

Test Report

Electromagnetic Compatibility (EMC)



Equipment Under Test: Sound source indicating camera

Brand name: NL Camera

Model: AC13

Manufacturer: Noiseless Acoustics Ltd
Sitratie 7
FI-00420 Helsinki
Finland

Customer: Noiseless Acoustics Ltd
Sitratie 7
FI-00420 Helsinki
Finland

Tests have been performed according to the following requirements

FCC CFR 47 Part 15 (October 2019)	Subpart B	Class A
ICES (Issue 6 + update April 2019)	003	Class A

Date: 12 March 2020

Issued by:

A handwritten signature in blue ink.

Jani Tuomela
EMC/RF Test Engineer

Date: 12 March 2020

Checked by:

A handwritten signature in blue ink.

Rauno Repo
Senior EMC/RF Specialist

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Equipment Under Test (EUT)

Brand name: NL Camera
Model: AC13
Serial no: -

Highest internal operation frequency of the EUT

1.4 GHz (+ 5GHz WLAN)

General description

The EUT is a battery powered handheld acoustic camera. It measures the direction of the sound source and converts it to visual form for the display. The EUT has a Wi-Fi module. Battery charging while using the camera is not allowed. The battery is carried in a shoulder back when the camera is used.

Wi-Fi module information

Module / Chip Information	Manufacturer	Raspberry Pi Trading Ltd
	Model No.	RPI3-MODBP
	FCC ID:	2ABCB-RPI3BP
	ISED Cert. No:	20953-RPI3P
	CE marked	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Type of the EUT

The EUT will be tested as a table-top unit.

Power requirements

Battery pack: Tracer Power BP2607-II LiFePO₄, 7 Ah, size: 92x45x65 mm
Rated voltage: 12 VDC
Rated current: 1 A
Rated frequency: DC

Mechanical Size of the EUT

Height: 28 cm Width: 17.5 cm Depth: 12 cm

Cable lengths and types

Cable: Power supply	Connection: From Battery to NL Camera	Length: 2 m (max)	Type: 4 wires shielded
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Peripherals

No peripherals.

Disclaimer

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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.

EUT Test Conditions During EMC-Testing

The camera was in operational mode and Wi-Fi was set to TX mode.

1. 5GHz WLAN_ch38(5190MHz) _Band width 40MHz_data rate MCS0
2. 2.4GHz WLAN_ ch 6 (2437MHz)_Band width 20MHz_data rate 6Mbps_g-mode



Figure 1: Block diagram of the test setup

Summary of Testing**Summary of Testing**

Test Specification	Description of Test	Result
FCC CFR 47 15/B §15.107, ICES-003 §6.1	Conducted Emissions	N/A¹⁾
FCC CFR 47 15/B §15.109, ICES-003 §6.2	Radiated Emissions, Class A	PASS

¹⁾ The EUT is a battery-operated device.

Test Facility

Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004	SGS Fimko Ltd Takomotie 8 FI-00380, HELSINKI FINLAND
Test Site:	<input type="checkbox"/> K10LAB, ISED Canada registration number: 8708A-1 <input checked="" type="checkbox"/> K5LAB, ISED Canada registration number: 8708A-2 <input type="checkbox"/> T10LAB

Radiated Emissions In The Frequency Range 30 MHz - 40 GHz.

Standard:	ANSI C63.4 (2014)
Tested by:	JAT, HEM
Date:	9-10 March 2020
Humidity:	30 – 60 %
Temperature:	22 ± 3 °C
Barometric pressure	860 – 1 060 hPa

Test plan

The radiated emission measurements were done within a semi anechoic screened chamber. Additional floor absorbers were used on the floor between the EUT and receiving antenna in radiated emission test above 1 GHz. The EUT was placed on a table 0.8 m above the reflecting ground plane. The measurement distance was 3 meters except above 26.5 GHz the distance was 1 m. Measurement results from 1m distance were extrapolated to 3 m distance using an extrapolation factor of 20 dB/decade according to FCC §15.31 (f) (1). The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations. The supply voltage to the turntable was fed through the filter.

Preliminary measurements were performed in three orthogonal positions to specify the worst case EUT orientation. The worst case was when the EUT microphones were pointing downwards.

Radiated measurement settings**Below 1 GHz****Preliminary testing:**

Turntable movement: 20 ° step
Turntable position: 10 ° to 350°
Antenna movement: 1.5 m step
Antenna height: 1.0 m to 4.0 m
Antenna polarization: Vertical and horizontal

Final testing:

Turntable movement: Continuous
Turntable position: ± 15 °
Antenna movement: Continuous
Antenna height: ± 0.75 m
Antenna polarization: Vertical and horizontal

1 - 18 GHz**Preliminary testing:**

Turntable movement: 15 ° step
Turntable position: 0 ° to 345°
Antenna movement: 1.0 m step
Antenna height: 1.0 m to 4.0 m
Antenna polarization: Vertical and horizontal

Final testing:

Turntable movement: Continuous
Turntable position: ± 15 °
Antenna movement: Continuous
Antenna height: ± 0.75 m
Antenna polarization: Vertical and horizontal

18 – 26.5 GHz

Preliminary testing:

Turtable movement:	Continuous
Turtable position:	0 ° to 360°
Antenna movement:	0.5 m step
Antenna height:	1.0 m to 2.0 m
Antenna polarization:	Vertical and horizontal

Final testing:

Turtable movement:	Continuous
Turtable position:	0 ° to 360°
Antenna movement:	Continuous
Antenna height:	1.0 m to 4.0 m
Antenna polarization:	Vertical and horizontal

26.5 - 40 GHz

Preliminary testing:

Turtable movement:	Continuous
Turtable position:	0 ° to 360°
Antenna movement:	no movement
Antenna height:	1.0 m
Antenna polarization:	Vertical and horizontal

Final testing:

Turtable movement:	Continuous
Turtable position:	0 ° to 360°
Antenna movement:	Continuous
Antenna height:	1.0 m to 4.0 m
Antenna polarization:	Vertical and horizontal

Measured Quasi-Peak Values In The Frequency Range 30 MHz - 1000 MHz

5GHz WLAN_ch38(5190MHz) _Band width 40MHz_data rate MCS0

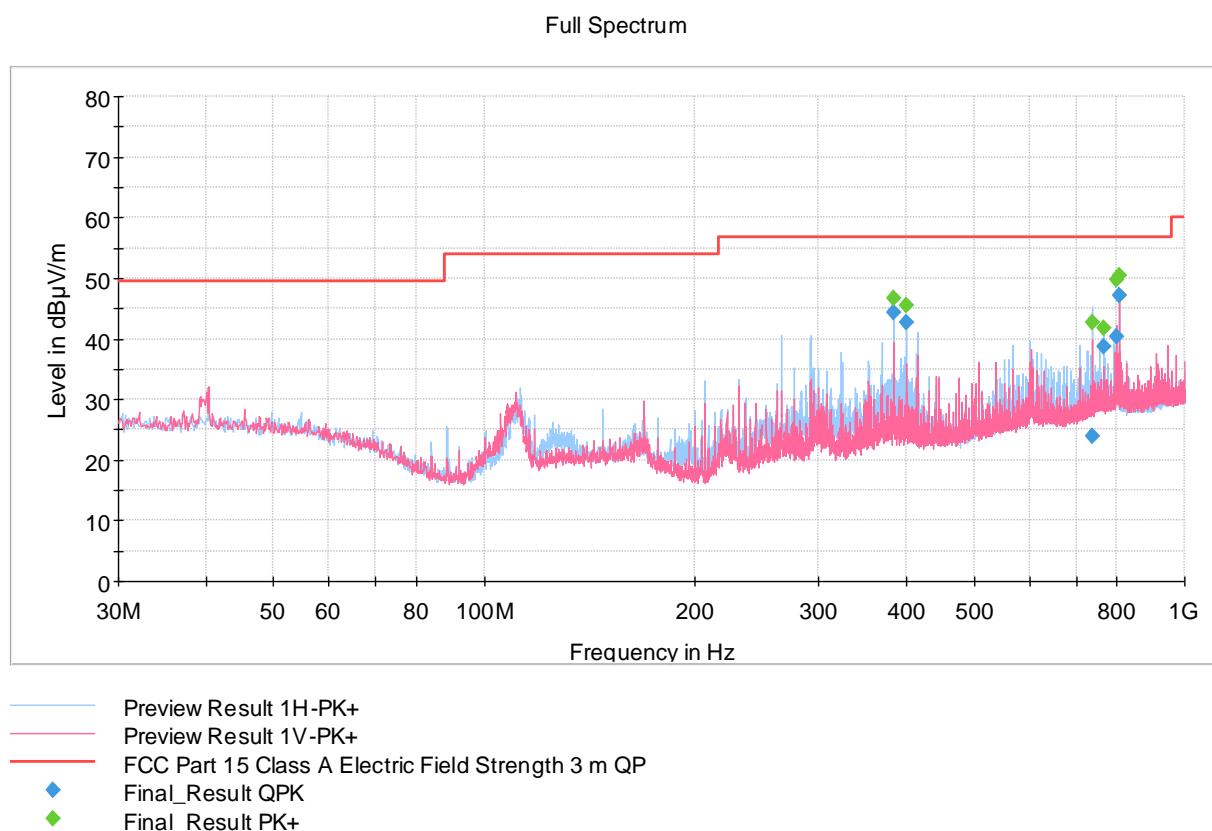


Figure 2: Results (final peak results are only informative)

Final measurements from the worst frequencies

Table 1: Final quasi-peak measurement from the worst frequencies

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
384.615000	44.37	56.86	12.49	1000.0	120.000	224.0	H	162.0	19.2
399.998000	42.80	56.86	14.06	1000.0	120.000	190.0	H	191.0	19.4
737.138000	23.89	56.86	32.97	1000.0	120.000	318.0	H	327.0	25.4
767.006000	38.62	56.86	18.24	1000.0	120.000	109.0	H	135.0	25.8
798.006000	40.36	56.86	16.50	1000.0	120.000	171.0	V	64.0	25.9
806.388000	47.27	56.86	9.59	1000.0	120.000	153.0	H	45.0	26.0

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables).

QuasiPeak values are measured values corrected with the correction factor.

Measured Peak and Average Values In The Frequency Range 1 GHz - 9 GHz

5GHz WLAN_ch38(5190MHz) _Band width 40MHz_data rate MCS0

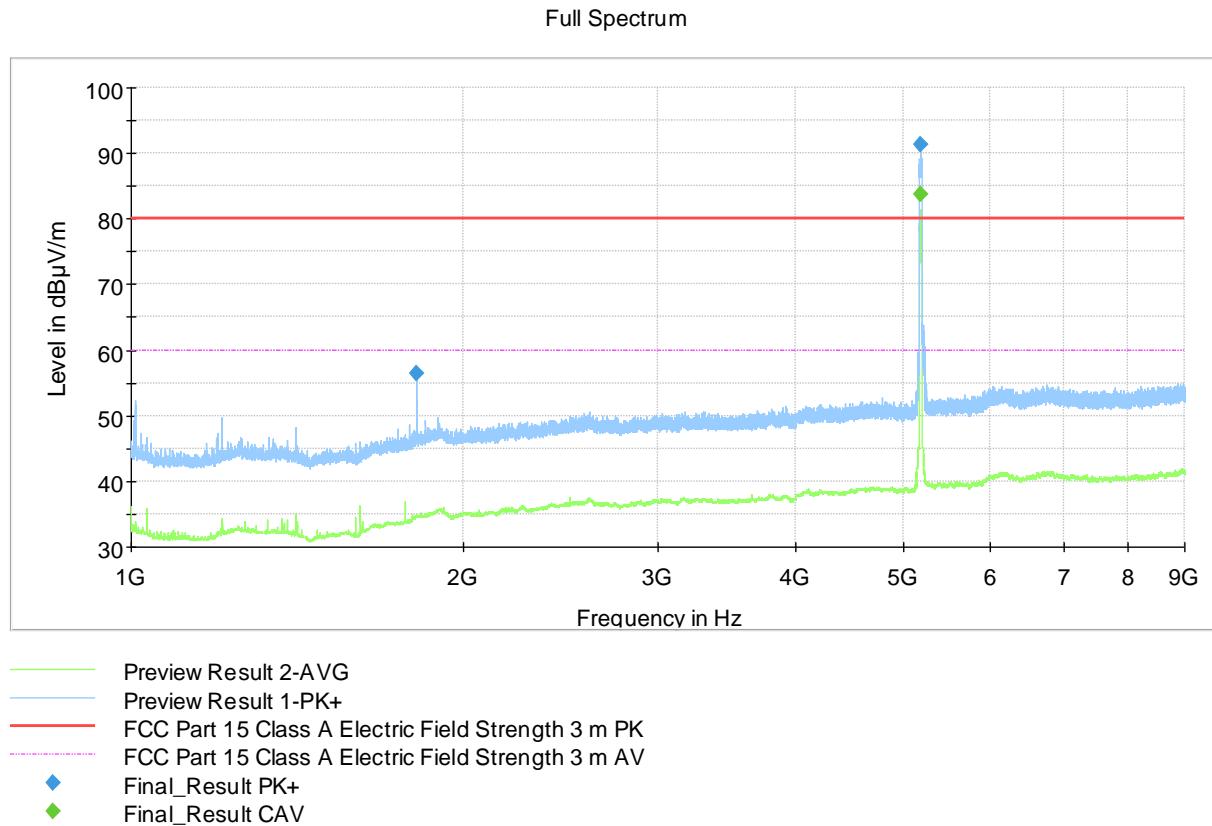


Figure 3: Results with peak and average detectors

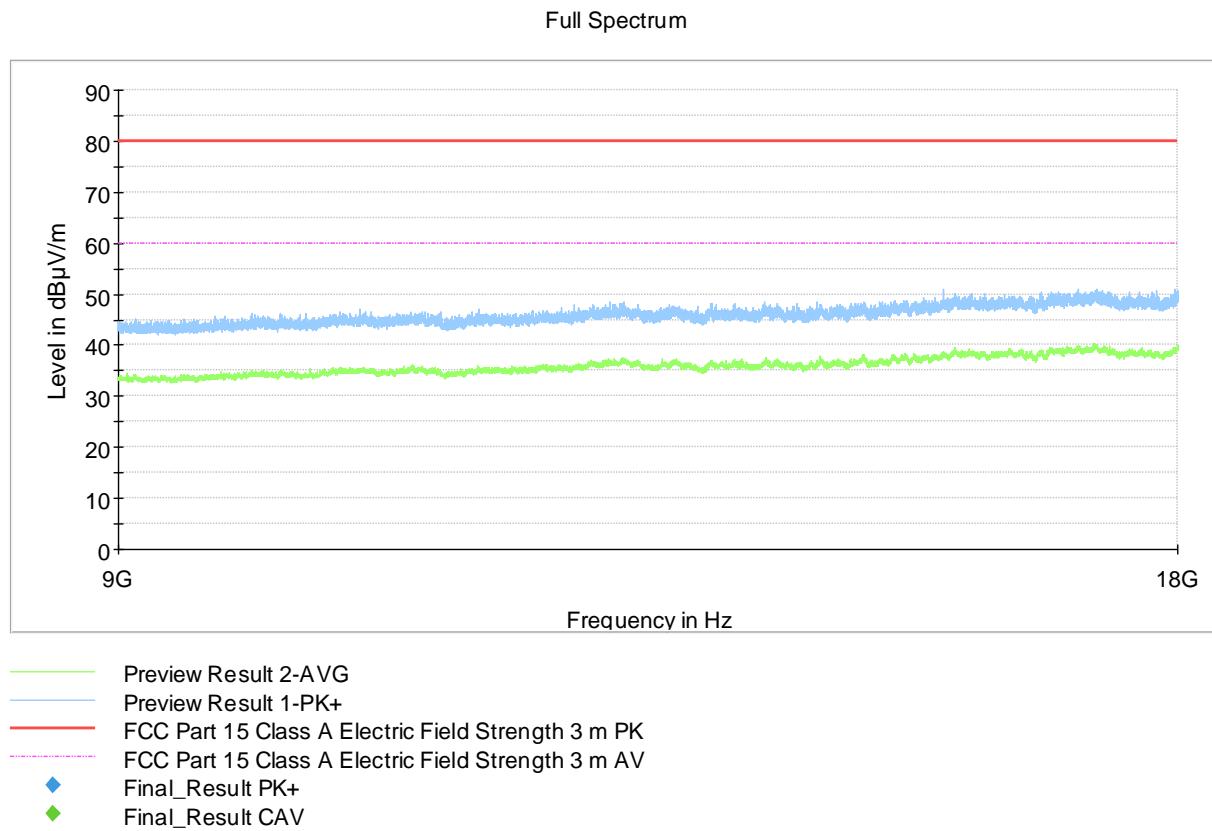
Final measurements from the worst frequencies

Table 2: Final peak and average measurement from the worst frequencies

Frequency (MHz)	MaxPeak (dB μ V/m)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1814.20000	56.54	---	80.00	23.46	1000.0	1000.000	125.0	V	126.0	11.7
5189.80000	91.36	---	---	---	1000.0	1000.000	168.0	H	74.0	16.6
5192.60000	---	83.76	---	---	1000.0	1000.000	168.0	H	74.0	16.6

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + amplifier + cables).

Peak and Average values are measured values corrected with the correction factor.

Measured Peak and Average Values In The Frequency Range 9 GHz - 18 GHz**5GHz WLAN_ch38(5190MHz) _Band width 40MHz_data rate MCS0****Figure 4: Results with peak and average detectors**

No final measurements were performed

Measured Peak and Average Values In The Frequency Range 18 GHz – 26.5 GHz.

5GHz WLAN_ch38(5190MHz) _Band width 40MHz_data rate MCS0

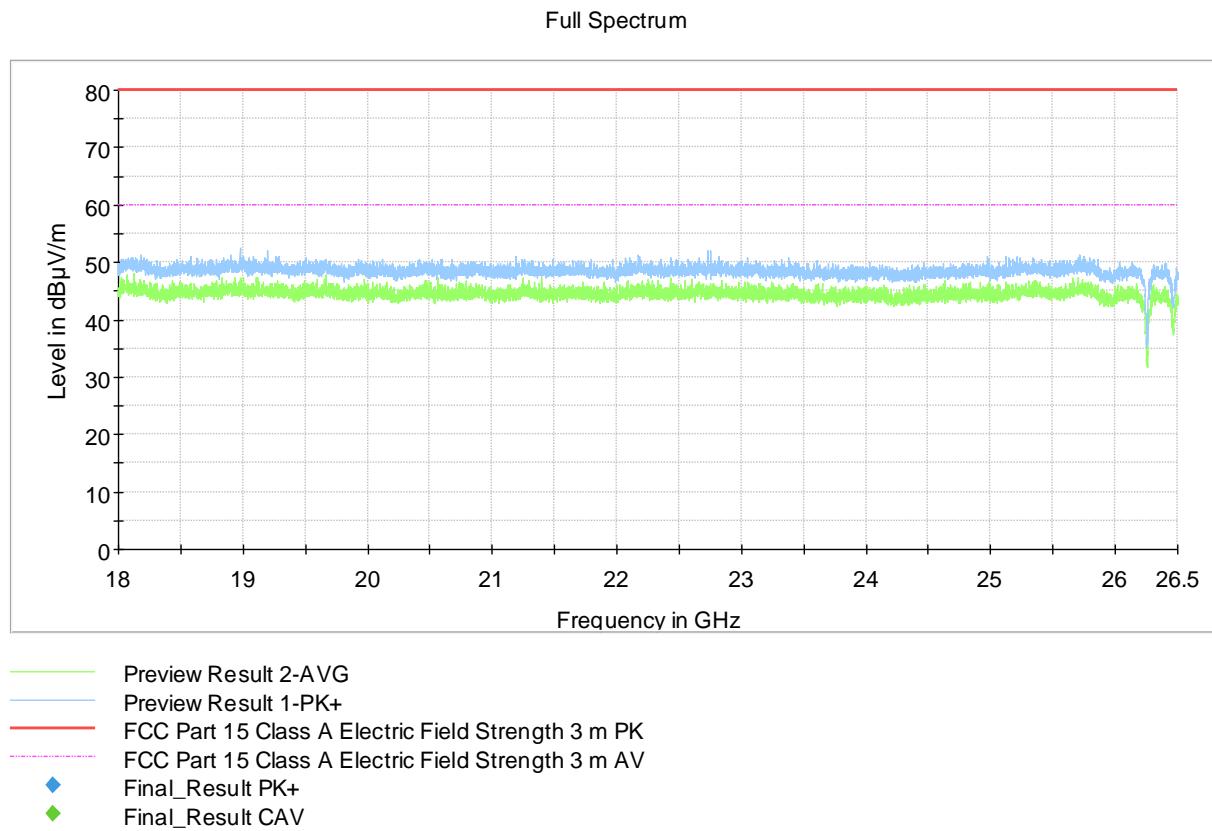


Figure 5: Results with peak and average detectors

No final measurements were performed

Measured Peak and Average Values In The Frequency Range 26.5 GHz – 40 GHz.

5GHz WLAN_ch38(5190MHz) _Band width 40MHz_data rate MCS0

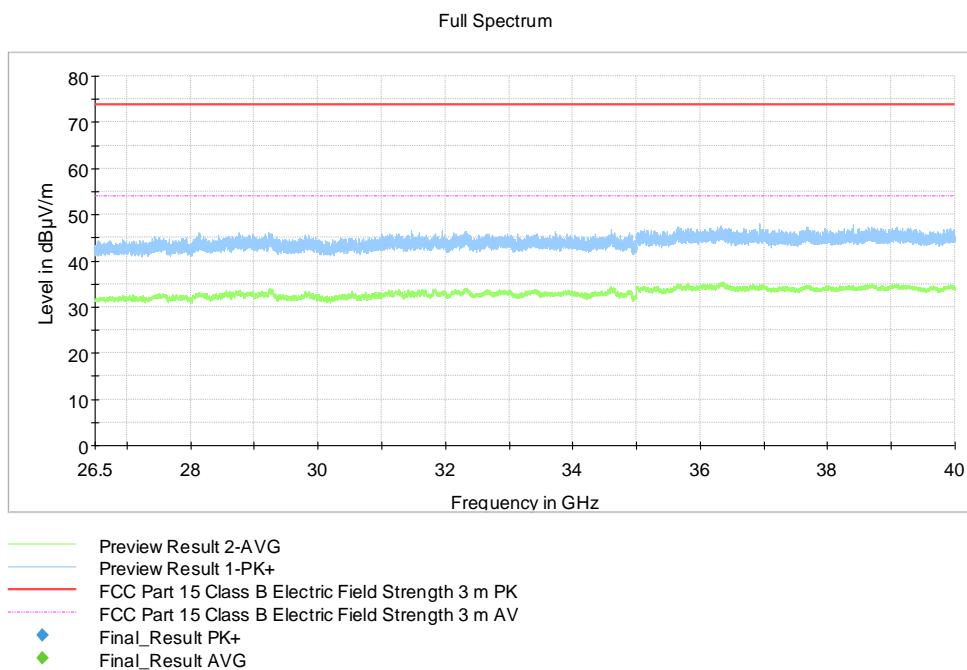


Figure 6: Results with peak and average detectors (horizontal polarity)

No final measurements were performed

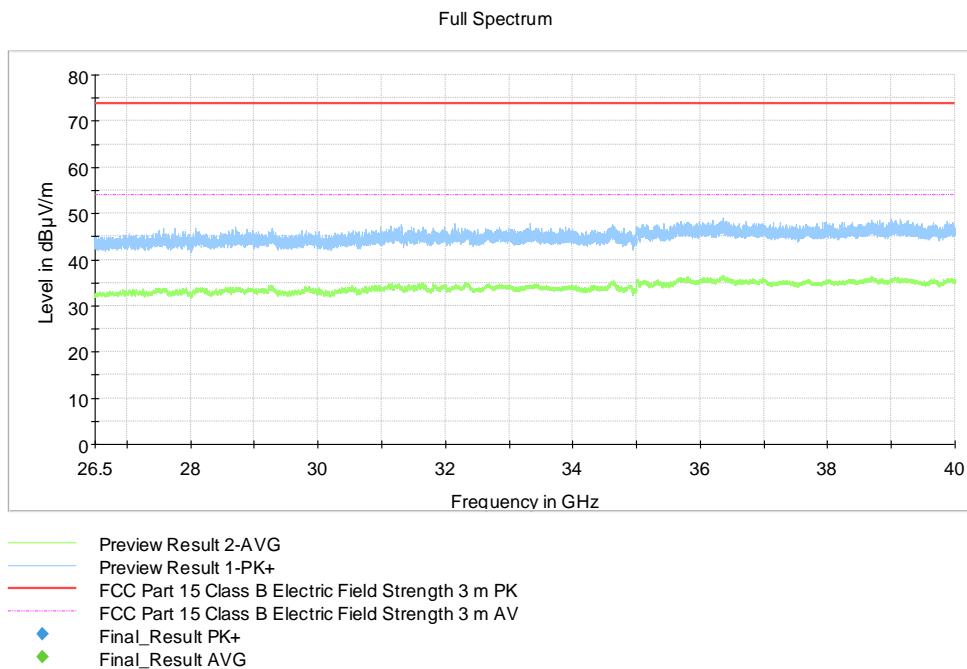
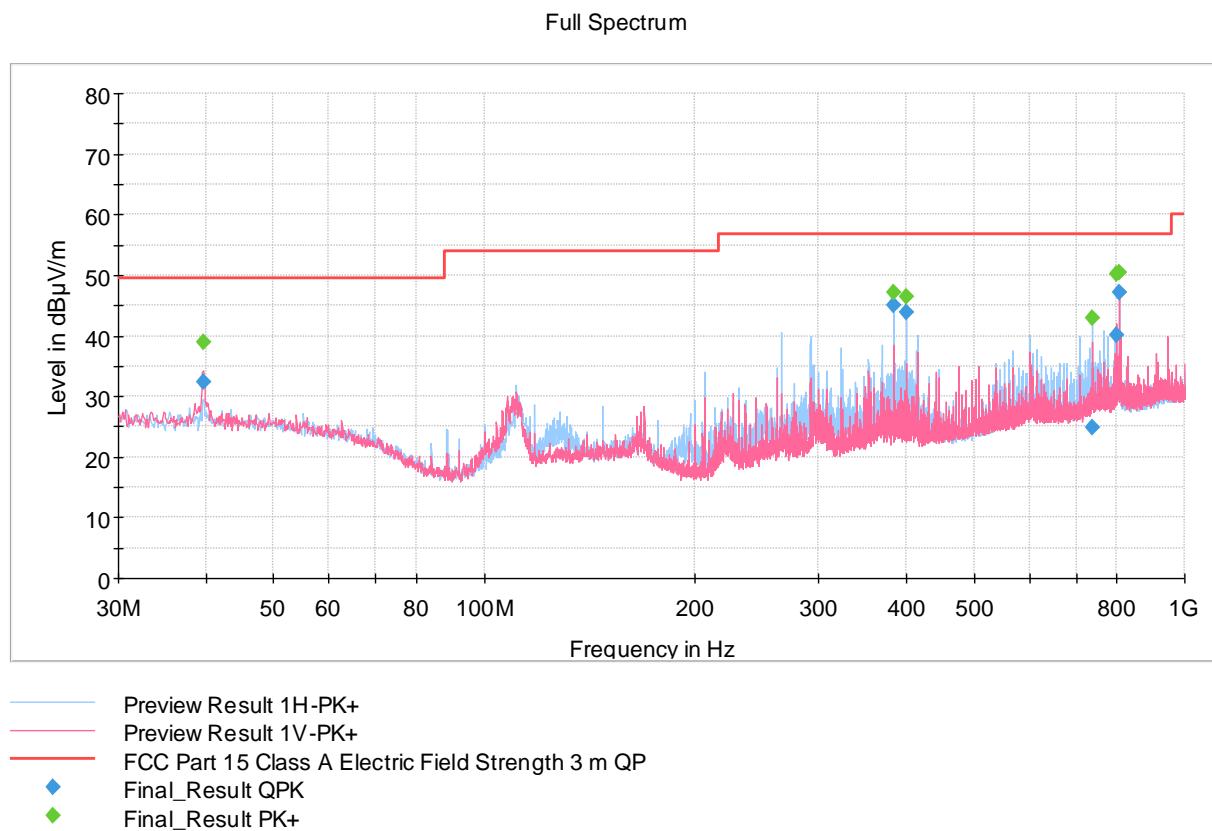


Figure 7: Results with peak and average detectors (vertical polarity)

No final measurements were performed

Measured Quasi-Peak Values In The Frequency Range 30 MHz - 1000 MHz.

2.4GHz WLAN_ch 6 (2437MHz) _Band width 20MHz_data rate 6Mbps_g-mode

**Figure 8:** Results (final peak results are only informative)

Final measurements from the worst frequencies

Table 3: Final quasi-peak measurement from the worst frequencies

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.680000	32.31	49.48	17.17	1000.0	120.000	100.0	V	101.0	17.3
384.615000	45.01	56.86	11.85	1000.0	120.000	226.0	H	176.0	19.2
399.998000	43.81	56.86	13.05	1000.0	120.000	218.0	H	170.0	19.4
738.098000	24.87	56.86	31.99	1000.0	120.000	289.0	H	144.0	25.4
798.006000	40.04	56.86	16.82	1000.0	120.000	172.0	V	79.0	25.9
806.388000	47.25	56.86	9.61	1000.0	120.000	155.0	H	42.0	26.0

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables).

QuasiPeak values are measured values corrected with the correction factor.

Measured Peak and Average Values In The Frequency Range 1 GHz - 4 GHz

2.4GHz WLAN_ch 6 (2437MHz)_Band width 20MHz_data rate 6Mbps_g-mode

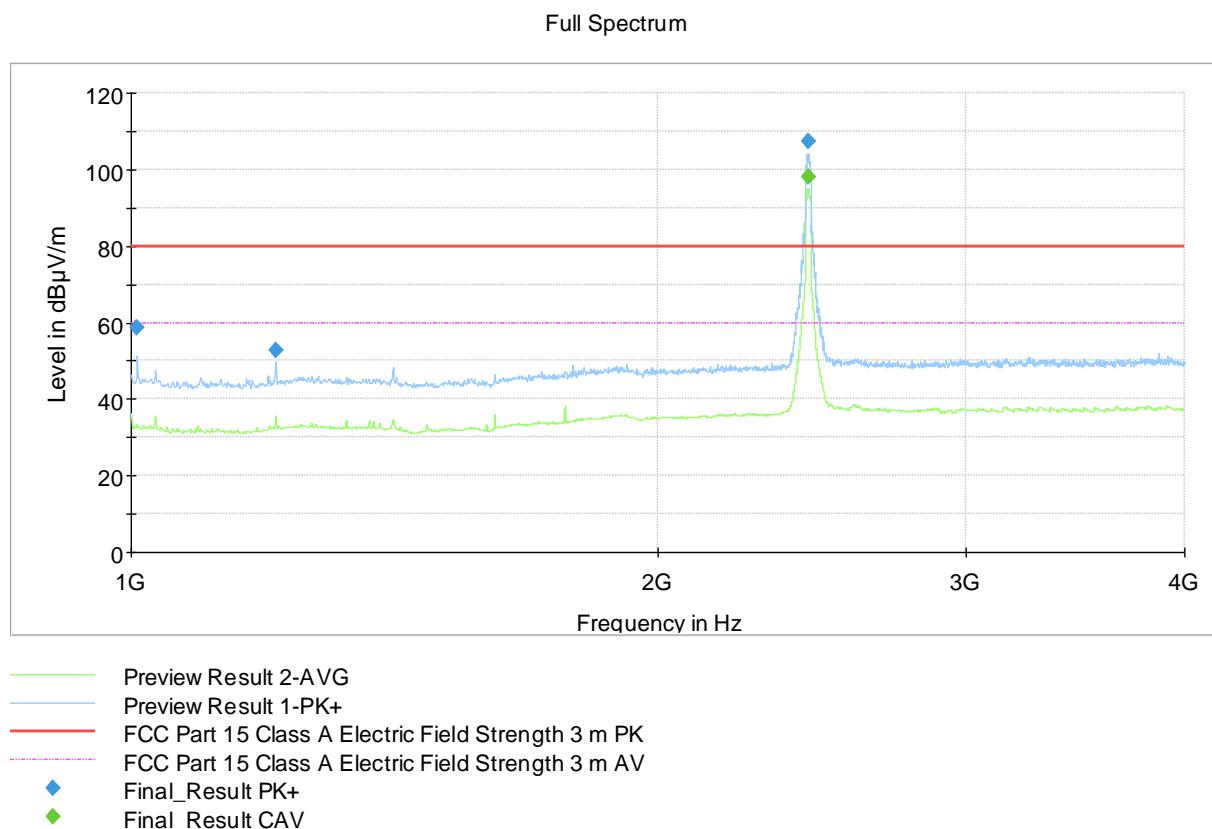


Figure 9: Results with peak and average detectors

Final measurements from the worst frequencies

Table 4: Final peak and average measurement from the worst frequencies

Frequency (MHz)	MaxPeak (dB μ V/m)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1007.92500	58.80	---	80.00	21.20	1000.0	1000.000	121.0	H	305.0	9.2
1209.77500	52.58	---	80.00	27.42	1000.0	1000.000	112.0	V	143.0	9.1
2436.45000	---	98.14	---	---	1000.0	1000.000	143.0	H	155.0	13.5
2437.60000	107.22	---	---	---	1000.0	1000.000	143.0	H	155.0	13.5

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + amplifier + cables). Peak and Average values are measured values corrected with the correction factor.

Measured Peak and Average Values In The Frequency Range 4 GHz - 18 GHz

2.4GHz WLAN_ch 6 (2437MHz) _Band width 20MHz_data rate 6Mbps_g-mode

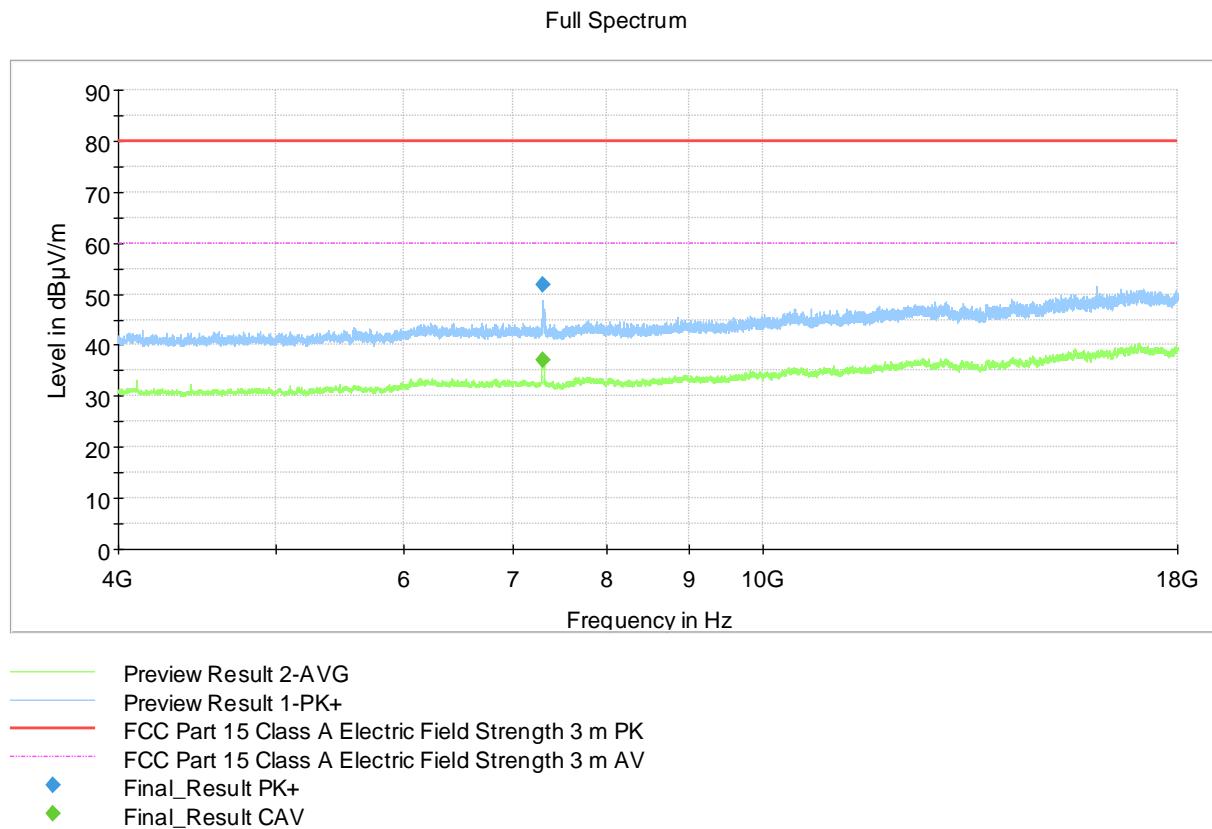


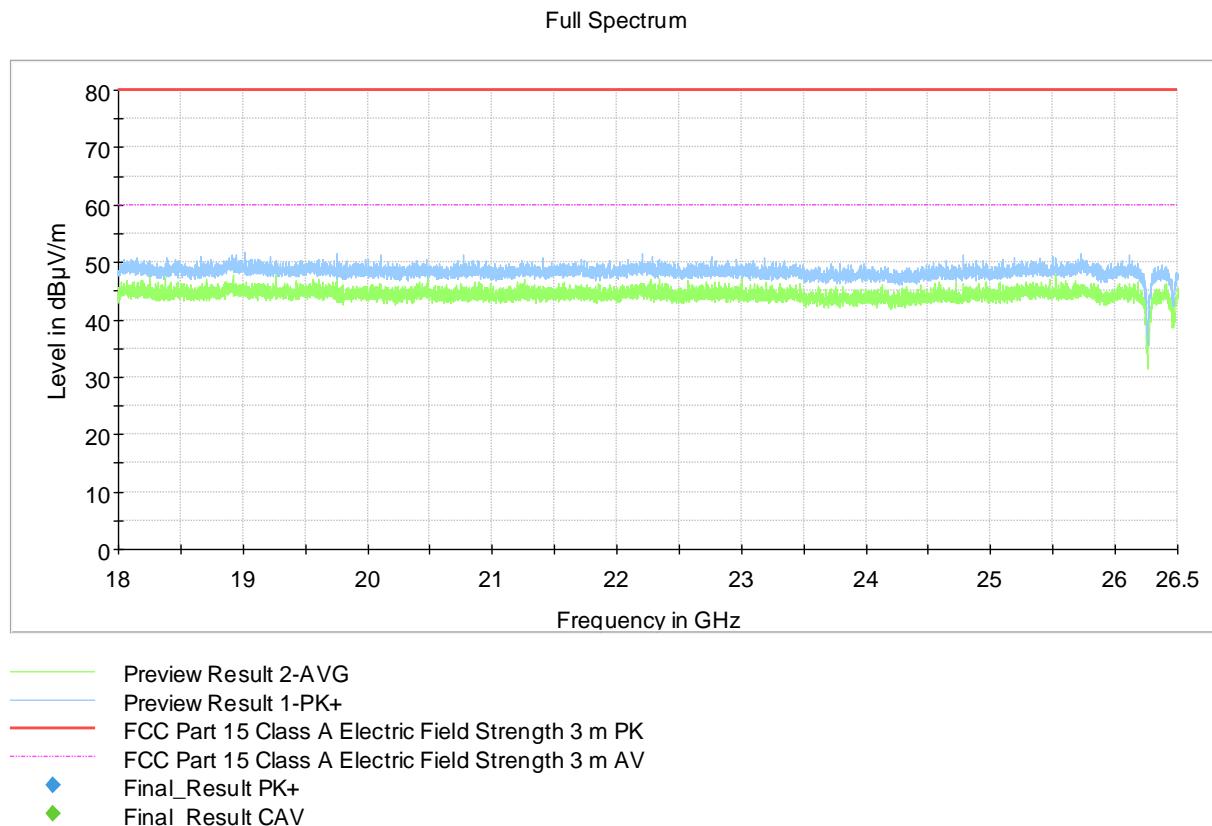
Figure 10: Results with peak and average detectors

Final measurements from the worst frequencies

Table 5: Final peak and average measurement from the worst frequencies

Frequency (MHz)	MaxPeak (dB μ V/m)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7304.90000	51.75	---	80.00	28.25	1000.0	1000.000	100.0	H	352.0	10.4
7308.20000	--	37.18	60.00	22.82	1000.0	1000.000	107.0	H	352.0	10.4

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + amplifier + cables). Peak and Average values are measured values corrected with the correction factor.

Measured Peak and Average Values In The Frequency Range 18 GHz – 26.5 GHz**2.4GHz WLAN_ch 6 (2437MHz) _Band width 20MHz_data rate 6Mbps_g-mode****Figure 11:** Results with peak and average detectors

No final measurements were performed

TEST EQUIPMENT**Radiated Emissions**

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
RF PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2019-10-09	2020-10-09
RF PREAMPLIFIER	CIAO	CA1840-5019	inv:10593	2019-10-08	2020-10-08
ANTENNA	EMCO	3117, emi 1-18GHz	inv:7293	2018-03-14	2020-03-14
ANTENNA	EMCO	3160-09, emi 18-26.5GHz	inv:7294	2020-02-20	2021-02-20
ANTENNA	ETS LINDGREN	3160-10, emi 26.5-40GHz	inv:9151	2019-08-07	2020-08-07
TURNTABLE MAST & TURNTABLE CONTROLLER	MATURO	DS430 UPGRADED	inv:10182	NCR	NCR
ANTENNA MAST	MATURO	NCD	inv:10183	NCR	NCR
ATTENUATOR	PASTERNACK	PE 7004-4 (4dB)	inv:10126	2019-04-01	2021-04-01
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2019-06-28	2020-06-27
ANTENNA	SCHWARZBECK	VULB 9168, emi 30-1000MHz	inv:8911	2018-10-25	2020-10-25
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2019-11-18	2020-11-18
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv:10517	2019-11-07	2020-11-07

NCR = No calibration required

END OF TEST REPORT