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LP-009

Test report

Number **T251-0842/24**

Project file: C20241801
Date: 2024-12-17
Pages: 57

Product: **Televend**

Type reference: **T1PRO**

Ratings: 10 - 15 V d.c.; 8 W
Class III

Trademark: televend CONNECT TO EMPOWER

Applicant: **Intis Ltd.**
Bani 73a, HR-10010 Zagreb, Croatia

Manufacturer: Intis Ltd.
Bani 73a, HR-10010 Zagreb, Croatia

Place of manufacture: Intis Ltd.
Bani 73a, HR-10010 Zagreb, Croatia

Summary of testing

Testing method: 47 CFR Part 15, Subpart C (Clause 15.247) last amended 2024-08-08 in conjunction with ANSI C63.10:2013

Testing location: SIQ Ljubljana
Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia

Remarks: Date of receipt of test items: 2024-09-23
Number of items tested: 2
Date of performance of tests: 2024-09-25 – 2024-12-06
The test results presented in this report relate only to the items tested.
The test items were tested in the condition as received.
The product complies with the requirements of the testing methods.

Tested by: Luka Cvajnar

Approved by: Marjan Mak

SIQ Ljubljana, Mašera-Spasićeva ulica 10, SI-1000 Ljubljana, Slovenia
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CONTENTS Page

1 GENERAL

EUT passed the performed tests.

History sheet			
Date	Report No.	Change	Revision
2024-12-17	T251-0842/24	Initial Test Report issued.	--

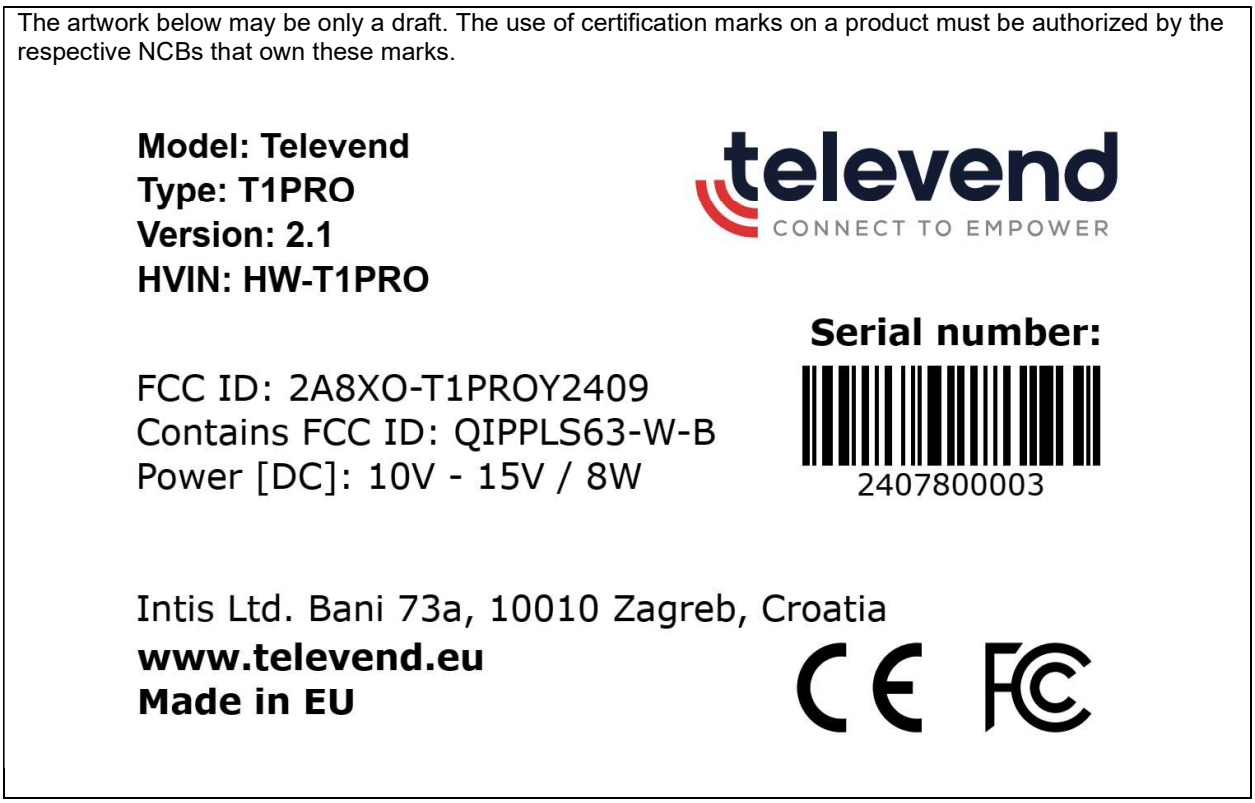
1.1 Description of equipment under test

Televend
Type: T1PRO
FCC ID: **2A8XO-T1PROY2409**
Contains FCC ID: **QIPPLS63-W-B**

Adaptive / non-adaptive equipment	non-adaptive equipment
Modulation type	Other than FHSS
Operating mode	Single antenna
SIQ Sample number:	Radiated sample: S202406683 Conducted sample: S202406682
Operating temperature range	0 °C to +55 °C
Maximum RF Output power	4 dBm
Operating frequency	2402 MHz – 2480 MHz
Number of channels	40
Antenna type and gain	Integral antenna, 0.5 dBi
Antenna Beamforming	/
Nominal channel bandwidth	1 MHz
Hardware version:	2.1
Firmware version:	29Y
HVIN:	HW-T1PRO

Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



1.2 Description of the test modes

The equipment uses only one antenna at any moment.

On all devices run test firmware Bluetooth Direct Test Mode and accompanied by a USB-UART converter interface. For testing purposes sample with integral antenna and modified sample with added u.FL connector was provided. For testing nRFgo Studio software program from Nordic Semiconductor was used.

1.2.1 Tested Channels

Channels	Data rate	Frequency [MHz]	TX power Settings [dBm]	Packet type	Packet length (bytes)
0 (Lowest)	1 Mbps	2402	4	PRBS9	37
19 (Middle)	1 Mbps	2440	4	PRBS9	37
39 (Highest)	1 Mbps	2480	4	PRBS9	37

Normal test condition:
Ambient temperature: 15 °C to 35 °C
Relative humidity: 30 % to 60 %
Atmospheric pressure: 860 mbar to 1060 mbar

1.3 Test Equipment used for testing

Manufacturer	Model No.	Used	Calibrated	Calibrated until
Radiated measurements				
Comtest engineering, SAC2 (together with controlling equipment)	SAC 3m	X	2022-04-14	2025-04-14
Maturo, Turn table (2 m diameter)	TT 2.0 SI	X	/	/
Maturo, Bore-sight antenna mast	BAM-4.0-P	X	/	/
Maturo, positioning equipment	NCD	X	/	/
Rohde & Schwarz, RFI receiver	ESW 44	X	2024-09-26	2026-03-26
Rohde & Schwarz, RFI receiver	ESW	/	2024-07-10	2026-01-10
R&S, Ultra Broadband Antenna	HL562E	X	2023-09-26	2026-09-26
PMI Low noise amplifier	PEC-42-1G40G	X	2023-09-18	2025-03-18
R&S, Horn Antenna	HF907	X	2023-08-22	2026-08-22
Conducted measurements				
R&S, Spectrum Analyzer	FSV 40	X	2022-11-03	2024-11-03
R&S, Vector signal generator	SMBV100B	/	/	/
R&S, Signal generator	SMB100A	/	2022-11-07	2024-11-07
R&S High resolution power meter	OSP-B157W8	X	2022-11-04	2024-11-04
R&S Switch unit	OSP-B157WX	X	2022-11-04	2024-11-04
R&S,Artificial Mains Network	ENV216	X	2022-06-21	2025-06-21
Wainwright Instruments, High pass	WHNX6-2555-	X	2024-05-30	2025-05-30
Wainwright Instruments, High pass	WHNX6-5925-	/	/	/
Wainwright Instruments, High pass	WHW2-16340-	/	/	/
R&S, Spectrum Analyzer	FSV 40	X	2024-11-08	2026-05-08
R&S, Signal generator	SMB100A	/	2024-11-13	2026-05-13
R&S High resolution power meter	OSP-B157W8	X	2024-11-13	2026-05-13
R&S Switch unit	OSP-B157WX	X	2024-11-13	2026-05-13

1.3.1 Measurement uncertainty

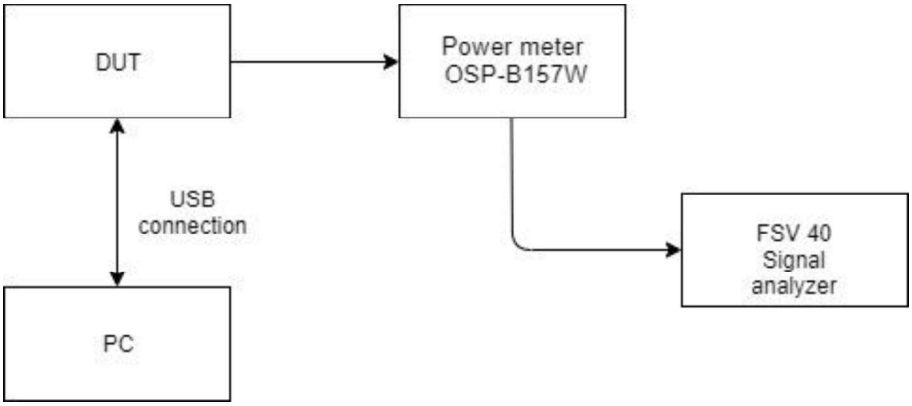
The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in ETSI TR 100 028-2 and C63.23. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor k=2.

Measurements	U_{LAB}	$U_{ETSI\ TR\ 100\ 028-2}$	$U_{C63.23}$
AC Line Conducted Emission	3.2 dB	/	±4,13
Spurious emission 30 – 300 MHz	4.2 dB	±6	/
Spurious emission 300 – 1000 MHz	4.4 dB	±6	/
Spurious emission 1 GHz – 18 GHz	5.1 dB	±6	/
Spurious emission 18 GHz – 26GHz	5.6 dB	±6	/
Tx spurious emission - conducted	< 1.8 dB	±4	/
6 dB Emission Bandwidth	< 2%	±5%	/
Maximum peak output power	< 1 dB	±0,75 dB	/
100 kHz Bandwidth of Frequency Band Edge	< 0.8 dB	/	/
Power Spectral Density	< 1.3 dB	±3 dB	/
Occupied bandwidth (99% emission bandwidth)	< 2%	±5%	/

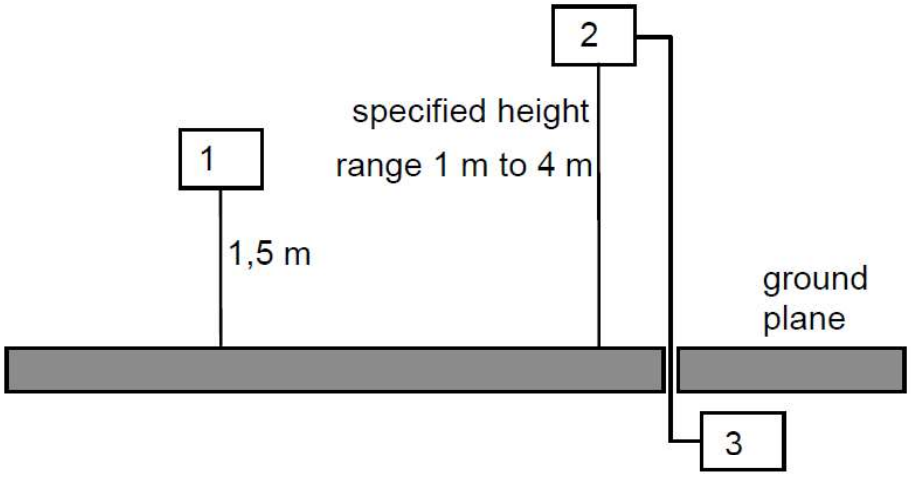
Note: Measurement uncertainty calculated in accordance with ETSI TR 100 028-2 and C63.23.

1.4 Test setup configurations

1.4.1 Conducted measurement test setup



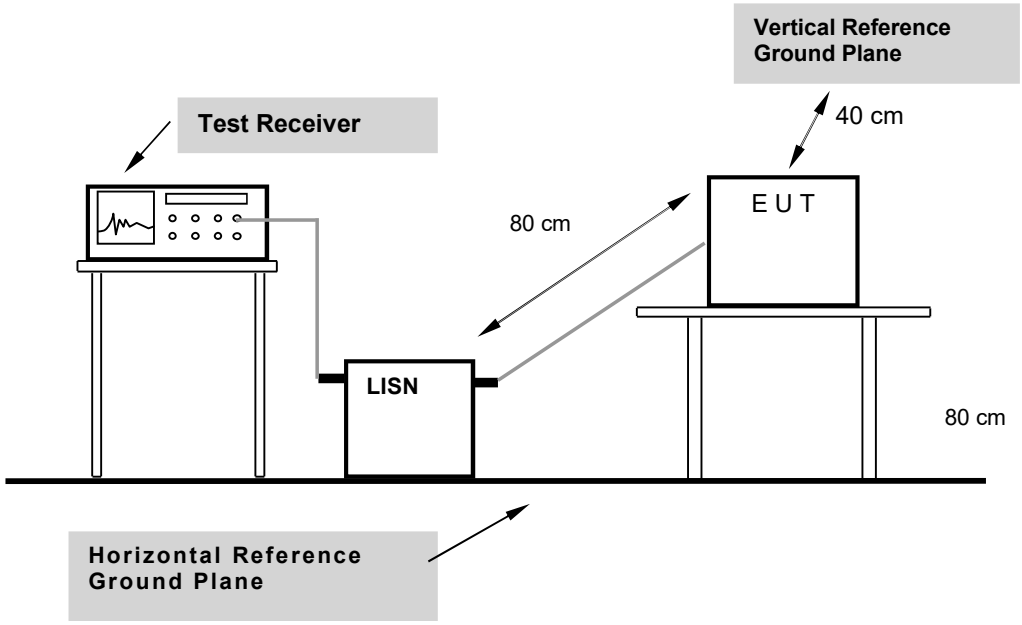
1.4.2 Radiated measurement test setup



1) UUT
2) Measurement antenna
3) Measurement equipment

Note: Bellow 1G non-conductive Table 80 cm above ground plane and above 1G non-conductive Table 150 cm above ground plane.

1.4.3 AC Line Conducted Emission



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

2 TEST SUMMARY

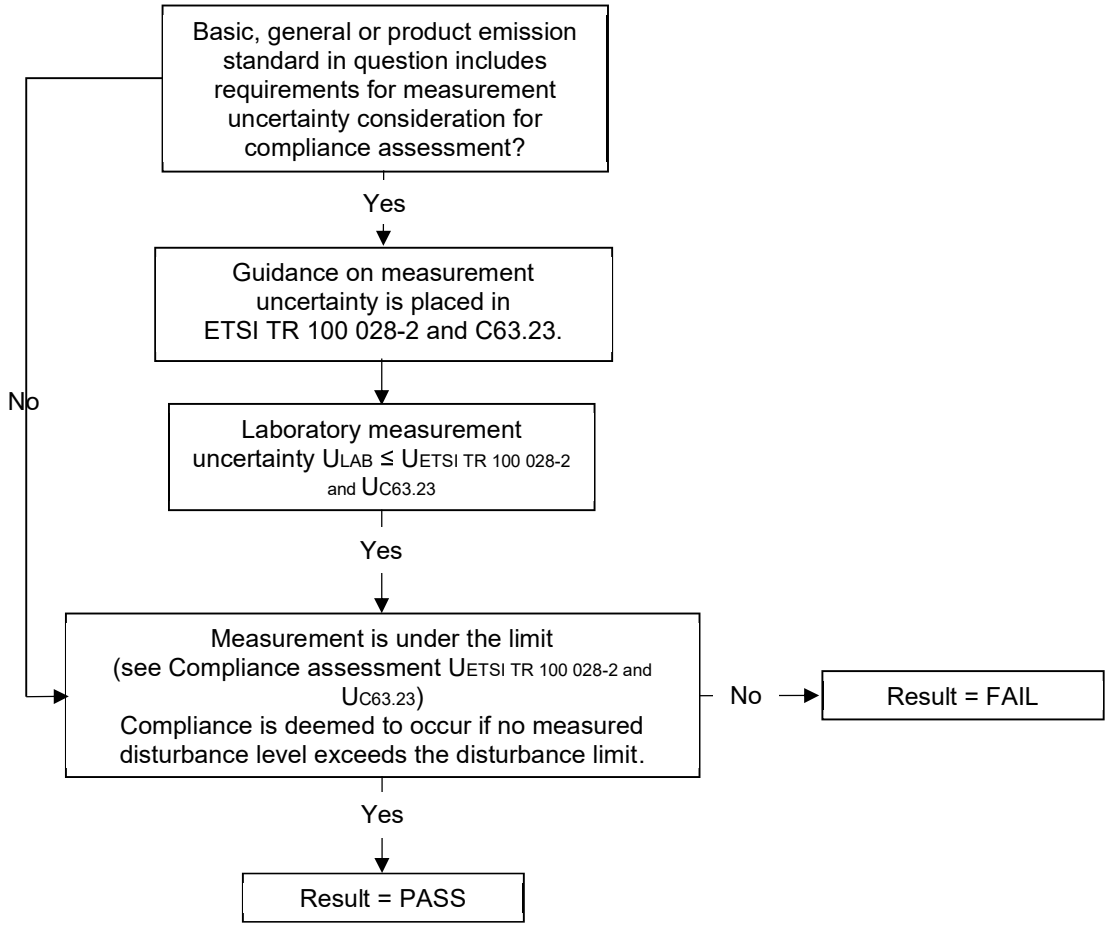
47 CFR 15.247			
Test	**47 CFR section**	**Section within the report**	**Conclusion**
Antenna Requirement	§ 15.203	3.1	PASS
AC Line Conducted Emission	§ 15.207 (a)	3.2	PASS
Spurious emission - Conducted	§ 15.247 (d)	3.3	PASS
Spurious emission - Radiated	§ 15.205, § 15.209, § 15.247 (d)	3.4	PASS
6 dB Emission Bandwidth	§ 15.247 (a) (2)	3.5	PASS
Maximum peak output power	§ 15.247 (b) (3)	3.6	PASS
100 kHz Bandwidth of Frequency Band Edge	§ 15.247 (d)	3.7	PASS
Power Spectral Density	§ 15.247 (e)	3.8	PASS

2.1 Application of decision rule

Application of decision rule and statement of conformity is defined in document TN023 Decision rule and measurement uncertainty.

As a general rule Pass/Fail decisions are based on simple acceptance rule and acceptance limits chosen based on simple acceptance (w = 0, AL = TL) except if a decision rule is governed by particular standard or guidance document.

Decision rule:



3 TESTS RESULTS

3.1 47 CFR § 15.203 – Antenna requirements

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.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According § 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs § 15.247 (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.1.1 Antenna Details

Type	Gain	Result
PCB antenna	0.5 dBi*	PASS

*Declared by manufacturer.

3.2 47 CFR § 15.207 – AC Line Conducted Emission

For an intentional radiator 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 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15–0.5	66 to 56*	56 to 46
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.2.1 Test procedure

EMI test receiver was set to investigate from 150 kHz to 30 MHz with the 9 kHz RBW.
During conducted emission EUT was connected to a LISN and maximum emissions was recorded in the QP and average detection mode.

3.2.2 Test setup

For the test setup refer to chapter 1.4.

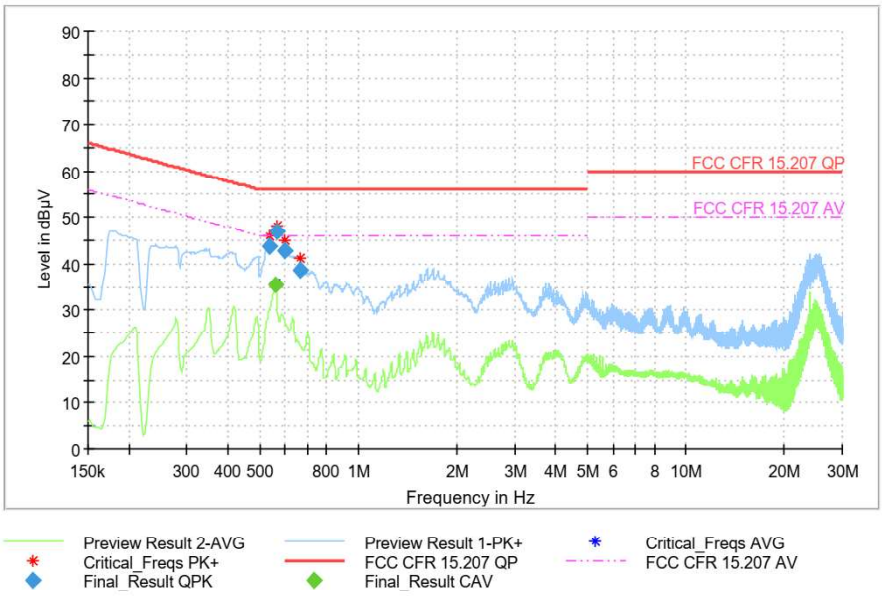
3.2.3 Test equipment

For the test equipment refer to chapter 1.3.

3.2.4 Test results

EUT Information

EUT:	Televand T1PRO
Mode:	Uin: 120 V / 60 Hz, Continious TX
Line:	L + N



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.564000	46.80	---	56.00	9.20	1000.0	9.000	N	ON	10.1
0.559500	---	35.53	46.00	10.47	1000.0	9.000	N	ON	10.1
0.534750	43.63	---	56.00	12.37	1000.0	9.000	N	ON	10.1
0.595500	42.80	---	56.00	13.20	1000.0	9.000	N	ON	10.1
0.663000	38.58	---	56.00	17.42	1000.0	9.000	L1	ON	10.0

Note: As per 47 CFR § 15.207(c) device was evaluated with a EGSTON E2EFSW3 AC/DC power supply

3.3 47 CFR § 15.247(d) - Spurious emission - Conducted

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

3.3.1 Test setup

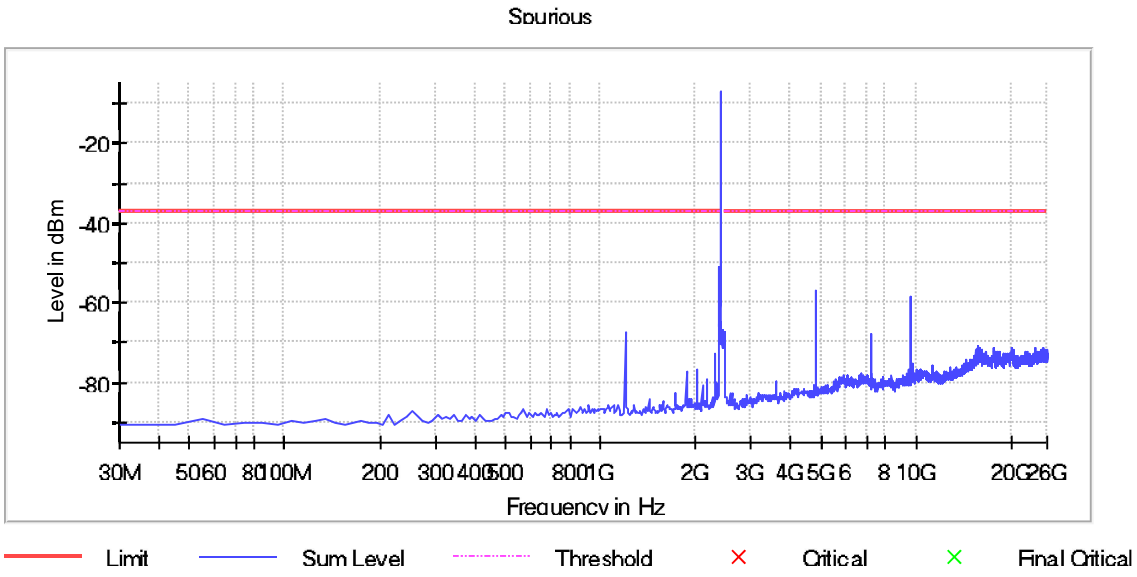
For the test setup refer to chapter 1.4

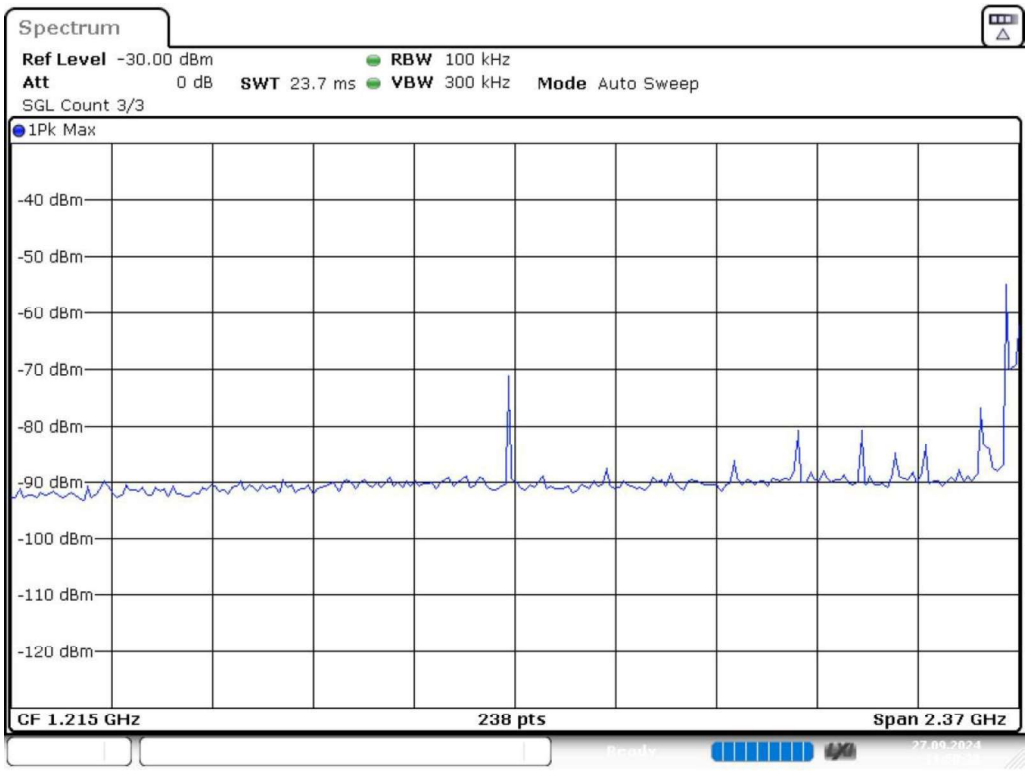
3.3.2 Test equipment

For the test equipment refer to chapter 1.3

3.3.3 Test results

Channel 2402 MHz:





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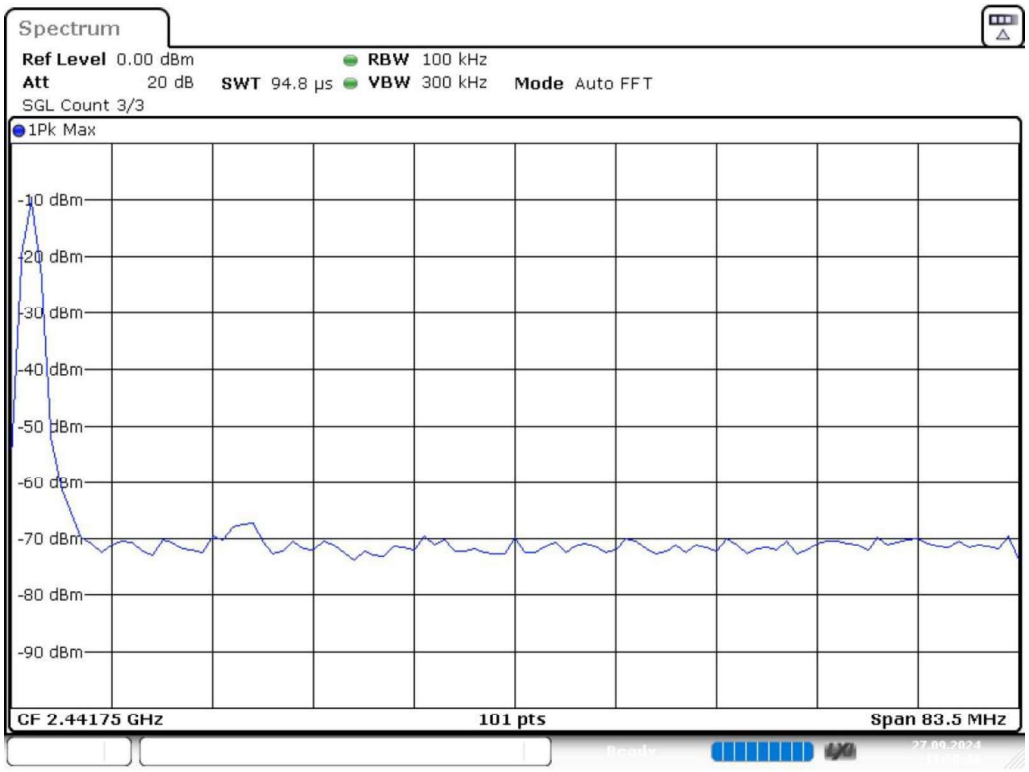

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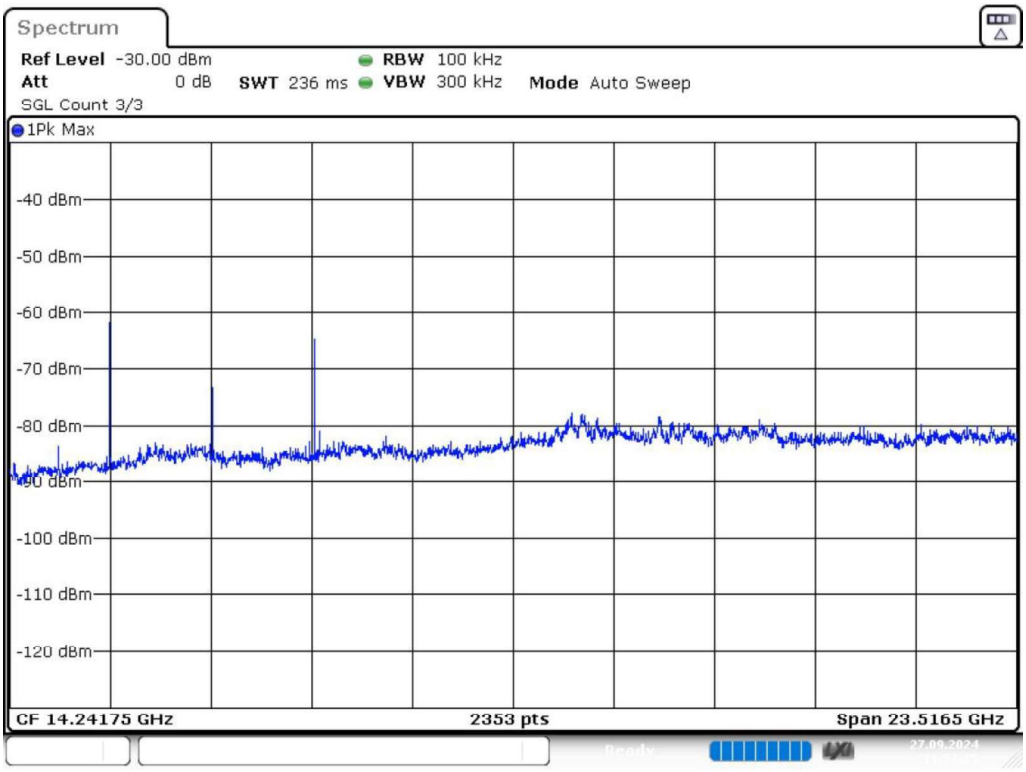
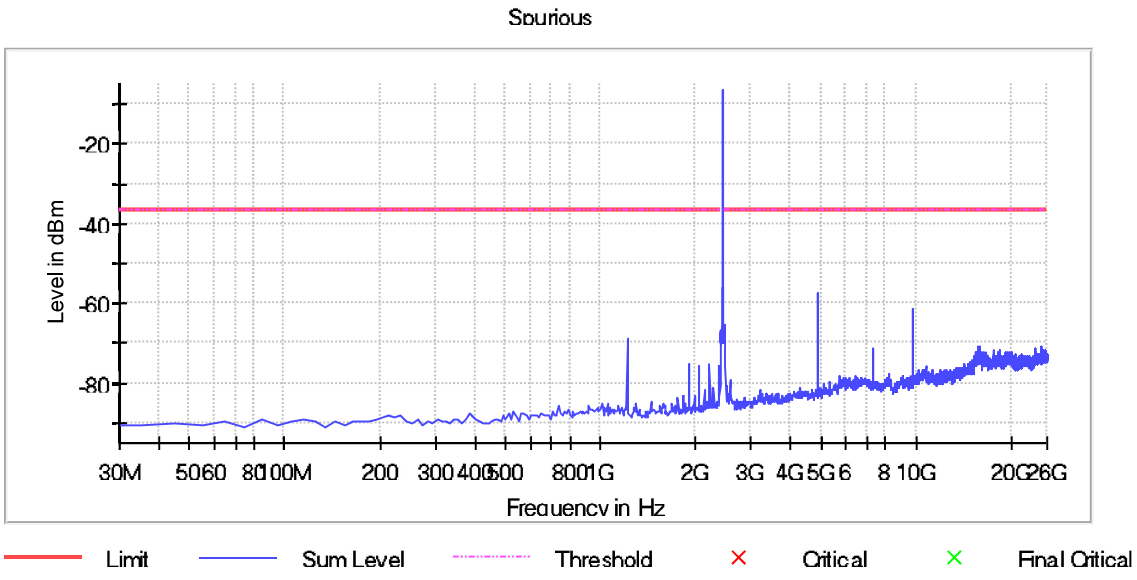
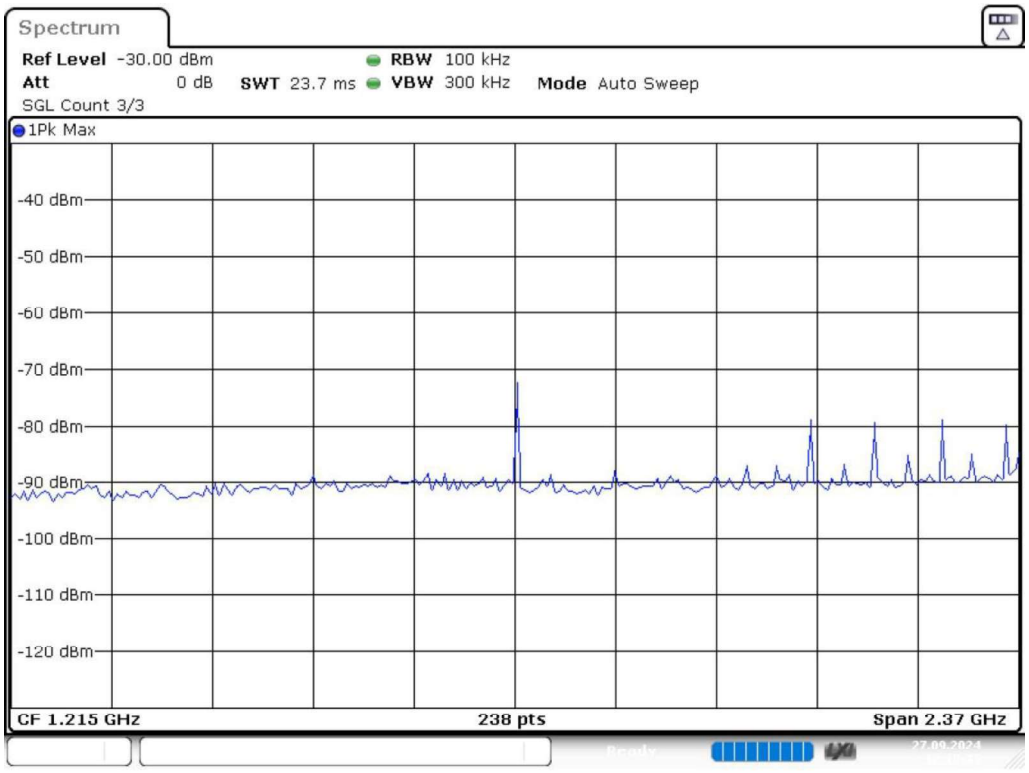


Channel 2440 MHz:





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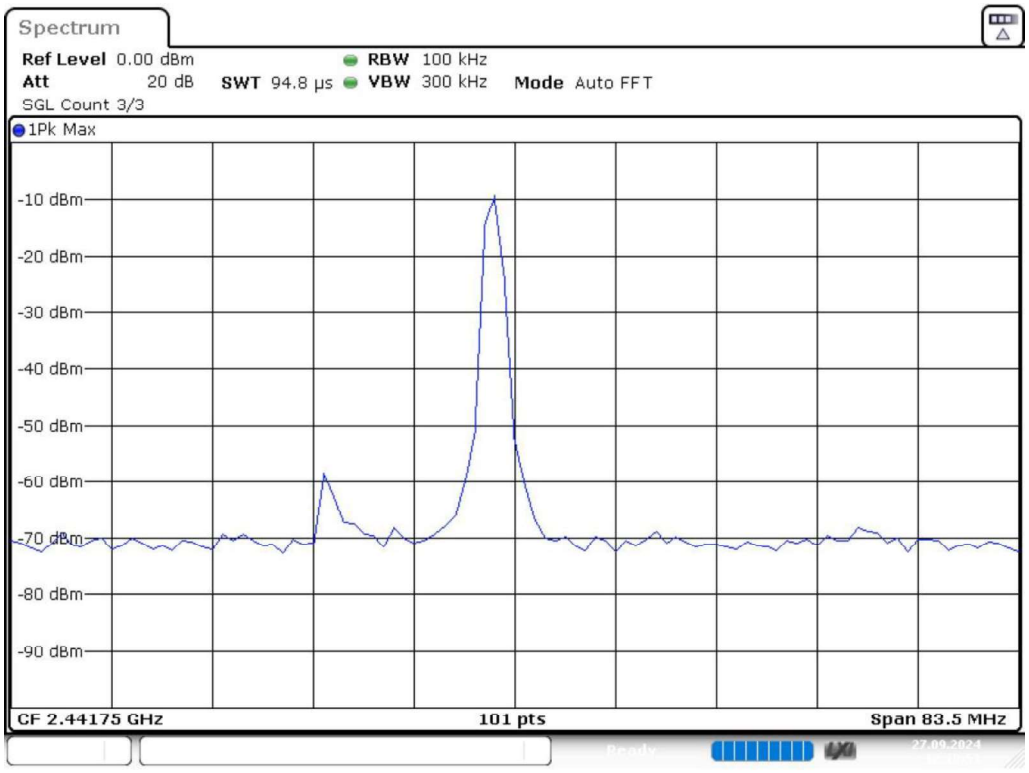

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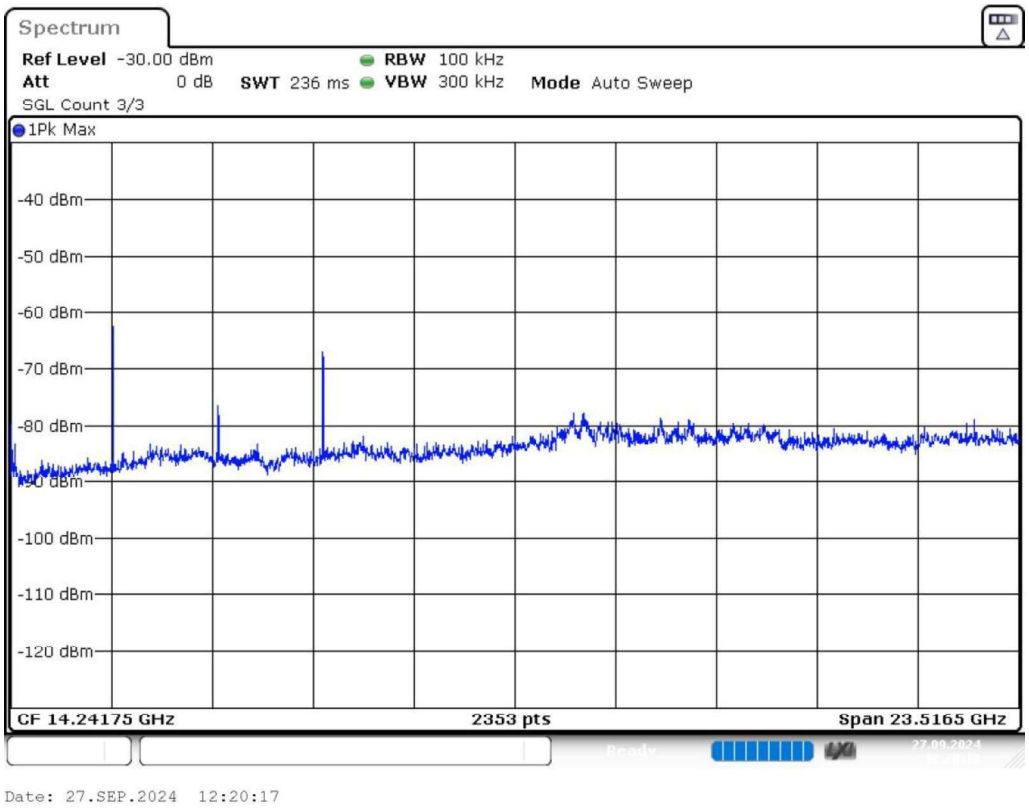
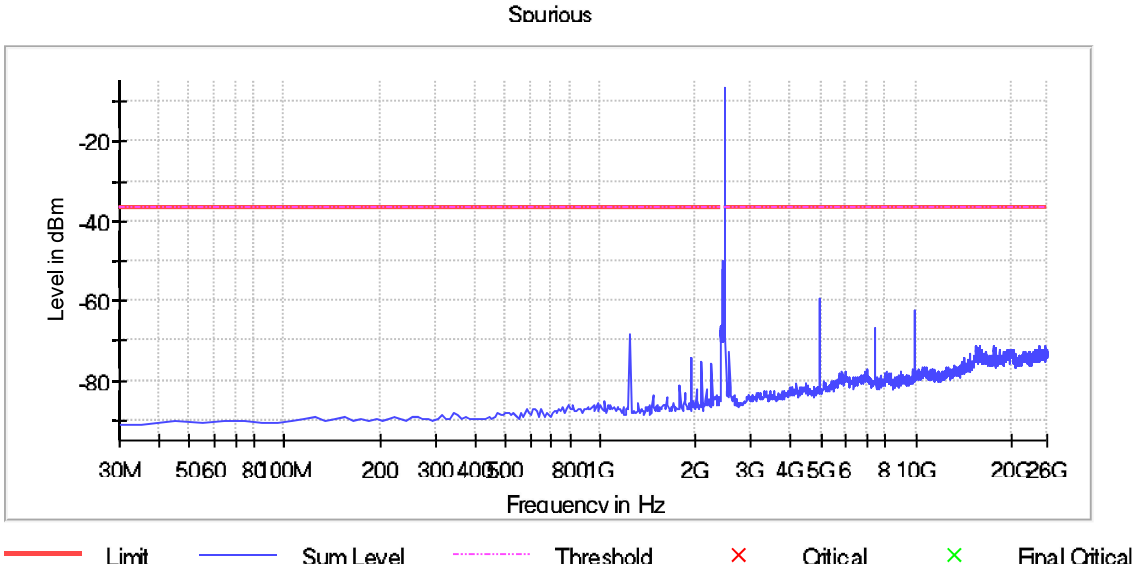
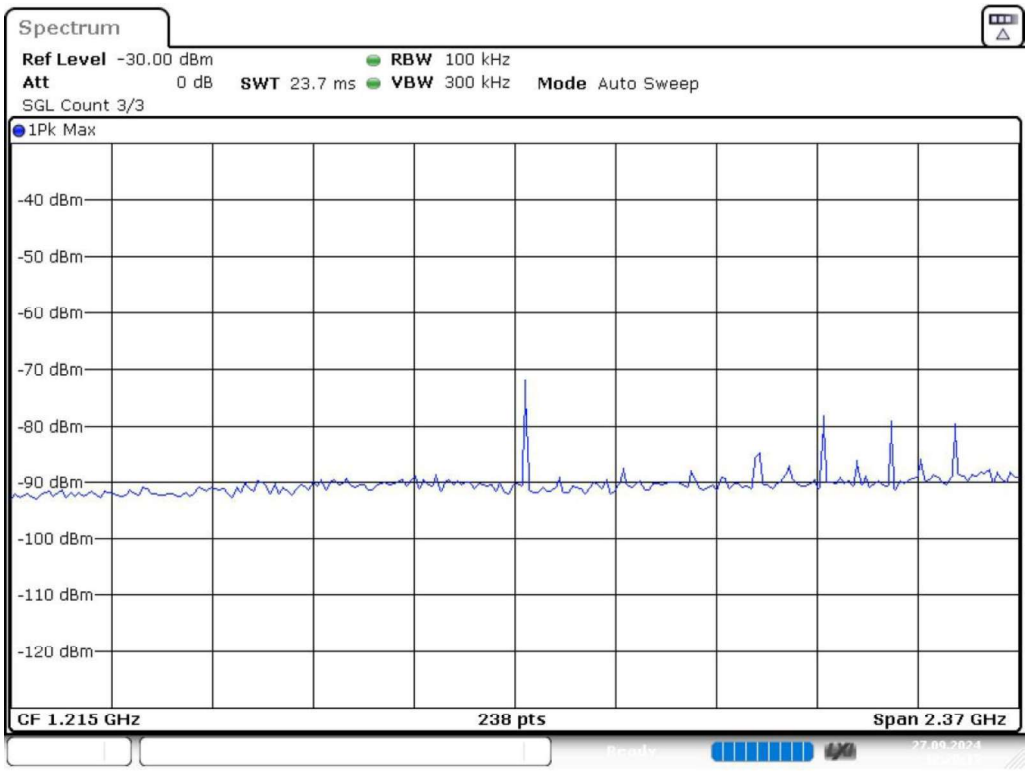


Channel 2480 MHz:





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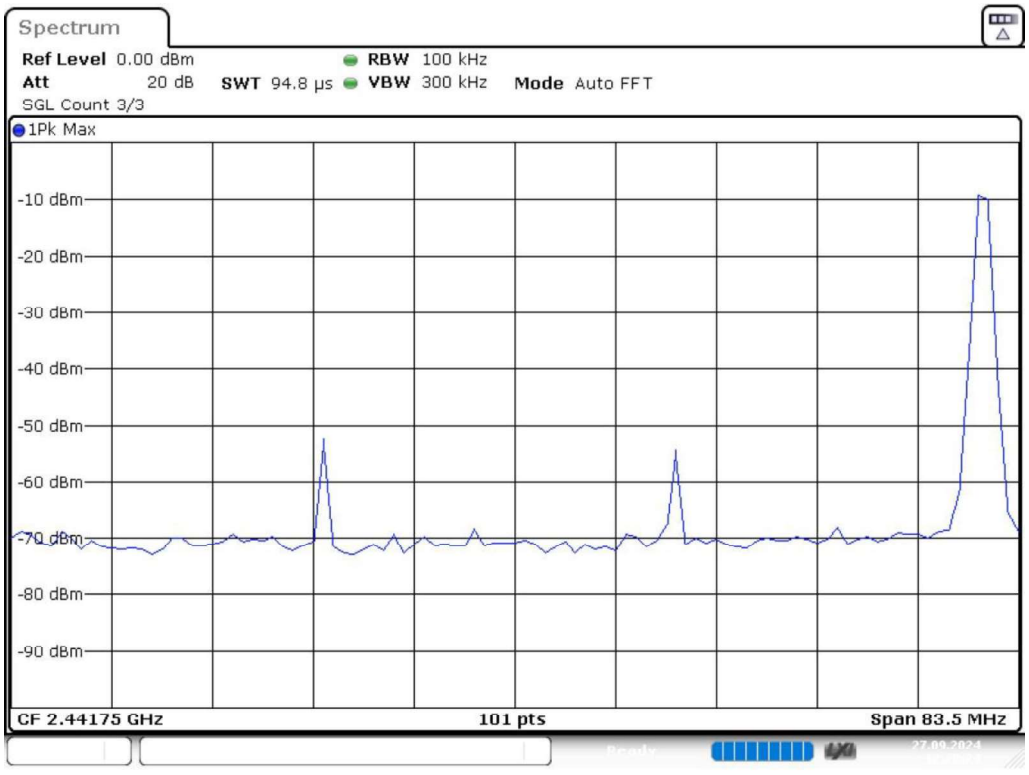

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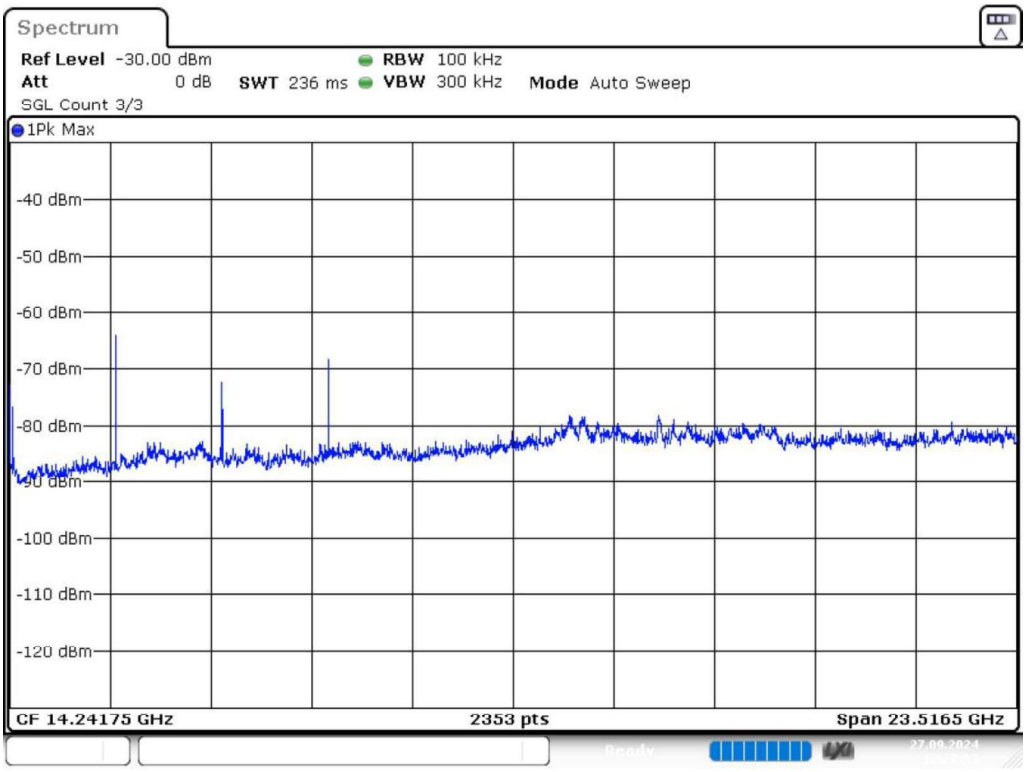

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3.4 47 CFR § 15.205, § 15.209, § 15.247 (d) – Spurious emission - Radiated

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

§ 15.205:

Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

§ 15.209:

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:

Frequency (MHz)	Field strength (microvolts/ meter)	Measurement distance (meters)
0.009-0.49	2400/F(kHz)	300
0.49-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

§ 15.35:

Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

3.4.1 Test procedure

According ANSI C63.10-2013:

Preliminary tests shall be performed following the procedures in 6.3 on a site meeting the requirements of 5.2. For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.

Final measurements are performed with the EUT rotated from 0° to 360°; the antenna height scanned in accordance with 6.6.3.1, 6.6.3.2, or 6.6.3.3, as appropriate; and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Variations in cable or wire placement shall be explored to maximize the measured emissions.
The emission signal shall be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured. This may be achieved by either pointing the

3.4.2 Test setup

For the test setup refer to chapter 1.4.

3.4.3 Test equipment

For the test equipment refer to chapter 1.3.

3.4.4 Test results

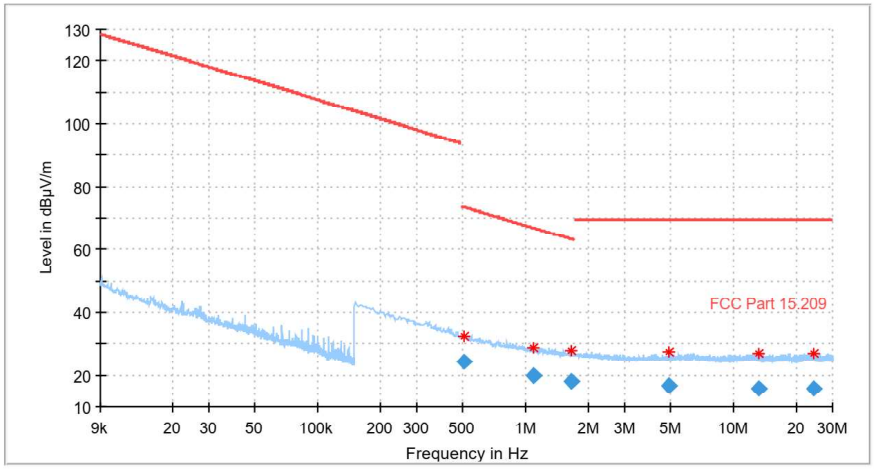
Radiated measurement:

Channel 2402 MHz:

EUT Information

EUT:	Televand T1PRO
Operating mode:	TX 2402 MHz

Full Spectrum



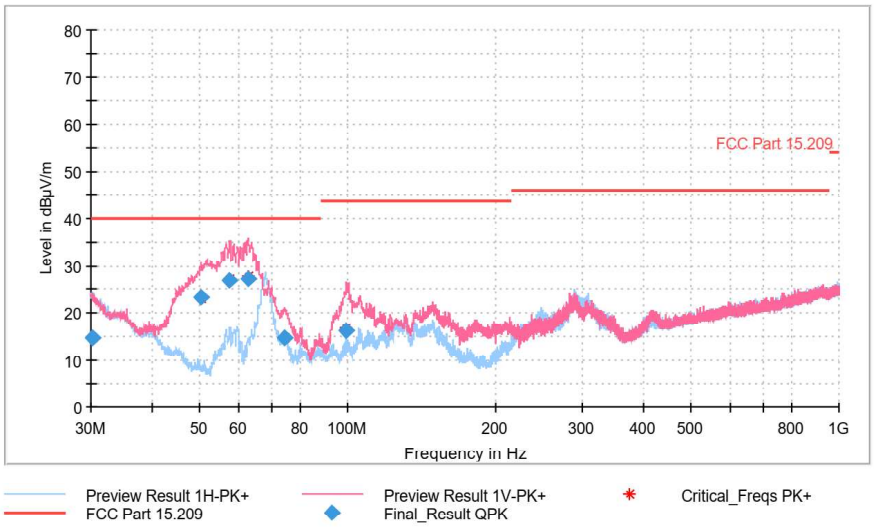
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1.671000	17.96	63.17	45.21	1000.0	9.000	100.0	H	179.0	16.9
1.090500	19.93	66.87	46.94	1000.0	9.000	100.0	H	330.0	16.9
0.510000	24.33	73.45	49.12	1000.0	9.000	100.0	H	109.0	16.8
4.920000	16.57	69.50	52.93	1000.0	9.000	100.0	H	167.0	17.0
13.267500	15.99	69.50	53.51	1000.0	9.000	100.0	H	225.0	17.1
24.220500	15.77	69.50	53.73	1000.0	9.000	100.0	H	225.0	17.5

EUT Information

EUT:	Televand T1PRO
Operating mode:	TX 2402 MHz

Full Spectrum



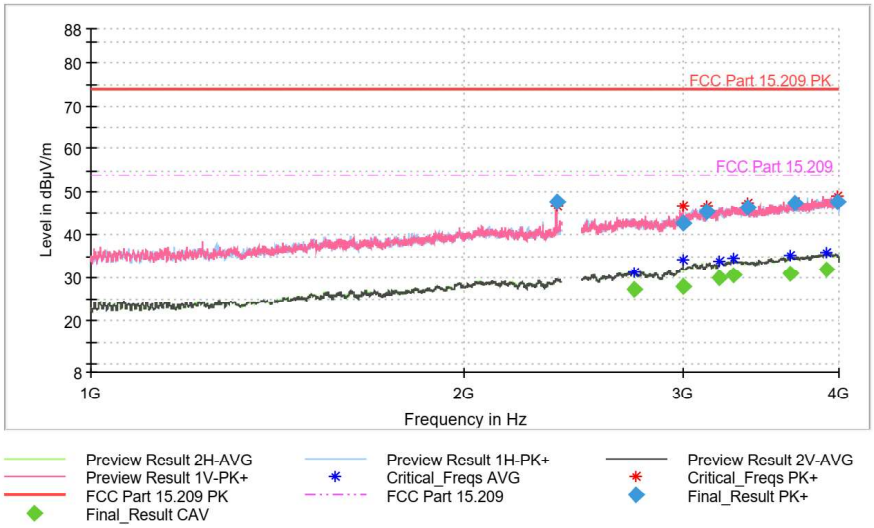
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	DET 2 (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
30.270000	14.59	---	40.00	25.41	135.0	H	17.0
50.250000	23.25	---	40.00	16.75	100.0	V	78.0
57.630000	26.76	---	40.00	13.24	169.0	V	156.0
62.760000	27.23	---	40.00	12.77	135.0	V	72.0
74.610000	14.65	---	40.00	25.35	115.0	V	78.0
99.390000	16.00	---	43.50	27.50	154.0	V	119.0

EUT Information

EUT:	Televand T1PRO
Operating mode:	TX 2402 MHz

Full Spectrum



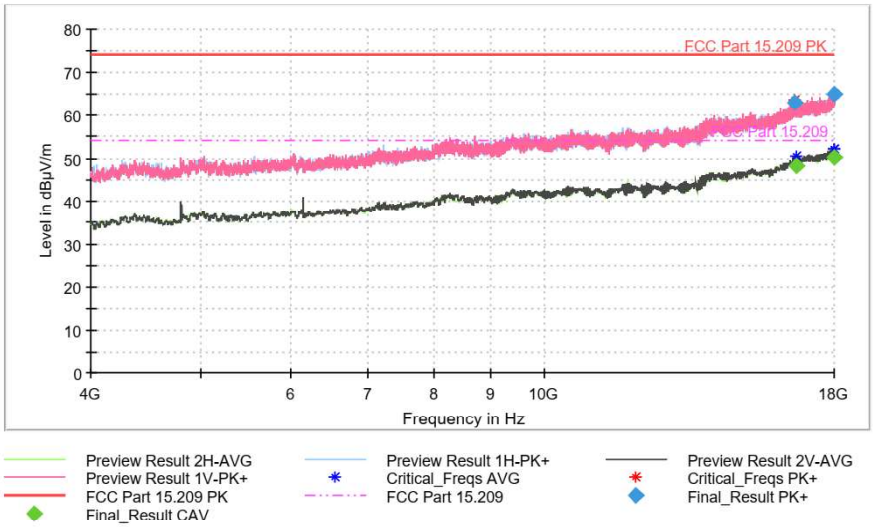
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
2369.000000	47.51	---	74.00	26.49	175.0	V	283.0
2733.500000	---	27.31	54.00	26.69	175.0	V	24.0
2996.500000	---	28.04	54.00	25.96	175.0	H	92.0
2999.500000	42.91	---	74.00	31.09	175.0	V	308.0
3134.250000	45.32	---	74.00	28.68	175.0	H	12.0
3208.250000	---	29.87	54.00	24.13	175.0	H	95.0
3289.750000	---	30.66	54.00	23.34	175.0	H	262.0
3380.000000	46.34	---	74.00	27.66	175.0	H	27.0
3658.750000	---	31.09	54.00	22.91	175.0	H	129.0
3688.000000	47.19	---	74.00	26.81	175.0	V	35.0
3906.000000	---	32.04	54.00	21.96	175.0	H	59.0
3992.750000	47.68	---	74.00	26.32	175.0	V	191.0

EUT Information

EUT	Televand T1PRO
OP MODE	TX, 2402 MHz

Full Spectrum



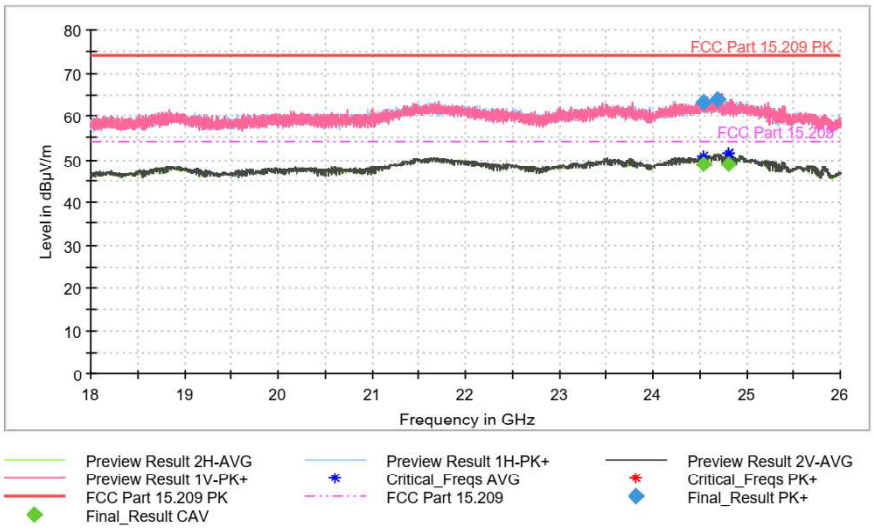
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
17976.250000	---	50.06	54.00	3.94	155.0	V	0.0
16689.250000	---	48.36	54.00	5.64	155.0	H	27.0
17999.500000	64.90	---	74.00	9.10	155.0	H	141.0
16643.750000	62.93	---	74.00	11.07	155.0	V	0.0

EUT Information

EUT	Televand T1PRO
OP MODE	TX, 2402 MHz

Full Spectrum



Final_Result

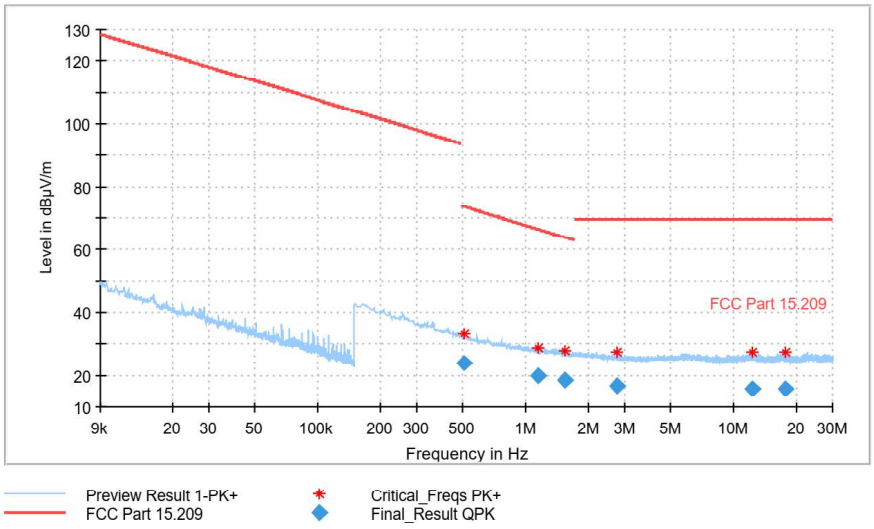
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
24803.500000	---	48.91	54.00	5.09	155.0	V	57.0
24543.750000	---	48.87	54.00	5.13	155.0	V	318.0
24695.000000	64.10	---	74.00	9.90	155.0	H	105.0
24544.000000	63.44	---	74.00	10.56	155.0	V	318.0

Channel 2440 MHz:

EUT Information

EUT:	Televand T1PRO
Operating mode:	TX 2440 MHz

Full Spectrum



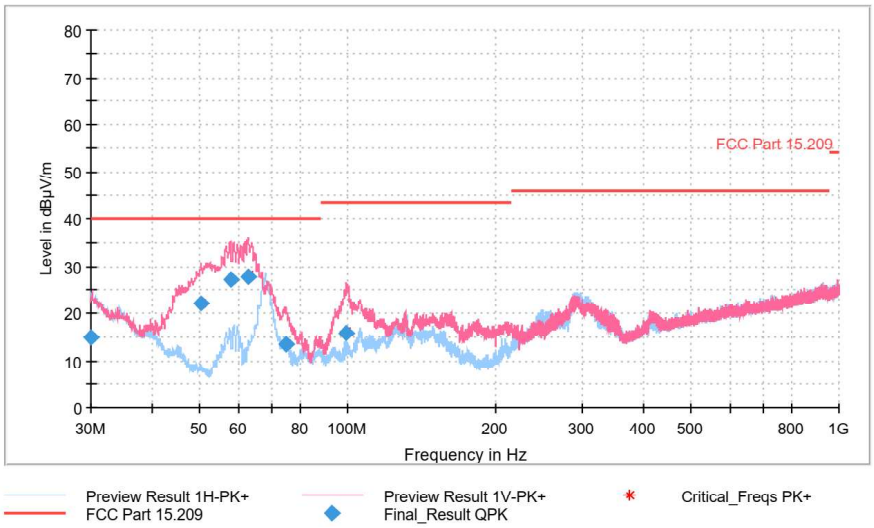
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1.551750	18.38	63.82	45.44	1000.0	9.000	100.0	H	28.0	16.9
1.144500	19.66	66.45	46.80	1000.0	9.000	100.0	H	145.0	16.9
0.505500	24.01	73.53	49.52	1000.0	9.000	100.0	H	6.0	16.8
2.760000	16.49	69.50	53.01	1000.0	9.000	100.0	H	275.0	16.9
17.772000	15.99	69.50	53.51	1000.0	9.000	100.0	H	349.0	17.3
12.378750	15.75	69.50	53.75	1000.0	9.000	100.0	H	275.0	17.0

EUT Information

EUT:	Televand T1PRO
Operating mode:	TX 2440 MHz

Full Spectrum



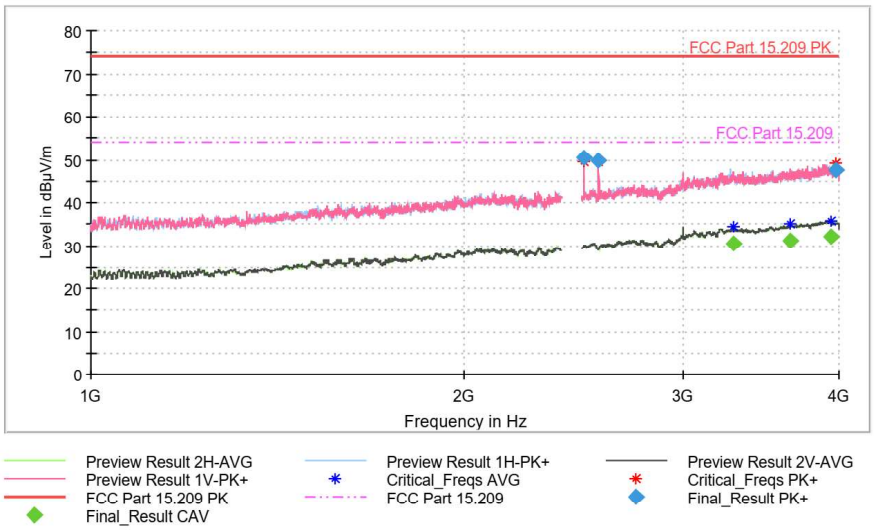
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	DET 2 (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
30.090000	14.78	---	40.00	25.22	188.0	H	283.0
50.310000	22.13	---	40.00	17.87	102.0	V	191.0
57.690000	27.20	---	40.00	12.80	167.0	V	126.0
62.760000	27.91	---	40.00	12.09	162.0	V	126.0
75.000000	13.52	---	40.00	26.48	115.0	V	39.0
99.360000	15.75	---	43.50	27.75	102.0	V	210.0

EUT Information

EUT:	Televand T1PRO
Operating mode:	TX 2440 MHz

Full Spectrum



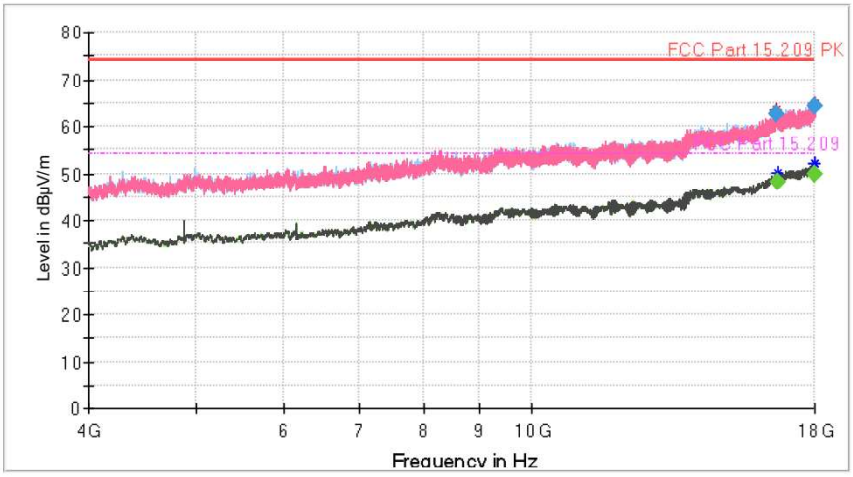
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
2492.000000	50.47	---	74.00	23.53	155.0	V	270.0
2562.500000	49.97	---	74.00	24.03	155.0	V	263.0
3288.250000	---	30.54	54.00	23.46	155.0	V	150.0
3659.000000	---	31.08	54.00	22.92	155.0	V	98.0
3939.750000	---	32.18	54.00	21.82	155.0	V	221.0
3981.250000	47.65	---	74.00	26.35	155.0	H	38.0

EUT Information

EUT	Televand T1PRO
OP MODE	TX, 2440 MHz

Full Spectrum



Preview Result 2 H-AVG
Preview Result 1 V-PK+
FCC Part 15.209 PK
Final_Result CAV
Preview Result 1 H-PK+
Critical_Freqs AVG
FCC Part 15.209
Preview Result 2 V-AVG
Critical_Freqs PK+
Final_Result PK+

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
17977.75000	---	49.98	54.00	4.02	155.0	V	335.0
16650.50000	---	48.16	54.00	5.84	155.0	H	358.0
17984.00000	64.41	---	74.00	9.59	155.0	H	84.0
16636.75000	62.76	---	74.00	11.24	155.0	V	335.0