

FCC Measurement/Technical Report on WLAN and Bluetooth Module MAYA-W160

FCC ID: XPYMAW160
IC: 8595A-MAYAW160

Test Report Reference: MDE_UBLOX_2404_FCC_03_rev01

Test Laboratory:

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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.

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

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz

Note:

The tests were selected and performed with reference to the FCC Public Notice "Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules, 558074 D01 15.247 Meas Guidance v05r02, 2019-04-02". ANSI C63.10-2013 is applied.

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for DTS (e.g. WLAN 2.4 GHz, BT LE) equipment from FCC and IC

DTS 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 | § 15.247 (a) (2) | RSS-247 Issue 3: 5.2 (a) |
| Peak conducted output power | § 15.247 (b) (3), (4) | RSS-247 Issue 3: 5.4 (d) |
| Transmitter spurious RF conducted emissions | § 15.247 (d) | RSS-Gen Issue 5 & AMD 1 & AMD 2: 6.13 / 8.9/8.10; RSS-247 Issue 3: 5.5 |
| Transmitter spurious radiated emissions | § 15.247 (d); § 15.209 (a) | RSS-Gen Issue 5 & AMD 1 & AMD 2: 6.13 / 8.9/8.10; RSS-247 Issue 3: 5.5 |
| Band edge compliance | § 15.247 (d) | RSS-247 Issue 3: 5.5 |
| Power density | § 15.247 (e) | RSS-247 Issue 3: 5.2 (b) |
| Antenna requirement | § 15.203 / 15.204 | RSS-Gen Issue 5 & AMD 1 & AMD 2: 8.3 |
| Receiver spurious emissions | – | – |

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 15 Subpart C §15.247

§ 15.247 (b) (3)

Peak Power Output

The measurement was performed according to ANSI C63.10, chapter 11.9.1.1/11.9.2.3.2

Final Result

| OP-Mode Radio Technology, Operating Frequency, Measurement method | Setup | Date | FCC | IC |
|---|--------------|------------|--------|--------|
| Bluetooth BDR, high, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth BDR, low, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth BDR, mid, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth EDR 2, high, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth EDR 2, low, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth EDR 2, mid, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth EDR 3, high, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth EDR 3, low, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth EDR 3, mid, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth LE 1 Mbps, high, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth LE 1 Mbps, low, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth LE 1 Mbps, mid, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth LE 2 Mbps, high, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth LE 2 Mbps, low, conducted | S04_160_AB02 | 2024-07-10 | Passed | Passed |
| Bluetooth LE 2 Mbps, mid, conducted | S04_160_AB02 | 2024-09-12 | Passed | Passed |
| WLAN b, high, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN b, low, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN b, mid, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN g, high, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN g, low, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN g, mid, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN n 20 MHz, high, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN n 20 MHz, low, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN n 20 MHz, mid, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN n 40 MHz, high, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN n 40 MHz, low, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |
| WLAN n 40 MHz, mid, conducted | S04_160_AB02 | 2024-07-08 | Passed | Passed |

47 CFR CHAPTER I FCC PART 15
Subpart C §15.247

§ 15.247 (d)

Transmitter Spurious Radiated Emissions

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 | | | | |
| Bluetooth BDR, high, 1 GHz - 26 GHz | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| Bluetooth BDR, high, 1 GHz - 26 GHz | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| Bluetooth BDR, mid, 30 MHz - 1 GHz Remark: Tested together with WLAN | S01_160_AB02 | 2024-08-12 | Passed | Passed |
| Bluetooth BDR, mid, 30 MHz - 1 GHz Remark: Tested together with WLAN | S03_160_AA01 | 2024-07-09 | Passed | Passed |
| Bluetooth BDR, mid, 9 kHz - 30 MHz Remark: Tested together with WLAN | S01_160_AB02 | 2024-08-12 | Passed | Passed |
| Bluetooth BDR, mid, 9 kHz - 30 MHz Remark: Tested together with WLAN | S03_160_AA01 | 2024-07-09 | Passed | Passed |
| WLAN b, high, 1 GHz - 26 GHz | S01_160_AC03 | 2024-08-05 | Passed | Passed |
| WLAN b, high, 1 GHz - 26 GHz | S03_160_AB02 | 2024-08-01 | Passed | Passed |
| WLAN b, high, 30 MHz - 1 GHz Remark: Tested together with Bluetooth | S01_160_AB02 | 2024-08-12 | Passed | Passed |
| WLAN b, high, 30 MHz - 1 GHz Remark: Tested together with Bluetooth | S03_160_AA01 | 2024-07-09 | Passed | Passed |
| WLAN b, high, 9 kHz - 30 MHz Remark: Tested together with Bluetooth | S01_160_AB02 | 2024-08-12 | Passed | Passed |
| WLAN b, high, 9 kHz - 30 MHz Remark: Tested together with Bluetooth | S03_160_AA01 | 2024-07-09 | Passed | Passed |
| WLAN b, low, 1 GHz - 26 GHz Remark: Tested in range 3.6 to 5.15 GHz only. | S01_160_AC03 | 2024-08-23 | Passed | Passed |
| WLAN b, mid, 1 GHz - 26 GHz Remark: Tested in range 3.6 to 5.15 GHz only. | S01_160_AC03 | 2024-08-23 | Passed | Passed |
| WLAN g, low, 1 GHz - 26 GHz Remark: Range 1 - 8 GHz tested only | S03_160_AC03 | 2024-08-14 | Passed | Passed |

47 CFR CHAPTER I FCC PART 15 § 15.247 (d)
Subpart C §15.247

Band Edge Compliance Radiated

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, Band Edge | | | | |
| Bluetooth BDR, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| Bluetooth BDR, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| Bluetooth EDR 2, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| Bluetooth EDR 2, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| Bluetooth EDR 3, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| Bluetooth EDR 3, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| Bluetooth LE 1 Mbps, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| Bluetooth LE 1 Mbps, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| Bluetooth LE 2 Mbps, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| Bluetooth LE 2 Mbps, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| WLAN b, high, high | S01_160_AC03 | 2024-08-05 | Passed | Passed |
| WLAN b, high, high | S03_160_AB02 | 2024-08-01 | Passed | Passed |
| WLAN g, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| WLAN g, low, low | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| WLAN g, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| WLAN n 20 MHz, low, low | S01_160_AC03 | 2024-08-14 | Passed | Passed |
| WLAN n 20 MHz, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| WLAN n 20 MHz, high, high | S03_160_AB02 | 2024-07-31 | Passed | Passed |
| WLAN n 40 MHz, low, low | S03_160_AC03 | 2024-08-26 | Passed | Passed |
| WLAN n 40 MHz, high, high | S01_160_AB02 | 2024-08-04 | Passed | Passed |
| WLAN n 40 MHz, low, low | S03_160_AC03 | 2024-08-26 | Passed | Passed |
| WLAN n 40 MHz, high, high | S03_160_AC03 | 2024-08-26 | Passed | Passed |

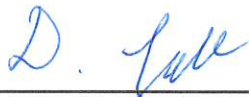
N/A: Not applicable

N/P: Not performed

2 REVISION HISTORY / SIGNATURES

| Report version control | | | |
|------------------------|--------------|------------------------|------------------|
| Version | Release date | Change Description | Version validity |
| initial | 2024-09-12 | -- | valid |
| rev01 | 2024-11-07 | Administrative changes | valid |

COMMENT: This test is a spot check report for antenna with higher gain at reduced power settings. Not all tests were performed. Full testing was performed in report MDE_UBLOX_2110_FCC_01 for a variant with different antenna connectors, while spot checks for this variant were performed in report MDE_UBLOX_2110_FCC_06.



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



(responsible for testing and report)
B.Sc. Mohamed Fraitat



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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: 2023-09-29

3.2 PROJECT DATA

Responsible for testing and report: B.Sc. Mohamed Fraitat
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2024-11-07
Testing Period: 2024-07-08 to 2024-09-12

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-W160-00B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Type | MAYA-W160-00B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PMN | MAYA-W160-00B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HVIN | MAYA-W160-00B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Declared EUT data by the supplier | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage Type | DC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Voltage Level | 1.8 V + 3.3 V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Antenna / Gain | External / 3 dBi (Molex Antenna), 4.1 dBi (Linx Antenna) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tested Modulation Type | BT Classic: GFSK (BDR), Pi/4 DQPSK (EDR 2), 8DPSK (EDR 3) BT LE: GFSK WLANb: DSSS WLANg/n: OFDM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Specific product description for the EUT | The EUT is a Bluetooth and WLAN module. In the 2.4 GHz band it supports SISO Mode only. Supported technologies are Bluetooth Classic, Bluetooth Low Energy and WLAN b, g, n 20 and 40 MHz bandwidth. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EUT ports (connected cables during testing): | Enclosure Data DC Antenna The EUT is a module with solder pads for surface mounting, so no cables were connected to the EUT itself. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tested datarates | BT Classic: 1 (BDR), 2 (EDR 2) and 3 Mbps (EDR 3) BT LE: 1 and 2 Mbps WLAN b: 1 Mbps, g: 6 Mbps, 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 | BT Classic: 6 dBm BT LE: 8 dBm WLAN: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="12">2.4 GHz</th> </tr> <tr> <th>Mode</th> <th>Ch.1</th> <th>Ch.2</th> <th>Ch.3</th> <th>Ch.4</th> <th>Ch.5</th> <th>Ch.6</th> <th>Ch.7</th> <th>Ch.8</th> <th>Ch.9</th> <th>Ch.10</th> <th>Ch.11</th> </tr> </thead> <tbody> <tr> <td>b</td> <td>16</td> <td colspan="6">16</td> <td colspan="4"></td> <td>16</td> </tr> <tr> <td>g</td> <td>14</td> <td>16</td> <td colspan="6">16</td> <td colspan="2"></td> <td>15</td> <td>14</td> </tr> <tr> <td>n20</td> <td>13</td> <td>14</td> <td colspan="6">14</td> <td colspan="2"></td> <td>14</td> <td>13</td> </tr> <tr> <td>n40</td> <td>N/A</td> <td>N/A</td> <td>12</td> <td>13</td> <td>14</td> <td colspan="3">13</td> <td>N/A</td> <td>N/A</td> <td></td> </tr> </tbody> </table> <p>Note by the laboratory: power reduced by 2 dB compared to original certification, gain raised by 1 / 2.1 dB</p> | 2.4 GHz | | | | | | | | | | | | Mode | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | Ch.8 | Ch.9 | Ch.10 | Ch.11 | b | 16 | 16 | | | | | | | | | | 16 | g | 14 | 16 | 16 | | | | | | | | 15 | 14 | n20 | 13 | 14 | 14 | | | | | | | | 14 | 13 | n40 | N/A | N/A | 12 | 13 | 14 | 13 | | | N/A | N/A | |
| 2.4 GHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mode | Ch.1 | Ch.2 | Ch.3 | Ch.4 | Ch.5 | Ch.6 | Ch.7 | Ch.8 | Ch.9 | Ch.10 | Ch.11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| b | 16 | 16 | | | | | | | | | | 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| g | 14 | 16 | 16 | | | | | | | | 15 | 14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| n20 | 13 | 14 | 14 | | | | | | | | 14 | 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| n40 | N/A | N/A | 12 | 13 | 14 | 13 | | | N/A | N/A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

4.2 EUT MAIN COMPONENTS

| Sample Name | Sample Code | Description |
|------------------|--|-------------|
| MAYA-W160 AA01 | AA01 | |
| Sample Parameter | Value | |
| Serial No. | M426C1DEB90FBA80522 | |
| HW Version | 04 | |
| SW Version | W16.92.21.p22-16.92.21.p22-MXM5X16298_V0 | |
| Comment | | |

| Sample Name | Sample Code | Description |
|------------------|--|-------------|
| MAYA-W160 AB02 | AB02 | - |
| Sample Parameter | Value | |
| Serial No. | M426C1DEB90FBA80400 | |
| HW Version | 04 | |
| SW Version | W16.92.21.p22-16.92.21.p22-MXM5X16298_V0 | |
| Comment | | |

| Sample Name | Sample Code | Description |
|------------------|--|-------------|
| MAYA-W160 AC03 | AC03 | - |
| Sample Parameter | Value | |
| Serial No. | M426C1DEB90FBA80400 | |
| HW Version | 04 | |
| SW Version | W16.92.21.p22-16.92.21.p22-MXM5X16298_V0 | |
| Comment | | |

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

4.3 ANCILLARY EQUIPMENT

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

| 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 |
|---------------|--|--|
| AUX 01 | Molex, 146153-0100, -, - , - | Molex PCB Antenna gain 2.4 GHz: 3 dBi 5 GHz: 4.0 dBi |
| AUX 02 | Linx, ANT-DB1-RAF-SMA, -, - , - | Linx Dipole Antenna gain 2.4 GHz: 4.1 dBi 5 GHz: 5.1 dBi |
| AUX 04 | NXP, i.MX 8M MINI on 8MMINI-BB, REV A5, -, TR23390198 | Board Computer connected to Evaluation board for setting modes |
| AUX 07 | UBLOX, MAYA-W1 EVK, Rev. A, - , 10000002386989006001 | Evaluation board for module providing ports |
| AUX 08 | UBLOX, MAYA-W1 EVK, Rev. A, - , 10000002386989005003 | Evaluation board for module providing ports |
| AUX 09 | UBLOX, MAYA-W1 EVK, Rev. A, - , 10000002386976004002 | 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 |
|--------------|---------------------------------|----------------------------------|
| S04_160_AB02 | MAYA-W160 AB02, AUX 04, AUX 08, | Conducted Setup |
| S03_160_AC03 | MAYA-W160 AC03, AUX 01, AUX 09, | With Molex Antenna |
| S01_160_AC03 | MAYA-W160 AB02, AUX 02, AUX 09, | With Linx Antenna |
| S01_160_AB02 | MAYA-W160 AB02, AUX 02, AUX 08, | With Linx Antenna |
| S03_160_AA01 | MAYA-W160 AA01, AUX 07, AUX 01, | With Molex Antenna |
| S03_160_AB02 | MAYA-W160 AB02, AUX 08, AUX 01, | With Molex Antenna |

4.6 OPERATING MODES / TEST CHANNELS

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

WLAN

20 MHz Test Channels:

Channel:

Frequency [MHz]

| 2.4 GHz ISM 2400 - 2483.5 MHz | | |
|----------------------------------|------|------|
| low | mid | high |
| 1 | 6 | 11 |
| 2412 | 2437 | 2462 |

40 MHz Test Channels:

Channel:

Frequency [MHz]

| low | mid | high |
|------|------|------|
| 3 | 6 | 11 |
| 2422 | 2437 | 2462 |

BT Test Channels:

Channel:

Frequency [MHz]

| 2.4 GHz ISM 2400 - 2483.5 MHz | | |
|----------------------------------|------|------|
| low | mid | high |
| 0 | 39 | 78 |
| 2402 | 2441 | 2480 |

BT LE Test Channels:

Channel:

Frequency [MHz]

| 2.4 GHz ISM 2400 - 2483.5 MHz | | |
|----------------------------------|------|------|
| low | mid | high |
| 0 | 19 | 39 |
| 2402 | 2440 | 2480 |

Duty Cycles were copied from the initial project (same samples, same commands)

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 PEAK POWER OUTPUT

Standard **FCC Part 15 Subpart C**

The test was performed according to:
ANSI C63.10, chapter 11.9.1.1/11.9.2.3.2

5.1.1 TEST DESCRIPTION

DTS EQUIPMENT:

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.

Maximum peak conducted output power (e.g. Bluetooth Low Energy):

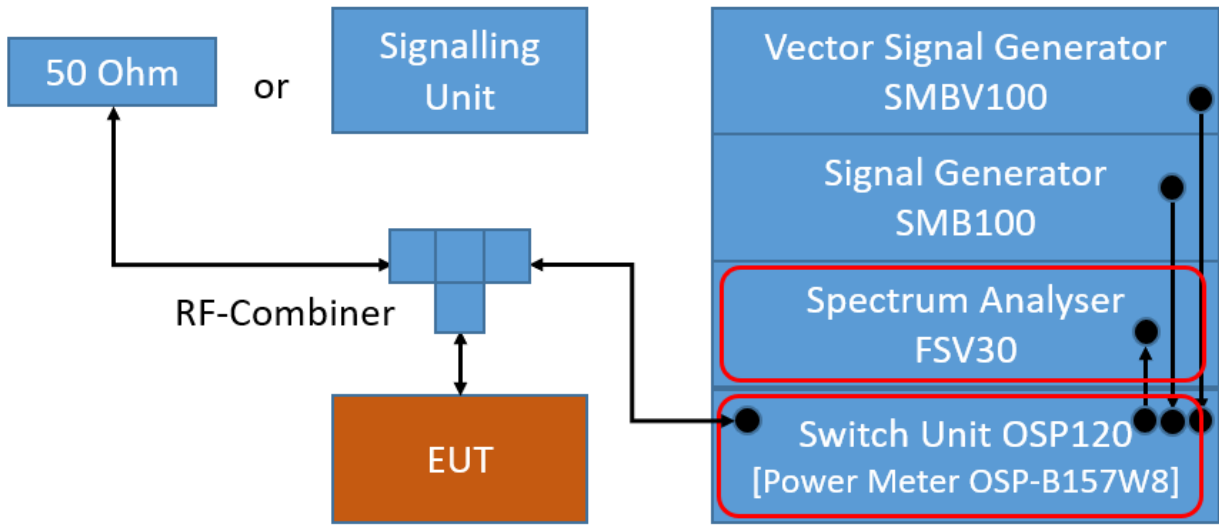
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered. The reference level of the spectrum analyser was set higher than the output power of the EUT.

Analyser settings:

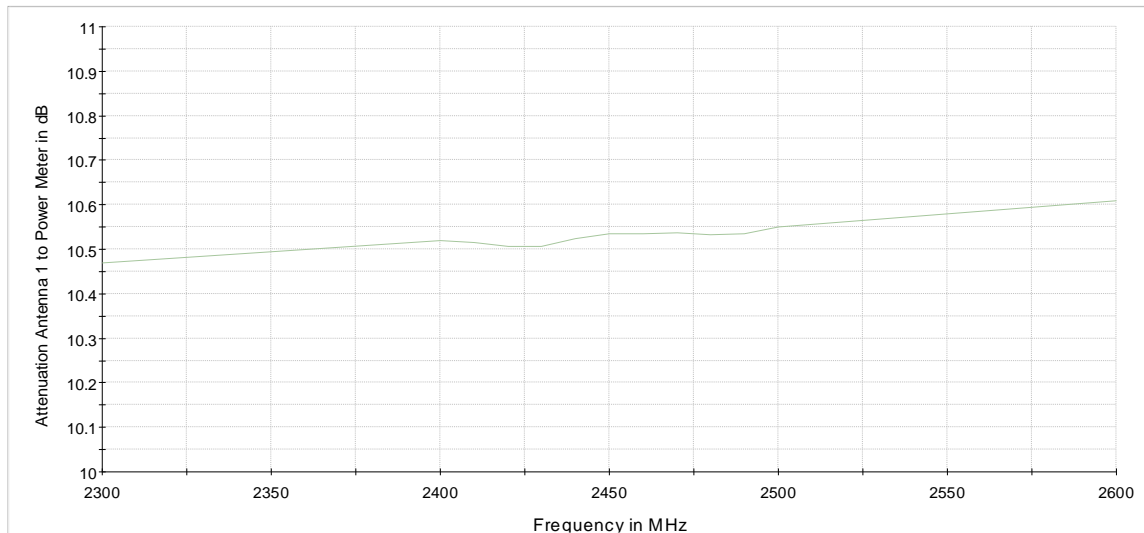
- Resolution Bandwidth (RBW): \geq DTS bandwidth
- Video Bandwidth (VBW): \geq 3 times RBW or maximum of analyzer
- Span: \geq 3 times RBW
- Trace: Maxhold
- Sweeps: Till stable (min. 300, max. 15000)
- Sweeptime: Auto
- Detector: Peak

Maximum conducted average output power (e.g. WLAN):

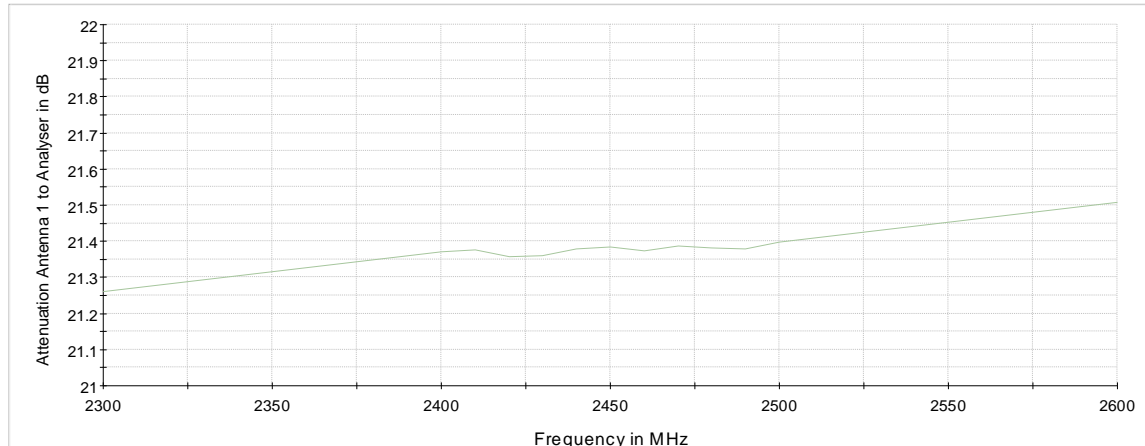
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered. Measurement is performed using the gated RF average power meter integrated in the OSP 120 module OSP-B157W8 with signal bandwidth >300 MHz.



TS8997; Output Power



Attenuation of the measurement path to Power Meter



Attenuation of the measurement path to Analyser

5.1.2 TEST REQUIREMENTS / LIMITS

DTS devices:

FCC Part 15, Subpart C, §15.247 (b) (3)

For systems using digital modulation techniques in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1 watt.

=> Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

Frequency Hopping Systems:

FCC Part 15, Subpart C, §15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

FCC Part 15, Subpart C, §15.247 (b) (2)

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW)

5.1.3 TEST PROTOCOL

Ambient temperature: 24 - 27 °C
 Air Pressure: 1009 - 1011 hPa
 Humidity: 40 - 50 %
 BT GFSK (1-DH1)

| Band | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 0 | 2402 | 5.5 | 30.0 | 24.5 | 9.6 |
| | 39 | 2441 | 5.3 | 30.0 | 24.7 | 9.4 |
| | 78 | 2480 | 5.1 | 30.0 | 24.9 | 9.2 |

BT π/4 DQPSK (2-DH1)

| Band | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 0 | 2402 | 4.4 | 30.0 | 25.6 | 8.5 |
| | 39 | 2441 | 4.4 | 30.0 | 25.6 | 8.5 |
| | 78 | 2480 | 4.2 | 30.0 | 25.8 | 8.3 |

BT 8-DPSK (3-DH1)

| Band | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 0 | 2402 | 4.9 | 30.0 | 25.1 | 9.0 |
| | 39 | 2441 | 4.7 | 30.0 | 25.3 | 8.8 |
| | 78 | 2480 | 4.4 | 30.0 | 25.6 | 8.5 |

BT LE 1 Mbit/s

| Band | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 0 | 2402 | 5.8 | 30.0 | 24.2 | 9.9 |
| | 19 | 2440 | 5.7 | 30.0 | 24.3 | 9.8 |
| | 39 | 2480 | 5.6 | 30.0 | 24.4 | 9.7 |

BT LE 2 Mbit/s

| Band | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 0 | 2402 | 5.9 | 30.0 | 24.1 | 10.0 |
| | 19 | 2440 | 5.9 | 30.0 | 24.1 | 10.0 |
| | 39 | 2480 | 6.5 | 30.0 | 23.5 | 10.6 |

WLAN b-Mode; 20 MHz; 1 Mbit/s

| Band | Channel No. | Frequency [MHz] | Maximum Average Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|-----------------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 1 | 2412 | 17.0 | 30.0 | 13.0 | 21.1 |
| | 6 | 2437 | 17.0 | 30.0 | 13.0 | 21.1 |
| | 11 | 2462 | 17.0 | 30.0 | 13.0 | 21.1 |

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

| Band | Channel No. | Frequency [MHz] | Maximum Average Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|-----------------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 1 | 2412 | 14.7 | 30.0 | 15.3 | 18.8 |
| | 6 | 2437 | 16.8 | 30.0 | 13.3 | 20.9 |
| | 11 | 2462 | 14.7 | 30.0 | 15.3 | 18.8 |

WLAN n-Mode; 20 MHz; MCS0

| Band | Channel No. | Frequency [MHz] | Maximum Average Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|-----------------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 1 | 2412 | 13.9 | 30.0 | 16.1 | 18.0 |
| | 6 | 2437 | 14.9 | 30.0 | 15.1 | 19.0 |
| | 11 | 2462 | 13.9 | 30.0 | 16.1 | 18.0 |

WLAN n-Mode; 40 MHz; MCS0

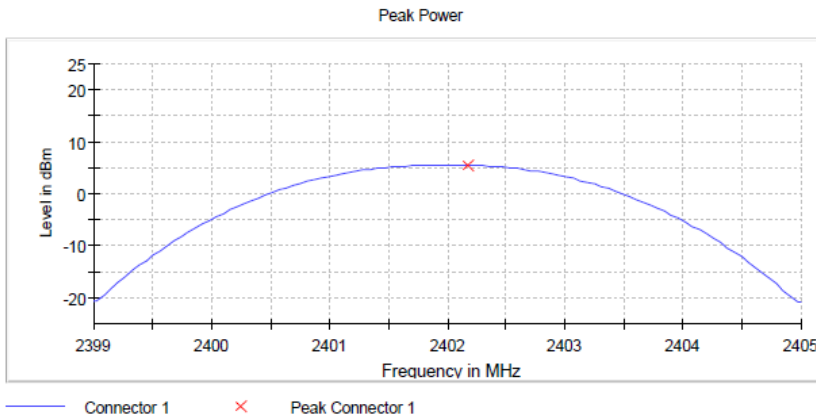
| Band | Channel No. | Frequency [MHz] | Maximum Average Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
|-------------|-------------|-----------------|-----------------------------|-------------|----------------------|---------------|
| 2.4 GHz ISM | 3 | 2422 | 12.8 | 30.0 | 17.2 | 16.9 |
| | 6 | 2437 | 14.8 | 30.0 | 15.2 | 18.9 |
| | 9 | 2452 | 13.7 | 30.0 | 16.3 | 17.8 |

Remark: Please see next sub-clause for the measurement plot.
No plots provided for WLAN (power meter measurement).

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

Radio Technology = Bluetooth BDR, Operating Frequency = low, Measurement method = conducted
(S04_160_AB02)

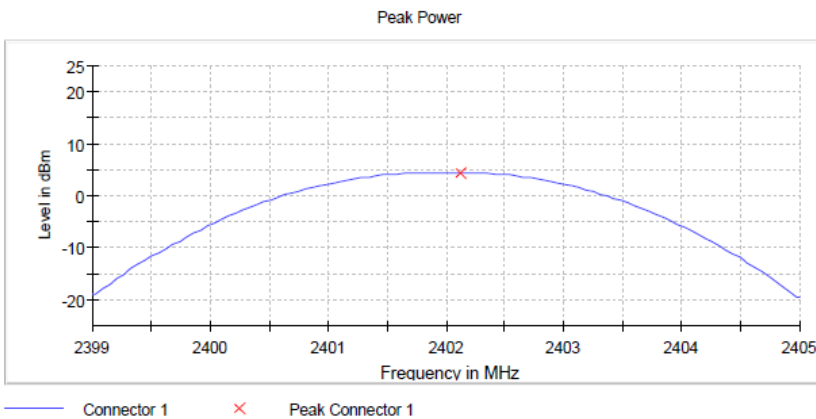
| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---------------------|------------------|-----------------|--------|
| 2402.000000 | 5.5 | 21.0 | PASS |



| Setting | Instrument Value |
|-----------------------|------------------|
| Start Frequency | 2.39900 GHz |
| Stop Frequency | 2.40500 GHz |
| Span | 6.000 MHz |
| RBW | 2.000 MHz |
| VBW | 10.000 MHz |
| SweepPoints | 101 |
| Sweeptime | 953.450 ns |
| Reference Level | 0.000 dBm |
| Attenuation | 20.000 dB |
| Detector | MaxPeak |
| SweepCount | 100 |
| Filter | 3 dB |
| Trace Mode | Max Hold |
| SweepType | FFT |
| Preamp | off |
| Stablemode | Trace |
| Stablevalue | 0.50 dB |
| Run | 4 / max. 150 |
| Stable | 3 / 3 |
| Max Stable Difference | 0.01 dB |

Radio Technology = Bluetooth EDR 2, Operating Frequency = low, Measurement method = conducted
(S04_160_AB02)

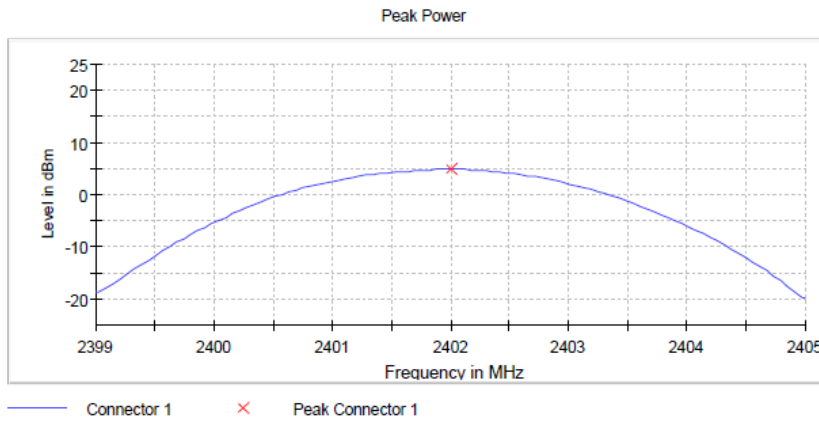
| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---------------------|------------------|-----------------|--------|
| 2402.000000 | 4.4 | 21.0 | PASS |



| Setting | Instrument Value |
|-----------------------|------------------|
| Start Frequency | 2.39900 GHz |
| Stop Frequency | 2.40500 GHz |
| Span | 6.000 MHz |
| RBW | 2.000 MHz |
| VBW | 10.000 MHz |
| SweepPoints | 101 |
| Sweeptime | 953.450 ns |
| Reference Level | 0.000 dBm |
| Attenuation | 20.000 dB |
| Detector | MaxPeak |
| SweepCount | 100 |
| Filter | 3 dB |
| Trace Mode | Max Hold |
| SweepType | FFT |
| Preamp | off |
| Stablemode | Trace |
| Stablevalue | 0.50 dB |
| Run | 4 / max. 150 |
| Stable | 3 / 3 |
| Max Stable Difference | 0.00 dB |

Radio Technology = Bluetooth EDR 3, Operating Frequency = low, Measurement method = conducted (S04_160_AB02)

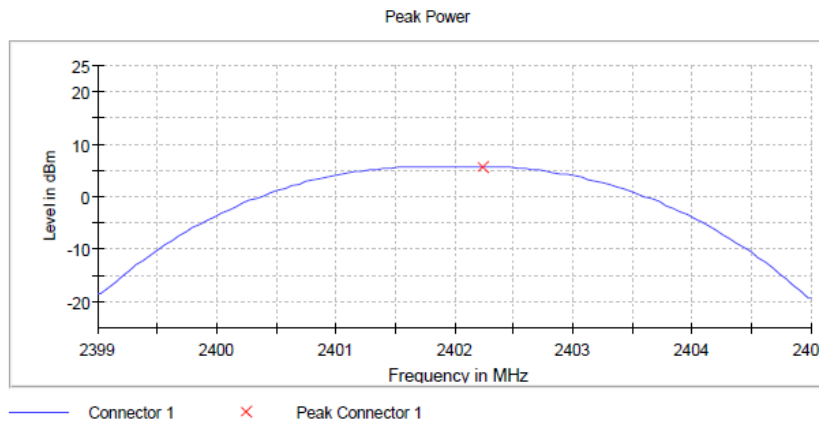
| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---------------------|------------------|-----------------|--------|
| 2402.000000 | 4.9 | 21.0 | PASS |



| Setting | Instrument Value |
|-----------------------|------------------|
| Start Frequency | 2.39900 GHz |
| Stop Frequency | 2.40500 GHz |
| Span | 6.000 MHz |
| RBW | 2.000 MHz |
| VBW | 10.000 MHz |
| SweepPoints | 101 |
| Sweeptime | 953.450 ns |
| Reference Level | 0.000 dBm |
| Attenuation | 20.000 dB |
| Detector | MaxPeak |
| SweepCount | 100 |
| Filter | 3 dB |
| Trace Mode | Max Hold |
| Sweeptype | FFT |
| Preamp | off |
| Stablemode | Trace |
| Stablevalue | 0.50 dB |
| Run | 4 / max. 150 |
| Stable | 3 / 3 |
| Max Stable Difference | 0.00 dB |

Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = low, Measurement method = conducted (S04_160_AB02)

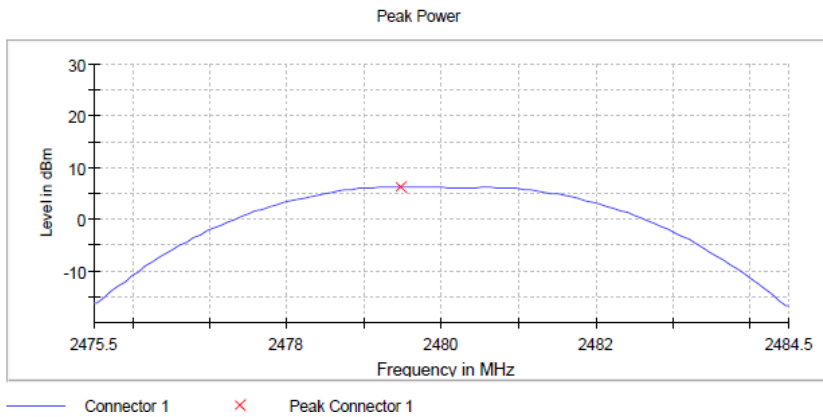
| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---------------------|------------------|-----------------|--------|
| 2402.000000 | 5.8 | 30.0 | PASS |



| Setting | Instrument Value |
|-----------------------|------------------|
| Start Frequency | 2.39900 GHz |
| Stop Frequency | 2.40500 GHz |
| Span | 6.000 MHz |
| RBW | 2.000 MHz |
| VBW | 10.000 MHz |
| SweepPoints | 101 |
| Sweeptime | 953.450 ns |
| Reference Level | 0.000 dBm |
| Attenuation | 20.000 dB |
| Detector | MaxPeak |
| SweepCount | 100 |
| Filter | 3 dB |
| Trace Mode | Max Hold |
| Sweeptype | FFT |
| Preamp | off |
| Stablemode | Trace |
| Stablevalue | 0.50 dB |
| Run | 4 / max. 150 |
| Stable | 3 / 3 |
| Max Stable Difference | 0.00 dB |

Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = high, Measurement method = conducted (S04_160_AB02)

| DUT Frequency (MHz) | Peak Power (dBm) | Limit Max (dBm) | Result |
|---------------------|------------------|-----------------|--------|
| 2480.000000 | 6.4 | 30.0 | PASS |



| Setting | Instrument Value |
|-----------------------|------------------|
| Start Frequency | 2.47550 GHz |
| Stop Frequency | 2.48450 GHz |
| Span | 9.000 MHz |
| RBW | 3.000 MHz |
| VBW | 10.000 MHz |
| SweepPoints | 101 |
| SweepTime | 1.271 μ s |
| Reference Level | 0.000 dBm |
| Attenuation | 20.000 dB |
| Detector | MaxPeak |
| SweepCount | 100 |
| Filter | 3 dB |
| Trace Mode | Max Hold |
| SweepType | FFT |
| Preamp | off |
| Stablemode | Trace |
| Stablevalue | 0.50 dB |
| Run | 4 / max. 150 |
| Stable | 3 / 3 |
| Max Stable Difference | 0.00 dB |

5.1.5 TEST EQUIPMENT USED

- R&S TS8997

5.2 TRANSMITTER SPURIOUS RADIATED EMISSIONS

Standard **FCC Part 15 Subpart C**

The test was performed according to:

ANSI C63.10, chapter 6.4, 6.5, 6.6.5

5.2.1 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:

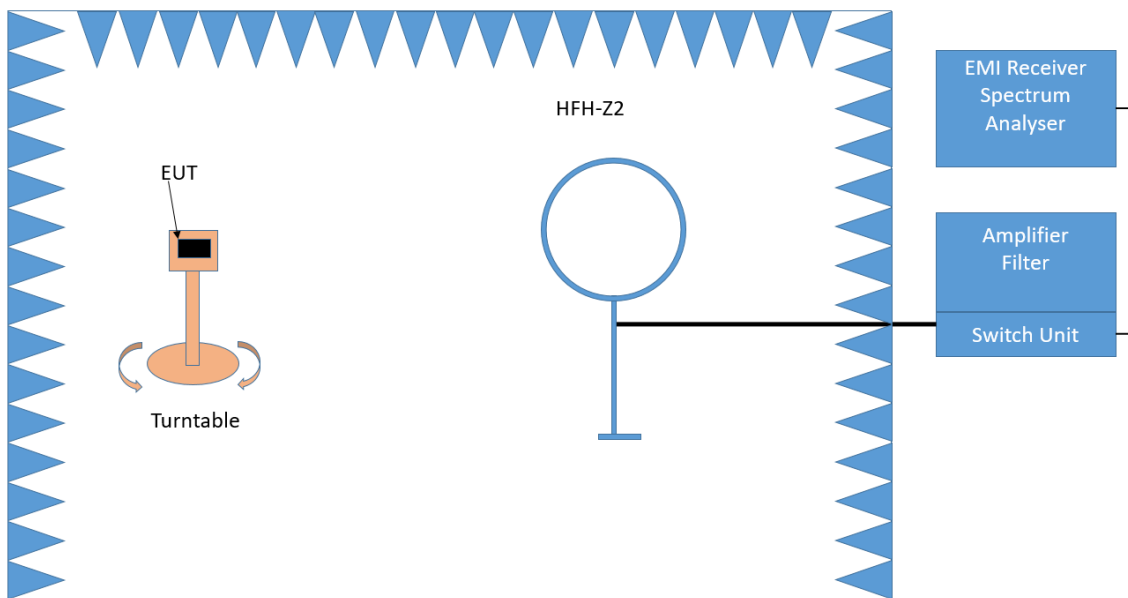
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHz: Chapter 6.6 (procedure according 6.6.5 used)

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
- Antenna height: 1 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)

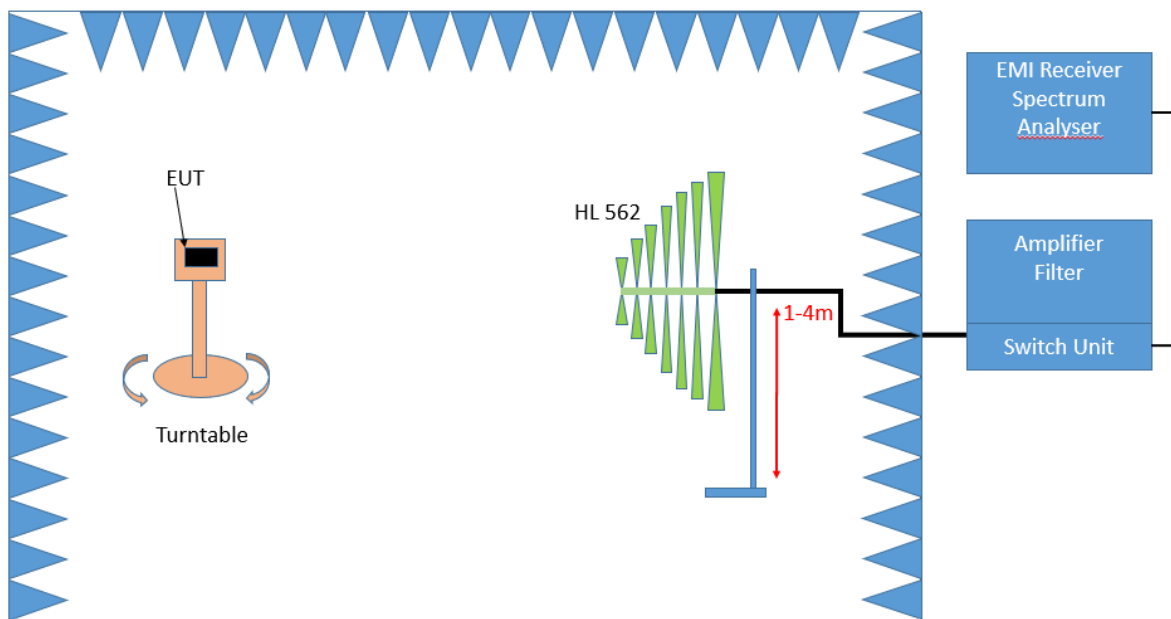
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

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.

- Detector: Quasi-Peak (9 kHz - 150 kHz, Peak / Average 150 kHz- 30 MHz)
- 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 between 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

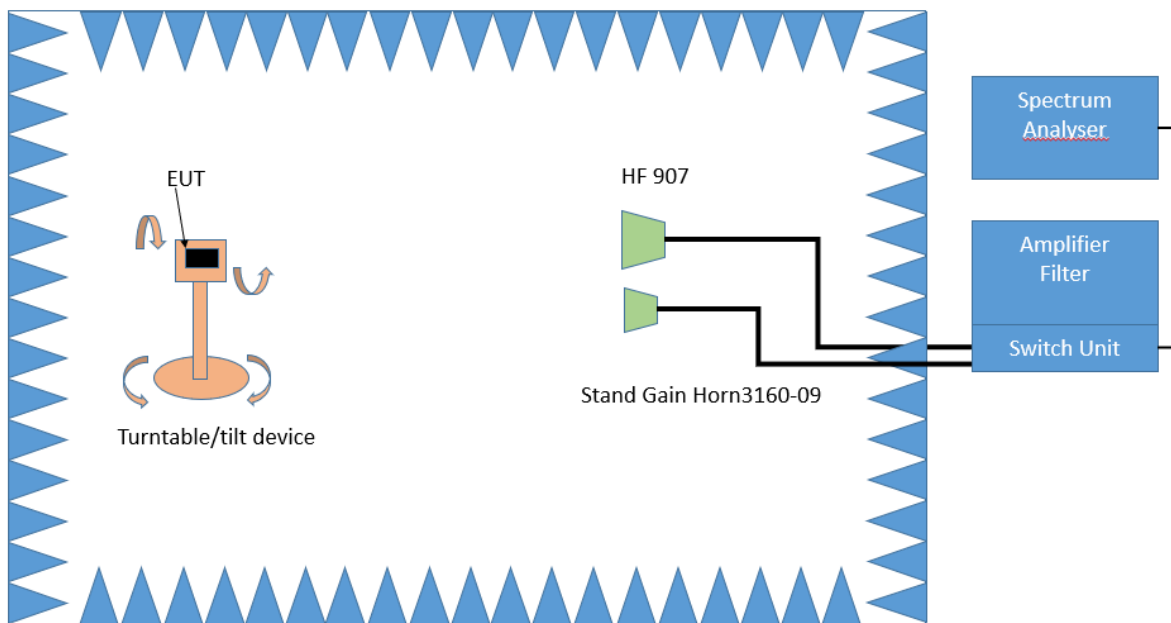
After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

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 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

5.2.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

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: $\text{Limit (dB}\mu\text{V}/\text{m)} = 20 \log (\text{Limit } (\mu\text{V}/\text{m})/1\mu\text{V}/\text{m})$

5.2.3 TEST PROTOCOL

Ambient temperature: 26 – 29 °C
 Air Pressure: 1003 – 1011 hPa
 Humidity: 44 – 52 %
 BT GFSK (1-DH1)
 Applied duty cycle correction (AV): 0.1 dB

| Antenna | Ch. Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] | Limit Type |
|---------|------------------------|----------------------|-------------------------|----------|-----------|----------------|----------------------|------------|
| Molex | 2480 | 4960.0 | 50.7 | PEAK | 1000 | 74.0 | 23.3 | RB |
| Molex | 2480 | 4960.0 | 41.7 | AV | 1000 | 54.0 | 12.3 | RB |
| Linx | 2480 | 4960.0 | 52.8 | PEAK | 1000 | 74.0 | 21.2 | RB |
| Linx | 2480 | 4960.0 | 45.9 | AV | 1000 | 54.0 | 8.1 | RB |

WLAN b-Mode; 20 MHz; 1 Mbit/s
 Applied duty cycle correction (AV): 0 dB

| Antenna | Ch. Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] | Limit Type |
|---------|------------------------|----------------------|-------------------------|----------|-----------|----------------|----------------------|------------|
| Linx | 2412 | 3617.8 | 58.3 | PEAK | 1000 | 74.0 | 15.7 | RB |
| Linx | 2412 | 3617.8 | 51.8 | AV | 1000 | 54.0 | 2.2 | RB |
| Linx | 2412 | 4018.4 | 58.6 | PEAK | 1000 | 74.0 | 15.4 | RB |
| Linx | 2412 | 4018.4 | 53.0 | AV | 1000 | 54.0 | 1.0 | RB |
| Linx | 2412 | 4824.0 | 54.2 | PEAK | 1000 | 74.0 | 19.8 | RB |
| Linx | 2412 | 4824.0 | 48.9 | AV | 1000 | 54.0 | 5.1 | RB |
| Molex | 2462 | 2488.1 | 57.7 | PEAK | 1000 | 74.0 | 16.3 | RB |
| Molex | 2462 | 2488.1 | 48.5 | AV | 1000 | 54.0 | 5.5 | RB |
| Molex | 2462 | 3692.8 | 54.8 | PEAK | 1000 | 74.0 | 19.2 | RB |
| Molex | 2462 | 3692.8 | 47.1 | AV | 1000 | 54.0 | 6.9 | RB |
| Molex | 2462 | 4105.2 | 53.8 | PEAK | 1000 | 74.0 | 20.2 | RB |
| Molex | 2462 | 4105.2 | 45.8 | AV | 1000 | 54.0 | 8.2 | RB |
| Molex | 2462 | 4924.0 | 54.7 | PEAK | 1000 | 74.0 | 19.3 | RB |
| Molex | 2462 | 4924.0 | 50.1 | AV | 1000 | 54.0 | 3.9 | RB |
| Molex | 2462 | 7386.8 | 57.6 | PEAK | 1000 | 74.0 | 16.4 | RB |
| Molex | 2462 | 7386.8 | 51.3 | AV | 1000 | 54.0 | 2.7 | RB |
| Molex | 2462 | 12311.0 | 54.9 | PEAK | 1000 | 74.0 | 19.1 | RB |
| Molex | 2462 | 12311.0 | 46.1 | AV | 1000 | 54.0 | 7.9 | RB |
| Linx | 2437 | 3655.4 | 58.8 | PEAK | 1000 | 74.0 | 15.2 | RB |
| Linx | 2437 | 3655.4 | 52.5 | AV | 1000 | 54.0 | 1.5 | RB |
| Linx | 2437 | 4060.2 | 56.3 | PEAK | 1000 | 74.0 | 17.7 | RB |
| Linx | 2437 | 4060.2 | 50.0 | AV | 1000 | 54.0 | 4.0 | RB |
| Linx | 2437 | 4873.9 | 54.6 | PEAK | 1000 | 74.0 | 19.4 | RB |
| Linx | 2437 | 4873.9 | 49.7 | AV | 1000 | 54.0 | 4.3 | RB |
| Linx | 2462 | 3693.0 | 57.8 | PEAK | 1000 | 74.0 | 16.2 | RB |
| Linx | 2462 | 3693.0 | 51.4 | AV | 1000 | 54.0 | 2.6 | RB |
| Linx | 2462 | 4102.4 | 55.5 | PEAK | 1000 | 74.0 | 18.5 | RB |
| Linx | 2462 | 4102.4 | 48.6 | AV | 1000 | 54.0 | 5.4 | RB |
| Linx | 2462 | 4924.1 | 56.0 | PEAK | 1000 | 74.0 | 18.0 | RB |
| Linx | 2462 | 4924.1 | 52.2 | AV | 1000 | 54.0 | 1.8 | RB |

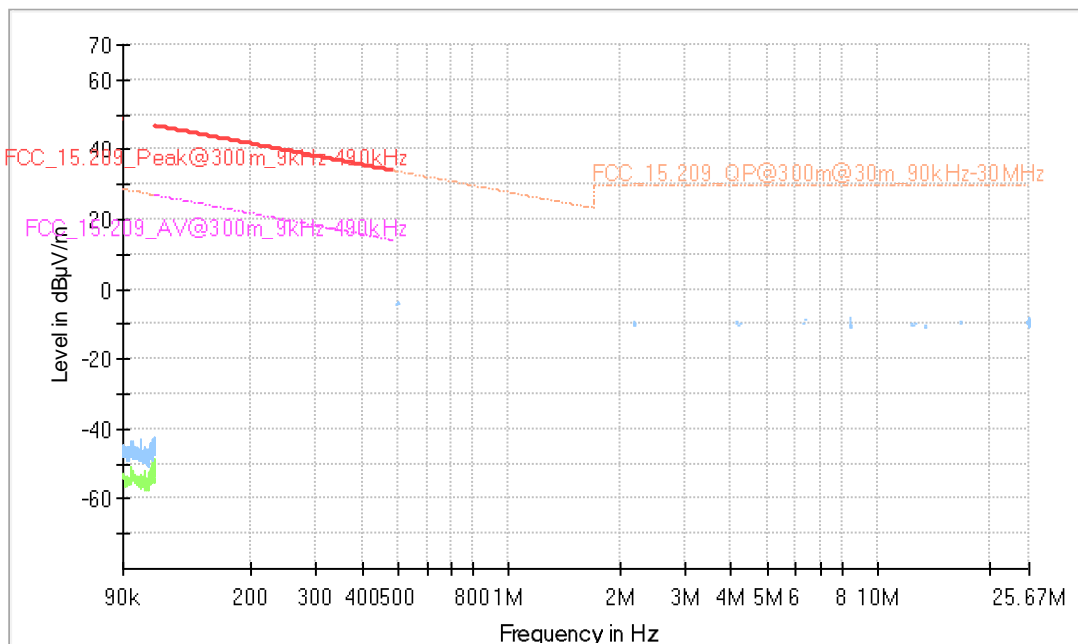
WLAN g-Mode; 20 MHz; 6 Mbit/s
 Applied duty cycle correction (AV): 0.1 dB

| Antenna | Ch. Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] | Limit Type |
|---------|------------------------|----------------------|-------------------------|----------|-----------|----------------|----------------------|------------|
| Molex | 2412 | 1607.9 | 54.6 | PEAK | 1000 | 74.0 | 19.4 | RB |
| Molex | 2412 | 1607.9 | 40.5 | AV | 1000 | 54.0 | 13.5 | RB |
| Molex | 2412 | 3616.8 | 51.2 | PEAK | 1000 | 74.0 | 22.8 | RB |
| Molex | 2412 | 3616.8 | 39.3 | AV | 1000 | 54.0 | 14.7 | RB |
| Molex | 2412 | 4016.6 | 57.7 | PEAK | 1000 | 74.0 | 16.3 | RB |
| Molex | 2412 | 4016.6 | 43.6 | AV | 1000 | 54.0 | 10.4 | RB |

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

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

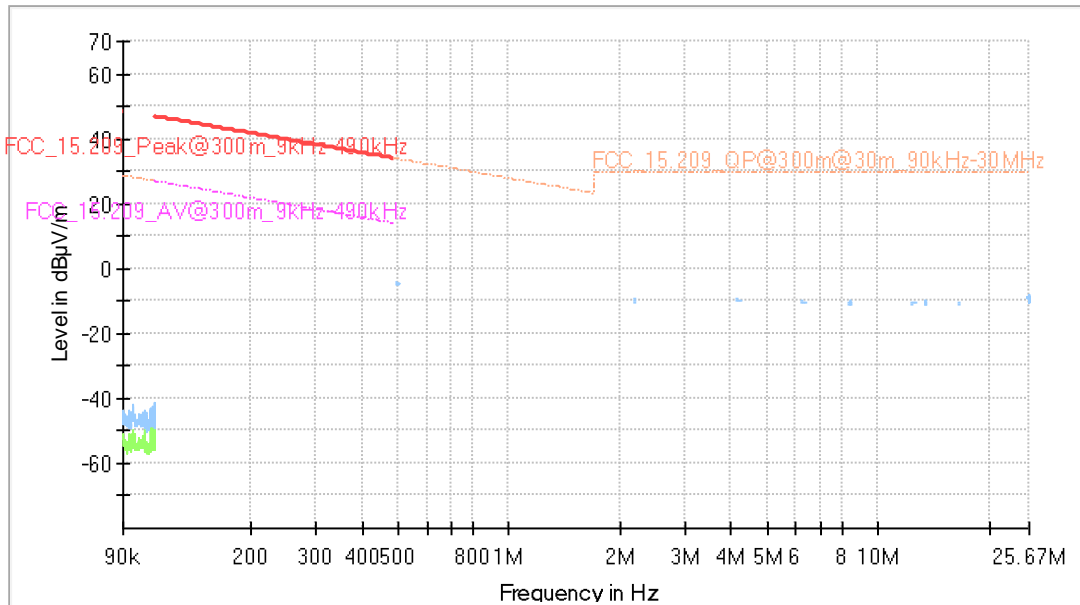
Radio Technology = Bluetooth BDR, Operating Frequency = mid, Measurement range = 9 kHz - 30 MHz
 (S01_160_AB02)



Final Result

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

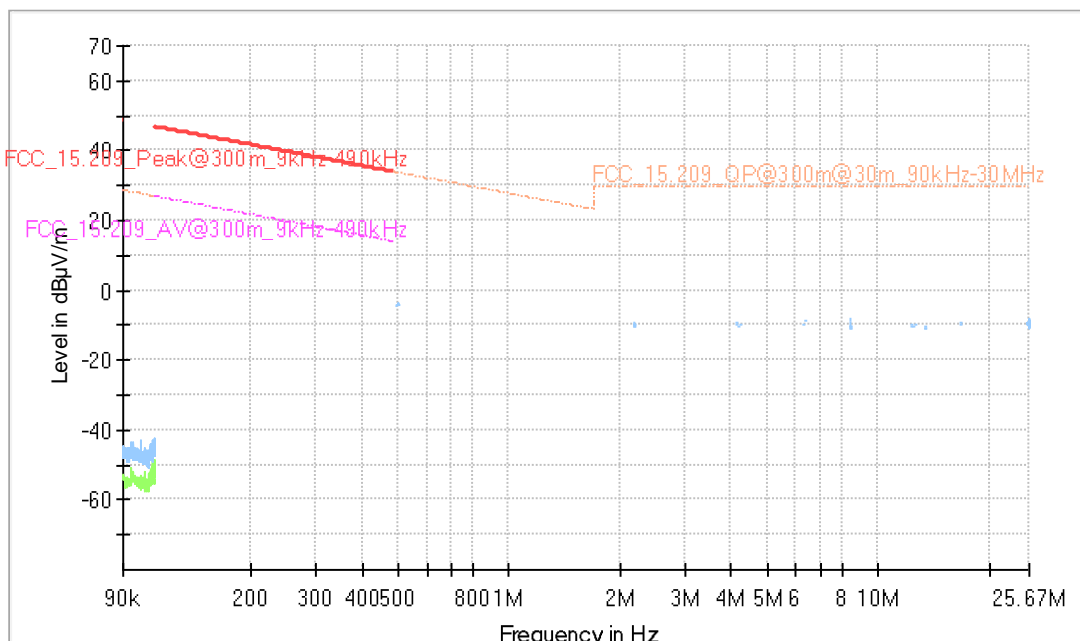
Radio Technology = Bluetooth BDR, Operating Frequency = mid, Measurement range = 9 kHz - 30 MHz
(S03_160_AA01)



Final Result

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

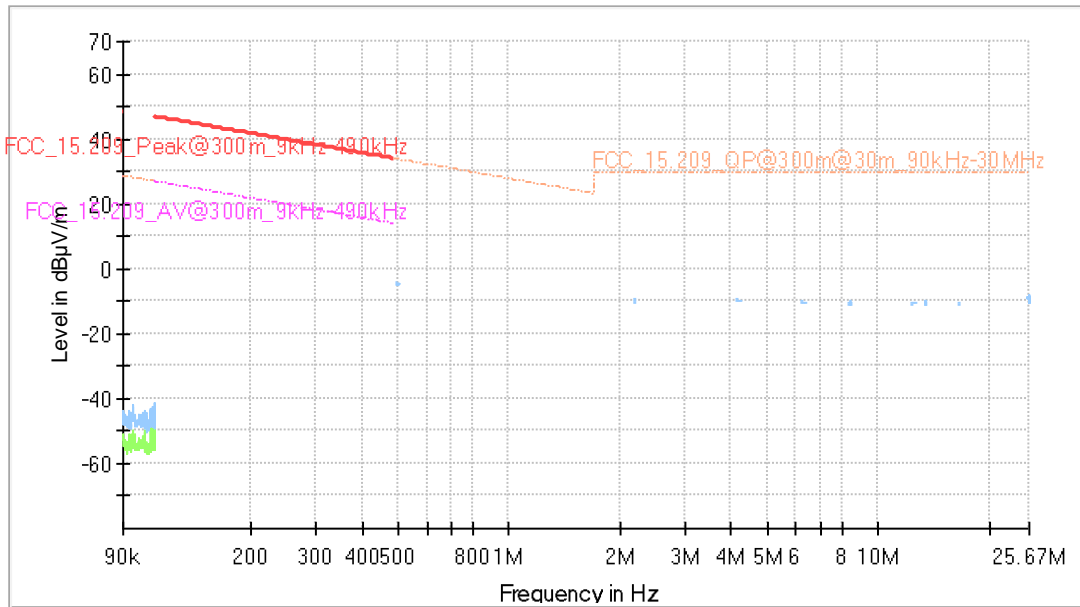
Radio Technology = WLAN b, Operating Frequency = high, Measurement range = 9 kHz - 30 MHz
(S01_160_AB02)



Final Result

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

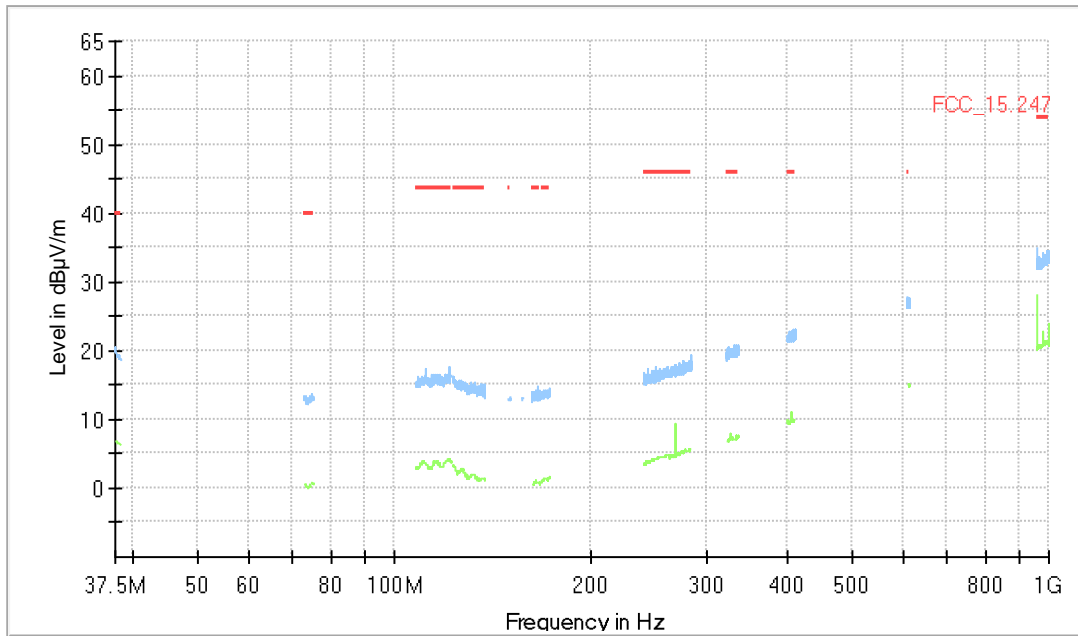
Radio Technology = WLAN b, Operating Frequency = high, Measurement range = 9 kHz - 30 MHz
(S03_160_AA01)



Final Result

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

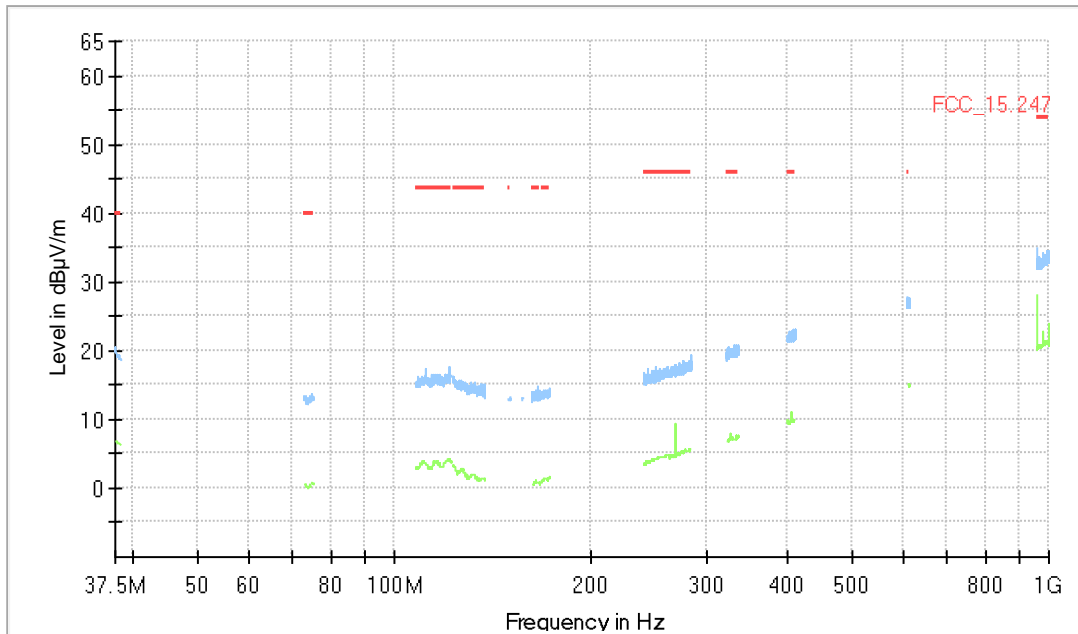
Radio Technology = WLAN b, Operating Frequency = high, Measurement range = 30 MHz - 1 GHz
(S03_160_AA01)



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) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| --- | --- | --- | --- | --- | --- | --- | | --- | --- |

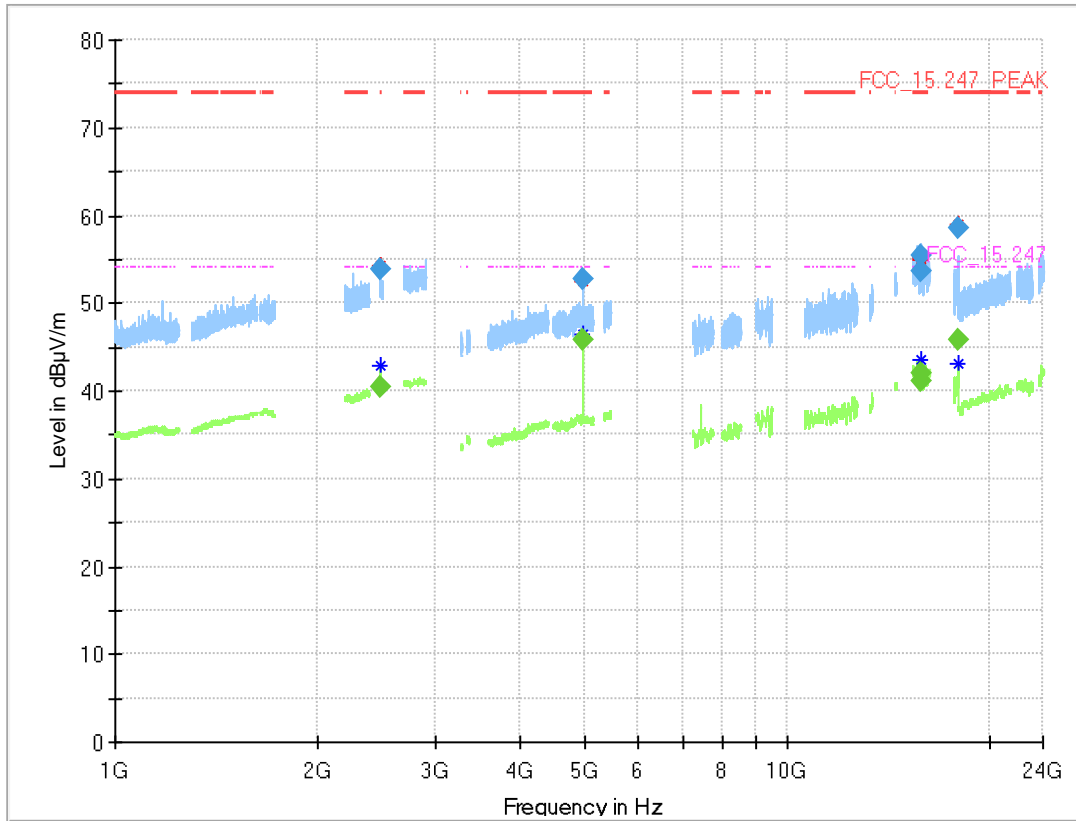
Radio Technology = Bluetooth BDR, Operating Frequency = mid, Measurement range = 30 MHz - 1 GHz (S03_160_AA01)



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) |
|-----------------|--------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|--------------|
| --- | --- | --- | --- | --- | --- | --- | | --- | --- |

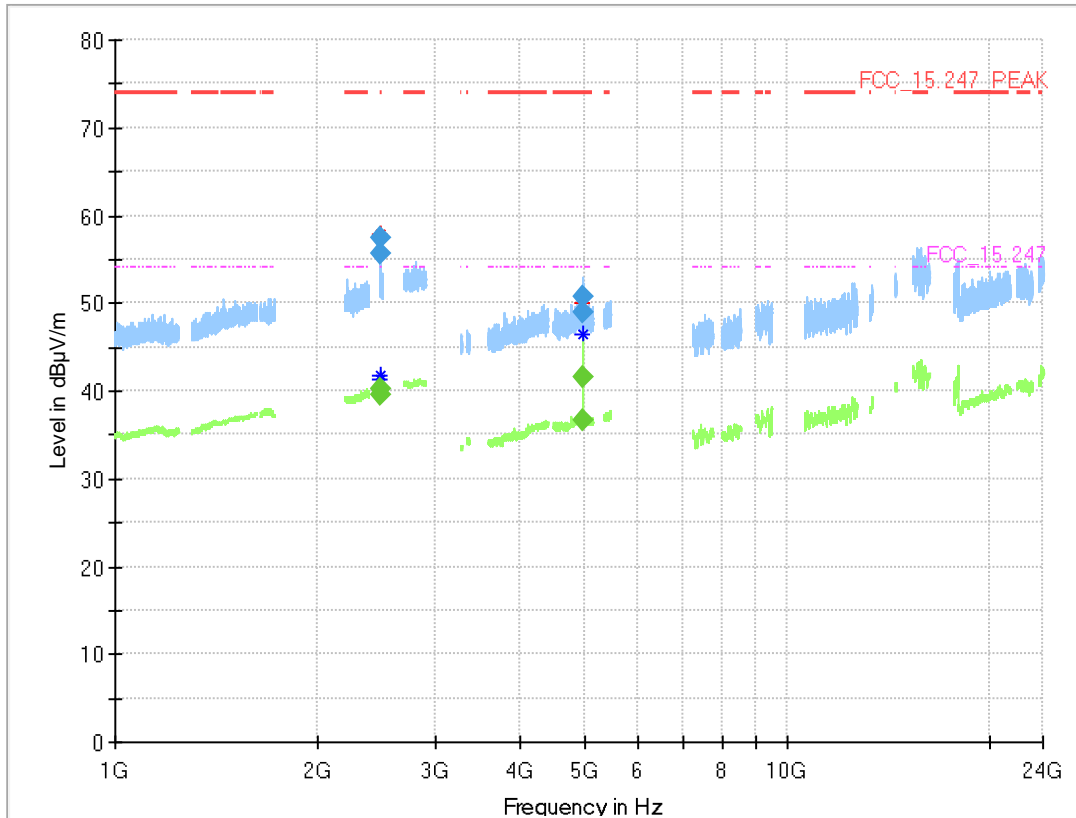
Radio Technology = Bluetooth BDR, Operating Frequency = high, Measurement range = 1 GHz
 - 26 GHz
 (S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.500 | --- | 40.6 | 54.00 | 13.44 | 1000.0 | 1000.000 | 150.0 | V | -97.0 | 75.0 | 7.8 |
| 2483.500 | 53.9 | --- | 74.00 | 20.08 | 1000.0 | 1000.000 | 150.0 | V | -97.0 | 75.0 | 7.8 |
| 4960.038 | --- | 45.8 | 54.00 | 8.21 | 1000.0 | 1000.000 | 150.0 | H | 61.0 | -6.0 | 5.9 |
| 4960.038 | 52.8 | --- | 74.00 | 21.21 | 1000.0 | 1000.000 | 150.0 | H | 61.0 | -6.0 | 5.9 |
| 15800.358 | --- | 41.0 | 54.00 | 12.97 | 1000.0 | 1000.000 | 150.0 | V | -112.0 | 15.0 | -0.3 |
| 15800.358 | 53.7 | --- | 74.00 | 20.28 | 1000.0 | 1000.000 | 150.0 | V | -112.0 | 15.0 | -0.3 |
| 15852.350 | --- | 41.9 | 54.00 | 12.07 | 1000.0 | 1000.000 | 150.0 | V | 85.0 | -6.0 | 0.6 |
| 15852.350 | 55.4 | --- | 74.00 | 18.62 | 1000.0 | 1000.000 | 150.0 | V | 85.0 | -6.0 | 0.6 |
| 17974.200 | --- | 45.8 | 54.00 | 8.22 | 1000.0 | 1000.000 | 150.0 | H | 94.0 | 4.0 | 3.0 |
| 17974.200 | 58.4 | --- | 74.00 | 15.56 | 1000.0 | 1000.000 | 150.0 | H | 94.0 | 4.0 | 3.0 |

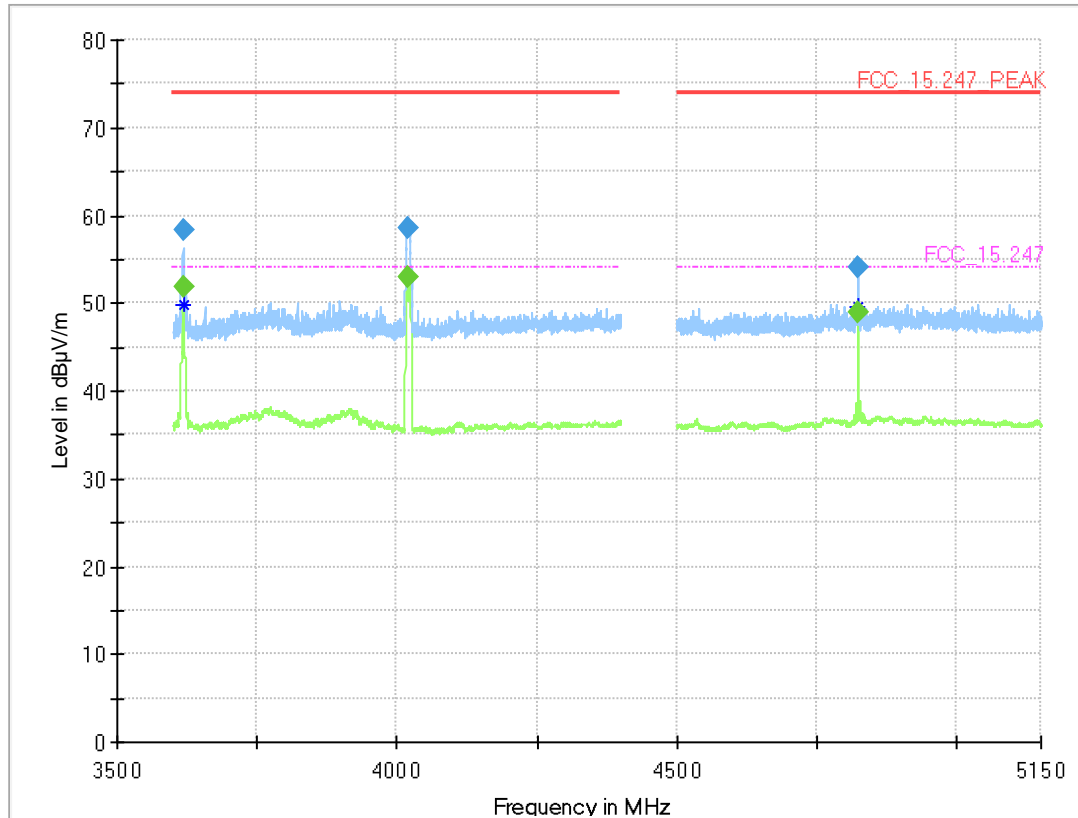
Radio Technology = Bluetooth BDR, Operating Frequency = high, Measurement range = 1 GHz
 - 26 GHz
 (S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.500 | --- | 40.3 | 54.00 | 13.67 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 91.0 | 7.8 |
| 2483.500 | 57.4 | --- | 74.00 | 16.61 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 91.0 | 7.8 |
| 2484.243 | --- | 39.5 | 54.00 | 14.48 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 92.0 | 7.8 |
| 2484.243 | 55.5 | --- | 74.00 | 18.46 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 92.0 | 7.8 |
| 4960.038 | --- | 41.6 | 54.00 | 12.45 | 1000.0 | 1000.000 | 150.0 | V | 95.0 | -15.0 | 5.9 |
| 4960.038 | 50.7 | --- | 74.00 | 23.35 | 1000.0 | 1000.000 | 150.0 | V | 95.0 | -15.0 | 5.9 |
| 4960.850 | --- | 36.7 | 54.00 | 17.32 | 1000.0 | 1000.000 | 150.0 | H | 55.0 | 75.0 | 5.9 |
| 4960.850 | 49.0 | --- | 74.00 | 25.05 | 1000.0 | 1000.000 | 150.0 | H | 55.0 | 75.0 | 5.9 |

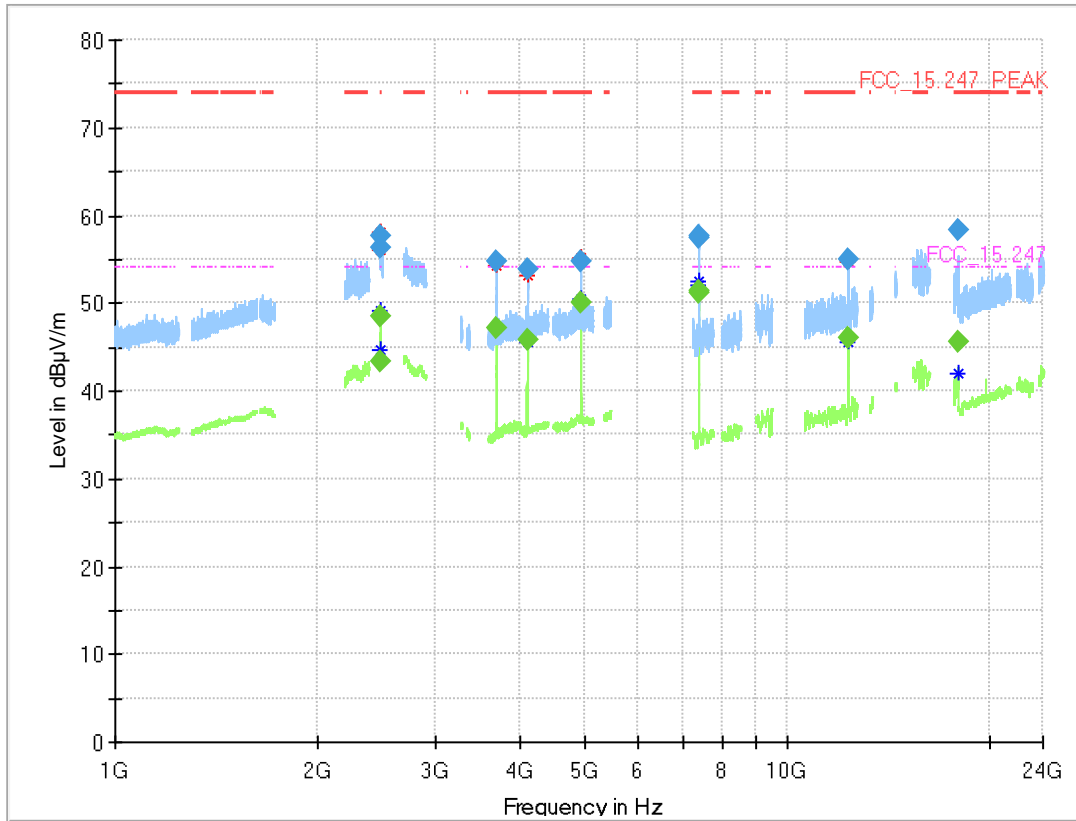
Radio Technology = WLAN b, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
 (S01_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 3617.800 | --- | 51.8 | 54.00 | 2.22 | 1000.0 | 1000.000 | 150.0 | H | 141.0 | 14.0 | 3.2 |
| 3617.800 | 58.3 | --- | 74.00 | 15.67 | 1000.0 | 1000.000 | 150.0 | H | 141.0 | 14.0 | 3.2 |
| 4018.400 | --- | 53.0 | 54.00 | 0.99 | 1000.0 | 1000.000 | 150.0 | V | 96.0 | 98.0 | 3.5 |
| 4018.400 | 58.6 | --- | 74.00 | 15.36 | 1000.0 | 1000.000 | 150.0 | V | 96.0 | 98.0 | 3.5 |
| 4824.025 | --- | 48.9 | 54.00 | 5.12 | 1000.0 | 1000.000 | 150.0 | V | -22.0 | -7.0 | 5.6 |
| 4824.025 | 54.2 | --- | 74.00 | 19.82 | 1000.0 | 1000.000 | 150.0 | V | -22.0 | -7.0 | 5.6 |

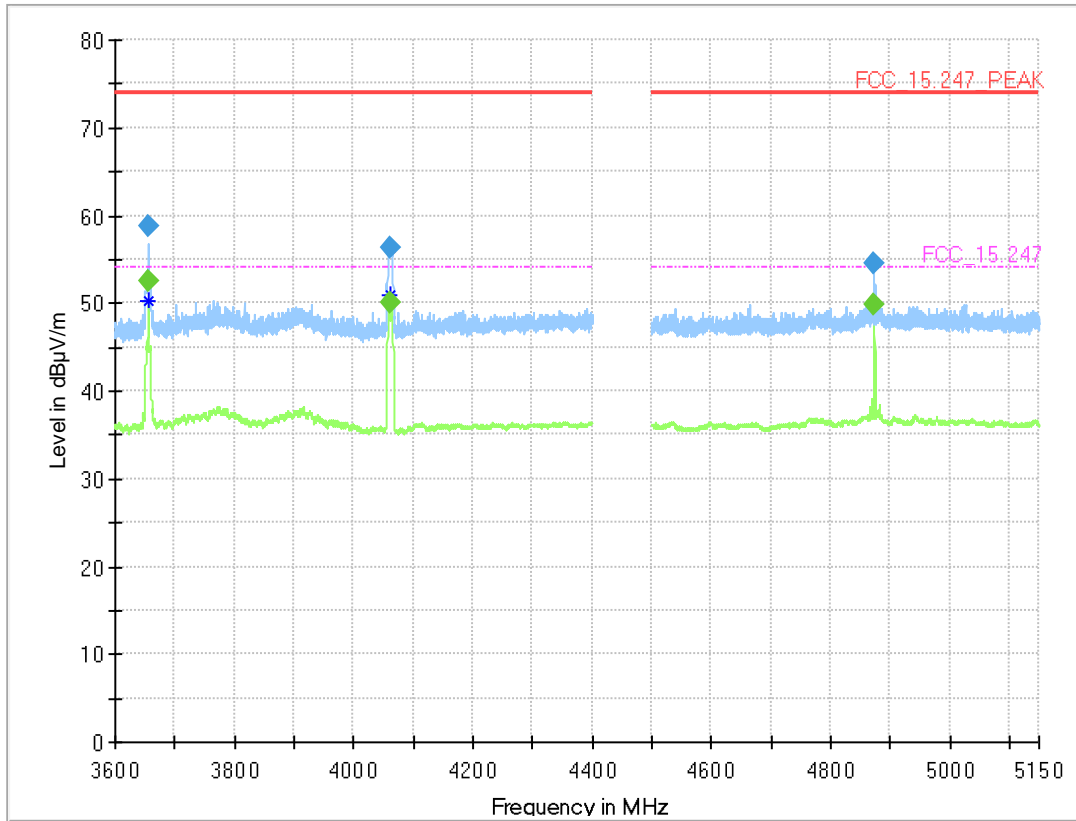
Radio Technology = WLAN b, Operating Frequency = high, Measurement range = 1 GHz - 26 GHz
(S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.500 | --- | 43.4 | 54.00 | 10.58 | 1000.0 | 1000.000 | 150.0 | H | -175.0 | 83.0 | 7.8 |
| 2483.500 | 56.2 | --- | 74.00 | 17.80 | 1000.0 | 1000.000 | 150.0 | H | -175.0 | 83.0 | 7.8 |
| 2488.120 | --- | 48.5 | 54.00 | 5.53 | 1000.0 | 1000.000 | 150.0 | H | -169.0 | 15.0 | 7.9 |
| 2488.120 | 57.7 | --- | 74.00 | 16.30 | 1000.0 | 1000.000 | 150.0 | H | -169.0 | 15.0 | 7.9 |
| 3692.800 | --- | 47.1 | 54.00 | 6.91 | 1000.0 | 1000.000 | 150.0 | H | -146.0 | 9.0 | 3.2 |
| 3692.800 | 54.8 | --- | 74.00 | 19.22 | 1000.0 | 1000.000 | 150.0 | H | -146.0 | 9.0 | 3.2 |
| 4105.200 | --- | 45.8 | 54.00 | 8.23 | 1000.0 | 1000.000 | 150.0 | V | 161.0 | 86.0 | 5.0 |
| 4105.200 | 53.8 | --- | 74.00 | 20.17 | 1000.0 | 1000.000 | 150.0 | V | 161.0 | 86.0 | 5.0 |
| 4923.963 | --- | 50.1 | 54.00 | 3.86 | 1000.0 | 1000.000 | 150.0 | H | -120.0 | 75.0 | 6.6 |
| 4923.963 | 54.7 | --- | 74.00 | 19.32 | 1000.0 | 1000.000 | 150.0 | H | -120.0 | 75.0 | 6.6 |
| 7385.000 | --- | 51.3 | 54.00 | 2.75 | 1000.0 | 1000.000 | 150.0 | H | -183.0 | 91.0 | -11.0 |
| 7385.000 | 57.5 | --- | 74.00 | 16.54 | 1000.0 | 1000.000 | 150.0 | H | -183.0 | 91.0 | -11.0 |
| 7386.750 | --- | 51.3 | 54.00 | 2.69 | 1000.0 | 1000.000 | 150.0 | H | -189.0 | 91.0 | -10.9 |
| 7386.750 | 57.6 | --- | 74.00 | 16.43 | 1000.0 | 1000.000 | 150.0 | H | -189.0 | 91.0 | -10.9 |
| 12310.975 | --- | 46.1 | 54.00 | 7.91 | 1000.0 | 1000.000 | 150.0 | H | 64.0 | 104.0 | -4.3 |
| 12310.975 | 54.9 | --- | 74.00 | 19.08 | 1000.0 | 1000.000 | 150.0 | H | 64.0 | 104.0 | -4.3 |
| 17984.550 | --- | 45.6 | 54.00 | 8.41 | 1000.0 | 1000.000 | 150.0 | V | -176.0 | -3.0 | 3.1 |
| 17984.550 | 58.2 | --- | 74.00 | 15.79 | 1000.0 | 1000.000 | 150.0 | V | -176.0 | -3.0 | 3.1 |

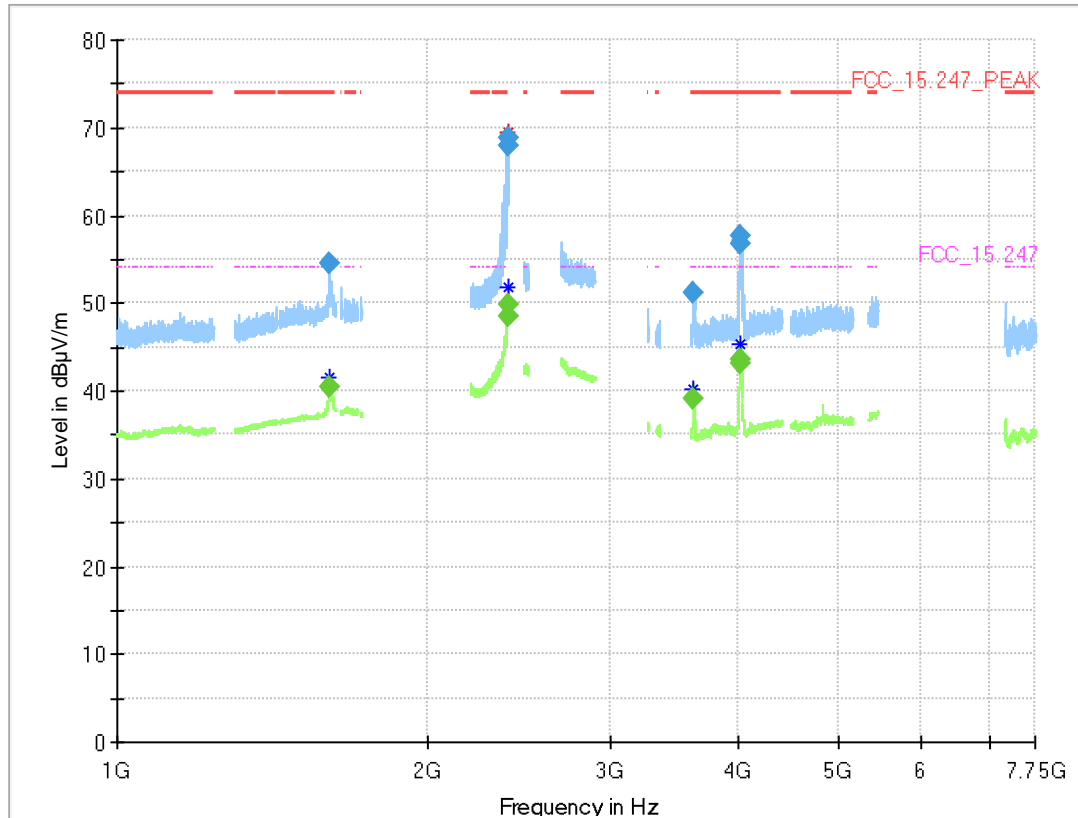
Radio Technology = WLAN b, Operating Frequency = mid, Measurement range = 1 GHz - 26 GHz
 (S01_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 3655.400 | --- | 52.5 | 54.00 | 1.55 | 1000.0 | 1000.000 | 150.0 | H | -104.0 | 3.0 | 2.7 |
| 3655.400 | 58.8 | --- | 74.00 | 15.17 | 1000.0 | 1000.000 | 150.0 | H | -104.0 | 3.0 | 2.7 |
| 4060.200 | --- | 50.0 | 54.00 | 3.95 | 1000.0 | 1000.000 | 150.0 | H | 91.0 | -13.0 | 4.1 |
| 4060.200 | 56.3 | --- | 74.00 | 17.70 | 1000.0 | 1000.000 | 150.0 | H | 91.0 | -13.0 | 4.1 |
| 4873.913 | --- | 49.7 | 54.00 | 4.26 | 1000.0 | 1000.000 | 150.0 | H | 91.0 | 81.0 | 6.4 |
| 4873.913 | 54.6 | --- | 74.00 | 19.42 | 1000.0 | 1000.000 | 150.0 | H | 91.0 | 81.0 | 6.4 |

Radio Technology = WLAN g, Operating Frequency = low, Measurement range = 1 GHz - 26 GHz
(S03_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 1607.925 | 54.6 | --- | 74.00 | 19.43 | 1000.0 | 1000.000 | 150.0 | H | 117.0 | 16.0 | 5.3 |
| 1607.925 | --- | 40.4 | 54.00 | 13.64 | 1000.0 | 1000.000 | 150.0 | H | 117.0 | 16.0 | 5.3 |
| 2389.760 | 67.9 | --- | 74.00 | 6.11 | 1000.0 | 1000.000 | 150.0 | H | -8.0 | 70.0 | 7.6 |
| 2389.760 | --- | 48.4 | 54.00 | 5.61 | 1000.0 | 1000.000 | 150.0 | H | -8.0 | 70.0 | 7.6 |
| 2389.840 | 68.8 | --- | 74.00 | 5.17 | 1000.0 | 1000.000 | 150.0 | H | 12.0 | 110.0 | 7.6 |
| 2389.840 | --- | 49.9 | 54.00 | 4.10 | 1000.0 | 1000.000 | 150.0 | H | 12.0 | 110.0 | 7.6 |
| 3616.800 | --- | 39.2 | 54.00 | 14.81 | 1000.0 | 1000.000 | 150.0 | H | -153.0 | -1.0 | 3.2 |
| 3616.800 | 51.2 | --- | 74.00 | 22.81 | 1000.0 | 1000.000 | 150.0 | H | -153.0 | -1.0 | 3.2 |
| 4016.600 | 57.7 | --- | 74.00 | 16.27 | 1000.0 | 1000.000 | 150.0 | H | 154.0 | 9.0 | 3.5 |
| 4016.600 | --- | 43.5 | 54.00 | 10.49 | 1000.0 | 1000.000 | 150.0 | H | 154.0 | 9.0 | 3.5 |
| 4021.600 | --- | 43.2 | 54.00 | 10.84 | 1000.0 | 1000.000 | 150.0 | V | 31.0 | 94.0 | 3.5 |
| 4021.600 | 56.7 | --- | 74.00 | 17.28 | 1000.0 | 1000.000 | 150.0 | V | 31.0 | 94.0 | 3.5 |

5.2.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 2.4 GHz FCC
- Radiated Emissions SAC H-Field
- Radiated Emissions SAC up to 1 GHz

5.3 BAND EDGE COMPLIANCE RADIATED

Standard **FCC Part 15 Subpart C**

The test was performed according to:

ANSI C63.10, chapter 6.6.5

5.3.1 TEST DESCRIPTION

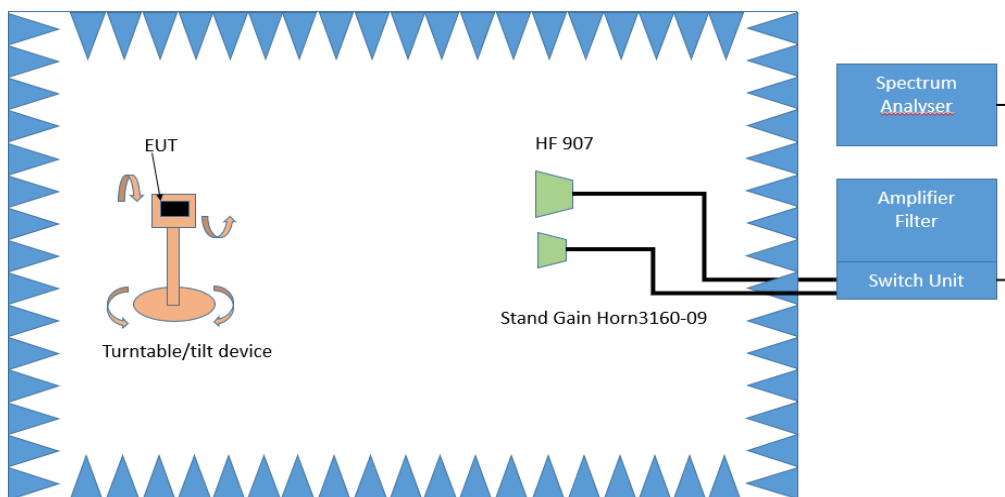
The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapter of ANSI C63.10:

- 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

5.3.2 TEST REQUIREMENTS / LIMITS

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: $\text{Limit (dB}\mu\text{V}/\text{m)} = 20 \log (\text{Limit } (\mu\text{V}/\text{m})/1\mu\text{V}/\text{m})$

5.3.3 TEST PROTOCOL

Ambient temperature: 26 – 29 °C
 Air Pressure: 1005 – 1012 hPa
 Humidity: 45 – 62 %
 BT GFSK (1-DH1)
 Applied duty cycle correction (AV): 0.1 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------|----------|-----------|----------------|----------------------|
| Linx | 2480 | 2483.5 | 53.9 | PEAK | 1000 | 74.0 | 20.1 |
| Linx | 2480 | 2483.5 | 40.7 | AV | 1000 | 54.0 | 13.3 |
| Molex | 2480 | 2483.5 | 57.4 | PEAK | 1000 | 74.0 | 16.6 |
| Molex | 2480 | 2483.5 | 40.4 | AV | 1000 | 54.0 | 13.6 |

BT π/4 DQPSK (2-DH1)
 Applied duty cycle correction (AV): 0.2 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------|----------|-----------|----------------|----------------------|
| Linx | 2480 | 2483.5 | 57.5 | PEAK | 1000 | 74.0 | 16.5 |
| Linx | 2480 | 2483.5 | 41.6 | AV | 1000 | 54.0 | 12.4 |
| Molex | 2480 | 2483.5 | 57.9 | PEAK | 1000 | 74.0 | 16.1 |
| Molex | 2480 | 2483.5 | 41.8 | AV | 1000 | 54.0 | 12.2 |

BT 8-DPSK (3-DH1)
 Applied duty cycle correction (AV): 0.3 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------|----------|-----------|----------------|----------------------|
| Molex | 2480 | 2483.5 | 61.4 | PEAK | 1000 | 74.0 | 12.6 |
| Molex | 2480 | 2483.5 | 43.2 | AV | 1000 | 54.0 | 10.8 |
| Linx | 2480 | 2483.5 | 60.8 | PEAK | 1000 | 74.0 | 13.2 |
| Linx | 2480 | 2483.5 | 42.7 | AV | 1000 | 54.0 | 11.3 |

BT LE 1 Mbit/s
 Applied duty cycle correction (AV): 1.4 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBµV/m] | Detector | RBW [kHz] | Limit [dBµV/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------|----------|-----------|----------------|----------------------|
| Molex | 2480 | 2483.5 | 54.5 | PEAK | 1000 | 74.0 | 19.5 |
| Molex | 2480 | 2483.5 | 39.9 | AV | 1000 | 54.0 | 14.1 |
| Linx | 2480 | 2483.5 | 54.3 | PEAK | 1000 | 74.0 | 19.7 |
| Linx | 2480 | 2483.5 | 40.7 | AV | 1000 | 54.0 | 13.3 |

BT LE 2 Mbit/s

Applied duty cycle correction (AV): 7.4 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dB μ V/m] | Detector | RBW [kHz] | Limit [dB μ V/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------------|----------|-----------|----------------------|----------------------|
| Molex | 2480 | 2483.5 | 58.8 | PEAK | 1000 | 74.0 | 15.2 |
| Molex | 2480 | 2483.5 | 46.4 | AV | 1000 | 54.0 | 7.6 |
| Linx | 2480 | 2483.5 | 59.0 | PEAK | 1000 | 74.0 | 15.0 |
| Linx | 2480 | 2483.5 | 46.6 | AV | 1000 | 54.0 | 7.4 |

WLAN b-Mode; 20 MHz; 1 Mbit/s

Applied duty cycle correction (AV): 0 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dB μ V/m] | Detector | RBW [kHz] | Limit [dB μ V/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------------|----------|-----------|----------------------|----------------------|
| Linx | 2462 | 2483.5 | 57.8 | PEAK | 1000 | 74.0 | 16.2 |
| Linx | 2462 | 2483.5 | 46.4 | AV | 1000 | 54.0 | 7.6 |
| Molex | 2462 | 2483.5 | 57.7 | PEAK | 1000 | 74.0 | 16.3 |
| Molex | 2462 | 2483.5 | 48.5 | AV | 1000 | 54.0 | 5.5 |

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

Applied duty cycle correction (AV): 0.1 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dB μ V/m] | Detector | RBW [kHz] | Limit [dB μ V/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------------|----------|-----------|----------------------|----------------------|
| Linx | 2462 | 2483.5 | 73.3 | PEAK | 1000 | 74.0 | 0.7 |
| Linx | 2462 | 2483.5 | 53.7 | AV | 1000 | 54.0 | 0.3 |
| Molex | 2412 | 2390.0 | 68.8 | PEAK | 1000 | 74.0 | 5.2 |
| Molex | 2412 | 2390.0 | 50.0 | AV | 1000 | 54.0 | 4.0 |
| Molex | 2462 | 2483.5 | 67.8 | PEAK | 1000 | 74.0 | 6.2 |
| Molex | 2462 | 2483.5 | 46.3 | AV | 1000 | 54.0 | 7.7 |

WLAN n-Mode; 20 MHz; MCS0

Applied duty cycle correction (AV): 0.1 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dB μ V/m] | Detector | RBW [kHz] | Limit [dB μ V/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------------|----------|-----------|----------------------|----------------------|
| Linx | 2412 | 2390.0 | 71.1 | PEAK | 1000 | 74.0 | 2.9 |
| Linx | 2412 | 2390.0 | 52.5 | AV | 1000 | 54.0 | 1.5 |
| Linx | 2462 | 2483.5 | 69.5 | PEAK | 1000 | 74.0 | 4.5 |
| Linx | 2462 | 2483.5 | 47.5 | AV | 1000 | 54.0 | 6.5 |
| Molex | 2462 | 2483.5 | 63.6 | PEAK | 1000 | 74.0 | 10.4 |
| Molex | 2462 | 2483.5 | 44.8 | AV | 1000 | 54.0 | 9.2 |

WLAN n-Mode; 40 MHz; MCS0

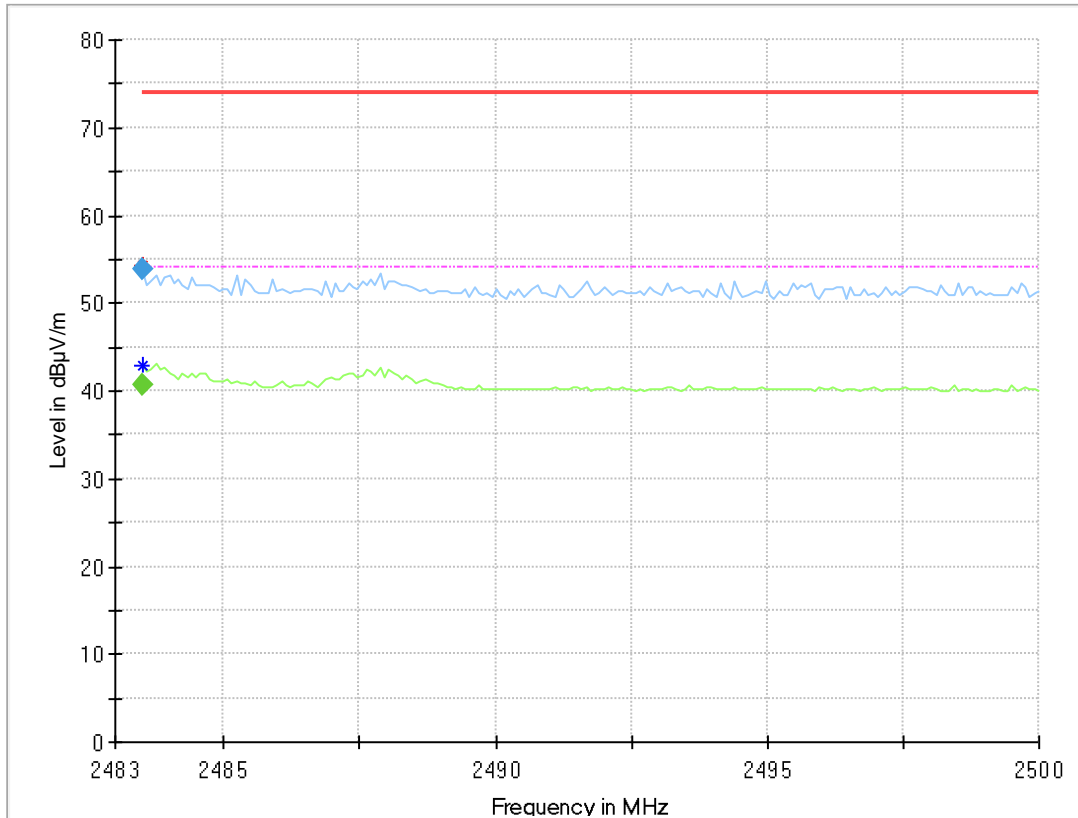
Applied duty cycle correction (AV): 0.1 dB

| Antenna | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dB μ V/m] | Detector | RBW [kHz] | Limit [dB μ V/m] | Margin to Limit [dB] |
|---------|------------------------|-----------------------|-------------------------------|----------|-----------|----------------------|----------------------|
| Linx | 2422 | 2390.0 | 69.7 | PEAK | 1000 | 74.0 | 4.3 |
| Linx | 2422 | 2390.0 | 51.2 | AV | 1000 | 54.0 | 2.8 |
| Linx | 2452 | 2483.5 | 71.7 | PEAK | 1000 | 74.0 | 2.3 |
| Linx | 2452 | 2483.5 | 50.5 | AV | 1000 | 54.0 | 3.5 |
| Molex | 2422 | 2390.0 | 67.1 | PEAK | 1000 | 74.0 | 6.9 |
| Molex | 2422 | 2390.0 | 50.9 | AV | 1000 | 54.0 | 3.1 |
| Molex | 2452 | 2483.5 | 67.2 | PEAK | 1000 | 74.0 | 6.8 |
| Molex | 2452 | 2483.5 | 48.3 | AV | 1000 | 54.0 | 5.7 |

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

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

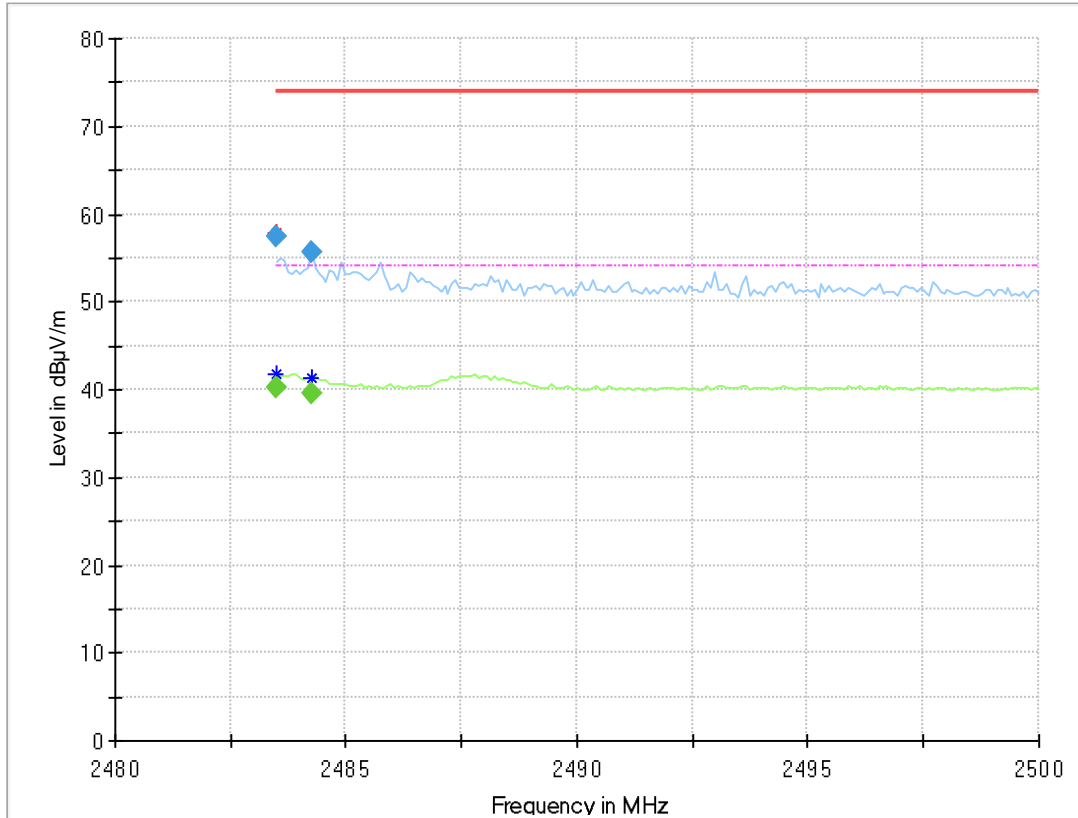
Radio Technology = Bluetooth BDR, Operating Frequency = high, Band Edge = high (S01_160_AB02)



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) | Cor. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 2483.500 | 53.9 | --- | 74.0 | 20.08 | 1000.0 | 1000.00 | 150. | V | -97.0 | 75.0 | 7.8 |
| 2483.500 | --- | 40.6 | 54.0 | 13.44 | 1000.0 | 1000.00 | 150. | V | -97.0 | 75.0 | 7.8 |

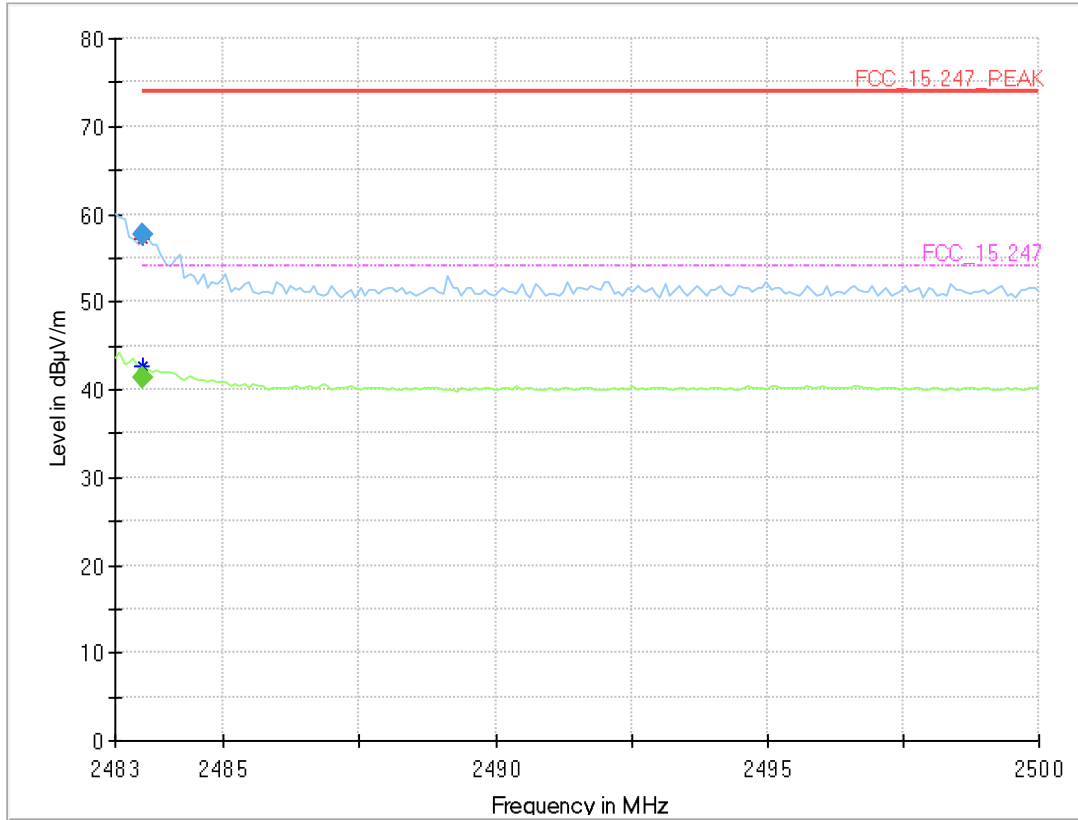
Radio Technology = Bluetooth BDR, Operating Frequency = high, Band Edge = high (S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.500 | --- | 40.3 | 54.00 | 13.67 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 91.0 | 7.8 |
| 2483.500 | 57.4 | --- | 74.00 | 16.61 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 91.0 | 7.8 |
| 2484.243 | --- | 39.5 | 54.00 | 14.48 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 92.0 | 7.8 |
| 2484.243 | 55.5 | --- | 74.00 | 18.46 | 1000.0 | 1000.000 | 150.0 | V | -11.0 | 92.0 | 7.8 |

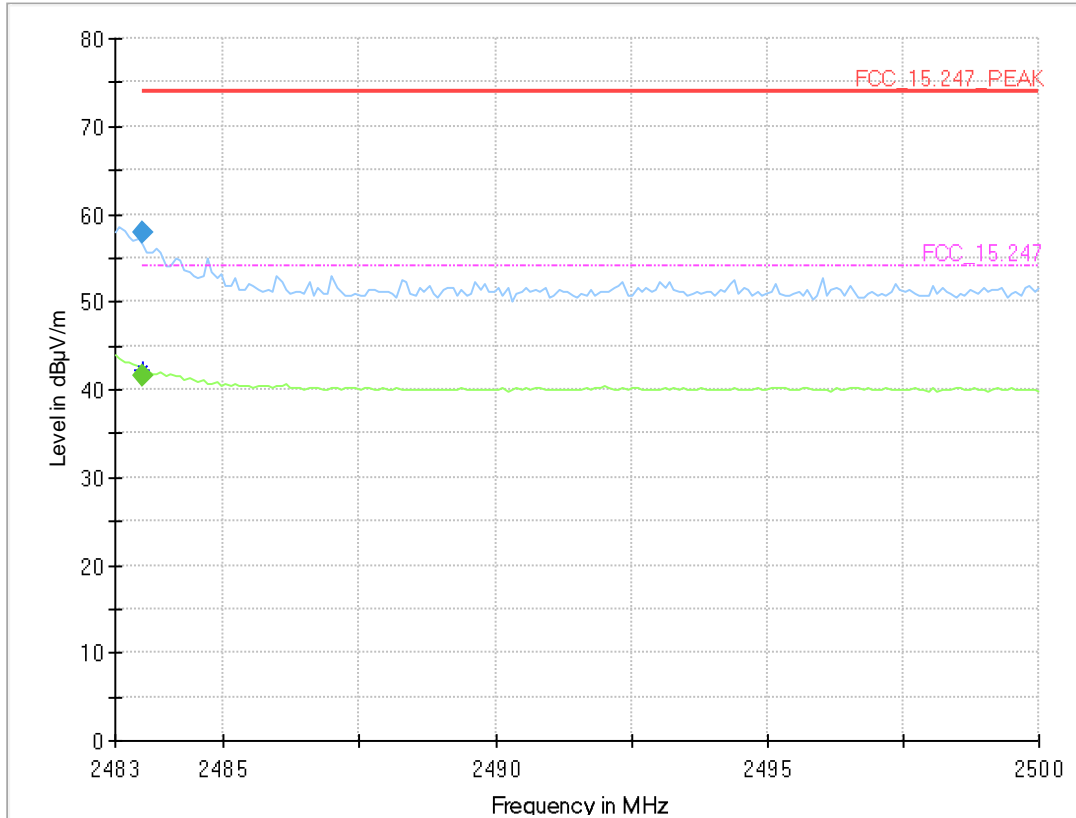
Radio Technology = Bluetooth EDR 2, Operating Frequency = high, Band Edge = high (S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 41.4 | 54.00 | 12.64 | 1000.0 | 1000.000 | 150.0 | V | -92.0 | 84.0 | 7.8 |
| 2483.510 | 57.5 | --- | 74.00 | 16.45 | 1000.0 | 1000.000 | 150.0 | V | -92.0 | 84.0 | 7.8 |

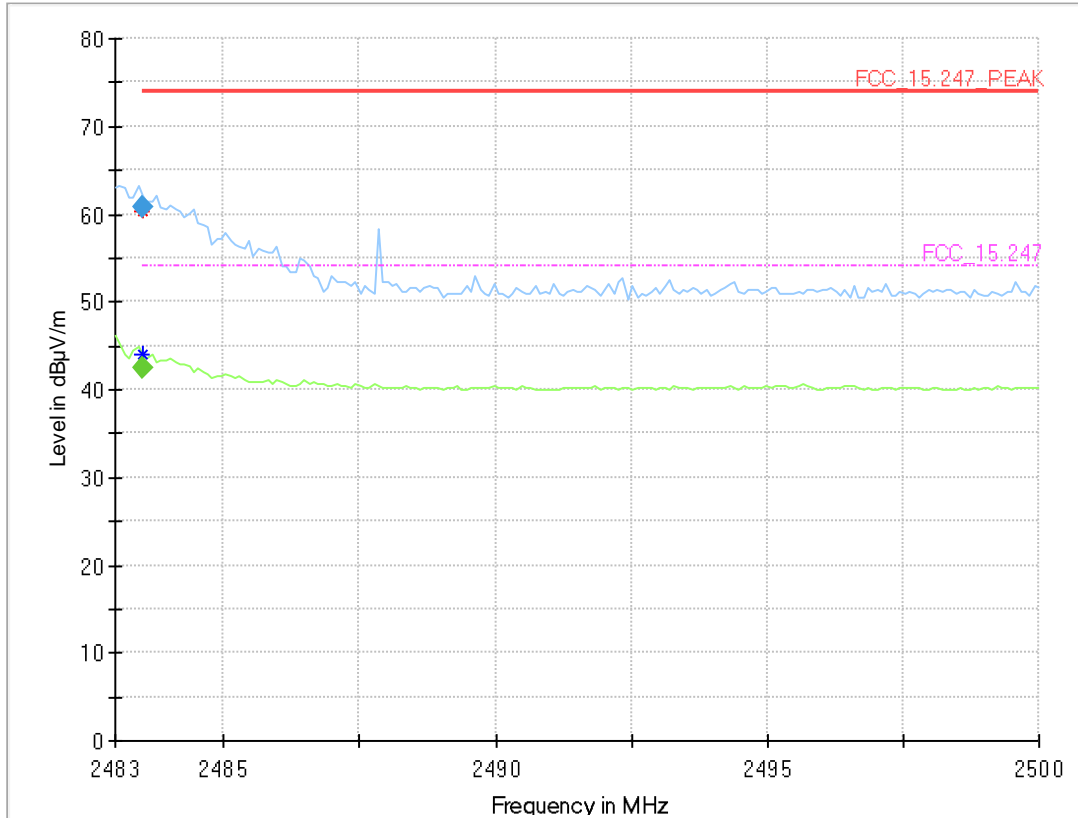
Radio Technology = Bluetooth EDR 2, Operating Frequency = high, Band Edge = high (S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 41.6 | 54.00 | 12.40 | 1000.0 | 1000.000 | 150.0 | V | -173.0 | 96.0 | 7.8 |
| 2483.510 | 57.9 | --- | 74.00 | 16.11 | 1000.0 | 1000.000 | 150.0 | V | -173.0 | 96.0 | 7.8 |

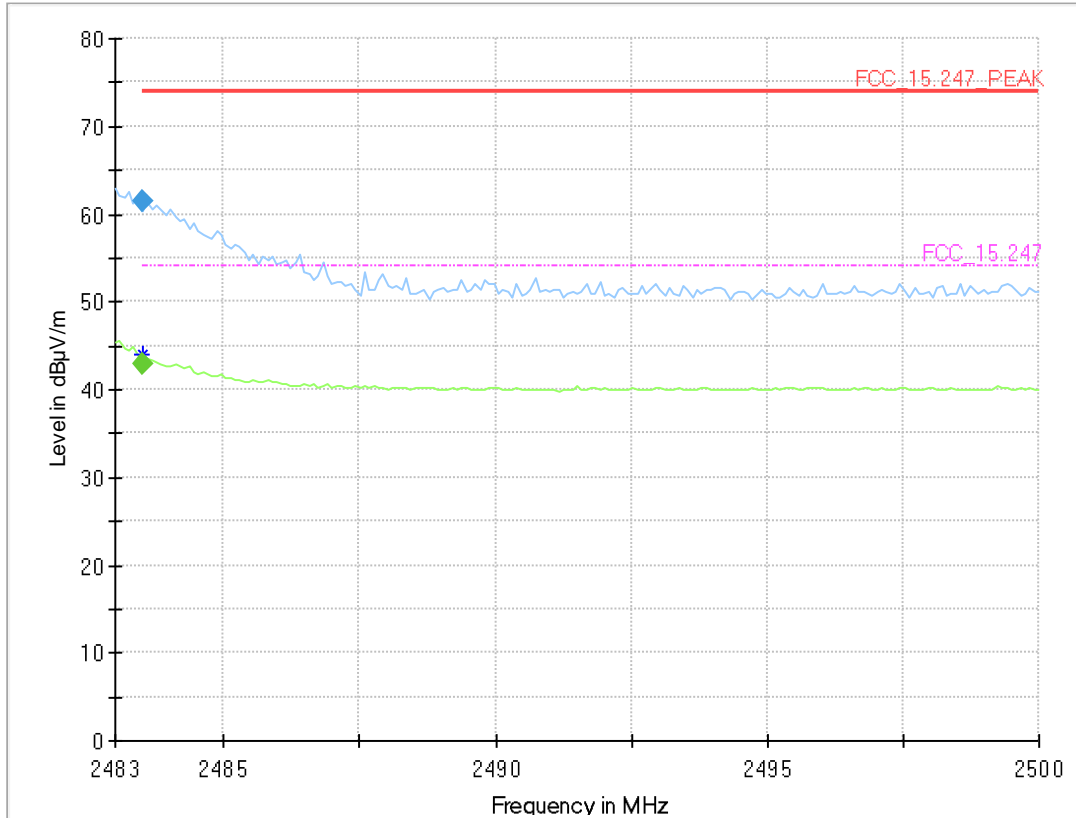
Radio Technology = Bluetooth EDR 3, Operating Frequency = high, Band Edge = high (S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 42.4 | 54.00 | 11.57 | 1000.0 | 1000.000 | 150.0 | V | -94.0 | 81.0 | 7.8 |
| 2483.510 | 60.8 | --- | 74.00 | 13.17 | 1000.0 | 1000.000 | 150.0 | V | -94.0 | 81.0 | 7.8 |

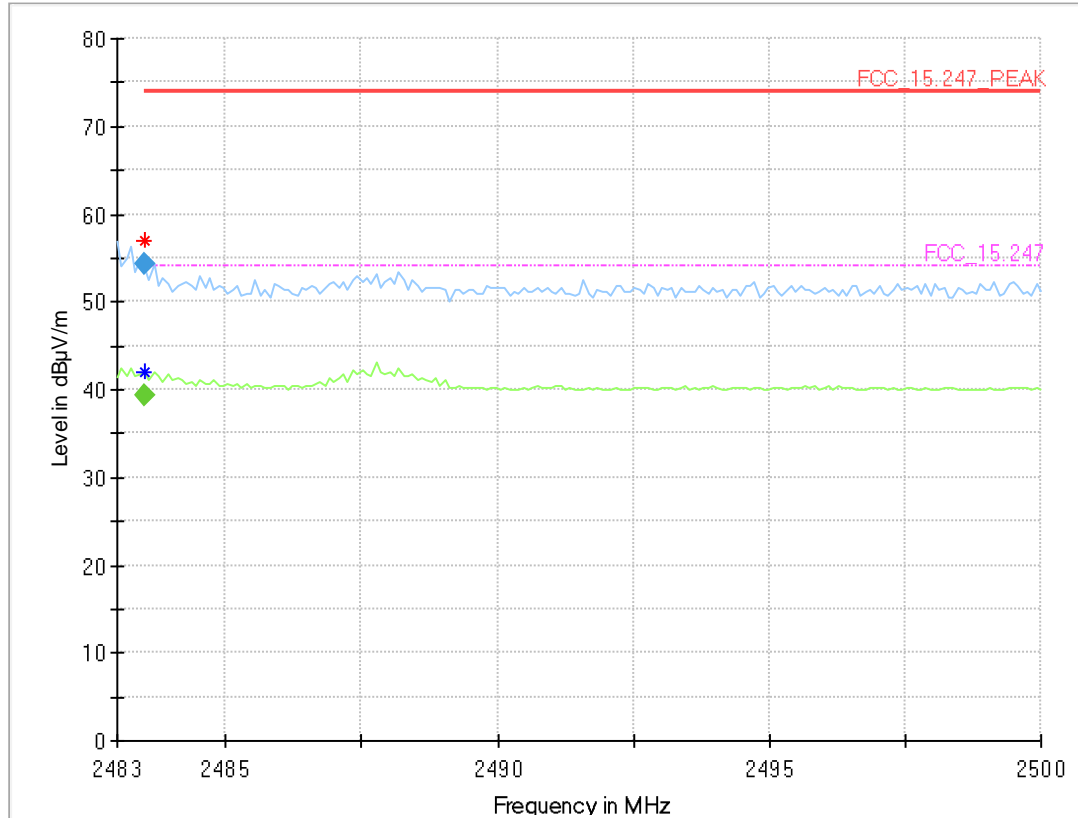
Radio Technology = Bluetooth EDR 3, Operating Frequency = high, Band Edge = high (S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 42.9 | 54.00 | 11.06 | 1000.0 | 1000.000 | 150.0 | V | -175.0 | 94.0 | 7.8 |
| 2483.510 | 61.4 | --- | 74.00 | 12.55 | 1000.0 | 1000.000 | 150.0 | V | -175.0 | 94.0 | 7.8 |

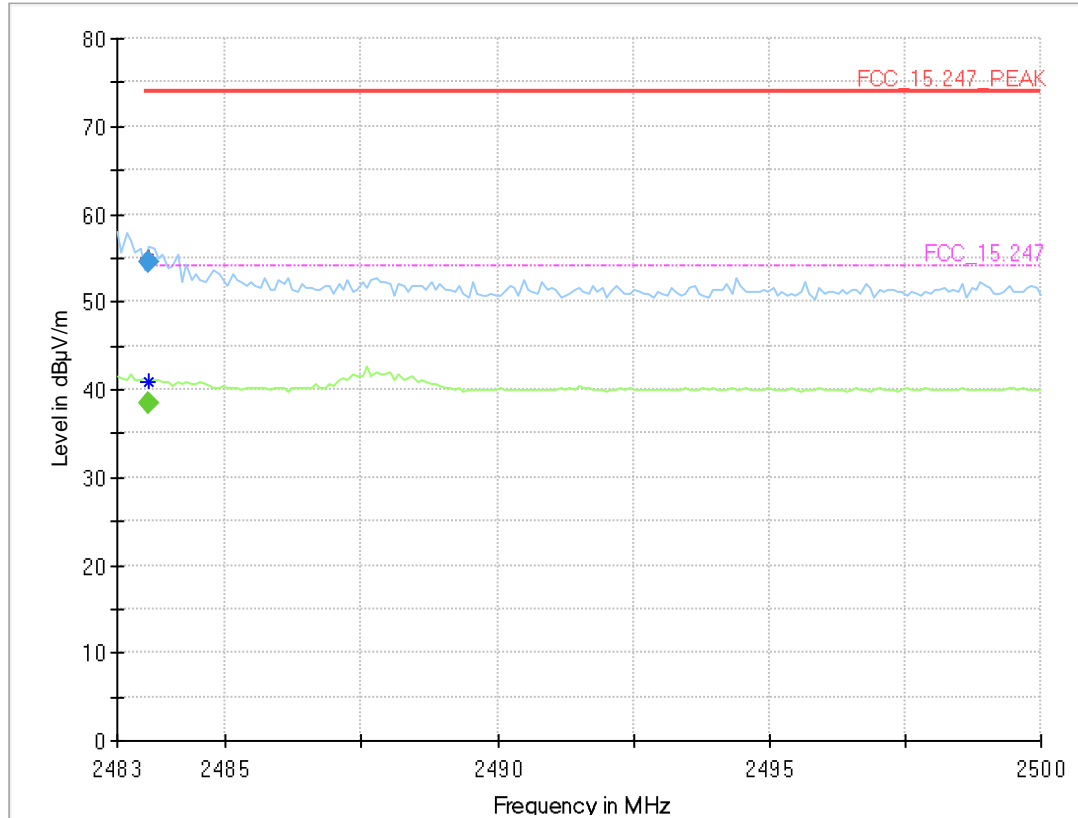
Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = high, Band Edge = high (S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 39.3 | 54.00 | 14.67 | 1000.0 | 1000.000 | 150.0 | V | -85.0 | 100.0 | 7.8 |
| 2483.510 | 54.3 | --- | 74.00 | 19.74 | 1000.0 | 1000.000 | 150.0 | V | -85.0 | 100.0 | 7.8 |

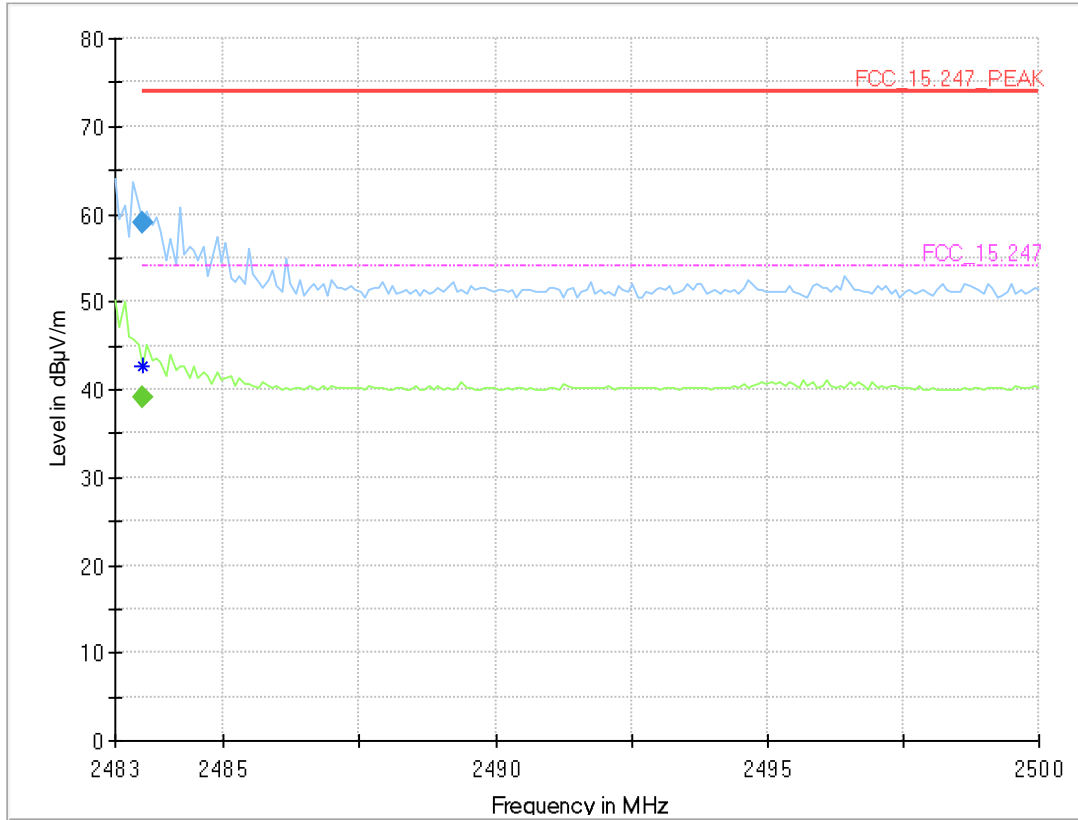
Radio Technology = Bluetooth LE 1 Mbps, Operating Frequency = high, Band Edge = high (S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.595 | --- | 38.5 | 54.00 | 15.51 | 1000.0 | 1000.000 | 150.0 | V | 21.0 | 79.0 | 7.8 |
| 2483.595 | 54.5 | --- | 74.00 | 19.51 | 1000.0 | 1000.000 | 150.0 | V | 21.0 | 79.0 | 7.8 |

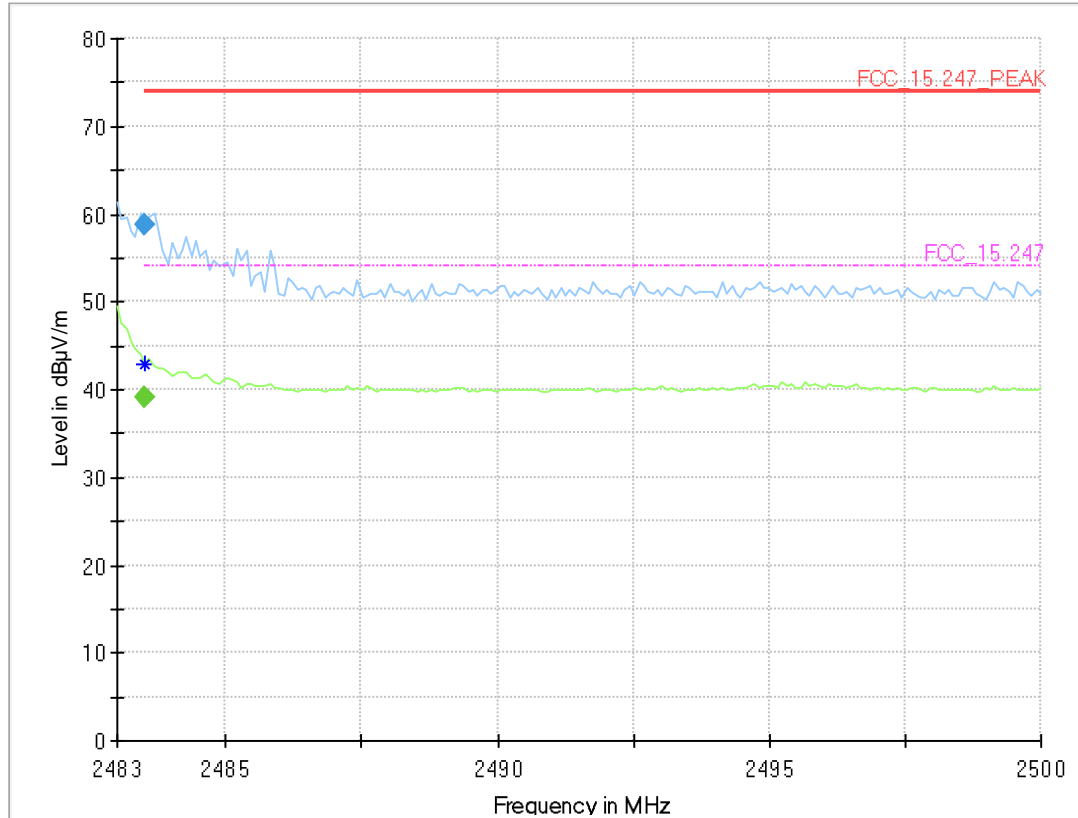
Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = high, Band Edge = high (S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 39.2 | 54.00 | 14.81 | 1000.0 | 1000.000 | 150.0 | H | -58.0 | -4.0 | 7.8 |
| 2483.510 | 59.0 | --- | 74.00 | 15.01 | 1000.0 | 1000.000 | 150.0 | H | -58.0 | -4.0 | 7.8 |

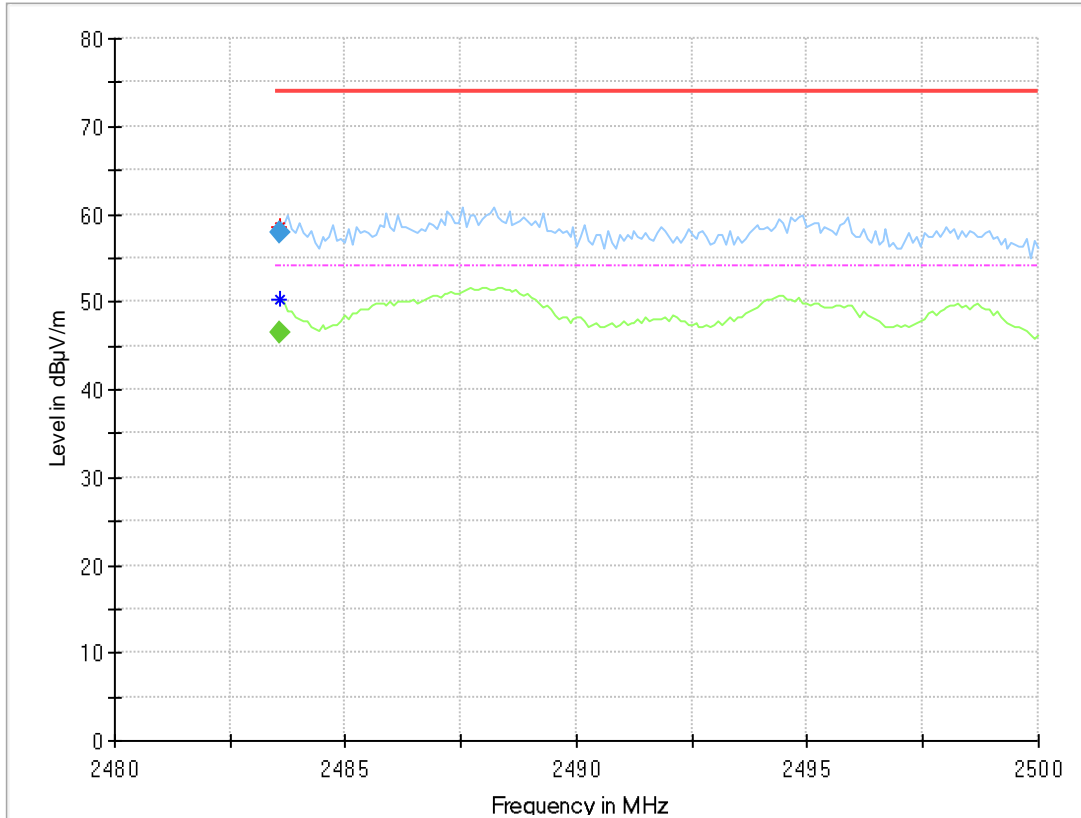
Radio Technology = Bluetooth LE 2 Mbps, Operating Frequency = high, Band Edge = high (S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 39.0 | 54.00 | 14.96 | 1000.0 | 1000.000 | 150.0 | V | -152.0 | 94.0 | 7.8 |
| 2483.510 | 58.8 | --- | 74.00 | 15.17 | 1000.0 | 1000.000 | 150.0 | V | -152.0 | 94.0 | 7.8 |

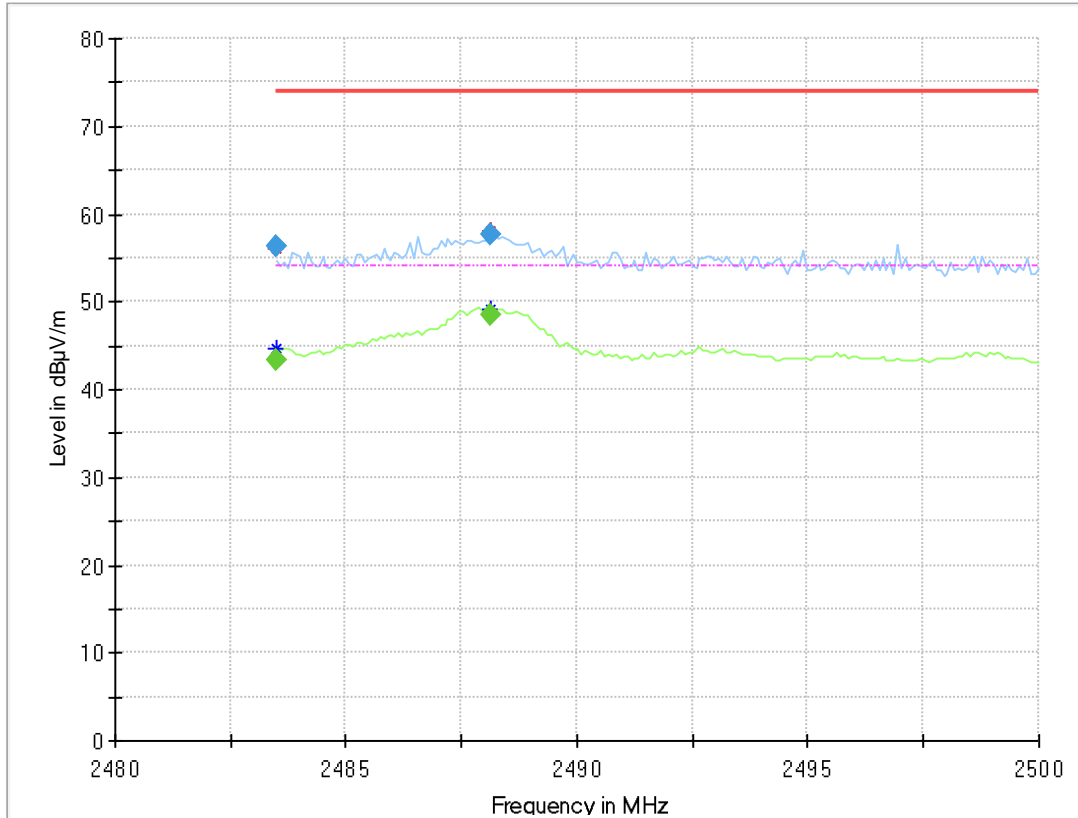
Radio Technology = WLAN b, Operating Frequency = high, Band Edge = high
(S01_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.583 | --- | 46.4 | 54.00 | 7.61 | 1000.0 | 1000.000 | 150.0 | H | -152.0 | -2.0 | 7.8 |
| 2483.583 | 57.8 | --- | 74.00 | 16.16 | 1000.0 | 1000.000 | 150.0 | H | -152.0 | -2.0 | 7.8 |

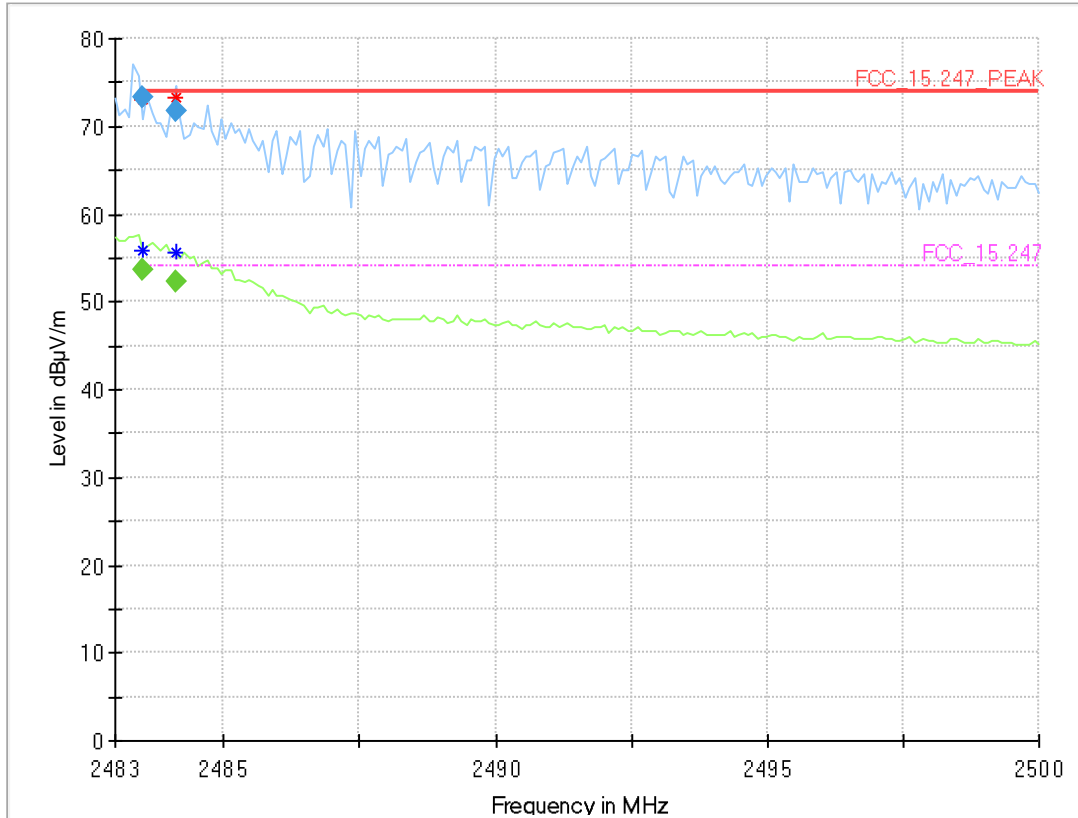
Radio Technology = WLAN b, Operating Frequency = high, Band Edge = high
(S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.500 | --- | 43.4 | 54.00 | 10.58 | 1000.0 | 1000.000 | 150.0 | H | -175.0 | 83.0 | 7.8 |
| 2483.500 | 56.2 | --- | 74.00 | 17.80 | 1000.0 | 1000.000 | 150.0 | H | -175.0 | 83.0 | 7.8 |
| 2488.120 | --- | 48.5 | 54.00 | 5.53 | 1000.0 | 1000.000 | 150.0 | H | -169.0 | 15.0 | 7.9 |
| 2488.120 | 57.7 | --- | 74.00 | 16.30 | 1000.0 | 1000.000 | 150.0 | H | -169.0 | 15.0 | 7.9 |

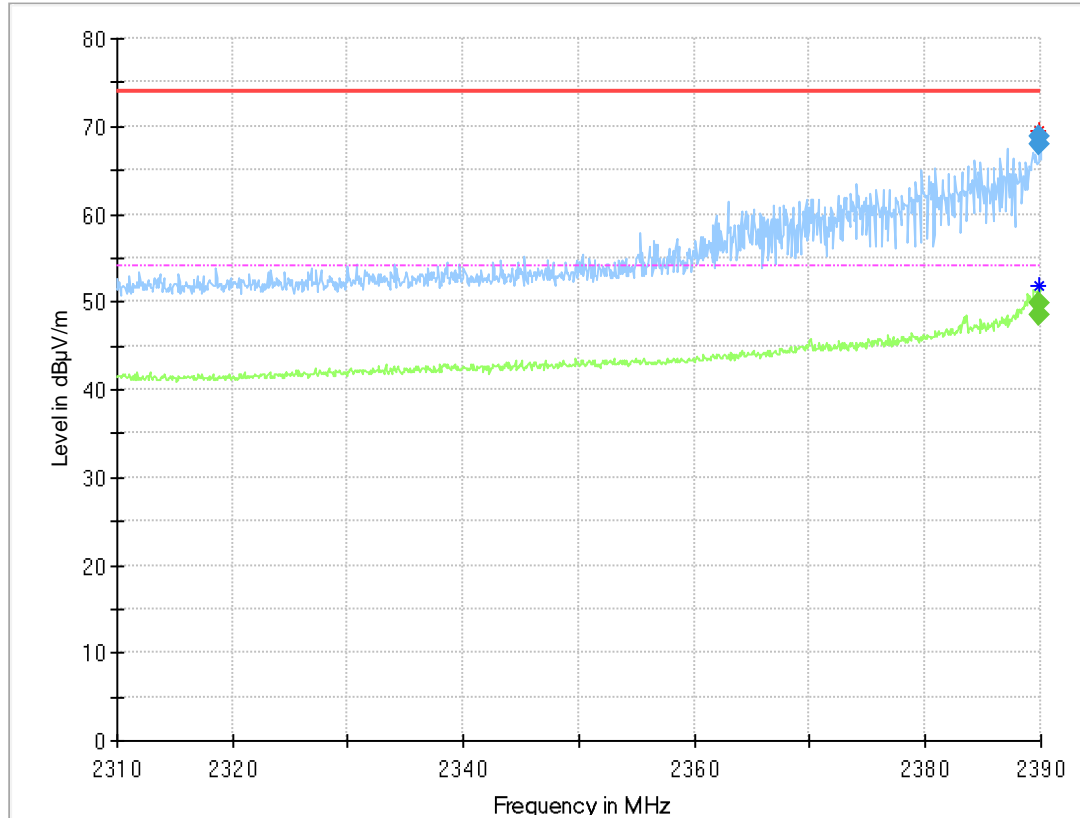
Radio Technology = WLAN g, Operating Frequency = high, Band Edge = high
(S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 53.6 | 54.00 | 0.38 | 1000.0 | 1000.000 | 150.0 | H | 109.0 | -6.0 | 7.8 |
| 2483.510 | 73.3 | --- | 74.00 | 0.71 | 1000.0 | 1000.000 | 150.0 | H | 109.0 | -6.0 | 7.8 |
| 2484.105 | --- | 52.4 | 54.00 | 1.65 | 1000.0 | 1000.000 | 150.0 | H | 109.0 | -15.0 | 7.8 |
| 2484.105 | 71.7 | --- | 74.00 | 2.30 | 1000.0 | 1000.000 | 150.0 | H | 109.0 | -15.0 | 7.8 |

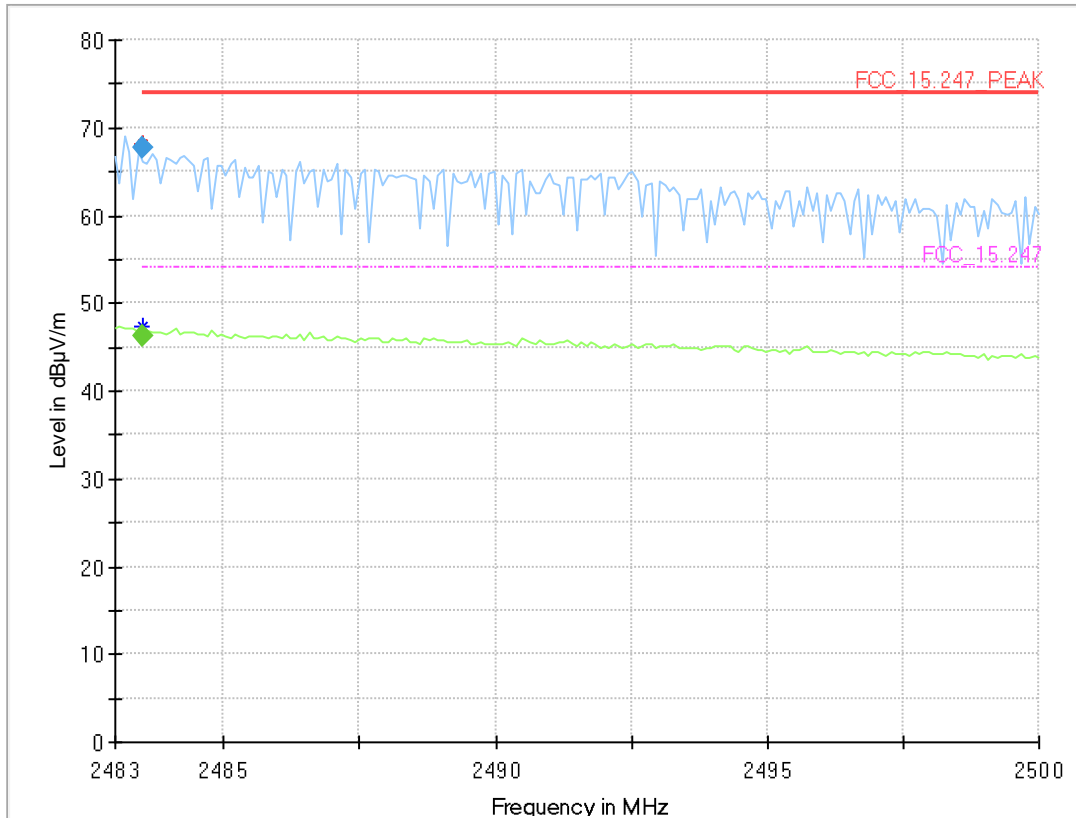
Radio Technology = WLAN g, Operating Frequency = low, Band Edge = low (S03_160_AB02)



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) | Cor. (dB/m) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 2389.760 | --- | 48.4 | 54.0 | 5.61 | 1000.0 | 1000.00 | 150. | H | -8.0 | 70.0 | 7.6 |
| 2389.760 | 67.9 | --- | 74.0 | 6.11 | 1000.0 | 1000.00 | 150. | H | -8.0 | 70.0 | 7.6 |
| 2389.840 | --- | 49.9 | 54.0 | 4.10 | 1000.0 | 1000.00 | 150. | H | 12.0 | 110.0 | 7.6 |
| 2389.840 | 68.8 | --- | 74.0 | 5.17 | 1000.0 | 1000.00 | 150. | H | 12.0 | 110.0 | 7.6 |

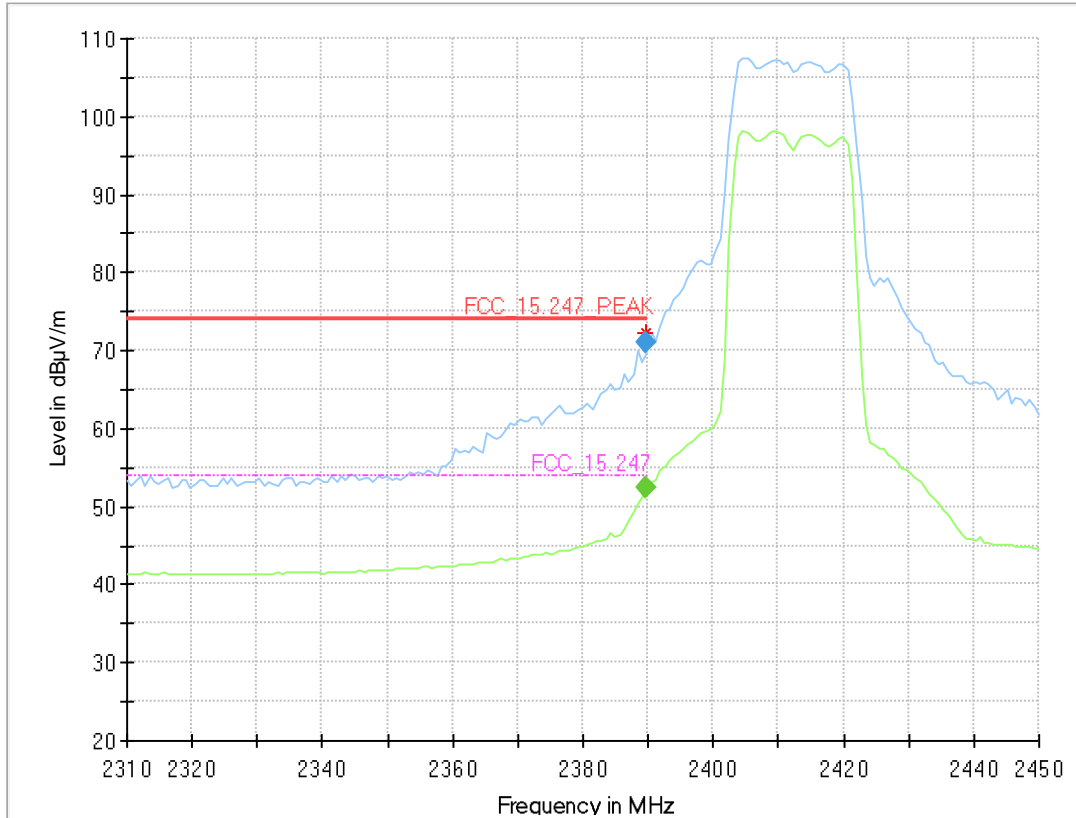
Radio Technology = WLAN g, Operating Frequency = high, Band Edge = high
(S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 46.2 | 54.00 | 7.79 | 1000.0 | 1000.000 | 150.0 | H | -161.0 | 8.0 | 7.8 |
| 2483.510 | 67.8 | --- | 74.00 | 6.19 | 1000.0 | 1000.000 | 150.0 | H | -161.0 | 8.0 | 7.8 |

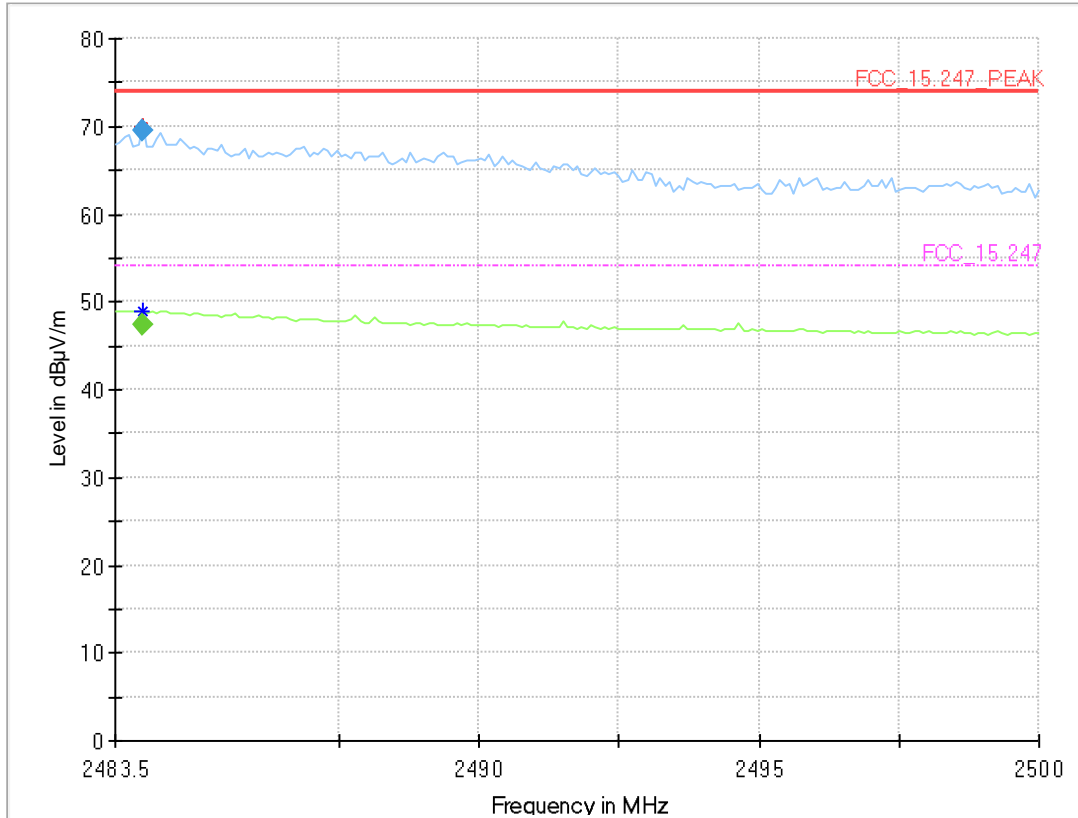
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Band Edge = low (S01_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2389.800 | --- | 52.4 | 54.00 | 1.60 | 1000.0 | 1000.000 | 150.0 | V | -185.0 | 8.0 | 7.6 |
| 2389.800 | 71.1 | --- | 74.00 | 2.90 | 1000.0 | 1000.000 | 150.0 | V | -185.0 | 8.0 | 7.6 |

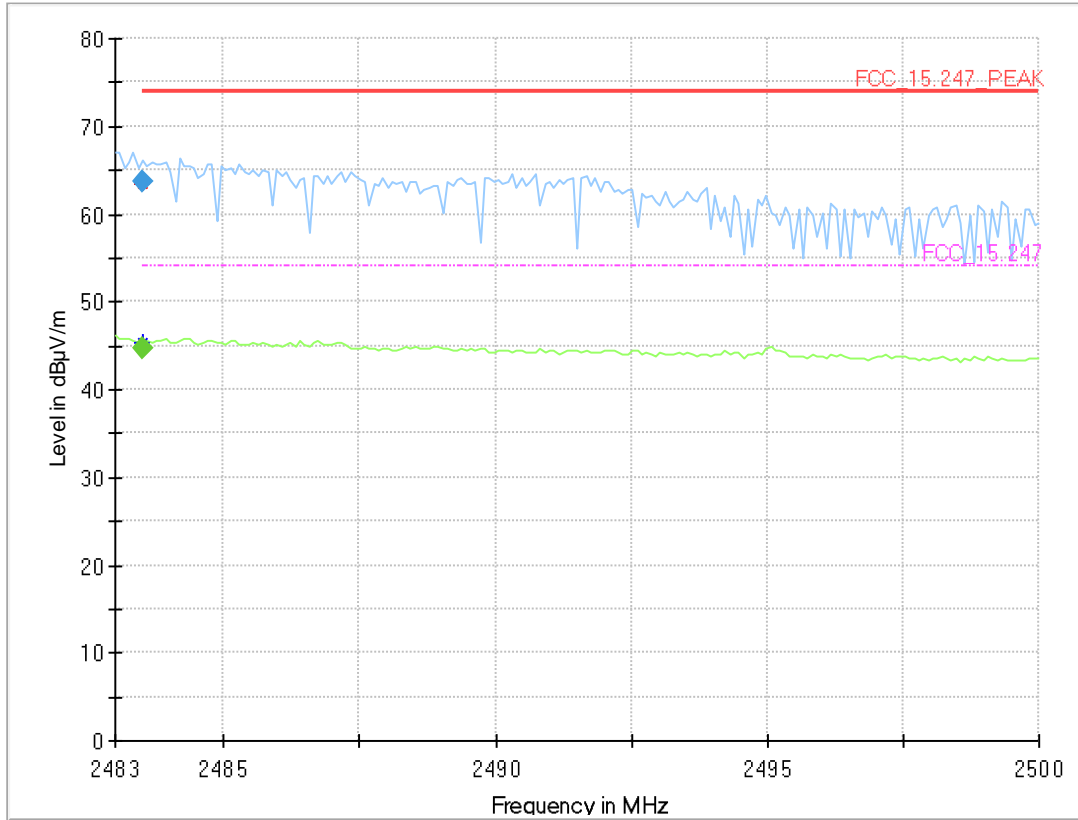
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Band Edge = high
(S01_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.995 | --- | 47.4 | 54.00 | 6.57 | 1000.0 | 1000.000 | 150.0 | H | 120.0 | 4.0 | 43.6 |
| 2483.995 | 69.5 | --- | 74.00 | 4.55 | 1000.0 | 1000.000 | 150.0 | H | 120.0 | 4.0 | 43.6 |

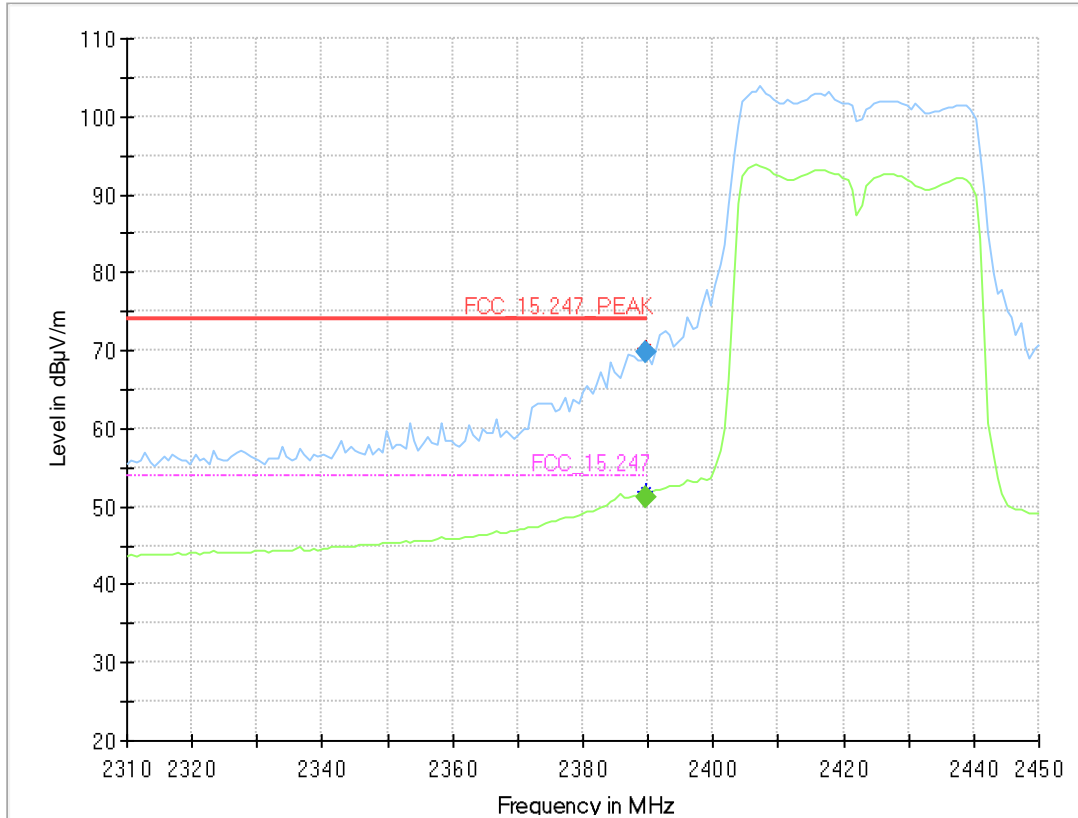
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Band Edge = high
(S03_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2483.510 | --- | 44.7 | 54.00 | 9.33 | 1000.0 | 1000.000 | 150.0 | V | -101.0 | 89.0 | 7.8 |
| 2483.510 | 63.6 | --- | 74.00 | 10.36 | 1000.0 | 1000.000 | 150.0 | V | -101.0 | 89.0 | 7.8 |

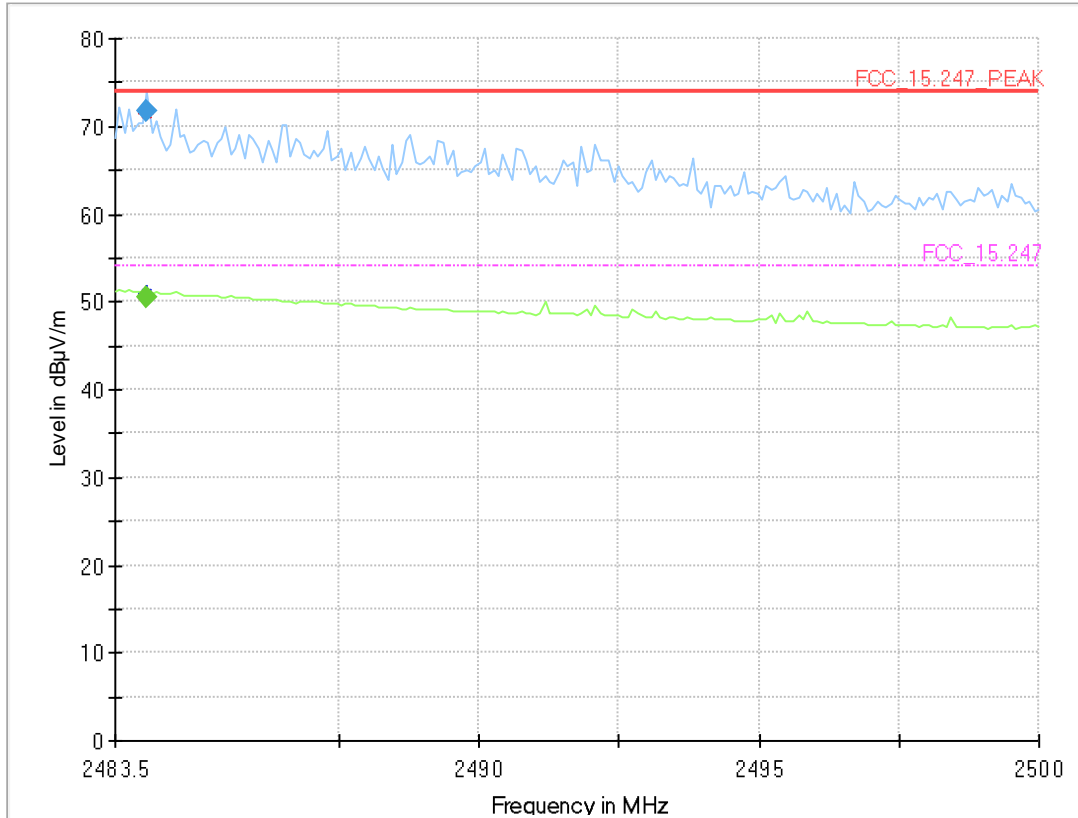
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Band Edge = low
(S01_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2389.800 | --- | 51.1 | 54.00 | 2.91 | 1000.0 | 1000.000 | 150.0 | H | 123.0 | 15.0 | 43.3 |
| 2389.800 | 69.7 | --- | 74.00 | 4.30 | 1000.0 | 1000.000 | 150.0 | H | 123.0 | 15.0 | 43.3 |

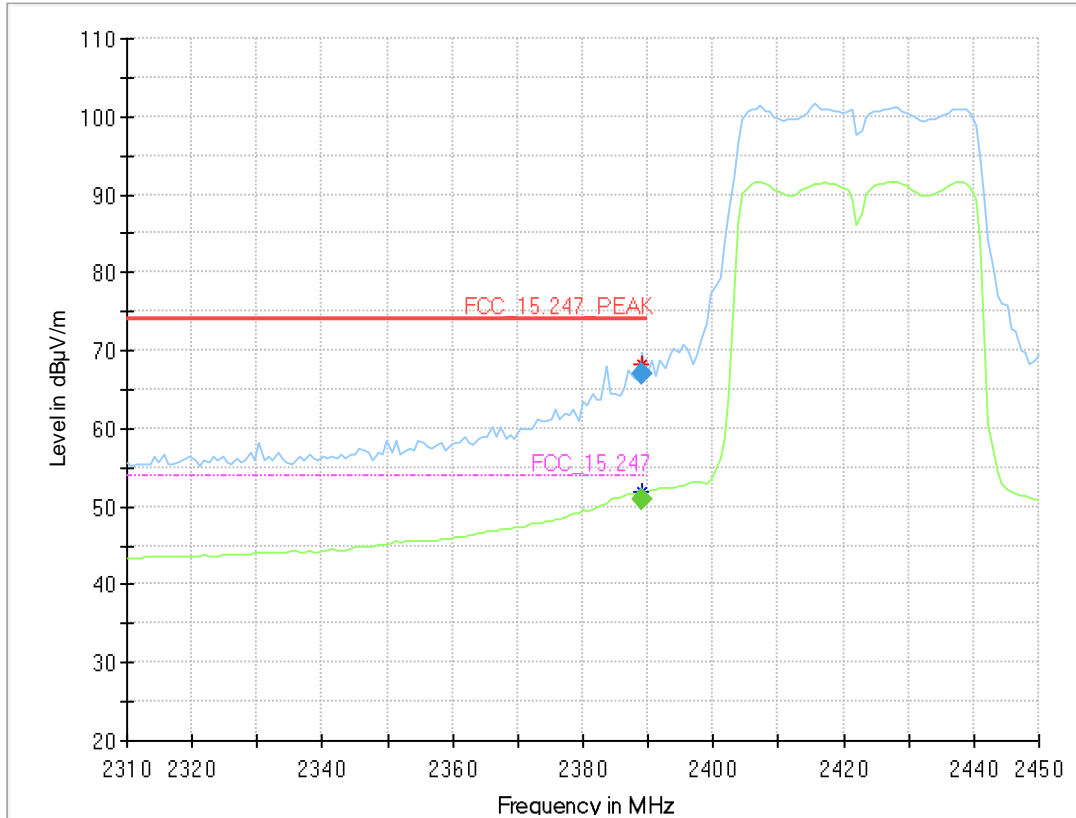
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Band Edge = high
(S01_160_AB02)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2484.078 | --- | 50.4 | 54.00 | 3.57 | 1000.0 | 1000.000 | 150.0 | H | 116.0 | 10.0 | 43.6 |
| 2484.078 | 71.7 | --- | 74.00 | 2.31 | 1000.0 | 1000.000 | 150.0 | H | 116.0 | 10.0 | 43.6 |

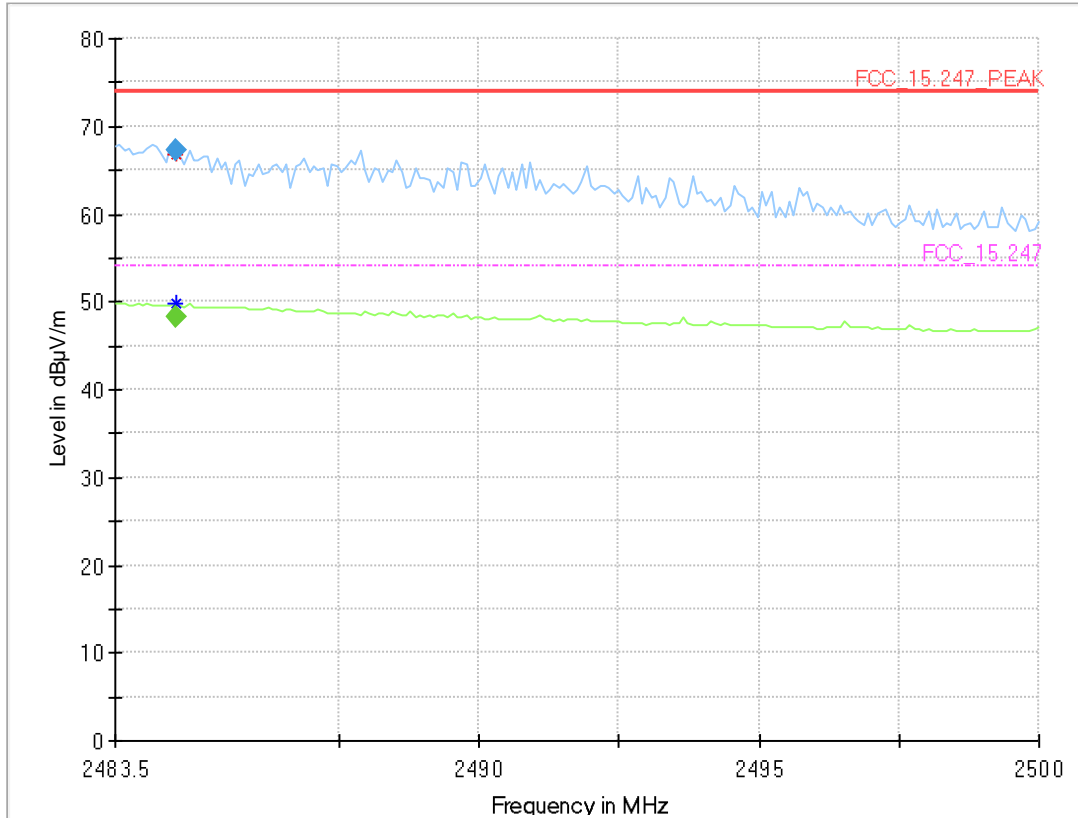
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Band Edge = low (S03_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2389.100 | --- | 50.8 | 54.00 | 3.16 | 1000.0 | 1000.000 | 150.0 | H | -5.0 | 105.0 | 43.2 |
| 2389.100 | 67.1 | --- | 74.00 | 6.93 | 1000.0 | 1000.000 | 150.0 | H | -5.0 | 105.0 | 43.2 |

Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Band Edge = high
(S03_160_AC03)



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) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|--------------|
| 2484.573 | --- | 48.2 | 54.00 | 5.83 | 1000.0 | 1000.000 | 150.0 | H | 153.0 | 6.0 | 43.6 |
| 2484.573 | 67.2 | --- | 74.00 | 6.83 | 1000.0 | 1000.000 | 150.0 | H | 153.0 | 6.0 | 43.6 |

5.3.5 TEST EQUIPMENT USED

- Radiated Emissions FAR 2.4 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 | FSV30 | Signal Analyzer 10 Hz - 30 GHz | Rohde & Schwarz | 103005 | 2023-08 | 2025-08 |
| 1.3 | FSW43 | Signal Analyser | Rohde & Schwarz GmbH & Co. KG | 102013 | 2023-07 | 2025-07 |
| 1.4 | Opus10 THI (8152.00) | T/H Logger 14 | Lufft Mess- und Regeltechnik GmbH | 13993 | 2023-12 | 2025-12 |
| 1.5 | HMP2020 | Programmable Power Supply | Rohde & Schwarz GmbH & Co. KG | 101992 | N/A | N/A |
| 1.6 | OSP120 | Contains Power Meter and Switching Unit OSP-B157W8 PLUS | Rohde & Schwarz | 101158 | 2021-08 | 2024-08 |
| 1.7 | CS-RUB6 | Rubidium Frequency Standard | Rohde & Schwarz GmbH & Co. KG | 100321 | 2023-10 | 2024-10 |

2 Radiated Emissions FAR 2.4 GHz FCC
 Radiated emission tests for 2.4 GHz ISM devices 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 |
| 2.6 | JS4-18002600-32-5P | Broadband Amplifier 18 GHz - 26 GHz | Miteq | 849785 | N/A | N/A |
| 2.7 | FSW43 | Spectrum Analyzer | Rohde & Schwarz GmbH & Co. KG | 103779 | 2023-04 | 2025-04 |
| 2.8 | EP 1200/B, NA/B1 | AC Source, Amplifier with integrated variable Oscillator | Spitzenberger & Spies GmbH & Co. KG | B6278 | N/A | N/A |
| 2.9 | 3160-09 | Standard Gain / Pyramidal Horn Antenna 26.5 GHz | EMCO Elektronik GmbH | 00083069 | N/A | N/A |
| 2.10 | WHKX 7.0/18G-8SS | High Pass Filter | Wainwright Instruments GmbH | 09 | N/A | N/A |
| 2.11 | MA3000/0800-XP-ET-compact | Bore Sight Antenna Mast | innco systems GmbH | 9210522 | N/A | N/A |
| 2.12 | TT 1.5 WI | Turn Table | Maturo GmbH | - | N/A | N/A |
| 2.13 | 5HC3500/18000-1.2-KK | High Pass Filter | Trilithic | 200035008 | N/A | N/A |
| 2.14 | Opus 20 THI (8120.00) | ThermoHygro Datalogger | Lufft Mess- und Regeltechnik GmbH | 115.0318.0802.033 | 2023-08 | 2025-08 |
| 2.15 | TD1.5-10kg | EUT Tilt Device (Rohacell) | Maturo GmbH | TD1.5-10kg/024/3790709 | N/A | N/A |
| 2.16 | AFS42-00101800-25-S-42 | Broadband Amplifier 25 MHz - 18 GHz | Miteq | 2035324 | N/A | N/A |
| 2.17 | HF 907 | Double-ridged horn | Rohde & Schwarz | 102444 | 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 |
| 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 | Lufft Mess- und Regeltechnik GmbH | 13936 | 2023-12 | 2025-12 |
| 4.3 | ESW44 | EMI Receiver / Spectrum Analyzer | Rohde & Schwarz GmbH & Co. KG | 101603 | 2024-03 | 2026-03 |
| 4.4 | Anechoic Chamber 01 | SAC/FAR, 10.58 m x 6.38 m x 6.00 m | Frankonia Germany EMC Solution GmbH | none | N/A | N/A |
| 4.5 | HL 562 ULTRALOG | Biconical-log- per antenna (30 MHz - 3 GHz) with HL 562E biconicals | Rohde & Schwarz GmbH & Co. KG | 830547/003 | 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 | Lufft Mess- und Regeltechnik GmbH | 12488 | 2023-12 | 2025-12 |
| 4.8 | EP 1200/B, NA/B1 | AC Source, Amplifier with integrated variable Oscillator | Spitzenberger & Spies GmbH & Co. KG | B6278 | N/A | N/A |
| 4.9 | DS 420S | Turn Table 2 m diameter | HD GmbH | 420/573/99 | N/A | N/A |
| 4.10 | 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 | AM4.0/180/1192 0513 | N/A | N/A |

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

6.2 TEST EQUIPMENT SOFTWARE

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

7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

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

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

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

Sample calculation

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

U = Receiver reading

LISN Insertion loss = Voltage Division Factor of LISN

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

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

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

| Frequency 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

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

U = Receiver reading

AF = Antenna factor

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

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

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

Table shows an extract of values

7.3 ANTENNA R&S HL562 (30 MHz – 1 GHz)

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

| 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 |

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

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

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

Sample calculation

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

U = Receiver reading

AF = Antenna factor

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

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

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

Tables show an extract of values.

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

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

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

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

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

Sample calculation

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

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

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

Sample calculation

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

U = Receiver reading

AF = Antenna factor

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

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

Table shows an extract of values.

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

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

Sample calculation

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

U = Receiver reading

AF = Antenna factor

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

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

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

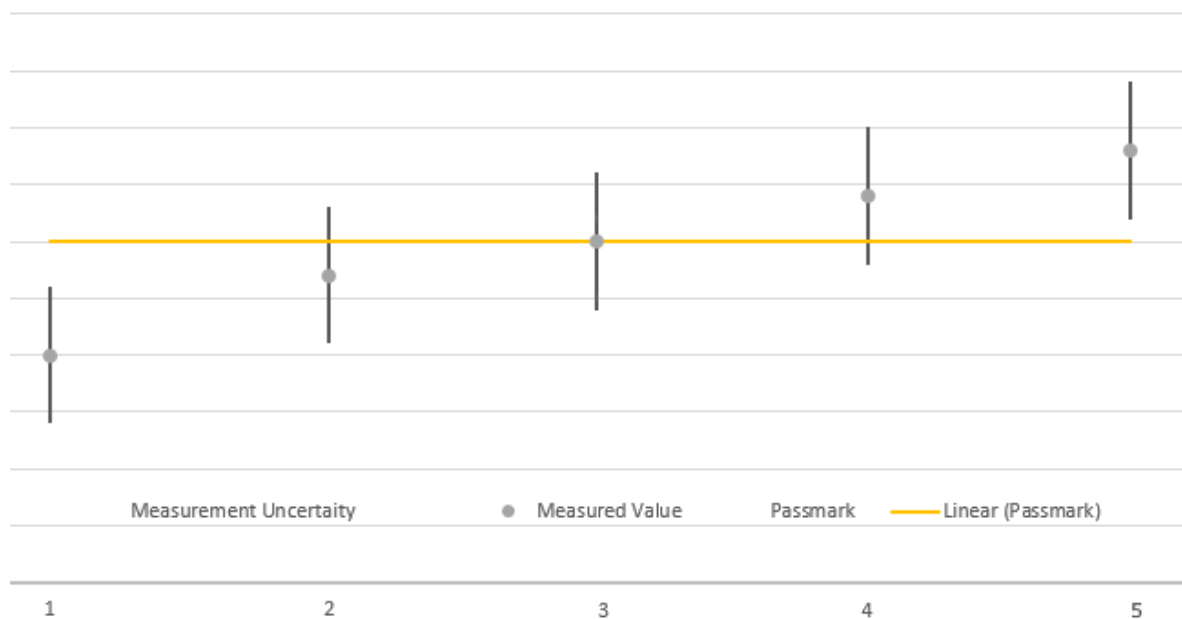
Linear interpolation will be used for frequencies in between the values in the table.

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*****