telefication bv
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-247, RSS-Gen

Product name	: BIG SCOPE
Applicant	: in-lite bv
FCC ID	: 2AU26-BIGSCOPE
IC ID	: 25679-BIGSCOPE

Test report No. : 200800422 01 Ver 1.00

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	31-07-2021	First draft	PS
v1.00	23-09-2021	Final release	PS

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	--	Pass (Notes 1, 2)

Notes:

1) With a lowest channel frequency of 2402 MHz and a channel bandwidth of 1 MHz, the authorized band edge (2400 MHz) is distant enough to meet the band-edge requirement.
2) The highest channel frequency of 2480 MHz is distant enough from the authorized band edge (2483.5 MHz) to meet the band-edge requirement. .

1 General Description

1.1 Applicant

Client name:	In-lite design bv
Address:	Stephensonweg 18
Zip code:	4207 HB Gorinchem, The Netherlands
Telephone:	0184688760
E-mail:	wilbrand.menzo@in-lite.nl
Contact name:	Mr. Wilbrand Menzo

1.2 Manufacturer

Manufacturer name:	In-lite design bv
Address:	Stephensonweg 18
Zip code:	4207 HB Gorinchem, The Netherlands
Telephone:	0184688760
E-mail:	wilbrand.menzo@in-lite.nl
Contact name:	Mr. Wilbrand Menzo

1.3 Tested Equipment Under Test (EUT)

Product name:	BIG SCOPE
Brand name:	in-lite
FCC ID:	2AU26-BIGSCOPE
IC ID:	25679-BIGSCOPE
Product type:	2.4 GHz wireless data transmission equipment
Model(s):	BIG SCOPE TONE
Batch and/or serial No.	--
Software version:	--
Hardware version:	--
Date of receipt	04-05-2021
Tests started:	29-06-2021
Testing ended:	30-06-2021

1.4 Product specifications of Equipment under test

Tx Frequency:	2400 – 2483.5 MHz
Rx frequency:	2400 – 2483.5 MHz
Antenna type:	PCB
Antenna gain:	Not provided
Type of modulation:	GFSK
Emission designator	1M00G1D

1.5 Environmental conditions

Test date	29-06-2021
Ambient temperature	23.8 °C
Humidity	63.1 %

1.6 Measurement standards

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

1.7 Applicable standards

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

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

1.8 Observation and remarks

None.

1.9 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 conducted tests are performed by:

Name : ing P.A. Suringa

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 04-10-2021

Name : ing. R. van Barneveld

Function : Test Engineer

Signature :

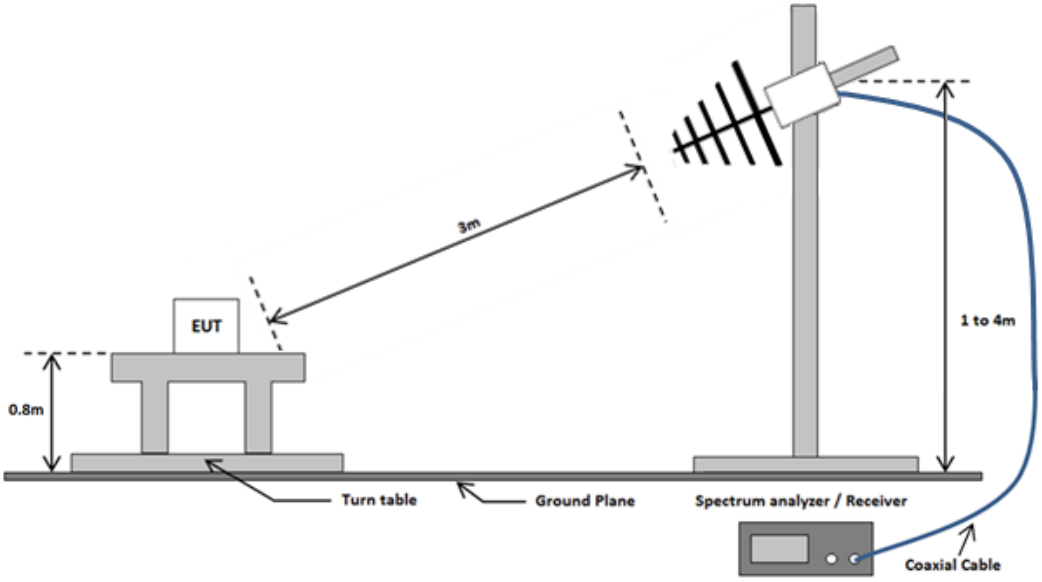
2 Test configuration of the Equipment Under Test

2.1 Test mode

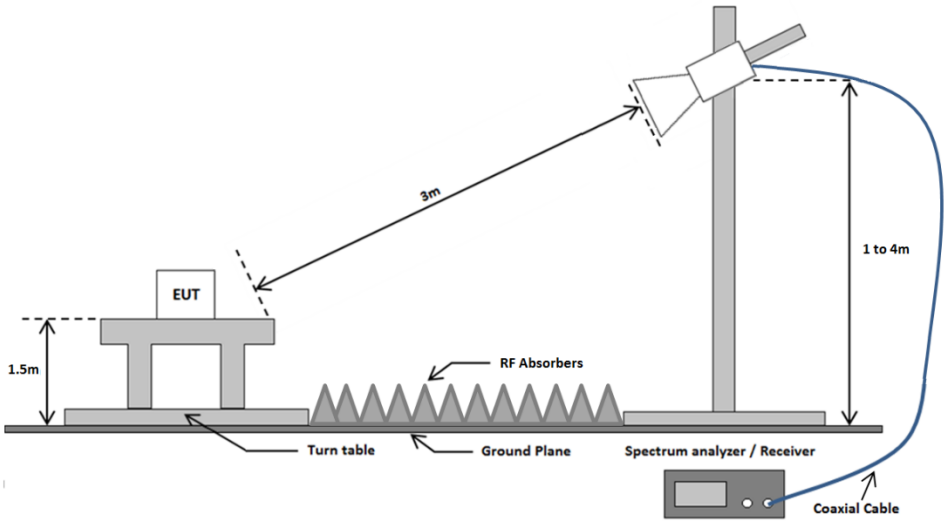
The applicant provide a test tool in which it was possible to select channels and to switch modulation on/off.

2.2 Test setups

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, 3.2, 3.3
3.0 GHz HPF	Wainwright	WHK3.0/18G-10EF	TE01140	3.1
Biconilog antenna	Chase	CBL6112A	TE00967	3.1
Horn antenna	EMCO	3115	TE00531	3.1, 3.4, 3.5
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	TE11175	3.1, 3.4, 3.5
Horn antenna	FLANN-MICROWAVE	20240-25	TE 00818	3.1
Preamplifier 18-26 GHz	Miteq	JS4-18004000-33-8P	TE 11131	3.1
Test software	DARE	Radimation Version 2016.2.8	--	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)
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

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

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
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

3.1.6 Plots of the Radiated Spurious Emissions Measurement

30 -1000 MHz

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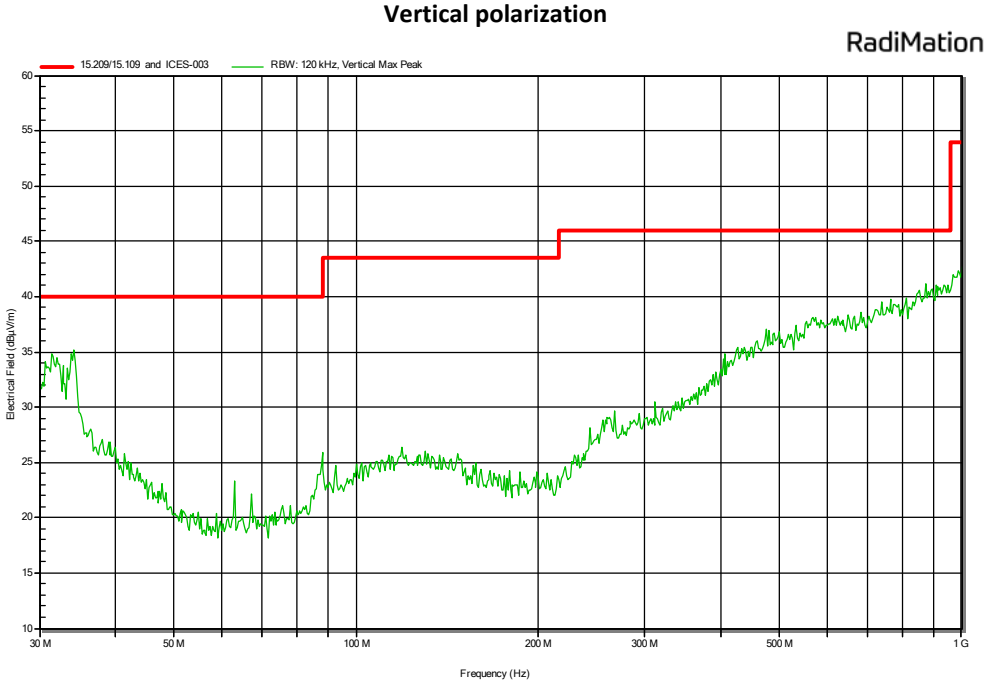
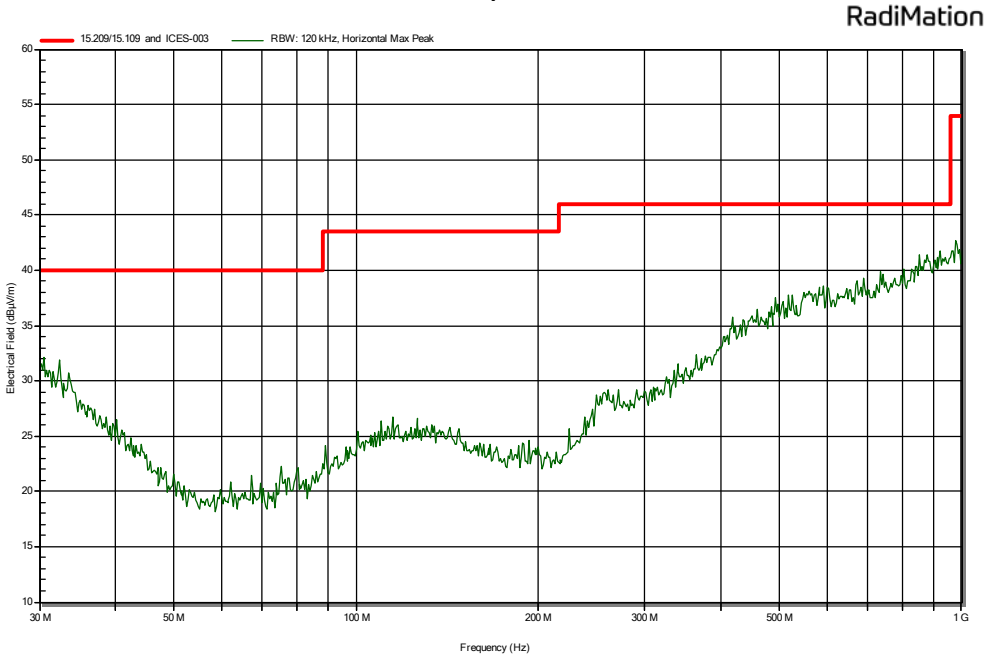
Vertical polarization



Horizontal polarization



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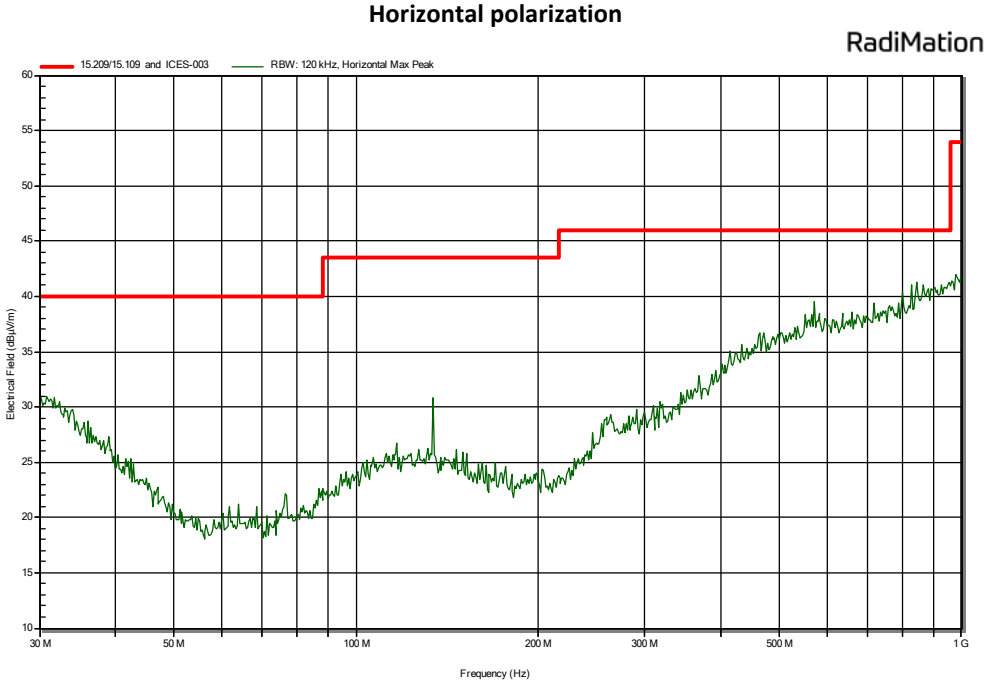
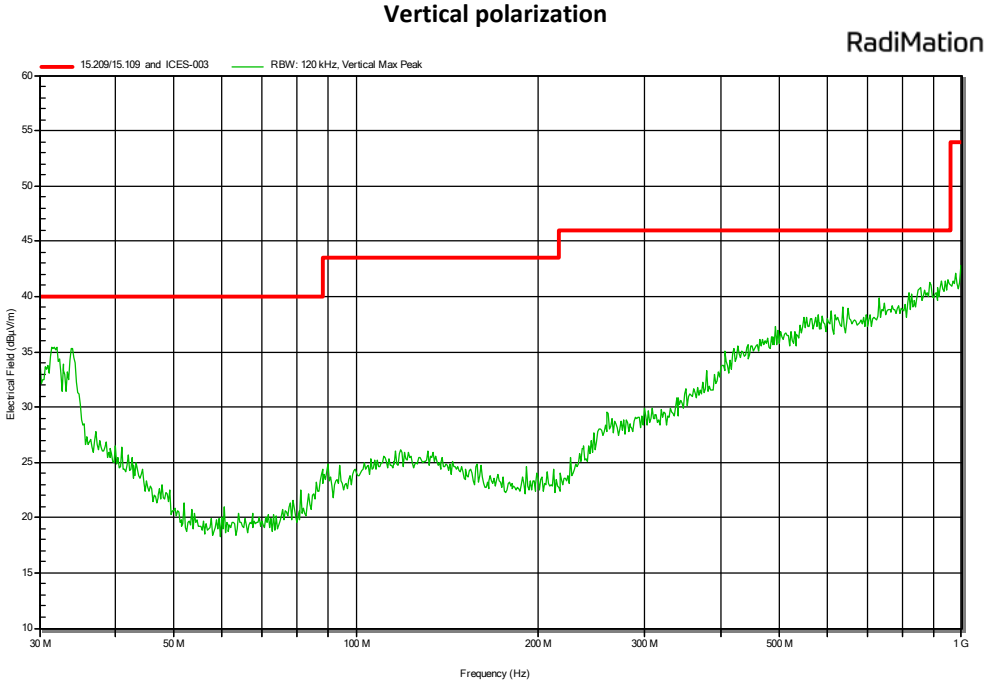
Horizontal polarization



Vertical polarization



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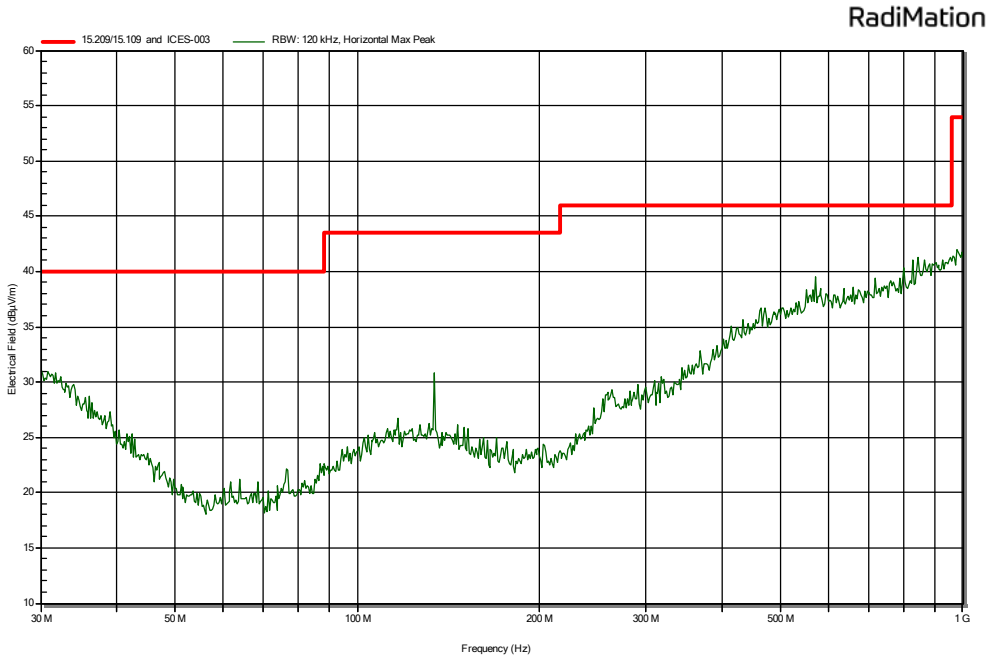
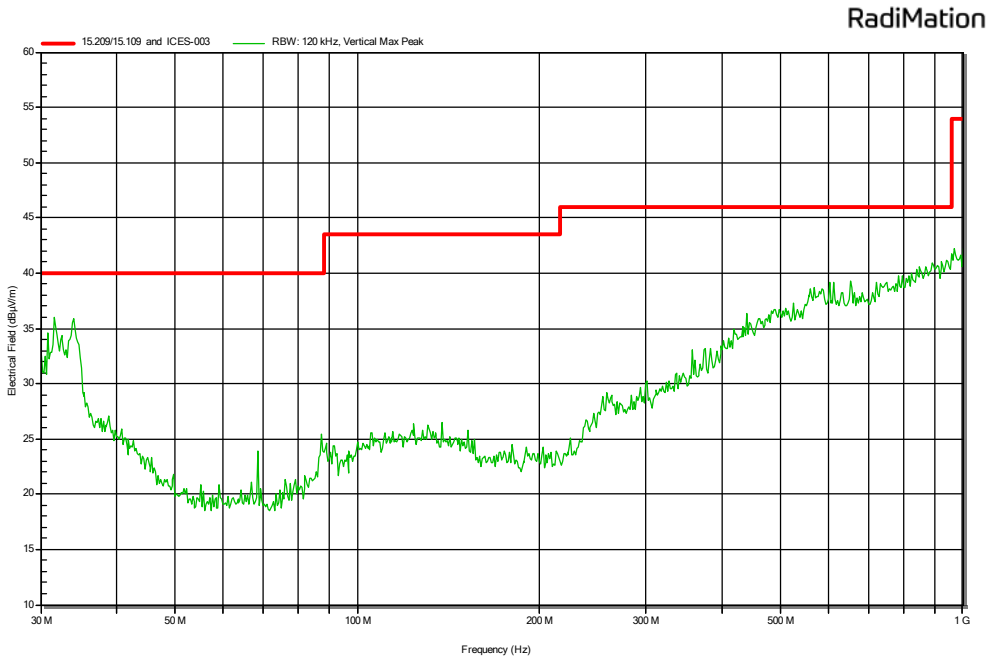
Horizontal polarization



Vertical polarization



1 -18 GHz

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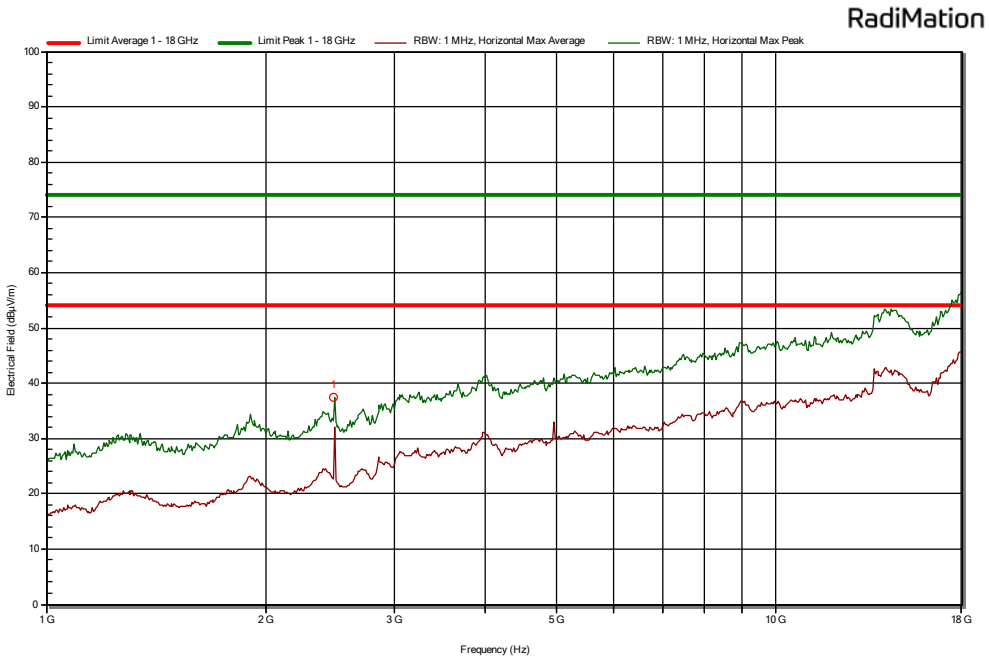
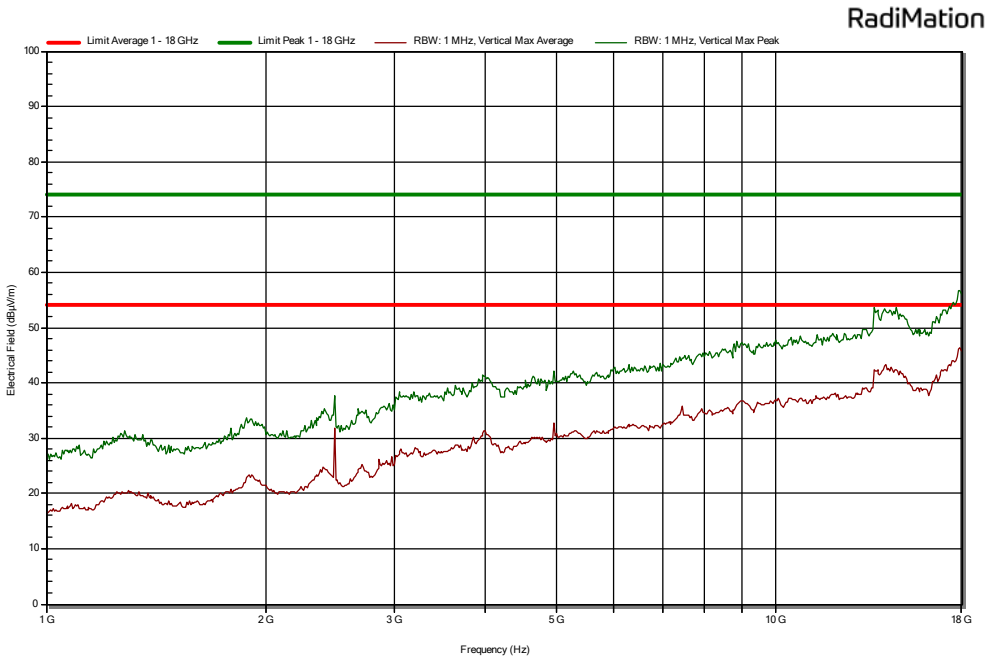
Horizontal polarization



Vertical polarization



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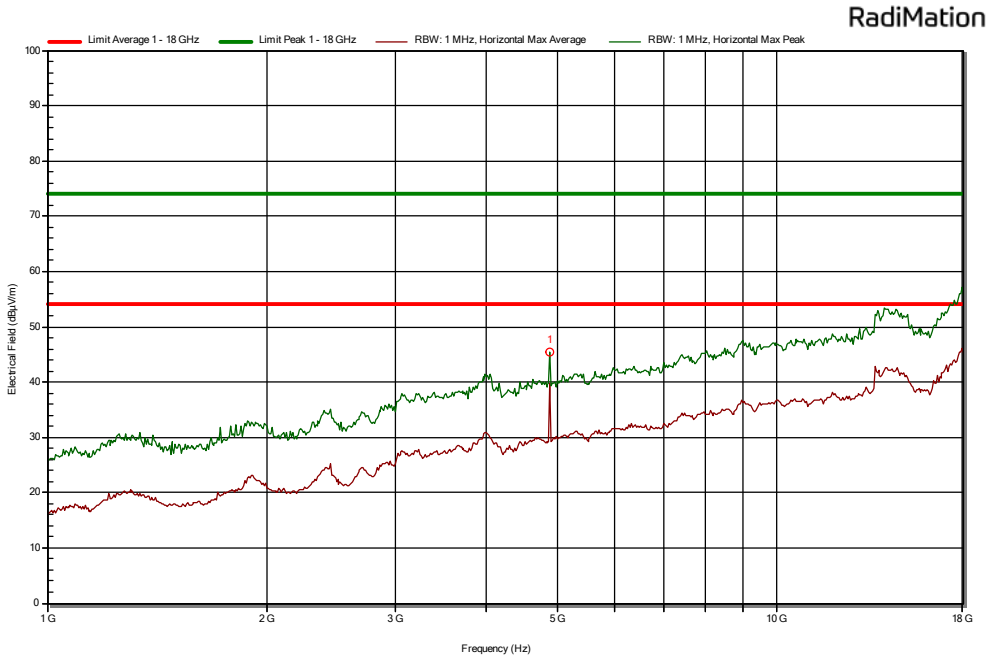
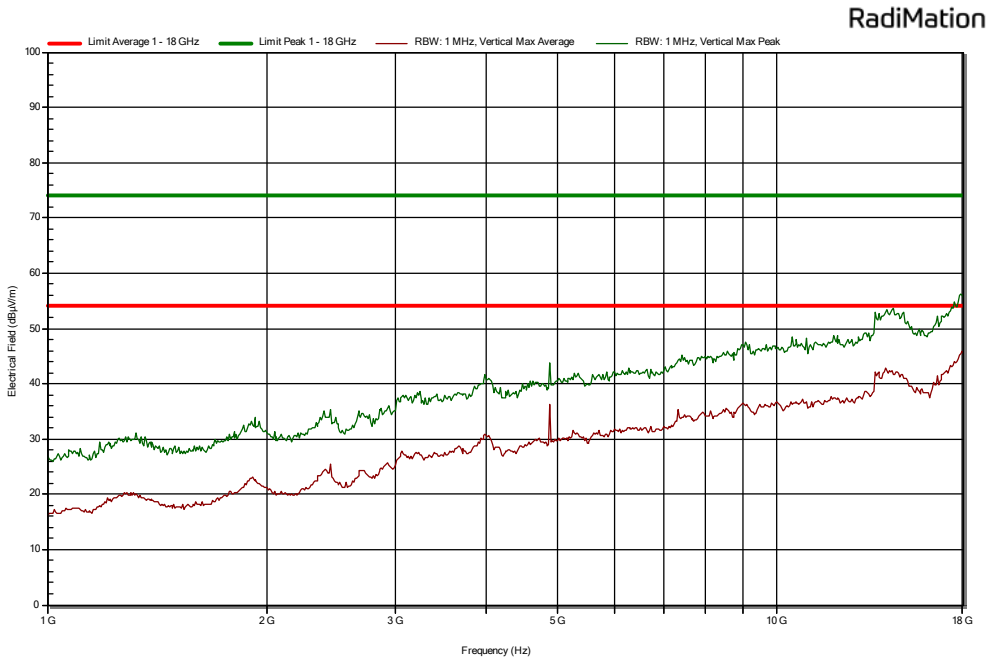
Horizontal polarization



Vertical polarization



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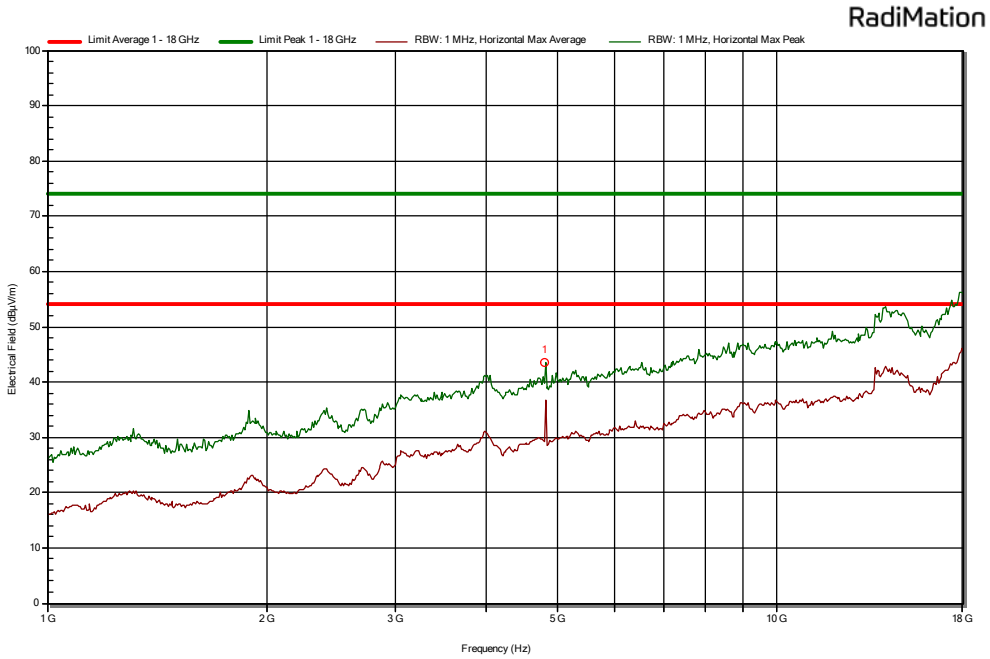
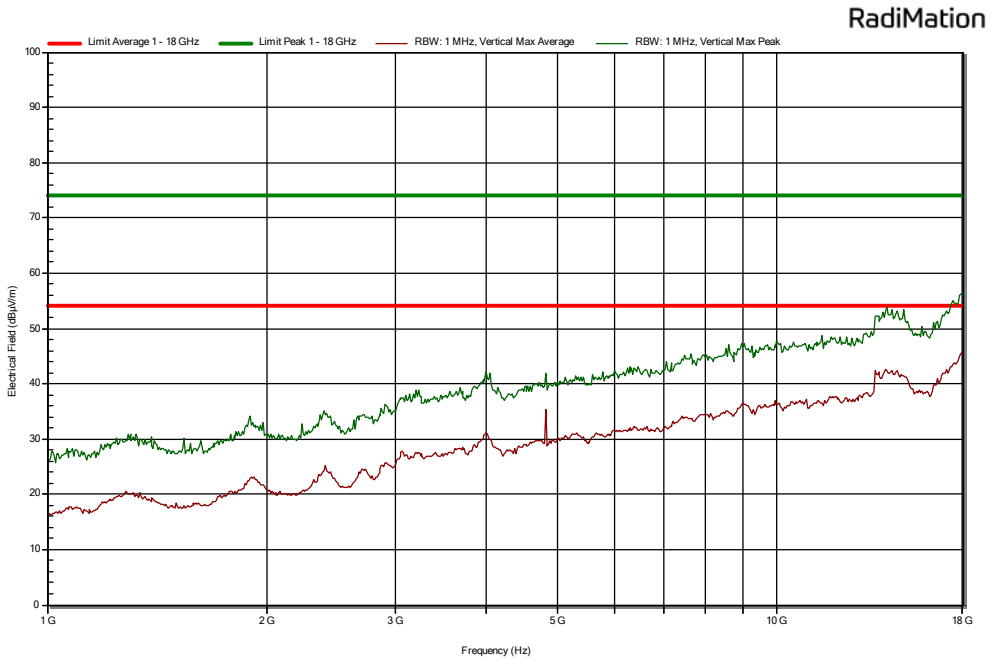
Horizontal polarization



Vertical polarization



18 – 26 GHz

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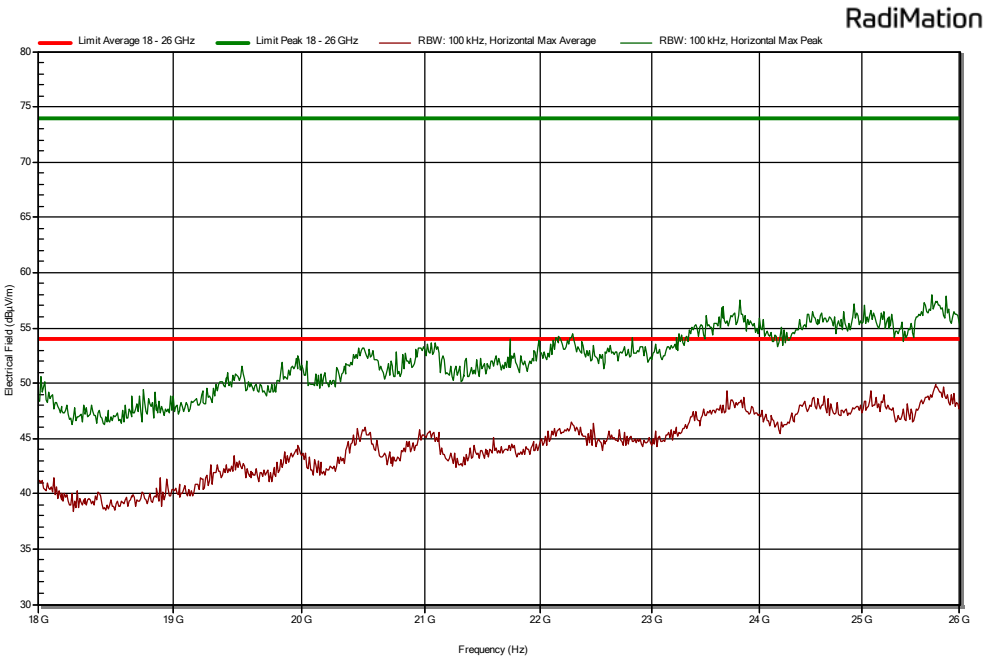
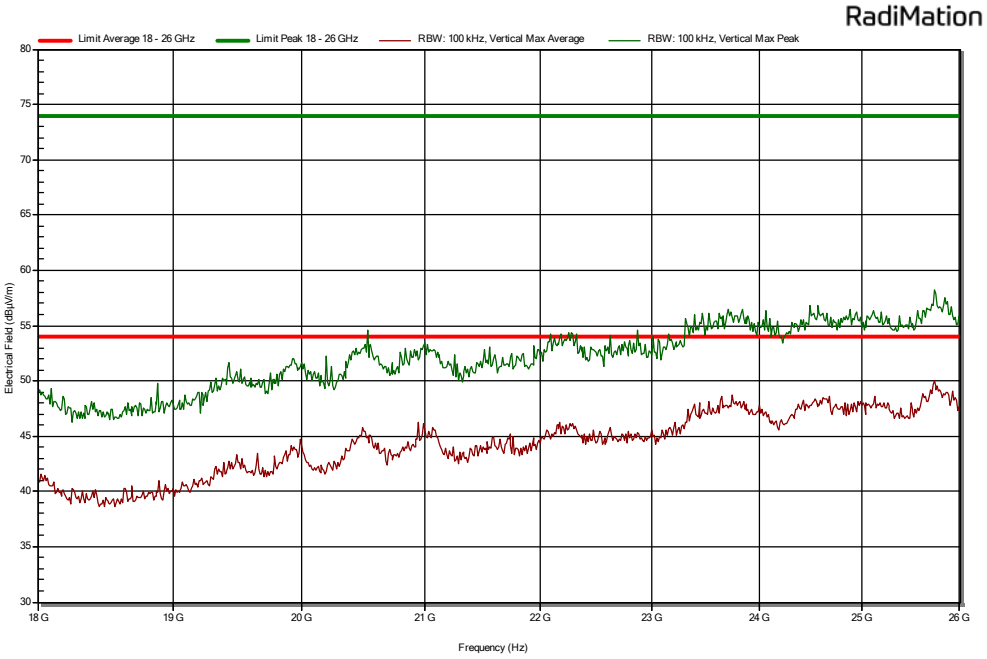
Horizontal polarization



Vertical polarization



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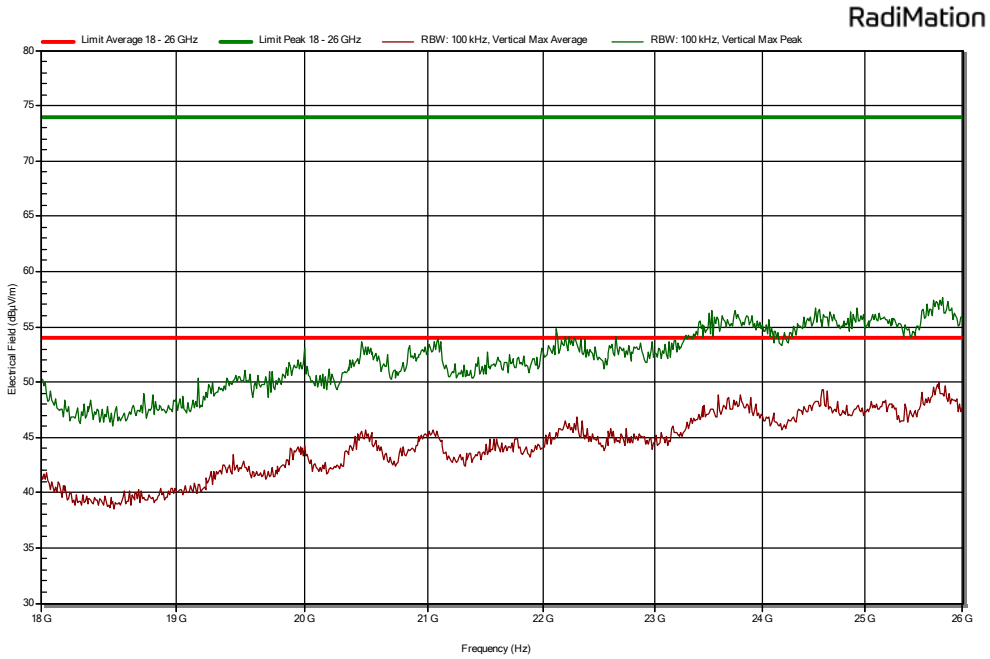
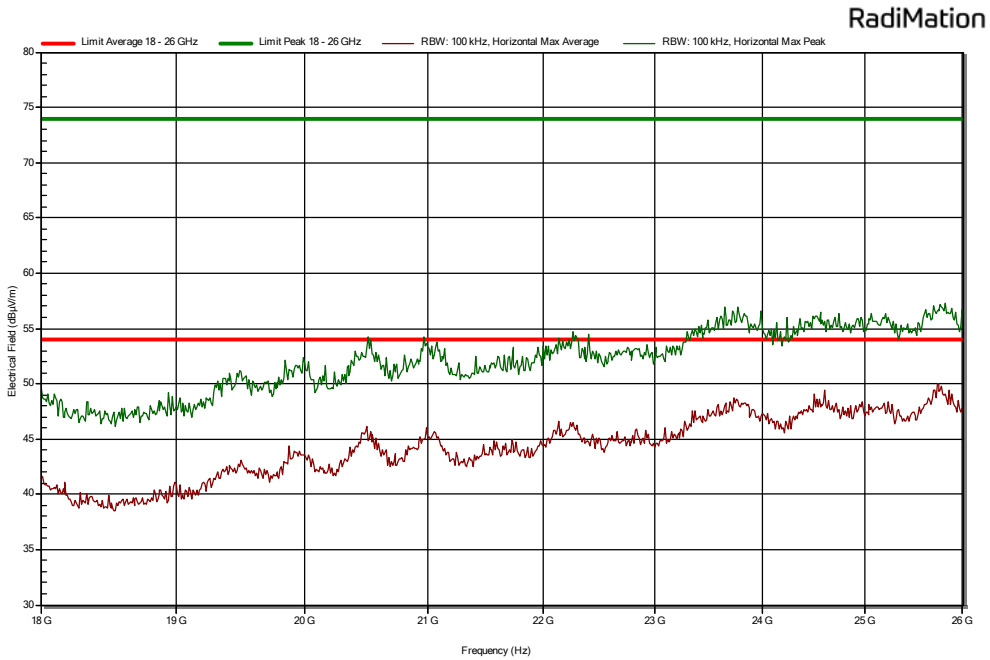
Vertical polarization



Horizontal polarization



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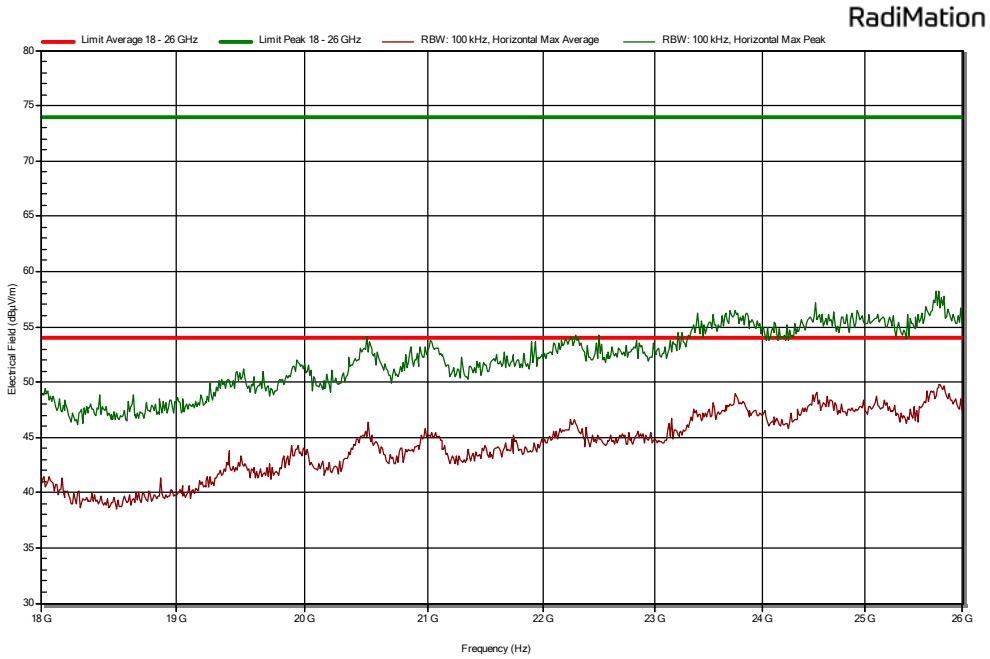
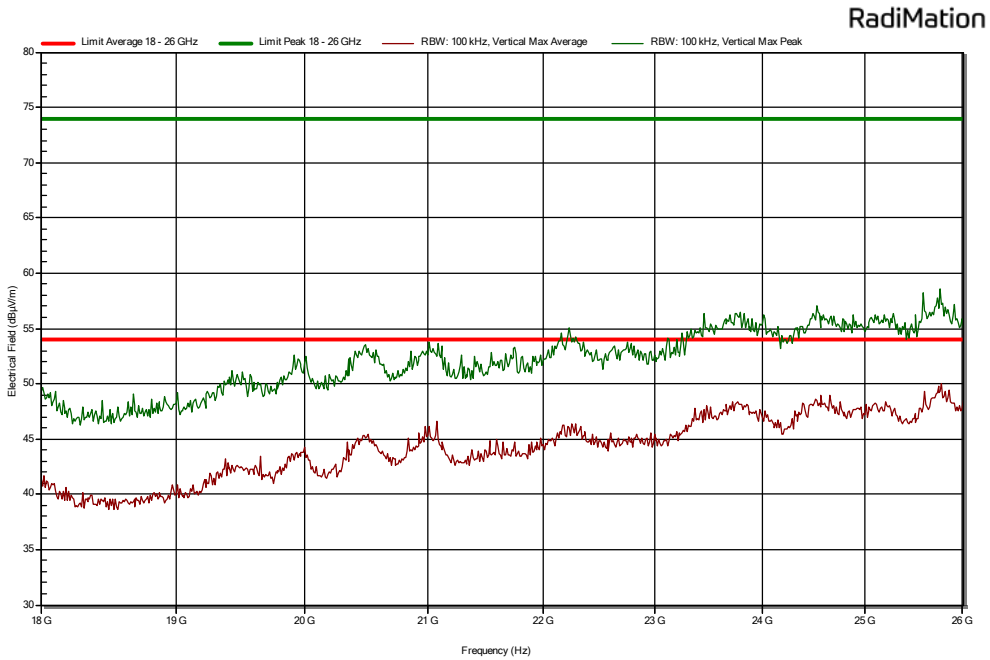
Horizontal polarization



Vertical 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)
Proprietary	37	2402	1 Mbps	680
	17	2440	1 Mbps	610
	39	2480	1 Mbps	690
Uncertainty	± 36.2 kHz			

3.2.6 Plots of the 6 dB bandwidth measurement

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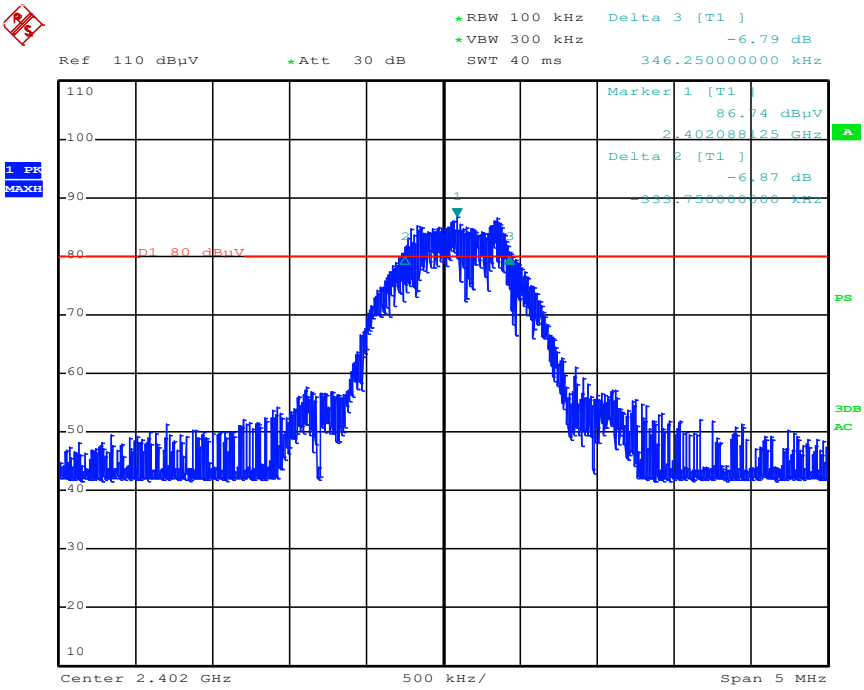

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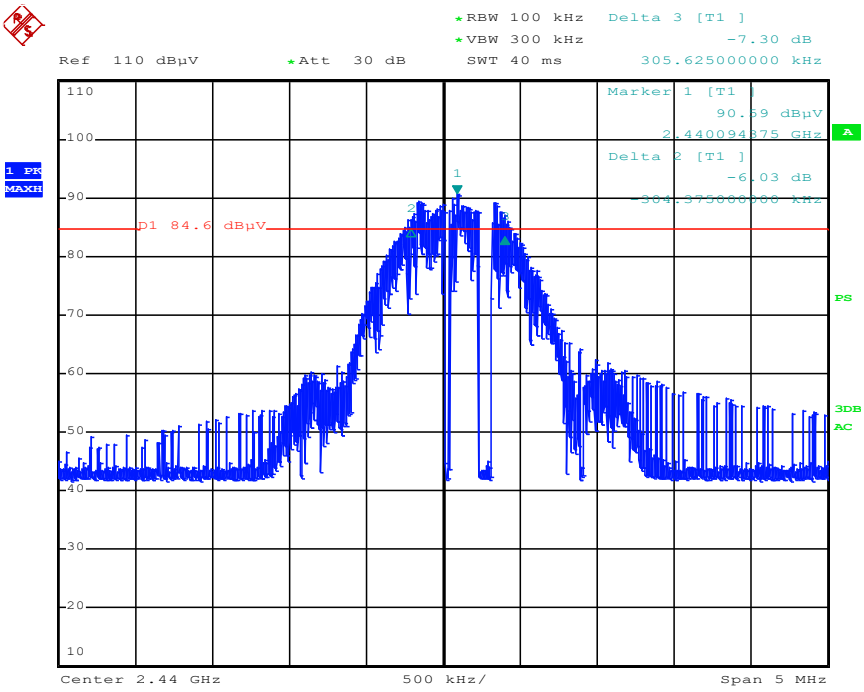
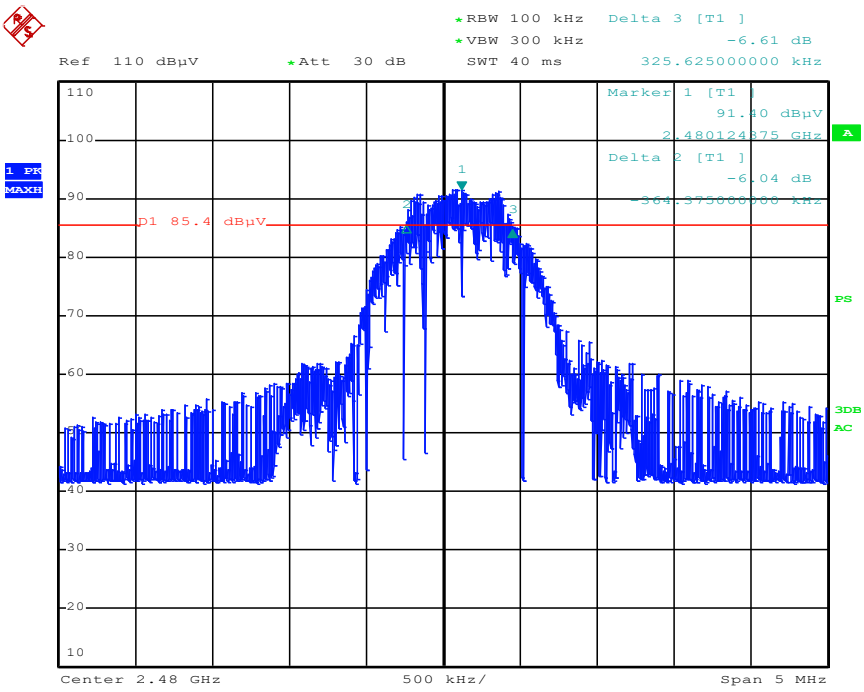


CH 39


RBW 100 kHz
VBW 300 kHz
SWT 40 ms
Delta 3 [T1]
-6.61 dB
325.625000000 kHz
Ref 110 dBµV
Att 30 dB
Marker 1 [T1]
91.40 dBµV
2.480124375 GHz
Delta 2 [T1]
-6.04 dB
-364.375000000 kHz
1 PK
MAXH
D1 85.4 dBµV
PS
3DB
AC
Center 2.48 GHz
500 kHz/
Span 5 MHz

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.

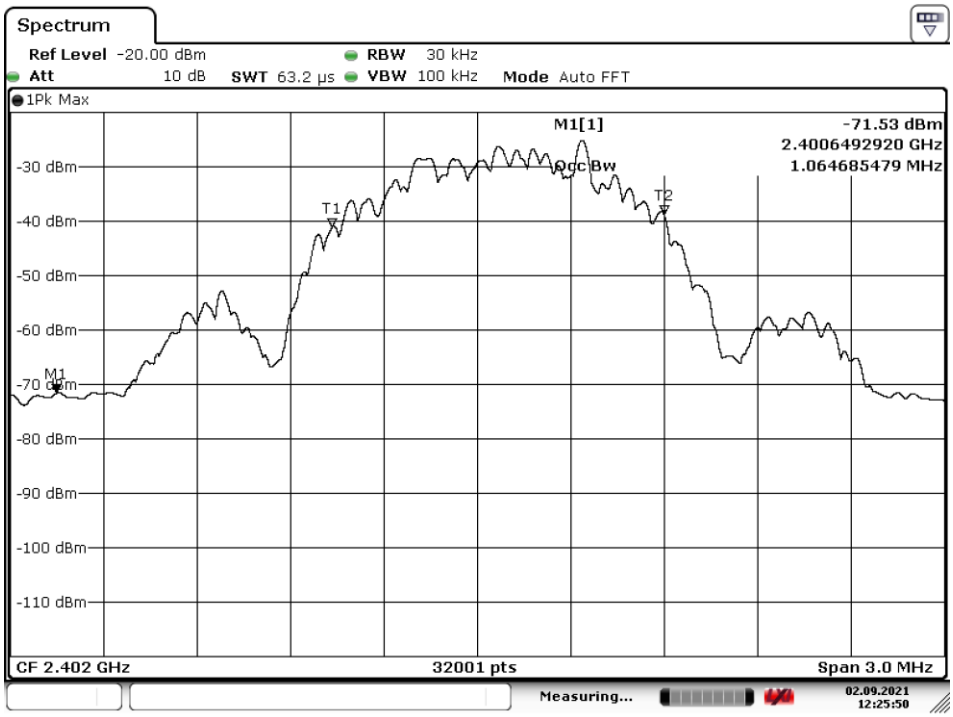
1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW ≥ 3x RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until 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 (kHz)
Proprietary	37	2402	1 Mbps	1064.7
	39	2480	1 Mbps	1086.0
Uncertainty	± 42 kHz			

3.3.6 Plots of the 99% occupied bandwidth measurement

Channel 37

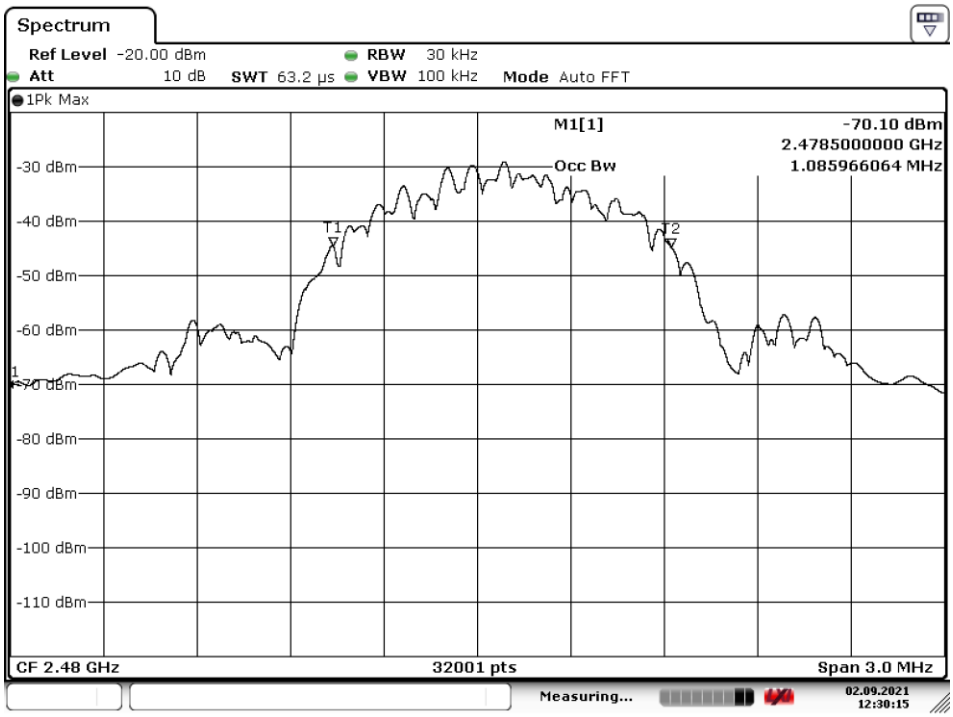


IEEE802_11b, channel: 7 : Measure RX Spurious Emission 1 - 1

2.5 GHz

Date: 2.SEP.2021 12:25:50

Channel 39



IEEE802_11b, channel: 7 : Measure RX Spurious Emission 1 - 1

2.5 GHz

Date: 2.SEP.2021 12:30:14

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)
Proprietary	37	2402	1 Mbps	5.3
	17	2440	1 Mbps	5.3
	39	2480	1 Mbps	8.3
Uncertainty	+/- 5.7 dB			

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/10 kHz)
Proprietary	37	2402	1 Mbps	0.4
	17	2440	1 Mbps	-0.4
	39	2480	1 Mbps	3.7
Uncertainty	+/-5.7 dB			

3.5.6 Plots of the Power Spectral Density measurement

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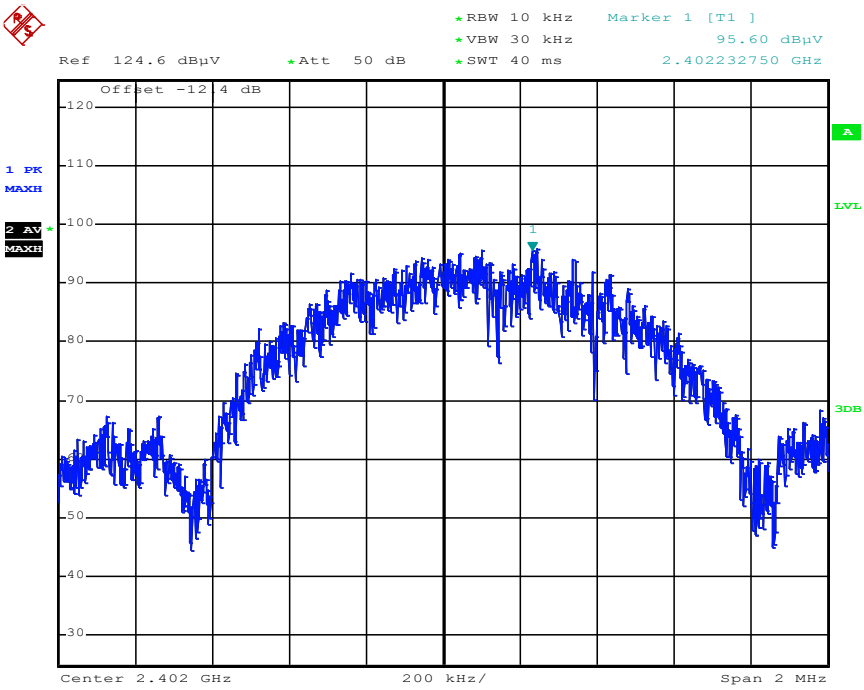

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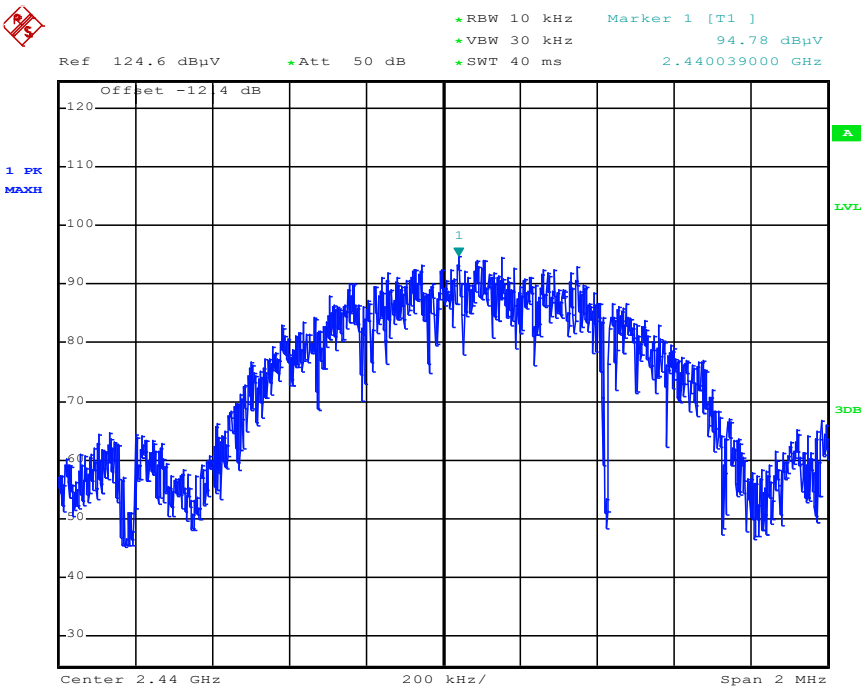

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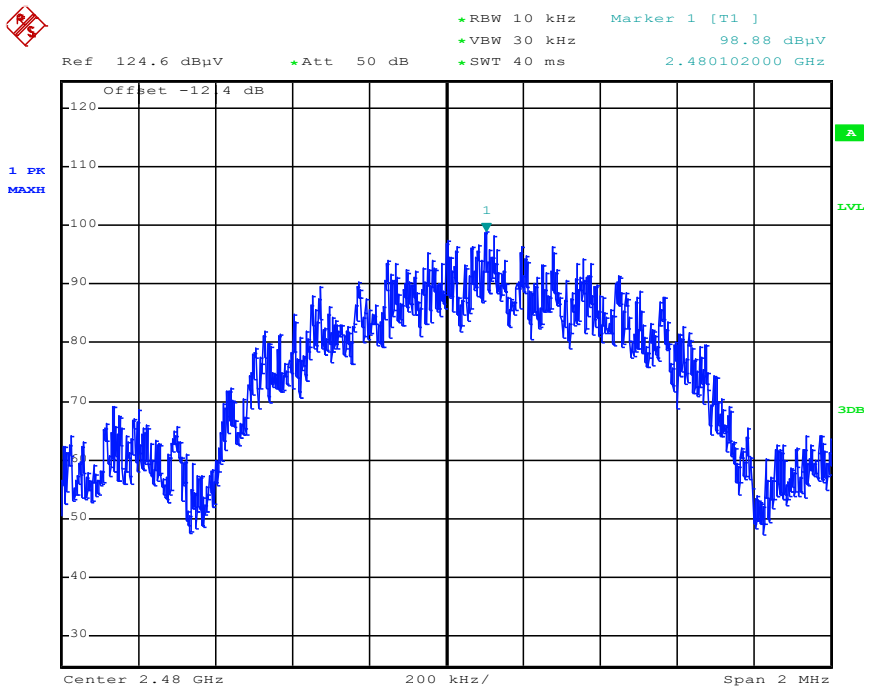
RBW 10 kHz
VBW 30 kHz
SWT 40 ms
Marker 1 [T1]
98.88 dBµV
2.480102000 GHz
Ref 124.6 dBµV
Att 50 dB
Offset -12.4 dB
1 PK
MAXH
A
LVL
3DB
Center 2.48 GHz
200 kHz/
Span 2 MHz

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