

FCC Measurement/Technical Report on

C400 ECU MID NA 4.5G
Type 1589.1

FCC ID: 2AJW515891
IC: 21979-15891

Test Report Reference: MDE_CONTI_2134_FCC_05

Test Laboratory:

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Deutsche
Akkreditierungsstelle
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 6 GHz (U-NII) DEVICES PART 15, SUBPART E, 987594 D02 U-NII 6GHz EMC Measurement v01r01, 2021-02-04".

ANSI C63.10-2013 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, §15.403 (i)

26 dB Bandwidth

The measurement was performed according to ANSI C63.10, chapter 12.4.1

Final Result

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	Date	FCC	IC
WLAN a, high, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN a, low, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN a, mid, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN ac 20 MHz, high, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN ac 20 MHz, low, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN ac 20 MHz, mid, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN ac 40 MHz, high, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN ac 40 MHz, low, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN n 20 MHz, high, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN n 20 MHz, low, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN n 20 MHz, mid, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN n 40 MHz, high, U-NII-1	S01_AD03	2024-03-07	Performed	N/A
WLAN n 40 MHz, low, U-NII-1	S01_AD03	2024-03-07	Performed	N/A

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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-1	S01_AD03	2024-05-15	N/A	Performed
WLAN a, low, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN a, mid, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN ac 20 MHz, high, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN ac 20 MHz, low, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN ac 20 MHz, mid, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN ac 40 MHz, high, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN ac 40 MHz, low, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN n 20 MHz, high, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN n 20 MHz, low, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN n 20 MHz, mid, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN n 40 MHz, high, U-NII-1	S01_AD03	2024-05-15	N/A	Performed
WLAN n 40 MHz, low, U-NII-1	S01_AD03	2024-05-15	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-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN a, low, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN a, mid, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN ac 20 MHz, high, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN ac 20 MHz, low, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN ac 20 MHz, mid, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN ac 40 MHz, high, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN ac 40 MHz, low, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN n 20 MHz, high, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN n 20 MHz, low, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN n 20 MHz, mid, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN n 40 MHz, high, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed
WLAN n 40 MHz, low, U-NII-1	S01_AD03/ S01_BA04	2024-03-07/ 2024-08-12	Passed	Passed

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

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-1	S01_AD03	2024-03-07	Passed	N/A
WLAN a, low, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN a, mid, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN ac 20 MHz, high, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN ac 20 MHz, low, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN ac 20 MHz, mid, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN ac 40 MHz, high, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN ac 40 MHz, low, U-NII-1	S01_AD03	2024-03-07	Passed	N/A

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

Peak Power Spectral Density

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

Final Result

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Subband				
WLAN n 20 MHz, high, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN n 20 MHz, low, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN n 20 MHz, mid, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN n 40 MHz, high, U-NII-1	S01_AD03	2024-03-07	Passed	N/A
WLAN n 40 MHz, low, U-NII-1	S01_AD03	2024-03-07	Passed	N/A

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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, Antenna				
WLAN a, high, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
Remark: Only Band Edges and harmonics				
WLAN a, high, 30MHz - 1GHz, U-NII-1, external	S02_AD03	2024-03-10	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-1, external	S02_AD03	2024-04-05	Passed	Passed
Remark: Only Band Edges and harmonics				
WLAN a, low, 30MHz - 1GHz, U-NII-1, external	S02_AD03	2024-03-10	Passed	Passed
WLAN a, low, 9kHz - 30MHz, U-NII-1, external	S02_AD03	2024-04-25	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-1, internal	S02_AD03	2024-04-09	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-1, external	S02_AD03	2024-03-10	Passed	Passed
WLAN ac 20 MHz, low, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
Remark: Only Band Edges and harmonics				
WLAN ac 20 MHz, high, 1GHz - 26GHz, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
Remark: Only Band Edges and harmonics				
WLAN ac 40 MHz, high, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-07	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, Antenna				
WLAN ac 40 MHz, high, 1GHz - 26GHz, U-NII-1, external Remark: Only Band Edges and harmonics	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 40 MHz, low, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 40 MHz, low, 1GHz - 26GHz, U-NII-1, external Remark: Only Band Edges and harmonics	S02_AD03	2024-04-07	Passed	Passed
WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-1, external Remark: Only Band Edges and harmonics	S02_AD03	2024-04-07	Passed	Passed
WLAN n 20 MHz, low, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN n 20 MHz, low, 1GHz - 26GHz, U-NII-1, external Remark: Only Band Edges and harmonics	S02_AD03	2024-04-05	Passed	Passed
WLAN n 20 MHz, mid, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN n 40 MHz, high, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN n 40 MHz, high, 1GHz - 26GHz, U-NII-1, external Remark: Only Band Edges and harmonics	S02_AD03	2024-04-07	Passed	Passed
WLAN n 40 MHz, high, 30MHz - 1GHz, U-NII-1, external	S02_AD03	2024-03-10	Passed	Passed
WLAN n 40 MHz, low, 1GHz - 26GHz, U-NII-1, internal	S02_AD03	2024-04-08	Passed	Passed
WLAN n 40 MHz, low, 1GHz - 26GHz, U-NII-1, external Remark: Only Band Edges and harmonics	S02_AD03	2024-04-06	Passed	Passed
WLAN n 40 MHz, low, 30MHz - 1GHz, U-NII-1, external	S02_AD03	2024-03-10	Passed	Passed
WLAN n 40 MHz, low, 9kHz - 30MHz, U-NII-1, external	S02_AD03	2024-04-25	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, Antenna				
WLAN a, low, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN a, high, U-NII-1, internal	S02_AD03	2024-04-06	Passed	Passed
WLAN a, low, U-NII-1, external	S02_AD03	2024-04-05	Passed	Passed
WLAN a, high, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 20 MHz, low, U-NII-1, internal	S02_AD03	2024-04-05	Passed	Passed
WLAN ac 20 MHz, high, U-NII-1, internal	S02_AD03	2024-04-05	Passed	Passed
WLAN ac 20 MHz, low, U-NII-1, external	S02_AD03	2024-04-05	Passed	Passed
WLAN ac 20 MHz, high, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 40 MHz, low, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 40 MHz, high, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 40 MHz, low, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
WLAN ac 40 MHz, high, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
WLAN n 20 MHz, low, U-NII-1, internal	S02_AD03	2024-04-05	Passed	Passed
WLAN n 20 MHz, high, U-NII-1, internal	S02_AD03	2024-04-05	Passed	Passed
WLAN n 20 MHz, low, U-NII-1, external	S02_AD03	2024-04-05	Passed	Passed
WLAN n 20 MHz, high, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
WLAN n 40 MHz, low, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN n 40 MHz, high, U-NII-1, internal	S02_AD03	2024-04-07	Passed	Passed
WLAN n 40 MHz, low, U-NII-1, external	S02_AD03	2024-04-07	Passed	Passed
WLAN n 40 MHz, high, U-NII-1, external	S02_AD03	2024-04-07	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	2024-09-17	--	valid
--	--	--	--

COMMENT: -



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



(responsible for testing and report)
BSc. Mhd Mouaz Saad



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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: 2023-09-29

3.2 PROJECT DATA

Responsible for testing and report: BSc. Mhd Mouaz Saad
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2024-09-17
Testing Period: 2024-03-07 to 2024-08-12

3.3 APPLICANT DATA

Company Name: Continental Automotive Technologies GmbH
Address: Heinrich-Hertz-Straße 45
78052 Villingen-Schwenningen
Germany
Contact Person: Patrick Seng

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	The CM4 is a communication module with several wired interfaces to the vehicle. Additional functions as GNSS, mobile communication, WiFi and Bluetooth are provided.
Product name	C400 ECU MID NA 4.5G
Type	Type 1589.1
Declared EUT data by the supplier	
Voltage Type	DC
Voltage Level	24 V
Antenna / Gain	@ 5 GHz: Internal / 5.1 dBi External / 4.7 dBi
Tested Modulation Type	OFDM
Specific product description	The EUT supports in the 5 GHz band SISO Mode only. Supported WLAN modes are a, n and ac, with a 20 MHz BW, n 20 and 40 MHz BW as well as ac in 20 and 40 MHz BW. only U-NII band 1 are supported (without DFS)
EUT ports (connected cables during testing):	- DC cable Harness (unshielded, 2 m) - GNSS/Cellular/WiFi/Bluetooth antenna ports - USB connector (for testing purposes only)
Tested Datarates	WLAN a: 6 Mbit WLAN n: MCS 0 WLAN ac: MCS 0
Special software used for testing	ADB Shell, QRCT from Qualcomm
TPC supported	No

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT_AD03	DE1480003ad03	Conducted/ Radiated Sample
Sample Parameter	Value	
Serial No.	23325-0004	
HW Version	CM4	
SW Version	TRATON_CM4_26.12.1.16	
Comment	-	

Sample Name	Sample Code	Description
EUT_BA04	DE1480003ba04	ISED power Sample
Sample Parameter	Value	
Serial No.	23331-0002	
HW Version	CM4	
SW Version	TRATON_CM4_26.12.1.17	
Comment	sample with reduced output power	

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.

Device	Details (Manufacturer, Type Model, OUT Code)	Description
ANC1	DESAY SV, 4829.01 roof top antenna, DE1480003AUX1	GNSS, Cellular Antenna
ANC2	DESAY SV, 4828.01 roof top antenna, DE1480003AUX2	WIFI/BT, Cellular Antenna

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 A	continental, -, -, -, -	Cable Harness

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_AD03	EUT_AD03, AUX A	Conducted Setup
S02_AD03	EUT_AD03, ANC1, ANC2, AUX A	Radiated Setup
S01_BA04	EUT_BA04, AUX A	ISED Power Conducted Setup

4.6 OPERATING MODES / TEST CHANNELS

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

U-NII-Subband 1 5150 - 5250 MHz			Nom. BW
low	mid	high	20 MHz
36	40	48	Ch.-No.
5180	5200	5240	MHz

low	mid	high	40 MHz
38	-	46	Ch.-No.
5190	-	5230	MHz

4.7 DUTY CYCLE



4.8 PRODUCT LABELLING

4.8.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.8.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 26 DB BANDWIDTH

Standard **FCC Part 15 Subpart E**

The test was performed according to:

ANSI C63.10, chapter 12.4.1

5.1.1 TEST DESCRIPTION

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

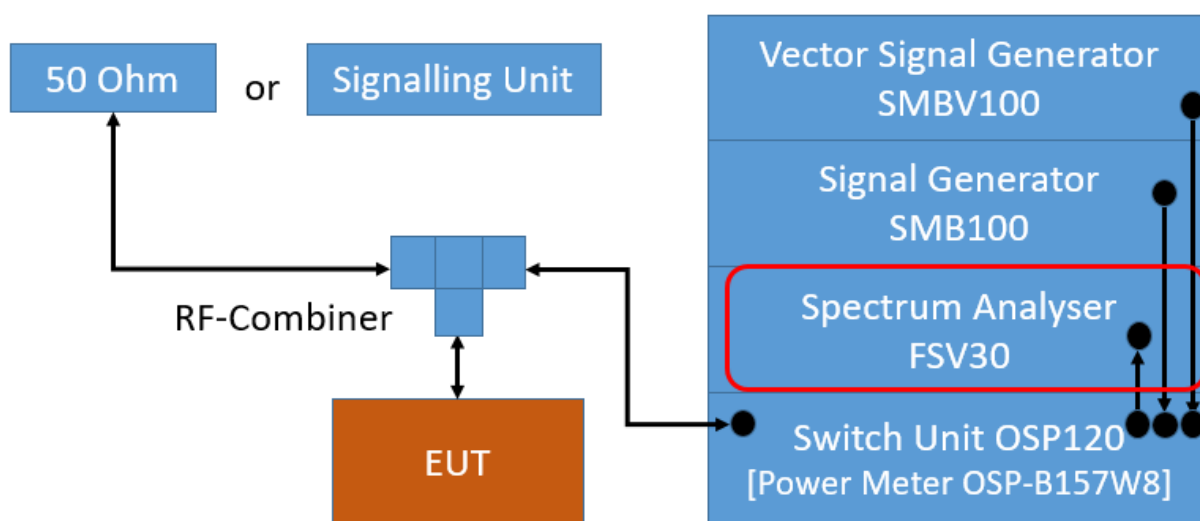
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

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): initially approx. 1 % of nominal emission bandwidth
- Video Bandwidth (VBW): > RBW
- Span: 40 / 80 / 160 / 320 MHz (for 20 / 40 / 80 / 160 MHz nominal bandwidth)
- Trace: Maxhold
- Sweeps: Until the trace is stable
- Sweptime: Auto
- Detector: Peak



TS8997; Occupied Channel Bandwidth 6 dB / 26 dB / 99 %

5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart E

There exist no applicable limits. The test was performed to determine the limits for the "Maximum Conducted Output Power" and DFS test cases.

Therefore no result was applied.

5.1.3 TEST PROTOCOL

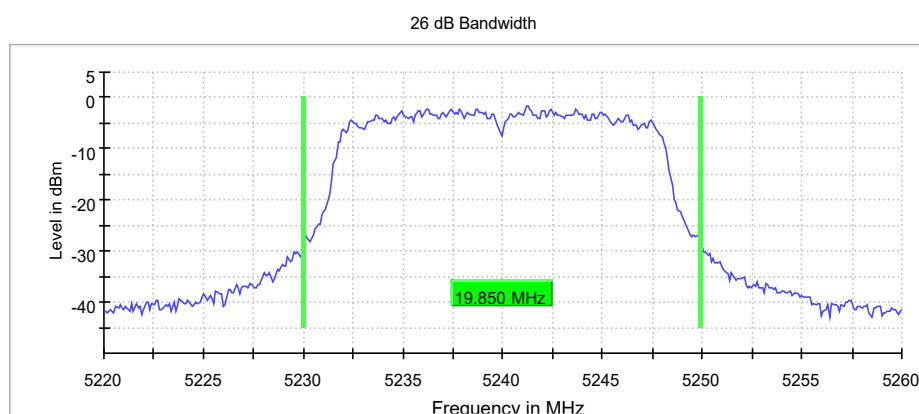
Ambient temperature: 23 °C
 Air Pressure: 1001 hPa
 Humidity: 38 %

Radio Technology	Subband	Operating Frequency	26 dB Bandwidth [MHz]
WLAN a	U-NII-1	low	19.3
WLAN a	U-NII-1	mid	19.5
WLAN a	U-NII-1	high	19.9
WLAN n 20 MHz	U-NII-1	low	20.1
WLAN n 20 MHz	U-NII-1	mid	20.1
WLAN n 20 MHz	U-NII-1	high	20.1
WLAN n 40 MHz	U-NII-1	low	42.9
WLAN n 40 MHz	U-NII-1	high	42.6
WLAN ac 20 MHz	U-NII-1	low	20.1
WLAN ac 20 MHz	U-NII-1	mid	20.4
WLAN ac 20 MHz	U-NII-1	high	20.2
WLAN ac 40 MHz	U-NII-1	low	42.0
WLAN ac 40 MHz	U-NII-1	high	41.5

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

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

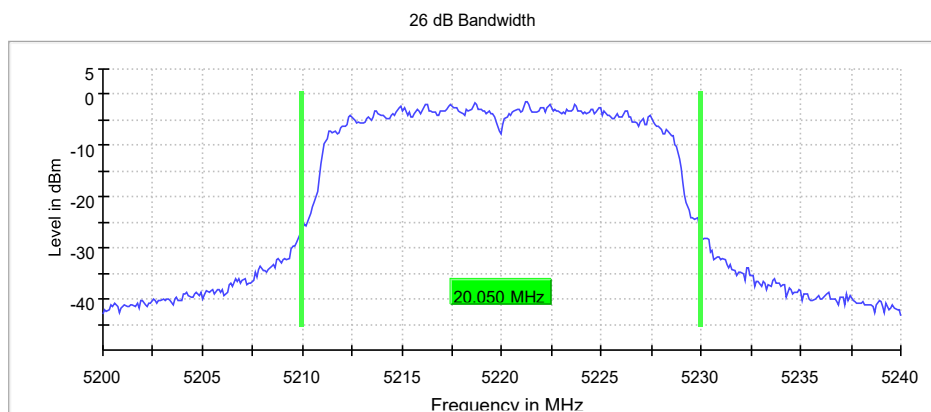
Radio Technology = WLAN a, Operating Frequency = high,
 (S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.22000 GHz
Stop Frequency	5.26000 GHz
Span	40.000 MHz
RBW	200.000 kHz
VBW	1.000 MHz
SweepPoints	400
SweepTime	1.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	68 / max. 150
Stable	5 / 5
Max Stable Difference	0.00 dB

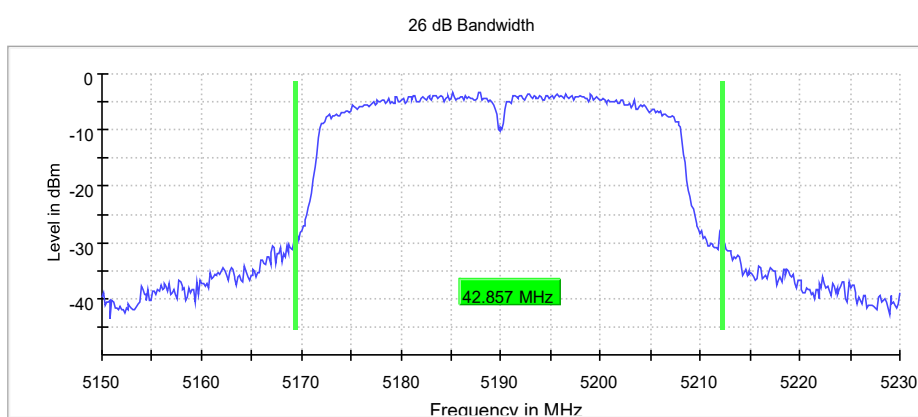
Radio Technology = WLAN n 20 MHz, Operating Frequency = mid
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.20000 GHz
Stop Frequency	5.24000 GHz
Span	40.000 MHz
RBW	200.000 kHz
VBW	1.000 MHz
SweepPoints	400
SweepTime	1.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	84 / max. 150
Stable	5 / 5
Max Stable Difference	0.00 dB

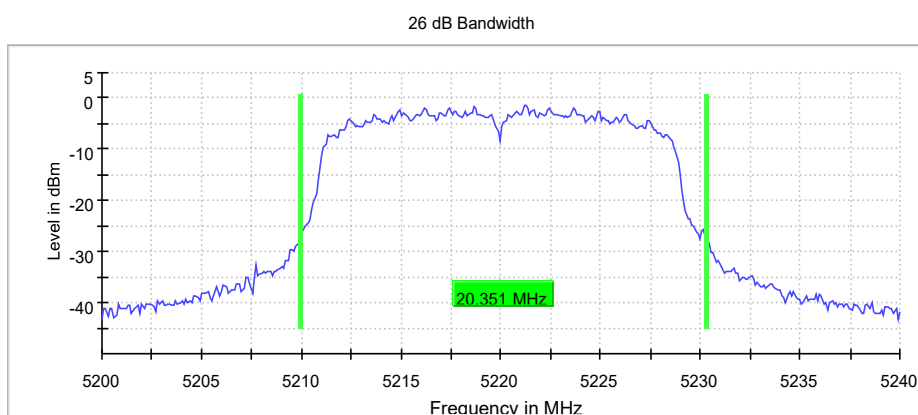
Radio Technology = WLAN n 40 MHz, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.15000 GHz
Stop Frequency	5.23000 GHz
Span	80.000 MHz
RBW	300.000 kHz
VBW	1.000 MHz
SweepPoints	533
SweepTime	1.000 ms
Reference Level	0.000 dBm
Attenuation	10.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	94 / max. 150
Stable	5 / 5
Max Stable Difference	0.04 dB

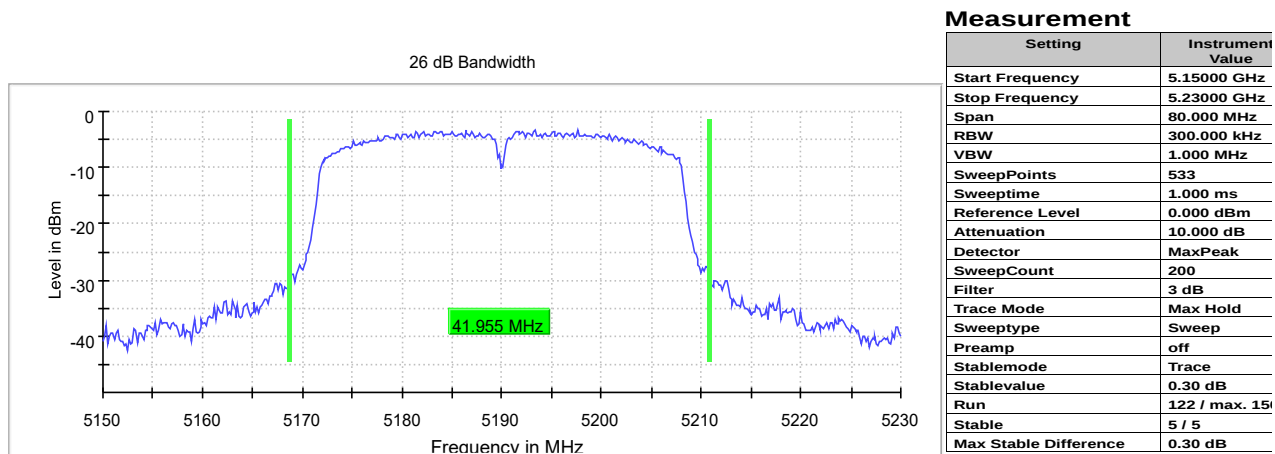
Radio Technology = WLAN ac 20 MHz, Operating Frequency = mid
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.20000 GHz
Stop Frequency	5.24000 GHz
Span	40.000 MHz
RBW	200.000 kHz
VBW	1.000 MHz
SweepPoints	400
SweepTime	1.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	63 / max. 150
Stable	5 / 5
Max Stable Difference	0.02 dB

Radio Technology = WLAN ac 40 MHz, Operating Frequency = low
 (S01_AD03)



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 12.4.2 (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.

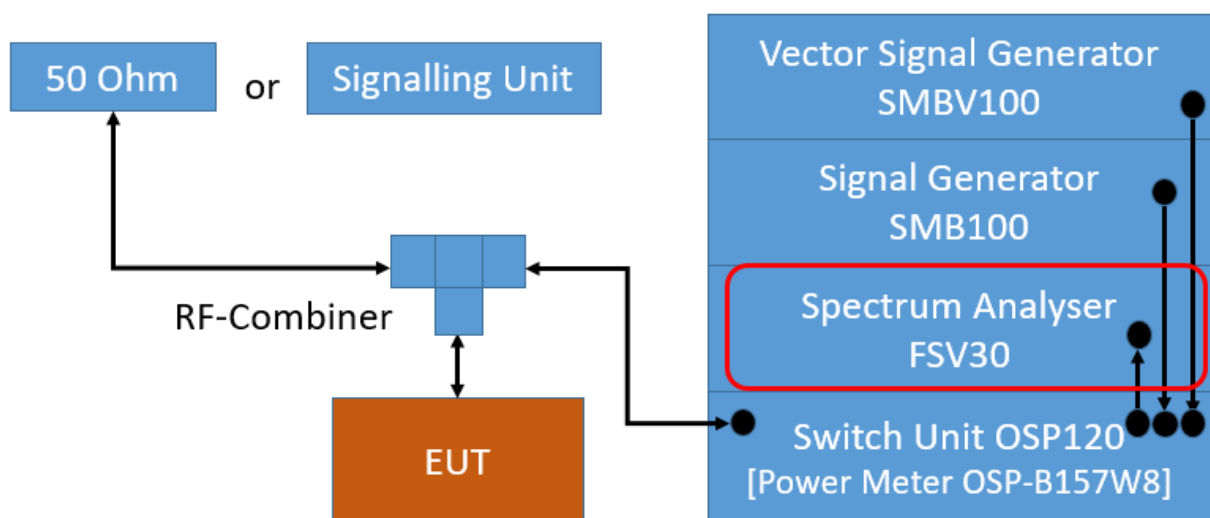
The results recorded were measured with the modulation which produce the worst-case (widest) emission bandwidth.

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): approx. ≥ 1 % of the span, but not below
- Video Bandwidth (VBW): ≥ 3 times the RBW
- Span: 40 / 80 / 160 / 320 MHz (for 20 / 40 / 80 / 160 MHz nominal bandwidth)
- Trace: Maxhold
- Sweeps: Until the trace is stable
- Sweep time: Auto
- Detector: Peak

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



TS8997; Occupied Channel Bandwidth 6 dB / 26 dB / 99 %

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

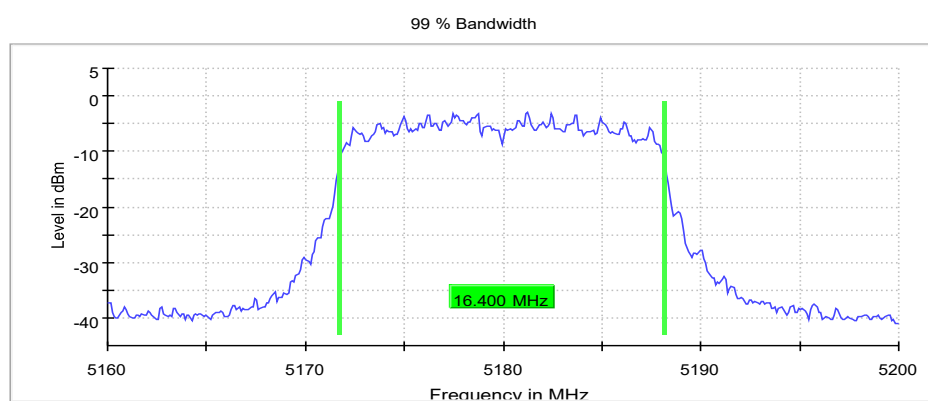
Ambient temperature: 23 °C
Air Pressure: 1001 hPa
Humidity: 38 %

Radio Technology	Subband	Operating Frequency	99% Bandwidth [MHz]
WLAN a	U-NII-1	low	16.4
WLAN a	U-NII-1	mid	16.4
WLAN a	U-NII-1	high	16.3
WLAN n 20 MHz	U-NII-1	low	17.4
WLAN n 20 MHz	U-NII-1	mid	17.4
WLAN n 20 MHz	U-NII-1	high	17.4
WLAN n 40 MHz	U-NII-1	low	36.3
WLAN n 40 MHz	U-NII-1	high	36.0
WLAN ac 20 MHz	U-NII-1	low	17.4
WLAN ac 20 MHz	U-NII-1	mid	17.4
WLAN ac 20 MHz	U-NII-1	high	17.4
WLAN ac 40 MHz	U-NII-1	low	36.0
WLAN ac 40 MHz	U-NII-1	high	36.3

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

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

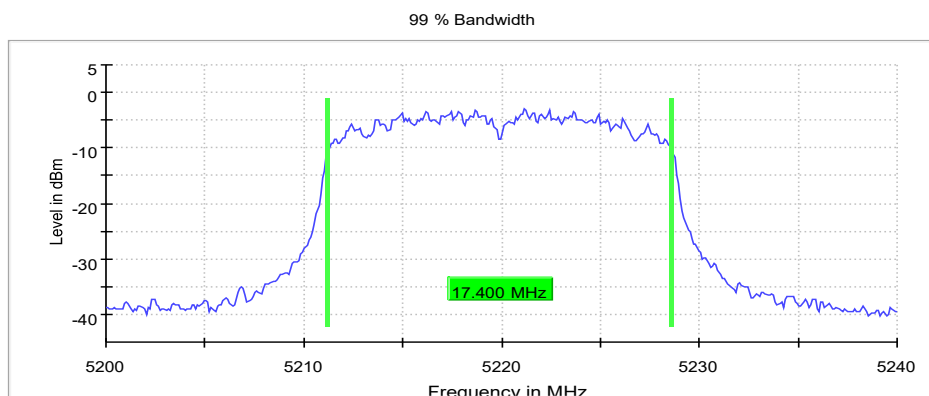
Radio Technology = WLAN a, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.16000 GHz
Stop Frequency	5.20000 GHz
Span	40.000 MHz
RBW	200.000 kHz
VBW	1.000 MHz
SweepPoints	400
Sweeptime	28.477 µs
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	21 / max. 15
Stable	5 / 5
Max Stable Difference	0.11 dB

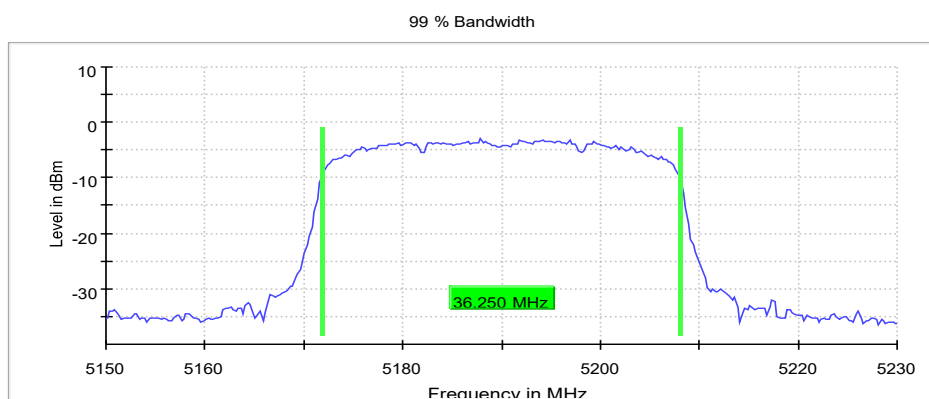
Radio Technology = WLAN n 20 MHz, Operating Frequency = mid
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.20000 GHz
Stop Frequency	5.24000 GHz
Span	40.000 MHz
RBW	200.000 kHz
VBW	1.000 MHz
SweepPoints	400
SweepTime	28.477 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	83 / max. 15
Stable	5 / 5
Max Stable Difference	0.02 dB

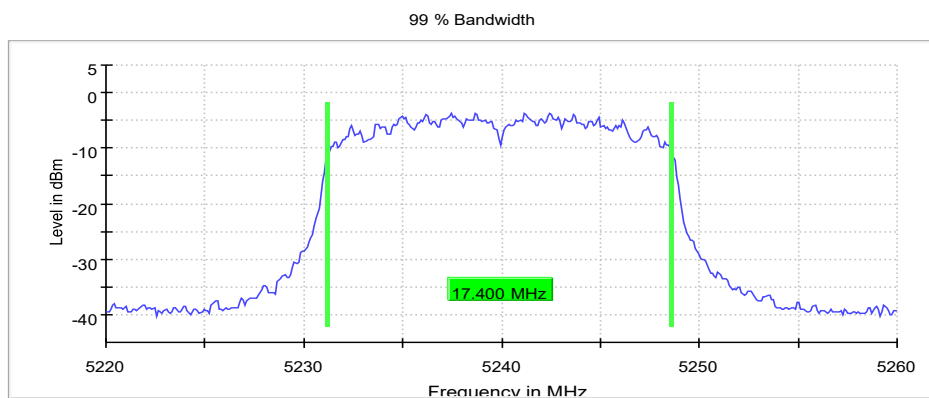
Radio Technology = WLAN n 40 MHz, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.15000 GHz
Stop Frequency	5.23000 GHz
Span	80.000 MHz
RBW	500.000 kHz
VBW	2.000 MHz
SweepPoints	320
SweepTime	18.906 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	92 / max. 15
Stable	5 / 5
Max Stable Difference	0.03 dB

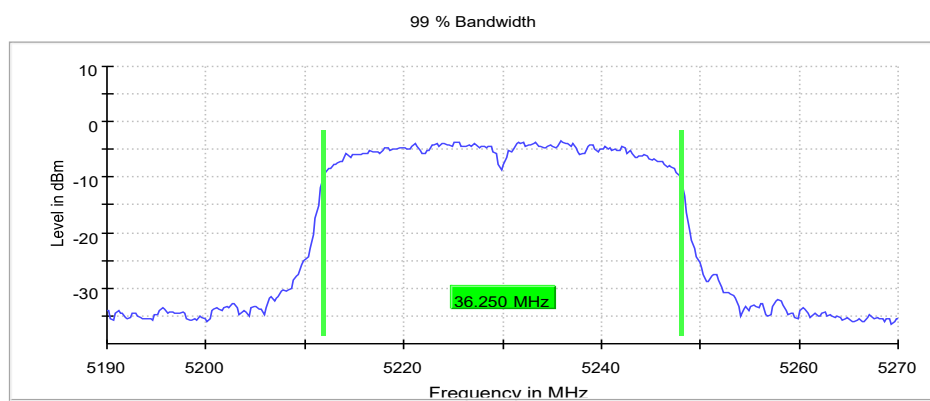
Radio Technology = WLAN ac 20 MHz, Operating Frequency = high
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.22000 GHz
Stop Frequency	5.26000 GHz
Span	40.000 MHz
RBW	200.000 kHz
VBW	1.000 MHz
SweepPoints	400
SweepTime	28.477 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	83 / max. 15
Stable	5 / 5
Max Stable Difference	0.10 dB

Radio Technology = WLAN ac 40 MHz, Operating Frequency = high
 (S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.19000 GHz
Stop Frequency	5.27000 GHz
Span	80.000 MHz
RBW	500.000 kHz
VBW	2.000 MHz
SweepPoints	320
SweepTime	18.906 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	200
Filter	3 dB
Trace Mode	Max Hold
SweepType	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	94 / max. 15
Stable	5 / 5
Max Stable Difference	0.29 dB

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 12.3.3.2

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

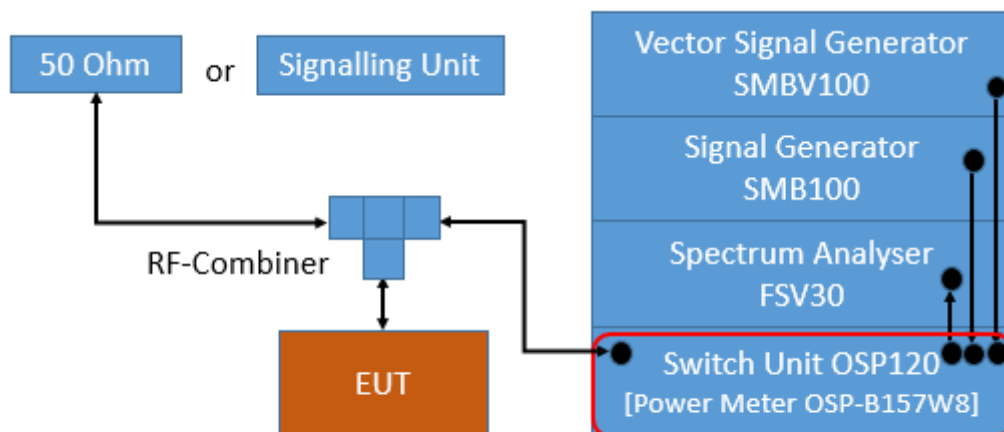
For U-NII bands 1, 2A, 2C, 3:

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.

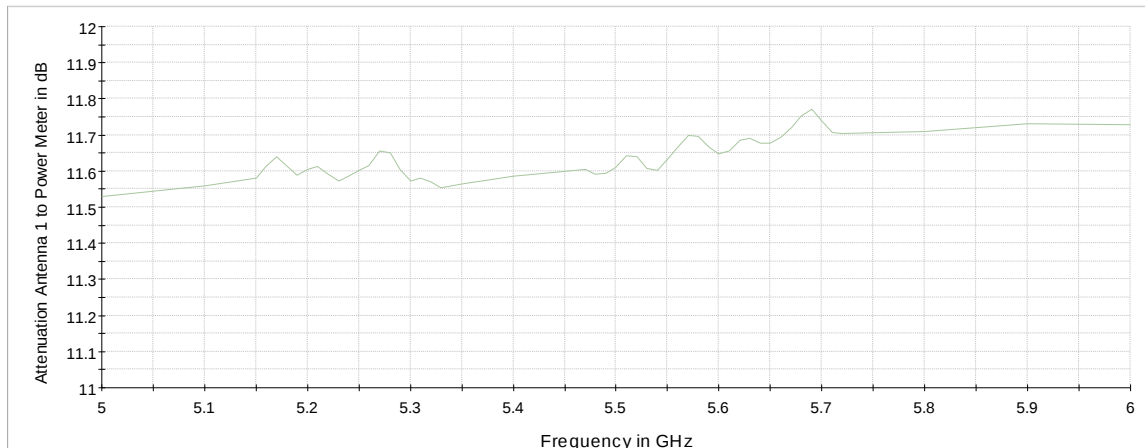
The OSP-B157W is a gated RF average power meter with a signal bandwidth > 300 MHz.

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

For U-NII bands 5,6,7,8:

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.

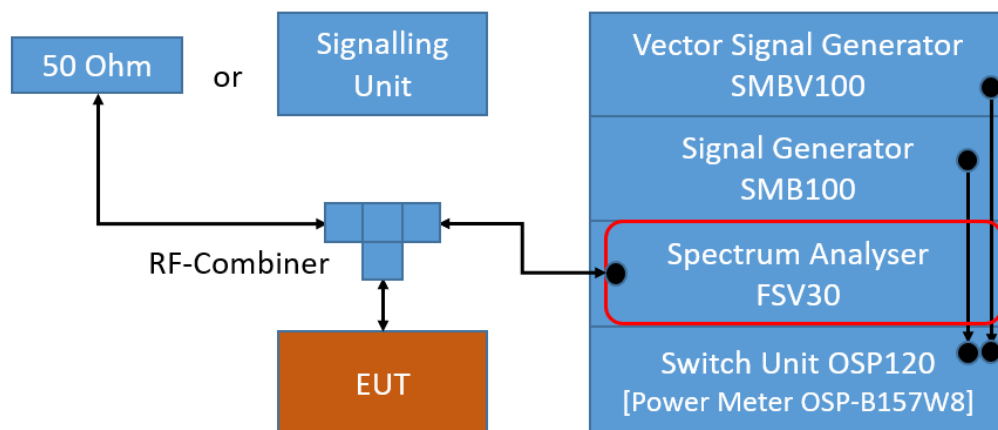
Analyzer settings:

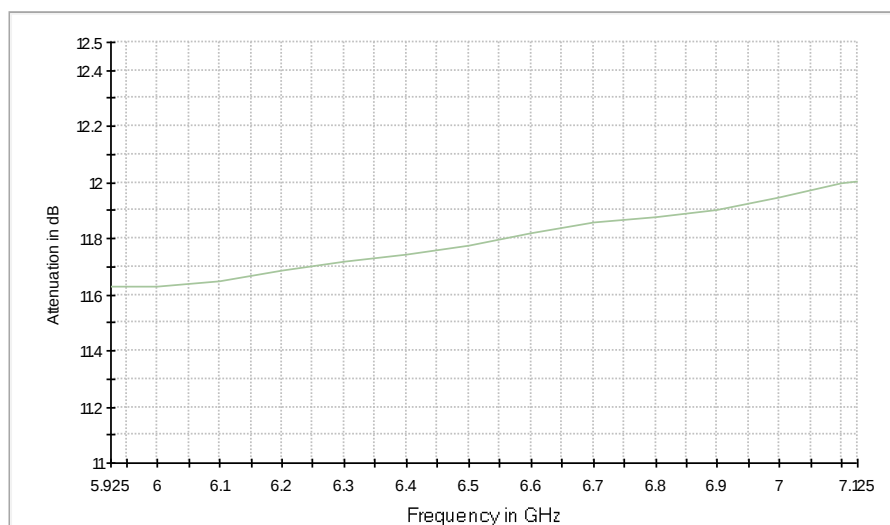
- Resolution Bandwidth (RBW): 1 MHz
- Video Bandwidth (VBW): 3 MHz
- Trace: Average, RMS power averaging mode
- Sweeps: at least 100
- Sweep time: Auto
- Detector: RMS
- Trigger: free run (DC > 98 %) or gated mode (DC < 98 %)

See worst case result plots for details

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 **SA-1**.





Attenuation of measurement path

5.3.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15, Subpart E, §15.407 (a) (1) (i): Outdoor access point:

For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:

Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.

The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

§15.407 (a) (1) (ii): Indoor access point:

Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.

§15.407 (a) (1) (iii): Fixed point-to-point access points:

Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 23 dBi.

§15.407 (a) (1) (iv): Client devices:

Limit: 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi.

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

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

All frequency bands: B is the 99% emission bandwidth in MHz.

RSS-247, 6.2.1.1, Band 5150-5250 MHz, indoor operation only, except for OEM devices installed by vehicle manufacturers:

Limits:

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10 \log_{10} B$, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW. (e.i.r.p.)

Other devices: 200 mW (23 dBm) or $10 + 10 \log_{10} B$ [dBm], whichever power is less.

5.3.3 TEST PROTOCOL

Ambient temperature: 23 °C
 Air Pressure: 1001 hPa
 Humidity: 38 %
 Setup: S01_AD03
 WLAN a-Mode; 20 MHz; 6 Mbit/s

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	
1	FCC	5180	6.6	11.7	24.0	17.4	30.0	18.3	1)
	FCC	5200	6.4	11.5	24.0	17.6	30.0	18.5	1)
	FCC	5240	6.1	11.2	24.0	17.9	30.0	18.8	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	
1	FCC	5180	6.4	11.5	24.0	17.6	30.0	18.5	1)
	FCC	5200	6.6	11.7	24.0	17.4	30.0	18.3	1)
	FCC	5240	6.2	11.3	24.0	17.8	30.0	18.7	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	
1	FCC	5190	6.7	11.8	24.0	17.3	30.0	18.2	1)
	FCC	5230	6.2	11.3	24.0	17.8	30.0	18.7	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	
1	FCC	5180	7.0	12.1	24.0	17.0	30.0	17.9	1)
	FCC	5200	6.5	11.6	24.0	17.5	30.0	18.4	1)
	FCC	5240	6.2	11.3	24.0	17.8	30.0	18.7	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	FCC Cond. Limit [dBm]	Margin [dB]	FCC EIRP Limit [dBm]	Margin [dB]	
1	FCC	5190	6.7	11.8	24.0	17.3	30.0	18.2	1)
	FCC	5230	6.2	11.3	24.0	17.8	30.0	18.7	1)

Ambient temperature: 25 °C
 Air Pressure: 1010 hPa
 Humidity: 42 %
 Setup: S01_BA04
 WLAN a-Mode; 20 MHz; 6 Mbit/s

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]	
1	ISED	5180	6.5	11.6	N/A	-	11.8	0.2	1)
	ISED	5200	5.9	11.0	N/A	-	11.8	0.8	1)
	ISED	5240	5.5	10.6	N/A	-	11.8	1.2	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]	
1	ISED	5180	6.3	11.4	N/A	-	11.8	0.4	1)
	ISED	5200	5.7	10.8	N/A	-	11.8	1.0	1)
	ISED	5240	5.3	10.4	N/A	-	11.8	1.4	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]	
1	ISED	5190	5.9	11.0	N/A	-	11.8	0.8	1)
	ISED	5230	5.4	10.5	N/A	-	11.8	1.3	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]	
1	ISED	5180	6.3	11.4	N/A	-	11.8	0.4	1)
	ISED	5200	5.7	10.8	N/A	-	11.8	1.0	1)
	ISED	5240	5.3	10.4	N/A	-	11.8	1.4	1)

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

U-NII-Subband	Power	TX Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	ISED Cond. Limit [dBm]	Margin [dB]	ISED EIRP Limit [dBm]	Margin [dB]	
1	ISED	5190	5.9	11.0	N/A	-	11.8	0.8	1)
	ISED	5230	5.3	10.4	N/A	-	11.8	1.4	1)

1) no additional limit applies related to the elevation.

Comment:

- "MAXIMUM CONDUCTED OUTPUT POWER" measurements were performed for FCC and IC separately, because for Canada the output power will be limited to fulfil the ISED output power Limits.
- Power Meter measurement, no plots provided.
- The Gain of Internal Antenna (5.1 dBi) was used to determine the EIRP, because it represents the worst case by "MAXIMUM CONDUCTED OUTPUT POWER" measurements.

5.3.4 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 12.5 (SA-3)

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:

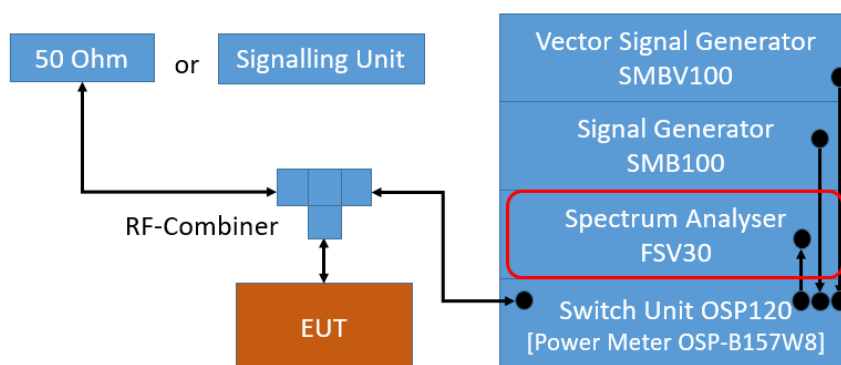
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

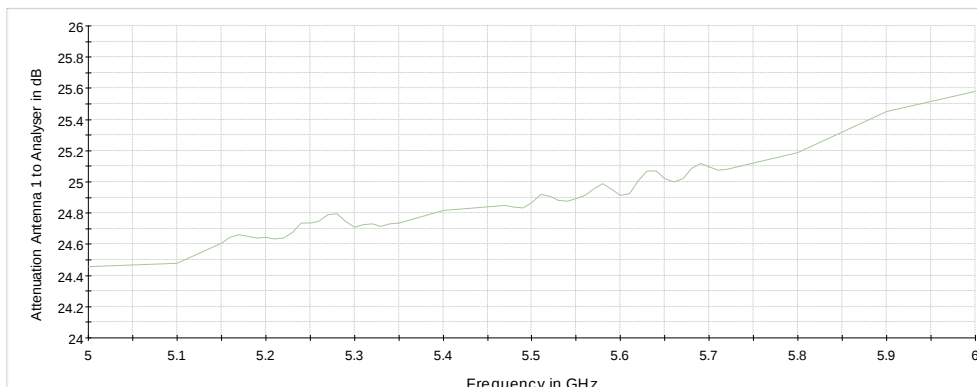
- Resolution Bandwidth (RBW): 1 MHz (for subband 3: 500 kHz)
- Video Bandwidth (VBW): 3 MHz (for subband 3: 2 MHz)
- Trace: Max Hold
- Sweeps: till stable (at least 180, max. 900)
- Sweeptime: $\leq$ Number of sweep points x Min. Transmitter on time
- Detector: RMS
- Trigger: free run

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-3**.



TS8997; Maximum Power Spectral Density



Attenuation of the measurement path

For U-NII bands 5, 6, 7, 8:

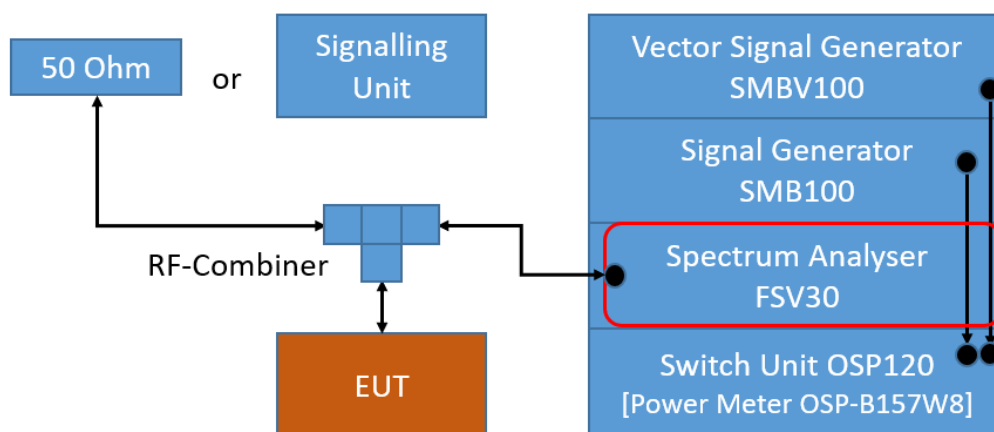
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

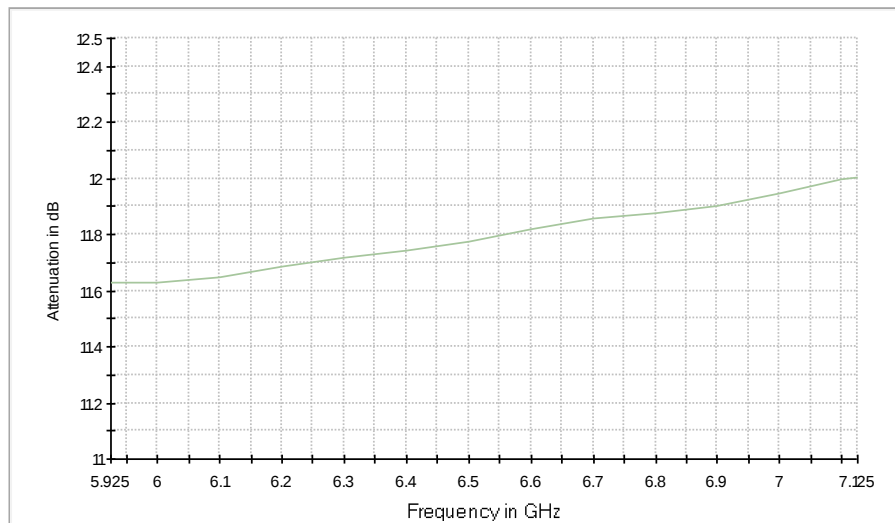
Analyzer settings:

- Resolution Bandwidth (RBW): 1 MHz
- Video Bandwidth (VBW): 3 MHz
- Trace: Average, RMS power averaging mode
- Sweeps: at least 100
- Sweep time: Auto
- Detector: RMS
- Trigger: free run (DC >98 %) or gated mode (DC < 98 %)

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**.





Attenuation of measurement path

5.4.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15, Subpart E, §15.407 (a) (1)

For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:

(i) and (ii), outdoor and indoor access points: Limit: 17 dBm/MHz.

(iv), mobile and portable client devices: Limit: 11 dBm/MHz.

B) IC

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

RSS-247, 6.2.1 (1), Band 5150-5250 MHz, indoor operation only:

Limit (e.i.r.p.): 10 dBm/MHz.

5.4.3 TEST PROTOCOL

Ambient temperature: 23 °C
 Air Pressure: 1001 hPa
 Humidity: 38 %
 WLAN a-Mode; 20 MHz; 6 Mbit/s

U-NII-Subband	Power	Freq. [MHz]	MPSD [dBm/ MHz]	E.I.R.P MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]
1	FCC	5180	-3.4	1.7	17.0	20.4	N/A
	FCC	5200	-3.7	1.4	17.0	20.7	N/A
	FCC	5240	-4.0	1.1	17.0	21.0	N/A

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

U-NII-Subband	Power	Freq. [MHz]	MPSD [dBm/ MHz]	E.I.R.P MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]
1	FCC	5180	-3.8	1.3	17.0	20.8	N/A
	FCC	5200	-4.1	1.0	17.0	21.1	N/A
	FCC	5240	-4.5	0.6	17.0	21.5	N/A

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

U-NII-Subband	Power	Freq. [MHz]	MPSD [dBm/ MHz]	E.I.R.P MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]
1	FCC	5190	-5.6	-0.5	17.0	22.6	N/A
	FCC	5230	-6.0	-0.9	17.0	23.0	N/A

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

U-NII-Subband	Power	Freq. [MHz]	MPSD [dBm/ MHz]	E.I.R.P MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]
1	FCC	5180	-3.8	1.3	17.0	20.8	N/A
	FCC	5200	-4.1	1.0	17.0	21.1	N/A
	FCC	5240	-4.5	0.6	17.0	21.5	N/A

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

U-NII-Subband	Power	Freq. [MHz]	MPSD [dBm/ MHz]	E.I.R.P MPSD [dBm/ MHz]	FCC Limit [dBm/MHz]	Margin [dB]	ISED Limit [dBm/MHz]
1	FCC	5190	-5.6	-0.5	17.0	22.6	N/A
	FCC	5230	-5.8	-0.7	17.0	22.8	N/A

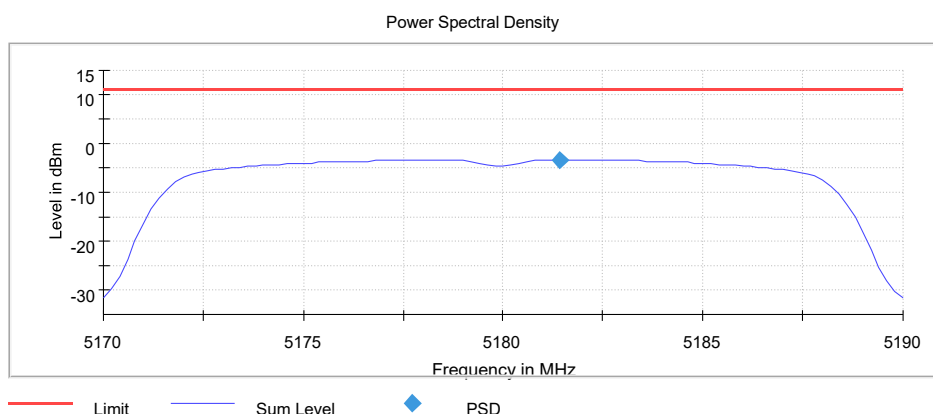
Remark: Please see next sub-clause for the measurement plot.

Comment:

- The Gain of internal Antenna (5.1 dBi) was used to determine the EIRP, because it represents the worst case by "MAXIMUM CONDUCTED OUTPUT POWER" measurements.

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

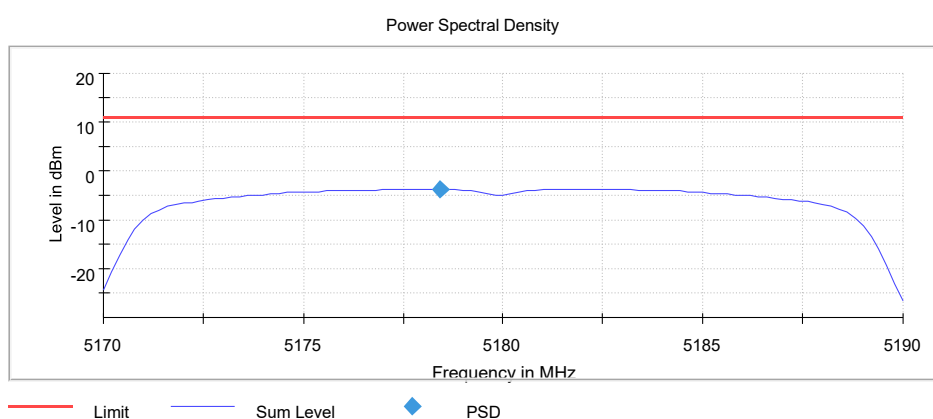
Radio Technology = WLAN a, Operating Frequency = low,
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.17000 GHz
Stop Frequency	5.19000 GHz
Span	20.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
SweepTime	505.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	RMS
SweepCount	119
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	4 / max. 15
Stable	3 / 3
Max Stable Difference	0.01 dB

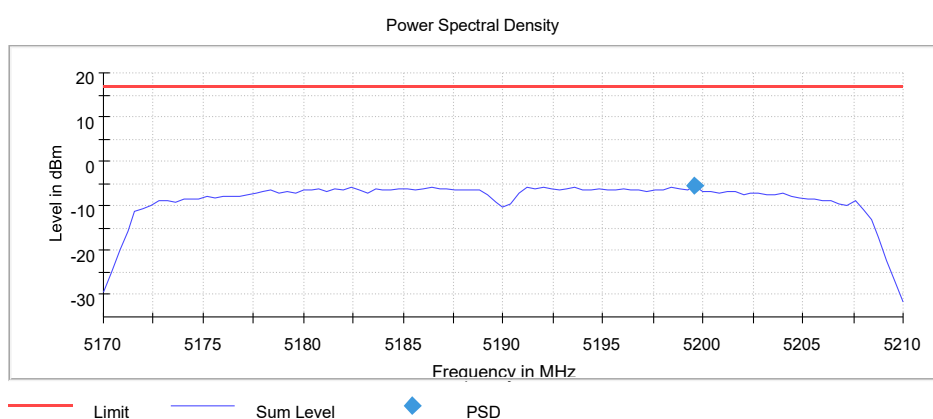
Radio Technology = WLAN n 20 MHz, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.17000 GHz
Stop Frequency	5.19000 GHz
Span	20.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
SweepTime	505.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	RMS
SweepCount	119
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	4 / max. 15
Stable	3 / 3
Max Stable Difference	0.04 dB

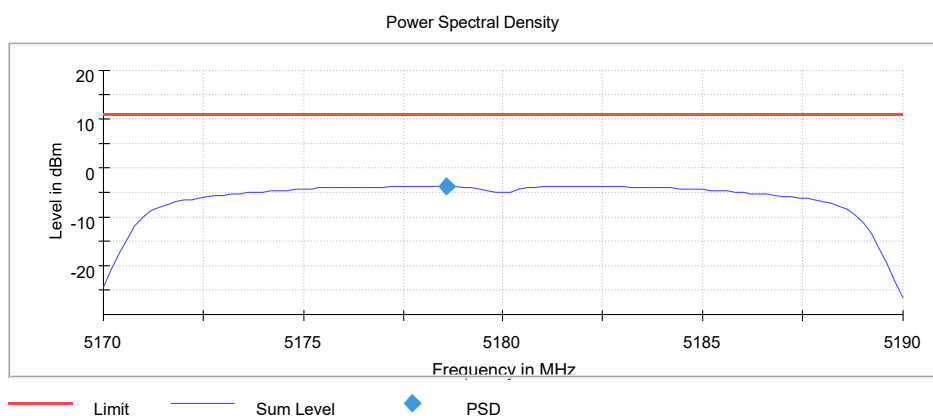
Radio Technology = WLAN n 40 MHz, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.17000 GHz
Stop Frequency	5.21000 GHz
Span	40.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
SweepTime	1.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	RMS
SweepCount	0
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	15 / max. 15
Stable	1 / 3
Max Stable Difference	0.00 dB

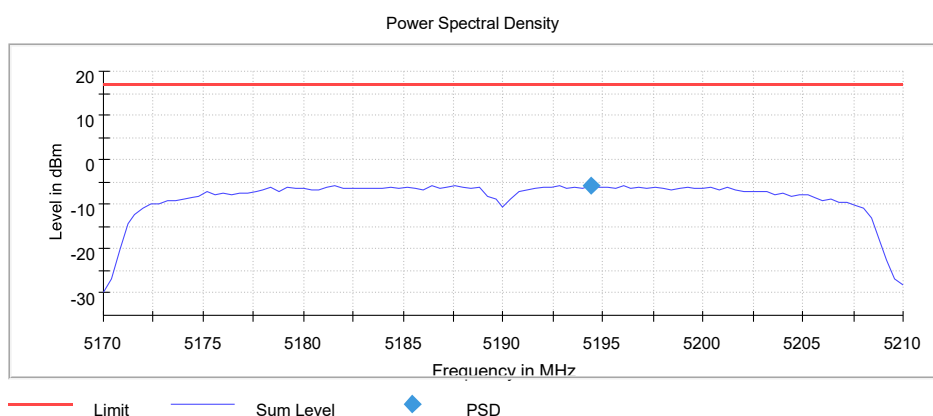
Radio Technology = WLAN ac 20 MHz, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.17000 GHz
Stop Frequency	5.19000 GHz
Span	20.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
SweepTime	505.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	RMS
SweepCount	119
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	4 / max. 15
Stable	3 / 3
Max Stable Difference	0.03 dB

Radio Technology = WLAN ac 40 MHz, Operating Frequency = low
(S01_AD03)



Measurement

Setting	Instrument Value
Start Frequency	5.17000 GHz
Stop Frequency	5.21000 GHz
Span	40.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
SweepTime	1.000 ms
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	RMS
SweepCount	0
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	15 / max. 15
Stable	3 / 3
Max Stable Difference	0.00 dB

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

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:

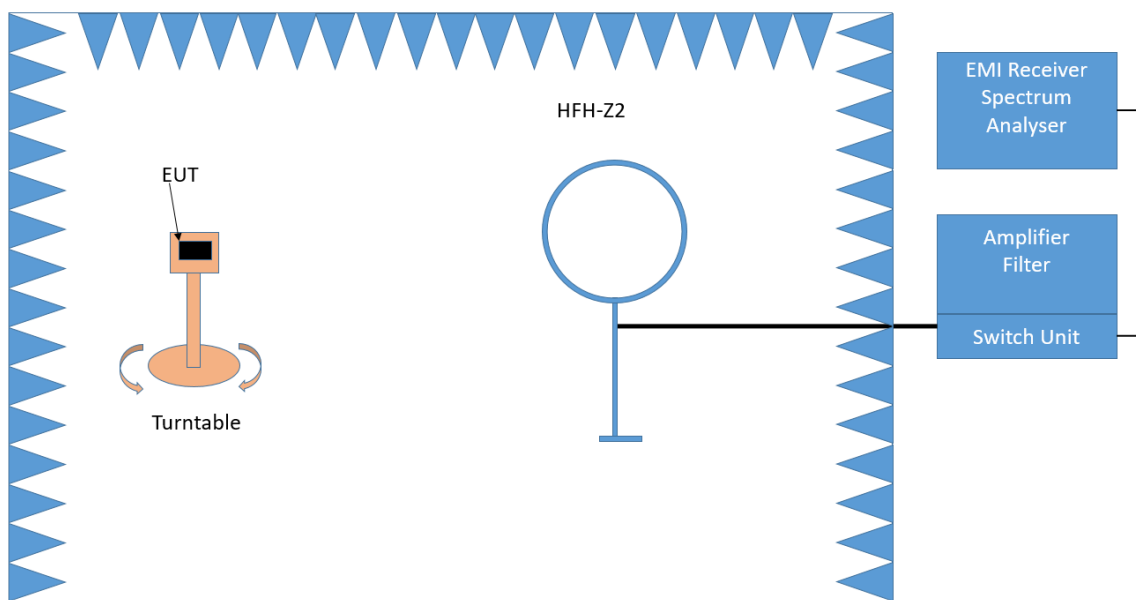
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHz: Chapter 6.6 (procedure according 6.6.5 used)

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)

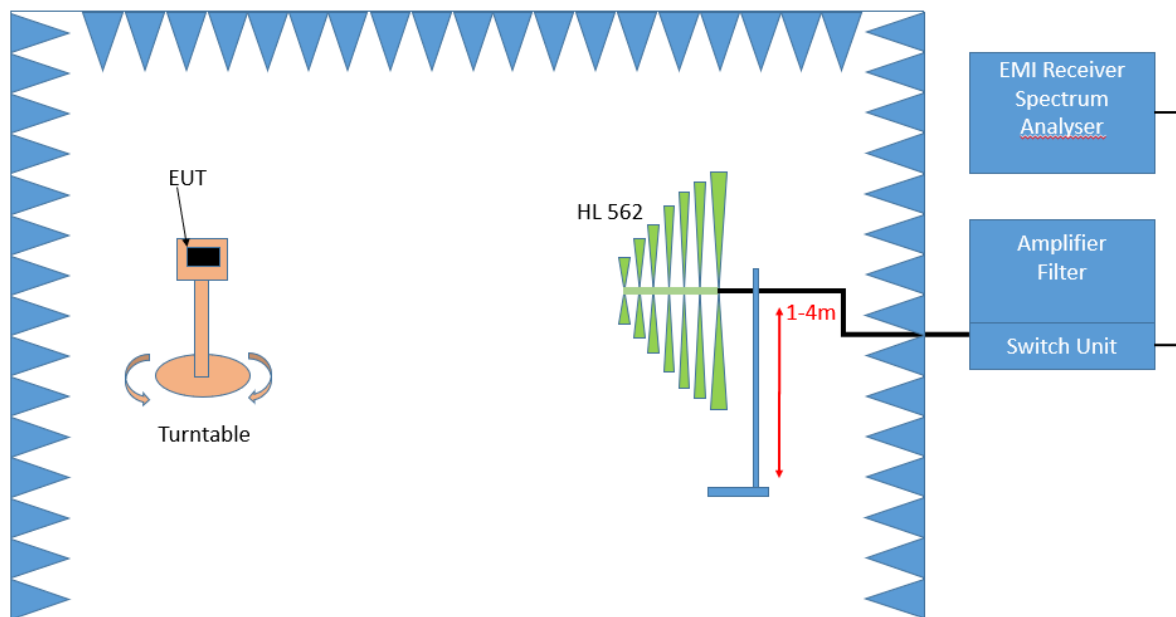
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

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

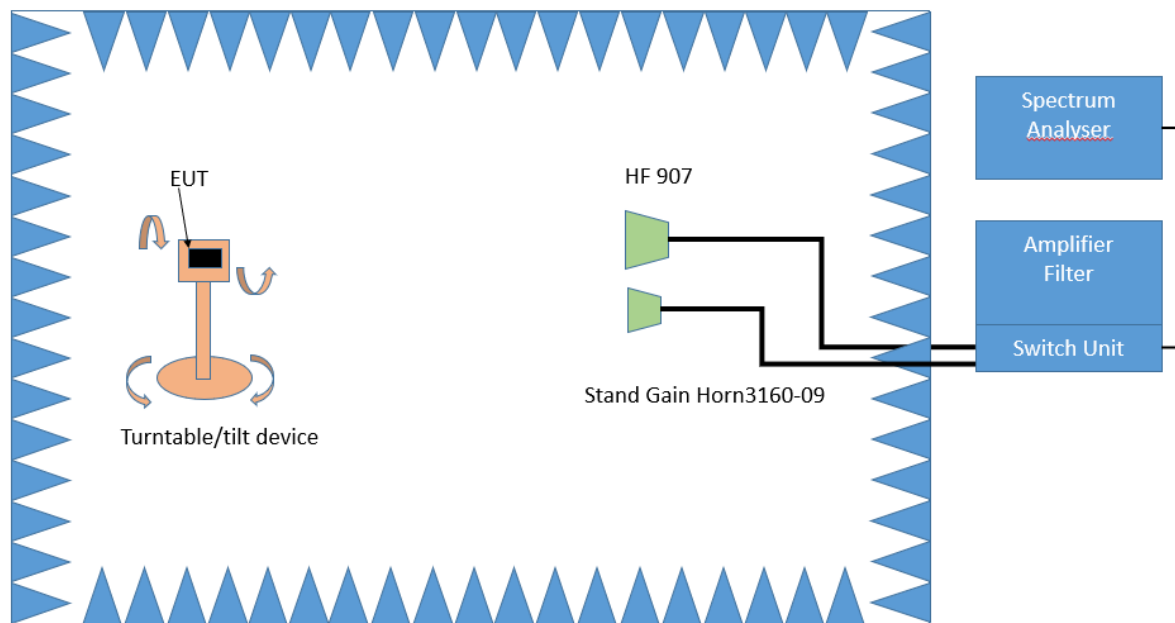
After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

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:

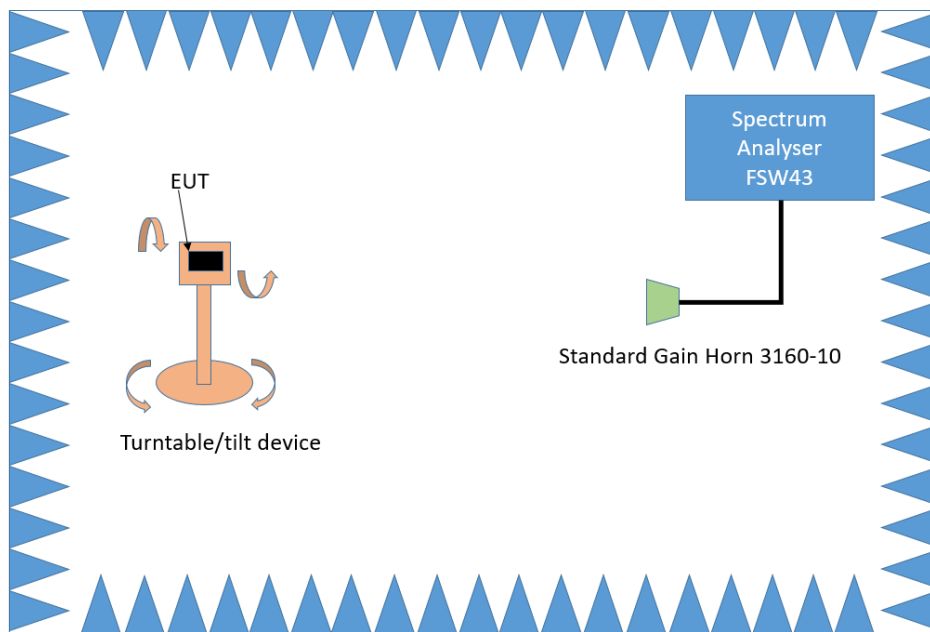
Spectrum analyser settings for step 3:

- 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

5.5.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15 Subpart E, §15.407 (b)(1)

For transmitters operating in the 5150–5250 MHz band:

Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

B) IC

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

RSS-247, 6.2.1.2, Emissions outside the band 5150-5250 MHz, indoor operation only:

Limit: –27 dBm/MHz EIRP outside of the band 5150–5250 MHz.

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:

22 - 24 °C

Air Pressure:

999 - 1003 hPa

Humidity:

38 - 45 %

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

Applied duty cycle correction (AV): 0.4 dB

Antenna	Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
external	36	5180	30.3	12.9	QP	120	40.0	27.2	RB
external	36	5180	849.6	19.6	QP	120	46.0	26.4	RB
external	36	5180	15616.6	42.0	AV	1000	54.0	12.0	RB
external	36	5180	15616.6	54.3	PEAK	1000	74.0	19.7	RB
external	36	5180	25850.0	54.4	PEAK	1000	68.2	13.8	UE
external	40	5200	30.1	13.4	QP	120	40.0	26.6	RB
external	40	5200	47.9	6.3	QP	120	40.0	33.7	RB
external	40	5200	839.5	19.2	QP	120	46.0	26.8	RB
external	48	5240	47.9	8.5	QP	120	40.0	31.6	RB
external	48	5240	755.0	17.6	QP	120	46.0	28.4	RB
external	48	5240	15640.5	41.8	AV	1000	54.0	12.2	RB
external	48	5240	15640.5	54.7	PEAK	1000	74.0	19.3	RB
internal	36	5180	5748.1	58.3	PEAK	1000	68.2	9.9	UE
internal	36	5180	6906.7	64.9	PEAK	1000	68.2	3.3	UE
internal	36	5180	16639.5	56.6	PEAK	1000	68.2	11.6	UE
internal	36	5180	24815.9	54.6	PEAK	1000	68.2	13.6	UE
internal	40	5200	6502.0	59.4	PEAK	1000	68.2	8.8	UE
internal	40	5200	6933.3	65.8	PEAK	1000	68.2	2.4	UE
internal	40	5200	13727.2	53.2	PEAK	1000	68.2	15.0	UE
internal	40	5200	17989.5	46.5	AV	1000	54.0	7.5	RB
internal	40	5200	17989.5	59.0	PEAK	1000	74.0	15.0	RB
internal	40	5200	24808.2	55.3	PEAK	1000	68.2	12.9	UE
internal	48	5240	6986.6	65.5	PEAK	1000	68.2	2.7	UE

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

Applied duty cycle correction (AV): 0.5 dB

Antenna	Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
external	36	5180	5452.7	45.2	AV	1000	54.0	8.8	RB
external	36	5180	5452.7	57.5	PEAK	1000	74.0	16.5	RB
external	36	5180	15650.5	42.0	AV	1000	54.0	12.0	RB
external	36	5180	15650.5	54.5	PEAK	1000	74.0	19.5	RB
external	48	5240	15620.1	42.0	AV	1000	54.0	12.0	RB
external	48	5240	15620.1	54.4	PEAK	1000	74.0	19.6	RB
internal	36	5180	6906.7	67.0	PEAK	1000	68.2	1.2	UE
internal	40	5200	2450.3	50.3	PEAK	1000	68.2	17.9	UE
internal	40	5200	2764.8	38.9	AV	1000	54.0	15.1	RB
internal	40	5200	2764.8	51.2	PEAK	1000	74.0	22.8	RB
internal	40	5200	4886.4	44.7	AV	1000	54.0	9.3	RB
internal	40	5200	4886.4	57.1	PEAK	1000	74.0	16.9	RB
internal	40	5200	6933.3	66.6	PEAK	1000	68.2	1.6	UE
internal	40	5200	16660.7	57.2	PEAK	1000	68.2	11.0	UE
internal	48	5240	4745.9	44.2	AV	1000	54.0	9.8	RB
internal	48	5240	4745.9	57.3	PEAK	1000	74.0	16.7	RB
internal	48	5240	15606.9	42.1	AV	1000	54.0	11.9	RB
internal	48	5240	15606.9	54.6	PEAK	1000	74.0	19.4	RB

WLAN n-Mode; 40 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 0.9 dB

Antenna	Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
external	38	5190	47.7	9.2	QP	120	40.0	30.8	RB
external	38	5190	672.6	16.2	QP	120	46.0	29.8	RB
external	38	5190	838.2	19.2	QP	120	46.0	26.8	RB
external	38	5190	5403.1	45.5	AV	1000	54.0	8.5	RB
external	38	5190	5403.1	57.4	PEAK	1000	74.0	16.6	RB
external	38	5190	15625.6	42.4	AV	1000	54.0	11.6	RB
external	38	5190	15625.6	54.5	PEAK	1000	74.0	19.5	RB
external	46	5230	47.9	4.4	QP	120	40.0	35.6	RB
external	46	5230	637.5	16.1	QP	120	46.0	29.9	RB
external	46	5230	15648.6	42.2	AV	1000	54.0	11.8	RB
external	46	5230	15648.6	54.0	PEAK	1000	74.0	20.0	RB
internal	38	5190	5143.0	47.3	AV	1000	54.0	6.7	38
internal	38	5190	5143.0	71.0	PEAK	1000	74.0	3.0	38
internal	38	5190	6919.9	65.3	PEAK	1000	68.2	2.9	38
internal	46	5230	1758.4	47.9	PEAK	1000	68.2	20.3	46
internal	46	5230	6973.4	65.7	PEAK	1000	68.2	2.5	46

WLAN ac-Mode; 20 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 0.5 dB

Antenna	Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
external	36	5180	-	-	-	1000	-	>6	-
external	48	5240	15678.9	41.8	AV	1000	54.0	12.2	RB
external	48	5240	15678.9	54.3	PEAK	1000	74.0	19.7	RB
internal	36	5180	5418.0	47.0	AV	1000	54.0	7.0	RB
internal	36	5180	5418.9	58.2	PEAK	1000	74.0	15.8	RB
internal	36	5180	15620.7	42.1	AV	1000	54.0	11.9	RB
internal	36	5180	15620.7	54.4	PEAK	1000	74.0	19.6	RB
internal	36	5180	25996.9	54.6	PEAK	1000	68.2	13.6	UE
internal	48	5240	-	-	-	1000	-	>6	-

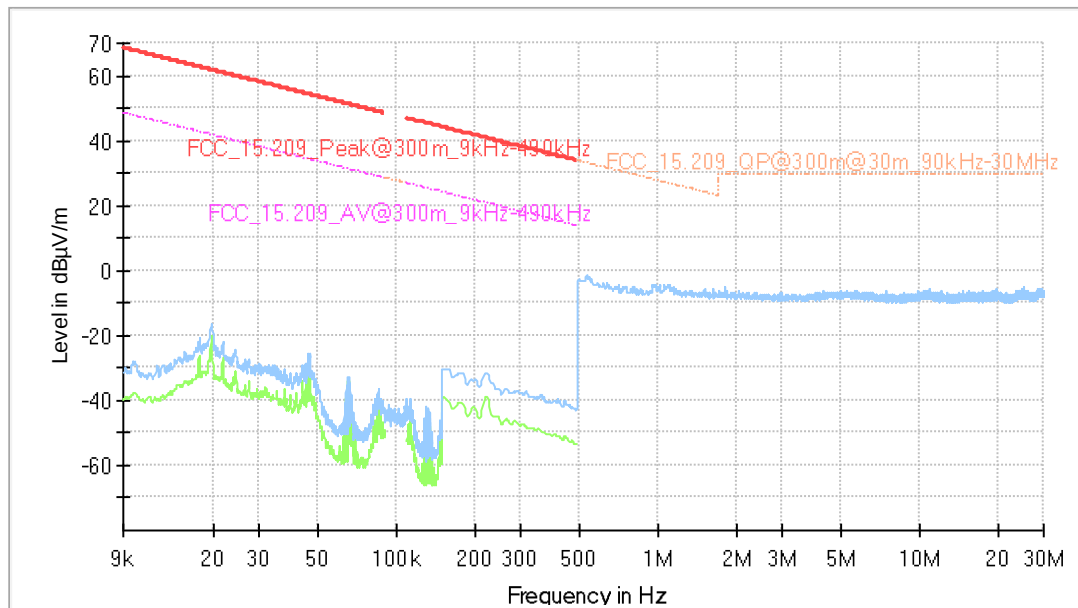
WLAN ac-Mode; 40 MHz; MCS 0; SISO
Applied duty cycle correction (AV): 0.9 dB

Antenna	Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
external	38	5190	15633.7	42.2	AV	1000	54.0	11.8	RB
external	38	5190	15633.7	54.2	PEAK	1000	74.0	19.8	RB
external	46	5230	15630.0	42.3	AV	1000	54.0	11.7	RB
external	46	5230	15630.0	54.6	PEAK	1000	74.0	19.4	RB
internal	38	5190	5147.6	69.9	PEAK	1000	74.0	4.1	RB
internal	38	5190	5147.6	48.5	AV	1000	54.0	5.5	RB
internal	38	5190	6919.9	66.5	PEAK	1000	68.2	1.7	UE
internal	46	5230	2408.0	54.4	PEAK	1000	68.2	13.8	UE
internal	46	5230	2473.0	50.0	PEAK	1000	68.2	18.2	UE
internal	46	5230	5572.1	58.1	PEAK	1000	68.2	10.1	UE
internal	46	5230	6973.4	65.9	PEAK	1000	68.2	2.3	UE

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

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

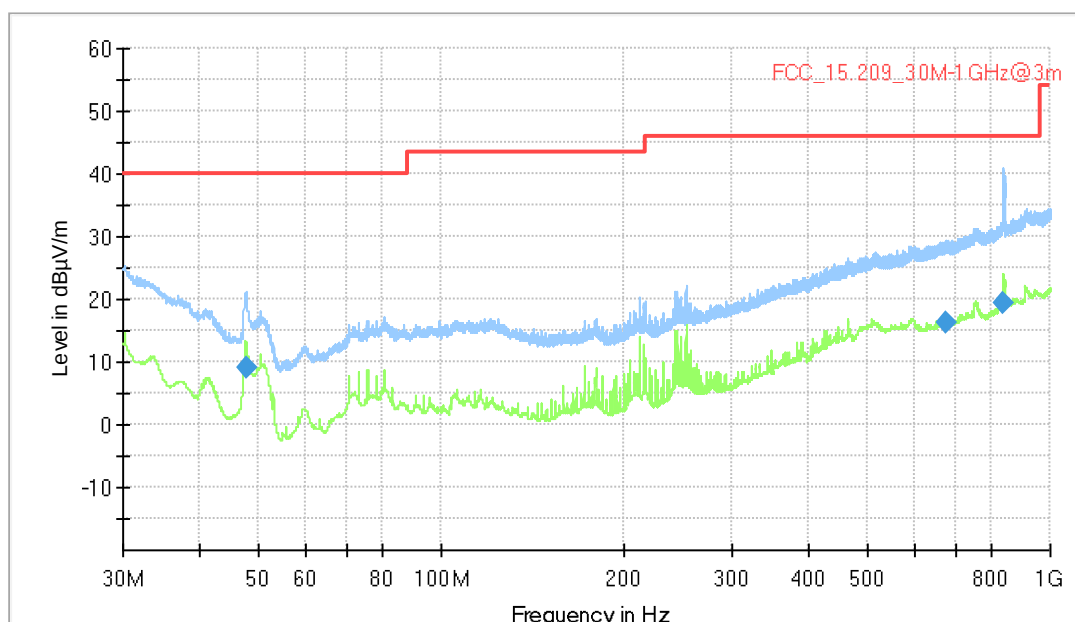
Modulation= WLAN a, Operating Channel = low,
 Measurement range = 9 kHz - 30 MHz
 (S02_AD03, external Antenna)



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)
---	---	---	---	---	---	---	---	---	---

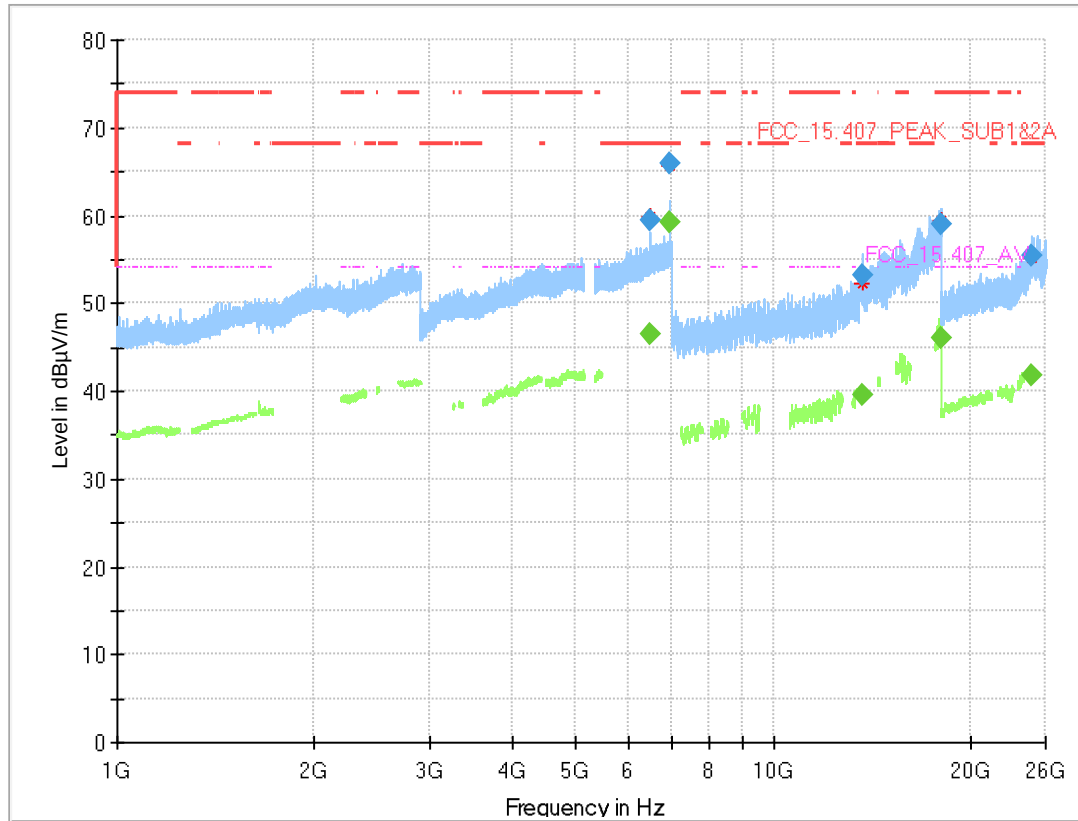
Modulation= WLAN n40, Operating Channel = low,
 Measurement range = 30 MHz - 1 GHz
 (S02_AD03, external Antenna)



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)
47.730000	9.17	40.00	30.83	1000.0	120.000	104.0	V	49.0	8.4
672.630000	16.24	46.00	29.76	1000.0	120.000	113.0	H	-185.0	23.7
838.230000	19.22	46.00	26.78	1000.0	120.000	287.0	H	21.0	26.8

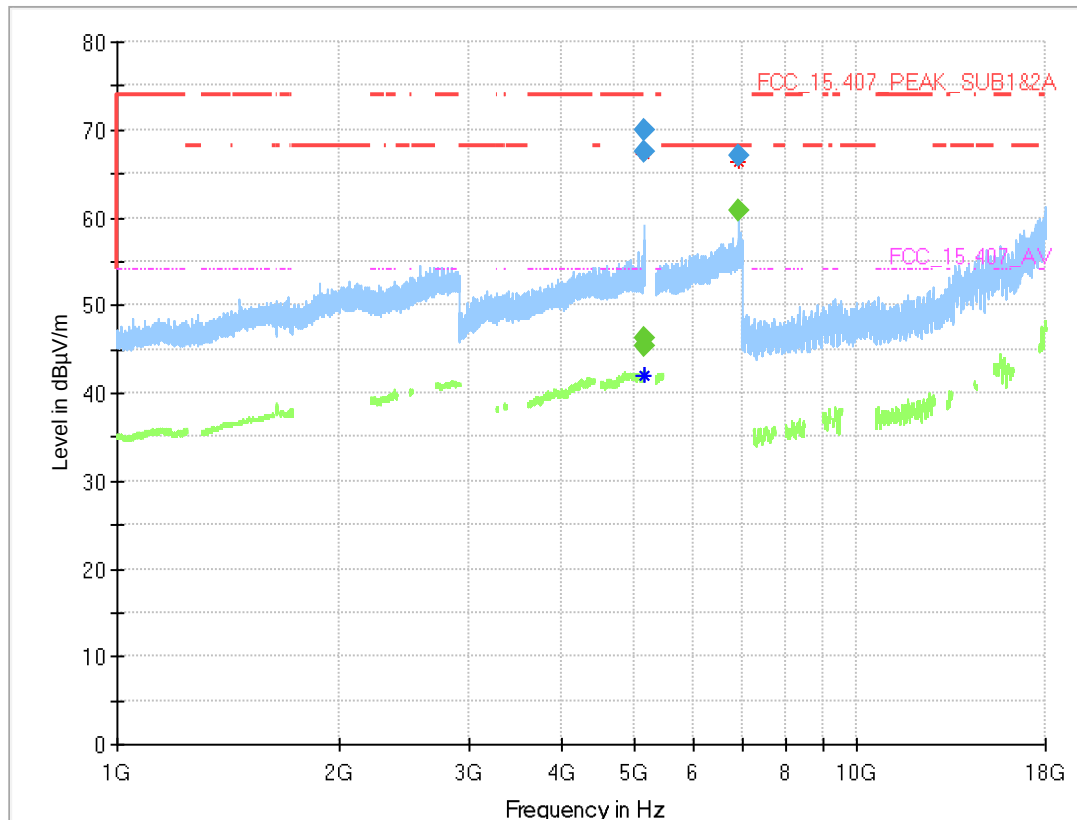
Modulation= WLAN a, Operating Channel = mid,
Measurement range = 1 GHz - 26 GHz
(S02_AD03, internal Antenna)



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)
6501.964	---	46.5	---	---	1000.0	1000.000	150.0	V	97.0	-12.0	18.3
6501.964	59.4	---	68.20	8.79	1000.0	1000.000	150.0	V	97.0	-12.0	18.3
6933.318	---	59.1	---	---	1000.0	1000.000	150.0	H	-46.0	96.0	19.3
6933.318	65.8	---	68.20	2.38	1000.0	1000.000	150.0	H	-46.0	96.0	19.3
13727.206	---	39.6	---	---	1000.0	1000.000	150.0	H	-185.0	96.0	-2.7
13727.206	53.2	---	68.20	14.96	1000.0	1000.000	150.0	H	-185.0	96.0	-2.7
17989.500	---	46.1	54.00	7.91	1000.0	1000.000	150.0	H	-124.0	105.0	3.0
17989.500	59.0	---	74.00	14.96	1000.0	1000.000	150.0	H	-124.0	105.0	3.0
24808.200	---	41.8	---	---	1000.0	1000.000	150.0	H	129.0	15.0	20.3
24808.200	55.3	---	68.20	12.85	1000.0	1000.000	150.0	H	129.0	15.0	20.3

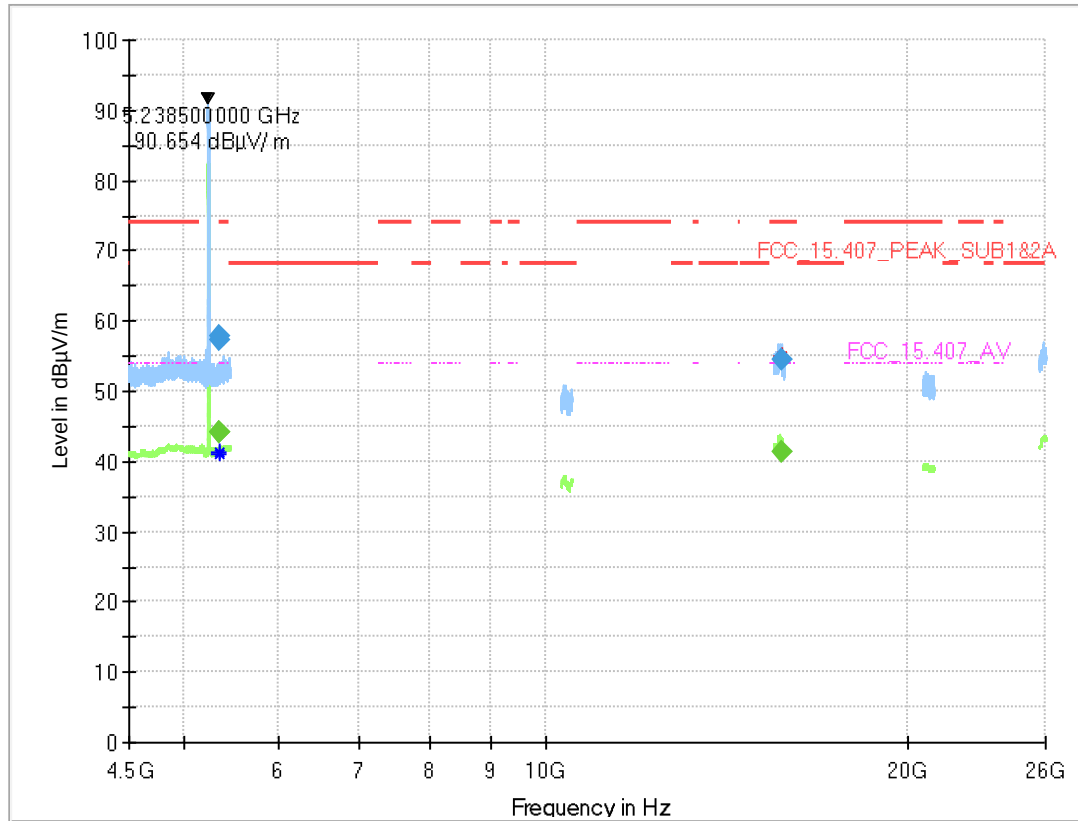
Modulation= WLAN n20, Operating Channel = low,
 Measurement range = 1 GHz - 26 GHz
 (S02_AD03, internal Antenna)



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)
5148.863	---	46.4	54.00	7.65	1000.0	1000.000	150.0	H	9.0	86.0	15.0
5148.863	69.9	---	74.00	4.11	1000.0	1000.000	150.0	H	9.0	86.0	15.0
5150.000	---	45.4	54.00	8.59	1000.0	1000.000	150.0	H	45.0	75.0	15.0
5150.000	67.4	---	74.00	6.59	1000.0	1000.000	150.0	H	45.0	75.0	15.0
6906.676	---	60.8	---	---	1000.0	1000.000	150.0	H	-4.0	78.0	18.8
6906.676	67.0	---	68.20	1.21	1000.0	1000.000	150.0	H	-4.0	78.0	18.8

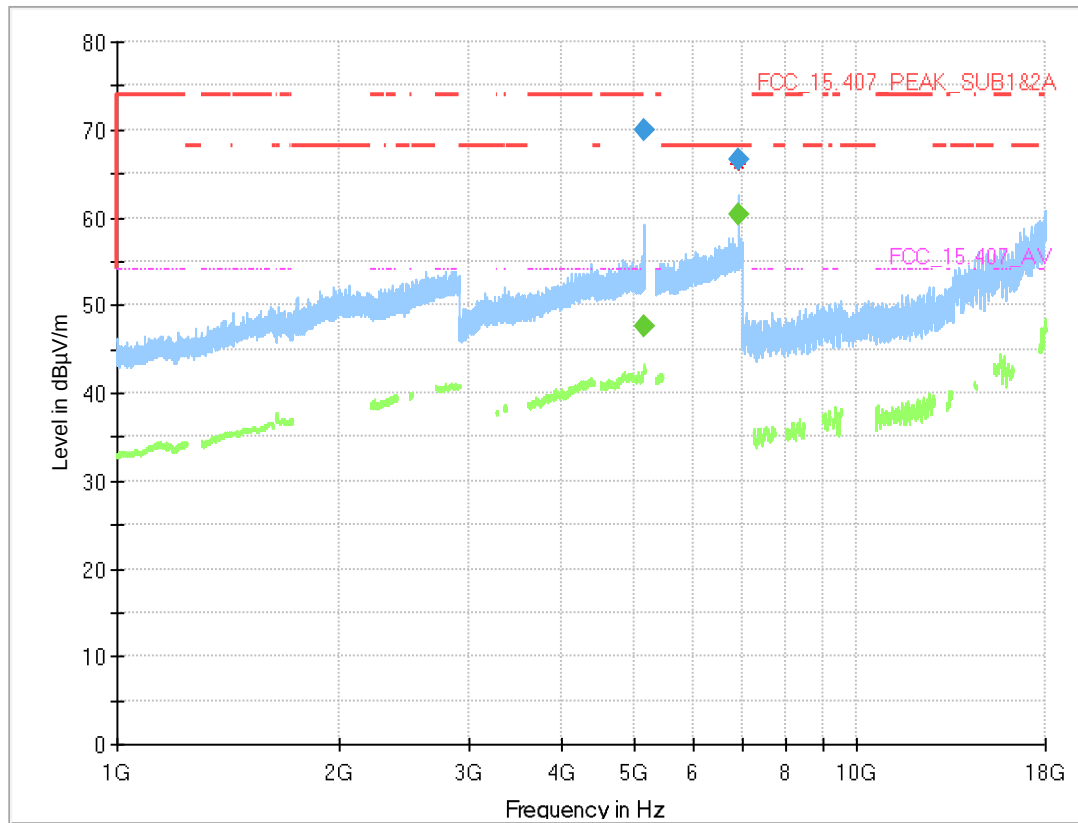
Modulation= WLAN ac20, Operating Channel = high,
Measurement range = 1 GHz - 26 GHz
(S02_AD03, external Antenna)



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)
5350.000	---	44.2	54.00	9.80	1000.0	1000.000	150.0	V	-183.0	15.0	15.3
5350.000	57.2	---	74.00	16.82	1000.0	1000.000	150.0	V	-183.0	15.0	15.3
5350.880	---	44.2	54.00	9.79	1000.0	1000.000	150.0	V	-171.0	105.0	15.3
5350.880	57.8	---	74.00	16.23	1000.0	1000.000	150.0	V	-171.0	105.0	15.3
15678.923	---	41.3	54.00	12.66	1000.0	1000.000	150.0	V	-79.0	2.0	0.1
15678.923	54.3	---	74.00	19.67	1000.0	1000.000	150.0	V	-79.0	2.0	0.1

Modulation= WLAN ac40, Operating Channel = low,
 Measurement range = 1 GHz - 26 GHz
 (S02_AD03, internal Antenna)



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)
5147.563	---	47.6	54.00	6.45	1000.0	1000.000	150.0	H	11.0	100.0	15.1
5147.563	69.9	---	74.00	4.07	1000.0	1000.000	150.0	H	11.0	100.0	15.1
6919.920	---	60.3	---	---	1000.0	1000.000	150.0	H	-11.0	96.0	19.0
6919.920	66.5	---	68.20	1.70	1000.0	1000.000	150.0	H	-11.0	96.0	19.0

Modulation= WLAN a, Operating Channel = mid,
Measurement range = 26 GHz - 40 GHz
(S02_AD03, internal Antenna)



5.5.5 TEST EQUIPMENT USED

- Radiated Emissions SAC H-Field
- Radiated Emissions FAR 5 GHz FCC
- Radiated Emissions SAC up to 1 GHz

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

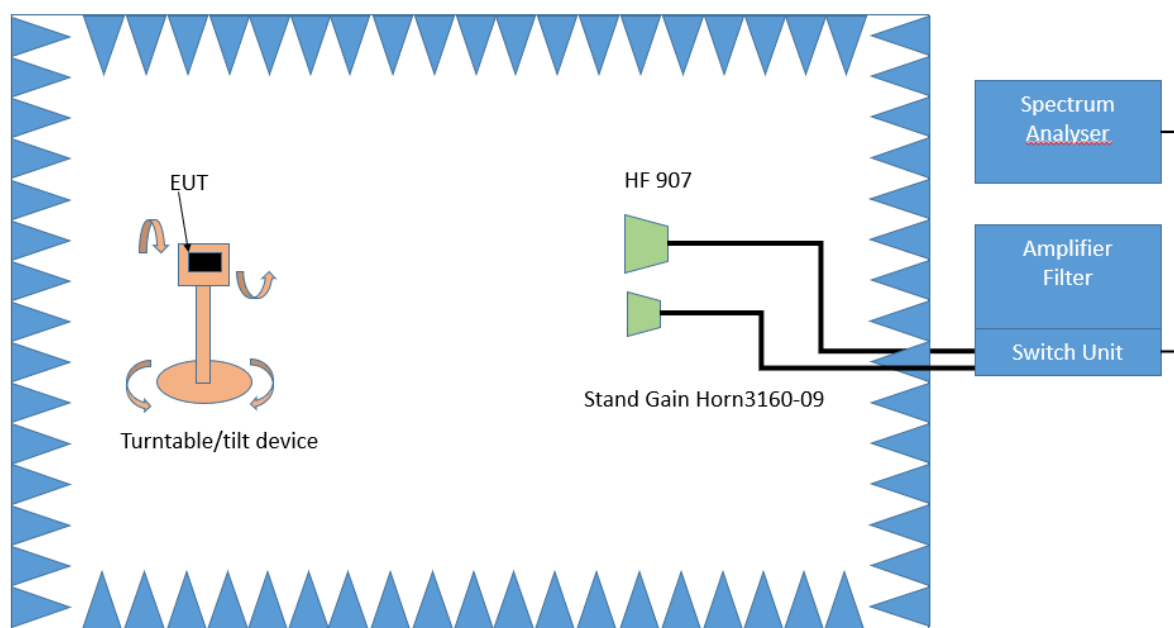
The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapter of ANSI C63.10:

- Chapter 6.10.5

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 (procedure according ANSI C63.10, chapter 6.6.5).

3. Measurement above 1 GHz



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

Step 1:

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 °.

Spectrum analyser settings:

- Detector: Peak, Average
- RBW = 1 MHz
- VBW = 3 MHz

Step 2:

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

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

Spectrum analyser settings:

- Detector: Peak

Step 3:

Spectrum analyser settings for step 3:

- Detector: Peak / CISPR Average
- Measured frequencies: in step 1 determined frequencies
- RBW = 1 MHz
- VBW = 3 MHz
- Measuring time: 1 s

5.6.2 TEST REQUIREMENTS / LIMITS

A) FCC

FCC Part 15 Subpart E, §15.407 (b)(1)

For transmitters operating in the 5150–5250 MHz band:

Limit: -27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

B) IC

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

RSS-247, 6.2.1.2, Emissions outside the band 5150-5250 MHz, indoor operation only:

Limit: -27 dBm/MHz EIRP outside of the band 5150–5250 MHz.

C) FCC & IC

For band edges connected to a restricted band, the limits are specified in Section 15.209(a)

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

Frequency in MHz	Limit ($\mu\text{V}/\text{m}$)	Measurement distance (m)	Limits ($\text{dB}\mu\text{V}/\text{m}$)
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 ($\mu\text{V}/\text{m}$)	Measurement distance (m)	Limits ($\text{dB}\mu\text{V}/\text{m}$)
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)

5.6.3 TEST PROTOCOL

Ambient temperature: 24 °C
 Air Pressure: 1003 hPa
 Humidity: 45 %
 WLAN a-Mode; 20 MHz; 6 Mbit/s
 Applied duty cycle correction (AV): 0.4 dB

Antenna	U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
internal	1	36	5180	5150.0	71.4	PEAK	1000	74.0	2.6	BE-RB	FCC&IC
internal	1	36	5180	5150.0	47.4	AV	1000	54.0	6.6	BE-RB	FCC&IC
external	1	36	5180	5150.0	57.7	PEAK	1000	74.0	16.3	BE-RB	FCC&IC
external	1	36	5180	5150.0	44.6	AV	1000	54.0	9.4	BE-RB	FCC&IC

WLAN n-Mode; 20 MHz; MCS 0; SISO
 Applied duty cycle correction (AV): 0.5 dB

Antenna	U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
internal	1	36	5180	5150.0	69.9	PEAK	1000	74.0	4.1	BE-RB	FCC&IC
internal	1	36	5180	5150.0	46.9	AV	1000	54.0	7.1	BE-RB	FCC&IC
external	1	36	5180	5150.0	59.3	PEAK	1000	74.0	14.7	BE-RB	FCC&IC
external	1	36	5180	5150.0	44.7	AV	1000	54.0	9.3	BE-RB	FCC&IC

WLAN n-Mode; 40 MHz; MCS 0; SISO
 Applied duty cycle correction (AV): 0.9 dB

Antenna	U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
internal	1	38	5190	5150.0	69.7	PEAK	1000	74.0	4.3	BE-RB	FCC&IC
internal	1	38	5190	5150.0	48.0	AV	1000	54.0	6.0	BE-RB	FCC&IC
external	1	38	5190	5150.0	63.5	PEAK	1000	74.0	10.5	BE-RB	FCC&IC
external	1	38	5190	5150.0	45.6	AV	1000	54.0	8.4	BE-RB	FCC&IC

WLAN ac-Mode; 20 MHz; MCS 0; SISO
 Applied duty cycle correction (AV): 0.5 dB

Antenna	U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
internal	1	36	5180	5150.0	70.7	PEAK	1000	74.0	3.3	BE-RB	FCC&IC
internal	1	36	5180	5150.0	47.4	AV	1000	54.0	6.6	BE-RB	FCC&IC
external	1	36	5180	5150.0	57.1	PEAK	1000	74.0	16.9	BE-RB	FCC&IC
external	1	36	5180	5150.0	44.6	AV	1000	54.0	9.4	BE-RB	FCC&IC

WLAN ac-Mode; 40 MHz; MCS 0; SISO
 Applied duty cycle correction (AV): 0.9 dB

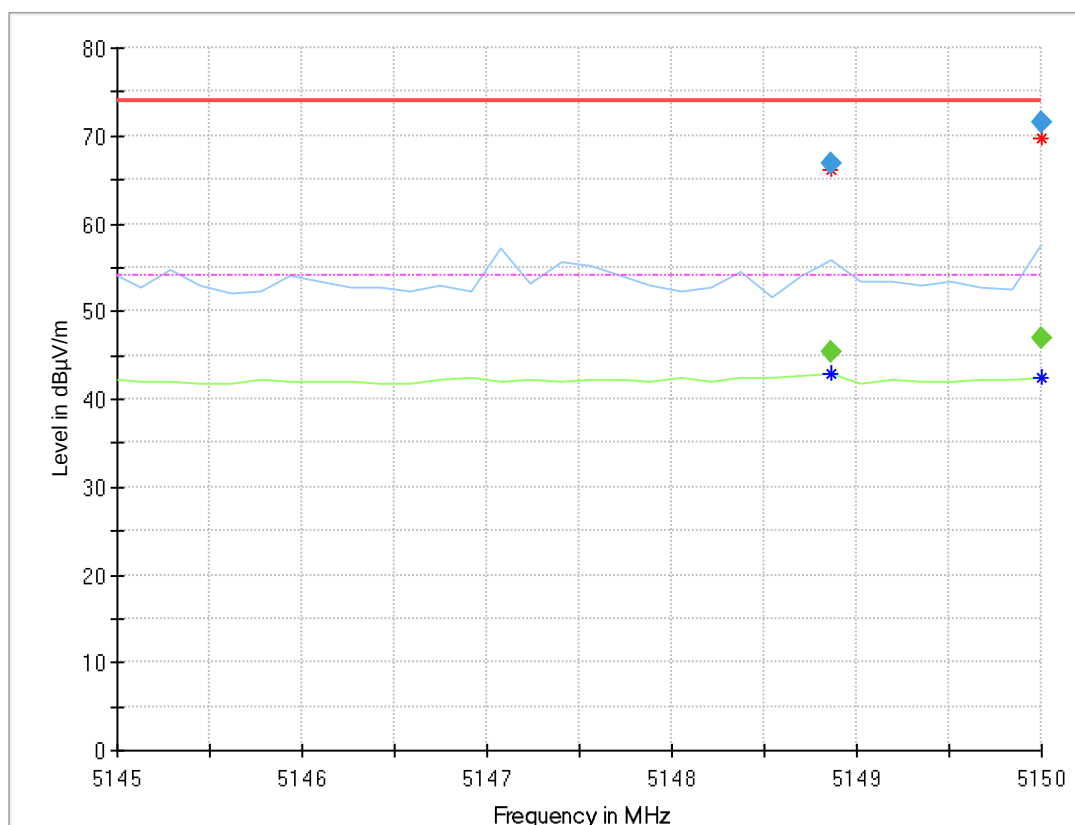
Antenna	U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type	FCC /IC?
internal	1	38	5190	5150.0	69.9	PEAK	1000	74.0	4.1	BE-RB	FCC&IC
internal	1	38	5190	5150.0	48.5	AV	1000	54.0	5.5	BE-RB	FCC&IC
external	1	38	5190	5150.0	64.0	PEAK	1000	74.0	10.0	BE-RB	FCC&IC
external	1	38	5190	5150.0	45.5	AV	1000	54.0	8.5	BE-RB	FCC&IC

Mode	U-NII-Subband	Ch. No.	Ch. Center Freq. [MHz]	Unwanted Emissions in Band 2A attenuated more than 26 dB below channel power?
WLAN a	1	48	5240	Yes
WLAN n 20 MHz	1	48	5240	Yes
WLAN n 40 MHz	1	46	5230	Yes
WLAN ac 20 MHz	1	48	5240	Yes
WLAN ac 40 MHz	1	46	5230	Yes

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

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

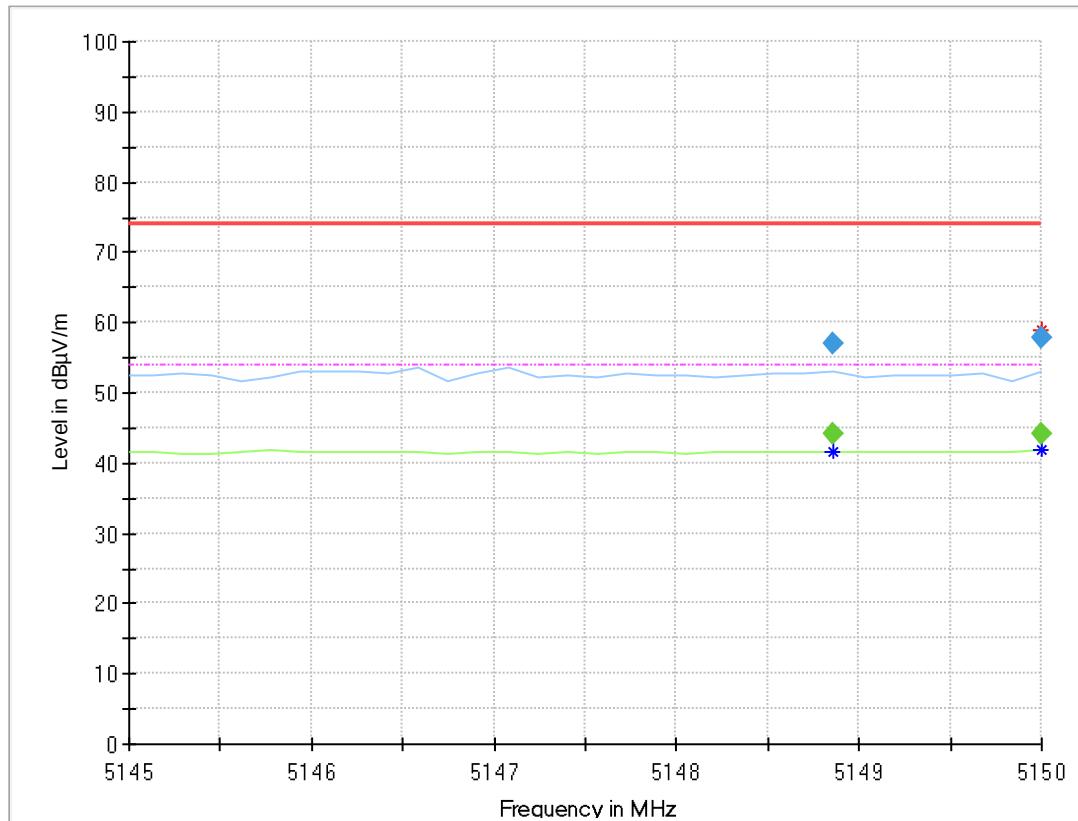
Modulation= WLAN a, Operating Channel = low, Band Edge = low
(S02_AD03, internal Antenna)



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)
5148.863	---	45.3	54.00	8.67	1000.0	1000.000	150.0	H	51.0	75.0	15.0
5148.863	66.8	---	74.00	7.18	1000.0	1000.000	150.0	H	51.0	75.0	15.0
5150.000	---	47.0	54.00	7.01	1000.0	1000.000	150.0	H	9.0	88.0	15.0
5150.000	71.4	---	74.00	2.58	1000.0	1000.000	150.0	H	9.0	88.0	15.0

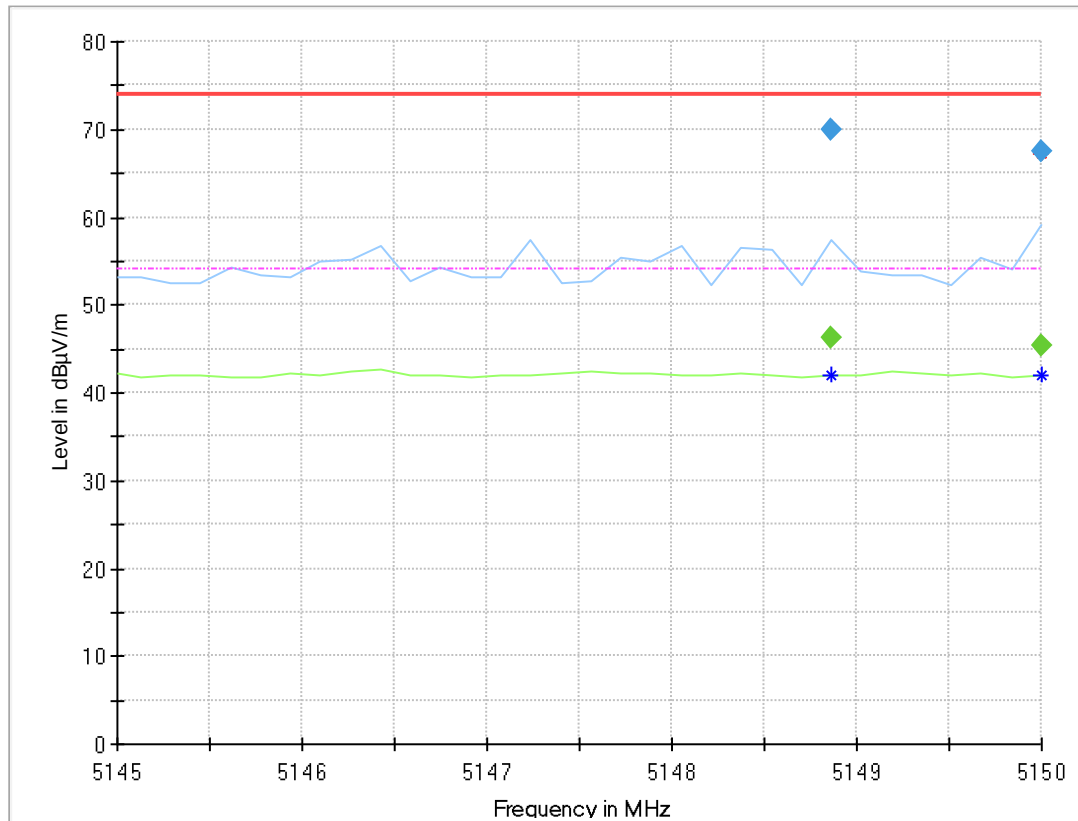
Modulation= WLAN a, Operating Channel = low, Band Edge = low
(S02_AD03, external Antenna)



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)
5148.863	---	44.1	54.00	9.88	1000.0	1000.000	150.0	H	146.0	105.0	15.0
5148.863	57.0	---	74.00	17.02	1000.0	1000.000	150.0	H	146.0	105.0	15.0
5150.000	---	44.2	54.00	9.78	1000.0	1000.000	150.0	V	-34.0	105.0	15.0
5150.000	57.7	---	74.00	16.25	1000.0	1000.000	150.0	V	-34.0	105.0	15.0

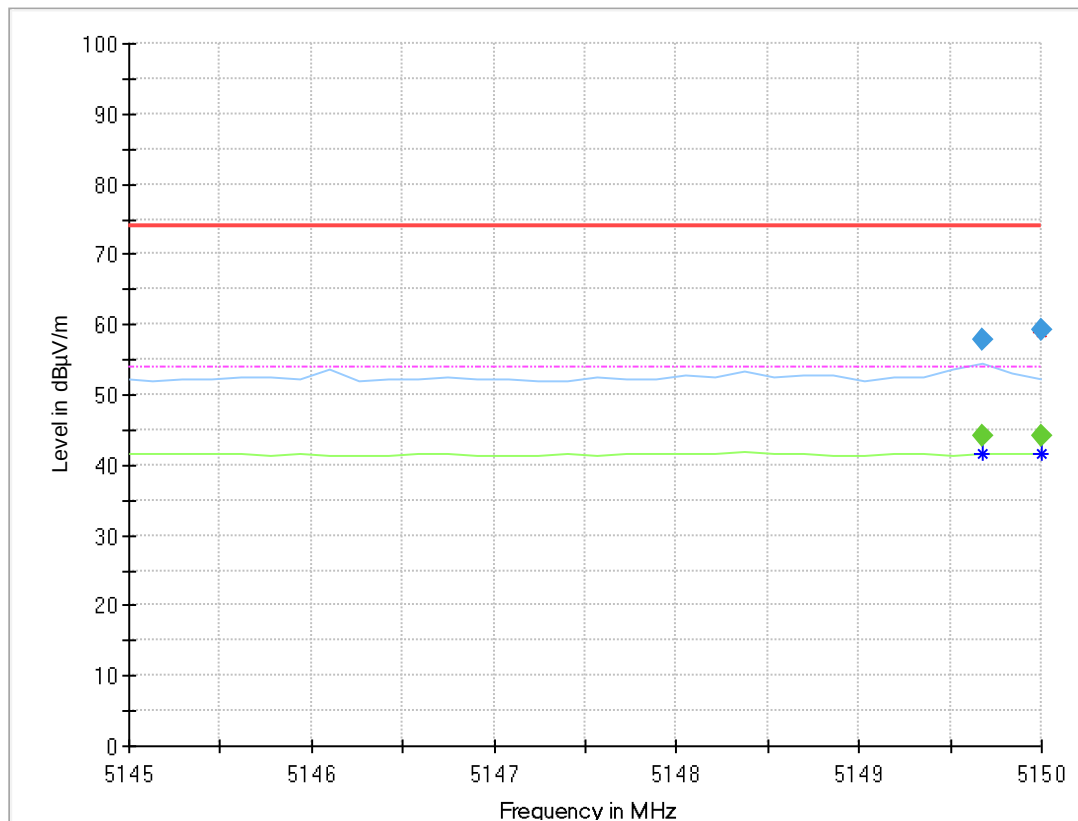
Modulation= WLAN n20, Operating Channel = low, Band Edge = low
(S02_AD03, internal Antenna)



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)
5148.863	---	46.4	54.00	7.65	1000.0	1000.000	150.0	H	9.0	86.0	15.0
5148.863	69.9	---	74.00	4.11	1000.0	1000.000	150.0	H	9.0	86.0	15.0
5150.000	---	45.4	54.00	8.59	1000.0	1000.000	150.0	H	45.0	75.0	15.0
5150.000	67.4	---	74.00	6.59	1000.0	1000.000	150.0	H	45.0	75.0	15.0

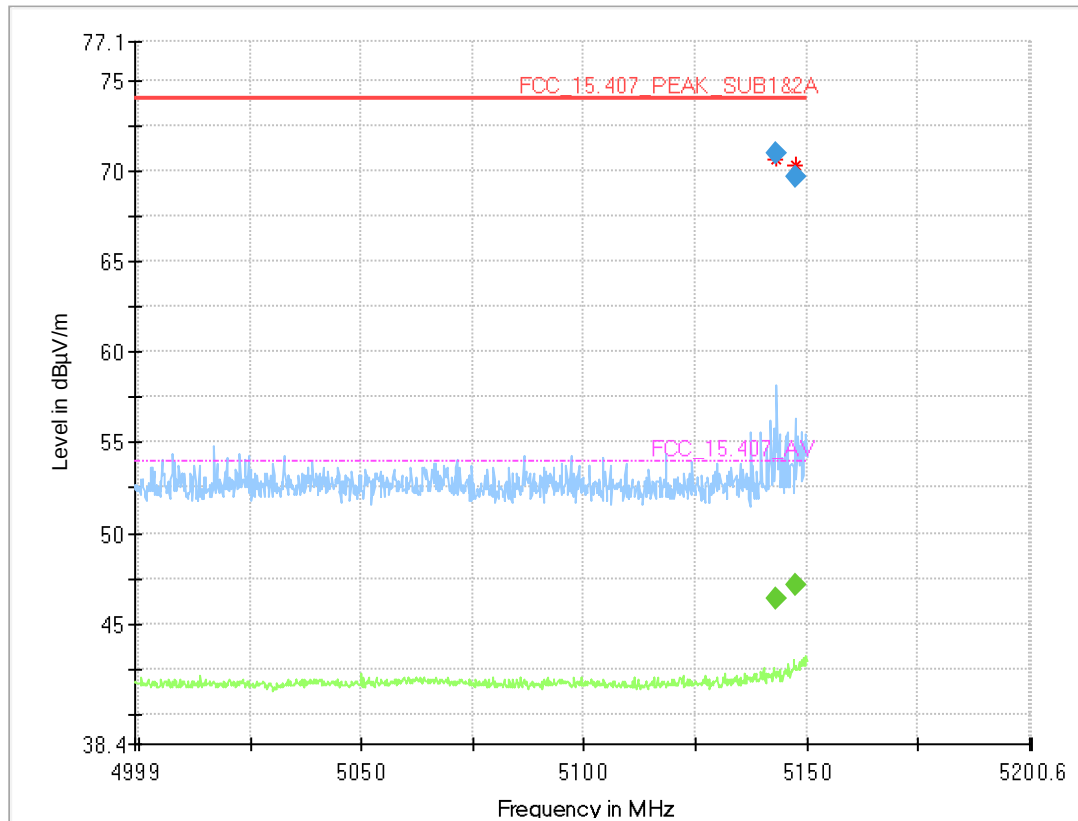
Modulation= WLAN n20, Operating Channel = low, Band Edge = low
(S02_AD03, external Antenna)



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)
5149.675	---	44.2	54.00	9.83	1000.0	1000.000	150.0	V	-79.0	15.0	15.0
5149.675	57.9	---	74.00	16.13	1000.0	1000.000	150.0	V	-79.0	15.0	15.0
5150.000	---	44.2	54.00	9.80	1000.0	1000.000	150.0	H	146.0	-10.0	15.0
5150.000	59.3	---	74.00	14.67	1000.0	1000.000	150.0	H	146.0	-10.0	15.0

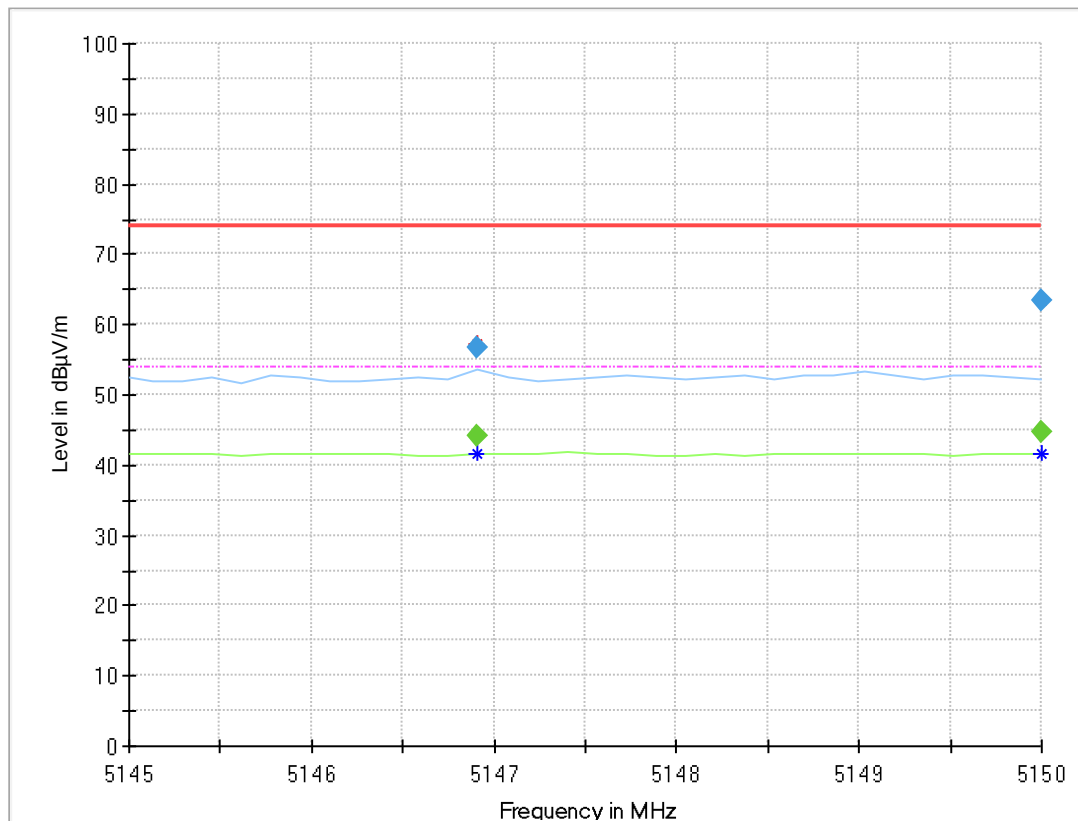
Modulation= WLAN n40, Operating Channel = low, Band Edge = low
(S02_AD03, internal Antenna)



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)
5143.338	---	46.4	54.00	7.59	1000.0	1000.000	150.0	H	11.0	92.0	15.1
5143.338	71.0	---	74.00	3.02	1000.0	1000.000	150.0	H	11.0	92.0	15.1
5147.400	---	47.1	54.00	6.87	1000.0	1000.000	150.0	H	11.0	96.0	15.1
5147.400	69.7	---	74.00	4.33	1000.0	1000.000	150.0	H	11.0	96.0	15.1

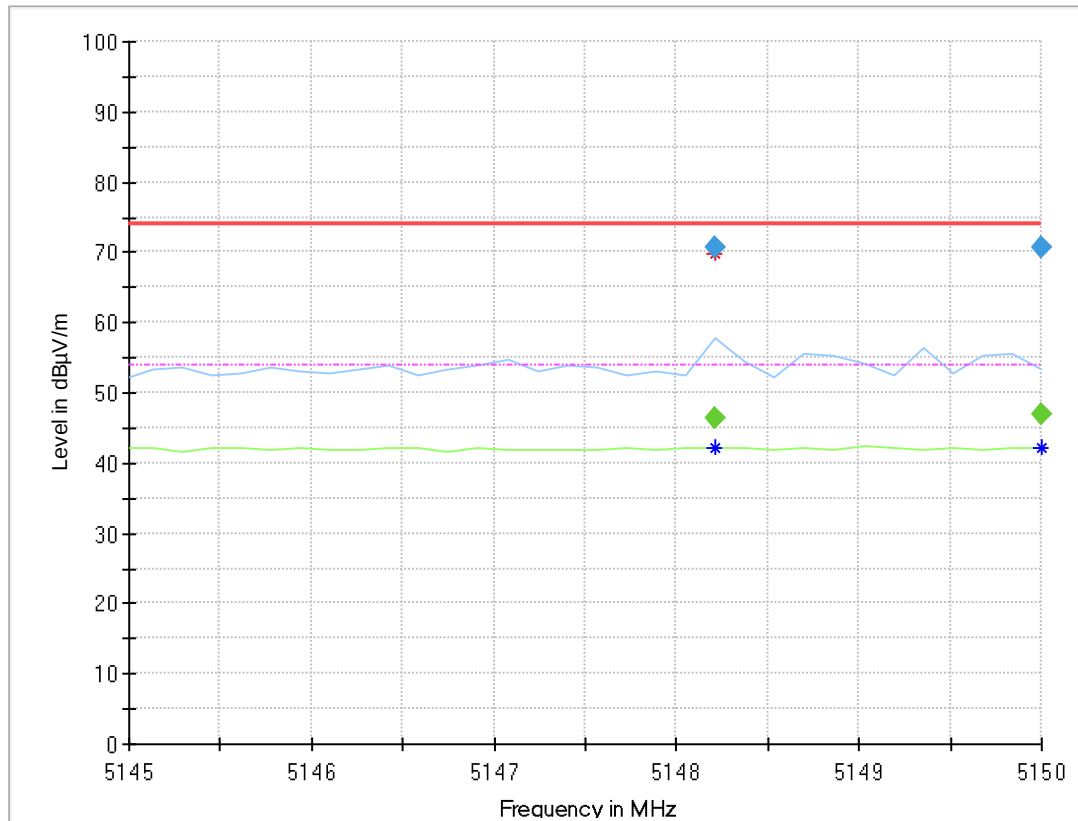
Modulation= WLAN n40, Operating Channel = low, Band Edge = low
(S02_AD03, external Antenna)



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)
5146.913	56.8	---	74.00	17.20	1000.0	1000.000	150.0	H	95.0	-2.0	15.1
5146.913	---	44.1	54.00	9.93	1000.0	1000.000	150.0	H	95.0	-2.0	15.1
5150.000	63.5	---	74.00	10.46	1000.0	1000.000	150.0	H	11.0	15.0	15.0
5150.000	---	44.7	54.00	9.34	1000.0	1000.000	150.0	H	11.0	15.0	15.0

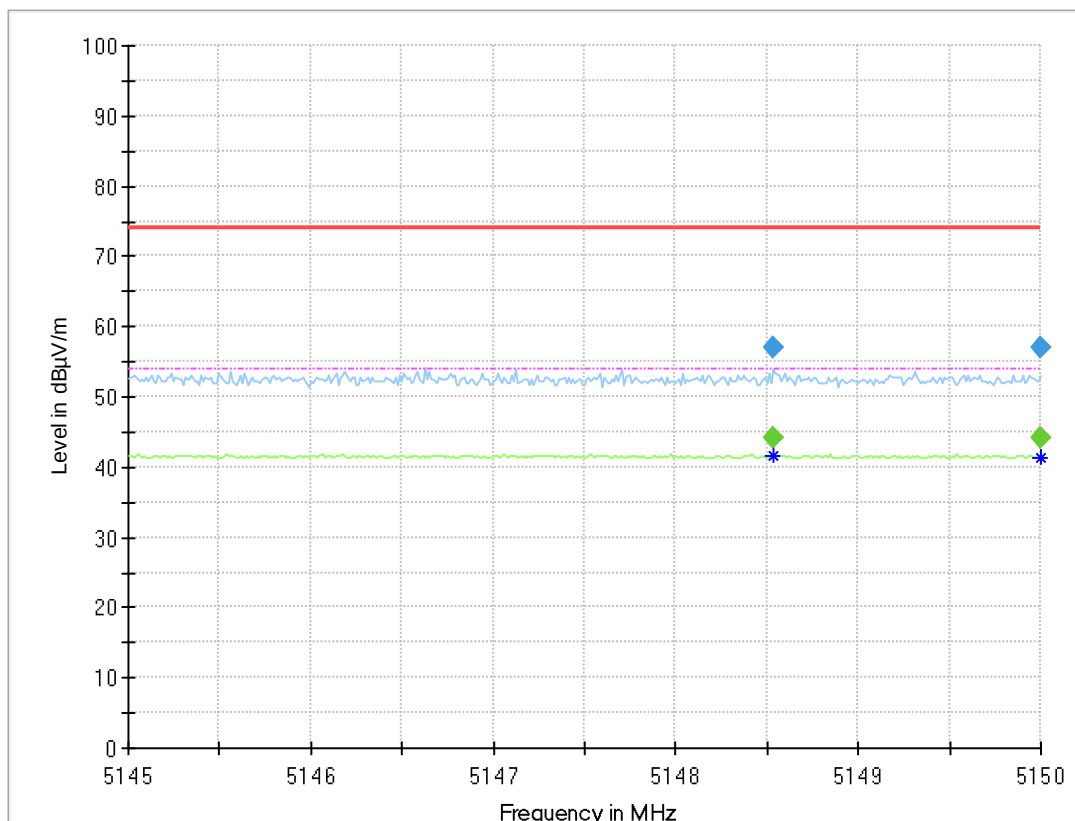
Modulation= WLAN ac20, Operating Channel = low, Band Edge = low
(S02_AD03, internal Antenna)



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)
5148.213	---	46.5	54.00	7.51	1000.0	1000.000	150.0	H	11.0	104.0	15.0
5148.213	70.7	---	74.00	3.28	1000.0	1000.000	150.0	H	11.0	104.0	15.0
5150.000	---	46.9	54.00	7.09	1000.0	1000.000	150.0	H	11.0	89.0	15.0
5150.000	70.7	---	74.00	3.31	1000.0	1000.000	150.0	H	11.0	89.0	15.0

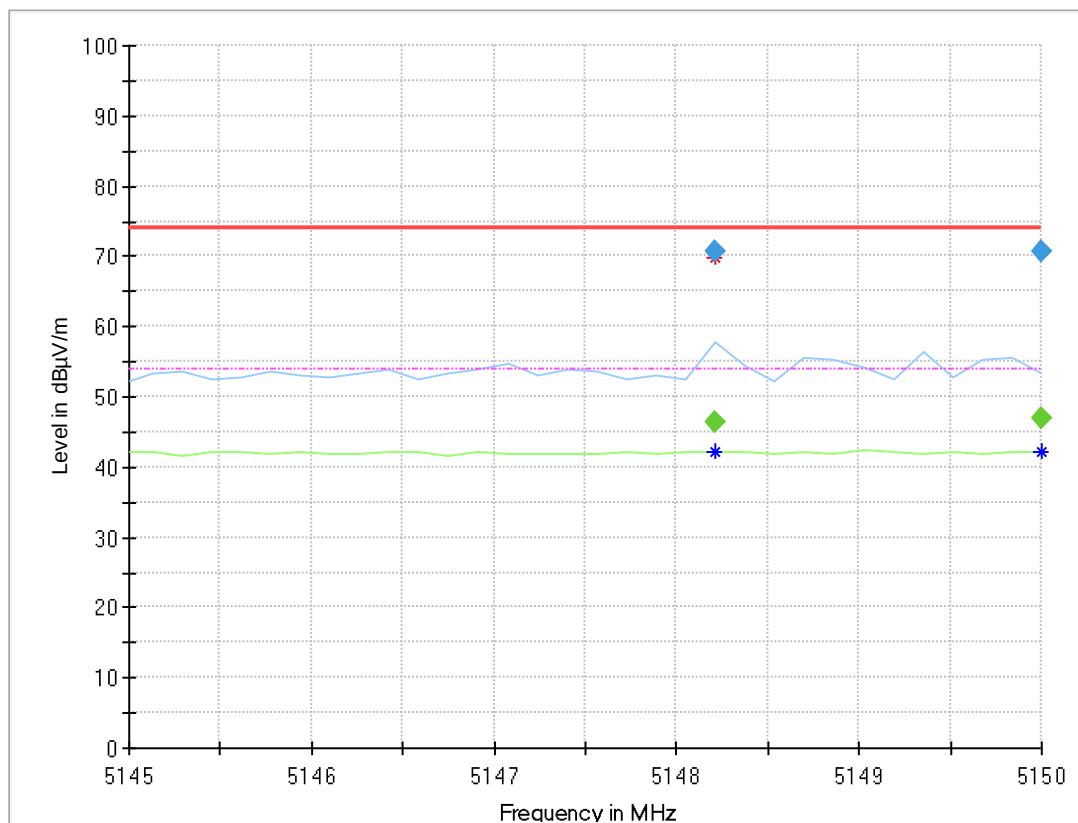
Modulation= WLAN ac20, Operating Channel = low, Band Edge = low
(S02_AD03, external Antenna)



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)
5148.538	57.1	---	74.00	16.90	1000.0	1000.000	150.0	V	-36.0	102.0	15.0
5148.538	---	44.1	54.00	9.94	1000.0	1000.000	150.0	V	-36.0	102.0	15.0
5150.000	57.0	---	74.00	16.99	1000.0	1000.000	150.0	V	-34.0	15.0	15.0
5150.000	---	44.0	54.00	9.96	1000.0	1000.000	150.0	V	-34.0	15.0	15.0

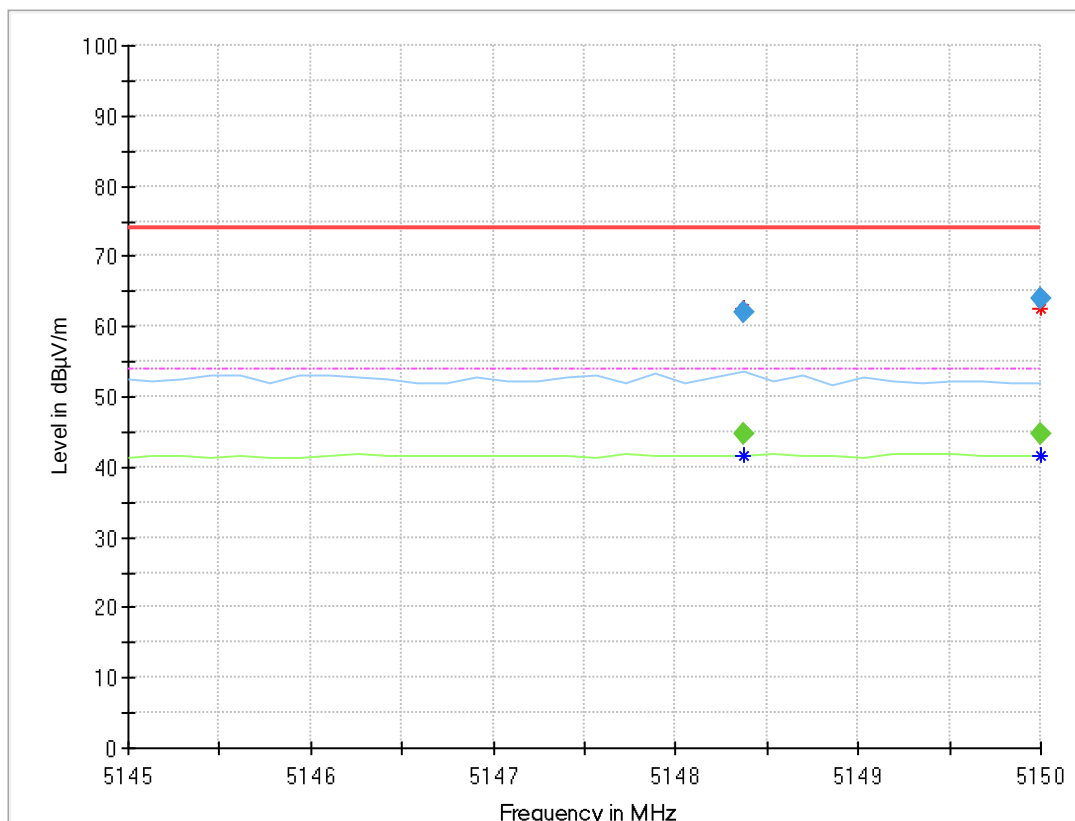
Modulation= WLAN ac40, Operating Channel = low, Band Edge = low
(S02_AD03, internal Antenna)



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)
5148.213	---	46.5	54.00	7.51	1000.0	1000.000	150.0	H	11.0	104.0	15.0
5148.213	70.7	---	74.00	3.28	1000.0	1000.000	150.0	H	11.0	104.0	15.0
5150.000	---	46.9	54.00	7.09	1000.0	1000.000	150.0	H	11.0	89.0	15.0
5150.000	70.7	---	74.00	3.31	1000.0	1000.000	150.0	H	11.0	89.0	15.0

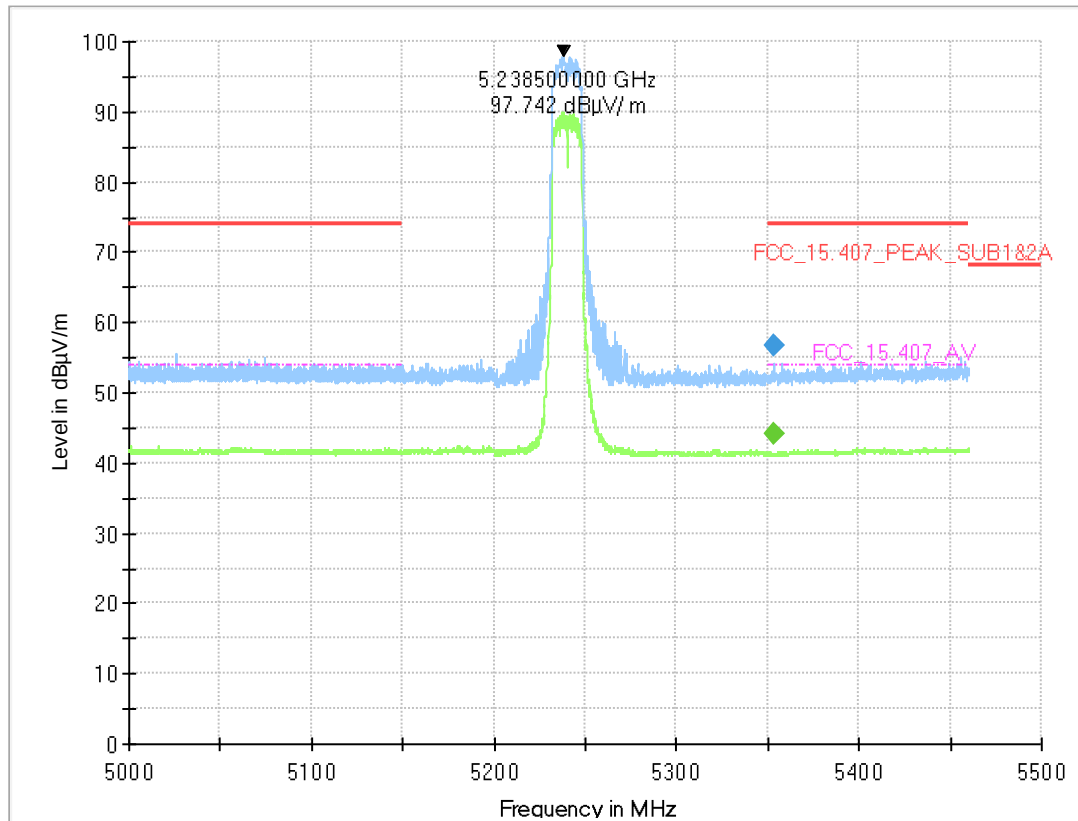
Modulation= WLAN ac40, Operating Channel = low, Band Edge = low
(S02_AD03, external Antenna)



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)
5148.375	62.0	---	74.00	12.03	1000.0	1000.000	150.0	H	8.0	105.0	15.0
5148.375	---	44.7	54.00	9.30	1000.0	1000.000	150.0	H	8.0	105.0	15.0
5150.000	64.0	---	74.00	9.99	1000.0	1000.000	150.0	H	2.0	15.0	15.0
5150.000	---	44.6	54.00	9.38	1000.0	1000.000	150.0	H	2.0	15.0	15.0

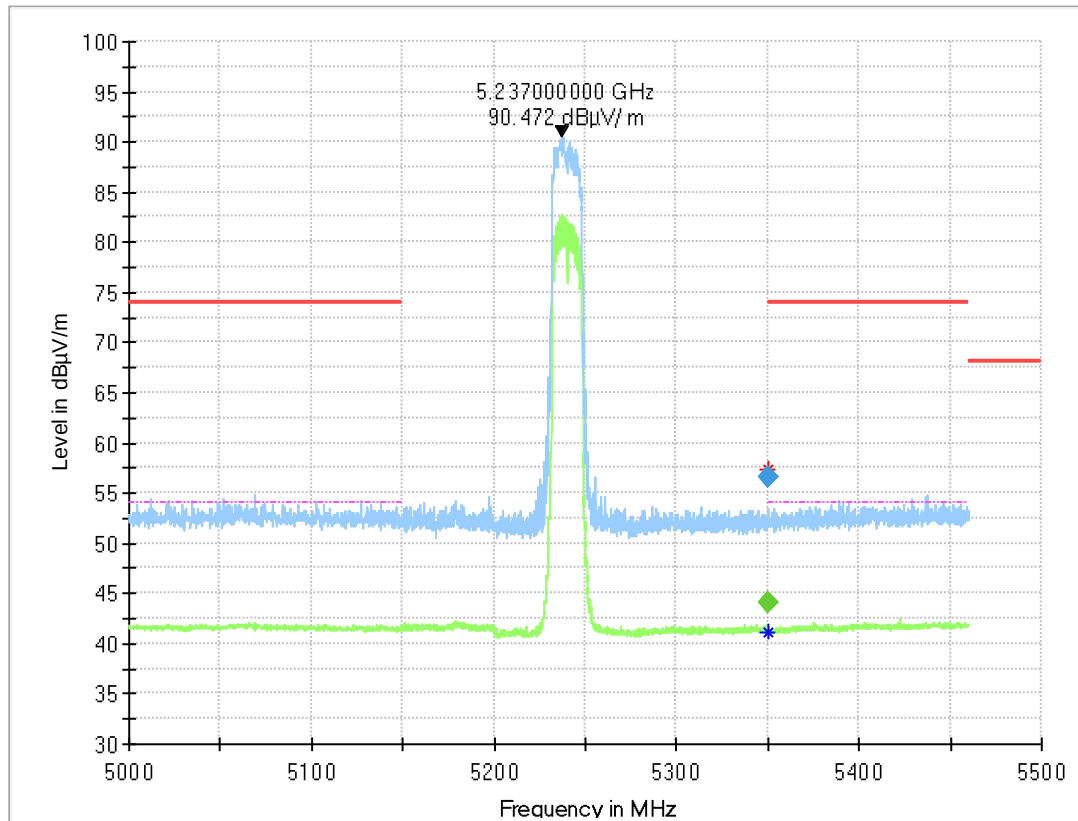
Modulation= WLAN a, Operating Channel = high, Band Edge = high
(S02_AD03, internal Antenna)



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)
5353.630	---	44.1	54.00	9.86	1000.0	1000.000	150.0	V	86.0	86.0	15.3
5353.630	56.8	---	74.00	17.18	1000.0	1000.000	150.0	V	86.0	86.0	15.3

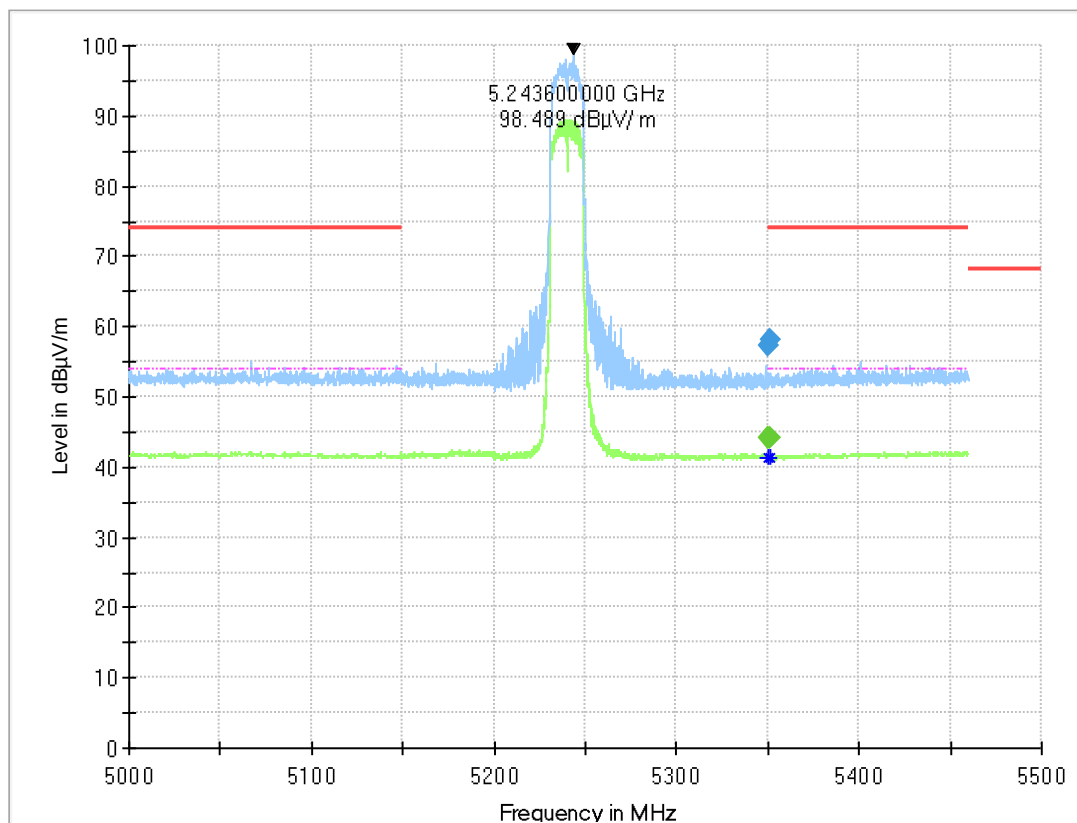
Modulation= WLAN a, Operating Channel = high, Band Edge = high
(S02_AD03, external Antenna)



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)
5350.550	---	44.1	54.00	9.87	1000.0	1000.000	150.0	H	-91.0	86.0	15.3
5350.550	56.6	---	74.00	17.38	1000.0	1000.000	150.0	H	-91.0	86.0	15.3

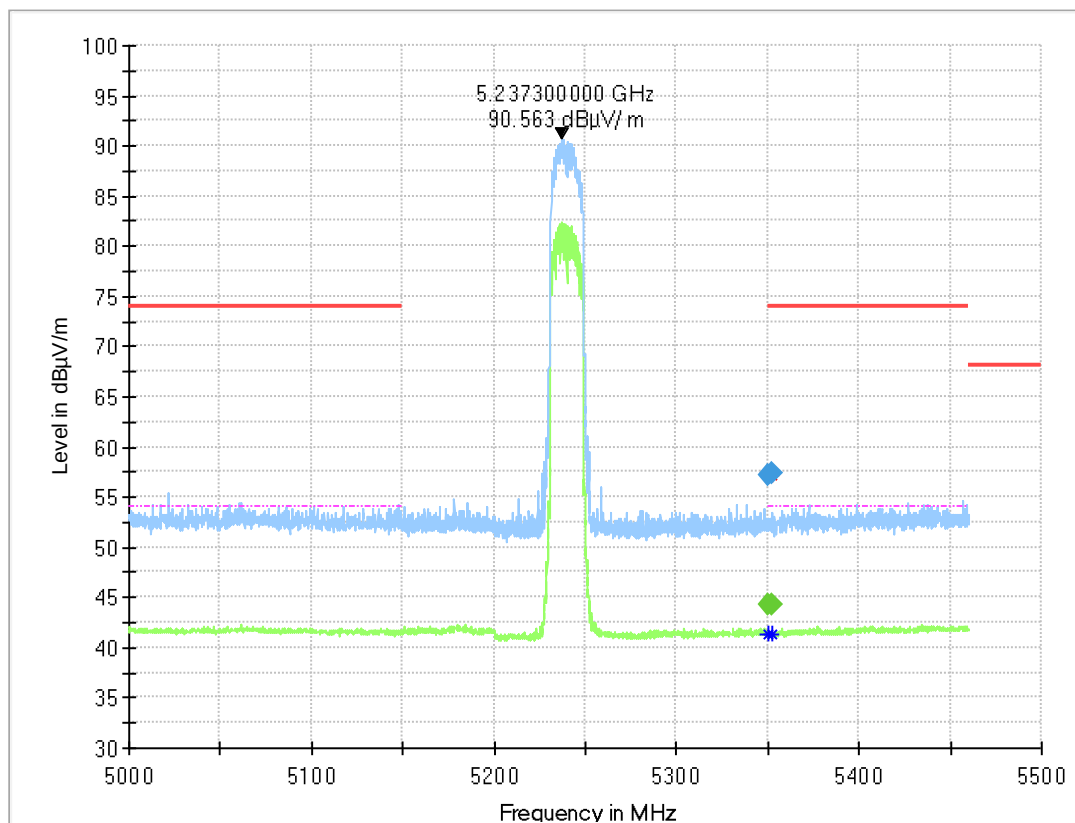
Modulation= WLAN n20, Operating Channel = high, Band Edge = high
(S02_AD03, internal Antenna)



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)
5350.000	---	44.2	54.00	9.81	1000.0	1000.000	150.0	V	-55.0	-8.0	15.3
5350.000	57.3	---	74.00	16.67	1000.0	1000.000	150.0	V	-55.0	-8.0	15.3
5351.650	---	44.2	54.00	9.79	1000.0	1000.000	150.0	H	48.0	15.0	15.3
5351.650	58.1	---	74.00	15.90	1000.0	1000.000	150.0	H	48.0	15.0	15.3

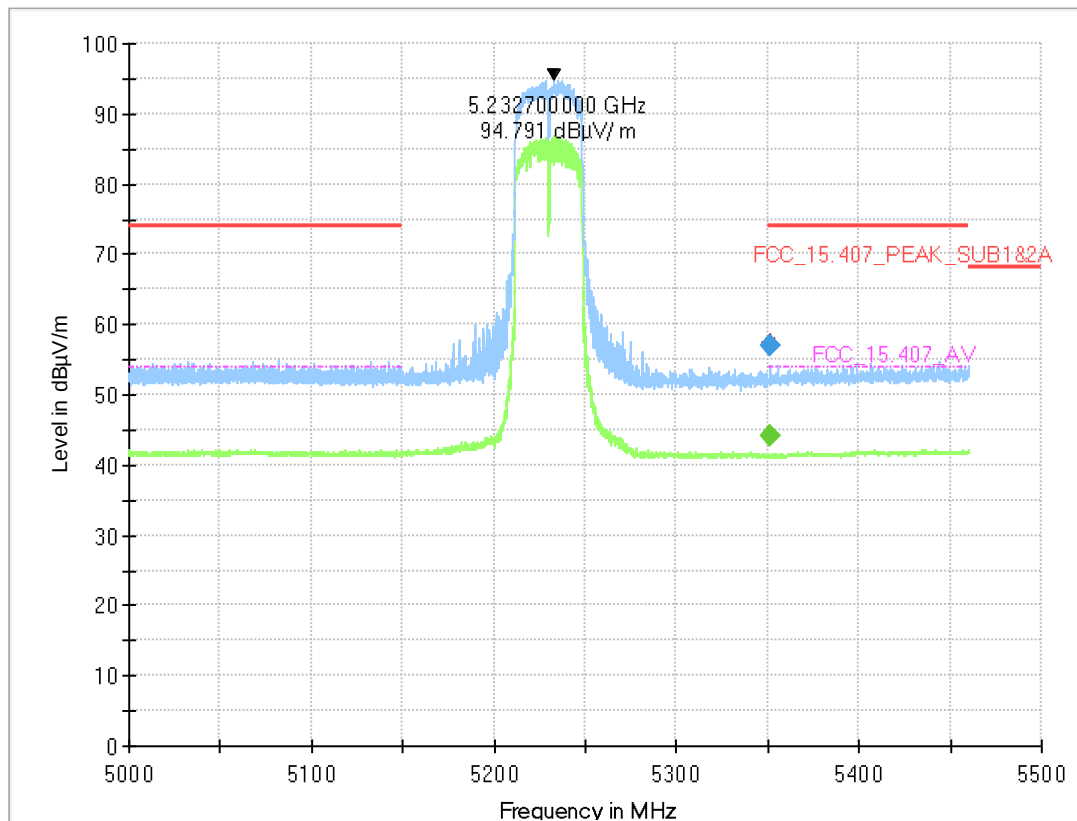
Modulation= WLAN n20, Operating Channel = high, Band Edge = high
(S02_AD03, external Antenna)



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)
5350.000	57.2	---	74.00	16.78	1000.0	1000.000	150.0	H	-173.0	92.0	15.3
5350.000	---	44.2	54.00	9.79	1000.0	1000.000	150.0	H	-173.0	92.0	15.3
5351.980	57.3	---	74.00	16.67	1000.0	1000.000	150.0	H	-81.0	-7.0	15.3
5351.980	---	44.2	54.00	9.77	1000.0	1000.000	150.0	H	-81.0	-7.0	15.3

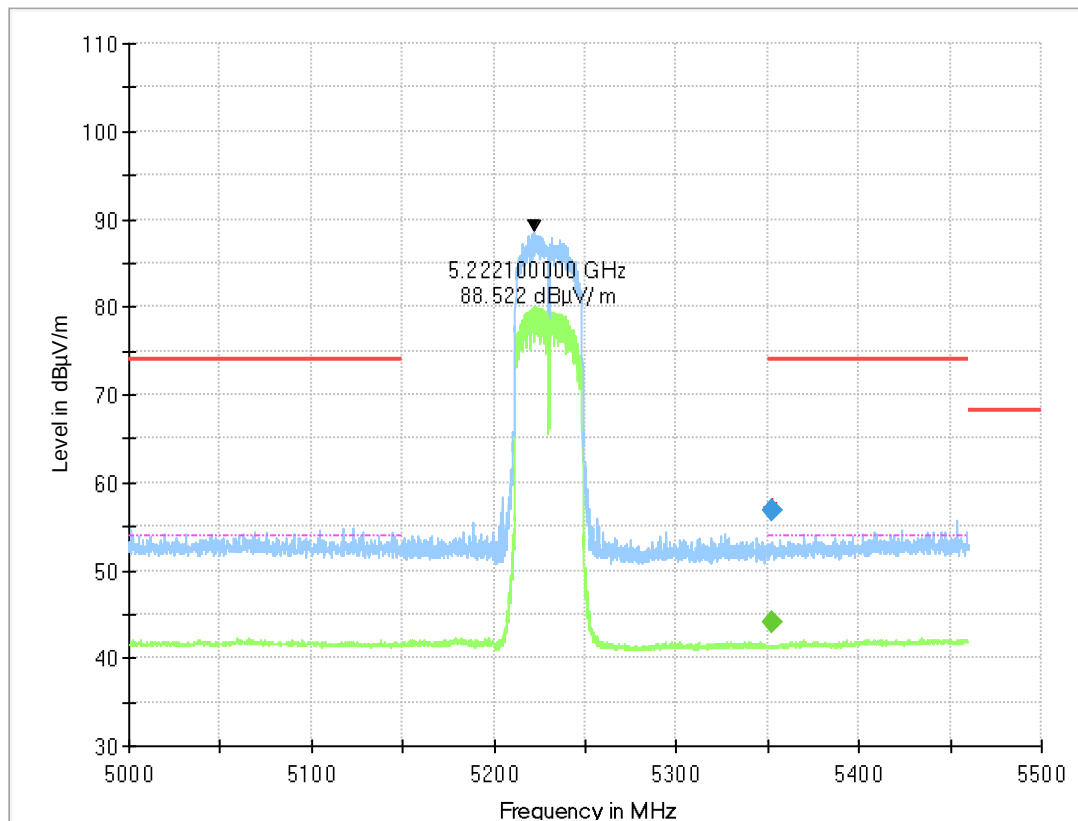
Modulation= WLAN n40, Operating Channel = high, Band Edge = high
(S02_AD03, internal Antenna)



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)
5350.990	---	44.1	54.00	9.88	1000.0	1000.000	150.0	H	93.0	6.0	15.3
5350.990	57.0	---	74.00	16.98	1000.0	1000.000	150.0	H	93.0	6.0	15.3

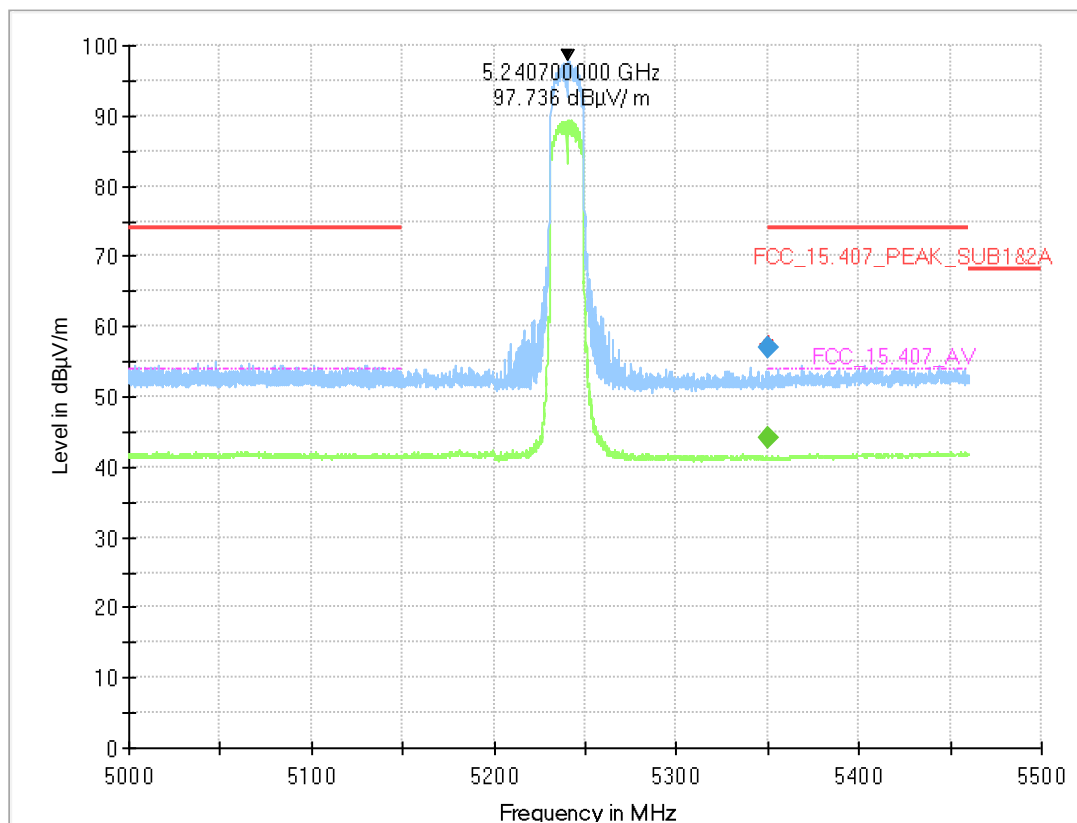
Modulation= WLAN n40, Operating Channel = high, Band Edge = high
(S02_AD03, external Antenna)



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)
5351.980	---	44.1	54.00	9.93	1000.0	1000.000	150.0	H	5.0	89.0	15.3
5351.980	56.8	---	74.00	17.20	1000.0	1000.000	150.0	H	5.0	89.0	15.3

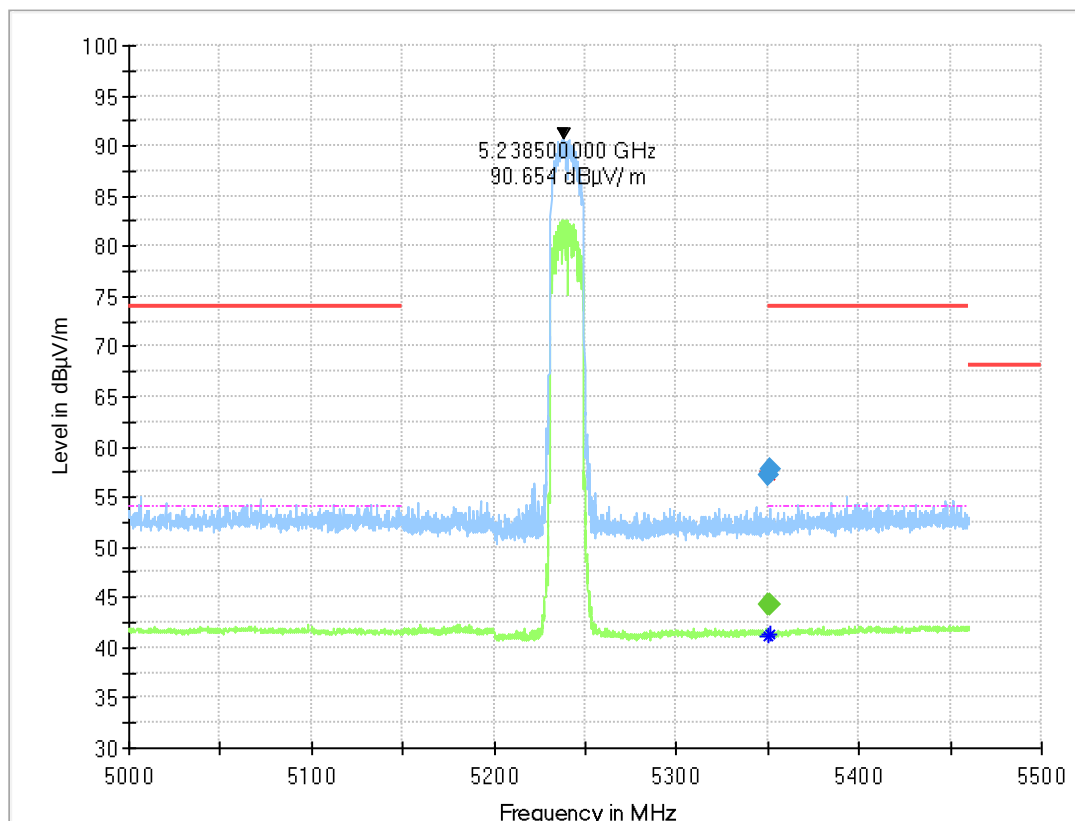
Modulation= WLAN ac20, Operating Channel = high, Band Edge = high
(S02_AD03, internal Antenna)



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)
5350.660	---	44.1	54.00	9.90	1000.0	1000.000	150.0	V	-169.0	105.0	15.3
5350.660	57.0	---	74.00	17.02	1000.0	1000.000	150.0	V	-169.0	105.0	15.3

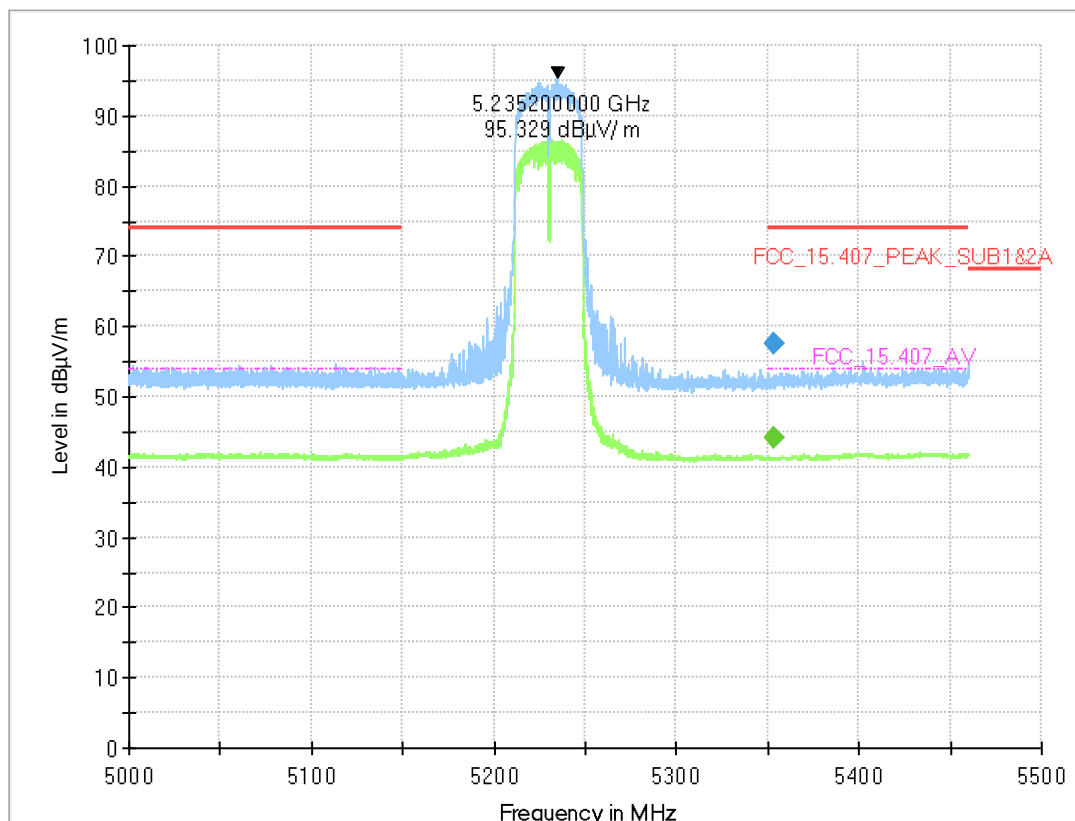
Modulation= WLAN ac20, Operating Channel = high, Band Edge = high
(S02_AD03, external Antenna)



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)
5350.000	---	44.2	54.00	9.80	1000.0	1000.000	150.0	V	-183.0	15.0	15.3
5350.000	57.2	---	74.00	16.82	1000.0	1000.000	150.0	V	-183.0	15.0	15.3
5350.880	---	44.2	54.00	9.79	1000.0	1000.000	150.0	V	-171.0	105.0	15.3
5350.880	57.8	---	74.00	16.23	1000.0	1000.000	150.0	V	-171.0	105.0	15.3

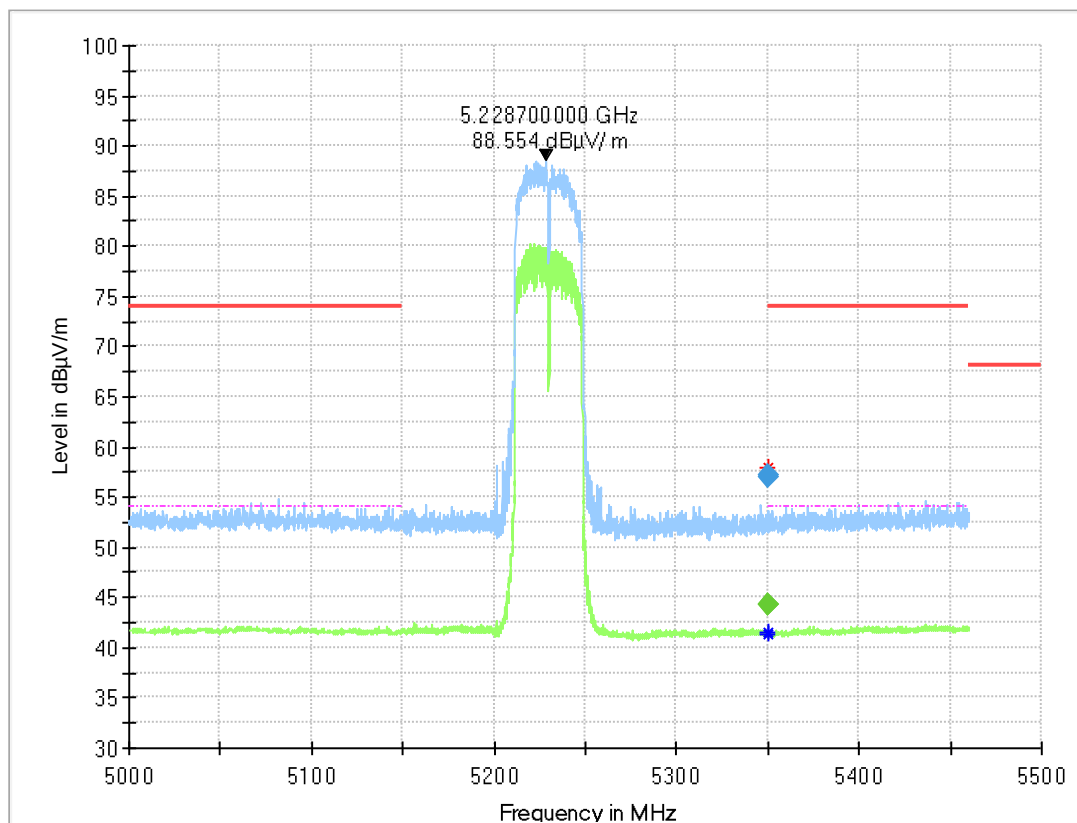
Modulation= WLAN ac40, Operating Channel = high, Band Edge = high
(S02_AD03, internal Antenna)



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)
5353.410	---	44.1	54.00	9.90	1000.0	1000.000	150.0	H	54.0	4.0	15.3
5353.410	57.5	---	74.00	16.47	1000.0	1000.000	150.0	H	54.0	4.0	15.3

Modulation= WLAN ac40, Operating Channel = high, Band Edge = high
(S02_AD03, external Antenna)



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)
5350.000	---	44.2	54.00	9.78	1000.0	1000.000	150.0	H	7.0	0.0	15.3
5350.000	57.1	---	74.00	16.88	1000.0	1000.000	150.0	H	7.0	0.0	15.3
5350.330	---	44.2	54.00	9.79	1000.0	1000.000	150.0	H	132.0	12.0	15.3
5350.330	57.0	---	74.00	16.98	1000.0	1000.000	150.0	H	132.0	12.0	15.3

5.6.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 5 GHz FCC

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	2022-06	2024-06
1.4	FSV30	Signal Analyzer 10 Hz - 30 GHz	Rohde & Schwarz	103005	2023-08	2025-08
1.5	FSW43	Signal Analyser	Rohde & Schwarz GmbH & Co. KG	102013	2023-07	2025-07
1.6	Opus10 THI (8152.00)	T/H Logger 14	Lufft Mess- und Regeltechnik GmbH	13993	2023-12	2025-12
1.7	HMP2020	Programmable Power Supply	Rohde & Schwarz GmbH & Co. KG	101992	N/A	N/A
1.8	SMBV100A	Vector Signal Generator 9 kHz - 6 GHz	Rohde & Schwarz	259291	2023-01	2026-01
1.9	OSP120	Contains Power Meter and Switching Unit OSP-B157W8 PLUS	Rohde & Schwarz	101158	2021-08	2024-08
1.10	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2024-10

- 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
2.5	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
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	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	N/A	N/A
2.9	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A	N/A
2.10	MA3000/0800-XP-ET-compact	Bore Sight Antenna Mast	innco systems GmbH	9210522	N/A	N/A
2.11	TT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
2.12	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronik GmbH	00086675	N/A	N/A
2.13	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	2023-08	2025-08
2.14	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
2.15	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324	N/A	N/A
2.16	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2021-09	2024-09

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
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

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
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	2024-10

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	Lufth 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	2021-09	2024-09
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	Lufth 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	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2024-10
4.11	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/11920513	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 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

Frequency MHz	AF HFH-Z2) 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. (-40 dB/ decade) dB	d _{Limit} (meas. distance (limit) m	d _{used} (meas. distance (used) 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

7.2 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

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

U = Receiver reading

AF = Antenna factor

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

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.

7.3 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.

7.4 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.

7.5 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 = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

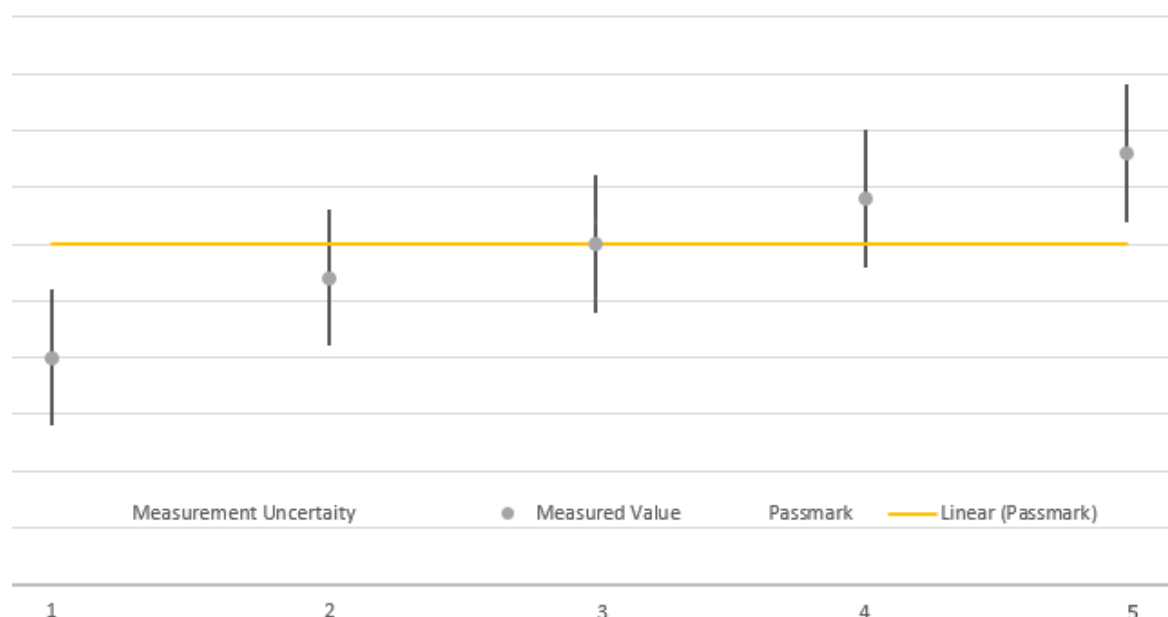
Linear interpolation will be used for frequencies in between the values in the table.

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*****