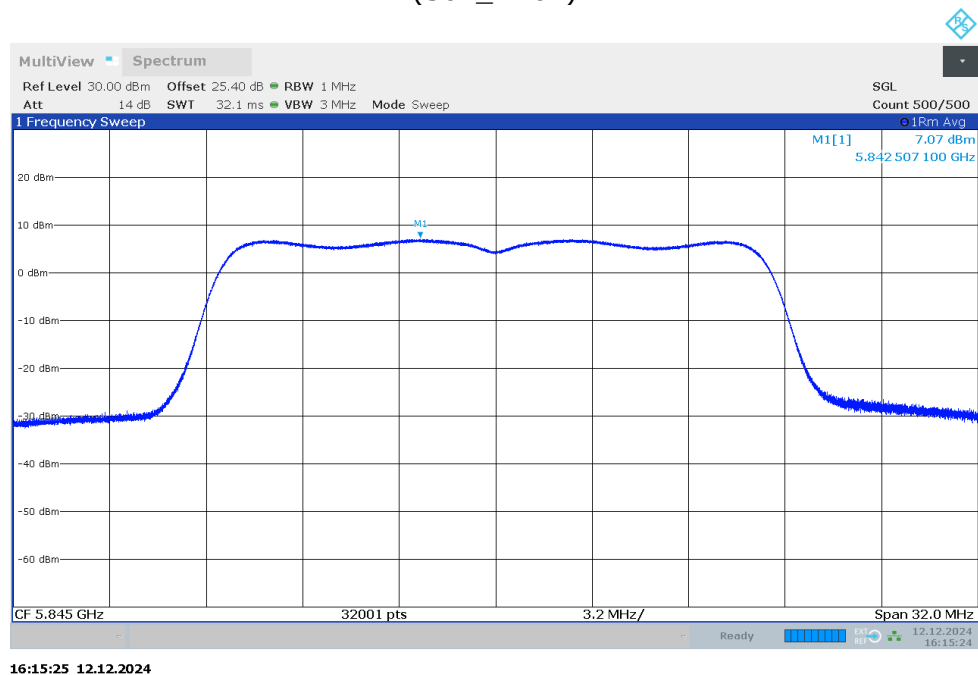


16:21:45 12.12.2024

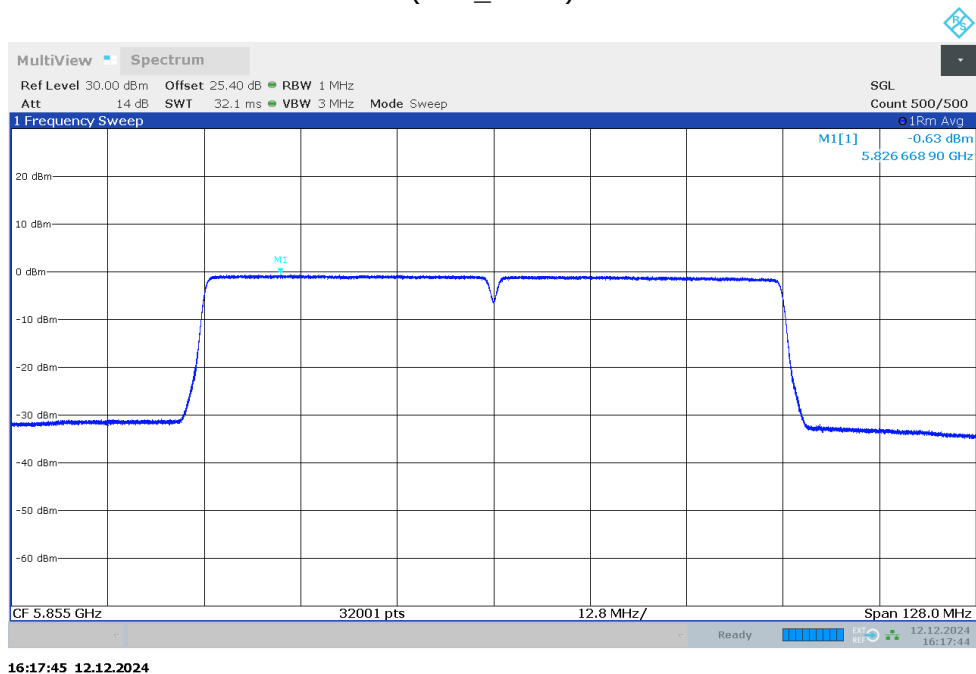
Radio Technology = WLAN a, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4
(S01_AD02)



Radio Technology = WLAN ac 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



Radio Technology = WLAN ac 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S01_AD02)



16:17:45 12.12.2024

5.4.5 TEST EQUIPMENT USED

- R&S TS8997

5.5 UNDESIRABLE EMISSIONS; GENERAL FIELD STRENGTH LIMITS

Standard **FCC Part 15 Subpart E**

The test was performed according to:

ANSI C63.10, chapter 6.4, 6.5, 6.6.5

5.5.1 TEST DESCRIPTION

Radiated Measurements of enclosure with 50 Ohm termination at antenna port:

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapters of ANSI C63.10:

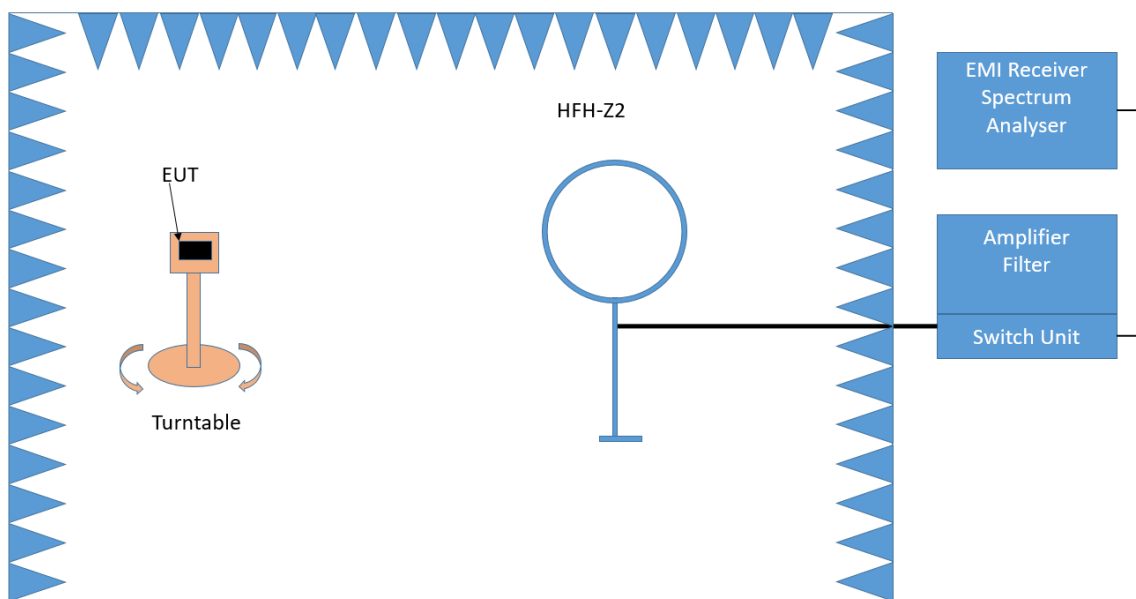
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHz: Chapter 6.6 (procedure according 6.6.5 used)

The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered.

Below 1 GHz:

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

1. Measurement up to 30 MHz



Test Setup; Spurious Emission Radiated (SAC), 9 kHz – 30 MHz

The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement

- Anechoic chamber
- Antenna distance: 3 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 - 30 MHz
- Frequency steps: 0.05 kHz and 2.25 kHz
- IF-Bandwidth: 0.2 kHz and 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)

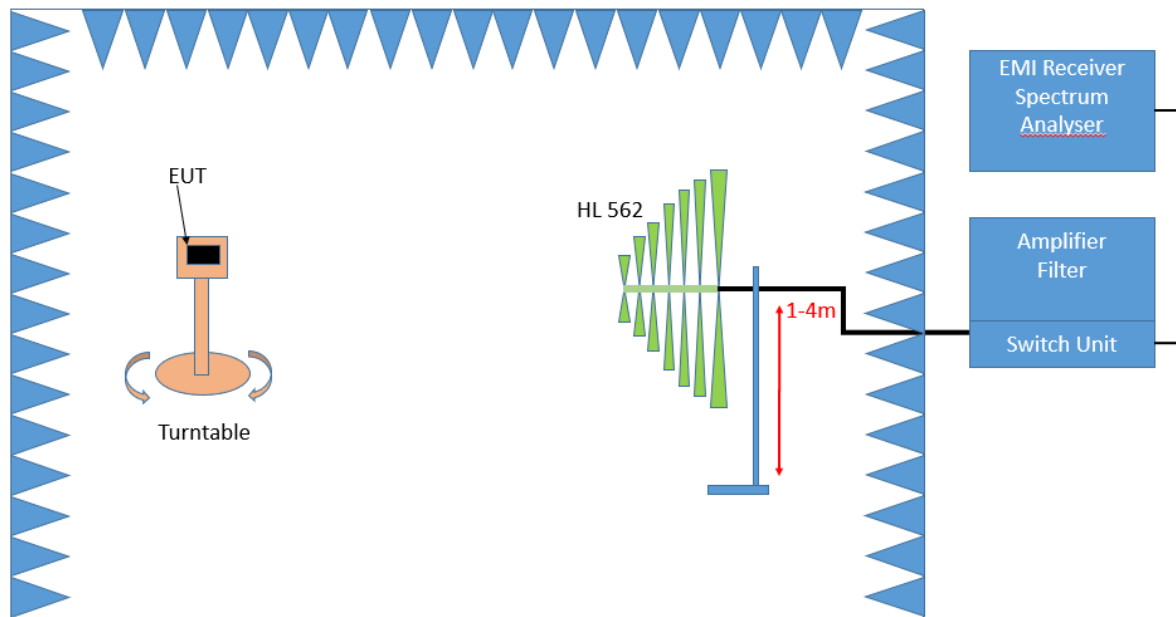
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test site
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 - 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF-Bandwidth: 0.2 - 10 kHz
- Measuring time / Frequency step: 1 s

2. Measurement above 30 MHz and up to 1 GHz



Test Setup; Spurious Emission Radiated (SAC), 30 MHz- 1GHz

Step 1: Preliminary scan

This is a preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Antenna distance: 3 m
- Detector: Peak-Maxhold / Quasipeak (FFT-based)
- Frequency range: 30 - 1000 MHz
- Frequency steps: 30 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range: -180° to 90°

- Turntable step size: 90°
- Height variation range: 1 – 4 m
- Height variation step size: 1.5 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by 360°. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by 1 – 4 meter. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: 360 °
- Height variation range: 1 – 4 m
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with QP detector

With the settings determined in step 2, the final measurement will be performed:

EMI receiver settings for step 3:

- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

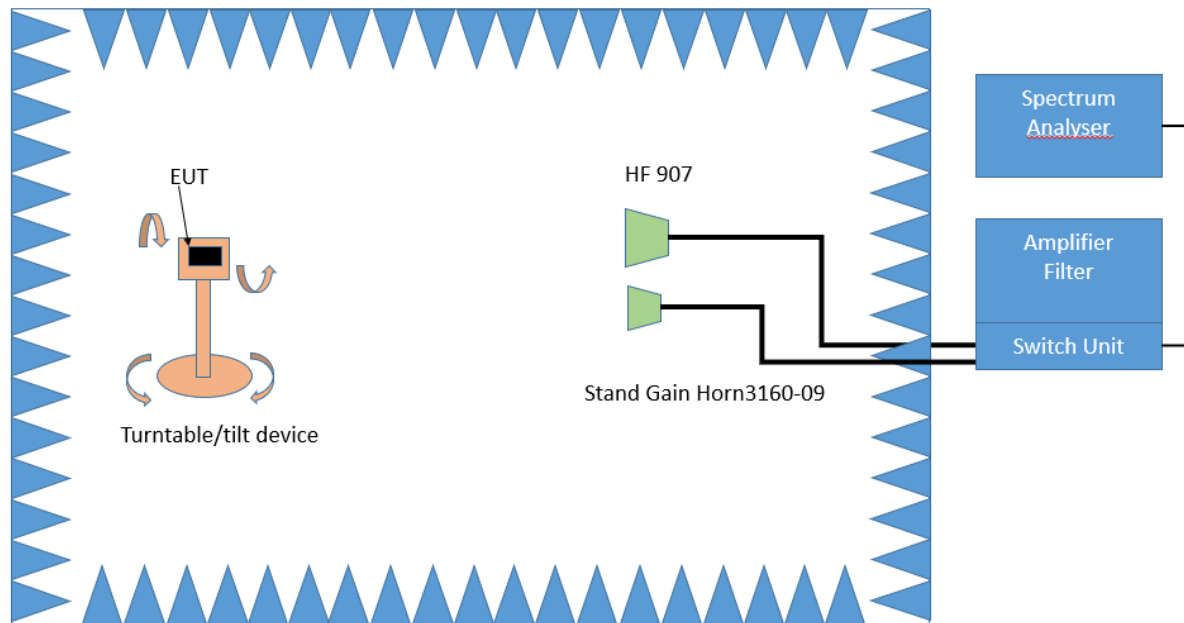
After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

Above 1 GHz:

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only.

3. Measurement 1 GHz up to 26.5 GHz



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz

Step 1:

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only.

The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.

The turn table step size (azimuth angle) for the preliminary measurement is 45 °.

Step 2:

Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna in step 2 is omitted. Instead of this, a maximum search with a step size $\pm 45^\circ$ for the elevation axis is performed.

The turn table azimuth will slowly vary by $\pm 22.5^\circ$.

The elevation angle will slowly vary by $\pm 45^\circ$

EMI receiver settings (for all steps):

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

Step 3:

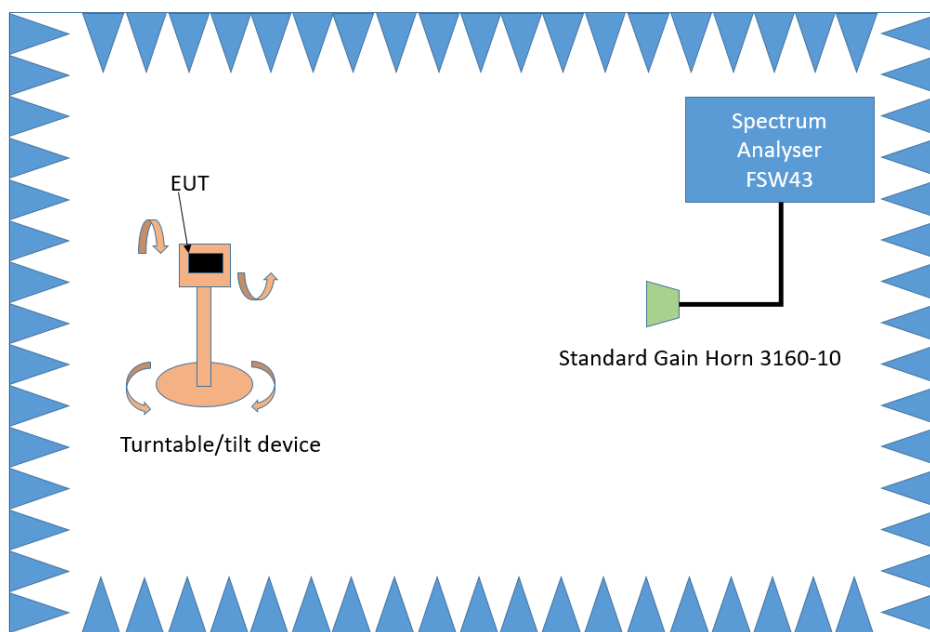
Spectrum analyser settings for step 3:

- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

4. Measurement above 26.5 GHz up to 40 GHz

The following modifications, compared to the frequency range 1 GHz – 26.5 GHz, apply to the measurement procedure for the frequency range above 26.5 GHz:

- Measurement distance: 1m

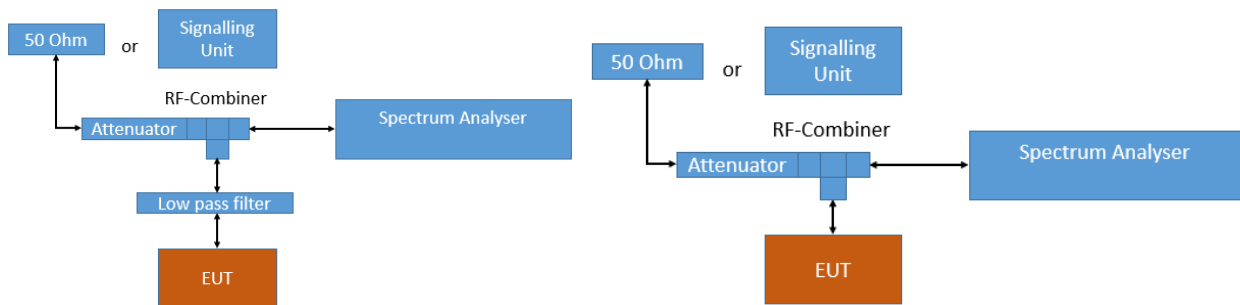


Test Setup; Spurious Emission Radiated (FAC), 26.5 – 40 GHz

Conducted Measurements at antenna ports:

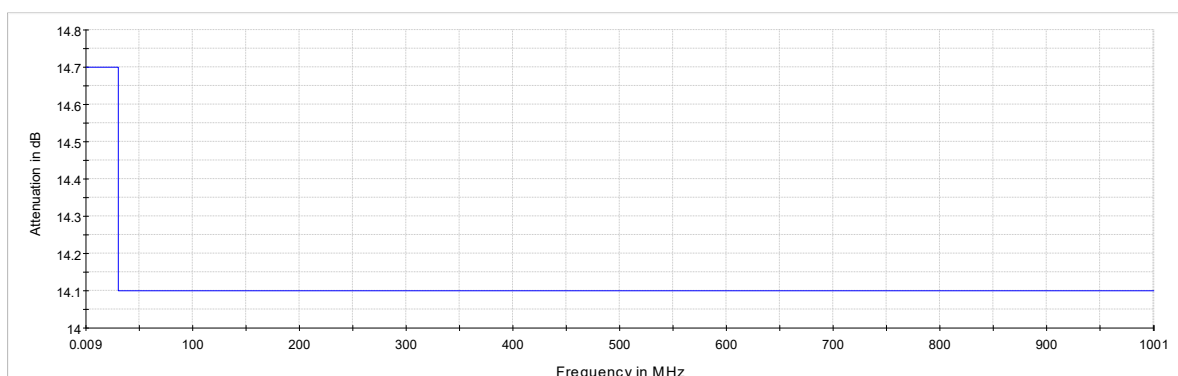
The Equipment Under Test (EUT) was set up to perform the spurious emissions measurements.

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.



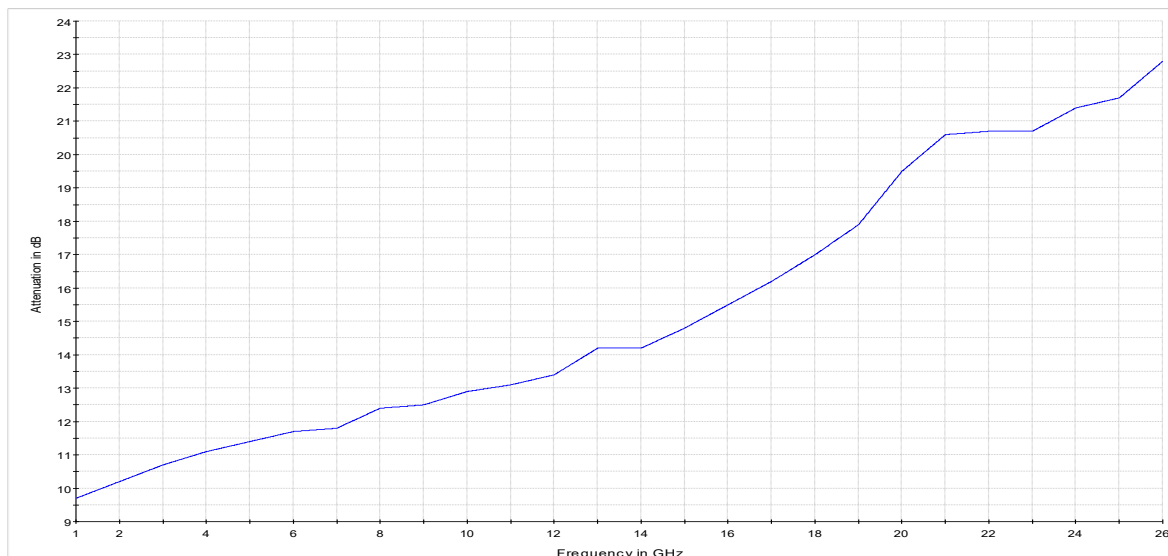
Measurement <1 GHz

Measurement 1 GHz - 26 GHz



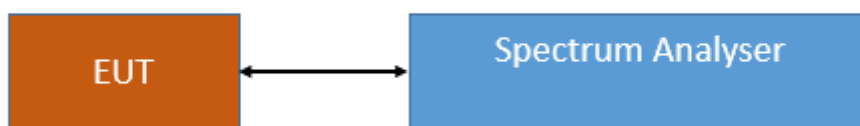
Transducer DUT1_3dB_TP2000_FCC_below1G

The attenuation of the transducer includes the path attenuation of the measurement cable as well as the low pass filter. In addition, it includes the ground reflection factor.



Transducer DUT1_3dB_UFLx

The attenuation of the transducer includes the path attenuation of the measurement cable and the UFL cable connecting the measurement cable and the EUT



Measurement 26 GHz - 40 GHz

For the measurements from 26 to 40 GHz only the highest path attenuation of measurement + UFL cable was used for the measurement as trace offset (15.3 dB).

Analyser settings:

- Frequency range: 0.009 – 30 MHz
- Resolution Bandwidth (RBW): 10 kHz
- Video Bandwidth (VBW): 30 kHz
- Trace: Maxhold
- Sweeps: till stable
- Sweep Time: coupled
- Detector: Peak

- Frequency range: 30 – 1000 MHz
- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Trace: Maxhold
- Sweeps: till stable
- Sweep Time: coupled
- Detector: Peak

- Frequency range: 1000 – 26000 MHz
- Resolution Bandwidth (RBW): 1000 kHz
- Video Bandwidth (VBW): 3000 kHz
- Trace: Maxhold, Average Power
- Sweeps: 500
- Sweep Time: coupled
- Detector: Peak, RMS

- Frequency range: 26000 – 40000 MHz
- Resolution Bandwidth (RBW): 1000 kHz
- Video Bandwidth (VBW): 3000 kHz
- Trace: Maxhold, Average Power
- Sweeps: 1000
- Sweep Time: coupled
- Detector: Peak, RMS

For the conducted emissions in restricted bands the Value is measured in dBm and then converted to dBμV/m as given in KDB 789033:

1. Measure the conducted output power in dBm.
2. Add the maximum antenna gain in dBi. (Included in measurement result by offset)
3. Add the appropriate ground reflection factor (included in measurement result by transducer factor)
 - 6 dB for frequencies ≤ 30 MHz;
 - 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive; and
 - 0 dB for frequencies > 1000 MHz).
4. Convert the resultant EIRP level to an equivalent electric field strength level using the following relationship:
 - $E = \text{EIRP} - 20 \log D + 104.8$
 - Where E is the electric field strength in dBμV/m,
 - EIRP is the equivalent isotropically radiated power in dBm
 - D is the specified measurement distance in m

Value [dBμV/m] = Measured value [dBm] (including gain and ground reflection factor) – 20 log D + 104.8

5.5.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15 Subpart E, §15.407 (b)(4)

For transmitters operating in the 5725–5850 MHz band:

Limit: –27 dBm/MHz at 75 MHz or more above or below the band edge
increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge
increasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edge
increasing linearly to 27 dBm/MHz at the band edge.

FCC Part 15 Subpart E, §15.407 (b)(5)

For transmitters operating in the 5850–5925 MHz band:

Above Band:

Indoor Access Point Limit: 15 dBm/MHz at band edge
decreasing linearly to -7 dBm/MHz at 5925 MHz.

Client Device Limit: -5 dBm/MHz at band edge
decreasing linearly to -27 dBm/MHz at 5925 MHz.

Below Band: –27 dBm/MHz 5650 MHz
increasing linearly to 10 dBm/MHz at 5.7 GHz
increasing linearly to 15.6 dBm/MHz at 5.72 GHz
increasing linearly to 27 dBm/MHz at 5725 MHz.

B) IC

RSS-247, 6.2.4.2, Emissions outside the band 5725-5850 MHz:

- 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- 27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

RSS-247, 6.2.5.3, Emissions outside the band 5850-5925 MHz:

For band edge 5725 and below:

- 27 dBm/MHz at 5725 MHz decreasing linearly to 15.6 dBm/MHz at 5 MHz below the band edge 5725 MHz;
 - 15.6 dBm/MHz at 5 MHz below the band edge 5725 MHz decreasing linearly to 10 dBm/MHz at 25 MHz below the band edge 5725 MHz;
 - 10 dBm/MHz at 25 MHz below the band edge 5725 MHz decreasing linearly to -27 dBm/MHz at 75 MHz below the band edge 5725 MHz; and
 - 27 dBm/MHz at frequencies more than 75 MHz below the band edge 5725 MHz.
- Using peak detector.

For band edge 5925 MHz and above:

- Fixed outdoor access points and fixed outdoor client devices shall not exceed -27 dBm/MHz e.i.r.p. spectral density at or above the 5895 MHz band edge.
- Indoor access points or indoor subordinate devices shall not exceed 15 dBm/MHz e.i.r.p. spectral density at the 5895 MHz band edge and shall decrease linearly to not exceed -7 dBm/MHz e.i.r.p. spectral density at or above 5925 MHz.
- Client devices shall not exceed -5 dBm/MHz e.i.r.p. spectral density at the 5895 MHz band edge and shall decrease linearly to not exceed -27 dBm/MHz e.i.r.p. spectral density at or above 5925 MHz.

Using average detection.

C) FCC & IC

FCC Part 15 Subpart E, §15.405

The provisions of §§ 15.203 and 15.205 are included.

§15.407 (b)(6)

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209.

§15.407 (b)(7)

The provisions of §15.205 apply to intentional radiators operating under this section

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limits (dBµV/m)
0.009 – 0.49	2400/F(kHz)@300m	3	(48.5 – 13.8)@300m
0.49 – 1.705	24000/F(kHz)@30m	3	(33.8 – 23.0)@30m
1.705 – 30	30@30m	3	29.5@30m

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (2).

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limits (dBµV/m)
30 – 88	100@3m	3	40.0@3m
88 – 216	150@3m	3	43.5@3m
216 – 960	200@3m	3	46.0@3m
960 – 26000	500@3m	3	54.0@3m
26000 – 40000	500@3m	1	54.0@3m

The measured values above 26 GHz are corrected with an inverse linear distance extrapolation factor (20 dB/decade).

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor:

- Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)
- Limit (dBµV/m) = EIRP [dBm] – 20 log (d [m]) + 104.8

Limit types (in result tables):

RB – Emissions falls into a "Restricted Band" according FCC §§15.205 and 15.209 *)

UE – "Undesirable Emission Limit" according FCC §15.407

BE-RB – Band Edge Limit basing on "Restricted Band Limits"

BE-UE – Band Edge Limit basing on "Undesirable Emission Limit"

*) Below 1 GHz the limits of §15.209 are applied for all frequencies.

5.5.3 TEST PROTOCOL

Ambient temperature: 23 - 26 °C
Air Pressure: 1010 - 1024 hPa
Humidity: 36 - 56 %

WLAN a-Mode; 20 MHz; 6 Mbit/s								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5845	200.0	33.5	PEAK	100	43.5	10.0	RB
Conducted	5865	200.0	33.5	PEAK	100	43.5	10.0	RB
Conducted	5885	200.0	33.8	PEAK	100	43.5	9.7	RB
Radiated	5885	-	-	-	-	-	-	-

WLAN n-Mode; 20 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5845	-	-	-	-	-	-	-
Conducted	5865	-	-	-	-	-	-	-
Conducted	5885	-	-	-	-	-	-	-

WLAN n-Mode; 40 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5835	-	-	-	-	-	-	-
Conducted	5875	-	-	-	-	-	-	-

WLAN ac-Mode; 20 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5845	-	-	-	-	-	-	-
Conducted	5865	-	-	-	-	-	-	-
Conducted	5885	-	-	-	-	-	-	-

WLAN ac-Mode; 40 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5835	-	-	-	-	-	-	-
Conducted	5875	-	-	-	-	-	-	-

WLAN ac-Mode; 80 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5855	-	-	-	-	-	-	-

WLAN ax-Mode; 20 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5845	200.0	34.3	PEAK	100	43.5	9.2	RB
Conducted	5865	200.0	32.8	PEAK	100	43.5	10.7	RB
Conducted	5885	200.0	32.8	PEAK	100	43.5	10.7	RB
Radiated	5885	-	-	-	-	-	-	-

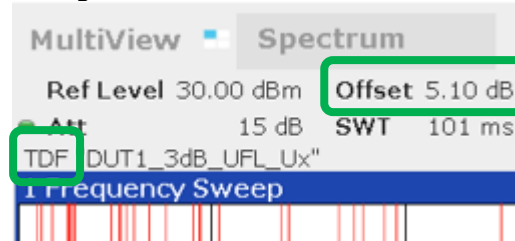
WLAN ax-Mode; 40 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5835	-	-	-	-	-	-	-
Conducted	5875	-	-	-	-	-	-	-

WLAN ax-Mode; 80 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
Conducted	5855	-	-	-	-	-	-	-

Remark: Radiated tests were performed with 50 Ohm termination at the antenna port.
Empty rows show tested channels where no non-noise floor peaks closer than 6 dB to the limit were found.
Please see next sub-clause for the measurement plot.

5.5.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

For plots showing TDF in the upper corner of the plot a transducer factor was used in the measurement compensating the path attenuation as well as ground reflection factor. The antenna gain is considered in form of trace offset.



Since the transducer below 1 GHz was missing the path attenuation of the UFL cable, it was added to the antenna gain in the trace offset.

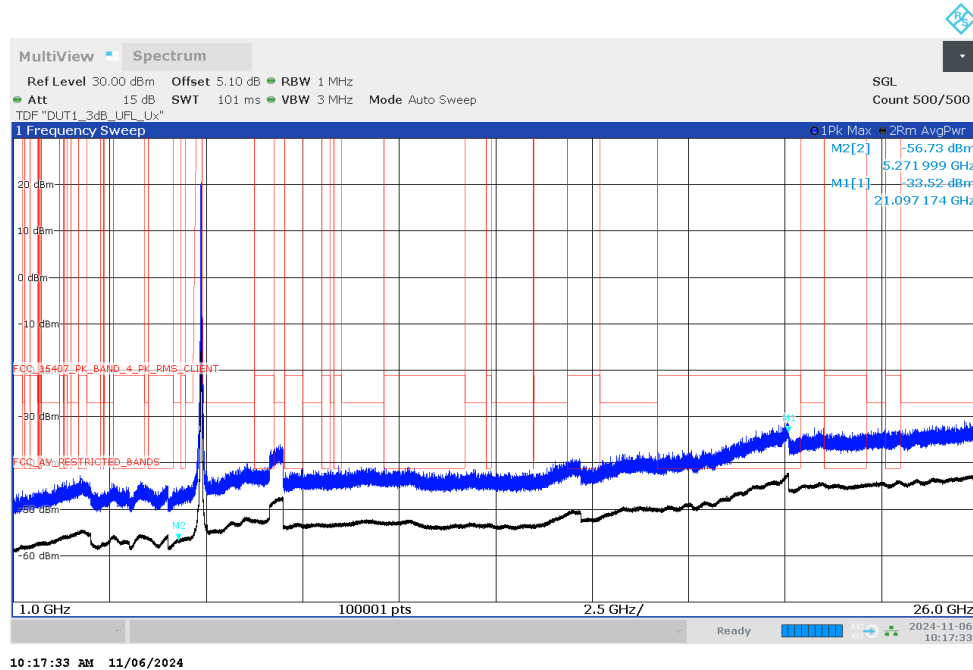
For the other plots the offset includes the worst case path attenuation of the measurement range as well as ground reflection factor and antenna gain.

For example range 26-40 GHz, highest path attenuation of measurement range = 15.3 dB, ground reflection factor of measurement range = 0 dB, antenna gain = 5.1 dBi.

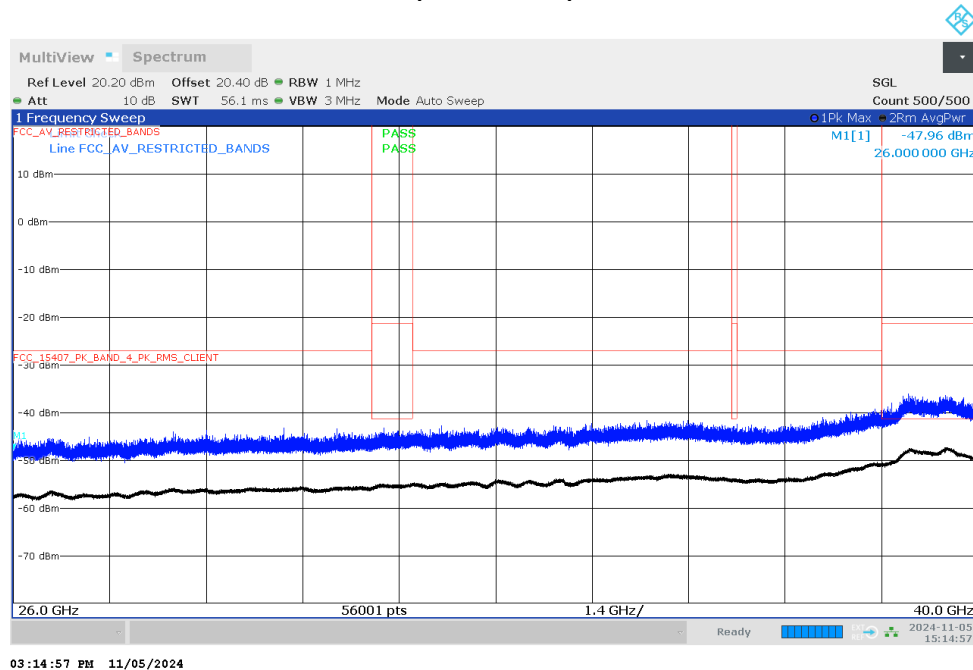
Resulting offset = 15.3 + 0 + 5.1 dB = 20.4 dB

Conducted Measurement Plots

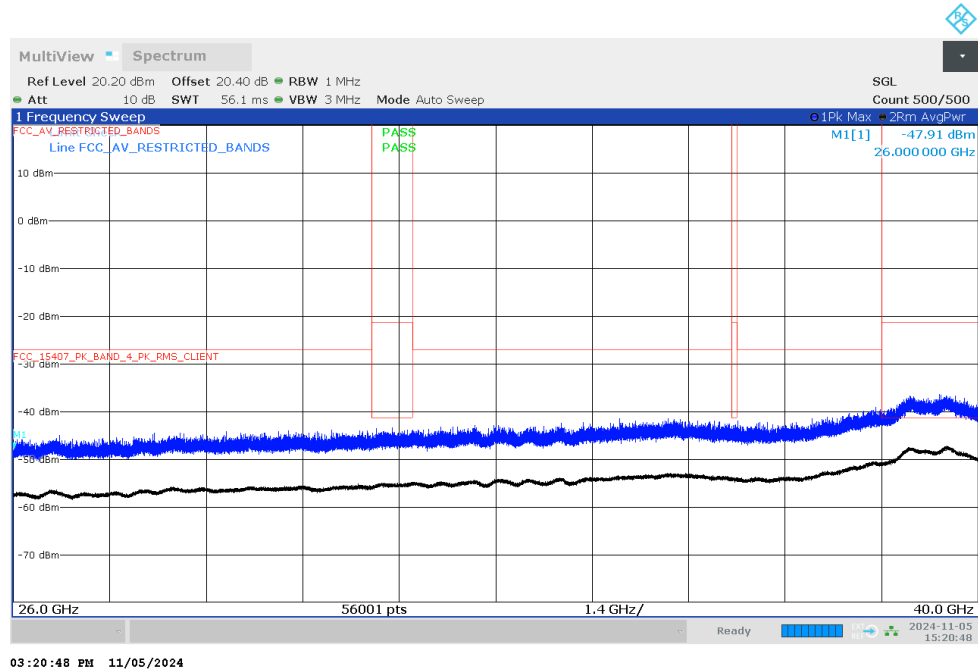
Radio Technology = WLAN ac 20 MHz, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S01_AD02)



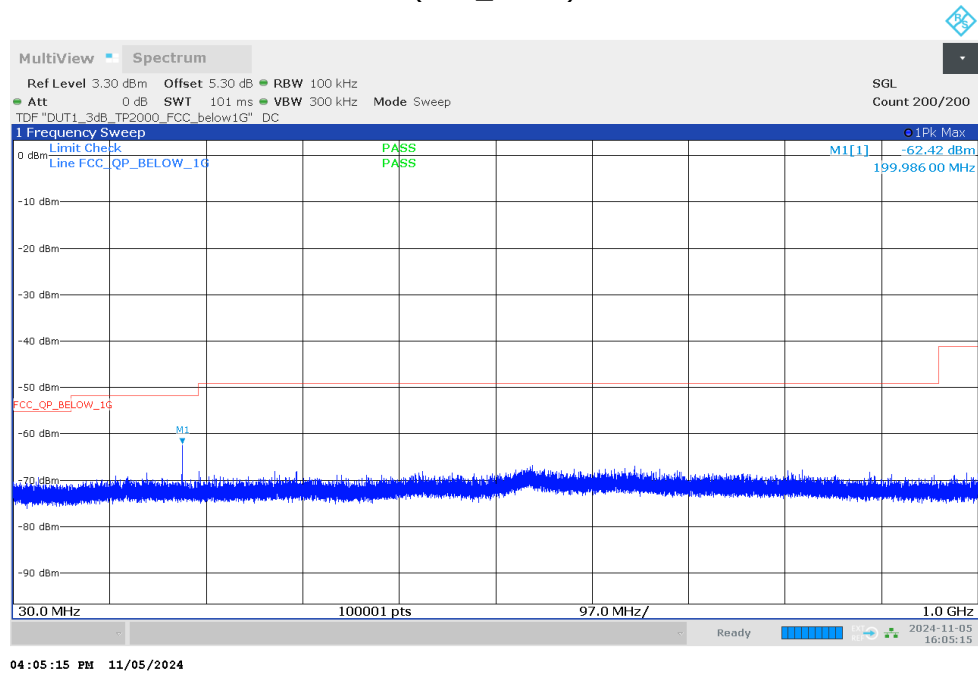
Radio Technology = WLAN a, Operating Frequency = straddle, Measurement range = 26GHz - 40GHz, Subband = U-NII-3 + U-NII-4 (S01_AD02)



Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 26GHz - 40GHz, Subband = U-NII-4 (S01_AD02)

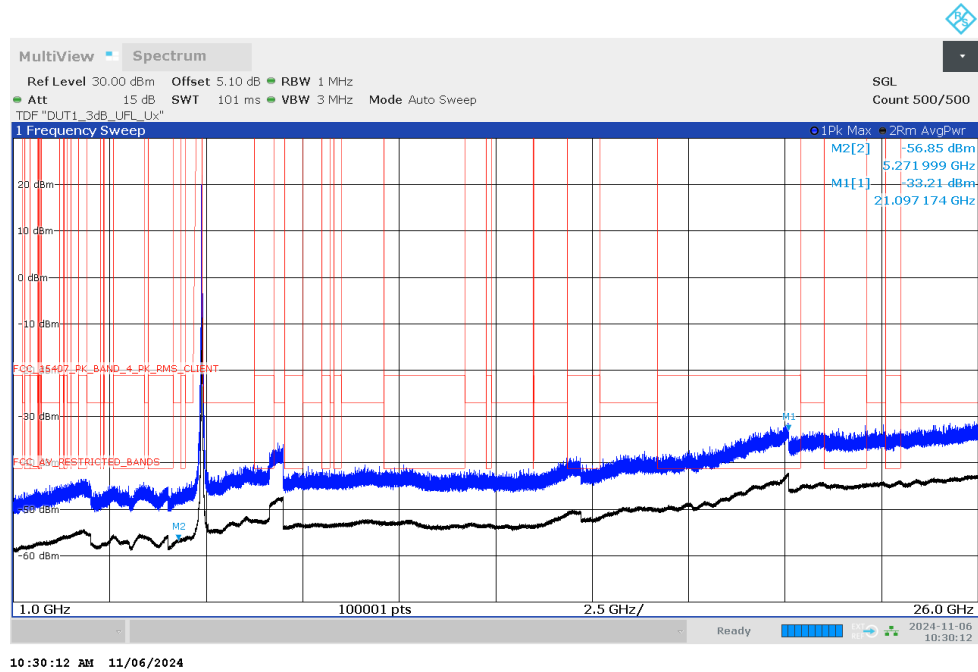


Radio Technology = WLAN ax 20 MHz, Operating Frequency = low, Measurement range = 30MHz - 1GHz, Subband = U-NII-4 (S01_AD02)

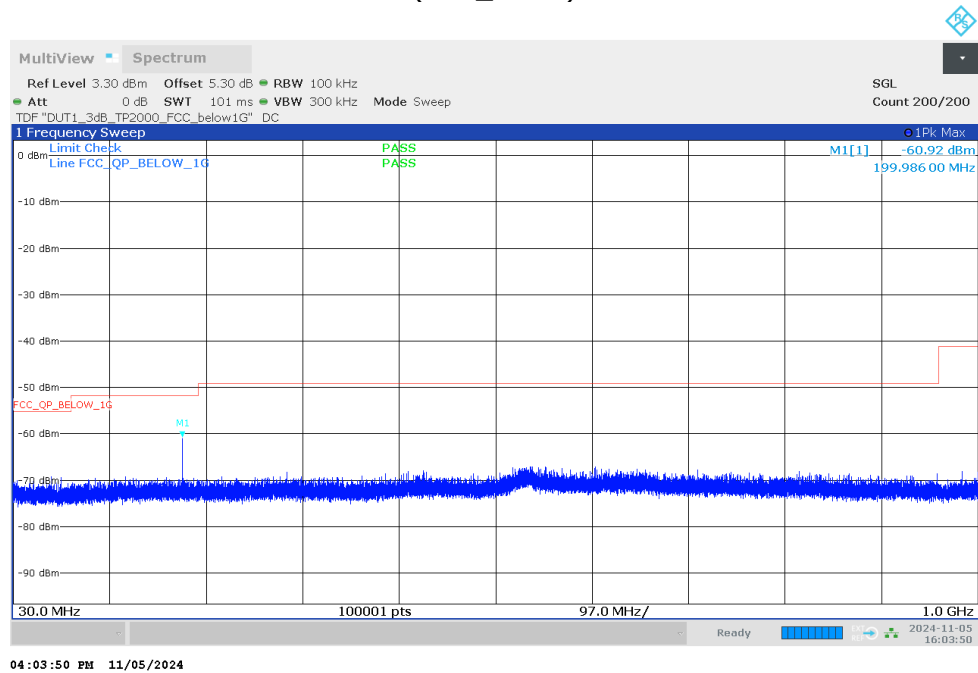


Remark: An additional 0.2 dB are added to the offset since the used transducer is missing the UFL cable.

Radio Technology = WLAN ax 20 MHz, Operating Frequency = high, Measurement range =
1GHz - 26GHz, Subband = U-NII-4
(S01_AD02)

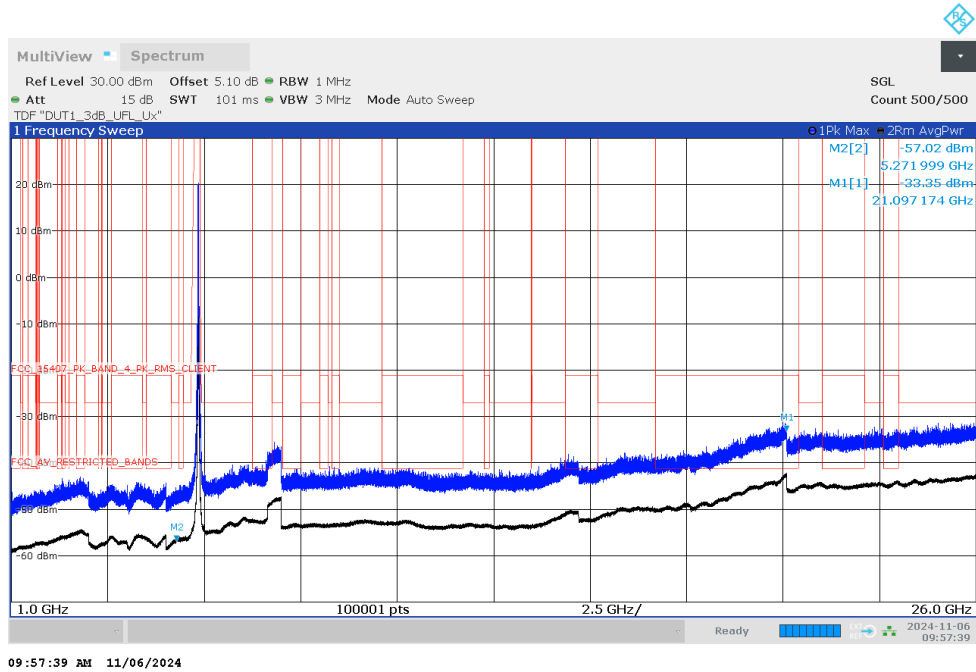


Radio Technology = WLAN ax 20 MHz, Operating Frequency = straddle, Measurement range =
30MHz - 1GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)

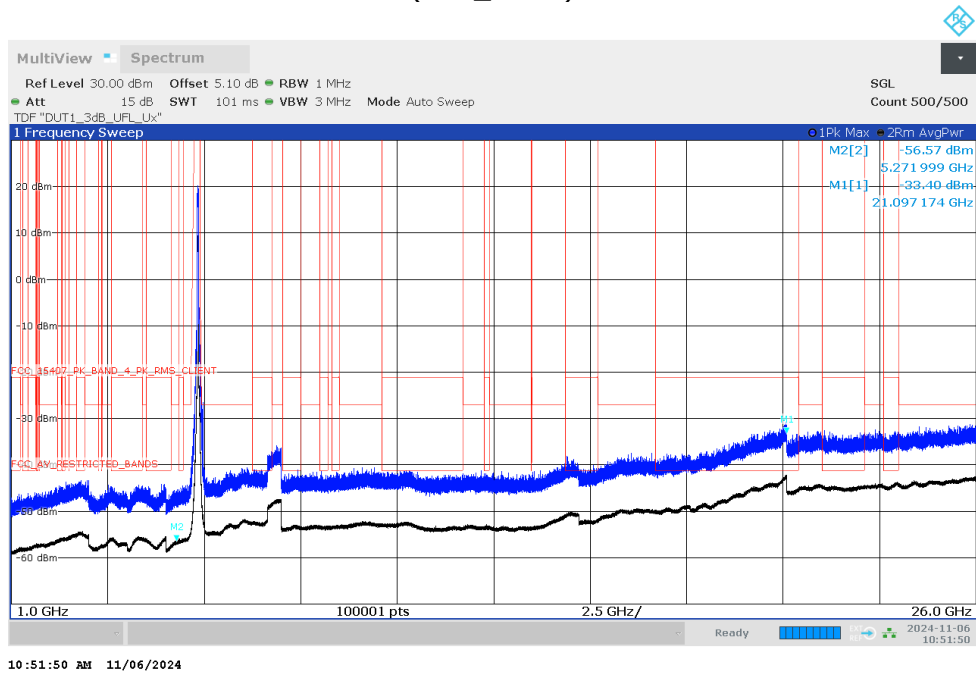


Remark: An additional 0.2 dB are added to the offset since the used transducer is missing the UFL cable.

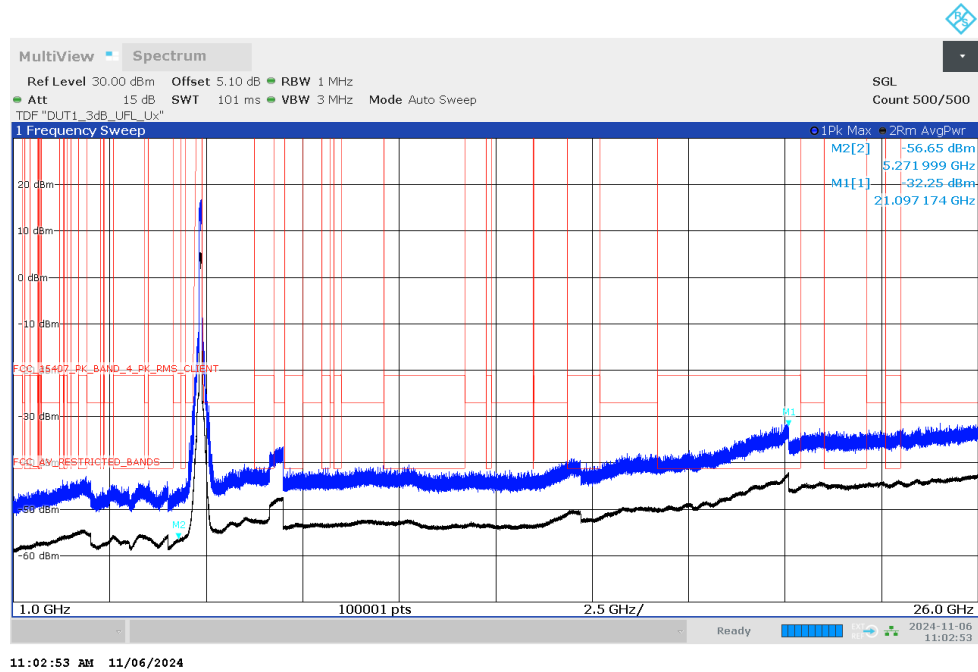
Radio Technology = WLAN n 20 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



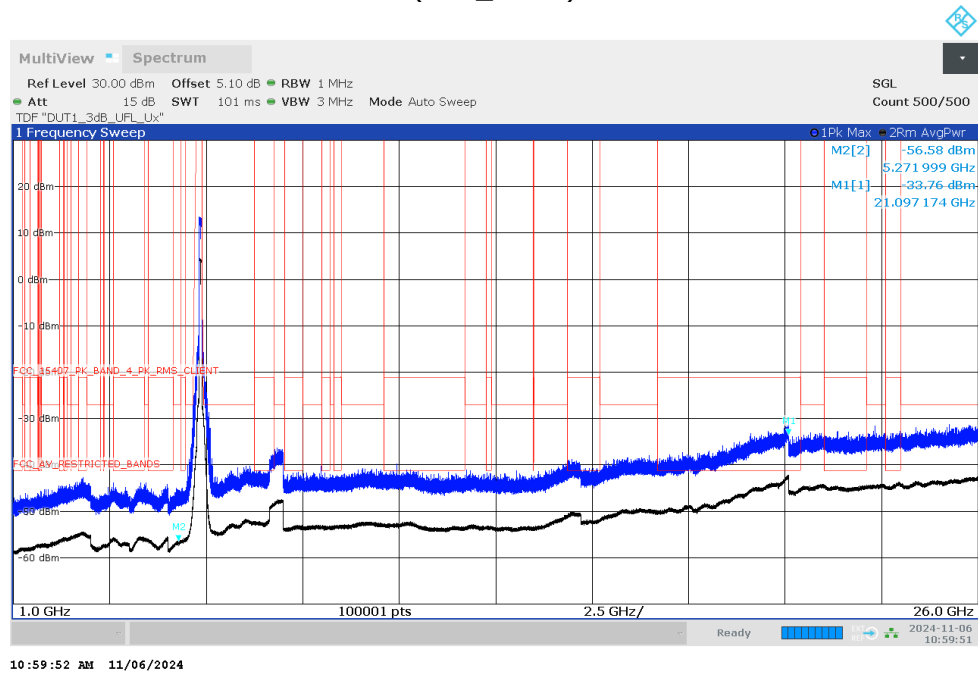
Radio Technology = WLAN ax 40 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



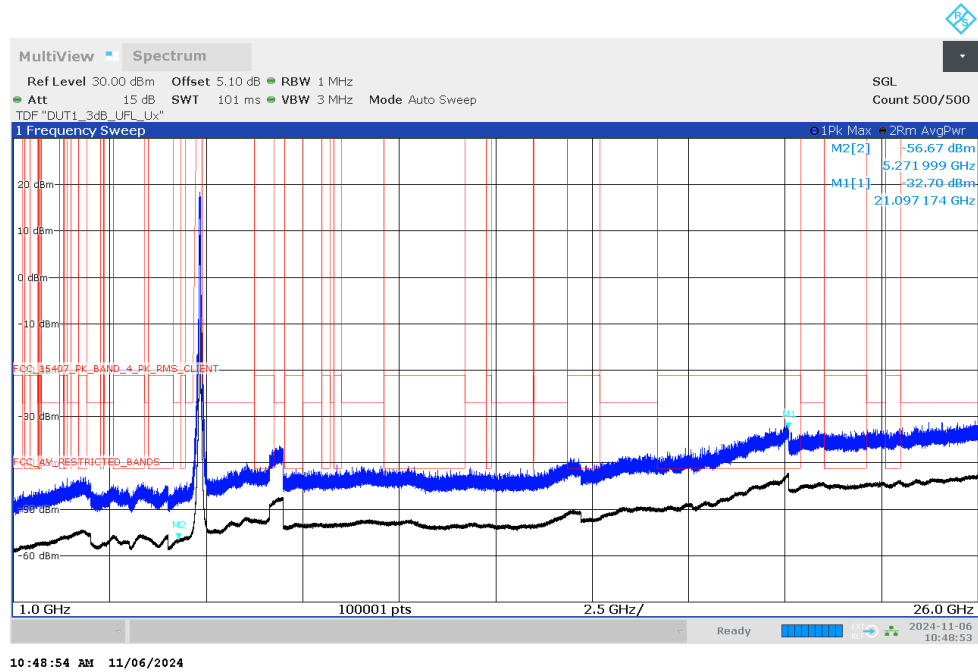
Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



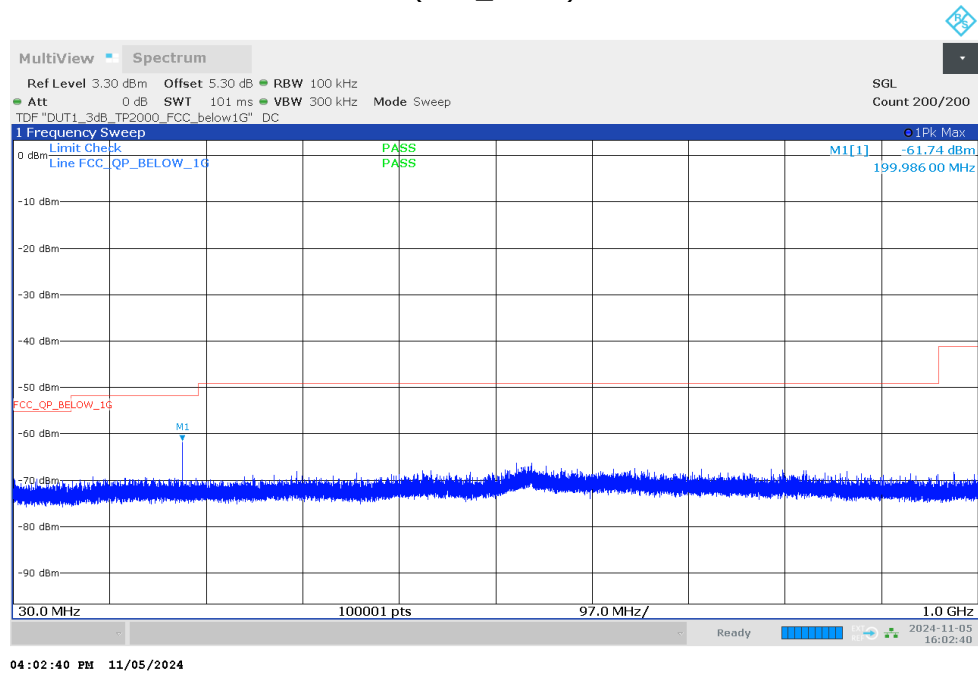
Radio Technology = WLAN ac 80 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



Radio Technology = WLAN ac 40 MHz, Operating Frequency = straddle, Measurement range = 1GHz - 26GHz, Subband = U-NII-3 + U-NII-4 (S01_AD02)

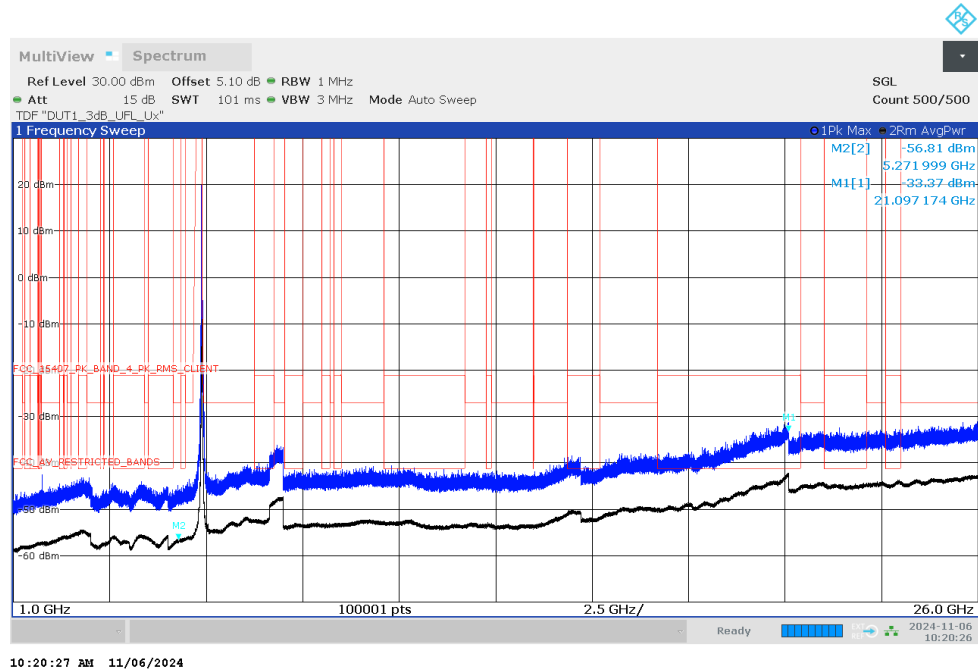


Radio Technology = WLAN a, Operating Frequency = straddle, Measurement range = 30MHz - 1GHz, Subband = U-NII-3 + U-NII-4 (S01_AD02)

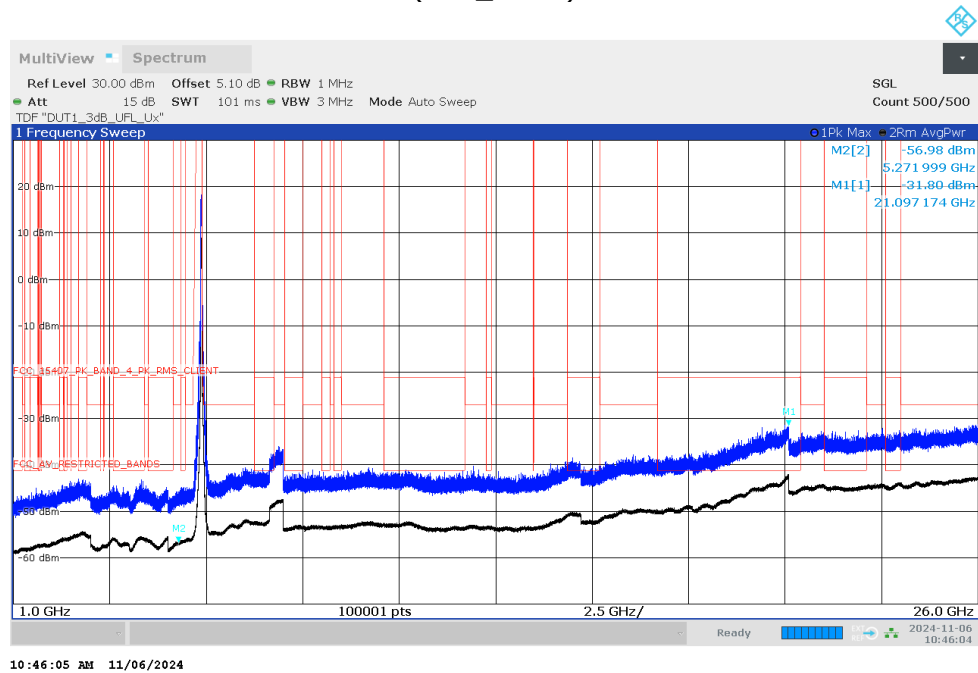


Remark: An additional 0.2 dB are added to the offset since the used transducer is missing the UFL cable.

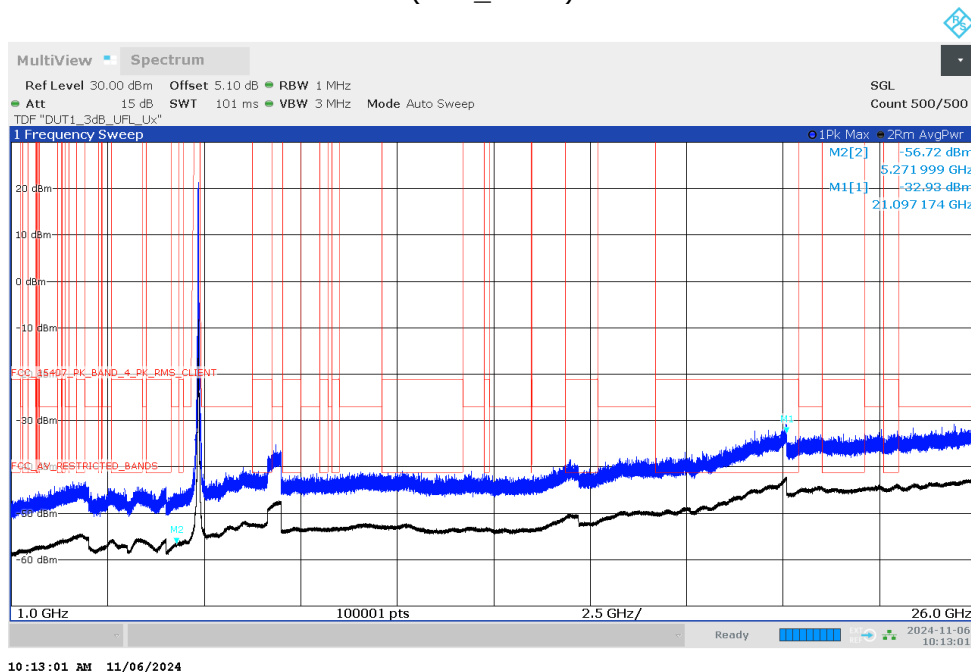
Radio Technology = WLAN ac 20 MHz, Operating Frequency = high, Measurement range =
1GHz - 26GHz, Subband = U-NII-4
(S01_AD02)



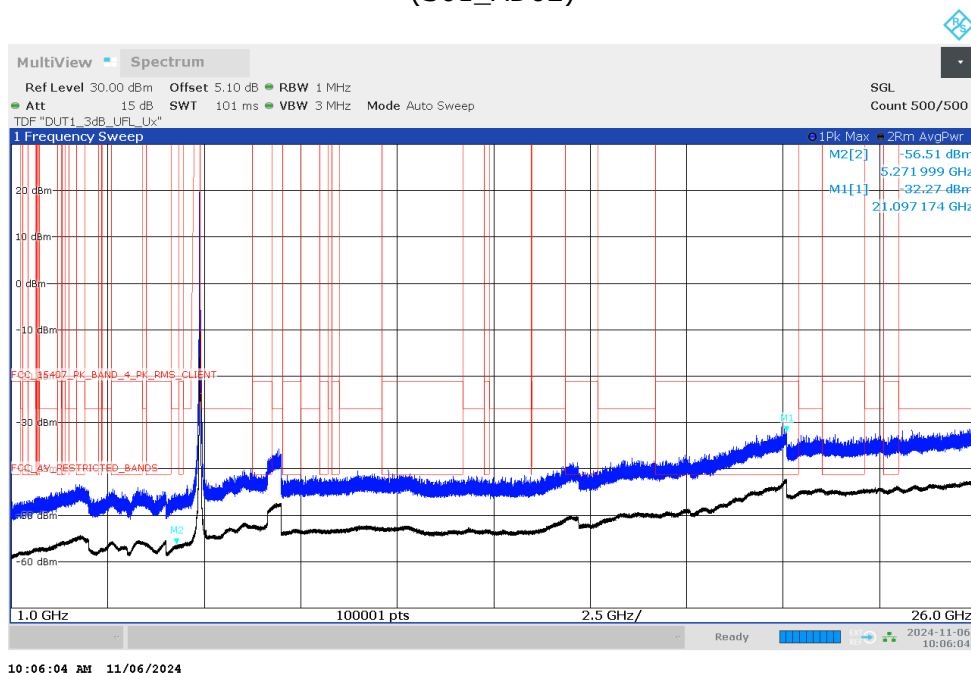
Radio Technology = WLAN ac 40 MHz, Operating Frequency = low, Measurement range =
1GHz - 26GHz, Subband = U-NII-4
(S01_AD02)



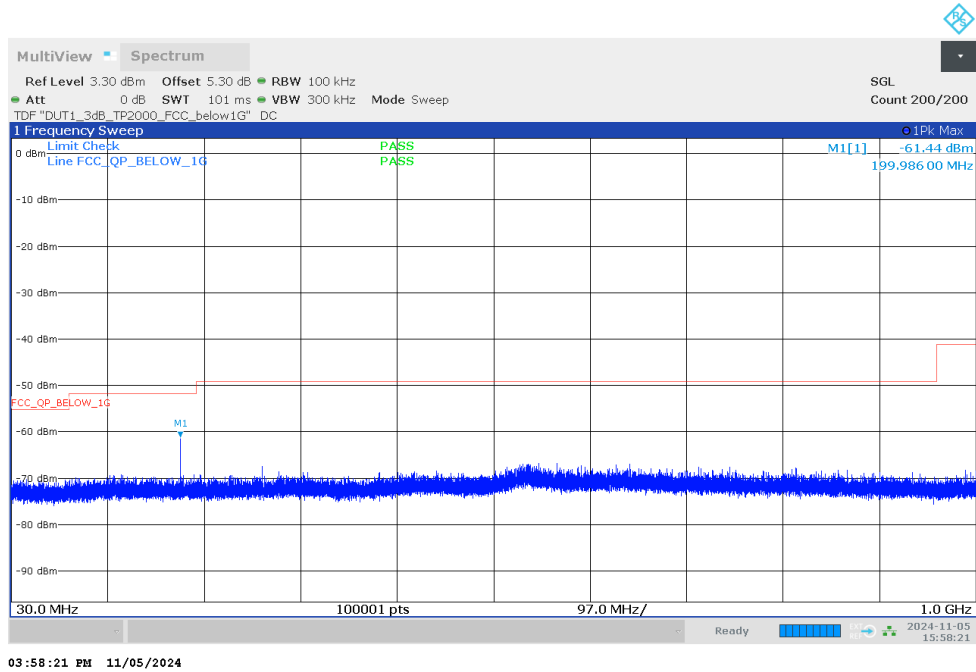
Radio Technology = WLAN ac 20 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Measurement range =
1GHz - 26GHz, Subband = U-NII-4
(S01_AD02)



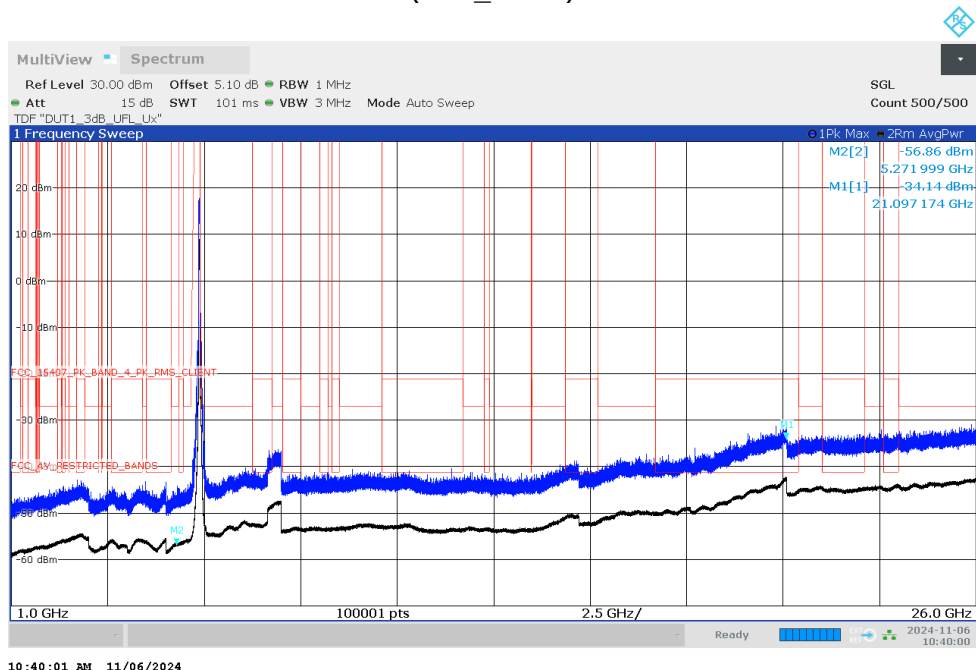
Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 30MHz - 1GHz, Subband = U-NII-4 (S01_AD02)



03:58:21 PM 11/05/2024

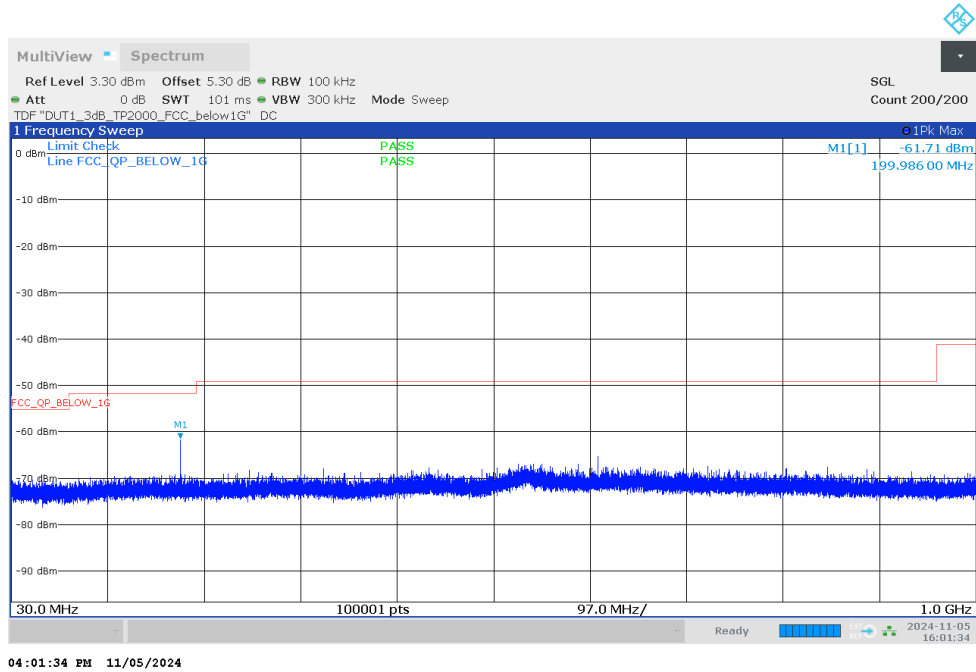
Remark: An additional 0.2 dB are added to the offset since the used transducer is missing the UFL cable.

Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S01_AD02)



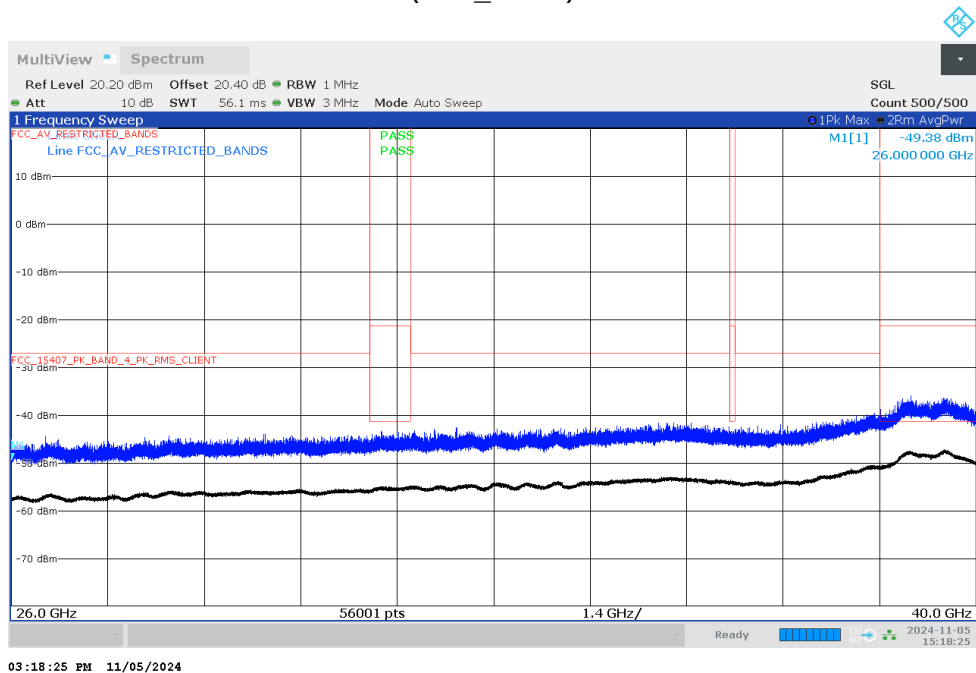
10:40:01 AM 11/06/2024

Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 30MHz - 1GHz, Subband = U-NII-4 (S01_AD02)

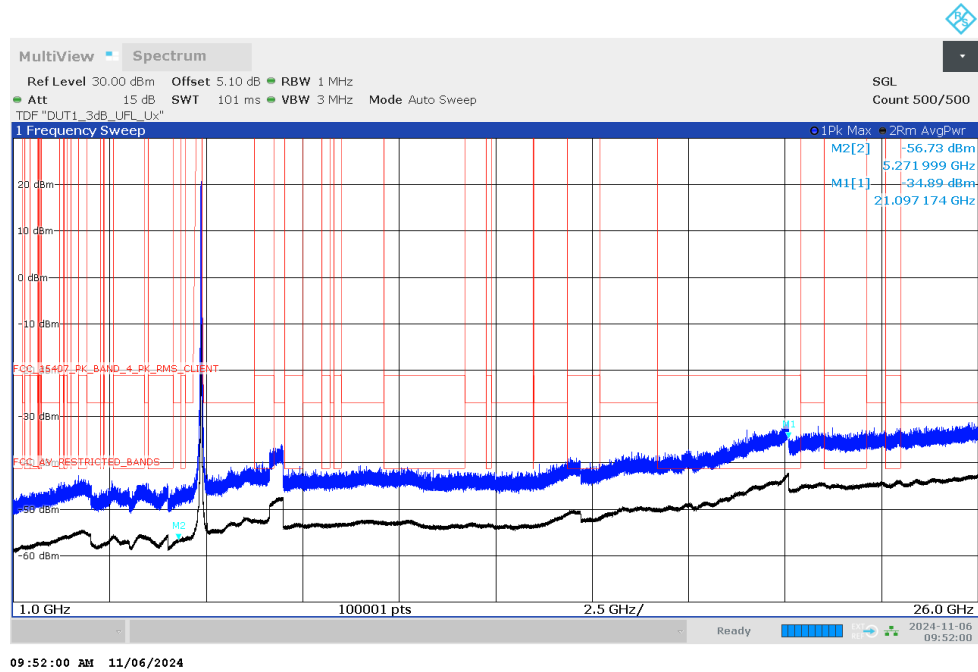


Remark: An additional 0.2 dB are added to the offset since the used transducer is missing the UFL cable.

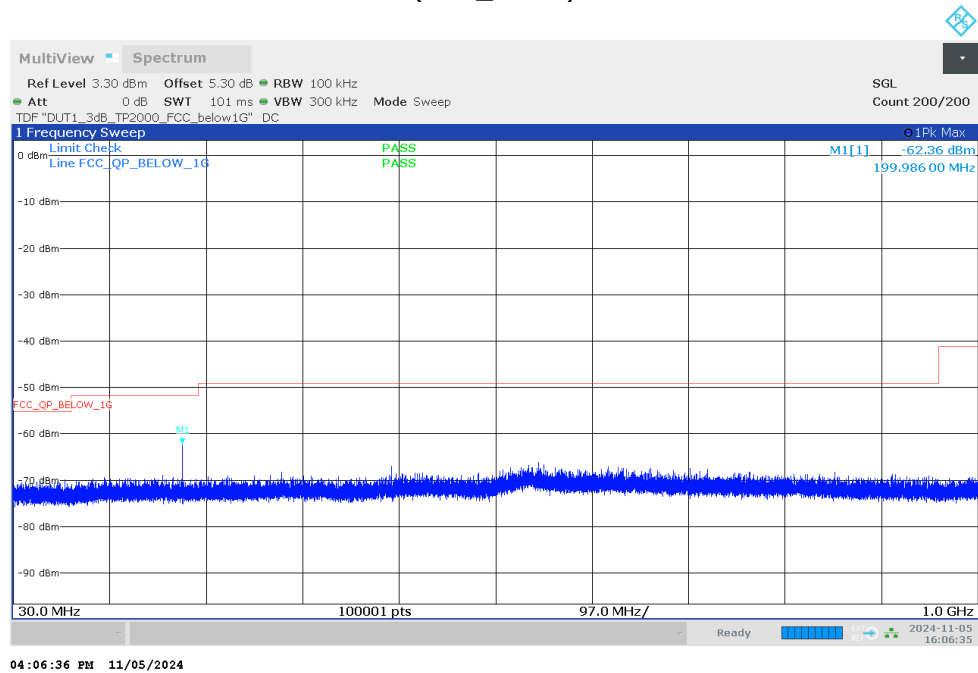
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 26GHz - 40GHz, Subband = U-NII-4 (S01_AD02)



Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S01_AD02)

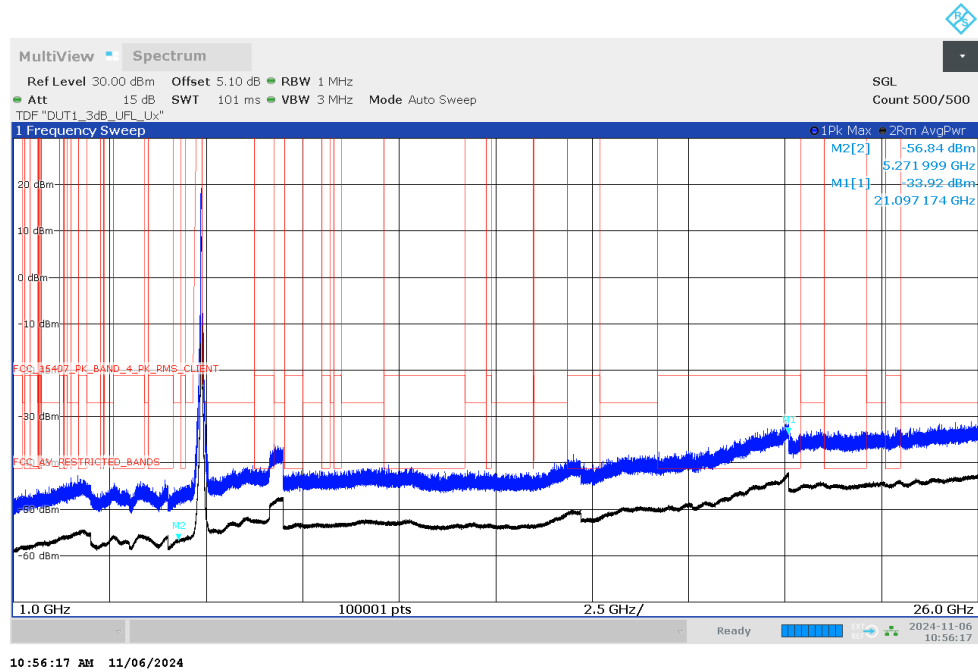


Radio Technology = WLAN ax 20 MHz, Operating Frequency = high, Measurement range = 30MHz - 1GHz, Subband = U-NII-4 (S01_AD02)

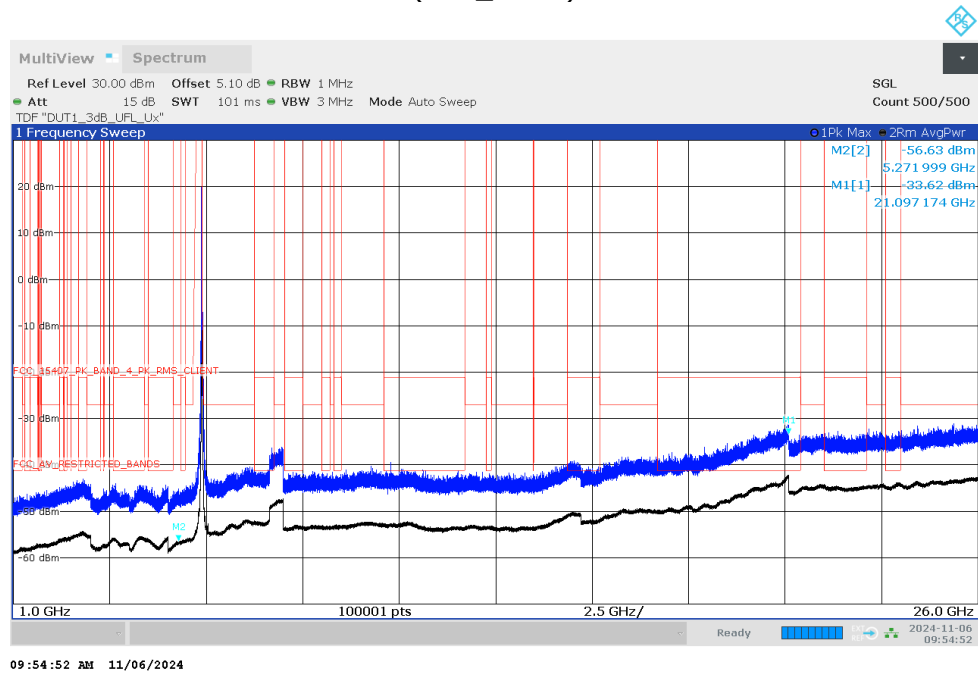


Remark: An additional 0.2 dB are added to the offset since the used transducer is missing the UFL cable.

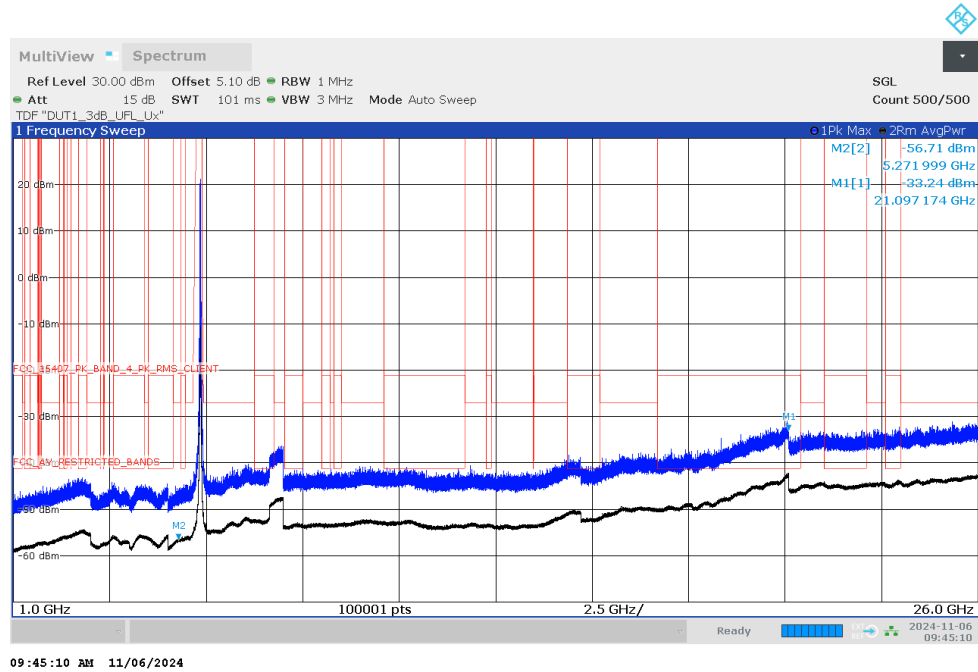
Radio Technology = WLAN ax 40 MHz, Operating Frequency = low, Measurement range =
1GHz - 26GHz, Subband = U-NII-4
(S01_AD02)



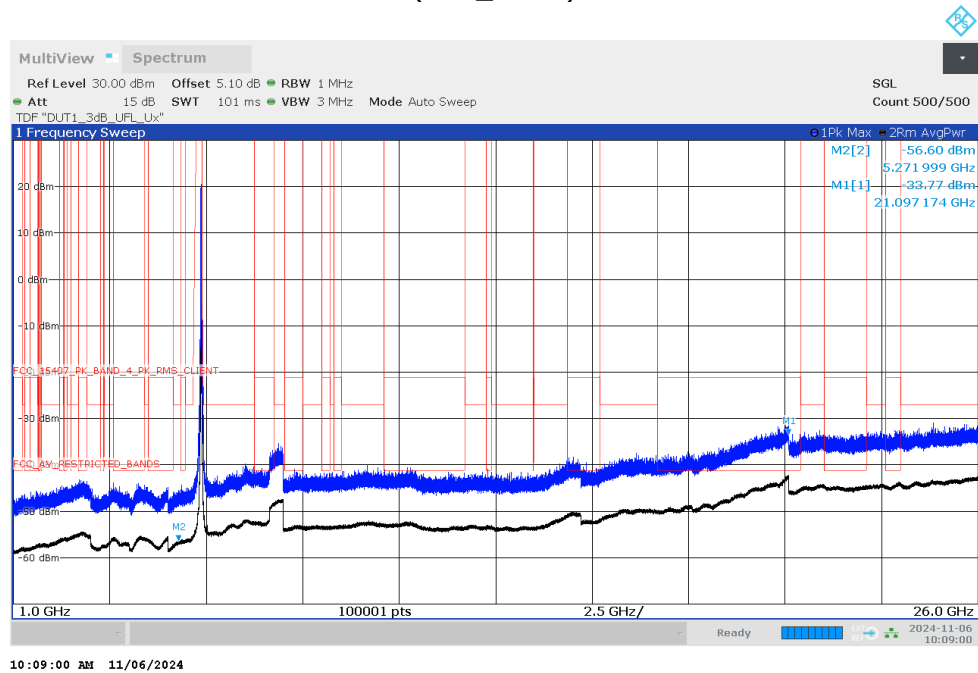
Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 1GHz -
26GHz, Subband = U-NII-4
(S01_AD02)



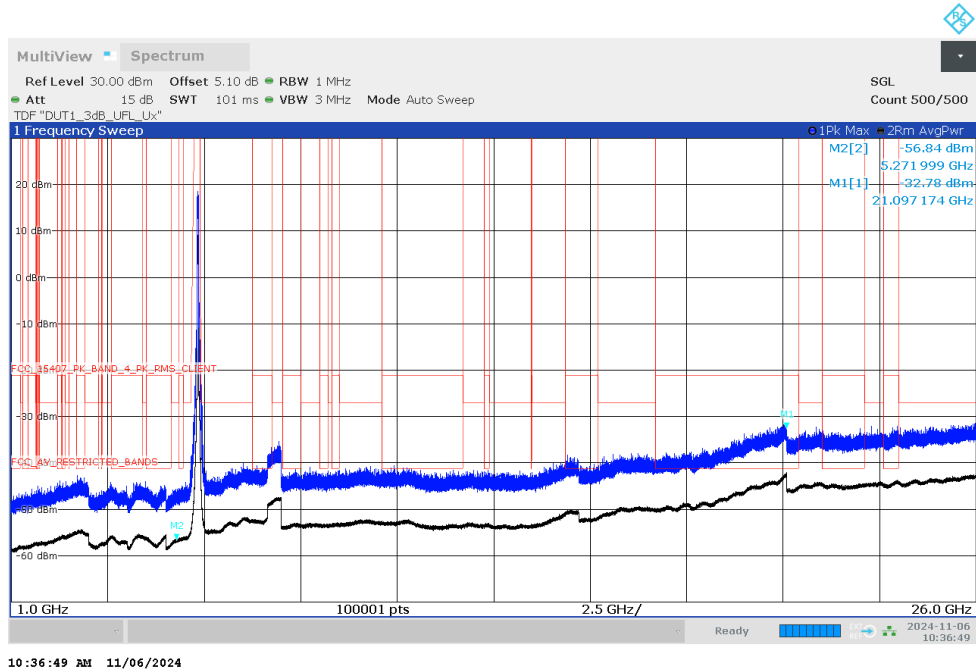
Radio Technology = WLAN a, Operating Frequency = straddle, Measurement range = 1GHz - 26GHz, Subband = U-NII-3 + U-NII-4 (S01_AD02)



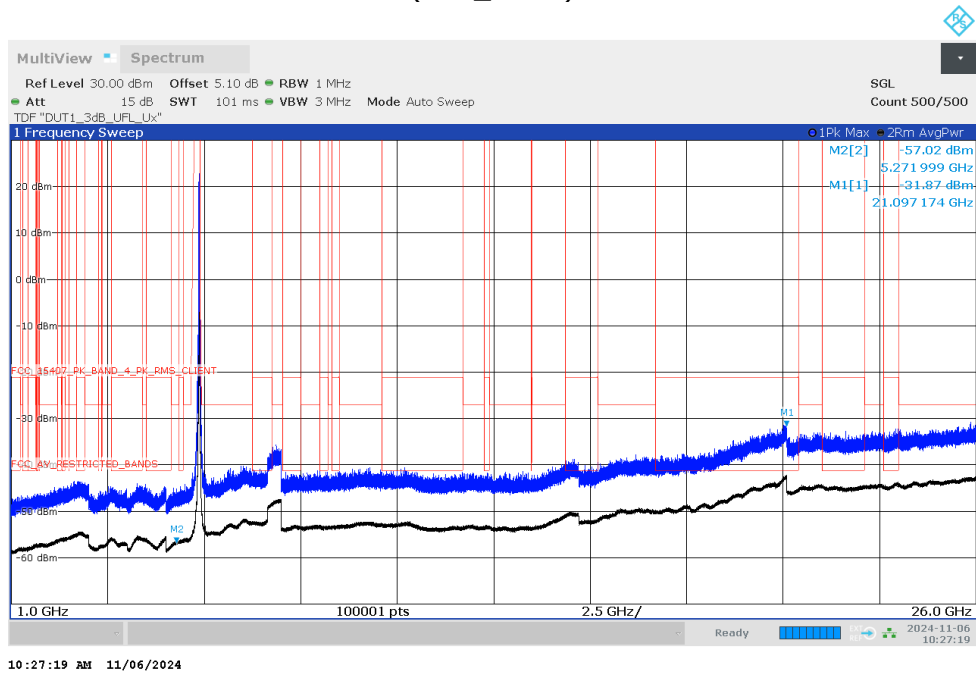
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S01_AD02)



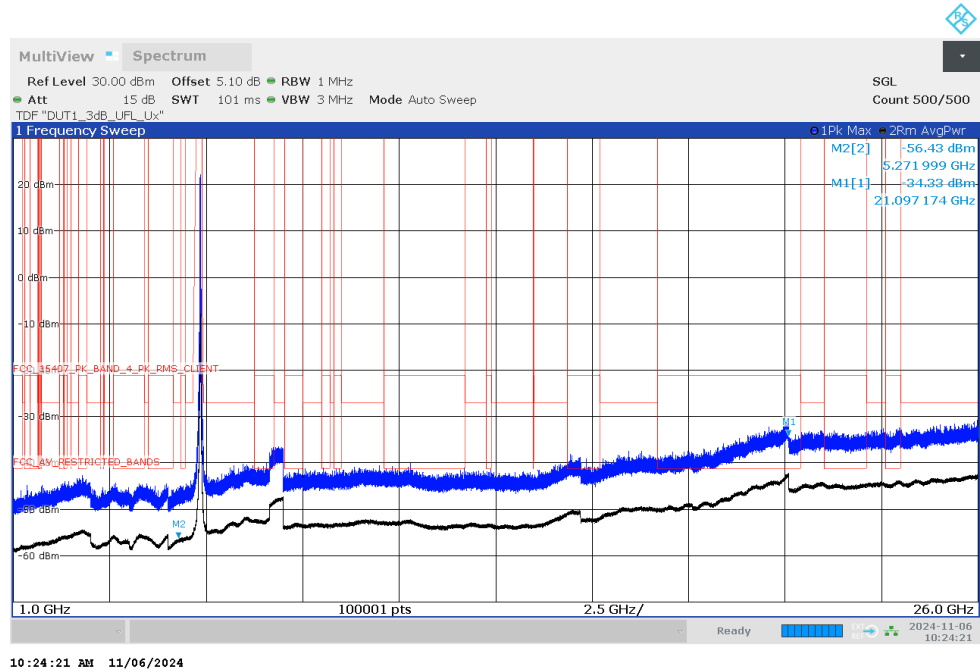
Radio Technology = WLAN n 40 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



Radio Technology = WLAN ax 20 MHz, Operating Frequency = low, Measurement range =
1GHz - 26GHz, Subband = U-NII-4
(S01_AD02)



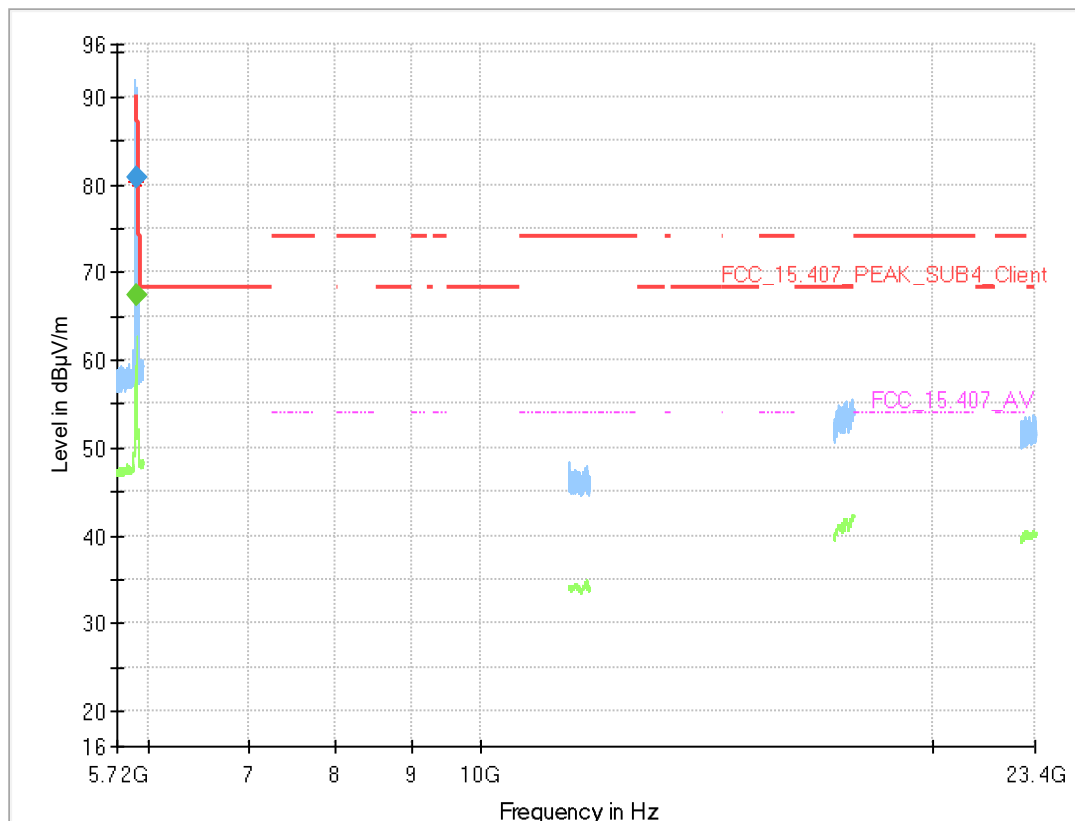
Radio Technology = WLAN ax 20 MHz, Operating Frequency = straddle, Measurement range =
1GHz - 26GHz, Subband = U-NII-3 + U-NII-4
(S01_AD02)



10:24:21 AM 11/06/2024

Radiated Measurement Plots

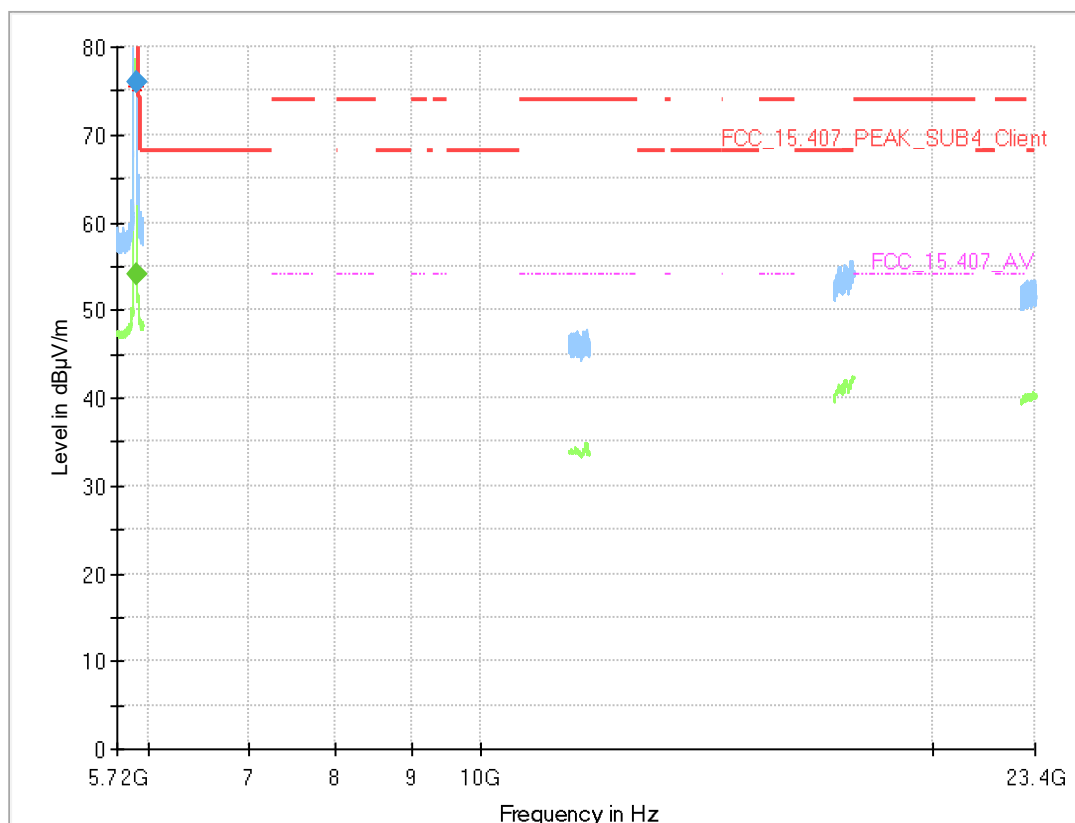
Radio Technology = WLAN ax 20 MHz, Operating Frequency = high, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S02_AC02)



Final Result

Frequency (MHz)	MaxPeak (dB μ V/m)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
5895.010	---	67.5	---	---	1000.0	1000.000	150.0	V	-124.0	95.0	16.3
5895.010	80.8	---	90.19	9.41	1000.0	1000.000	150.0	V	-124.0	95.0	16.3

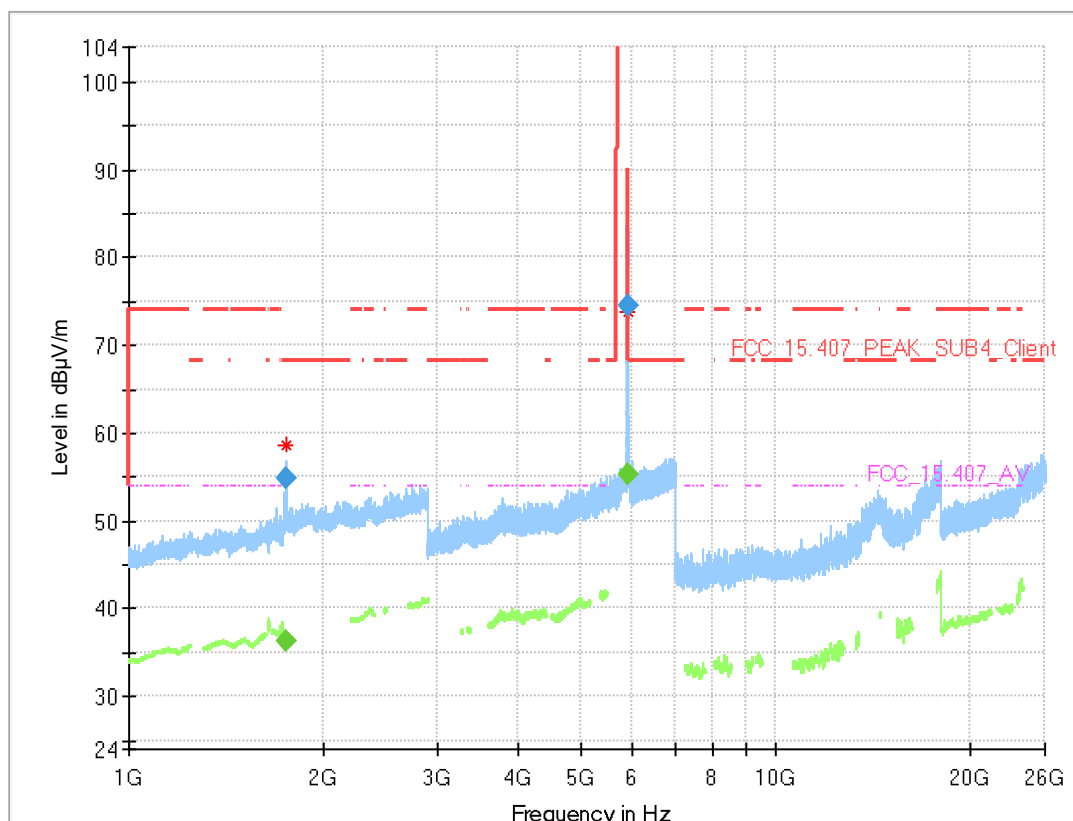
Radio Technology = WLAN ax 40 MHz, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S02_AC02)



Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
5895.010	---	54.1	---	---	1000.0	1000.000	150.0	H	-10.0	-11.0	16.3
5895.010	76.1	---	90.19	14.11	1000.0	1000.000	150.0	H	-10.0	-11.0	16.3

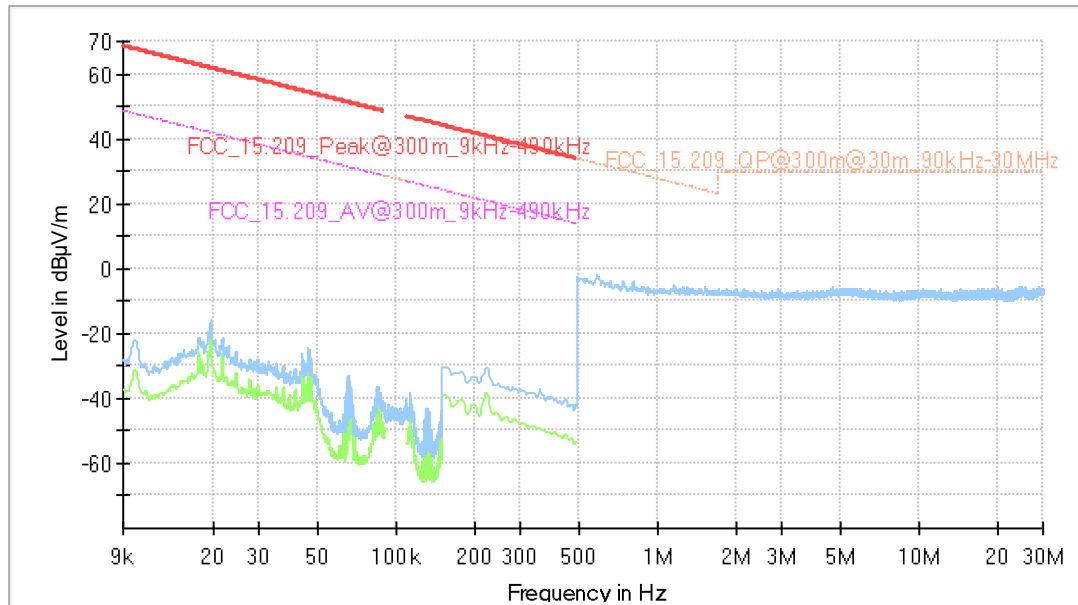
Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 1GHz - 26GHz, Subband = U-NII-4 (S02_AC02)



Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
1748.957	---	36.4	---	---	1000.0	1000.000	150.0	H	-191.0	-12.0	6.0
1748.957	54.8	---	68.20	13.39	1000.0	1000.000	150.0	H	-191.0	-12.0	6.0
5895.000	---	55.3	---	---	1000.0	1000.000	150.0	H	-10.0	-1.0	16.3
5895.000	74.5	---	90.20	15.72	1000.0	1000.000	150.0	H	-10.0	-1.0	16.3

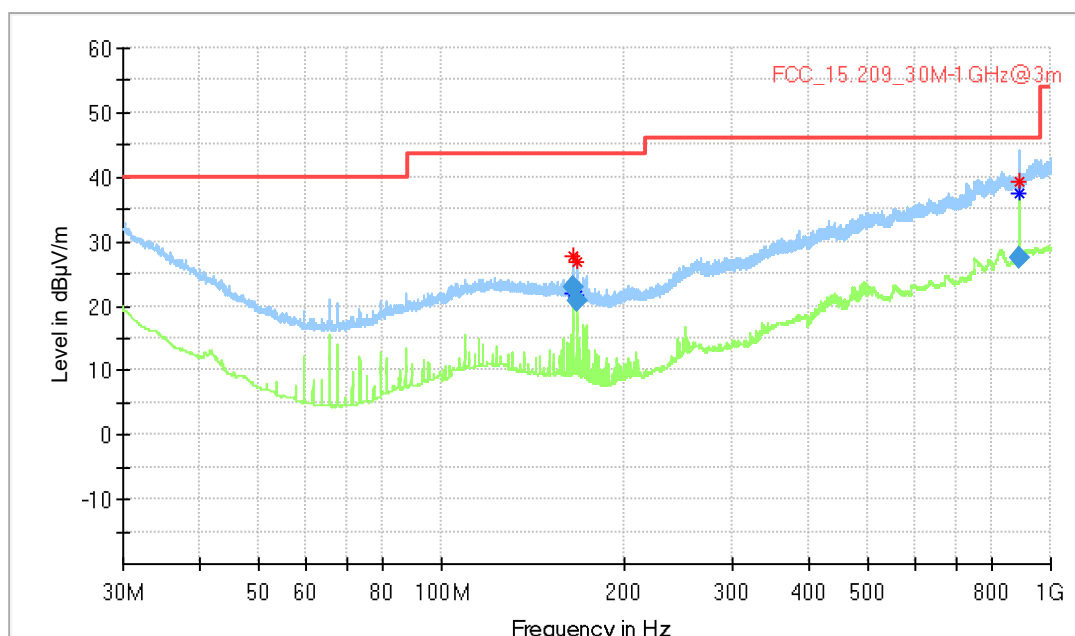
Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 9kHz - 30MHz, Subband = U-NII-4 (S02_AC02)



Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
---	---	---	---	---	---	---	---	---	---

Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 30MHz - 1GHz, Subband = U-NII-4 (S02_AC02)



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
164.670000	22.96	43.50	20.54	1000.0	120.000	110.0	V	-85.0	18.5
166.650000	20.89	43.50	22.61	1000.0	120.000	104.0	V	-102.0	18.3
889.470000	27.36	46.00	18.64	1000.0	120.000	250.0	V	-91.0	35.1

5.5.5 TEST EQUIPMENT USED

- Radiated Emissions SAC H-Field
- Radiated Emissions FAR 5 GHz FCC
- Radiated Emissions SAC up to 1 GHz
- R&S TS8997

5.6 BAND EDGE

Standard **FCC Part 15 Subpart E**

The test was performed according to:

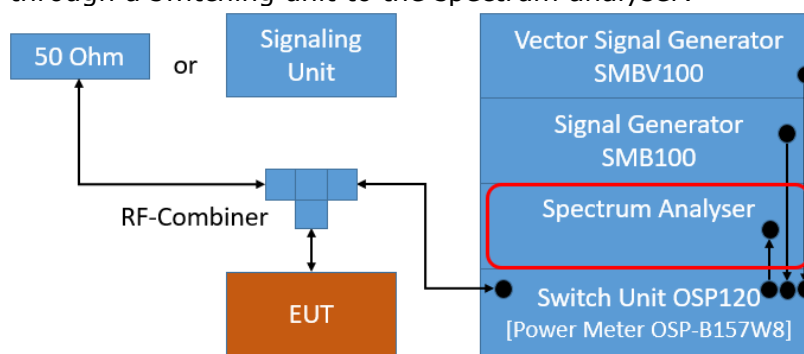
ANSI C63.10, chapter 6.6.5

5.6.1 TEST DESCRIPTION

See test case: 5.5 UNDESIRABLE EMISSIONS; GENERAL FIELD STRENGTH LIMITS

Deviation form Undesirable Emissions:

EUT is connected through a switching unit to the spectrum analyser:



TS8997

Results are given in dBm/MHz for this test case since limits are given in dBm/MHz. This means calculation is done the other way around, conducted results are taken as is and 95.2 dB is subtracted from the radiated results.

5.6.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15 Subpart E, §15.407 (b)(5)

For transmitters operating in the 5850–5925 MHz band:

Above Band:

Indoor Access Point Limit: 15 dBm/MHz at band edge
decreasing linearly to -7 dBm/MHz at 5925 MHz.

Client Device Limit: -5 dBm/MHz at band edge
decreasing linearly to -27 dBm/MHz at 5925 MHz.

Below Band: -27 dBm/MHz 5650 MHz
increasing linearly to 10 dBm/MHz at 5.7 GHz
increasing linearly to 15.6 dBm/MHz at 5.72 GHz
increasing linearly to 27 dBm/MHz at 5725 MHz.

B) IC

Different frequency bands and limits apply, as compared to the FCC requirements.

RSS-247, 6.2.5.3, For the band edge 5725 MHz and below, all devices shall be measured using peak detection and shall comply with the following e.i.r.p. spectral density limits:

- 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;

- b. 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- c. 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- d. -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

For the 5895 MHz band edge and above, all devices shall be measured using average detection and shall comply with the following e.i.r.p. spectral density limits:

- a. Fixed outdoor access points and fixed outdoor client devices shall not exceed -27 dBm/MHz e.i.r.p. spectral density at or above the 5895 MHz band edge.;
- b. Indoor access points or indoor subordinate devices shall not exceed 15 dBm/MHz e.i.r.p. spectral density at the 5895 MHz band edge and shall decrease linearly to not exceed -7 dBm/MHz e.i.r.p. spectral density at or above 5925 MHz.
- c. Client devices shall not exceed -5 dBm/MHz e.i.r.p. spectral density at the 5895 MHz band edge and shall decrease linearly to not exceed -27 dBm/MHz e.i.r.p. spectral density at or above 5925 MHz.

5.6.3 TEST PROTOCOL

Ambient temperature: 23 - 26 °C
Air Pressure: 1010 - 1024 hPa
Humidity: 36 - 56 %

WLAN a-Mode; 20 MHz; 6 Mbit/s

Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
4	Radiated	5885	5895.0	-20.7	PEAK	1000	-5	15.7
3	Conducted	5845	5725.0	-40.8	PEAK	1000	27	67.8
3	Conducted	5845	5650.0	-43.3	PEAK	1000	-27	16.3
4	Conducted	5885	5895.0	-16.2	RMS	1000	-5	11.2
4	Conducted	5885	5925.0	-43.9	RMS	1000	-27	16.9

WLAN n-Mode; 20 MHz; MCS 0; SISO

Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
3	Conducted	5845	5725.0	-41.6	PEAK	1000	27	68.6
3	Conducted	5845	5650.0	-42.7	PEAK	1000	-27	15.7
4	Conducted	5885	5895.0	-10.8	RMS	1000	-5	5.8
4	Conducted	5885	5925.0	-42.4	RMS	1000	-27	15.4

WLAN n-Mode; 40 MHz; MCS 0; SISO

Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
3	Conducted	5835	5725.0	-29.8	PEAK	1000	27	56.8
3	Conducted	5835	5650.0	-39.2	PEAK	1000	-27	12.2
4	Conducted	5875	5895.0	-19.1	RMS	1000	-5	14.1
4	Conducted	5875	5925.0	-34.4	RMS	1000	-27	7.4

WLAN ac-Mode; 20 MHz; MCS 0; SISO

Applied duty cycle correction (AV): 0 dB

U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
3	Conducted	5845	5725.0	-41.6	PEAK	1000	27	68.6
3	Conducted	5845	5650.0	-40.7	PEAK	1000	-27	13.7
4	Conducted	5885	5895.0	-10.8	RMS	1000	-5	5.8
4	Conducted	5885	5925.0	-42.5	RMS	1000	-27	15.5

WLAN ac-Mode; 40 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
3	Conducted	5835	5725.0	-32.4	PEAK	1000	27	59.4
3	Conducted	5835	5650.0	-41.1	PEAK	1000	-27	14.1
4	Conducted	5875	5895.0	-18.9	RMS	1000	-5	13.9
4	Conducted	5875	5925.0	-34.3	RMS	1000	-27	7.3

WLAN ac-Mode; 80 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
3+4	Conducted	5855	5725.0	-22.7	PEAK	1000	27	49.7
3+4	Conducted	5855	5650.0	-28.7	PEAK	1000	-27	1.7
3+4	Conducted	5855	5895.0	-18.8	RMS	1000	-5	14.6
3+4	Conducted	5855	5925.0	-34.2	RMS	1000	-27	2.8

WLAN ax-Mode; 20 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
4	Radiated	5885	5895.0	-14.4	PEAK	1000	-5	9.4
3	Conducted	5845	5725.0	-40.4	PEAK	1000	27	67.4
3	Conducted	5845	5650.0	-42.2	PEAK	1000	-27	15.2
4	Conducted	5885	5895.0	-6.1	RMS	1000	-5	1.1
4	Conducted	5885	5925.0	-51.2	RMS	1000	-27	24.2

WLAN ax-Mode; 40 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
4	Radiated	5875	5895.0	-19.1	PEAK	1000	-5	14.1
3	Conducted	5835	5725.0	-33.6	PEAK	1000	27	60.6
3	Conducted	5835	5650.0	-40.9	PEAK	1000	-27	13.9
4	Conducted	5875	5895.0	-12.9	RMS	1000	-5	7.9
4	Conducted	5875	5925.0	-32.8	RMS	1000	-27	5.8

WLAN ax-Mode; 80 MHz; MCS 0; SISO								
Applied duty cycle correction (AV): 0 dB								
U-NII-Subband	Meas. Method	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBm/MHz]	Detector	RBW [kHz]	Limit [dBm/MHz]	Margin [dB]
3+4	Radiated	5855	5895.0	-23.1	PEAK	1000	-5	18.1
3+4	Conducted	5855	5725.0	-20.0	PEAK	1000	27	47.0
3+4	Conducted	5855	5650.0	-29.0	PEAK	1000	-27	2.0
3+4	Conducted	5855	5895.0	-14.3	RMS	1000	-5	9.3
3+4	Conducted	5855	5925.0	-28.9	RMS	1000	-27	1.9

Remark: Radiated Measurements were performed with 50 Ohm termination at the antenna port and peak detector result is compared to RMS limit (Peak detector is worst case compared to RMS detector, so if Peak detector passes, RMS will also pass).

No radiated measurements were performed for straddle channels at lower Band Edge because the 80 MHz straddle channel at high band edge already shows that the lower band edge is not critical.
Please see next sub-clause for the measurement plot.

5.6.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Conducted Measurements

The conducted measurement plot offset includes the path attenuation at the lower band edge for lower band edge measurements of straddle channels or the path attenuation at the higher band edge for high band edge measurements of high band edge. It also includes the antenna gain.

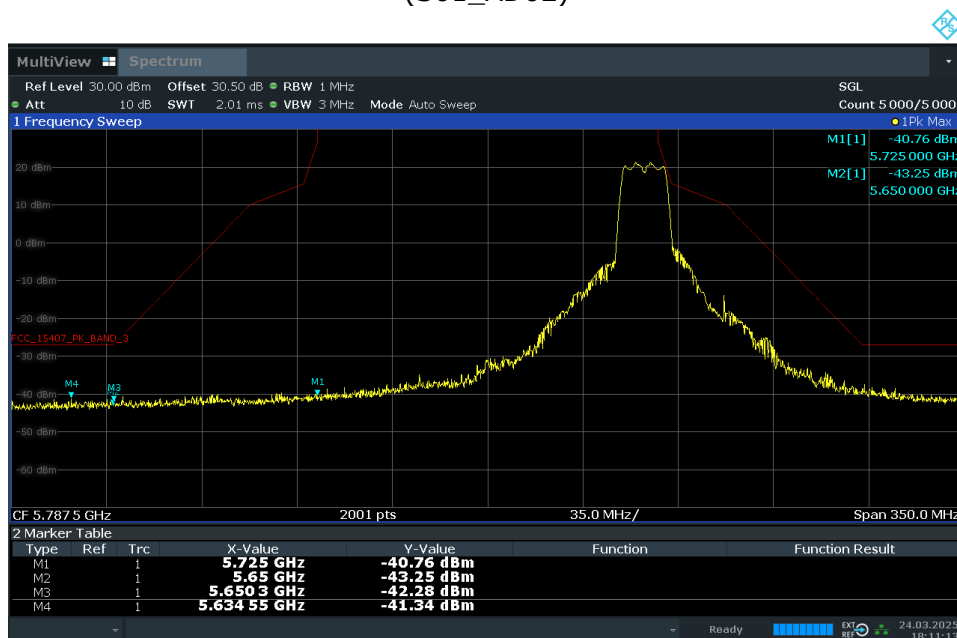
Path attenuation at lower BE = 11.7 dB (Measuring cable + UFL cable) + 13.7 (switching unit to analyser, at higher BE = 11.7 dB (Measuring cable + UFL cable) + 13.8 (switching unit to analyser.

Antenna gain = 5.1 dBi.

Resulting offset lower BE = 11.7 + 13.7 + 5.1 dB = 30.5 dB

Resulting offset higher BE = 11.7 + 13.8 + 5.1 dB = 30.6 dB

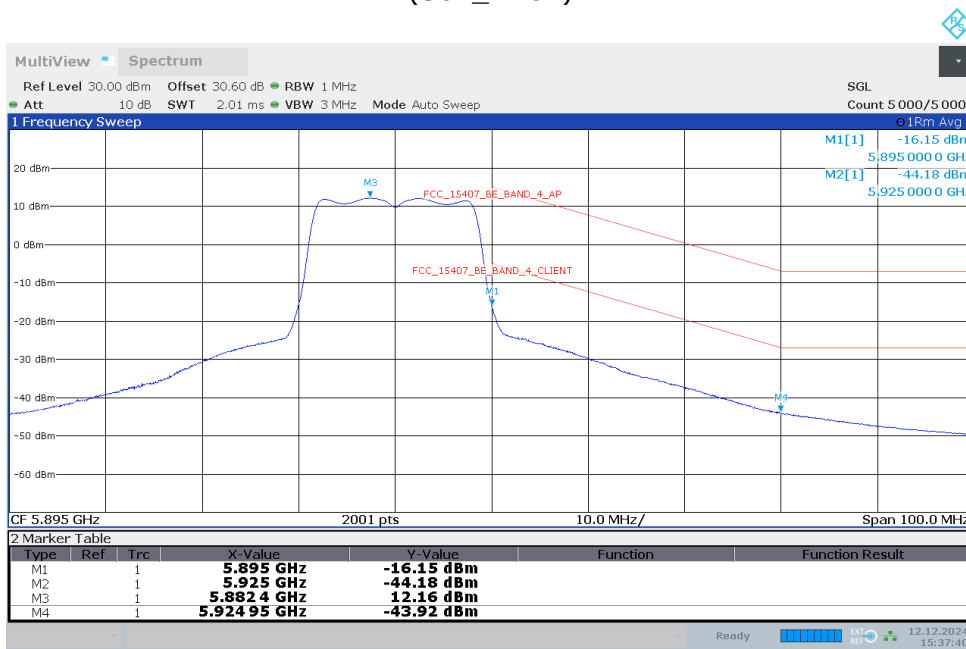
Radio Technology = WLAN a, Operating Frequency = straddle, Subband = U-NII-3 + 4, low BE (S01_AD02)



18:11:13 24.03.2025

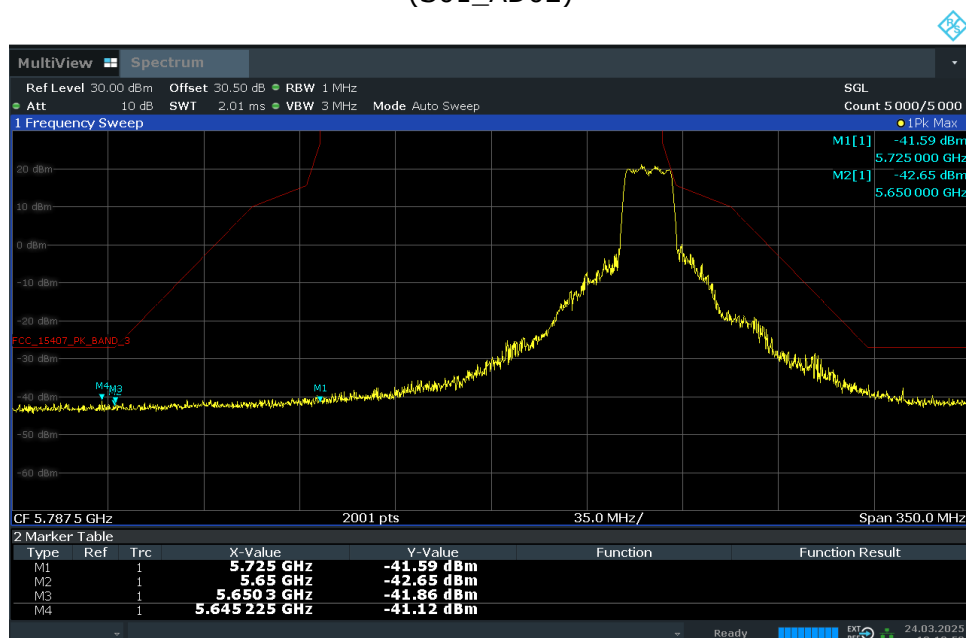
The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

Radio Technology = WLAN a, Operating Frequency = high, Subband = U-NII-4, high BE
(S01_AD02)



15:37:41 12.12.2024

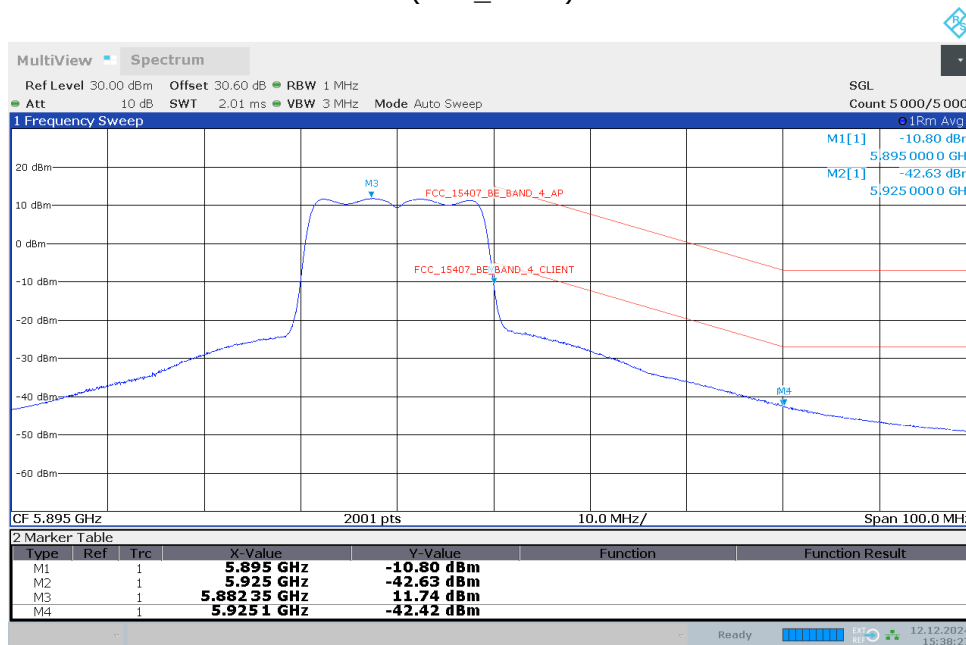
Radio Technology = WLAN n 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 + 4, low BE
(S01_AD02)



18:19:50 24.03.2025

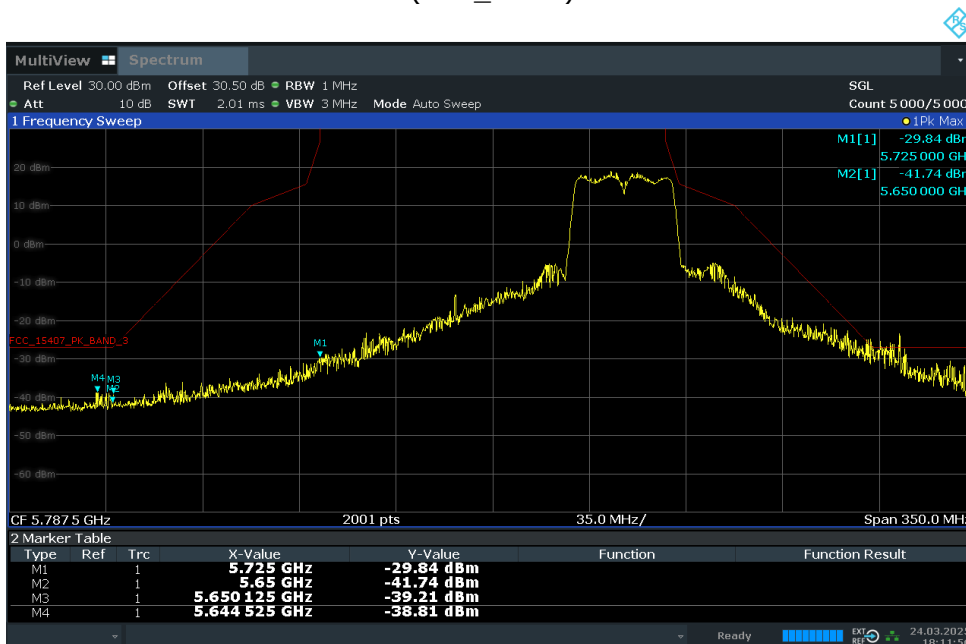
The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-4, high BE
(S01_AD02)



15:38:28 12.12.2024

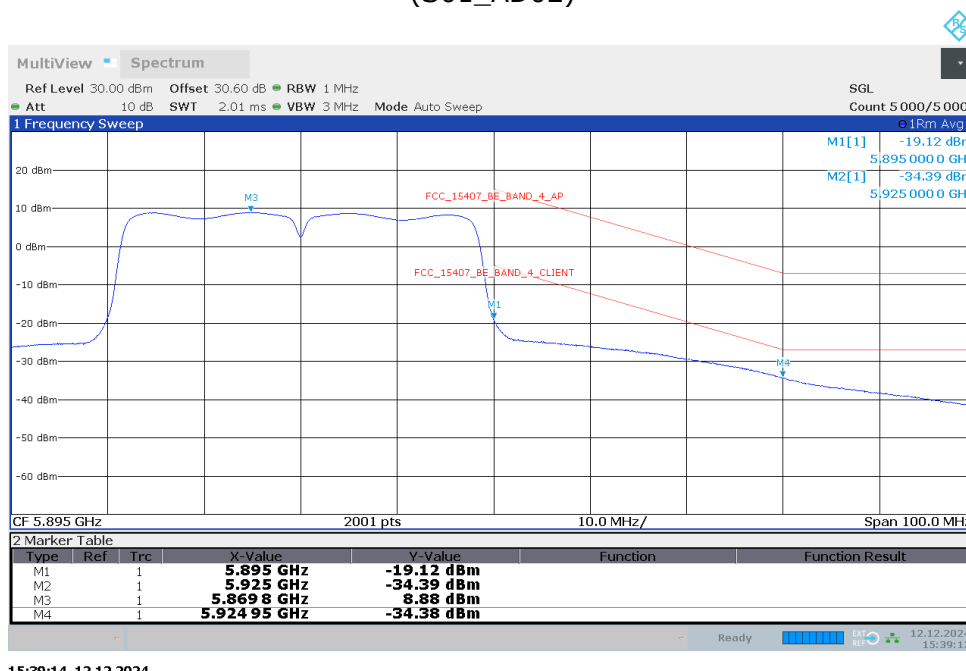
Radio Technology = WLAN n 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + 4, low BE
(S01_AD02)



18:11:57 24.03.2025

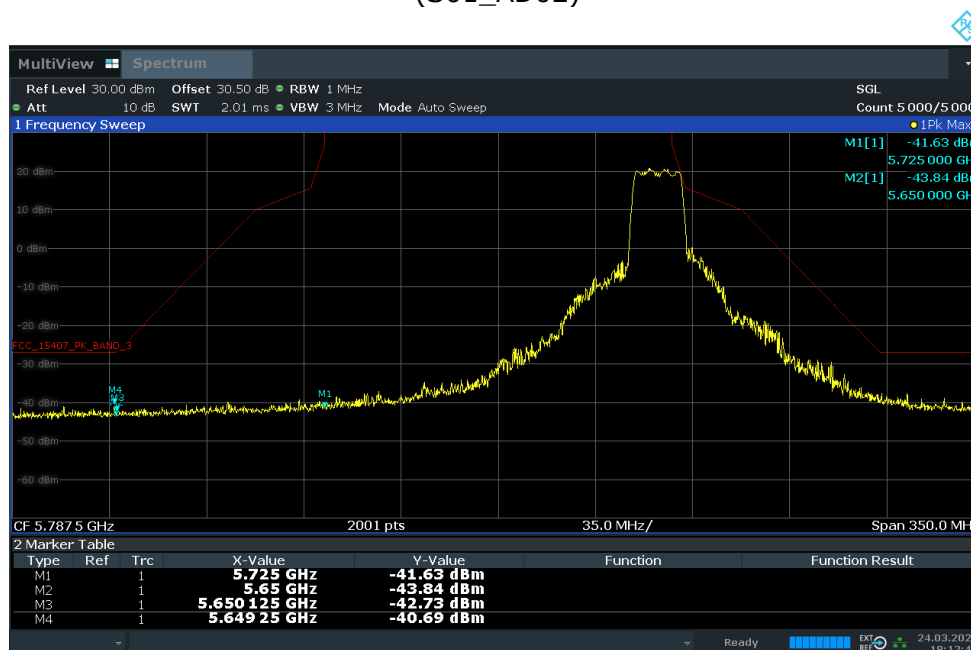
The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-4, high BE (S01_AD02)



15:39:14 12.12.2024

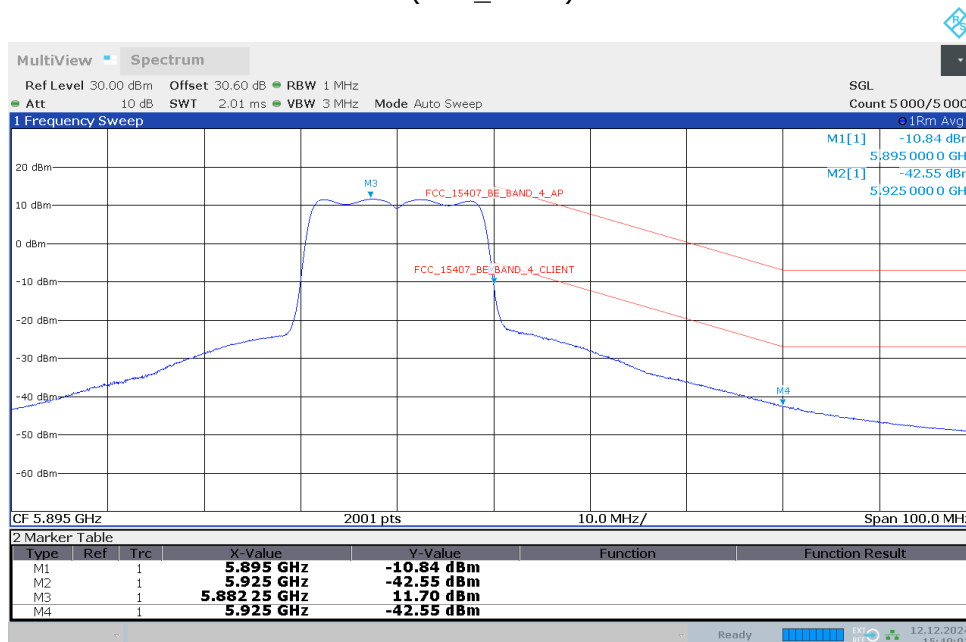
Radio Technology = WLAN ac 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 + 4, low BE (S01_AD02)



18:12:41 24.03.2025

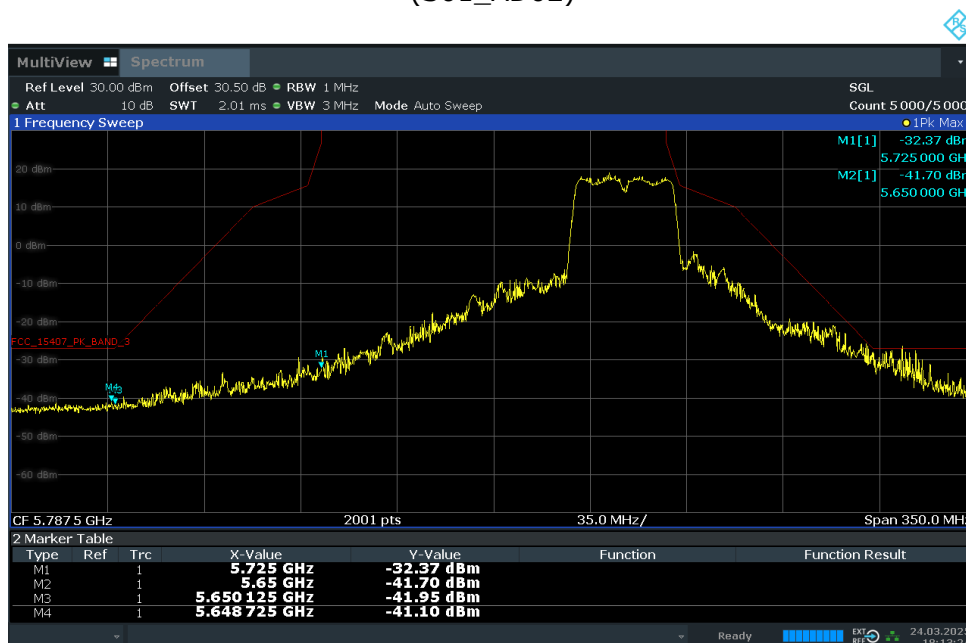
The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

Radio Technology = WLAN ac 20 MHz, Operating Frequency = high, Subband = U-NII-4, high BE
(S01_AD02)



15:40:01 12.12.2024

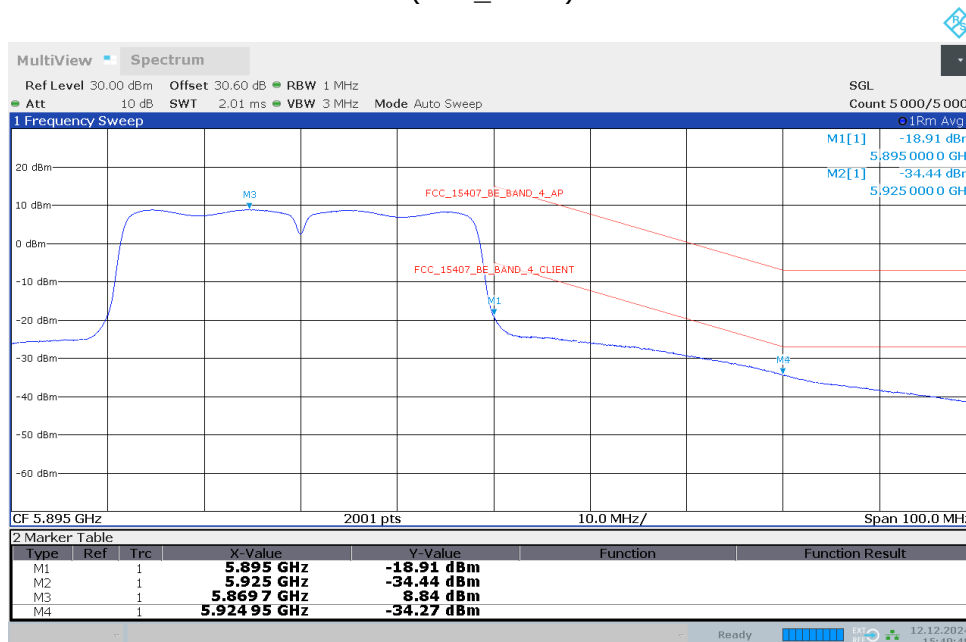
Radio Technology = WLAN ac 40 MHz, Operating Frequency = straddle, Subband = U-NII-4, low BE
(S01_AD02)



18:13:25 24.03.2025

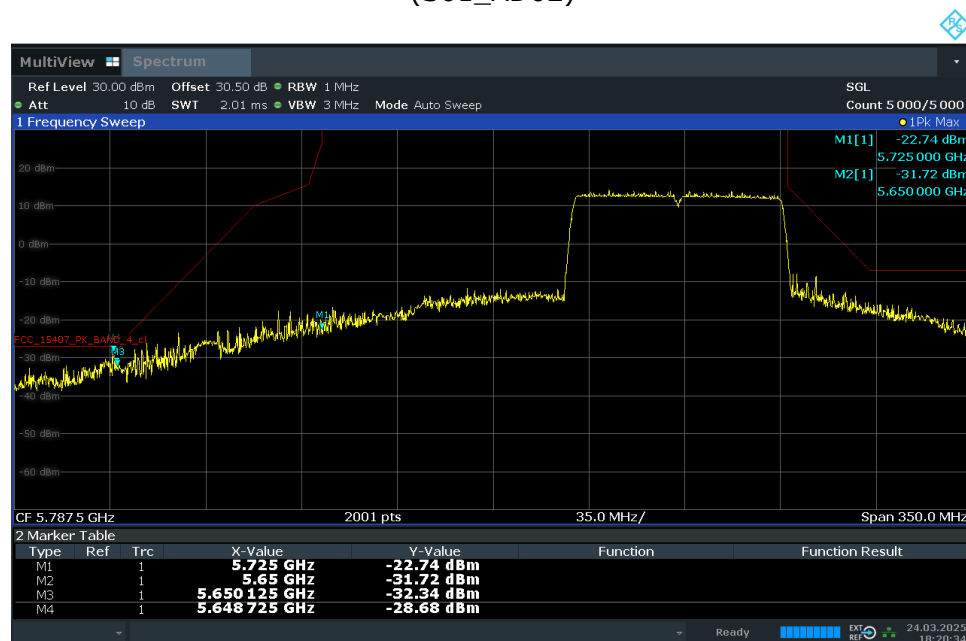
The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

Radio Technology = WLAN ac 40 MHz, Operating Frequency = low, Subband = U-NII-4, high BE
(S01_AD02)



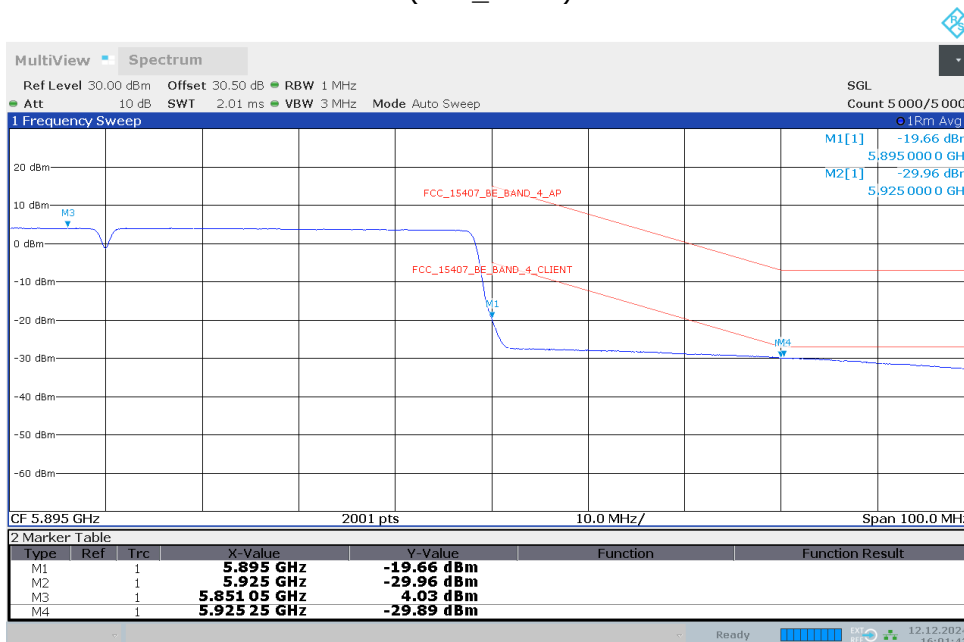
15:40:48 12.12.2024

Radio Technology = WLAN ac 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4, low BE
(S01_AD02)



18:20:34 24.03.2025

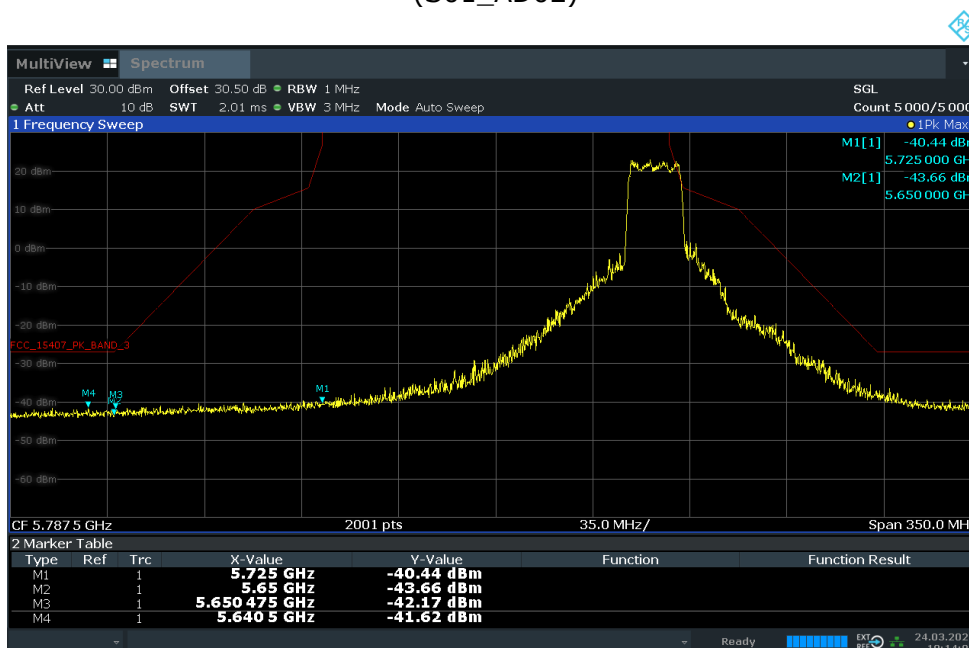
Radio Technology = WLAN ac 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 + U-NII-4, high BE (S01_AD02)



16:01:44 12.12.2024

Offset 0.1 too low, 0.1 added to result in result table

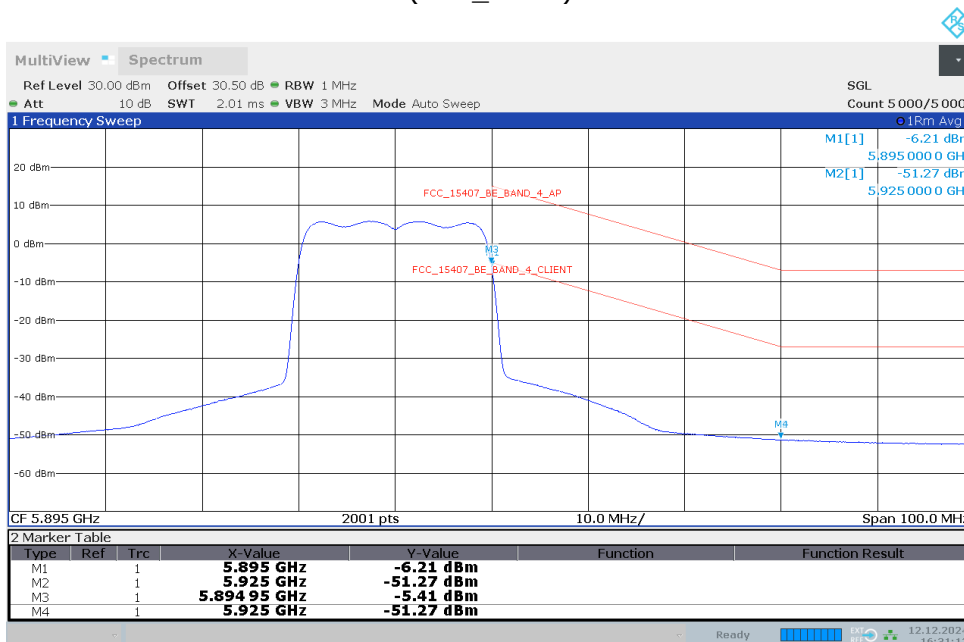
Radio Technology = WLAN ax 20 MHz, Operating Frequency = straddle, Subband = U-NII-3 + 4, low BE (S01_AD02)



18:14:09 24.03.2025

The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

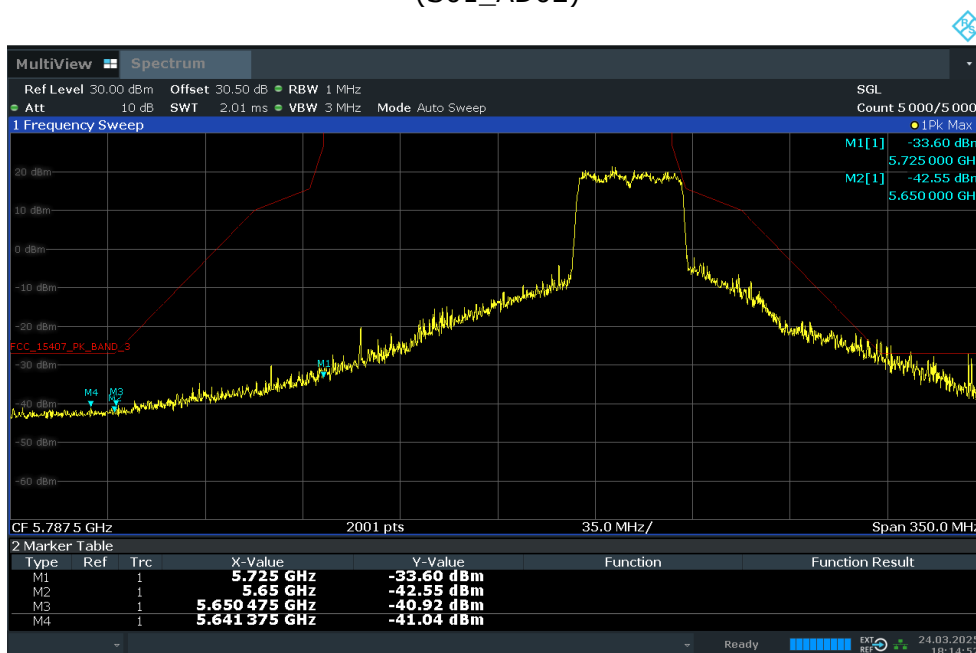
Radio Technology = WLAN ax 20 MHz, Operating Frequency = high, Subband = U-NII-4, high BE
(S01_AD02)



16:31:12 12.12.2024

Offset 0.1 too low, 0.1 added to result in result table

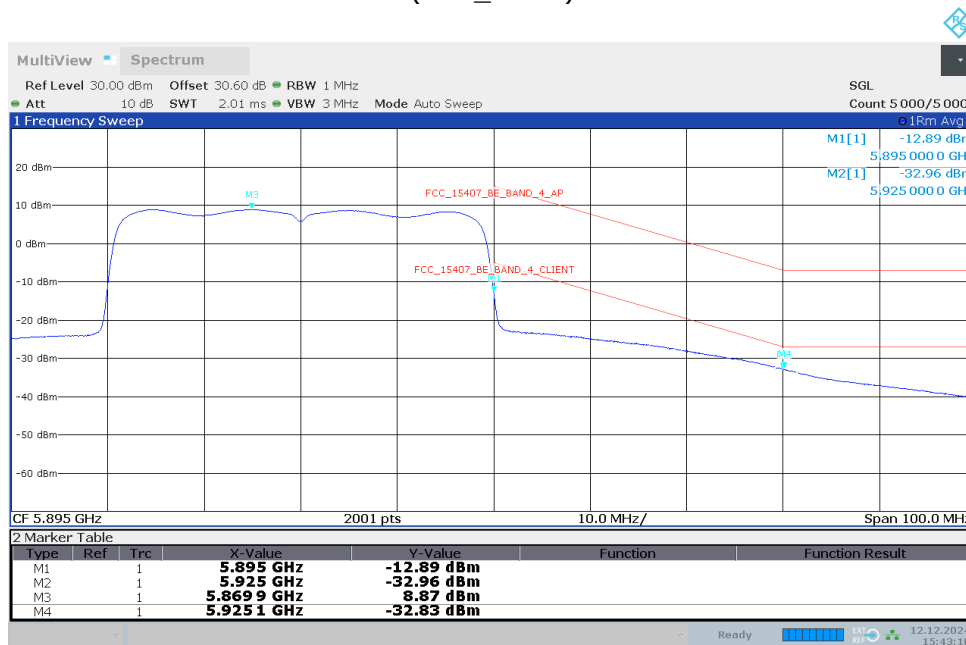
Radio Technology = WLAN ax 40 MHz, Operating Frequency = straddle, Subband = U-NII-3 + 4, low BE
(S01_AD02)



18:14:52 24.03.2025

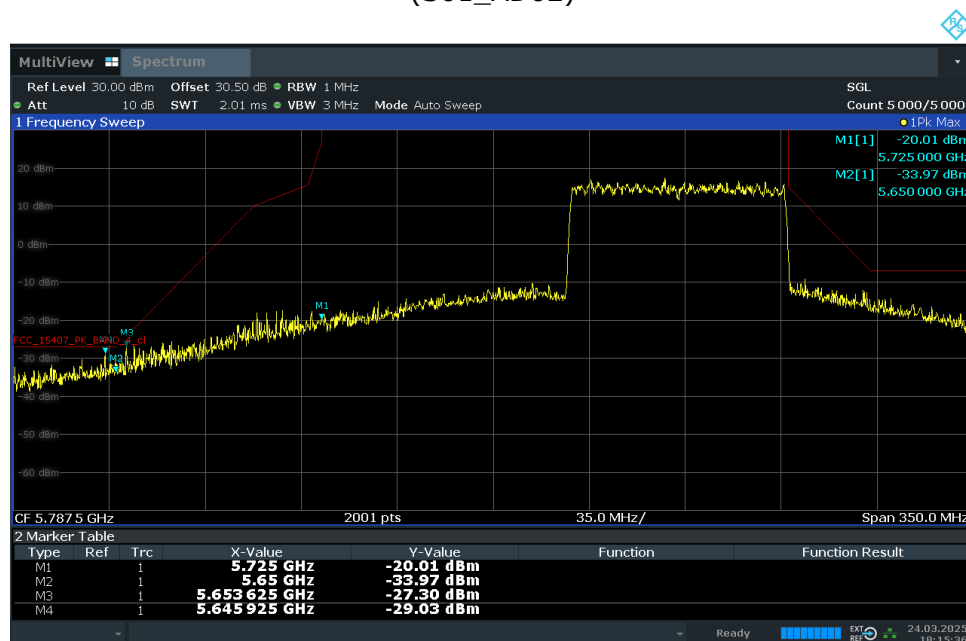
The limit line is the Band 3 limit line. Only the part at the lower band edge is applicable for the straddle channel.

Radio Technology = WLAN ax 40 MHz, Operating Frequency = low, Subband = U-NII-4, high
BE
(S01_AD02)



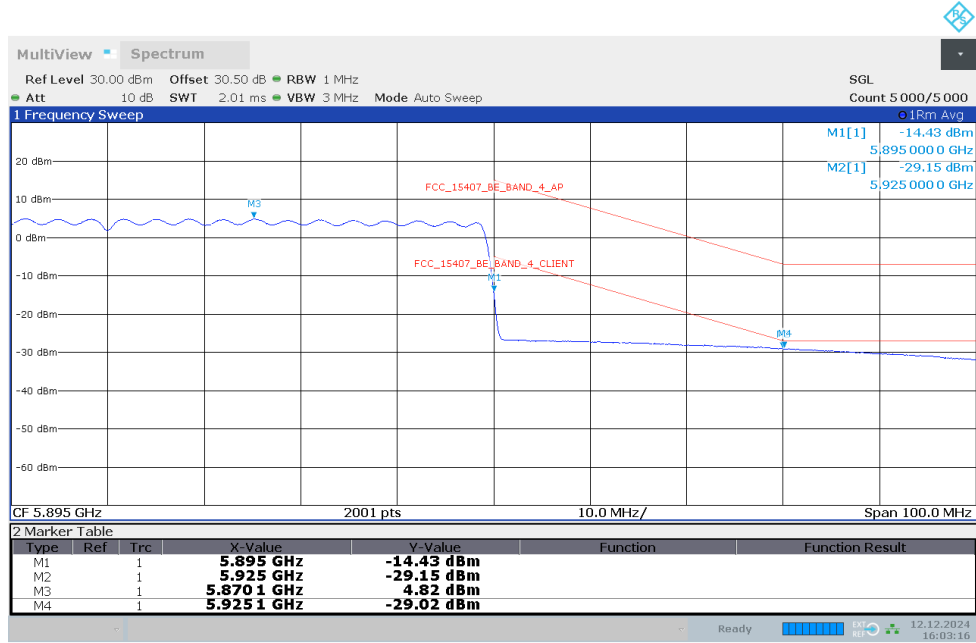
15:43:10 12.12.2024

Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4, low BE
(S01_AD02)



18:15:37 24.03.2025

Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4, high BE
(S01_AD02)

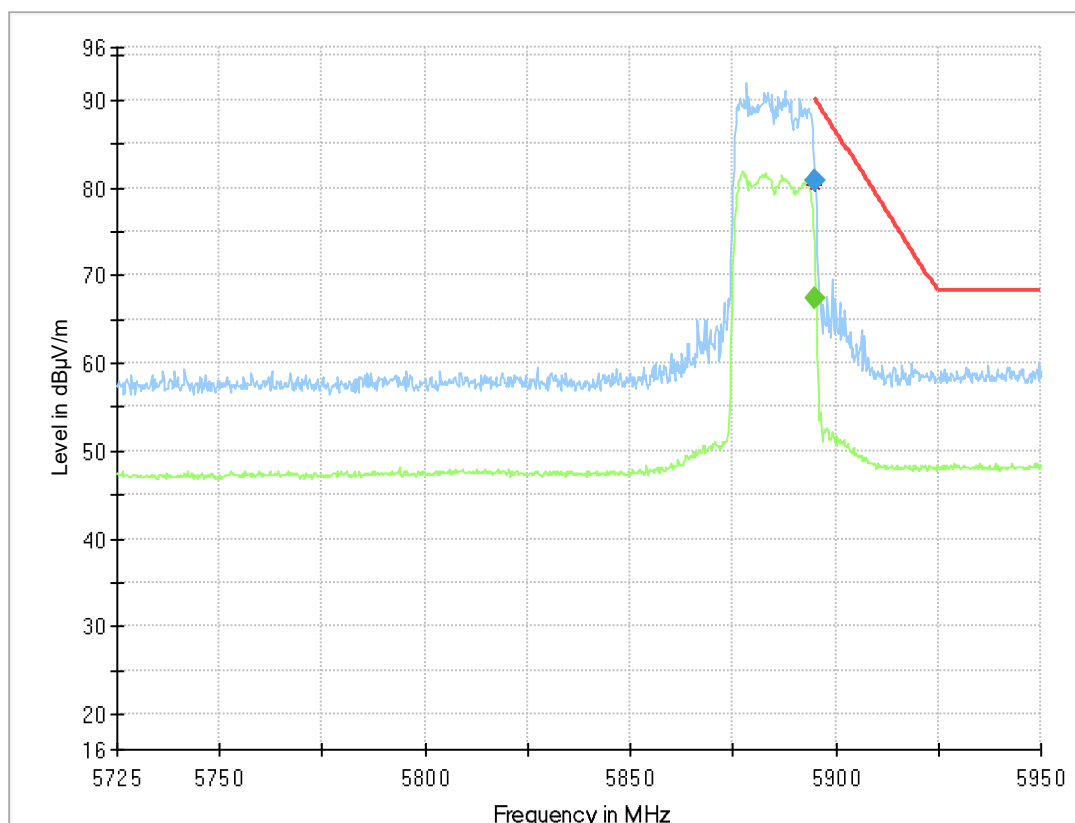


16:03:17 12.12.2024

Offset 0.1 too low, 0.1 added to result in result table

Radiated Measurements with 50 Ohm termination

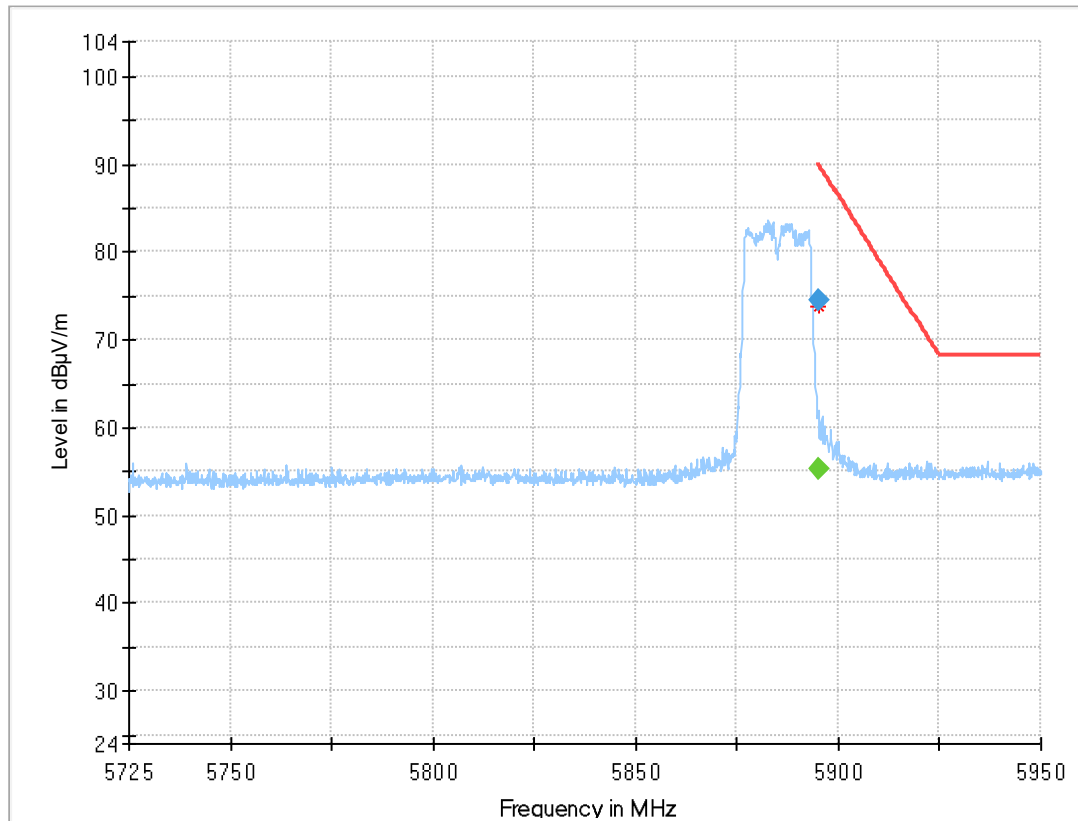
Radio Technology = WLAN ax 20 MHz, Operating Frequency = high, Subband = U-NII-4 (S02_AC02)



Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
5895.010	---	67.5	---	---	1000.0	1000.000	150.0	V	-124.0	95.0	16.3
5895.010	80.8	---	90.19	9.41	1000.0	1000.000	150.0	V	-124.0	95.0	16.3

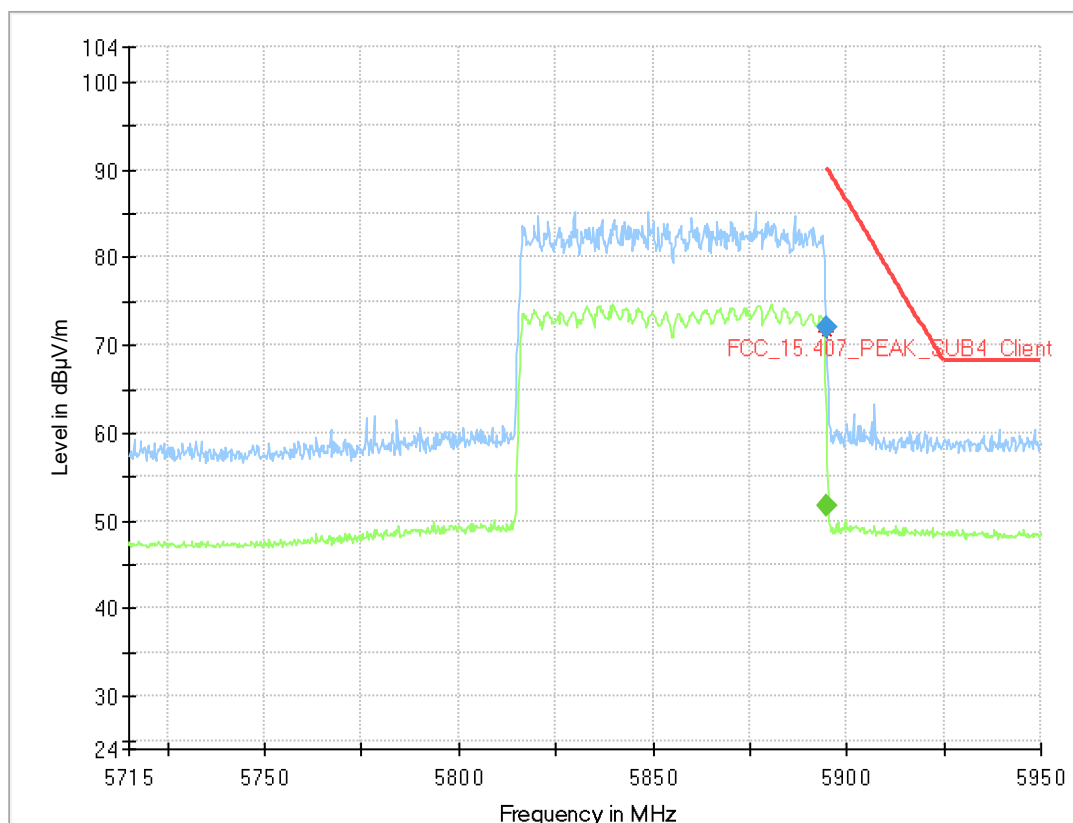
Radio Technology = WLAN a, Operating Frequency = high, Subband = U-NII-4
(S02_AC02)



Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
5895.000	---	55.3	---	---	1000.0	1000.000	150.0	H	-10.0	-1.0	16.3
5895.000	74.5	---	90.20	15.72	1000.0	1000.000	150.0	H	-10.0	-1.0	16.3

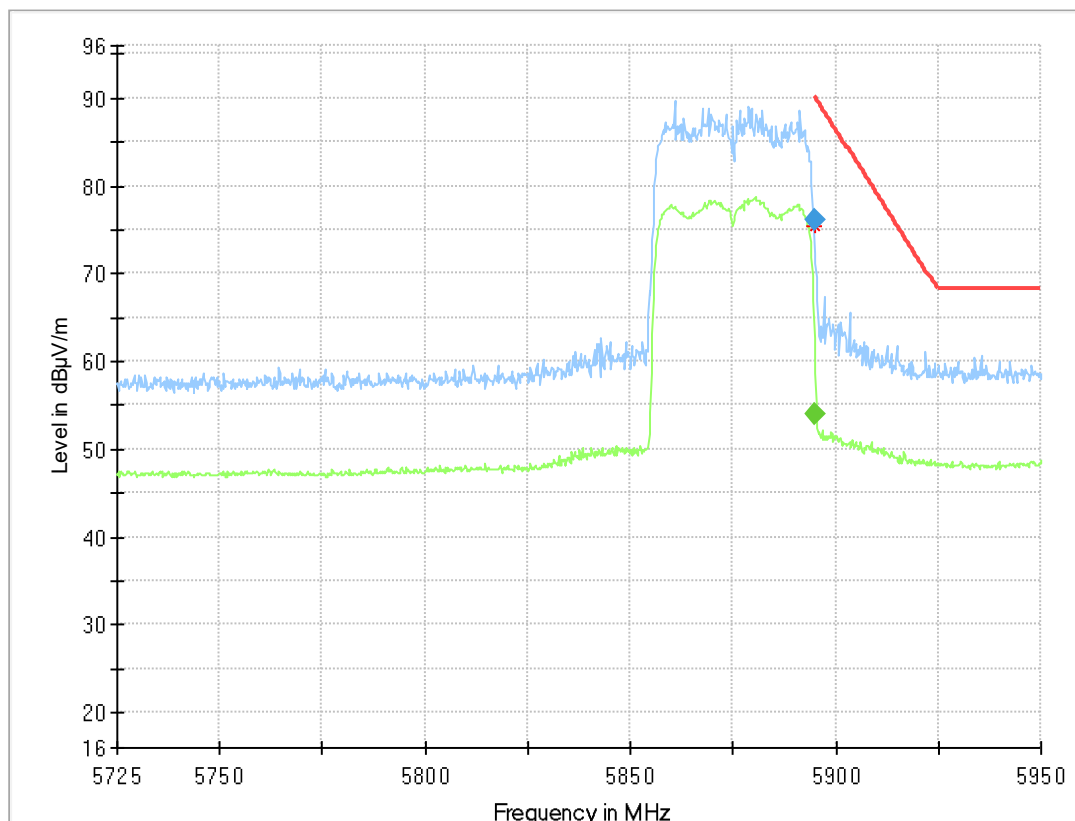
Radio Technology = WLAN ax 80 MHz, Operating Frequency = straddle, Subband = U-NII-3 +
U-NII-4
(S02_AC02)



Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
5895.010	---	51.8	---	---	1000.0	1000.000	150.0	H	-11.0	-6.0	16.3
5895.010	72.1	---	90.19	18.13	1000.0	1000.000	150.0	H	-11.0	-6.0	16.3

Radio Technology = WLAN ax 40 MHz, Operating Frequency = low, Subband = U-NII-4 (S02_AC02)



Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
5895.010	---	54.1	---	---	1000.0	1000.000	150.0	H	-10.0	-11.0	16.3
5895.010	76.1	---	90.19	14.11	1000.0	1000.000	150.0	H	-10.0	-11.0	16.3

5.6.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 5 GHz FCC
- R&S TS8997

6 TEST EQUIPMENT

6.1 TEST EQUIPMENT HARDWARE

- 1 R&S TS8997
2.4 and 5 GHz Bands Conducted Test Lab

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
1.2	SMB100A	Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	107695	2024-07	2027-07
1.3	EX520	Digital Multimeter 12	Extech Instruments Corp	05157876		
1.4	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2023-08	2025-08
1.5	Opus10 THI (8152.00N)	T/H Logger 01	Lufft Mess- und Regeltechnik GmbH	5809	2023-12	2025-12
1.6	Temperature Chamber VT 4002	Temperature Chamber Vötsch 03	Vötsch	58566002150010	2024-07	2026-07
1.7	FSW43	Signal Analyser	Rohde & Schwarz GmbH & Co. KG	102013	2023-07	2025-07
1.8	Opus10 THI (8152.00)	T/H Logger 14	Lufft Mess- und Regeltechnik GmbH	13993	2023-12	2025-12
1.9	HMP2020	Programmable Power Supply	Rohde & Schwarz GmbH & Co. KG	101992	N/A	N/A
1.10	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2023-01	2026-01
1.11	OSP120	Contains Power Meter and Switching Unit OSP-B157W8 PLUS	Rohde & Schwarz	101158	2024-08	2027-08
1.12	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10

- 2 Radiated Emissions FAR 5 GHz FCC
Radiated Emissions Tests for 5 GHz bands in a fully anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
2.2	Innco Systems CO3000	Controller for bore sight mast FAC	innco systems GmbH	CO3000/1460/54740522/P	N/A	N/A
2.3	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq		N/A	N/A
2.4	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	N/A	N/A

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
2.6	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	N/A	N/A
2.7	FSW43	Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	103779	2023-04	2025-04
2.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
2.9	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	N/A	N/A
2.10	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A	N/A
2.11	MA3000/0800-XP-ET-compact	Bore Sight Antenna Mast	innco systems GmbH	9210522	N/A	N/A
2.12	TT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
2.13	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronik GmbH	00086675	N/A	N/A
2.14	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	2023-08	2025-08
2.15	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
2.16	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324	N/A	N/A
2.17	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2024-10	2027-10

3 Radiated Emissions SAC H-Field

Radiated emission tests in the H-Field in a semi anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
3.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
3.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
3.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2024-03	2026-03
3.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
3.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
3.6	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
3.7	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
3.8	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
3.9	HFH2-Z2	Loop Antenna + 3 Axis Tripod	Rohde & Schwarz GmbH & Co. KG	829324/006	2024-04	2027-04
3.10	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10

- 4 Radiated Emissions SAC up to 1 GHz
Radiated emission tests up to 1 GHz in a semi anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
4.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
4.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
4.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2024-03	2026-03
4.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
4.5	HL 562 ULTRALOG	Biconical-log-per antenna (30 MHz - 3 GHz) with HL 562E biconicals	Rohde & Schwarz GmbH & Co. KG	830547/003		
4.6	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
4.7	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
4.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
4.9	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
4.10	HL562E ULTRALOG	Biconical-log-per Antenna (30 MHz - 6 GHz)	Rohde & Schwarz GmbH & Co. KG	102299	2024-07	2027-07

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
4.11	Chase CBL6111C + INMET 64671 18N-6dB	Hybrid Antenna with 6dB Attenuator		2624 Kartei-Nr E-003226/K1026	2023-03	2026-03
4.12	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10
4.13	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/1192 0513	N/A	N/A

The calibration interval is the time interval between "Last Calibration" and "Calibration Due"

6.2 TEST EQUIPMENT SOFTWARE

Semi-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
INNCO Mast Controller	1.02.62
INNCO Mast Height	34.10
INNCO Mast Elevation	36.11
MATURO Controller	1.24
MATURO Mast	12.19
MATURO Turn-Table	30.10
Fully-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
MATURO Controller	1.30
MATURO Turn-Unit	11.10
MATURO Mast	12.10
MATURO Turntable	12.11
INNCO Controller	1.03.02
INNCO Mast Height	34.10
INNCO Mast Elevation	36.11
TS 8997	
WMS32 Measurement Software	11.60.00 (till 2024-03-19), 11.70.00 + Hotfix 01
Conducted AC Emissions:	
Software	Version
EMC32 Measurement Software	10.60.20

7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

7.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

Frequency		Corr.	LISN insertion loss ESH3-Z5	cable loss (incl. 10 dB atten- uator)
MHz		dB	dB	dB
0.15		10.1	0.1	10.0
5		10.3	0.1	10.2
7		10.5	0.2	10.3
10		10.5	0.2	10.3
12		10.7	0.3	10.4
14		10.7	0.3	10.4
16		10.8	0.4	10.4
18		10.9	0.4	10.5
20		10.9	0.4	10.5
22		11.1	0.5	10.6
24		11.1	0.5	10.6
26		11.2	0.5	10.7
28		11.2	0.5	10.7
30		11.3	0.5	10.8

Sample calculation

$$U_{\text{LISN}} (\text{dB } \mu\text{V}) = U (\text{dB } \mu\text{V}) + \text{Corr. (dB)}$$

U = Receiver reading

LISN Insertion loss = Voltage Division Factor of LISN

Corr. = sum of single correction factors of used LISN, cables, switch units (if used)

Linear interpolation will be used for frequencies in between the values in the table.

7.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

Frequency	AF HFH- Z2)	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-40 dB/ decade)	d _{Limit} (meas. distance (limit)	d _{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
0.009	20.50	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.01	20.45	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.015	20.37	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.02	20.36	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.025	20.38	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.03	20.32	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.05	20.35	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.08	20.30	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.1	20.20	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.2	20.17	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.3	20.14	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.49	20.12	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.490001	20.12	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.5	20.11	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.8	20.10	-39.6	0.1	0.1	0.1	0.1	-40	30	3
1	20.09	-39.6	0.1	0.1	0.1	0.1	-40	30	3
2	20.08	-39.6	0.1	0.1	0.1	0.1	-40	30	3
3	20.06	-39.6	0.1	0.1	0.1	0.1	-40	30	3
4	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
5	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
6	20.02	-39.5	0.2	0.1	0.1	0.1	-40	30	3
8	19.95	-39.5	0.2	0.1	0.1	0.1	-40	30	3
10	19.83	-39.4	0.2	0.1	0.2	0.1	-40	30	3
12	19.71	-39.4	0.2	0.1	0.2	0.1	-40	30	3
14	19.54	-39.4	0.2	0.1	0.2	0.1	-40	30	3
16	19.53	-39.3	0.3	0.1	0.2	0.1	-40	30	3
18	19.50	-39.3	0.3	0.1	0.2	0.1	-40	30	3
20	19.57	-39.3	0.3	0.1	0.2	0.1	-40	30	3
22	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
24	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
26	19.54	-39.3	0.3	0.1	0.2	0.1	-40	30	3
28	19.46	-39.2	0.3	0.1	0.3	0.1	-40	30	3
30	19.73	-39.1	0.4	0.1	0.3	0.1	-40	30	3

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-40 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values

7.3 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

($d_{\text{Limit}} = 3 \text{ m}$)

Frequency	AF R&S HL562	Corr.
MHz	dB (1/m)	dB
30	18.6	0.6
50	6.0	0.9
100	9.7	1.2
150	7.9	1.6
200	7.6	1.9
250	9.5	2.1
300	11.0	2.3
350	12.4	2.6
400	13.6	2.9
450	14.7	3.1
500	15.6	3.2
550	16.3	3.5
600	17.2	3.5
650	18.1	3.6
700	18.5	3.6
750	19.1	4.1
800	19.6	4.1
850	20.1	4.4
900	20.8	4.7
950	21.1	4.8
1000	21.6	4.9

cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit))	d_{used} (meas. distance (used))
dB	dB	dB	dB	dB	m	m
0.29	0.04	0.23	0.02	0.0	3	3
0.39	0.09	0.32	0.08	0.0	3	3
0.56	0.14	0.47	0.08	0.0	3	3
0.73	0.20	0.59	0.12	0.0	3	3
0.84	0.21	0.70	0.11	0.0	3	3
0.98	0.24	0.80	0.13	0.0	3	3
1.04	0.26	0.89	0.15	0.0	3	3
1.18	0.31	0.96	0.13	0.0	3	3
1.28	0.35	1.03	0.19	0.0	3	3
1.39	0.38	1.11	0.22	0.0	3	3
1.44	0.39	1.20	0.19	0.0	3	3
1.55	0.46	1.24	0.23	0.0	3	3
1.59	0.43	1.29	0.23	0.0	3	3
1.67	0.34	1.35	0.22	0.0	3	3
1.67	0.42	1.41	0.15	0.0	3	3
1.87	0.54	1.46	0.25	0.0	3	3
1.90	0.46	1.51	0.25	0.0	3	3
1.99	0.60	1.56	0.27	0.0	3	3
2.14	0.60	1.63	0.29	0.0	3	3
2.22	0.60	1.66	0.33	0.0	3	3
2.23	0.61	1.71	0.30	0.0	3	3

($d_{\text{Limit}} = 10 \text{ m}$)

30	18.6	-9.9
50	6.0	-9.6
100	9.7	-9.2
150	7.9	-8.8
200	7.6	-8.6
250	9.5	-8.3
300	11.0	-8.1
350	12.4	-7.9
400	13.6	-7.6
450	14.7	-7.4
500	15.6	-7.2
550	16.3	-7.0
600	17.2	-6.9
650	18.1	-6.9
700	18.5	-6.8
750	19.1	-6.3
800	19.6	-6.3
850	20.1	-6.0
900	20.8	-5.8
950	21.1	-5.6
1000	21.6	-5.6

0.29	0.04	0.23	0.02	-10.5	10	3
0.39	0.09	0.32	0.08	-10.5	10	3
0.56	0.14	0.47	0.08	-10.5	10	3
0.73	0.20	0.59	0.12	-10.5	10	3
0.84	0.21	0.70	0.11	-10.5	10	3
0.98	0.24	0.80	0.13	-10.5	10	3
1.04	0.26	0.89	0.15	-10.5	10	3
1.18	0.31	0.96	0.13	-10.5	10	3
1.28	0.35	1.03	0.19	-10.5	10	3
1.39	0.38	1.11	0.22	-10.5	10	3
1.44	0.39	1.20	0.19	-10.5	10	3
1.55	0.46	1.24	0.23	-10.5	10	3
1.59	0.43	1.29	0.23	-10.5	10	3
1.67	0.34	1.35	0.22	-10.5	10	3
1.67	0.42	1.41	0.15	-10.5	10	3
1.87	0.54	1.46	0.25	-10.5	10	3
1.90	0.46	1.51	0.25	-10.5	10	3
1.99	0.60	1.56	0.27	-10.5	10	3
2.14	0.60	1.63	0.29	-10.5	10	3
2.22	0.60	1.66	0.33	-10.5	10	3
2.23	0.61	1.71	0.30	-10.5	10	3

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + \text{AF (dB 1/m)} + \text{Corr. (dB)}$
 U = Receiver reading
 AF = Antenna factor
 Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
 $\text{distance correction} = -20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$
 Linear interpolation will be used for frequencies in between the values in the table.
 Tables show an extract of values.

7.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
1000	24.4	-19.4
2000	28.5	-17.4
3000	31.0	-16.1
4000	33.1	-14.7
5000	34.4	-13.7
6000	34.7	-12.7
7000	35.6	-11.0

cable loss 1 (relay + cable inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit, atten- uator & pre-amp)	cable loss 4 (to receiver)		
dB	dB	dB	dB		
0.99	0.31	-21.51	0.79		
1.44	0.44	-20.63	1.38		
1.87	0.53	-19.85	1.33		
2.41	0.67	-19.13	1.31		
2.78	0.86	-18.71	1.40		
2.74	0.90	-17.83	1.47		
2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
3000	31.0	-23.4
4000	33.1	-23.3
5000	34.4	-21.7
6000	34.7	-21.2
7000	35.6	-19.8

cable loss 1 (relay inside chamber)	cable loss 2 (inside chamber)	cable loss 3 (outside chamber)	cable loss 4 (switch unit, atten- uator & pre-amp)	cable loss 5 (to receiver)	used for FCC 15.247
dB	dB	dB	dB	dB	
0.47	1.87	0.53	-27.58	1.33	
0.56	2.41	0.67	-28.23	1.31	
0.61	2.78	0.86	-27.35	1.40	
0.58	2.74	0.90	-26.89	1.47	
0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
7000	35.6	-57.3
8000	36.3	-56.3
9000	37.1	-55.3
10000	37.5	-56.2
11000	37.5	-55.3
12000	37.6	-53.7
13000	38.2	-53.5
14000	39.9	-56.3
15000	40.9	-54.1
16000	41.3	-54.1
17000	42.8	-54.4
18000	44.2	-54.7

cable loss 1 (relay inside chamber)	cable loss 2 (High Pass)	cable loss 3 (pre- amp)	cable loss 4 (inside chamber)	cable loss 5 (outside chamber)	cable loss 6 (to receiver)
dB	dB	dB	dB	dB	dB
0.56	1.28	-62.72	2.66	0.94	1.46
0.69	0.71	-61.49	2.84	1.00	1.53
0.68	0.65	-60.80	3.06	1.09	1.60
0.70	0.54	-61.91	3.28	1.20	1.67
0.80	0.61	-61.40	3.43	1.27	1.70
0.84	0.42	-59.70	3.53	1.26	1.73
0.83	0.44	-59.81	3.75	1.32	1.83
0.91	0.53	-63.03	3.91	1.40	1.77
0.98	0.54	-61.05	4.02	1.44	1.83
1.23	0.49	-61.51	4.17	1.51	1.85
1.36	0.76	-62.36	4.34	1.53	2.00
1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

Tables show an extract of values.

7.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

Frequency	AF EMCO 3160-09	Corr.	cable loss 1 (inside chamber)	cable loss 2 (pre- amp)	cable loss 3 (inside chamber)	cable loss 4 (switch unit)	cable loss 5 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB
18000	40.2	-23.5	0.72	-35.85	6.20	2.81	2.65
18500	40.2	-23.2	0.69	-35.71	6.46	2.76	2.59
19000	40.2	-22.0	0.76	-35.44	6.69	3.15	2.79
19500	40.3	-21.3	0.74	-35.07	7.04	3.11	2.91
20000	40.3	-20.3	0.72	-34.49	7.30	3.07	3.05
20500	40.3	-19.9	0.78	-34.46	7.48	3.12	3.15
21000	40.3	-19.1	0.87	-34.07	7.61	3.20	3.33
21500	40.3	-19.1	0.90	-33.96	7.47	3.28	3.19
22000	40.3	-18.7	0.89	-33.57	7.34	3.35	3.28
22500	40.4	-19.0	0.87	-33.66	7.06	3.75	2.94
23000	40.4	-19.5	0.88	-33.75	6.92	3.77	2.70
23500	40.4	-19.3	0.90	-33.35	6.99	3.52	2.66
24000	40.4	-19.8	0.88	-33.99	6.88	3.88	2.58
24500	40.4	-19.5	0.91	-33.89	7.01	3.93	2.51
25000	40.4	-19.3	0.88	-33.00	6.72	3.96	2.14
25500	40.5	-20.4	0.89	-34.07	6.90	3.66	2.22
26000	40.5	-21.3	0.86	-35.11	7.02	3.69	2.28
26500	40.5	-21.1	0.90	-35.20	7.15	3.91	2.36

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

7.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

Frequency GHz	AF EMCO 3160-10 dB (1/m)	Corr. dB	cable loss 1 (inside chamber) dB	cable loss 2 (outside chamber) dB	cable loss 3 (switch unit) dB	cable loss 4 (to receiver) dB	distance corr. (-20 dB/ decade) dB	d _{Limit} (meas. distance (limit) m	d _{used} (meas. distance (used) m
26.5	43.4	-11.2	4.4				-9.5	3	1.0
27.0	43.4	-11.2	4.4				-9.5	3	1.0
28.0	43.4	-11.1	4.5				-9.5	3	1.0
29.0	43.5	-11.0	4.6				-9.5	3	1.0
30.0	43.5	-10.9	4.7				-9.5	3	1.0
31.0	43.5	-10.8	4.7				-9.5	3	1.0
32.0	43.5	-10.7	4.8				-9.5	3	1.0
33.0	43.6	-10.7	4.9				-9.5	3	1.0
34.0	43.6	-10.6	5.0				-9.5	3	1.0
35.0	43.6	-10.5	5.1				-9.5	3	1.0
36.0	43.6	-10.4	5.1				-9.5	3	1.0
37.0	43.7	-10.3	5.2				-9.5	3	1.0
38.0	43.7	-10.2	5.3				-9.5	3	1.0
39.0	43.7	-10.2	5.4				-9.5	3	1.0
40.0	43.8	-10.1	5.5				-9.5	3	1.0

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

distance correction = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

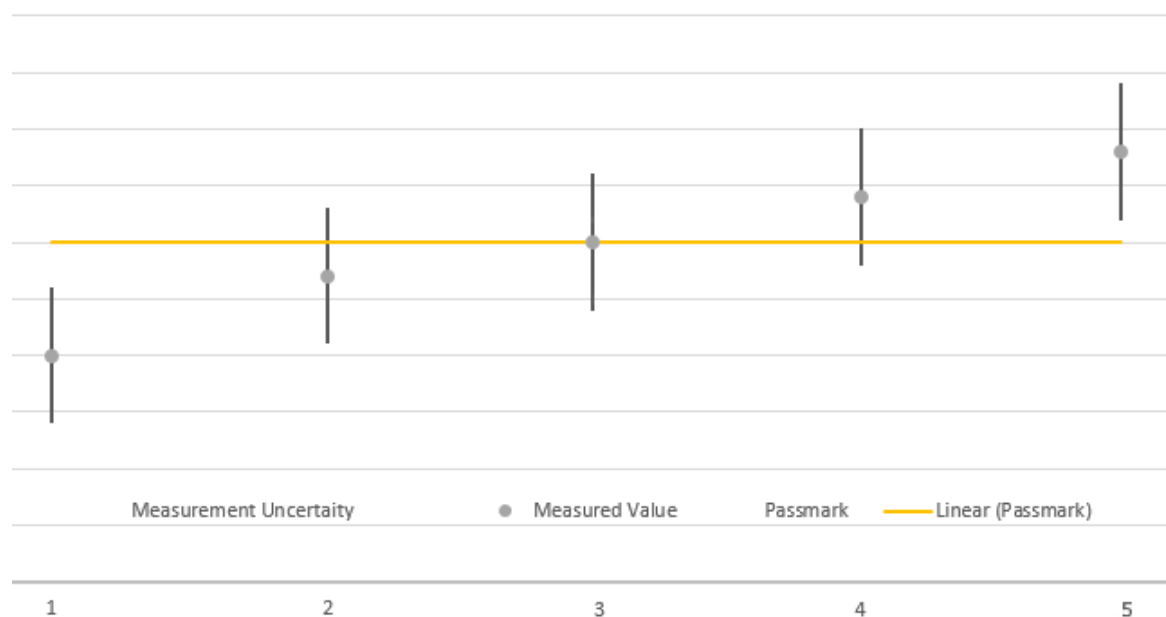
Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

8 MEASUREMENT UNCERTAINTIES

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power	± 5.5 dB
6 dB / 26 dB / 99% Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
Conducted Output Power	Power	± 2.2 dB
Band Edge Compliance	Power Frequency	± 2.2 dB ± 11.2 kHz
Frequency Stability	Frequency	± 25 Hz
Power Spectral Density	Power	± 2.2 dB

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) $k = 1.96$. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	on pass mark	within pass mark	Passed
4	above pass mark	within pass mark	Failed
5	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so-called shared risk principle.

9 PHOTO REPORT

Please see separate photo report.

*****END OF TEST REPORT*****