Test Report

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:	Bluetooth Low Energy Module
Model:	BGM13P22A
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:	11 May 2018	Date:	11 May 2018
Issued by:	Mikko Halonen Testing Engineer	Checked by:	Rauno Repo Testing Engineer

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Equipment Under Test (EUT)

Trade mark:	Silicon Labs
Model:	BGM13P22A
Type:	Bluetooth Low Energy Module
Serial no:	-
FCC ID:	QOQBGM13P
IC:	5123A-BGM13P

Description of the EUT

BGM13P is a Bluetooth low energy module. BGM13P22A variant is equipped with integral chip antenna.

Classification of the device

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

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

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	104	125K Coded	PRBS9 (GFSK)	255
19	2440	104	125K Coded	PRBS9 (GFSK)	255
39	2480	104	125K Coded	PRBS9 (GFSK)	255

Test Facility

Testing Laboratory / address: FCC registration number: **904175**	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
Test Site:	☐ Kara 10, ISED Canada registration number: **8708A-1** ☒ Kara 5, ISED Canada registration number: **8708A-2** ☐ Laru 3 ☐ Kallio 10

TEST RESULTS

Transmitter Radiated Spurious Emissions 9 kHz - 26500 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	MIH	
Date:	25 April - 4 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 [µV/m]	Limit [dBµV/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)

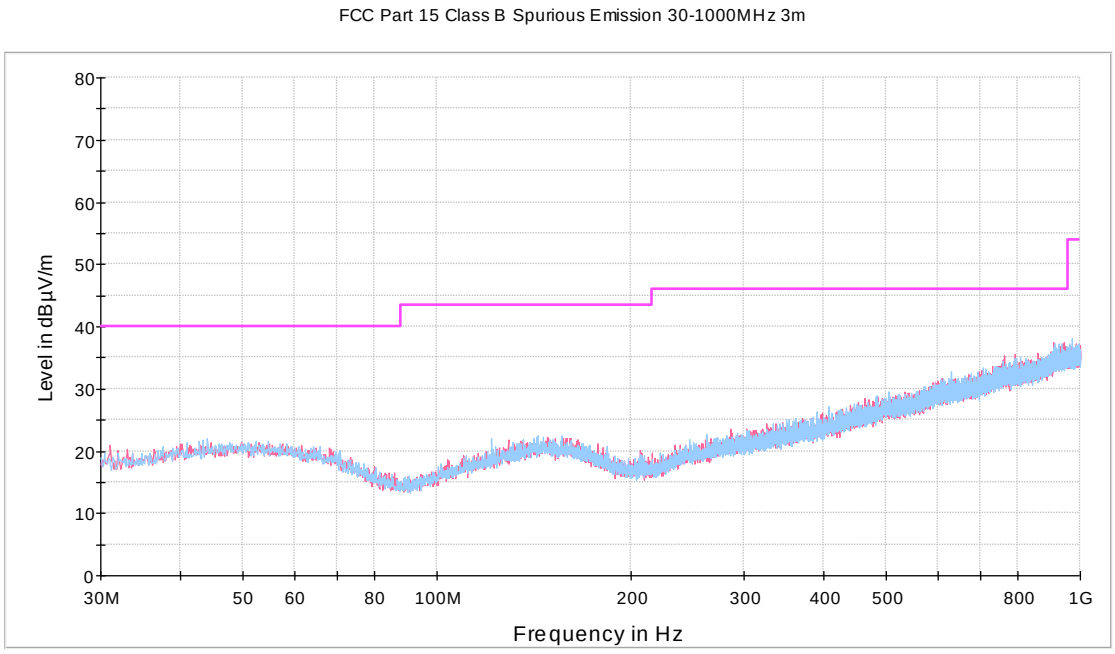

Figure 1: Channel 0 low 30 MHz – 1000 MHz

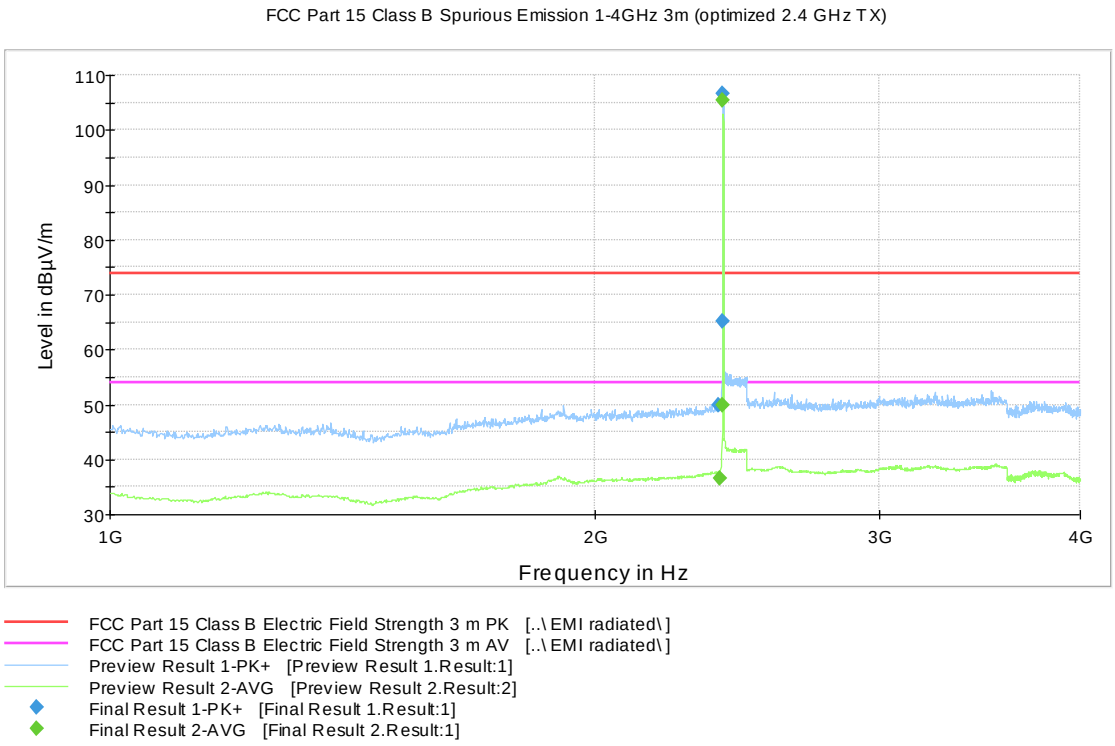

Figure 2: Channel 0 low 1 GHz – 4 GHz

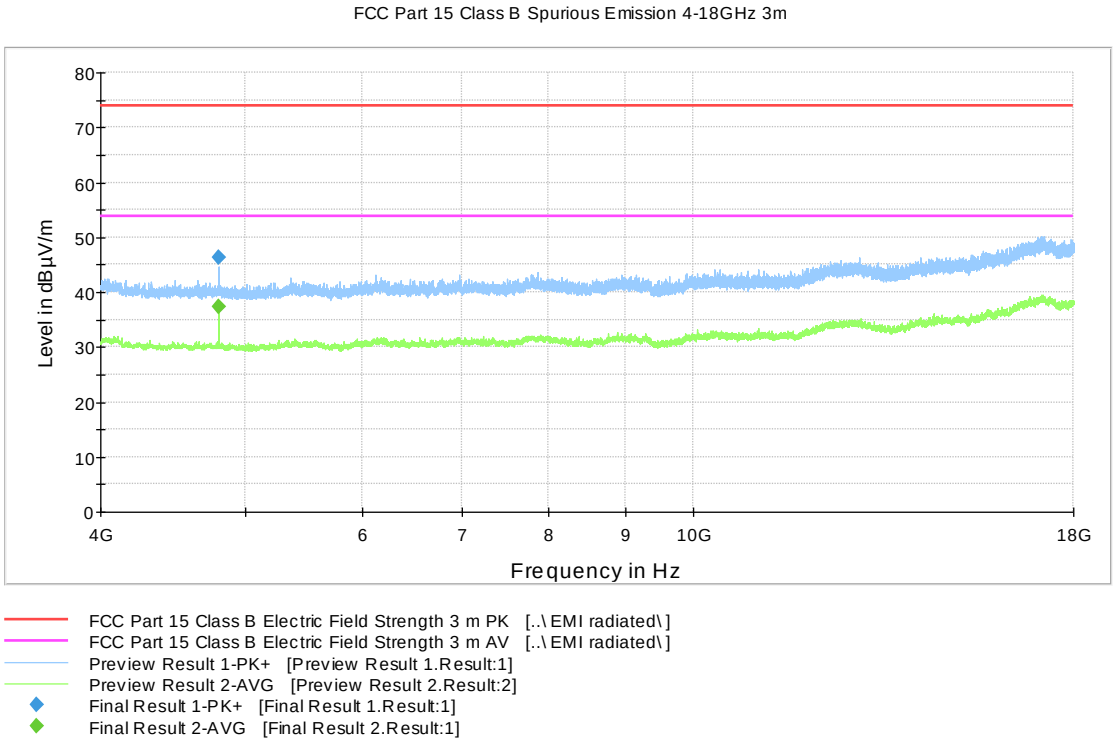

Figure 3: Channel 0 low 4 GHz – 18 GHz

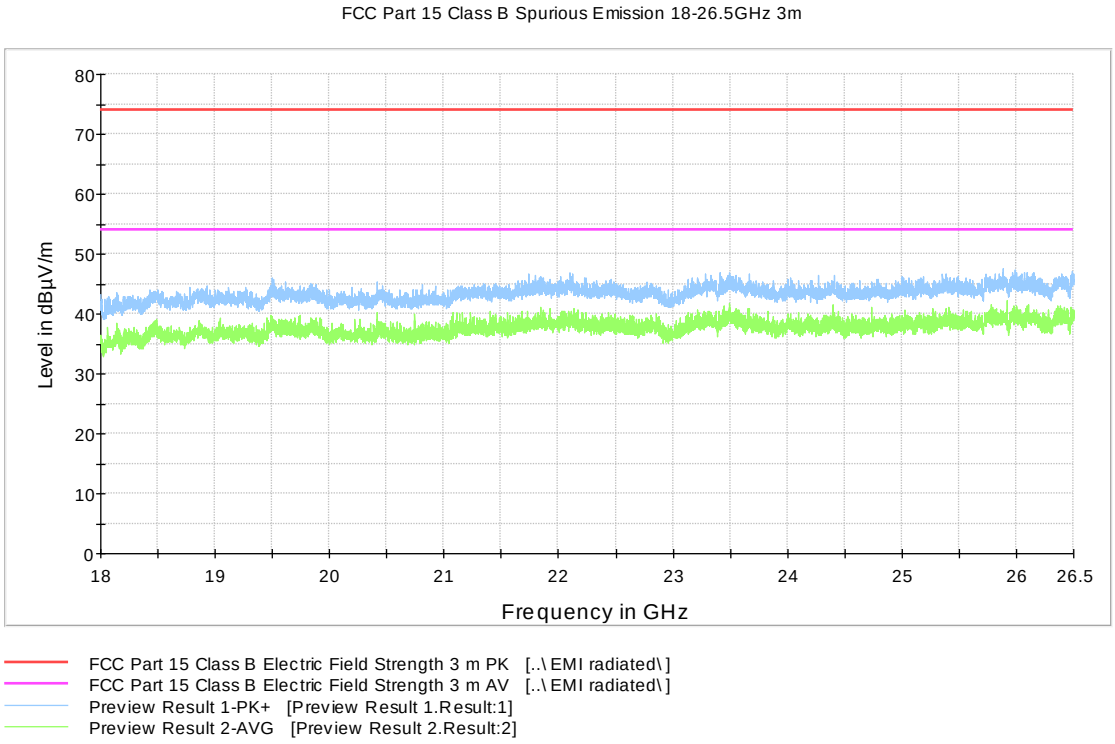

Figure 4: Channel 0 low 18 GHz – 26.5 GHz

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)
2386.600000	49.9	1000.0	1000.000	302.0	V	249.0	14.6	24.0	73.9
2400.000000	65.1	1000.0	1000.000	313.0	H	242.0	14.7	8.8	73.9
4803.300000	46.4	1000.0	1000.000	218.0	V	224.0	8.4	27.5	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)
2389.600000	36.4	1000.0	1000.000	400.0	V	325.0	14.6	17.5	53.9
2400.000000	50.0	1000.0	1000.000	314.0	H	242.0	14.7	3.9	53.9
4803.800000	37.4	1000.0	1000.000	150.0	H	186.0	8.4	16.5	53.9

Middle channel (19)

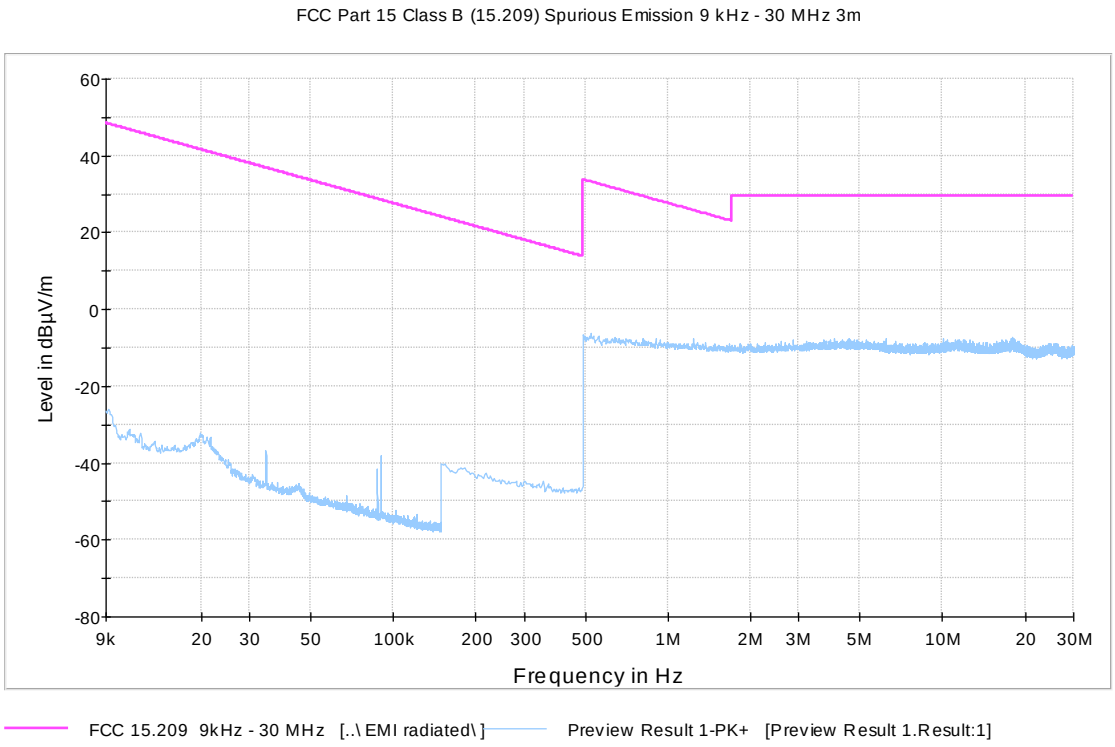

Figure 5: Channel 19 mid 9 kHz – 30 MHz

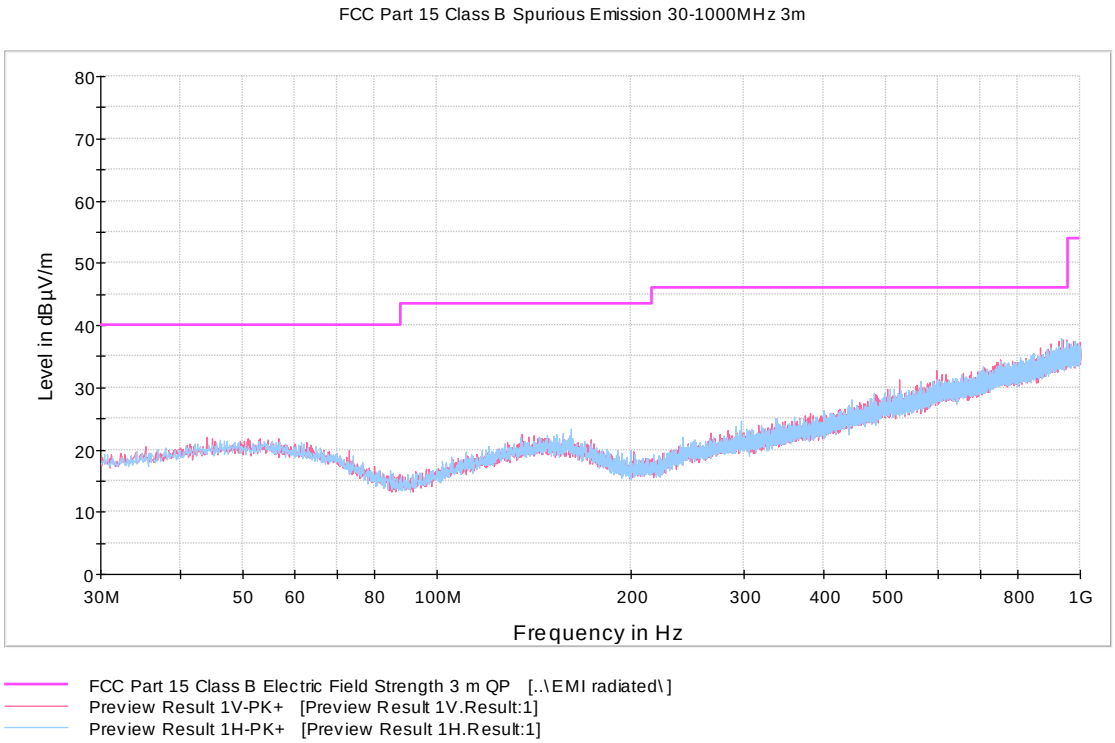

Figure 6: Channel 19 mid 30 MHz – 1000 MHz

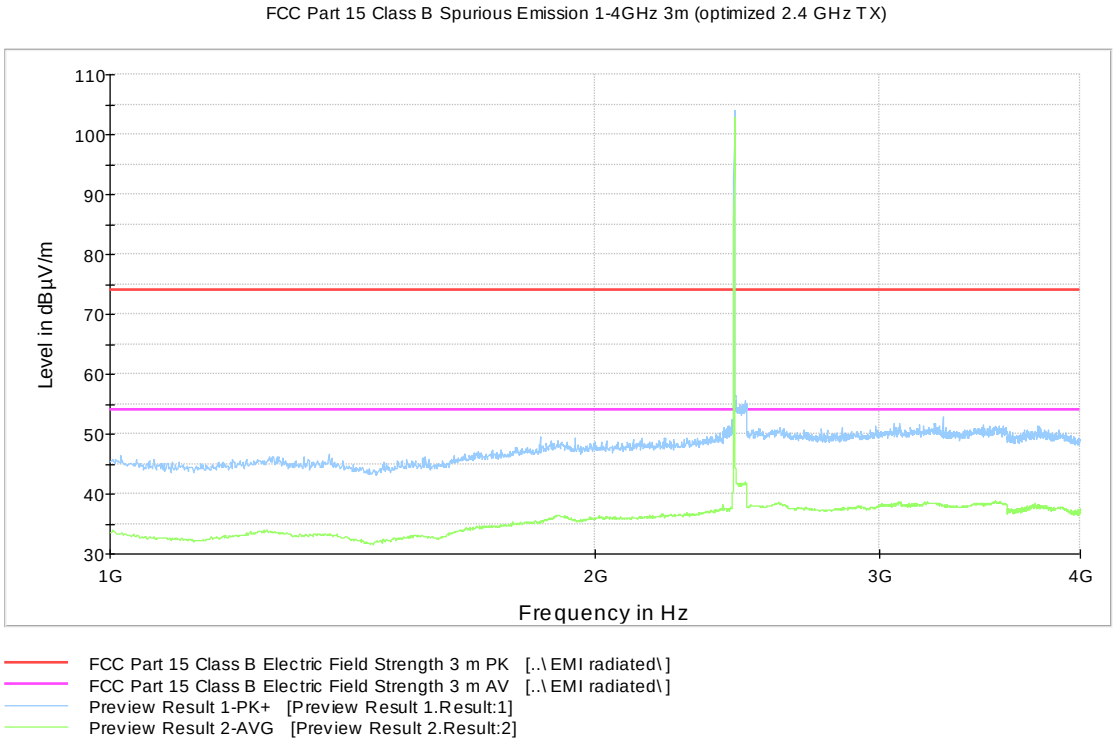

Figure 7: Channel 19 mid 1 GHz – 4 GHz

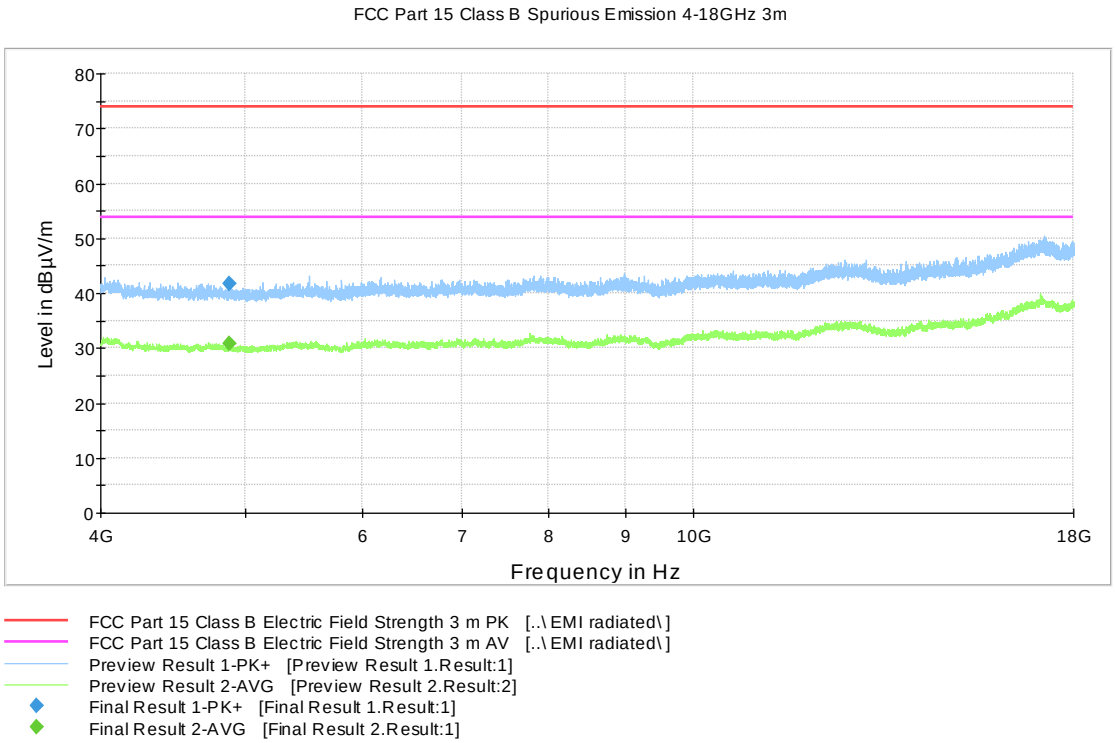

Figure 8: Channel 19 mid 4 GHz – 18 GHz

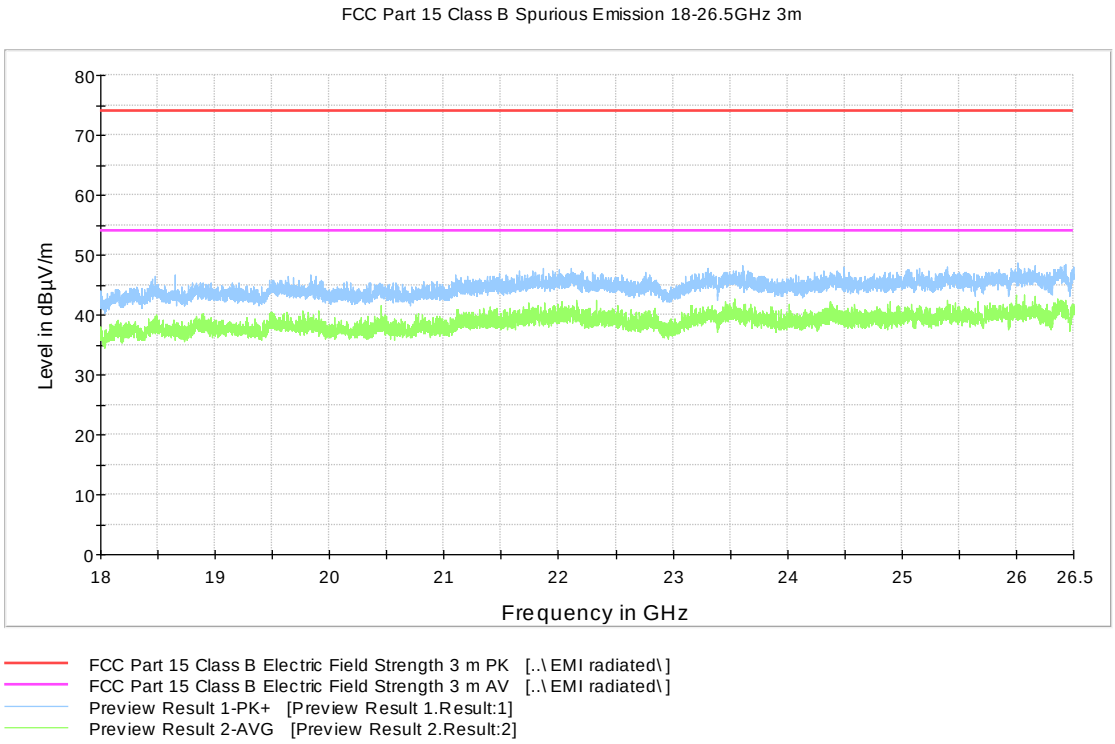

Figure 9: Channel 19 mid 18 GHz – 26.5 GHz

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)
4878.800000	41.6	1000.0	1000.000	400.0	V	287.0	8.4	32.3	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)
4879.600000	30.8	1000.0	1000.000	150.0	H	350.0	8.4	23.1	53.9

High channel (39)

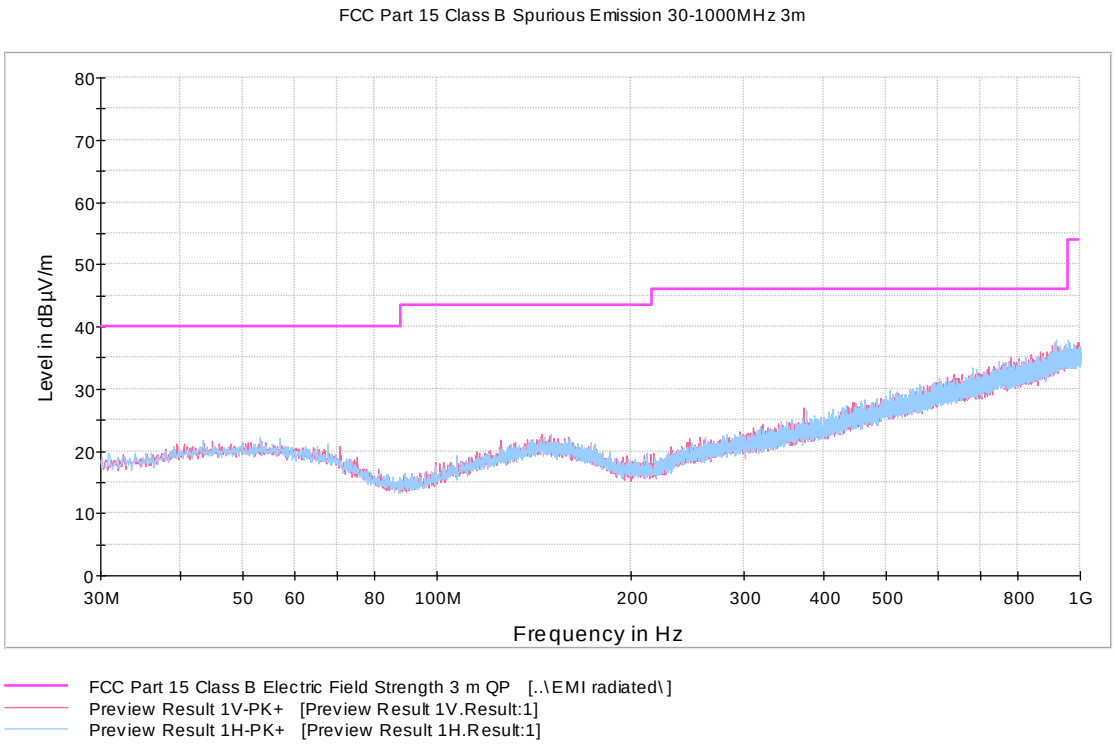

Figure 10: Channel 39 high 30 MHz – 1000 MHz

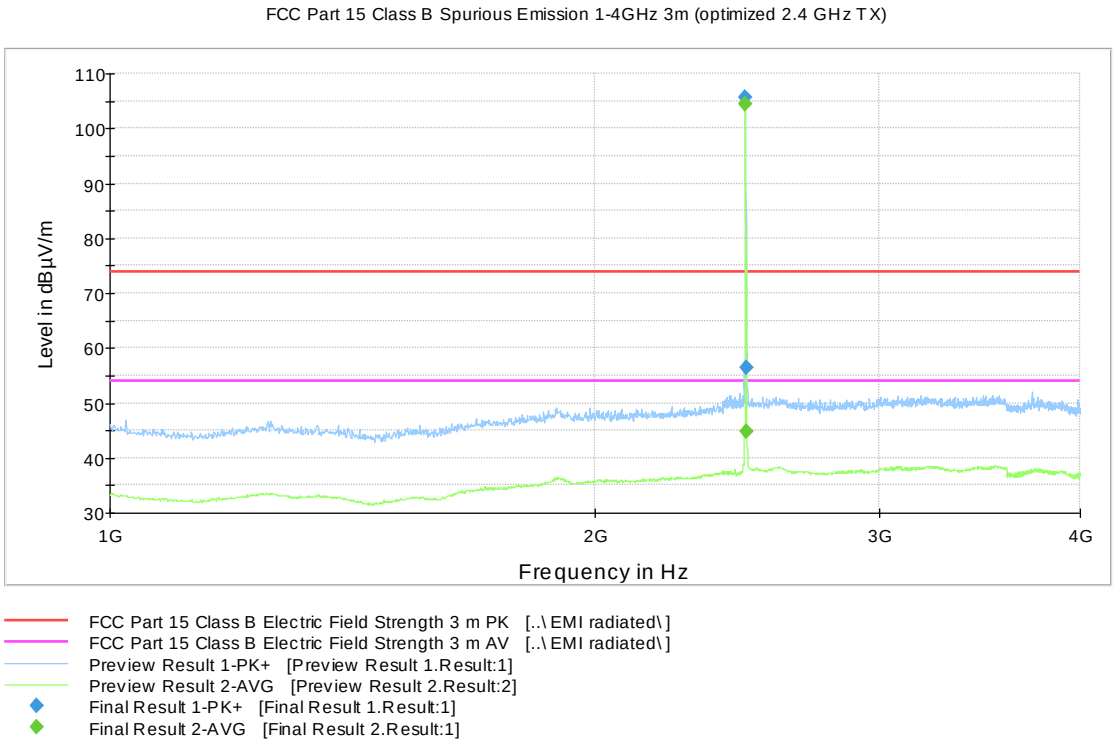

Figure 11: Channel 39 high 1 GHz – 4 GHz

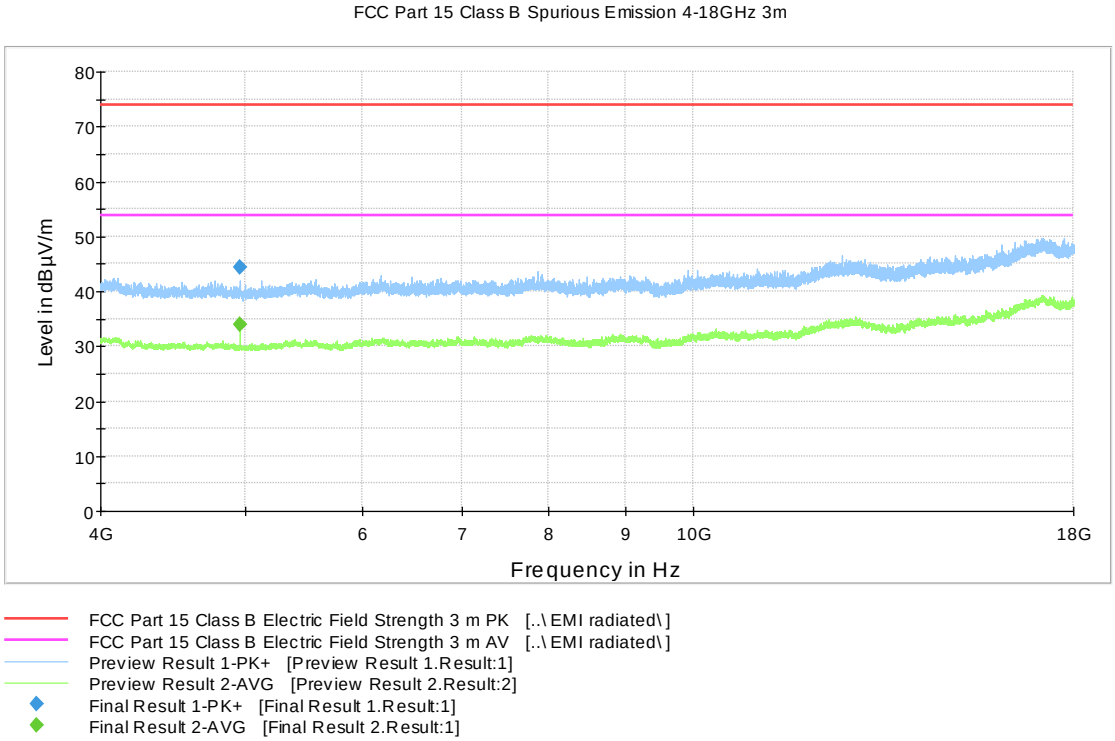

Figure 12: Channel 39 high 4 GHz – 18 GHz

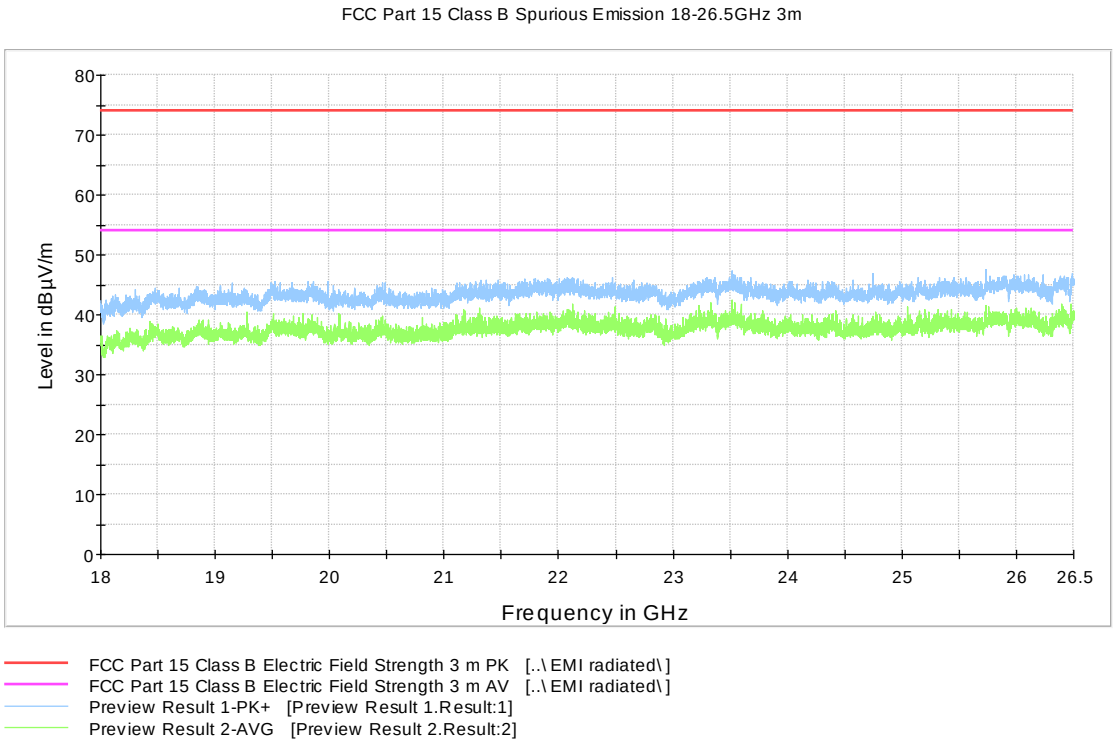

Figure 13: Channel 39 high 18 GHz – 26.5 GHz

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)
2483.900000	56.5	1000.0	1000.000	365.0	H	298.0	14.7	17.4	73.9
4960.300000	44.3	1000.0	1000.000	150.0	V	83.0	8.3	29.6	73.9

Table 7: Average results**, c**hannel 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	44.9	1000.0	1000.000	150.0	H	84.0	14.7	9.0	53.9
4959.700000	33.9	1000.0	1000.000	150.0	H	350.0	8.3	20.0	53.9

Radiated Band Edge results

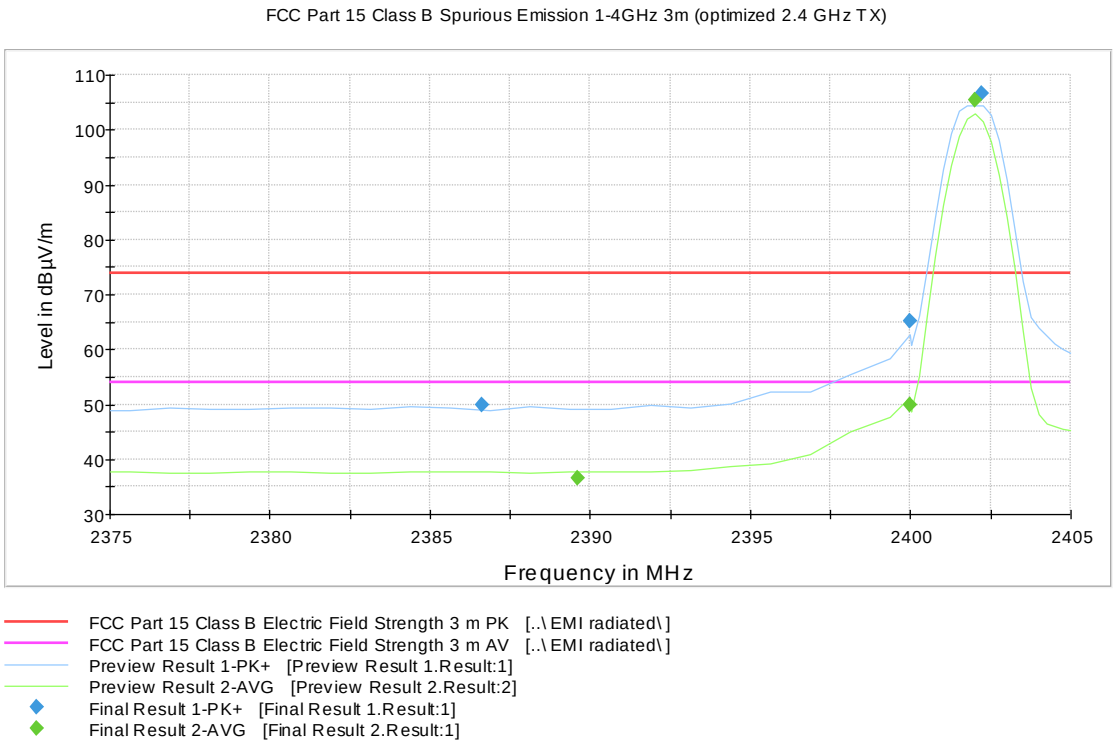

Figure 14: Radiated Band Edge measurement graph, Channel 0 low

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)
2386.600000	49.9	1000.0	1000.000	302.0	V	249.0	14.6	24.0	73.9
2400.000000	65.1	1000.0	1000.000	313.0	H	242.0	14.7	23.5	86.6

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)
2389.600000	36.4	1000.0	1000.000	400.0	V	325.0	14.6	17.5	53.9
2400.000000	50.0	1000.0	1000.000	314.0	H	242.0	14.7	35.3	85.3

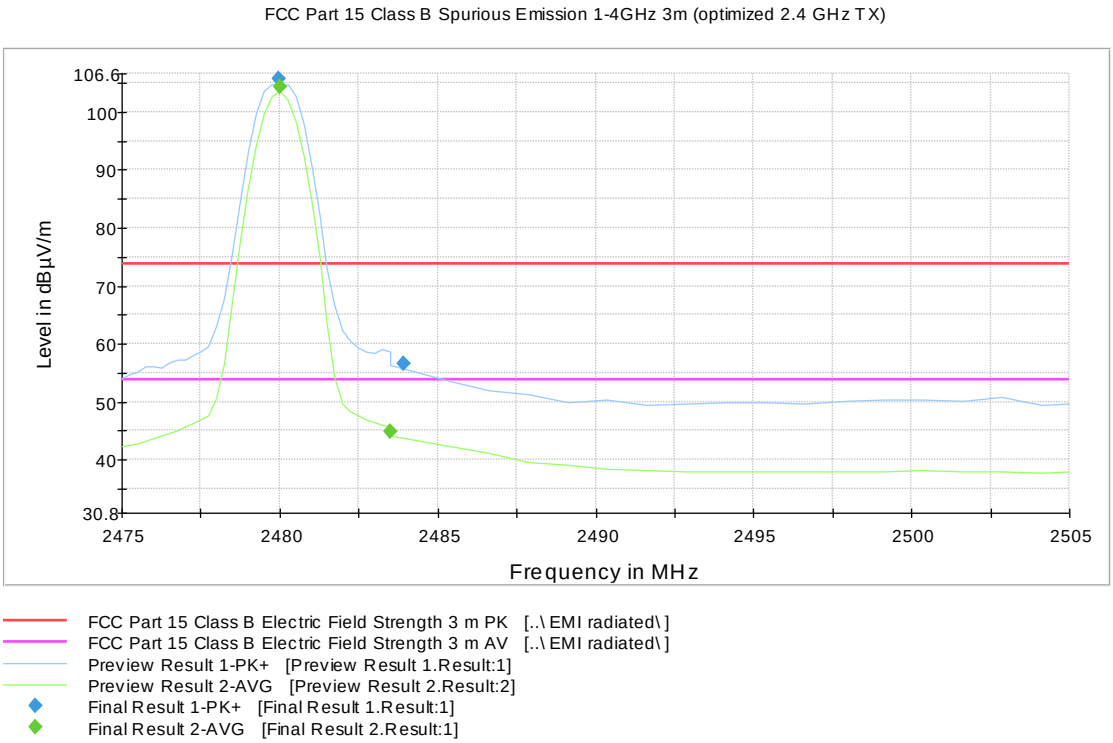

Figure 15: Radiated Band Edge measurement graph, Channel 39 high

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)
2483.900000	56.5	1000.0	1000.000	365.0	H	298.0	14.7	17.4	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	44.9	1000.0	1000.000	150.0	H	84.0	14.7	9.0	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	PASTERNACK	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