Limited test report

REP114534-1R1TRFWL

Date of issue: September 25, 2025

Applicant:

Huupe, Inc.

Product description:

Huupe module with Quectel FC900E with custom antenna

Model:

H-FC900E

Product marketing name(s):

None

FCC ID:

2BOIM-FC900E

ISED certification number:

33905-FC900E

Specifications:

- FCC 47 CFR Part 15, Subpart C – §15.247
  Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz
- Industry Canada RSS-247, Issue 3
  Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Nemko USA Inc., a testing laboratory, is accredited by ANAB. The tests included in this report are within the scope of this accreditation.

Lab and test locations

Company name	Nemko USA Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
State	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
FCC Site Number	Test Firm Registration Number: 392943; Designation Number: US5058
ISED Test Site	2040B-3

Tested by	Lan Sayasane, Sr. EMC Test Engineer
Reviewed by	James Cunningham, EMC/WL Manager
Review date	September 25, 2025
Reviewer signature	James Cunningham Digitally signed by James Cunningham DN: cn=James Cunningham, c=US, o=Nemko, ou=EMC/WL, email=james.cunningham@nemko.com Reason: I am approving this document Date: 2025.09.25 11:43:17 -07'00'

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.
This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, NIST, or any agency of the U.S. Government.

Copyright notification

Nemko USA Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.
Nemko USA Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.
© Nemko USA Inc.

Table of Contents

Table of Contents **3**
Section 1 Report summary **4**
1.1 Test specifications 4
1.2 Exclusions 4
1.3 Statement of compliance 4
1.4 Test report revision history 4
Section 2 Summary of test results **5**
2.1 Sample information 5
2.2 Testing period 5
2.3 Test results 5
Section 3 Equipment under test (EUT) details **7**
3.1 Disclaimer 7
3.2 Applicant 7
3.3 Manufacturer 7
3.4 EUT information 7
3.5 Transmitter Information 7
3.6 EUT setup details 8
Section 4 Engineering considerations **9**
4.1 Modifications incorporated in the EUT 9
4.2 Technical judgement 9
4.3 Deviations from laboratory test procedures 9
Section 5 Test conditions **10**
5.1 Atmospheric conditions 10
5.2 Power supply range 10
Section 6 Measurement uncertainty **11**
6.1 Uncertainty of measurement 11
Section 7 Test equipment **12**
7.1 Test equipment list 12
7.2 Test software list 12
Section 8 Testing data **13**
8.1 Maximum peak output power 13
8.2 Spurious emissions 15

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart C – §15.247	Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz
Industry Canada RSS-247, Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.2 Exclusions

Limited testing:

- EIRP calculation
- Radiated Spurious Emissions
- Band Edge

1.3 Statement of compliance

Testing was performed against all relevant requirements of the test standard(s) except as described in Section 1.2 above.

Results obtained indicate that the product under test complies in full with the tested requirements.

The test results relate only to the item(s) tested.

See “Section 2 Summary of test results” for full details.

1.4 Test report revision history

Table 1.4-1: *Test report revision history*

Revision #	Issue Date	Details of changes made to test report
REP114534-1TRFWL	September 24, 2025	Original report issued
REP114534-1R1TRFWL	September 25, 2025	Minor corrections, added EIRP calculations

Section 2 Summary of test results

2.1 Sample information

Receipt date	12-Sep-25
Nemko sample ID number	PRJ0083387

2.2 Testing period

Test start date	12-Sep-25
Test end date	15-Sep-25

2.3 Test results

Table 2.3-1: *FCC 47 CFR Part 15, Subpart B & C, general requirements*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not tested [1]
§15.31(e)	Variation of power source	Not tested
§15.203	Antenna requirement	Not tested
§15.231(c)	20 dB bandwidth	Not tested

Notes: [1] EUT is DC powered from dedicated DC source or battery powered

Table 2.3-2: *FCC 47 CFR Part 15, Subpart C, §15.247 requirements*

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Not tested
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Pass
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not tested
§15.247(b)(4)	Transmitting antennas of directional gain greater than 6 dBi	Not applicable
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Not tested
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Table 2.3-3: *ISED RSS-247 requirements*

Part	Test description	Verdict
5.1 (a)	Bandwidth of a frequency hopping channel	Not applicable
5.1 (b)	Minimum channel spacing for frequency hopping systems	Not applicable
5.1 (c)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
5.1 (d)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.1 (e)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
5.2 (a)	Minimum 6 dB bandwidth	Not tested
5.2 (b)	Maximum power spectral density	Not tested
5.3 (a)	Digital modulation turned off	Not applicable
5.3 (b)	Frequency hopping turned off	Not applicable
5.4 (a)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
5.4 (b)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.4 (c)	Frequency hopping systems operating in the 5725–5850 MHz	Not applicable
5.4 (d)	Systems employing digital modulation techniques	Pass
5.4 (e)	Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
5.4 (f)	Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams	Not applicable
5.5	Out-of-band emissions	Pass

Table 2.3-4: *ISED RSS-GEN requirements*

Part	Test description	Verdict
6.7	Occupied bandwidth (99%)	Not tested
7.3	Receiver radiated emission limits	Not applicable [1]
7.4	Receiver conducted emission limits	Not applicable [1]
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not tested

Notes: [1] Only applicable to scanner receivers or stand-alone receivers operating in the band 30-960 MHz

Section 3 Equipment under test (EUT) details

3.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

3.2 Applicant

Company name	Huupe, Inc.
Address	17875 Von Karman Ave
City	Irvine
State	CA
Postal/Zip code	92614
Country	USA

3.3 Manufacturer

Company name	Huupe, Inc.
Address	17875 Von Karman Ave
City	Irvine
State	CA
Postal/Zip code	92614
Country	USA

3.4 EUT information

Product name	Huupe module with Quectel FC900E with custom antenna
Model	H-FC900E
Variant(s)	None
Serial number	HMC2532021499
Part number	N/A
Power requirements	Battery Operation
Description/theory of operation	Huupe module with Quectel FC900E with custom antenna
Operational frequencies	Low: 2402 MHz / Mid: 2440 MHz / High: 2480 MHz
Software details	Version 08122025

3.5 Transmitter Information

Frequency band	2400 – 2483.5 MHz
Transmitter type	☐ Frequency hopping spread spectrum (FHSS) ☒ Digital transmission system (DTS) ☐ Hybrid FHSS / DTS
Minimum frequency (MHz)	2402
Maximum frequency (MHz)	2480
Type of modulation	GFSK
Data rate	☐ 125 kbps operation ☐ 500 kbps operation ☒ 1 Mbps operation ☒ 2 Mbps operation
Tested frequencies	2402 MHz (low), 2440 MHz (middle), and 2480 MHz (high)
Antenna type	FPC patch
Antenna peak gain	6.5 dBi

3.6 EUT setup details

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
None	N/A	N/A	N/A	N/A

Table 3.6-2: *EUT interface ports*

Description	Qty.
USB (Type C)	1

Table 3.6-3: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
None	N/A	N/A	N/A	N/A

Table 3.6-4: *Inter-connection cables*

Cable description	From	To	Length (m)
None	N/A	N/A	N/A

Figure 3.6-1: Test setup diagram

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

None.

4.2 Technical judgement

None.

4.3 Deviations from laboratory test procedures

None.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics, and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty calculations*

Measurement		U_{cispr} **dB**	U_{lab} **dB**
Conducted disturbance at AC mains and other port power using a V-AMN	9 kHz to 150 kHz	3.8	2.9
	150 kHz to 30 MHz	3.4	2.3
Conducted disturbance at telecommunication port using AAN	150 kHz to 30 MHz	5.0	4.3
Conducted disturbance at telecommunication port using CVP	150 kHz to 30 MHz	3.9	2.9
Conducted disturbance at telecommunication port using CP	150 kHz to 30 MHz	2.9	1.4
Conducted disturbance at telecommunication port using CP and CVP	150 kHz to 30 MHz	4.0	3.1
Radiated disturbance (electric field strength in a SAC)	30 MHz to 1 GHz	6.3	5.5
Radiated disturbance (electric field strength in a FAR)	1 GHz to 6 GHz	5.2	4.7
Radiated disturbance (electric field strength in a FAR)	6 GHz to 18 GHz	5.5	5.0

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

V-AMN: V type artificial mains network
AAN: Asymmetric artificial network
CP: Current probe
CVP: Capacitive voltage probe
SAC: Semi-anechoic chamber
FAR: Fully anechoic room

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: *Test Equipment List*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver	Rhode & Schwarz	ESU 40	E1121	1 year	03-Oct-2025
System Controller	Sunol Sciences	SC104V	E1191	NCR	NCR
Antenna, Bilog	Schaffner	CBL 6111D	1763	2 years	16-Jul-2026
Antenna, DRG Horn	ETS-Lindgren	3117-PA	E1160	2 years	17-May-2026
Antenna, Standard Gain Horn	Eravant	SAZ-2410-42-S1	EW107	1 year	11-Feb-2026
Low Noise Amplifier	Eravant	SBL-1834034038-KFKF	EW111	NCR	NCR
Antenna, Gain Horn	Eravant	SAZ-2410-28-S1	EW108	1 year	11-Feb-2026
Waveguide to Coax Adapter Ka Band Right Angle	Eravant	SWC-28KM-R1	EW101	NCR	NCR
Notch Filter	Micro-Tonics	BRM50702-02	E1142	NCR	NCR
Band Reject Filter	Micro-Tonics	BRM50716	EW103	NCR	NCR

Notes: NCR: no calibration required
VBU: verify before use

7.2 Test software list

Table 7.2-1: *Test Software*

Manufacturer	Details
Rohde & Schwarz	EMC 32 V10.60.15 (radiated emissions)

Section 8 Testing data

8.1 Maximum peak output power

8.1.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(b)(3)
- ISED: RSS-247 5.4(d)
- Test method: ANSI C63.10-2020 §11.9.1.1 (RBW ≥ DTS BW)

§15.247:

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

RSS-247:

5.4 Devices shall comply with the following requirements, where applicable:

(d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The EIRP shall not exceed 4 W, except as provided in RSS 247 section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

8.1.2 Test summary

Verdict	Pass		
Test date	September 12, 2025	Temperature	22 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1005.0 mbar
Test location	☐ Wireless bench (conducted tests) ☐ 10 m semi-anechoic chamber (radiated tests) ☐ 3 m semi-anechoic chamber (radiated tests) ☒ Other: Calculation only	Relative humidity	56 %

8.1.3 Notes

Results below are taken from the original module certification report. EIRP has been re-calculated based on the custom antenna being used.

8.1.4 Test data

Table 8.1-1: *Maximum peak output power test data*

Test Frequency (MHz)	Modulation	Conducted Power (dBm)	Limit (dBm)	EIRP (dBm) (ISED)
2402	GFSK, 1 Mbps	-0.89	≤ 30	5.61
2440	GFSK, 1 Mbps	-0.72	≤ 30	5.78
2480	GFSK, 1 Mbps	-0.58	≤ 30	5.92

Note: EIRP = conducted power (from original module certification test report) + antenna gain (custom antenna, 6.5 dBi gain)

8.2 Spurious emissions

8.2.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(d)
- RSS-247: §5.5
- Test method: ANSI C63.10-2020 §6.10.4 (authorized band edge)
- Test method: ANSI C63.10-2020 §11.11 (antenna port conducted spurious emissions)
- Test method: ANSI C63.10-2020 §11.12.3 (radiated restricted band edge)
- Test method: ANSI C63.10-2020 §6.5, 6.6 (radiated emissions in restricted bands)

§15.247:

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

RSS-247:

5.5 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Table 8.2-1: *FCC §15.209 / RSS-GEN §8.9– Radiated emission limits*

Frequency, MHz	Field strength of emissions µV/m	dBµV/m	Measurement distance, m
0.009–0.490	2400/F	$67.6 – 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 – 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Table 8.2-2: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

Table 8.2-3: *ISED RSS-GEN restricted frequency bands*

MHz	MHz	GHz
090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

8.2.2 Test summary

Verdict	Pass		
Test date	September 12, 2025	Temperature	22 °C
Test engineer	Lan Sayasane, Sr. EMC Test Engineer	Air pressure	1005.0 mbar
Test location	☐ Wireless bench (conducted tests) ☐ 10 m semi-anechoic chamber (radiated tests) ☒ 3 m semi-anechoic chamber (radiated tests) ☐ Other:	Relative humidity	56 %

8.2.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power. Low, middle, and high channels were tested. The spectrum was searched from 30 MHz to 26 GHz (above the 10th harmonic of the highest transmit frequency).

For radiated measurements, the EUT was investigated to identify the worst case orientation with respect to the fundamental transmitter power. All measurements were performed with the EUT in that worst-case orientation.

The spectral plots within this section have been corrected with all relevant transducer factors.

Radiated emissions are reported for the modulation / data rate settings: GFSK / 1Mbps and 2Mbps.

8.2.4 Setup details

EUT power input during test	Battery
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other:

Spectrum analyzer settings (conducted emissions):

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

Receiver settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (preview measurements) Quasi-Peak (final measurements)

Receiver settings for radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (preview measurements) Peak and average (final measurements)

8.2.5 Test data

Radiated spurious emissions:

- **Restricted band edge:**

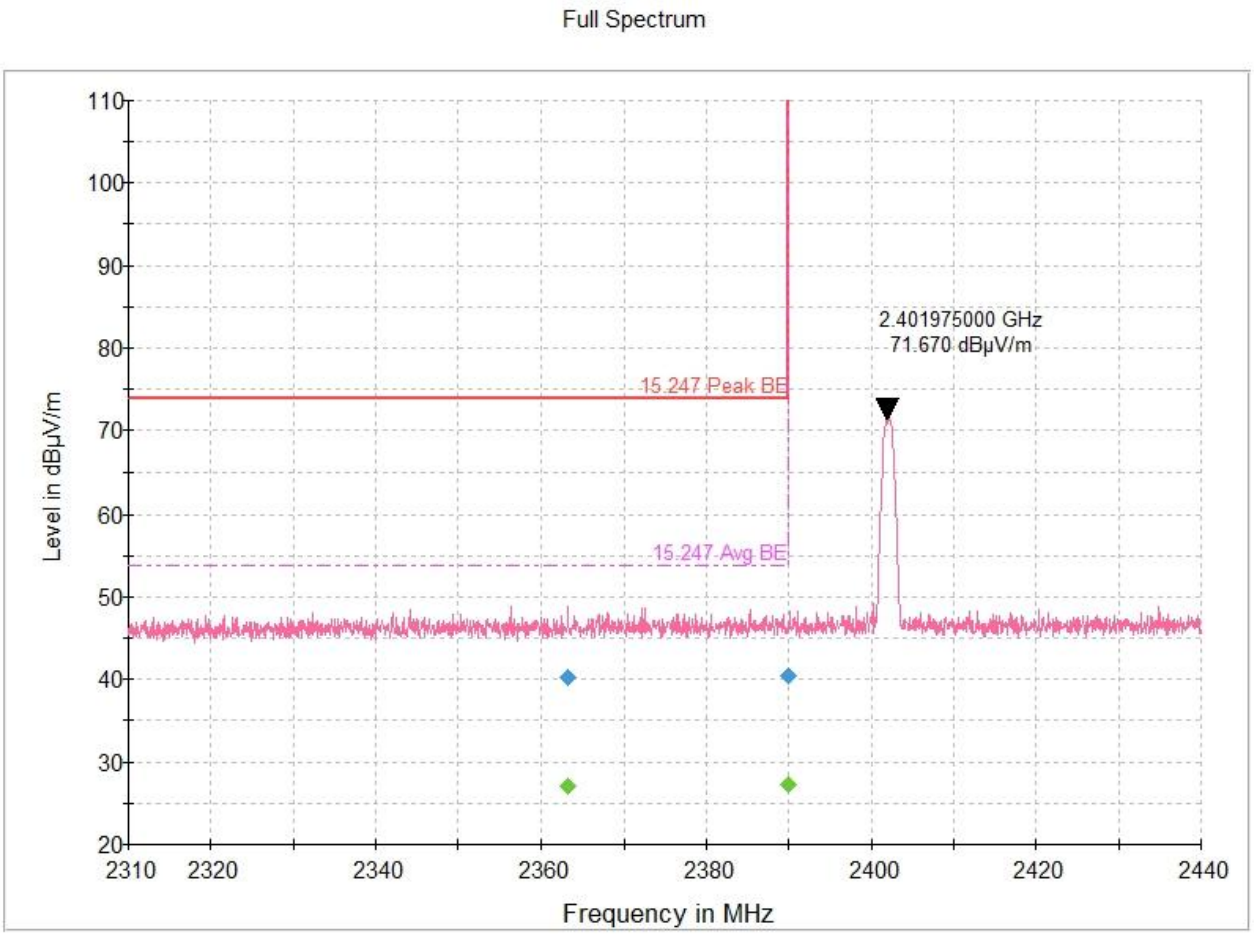

Figure 8.2-1: *Radiated emissions spectral plot (2.31 GHz - 2.44 GHz) – 2402 MHz (1 Mbps) - Vertical*

Table 8.2-4*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2363.365000	---	27.09	53.90	26.81	5000.0	1000.000	132.0	V	333.0	-4.1
2363.365000	40.29	---	73.90	33.61	5000.0	1000.000	132.0	V	333.0	-4.1
2390.000000	---	27.31	53.90	26.59	5000.0	1000.000	139.0	V	194.0	-4.0
2390.000000	40.47	---	73.90	33.43	5000.0	1000.000	139.0	V	194.0	-4.0

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

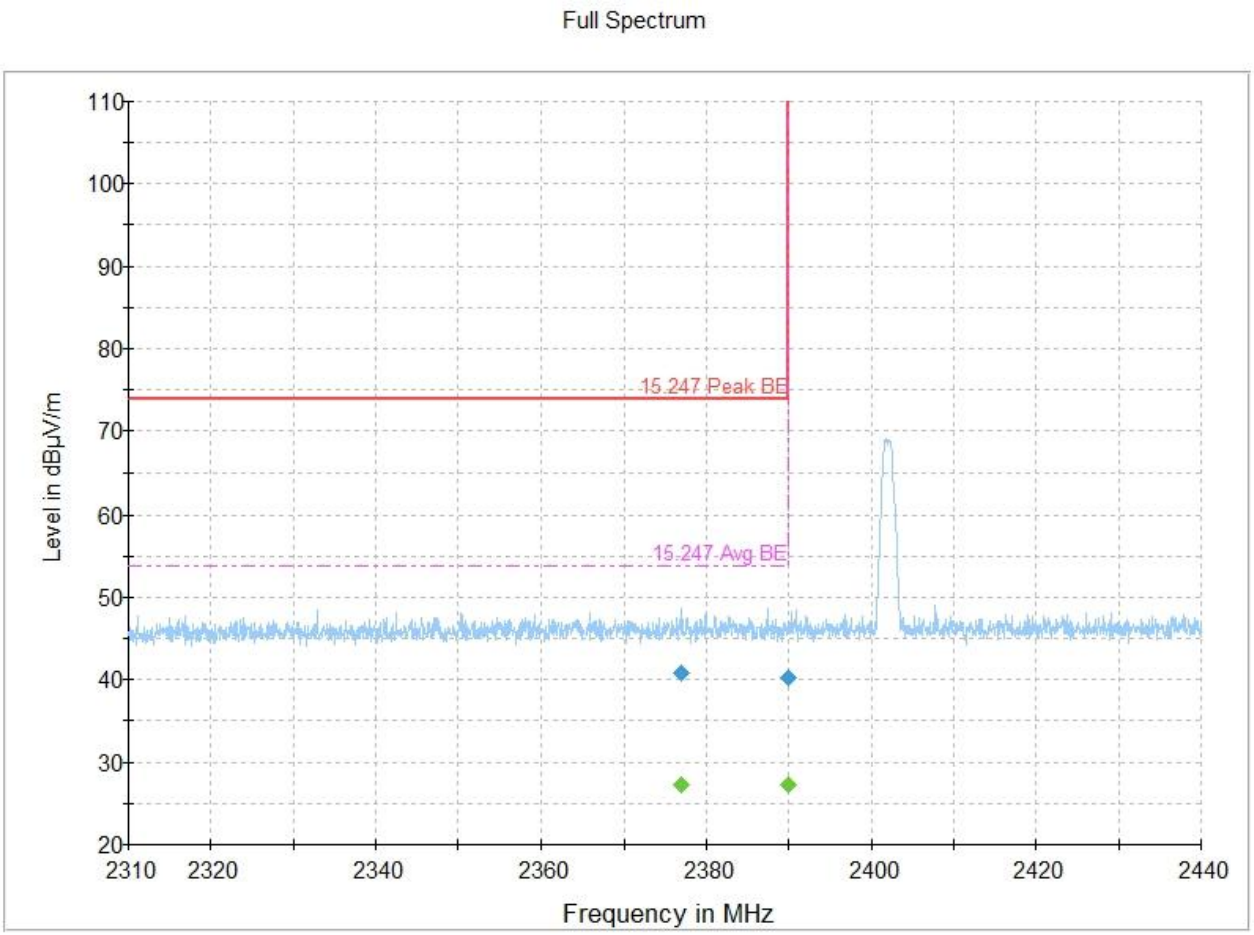

Figure 8.2-2: *Radiated emissions spectral plot (2.31 GHz - 2.44 GHz) – 2402 MHz (1 Mbps) - Horizontal*

Table 8.2-5*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2376.820000	40.83	---	73.90	33.07	5000.0	1000.000	361.0	H	243.0	-4.1
2376.820000	---	27.21	53.90	26.69	5000.0	1000.000	361.0	H	243.0	-4.1
2390.000000	40.31	---	73.90	33.59	5000.0	1000.000	138.0	H	276.0	-4.0
2390.000000	---	27.31	53.90	26.59	5000.0	1000.000	138.0	H	276.0	-4.0

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

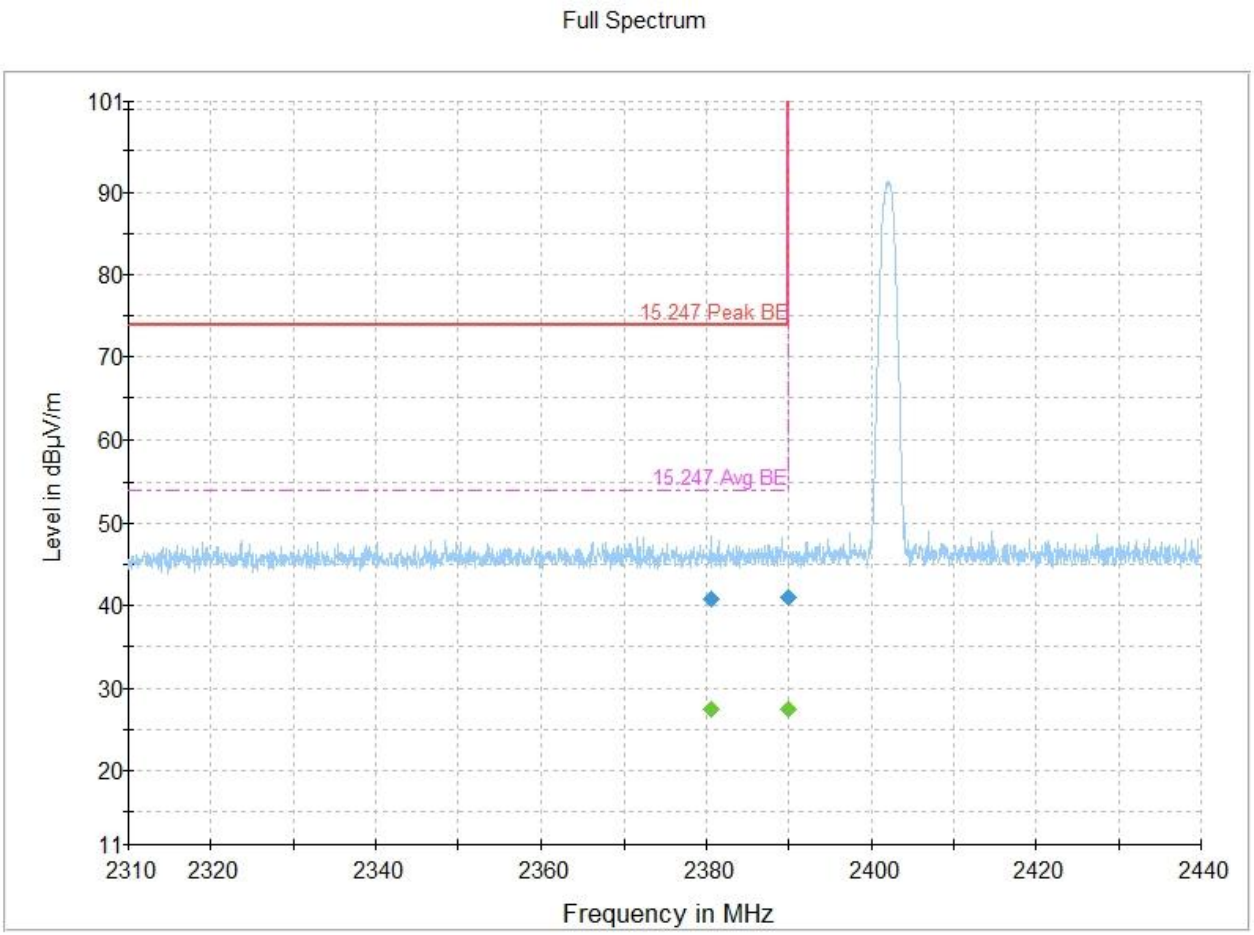

Figure 8.2-3: *Radiated emissions spectral plot (2.31 GHz - 2.44 GHz) – 2402 MHz (2 Mbps) - Vertical*

Table 8.2-6*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2380.460000	---	27.34	53.90	26.56	5000.0	1000.000	148.0	V	152.0	-4.1
2380.460000	40.83	---	73.90	33.07	5000.0	1000.000	148.0	V	152.0	-4.1
2390.000000	---	27.50	53.90	26.40	5000.0	1000.000	399.0	V	322.0	-4.0
2390.000000	40.97	---	73.90	32.93	5000.0	1000.000	399.0	V	322.0	-4.0

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

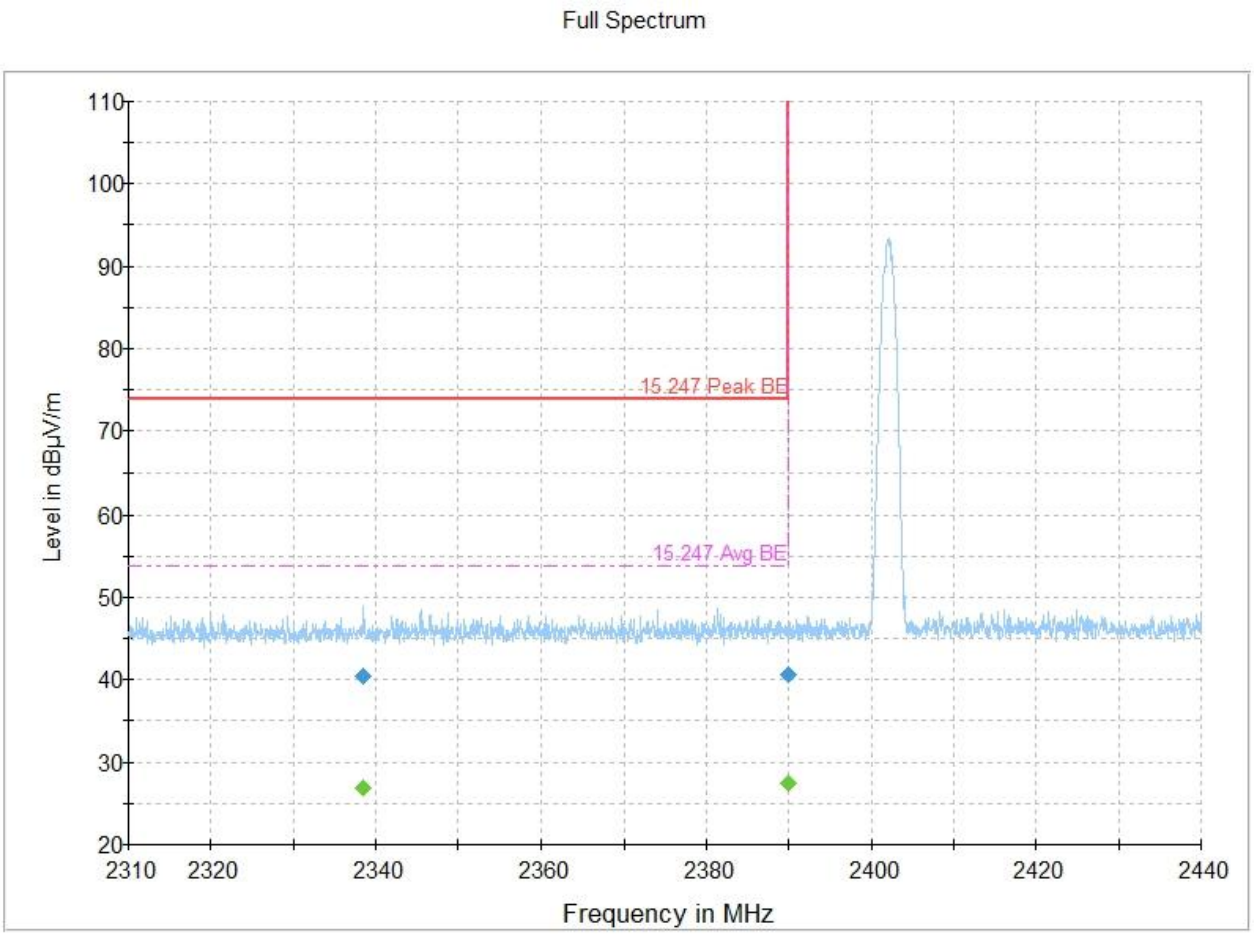

Figure 8.2-4: *Radiated emissions spectral plot (2.31 GHz - 2.44 GHz) – 2402 MHz (2 Mbps) - Horizontal*

Table 8.2-7*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2338.535000	40.40	---	73.90	33.50	5000.0	1000.000	191.0	H	302.0	-4.2
2338.535000	---	26.96	53.90	26.94	5000.0	1000.000	191.0	H	302.0	-4.2
2390.000000	40.67	---	73.90	33.23	5000.0	1000.000	219.0	H	271.0	-4.0
2390.000000	---	27.40	53.90	26.50	5000.0	1000.000	219.0	H	271.0	-4.0

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

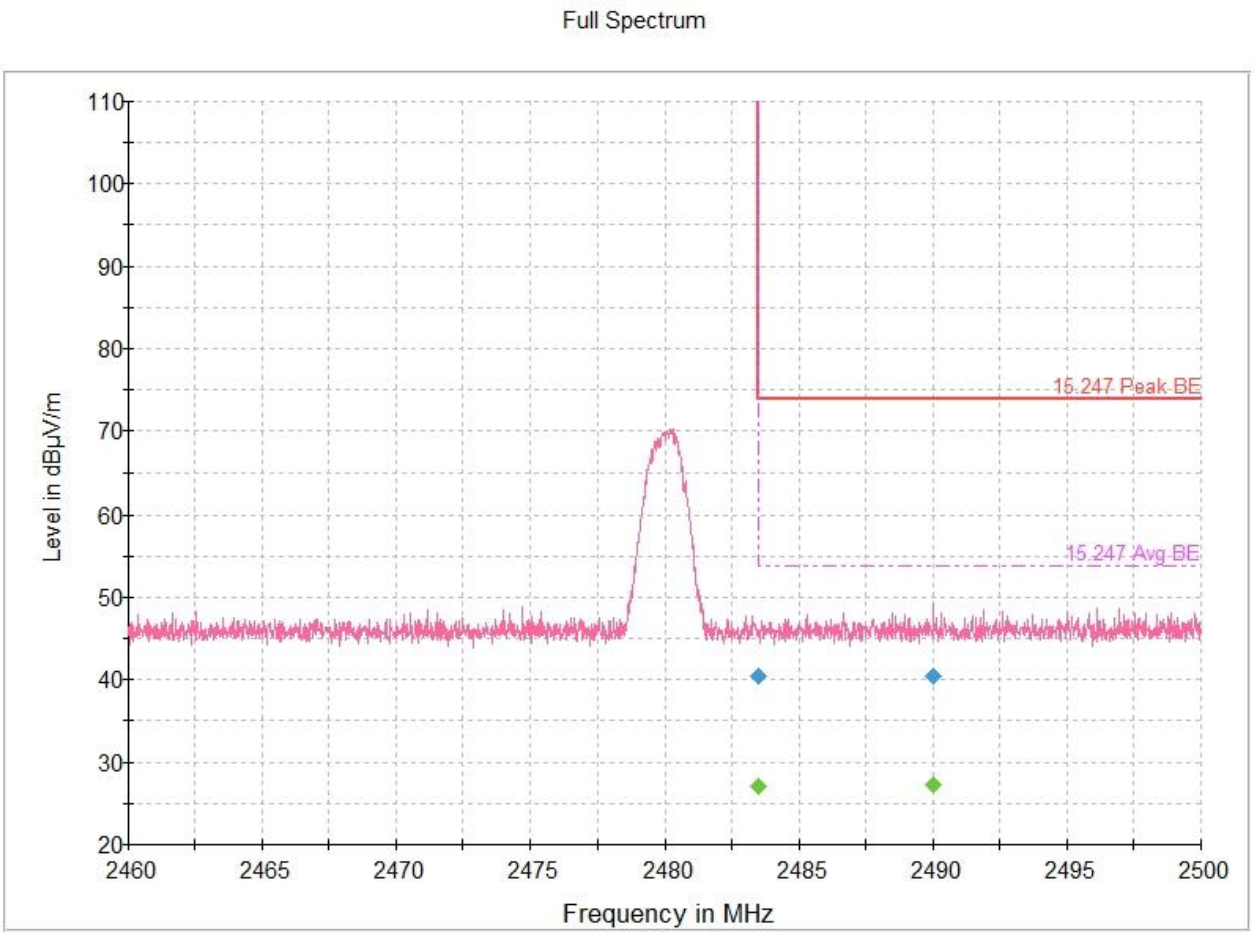

Figure 8.2-5: *Radiated emissions spectral plot (2.46 GHz - 2.5 GHz) – 2480 MHz (1 Mbps) - Vertical*

Table 8.2-8*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	27.14	53.90	26.76	5000.0	1000.000	359.0	V	88.0	-3.8
2483.500000	40.41	---	73.90	33.50	5000.0	1000.000	359.0	V	88.0	-3.8
2490.000000	---	27.32	53.90	26.58	5000.0	1000.000	371.0	V	240.0	-3.8
2490.000000	40.40	---	73.90	33.50	5000.0	1000.000	371.0	V	240.0	-3.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

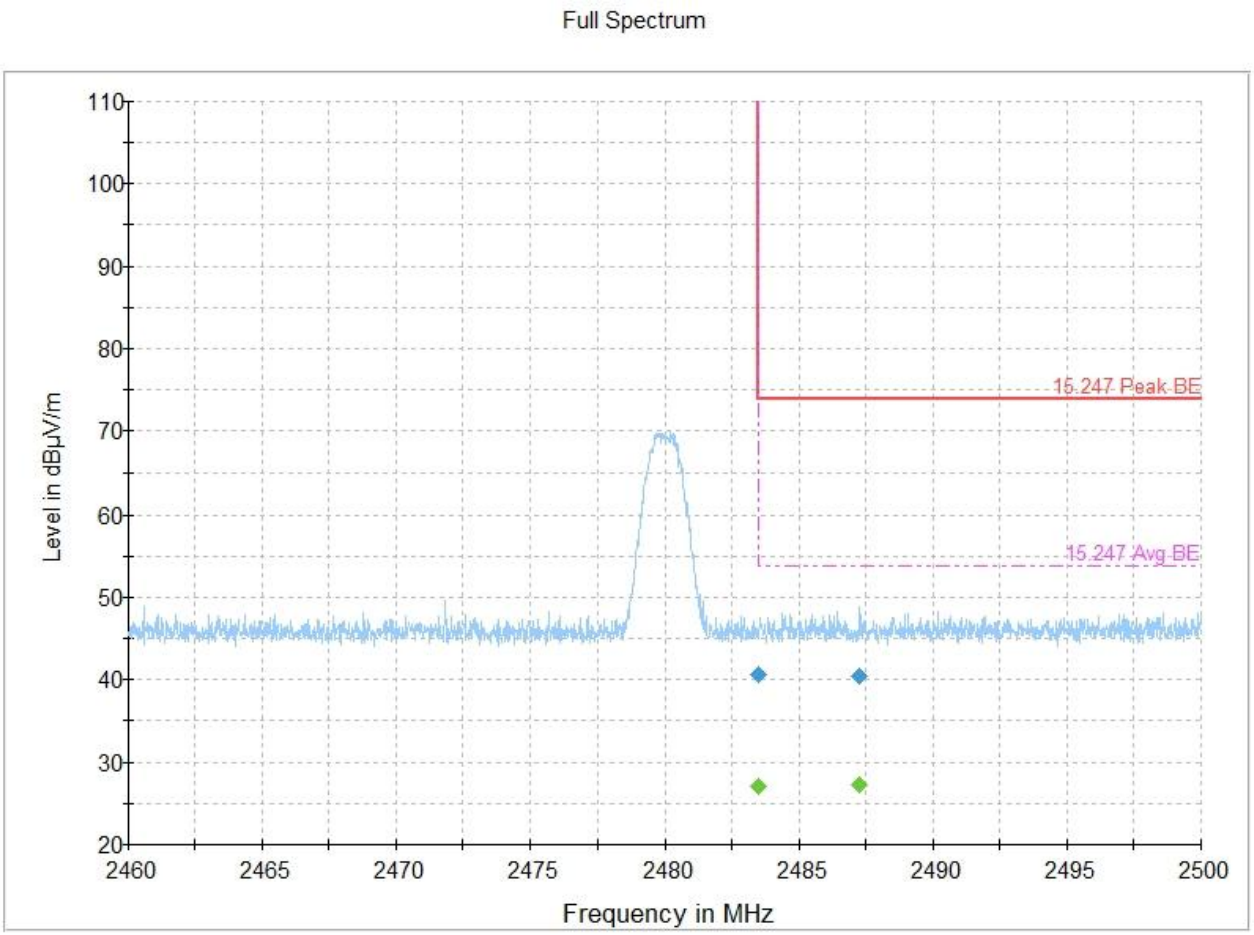

Figure 8.2-6: *Radiated emissions spectral plot (2.46 GHz - 2.5 GHz) – 2480 MHz (1 Mbps) - Horizontal*

Table 8.2-9*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	27.08	53.90	26.82	5000.0	1000.000	149.0	H	186.0	-3.8
2483.500000	40.59	---	73.90	33.31	5000.0	1000.000	149.0	H	186.0	-3.8
2487.260000	---	27.25	53.90	26.65	5000.0	1000.000	371.0	H	319.0	-3.8
2487.260000	40.38	---	73.90	33.52	5000.0	1000.000	371.0	H	319.0	-3.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

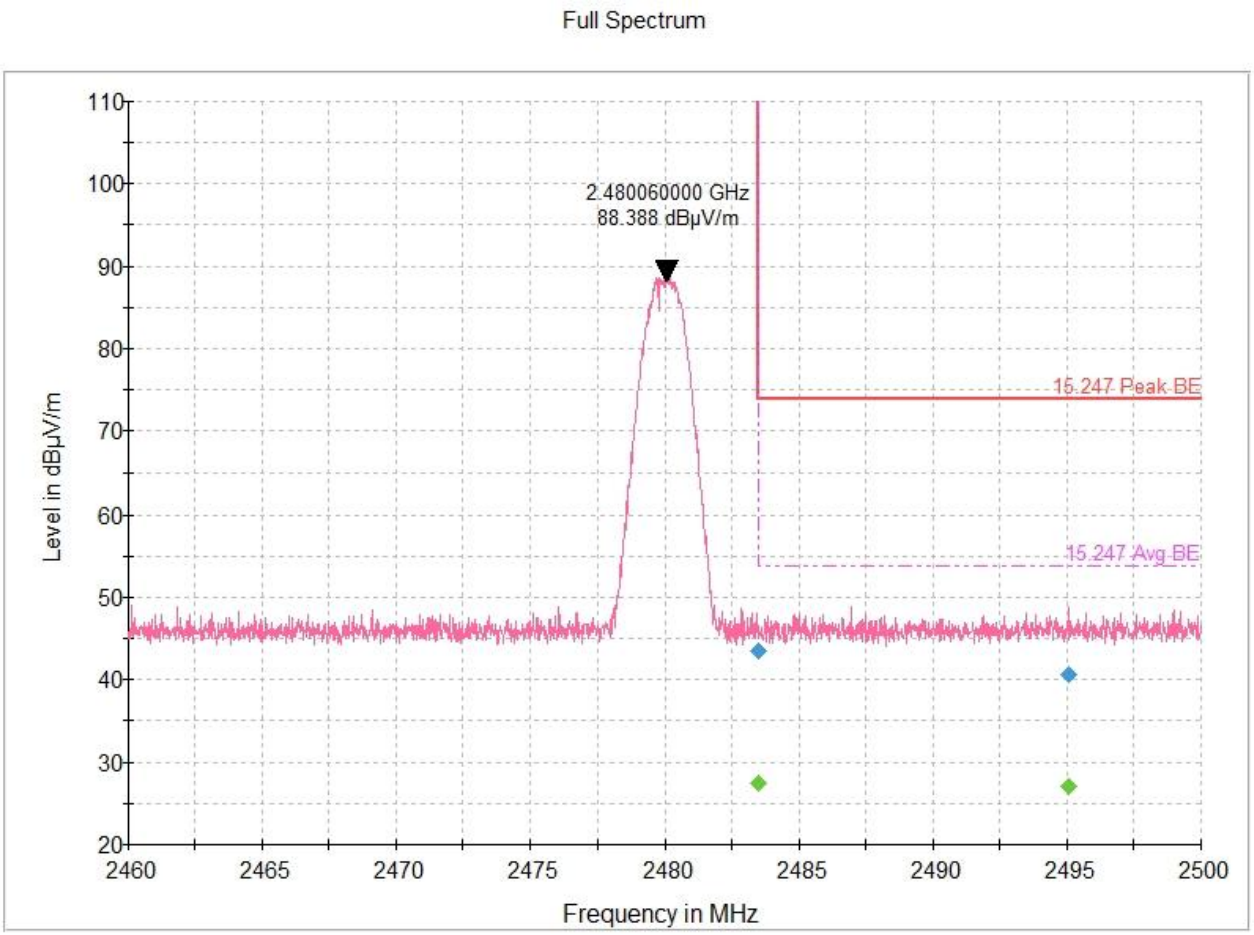

Figure 8.2-7: *Radiated emissions spectral plot (2.46 GHz - 2.5 GHz) – 2480 MHz (2 Mbps) - Vertical*

Table 8.2-10*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	43.52	---	73.90	30.38	5000.0	1000.000	101.0	V	287.0	-3.8
2483.500000	---	27.37	53.90	26.53	5000.0	1000.000	101.0	V	287.0	-3.8
2495.080000	40.59	---	73.90	33.31	5000.0	1000.000	101.0	V	312.0	-3.7
2495.080000	---	27.13	53.90	26.77	5000.0	1000.000	101.0	V	312.0	-3.7

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

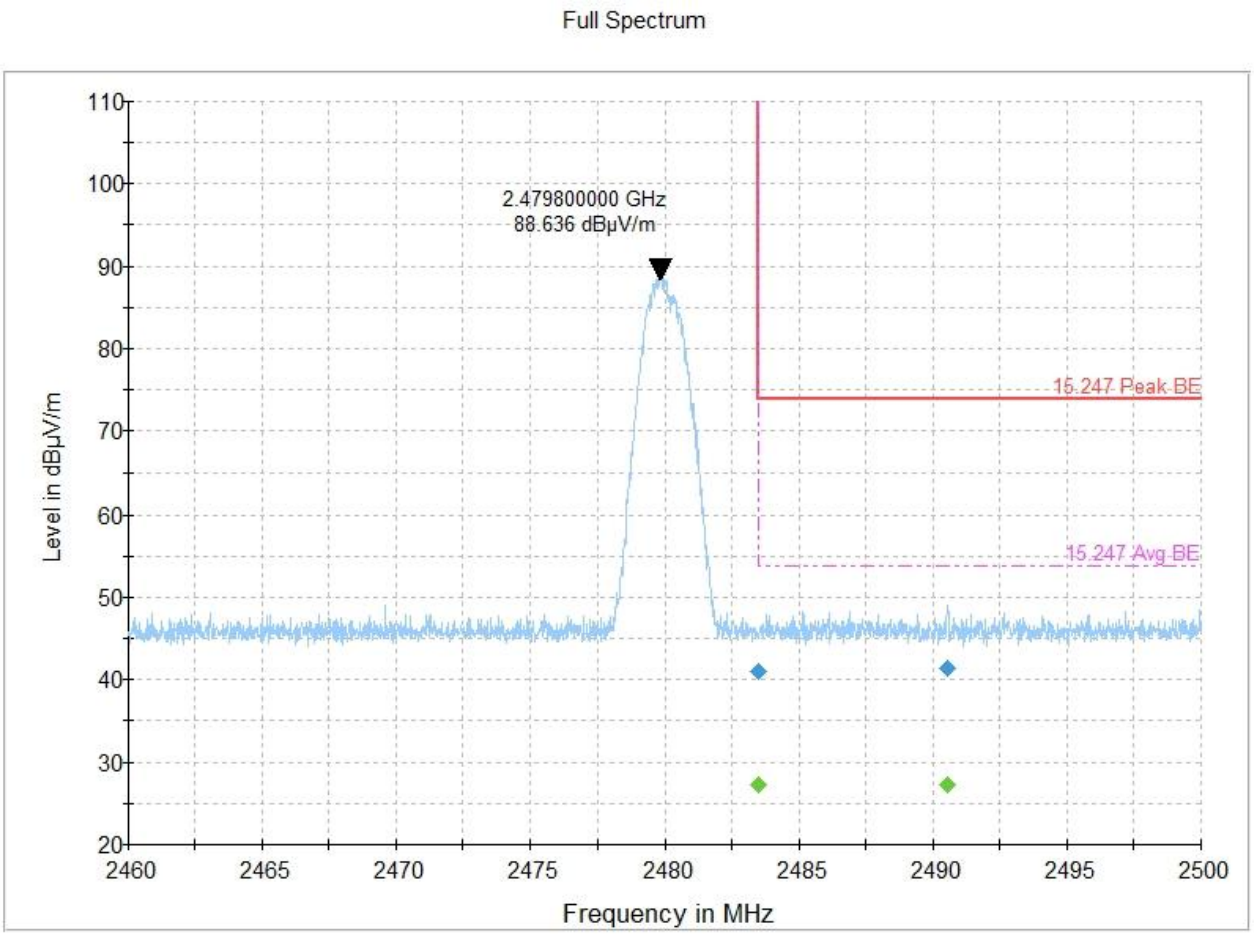

Figure 8.2-8: *Radiated emissions spectral plot (2.46 GHz - 2.5 GHz) – 2480 MHz (2 Mbps) - Horizontal*

Table 8.2-11*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	27.21	53.90	26.69	5000.0	1000.000	368.0	H	264.0	-3.8
2483.500000	41.05	---	73.90	32.85	5000.0	1000.000	368.0	H	264.0	-3.8
2490.520000	---	27.19	53.90	26.71	5000.0	1000.000	399.0	H	0.0	-3.8
2490.520000	41.47	---	73.90	32.43	5000.0	1000.000	399.0	H	0.0	-3.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

- **Radiated spurious emissions, restricted bands:**

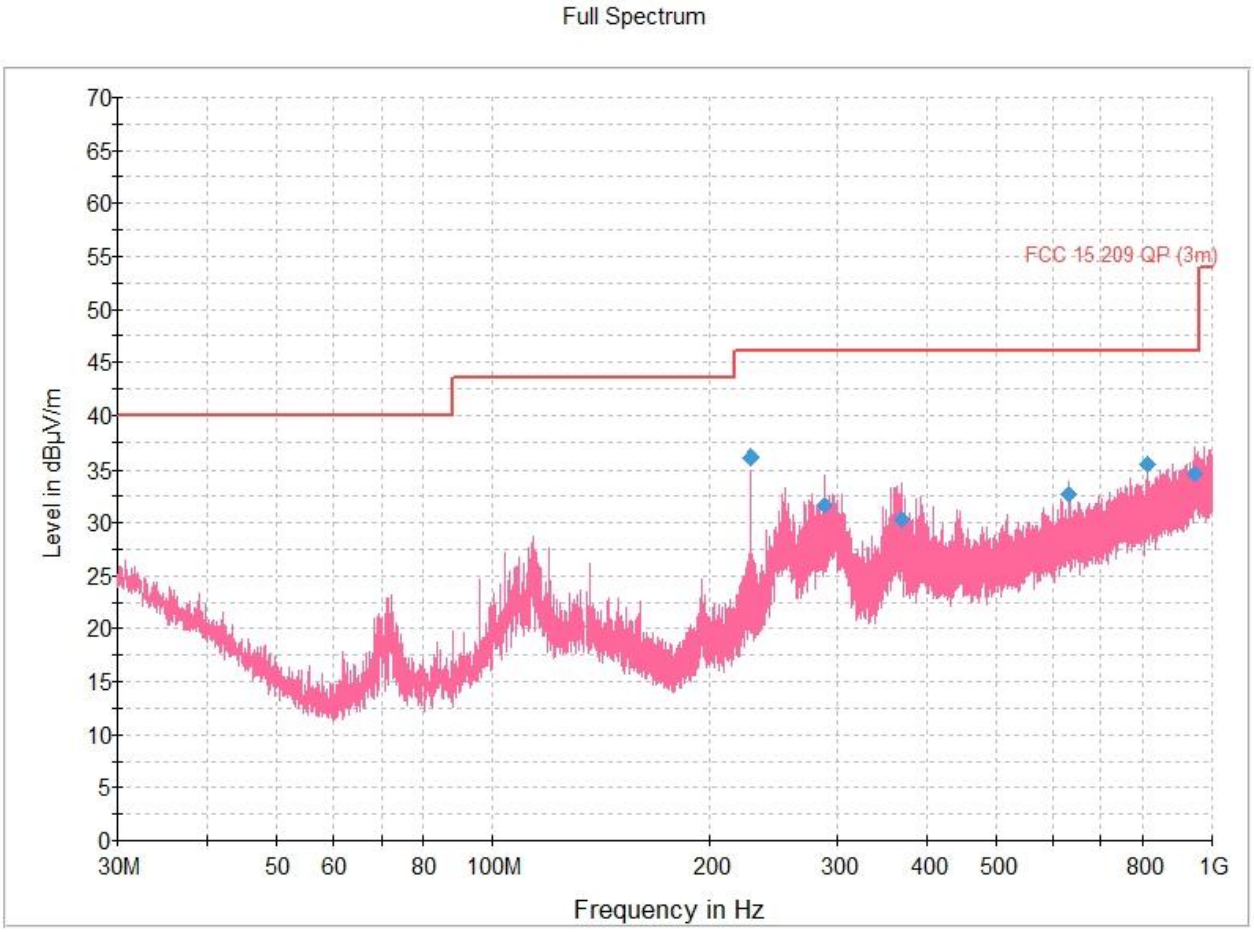

Figure 8.2-9: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2440 MHz (1 Mbps) - Vertical*

Table 8.2-12*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
227.512000	36.14	46.00	9.86	5000.0	120.000	202.0	V	0.0	18.8
287.975333	31.59	46.00	14.41	5000.0	120.000	214.0	V	0.0	21.8
369.782000	30.34	46.00	15.66	5000.0	120.000	138.0	V	114.0	24.2
629.982000	32.69	46.00	13.31	5000.0	120.000	146.0	V	126.0	30.0
812.471333	35.54	46.00	10.46	5000.0	120.000	101.0	V	346.0	32.5
946.682667	34.70	46.00	11.30	5000.0	120.000	343.0	V	247.0	34.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

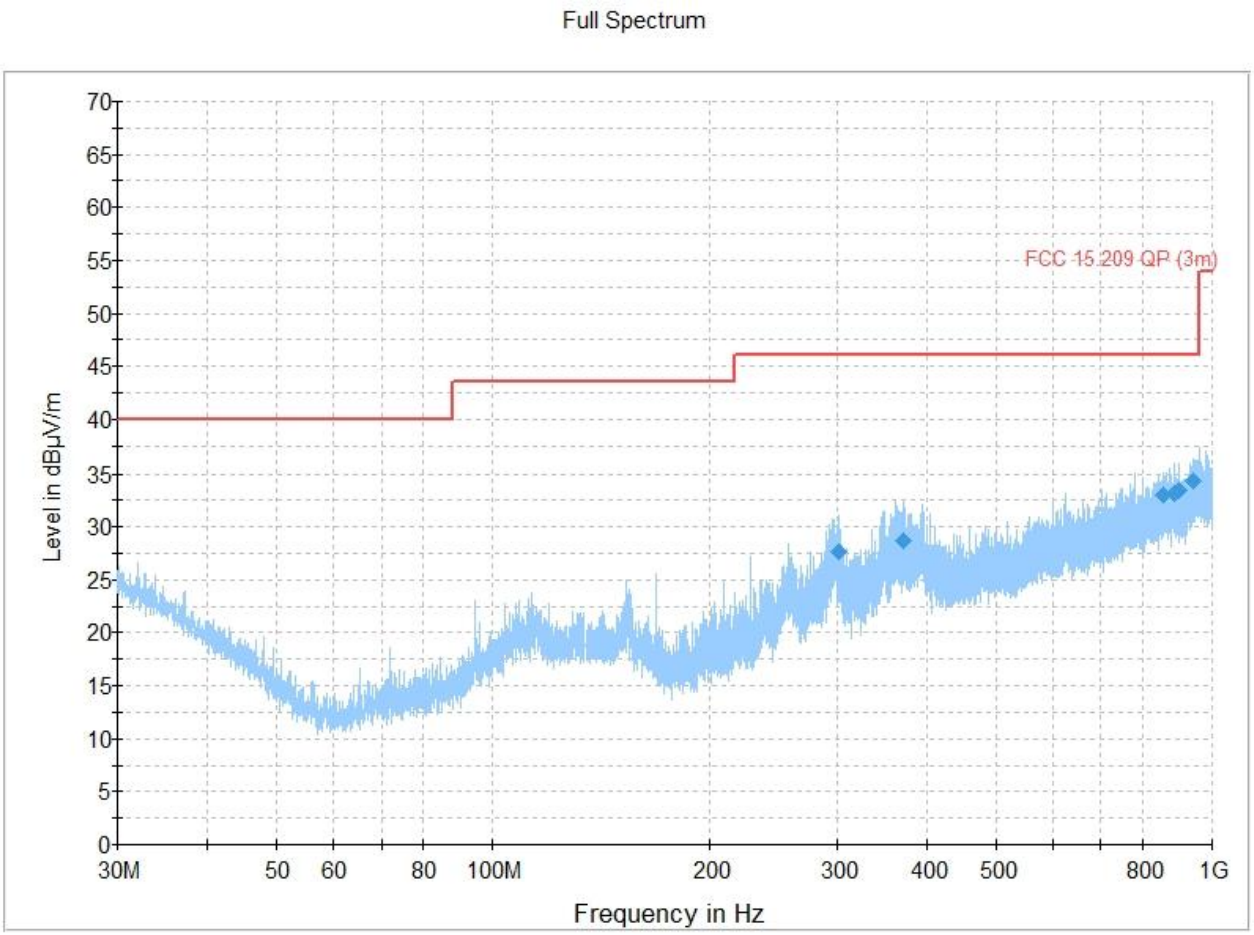

Figure 8.2-10: *Radiated emissions spectral plot (30 MHz - 1 GHz) – 2440 MHz (1 Mbps) - Horizontal*

Table 8.2-13*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
301.894000	27.60	46.00	18.40	5000.0	120.000	101.0	H	0.0	22.2
371.168000	28.72	46.00	17.28	5000.0	120.000	193.0	H	319.0	24.3
856.155333	32.99	46.00	13.01	5000.0	120.000	165.0	H	69.0	33.3
883.972333	33.13	46.00	12.87	5000.0	120.000	399.0	H	208.0	33.3
899.998667	33.38	46.00	12.62	5000.0	120.000	119.0	H	0.0	33.4
941.159667	34.38	46.00	11.62	5000.0	120.000	367.0	H	0.0	34.5

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

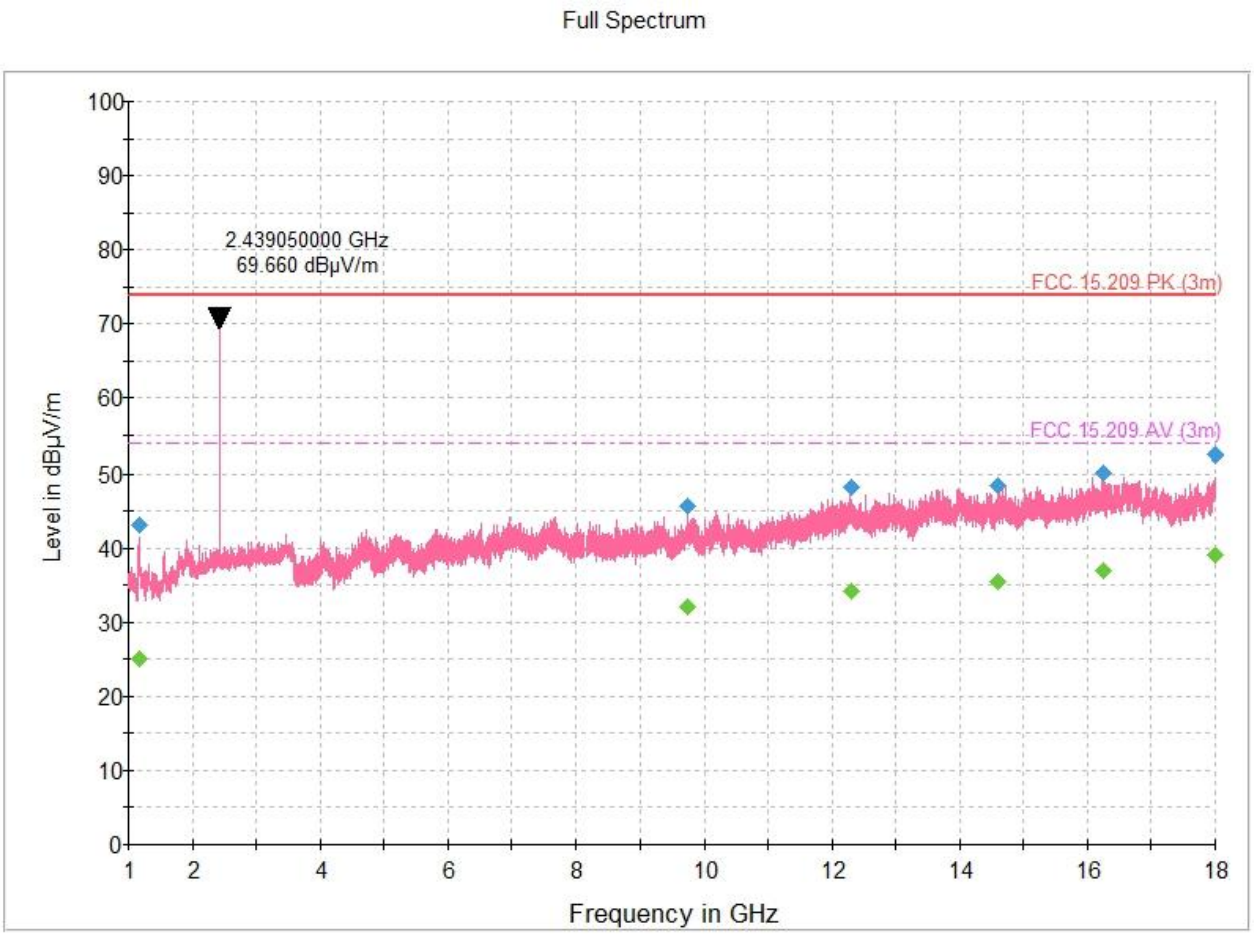

Figure 8.2-11: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2440 MHz (1 Mbps) - Vertical*

Table 8.2-14*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1183.400000	---	25.15	53.90	28.75	5000.0	1000.000	184.0	V	96.0	-10.8
1183.400000	42.99	---	73.90	30.91	5000.0	1000.000	184.0	V	96.0	-10.8
9730.400000	---	31.99	53.90	21.91	5000.0	1000.000	137.0	V	0.0	10.7
9730.400000	45.65	---	73.90	28.25	5000.0	1000.000	137.0	V	0.0	10.7
12288.150000	48.21	---	73.90	25.69	5000.0	1000.000	324.0	V	354.0	15.6
12288.150000	---	34.25	53.90	19.65	5000.0	1000.000	324.0	V	354.0	15.6
14593.150000	48.45	---	73.90	25.45	5000.0	1000.000	327.0	V	0.0	18.1
14593.150000	---	35.39	53.90	18.51	5000.0	1000.000	327.0	V	0.0	18.1
16236.300000	50.03	---	73.90	23.87	5000.0	1000.000	397.0	V	205.0	23.1
16236.300000	---	36.93	53.90	16.97	5000.0	1000.000	397.0	V	205.0	23.1
17997.550000	52.36	---	73.90	21.54	5000.0	1000.000	334.0	V	299.0	24.9
17997.550000	---	39.16	53.90	14.74	5000.0	1000.000	334.0	V	299.0	24.9

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

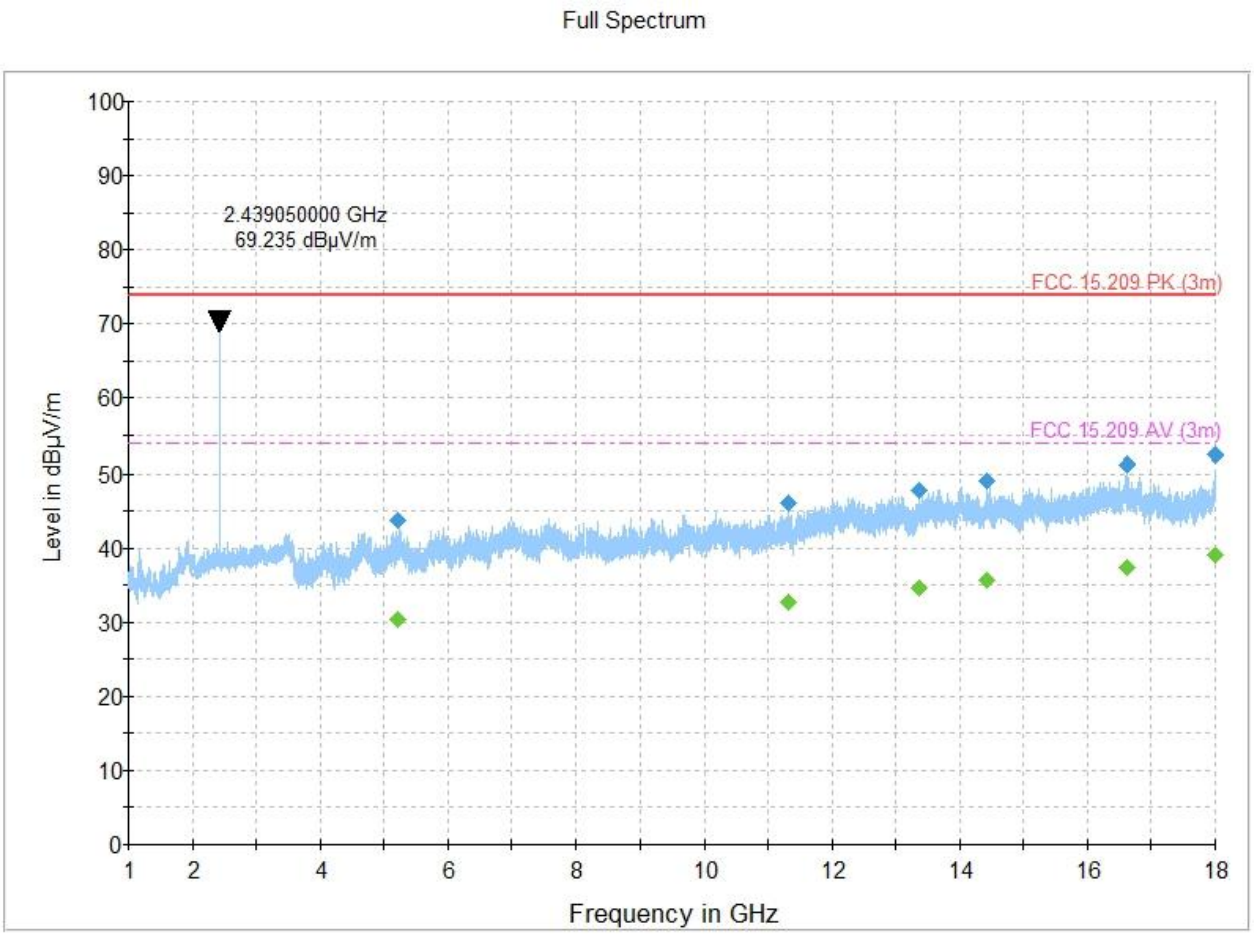

Figure 8.2-12: *Radiated emissions spectral plot (1 GHz - 18 GHz) – 2440 MHz (1 Mbps) - Horizontal*

Table 8.2-15*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5231.350000	---	30.41	53.90	23.49	5000.0	1000.000	202.0	H	244.0	3.1
5231.350000	43.79	---	73.90	30.11	5000.0	1000.000	202.0	H	244.0	3.1
11316.750000	---	32.75	53.90	21.15	5000.0	1000.000	203.0	H	320.0	11.8
11316.750000	46.03	---	73.90	27.87	5000.0	1000.000	203.0	H	320.0	11.8
13364.950000	47.86	---	73.90	26.04	5000.0	1000.000	129.0	H	282.0	17.4
13364.950000	---	34.62	53.90	19.28	5000.0	1000.000	129.0	H	282.0	17.4
14426.850000	---	35.77	53.90	18.13	5000.0	1000.000	399.0	H	0.0	17.5
14426.850000	49.10	---	73.90	24.80	5000.0	1000.000	399.0	H	0.0	17.5
16626.600000	51.20	---	73.90	22.70	5000.0	1000.000	323.0	H	355.0	23.5
16626.600000	---	37.34	53.90	16.56	5000.0	1000.000	323.0	H	355.0	23.5
17993.400000	---	39.13	53.90	14.77	5000.0	1000.000	328.0	H	170.0	24.8
17993.400000	52.45	---	73.90	21.45	5000.0	1000.000	328.0	H	170.0	24.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

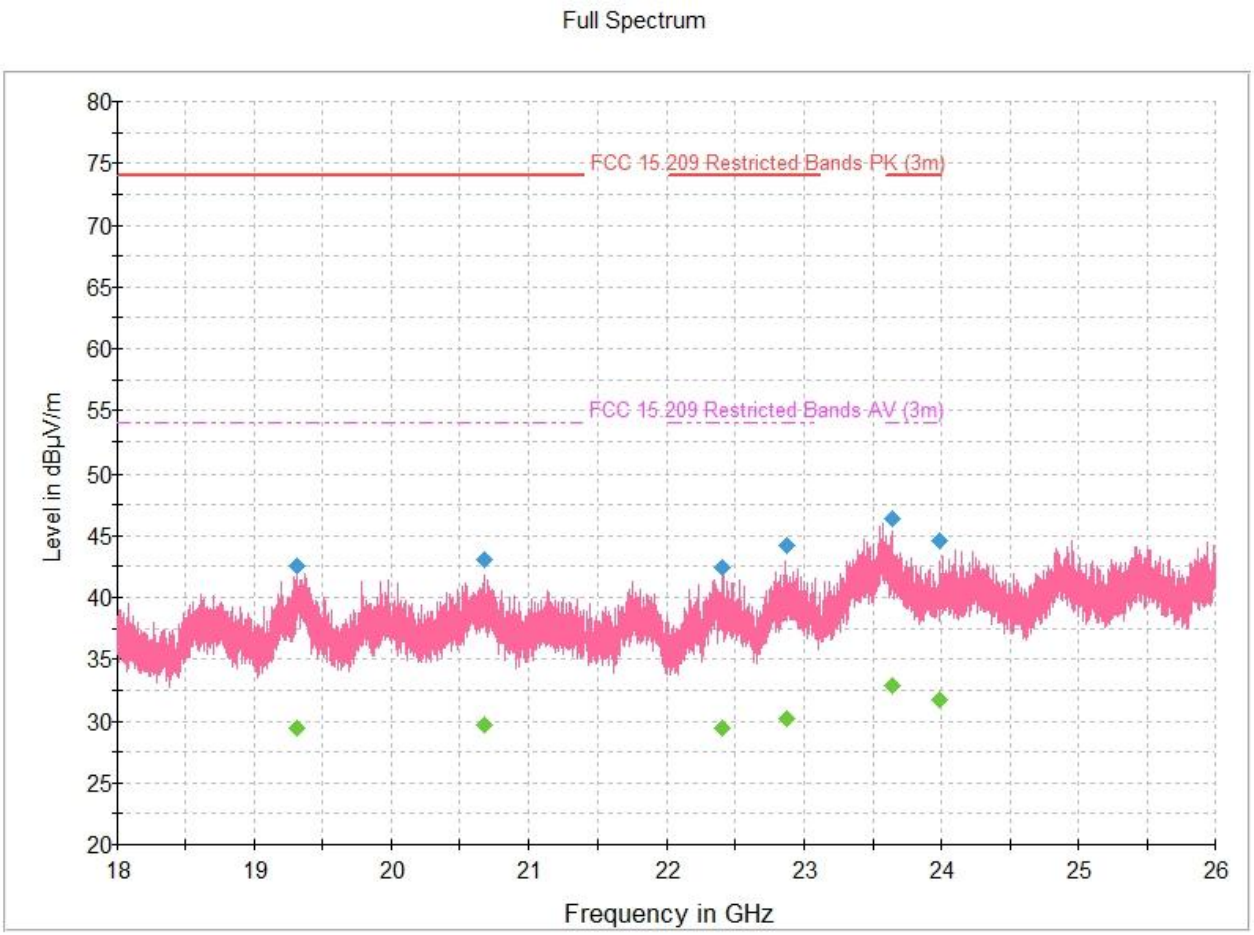

Figure 8.2-13: *Radiated emissions spectral plot (18 GHz - 26 GHz) – 2440 MHz (1 Mbps) - Vertical*

Table 8.2-16*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19308.900000	---	29.44	53.98	24.54	5000.0	1000.000	277.0	V	51.0	14.8
19308.900000	42.57	---	73.98	31.41	5000.0	1000.000	277.0	V	51.0	14.8
20674.300000	---	29.72	53.98	24.26	5000.0	1000.000	354.0	V	66.0	16.4
20674.300000	43.05	---	73.98	30.93	5000.0	1000.000	354.0	V	66.0	16.4
22396.900000	42.47	---	73.98	31.51	5000.0	1000.000	261.0	V	243.0	17.3
22396.900000	---	29.41	53.98	24.57	5000.0	1000.000	261.0	V	243.0	17.3
22870.900000	44.19	---	73.98	29.79	5000.0	1000.000	266.0	V	53.0	19.2
22870.900000	---	30.24	53.98	23.74	5000.0	1000.000	266.0	V	53.0	19.2
23638.900000	46.33	---	73.98	27.65	5000.0	1000.000	379.0	V	166.0	22.8
23638.900000	---	32.87	53.98	21.11	5000.0	1000.000	379.0	V	166.0	22.8
23986.700000	44.63	---	73.98	29.35	5000.0	1000.000	101.0	V	109.0	21.6
23986.700000	---	31.76	53.98	22.22	5000.0	1000.000	101.0	V	109.0	21.6

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

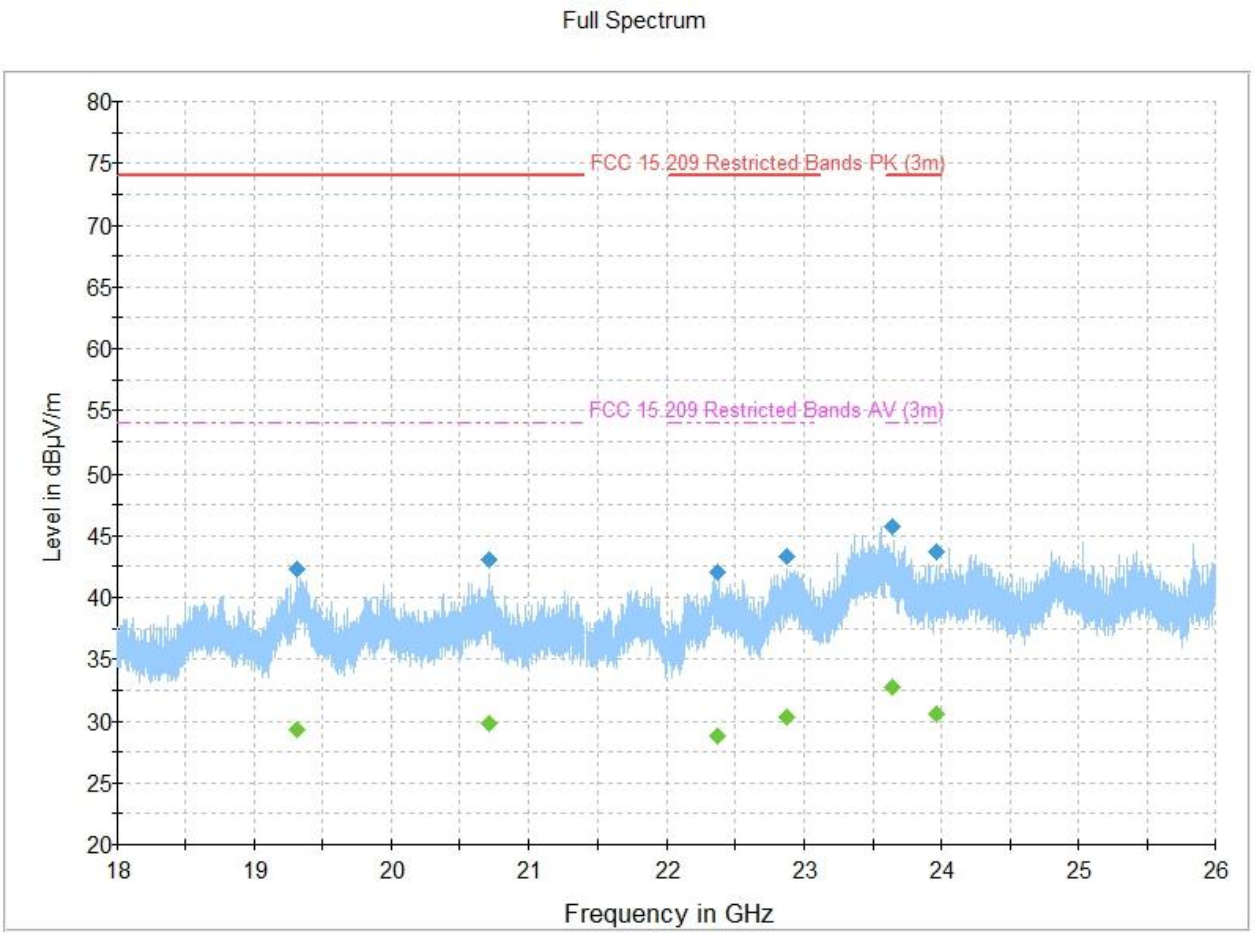

Figure 8.2-14: *Radiated emissions spectral plot (18 GHz - 26 GHz) – 2440 MHz (1 Mbps) - Horizontal*

Table 8.2-17*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19314.500000	42.33	---	73.98	31.65	5000.0	1000.000	306.0	H	0.0	14.8
19314.500000	---	29.28	53.98	24.70	5000.0	1000.000	306.0	H	0.0	14.8
20716.900000	---	29.77	53.98	24.21	5000.0	1000.000	136.0	H	355.0	16.8
20716.900000	43.06	---	73.98	30.92	5000.0	1000.000	136.0	H	355.0	16.8
22370.900000	---	28.80	53.98	25.18	5000.0	1000.000	399.0	H	280.0	17.3
22370.900000	42.02	---	73.98	31.96	5000.0	1000.000	399.0	H	280.0	17.3
22876.100000	---	30.35	53.98	23.63	5000.0	1000.000	388.0	H	268.0	19.2
22876.100000	43.35	---	73.98	30.63	5000.0	1000.000	388.0	H	268.0	19.2
23649.300000	---	32.80	53.98	21.18	5000.0	1000.000	388.0	H	260.0	22.7
23649.300000	45.76	---	73.98	28.22	5000.0	1000.000	388.0	H	260.0	22.7
23962.100000	43.73	---	73.98	30.25	5000.0	1000.000	286.0	H	317.0	21.6
23962.100000	---	30.63	53.98	23.35	5000.0	1000.000	286.0	H	317.0	21.6

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

End of test report