


Test report No:
 NIE: 69168RRF.001

Test report

USA FCC Part 15.249, 15.209

CANADA RSS-210, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

| | |
|---|---|
| (*) Identification of item tested | Hearing aid |
| (*) Trademark | Phonak |
| (*) Model and /or type reference | Phonak Audéo P90-R Fit |
| Other identification of the product | HW version: 050-0870 SW version: 067-1466 FCC ID: KWC-PRF IC: 2262A-PRF |
| (*) Features | Bluetooth BR, Bluetooth LE, DM, Flora |
| Applicant | SONOVA USA INC. 444 Commerce St. Aurora, IL 60504 |
| Test method requested, standard | USA FCC Part 15.249 (10-1-20 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 (10-1-20 Edition): Radiated emission limits; general requirements. CANADA RSS-210 Issue 10 (December 2019). CANADA RSS-Gen Issue 5 Amendment 2 (February 2021). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices. |
| Summary | IN COMPLIANCE |
| Approved by (name / position & signature) | Rafael López EMC Consumer & RF Lab. Manager  2022.02.15 14:40:34 +01'00' |
| Date of issue | 2022-02-15 |
| Report template No | FDT08_23 (* "Data provided by the client") |

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Competences and guarantees

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model Phonak Audéo P90-R Fit is a hearing aid type RIC (receive in the canal).

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

| Control N° | Description | Model | Serial N° | Date of reception |
|------------|-------------|---------------------------|-----------|-------------------|
| 69168B/001 | Hearing aid | Phonak Audéo P90-R Fit | --- | 2021/11/25 |

Sample S/01 has undergone the following test(s): All the Conducted tests indicated in Appendixes A, B, C, D.

- Sample S/02 is composed of the following elements:

| Control N° | Description | Model | Serial N° | Date of reception |
|------------|-------------|---------------------------|-----------|-------------------|
| 69168B/009 | Hearing aid | Phonak Audéo P90-R Fit | WL36H1A5D | 2021/11/29 |

Sample S/02 has undergone the following test(s): All the Radiated tests indicated in Appendixes A, B, C, D.

Test sample description

| | | | | | | | |
|---|-------------------------------------|--------------------------------|--------------------------|--------------------------|-----------------------------------|--------------------------|--------------------------|
| Ports.....: | Port name and description | Cable | | | | | |
| | | Specified max length [m] | Attached during test | Shielded | Coupled to patient ⁽³⁾ | | |
| | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Supplementary information to the ports.....: | -- | | | | | | |
| Rated power supply | Voltage and Frequency | | Reference poles | | | | |
| | | | L1 | L2 | L3 | N | PE |
| | <input type="checkbox"/> | AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | <input checked="" type="checkbox"/> | DC: 3.7V rechargeable battery | | | | | |
| Rated Power | -- | | | | | | |
| Clock frequencies | -- | | | | | | |
| Other parameters.....: | -- | | | | | | |
| Software version | 050-0870 | | | | | | |
| Hardware version.....: | 067-1466 | | | | | | |
| Dimensions in cm (W x H x D)....: | -- | | | | | | |
| Mounting position.....: | <input type="checkbox"/> | Table top equipment | | | | | |
| | <input type="checkbox"/> | Wall/Ceiling mounted equipment | | | | | |
| | <input type="checkbox"/> | Floor standing equipment | | | | | |
| | <input type="checkbox"/> | Hand-held equipment | | | | | |
| | <input checked="" type="checkbox"/> | Other: Hearing aid | | | | | |
| Modules/parts | Module/parts of test item | | Type | | Manufacturer | | |
| | -- | | | | | | |
| Accessories (not part of the test item).....: | Description | | Type | | Manufacturer | | |
| | -- | | | | | | |
| Documents as provided by the applicant.....: | Description | | File name | | Issue date | | |
| | -- | | | | | | |

⁽³⁾ Only for Medical Equipment

Identification of the client

SONOVA AG
Laubisrütistrasse 28
8712 Stäfa, Switzerland

Testing period and place

| | |
|---------------|--|
| Test Location | DEKRA Testing and Certification S.A.U. |
| Date (start) | 2022-01-03 |
| Date (finish) | 2022-01-05 |

Document history

| Report number | Date | Description |
|---------------|------------|---------------|
| 69168RRF.001 | 2022-02-15 | First release |

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

| | |
|-------------------|------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |

In the semianechoic chamber, the following limits were not exceeded during the test.

| | |
|-------------------|------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

| | |
|-------------------|------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |

Remarks and comments

The tests have been performed by the technical personnel: Jaime Barranquero.

Used instrumentation:

Conducted Measurements:

| | Last Calibration | Due Calibration |
|--|------------------|-----------------|
| 1. Signal and Spectrum Analyzer 2 Hz - 50 GHz ROHDE AND SCHWARZ FSW50 | 2021/07 | 2023/07 |
| 2. DC POWER SUPPLY 30V/3A 90W, GPS-3030D, GW INSTEK | N.A. | N.A. |
| 3. Digital Multimeter, FLUKE 175 | 2021/11 | 2022/11 |

Radiated Measurements:

| | Last Calibration | Due Calibration |
|---|------------------|-----------------|
| 1. Semianechoic Absorber Lined Chamber ALBATROSS P29419 | N/A | N/A |
| 2. Shielded Room ALBATROSS P29419 | N/A | N/A |
| 3. Ultralog Antenna 30MHz-6GHz ROHDE AND SCHWARZ HL562E UPG | 2019/10 | 2022/10 |
| 4. EMI Test Receiver 2Hz – 44GHz ROHDE AND SCHWARZ ESW44 | 2021/12 | 2023/12 |
| 5. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120D | 2019/11 | 2022/11 |
| 6. RF pre-amplifier, 30dB, 500 MHz-18 GHz SCHWARZBECK BBV 9718 C | 2021/02 | 2022/02 |
| 7. Horn Antenna 18-40GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170 | 2021/03 | 2024/03 |
| 8. RF pre-amplifier G>30dB, 18-40GHz, BONN ELEKTRONIK BLMA 1840-3G | 2019/11 | 2021/11 |

Testing verdicts

| | |
|-----------------|-----|
| Not applicable: | N/A |
| Pass: | P |
| Fail: | F |
| Not measured: | N/M |

Summary

1. Bluetooth Low Energy

| FCC PART 15 PARAGRAPH / RSS-210 | | | |
|---|--|---------|--------|
| Requirement – Test case | | Verdict | Remark |
| 15.249 (a) / RSS-210 B.10 (a) | Field strength of fundamental and harmonic emissions | P | |
| 15.249 (d) / RSS-210 B.10 (b) | Emissions radiated outside of the specific frequency bands | P | |
| <u>Supplementary information and remarks:</u> None. | | | |

2. Bluetooth Basic Rate

| FCC PART 15 PARAGRAPH / RSS-210 | | | |
|---|--|---------|--------|
| Requirement – Test case | | Verdict | Remark |
| 15.249 (a) / RSS-210 B.10 (a) | Field strength of fundamental and harmonic emissions | P | |
| 15.249 (d) / RSS-210 B.10 (b) | Emissions radiated outside of the specific frequency bands | P | |
| <u>Supplementary information and remarks:</u> None. | | | |

3. Proprietary protocol DM 2.4 GHz

| FCC PART 15 PARAGRAPH / RSS-210 | | | |
|---|--|---------|--------|
| Requirement – Test case | | Verdict | Remark |
| 15.249 (a) / RSS-210 B.10 (a) | Field strength of fundamental and harmonic emissions | P | |
| 15.249 (d) / RSS-210 B.10 (b) | Emissions radiated outside of the specific frequency bands | P | |
| <u>Supplementary information and remarks:</u> None. | | | |

4. Proprietary protocol Flora 2.4 GHz

| FCC PART 15 PARAGRAPH / RSS-210 | | | |
|---|--|---------|--------|
| Requirement – Test case | | Verdict | Remark |
| 15.249 (a) / RSS-210 B.10 (a) | Field strength of fundamental and harmonic emissions | P | |
| 15.249 (d) / RSS-210 B.10 (b) | Emissions radiated outside of the specific frequency bands | P | |
| <u>Supplementary information and remarks:</u> None. | | | |

Appendix A: Test results. Bluetooth Low Energy

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TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

| | |
|------------------------|------------------------------|
| V nominal: | 3.7 Vdc rechargeable battery |
| Type of Power Supply: | Rechargeable battery. |
| Type of Antenna: | Integral |
| Declared Antenna Gain: | -8.5 dBi |

TEST FREQUENCIES:

| | |
|-----------------|----------|
| Low Channel: | 2402 MHz |
| Middle Channel: | 2440 MHz |
| High Channel: | 2480 MHz |

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The DC supply voltage is applied using an external battery.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

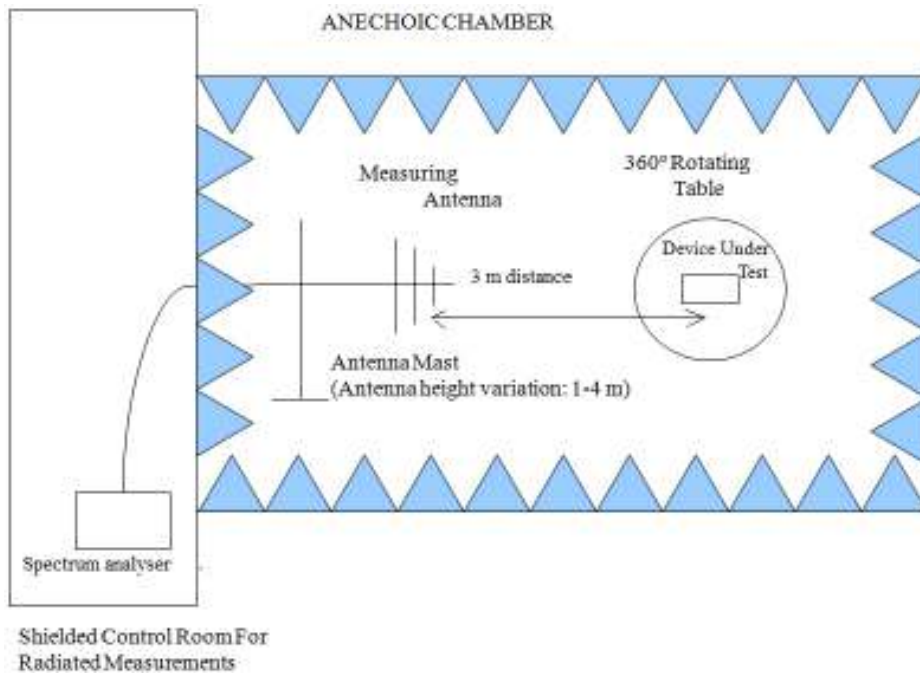
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

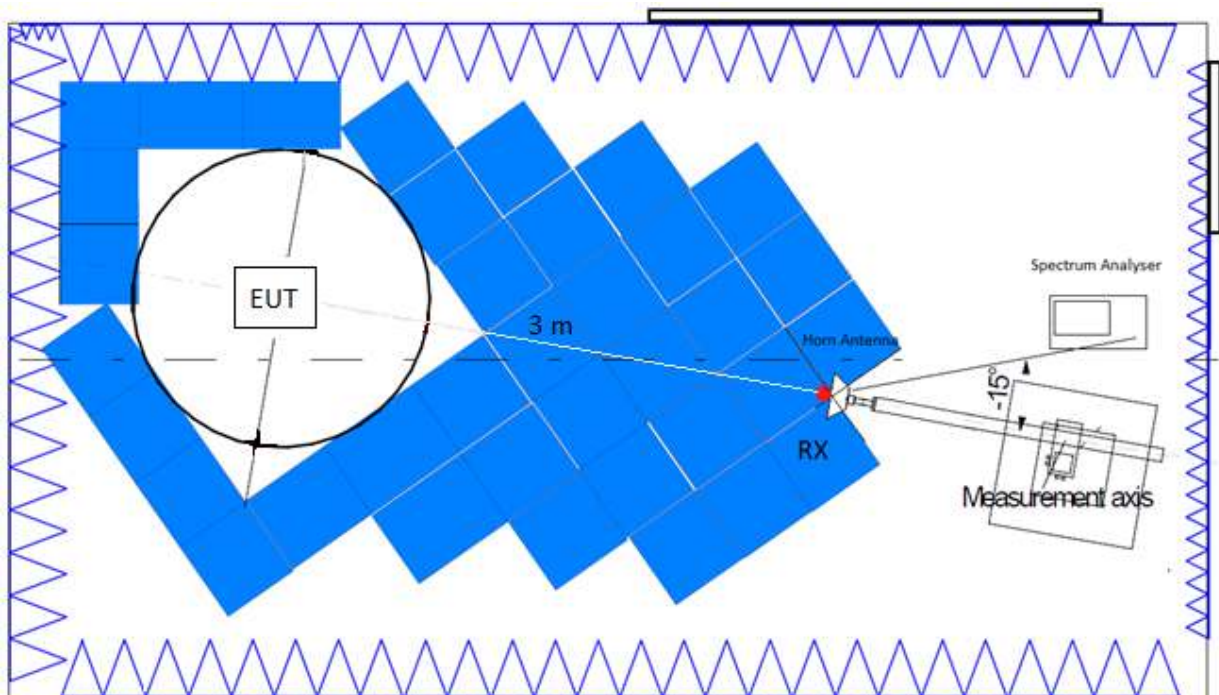
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

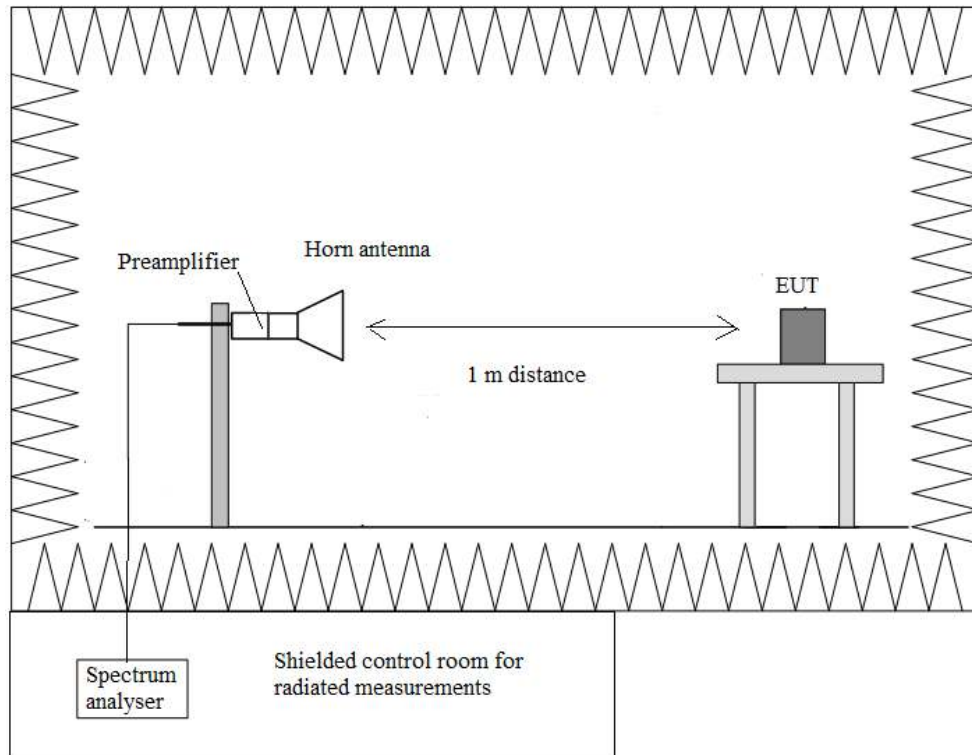
Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



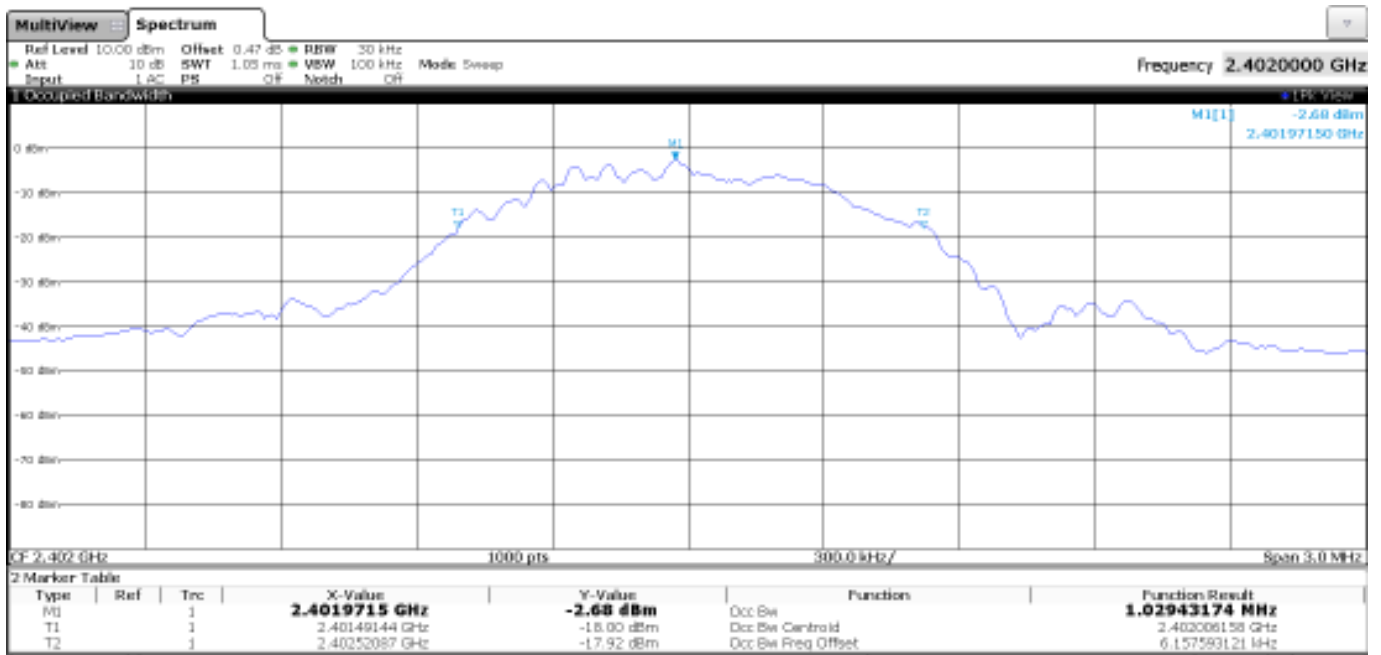
Occupied Bandwidth

RESULTS:

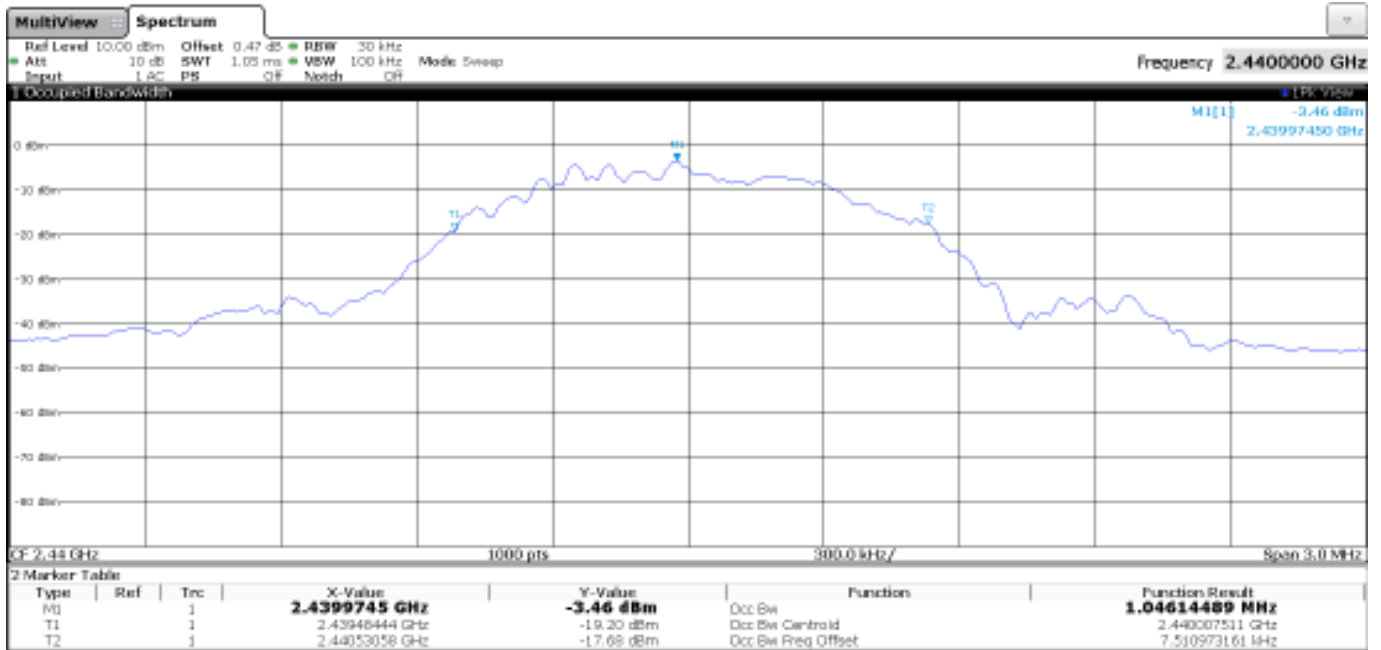
| | | | |
|-------------------------------|-------------------------|----------------------------|--------------------------|
| | Low Channel 2402 MHz | Middle Channel 2440 MHz | High Channel 2480 MHz |
| 99% Bandwidth (MHz) | 1.0294 | 1.0461 | 1.0656 |
| Measurement Uncertainty (kHz) | <±3.64 | | |

Verdict: PASS

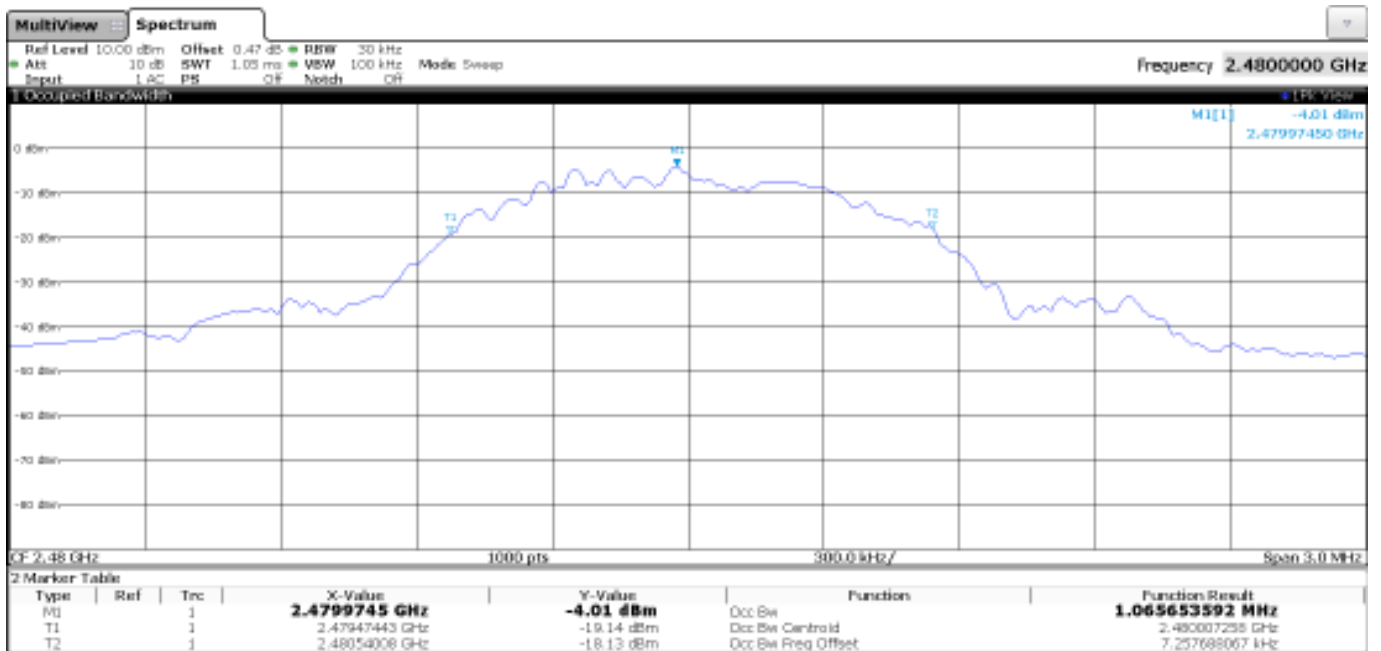
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of fundamental (mV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------------|--------------------------------------|-------------------------|--------------------------|
| 902 - 928 | 50 | 93.98 | 3 |
| 2400 – 2483.5 | 50 | 93.98 | 3 |
| 5725 - 5875 | 50 | 93.98 | 3 |
| 24000-24250 | 250 | 107.96 | 3 |

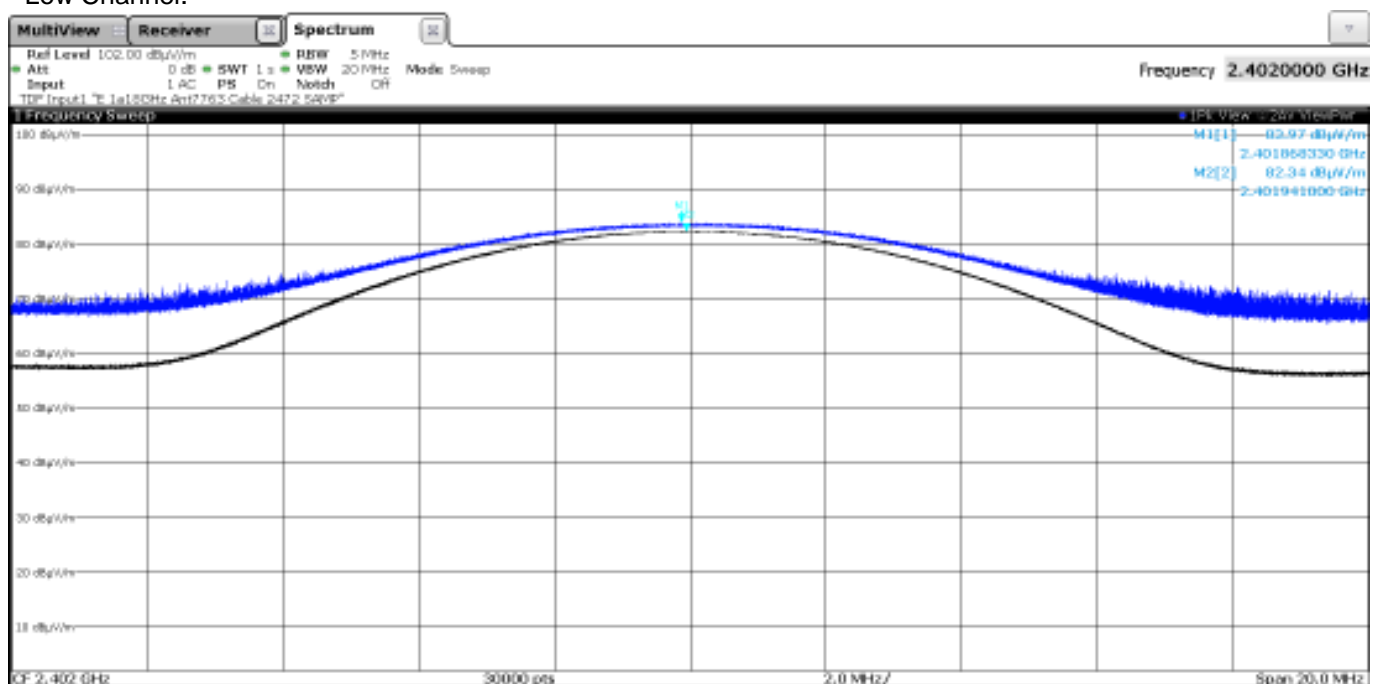
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

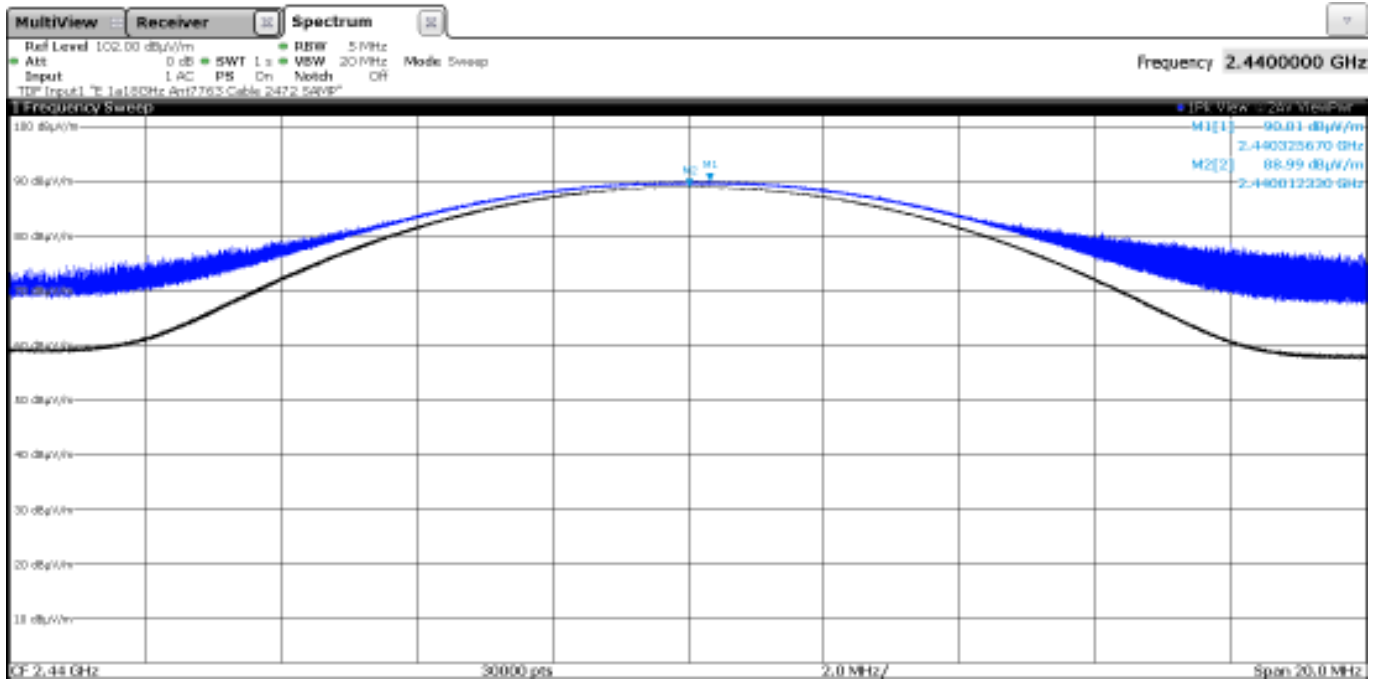
| | Low Channel 2402 MHz | Middle Channel 2440 MHz | High Channel 2480 MHz |
|---------------------------------|-------------------------|----------------------------|--------------------------|
| Average Field Strength (dBµV/m) | 82.34 | 88.99 | 88.58 |
| Peak Field Strength (dBµV/m) | 83.97 | 90.01 | 89.52 |
| Measurement Uncertainty (dB) | <±4.01 | | |

Verdict: PASS

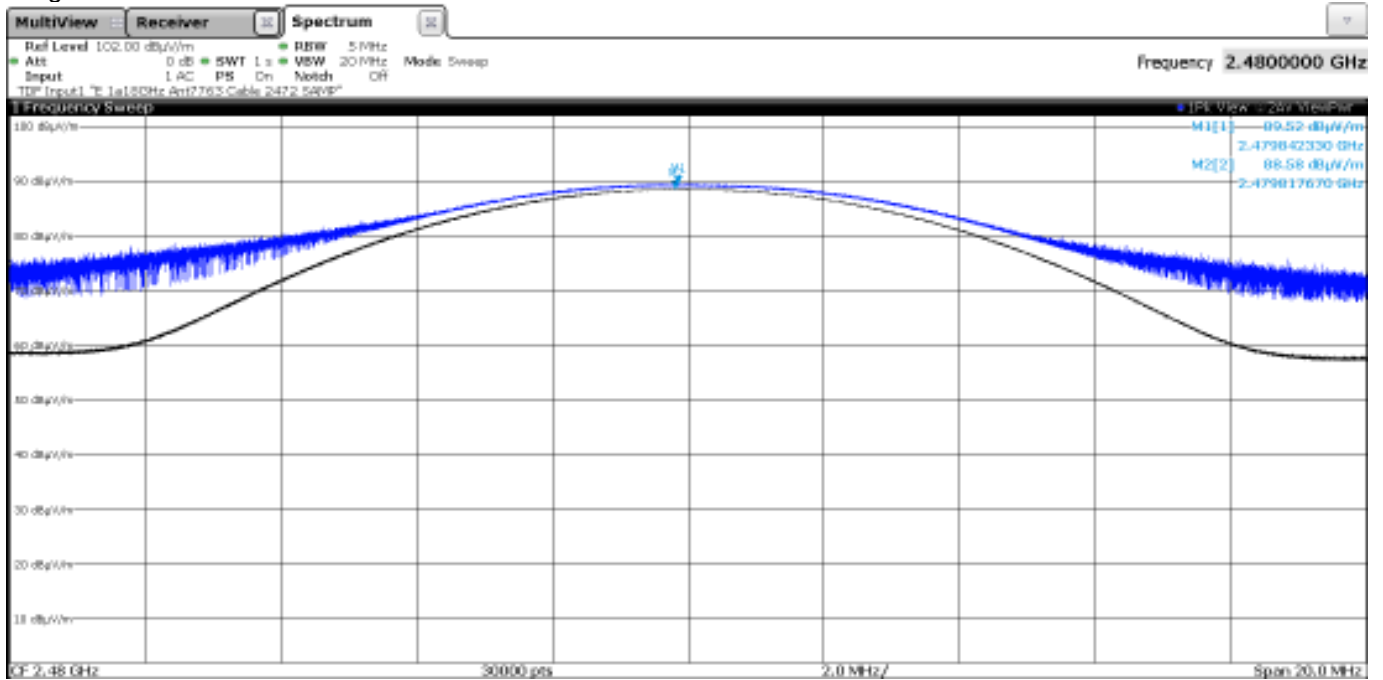
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of harmonics ($\mu\text{V/m}$) | Field strength of harmonics (dB $\mu\text{V/m}$) | Measurement distance (m) |
|-----------------------------|---|---|--------------------------|
| 902 - 928 | 500 | 54 | 3 |
| 2400 – 2483.5 | 500 | 54 | 3 |
| 5725 - 5875 | 500 | 54 | 3 |
| 24000-24250 | 2500 | 67.96 | 3 |

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

| Frequency Range (MHz) | Field strength ($\mu\text{V/m}$) | Field strength (dB $\mu\text{V/m}$) | Measurement distance (m) |
|-----------------------|------------------------------------|--------------------------------------|--------------------------|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 30 |
| 1.705 - 30.0 | 30 | - | 30 |
| 30 - 88 | 100 | 40 | 3 |
| 88 - 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| 960 - 25000 | 500 | 54 | 3 |

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-17 GHz and at distance of 1m for the frequency range 17 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty $<\pm 5.15$ dB

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel (2440 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- High Channel (2480 MHz):

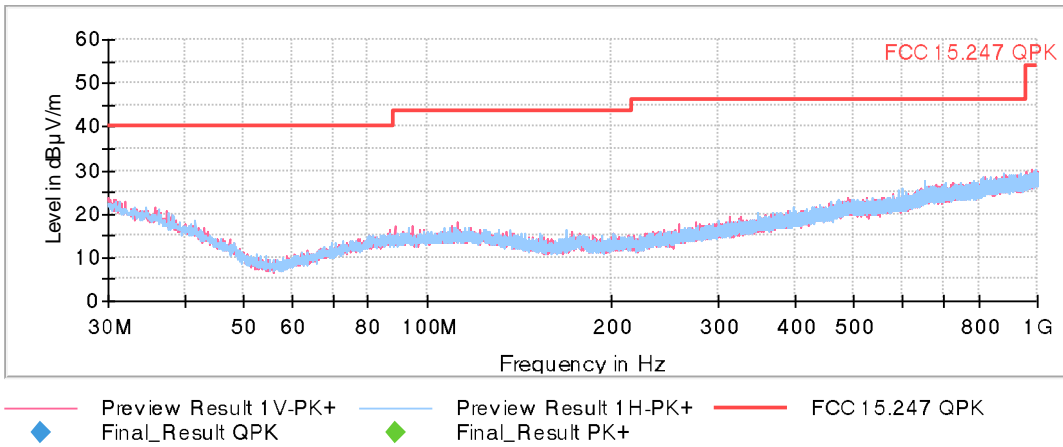
| Spurious frequency (GHz) | Emission Level (dB μ V/m) | Polarization | Detector | Measurement Uncertainty (dB) |
|--------------------------|-------------------------------|--------------|----------|------------------------------|
| 2.483666667 | 63.04 | H | Peak | $<\pm 4.94$ |
| | 50.08 | | Average | |

Measurement Uncertainty: 1-3 GHz $<\pm 4.94$ dB
 3-17 GHz $<\pm 4.28$ dB
 17-26 GHz $<\pm 4.89$ dB

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

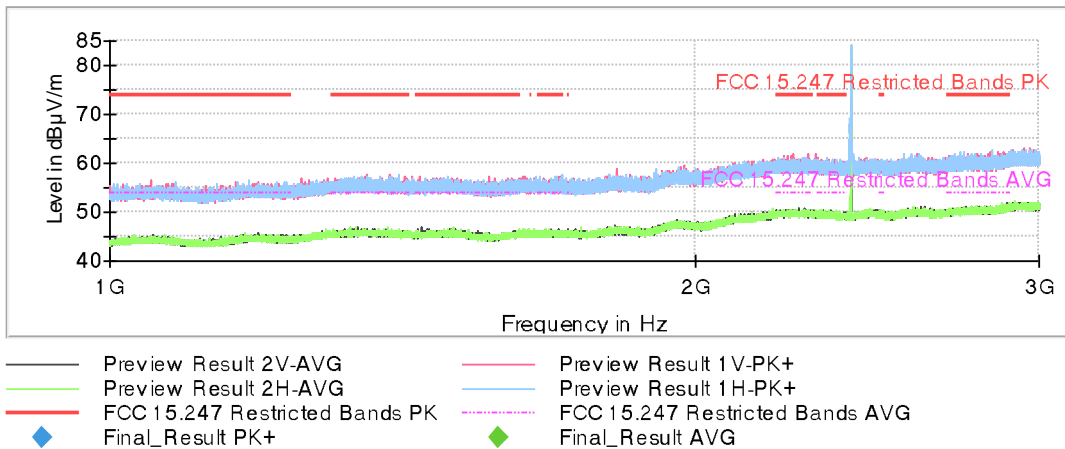
The spurious frequencies detected do not depend on the operating channel.



This plot is valid for the Low, Middle and High Channels.

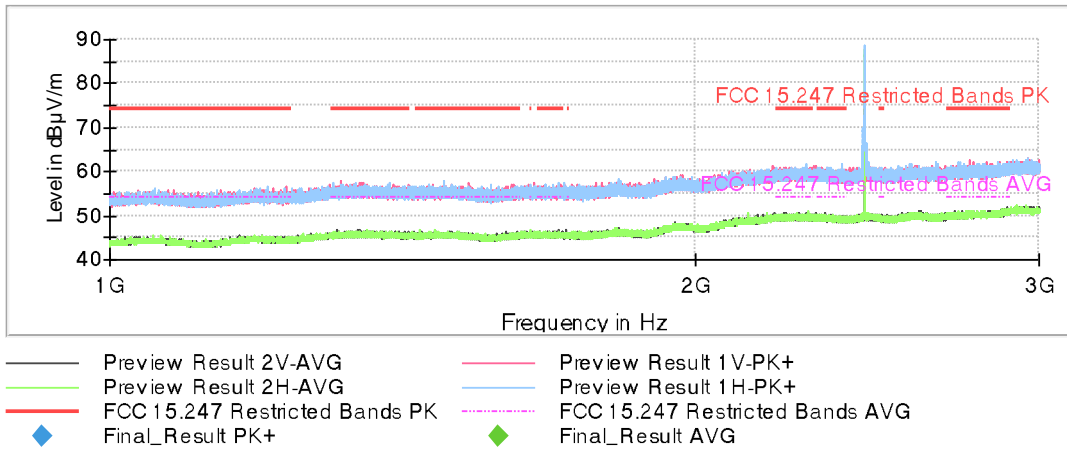
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



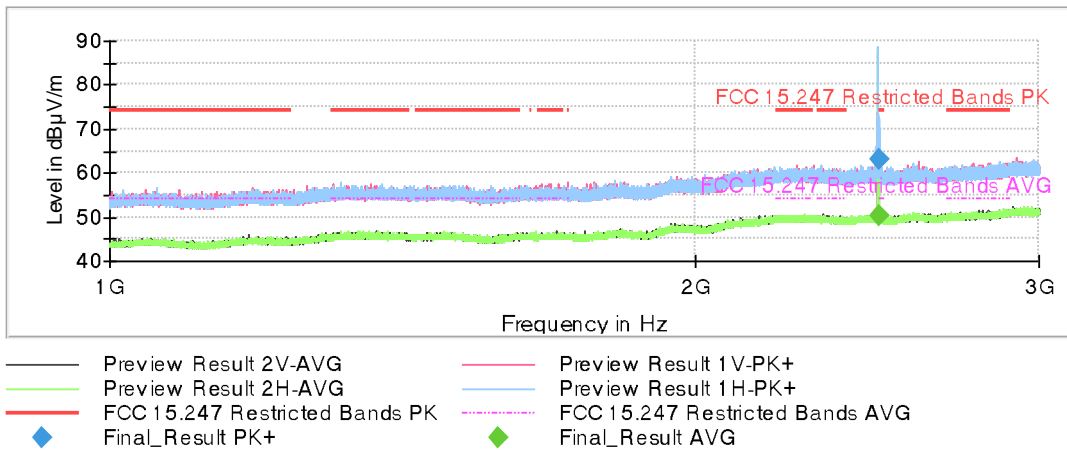
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

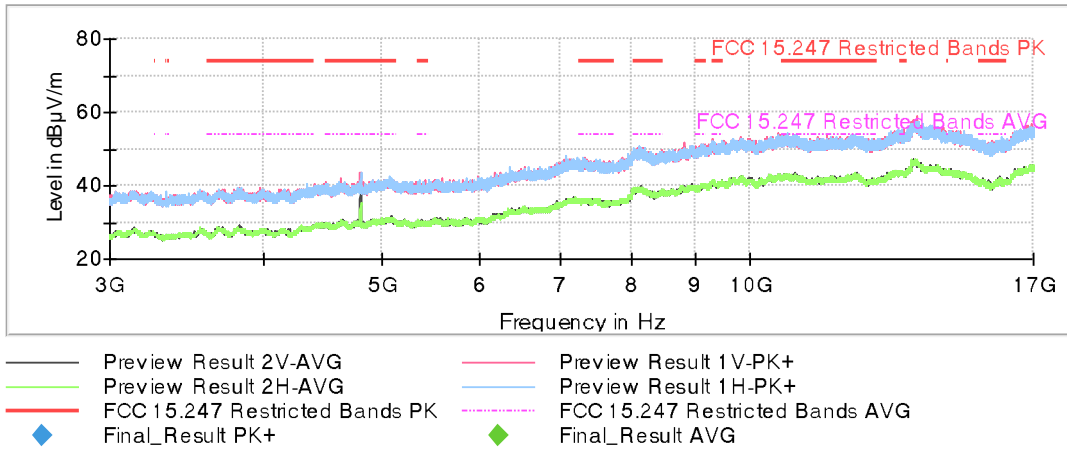
- High Channel:



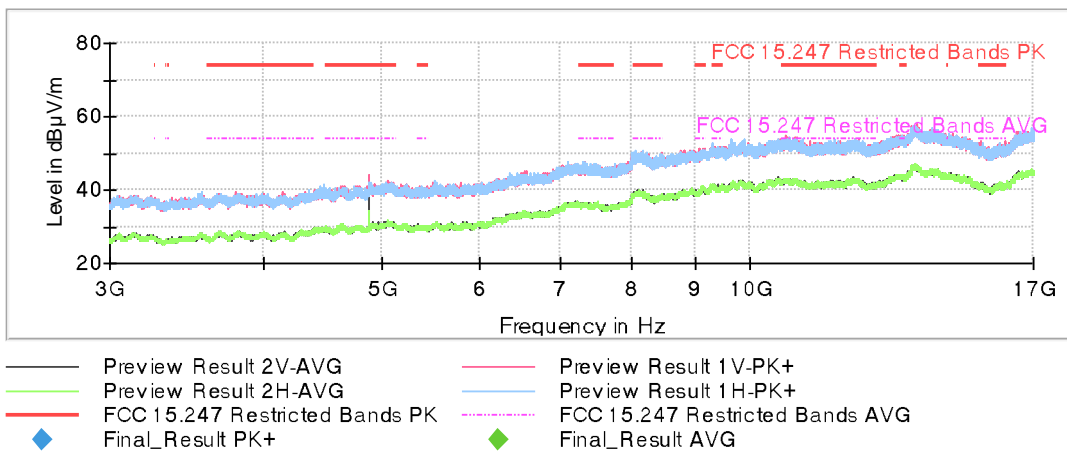
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

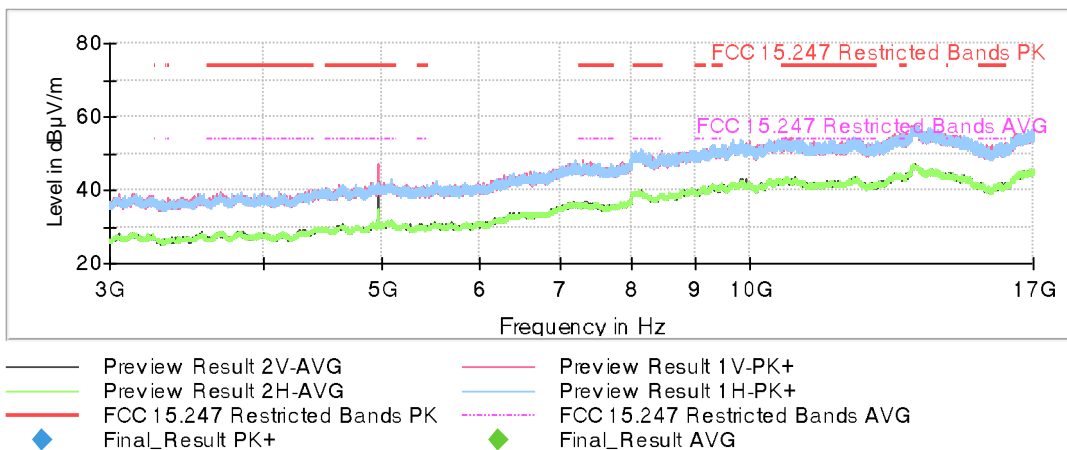
- Low Channel:



- Middle Channel:

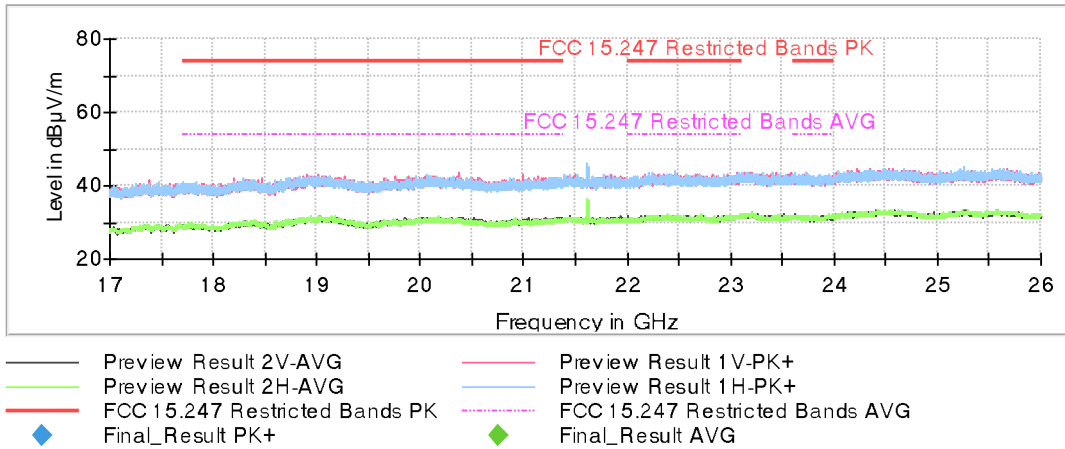


- High Channel:

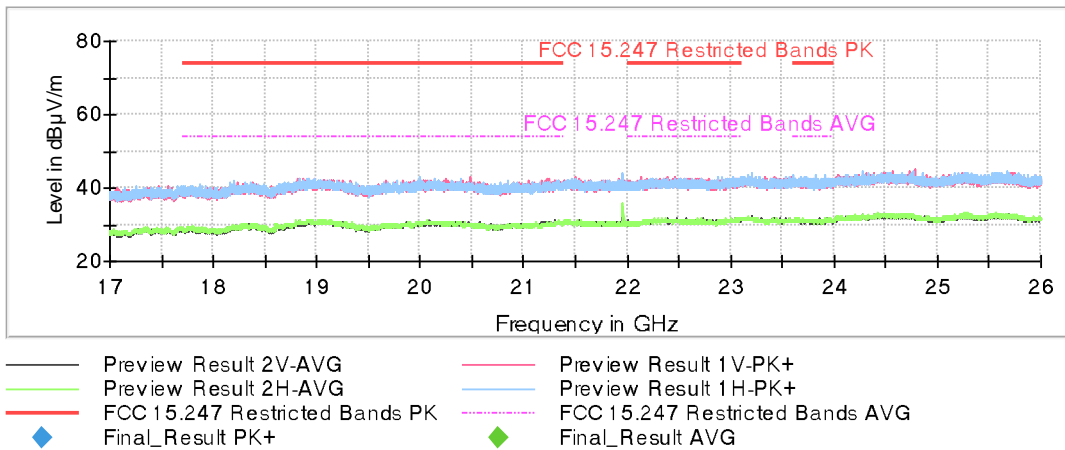


FREQUENCY RANGE 17 - 26 GHz

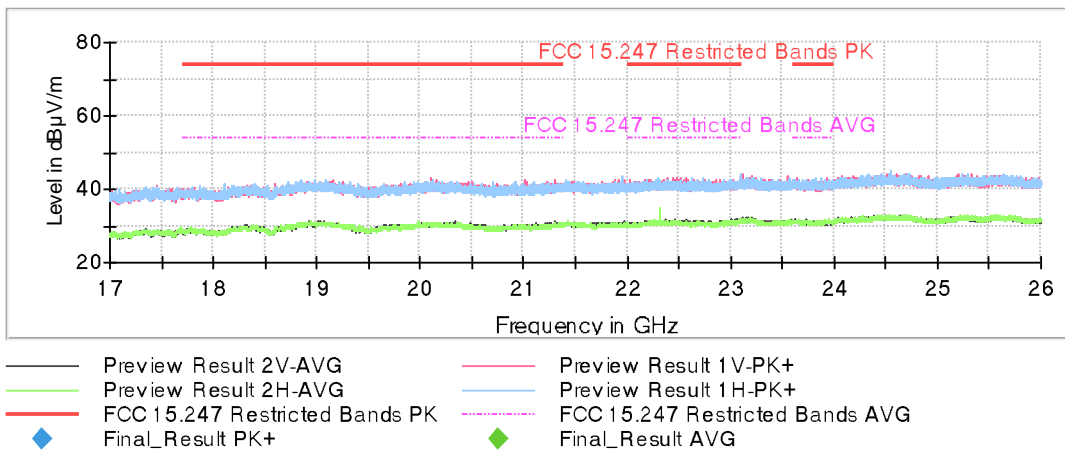
- Low Channel:



- Middle Channel:



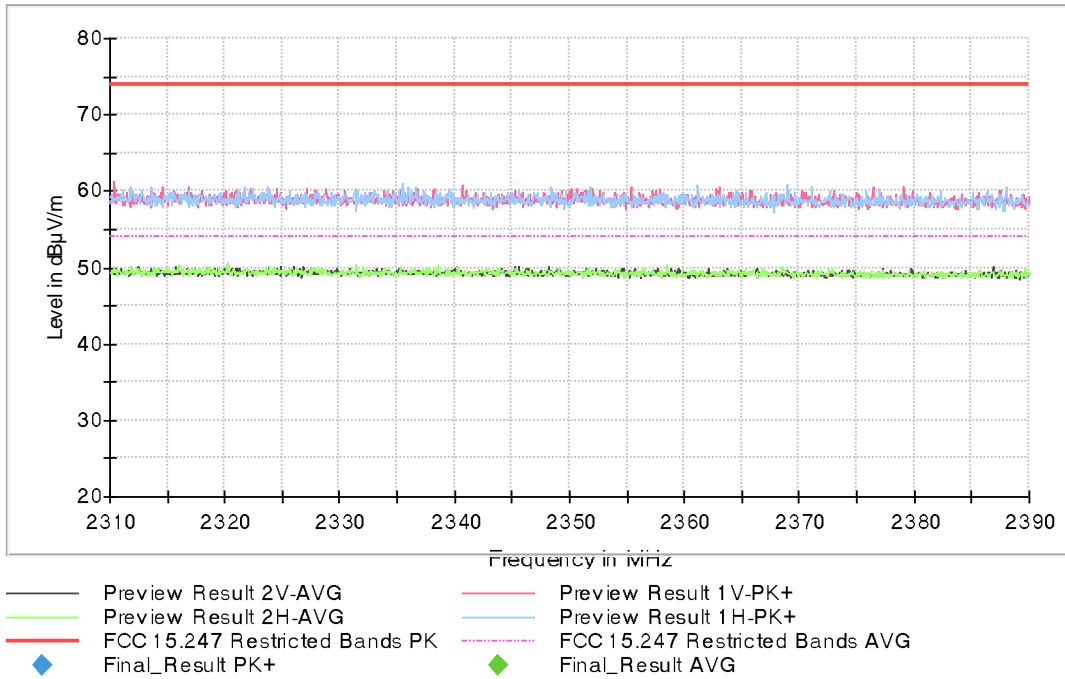
- High Channel:



FREQUENCY RANGE 2.31-2.39 GHz

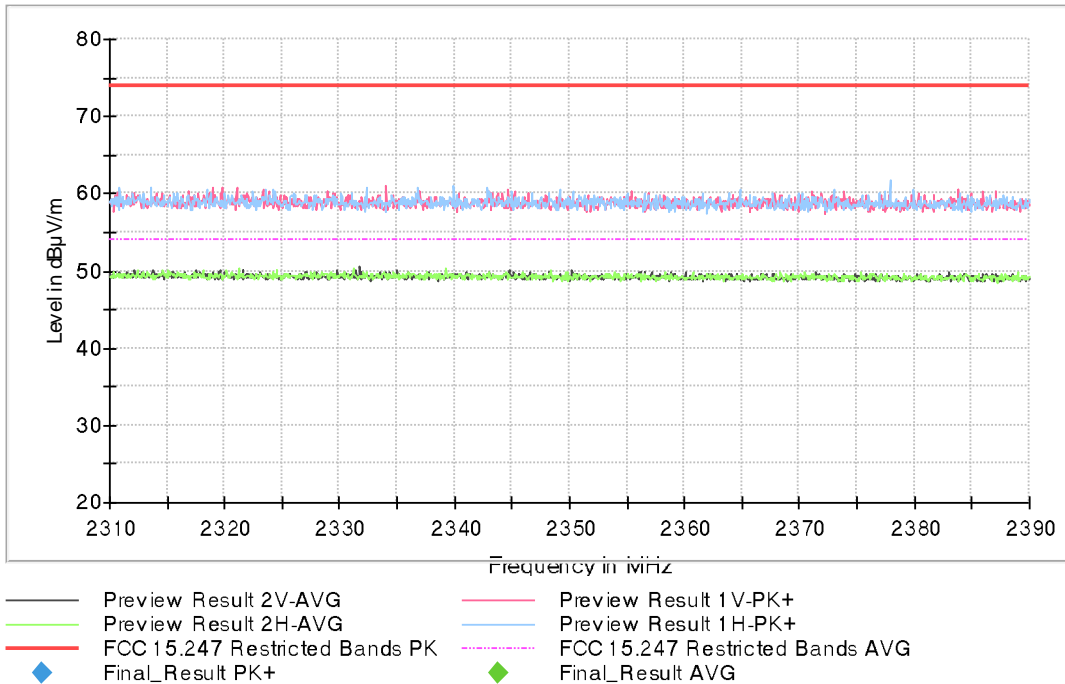
- Low Channel:

Full Spectrum



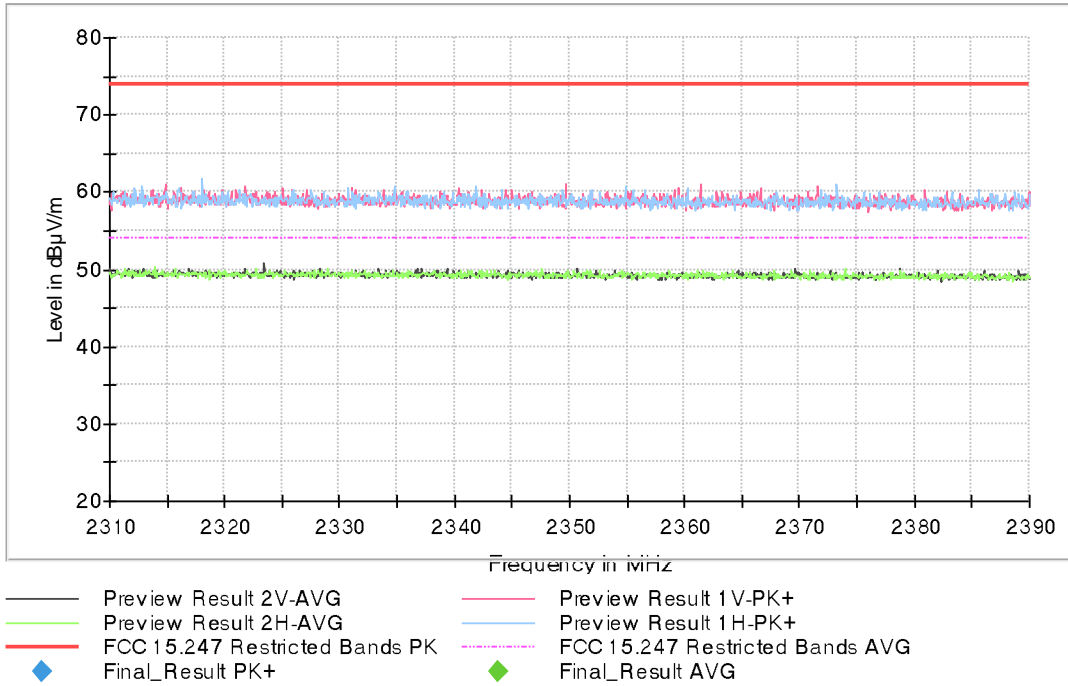
- Middle Channel:

Full Spectrum



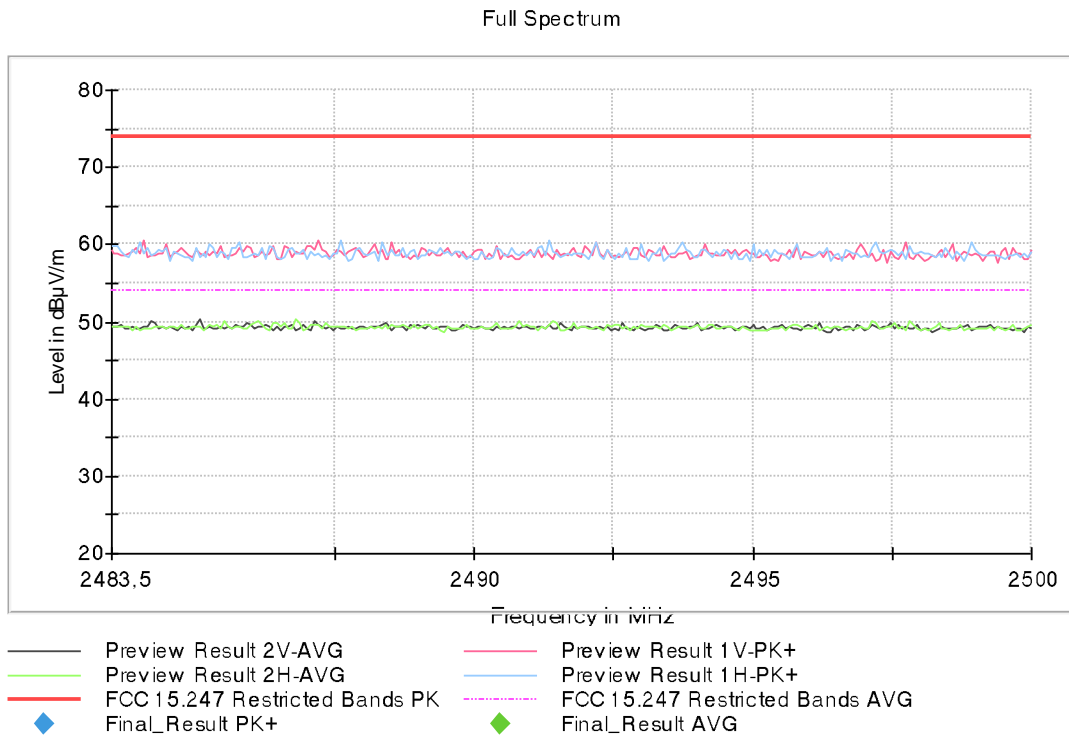
- High Channel:

Full Spectrum

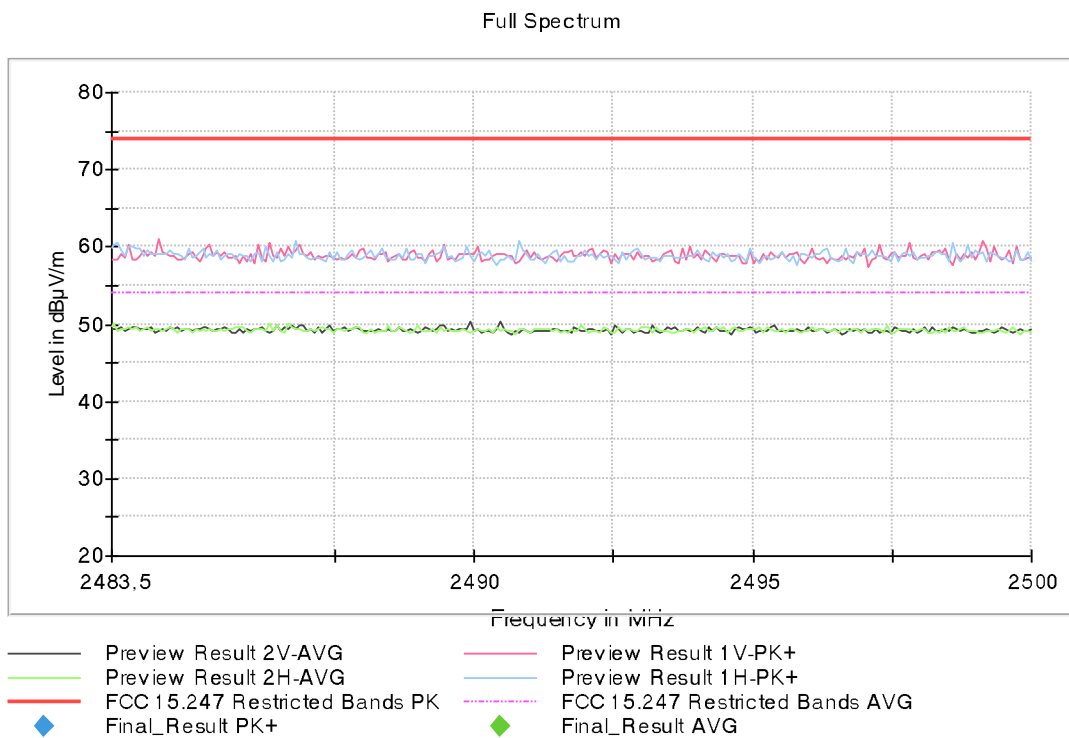


FREQUENCY RANGE 2.4835-2.5 GHz

- Low Channel:

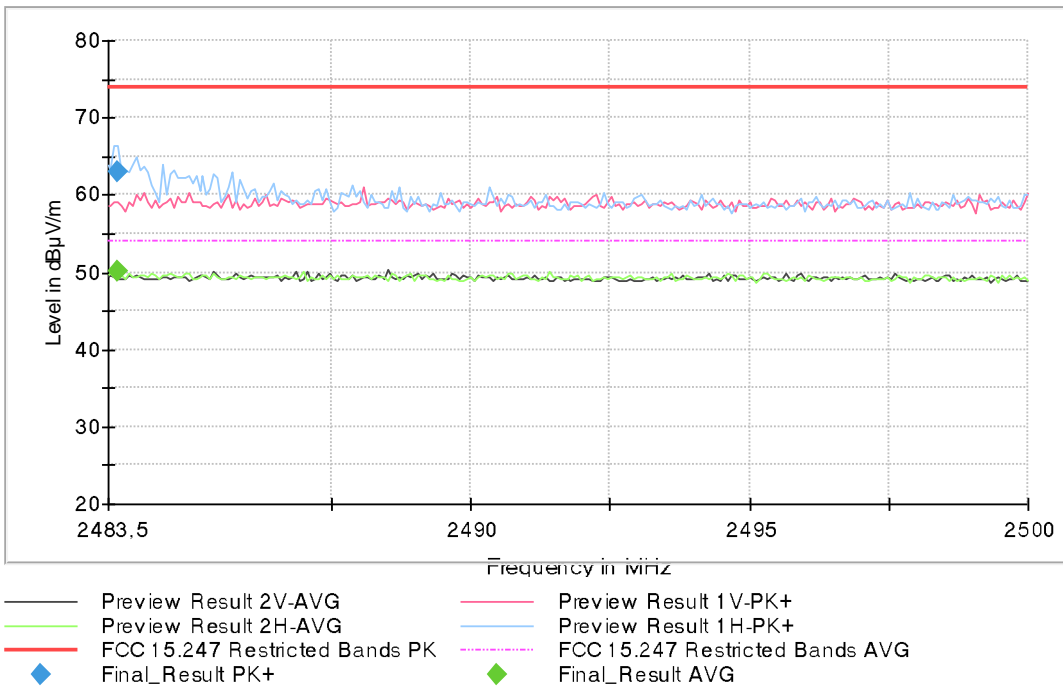


- Middle Channel:



- High Channel:

Full Spectrum



Appendix B: Test results. Bluetooth Basic Rate

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TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

| | |
|------------------------|------------------------------|
| V nominal: | 3.7 Vdc rechargeable battery |
| Type of Power Supply: | Rechargeable battery. |
| Type of Antenna: | Integral |
| Declared Antenna Gain: | -8.5 dBi |

TEST FREQUENCIES:

| | |
|-----------------|----------|
| Low Channel: | 2402 MHz |
| Middle Channel: | 2441 MHz |
| High Channel: | 2480 MHz |

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The DC supply voltage is applied using an external battery.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

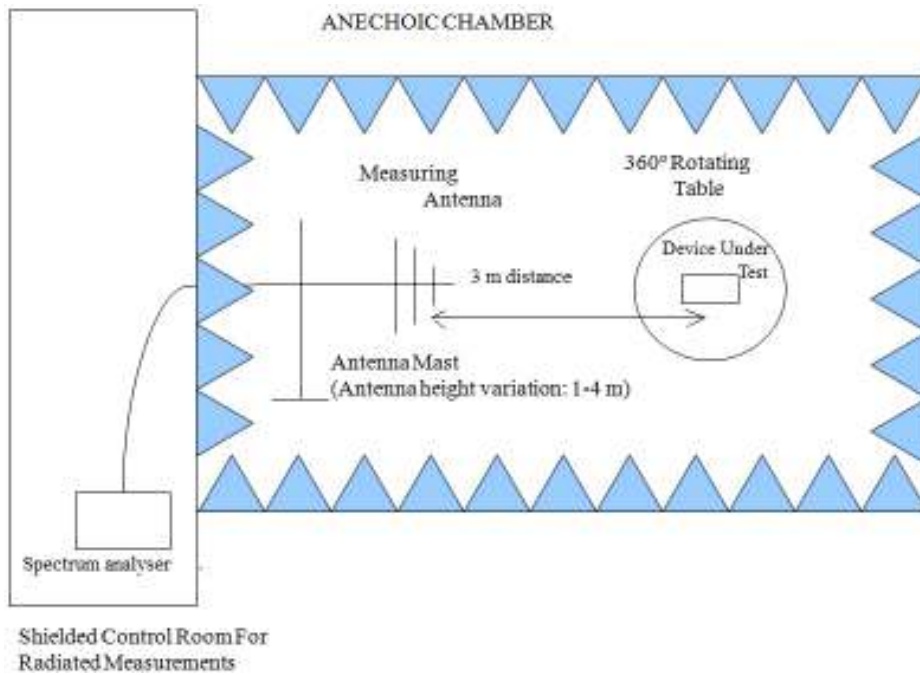
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

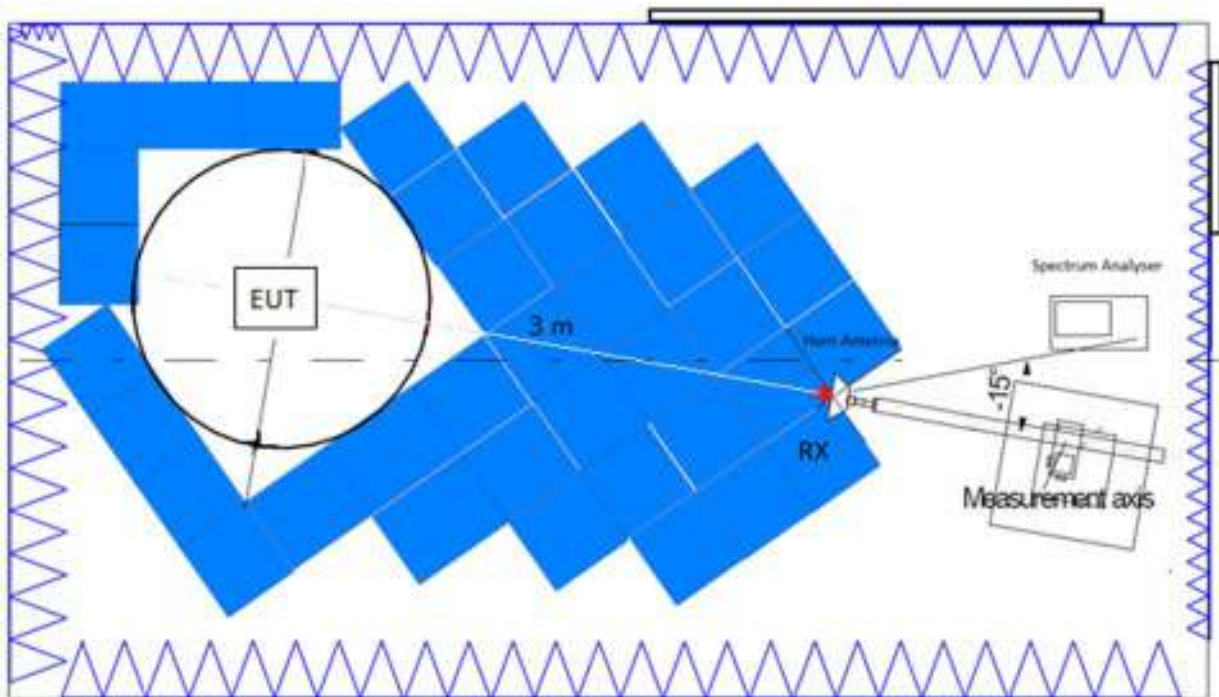
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

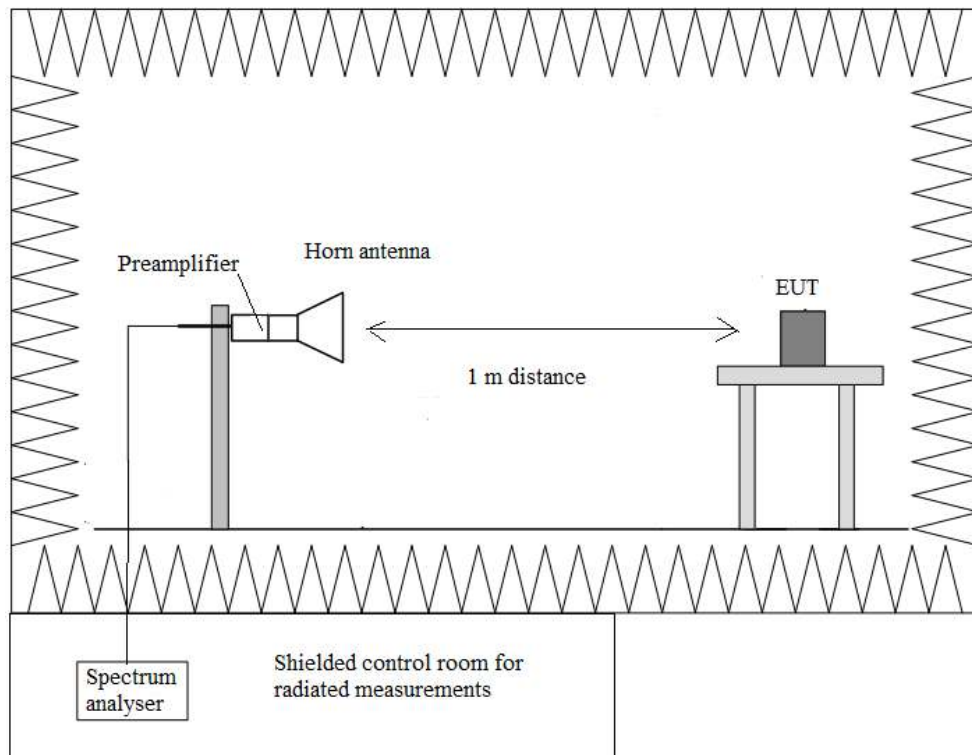
Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



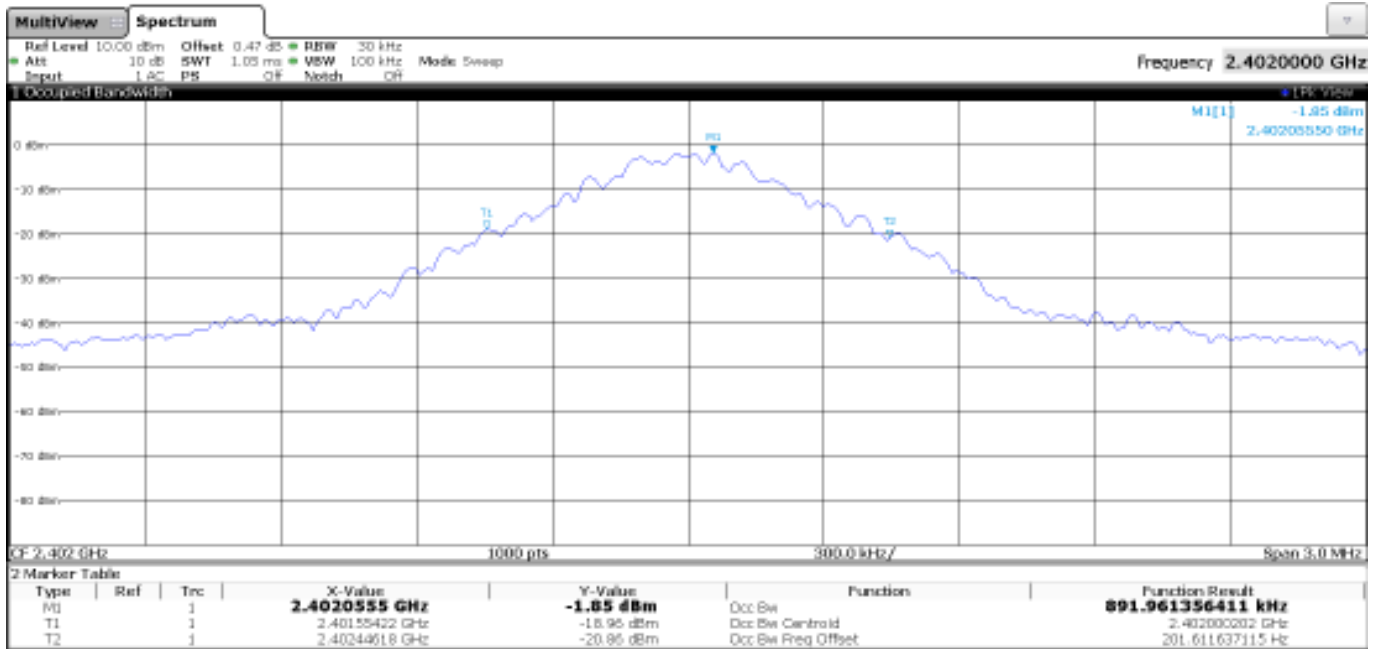
Occupied Bandwidth

RESULTS:

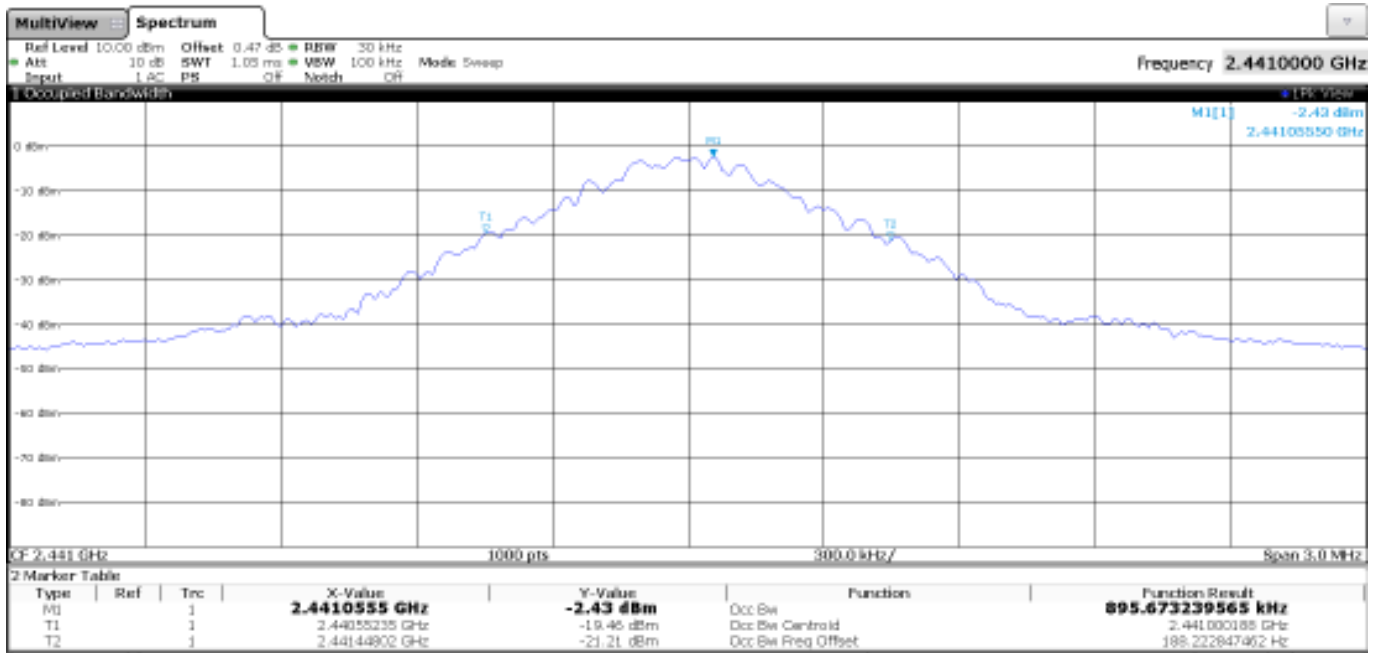
| | | | |
|-------------------------------|-------------------------|----------------------------|--------------------------|
| | Low Channel 2402 MHz | Middle Channel 2441 MHz | High Channel 2480 MHz |
| 99% Bandwidth (MHz) | 0.8920 | 0.8957 | 0.8967 |
| Measurement Uncertainty (kHz) | <±3.64 | | |

Verdict: PASS

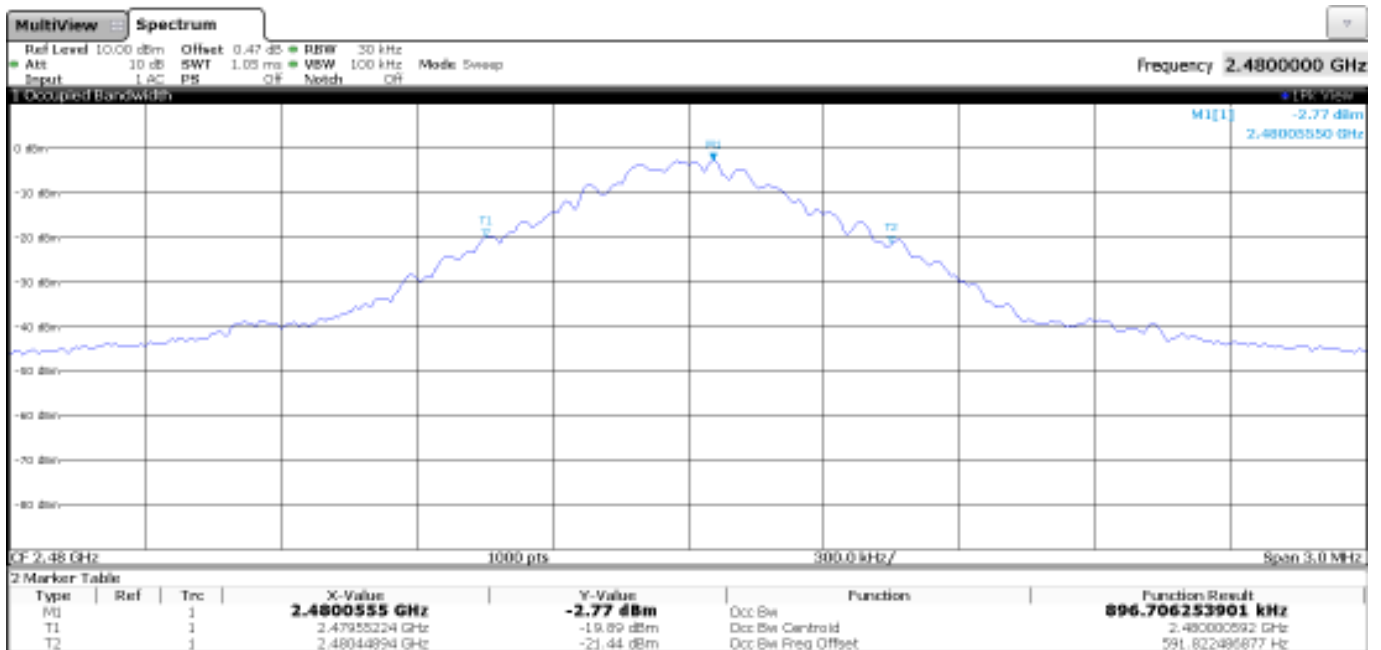
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of fundamental (mV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------------|--------------------------------------|-------------------------|--------------------------|
| 902 - 928 | 50 | 93.98 | 3 |
| 2400 – 2483.5 | 50 | 93.98 | 3 |
| 5725 - 5875 | 50 | 93.98 | 3 |
| 24000-24250 | 250 | 107.96 | 3 |

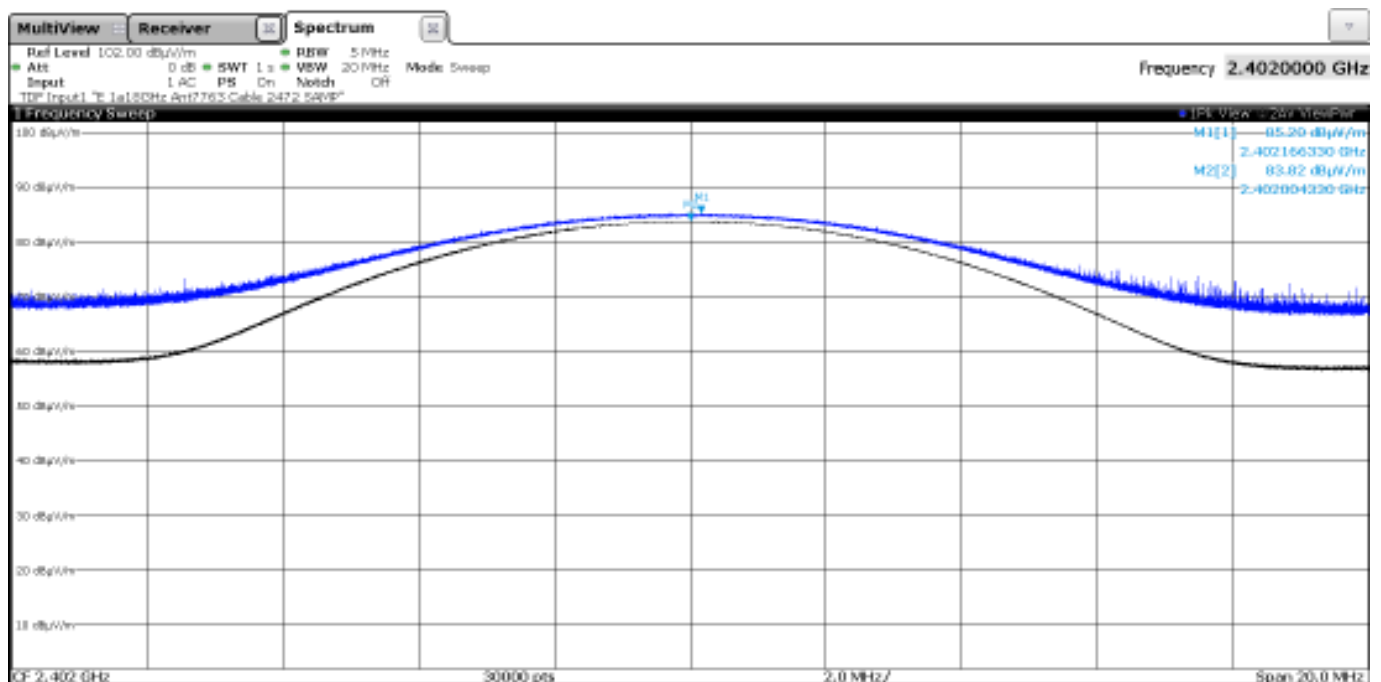
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

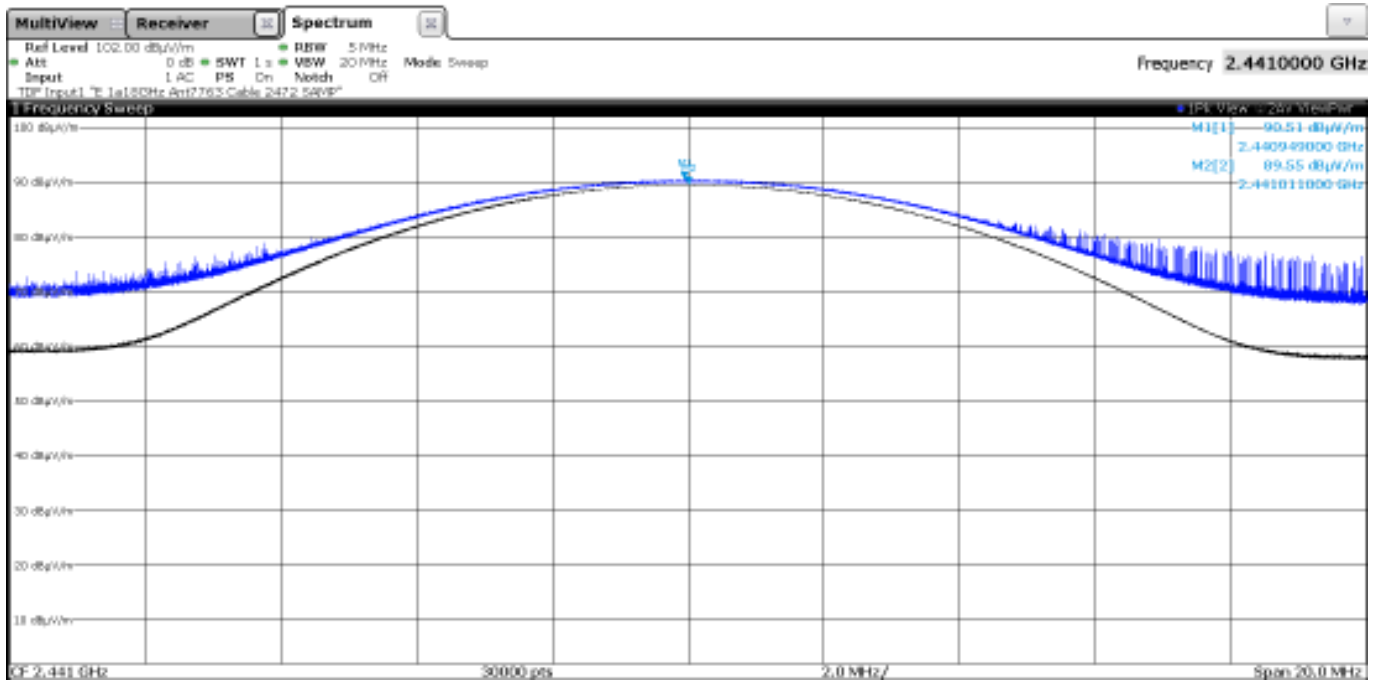
| | Low Channel 2402 MHz | Middle Channel 2441 MHz | High Channel 2480 MHz |
|---------------------------------|-------------------------|----------------------------|--------------------------|
| Average Field Strength (dBµV/m) | 83.82 | 89.55 | 88.67 |
| Peak Field Strength (dBµV/m) | 85.20 | 90.51 | 89.55 |
| Measurement Uncertainty (dB) | <±4.01 | | |

Verdict: PASS

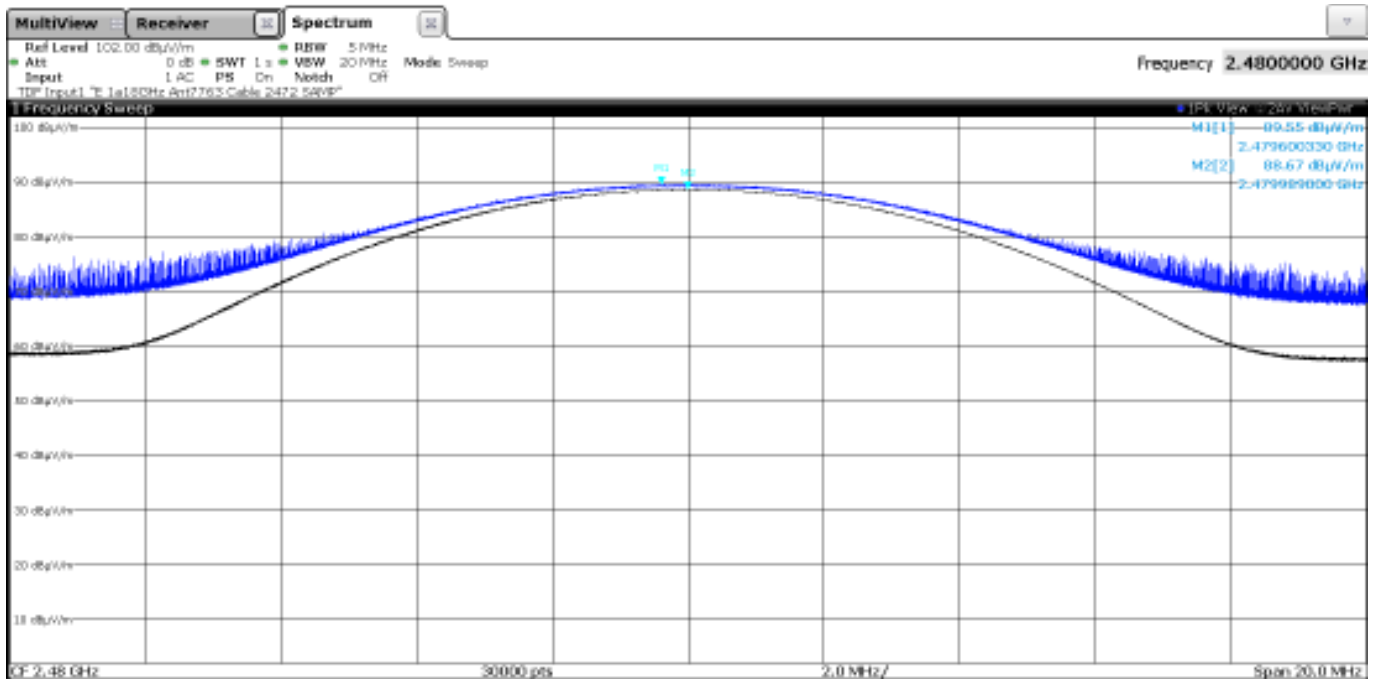
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of harmonics (µV/m) | Field strength of harmonics (dBµV/m) | Measurement distance (m) |
|-----------------------------|------------------------------------|--------------------------------------|--------------------------|
| 902 - 928 | 500 | 54 | 3 |
| 2400 – 2483.5 | 500 | 54 | 3 |
| 5725 - 5875 | 500 | 54 | 3 |
| 24000-24250 | 2500 | 67.96 | 3 |

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

| Frequency Range (MHz) | Field strength (µV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------|-----------------------|-------------------------|--------------------------|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 30 |
| 1.705 - 30.0 | 30 | - | 30 |
| 30 - 88 | 100 | 40 | 3 |
| 88 - 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| 960 - 25000 | 500 | 54 | 3 |

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-17 GHz and at distance of 1 m for the frequency range 17 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty $<\pm 5.15$ dB

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel (2441 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- High Channel (2480 MHz):

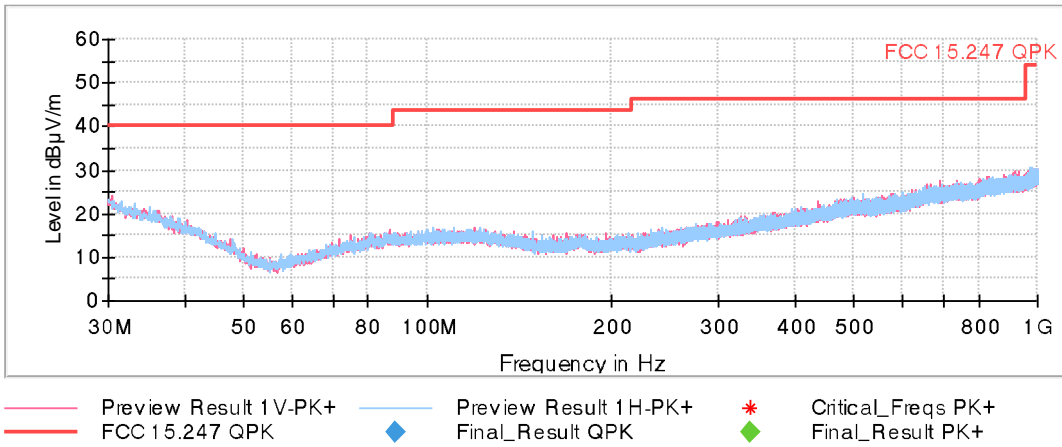
No spurious frequencies detected at less than 20 dB below the limit.

| | | |
|--------------------------|-----------|----------------|
| Measurement Uncertainty: | 1-3 GHz | $<\pm 4.94$ dB |
| | 3-17 GHz | $<\pm 4.28$ dB |
| | 17-26 GHz | $<\pm 4.89$ dB |

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

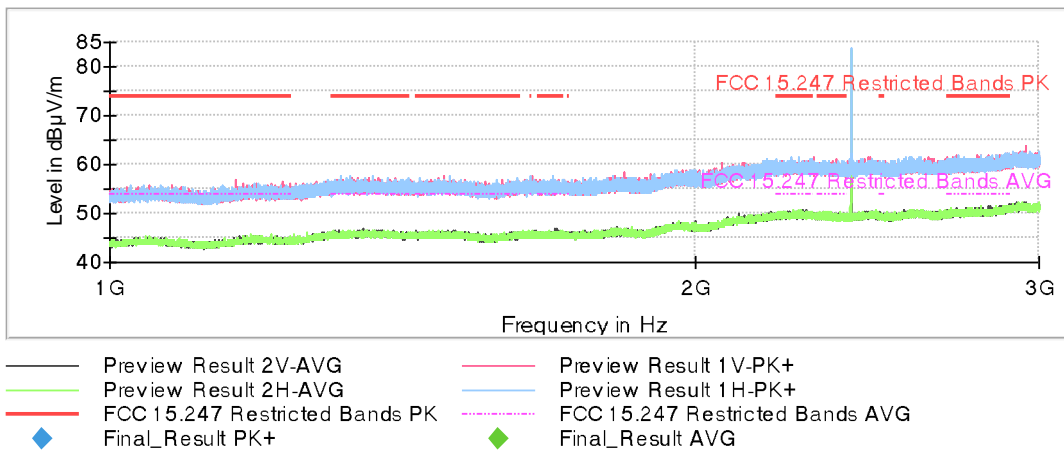
The spurious frequencies detected do not depend on the operating channel.



This plot is valid for the Low, Middle and High Channels.

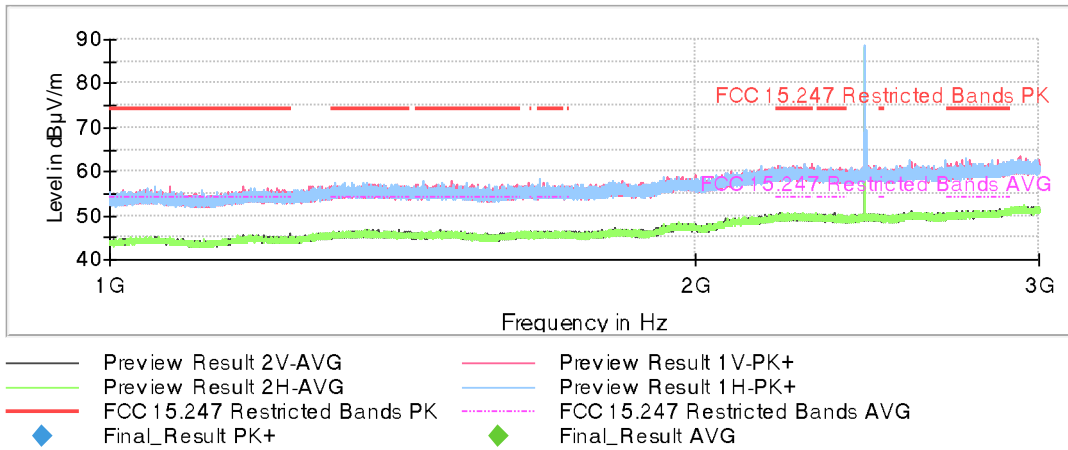
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



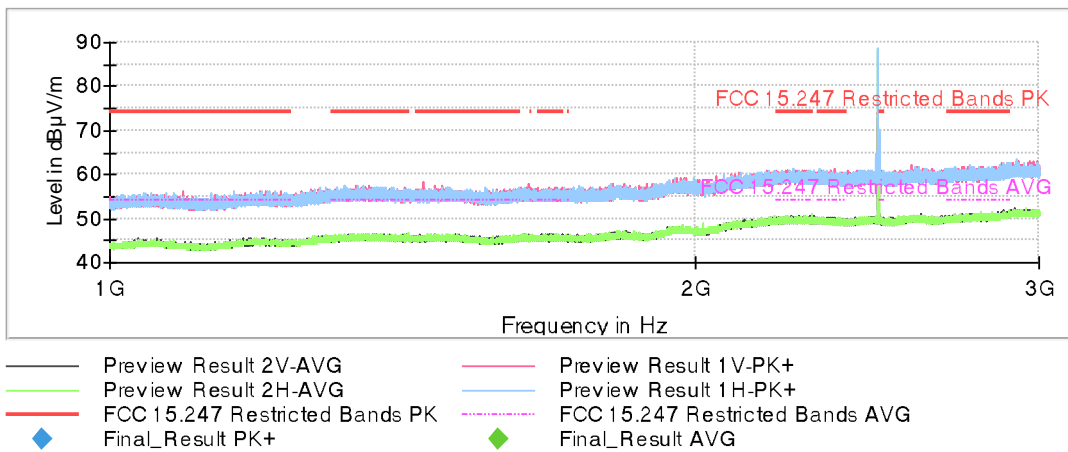
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

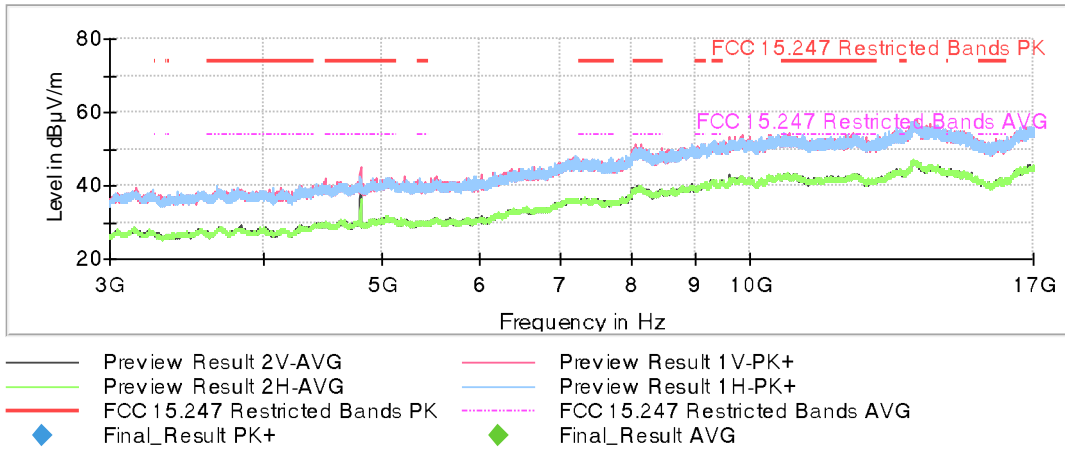
- High Channel:



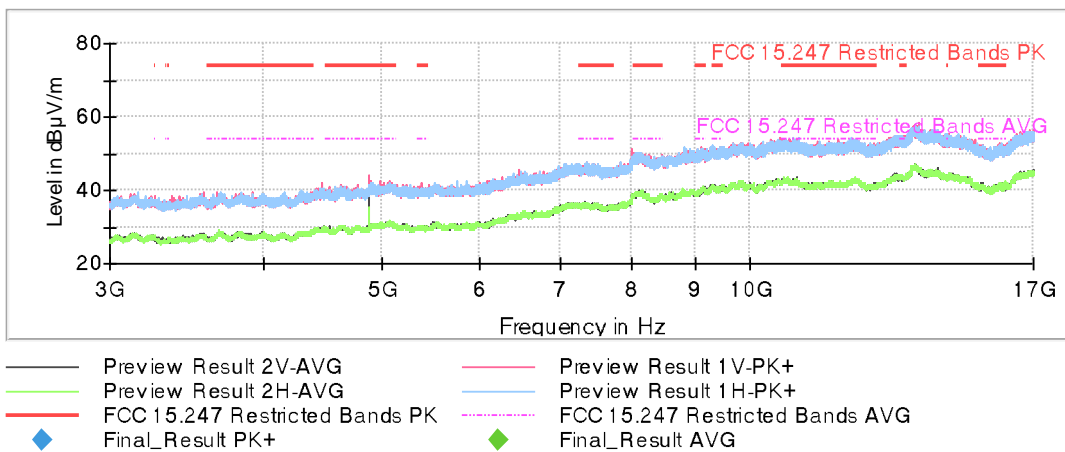
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

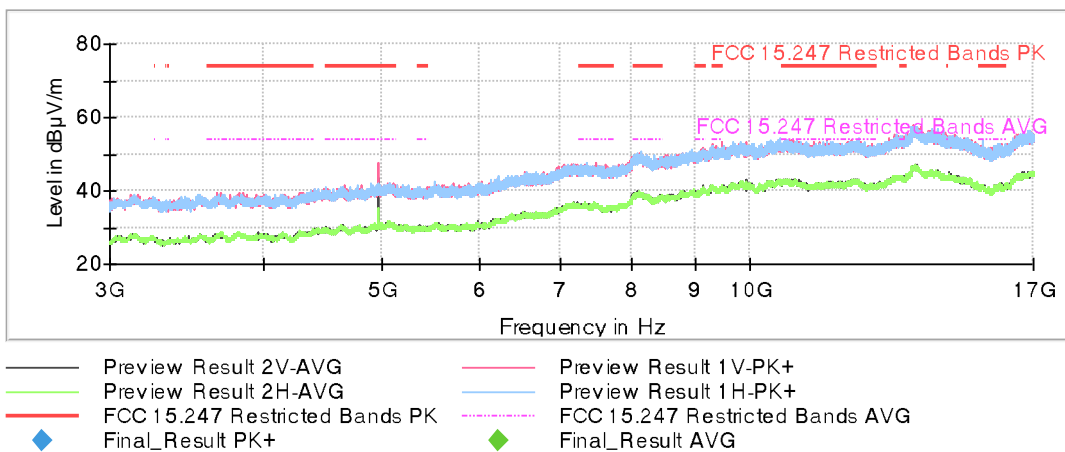
- Low Channel:



- Middle Channel:

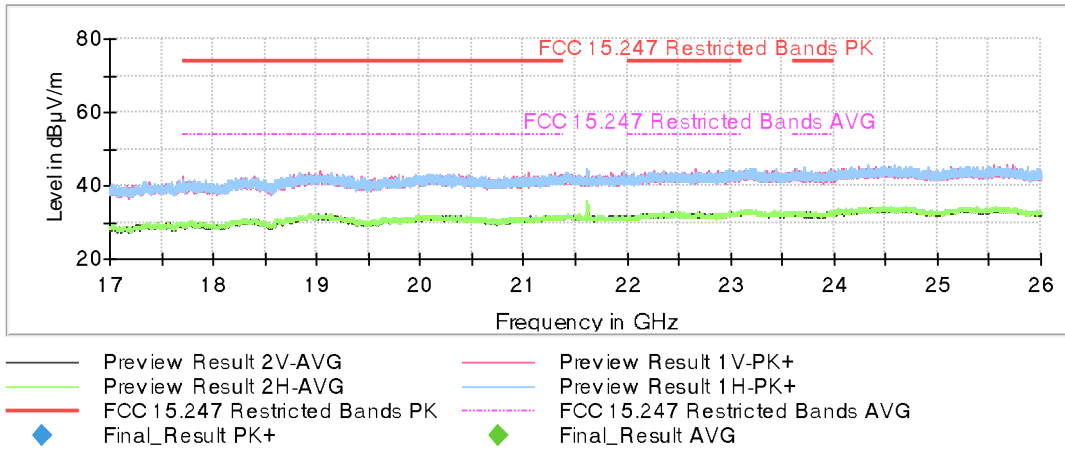


- High Channel:

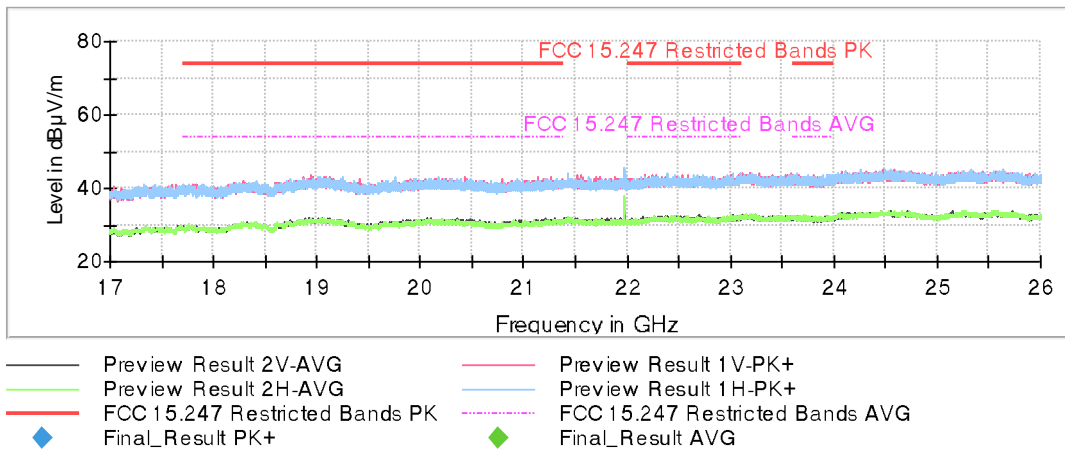


FREQUENCY RANGE 17 - 26 GHz

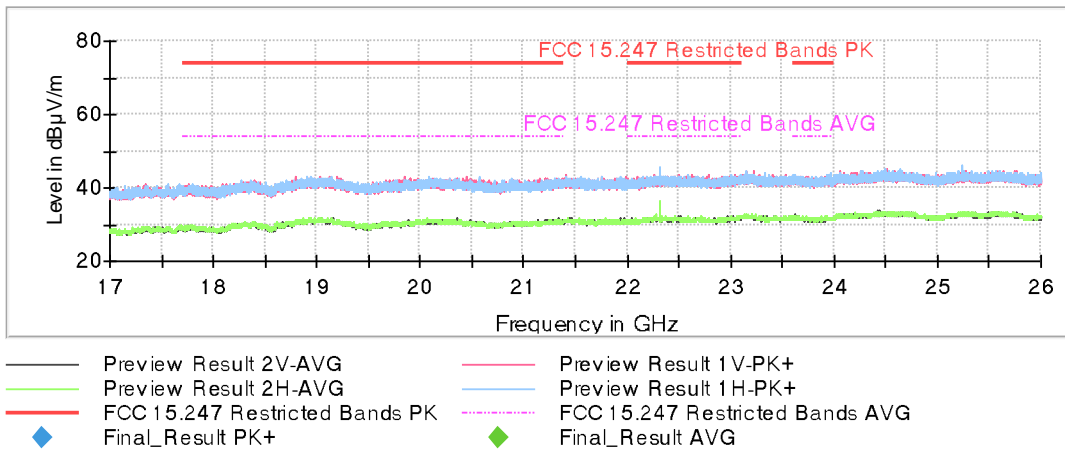
- Low Channel:



- Middle Channel:



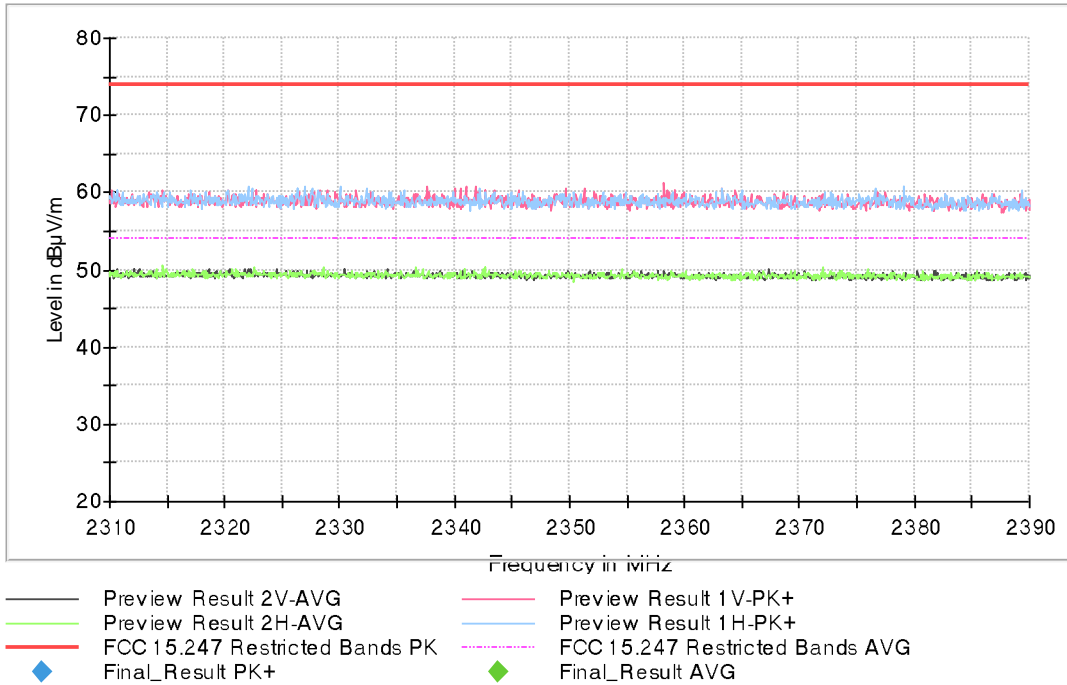
- High Channel:



FREQUENCY RANGE 2.31-2.39 GHz

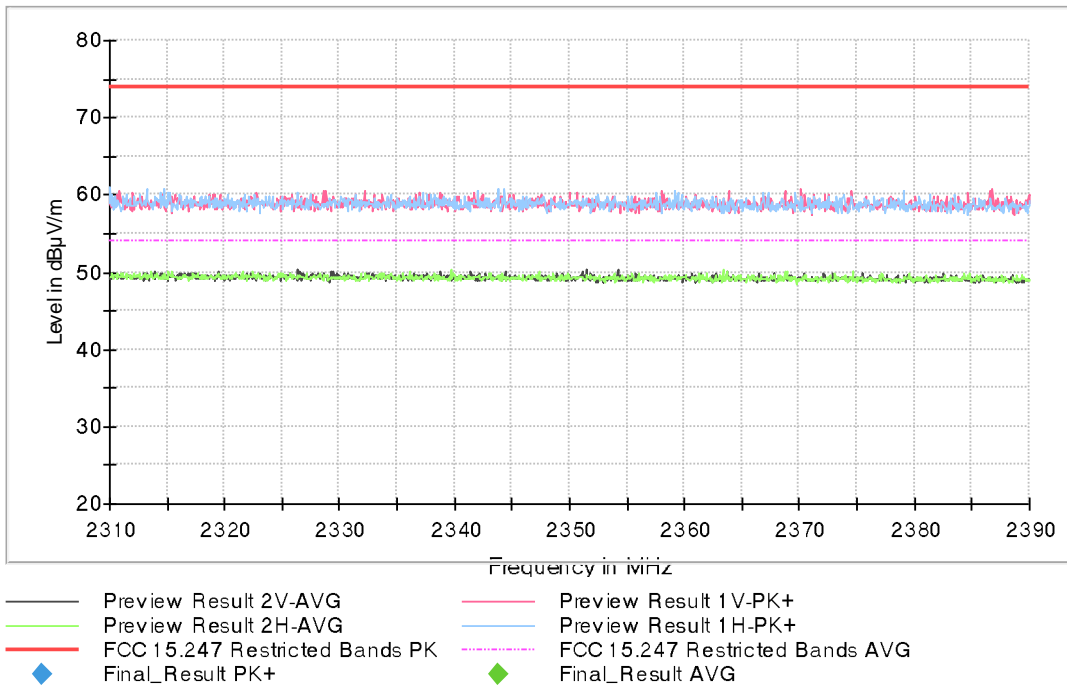
- Low Channel:

Full Spectrum



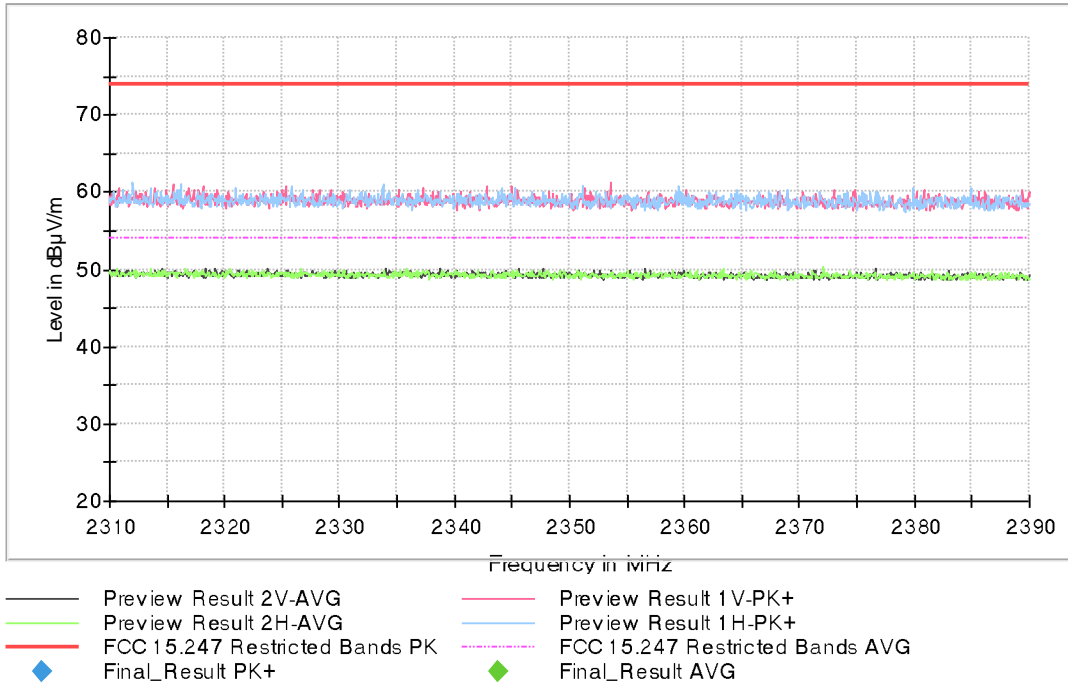
- Middle Channel:

Full Spectrum



- High Channel:

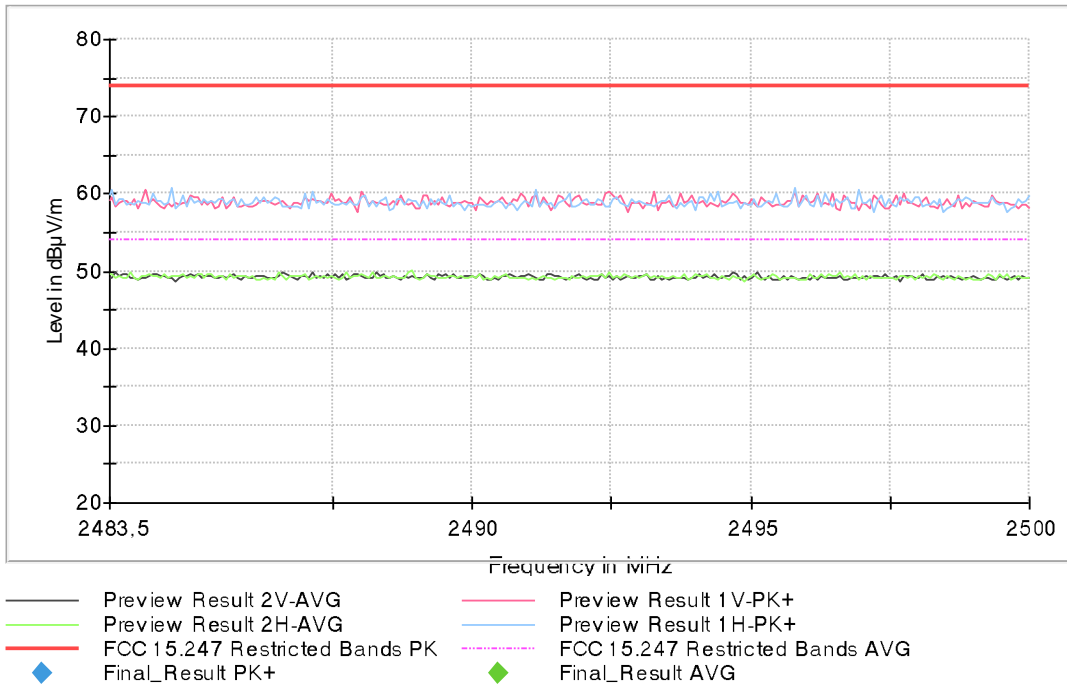
Full Spectrum



FREQUENCY RANGE 2.4835-2.5 GHz

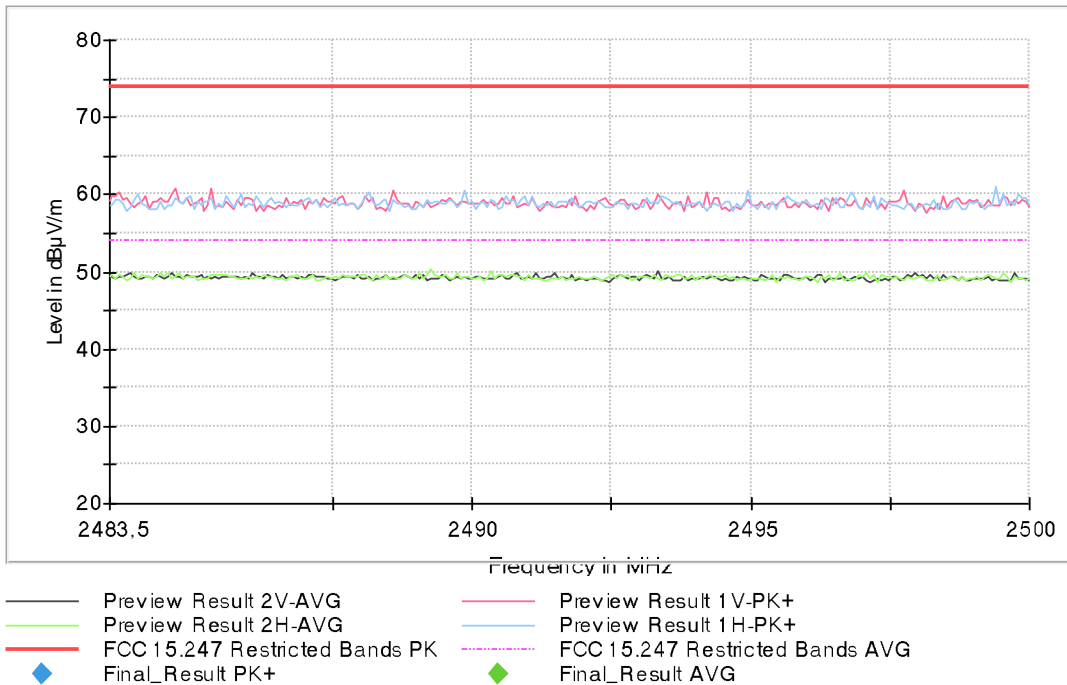
- Low Channel:

Full Spectrum



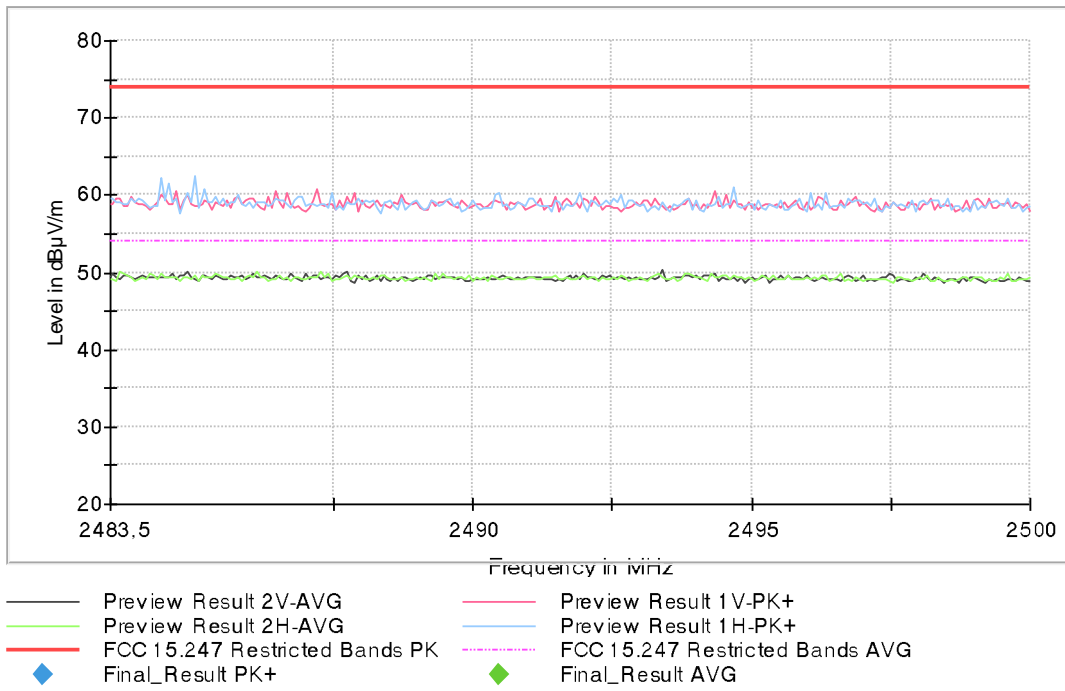
- Middle Channel:

Full Spectrum



- High Channel:

Full Spectrum



Appendix C: Test results. Proprietary protocol DM 2.4 GHz

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TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

| | |
|------------------------|------------------------------|
| V nominal: | 3.7 Vdc rechargeable battery |
| Type of Power Supply: | Rechargeable battery. |
| Type of Antenna: | Integral |
| Declared Antenna Gain: | -8.5 dBi |

TEST FREQUENCIES:

| | |
|-----------------|----------|
| Low Channel: | 2402 MHz |
| Middle Channel: | 2440 MHz |
| High Channel: | 2480 MHz |

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The DC supply voltage is applied using an external battery.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

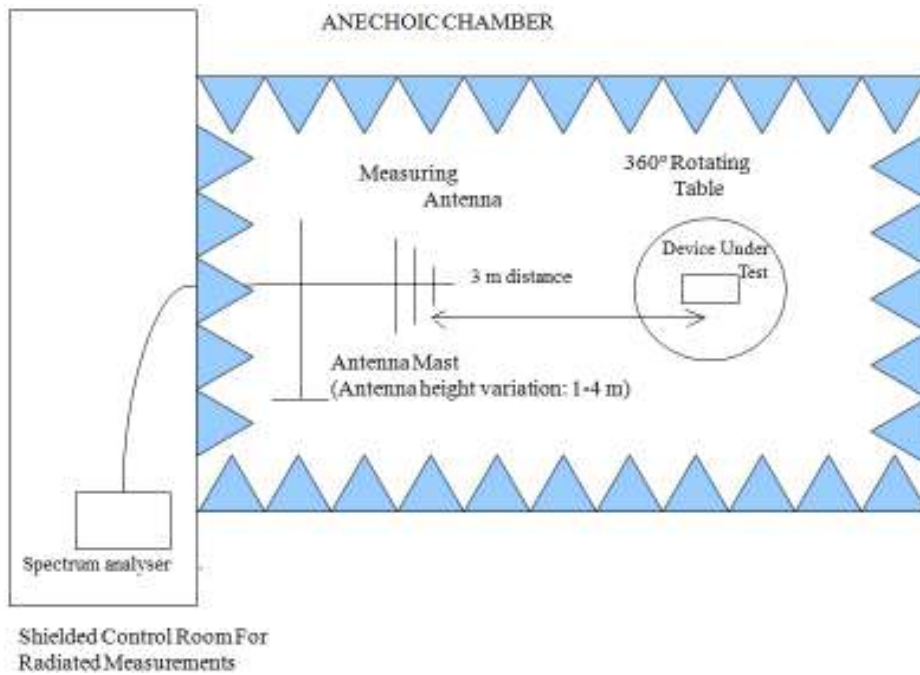
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

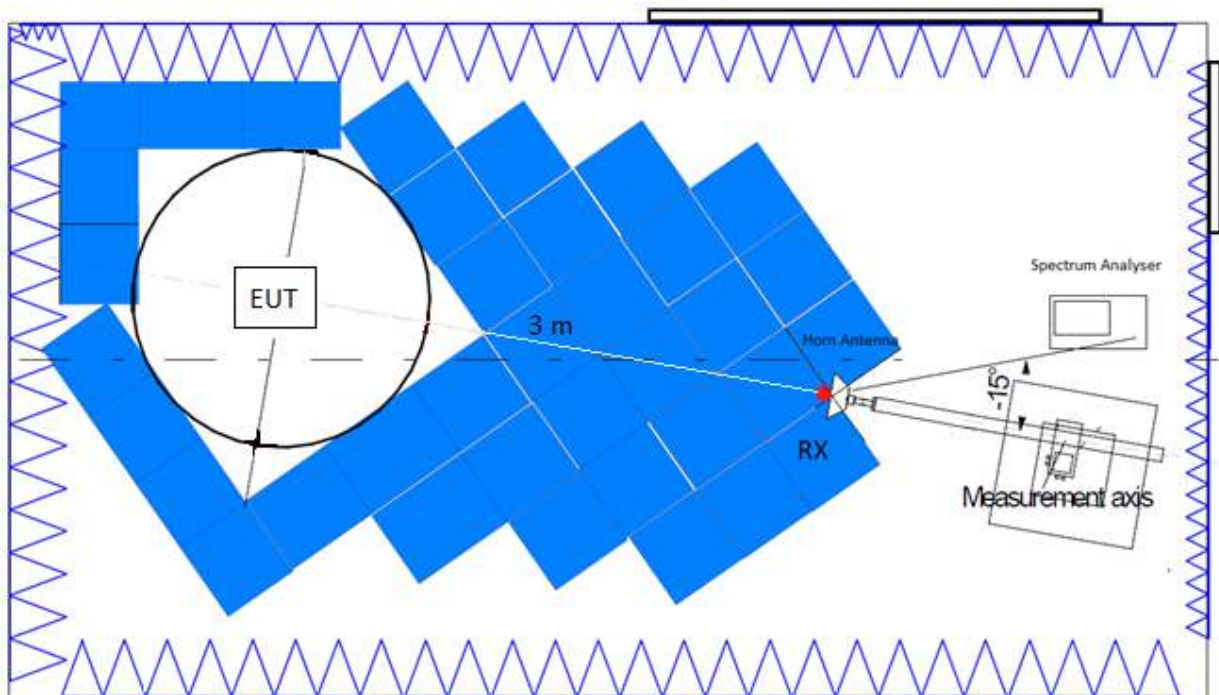
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

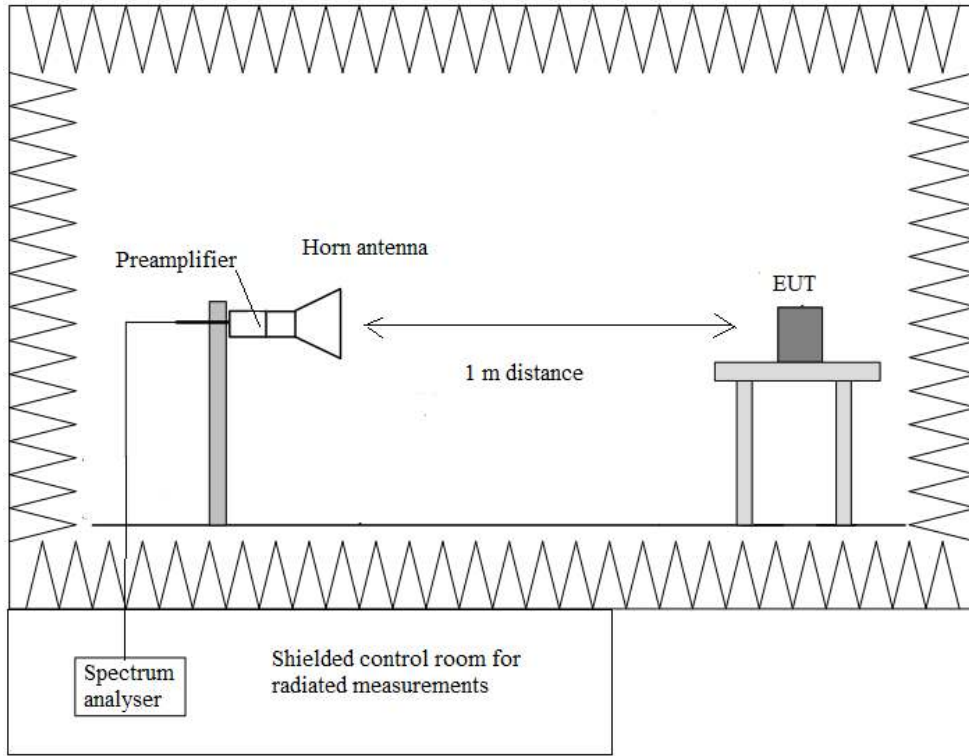
Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



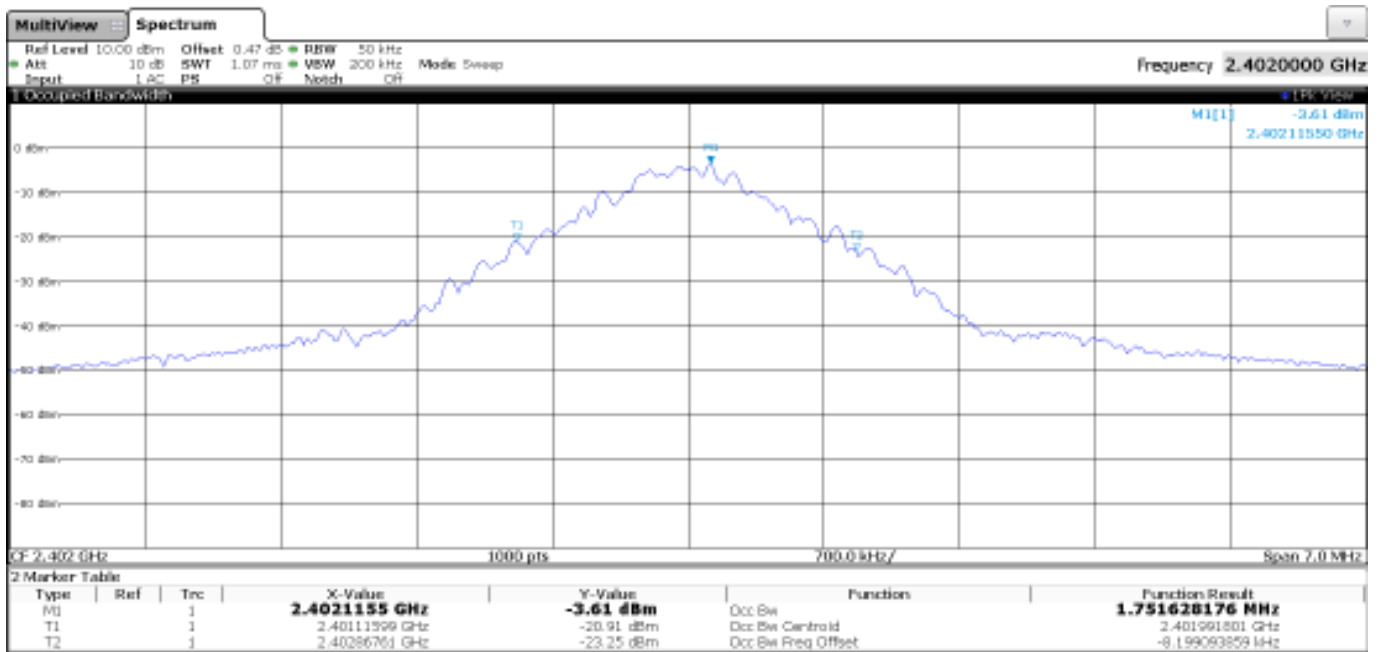
Occupied Bandwidth

RESULTS:

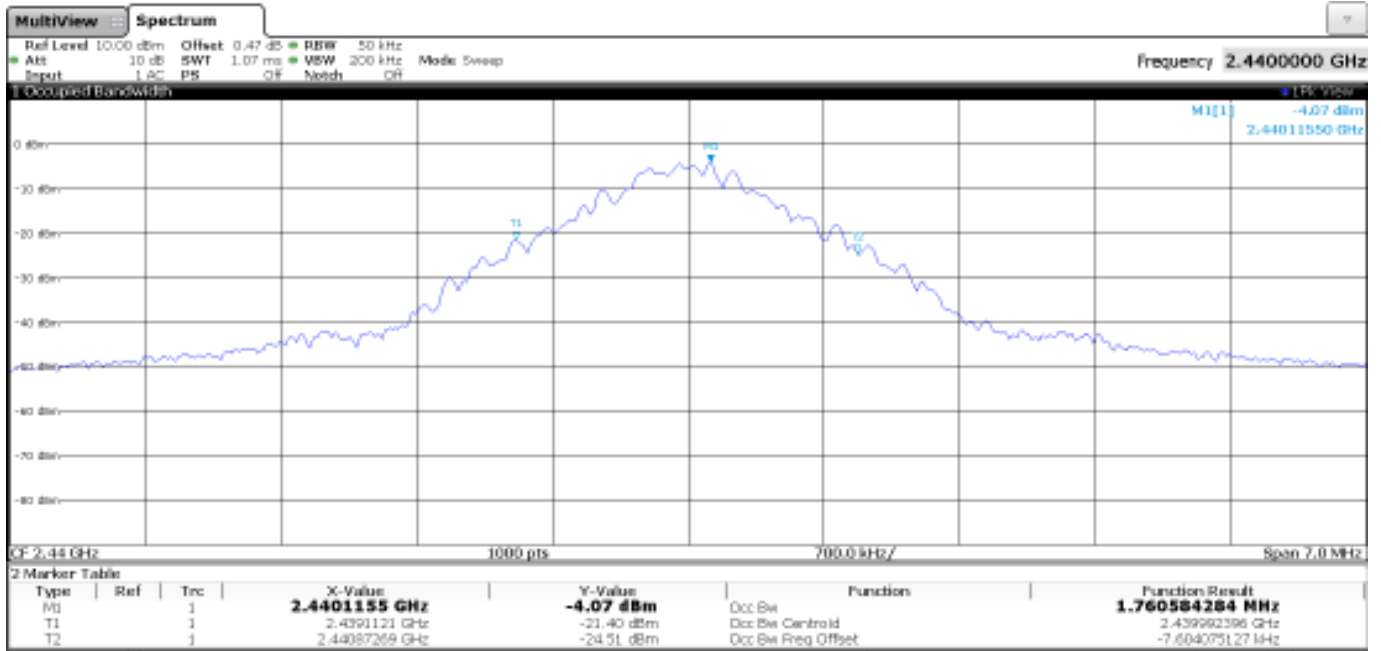
| | | | |
|-------------------------------|-------------------------|----------------------------|--------------------------|
| | Low Channel 2402 MHz | Middle Channel 2440 MHz | High Channel 2480 MHz |
| 99% Bandwidth (MHz) | 1.7516 | 1.7606 | 1.7536 |
| Measurement Uncertainty (kHz) | <±3.75 | | |

Verdict: PASS

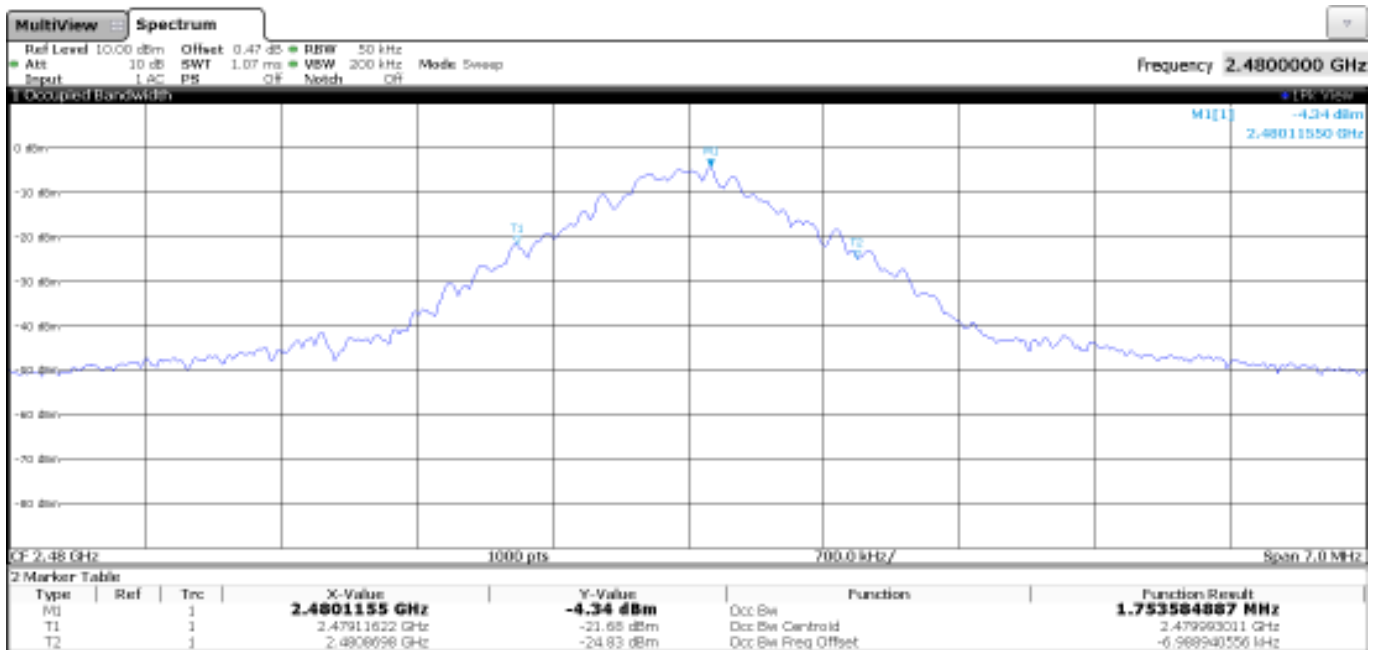
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of fundamental (mV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------------|--------------------------------------|-------------------------|--------------------------|
| 902 - 928 | 50 | 93.98 | 3 |
| 2400 – 2483.5 | 50 | 93.98 | 3 |
| 5725 - 5875 | 50 | 93.98 | 3 |
| 24000-24250 | 250 | 107.96 | 3 |

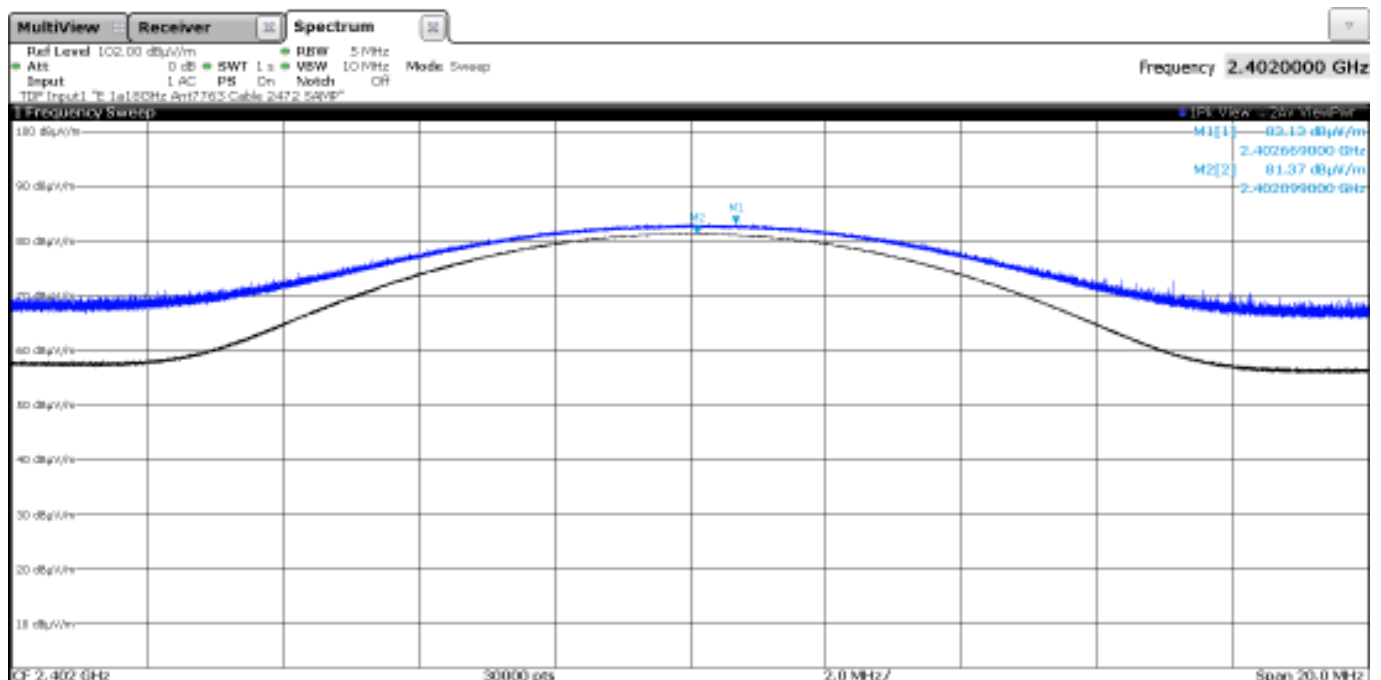
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

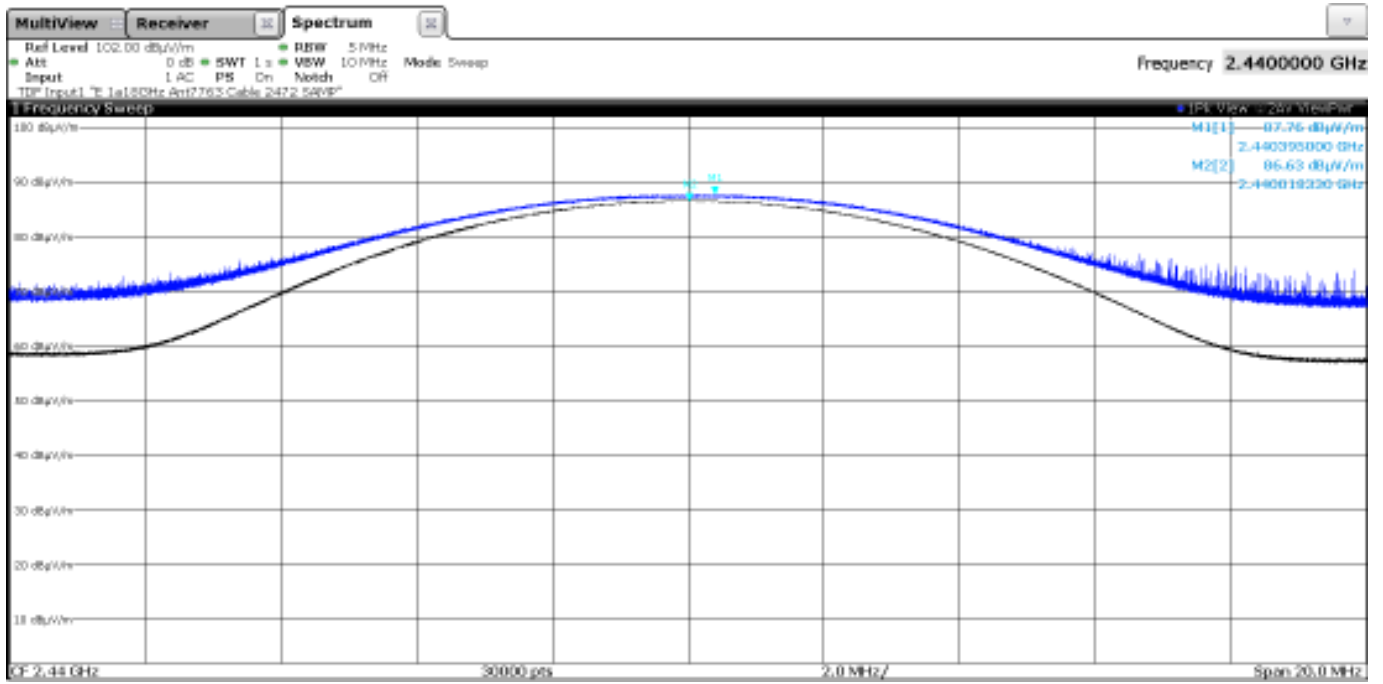
| | Low Channel 2402 MHz | Middle Channel 2440 MHz | High Channel 2480 MHz |
|---------------------------------|-------------------------|----------------------------|--------------------------|
| Average Field Strength (dBµV/m) | 81.37 | 86.63 | 86.33 |
| Peak Field Strength (dBµV/m) | 83.13 | 87.76 | 87.42 |
| Measurement Uncertainty (dB) | <±4.01 | | |

Verdict: PASS

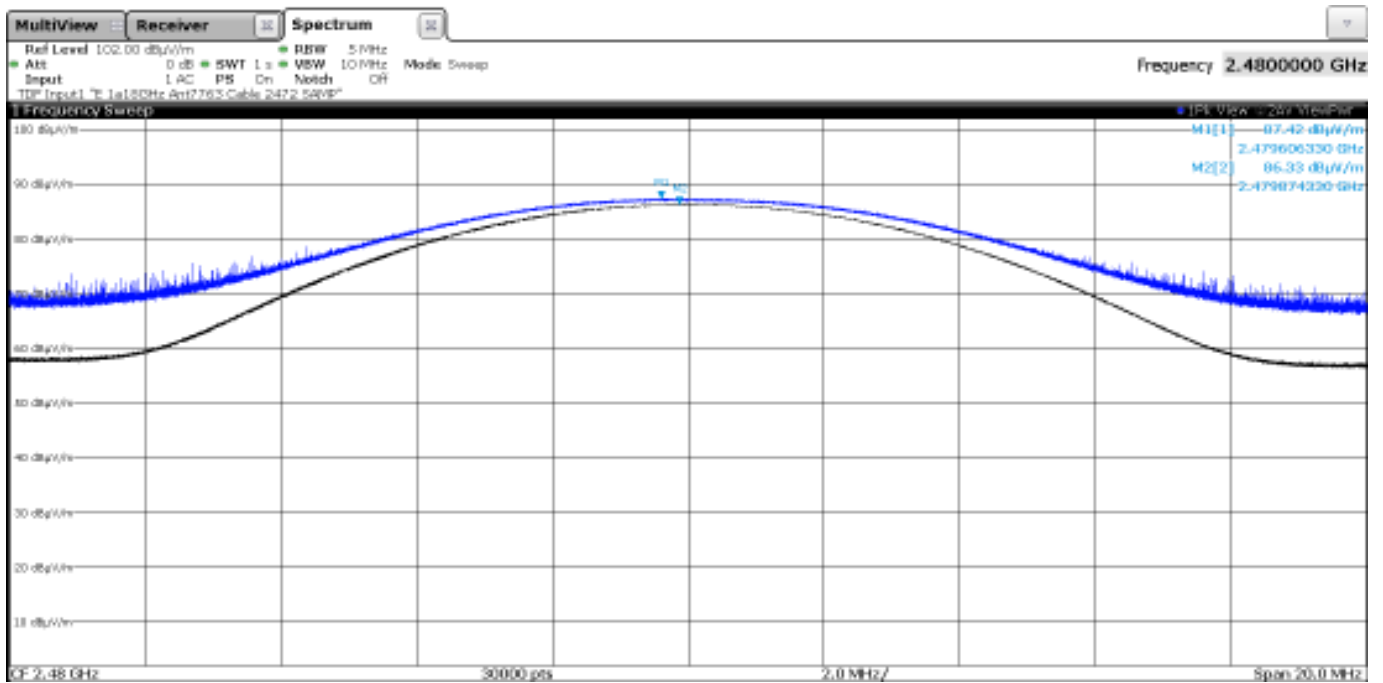
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of harmonics (µV/m) | Field strength of harmonics (dBµV/m) | Measurement distance (m) |
|-----------------------------|------------------------------------|--------------------------------------|--------------------------|
| 902 - 928 | 500 | 54 | 3 |
| 2400 – 2483.5 | 500 | 54 | 3 |
| 5725 - 5875 | 500 | 54 | 3 |
| 24000-24250 | 2500 | 67.96 | 3 |

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

| Frequency Range (MHz) | Field strength (µV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------|-----------------------|-------------------------|--------------------------|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 30 |
| 1.705 - 30.0 | 30 | - | 30 |
| 30 - 88 | 100 | 40 | 3 |
| 88 - 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| 960 - 25000 | 500 | 54 | 3 |

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-17 GHz and at distance of 1 m for the frequency range 17 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty (dB) $< \pm 5.15$

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel (2440 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- High Channel (2480 MHz):

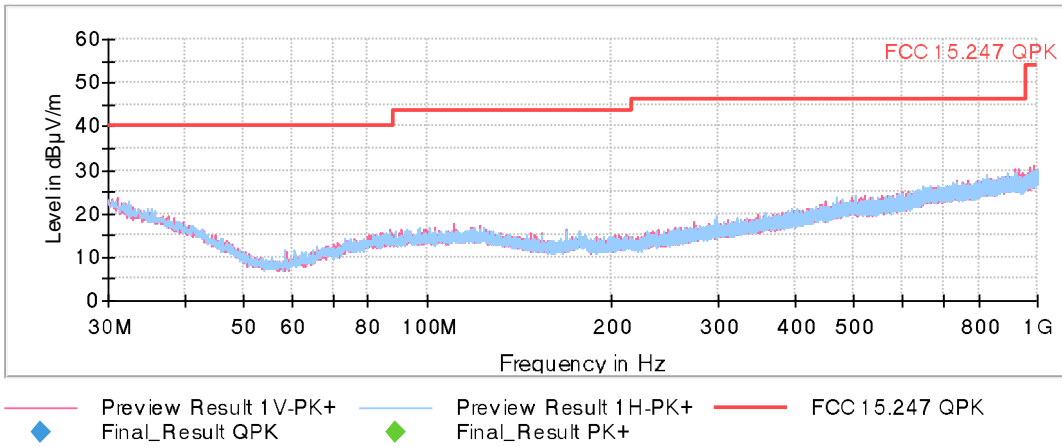
No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty: 1-3 GHz $< \pm 4.94$ dB
 3-17 GHz $< \pm 4.28$ dB
 17-26 GHz $< \pm 4.89$ dB

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

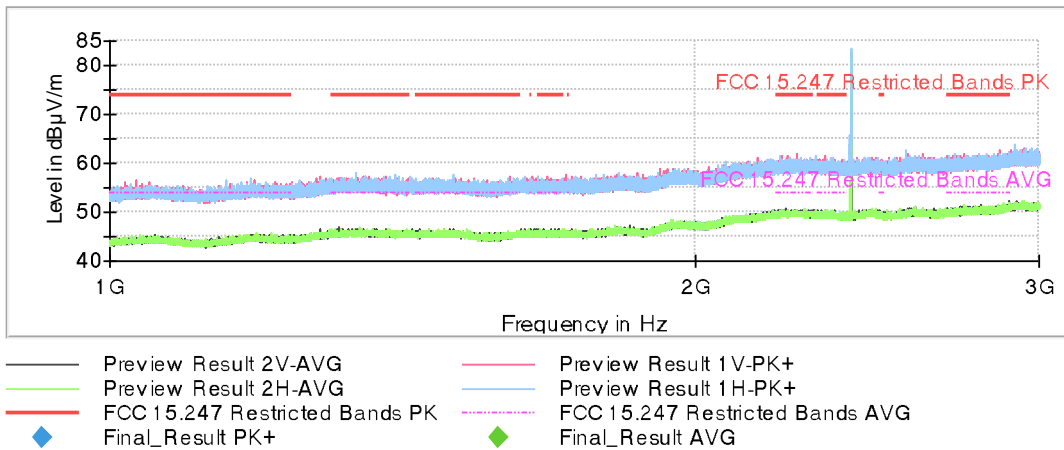
The spurious frequencies detected do not depend on the operating channel.



This plot is valid for the Low, Middle and High Channels.

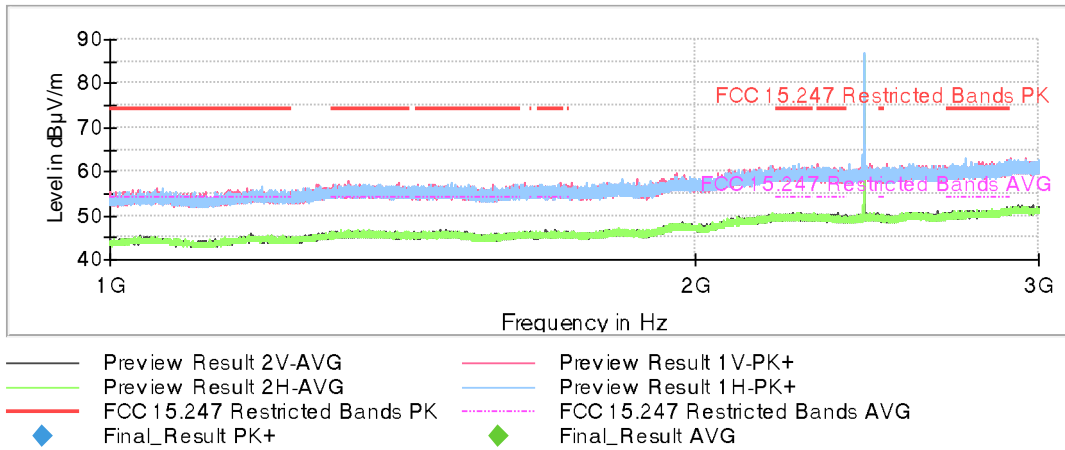
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



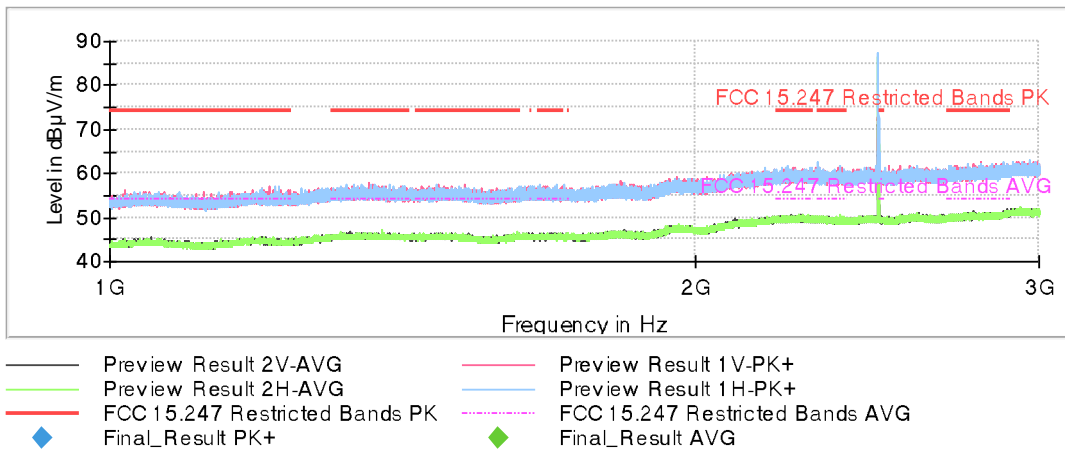
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

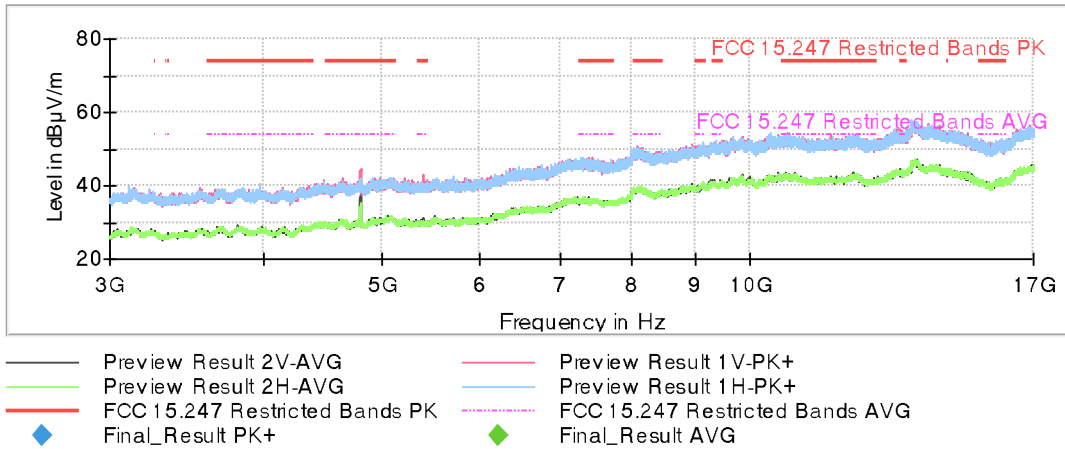
- High Channel:



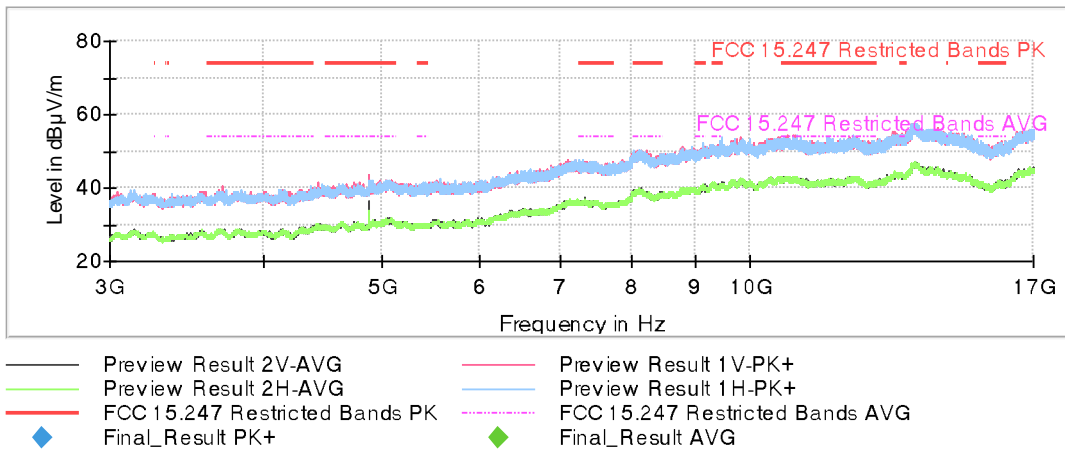
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

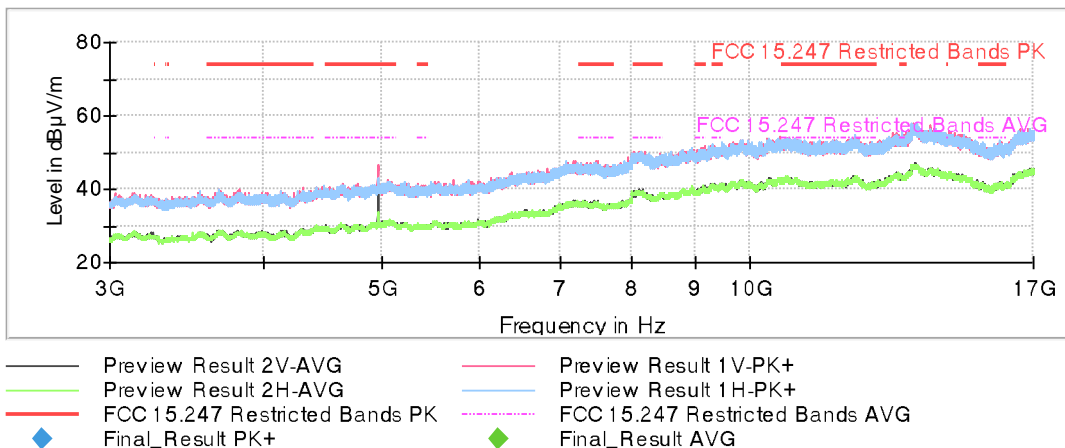
- Low Channel:



- Middle Channel:

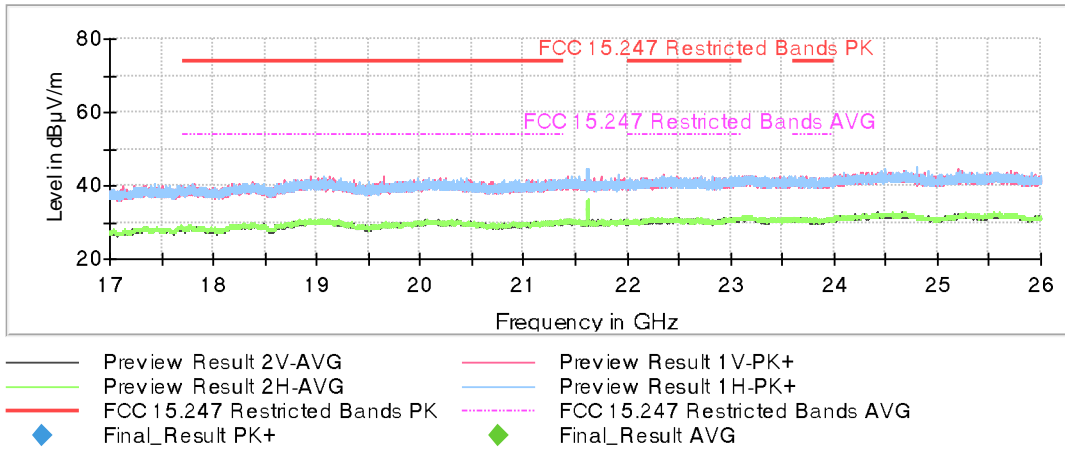


- High Channel:

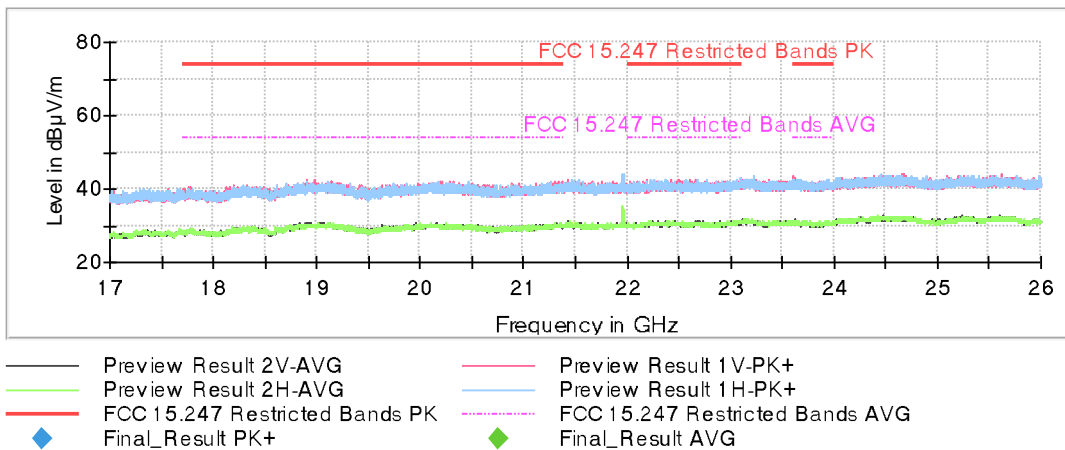


FREQUENCY RANGE 17 - 26 GHz

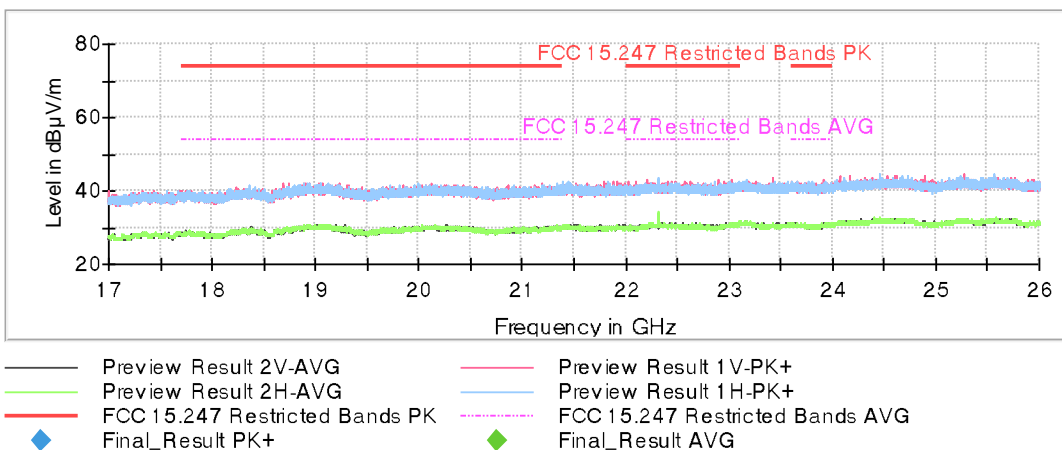
- Low Channel:



- Middle Channel:



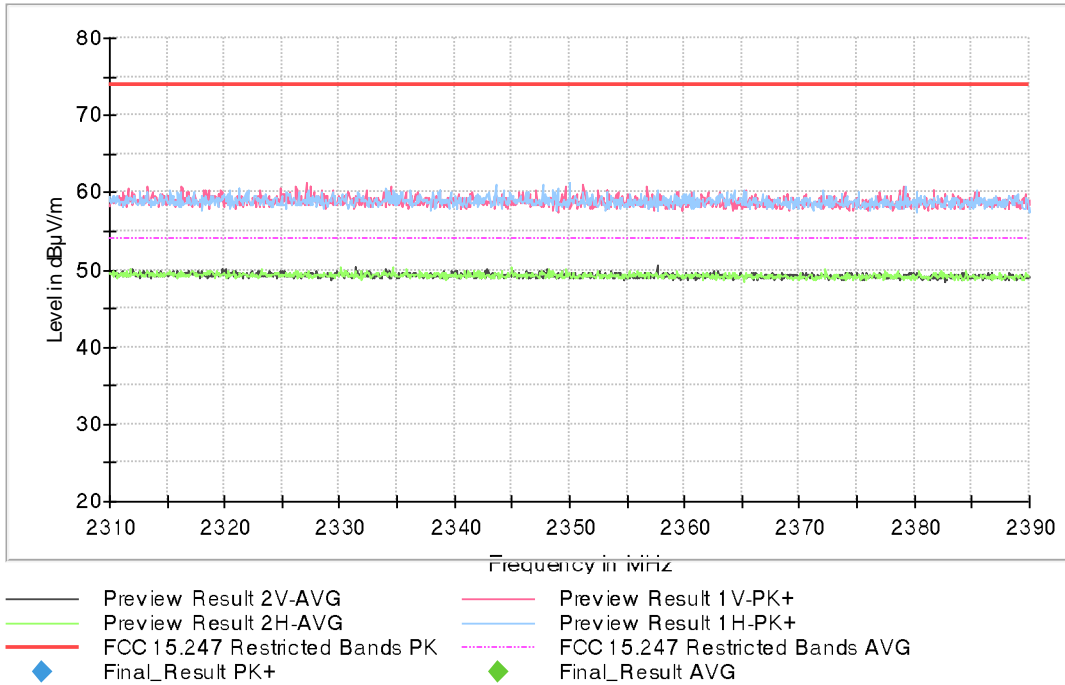
- High Channel:



FREQUENCY RANGE 2.31-2.39 GHz

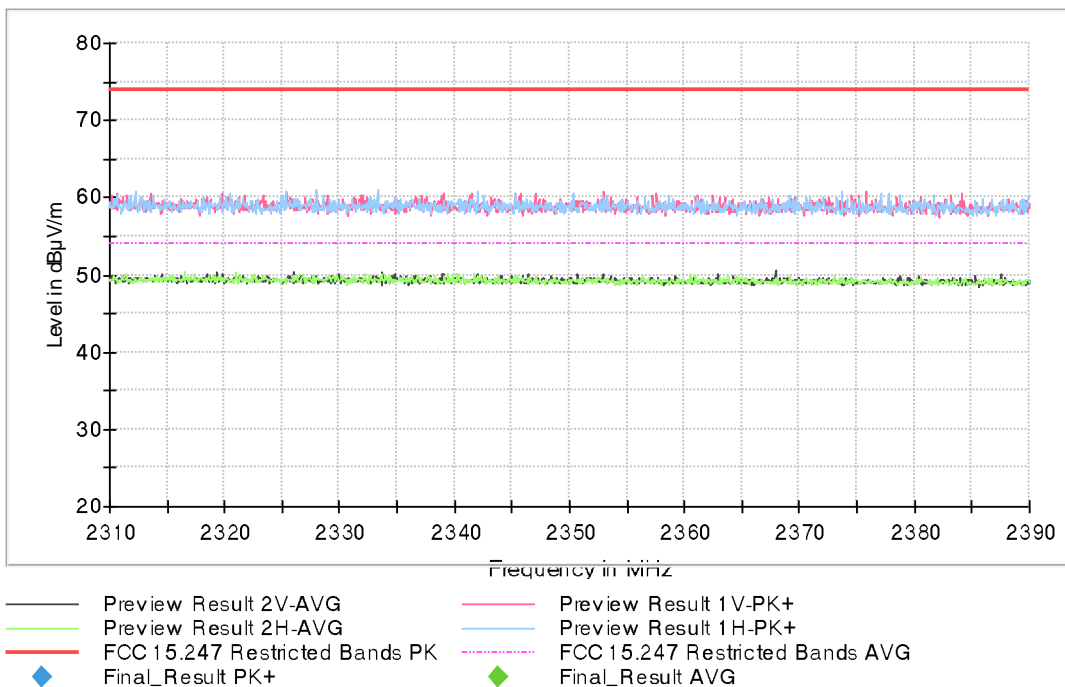
- Low Channel:

Full Spectrum



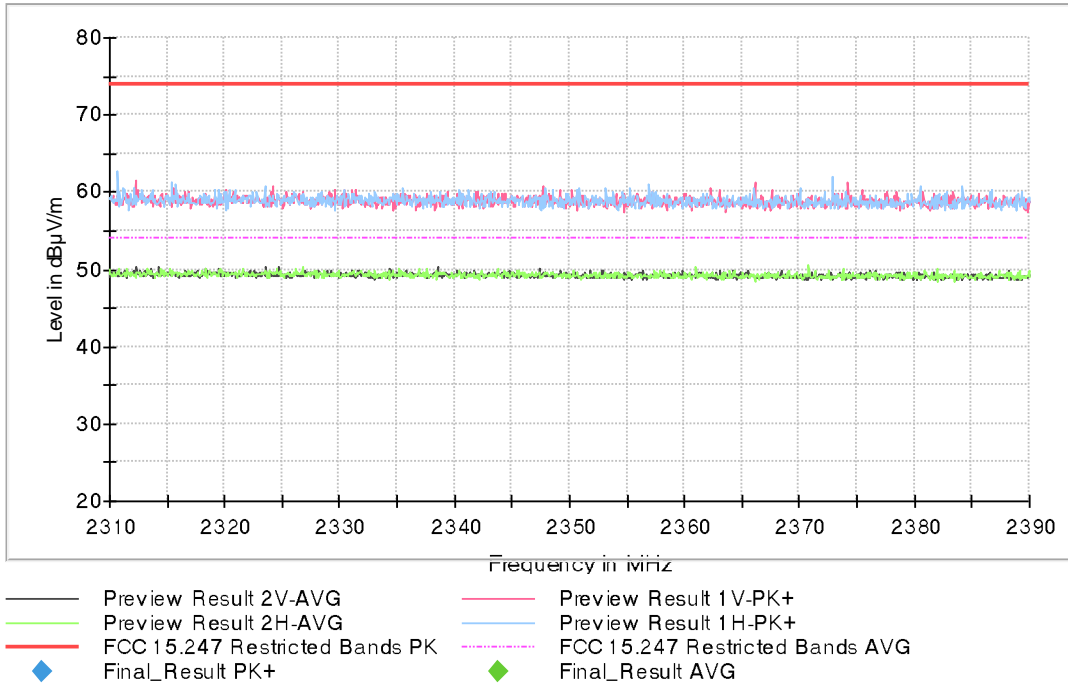
- Middle Channel:

Full Spectrum



- High Channel:

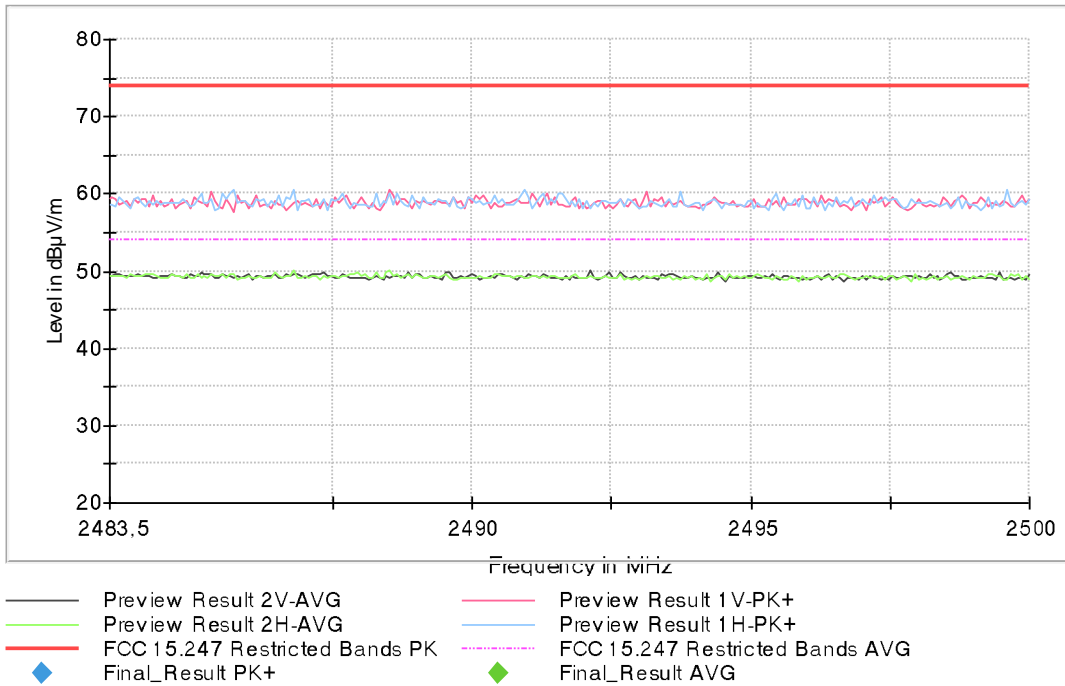
Full Spectrum



FREQUENCY RANGE 2.4835-2.5 GHz

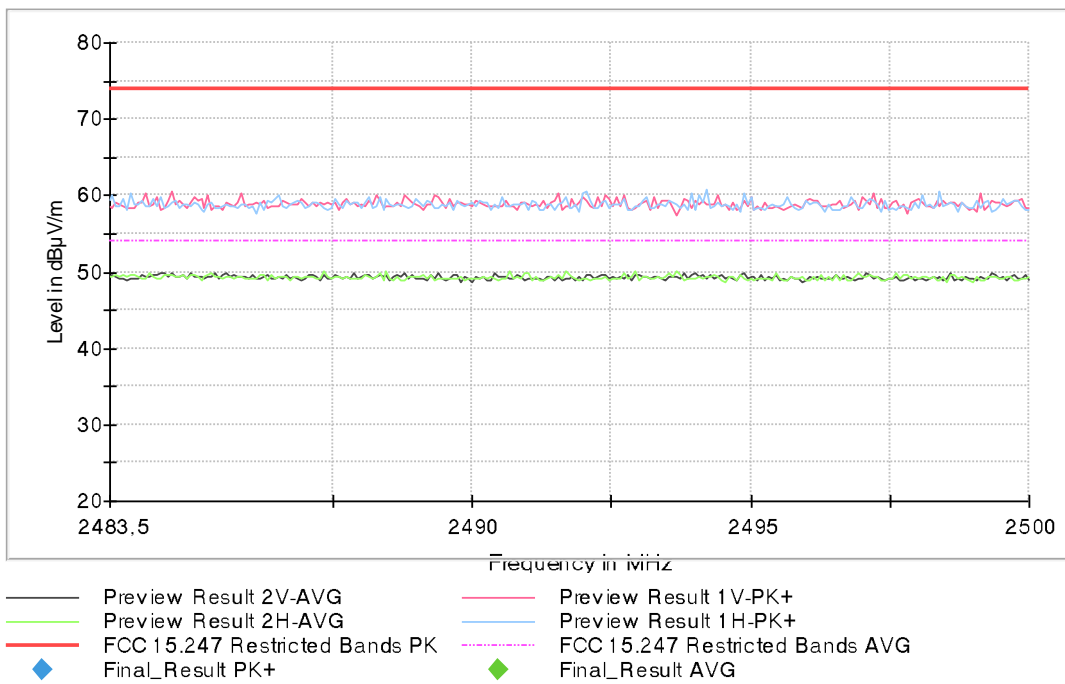
- Low Channel:

Full Spectrum



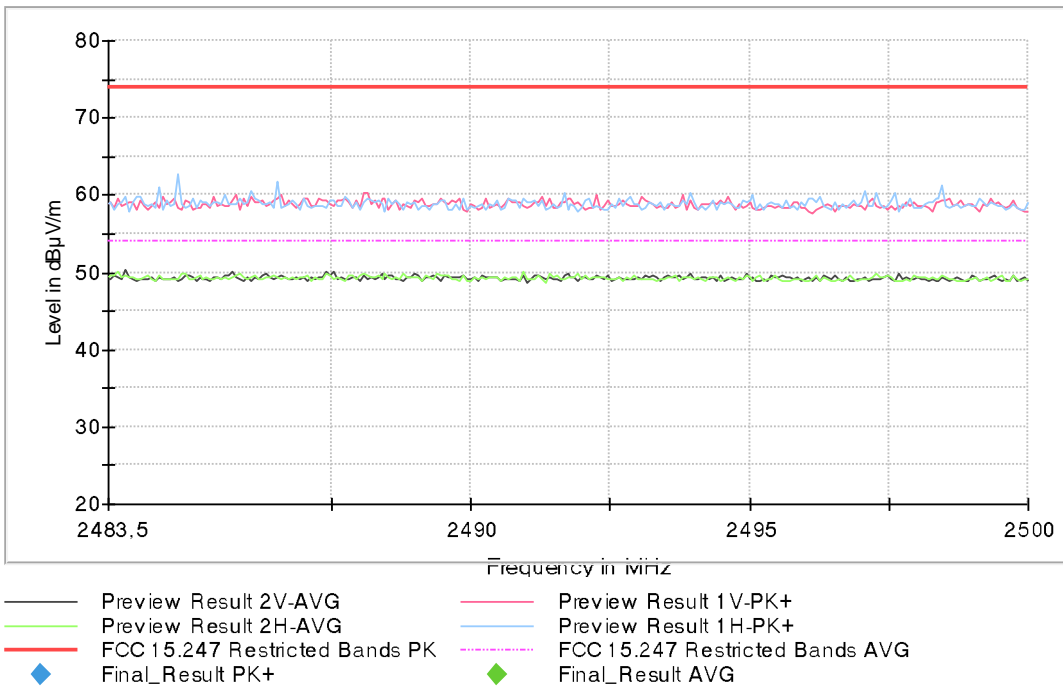
- Middle Channel:

Full Spectrum



- High Channel:

Full Spectrum



Appendix D: Test results. Proprietary protocol Flora 2.4 GHz

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TEST CONDITIONS

POWER SUPPLY (V) and ANTENNA:

| | |
|------------------------|------------------------------|
| V nominal: | 3.7 Vdc rechargeable battery |
| Type of Power Supply: | Rechargeable battery. |
| Type of Antenna: | Integral |
| Declared Antenna Gain: | -8.5 dBi |

TEST FREQUENCIES:

| | |
|-----------------|----------|
| Low Channel: | 2402 MHz |
| Middle Channel: | 2440 MHz |
| High Channel: | 2480 MHz |

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The DC supply voltage is applied using an external battery.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

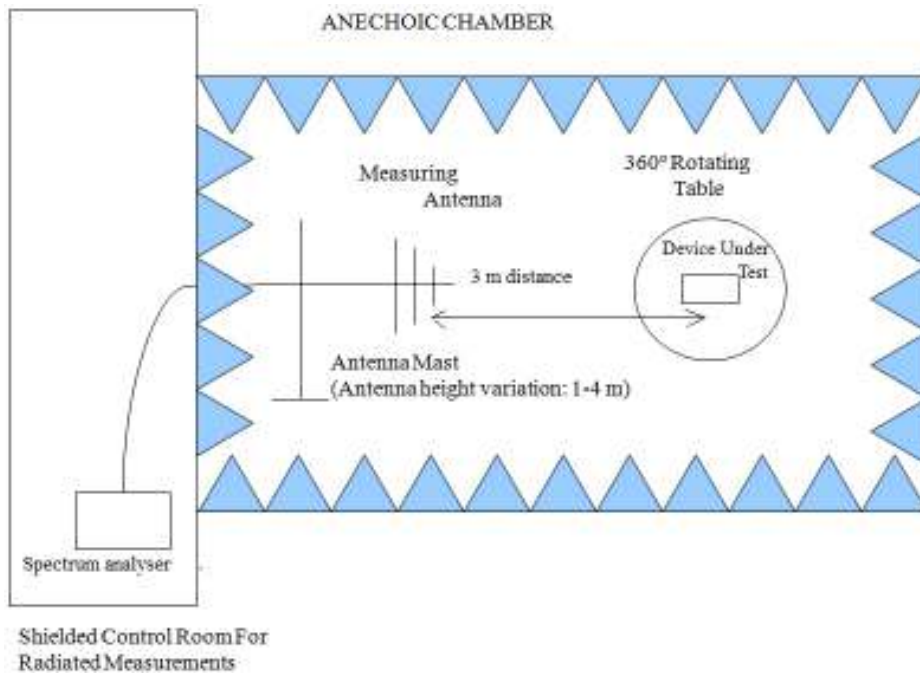
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

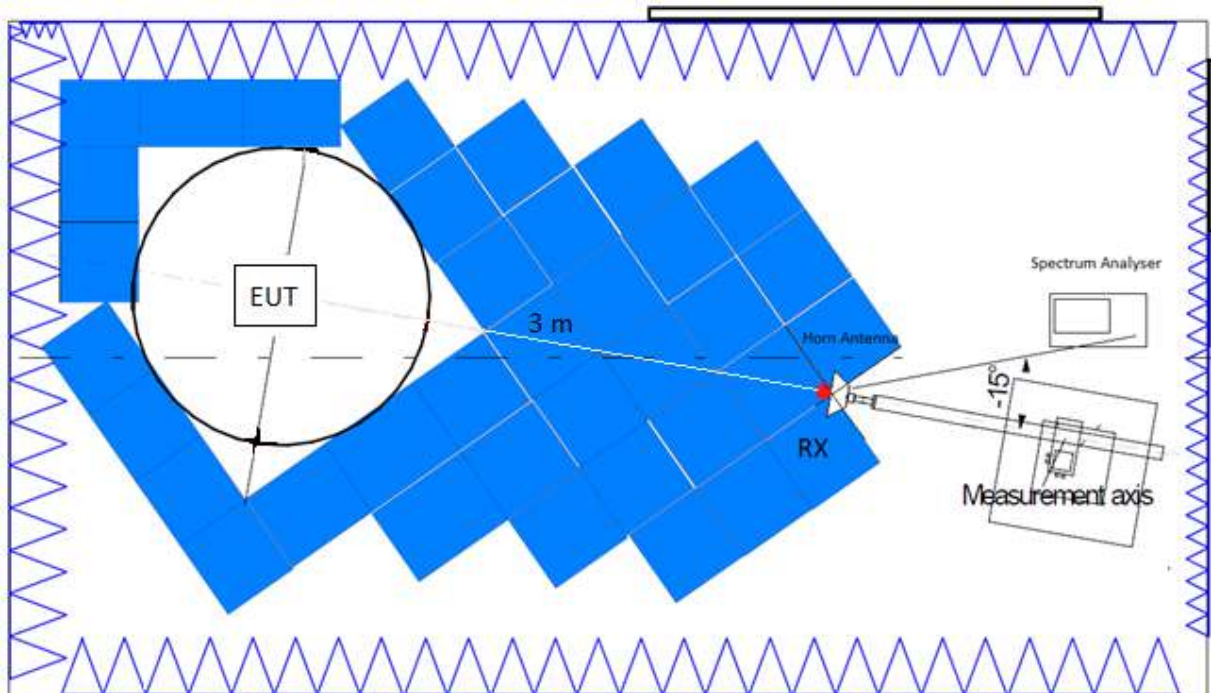
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

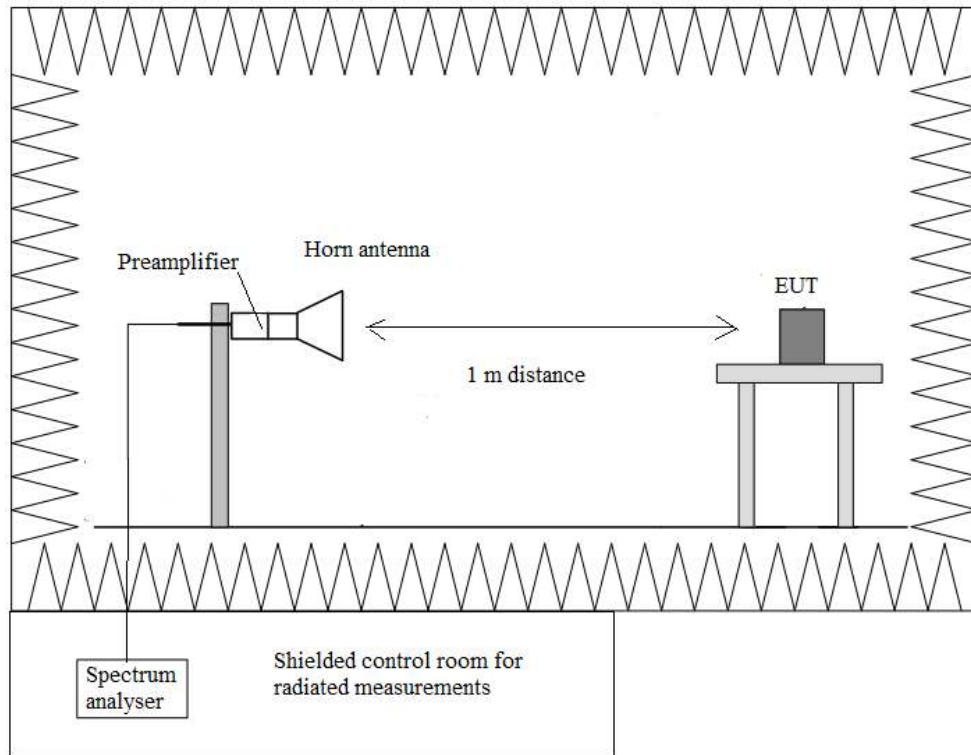
Radiated measurements setup $f < 1$ GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



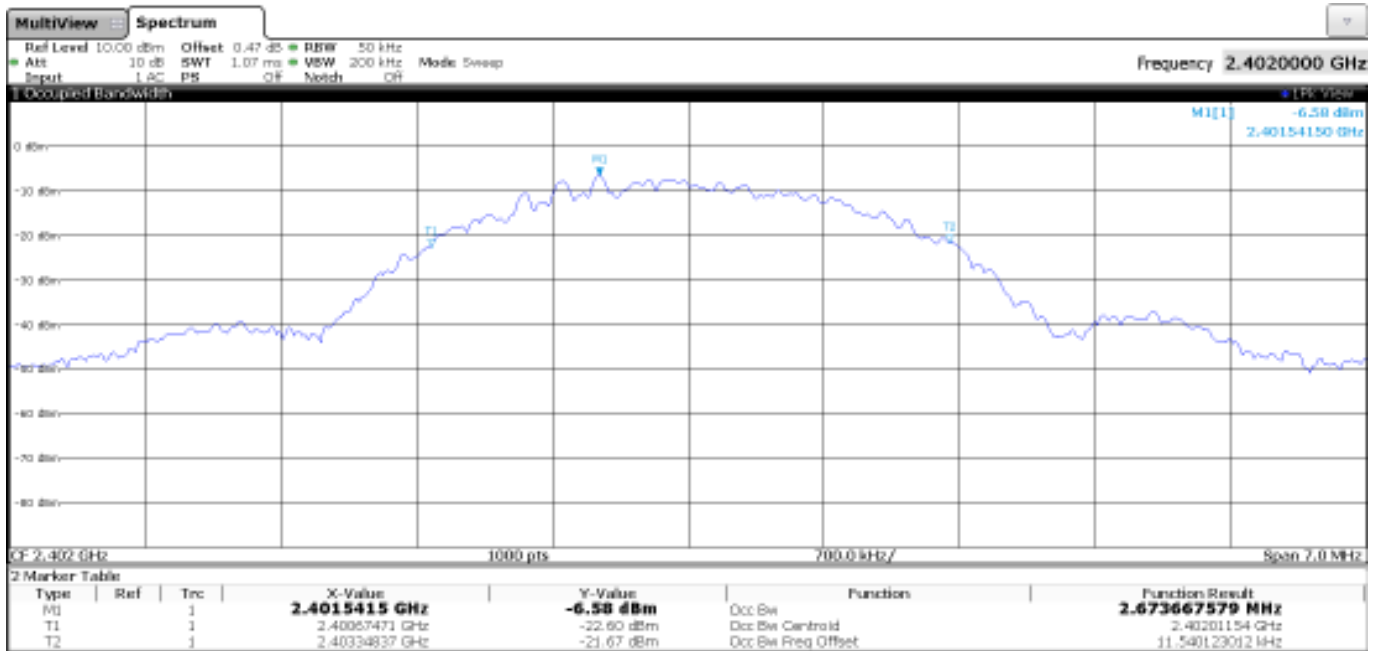
Occupied Bandwidth

RESULTS:

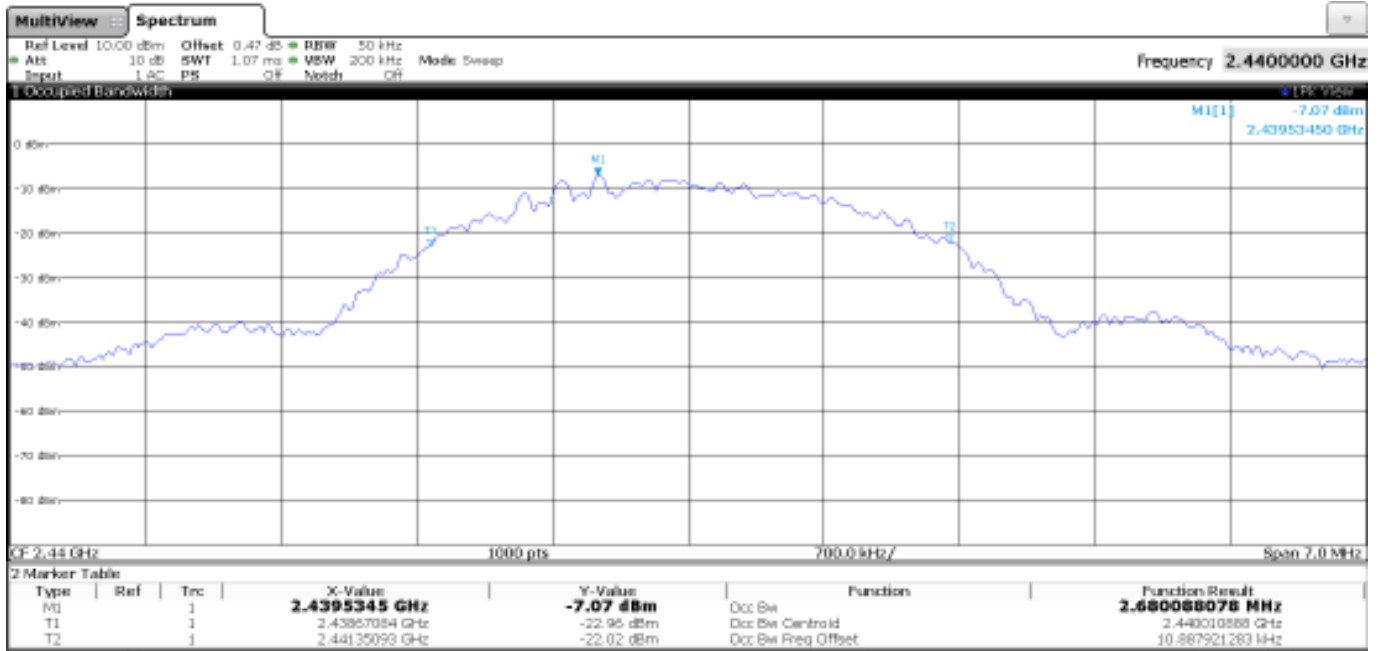
| | | | |
|-------------------------------|-------------------------|----------------------------|--------------------------|
| | Low Channel 2402 MHz | Middle Channel 2440 MHz | High Channel 2480 MHz |
| 99% Bandwidth (MHz) | 2.6737 | 2.6801 | 2.6754 |
| Measurement Uncertainty (kHz) | <±6.18 | | |

Verdict: PASS

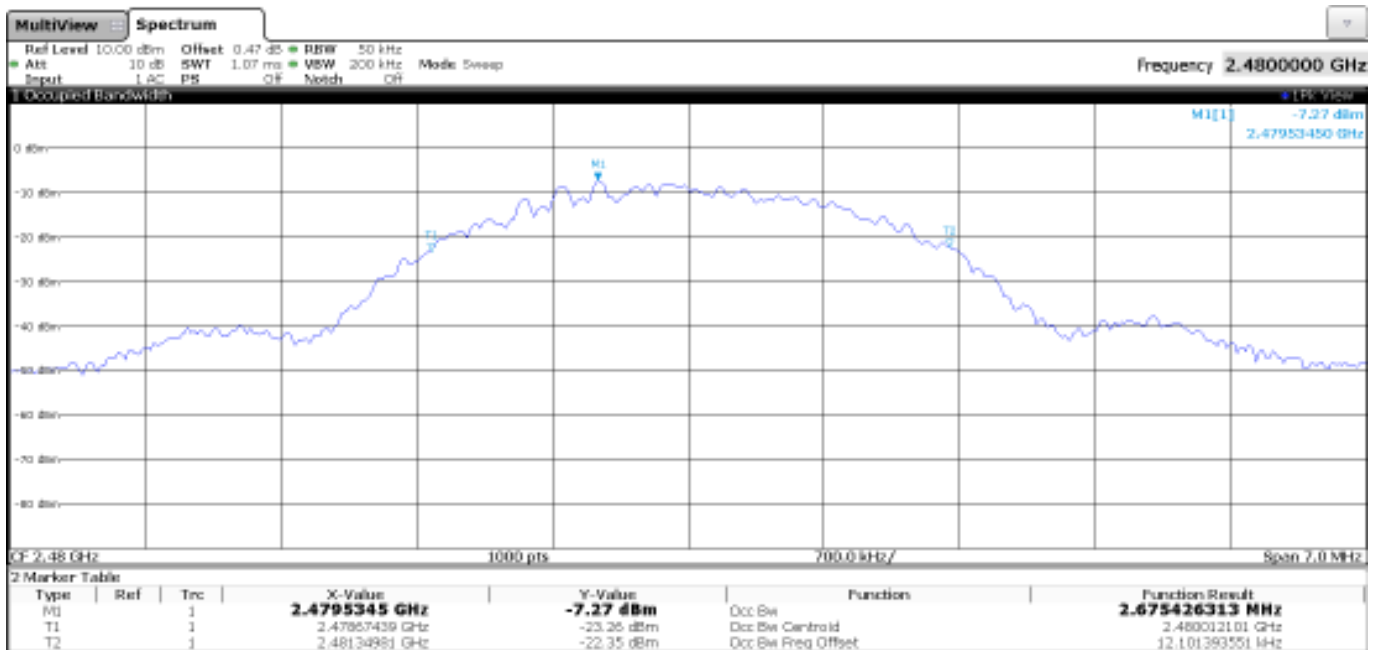
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (a) / RSS-210 B.10 (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of fundamental (mV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------------|--------------------------------------|-------------------------|--------------------------|
| 902 - 928 | 50 | 93.98 | 3 |
| 2400 – 2483.5 | 50 | 93.98 | 3 |
| 5725 - 5875 | 50 | 93.98 | 3 |
| 24000-24250 | 250 | 107.96 | 3 |

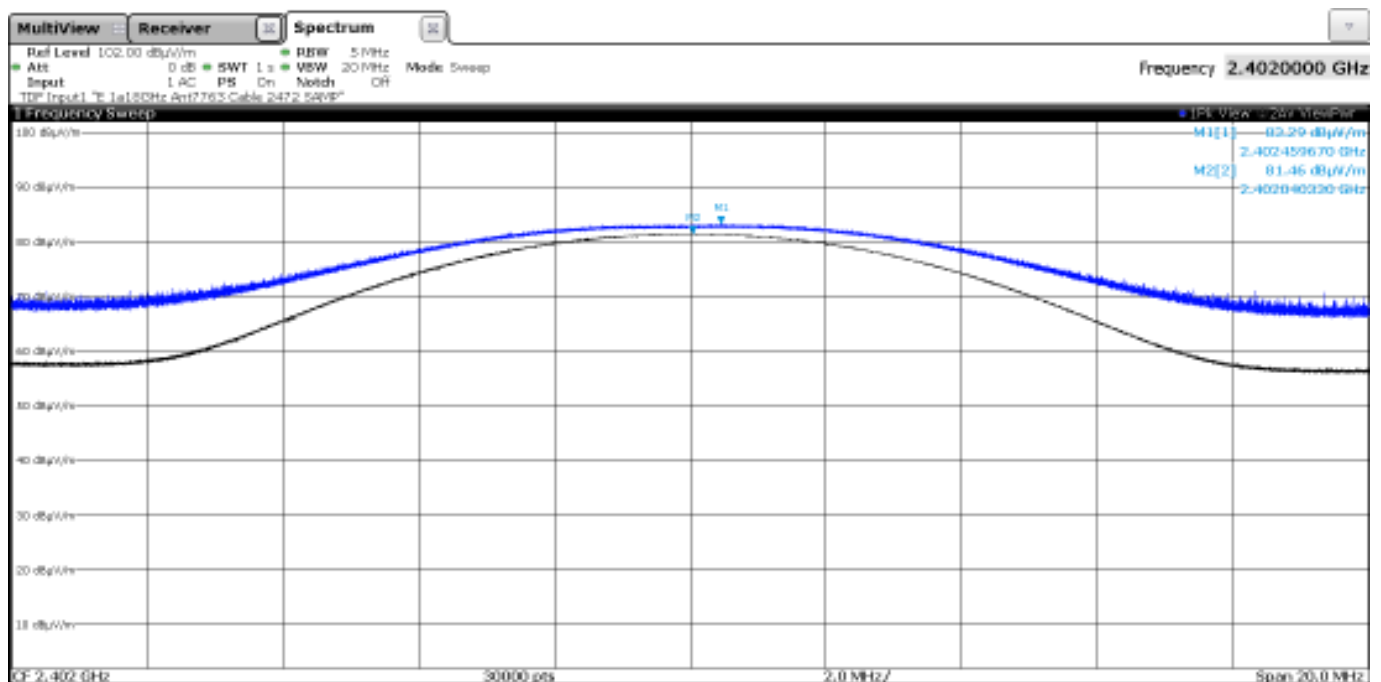
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

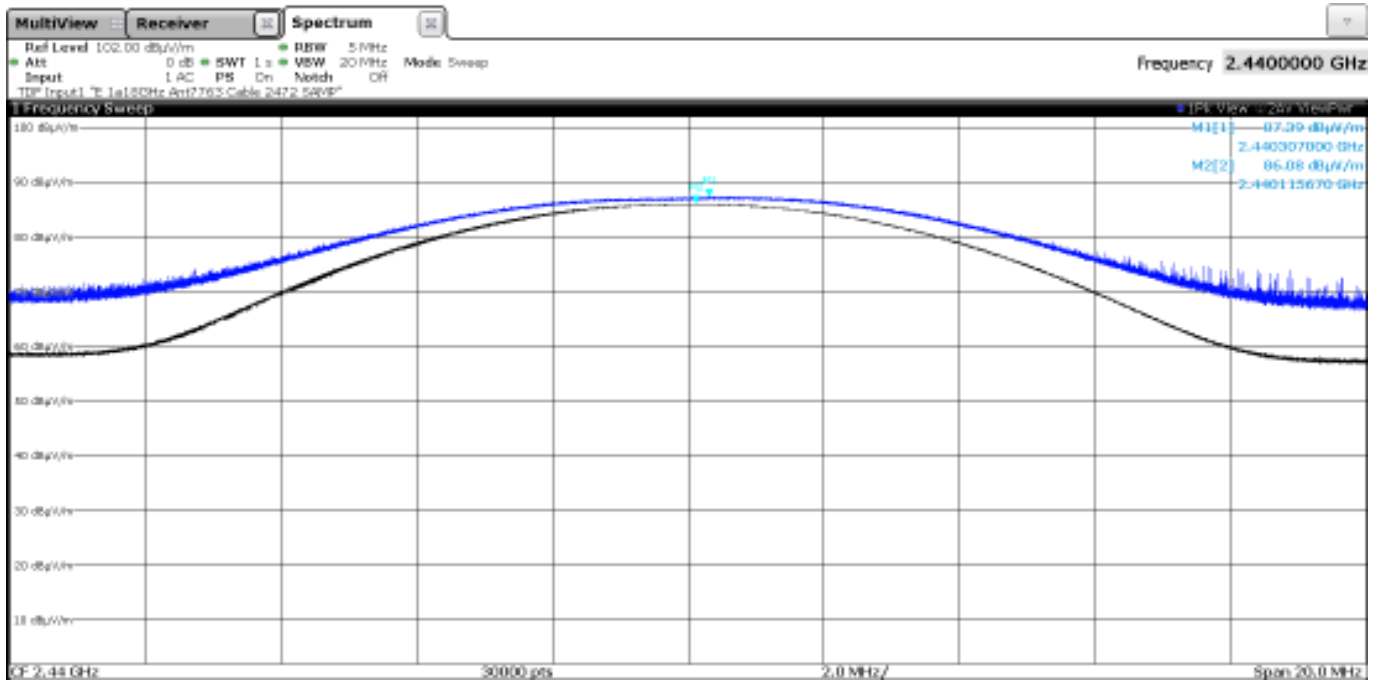
| | Low Channel 2402 MHz | Middle Channel 2440 MHz | High Channel 2480 MHz |
|---------------------------------|-------------------------|----------------------------|--------------------------|
| Average Field Strength (dBµV/m) | 81.46 | 86.08 | 85.71 |
| Peak Field Strength (dBµV/m) | 83.29 | 87.39 | 87.07 |
| Measurement Uncertainty (dB) | <±3.98 | | |

Verdict: PASS

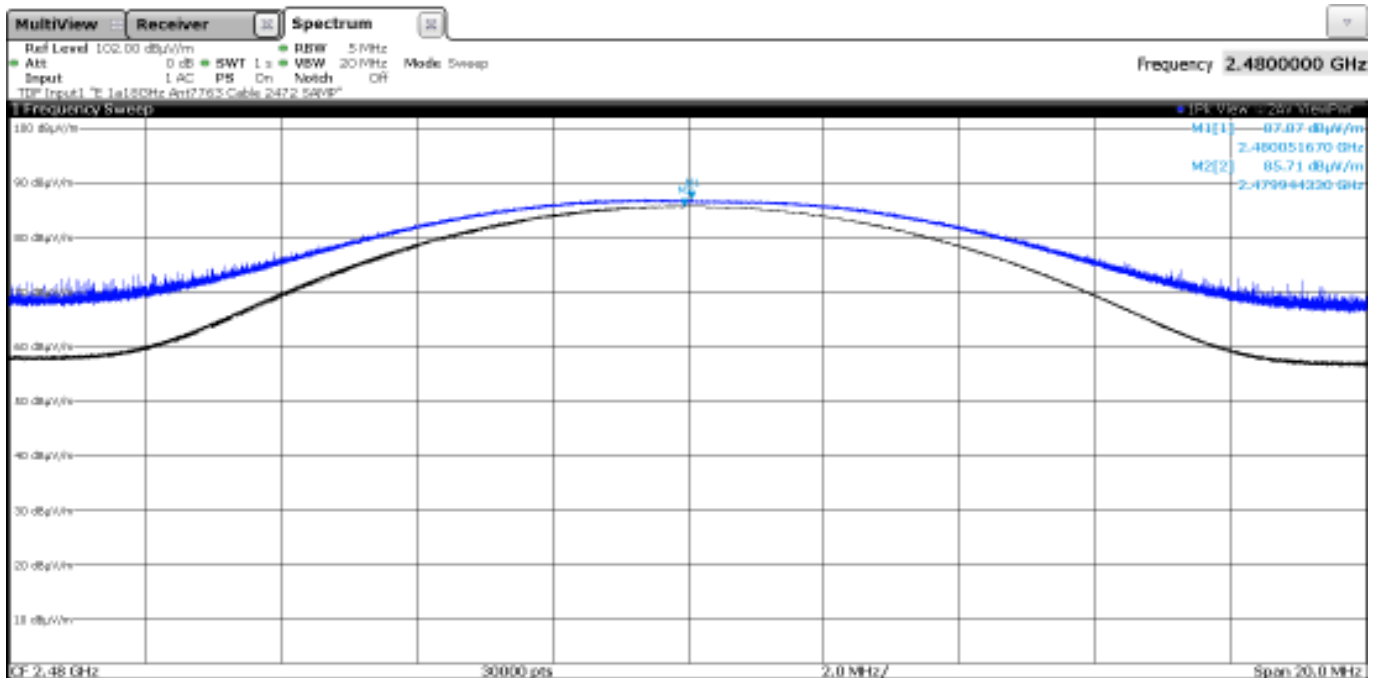
- Low Channel:



- Middle Channel:



- High Channel:



15.249 (d) / RSS-210 B.10 (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

| Fundamental frequency (MHz) | Field strength of harmonics (µV/m) | Field strength of harmonics (dBµV/m) | Measurement distance (m) |
|-----------------------------|------------------------------------|--------------------------------------|--------------------------|
| 902 - 928 | 500 | 54 | 3 |
| 2400 – 2483.5 | 500 | 54 | 3 |
| 5725 - 5875 | 500 | 54 | 3 |
| 24000-24250 | 2500 | 67.96 | 3 |

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

| Frequency Range (MHz) | Field strength (µV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|-----------------------|-----------------------|-------------------------|--------------------------|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 30 |
| 1.705 - 30.0 | 30 | - | 30 |
| 30 - 88 | 100 | 40 | 3 |
| 88 - 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| 960 - 25000 | 500 | 54 | 3 |

Whichever is the lesser attenuation.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-17 GHz and at distance of 1 m for the frequency range 17 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious signals detected do not depend on the operating channel.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty (dB) $<\pm 5.15$

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- Low Channel (2402 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel (2440 MHz):

No spurious frequencies detected at less than 20 dB below the limit.

- High Channel (2480 MHz):

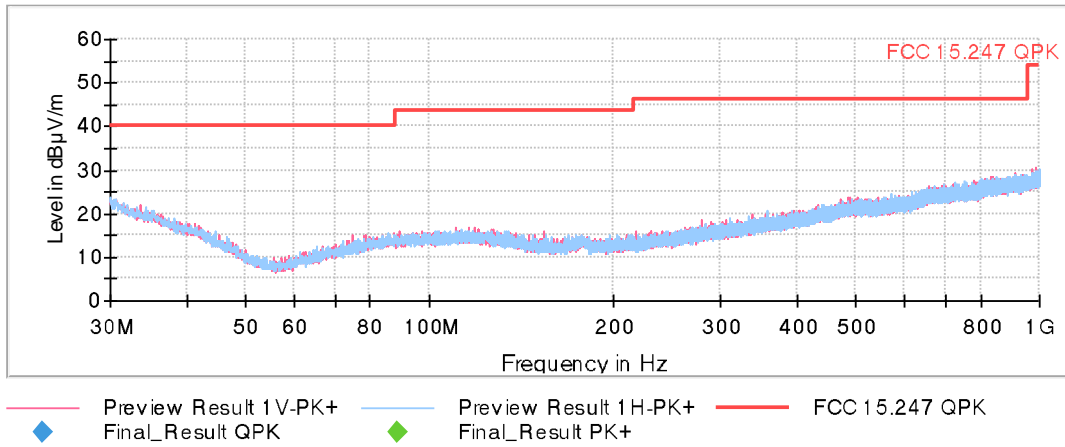
No spurious frequencies detected at less than 20 dB below the limit.

Measurement Uncertainty: 1-3 GHz $<\pm 4.94$ dB
3-17 GHz $<\pm 4.28$ dB
17-26 GHz $<\pm 4.89$ dB

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz

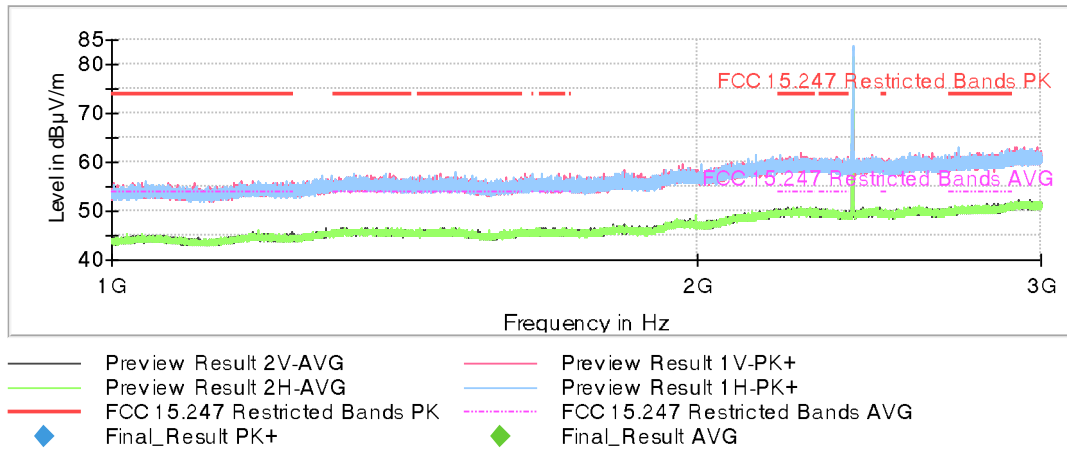
The spurious frequencies detected do not depend on the operating channel.



This plot is valid for the Low, Middle and High Channels.

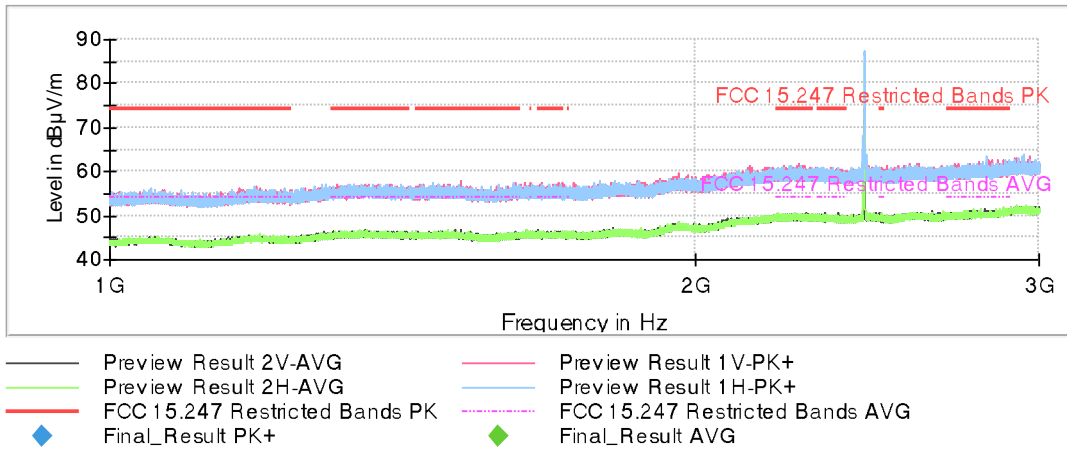
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



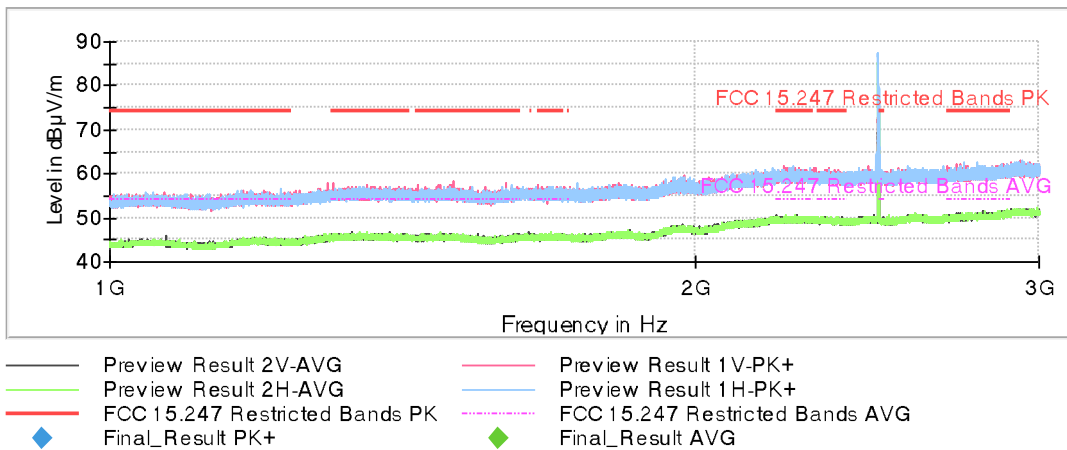
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

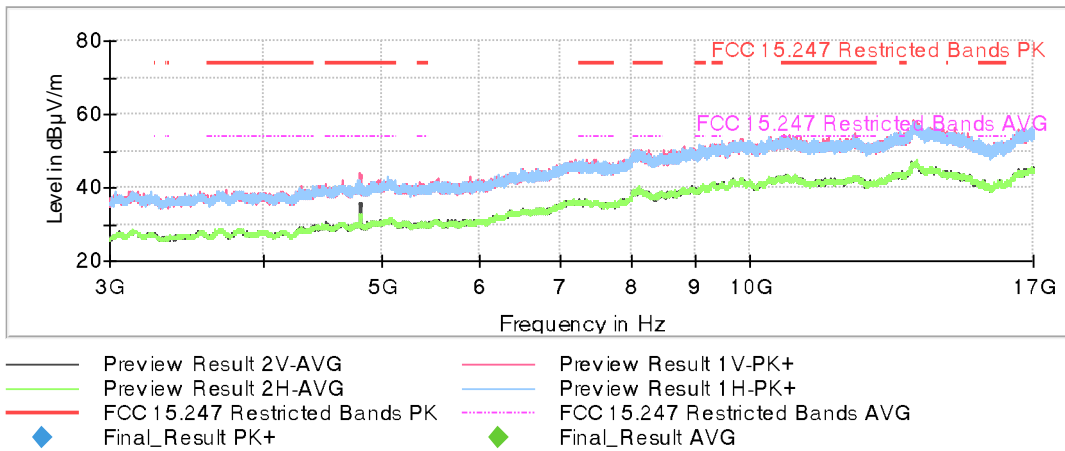
- High Channel:



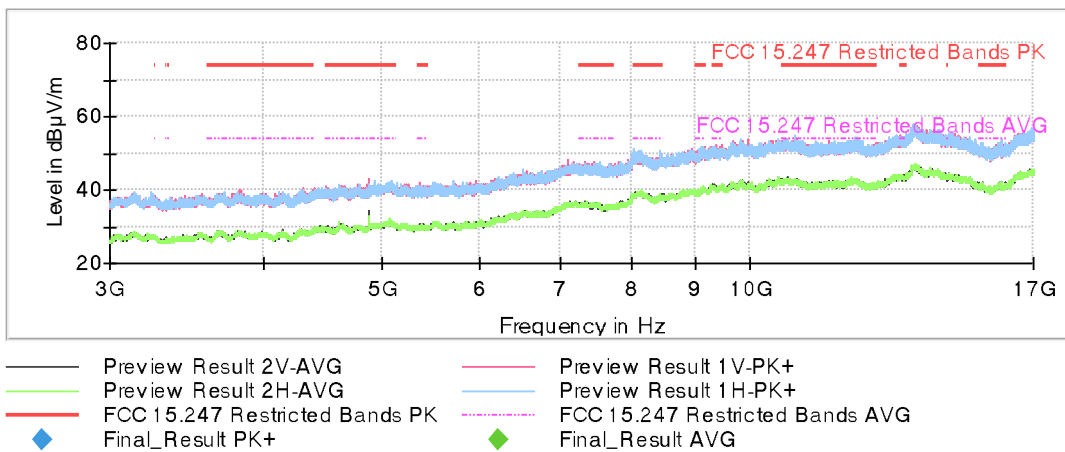
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

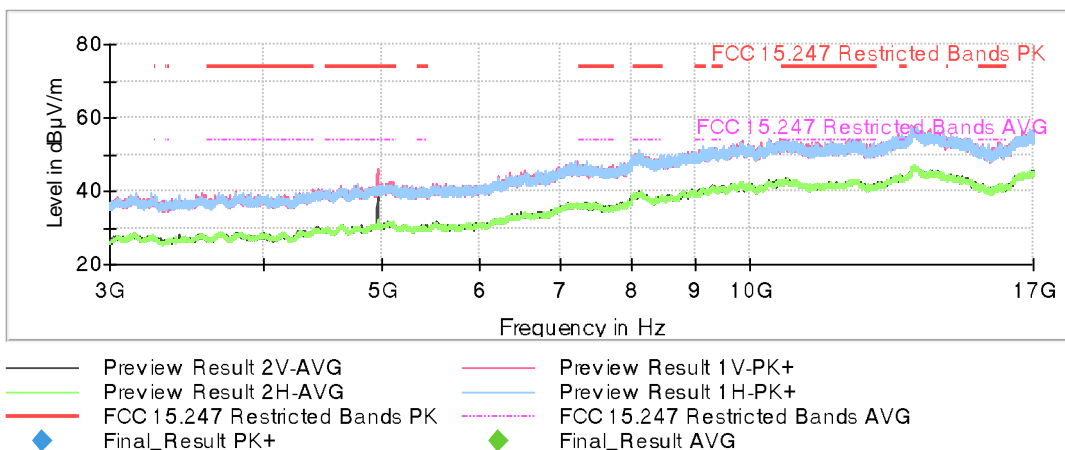
- Low Channel:



- Middle Channel:

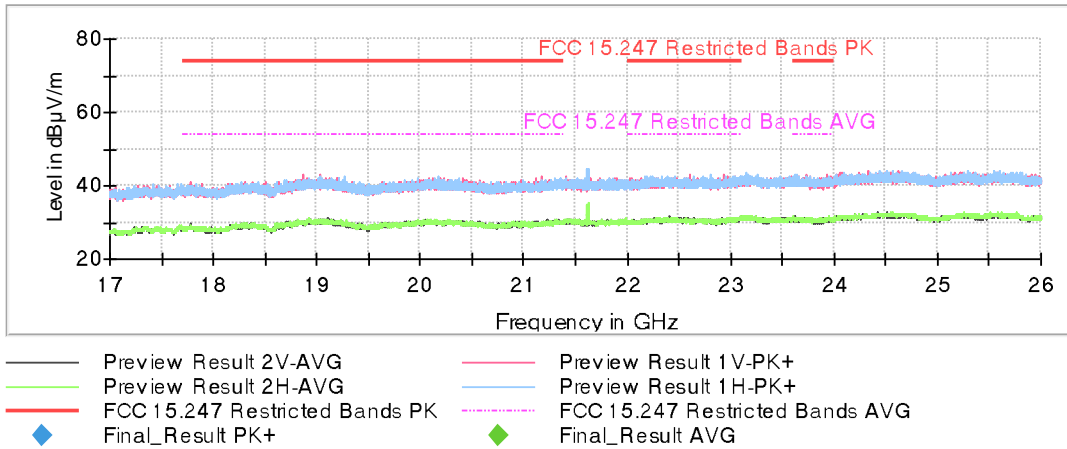


- High Channel:

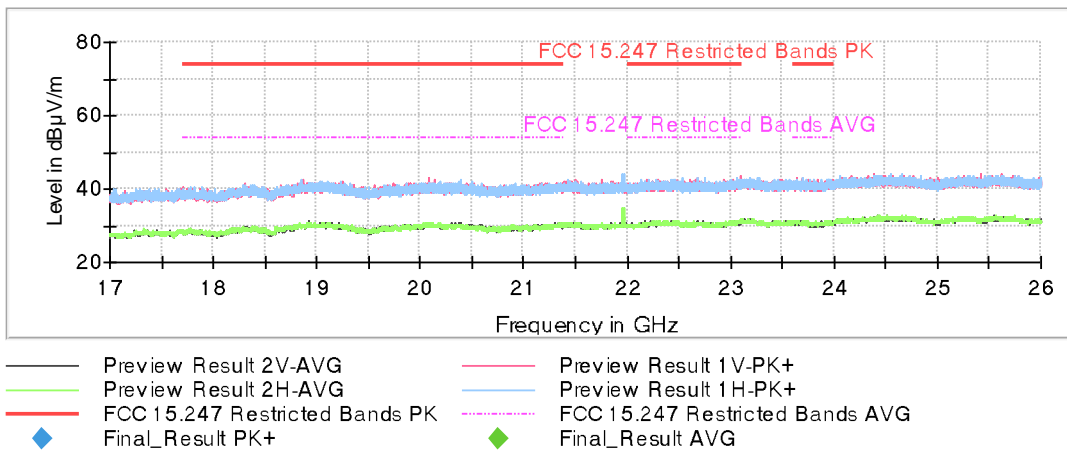


FREQUENCY RANGE 17 - 26 GHz

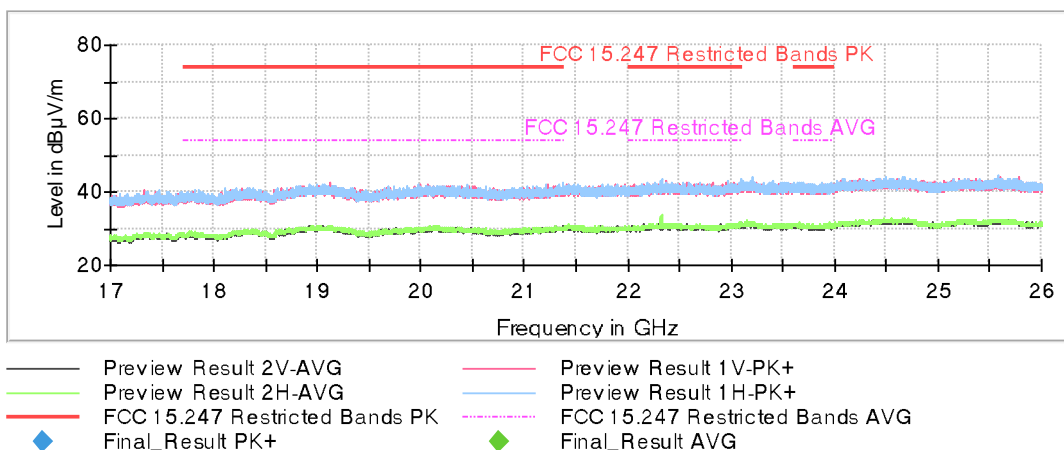
- Low Channel:



- Middle Channel:



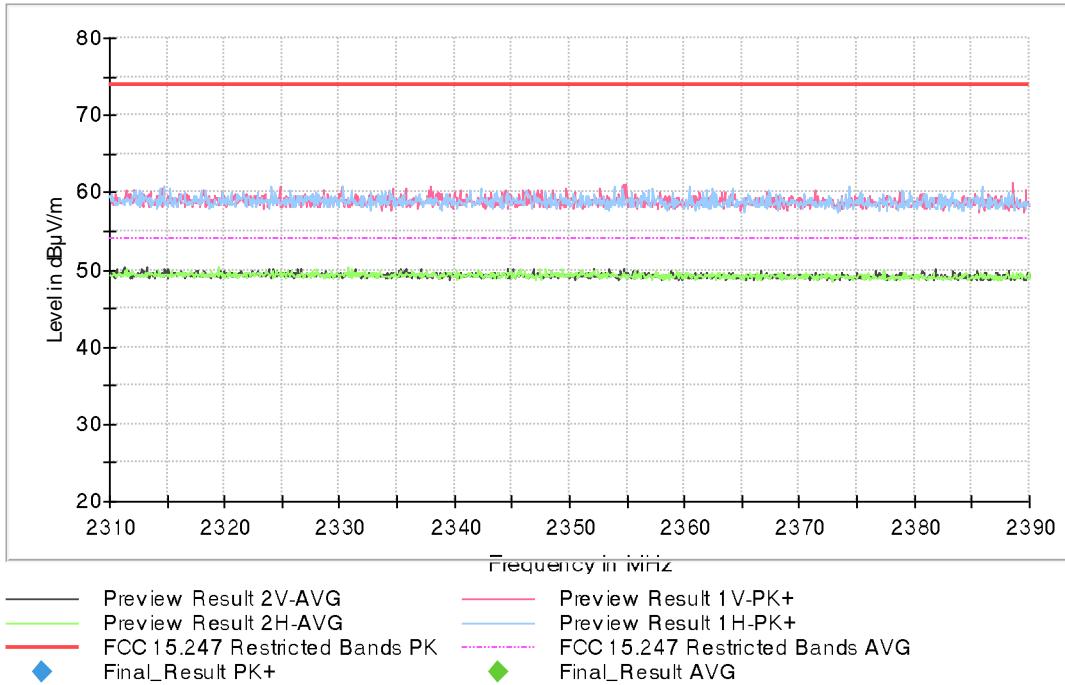
- High Channel:



FREQUENCY RANGE 2.31-2.39 GHZ

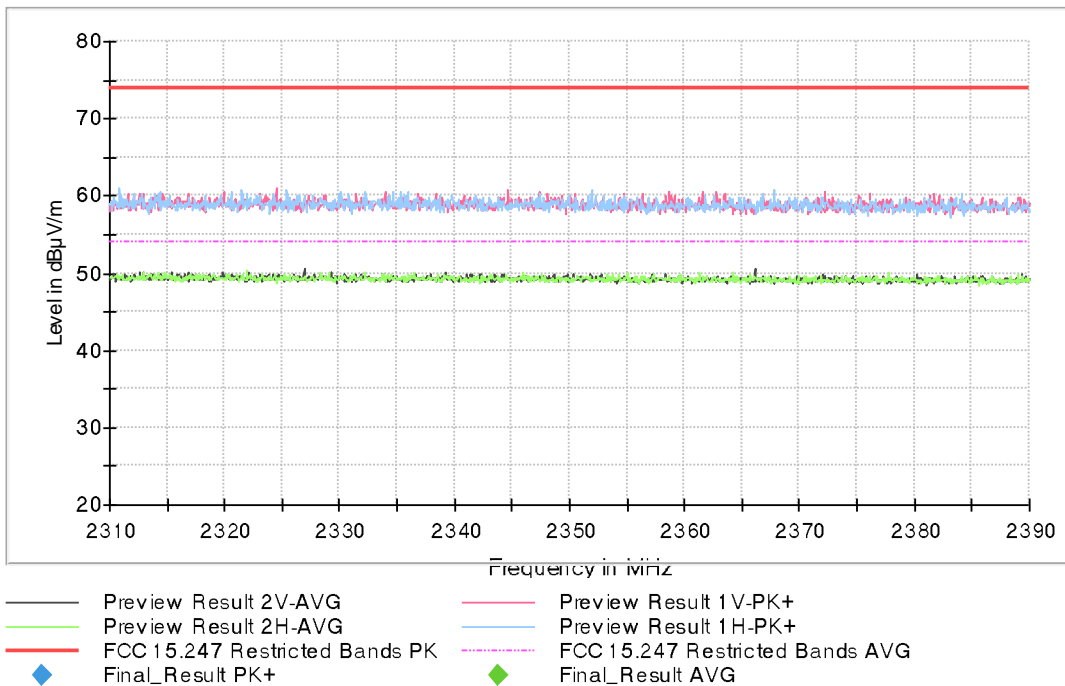
- Low Channel:

Full Spectrum



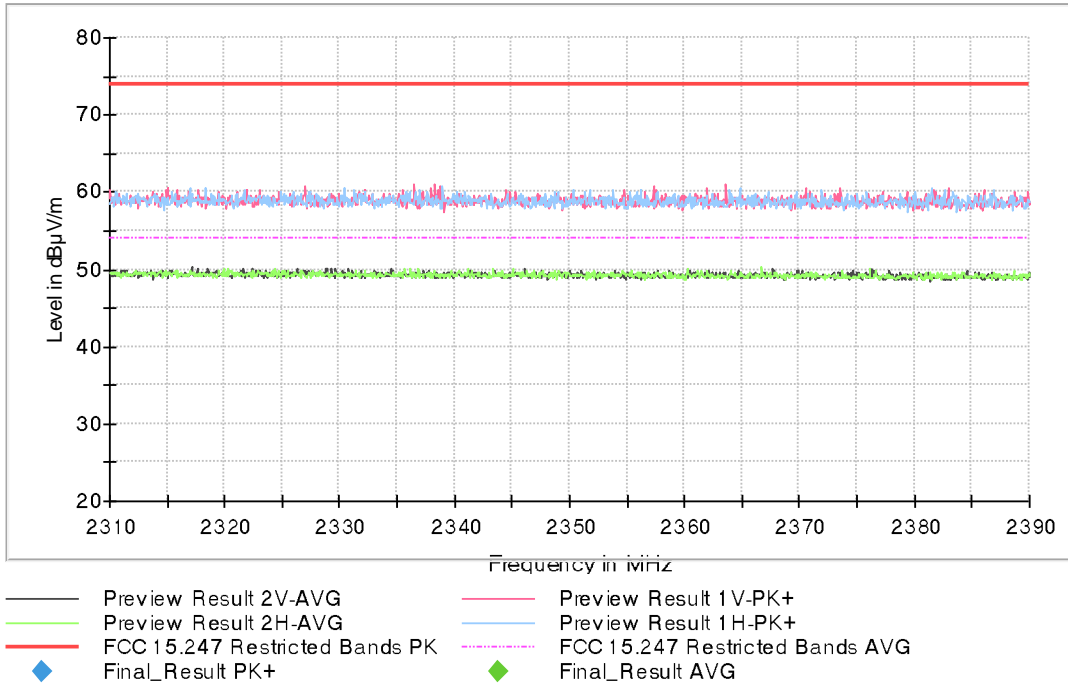
- Middle Channel:

Full Spectrum



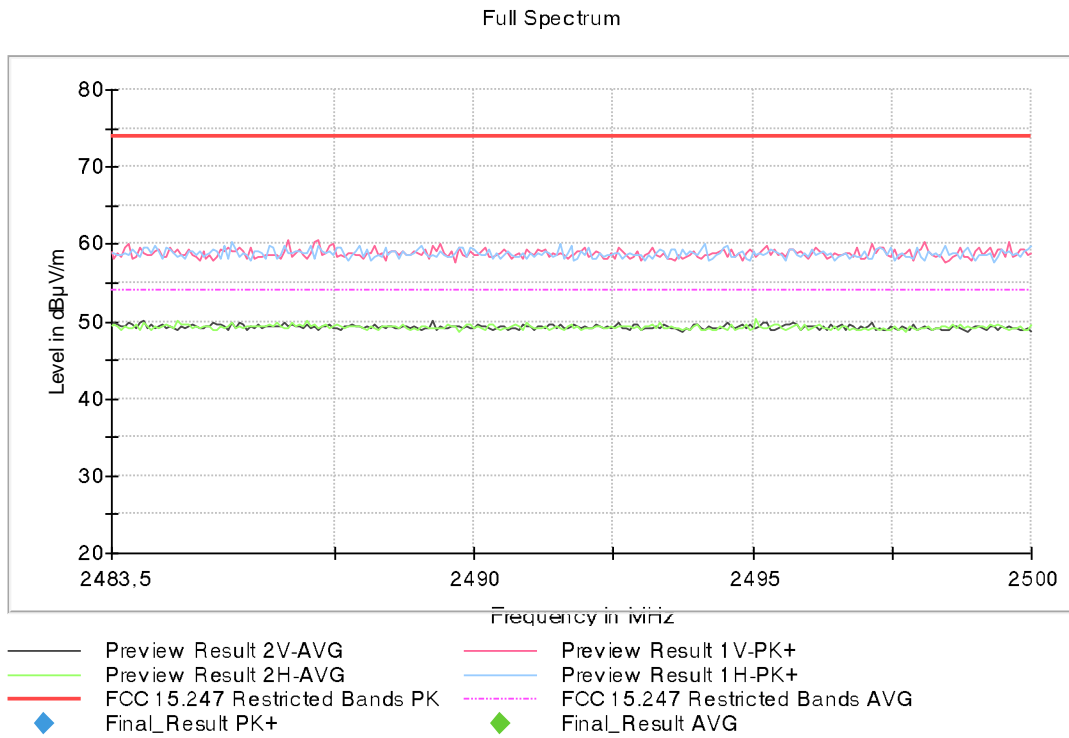
- High Channel:

Full Spectrum

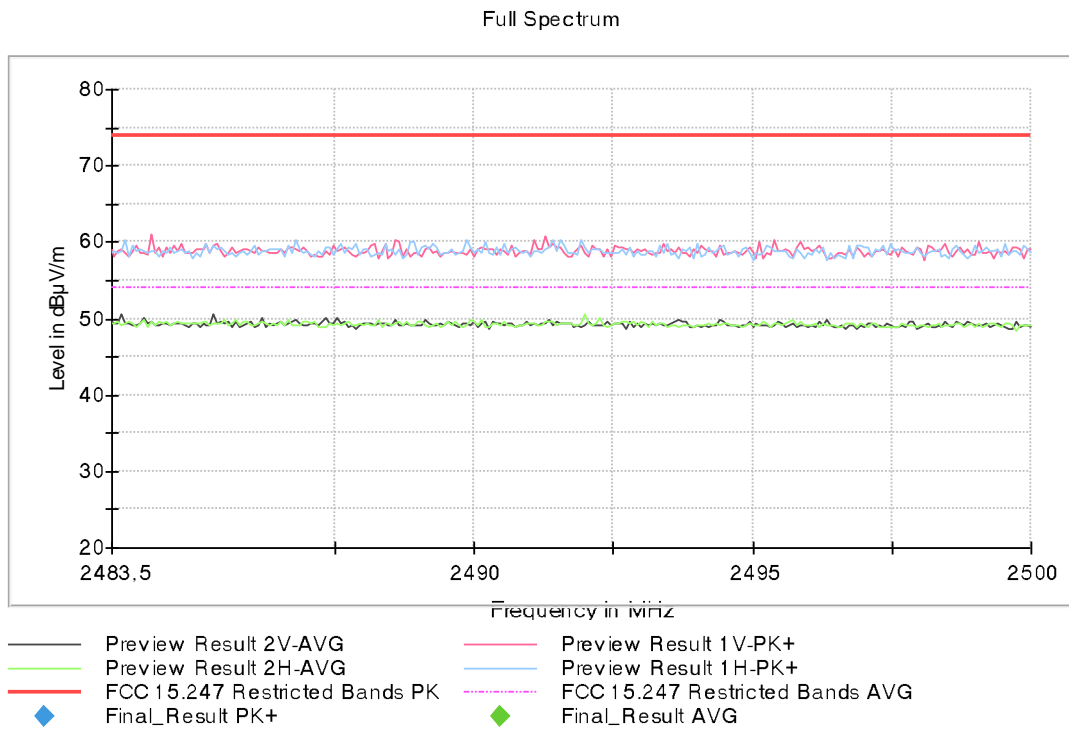


FREQUENCY RANGE 2.4835-2.5 GHz

- Low Channel:



- Middle Channel:



- High Channel:

Full Spectrum

