

RADIO TEST REPORT

No. 1516318STO-001, Ed. 3

RF Performance

EQUIPMENT UNDER TEST

Equipment: ZigBee radio module
Type/Model: ICC-1
Manufacturer: IKEA of Sweden AB
Tested by request of: IKEA of Sweden AB

SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

47 CFR Part 15 (2014): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2014): Subpart B: Unintentional radiators

RSS-GEN Issue 4 (2014): General requirements of compliance of radio apparatus (2014)

RSS-247 Issue 1 (2015): Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

For details, see clause 2 – 4.

Date of issue: 2016-04-15

Tested by:


Kajsa From

Approved by:


Matti Virkki

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Revision History

Edition	Date	Description	Changes
1	2015-10-09	First release	
2	2015-10-23	Second release	Section 2.2 FCC ID and IC ID added. Manufacturer company corrected.
3	2016-04-15	Third release	IC ID corrected in Section 2.2. Test setup is specified for conducted tests in sections 7.1, 8.1, 9.1, 10.1 and 11.1. Section 2.4 Peripheral equipment is added.

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1 CLIENT INFORMATION

The EUT has been tested by request of

Company: IKEA of Sweden AB
Box 702
343 81 Älmhult
Sweden

Name of contact: Ulf Axelsson
Phone +46 476 585 971

2 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment: ZigBee radio module
Type/Model: ICC-1
Brand name: IKEA
EUT number: B18 / A13
Manufacturer: IKEA of Sweden AB
Transmitter frequency range: 2405 – 2480 MHz
Receiver frequency range: 2405 – 2480 MHz

Frequency agile or hopping: ☐ Yes ☒ No
Antenna: ☒ Internal antenna ☐ External antenna
Antenna connector: ☒ None, internal antenna ☐ Yes,
Antenna gain: -2.5 dBi
Rating RF output power: 14 dBm (to antenna)
Type of modulation: OQPSK
Temperature range: ☐ Category I (General): -20°C to +55°C
☐ Category II (Portable equipment): -10°C to +55°C
☐ Category III (Equipment for normal indoor use): +5°C to +35°C
☒ Other: -40°C to +125°C
Transmitter stand by mode supported: ☒ Yes ☐ No

2.2 FCC ID and IC ID

FCC ID: FHO-ICC-1
IC ID: 10912A-ICC1

2.3 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	EUT number	Comment
ZigBee module	ICC-1	B18	Internal antenna
ZigBee module	ICC-1	A13	SMA connector

2.4 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type / Model	Manufacturer	Inv. no.	Note
Power supply	NGSM 32/10	Rohde & Schwarz	40021	Used to power EUT during conducted tests
Power supply	B202	Oltronix	6655	Used to power EUT during radiated tests

2.5 Test signals and operation modes

Continuous signal with OQPSK modulation is used.

Duty cycle measurement are made with EUT transmitting with maximum duty cycle available in test software, which means a ZigBee stream of packets with 127 bytes payload and an inter packet delay of approximately 16 ms.

2.6 Modifications made to improve EMC-characteristics

The following modifications were required to obtain the results presented in this report:

Output power on the highest channel is reduced.

Upper band edge measurement, conducted output power on highest channel and field strength of first harmonic on upper channel are measured after the output power reduction.

3 TEST SPECIFICATIONS

3.1 Standards

Requirements:

47 CFR Part 15 (2014): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2014): Subpart B: Unintentional radiators.

RSS-GEN Issue 4 (2014): General requirements of compliance of radio apparatus (2014).

RSS-247 Issue 1 (2015): Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test methods:

ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.2 Additions, deviations and exclusions from standards and accreditation

RSS-GEN Issue 4 (2014) and RSS-247 Issue 1 (2015) are not within Intertek's scope of accreditation.

No other additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
P.O. Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913

Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002

Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
5 m CHAMBER	Semi-anechoic 5 m	2042G-3

4 TEST SUMMARY

The results in this report apply only to sample tested:

Requirement	Description	Result
FCC §15.203 RSS-GEN, section 8.3	Antenna requirement The EUT has integrated non detachable antenna which can't be remove without breaking the EUT.	PASS
FCC §15.207 RSS-GEN, section 8.8 table 3	Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port Battery operated equipment.	NA
FCC §15.247 (b)(4) RSS-247 5.4(4), 5.4(5)	Field strength of fundamental and antenna gain The EUT complies with the limits. Antenna gain is less than 6 dBi.	PASS
FCC §15.247 (d), 15.209(a) RSS-GEN 8.9 RSS-247 5.5	Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz The EUT complies with the limits. The margin to the limit was at least 14 dB. See clause 6.4.	PASS
FCC §15.247(d), 15.209(a) RSS-GEN 8.9 RSS-247 5.5	Radiated emission of electromagnetic fields in the frequency range above 1 GHz The EUT complies with the limits. The margin to the limit was at least 9.0 dB at 4889.0 MHz. See clause 6.5	PASS
FCC §15.247(a)(2) RSS-GEN, section 6.6 RSS-247 5.2(1)	Occupied bandwidth The EUT complies with the limits. The margin to the limit is at least 1.14 MHz See clause 8.4.	PASS
FCC §15.247(b) RSS-247 5.4(4)	Conducted output power The EUT complies with the limits. The margin to the limit was at least 16.9 dB dB at 2445 MHz. See clause 7.4.	PASS
FCC §15.247(e) RSS-247 5.2(2)	Peak power spectral density The EUT complies with the limits. The margin to the limit was at least 10.3 dB at 2445.4 MHz See clause 10.4.	PASS
FCC §15.247(e) RSS-210 A8.5	Band edge The EUT complies with the limits. The margin to the limit was at least 1.6 dB at 2483.5 MHz The measured result is below the upper limit, but by a margin less than half of the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance.	PASS

5 FIELD STRENGTH OF FUNDAMENTAL AND RADIATED BAND EDGE

Date of test:	2015-09-14	Test location:	5 m chamber
EUT number:	B18	Ambient temp:	21 °C
Tested by:	Kajsa From / Robert Hietala	Relative humidity:	59 %
Test result:	Pass	Margin:	1.6 dB

5.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10. Marker-delta method is used to determine the upper band edge level.

The EUT was set up in order to emit maximum disturbances.

The EUT was placed on an insulating support 1.5 m above the turntable which is part of the reference ground plane.

EUT was evaluated in three orthogonal orientations.

5.2 Test conditions

Test receiver set-up:

Preview test:	Peak,	RBW 1 MHz	VBW 3 MHz
Final test:	Peak,	RBW 1 MHz/100kHz	
	Average	Peak value + 20 x LOG (Duty cycle)	

Measuring distance: 3 m

Measuring angle: 0 – 359°

Antenna

Height above ground plane: 1 – 4 m

Polarisation: Vertical and Horizontal

Type: Horn

Antenna tilt: Activated

5.3 Requirement

Outside the restricted bands:

Reference: CFR 47 §15.247(d), RSS-247 5.5,

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

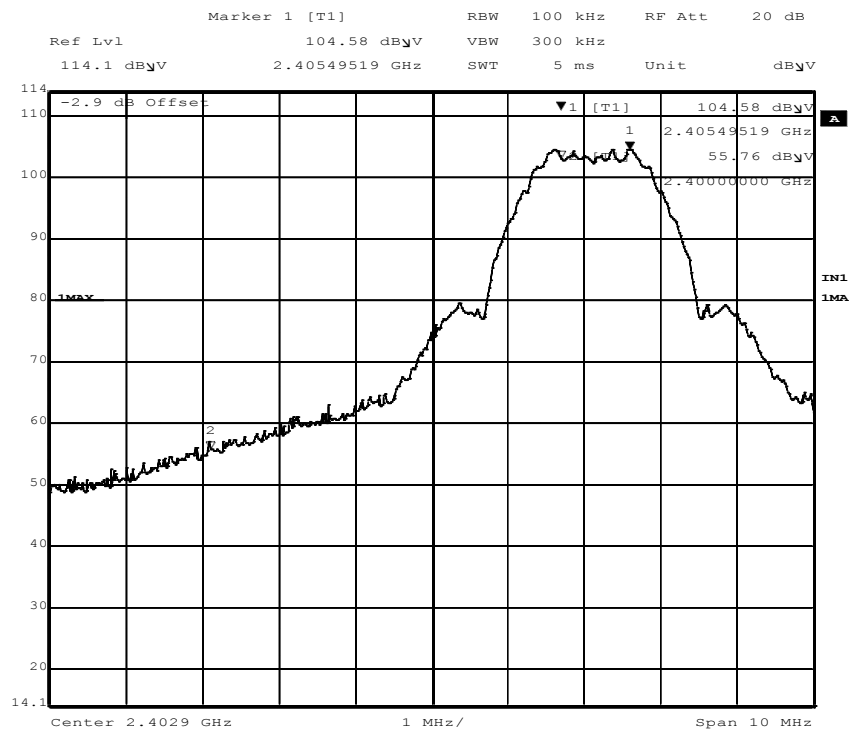
Within restricted bands:

Reference: CFR 47 §15.209, RSS-Gen section 8.9

Field strength of emissions must comply with limits shown in table below

Frequency range [MHz]	Field strength at 3 m (dBµV/m)	Detector (dBµV/m)
30 – 88	40.0	Quasi Peak
88 – 216	43.5	Quasi Peak
216 – 960	46.0	Quasi Peak
960 – 1000	54.0	Quasi Peak
Above 1000	54.0 / 74.0	Average / Peak

5.4 Test results

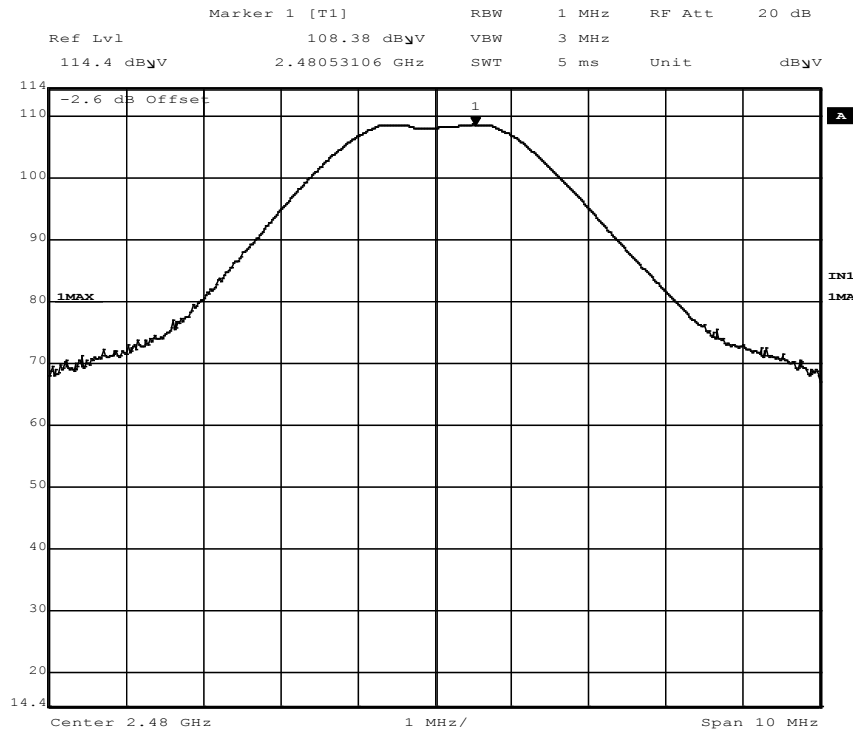


Date: 22.SEP.2015 14:01:50

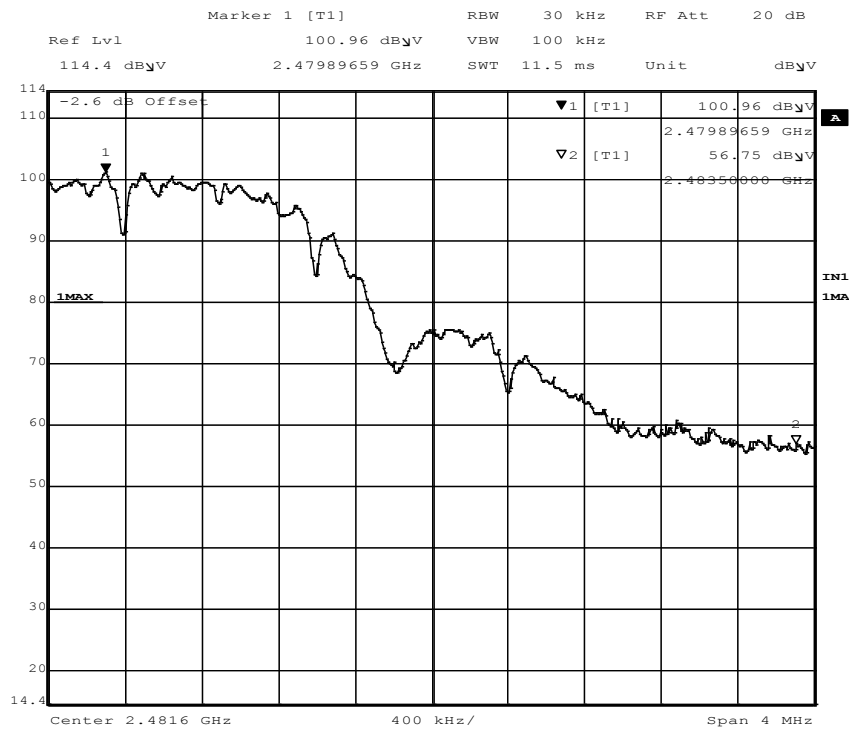
Screenshot: Lower band edge sweep

Field strength of fundamental and band edge, low channel

Frequency [MHz]	Level [dBμV/m]	Delta [dBc]	Limit [dBc]	Detector	EUT Orientation	Polarization H/V	Margin [dB]
2405.5	104.6	--	--	Peak	Z	H	--
2400.0	55.8	48.8	20.0	Peak	Z	H	28.8



Date: 22.SEP.2015 14:08:51

Screenshot: Upper band edge, fundamental emission

Date: 22.SEP.2015 14:13:45

Screenshot: Marker-delta measurement at upper band edge

Marker-delta measurement gives 44.2 dB attenuation.

Field strength of fundamental and band edge, high channel

Frequency [MHz]	Level [dB μ V/m]	Limit [dB μ V/m]	Detector	EUT Orientation	Polarization H/V	Margin [dB]
2480.5	108.4	--	Peak	Z	H	--
2483.5	64.2	74.0	Peak	Z	H	9.8
2480.5	96.6	--	Avg	Z	H	--
2483.5	52.4	54.0	Avg	Z	H	1.6*

* The measured result is below the upper limit, but by a margin less than half of the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance.

6 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHZ TO 26.5 GHZ

Date of test:	2015-09-15	Test location:	5 m chamber / Wireless chamber
EUT number:	B18	Ambient temp:	21 – 22 °C
Tested by:	Kajsa From / Robert Hietala	Relative humidity:	54 – 59 %
Test result:	Pass	Margin:	9.0 dB

6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10.

The EUT was set up in order to emit maximum disturbances.

The EUT was placed on an insulating support above the turntable which is part of the reference ground plane. For RX measurements above 1 GHz and TX measurements above 13 GHz preview sweeps were made in fully anechoic shielded chamber at 3 m distance and antenna and EUT on 1.3 m height. All other measurements are made with EUT on 1.5 m height for measurements above 1 GHz and 0.8 m height for measurements below 1 GHz.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated in the frequency-range 30 – 1000 MHz. Above 1 GHz additionally the average detector was activated.

EUT was evaluated in three orthogonal orientations.

6.2 Test conditions**Test set-up:****30 MHz to 1000 MHz**

Test receiver set-up:

Preview test: Peak, RBW 120 kHz. VBW 1 MHz

Final test: Quasi-Peak, RBW 120 kHz

EUT height above ground plane: 0.8 m

Measuring distance: 3 m

Measuring angle: 0 – 359°

Antenna

Height above ground plane: 1 – 4 m

Polarisation: Vertical and Horizontal

Type: Bilog

Test set-up:**1 GHz – 26.5 GHz**

Test receiver set-up:

Preview test: Peak, RBW 1 MHz. VBW 3 MHz

Average, RBW 1 MHz. VBW 3 MHz

Final test: Peak, RBW 1 MHz

Average Peak value + 20 x LOG (Duty cycle)

EUT height above ground plane: 1.5 m

Measuring distance: 3 m

Measuring angle: 0 – 359°

Antenna

Height above ground plane: 1 – 4 m

Polarisation: Vertical and Horizontal

Type: Horn

Antenna tilt: Activated

6.3 Radiated Emission requirements

Outside the restricted bands:

Reference: CFR 47§15.247(d), RSS-247 5.5,

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

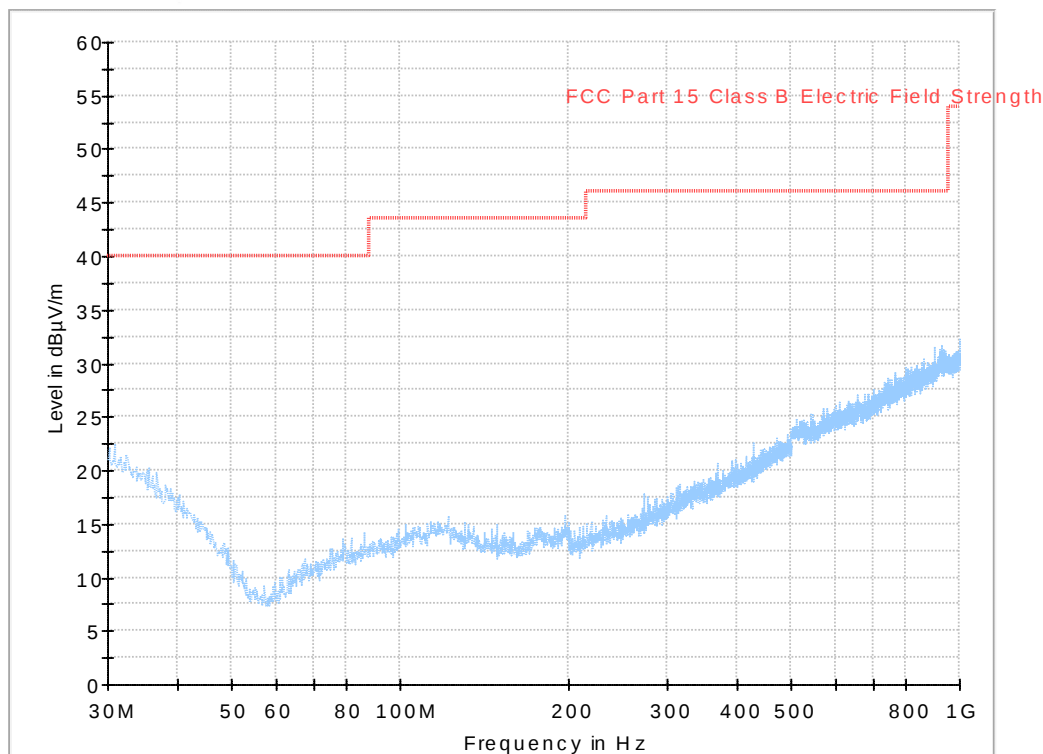
Within restricted bands:

Reference: CFR 47 §15.209, §15.109, RSS-Gen section 8.9

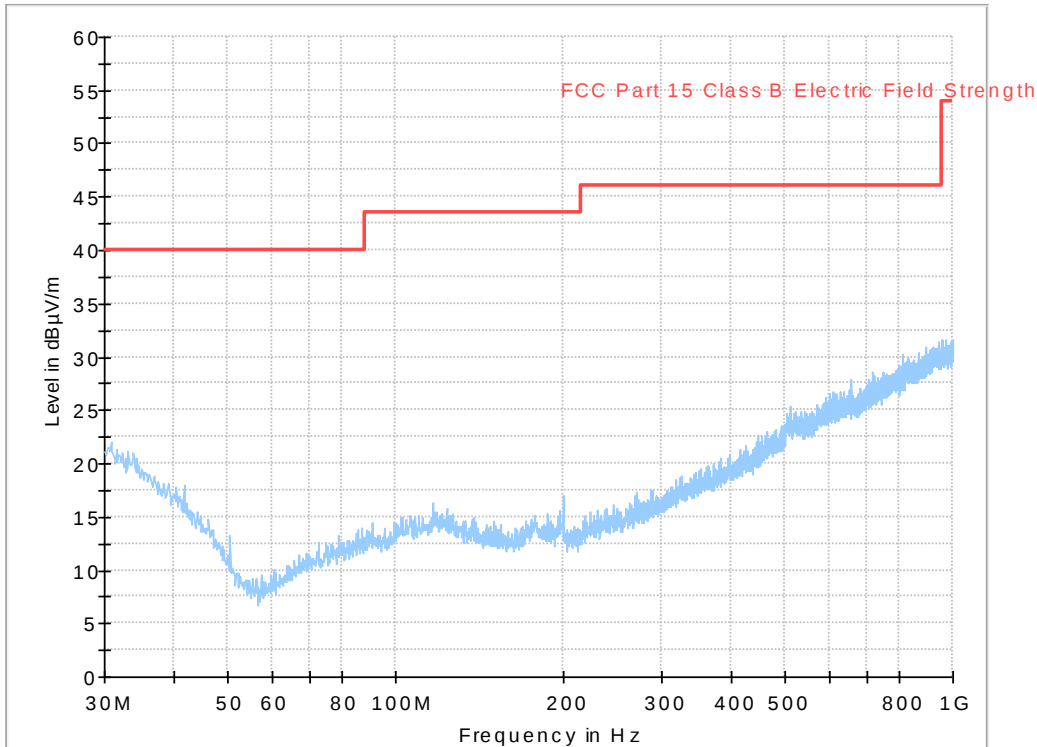
Field strength of emissions must comply with limits shown in table below

Frequency range [MHz]	Field strength at 3 m (dB μ V/m)	Detector (dB μ V/m)
30 – 88	40.0	Quasi Peak
88 – 216	43.5	Quasi Peak
216 – 960	46.0	Quasi Peak
960 – 1000	54.0	Quasi Peak
Above 1000	54.0 / 74.0	Average / Peak

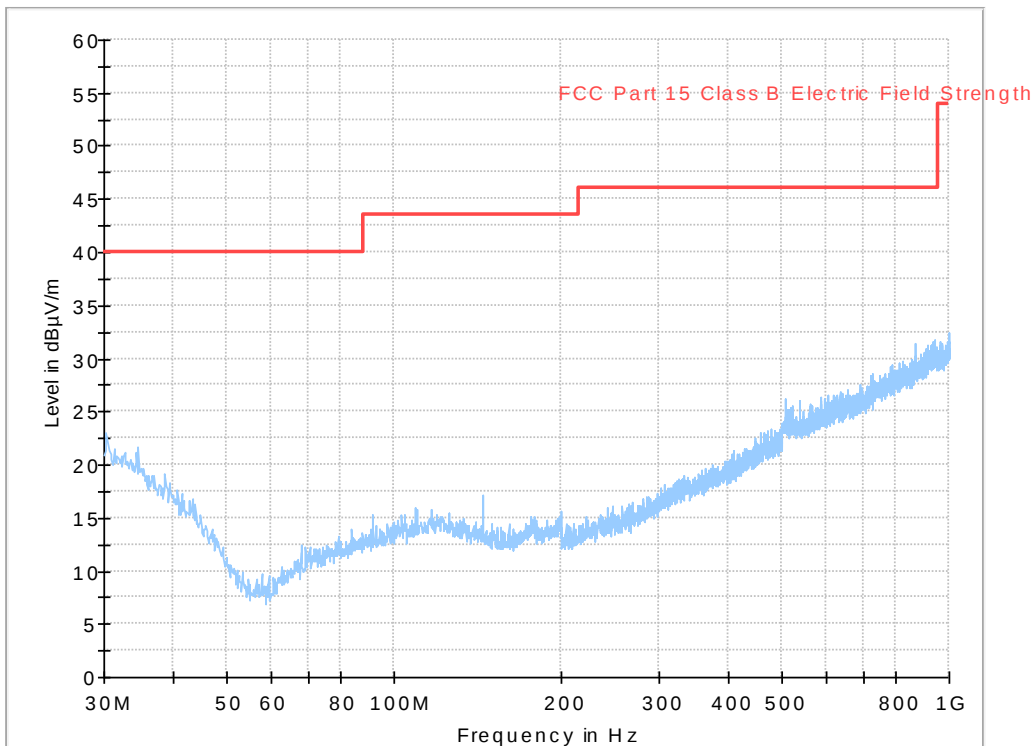
6.4 Test results 30 MHz – 1000 MHz



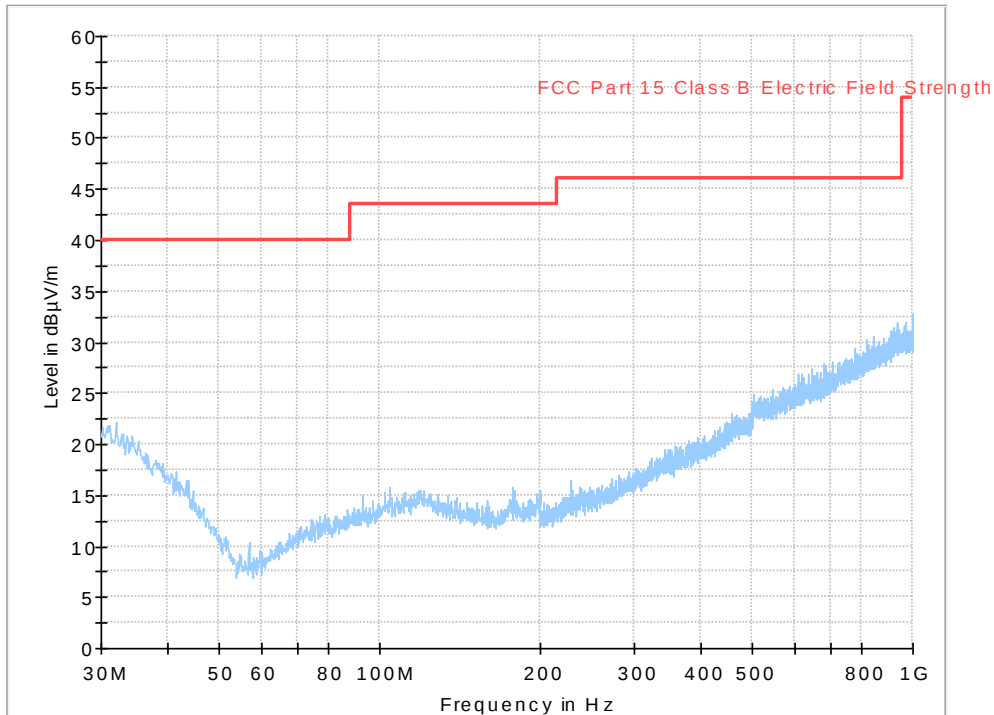
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX low channel, EUT orientation Z.



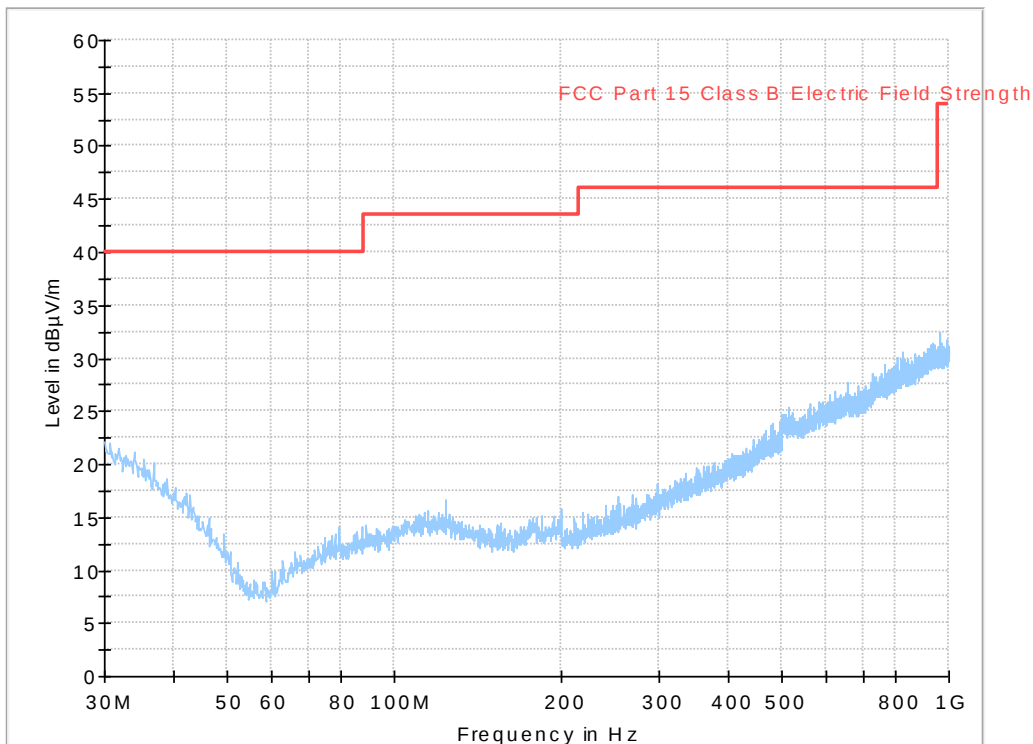
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX middle channel, EUT orientation Y.



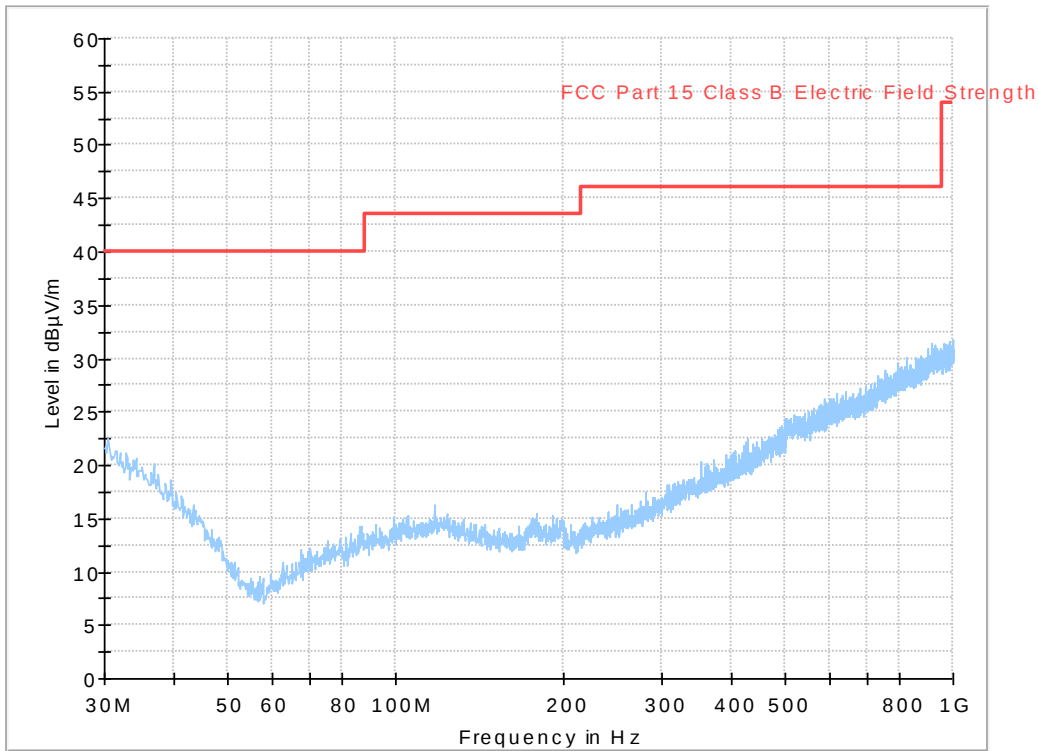
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX middle channel, EUT orientation Z.



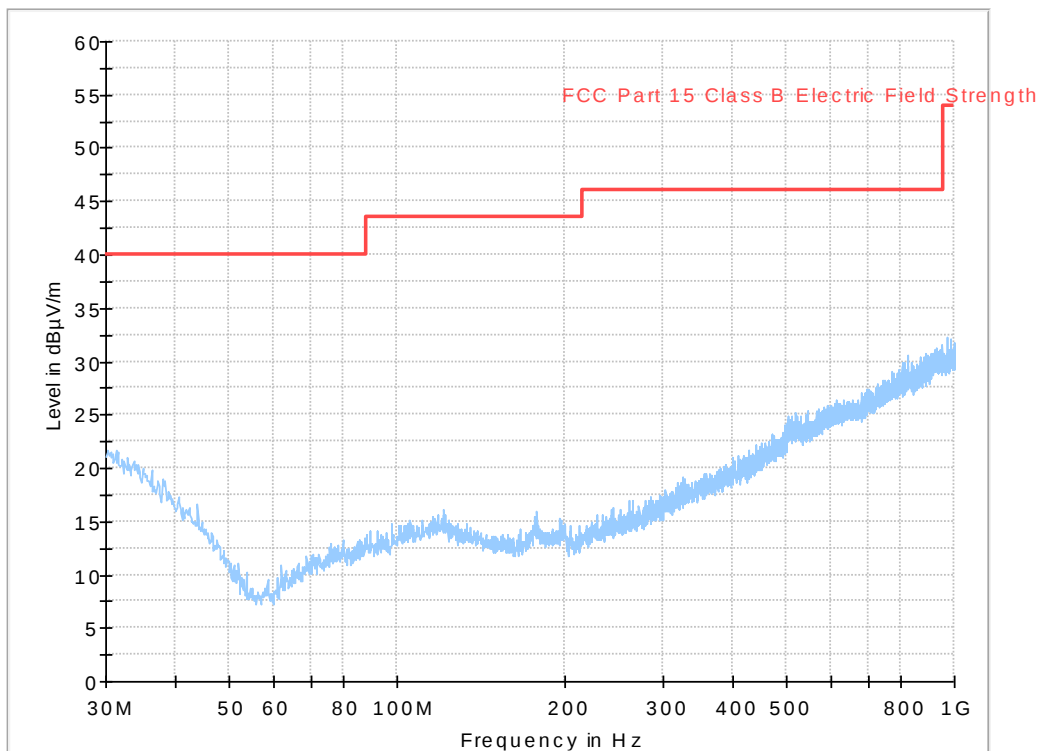
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX middle channel, EUT orientation X.



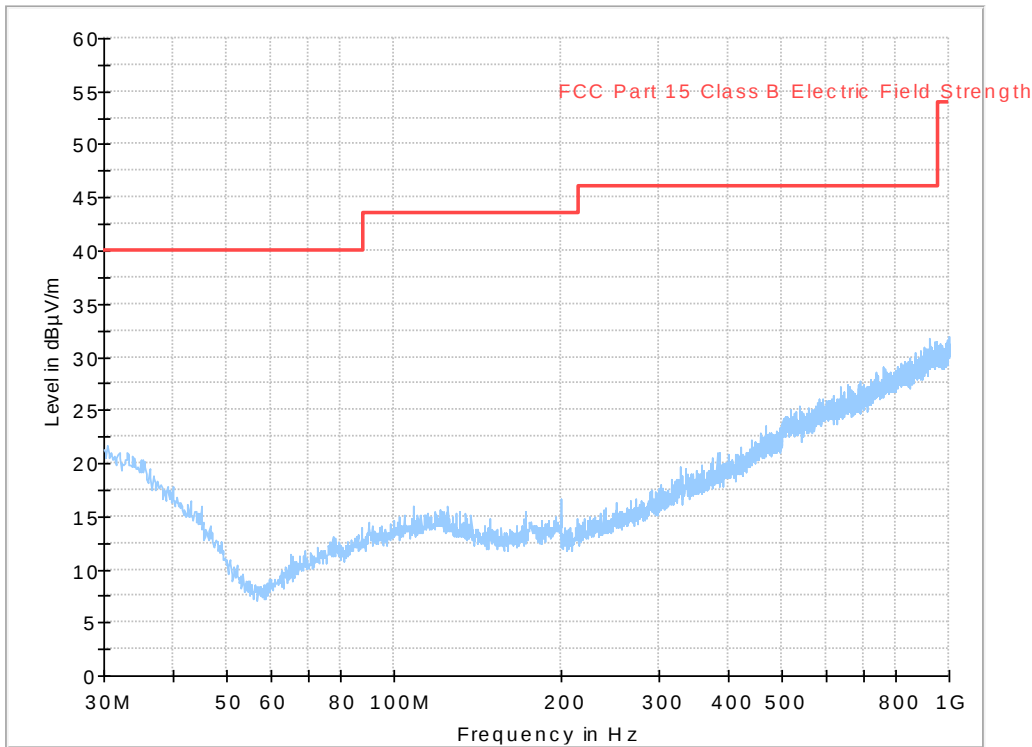
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX high channel, EUT orientation Z.



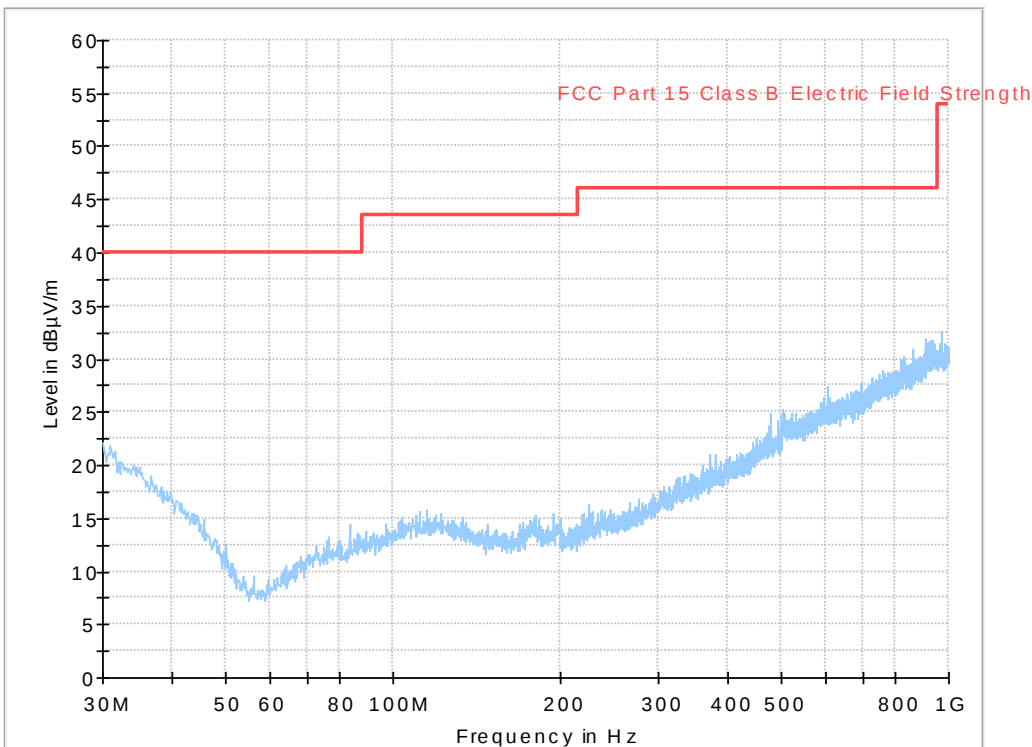
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX low channel, EUT orientation Z.



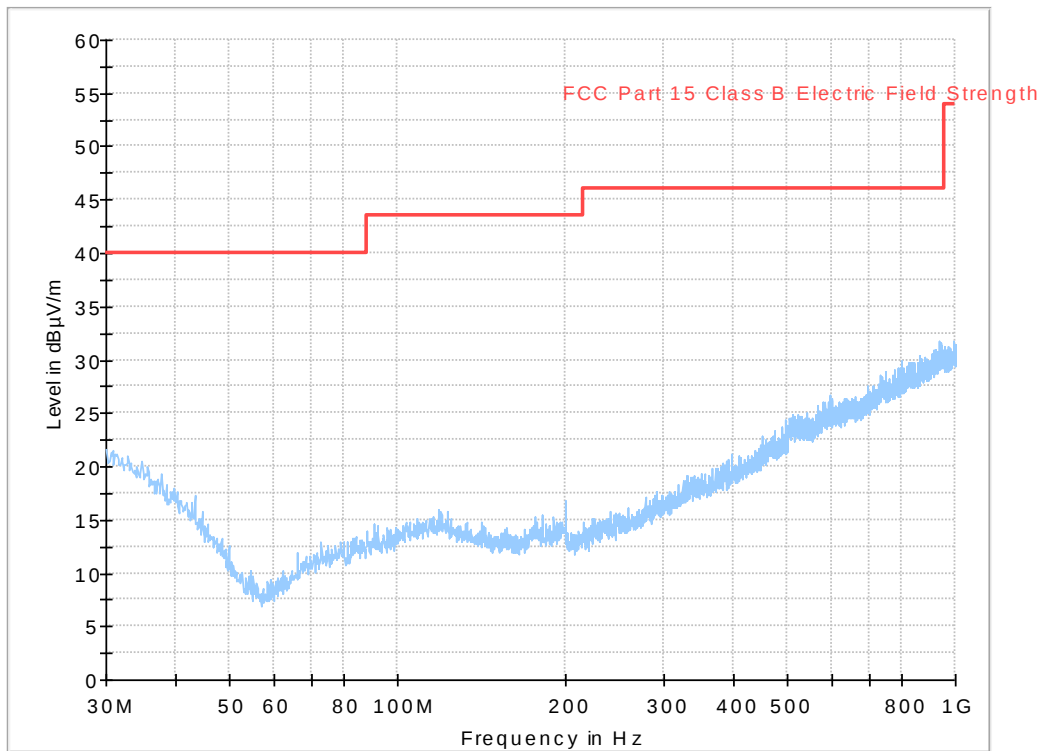
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX middle channel, EUT orientation Y.



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX middle channel, EUT orientation Z.



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX middle channel, EUT orientation X.



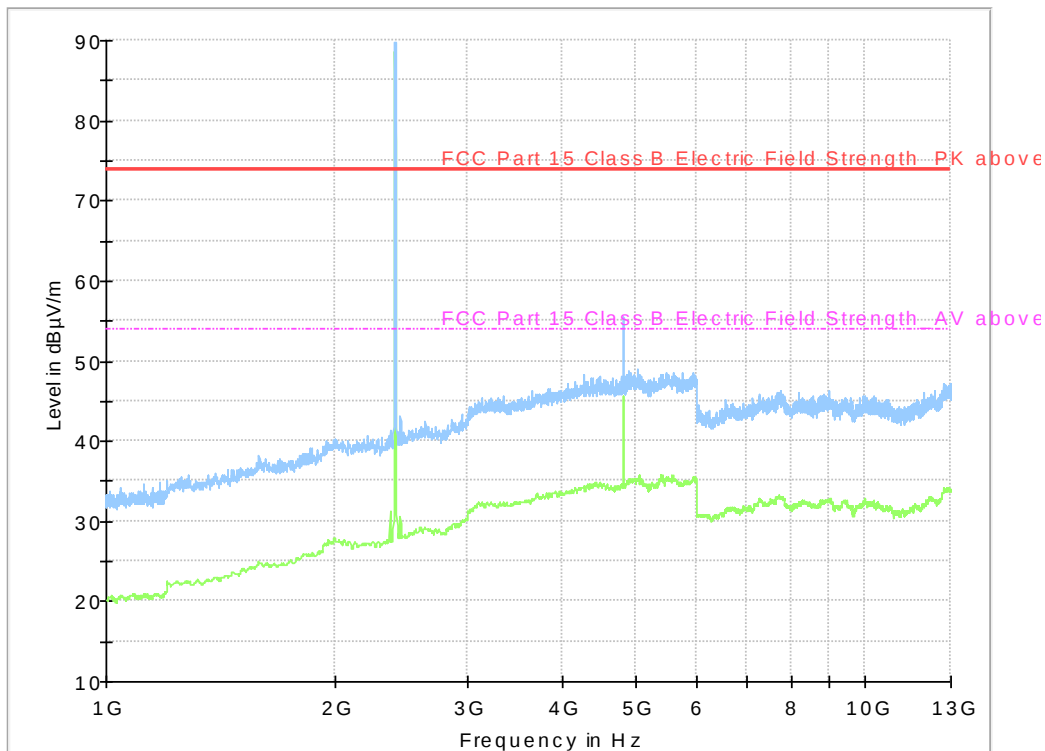
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX high channel, EUT orientation Z.

Measurement results, Quasi Peak

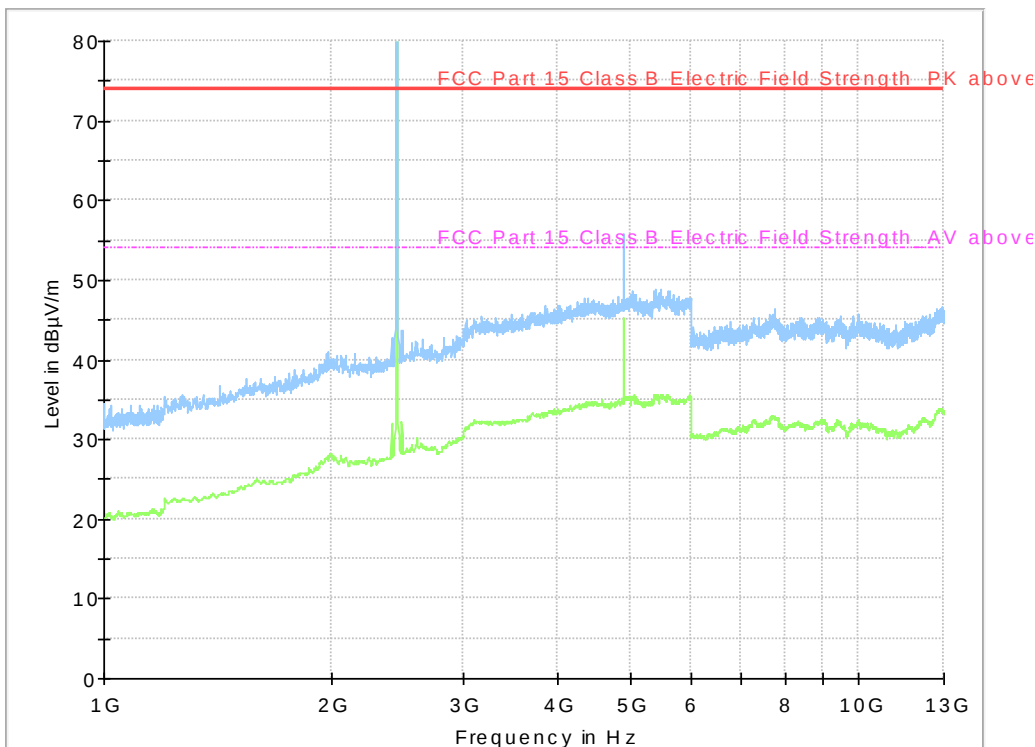
No emissions are found above noise floor or closer than 20 dB from limit. Margin to noise floor is at least 14 dB.

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

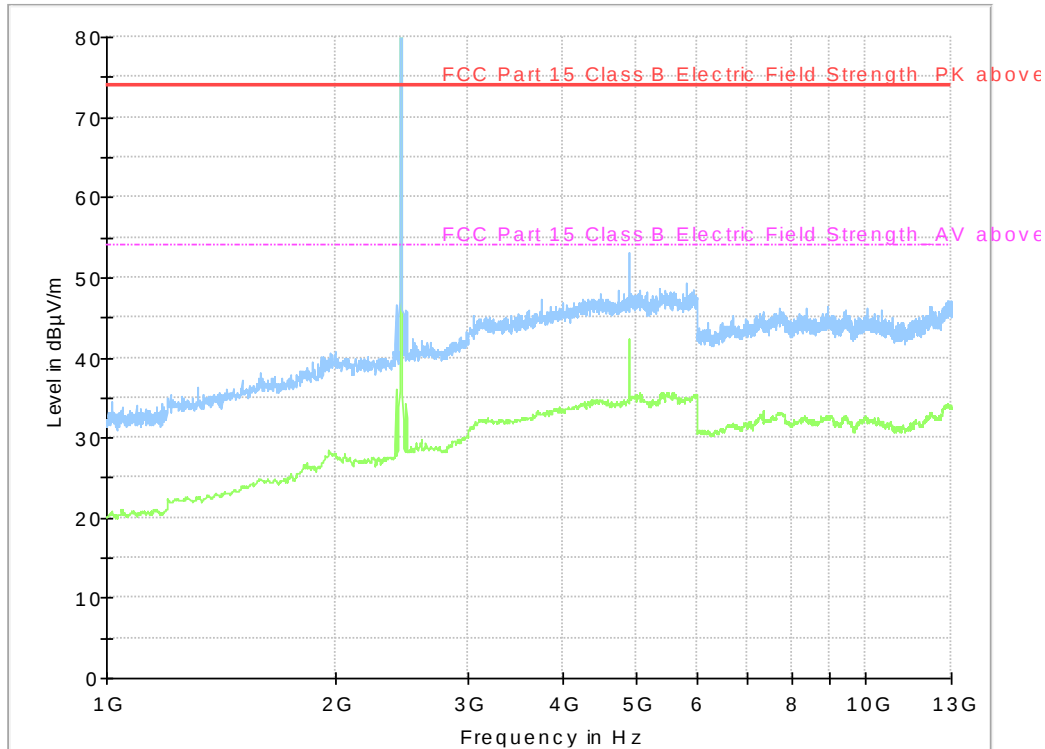
6.5 Test results 1 GHz – 26.5 GHz



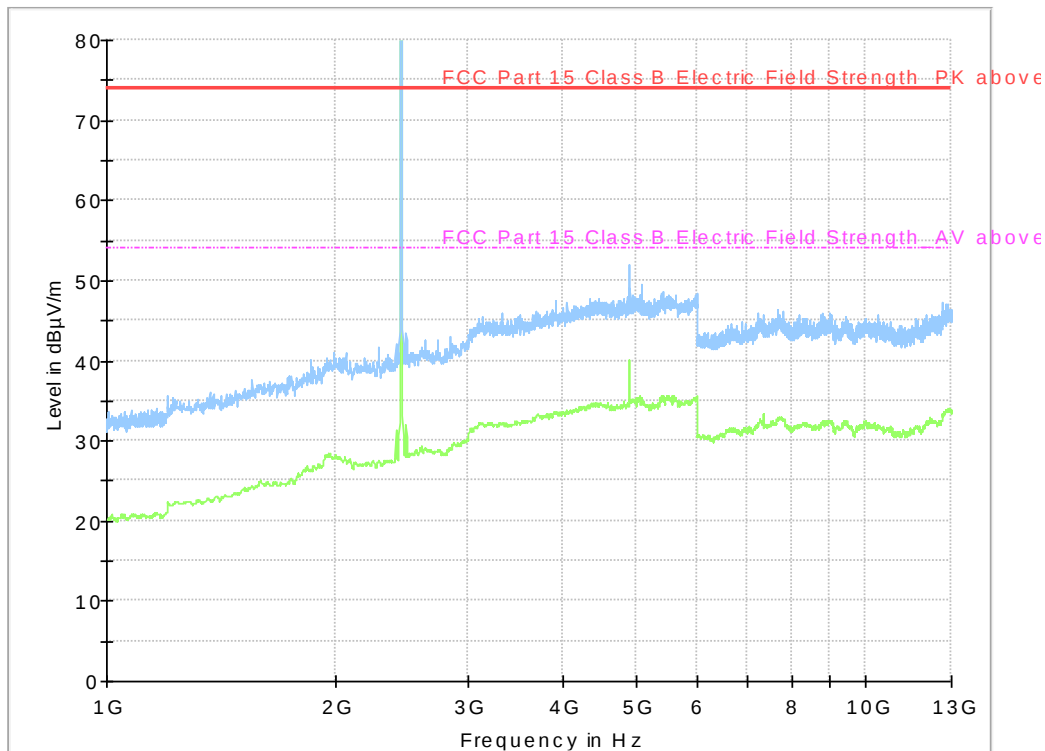
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. TX low channel, EUT orientation Y.



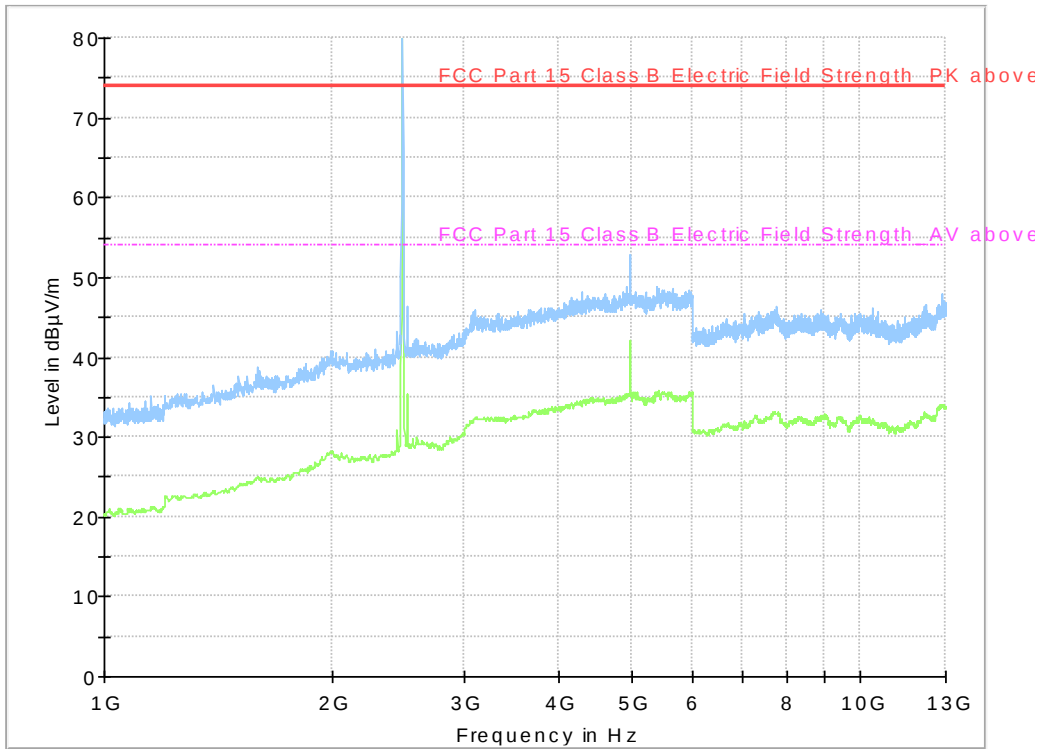
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. TX middle channel, EUT orientation Y.



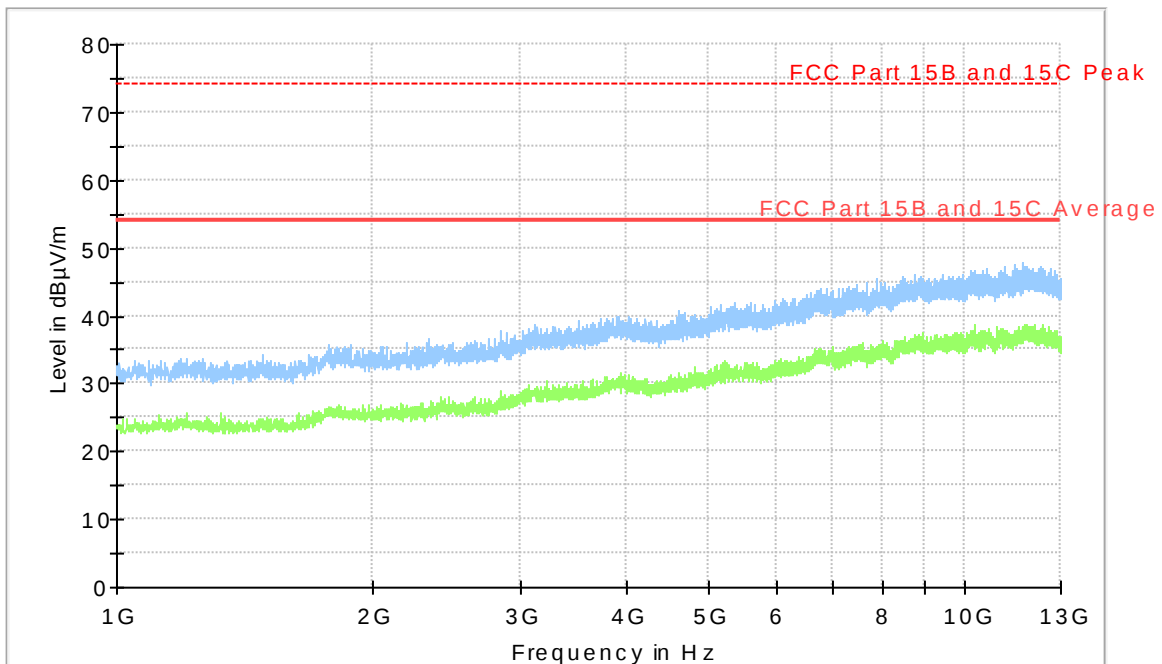
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. TX middle channel, EUT orientation Z.



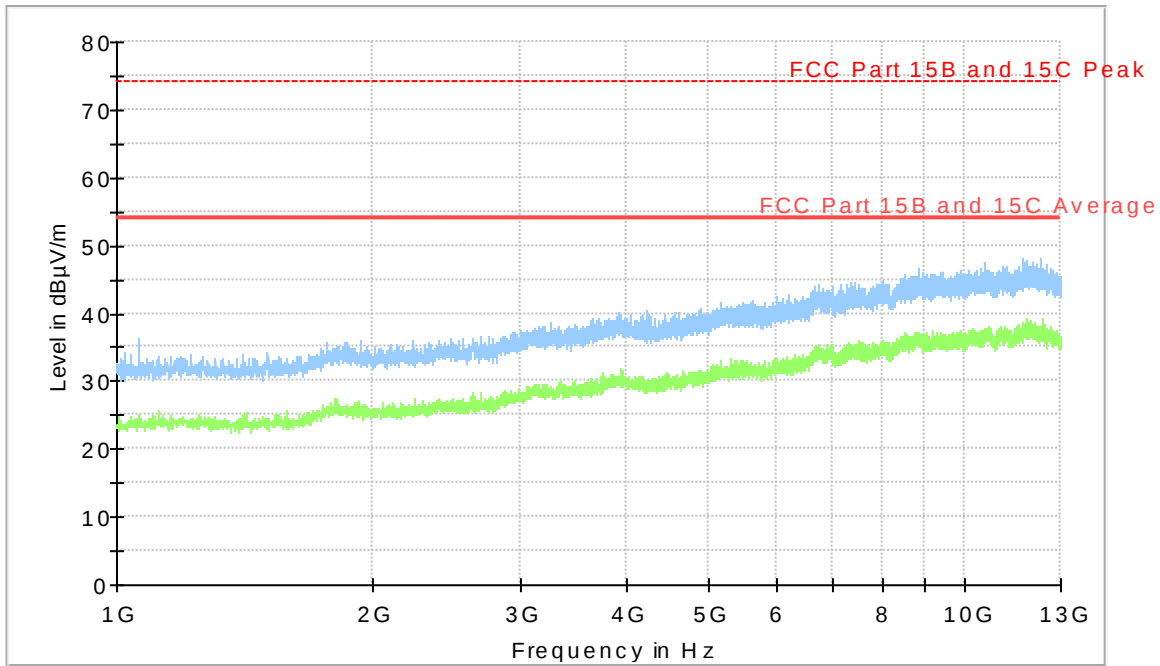
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. TX middle channel, EUT orientation X.



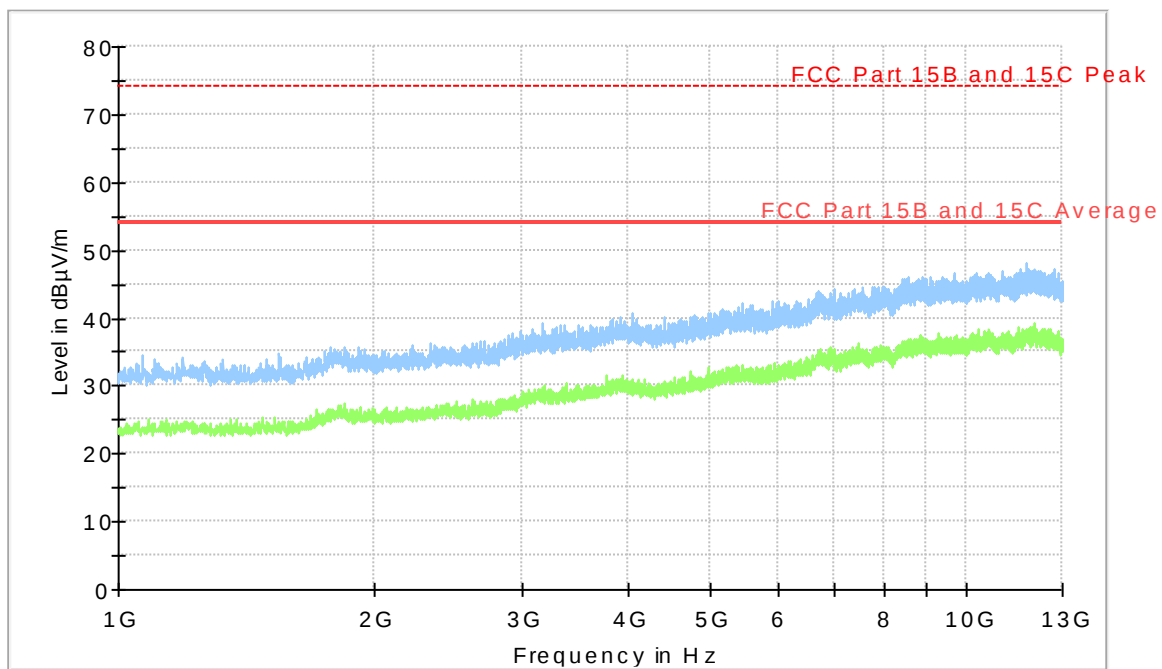
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. TX high channel, EUT orientation Y.



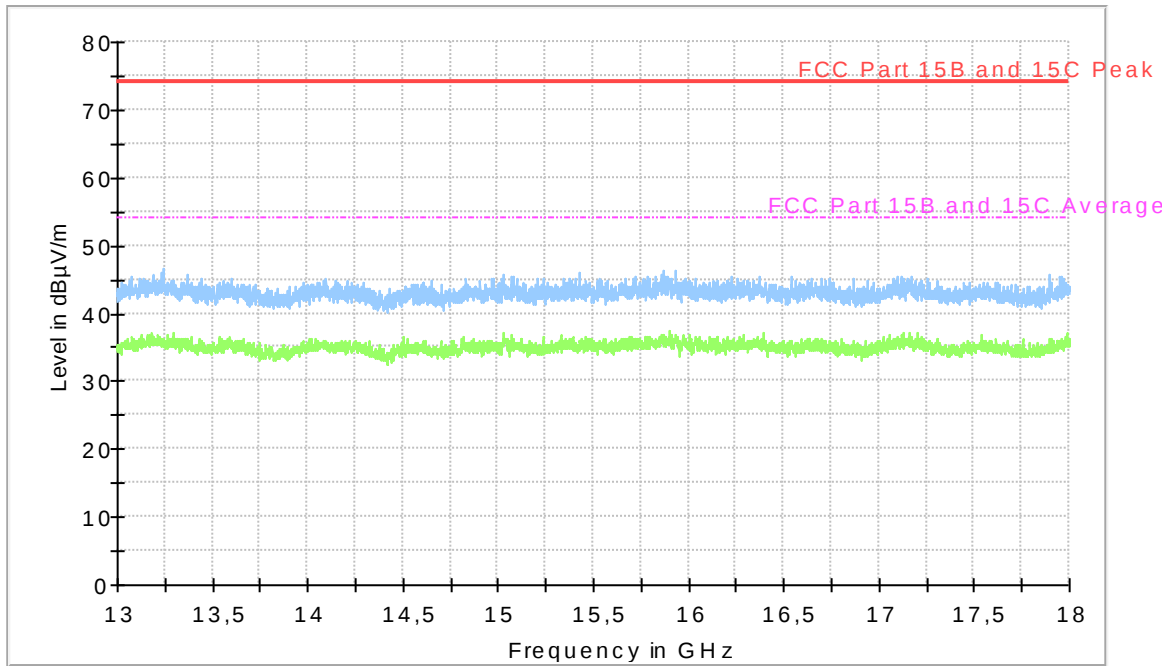
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. RX low channel, EUT orientation Y.



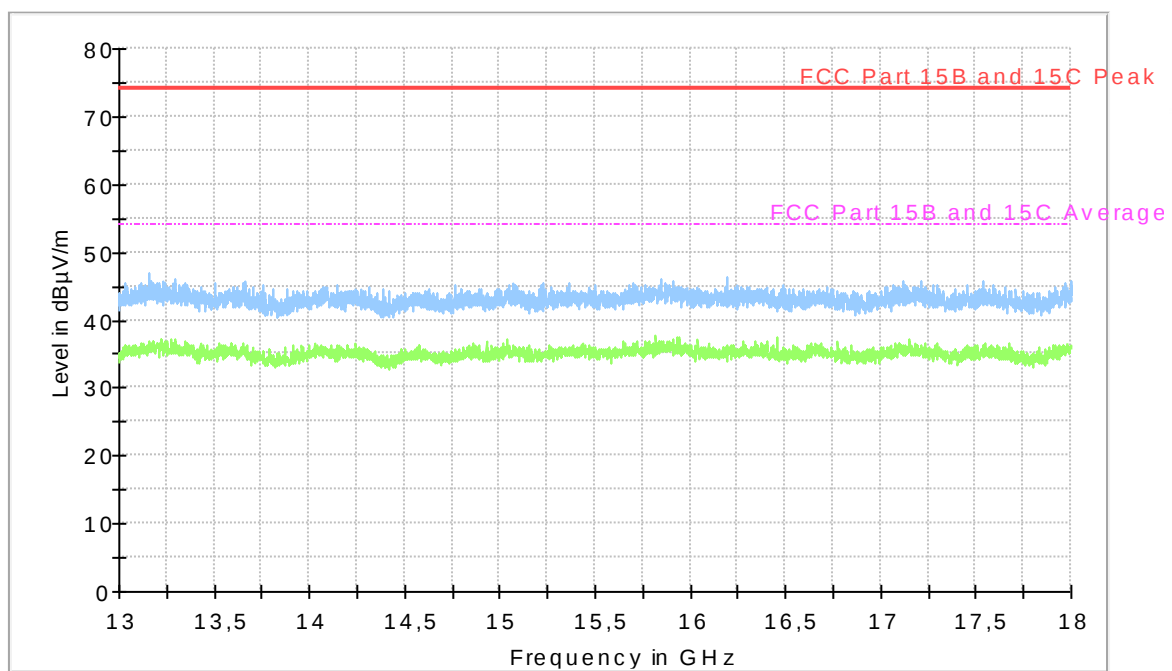
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. RX middle channel, EUT orientation Y.



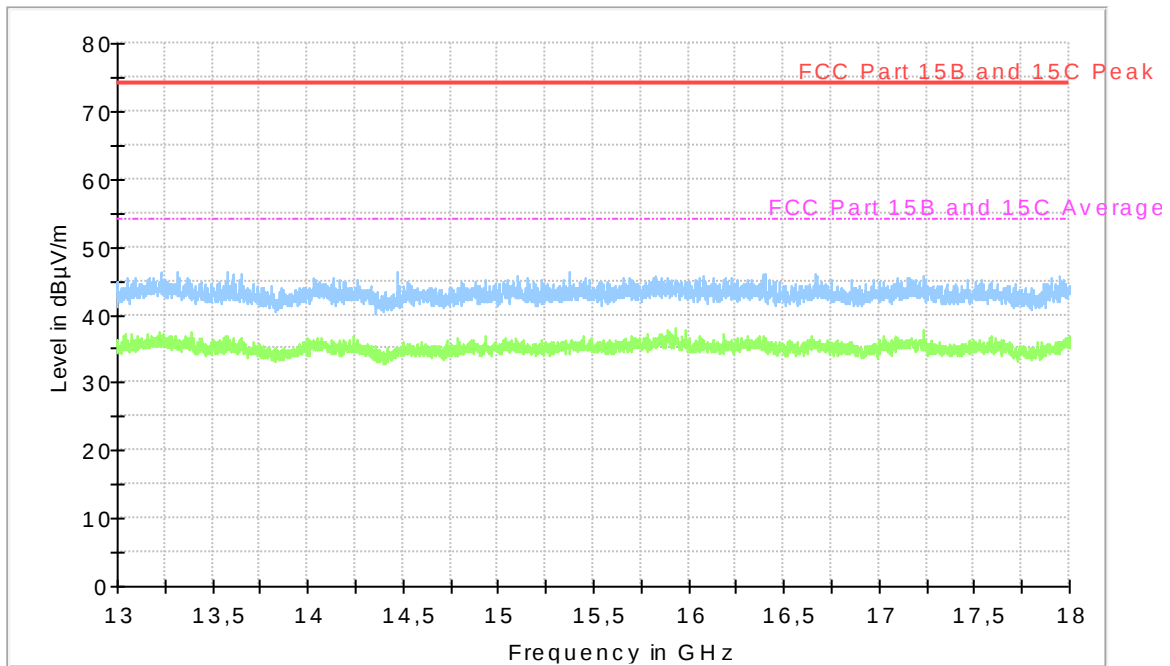
Diagram, Peak overview sweep, 1 – 13 GHz at 3 m distance. RX high channel, EUT orientation Y.



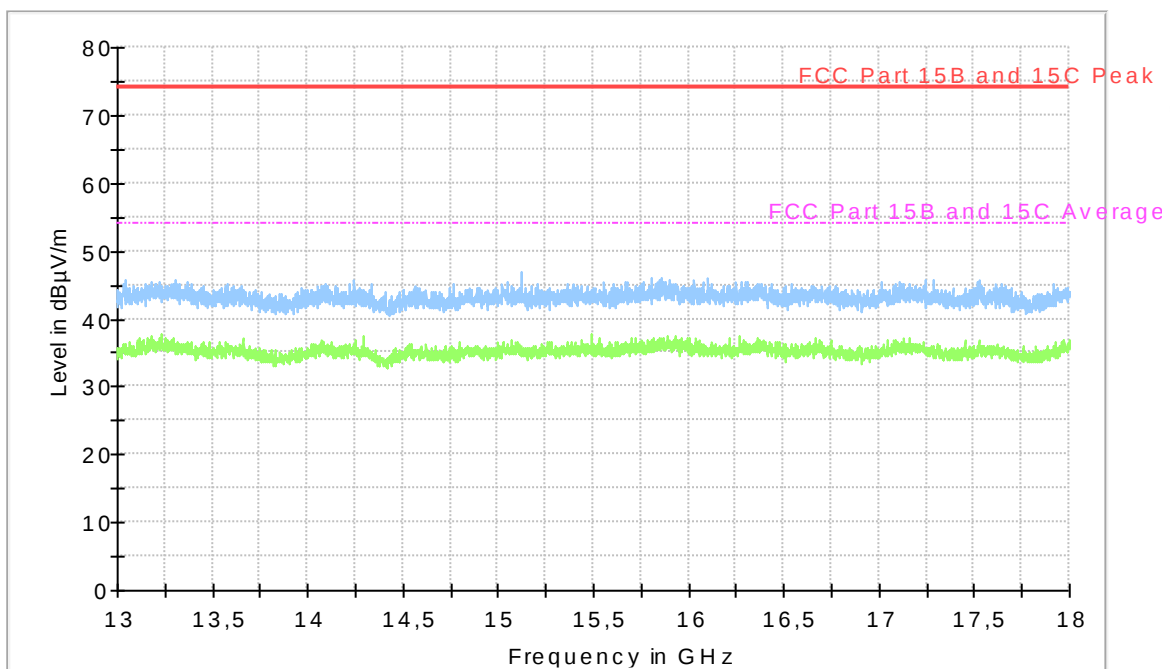
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX low channel, EUT orientation Y.



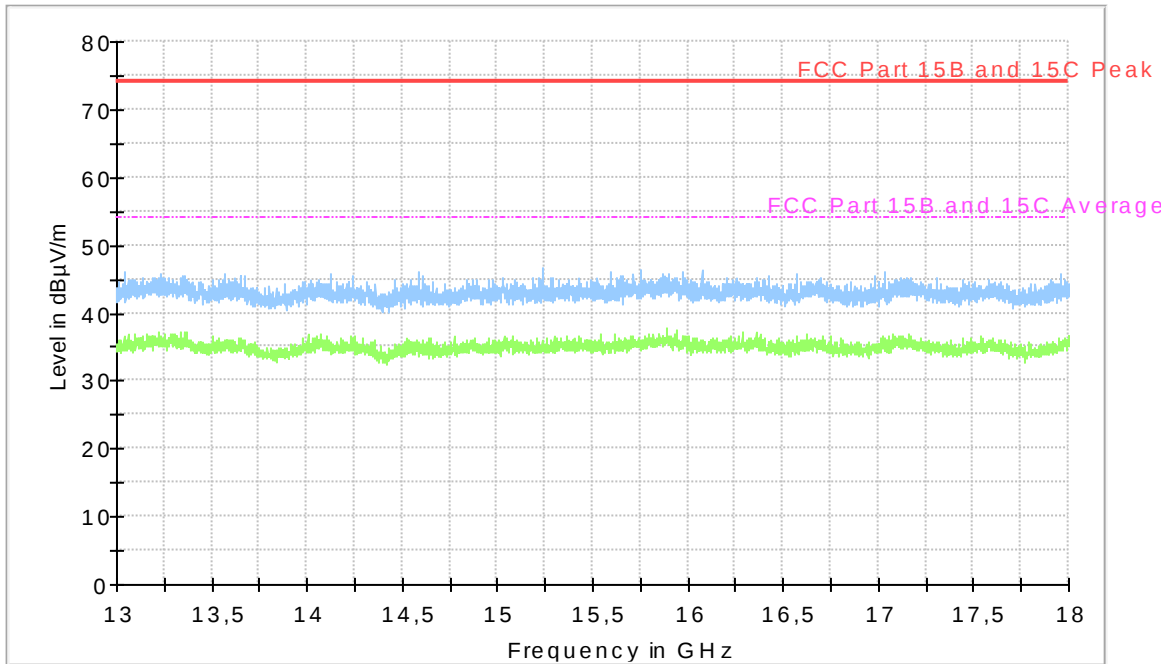
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX middle channel, EUT orientation Y.



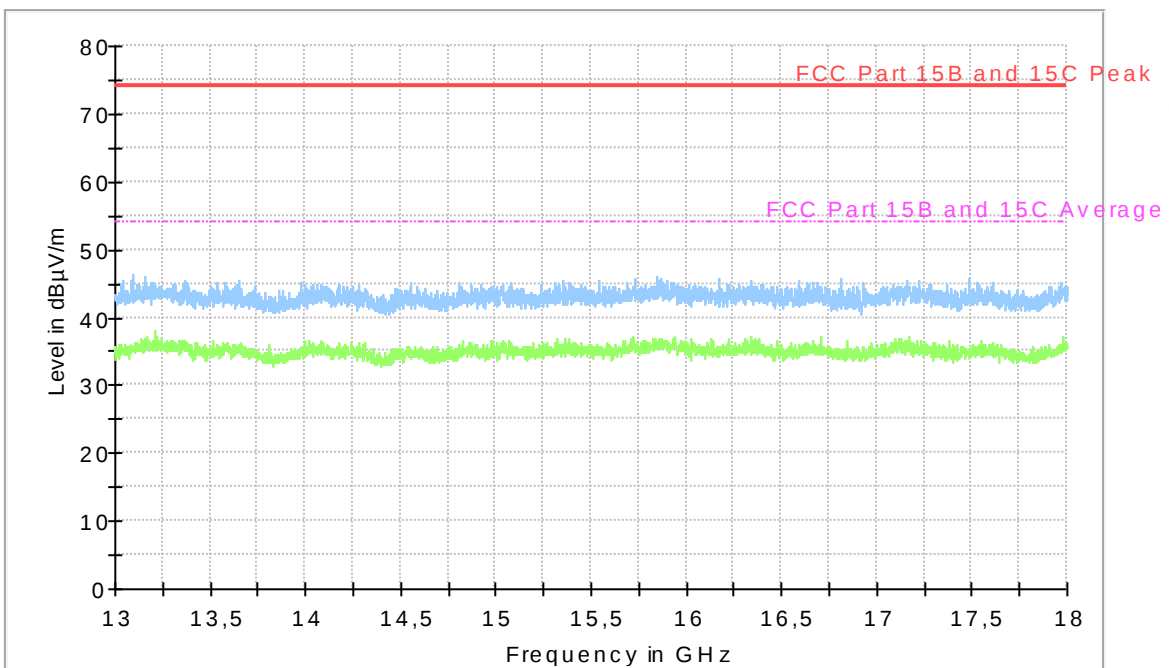
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX middle channel, EUT orientation Z.



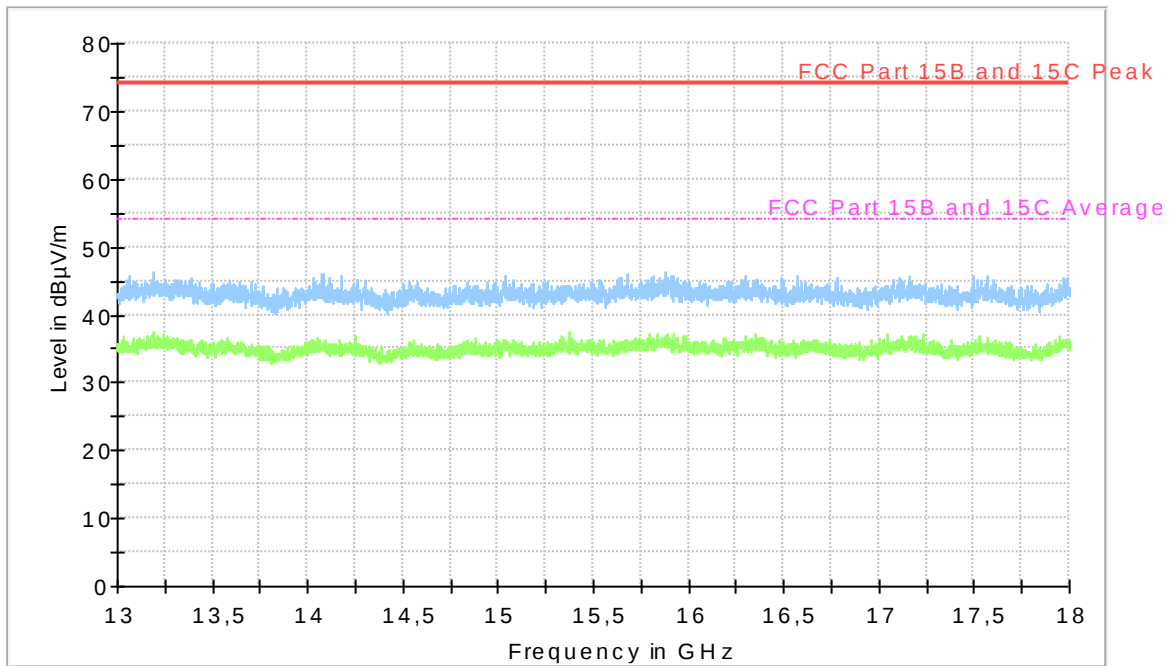
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX middle channel, EUT orientation X.



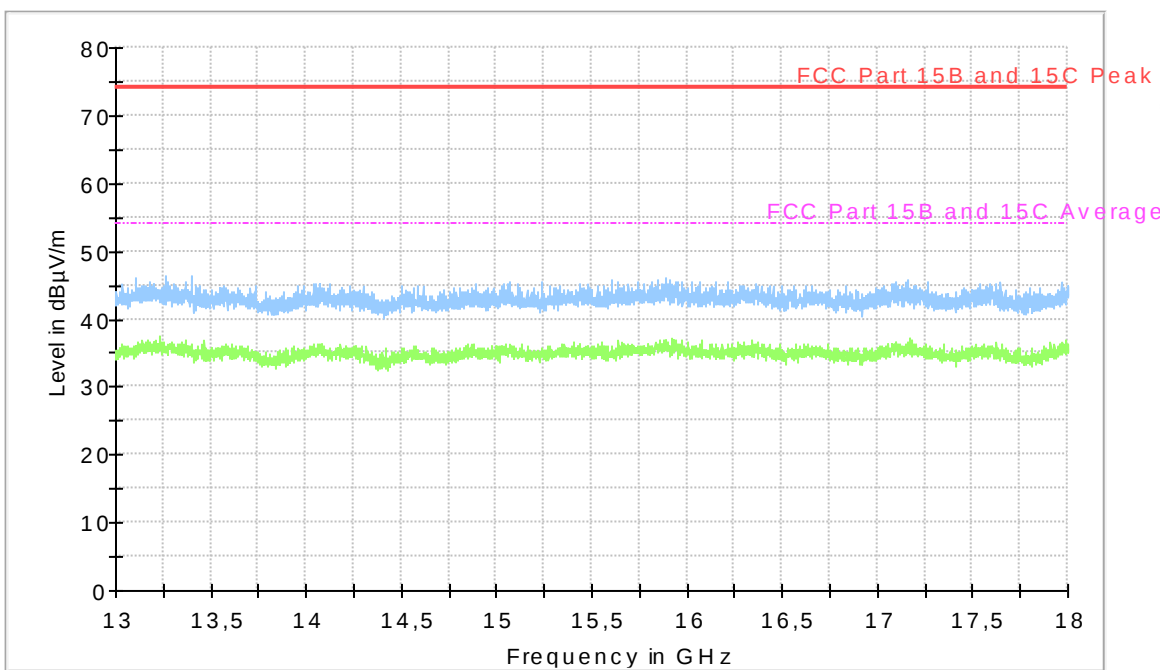
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX high channel, EUT orientation Y.



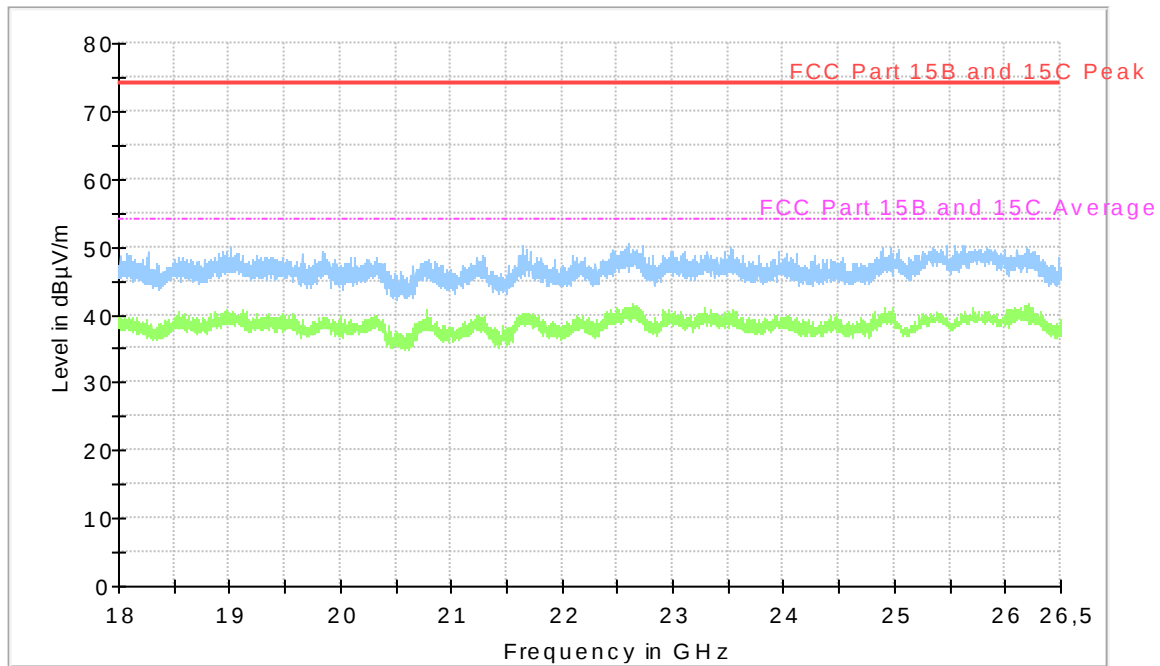
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. RX low channel, EUT orientation Y.



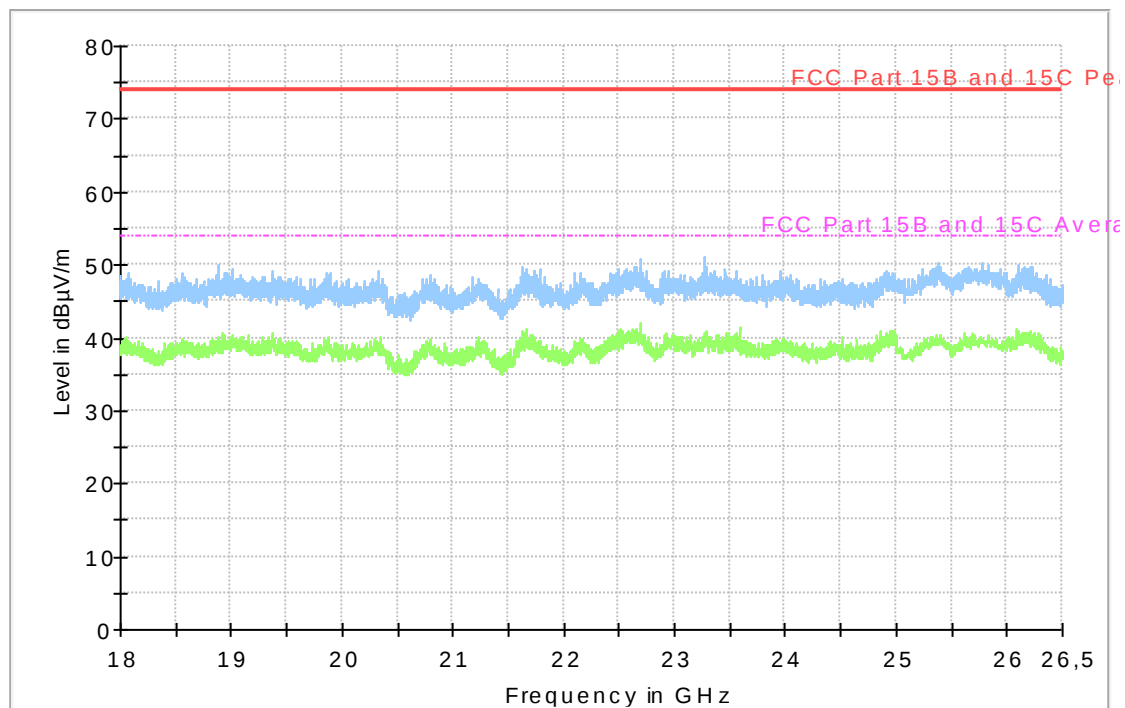
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. RX middle channel, EUT orientation Y.



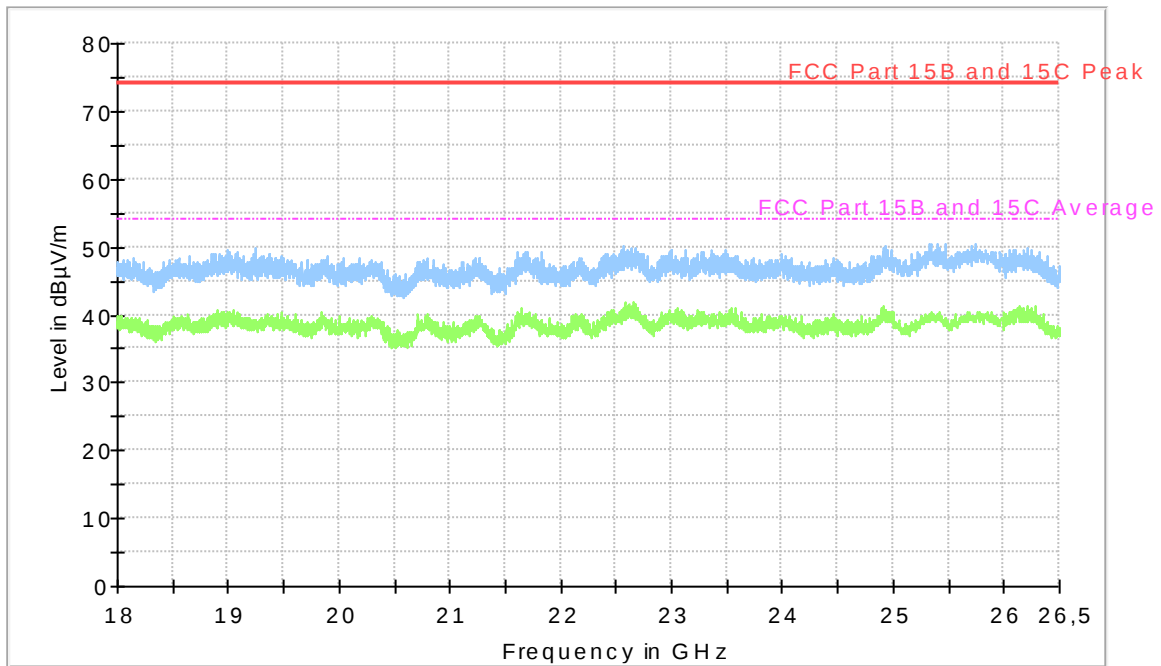
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. RX high channel, EUT orientation Y.



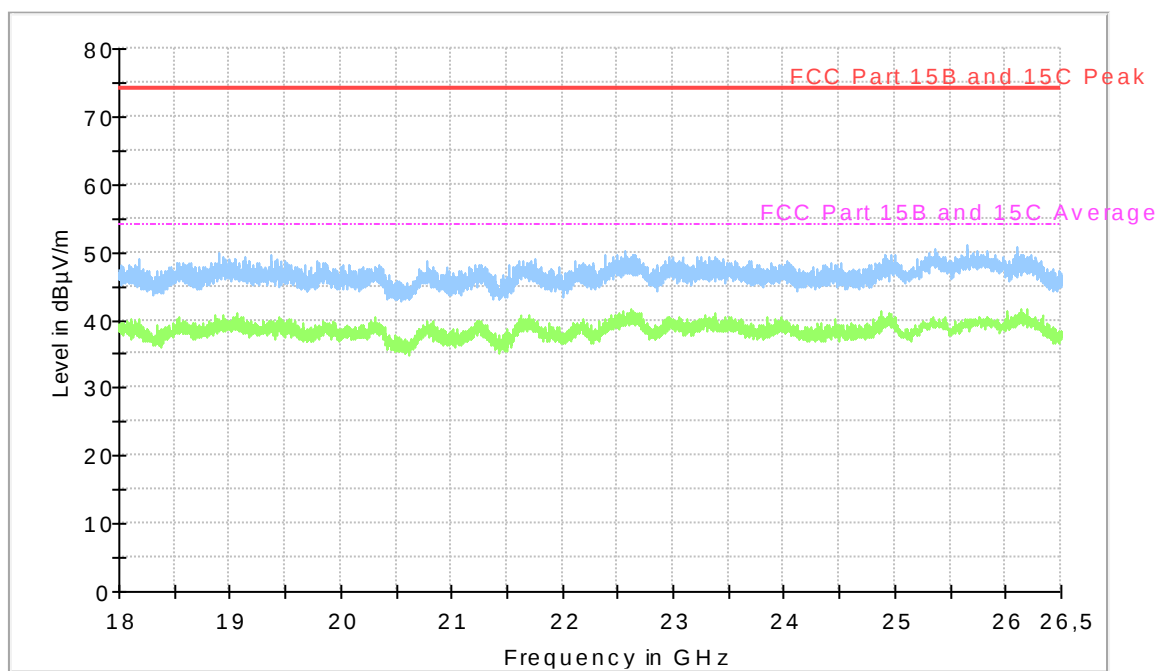
Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX low channel, EUT orientation Y.



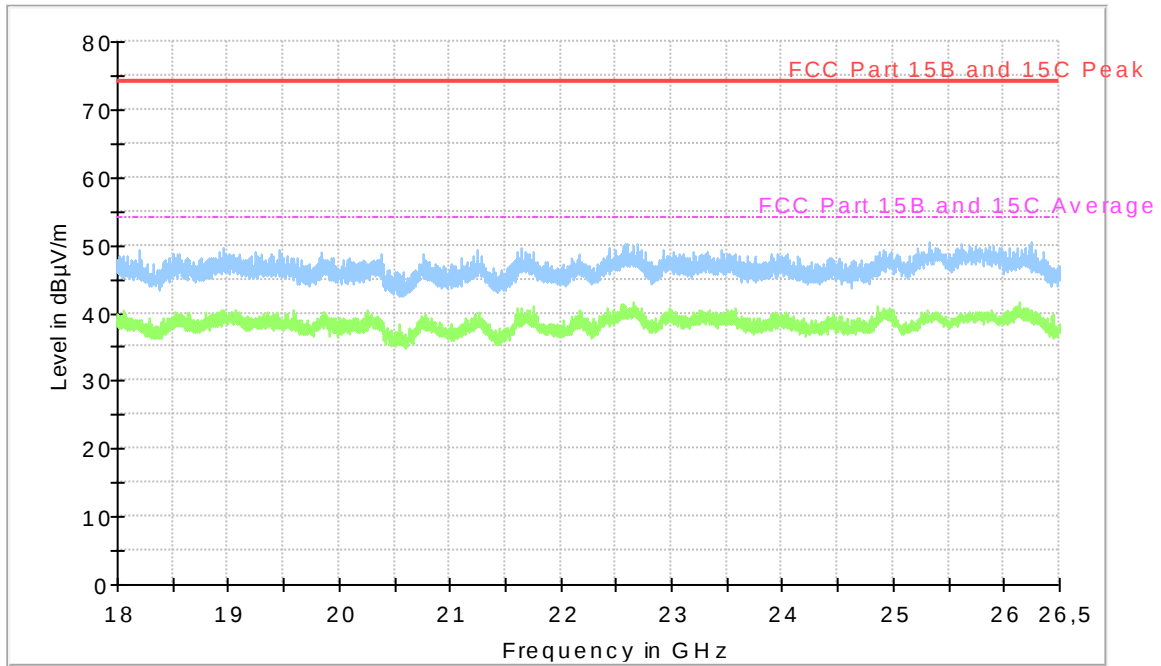
Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX middle channel, EUT orientation Y.



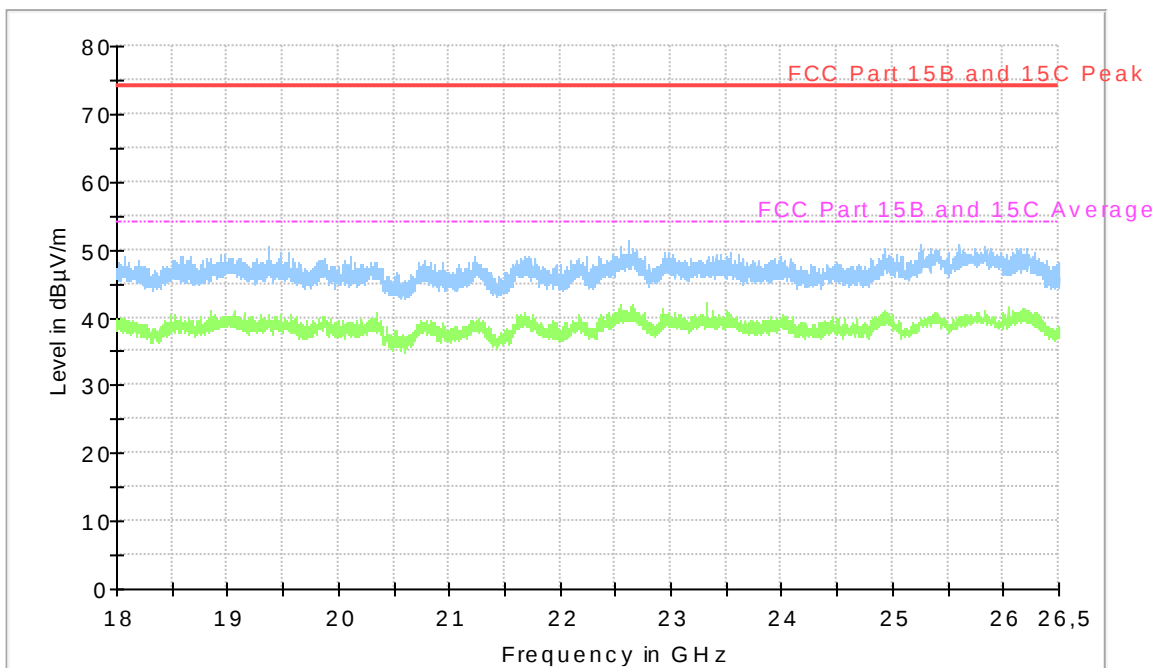
Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX middle channel, EUT orientation Z.



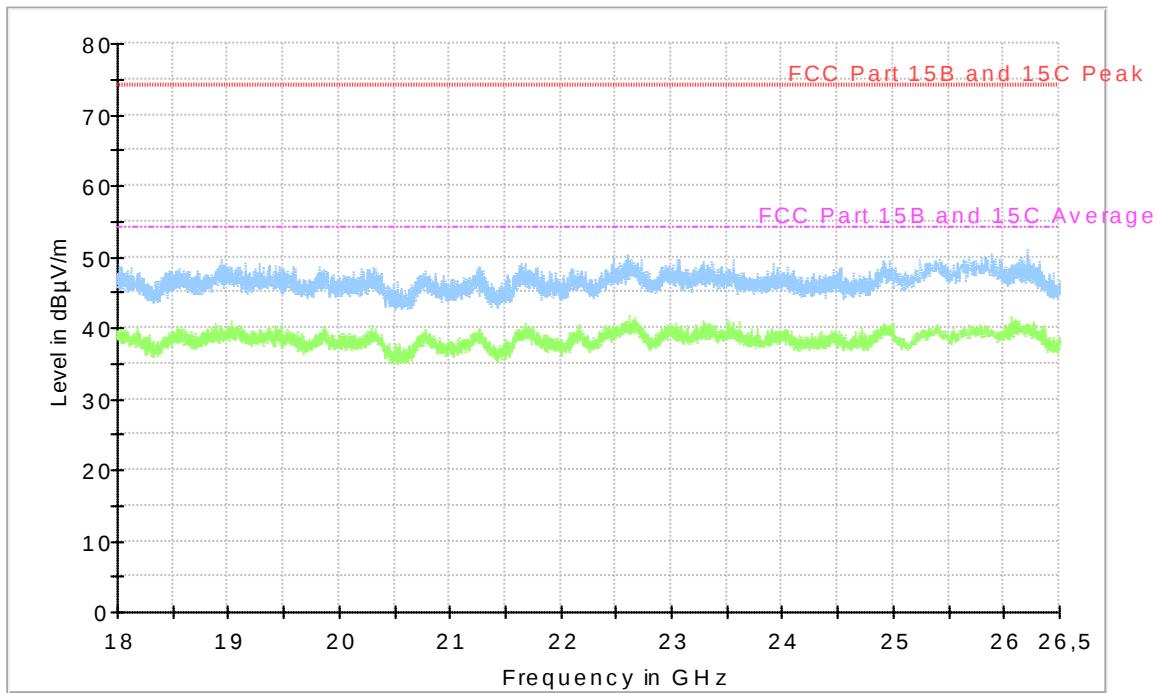
Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX middle channel, EUT orientation X.



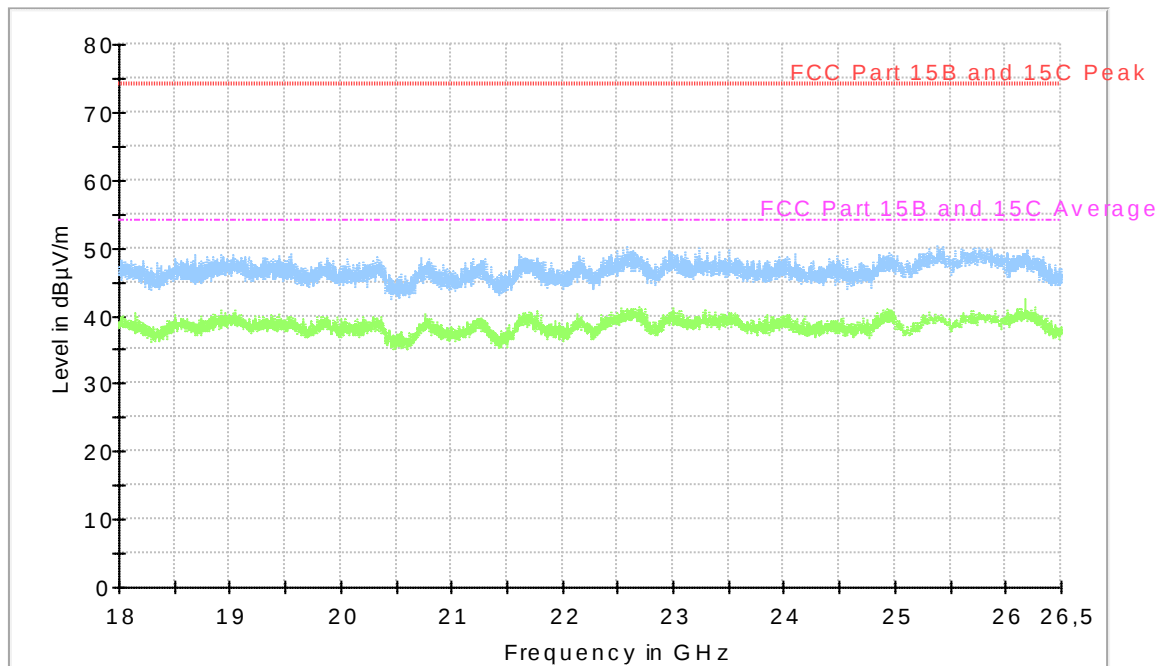
Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX high channel, EUT orientation Y.



Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. RX low channel, EUT orientation Y.



Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. RX middle channel, EUT orientation Y.



Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. RX high channel, EUT orientation Y.

Measurement results, Peak, low channel TX

Frequency [MHz]	Level [dBμV/m]	Limit [dBμV/m]	EUT orientation	Polarization H/V	Margin [dB]
2367.2	47.9	74.0	Z	V	26.1
4811.0	55.9	74.0	Y	H	18.1

Measurement results, Average, low channel TX

Frequency [MHz]	Level [dBμV/m]	Limit [dBμV/m]	EUT orientation	Polarization H/V	Margin [dB]
2367.2	36.1	54.0	Z	H	17.9
4811.0	44.1	54.0	Y	V	9.9

Measurement results, Peak, middle channel TX

Frequency [MHz]	Level [dBμV/m]	Limit [dBμV/m]	EUT orientation	Polarization H/V	Margin [dB]
4889.0	56.8	74.0	Y	V	17.2

Measurement results, Average, middle channel TX

Frequency [MHz]	Level [dBμV/m]	Limit [dBμV/m]	EUT orientation	Polarization H/V	Margin [dB]
4889.0	45.0	54.0	Y	V	9.0

Measurement results, Peak, high channel TX

Frequency [MHz]	Level [dBμV/m]	Limit [dBμV/m]	EUT orientation	Polarization H/V	Margin [dB]
2519.0	51.7	74.0	Z	H	22.3
4961.1	54.6	74.0	Y	V	19.4

Measurement results, Average, high channel TX

Frequency [MHz]	Level [dBμV/m]	Limit [dBμV/m]	EUT orientation	Polarization H/V	Margin [dB]
2519.0	39.9	54.0	Z	H	14.1
4961.1	42.8	54.0	Y	V	11.2

Measurement results, RX

No emissions are found above noise floor.

Result [dBμV/m] = Analyser reading [dBμV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

7 PEAK CONDUCTED OUTPUT POWER

Date of test:	2015-09-22	Test location:	Wireless Center
EUT number:	A13	Ambient temp:	23 °C
Tested by:	Robert Hietala / Kajsa From	Relative humidity:	48 %
Test result:	Pass	Margin:	16.9 dB

7.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 section 11.9.1.1.

Spectrum analyser with is used to determine the conducted output power. EUT with temporary antenna connector is connected to spectrum via RF-cable and attenuator.

7.2 Test conditions

Detector: Peak,
 RBW: >OBW
 VBW: >3 x RBW
 Span: >3 x OBW

The EUT was set up in order to emit maximum disturbances.

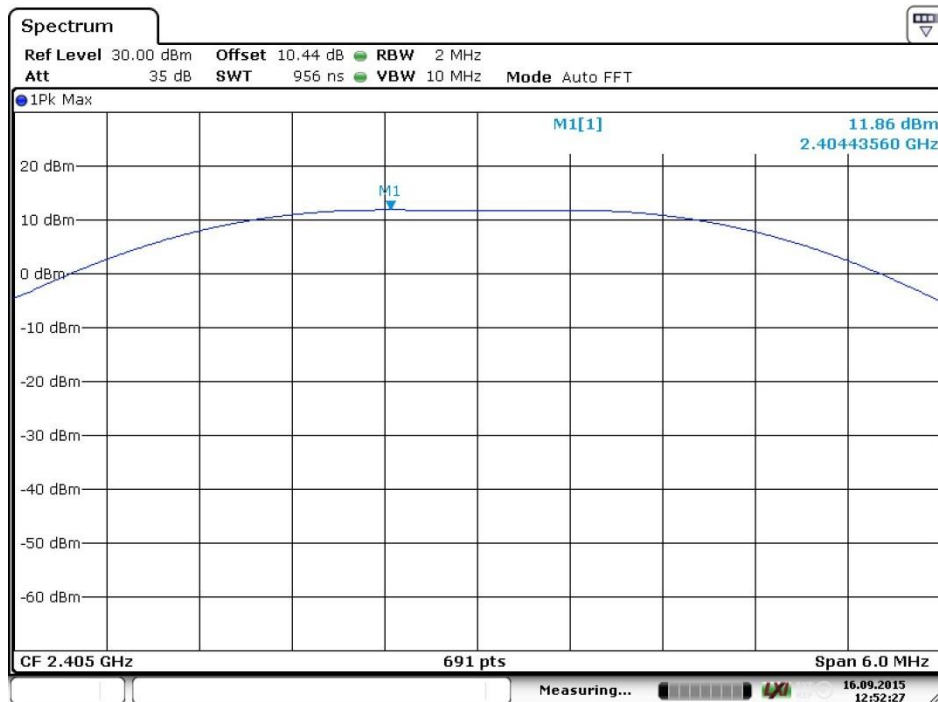
7.3 Requirements

Reference: CFR 47§15.247(b)(3), RSS-247 5.4

For DTSSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W.

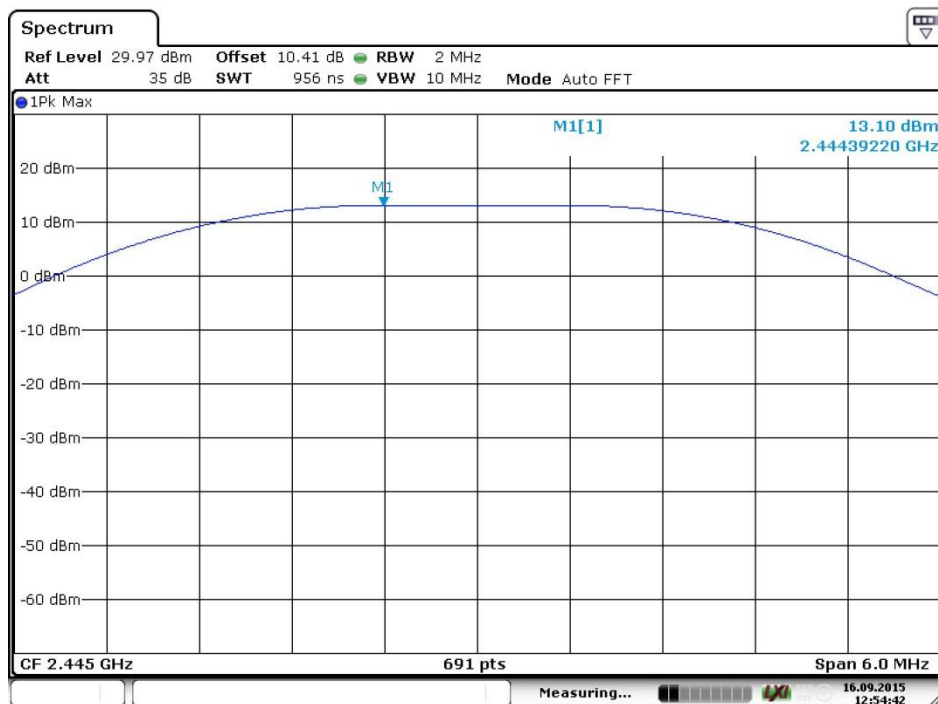
7.4 Test results

Channel [MHz]	Output power [dBm]
2405	11.9
2445	13.1
2480	9.9



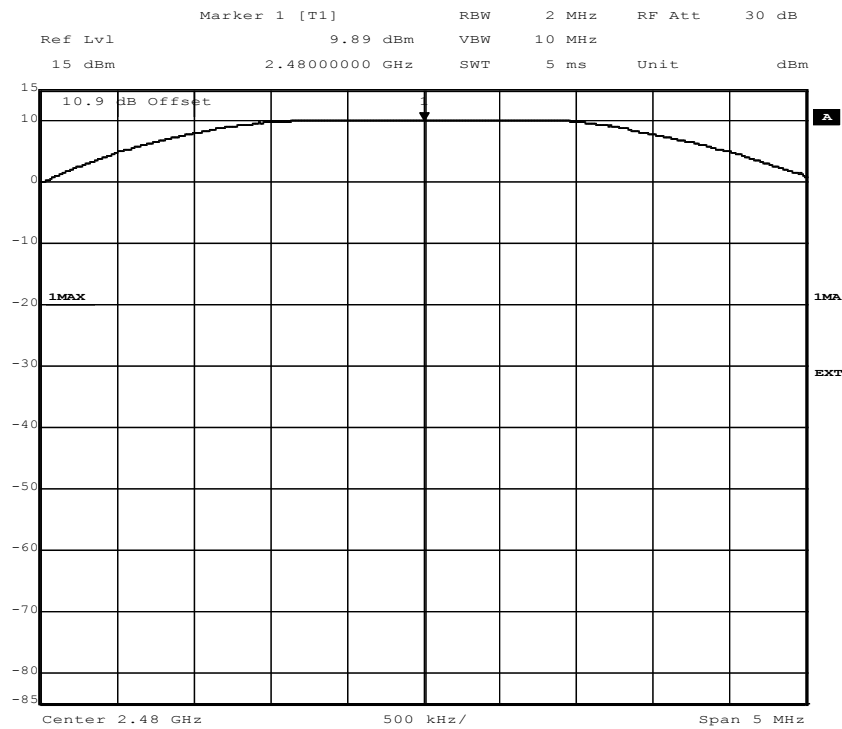
Date: 16.SEP.2015 12:52:27

Screenshot: Output power, low channel



Date: 16.SEP.2015 12:54:42

Screenshot: Output power, middle channel



Date: 22.SEP.2015 15:43:48

Screenshot: Output power, high channel

8 OCCUPIED 6 DB BANDWIDTH

Date of test:	2015-09-16	Test location:	Wireless Center
EUT number:	A13	Ambient temp:	23 °C
Tested by:	Robert Hietala / Kajsa From	Relative humidity:	48 %
Test result:	Pass	Margin:	1.14 MHz

8.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 section 11.8.1.

Spectrum analyser is used to determine the occupied 6 dB bandwidth. EUT with temporary antenna connector is connected to spectrum via RF-cable and attenuator.

8.2 Test conditions

Detector: Peak,
 RBW: 100 kHz
 VBW: 3 x RBW
 Span: >1,5 x OBW

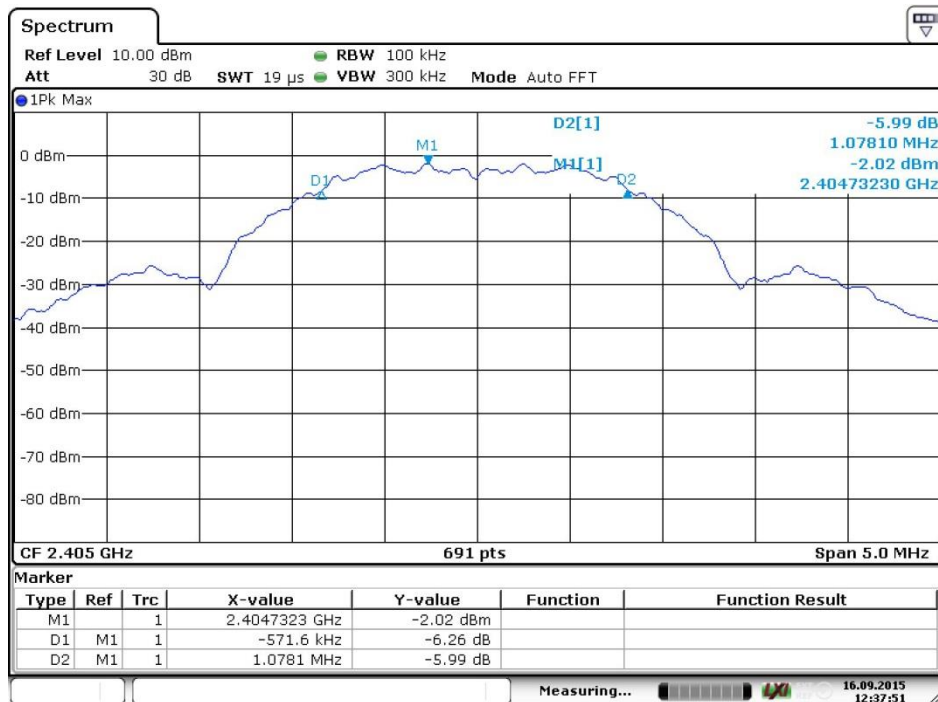
The EUT was set up in order to emit maximum disturbances.

8.3 Requirements

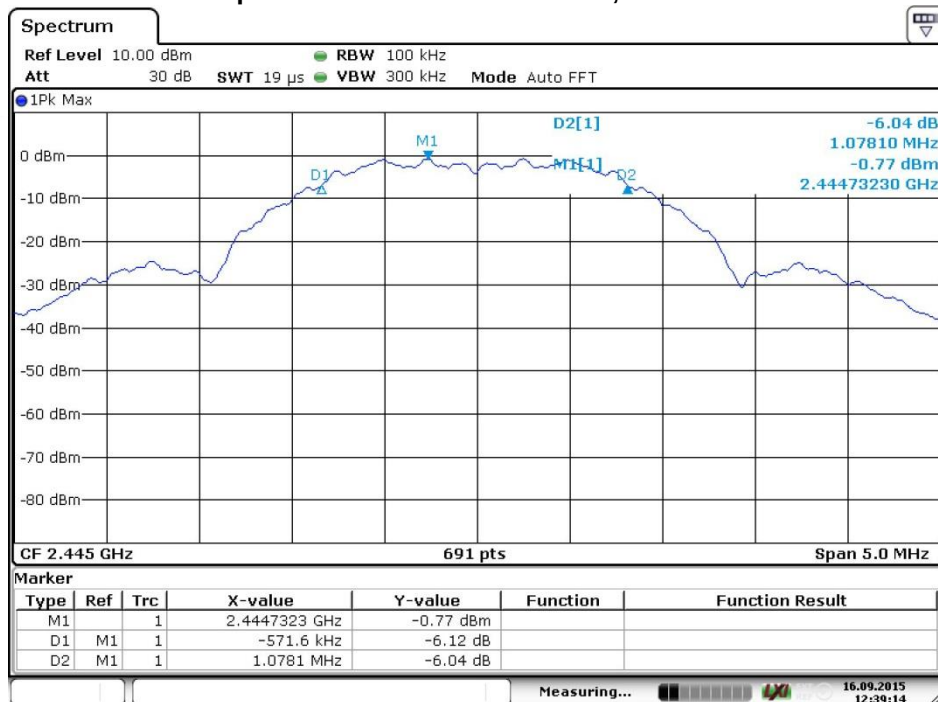
Reference: CFR 47§15.247(a)(2), RSS-247 5.2(1)
 The minimum 6 dB bandwidth shall be 500 kHz.

8.4 Test results

Channel [MHz]	6 dB BW [MHz]
2405	1.65
2445	1.65
2480	1.64

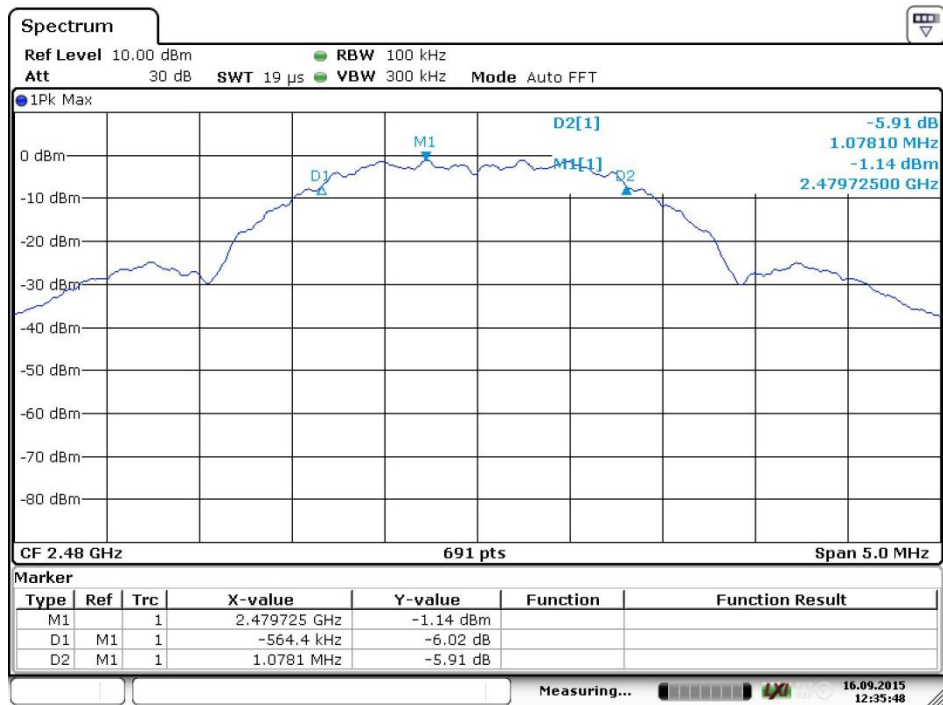


Date: 16.SEP.2015 12:37:51

Screenshot: Occupied bandwidth Measurement, low channel

Date: 16.SEP.2015 12:39:14

Screenshot: Occupied bandwidth Measurement, middle channel



Date: 16.SEP.2015 12:35:49

Screenshot: Occupied bandwidth Measurement, high channel

9 99 % BANDWIDTH

Date of test:	2015-09-16	Test location:	Wireless Center
EUT number:	A13	Ambient temp:	23 °C
Tested by:	Robert Hietala / Kajsa From	Relative humidity:	48 %
Test result:	Pass	Margin:	-

9.1 Test set-up and test procedure.

The test method is in accordance with RSS-GEN section 6.6.

Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth. EUT with temporary antenna connector is connected to spectrum via RF-cable and attenuator.

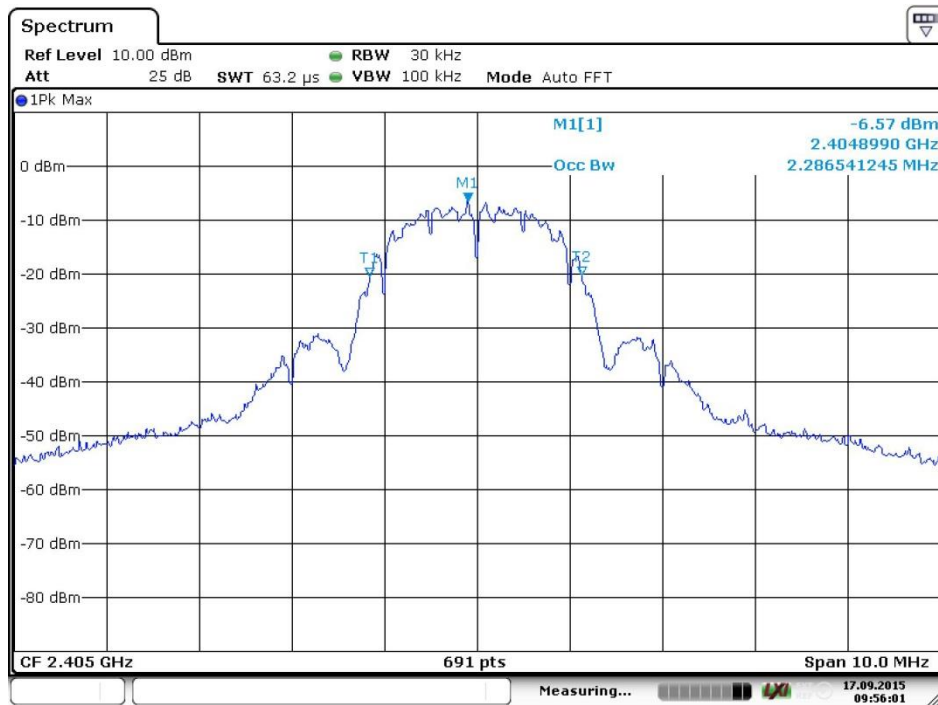
9.2 Test conditions

Detector: Peak,
 RBW: 1 – 5 % of OBW
 VBW: 3 x RBW

The EUT was set up in order to emit maximum disturbances.

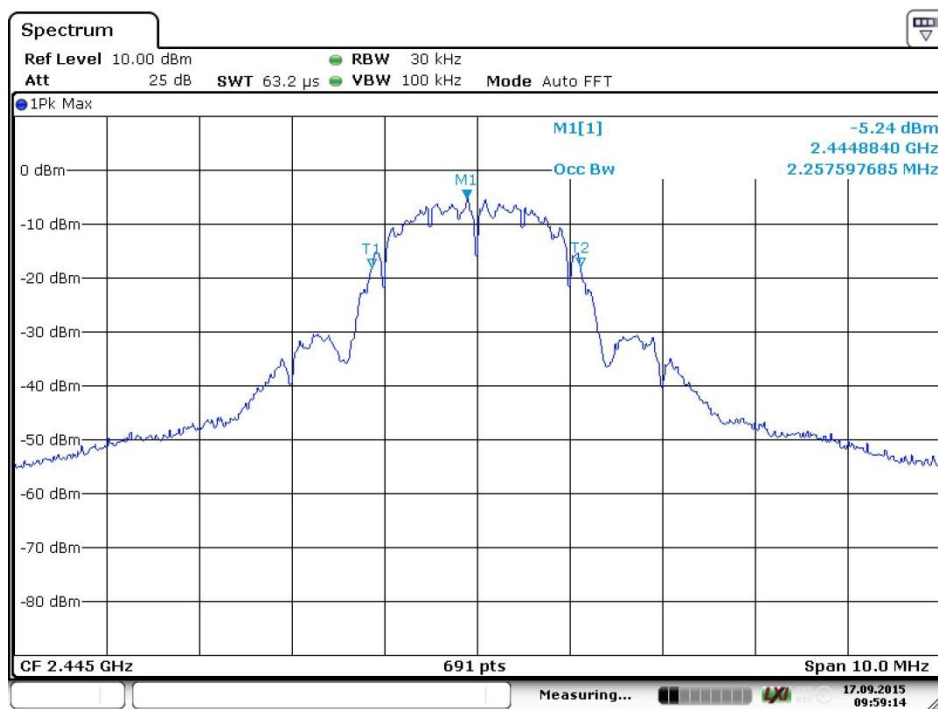
9.3 Test results

Channel [MHz]	99 % BW [MHz]
2405	2.29
2445	2.26
2480	2.29



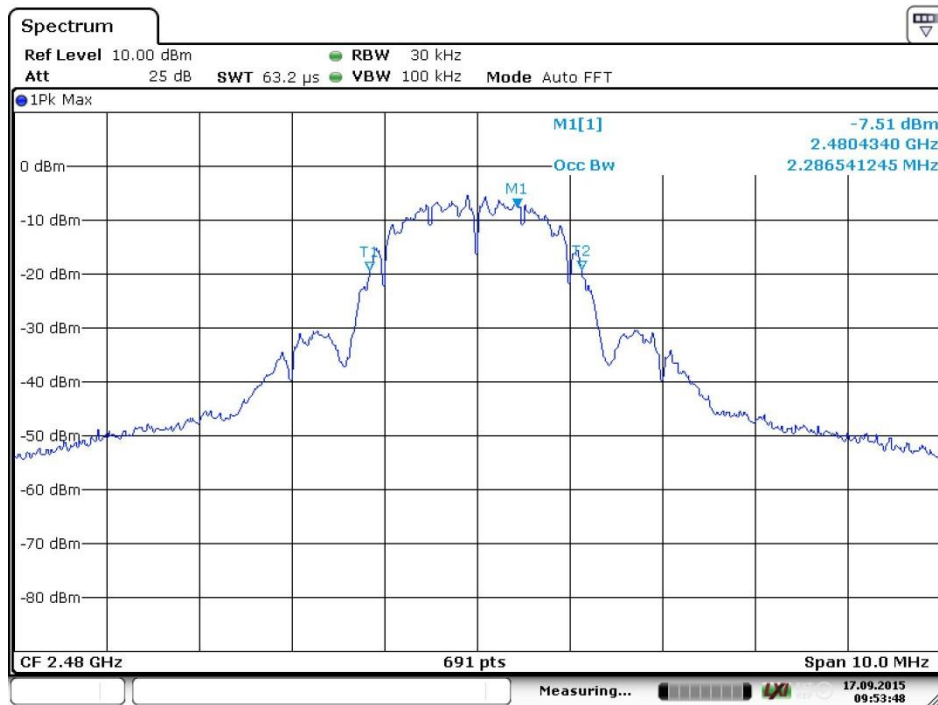
Date: 17.SEP.2015 09:56:01

Screenshot: Occupied bandwidth Measurement, low channel



Date: 17.SEP.2015 09:59:14

Screenshot: Occupied bandwidth Measurement, middle channel



Date: 17.SEP.2015 09:53:47

Screenshot: Occupied bandwidth Measurement, high channel

10 PEAK POWER SPECTRAL DENSITY

Date of test:	2015-09-16	Test location:	Wireless Center
EUT number:	A13	Ambient temp:	23 °C
Tested by:	Robert Hietala / Kajsa From	Relative humidity:	48 %
Test result:	Pass	Margin:	10.3 dB

10.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 section 11.10.2.

Spectrum analyser is used to determine the power spectral density. EUT with temporary antenna connector is connected to spectrum via RF-cable and attenuator.

10.2 Test conditions

Detector: Peak,
 RBW: 3 kHz
 VBW: >3 x RBW
 Span: 1.5 x 6 dB bandwidth

The EUT was set up in order to emit maximum disturbances.

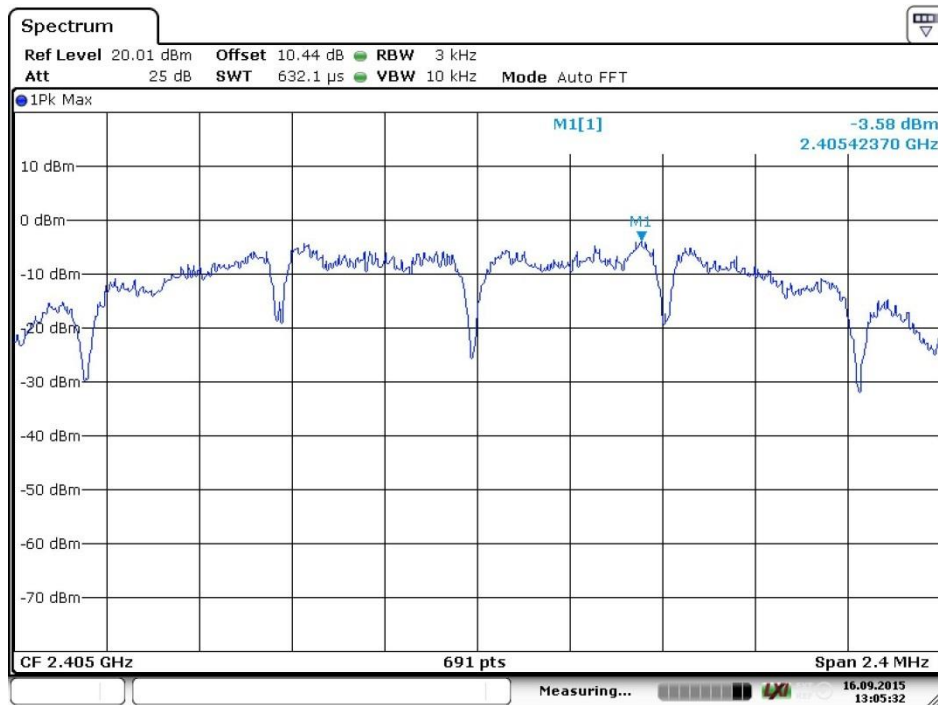
10.3 Requirements

Reference: CFR 47§15.247(3), RSS-247 5.2(2)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

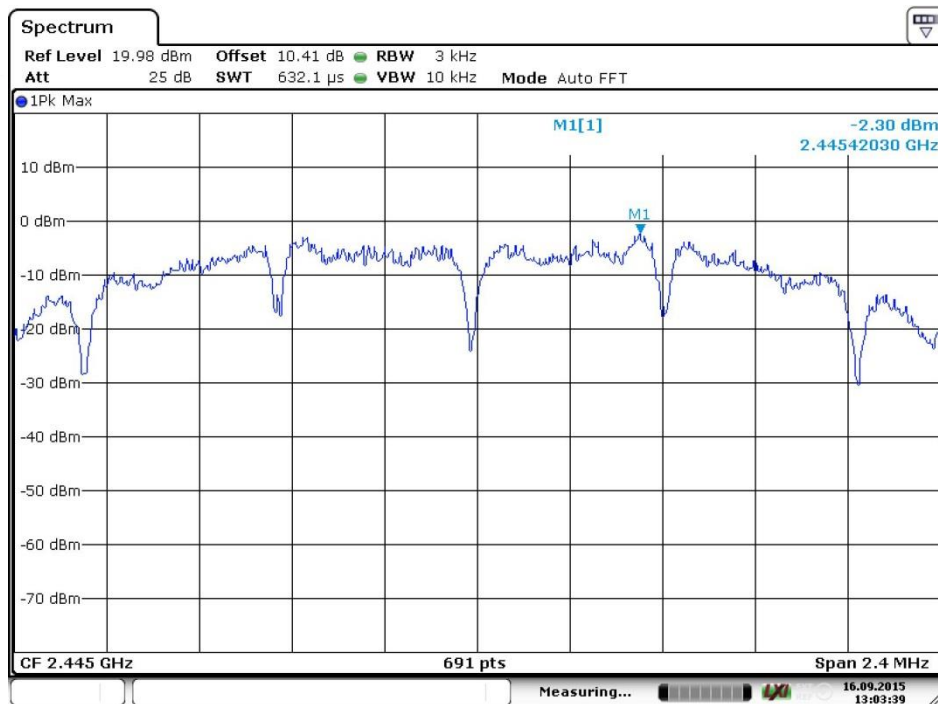
10.4 Test results

Channel [MHz]	PSD [dBm/3kHz]
2405	-3.6
2445	-2.3
2480	-5.5



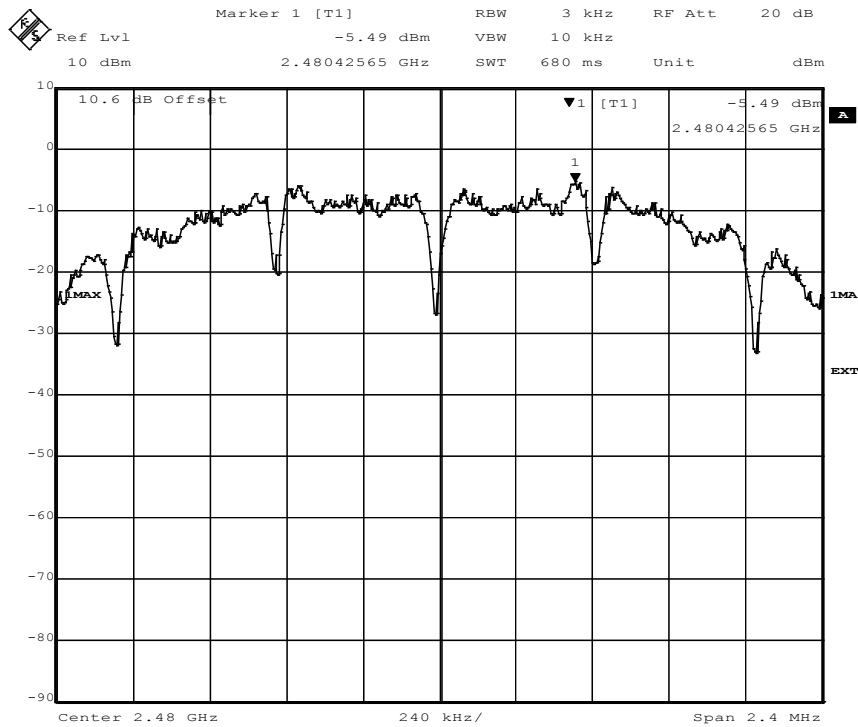
Date: 16.SEP.2015 13:05:32

Screenshot: Peak power spectral density, low channel



Date: 16.SEP.2015 13:03:40

Screenshot: Peak power spectral density, middle channel



Date: 23.SEP.2015 14:33:14

Screenshot: Peak power spectral density, high channel

11 TRANSMITTER DUTY CYCLE FOR PULSED TRANSMISSIONS

Date of test:	2015-09-17	Test location:	Wireless Center
EUT number:	A13	Ambient temp:	23 °C
Tested by:	Robert Hietala / Kajsa From	Relative humidity:	65 %
Test result:	Pass	Margin:	-

11.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10 section 7.5.

Spectrum analyser is used to determine the transmitter duty cycle. EUT with temporary antenna connector is connected to spectrum via RF-cable and attenuator.

11.2 Test conditions

Detector: Peak
 RBW: 3 MHz
 VBW: 3 MHz
 Span: 0 Hz
 Sweep time: 100 ms

11.3 Requirement

CFR 47 15.35(c) and RSS-GEN section 6.10

11.4 Test results

Due to restrictions in the test software maximum declared duty cycle from client differs from maximum measured duty cycle. Measured duty cycle value is used for peak to average correction factor in section 5 and 6.

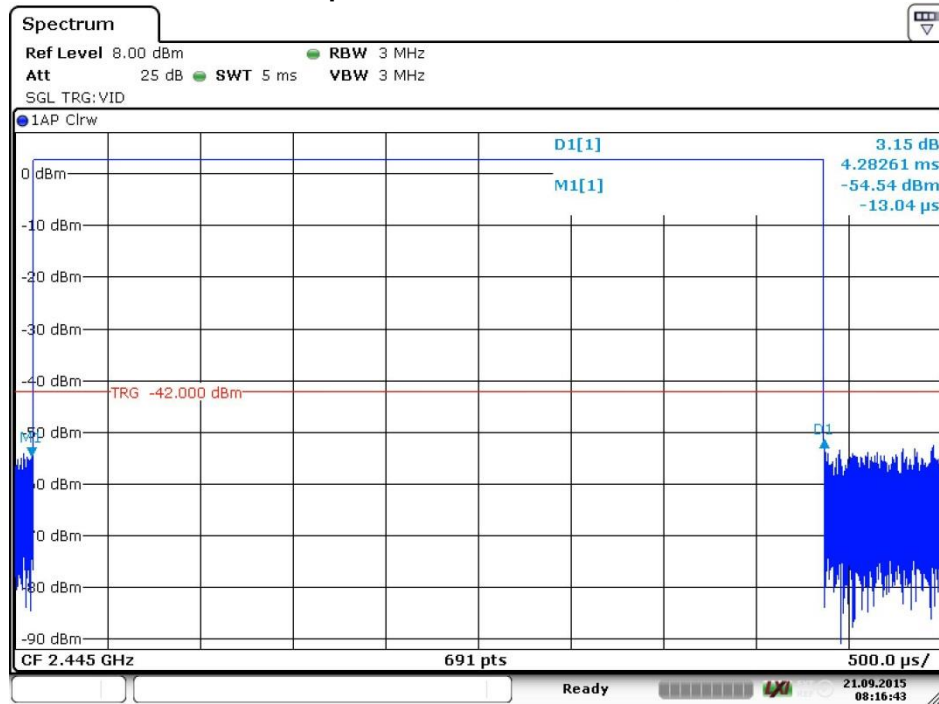
Maximum duty cycle declared by client:

Maximum number of TX pulses during 116 ms is 12. Maximum pulse length is 2.315 ms.
 This gives maximum $T_{on} = 11 \cdot 2.315 = 25.46$ ms during 100 ms
 Duty cycle is calculated $T_{on} / 100 \text{ ms} = 0.2546$
 Peak to average correction factor = $20 \text{ LOG (Duty cycle)} = -11.9$

Maximum measured duty cycle:

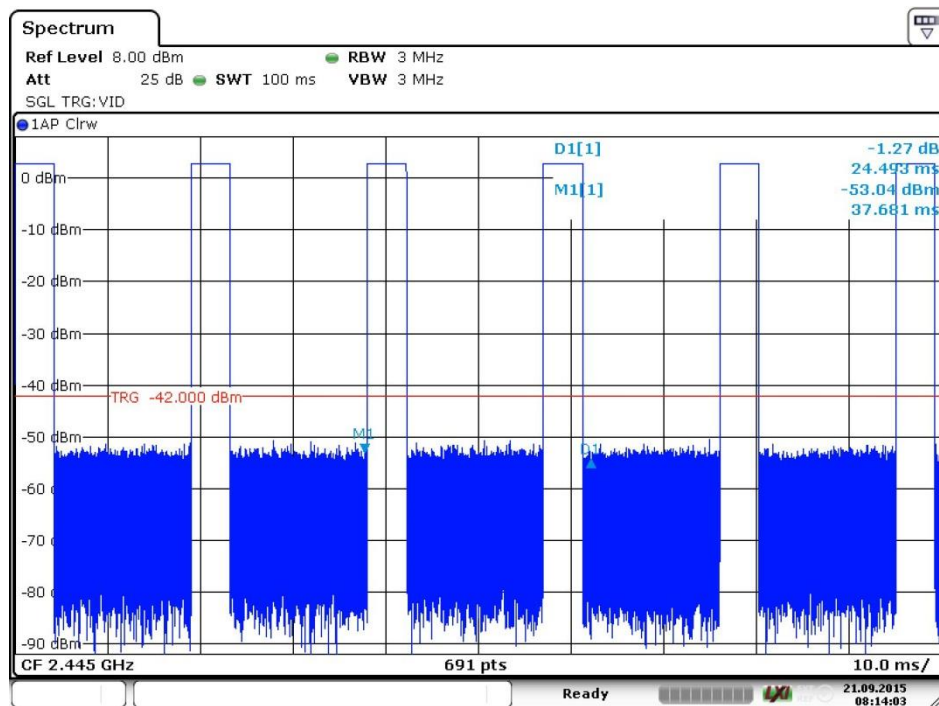
$T_{on} = 4.28 \cdot 6 = 25.68$ ms
 Duty cycle is calculated $T_{on} / 100 \text{ ms} = 0.2568$
 Peak to average correction factor = $20 \text{ LOG (Duty cycle)} = -11.8$

Screenshot: Time of one pulse



Date: 21.SEP.2015 08:16:43

Screen shot: 100 ms measurement



Date: 21.SEP.2015 08:14:03

12 TEST EQUIPMENT**5m Chamber**

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32	--	--	--
Receiver	Rohde & Schwarz	ESIB26	32287	2015-06	1 year
BiLog antenna	Rohde & Schwarz	HL562	32310	2015-02	1 year
Horn antenna	Rohde & Schwarz	HF907	32550	2015-04	1 year
Preamplifier + HP filter	Rohde & Schwarz	TS-PRE1	32297	2015-07	1 year
Measurement cable	Rohde & Schwarz	LMR400UF	9988	2015-01	1 year
Measurement cable	Radiall	SHF8M	9989	2015-07	1 year
Measurement cable	Rosenberger	JFB293C	9982	2015-06	1 year
Measurement cable	Rosenberger	JFB293C	9981	2015-06	1 year
Measurement cable	Rosenberger	UFB311A	39053	2015-06	1 year
Pulse limiter	Rohde & Schwarz	ESH3-Z2	32456	2015-06	1 year
Multimeter	Fluke	287	31173	2015-02	1 year
Power supply	Oltronix	B202	6655	--	--

Wireless Center and 3m FAC

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32	--	--	--
Signal analyzer	Rohde & Schwarz	FSIQ 40	12793	2015-07	1 year
Measurement cable	Huber + Suhner	Sucoflex 104 PE	39070	2015-07	1 year
Measurement cable	Huber + Suhner	Sucoflex 104 PE	39079	2015-07	1 year
Measurement cable	Huber + Suhner	Sucoflex 104	5191	2015-07	1 year
Horn antenna	EMCO	3115	4936	2014-04	3 years
Pre amplifier	Sangus	00101400-23-10P -6-S ; AFS44-12002400-32-10P -44	12335	2015-07	1 year
Horn antenna	EMCO	3160-08	30099	2013-10	3 years
Horn antenna	EMCO	3160-09	30101	2013-10	3 years
Signal analyzer:	Rohde & Schwarz	FSV	32594	2015-07	1 year
Signal generator:	Rohde & Schwarz	SMB100A	32592	2015-07	1 year
Multimeter	Gossen Metrawatt	Metra Hit 26 S	30137	2015-06	1 year
Power supply	Rohde & Schwarz	NGSM 32/10	40021	--	--
Power supply	Oltronix	B202	6655	--	--
Attenuator	Huber + Suhner	5910_N-50-010/199_NE	32696	2015-07	1 year

13 MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz ± 3.6 dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 5.1 dB
Uncertainty for the frequency range 1 to 18 GHz at 3 m	± 4.7 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 4.8 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.7 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

14 TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1516318STO-001 Annex 1, Ed.1.

Test set up photos are in separate document 1516318STO-001 Annex 2, Ed.1.