TEST REPORT

Report Number: 104590627MIN-001
Project Number: G104590627

Testing performed on the
Flash Wireless Smart Thermostat (Wi-Fi)

to
47 CFR, Part 15. 247:2021
RSS- 247, Issue 2, 2017
RSS-Gen, Issue 5, 2019, Amendment 2

For
Ademco Inc.

Test Performed by:	Test Authorized by:
Intertek Testing Services NA, Inc.	Ademco Inc.
40 51st Way NE, Suite 100	1985 Douglas Dr N
Fridley, MN 55421 USA	Golden Valley, MN 55422, USA

Prepared by: Richard Blonigen

Reviewed by: Uri Spector

Date of issue: August 24, 2021

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1.0 GENERAL DESCRIPTION

Model:	Flash
Type of EUT:	Wireless Smart Thermostat Wi-Fi Transceiver
Serial Number:	SN: 070 Radiated Unit SN: 330 Conducted Unit
Related Submittal(s) Grants:	None
Company:	Ademco Inc.
Customer:	Dave Mulhouse
Address:	1985 Douglas Dr N Golden Valley, MN 55422, USA
e-mail:	Dave.mulhouse@resideo.com
Test Standards:	☒ 47 CFR, Part 15:2021, §15.247 ☒ RSS–247, Issue 2, 2017 ☒ RSS-Gen, Issue 5, 2019, Amendment 2
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	July 30, 2021
Test Work Started:	August 2, 2021
Test Work Completed:	August 24, 2021
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	2.4GHz Wi-Fi Transceiver
Transmitter Type:	☐ FHSS ☒ Digital Modulation ☒ Wi-Fi ☐ Blue Tooth
Permitted Band of Operation	2400 to 2483.5MHz
Operating Frequency Range(s):	2412 MHz – 2462 MHz, 802.11b, 802.11g, 802.11n20 2422 MHz – 2452 MHz, 802.11n40
Number of Channels:	11 for 802.11b, 802.11g, 802.11n20 7 for 802.11n40
Test Channels:	Ch.1 (2412MHz), Ch.6 (2437MHz), Ch.11 (2462MHz) for 802.11b, Ch.1 (2412MHz), Ch.6 (2437MHz), Ch. 10 (2457MHz), Ch.11 (2462MHz) for 802.11g, Ch.1 (2412MHz), Ch.2 (2417MHz), Ch.6 (2437MHz), Ch.10 (2457MHz), Ch.11 (2462MHz) for 802.11n20, Ch.3 (2422MHz), Ch.6 (2437MHz), Ch.8 (2447MHz), Ch.9 (2452MHz) for 802.11n40
Modulation:	802.11b/g/n /CCK/OFDM/MCS7
Antenna(s) Info:	PCB Trace Antenna Gain: 1.93dBi
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ External power source ☒ 24VAC via CUI Inc. 48A-24-500 power adapter
Special Test Arrangement:	None
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2013 and FCC 558074 D01 DTS Measurement Guidance

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:
☒ - Continuous transmissions (modulated signal)

Operating modes of the EUT:

No.	Description
1	Test Mode – The EUT transmitted continuously and per client was configured to transmit with 98.5% duty cycle. Software used for testing: espRFTool version: 2.5
2	Test was performed at: Ch.1 (2412MHz), Ch.6 (2437MHz), Ch.11 (2462MHz) for 802.11n, Ch.1 (2412MHz), Ch.6 (2437MHz), Ch.10 (2457MHz), Ch.11 (2462MHz) for 802.11g Ch.1 (2412MHz), Ch.2 (2417MHz), Ch.6 (2437MHz), Ch.10 (2457MHz), Ch.11 (2462MHz) for 802.11n20 Ch.3 (2422MHz), Ch.6 (2437MHz), Ch.8 (2447MHz), Ch.9 (2452MHz) for 802.11n40
3	Test was performed on 802.11 b/ g/n 20MHz & 40MHz.
4	802.11b data rate: 11Mbps; 802.11g data rate: 9Mbps; 802.11n-20MHz MCS0; 802.11n-40MHz MCS0

Channels Output Power Setting (Test Software setting) per client request:

No.	Mode	Channel	Output Power Level Setting
1	802.11b	Low Ch. 1 Middle Ch. 6 Upper Ch. 11	0 0 0
2	802.11g	Low Ch. 1 Middle Ch. 6 Ch. 10 Upper Ch. 11	0 0 0 5
3	802.11n-20	Low Ch. 1 Ch.2 Middle Ch. 6 Ch.10 Upper Ch. 11	4 0 0 0 8
4	802.11n-40	Low Ch. 3 Middle Ch. 6 Ch.8 Upper Ch. 9	10 10 10 18

Notes:

1. For conducted measurements client provided the sample configured with antenna connector instead of PCB trace antenna. For radiated measurements client provided the sample with PCB trace antenna.
2. Next channel in was tested at baseline power for all tests when power deviated from baseline on edge channels. All tests were found to be in compliance, therefore deviating power on above listed edge channels is deemed acceptable.

Cables:

No.	Type	Length	Designation	Note
1	2-wire unshielded	2m	AC Power	

Support equipment/Services:

No.	Item	Description
1	Asus Laptop	Computer for setup only (disconnected during measurements)
2	CUI Inc. 48A-24-500 power adapter	24VAC Power Source

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ **Normal**

Temperature:	+15 to +35 ° C
Humidity:	20-75 %
Atmospheric pressure:	86-106 kPa

☐ **Extreme**

☐ **Temperature:**

☐ **Supply voltage:**

1.4 Measurement uncertainty

Radiated Emissions:

Measurement	Frequency Range	Expanded Uncertainty (k=2)
Radiated Emissions, 3m	9 kHz-30 MHz	3.2 dB
Radiated Emissions, 10m	30-1000 MHz	4.0 dB
Radiated Emissions, 3m	30-1000 MHz	4.8 dB
Radiated Emissions, 3m	1-6 GHz	5.1 dB
Radiated Emissions, 3m	6-18 GHz	5.2 dB
Radiated Emissions, 3m	18-40 GHz	5.2 dB

AC Mains Conducted Emissions:

Measurement	Frequency Range	Expanded Uncertainty (k=2)
AC Line Conducted Emissions	150 kHz - 30 MHz	2.6 dB

Conducted Spurious RF Emissions:

The expanded uncertainty (k = 2) for Conducted Spurious Emissions has been determined to be: ±1.5 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.247(a) / RSS-247 5.2	6dB Emission bandwidth of a DTS Transmission	Pass
15.247(b), (c) / RSS-247 5.4	Conducted Output Power	Pass
15.247/(e) / RSS-247 5.2	Power spectral density	Pass
15.247(d) / RSS-247 5.5	Antenna conducted spurious emissions	Pass
15.247(d) / RSS-247 5.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass
15.207 / RSS-Gen 7.2.2	AC line conducted emissions	Pass

3.0 TEST CONDITIONS AND RESULTS

3.1 6dB Emission bandwidth of a DTS Transmission

802.11b

Low Frequency Channel (1) MHz	Middle Frequency Channel (6) MHz	Upper Frequency Channel (11) MHz	Minimum Bandwidth kHz	Result
10.38	10.42	10.15	500	**Pass**

802.11g

Low Frequency Channel (1) MHz	Middle Frequency Channel (6) MHz	Next In Upper Frequency Channel (10) MHz	Upper Frequency Channel (11) MHz	Minimum Bandwidth kHz	Result
16.40	16.39	16.39	16.55	500	**Pass**

802.11n- 20

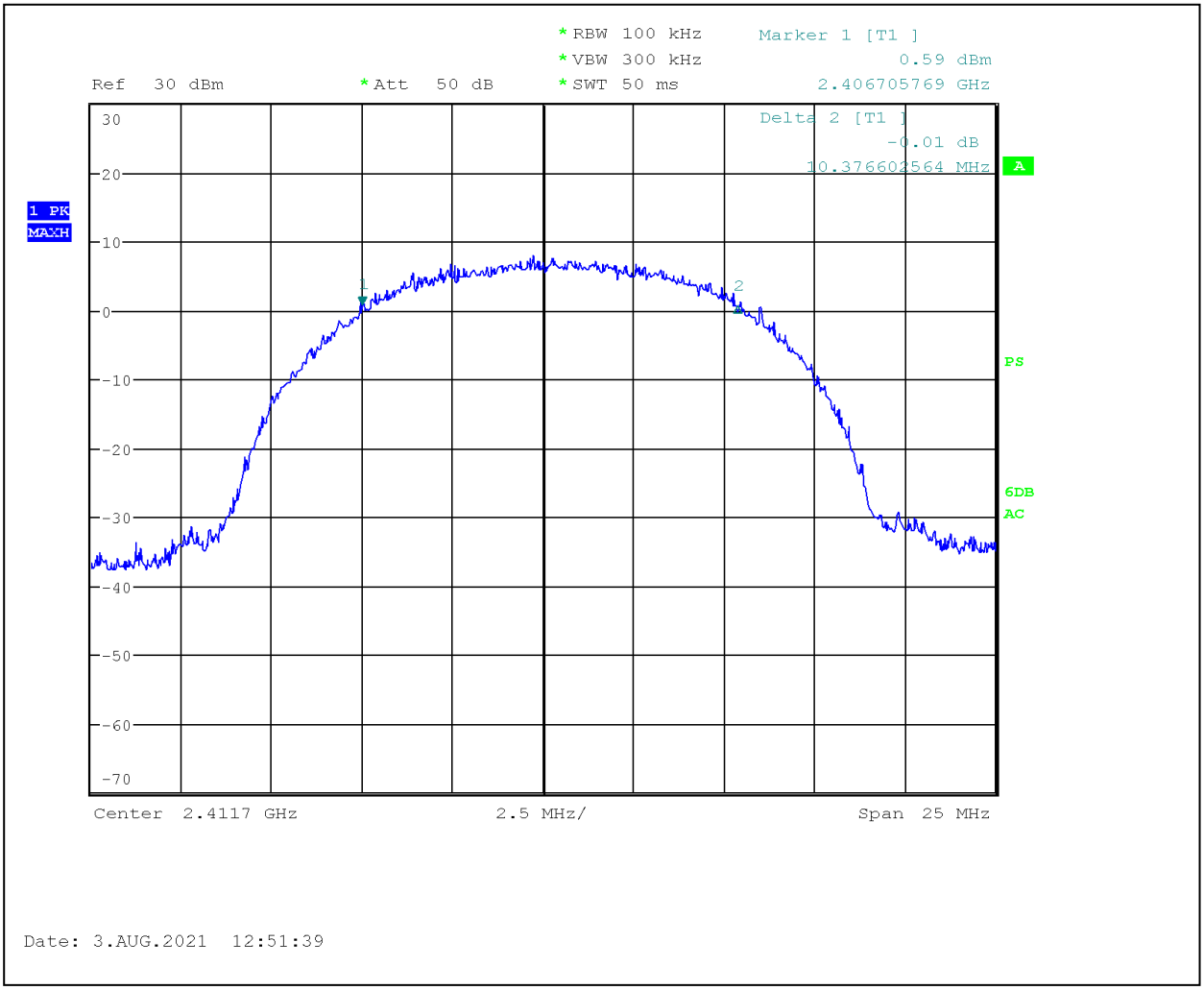
Low Frequency Channel (1) MHz	Next In Low Frequency Channel (2) MHz	Middle Frequency Channel (6) MHz	Next In Upper Frequency Channel (10) MHz	Upper Frequency Channel (11) MHz	Minimum Bandwidth kHz	Result
16.80	16.95	16.79	17.33	16.87	500	**Pass**

802.11n- 40

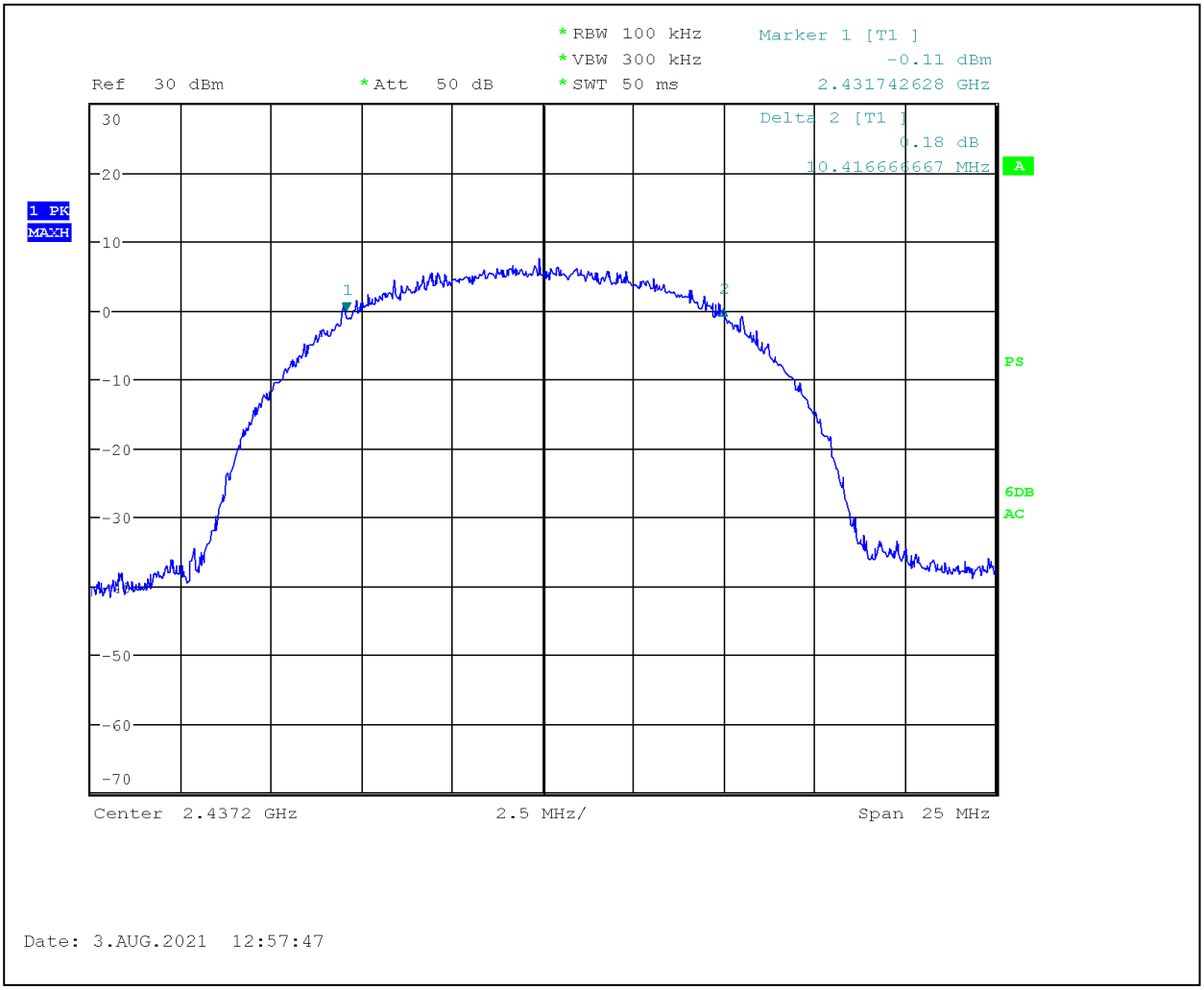
Low Frequency Channel (3) MHz	Middle Frequency Channel (6) MHz	Next In Upper Frequency Channel (8) MHz	Upper Frequency Channel (9) MHz	Minimum Bandwidth kHz	Result
32.32	32.99	32.21	32.27	500	**Pass**

Notes: RBW: 100kHz
VBW: 300kHz

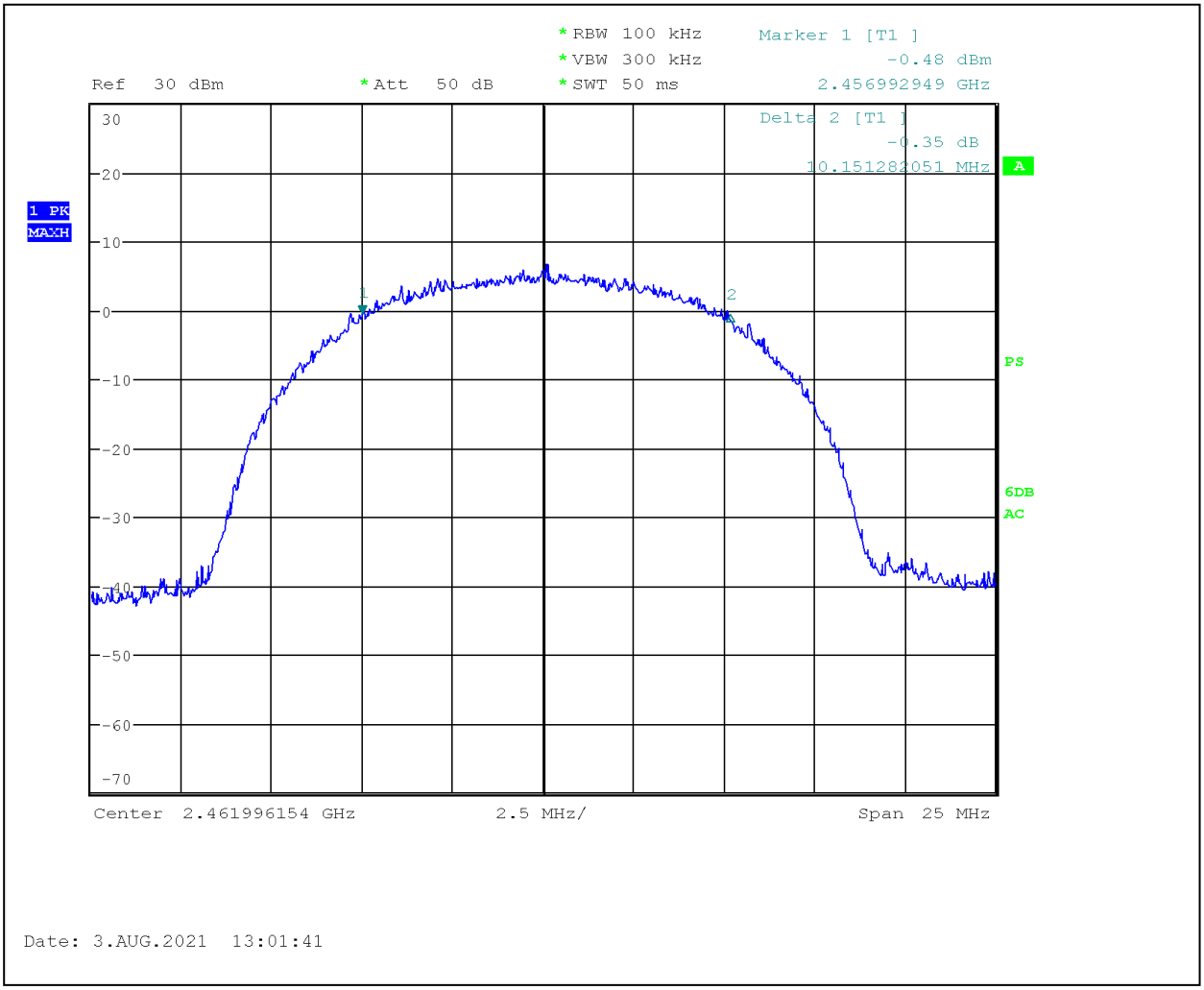
Graphs 3.1.1 – 3.1.3 show 802.11b
Graphs 3.1.4 – 3.1.7 show 802.11g
Graphs 3.1.8 – 3.1.12 show 802.11n20
Graphs 3.1.13 – 3.1.16 show 802.11n40


* RBW 100 kHz
* VBW 300 kHz
* SWT 50 ms
Marker 1 [T1]
0.59 dBm
2.406705769 GHz
Delta 2 [T1]
-0.01 dB
10.376602564 MHz
Ref 30 dBm
* Att 50 dB
1 PK
MAXH
A
PS
6DB
AC
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.4117 GHz
2.5 MHz/
Span 25 MHz
Date: 3.AUG.2021 12:51:39

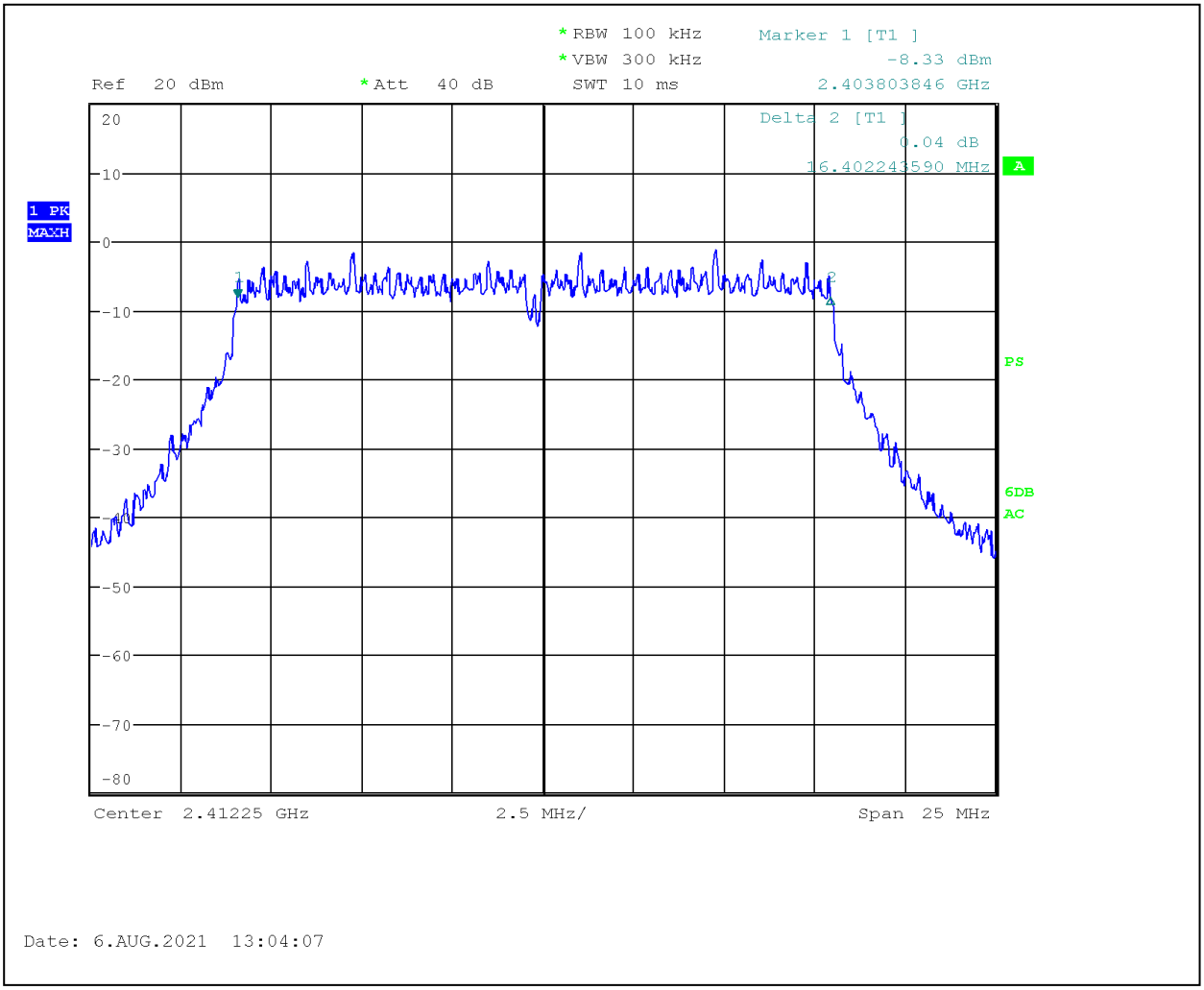
Graph 3.1.1


* RBW 100 kHz
* VBW 300 kHz
* SWT 50 ms
Marker 1 [T1]
-0.11 dBm
2.431742628 GHz
Ref 30 dBm
* Att 50 dB
Delta 2 [T1]
0.18 dB
10.416666667 MHz
1 PK
MAXH
A
PS
6DB
AC
30
20
10
0
-10
-20
-30
-50
-60
-70
Center 2.4372 GHz
2.5 MHz/
Span 25 MHz
Date: 3.AUG.2021 12:57:47

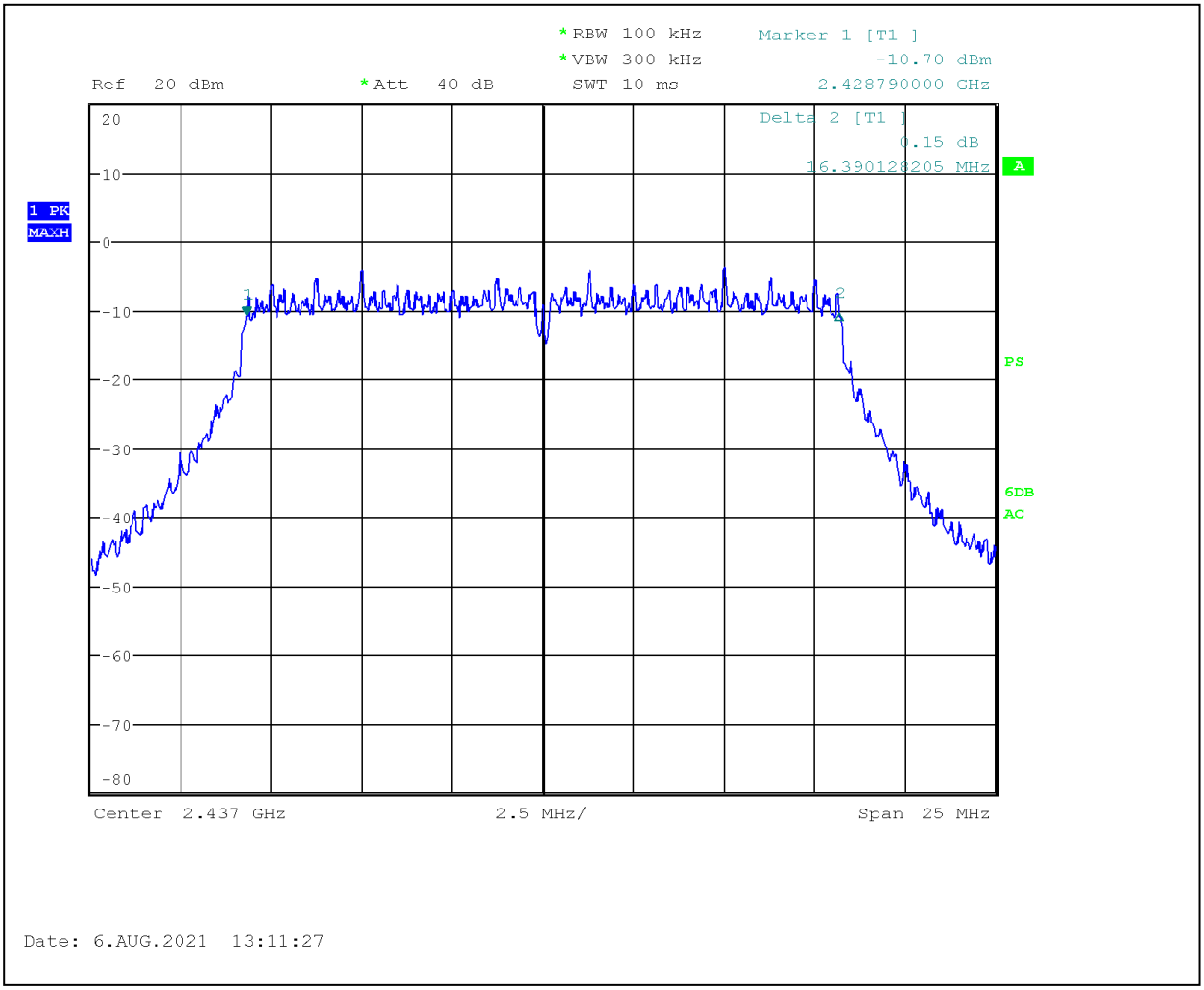
Graph 3.1.2


* RBW 100 kHz
* VBW 300 kHz
* SWT 50 ms
Marker 1 [T1]
-0.48 dBm
2.456992949 GHz
Delta 2 [T1]
-0.35 dB
10.151282051 MHz
Ref 30 dBm
* Att 50 dB
1 PK
MAXH
A
PS
6DB
AC
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.461996154 GHz
2.5 MHz/
Span 25 MHz
Date: 3.AUG.2021 13:01:41

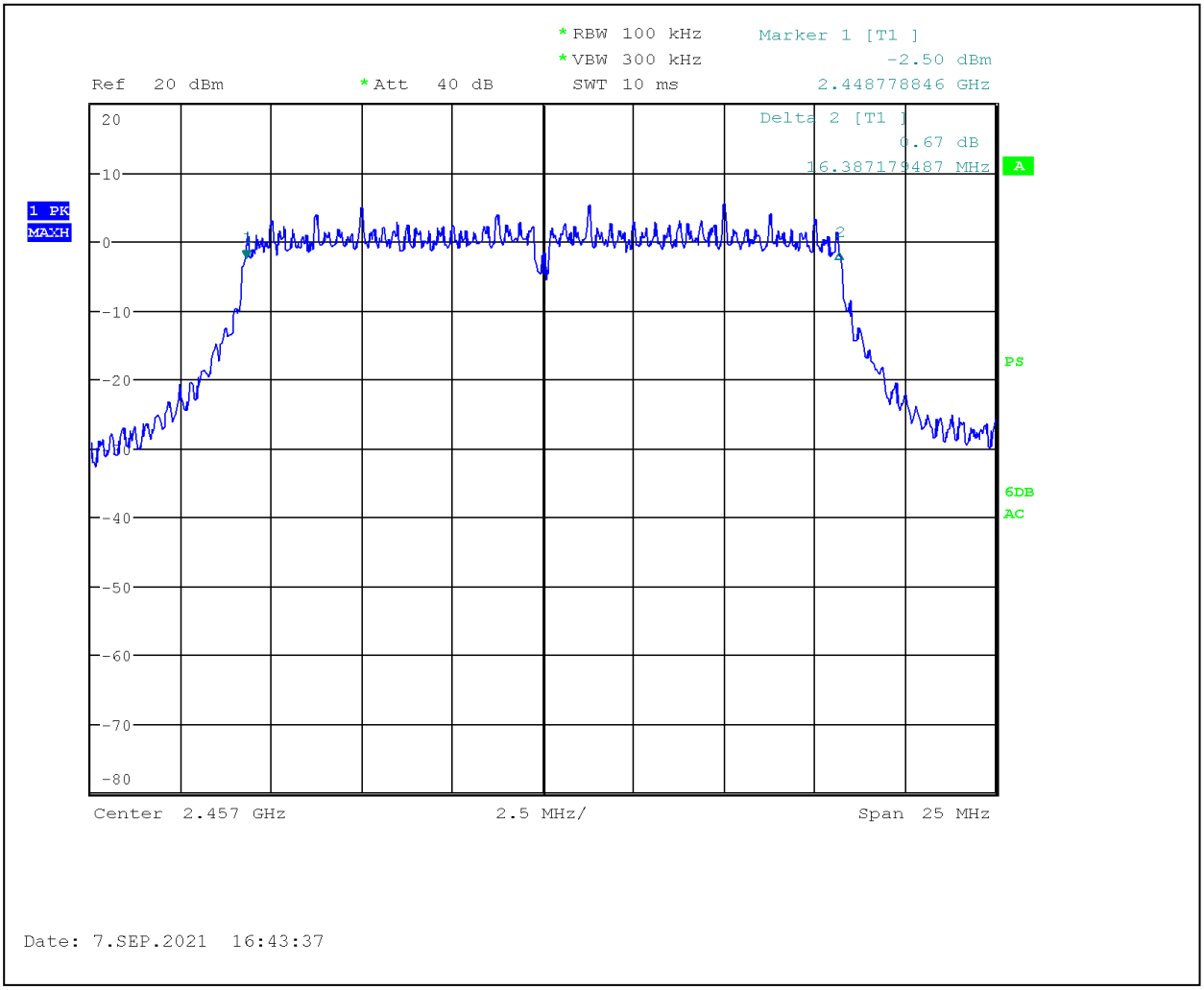
Graph 3.1.3


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-8.33 dBm
2.403803846 GHz
Delta 2 [T1]
0.04 dB
16.402243590 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.41225 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:04:07

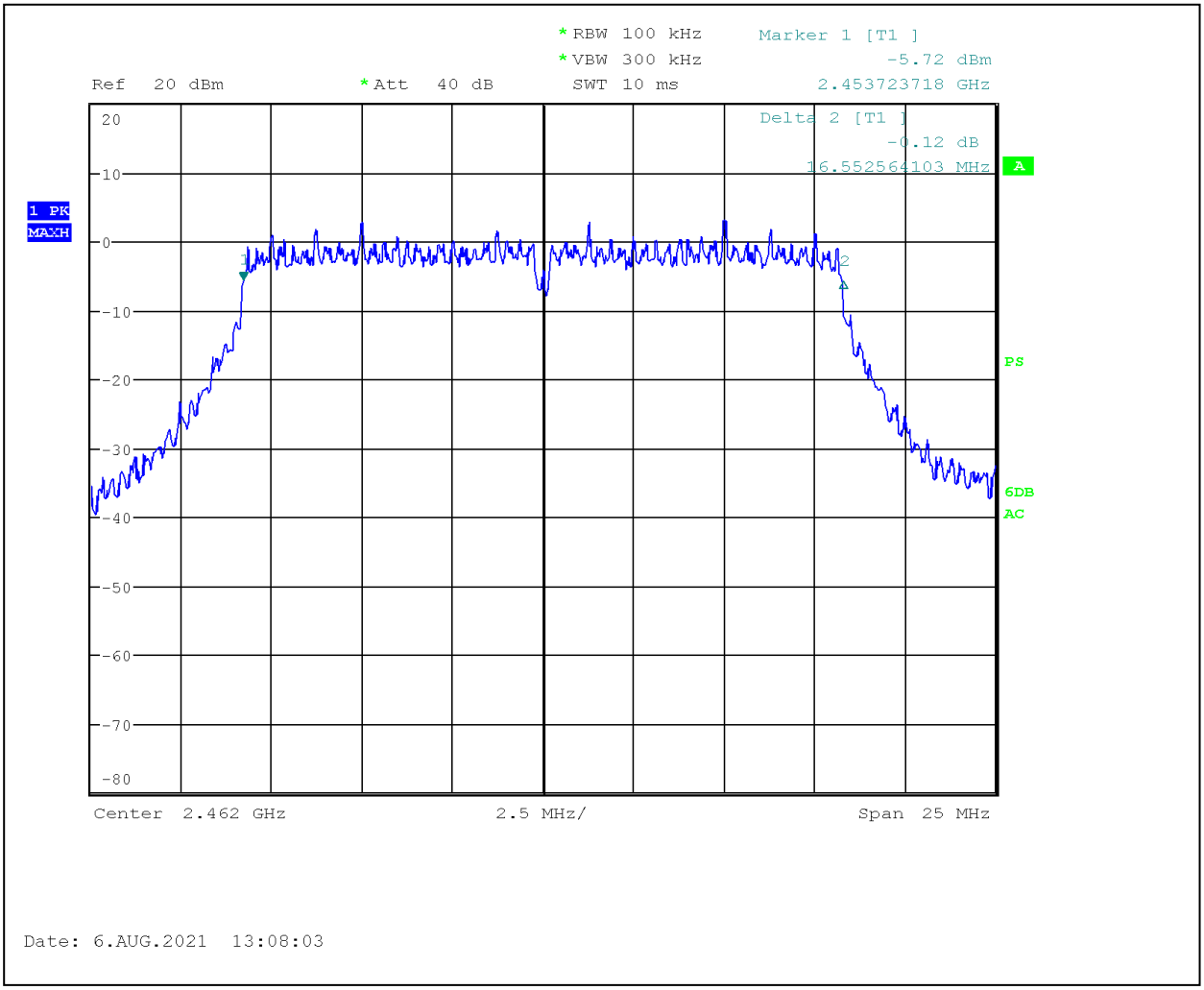
Graph 3.1.4


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-10.70 dBm
2.428790000 GHz
Delta 2 [T1]
0.15 dB
16.390128205 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.437 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:11:27

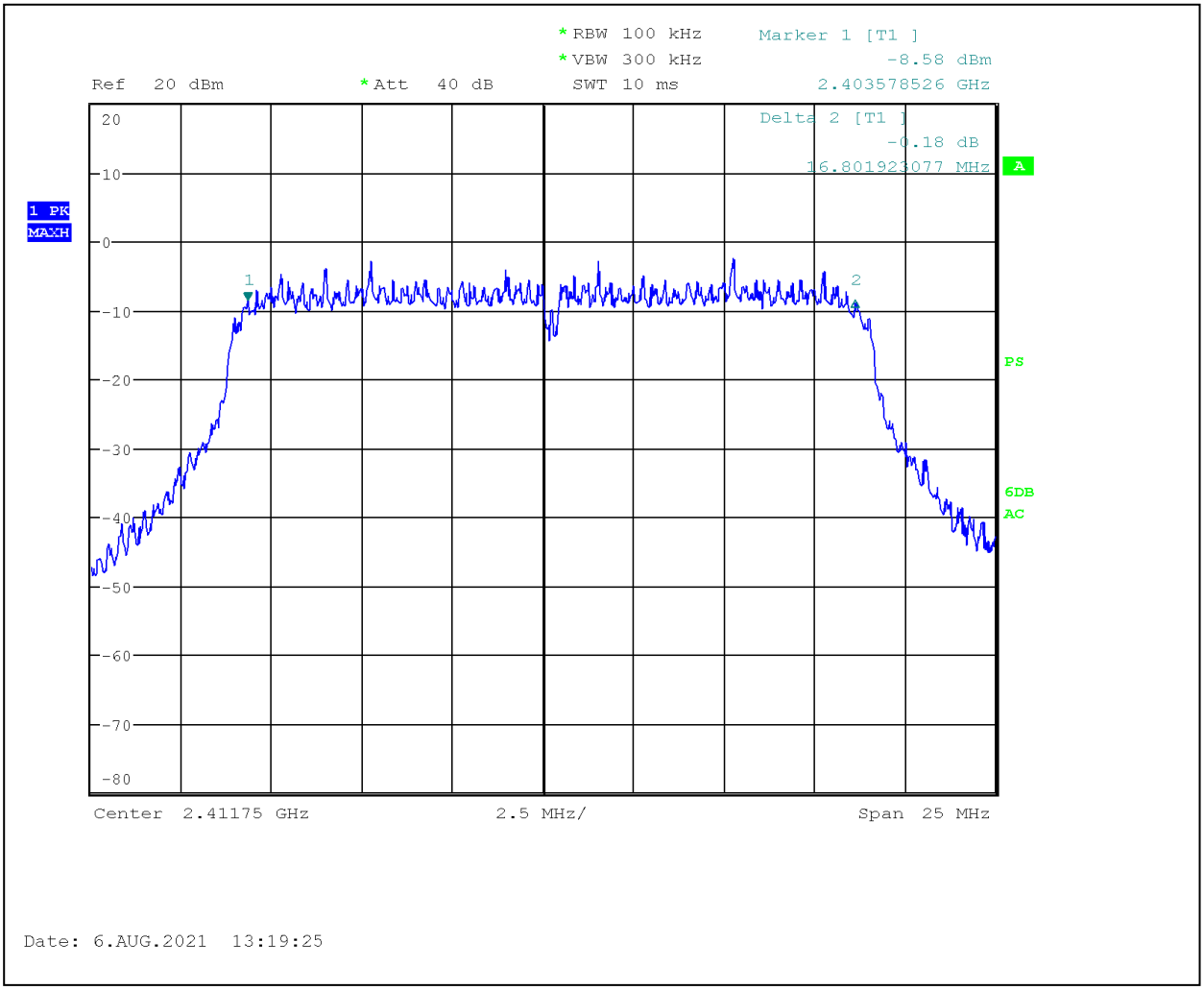
Graph 3.1.5


* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
-2.50 dBm
2.448778846 GHz
Delta 2 [T1]
0.67 dB
16.387179487 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.457 GHz
2.5 MHz/
Span 25 MHz
Date: 7.SEP.2021 16:43:37

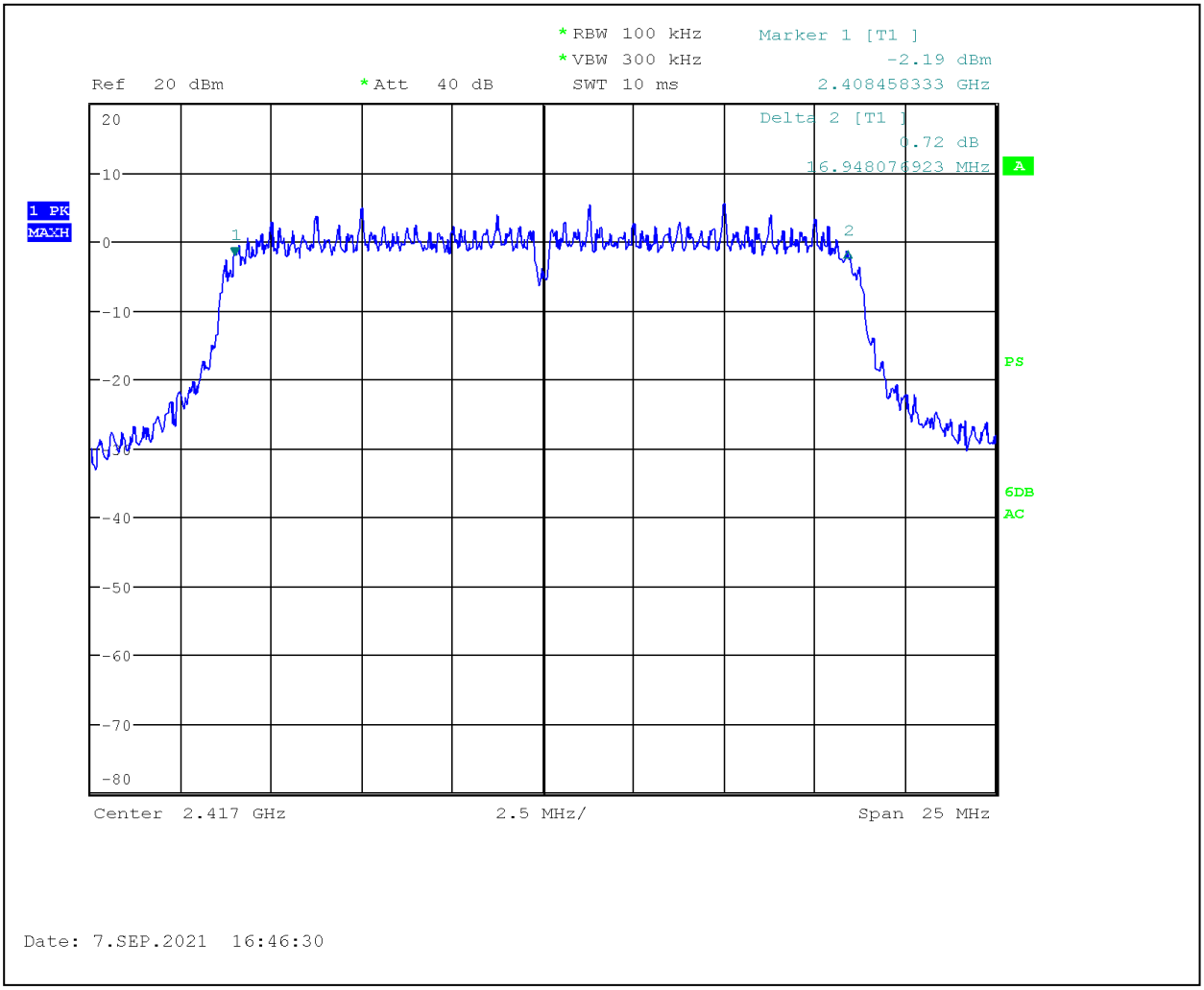
Graph 3.1.6


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-5.72 dBm
2.453723718 GHz
Delta 2 [T1]
-0.12 dB
16.552564103 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.462 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:08:03

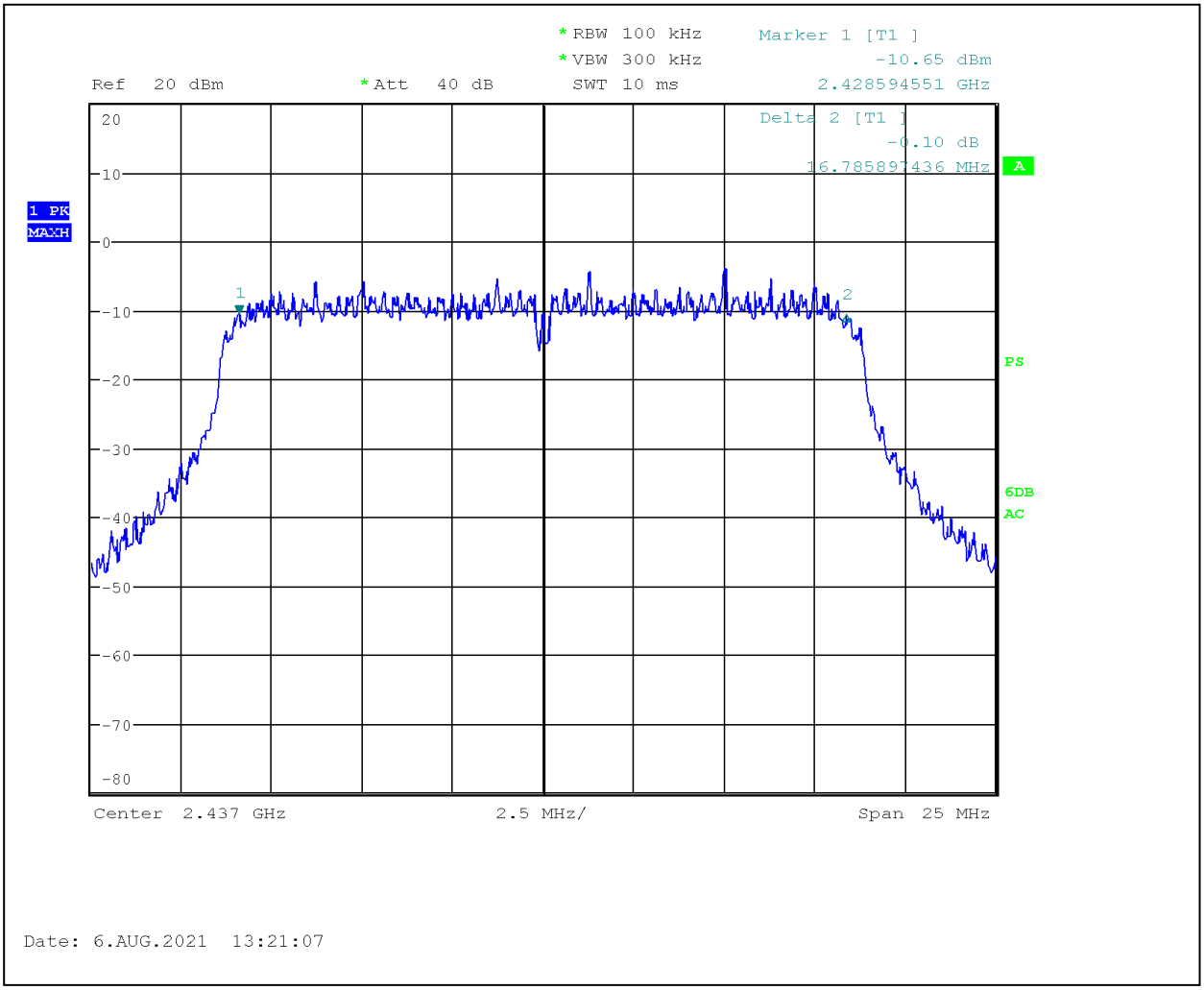
Graph 3.1.7


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-8.58 dBm
2.403578526 GHz
Delta 2 [T1]
-0.18 dB
16.801923077 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.41175 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:19:25

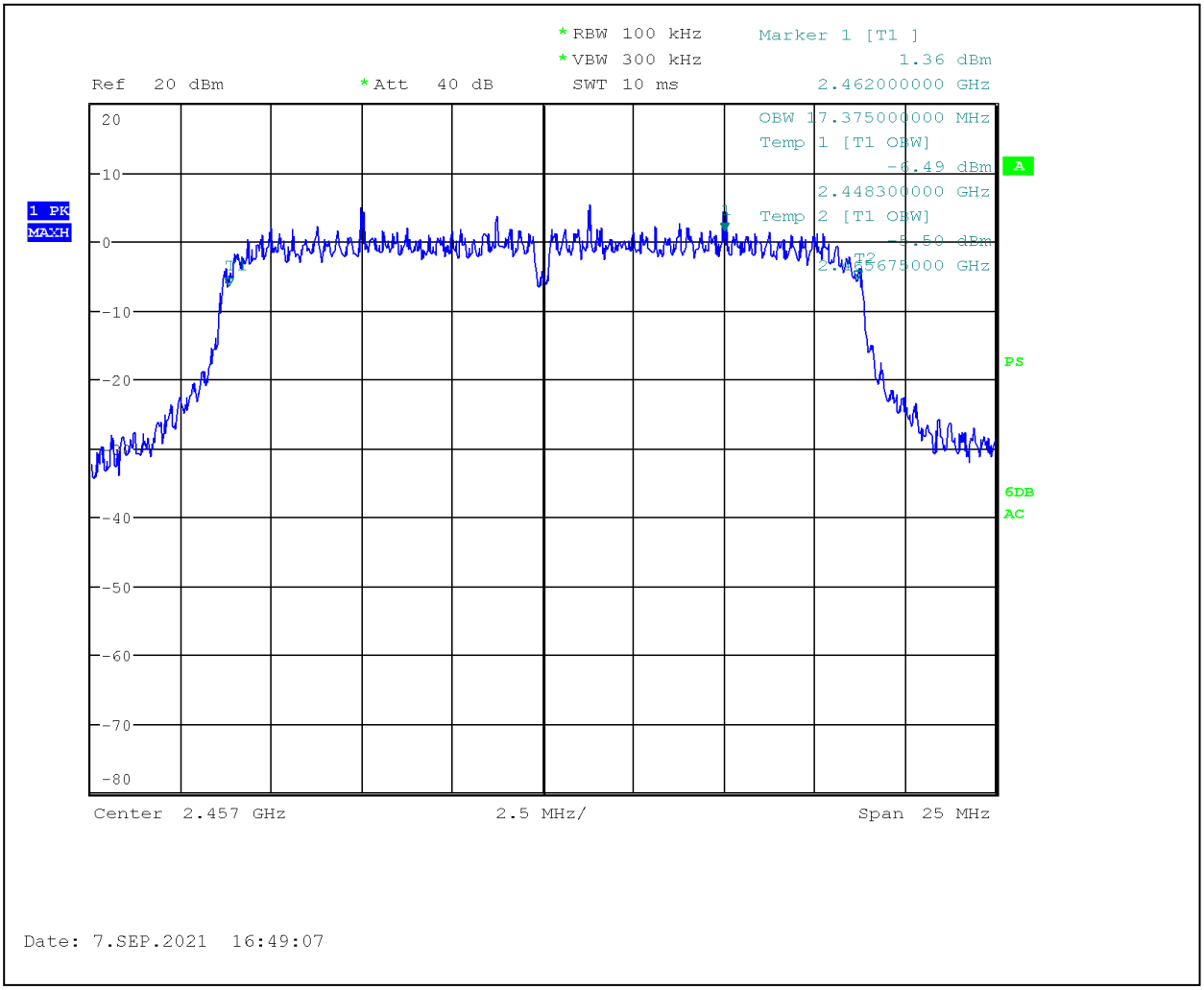
Graph 3.1.8


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-2.19 dBm
2.408458333 GHz
Delta 2 [T1]
0.72 dB
16.948076923 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.417 GHz
2.5 MHz/
Span 25 MHz
Date: 7.SEP.2021 16:46:30

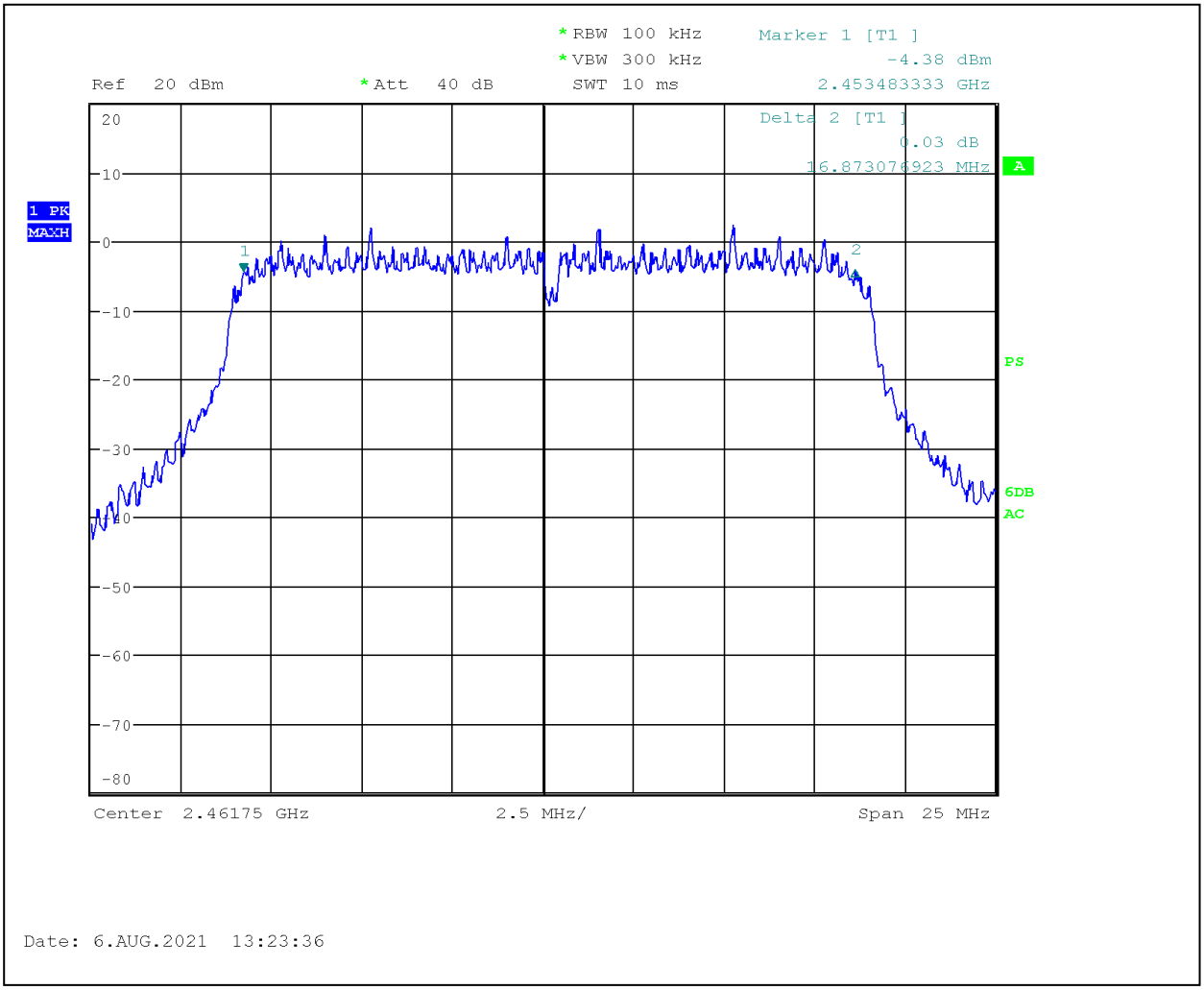
Graph 3.1.9


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-10.65 dBm
2.428594551 GHz
Delta 2 [T1]
-0.10 dB
16.785897436 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.437 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:21:07

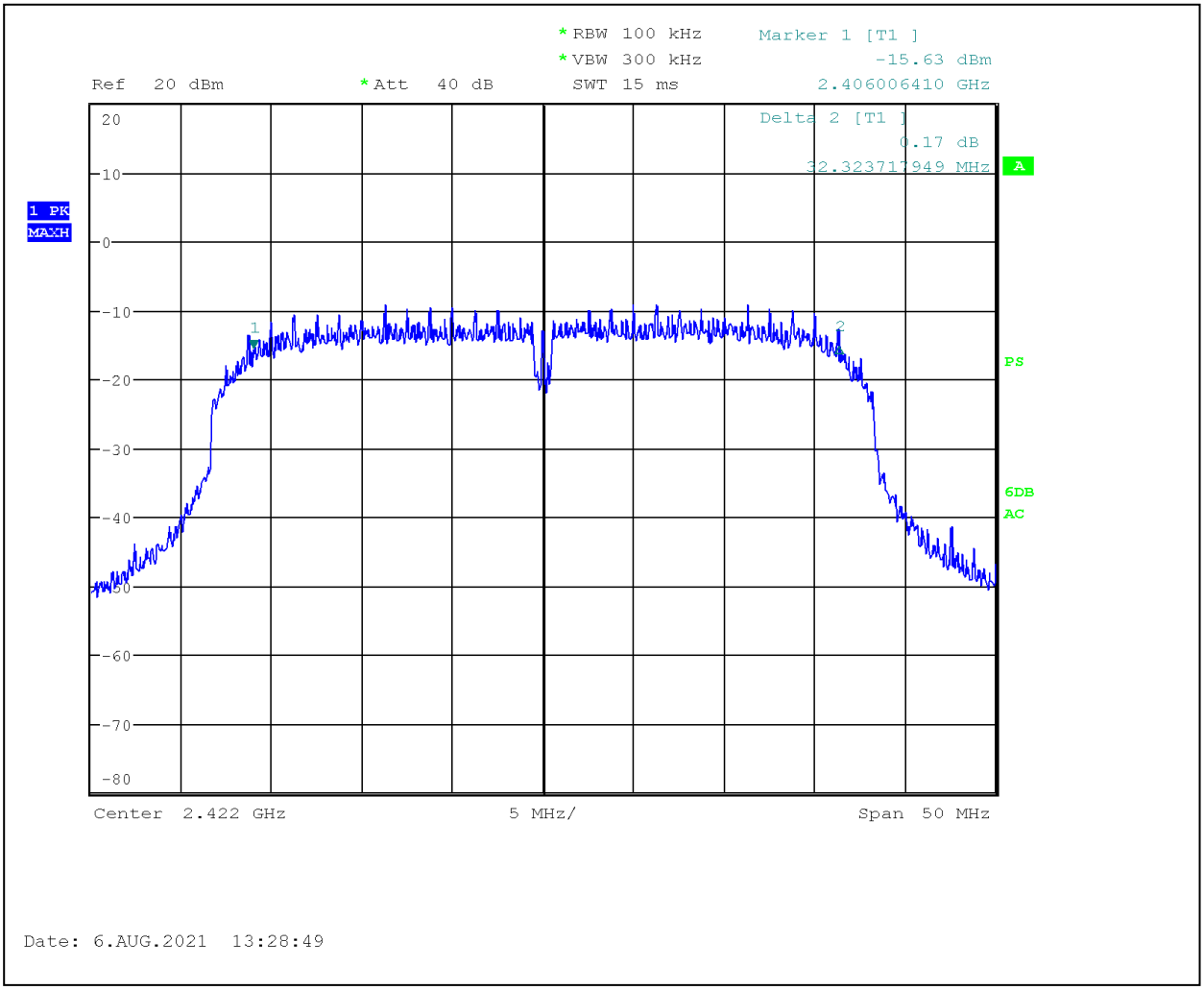
Graph 3.1.10


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
1.36 dBm
2.462000000 GHz
OBW 17.375000000 MHz
Temp 1 [T1 OBW]
-6.49 dBm
2.448300000 GHz
Temp 2 [T1 OBW]
-5.50 dBm
2.456675000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-40
-50
-60
-70
-80
Center 2.457 GHz
2.5 MHz/
Span 25 MHz
Date: 7.SEP.2021 16:49:07

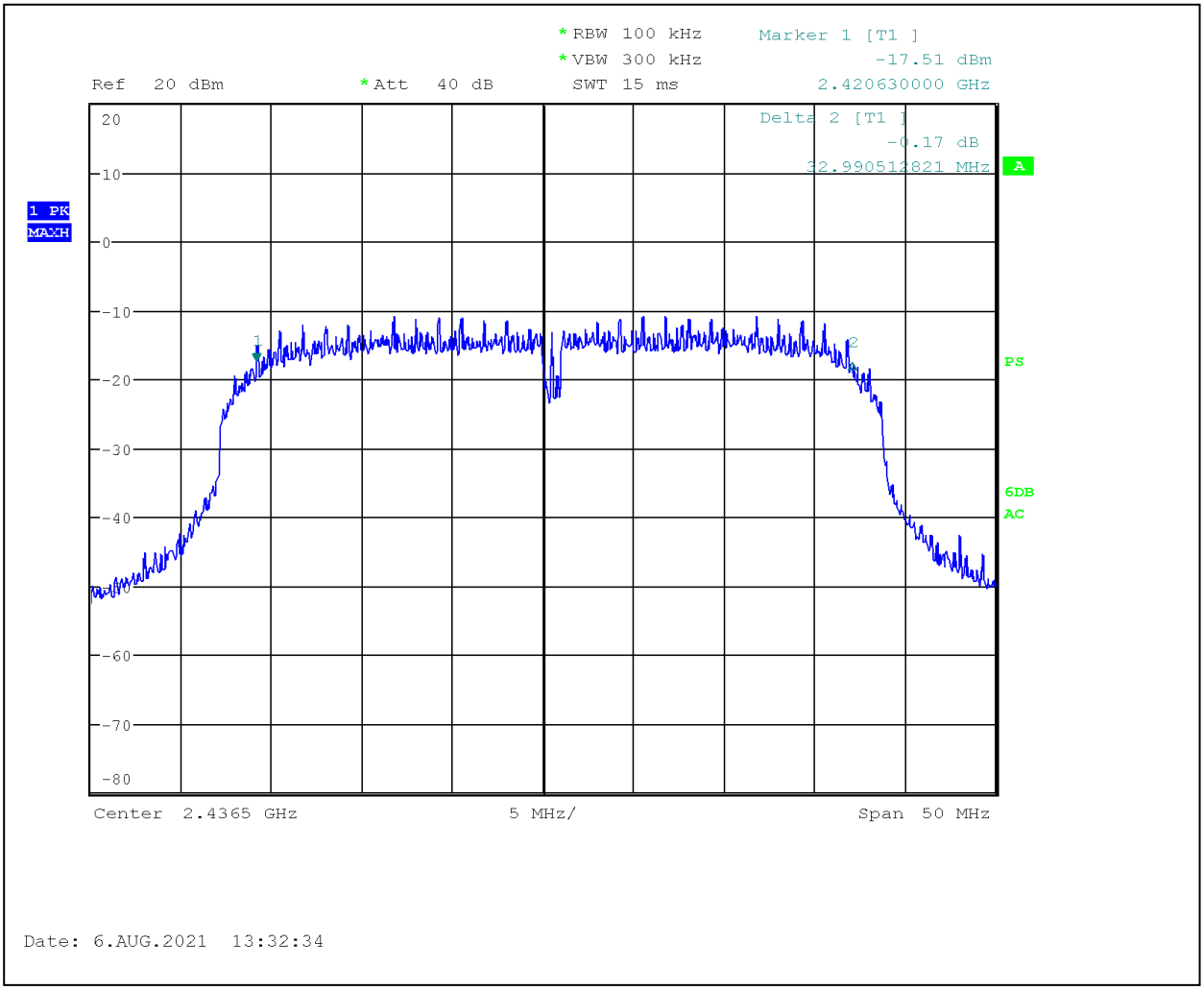
Graph 3.1.11


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
-4.38 dBm
2.453483333 GHz
Delta 2 [T1]
0.03 dB
16.873076923 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.46175 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:23:36

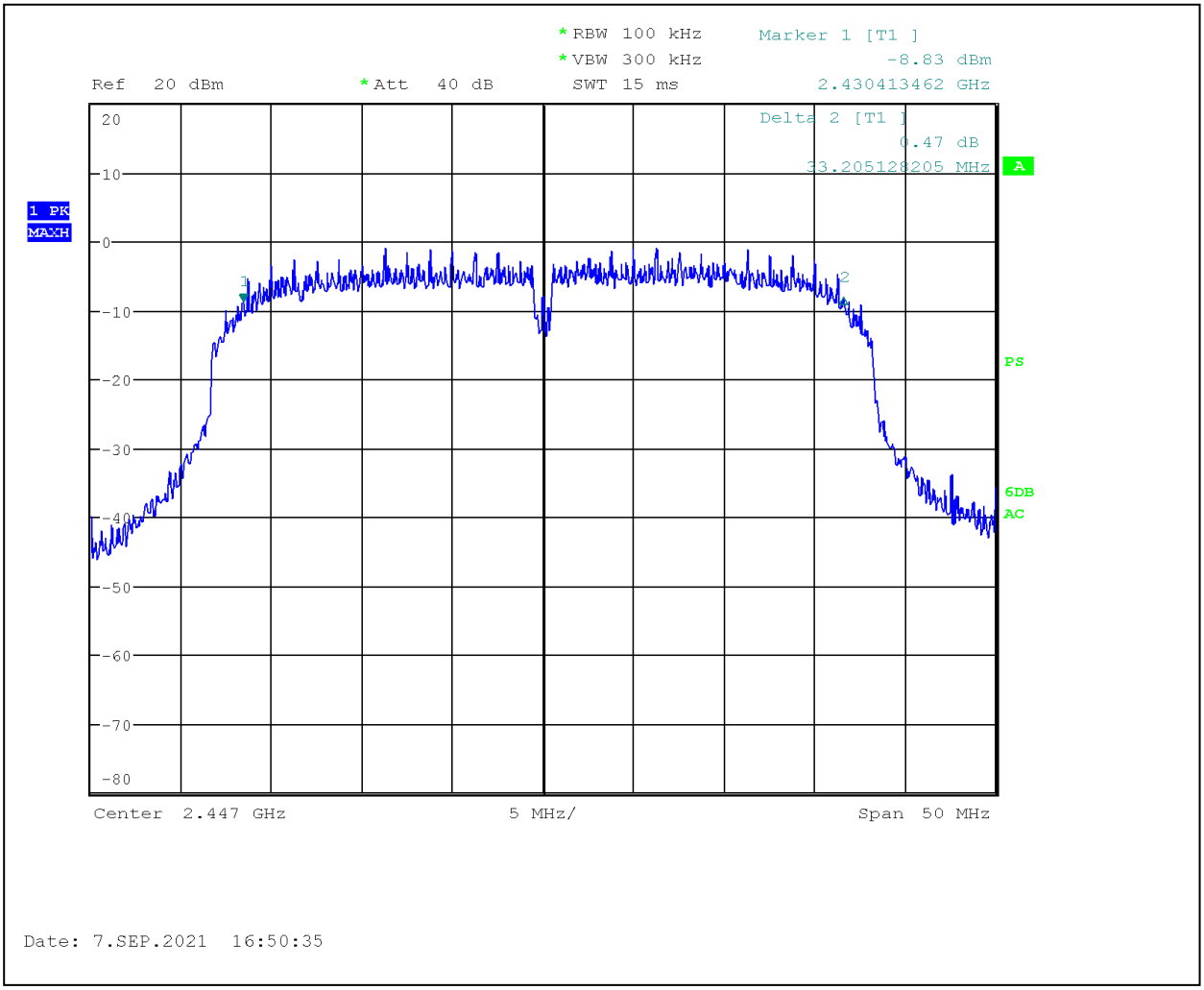
Graph 3.1.12


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 15 ms
Marker 1 [T1]
-15.63 dBm
2.406006410 GHz
Delta 2 [T1]
0.17 dB
32.323717949 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.422 GHz
5 MHz/
Span 50 MHz
Date: 6.AUG.2021 13:28:49

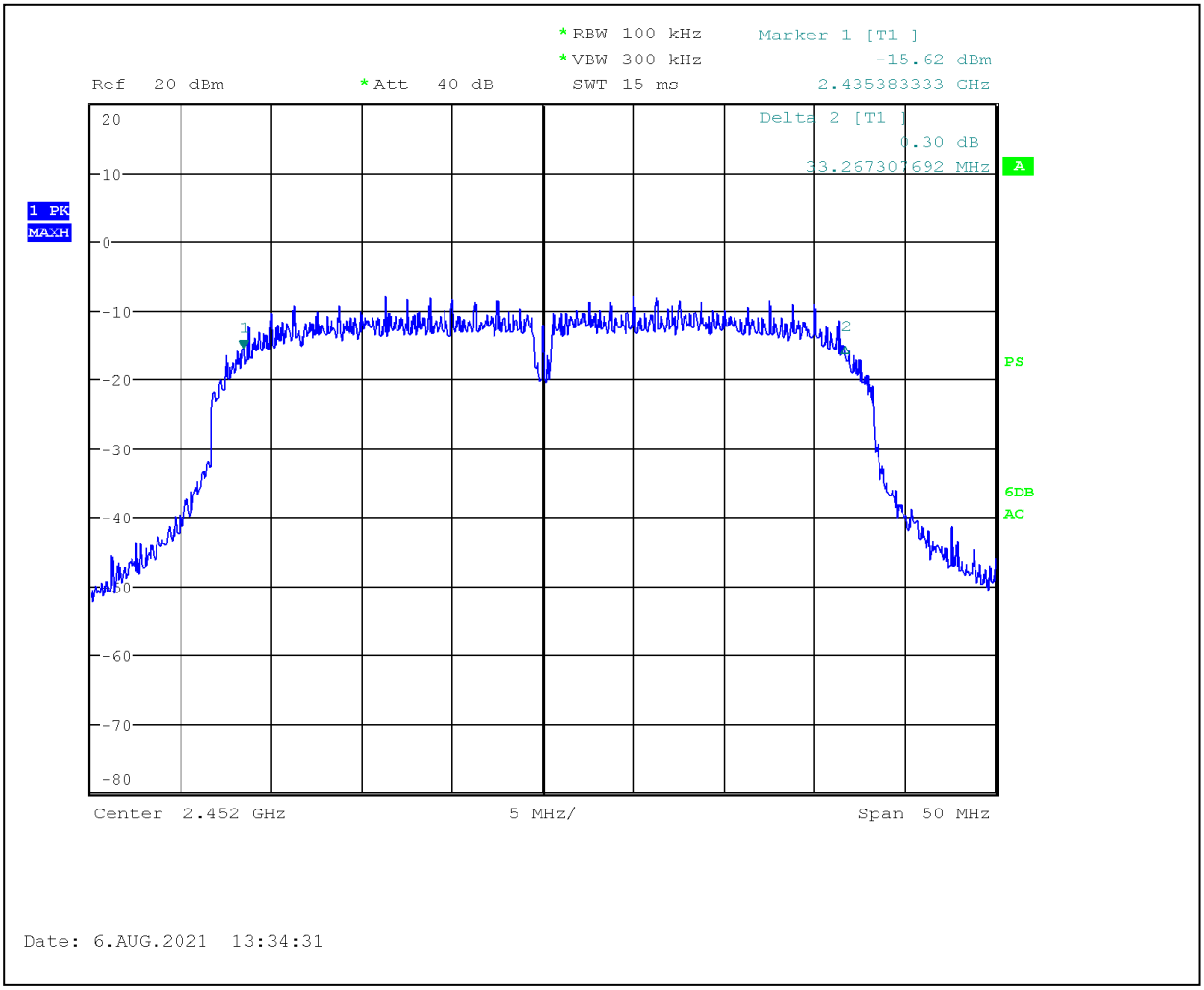
Graph 3.1.13


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 15 ms
Marker 1 [T1]
-17.51 dBm
2.420630000 GHz
Delta 2 [T1]
-0.17 dB
32.990513821 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.4365 GHz
5 MHz/
Span 50 MHz
Date: 6.AUG.2021 13:32:34

Graph 3.1.14


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 15 ms
Marker 1 [T1]
-8.83 dBm
2.430413462 GHz
Delta 2 [T1]
0.47 dB
33.205128205 MHz
A
1 PK
MAXH
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.447 GHz
5 MHz/
Span 50 MHz
Date: 7.SEP.2021 16:50:35

Graph 3.1.15


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 15 ms
Marker 1 [T1]
-15.62 dBm
2.435383333 GHz
Delta 2 [T1]
0.30 dB
33.267307692 MHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.452 GHz
5 MHz/
Span 50 MHz
Date: 6.AUG.2021 13:34:31

Graph 3.1.16

3.2 Occupied bandwidth (OBW) (99%)

802.11b

Low Frequency Channel (1) MHz	Middle Frequency Channel (6) MHz	Upper Frequency Channel (11) MHz	Result
13.125	13.025	13.05	**Pass**

802.11g

Low Frequency Channel (1) MHz	Middle Frequency Channel (6) MHz	Next In Upper Frequency Channel (10) MHz	Upper Frequency Channel (11) MHz	Result
16.45	16.45	16.45	16.45	**Pass**

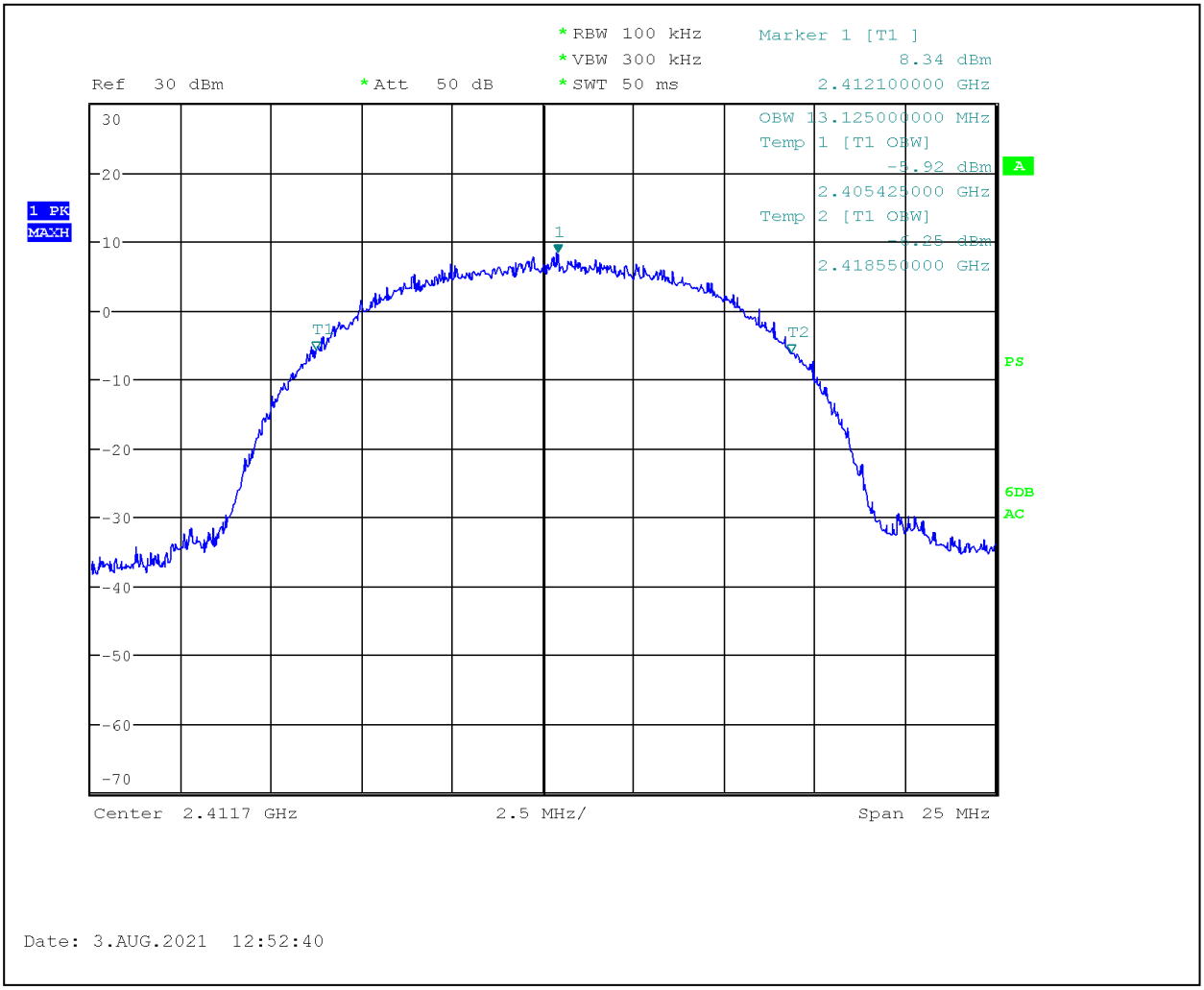
802.11n-20

Low Frequency Channel (1) MHz	Next In Low Frequency Channel (2) MHz	Middle Frequency Channel (6) MHz	Next In Upper Frequency Channel (10) MHz	Upper Frequency Channel (11) MHz	Result
17.40	17.35	17.40	17.38	17.35	**Pass**

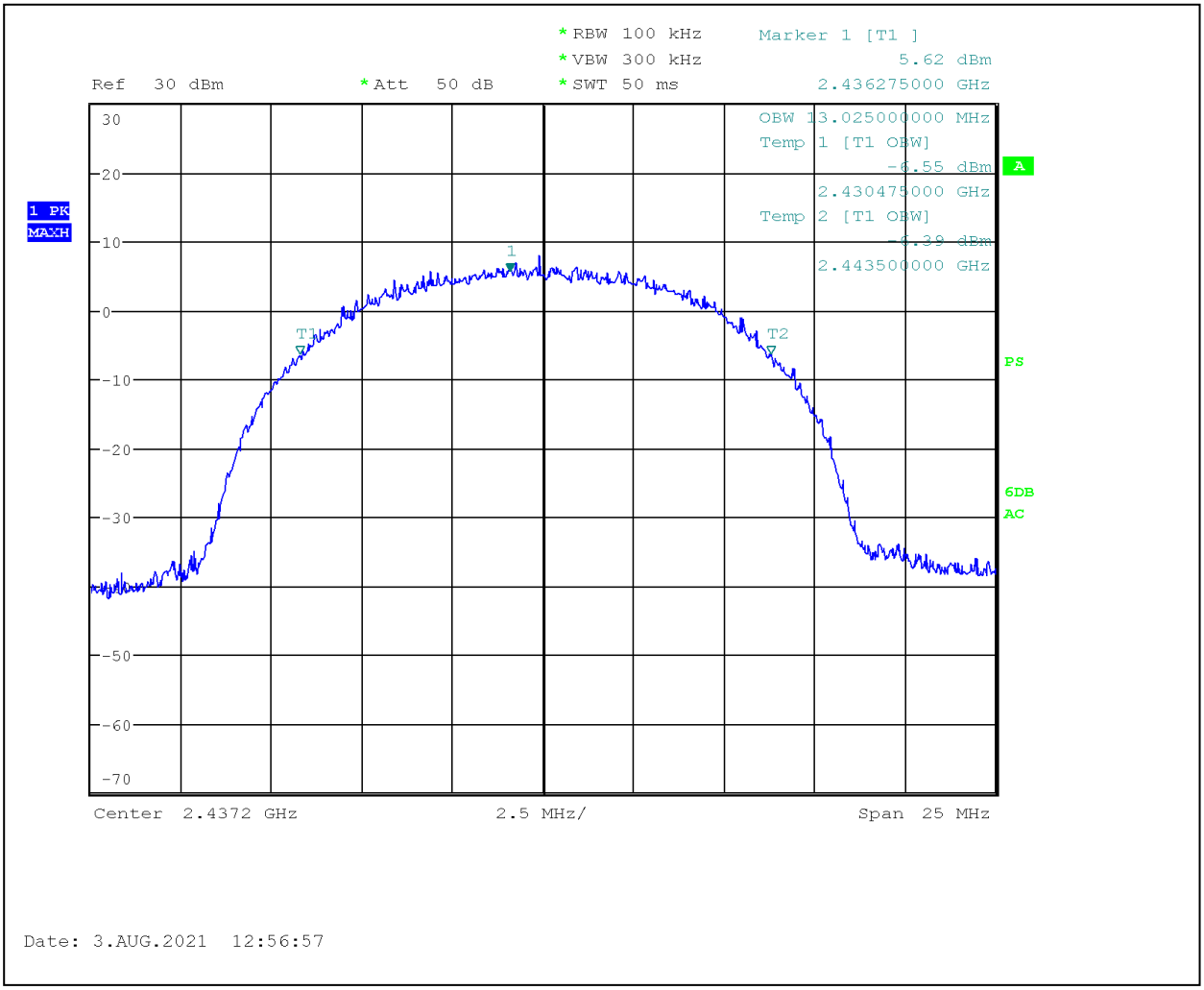
802.11n-40

Low Frequency Channel (3) MHz	Middle Frequency Channel (6) MHz	Next In Upper Frequency Channel (9) MHz	Upper Frequency Channel (9) MHz	Result
34.77	34.72	34.77	34.72	**Pass**

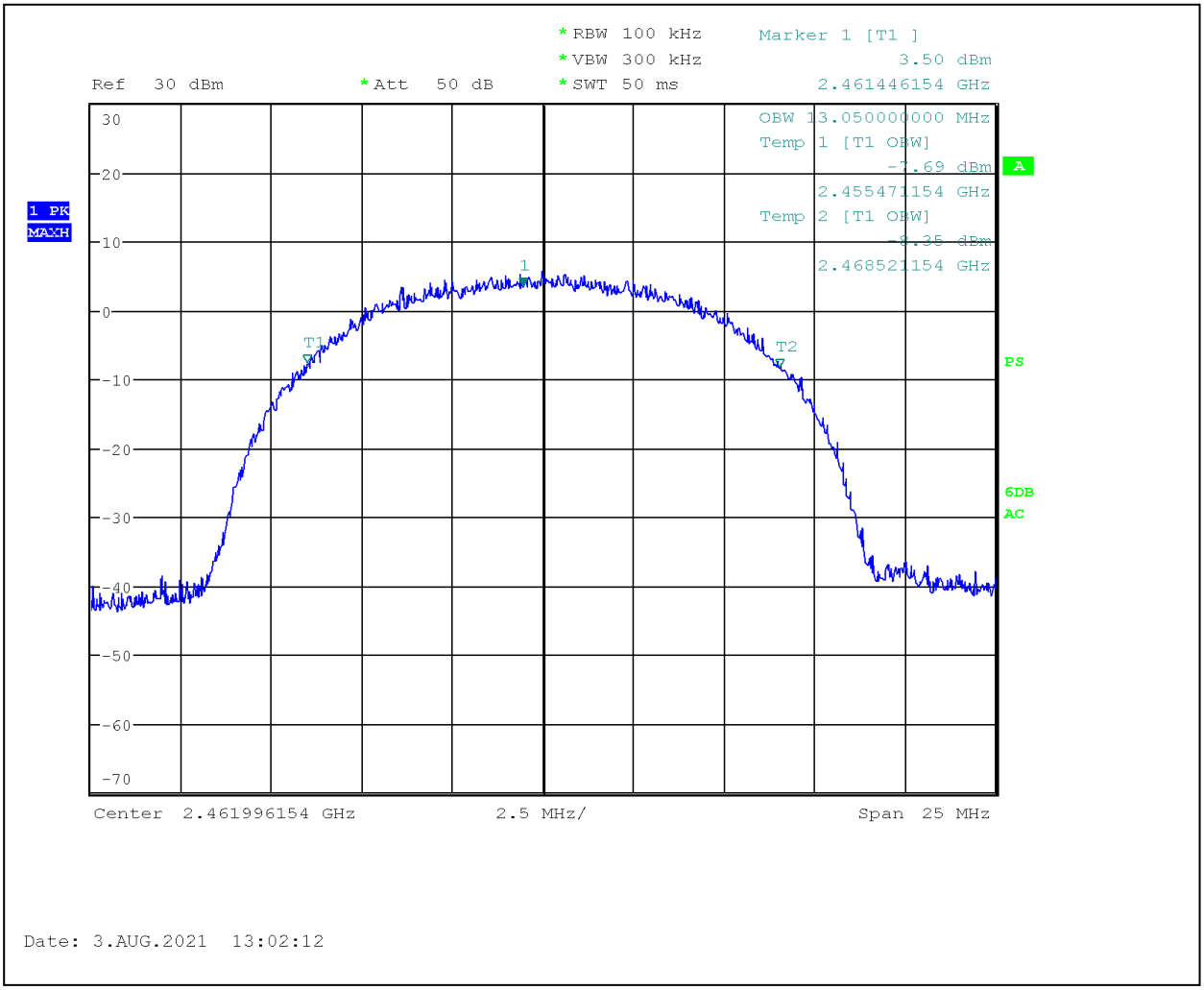
Notes: Graphs 3.2.1 – 3.2.3 show 802.11b
Graphs 3.2.4 – 3.2.7 show 802.11g
Graphs 3.2.8 – 3.2.12 show 802.11n20
Graphs 3.2.13 – 3.2.16 show 802.11n40


* RBW 100 kHz
* VBW 300 kHz
* SWT 50 ms
Marker 1 [T1]
8.34 dBm
2.412100000 GHz
Ref 30 dBm
* Att 50 dB
OBW 13.125000000 MHz
Temp 1 [T1 OBW]
-5.92 dBm
2.405425000 GHz
Temp 2 [T1 OBW]
-6.25 dBm
2.418550000 GHz
1 PK
MAXH
A
PS
6DB
AC
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.4117 GHz
2.5 MHz/
Span 25 MHz
Date: 3.AUG.2021 12:52:40

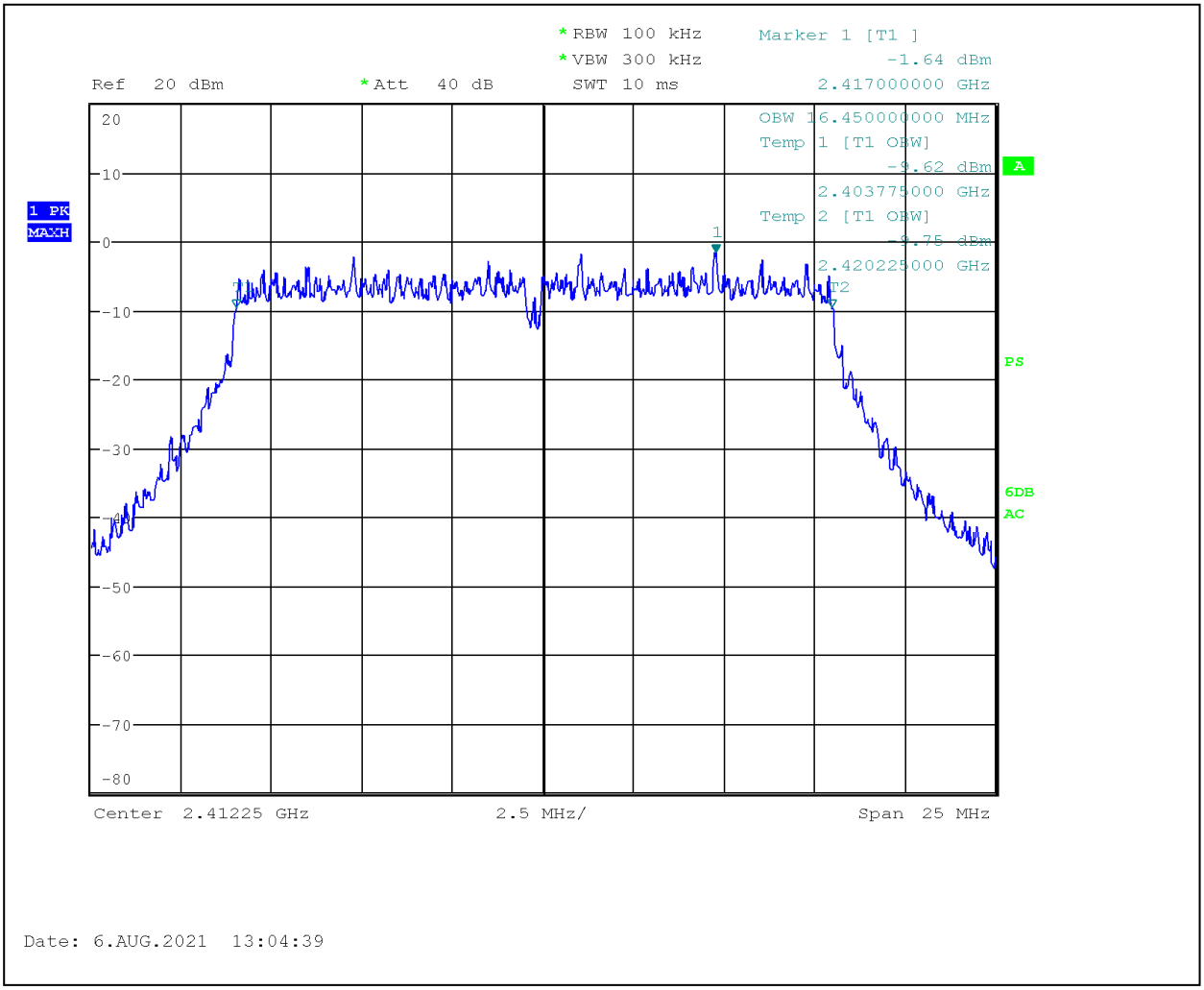
Graph 3.2.1


* RBW 100 kHz
* VBW 300 kHz
* SWT 50 ms
Marker 1 [T1]
5.62 dBm
2.436275000 GHz
Ref 30 dBm
* Att 50 dB
OBW 13.025000000 MHz
Temp 1 [T1 OBW]
-6.55 dBm
2.430475000 GHz
Temp 2 [T1 OBW]
-6.39 dBm
2.443500000 GHz
1 PK
MAXH
A
PS
6DB
AC
T1
T2
30
20
10
0
-10
-20
-30
-50
-60
-70
Center 2.4372 GHz
2.5 MHz/
Span 25 MHz
Date: 3.AUG.2021 12:56:57

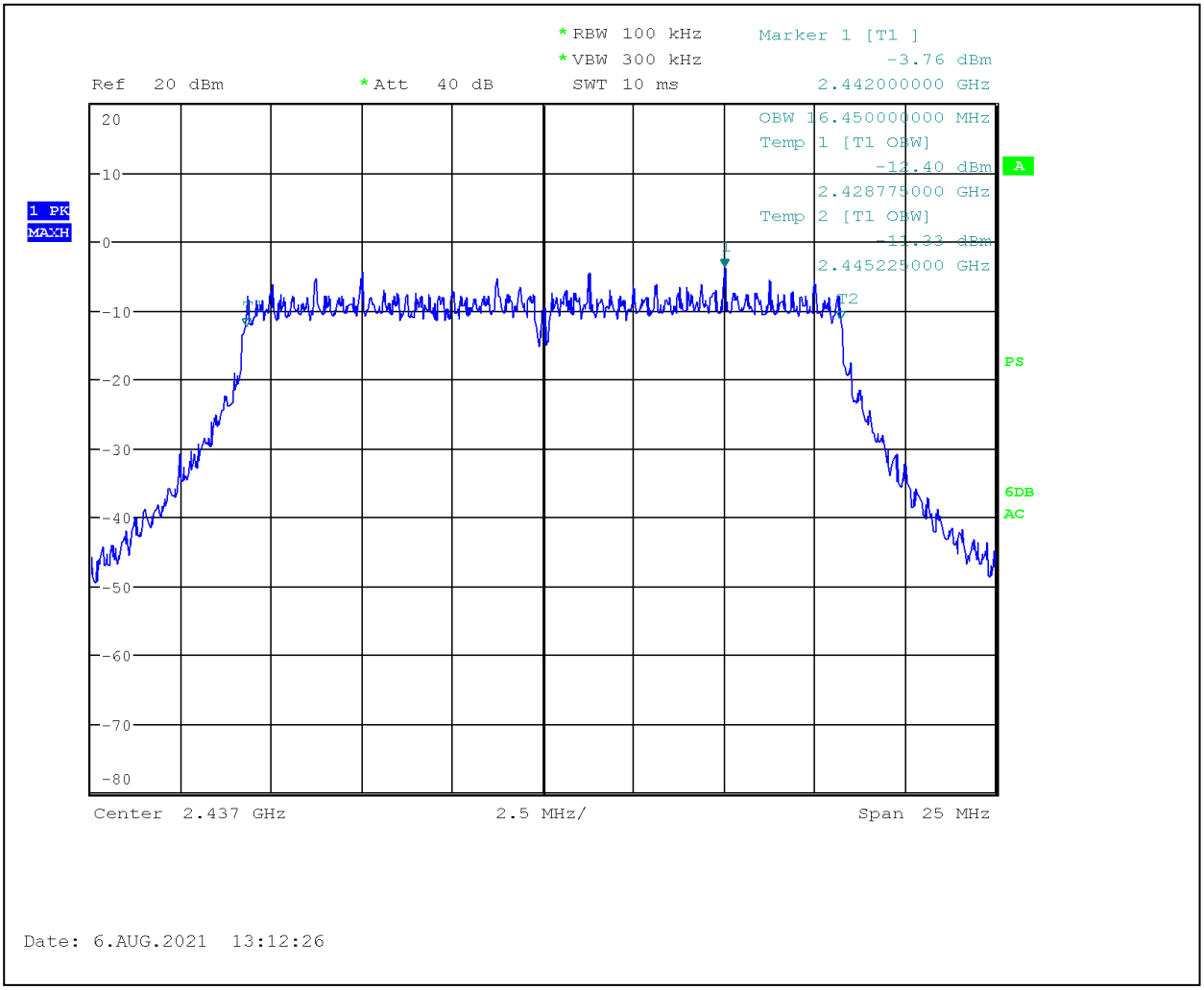
Graph 3.2.2


* RBW 100 kHz
* VBW 300 kHz
* SWT 50 ms
Marker 1 [T1]
3.50 dBm
2.461446154 GHz
Ref 30 dBm
* Att 50 dB
OBW 13.050000000 MHz
Temp 1 [T1 OBW]
-7.69 dBm
2.455471154 GHz
Temp 2 [T1 OBW]
-8.35 dBm
2.468521154 GHz
1 PK
MAXH
A
PS
6DB
AC
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
T1
T2
Center 2.461996154 GHz
2.5 MHz/
Span 25 MHz
Date: 3.AUG.2021 13:02:12

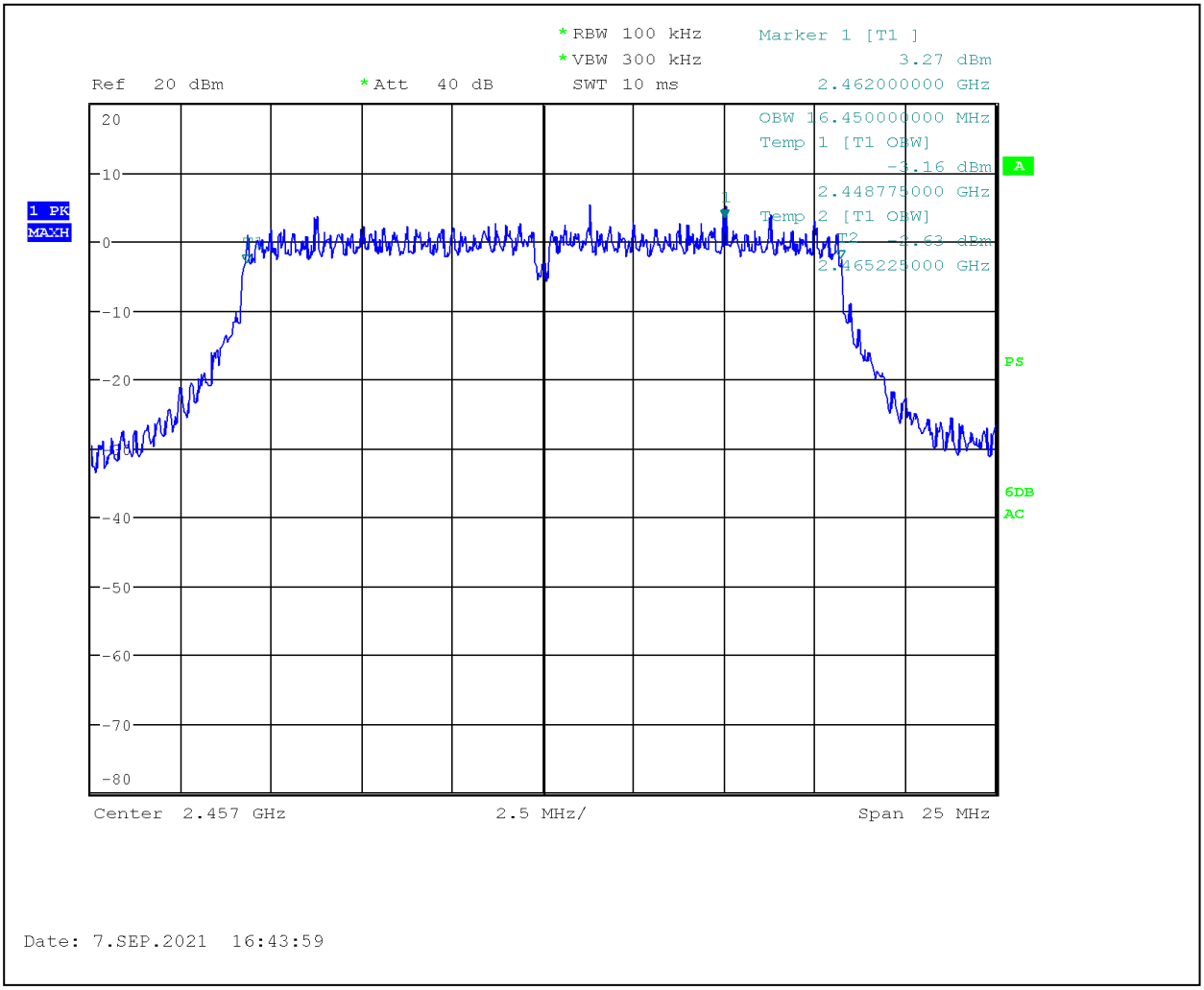
Graph 3.2.3


* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
-1.64 dBm
2.417000000 GHz
OBW 16.450000000 MHz
Temp 1 [T1 OBW]
-9.62 dBm
2.403775000 GHz
Temp 2 [T1 OBW]
-9.75 dBm
2.420225000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.41225 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:04:39

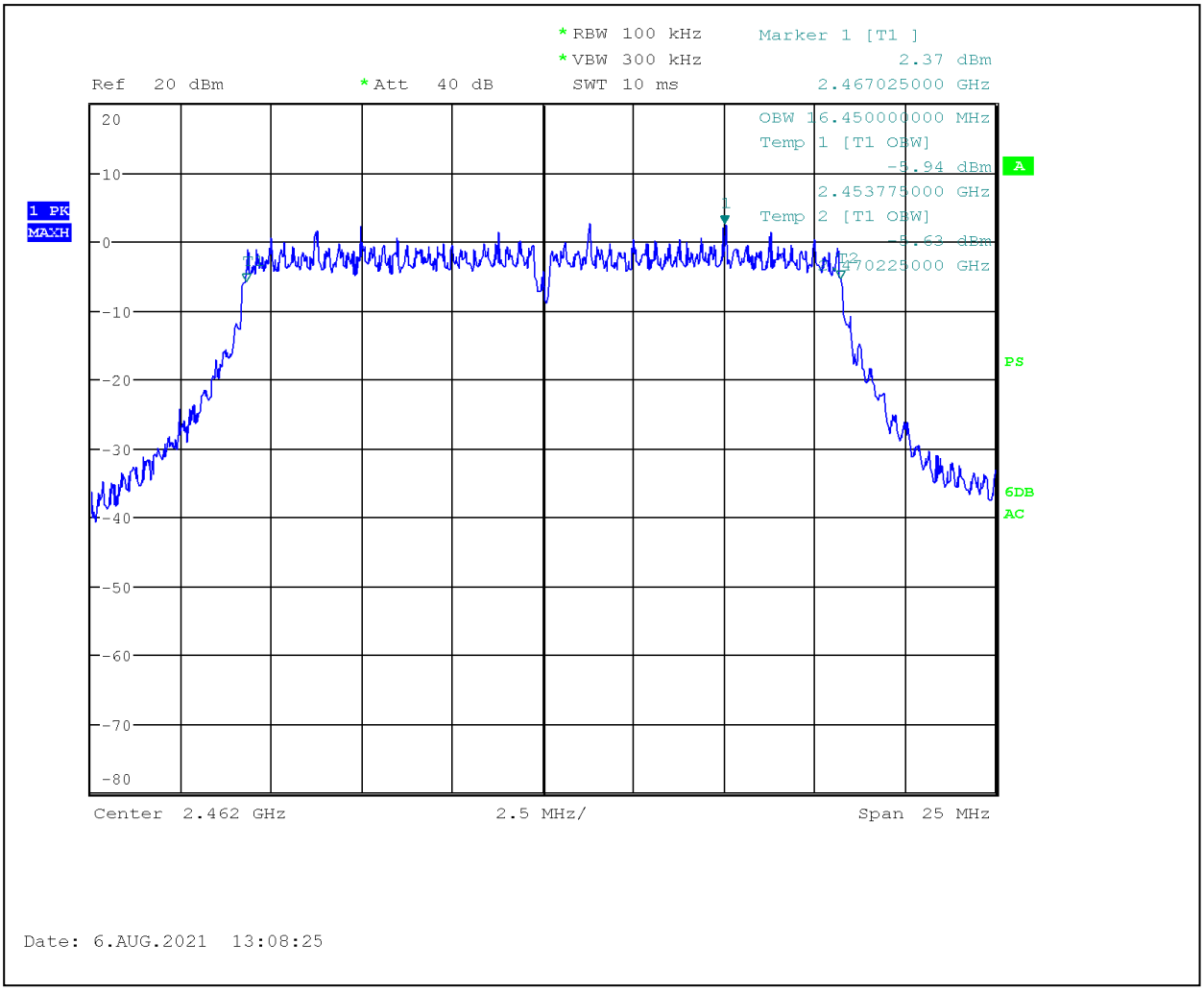
Graph 3.2.4


* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
-3.76 dBm
2.442000000 GHz
OBW 16.450000000 MHz
Temp 1 [T1 OBW]
-12.40 dBm
2.428775000 GHz
Temp 2 [T1 OBW]
-11.33 dBm
2.445225000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.437 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:12:26

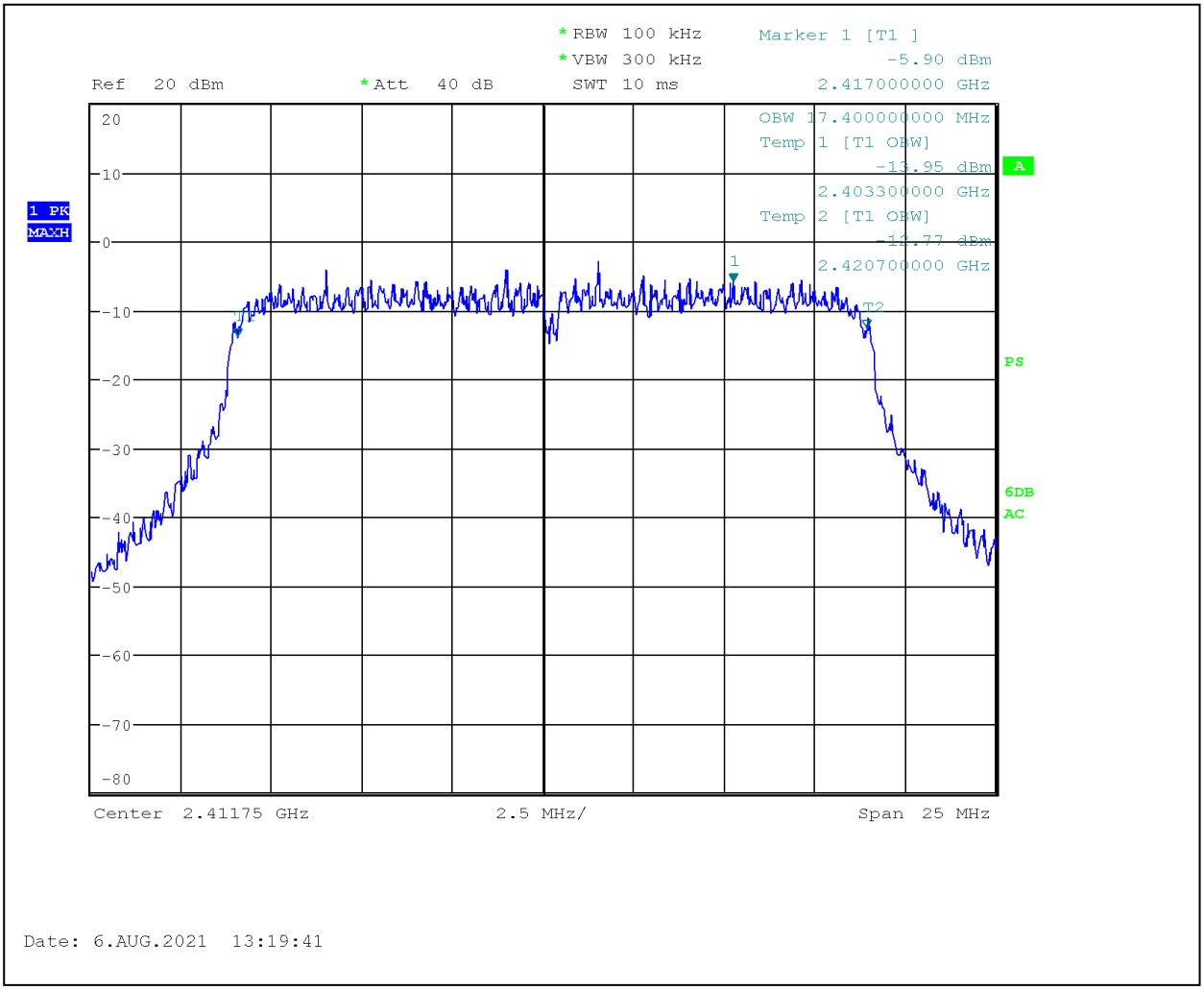
Graph 3.2.5


* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
3.27 dBm
2.462000000 GHz
OBW 16.450000000 MHz
Temp 1 [T1 OBW]
-3.16 dBm
2.448775000 GHz
Temp 2 [T1 OBW]
-2.63 dBm
2.465225000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-40
-50
-60
-70
-80
Center 2.457 GHz
2.5 MHz/
Span 25 MHz
Date: 7.SEP.2021 16:43:59

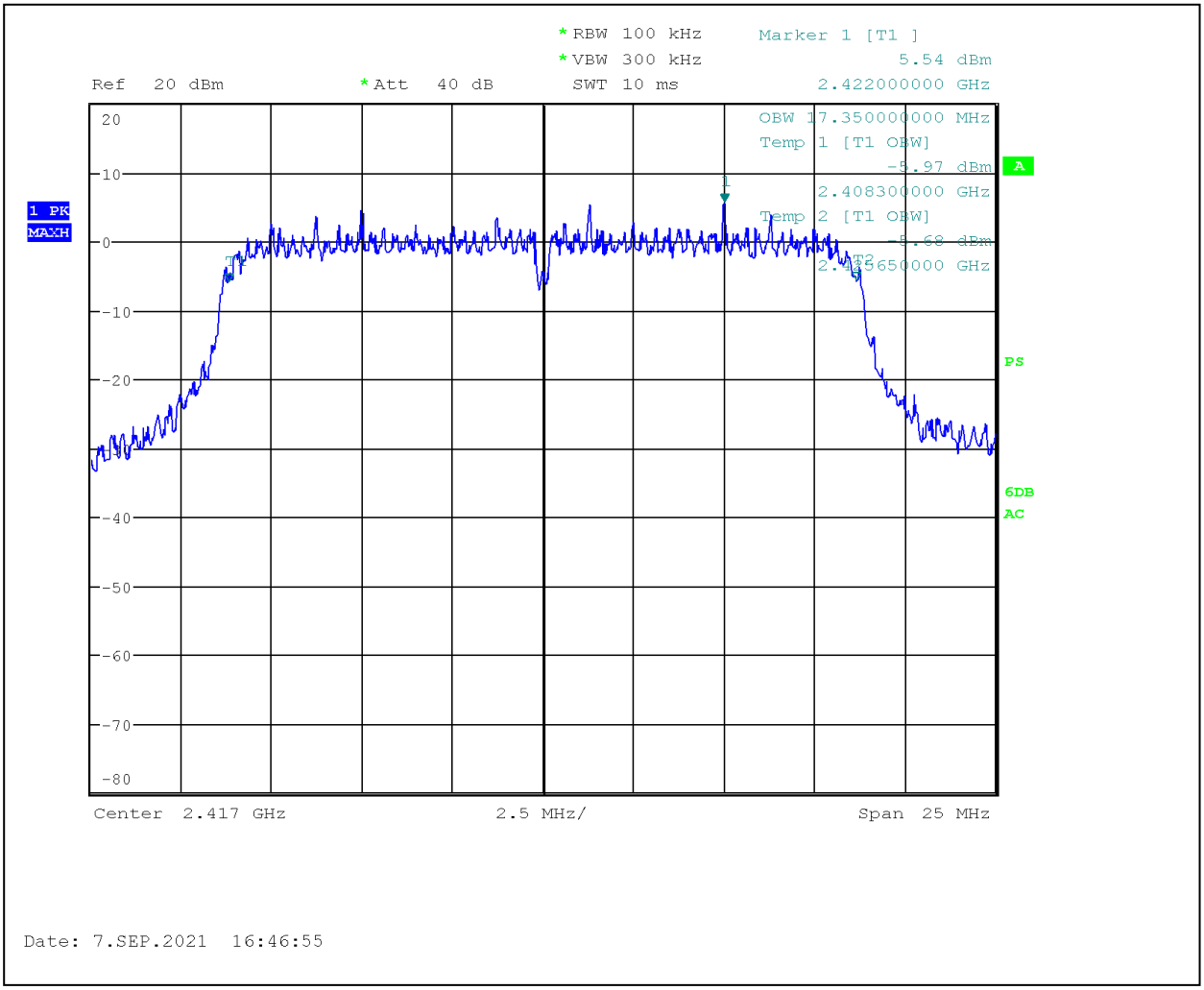
Graph 3.2.6


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
2.37 dBm
2.467025000 GHz
OBW 16.450000000 MHz
Temp 1 [T1 OBW]
-5.94 dBm
2.453775000 GHz
Temp 2 [T1 OBW]
-5.63 dBm
2.470225000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
-10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.462 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:08:25

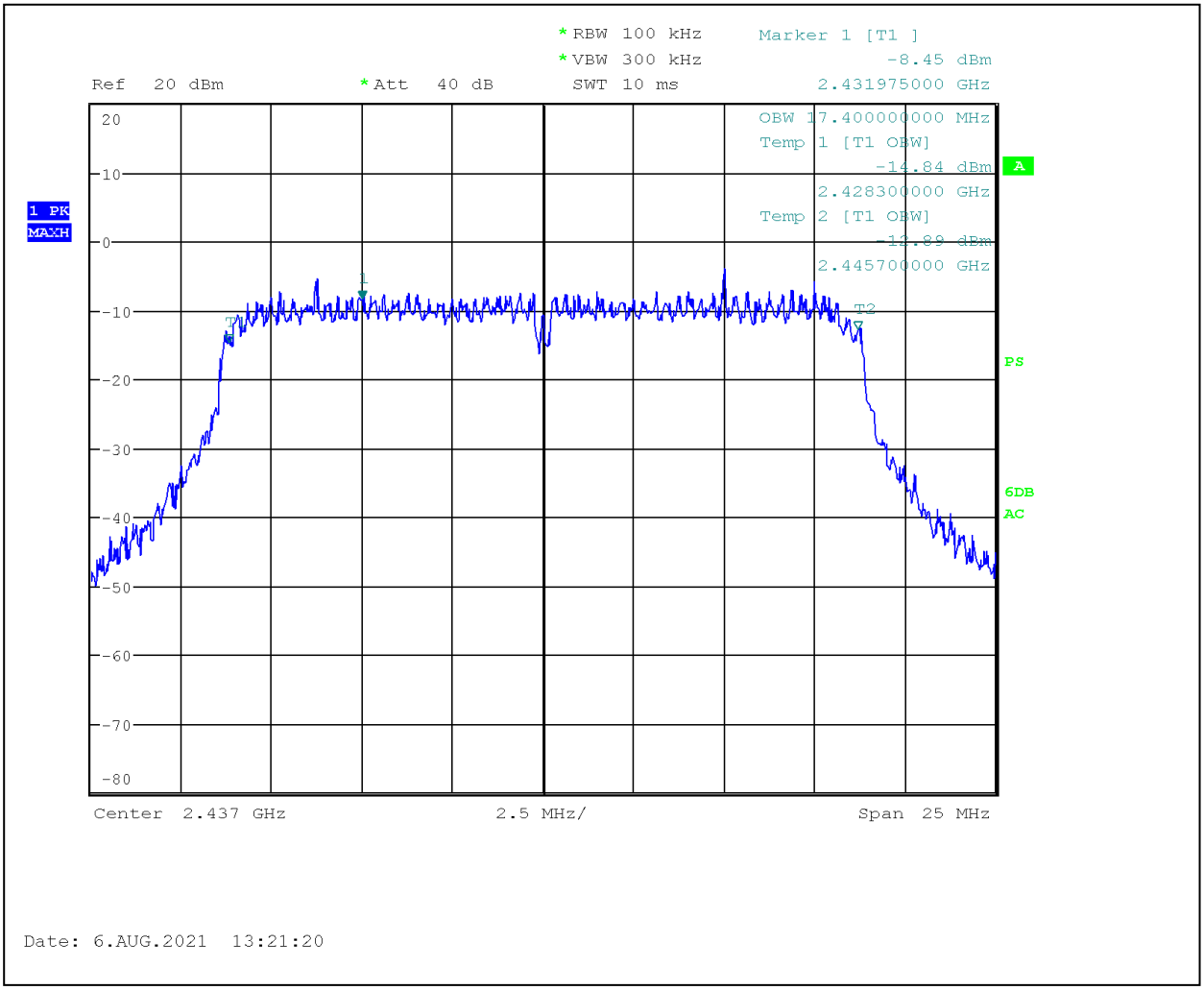
Graph 3.2.7


* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
-5.90 dBm
2.417000000 GHz
OBW 17.400000000 MHz
Temp 1 [T1 OBW]
-13.95 dBm
2.403300000 GHz
Temp 2 [T1 OBW]
-12.77 dBm
2.420700000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.41175 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:19:41

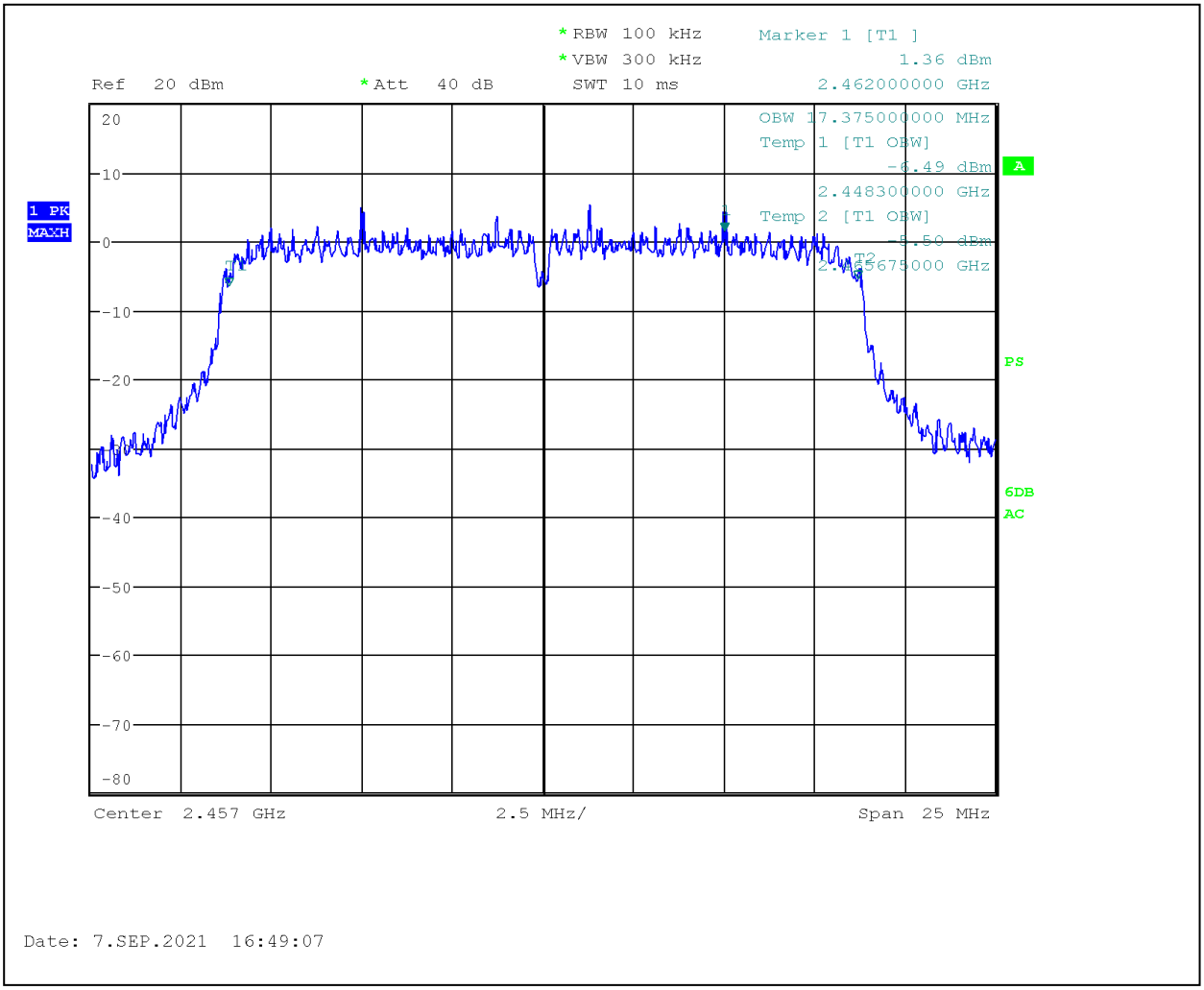
Graph 3.2.8


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
5.54 dBm
2.422000000 GHz
OBW 17.350000000 MHz
Temp 1 [T1 OBW]
-5.97 dBm
2.408300000 GHz
Temp 2 [T1 OBW]
-5.68 dBm
2.425650000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-40
-50
-60
-70
-80
Center 2.417 GHz
2.5 MHz/
Span 25 MHz
Date: 7.SEP.2021 16:46:55

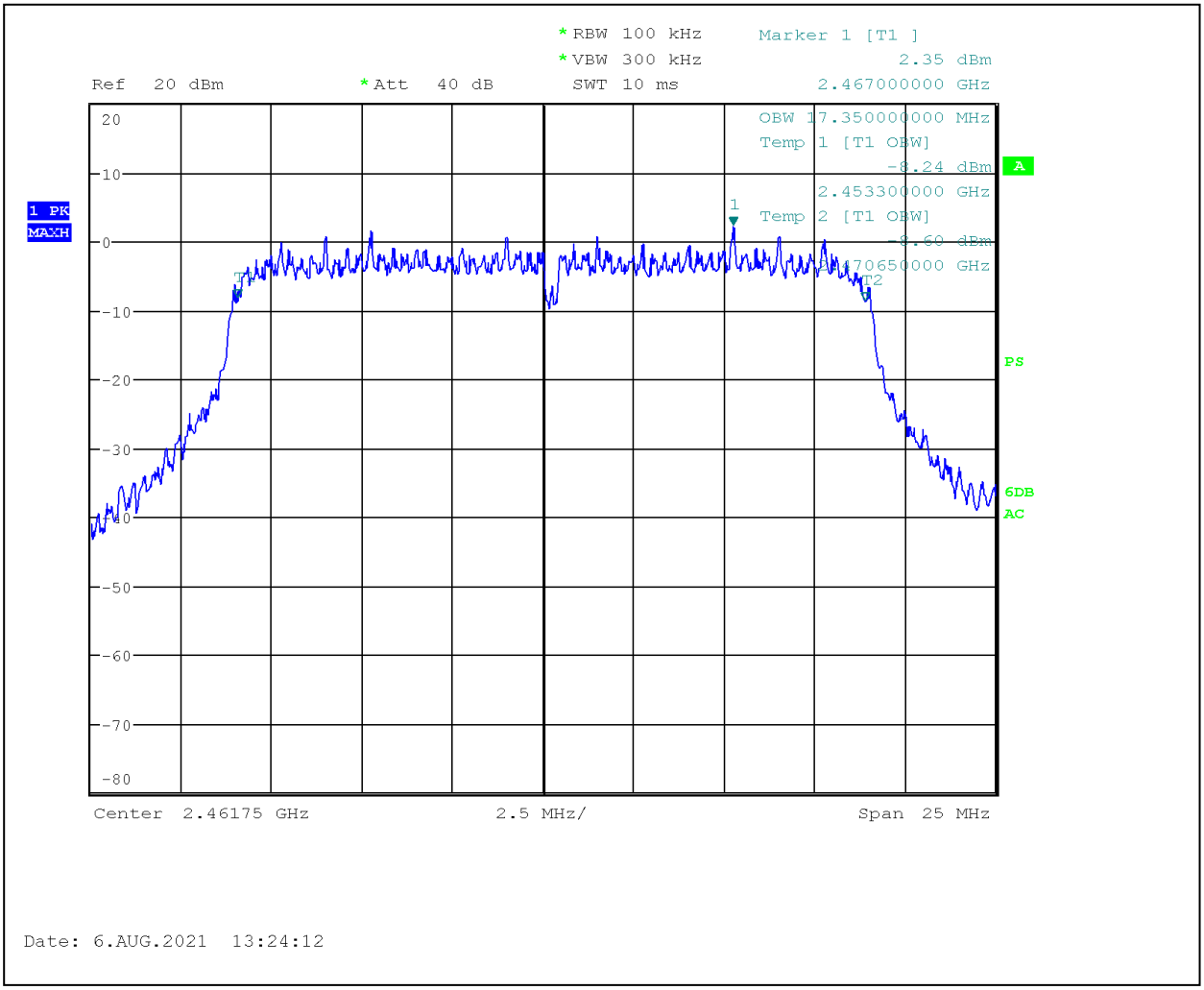
Graph 3.2.9


* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
-8.45 dBm
2.431975000 GHz
OBW 17.400000000 MHz
Temp 1 [T1 OBW]
-14.84 dBm
2.428300000 GHz
Temp 2 [T1 OBW]
-12.89 dBm
2.445700000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.437 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:21:20

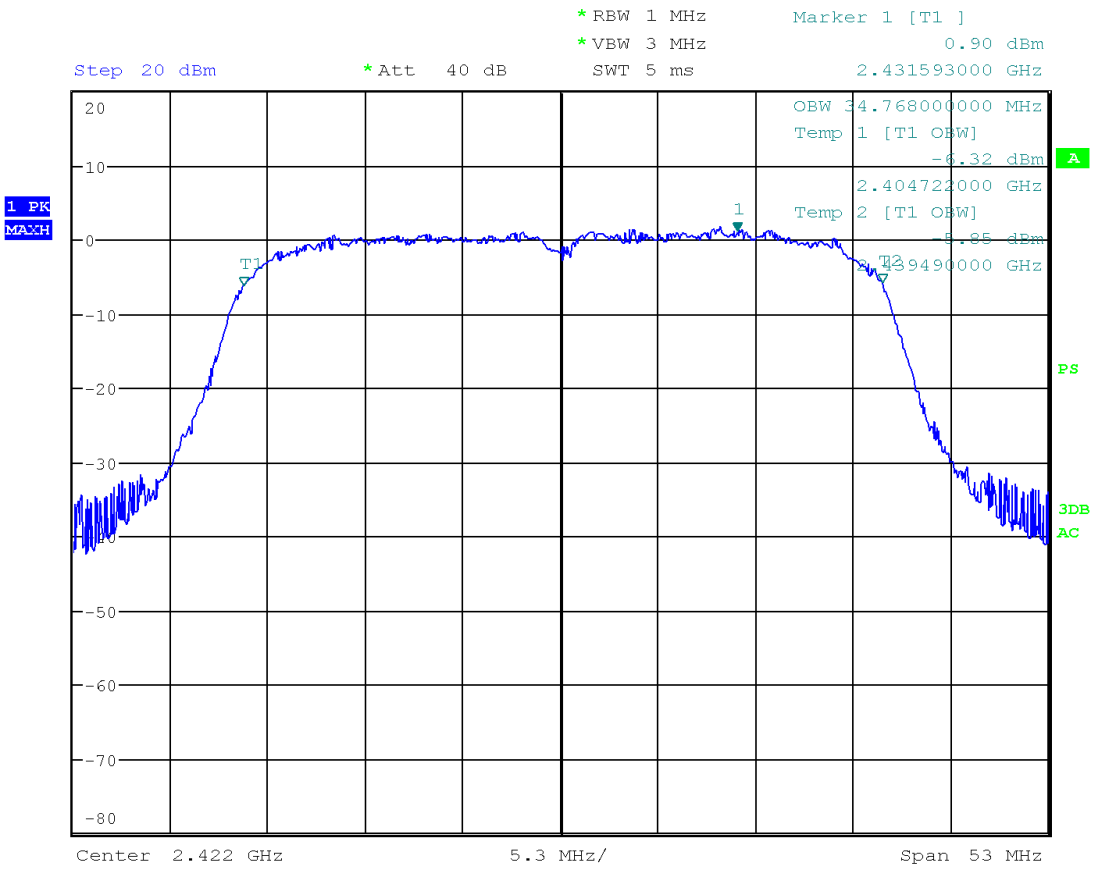
Graph 3.2.10


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 10 ms
Marker 1 [T1]
1.36 dBm
2.462000000 GHz
OBW 17.375000000 MHz
Temp 1 [T1 OBW]
-6.49 dBm
2.448300000 GHz
Temp 2 [T1 OBW]
-5.50 dBm
2.465675000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-40
-50
-60
-70
-80
Center 2.457 GHz
2.5 MHz/
Span 25 MHz
Date: 7.SEP.2021 16:49:07

Graph 3.2.11

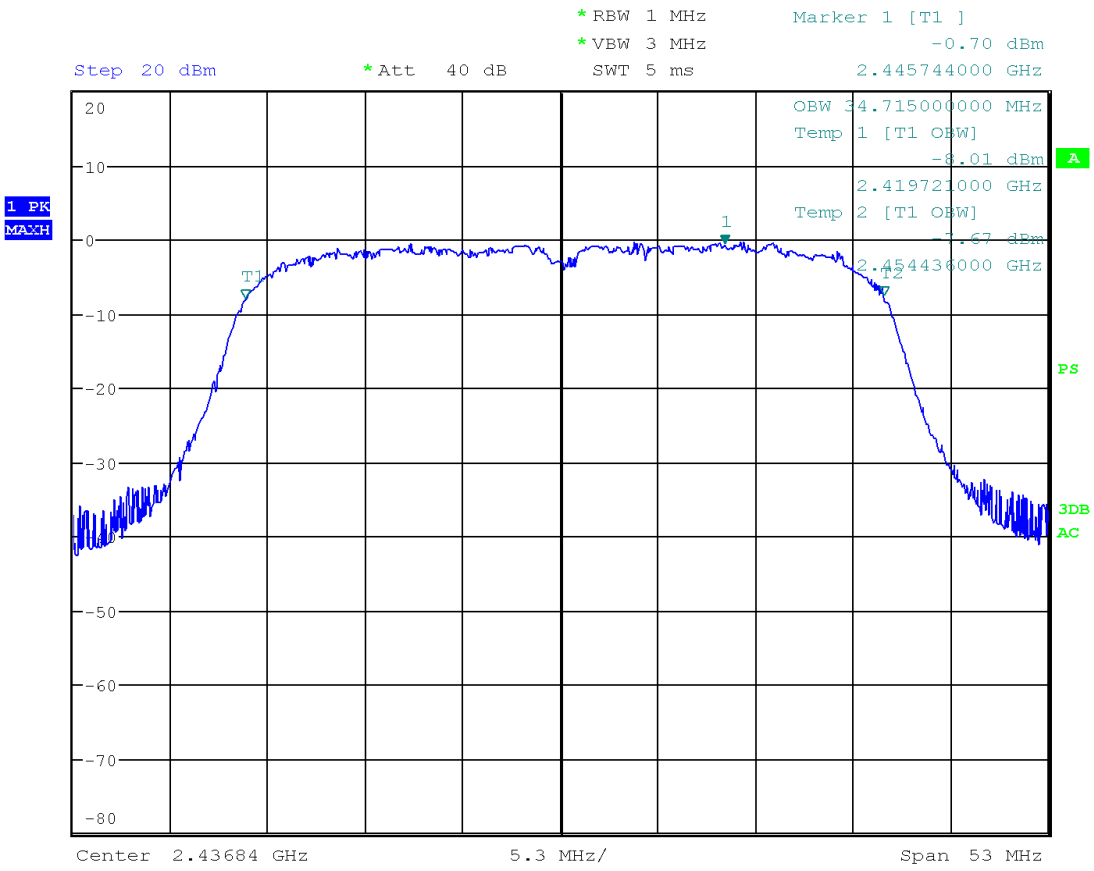

* RBW 100 kHz
* VBW 300 kHz
Ref 20 dBm
* Att 40 dB
SWT 10 ms
Marker 1 [T1]
2.35 dBm
2.467000000 GHz
OBW 17.350000000 MHz
Temp 1 [T1 OBW]
-8.24 dBm
2.453300000 GHz
Temp 2 [T1 OBW]
-8.60 dBm
2.470650000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.46175 GHz
2.5 MHz/
Span 25 MHz
Date: 6.AUG.2021 13:24:12

Graph 3.2.12



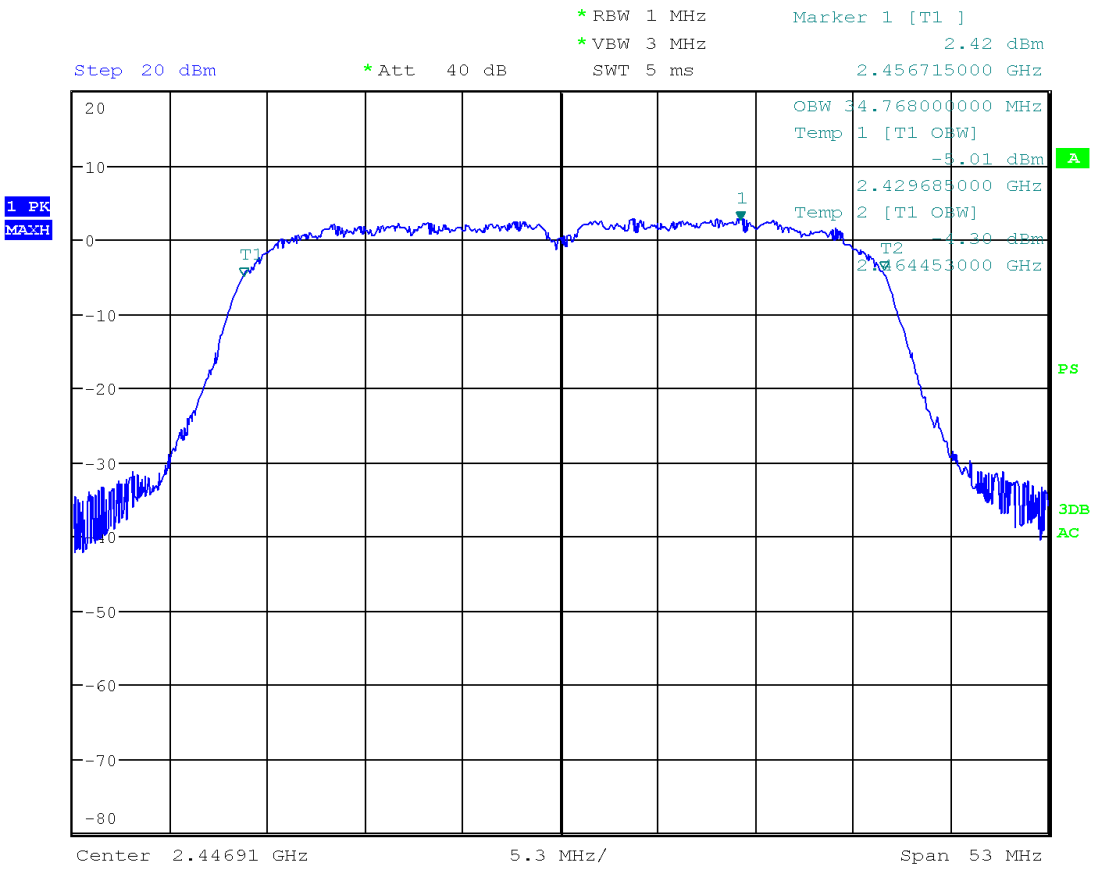
Date: 21.SEP.2021 17:11:59

Graph 3.2.13

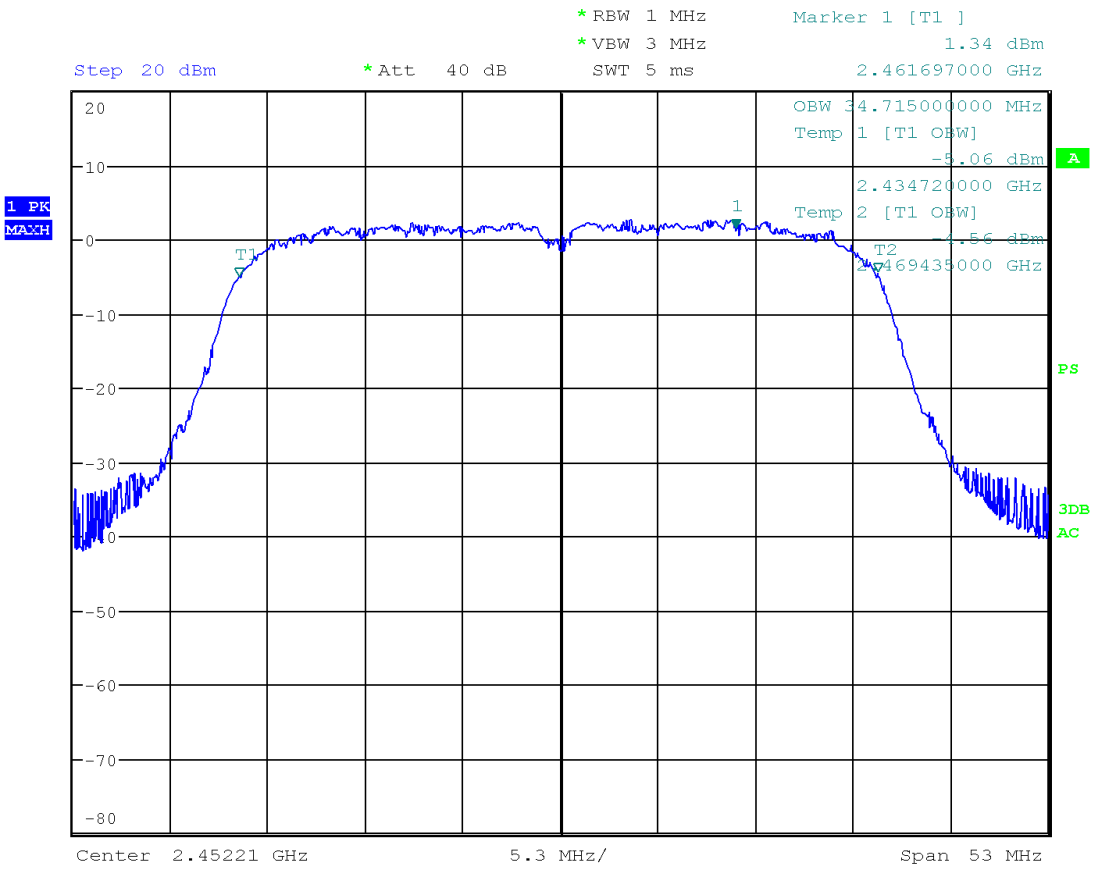


Date: 21.SEP.2021 17:11:25

Graph 3.2.14


* RBW 1 MHz
* VBW 3 MHz
Step 20 dBm
* Att 40 dB
SWT 5 ms
Marker 1 [T1]
2.42 dBm
2.456715000 GHz
OBW 34.768000000 MHz
Temp 1 [T1 OBW]
-5.01 dBm
2.429685000 GHz
Temp 2 [T1 OBW]
-4.30 dBm
2.464453000 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.44691 GHz
5.3 MHz/
Span 53 MHz
Date: 21.SEP.2021 17:10:54

Graph 3.2.15



Date: 21.SEP.2021 17:10:21

Graph 3.2.16

3.3 Conducted Output Power

Test result: **Pass**

Maximum Power: 20.2dBm (105mW / 0.105W) Margin: 9.8dB below the limits

Note: Conducted Average Power was performed according to ANSI C63.10-2013 Section 11.9.2.2.3 Method AVGSA-1A.

802.11b

Power Output:	**Conducted**					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency MHz	**Measured power dBm**	**Attenuaton dB**	**Power at Antenna dBm**	**Limit dBm**	**Limit Reduction dB**	**Margin dB**
2412	18.5	1.5	20.0	30	0	-10.0
Middle Frequency MHz						
2437	18.7	1.5	20.2	30	0	-9.8
Upper Frequency MHz						
2462	17.6	1.5	19.1	30	0	-10.9
RBW:	☒ 300kHz ☐ 3MHz ☐ 10MHz					
VBW:	☒ 1MHz ☐ 3MHz ☐ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

802.11g

Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency Ch.1 MHz	**Measured power dBm**	**Attenuaton dB**	**Power at Antenna dBm**	**Limit dBm**	**Limit Reduction dB**	**Margin dB**
2412	17.1	1.5	18.6	30	0	-11.4
Middle Frequency Ch.6 MHz						
2437	17.3	1.5	18.8	30	0	-11.2
Next In Upper Frequency Ch.10 MHz						
2457	16.7	1.5	18.2	30	0	-11.8
Upper Frequency Ch.11 MHz						
2462	15.4	1.5	16.9	30	0	-13.1
RBW: **VBW:**	☒ 300kHz ☐ 3MHz ☐ 10MHz ☒ 1MHz ☐ 3MHz ☐ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

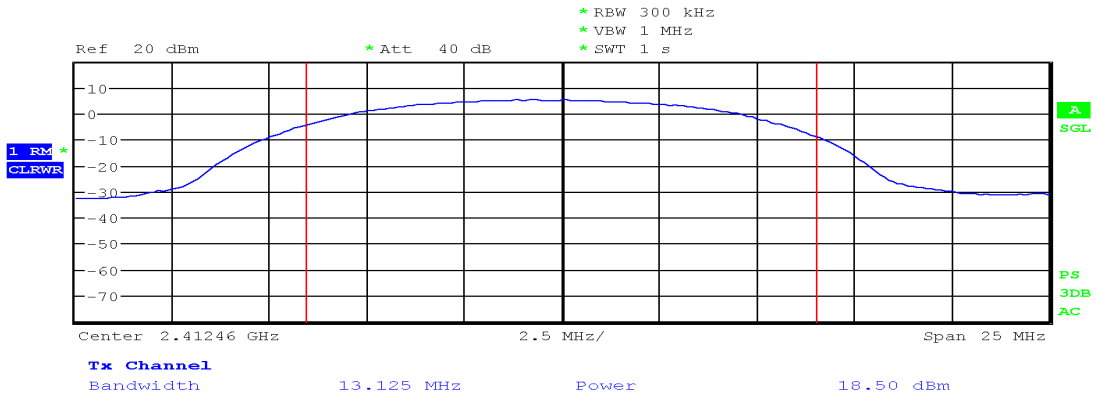
802.11n-20

Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency Ch.31MHz	**Measured power dBm**	**Attenuaton dB**	**Power at Antenna dBm**	**Limit dBm**	**Limit Reduction dB**	**Margin dB**
2412	16.5	1.5	18.0	30	0	-12.0
Next In Low Frequency Ch.2 MHz						
2417	17.2	1.5	18.7	30	0	-11.3
Middle Frequency Ch.6 MHz						
2437	17.0	1.5	18.5	30	0	-11.5
Next In Upper Frequency Ch.10 MHz						
2457	16.5	1.5	18.0	30	0	-12.0
Upper Frequency Ch.11 MHz						
2462	14.7	1.5	16.2	30	0	-13.8
RBW: **VBW:**	☒ 300kHz ☐ 3MHz ☐ 10MHz ☒ 1MHz ☐ 3MHz ☐ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

802.11n-40

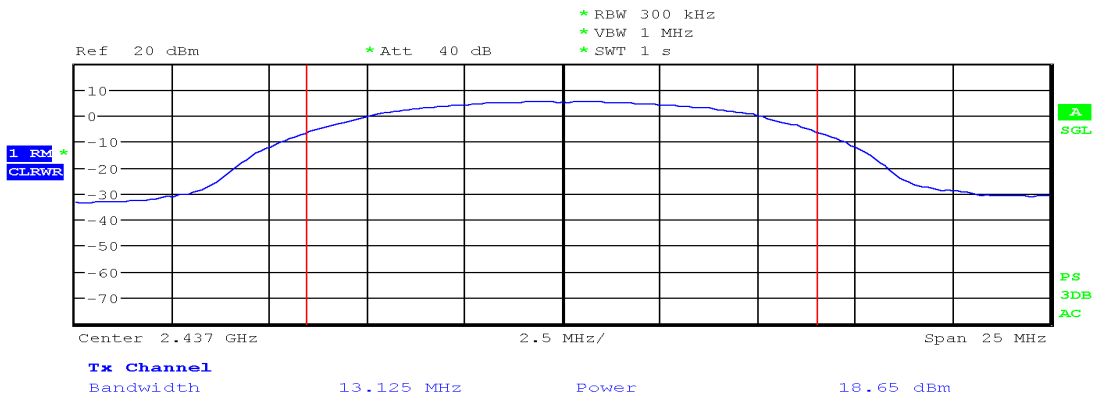
Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency Ch.3 MHz	**Measured power dBm**	**Attenuaton dB**	**Power at Antenna dBm**	**Limit dBm**	**Limit Reduction dB**	**Margin dB**
2422	14.7	1.5	16.2	30	0	-13.8
Middle Frequency Ch.6 MHz						
2437	14.6	1.5	16.1	30	0	-13.9
Next In Upper Frequency Ch.8 MHz						
2447	14.4	1.5	15.9	30	0	-14.1
Upper Frequency Ch.9 MHz						
2452	12.5	1.5	14.0	30	0	-16.0
RBW: **VBW:**	☒ 500kHz ☐ 3MHz ☐ 10MHz ☒ 2MHz ☐ 3MHz ☐ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

Notes: The maximum peak conducted output power limit is 1 W, or 30dBm
Graphs 3.3.1 - 3.3.3 show the conducted output power for 802.11b
Graphs 3.3.4 - 3.3.7 show the conducted output power for 802.11g
Graphs 3.3.8 - 3.3.12 show the conducted output power for 802.11n-20
Graphs 3.3.13 - 3.3.16 show the conducted output power for 802.11n-40



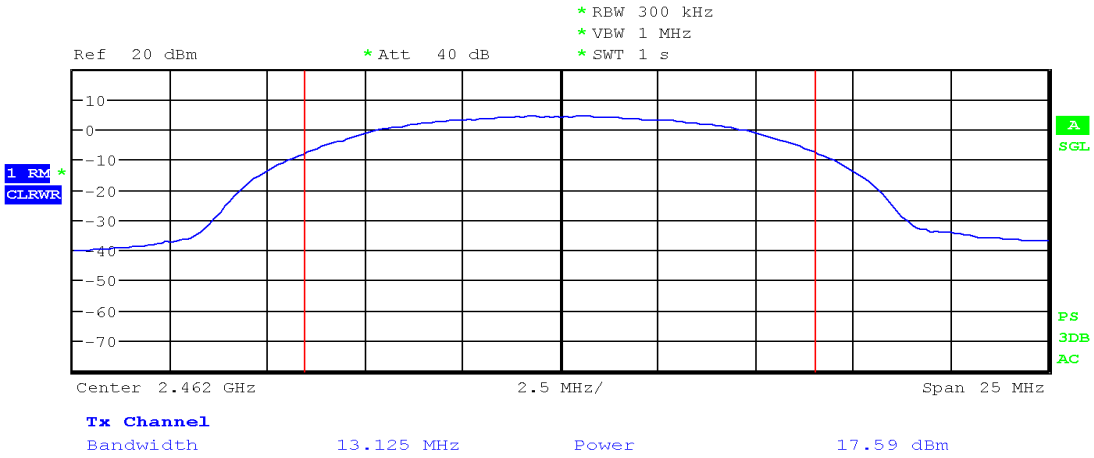
Date: 21.SEP.2021 18:08:22

Graph 3.3.1



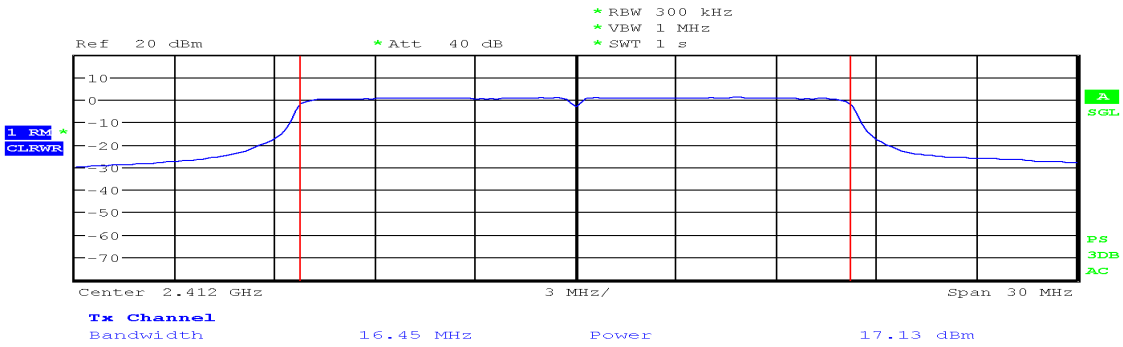
Date: 21.SEP.2021 18:09:51

Graph 3.3.2



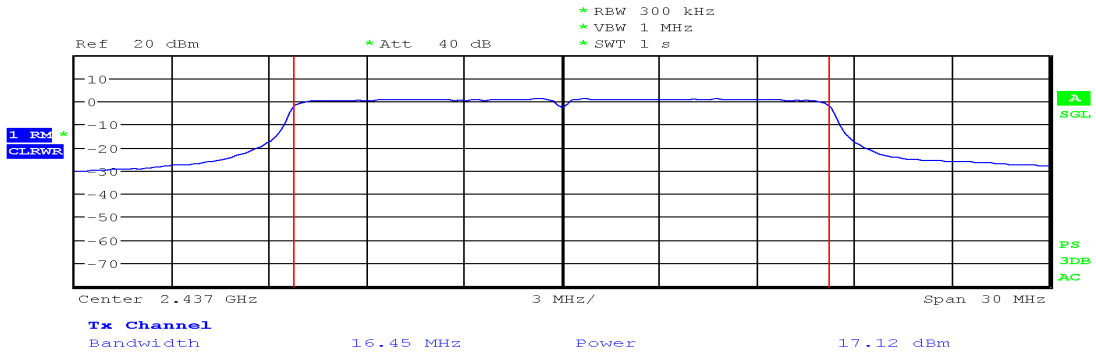
Date: 21.SEP.2021 18:10:24

Graph 3.3.3



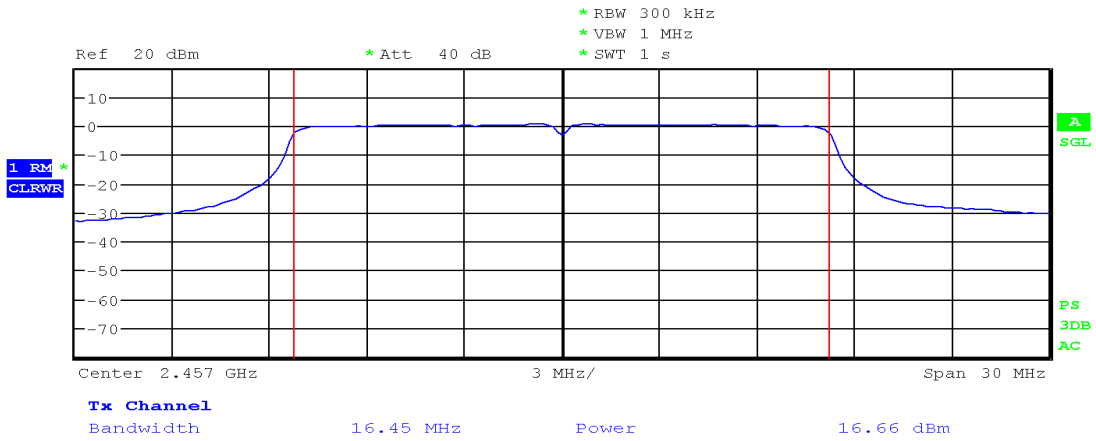
Date: 21.SEP.2021 18:13:28

Graph 3.3.4



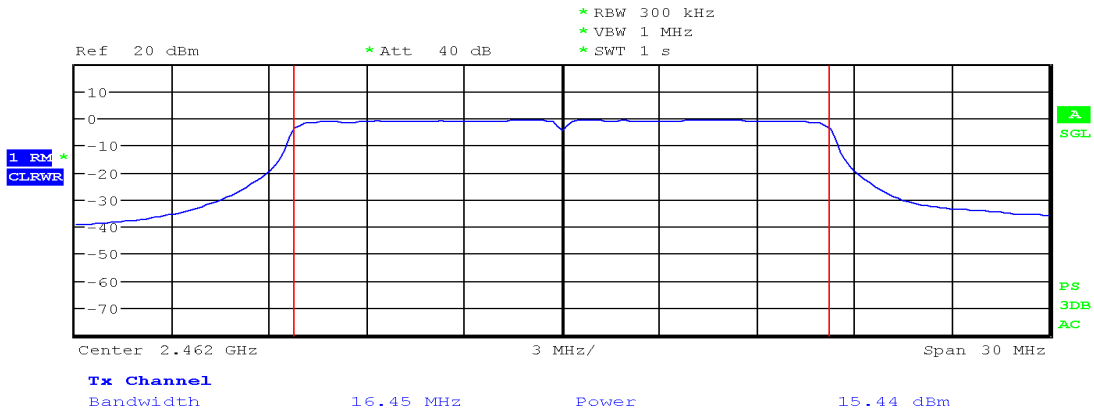
Date: 21.SEP.2021 18:14:01

Graph 3.3.5



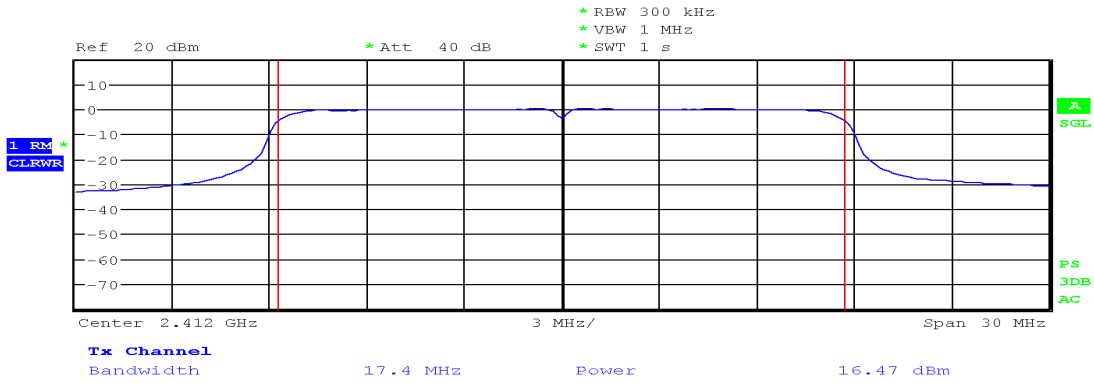
Date: 21.SEP.2021 18:14:27

Graph 3.3.6



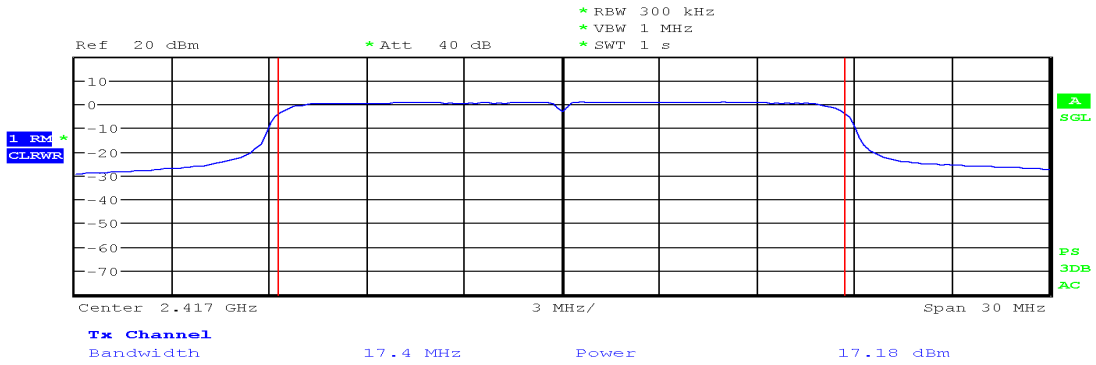
Date: 21.SEP.2021 18:14:59

Graph 3.3.7



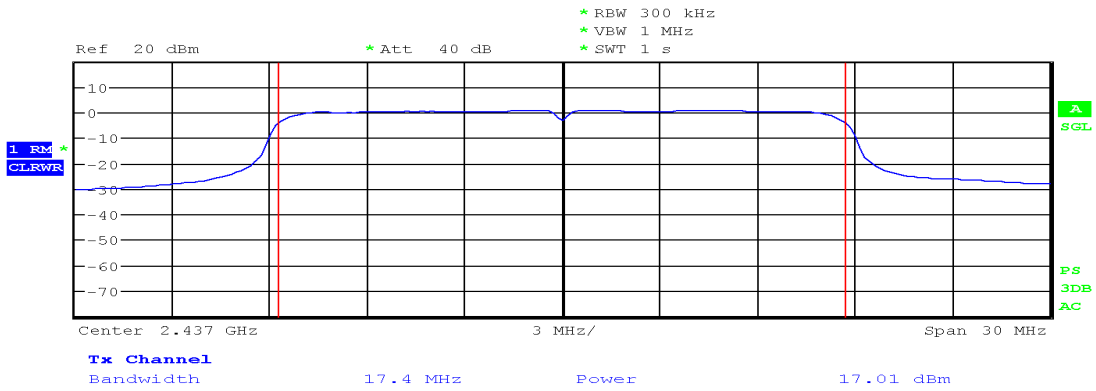
Date: 21.SEP.2021 18:18:00

Graph 3.3.8



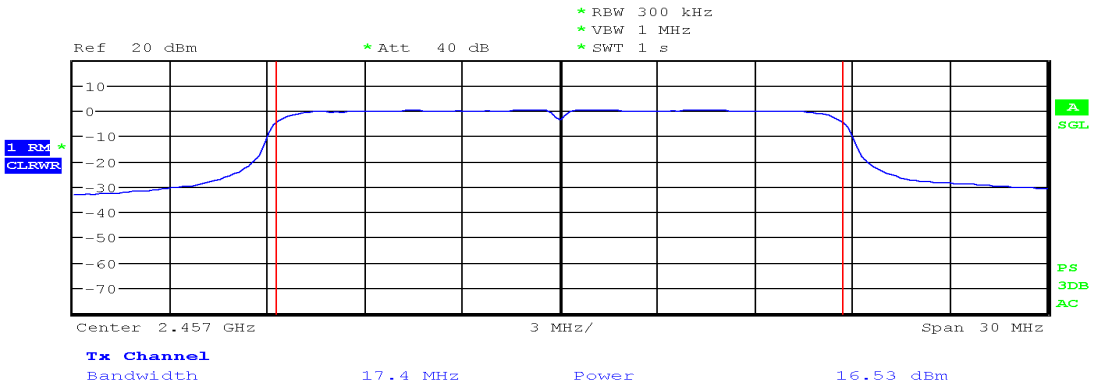
Date: 21.SEP.2021 18:18:40

Graph 3.3.9



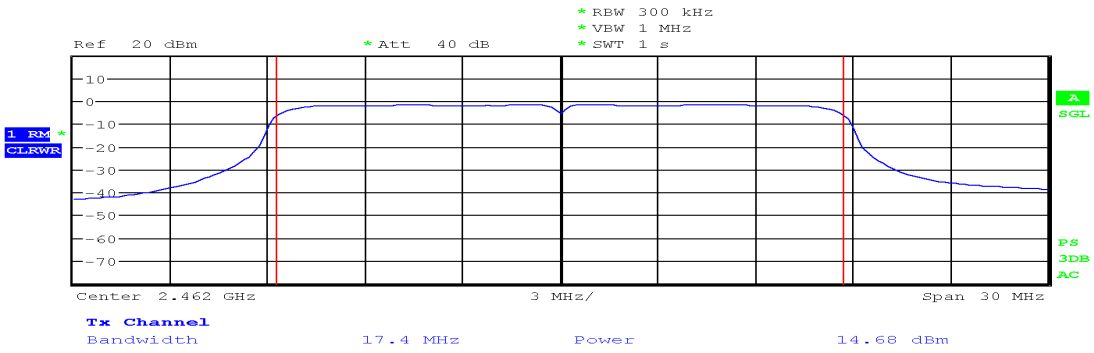
Date: 21.SEP.2021 18:19:18

Graph 3.3.10



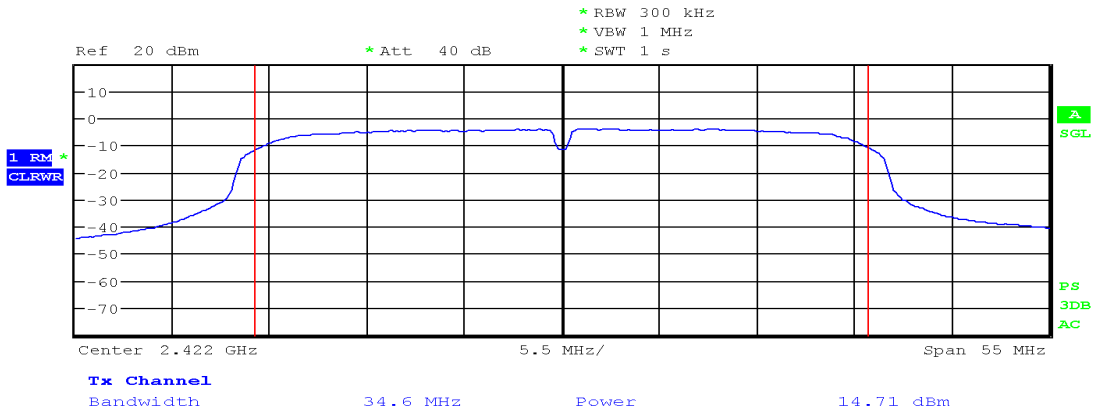
Date: 21.SEP.2021 18:19:43

Graph 3.3.11



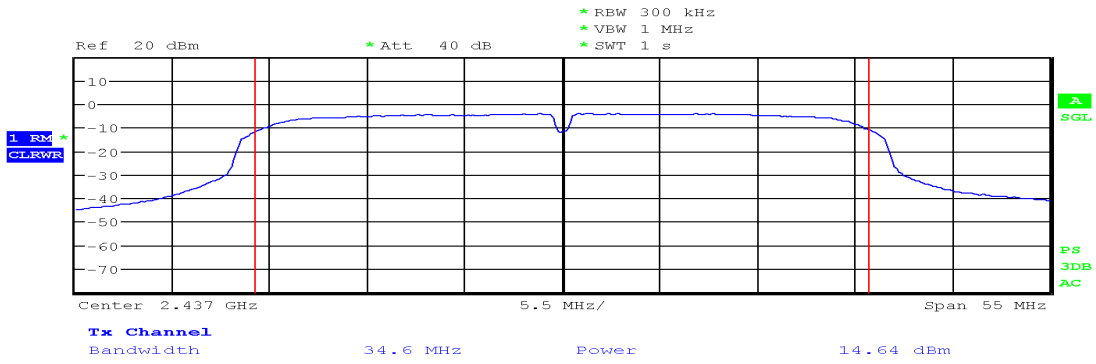
Date: 21.SEP.2021 18:22:29

Graph 3.3.12



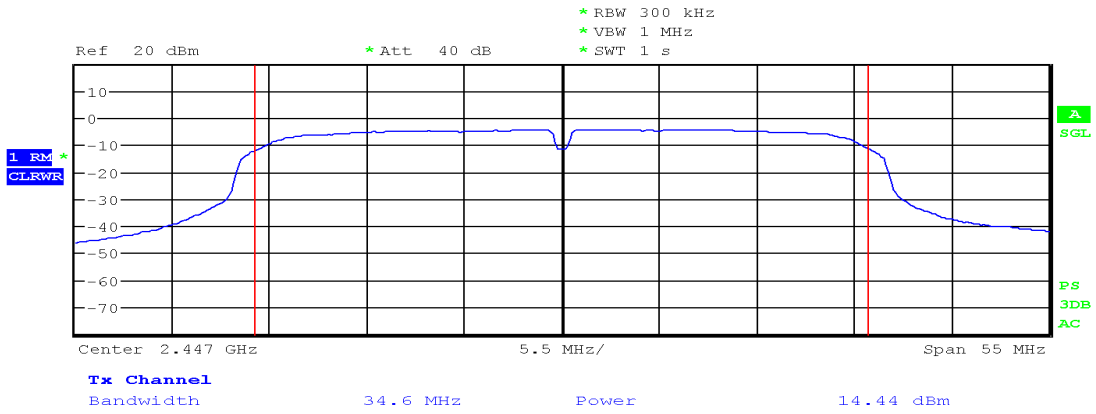
Date: 21.SEP.2021 18:26:39

Graph 3.3.13



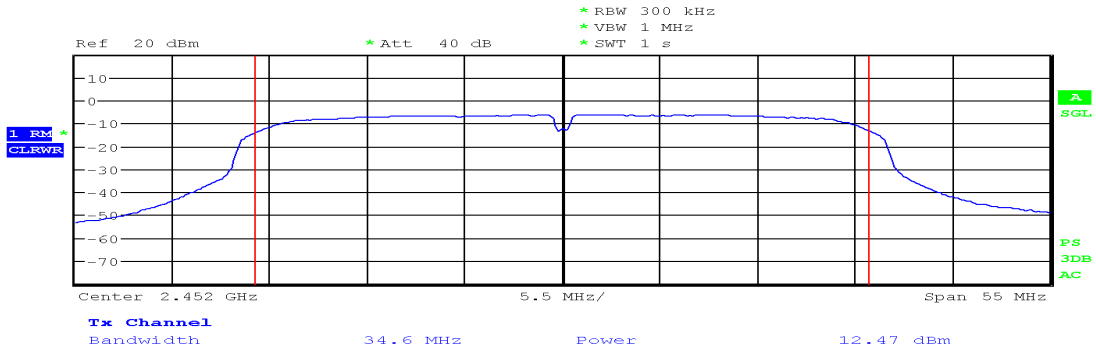
Date: 21.SEP.2021 18:27:02

Graph 3.3.14



Date: 21.SEP.2021 18:27:34

Graph 3.3.15



Date: 21.SEP.2021 18:28:03

Graph 3.3.16

3.4 Power spectral density

Notes: Average Power Spectral Density was used according to ANSI C63.10-2013 Section 11.10.4 Method AVGPSD-1A.
Measurements were performed for each modulation at low, middle and upper channels

802.11b

Power Output:	☒ Conducted Average		☐ Radiated	
	Measured Density dBm	**Power Density at Antenna dBm**	**Limit dBm**	**Margin dB**
Low Frequency Channel (1)	-6.7	-5.2	8	-13.2
Middle Frequency Channel (6)	-6.7	-5.2	8	-13.2
Upper Frequency Channel (11)	-8.0	-6.5	8	-14.5
Analyzer Settings:	☒ RBW=3KHz ☒ VBW=10KHz ☒ Span=30MHz ☒ Sweep=3.4sec			
Antenna Gain:	☒ < 6dBi and = 1.93dBi ☐ >6dBi and = dBi, limit reduction = dB			

Notes: The Power Spectral Density at Antenna was calculated adding the cable loss of 1.5dB from the measured density value.

802.11g

Power Output:	☒ Conducted ☐ Radiated			
	Measured Density dBm	**Power Density at Antenna dBm**	**Limit dBm**	**Margin dB**
Low Frequency Channel (1)	-9.9	-8.4	8	-16.4
Middle Frequency Channel (6)	-9.3	-7.8	8	-15.8
Next In Upper Frequency Channel (10)	-9.9	-8.4	8	-16.4
Upper Frequency Channel (11)	-11.0	-9.5	8	-17.5
Analyzer Settings:	☒ RBW=30KHz ☒ VBW=10KHz ☒ Span=30MHz ☒ Sweep=3.4sec			
Antenna Gain:	☒ < 6dBi and = 1.93dBi ☐ >6dBi and = dBi, limit reduction = dB			

Notes: The Power Spectral Density at Antenna was calculated adding the cable loss of 1.5dB from the measured density value.

802.11n-20

Power Output:	☒ Conducted ☐ Radiated			
	Measured Density dBm	**Power Density at Antenna dBm**	**Limit dBm**	**Margin dB**
Low Frequency Channel (1)	-9.7	-8.2	8	-16.2
Next In Low Frequency Channel (2)	-9.6	-8.1	8	-16.1
Middle Frequency Channel (6)	-9.9	-8.4	8	-16.4
Next In Upper Frequency Channel (10)	-10.5	-9.0	8	-17.0
Upper Frequency Channel (11)	-12.6	-11.1	8	-19.1
Analyzer Settings:	☒ RBW=3KHz ☒ VBW=10KHz ☒ Span=30MHz ☒ Sweep=3.4sec			
Antenna Gain:	☒ < 6dBi and = 1.93dBi ☐ >6dBi and = dBi, limit reduction = dB			

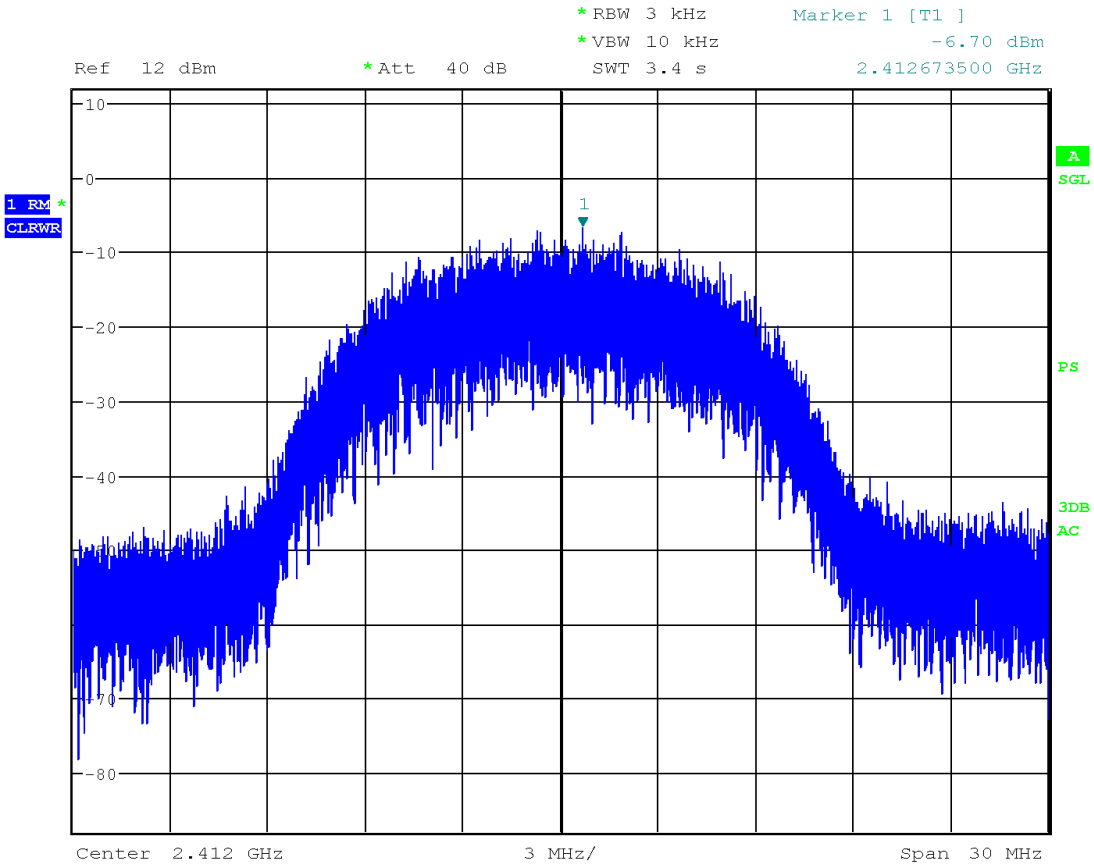
Notes: The Power Spectral Density at Antenna was calculated adding the cable loss of 1.5dB from the measured density value.

802.11n-40

Power Output:	☒ Conducted ☐ Radiated			
	Measured Density dBm	**Power Density at Antenna dBm**	**Limit dBm**	**Margin dB**
Low Frequency Channel (3)	-12.7	-11.2	8	-19.2
Middle Frequency Channel (6)	-13.3	-11.8	8	-19.8
Next In Upper Frequency Channel (8)	-12.6	-11.1	8	-19.9
Upper Frequency Channel (9)	-14.4	-12.9	8	-20.9
Analyzer Settings:	☒ RBW=5KHz ☒ VBW=20KHz ☒ Span=60MHz ☒ Sweep=3.4sec			
Antenna Gain:	☒ < 6dBi and = 1.93dBi ☐ >6dBi and = dBi, limit reduction = dB			

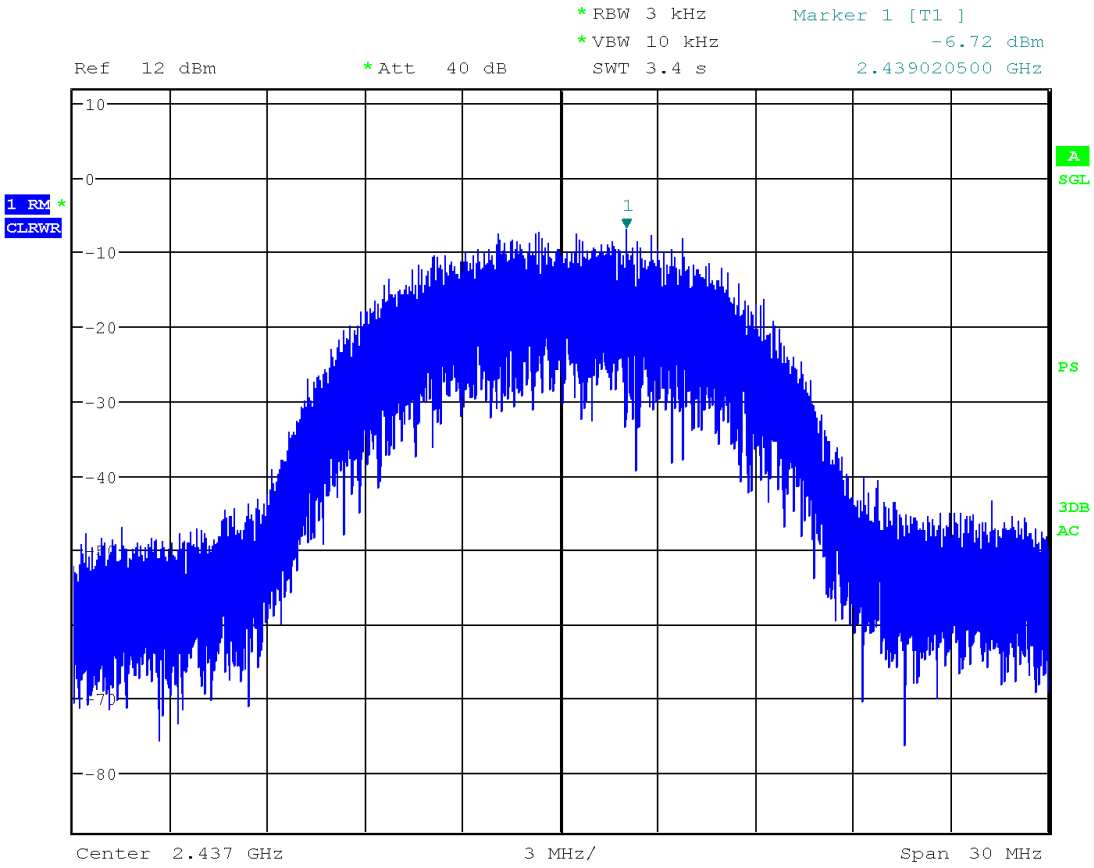
Notes: The Power Spectral Density at Antenna was calculated adding the cable loss of 1.5dB from the measured density value.

Graphs 3.4.1 – 3.4.3 show 802.11b
Graphs 3.4.4 – 3.4.7 show 802.11g
Graphs 3.4.8 – 3.4.12 show 802.11n20
Graphs 3.4.13 – 3.4.16 show 802.11n40



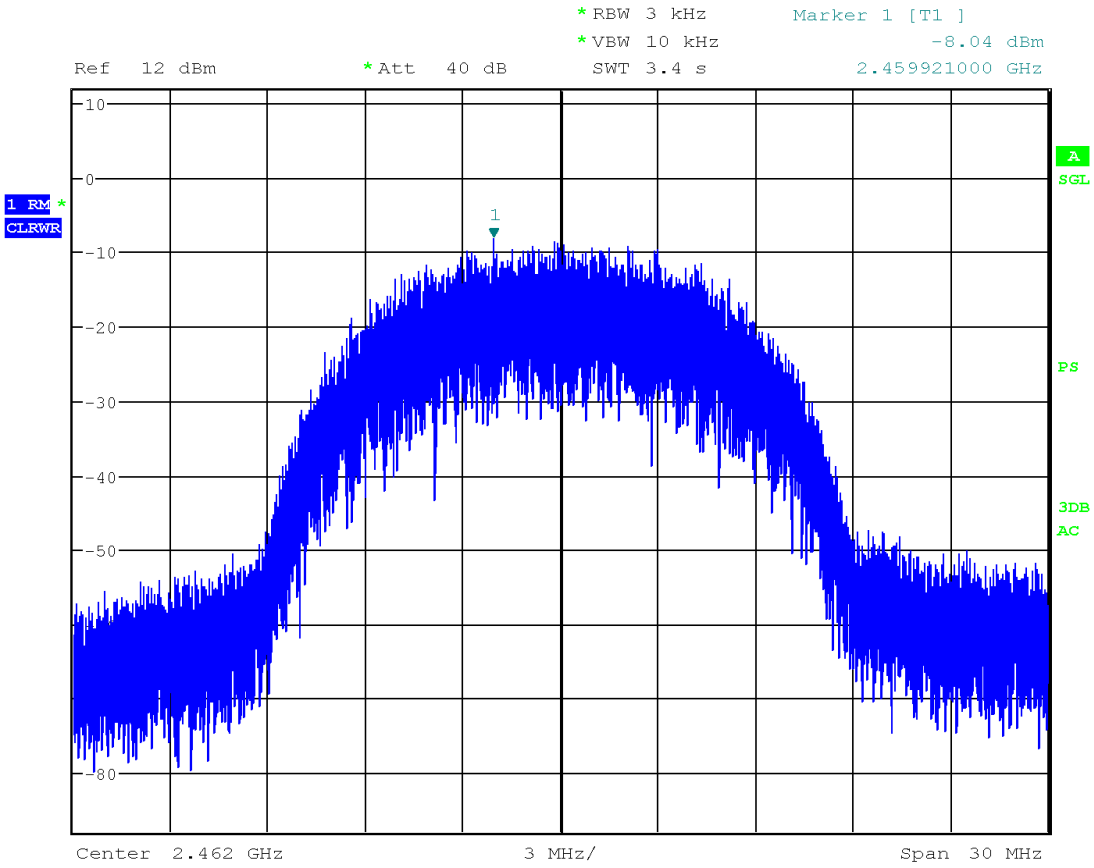
Date: 21.SEP.2021 18:37:07

Graph 3.4.1



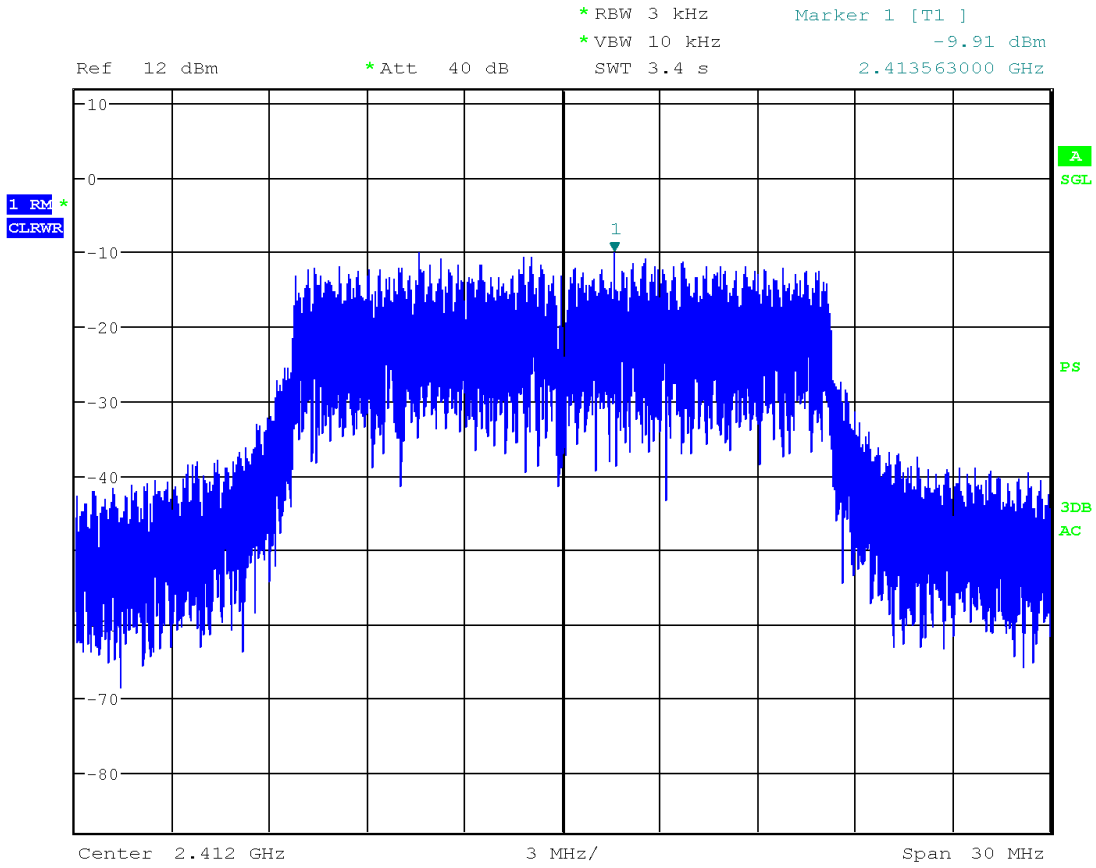
Date: 21.SEP.2021 18:37:46

Graph 3.4.2



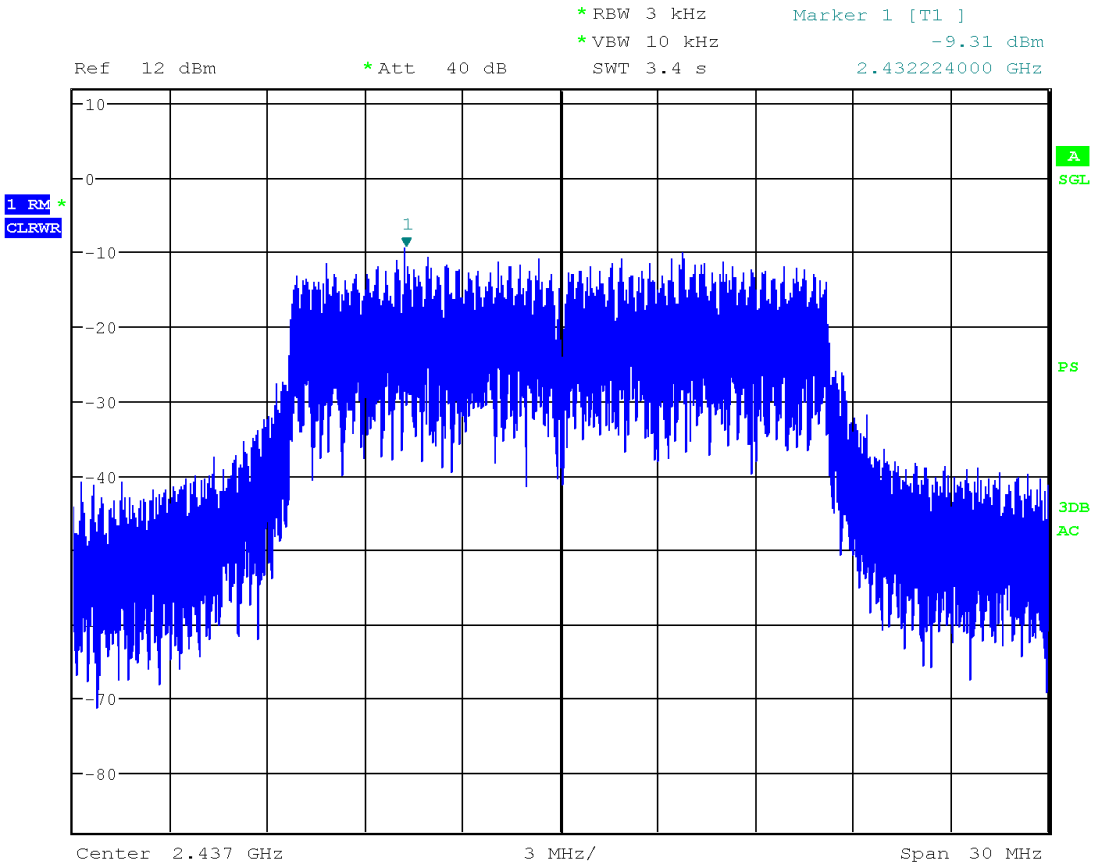
Date: 21.SEP.2021 18:38:23

Graph 3.4.3



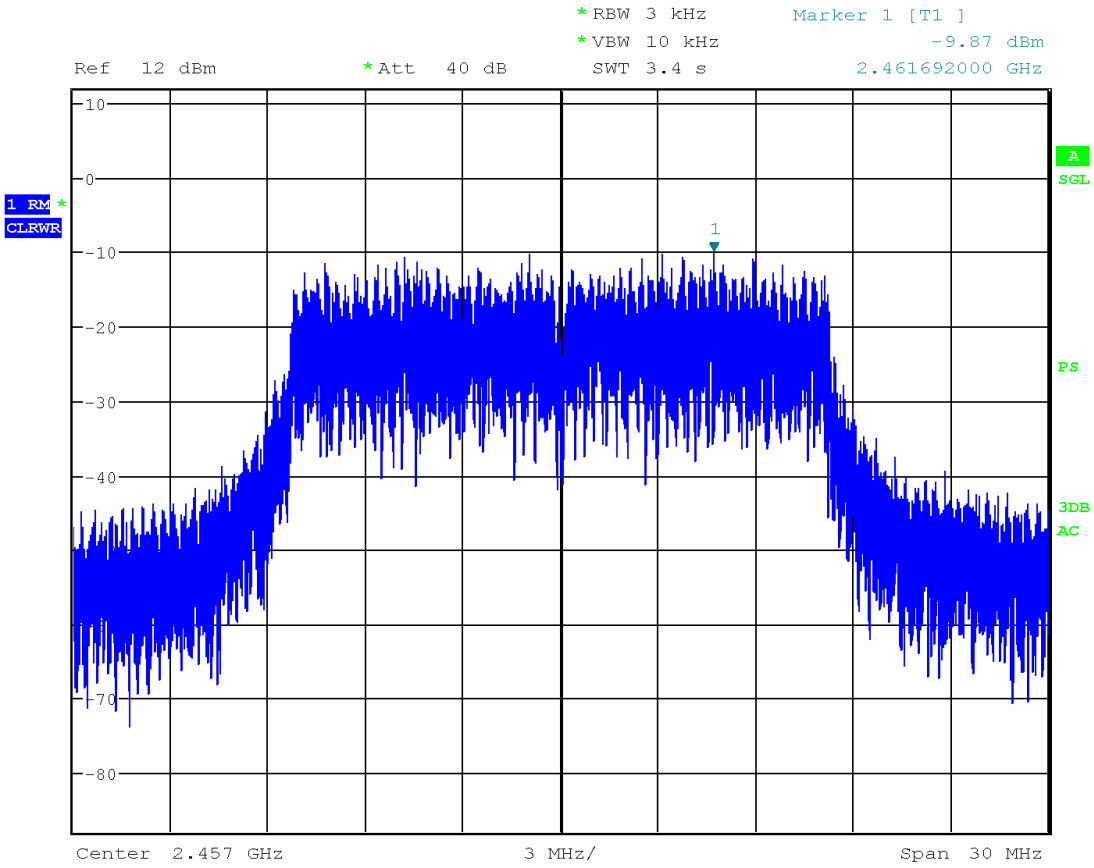
Date: 21.SEP.2021 18:44:13

Graph 3.4.4



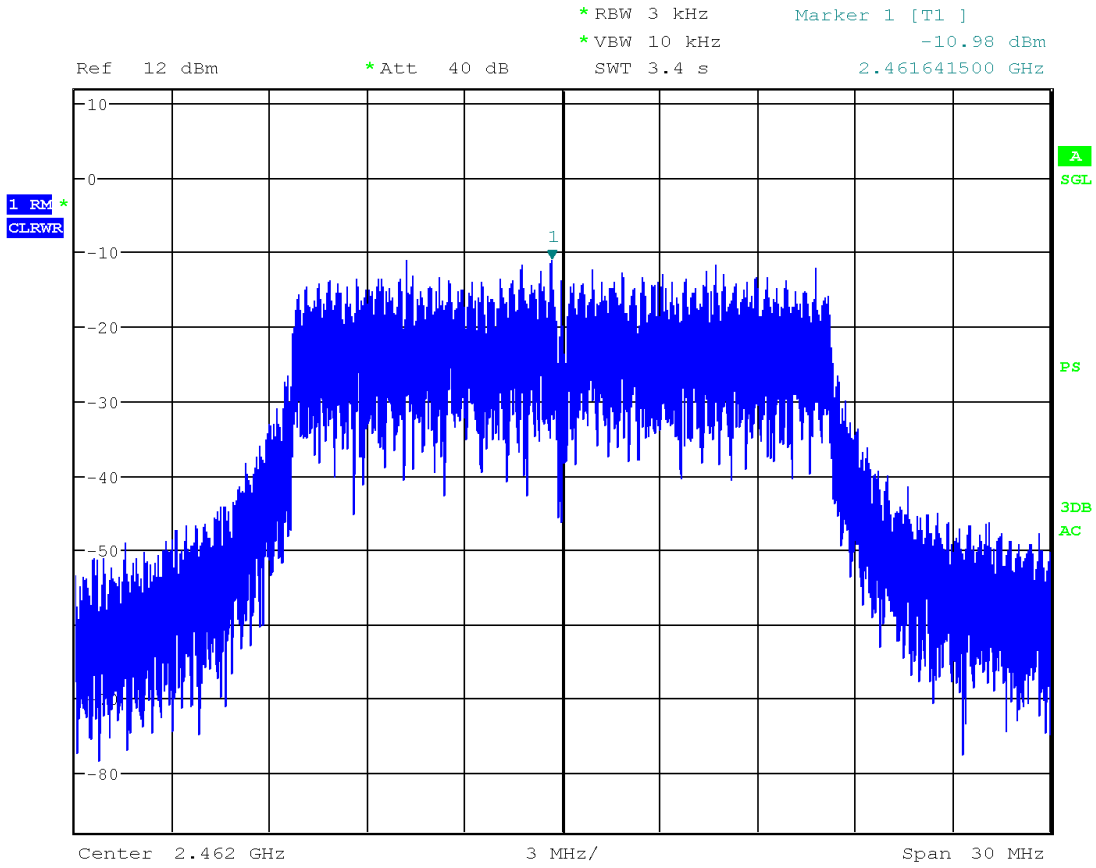
Date: 21.SEP.2021 18:44:51

Graph 3.4.5



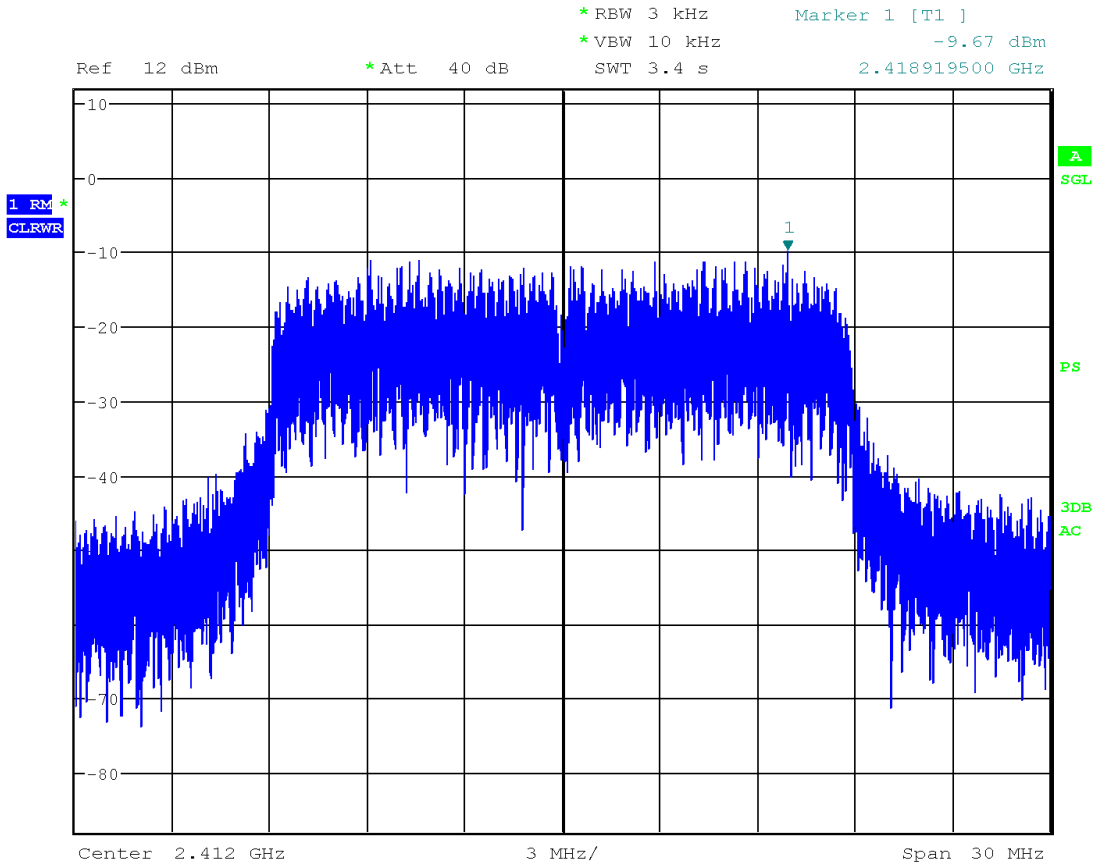
Date: 21.SEP.2021 18:45:33

Graph 3.4.6



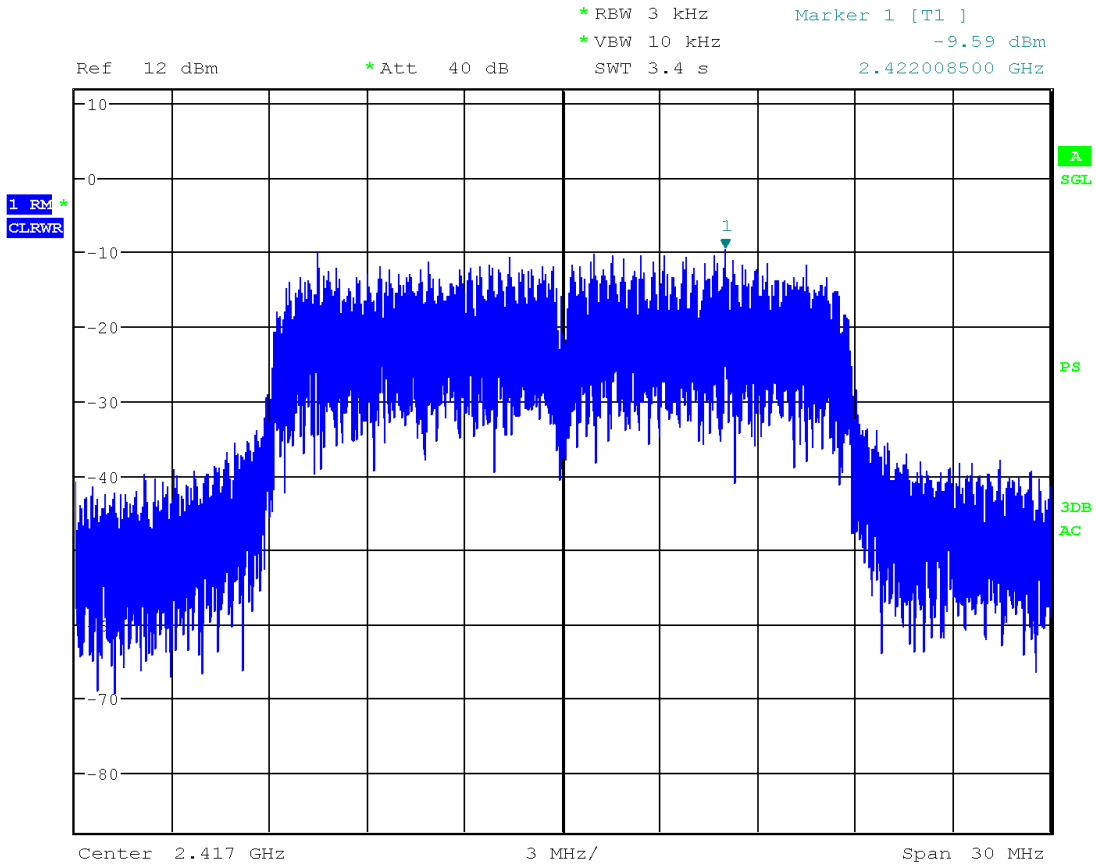
Date: 21.SEP.2021 18:46:13

Graph 3.4.7



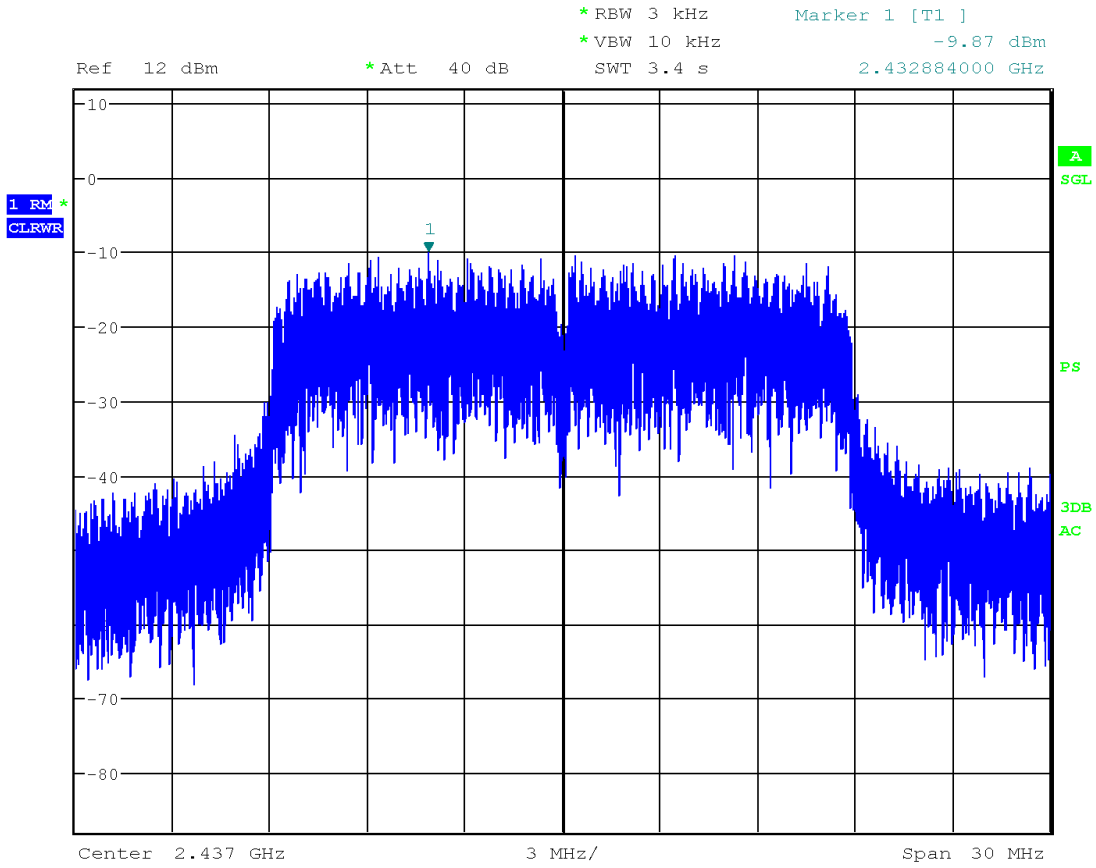
Date: 21.SEP.2021 18:47:58

Graph 3.4.8



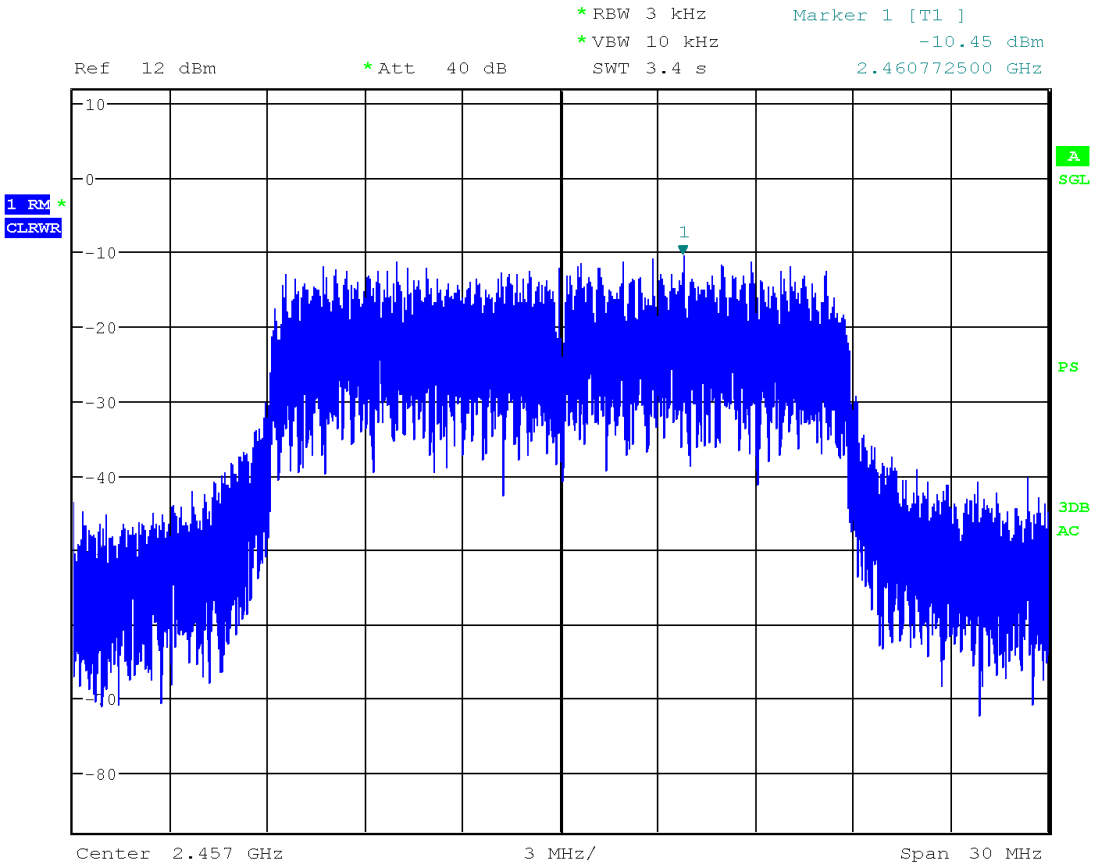
Date: 21.SEP.2021 18:48:31

Graph 3.4.9



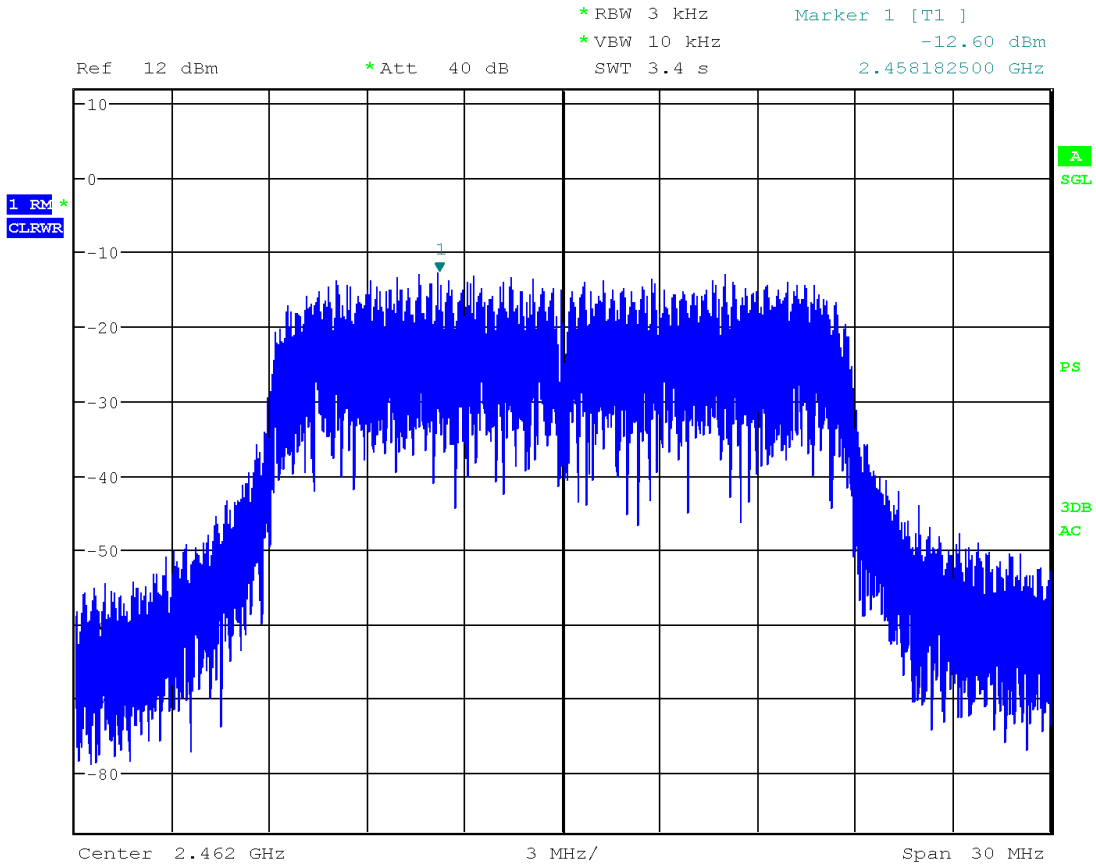
Date: 21.SEP.2021 18:49:06

Graph 3.4.10



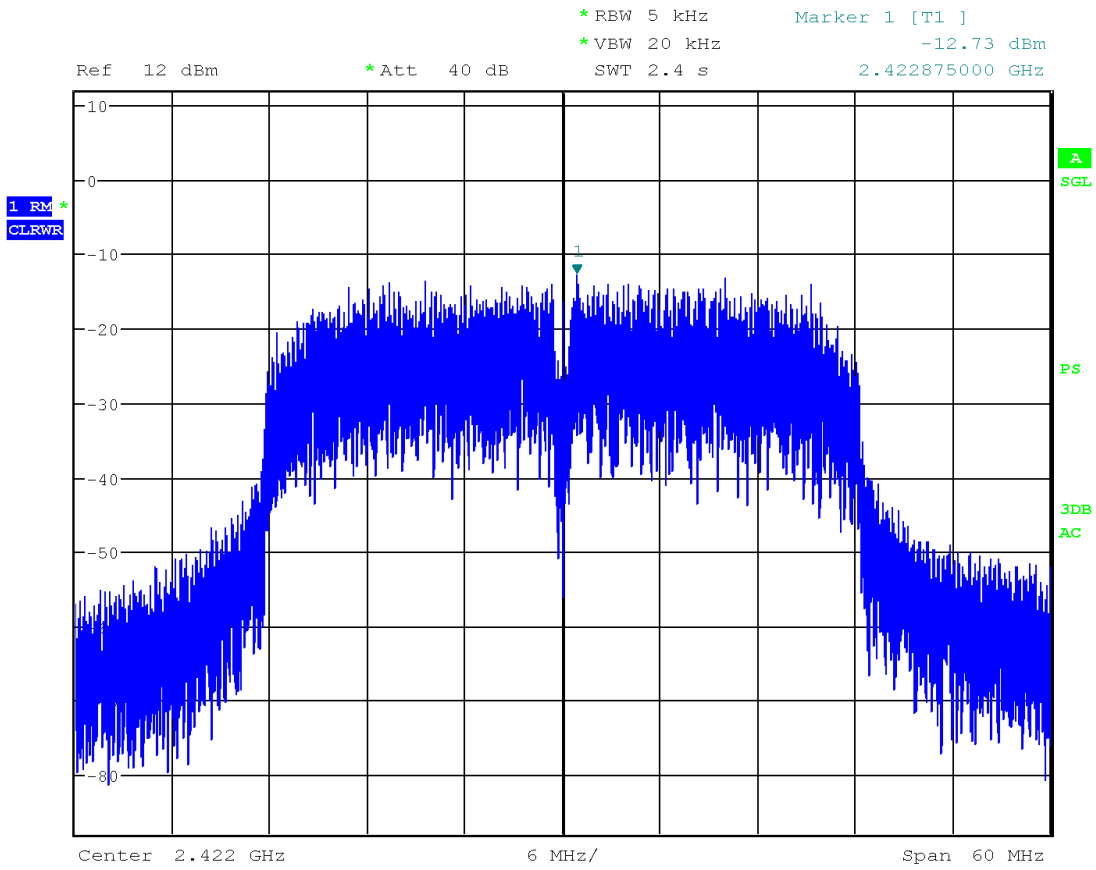
Date: 21.SEP.2021 18:49:32

Graph 3.4.11



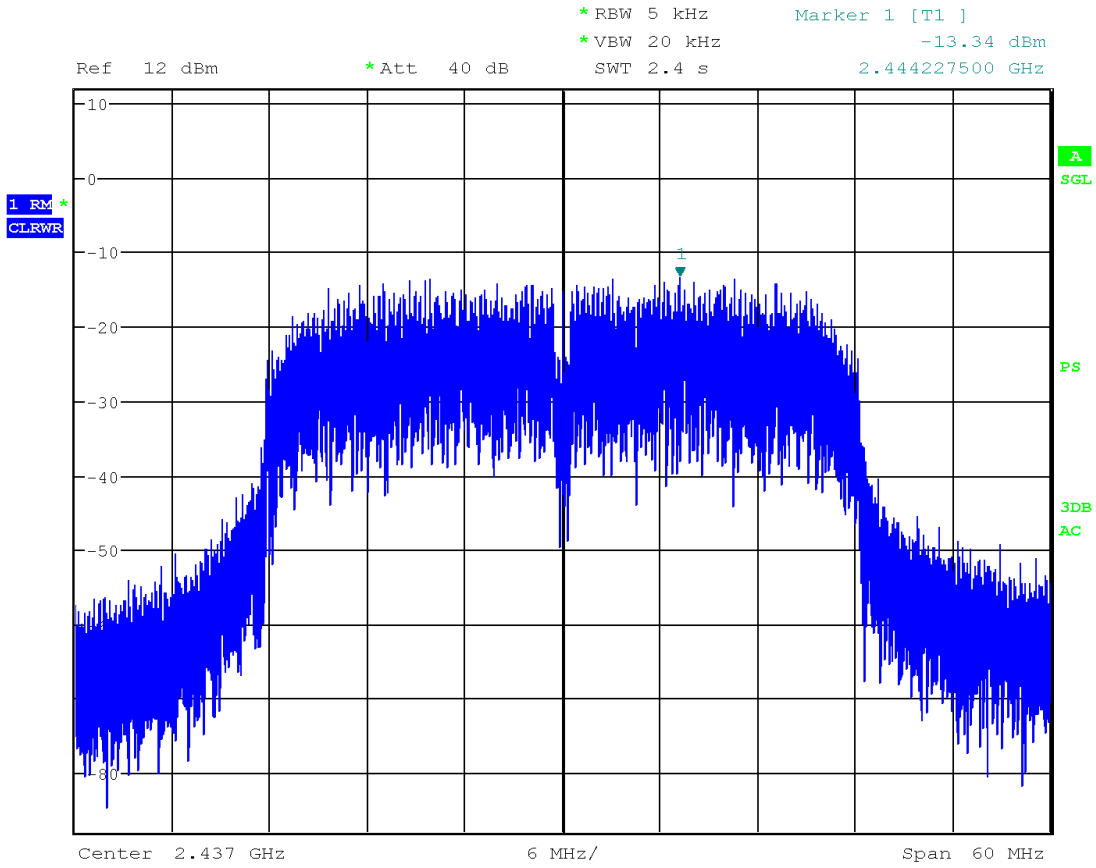
Date: 21.SEP.2021 18:50:00

Graph 3.4.12



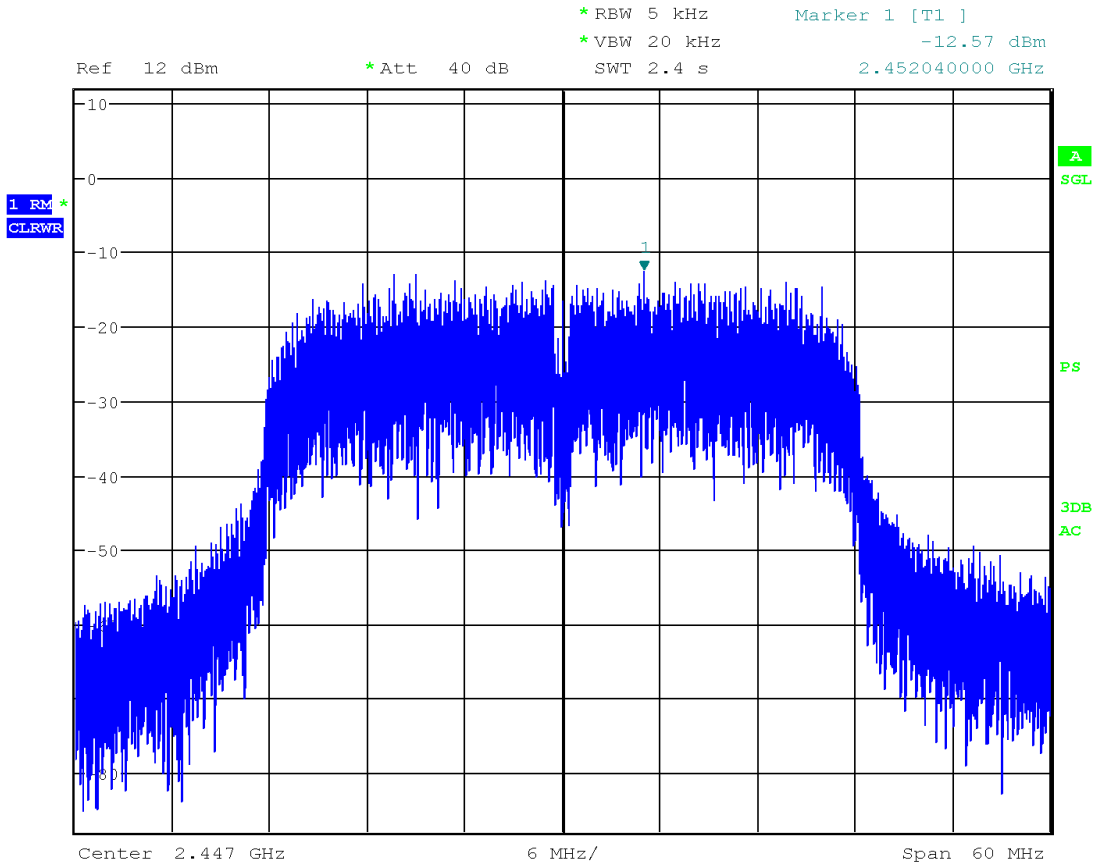
Date: 21.SEP.2021 18:53:49

Graph 3.4.13



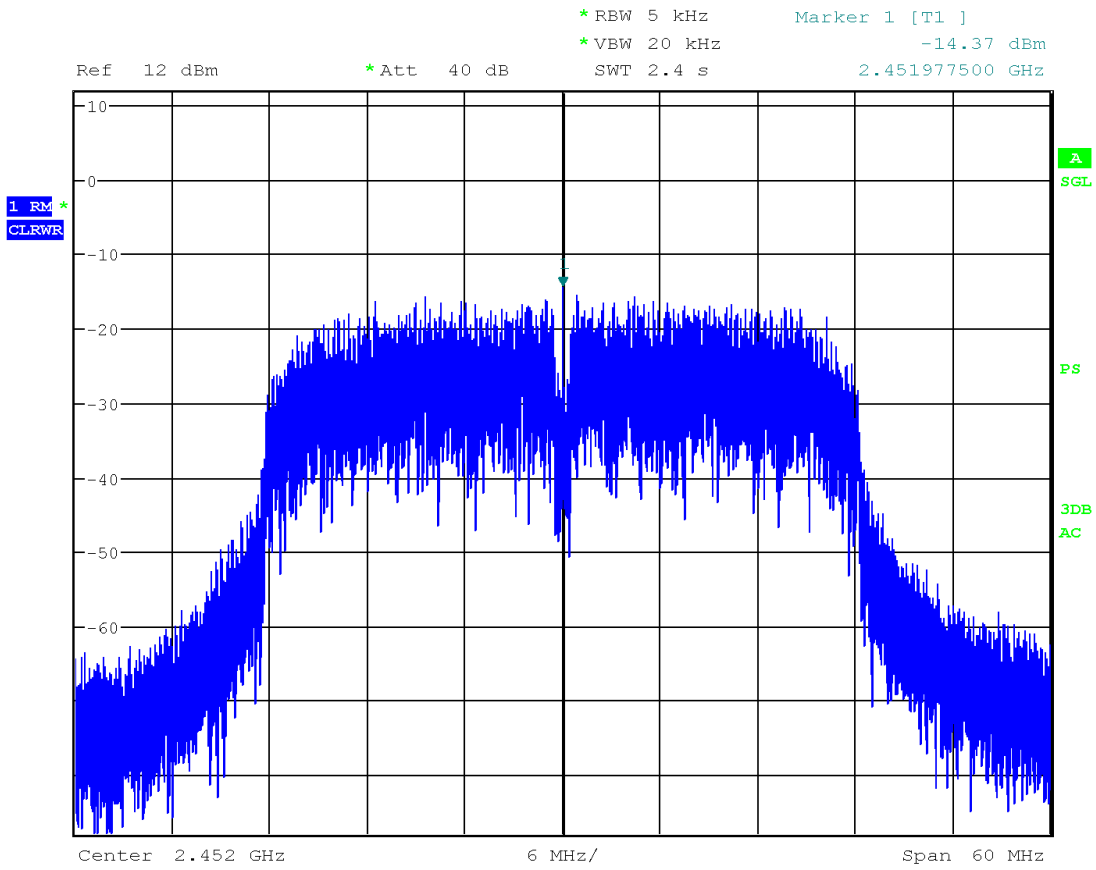
Date: 21.SEP.2021 18:54:10

Graph 3.4.14



Date: 21.SEP.2021 18:54:34

Graph 3.4.15



Date: 21.SEP.2021 18:55:00

Graph 3.4.16

3.5 Antenna conducted spurious emissions

802.11b

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel (1)	-51.5	-30	-21.5
Middle Frequency Channel (6)	-51.4	-30	-21.4
Upper Frequency Channel (11)	-51.3	-30	-21.3

802.11g

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel (1)	-49.0	-30	-19.0
Middle Frequency Channel (6)	-48.8	-30	-18.8
Next In Upper Frequency Channel (10)	-51.2	-30	-11.2
Upper Frequency Channel (11)	-49.4	-30	-19.4

802.11n-20

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel (1)	-47.6	-30	-17.6
Next In Low Frequency Channel (2)	-50.0	-30	-10.0
Middle Frequency Channel (6)	-47.9	-30	-17.9
Next In Upper Frequency Channel (10)	-50.2	-30	-20.2
Upper Frequency Channel (11)	-45.1	-30	-15.1

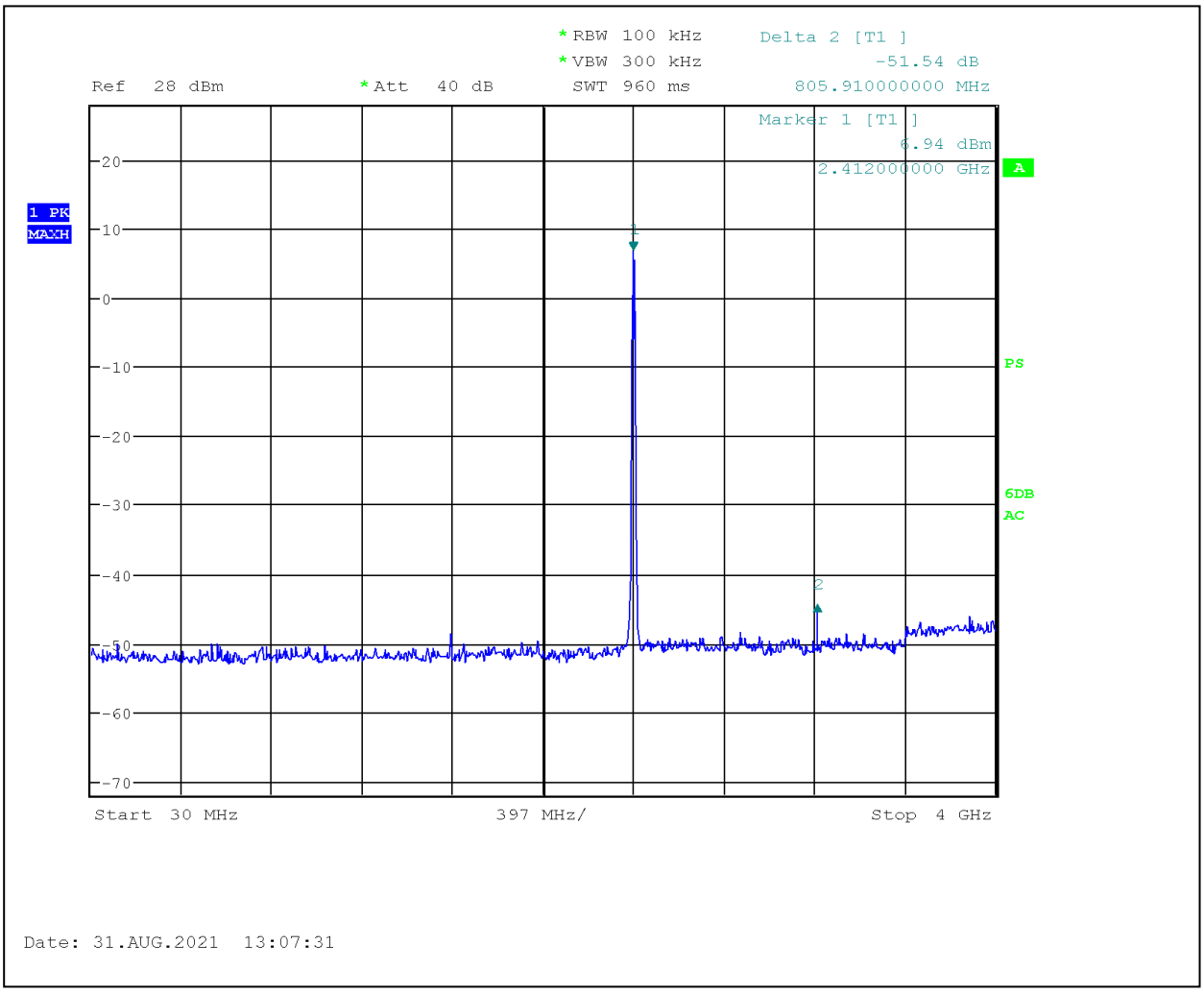
802.11n-40

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel (3)	-41.6	-30	-11.6
Middle Frequency Channel (6)	-44.5	-30	-14.5
Next In Upper Frequency Channel (8)	-46.5	-30	-16.5
Upper Frequency Channel (9)	-42.1	-30	-12.1

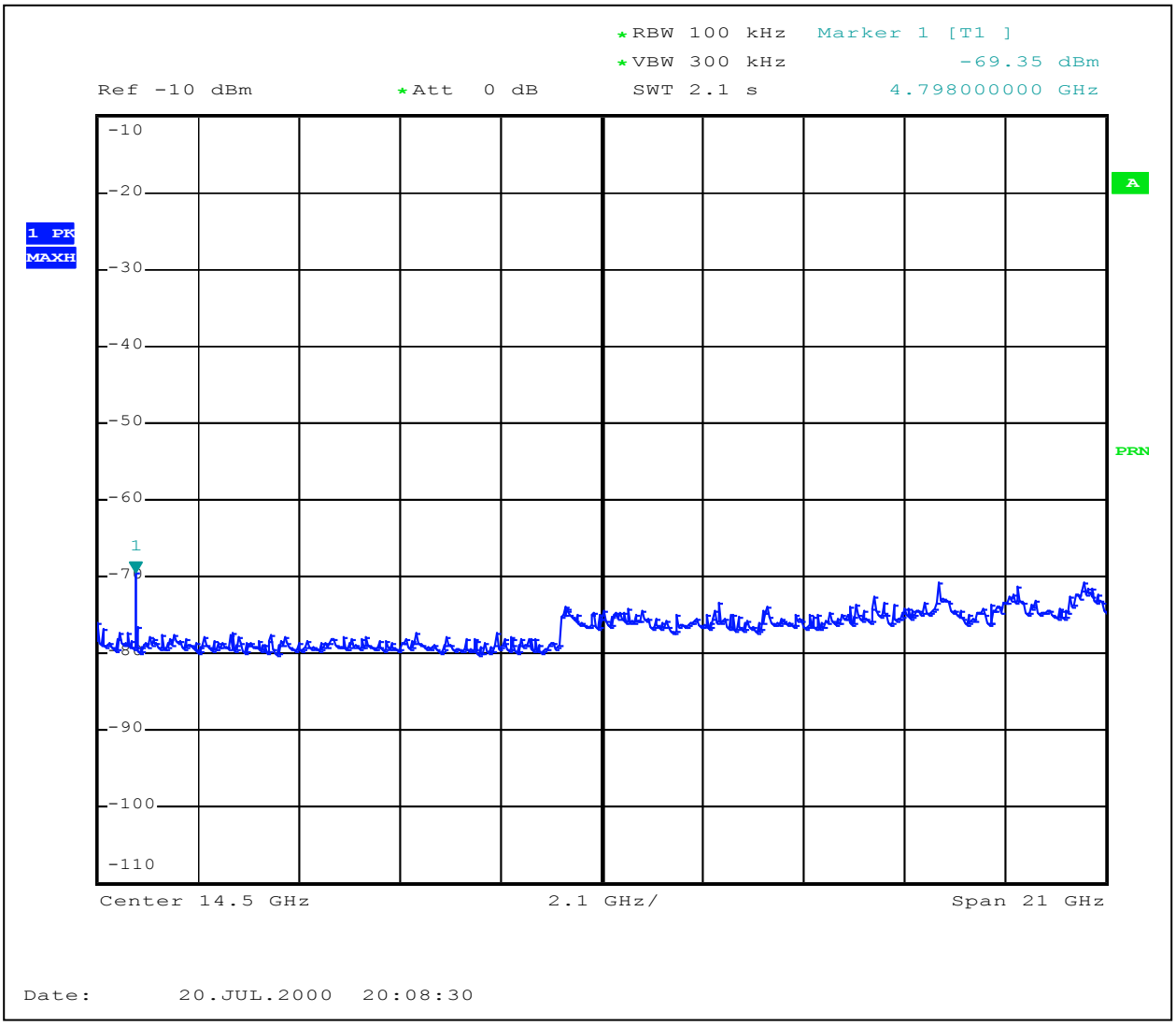
Notes: RBW:100kHz
VBW: 300kHz

Graphs 3.5.1 - 3.5.6 show antenna conducted spurious emissions for 802.11b
Graphs 3.5.7 - 3.5.14 show antenna conducted spurious emissions for 802.11g
Graphs 3.5.15 - 3.5.24 show antenna conducted spurious emissions for 802.11n-20
Graphs 3.5.25 - 3.5.32 show antenna conducted spurious emissions for 802.11n-40

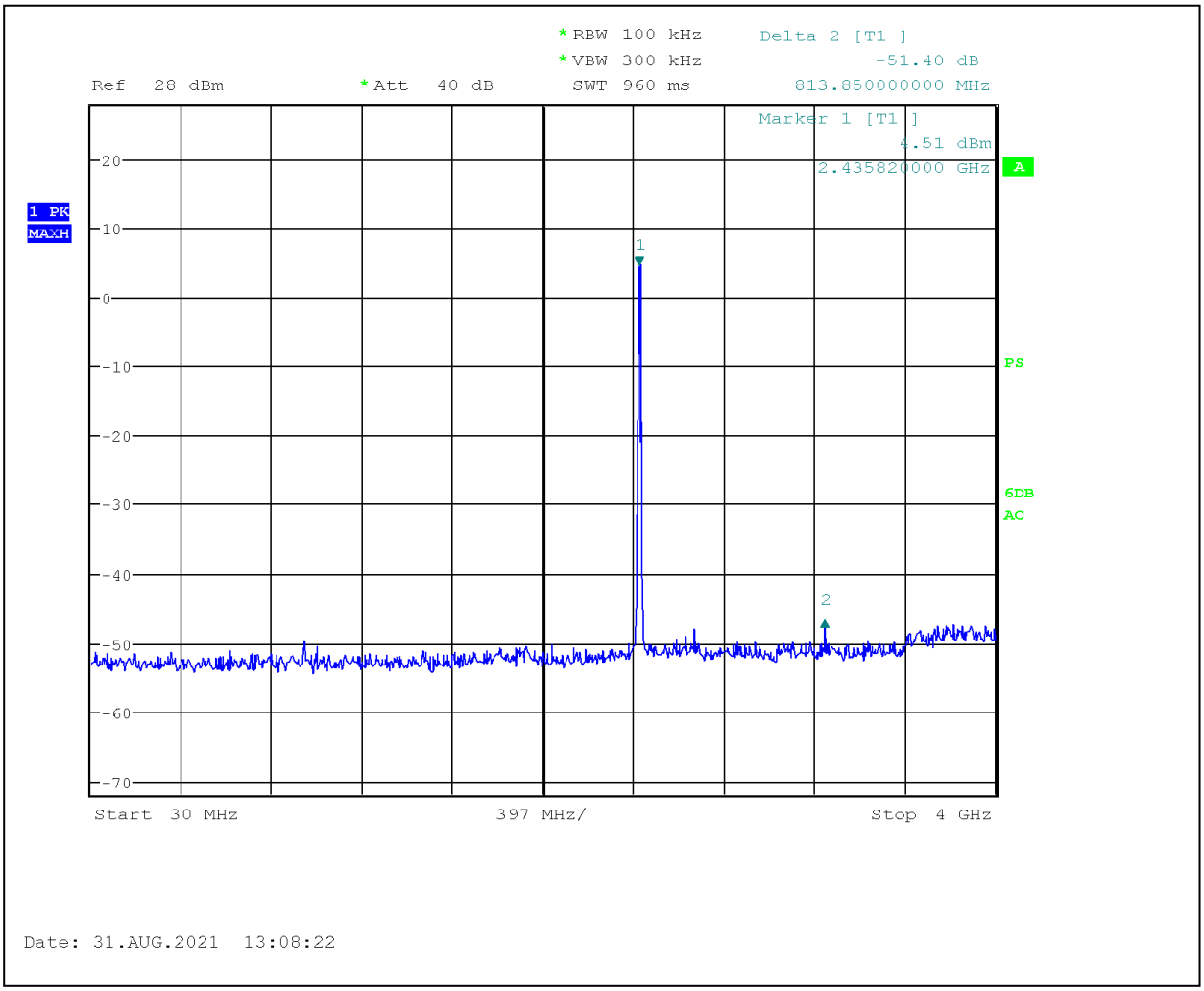
Graph 3.5.33 and 3.5.34 show band edge compliance for 802.11b
Graph 3.5.35, and 3.5.36 show band edge compliance for 802.11g
Graph 3.5.37 shows band edge compliance for ch.10 for 802.11g
Graph 3.5.38, and 3.5.39 show band edge compliance for 802.11n-20
Graph 3.5.40 and 3.5.41 show band edge compliance for ch.2 and ch.10 for 802.11n-20
Graph 3.5.42, and 3.5.43 show band edge compliance for 802.11n-40
Graph 3.5.44 shows band edge compliance for ch.8 for 802.11n-40


* RBW 100 kHz
* VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-51.54 dB
805.910000000 MHz
Ref 28 dBm
* Att 40 dB
Marker 1 [T1]
6.94 dBm
2.412000000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:07:31

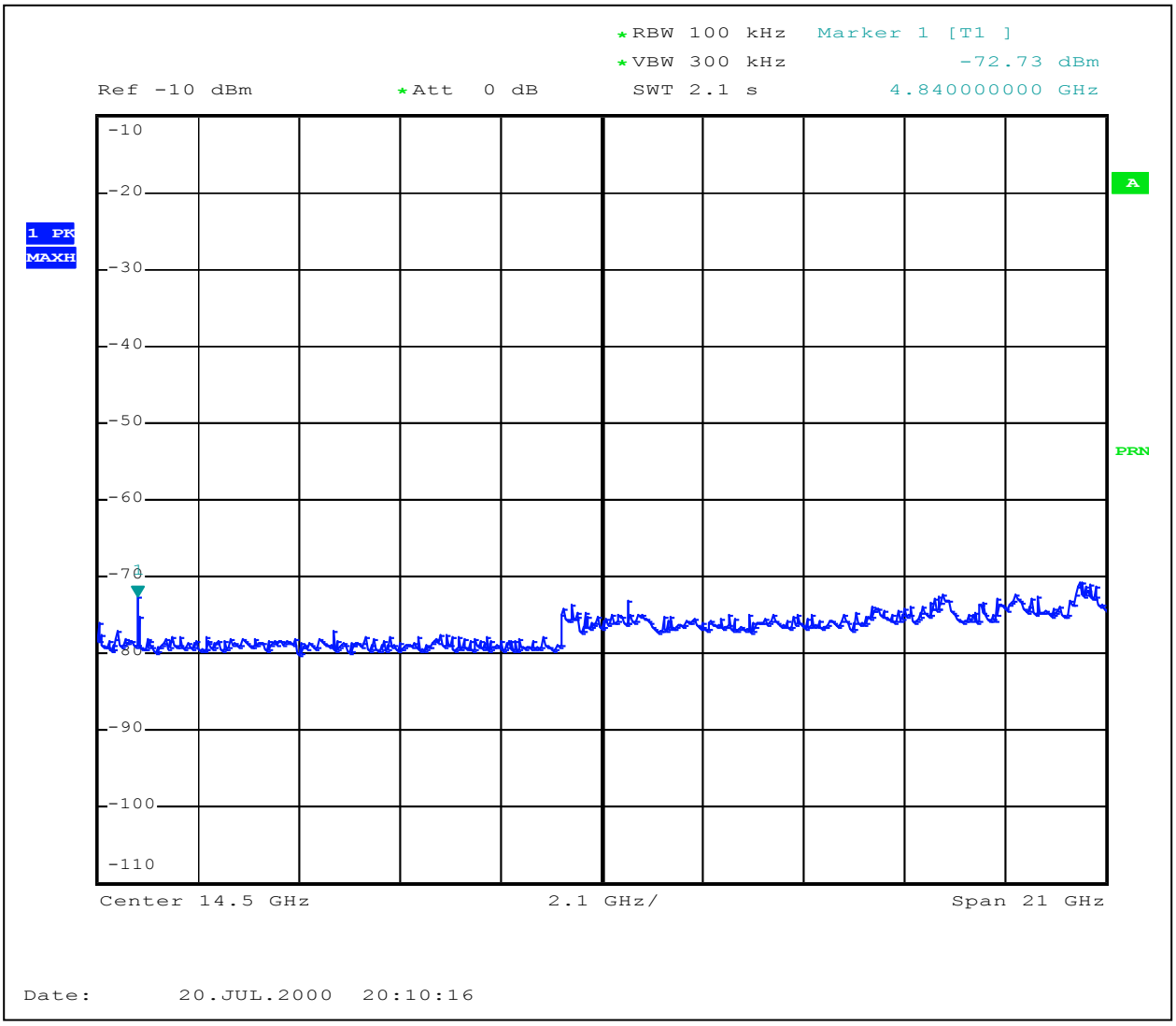
Graph 3.5.1


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-69.35 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
4.798000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:08:30

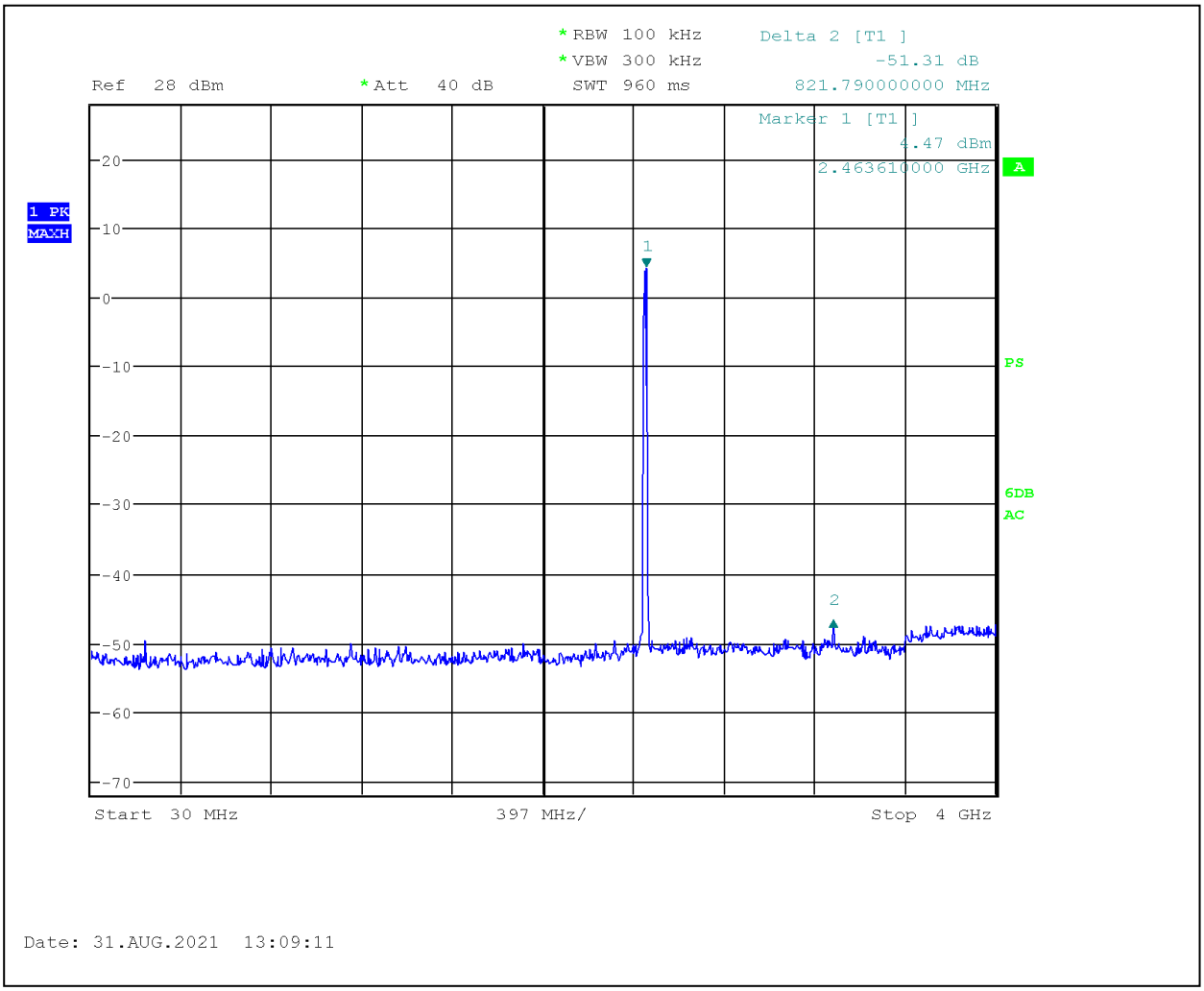
Graph 3.5.2


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-51.40 dB
813.850000000 MHz
Marker 1 [T1]
4.51 dBm
2.435820000 GHz
Ref 28 dBm
*Att 40 dB
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:08:22

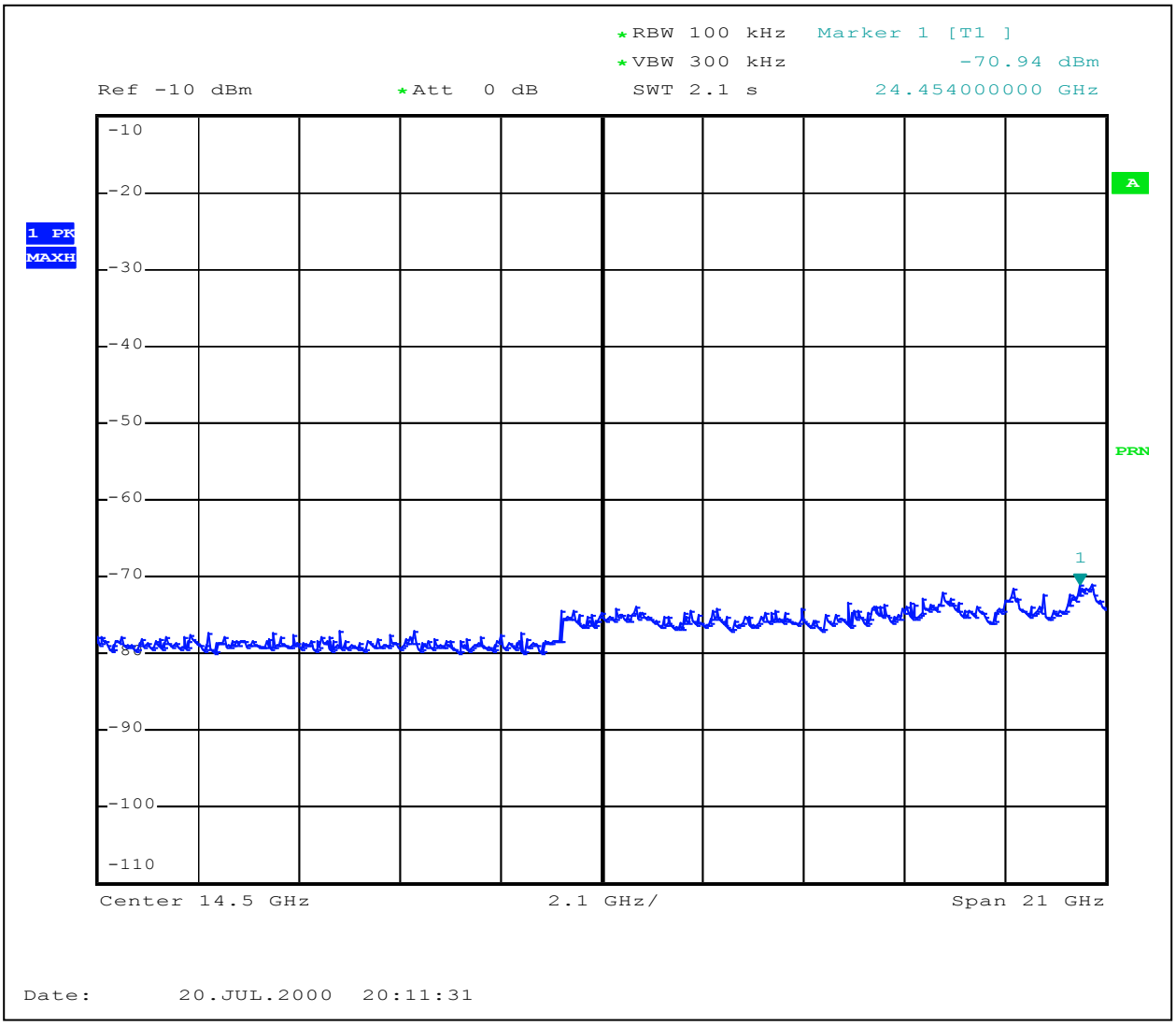
Graph 3.5.3


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-72.73 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
4.840000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:10:16

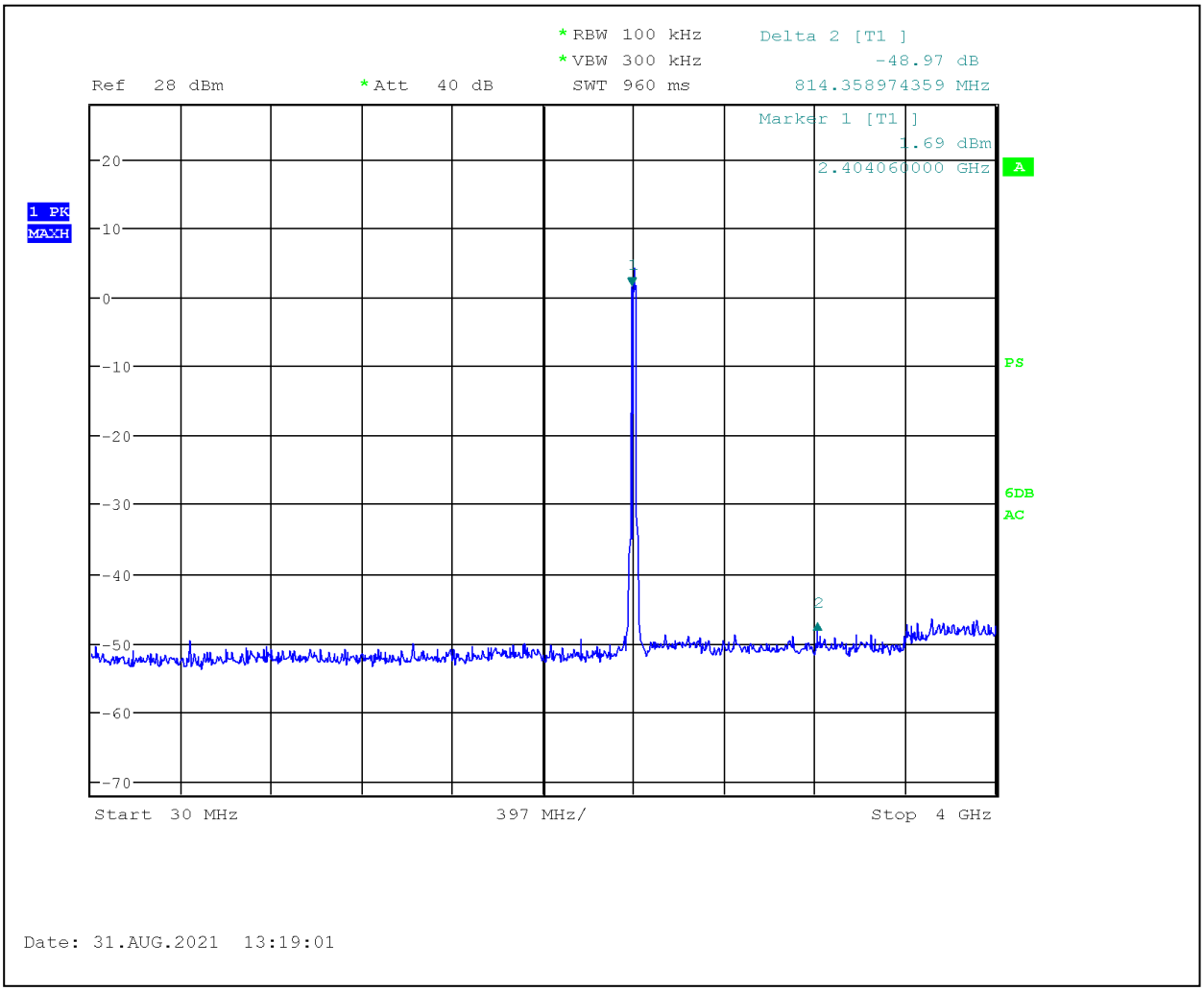
Graph 3.5.4


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-51.31 dB
821.790000000 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
4.47 dBm
2.463610000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:09:11

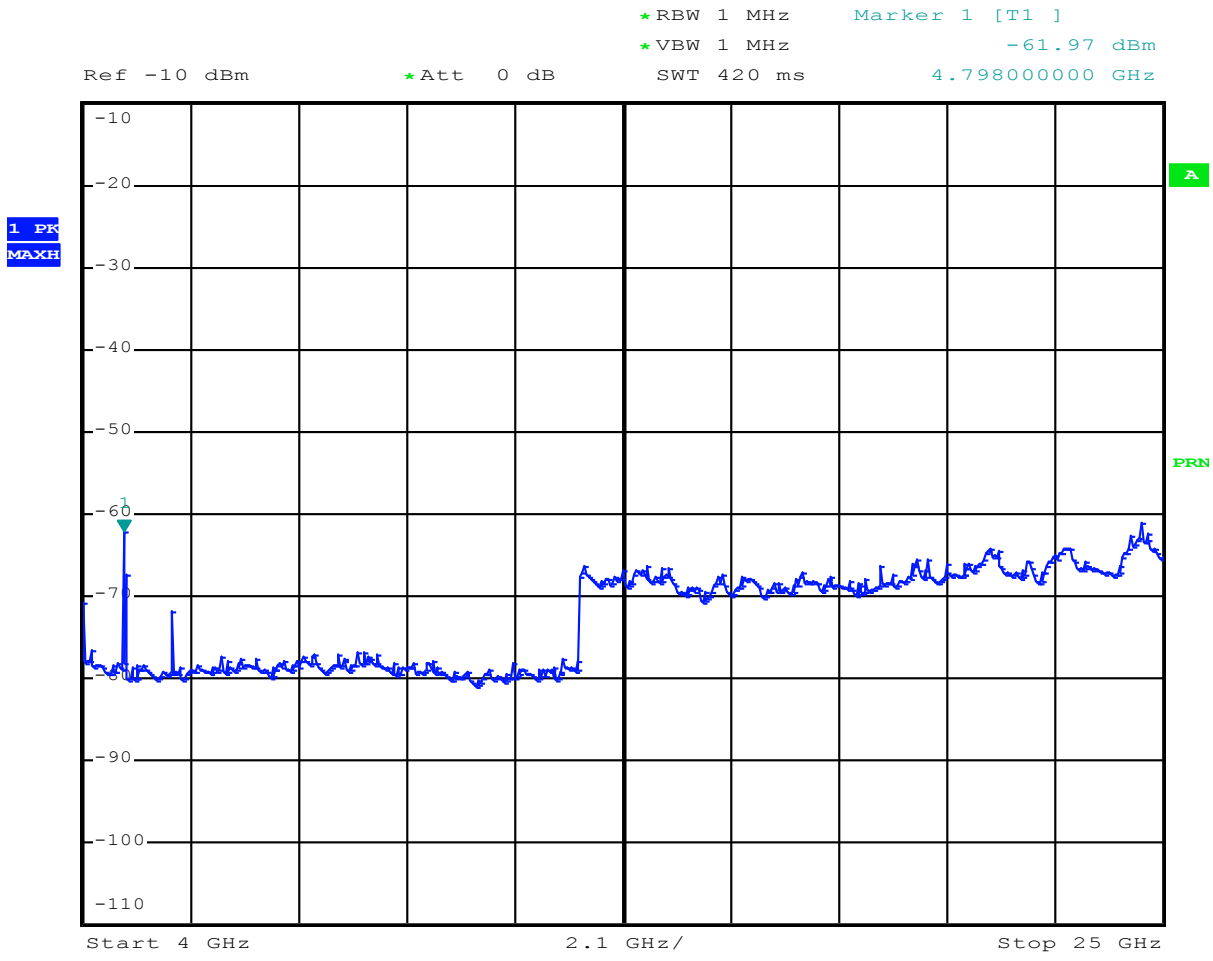
Graph 3.5.5


*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1]
-70.94 dBm
24.454000000 GHz
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:11:31

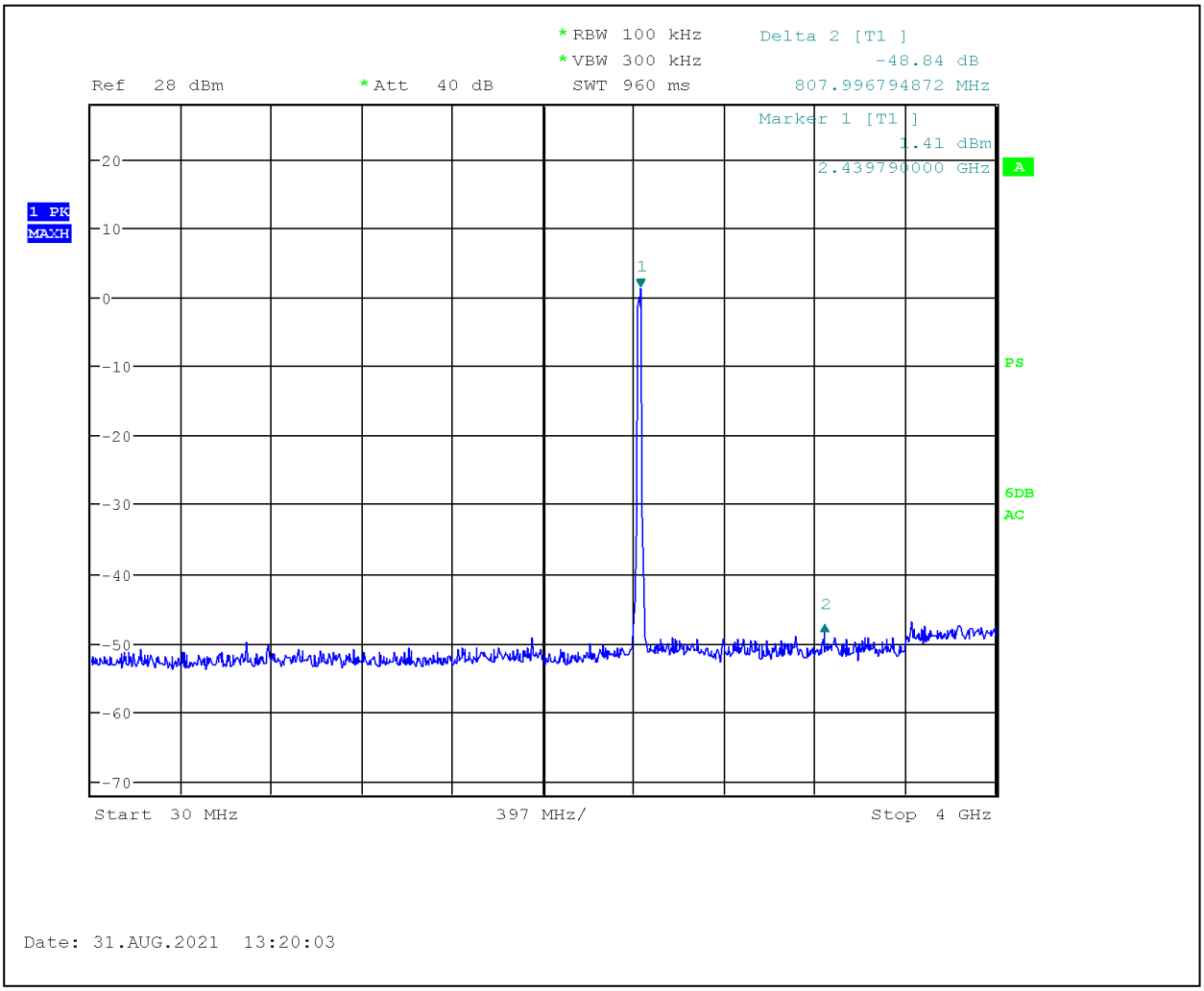
Graph 3.5.6


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-48.97 dB
814.358974359 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
1.69 dBm
2.404060000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:19:01

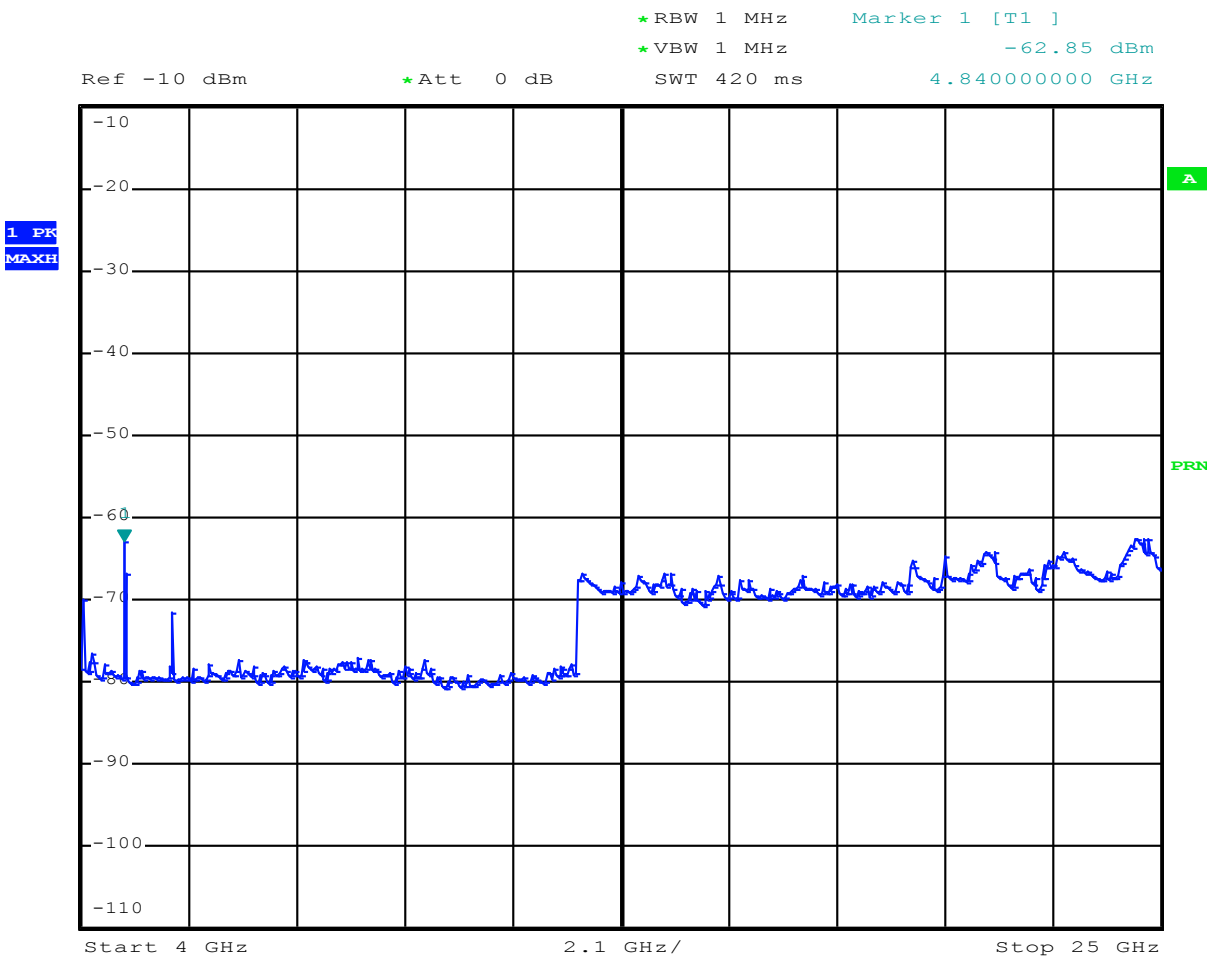
Graph 3.5.7


*RBW 1 MHz
Marker 1 [T1]
*VBW 1 MHz
-61.97 dBm
Ref -10 dBm
*Att 0 dB
SWT 420 ms
4.798000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 13.JUL.2000 23:39:26

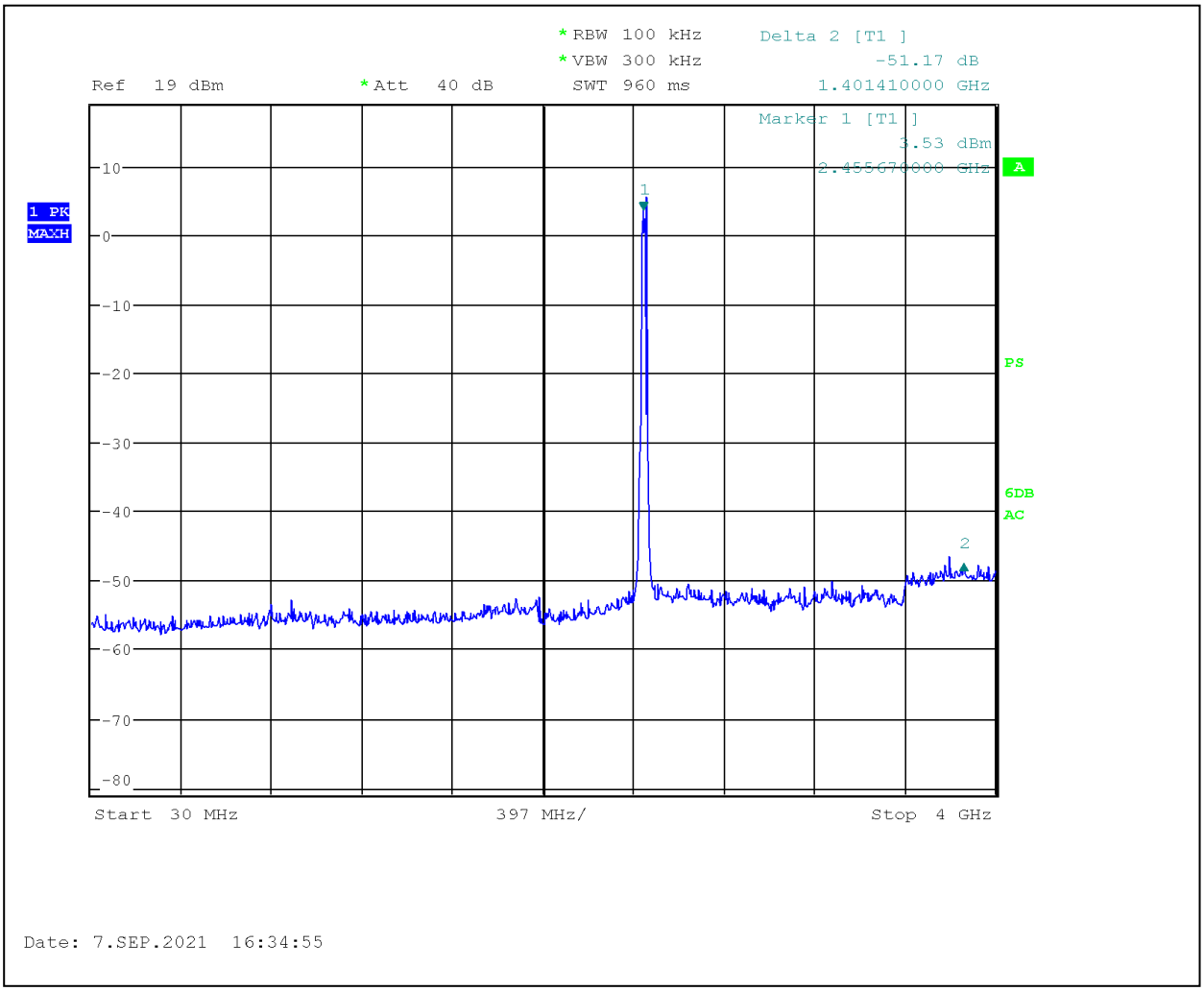
Graph 3.5.8


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-48.84 dB
807.996794872 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
1.41 dBm
2.439790000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:20:03

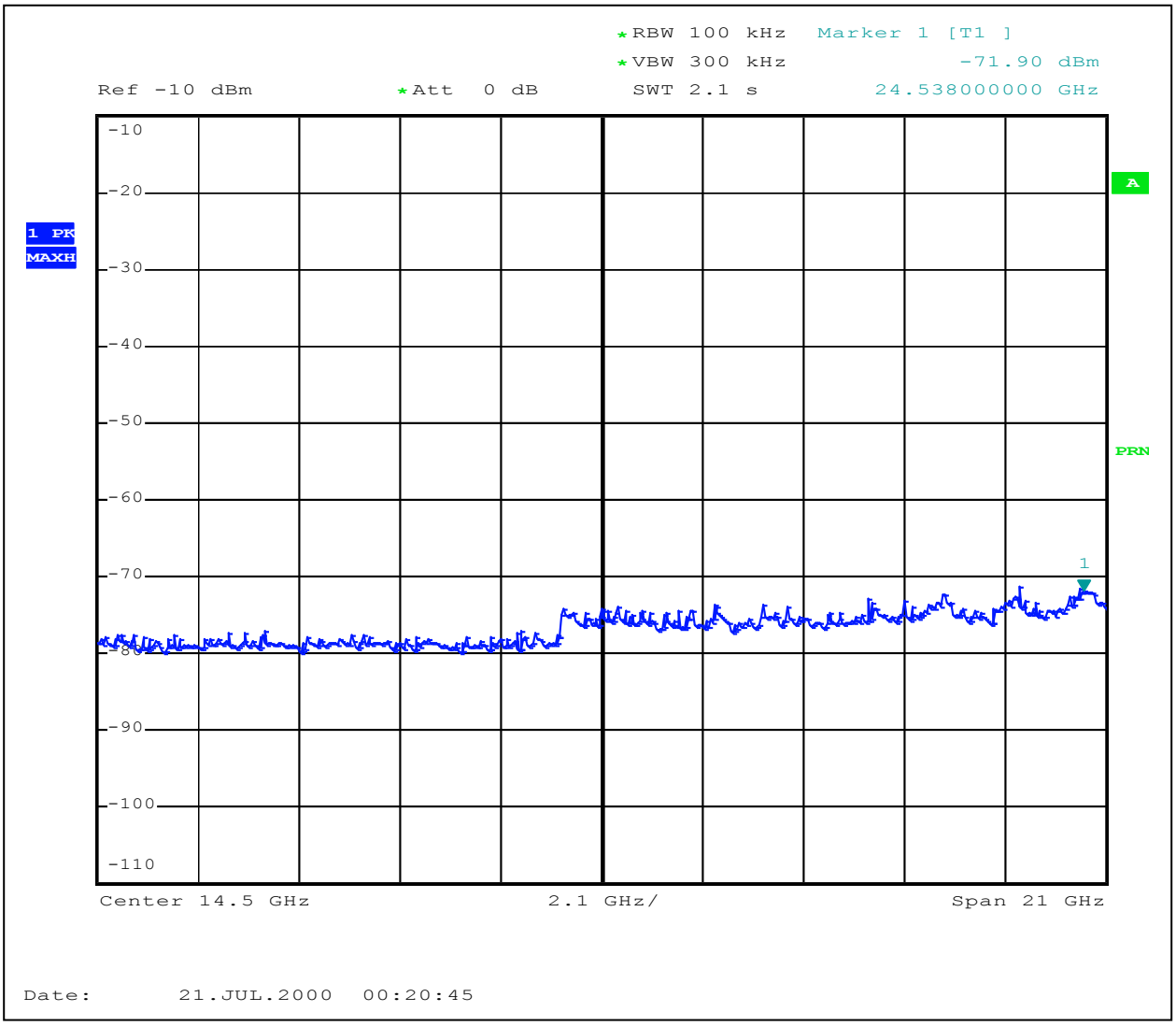
Graph 3.5.9


*RBW 1 MHz
Marker 1 [T1]
*VBW 1 MHz
-62.85 dBm
Ref -10 dBm
*Att 0 dB
SWT 420 ms
4.840000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 13.JUL.2000 23:43:30

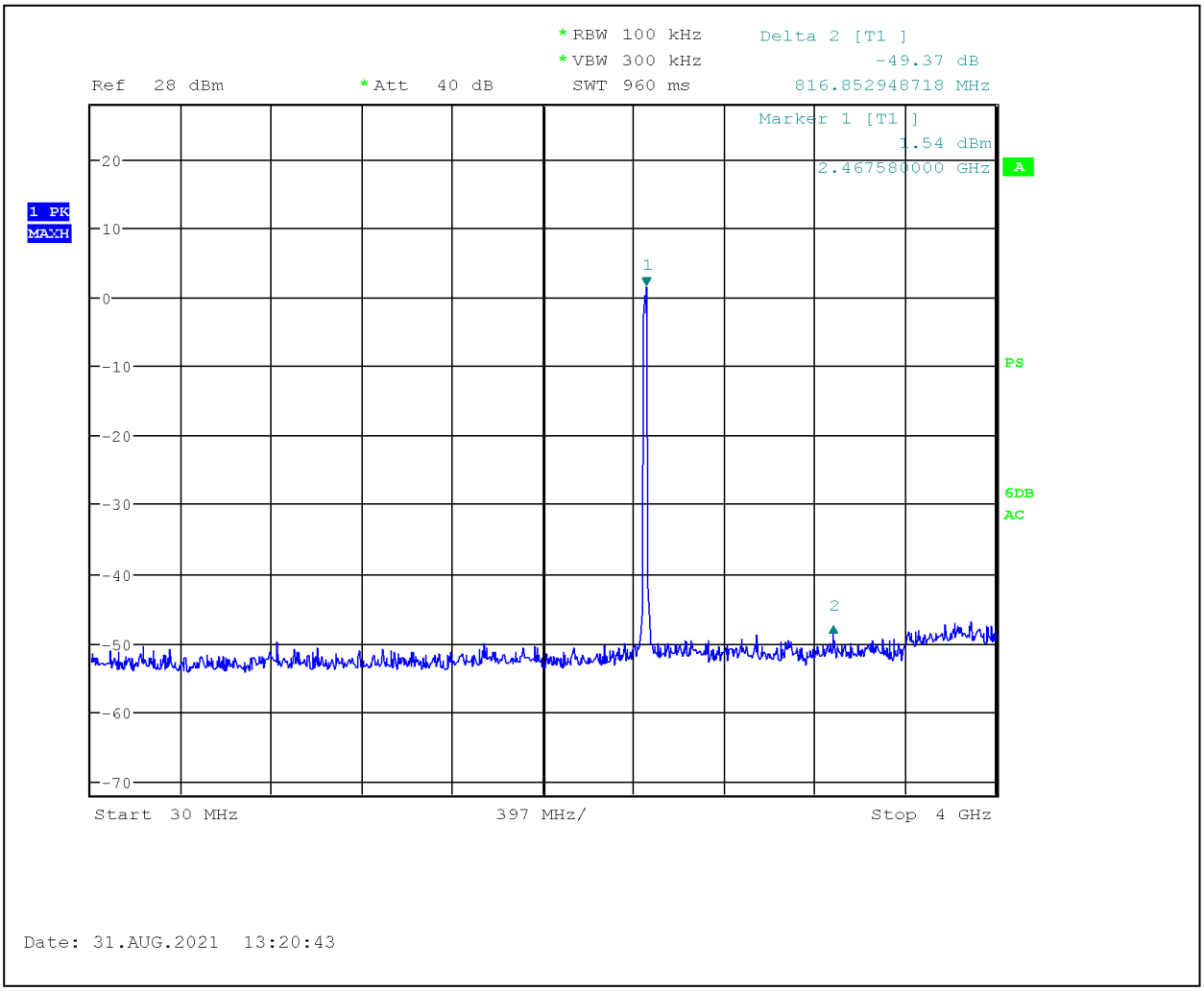
Graph 3.5.10


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-51.17 dB
1.401410000 GHz
Ref 19 dBm
*Att 40 dB
Marker 1 [T1]
3.53 dBm
2.455670000 GHz
1 PK
MAXH
A
PS
6DB
AC
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 7.SEP.2021 16:34:55

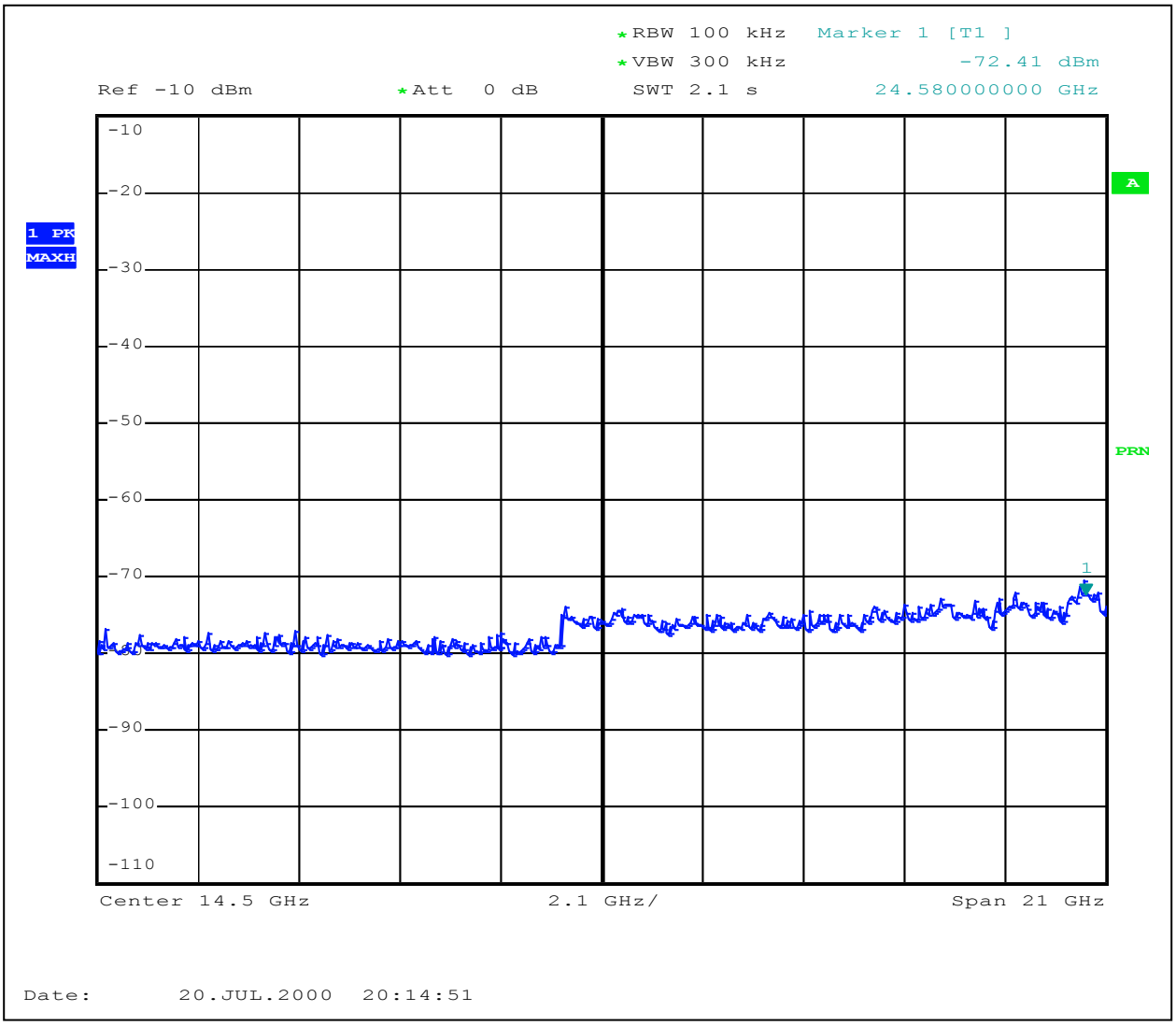
Graph 3.5.11


*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1]
-71.90 dBm
24.538000000 GHz
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 21.JUL.2000 00:20:45

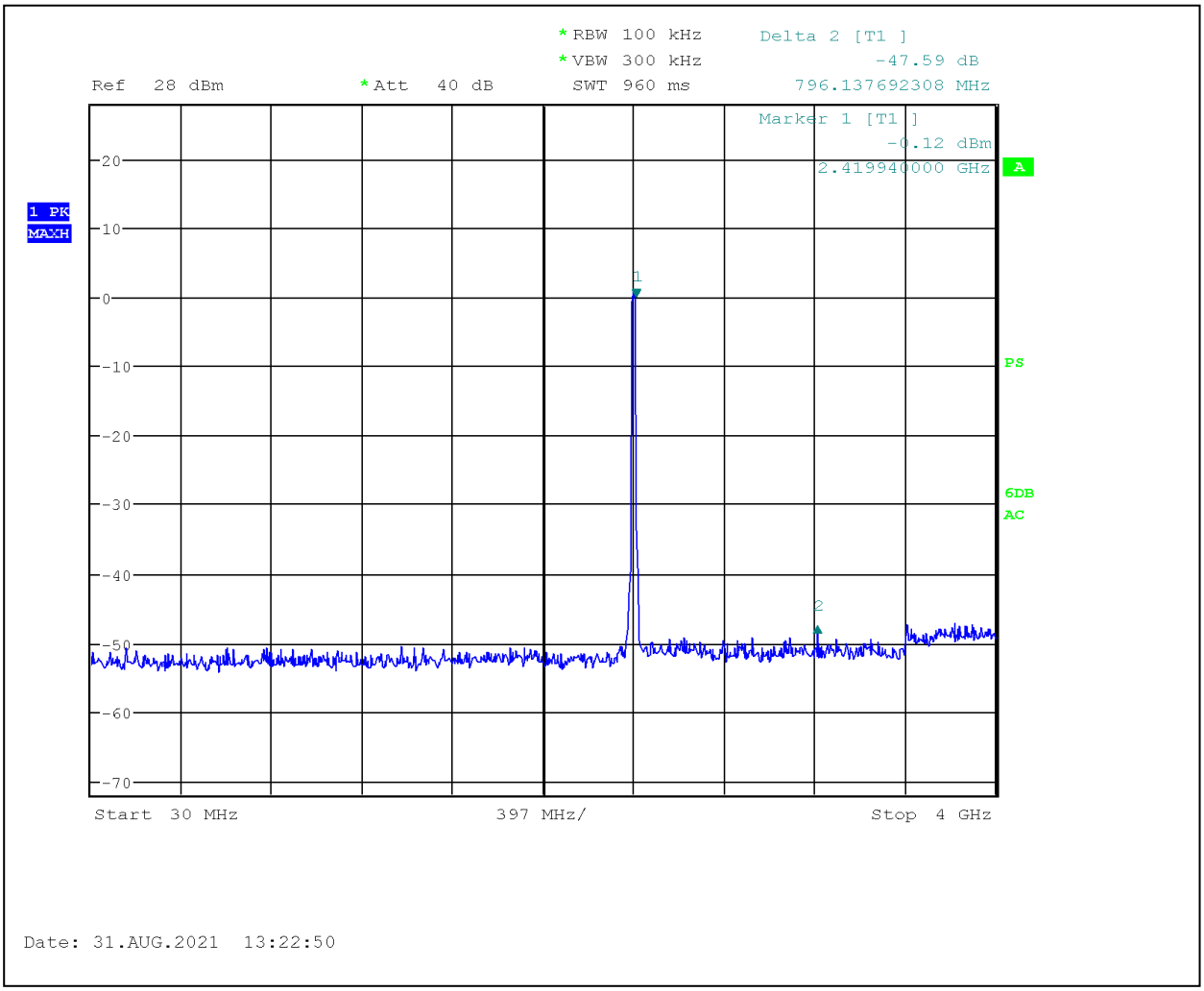
Graph 3.5.12


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-49.37 dB
816.852948718 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
1.54 dBm
2.467580000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:20:43

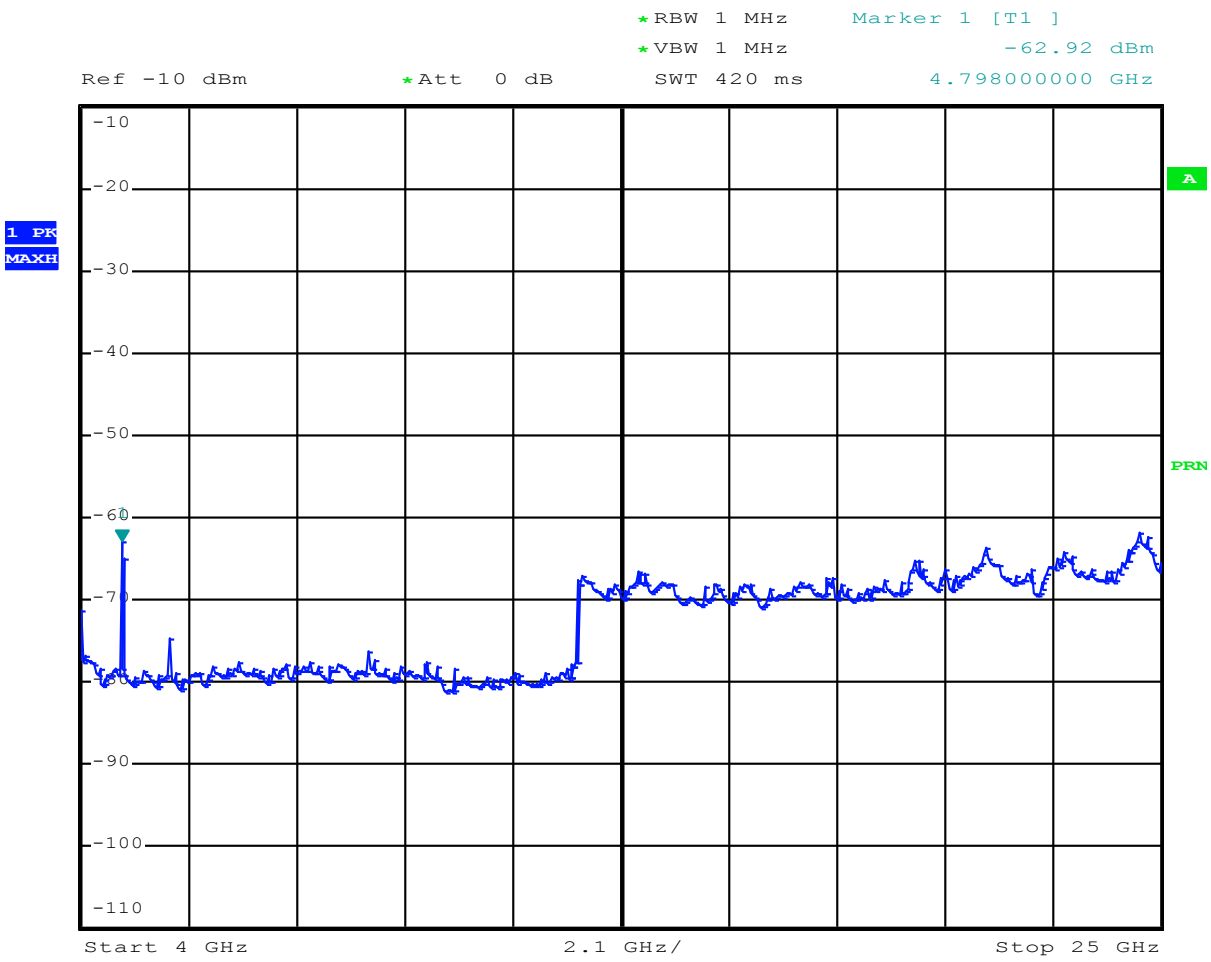
Graph 3.5.13


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-72.41 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
24.580000000 GHz
-10
-20
-30
-40
-50
-60
-70
-90
-100
-110
1 PK
MAXH
A
PRN
1
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:14:51

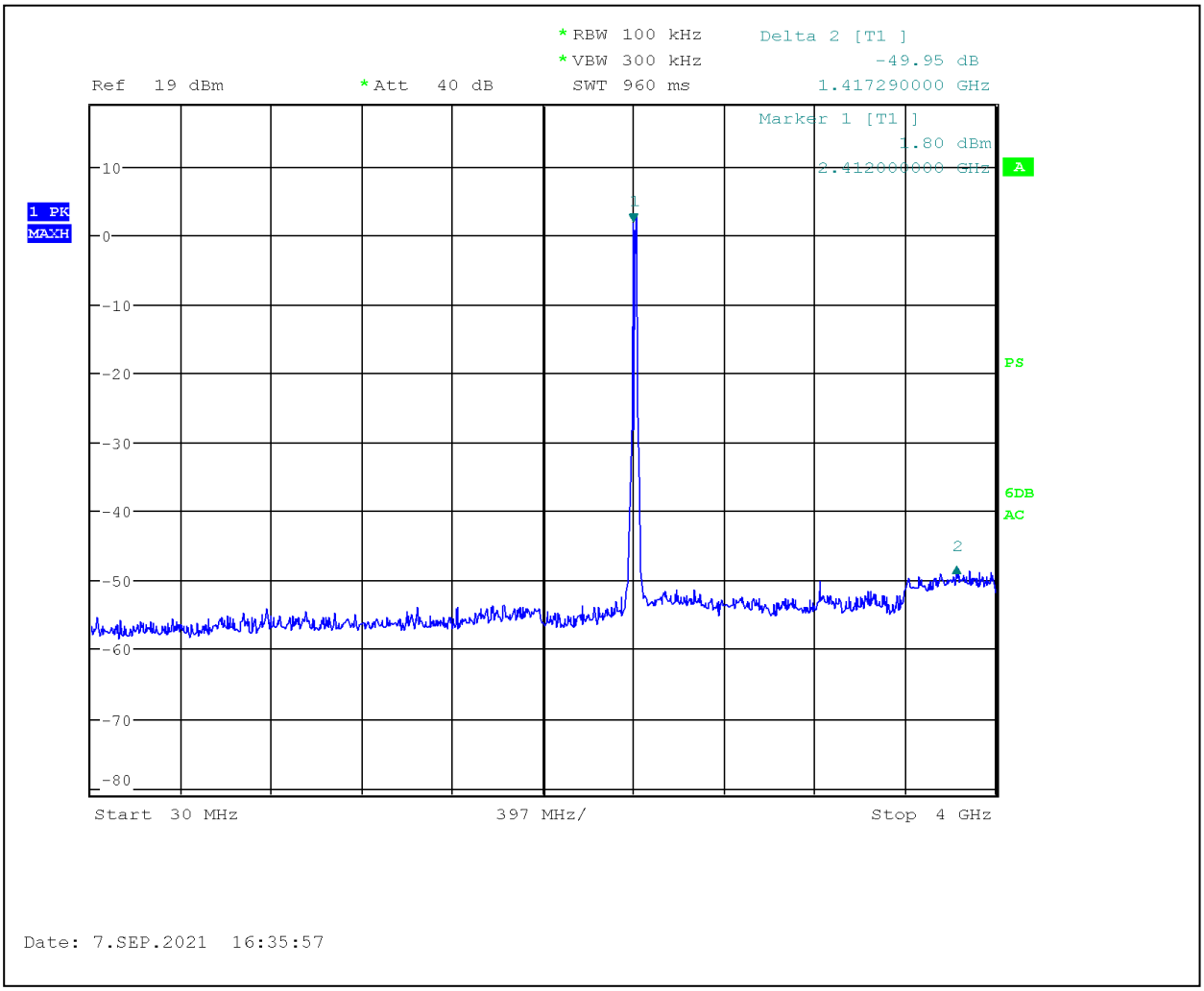
Graph 3.5.14


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-47.59 dB
796.137692308 MHz
Marker 1 [T1]
-0.12 dBm
2.419940000 GHz
Ref 28 dBm
*Att 40 dB
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:22:50

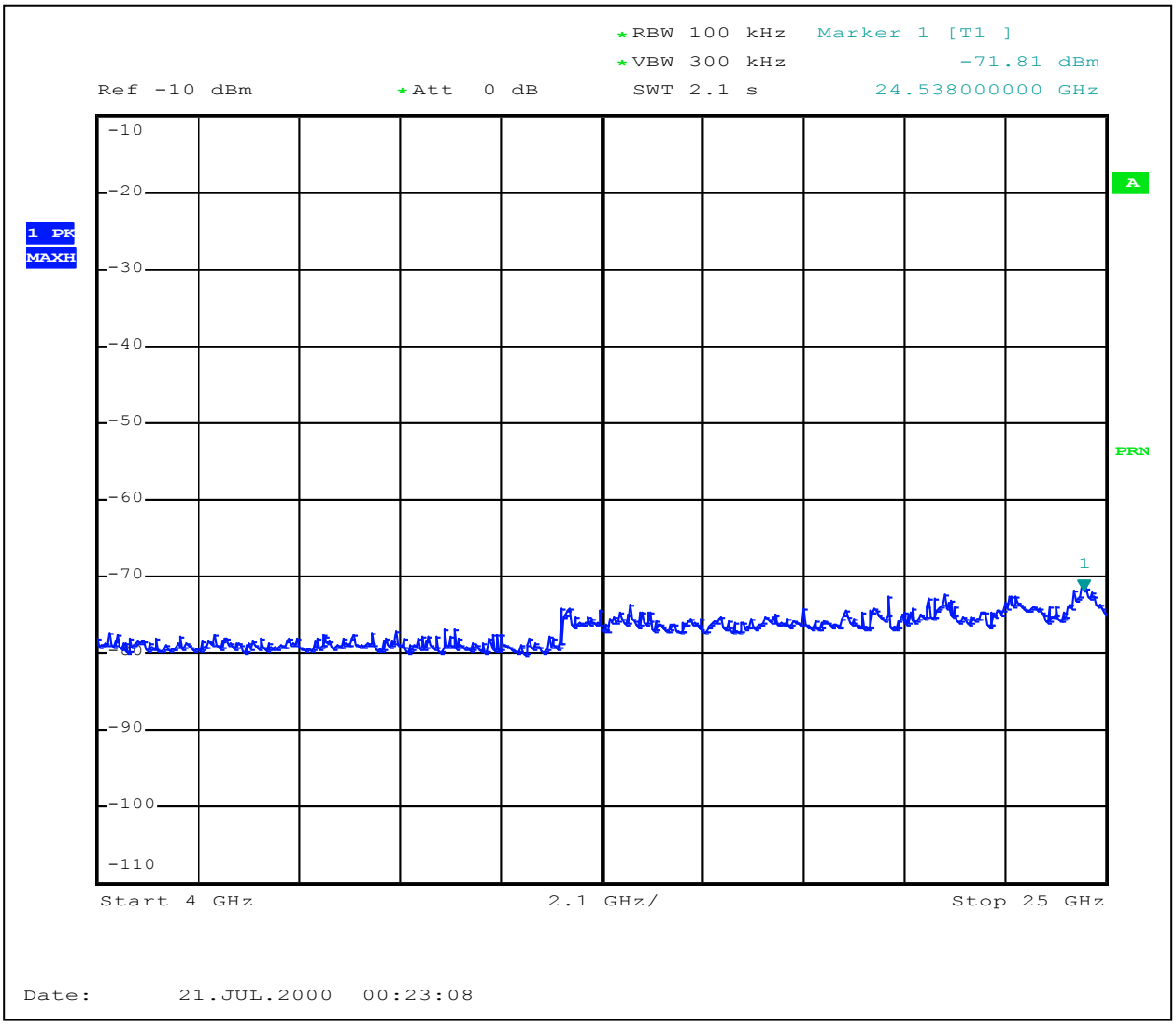
Graph 3.5.15


*RBW 1 MHz
Marker 1 [T1]
*VBW 1 MHz
-62.92 dBm
Ref -10 dBm
*Att 0 dB
SWT 420 ms
4.798000000 GHz
1 PK
MAXH
A
PRN
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 13.JUL.2000 23:46:14

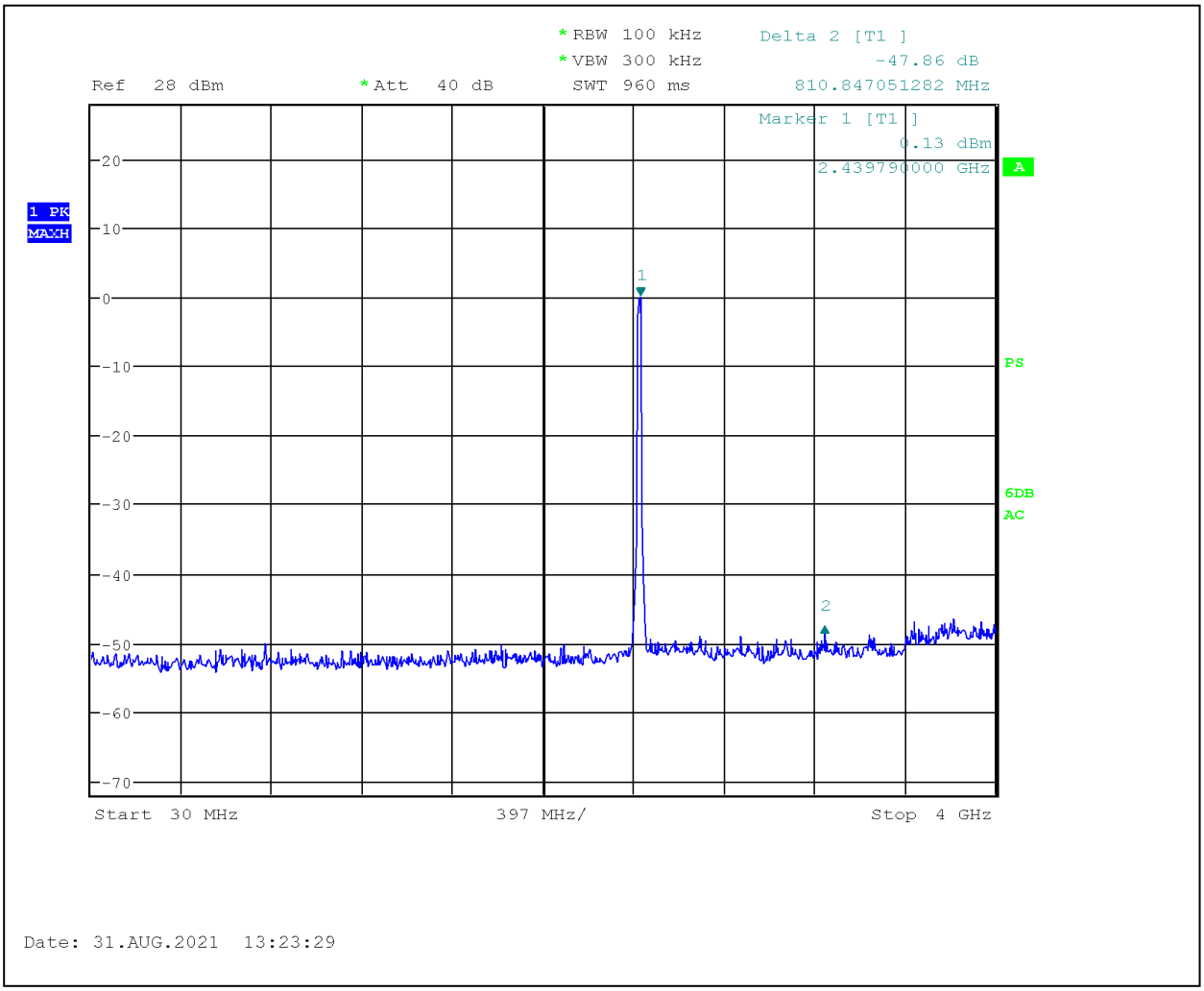
Graph 3.5.16


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-49.95 dB
1.417290000 GHz
Ref 19 dBm
*Att 40 dB
Marker 1 [T1]
1.80 dBm
2.412000000 GHz
1 PK
MAXH
A
PS
6DB
AC
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 7.SEP.2021 16:35:57

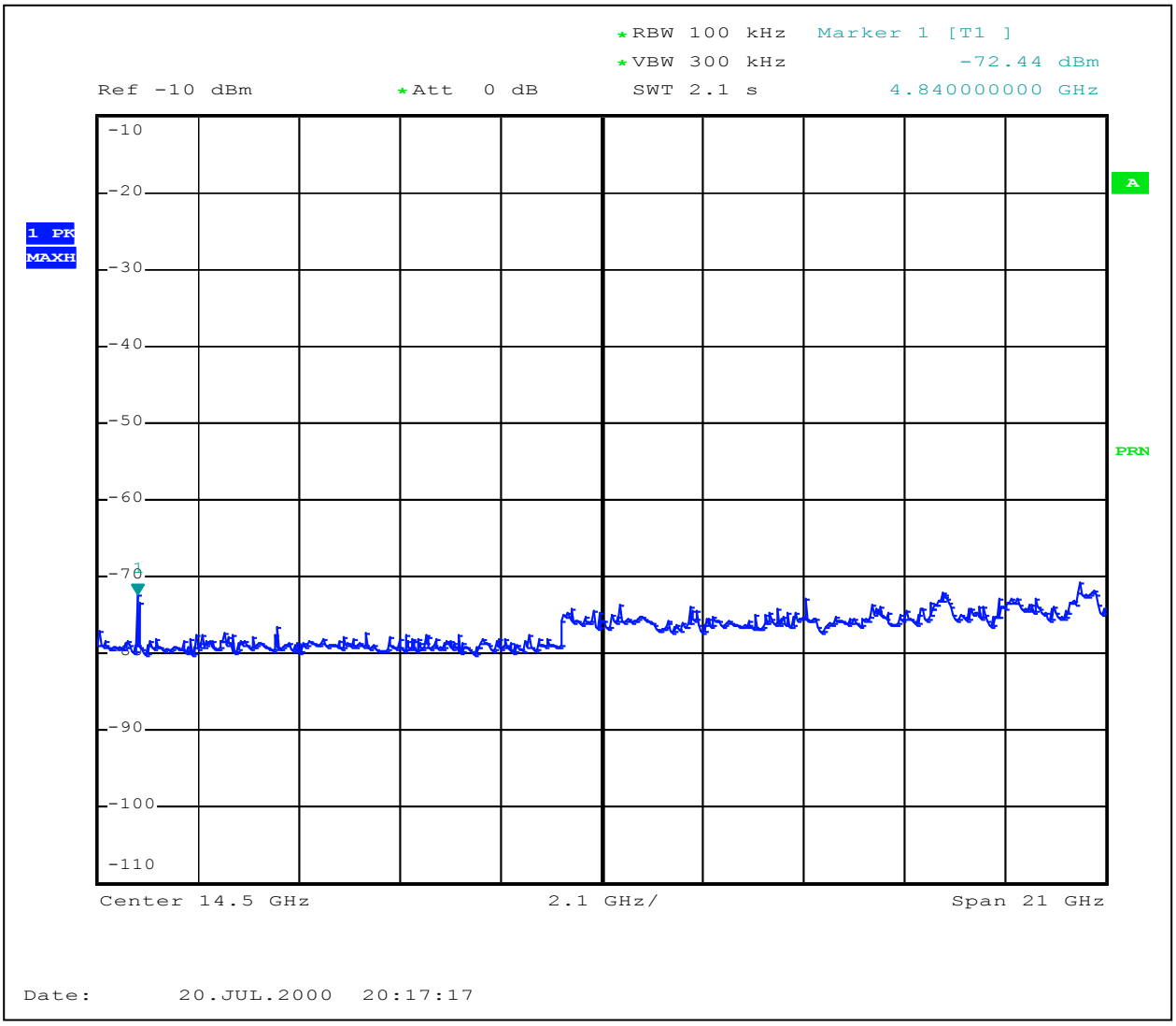
Graph 3.5.17


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-71.81 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
24.538000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 21.JUL.2000 00:23:08

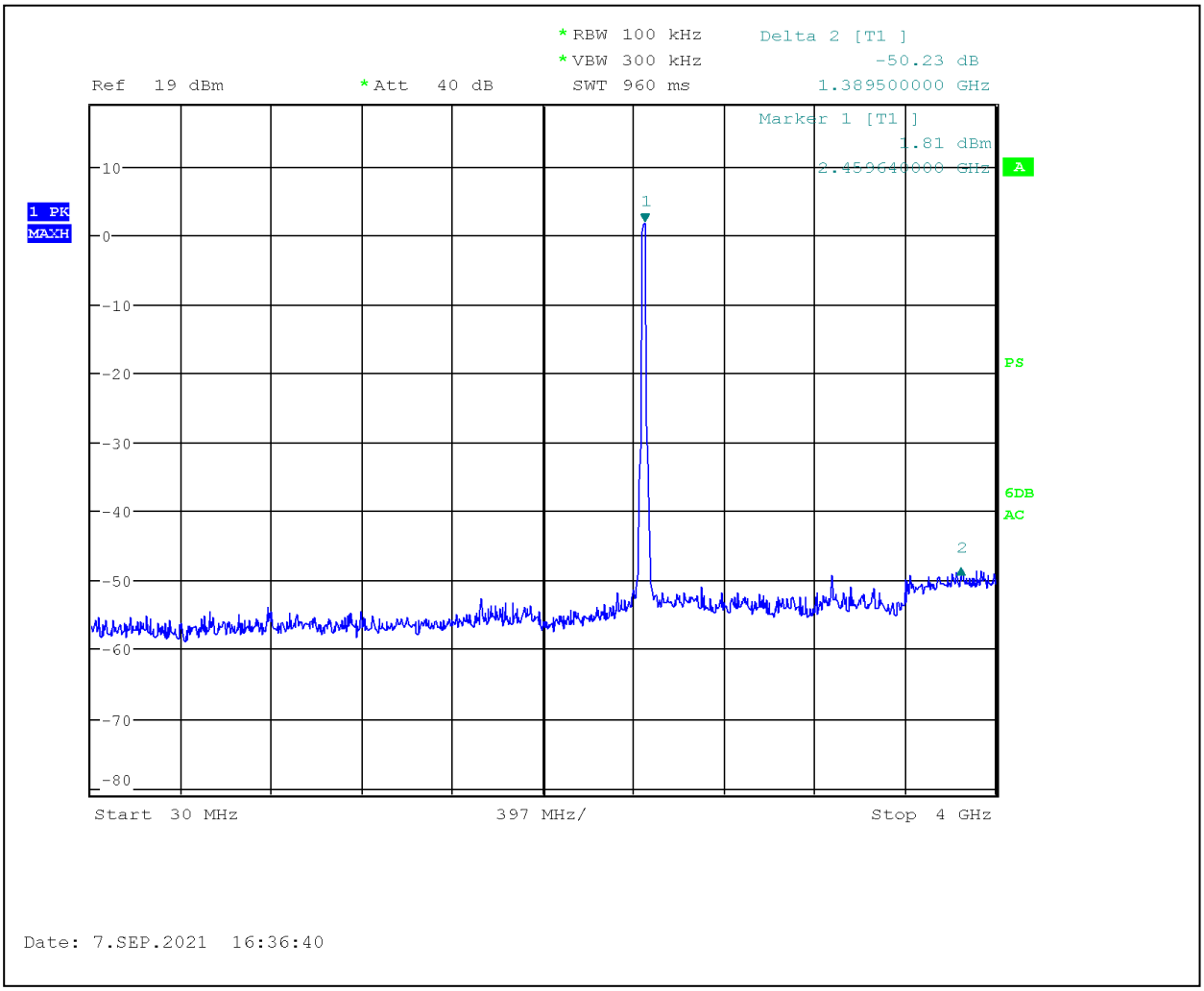
Graph 3.5.18


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-47.86 dB
810.847051282 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
0.13 dBm
2.439790000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:23:29

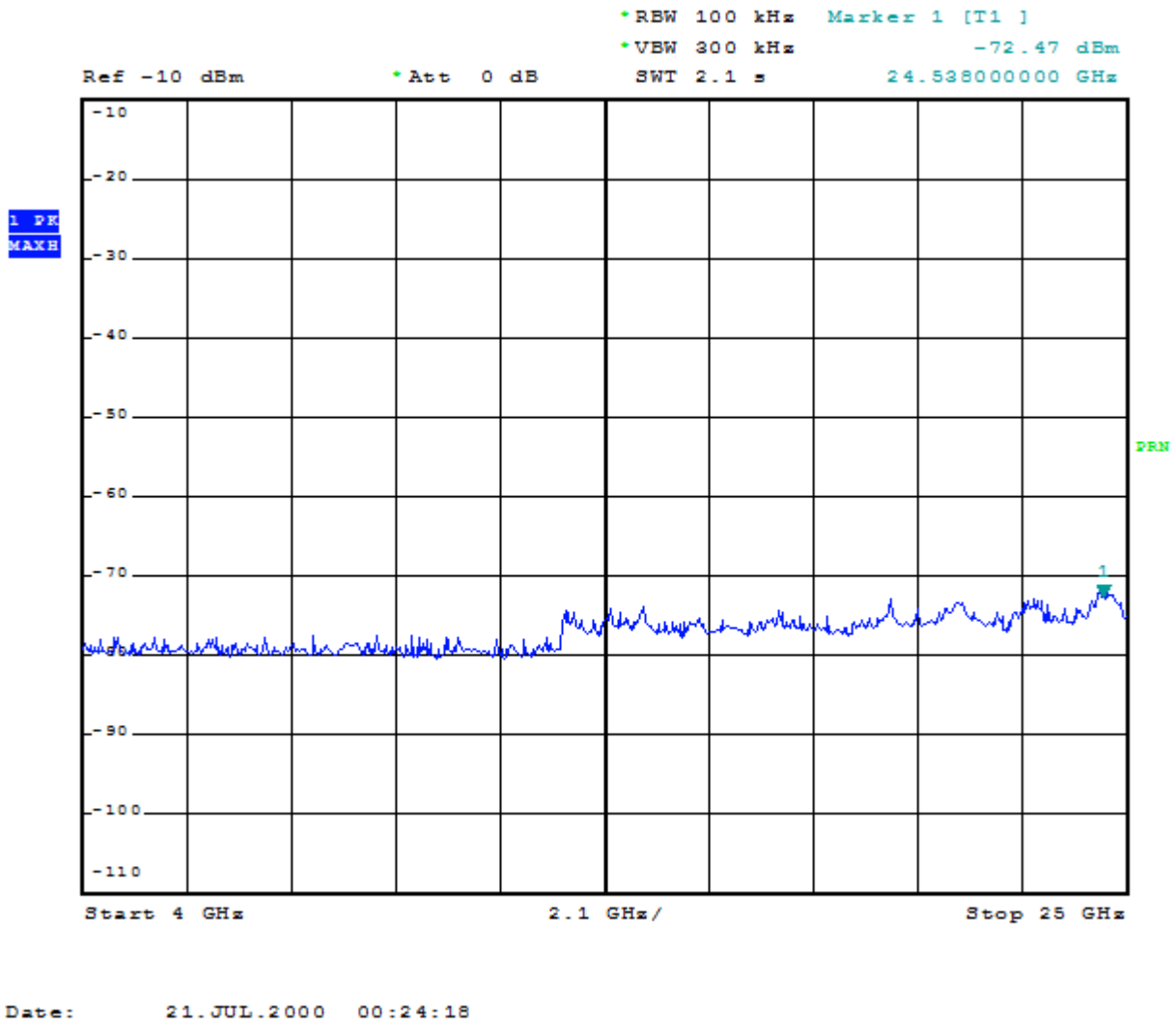
Graph 3.5.19


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-72.44 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
4.840000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:17:17

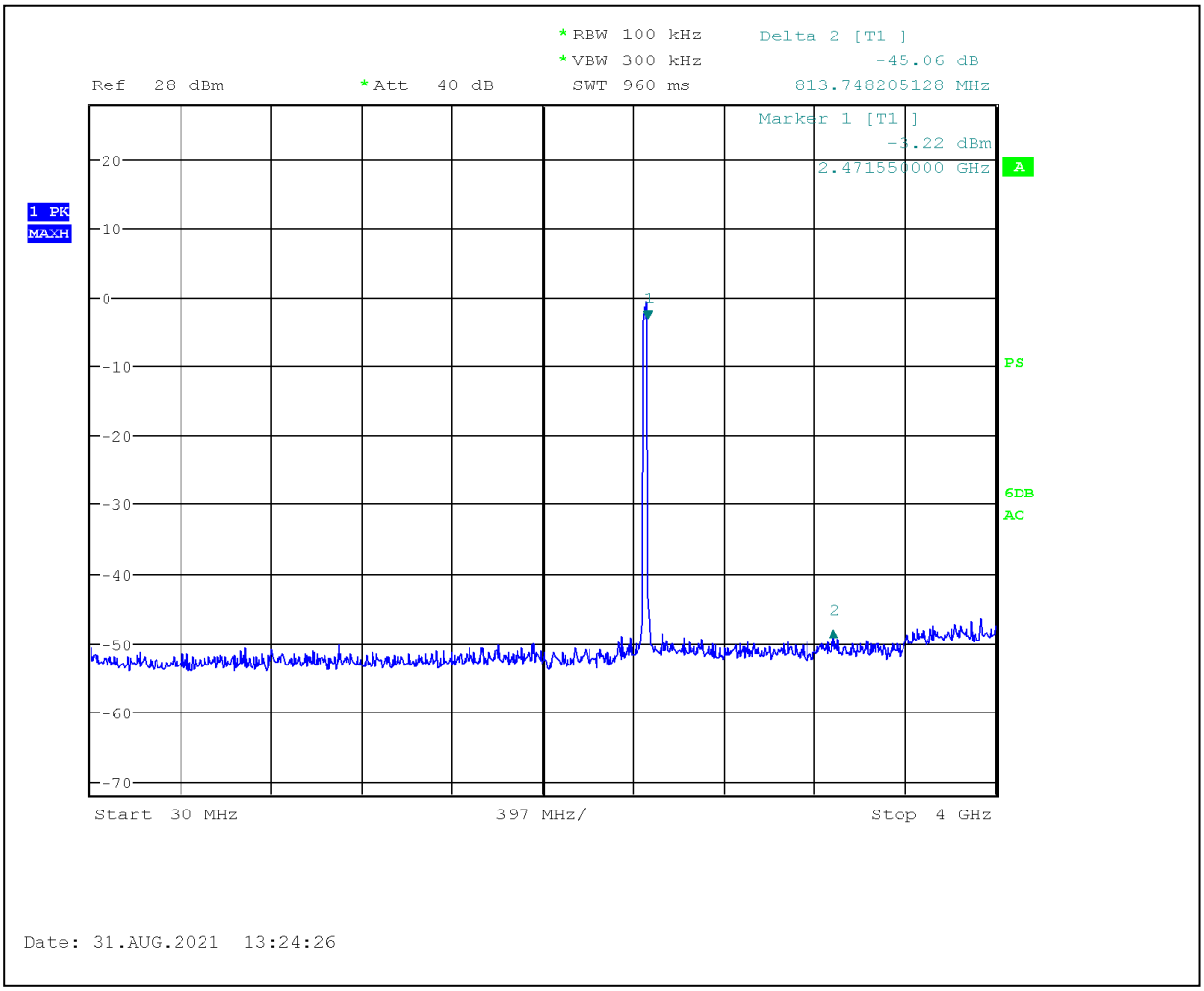
Graph 3.5.20


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-50.23 dB
1.389500000 GHz
Marker 1 [T1]
1.81 dBm
2.459640000 GHz
Ref 19 dBm
*Att 40 dB
1 PK
MAXH
A
PS
6DB
AC
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 7.SEP.2021 16:36:40

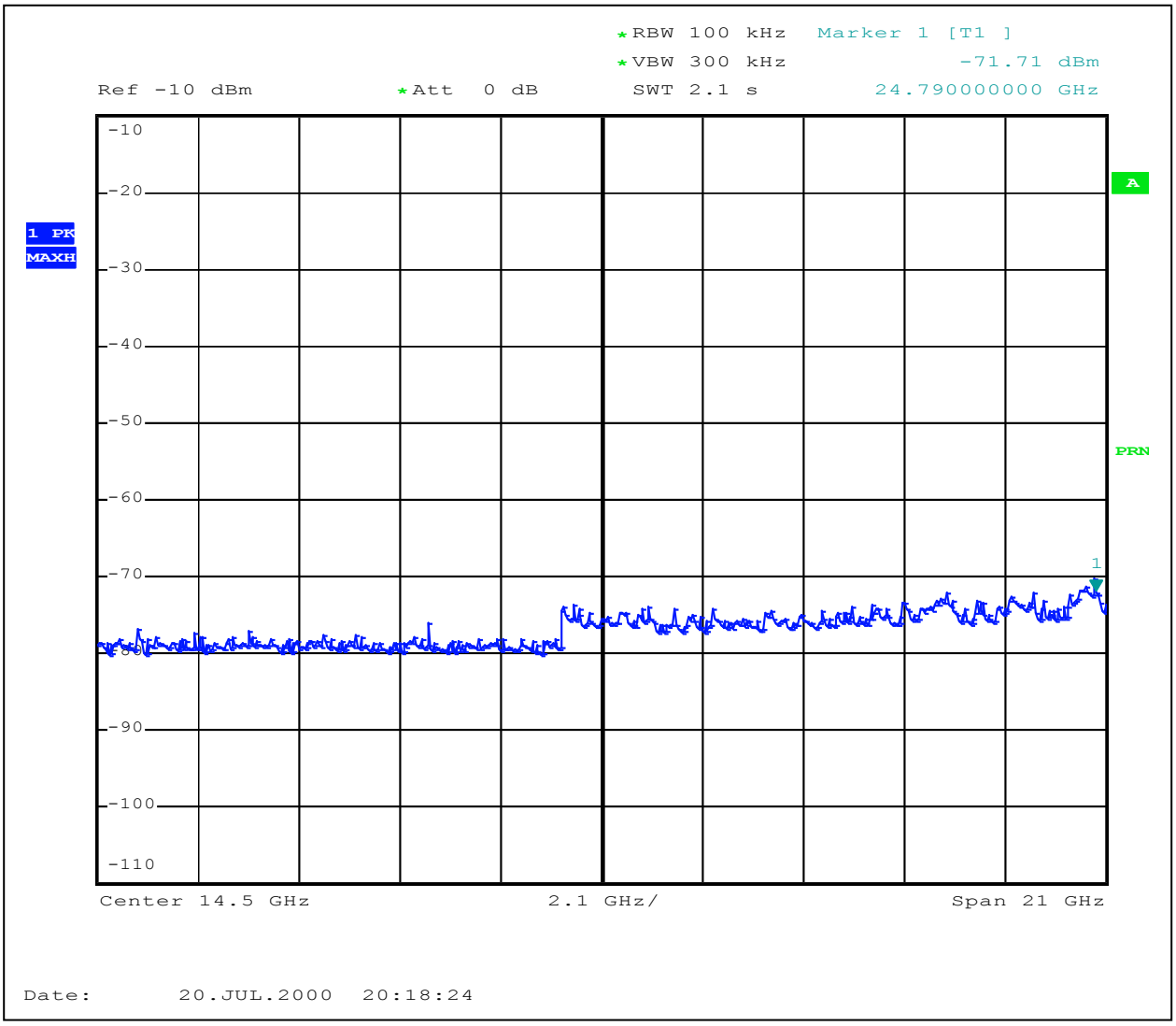
Graph 3.5.21


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-72.47 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
24.538000000 GHz
1 PK
MAXH
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
PRN
1
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 21.JUL.2000 00:24:18

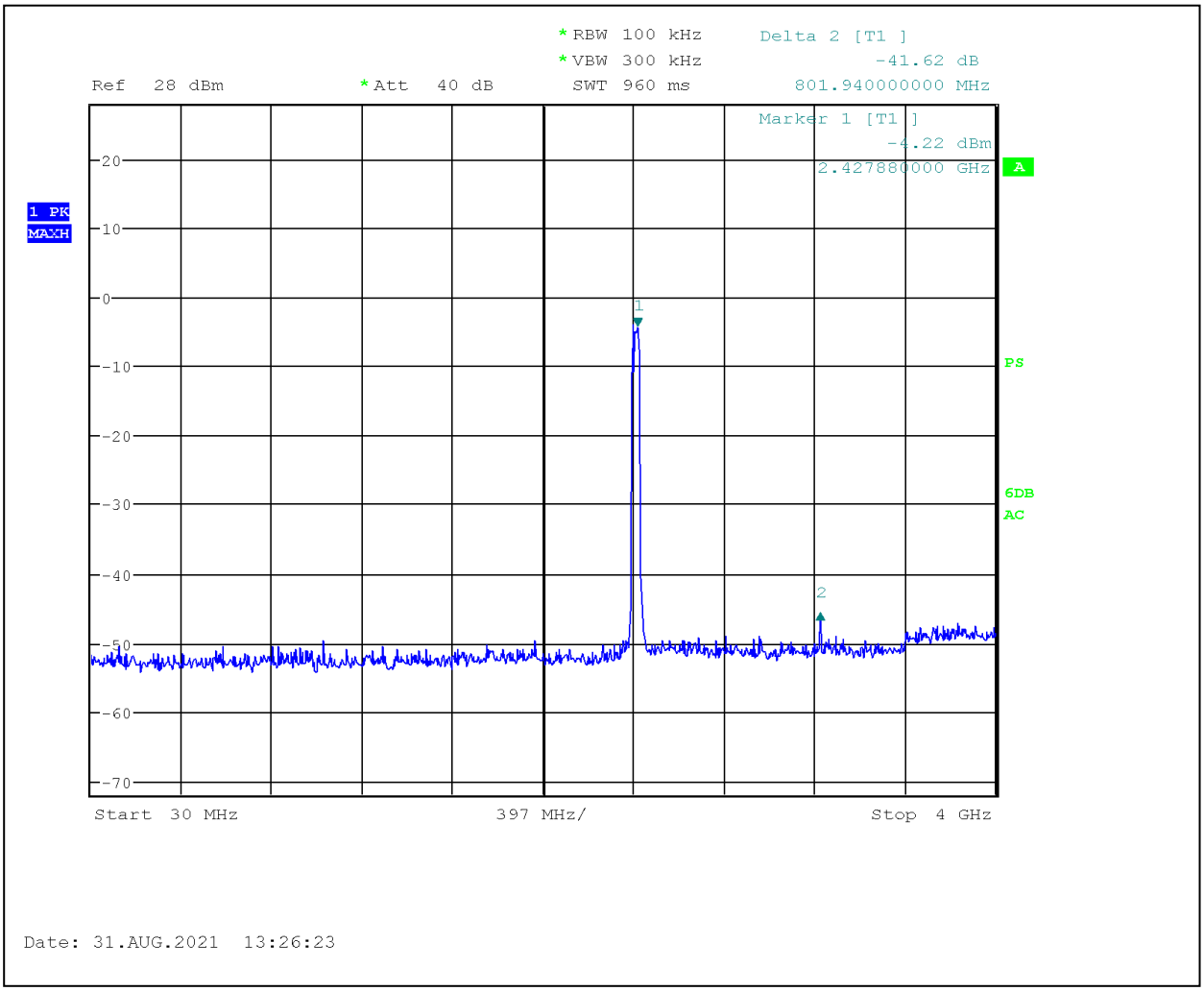
Graph 3.5.22


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-45.06 dB
813.748205128 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
-3.22 dBm
2.471550000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:24:26

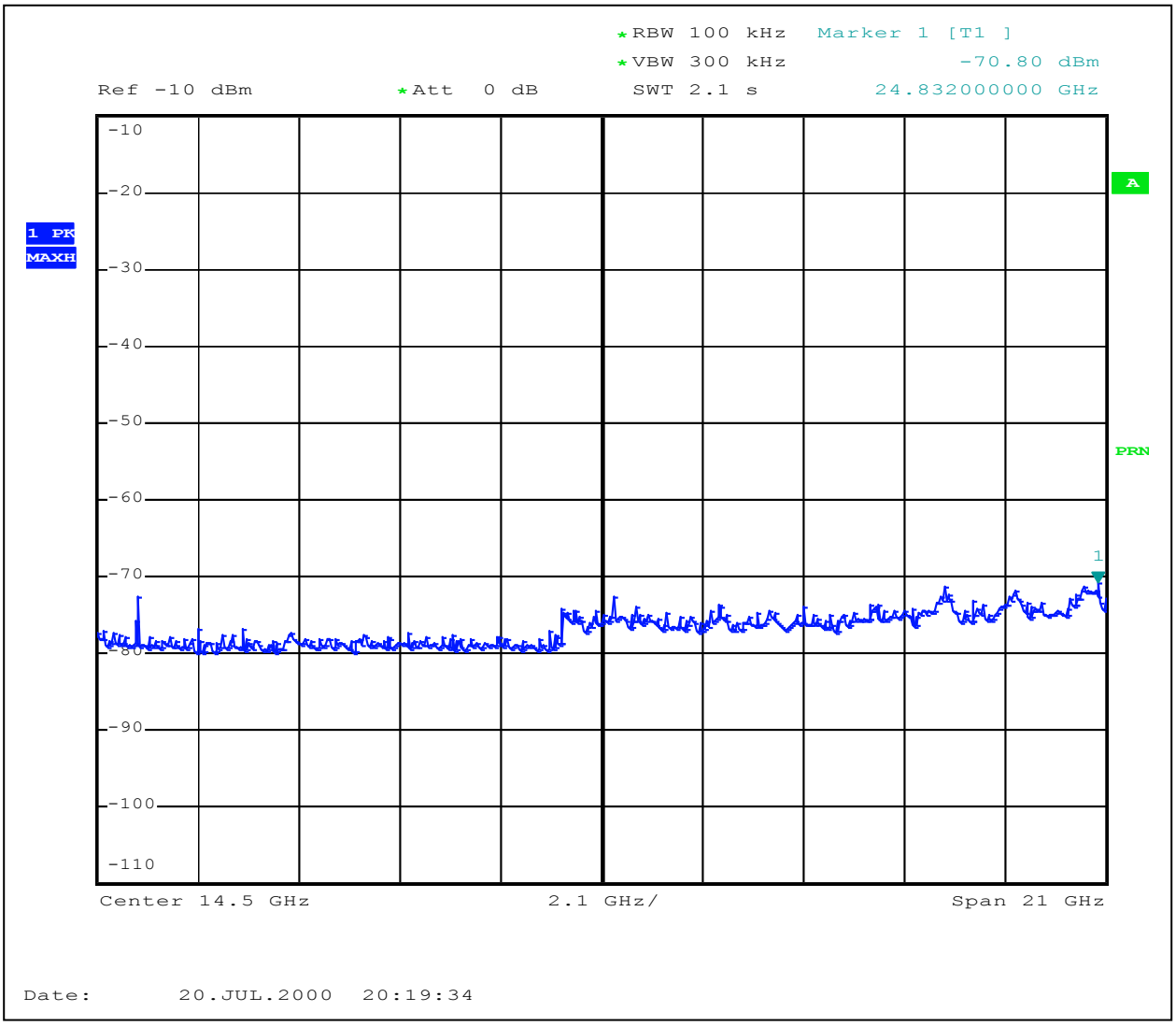
Graph 3.5.23


*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1]
-71.71 dBm
24.790000000 GHz
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:18:24

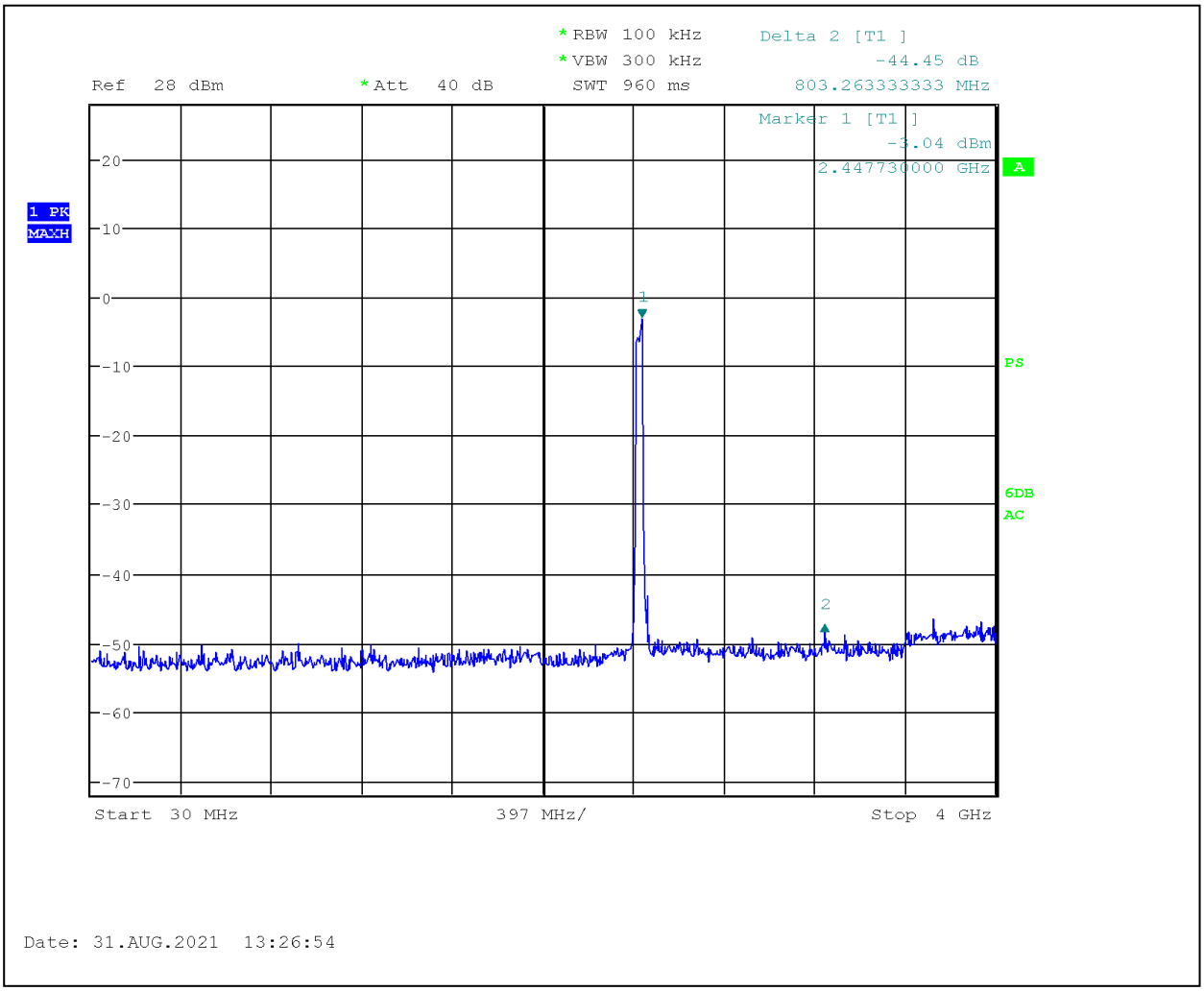
Graph 3.5.24


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-41.62 dB
801.940000000 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
-4.22 dBm
2.427880000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:26:23

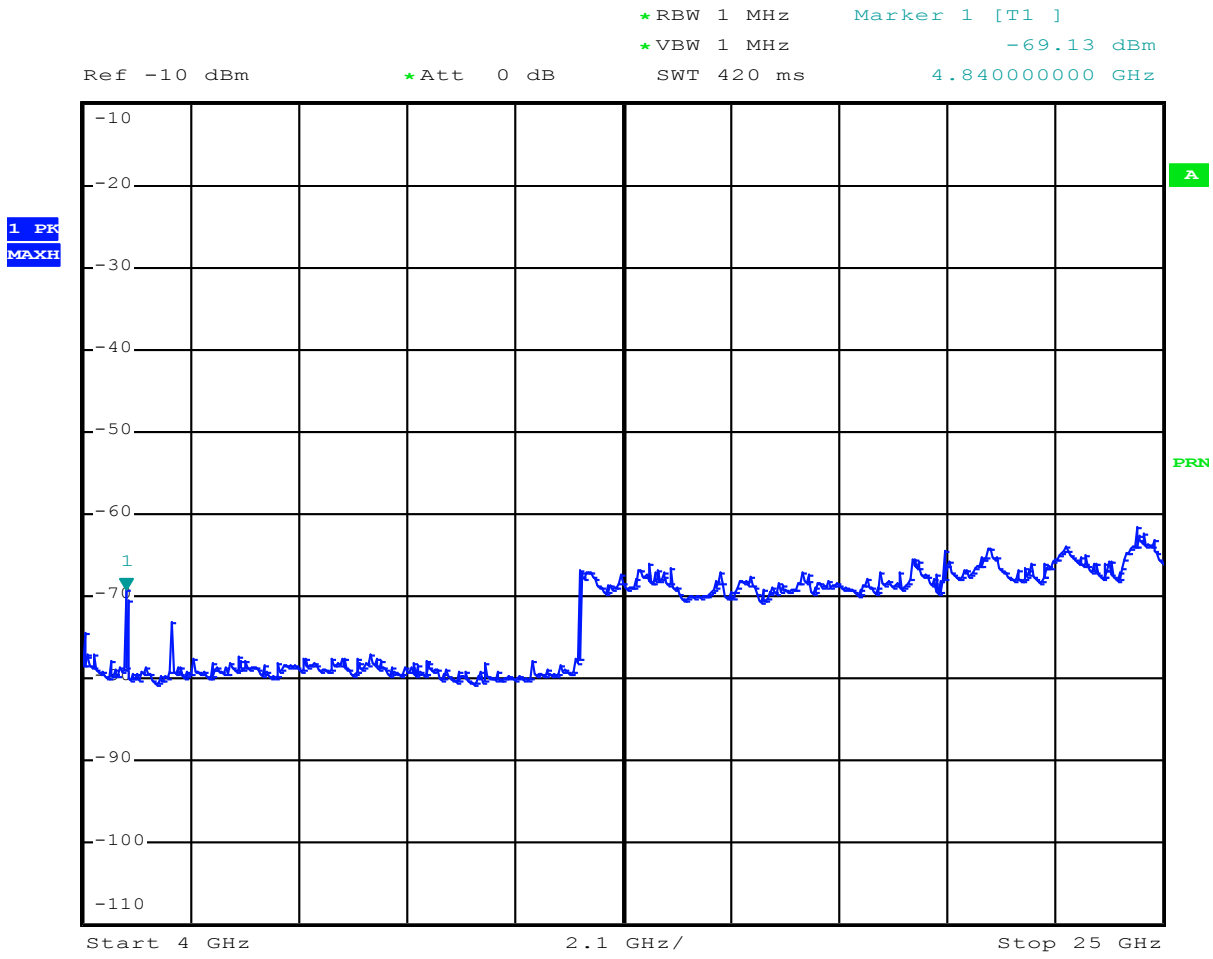
Graph 3.5.25


*RBW 100 kHz
*VBW 300 kHz
Marker 1 [T1]
-70.80 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
24.832000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Center 14.5 GHz
2.1 GHz/
Span 21 GHz
Date: 20.JUL.2000 20:19:34

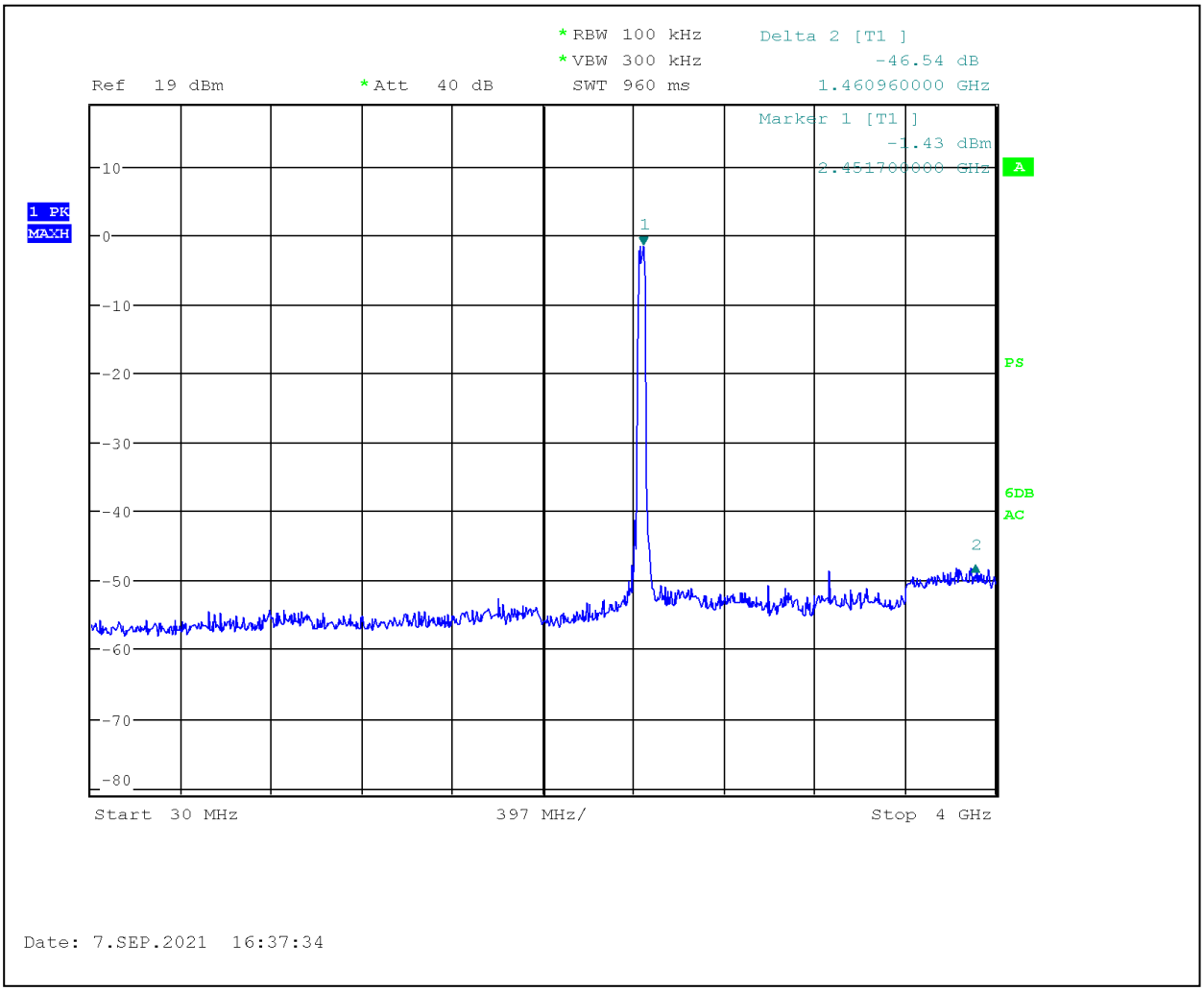
Graph 3.5.26


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-44.45 dB
803.263333333 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
-3.04 dBm
2.447730000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:26:54

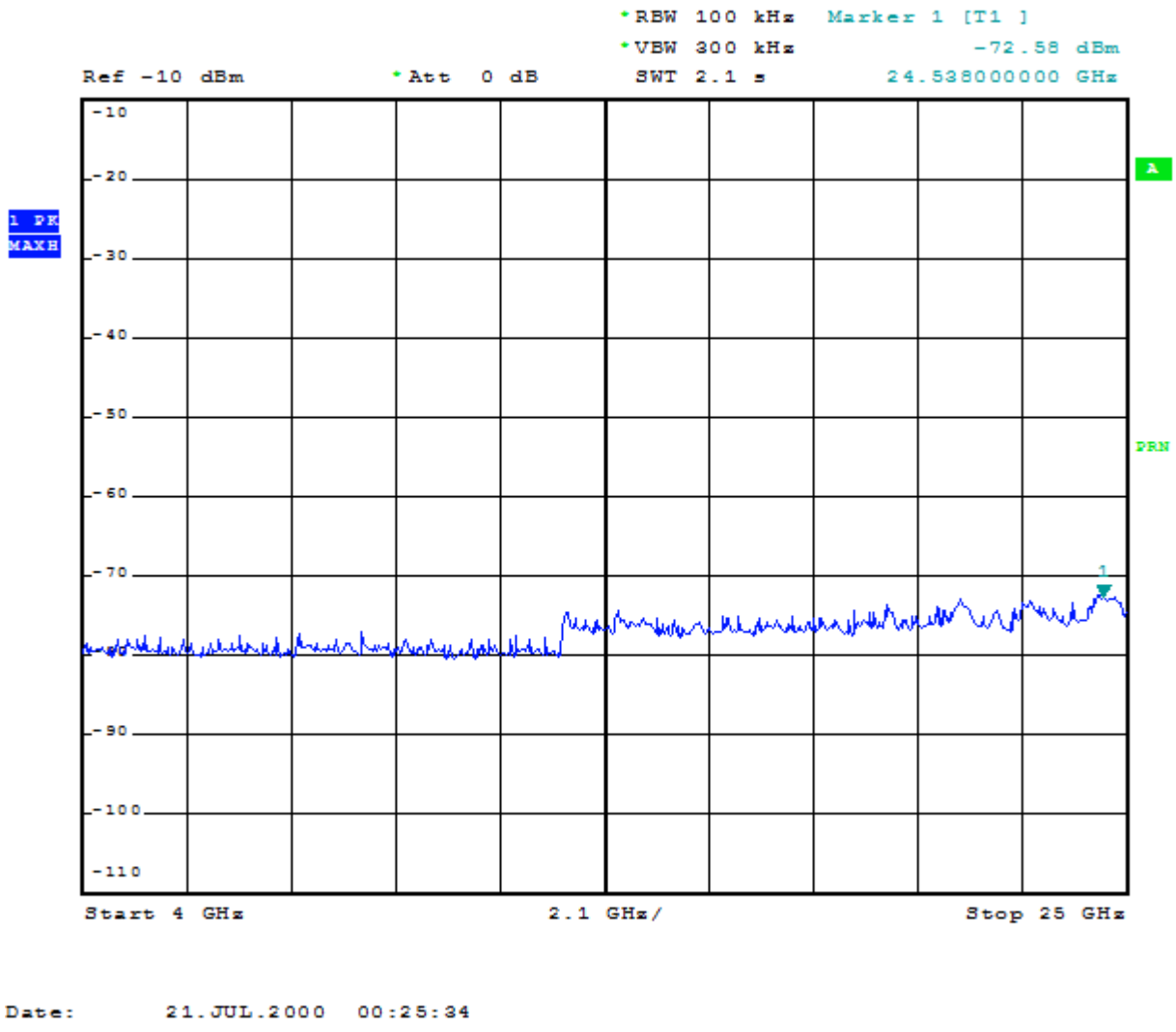
Graph 3.5.27


*RBW 1 MHz
Marker 1 [T1]
*VBW 1 MHz
-69.13 dBm
Ref -10 dBm
*Att 0 dB
SWT 420 ms
4.840000000 GHz
-10
-20
-30
-40
-50
-60
-70
-90
-100
-110
1 PK
MAXH
A
PRN
1
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 13.JUL.2000 23:54:56

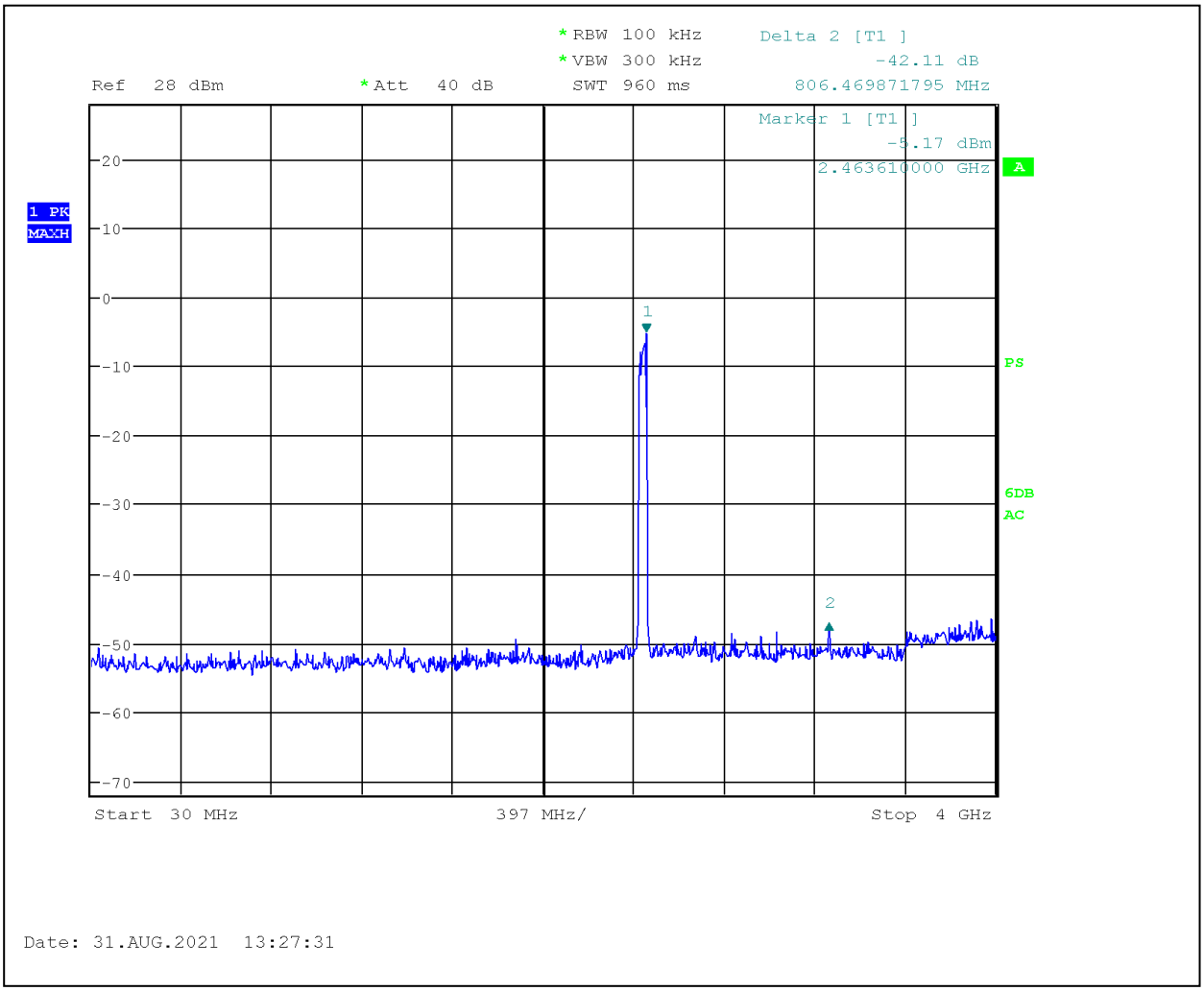
Graph 3.5.28


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-46.54 dB
1.460960000 GHz
Marker 1 [T1]
-1.43 dBm
2.451700000 GHz
Ref 19 dBm
*Att 40 dB
1 PK
MAXH
A
PS
6DB
AC
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 7.SEP.2021 16:37:34

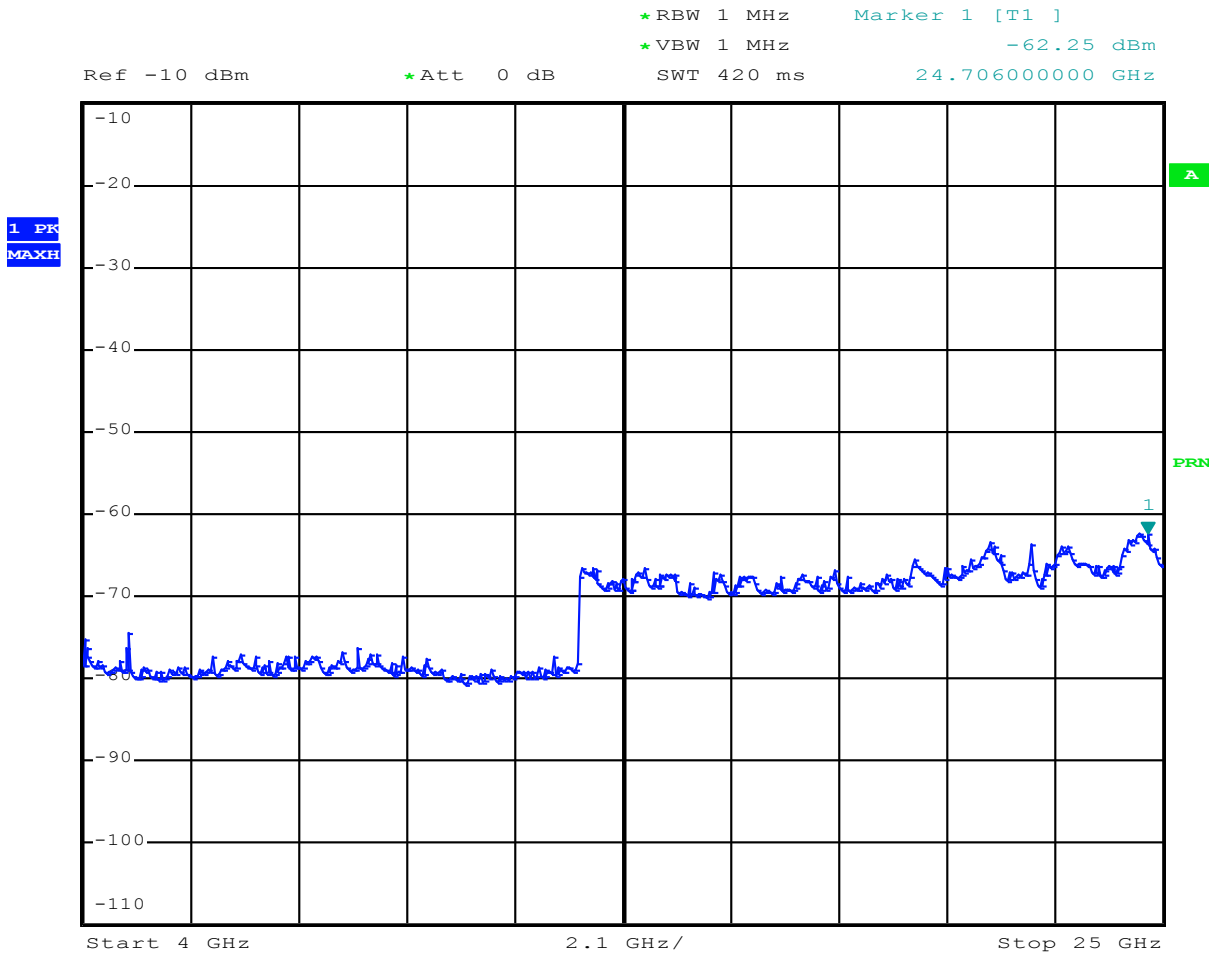
Graph 3.5.29


*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-72.58 dBm
Ref -10 dBm
*Att 0 dB
SWT 2.1 s
24.538000000 GHz
-10
-20
-30
-40
-50
-60
-70
-90
-100
-110
1 PK
MAXH
A
PRN
1
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 21.JUL.2000 00:25:34

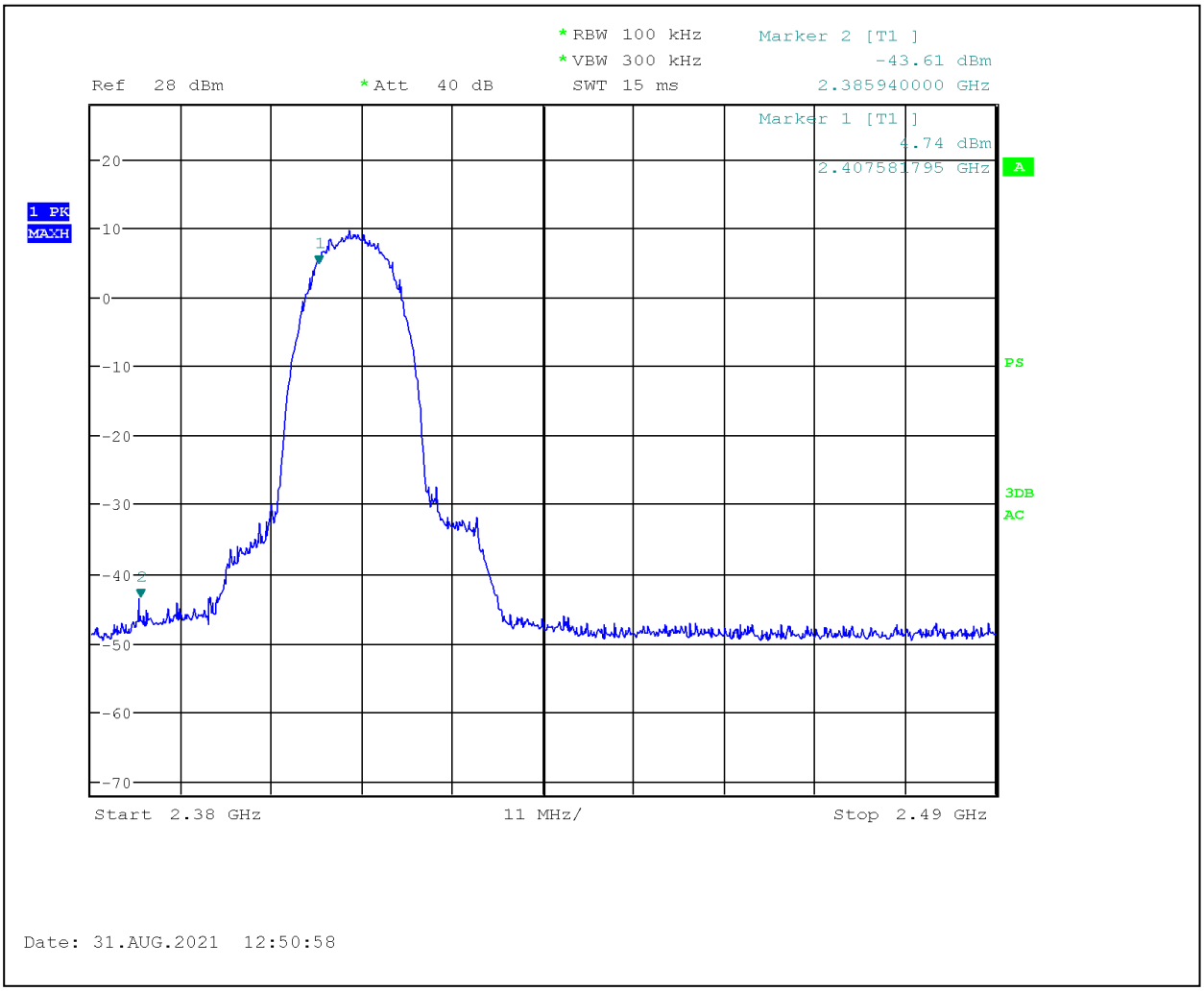
Graph 3.5.30


*RBW 100 kHz
*VBW 300 kHz
SWT 960 ms
Delta 2 [T1]
-42.11 dB
806.469871795 MHz
Ref 28 dBm
*Att 40 dB
Marker 1 [T1]
-5.17 dBm
2.463610000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
397 MHz/
Stop 4 GHz
Date: 31.AUG.2021 13:27:31

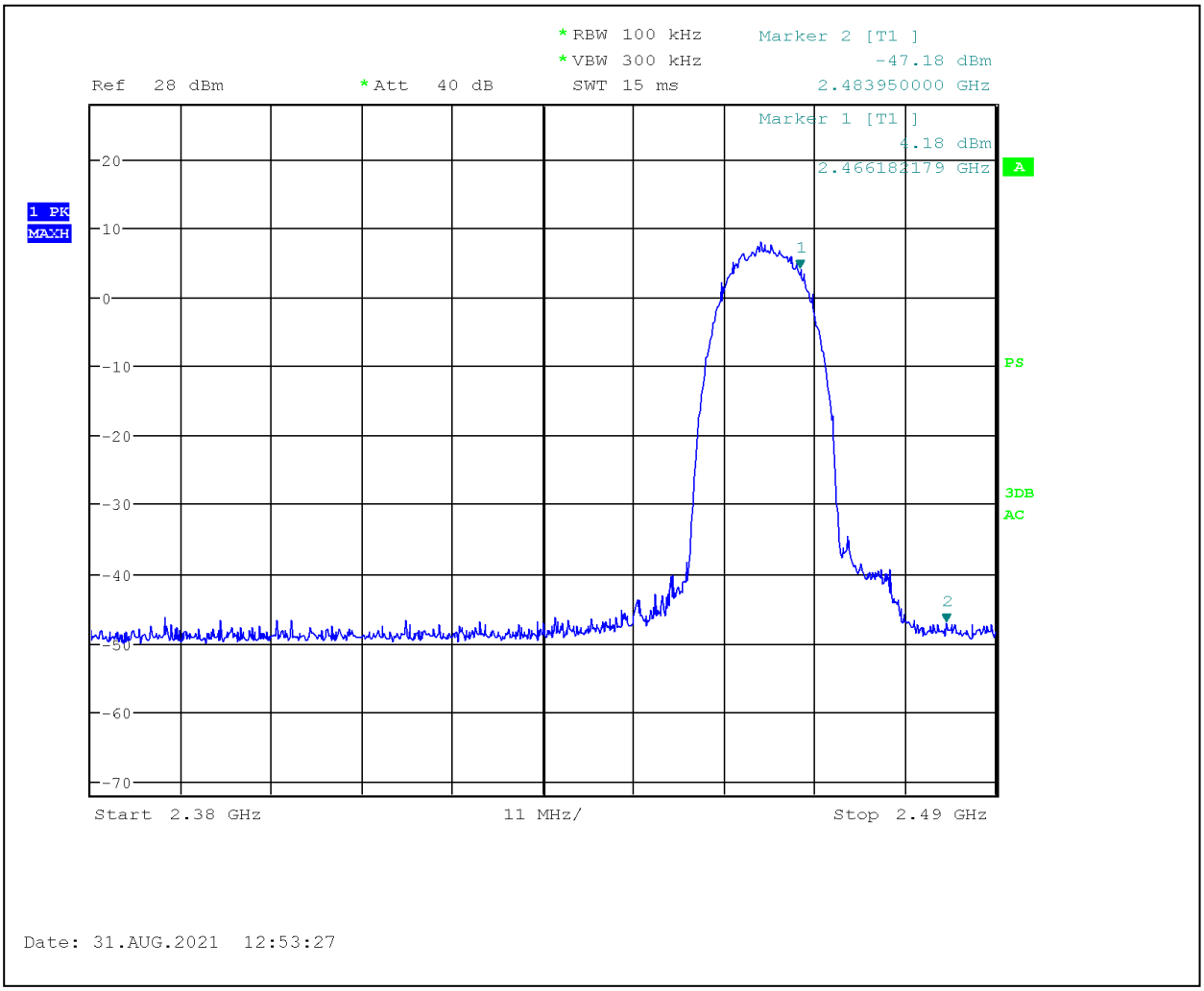
Graph 3.5.31


*RBW 1 MHz
Marker 1 [T1]
*VBW 1 MHz
-62.25 dBm
Ref -10 dBm
*Att 0 dB
SWT 420 ms
24.706000000 GHz
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
1 PK
MAXH
A
PRN
1
Start 4 GHz
2.1 GHz/
Stop 25 GHz
Date: 13.JUL.2000 23:56:09

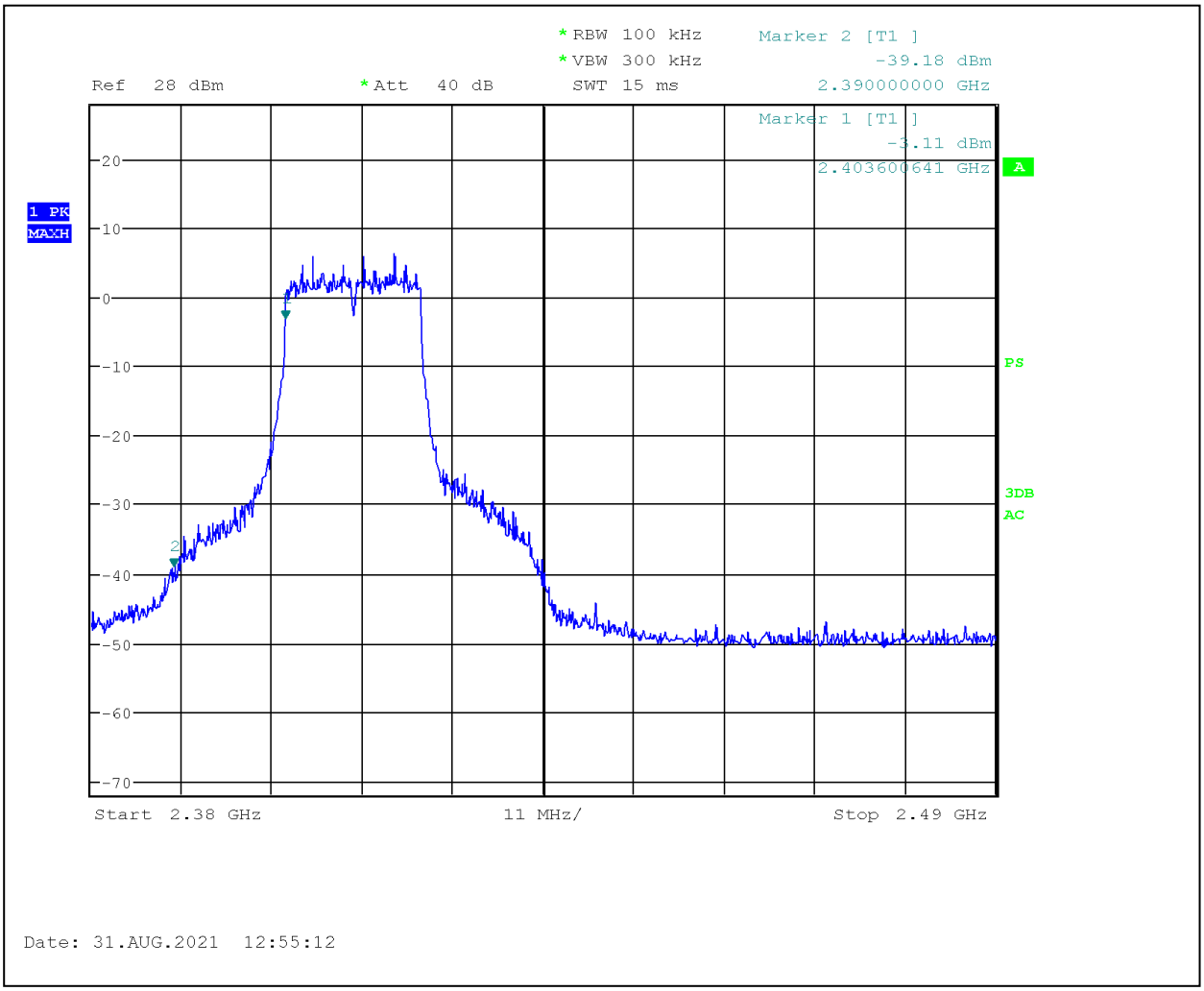
Graph 3.5.32


*RBW 100 kHz
*VBW 300 kHz
Ref 28 dBm
*Att 40 dB
SWT 15 ms
Marker 2 [T1]
-43.61 dBm
2.385940000 GHz
Marker 1 [T1]
4.74 dBm
2.407581795 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 12:50:58

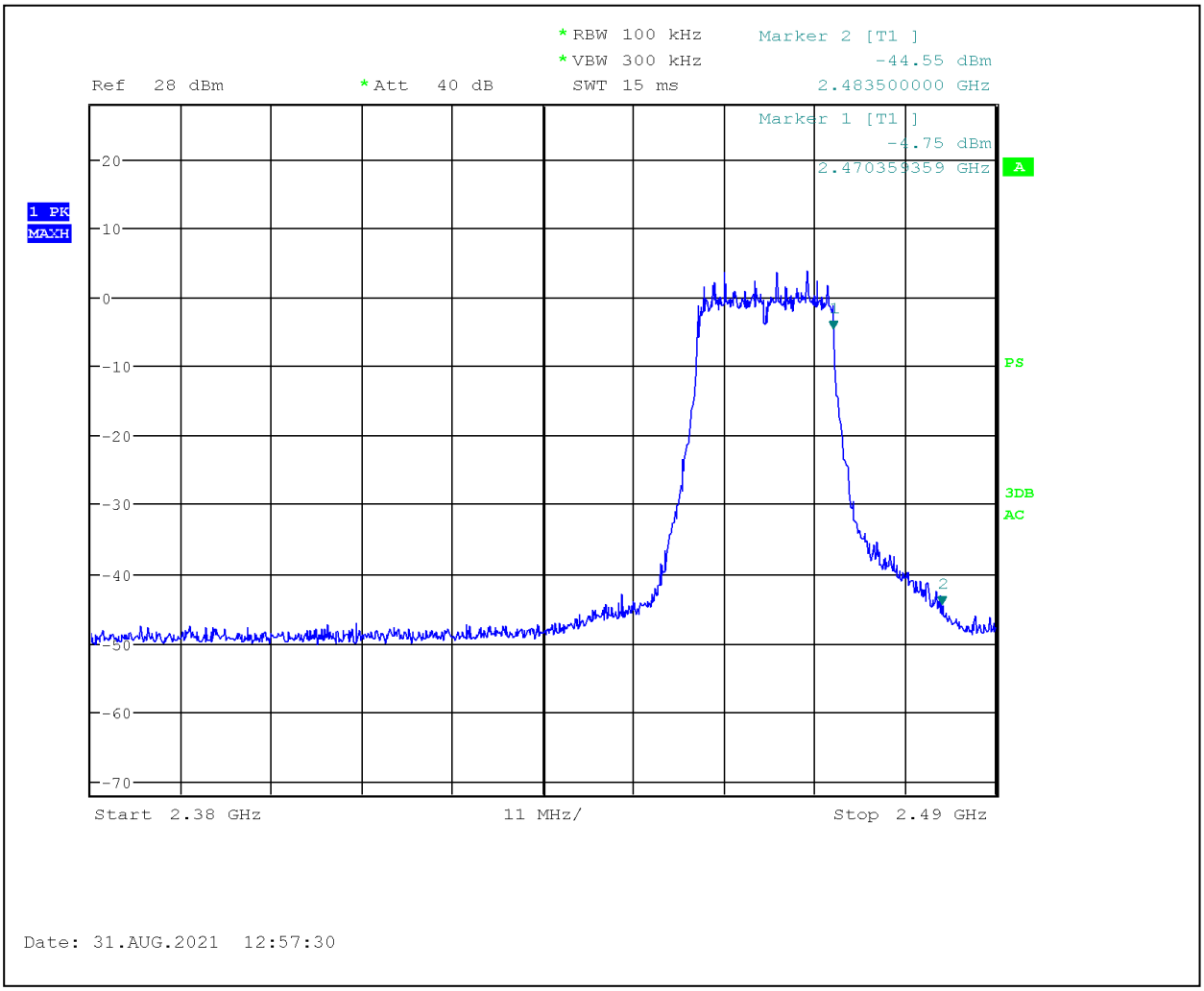
Graph 3.5.33


*RBW 100 kHz
*VBW 300 kHz
Ref 28 dBm
*Att 40 dB
SWT 15 ms
Marker 2 [T1]
-47.18 dBm
2.483950000 GHz
Marker 1 [T1]
4.18 dBm
2.466182179 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 12:53:27

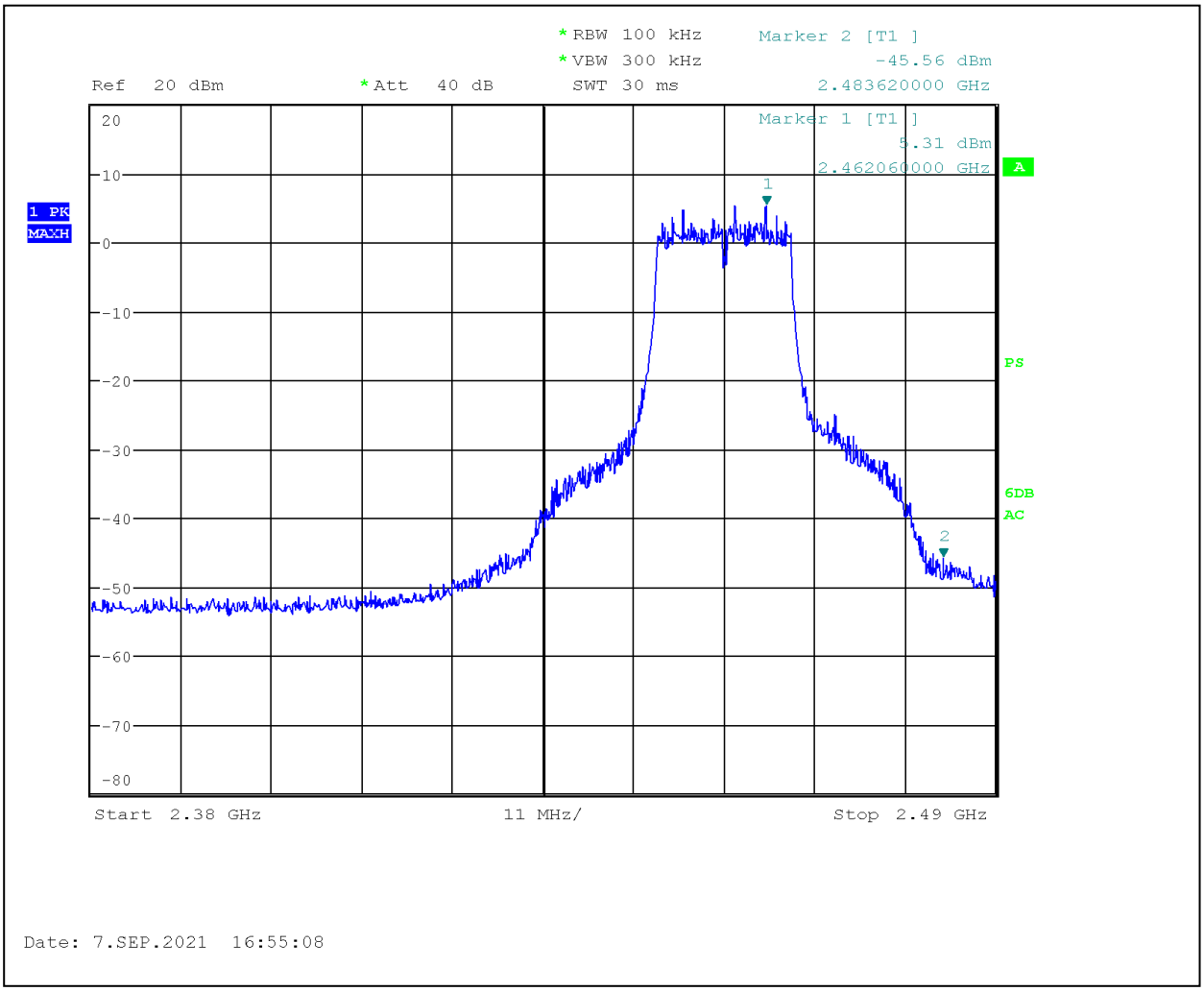
Graph 3.5.34


*RBW 100 kHz
*VBW 300 kHz
Ref 28 dBm
*Att 40 dB
SWT 15 ms
Marker 2 [T1]
-39.18 dBm
2.390000000 GHz
Marker 1 [T1]
-3.11 dBm
2.403600641 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 12:55:12

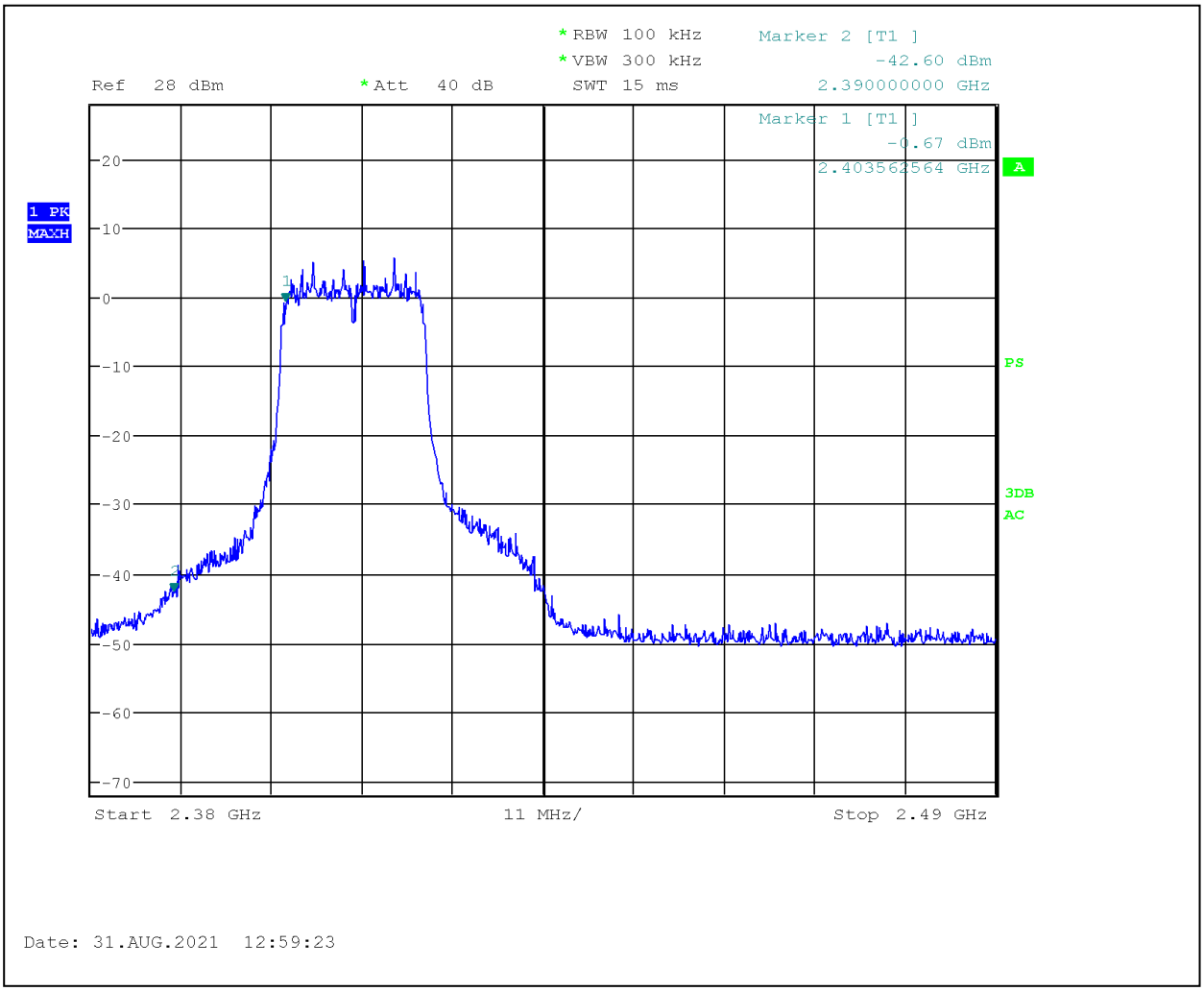
Graph 3.5.35


*RBW 100 kHz
*VBW 300 kHz
Ref 28 dBm
*Att 40 dB
SWT 15 ms
Marker 2 [T1]
-44.55 dBm
2.483500000 GHz
Marker 1 [T1]
-4.75 dBm
2.470359359 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 12:57:30

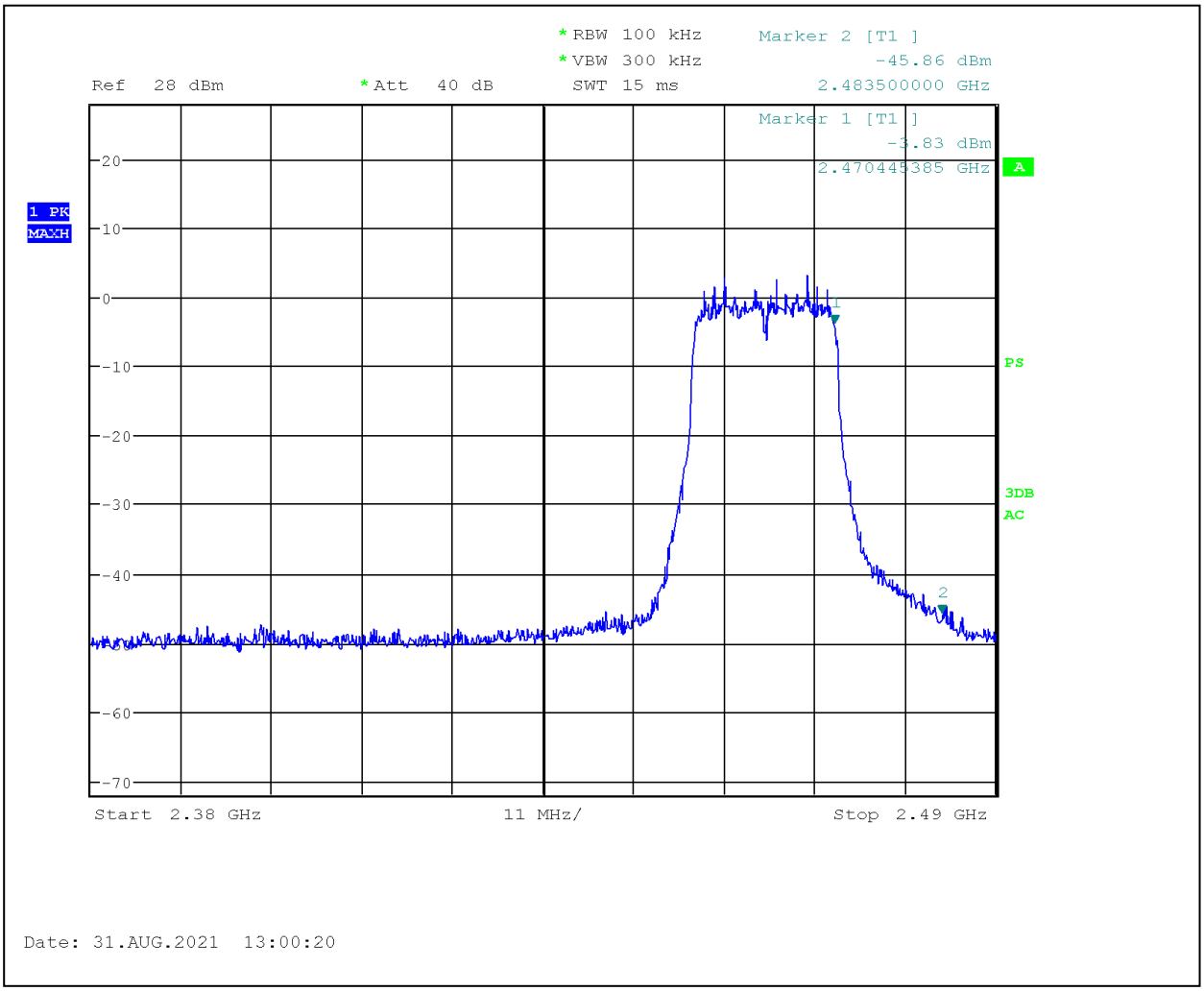
Graph 3.5.36


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 30 ms
Marker 2 [T1]
-45.56 dBm
2.483620000 GHz
Marker 1 [T1]
5.31 dBm
2.462060000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 7.SEP.2021 16:55:08

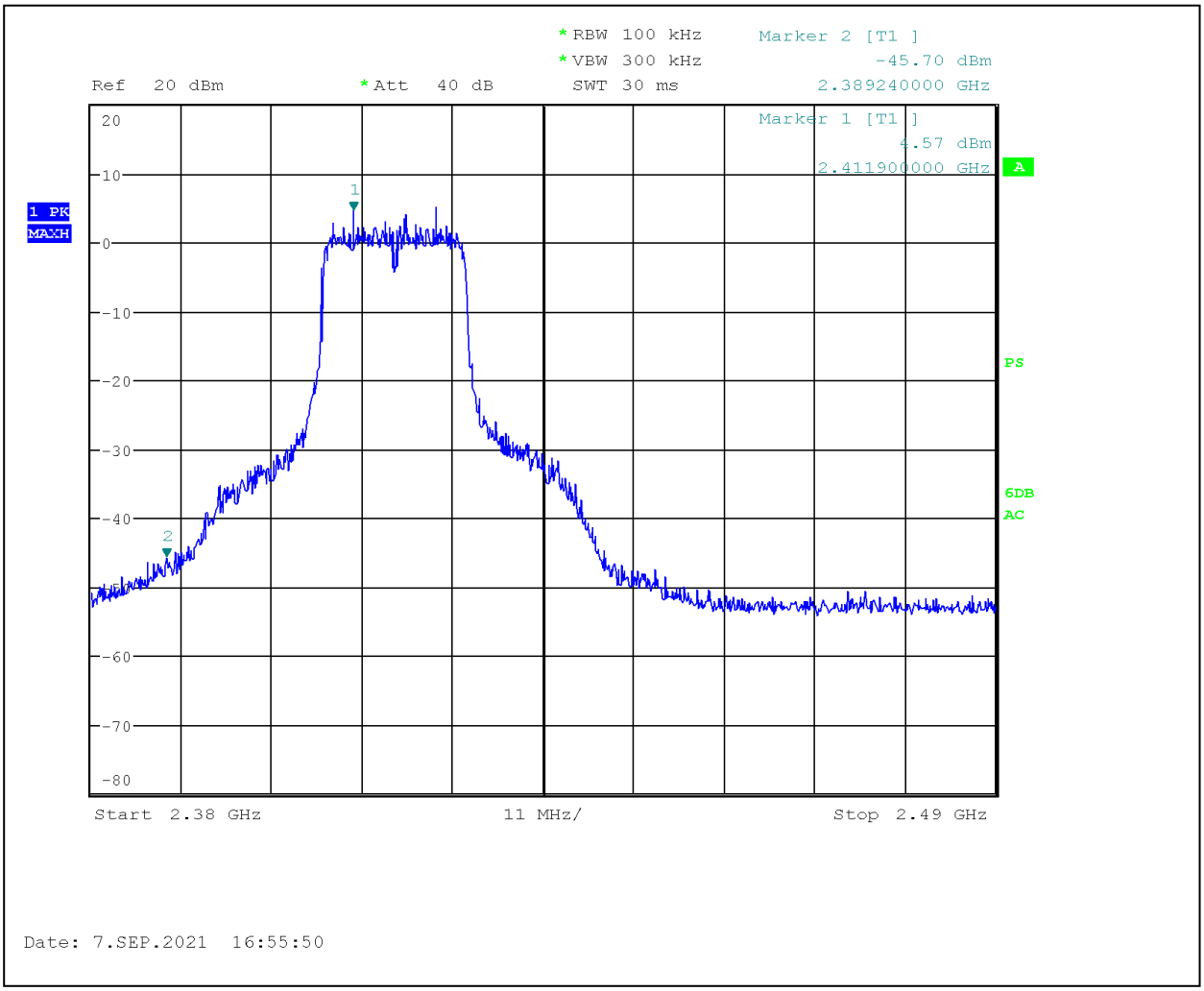
Graph 3.5.37


*RBW 100 kHz
*VBW 300 kHz
Ref 28 dBm
*Att 40 dB
SWT 15 ms
Marker 2 [T1]
-42.60 dBm
2.390000000 GHz
Marker 1 [T1]
-0.67 dBm
2.403562564 GHz
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 12:59:23

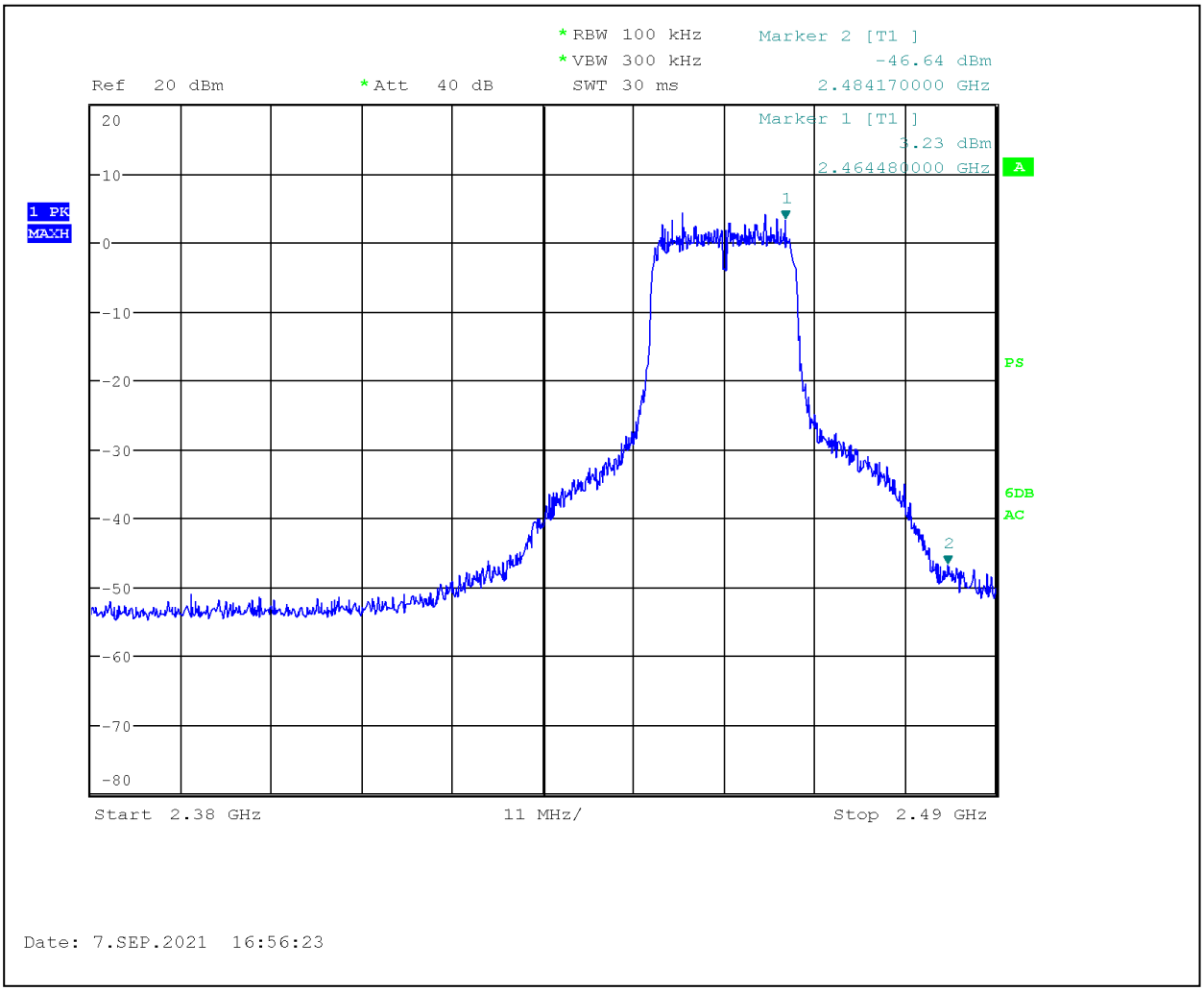
Graph 3.5.38


*RBW 100 kHz
*VBW 300 kHz
SWT 15 ms
Marker 2 [T1]
-45.86 dBm
2.483500000 GHz
Marker 1 [T1]
-3.83 dBm
2.470445385 GHz
Ref 28 dBm
*Att 40 dB
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 13:00:20

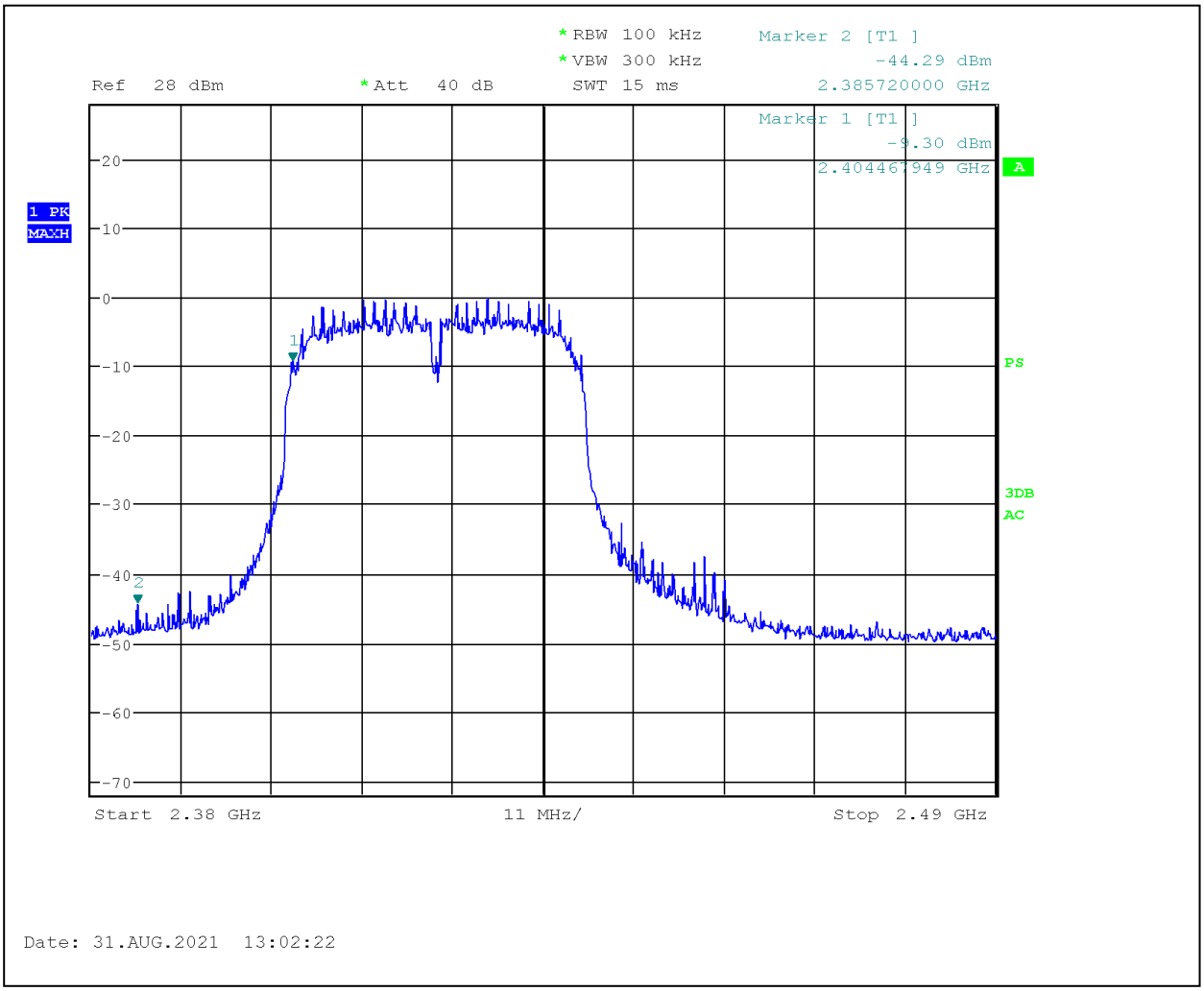
Graph 3.5.39


*RBW 100 kHz
*VBW 300 kHz
SWT 30 ms
Marker 2 [T1]
-45.70 dBm
2.389240000 GHz
Marker 1 [T1]
4.57 dBm
2.411900000 GHz
Ref 20 dBm
*Att 40 dB
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-60
-70
-80
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 7.SEP.2021 16:55:50

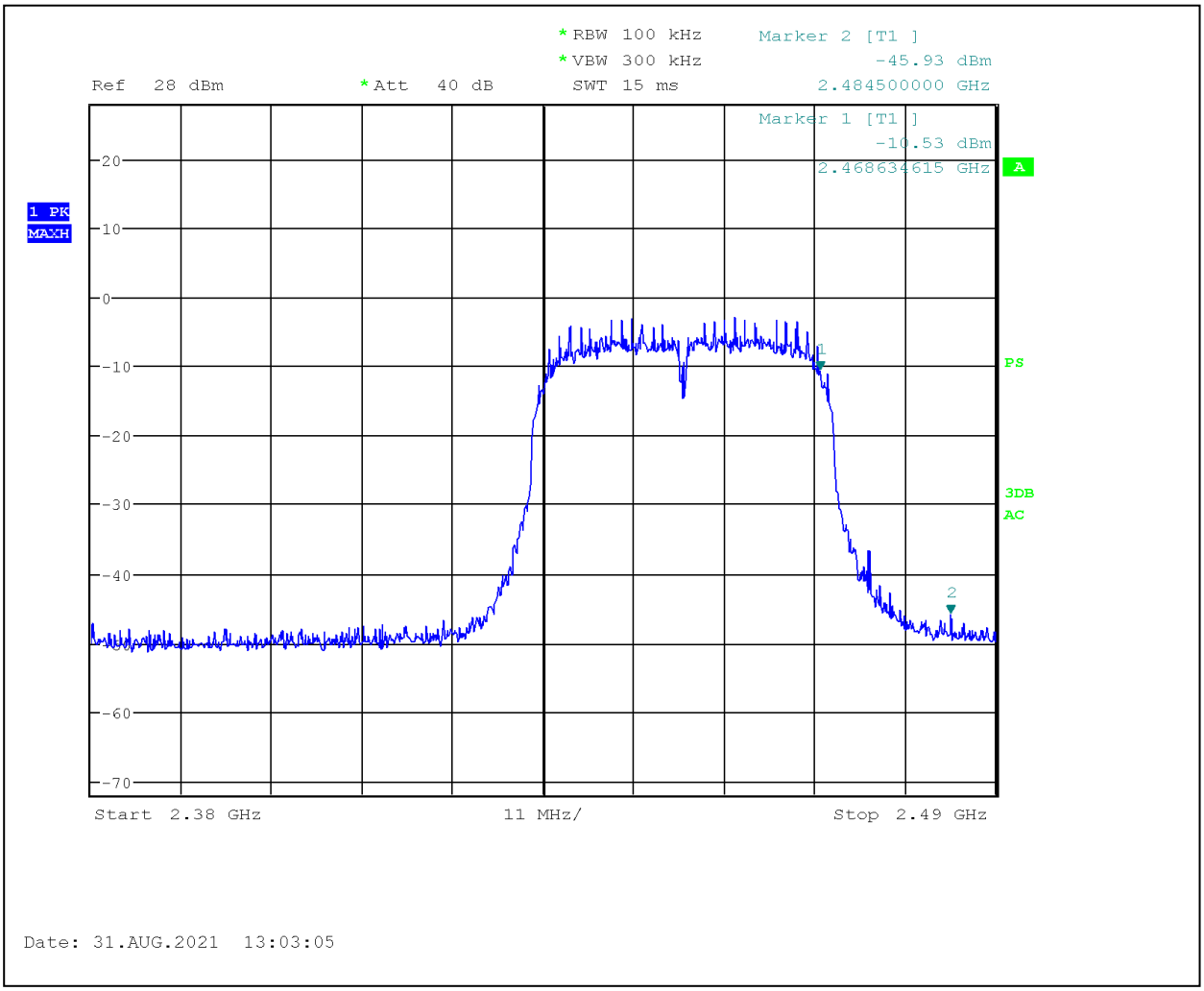
Graph 3.5.40


*RBW 100 kHz
*VBW 300 kHz
Ref 20 dBm
*Att 40 dB
SWT 30 ms
Marker 2 [T1]
-46.64 dBm
2.484170000 GHz
Marker 1 [T1]
3.23 dBm
2.464480000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 7.SEP.2021 16:56:23

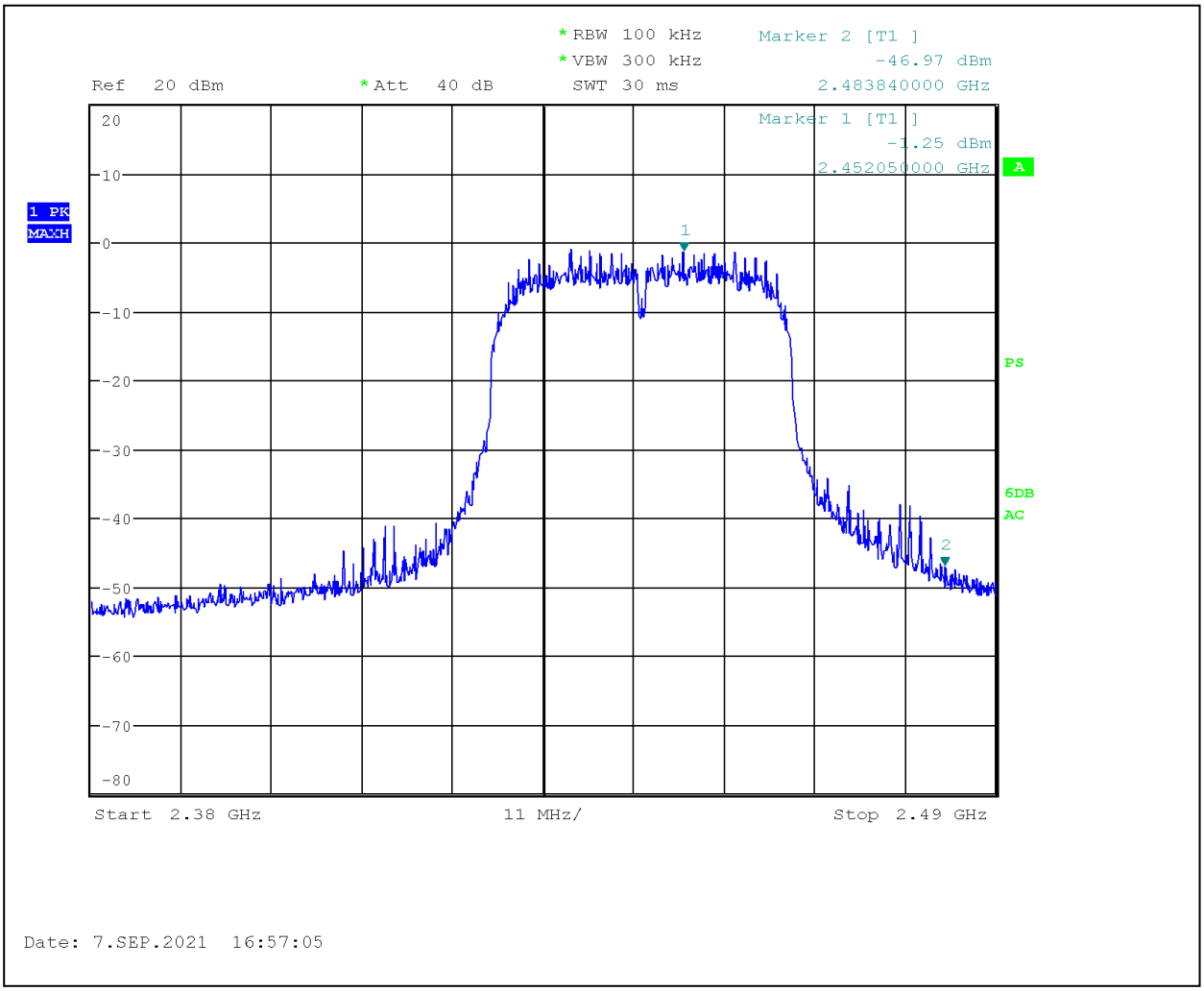
Graph 3.5.41


*RBW 100 kHz
*VBW 300 kHz
SWT 15 ms
Marker 2 [T1]
-44.29 dBm
2.385720000 GHz
Marker 1 [T1]
-9.30 dBm
2.404467949 GHz
Ref 28 dBm
*Att 40 dB
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 13:02:22

Graph 3.5.42


*RBW 100 kHz
*VBW 300 kHz
SWT 15 ms
Marker 2 [T1]
-45.93 dBm
2.484500000 GHz
Marker 1 [T1]
-10.53 dBm
2.468634615 GHz
Ref 28 dBm
*Att 40 dB
1 PK
MAXH
A
PS
3DB
AC
20
10
0
-10
-20
-30
-40
-60
-70
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 31.AUG.2021 13:03:05

Graph 3.5.43


*RBW 100 kHz
*VBW 300 kHz
SWT 30 ms
Marker 2 [T1]
-46.97 dBm
2.483840000 GHz
Ref 20 dBm
*Att 40 dB
Marker 1 [T1]
-1.25 dBm
2.452050000 GHz
1 PK
MAXH
A
PS
6DB
AC
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 2.38 GHz
11 MHz/
Stop 2.49 GHz
Date: 7.SEP.2021 16:57:05

Graph 3.5.44

3.6 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. AVG Margin Spurious: 10.4dB below the limits
Max. Peak Margin Spurious: 20.9dB below the limits
Max. Margin Bandedge Compliance: 1.3dB below the limits

EUT was configured to transmit continuously. Radiated emission measurements were performed from 9 kHz to 25 GHz according to the procedure described in ANSI C64.10.

Spectrum analyzer resolution bandwidth is 200 Hz for frequencies 9 kHz to 150 kHz. Resolution bandwidth is 120 kHz for frequencies 30 MHz to 1000 MHz and 1 MHz for frequencies above 1 GHz. Above 1 GHz, both Peak and Average measurements were performed. The Peak level of radiated emissions was measured with a peak detector. The Average level of radiated emissions was measured with an RMS detector with trace averaging.

The EUT is placed on a non-conductive turntable that is 80 cm in height for frequencies 30 MHz to 1000 MHz, 1.5 meters for frequency above 1000 MHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Data included is representative of the worst-case configuration (the configuration which resulted in the highest emission levels). Data provided is corrected for distance, cables, preamp, filters and antenna factors then compared to the limits

Note 1: Per client specification, the EUT is installed in vertical orientation. The installation orientation should be reflected in the user manual.
Note 2: No Spurious emissions were detected in the frequency range 9 kHz to 30MHz and above 3rd harmonic.

Date:	August 16 – September 8, 2021	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC part 15.247(d)	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	22°C; 43%(RH); 98kPa	
Equipment Verification:	☒	
Note:	802.11b	

Table 3.6.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
802.11b channel low										
4826.00	V	100	32.9	2.7	43.2	50.1	42.5	54.0	-11.5	AVG
4826.00	V	100	32.9	2.7	43.2	60.7	53.1	74.0	-20.9	Peak
4826.00	H	100	32.9	2.7	43.2	48.5	40.9	54.0	-13.1	AVG
4826.00	H	100	32.9	2.7	43.2	57.8	50.2	74.0	-23.8	Peak
802.11b channel mid										
4874.00	V	100	33.0	2.7	43.2	51.1	43.5	54.0	-10.4	AVG
4874.00	V	100	33.0	2.7	43.2	60.5	52.9	74.0	-21.1	Peak
4874.00	H	100	33.0	2.7	43.2	49.2	41.6	54.0	-12.3	AVG
4874.00	H	100	33.0	2.7	43.2	56.8	49.2	74.0	-24.8	Peak
802.11b channel high										
4924.00	V	100	33.0	2.7	43.2	49.9	42.4	54.0	-11.6	AVG
4924.00	V	100	33.0	2.7	43.2	59.1	51.6	74.0	-22.4	Peak
4924.00	H	100	33.0	2.7	43.2	47.2	39.7	54.0	-14.3	AVG
4924.00	H	100	33.0	2.7	43.2	59.0	51.5	74.0	-22.5	Peak

Date:	August 16 – September 8, 2021	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC part 15.247(d)	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	22°C; 43%(RH); 98kPa	
Equipment Verification:	☒	
Note:	802.11g	

Table 3.6.2

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
802.11g channel low										
4822.00	V	100	32.9	2.7	43.2	48.3	40.7	54.0	-13.3	AVG
4822.00	V	100	32.9	2.7	43.2	57.7	50.1	74.0	-23.9	Peak
4822.00	H	100	32.9	2.7	43.2	43.2	35.6	54.0	-18.4	AVG
4822.00	H	100	32.9	2.7	43.2	52.1	44.5	74.0	-29.5	Peak
802.11g channel mid										
4880.00	V	100	33.0	2.7	43.2	49.7	42.2	54.0	-11.8	AVG
4880.00	V	100	33.0	2.7	43.2	58.1	50.6	74.0	-23.4	Peak
4880.00	H	100	33.0	2.7	43.2	44.1	36.6	54.0	-17.4	AVG
4880.00	H	100	33.0	2.7	43.2	52.2	44.7	74.0	-29.3	Peak
802.11g channel 10										
4916.00	V	100	33.0	2.7	43.2	46.2	38.7	54.0	-15.3	AVG
4916.00	V	100	33.0	2.7	43.2	55.0	47.5	74.0	-26.5	Peak
4916.00	H	100	33.0	2.7	43.2	39.8	32.3	54.0	-21.7	AVG
4916.00	H	100	33.0	2.7	43.2	49.1	41.6	74.0	-32.4	Peak
802.11g channel high										
4922.00	V	100	33.0	2.7	43.2	42.8	35.3	54.0	-18.7	AVG
4922.00	V	100	33.0	2.7	43.2	53.1	45.6	74.0	-28.4	Peak
7387.00	V	100	36.1	3.4	43.7	30.2	26.0	54.0	-28.0	AVG
4922.00	H	100	33.0	2.7	43.2	39.0	31.5	54.0	-22.5	AVG
4922.00	H	100	33.0	2.7	43.2	57.5	50.0	74.0	-24.0	Peak
7387.00	H	100	36.1	3.4	43.7	30.6	26.4	54.0	-27.6	AVG

Date:	August 16 – September 8, 2021	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC part 15.247(d)	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	22°C; 43%(RH); 98kPa	
Equipment Verification:	☒	
Note:	802.11n-20	

Table 3.6.3

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
802.11n 20M channel low										
4820.00	V	100	32.9	2.7	43.2	48.6	41.0	54.0	-13.0	AVG
4820.00	V	100	32.9	2.7	43.2	55.5	47.9	74.0	-26.1	Peak
4820.00	H	100	32.9	2.7	43.2	45.3	37.7	54.0	-16.3	AVG
4820.00	H	100	32.9	2.7	43.2	51.8	44.2	74.0	-29.8	Peak
802.11n 20M channel 2										
4840.00	V	100	32.9	2.7	43.2	46.9	39.3	54.0	-14.7	AVG
4840.00	V	100	32.9	2.7	43.2	54.5	46.9	74.0	-27.1	Peak
4840.00	H	100	32.9	2.7	43.2	41.2	33.6	54.0	-20.4	AVG
4840.00	H	100	32.9	2.7	43.2	49.1	41.5	74.0	-32.5	Peak
802.11n 20M channel mid										
4870.00	V	100	33.0	2.7	43.2	48.9	41.3	54.0	-12.6	AVG
4870.00	V	100	33.0	2.7	43.2	56.3	48.7	74.0	-25.3	Peak
4870.00	H	100	33.0	2.7	43.2	46.0	38.4	54.0	-15.5	AVG
4870.00	H	100	33.0	2.7	43.2	52.0	44.4	74.0	-29.6	Peak
802.11n 20M channel 10										
4916.00	V	100	33.0	2.7	43.2	48.2	40.7	54.0	-13.3	AVG
4916.00	V	100	33.0	2.7	43.2	56.0	48.5	74.0	-25.5	Peak
4916.00	H	100	33.0	2.7	43.2	42.6	35.1	54.0	-18.9	AVG
4916.00	H	100	33.0	2.7	43.2	49.9	42.4	74.0	-31.6	Peak
802.11n 20M channel high										
4926.00	V	100	33.0	2.7	43.2	48.0	40.5	54.0	-13.5	AVG
4926.00	V	100	33.0	2.7	43.2	55.0	47.5	74.0	-26.5	Peak
4926.00	H	100	33.0	2.7	43.2	44.3	36.8	54.0	-17.2	AVG
4926.00	H	100	33.0	2.7	43.2	51.2	43.7	74.0	-30.3	Peak

Date:	August 16 – September 8, 2021	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC part 15.247(d)	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	22°C; 43%(RH); 98kPa	
Equipment Verification:	☒	
Note:	802.11n-40	

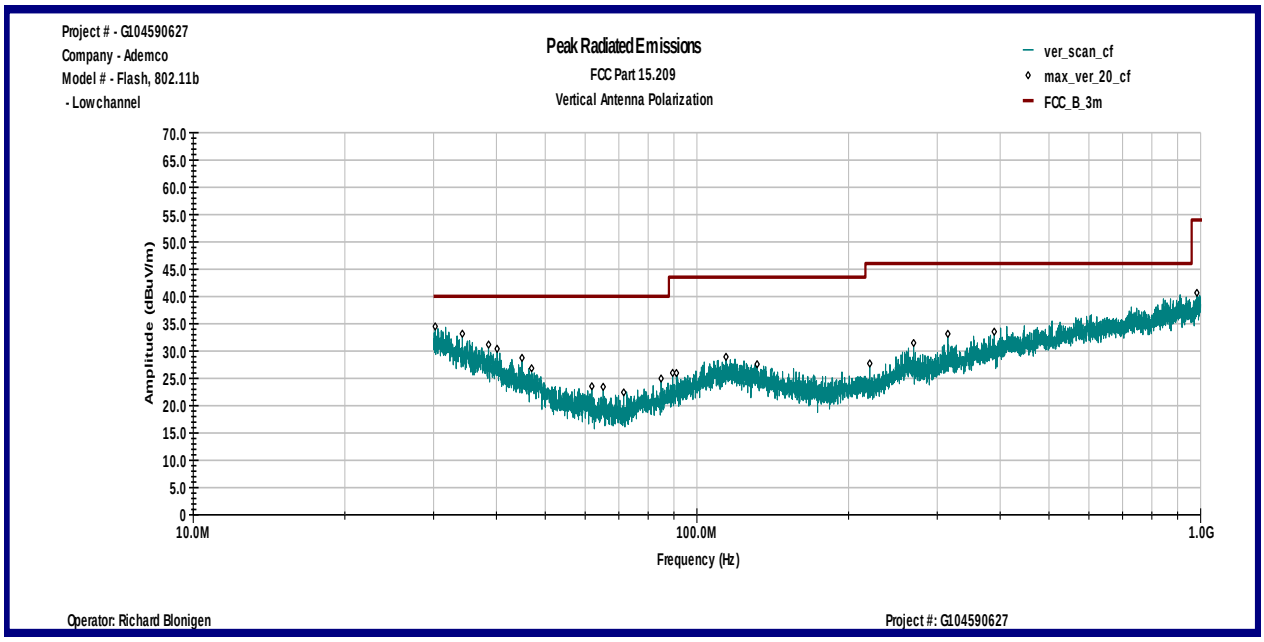
Table 3.6.4

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
802.11n 40M channel low										
4859.00	V	100	32.9	2.7	43.2	43.2	35.6	54.0	-18.3	AVG
4859.00	V	100	32.9	2.7	43.2	50.7	43.1	74.0	-30.9	Peak
4859.00	H	100	32.9	2.7	43.2	40.1	32.5	54.0	-21.4	AVG
4859.00	H	100	32.9	2.7	43.2	48.8	41.2	74.0	-32.8	Peak
802.11n 40M channel mid										
4873.00	V	100	33.0	2.7	43.2	47.2	39.6	54.0	-14.3	AVG
4873.00	V	100	33.0	2.7	43.2	55.6	48.0	74.0	-26.0	Peak
4873.00	H	100	33.0	2.7	43.2	44.5	36.9	54.0	-17.0	AVG
4873.00	H	100	33.0	2.7	43.2	49.4	41.8	74.0	-32.2	Peak
802.11n 40M channel 8										
4892.50	V	100	33.0	2.7	43.2	38.6	31.1	54.0	-22.9	AVG
4892.50	V	100	33.0	2.7	43.2	51.8	44.3	74.0	-29.7	Peak
4892.50	H	100	33.0	2.7	43.2	33.4	25.9	54.0	-28.1	AVG
4892.50	H	100	33.0	2.7	43.2	47.0	39.5	74.0	-34.5	Peak
802.11n 40M channel high										
4913.00	V	100	33.0	2.7	43.2	42.9	35.4	54.0	-18.6	AVG
4913.00	V	100	33.0	2.7	43.2	47.8	40.3	74.0	-33.7	Peak
4913.00	H	100	33.0	2.7	43.2	39.8	32.3	54.0	-21.7	AVG
4913.00	H	100	33.0	2.7	43.2	51.8	44.3	74.0	-29.7	Peak

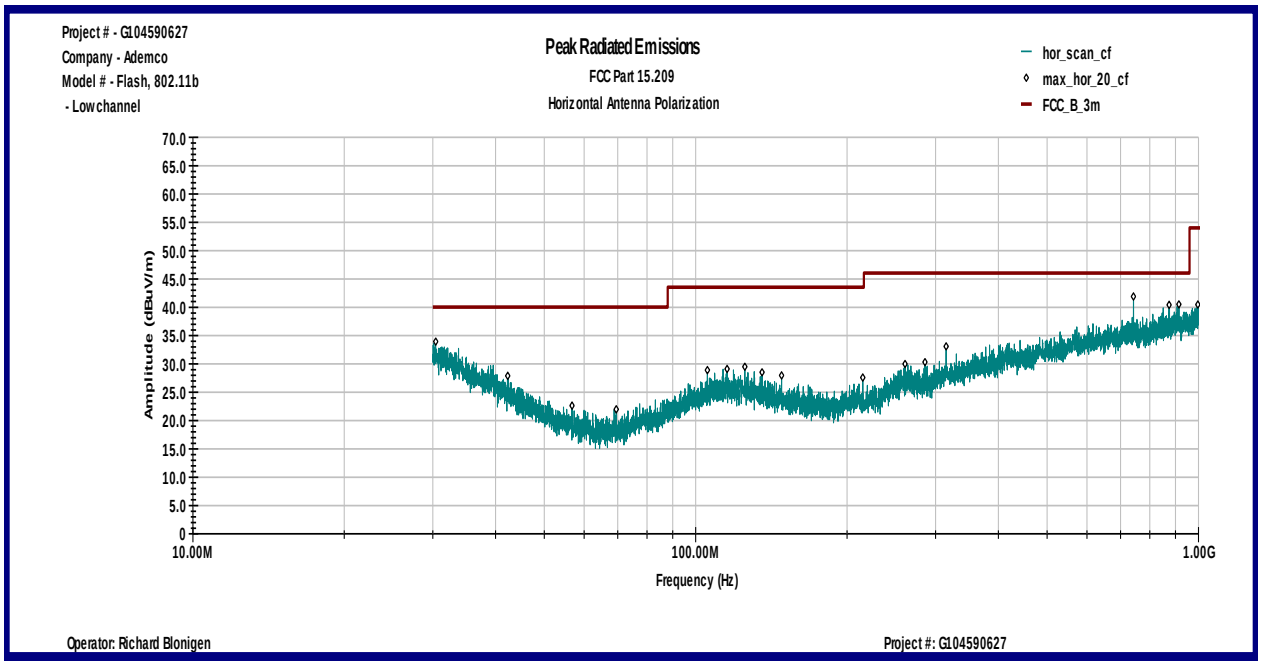
Date:	August 16 – September 8, 2021	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC part 15.247(d)	
Test Point:	Enclosure	
Operation mode:	See page 5	
Environmental Conditions:	22°C; 43%(RH); 98kPa	
Equipment Verification:	☒	
Note:	Bandedge Compliance	

Table 3.6.5

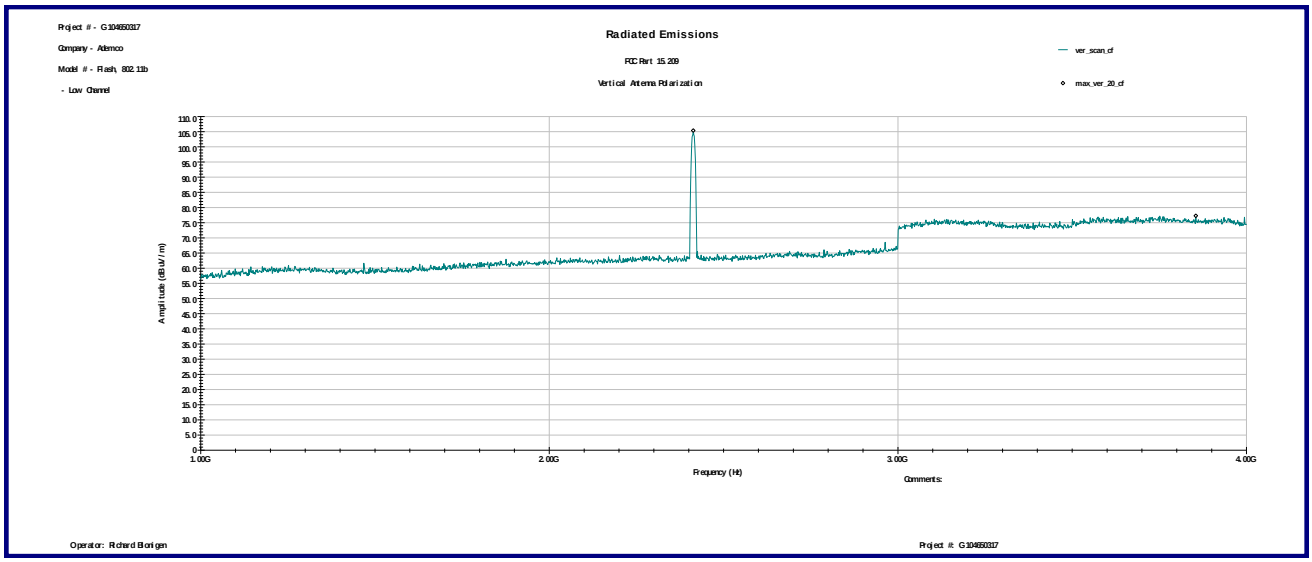
Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Peak Reading	Total @ 3m	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	
802.11b										
2390.00	V	100	28.1	1.9	0.0	12.2	42.2	54.0	-11.8	
2390.00	H	100	28.1	1.9	0.0	13.8	43.8	54.0	-10.2	
2483.50	V	100	28.4	1.9	0.0	11.9	42.2	54.0	-11.8	
2483.50	H	100	28.4	1.9	0.0	12.3	42.6	54.0	-11.4	
802.11g										
2390.00	V	100	28.1	1.9	0.0	14.1	44.1	54.0	-9.9	
2390.00	H	100	28.1	1.9	0.0	18.1	48.1	54.0	-5.9	
2483.50	V	100	28.4	1.9	0.0	16.1	46.4	54.0	-7.6	
2483.50	H	100	28.4	1.9	0.0	17.2	47.5	54.0	-6.5	
802.11g channel 10										
2483.50	V	100	28.4	1.9	0.0	20.6	50.8	54.0	-3.2	
2483.50	H	100	28.4	1.9	0.0	22.5	52.7	54.0	-1.3	
802.11n 20										
2390.00	V	100	28.1	1.9	0.0	12.6	42.6	54.0	-11.4	
2390.00	H	100	28.1	1.9	0.0	13.3	43.3	54.0	-10.7	
2483.50	V	100	28.4	1.9	0.0	12.6	42.9	54.0	-11.1	
2483.50	H	100	28.4	1.9	0.0	15.5	45.8	54.0	-8.2	
802.11n 20 channel 2										
2390.00	V	100	28.1	1.9	0.0	20.0	50.0	54.0	-4.0	
2390.00	H	100	28.1	1.9	0.0	21.4	51.4	54.0	-2.6	
802.11n 20 channel 10										
2483.50	V	100	28.4	1.9	0.0	18.8	49.1	54.0	-4.9	
2483.50	H	100	28.4	1.9	0.0	21.4	51.7	54.0	-2.3	
802.11n 40M										
2390.00	V	100	28.1	1.9	0.0	12.1	42.1	54.0	-11.9	
2390.00	H	100	28.1	1.9	0.0	13.0	43.0	54.0	-11.0	
2483.50	V	100	28.4	1.9	0.0	12.1	42.4	54.0	-11.6	
2483.50	H	100	28.4	1.9	0.0	13.1	43.4	54.0	-10.6	
802.11n 40 channel 8										
2483.50	V	100	28.4	1.9	0.0	11.8	42.1	54.0	-11.9	
2483.50	H	100	28.4	1.9	0.0	12.6	42.9	54.0	-11.1	



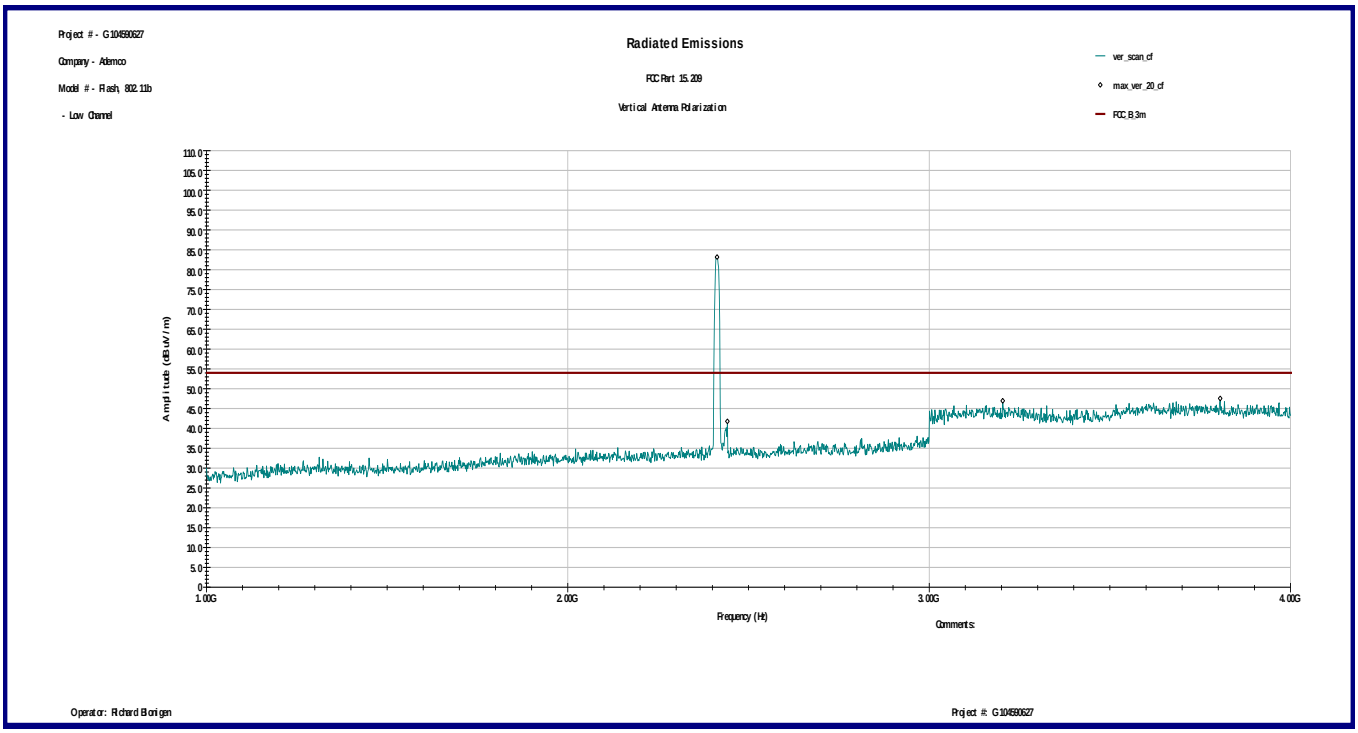
Graph 3.6.1



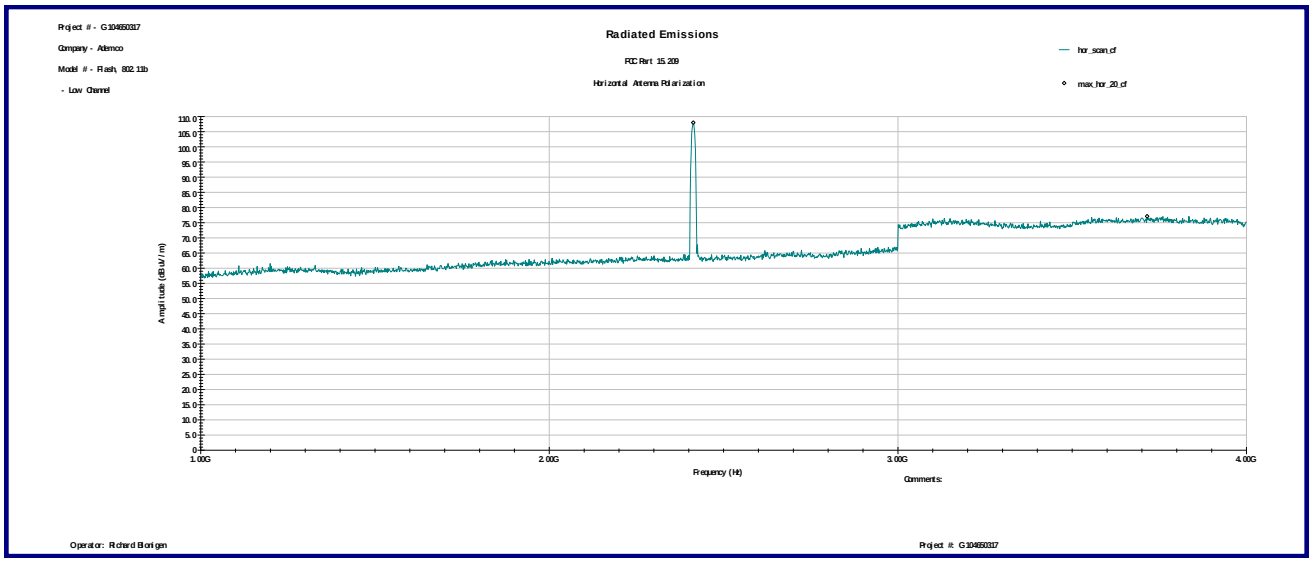
Graph 3.6.2



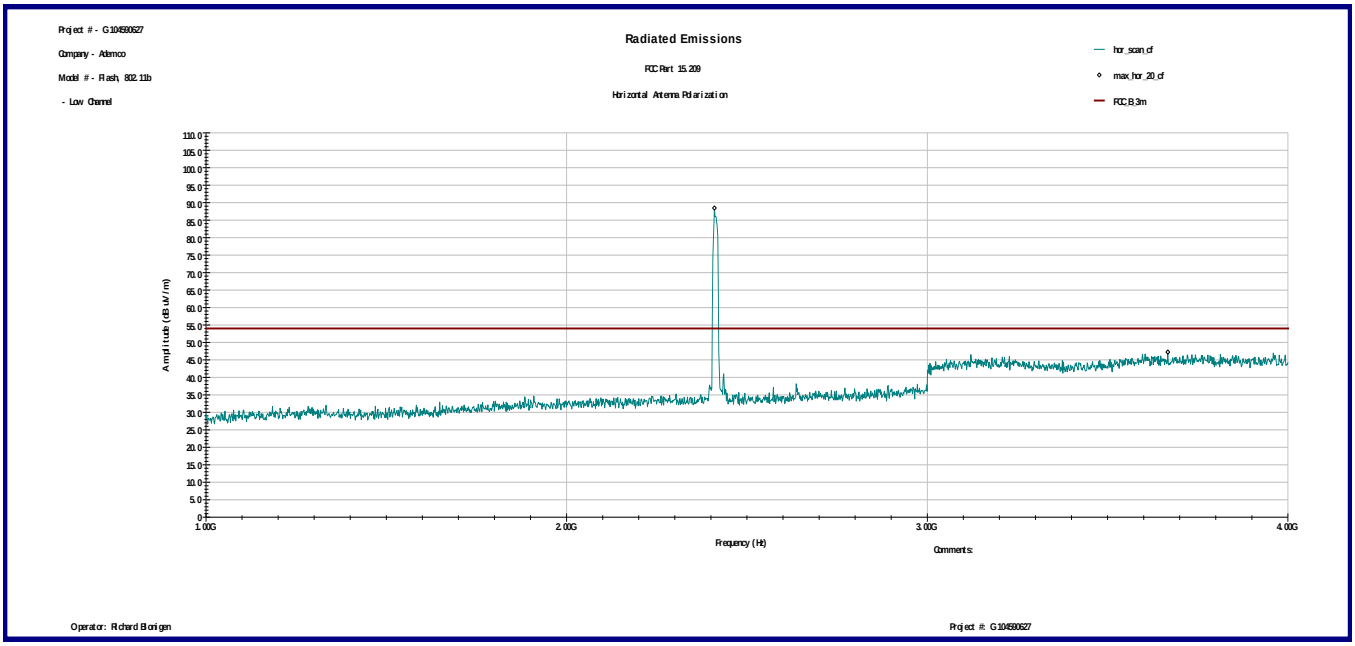
Graph 3.6.3



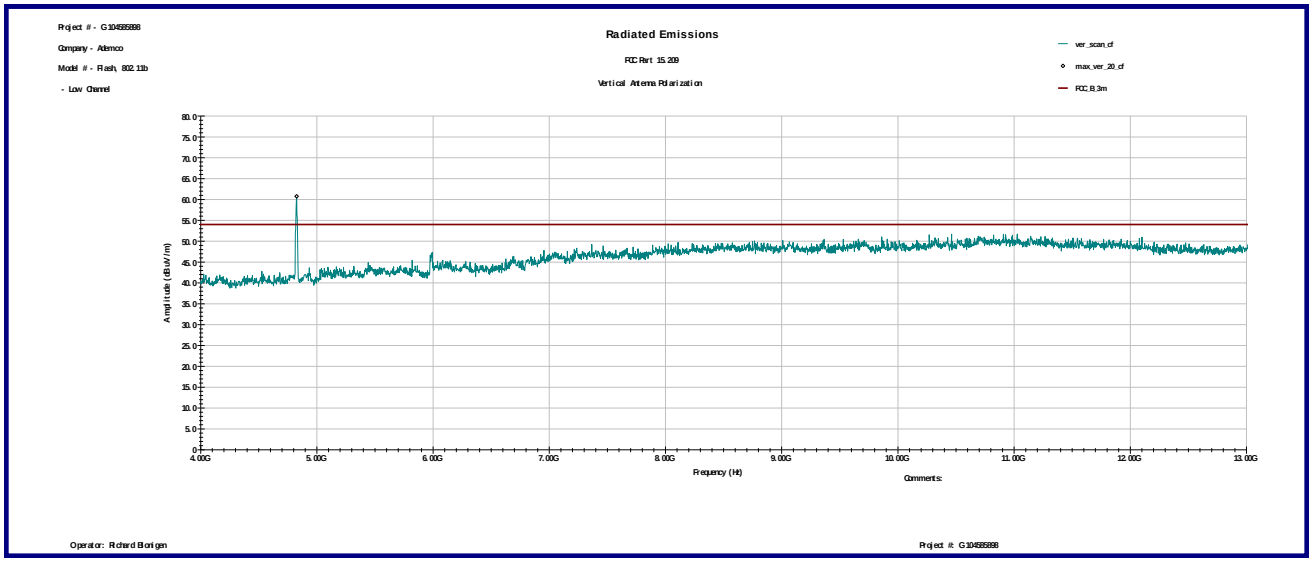
Graph 3.6.4



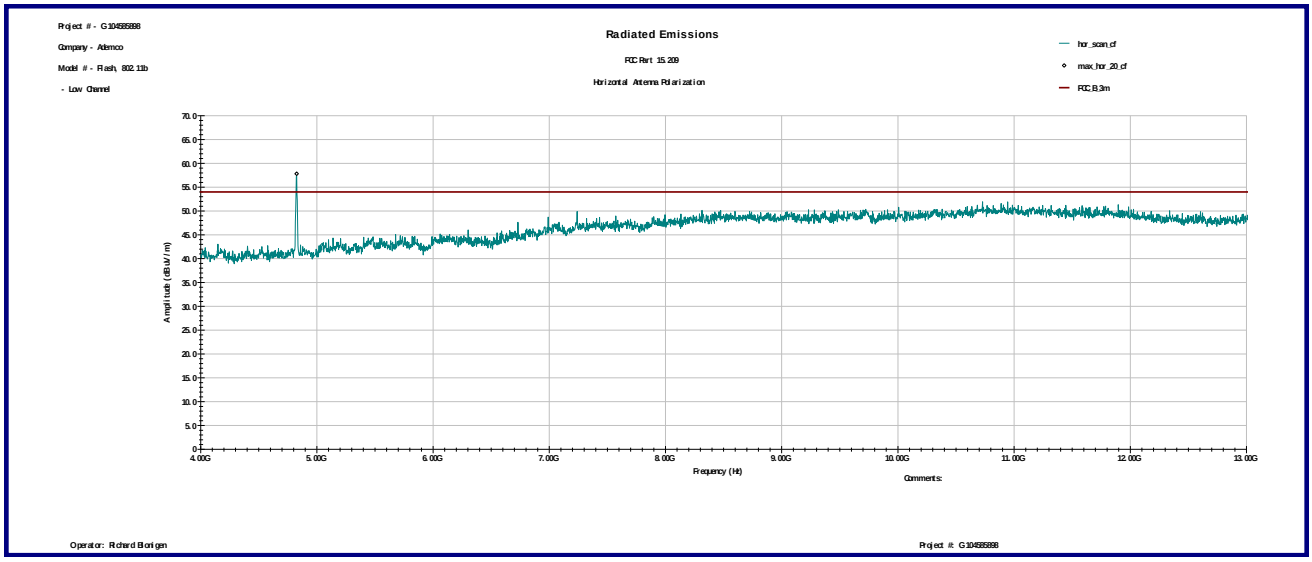
Graph 3.6.5



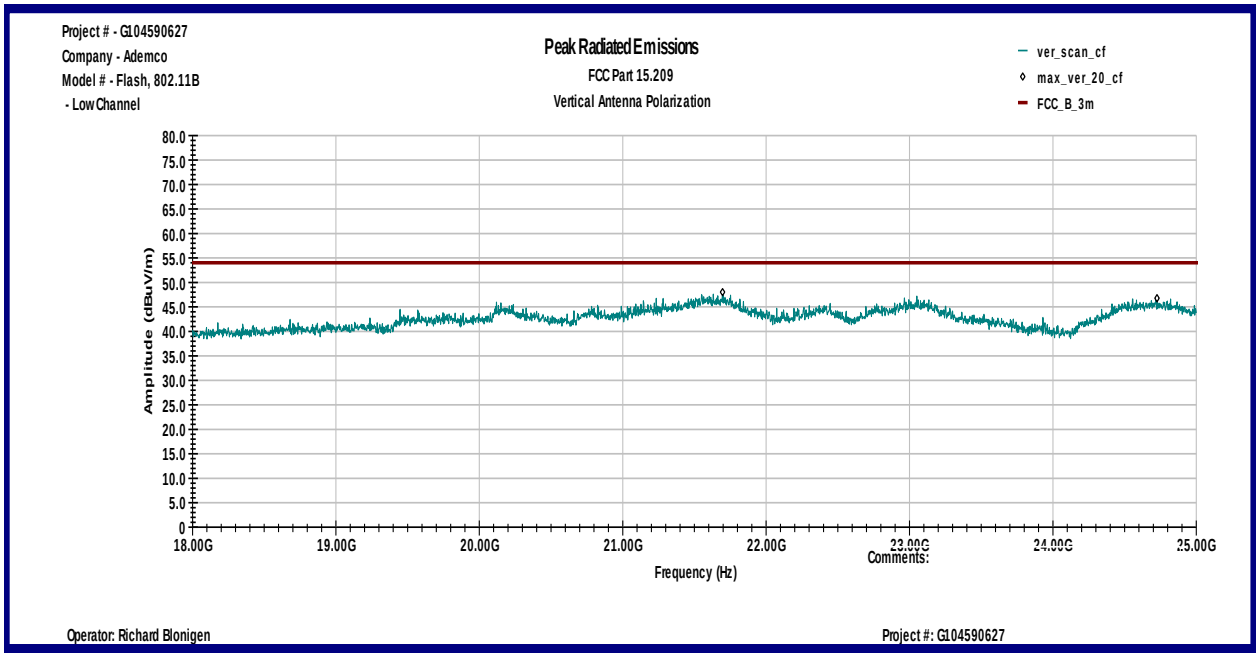
Graph 3.6.6



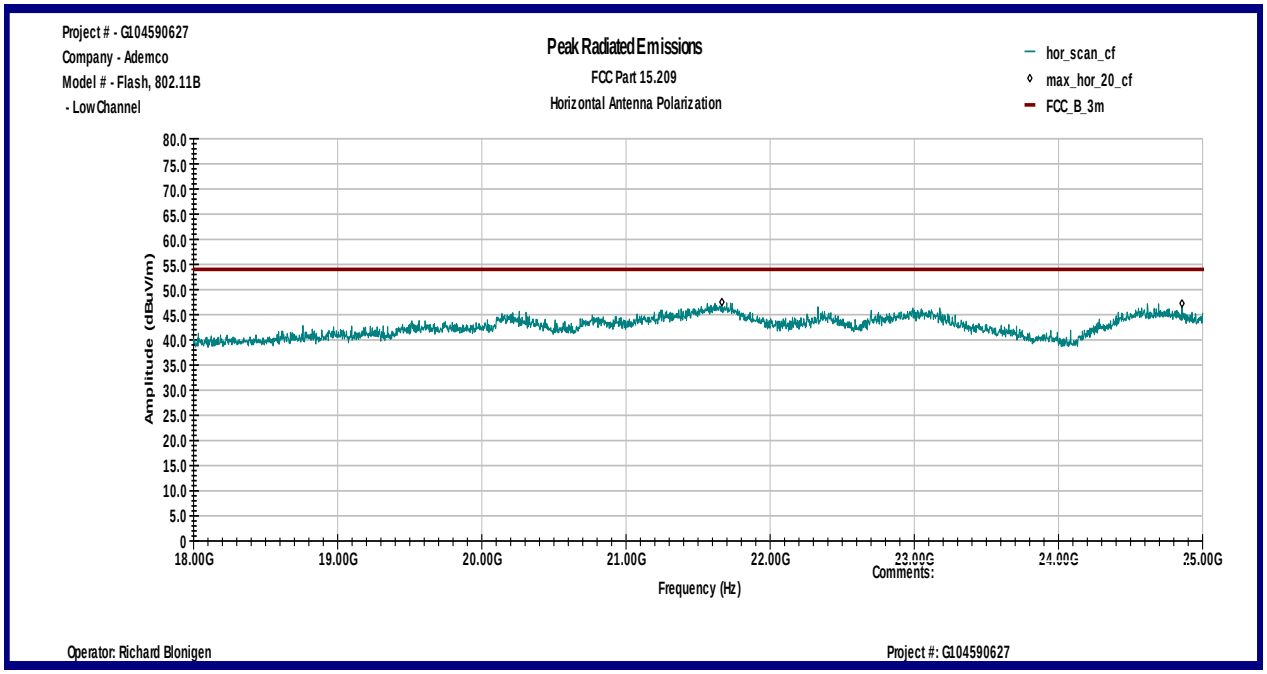
Graph 3.6.7



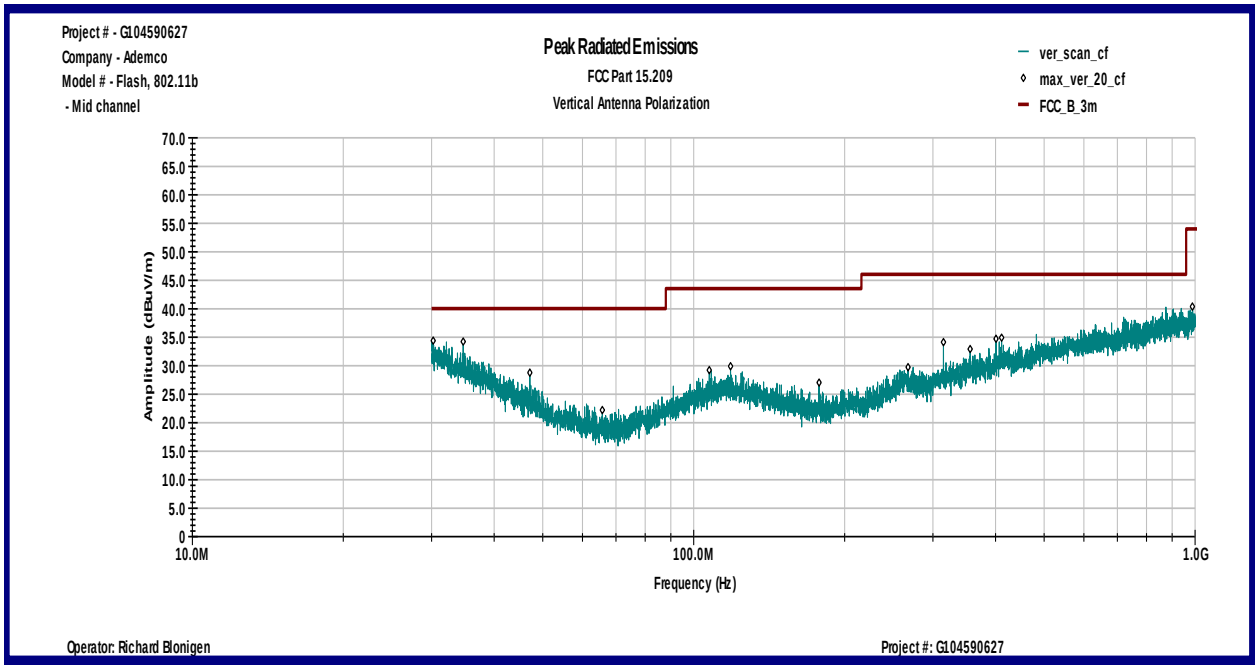
Graph 3.6.8



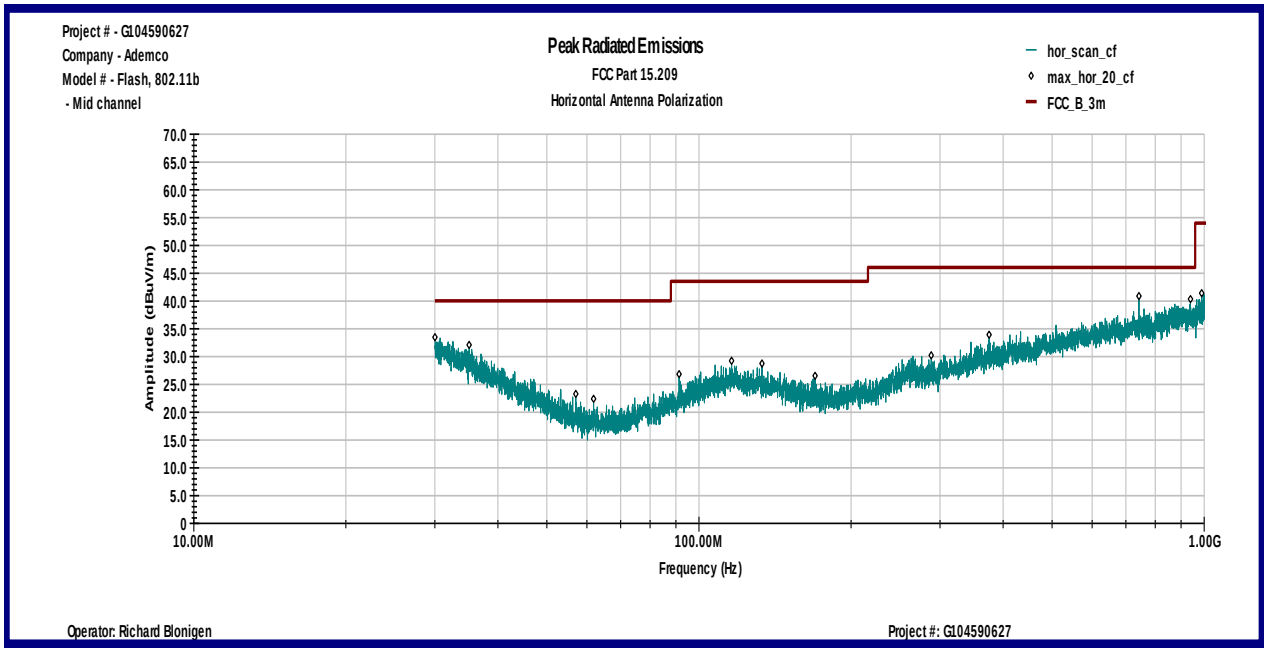
Graph 3.6.9



Graph 3.6.10



Graph 3.6.11



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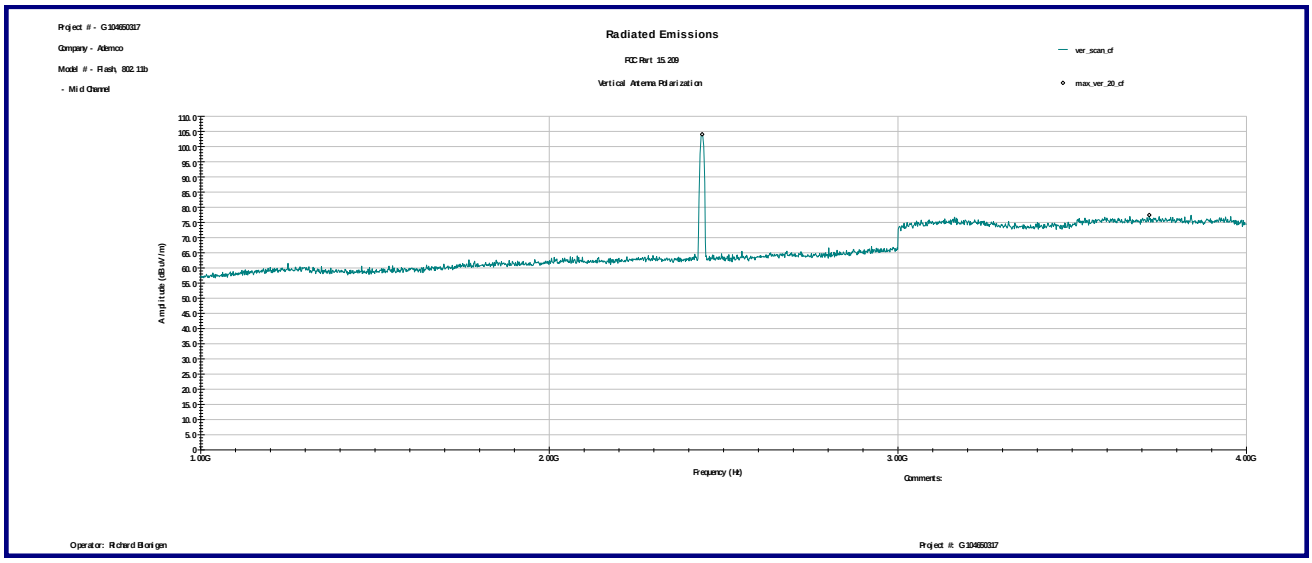
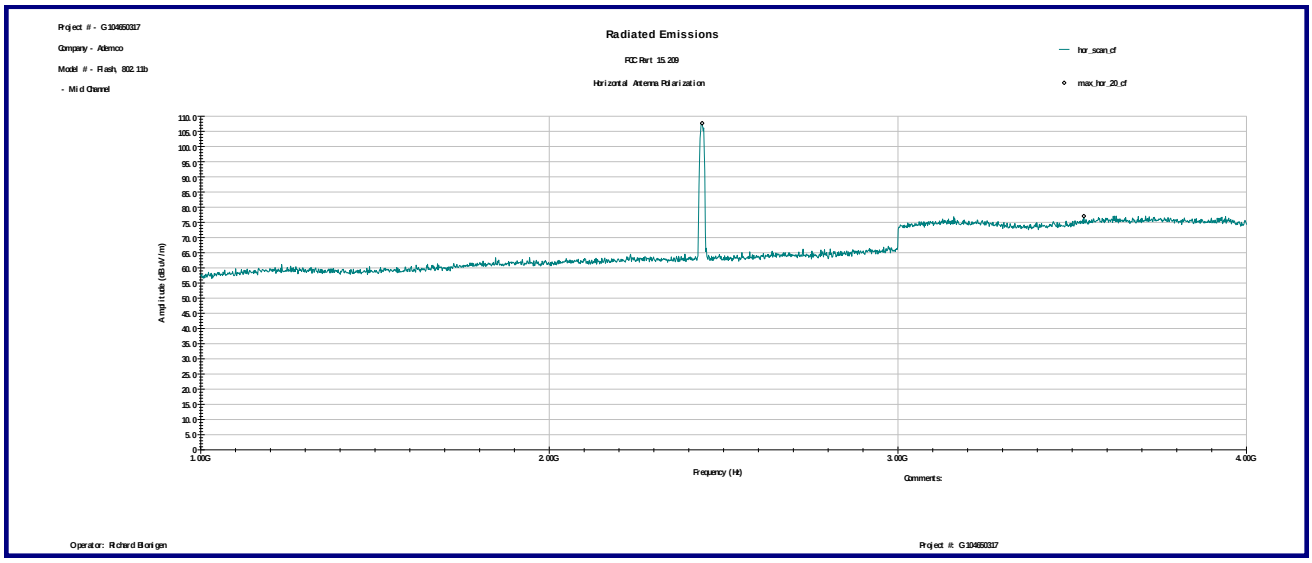


Graph 3.6.13



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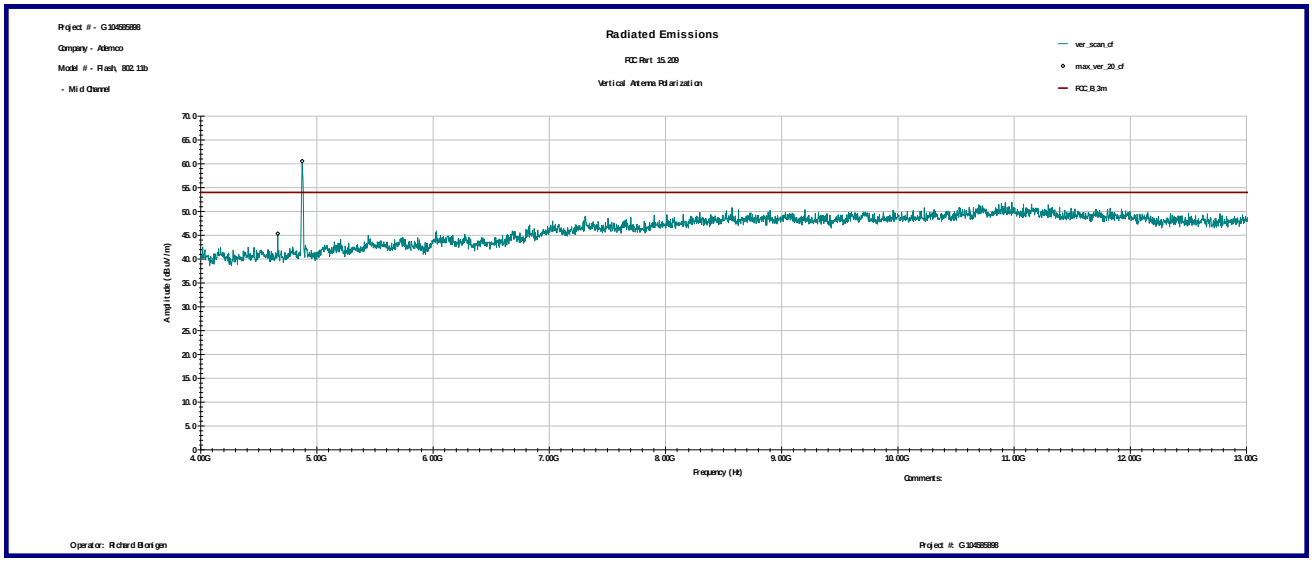
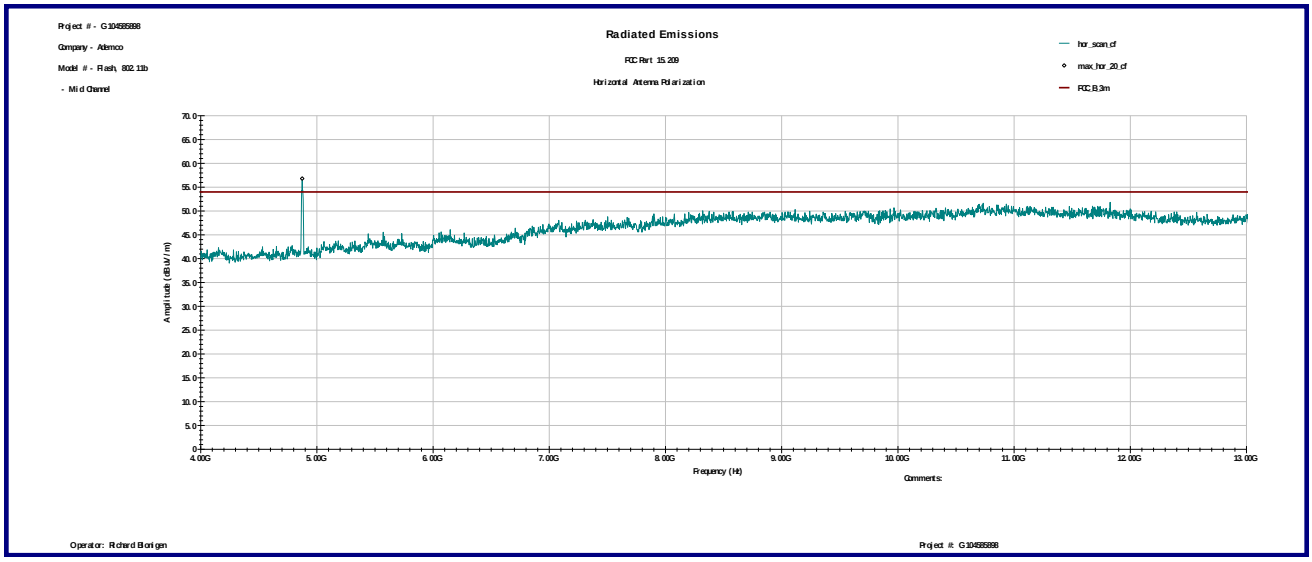


Graph 3.6.15



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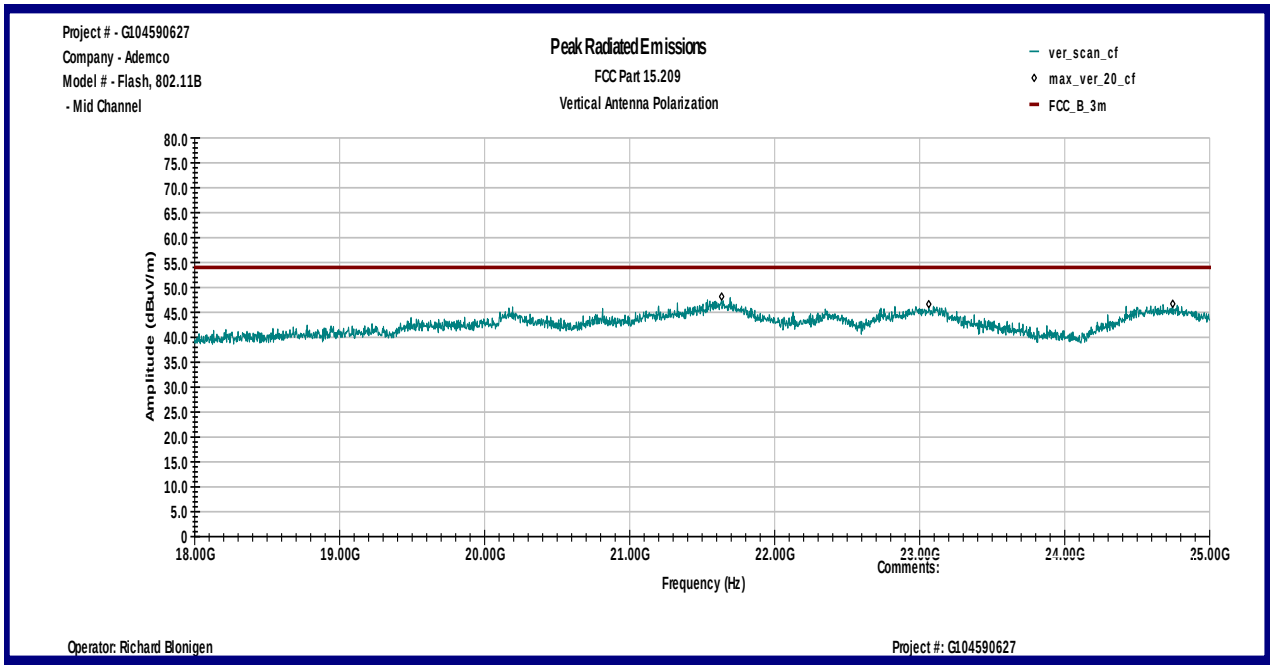

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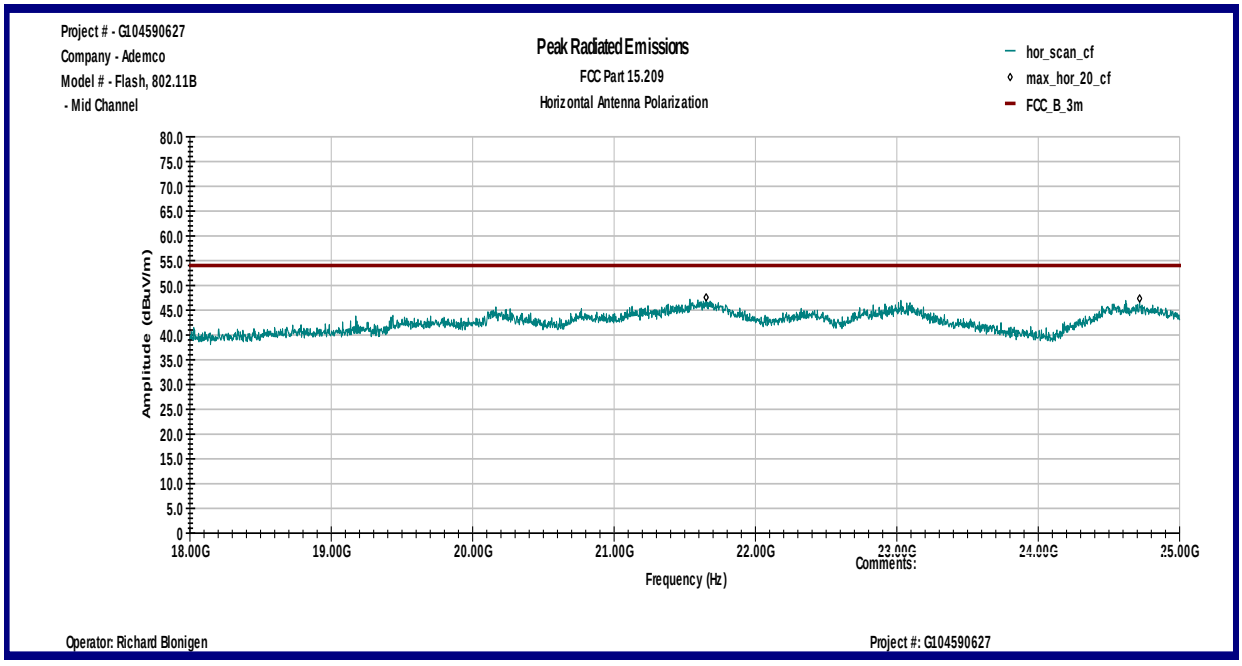

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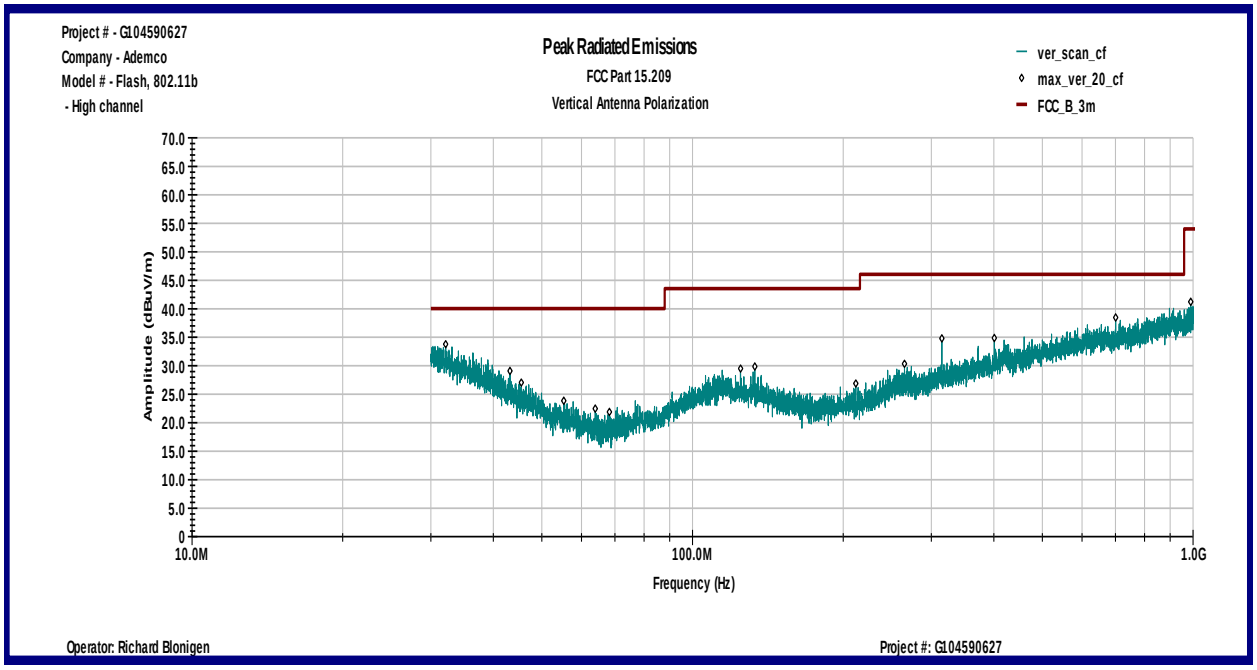

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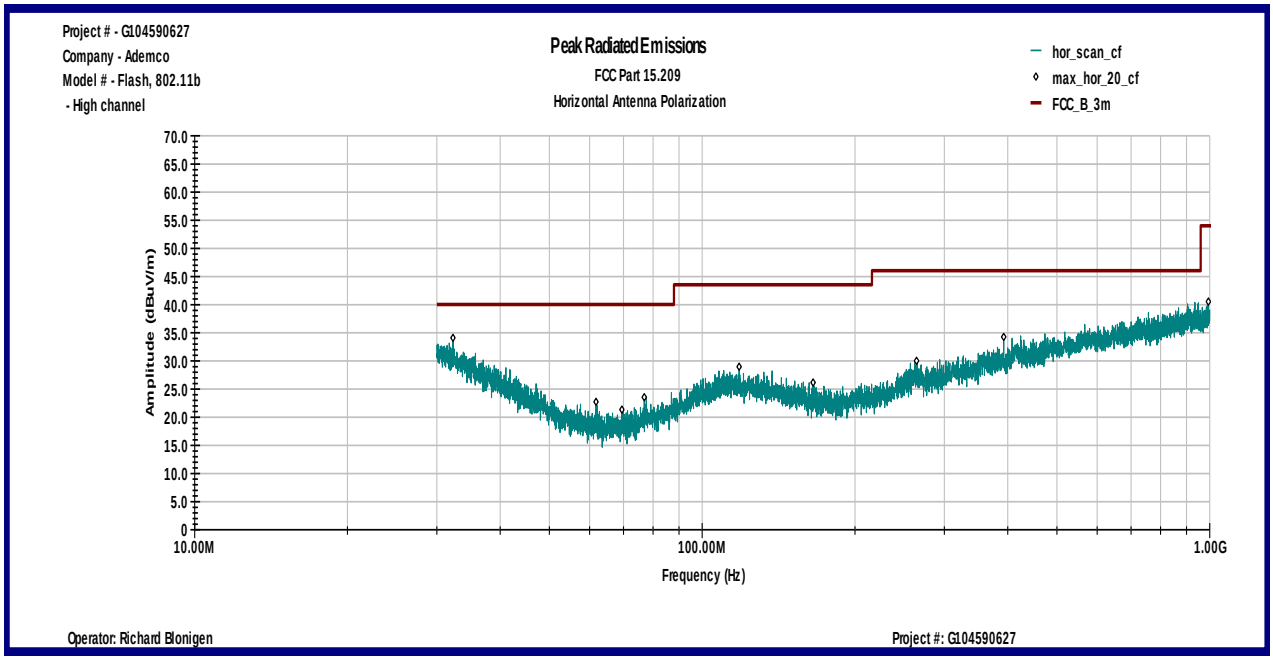
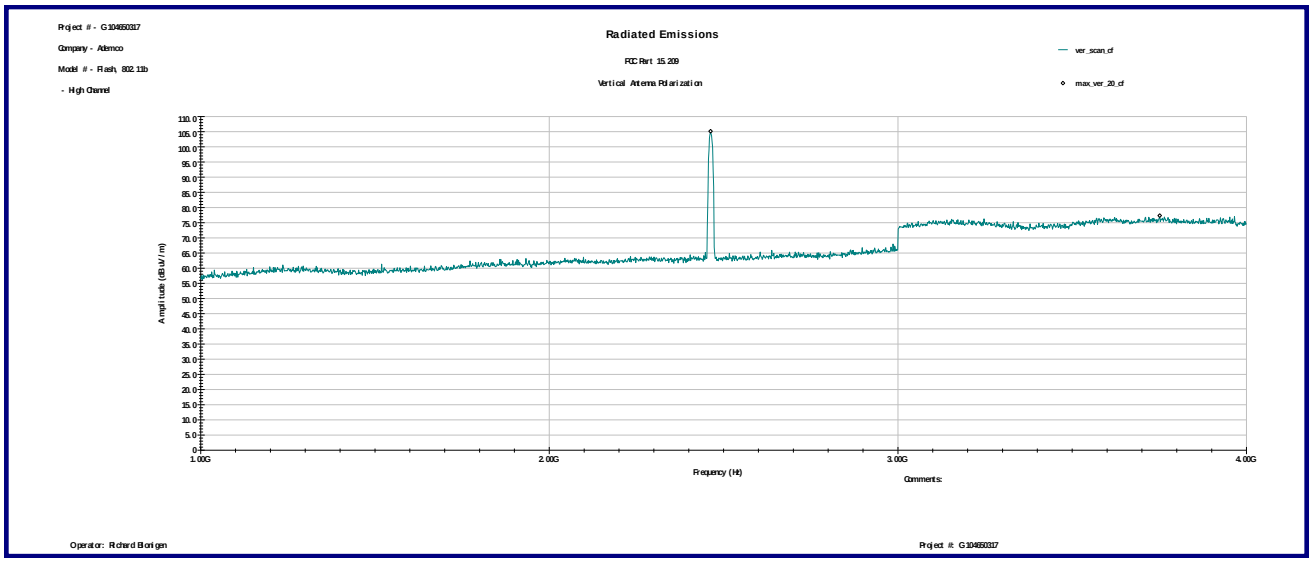


Graph 3.6.20



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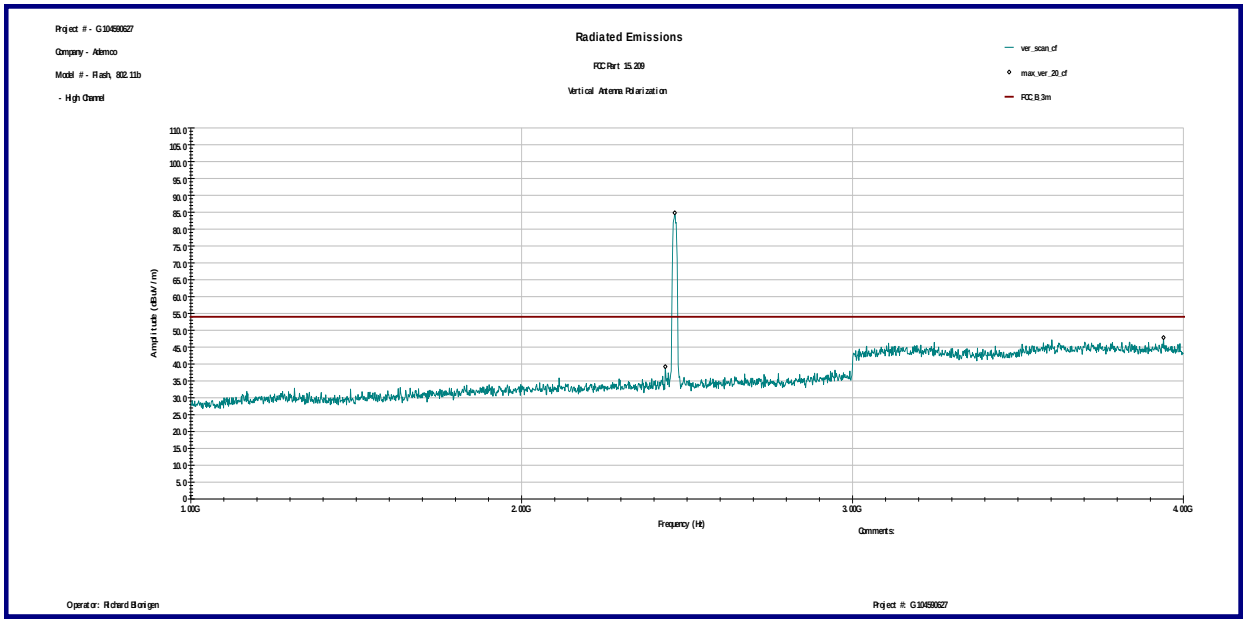

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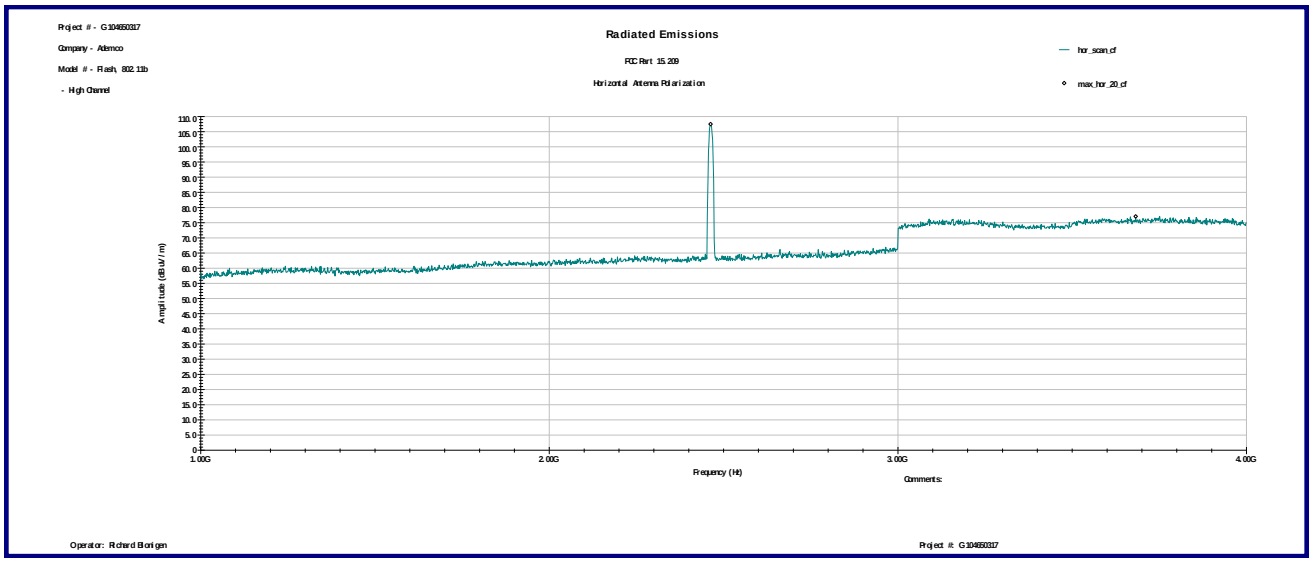

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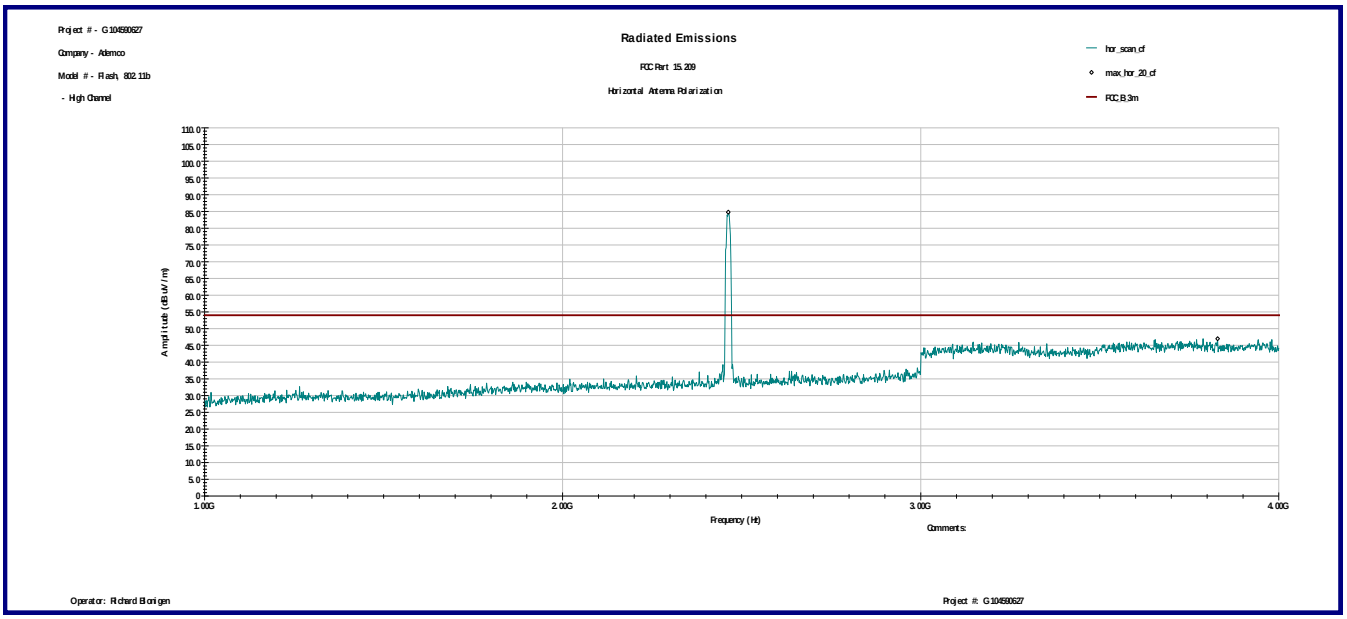

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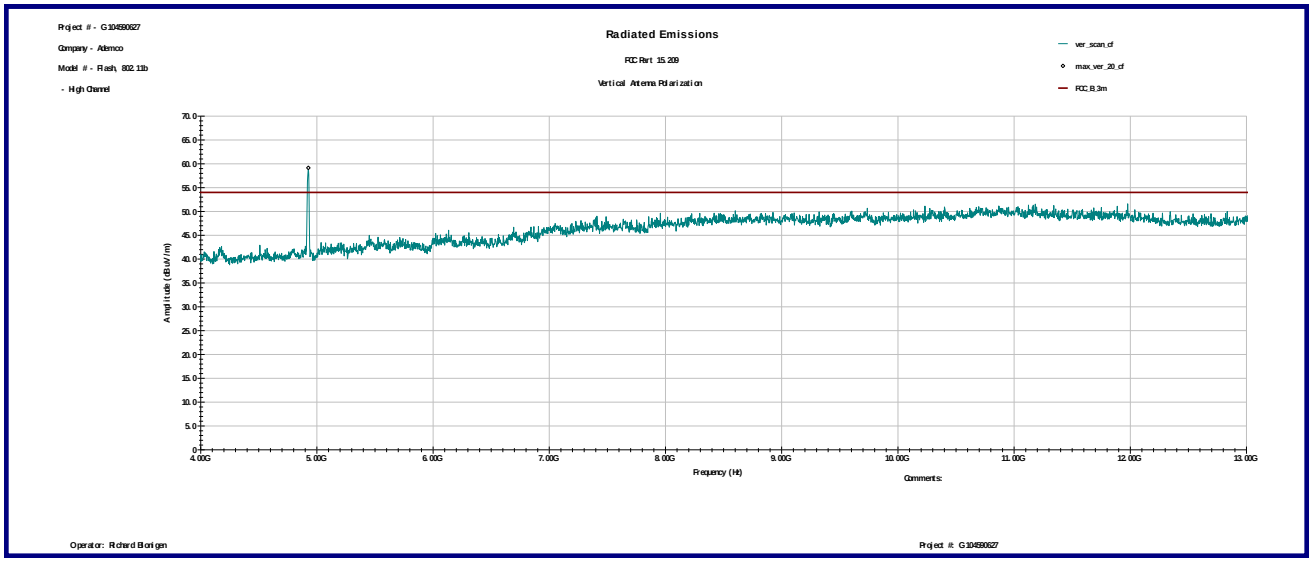

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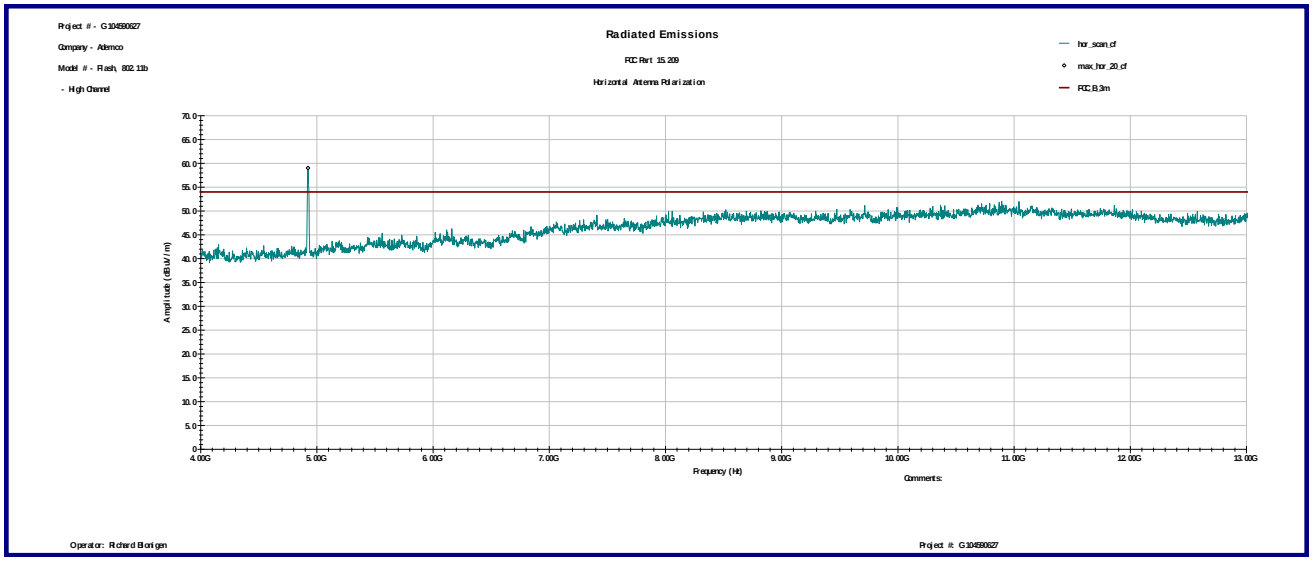

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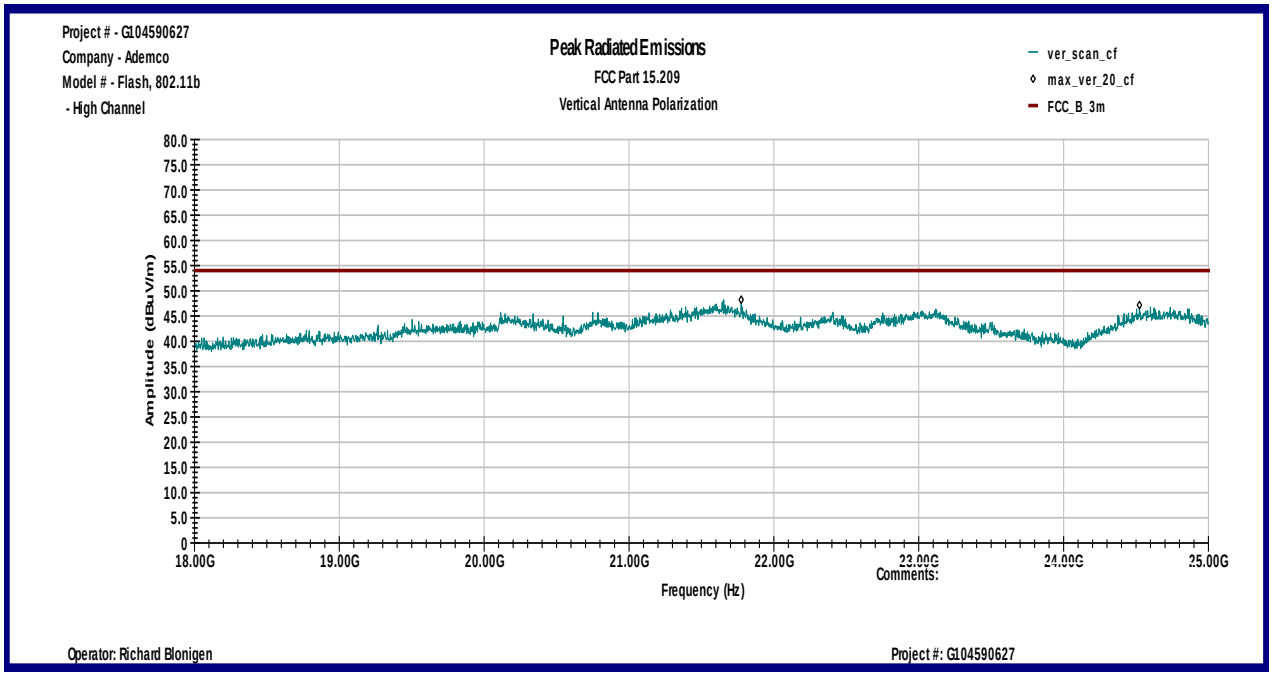

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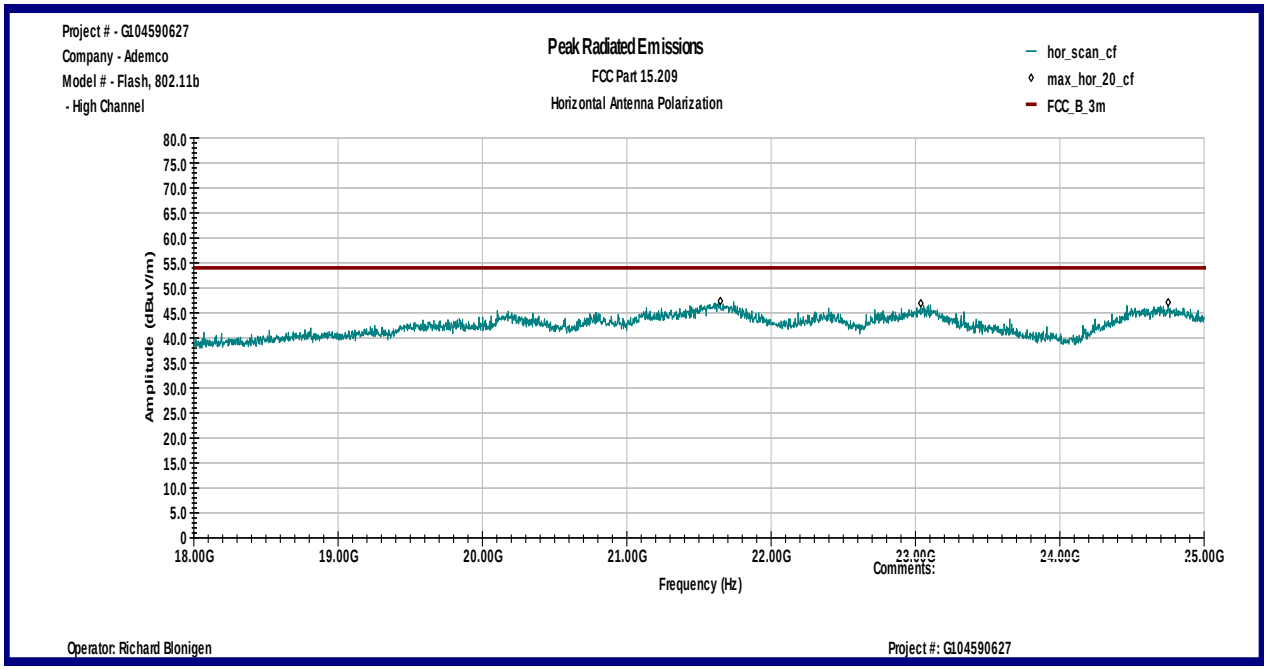

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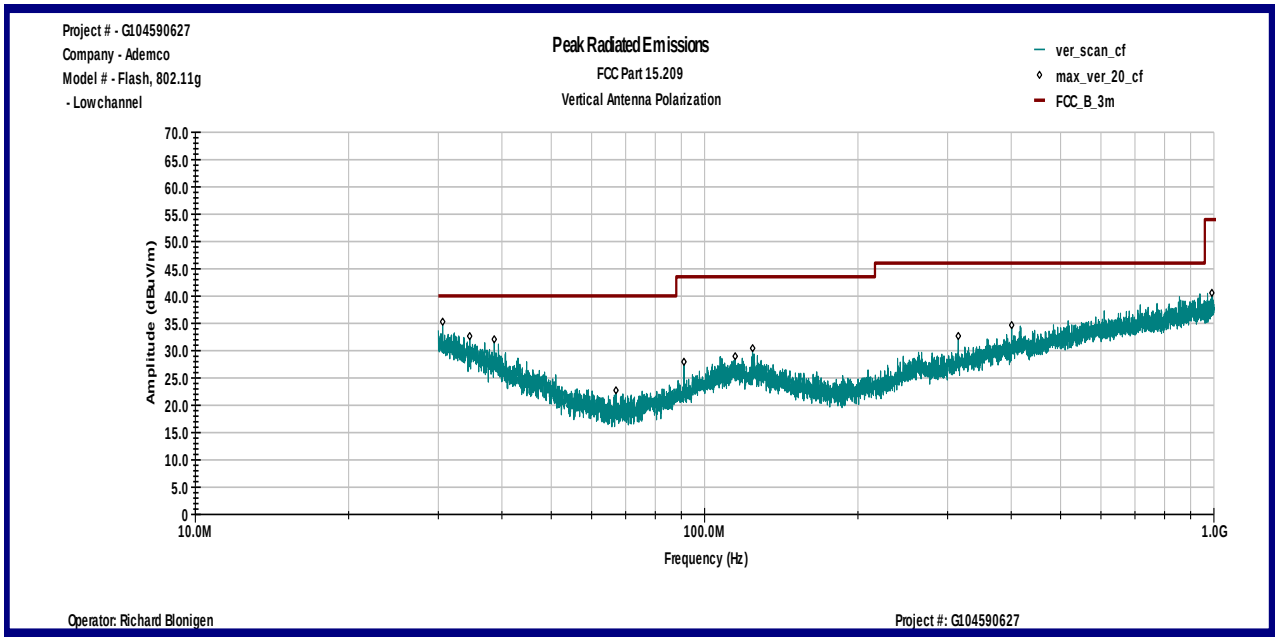

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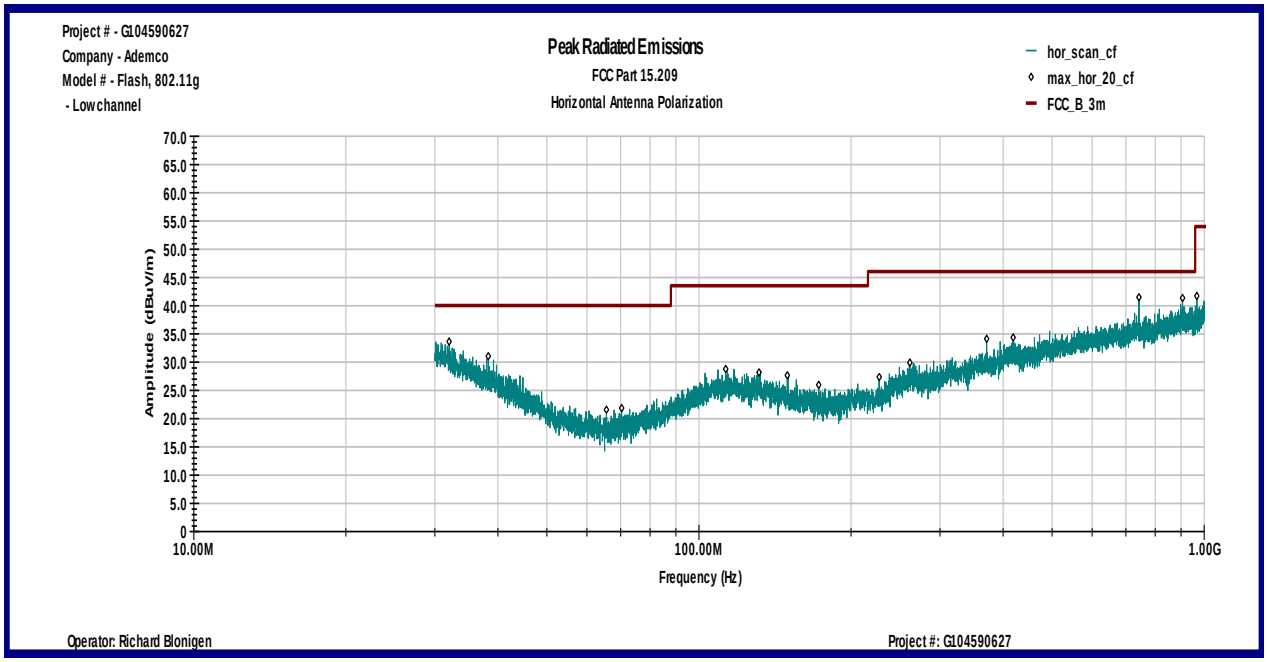

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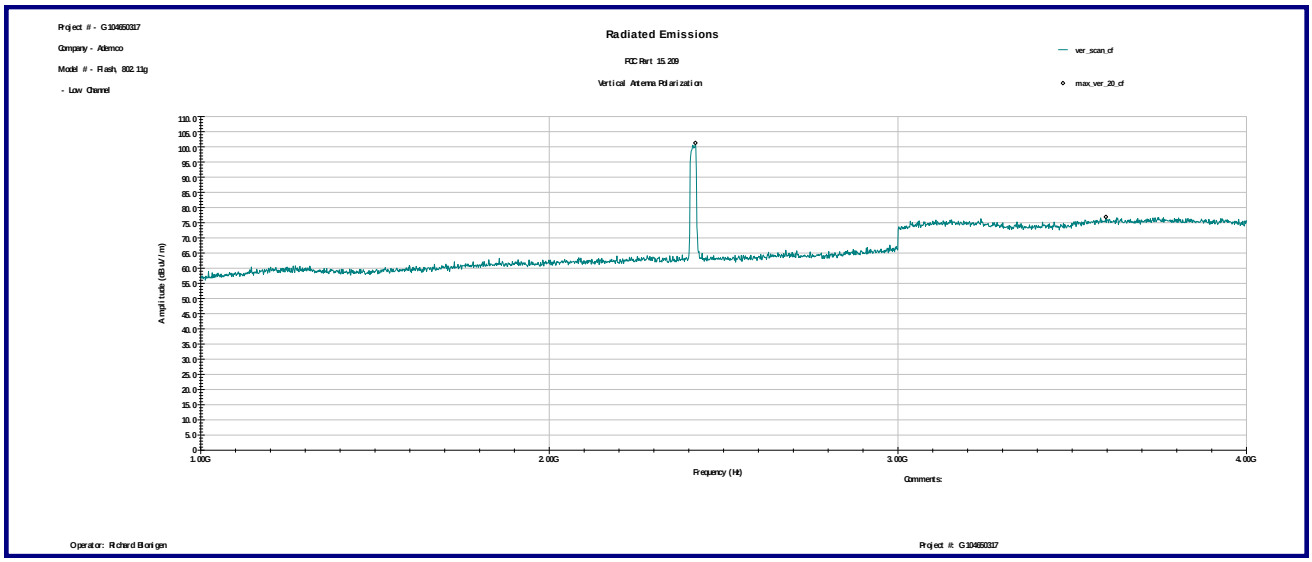

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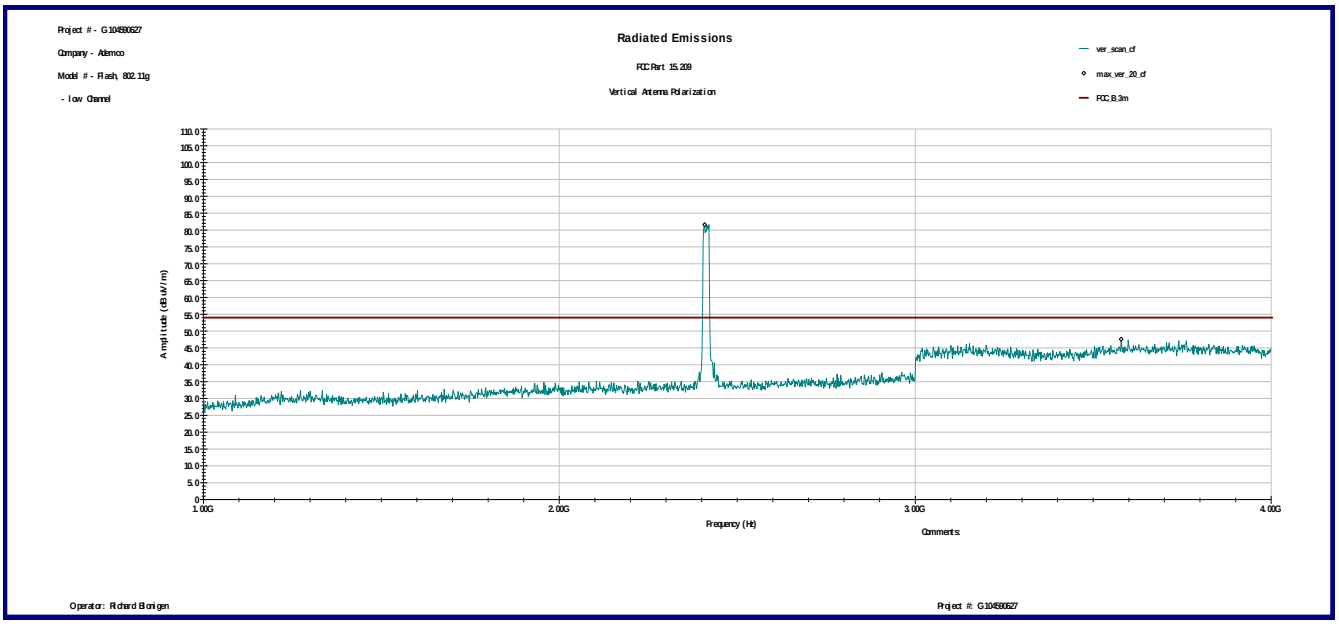

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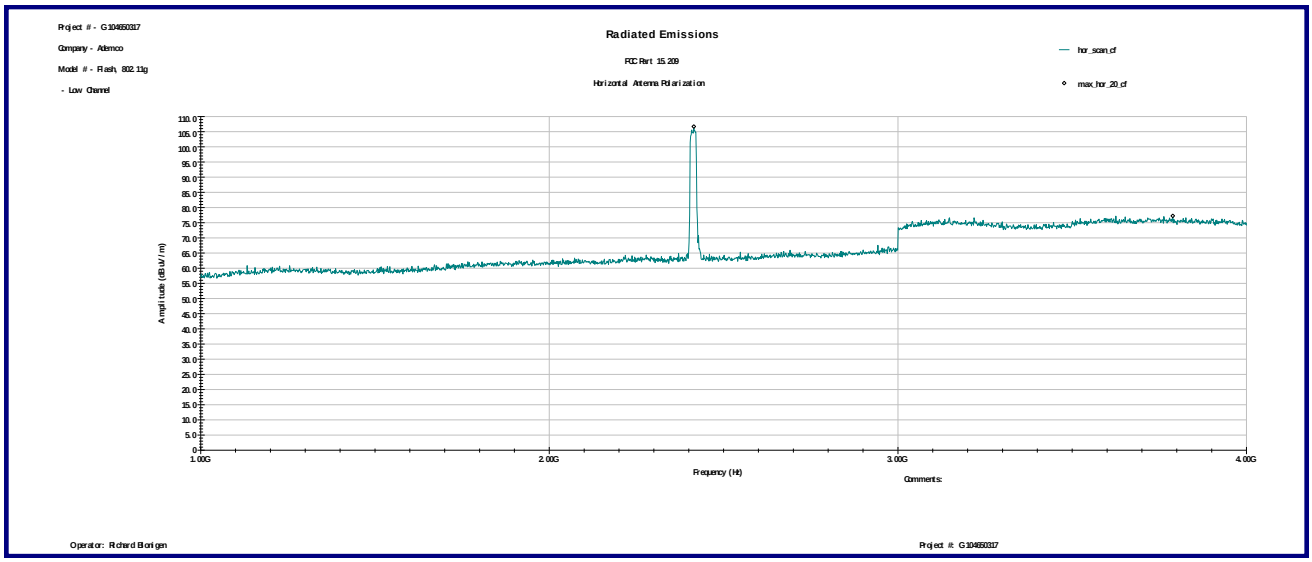

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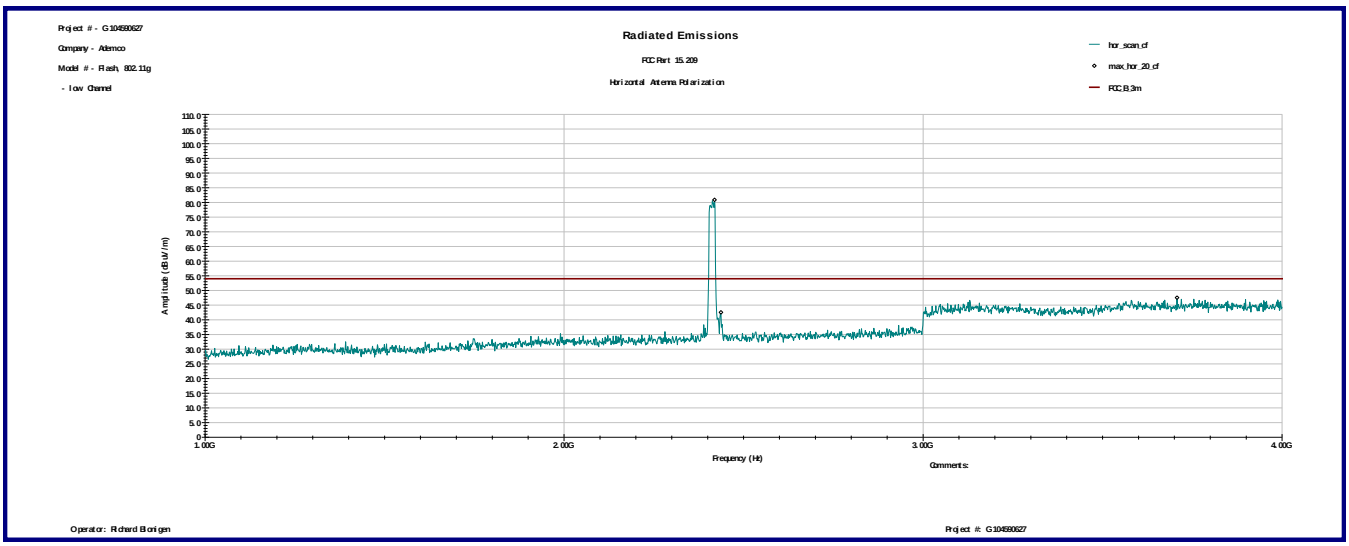

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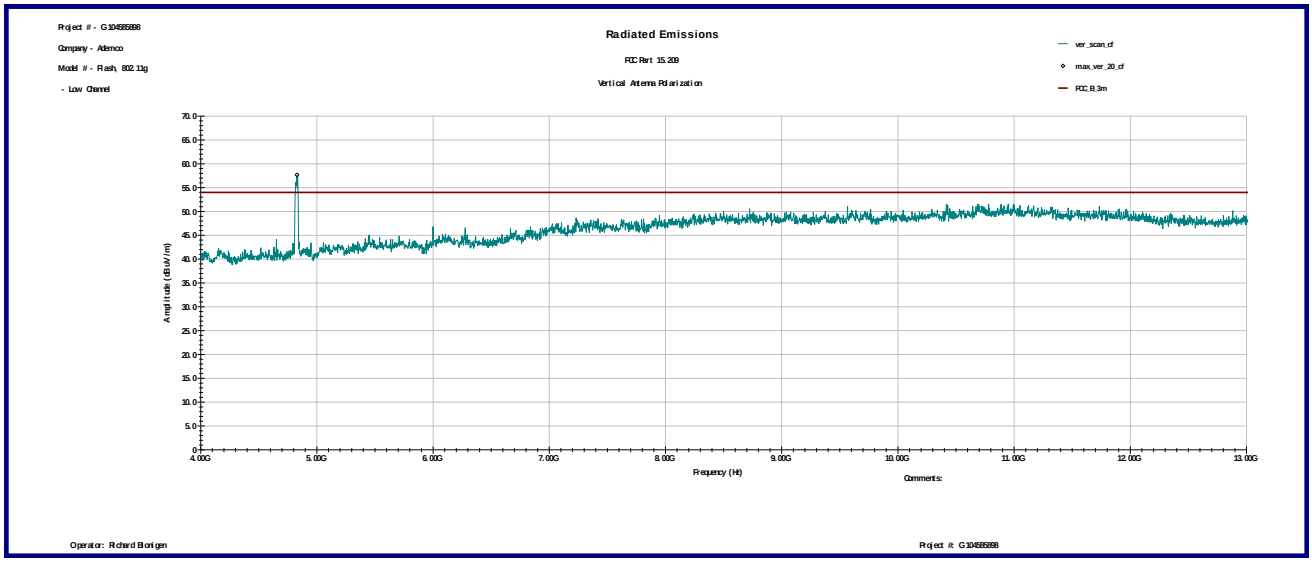

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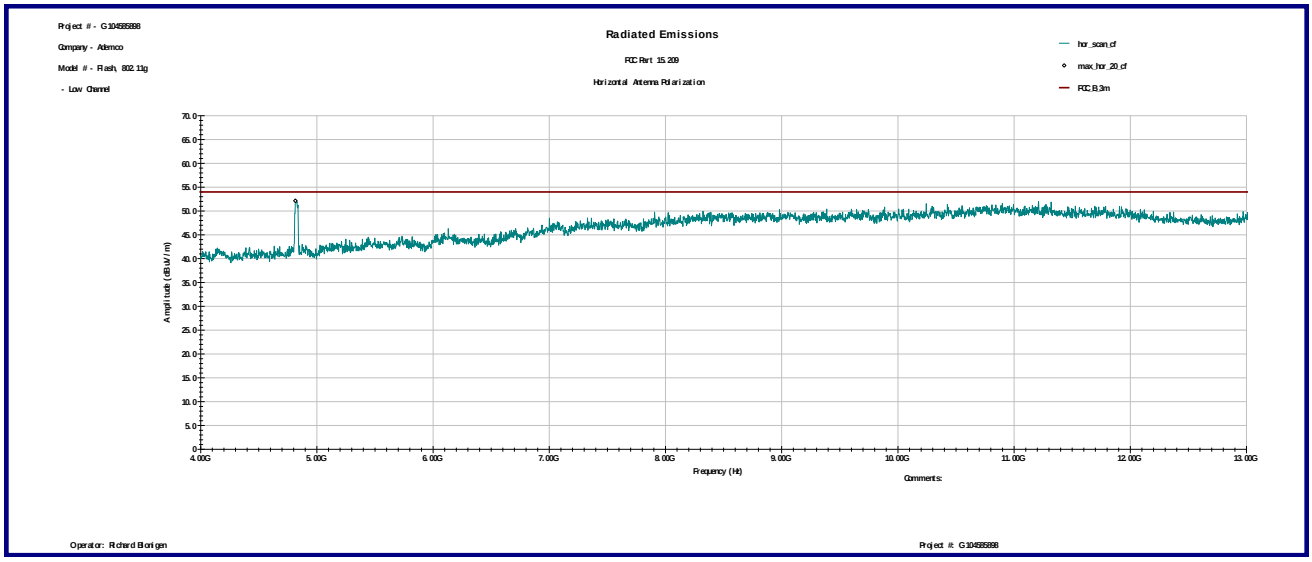

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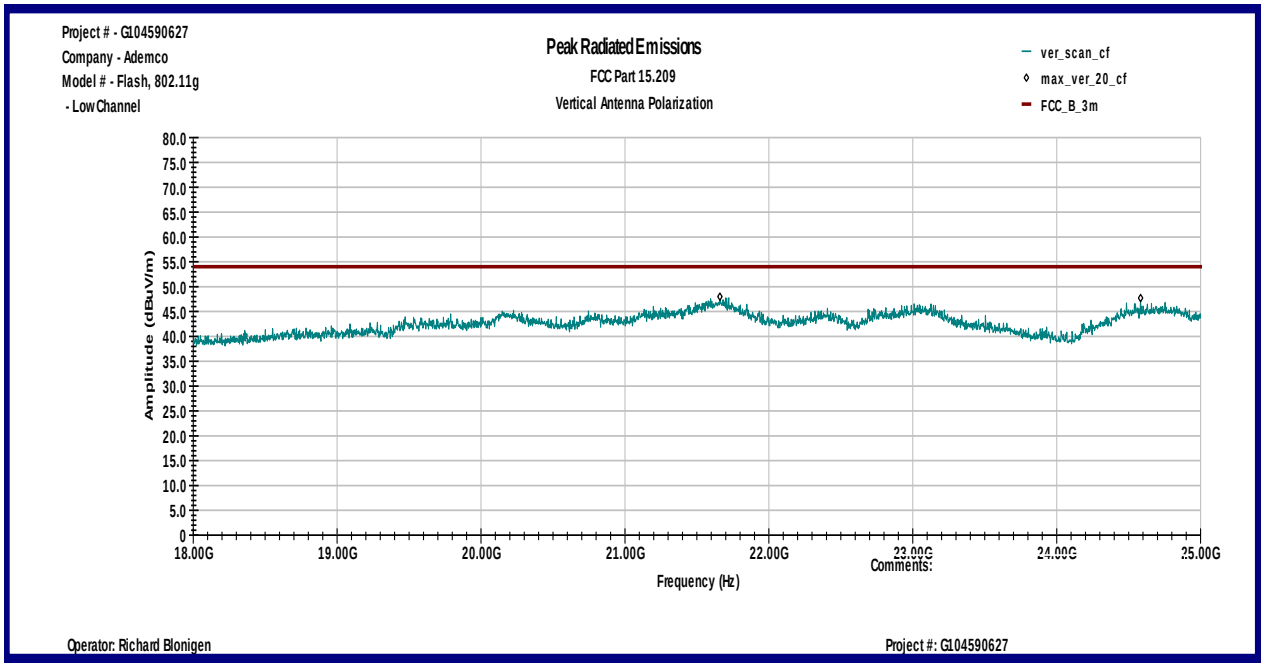

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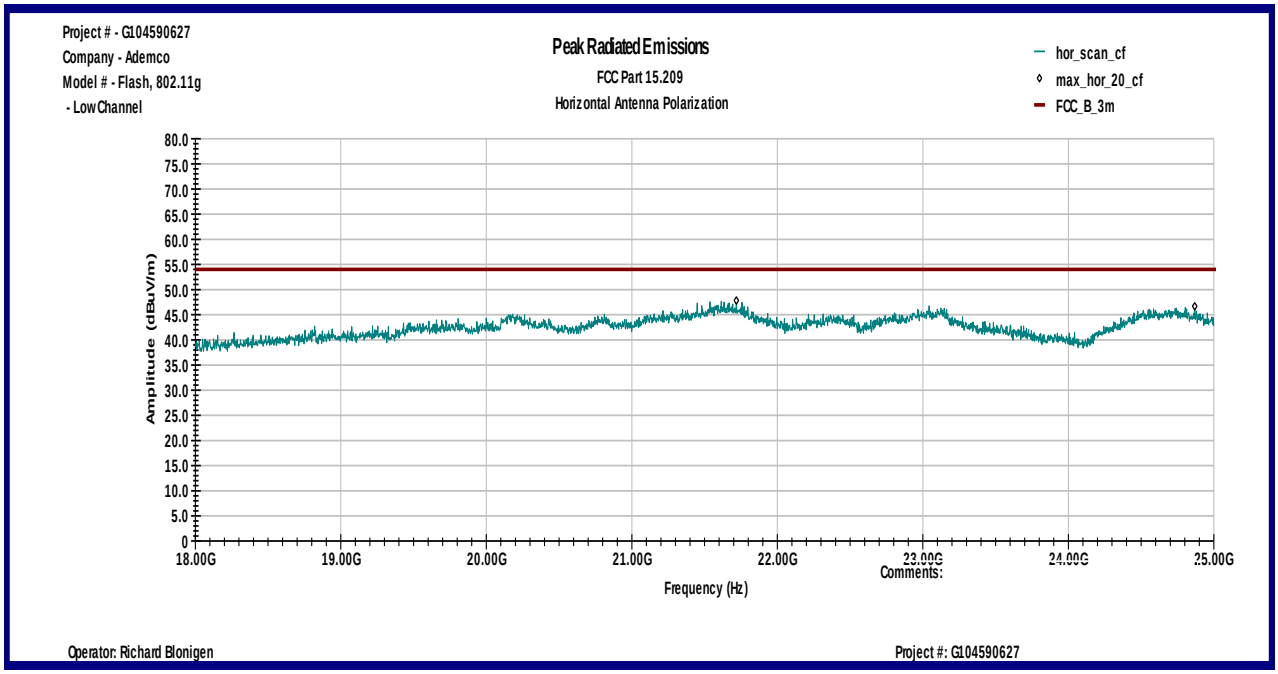

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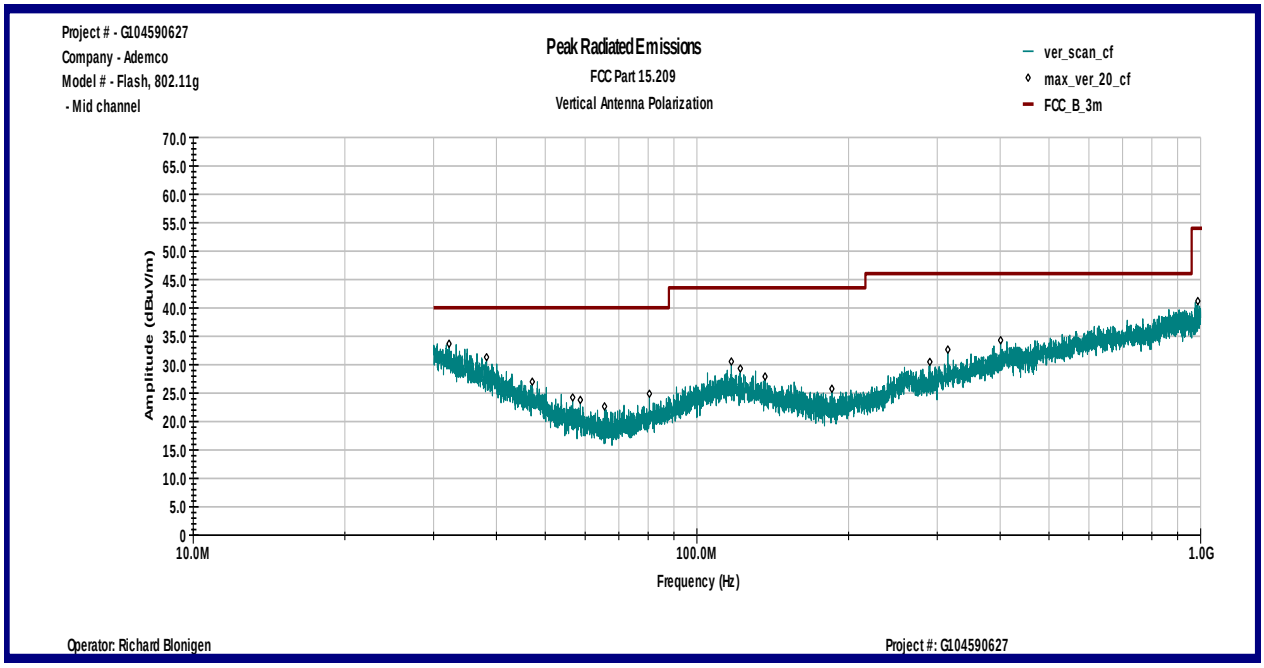

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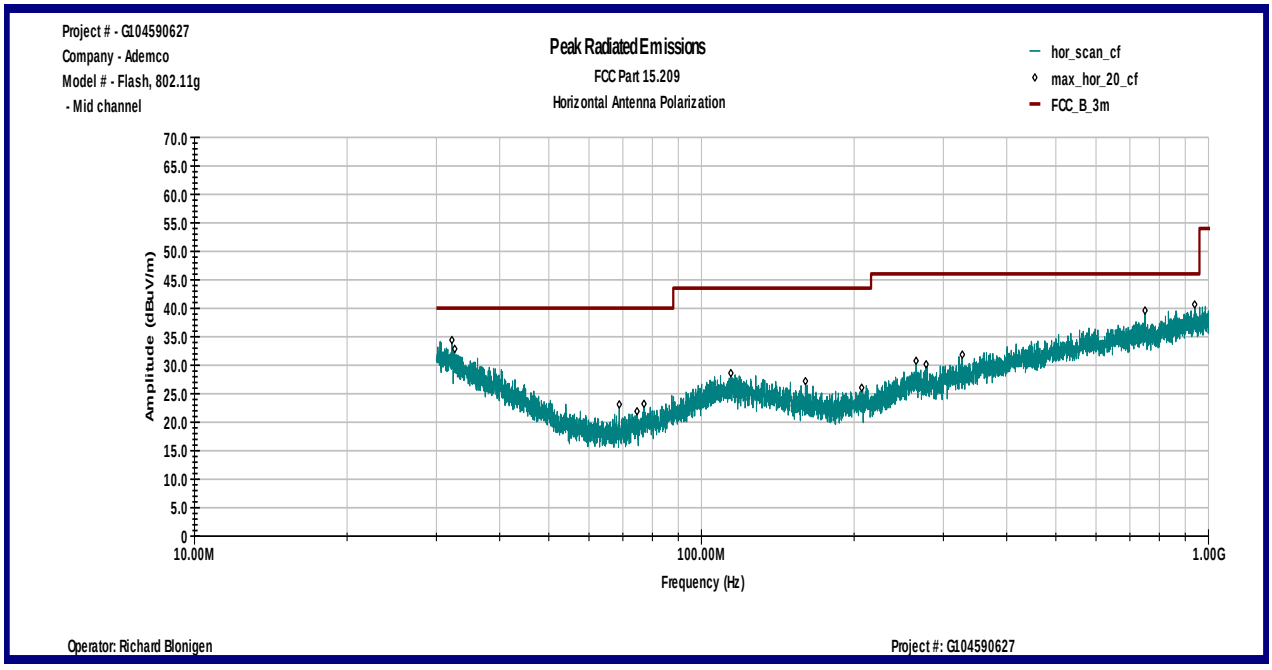
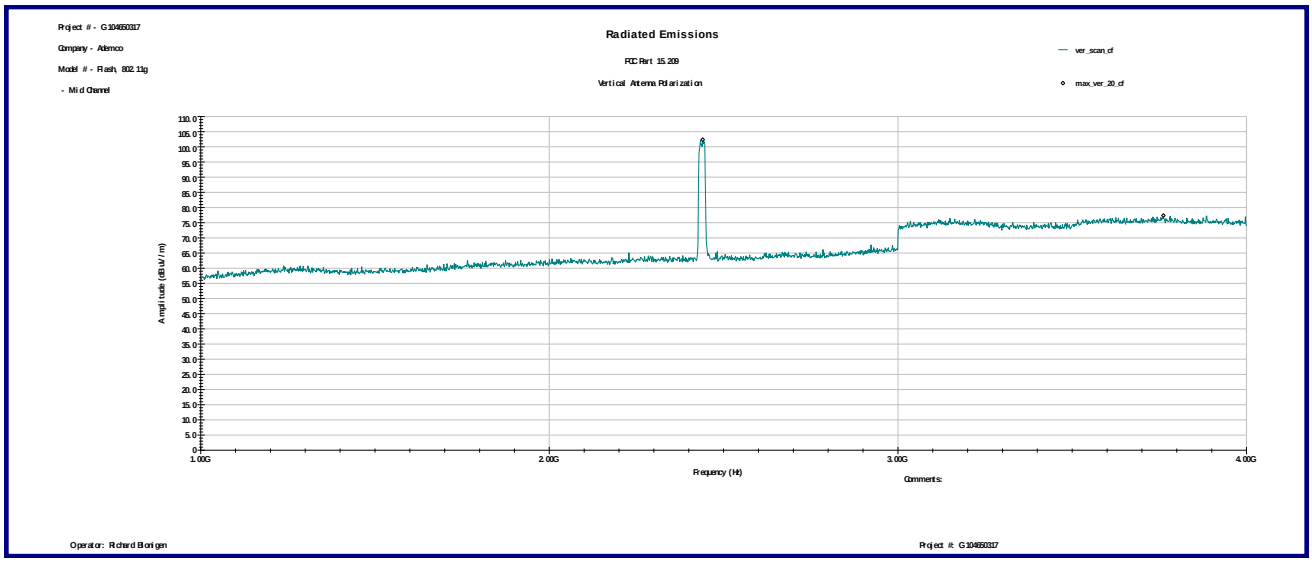


Graph 3.6.40



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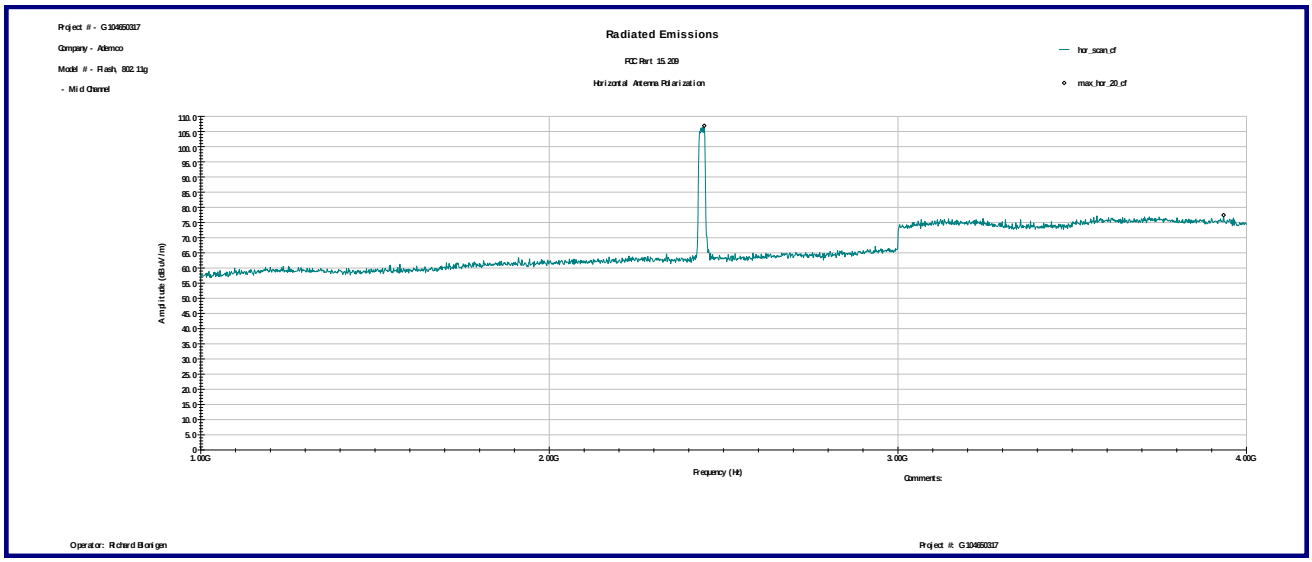

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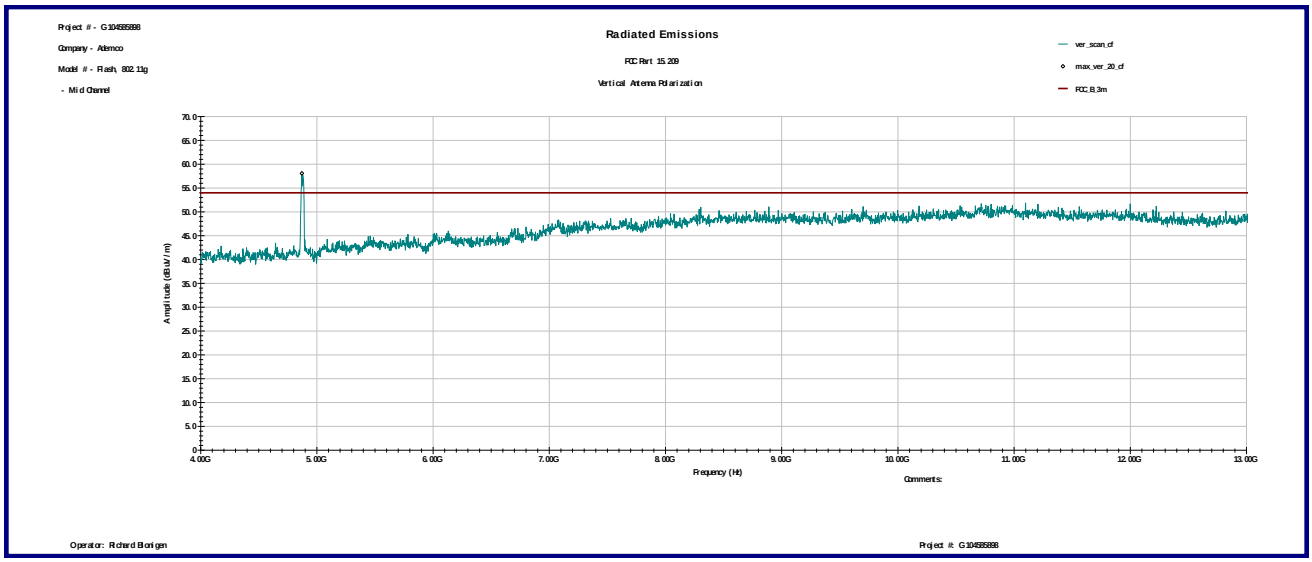

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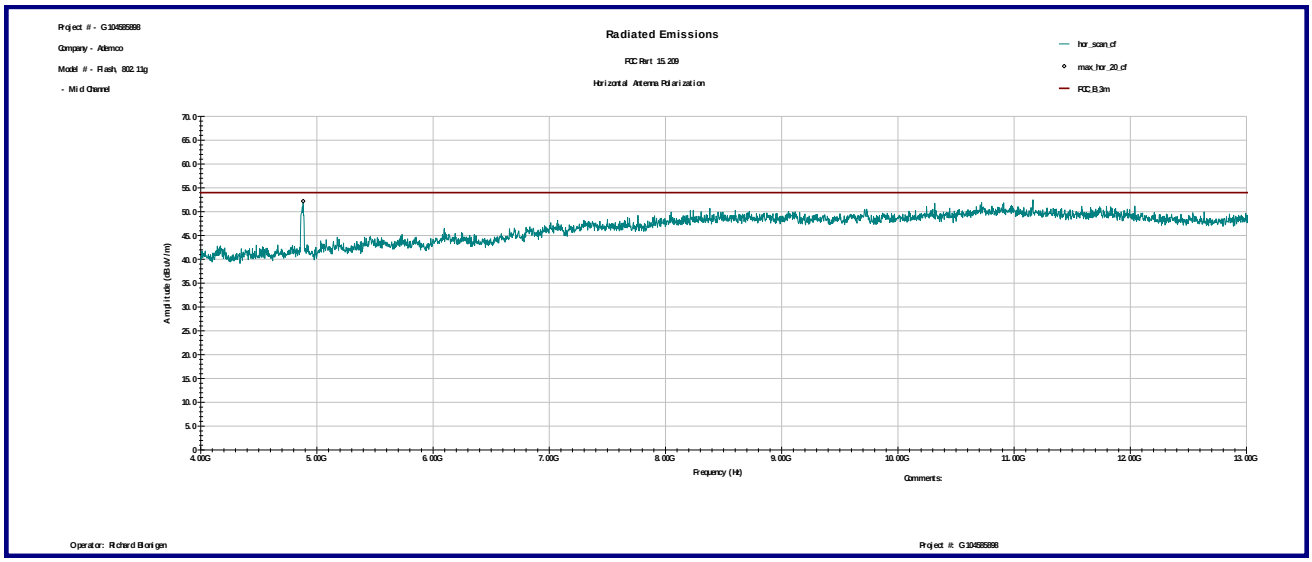

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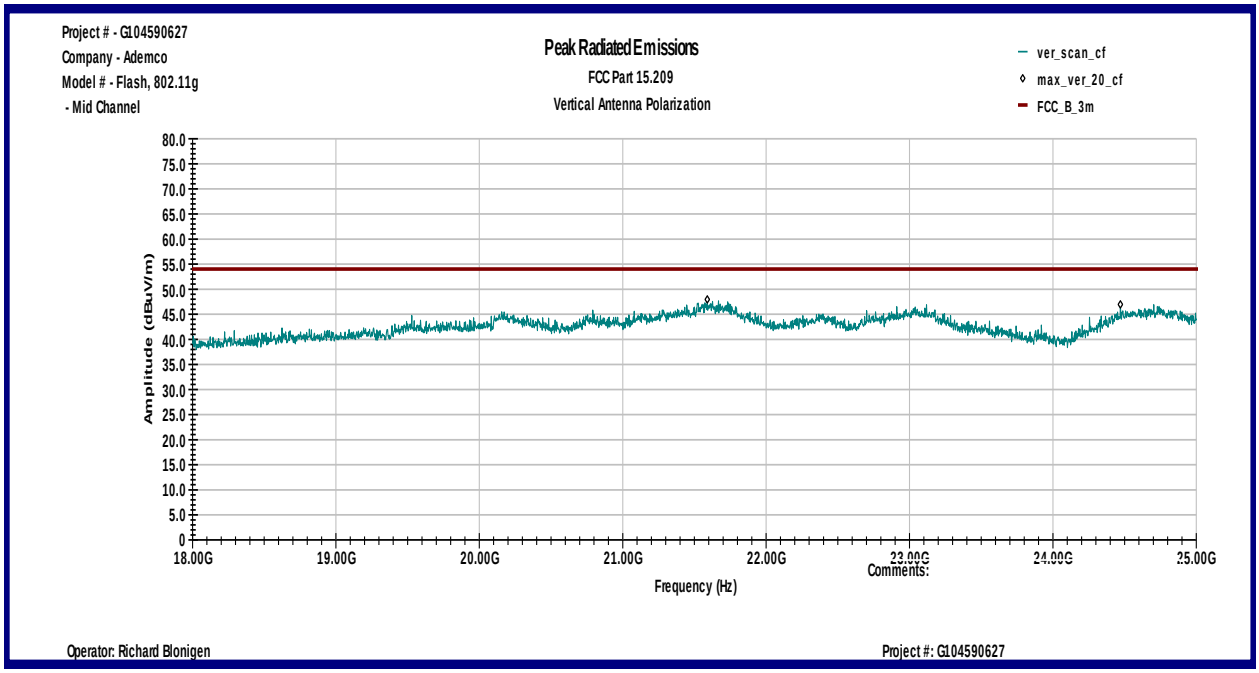

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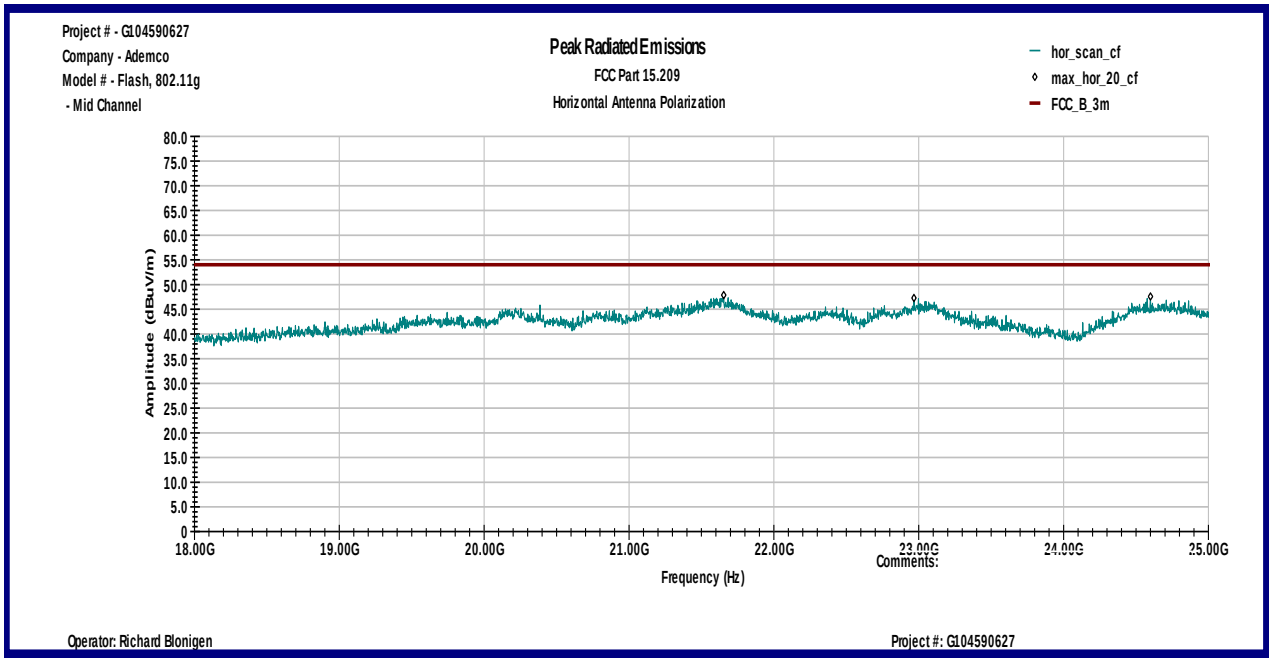

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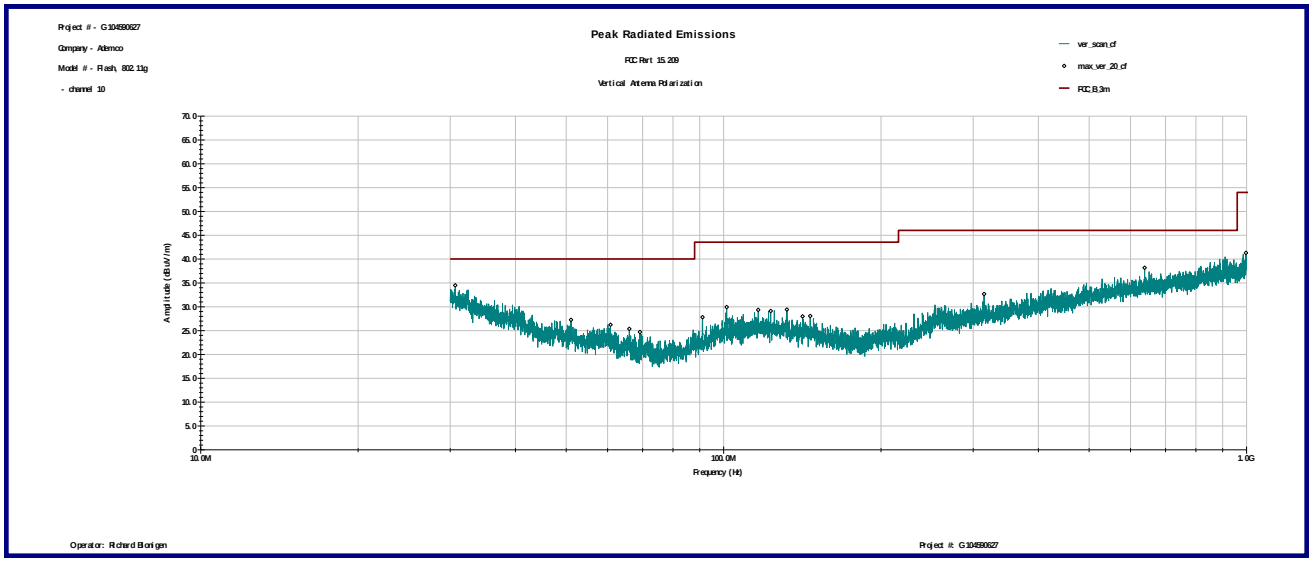

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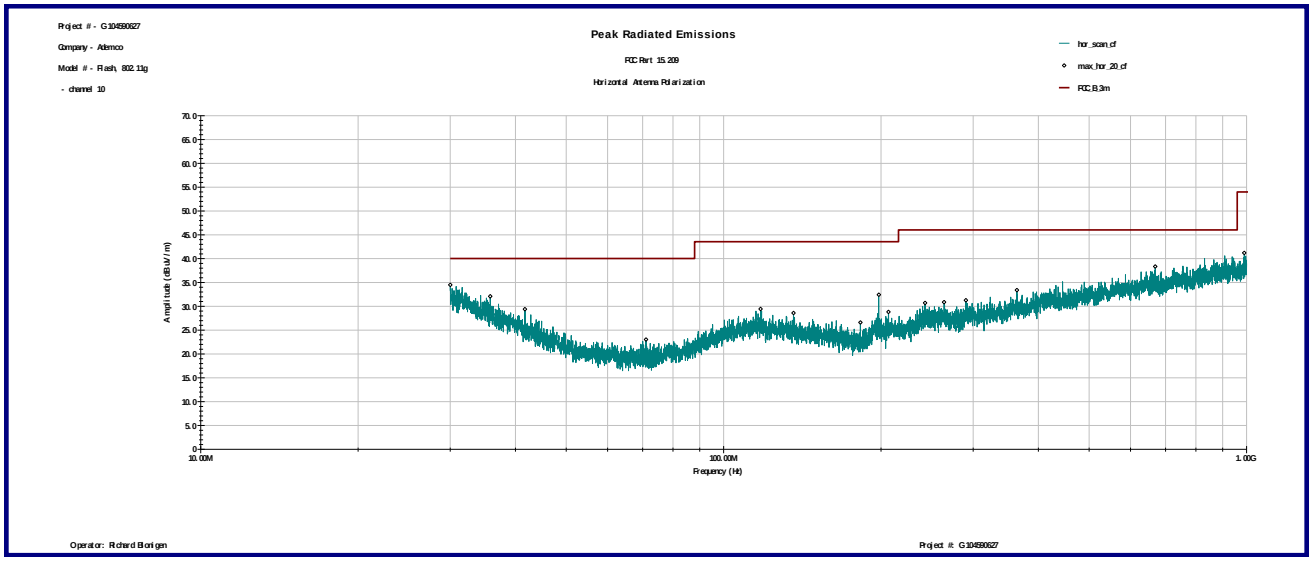

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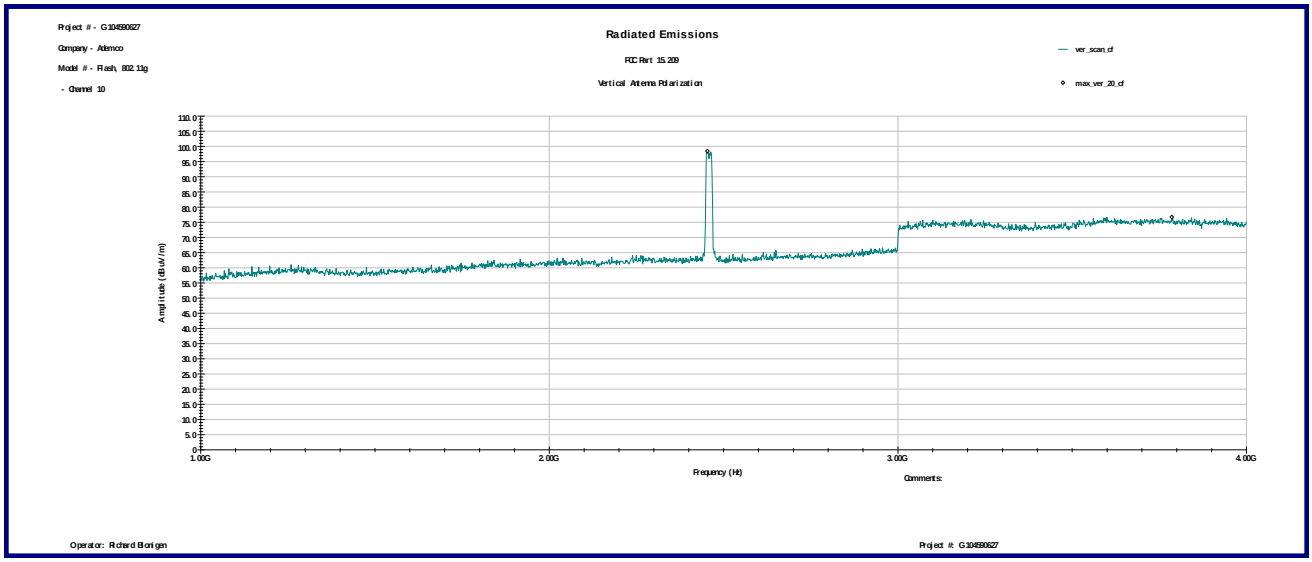

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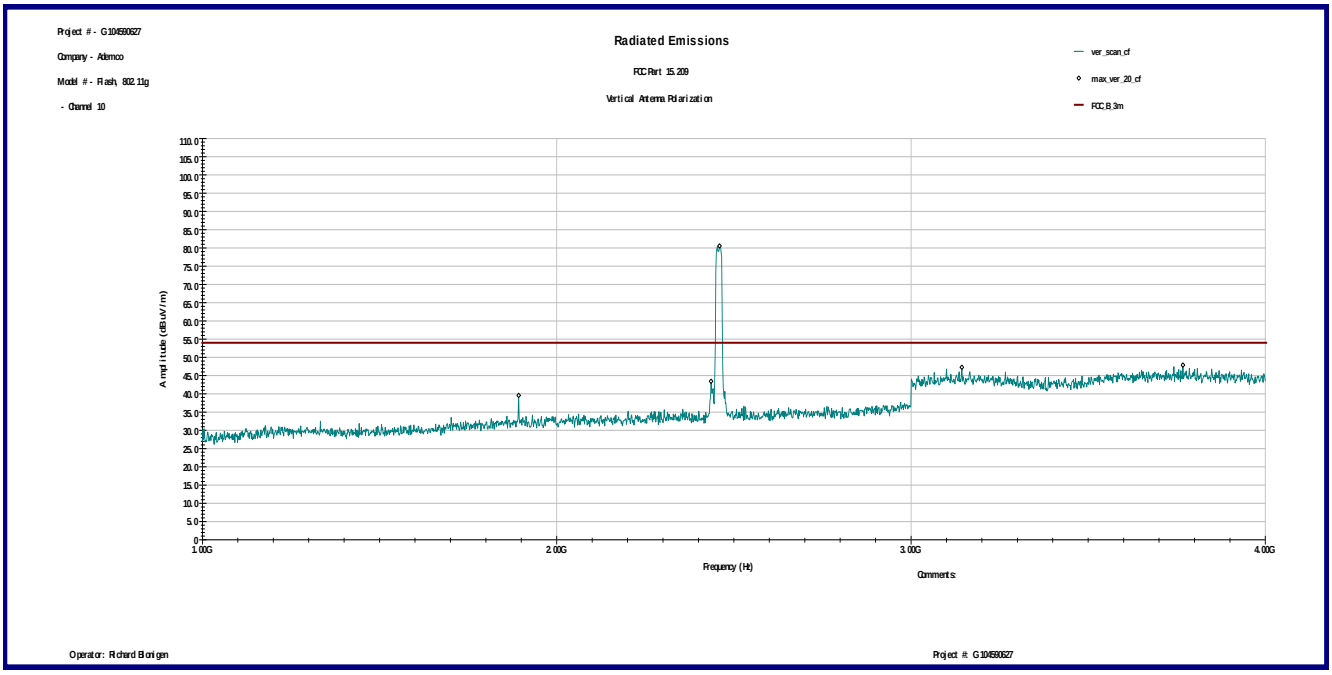
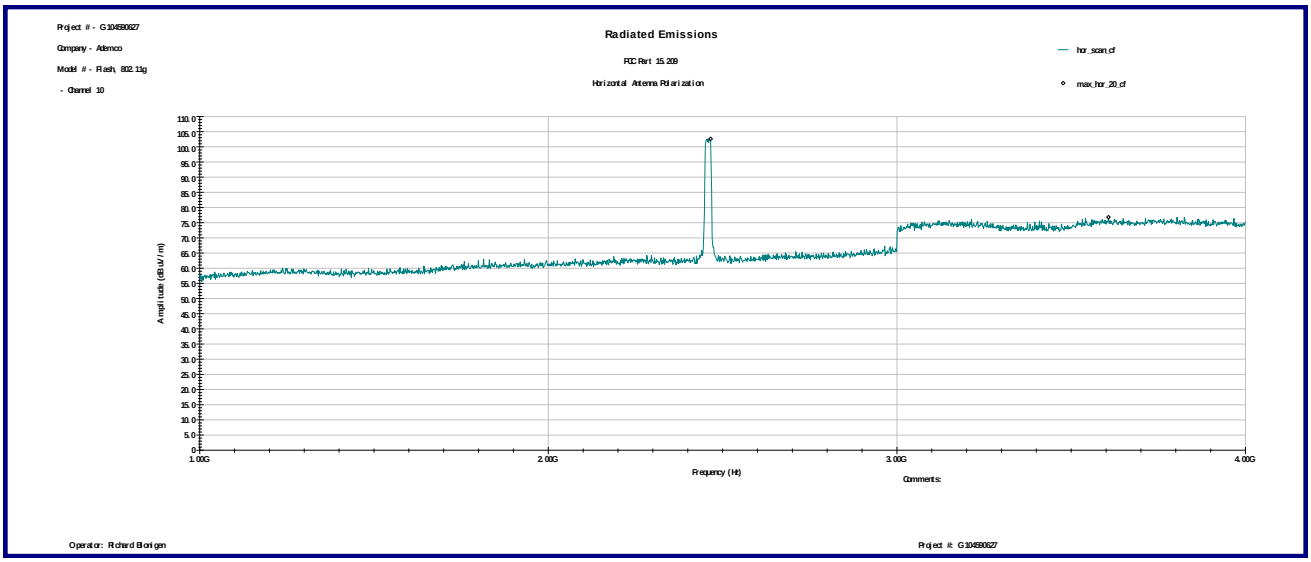


Graph 3.6.50



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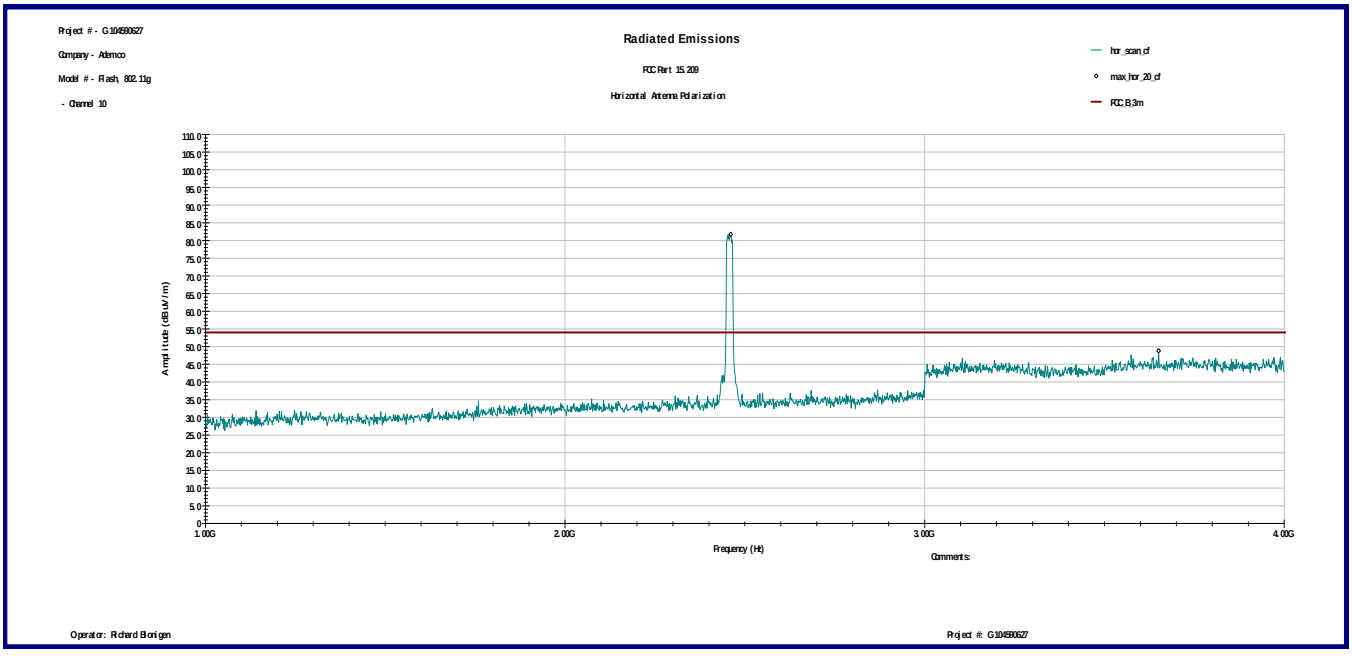

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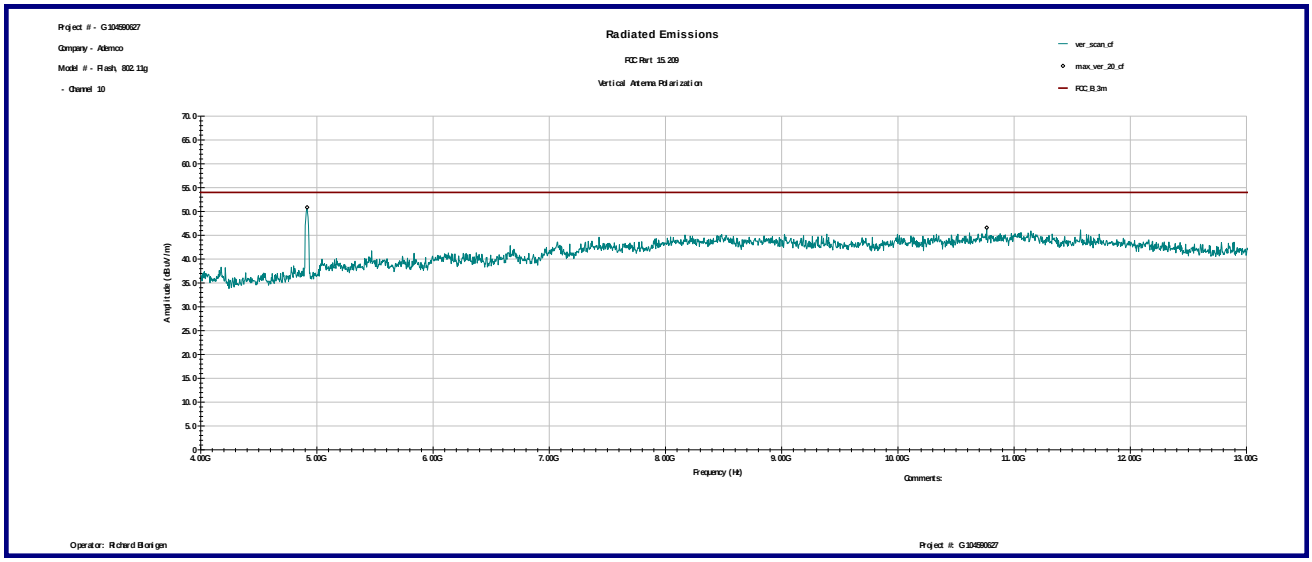

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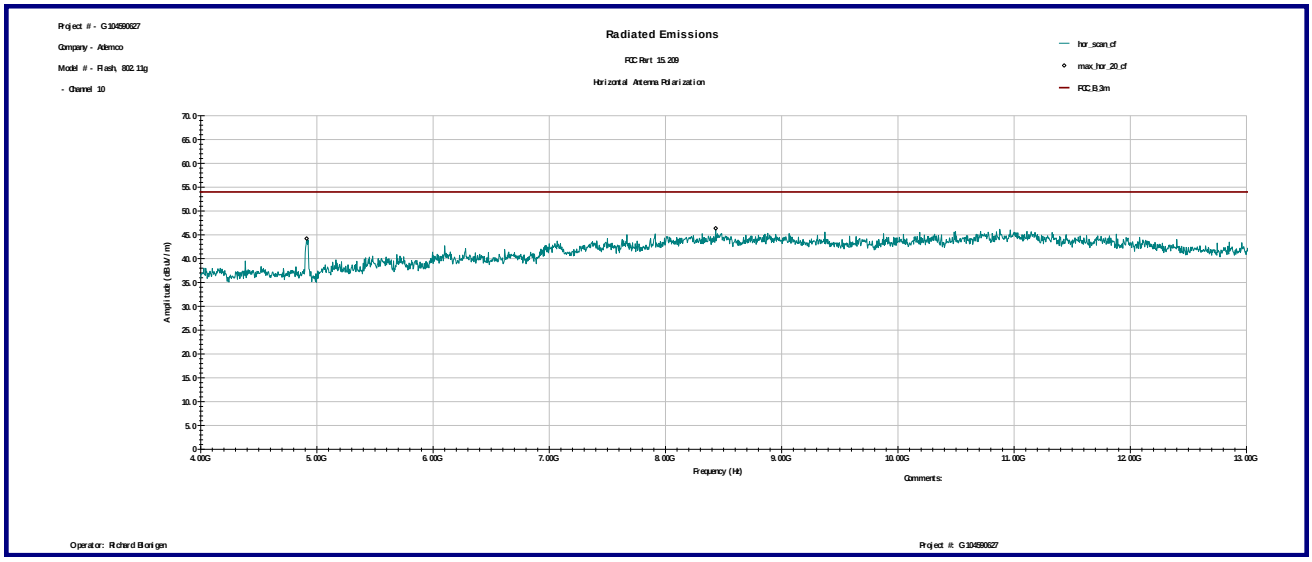

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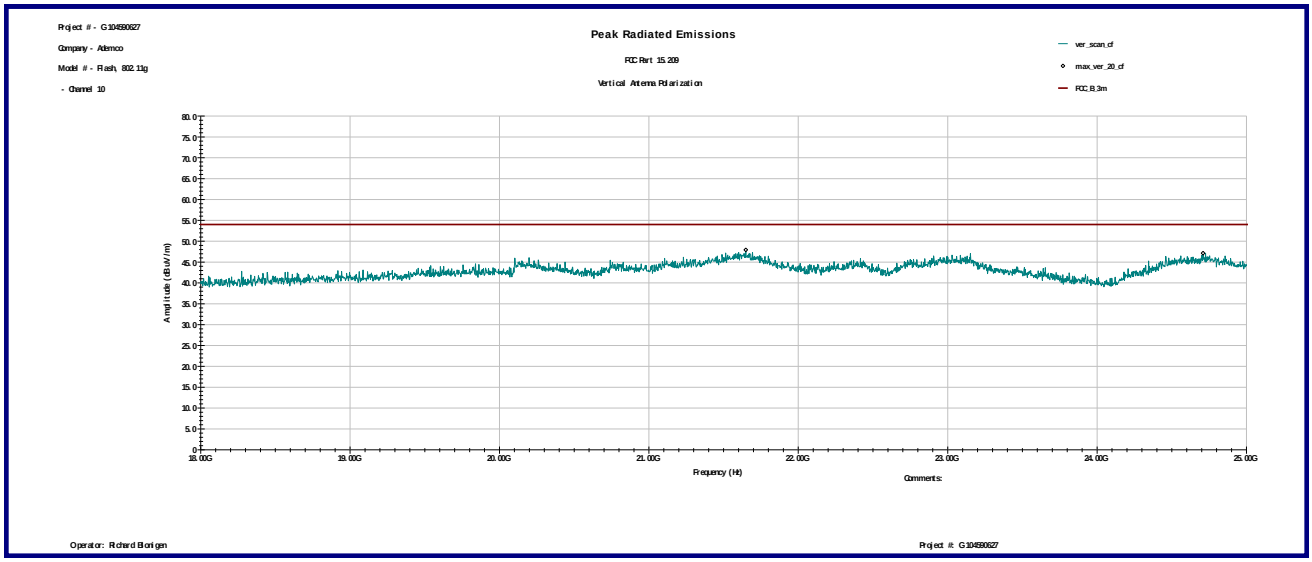
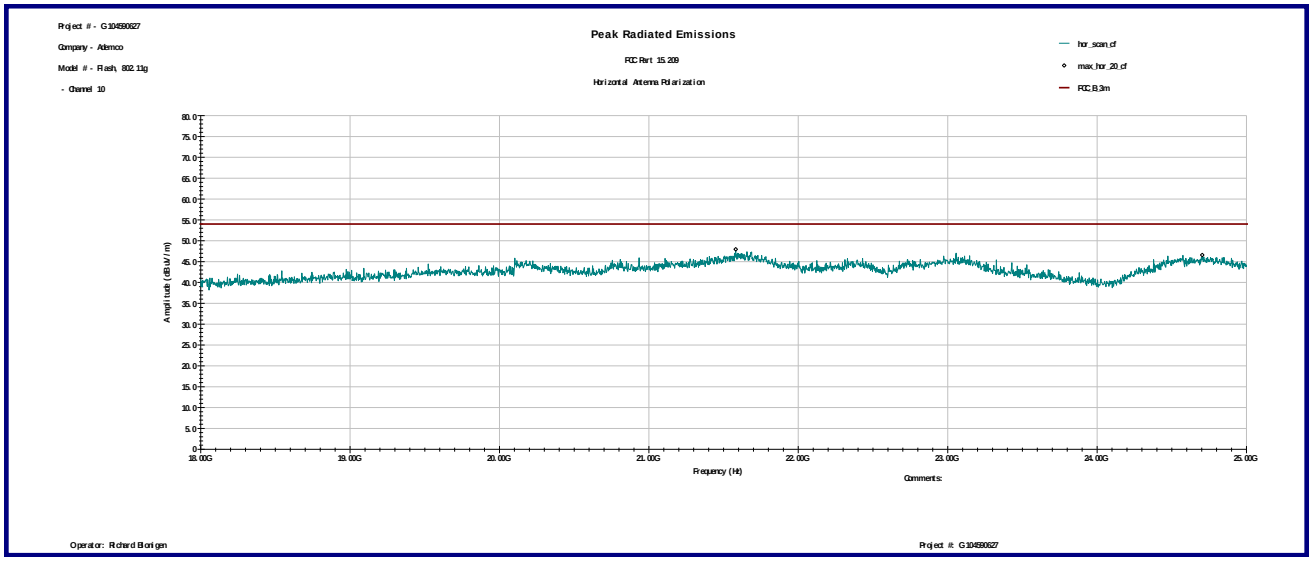


Graph 3.6.55



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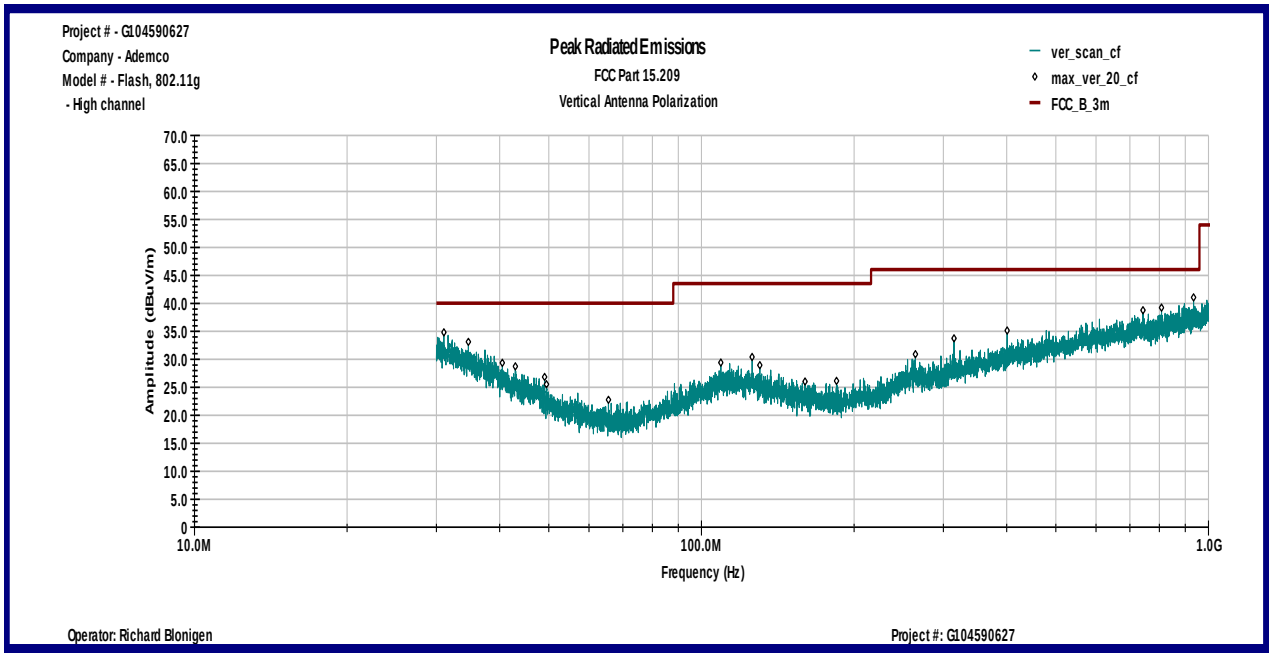

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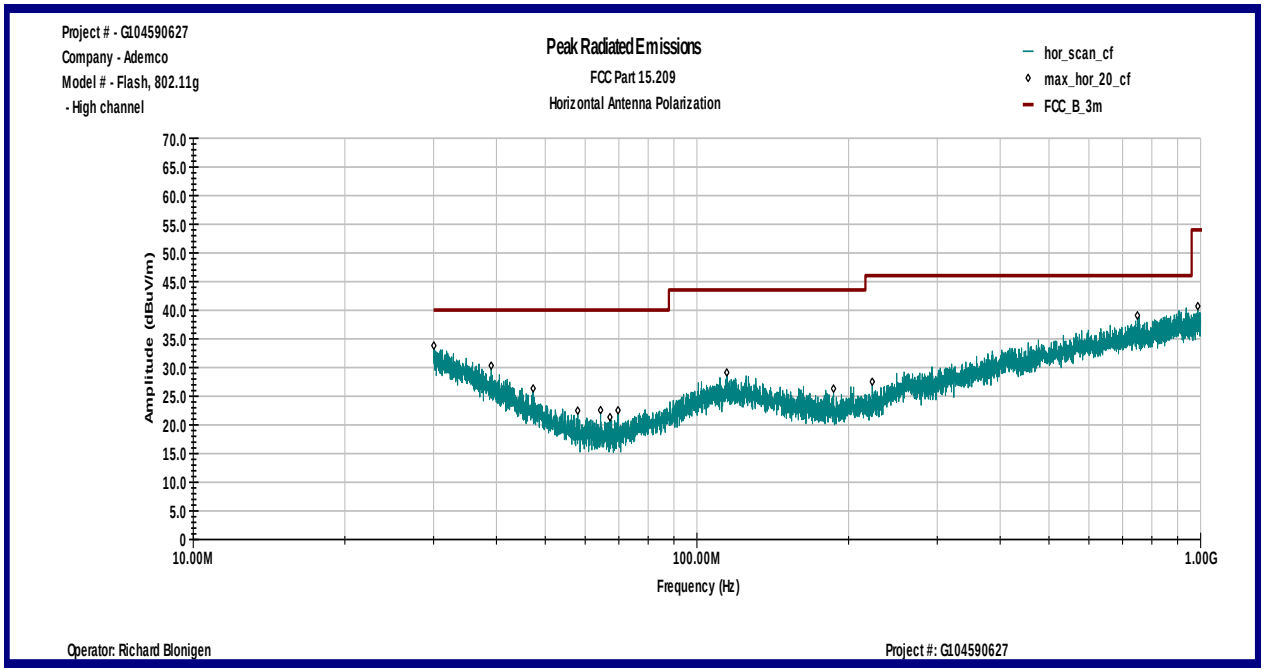
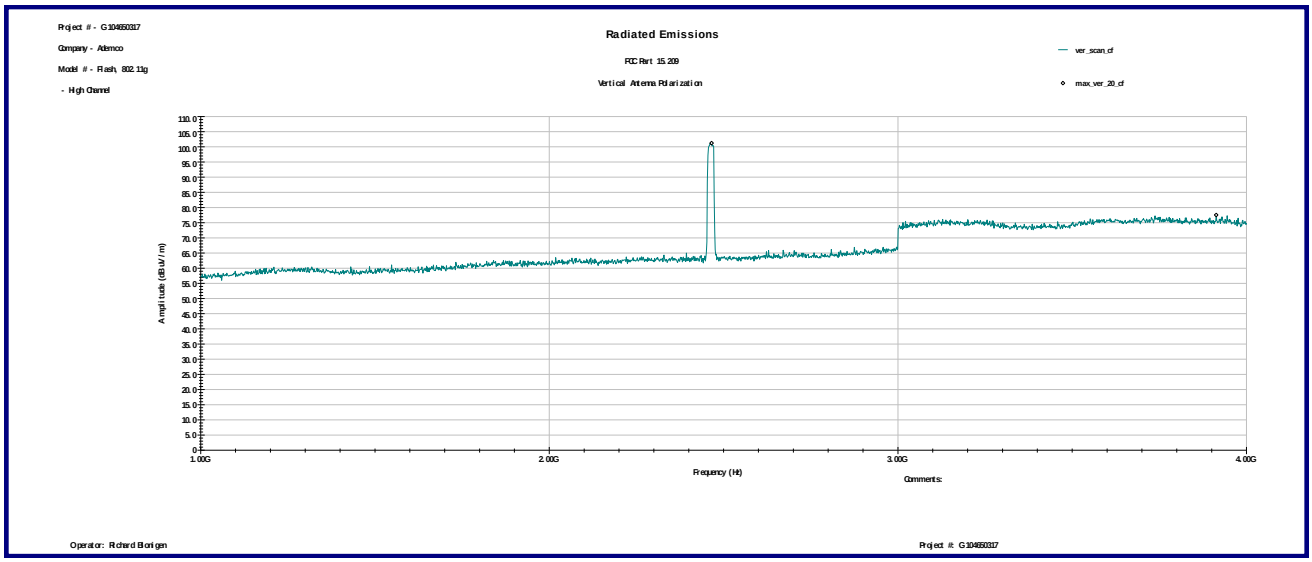
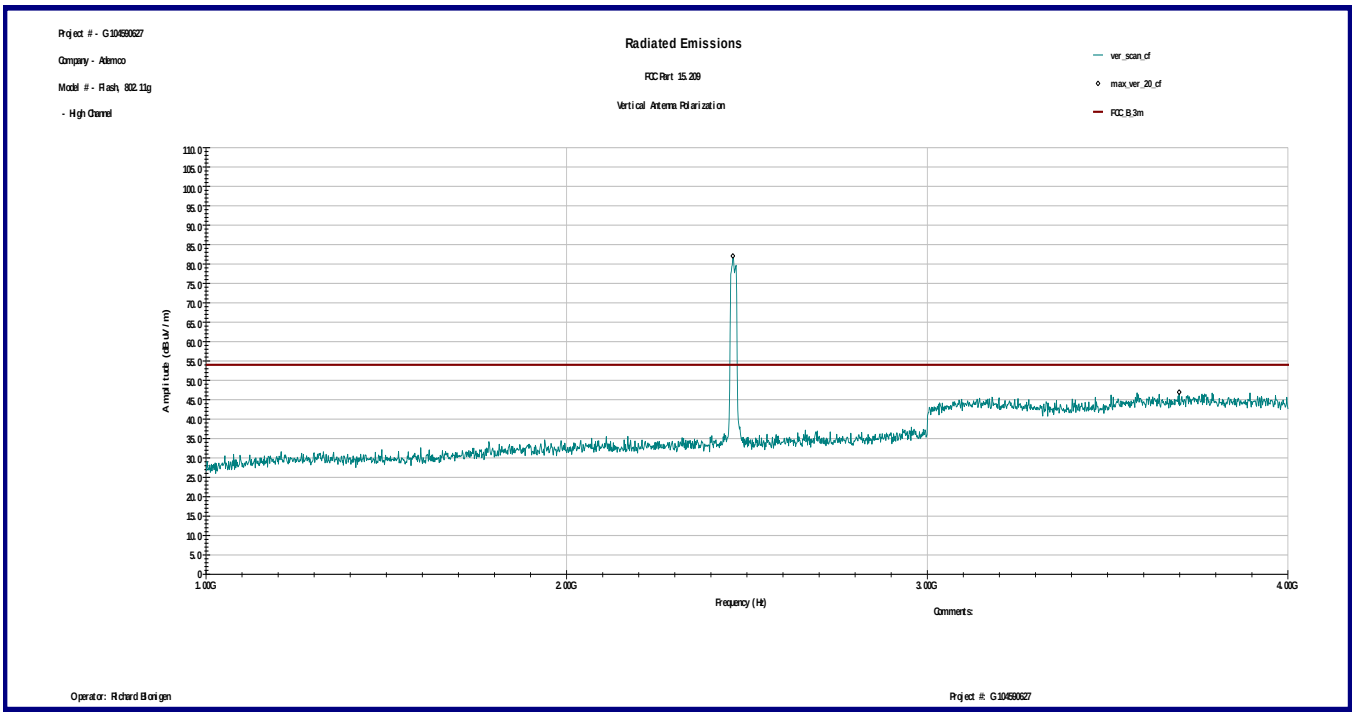


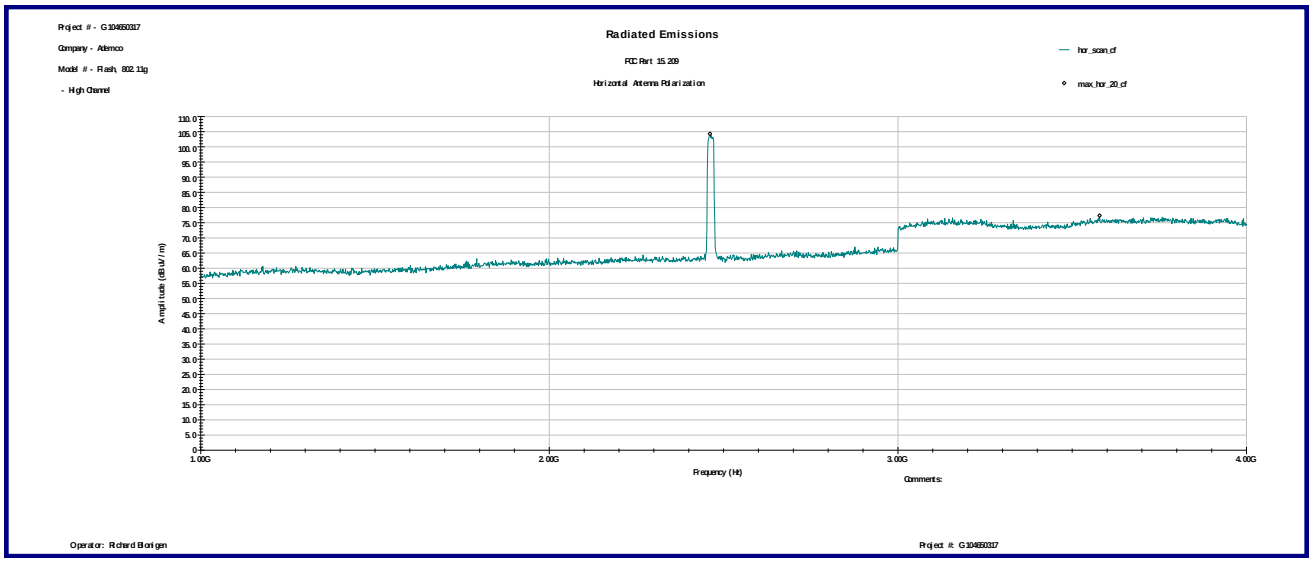
Graph 3.6.58



Graph 3.6.59



Graph 3.6.60



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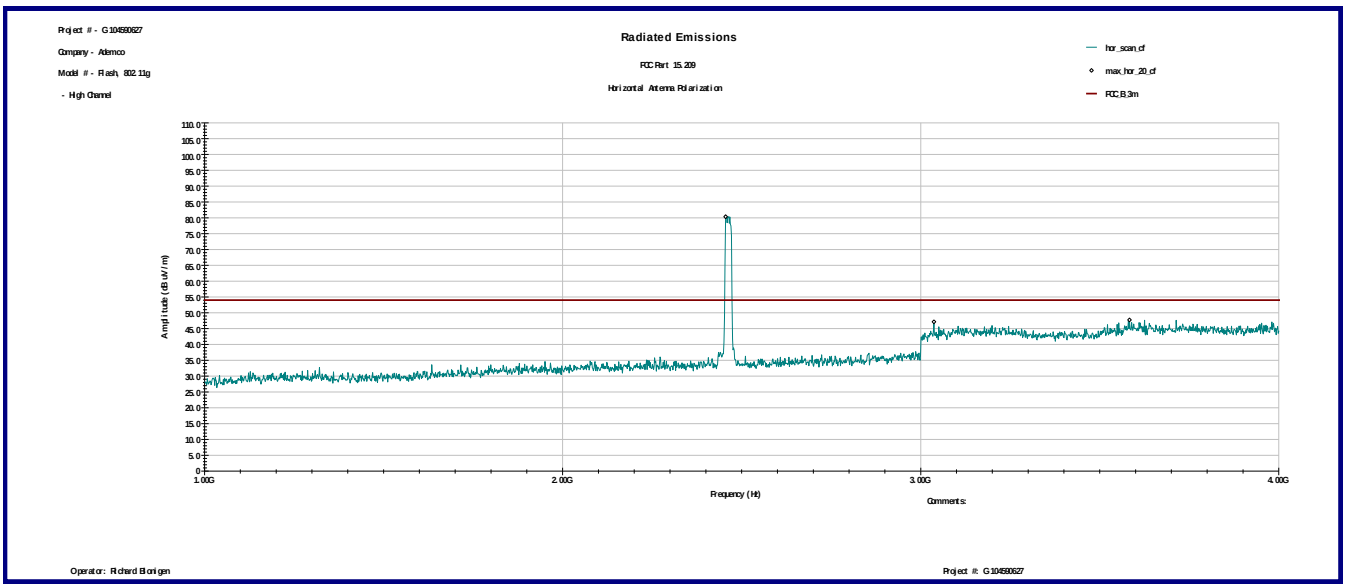

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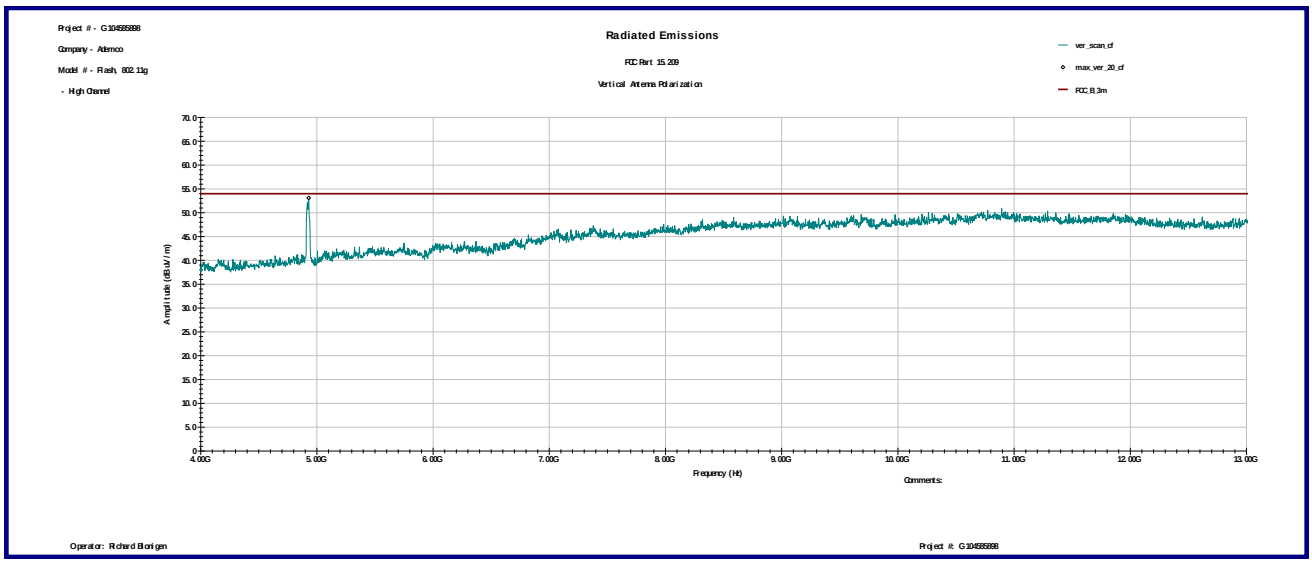
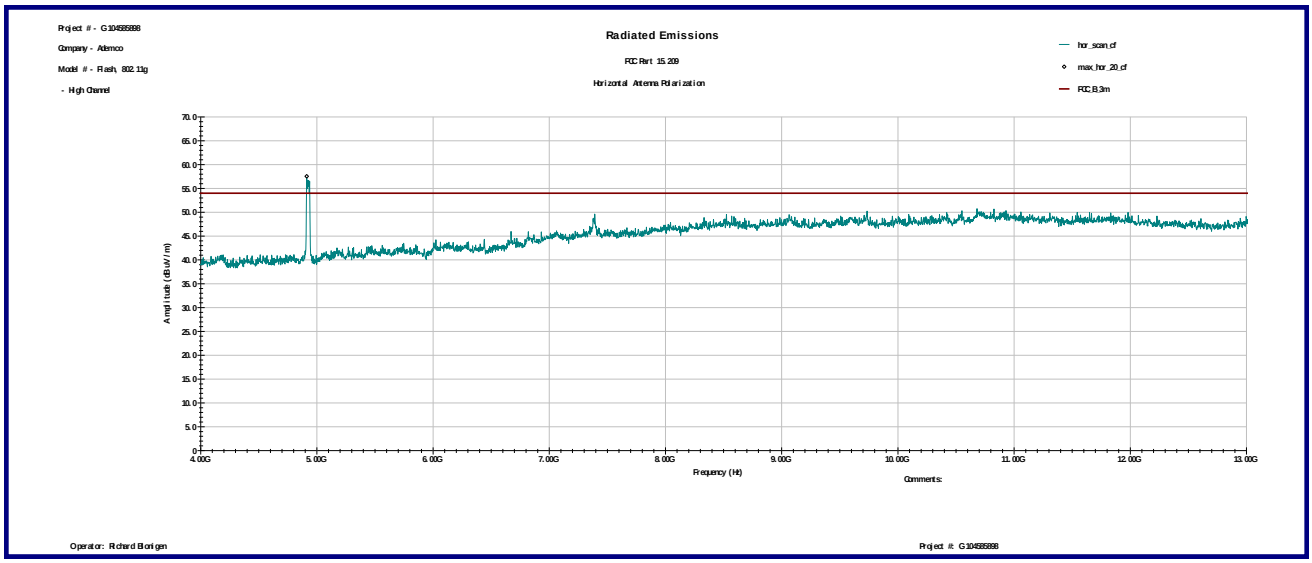


Graph 3.6.63



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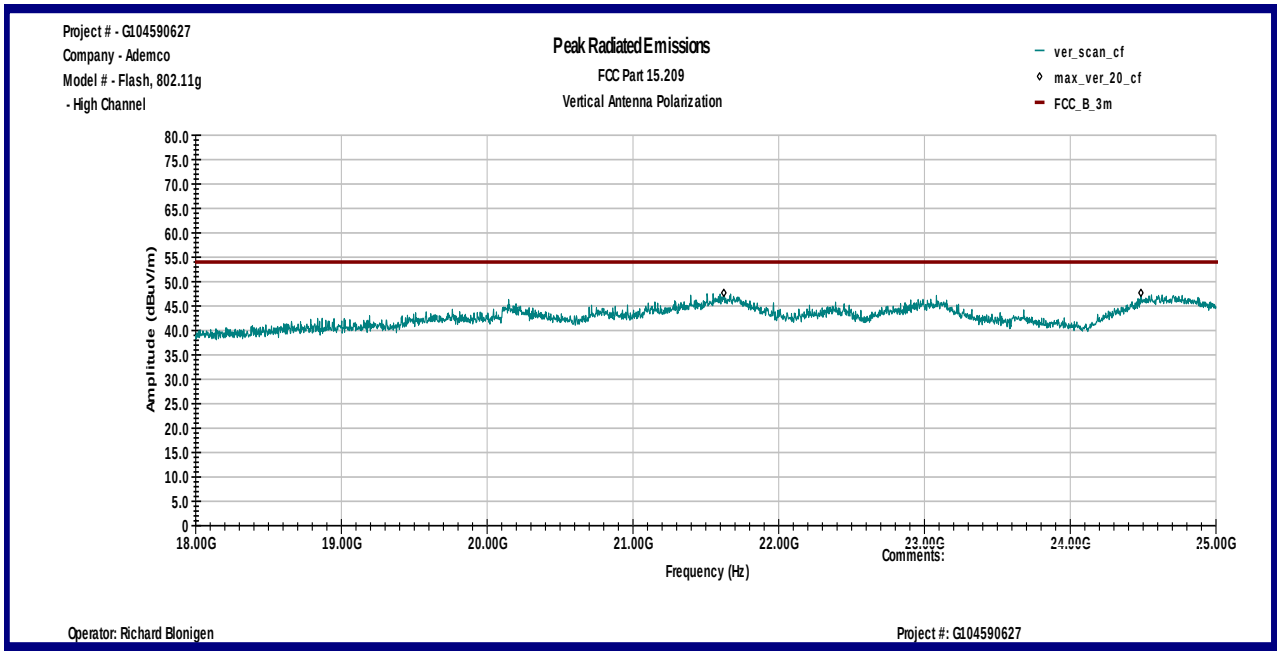
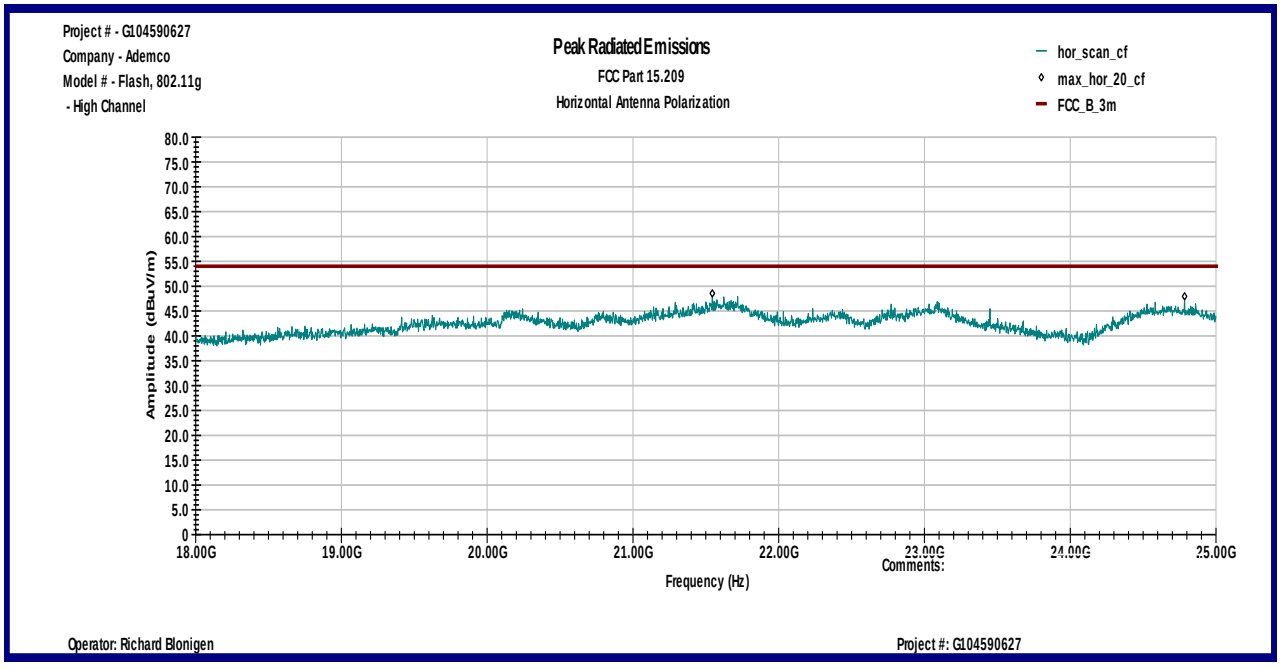
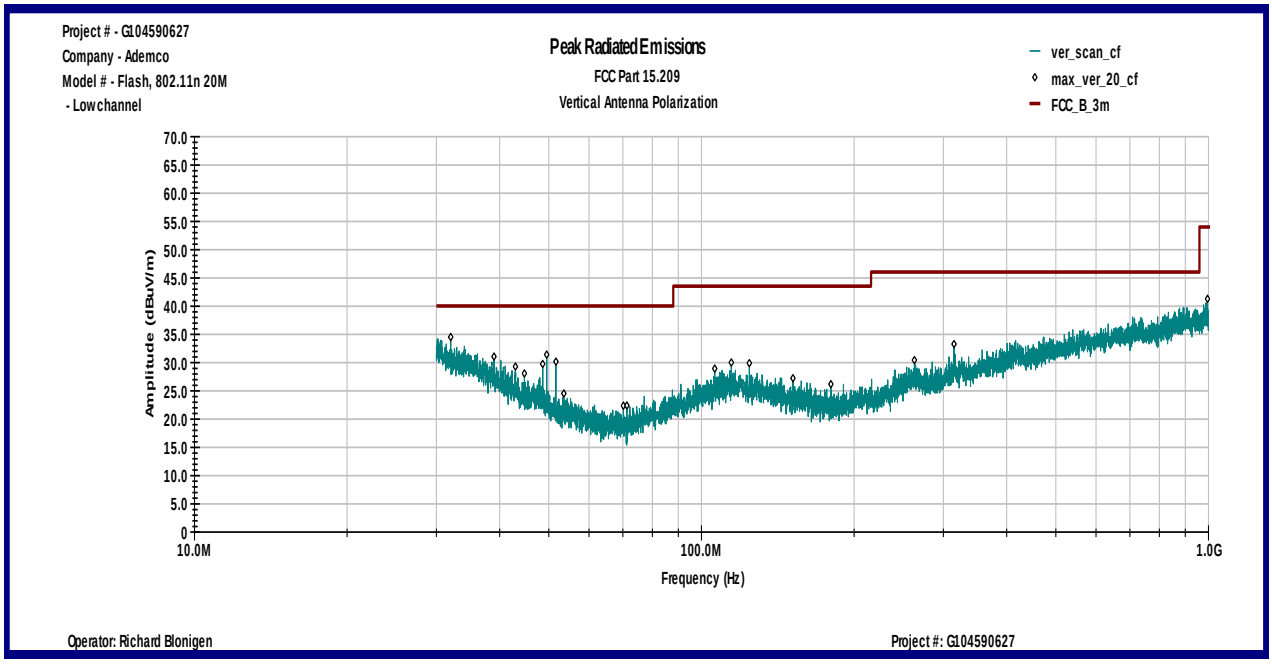


Graph 3.6.65



Graph 3.6.66



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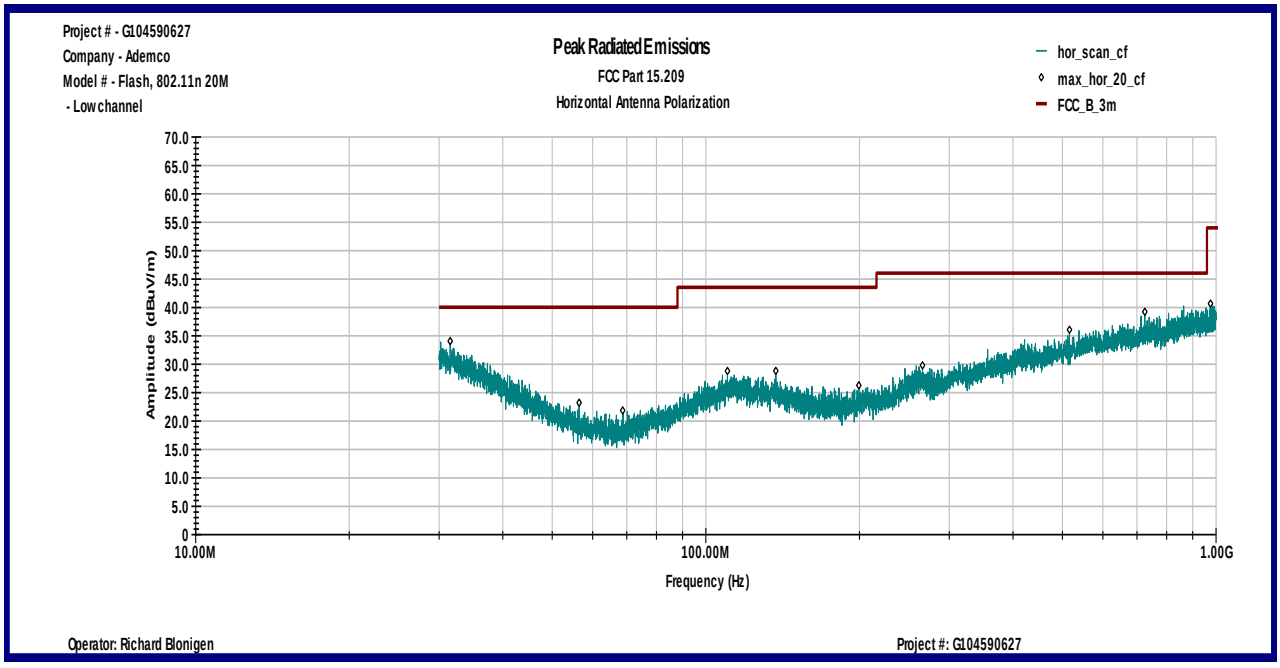

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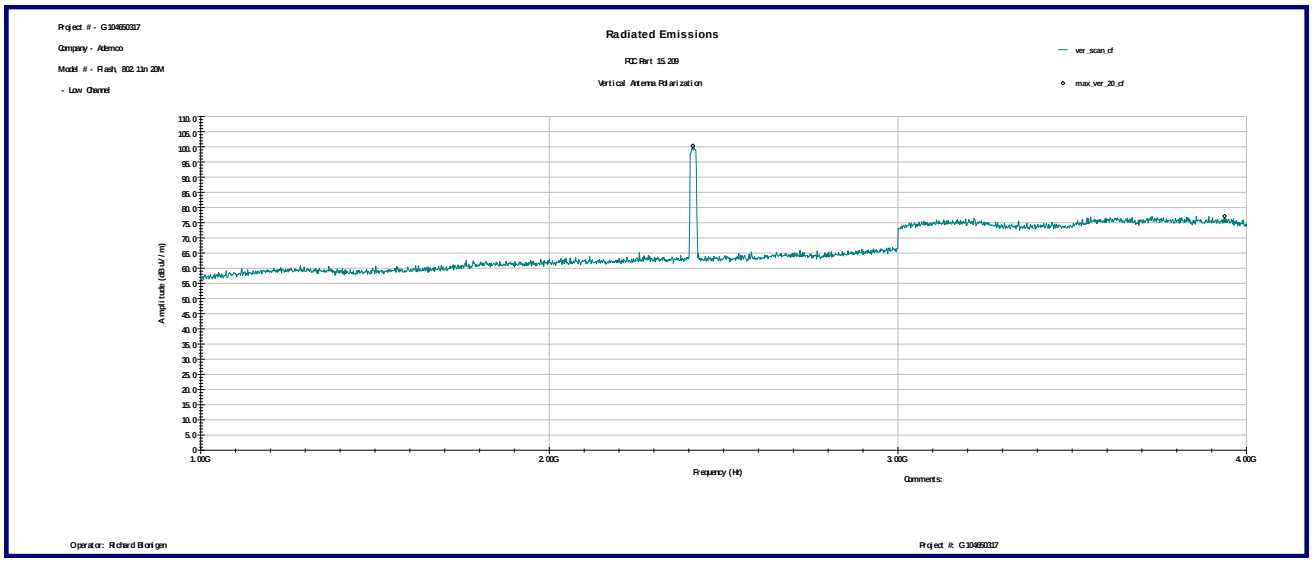

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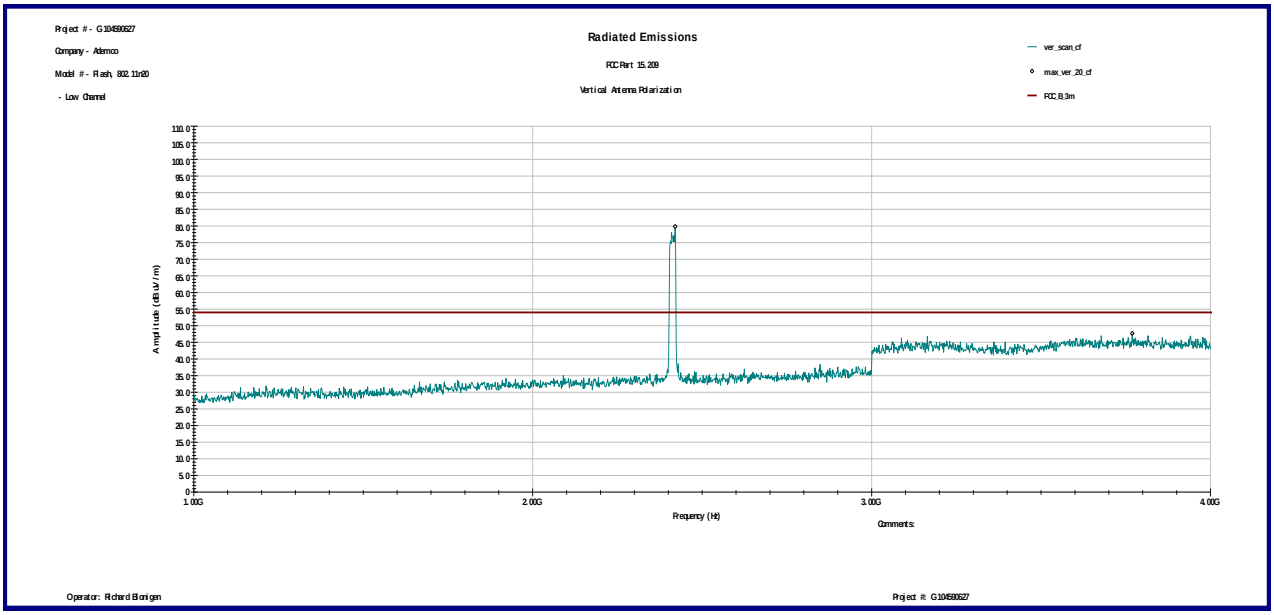

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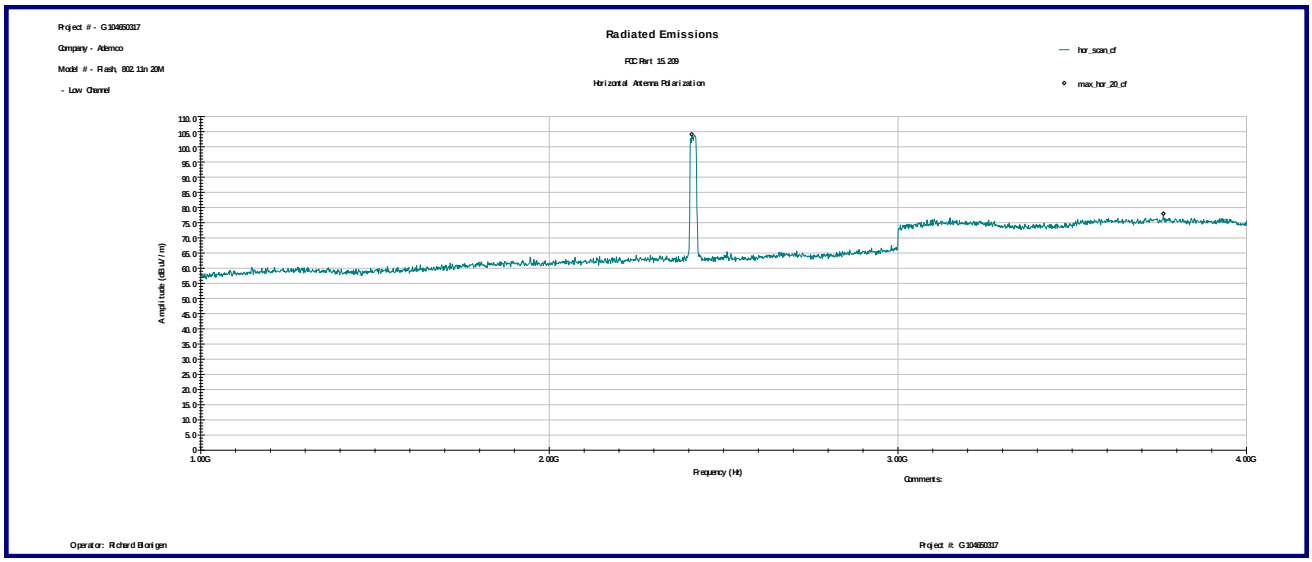

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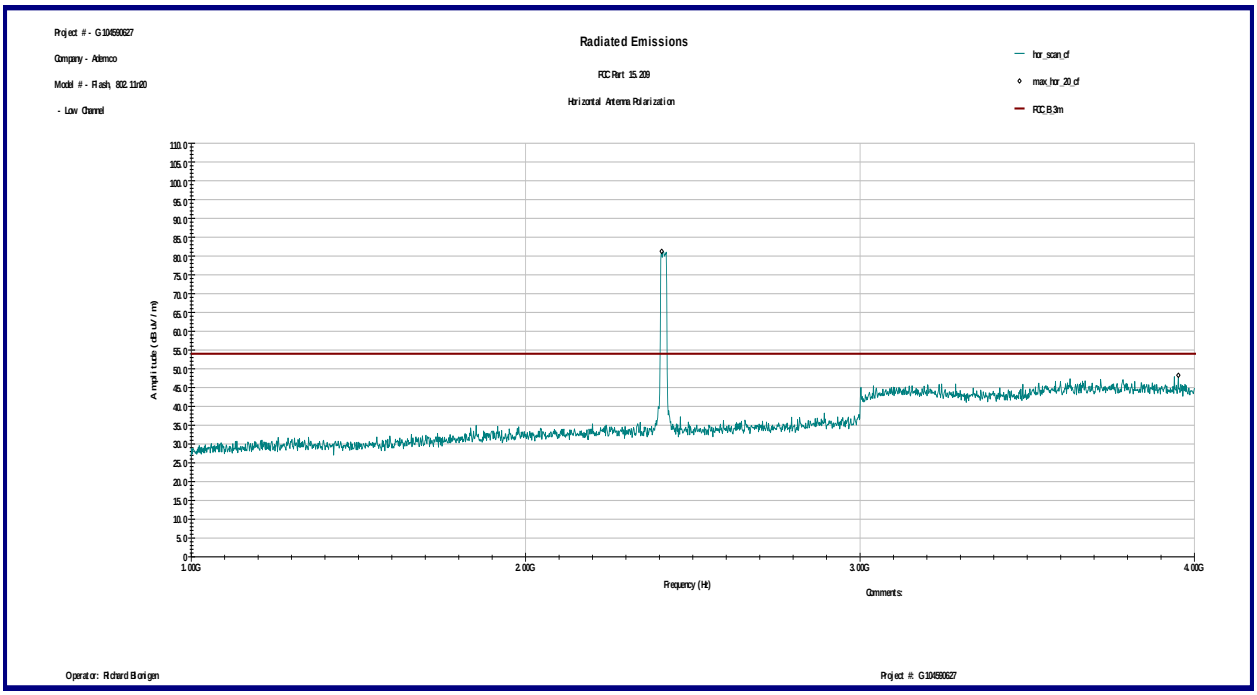

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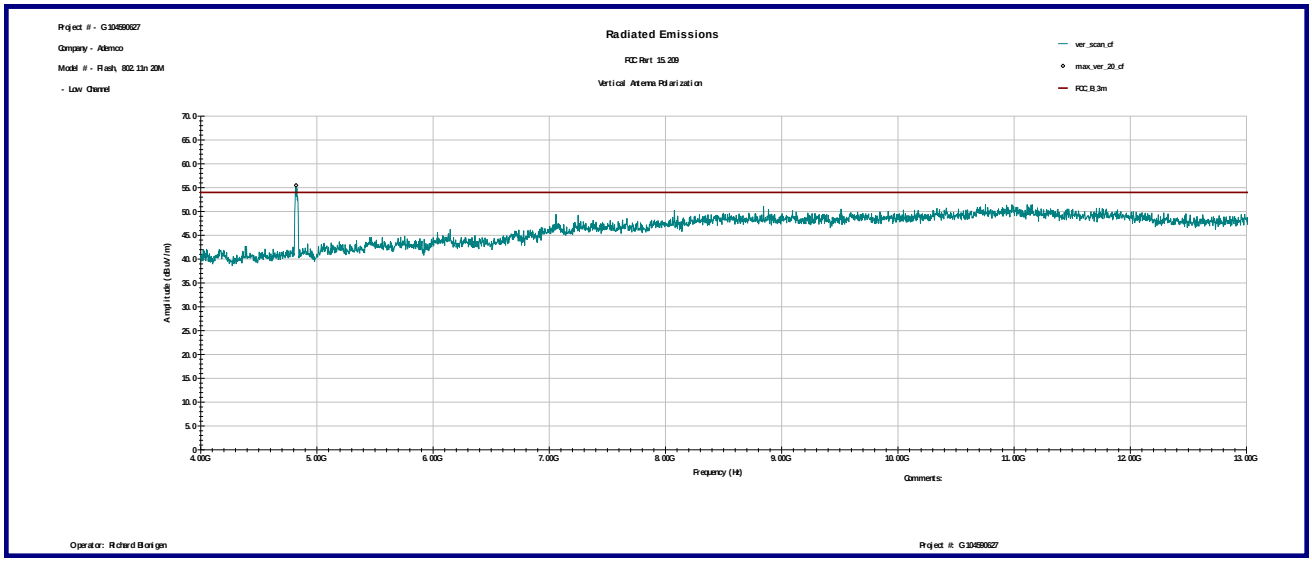

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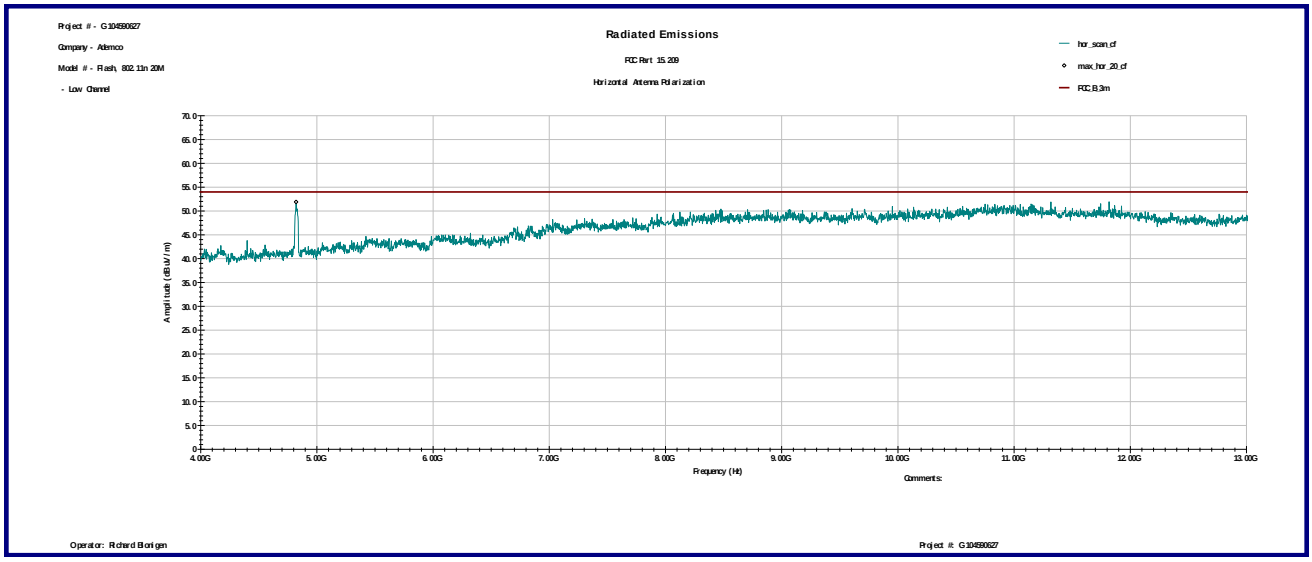

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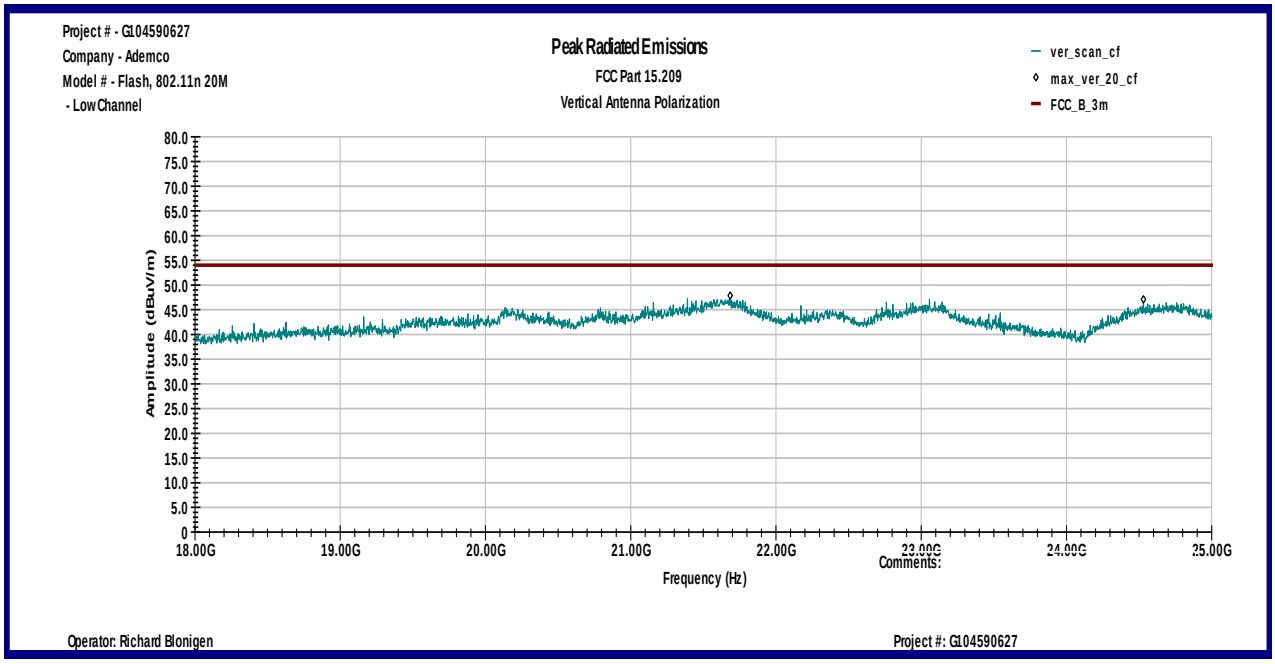

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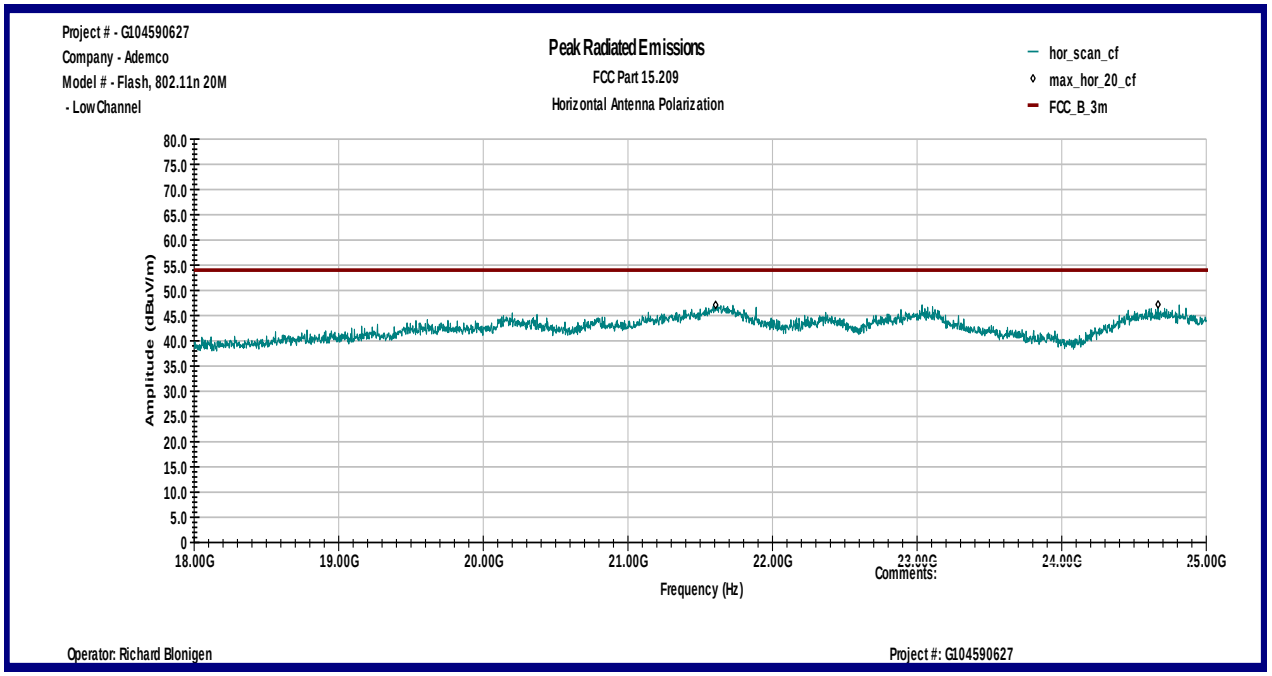

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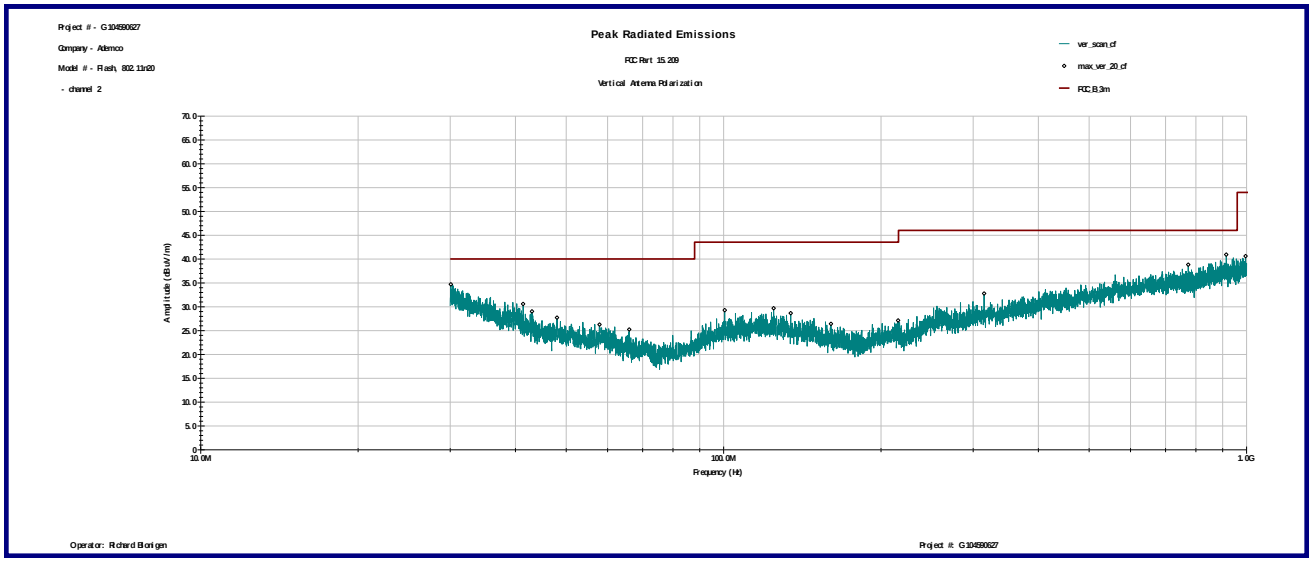

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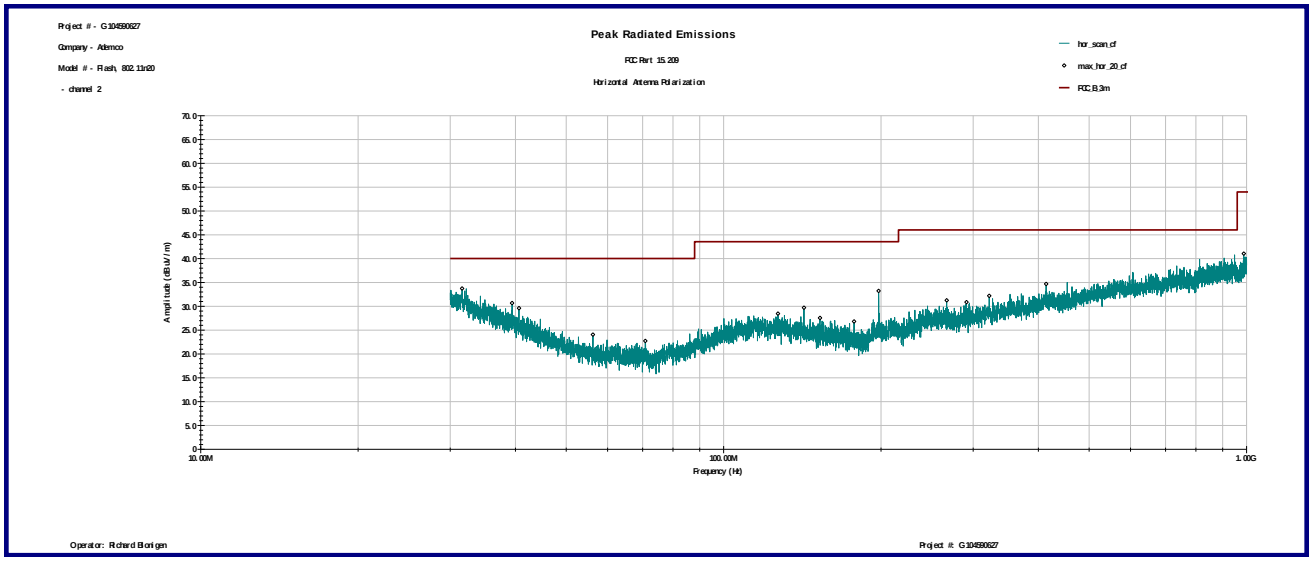

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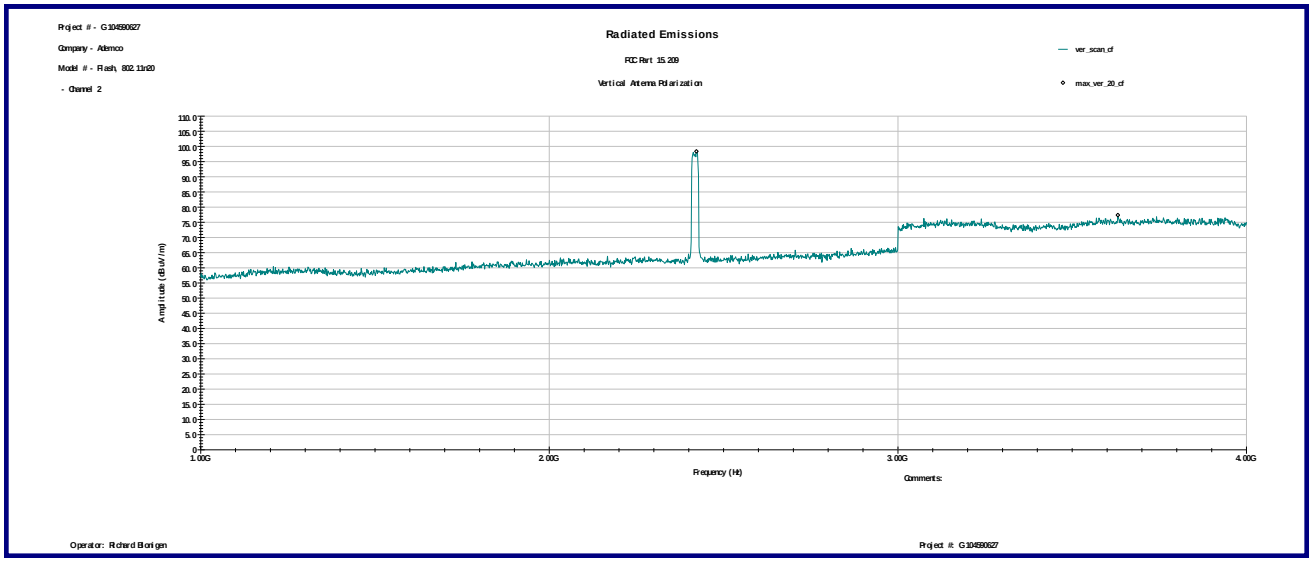

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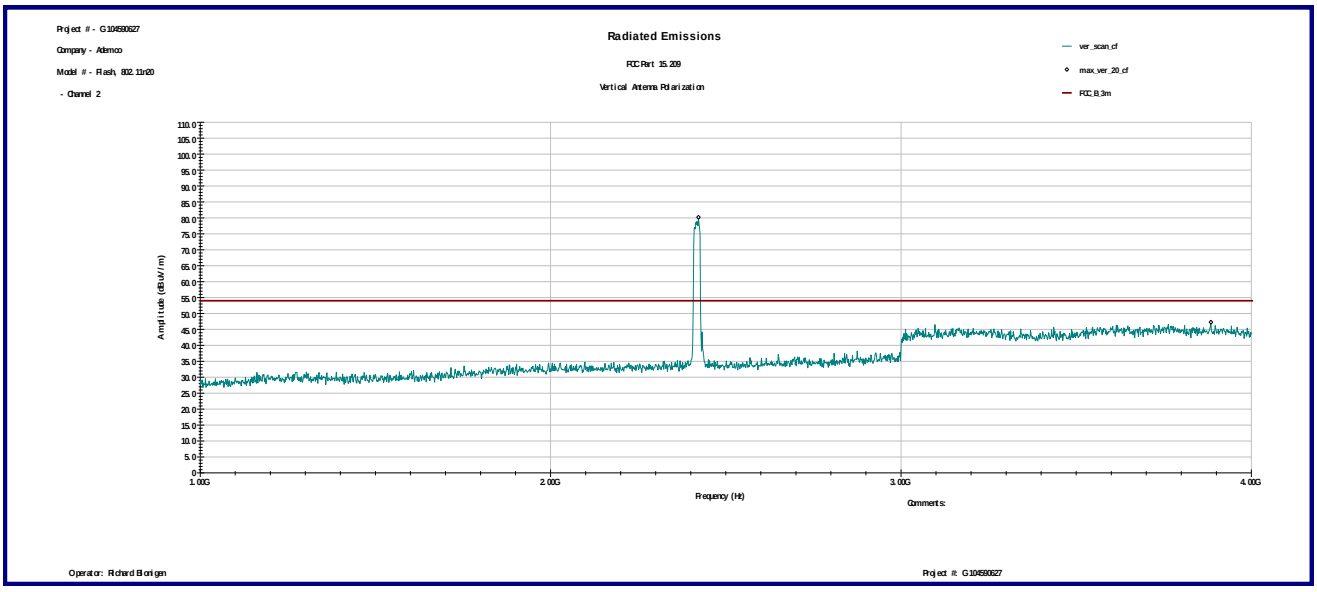

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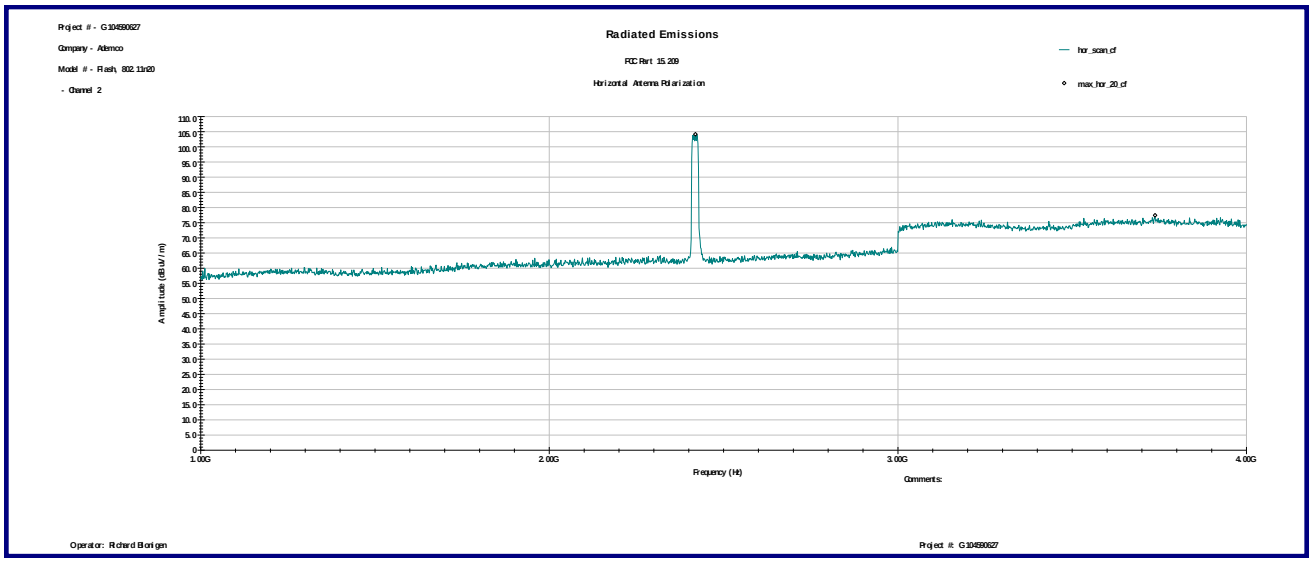

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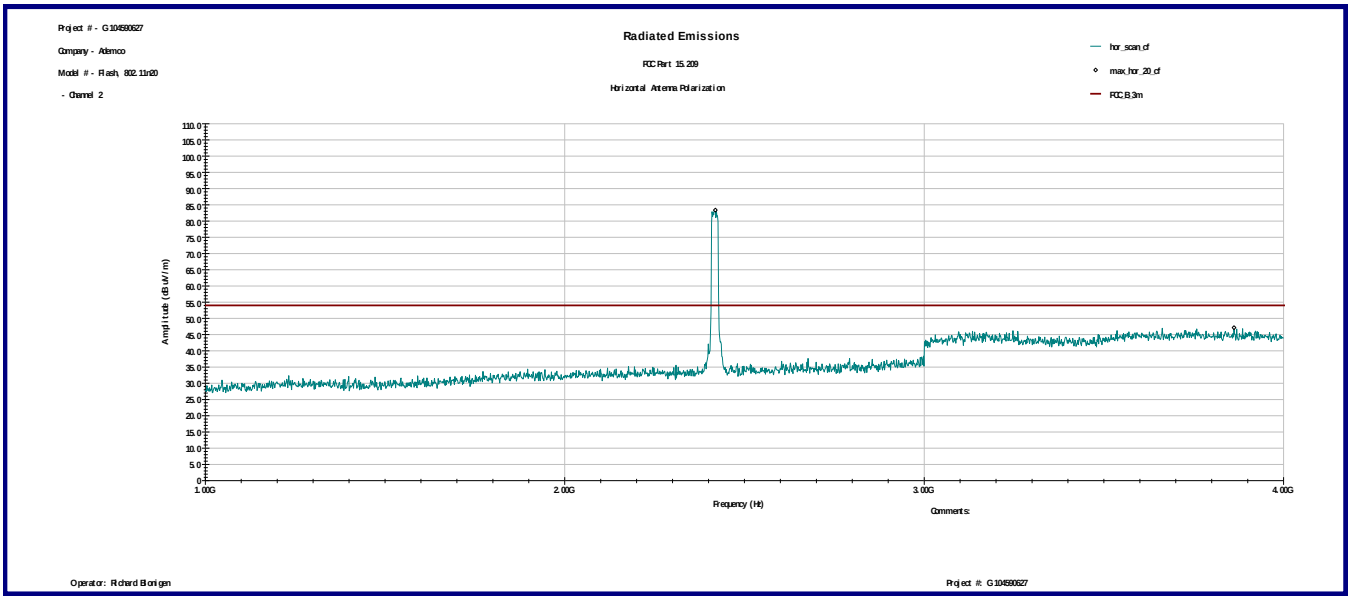
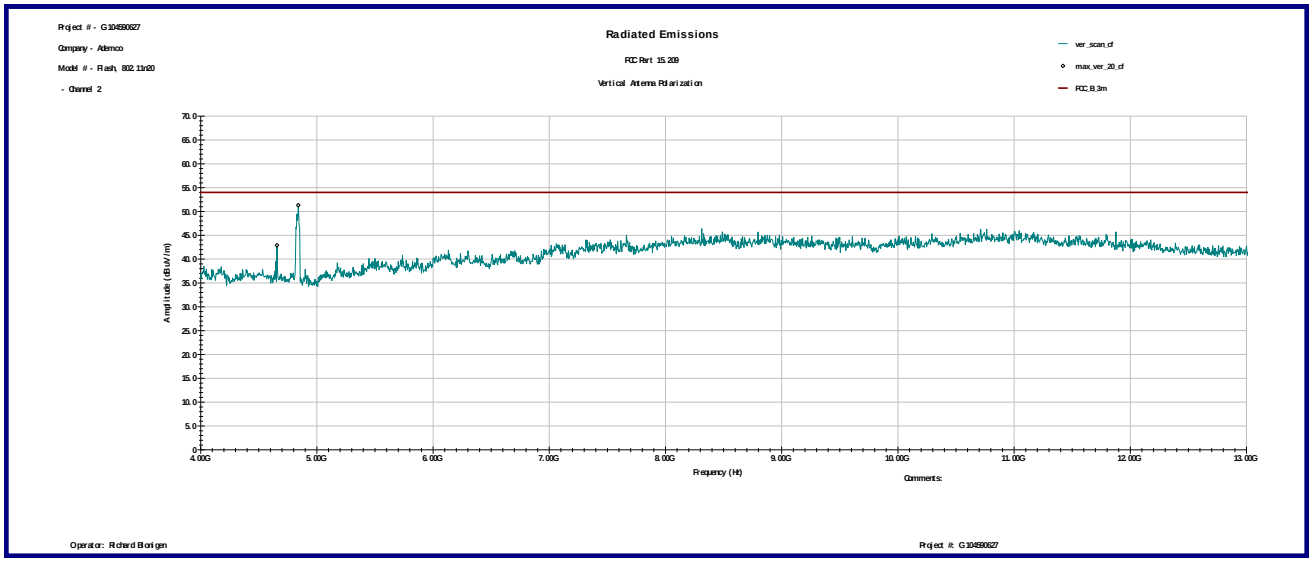


Graph 3.6.82



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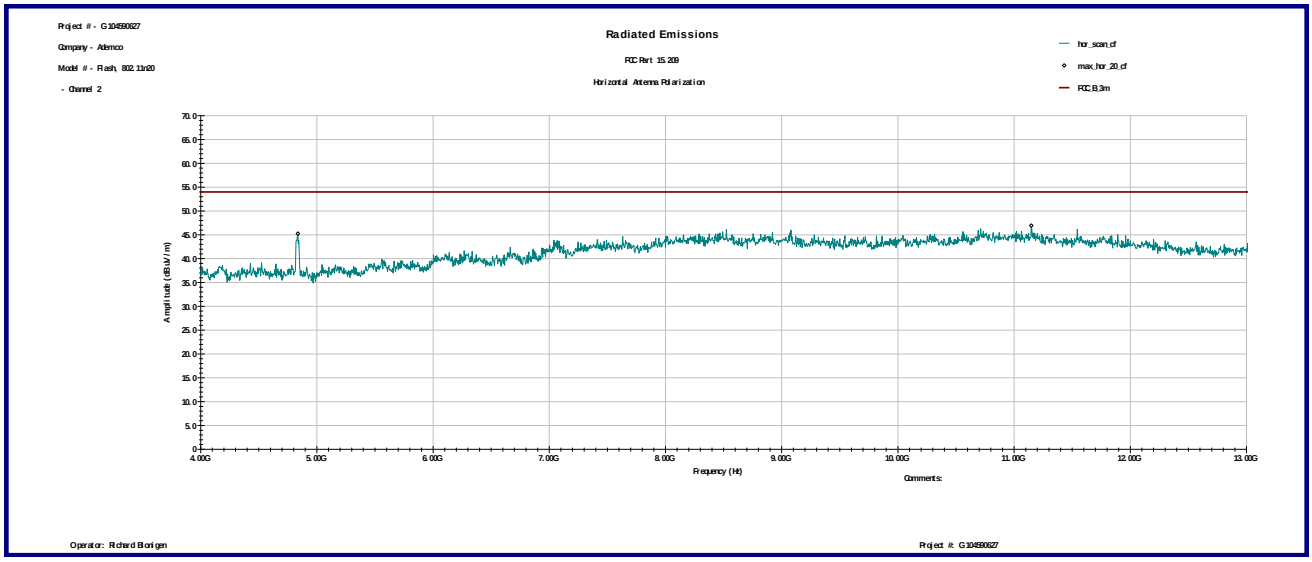

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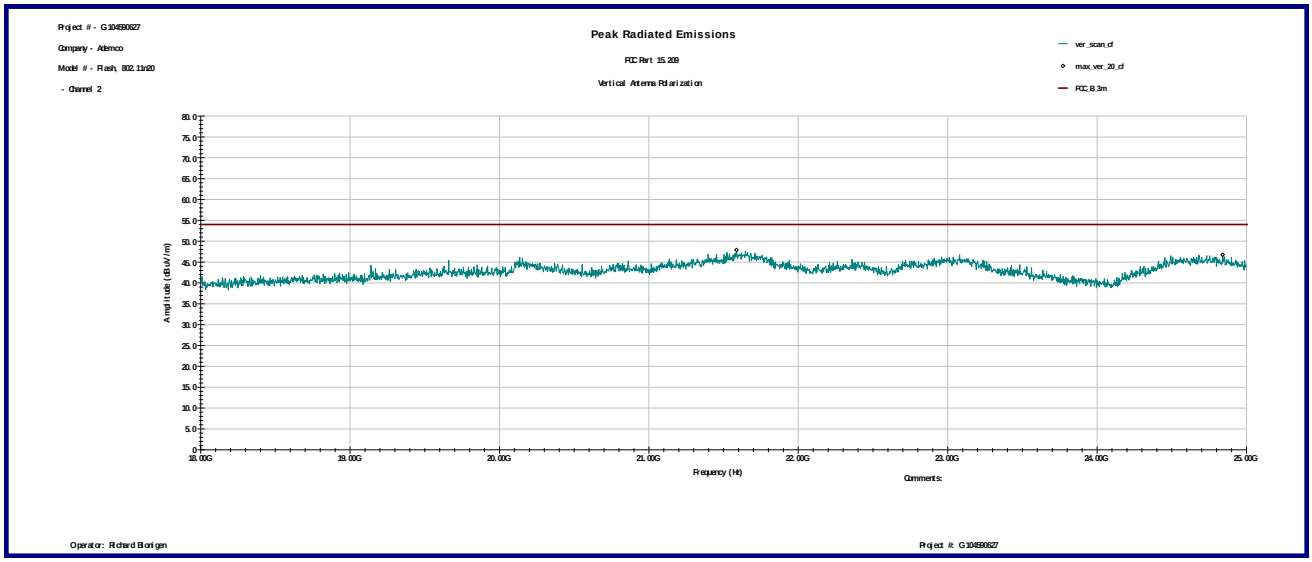

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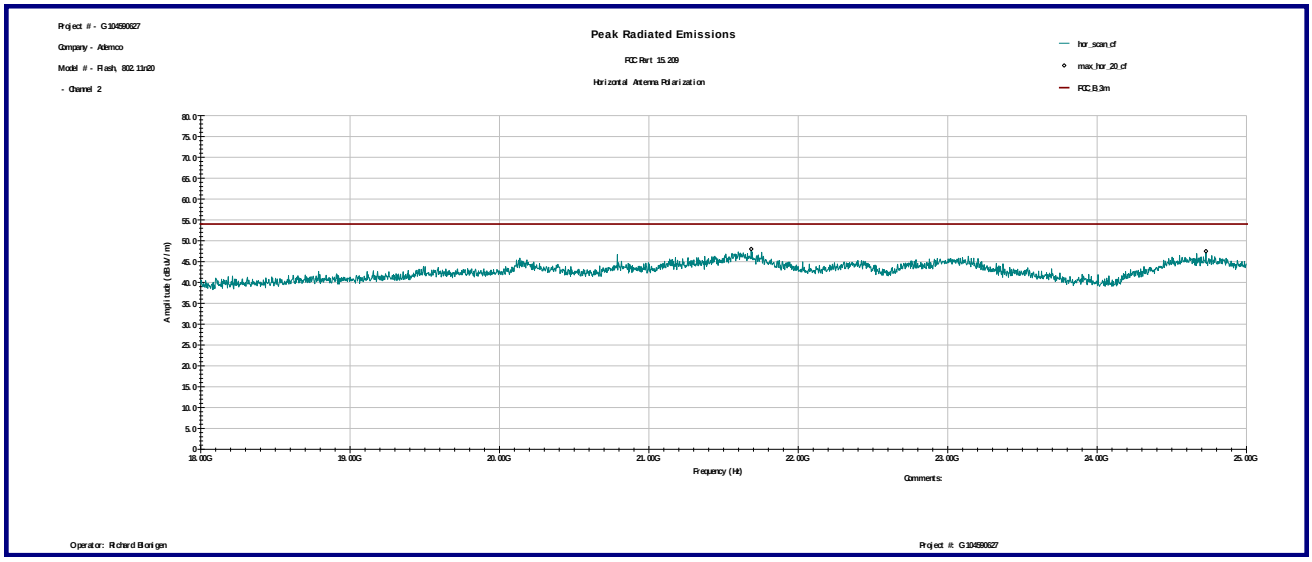

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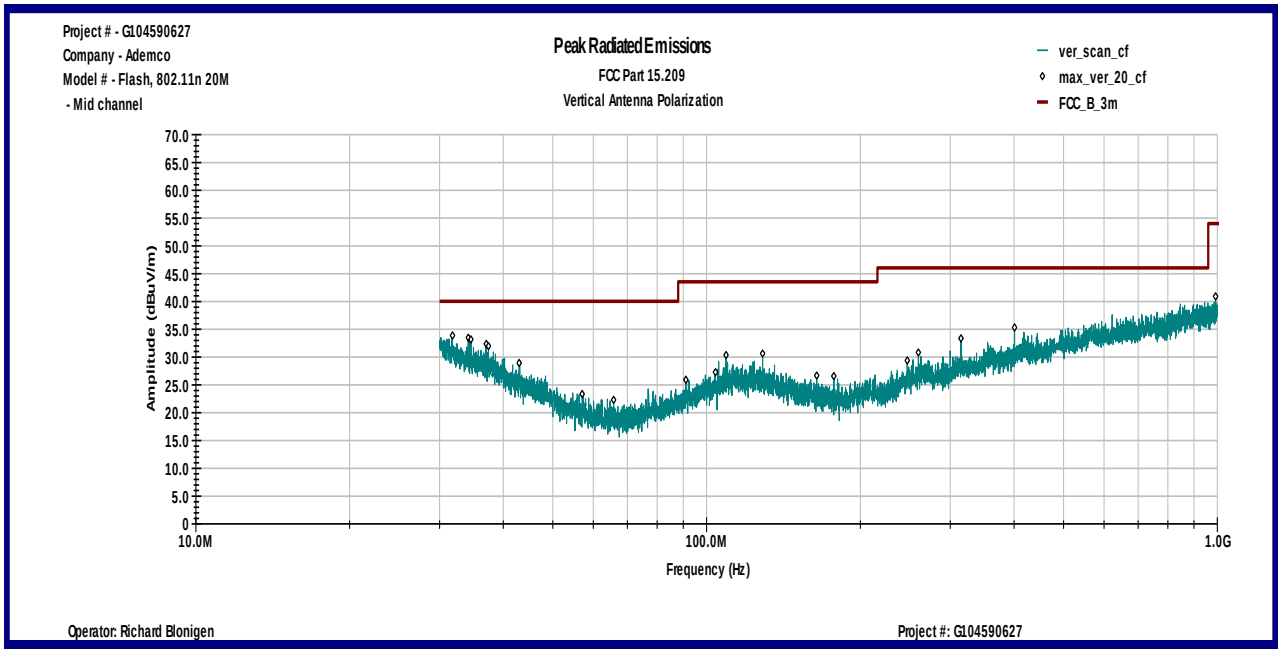

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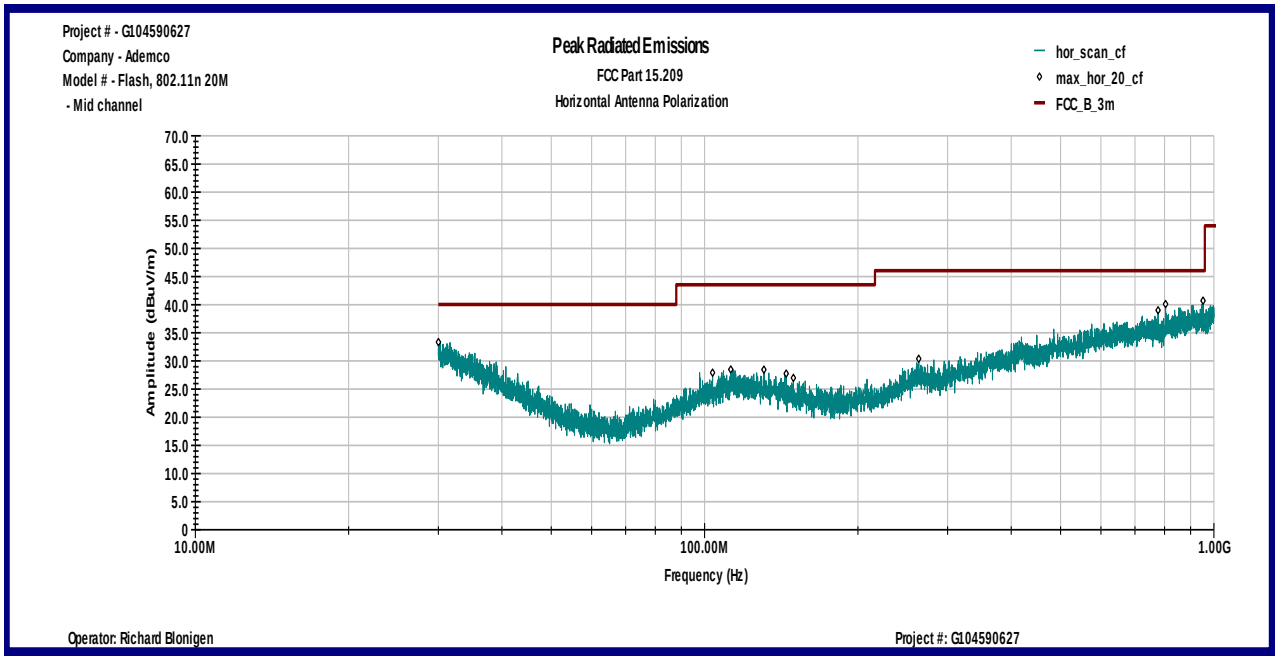

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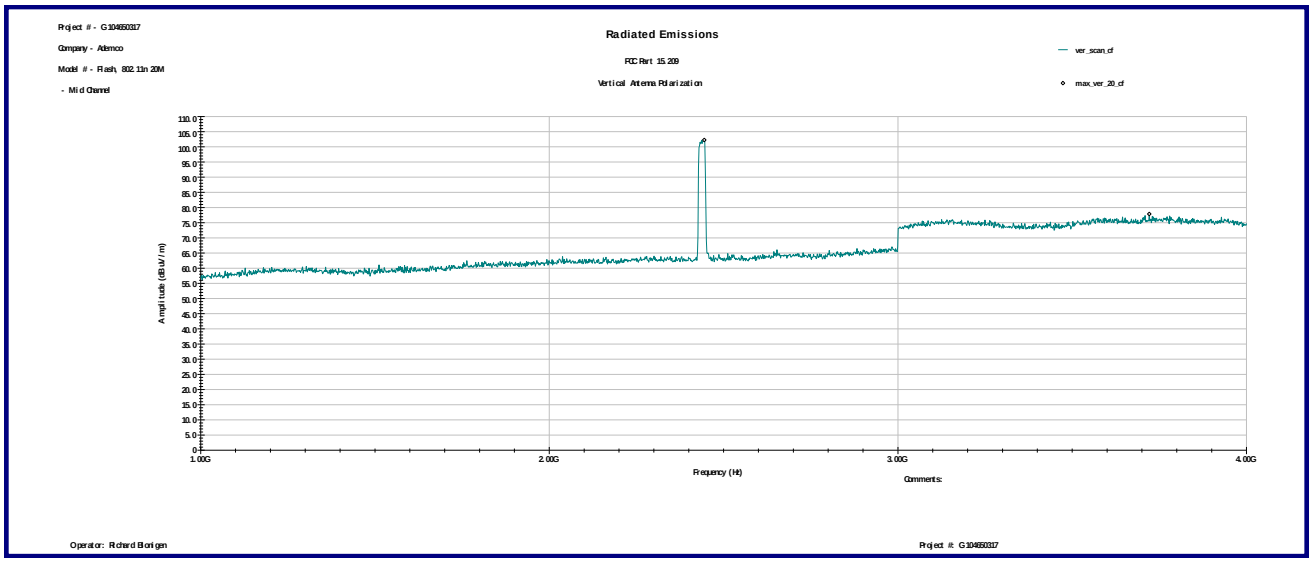

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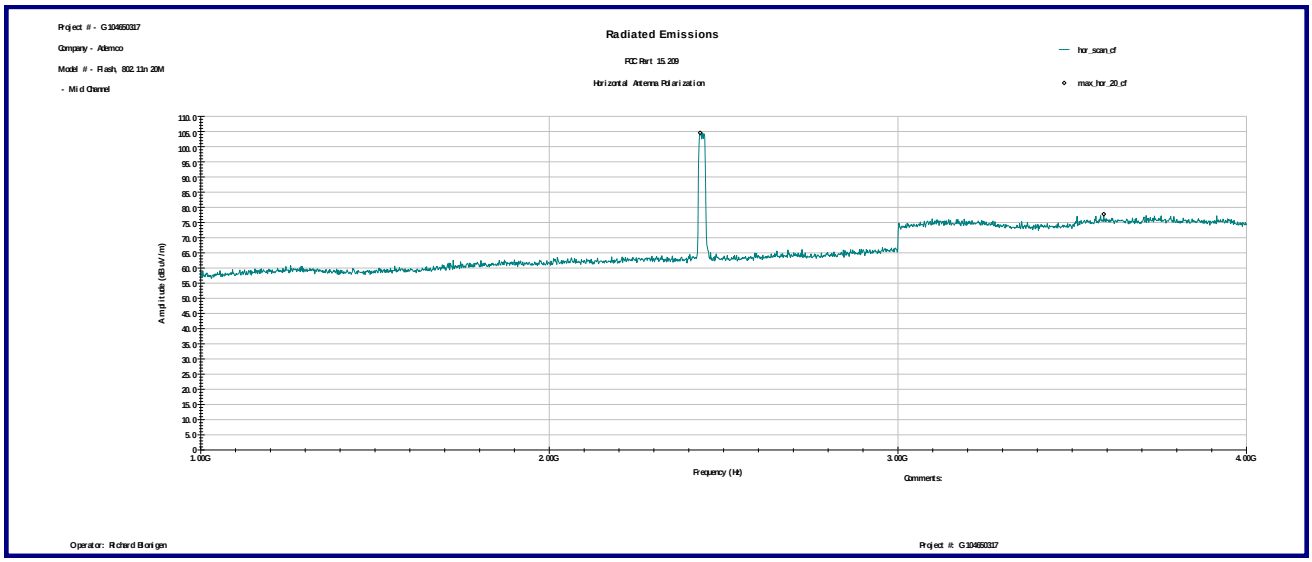

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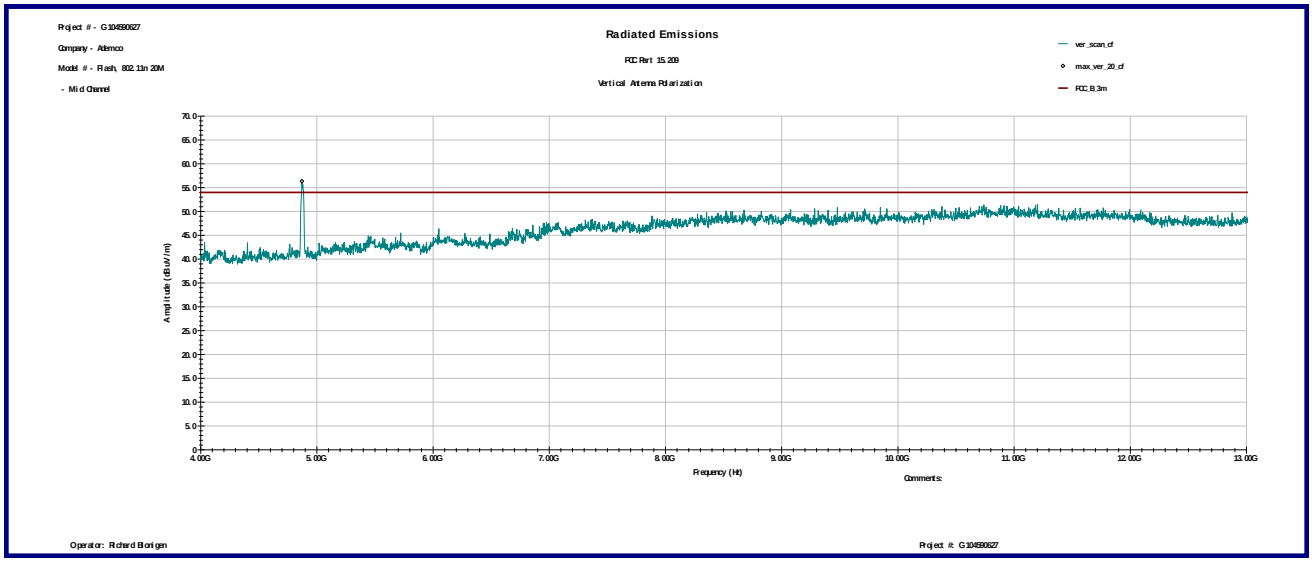
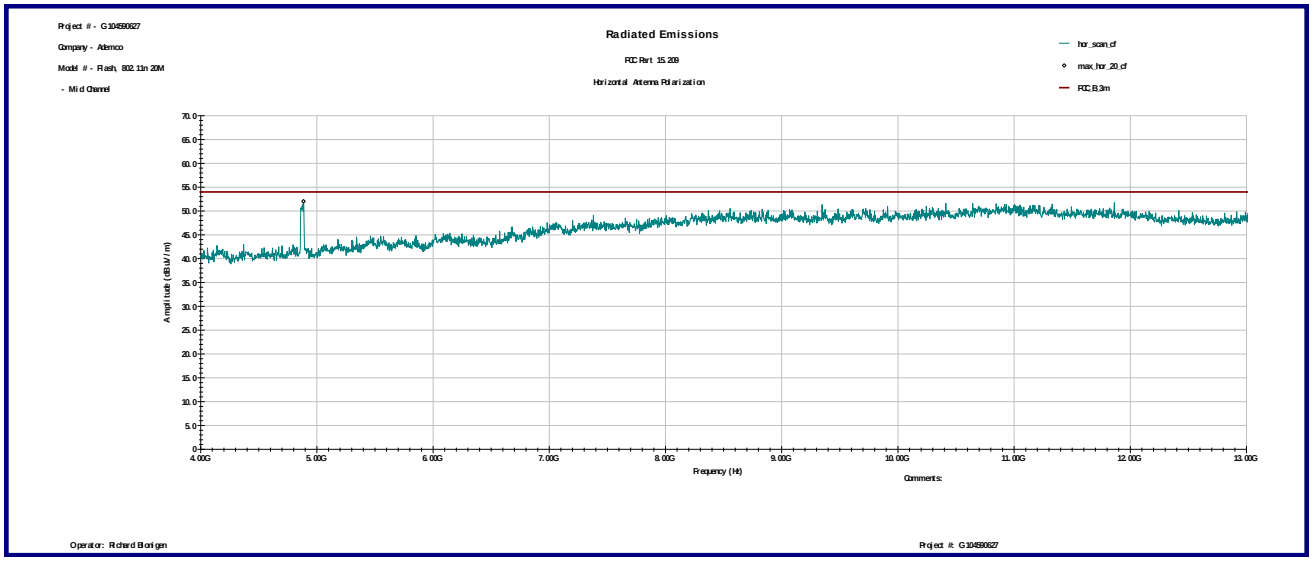


Graph 3.6.91



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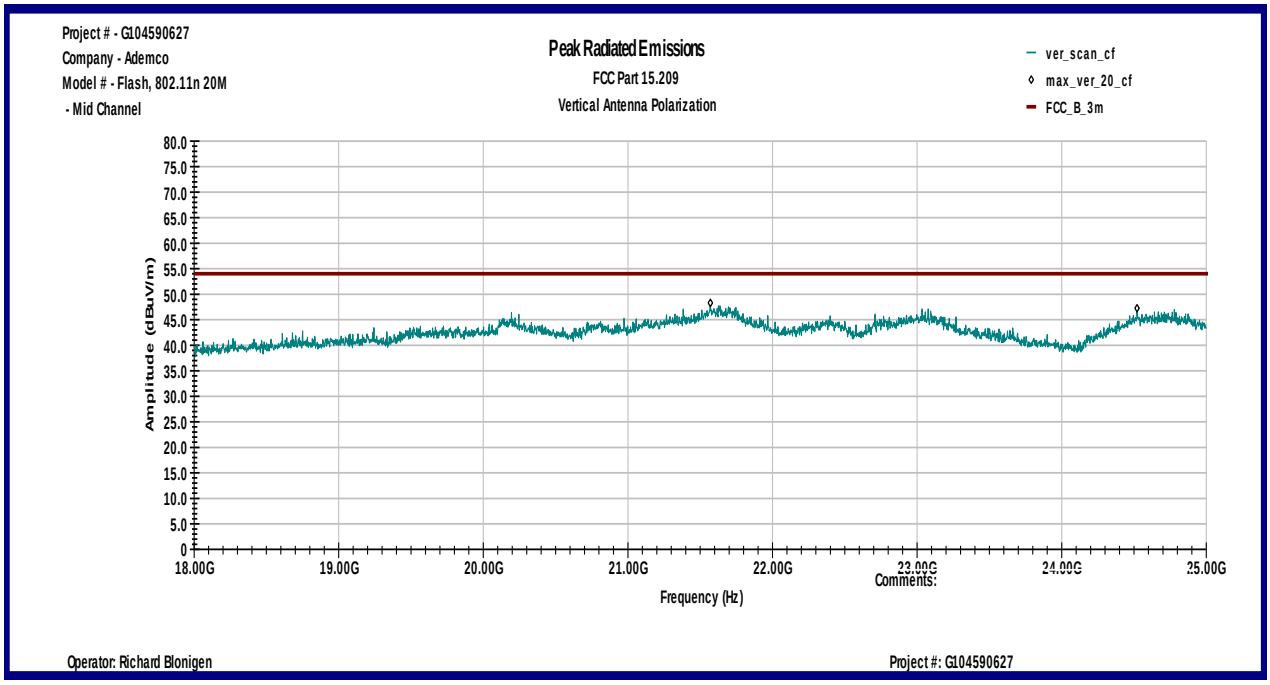

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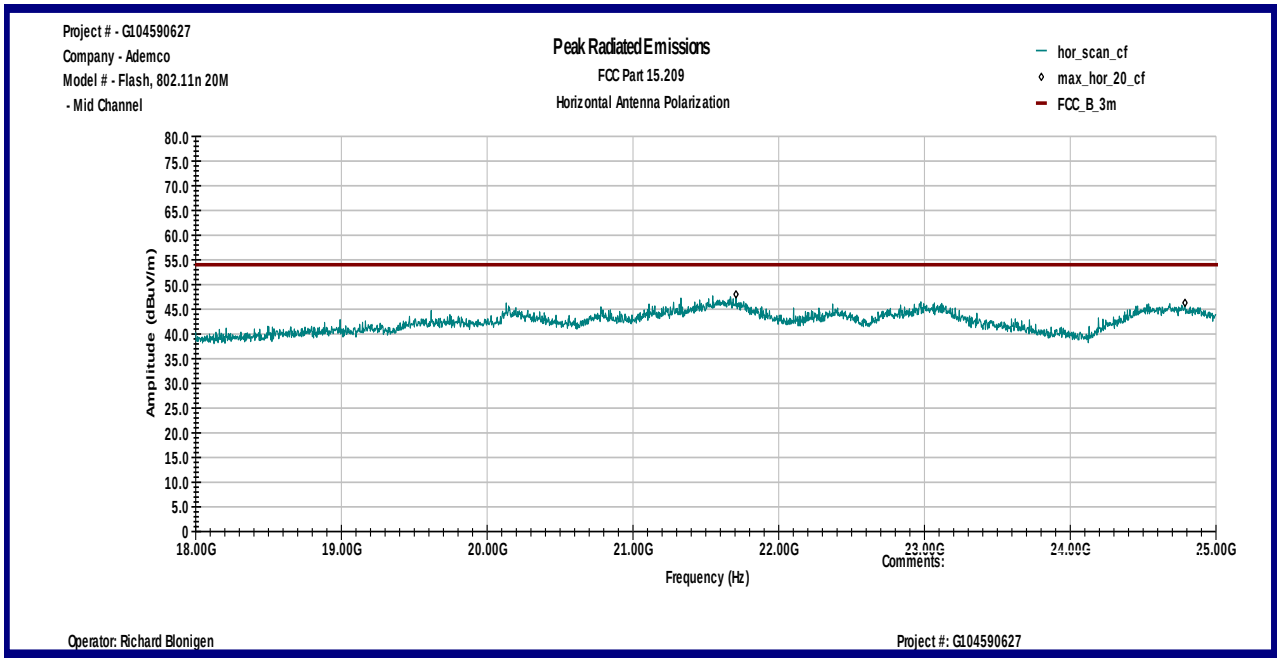
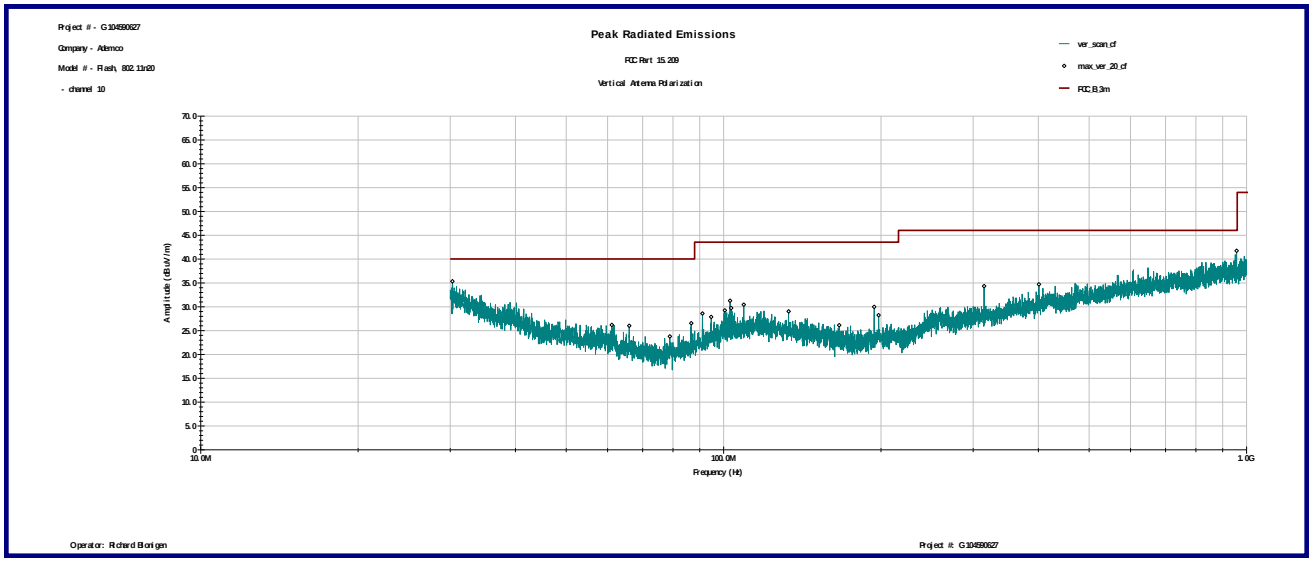


Graph 3.6.94



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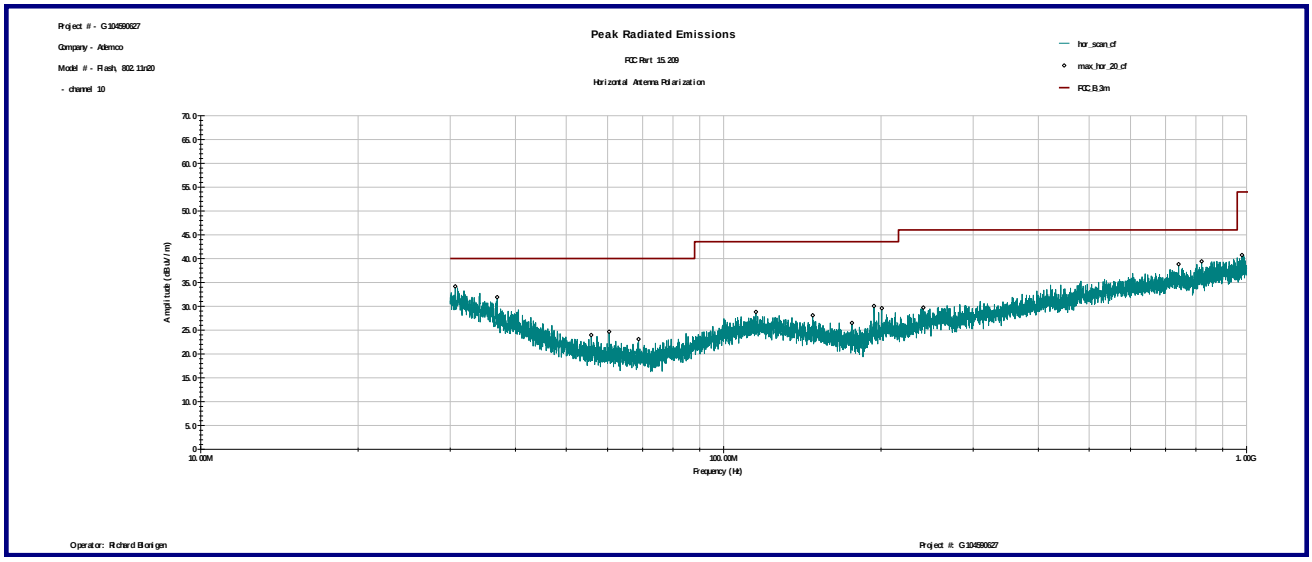

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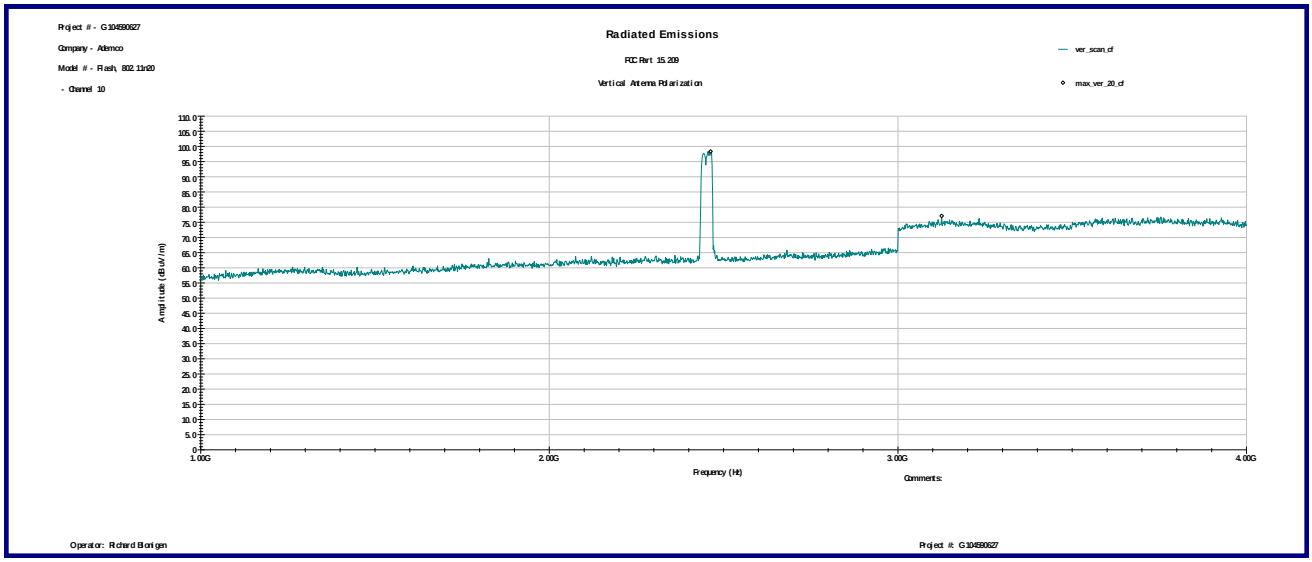

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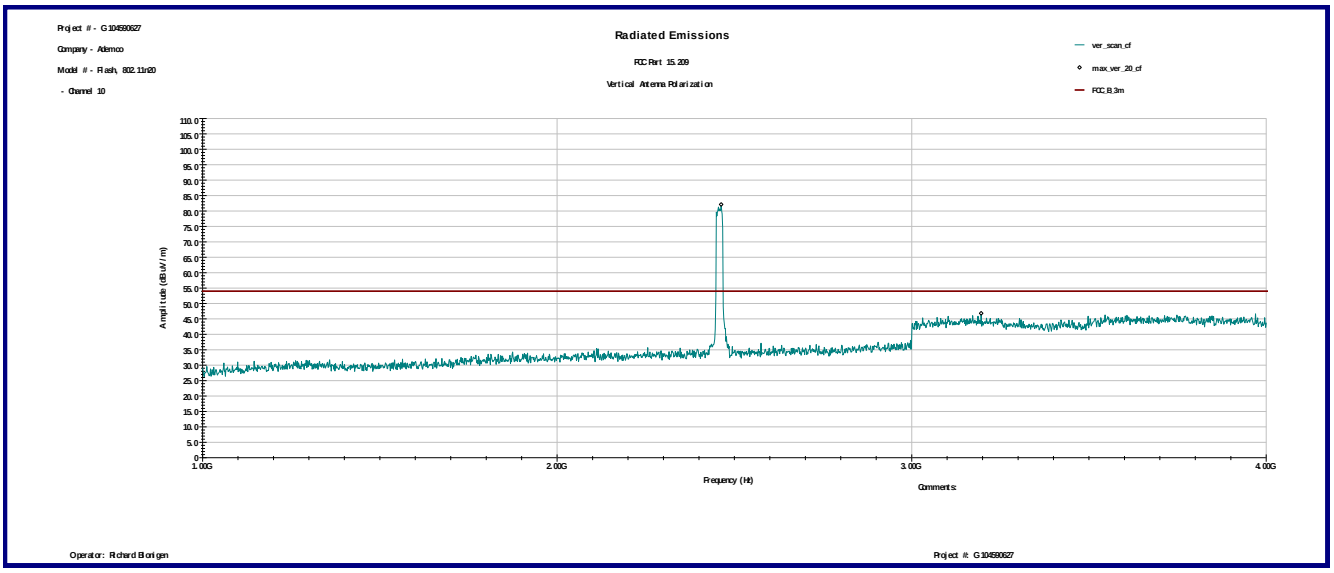

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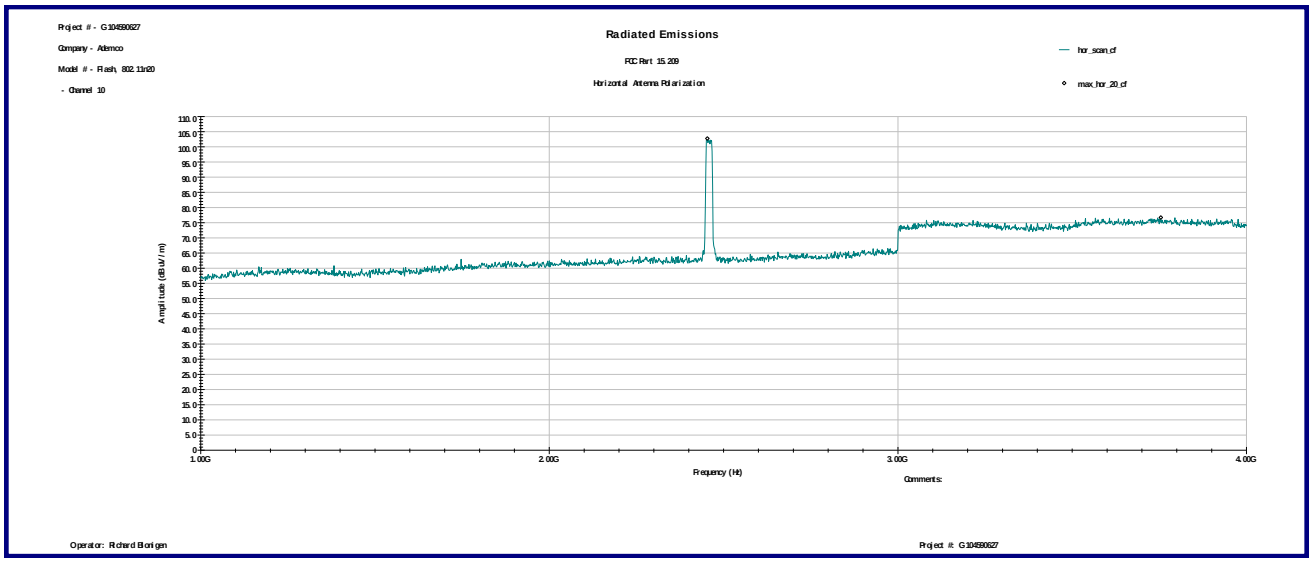

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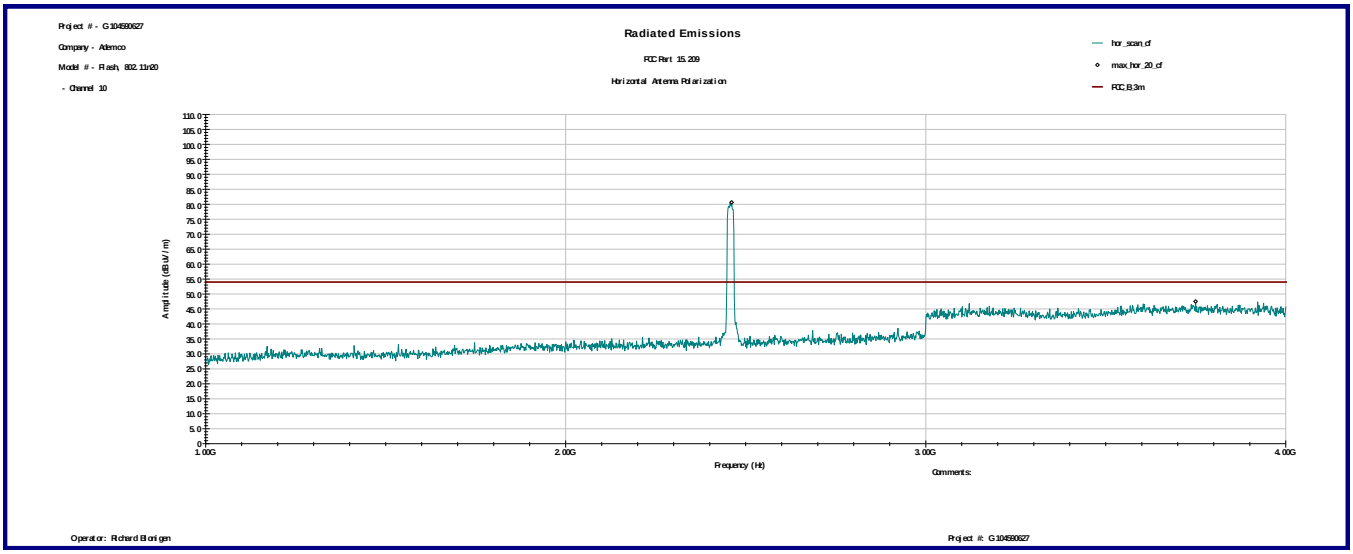

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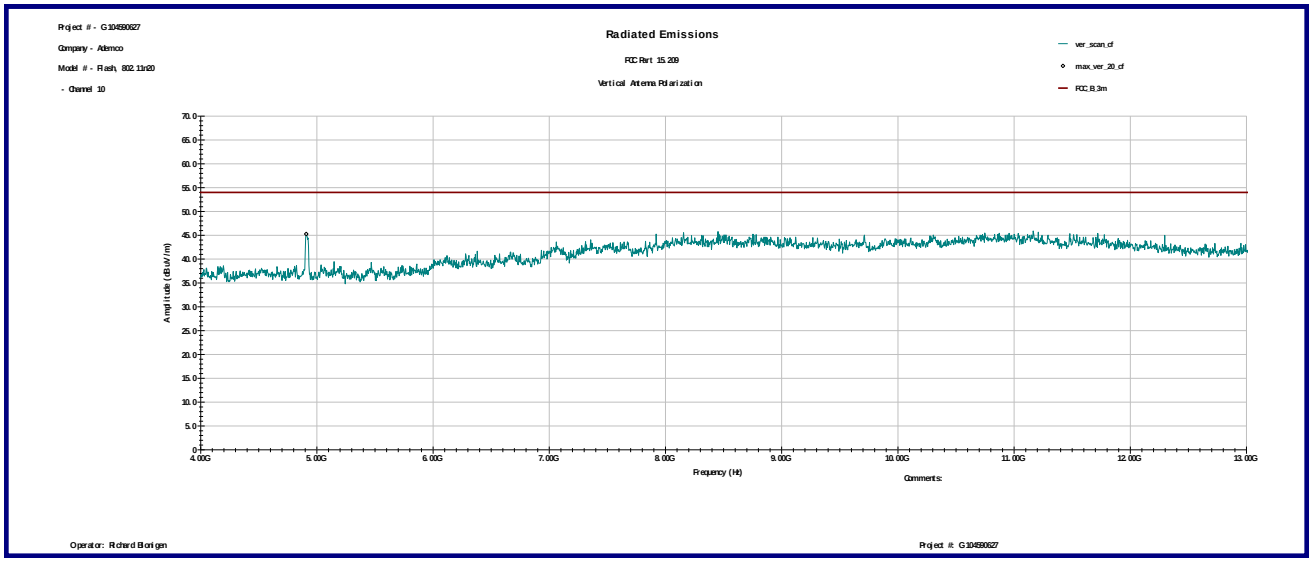

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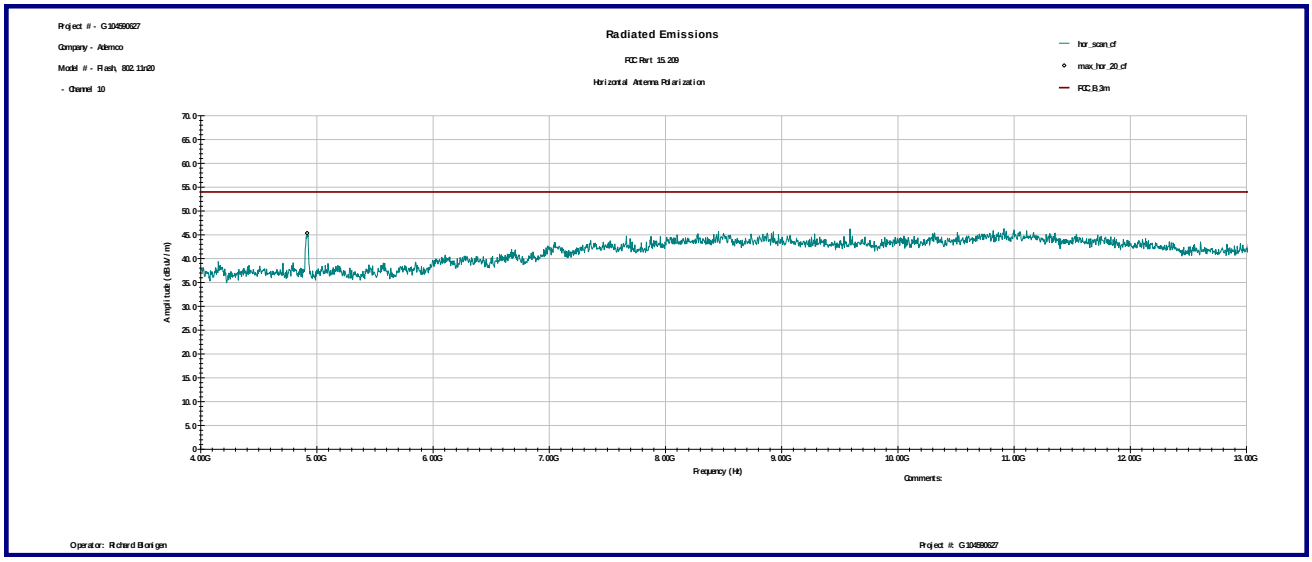

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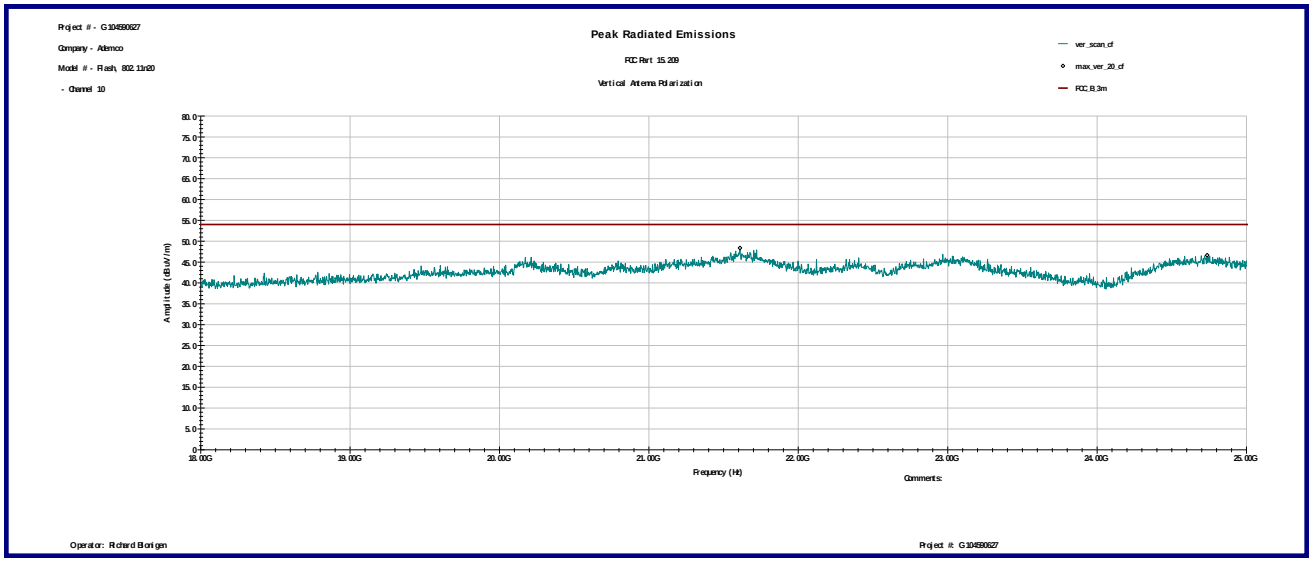

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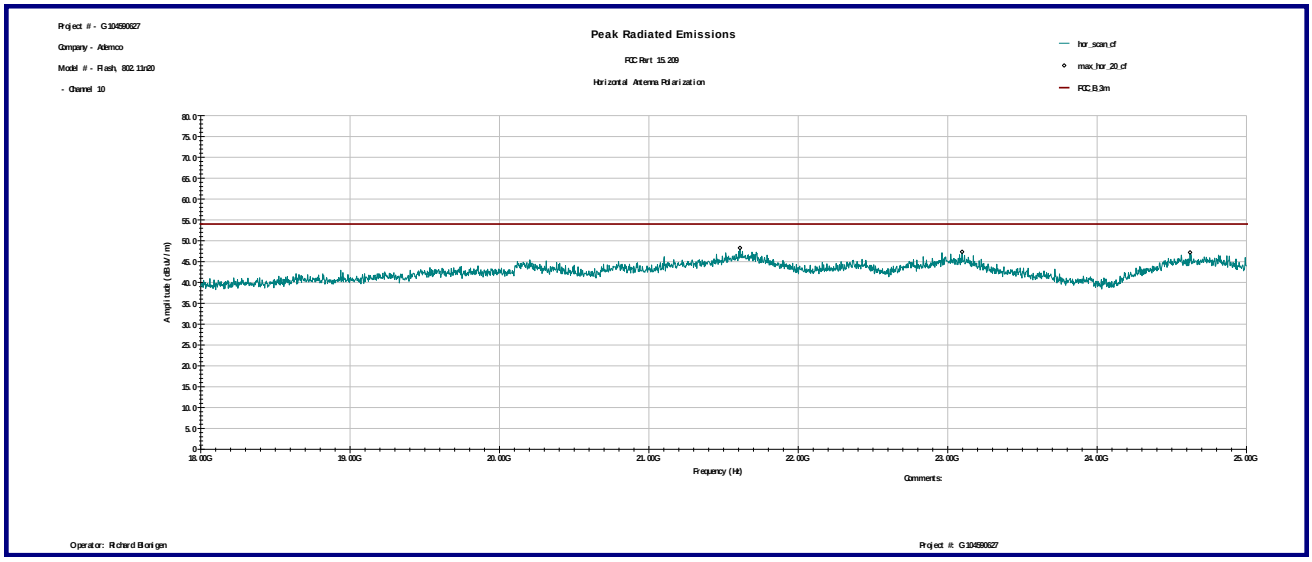

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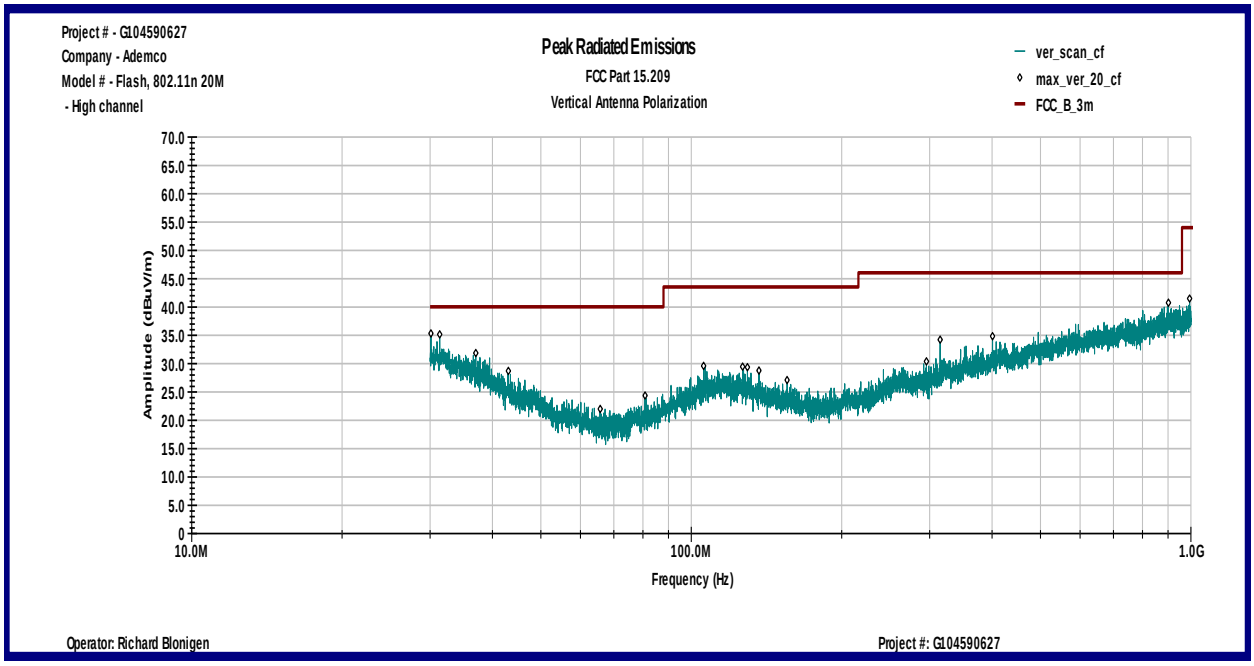

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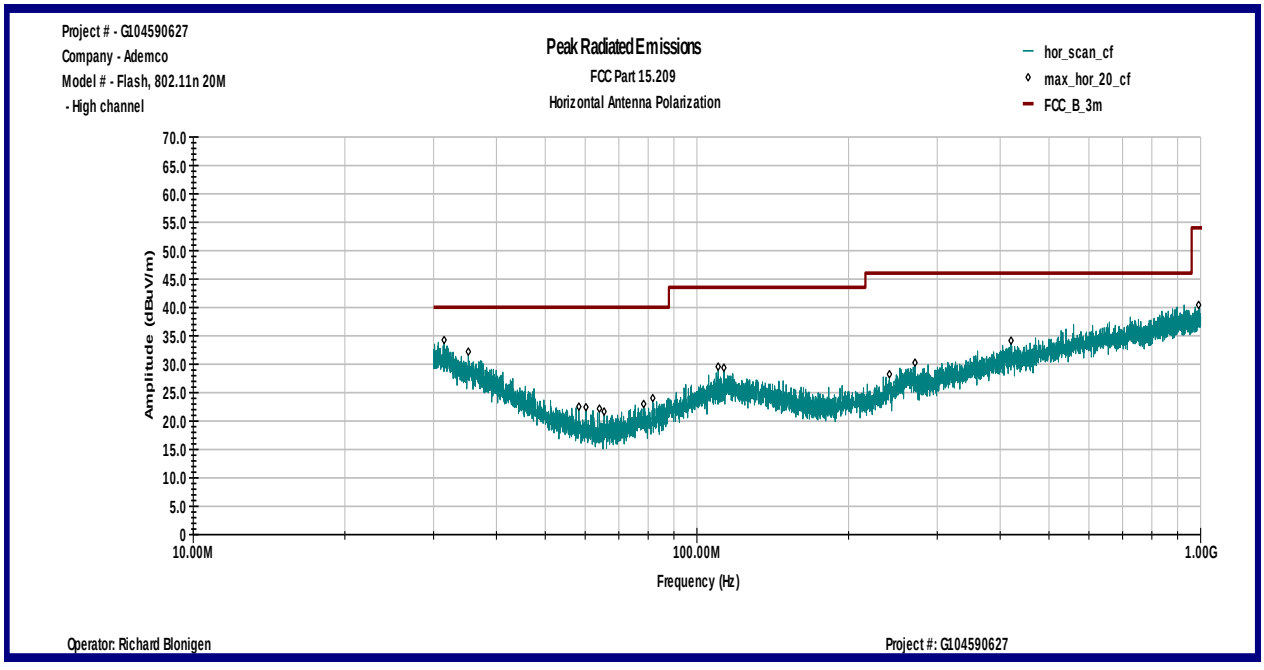

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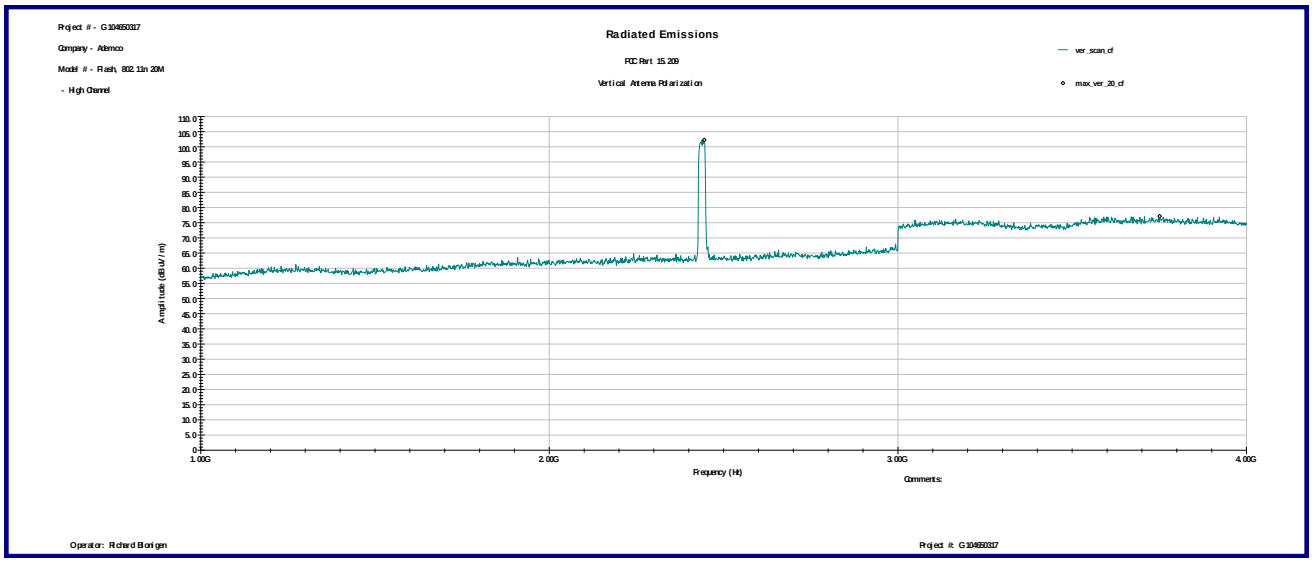

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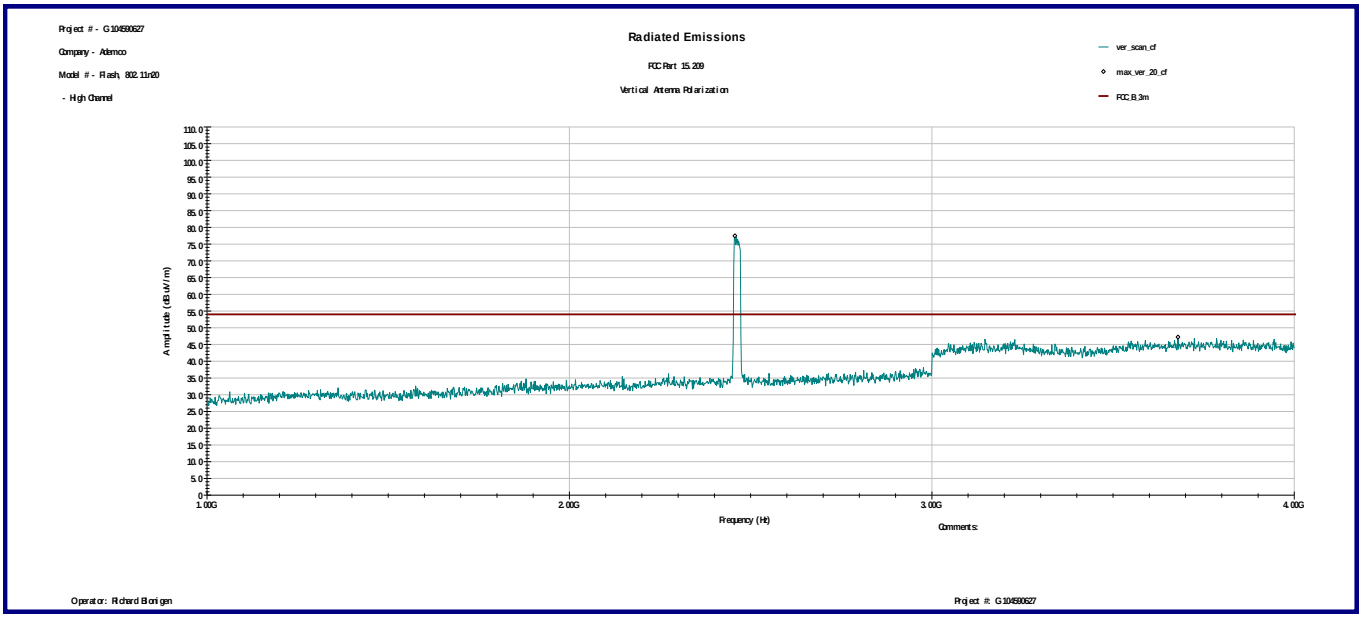

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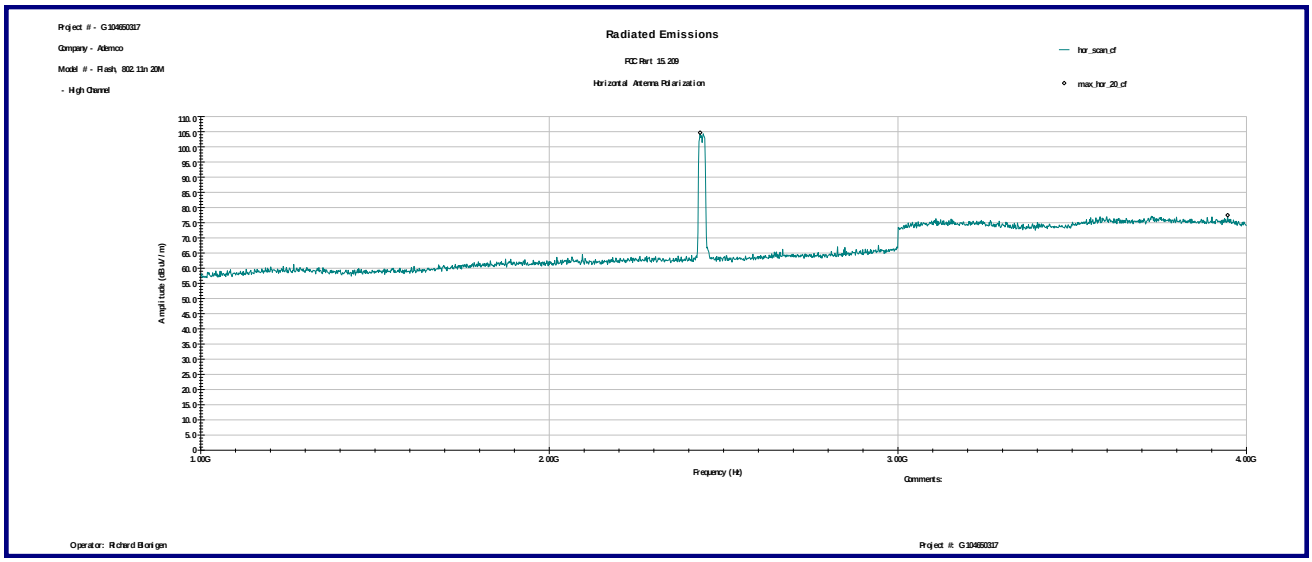

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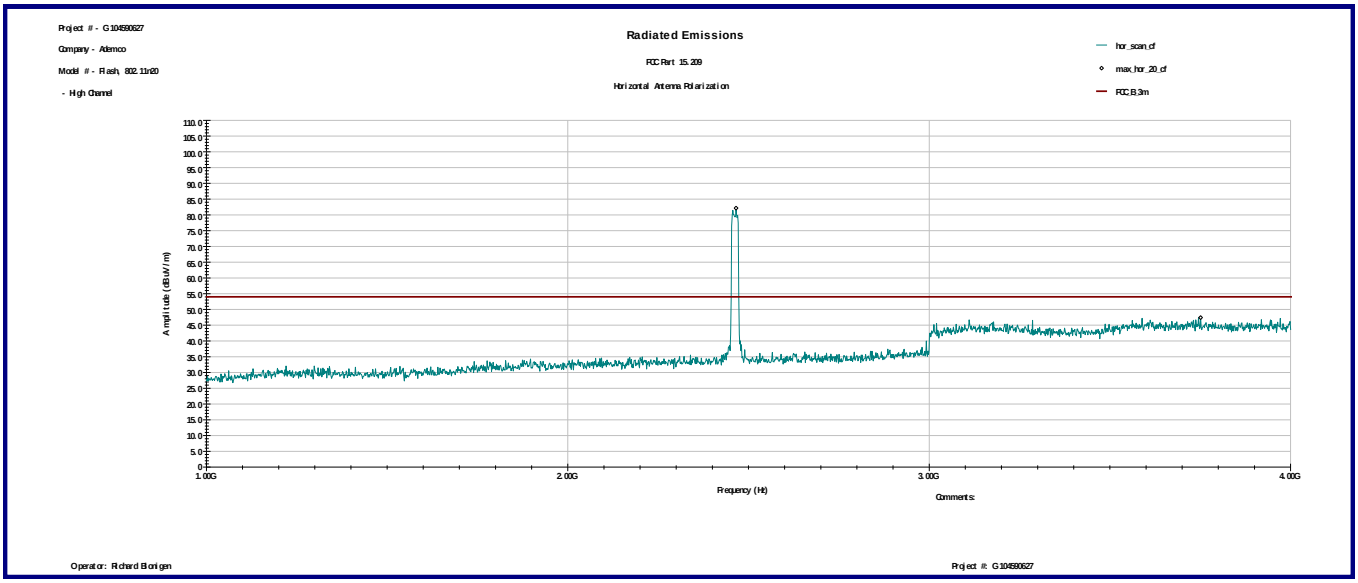

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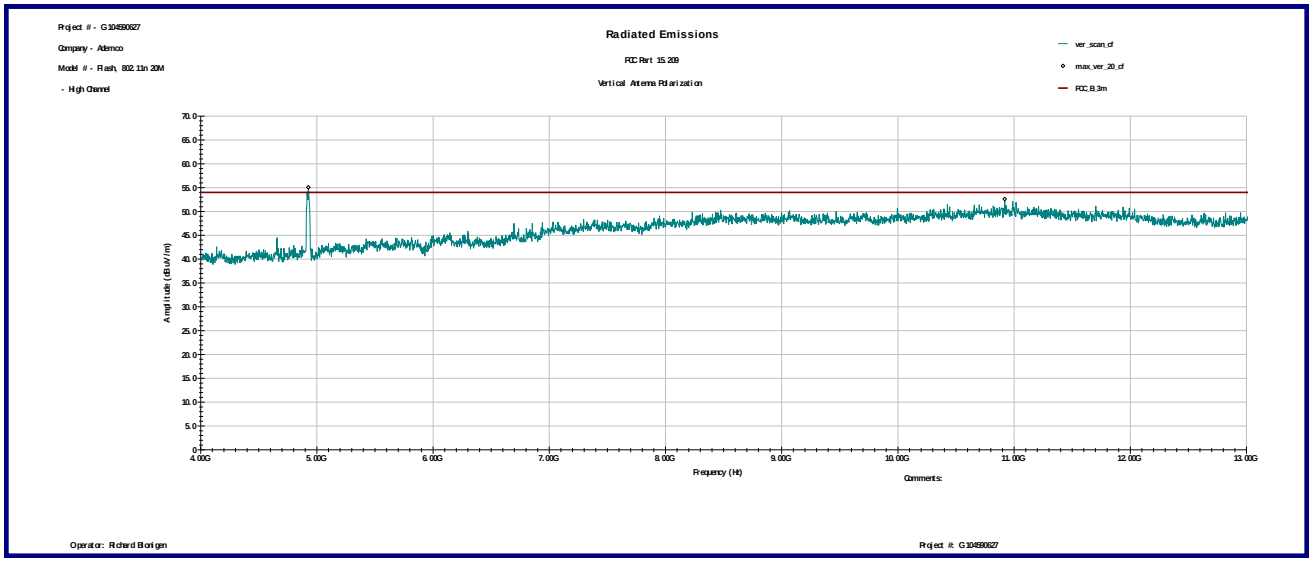

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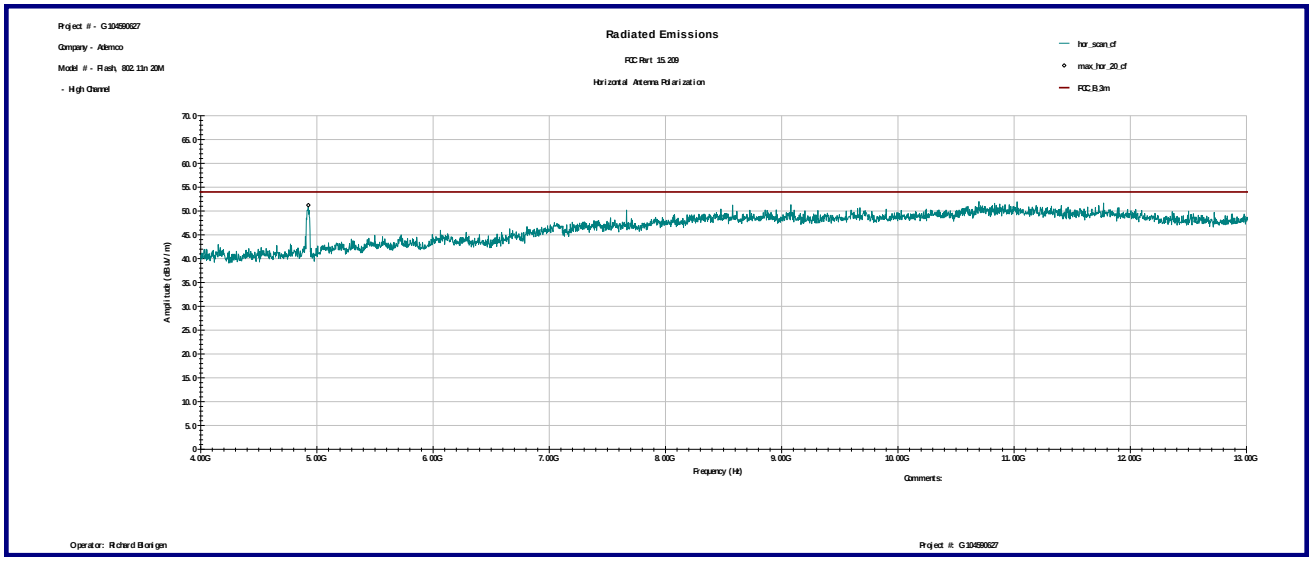
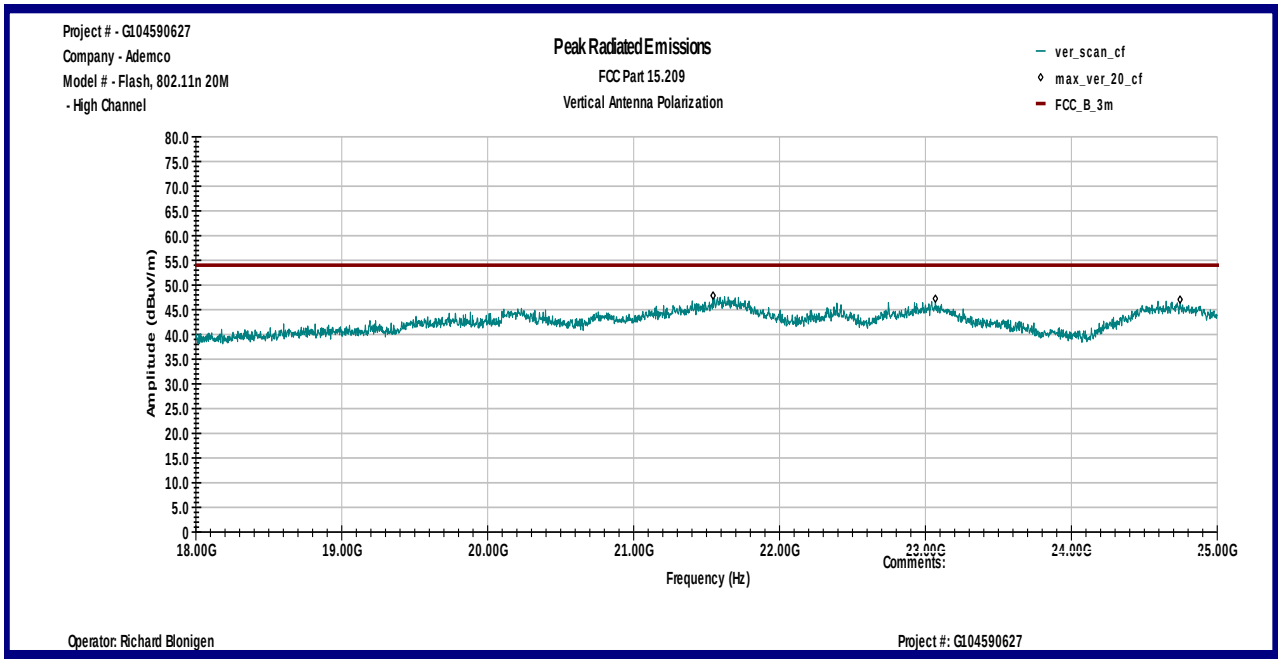
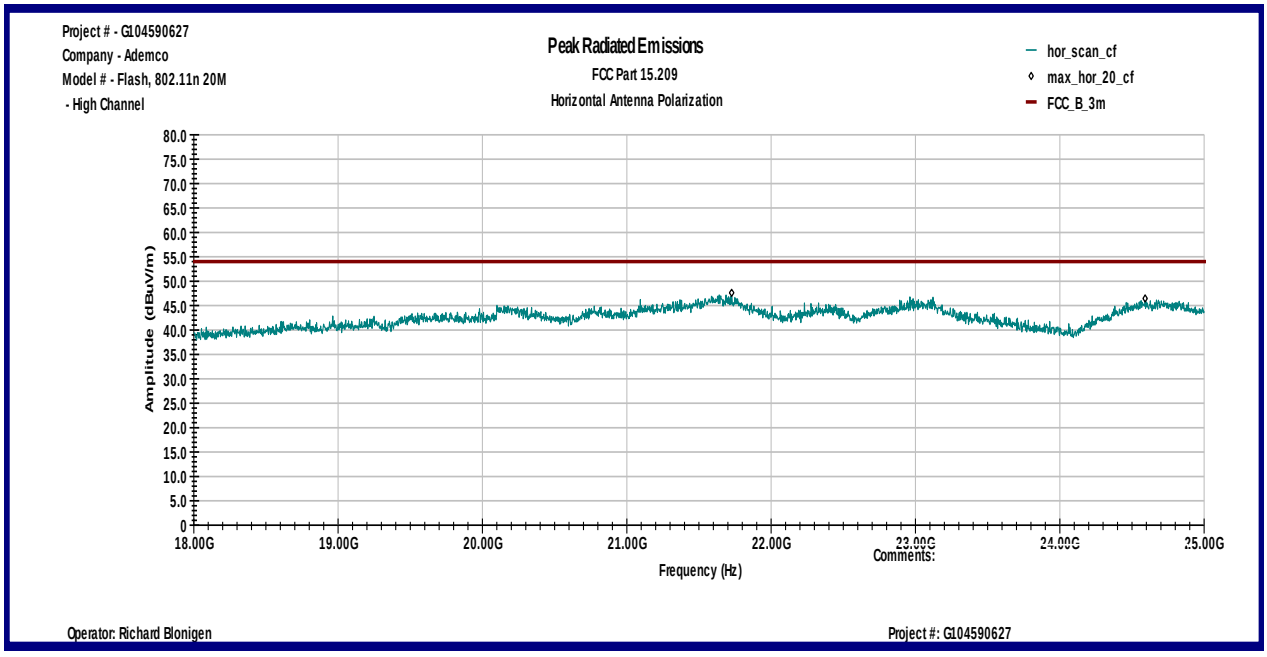


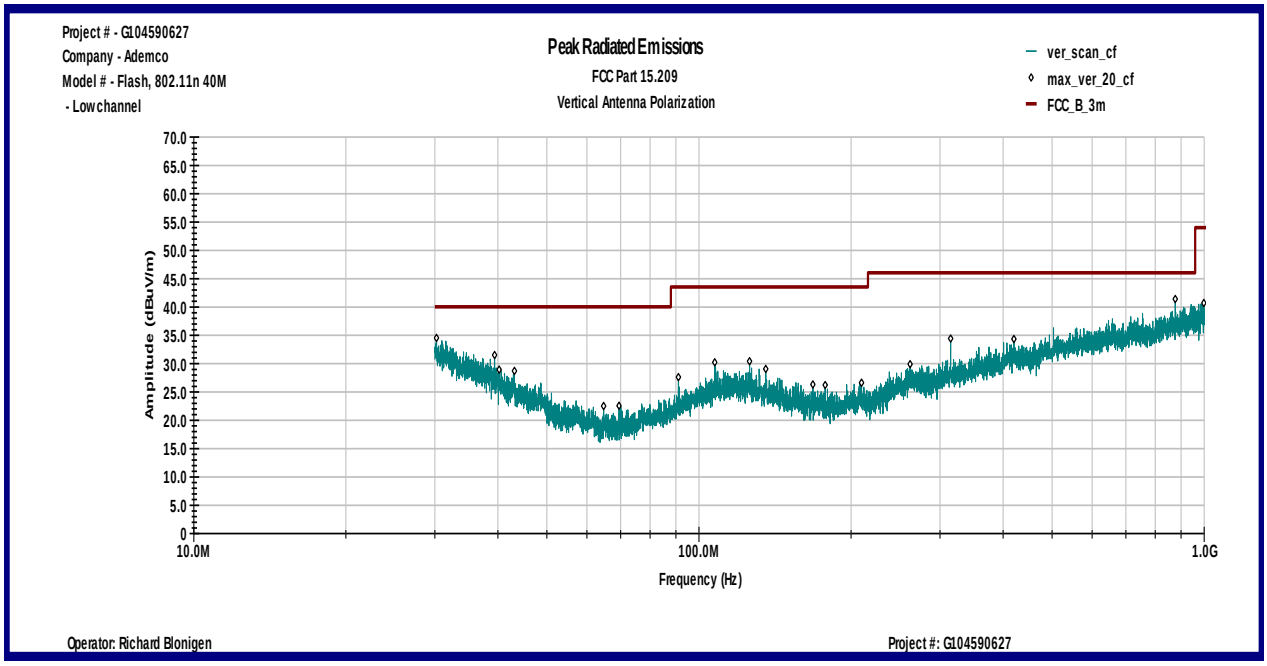
Graph 3.6.112



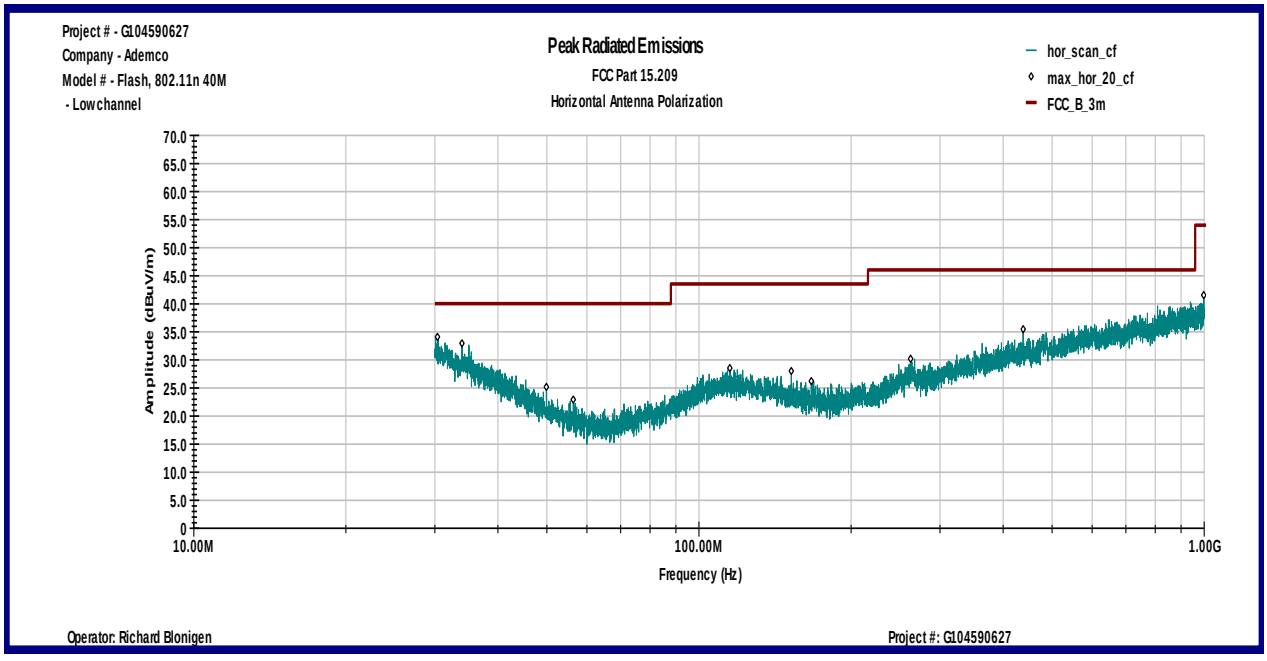
Graph 3.6.113



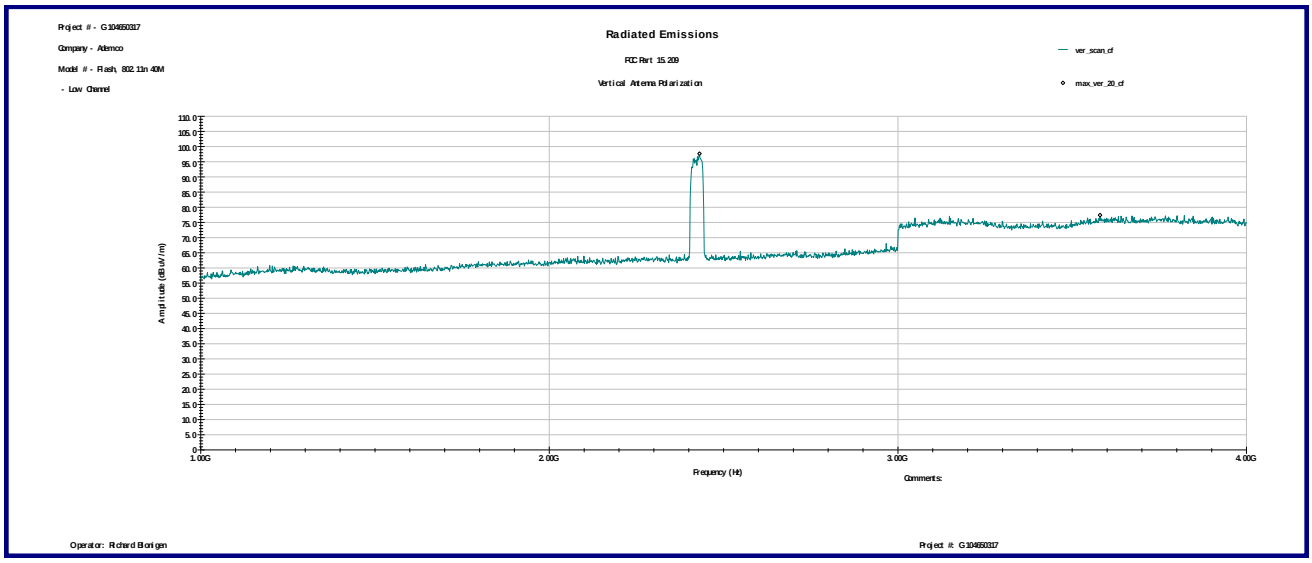
Graph 3.6.114



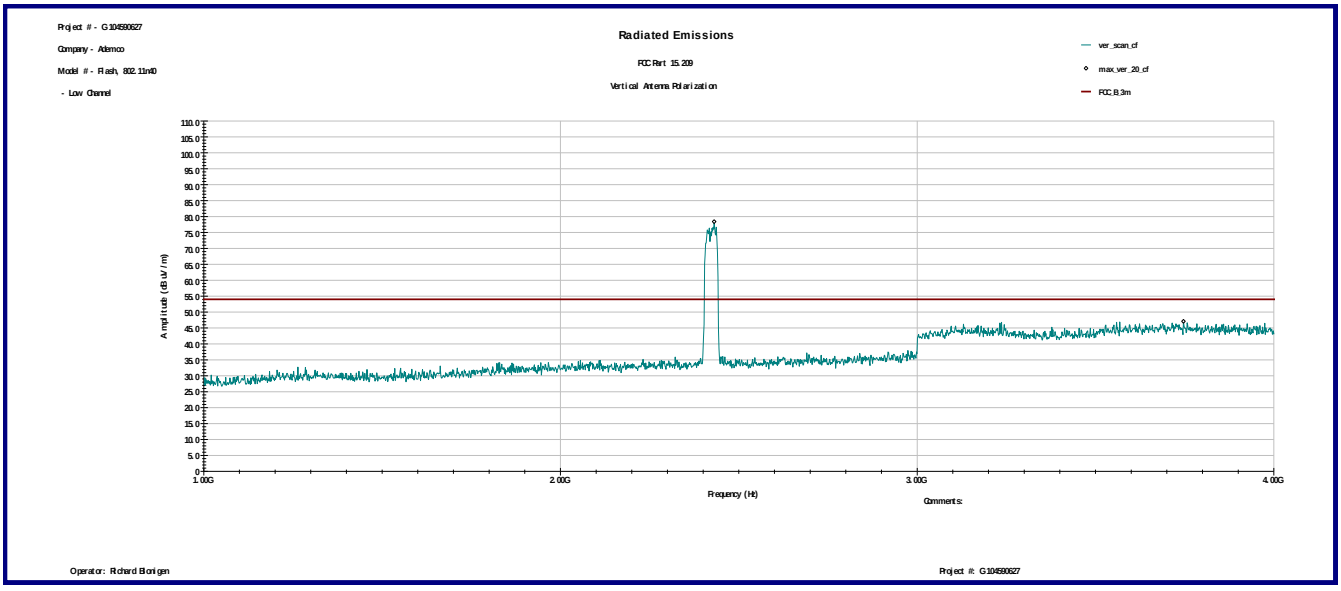
Graph 3.6.115



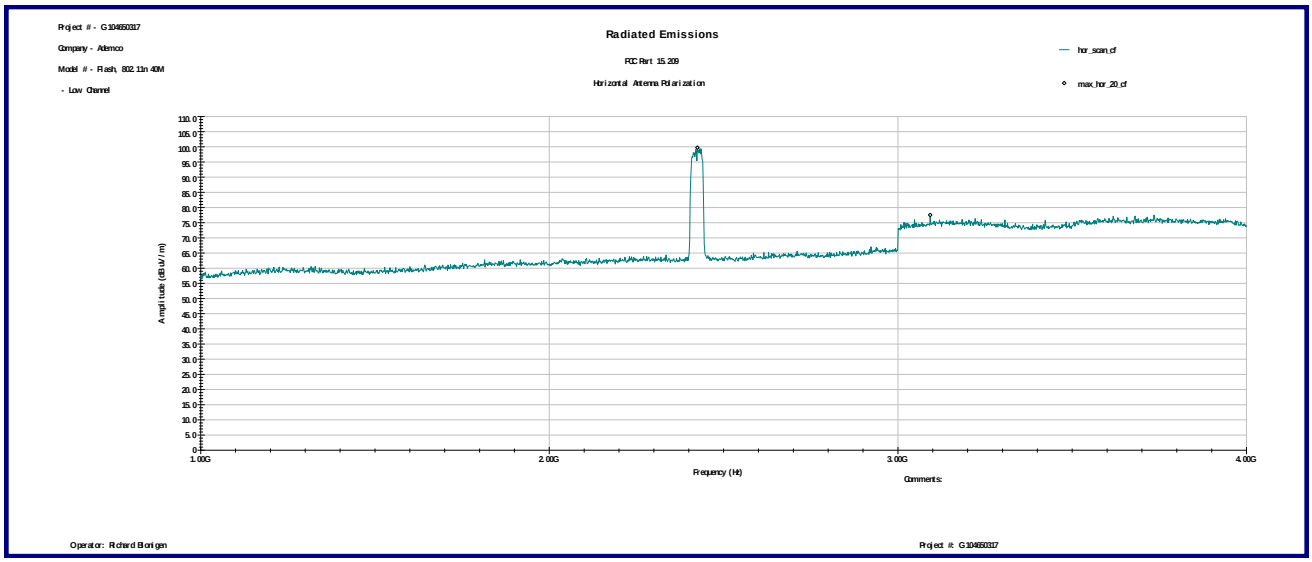
Graph 3.6.116



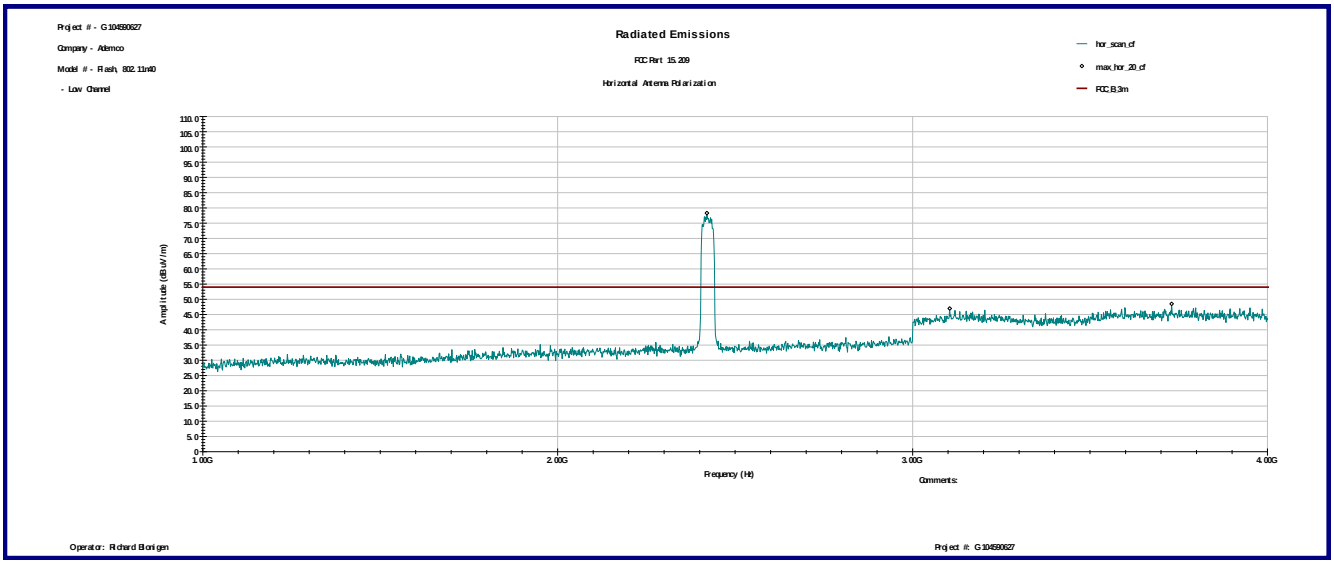
Graph 3.6.117



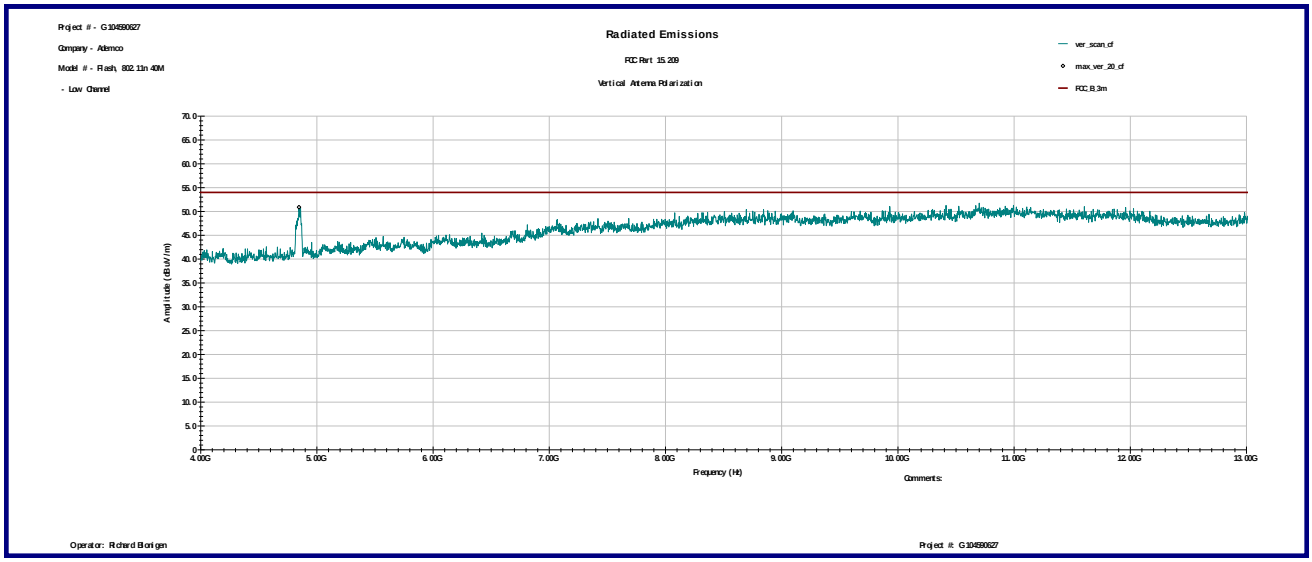
Graph 3.6.118



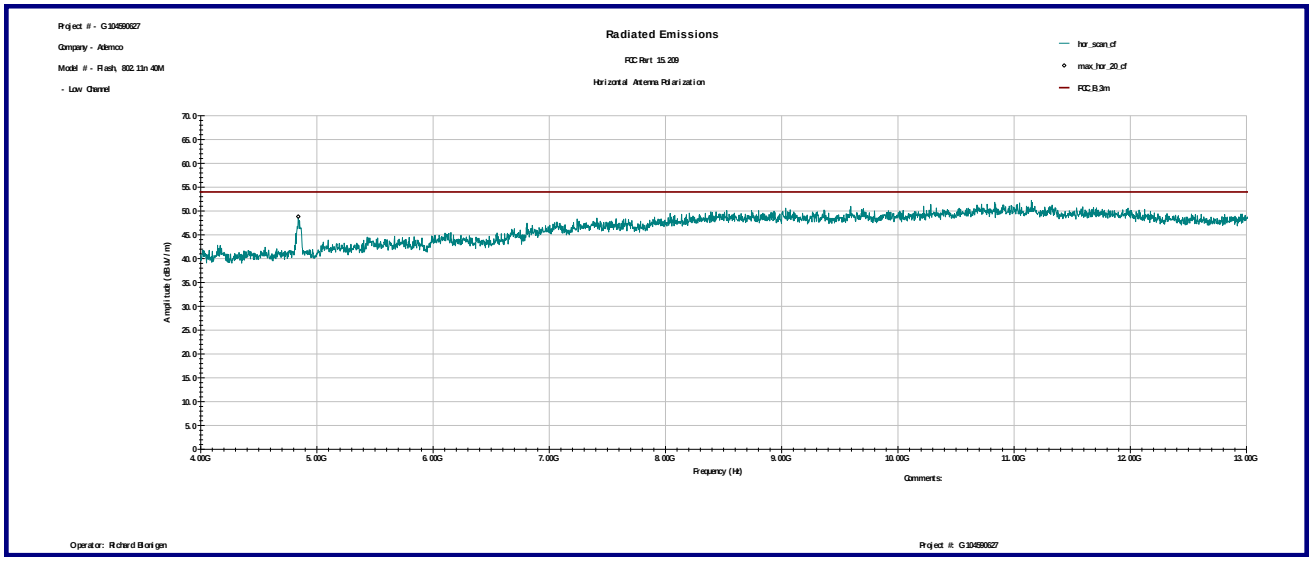
Graph 3.6.119



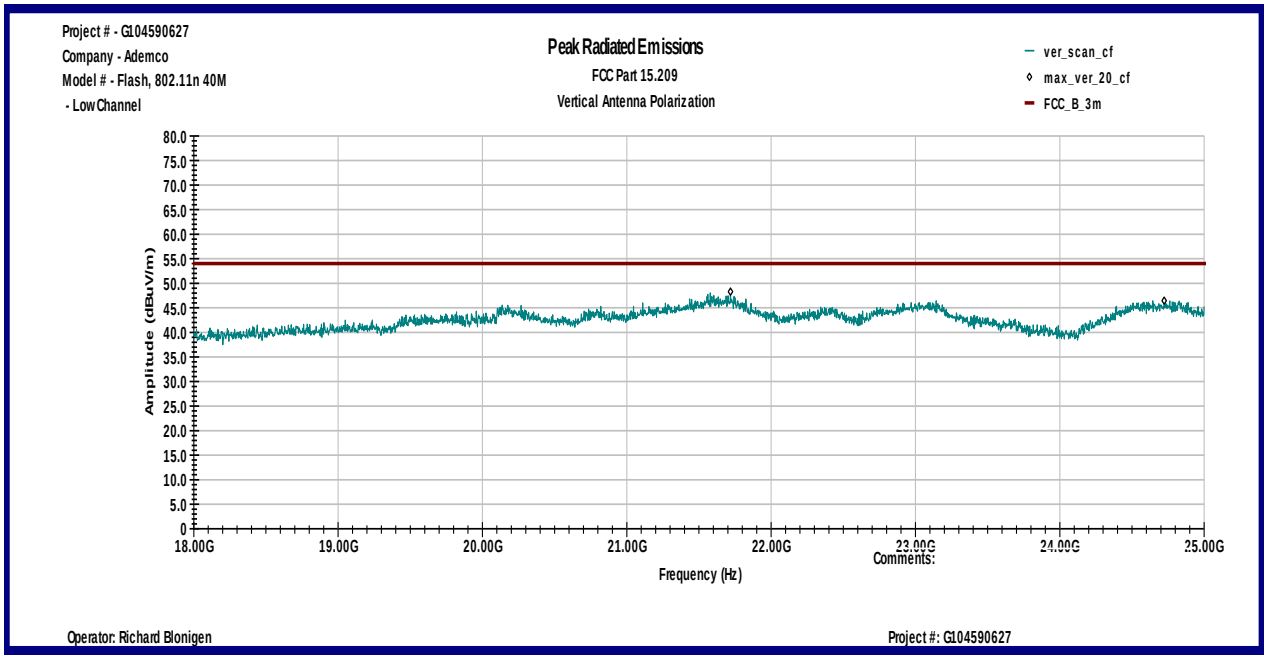
Graph 3.6.120



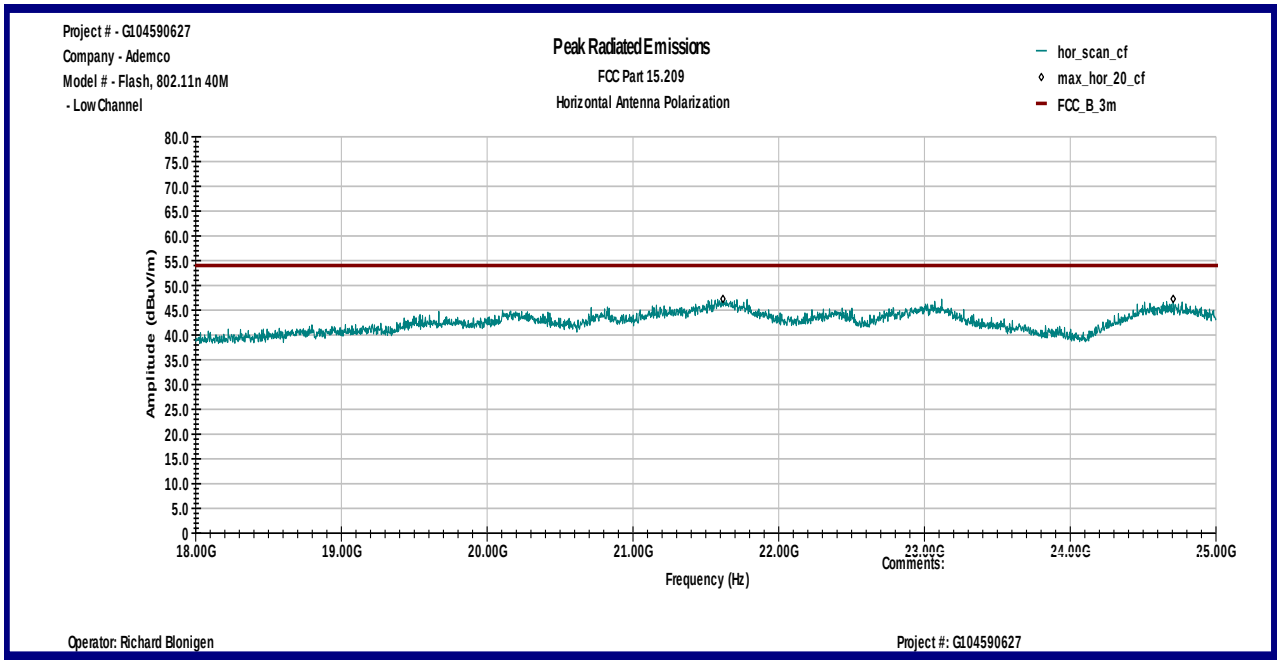
Graph 3.6.121



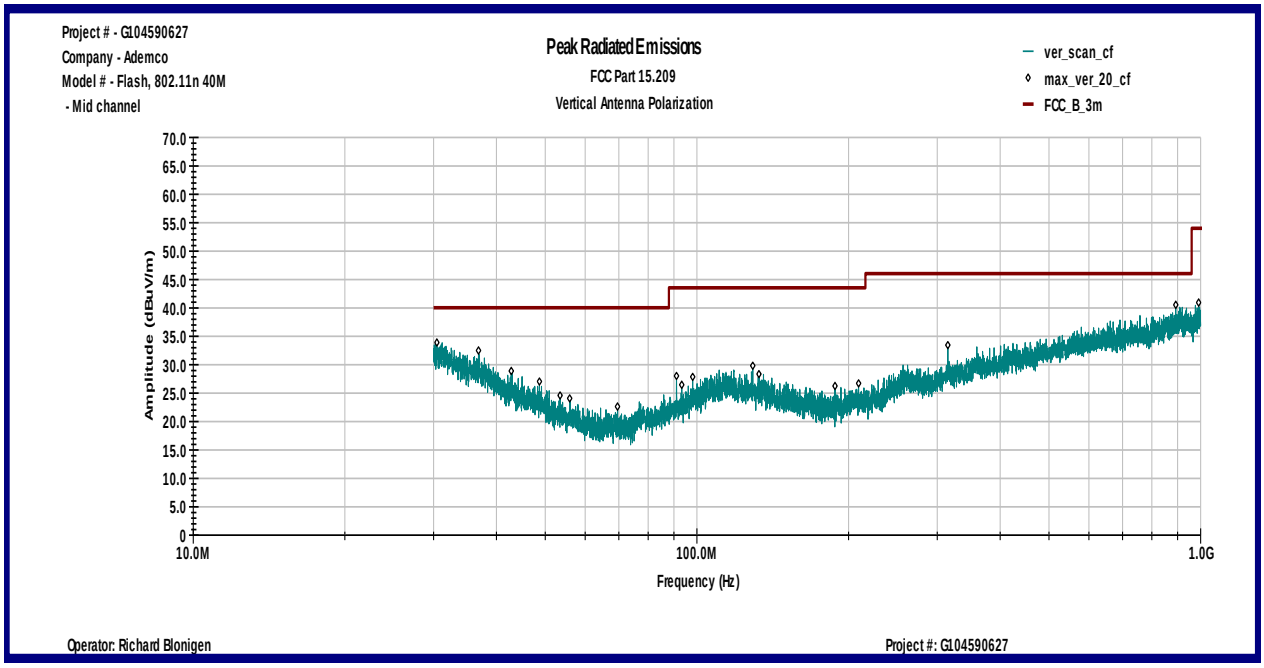
Graph 3.6.122



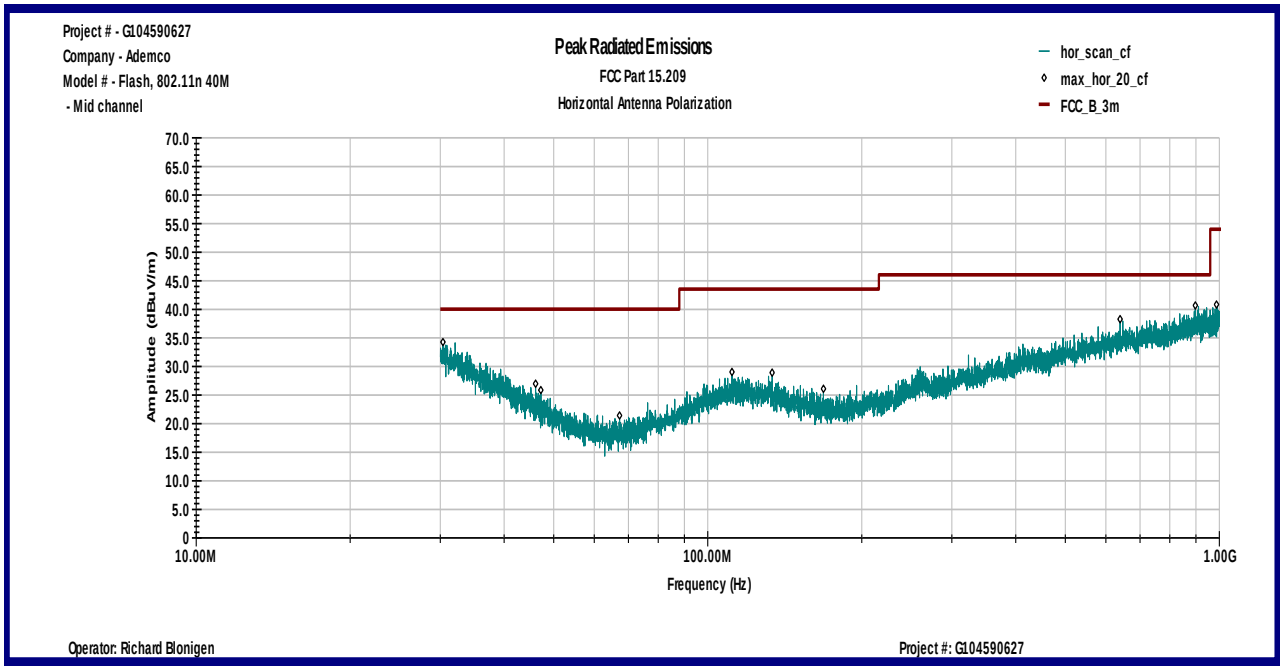
Graph 3.6.123



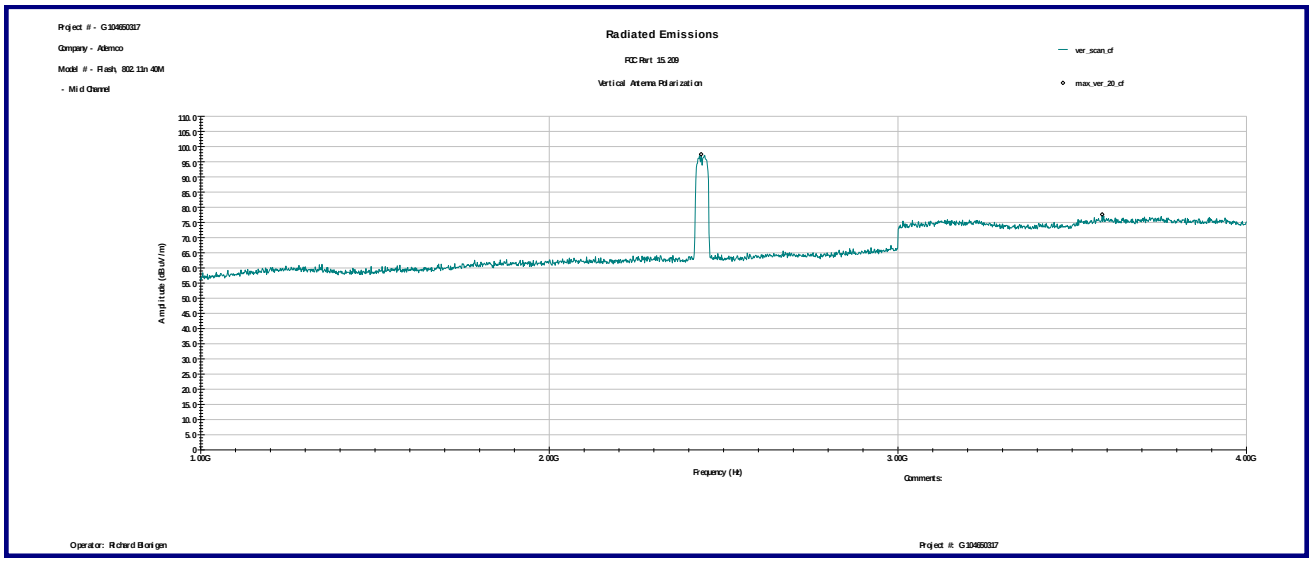
Graph 3.6.124



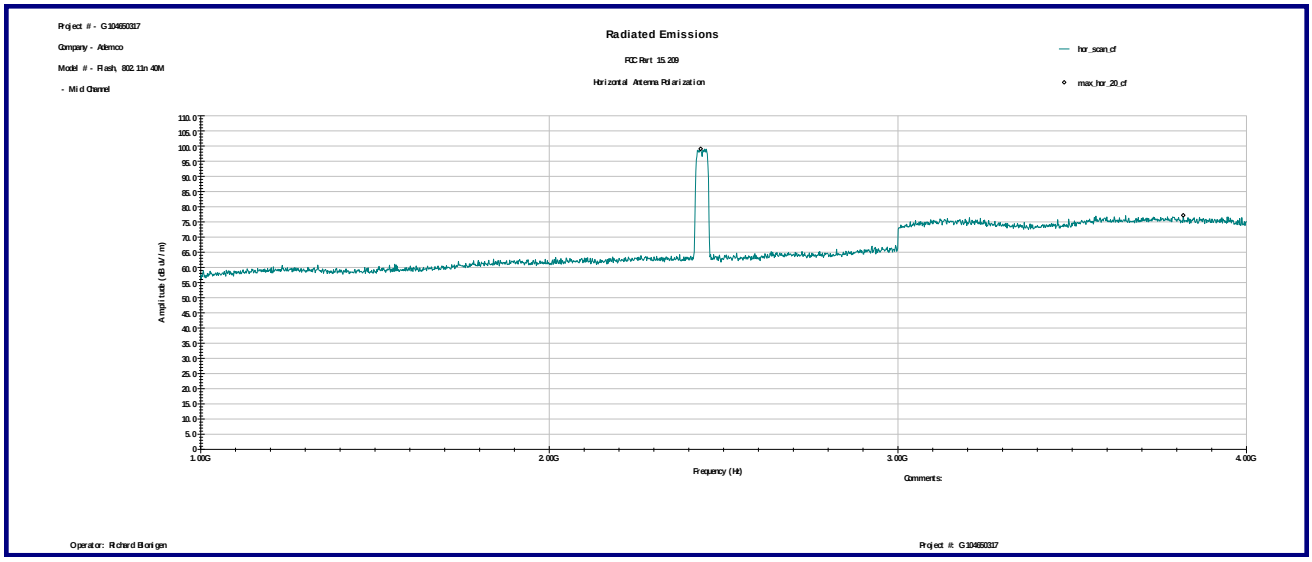
Graph 3.6.125



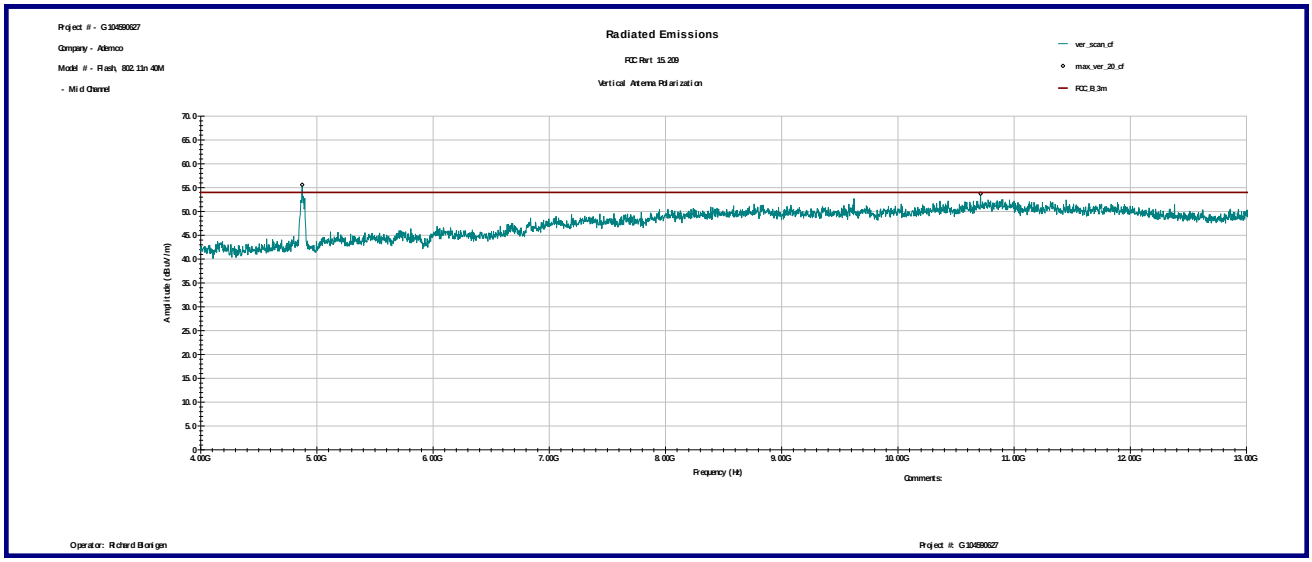
Graph 3.6.126



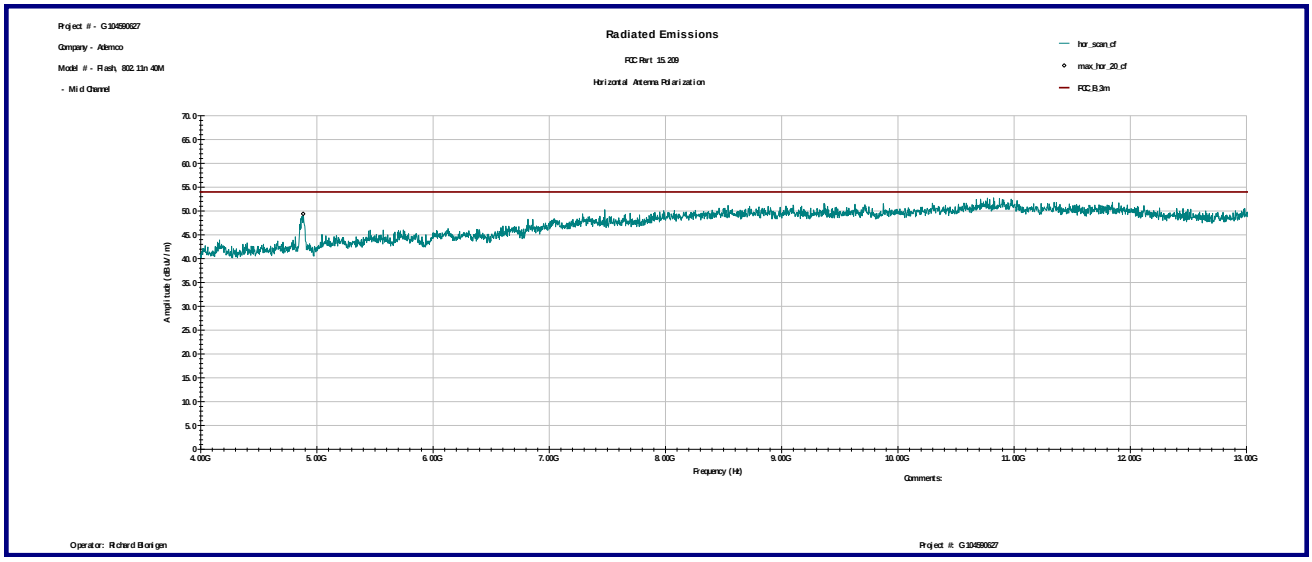
Graph 3.6.127



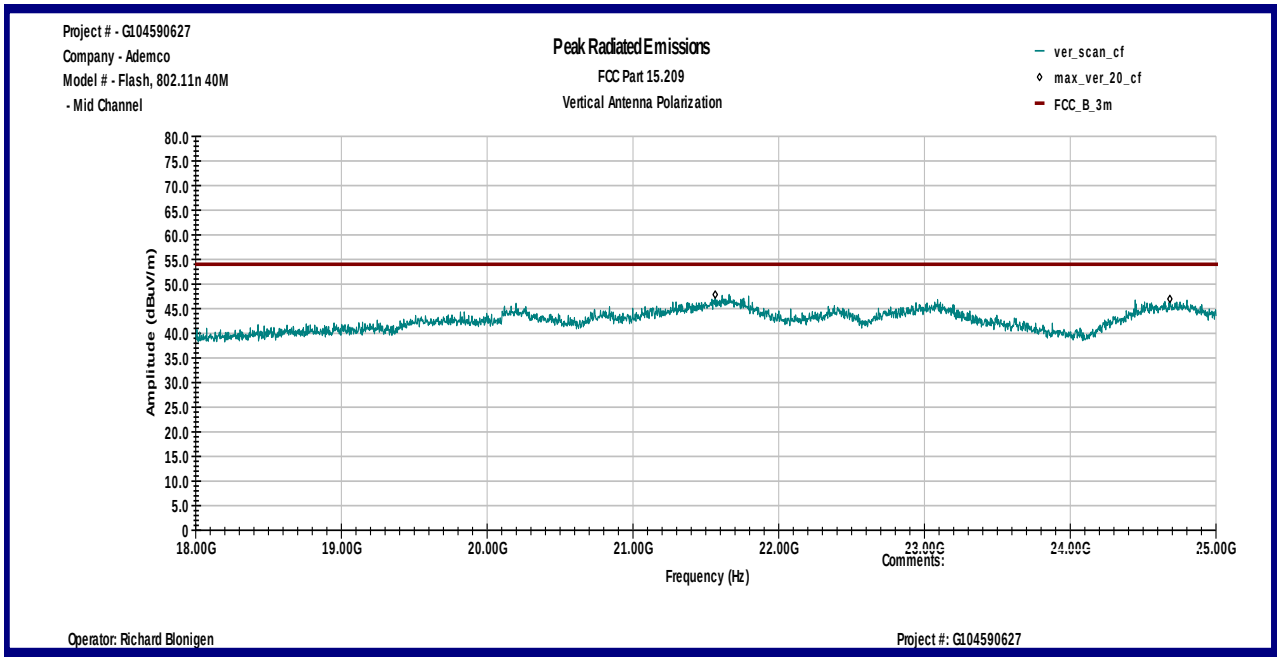
Graph 3.6.128



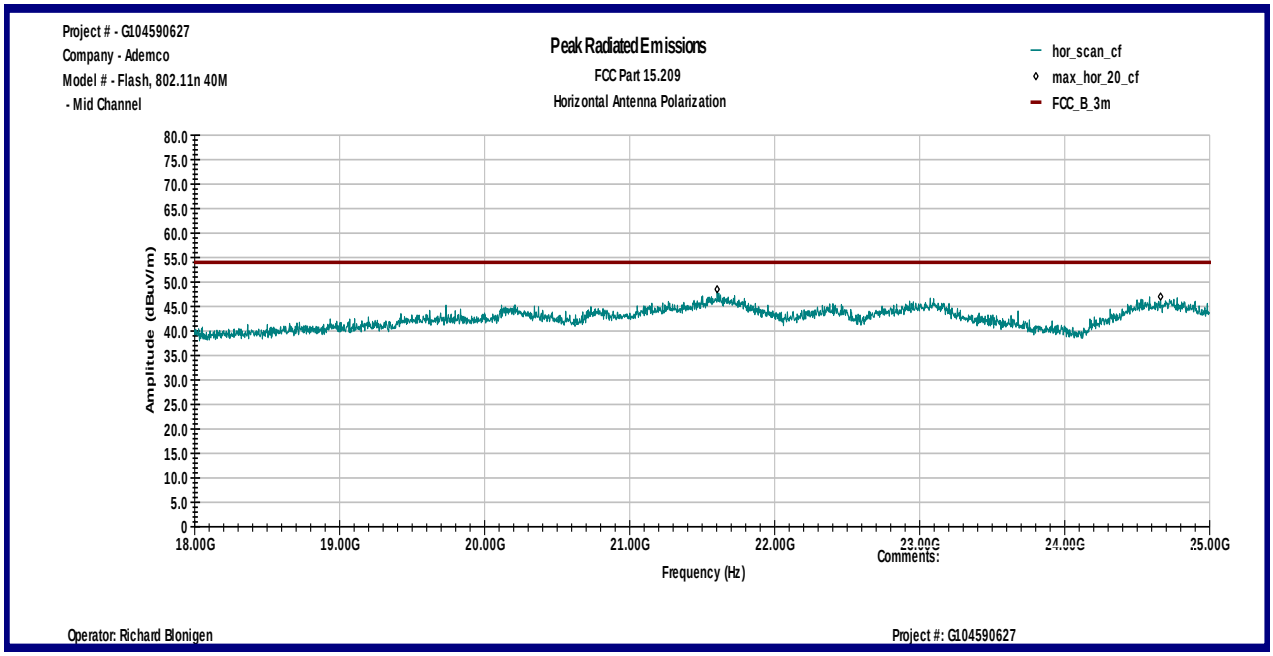
Graph 3.6.129



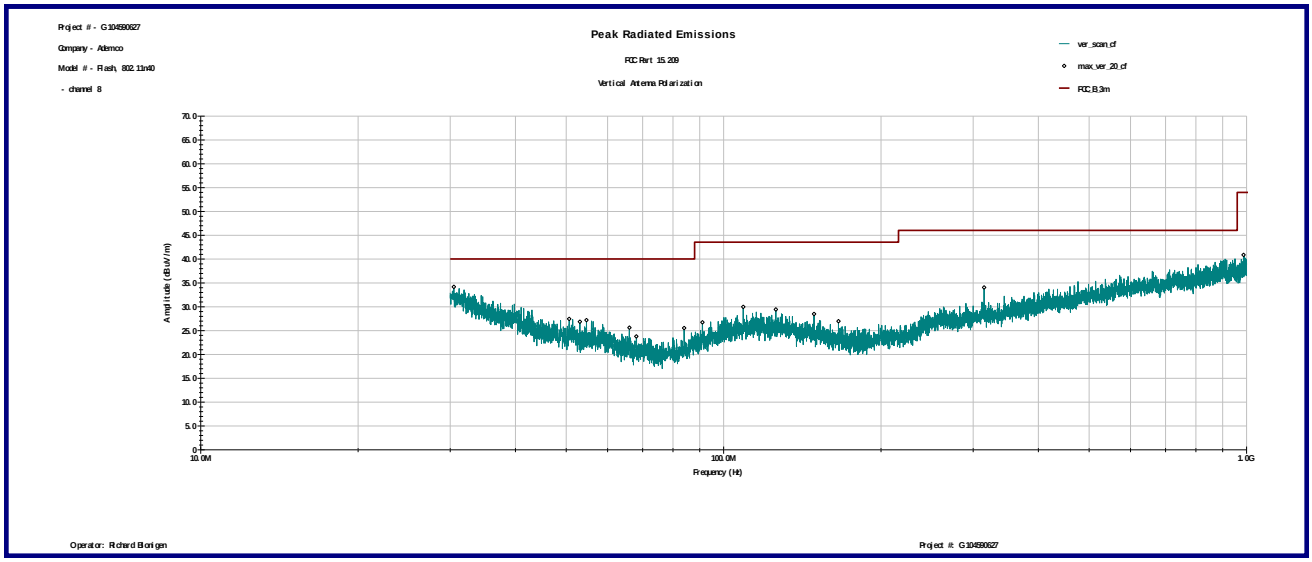
Graph 3.6.130



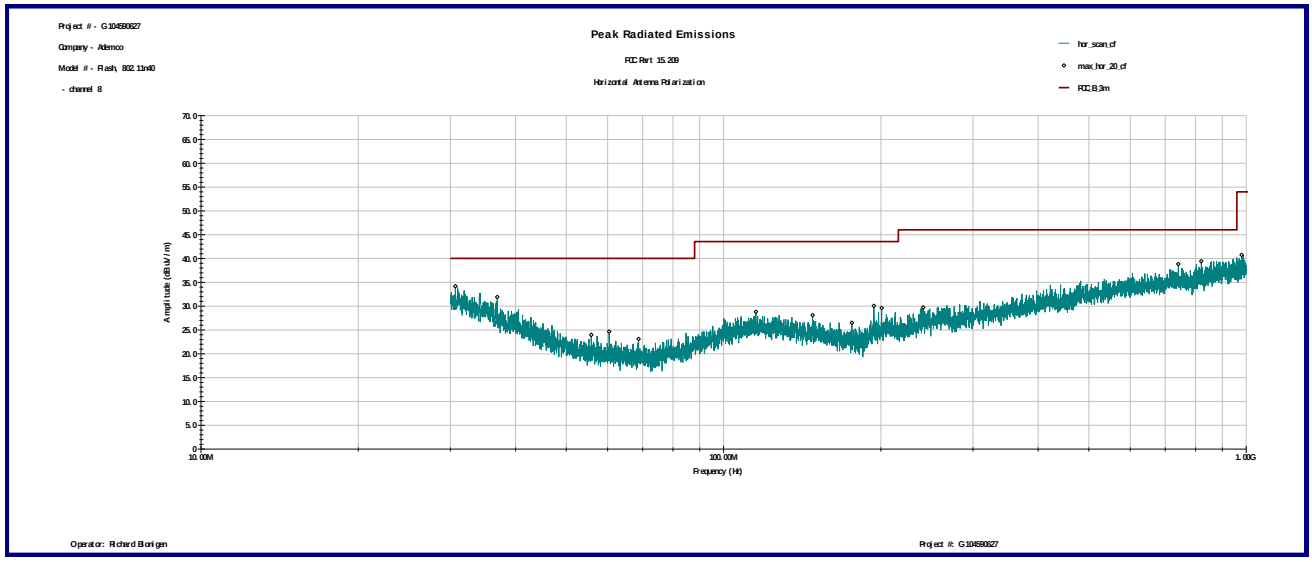
Graph 3.6.131



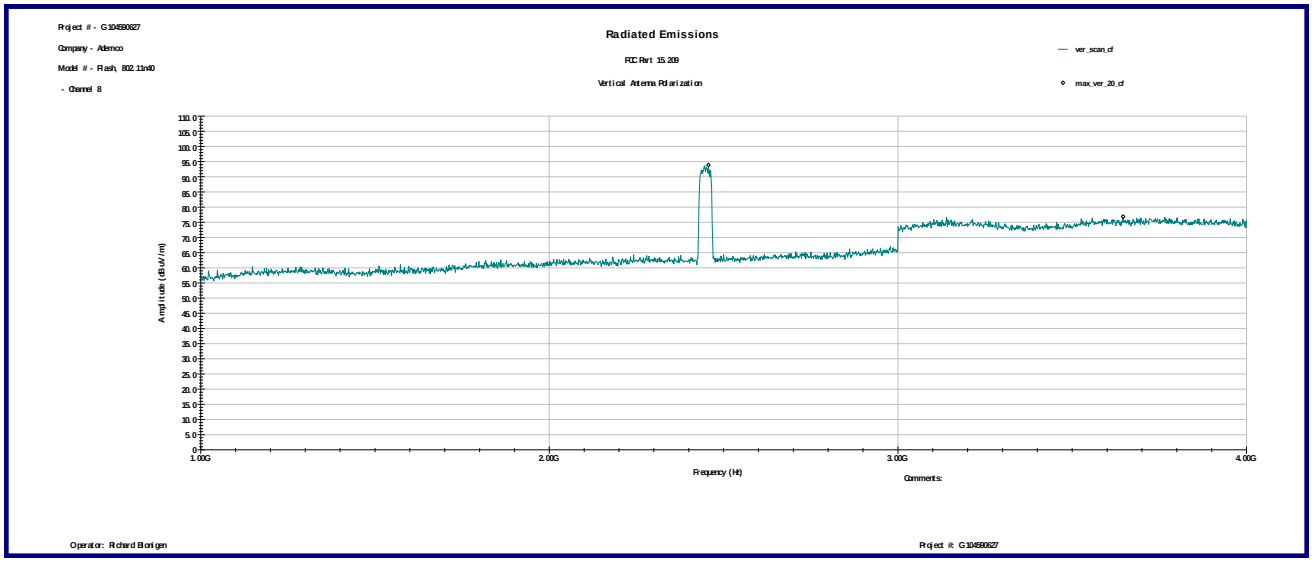
Graph 3.6.132



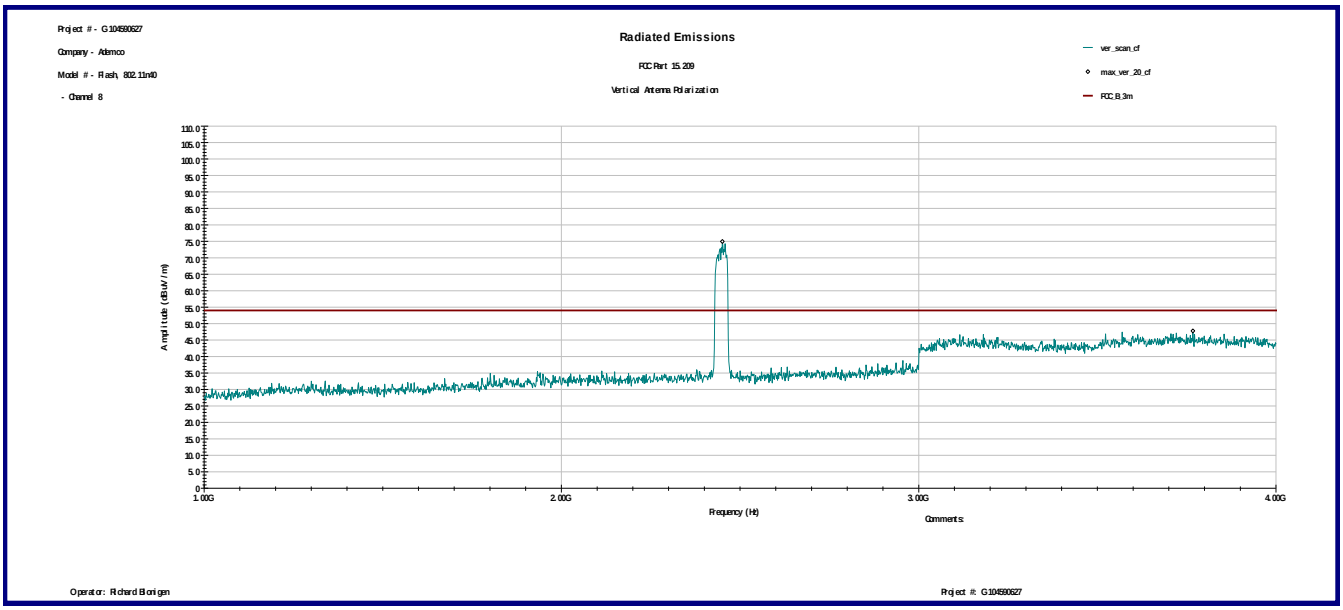
Graph 3.6.133



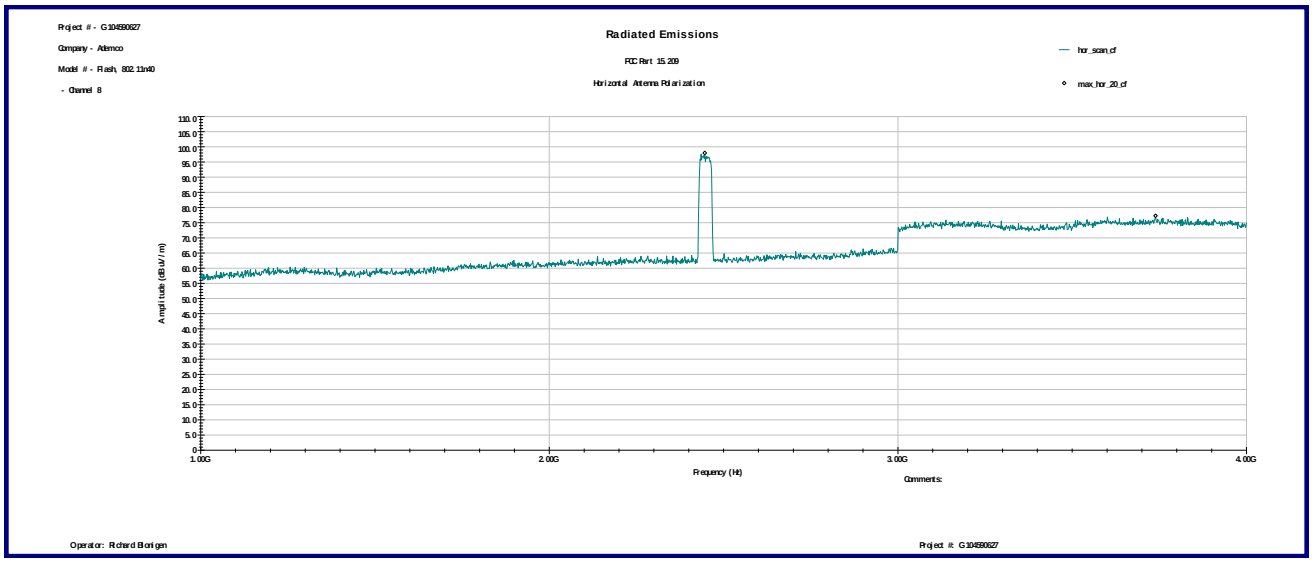
Graph 3.6.134



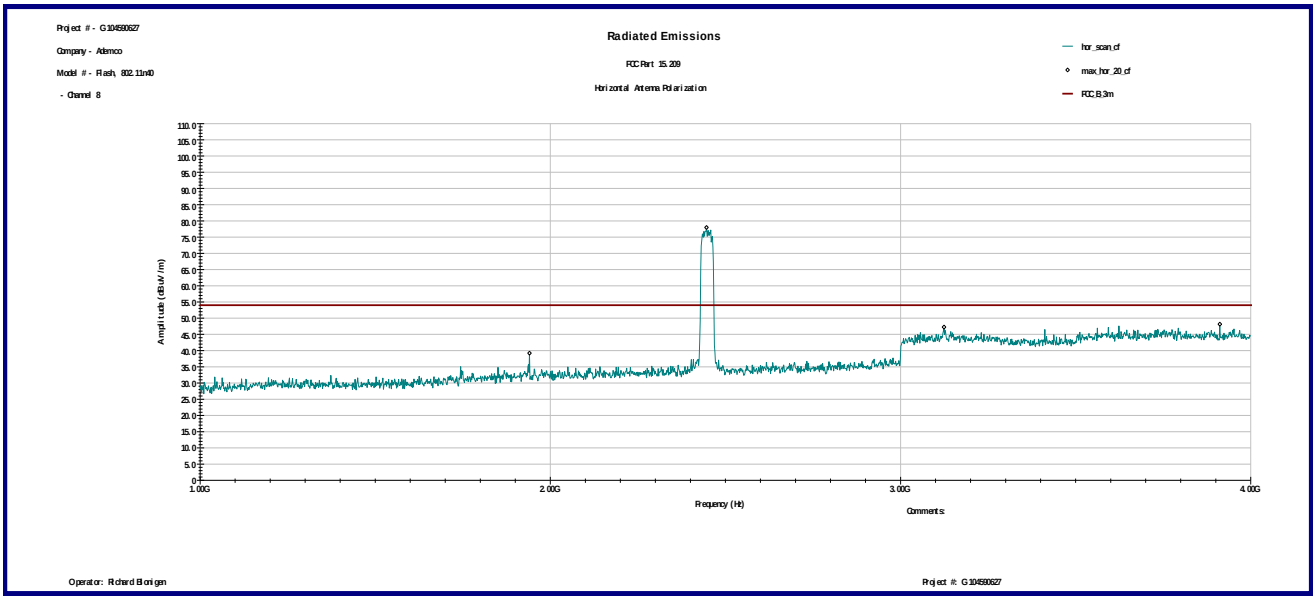
Graph 3.6.135



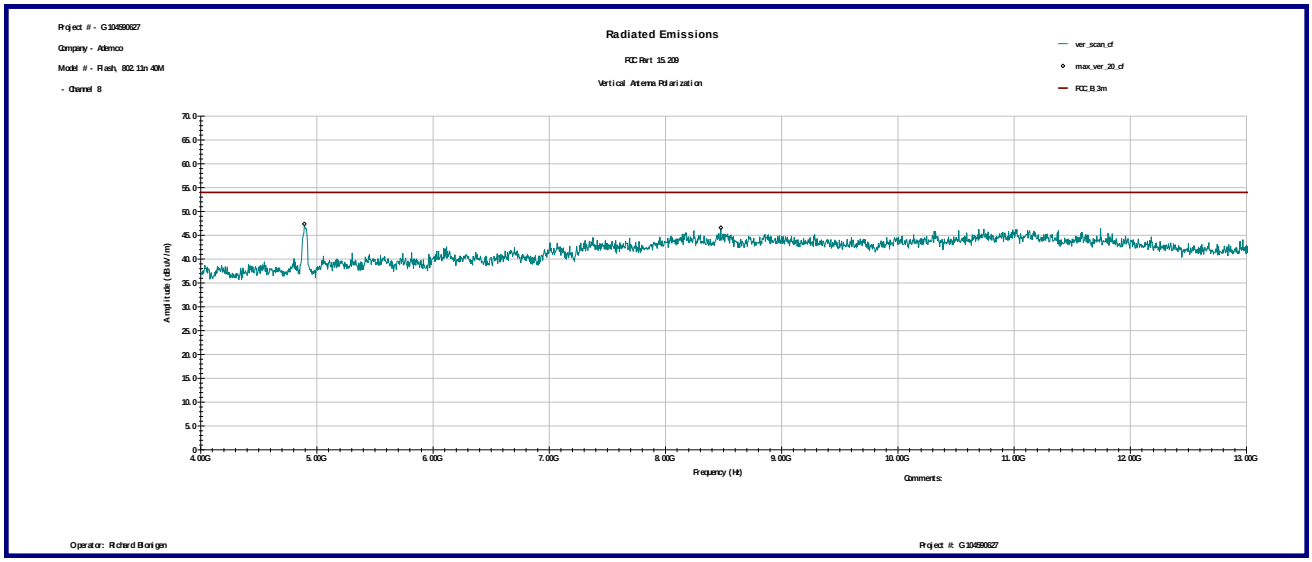
Graph 3.6.136



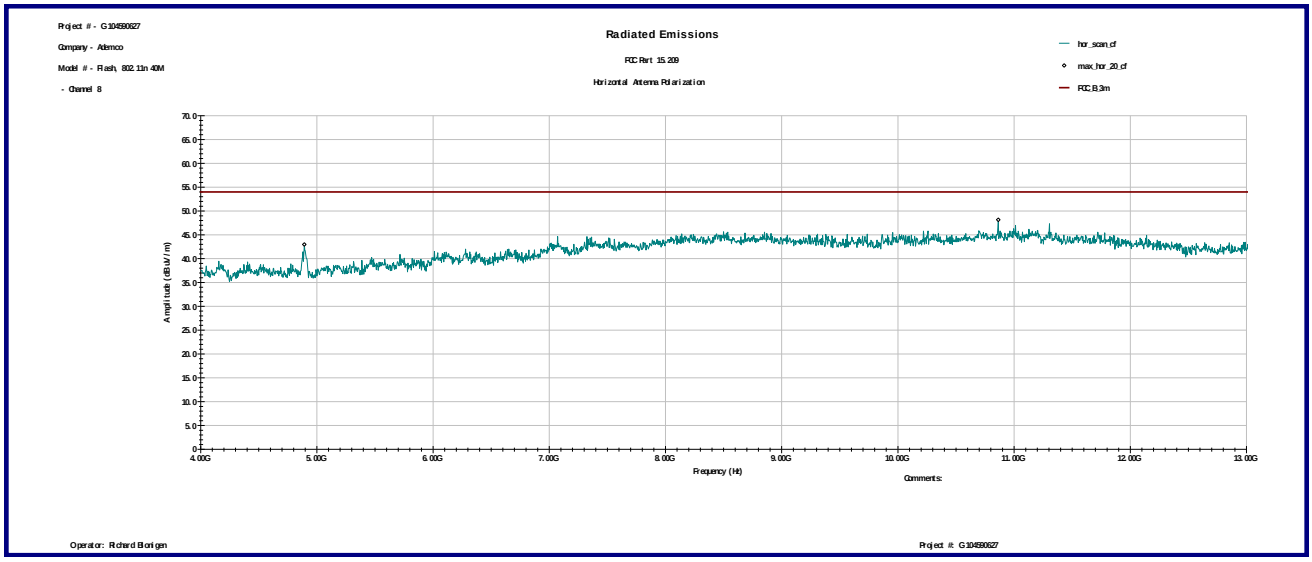
Graph 3.6.137



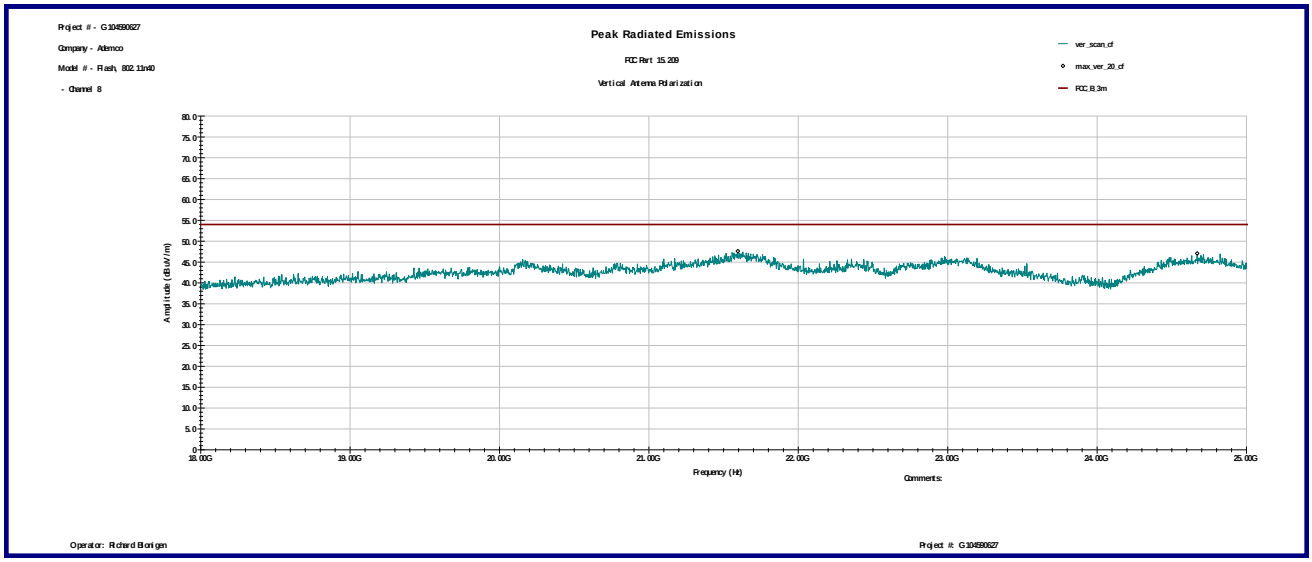
Graph 3.6.138



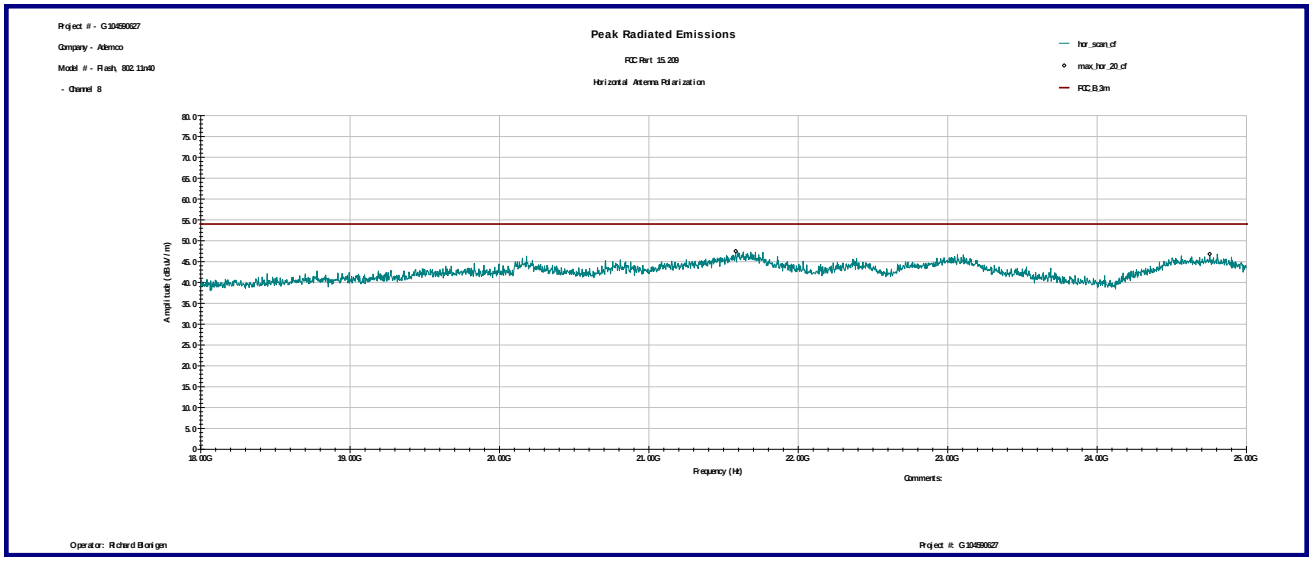
Graph 3.6.139



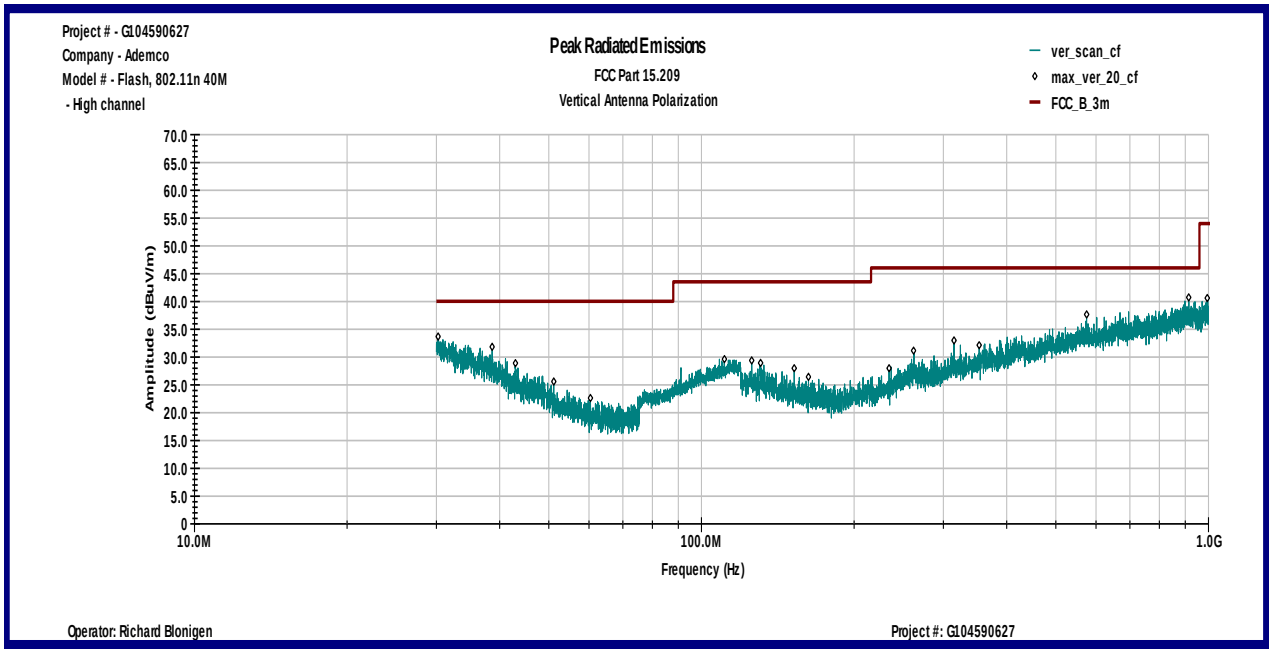
Graph 3.6.140



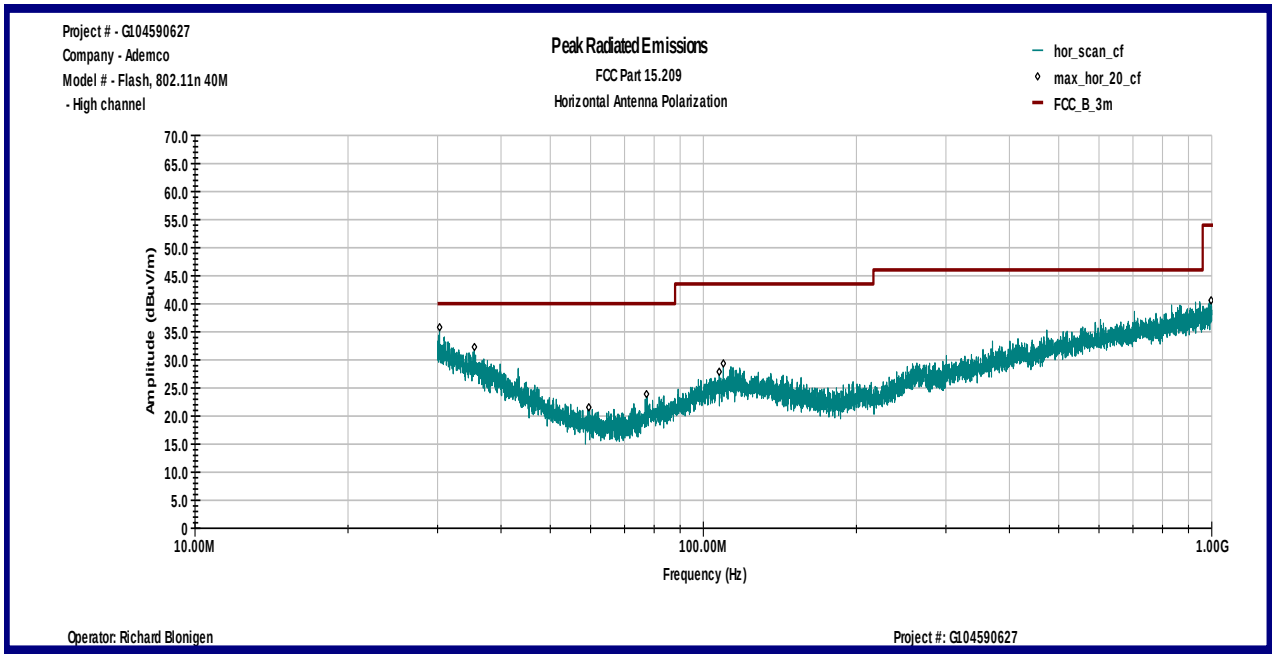
Graph 3.6.141



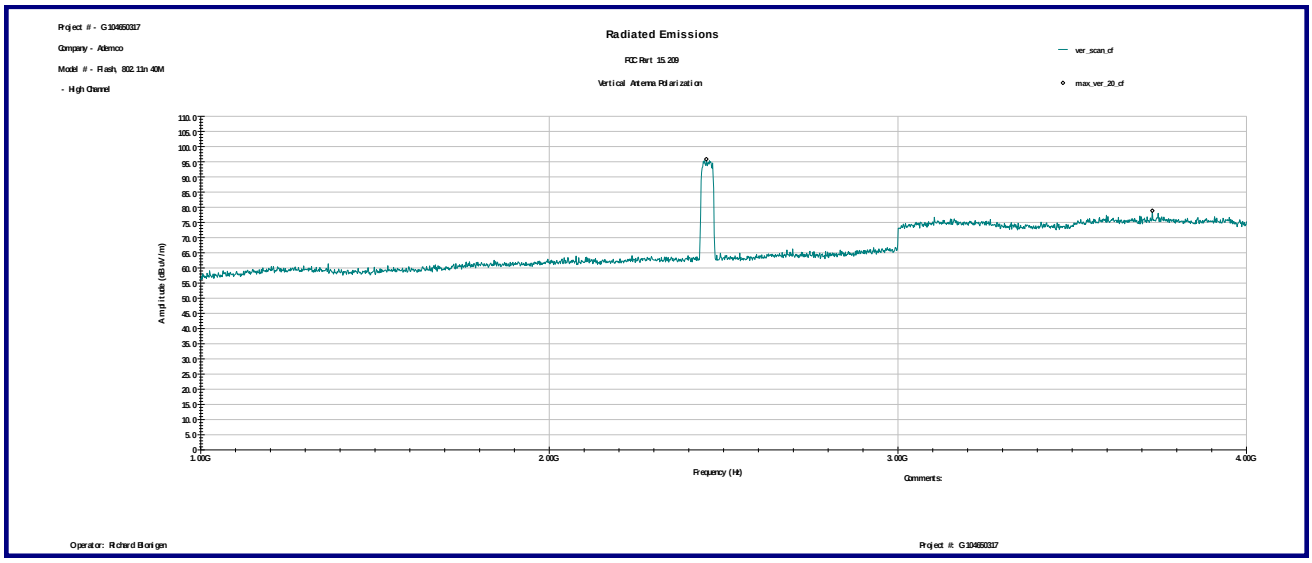
Graph 3.6.142



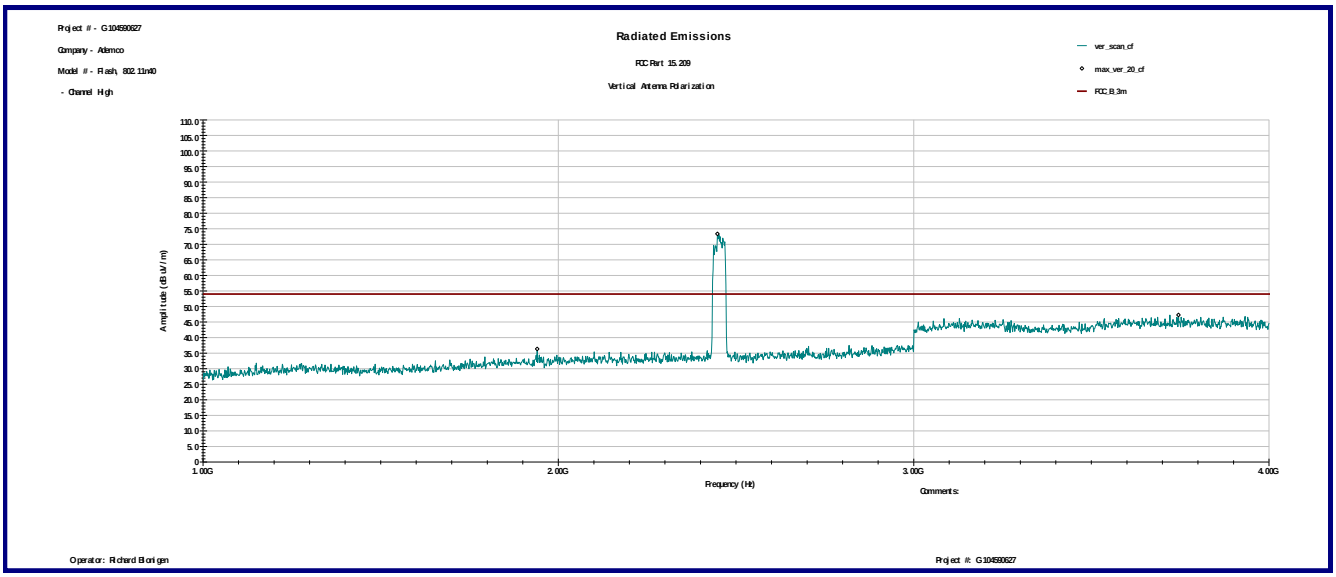
Graph 3.6.143



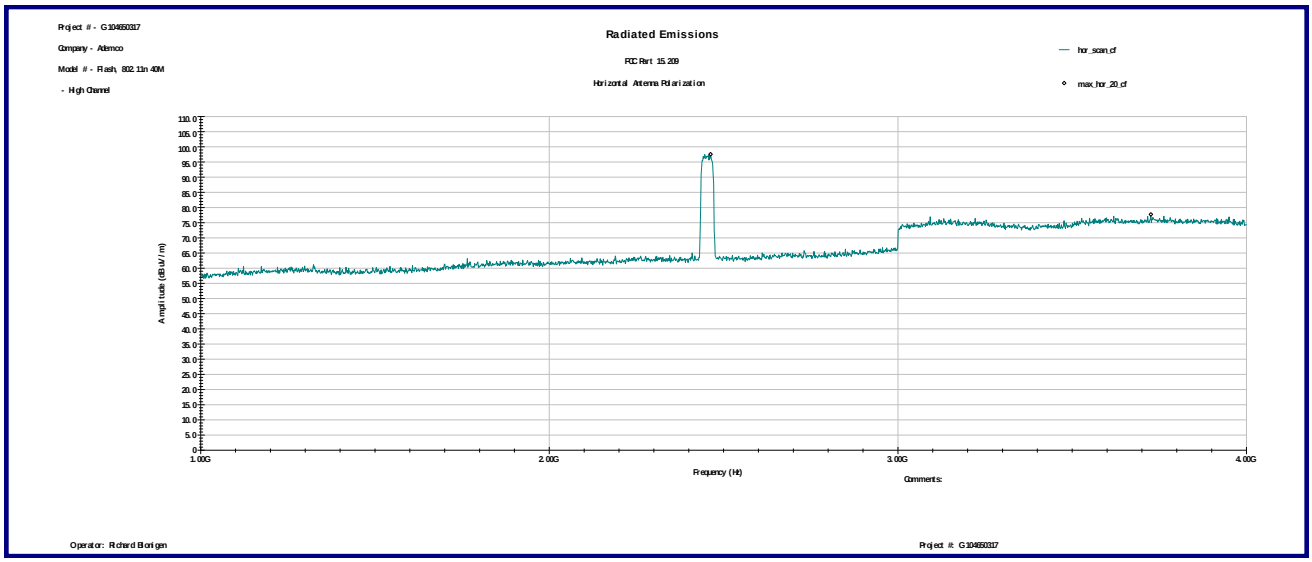
Graph 3.6.144



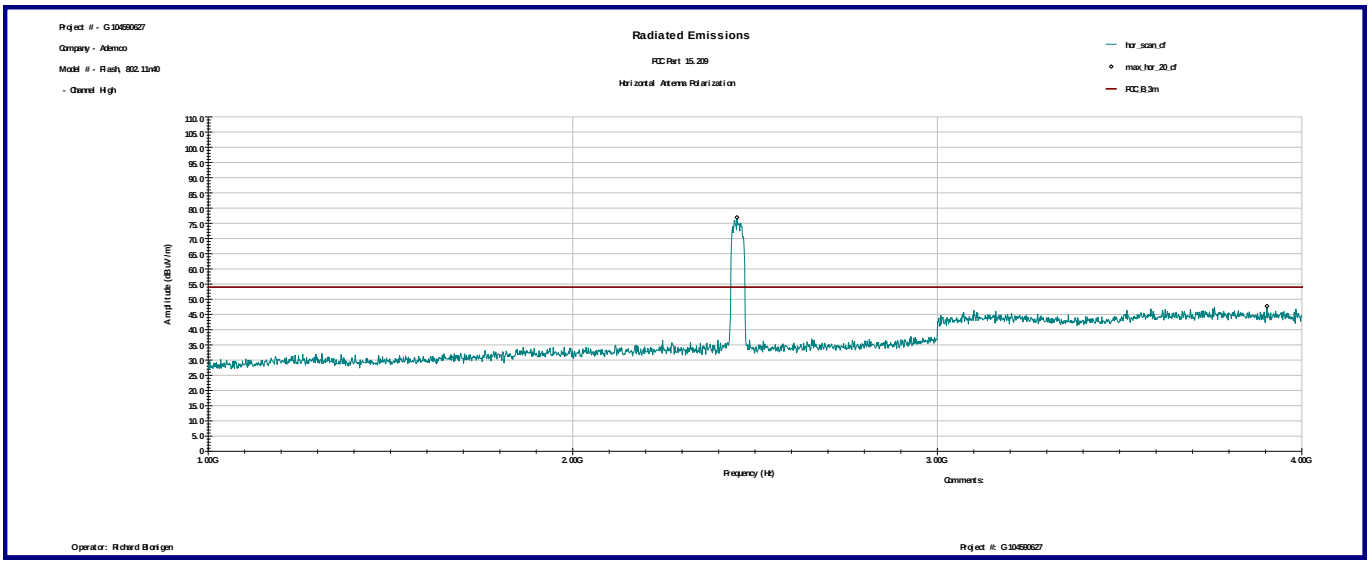
Graph 3.6.145



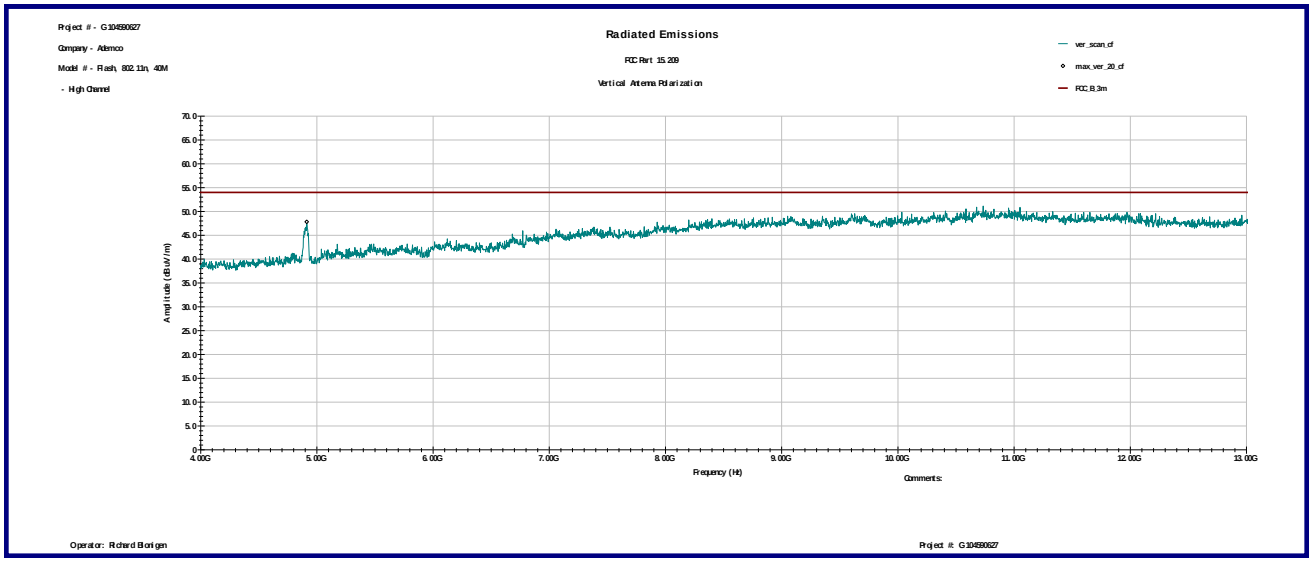
Graph 3.6.146



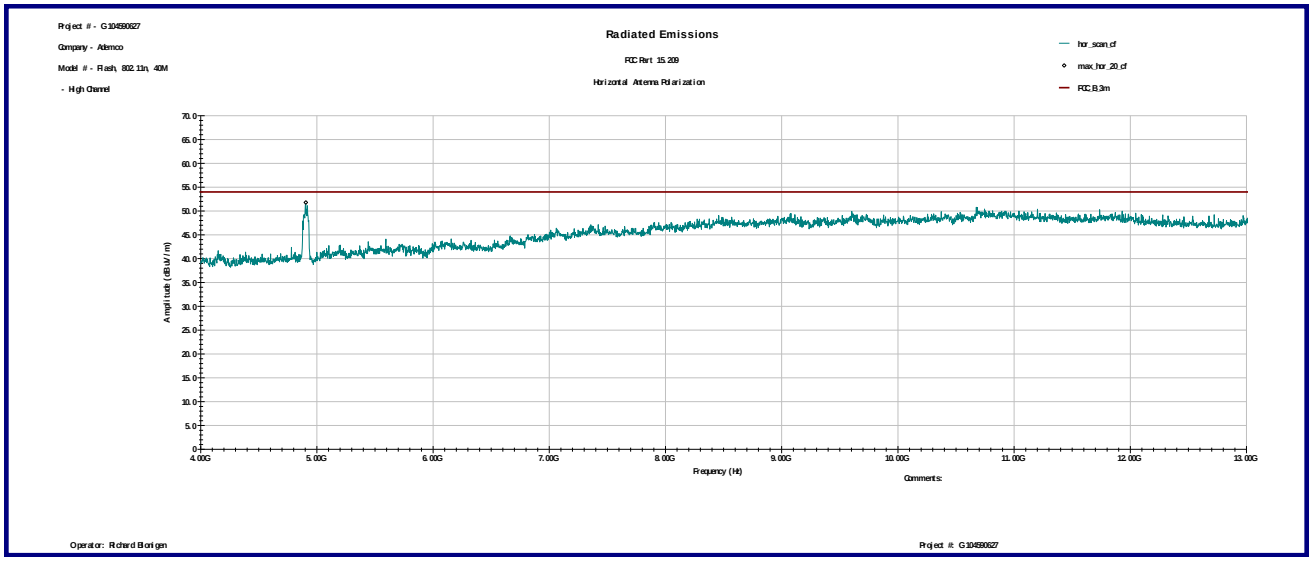
Graph 3.6.147



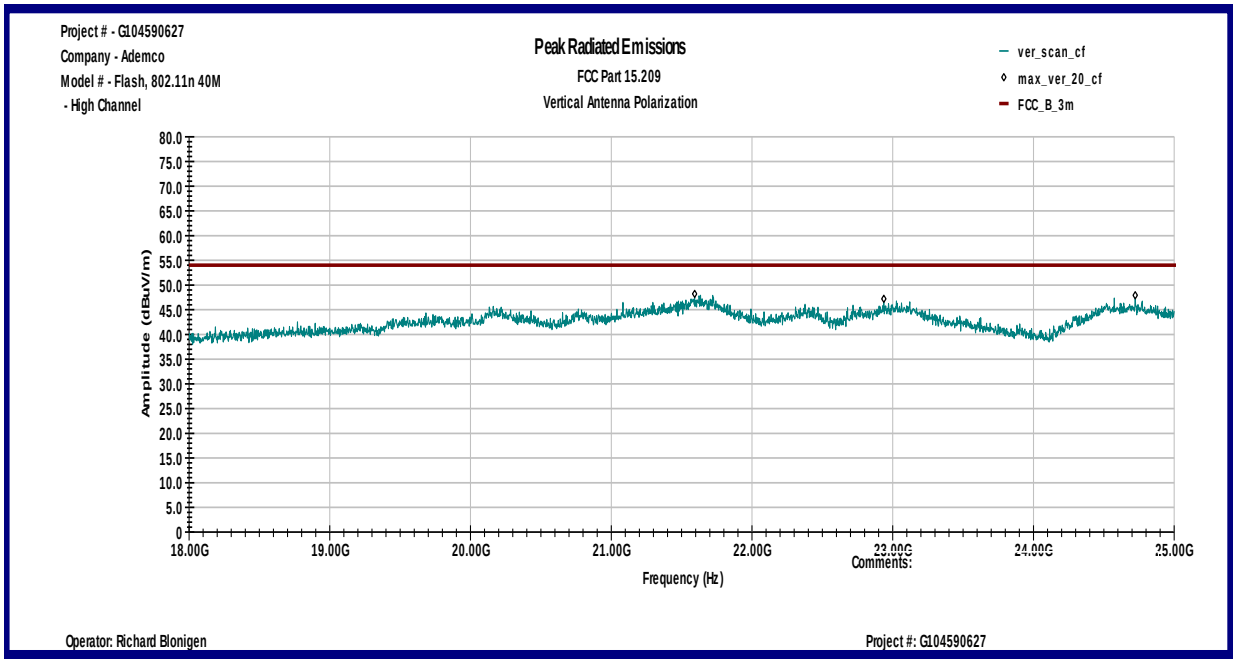
Graph 3.6.148



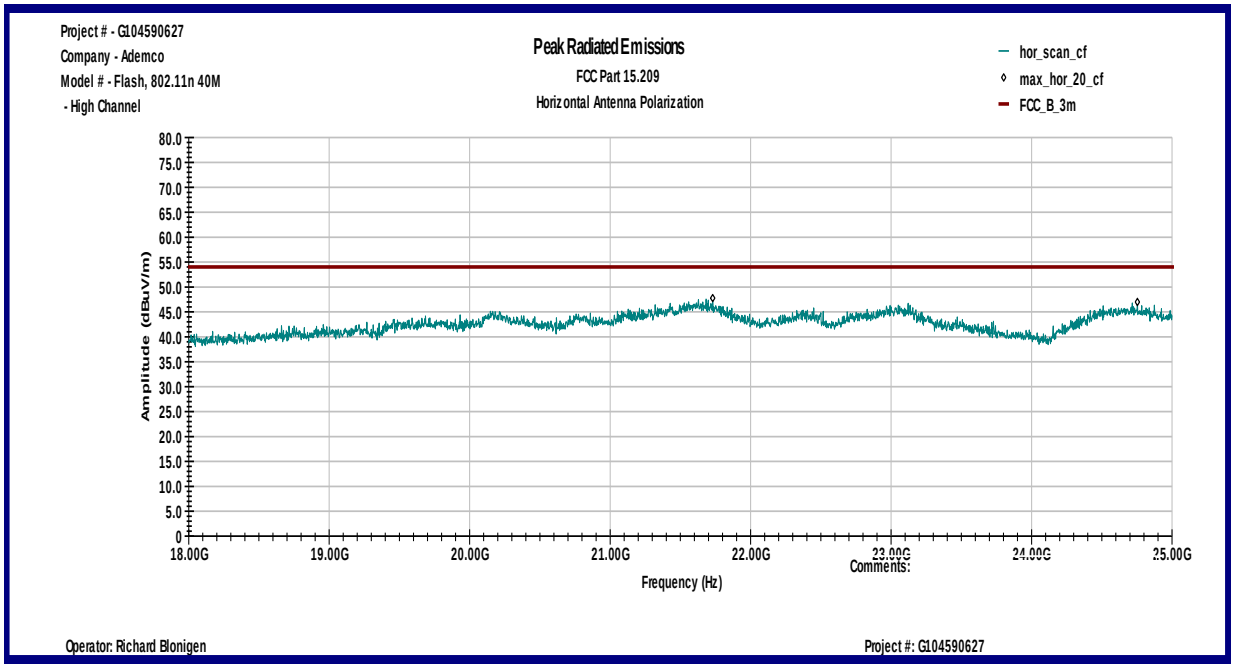
Graph 3.6.149



Graph 3.6.150



Graph 3.6.151



Graph 3.6.152

3.7 RF Exposure Compliance

FCC §1.1310 Radiofrequency radiation exposure limits

Table 1 below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic field.

Table 1 – Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power Density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	842/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

F = frequency in MHz * = Plane-wave equivalent power density

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Table 2 below sets forth limits for the RF field strength.

Table 2 – RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency range (MHz)	Electric field strength (V/m rms)	Magnetic field strength (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz. *Based on nerve stimulation (NS) **Based on specific absorption rate (SAR)

The maximum measured antenna conducted power, P is 20.2dBm

The antenna gain, G is 1.93dBi

The maximum EIRP power = P + G
ERP = 20.2 + 1.93= 22.13dBm, or 163.3mW

The limits for Maximum Permissible Exposure (MPE) reference to Table 1 and Table 2 in section 3.7

The Power Density, S in mW/cm^2 is related to EIRP in mW and Antenna Separation Distance, D in cm with the equation:

$S = EIRP / 4\pi D^2$

If antenna Safe Separation Distance is 20cm,
$S = 163.3 / 4\pi 20^2$,
$S = 0.0325mW/cm^2 = 0.325W/m^2$, or below the Maximum Permissible Exposure (MPE)

3.8 AC line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 24.8dB below the limits

Note: EUT was configured to transmit continuously. Conducted emission measurements were performed from 150 kHz to 30 MHz. Analyzer setting used: Resolution Bandwidth is 9 kHz and Video Bandwidth is 30 kHz.

Test performed at 120VAC power input of the 24VAC Power Source

Date:	August 23, 2021	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC part 15.207	
Test Point:	Power Line	
Operation mode:	See page 5	
Environmental Conditions:	21°C; 42%(RH); 98kPa	
Equipment Verification:	☒	
Note:	None	

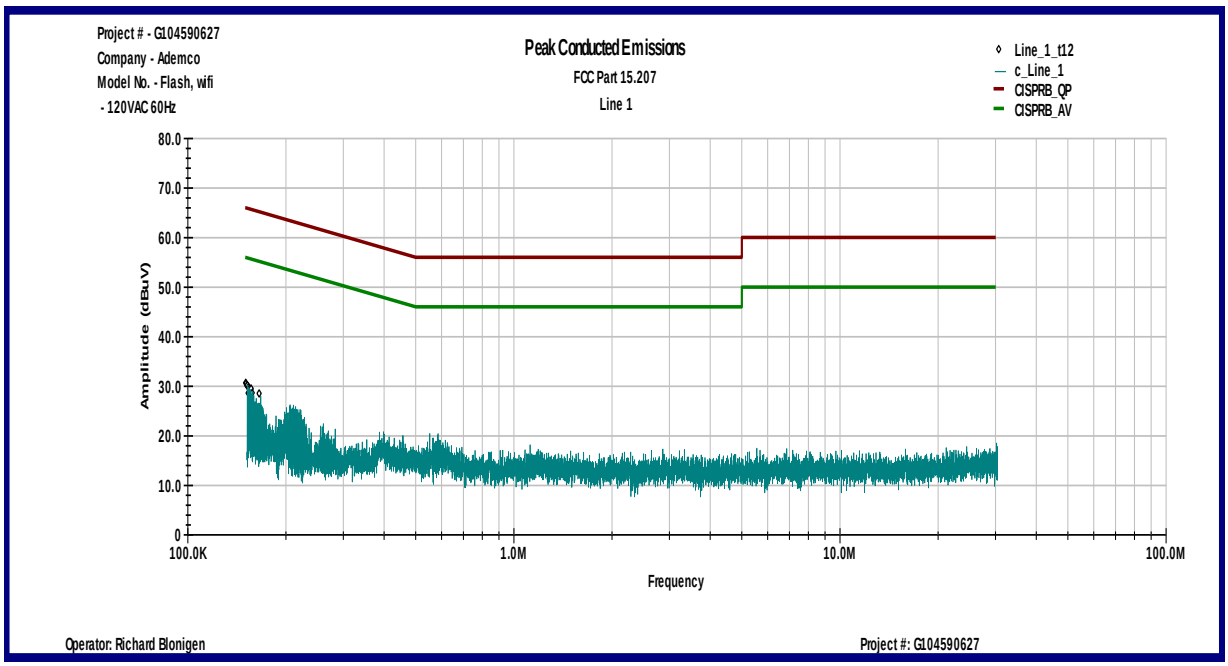
Table 3.8.1

Line 1

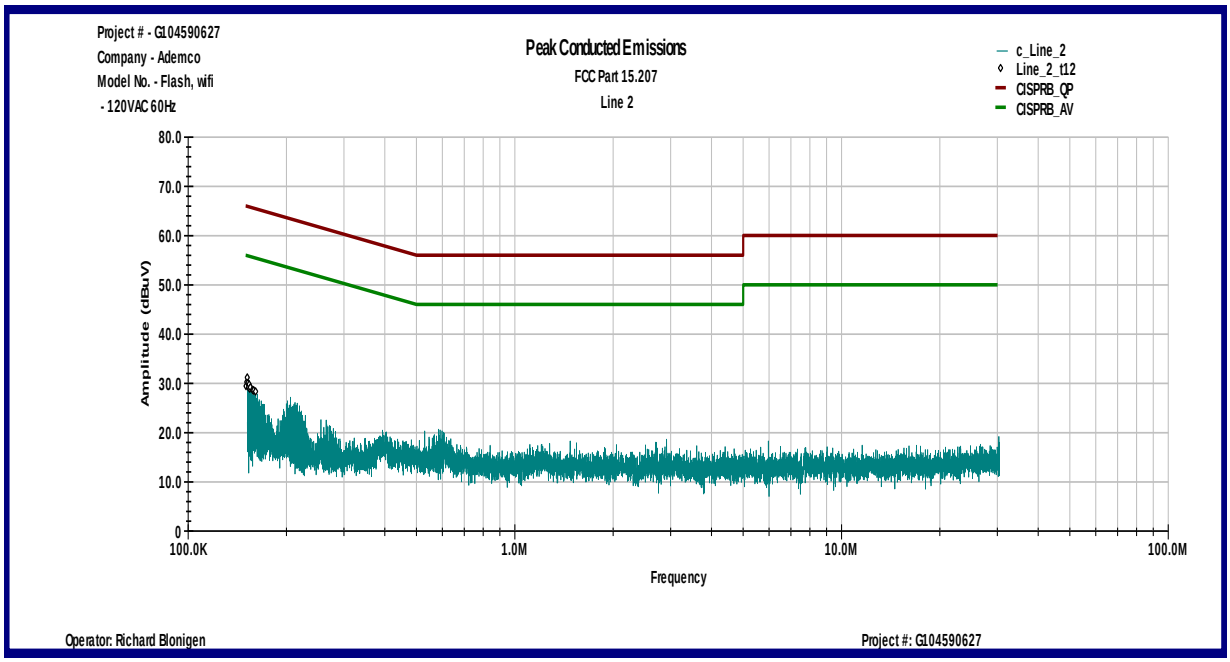
Frequency	Peak dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
150.47 KHz	30.7	66.0	56.0	-35.3	-25.3
151.01 KHz	30.5	65.9	55.9	-35.4	-25.4
151.79 KHz	30.1	65.9	55.9	-35.8	-25.8
152.33 KHz	30.2	65.9	55.9	-35.7	-25.7
153.11 KHz	28.6	65.8	55.8	-37.2	-27.2
153.65 KHz	29.9	65.8	55.8	-35.9	-25.9
154.43 KHz	29.5	65.8	55.8	-36.2	-26.2
154.97 KHz	28.9	65.7	55.7	-36.8	-26.8
156.21 KHz	29.5	65.7	55.7	-36.2	-26.2
156.37 KHz	29.5	65.7	55.7	-36.2	-26.2
157.61 KHz	28.7	65.6	55.6	-36.9	-26.9
165.46 KHz	28.5	65.2	55.2	-36.7	-26.7

Line 2

Frequency	Peak dBµV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
150.39 KHz	29.4	66.0	56.0	-36.6	-26.6
151.17 KHz	30.3	65.9	55.9	-35.7	-25.7
151.71 KHz	31.2	65.9	55.9	-34.8	-24.8
152.41 KHz	30.1	65.9	55.9	-35.8	-25.8
153.03 KHz	29.2	65.8	55.8	-36.7	-26.7
153.73 KHz	29.8	65.8	55.8	-36.0	-26.0
154.35 KHz	28.9	65.8	55.8	-36.9	-26.9
155.05 KHz	29.2	65.7	55.7	-36.6	-26.6
157.61 KHz	28.7	65.6	55.6	-36.9	-26.9
158.31 KHz	28.5	65.6	55.6	-37.1	-27.1
158.86 KHz	28.6	65.5	55.5	-37.0	-27.0
160.87 KHz	28.3	65.4	55.4	-37.1	-27.1



Graph 3.8.1



Graph 3.8.2

4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	LAST CAL DATE	CAL DUE
Spectrum Analyzer	R & S	FSP 40	100024	12559	02/12/2021	02/12/2022
Spectrum Analyzer	R & S	ESU	100398	25283	07/26/2021	07/26/2022
Spectrum Analyzer	R & S	ESCI	100358	12909	02/10/2021	02/10/2022
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	05/18/2021	05/18/2022
Chamber HF Cable	Insulated Wire Inc.	SPS-2303-3600-SPRX		12670	06/09/2021	06/09/2022
Chamber HF Cable	Insulated Wire Inc.	SPS-2301-3600-SPS		172517	06/09/2021	06/09/2022
Chamber RE Cable	Coleman	RG214/U M17/164-00001		172505	06/09/2021	06/09/2022
Horn Antenna	EMCO	3115	9507-4513	9936	08/17/2020	08/17/2021
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	01/22/2021	01/22/2022
Loop Antenna	ETS	6512	00060486	19942	02/22/2021	02/22/2022
LISN	COM-Power	Li-215A	191970	172315	08/09/2021	08/09/2022
Pre-Amplifier	MITEQ	LNA-40-00101800-35-15P	2108525	172474	06/30/2021	06/30/2022
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	01/20/2021	01/20/2022
High Pass Filter	Reactel	9HS-4G/24-S12	20-01		04/08/2021	04/08/2022
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	VBU

5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	8-24-2021	104590627MIN-001	RB	US	Original Issue
1	9-9-2021	104590627MIN-001	RB 	US 	Additional channels for 802.11g, 802.11n-20 and 802.11n-40 were tested to show compliance
2	9-23-2021	104590627MIN-001	RB 	US 	Fixed typo, conducted measurements were retested, plots for radiated average measurements were added