Test Report

HELEM2304000201-1 v1.1

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:	Remote controller for AINA PTT with BLE connection
Model:	AINA MULTIFUNCTION BUTTON
Type:	AMB
Trademark:	AINA
Manufacturer/Customer:	AINA Wireless Finland Oy Joensuunkatu 7 G FI-24100, Salo 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 Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under §15.247 of the FCC rules (April 2, 2019)

Date:	1 July 2024	Date:	1 July 2024
Issued by:	Pekka Kälviäinen Testing Engineer	Checked by:	Henri Mäki 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	13 July 2023
1.1	RSS-247 Issue 2 updated to Issue 3	1 July 2024

PRODUCT DESCRIPTION

Equipment Under Test

Equipment Under Test:	Remote controller for AINA PTT with BLE connection
Trademark:	AINA
Model:	AINA MULTIFUNCTION BUTTON
Type:	AMB
Serial no:	-
FCC ID:	-
IC:	-
Parallel models:	AINA PTT SMART BUTTON. Electrically identical, different housing.
Radio module or chip:	Nordic Semiconductor nRF52833

General Description

The equipment under test is a remote controller for AINA PTT voice responder. Connection works with Bluetooth Low Energy. The EUT also has a passive NFC tag.

Classification

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

Samples and Modifications

No.	Name	Description
1	Sample 1	Sample with test software enabling continuous transmit mode. Used for radiated tests.
2	Sample 2	Sample with test software enabling continuous transmit mode. Temporary antenna connector soldered in to replace original antenna. Used for conducted tests.

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 ceramic chip
Antenna gain:	+0.5 dBi
Antenna count:	1
EUT dimensions:	Height: 16 mm Width: 46 mm Length: 76 mm
Power requirements:	3.0 VDC (CR2032 battery)
Operating temperature range:	-20…+60 °C

Ports and Cables

Cable / Port	Description
-	-

Peripherals

Peripheral	Description / Usage
-	-

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.203	Antenna Requirement	**PASS**
§15.207 / RSS-Gen 8.8	AC Power-Line Conducted Emissions	**PASS**
§15.247(a)(2) / RSS-247 5.2 a)	6 dB Bandwidth	**PASS**
RSS-Gen 6.7	Occupied Bandwidth 99 %	**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	**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 had a test software installed that allowed the radio to be set to transmit continually with the EUT buttons. Same modulation and transmit power as with the production model were used during the tests. The orientation with the highest emissions was determined by testing all possible orientations.

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 and was configured with the EUT buttons.

Radiated tests were performed in a semi-anechoic chamber with a measurement distance of 3 meters. During measurements above 1 GHz absorbers were placed on the floor. The EUT was configured with its own buttons.

A modified CR2032 battery was used in all tests, allowing the use of a laboratory power supply to feed power into the EUT instead of a normal CR2032 battery. This was done because a CR2032 cannot supply enough power for continuous radio transmit. Input voltage was 3.0 DCV.

Figure 1: Test setup block diagram (conducted RF tests)

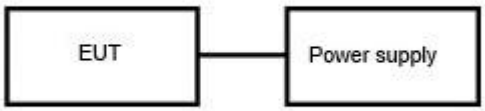

Figure 2: Test setup block diagram (radiated tests)

Table 1: Test frequencies and settings

Data rate	Channel	Frequency [MHz]
1 Mbps (LE 1M PHY)	37	2402
	17	2440
	39	2480

Test Facility

Testing Laboratory / address: FCC designation number: **FI0002** ISED CAB identifier: **T004**	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI 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: HAM
Date: 7 July 2023
Test result: **PASS**

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	

6 dB Bandwidth

Standard:	ANSI C63.10-2020
Tested by:	HAM
Date:	7 July 2023
Temperature:	24 °C
Humidity:	44 %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 emissions 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 emissions.

The minimum 6 dB bandwidth shall be at least 500 kHz.

Sample 2 was used for the test.

Test results

Table 2: Test results for 6 dB Bandwidth

Data Rate	Frequency [MHz]	6 dB BW [kHz]	Limit [kHz]	Result
1 Mbps	2402	752.476	≥ 500	**PASS**
	2440	752.476		**PASS**
	2480	752.476		**PASS**

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

Setting	Value
Span	4.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
Sweep Points	101
Sweep Time	18.938 µs
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
Filter	3 dB
Trace Mode	Max Hold
Sweep Type	FFT
Preamp	off

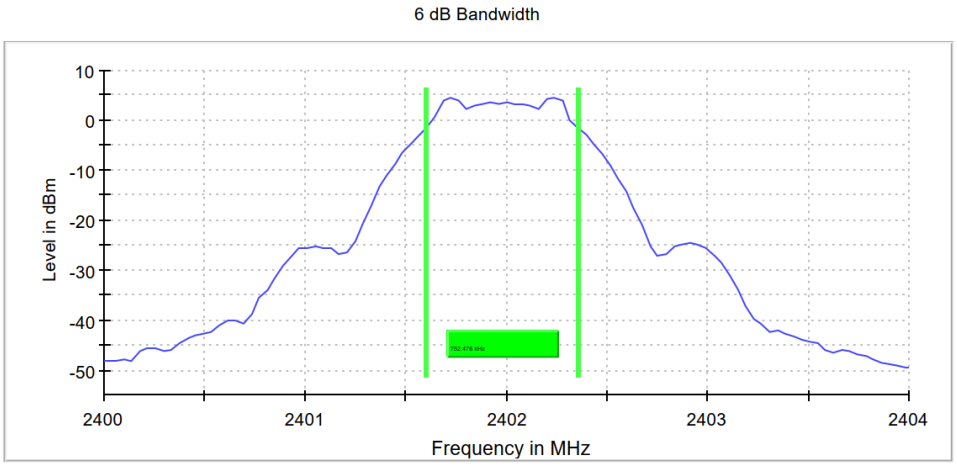

Figure 3: 6 dB Bandwidth (TX 2402 MHz)

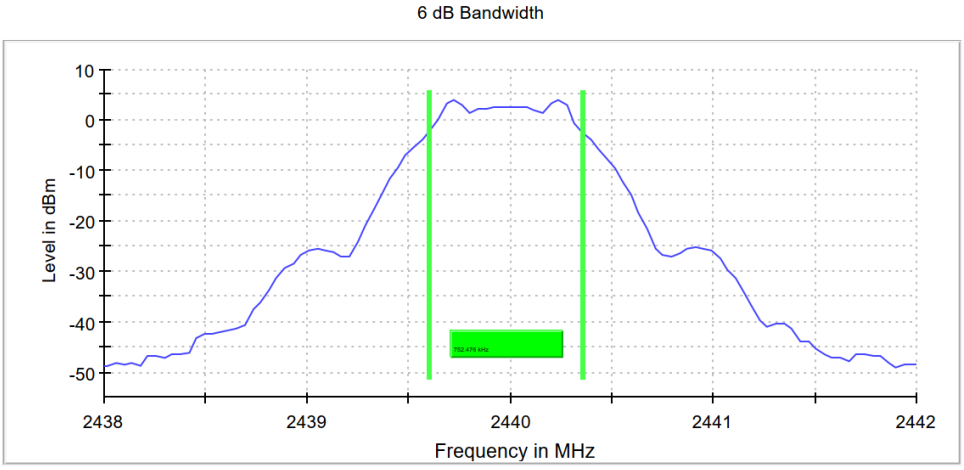

Figure 4: 6 dB Bandwidth (TX 2440 MHz)

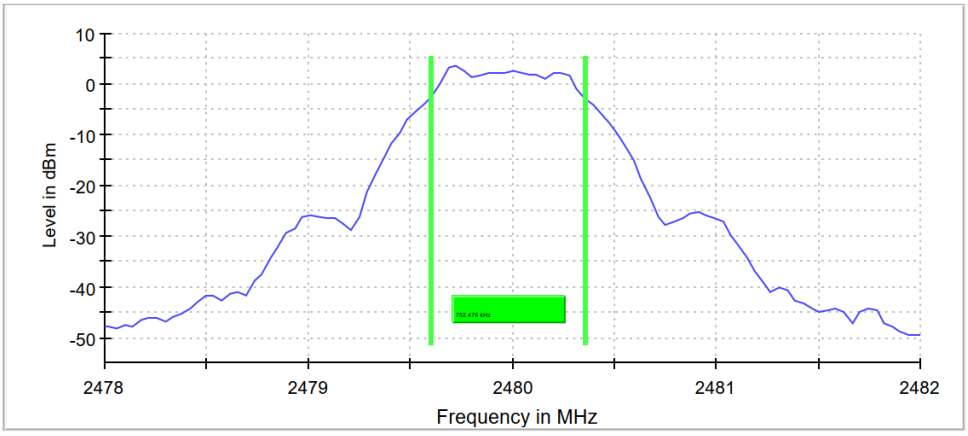

Figure 5: 6 dB Bandwidth (TX 2480 MHz)

Occupied Bandwidth 99%

Standard: RSS-Gen
Tested by: HAM
Date: 7 July 2023
Temperature: 24 °C
Humidity: 44 %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 emission is contained. Sample 2 was used for the test.

Test results

Table 3: Test results for Occupied Bandwidth 99%

Data Rate	Frequency [MHz]	OBW 99% [MHz]	Limit [MHz]	Result
1 Mbps	2402	1.070000	-	**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	4.000 MHz
RBW	20.000 kHz
VBW	100.000 kHz
Sweep Points	400
Sweep Time	94.824 µs
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
Filter	3 dB
Trace Mode	Max Hold
Sweep Type	FFT
Preamp	off

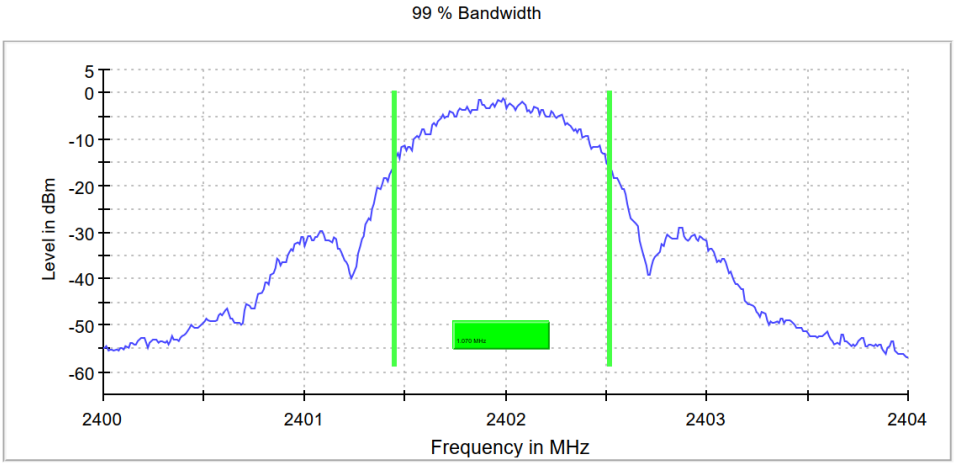

Figure 6: Occupied Bandwidth 99% (TX 2402 MHz)

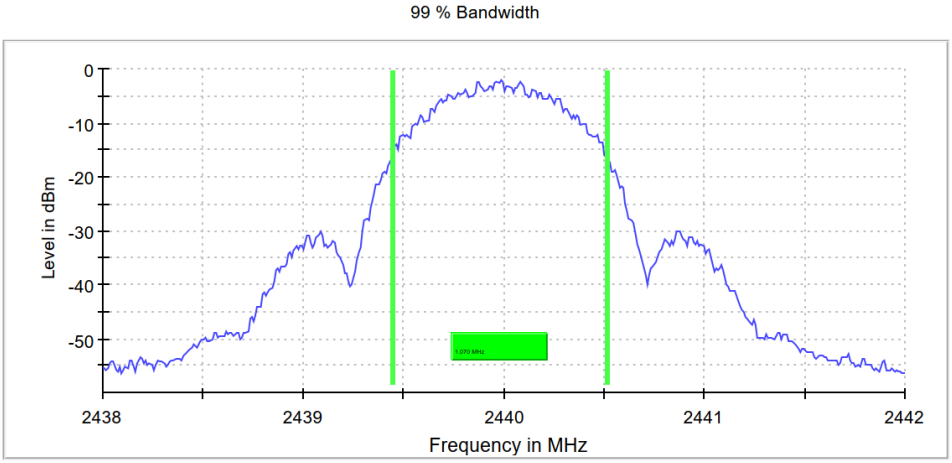

Figure 7: Occupied Bandwidth 99% (TX 2440 MHz)

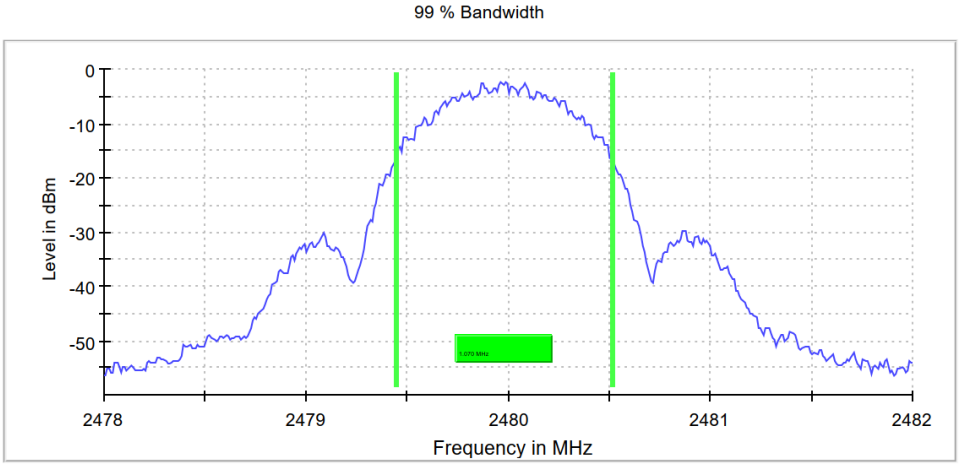

Figure 8: Occupied Bandwidth 99% (TX 2480 MHz)

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10-2020
Tested by:	HAM
Date:	7 July 2023
Temperature:	24 °C
Humidity:	44 %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 radiator 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.
Sample 2 was used for the test.

Test results

Table 4: Test results for Maximum Peak Conducted Output Power

Data Rate	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Result
1 Mbps	2402	4.9	30	PASS
	2440	4.1		PASS
	2480	3.9		PASS

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

Setting	Value
Span	9.000 MHz
RBW	3.000 MHz
VBW	10.000 MHz
SweepPoints	101
Sweeptime	1.271 µs
Reference Level	10.000 dBm
Attenuation	30.000 dB
Detector	MaxPeak
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off

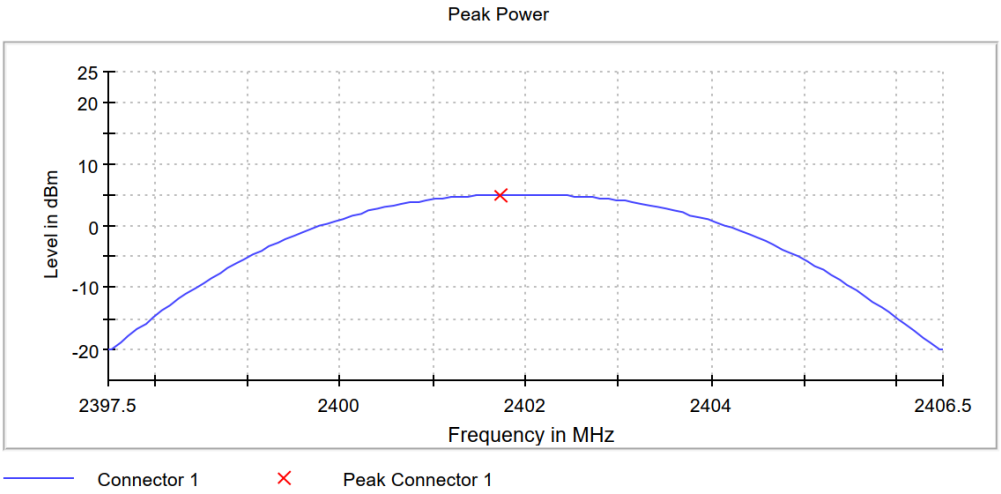

Figure 9: Maximum Peak Conducted Output Power (TX 2402 MHz)

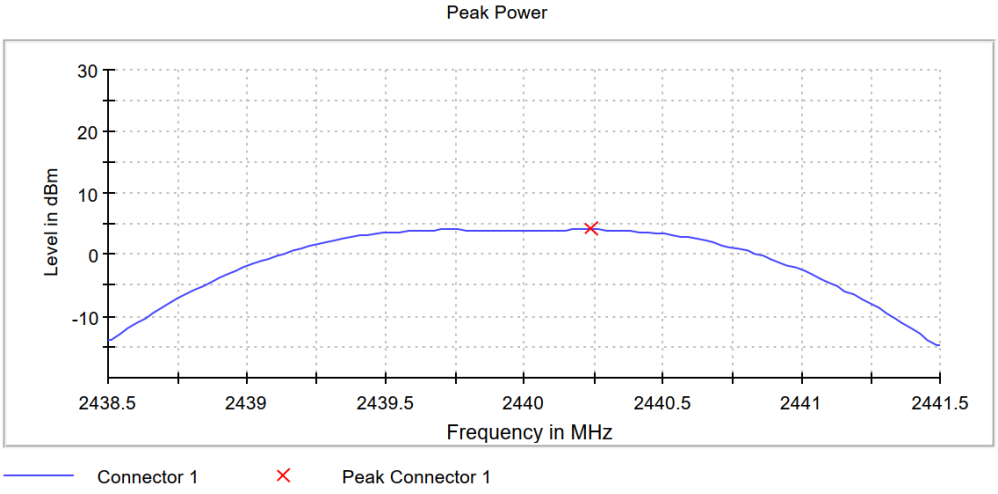

Figure 10: Maximum Peak Conducted Output Power (TX 2440 MHz)

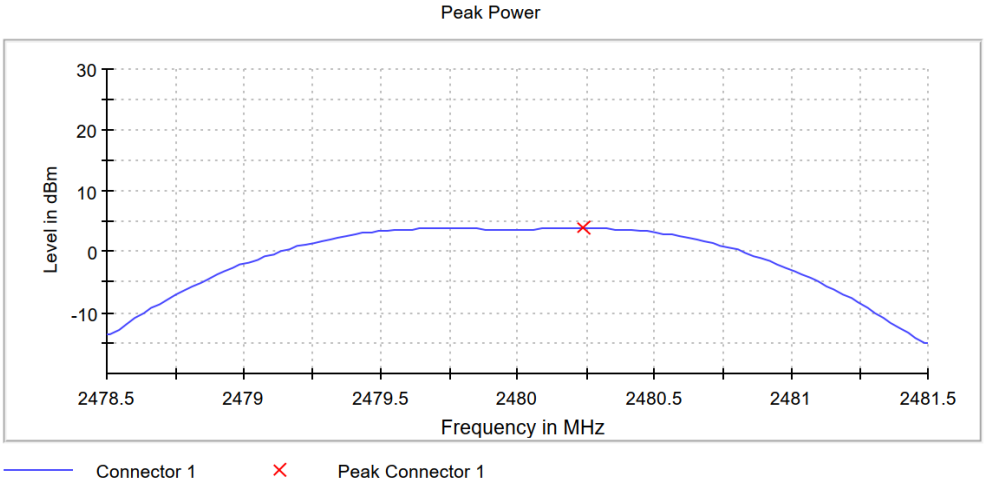

Figure 11: Maximum Peak Conducted Output Power (TX 2480 MHz)

Unwanted Emissions (conducted)

Standard:	ANSI C63.10-2020
Tested by:	HAM
Date:	7 July 2023
Temperature:	24 °C
Humidity:	44 %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.

Sample 2 was used for the test.

Test results

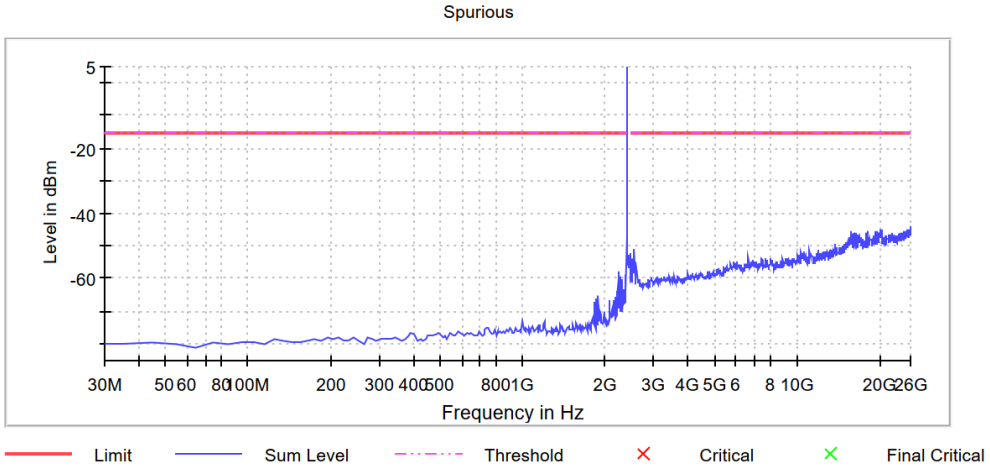

Figure 12: Unwanted Emissions, conducted (TX 2402 MHz)

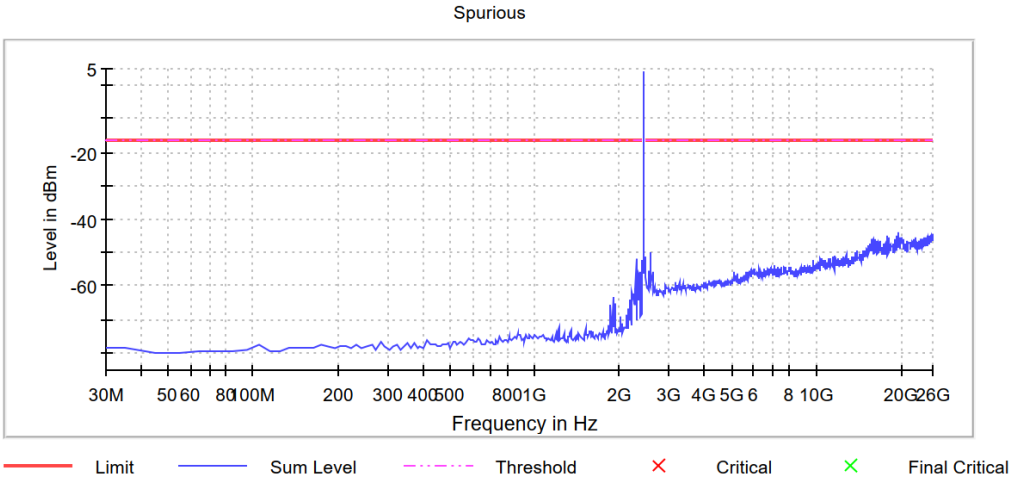

Figure 13: Unwanted Emissions, conducted (TX 2440 MHz)

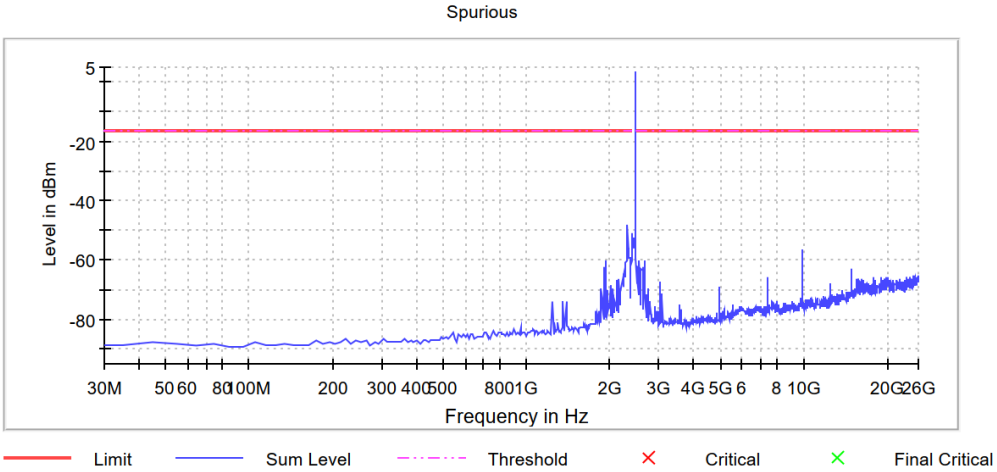

Figure 14: Unwanted Emissions, conducted (TX 2480 MHz)

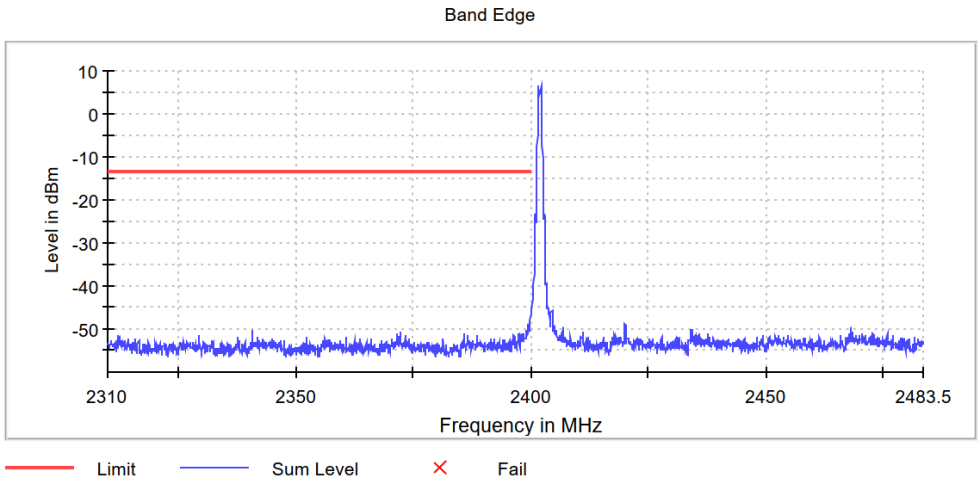

Figure 15: Lower Band-Edge, conducted (TX 2402 MHz)

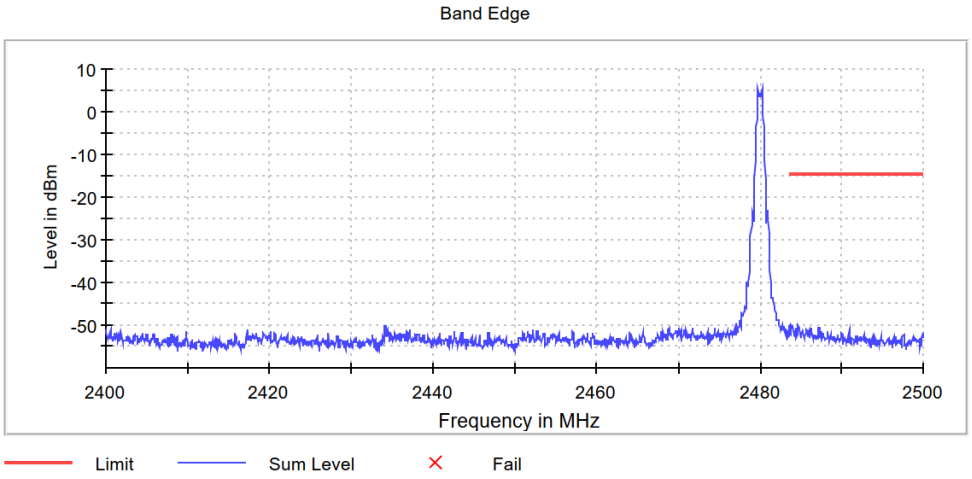

Figure 16: Upper Band-Edge, conducted (TX 2480 MHz)

Unwanted Emissions (radiated)

Standard:	ANSI C63.10-2020	
Tested by:	LAS	LAS
Date:	8 July 2023	10 July 2023
Temperature:	22 °C	23 °C
Humidity:	55 %RH	46 %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.

Investigative measurements were performed in order to find the worst-case orientation for the EUT. The final measurements were performed in the worst-case orientation.

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.

Sample 1 was used for the test.

Test results (TX 2402 MHz)

Table 5: Test results with quasi-peak detector (TX 2402 MHz)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.440000	16.84	40.00	23.16	15 x 1000.0	120.000	378.0	V	0.0	16.8
947.725000	24.05	46.00	21.95	15 x 1000.0	120.000	247.0	H	133.0	31.9

Table 6: Test results with peak detector (TX 2402 MHz)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2400.000000	53.03	75.94 *)	22.91	15 x 1000.0	1000.000	226.0	V	73.0	13.7
2402.200000	95.94	---	---	15 x 1000.0	1000.000	271.0	H	243.0	13.7

*) -20 dBc

Table 7: Test results with average detector (TX 2402 MHz)

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2370.025000	35.87	54.00	18.13	15 x 1000.0	1000.000	225.0	H	111.0	13.3
2400.000000	43.45	---	---	15 x 1000.0	1000.000	200.0	H	255.0	13.7
2494.750000	36.02	54.00	17.98	15 x 1000.0	1000.000	237.0	H	167.0	13.8
2882.050000	36.68	54.00	17.32	15 x 1000.0	1000.000	180.0	V	29.0	14.4
3266.900000	36.51	54.00	17.49	15 x 1000.0	1000.000	100.0	V	240.0	14.3
3334.900000	36.53	54.00	17.47	15 x 1000.0	1000.000	215.0	V	239.0	14.4
3345.950000	36.56	54.00	17.44	15 x 1000.0	1000.000	215.0	V	26.0	14.4
17995.900000	38.39	54.00	15.61	15 x 1000.0	1000.000	230.0	V	0.0	26.3
18676.950000	40.17	54.00	13.83	15 x 1000.0	1000.000	100.0	H	171.0	8.0

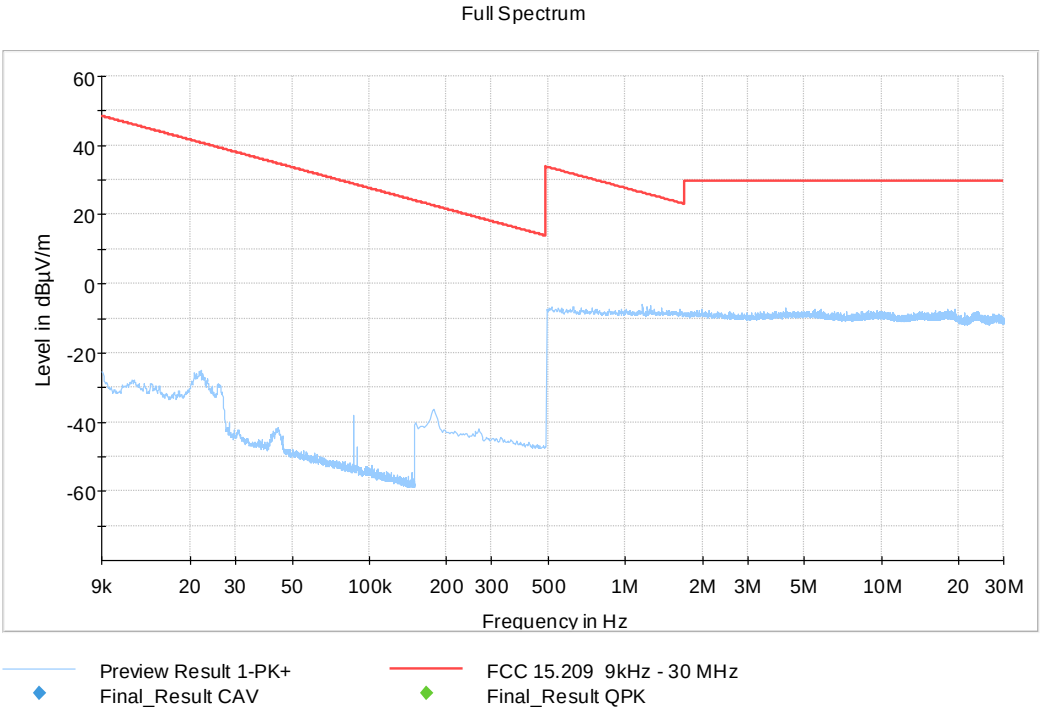

Figure 17: Unwanted Emissions, radiated 9 kHz – 30 MHz (TX 2402 MHz)

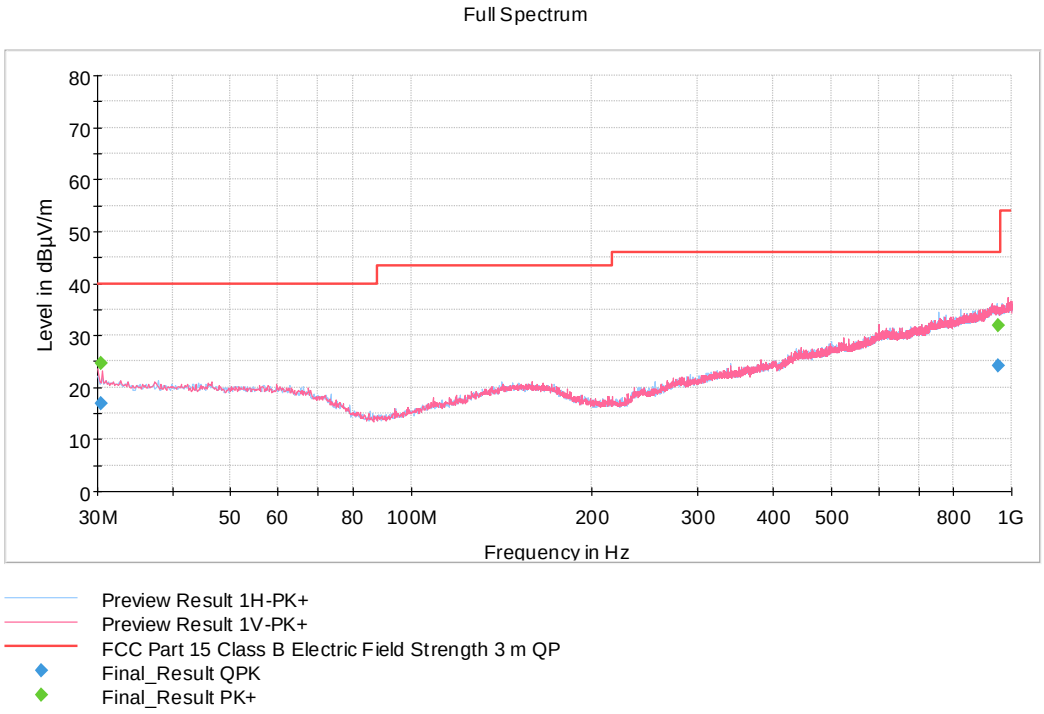

Figure 18: Unwanted Emissions, radiated 30 – 1000 MHz (TX 2402 MHz)

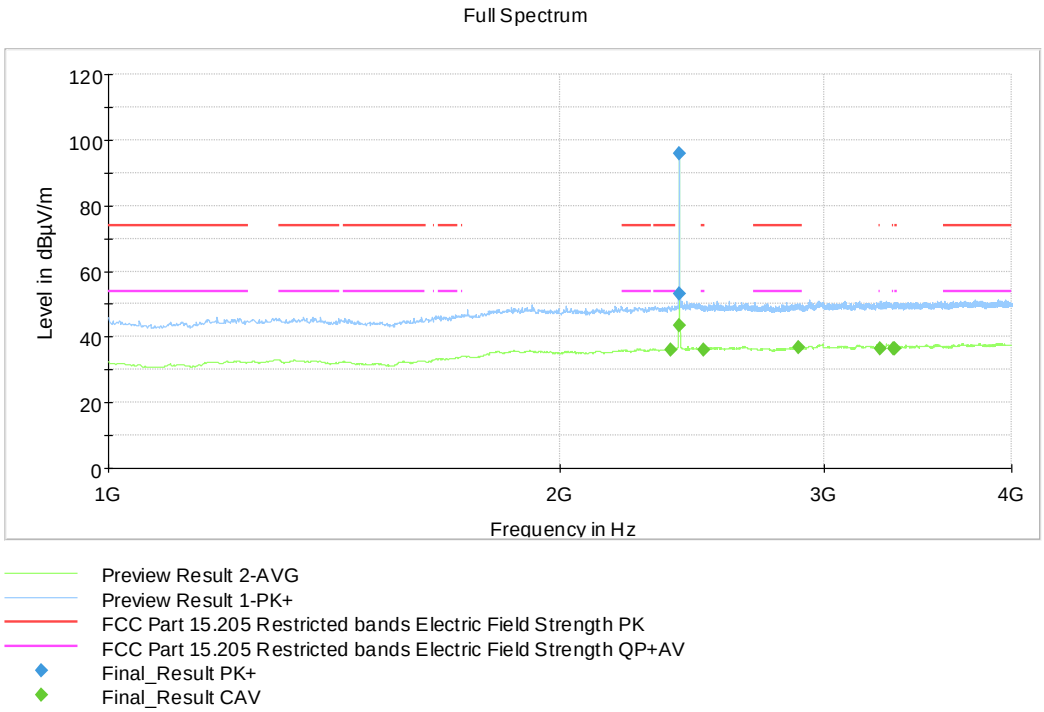

Figure 19: Unwanted Emissions, radiated 1 – 4 GHz (TX 2402 MHz)

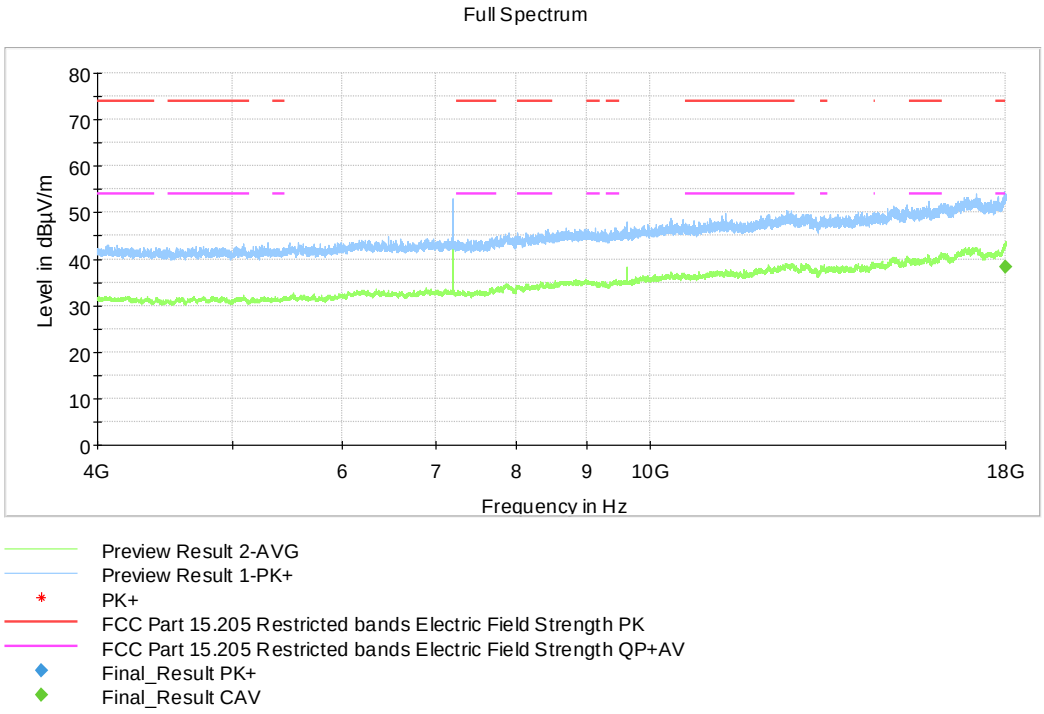

Figure 20: Unwanted Emissions, radiated 4 – 18 GHz (TX 2402 MHz)

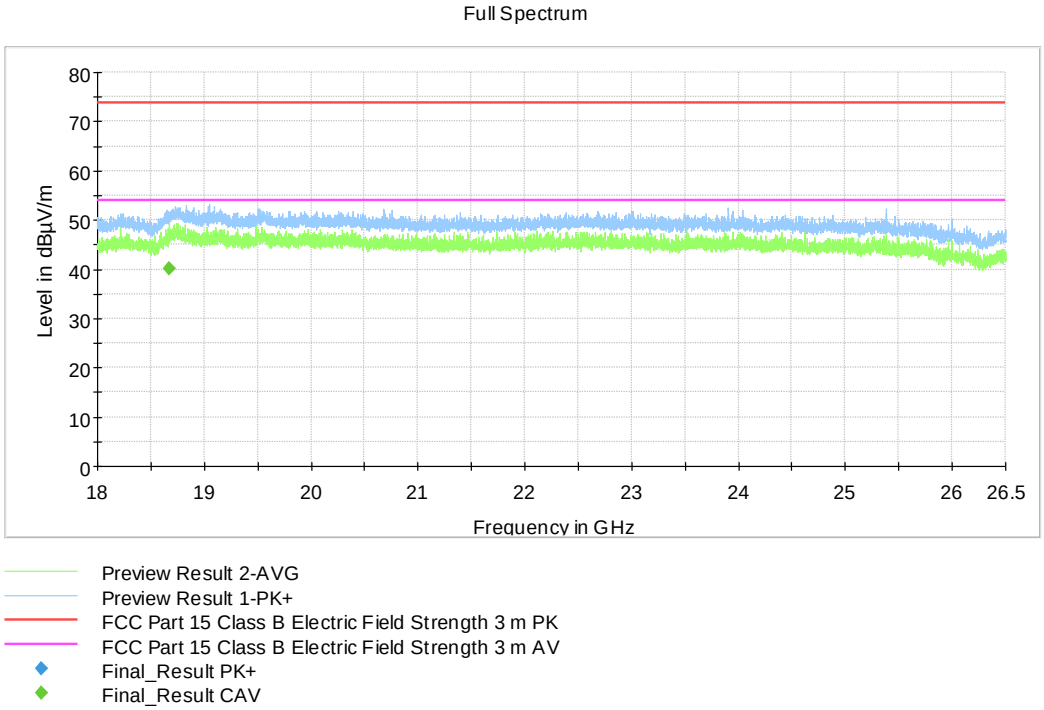

Figure 21: Unwanted Emissions, radiated 18 – 26.5 GHz (TX 2402 MHz)

Test results (TX 2440 MHz)

Table 8: Test results with quasi-peak detector (TX 2440 MHz)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.375000	16.21	40.00	23.79	15 x 1000.0	120.000	382.0	V	20.0	16.6
954.285000	24.26	46.00	21.74	15 x 1000.0	120.000	140.0	H	333.0	31.9

Table 9: Test results with peak detector (TX 2440 MHz)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2439.750000	96.21	---	---	15 x 1000.0	1000.000	240.0	H	68.0	13.6
7319.200000	54.04	74.00	19.96	15 x 1000.0	1000.000	100.0	V	268.0	10.7

Table 10: Test results with average detector (TX 2440 MHz)

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2259.975000	35.68	54.00	18.32	15 x 1000.0	1000.000	284.0	H	353.0	13.5
2389.125000	35.77	54.00	18.23	15 x 1000.0	1000.000	206.0	V	190.0	13.6
2881.000000	36.67	54.00	17.33	15 x 1000.0	1000.000	190.0	H	225.0	14.4
3260.450000	36.56	54.00	17.44	15 x 1000.0	1000.000	250.0	H	115.0	14.4
3345.550000	36.56	54.00	17.44	15 x 1000.0	1000.000	235.0	V	296.0	14.4
3349.800000	36.53	54.00	17.47	15 x 1000.0	1000.000	201.0	H	29.0	14.4
7319.300000	46.01	54.00	7.99	15 x 1000.0	1000.000	107.0	V	269.0	10.7
9437.000000	32.76	54.00	21.24	15 x 1000.0	1000.000	205.0	V	183.0	14.2
12637.700000	36.12	54.00	17.88	15 x 1000.0	1000.000	261.0	H	22.0	18.2
13385.700000	34.34	54.00	19.66	15 x 1000.0	1000.000	230.0	V	141.0	17.4
14499.400000	36.03	54.00	17.97	15 x 1000.0	1000.000	100.0	V	351.0	18.7
16196.900000	37.31	54.00	16.69	15 x 1000.0	1000.000	266.0	H	2.0	22.1
18801.400000	40.21	54.00	13.79	15 x 1000.0	1000.000	209.0	V	194.0	8.0
26038.900000	37.65	54.00	16.35	15 x 1000.0	1000.000	100.0	H	324.0	9.9

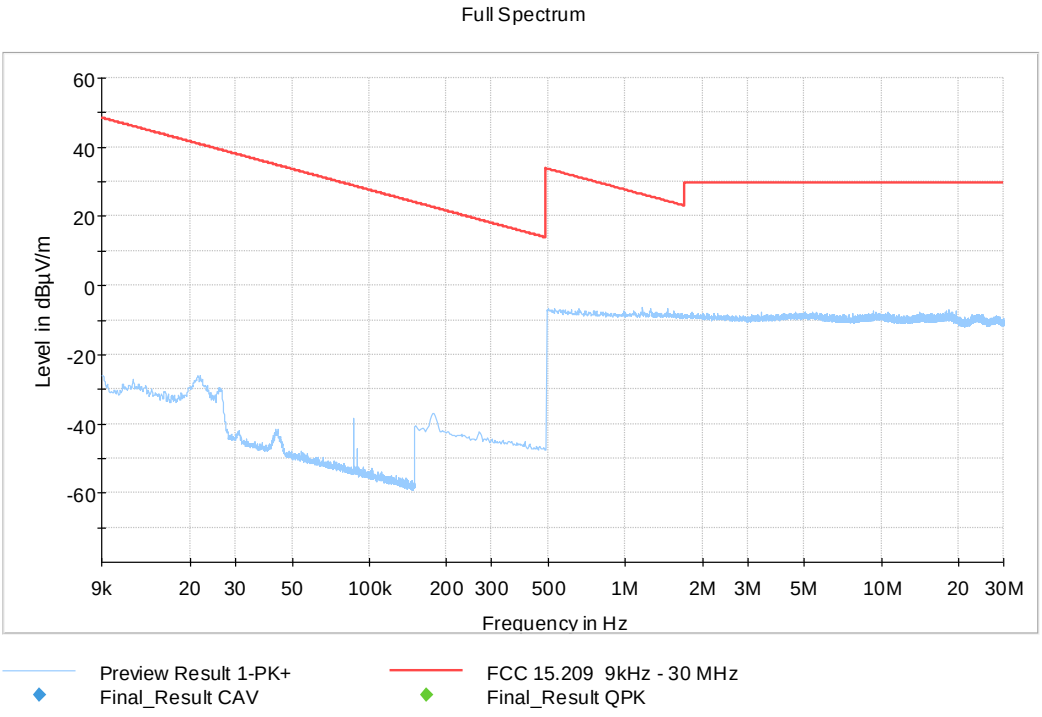

Figure 22: Unwanted Emissions, radiated 9 kHz – 30 MHz (TX 2440 MHz)

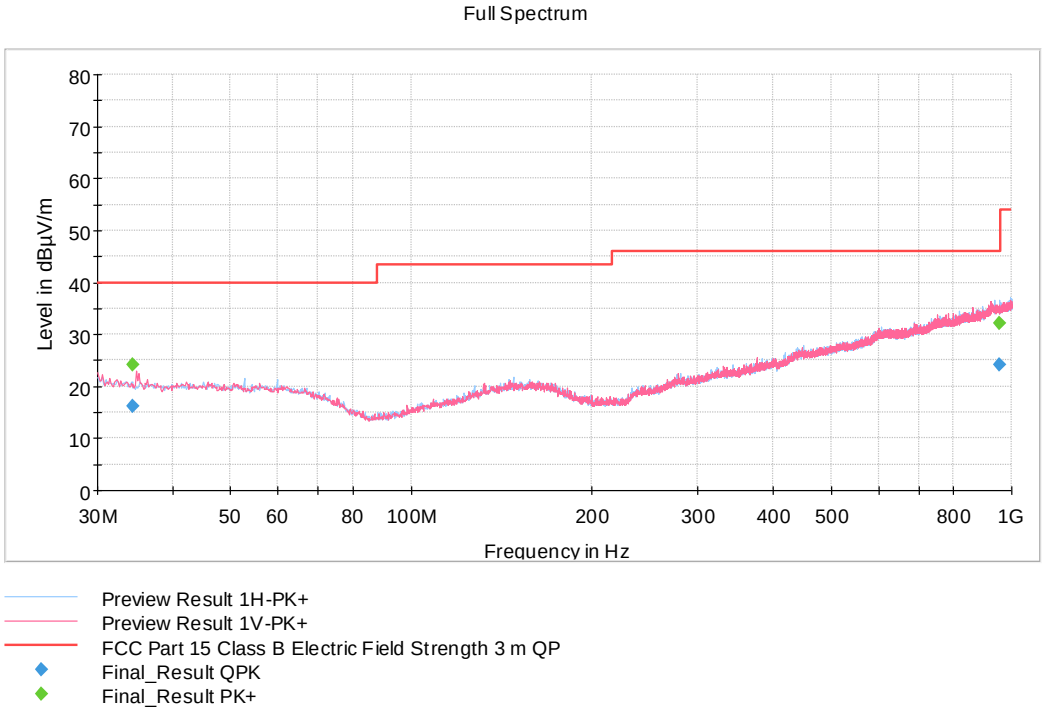

Figure 23: Unwanted Emissions, radiated 30 – 1000 MHz (TX 2440 MHz)

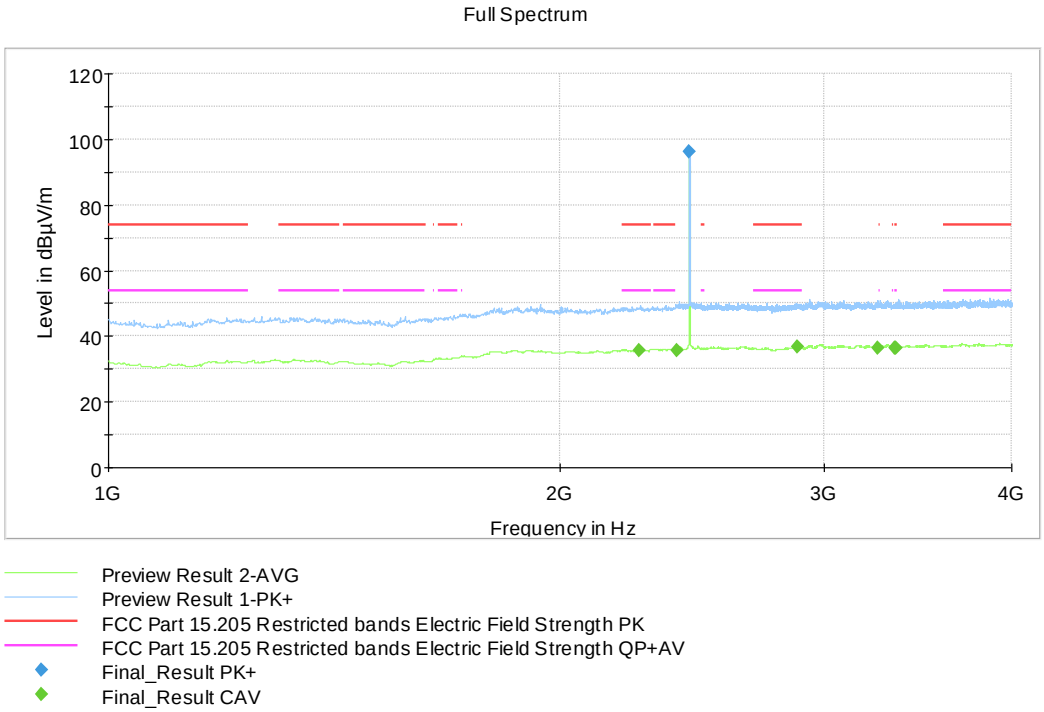

Figure 24: Unwanted Emissions, radiated 1 – 4 GHz (TX 2440 MHz)

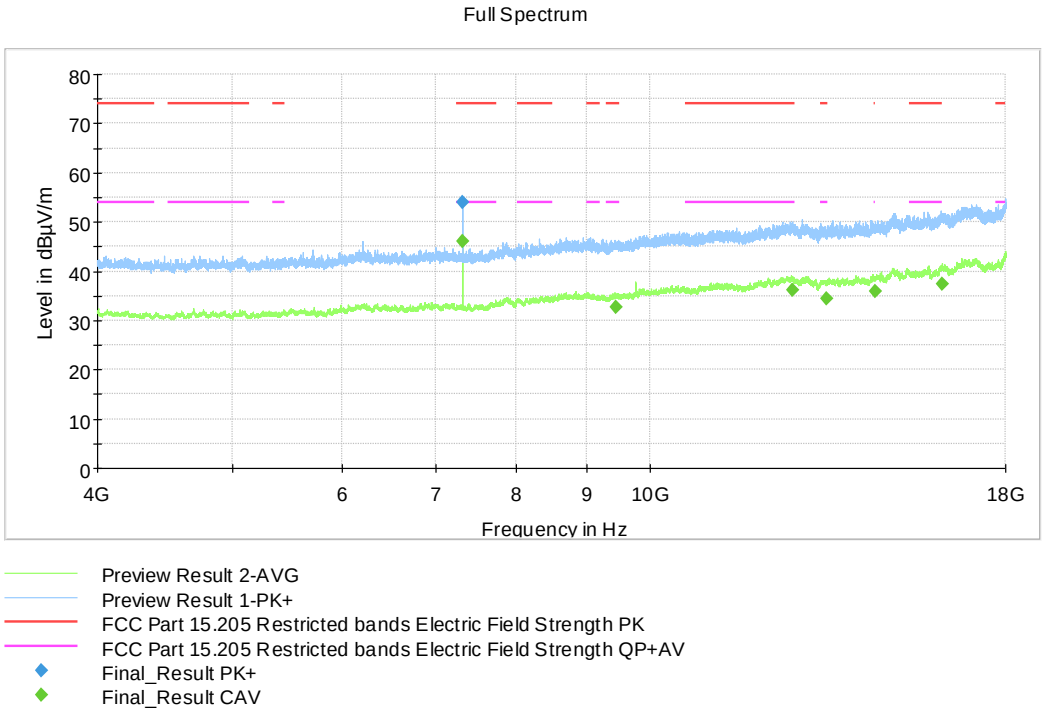

Figure 25: Unwanted Emissions, radiated 4 – 18 GHz (TX 2440 MHz)

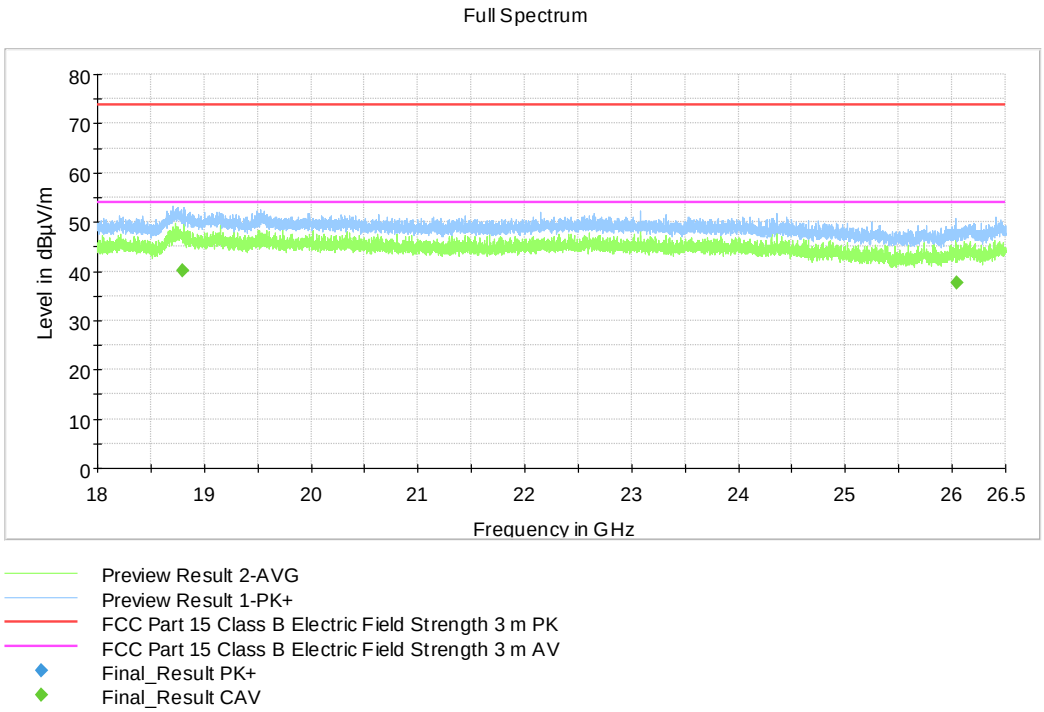

Figure 26: Unwanted Emissions, radiated 18 – 26.5 GHz (TX 2440 MHz)

Test results (TX 2480 MHz)

Table 11: Test results for quasi-peak detector (2480 MHz)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.400000	16.85	40.00	23.15	15 x 1000.0	120.000	342.0	V	221.0	16.8
926.705000	24.25	46.00	21.75	15 x 1000.0	120.000	371.0	V	356.0	31.8

Table 12: Test results with peak detector (TX 2480 MHz)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2479.800000	98.68	---	---	15 x 1000.0	1000.000	100.0	H	96.0	13.7
2483.500000	52.70	74.00	21.30	15 x 1000.0	1000.000	264.0	H	240.0	13.7

Table 13: Test results with average detector (TX 2480 MHz)

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.375000	35.84	54.00	18.16	15 x 1000.0	1000.000	250.0	V	342.0	13.6
2483.500000	38.38	54.00	15.62	15 x 1000.0	1000.000	285.0	H	111.0	13.7
2492.100000	36.03	54.00	17.97	15 x 1000.0	1000.000	149.0	H	94.0	13.8
2881.450000	36.69	54.00	17.31	15 x 1000.0	1000.000	284.0	V	87.0	14.4
3266.150000	36.54	54.00	17.46	15 x 1000.0	1000.000	234.0	V	115.0	14.3
3335.800000	36.55	54.00	17.45	15 x 1000.0	1000.000	214.0	V	12.0	14.4
3351.200000	36.54	54.00	17.46	15 x 1000.0	1000.000	200.0	H	145.0	14.4
7439.300000	45.76	54.00	8.24	15 x 1000.0	1000.000	100.0	V	291.0	10.4
18742.350000	41.06	53.90	12.84	15 x 1000.0	1000.000	128.0	V	150.0	8.2
26204.450000	38.02	53.90	15.88	15 x 1000.0	1000.000	107.0	H	193.0	9.8

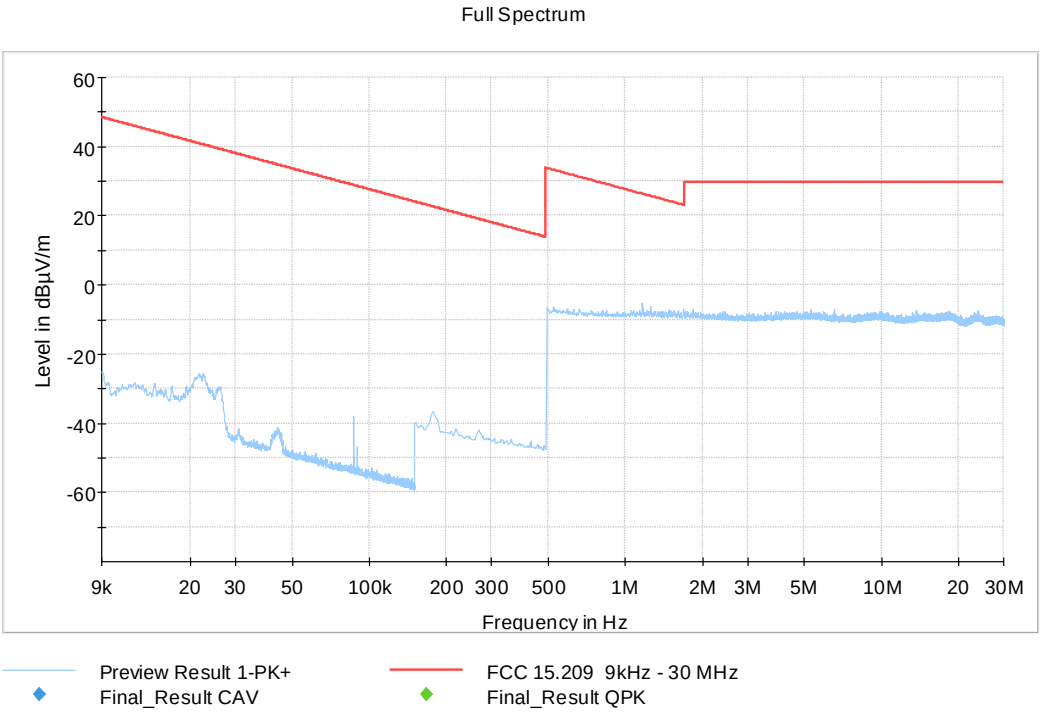

Figure 27: Unwanted Emissions, radiated 9 kHz – 30 MHz (TX 2480 MHz)

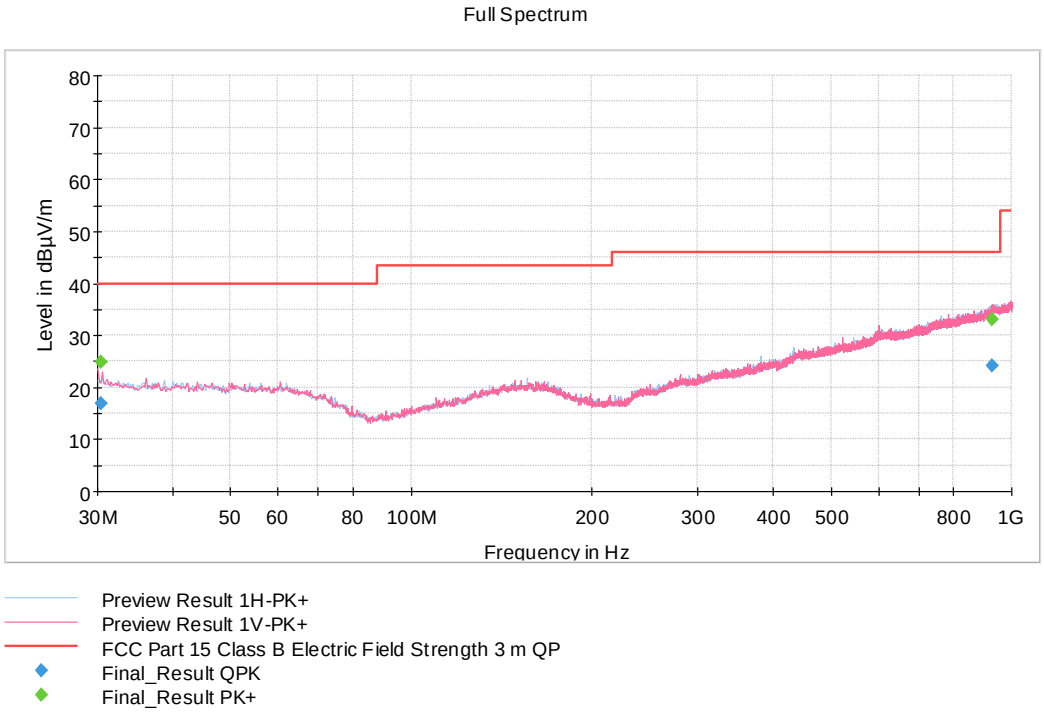

Figure 28: Unwanted Emissions, radiated 30 – 1000 MHz (TX 2480 MHz)

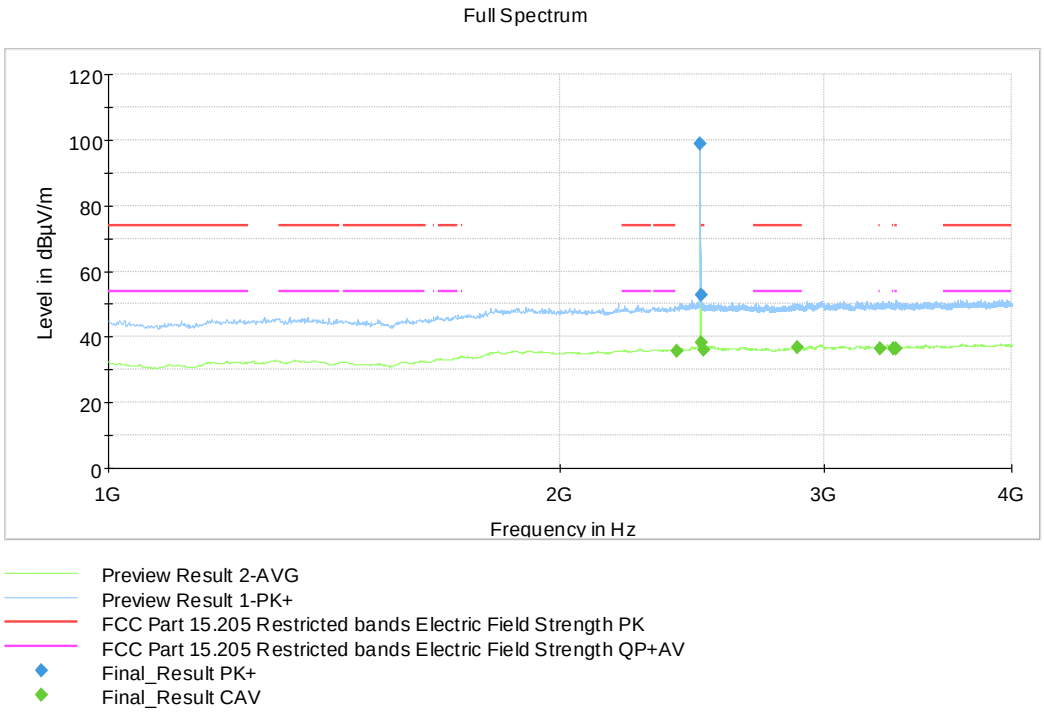

Figure 29: Unwanted Emissions, radiated 1 – 4 GHz (TX 2480 MHz)

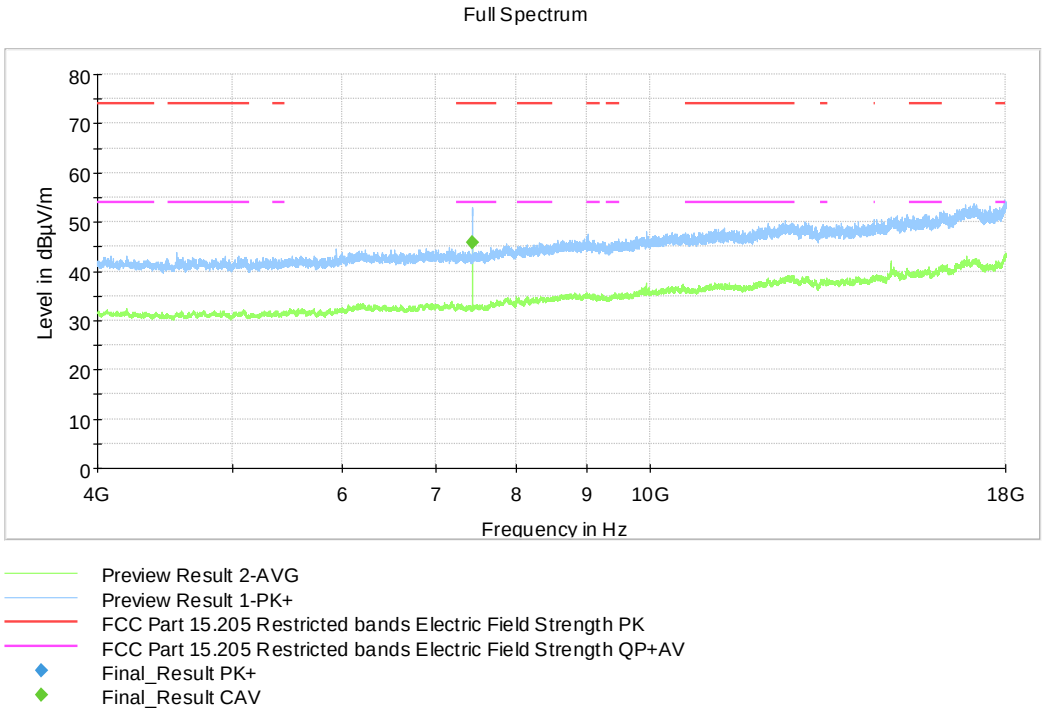

Figure 30: Unwanted Emissions, radiated 4 – 18 GHz (TX 2480 MHz)

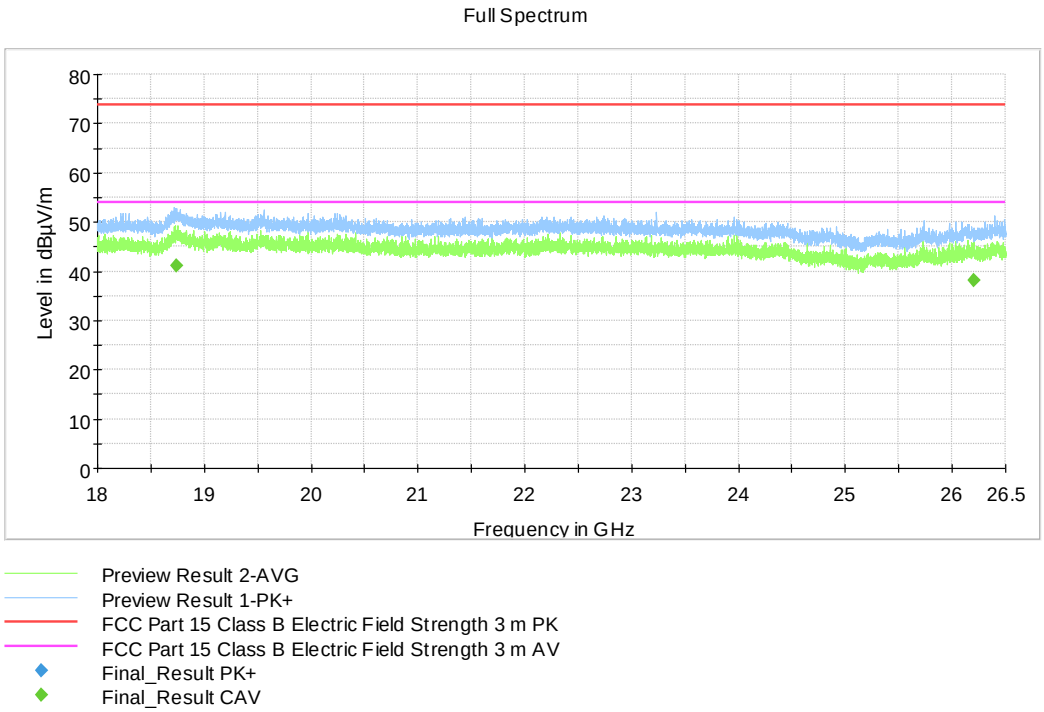

Figure 31: Unwanted Emissions, radiated 18 – 26.5 GHz (TX 2480 MHz)

Radiated lower and upper band edge results

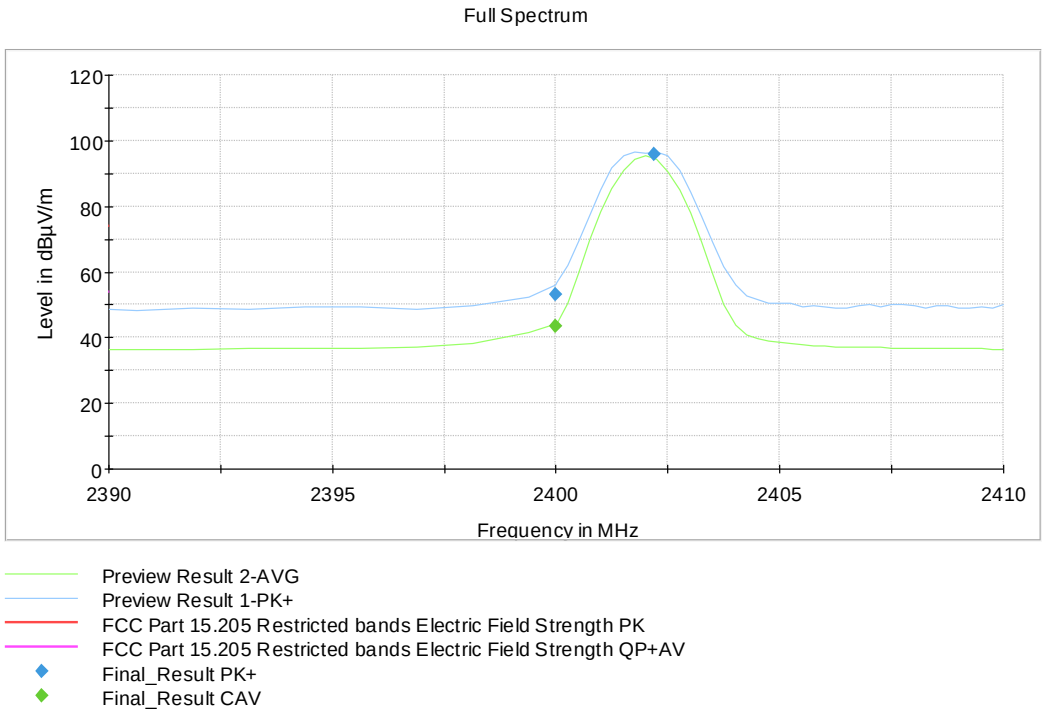

Figure 32: Lower Band-Edge, radiated (TX 2402 MHz)

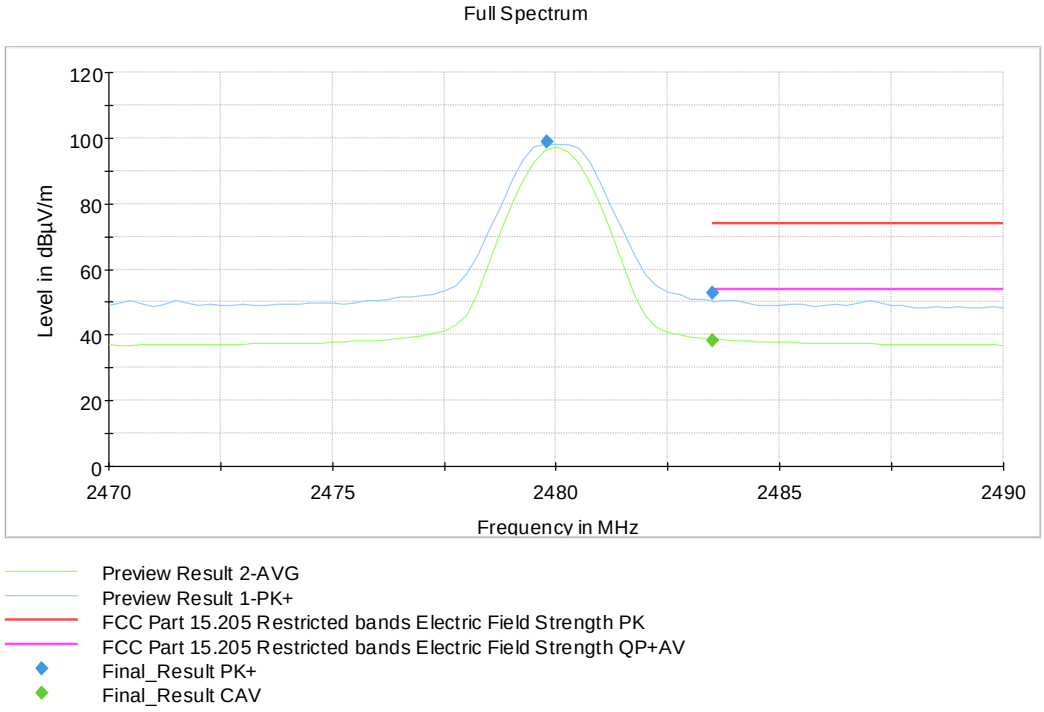

Figure 33: Upper Band-Edge, radiated (TX 2480 MHz)

Table 14: Radiated lower and upper band edge peak results

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2400.000000	53.03	75.94 *)	22.91	15 x 1000.0	1000.000	226.0	V	73.0	13.7
2402.200000	95.94	---	---	15 x 1000.0	1000.000	271.0	H	243.0	13.7
2479.800000	98.68	---	---	15 x 1000.0	1000.000	100.0	H	96.0	13.7
2483.500000	52.70	74.00	21.30	15 x 1000.0	1000.000	264.0	H	240.0	13.7

*) -20 dBc

Table 15: Radiated lower and upper band edge average results

Frequency (MHz)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2400.000000	43.45	---	---	15 x 1000.0	1000.000	200.0	H	255.0	13.7
2483.500000	38.38	54.00	15.62	15 x 1000.0	1000.000	285.0	H	111.0	13.7

Power Spectral Density

Standard: ANSI C63.10-2020
Tested by: HAM
Date: 7 July 2023
Temperature: 24 °C
Humidity: 44 %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.

Sample 2 was used for the test.

Test results

Table 16: Test results for Power Spectral Density

Data rate	Frequency [MHz]	PSD [dBm/10 kHz]	Limit [dBm/3 kHz]	Result
1 Mbps	2402	-4.339	≤ 8	PASS
	2440	-5.171		PASS
	2480	-5.484		PASS

Note: Compliance was determined in a 10 kHz band.

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

Setting	Value
Span	3.000 MHz
RBW	10.000 kHz
VBW	30.000 kHz
Sweep Points	600
Sweep Time	3.000 ms
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
Filter	3 dB
Trace Mode	Max Hold
Sweep Type	Sweep
Preamp	off

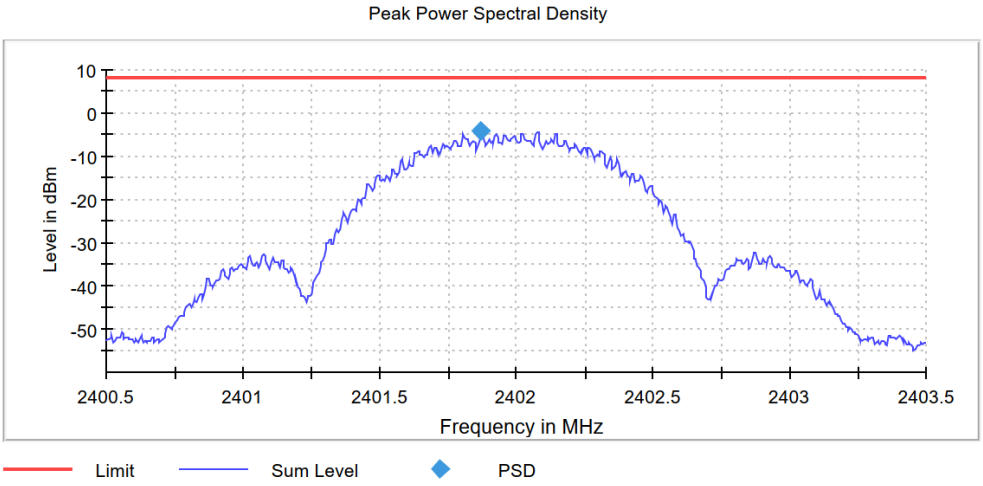

Figure 34: Power Spectral Density (TX 2402 MHz)

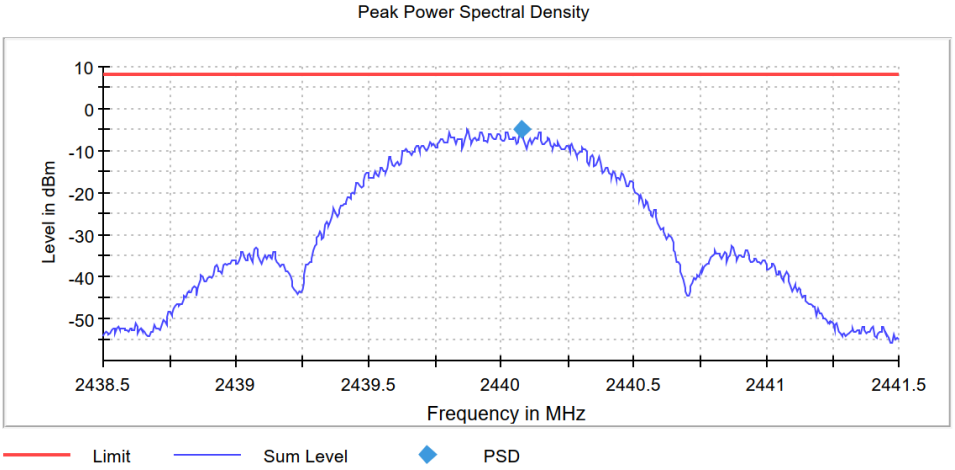

Figure 35: Power Spectral Density (TX 2440 MHz)

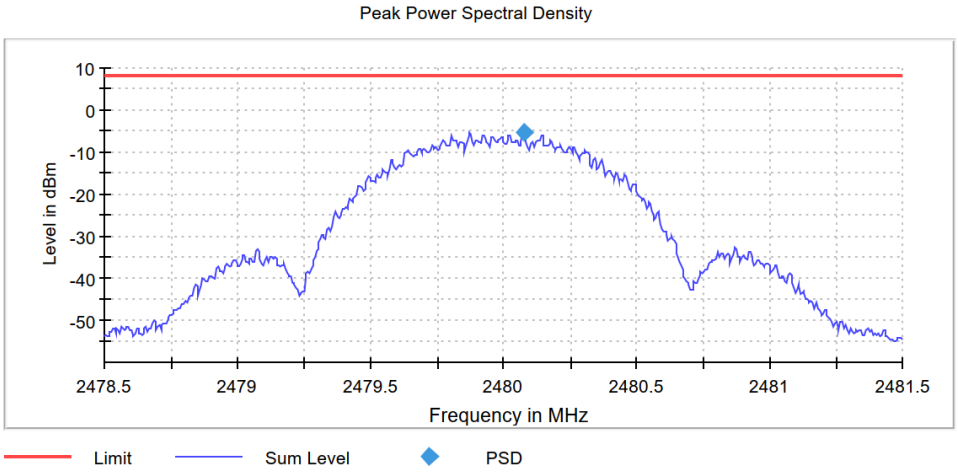

Figure 36: Power Spectral Density (TX 2480 MHz)

TEST EQUIPMENT

Conducted RF Tests

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
MULTIMETER	FLUKE	289	sn:59090035	2022-11-29	2023-11-29
SWITCH UNIT FOR BASE MODULE	ROHDE & SCHWARZ	OSP120	inv:10882	2023-07-03	2024-07-02
BASE MODULE	ROHDE & SCHWARZ	OSP-B157W8	inv:10883	2023-07-03	2024-07-02
EXTENSION MODULE	ROHDE & SCHWARZ	OSP-B157WX	inv:10884	2023-07-03	2024-07-02
SWITCH UNIT FOR EXTENSION MODULE	ROHDE & SCHWARZ	OSP120	inv:9289	2023-07-03	2024-07-02
POWER SUPPLY	THANDAR	PL330TP	inv:9787	NCR	NCR
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSV40	inv:10881	2023-06-16	2024-06-16
TEST SOFTWARE	ROHDE & SCHWARZ	WMS32	-	-	-

Unwanted Emissions (radiated)

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
ANTENNA	EMCO	3160-09	inv. 7294	2023-02-23	2024-02-23
ANTENNA	EMCO	3117	inv. 7293	2022-06-16	2024-06-16
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 MAST	MATURO	TAM 4.0E	inv. 10181	NCR	NCR
ATTENUATOR	PASTERNACK	10 dB, DC-40 GHz	sn. A1	2023-03-20	2025-03-20
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv. 10126	2023-03-13	2024-03-13
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10670	2023-06-19	2024-06-19
FILTER	WAINWRIGHT	WHKX4.0/18G-10SS	inv. 10403	2023-01-09	2025-01-09
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv. 10183	NCR	NCR
MULTIMETER	FLUKE	289	sn:59090035	2022-11-29	2023-11-29
POWER SUPPLY	THANDAR	PL330TP	inv:9787	NCR	NCR
RF PREAMPLIFIER	CIAO	CA1840-5019	inv. 10593	2022-09-21	2023-09-21
RF PREAMPLIFIER	CIAO	CA118-3123	inv. 10278	2022-09-21	2023-09-21
TEST SOFTWARE	ROHDE & SCHWARZ	EMC32	-	-	-
TURNTABLE	MATURO	DS430 UPGRADED	inv. 10182	NCR	NCR

NCR = No Calibration Required

END OF REPORT