Test Report

HELEM2404000146-1 v1.2

FINAS Finnish Accreditation Service T004 (EN ISO/IEC 17025)

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C AND ISED CANADA REQUIREMENTS

Equipment Under Test:	Swing Handle
Trademark:	Abloy
Model:	SHK/A1
Type:	-
Manufacturer / Customer:	Abloy Oy Wahlforssinkatu 20 FI-80100 Joensuu Finland
FCC Rule Part:	§15.247
IC Rule Part:	RSS-247, Issue 3, 2023 RSS-Gen, Issue 5 Amendment 2, 2021
KDB:	558074 D01 15.247 Meas Guidance v05r02

Date:	26 May 2025	Date:	26 May 2025
Issued by:		Checked by:	
	Henri Mäki Testing Engineer		Pekka Kälviäinen Testing Engineer

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GENERAL REMARKS

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	16 July 2024
1.1	Test results for radiated emissions in the frequency range 1-4 GHz updated with new results, original results with faulty test equipment deleted. Test equipment list updated accordingly.	22 July 2024
1.2	Laboratory address corrected on page 8.	26 May 2025

PRODUCT DESCRIPTION

Equipment Under Test

Equipment Under Test:	Swing Handle
Trademark:	Abloy
Model:	SHK/A1
Type:	-
Serial no:	-
FCC ID:	-
IC:	-
Radio module or chip:	proprietary BLE module, based on Nordic Semiconductor nRF52840

General Description

The equipment under test is a swing handle intended for outdoor cabinets used by telecom, energy, and data center companies, as well as utilities. The handle enables keyless opening, using only a mobile phone. The equipment is battery-powered, and the handle can be operated through the USB-C port with a backup power source if the battery is depleted.

Classification

Fixed device	☒
Mobile Device (Human body distance > 20 cm)	☐
Portable Device (Human body distance < 20 cm)	☐

Samples and Modifications

No.	Name	Description
1	Radiated	Normal sample operated with a test software
2	Conducted	PCB sample with an SMA connector

Ratings and declarations

Operating frequency range:	2402 – 2480 MHz
Nominal channel bandwidth:	1 MHz
Number of channels:	40
Channel separation:	2 MHz
Transmission technique:	DSSS
Modulation:	GFSK
Data rate:	1 Mbps
Antenna type:	Integral inverted F antenna
Antenna gain:	-3.86 dBi
Antenna count:	1
EUT dimensions:	205 x 55 x 32 mm, 0.5 kg
Power requirements:	Battery-operated (lithium battery 3 V, CR15H270)
Operating temperature range:	-25…+60 °C

Ports and Cables

Cable / Port	Description
USB-C	Used to configure the EUT with the peripheral mobile phone. In normal use the port is only used to open the lock in case of emergency.

Peripherals

Peripheral	Description / Usage
Mobile Phone	Configuring the EUT through USB-C port

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.203	Antenna Requirement	**PASS**
§15.207(a) / RSS-Gen 8.8	AC Power-Line Conducted Emissions	**N/A**
RSS-Gen 6.7	Occupied Bandwidth 99 %	**PASS**
§15.247(a)(2) / RSS-247 5.2 a)	6 dB Bandwidth	**PASS**
§15.247(b)(3) / RSS-247 5.4 d)	Maximum Peak Conducted Output Power	**PASS**
§15.247(d) / RSS-247 5.5	Unwanted Emissions (conducted)	**PASS**
§15.247(d) / RSS-247 5.5	Unwanted Emissions (radiated)	**PASS**
§15.247(e) / RSS-247 5.2 b)	Power Spectral Density	**PASS**

The decision rule applied for the tests results stated in this test report is according to the requirements of section 1.4 of ANSI C63.10-2020.

EUT Test Conditions during Testing

The EUT was in continuous transmit mode during all the tests. The EUT was configured into the wanted channel using software provided by the manufacturer.

Conducted RF tests were performed with an automated Rohde & Schwarz TS8997 measurement system. The EUT was connected to the measurement system with a coaxial cable. The EUT was powered with a DC power supply and configured with the peripheral mobile phone.

During radiated tests the EUT was powered with a battery. The peripheral mobile phone was used to configure the EUT but was removed during testing.

Table 1: Test frequencies and settings

Channel	Frequency [MHz]	Data rate	TX power	Duty cycle
37	2402	1 Mbps	8 dBm	100 %
17	2440			
39	2480			

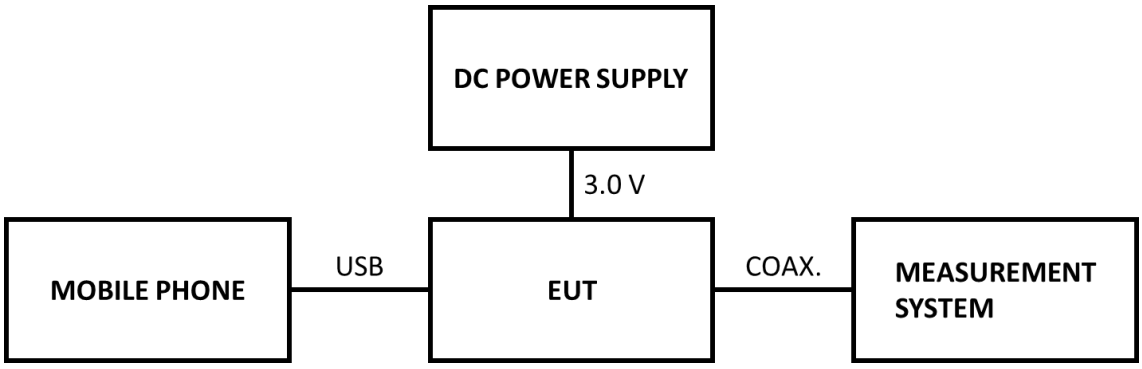

Figure 1: Test setup block diagram (conducted tests)

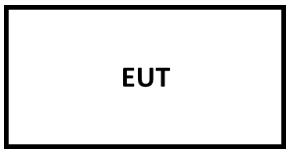

Figure 2: Test setup block diagram (radiated tests)

Test Facility

Testing Laboratory / address: FCC designation number: **FI0002** ISED CAB identifier: **T004**	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND
Test Site:	☐ K10LAB, ISED Canada registration number: **8708A-1** ☒ K5LAB, ISED Canada registration number: **8708A-2** ☐ T10LAB

TEST RESULTS

Antenna Requirement

Standard: FCC Rule §15.203
Tested by: HEM
Date: 5 July 2024

FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Specification	Requirement (at least one of the following shall be applied)	Conclusion
§15.203	1. Permanently attached antenna 2. Unique coupling to the intentional radiator 3. Professionally installed radio. The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	**PASS**
Note	Option 1 is used	

Occupied Bandwidth 99 %

Standard: RSS-Gen Issue 5
Tested by: HEM
Date: 5 July 2024
Temperature: 23 °C
Humidity: 52 %RH

Test result: **PASS**

RSS-Gen clause 6.7

The occupied bandwidth is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained.

Test results

Table 2: Test results for Occupied Bandwidth 99 %

Frequency [MHz]	OBW 99 % [MHz]	Limit [MHz]	Result
2402	1.055000	-	PASS
2440	1.070000		PASS
2480	1.070000		PASS

The conducted measurement was performed with a spectrum analyzer using the following settings:

Setting	Value
Span	2 MHz
RBW	10 kHz
VBW	30 kHz
Sweep Points	400
Sweep Time	189.648 µs
Detector	MaxPeak
Trace Mode	Max Hold
Sweep Type	FFT

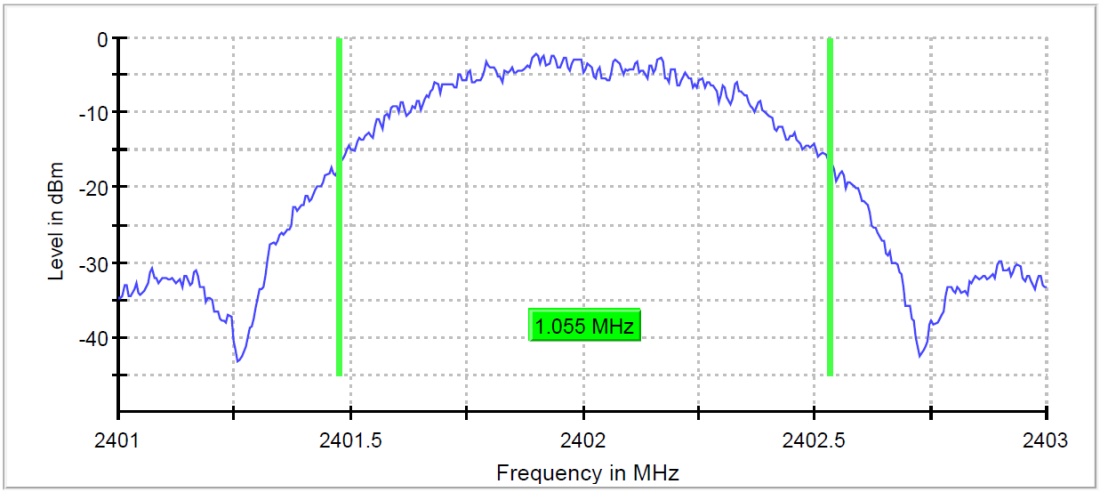

Figure 3: Occupied Bandwidth 99 % (bottom channel)

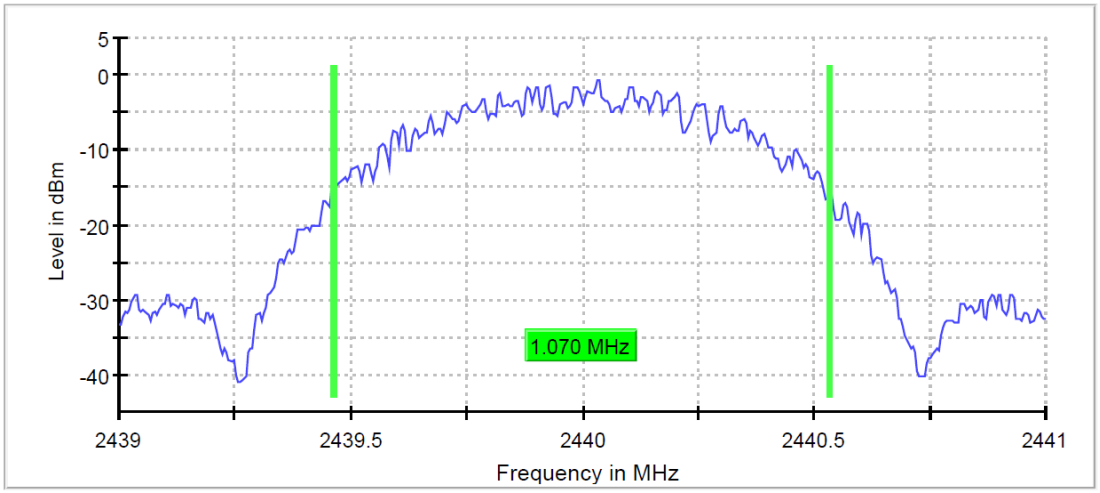

Figure 4: Occupied Bandwidth 99 % (middle channel)

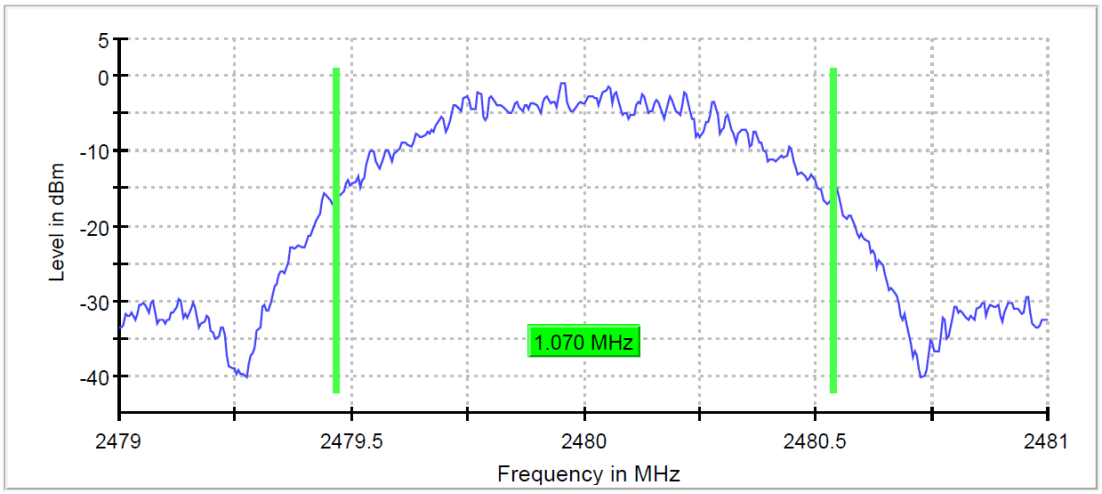

Figure 5: Occupied Bandwidth 99 % (top channel)

6 dB Bandwidth

Standard: ANSI C63.10-2020
Tested by: HEM
Date: 5 July 2024
Temperature: 23 °C
Humidity: 52 %RH

Test result: **PASS**

FCC §15.247(a)(2)
RSS-247 clause 5.2 a)

The 6 dB bandwidth is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 6 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The minimum 6 dB bandwidth shall be 500 kHz.

Test results

Table 3: Test results for 6 dB Bandwidth

Frequency [MHz]	6 dB BW [kHz]	Limit [kHz]	Result
2402	752.476	≥ 500	PASS
2440	752.476		PASS
2480	732.674		PASS

The conducted measurement was performed with a spectrum analyzer using the following settings:

Setting	Value
Span	2 MHz
RBW	100 kHz
VBW	300 kHz
Sweep Points	101
Sweep Time	18.938 µs
Detector	MaxPeak
Trace Mode	Max Hold
Sweep Type	FFT

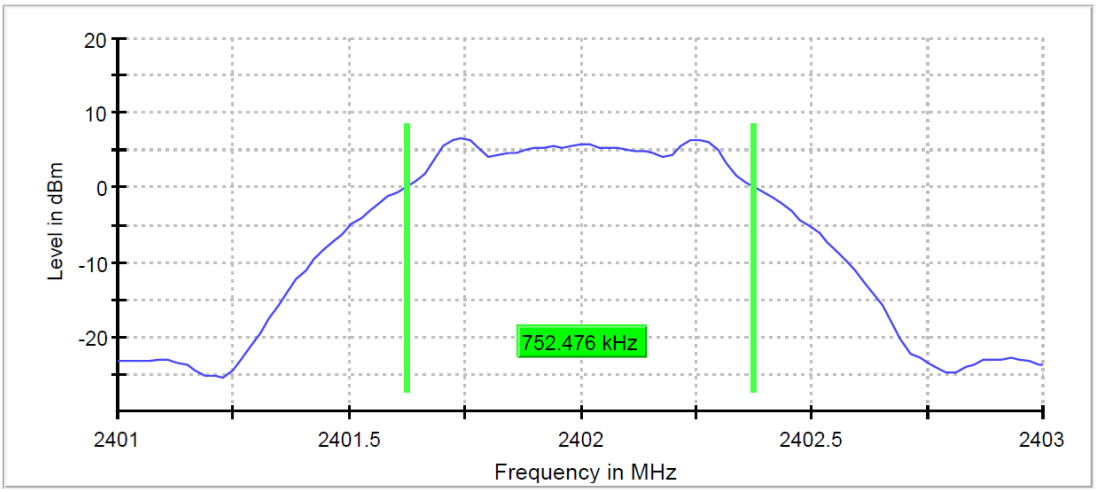

Figure 6: 6 dB Bandwidth (bottom channel)

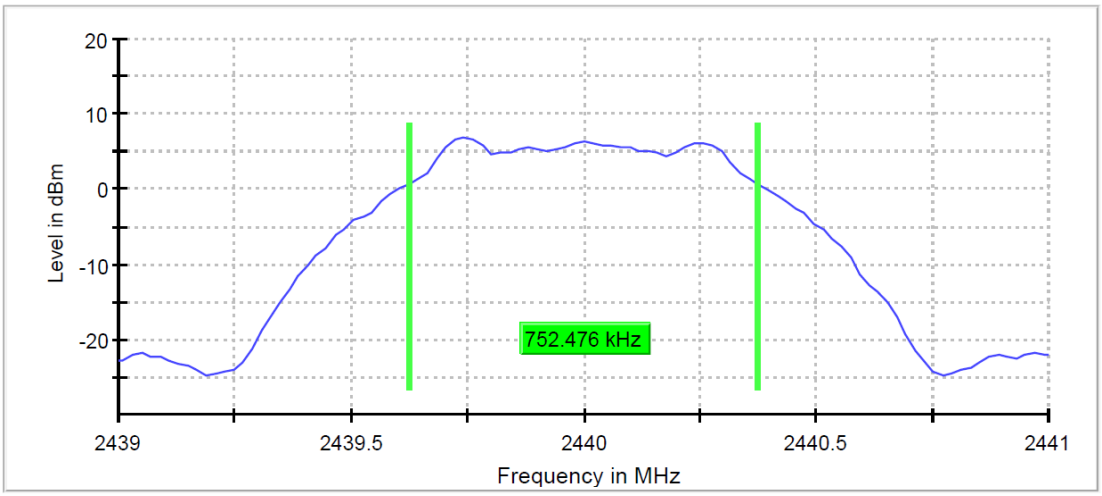

Figure 7: 6 dB Bandwidth (middle channel)

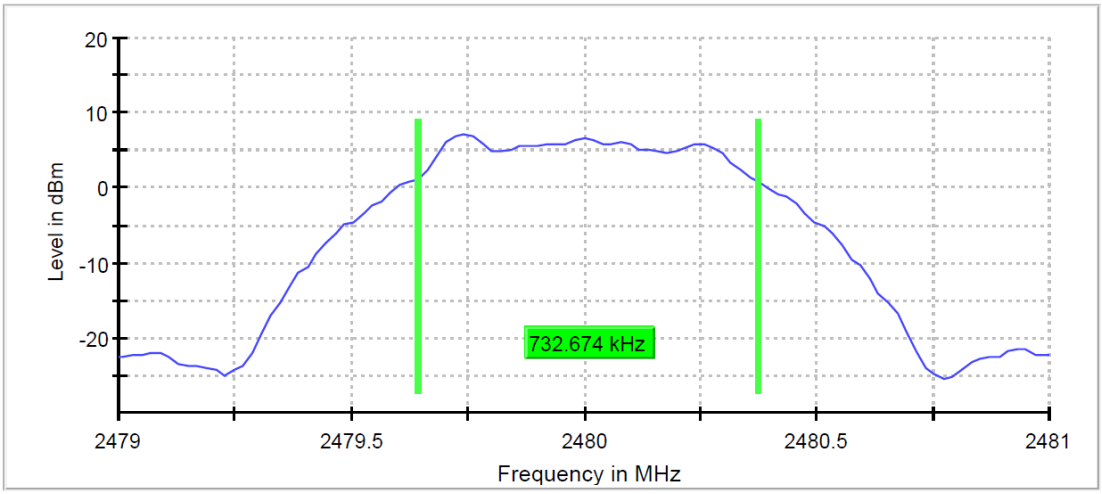

Figure 8: 6 dB Bandwidth (top channel)

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10-2020
Tested by:	HEM
Date:	5 July 2024
Temperature:	23 °C
Humidity:	52 %RH
Measurement uncertainty:	± 2.87dB, level of confidence 95 % (k = 2)

Test result: **PASS**

FCC §15.247(b)(3)
RSS-247 clause 5.4 d)

For systems using digital modulation in the 2400-2483.5 MHz band the maximum peak conducted output power of the intentional radiated shall not exceed 1 W (30 dBm). The conducted output power limit is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test results

Table 4: Test results for Maximum Peak Conducted Output Power

Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Result
2402	6.9	30	PASS
2440	7.3		PASS
2480	7.4		PASS

The conducted measurement was performed with a spectrum analyzer using the following settings:

Setting	Value
Span	3 MHz
RBW	1 MHz
VBW	3 MHz
Sweep Points	101
Sweep Time	1.907 µs
Detector	MaxPeak
Trace Mode	Max Hold
Sweep Type	FFT

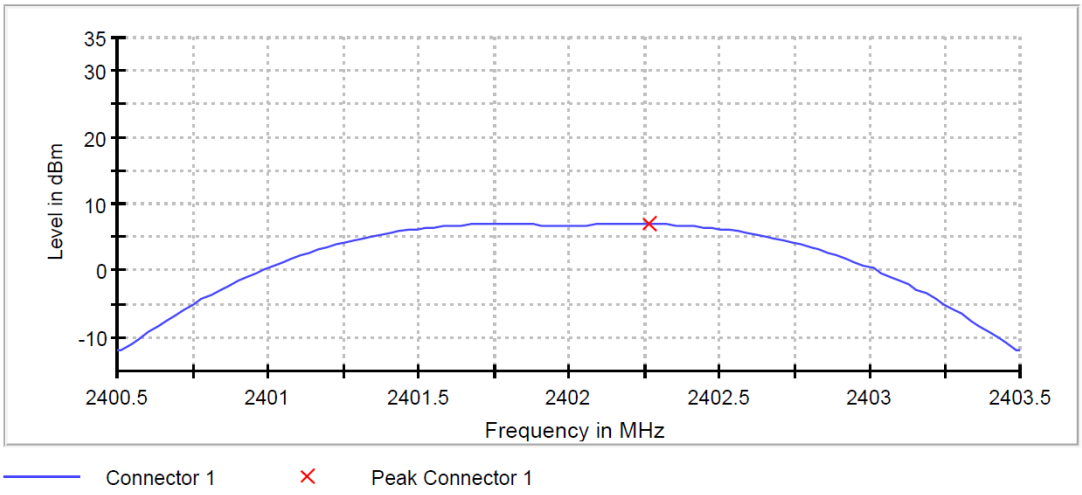

Figure 9: Maximum Peak Conducted Output Power (bottom channel)

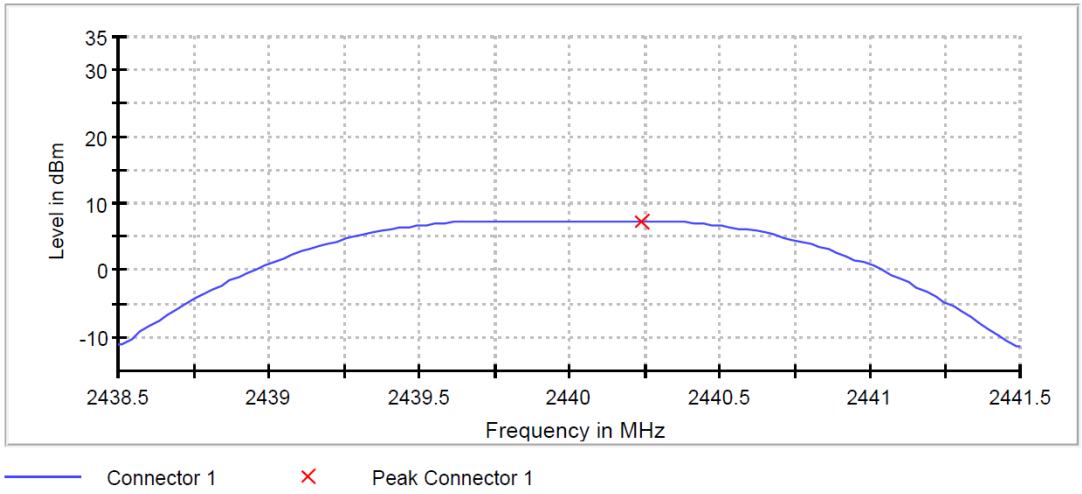

Figure 10: Maximum Peak Conducted Output Power (middle channel)

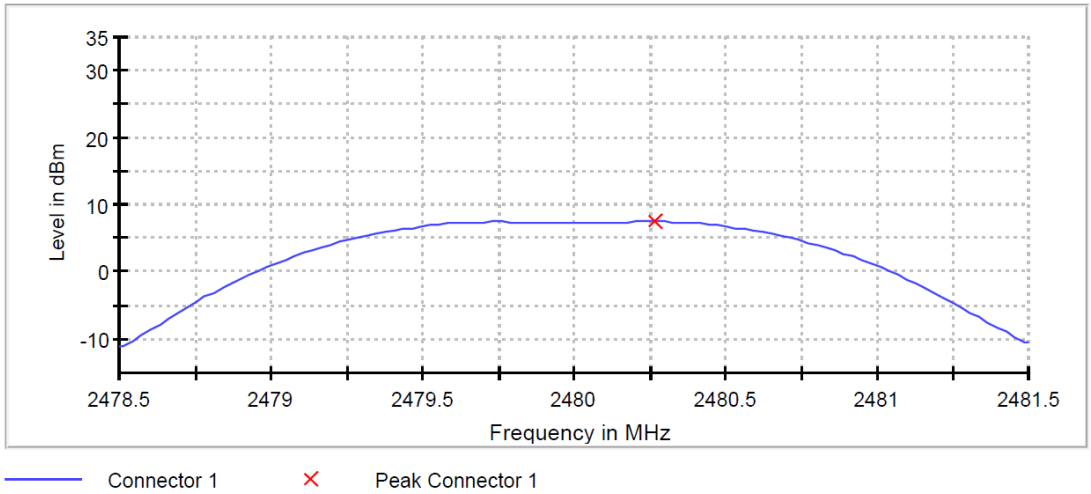

Figure 11: Maximum Peak Conducted Output Power (top channel)

Unwanted Emissions (conducted)

Standard:	ANSI C63.10-2020
Tested by:	HEM
Date:	5 July 2024
Temperature:	23 °C
Humidity:	52 %RH
Measurement uncertainty:	± 2.87 dB, level of confidence 95 % (k = 2)

Test result: **PASS**

FCC §15.247(d)
RSS-247 clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the 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.

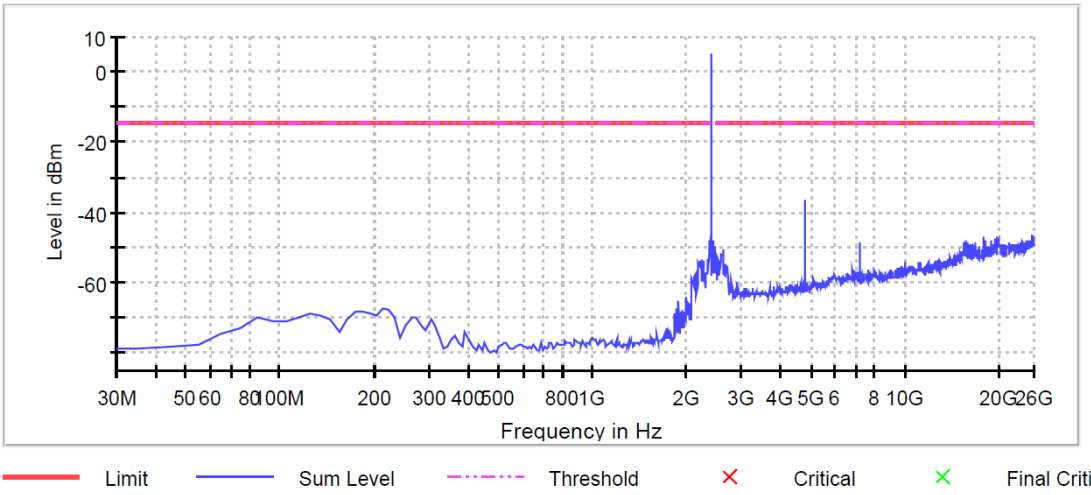

Figure 12: Unwanted emissions, conducted (bottom channel)

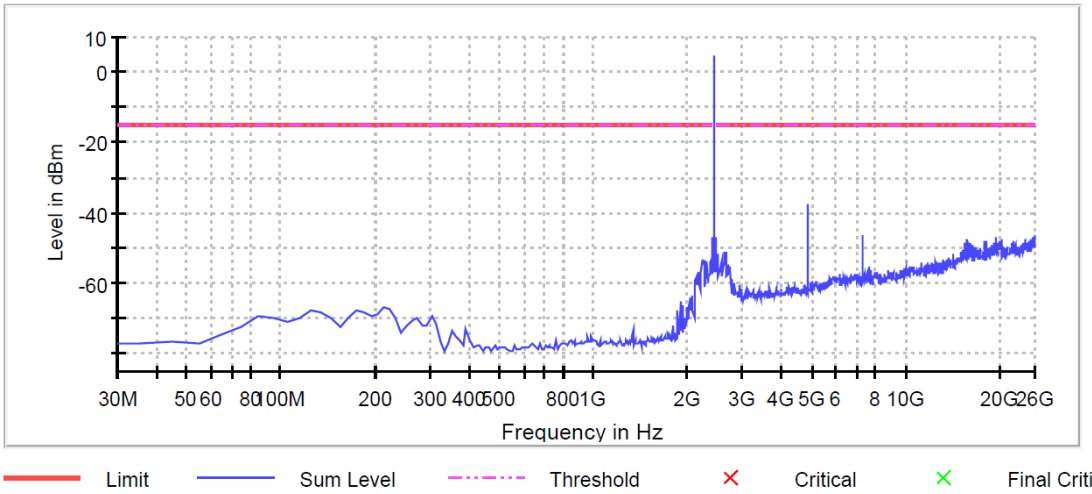

Figure 13: Unwanted emissions, conducted (middle channel)

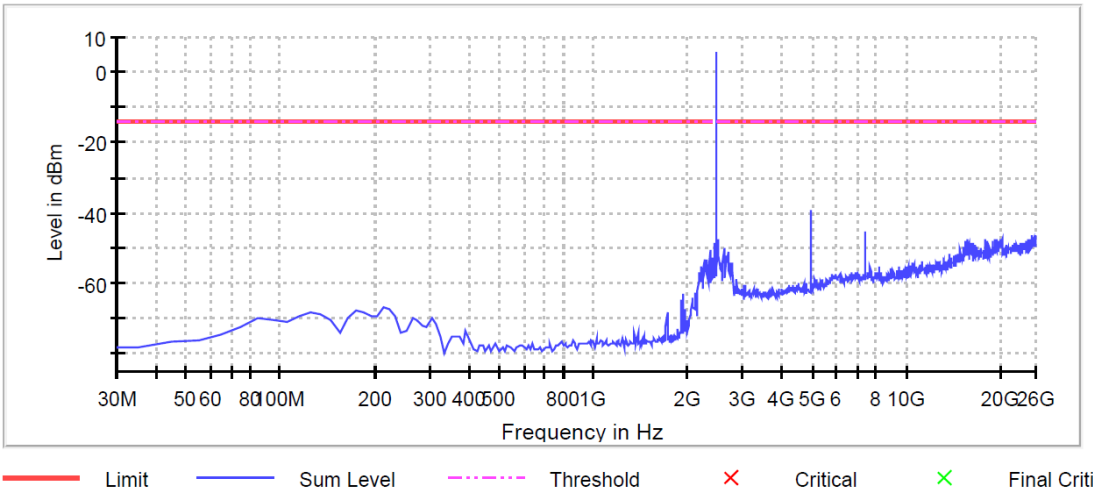

Figure 14: Unwanted emissions, conducted (top channel)

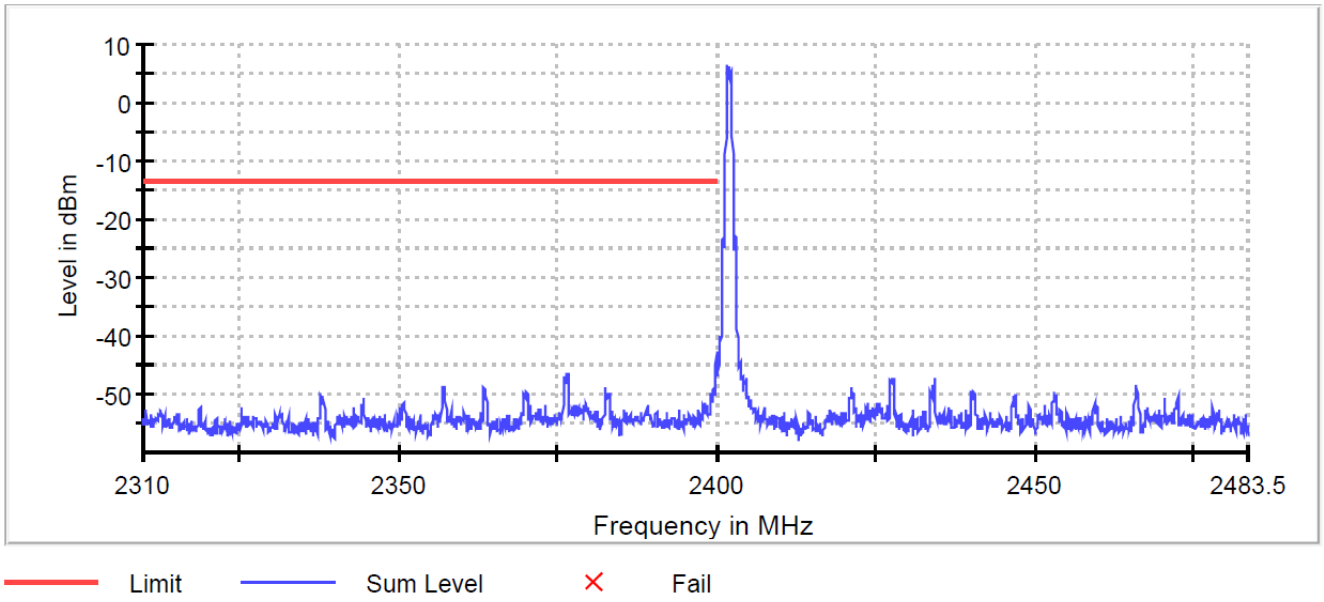

Figure 15: Lower band-edge, conducted (bottom channel)

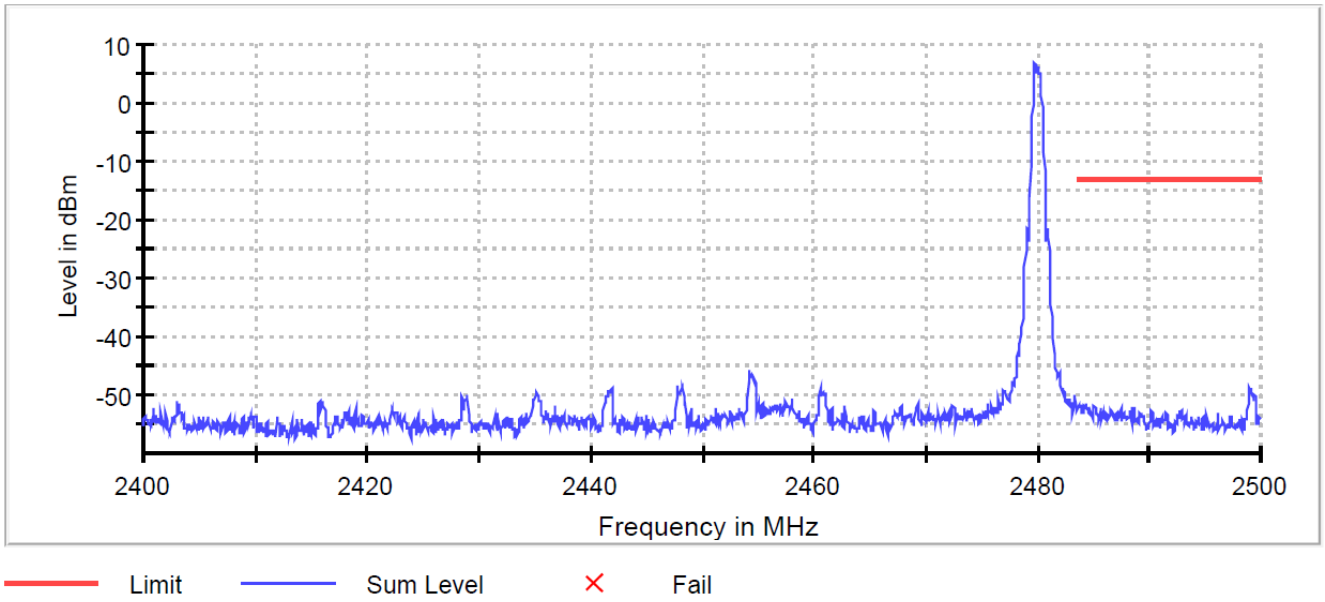

Figure 16: Upper band-edge, conducted (top channel)

Unwanted Emissions (radiated)

Standard:	ANSI C63.10-2020			
Tested by:	HEM			
Date:	8 July 2024	9 July 2024	10 July 2024	21 July 2024
Temperature:	23 °C	23 °C	23 °C	20 °C
Humidity:	46 %RH	48 %RH	47 %RH	58 %RH
Measurement uncertainty:	± 4.51 dB, level of confidence 95 % (k = 2)			

Test result: **PASS**

FCC §15.247(d)
RSS-247 clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the 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. Attenuation below the general limits specified in §15.209(a) and RSS-Gen clause 8.9 is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen clause 8.10, must also comply with the radiated emission limits specified in §15.209(a) and RSS-Gen clause 8.9.

Radiated tests are performed in a semi-anechoic chamber with a measurement distance of 3 meters. During measurements above 1 GHz absorbers are placed on the floor. The results below 30 MHz are extrapolated to 30 m or 300 m distance by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The result value is the measured value corrected with the correction factor.

Test results

Table 5: Unwanted radiated emissions (quasi-peak detector)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Channel
924.645000	22.54	46.00	23.46	1000.0	120.000	164.0	H	214.0	31.9	Bottom

Table 6: Unwanted radiated emissions (average detector)

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Channel
7205.300000	42.78	---	---	1000.0	1000.000	203.0	H	227.0	11.4	Bottom
7319.400000	42.55	54.00	11.45	1000.0	1000.000	164.0	H	226.0	11.4	Middle
7439.300000	42.36	54.00	11.64	1000.0	1000.000	169.0	H	228.0	11.1	Top

Table 7: Unwanted radiated emissions (peak detector)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Channel
2400.000000	64.30	75.56	11.26	1000.0	1000.000	204.0	H	290.0	14.4	Bottom
2401.800000	95.56	---	---	1000.0	1000.000	227.0	H	60.0	14.4	Bottom
2440.250000	96.75	---	---	1000.0	1000.000	165.0	H	291.0	14.4	Middle
2480.250000	99.88	---	---	1000.0	1000.000	213.0	H	280.0	14.4	Top
2483.500000	52.87	74.00	21.13	1000.0	1000.000	213.0	H	287.0	14.5	Top
7206.900000	51.61	75.56	23.95	1000.0	1000.000	204.0	H	223.0	11.4	Bottom
7319.200000	51.75	74.00	22.25	1000.0	1000.000	164.0	H	227.0	11.4	Middle
7440.700000	51.47	74.00	22.53	1000.0	1000.000	168.0	H	226.0	11.1	Top

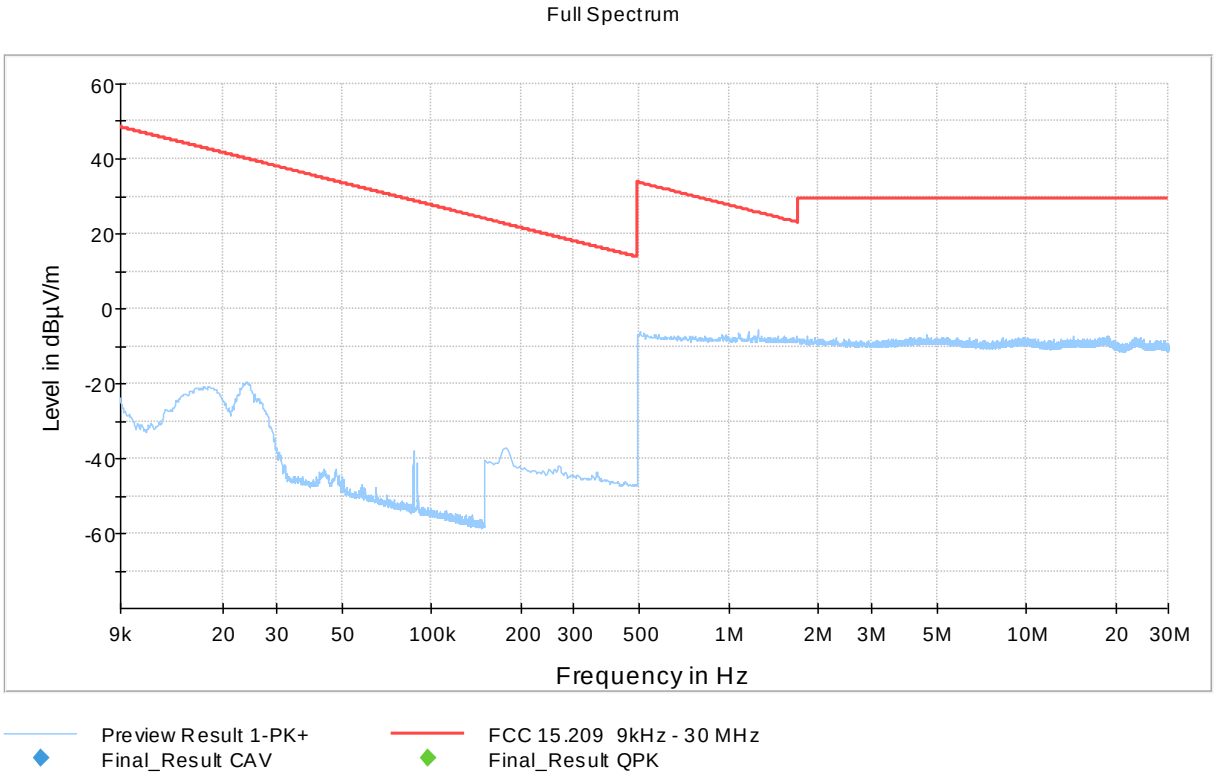

Figure 17: Unwanted radiated emissions 9 kHz – 30 MHz (bottom channel)

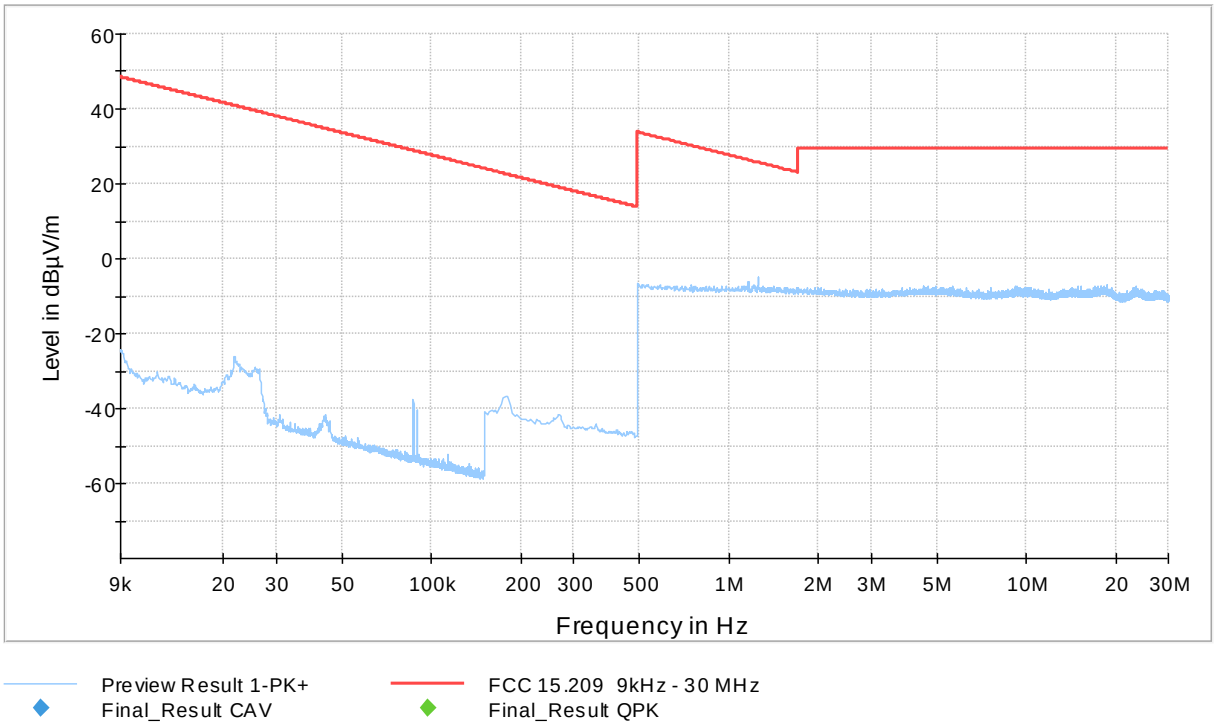

Figure 18: Unwanted radiated emissions 9 kHz – 30 MHz (middle channel)

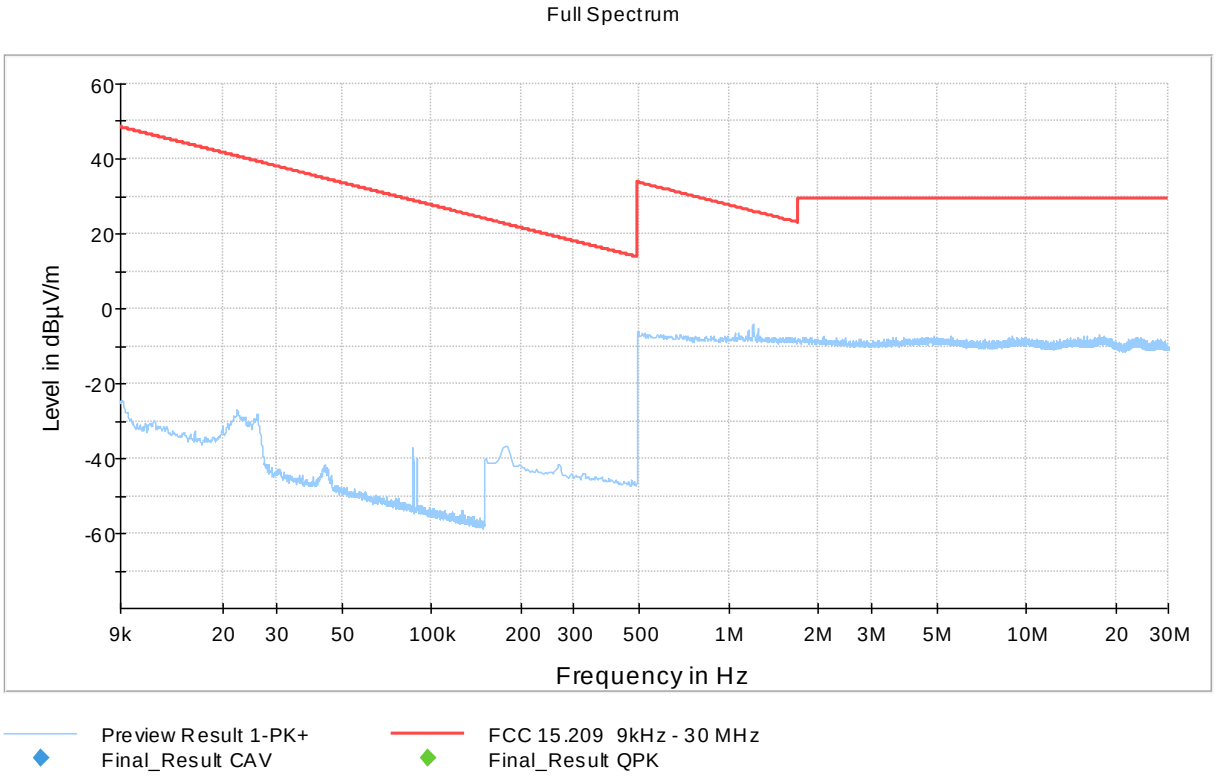

Figure 19: Unwanted radiated emissions 9 kHz – 30 MHz (top channel)

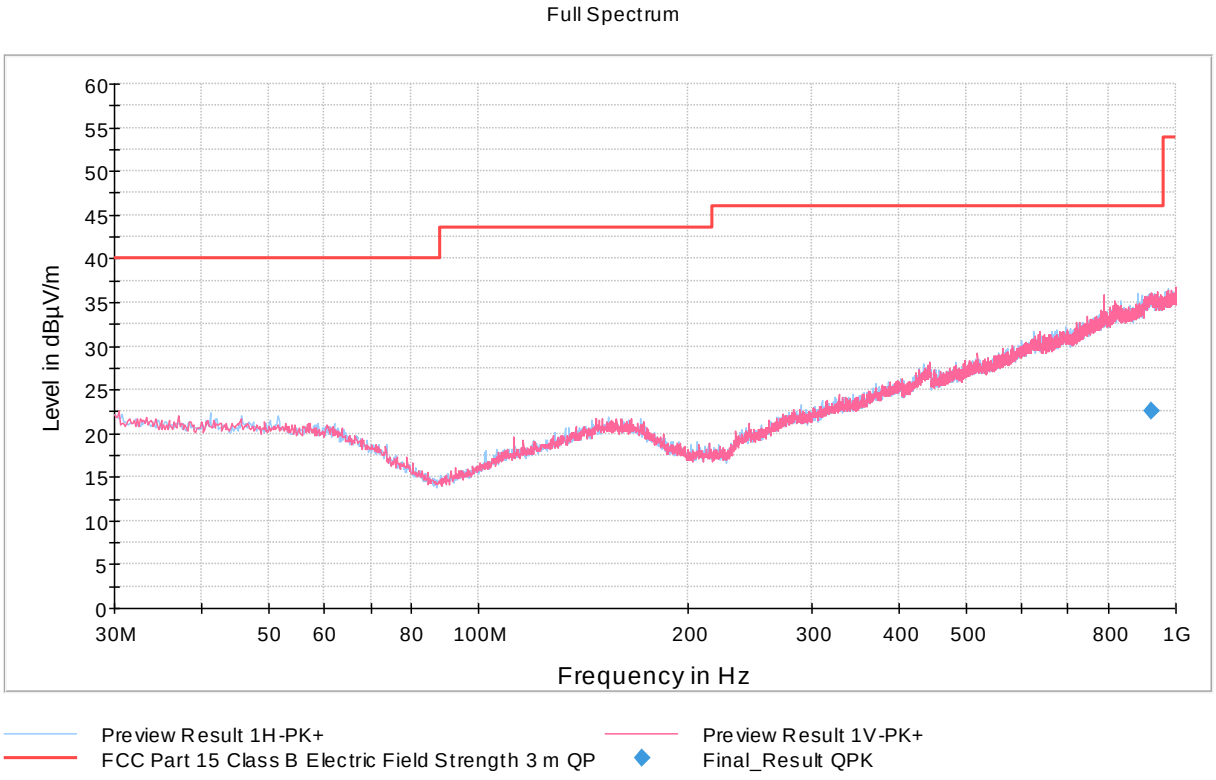

Figure 20: Unwanted radiated emissions 30 – 1000 MHz (bottom channel)

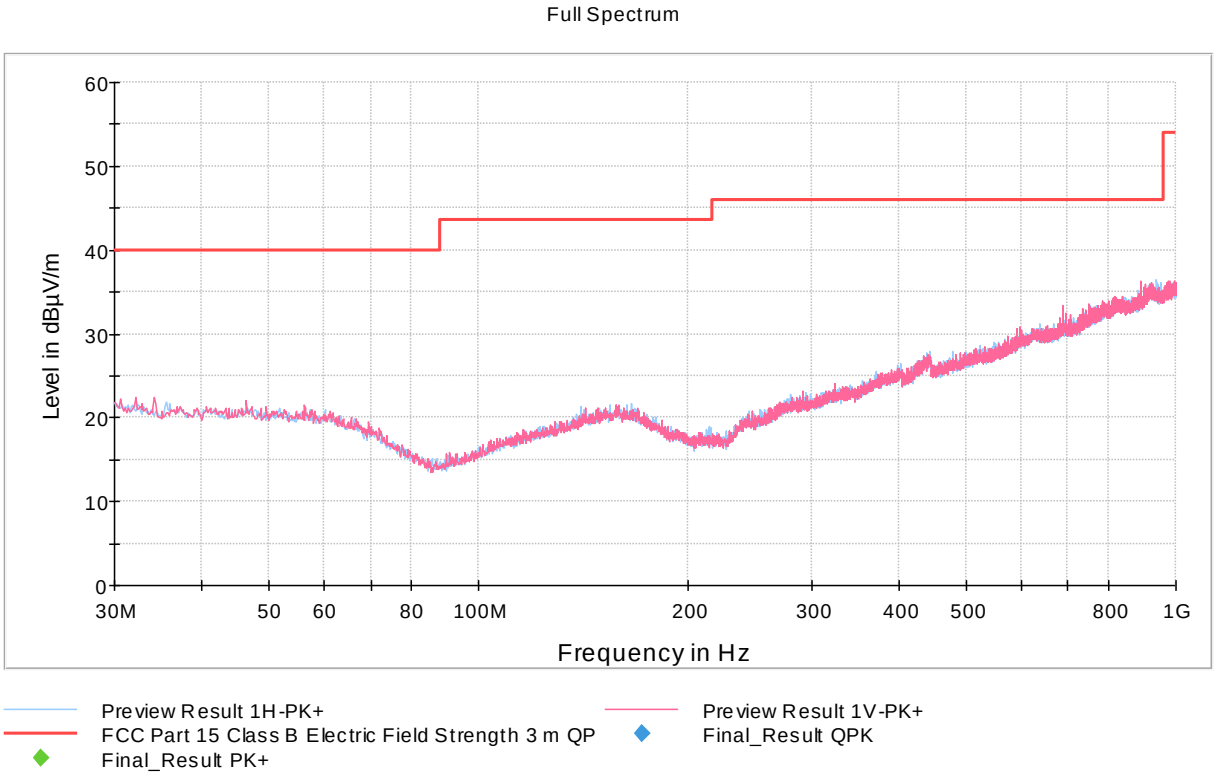

Figure 21: Unwanted radiated emissions 30 – 1000 MHz (middle channel)

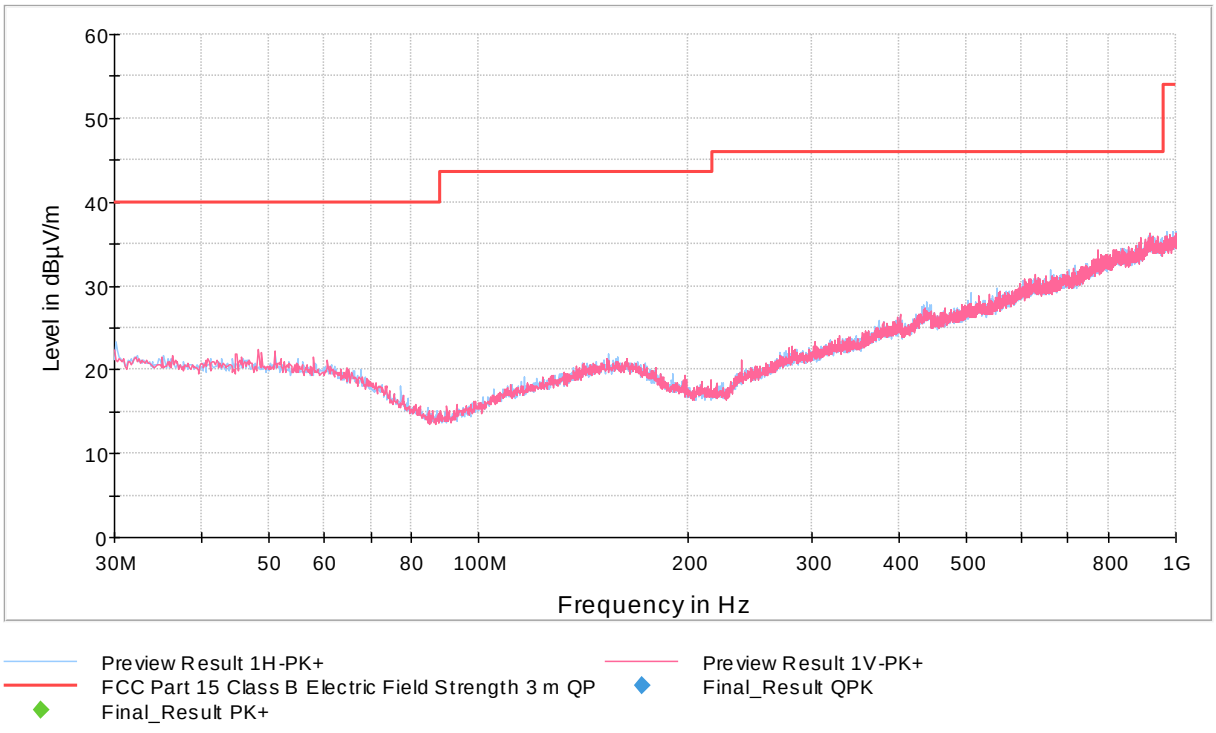

Figure 22: Unwanted radiated emissions 30 – 1000 MHz (top channel)

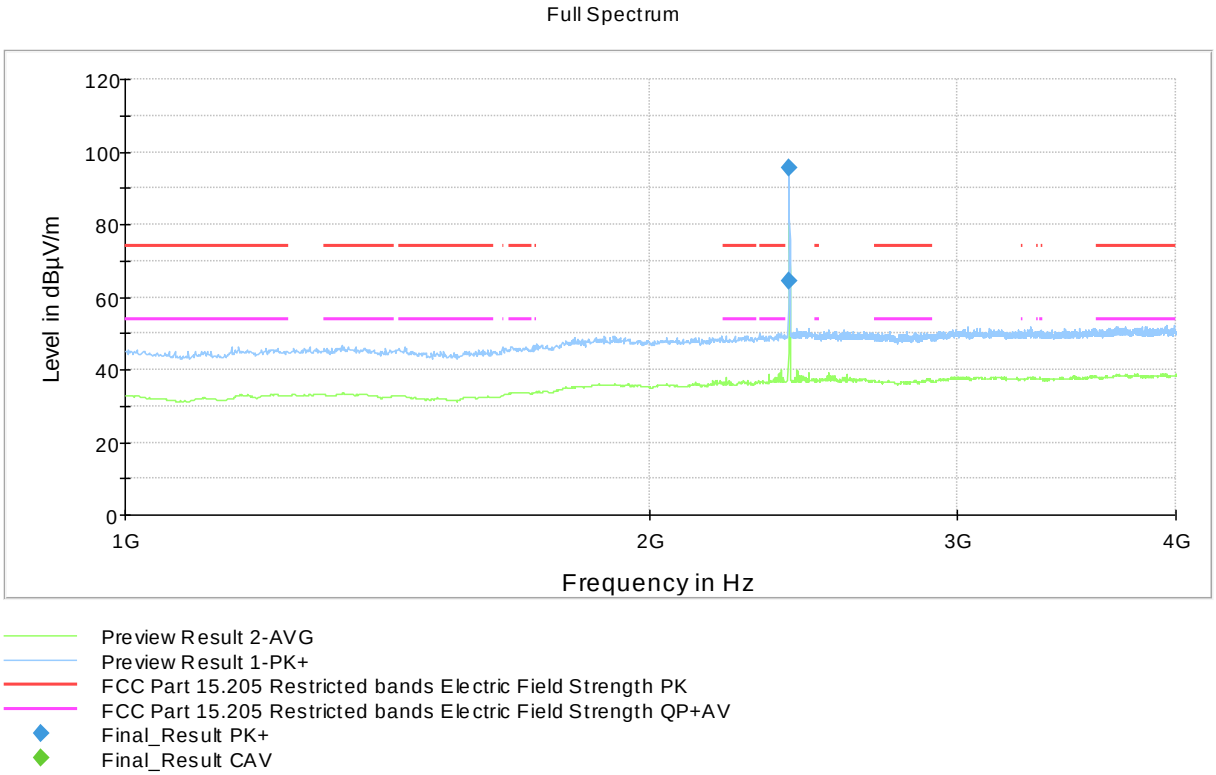

Figure 23: Unwanted radiated emissions 1 – 4 GHz (bottom channel)

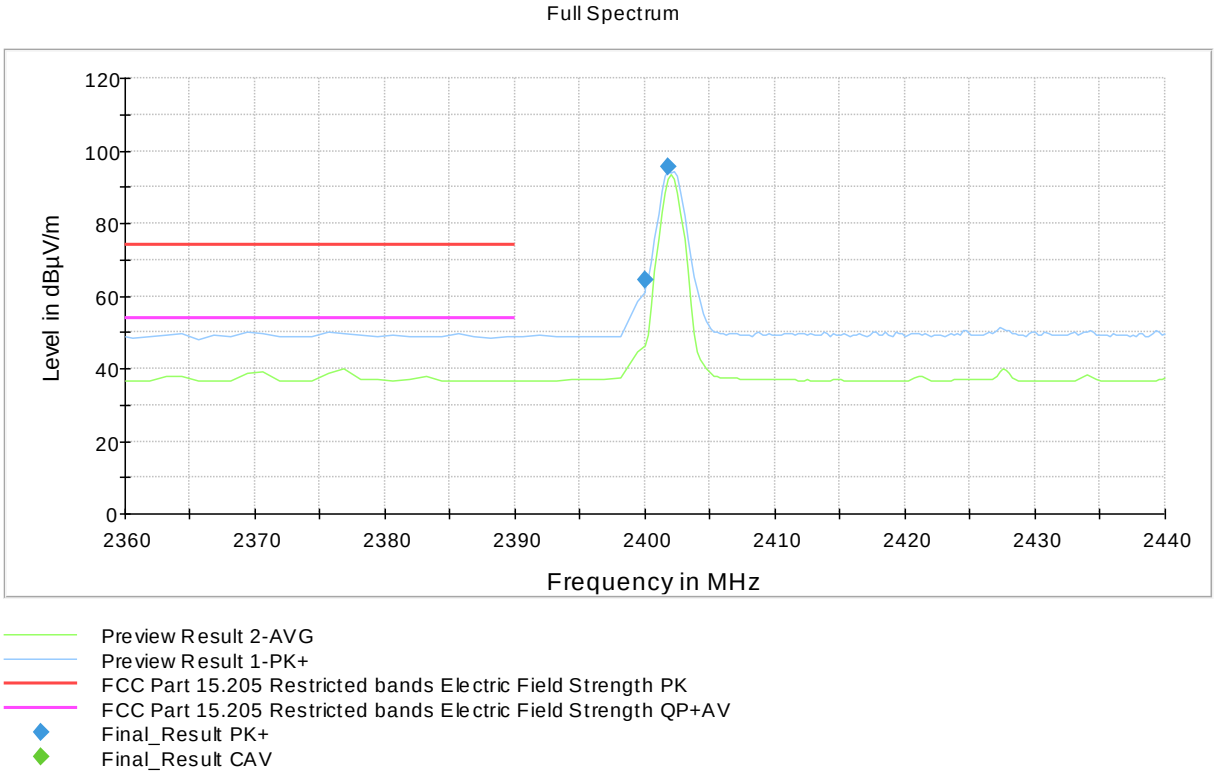

Figure 24: Lower band-edge (bottom channel)

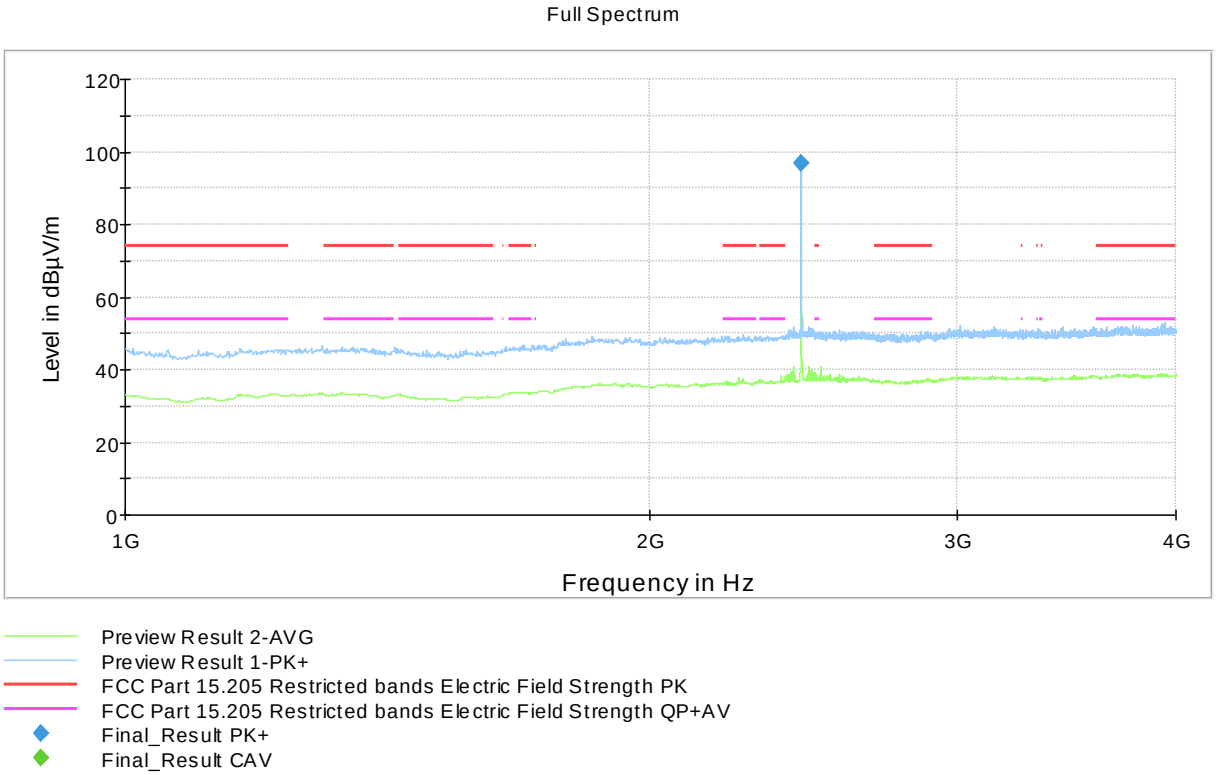

Figure 25: Unwanted radiated emissions 1 – 4 GHz (middle channel)

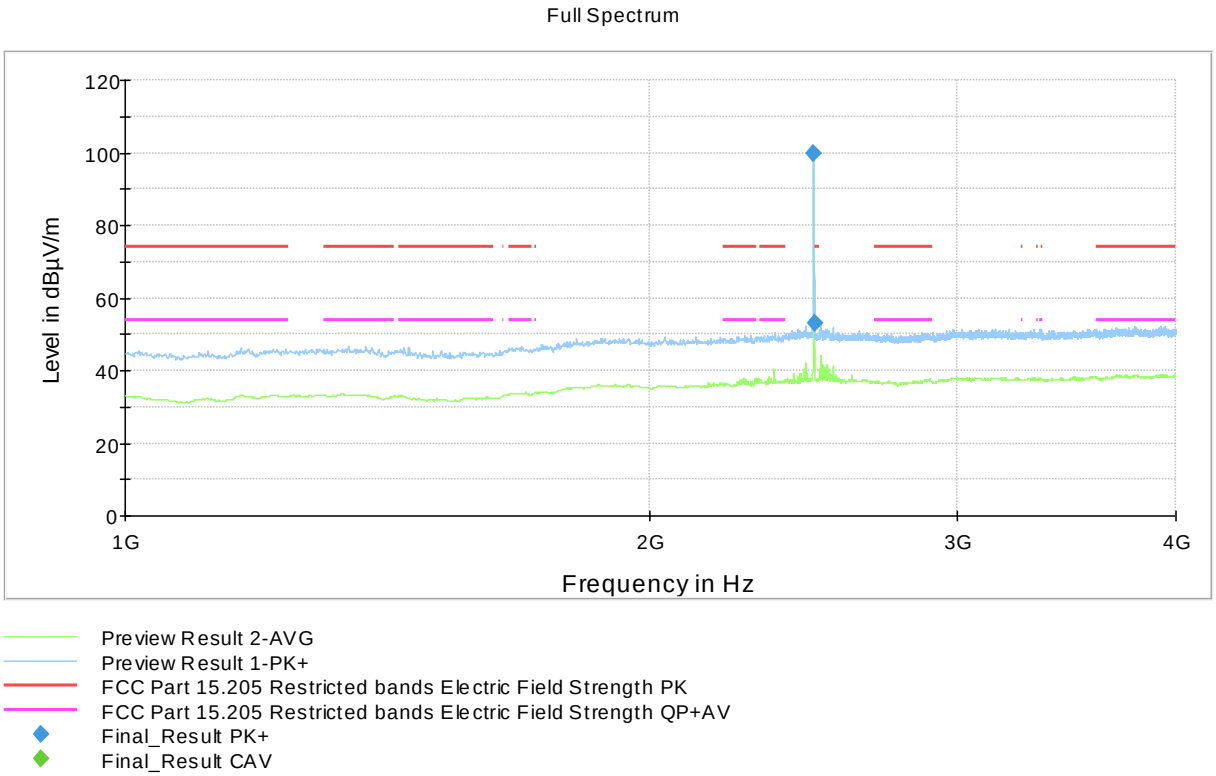

Figure 26: Unwanted radiated emissions 1 – 4 GHz (top channel)

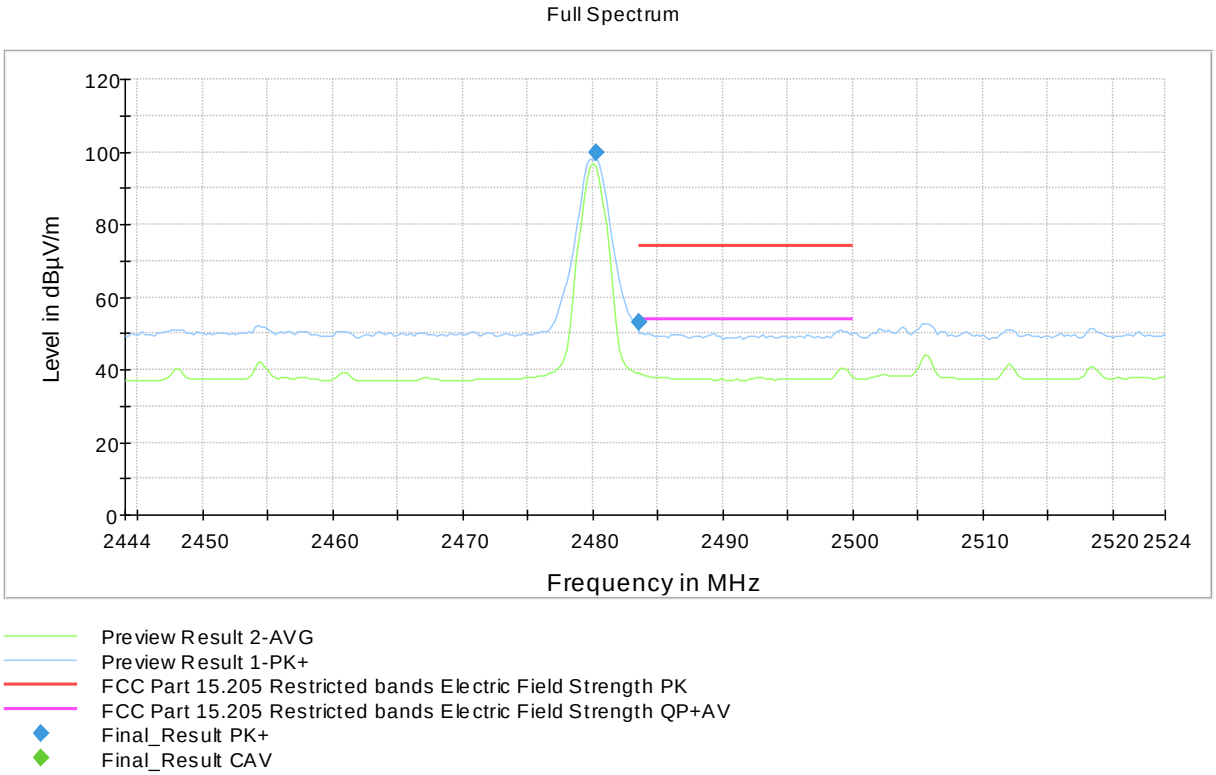

Figure 27: Upper band-edge (top channel)

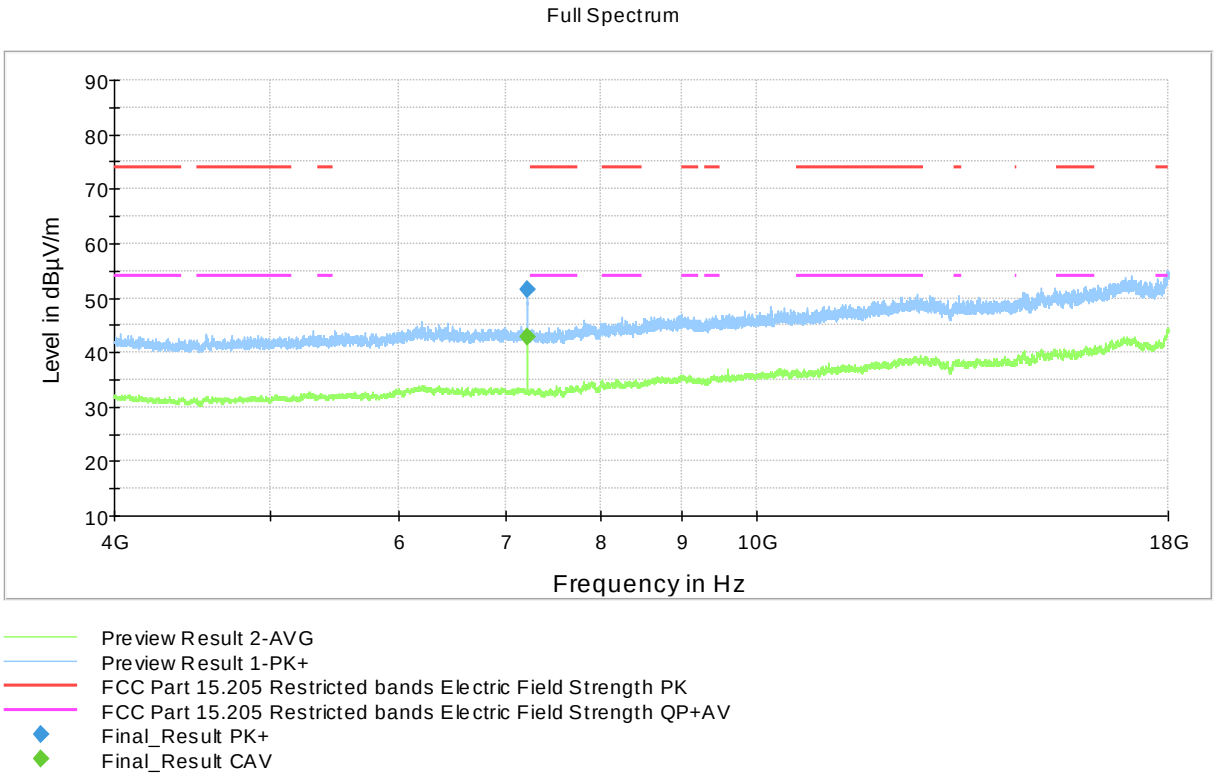

Figure 28: Unwanted radiated emissions 4 – 18 GHz (bottom channel)

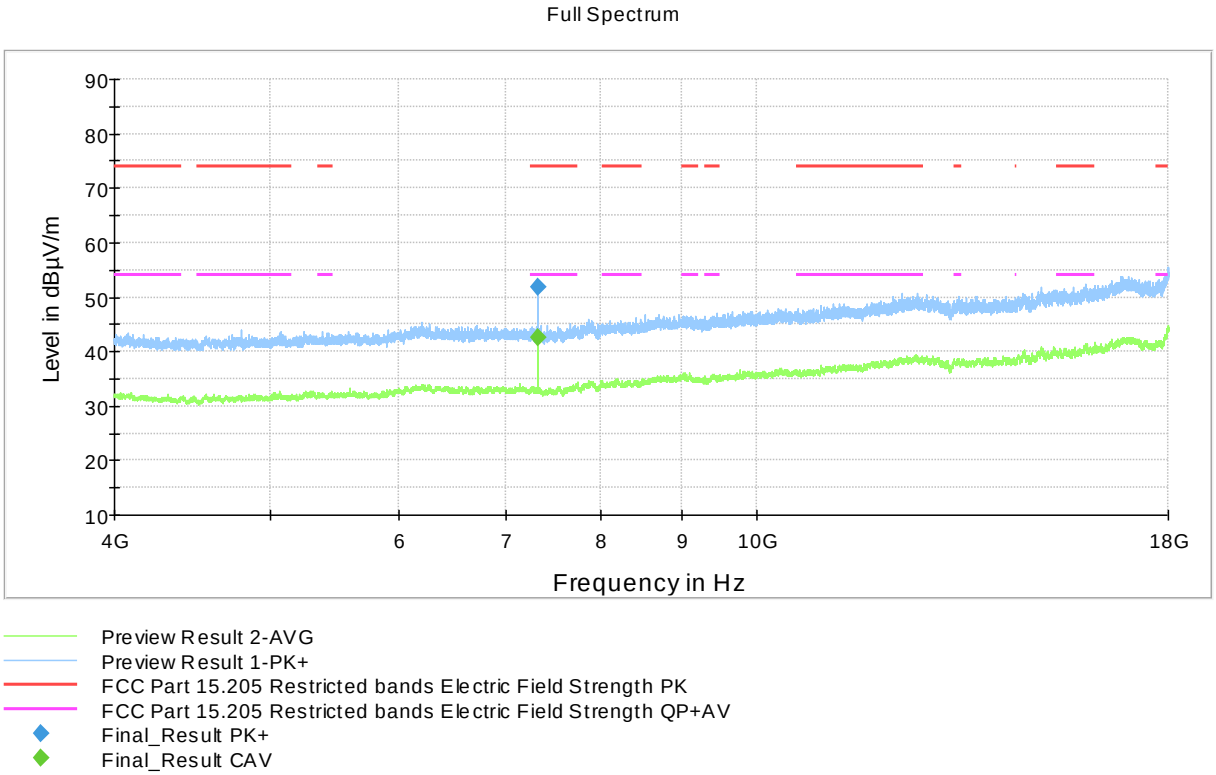

Figure 29: Unwanted radiated emissions 4 – 18 GHz (middle channel)

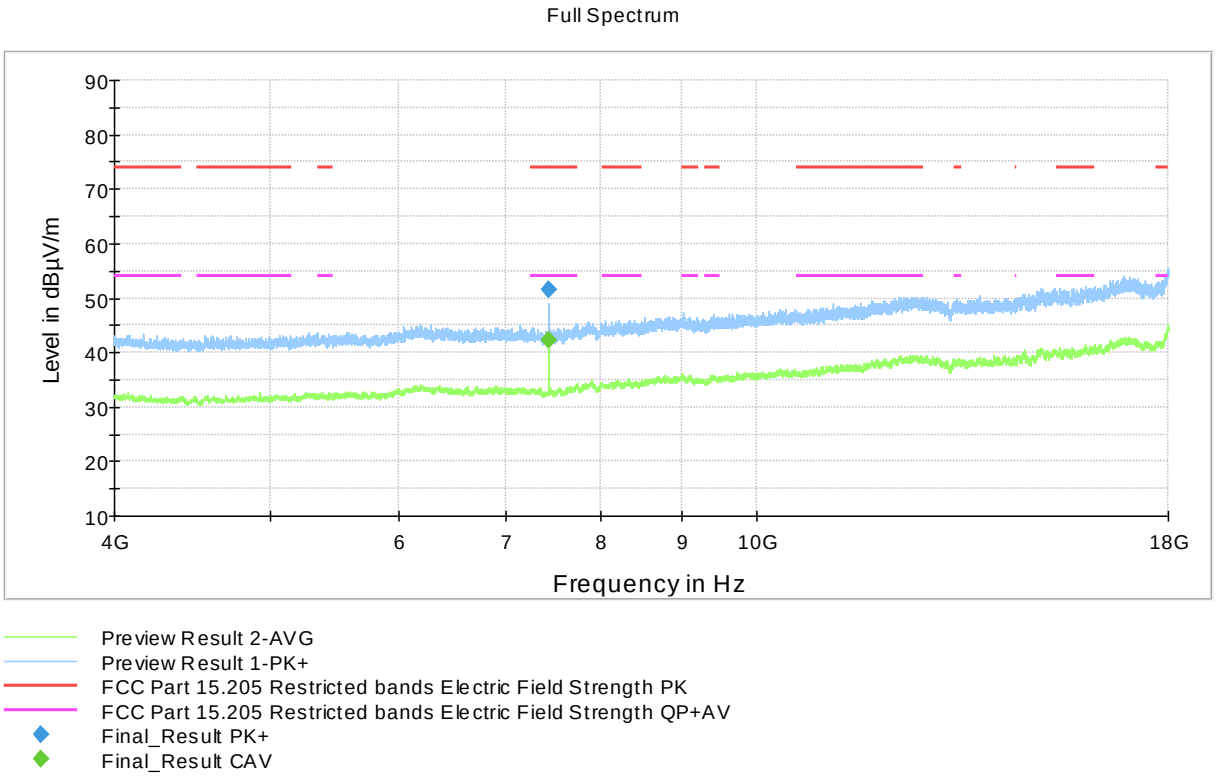

Figure 30: Unwanted radiated emissions 4 – 18 GHz (top channel)

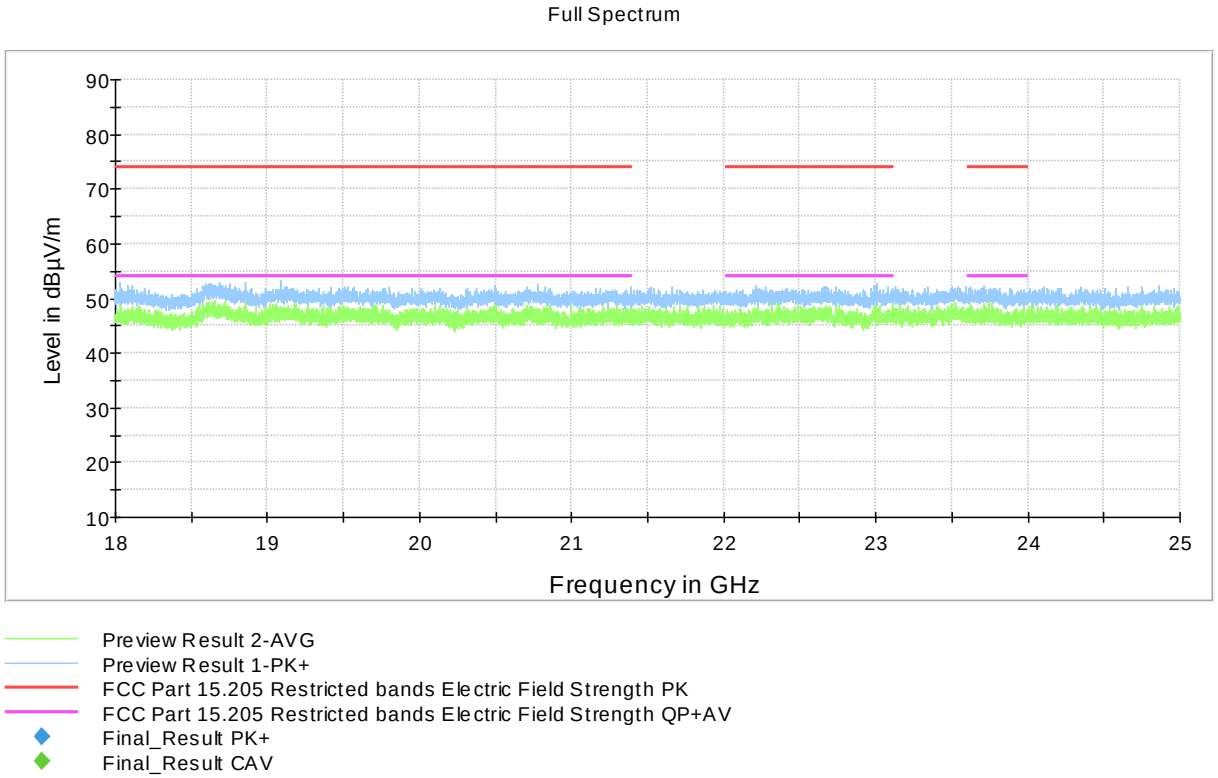

Figure 31: Unwanted radiated emissions 18 – 25 GHz (bottom channel)

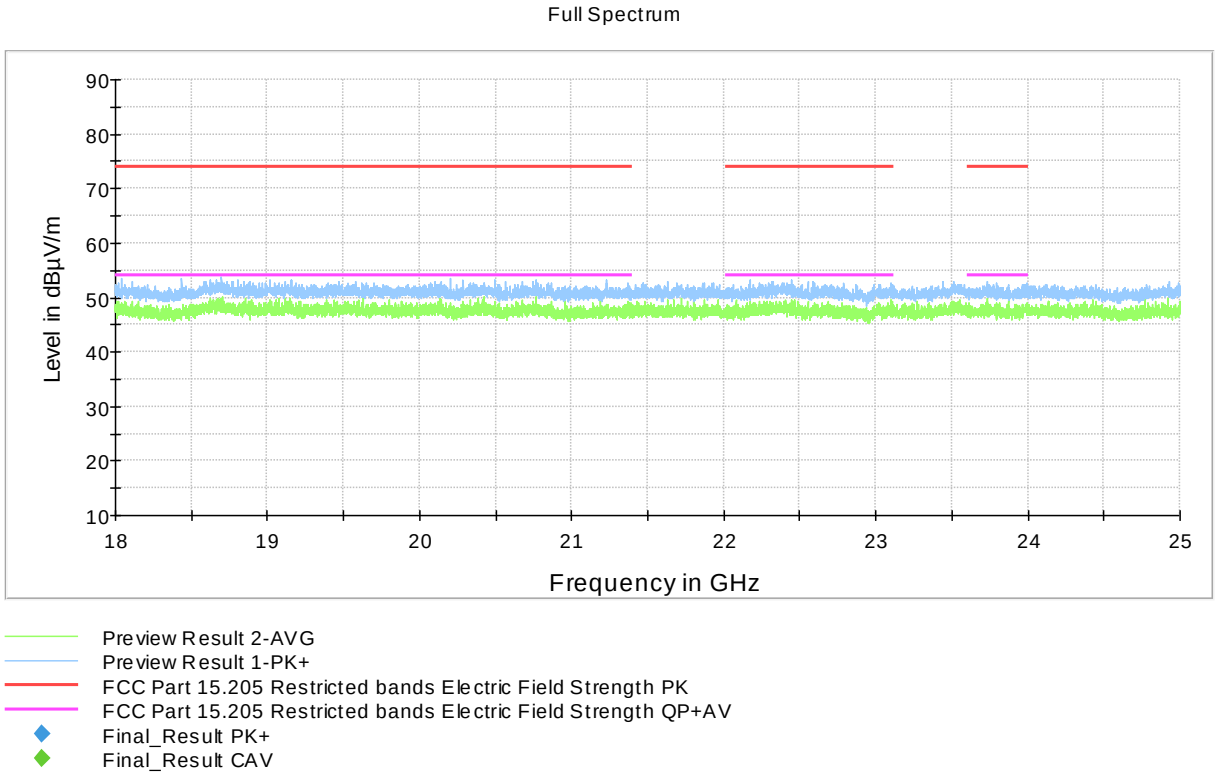

Figure 32: Unwanted radiated emissions 18 – 25 GHz (middle channel)

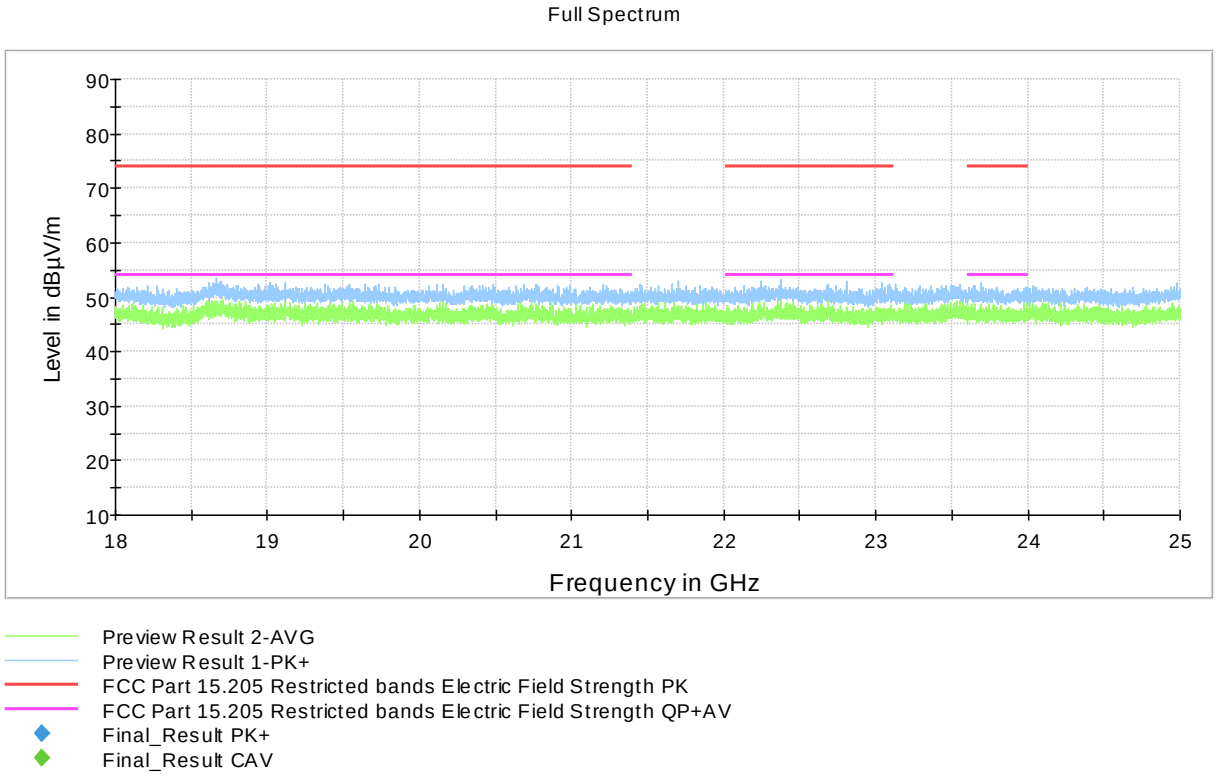

Figure 33: Unwanted radiated emissions 18 – 25 GHz (top channel)

Power Spectral Density

Standard: ANSI C63.10-2020
Tested by: HEM
Date: 5 July 2024
Temperature: 23 °C
Humidity: 52 %RH

Test result: **PASS**

FCC §15.247(e)
RSS-247 clause 5.2 b)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test results

Table 8: Test results for Power Spectral Density

Frequency [MHz]	PSD [dBm/10 kHz]	Limit [dBm/3 kHz]	Result
2402	-2.025	8	PASS
2440	-0.549		PASS
2480	-1.012		PASS

Note: The compliance was determined in a 10 kHz band.

The conducted measurement was performed with a spectrum analyzer using the following settings:

Setting	Value
Span	1.5 MHz
RBW	10 kHz
VBW	30 kHz
Sweep Points	300
Sweep Time	1.5 ms
Detector	MaxPeak
Trace Mode	Max Hold
Sweep Type	Sweep

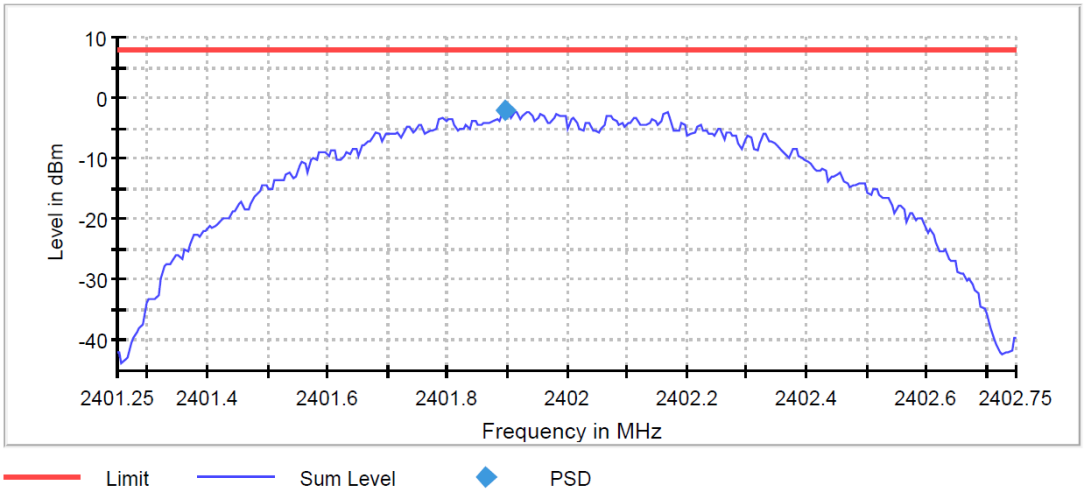

Figure 34: Power Spectral Density (bottom channel)

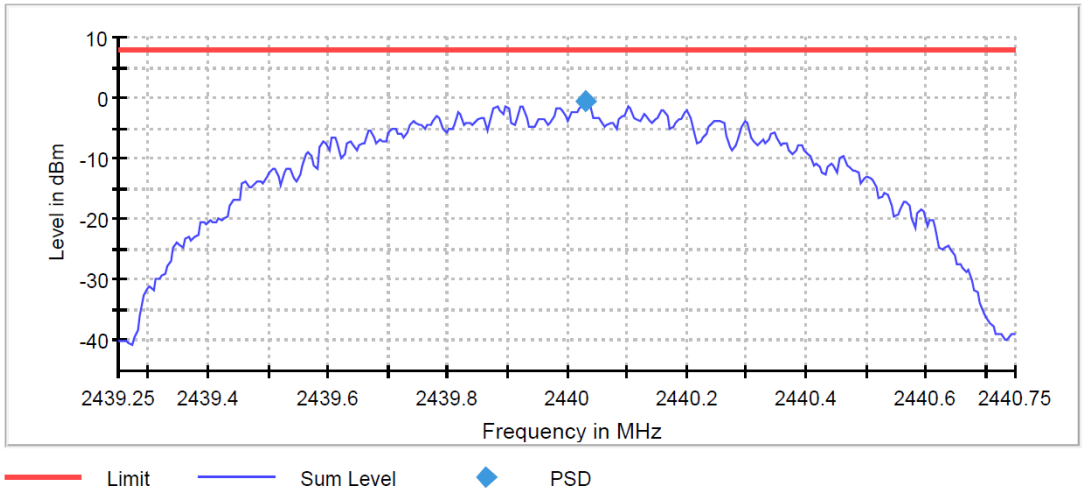

Figure 35: Power Spectral Density (middle channel)

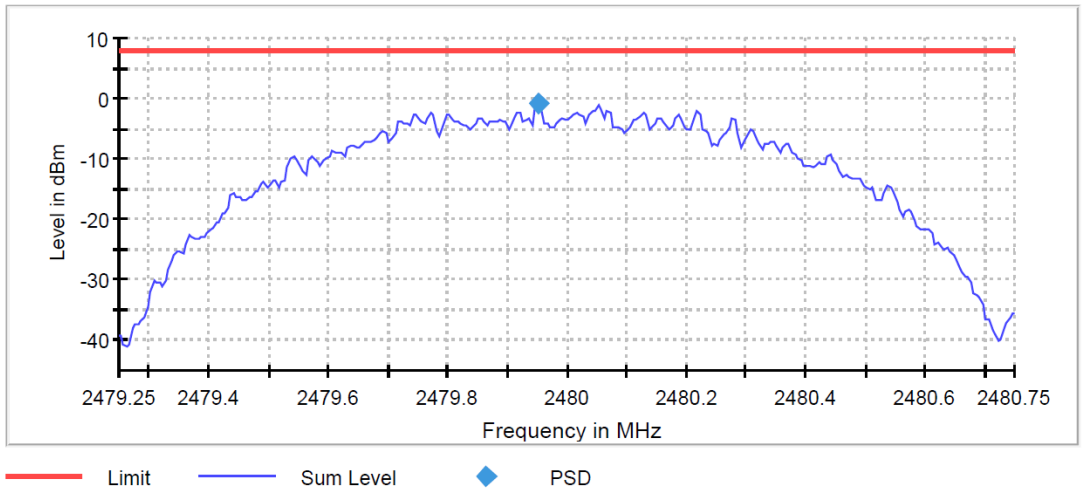

Figure 36: Power Spectral Density (top channel)

TEST EQUIPMENT

Conducted tests

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
BASE MODULE	ROHDE & SCHWARZ	OSP-B157W8	inv. 10883	2023-07-03	2024-07-31
CABLE	SUHNER	SUCOFLEX 104	inv. C119	2023-07-13	2024-07-13
EQUIPMENT RACK	ROHDE & SCHWARZ	TS97-RA	inv. 9291	NCR	NCR
EXTENSION MODULE	ROHDE & SCHWARZ	OSP-B157WX	inv. 10884	2023-07-03	2024-07-31
POWER SUPPLY	THANDAR	PL330TP	inv. 109042	NCR	NCR
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSV40	inv. 10881	2024-06-13	2025-06-12
SWITCH UNIT FOR BASE MODULE	ROHDE & SCHWARZ	OSP120	inv. 10882	2023-07-03	2024-07-31
SWITCH UNIT FOR EXTENSION MODULE	ROHDE & SCHWARZ	OSP120	inv. 9289	2023-07-03	2024-07-31

Radiated tests

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv. 8013	2022-10-25	2024-10-25
ANTENNA	SCHWARZBECK	VULB 9168	inv. 8911	2022-11-29	2024-11-29
ANTENNA	EMCO	3160-09, emi 18-26.5GHz	inv. 7294	2024-01-31	2025-01-31
ANTENNA	ETS LINDGREN	3117	inv. 9569	2023-05-05	2025-05-05
ANTENNA MAST	MATURO	TAM 4.0E	inv. 10181	NCR	NCR
ATTENUATOR	HUBER & SUHNER	6610.19.AA (10dB)	sn. A3	2023-01-04	2025-01-04
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv. 10126	2024-02-16	2025-02-16
CABLE	SUHNER	SUCOFLEX 126E 18-26.5GHz	inv. C134	2024-04-05	2025-04-05
CABLE	SUHNER	SUCOFLEX 126E 1-18GHz	inv. C137	2024-04-05	2025-04-05
COAX CHAIN K5 EMI < 1GHz	-	C053+FP3AirC+C138	-	2024-03-28	2025-03-28
COAX CHAIN K5 EMI 1GHz-26.5GHz	-	C135+C149	-	2024-03-28	2025-03-28
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv. 10679	2024-06-12	2025-06-11
FILTER	WAINWRIGHT	HP, WHKX4.0/18G-10SS	inv. 10403	2023-01-09	2025-01-09
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv. 10183	NCR	NCR
RF PREAMPLIFIER	CIAO	CA1840-5019	inv. 10593	2023-09-15	2024-09-15
RF PREAMPLIFIER	CIAO	CA118-3123	inv. 10278	2023-09-15	2024-09-15
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv. 10517	2023-10-30	2024-10-30
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
TURNTABLE	MATURO	DS430 UPGRADED	inv. 10182	NCR	NCR

NCR = No Calibration Required

END OF REPORT