

Test report

436028-1TRFWL

Date of issue: July 16, 2021

Applicant:
Canary Medical

Product:
Base Station

Model:
CBS

FCC ID: 2AYAJ-CBS

Specifications:

◆ FCC 47 CFR Part 15 Subpart C §15.249

Operation within the bands 902-928 MHz, 2400 – 2483.5 MHz, 5725 – 5875 MHz and 24.0 – 24.25 GHz

Lab and test locations

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State	California
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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	Martha Espinoza, Wireless Engineer
Reviewed by	James Cunningham, EMC/MIL/WL Supervisor
Review date	July 16, 2021
Reviewer signature	

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.

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Section 1 Report summary

1.1 Applicant

Company name	Canary Medical
Address	2710 Loker Ave West, Suite 350
City	Carlsbad
Province/State	CA
Postal/Zip code	92010
Country	USA

1.2 Manufacturer

Company name	Canary Medical
Address	2710 Loker Ave West, Suite 350
City	Carlsbad
Province/State	CA
Postal/Zip code	92010
Country	USA

1.3 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause §15.249	Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
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1.4 Test methods

ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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1.5 Exclusions

None

1.6 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.7 Test report revision history

Table 1.7-1: Test report revision history

Revision #	Details of changes made to test report
436028-1TRFWL	Original report issued

Notes: None

Section 2 Summary of test results

2.1 FCC Part 15 Subpart C, general requirements

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass
§15.203	Antenna requirement	Pass ¹
§15.215(c)	20 dB occupied bandwidth	Pass

Notes: ¹EUT has an integrated antenna and it is not user accessible.

2.2 FCC Part 15.249 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	Not applicable
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: None

Section 3 Equipment under test (EUT) details

3.1 Sample information

Receipt date	June 21, 2021
Nemko sample ID number	NEx: 436028

3.2 EUT information

Product name	Base station
Model	BS3
Serial number	000010 (conducted sample); 000014 (radiated sample)
Part number	N/A

3.3 Technical information

Frequency band	2400 – 2483.5 MHz
Minimum frequency (MHz)	2410
Maximum frequency (MHz)	2430
Type of modulation	On-Off Keying (OOK)
Emission classification	N/A
Power requirements	USB Port
Antenna information	+4.94 dBi maximum antenna gain; -2.10 dBi average antenna gain reported. EUT has two antennas only for diversity, only one is used at once and both are identical according to manufacturer. Antenna one was considered as worst case and it was used for all the tests reported in this document.

3.4 EUT exercise and monitoring details

Radiated sample was configured through a console app (previously installed in a laptop) provided by client. The connection between laptop and EUT was through a USB cable. The console app executes the device according to the channel selected: low, middle or high channel. Each fix channel was programmed through cmd window, following the commands provided by manufacturer. The unit was able to transmit continuously in autonomous mode.

3.5 EUT setup details

Table 3.5-1: EUT interface ports

Description	Qty
USB Port	1

Table 3.5-2: Support equipment

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop	Dell	Vostro14 3000	N/A	---

Table 3.5-3: Inter-connection cables

Cable description	From	To	Length (m)
USB Cable	EUT	Laptop	2

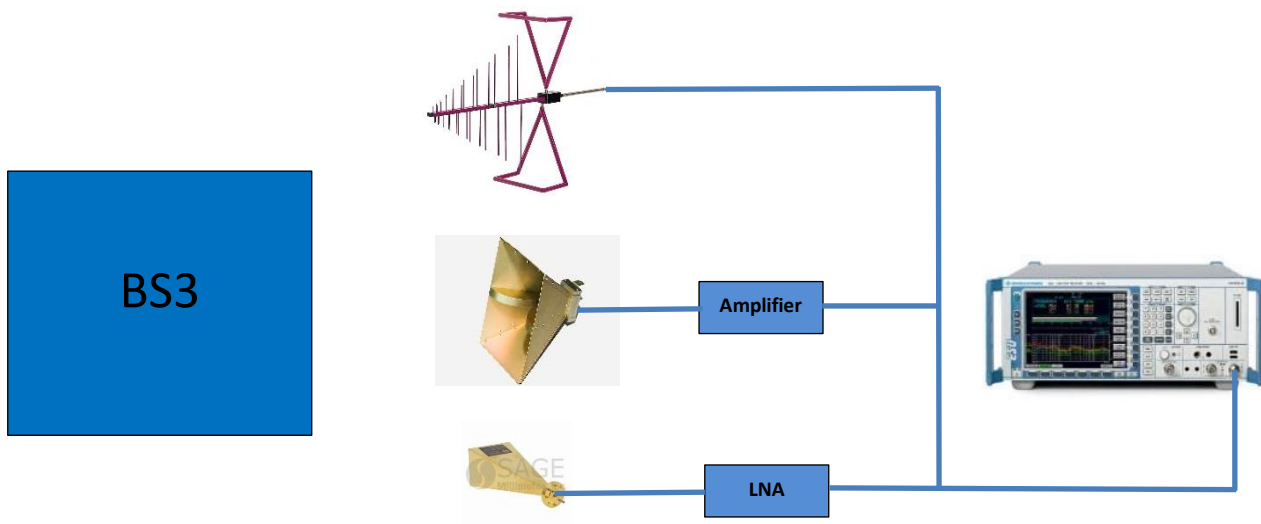


Figure 3.5-1: Test radiated setup

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

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 $\pm 5\%$, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements/ including OBW	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	1.38
Supply Voltages	0.05%
Time	2.09%

Table 6.1-1: Measurement uncertainty.

Important note: All testing in this document were done using the maximum radiation pattern from transmitter antenna for covering the worst case in all the measurements.

Section 7 Test equipment

7.1 Test Equipment

Table 7.1-1: Test Equipment List

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI Test Receiver	Rohde & Schwarz	ESU40	E1121	19 May 2021	19 May 2022
Spectrum analyzer	Rohde & Schwarz	FSV40	E1120	19 Nov 2019	19 Nov 2021
System controller	Sunol sciences	SC104V	E1191	NCR	NCR
DRG Horn	ETS-Lindgren	3117-PA	E1160	02 Dec 2020	02 Dec 2021
Bilog Antenna	Schaffner	CBL6111C	1763	18 Feb 2020	18 Feb 2022
Horn, Antenna	EMCO	3115	1033	15 Oct 2020	15 Oct 2021
Antenna Horn	Sage	SAR-2309-42-S2	E1143	13 Nov 2020	13 Nov 2022
Low Noise Amplifier	Sage	SBL-1834034030-KFKF	E1228	NCR	NCR

Table 7.1-2: Test Software

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.60.15

Section 8 Testing data

8.1 Occupied bandwidth: 20 dB Bandwidth

8.1.1 References

FCC

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through §15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

8.1.2 Test summary

Verdict	Pass		
Test date	July 9, 2021	Temperature	20°C
Test engineer	Martha Espinoza	Air pressure	1007 mbar
Test location	3m semi anechoic chamber	Relative humidity	49 %

8.1.3 Notes

Testing was performed with EUT transmitting on a fixed channel at full power. The transmission was continuously: Low, middle, and high channel were evaluated.

8.1.4 Setup details

EUT setup configuration	Tabletop
Test facility	Wireless Bench
Measurement method	ANSI C63.10

Receiver/spectrum analyzer settings:

Resolution bandwidth	1% - 5% OBW
Video bandwidth	3*RBW
Span	Between two times and five times OBW
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.1.5 Test data

Test Frequency (MHz)	20 dB Bandwidth (kHz)
2410	681.354
2420	680.229
2430	1379.676

Table 8.1-1: 20 dB occupied bandwidth test data

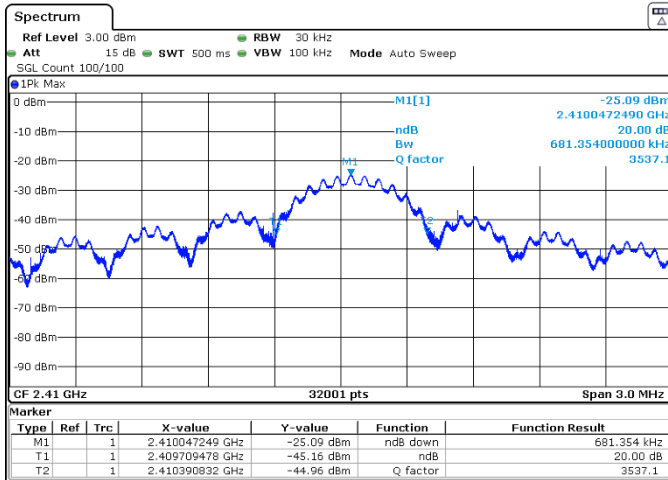


Figure 8.1-1: Low channel (2410 MHz): 20 dB OBW plot

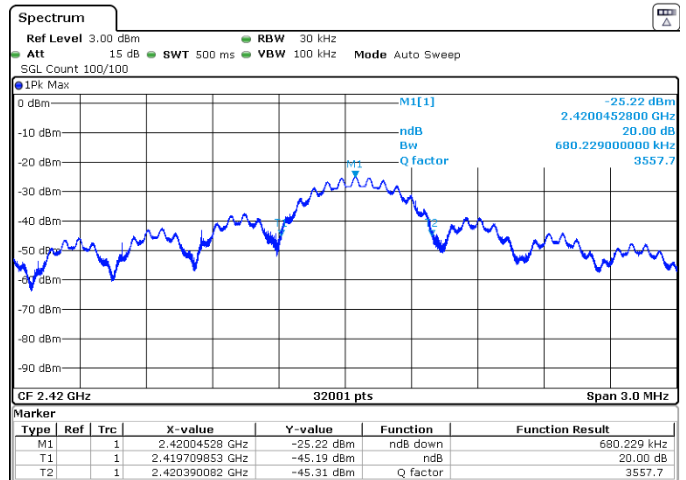


Figure 8.1-2: Middle channel (2420 MHz): 20 dB OBW plot

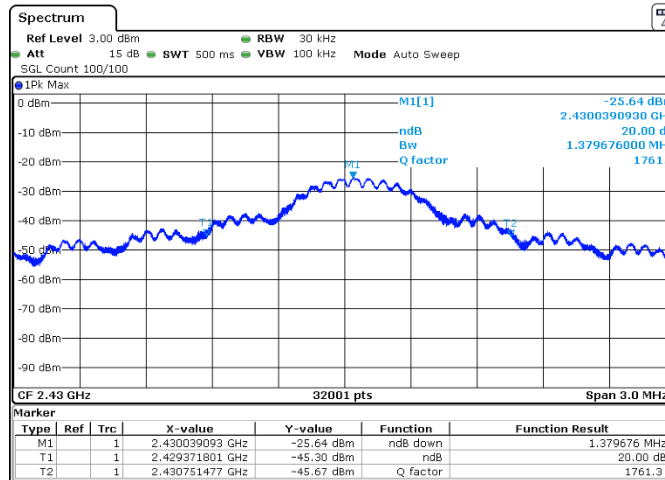


Figure 8.1-3: High channel (2430 MHz): 20 dB OBW plot

8.2 Field strength of fundamental, harmonics and spurious emissions

8.2.1 Definitions and limits

FCC:

The field strength of emissions from intentional radiators shall comply with the following table. Field strength limits are specified at 3 meters.

Table 8.2-1: Field strength limits

Fundamental frequency (MHz)	Field strength (mv/m)	Field strength (dB μ V/m)	Field strength of harmonics (mv/m)	Field strength of harmonics (dB μ V/m)
902 - 928	50	93.97	500	53.97
2400 – 2483.5	50	93.97	500	53.97
5725 - 5875	50	93.97	500	53.97
24000 - 24250	250	107.95	2500	67.95

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

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

§15.209 Radiated emission limits; general requirements

- (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Table 8.2-2: Spurious emissions limits

Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance (m)
30 - 88	40.00	3
88 - 216	43.52	3
216 - 960	46.02	3
Above 960	53.97	3

8.2.2 Test summary

Verdict	Pass		
Test date	July 6, 2021	Temperature	23°C
	July 7, 2021		24°C
	July 8, 2021		22°C
Test engineer	Martha Espinoza	Air pressure	1005; 1002 ; 1001 mbar
Test location	3m semi anechoic chamber	Relative humidity	61; 65; 65%

8.2.3 Notes

Testing was performed with EUT transmitting on a fixed channel at full power. The transmission made in continuous wave: low, middle, and high channel were evaluated. The spectrum was search from 30 MHz to 26 GHz (above the 10th harmonic of the highest transmit frequency). Radiated measurements were performed at a 3 m measurement distance.

8.2.4 Setup details

EUT setup configuration	Tabletop
Test facility	3m Chamber
Measurement method	ANSI C63.10

Spectrum analyzer settings for conducted spurious emissions:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
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)
Trace mode	Max Hold
Measurement time	5 s (final measurements)

Receiver settings for radiated measurements within restricted bands above 1 GHz (Fundamental signal and range from 18-26 GHz):

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Average and peak (final measurements)
Trace mode	Max Hold
Measurement time	5 s (final measurements)

Note: The sweep measurement in this range was made at 120 kHz RBW to compliance with the 6 dB noise floor under limit line as FCC requires. Maximization and final measurements were done at 1 MHz RBW.

Testing was performed with EUT transmitting on a fixed channel at full power. The transmission was continuously. Low, middle, and high channel were evaluated. The unit was able to transmit at 100 % of duty cycle

8.2.5 Test data

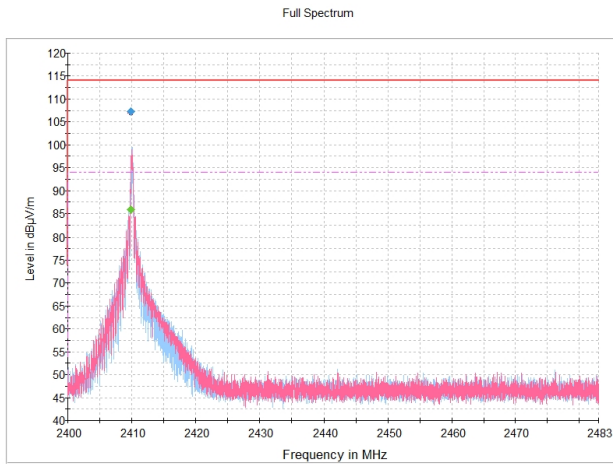


Figure 8.2-1: Field strength of fundamental: low channel (2410 MHz)

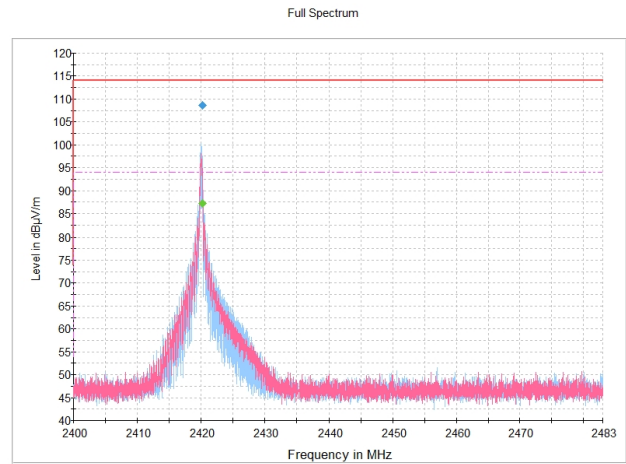


Figure 8.2-2: Field strength of fundamental: middle channel (2420 MHz)

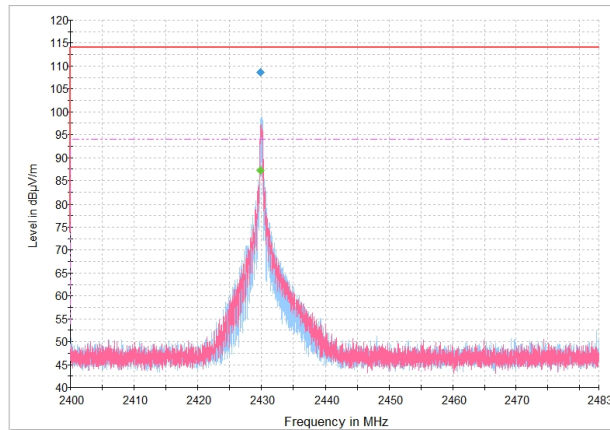
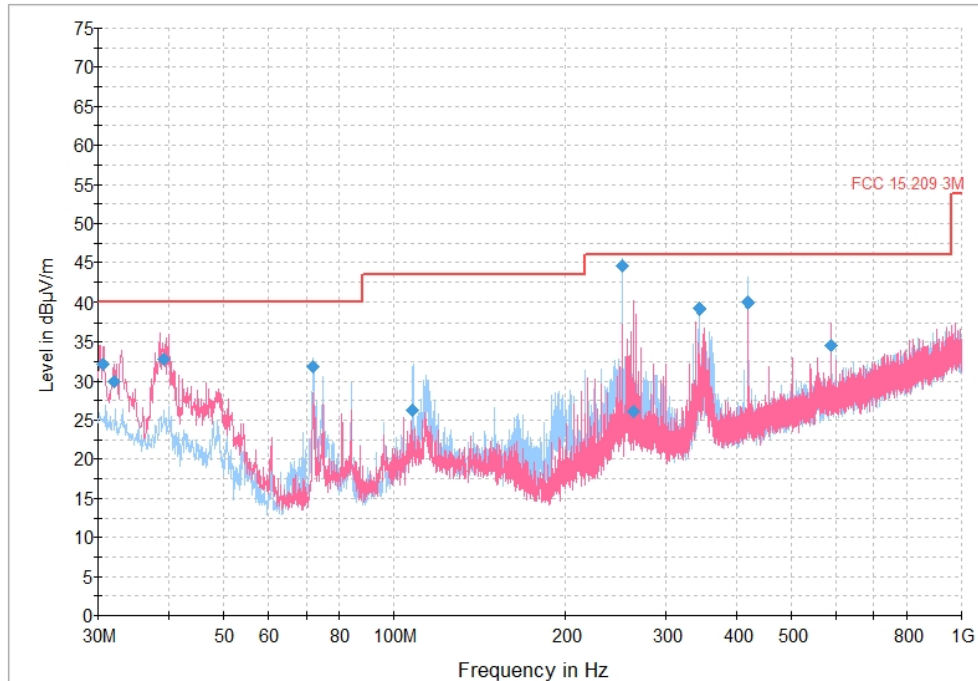


Figure 8.2-3: Field strength of fundamental: high channel (2430 MHz)

Table 8.2-3: Peak field strength of fundamental without correction factors applied

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2409.870000	---	85.87	93.97	8.10	5000.0	1000.000	150.0	H	150.0	35.3
2409.870000	107.25	---	114.00	6.75	5000.0	1000.000	150.0	H	150.0	35.3
2420.220000	108.61	---	114.00	5.39	5000.0	1000.000	128.0	H	157.0	35.3
2420.220000	---	87.20	93.97	6.77	5000.0	1000.000	128.0	H	157.0	35.3
2429.890000	---	87.14	93.97	6.83	5000.0	1000.000	130.0	H	155.0	35.3
2429.890000	108.55	---	114.00	5.45	5000.0	1000.000	130.0	H	155.0	35.3

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

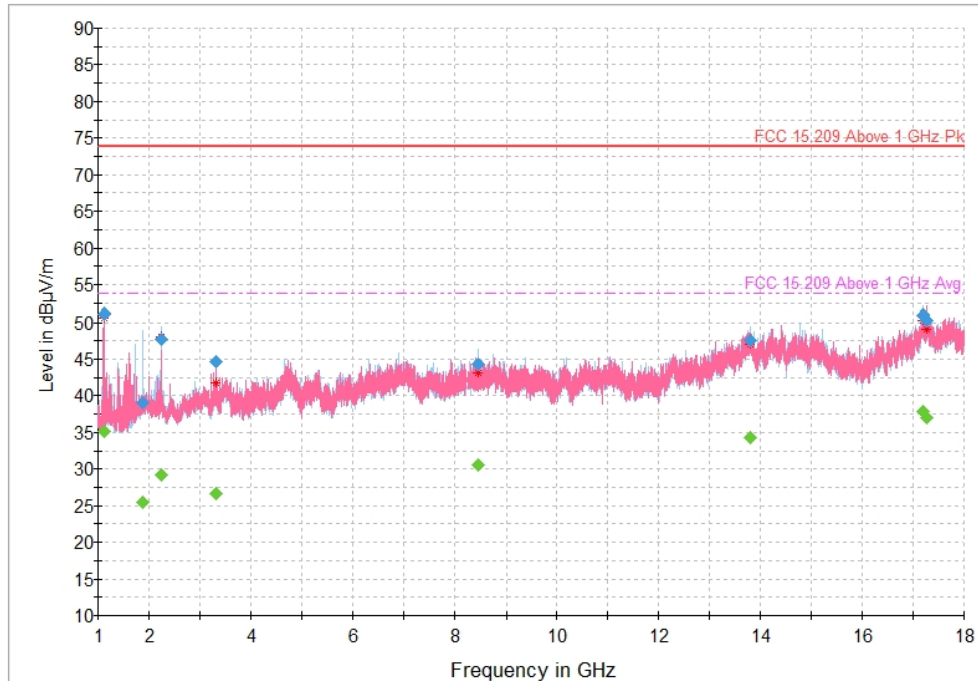
Figure 8.2-4: Radiated emissions, low channel (2410 MHz), 30 – 1000 MHz

Table 8.2-4: Radiated emissions, low channel (2410 MHz), 30 – 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.640000	32.14	40.00	7.86	5000.0	120.000	100.0	V	243.0	26.2
31.991667	29.91	40.00	10.09	5000.0	120.000	118.0	V	209.0	25.4
39.168333	32.77	40.00	7.23	5000.0	120.000	100.0	V	256.0	21.5
71.953333	31.84	40.00	8.16	5000.0	120.000	234.0	H	195.0	13.9
107.964167	26.21	43.50	17.29	5000.0	120.000	205.0	H	198.0	18.6
252.008333	44.53	46.00	1.47	5000.0	120.000	223.0	H	176.0	21.1
264.012500	26.06	46.00	19.94	5000.0	120.000	244.0	V	266.0	21.8
344.433333	39.16	46.00	6.84	5000.0	120.000	110.0	H	341.0	23.5
419.980833	39.98	46.00	6.02	5000.0	120.000	196.0	H	178.0	25.7
588.072500	34.61	46.00	11.39	5000.0	120.000	155.0	V	205.0	29.0

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

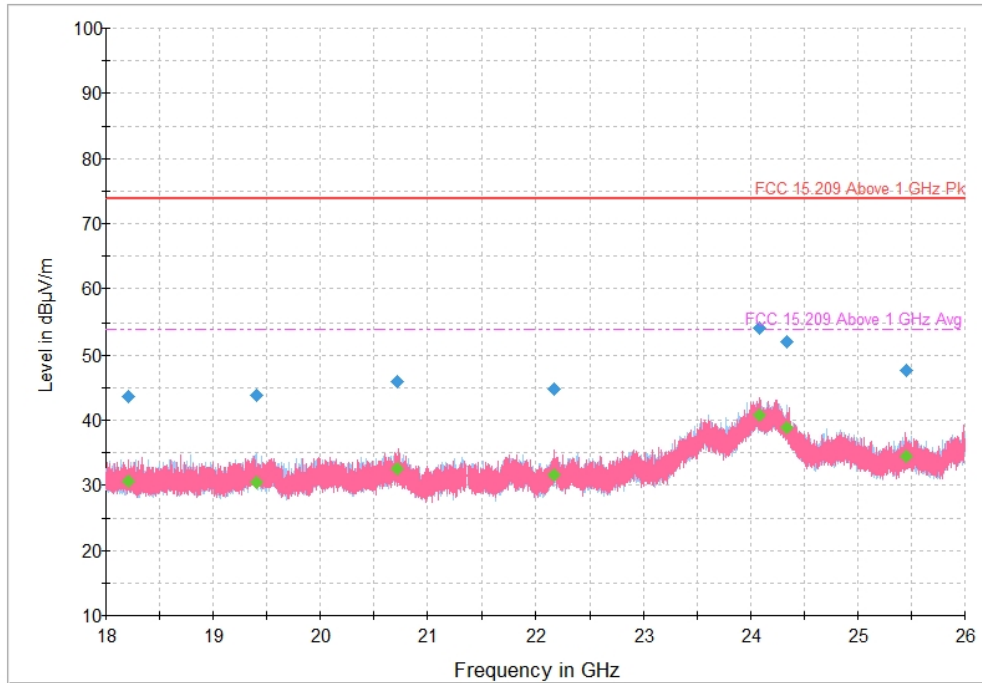
Figure 8.2-5: Radiated emissions, low channel (2410 MHz), 1 – 18 GHz

Table 8.2-5: Radiated emissions, low channel (2410 MHz), 1 - 18 GHz

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)
1115.700000	---	35.16	53.90	18.74	5000.0	1000.000	125.0	V	246.0	-13.8
1115.700000	51.05	---	73.90	22.85	5000.0	1000.000	125.0	V	246.0	-13.8
1868.650000	---	25.37	53.90	28.53	5000.0	1000.000	266.0	H	210.0	-10.3
1868.650000	39.05	---	73.90	34.85	5000.0	1000.000	266.0	H	210.0	-10.3
2254.150000	---	29.11	53.90	24.79	5000.0	1000.000	334.0	H	144.0	-9.7
2254.150000	47.68	---	73.90	26.22	5000.0	1000.000	334.0	H	144.0	-9.7
3327.950000	---	26.57	53.90	27.33	5000.0	1000.000	116.0	V	235.0	-5.9
3327.950000	44.72	---	73.90	29.18	5000.0	1000.000	116.0	V	235.0	-5.9
8459.100000	---	30.58	53.90	23.32	5000.0	1000.000	152.0	H	113.0	3.7
8459.100000	44.32	---	73.90	29.58	5000.0	1000.000	152.0	H	113.0	3.7
13794.050000	---	34.31	53.90	19.59	5000.0	1000.000	98.0	H	0.0	13.2
13794.050000	47.56	---	73.90	26.34	5000.0	1000.000	98.0	H	0.0	13.2
17194.550000	---	37.84	53.90	16.06	5000.0	1000.000	314.0	H	276.0	16.5
17194.550000	50.95	---	73.90	22.95	5000.0	1000.000	314.0	H	276.0	16.5
17275.100000	---	37.09	53.90	16.81	5000.0	1000.000	250.0	V	315.0	16.6
17275.100000	50.24	---	73.90	23.66	5000.0	1000.000	250.0	V	315.0	16.6

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits
 - ⁷ A 2.4 GHz filter was used to protect the receiver system.

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

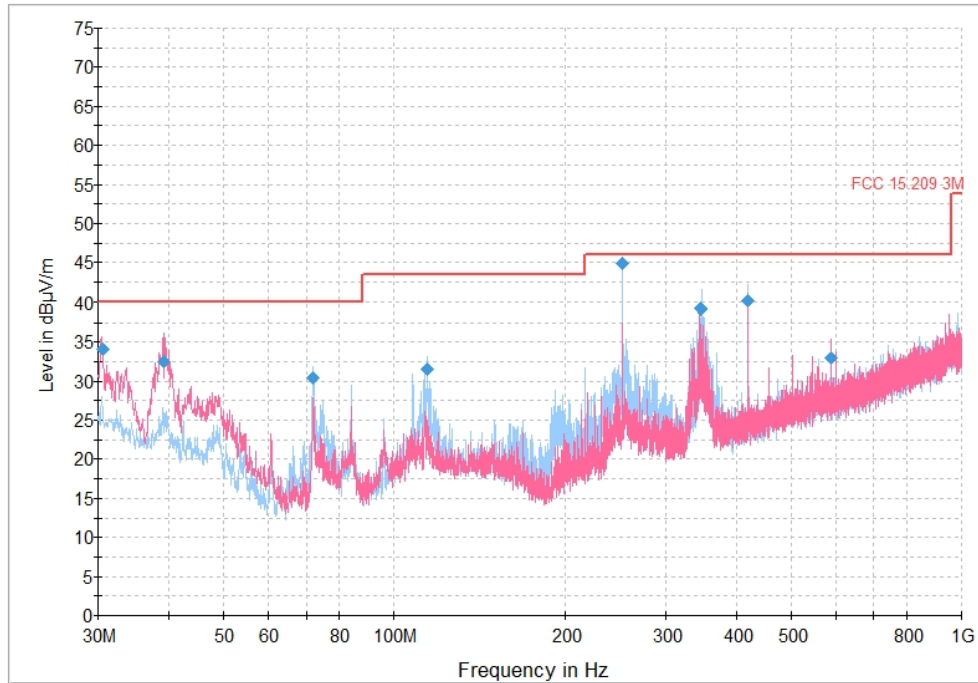
Figure 8.2-6: Radiated emissions, low channel (2410 MHz), 18 - 26 GHz

Table 8.2-6: Radiated emissions, low channel (2410 MHz), 18 - 26 GHz

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)
18208.600000	---	30.56	53.90	23.34	5000.0	1000.000	166.0	V	294.0	17.4
18208.600000	43.61	---	73.90	30.29	5000.0	1000.000	166.0	V	294.0	17.4
19401.933333	43.77	---	73.90	30.13	5000.0	1000.000	108.0	H	349.0	18.4
19401.933333	---	30.38	53.90	23.52	5000.0	1000.000	108.0	H	349.0	18.4
20722.733333	45.91	---	73.90	27.99	5000.0	1000.000	351.0	V	102.0	20.1
20722.733333	---	32.51	53.90	21.39	5000.0	1000.000	351.0	V	102.0	20.1
22165.400000	44.82	---	73.90	29.08	5000.0	1000.000	287.0	V	258.0	19.8
22165.400000	---	31.57	53.90	22.33	5000.0	1000.000	287.0	V	258.0	19.8
24088.600000	54.23	---	73.90	19.67	5000.0	1000.000	136.0	V	86.0	29.6
24088.600000	---	40.76	53.90	13.14	5000.0	1000.000	136.0	V	86.0	29.6
24335.000000	51.99	---	73.90	21.91	5000.0	1000.000	213.0	H	232.0	27.7
24335.000000	---	38.86	53.90	15.04	5000.0	1000.000	213.0	H	232.0	27.7
25449.400000	47.63	---	73.90	26.27	5000.0	1000.000	229.0	V	225.0	23.9
25449.400000	---	34.41	53.90	19.49	5000.0	1000.000	229.0	V	225.0	23.9

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

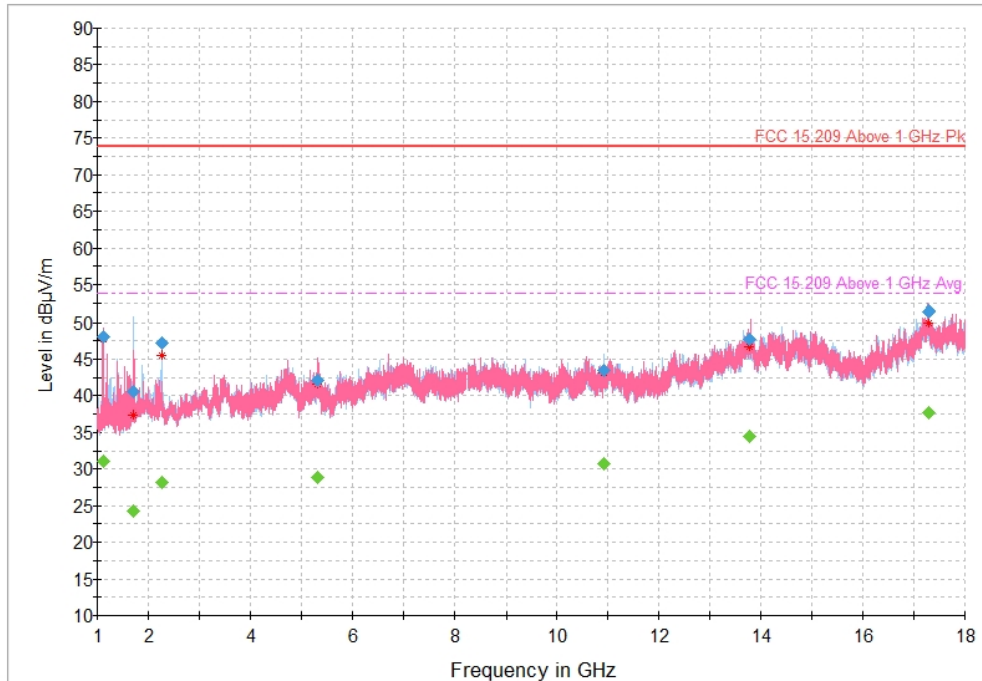
Figure 8.2.7: Radiated emissions, middle channel (2420 MHz), 30 – 1000 MHz

Table 8.2.7: Radiated emissions, middle channel (2420 MHz), 30 – 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.560000	34.02	40.00	5.98	5000.0	120.000	100.0	V	347.0	26.2
39.174167	32.53	40.00	7.47	5000.0	120.000	100.0	V	270.0	21.5
71.951667	30.46	40.00	9.54	5000.0	120.000	184.0	H	209.0	13.9
114.470000	31.61	43.50	11.89	5000.0	120.000	136.0	H	212.0	19.1
252.008333	44.96	46.00	1.04	5000.0	120.000	202.0	H	165.0	21.1
346.430000	39.21	46.00	6.79	5000.0	120.000	100.0	H	11.0	23.5
420.020833	40.14	46.00	5.86	5000.0	120.000	199.0	H	179.0	25.7
588.072500	33.01	46.00	12.99	5000.0	120.000	246.0	V	192.0	29.0

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

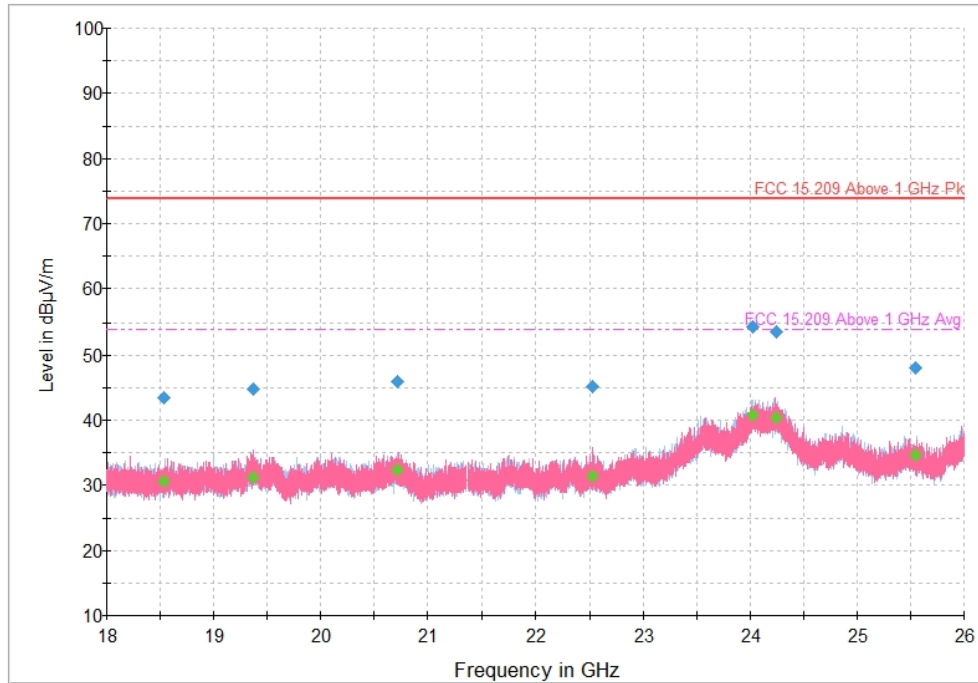
Figure 8.2-8: Radiated emissions, middle channel (2420 MHz), 1 – 18 GHz

Table 8.2-8: Radiated emissions, middle channel (2420 MHz), 1 - 18 GHz

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)
1113.150000	48.07	---	73.90	25.83	5000.0	1000.000	125.0	V	236.0	-13.8
1113.150000	---	31.08	53.90	22.82	5000.0	1000.000	125.0	V	236.0	-13.8
1711.450000	40.52	---	73.90	33.38	5000.0	1000.000	277.0	H	328.0	-11.8
1711.450000	---	24.21	53.90	29.69	5000.0	1000.000	277.0	H	328.0	-11.8
2263.950000	47.24	---	73.90	26.66	5000.0	1000.000	247.0	H	11.0	-9.6
2263.950000	---	28.15	53.90	25.75	5000.0	1000.000	247.0	H	11.0	-9.6
5329.750000	42.14	---	73.90	31.76	5000.0	1000.000	326.0	V	216.0	-0.8
5329.750000	---	28.90	53.90	25.00	5000.0	1000.000	326.0	V	216.0	-0.8
10927.700000	43.43	---	73.90	30.47	5000.0	1000.000	164.0	H	339.0	5.3
10927.700000	---	30.75	53.90	23.15	5000.0	1000.000	164.0	H	339.0	5.3
13784.600000	47.67	---	73.90	26.23	5000.0	1000.000	186.0	V	0.0	13.1
13784.600000	---	34.48	53.90	19.42	5000.0	1000.000	186.0	V	0.0	13.1
17280.600000	---	37.70	53.90	16.20	5000.0	1000.000	387.0	V	54.0	16.7
17280.600000	51.44	---	73.90	22.46	5000.0	1000.000	387.0	V	54.0	16.7

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits
 - ⁷ A 2.4 GHz filter was used to protect the receiver system

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

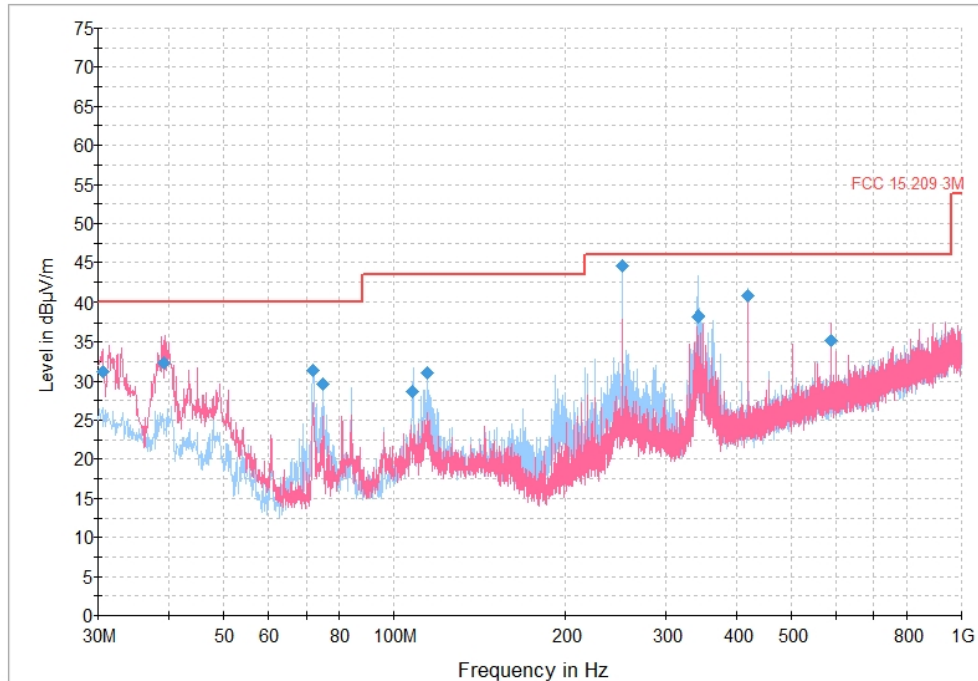
Figure 8.2-9: Radiated emissions, middle channel (2420 MHz), 18 - 26 GHz

Table 8.2-9: Radiated emissions, middle channel (2420 MHz), 18 - 26 GHz

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)
18537.666667	---	30.62	53.90	23.28	5000.0	1000.000	254.0	H	163.0	17.9
18537.666667	43.37	---	73.90	30.53	5000.0	1000.000	254.0	H	163.0	17.9
19372.333333	44.77	---	73.90	29.13	5000.0	1000.000	343.0	V	86.0	18.5
19372.333333	---	31.27	53.90	22.63	5000.0	1000.000	343.0	V	86.0	18.5
20719.400000	---	32.41	53.90	21.49	5000.0	1000.000	318.0	H	83.0	20.2
20719.400000	45.99	---	73.90	27.91	5000.0	1000.000	318.0	H	83.0	20.2
22524.200000	45.25	---	73.90	28.65	5000.0	1000.000	353.0	V	0.0	19.5
22524.200000	---	31.47	53.90	22.43	5000.0	1000.000	353.0	V	0.0	19.5
24026.200000	54.29	---	73.90	19.61	5000.0	1000.000	154.0	H	0.0	29.7
24026.200000	---	40.71	53.90	13.19	5000.0	1000.000	154.0	H	0.0	29.7
24243.266667	---	40.44	53.90	13.46	5000.0	1000.000	116.0	V	116.0	29.0
24243.266667	53.52	---	73.90	20.38	5000.0	1000.000	116.0	V	116.0	29.0
25544.600000	48.08	---	73.90	25.82	5000.0	1000.000	250.0	H	283.0	24.3
25544.600000	---	34.56	53.90	19.34	5000.0	1000.000	250.0	H	283.0	24.3

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

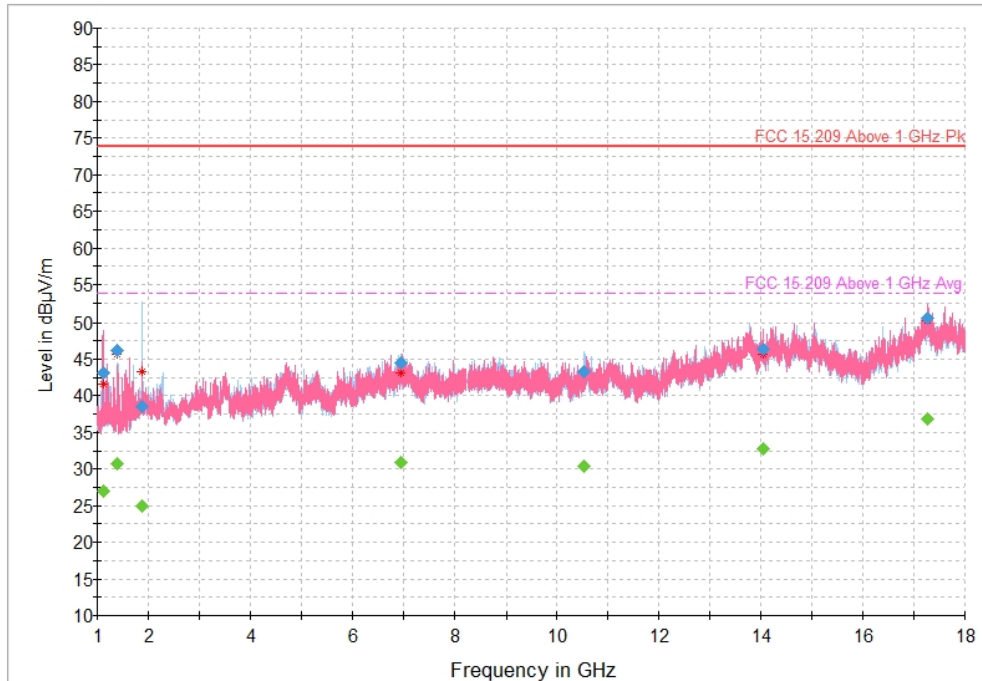
Figure 8.2-10: Radiated emissions, high channel (2430 MHz), 30 – 1000 MHz

Table 8.2-10: Radiated emissions, high channel (2430 MHz), 30 – 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.575000	31.26	40.00	8.74	5000.0	120.000	100.0	V	0.0	26.2
39.177500	32.40	40.00	7.60	5000.0	120.000	100.0	V	239.0	21.5
71.953333	31.32	40.00	8.68	5000.0	120.000	244.0	H	195.0	13.9
75.023333	29.64	40.00	10.36	5000.0	120.000	206.0	H	194.0	14.4
107.965000	28.64	43.50	14.86	5000.0	120.000	156.0	H	212.0	18.6
114.470833	31.07	43.50	12.43	5000.0	120.000	146.0	H	211.0	19.1
252.008333	44.55	46.00	1.45	5000.0	120.000	246.0	H	178.0	21.1
342.495000	38.19	46.00	7.81	5000.0	120.000	110.0	H	0.0	23.4
420.020833	40.78	46.00	5.22	5000.0	120.000	196.0	H	190.0	25.7
587.992500	35.17	46.00	10.83	5000.0	120.000	157.0	V	193.0	29.0

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

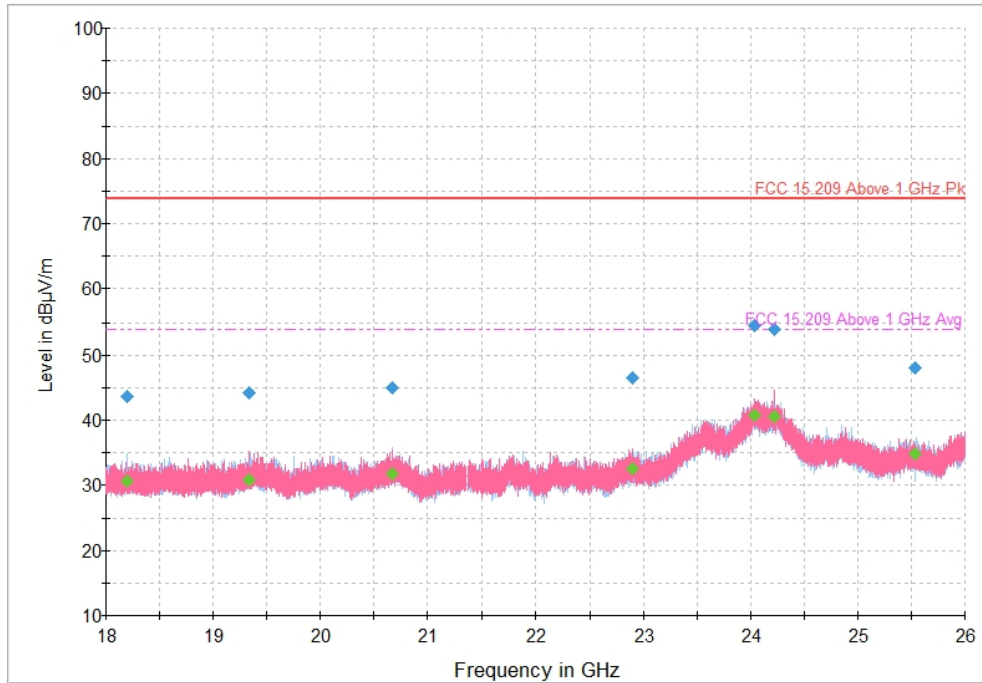
Figure 8.2-11: Radiated emissions, high channel (2430 MHz), 1 – 18 GHz

Table 8.2-11: Radiated emissions, high channel (2430 MHz), 1 - 18 GHz

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)
1121.550000	43.12	---	73.90	30.78	5000.0	1000.000	110.0	V	255.0	-13.7
1121.550000	---	27.03	53.90	26.87	5000.0	1000.000	110.0	V	255.0	-13.7
1394.150000	46.15	---	73.90	27.75	5000.0	1000.000	136.0	H	225.0	-13.7
1394.150000	---	30.76	53.90	23.14	5000.0	1000.000	136.0	H	225.0	-13.7
1880.250000	---	25.01	53.90	28.89	5000.0	1000.000	321.0	H	100.0	-10.1
1880.250000	38.51	---	73.90	35.39	5000.0	1000.000	321.0	H	100.0	-10.1
6953.600000	---	30.95	53.90	22.95	5000.0	1000.000	310.0	H	96.0	1.8
6953.600000	44.54	---	73.90	29.36	5000.0	1000.000	310.0	H	96.0	1.8
10531.700000	---	30.42	53.90	23.48	5000.0	1000.000	116.0	H	353.0	5.7
10531.700000	43.32	---	73.90	30.58	5000.0	1000.000	116.0	H	353.0	5.7
14039.600000	46.37	---	73.90	27.53	5000.0	1000.000	257.0	V	262.0	11.6
14039.600000	---	32.82	53.90	21.08	5000.0	1000.000	257.0	V	262.0	11.6
17273.300000	50.66	---	73.90	23.24	5000.0	1000.000	116.0	V	305.0	16.6
17273.300000	---	36.81	53.90	17.09	5000.0	1000.000	116.0	V	305.0	16.6

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits
 - ⁷ A 2.4 GHz filter was used to protect the receiver system

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.2-13: Radiated emissions, high channel (2430 MHz), 18 - 26 GHz

Table 8.2-12: Radiated emissions, high channel (2430 MHz), 18 - 26 GHz

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)
18197.800000	43.65	---	73.90	30.25	5000.0	1000.000	384.0	H	58.0	17.4
18197.800000	---	30.66	53.90	23.24	5000.0	1000.000	384.0	H	58.0	17.4
19337.133333	44.16	---	73.90	29.74	5000.0	1000.000	402.0	V	182.0	18.5
19337.133333	---	30.91	53.90	22.99	5000.0	1000.000	402.0	V	182.0	18.5
20670.600000	44.90	---	73.90	29.00	5000.0	1000.000	409.0	H	164.0	19.8
20670.600000	---	31.78	53.90	22.12	5000.0	1000.000	409.0	H	164.0	19.8
22895.400000	---	32.47	53.90	21.43	5000.0	1000.000	129.0	V	11.0	21.2
22895.400000	46.47	---	73.90	27.43	5000.0	1000.000	129.0	V	11.0	21.2
24031.933333	54.52	---	73.90	19.38	5000.0	1000.000	313.0	V	193.0	29.7
24031.933333	---	40.82	53.90	13.08	5000.0	1000.000	313.0	V	193.0	29.7
24218.200000	53.88	---	73.90	20.02	5000.0	1000.000	399.0	V	182.0	29.1
24218.200000	---	40.48	53.90	13.42	5000.0	1000.000	399.0	V	182.0	29.1
25531.400000	48.11	---	73.90	25.79	5000.0	1000.000	373.0	H	40.0	24.4
25531.400000	---	34.80	53.90	19.10	5000.0	1000.000	373.0	H	40.0	24.4

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m
 - ⁶ FCC 15.209 limits are equivalent to FCC 15.249 limits

8.3 Emissions at the band edges

8.3.1 Definitions and limits

FCC

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Table 8.3-1: 15.209 and RSS-Gen emissions field strength limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
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 8.3-2: 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			

8.3.2 Test summary

Verdict	Pass		
Test date	July 8, 2021	Temperature	22°C
Test engineer	Martha Espinoza	Air pressure	1001 mbar
Test location	3m semi anechoic chamber	Relative humidity	65 %

8.3.3 Observations, settings, and special notes

This is a radiated test. Signal was transmitting at max power and continuously mode: low and high channel were evaluated.

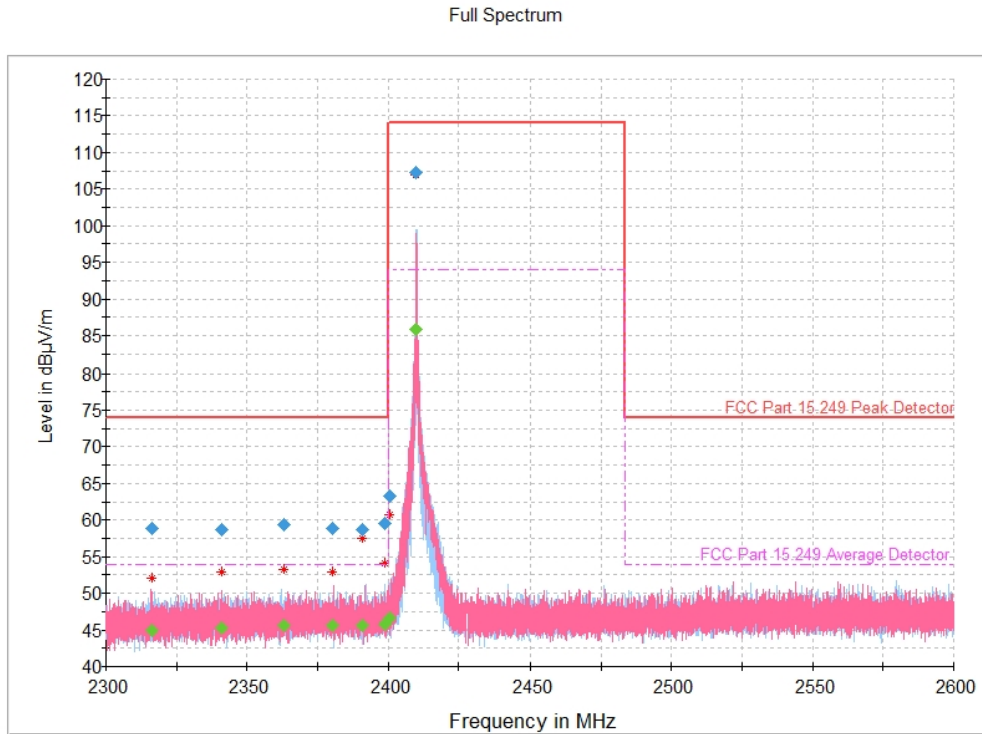
EUT setup configuration	Table top
Test facility	3M Chamber
Measurement method	ANSI C63.10

Spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	≥ 3 MHz
Detector mode	Peak
Trace mode	Max hold
Measurement time	Long enough for trace to stabilize

Note: The sweep measurement in this range was made at 120 kHz RBW to compliance with the 6 dB noise floor under limit line as FCC requires. Maximization and final measurements were done at 1 MHz RBW.

8.3.5 Test data



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

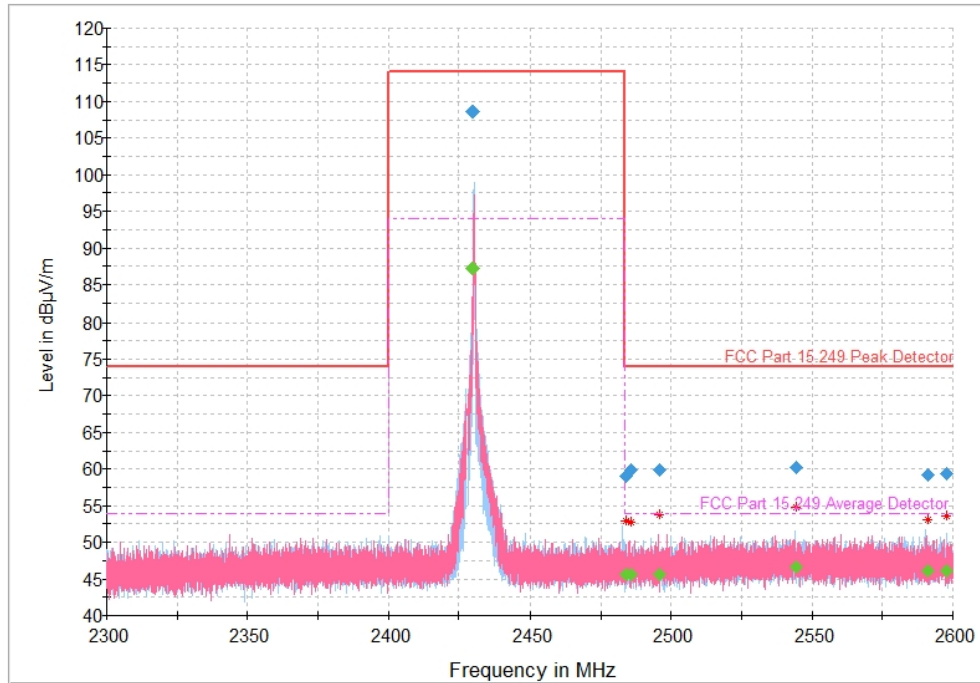
Figure 8.3-1: Band edges, low channel (2410 MHz).

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2316.500000	58.88	---	73.90	15.02	5000.0	1000.000	155.0	V	82.0	34.7
2316.500000	---	45.00	53.90	8.90	5000.0	1000.000	155.0	V	82.0	34.7
2340.850000	---	45.28	53.90	8.62	5000.0	1000.000	117.0	V	37.0	34.9
2340.850000	58.76	---	73.90	15.14	5000.0	1000.000	117.0	V	37.0	34.9
2363.130000	---	45.60	53.90	8.30	5000.0	1000.000	122.0	H	-11.0	35.2
2363.130000	59.34	---	73.90	14.56	5000.0	1000.000	122.0	H	-11.0	35.2
2380.260000	---	45.60	53.90	8.30	5000.0	1000.000	113.0	V	10.0	35.2
2380.260000	58.82	---	73.90	15.08	5000.0	1000.000	113.0	V	10.0	35.2
2391.020000	---	45.66	53.90	8.24	5000.0	1000.000	104.0	H	6.0	35.3
2391.020000	58.73	---	73.90	15.17	5000.0	1000.000	104.0	H	6.0	35.3
2398.700000	59.46	---	73.90	14.44	5000.0	1000.000	200.0	H	285.0	35.4
2398.700000	---	45.80	53.90	8.10	5000.0	1000.000	200.0	H	285.0	35.4
2400.750000	63.31	---	114.00	50.69	5000.0	1000.000	162.0	V	338.0	35.3
2400.750000	---	46.56	93.97	47.41	5000.0	1000.000	162.0	V	338.0	35.3
2409.870000	Fundamental signal just for reference				5000.0	1000.000	150.0	H	150.0	35.3
2409.870000	Fundamental signal just for reference				5000.0	1000.000	150.0	H	150.0	35.3

Table 8.3-3: Band edges, low channel (2410 MHz) results.

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m

Full Spectrum



The spectral plot shows the vertical (red plot) and horizontal (blue plot) scans. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators).

Figure 8.3-2: Band edges, high channel (2430 MHz).

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2429.890000	Fundamental signal just for reference				5000.0	1000.000	130.0	H	155.0	35.3
2429.890000	Fundamental signal just for reference				5000.0	1000.000	130.0	H	155.0	35.3
2483.930000	58.99	---	73.90	14.91	5000.0	1000.000	137.0	H	10.0	35.4
2483.930000	---	45.66	53.90	8.24	5000.0	1000.000	137.0	H	10.0	35.4
2485.900000	59.79	---	73.90	14.11	5000.0	1000.000	157.0	V	214.0	35.3
2485.900000	---	45.61	53.90	8.29	5000.0	1000.000	157.0	V	214.0	35.3
2496.020000	59.94	---	73.90	13.96	5000.0	1000.000	214.0	V	131.0	35.4
2496.020000	---	45.63	53.90	8.27	5000.0	1000.000	214.0	V	131.0	35.4
2544.210000	---	46.65	53.90	7.25	5000.0	1000.000	200.0	H	249.0	35.7
2544.210000	60.25	---	73.90	13.65	5000.0	1000.000	200.0	H	249.0	35.7
2591.050000	---	46.05	53.90	7.85	5000.0	1000.000	108.0	H	64.0	35.8
2591.050000	59.17	---	73.90	14.73	5000.0	1000.000	108.0	H	64.0	35.8
2597.690000	---	46.11	53.90	7.79	5000.0	1000.000	250.0	H	58.0	35.9
2597.690000	59.44	---	73.90	14.46	5000.0	1000.000	250.0	H	58.0	35.9

Table 8.3-4: Band edges, high channel (2430 MHz) results.

- 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 The maximum measured value observed over a period of 5 seconds was recorded.
 - ⁴ The spectral plot shows the vertical and horizontal scan separately.
 - ⁵ This measurement was done at 3m

8.4 AC Power Line Conduced Emissions

8.4.1 Definitions and limits

Title 47 → Chapter I → Subchapter A → Part 15 → Subpart C → §15.207(a)

For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.

Table 8.4-1: Conducted emissions limit

Frequency of emission, MHz	Conducted limit, dB μ V	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - Decreases with the logarithm of the frequency.

8.4.2 Test Summary

Verdict	Pass		
Test date	July 2, 2021	Temperature	24 °C
Test engineer	Martha Espinoza	Air pressure	1002 mbar
Test location	Ground plane	Relative humidity	65 %

8.4.3 Notes

Testing was performed with the EUT transmitting on a fixed channel at full power. The transmission was transmitting continuously: low, middle, and high channel were evaluated.

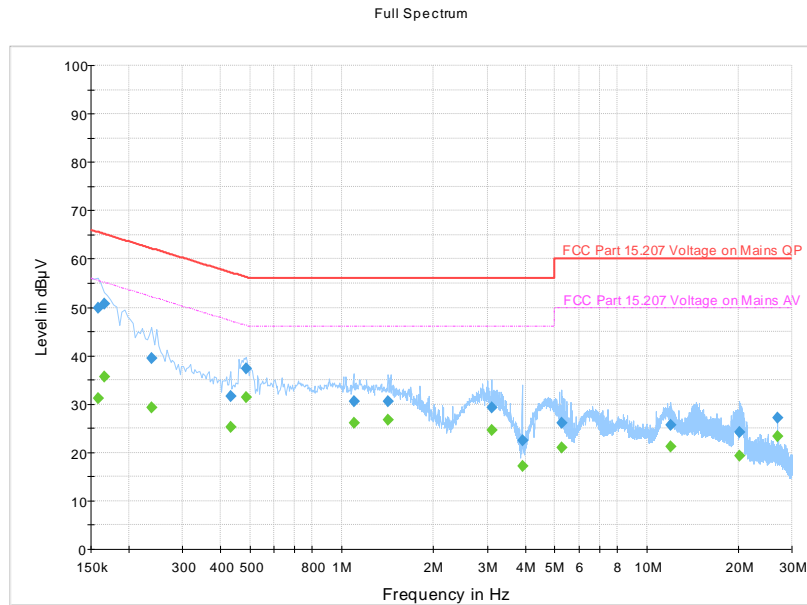
8.4.4 Setup Details

Port under test	AC mains
EUT setup configuration	Tabletop
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	– Peak and Average (Preview measurement) – Quasi-peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 5000 ms (Quasi-peak final measurement) – 5000 ms (CAverage final measurement)

8.4.5 Test Data



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.4-1: AC conducted emissions, 150 kHz – 30 MHz (Unit transmitting at low channel, 2410 MHz)

Table 8.4-2: AC conducted emissions, 150 kHz – 30 MHz (Unit transmitting at low channel, 2410 MHz)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.158000	---	31.18	55.57	24.39	5000.0	9.000	N	ON	19.6
0.158000	49.96	---	65.57	15.60	5000.0	9.000	N	ON	19.6
0.166000	50.71	---	65.16	14.44	5000.0	9.000	L1	ON	19.6
0.166000	---	35.66	55.16	19.50	5000.0	9.000	L1	ON	19.6
0.238000	---	29.26	52.17	22.91	5000.0	9.000	L1	ON	19.5
0.238000	39.46	---	62.17	22.70	5000.0	9.000	L1	ON	19.5
0.430000	---	25.19	47.25	22.07	5000.0	9.000	N	ON	19.4
0.430000	31.60	---	57.25	25.65	5000.0	9.000	N	ON	19.4
0.486000	37.46	---	56.24	18.77	5000.0	9.000	L1	ON	19.4
0.486000	---	31.37	46.24	14.87	5000.0	9.000	L1	ON	19.4
1.094000	---	26.15	46.00	19.85	5000.0	9.000	L1	ON	19.4
1.094000	30.65	---	56.00	25.35	5000.0	9.000	L1	ON	19.4
1.418000	30.65	---	56.00	25.35	5000.0	9.000	L1	ON	19.4
1.418000	---	26.76	46.00	19.24	5000.0	9.000	L1	ON	19.4
3.098000	29.38	---	56.00	26.62	5000.0	9.000	L1	ON	19.3
3.098000	---	24.66	46.00	21.34	5000.0	9.000	L1	ON	19.3
3.906000	22.52	---	56.00	33.48	5000.0	9.000	L1	ON	19.3
3.906000	---	17.14	46.00	28.86	5000.0	9.000	L1	ON	19.3
5.270000	---	20.99	50.00	29.01	5000.0	9.000	L1	ON	19.3
5.270000	26.01	---	60.00	33.99	5000.0	9.000	L1	ON	19.3
12.010000	25.75	---	60.00	34.25	5000.0	9.000	L1	ON	19.9
12.010000	---	21.20	50.00	28.80	5000.0	9.000	L1	ON	19.9
20.138000	24.11	---	60.00	35.89	5000.0	9.000	L1	ON	20.2
20.138000	---	19.33	50.00	30.67	5000.0	9.000	L1	ON	20.2
27.002000	27.15	---	60.00	32.85	5000.0	9.000	L1	ON	20.0
27.002000	---	23.43	50.00	26.57	5000.0	9.000	L1	ON	20.0

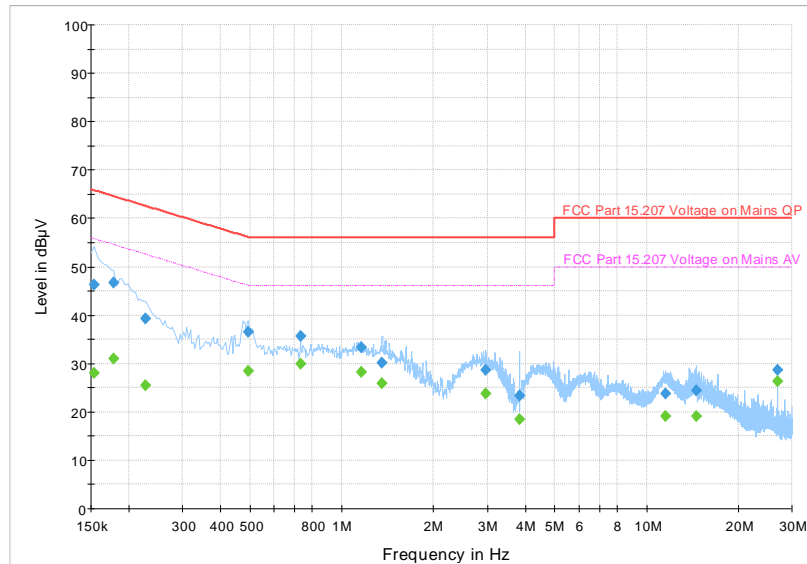
Notes:

¹ Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)

² Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

³ The maximum measured value observed over a period of 5 seconds was recorded.

Full Spectrum



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.4-2: AC conducted emissions, 150 kHz – 30 MHz (Unit transmitting at middle channel, 2420 MHz)

Table 8.4-3: AC conducted emissions, 150 kHz – 30 MHz (Unit transmitting at middle channel, 2420 MHz)

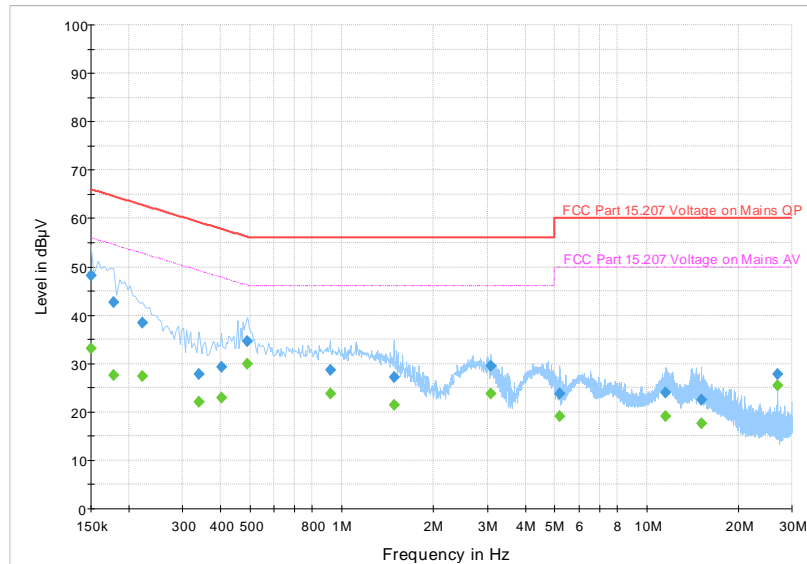
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154000	---	27.96	55.78	27.82	5000.0	9.000	N	ON	19.6
0.154000	46.32	---	65.78	19.47	5000.0	9.000	N	ON	19.6
0.178000	46.78	---	64.58	17.80	5000.0	9.000	L1	ON	19.6
0.178000	---	31.03	54.58	23.55	5000.0	9.000	L1	ON	19.6
0.226000	---	25.52	52.60	27.07	5000.0	9.000	N	ON	19.5
0.226000	39.28	---	62.60	23.32	5000.0	9.000	N	ON	19.5
0.494000	36.45	---	56.10	19.65	5000.0	9.000	N	ON	19.4
0.494000	---	28.38	46.10	17.72	5000.0	9.000	N	ON	19.4
0.730000	35.66	---	56.00	20.34	5000.0	9.000	L1	ON	19.4
0.730000	---	30.03	46.00	15.97	5000.0	9.000	L1	ON	19.4
1.154000	33.36	---	56.00	22.64	5000.0	9.000	L1	ON	19.4
1.154000	---	28.31	46.00	17.69	5000.0	9.000	L1	ON	19.4
1.350000	---	25.98	46.00	20.02	5000.0	9.000	L1	ON	19.4
1.350000	30.06	---	56.00	25.94	5000.0	9.000	L1	ON	19.4
2.974000	---	23.85	46.00	22.15	5000.0	9.000	L1	ON	19.4
2.974000	28.60	---	56.00	27.40	5000.0	9.000	L1	ON	19.4
3.822000	---	18.41	46.00	27.59	5000.0	9.000	L1	ON	19.3
3.822000	23.36	---	56.00	32.64	5000.0	9.000	L1	ON	19.3
11.578000	23.85	---	60.00	36.15	5000.0	9.000	N	ON	19.8
11.578000	---	19.18	50.00	30.82	5000.0	9.000	N	ON	19.8
14.598000	24.40	---	60.00	35.60	5000.0	9.000	L1	ON	20.2
14.598000	---	19.06	50.00	30.94	5000.0	9.000	L1	ON	20.2
27.002000	---	26.28	50.00	23.72	5000.0	9.000	N	ON	20.1
27.002000	28.59	---	60.00	31.41	5000.0	9.000	N	ON	20.1

Notes: ¹ Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)

² Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)

³ The maximum measured value observed over a period of 5 seconds was recorded.

Full Spectrum



The spectral plot has been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators)

Figure 8.4-3: AC conducted emissions, 150 kHz – 30 MHz (Unit transmitting at high channel, 2430 MHz)

Table 8.4-4: AC conducted emissions, 150 kHz – 30 MHz (Unit transmitting at high channel, 2430 MHz)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	48.29	---	66.00	17.71	5000.0	9.000	N	ON	19.6
0.150000	---	33.03	56.00	22.97	5000.0	9.000	N	ON	19.6
0.178000	---	27.62	54.58	26.96	5000.0	9.000	N	ON	19.5
0.178000	42.74	---	64.58	21.83	5000.0	9.000	N	ON	19.5
0.222000	---	27.41	52.74	25.33	5000.0	9.000	L1	ON	19.5
0.222000	38.38	---	62.74	24.37	5000.0	9.000	L1	ON	19.5
0.338000	---	22.13	49.25	27.12	5000.0	9.000	N	ON	19.4
0.338000	27.85	---	59.25	31.40	5000.0	9.000	N	ON	19.4
0.402000	---	22.99	47.81	24.82	5000.0	9.000	L1	ON	19.5
0.402000	29.40	---	57.81	28.41	5000.0	9.000	L1	ON	19.5
0.490000	34.67	---	56.17	21.50	5000.0	9.000	L1	ON	19.4
0.490000	---	29.88	46.17	16.29	5000.0	9.000	L1	ON	19.4
0.914000	28.69	---	56.00	27.31	5000.0	9.000	L1	ON	19.4
0.914000	---	23.88	46.00	22.12	5000.0	9.000	L1	ON	19.4
1.482000	---	21.53	46.00	24.47	5000.0	9.000	L1	ON	19.4
1.482000	27.16	---	56.00	28.84	5000.0	9.000	L1	ON	19.4
3.078000	---	23.83	46.00	22.17	5000.0	9.000	L1	ON	19.4
3.078000	29.55	---	56.00	26.45	5000.0	9.000	L1	ON	19.4
5.170000	---	19.07	50.00	30.93	5000.0	9.000	L1	ON	19.3
5.170000	23.75	---	60.00	36.25	5000.0	9.000	L1	ON	19.3
11.578000	---	19.20	50.00	30.80	5000.0	9.000	L1	ON	19.8
11.578000	23.89	---	60.00	36.11	5000.0	9.000	L1	ON	19.8
15.166000	---	17.55	50.00	32.45	5000.0	9.000	L1	ON	20.2
15.166000	22.41	---	60.00	37.59	5000.0	9.000	L1	ON	20.2
27.002000	27.78	---	60.00	32.22	5000.0	9.000	L1	ON	20.0
27.002000	---	25.42	50.00	24.58	5000.0	9.000	L1	ON	20.0

Notes:

- 1 Result (dBµV) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
- 2 Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)
- 3 The maximum measured value observed over a period of 5 seconds was recorded.

8.5 99% Occupied Bandwidth

8.5.1 References

FCC Part 15 → §2.202 (a)

(a) Occupied bandwidth. The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. In some cases, for example multichannel frequency-division systems, the percentage of 0.5 percent may lead to certain difficulties in the practical application of the definitions of occupied and necessary bandwidth; in such cases a different percentage may prove useful.

8.5.2 Test summary

Verdict	Pass		
Test date	July 9, 2021	Temperature	20°C
Test engineer	Martha Espinoza	Air pressure	1007 mbar
Test location	3m semi anechoic chamber	Relative humidity	60 %

8.5.3 Notes

Testing was performed with EUT transmitting on a fixed channel at full power. The transmission was continuously: Low, middle, and high channel were evaluated.

8.5.4 Setup details

EUT setup configuration	Tabletop
Test facility	Wireless Bench
Measurement method	ANSI C63.10

Receiver/spectrum analyzer settings:

Resolution bandwidth	1% - 5% OBW
Video bandwidth	3*RBW
Span	Between 1.5 times and 5 times OBW
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

Table 8.6-1: 99% OBW occupied bandwidth test data

Test Frequency (MHz)	99% OBW (MHz)
2410	2.685
2420	2.683
2430	2.687

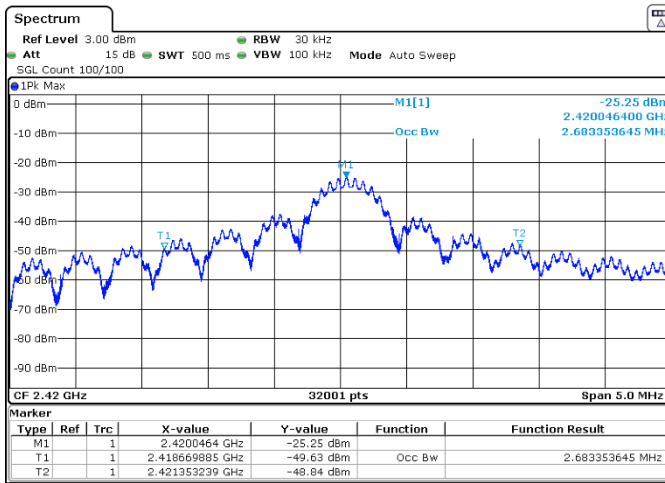


Figure 8.6-2: Low channel (2410 MHz): 99% OBW plot

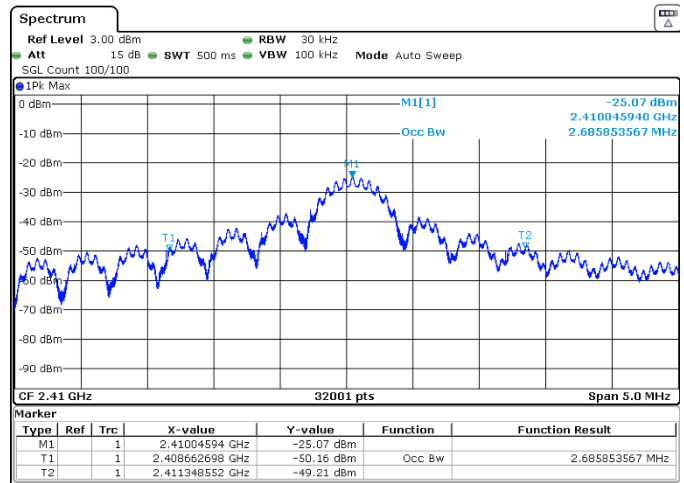


Figure 8.6-2: Middle channel (2420 MHz): 99% OBW plot

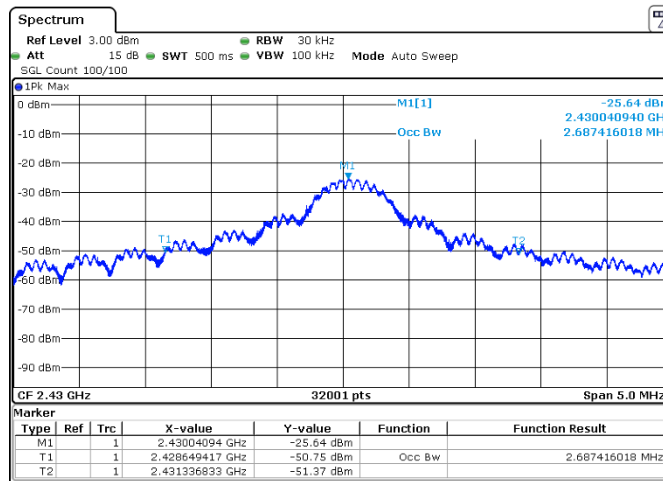
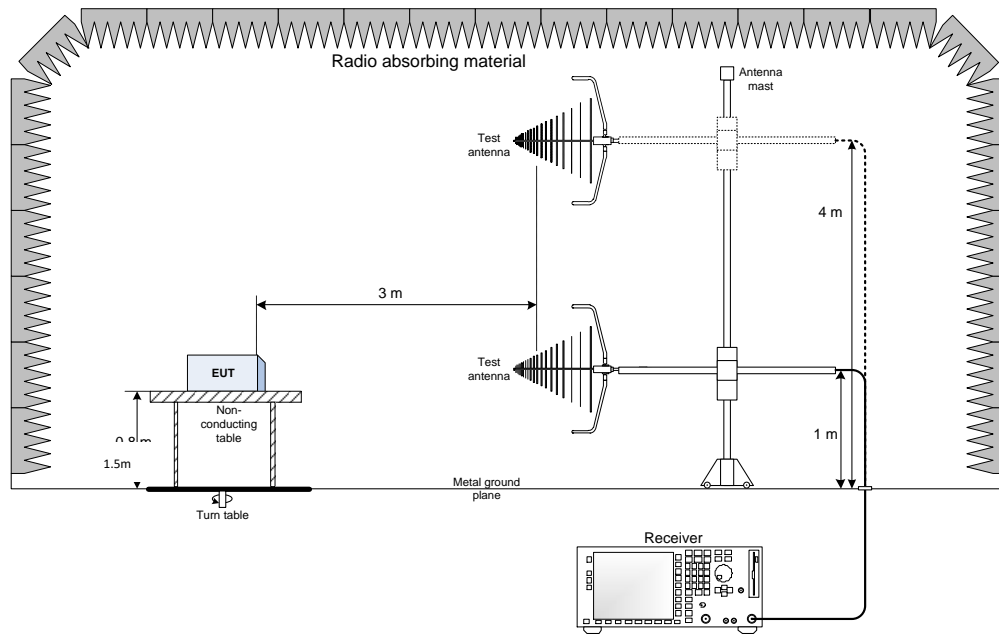


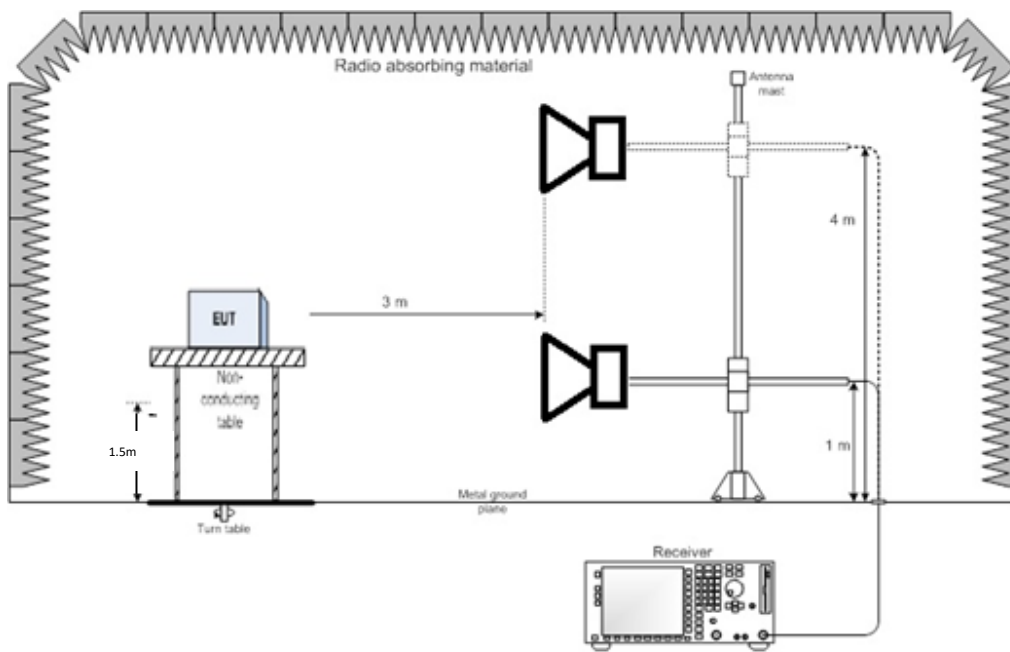
Figure 8.6-3: High channel (2430 MHz): 99% OBW plot

Section 9 Block diagrams of test set-ups

9.1 Radiated emissions set-up



30-1000MHz Setup



Above 1GHz Setup

Thank you for choosing

