

# RADIO TEST REPORT

No. 1707608STO-002, Ed. 2

## RF Performance

### EQUIPMENT UNDER TEST

Equipment: LED Lamp with Zigbee radio  
Type/Model: LED1624G9  
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 (2015): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2015): Subpart B: Unintentional radiators

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

RSS-247 Issue 2 (2017): 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: 2017-10-31

Tested by:



Daniel Nilsson

Approved by:



Matti Virkki

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**Revision History**

Edition	Date	Description	Changes
1	2017-05-11	First release	
2	2017-10-31	Edition 2	- Section 2.5 added - Measurement uncertainty for conducted measurements added

Version 1.00

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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: Yeonwoo Kim

## 2 EQUIPMENT UNDER TEST (EUT)

### 2.1 Identification of the EUT

Equipment: LED Lamp with Zigbee radio  
Type/Model: LED1624G9  
Brand name: IKEA  
Serial number: -  
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: -3.6 dBi  
Rating RF output power: 12.4 dBm (measured conducted)  
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 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	ID	Serial number	Comment
LED lamp, E26	LED 1624G9	LR	--	Sample transmitting at lowest channel with internal antenna
LED lamp, E26	LED 1624G9	MR	--	Sample transmitting at middle channel with internal antenna
LED lamp, E26	LED 1624G9	HR	--	Sample transmitting at highest channel with internal antenna
LED lamp, E26	LED 1624G9	LC	--	Sample transmitting at lowest channel with temporary antenna connector
LED lamp, E26	LED 1624G9	MC	--	Sample transmitting at middle channel with temporary antenna connector
LED lamp, E26	LED 1624G9	HC	--	Sample transmitting at highest channel with temporary antenna connector

During the tests the EUT supported following software:

Software	Version	Comment
Custom software	-	Software to allow the EUT to be set to transmit at fixed channels
Firmware	1.1.1.1	

## 2.3 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	Serial no.
USB Lab platform	TIF	--	--
Remote control	E1524	IKEA	--

## 2.4 Test signals and operation modes

High duty cycle operation (22%) with OQPSK modulation.

## 2.5 Opinions and interpretations

The EUT is available with two different sockets, E26 and E12. These two are identical in all respects except for the screw type. The version using E26 socket was arbitrarily chosen for testing.

**3 TEST SPECIFICATIONS**

**3.1 Standards**

Requirements:

47 CFR Part 15 (2016): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2016): Subpart B: Unintentional radiators

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

RSS-247 Issue 2 (2017): 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-247 Issue 2 (2017) is 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,  
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 #
BJÖRKHALLEN	Semi-anechoic 3 m	2042G-1

#### 4 TEST SUMMARY

The results in this report apply only to sample tested:

Requirement	Description	Result
<b>FCC §15.203 RSS-GEN 8.3</b>	<b>Antenna requirement</b> The EUT has integrated non detachable antenna which can't be remove without breaking the EUT.	<b>PASS</b>
<b>FCC §15.207, 15.107 6.1 Table 2,RSS- GEN 8.8 table 3</b>	<b>Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port</b> The margin to the limit was at least 10.0 dB at 0.173 MHz. See clause 5.3.	<b>PASS</b>
<b>FCC §15.247 (b)(4) RSS-247 5.4(d), 5.4(e)</b>	<b>Field strength of fundamental and antenna gain</b> The EUT complies with the limits.  Antenna gain is less than 6 dBi.	<b>PASS</b>
<b>FCC §15.247 (d), 15.209(a) RSS-GEN 8.9 RSS-247 5.5</b>	<b>Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz</b> The EUT complies with the limits. The margin to the limit was at least 11.5 dB at 926.592 MHz. See clause 7.4 – 7.5.	<b>PASS</b>
<b>FCC §15.247(d), 15.209(a) RSS-GEN 8.9 RSS-247 5.5</b>	<b>Radiated emission of electromagnetic fields in the frequency range above 1 GHz</b> The EUT complies with the limits. The margin to the limit was at least 14.5dB at 1106.8 MHz. See clause 7.6 – 7.7.	<b>PASS</b>
<b>FCC §15.247(a)(2) RSS-GEN 6.6 RSS-247 5.2(a)</b>	<b>Occupied bandwidth</b> The EUT complies with the limits. The margin to the limit is at least 0.96 MHz See clause 10.4.	<b>PASS</b>
<b>FCC §15.247(b) RSS-247 5.4(d)</b>	<b>Conducted output power</b> The EUT complies with the limits. The margin to the limit was at least 17.6 dB at 2480.0 MHz. See clause 9.4.	<b>PASS</b>
<b>FCC §15.247(e) RSS-247 5.2(b)</b>	<b>Peak power spectral density</b> The EUT complies with the limits. The margin to the limit was at least 8.8 dB at 2480.0 MHz. See clause 12.4.	<b>PASS</b>
<b>FCC §15.247(e) RSS-247 5.5</b>	<b>Band edge</b> The EUT complies with the limits. The margin to the limit was at least 0.1 dB at 2484.8 MHz. See clause 6.4.	<b>PASS*</b>

\* 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.



**5 CONDUCTED CONTINUOUS DISTURBANCES IN THE FREQUENCY-RANGE 0.15 TO 30 MHZ**

<b>Date of test:</b>	2017-03-23	<b>Test location:</b>	Bur 1
<b>EUT Serial:</b>	MC	<b>Ambient temp:</b>	22 °C
<b>Tested by:</b>	DNI	<b>Relative humidity:</b>	21 %
<b>Test result:</b>	Pass	<b>Margin:</b>	10.0

**5.1 Test set-up and test procedure**

The test method is in accordance with ANSI C63.10-2013 section 6.2.

The EUT was connected to the power via Artificial Mains Networks AMN.

The EUT was placed on an insulating support 0.8 m above the floor, 0.4 m from the vertical reference ground plane (RGP) and 0.8 m from the AMN/ISN.

Overview sweeps were performed for each lead.

During the tests the EUT was operated according to the mode of operation mentioned in clause 2.4.

**5.2 Requirement****Limits for conducted emission from AC mains**

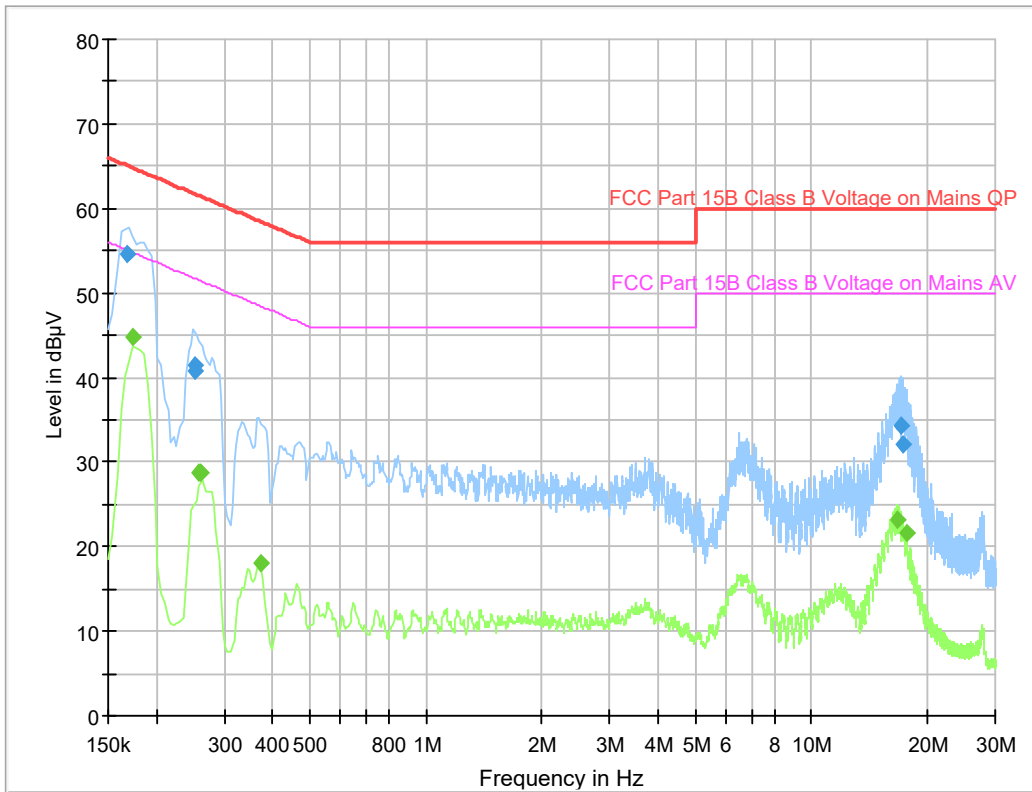
The EUT shall meet the limits for the standards.

Reference: 47 CFR §15.207

RSS-GEN, section 8.8 table 3

Frequency range [MHz]	Limits [dB $\mu$ V]	
	Quasi-Peak	Average
0.15 – 0.50	66 – 56	56 – 46
0,50 – 5.00	56	46
5.00 – 30.0	60	50

**5.3 Test results**



**Diagram, Peak and Average overview sweep**

**Measurement results, Quasi-peak**

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.168	54.7	65.1	L	10.4

**Measurement results, Average**

Frequency [MHz]	Level [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.173	44.8	54.8	N	10.0

All other measured disturbances have a margin of more than 20 dB to the limits.

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

## 6 FIELD STRENGTH OF FUNDAMENTAL AND RADIATED BAND EDGE

<b>Date of test:</b>	2017-03-13	<b>Test location:</b>	Björkhallen
<b>EUT Serial:</b>	LR, HR	<b>Ambient temp:</b>	22 °C
<b>Tested by:</b>	DNI	<b>Relative humidity:</b>	21 %
<b>Test result:</b>	Pass	<b>Margin:</b>	0.1 dB

### 6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013.

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.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak and average detector was activated.

EUT was evaluated in three orthogonal orientations.

### 6.2 Test conditions

<b>Test set-up:</b>	<b>1 GHz – 40 GHz</b>		
Test receiver set-up:			
Preview test:	Peak,	RBW 1 MHz	VBW 3 MHz
Final test:	Peak,	RBW 1 MHz	VBW 3 MHz
	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		

**6.3 Requirement**

Outside the restricted bands:  
Reference: CFR 47 §15.247(d), RSS-247 5.5,

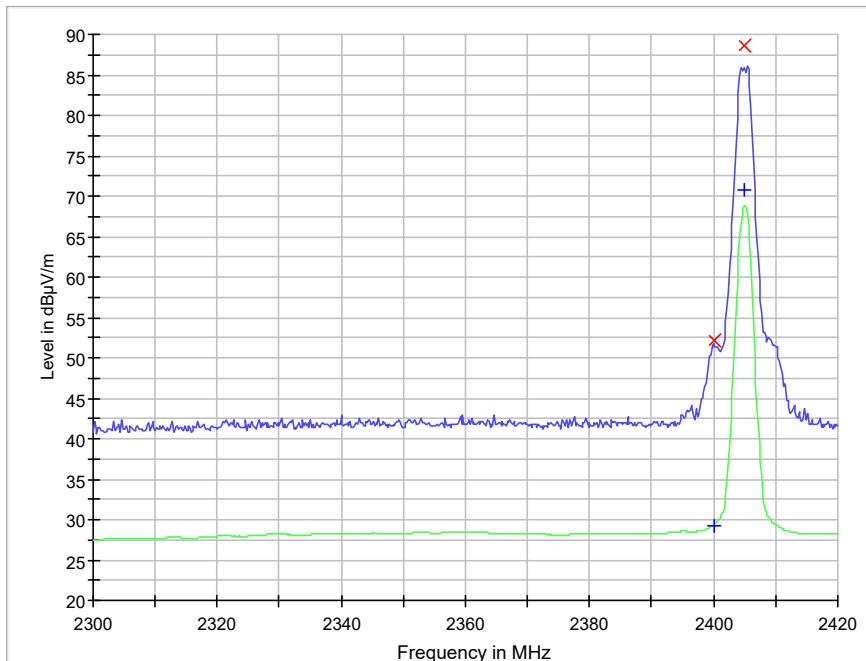
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either 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)	Field strength at 10 m (dBµV/m)	Detector (dBµV/m)
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	43.5 / 63.5	Average / Peak

**6.4 Test results**



**Lower band edge sweep**

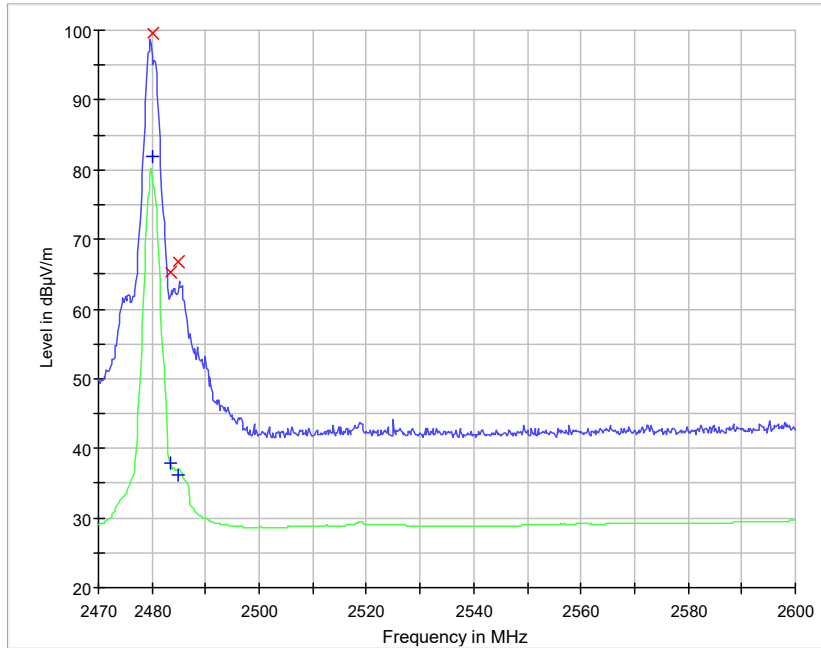
**Field strength of fundamental and band edge, low channel**

Frequency [MHz]	Level [dBµV/m]	Delta [dBc]	Limit [dBc]	Detector	EUT Orientation	Polarization H/V	Margin [dB]
2405.0*	88.7	--	--	Peak	X	V	--
2400.0	52.1	36.6	20.0	Peak	X	V	16.6

\*Carrier

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

**Upper band edge sweep**



**Marker-delta measurement at upper band edge**

**Field strength of fundamental and band edge, high channel**

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Detector	EUT Orientation	Polarization H/V	Margin [dB]
2480.0*	99.5	--	Peak	X	H	--
2483.5	65.3	74.0	Peak	X	H	8.7
2484.8	66.9	74.0	Peak	X	H	7.1
2483.5	52.3	54.0	Avg	X	H	1.7*
2484.8	53.9	54.0	Avg	X	H	0.1*

\*Carrier

\*\*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.

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

**7 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHZ TO 26 GHZ**

<b>Date of test:</b>	2017-03-10, 2017-03-13, 2017-03-14	<b>Test location:</b>	Björkhallen
<b>EUT Serial:</b>	LR, MR, HR	<b>Ambient temp:</b>	21.8 - 22.5 °C
<b>Tested by:</b>	DNI	<b>Relative humidity:</b>	21.2 - 28.9 %
<b>Test result:</b>	Pass	<b>Margin:</b>	11.5 dB

**7.1 Test set-up and test procedure.**

The test method is in accordance with ANSI C63.10-2013.

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

The EUT was placed on an insulating support 0.8 and 1.5 m above the turntable which is part of the reference ground plane.

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.

**7.2 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 VBW 1 MHz

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 VBW 3 MHz

Average Peak value + 20 x LOG (Duty cycle)

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

### 7.3 Requirements

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 $\mu$ V/m)	Field strength at 10 m (dB $\mu$ V/m)	Detector (dB $\mu$ V/m)
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	43.5 / 63.5	Average / Peak

The values for 10 m measuring distance are calculated by subtracting 10.5 dB from the 3 m limit. (i.e. an extrapolation factor of 20 dB/decade according to CFR 47 §15.31(f)(1))

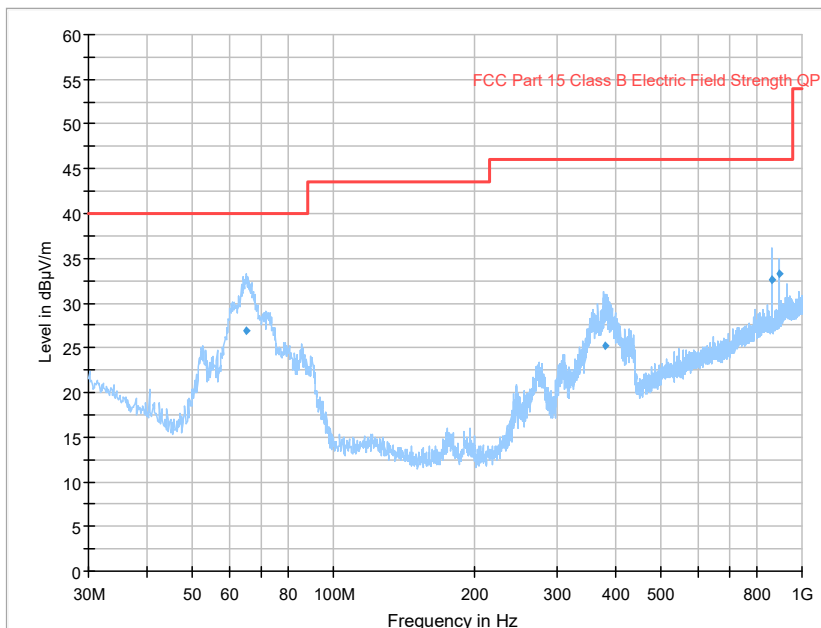
Outside the restricted bands:

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.

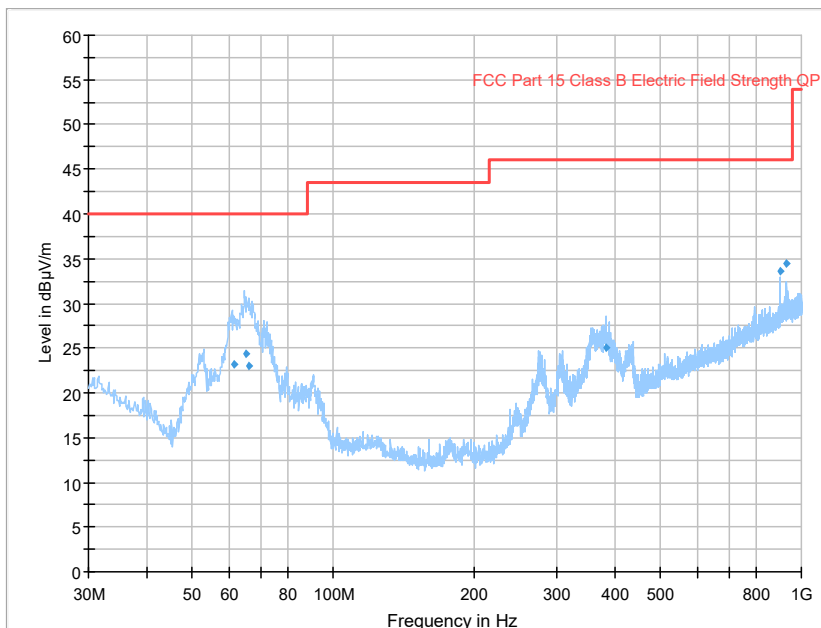
**7.4 Test results 30 MHz – 1000 MHz, TX**

Full Spectrum



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

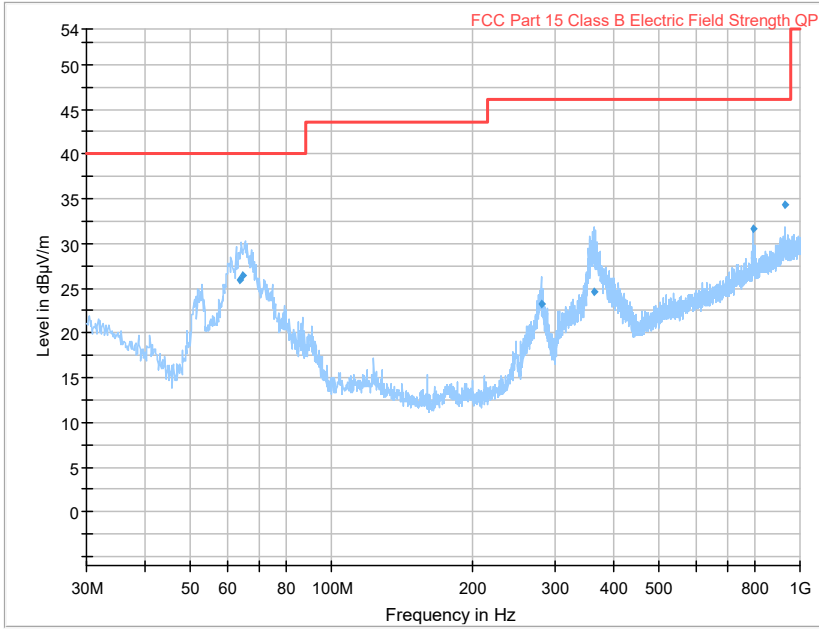
Full Spectrum



**Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX mid channel.**



Full Spectrum



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

**Measurement results, Quasi Peak, TX low channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Polarization H/V	Margin [dB]
65.351	26.8	40.0	V	13.2
379.397	25.2	46.0	V	20.8
860.463	32.6	46.0	H	13.4
896.411	33.3	46.0	V	12.8

Result [dB $\mu$ V/m] = Analyser reading [dB $\mu$ V] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

**Measurement results, Quasi Peak, TX mid channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Polarization H/V	Margin [dB]
61.181	23.1	40.0	V	16.9
64.929	24.4	40.0	V	15.6
66.233	23.1	40.0	V	16.9
382.765	25.0	46.0	V	21.0
902.444	33.6	46.0	V	12.5
926.592	34.5	46.0	H	11.5

Result [dB $\mu$ V/m] = Analyser reading [dB $\mu$ V] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

**Measurement results, Quasi Peak, TX high channel**

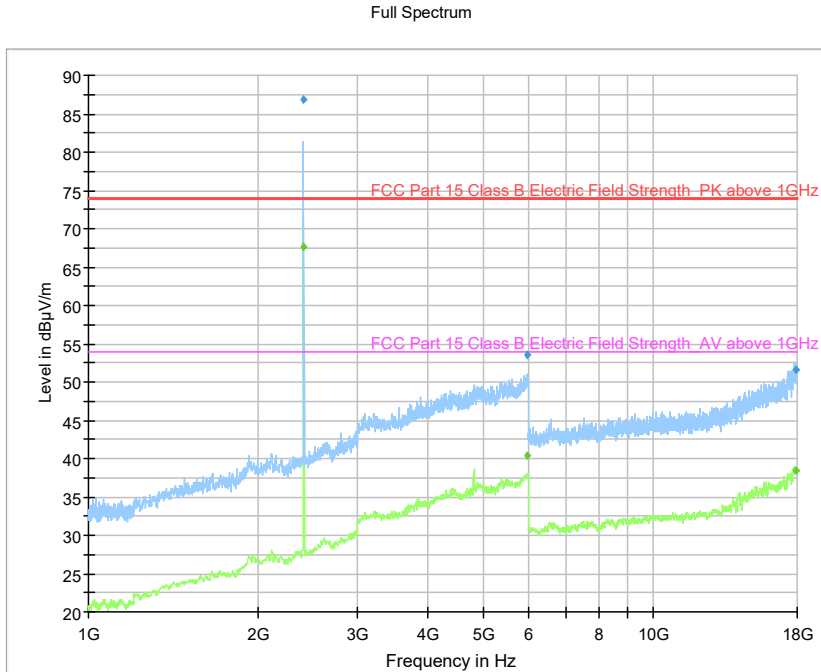
Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Polarization H/V	Margin [dB]
63.665	26.0	40.0	V	14.0
64.831	26.5	40.0	V	13.6
279.940	23.3	46.0	H	22.8
364.088	24.7	46.0	V	21.4
794.109	31.7	46.0	H	14.3
927.296	34.4	46.0	H	11.6

Result [dB $\mu$ V/m] = Analyser reading [dB $\mu$ V] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

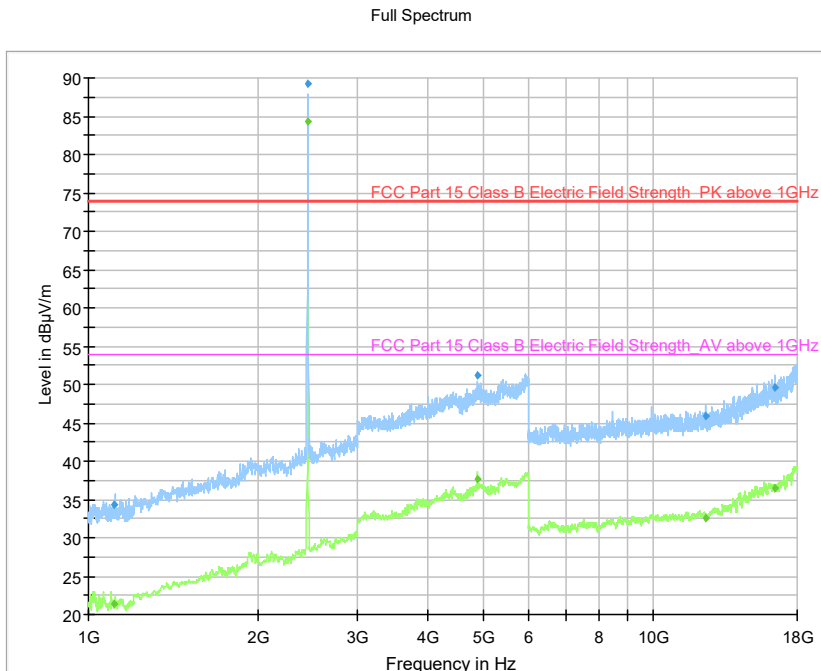
**7.5 Test results 30 MHz – 1000 MHz, RX**

RX mode was tested together with TX mode, see section 7.4.

**7.6 Test results 1 GHz – 26 GHz, TX**

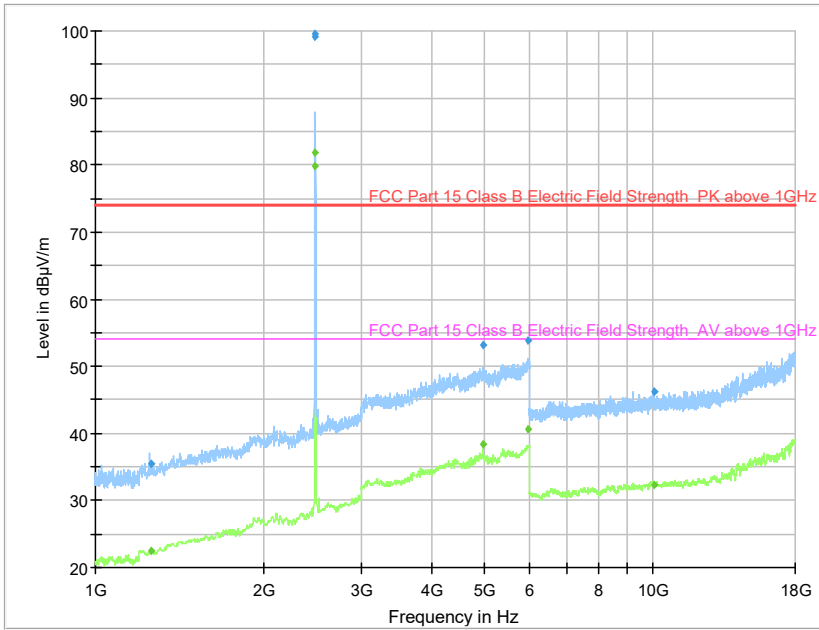


**Diagram, Peak overview sweep, 1– 18 GHz at 3 m distance. TX low channel.**



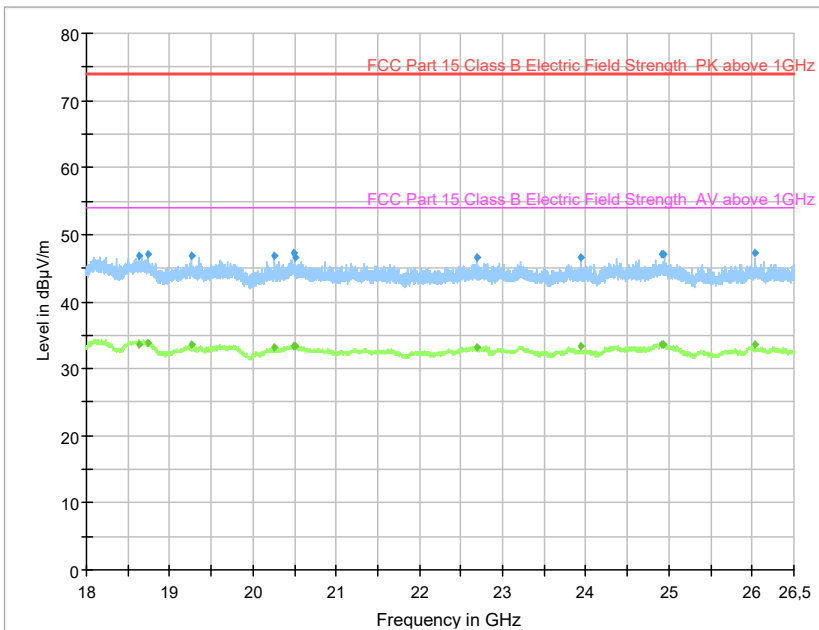
**Diagram, Peak overview sweep, 1– 18 GHz at 3 m distance. TX mid channel.**

Full Spectrum



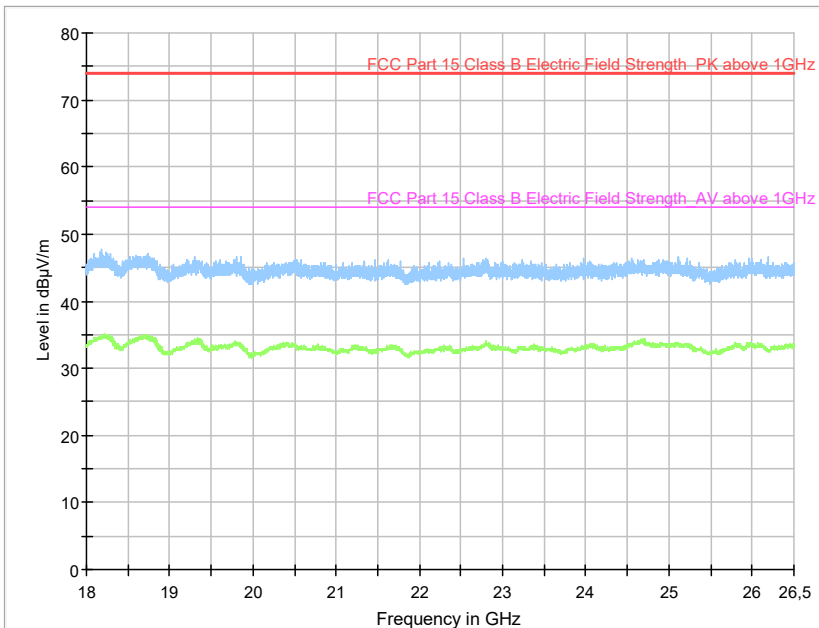
Diagram, Peak overview sweep, 1 – 18 GHz at 3 m distance. TX high channel.

Full Spectrum



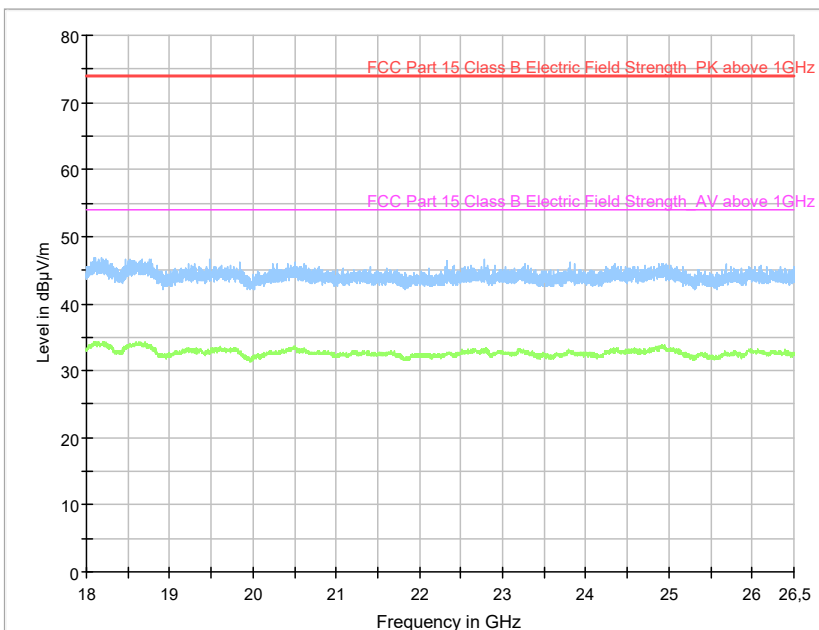
Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX low channel

Full Spectrum



**Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX mid channel**

Full Spectrum



**Diagram, Peak overview sweep, 18 – 26 GHz at 3 m distance. TX high channel**

**Measurement results, Peak, TX low channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	EUT orientation	Polarization H/V	Margin [dB]
2404.4*	86.9	74.0	X	V	-
5980.0	53.6	74.0	X	V	20.4
17903.0	51.5	74.0	X	V	22.5

\*Carrier

**Measurement results, Average, TX low channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	EUT orientation	Polarization H/V	Margin [dB]
2404.4*	73.9	-	X	V	-
5980.0	40.6	54.0	X	V	13.4
17903.0	38.5	54.0	X	V	15.5

\*Carrier

**Measurement results, Peak, TX middle channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	EUT orientation	Polarization H/V	Margin [dB]
1106.8	34.4	74.0	X	V	39.6
2444.9*	89.2	-	X	V	-
4887.6	51.3	74.0	X	H	22.7
12424.4	45.9	74.0	X	H	28.1
16433.3	49.6	74.0	X	V	24.4

\*Carrier

**Measurement results, Average, TX middle channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	EUT orientation	Polarization H/V	Margin [dB]
1106.8	21.4	54.0	X	V	14.5
2444.9*	76.2	-	X	V	-
4887.6	38.3	54.0	X	H	15.7
12424.4	32.9	54.0	X	H	21.1
16433.3	36.6	54.0	X	V	17.4

\*Carrier

**Measurement results, Peak, TX high channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	EUT orientation	Polarization H/V	Margin [dB]
1254.3	35.5	74.0	X	V	38.5
2480.0*	99.5	-	X	V	-
4960.9	53.1	74.0	X	V	20.9
5978.1	53.9	74.0	X	H	20.1
10037.5	46.3	74.0	X	H	27.7

\*Carrier

**Measurement results, Average, TX high channel**

Frequency [MHz]	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	EUT orientation	Polarization H/V	Margin [dB]
1254.3	22.5	54.0	X	V	15.5
2480.0*	86.5	-	X	V	-
4960.9	40.1	54.0	X	V	33.1
5978.1	40.9	54.0	X	H	33.9
10037.5	33.3	54.0	X	H	26.3

\*Carrier

Result [dB $\mu$ V/m] = Analyser reading [dB $\mu$ V] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

All other measured disturbances have a margin of at least 20 dB to the limit.

## 8 CONDUCTED BAND EDGE MEASUREMENT

<b>Date of test:</b>	2017-02-24	<b>Test location:</b>	Wireless Center
<b>EUT Serial:</b>	LC, HC	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	MTV	<b>Relative humidity:</b>	11 %
<b>Test result:</b>	Pass	<b>Margin:</b>	25.6 dB

### 8.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 6.10.4.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

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

### 8.2 Test conditions

Detector: Peak,  
RBW: 100 kHz  
VBW: 1 MHz  
Span: 10 / 20 MHz

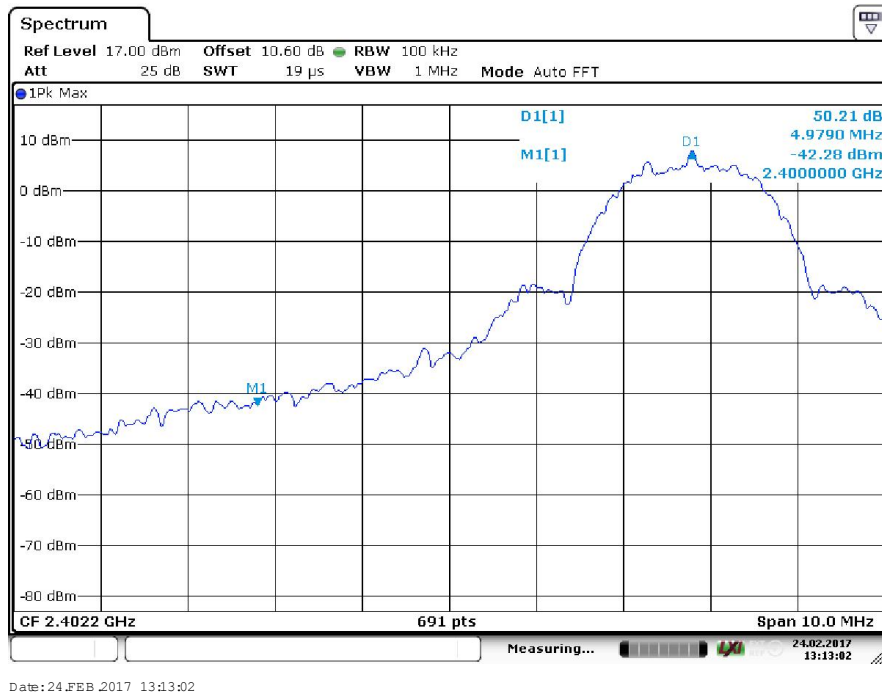
### 8.3 Requirement

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

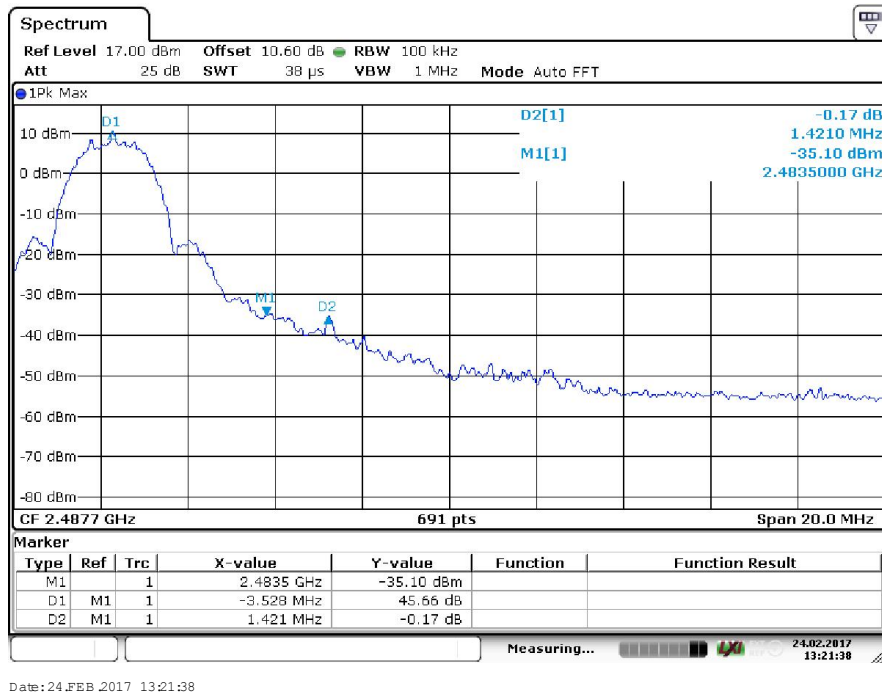
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either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



**8.4 Test results**



**Screenshot: Lower band edge sweep, single channel**



**Screenshot: Upper band edge sweep, single channel**

**Test results**

<b>Band edge</b>	<b>Delta [dBc]</b>	<b>Limit [dBc]</b>	<b>Margin [dB]</b>
Lower	-50.2	-20.0	32.0
Upper	-45.6	-20.0	25.6

**9 PEAK CONDUCTED OUTPUT POWER**

<b>Date of test:</b>	2017-02-24	<b>Test location:</b>	Wireless Center
<b>EUT Serial:</b>	LC, MC, HC	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	MTV	<b>Relative humidity:</b>	11 %
<b>Test result:</b>	Pass	<b>Margin:</b>	17.6 dB

**9.1 Test set-up and test procedure.**

The test method is in accordance with ANSI C63.10-2013 section 11.9.1.1.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

**9.2 Test conditions**

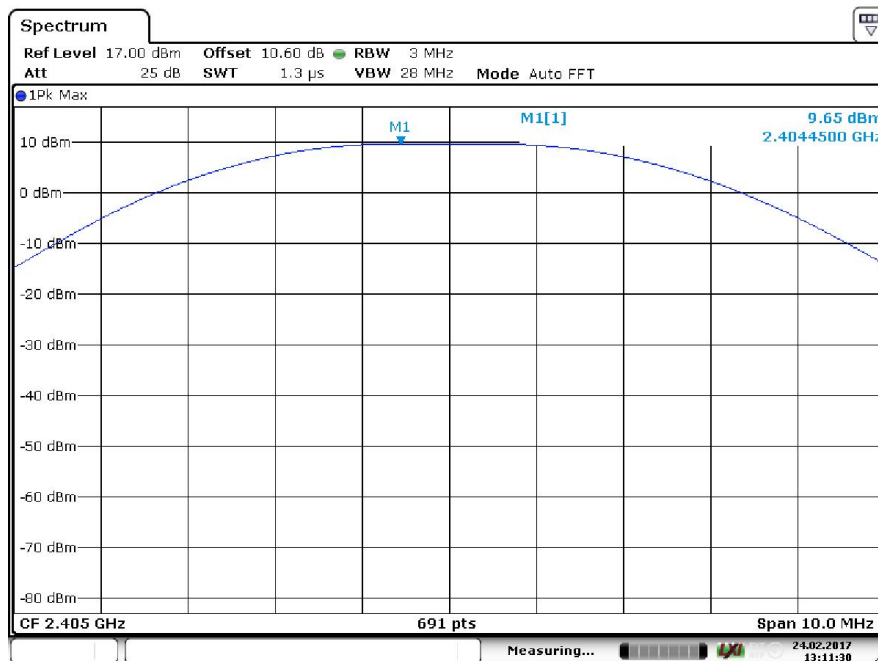
Detector: Peak,  
 RBW: >OBW  
 VBW: 3 x RBW  
 Span: >3 x OBW

**9.3 Requirements**

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

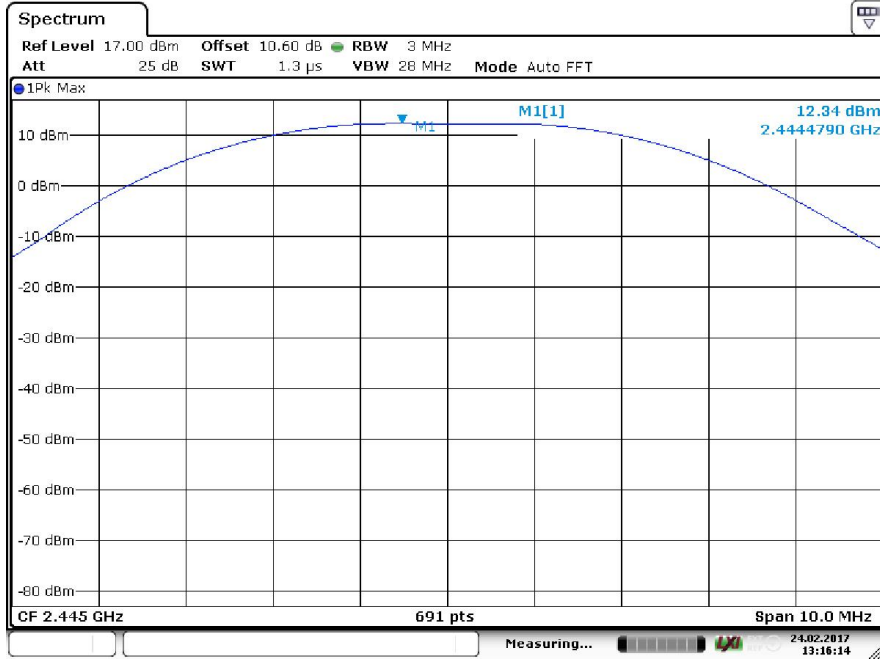
For DTSs employing digital modulation techniques operating in the bands 902 – 128 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz, the maximum peak conducted output power shall not exceed 1W.

**9.4 Test results**



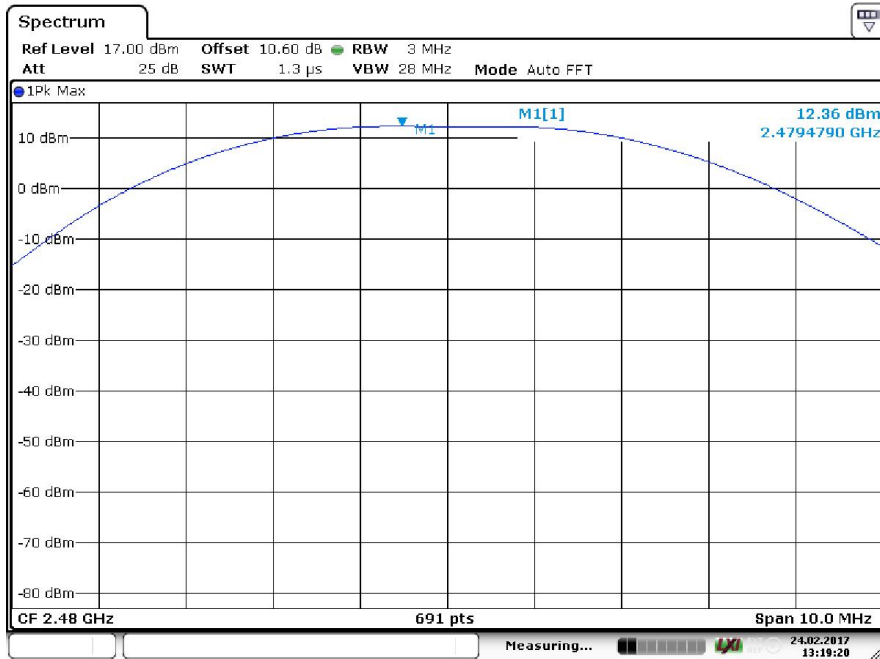
Date: 24.FEB.2017 13:11:30

**Screenshot: Output power, low channel**



Date: 24.FEB.2017 13:16:14

**Screenshot: Output power, middle channel**



Date: 24.FEB.2017 13:19:20

**Screenshot: Output power, high channel**

**Test result**

Channel [MHz]	Output power [dBm]
2405	9.7
2445	12.3
2480	12.4

**10 OCCUPIED 6 DB BANDWIDTH**

<b>Date of test:</b>	2017-02-24	<b>Test location:</b>	Wireless Center
<b>EUT Serial:</b>	LC, MC, HC	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	MTV	<b>Relative humidity:</b>	11 %
<b>Test result:</b>	Pass	<b>Margin:</b>	25.6 dB

**10.1 Test set-up and test procedure.**

The test method is in accordance with ANSI C63.10-2013 section 11.8.1.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

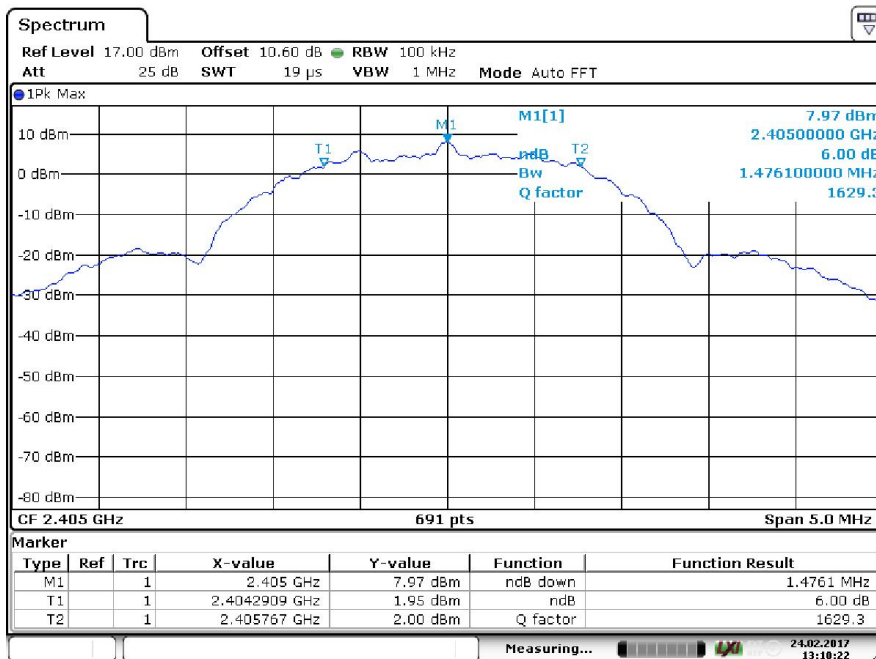
**10.2 Test conditions**

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

**10.3 Requirements**

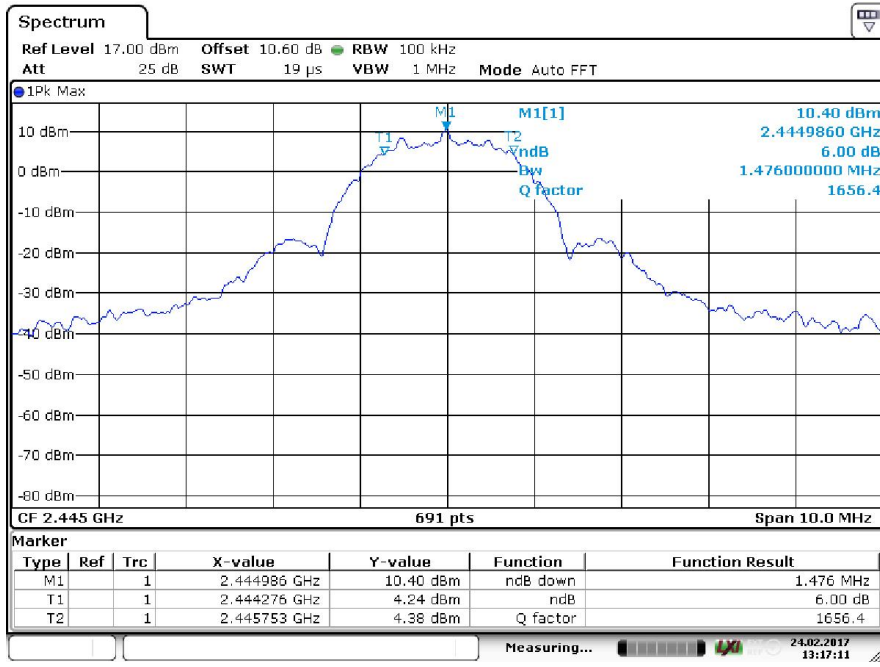
Reference: CFR 47§15.247(a)(2), RSS-247 5.2(1)  
 The minimum 6 dB bandwidth shall be 500 kHz.

**10.4 Test results**



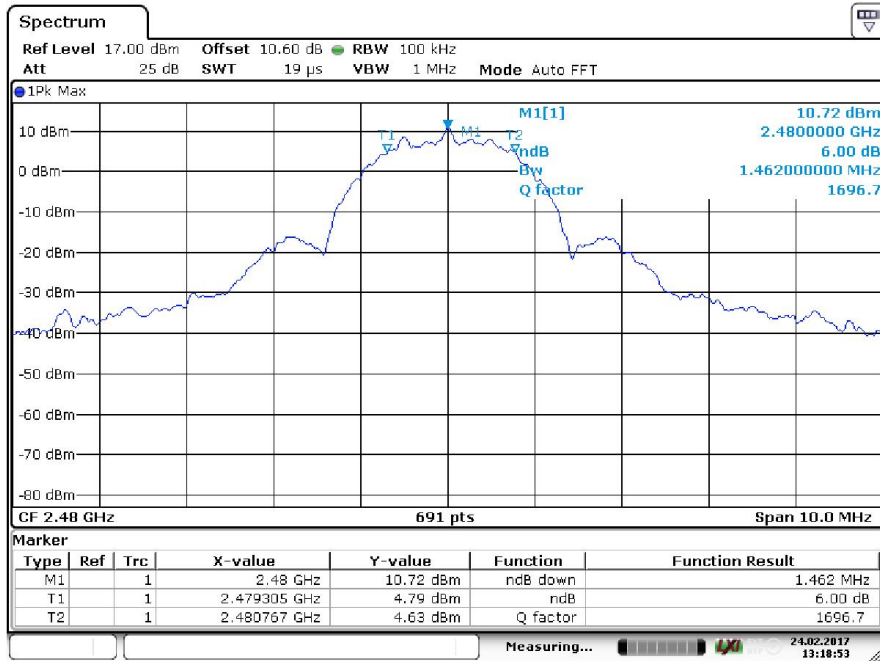
Date: 24.FEB.2017 13:10:22

**Screenshot: Occupied 6 dB bandwidth Measurement, low channel**



Date: 24.FEB.2017 13:17:11

**Screenshot: Occupied 6 dB bandwidth Measurement, middle channel**



Date: 24.FEB.2017 13:18:53

**Screenshot: Occupied 6 dB bandwidth Measurement, high channel**

**Test result**

Channel [MHz]	6 dB BW [MHz]
2405	1.48
2445	1.48
2480	1.46

**11 99 % BANDWIDTH**

<b>Date of test:</b>	2017-03-14	<b>Test location:</b>	Wireless Center
<b>EUT Serial:</b>	LR, MR, HR	<b>Ambient temp:</b>	23 °C
<b>Tested by:</b>	DNI	<b>Relative humidity:</b>	24 %
<b>Test result:</b>	Pass	<b>Margin:</b>	N/A

**11.1 Test set-up and test procedure.**

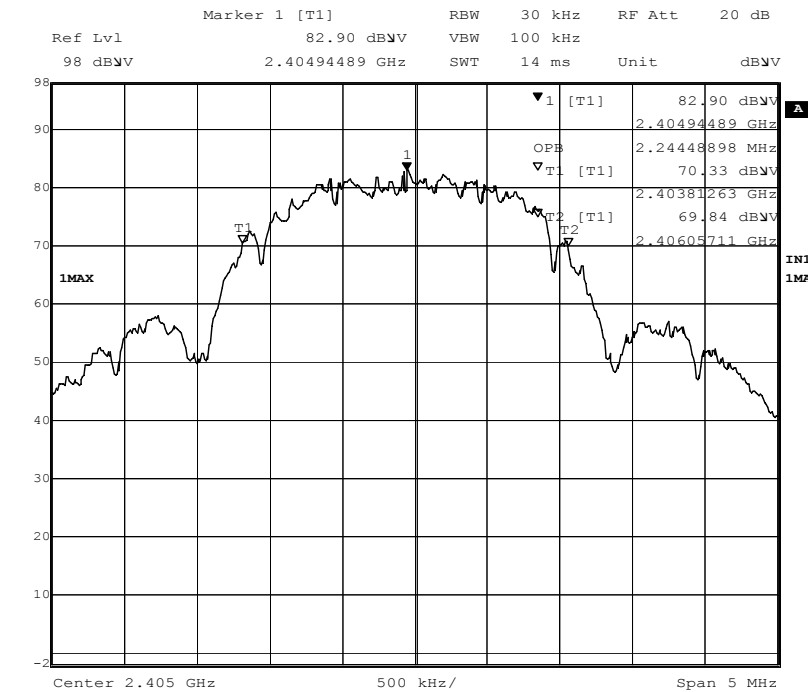
The test method is in accordance with RSS-GEN section 6.6.

The test set up was according to section 7.1.

**11.2 Test conditions**

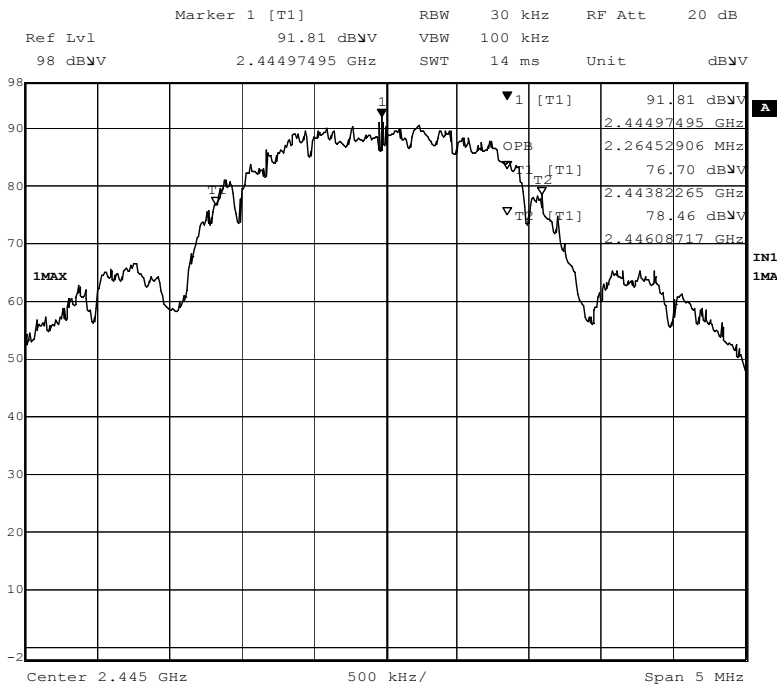
Detector: Peak,  
 RBW: 1 – 5 % of OBW  
 VBW: 3 x RBW

**11.3 Test results**



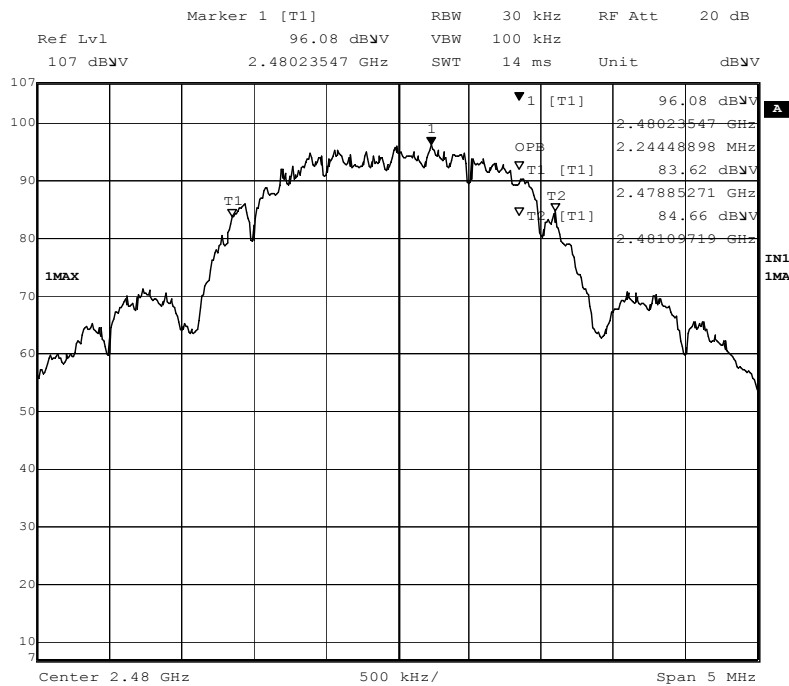
Date: 14.MAR.2017 07:02:40

**Screenshot: 99 % bandwidth Measurement, low channel**



Date: 14.MAR.2017 07:05:24

**Screenshot: 99 % bandwidth Measurement, middle channel**



Date: 14.MAR.2017 07:17:45

**Screenshot: 99 % bandwidth Measurement, high channel**

**Test result**

Channel [MHz]	99 % BW [MHz]
2405	2.24
2445	2.26
2480	2.24



**12 PEAK POWER SPECTRAL DENSITY**

<b>Date of test:</b>	2017-02-24	<b>Test location:</b>	Wireless Center
<b>EUT Serial:</b>	LC, MC, HC	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	MTV	<b>Relative humidity:</b>	11 %
<b>Test result:</b>	Pass	<b>Margin:</b>	8.8 dB

**12.1 Test set-up and test procedure.**

The test method is in accordance with ANSI C63.10-2013 section 11.10.2.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

**12.2 Test conditions**

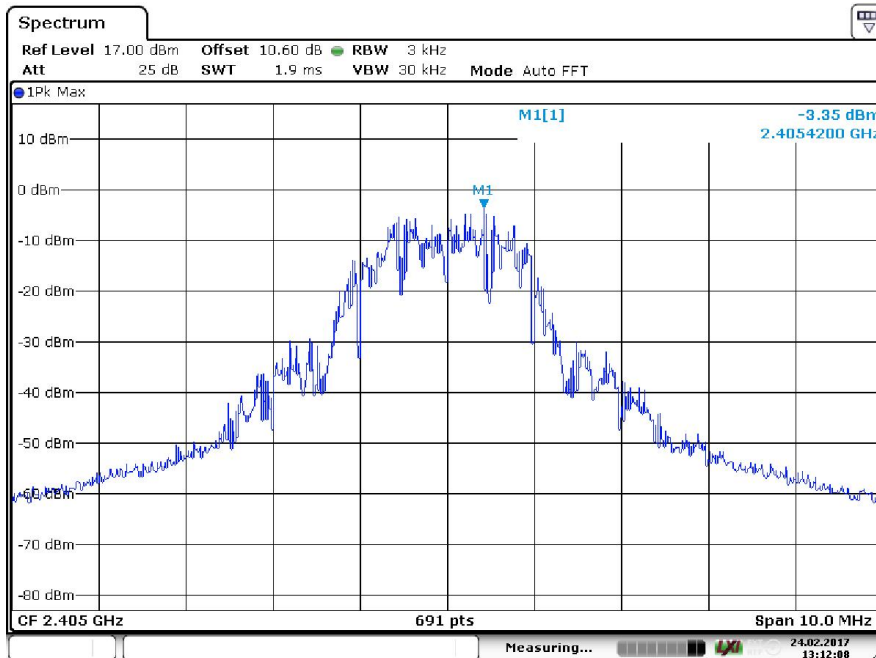
Detector: Peak,  
 RBW: 3 kHz  
 VBW: >3 x RBW  
 Span: 1.5 x 6 dB bandwidth

**12.3 Requirements**

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

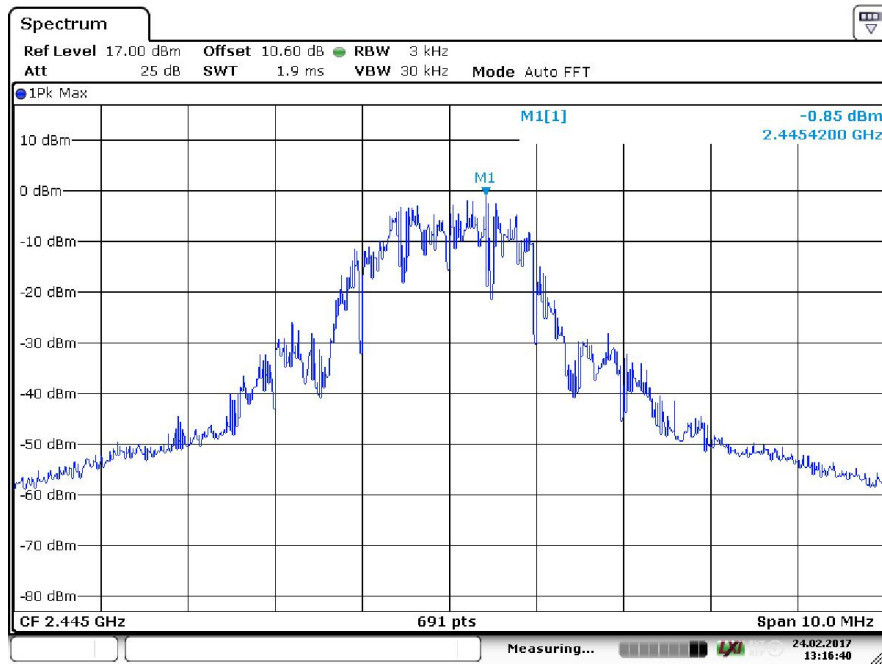
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

**12.4 Test results**



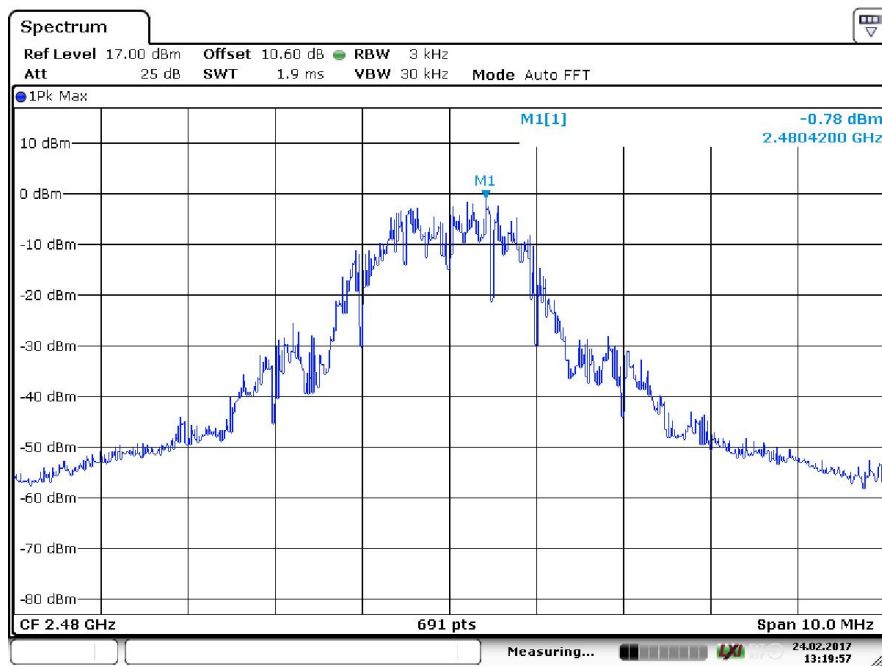
Date: 24.FEB.2017 13:12:09

**Screenshot: Peak power spectral density, low channel**



Date: 24.FEB.2017 13:16:40

**Screenshot: Peak power spectral density, middle channel**



Date: 24.FEB.2017 13:19:57

**Screenshot: Peak power spectral density, high channel**

**Test result**

Channel [MHz]	PSD [dBm/3kHz]
2405	-3.4
2445	-0.9
2480	-0.8

**13 TRANSMITTER DUTY CYCLE FOR PULSED TRANSMISSIONS**

<b>Date of test:</b>	2017-04-13	<b>Test location:</b>	Wireless Center
<b>EUT Serial:</b>	MC	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	DNI	<b>Relative humidity:</b>	30 %
<b>Test result:</b>	N/A	<b>Margin:</b>	N/A

**13.1 Test set-up and test procedure.**

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

The EUT was connected to spectrum analyser via rf-cable and attenuator.

**13.2 Test conditions**

Detector: Peak  
RBW 3 MHz  
VBW 3 MHz  
Span 0 Hz  
Sweep time 5/100 ms

**13.3 Requirement**

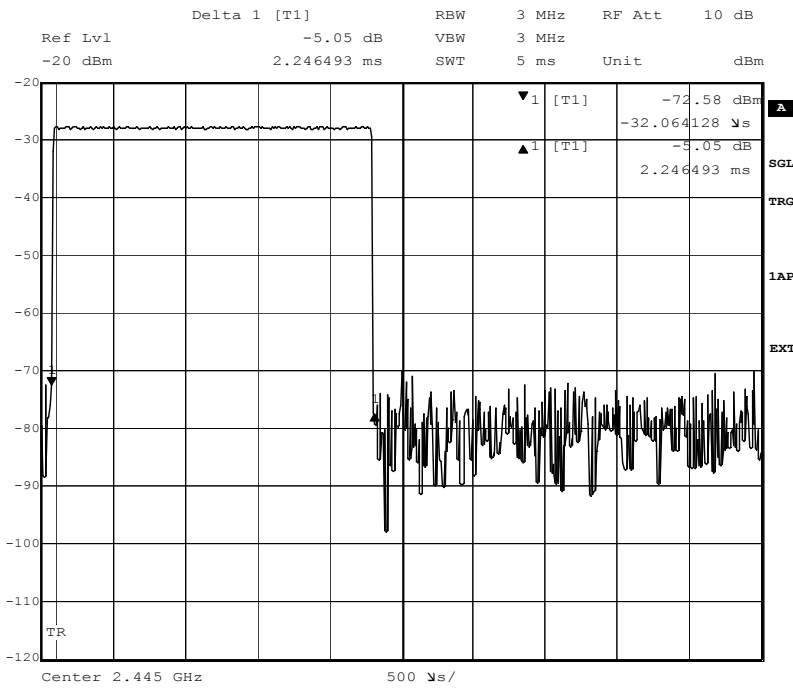
CFR 47 15.35(c) and RSS-GEN section 6.10

**13.4 Test results**

$T_{on} = 2.25 * 10 = 22.5$  ms

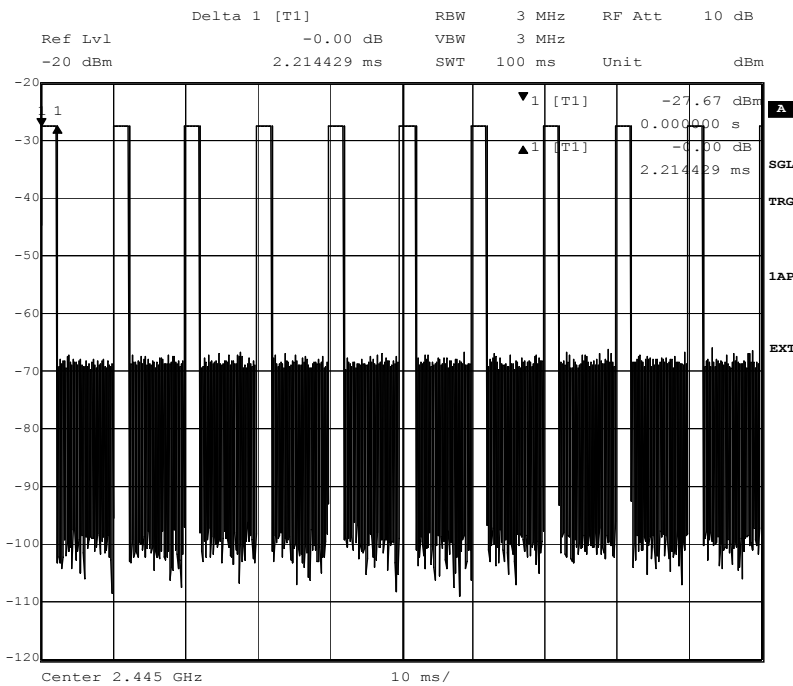
Duty cycle is calculated  $T_{on} / 100$  ms = 0.225

Peak to average correction factor =  $20 \text{ LOG (Duty cycle)}$  = -12.96



Date: 13.APR.2017 12:45:52

**Screenshot: Time of one pulse**



Date: 13.APR.2017 12:46:40

**Screen shot: 100 ms measurement**

## 14 TEST EQUIPMENT

## BUR 1

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. Date	Cal. Interval
Measurement receiver	Rohde & Schwarz	ESCI	12741	7/2016	1 year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	32798	7/2016	1 year
AMN / LISN	Rohde & Schwarz	ESH3-Z5	5875	7/2016	1 year

## Björk hallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. Date	Cal. Interval
Measurement receiver	Rohde & Schwarz	ESIB 26	32291	7/2016	1 year
Measurement receiver	Rohde & Schwarz	ESU 40	13178	7/2016	1 year
UltraLog antenna	Rohde & Schwarz	HL562	30711	12/2014	3 years
Horn antenna	Rohde & Schwarz	HF907	32307	7/2015	3 years
Pre amplifier	Rohde & Schwarz	TS-pre1	32306	7/2016	1 year
Horn antenna + preamp	Bonn	BLMA 1826-5A	31247	1/2017	3 years
Rf cable	Megaphase	GC12-K1K1-315	39127	7/2016	1 year

## Wireless Center

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. Date	Cal. Interval
Signal analyser:	Rohde & Schwarz	FSV	32594	7/2016	1 year
10 dB Attenuator:	Huber+Suhner	5910_N-50-010	32696	6/2016	1 year
Measurement cable	Huber+Suhner	Sucoflex 104 PE	39084	7/2016	1 year
Signal analyser:	Rohde & Schwarz	FSIQ40	12793	7/2016	1 year

**15 MEASUREMENT UNCERTAINTY**

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz  $\pm 3.7$  dB

Measurement uncertainty for conducted RF measurements  $\pm 1.3$  dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 30 to 1000 MHz at 3 m  $\pm 5.1$  dB

Uncertainty for the frequency range 30 to 1000 MHz at 10 m  $\pm 5.0$  dB

Uncertainty for the frequency range 1.0 to 18 GHz at 3 m  $\pm 4.7$  dB

Uncertainty for the frequency range 18 to 26 GHz at 3 m  $\pm 4.8$  dB

Uncertainty for the frequency range 26 to 40 GHz at 3 m  $\pm 5.7$  dB

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

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

## 16 TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1707608STO-002, Annex 1.

Test set up photos are in separate document 1707608STO-002, Annex 2.