

Test Report

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C and INDUSTRY CANADA REQUIREMENTS

Equipment Under Test: Dosimeter with BT LE

Type/ Model: MBD-2

Manufacturer: Mirion Technologies (RADOS) Oy
Mustionkatu 2
FI-20101 Turku
FINLAND

Customer: Mirion Technologies (RADOS) Oy
Mustionkatu 2
FI-20101 Turku
FINLAND

FCC Rule Part: 15.249: 2017
IC Rule Part: RSS-247, Issue 2, 2017
RSS-GEN Issue 4, 2014

Date: 07 November 2017

Issued by: 
Pekka Kälviäinen
Testing Engineer

07 November 2017


Rauno Repo
Testing Engineer

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Equipment Under Test (EUT)

Dosimeter
 Type/ Model: MBD-2
 Serial Number: 00001077

The EUT is a dosimeter to be used around a wrist or chest. The EUT uses 2.4 GHz Low Energy Bluetooth transmission.

Classification of the device

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input checked="" type="checkbox"/>

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

Ratings and declarations

Operating Frequency Range (OFR): 2402 - 2480 MHz
 Channels: 40 channels
 Channel separation: 2 MHz
 Modulation: GFSK
 Integrated antenna gain: 1.2 dBi

Power Supply

3V lithium battery, type CR2450N

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 90 days only. This document cannot be reproduced except in full, without prior approval of the Company

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.249, a / RSS-247 5.4	Maximum Peak Radiated Output Power	PASS
RSS-GEN 6.6	99 % Occupied Bandwidth	PASS
§15.249, a /RSS-247 5.5	Unintentional Radiated Emissions	PASS

EUT Test Conditions during Testing

The EUT was configured into the wanted channel and was in continuous transmit mode during all the tests.

During the radiated measurements above 1 GHz the EUT was on 150 cm high Styrofoam table. New battery was installed before the measurements.

Before the tests the EUT was set in X, Y, Z positions to specify the position having the highest radiated emission levels. The highest levels were received when the EUT was in a position display pointing upwards.

Following channels were used during the tests:

Channel	Frequency/ MHz
Low (CH 0)	2402
Mid (CH 12)	2426
High (CH 39)	2480

Test Facility

<input type="checkbox"/> Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Maximum Peak Conducted Output Power
Maximum Peak Radiated Output Power

Standard: ANSI C63.10 (2013)
Tested by: PKA; JSU
Date: 1 and 3 November 2017
Temperature: 22 °C
Humidity: 18 % RH
Measurement uncertainty ± 4.5 dB Level of confidence 95 % (k = 2)

FCC Rule: 15.249
Results:

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.

EUT was in continuous transmitting mode without any duty cycle.

low ch

Frequency (MHz)	QuasiP (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Antenna angle (deg)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Result
0.034490	-42.6	1000.	0.200	100.0	135	150.0	-59.9	79.5	36.8	PASS
0.090110	-32.3	1000.	0.200	100.0	45	28.0	-59.9	60.8	28.5	PASS
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Result
2400.000000	57.6	1000.	1000.000	354.0	V	337.0	14.7	16.3	73.9	PASS
2402.200000	95.0	1000.	1000.000	150.0	H	194.0	14.6	19.0	114	PASS
4804.500000	62.1	1000.	1000.000	193.0	H	163.0	17.5	11.8	73.9	PASS
7205.100000	58.2	1000.	1000.000	150.0	H	186.0	22.2	15.7	73.9	PASS

mid ch

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Result
2426.200000	95.2	1000.0	1000.000	165.0	H	200.0	14.5	18.8	114	PASS
4851.400000	62.2	1000.0	1000.000	150.0	H	169.0	17.6	11.7	73.9	PASS
7277.100000	58.9	1000.0	1000.000	233.0	V	196.0	21.9	15.0	73.9	PASS

high ch

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Result
2480.200000	90.7	1000.0	1000.000	166.0	H	184.0	14.7	23.3	114	PASS
2488.100000	51.0	1000.0	1000.000	302.0	V	73.0	14.8	22.9	73.9	PASS
4959.375000	53.9	1000.0	1000.000	169.0	V	163.0	8.2	20.0	73.9	PASS
7439.125000	56.5	1000.0	1000.000	100.0	V	110.0	12.1	17.4	73.9	PASS

Maximum Peak Conducted Output Power

EUT was in hopping mode.

low ch

Frequency (MHz)	Average (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Result
2400.000000	40.3	1000.0	1000.000	206.0	V	159.0	14.7	11.9	53.9	PASS
2402.000000	46.2	1000.0	1000.000	150.0	H	195.0	14.6	47.8	94	PASS
4804.000000	40.3	1000.0	1000.000	150.0	H	157.0	17.5	13.6	53.9	PASS
7206.500000	41.6	1000.0	1000.000	150.0	H	189.0	22.2	12.3	53.9	PASS

mid ch

Frequency (MHz)	Average (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Result
2426.000000	46.5	1000.0	1000.000	166.0	H	210.0	14.5	47.5	94	PASS
4851.900000	40.3	1000.0	1000.000	150.0	H	161.0	17.6	13.6	53.9	PASS
7278.500000	41.4	1000.0	1000.000	150.0	H	181.0	21.9	12.5	53.9	PASS

high ch

Frequency (MHz)	Average (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Result
2480.000000	42.5	1000.0	1000.000	165.0	H	180.0	14.7	51.5	94	PASS
2483.500000	40.1	1000.0	1000.000	165.0	H	187.0	14.7	13.8	53.9	PASS
4959.975000	30.9	1000.0	1000.000	181.0	V	160.0	8.2	23.0	53.9	PASS
7439.325000	33.4	1000.0	1000.000	105.0	V	96.0	12.1	20.5	53.9	PASS

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

Standard: ANSI C63.10 (2013)
Tested by: PKA, JSU
Date: 1 and 3 November 2017
Temperature: 22 °C
Humidity: 18 % RH
Measurement uncertainty: ± 4.51 dB Level of confidence 95 % (k = 2)

FCC Rule: 15.249

Test results

FCC Part 15 Class B (15.209) Spurious Emission 9 kHz - 30 MHz 3m

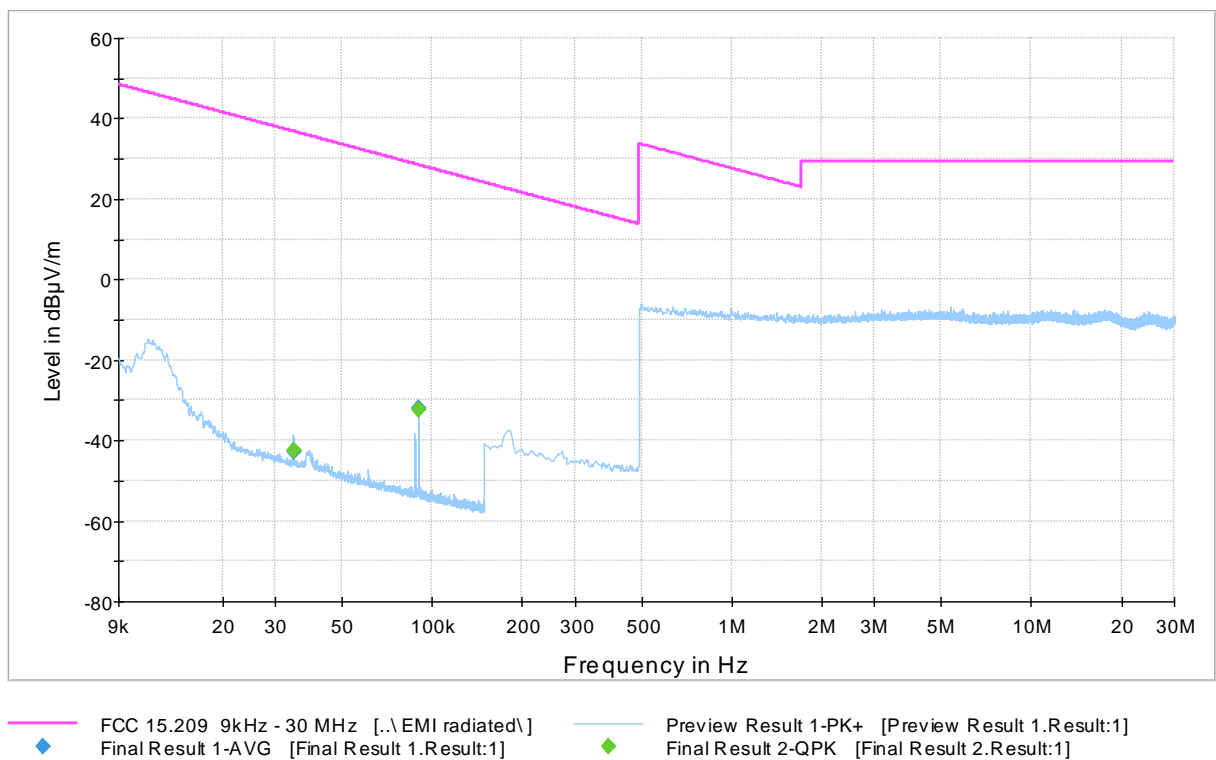


Figure 1. Measured curve with peak detector (Low channel). Final results on page 6.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

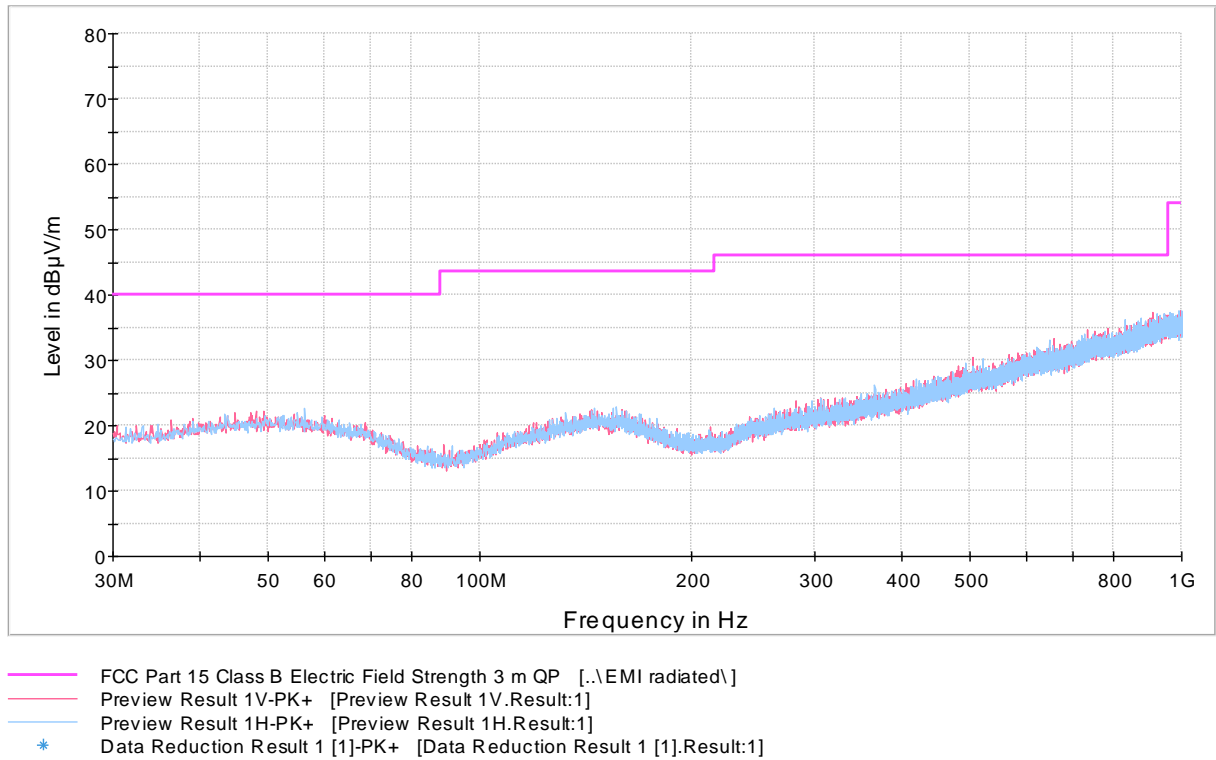


Figure 2. Measured curve with peak detector (Low channel). Final measurements were not performed because no peaks were detected above the noise floor.

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

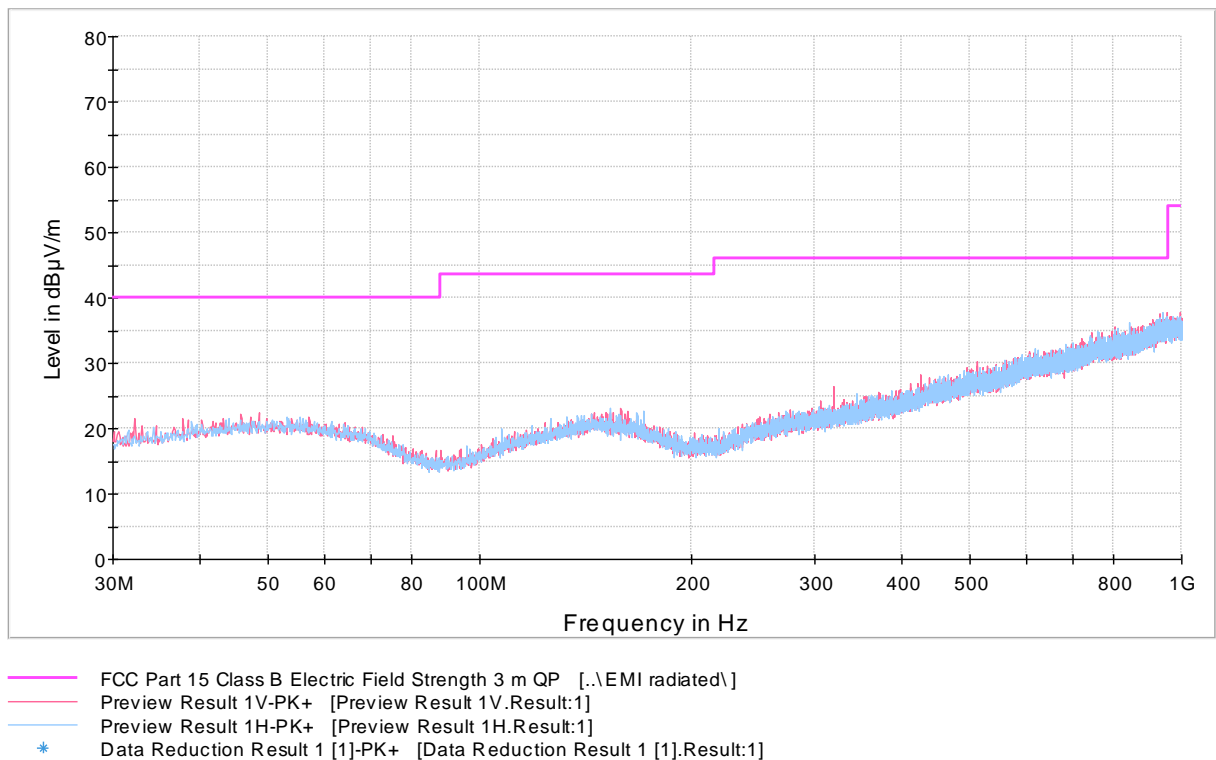


Figure 3. Measured curve with peak detector (Mid channel). Final measurements were not performed because no peaks were detected above the noise floor.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

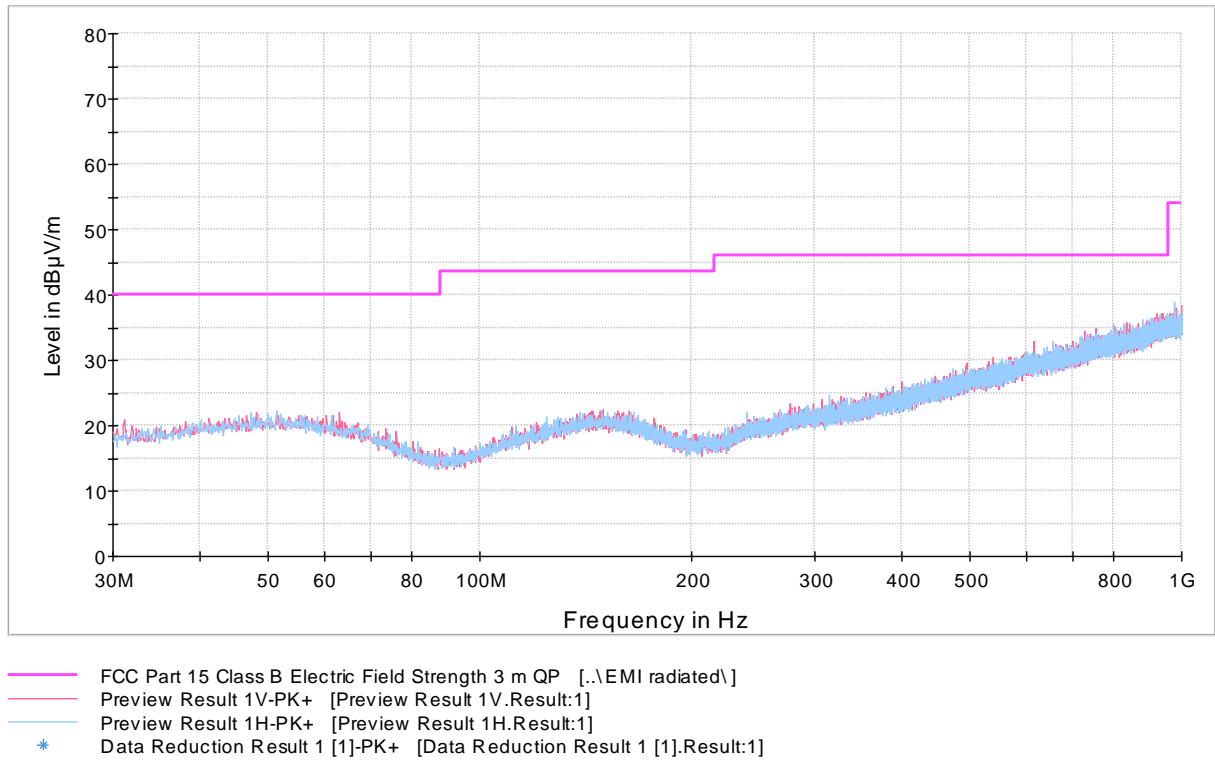


Figure 4. Measured curve with peak detector (High channel). Final measurements were not performed because no peaks were detected above the noise floor.

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

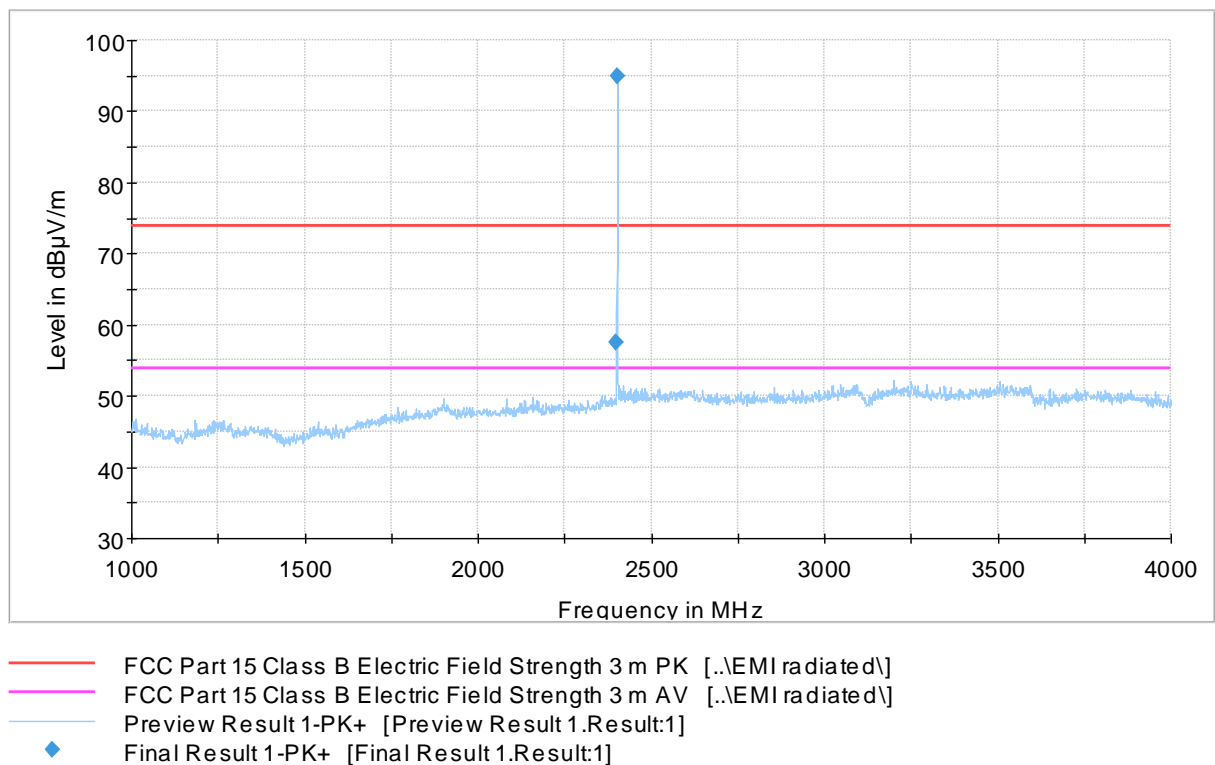
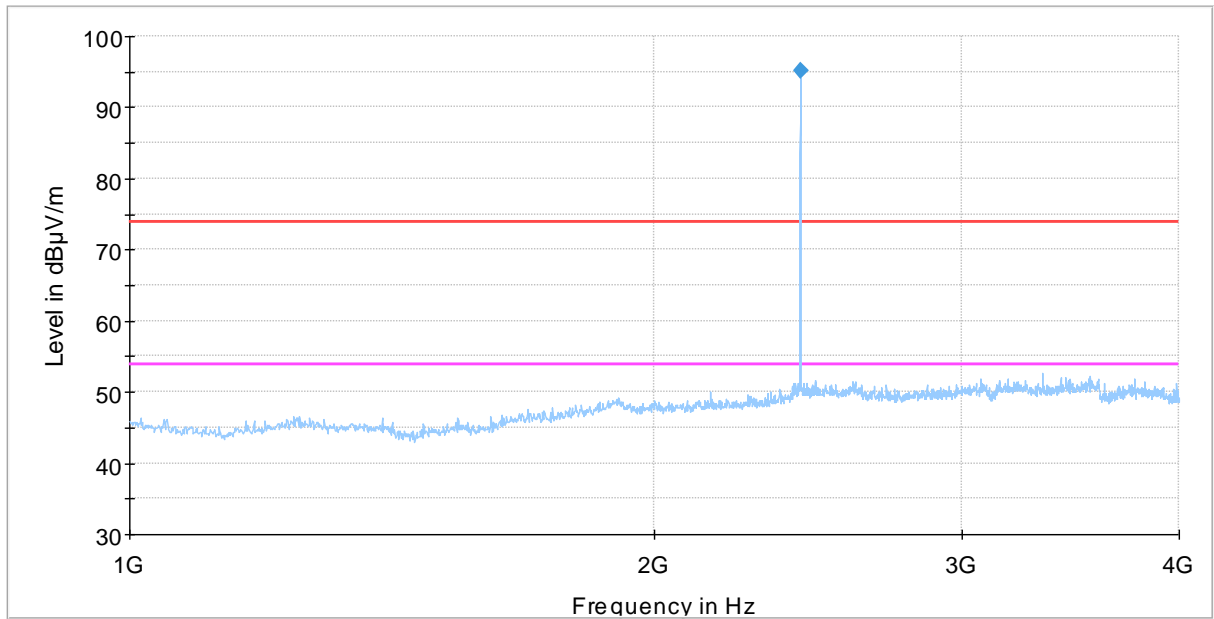


Figure 5. Measured curve with peak detector (Low channel). Final results on page 6.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

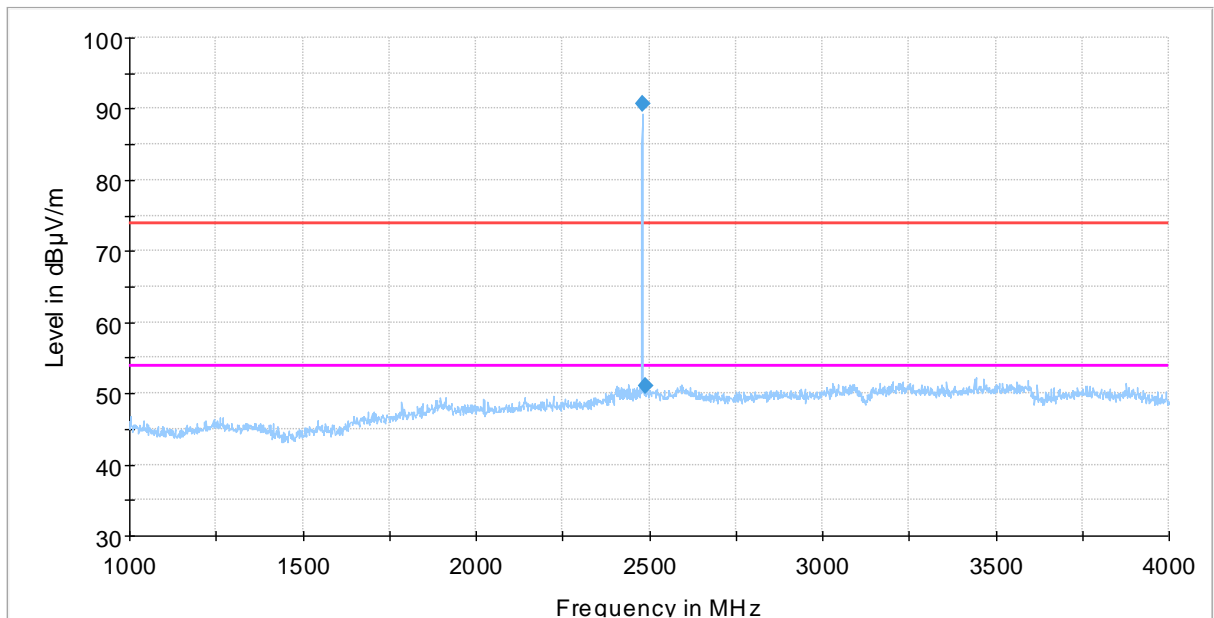
FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



- FCC Part 15 Class B Electric Field Strength 3 m PK [..\EMI radiated\]
- FCC Part 15 Class B Electric Field Strength 3 m AV [..\EMI radiated\]
- Preview Result 1-PK+ [Preview Result 1.Result:1]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]

Figure 6. Measured curve with peak detector (Mid channel). Final results on page 6.

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



- FCC Part 15 Class B Electric Field Strength 3 m PK [..\EMI radiated\]
- FCC Part 15 Class B Electric Field Strength 3 m AV [..\EMI radiated\]
- Preview Result 1-PK+ [Preview Result 1.Result:1]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]

Figure 7. Measured curve with peak detector (High channel). Final results on page 6.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

FCC Part 15 Class B Spurious Emission 4-18GHz 3m

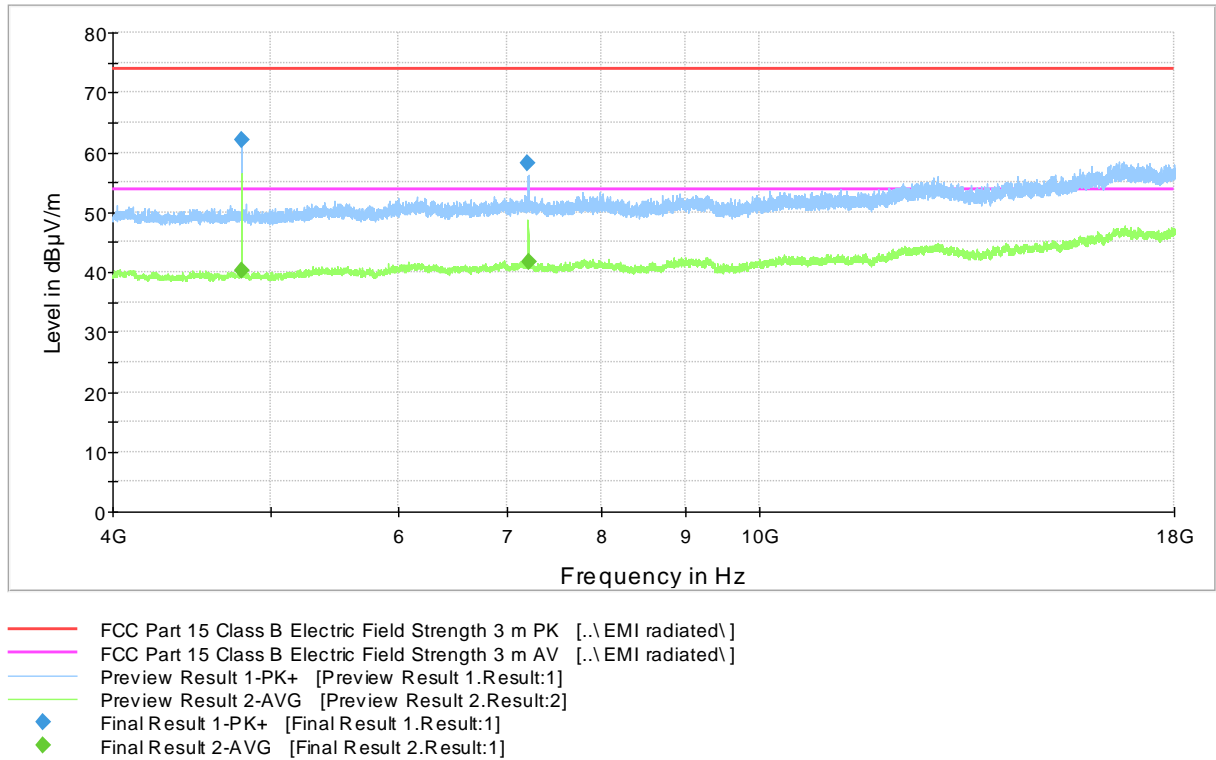


Figure 8. Measured curve with peak and average detectors (Low channel). Final results on page 6.

FCC Part 15 Class B Spurious Emission 4-18GHz 3m

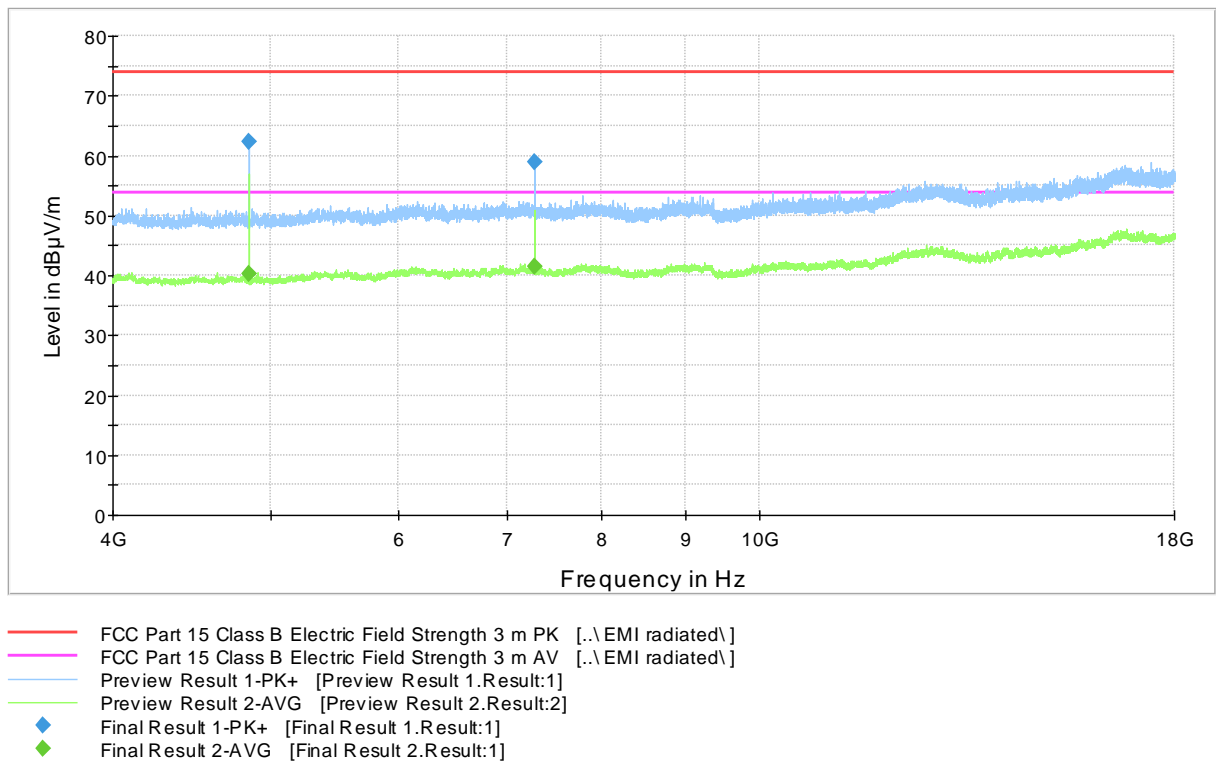
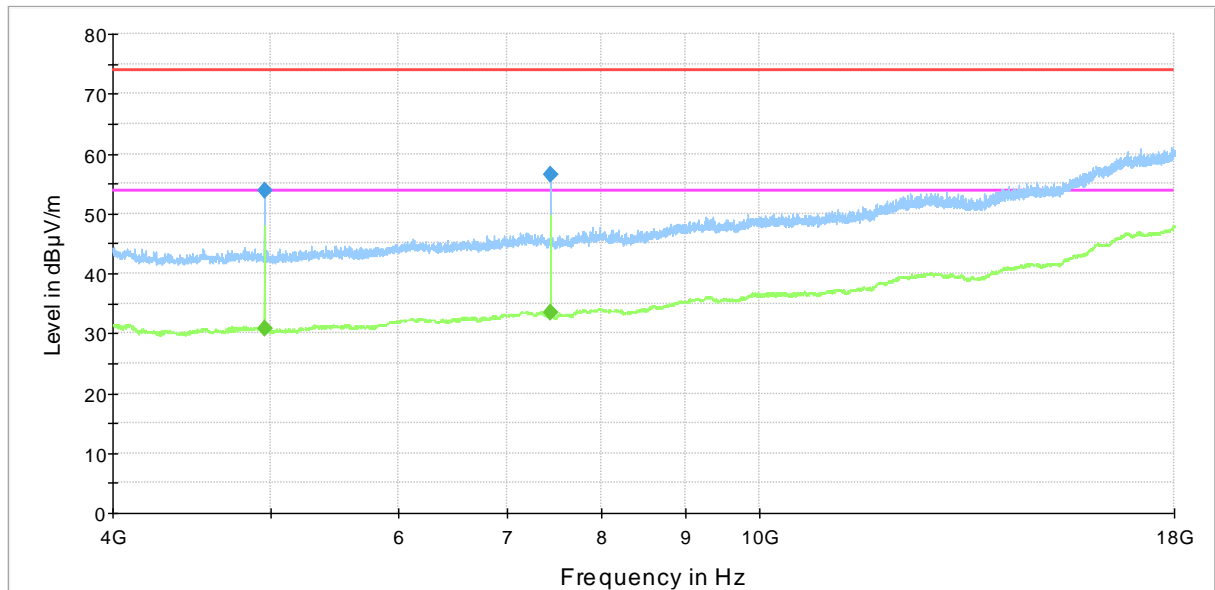


Figure 9. Measured curve with peak and average detectors (Mid channel). Final results on page 6.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

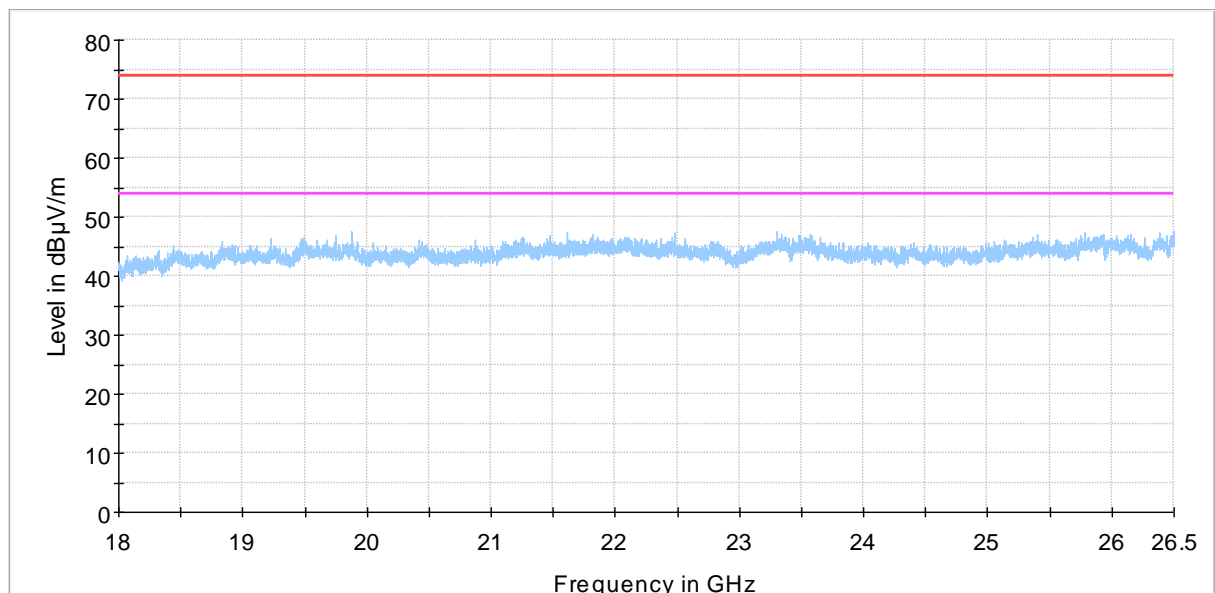
FCC Part 15 Class B Spurious Emission 4-18GHz 3m



- FCC Part 15 Class B Electric Field Strength 3 m PK [..\EMI radiated\]
- FCC Part 15 Class B Electric Field Strength 3 m AV [..\EMI radiated\]
- ExistingD1-PK+ [ExistingD1.Result:1]
- ExistingD2-AVG [ExistingD2.Result:2]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]
- ◆ Final Result 2-AVG [Final Result 2.Result:1]

Figure 10. Measured curve with peak and average detectors (High channel). Final result see page 6.

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



- FCC Part 15 Class B Electric Field Strength 3 m PK [..\EMI radiated\]
- FCC Part 15 Class B Electric Field Strength 3 m AV [..\EMI radiated\]
- Preview Result 1-PK+ [Preview Result 1.Result:1]
- * Data Reduction Result 1 [1]-PK+ [Data Reduction Result 1 [1].Result:1]
- * Data Reduction Result 2 [1]-AVG [Data Reduction Result 2 [1].Result:2]

Figure 11. Measured curve with peak detector (Low channel). Final measurements were not performed because no peaks were detected above the noise floor.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m

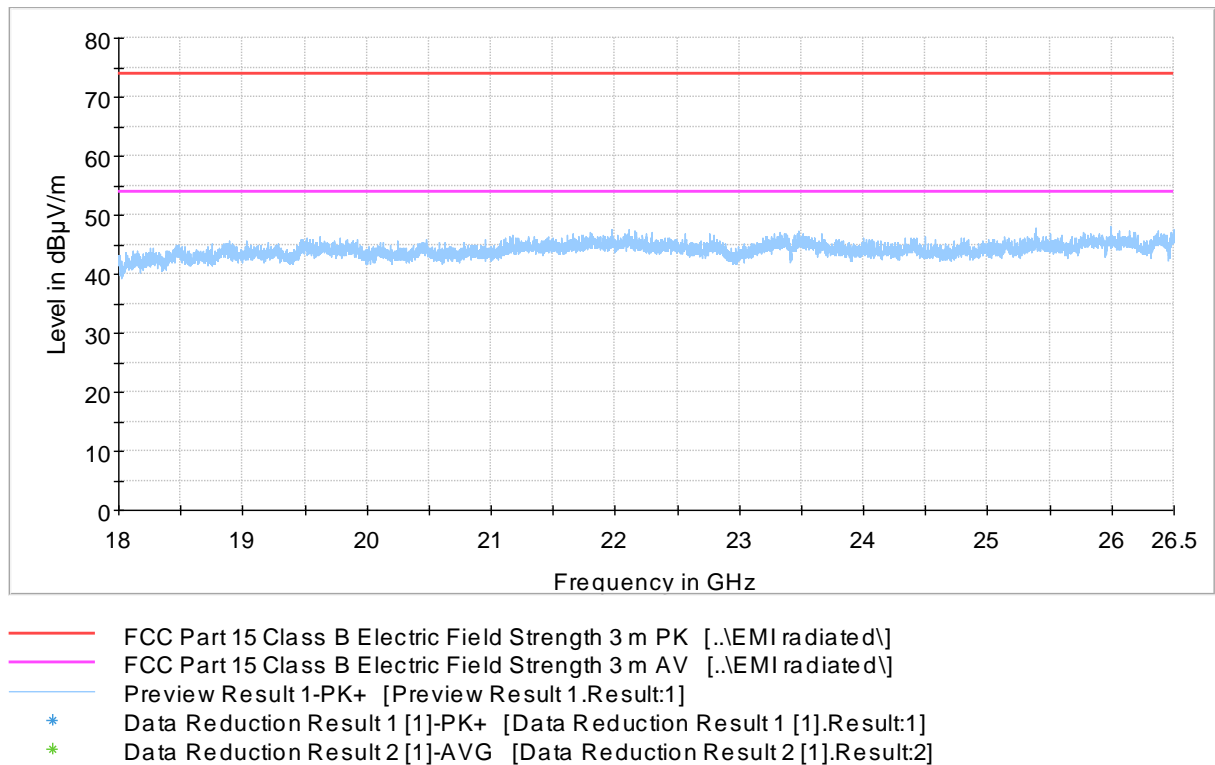


Figure 12. Measured curve with peak detector (Mid channel). Final measurements were not performed because no peaks were detected above the noise floor.

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m

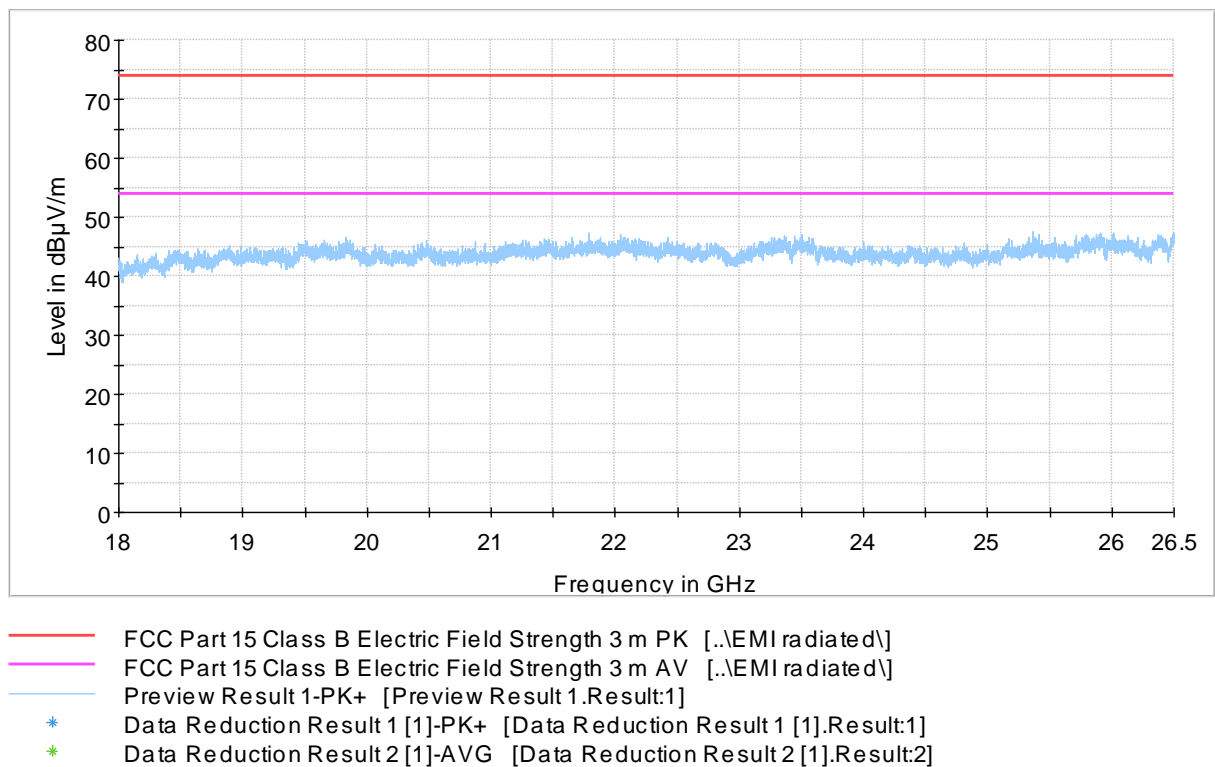


Figure 13. Measured curve with peak detector (High channel). Final measurements were not performed because no peaks were detected above the noise floor.

Transmitter Radiated Emissions 0.009 MHz to 26.5 GHz

Radiated Band Edge Measurement results

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

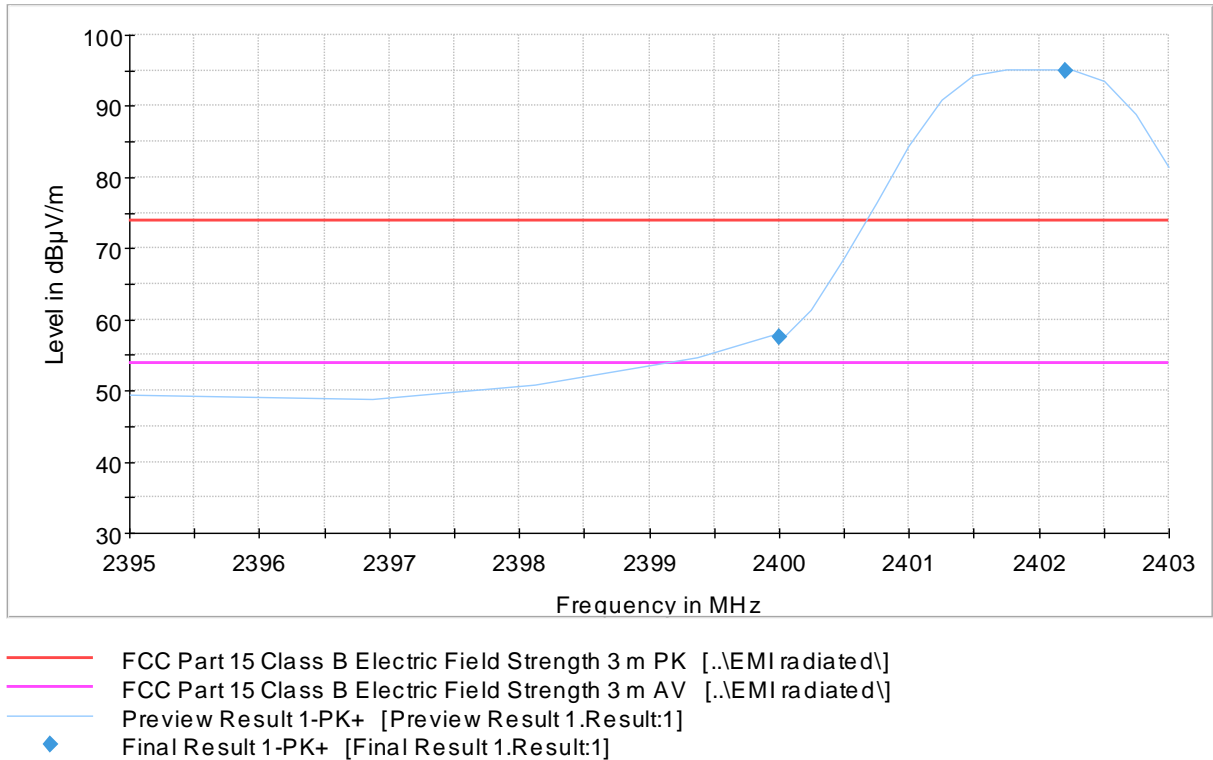


Figure 14. Low channel band edge. Final results on page 6.

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

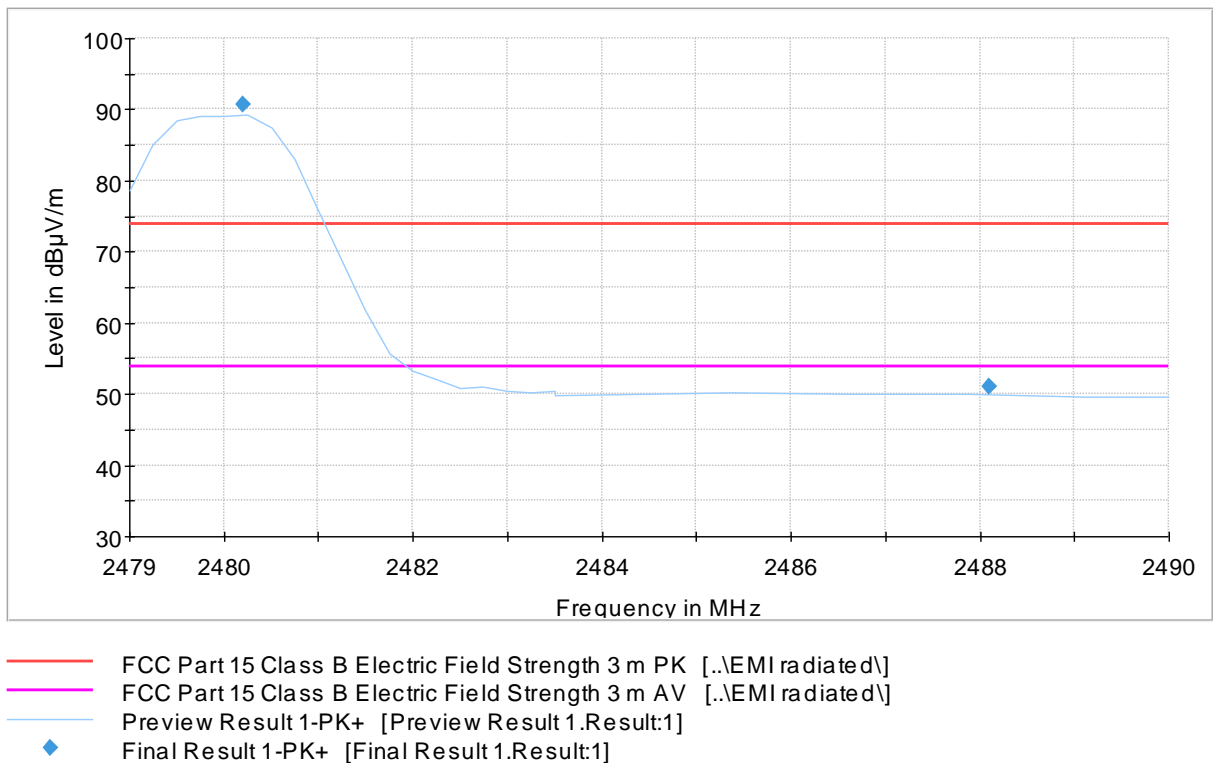


Figure 15. High channel band edge. Final results on page 6.

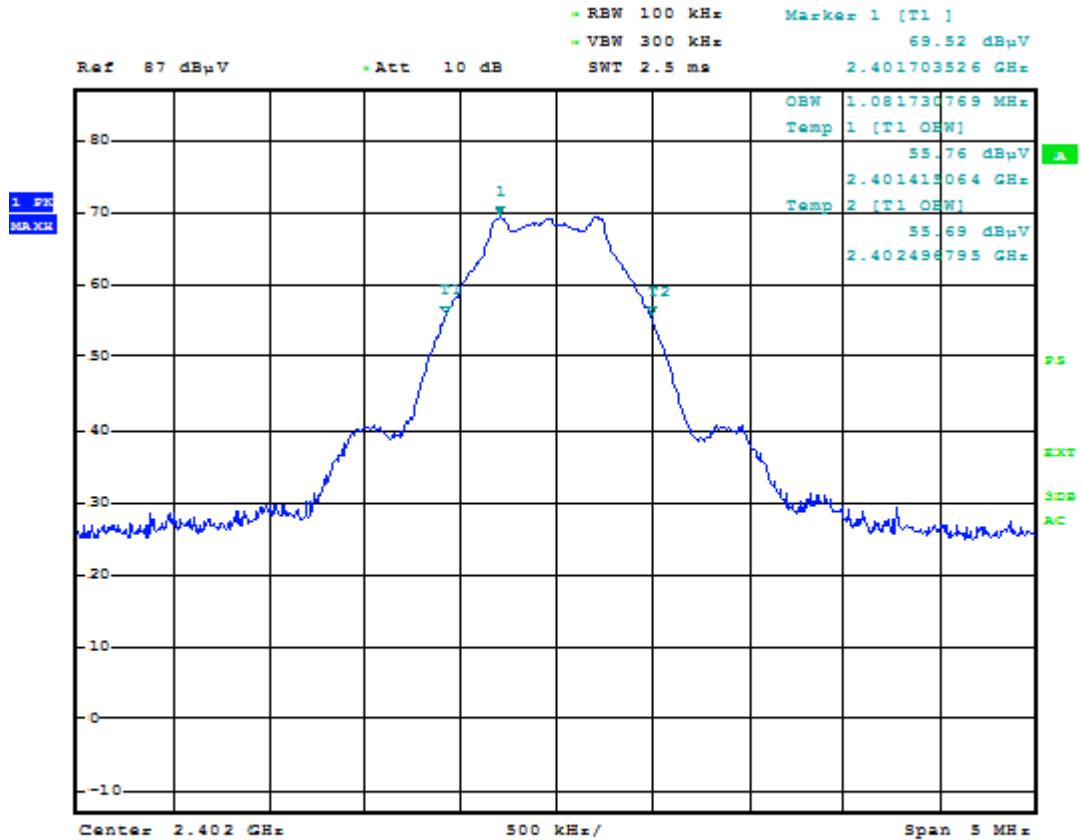
99% Occupied Bandwidth

Standard: RSS-GEN (2014)
 Tested by: PKA
 Date: 3 November 2017
 Temperature: 22 °C
 Humidity: 18 % RH

RSS-GEN 6.6

Table 1. 99 % OBW test results.

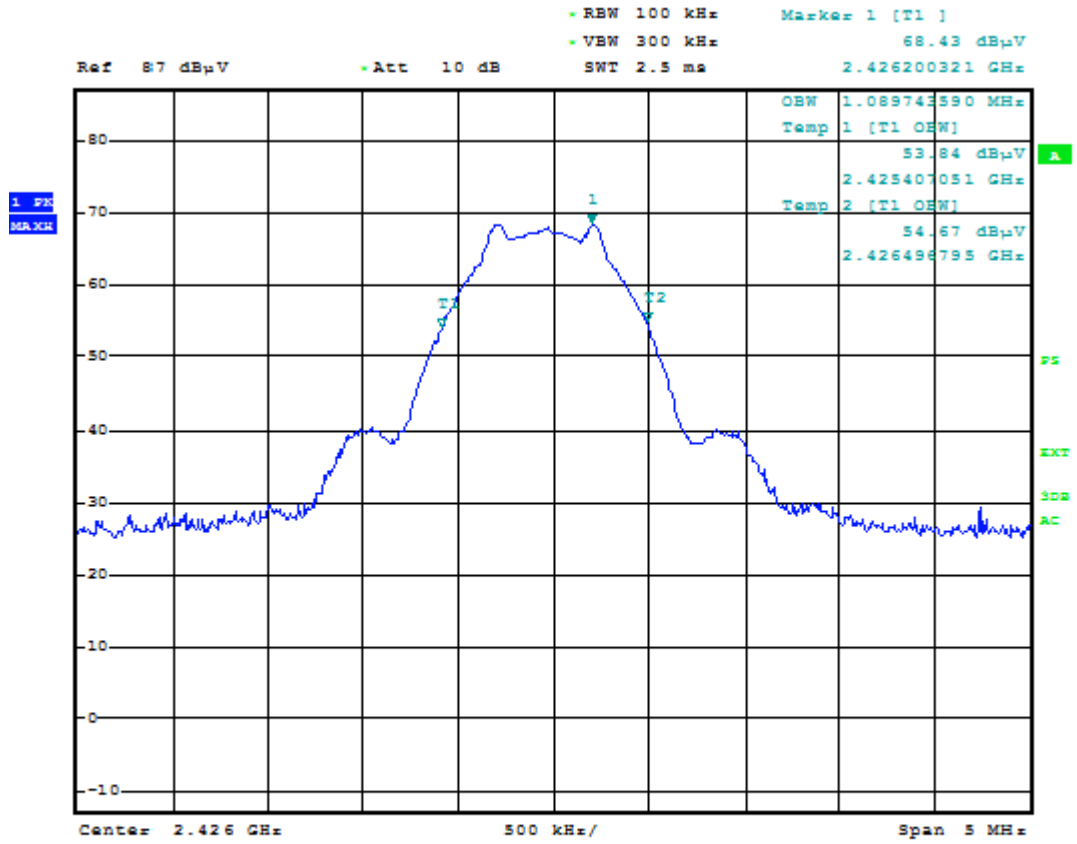
Channel	Limit	99 % BW [MHz]	Result
Low	-	1.081730769	PASS
Mid	-	1.089743590	PASS
High	-	1.105765231	PASS



Date: 3.NOV.2017 14:30:23

Figure 16. 99 % OBW. Low channel.

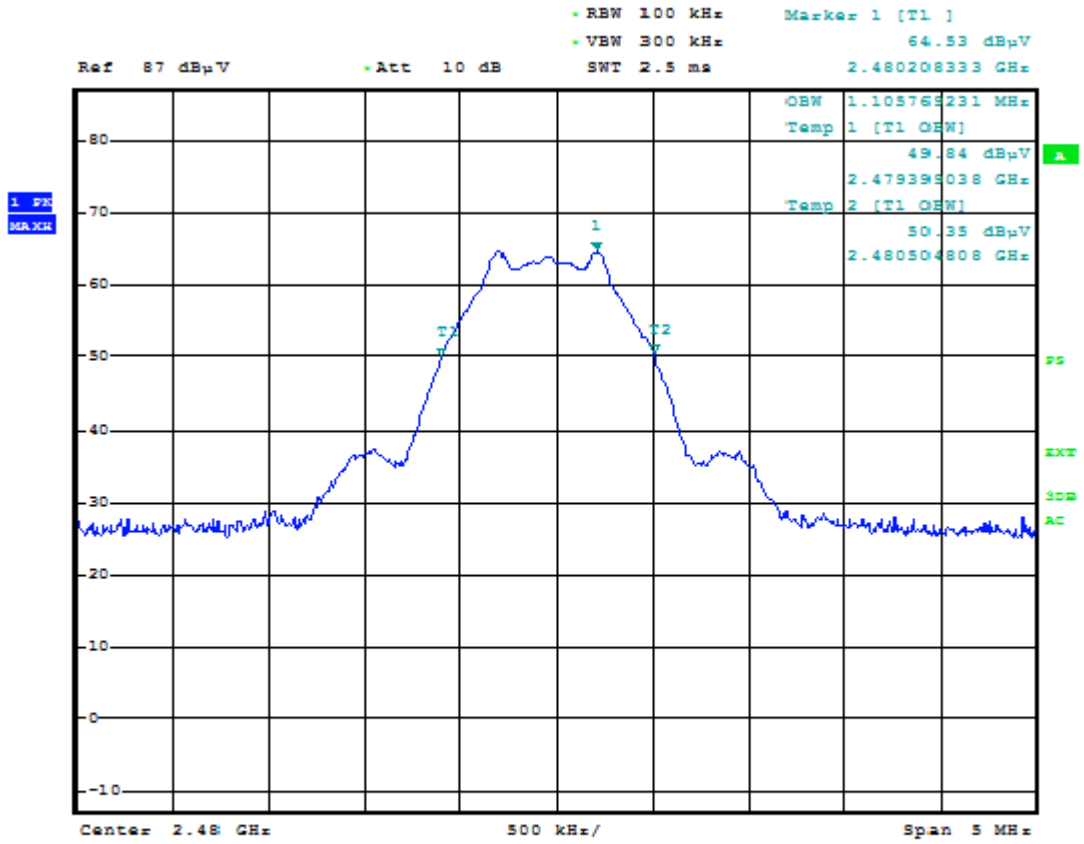
Transmitter Radiated Emissions 30 MHz to 26.5 GHz



Date: 3.NOV.2017 14:24:32

Figure 17. 99 % OBW. Mid channel.

Transmitter Radiated Emissions 30 MHz to 26.5 GHz



Date: 3.NOV.2017 14:20:19

Figure 18. 99 % OBW. High channel.

LIST OF TEST EQUIPMENT

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2016-08-29	2018-08-29
PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2016-11-28	2017-11-28
POWER SUPPLY	DELTA	SM 130-25D	inv:10406	-	-
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2016-08-29	2018-08-29
ANTENNA	EMCO	3117	inv:7293	2016-03-16	2018-03-06
ANTENNA	EMCO	3160-09	inv:7294	2017-03-16	2018-03-16
ANTENNA	ETS LINDGREN	3160-10	inv:9151	2013-08-06	2018-08-06
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2017-07-10	2018-07-10
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2016-10-25	2018-10-25
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2017-02-21	2018-02-21
HIGH PASS FILTER	WAINWRIGHT	WHKX4.0/18G-10SS	inv:10403	2017-03-01	2019-03-01