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The Netherlands
Chamber of Commerce
51565536
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telefication

FCC and IC Test report for parts 15.109, 15.209, 15.247 RSS-210, RSS-247, RSS-Gen

Product name	: Classified Thru axle
Applicant	: Classified Cycling BV
FCC ID	: 2AZ7ACLASSIBV1
IC ID	: 27531CLASSIBV1

Test report No. : 201001129 002 v2.00

Laboratory information

Accreditation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001.

Telefication is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.
The Industry Canada company number for Telefication is: 4173A.

Telefication is a registered Conformity Assessment body (CAB) under the Japan-EC MRA (Agreement on Mutual Recognition between Japan and the European Community). The registration number is: 201.

Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands.

Testing Location

Test Site	Kiwa Telefication BV
Test Site location	Wilmersdorf 50 7327 AC Apeldoorn The Netherlands Tel. +31 88998 3393
Test Site FCC	NL0001
CABID	NL0001

Revision History

Version	Date	Remarks	By
v0.50	17-08-2021	First draft	RvB
v1.00	22-09-2021	Release version	RvB
v2.00	07-02-2022	Added output power and PSD plots	RvB

Table of Contents

Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.247(d) 15.209 (a)	RSS-Gen 8.9	Radiated spurious emissions	3.1	Pass
15.205 (a)	RSS Gen 8.10	Spurious emissions in the restricted bands	3.1	Pass
15.247 (a)	RSS-247 5.2(a)	6 dB bandwidth	3.2	Pass
--	RSS-Gen 6.7	99% bandwidth	3.3	Pass
15.247 (b)	RSS-247 5.4 (d)	RF output power	3.4	Pass
15.247 (e)	RSS-247 5.2 (b)	Power spectral density	3.5	Pass
15.247 (d)	RSS-247 5.5	Band edge	3.6	Pass

1 General Description

Client name:	Classified Cycling BV
Address:	Slachthuisstraat 120 B10, 2300, Turnhout, Belgium
Telephone:	+32494843464
E-mail:	Kristof.verpoorten@classified-cycling.cc
Contact name:	Kristof Verpoorten

1.1 Manufacturer

Manufacturer name:	Classified Cycling BV
Address:	Slachthuisstraat 120 B10, 2300, Turnhout, Belgium
Telephone:	+32494843464
E-mail:	Kristof.verpoorten@classified-cycling.cc
Contact name:	Kristof Verpoorten

1.2 Tested Equipment Under Test (EUT)

Product name:	Classified Thru axle
Description:	Thru axle
Brand name:	Classified Cycling
FCC ID:	2AZ7ACLASSIBV1
IC ID:	27531CLASSIBV1
Model(s):	See chapter 1.7 “Observations and Remarks”
Software version:	Module B V3.75
Hardware version:	029_002_01
Date of receipt	03-03-2021
Tests started:	04-03-2021
Testing ended:	04-05-2021

1.3 Product specifications of Equipment under test

Tx Frequency:	BLE: 2400 – 2483.5 MHz ANT+: 2457 MHz
Rx frequency:	BLE: 2400 – 2483.5 MHz ANT+: 2457 MHz
Antenna type:	Ceramic chip antenna
Antenna gain:	3.6 dBi
Type of modulation:	BLE: GFSK ANT+: GFSK
Emission designator	BLE: 1M06G1D ANT+: 1M05G1D

Disclaimer: The antenna gain and operating frequency bands are declared by the applicant

1.4 Environmental conditions

Test date	12-03-2021	23-03-2021	08-04-2021	04-05-2021
Ambient temperature	21.3°C	21.6°C	21.4°C	21.0°C
Humidity	35.8%	32.6%	33.7%	37.2%

1.5 Measurement standards

- ANSI C63.4:2014
- ANSI C63.10:2013

1.6 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.109
- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart C §15.247
- RSS-Gen Issue 5
- RSS-247 Issue 2

1.7 Observation and remarks

The EUT is battery powered.
Model overview:

Product name:	Variant/OEM	Hardware version	Note
Classified Thru axle	OEM	029_002_01	Tested model
Classified Thru axle	OEM	029_002_02	Standard configuration certain OEM
Classified Thru axle	Varian	029_037_00	Length A
Classified Thru axle	Varian	029_038_00	Length B
Classified Thru axle	Varian	029_039_00	Length C
Classified Thru axle	Varian	029_047_00	Length D

1.8 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 *"Applicable standards".*

All tests are performed by:

Name : ing. R. van Barneveld

Review of test methods and report by:

Name : P. van Wanrooij, BASc

The above conclusions have been verified by the following signatory:

Date : 14-02-2022

Name : P. van Wanrooij

Function : Test Engineer

Signature :

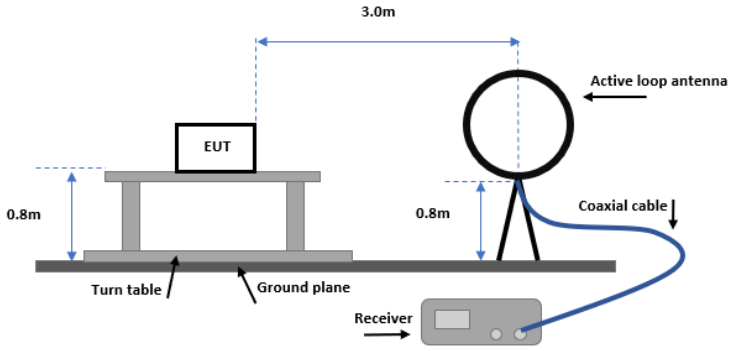
2 Test configuration of the Equipment Under Test

2.1 Test mode

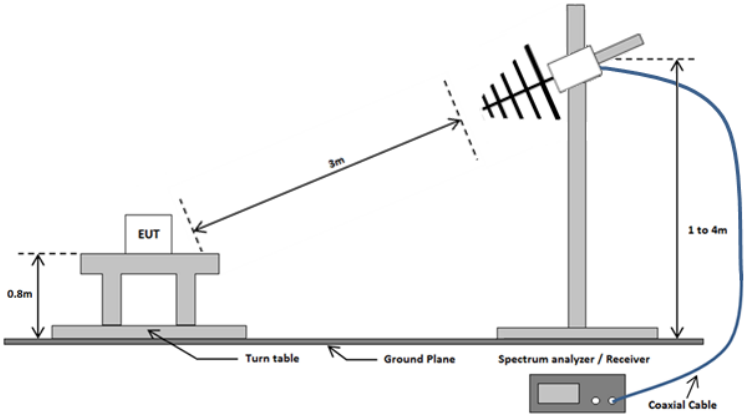
The applicant provided test mode firmware with which it was possible to perform all the tests.

2.2 Test setups

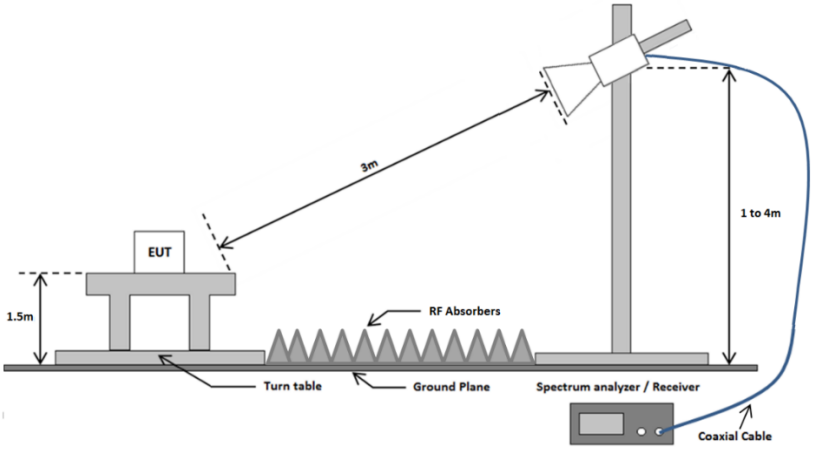
Radiated emissions test setup 9 kHz – 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
EMI Receiver	Rohde & Schwarz	ESCI	TE11128	3.1
Spectrum analyzer	Rohde & Schwarz	FSP40	TE11125	3.1
Spectrum Analyzer	Rohde & Schwarz	FSV40	TE01269	3.2 – 3.6
3.0 GHz HPF	Wainwright	WHK3.0/18G-10EF	TE01140	3.1
Active loop antenna	EMCO	6502	TE11171	3.1
Biconilog antenna	Chase	CBL6112A	TE00967	3.1
Horn antenna	EMCO	3115	TE00531	3.1
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	TE11175	3.1
Horn antenna	FLANN-MICROWAVE	20240-25	TE 00818	3.1
Preamplifier 18-26 GHz	Miteq	JS4-18004000-33-8P	TE 11131	3.1

2.4 Sample calculations

All formulas for data conversions and conversion factors are reported in chapter 4 of this test report.

3 Test results

3.1 Radiated spurious emissions

3.1.1 Limit

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	20*{log[2400]-log[F(kHz)]}	300*
0.490 – 1.705	24000/F(kHz)	20*{log[24000]-log[F(kHz)]}	30*
1.705 – 13.11 14.01 – 30.0	30	29.5	30*
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

*Note: Limit lines in the plots corrected to 3m measurement distance according to the method described in ANSI C63.10-2013, clause 6.4

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.1.4 Test procedure

9 kHz – 30 MHz: According to ANSI C63.4-2014, section 5.4.2 and 8.2.3
30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3

9 kHz to 30 MHz: IRN 026 – Method 10
30 MHz to 1 GHz: IRN 026 – Method 1
1 GHz to 18 GHz: IRN 026 – Method 2
18 to 26.5 GHz: IRN 026 – Method 3

3.1.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
9 kHz – 30 MHz	--	±1.6 dB
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 18 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB
18 – 26.5 GHz	Horizontal	±4.9 dB
	Vertical	±4.9 dB

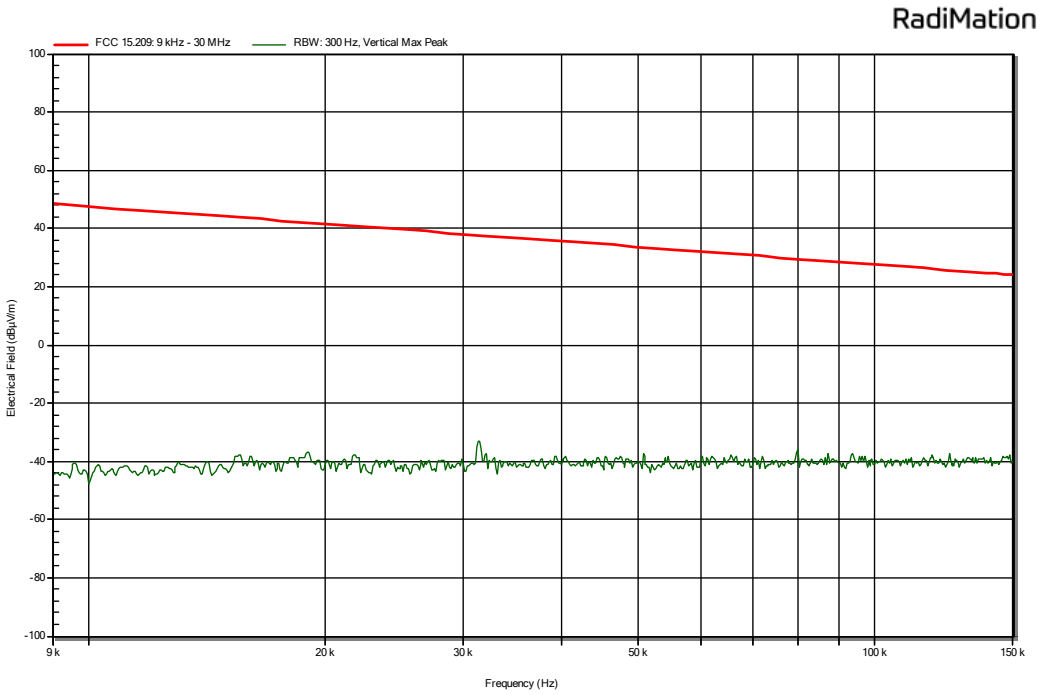
Pick Table

Frequency	Polarization	Technology
7,207 GHz	Horizontal	BLE

3.1.6 Plots of the Radiated Spurious Emissions Measurement

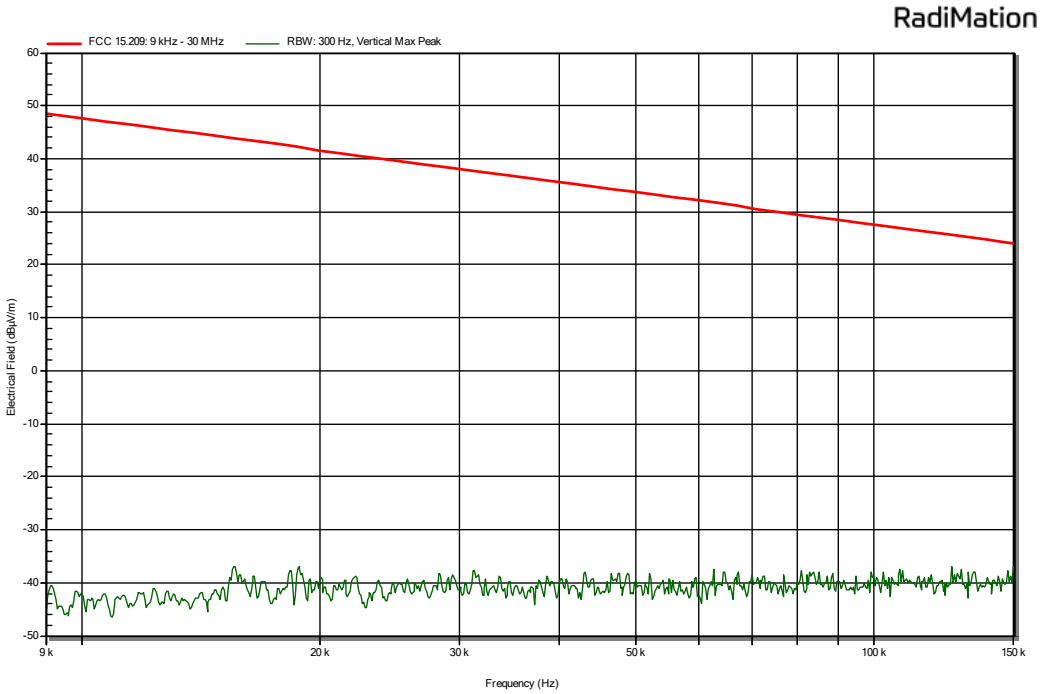
BLE

9 – 150 kHz

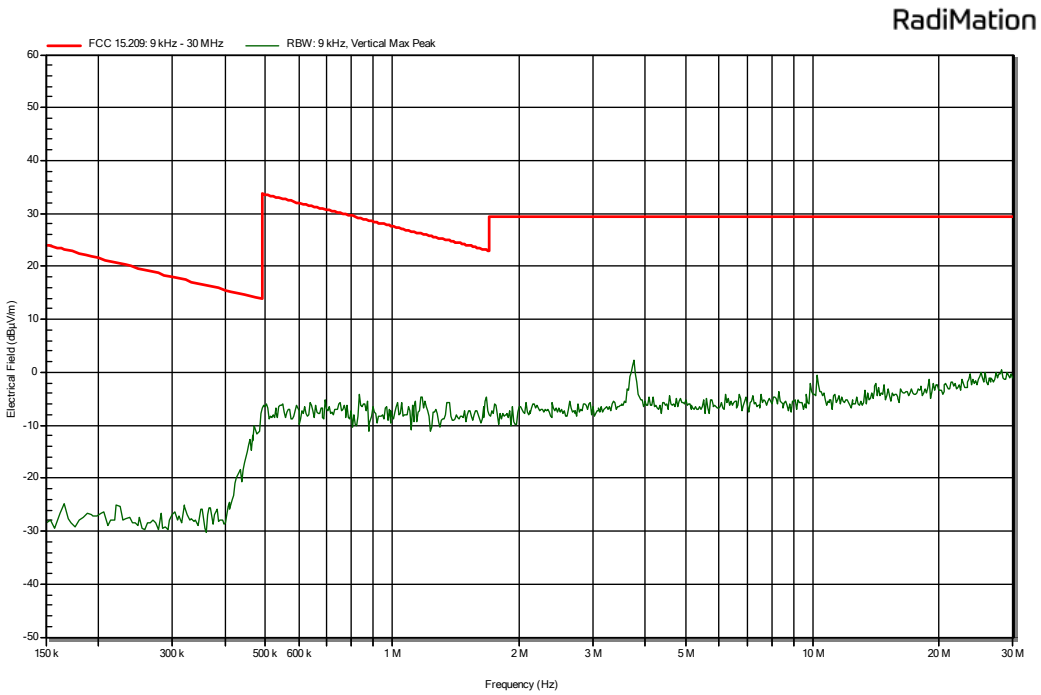


ANT+

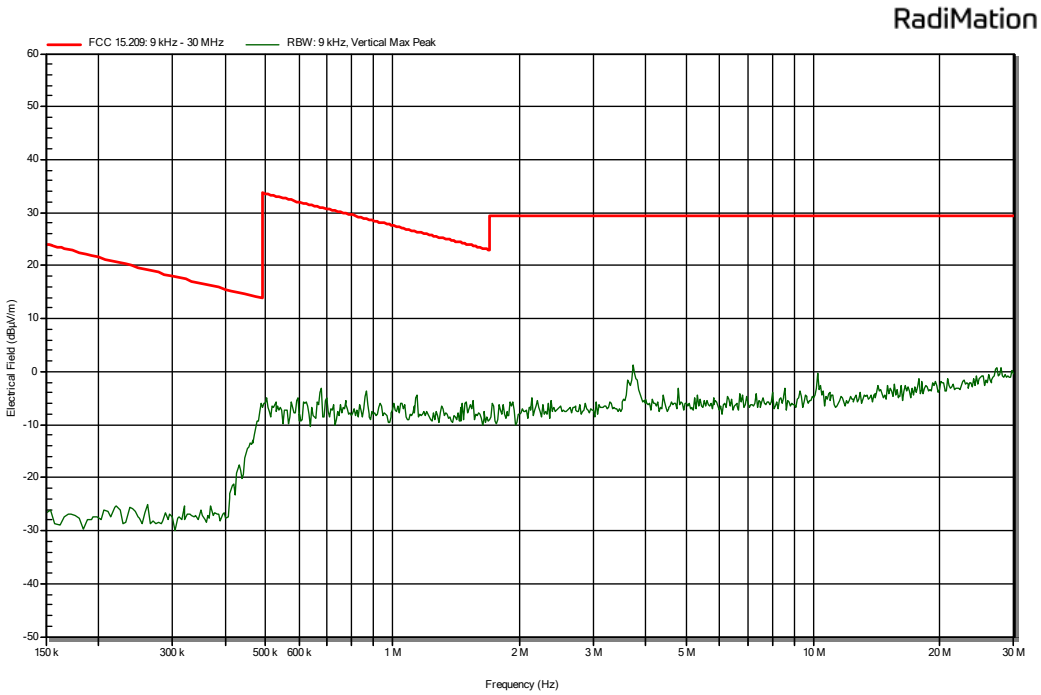
9 – 150 kHz



BLE
150 kHz – 30 MHz

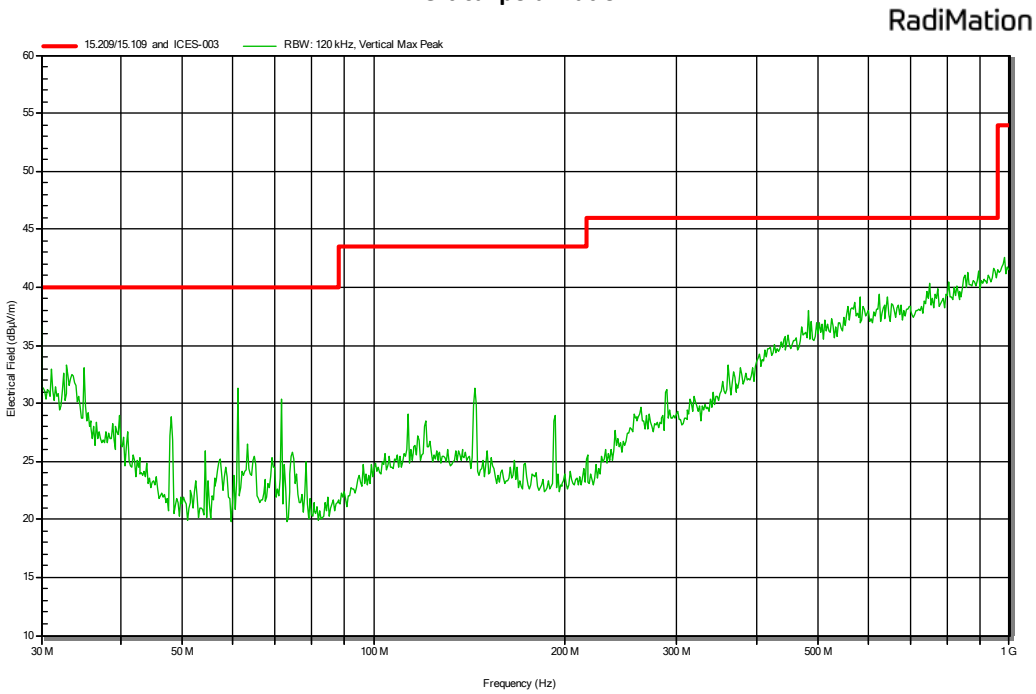


ANT+
150 kHz – 30 MHz

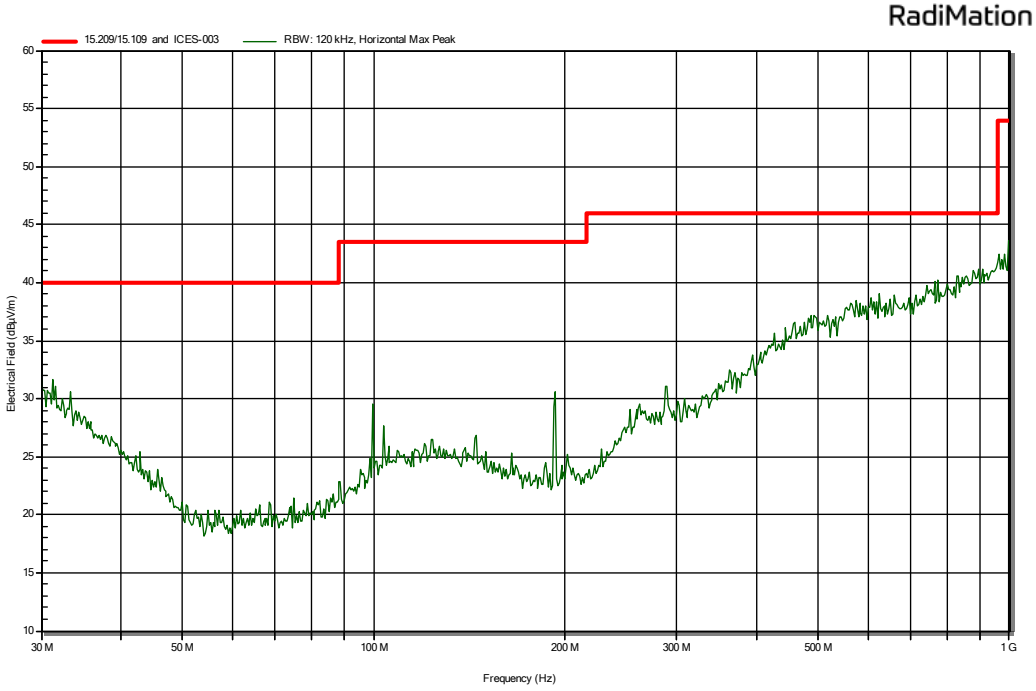


30 -1000 MHz

BLE Low Channel
Vertical polarization

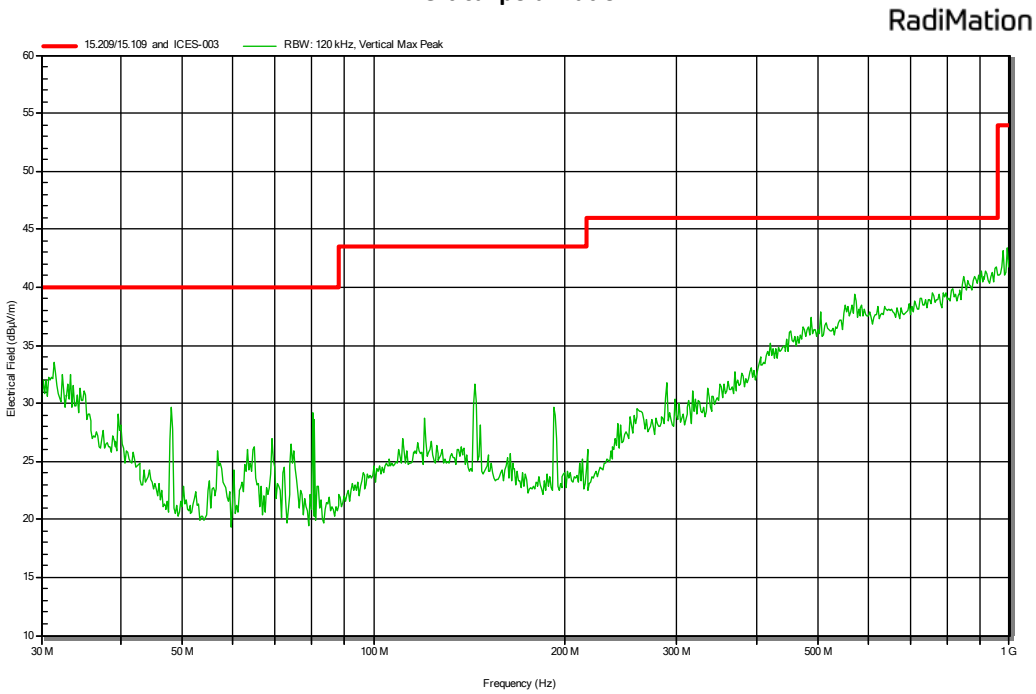


Horizontal polarization

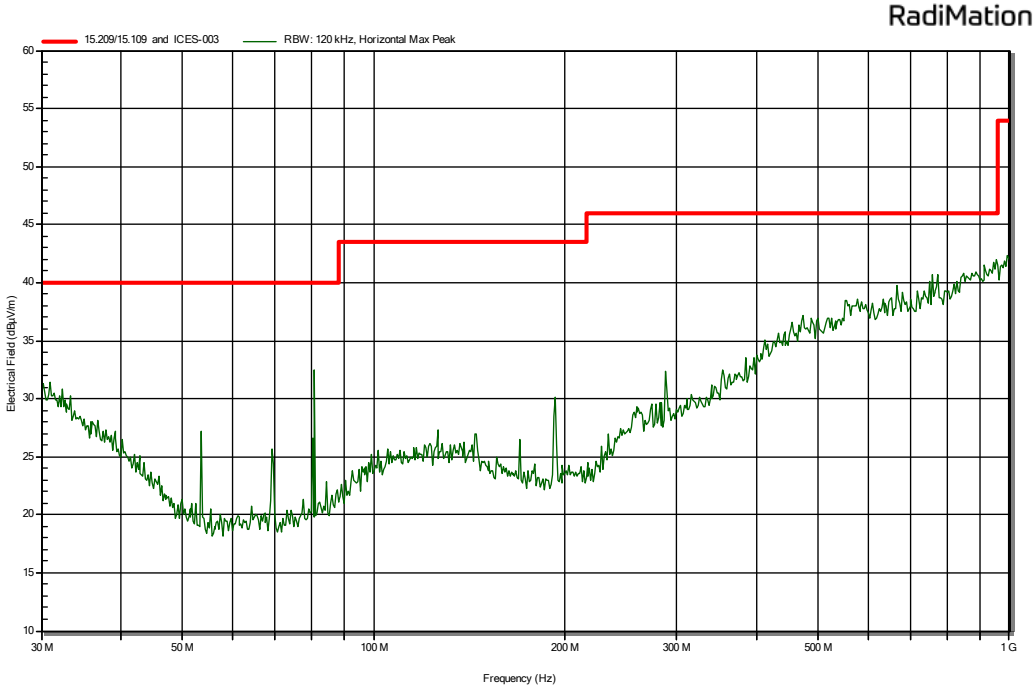


30 -1000 MHz

BLE Middle Channel
Vertical polarization

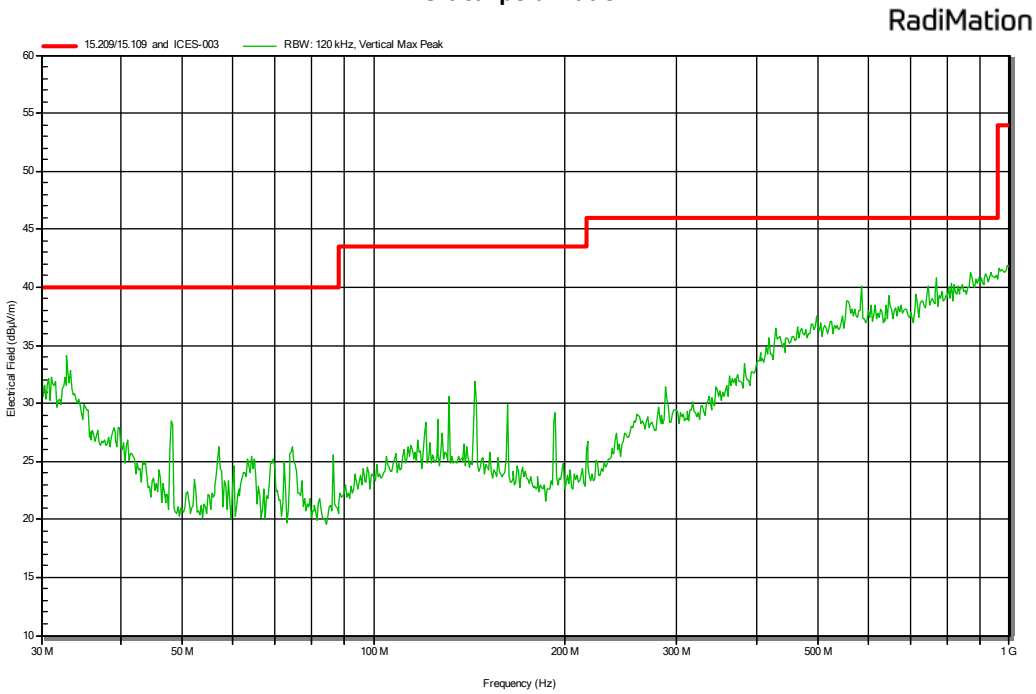


Horizontal polarization

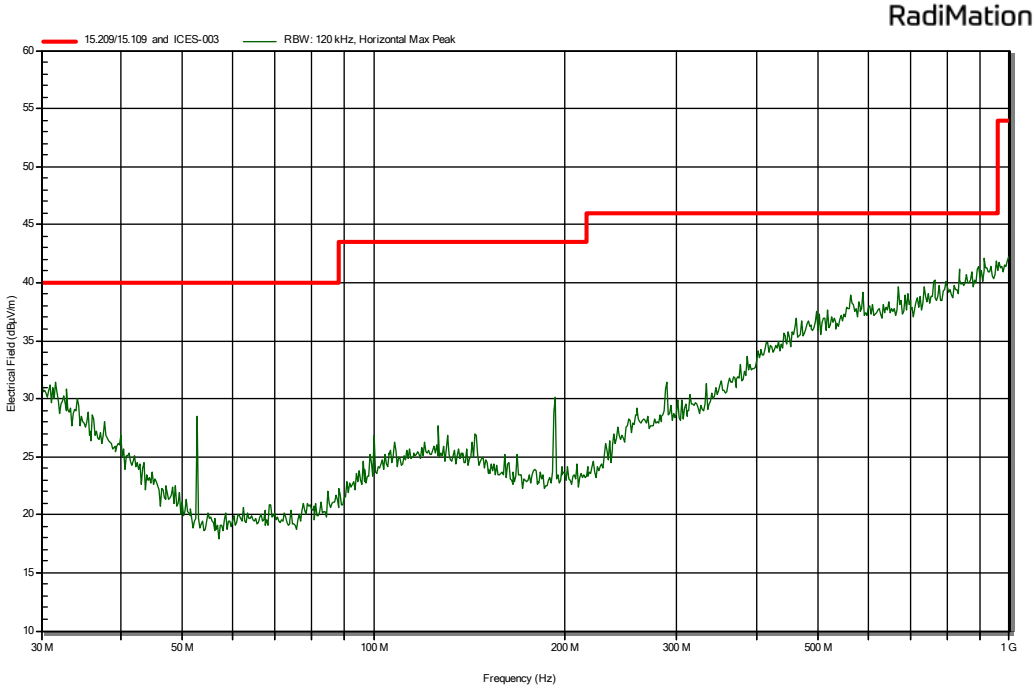


30 -1000 MHz

BLE High Channel
Vertical polarization



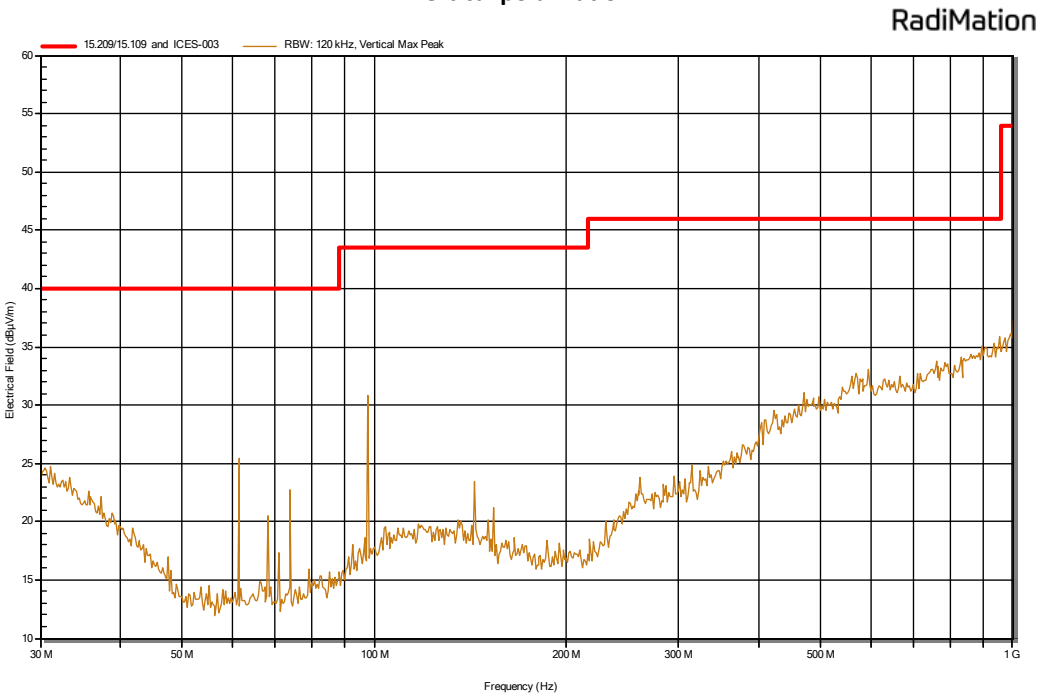
Horizontal polarization



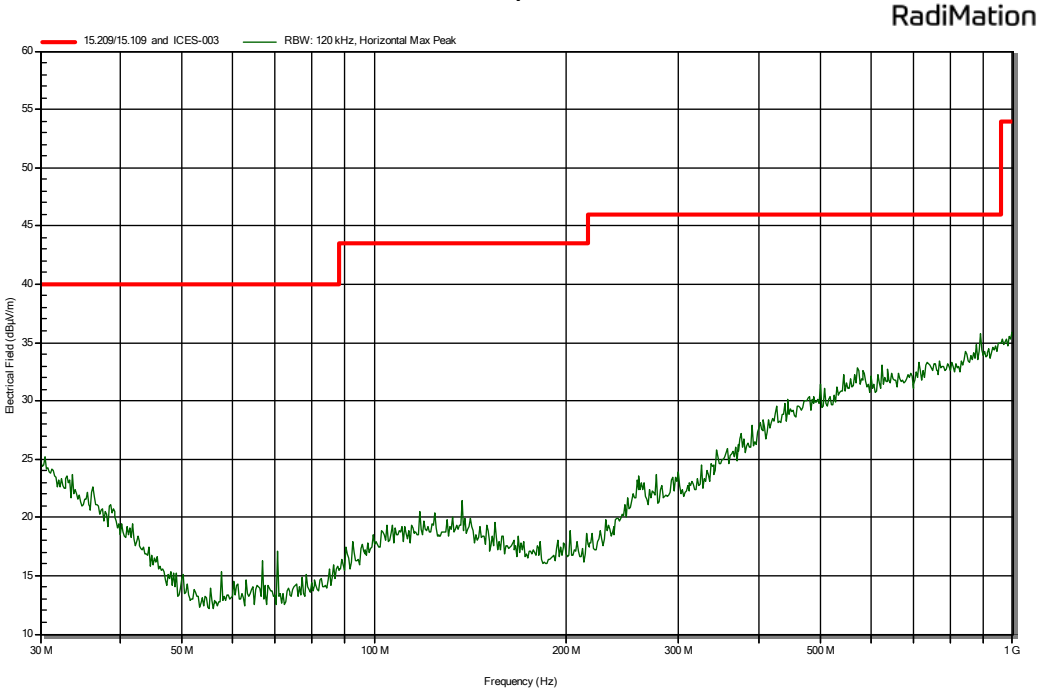
30 -1000 MHz

ANT+

Vertical polarization

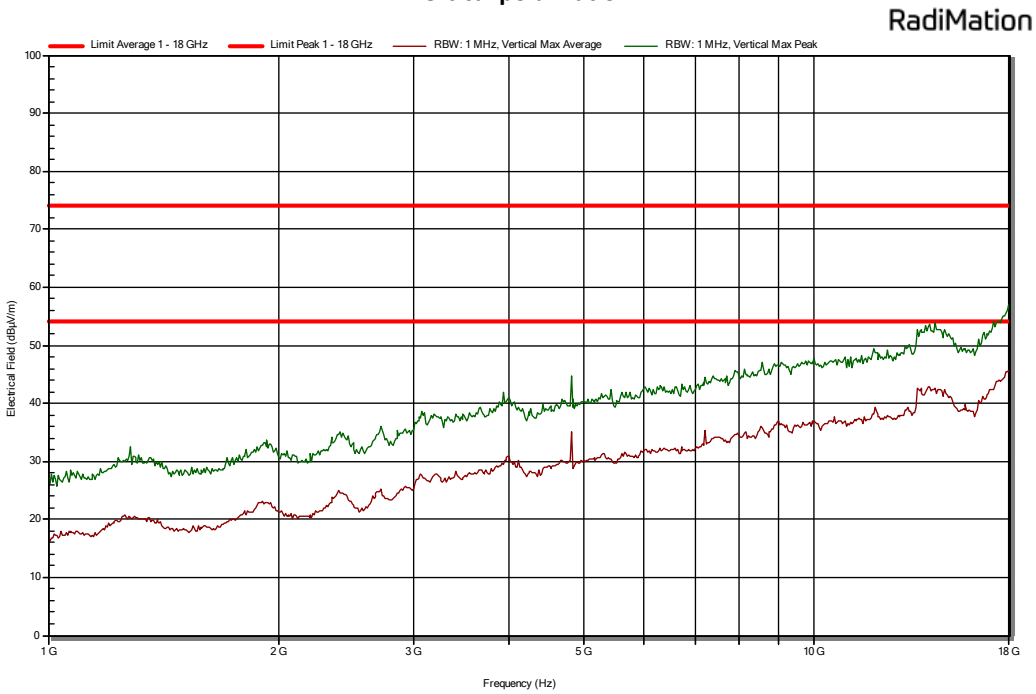


Horizontal polarization

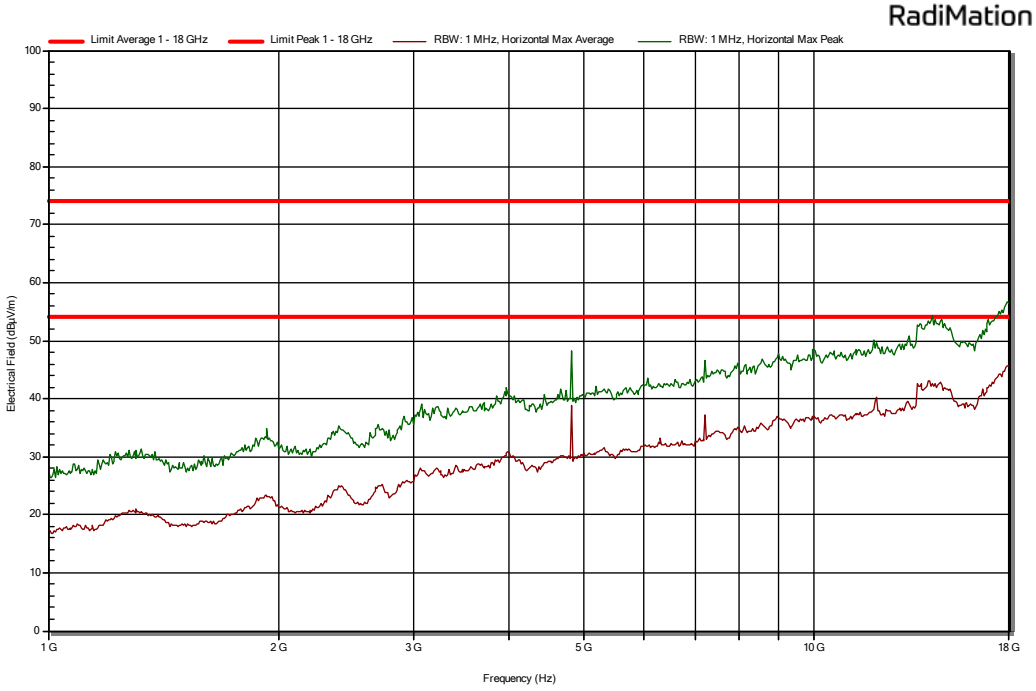


1 – 18 GHz

BLE Low Channel
Vertical polarization

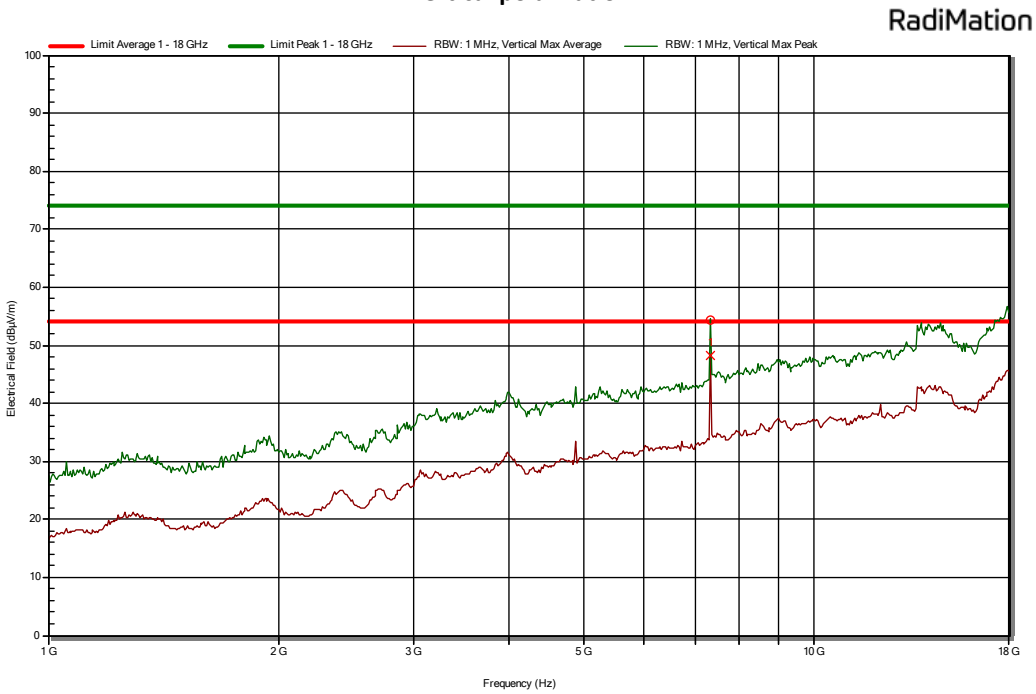


Horizontal polarization

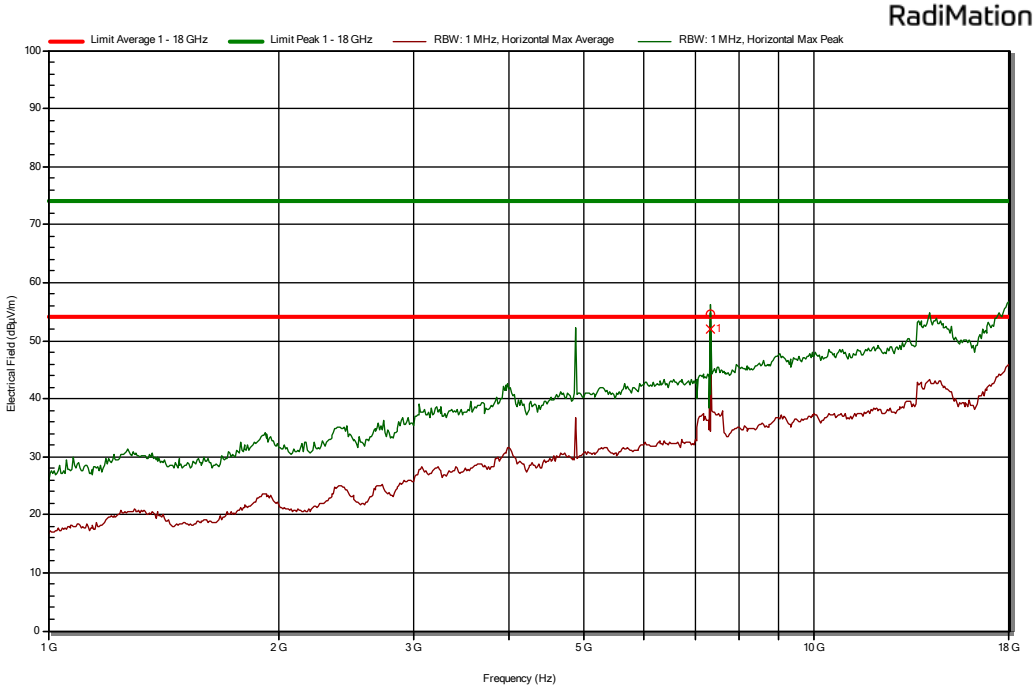


1 – 18 GHz

BLE Middle Channel
Vertical polarization



Horizontal polarization

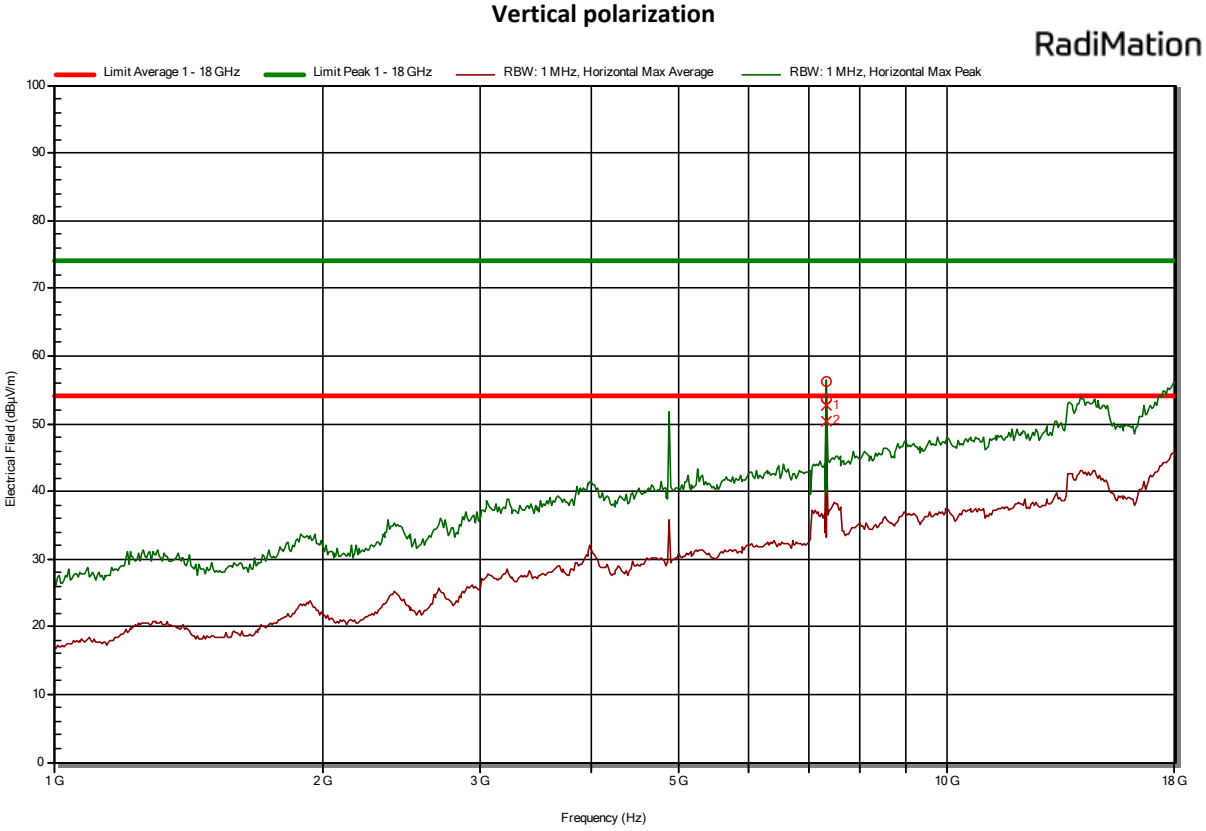


Measured Peaks

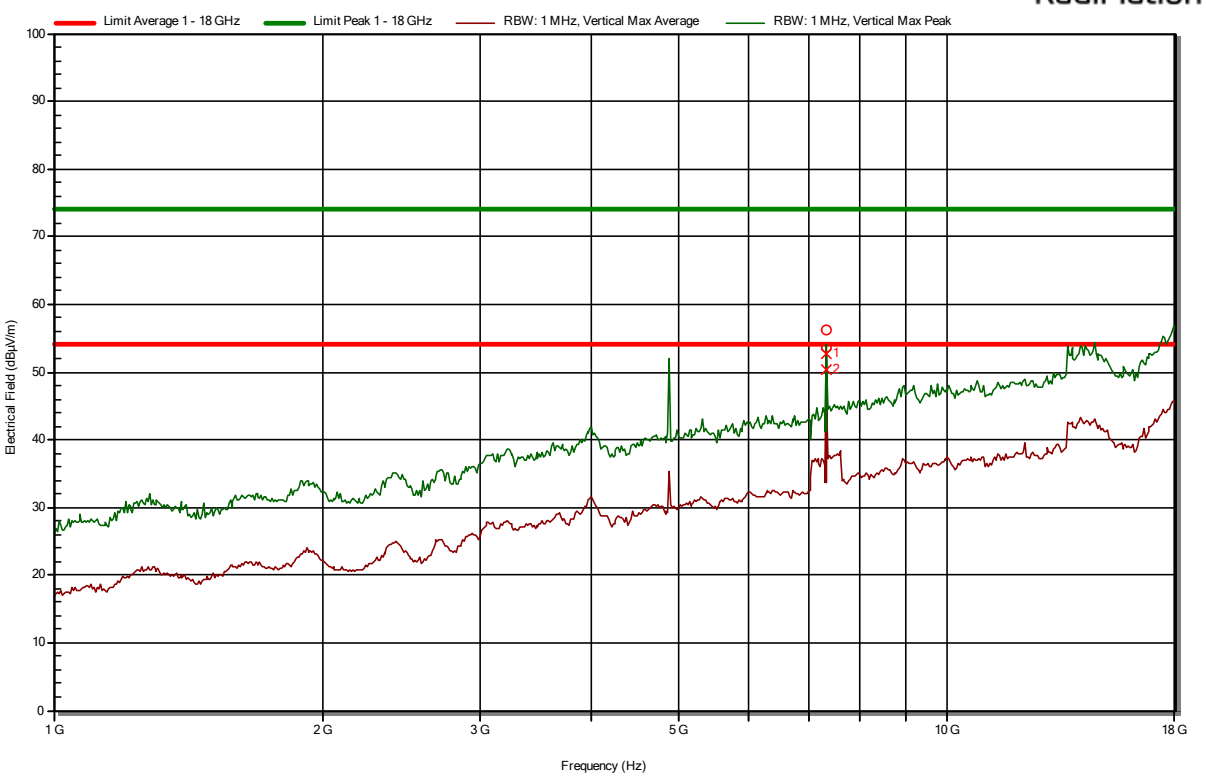
Frequency	Peak	Peak Limit	Average	Average Limit	Status	Angle	Height	Polarization
7,32 GHz	54,4 dBµV/m	74 dBµV/m	48,2 dBµV/m	54 dBµV/m	Pass	275 degrees	1 m	Vertical
7,319 GHz	54,6 dBµV/m	74 dBµV/m	52 dBµV/m	54 dBµV/m	Pass	35 degrees	2,5 m	Horizontal

1 – 18 GHz

BLE High Channel
Vertical polarization



Horizontal polarization



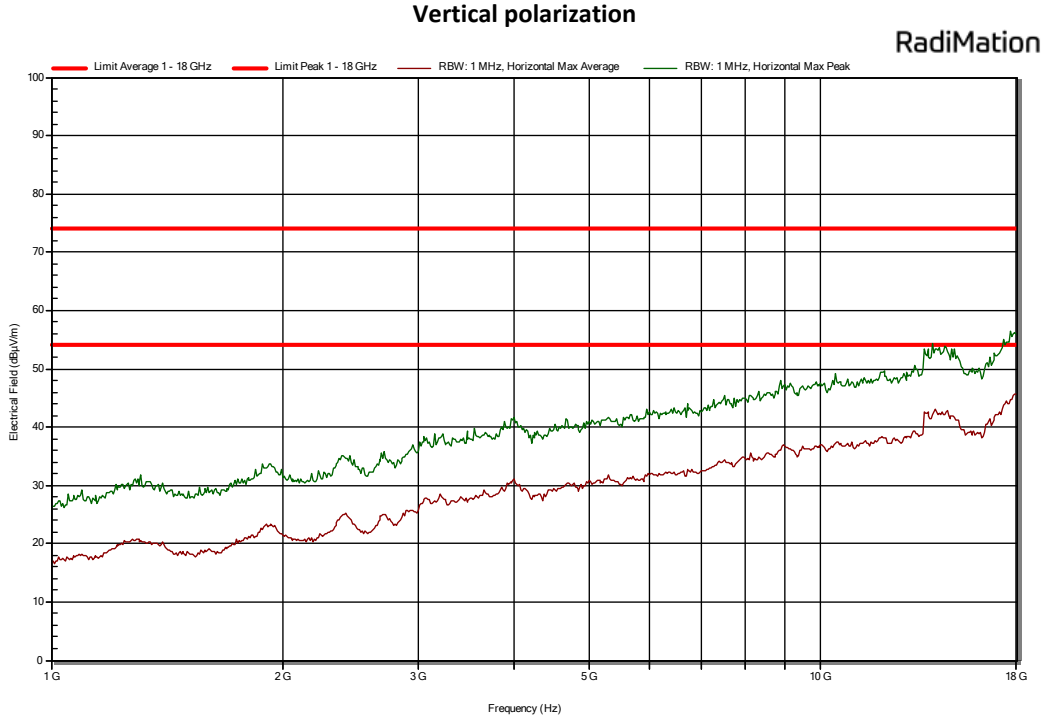
Measured Peaks

Frequency	Peak	Peak Limit	Average	Average Limit	Status	Angle	Height	Polarization
7,319 GHz	56,1 dBµV/m	74 dBµV/m	52,7 dBµV/m	54 dBµV/m	Pass	13 degrees	1,5 m	Horizontal
7,321 GHz	53,6 dBµV/m	74 dBµV/m	50,4 dBµV/m	54 dBµV/m	Pass	3 degrees	3 m	Vertical

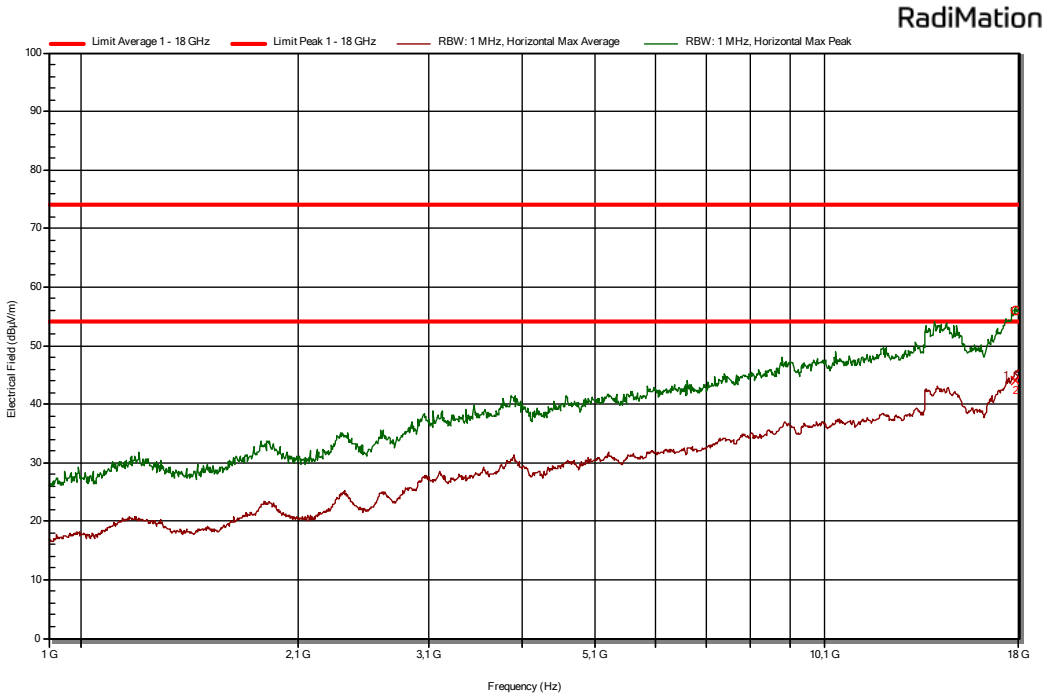
1 – 18 GHz

ANT+

Vertical polarization



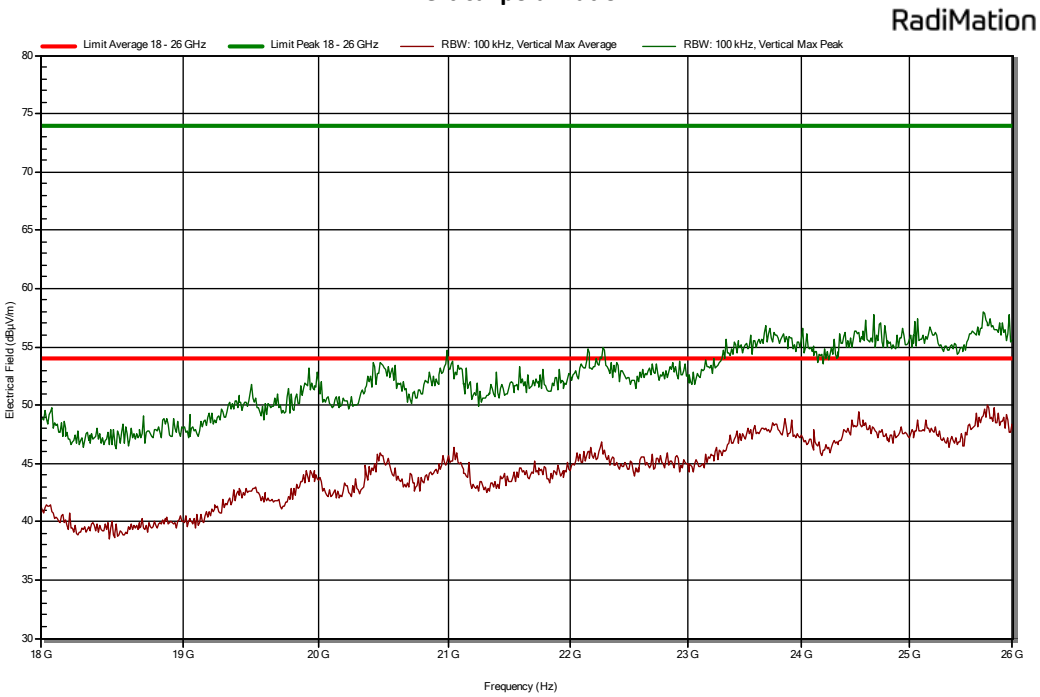
Horizontal polarization



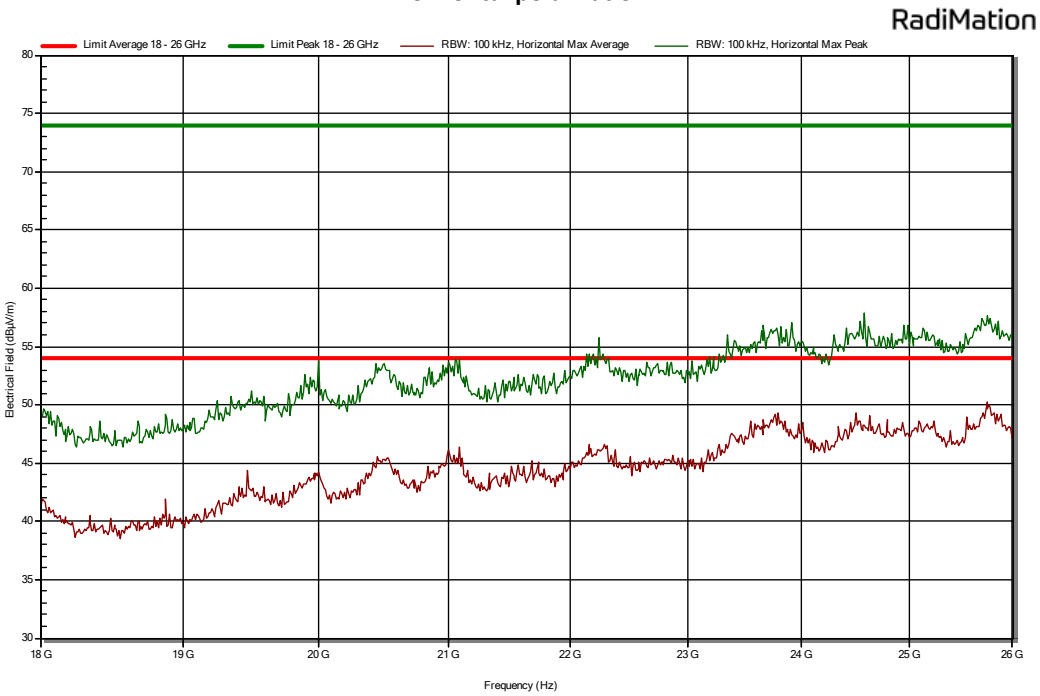
Frequency	Peak	Peak Limit	Average	Average Limit	Status	Angle	Height	Distance	Polarization
17,958 GHz	56,1 dBµV/m	74 dBµV/m	44,7 dBµV/m	54 dBµV/m	Pass	306 degrees	2,5 m	3 m	Horizontal
17,828 GHz	56,1 dBµV/m	74 dBµV/m	44,1 dBµV/m	54 dBµV/m	Pass	90 degrees	4 m	3 m	Horizontal

18 – 26.5 GHz

BLE Low Channel
Vertical polarization

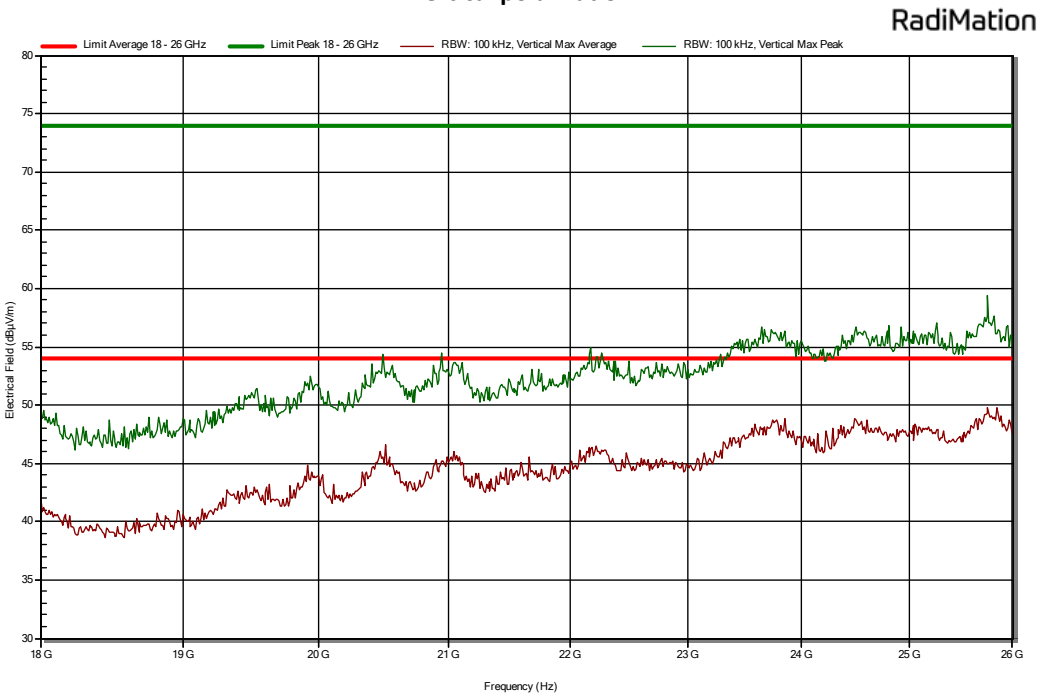


Horizontal polarization

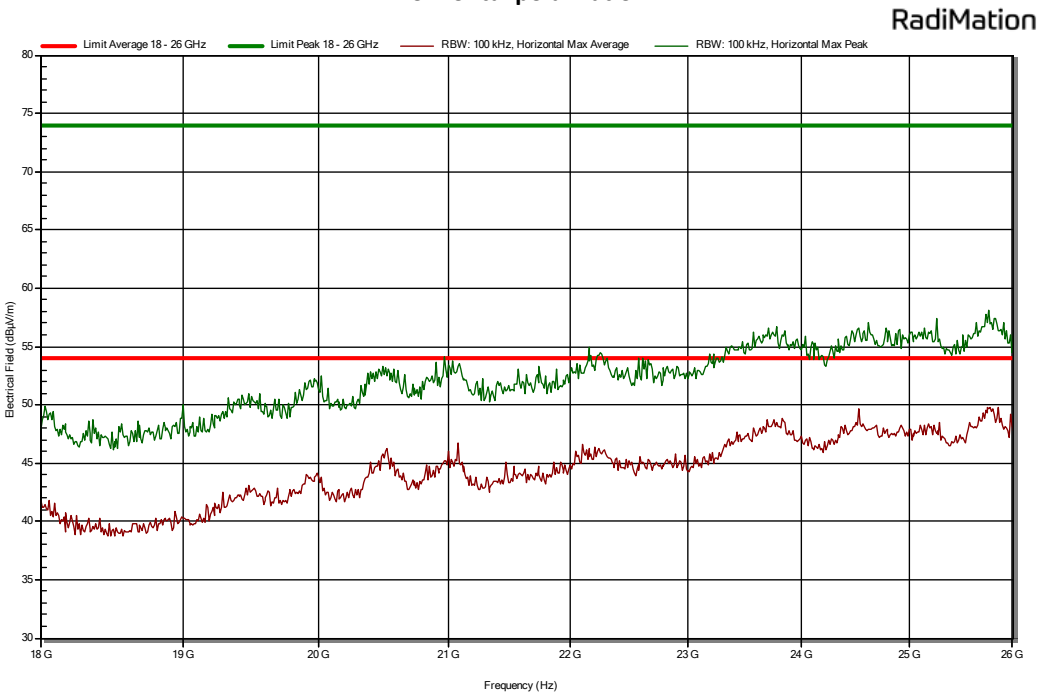


18 – 26.5 GHz

BLE Middle Channel
Vertical polarization

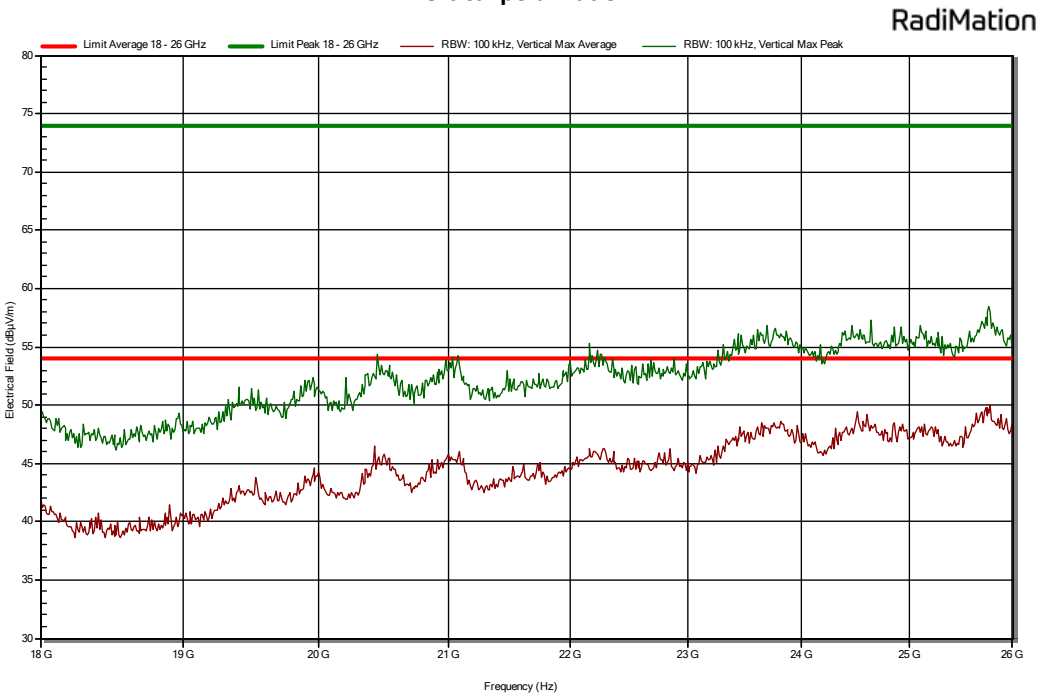


Horizontal polarization

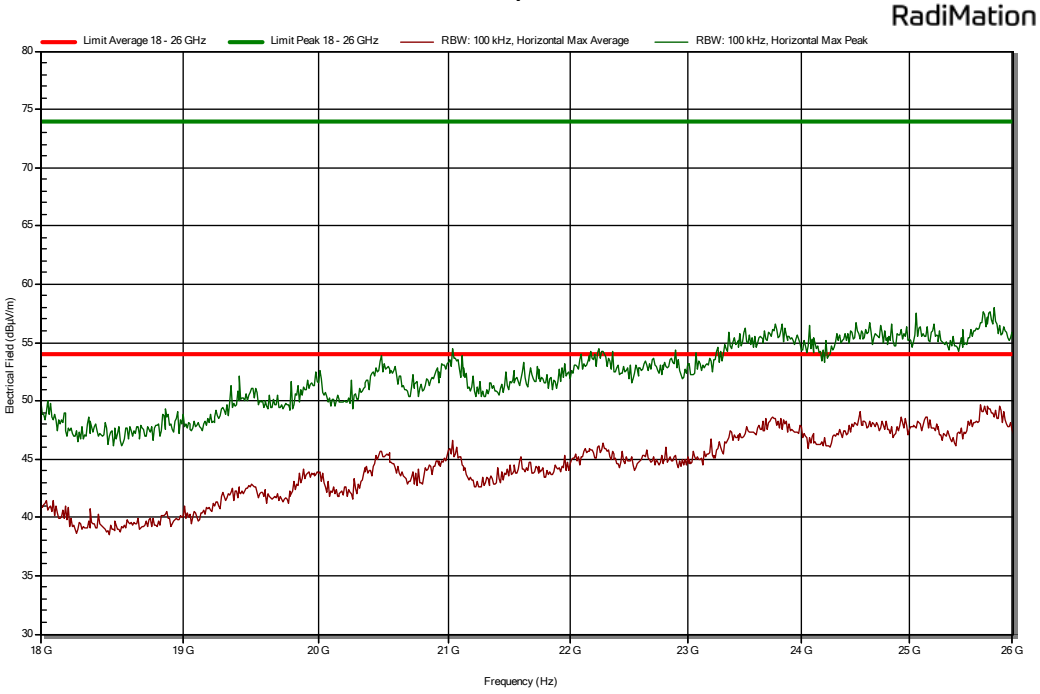


18 – 26.5 GHz

BLE High Channel
Vertical polarization



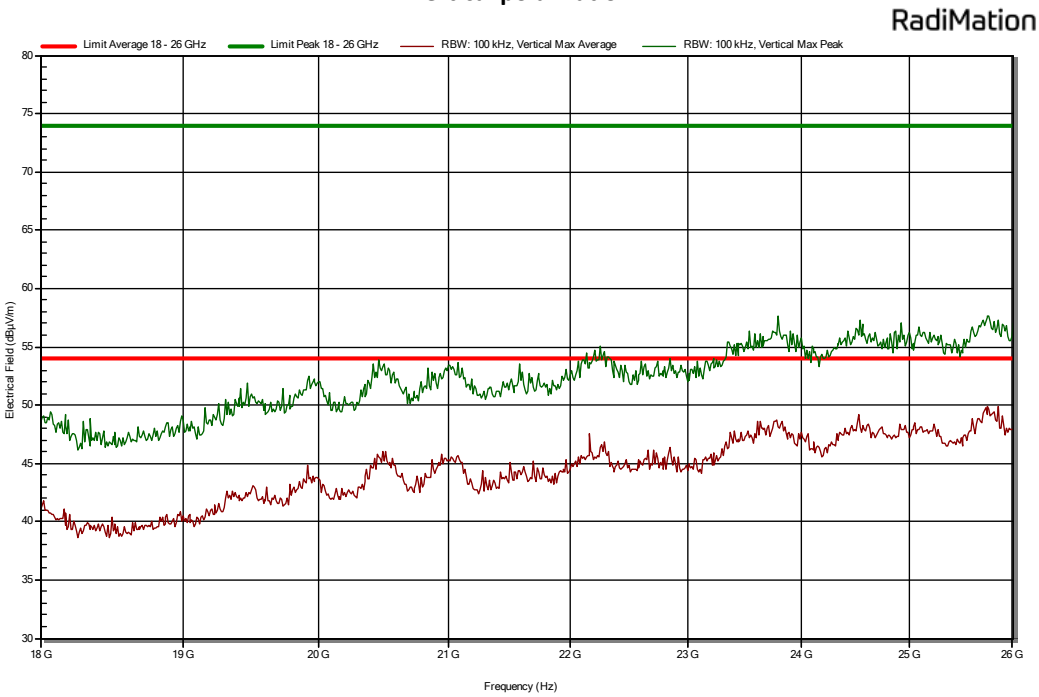
Horizontal polarization



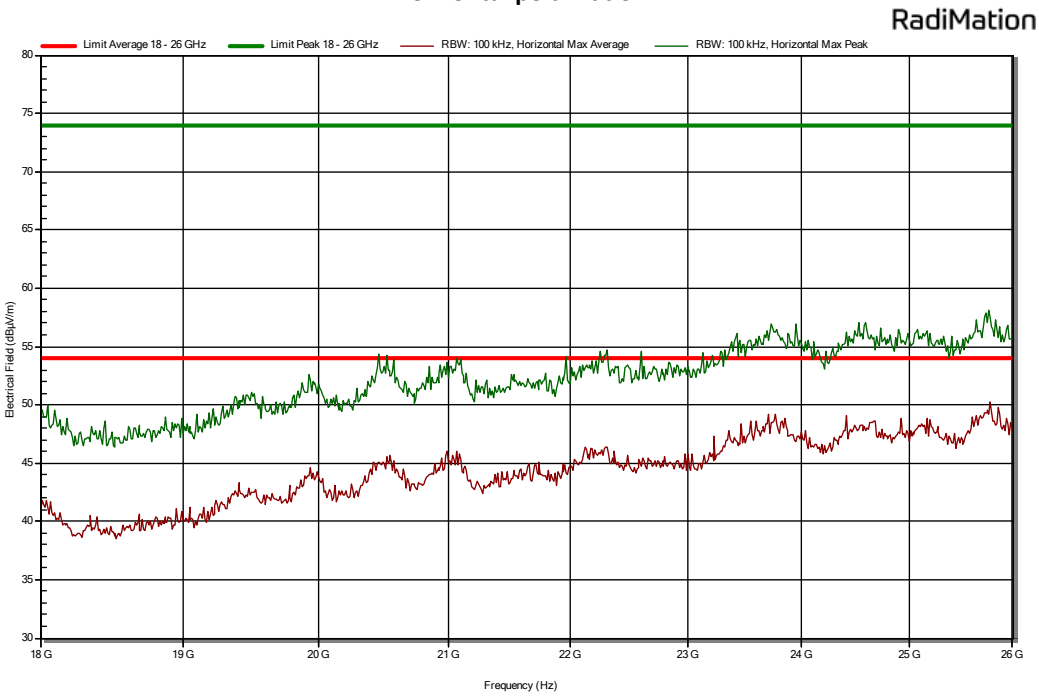
18 – 26.5 GHz

ANT+

Vertical polarization



Horizontal polarization



3.2 6dB bandwidth Measurement

3.2.1 Limit

The minimum 6 dB Bandwidth shall be at least 500 kHz.

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.2.4 Test procedure

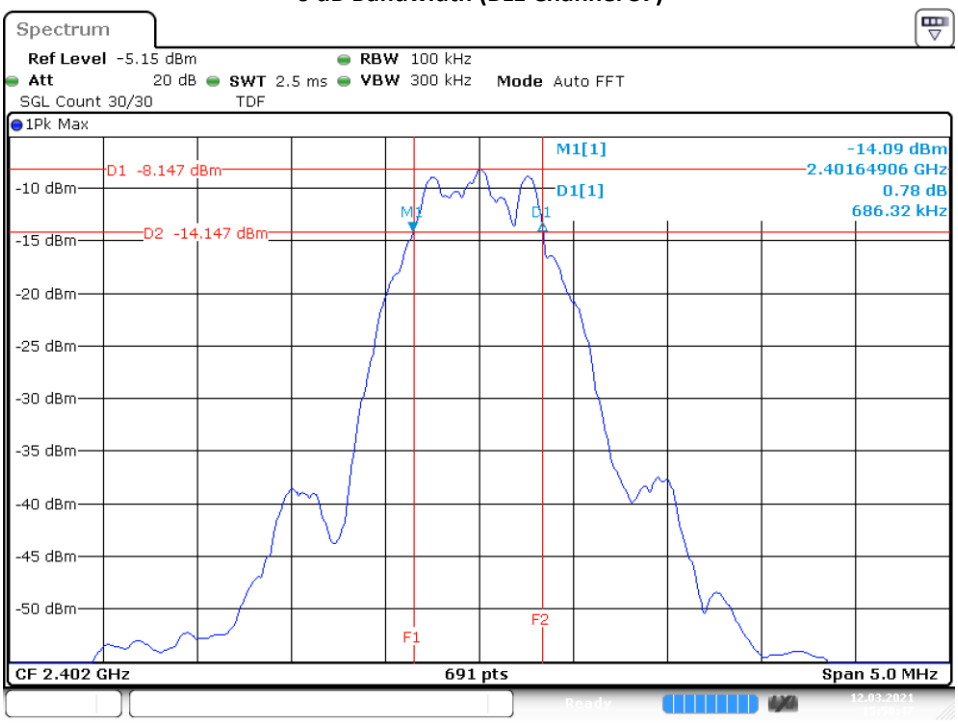
Tests according to ANSI C63.10
IRN 017 - Occupied bandwidth (Hz) Method 4 – DTS Bandwidth.

3.2.5 Test Results of the 6 dB bandwidth Measurement

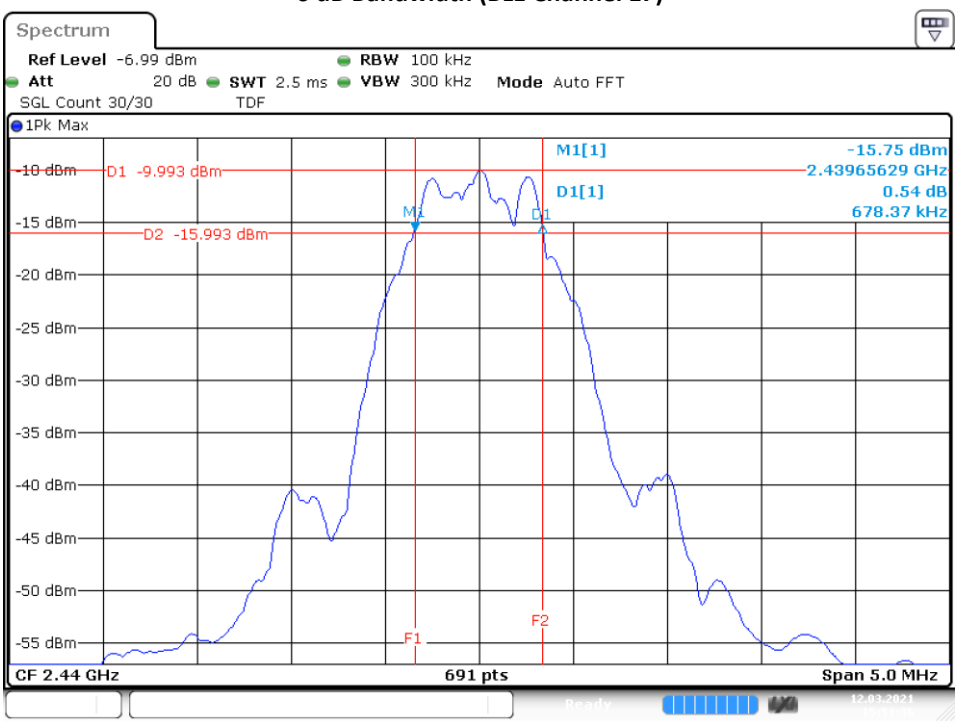
Technology Std.	Channel	Frequency (MHz)	Data rate	6dB bandwidth (kHz)
Bluetooth Low energy	37	2402	1 Mbps	686.32
	17	2440	1 Mbps	678.36
	39	2480	1 Mbps	678.36
ANT+	1	2457	60kBits/s	678.37
Uncertainty	± 36.2 kHz			

3.2.6 Plots of the 6 dB bandwidth Measurement

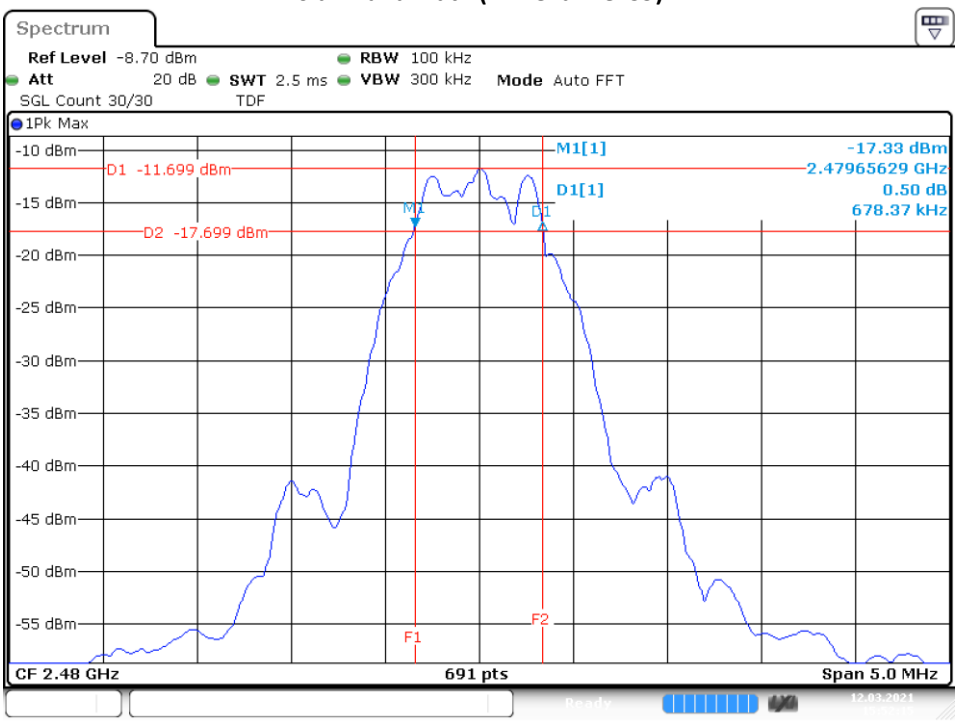
6 dB Bandwidth (BLE Channel 37)



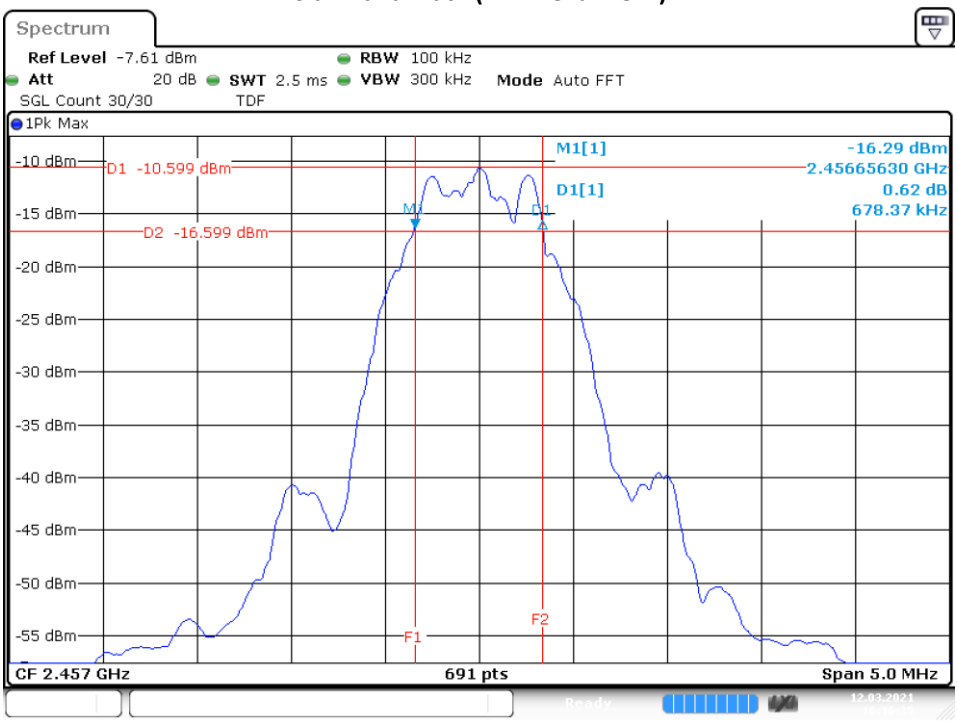
6 dB Bandwidth (BLE Channel 17)



6 dB Bandwidth (BLE Channel 39)



6 dB Bandwidth (ANT+ Channel 1)



3.3 99% Occupied Bandwidth

3.3.1 Limit

According to RSS-Gen 6.7

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.3.4 Test procedure

IRN 017 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

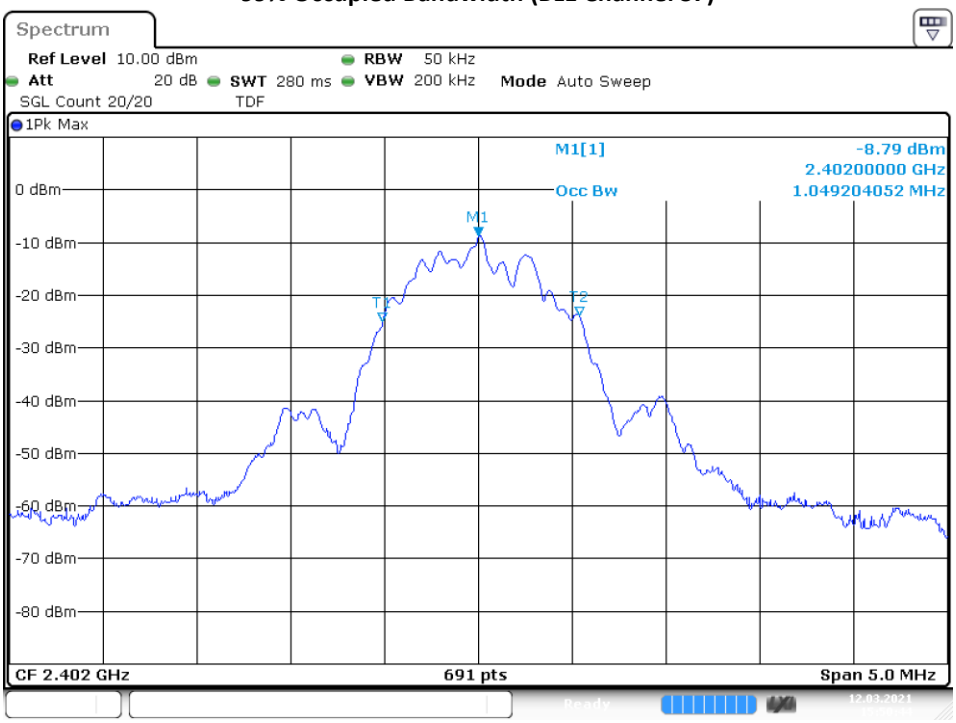
1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW ≥ 3x RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

3.3.5 Test results of the 99% occupied bandwidth measurement

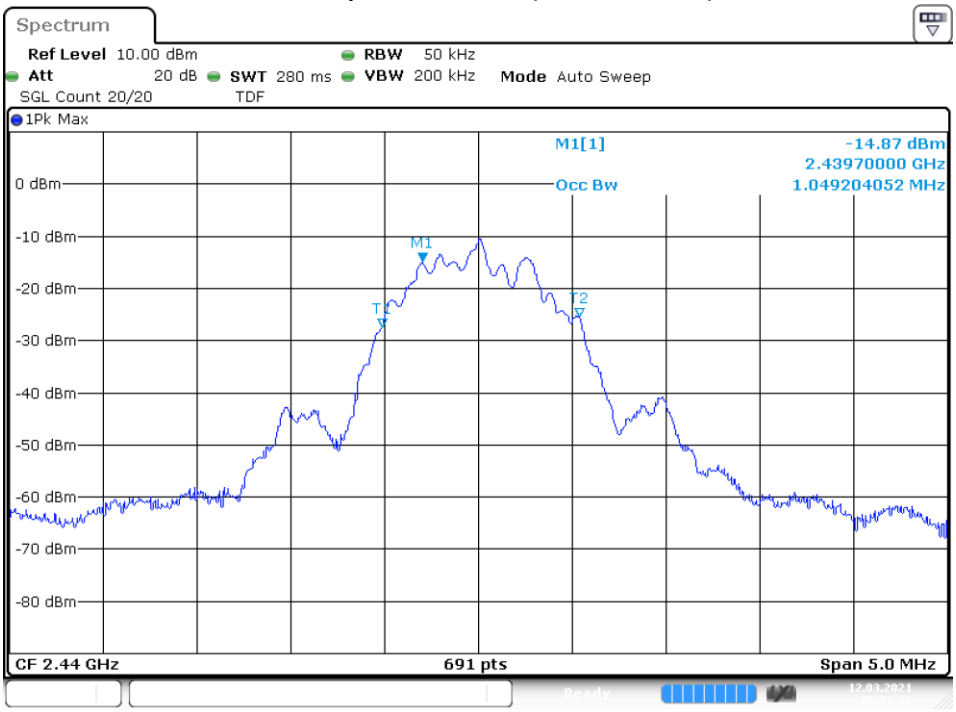
Technology Std.	Channel	Frequency (MHz)	Data rate	99% bandwidth (MHz)
Bluetooth Low energy	37	2402	1 Mbps	1.049
	17	2440	1 Mbps	1.049
	39	2480	1 Mbps	1.049
ANT+	1	2457	60kBits/s --	1.049
Uncertainty	± 12 kHz			

3.3.6 Plots of the 99% occupied bandwidth measurement

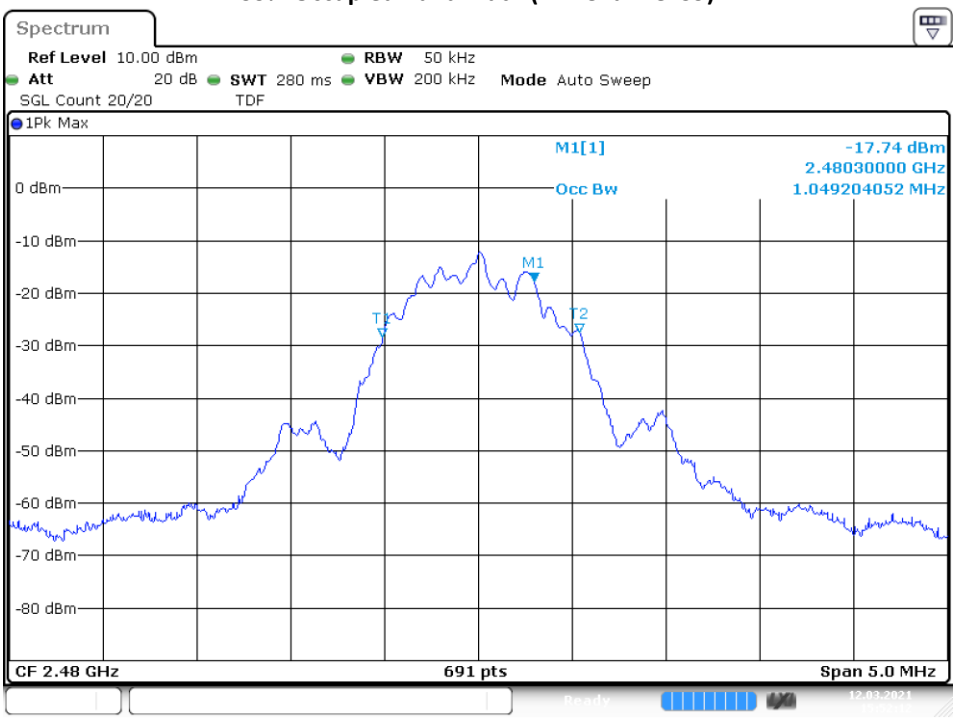
99% Occupied Bandwidth (BLE Channel 37)



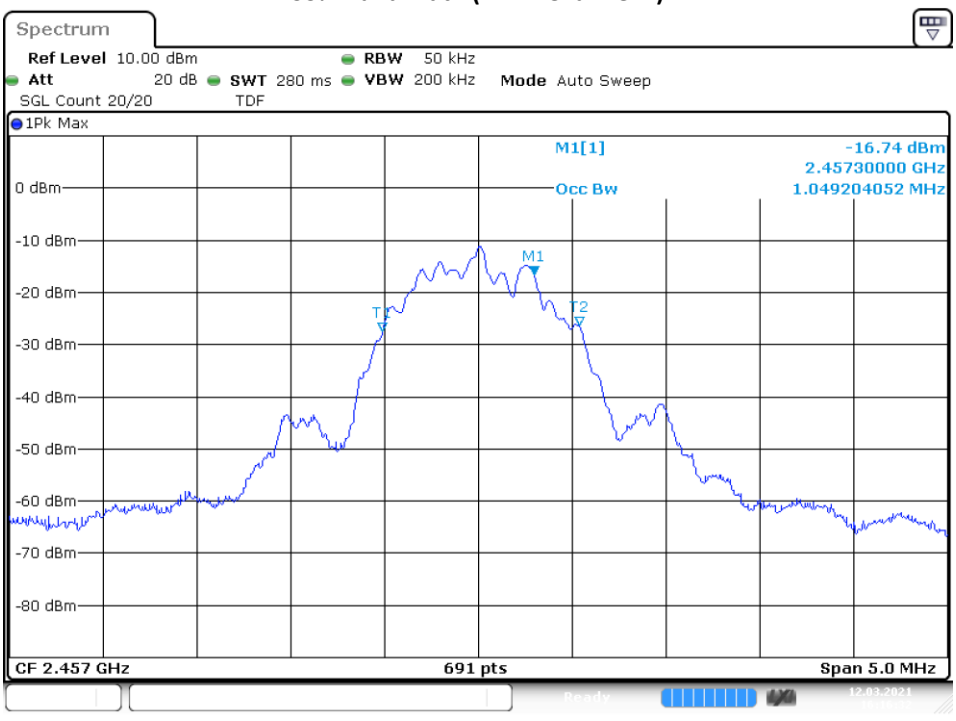
99% Occupied Bandwidth (BLE Channel 17)



99% Occupied Bandwidth (BLE Channel 39)



99% Bandwidth (ANT+ Channel 1)



3.4 Output Power Measurement

3.4.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.4.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.

IRN 014 - RF power (W) - Method 1 – AVGSA (DTS) according to ANSI C63.10.

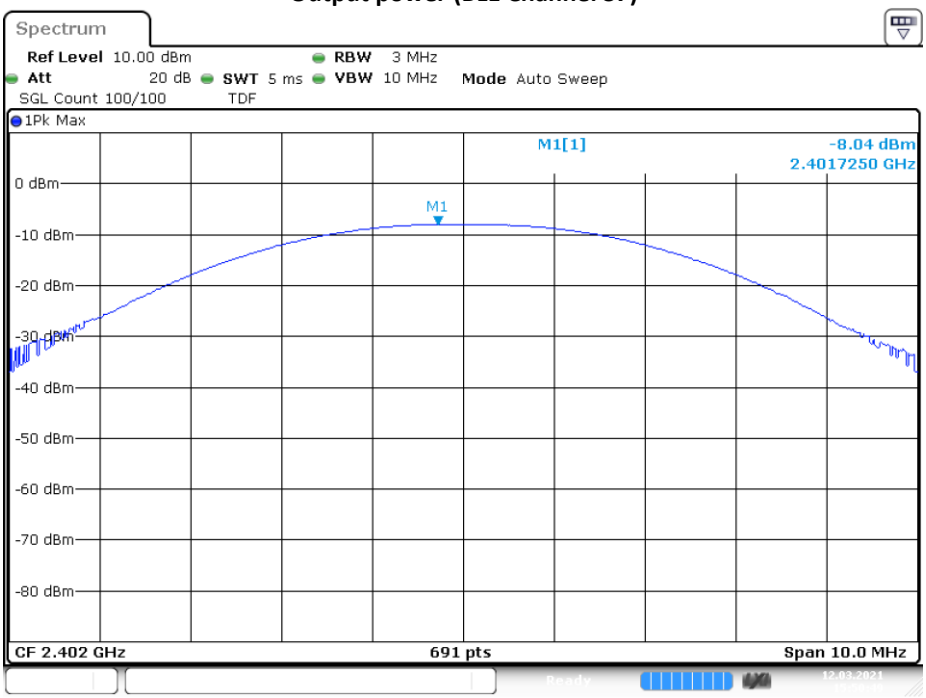
3.4.5 Test results of Output Power Measurement

Peak method

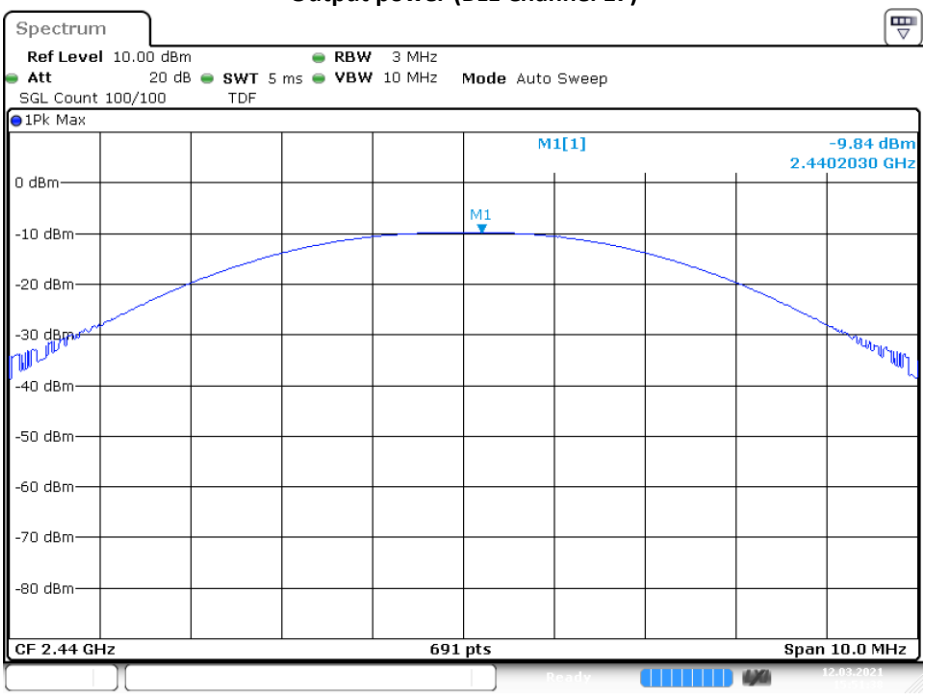
Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power (dBm)
Bluetooth Low Energy	37	2402	1 Mbps	-8.04
	17	2440	1 Mbps	-9.84
	39	2480	1 Mbps	-11.55
ANT+	1	2457	60kBits/s	-10.48
Uncertainty	±0.71 dB			

3.4.6 Plots of the Output power measurement

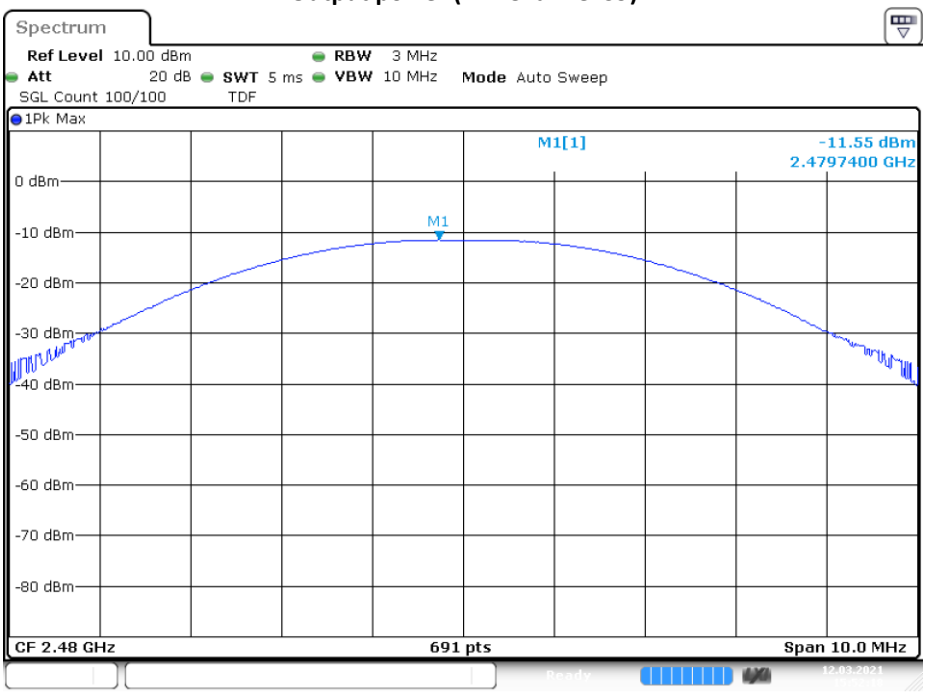
Output power (BLE Channel 37)



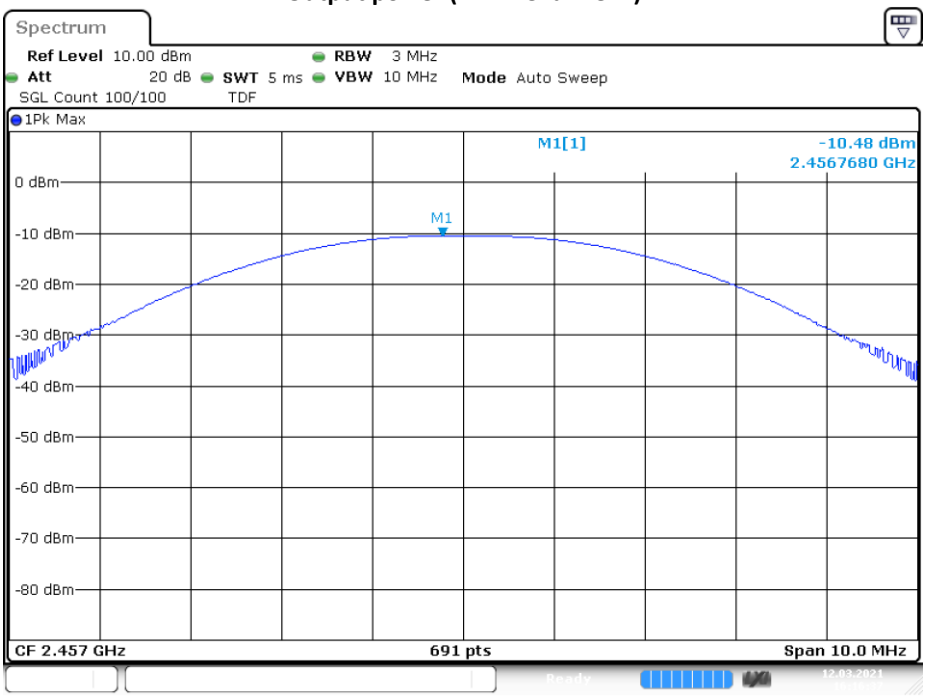
Output power (BLE Channel 17)



Output power (BLE Channel 39)



Output power (ANT+ Channel 1)



3.5 Power Spectral Density

3.5.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.5.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.5.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.

IRN 030 - Spectral power density (W per n.Hz) - Method 5 – Peak method PKPSD (PSD in 3 kHz band)

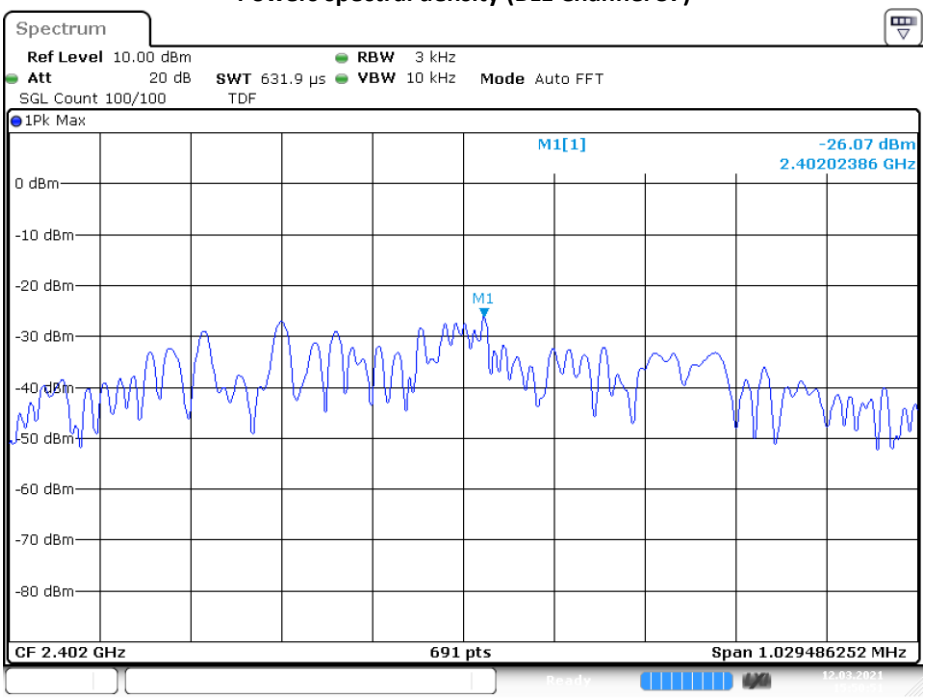
3.5.5 Test results of Power Spectral Density Measurement

Peak Power spectral density

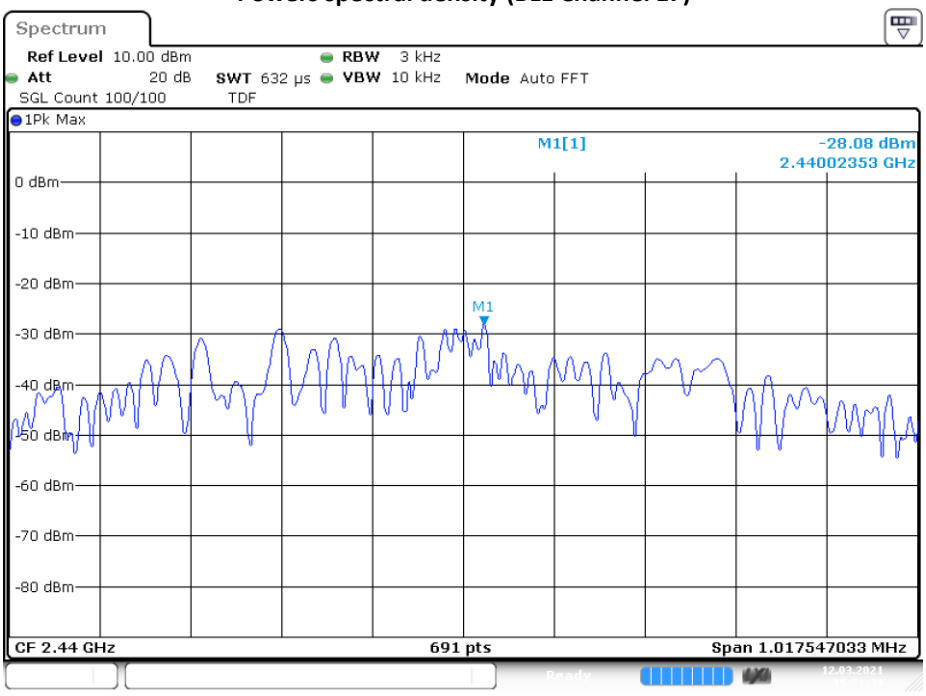
Technology Std.	Channel	Frequency (MHz)	Data rate	PSD (dBm/3 kHz)
Bluetooth Low Energy	37	2402	1 Mbps	-26.07
	17	2440	1 Mbps	-28.08
	39	2480	1 Mbps	-29.56
ANT+	1	2457	60kBits/s	-28.89
Uncertainty	±2 dB			

3.5.6 Plots of the Power spectral density measurement

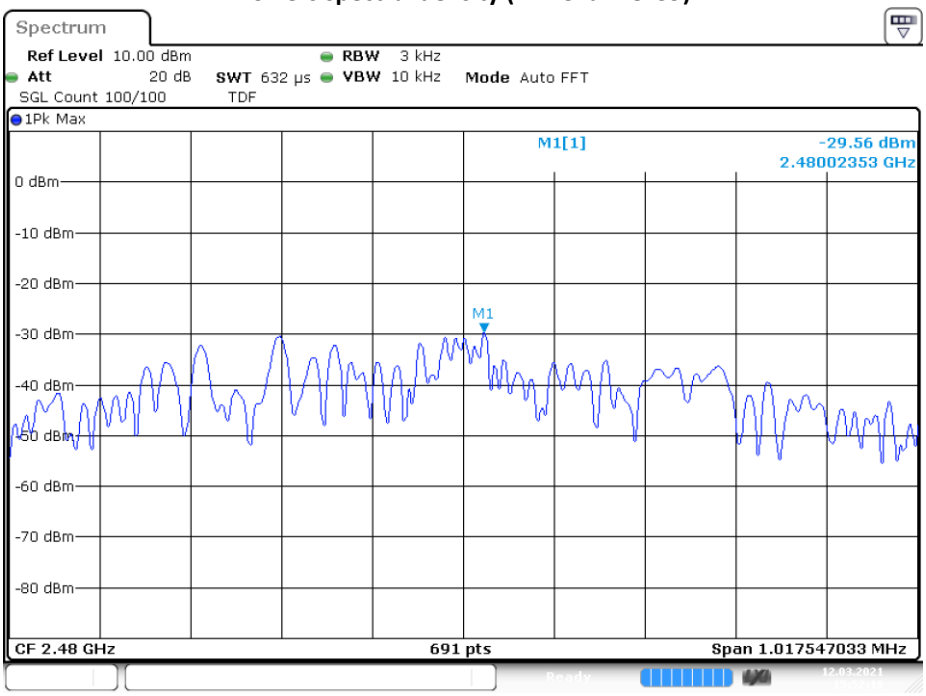
Powers spectral density (BLE Channel 37)



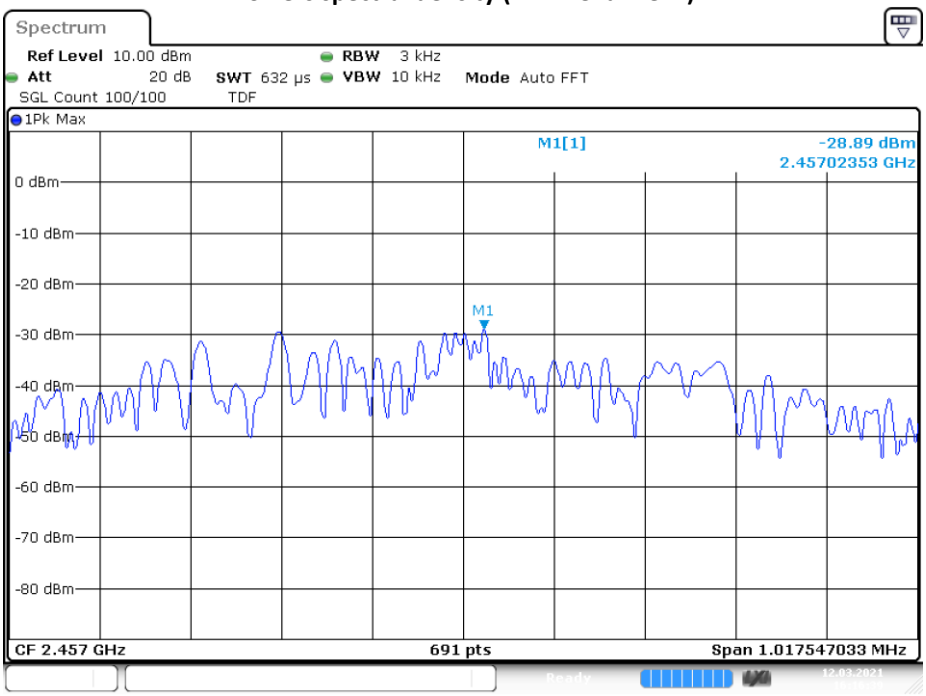
Powers spectral density (BLE Channel 17)



Powers spectral density (BLE Channel 39)



Powers spectral density (ANT+ Channel 1)



3.6 Band edge Measurement

3.6.1 Limit

Band edge:
At the edge of the authorized band the RF power shall be at least 20 dB down.

3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.6.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.6.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05, sections 11.3 and 12.1. IRN 026 - Radiated electrical disturbance (V per m) Method 6 – Radiated electrical disturbance at the Authorized band edge.

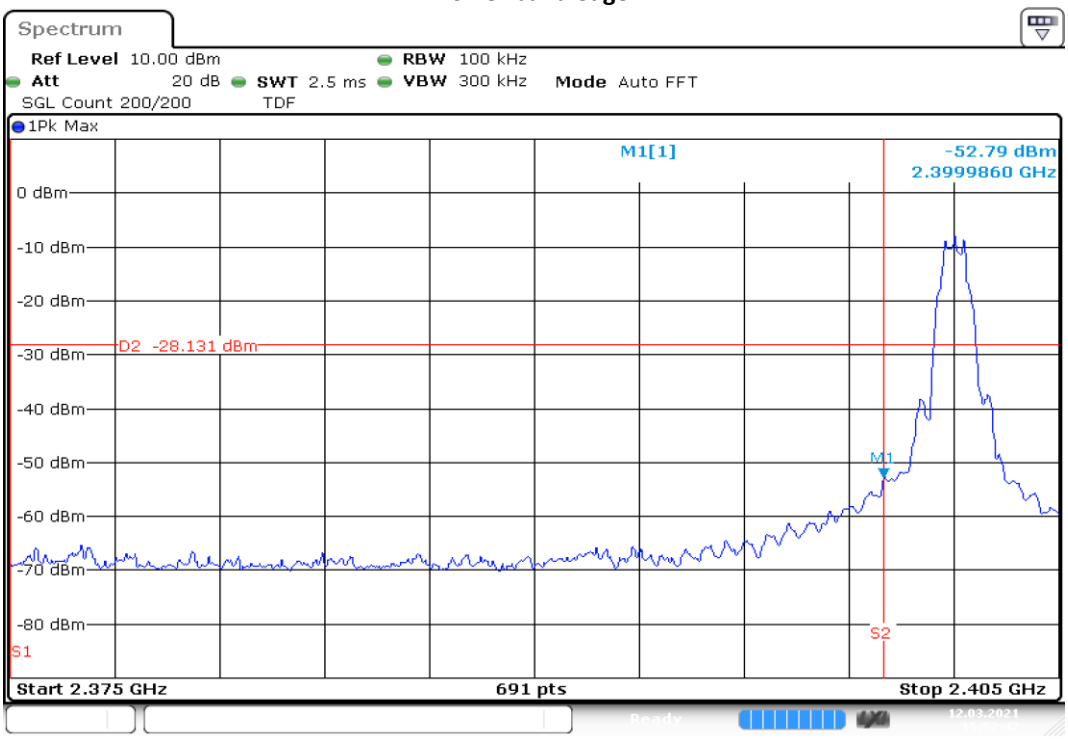
3.6.5 Measurement Uncertainty

± 5.7 dB.

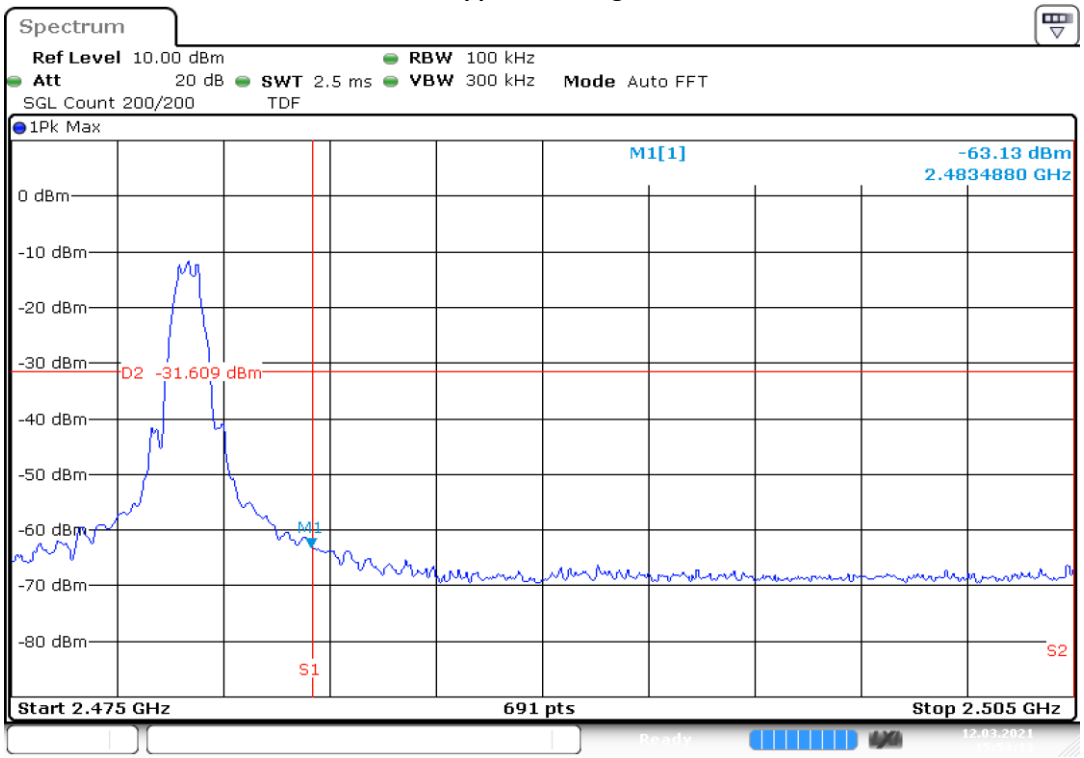
3.6.6 Plots of the Band edge Measurements

See next page.
Note: no band edge measurement have been performed for ANT+, as the operating frequency is more than 20 MHz away from the operating band.

Lower band edge



Upper band edge



4 Sample calculations

All formulas for data conversions and conversion factors are reported in this chapter.

Field Strength Measurement:

E (dBµV/m) = U(dBµV) + AF (dB/m) + Corr. (dB)

Where:
E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
CL = Cable loss

Corr. = sum of single correction factors of used cable and amplifier (if applicable).
Linear interpolation will be used for frequencies in between the values in the table.
Tables shows an extract of the values.

Frequency (Mhz)	**AF (dB/m)** **TE 00967** **Chase CBL6112A** **SN: 2308**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
30	18,6	0,68	19,28
100	10,7	1,15	11,85
150	10,6	1,41	12,01
200	9,3	1,63	10,93
250	12,6	1,93	14,53
300	13,3	2,12	15,42
350	14,6	2,2	16,8
400	15,5	2,29	17,79
450	16,9	2,53	19,43
500	17,5	2,67	20,17
550	18,4	2,9	21,3
600	18,8	3,02	21,82
650	19,2	3,09	22,29
700	19	3,22	22,22
750	19,8	3,56	23,36
800	19,7	3,69	23,39
900	20,4	3,81	24,21
950	20,8	3,91	24,71
1000	21,2	4,3	25,5

Frequency (Mhz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
1000	23,6	40,4	2,0	66
1500	25,1	40,5	2,4	68
2000	27,1	40,5	2,7	70,3
2500	28,6	40,7	3,2	72,5
3000	30,5	40,7	3,2	74,4
3500	31,2	40,7	3,4	75,3
4000	32,7	40,9	4,9	78,5
4500	32,4	40,9	4,4	77,7
5000	33,2	40,7	4,6	78,5
5500	34,0	40,5	4,5	79
6000	34,6	40,0	5,2	79,8
6500	34,3	39,4	5,9	79,6
7000	35,2	38,6	5,7	79,5
7500	36,4	39,2	5,9	81,5
8000	37,0	38,9	6,3	82,2
8500	37,5	38,4	6,4	82,3
9000	38,1	37,4	6,5	82
9500	37,8	37,0	7,1	81,9
10000	38,2	36,5	7,3	82
10500	38,1	36,7	7,6	82,4
11000	38,3	36,9	8,3	83,5
11500	38,5	37,6	8,1	84,2
12000	39,1	38,3	8,4	85,8
12500	38,7	38,5	8,3	85,5
13000	39,2	38,9	9,2	87,3
13500	40,5	40,2	8,3	89
14000	41,1	40,0	8,2	89,3
14500	41,4	40,1	8,2	89,7
15000	40,2	41,4	8,3	89,9
15500	37,9	41,4	8,6	87,9
16000	37,5	42,8	9,2	89,5
16500	38,6	42,3	8,8	89,7
17000	41,1	43,1	9,4	93,6
17500	42,7	43,2	9,4	95,3
18000	44,0	44,2	9,8	98

Frequency (Mhz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
18000	31,3	26,2	9,8	67,3
19000	31,5	26,1	9,6	67,2
20000	31,7	25,9	11	68,6
21000	31,9	24,3	10,7	66,9
22000	32,1	18,3	10,5	60,9
23000	32,2	18,9	10,8	61,9
24000	32,3	23,6	11,4	67,3
25000	32,4	24,5	11,6	68,5
26000	32,5	25,3	11,7	69,5