FCC Measurement/Technical Report on

WLAN and Bluetooth Module MAYA-W166

FCC ID: XPYMAYAW166
IC: 8595A-MAYAW166

Test Report Reference: MDE_UBLOX_2110_FCC_04

Test Laboratory:
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle
D-PL-12140-01-01
D-PL-12140-01-02
D-PL-12140-01-03

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 (10-1-20 Edition) and 15 (10-1-20 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 Public Notice "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".

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: 8.8
Occupied bandwidth	§ 15.403 (26 dB) / § 15.407 (e) (6 dB)	RSS-247 Issue 2: 6.2.1.1, 6.2.2.1, 6.2.3.1 (99%) RSS-247 Issue 2: 6.2.4.1 (6 dB)
Maximum conducted output power	§ 15.407 (a) (1) to (8), (11)	RSS-247 Issue 2: 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.1
Maximum power spectral density	§ 15.407 (a) (1) to (8), (12)	RSS-247 Issue 2: 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.1
Transmitter undesirable emissions; General Field Strength Limits, Restricted Bands	§ 15.407 (b) § 15.209 (a)	RSS-Gen Issue 5: 6.13/8.9/8.10; RSS-247 Issue 2: 3.3/6.2 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.2
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 2: 6.2.2.1, 6.2.3.1, 6.3
Antenna requirement	§ 15.203 / 15.204 § 15.407 (a) (9)	RSS-Gen Issue 5: 8.3
Receiver spurious emissions	–	-

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 15 Subpart E §15.407 — **FCC §15.207**

AC Conducted Emissions

The measurement was performed according to ANSI C63.10 6.2 — **Final Result**

OP-Mode	Setup	Date	FCC	IC
Operating mode				
worst case	S03_166_AE01	2022-07-29	Passed	Passed

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 12.4.1 — **Final Result**

OP-Mode	Setup	Date	FCC	IC
Radio Technology, Operating Frequency, Subband				
WLAN a, high, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, high, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, high, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, high, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, low, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, low, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, low, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, low, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, mid, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, mid, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, mid, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN a, mid, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, high, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, high, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, high, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, high, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, low, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, low, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, low, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, low, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, mid, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, mid, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, mid, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 20 MHz, mid, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, high, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, high, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, high, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, high, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, low, U-NII-1	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, low, U-NII-2A	S01_166_AB01	2022-07-05	Passed	Passed

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 12.4.1			**Final Result**	
OP-Mode Radio Technology, Operating Frequency, Subband	**Setup**	**Date**	**FCC**	**IC**
WLAN n 40 MHz, low, U-NII-2C	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, low, U-NII-3	S01_166_AB01	2022-07-05	Passed	Passed
WLAN n 40 MHz, mid, U-NII-2C	S01_166_AB01	2022-07-05	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 6.4, 6.5, 6.6.5			**Final Result**	
OP-Mode Radio Technology, Operating Frequency, Measurement range, Subband	**Setup**	**Date**	**FCC**	**IC**
WLAN a, high, 1GHz - 26GHz, U-NII-1	S02_166_AE01	2022-06-20	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-2A	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-2C	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-3	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, high, 1GHz - 26GHz, U-NII-3	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, high, 9kHz - 30MHz, U-NII-2C	S02_166_AE01	2022-06-23	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-1	S02_166_AD01	2022-06-20	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-2A	S02_166_AE01	2022-06-20	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-2C	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, low, 1GHz - 26GHz, U-NII-3	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, low, 9kHz - 30MHz, U-NII-1	S02_166_AE01	2022-06-23	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-1	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-1	S02_166_AB01	2022-07-21	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-1	S02_166_AE01	2022-06-20	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-2A	S02_166_AE01	2022-06-20	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-2C	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, mid, 1GHz - 26GHz, U-NII-3	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-1	S02_166_AE01	2022-06-24	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-2A	S02_166_AE01	2022-06-24	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-2C	S02_166_AE01	2022-06-24	Passed	Passed
WLAN a, mid, 26GHz - 40GHz, U-NII-3	S02_166_AE01	2022-06-24	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-1	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-1	S02_166_AB01	2022-07-25	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-1	S02_166_AE01	2022-06-23	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-2A	S02_166_AE01	2022-06-23	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-2C	S02_166_AE01	2022-06-23	Passed	Passed
WLAN a, mid, 30MHz - 1GHz, U-NII-3	S02_166_AE01	2022-06-23	Passed	Passed
WLAN a, mid, 9kHz - 30MHz, U-NII-1	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, mid, 9kHz - 30MHz, U-NII-1	S02_166_AB01	2022-07-21	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 6.4, 6.5, 6.6.5 **Final Result**

OP-Mode Radio Technology, Operating Frequency, Measurement range, Subband	Setup	Date	FCC	IC
WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-2A Remark: Measurement Range: 1-18 GHz	S02_166_AE01	2022-06-22	Passed	Passed
WLAN n 20 MHz, high, 1GHz - 26GHz, U-NII-3 Remark: Measurement Range: 1-18 GHz	S02_166_AE01	2022-06-22	Passed	Passed
WLAN n 20 MHz, low, 1GHz - 26GHz, U-NII-2C Remark: Measurement Range: 1-18 GHz	S02_166_AE01	2022-06-22	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 6.6.5 **Final Result**

OP-Mode Radio Technology, Operating Frequency, Subband	Setup	Date	FCC	IC
WLAN a, high, U-NII-2A	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, high, U-NII-2A	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, high, U-NII-2C	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, high, U-NII-2C	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, high, U-NII-3	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, high, U-NII-3	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, low, U-NII-1	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, low, U-NII-1	S02_166_AD01	2022-06-20	Passed	Passed
WLAN a, low, U-NII-2C	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, low, U-NII-2C	S02_166_AE01	2022-06-21	Passed	Passed
WLAN a, low, U-NII-3	S01_166_AB01	2022-07-29	Passed	Passed
WLAN a, low, U-NII-3	S02_166_AE01	2022-06-21	Passed	Passed
WLAN n 20 MHz, high, U-NII-2A	S02_166_AE01	2022-06-21	Passed	Passed
WLAN n 20 MHz, high, U-NII-2C	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 20 MHz, high, U-NII-3	S02_166_AE01	2022-06-21	Passed	Passed
WLAN n 20 MHz, low, U-NII-1	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 20 MHz, low, U-NII-2C	S02_166_AF01	2022-06-25	Passed	Passed
WLAN n 20 MHz, low, U-NII-3	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 40 MHz, high, U-NII-2A	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 40 MHz, high, U-NII-2C	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 40 MHz, high, U-NII-3	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 40 MHz, low, U-NII-1	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 40 MHz, low, U-NII-2C	S02_166_AE01	2022-06-24	Passed	Passed
WLAN n 40 MHz, low, U-NII-3	S02_166_AE01	2022-06-24	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	2022-08-08	--	valid
--	--	--	--

COMMENT: Another variant of the EUT has already been tested that according to the applicant is identical in the 5 GHz transceiver part. Due to this only spot checks and measurements with integral antenna have been performed. Test Report Reference: MDE_UBLOX_2110_FCC_02

(responsible for accreditation scope)
Dipl.-Ing. Daniel Gall

(responsible for testing and report)
B.Sc. Jens Dörwald

7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
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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-12140-01-01| -02 | -03
FCC Designation Number:	DE0015
FCC Test Firm Registration:	929146
ISED CAB Identifier	DE0007; ISED#: 3699A
Responsible for accreditation scope:	Dipl.-Ing. Daniel Gall
Report Template Version:	2021-09-09

3.2 PROJECT DATA

Responsible for testing and report:	B.Sc. Jens Dörwald
Employees who performed the tests:	documented internally at 7Layers
Date of Report:	2022-08-08
Testing Period:	2022-06-20 to 2022-07-29

3.3 APPLICANT DATA

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

3.4 MANUFACTURER DATA

Company Name:	please see Applicant Data
Address:	
Contact Person:	

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Host-based module with WLAN and Bluetooth technology
Product name	MAYA-W166
Type	MAYA-W166-00B-00 MAYA-W166-01B-00
Declared EUT data by the supplier	
Voltage Type	DC
Voltage Level	1.8 V + 3.3 V
Tested Modulation Type	OFDM
Specific product description	The EUT is a Bluetooth and WLAN module. In the 5 GHz band it supports SISO Mode only. Supported WLAN modes are a and n with a 20 MHz BW, n with 40 MHz BW. The U-NII bands 1, 2A, 2C and 3 are supported. For this report the EUT is a slave without radar detection in the relevant DFS bands.
Ports of the device	Enclosure Data DC Power Antenna The EUT is a module with solder pads for surface mounting, so no cables were connected to the EUT itself.
Antenna 1	MAYA-W166-00B-00: Integral / -0.9 dBi MAYA-W166-01B-00: External / 2 dBi (No antennas were provided for the tests, radiated measurements were performed with 50 Ohm terminations)
Tested Datarates	WLAN a: 6 Mbit WLAN n: MCS 0
Special software used for testing	Scripts were provided by the applicant on a laptop that control a board computer, which sets the test modes of the EUT.
Used output power	<table><tr><td>Mode | Ch.</td><td>36</td><td>40</td><td>44</td><td>48</td><td>52</td><td>56</td><td>60</td><td>64</td><td>100</td><td>104</td><td>108</td><td>112</td><td>116</td><td>132</td><td>136</td><td>140</td><td>149</td><td>153</td><td>157</td><td>161</td><td>165</td></tr><tr><td>A</td><td>17</td><td>17</td><td>17</td><td>17</td><td>17</td><td>17</td><td>17</td><td>16</td><td>16</td><td>18</td><td>18</td><td>18</td><td>18</td><td>18</td><td>16</td><td>14</td><td>16</td><td>16</td><td>17</td><td>18</td><td>18</td></tr><tr><td>N20 SISO</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>15</td><td>15</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td><td>14</td><td>16</td><td>16</td><td>16</td><td>16</td><td>16</td></tr><tr><td>N40 SISO</td><td colspan="2">14</td><td colspan="2">16</td><td colspan="2">16</td><td colspan="2">14</td><td colspan="2">13</td><td colspan="2">16</td><td>N/A</td><td colspan="3">13</td><td></td><td colspan="2">16</td><td colspan="2">16</td><td>N/A</td></tr></table>

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
MAYA W166 AB01	DE1015159ab01	MAYA-W166-01B-00
Sample Parameter	**Value**	
Serial No.	AK36C1DEB90E4A80400	
HW Version	04	
SW Version	W16.92.21.p22-16.92.21.p22-MXM5X16298_V0	
Comment	Antenna Pin Sample	
Integral Antenna		

Sample Name	Sample Code	Description
MAYA W166 AD01	DE1015159ad01	MAYA-W166-00B-00
Sample Parameter	**Value**	
Serial No.	M406C1DEB90B95C0400	
HW Version	04	
SW Version	W16.92.21.p22-16.92.21.p22-MXM5X16298_V0	
Comment	Integral antenna sample	
Integral Antenna		

Sample Name	Sample Code	Description
MAYA W166 AE01	DE1015159ae01	MAYA-W166-00B-00
Sample Parameter	**Value**	
Serial No.	M406C1DEB90B93C0400	
HW Version	04	
SW Version	W16.92.21.p22-16.92.21.p22-MXM5X16298_V0	
Comment	Integral antenna sample	
Integral Antenna		

Sample Name	Sample Code	Description
MAYA W166 AF01	DE1015159af01	MAYA-W166-00B-00
Sample Parameter	**Value**	
Serial No.	M406C1DEB90B8B00400	
HW Version	04	
SW Version	W16.92.21.p22-16.92.21.p22-MXM5X16298_V0	
Comment	Integral antenna sample	
Integral Antenna		

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
-	-	-

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**
AUX20	Toradex, Ixora, V1.2A, -, 10824714	Board Computer connected to Evaluation board for setting modes
AUX21	Toradex, Ixora, V1.2A, -, 10824739	Board Computer connected to Evaluation board for setting modes
AUX22	DELL, Latitude E7250, -, -, 43283371358	Laptop computer with prepared scripts controlling AUX10
AUX23	DELL, Latitude E7270, 2016, -, 14393036990	Laptop computer with prepared scripts controlling AUX11
AUX6	UBLOX, MAYA-W1 EVK, Rev. A, - , 10000002386976004001	Evaluation Board for module providing ports
AUX7	UBLOX, , -, -, 10000002636490002002	Evaluation Board for module providing ports
AUX8	UBLOX, MAYA-W1 EVK, Rev. A, - , 10000002636490002004	Evaluation Board for module providing ports
AUX9	UBLOX, MAYA-W1 EVK, Rev. A, - , 10000002636490001002	Evaluation Board for module providing ports

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**
S02_166_AF01	MAYA W166 AF01, AUX8,	Radiated Setup
S02_166_AB01	MAYA W166 AB01, AUX6,	Radiated Setup
S01_166_AB01	MAYA W166 AB01, AUX6, AUX10 + AUX12 or AUX 11 + AUX 13	Conducted Setup
S03_166_AE01	MAYA W166 AE01, AUX9,	AC Conducted Setup
S02_166_AD01	MAYA W166 AD01, AUX7,	Radiated Setup
S02_166_AE01	MAYA W166 AE01, AUX9,	Radiated 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			U-NII-Subband 2A 5250 - 5350 MHz			U-NII-Subband 2C 5470 - 5725 MHz			U-NII-Subband 3 5725 - 5850 MHz			Nom. BW
low	mid	high	low	mid	high	low	mid	high	low	mid	high	20 MHz
36	40	48	52	60	64	100	116	140	149	157	165	Ch.-No.
5180	5200	5240	5260	5300	5320	5500	5580	5700	5745	5785	5825	MHz

low	mid	high	low	mid	high	low	mid	high	low	mid	high	40 MHz
38	-	46	54	-	62	102	110	138	151	-	159	Ch.-No.
5190	-	5230	5270	-	5310	5510	5550	5690	5755	-	5795	MHz

4.7 PRODUCT LABELLING

4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

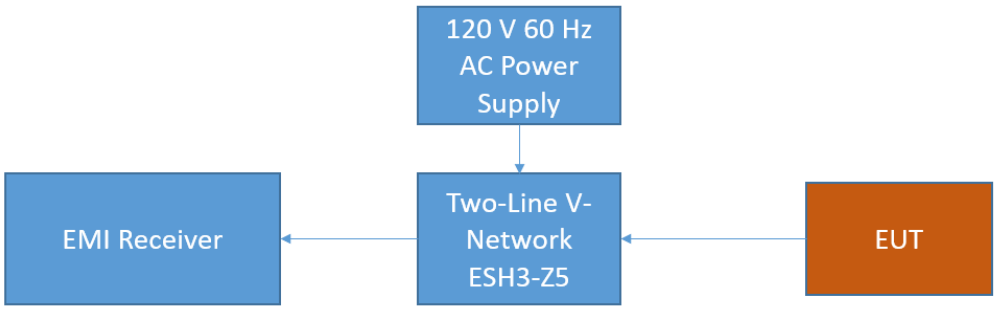
5.1 AC CONDUCTED EMISSIONS

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10 6.2

5.1.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C 63.10
The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50µH || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.



FCC Conducted Emissions on AC

The measurement procedure consists of two steps. It is implemented into the EMI test software EMC-32 from R&S.

Step 1: Preliminary scan
Intention of this step is, to determine the conducted EMI-profile of the EUT.
EMI receiver settings:
- Detector: Peak – Maxhold & Average
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 2.5 kHz
- IF–Bandwidth: 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement
Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.
EMI receiver settings:
- Detector: Quasi-Peak & (CISPR) Average

- IF Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:
1) Neutral lead - reference ground (PE grounded)
2) Phase lead - reference ground (PE grounded)
3) Neutral lead - reference ground (PE floating)
4) Phase lead - reference ground (PE floating)

The highest value is reported.

5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart C, §15.207

Frequency (MHz)	QP Limits (dBµV)	AV Limits (dBµV)
0.15 – 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

5.1.3 TEST PROTOCOL

Temperature: TT °C
Air Pressure: PPPP hPa
Humidity: HH %

Power line	**PE**	**Frequency [MHz]**	**Measured value QP [dBµV]**	**Measured value AV [dBµV]**	**Limit [dBµV]**	**Margin [dB]**
N	GND	12.01	45.7	-	60.0	14.3
N	GND	12.01	-	42.0	50.0	8.0
N	FLO	24.01	46.4	-	60.0	13.6
N	FLO	24.01	-	43.8	50.0	6.2

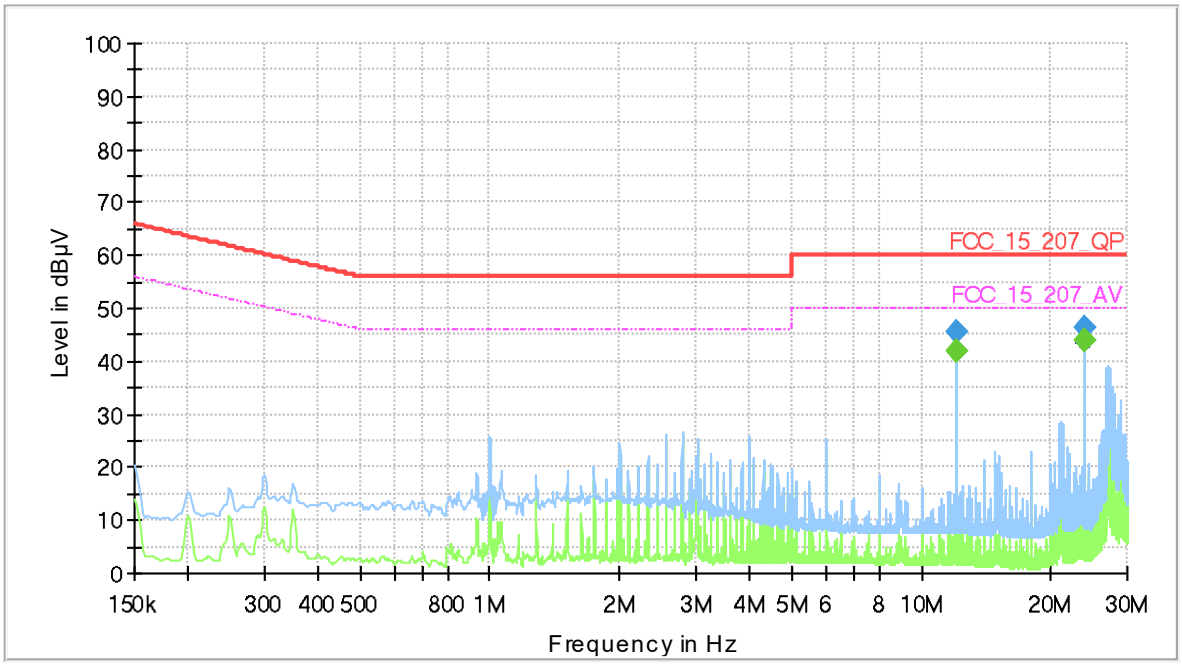
Remark: Please see next sub-clause for the measurement plot.

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

Operating mode = worst case
(S03_166_AE01)

Common Information

Test Description:	Conducted Emissions
Test Standard:	FCC §15.207, ANSI C63.10
EUT / Setup Code:	DE1015159ae01
Operating Conditions:	120 V 60 Hz for Power Supply, 3,3/1,8 for EUT, WLAN5 TX A-Mode 6Mbps CH116 PWR18
Operator Name:	GAL / CAP
Comment:	-
Legend:	Trace: blue = QP, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final CISPR AV
Tested Port / used LISN:	AC mains => 1st LISN ESH3-Z5
Termination of other ports:	-



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Line	PE	Corr. (dB)
12.005250	---	42.00	50.00	8.00	1000.0	9.000	N	GND	10.7
12.005250	45.72	---	60.00	14.28	1000.0	9.000	N	GND	10.7
24.009000	46.44	---	60.00	13.56	1000.0	9.000	N	FLO	11.2
24.009000	---	43.76	50.00	6.24	1000.0	9.000	N	FLO	11.2

5.1.5 TEST EQUIPMENT USED

- Conducted Emissions FCC

5.2 MAXIMUM CONDUCTED OUTPUT POWER

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10 12.3.3.2

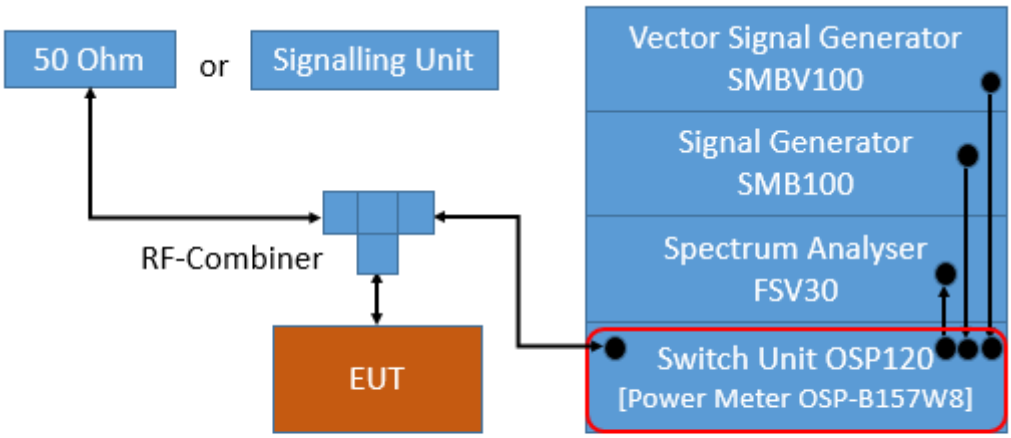
5.2.1 TEST DESCRIPTION

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

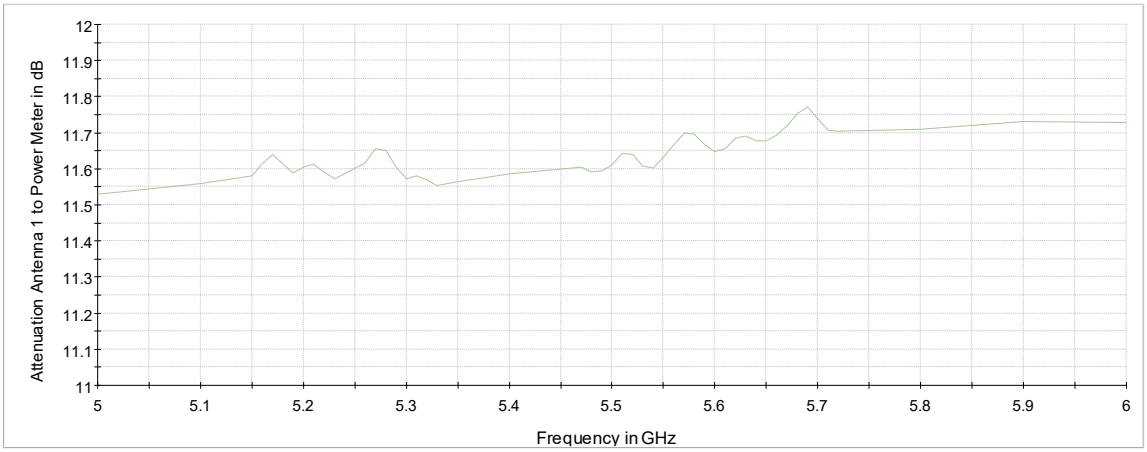
For U-NII bands 1, 2A, 2C, 3:
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

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

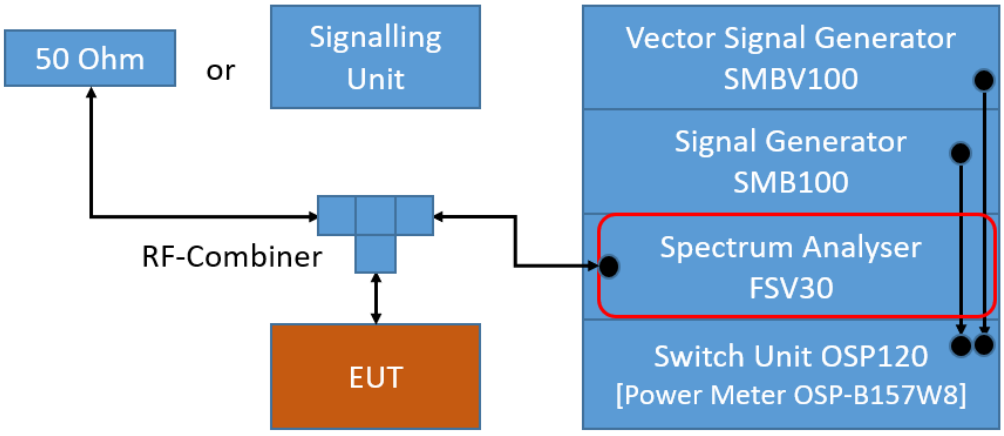
For U-NII bands 5,6,7,8:
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

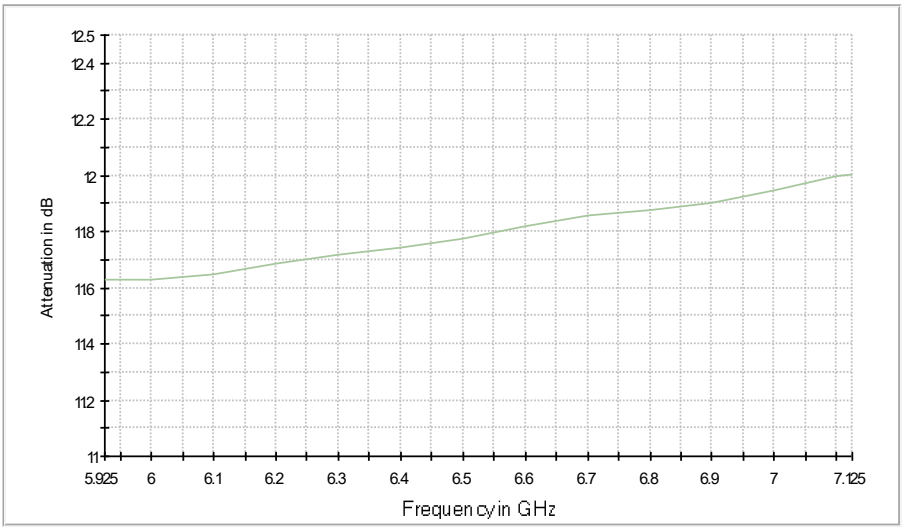
Analyzer settings:

- Resolution Bandwidth (RBW): 1 MHz
- Video Bandwidth (VBW): 3 MHz
- Trace: Average, RMS power averaging mode
- Sweeps: at least 100
- Sweeptime: 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

5.2.2 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) (2)
For systems using digital modulation techniques in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands:
Limit: 250 mW (24 dBm) or 11 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.

FCC Part 15, Subpart E, §15.407 (a) (3):
For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:
Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi. The antenna gain limitation is not applicable for fixed point-to-point devices.

FCC Part 15, Subpart E, §15.407 (a) (4):
For a standard power access point and fixed client devices in the 5.925 – 6.425 GHz and 6.525 – 6.875 GHz bands:
Limit: 4 W (36 dBm) e.i.r.p.
For outdoor devices, 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).

FCC Part 15, Subpart E, §15.407 (a) (5):
For an indoor access point in the 5.925 – 7.125 GHz bands:
Limit: 1 W (30 dBm)e.i.r.p.

FCC Part 15, Subpart E, §15.407 (a) (6):
For a subordinate device operating under an indoor access point in the 5.925 – 7.125 GHz bands:
Limit: 1 W (30 dBm)e.i.r.p.

FCC Part 15, Subpart E, §15.407 (a) (7):
For a client device, except for fixed client devices, operating under standard power access point in the 5.925-6.425 GHz and 6.525-6.875 GHz bands:
Limit: 1 W (30 dBm)e.i.r.p.
The client device must limit it's power to no more than 6 dB below its associated standard power access point's authorized transmit power.

FCC Part 15, Subpart E, §15.407 (a) (8):
For client devices operating under the control of an indoor access point in the 5.925 – 7.125 GHz bands:
Limit: 250 mW (24 dBm)e.i.r.p.

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.

RSS-247, 6.2.2.1, Band 5250-5350 MHz:
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 TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
Devices, other devices than installed in vehicles:
Maximum conducted Power: 250 mW (24 dBm) or 11 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 1.0 W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.

Outdoor fixed devices with a maximum e.i.r.p. greater than 200 mW shall comply with the following e.i.r.p. at different elevations, where θ is the angle above the local horizontal plane (of the Earth) as shown below:

i.-13 dBW/MHzfor 0°≤ θ< 8°
ii.-13 −0.716 (θ-8) dBW/MHzfor 8° ≤ θ< 40°
iii.-35.9 −1.22 (θ-40) dBW/MHzfor 40° ≤ θ ≤45°
iv.-42 dBW/MHzfor θ > 45°

RSS-247, 6.2.3.1, Bands 5470-5600 MHz and 5650-5725 MHz:
Limits:
Maximum conducted Power: 250 mW (24 dBm) or 11 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 1.0 W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.

Note: Devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

RSS-247, 6.2.4.1, Band 5725-5850 MHz:
Limits:
Maximum conducted Power: 1 W (30 dBm)
e.i.r.p.: 4 W (36 dBm)

5.2.3 TEST PROTOCOL

Ambient temperature: 24-26 °C
Air Pressure: 990-1020 hPa
Humidity: 30-40 %

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

U-NII-Sub-band	Freq. [MHz]	Cond. Power Variant W161 [dBm]	Cond. Power Variant W166 [dBm]	Power Difference [dB]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	5180	17.1	16.9	-0.2	30.0	13.1	N/A		22.2	3.3	1)
	5220	17.0	16.9	-0.1	30.0	13.1	N/A		22.2	3.3	1)
	5240	17.2	17.0	-0.2	30.0	13.0	N/A		22.2	3.2	1)
2A	5260	17.1	17.0	-0.1	24.0	7.0	23.2	6.2	29.2	10.2	1)
	5280	17.2	17.2	0.0	24.0	6.8	23.2	6.0	29.2	10.0	1)
	5320	16.4	16.1	-0.3	24.0	7.9	23.2	7.1	29.2	11.1	1)
2C	5500	15.8	15.8	0.0	24.0	8.2	23.2	7.4	29.2	11.4	
	5580	17.9	17.8	-0.1	24.0	6.2	23.2	5.4	29.2	9.4	
	5700	13.9	14.0	0.1	23.9	9.9	23.2	9.2	29.2	13.2	
3	5745	16.2	16.2	0.0	30.0	13.8	30.0	13.8	36.0	17.8	
	5785	17.0	17.1	0.1	30.0	12.9	30.0	12.9	36.0	16.9	
	5825	17.8	18.0	0.2	30.0	12.0	30.0	12.0	36.0	16.0	

WLAN n-Mode; 20 MHz; MCS0; SISO

U-NII-Sub-band	Freq. [MHz]	Cond. Power Variant W161 [dBm]	Cond. Power Variant W166 [dBm]	Power Difference [dB]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	5180	16.1	16.0	-0.1	30.0	14.0	N/A		22.5	4.5	1)
	5220	16.1	16.0	-0.1	30.0	14.0	N/A		22.5	4.5	1)
	5240	16.2	16.2	0.0	30.0	13.8	N/A		22.5	4.3	1)
2A	5260	16.2	16.1	-0.1	24.0	7.9	23.5	7.4	29.5	11.4	1)
	5280	16.4	16.3	-0.1	24.0	7.7	23.5	7.2	29.5	11.2	1)
	5320	15.4	15.3	-0.1	24.0	8.7	23.5	8.2	29.5	12.2	1)
2C	5500	15.0	15.0	0.0	24.0	9.0	23.5	8.5	29.5	12.5	
	5580	16.1	16.0	-0.1	24.0	8.0	23.5	7.5	29.5	11.5	
	5700	14.3	14.2	-0.1	24.0	9.8	23.5	9.3	29.5	13.3	
3	5745	16.3	16.3	0.0	30.0	13.7	30.0	13.7	36.0	17.7	
	5785	16.2	16.3	0.1	30.0	13.7	30.0	13.7	36.0	17.7	
	5825	16.1	16.1	0.0	30.0	13.9	30.0	13.9	36.0	17.9	

WLAN n-Mode; 40 MHz; MCS0; SISO

U-NII-Sub-band	Freq. [MHz]	Cond. Power Variant W161 [dBm]	Cond. Power Variant W166 [dBm]	Power Difference [dB]	FCC Cond. Limit [dBm]	Margin [dB]	IC Cond. Limit [dBm]	Margin [dB]	IC EIRP Limit [dBm]	Margin [dB]	
1	5190	14.1	13.9	-0.2	30.0	16.1	N/A		23.0	7.1	1)
	5230	16.2	16.0	-0.2	30.0	14.0	N/A		23.0	5.0	1)
2A	5270	16.1	16.0	-0.1	24.0	8.0	24.0	8.0	30.0	12.0	1)
	5310	14.3	14.2	-0.1	24.0	9.8	24.0	9.8	30.0	13.8	1)
2C	5510	12.7	12.8	0.1	24.0	11.2	24.0	11.2	30.0	15.2	
	5550	15.8	16.0	0.2	24.0	8.0	24.0	8.0	30.0	12.0	
	5670	13.0	12.9	-0.1	24.0	11.1	24.0	11.1	30.0	15.1	
3	5755	16.1	16.2	0.1	30.0	13.8	30.0	13.8	36.0	17.8	
	5795	16.0	16.1	0.1	30.0	13.9	30.0	13.9	36.0	17.9	

Remark: Please see next sub-clause for the measurement plot.
Acceptable difference in power to skip repetition of conducted measurements: 0.9 dB.

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

Power Meter measurement, no plots provided.

5.2.5 TEST EQUIPMENT USED

- R&S TS8997

5.3 UNDESIRABLE EMISSIONS; GENERAL FIELD STRENGTH LIMITS

Standard **FCC Part 15 Subpart E**

The test was performed according to:
ANSI C63.10

5.3.1 TEST DESCRIPTION

Radiated Measurement with integral antenna or 50 Ohm termination at antenna port

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

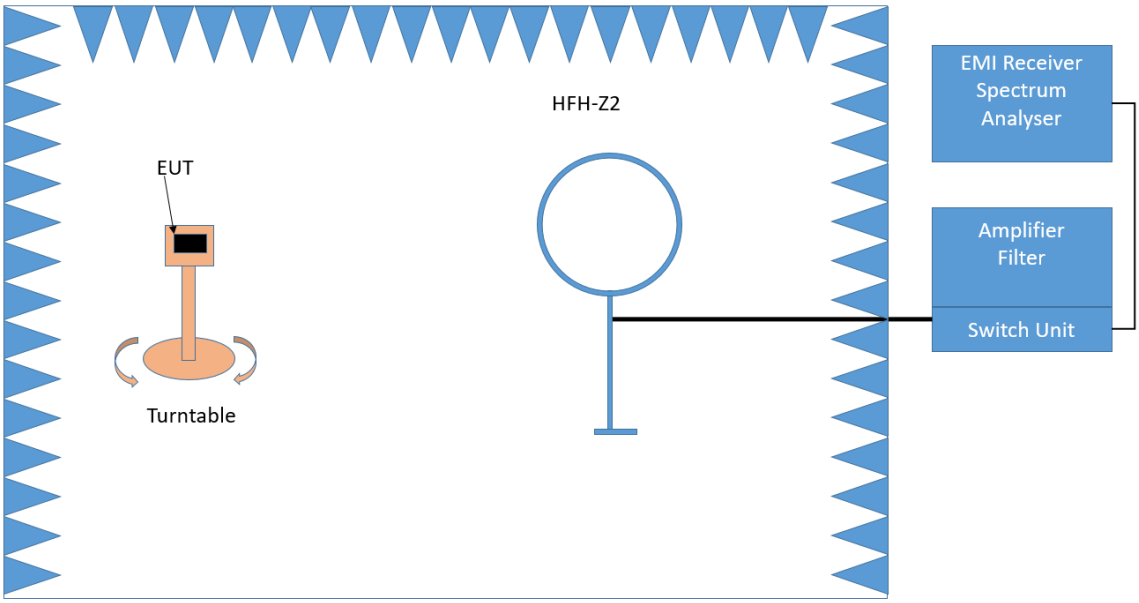
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHZ: Chapter 6.6 (procedure according 6.6.5 used)

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

Below 1 GHz:

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

1. Measurement up to 30 MHz



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

The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement

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

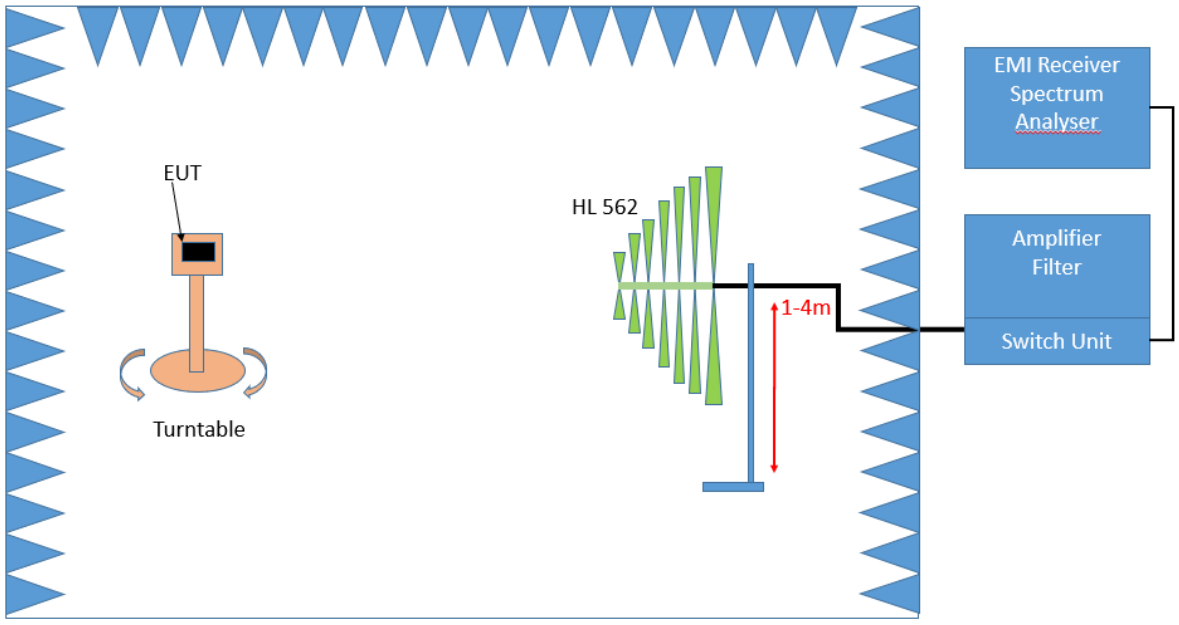
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement

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

- Open area test side
- 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

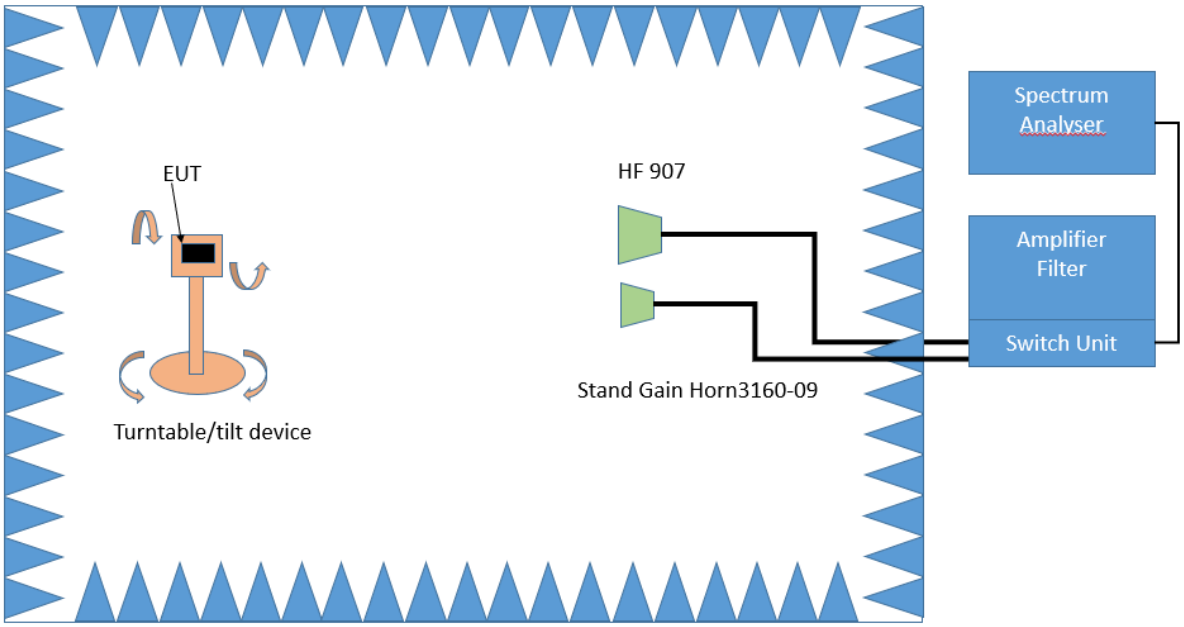
Step 3: Final measurement with QP detector
With the settings determined in step 2, the final measurement will be performed:
EMI receiver settings for step 3:
- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

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 °.

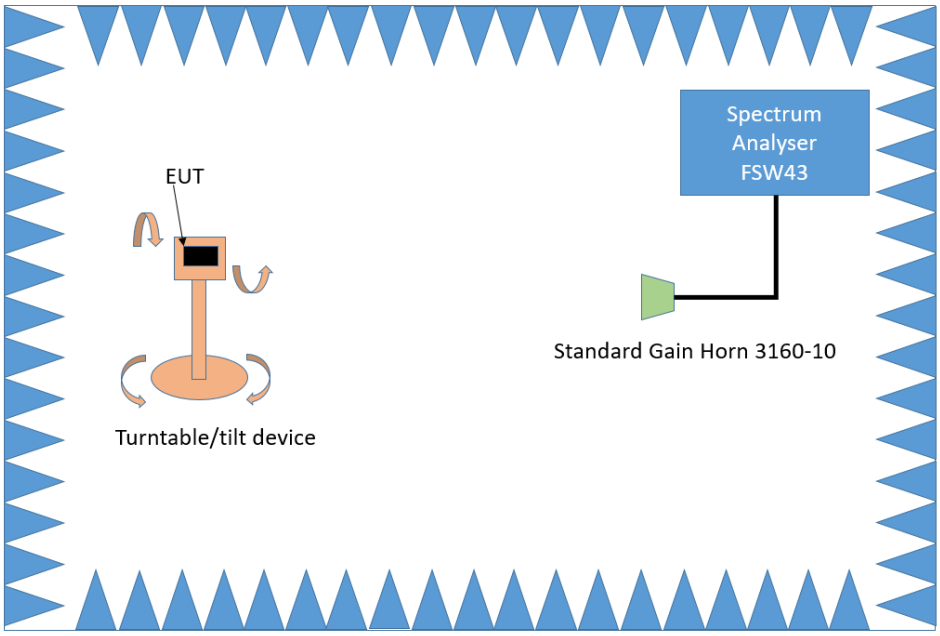
Step 2:
Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna instep 2 is omitted. Instead of this, a maximum search with a step size ± 45° for the elevation axis is performed.
The turn table azimuth will slowly vary by ± 22.5°.
The elevation angle will slowly vary by ± 45°
EMI receiver settings (for all steps):
- Detector: Peak, Average
- IF Bandwidth = 1 MHz

Step 3:
Spectrum analyser settings for step 3:
- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

4. Measurement above 26.5 GHz up to 40 GHz

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

- Measurement distance: 1m

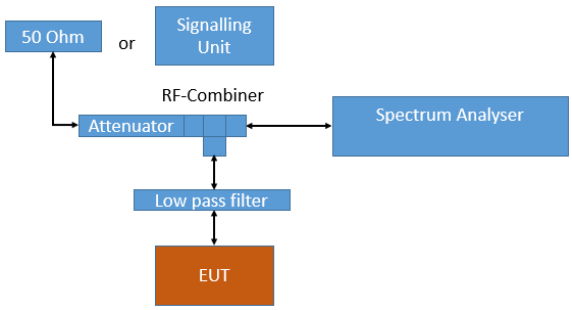


Test Setup; Spurious Emission Radiated (FAC), 26.5 – 40 GHz

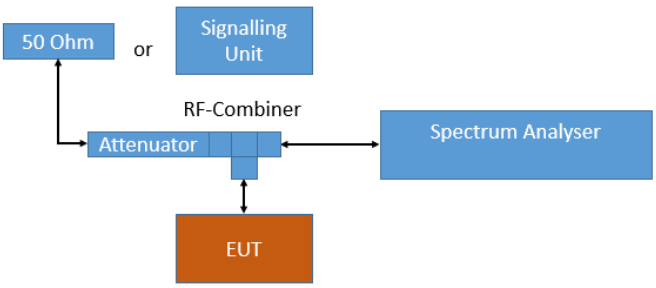
Conducted Measurements at antenna ports

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

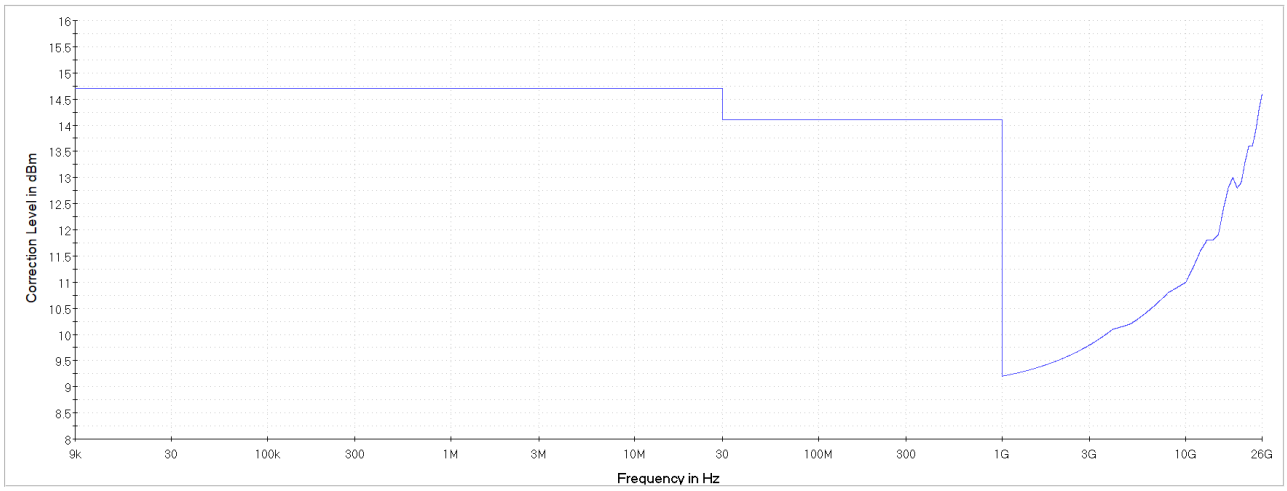
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

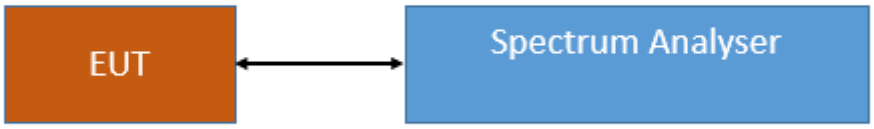


Measurement <1 GHz



Measurement 1 GHz - 26 GHz





Measurement 26 GHz - 40 GHz

Analyser settings:

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

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

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

- Frequency range: 26000 – 40000 MHz
- Resolution Bandwidth (RBW): 1000 kHz
- Video Bandwidth (VBW): 3000 kHz

- Trace: Maxhold, Average Power
- Sweeps: 1000
- Sweep Time: coupled
- Detector: Peak, RMS

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

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

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

5.3.2 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.

FCC Part 15 Subpart E, §15.407 (b)(2)
For transmitters operating in the 5250–5350 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E, §15.407 (b)(3)
For transmitters operating in the 5470–5725 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.

FCC Part 15 Subpart E, §15.407 (b)(4)
For transmitters operating in the 5725–5850 MHz band:
Limit: –27 dBm/MHz at 75 MHz or more above or below the band edge
increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge
increasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edge
increasing linearly to 27 dBm/MHz at the band edge.

FCC Part 15 Subpart E, §15.407 (b) (5)
For transmitters operating within the 5.925-7.125 GHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5.925-7.125 GHz.

FCC Part 15 Subpart E, §15.407 (b) (6)
For transmitters operating within the 5.925-7.125 GHz bands:
Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

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.

RSS-247, 6.2.2.2, Emissions outside the band 5250-5350 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5250–5350 MHz.

RSS-247, 6.2.3.2, Emissions outside the bands 5470-5600 MHz and 5650-5725 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.
However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p.at 5850 MHz instead of 5725 MHz.
Note: No operation is permitted for the frequency range 5600–5650 MHz.

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

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

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.

5.3.3 TEST PROTOCOL

Ambient temperature: 26–30 °C
Air Pressure: 1000–1016 hPa
Humidity: 30–40 %
WLAN a-Mode; 20 MHz; 6 Mbit/s
Applied duty cycle correction (AV): 0 dB

Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
Radiated Integral Antenna	5200	4954.4	59.9	PEAK	1000	74.0	14.1	RB
Radiated Integral Antenna	5200	4954.4	45.6	AV	1000	54.0	8.4	RB
Radiated Integral Antenna	5785	3856.7	60.8	PEAK	1000	74.0	13.2	RB
Radiated Integral Antenna	5785	3856.7	48.1	AV	1000	54.0	5.9	RB
Radiated Integral Antenna	5825	3883.4	63.0	PEAK	1000	74.0	11.0	RB
Radiated Integral Antenna	5825	3883.4	50.6	AV	1000	54.0	3.4	RB
Radiated Integral Antenna	5825	5412.8	65.1	PEAK	1000	74.0	8.9	RB
Radiated Integral Antenna	5825	5412.8	47.6	AV	1000	54.0	6.4	RB
Conducted	5200	5465.8	62.0	PEAK	1000	68.2	6.2	UE
Conducted	5825	3883.6	54.7	PEAK	1000	74.0	19.3	RB
Conducted	5825	3883.3	46.6	AV	1000	54.0	7.4	RB

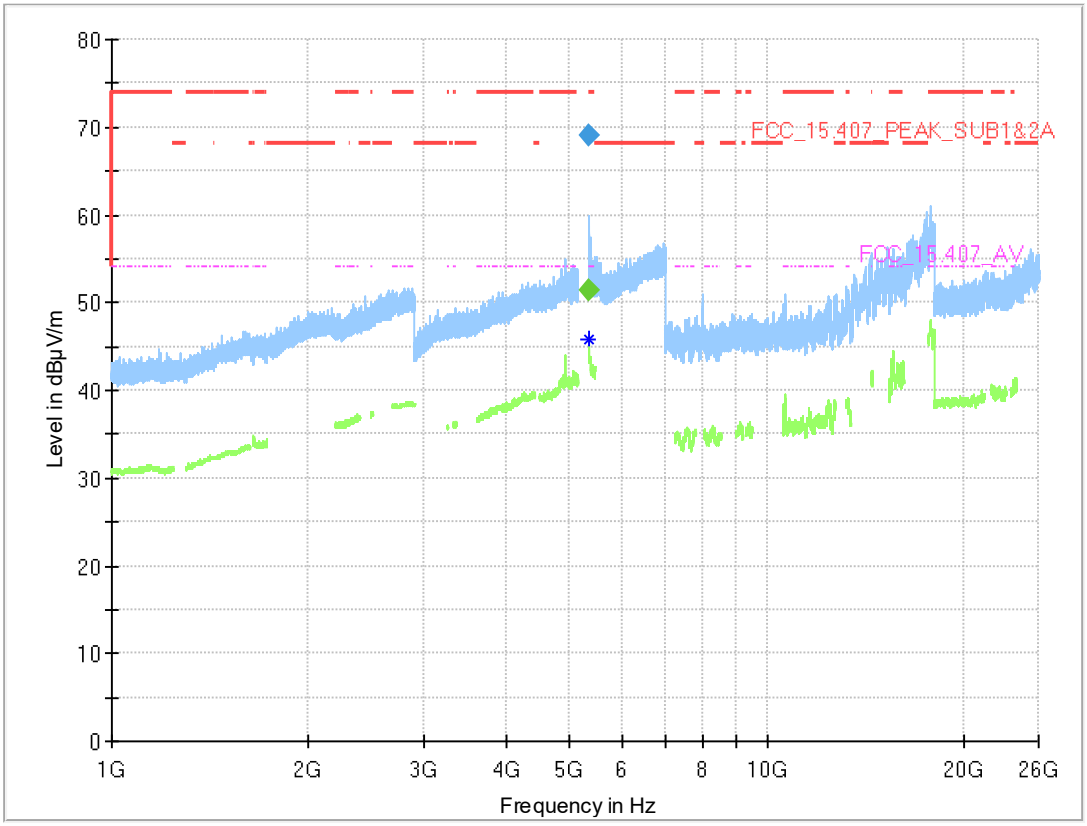
WLAN n-Mode; 20 MHz; MCS0; SISO
Applied duty cycle correction (AV): 0 dB

Measurement Method	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
Radiated Integral Antenna	5320	-	-	-	-	-	-	-
Radiated Integral Antenna	5500	-	-	-	-	-	-	-
Radiated Integral Antenna	5700	-	-	-	-	-	-	-

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

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

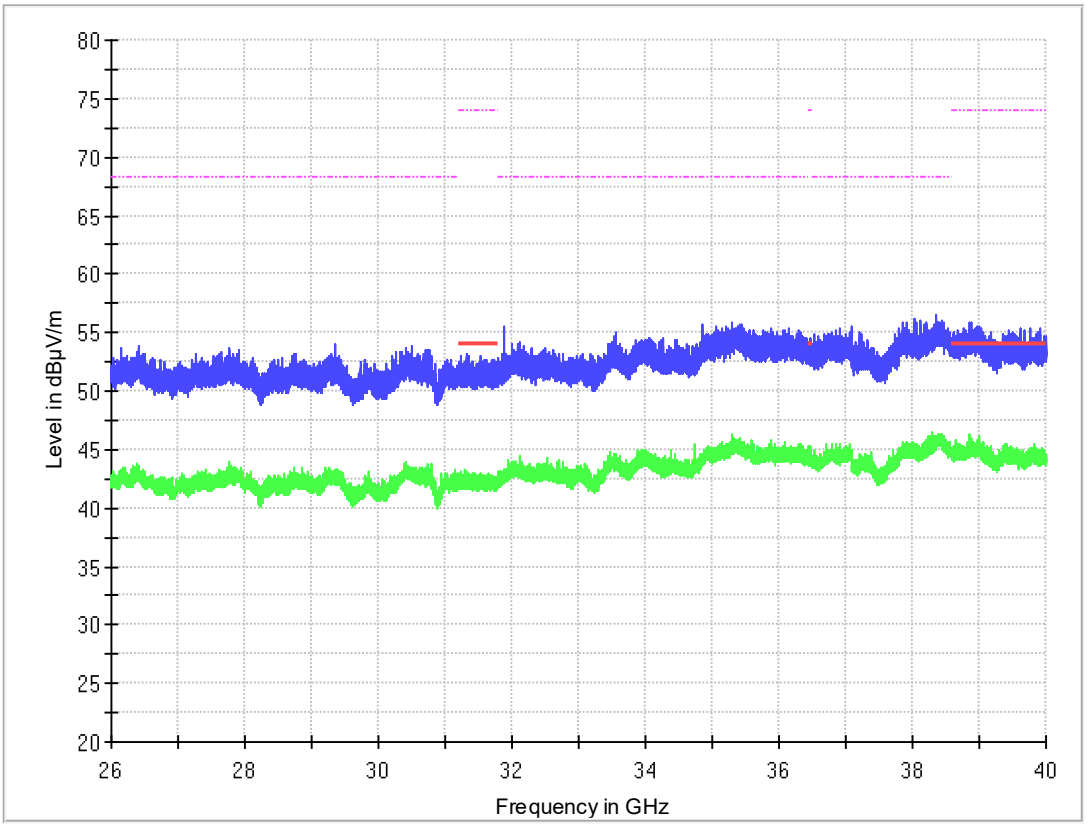
Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 1GHz - 26GHz, Subband = U-NII-2A
(S02_166_AE01)



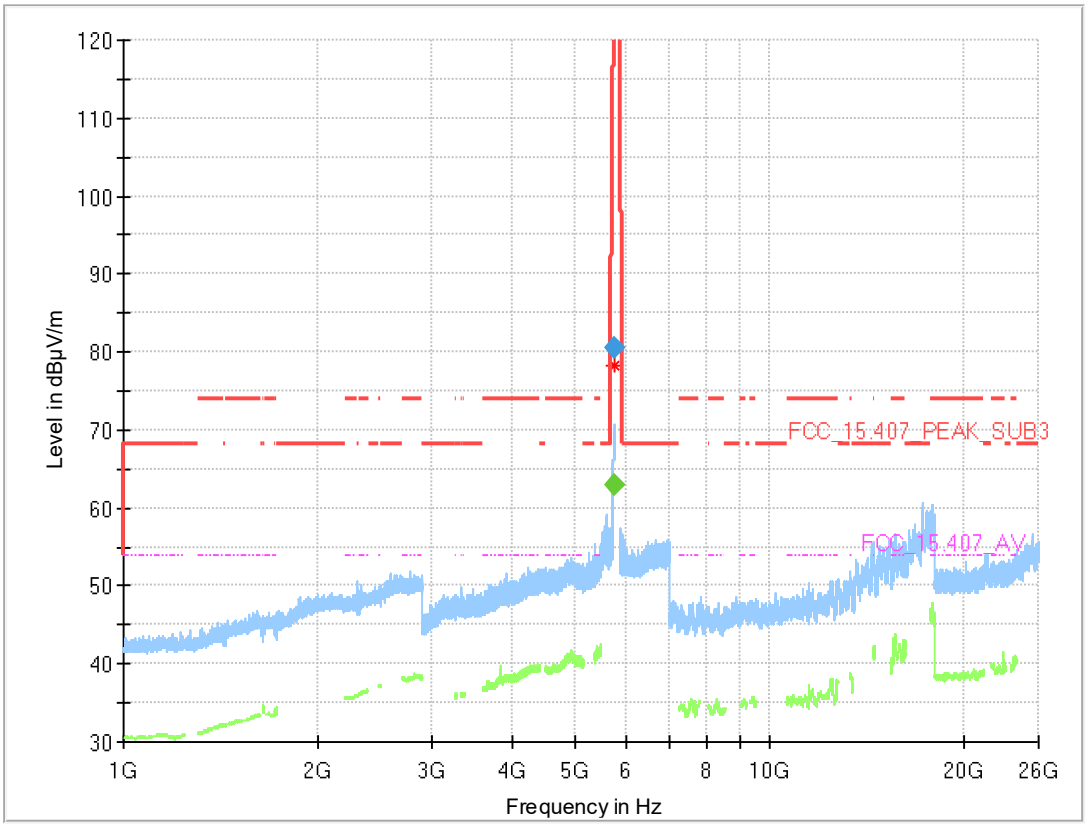
Final_Result

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)
5350.110	---	51.3	54.00	2.70	1000.0	1000.000	150.0	H	-139.0	4.0	14.1
5350.110	69.1	---	74.00	4.88	1000.0	1000.000	150.0	H	-139.0	4.0	14.1

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 26GHz - 40GHz, Subband = U-NII-2A
(S02_166_AE01)



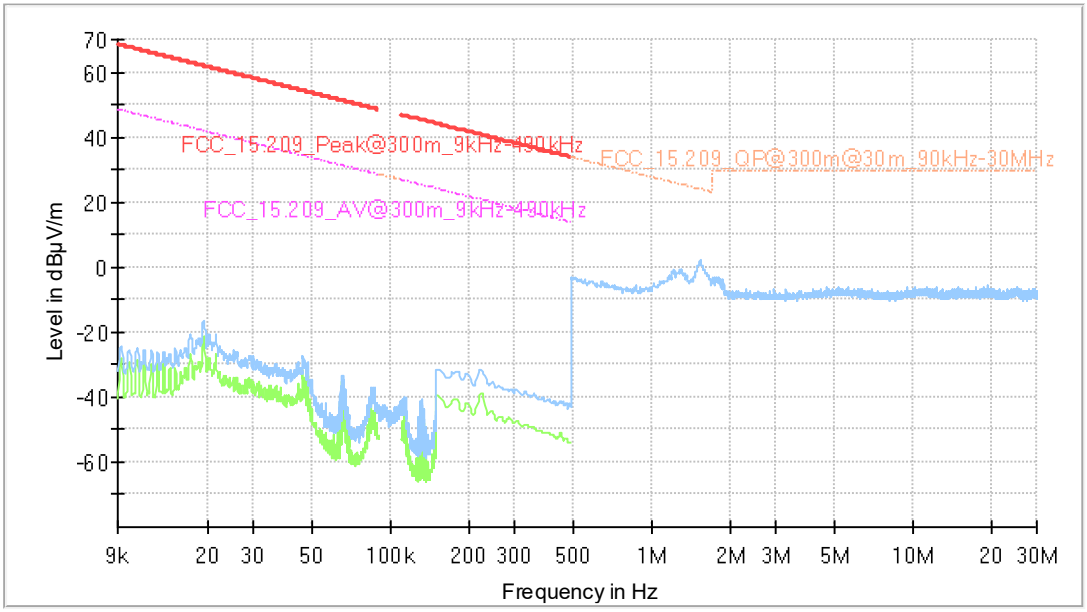
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-3
(S02_166_AE01)



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)
5724.700	---	62.8	---	---	1000.0	1000.000	150.0	H	-136.0	7.0	14.2
5724.700	80.6	---	121.5	40.93	1000.0	1000.000	150.0	H	-136.0	7.0	14.2

Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 9kHz - 30MHz, Subband = U-NII-2C
(S02_166_AE01)



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)
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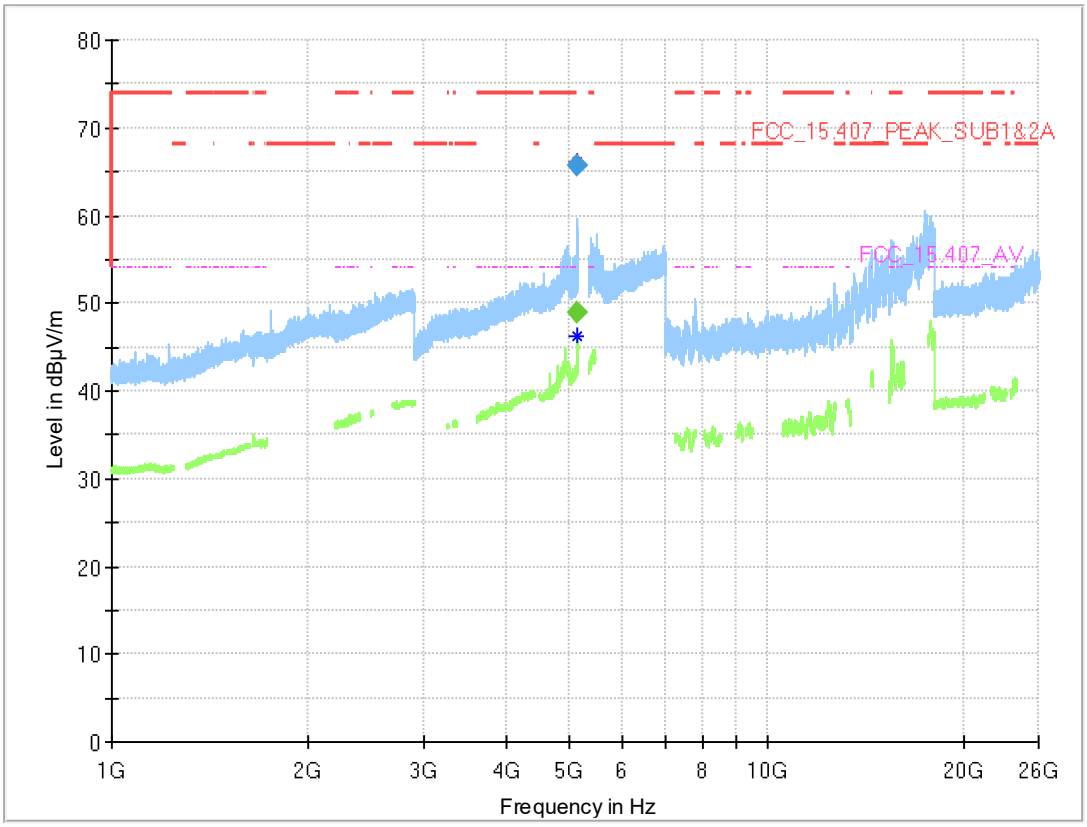
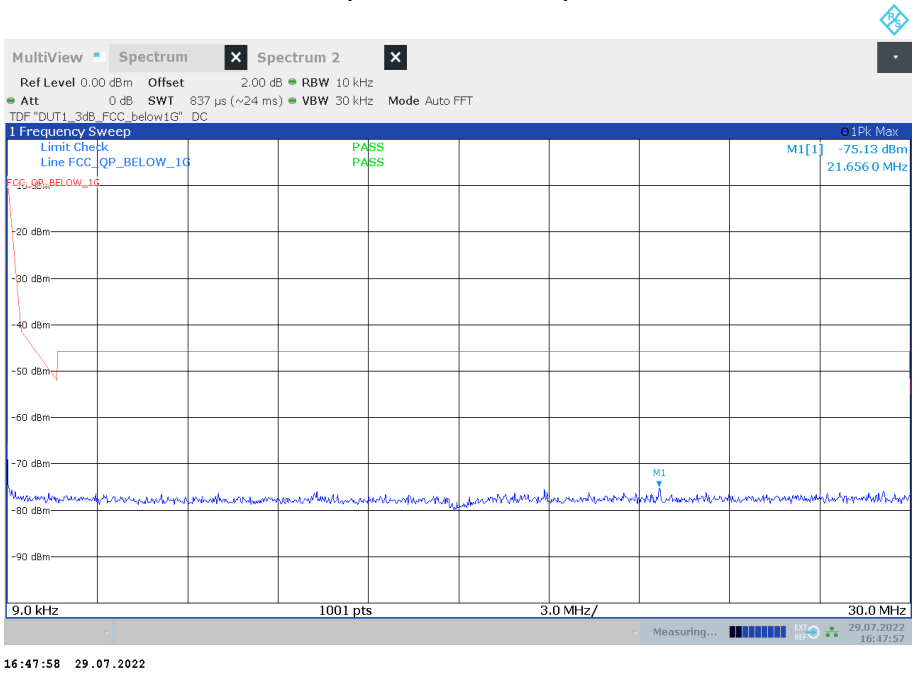
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-1
(S02_166_AD01)



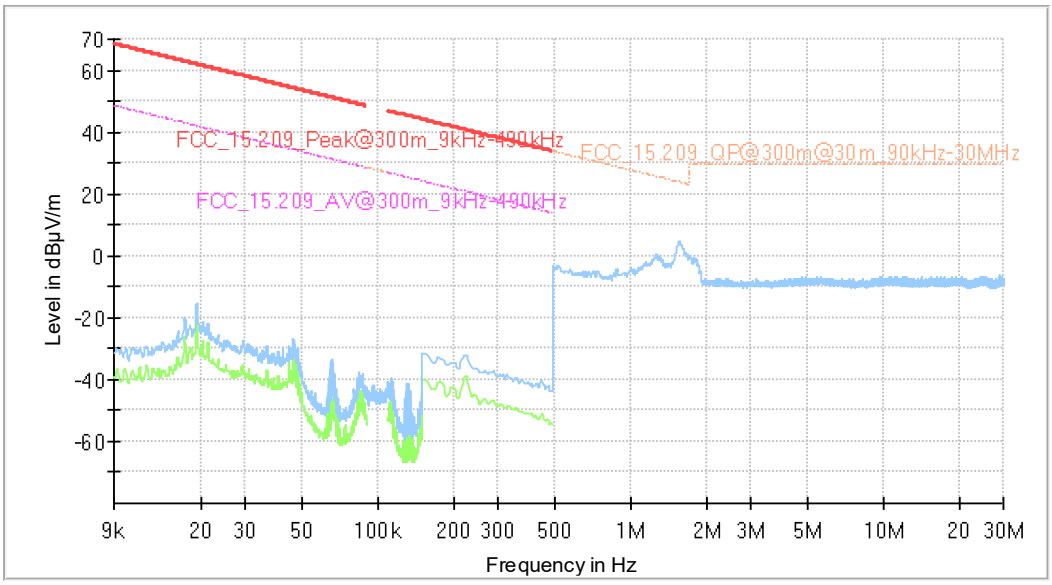
Final_Result

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)
5149.838	---	49.0	54.00	4.96	1000.0	1000.000	150.0	H	-134.0	15.0	13.5
5149.838	65.7	---	74.00	8.29	1000.0	1000.000	150.0	H	-134.0	15.0	13.5

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 9kHz - 30MHz, Subband = U-NII-1
(S01_166_AB01)



Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 9kHz - 30MHz, Subband = U-NII-1
(S02_166_AB01)



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)
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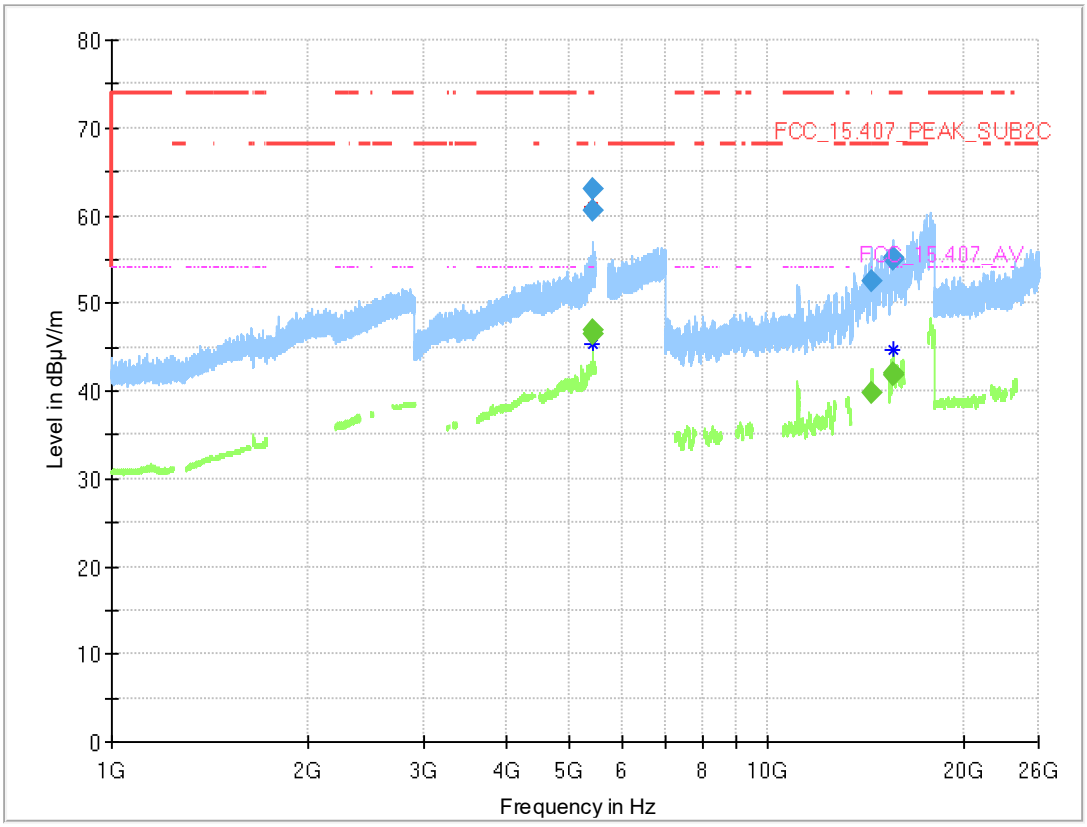
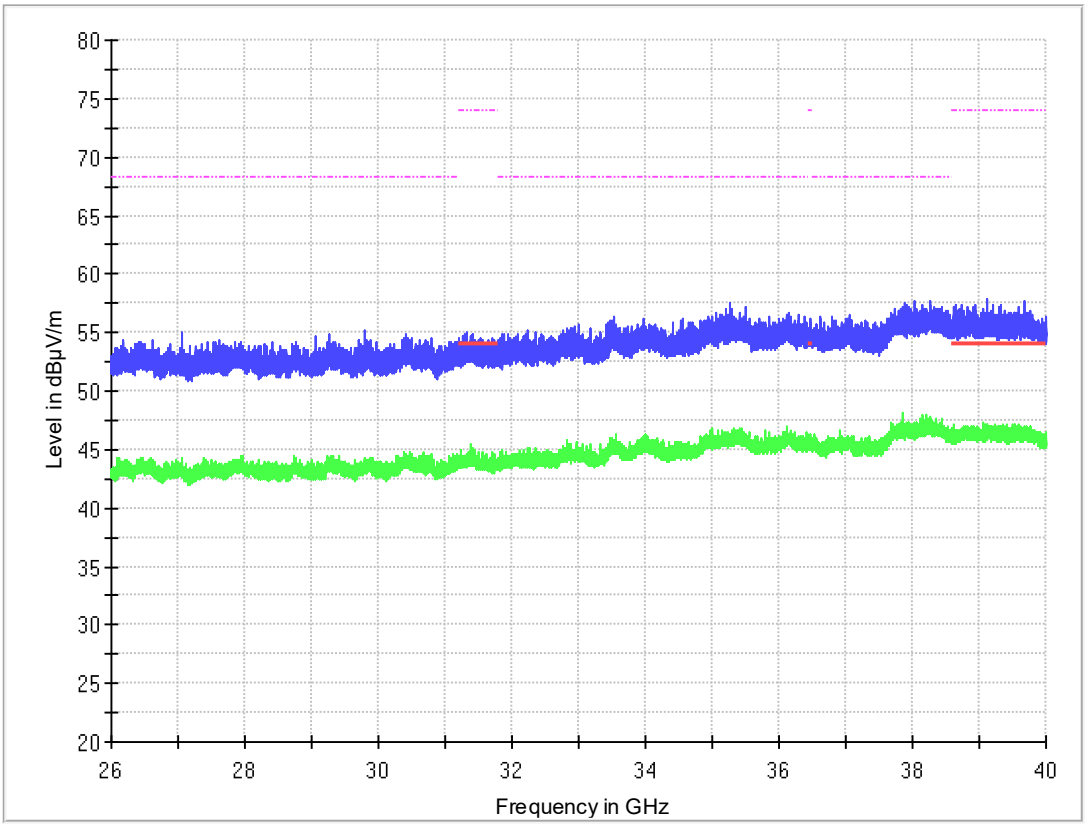
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 1GHz - 26GHz, Subband = U-NII-2C
(S02_166_AE01)



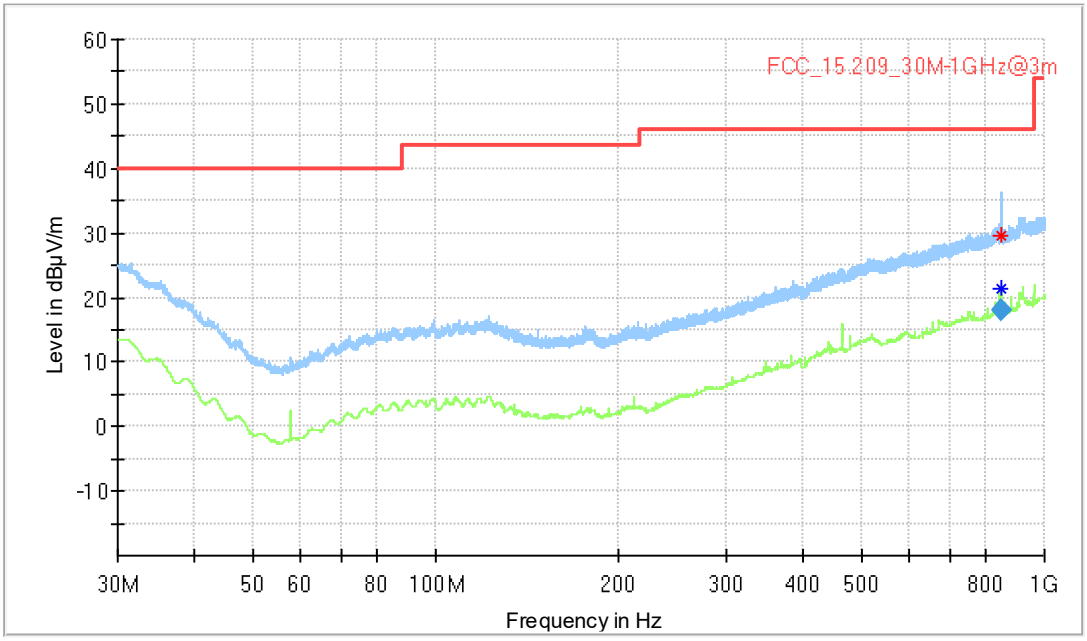
Final_Result

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)
5407.310	---	46.5	54.00	7.51	1000.0	1000.000	150.0	H	-173.0	-1.0	14.5
5407.310	60.5	---	74.00	13.52	1000.0	1000.000	150.0	H	-173.0	-1.0	14.5
5407.530	---	47.0	54.00	6.96	1000.0	1000.000	150.0	H	-169.0	1.0	14.5
5407.530	63.0	---	74.00	11.00	1000.0	1000.000	150.0	H	-169.0	1.0	14.5
14477.650	---	39.8	54.00	14.16	1000.0	1000.000	150.0	V	-169.0	13.0	-3.2
14477.650	52.6	---	74.00	21.39	1000.0	1000.000	150.0	V	-169.0	13.0	-3.2
15594.375	---	41.9	54.00	12.11	1000.0	1000.000	150.0	V	36.0	91.0	-1.1
15594.375	55.2	---	74.00	18.76	1000.0	1000.000	150.0	V	36.0	91.0	-1.1
15597.492	---	41.9	54.00	12.08	1000.0	1000.000	150.0	V	-169.0	105.0	-1.0
15597.492	55.0	---	74.00	18.98	1000.0	1000.000	150.0	V	-169.0	105.0	-1.0

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 26GHz - 40GHz, Subband = U-NII-1
(S02_166_AE01)



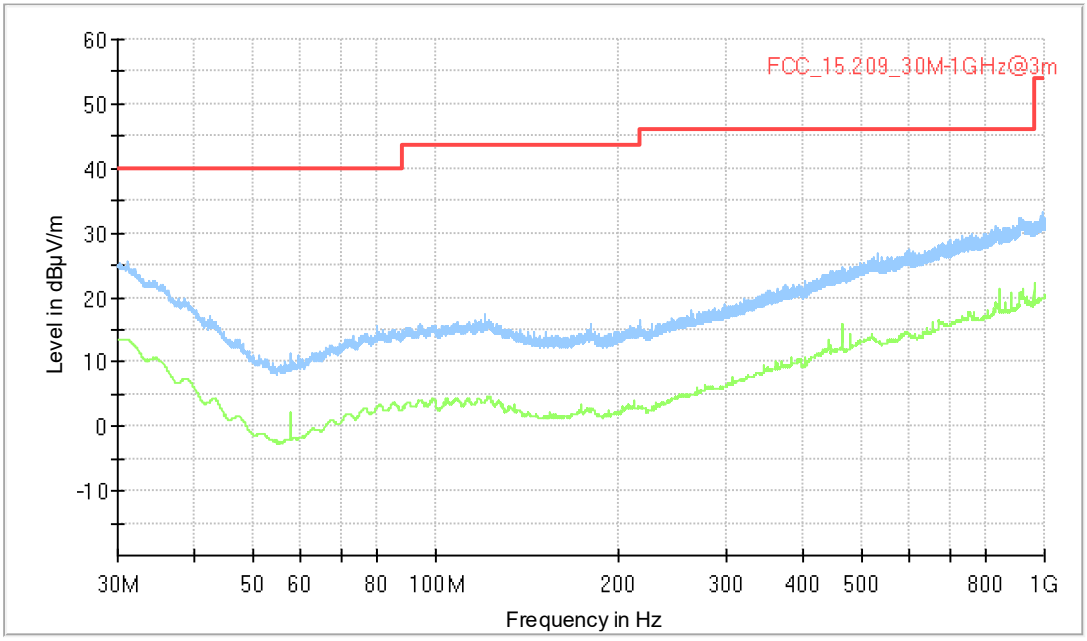
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 30MHz - 1GHz, Subband = U-NII-2C
(S02_166_AE01)



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)
850.860000	18.14	46.00	27.86	1000.0	120.000	178.0	H	-101.0	24.8

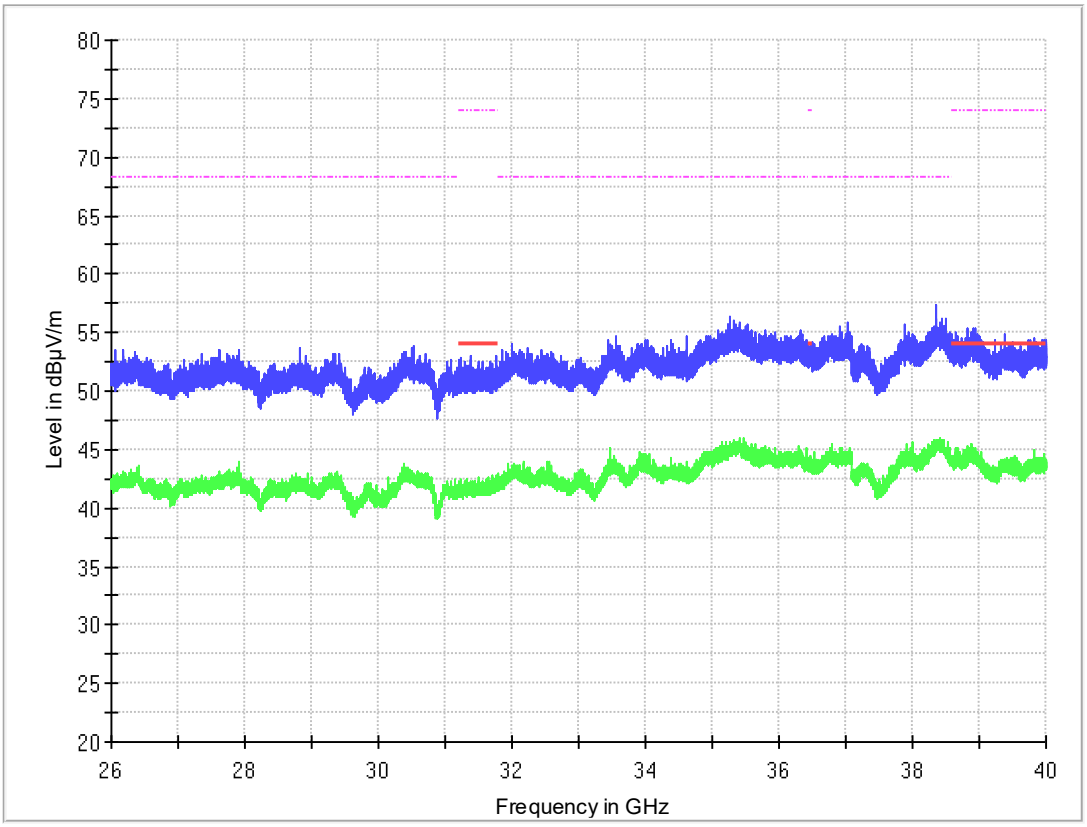
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 30MHz - 1GHz, Subband = U-NII-3
(S02_166_AE01)



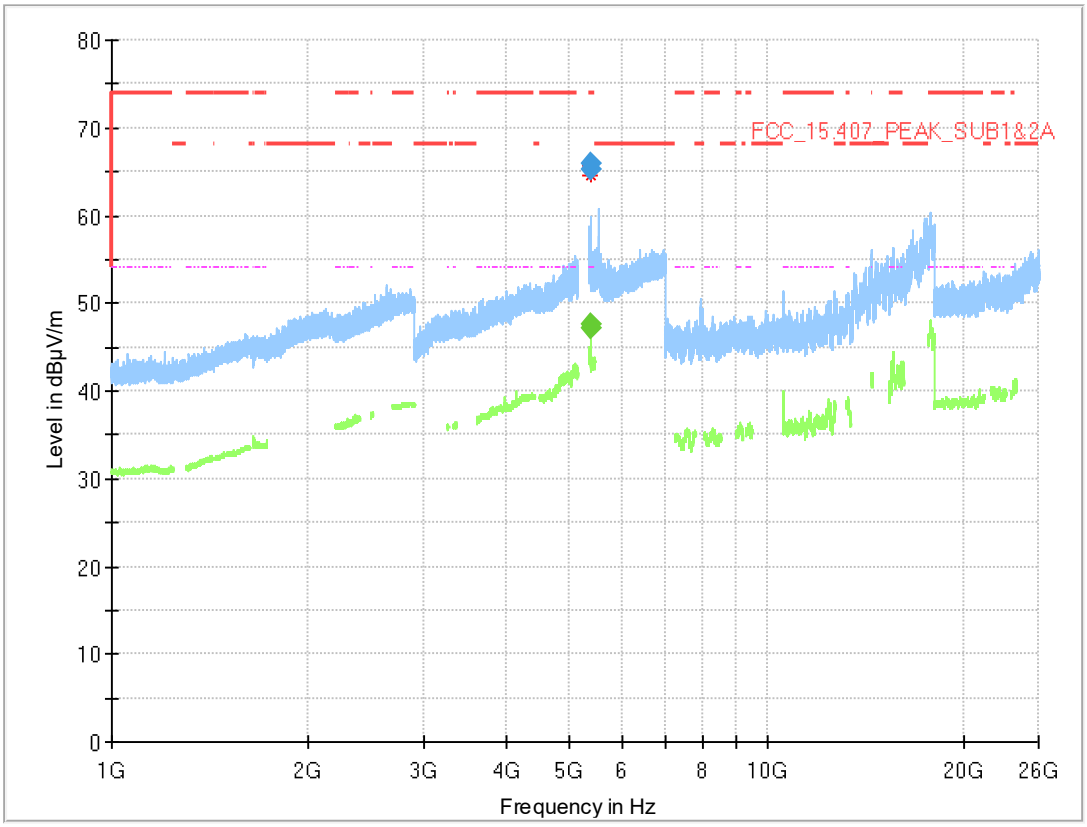
Final_Result

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

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 26GHz - 40GHz, Subband = U-NII-2C
(S02_166_AE01)



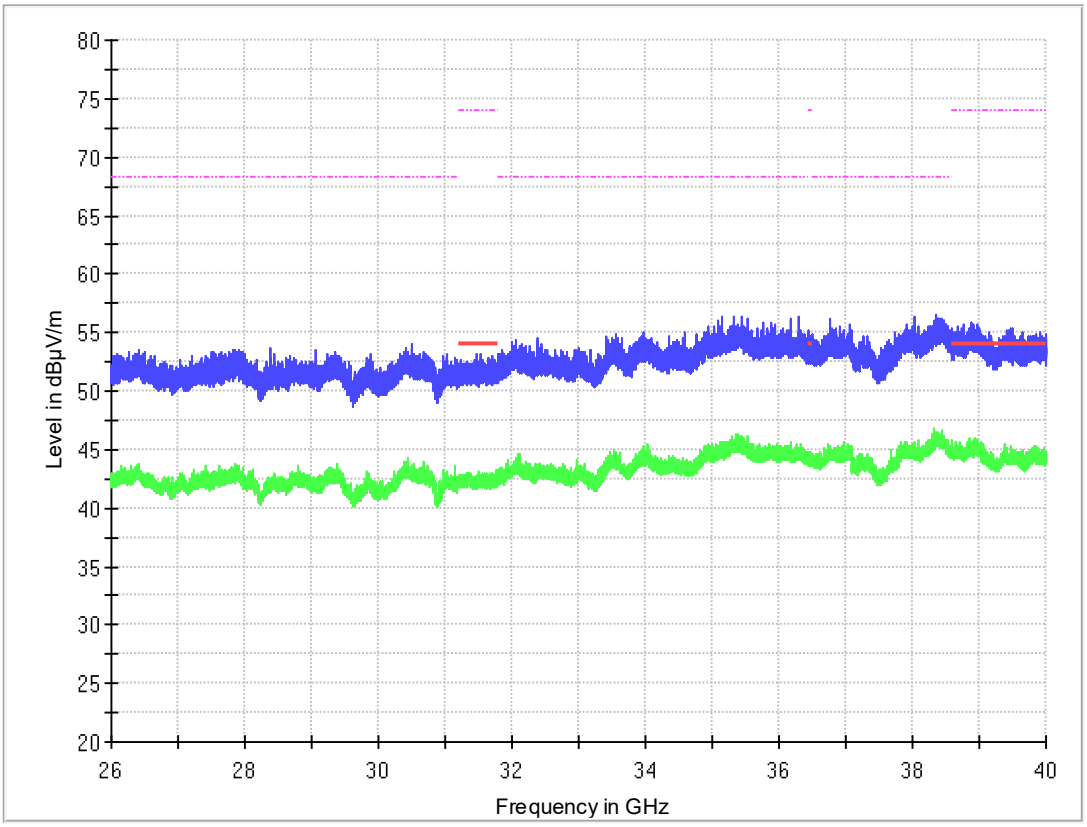
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 1GHz - 26GHz, Subband = U-NII-2A
(S02_166_AE01)



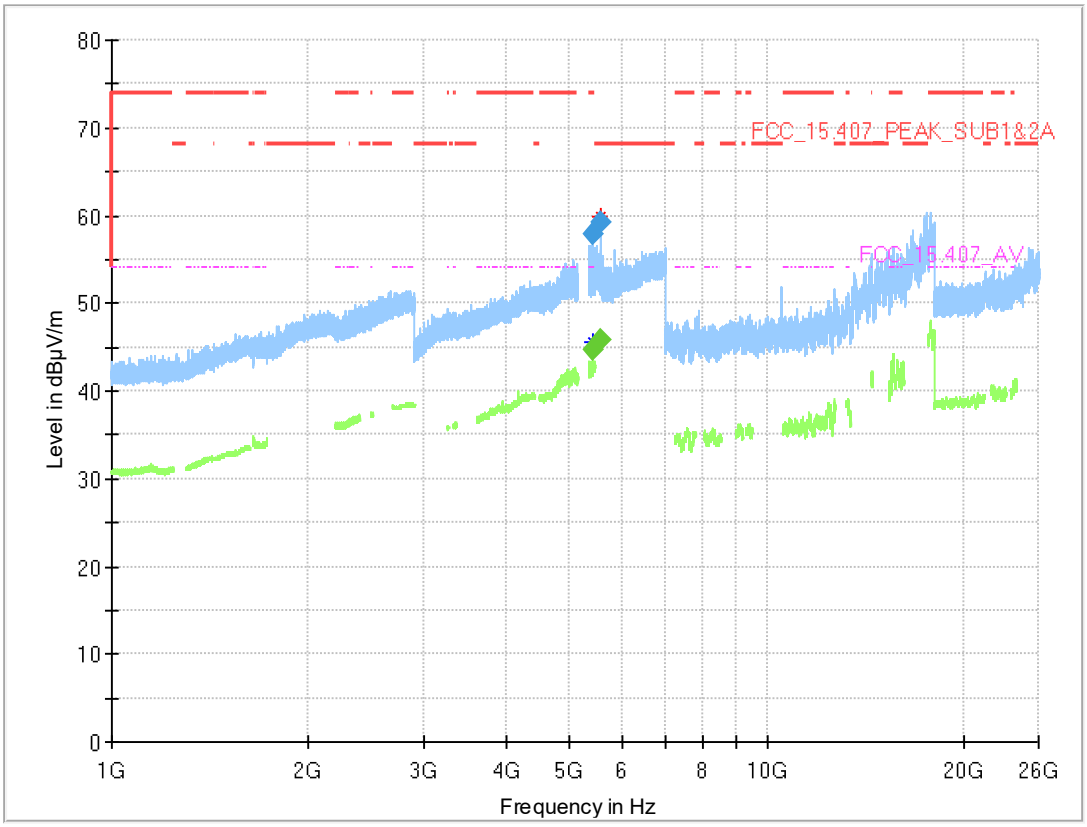
Final_Result

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)
5384.100	---	47.2	54.00	6.84	1000.0	1000.000	150.0	H	-142.0	2.0	14.3
5384.100	65.3	---	74.00	8.72	1000.0	1000.000	150.0	H	-142.0	2.0	14.3
5384.210	---	47.6	54.00	6.36	1000.0	1000.000	150.0	H	-146.0	4.0	14.3
5384.210	65.9	---	74.00	8.10	1000.0	1000.000	150.0	H	-146.0	4.0	14.3

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 26GHz - 40GHz, Subband = U-NII-3
(S02_166_AE01)



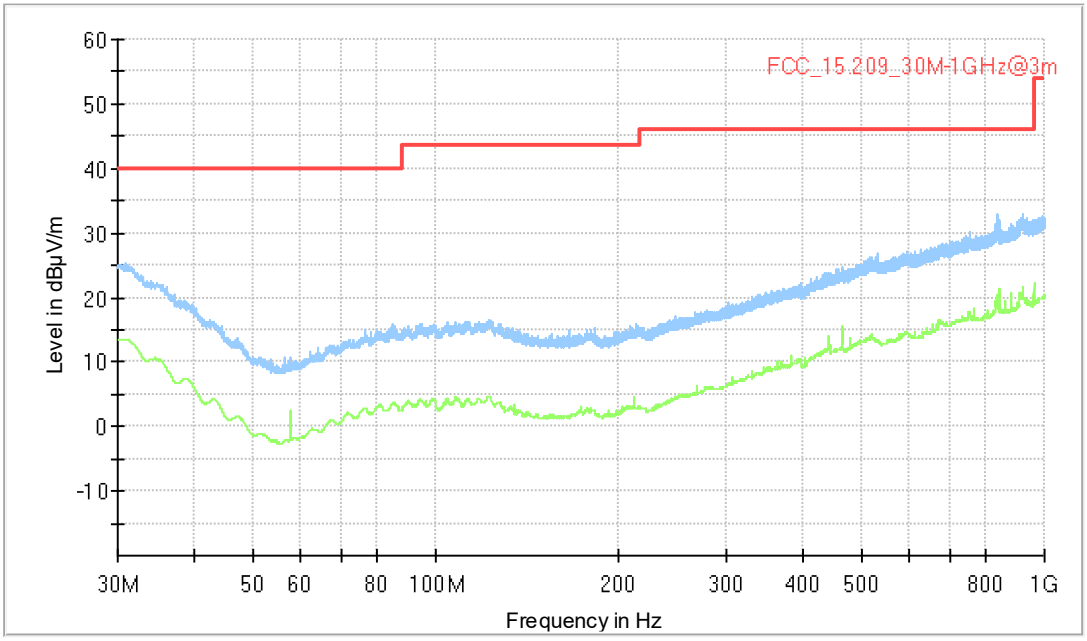
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-2A
(S02_166_AE01)



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)
5426.010	57.9	---	74.00	16.05	1000.0	1000.000	150.0	H	-9.0	-5.0	14.5
5426.010	---	44.7	54.00	9.30	1000.0	1000.000	150.0	H	-9.0	-5.0	14.5
5579.658	59.2	---	68.20	9.02	1000.0	1000.000	150.0	H	-138.0	7.0	14.4
5579.658	---	45.9	---	---	1000.0	1000.000	150.0	H	-138.0	7.0	14.4

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 30MHz - 1GHz, Subband = U-NII-2A
(S02_166_AE01)



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)
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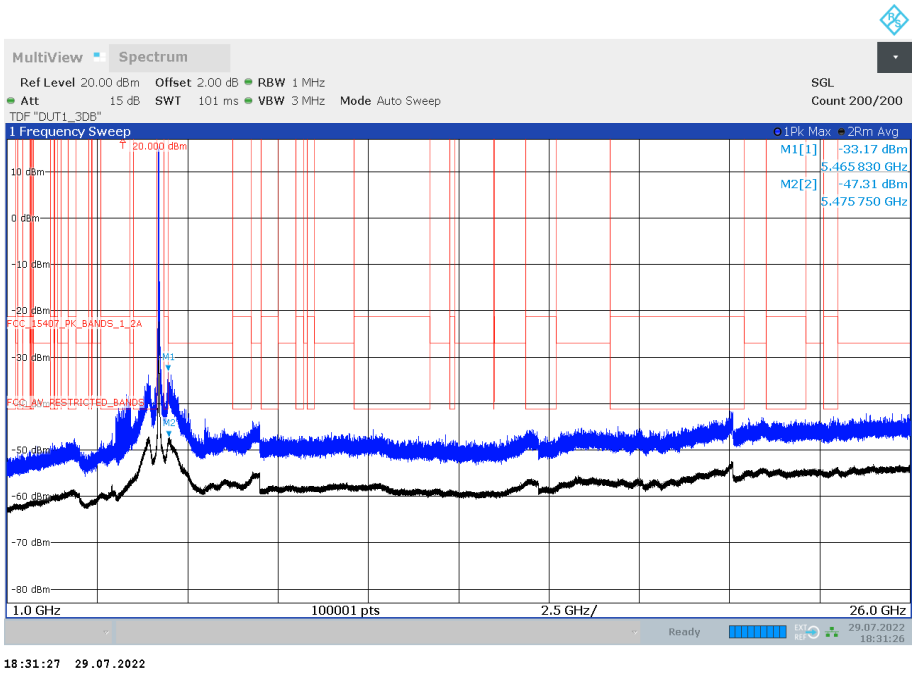
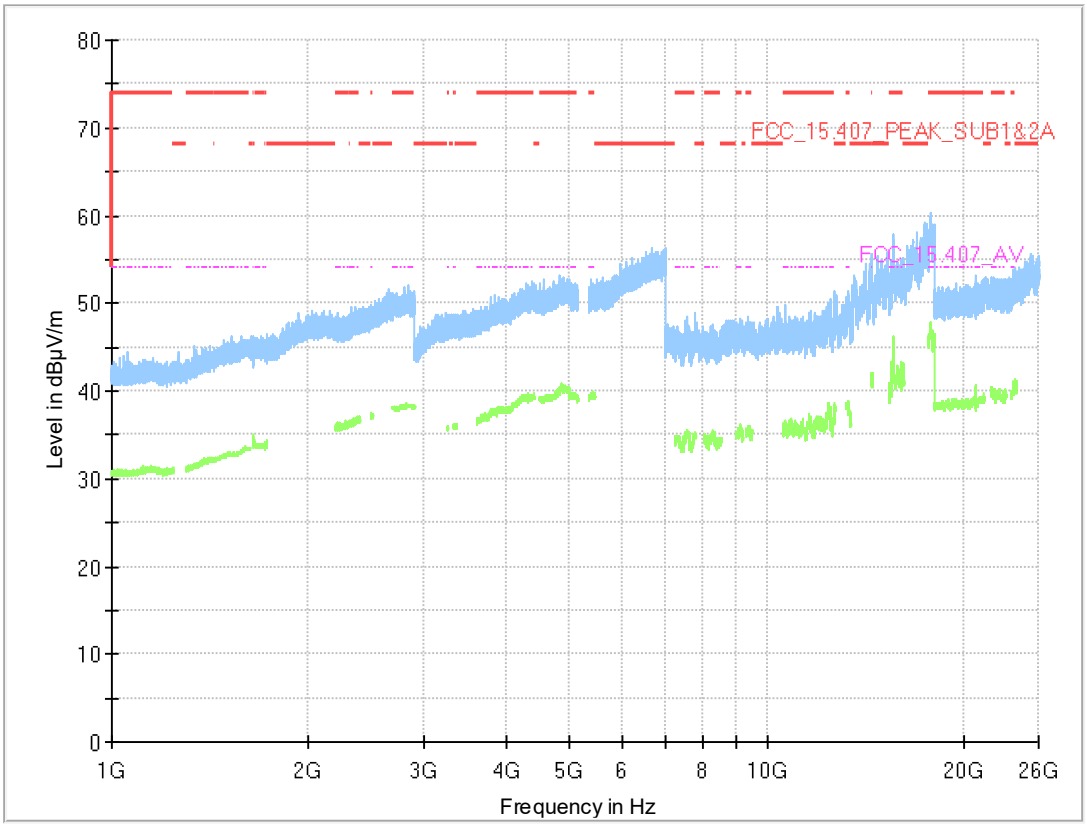
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 1GHz - 26GHz, Subband = U-NII-1
(S01_166_AB01)



Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 1GHz - 26GHz, Subband = U-NII-1
(S02_166_AB01)



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)
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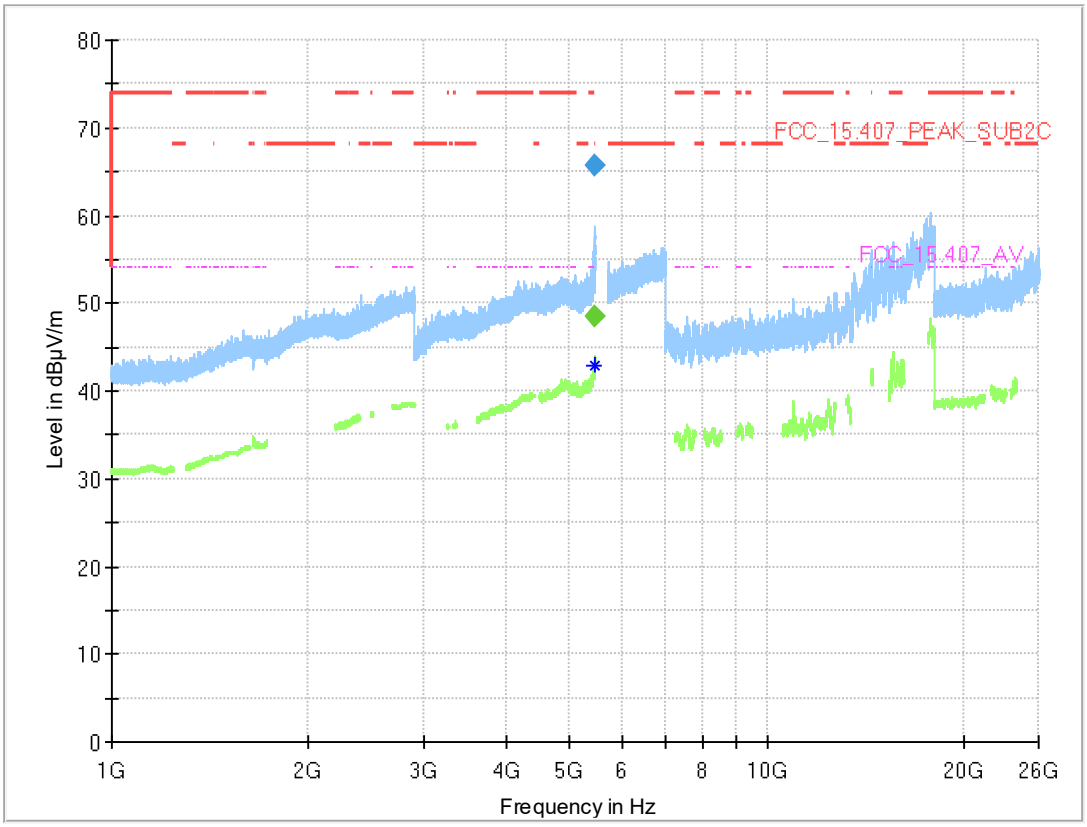
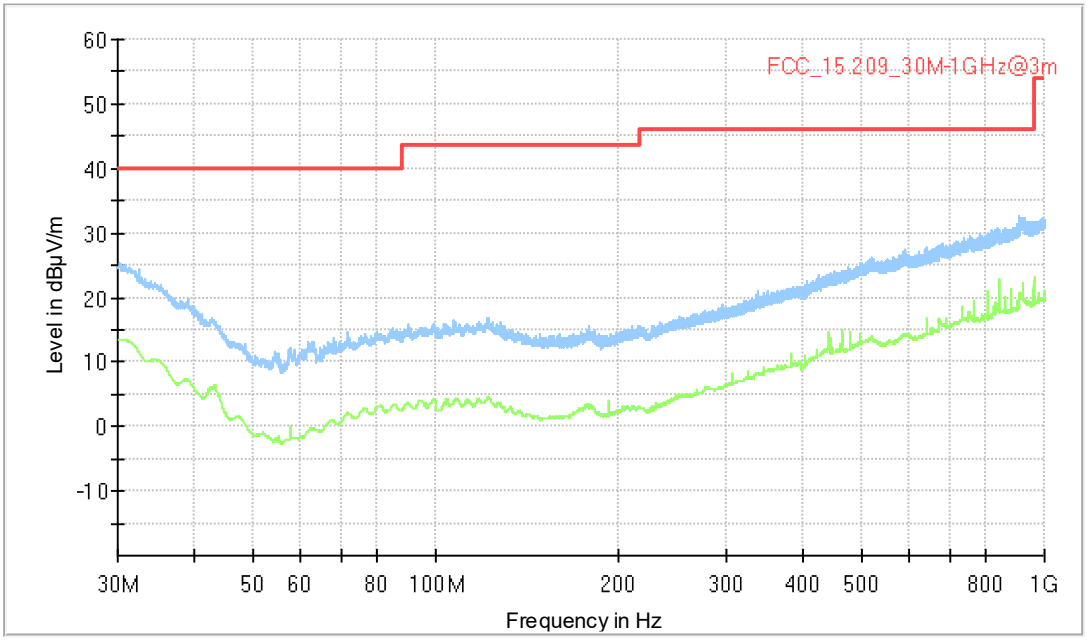
Radio Technology = WLAN a, Operating Frequency = low, Measurement range = 1GHz - 26GHz, Subband = U-NII-2C
(S02_166_AE01)



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)
5458.570	---	48.5	54.00	5.51	1000.0	1000.000	150.0	H	-143.0	6.0	14.5
5458.570	65.6	---	74.00	8.39	1000.0	1000.000	150.0	H	-143.0	6.0	14.5

Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 30MHz - 1GHz, Subband = U-NII-1
(S02_166_AB01)



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)
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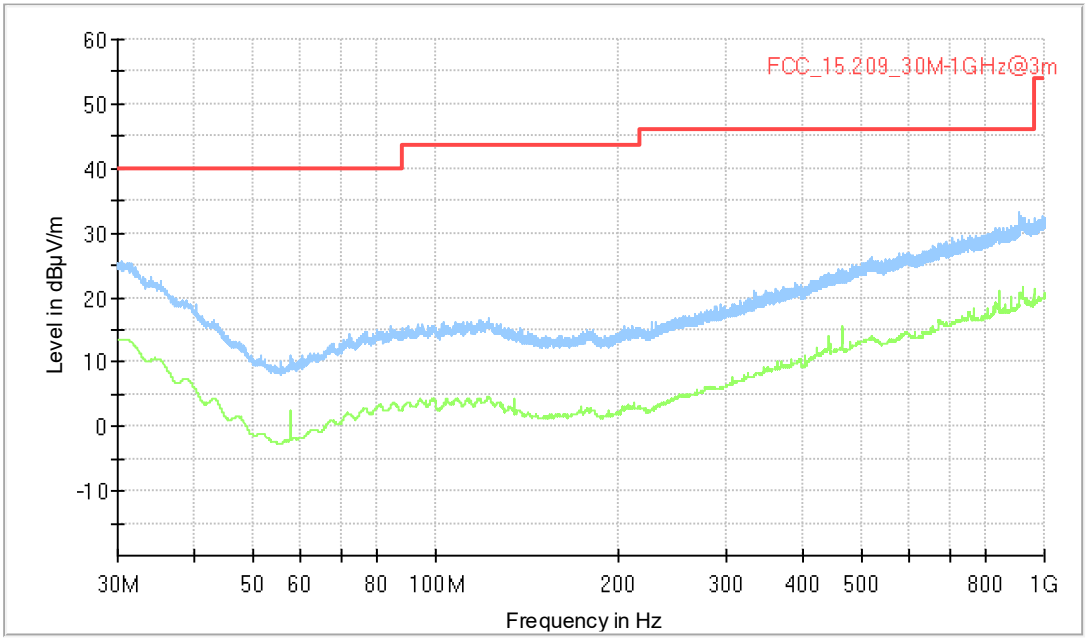
Radio Technology = WLAN a, Operating Frequency = mid, Measurement range = 30MHz - 1GHz, Subband = U-NII-1
(S02_166_AE01)



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)
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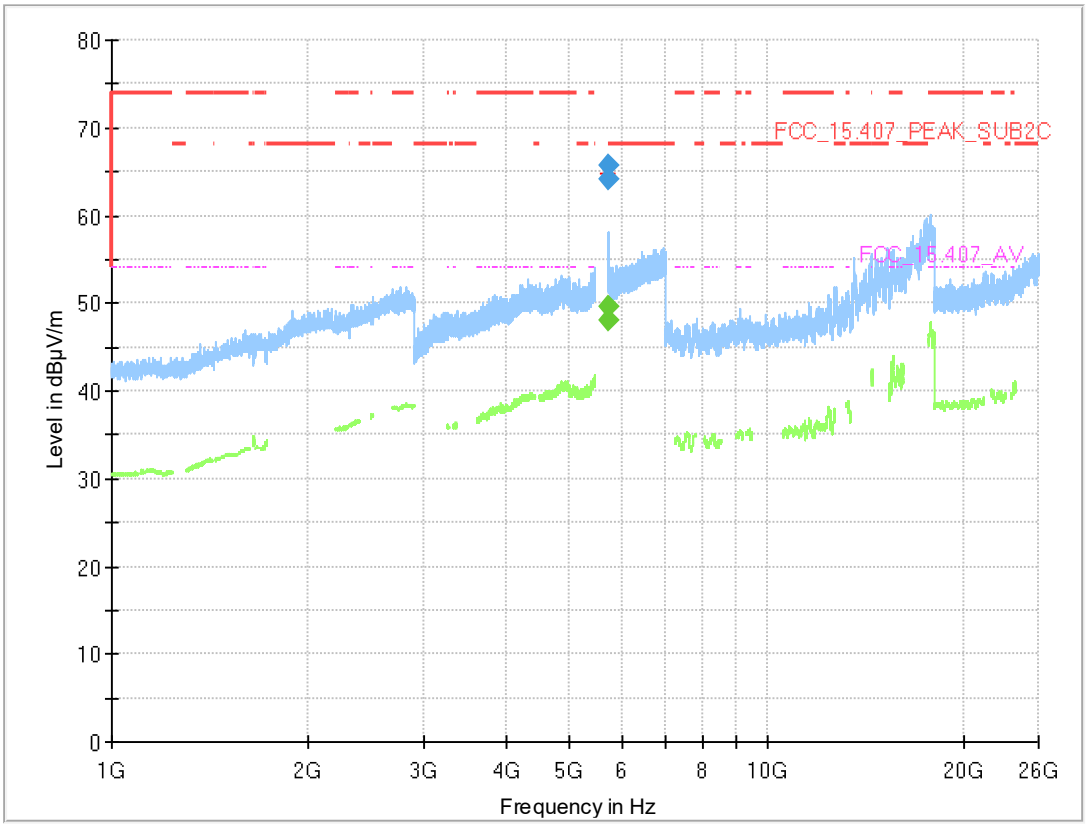
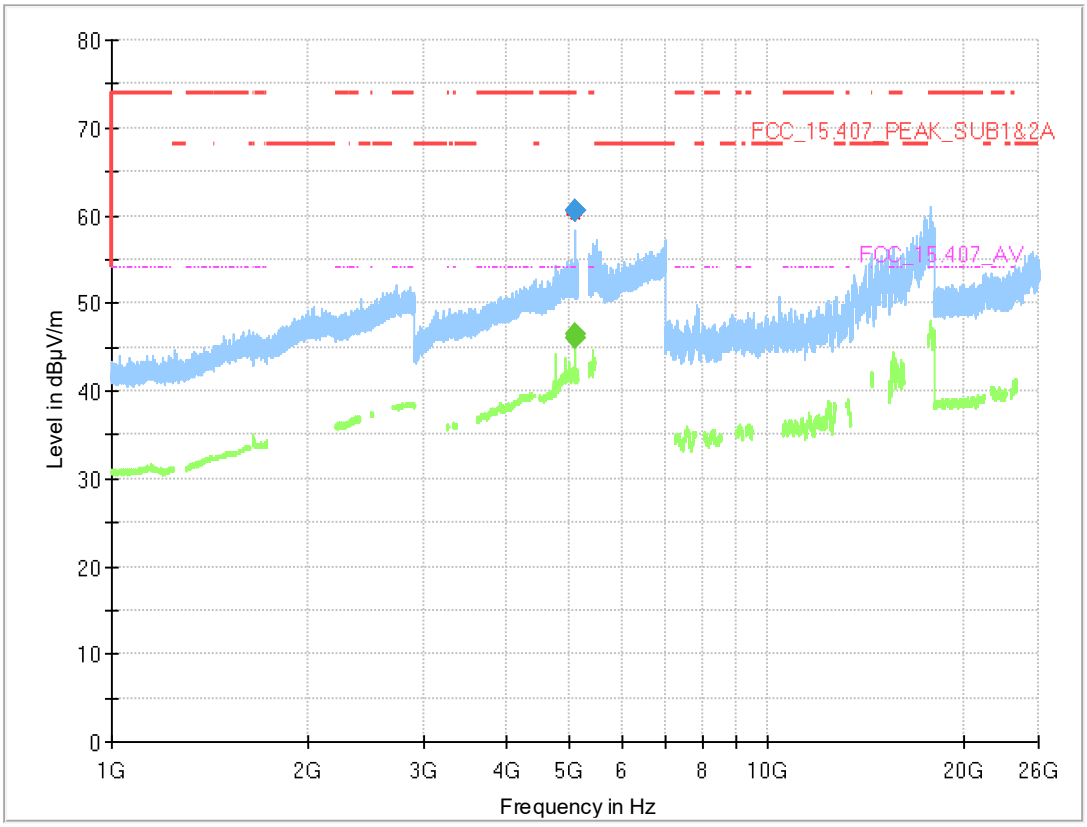
Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 1GHz - 26GHz, Subband = U-NII-2C
(S02_166_AE01)



Final_Result

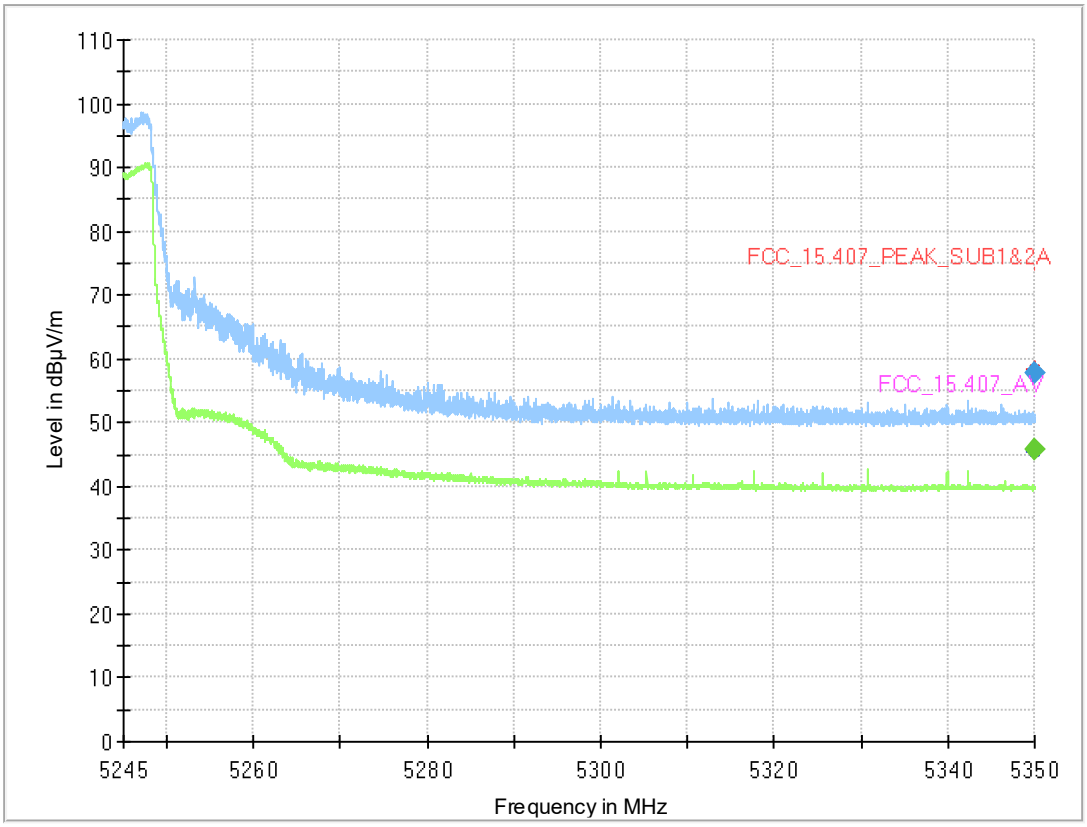
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
5725.297	65.6	---	68.20	2.61	1000.0	1000.000	150.0	H	-137.0	9.0	14.2
5725.297	---	49.6	---	---	1000.0	1000.000	150.0	H	-137.0	9.0	14.2
5727.076	---	48.0	---	---	1000.0	1000.000	150.0	H	-137.0	-1.0	14.2
5727.076	64.1	---	68.20	4.12	1000.0	1000.000	150.0	H	-137.0	-1.0	14.2

Radio Technology = WLAN a, Operating Frequency = high, Measurement range = 1GHz - 26GHz, Subband = U-NII-1
(S02_166_AE01)



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)
5111.325	---	46.4	54.00	7.55	1000.0	1000.000	150.0	H	-144.0	4.0	13.7
5111.325	60.6	---	74.00	13.37	1000.0	1000.000	150.0	H	-144.0	4.0	13.7
5111.488	---	46.0	54.00	7.98	1000.0	1000.000	150.0	H	-141.0	-2.0	13.7
5111.488	60.6	---	74.00	13.41	1000.0	1000.000	150.0	H	-141.0	-2.0	13.7



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	57.9	---	74.00	16.13	1000.0	1000.000	150.0	H	-187.0	15.0	14.1
5350.000	---	45.7	54.00	8.27	1000.0	1000.000	150.0	H	-146.0	6.0	14.1