

Test Report



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

Equipment Under Test: Multi-Protocol Wireless Module

Model: MGM12P02GA

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 5, 2017)

Date: 2 August 2018

Issued by:

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Jani Tuomela
Testing Engineer

Date: 2 August 2018

Checked by:

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Rauno Repo
Testing Engineer

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Equipment Under Test (EUT)

Trade mark:	Silicon Labs
Model:	MGM12P02GA
Type:	Multi-Protocol Wireless Module
Serial no:	-
FCC ID:	QOQMGM12P0
IC:	5123A-MGM12P0

Description of the EUT

MGM12P is a multi-protocol wireless module. MGM12P02GA variant is equipped with integral chip antenna.

This test report contains test results for ZigBee.

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):	2405 - 2480 MHz
Channels:	15
Channel separation:	5 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

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
11	2405	104
19	2445	104
26	2480	104

Test Facility

Testing Laboratory / address: FCC registration number: 904175	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
Test Site:	<input type="checkbox"/> Kara 10, ISED Canada registration number: 8708A-1 <input checked="" type="checkbox"/> Kara 5, ISED Canada registration number: 8708A-2 <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: JAT
Date: 31 July – 1 August 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 [μ V/m]	Limit [dB μ 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

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

Low channel (11)

Full Spectrum

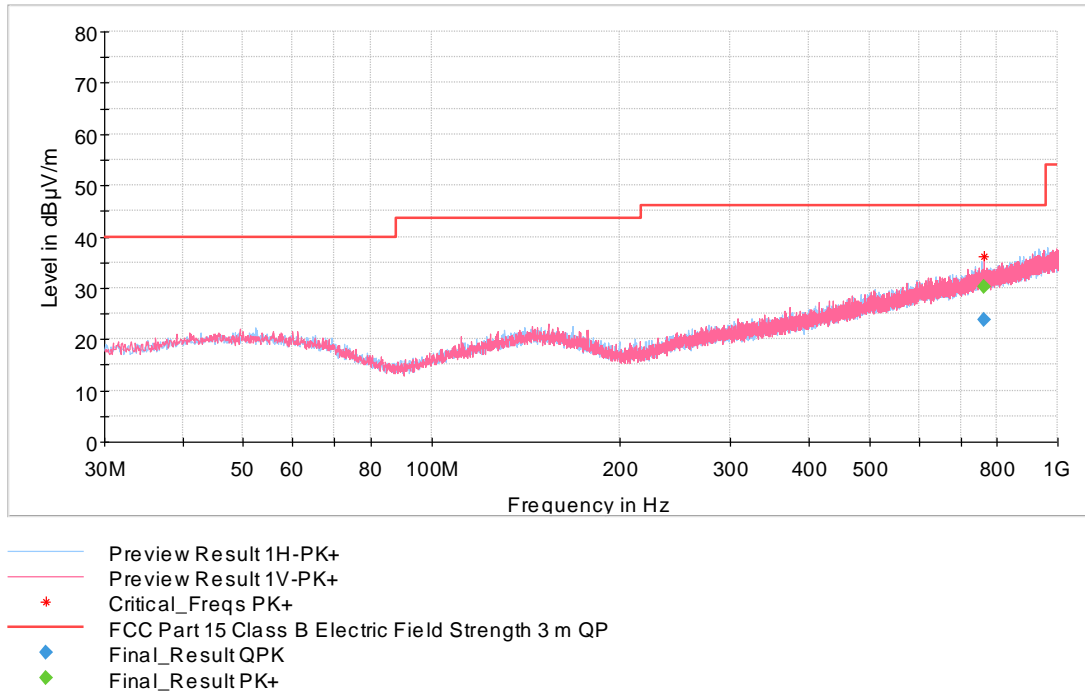


Figure 1: Channel 11 low 30 MHz – 1000 MHz

Full Spectrum

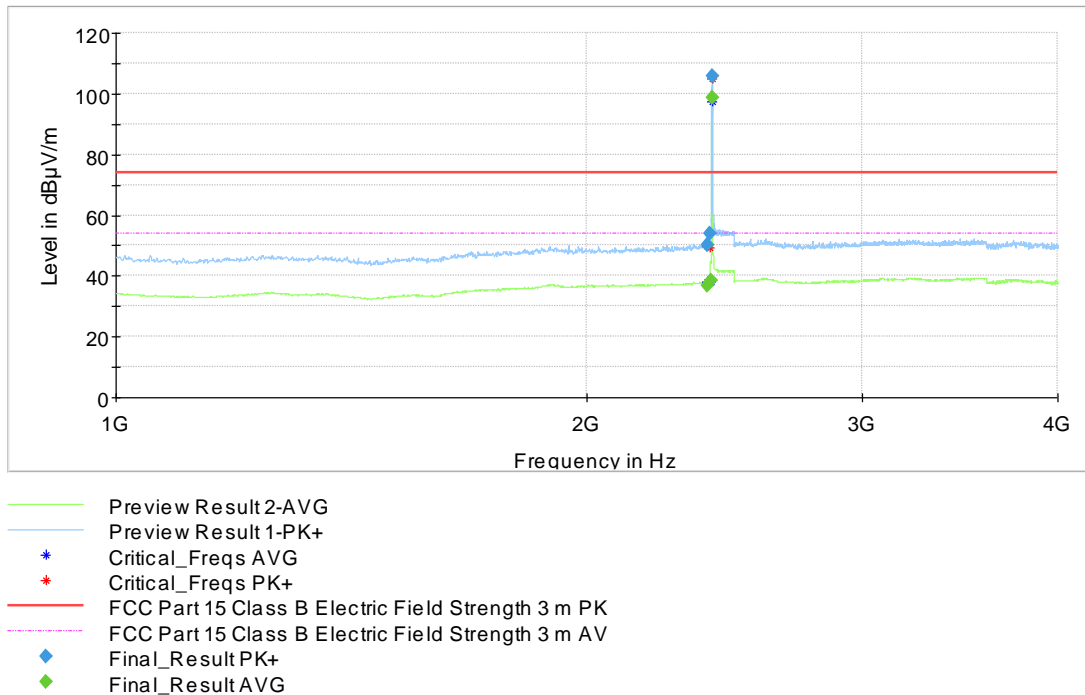
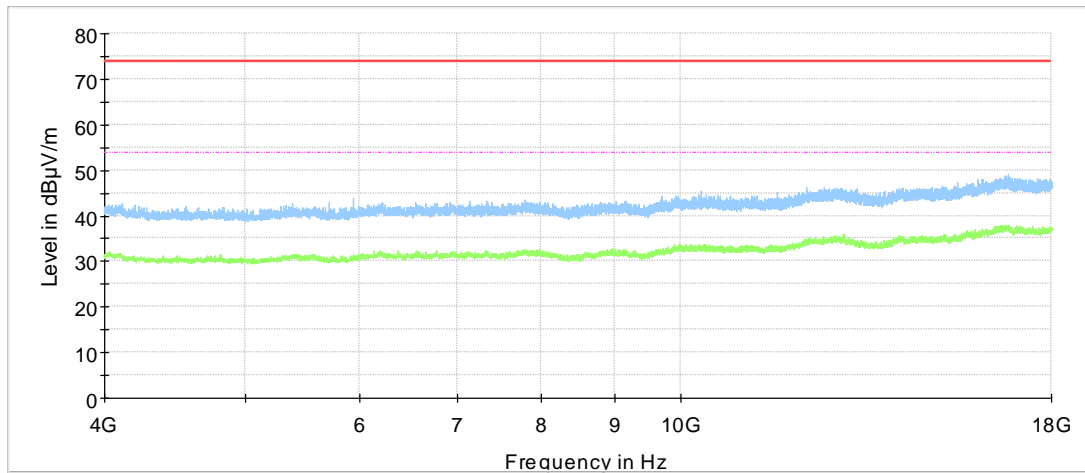


Figure 2: Channel 11 low 1 GHz – 4 GHz

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

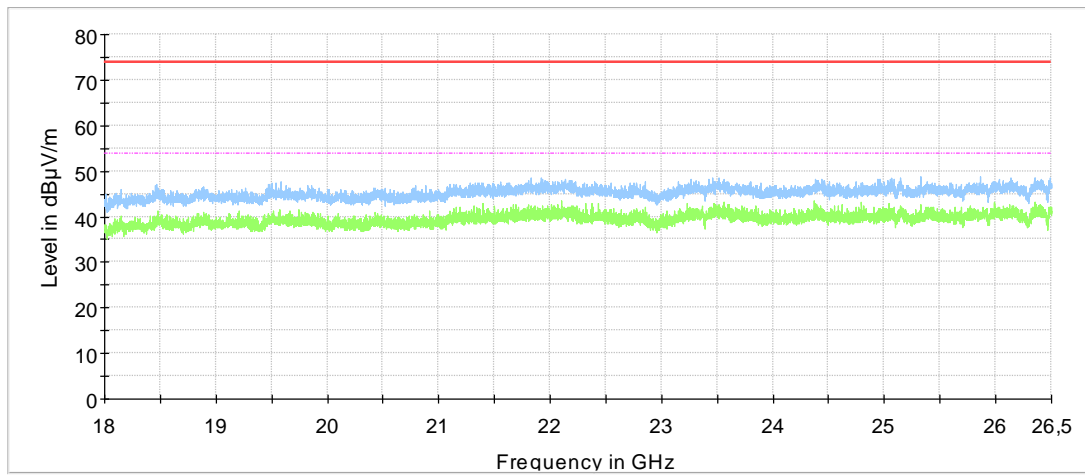
Full Spectrum



- Preview Result 2-AVG
- Preview Result 1-PK+
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- FCC Part 15 Class B Electric Field Strength 3 m PK
- - - FCC Part 15 Class B Electric Field Strength 3 m AV
- ◆ Final_Result PK+
- ◆ Final_Result AVG

Figure 3: Channel 11 low 4 GHz – 18 GHz

Full Spectrum



- Preview Result 2-AVG
- Preview Result 1-PK+
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- FCC Part 15 Class B Electric Field Strength 3 m PK
- - - FCC Part 15 Class B Electric Field Strength 3 m AV
- ◆ Final_Result PK+
- ◆ Final_Result AVG

Figure 4: Channel 11 low 18 GHz – 26.5 GHz

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz
Table 1: Peak and Average results, channel 11 low

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
762.527000	---	30.30	46.00	15.70	1000.0	120.000	328.0	V	314.0	25.0
762.527000	23.76	---	46.00	22.24	1000.0	120.000	328.0	V	314.0	25.0
2386.800000	50.17	---	73.90	23.73	1000.0	1000.000	176.0	V	270.0	14.6
2389.800000	---	36.92	53.90	16.98	1000.0	1000.000	400.0	V	205.0	14.6
2399.400000	53.83	---	73.90	20.07	1000.0	1000.000	386.0	V	208.0	14.7
2400.000000	---	38.62	53.90	15.28	1000.0	1000.000	280.0	V	111.0	14.7

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

Middle channel (19)

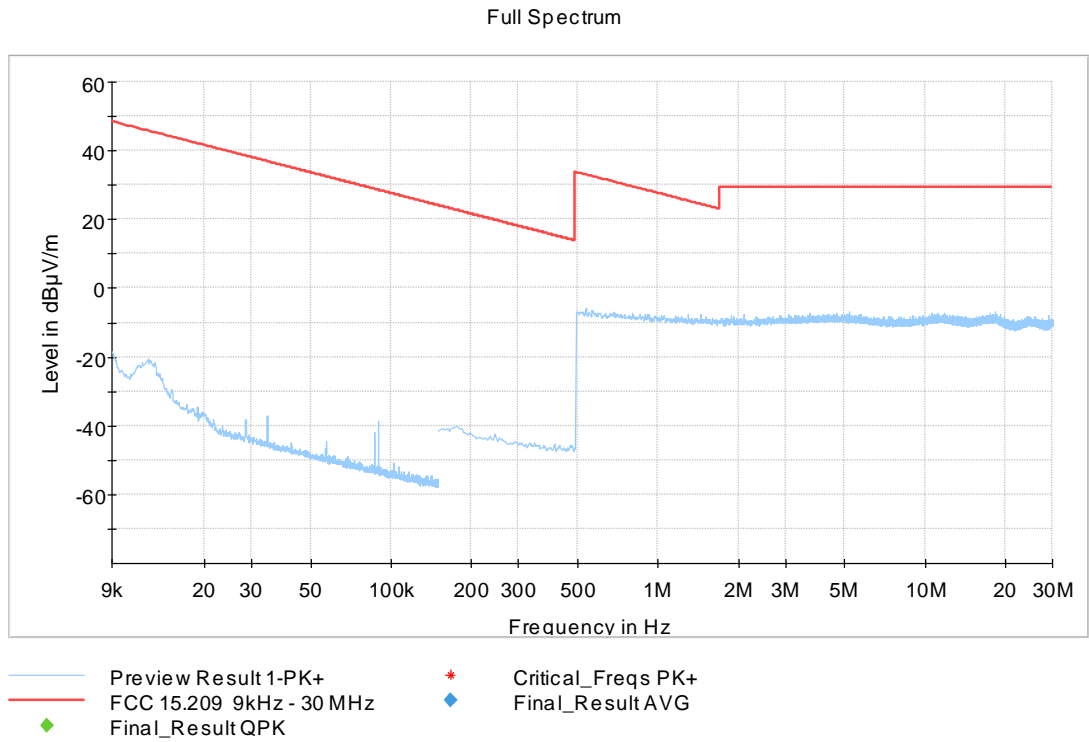


Figure 5: Channel 19 mid 9 kHz – 30 MHz

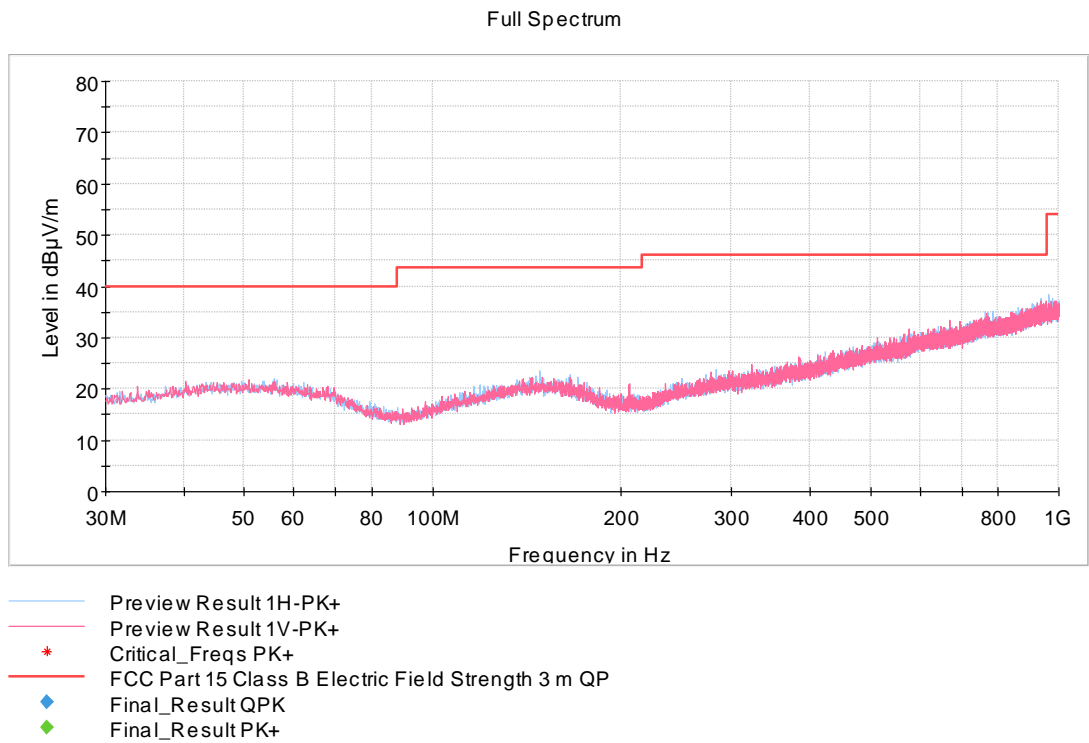


Figure 6: Channel 19 mid 30 MHz – 1000 MHz

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

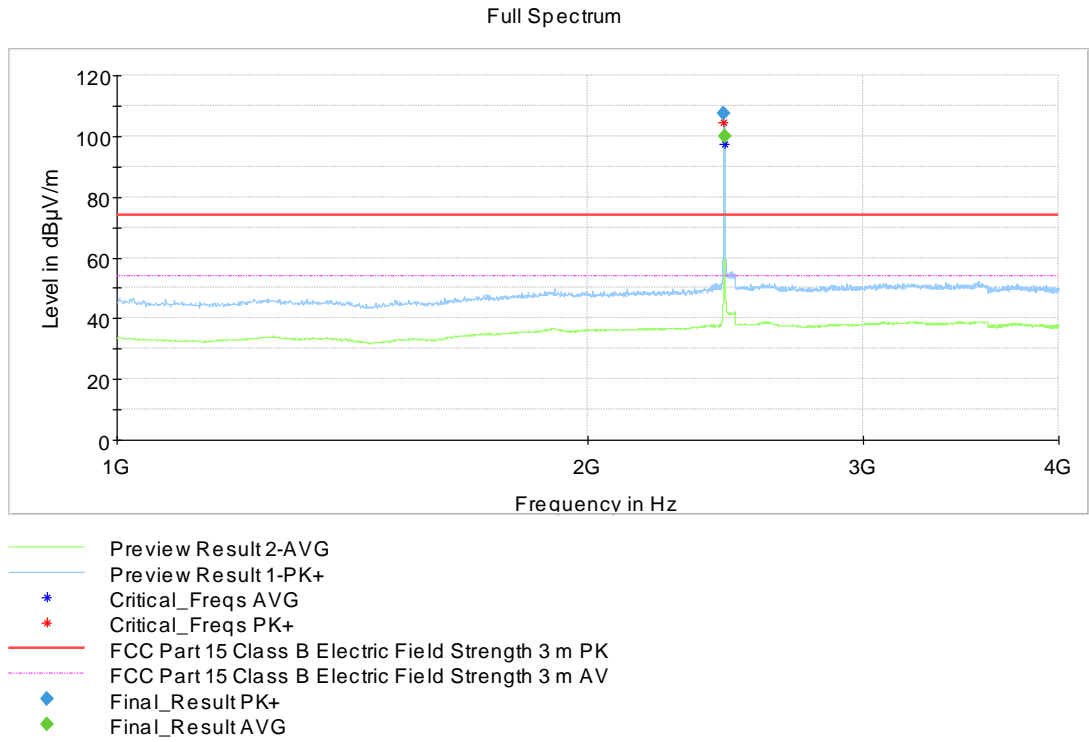


Figure 7: Channel 19 mid 1 GHz – 4 GHz

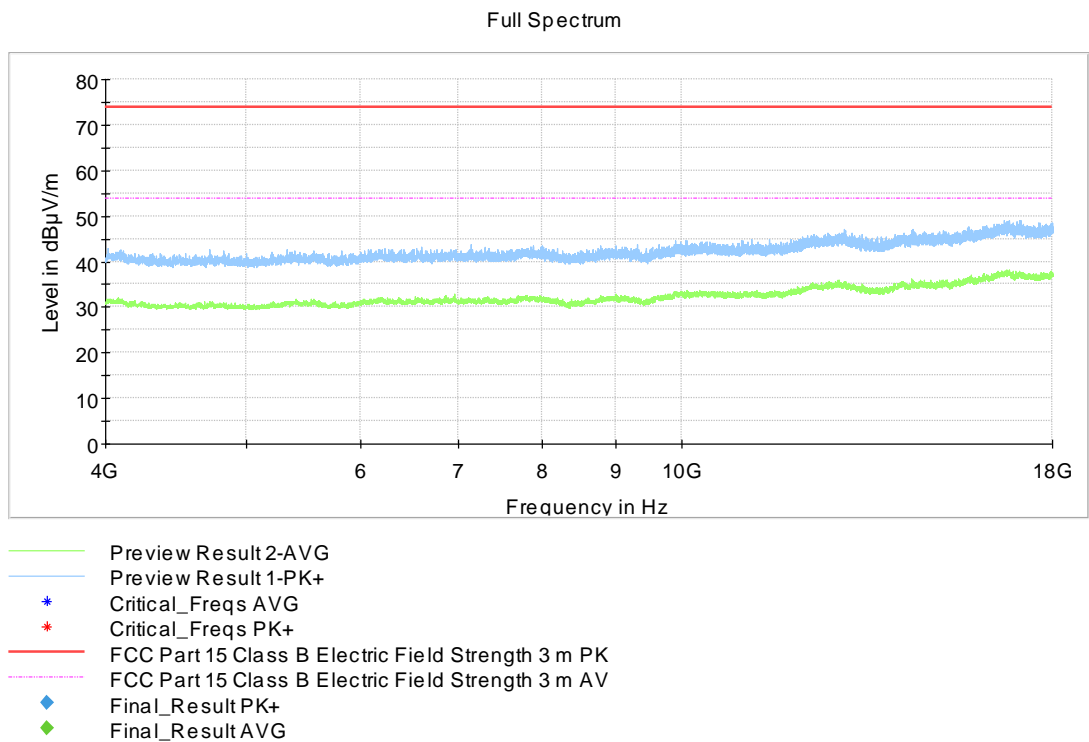


Figure 8: Channel 19 mid 4 GHz – 18 GHz

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

Full Spectrum

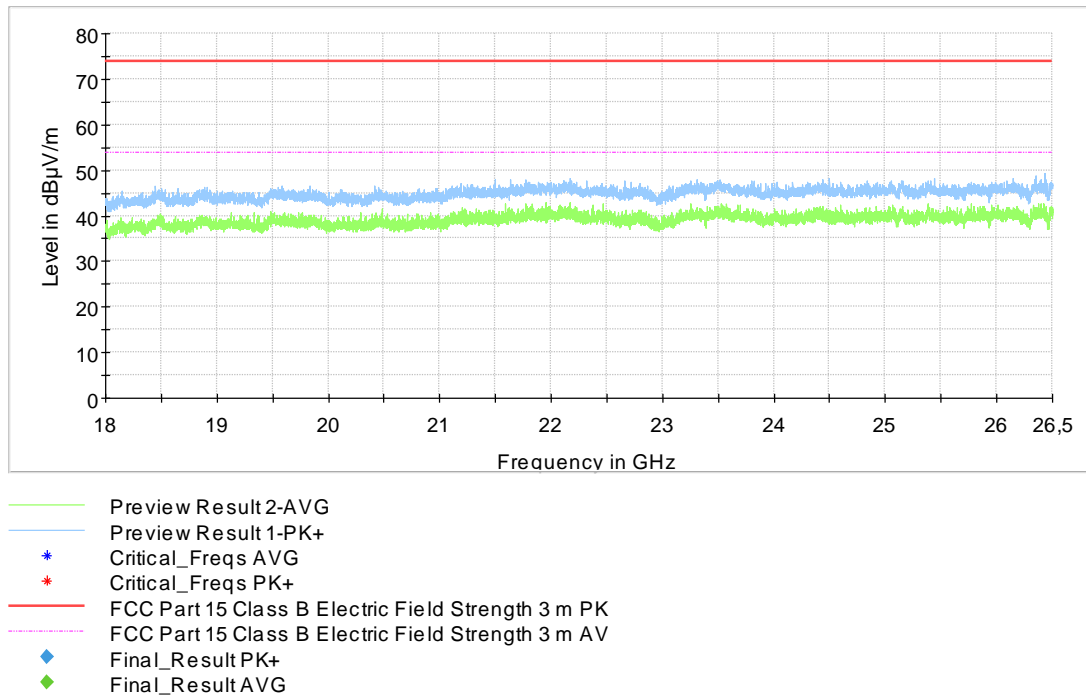


Figure 9: Channel 19 mid 18 GHz – 26.5 GHz

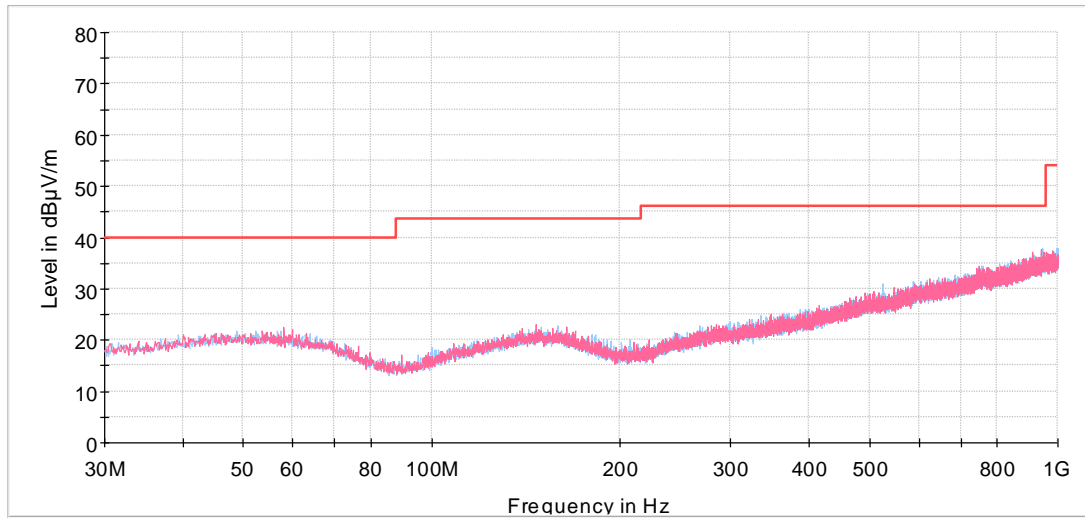
Table 2: Peak and Average results, channel 19 mid

<p>No final measurements were made; no emissions near the limit.</p>

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

High channel (26)

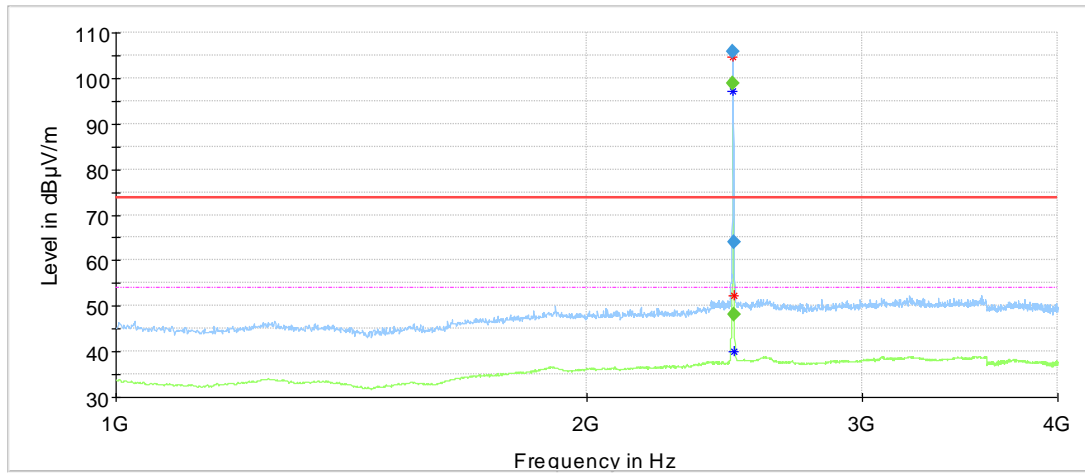
Full Spectrum



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- * Critical_Freqs PK+
- FCC Part 15 Class B Electric Field Strength 3 m QP
- ◆ Final_Result QPK
- ◆ Final_Result PK+

Figure 10: Channel 26 high 30 MHz – 1000 MHz

Full Spectrum



- Preview Result 2-AVG
- Preview Result 1-PK+
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- FCC Part 15 Class B Electric Field Strength 3 m PK
- FCC Part 15 Class B Electric Field Strength 3 m AV
- ◆ Final_Result PK+
- ◆ Final_Result AVG

Figure 11: Channel 26 high 1 GHz – 4 GHz

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

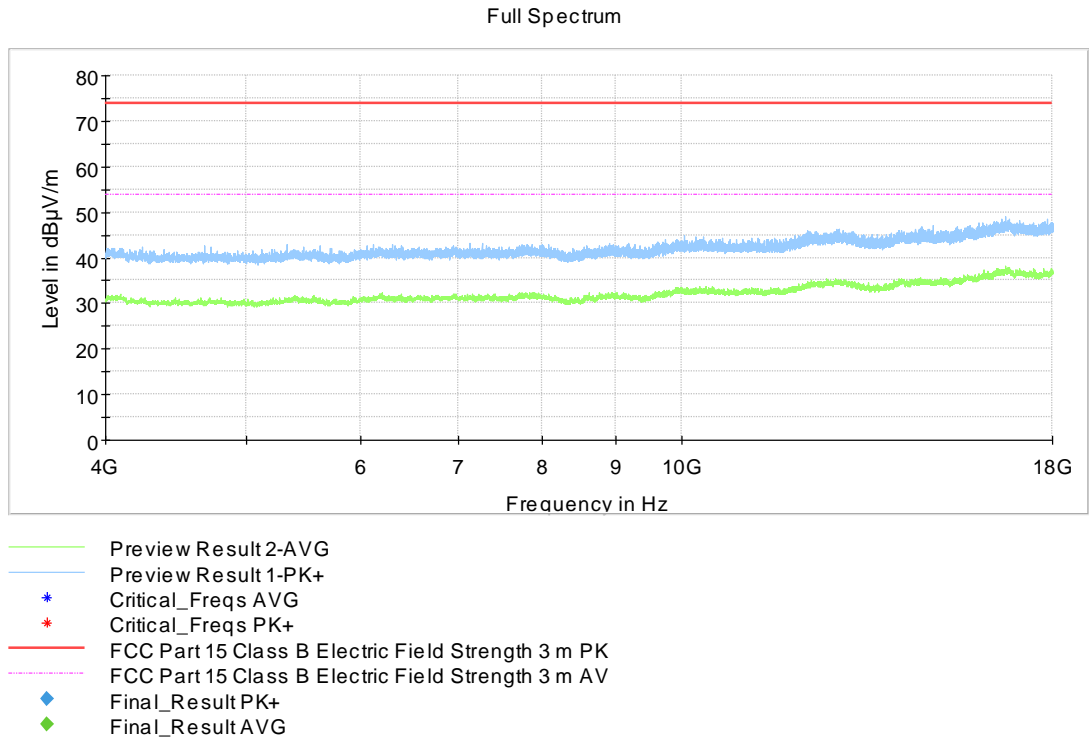


Figure 12: Channel 26 high 4 GHz – 18 GHz

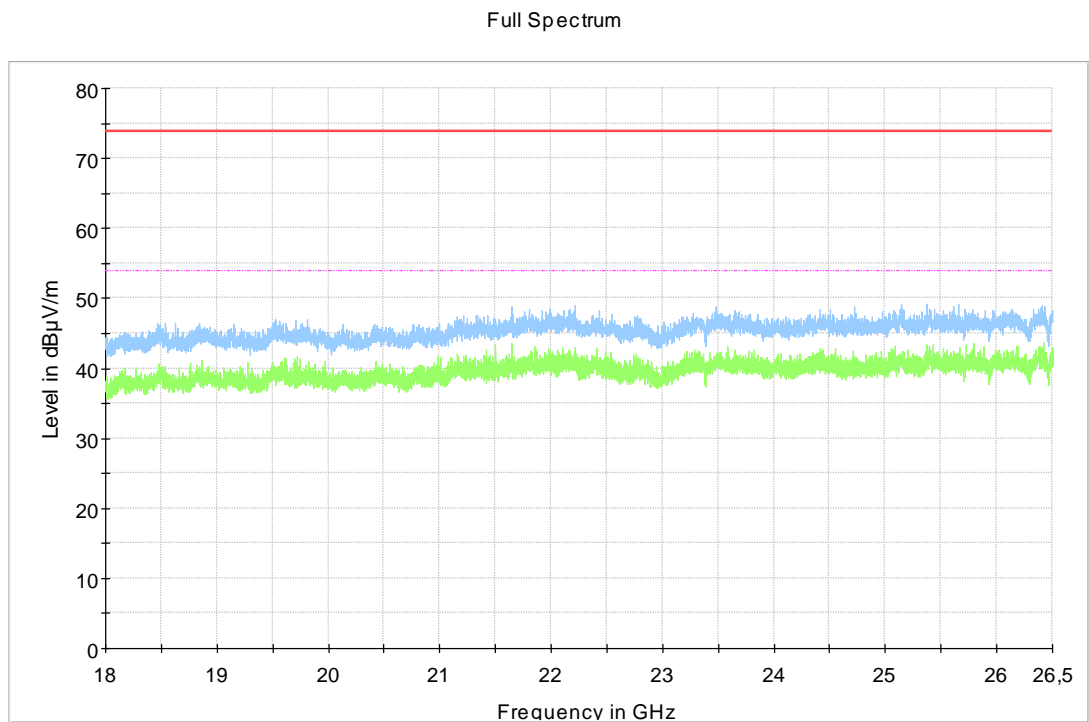


Figure 13: Channel 26 high 18 GHz – 26.5 GHz

Table 3: Peak and Average results, channel 26 high

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	48.21	53.90	5.69	1000.0	1000.000	157.0	H	240.0	14.7
2483.500000	64.10	---	73.90	9.80	1000.0	1000.000	176.0	H	242.0	14.7

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

Radiated Band Edge results

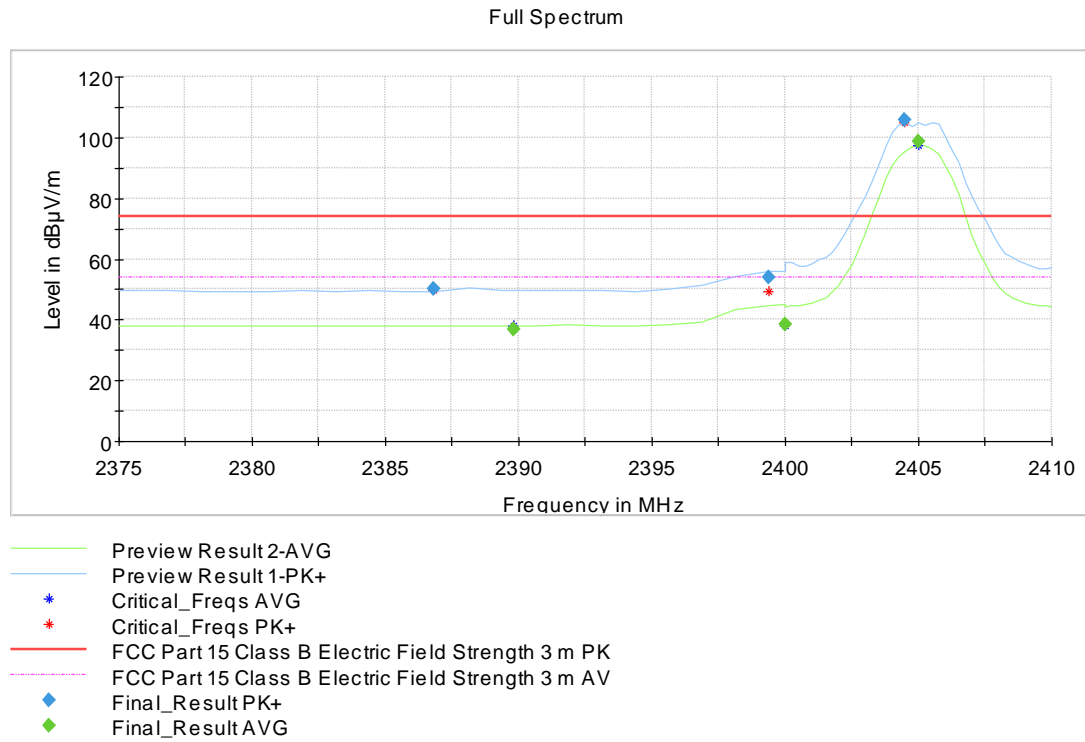


Figure 14: Radiated Band Edge measurement graph, Channel 11 low

Table 4: Peak and Average results, channel 11 low

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2386.800000	50.17	---	73.90	23.73	1000.0	1000.000	176.0	V	270.0	14.6
2389.800000	---	36.92	53.90	16.98	1000.0	1000.000	400.0	V	205.0	14.6
2399.400000	53.83	---	73.90	20.07	1000.0	1000.000	386.0	V	208.0	14.7
2400.000000	---	38.62	53.90	15.28	1000.0	1000.000	280.0	V	111.0	14.7

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

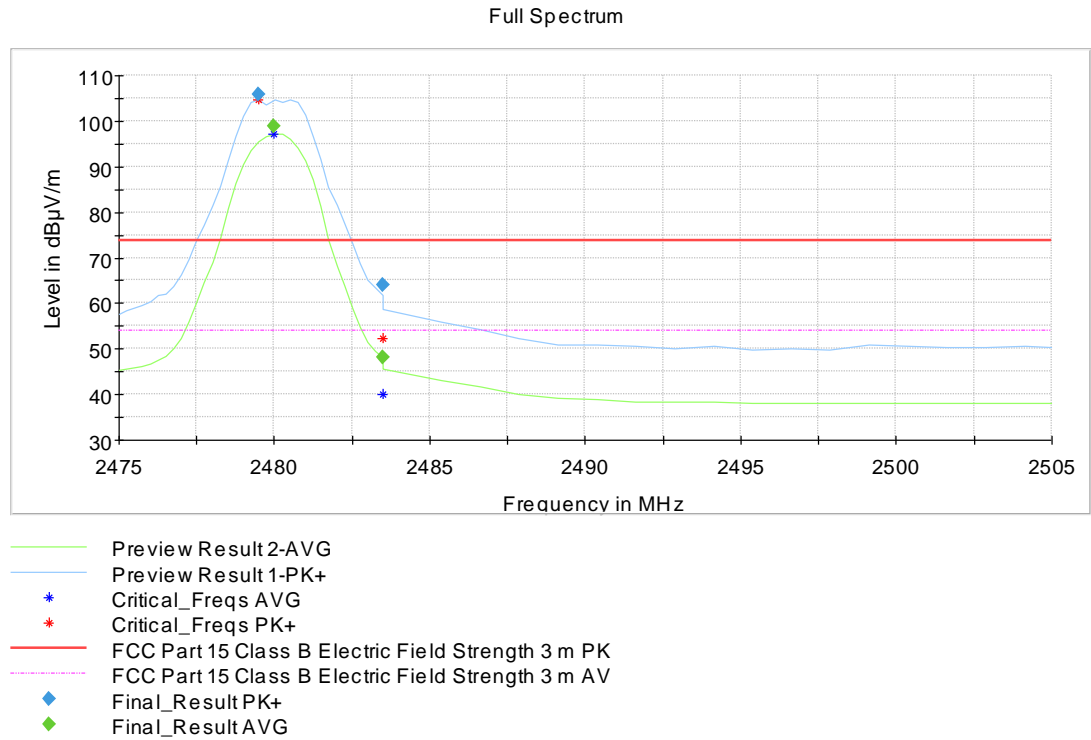


Figure 15: Radiated Band Edge measurement graph, Channel 26 high

Table 5: Peak and Average results, channel 26 high

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500000	---	48.21	53.90	5.69	1000.0	1000.000	157.0	H	240.0	14.7
2483.500000	64.10	---	73.90	9.80	1000.0	1000.000	176.0	H	242.0	14.7

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	AMC MICROWAVE	ALS1826-41-12	sn:11	2017-11-16	2018-11-16
PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2017-11-16	2018-11-16
ANTENNA	EMCO	3117	inv:7293	2018-03-14	2020-03-14
ATTENUATOR	HUBER&SUHNER	6830.19.A	inv:10394	2017-11-01	2019-11-01
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
ATTENUATOR	PASTERNAK	10 dB, DC-40 GHz	sn:A1	2017-11-16	2019-11-16
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2018-06-27	2019-06-27
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2016-08-29	2018-08-29
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2016-10-25	2018-10-25
POWER SUPPLY	THANDAR	TS3021S	sn:099610	-	-
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2018-04-05	2019-04-05
FILTER	WAINWRIGHT	HP, WHKX4.0/18G-10SS	inv:10403	2017-03-01	2019-03-01
MULTIMETER	BECKMAN	DM95	inv:8255	2017-12-19	2018-12-19