

# Test Report



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

Equipment Under Test: Multi-Protocol Wireless Module

Model: MGM12P32GA

Manufacturer: Silicon Laboratories Finland Oy  
Bertel Jungin aukio 3  
FI-02600 ESPOO  
FINLAND

Customer: Silicon Laboratories Finland Oy  
Bertel Jungin aukio 3  
FI-02600 ESPOO  
FINLAND

FCC Rule Part: 15.247: 2017  
IC Rule Part: RSS-247, Issue 2, 2017  
RSS-GEN Issue 4, 2014

KDB: Guidance for Performing Compliance  
Measurements on Digital Transmission Systems  
(DTS) Operating Under §15.247 (April 8, 2016)

Date: 23 May 2018

Issued by:

A blue ink signature of Mikko Halonen.

Mikko Halonen  
Testing Engineer

Date: 23 May 2018

Checked by:

A blue ink signature of Rauno Repo.

Rauno Repo  
Testing Engineer

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## Equipment Under Test (EUT)

Trade mark:	Silicon Labs
Model:	MGM12P32GA
Type:	Multi-Protocol Wireless Module
Serial no:	-
FCC ID:	QOQMGM12P3
IC:	5123A-MGM12P3

## Description of the EUT

MGM12P32G is a multi-protocol wireless module. MGM12P32GA variant is equipped with integral chip antenna.

This test report contains test results for Bluetooth Low Energy.

## Classification of the device

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

## Modifications Incorporated in the EUT

No modifications.

## Ratings and declarations

Operating Frequency Range (OFR):	2402 - 2480 MHz
Channels:	40
Channel separation:	2 MHz
Modulation:	GFSK
Integral Antenna gain:	1 dBi

## Power Supply

Operating voltage range: 2.0 - 3.8 VDC (tested with 3.3V regulated by the development board)

In tests the development board was supplied with laboratory power supply.

## Mechanical Size of the EUT

Height: 2 mm

Width: 20 mm

Length: 15 mm

## 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
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	N/T <sup>(1)</sup>
§15.247(b)(3) / RSS-247 5.4(d)	Maximum Peak Conducted Output Power	N/T <sup>(1)</sup>
§15.247(a)(2) / RSS-247 5.2(a)	6 dB Bandwidth	N/T <sup>(1)</sup>
§15.247(e) / RSS-247 5.2(b)	Power Spectral Density	N/T <sup>(1)</sup>
RSS-GEN 6.6	99% Occupied Bandwidth	N/T <sup>(1)</sup>
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	N/T <sup>(1)</sup>
§15.209(a), §15.247(d) / RSS-247 5.5	Radiated Emissions Within the Restricted Bands	<b>PASS</b>

1) Not tested by the request of the customer

NOTE: RSS-247 and RSS-GEN not included accreditation scope of test laboratory.

### EUT Test Conditions during Testing

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

The EUT was installed in the development board.

Following channels and settings were used during the tests:

Table 1: Test frequencies and setting used in tests

Channel	Frequency (MHz)	Power setting	PHY	Low energy transmit	Packet Length
0	2402	200	1M	PRBS9 (GFSK)	255
19	2440	200	1M	PRBS9 (GFSK)	255
39	2480	200	1M	PRBS9 (GFSK)	255

### Test Facility

Testing Laboratory / address: FCC registration number: <b>904175</b>	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
Test Site:	<input type="checkbox"/> Kara 10, ISED Canada registration number: <b>8708A-1</b> <input checked="" type="checkbox"/> Kara 5, ISED Canada registration number: <b>8708A-2</b> <input type="checkbox"/> Laru 3 <input type="checkbox"/> Kallio 10

## TEST RESULTS

### Transmitter Radiated Spurious Emissions 9 kHz - 26500 MHz

**Standard:** ANSI C63.10 (2013)  
**Tested by:** MIH / RRE  
**Date:** 15 - 16 May 2018  
**Temperature:** 23 ± 3 °C  
**Humidity:** 20 - 60 % RH  
**Measurement uncertainty:** ± 4.51 dB Level of confidence 95 % (k = 2)

**FCC Rule: 15.247(d), 15.209(a)**  
**RSS-247 5.5**

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. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). Peak values of emissions below 1000 MHz measured for reference as well as transmitter fundamental.

In the frequency range 9 kHz – 30 MHz measurements were performed in middle channel.

Frequency range [MHz]	Limit [ $\mu$ V/m]	Limit [dB $\mu$ V/m]	Detector
30 - 80	100	40.0	Quasi-peak
88 - 216	150	43.5	Quasi-peak
216 - 960	200	46.0	Quasi-peak
960 - 1000	500	53.9	Quasi-peak
Above 1000	500	53.9	Average
Above 1000	5000	73.9	Peak

Low channel (0)

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

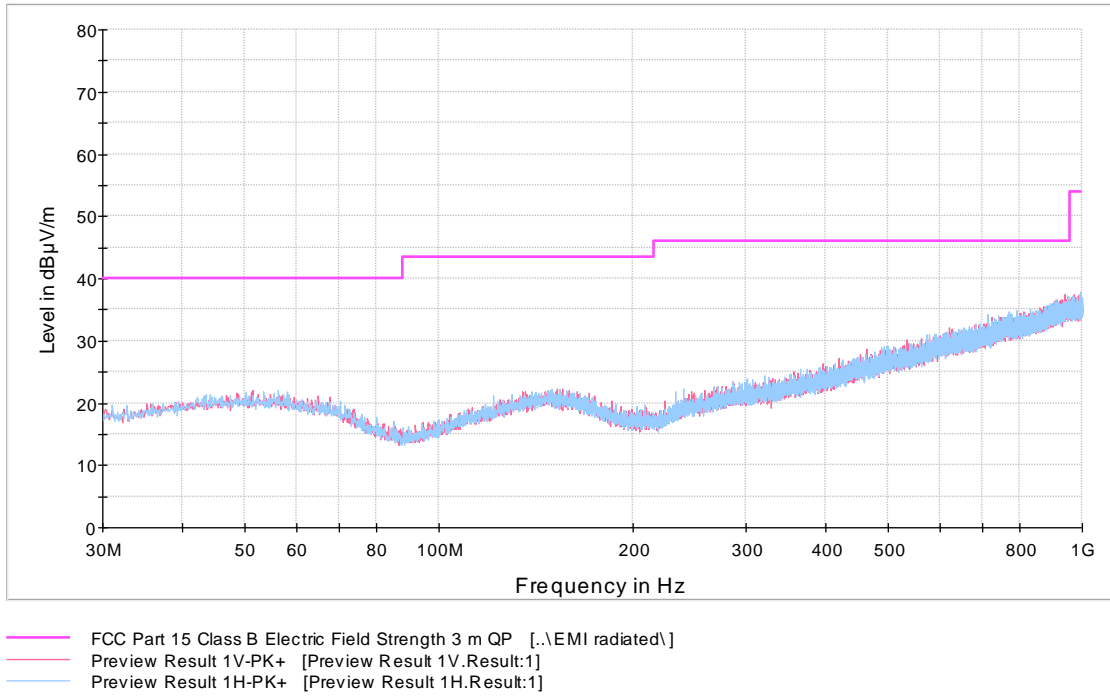


Figure 1: Channel 0 low 30 MHz – 1000 MHz

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

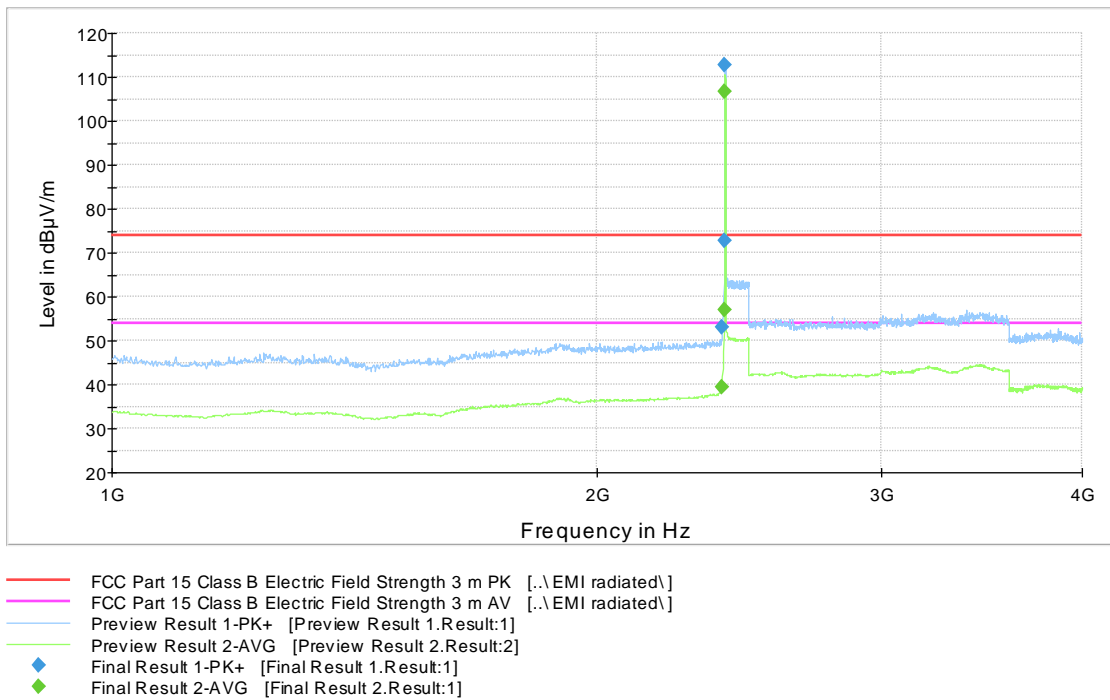
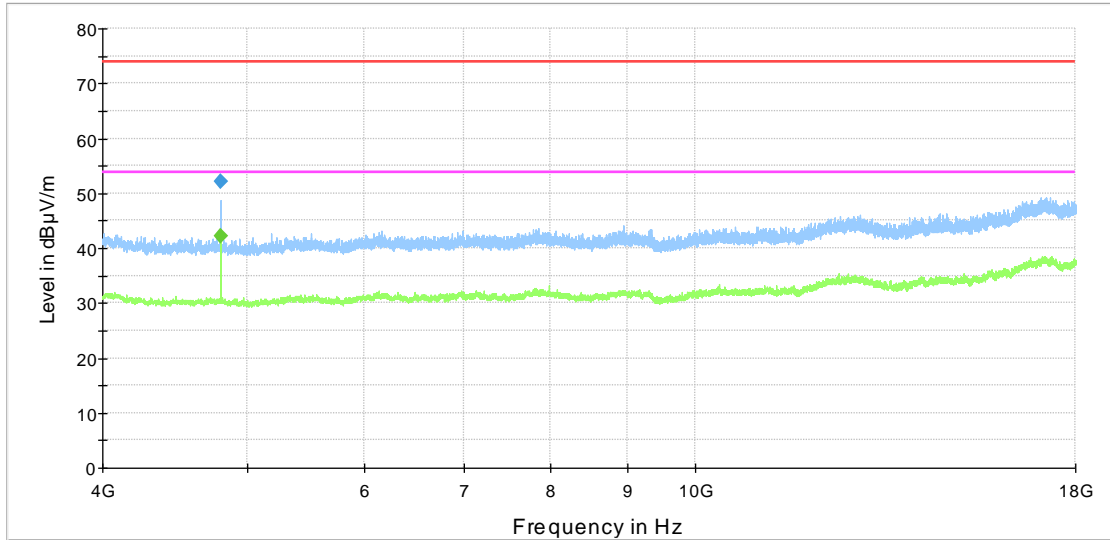


Figure 2: Channel 0 low 1 GHz – 4 GHz

**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

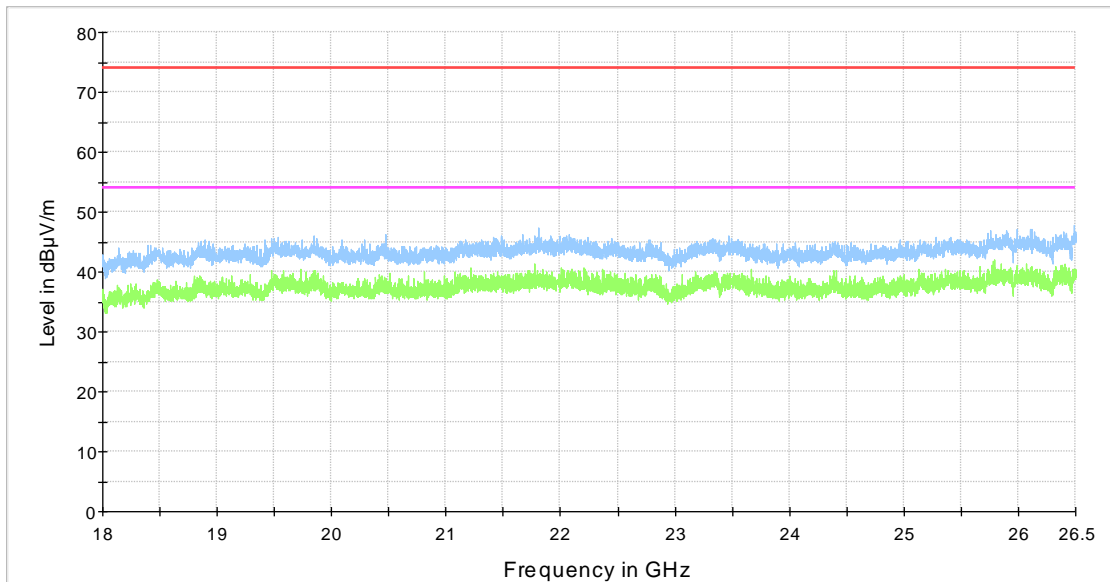
FCC Part 15 Class B Spurious Emission 4-18GHz 3m



- 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\]
- Preview Result 1-PK+ [Preview Result 1.Result:1]
- Preview Result 2-AVG [Preview Result 2.Result:2]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]
- ◆ Final Result 2-AVG [Final Result 2.Result:1]

**Figure 3: Channel 0 low 4 GHz – 18 GHz**

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]
- Preview Result 2-AVG [Preview Result 2.Result:2]

**Figure 4: Channel 0 low 18 GHz – 26.5 GHz**



**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

**Table 2:** Peak results, channel 0 low

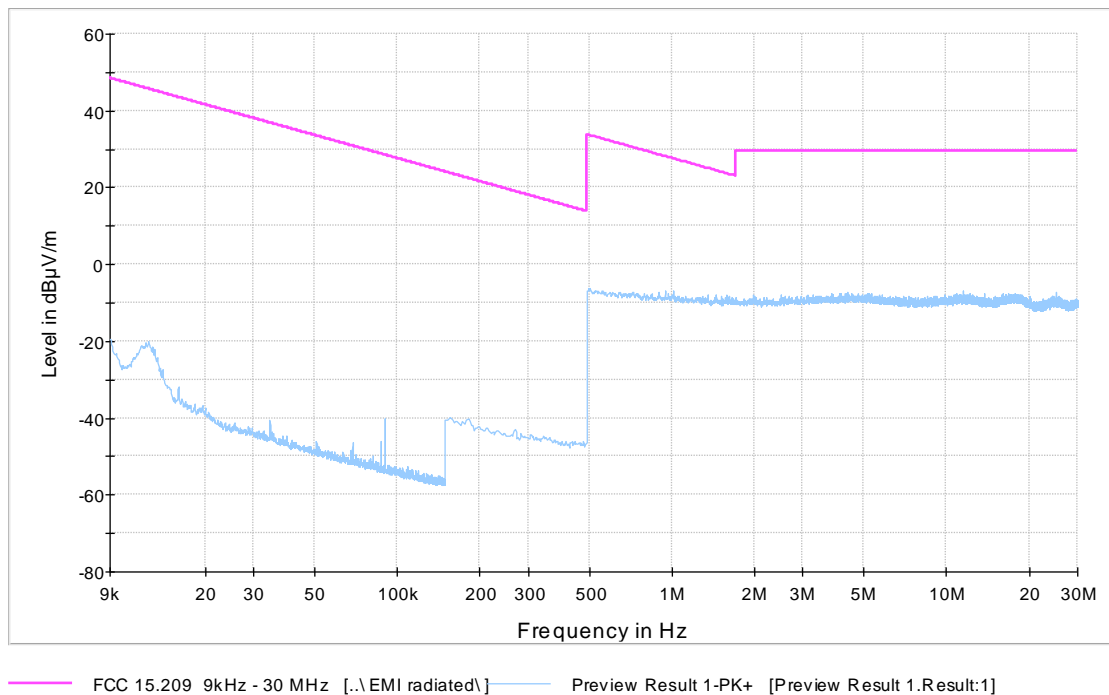
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2389.000000	53.2	1000.0	1000.000	150.0	H	25.0	14.6	20.7	73.9
2400.000000	72.6	1000.0	1000.000	179.0	H	29.0	14.7	20.2	92.8
4803.900000	52.2	1000.0	1000.000	286.0	V	72.0	8.4	21.7	73.9

**Table 3:** Average results, channel 0 low

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	39.5	1000.0	1000.000	230.0	H	25.0	14.6	14.4	53.9
2400.000000	57.0	1000.0	1000.000	271.0	H	9.0	14.7	29.7	86.7
4804.000000	42.2	1000.0	1000.000	150.0	V	55.0	8.4	11.7	53.9

**Middle channel (19)**

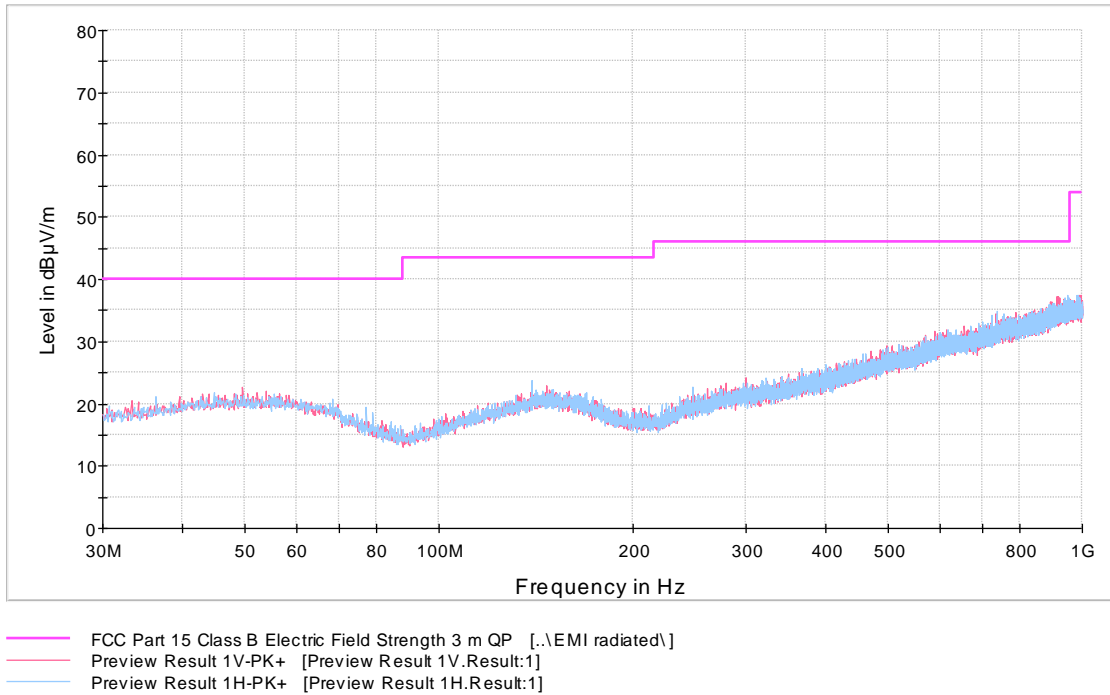
FCC Part 15 Class B (15.209) Spurious Emission 9 kHz - 30 MHz 3m



**Figure 5:** Channel 19 mid 9 kHz – 30 MHz

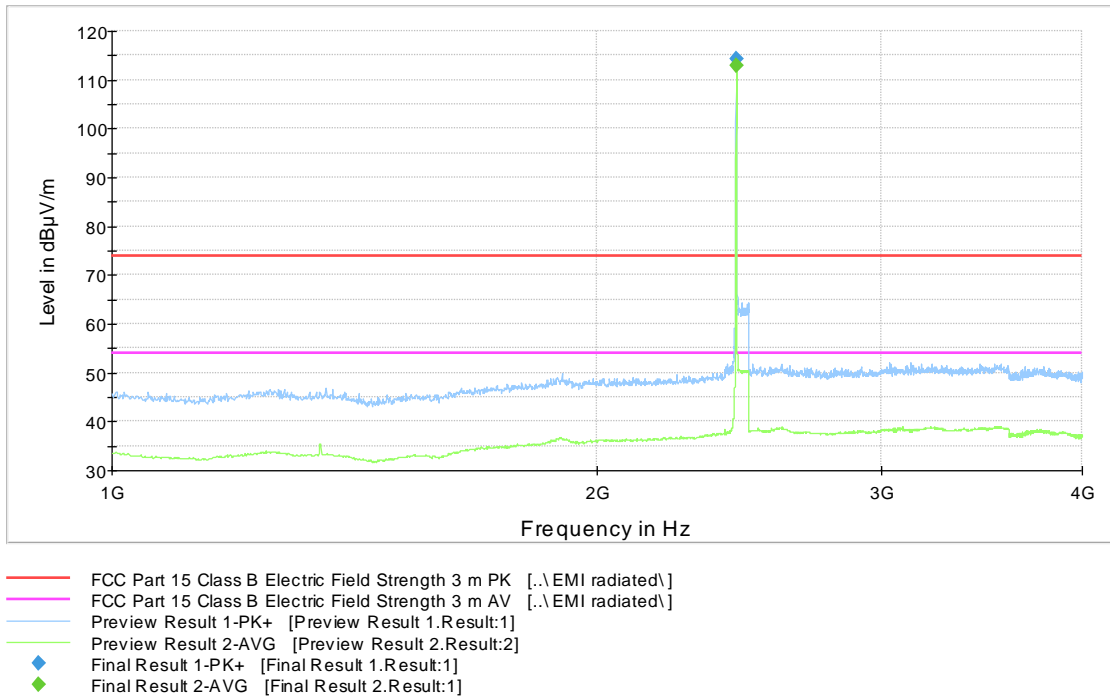
**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

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



**Figure 6: Channel 19 mid 30 MHz – 1000 MHz**

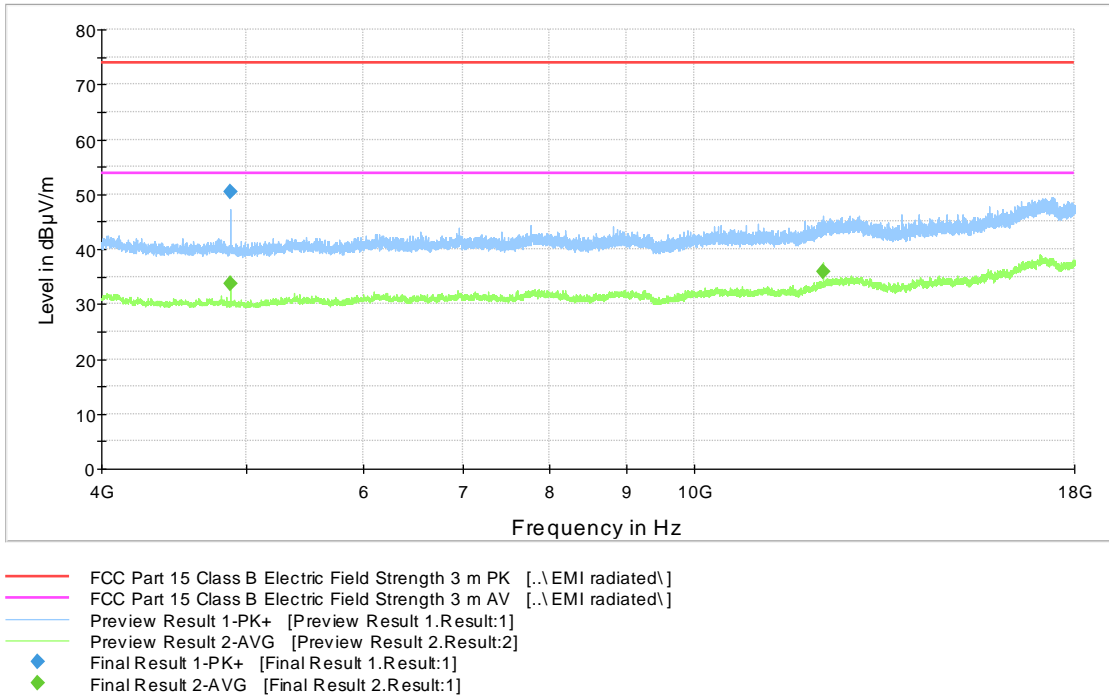
FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 7: Channel 19 mid 1 GHz – 4 GHz**

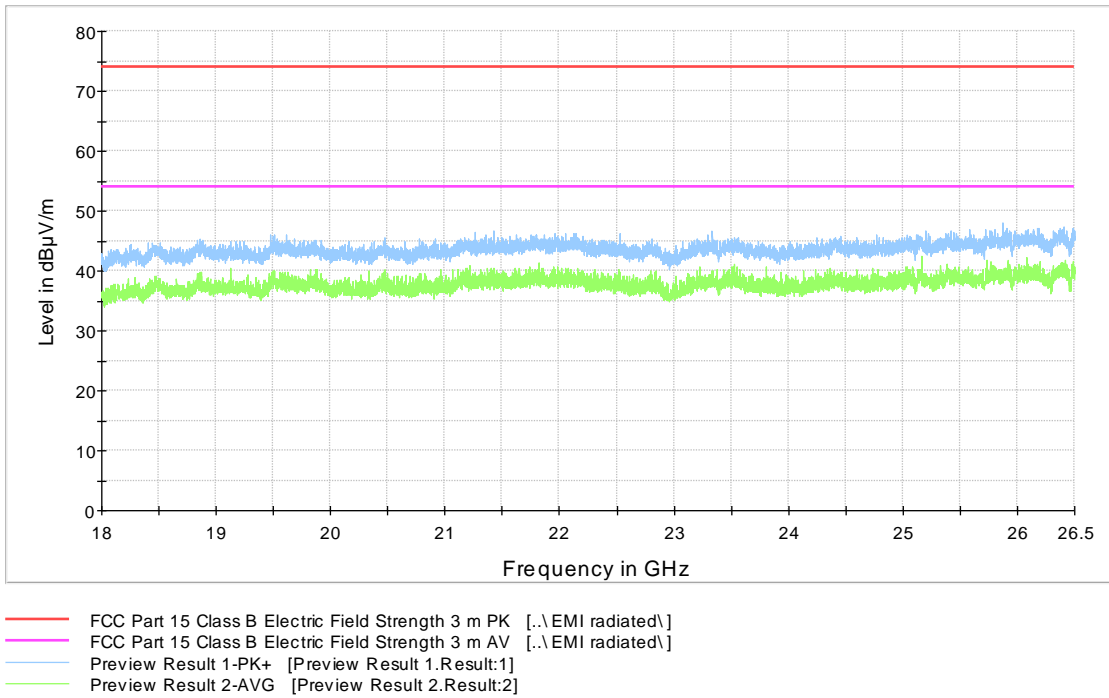
**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

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



**Figure 8: Channel 19 mid 4 GHz – 18 GHz**

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



**Figure 9: Channel 19 mid 18 GHz – 26.5 GHz**

**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

**Table 4:** Peak results, channel 19 mid

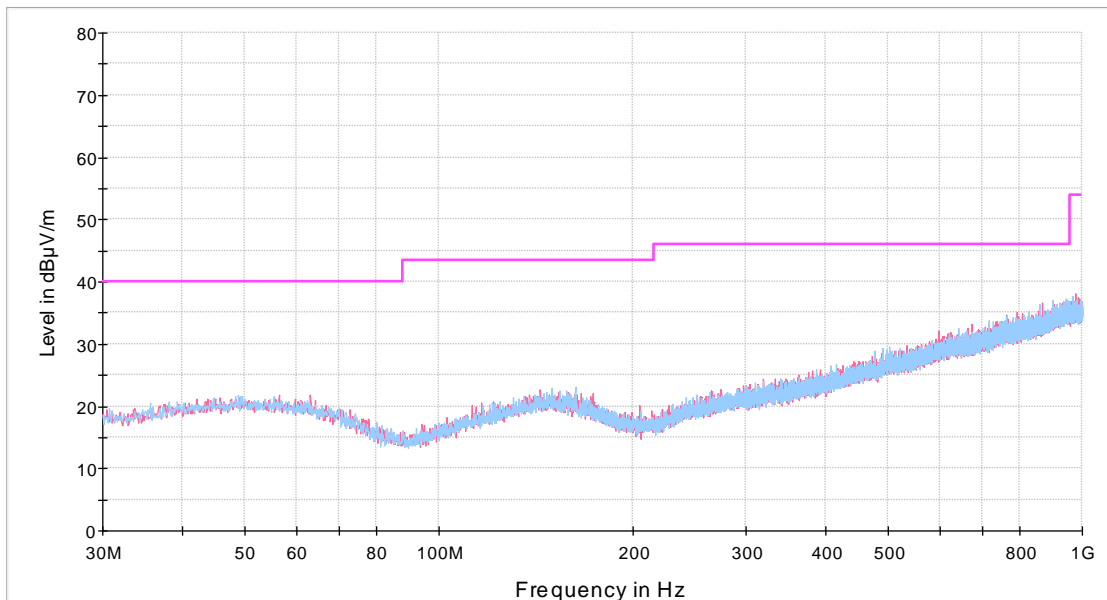
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4880.100000	50.4	1000.0	1000.000	150.0	V	70.0	8.4	23.5	73.9

**Table 5:** Average results, channel 19 mid

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4879.800000	33.8	1000.0	1000.000	278.0	V	66.0	8.4	20.1	53.9
12201.10000	35.9	1000.0	1000.000	150.0	H	330.0	19.8	18.0	53.9

**High channel (39)**

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

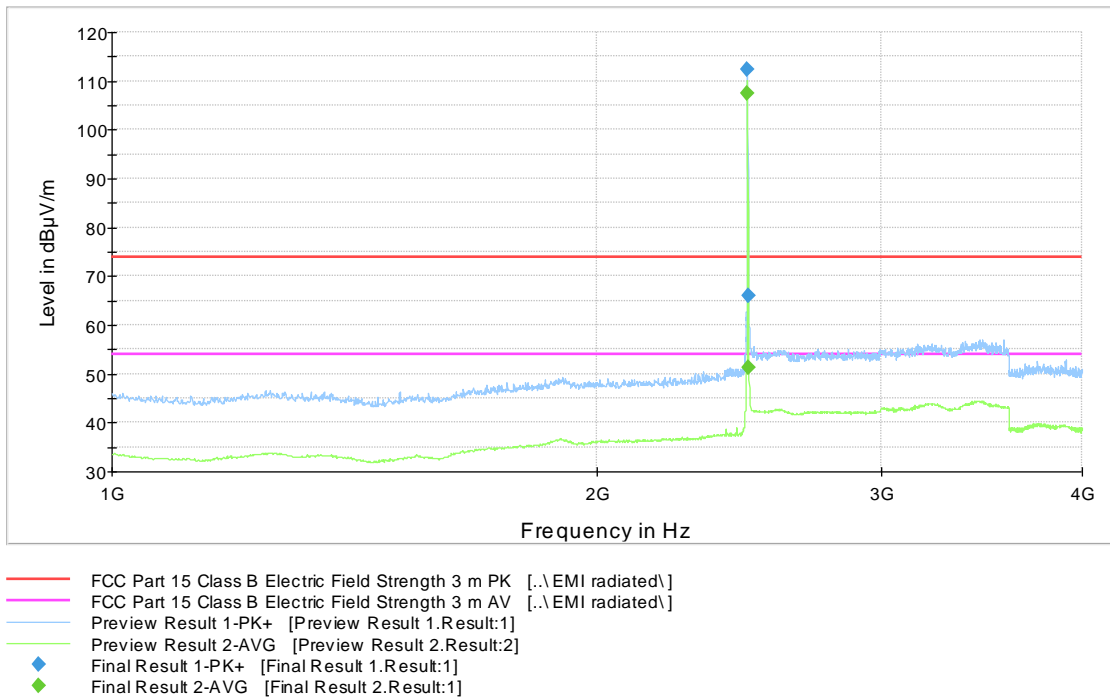


- FCC Part 15 Class B Electric Field Strength 3 m QP [.\EMI radiated\]
- Preview Result 1V-PK+ [Preview Result 1V.Result:1]
- Preview Result 1H-PK+ [Preview Result 1H.Result:1]

**Figure 10:** Channel 39 high 30 MHz – 1000 MHz

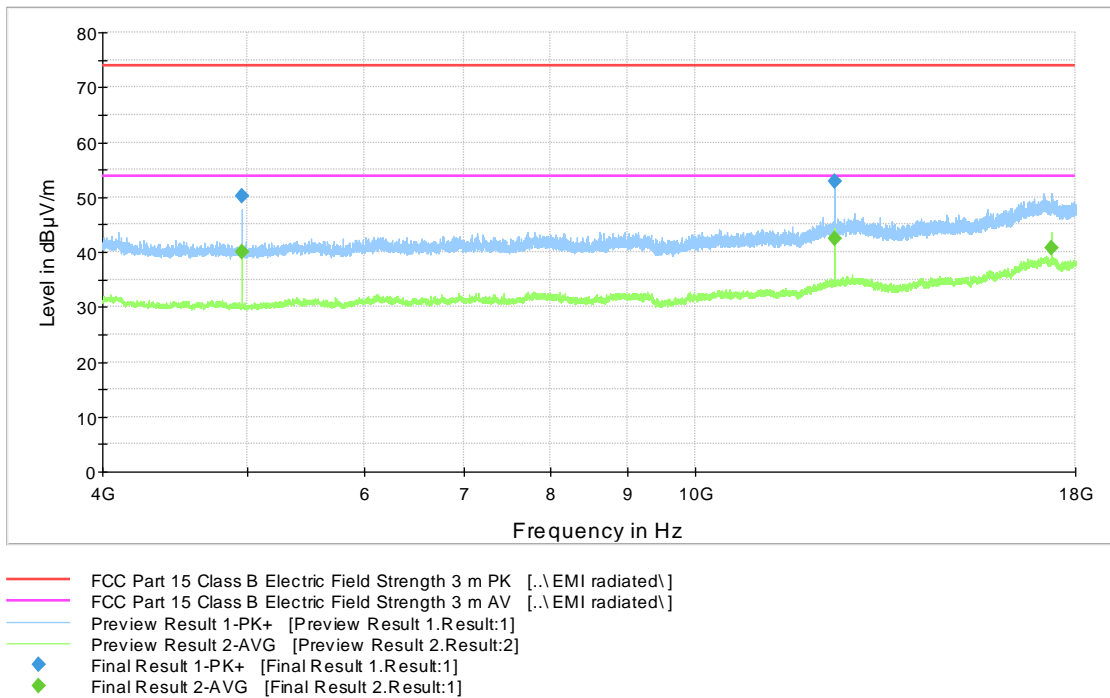
**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

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



**Figure 11: Channel 39 high 1 GHz – 4 GHz**

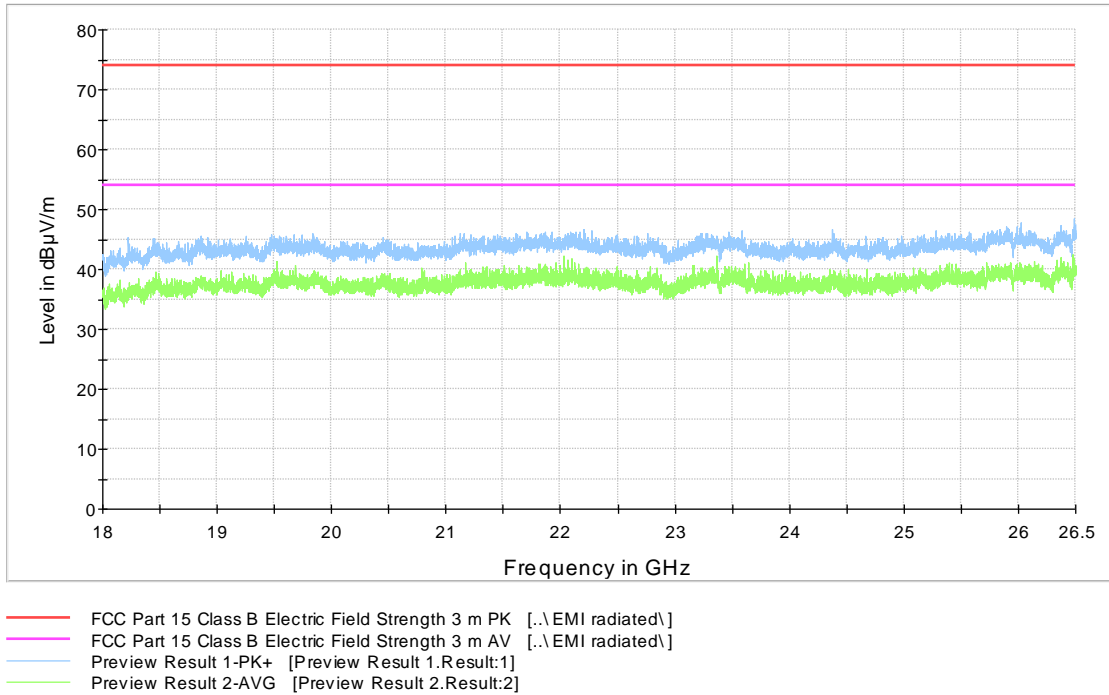
FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 12: Channel 39 high 4 GHz – 18 GHz**

**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**

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



**Figure 13:** Channel 39 high 18 GHz – 26.5 GHz

**Table 6:** Peak results, channel 39 high

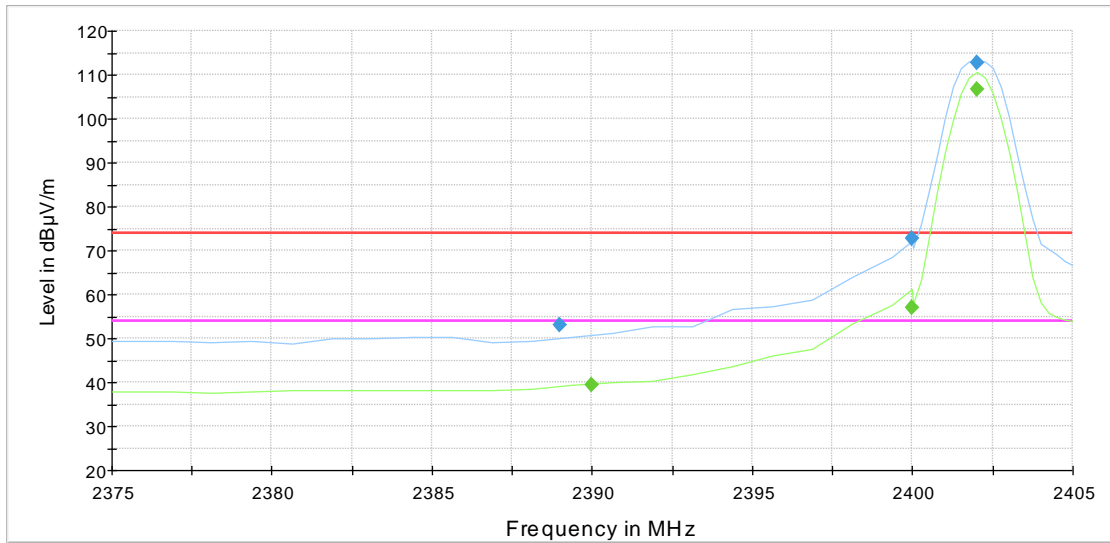
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	65.9	1000.0	1000.000	217.0	H	22.0	14.7	8.0	73.9
4960.100000	50.2	1000.0	1000.000	257.0	H	18.0	8.3	23.7	73.9
12401.20000	52.7	1000.0	1000.000	150.0	H	334.0	20.1	21.2	73.9

**Table 7:** Average results, channel 39 high

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	51.3	1000.0	1000.000	270.0	H	18.0	14.7	2.6	53.9
4960.100000	40.1	1000.0	1000.000	285.0	V	68.0	8.3	13.8	53.9
12401.10000	42.4	1000.0	1000.000	150.0	H	31.0	20.1	11.5	53.9
17358.40000	40.7	1000.0	1000.000	150.0	H	47.0	28.4	13.2	53.9

**Radiated Band Edge results**

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]
- Preview Result 2-AVG [Preview Result 2.Result:2]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]
- ◆ Final Result 2-AVG [Final Result 2.Result:1]

**Figure 14:** Radiated Band Edge measurement graph, Channel 0 low

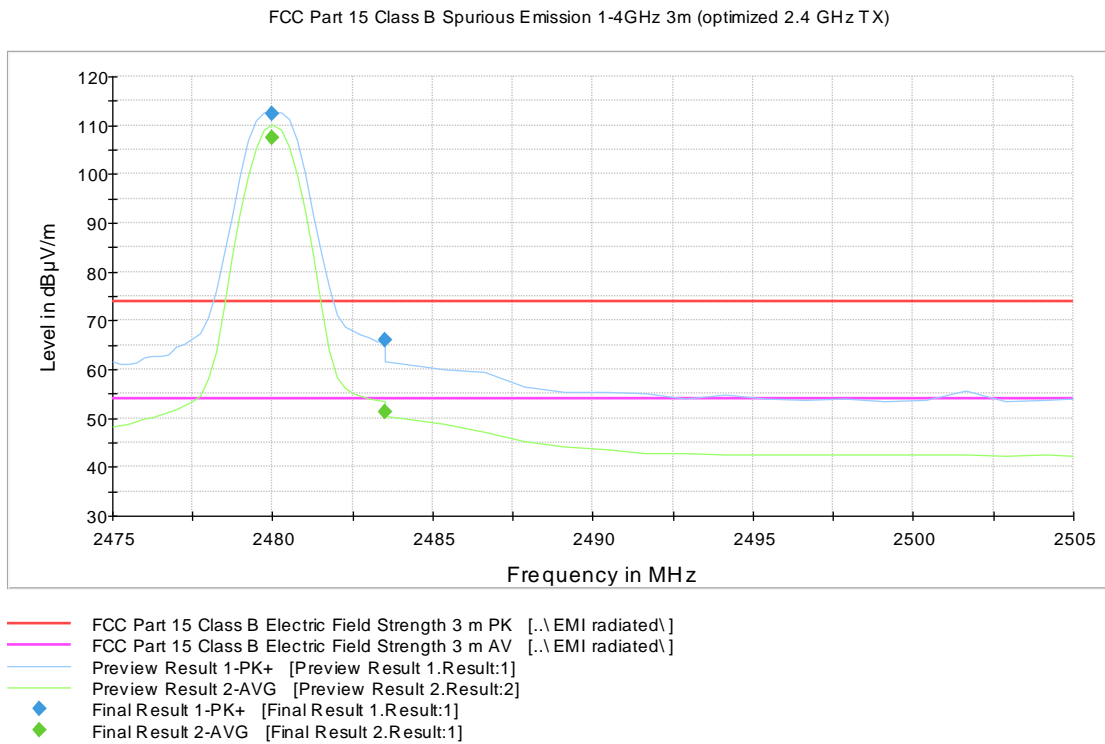
**Table 8:** Peak results, channel 0 low

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2389.000000	53.2	1000.0	1000.000	150.0	H	25.0	14.6	20.7	73.9
2400.000000	72.6	1000.0	1000.000	179.0	H	29.0	14.7	20.2	92.8

**Table 9:** Average results, channel 0 low

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	39.5	1000.0	1000.000	230.0	H	25.0	14.6	14.4	53.9
2400.000000	57.0	1000.0	1000.000	271.0	H	9.0	14.7	29.7	86.7

**Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz**



**Figure 15:** Radiated Band Edge measurement graph, Channel 39 high

**Table 10:** Peak results, channel 39 high

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	65.9	1000.0	1000.000	217.0	H	22.0	14.7	8.0	73.9

**Table 11:** Average results, channel 39 high

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	51.3	1000.0	1000.000	270.0	H	18.0	14.7	2.6	53.9



## TEST EQUIPMENT

### RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
ANTENNA	A.H. SYSTEMS	SAS-200/518	inv:7873	-	-
SPECTRUM ANALYZER	AGILENT	E7405A	inv:9746	2018-01-08	2020-01-08
PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2017-11-16	2018-11-16
PREAMPLIFIER	ALC MICROWAVE	AWX-2018-40-08	inv:9749	2017-08-30	2018-08-30
POWER SUPPLY	THANDAR	TS3021S	inv:3484	-	-
MULTIMETER	FLUKE	Fluke 87	inv:9470	2017-12-19	2018-12-19
ANTENNA	EMCO	3117	inv:7293	2018-03-14	2020-03-14
ANTENNA	EMCO	3160-09	inv:7294	2018-03-19	2019-03-19
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	-	-
ATTENUATOR	PASTERNAK	10dB DC-40GHz	-	-	-
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	2018-04-05	2019-04-05
HIGH PASS FILTER	WAINWRIGHT	WHKX4.0/18G-10SS	inv:10403	2017-03-01	2019-03-01