

FCC LISTED, REGISTRATION NUMBER: 905266

**IC LISTED REGISTRATION NUMBER
IC 4621A-1**

AT4 wireless, S.A.

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Registro Mercantil de Málaga, Tomo 1169,
Libro 82, Folio 133, Hoja MA3729

TEST REPORT

REFERENCE STANDARD:

USA FCC Part 15.247, 15.207

CANADA RSS-210, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

Licence-Exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

General Requirements and Information for the Certification of Radio Apparatus.

NIE : 39342RRF.004

Approved by : A. Llamas / RF Lab. Manager
(name / position & signature)

Elaboration date : 2013-08-09

Identification of item tested : FITNESS MONITOR

Trademark : ADIDAS

Model and/or type reference : G76792

Serial number : D10813060000099, D10813060000106

Other identification of the product : Commercial name: MICOACH SMART RUN
Hw version: 7.0.0
Sw version: 1.6.2
FCC ID: ZLGSMARTRUN
IC ID: 9722B-SMARTRUN

Features : Bluetooth 4.0+EDR, Wlan b/g/n20 1x1, GPS receiver, battery charger

Description : FITNESS MONITOR

Applicant : ADIDAS AG

Address : WORLD OF SPORTS, ADI-DASSLER-STRABE 1, D-91074
HERZOGENAUERACH, GERMANY

CIF/NIF/Passport : DE132490588

Contact person: : Simon Drabble

Telephone / Fax : +49 160 8 84 2687 / +49 9132 84 5773

e-mail: : simon.drabble@adidas.com

Test samples supplier : ELEKTROBIT

Address : Tutkijantie 8, Oulu FINLAND

CIF/NIF/Passport : 1737565-0

Contact person: : Pertti Harmaala

Telephone / Fax : +358 403445781

e-mail: : Pertti.harmaala@elektrobit.com

Manufacturer : Same as applicant

Test method requested	See Standard																																																																		
Standard	USA FCC Part 15.247 10-1-11 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-11 Edition: Radiated emission limits; general requirements. CANADA RSS-210 Issue 8 (December 2010). CANADA RSS-Gen Issue 3 (December 2010). Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03 dated 08/04/2013. ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices.																																																																		
Test procedure	PERF034																																																																		
Non-standardized test method	N/A																																																																		
Used instrumentation	<u>Conducted Measurements</u> <table> <thead> <tr> <th></th> <th>Last Cal. date</th> <th>Cal. due date</th> </tr> </thead> <tbody> <tr> <td>1. Spectrum Analyzer Agilent E4440A</td> <td>2012/02</td> <td>2014/02</td> </tr> <tr> <td>2. EMI Test Receiver R&S ESU40</td> <td>2012/03</td> <td>2014/03</td> </tr> <tr> <td>3. Universal Power Meter R&S NRP-Z11</td> <td>2012/12</td> <td>2014/12</td> </tr> <tr> <td>4. Transient limiter. HP 11947A</td> <td>2012/09</td> <td>2014/09</td> </tr> <tr> <td>5. Line Impedance Stabilization Network (L.I.S.N.) R&S. ESH2-Z5</td> <td>2013/01</td> <td>2015/01</td> </tr> <tr> <td>6. DC power supply R&S NGPE 40/40</td> <td>2011/11</td> <td>2014/11</td> </tr> </tbody> </table> <u>Radiated Measurements</u> <table> <thead> <tr> <th></th> <th>Last Cal. date</th> <th>Cal. due date</th> </tr> </thead> <tbody> <tr> <td>1. Semianechoic Absorber Lined Chamber IR 11. BS</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>2. Control Chamber IR 12.BC</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>3. Hybrid Bilog antenna Sunol Sciences Corporation JB6</td> <td>2011/05</td> <td>2014/05</td> </tr> <tr> <td>4. Antenna mast EM 1072 NMT</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>5. Rotating table EM 1084-4. ON</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>6. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E</td> <td>2011/05</td> <td>2014/05</td> </tr> <tr> <td>7. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J</td> <td>2011/09</td> <td>2014/09</td> </tr> <tr> <td>8. EMI Test Receiver R&S ESIB26</td> <td>2011/11</td> <td>2013/11</td> </tr> <tr> <td>9. RF pre-amplifier Miteq JS4-12002600-30-5A.</td> <td>2012/07</td> <td>2014/07</td> </tr> <tr> <td>10. Multi Device Controller EMCO 2090</td> <td>N.A.</td> <td>N.A.</td> </tr> <tr> <td>11. Spectrum Analyzer Agilent E4440A</td> <td>2012/02</td> <td>2014/02</td> </tr> <tr> <td>12. RF pre-amplifier Miteq AFS5-04001300-15-10P-6.</td> <td>2012/07</td> <td>2014/07</td> </tr> <tr> <td>13. RF pre-amplifier Schaffner CPA 9231.</td> <td>2013/06</td> <td>2015/06</td> </tr> <tr> <td>14. EMI Test Receiver R&S ESU40</td> <td>2012/03</td> <td>2014/03</td> </tr> </tbody> </table>		Last Cal. date	Cal. due date	1. Spectrum Analyzer Agilent E4440A	2012/02	2014/02	2. EMI Test Receiver R&S ESU40	2012/03	2014/03	3. Universal Power Meter R&S NRP-Z11	2012/12	2014/12	4. Transient limiter. HP 11947A	2012/09	2014/09	5. Line Impedance Stabilization Network (L.I.S.N.) R&S. ESH2-Z5	2013/01	2015/01	6. DC power supply R&S NGPE 40/40	2011/11	2014/11		Last Cal. date	Cal. due date	1. Semianechoic Absorber Lined Chamber IR 11. BS	N.A.	N.A.	2. Control Chamber IR 12.BC	N.A.	N.A.	3. Hybrid Bilog antenna Sunol Sciences Corporation JB6	2011/05	2014/05	4. Antenna mast EM 1072 NMT	N.A.	N.A.	5. Rotating table EM 1084-4. ON	N.A.	N.A.	6. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E	2011/05	2014/05	7. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J	2011/09	2014/09	8. EMI Test Receiver R&S ESIB26	2011/11	2013/11	9. RF pre-amplifier Miteq JS4-12002600-30-5A.	2012/07	2014/07	10. Multi Device Controller EMCO 2090	N.A.	N.A.	11. Spectrum Analyzer Agilent E4440A	2012/02	2014/02	12. RF pre-amplifier Miteq AFS5-04001300-15-10P-6.	2012/07	2014/07	13. RF pre-amplifier Schaffner CPA 9231.	2013/06	2015/06	14. EMI Test Receiver R&S ESU40	2012/03	2014/03
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Competences and guarantees

AT4 wireless is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

AT4 wireless is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621A-1.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the AT4 wireless internal documents:

PODT000: : Procedimiento para el cálculo de incertidumbres de medida

Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample M/01 is composed of the following elements:

<u>Control Nº</u>	<u>Description</u>	<u>Model</u>	<u>Serial Nº</u>	<u>Date of reception</u>
39342C/08	Fitness monitor with integral antenna	G76792	D10813060000106	02/07/2013

Sample M/02 is composed of the following elements:

<u>Control Nº</u>	<u>Description</u>	<u>Model</u>	<u>Serial Nº</u>	<u>Date of reception</u>
39342C/07	Fitness monitor with antenna connector	G76792	D10813060000099	02/07/2013

Sample S/01 is composed of the following elements:

<u>Control Nº</u>	<u>Description</u>	<u>Model</u>	<u>Serial Nº</u>	<u>Date of reception</u>
39342C/01	MICOACH SMART RUN. Fitness Monitor	G76792	010813060000087	02/07/2013

Auxiliary element used with the sample S/01:

<u>Control Nº</u>	<u>Description</u>	<u>Model</u>	<u>Serial Nº</u>	<u>Date of reception</u>
39342/02	Charger base	---	B01-0008	02/07/2013

1. Sample M/01 has undergone following test(s).
All radiated tests indicated in annexes A and B.
2. Sample M/02 has undergone following test(s).
All conducted tests indicated in annexes A and B.
3. Sample S/01 has undergone the next test(s):
Continuous conducted emission, power leads, in appendix C.

Testing period

The performed test started on 2013-07-02 and finished on 2013-07-12.

The tests have been performed at AT4 wireless.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 20.0 °C Max. = 21.1 °C
Relative humidity	Min. = 64.2% Max. = 65.6 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber (21 meters x 11 meters x 8 meters), the following limits were not exceeded during the test.

Temperature	Min. = 20.6 °C Max. = 21.0 °C
Relative humidity	Min. = 60 % Max. = 63 %
Air pressure	Min. = 1019 mbar Max. = 1019 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements the following limits were not exceeded during the test:

Temperature	Min. = 24.1 °C Max. = 26.2 °C
Relative humidity	Min. = 48.8 % Max. = 50.4%
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

Summary

Considering the results of the performed test according to standard USA FCC Parts 15.247 and 15.207 / RSS-210, the item under test is **IN COMPLIANCE** with the requested specifications specified in the standard.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

Remarks and comments

None.

Testing verdicts

Not applicable	NA
Pass.....	P
Fail	F
Not measured.....	NM

1. WiFi 2.4 GHz (802.11b/g/n20)

FCC PART 15 PARAGRAPH / RSS-210	VERDICT			
	NA	P	F	NM
Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a) 6 dB Bandwidth		P		
Section 15.247 Subclause (b) / RSS-210 A8.4. (4) Maximum output power and antenna gain		P		
Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations conducted (Transmitter)		P		
Section 15.247 Subclause (d) / RSS-210 A8.5. Band-edge emissions compliance (Transmitter)		P		
Section 15.247 Subclause (e) / RSS-210 A8.2. (b) Power spectral density		P		
Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations radiated (Transmitter)		P		
Section 15.207. Conducted limits		P		

2. Bluetooth Low Energy

FCC PART 15 PARAGRAPH / RSS-210		VERDICT			
		NA	P	F	NM
Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a)	6 dB Bandwidth		P		
Section 15.247 Subclause (b) / RSS-210 A8.4. (4)	Maximum output power and antenna gain		P		
Section 15.247 Subclause (d) / RSS-210 A8.5.	Emission limitations conducted (Transmitter)		P		
Section 15.247 Subclause (d) / RSS-210 A8.5.	Band-edge emissions compliance (Transmitter)		P		
Section 15.247 Subclause (e) / RSS-210 A8.2. (b)	Power spectral density		P		
Section 15.247 Subclause (d) / RSS-210 A8.5.	Emission limitations radiated (Transmitter)		P		
Section 15.207.	Conducted limits		P		

APPENDIX A: Test results.“WiFi 2.4 GHz (802.11b/g/n20)”

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TEST CONDITIONS

Power supply (V):

$V_n = 3.7$ Vdc

$V_{min} = N/A$

$V_{max} = N/A$

Type of power supply: Rechargeable battery.

Declared Gain for antenna = -1.0 dBi

TEST FREQUENCIES:

For WiFi 802.11b/g/n20:

Lowest channel (1): 2412 MHz

Middle channel (6): 2437 MHz

Highest channel (11): 2462 MHz

The data rates of 1Mb/s for 802.11b, 6Mb/s for 802.11g and HT0 for 802.11n20 were selected using the test mode supplied with the Equipment Under Test (E.U.T.) based on preliminary testing that identified those rates corresponding to the worst cases for output power and band edge levels at restricted bands.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Occupied Bandwidth

RESULTS

1. WiFi 2.4GHz 802.11 b mode

Occupied Bandwidth (see next plots).

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
99% bandwidth (MHz)	14.34	14.10	13.95
Measurement uncertainty (kHz)	± 21.7		

2. WiFi 2.4GHz 802.11 g mode

Occupied Bandwidth (see next plots).

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
99% bandwidth (MHz)	16.89	16.83	16.86
Measurement uncertainty (kHz)	± 21.7		

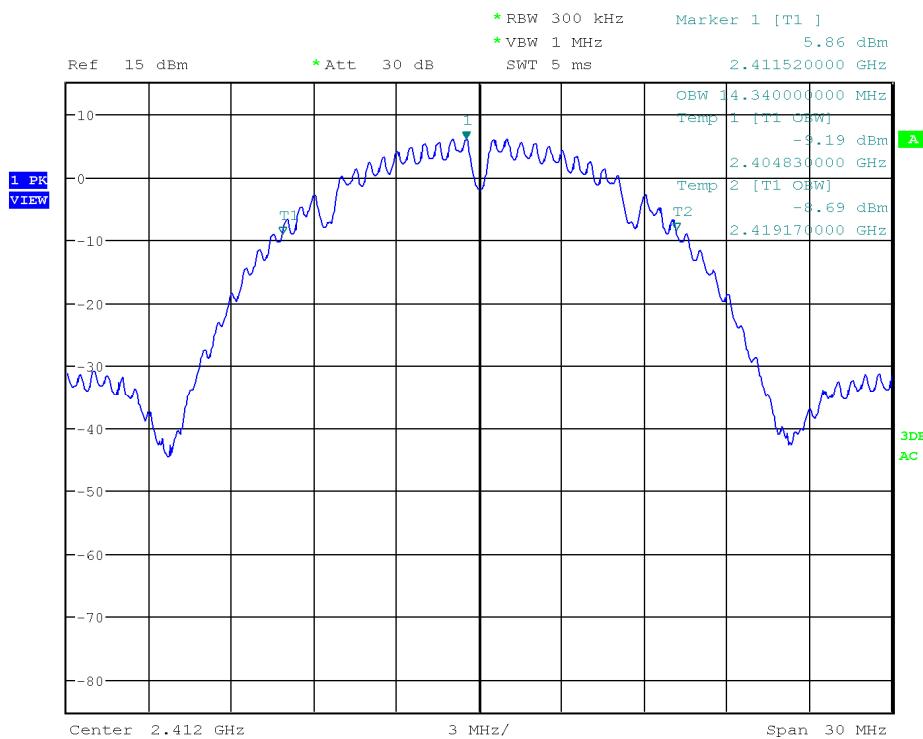
3. WiFi 2.4GHz 802.11 n20 mode

Occupied Bandwidth (see next plots).

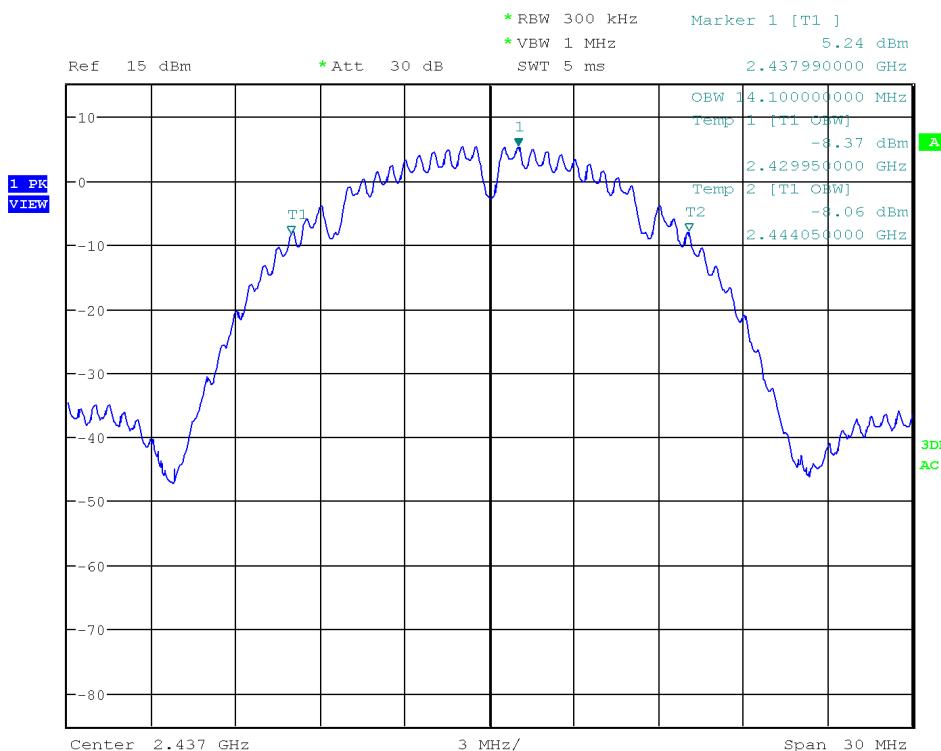
	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
99% bandwidth (MHz)	18.06	18.06	18.06
Measurement uncertainty (kHz)	± 21.7		

1. WiFi 2.4GHz 802.11 b mode

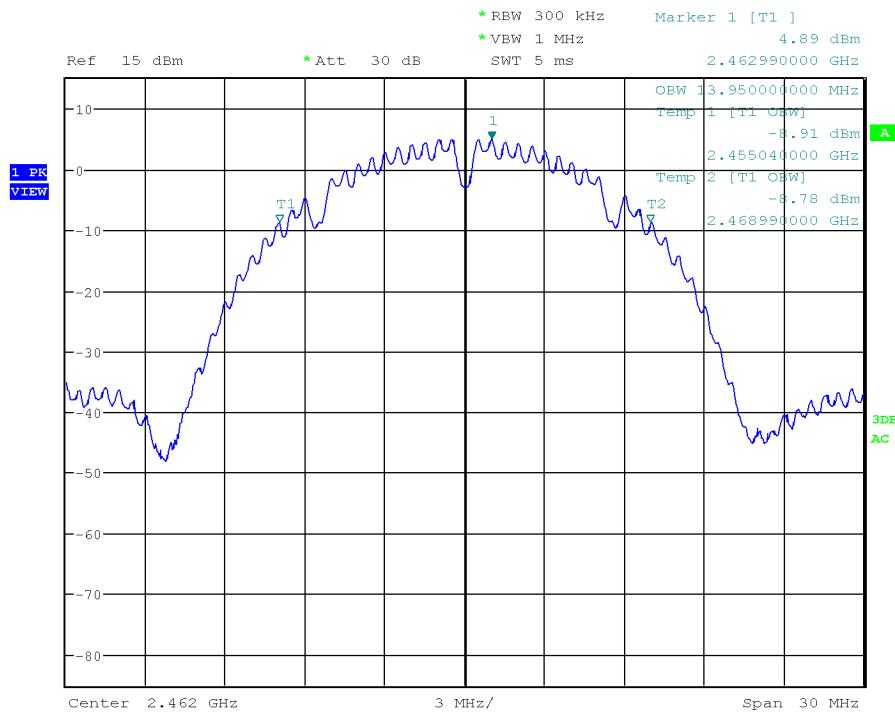
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.

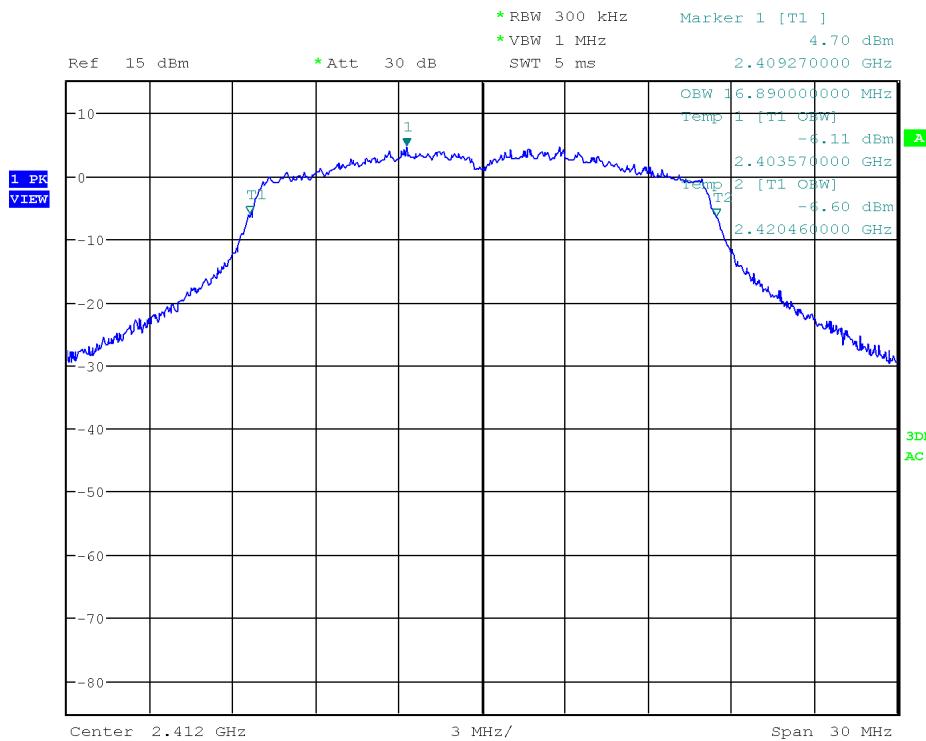


Highest Channel: 2462 MHz.

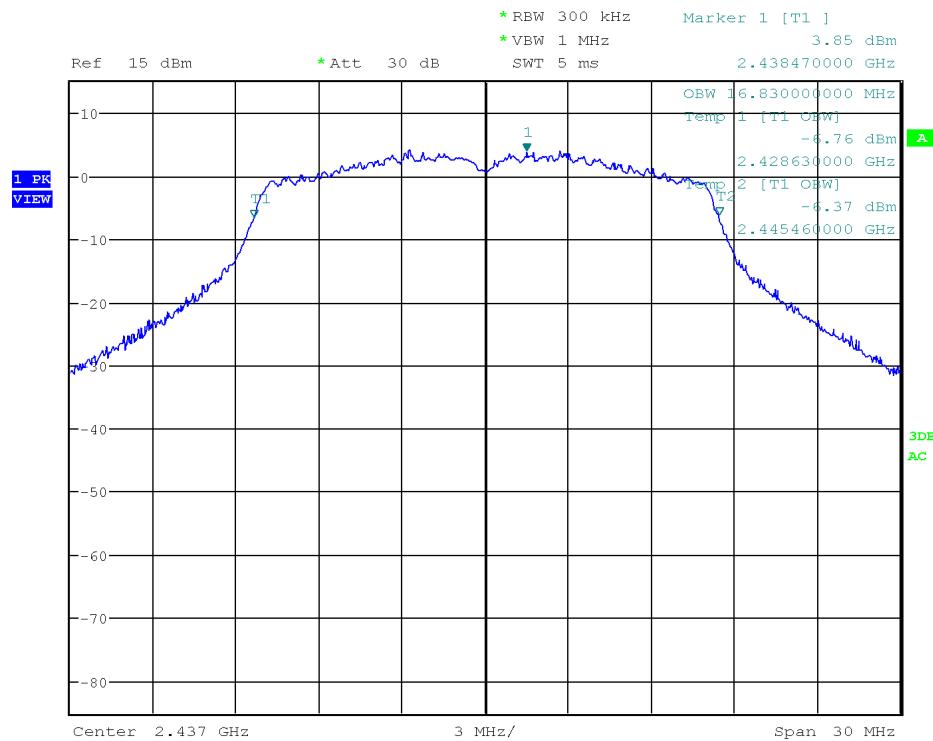


2. WiFi 2.4GHz 802.11 g mode

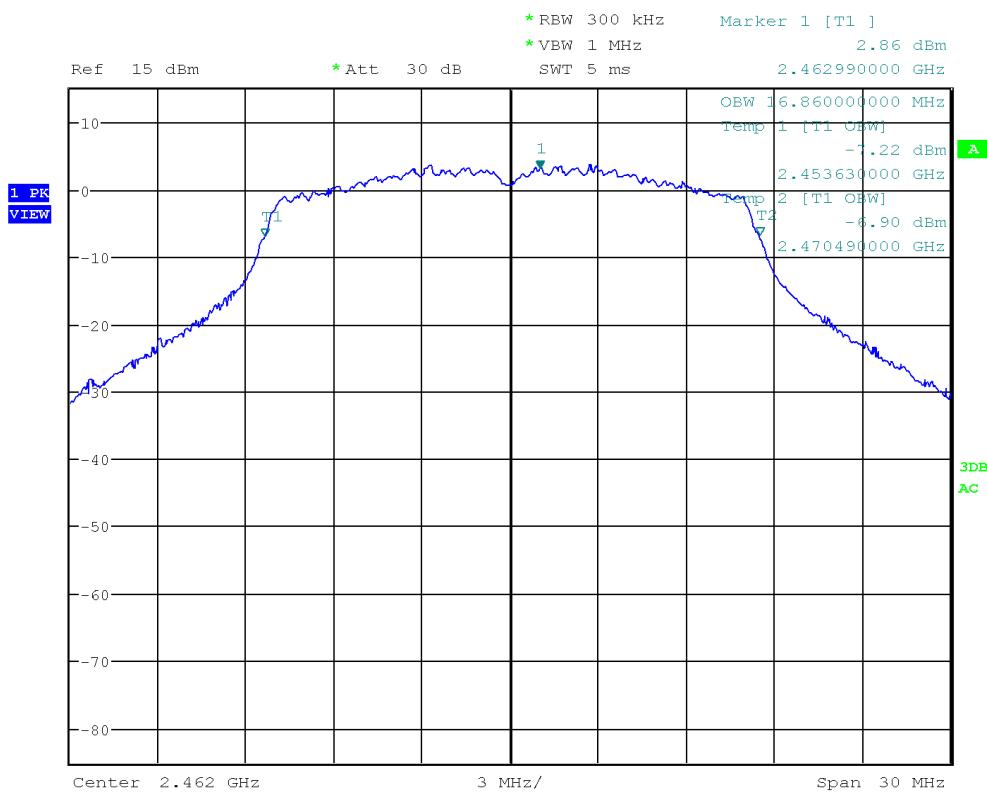
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.

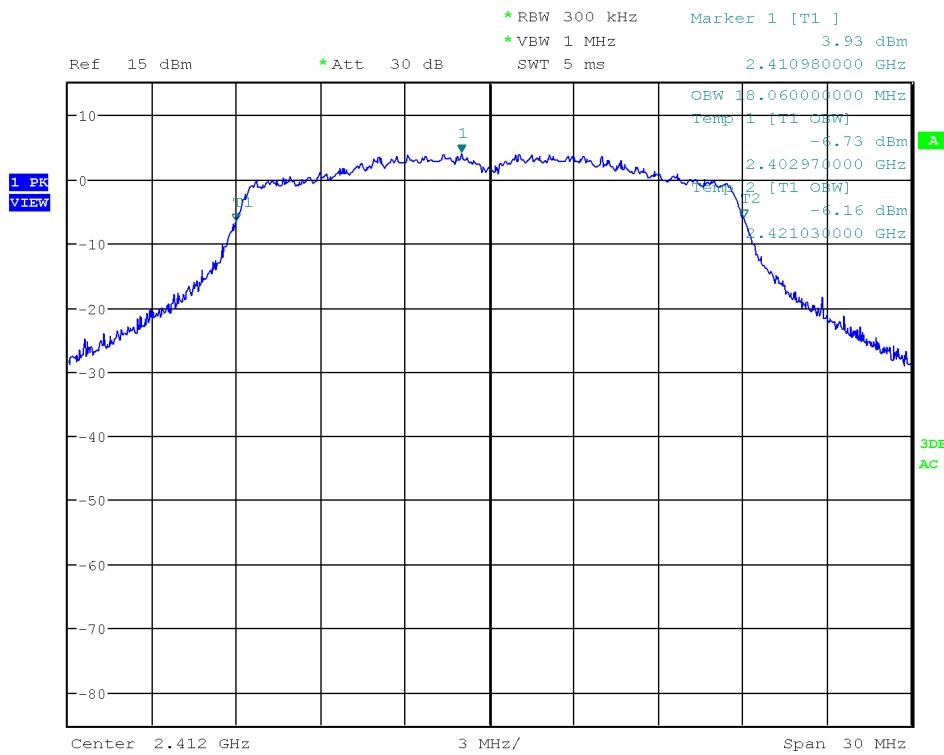


Highest Channel: 2462 MHz. Chain A.

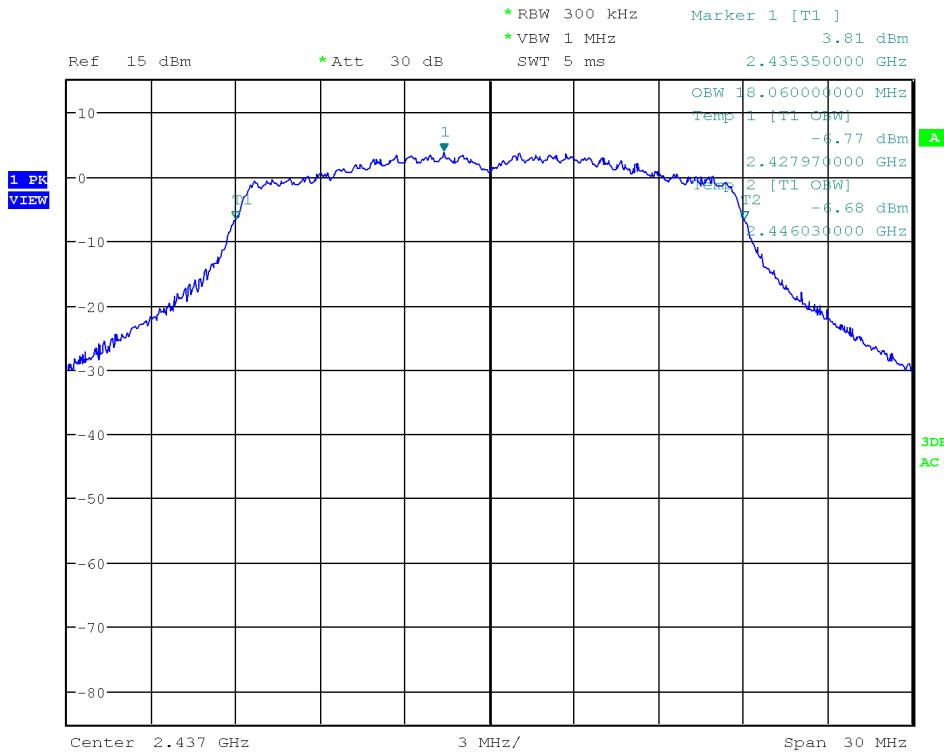


3. WiFi 2.4GHz 802.11 n20 mode

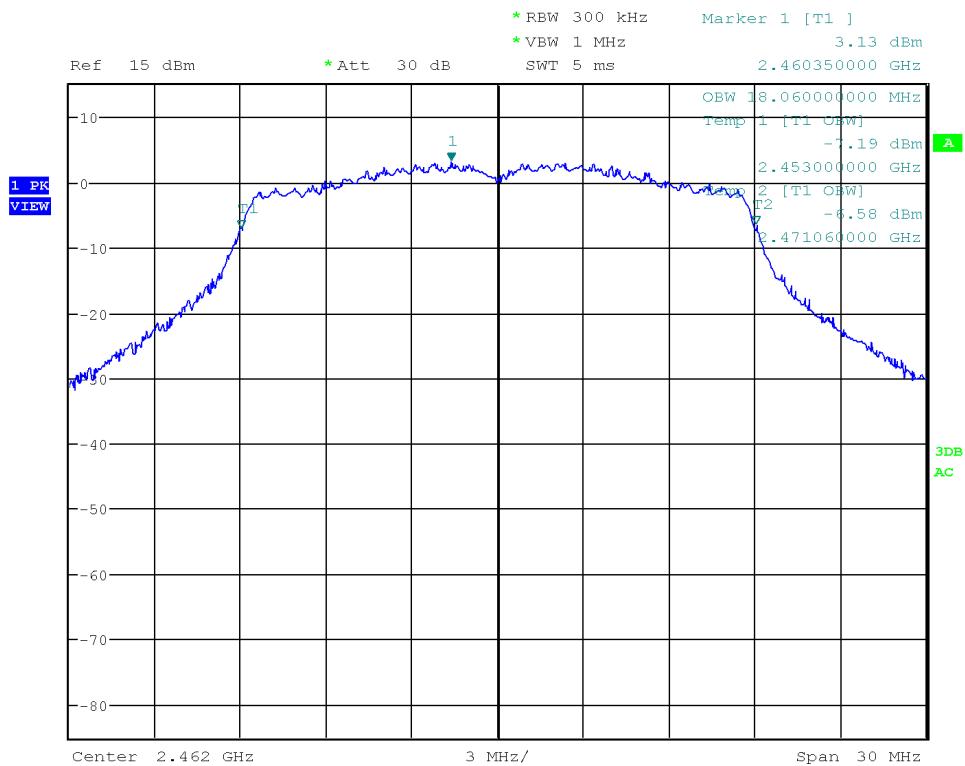
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.



Highest Channel: 2462 MHz.



Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a). 6 dB Bandwidth

SPECIFICATION

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

RESULTS

1. WiFi 2.4GHz 802.11 b mode

6 dB Bandwidth (see next plots).

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
6 dB Spectrum bandwidth (MHz)	10.064	9.090	9.538
Measurement uncertainty (kHz)		±89	

Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode

6 dB Bandwidth (see next plots).

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
6 dB Spectrum bandwidth (MHz)	15.300	15.106	15.513
Measurement uncertainty (kHz)		±89	

Verdict: PASS

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
6 dB Spectrum bandwidth (MHz)	15.449	16.186	15.961
Measurement uncertainty (kHz)		±89	

3. WiFi 2.4GHz 802.11 n20 mode

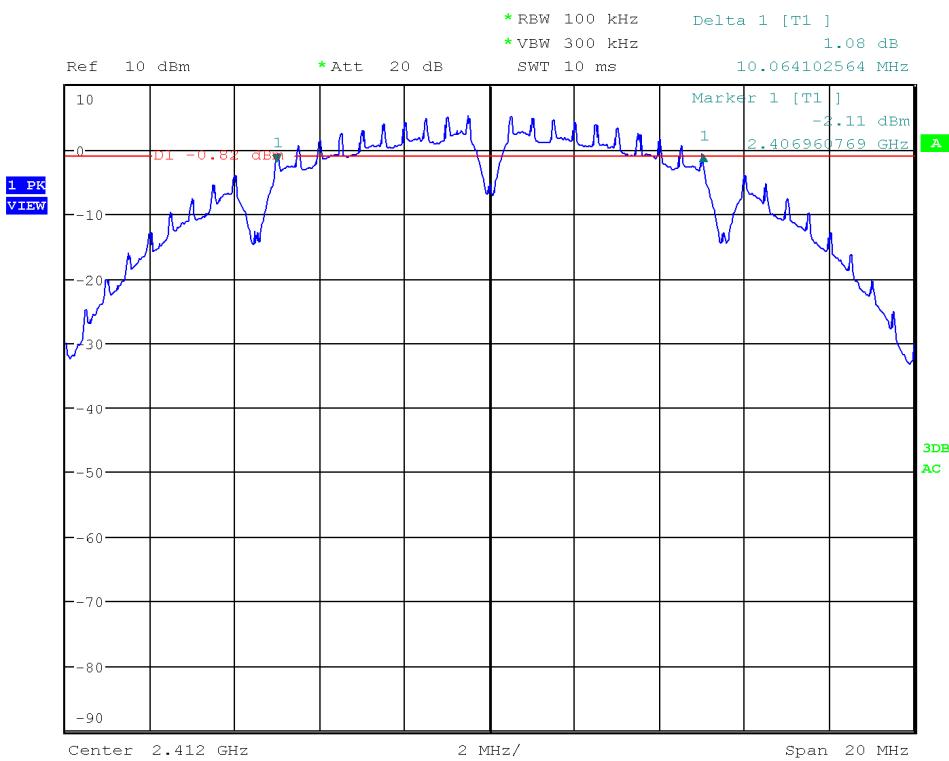
6 dB Bandwidth (see next plots).

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
6 dB Spectrum bandwidth (MHz)	15.449	16.186	15.961
Measurement uncertainty (kHz)	± 89		

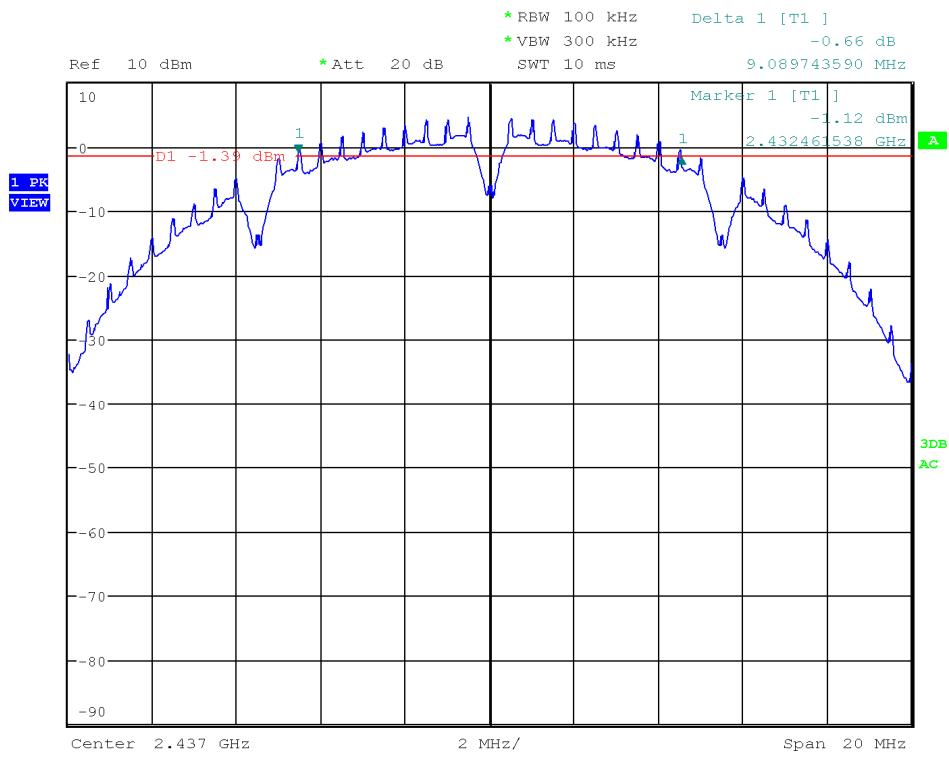
Verdict: PASS

1. WiFi 2.4GHz 802.11 b mode

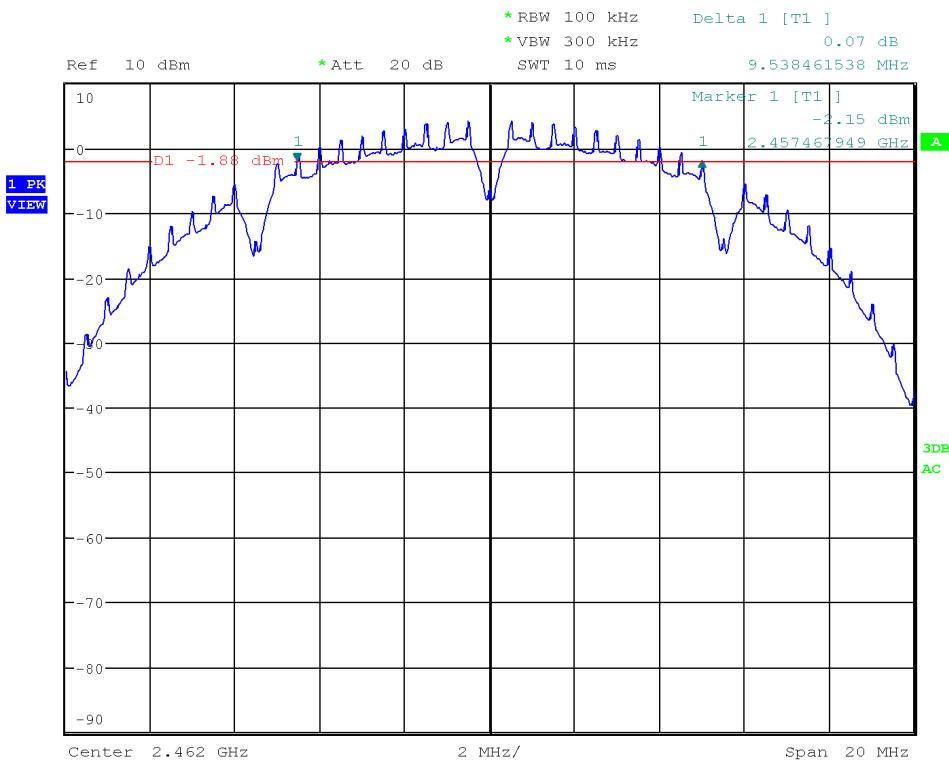
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.

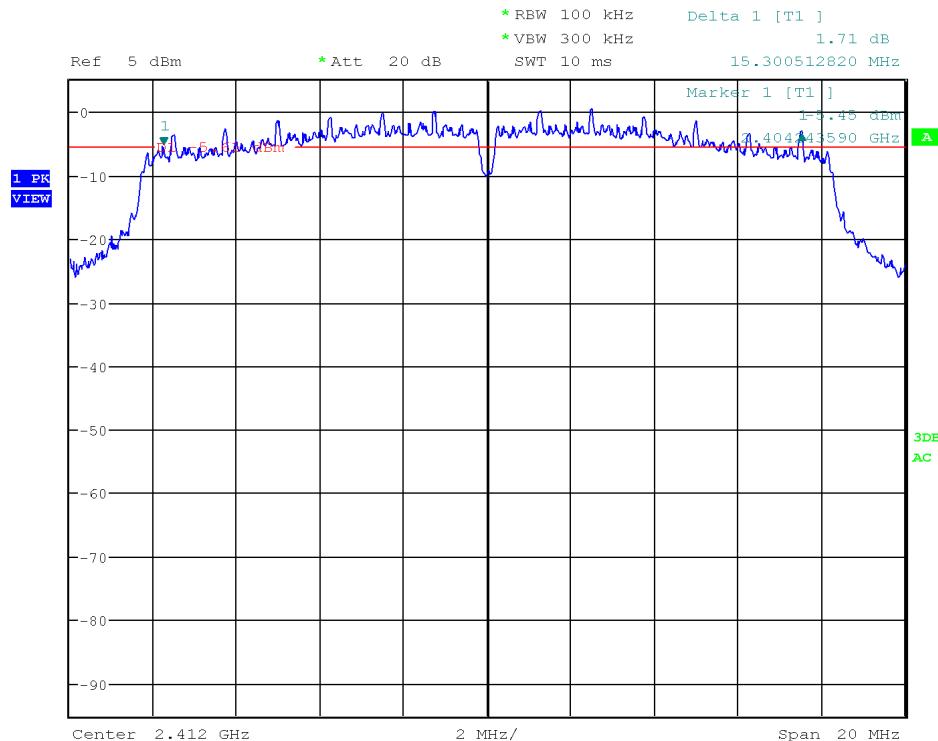


Highest Channel: 2462 MHz.

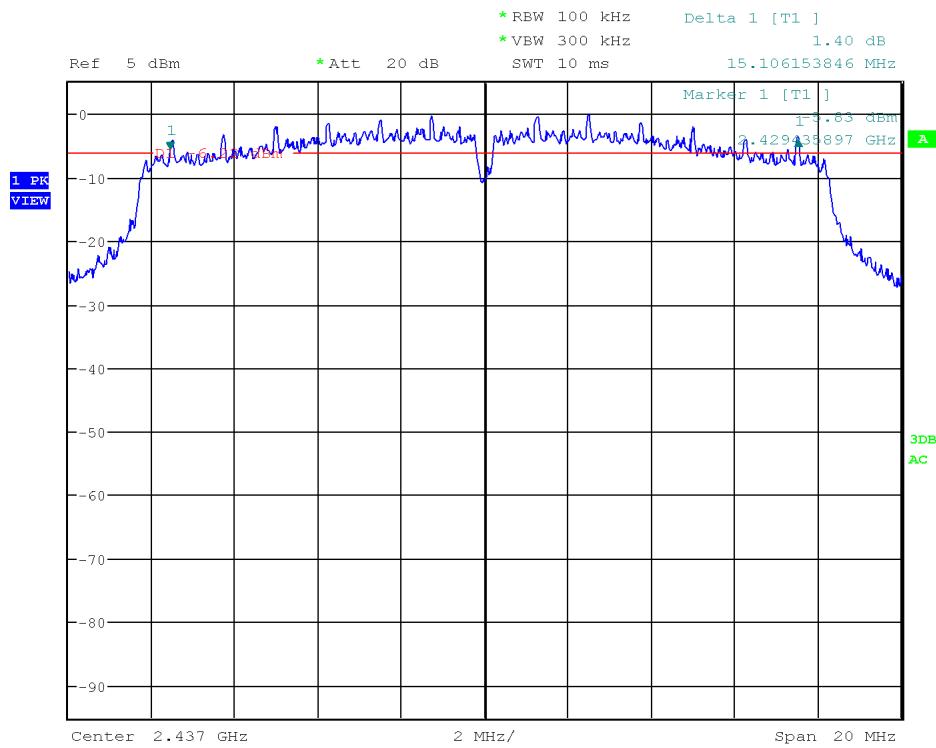


2. WiFi 2.4GHz 802.11 g mode

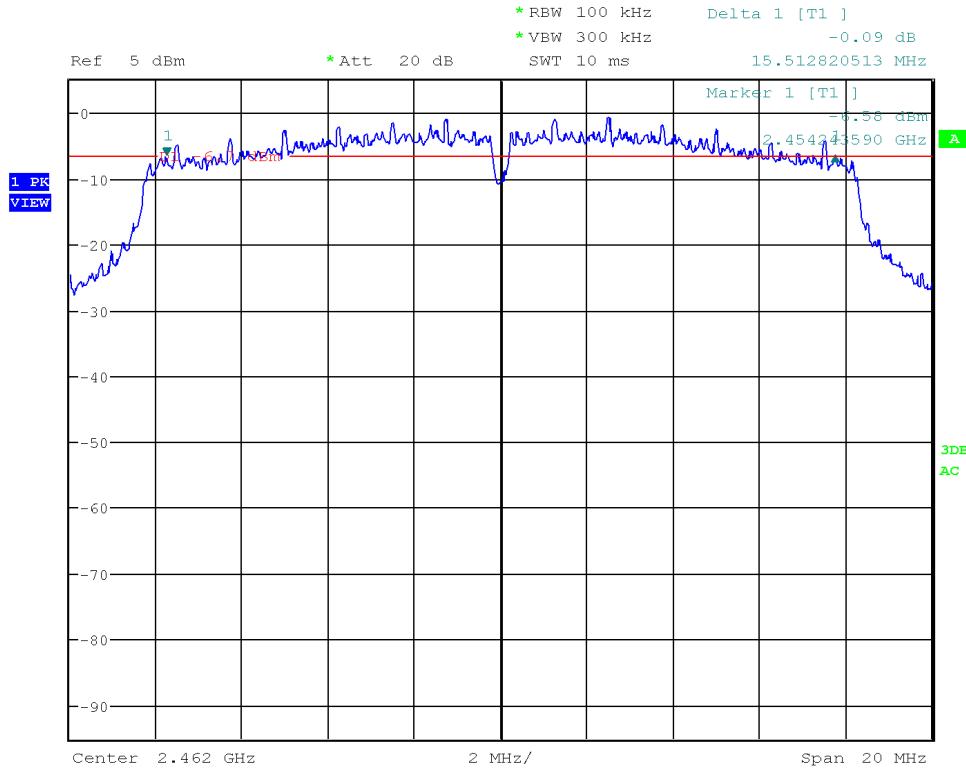
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.

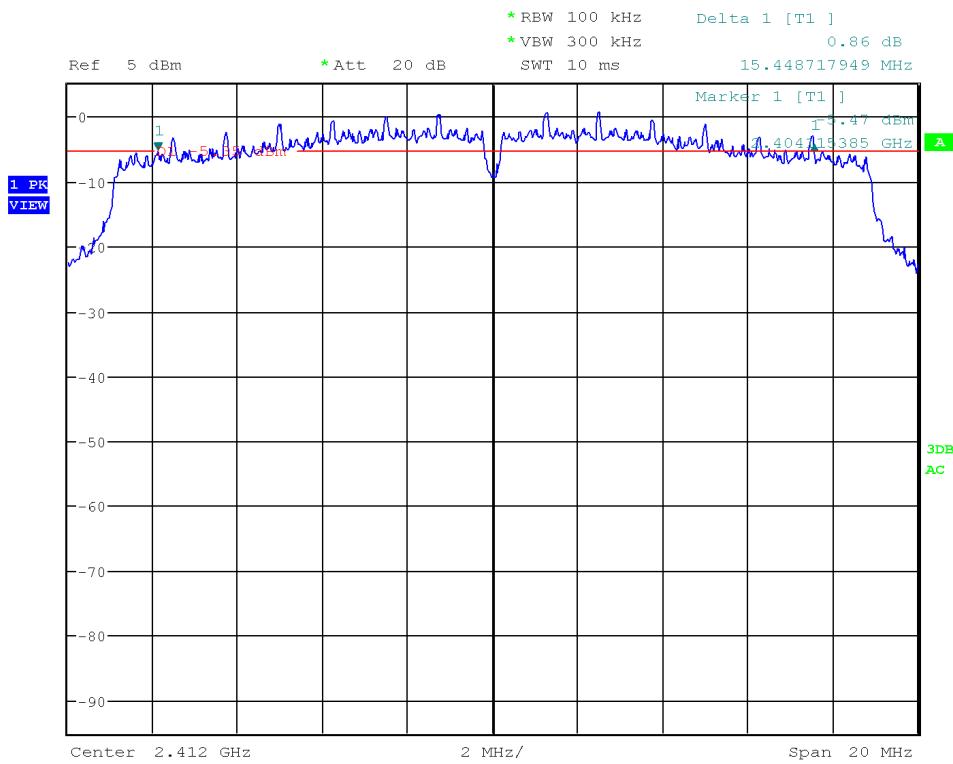


Highest Channel: 2462 MHz.

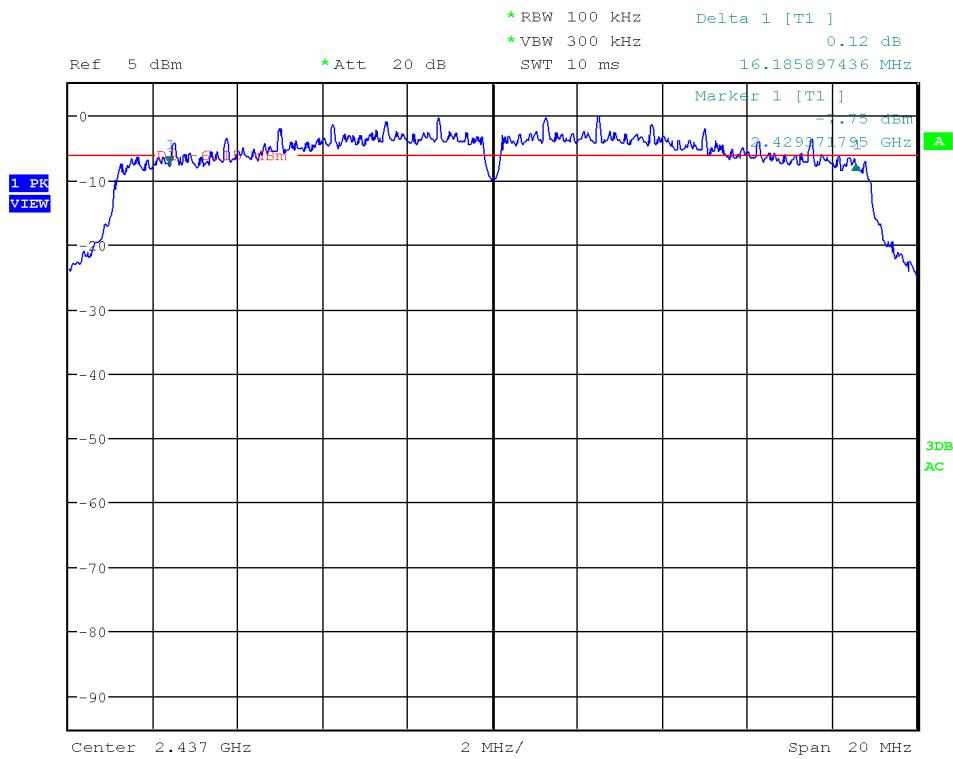


3. WiFi 2.4GHz 802.11 n20 mode

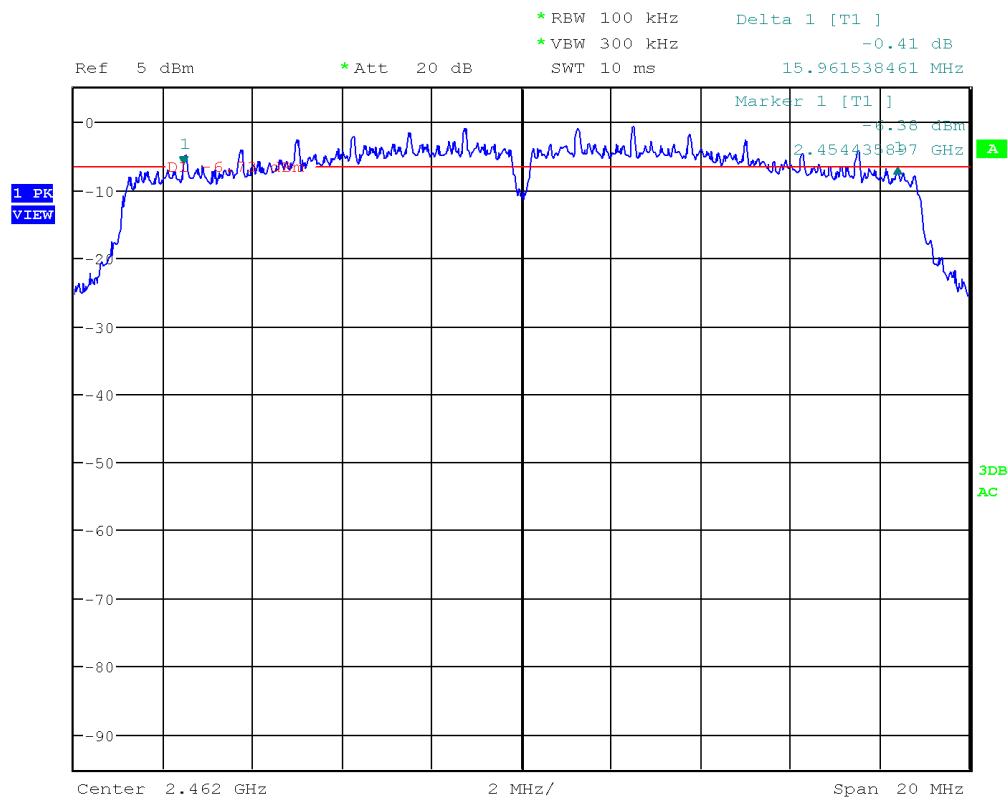
Lowest Channel: 2412 MHz.



Middle Channel: 2437 MHz.



Highest Channel: 2462 MHz.



Section 15.247 Subclause (b) / RSS-210 A8.4. (4). Maximum output power and antenna gain

SPECIFICATION

The maximum peak conducted output power of the intentional radiator shall not exceed 1 watt (30 dBm). The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS

The maximum peak conducted output power was measured using the method according to point 9.1.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03 dated 08/04/2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

1. WiFi 2.4GHz 802.11 b mode

MAXIMUM PEAK OUTPUT POWER.

Maximum declared antenna gain: -1.0 dBi.

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Maximum conducted power (dBm)	16.85	16.16	15.74
Maximum EIRP power (dBm)	15.85	15.16	14.74
Measurement uncertainty (dB)	± 1.5		

Average conducted power for SAR calculations	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Average conducted power (dBm)	13.05	11.9	11.8
Measurement uncertainty (dB)	± 1.5		

2. WiFi 2.4GHz 802.11 g mode

MAXIMUM PEAK OUTPUT POWER.

Maximum declared antenna gain: -1.0 dBi.

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Maximum conducted power (dBm)	19.30	18.76	18.44
Maximum EIRP power (dBm)	18.30	17.76	17.44
Measurement uncertainty (dB)	± 1.5		

Average conducted power for SAR calculations	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Average conducted power (dBm)	7.30	6.60	6.52
Measurement uncertainty (dB)	± 1.5		

3. WiFi 2.4GHz 802.11 n20 mode

MAXIMUM PEAK OUTPUT POWER.

Maximum declared antenna gain: -1.0 dBi.

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Maximum conducted power (dBm)	19.17	18.73	18.27
Maximum EIRP power (dBm)	18.17	17.73	17.27
Measurement uncertainty (dB)	± 1.5		

Average conducted power for SAR calculations	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Average conducted power (dBm)	7.00	6.20	6.12
Measurement uncertainty (dB)	± 1.5		

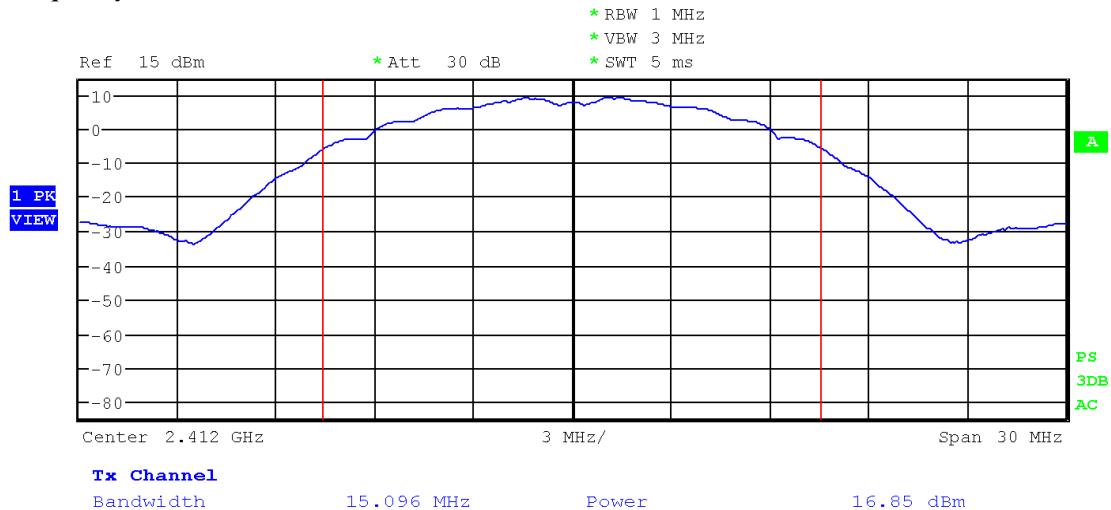
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

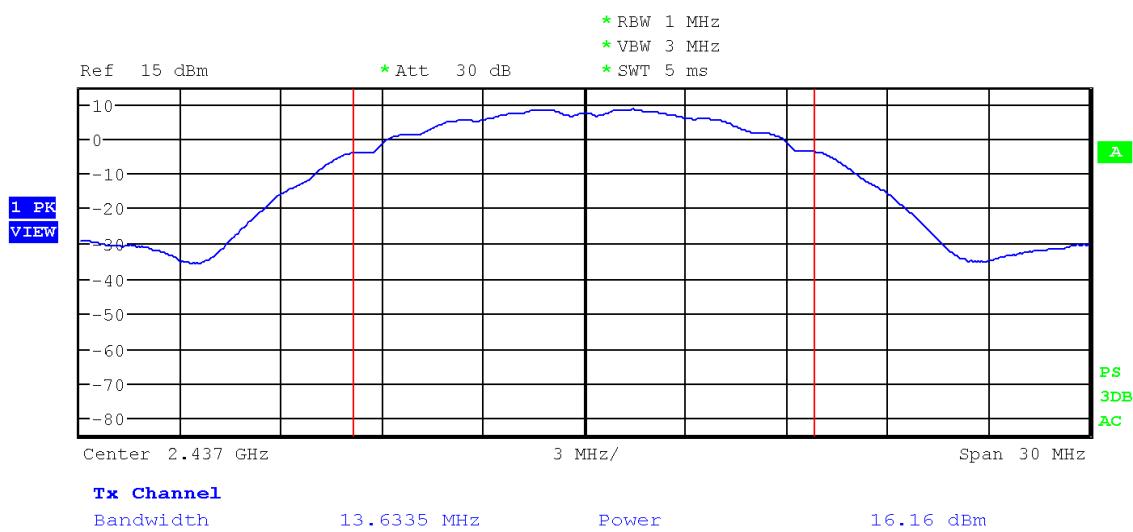
1. CONDUCTED POWER.

1. WiFi 2.4GHz 802.11 b mode

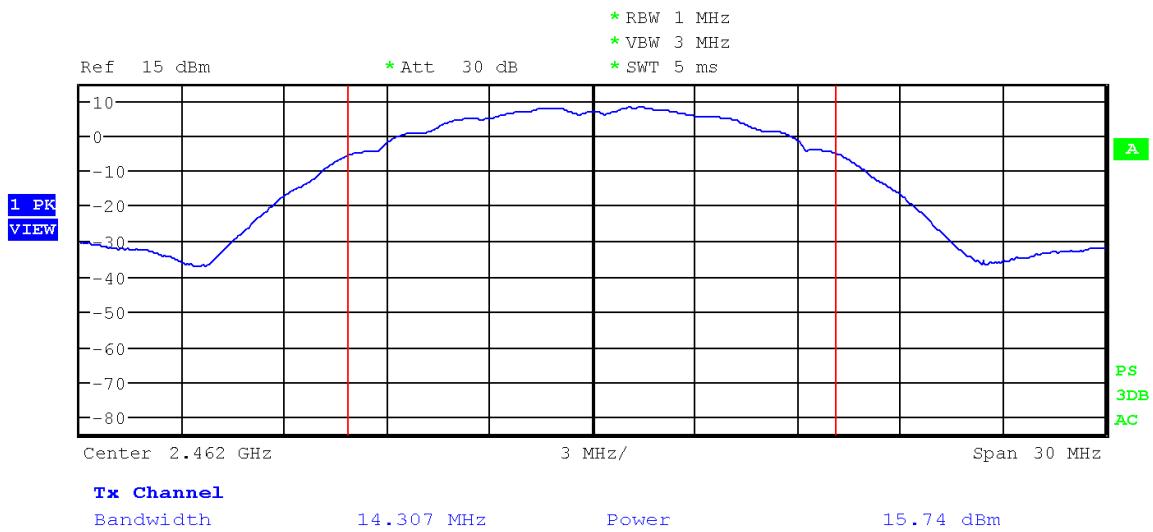
Low frequency 2412 MHz.



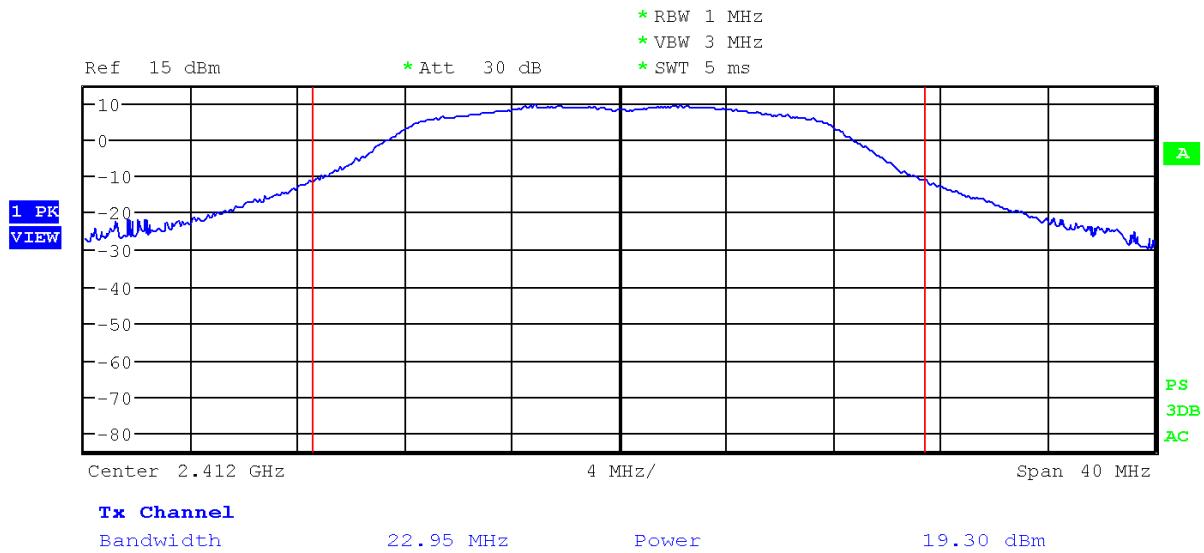
Middle frequency 2437 MHz.



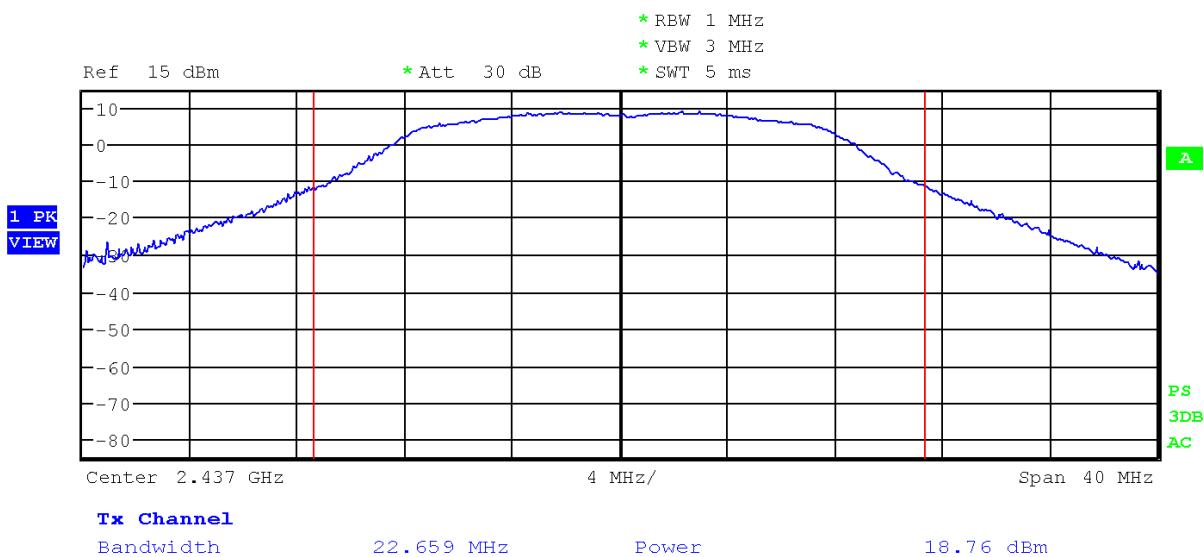
High frequency 2462 MHz.



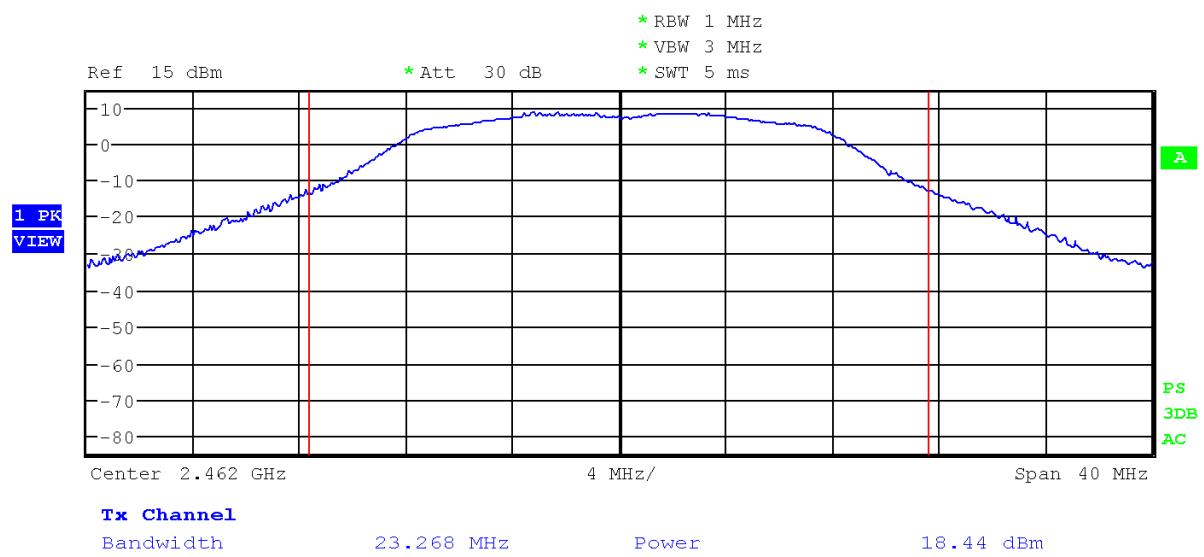
2. WiFi 2.4GHz 802.11 g mode
Low frequency 2412 MHz.



Middle frequency 2437 MHz.

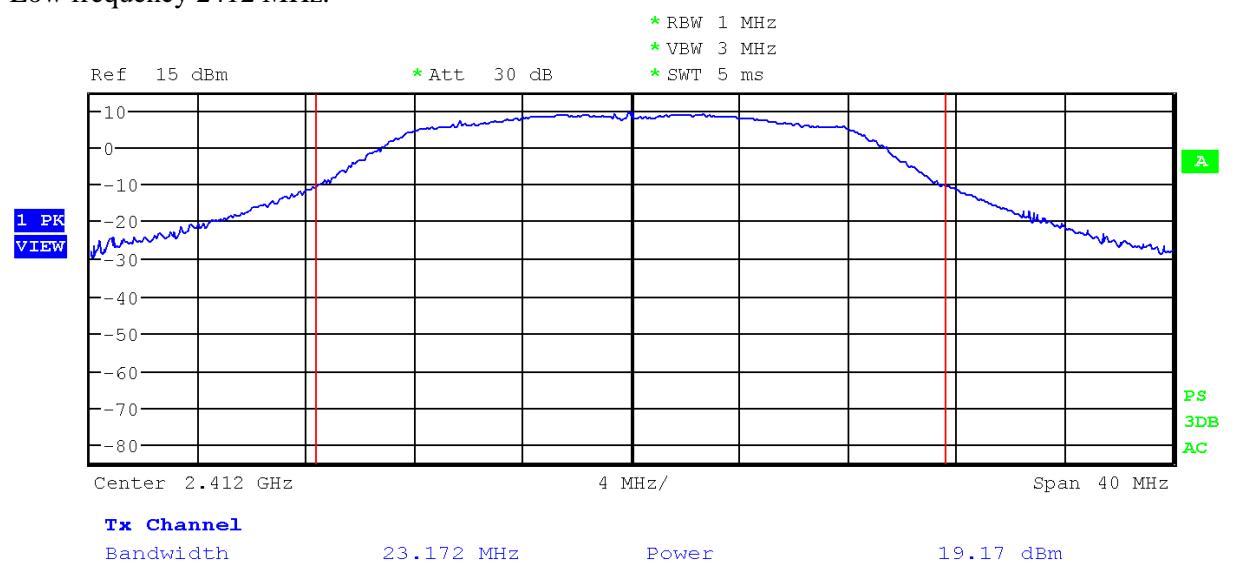


High frequency 2462 MHz.

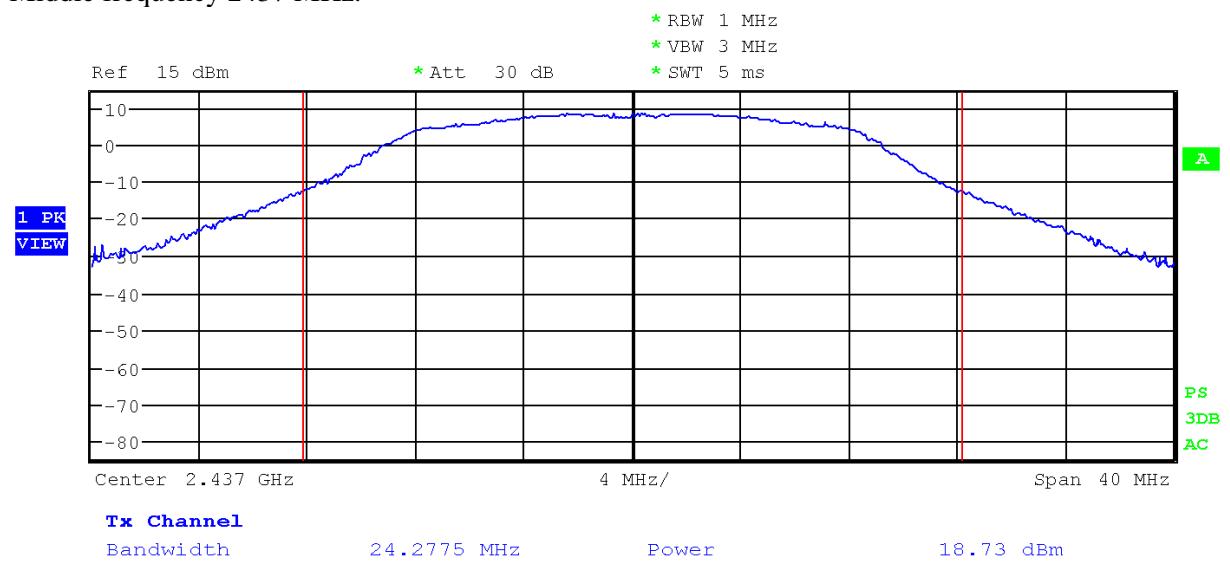


3. WiFi 2.4GHz 802.11 n20 mode

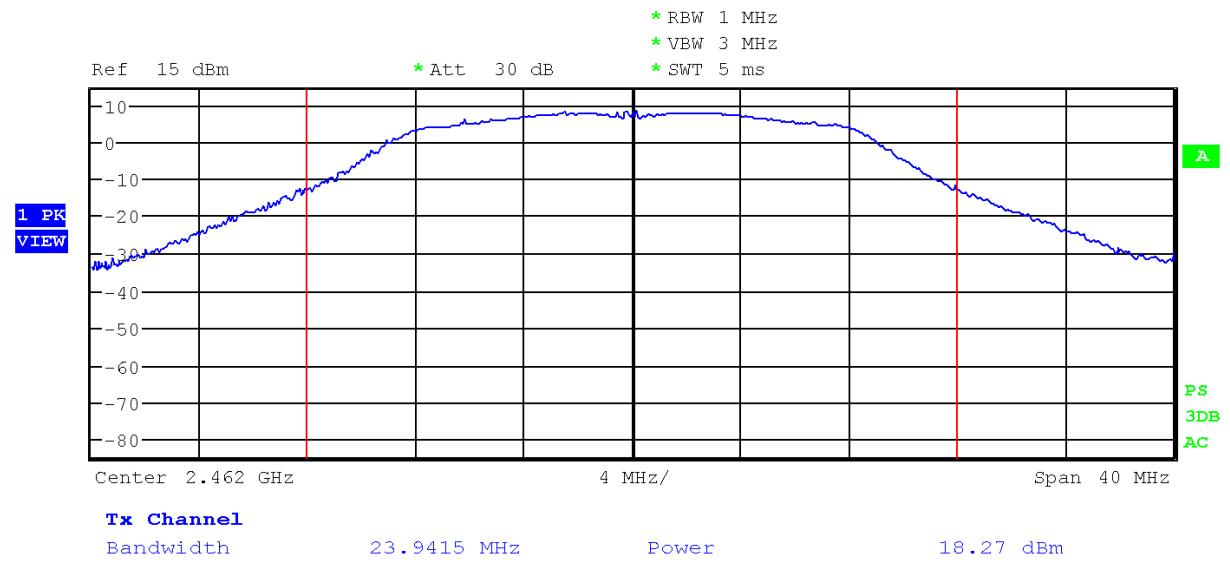
Low frequency 2412 MHz.



Middle frequency 2437 MHz.



High frequency 2462 MHz.



Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations conducted (Transmitter)

SPECIFICATION

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

1. WiFi 2.4GHz 802.11 b mode

Reference Level Measurement

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Reference Level Measurement (dBm)	5.14	4.49	3.93
Measurement uncertainty (dB)	± 1.5		

Lowest frequency 2412 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-14.86

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-15.51

Highest frequency 2462 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-16.07

Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode

Reference Level Measurement

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Reference Level Measurement (dBm)	0.28	-0.38	-0.78
Measurement uncertainty (dB)	± 1.5		

Lowest frequency 2412 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-19.72

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.38

Highest frequency 2462 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.78

Verdict: PASS

3. WiFi 2.4GHz 802.11 n20 mode

Reference Level Measurement

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Reference Level Measurement (dBm)	0.35	-0.20	-0.88
Measurement uncertainty (dB)	± 1.5		

Lowest frequency 2412 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-19.65

Middle frequency 2437 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.20

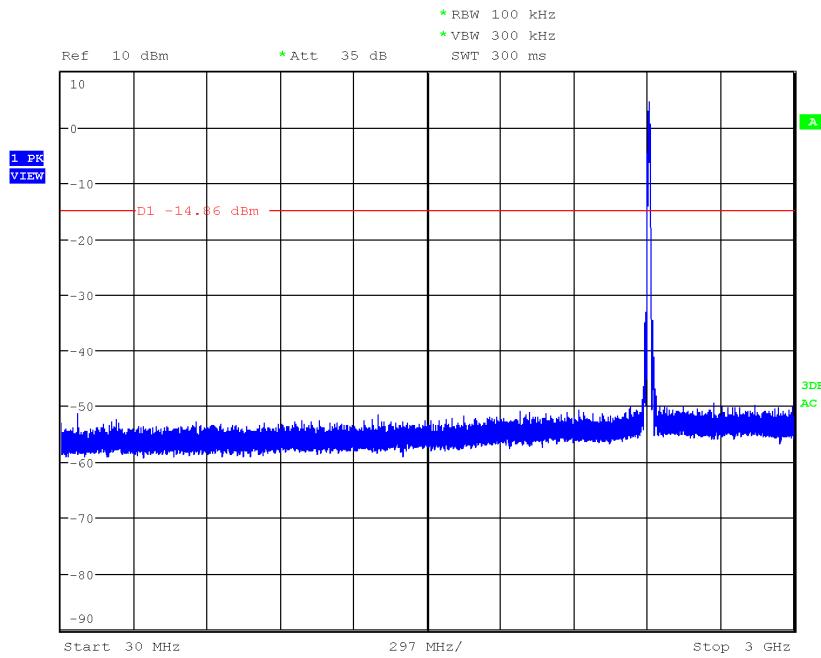
Highest frequency 2462 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.88

Verdict: PASS

See next plot of worst case: Mode b. Lowest Channel: 2412 MHz.

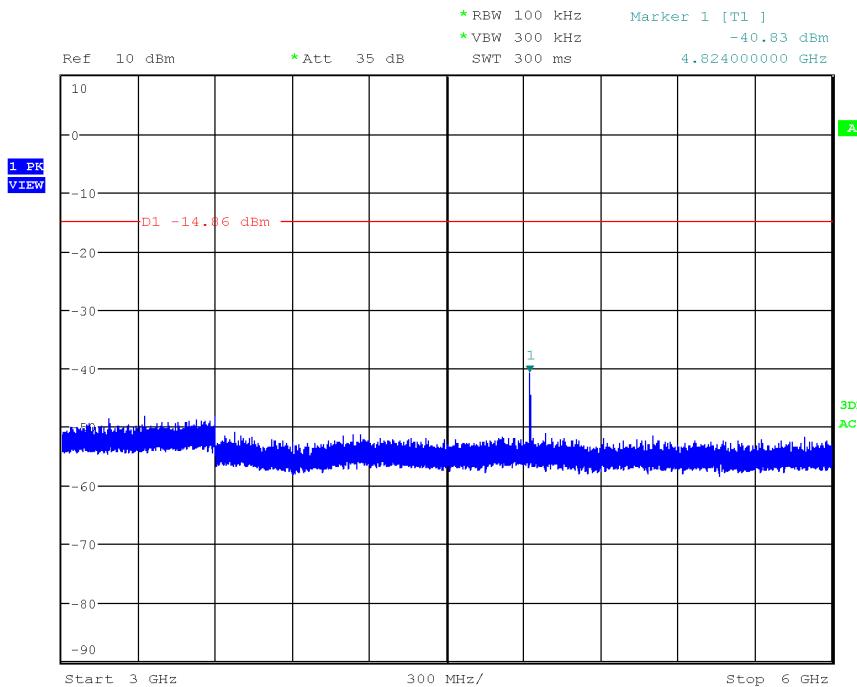
Number of sweep points: 30,001.

Plot 30 MHz to 3 GHz:

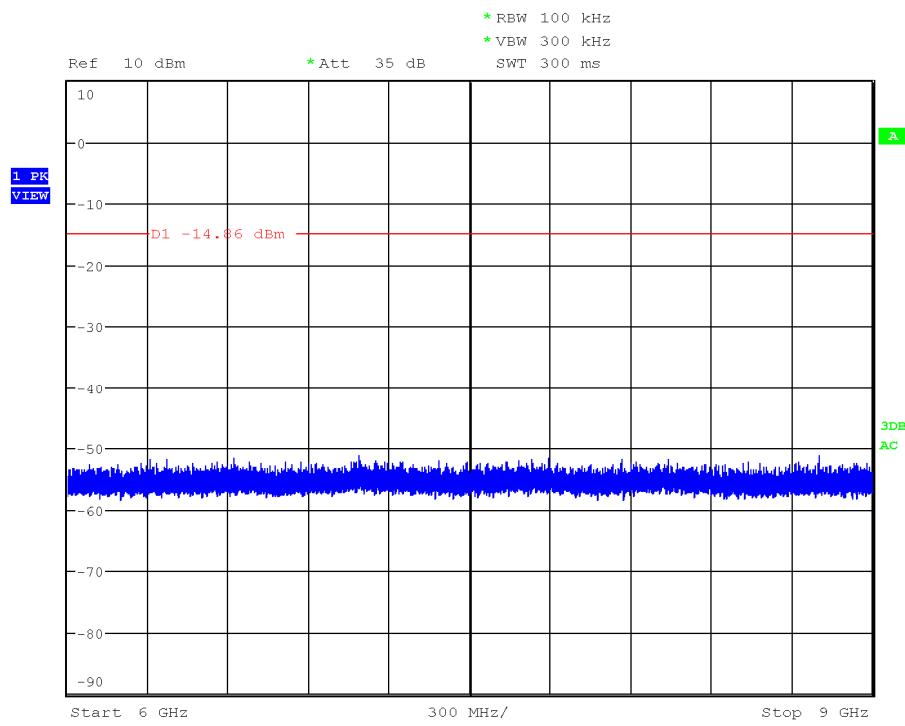


Note: The peak above the limit is the carrier frequency.

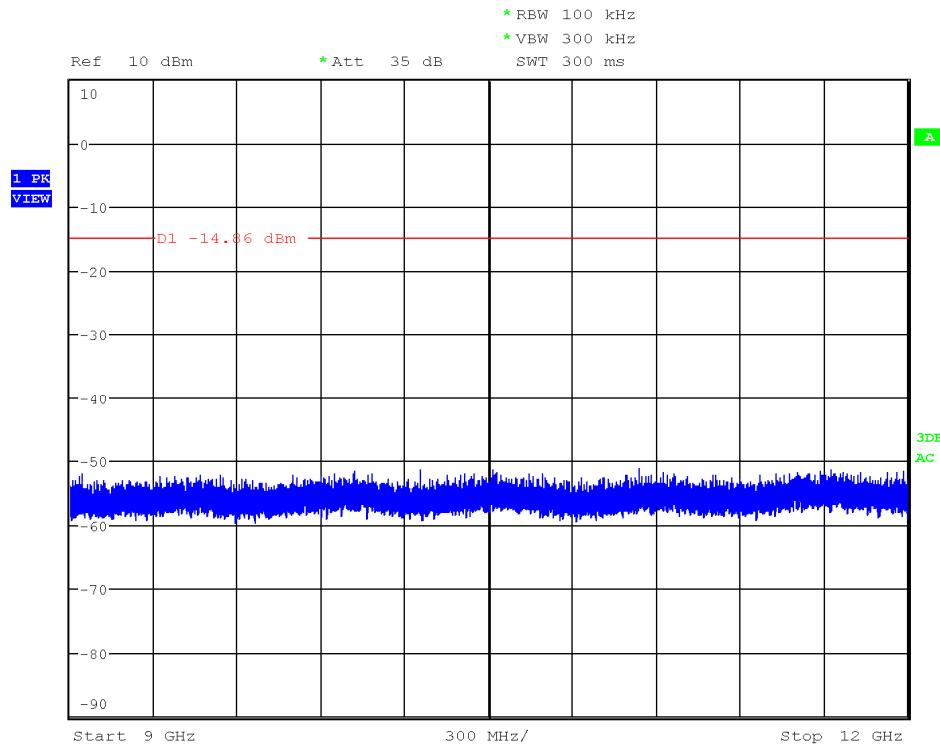
Plot 3 GHz to 6 GHz:



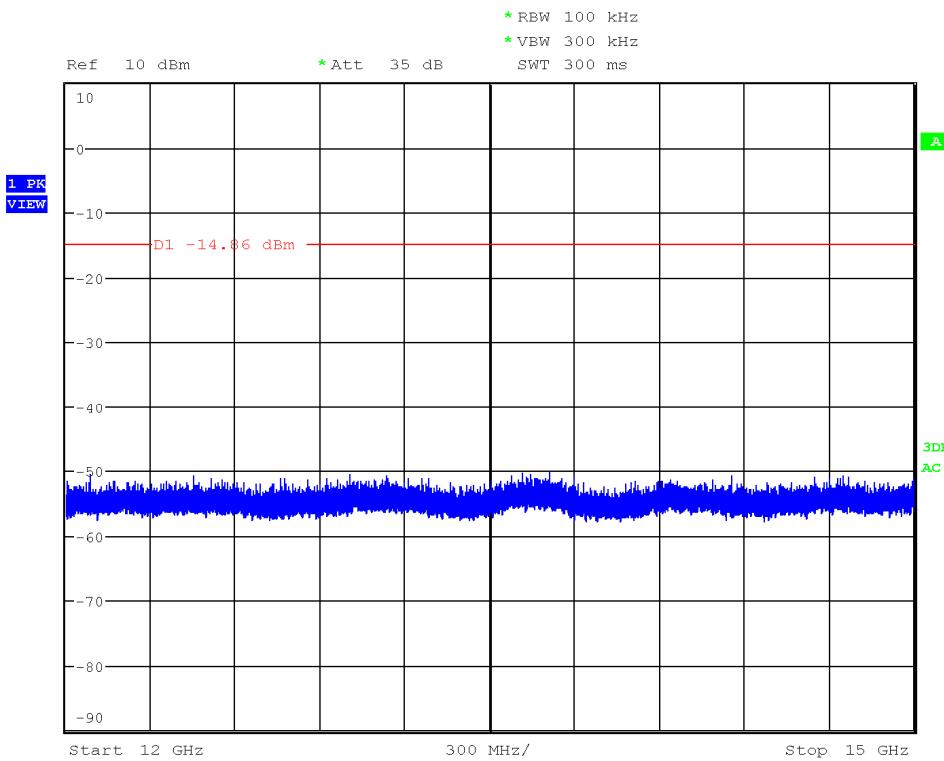
Plot 6 GHz to 9 GHz:



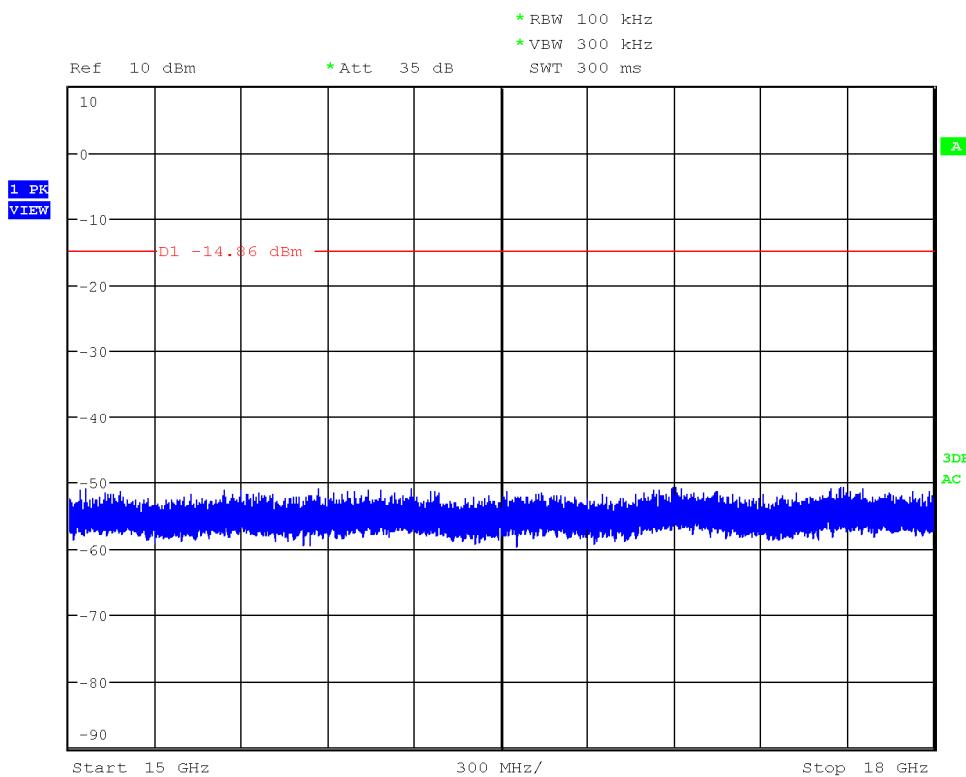
Plot 9 GHz to 12 GHz:



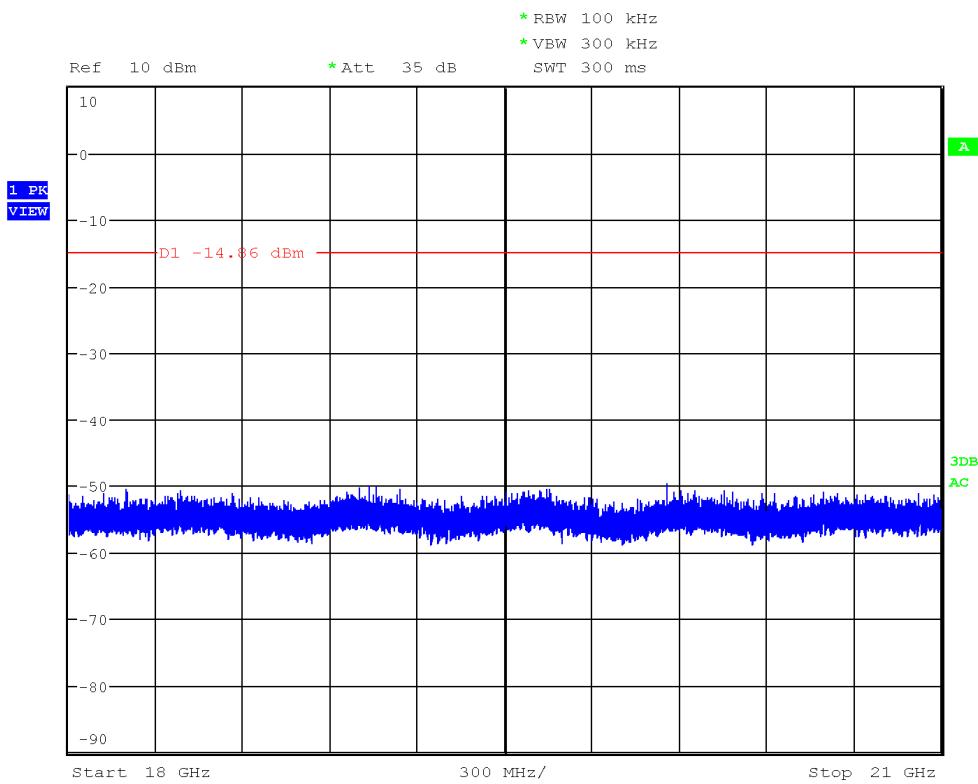
Plot 12 GHz to 15 GHz:



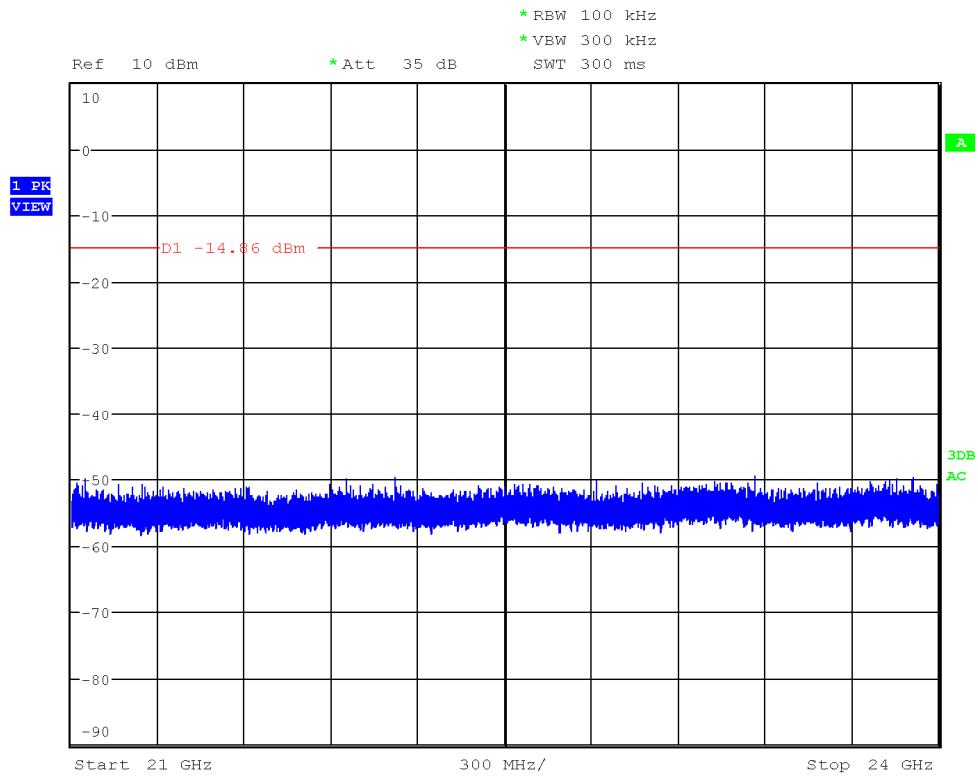
Plot 15 GHz to 18 GHz:



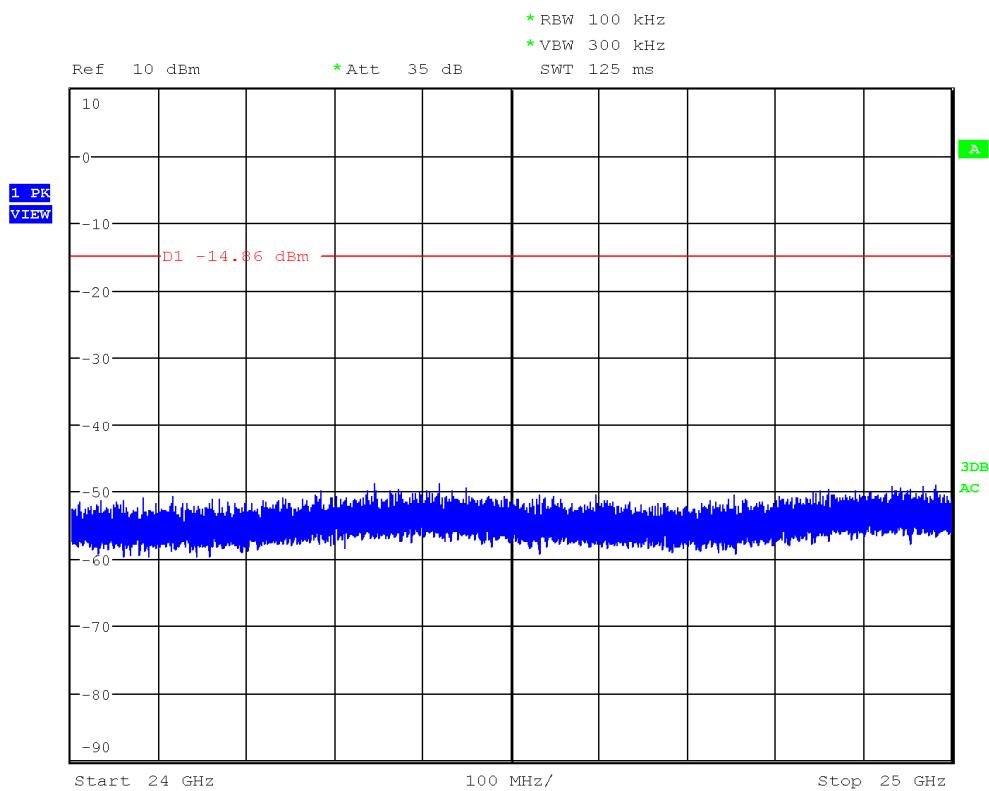
Plot 18 GHz to 21 GHz:



Plot 21 GHz to 24 GHz:



Plot 24 GHz to 25 GHz:



Section 15.247 Subclause (d) / RSS-210 A8.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION

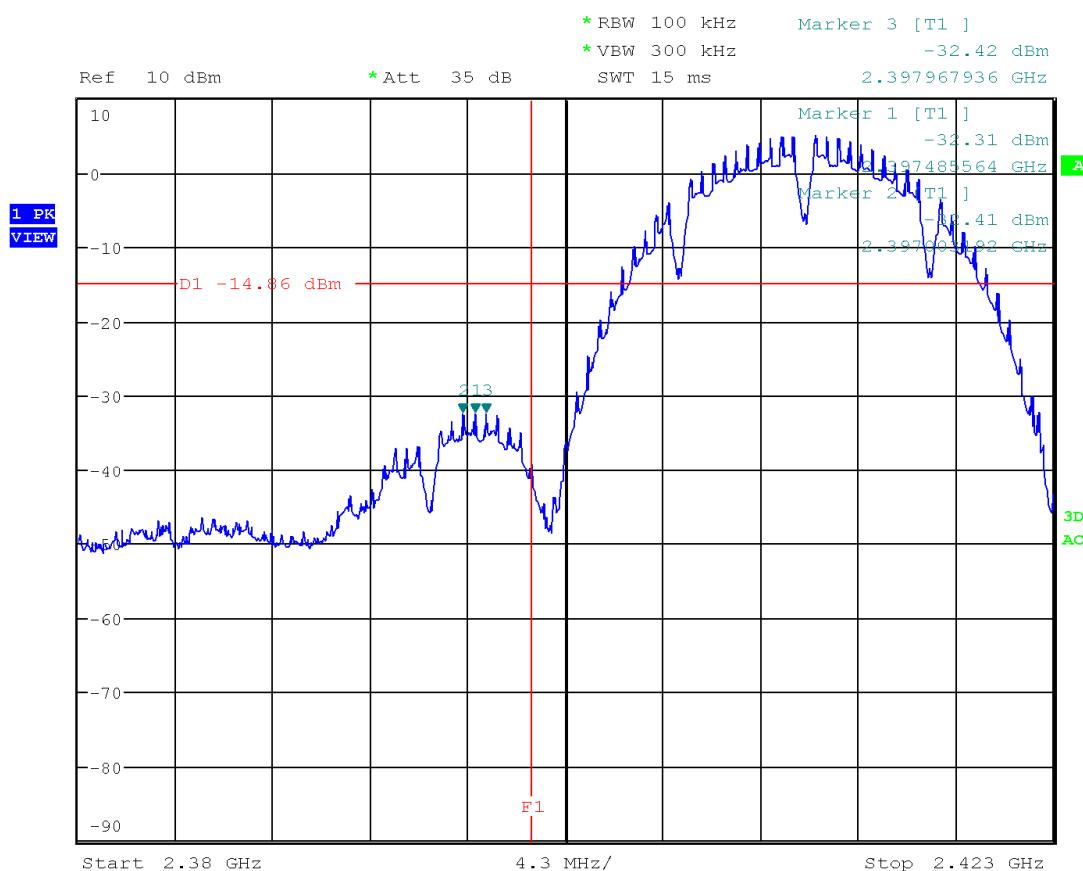
Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20dB below the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

Note: Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

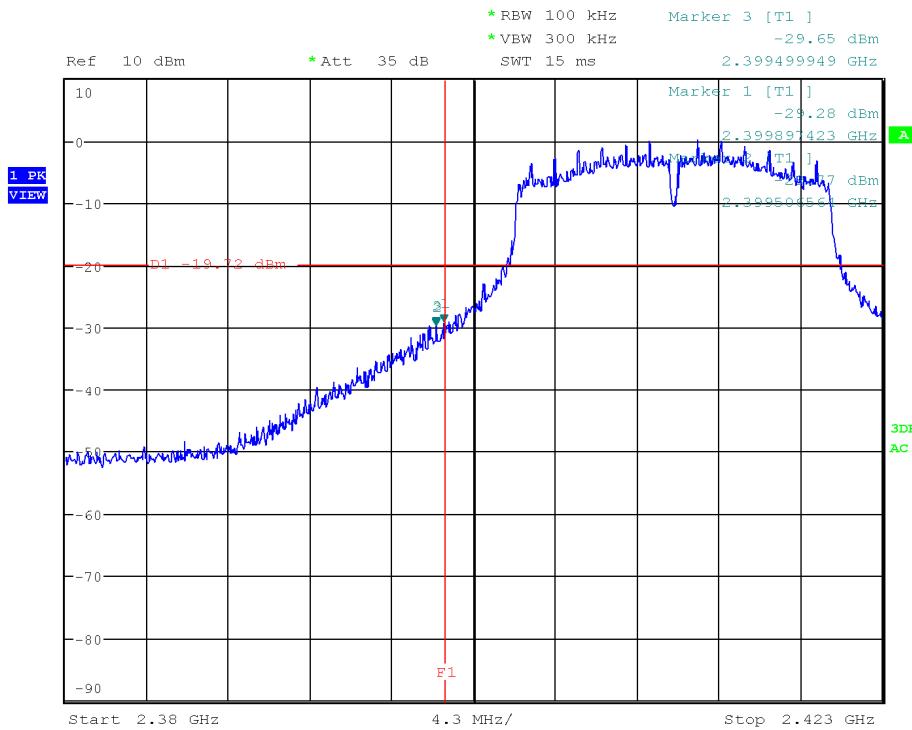
LOW FREQUENCY SECTION 2412 MHz. CONDUCTED.

1. WiFi 2.4GHz 802.11 b mode



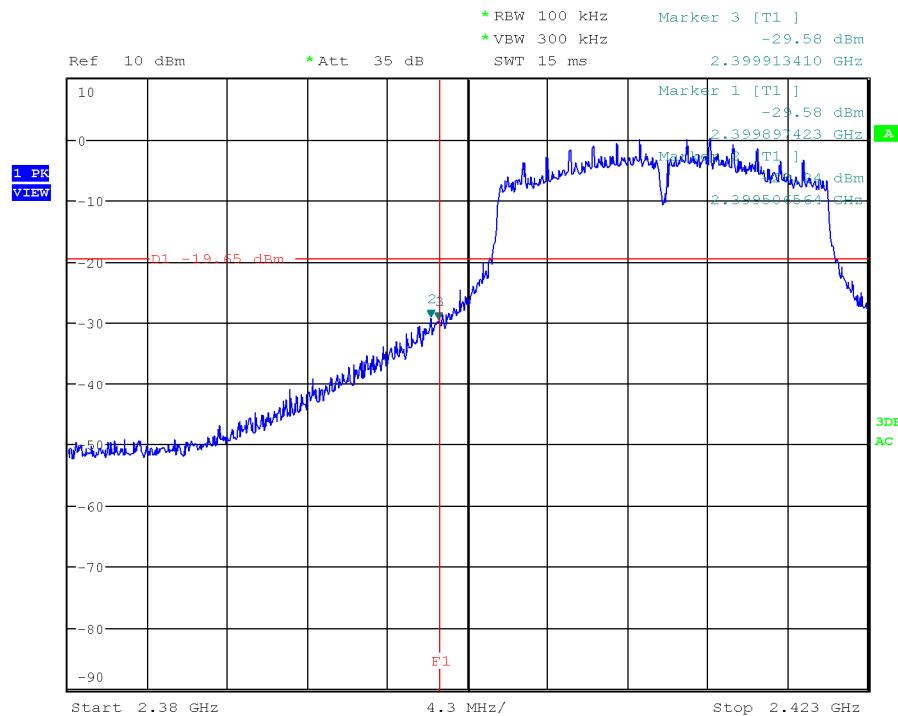
Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode



Verdict: PASS

3. WiFi 2.4GHz 802.11 n20 mode



Verdict: PASS

Section 15.247 Subclause (e) / RSS-210 A8.5. Power spectral density

SPECIFICATION

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.

RESULTS

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 10.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03 dated 08/04/2013.

1. WiFi 2.4GHz 802.11 b mode

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Power spectral density (dBm)	-7.47	-8.20	-8.55
Measurement uncertainty (dB)	± 1.5		

2. WiFi 2.4GHz 802.11 g mode

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Power spectral density (dBm)	-12.58	-14.09	-13.73
Measurement uncertainty (dB)	± 1.5		

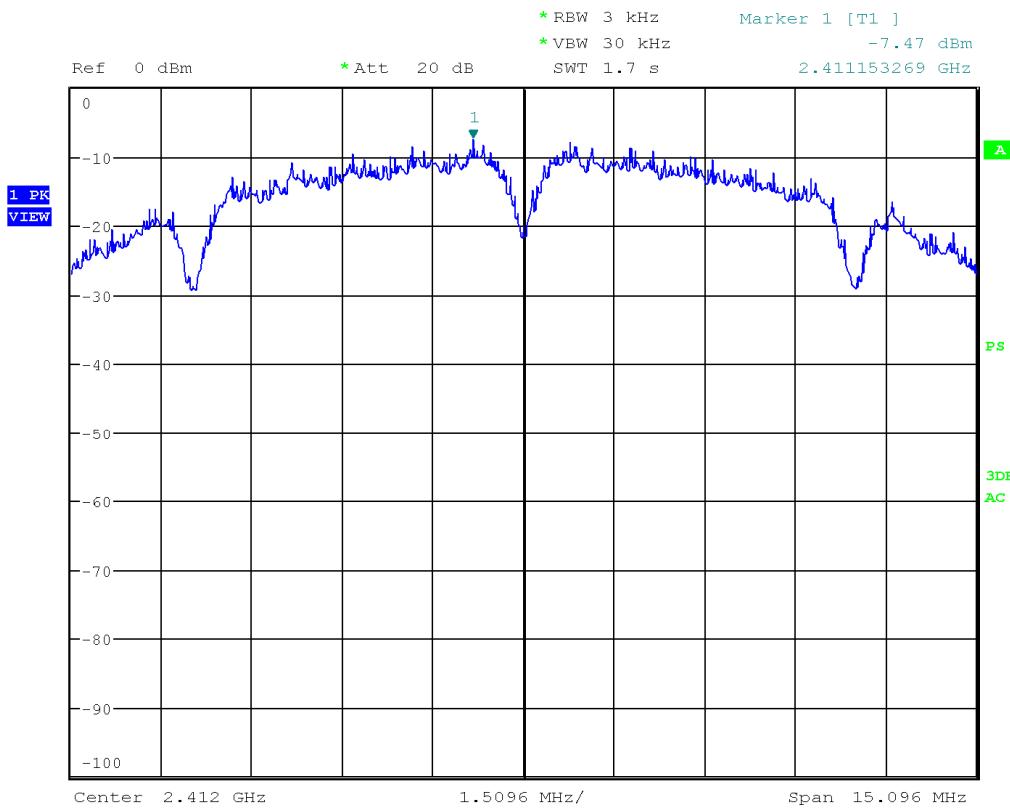
3. WiFi 2.4GHz 802.11 n20 mode

	Lowest frequency 2412 MHz	Middle frequency 2437 MHz	Highest frequency 2462 MHz
Power spectral density (dBm)	-13.28	-13.30	-13.56
Measurement uncertainty (dB)	± 1.5		

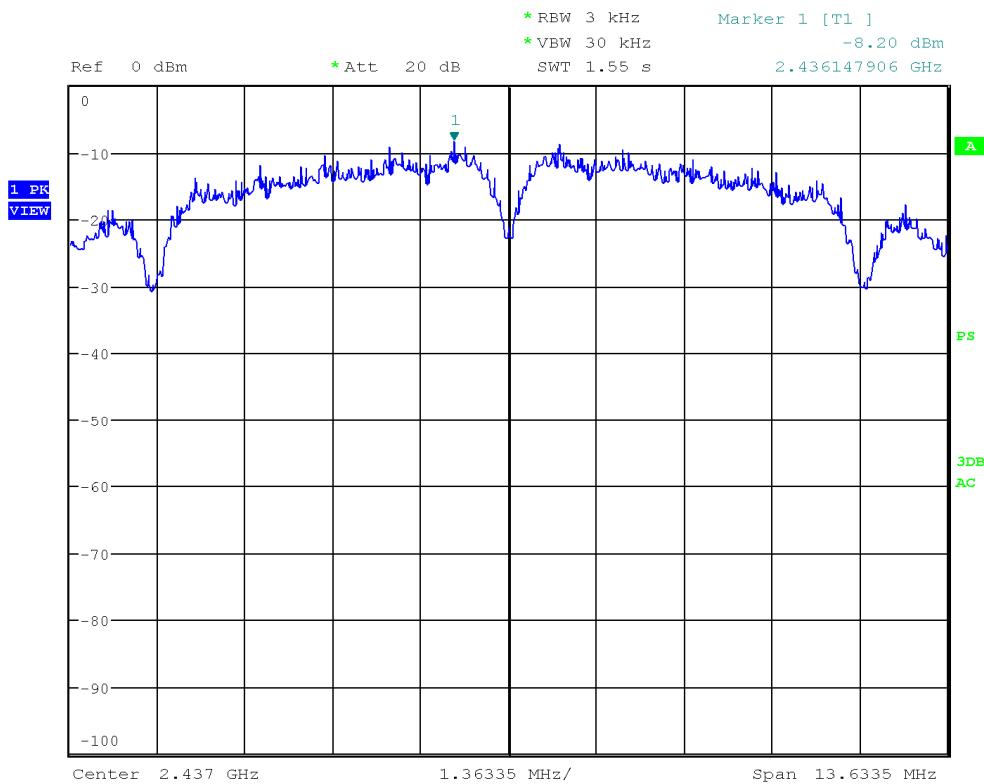
Verdict: PASS

1. WiFi 2.4GHz 802.11 b mode

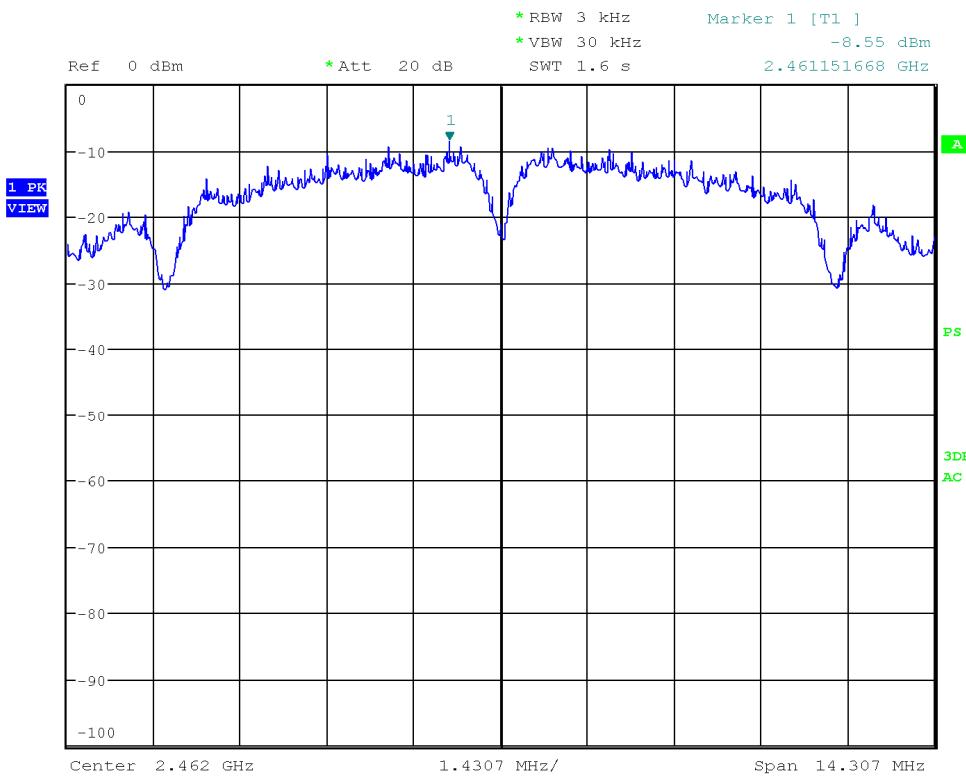
Low frequency 2412 MHz.



Middle frequency 2437 MHz.

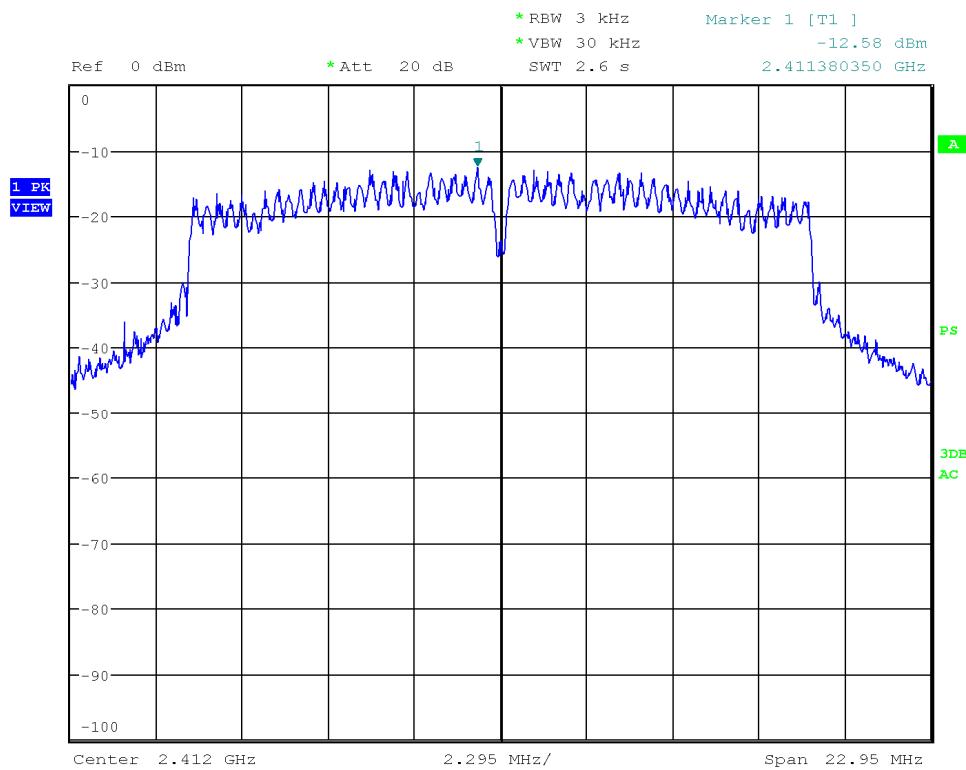


High frequency 2462 MHz.

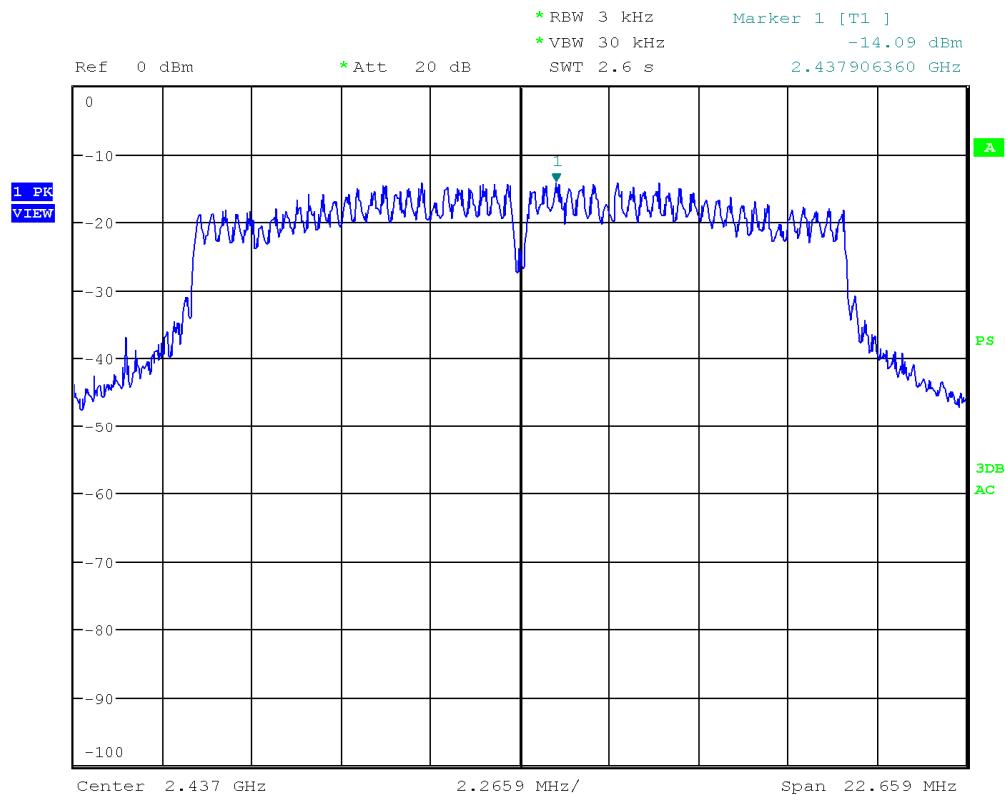


2. WiFi 2.4GHz 802.11 g mode

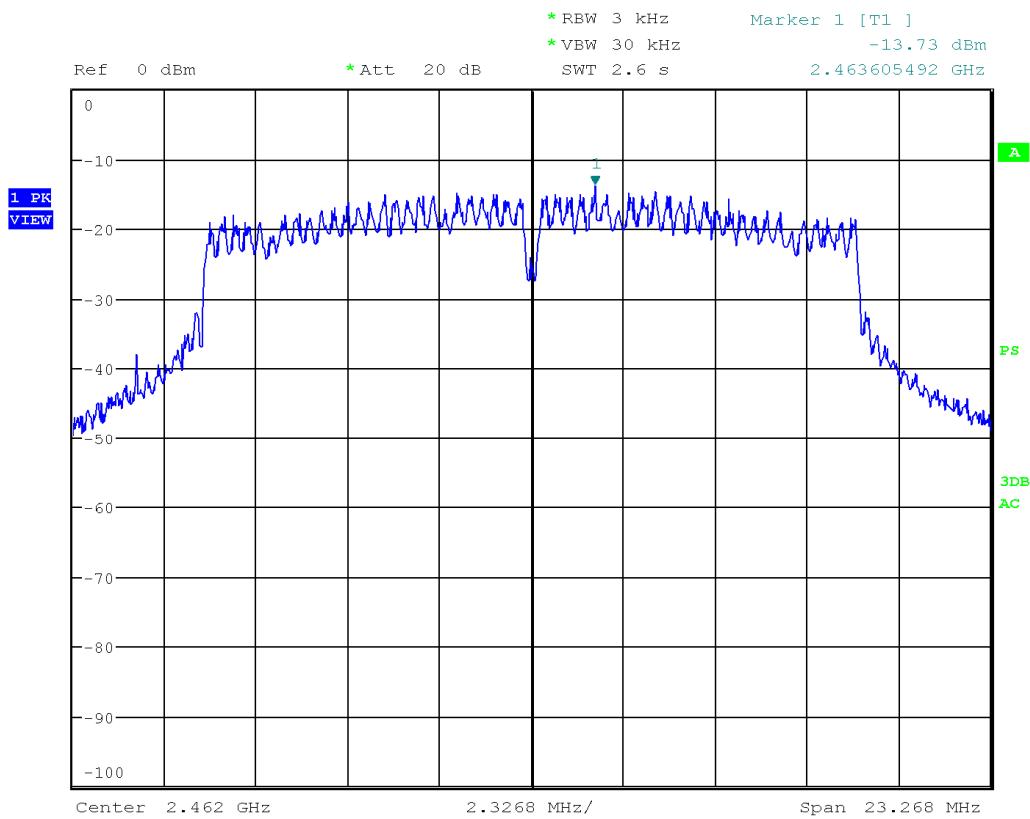
Low frequency 2412 MHz.



Middle frequency 2437 MHz.

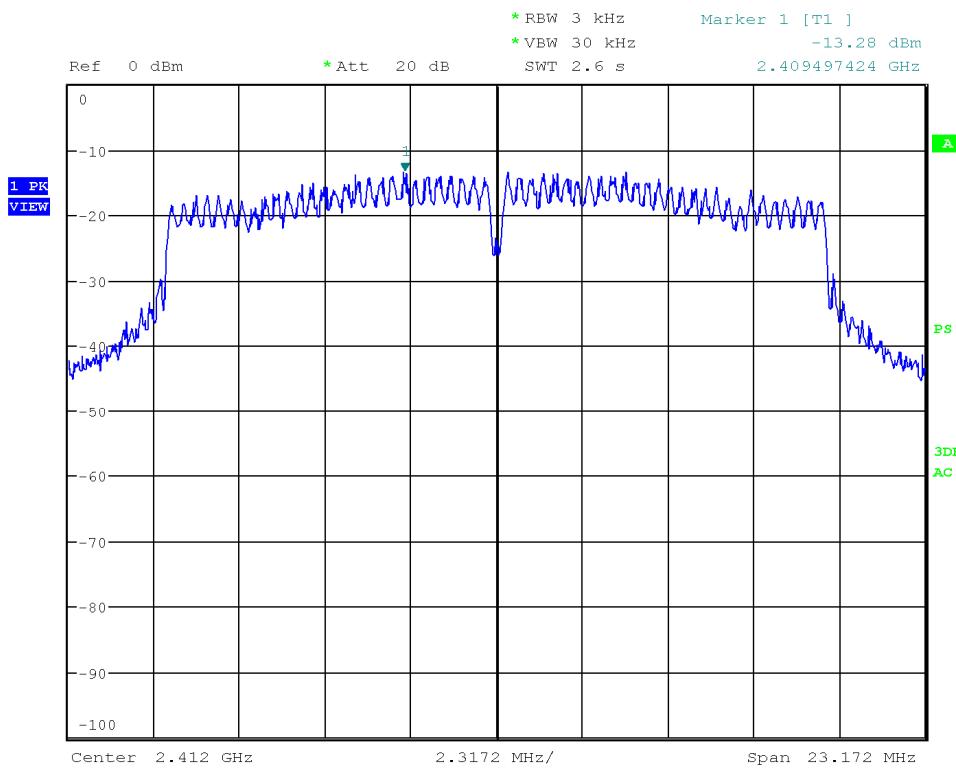


High frequency 2462 MHz.

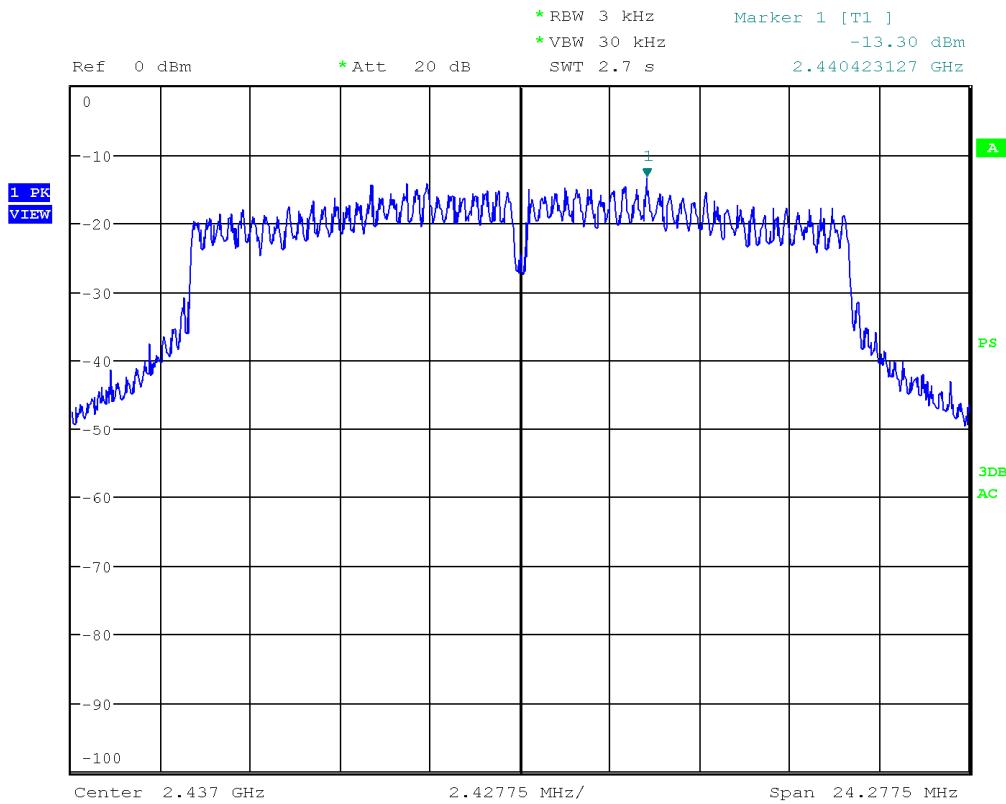


3. WiFi 2.4GHz 802.11 n20 mode

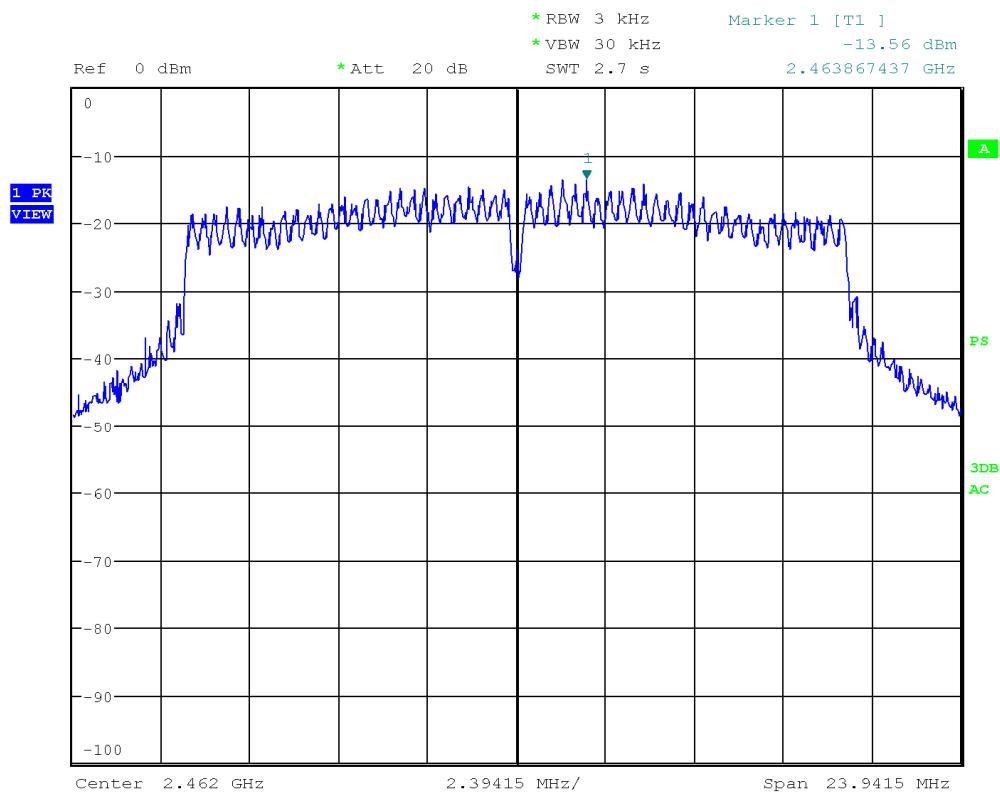
Low frequency 2412 MHz.



Middle frequency 2437 MHz.



High frequency 2462 MHz.



Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations radiated (Transmitter)

SPECIFICATION

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz-1000 MHz.

The spurious signals detected do not depend on either the operating channel or the modulation mode.

Highest spurious levels:

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
39.719438	V	Quasi-Peak	27.48	± 3.8
49.438877	V	Quasi-Peak	23.13	± 3.8

Frequency range 1 GHz-25 GHz

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

For OFDM modulation modes (802.11g and 802.11n20), a preliminary measurement in the central channel in the range 1-12.75 GHz was performed to determine the worst case. The lowest and highest channels were measured for out-of-band emissions for the worst case (802.11n20).

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

1. WiFi 2.4GHz 802.11 b mode

1.1. CHANNEL 1: LOWEST (2412 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.387360	V	Peak	48.98	± 4.09
2.484573	V	Peak	45.34	± 4.09
4.823250	H	Peak	43.16	± 4.09

1.2. CHANNEL 6: MIDDLE (2437 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.388560	V	Peak	46.99	± 4.09
2.484259	V	Peak	46.66	± 4.09
4.874006	H	Peak	44.58	± 4.09

1.3. CHANNEL 11: HIGHEST (2462 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.488219	V	Peak	48.46	\pm 4.09
4.923187	H	Peak	43.19	\pm 4.09

Verdict: PASS

2. WiFi 2.4GHz 802.11 g mode

2.1. CHANNEL 1: LOWEST (2412 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted band 2.31-2.39 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.39000	V	Peak	61.92	\pm 4.09
		Average	44.98	\pm 4.09

2.2. CHANNEL 6: MIDDLE (2437 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.38992	V	Peak	45.94	\pm 4.09
2.493994	V	Peak	45.37	\pm 4.09

2.3. CHANNEL 11: HIGHEST (2462 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted band 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.483632	V	Peak	51.48	\pm 4.09

Verdict: PASS

3. WiFi 2.4GHz 802.11 n20 mode (Worst case OFDM)

3.1. CHANNEL 1 (2412 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.31-2.39 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.390000	V	Peak	62.78	\pm 4.09
		Average	46.85	\pm 4.09
4.831500	H	Peak	39.53	\pm 4.09

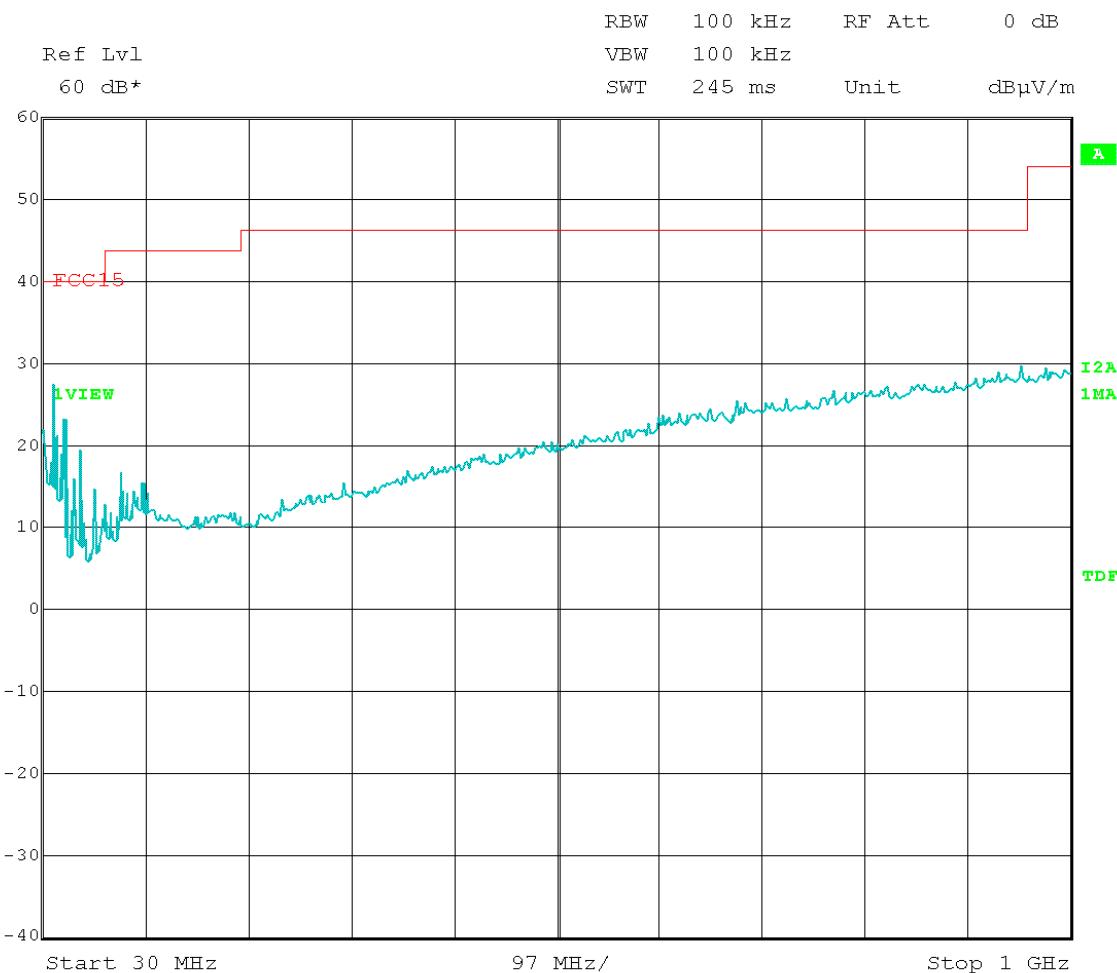
3.2. CHANNEL 6: MIDDLE (2437 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.388000	V	Peak	45.34	\pm 4.09
2.483698	V	Peak	46.59	\pm 4.09
4.869750	H	Peak	40.54	\pm 4.09

3.3. CHANNEL 11 (2462 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted bands 2.4835-2.5 GHz.

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.483599	V	Peak	52.03	\pm 4.09

FREQUENCY RANGE 30 MHz-1000 MHz.

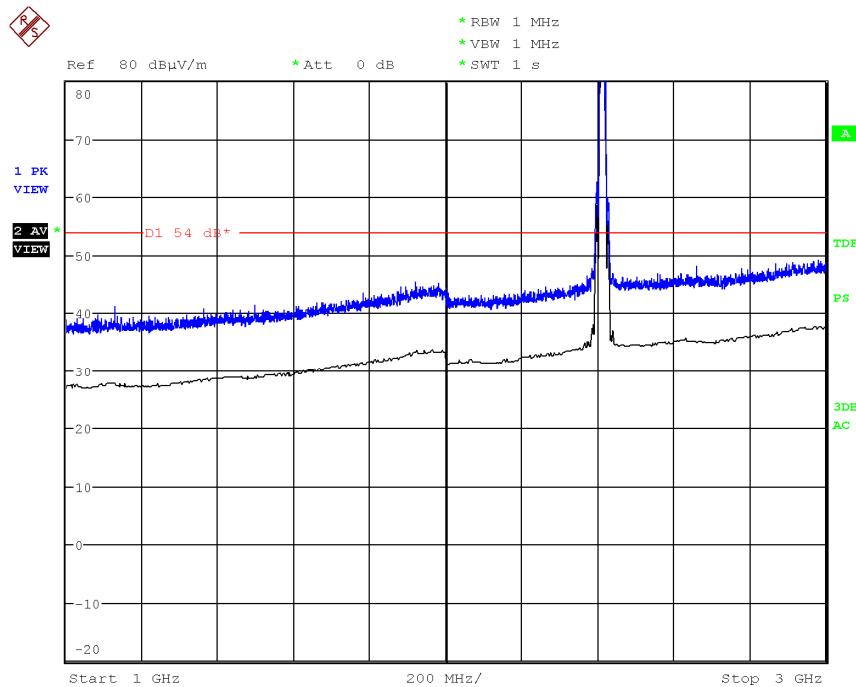


(This plot is valid for all three channels and all modulation modes).

FREQUENCY RANGE 1 GHz to 3 GHz.

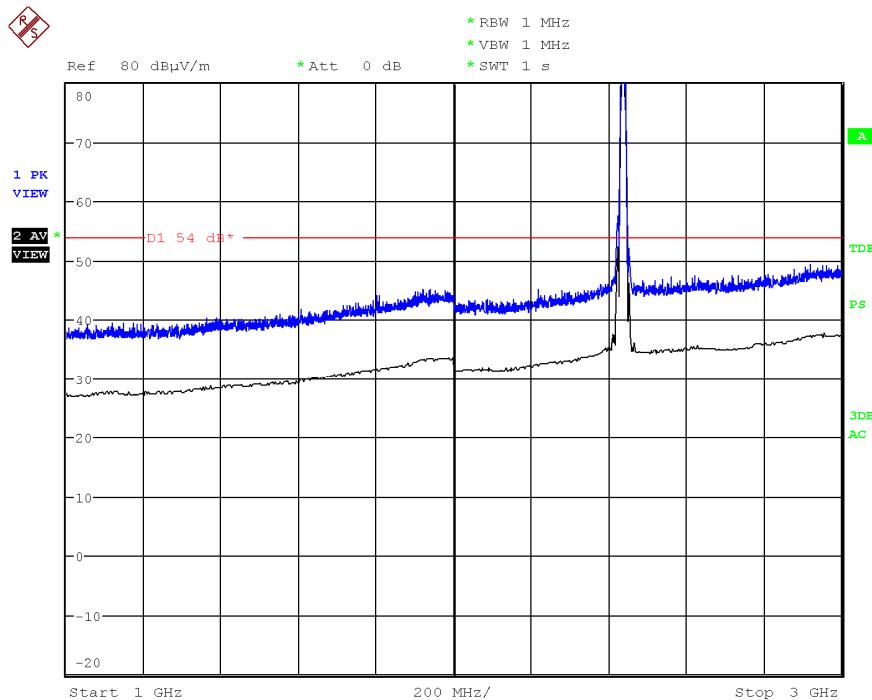
1. WiFi 2.4GHz 802.11 b mode

CHANNEL 1 (2412 MHz).



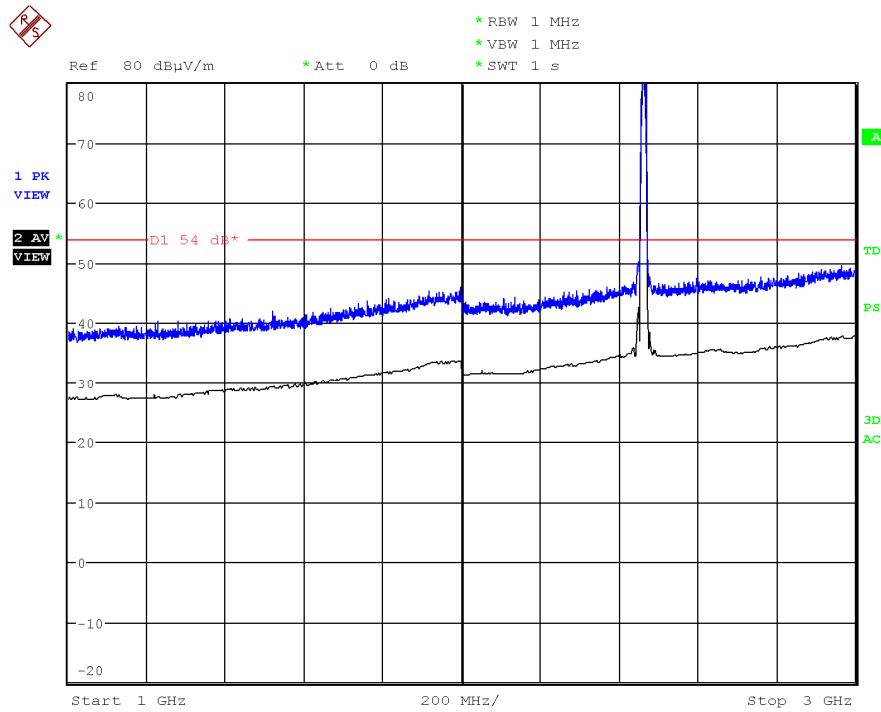
Note: The peak above the limit is the carrier frequency.

CHANNEL 6 (2437 MHz).



Note: The peak above the limit is the carrier frequency.

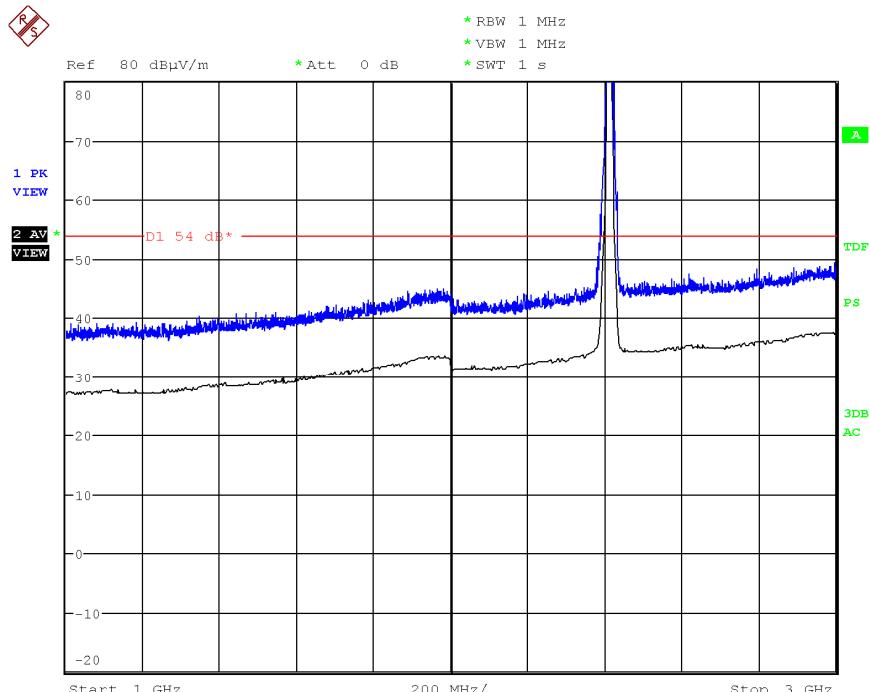
CHANNEL 11 (2462 MHz).



Note: The peak above the limit is the carrier frequency.

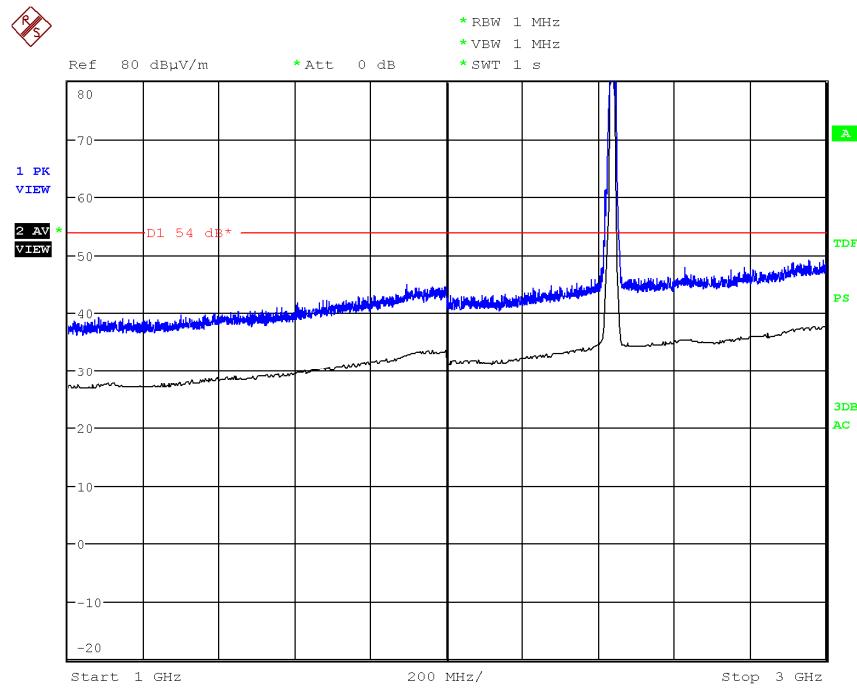
2. WiFi 2.4GHz 802.11 g mode

CHANNEL 1 (2412 MHz).



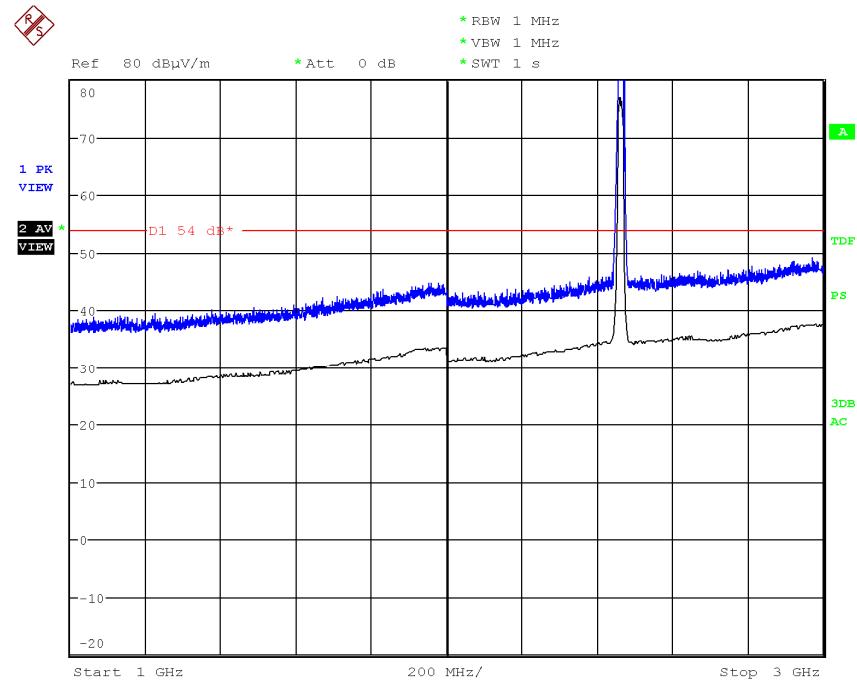
Note: The peak above the limit is the carrier frequency.

CHANNEL 6 (2437 MHz).



Note: The peak above the limit is the carrier frequency.

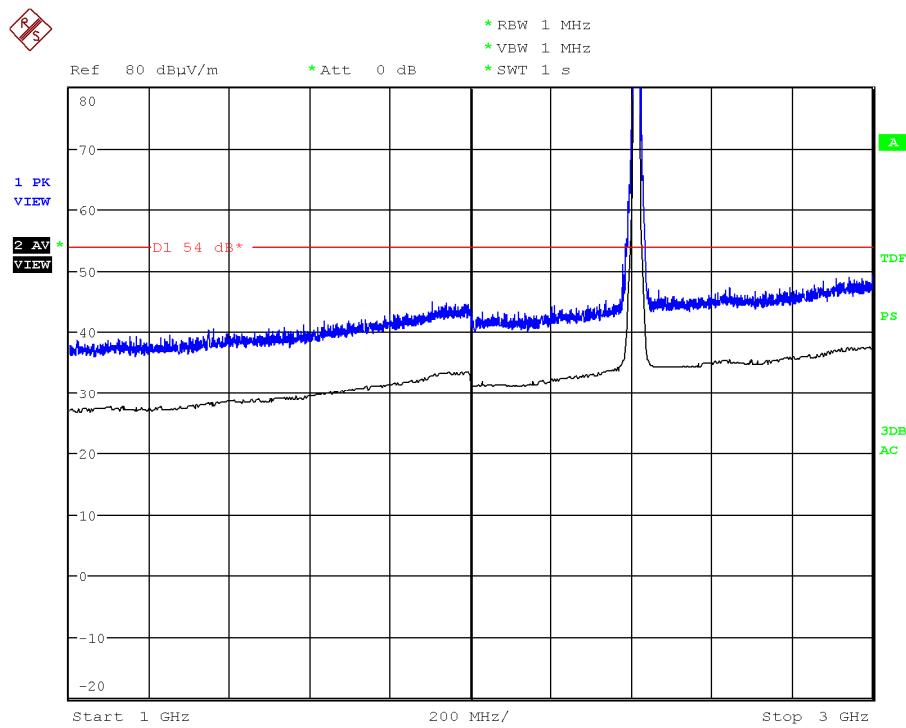
CHANNEL 11 (2462 MHz).



Note: The peak above the limit is the carrier frequency.

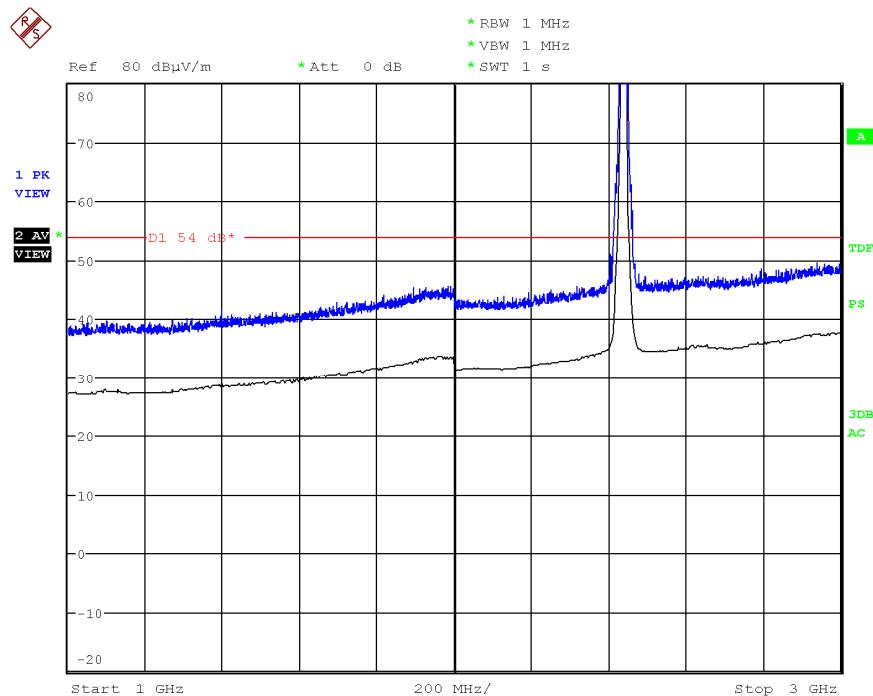
3. WiFi 2.4GHz 802.11 n20 mode

CHANNEL 1 (2412 MHz).



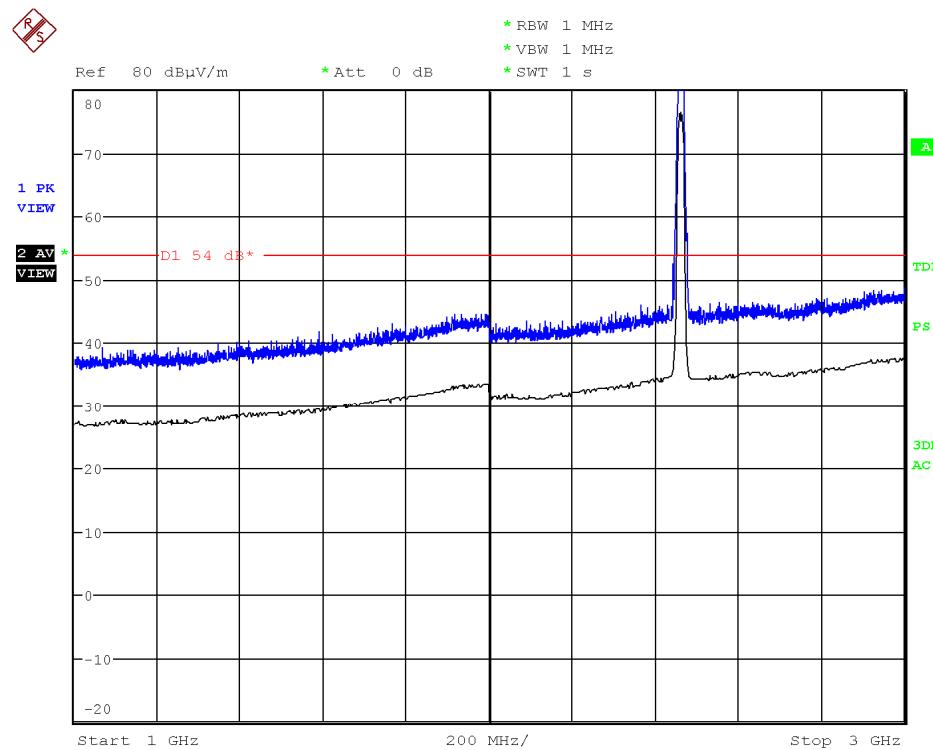
Note: The peak above the limit is the carrier frequency.

CHANNEL 6 (2437 MHz).



Note: The peak above the limit is the carrier frequency.

CHANNEL 11 (2462 MHz).

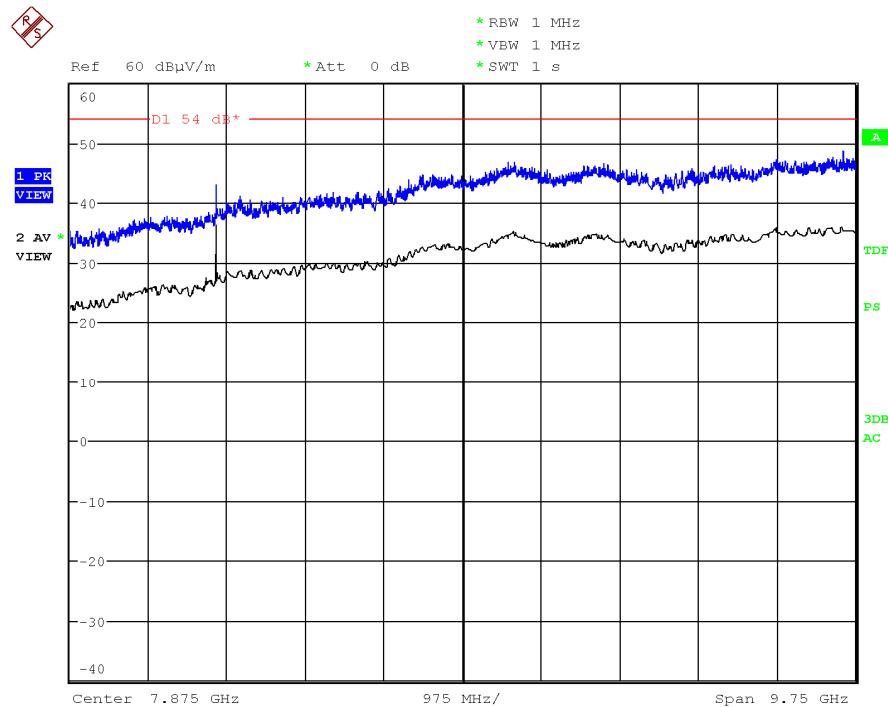


Note: The peak above the limit is the carrier frequency.

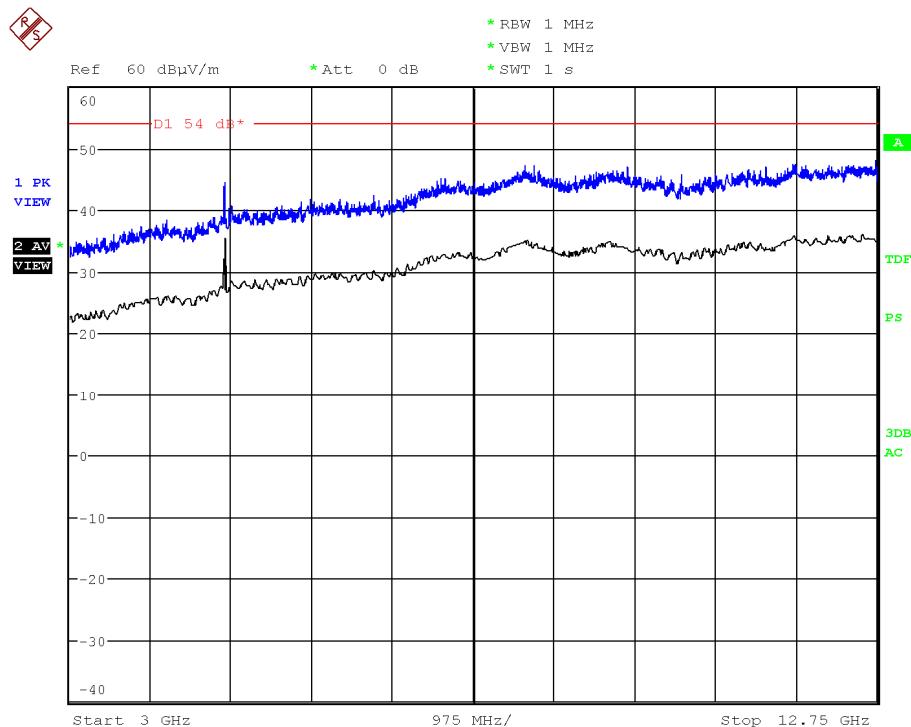
FREQUENCY RANGE 3 GHz to 12.75 GHz.

1. WiFi 2.4GHz 802.11 b mode

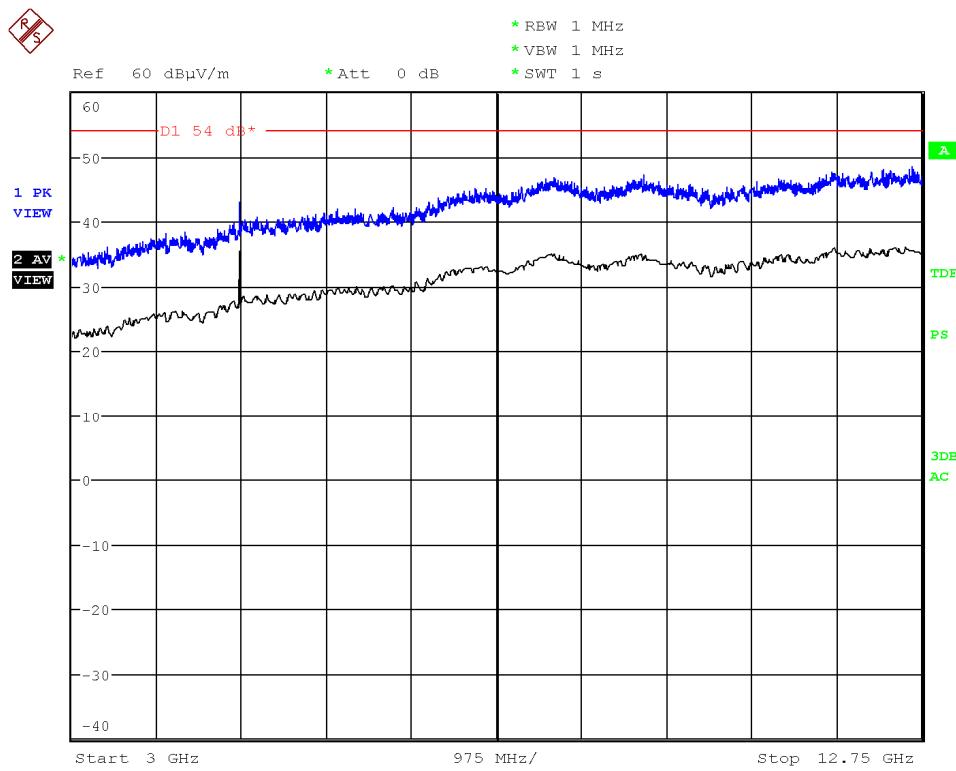
CHANNEL 1 (2412 MHz).



CHANNEL 6 (2437 MHz).

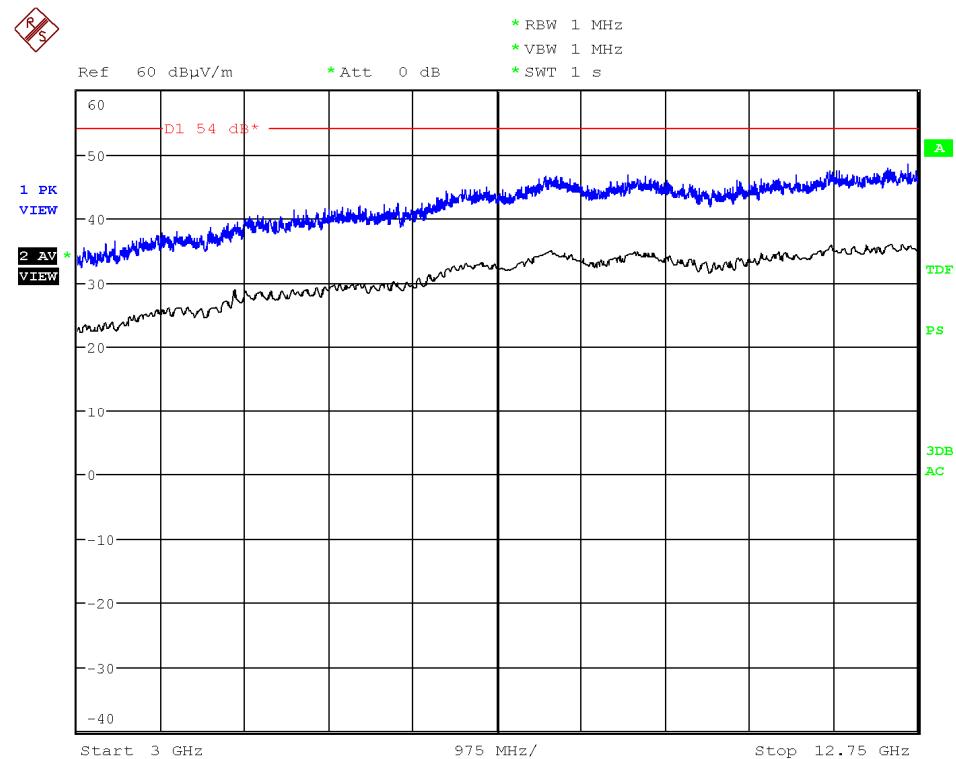


CHANNEL 11 (2462 MHz).

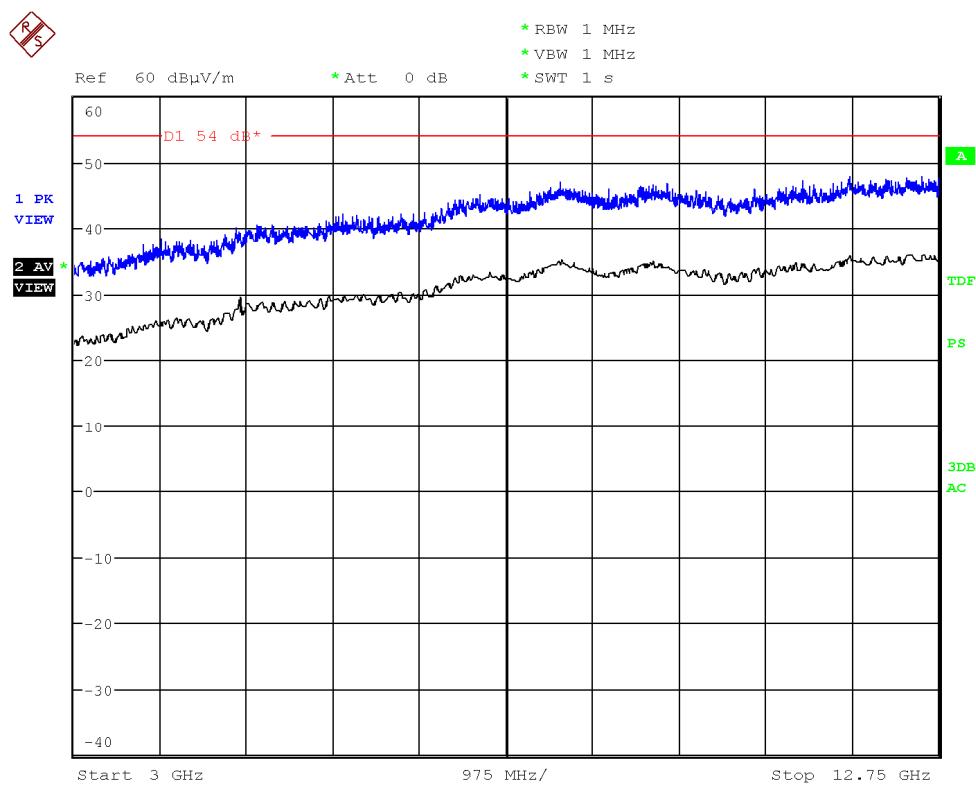


2. WiFi 2.4GHz 802.11 g mode

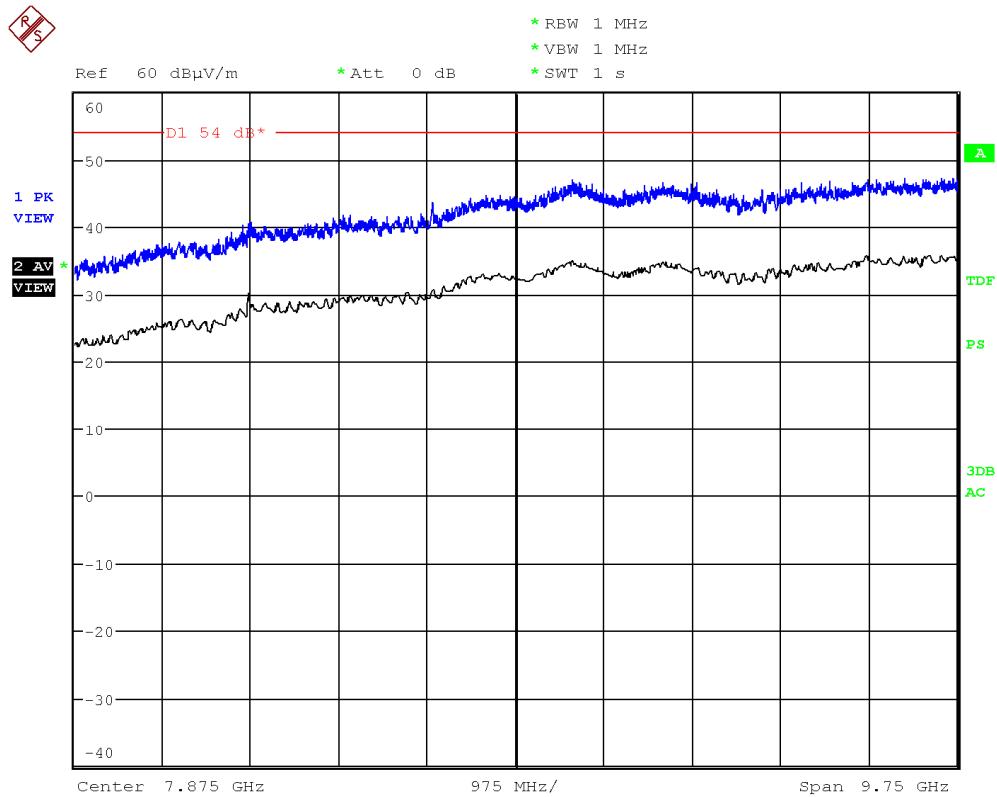
CHANNEL 1 (2412 MHz).



CHANNEL 6 (2437 MHz).

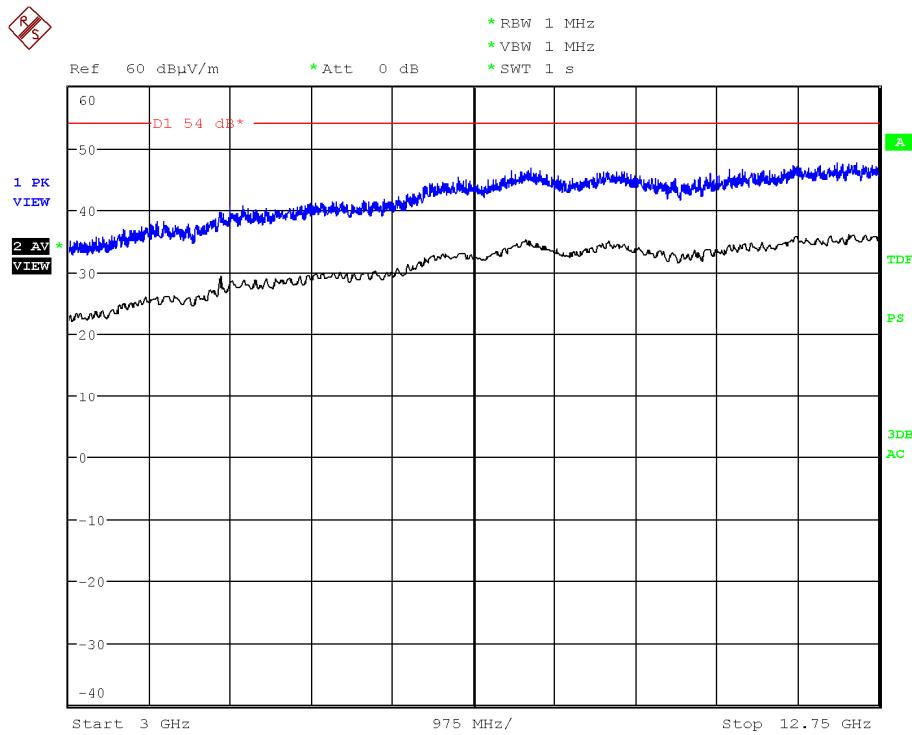


CHANNEL 11 (2462 MHz).

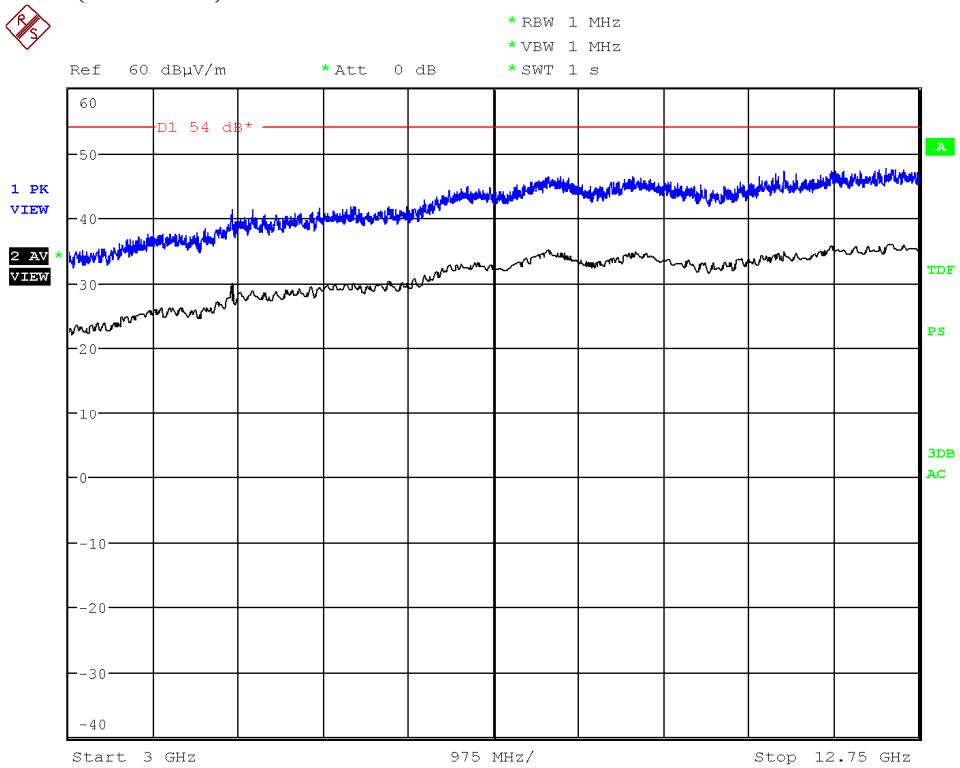


3. WiFi 2.4GHz 802.11 n20 mode

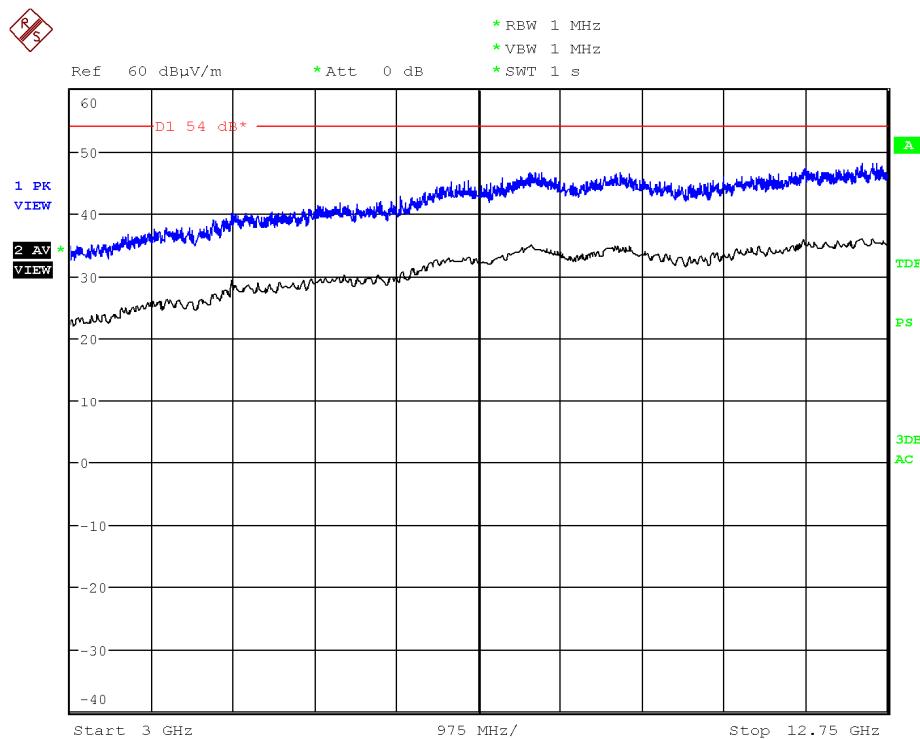
CHANNEL 1 (2412 MHz).



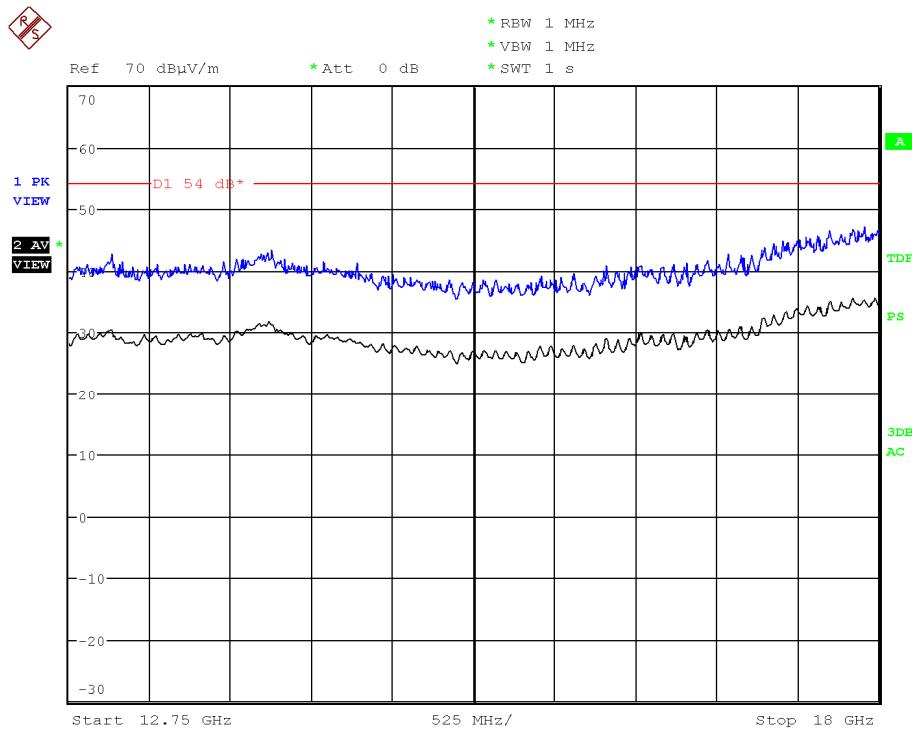
CHANNEL 6 (2437 MHz).



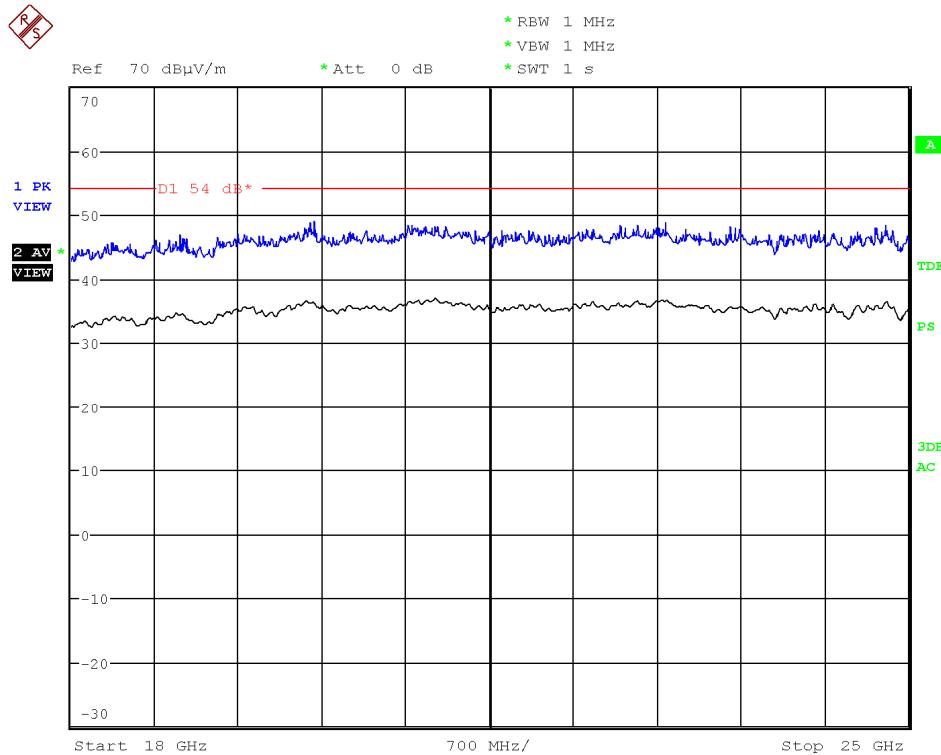
CHANNEL 11 (2462 MHz).



FREQUENCY RANGE 12.75 GHz to 18 GHz. No spurious signals were detected in all modulation modes and channels tested.



FREQUENCY RANGE 18 GHz to 25 GHz. No spurious signals were detected.

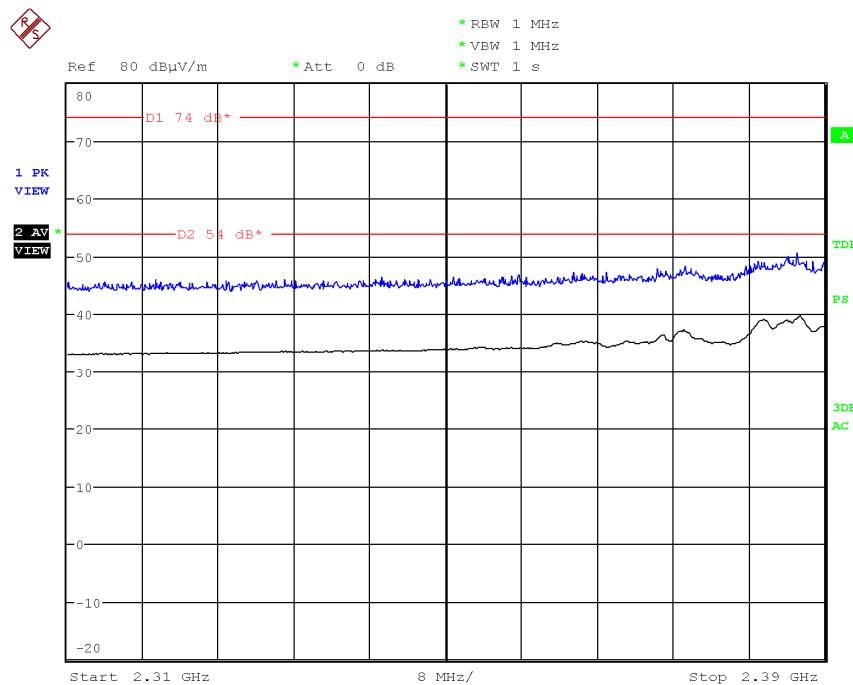


Radiated spurious emissions at band-edges and inside restricted bands 2.31-2.39 GHz and 2.4835 – 2.5 GHz.

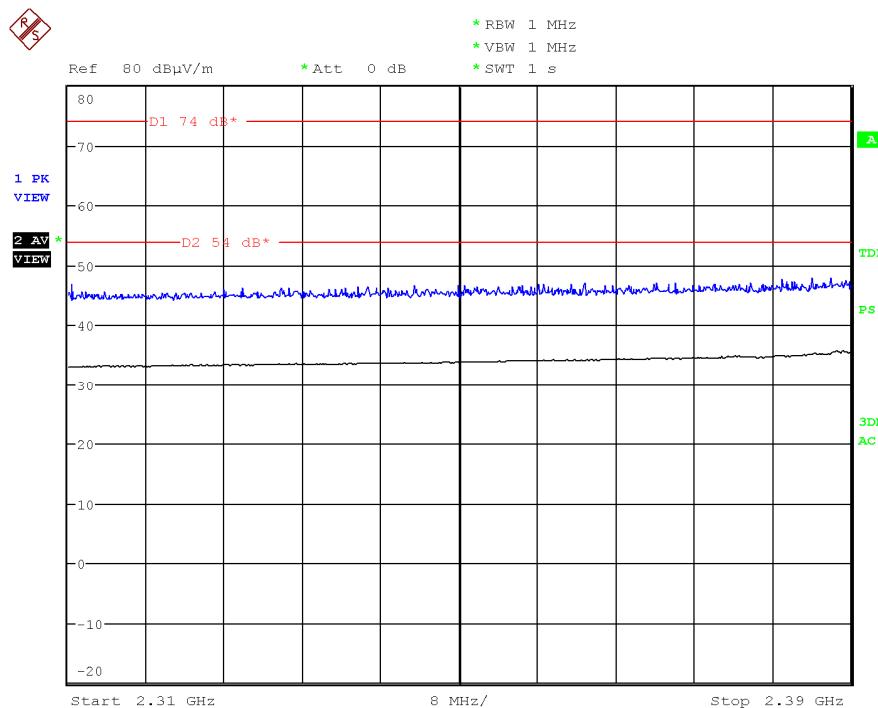
FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

1. WiFi 2.4GHz 802.11 b mode

CHANNEL 1 (2412 MHz).

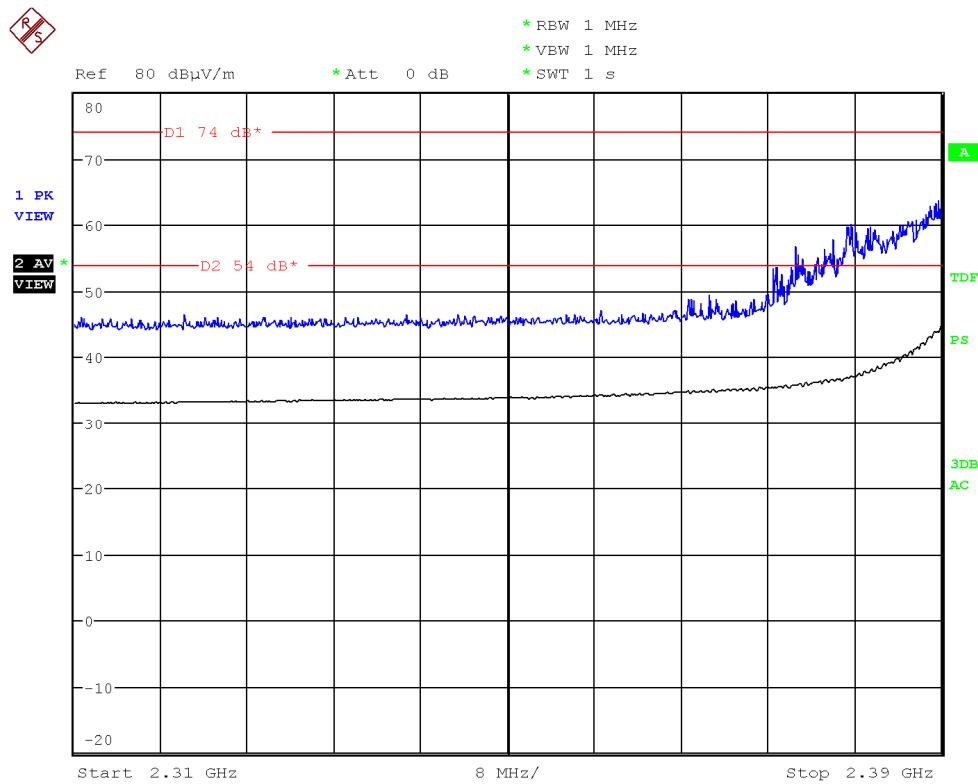


CHANNEL 6 (2437 MHz).

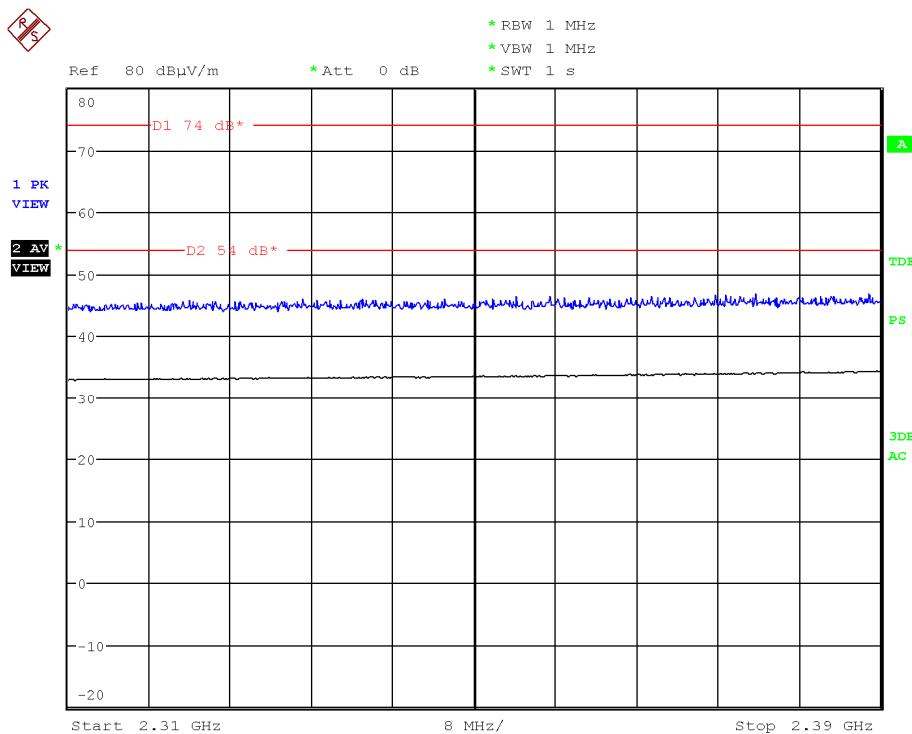


2. WiFi 2.4GHz 802.11 g mode

CHANNEL 1 (2412 MHz).

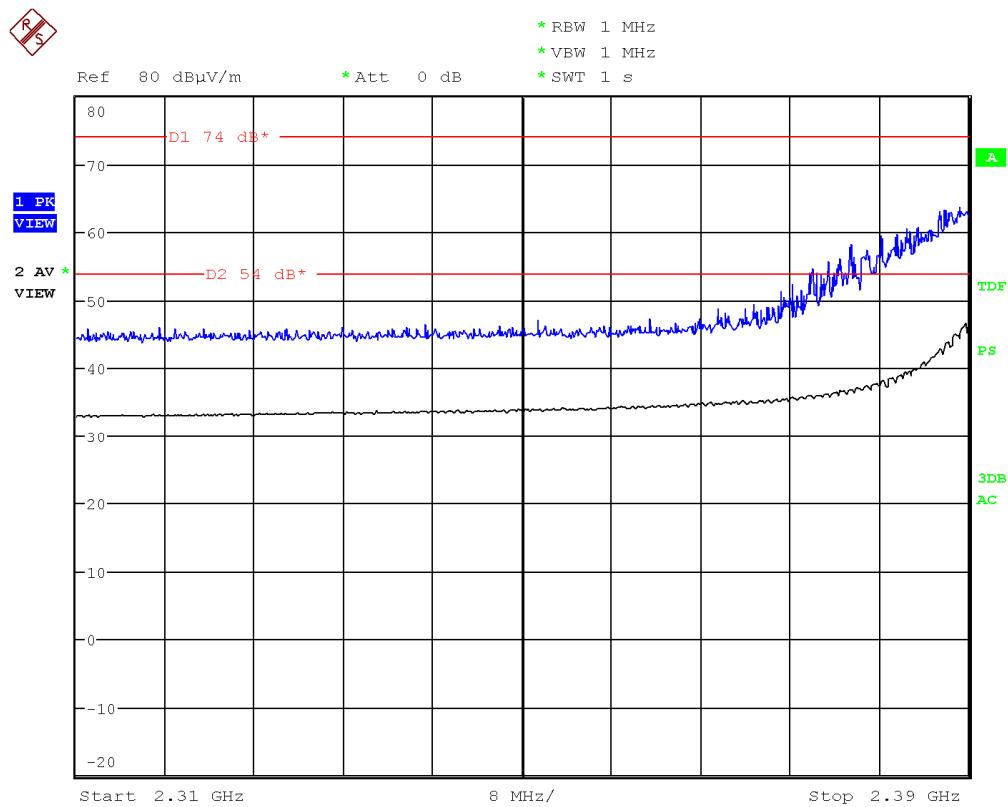


CHANNEL 6 (2437 MHz).

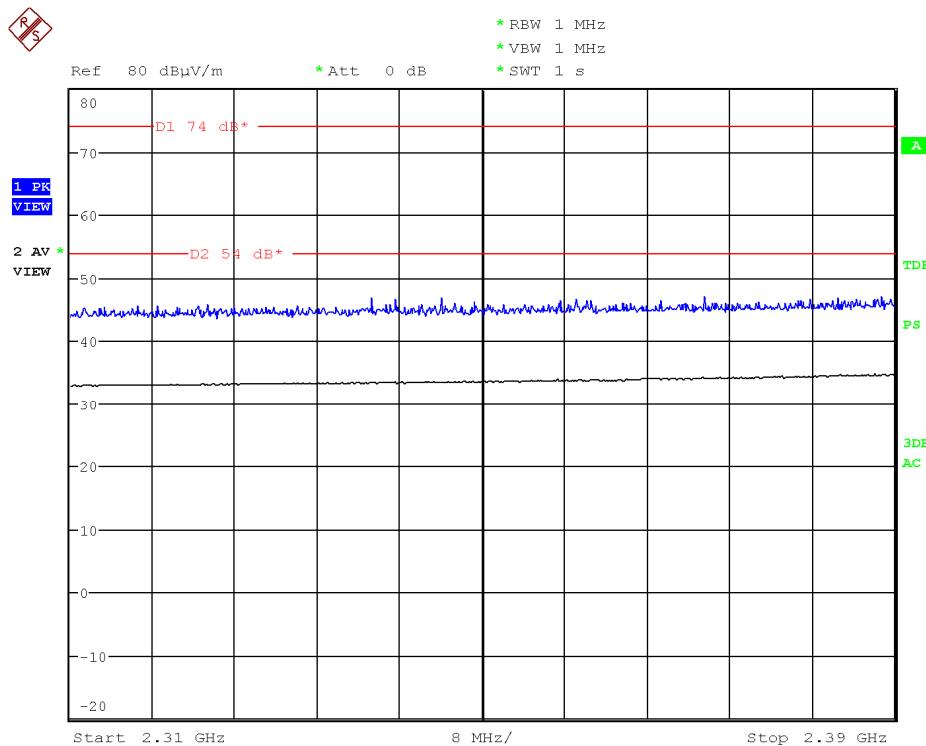


3. WiFi 2.4GHz 802.11 n20 mode

CHANNEL 1 (2412 MHz).



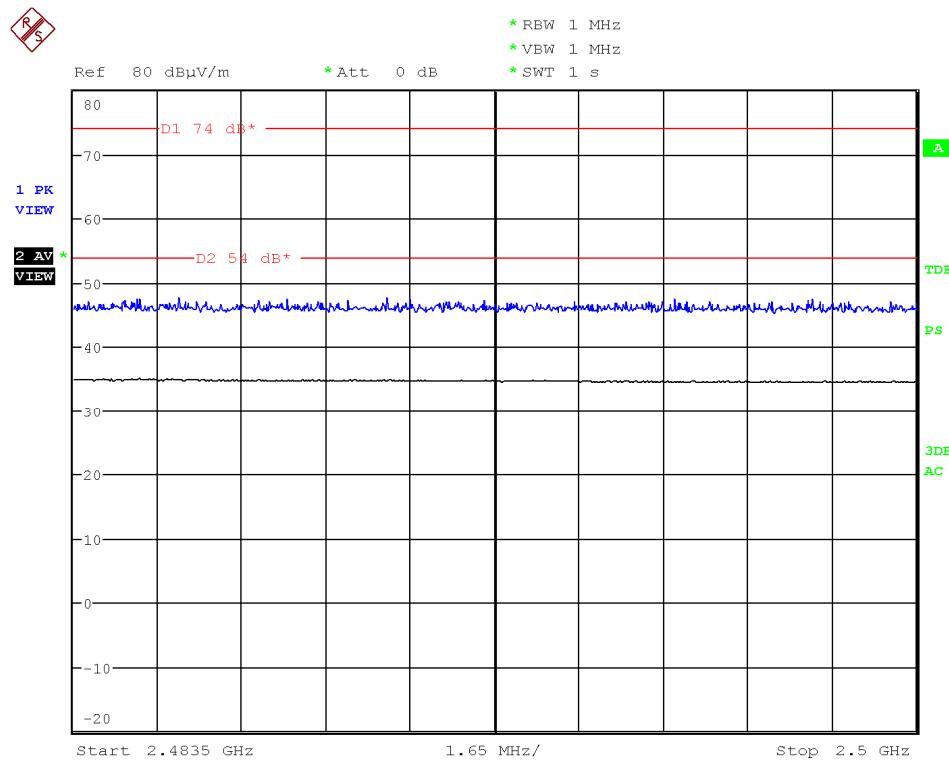
CHANNEL 6 (2437 MHz).



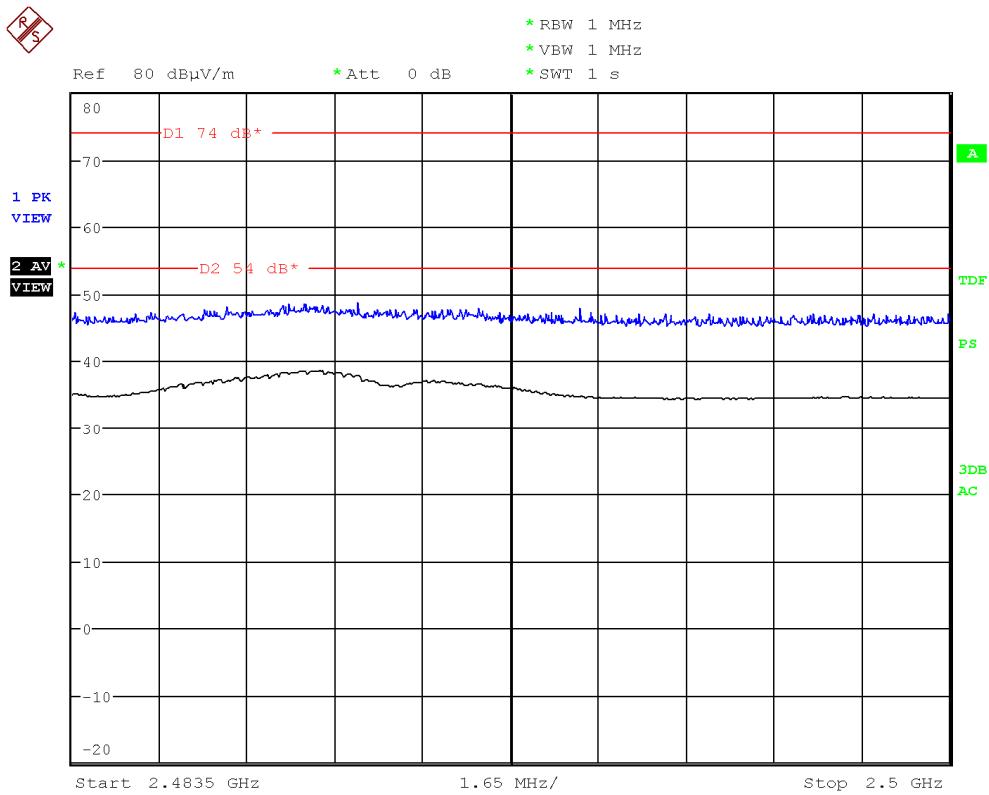
FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

1. WiFi 2.4GHz 802.11 b mode

CHANNEL 6 (2437 MHz).

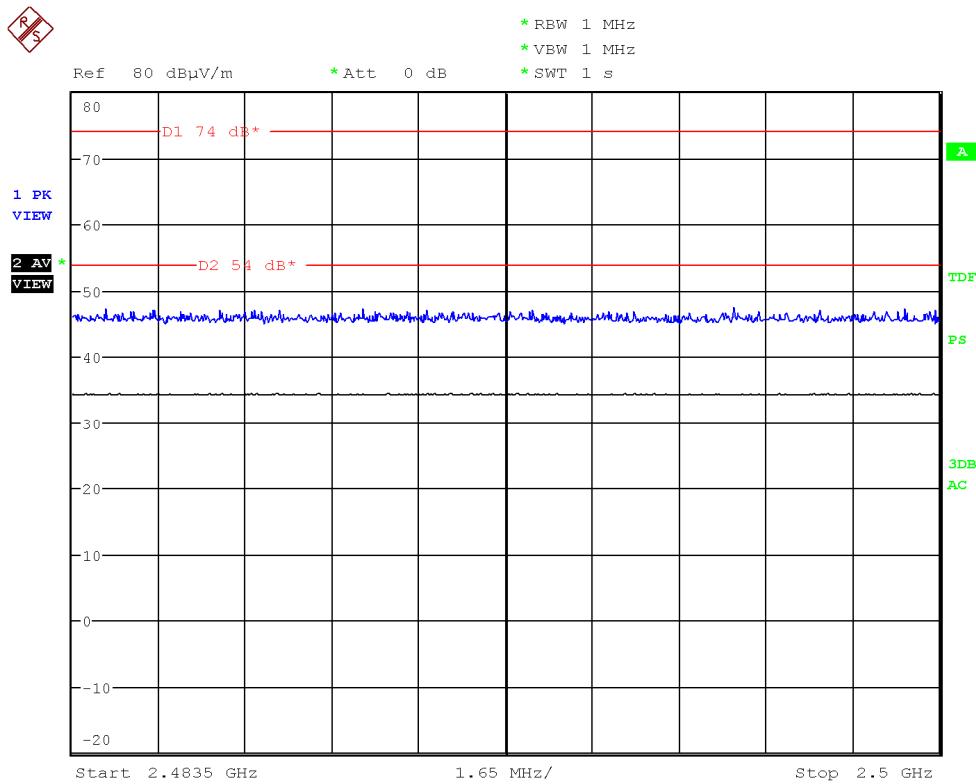


CHANNEL 11 (2462 MHz).

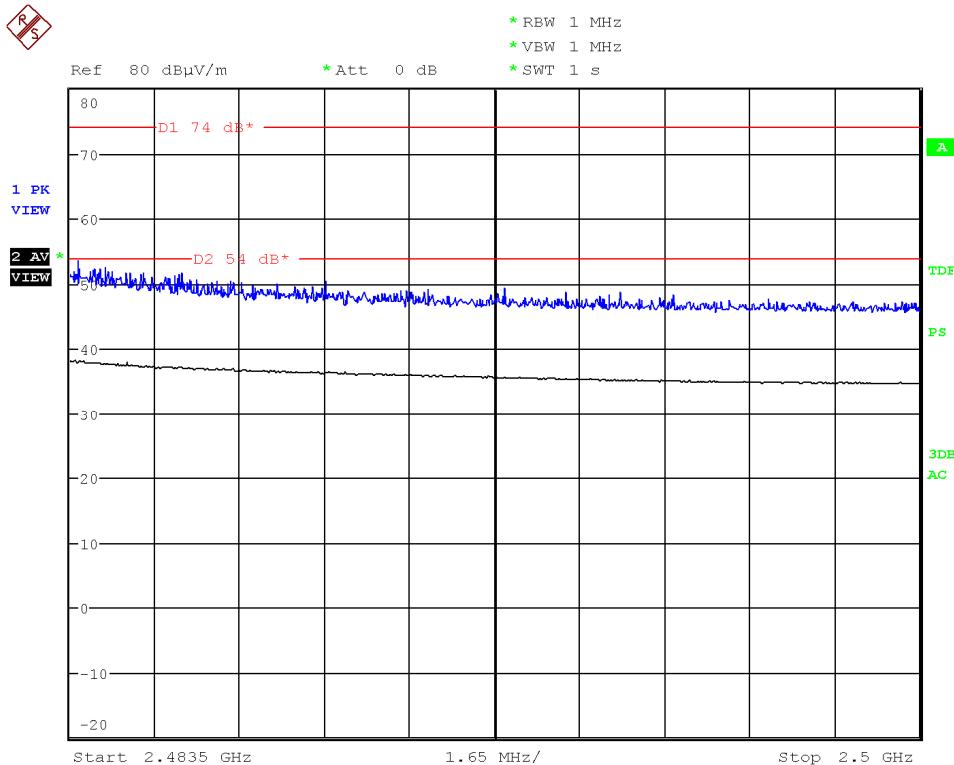


2. WiFi 2.4GHz 802.11 g mode

CHANNEL 6 (2437 MHz).

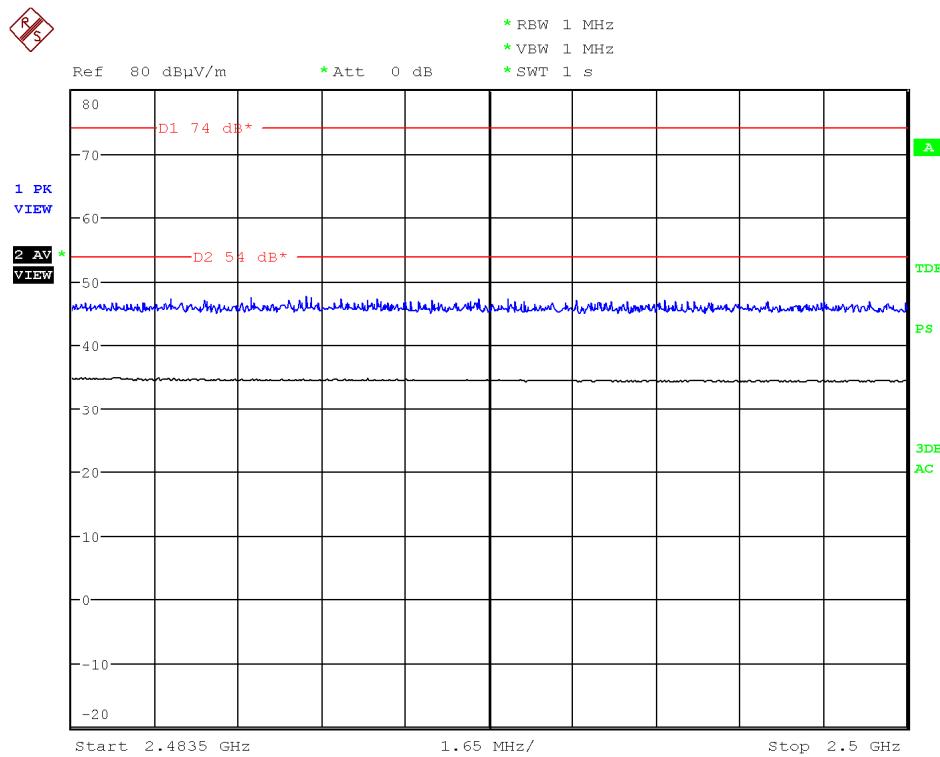


CHANNEL 11 (2462 MHz).

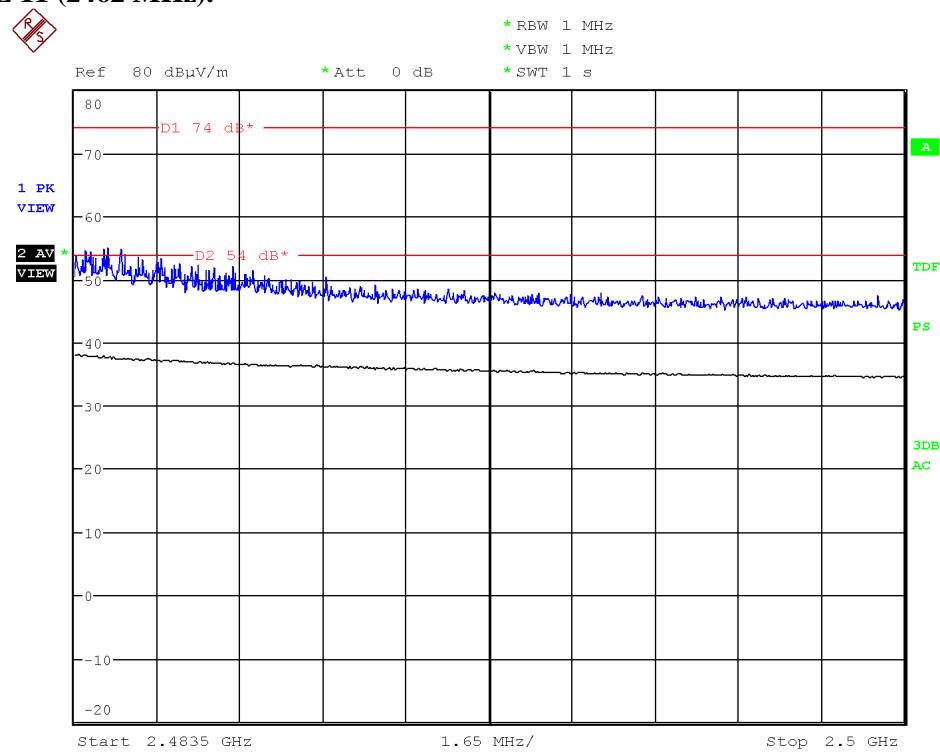


3. WiFi 2.4GHz 802.11 n20 mode

CHANNEL 6 (2437 MHz).



CHANNEL 11 (2462 MHz).



APPENDIX B: Test results. “Bluetooth Low Energy”

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TEST CONDITIONS

Power supply (V):

$V_n = 3.7$ Vdc

$V_{min} = N/A$

$V_{max} = N/A$

Type of power supply: Rechargeable battery.

Declared Gain for antenna = -1.0 dBi

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

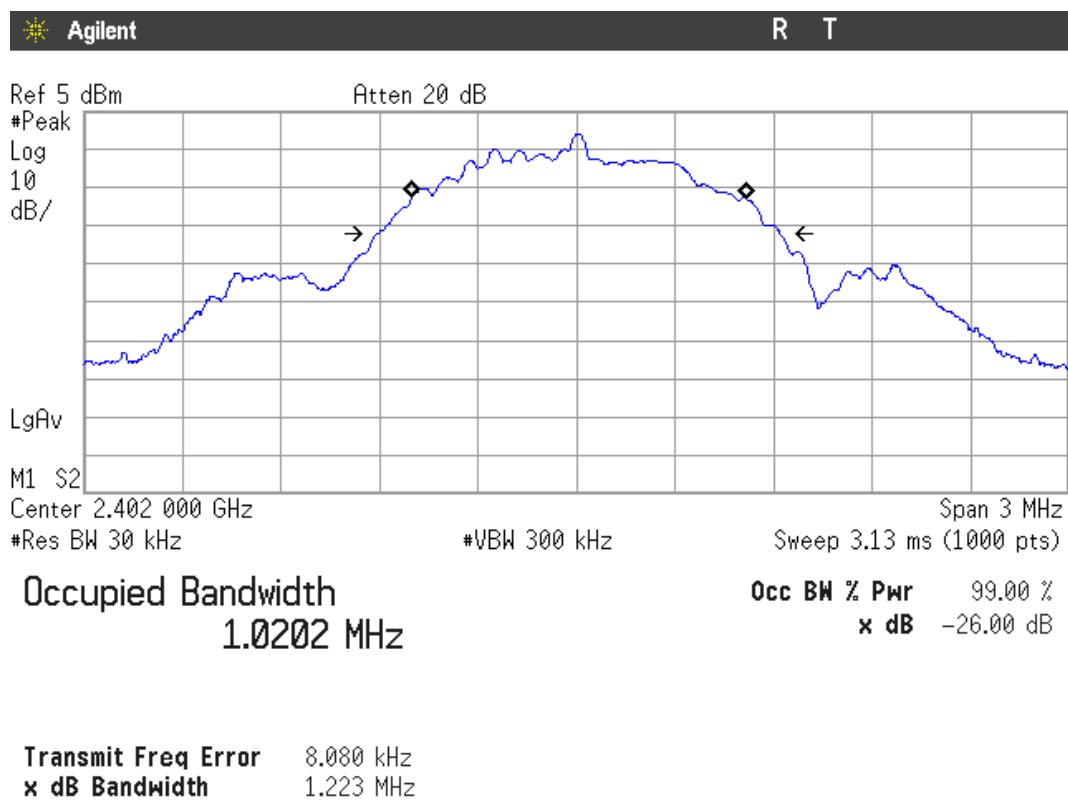
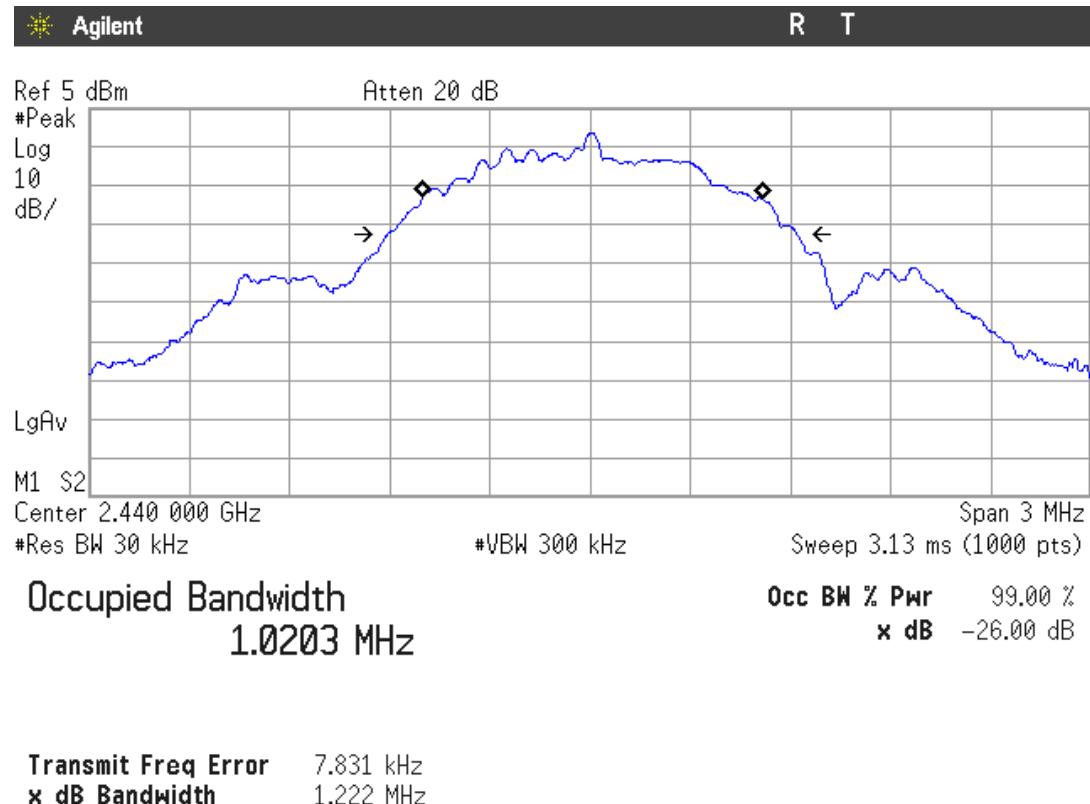
Measurements were made in both horizontal and vertical planes of polarization.

Occupied bandwidth

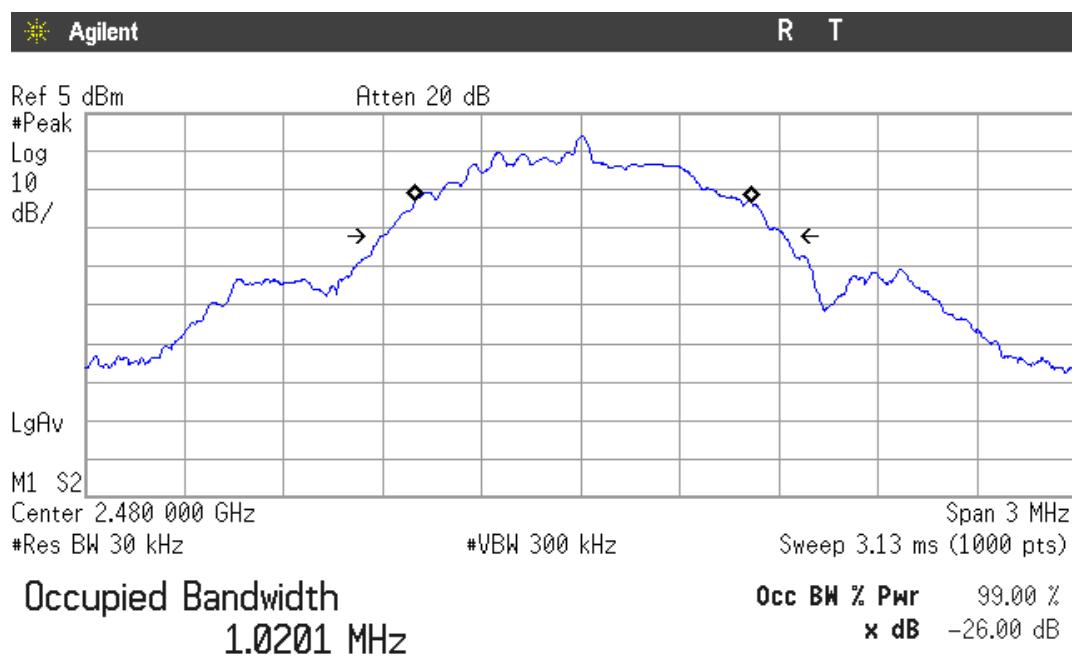
RESULTS

(see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% bandwidth (MHz)	1.020	1.020	1.020
-26 dBc bandwidth (MHz)	1.223	1.222	1.220
Measurement uncertainty (kHz)	± 21.7		

Lowest Channel

Middle Channel


Highest channel



Transmit Freq Error 7.395 kHz
x dB Bandwidth 1.220 MHz

Section 15.247 Subclause (a) (2) / RSS-210 A8.2. (a). 6 dB Bandwidth**SPECIFICATION**

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

RESULTS

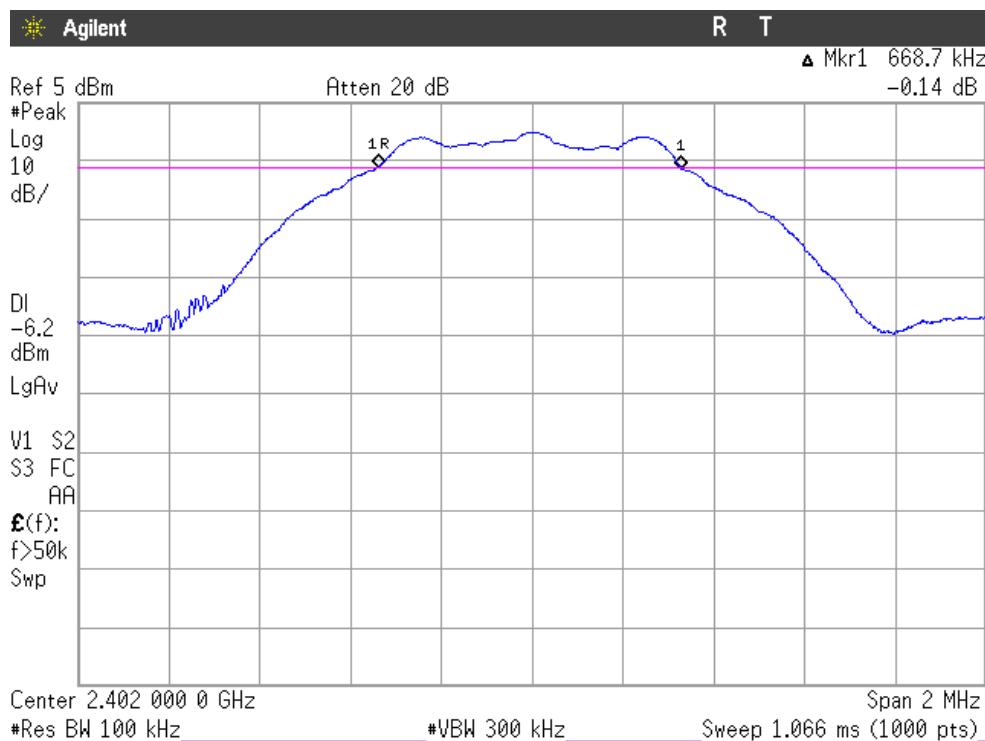
6 dB Bandwidth (see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
6 dB Spectrum bandwidth (kHz)	668.7	664.7	668.7
Measurement uncertainty (kHz)	± 21.7		

Verdict: PASS

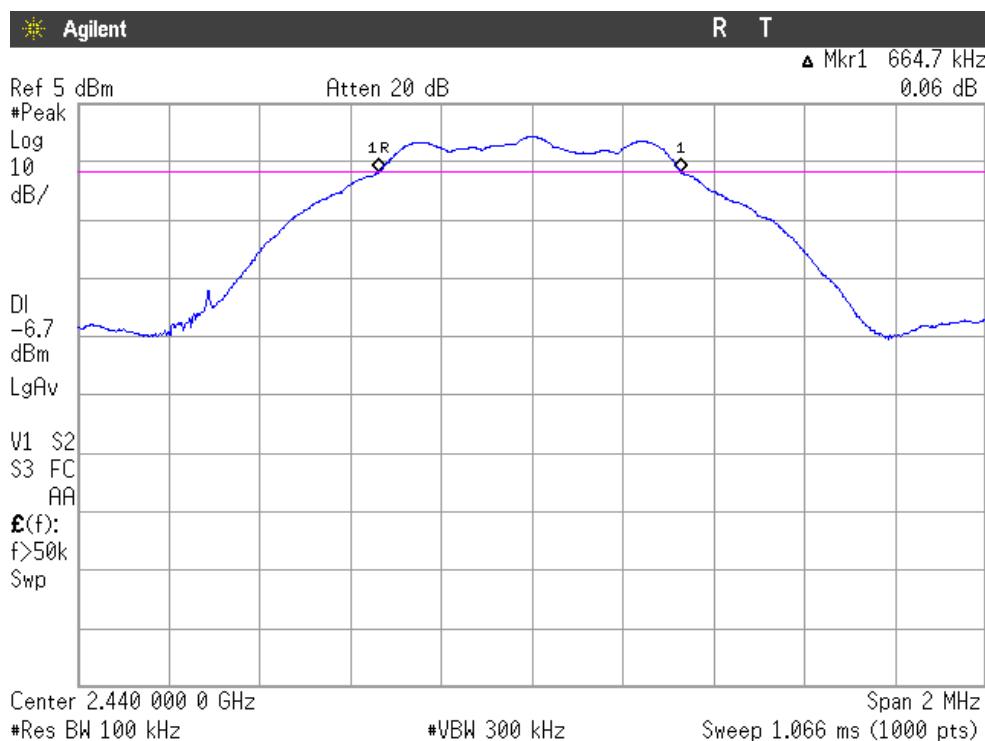
6 dB BANDWIDTH.

Lowest Channel



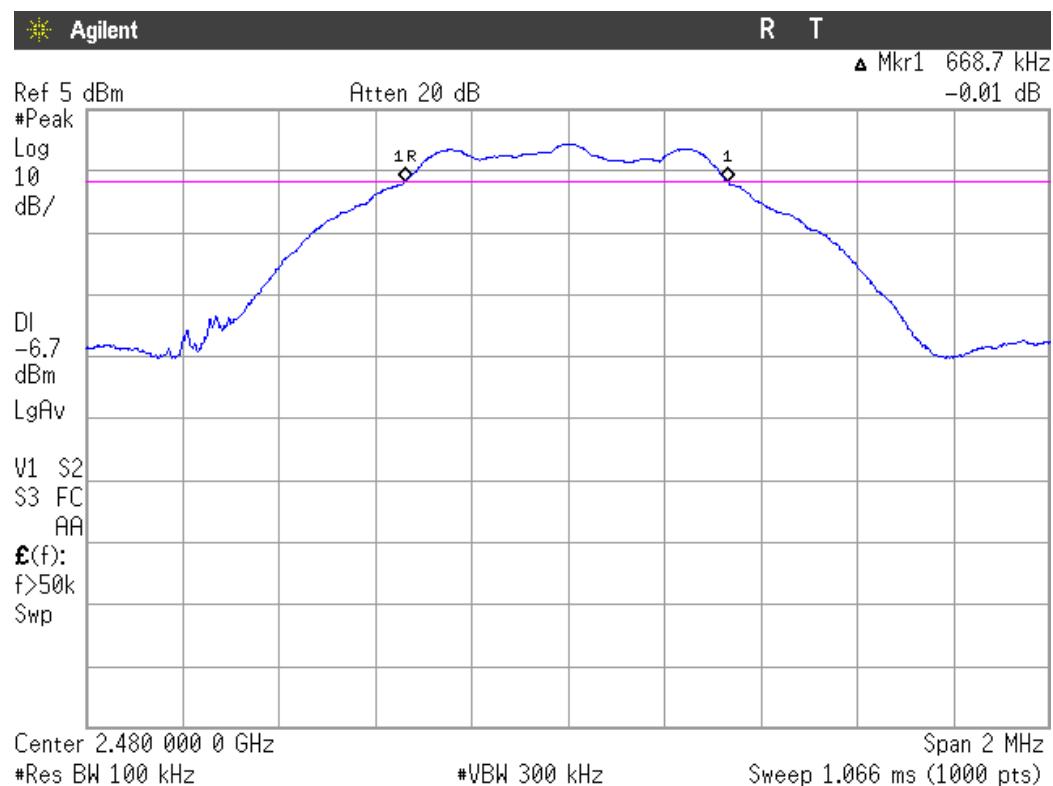
6 dB BANDWIDTH.

Middle Channel



6 dB BANDWIDTH.

Highest Channel



Section 15.247 Subclause (b) / RSS-210 A8.4. (4). Maximum output power and antenna gain

SPECIFICATION

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS

The maximum peak conducted output power was measured using the method according to point 9.1.1. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03 dated 08/04/2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

MAXIMUM OUTPUT POWER. See next plots.

Maximum declared antenna gain: -1.0 dBi.

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Maximum conducted power (dBm)	-0.02	-0.63	-0.63
Maximum EIRP power (dBm)	-1.02	-1.63	-1.63
Measurement uncertainty (dB)		±1.5	

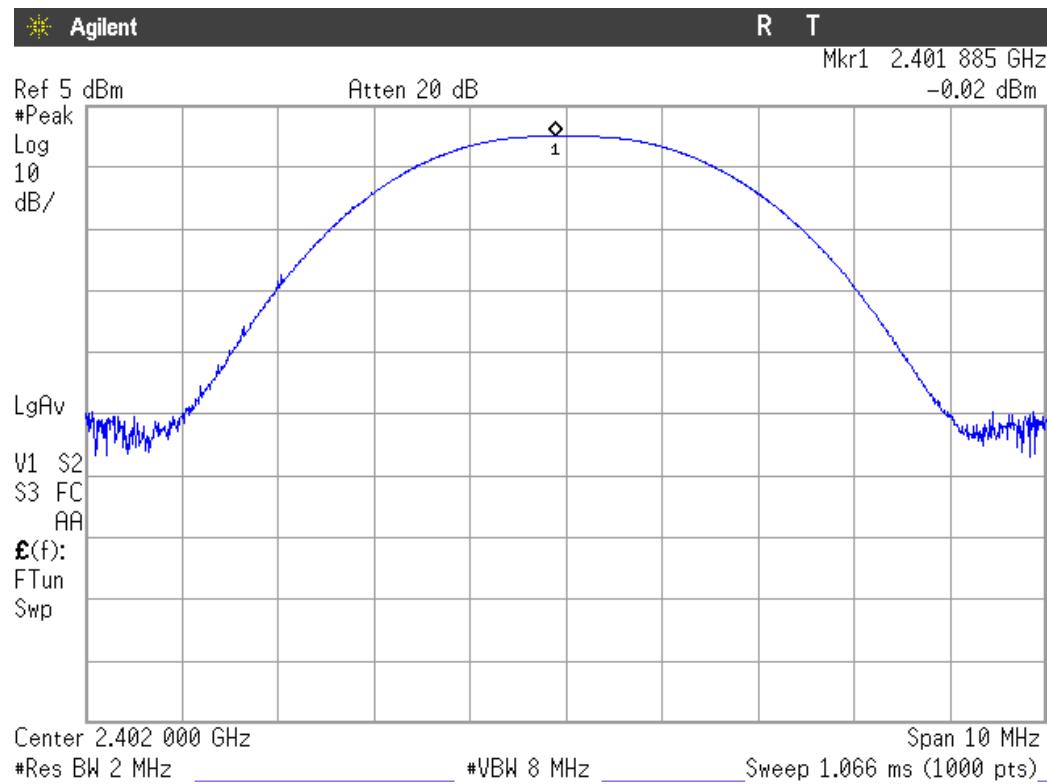
Average conducted power for SAR calculations	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Average conducted power (dBm)	-2.02	-3.02	-2.80
Measurement uncertainty (dB)		±1.5	

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

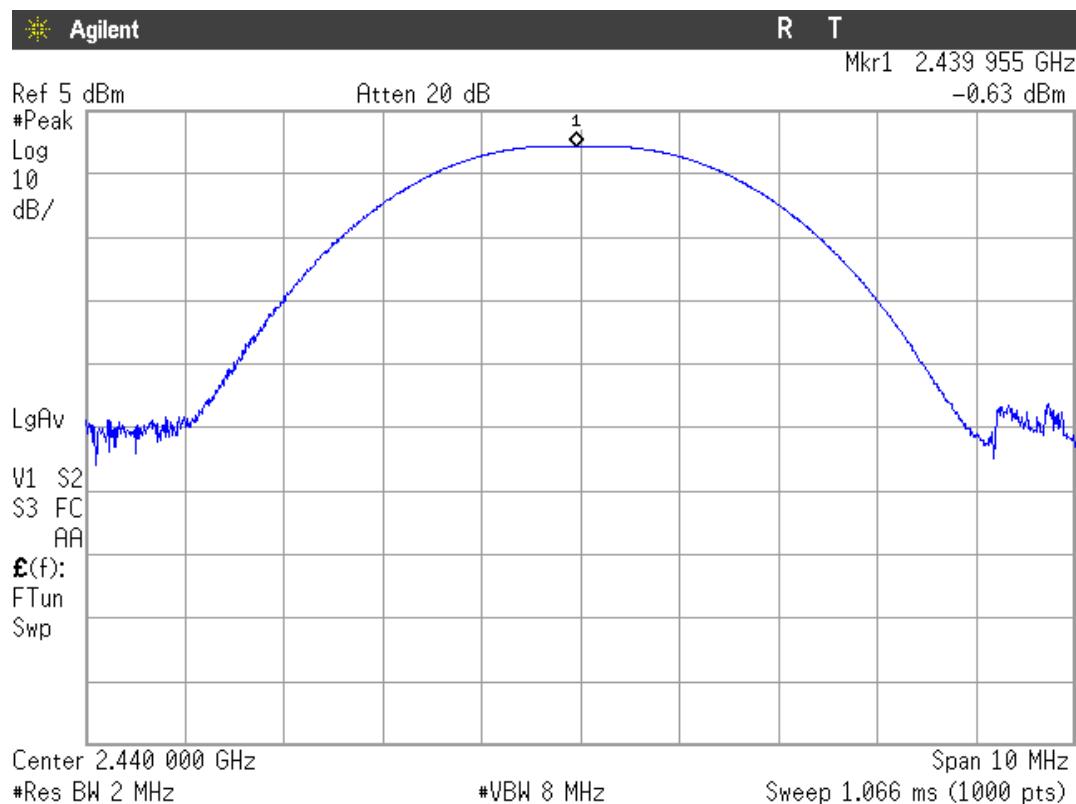
Verdict: PASS

CONDUCTED PEAK POWER.

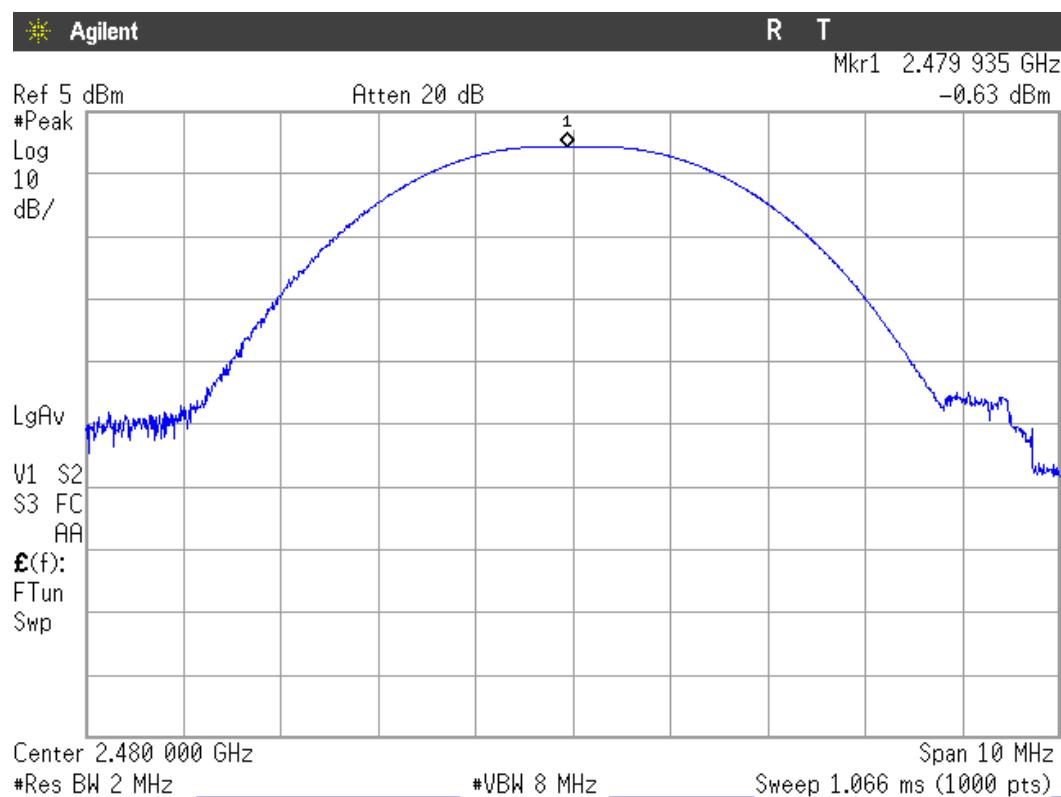
Lowest frequency



Middle frequency



Highest frequency



Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations conducted (Transmitter)

SPECIFICATION

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

Reference Level Measurement

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Reference Level Measurement (dBm)	-0.15	-0.77	-0.76
Measurement uncertainty (dB)	± 1.5		

Lowest frequency 2402 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.15

Middle frequency 2440 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.77

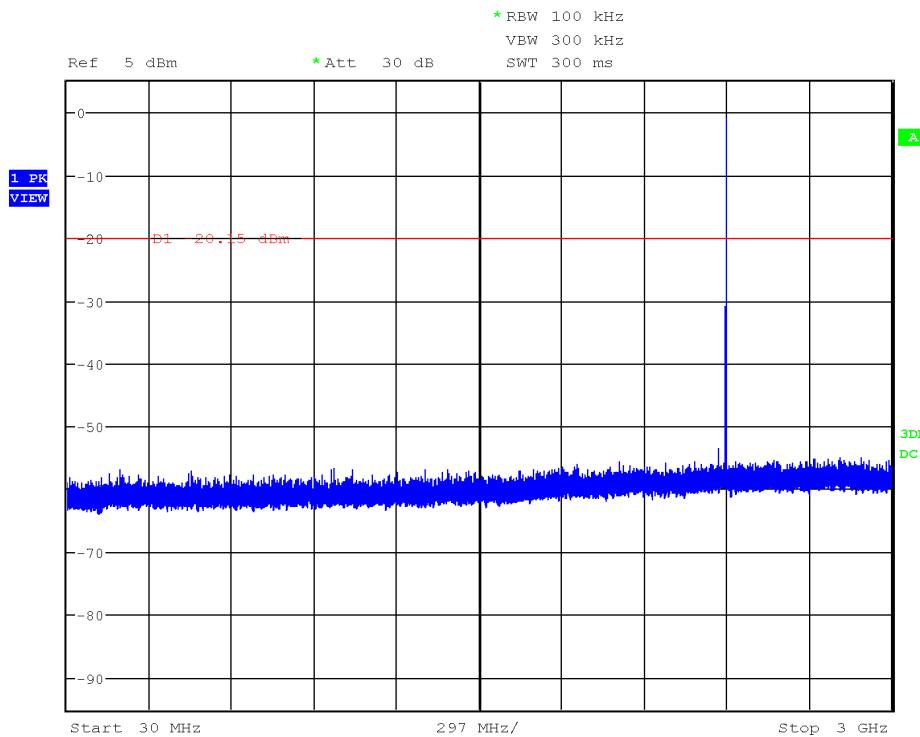
Highest frequency 2480 MHz	Limit (dBm)
All peaks are more than 20 dB below the limit.	-20.76

Verdict: PASS

See next plot of worst case: Lowest frequency 2402 MHz.

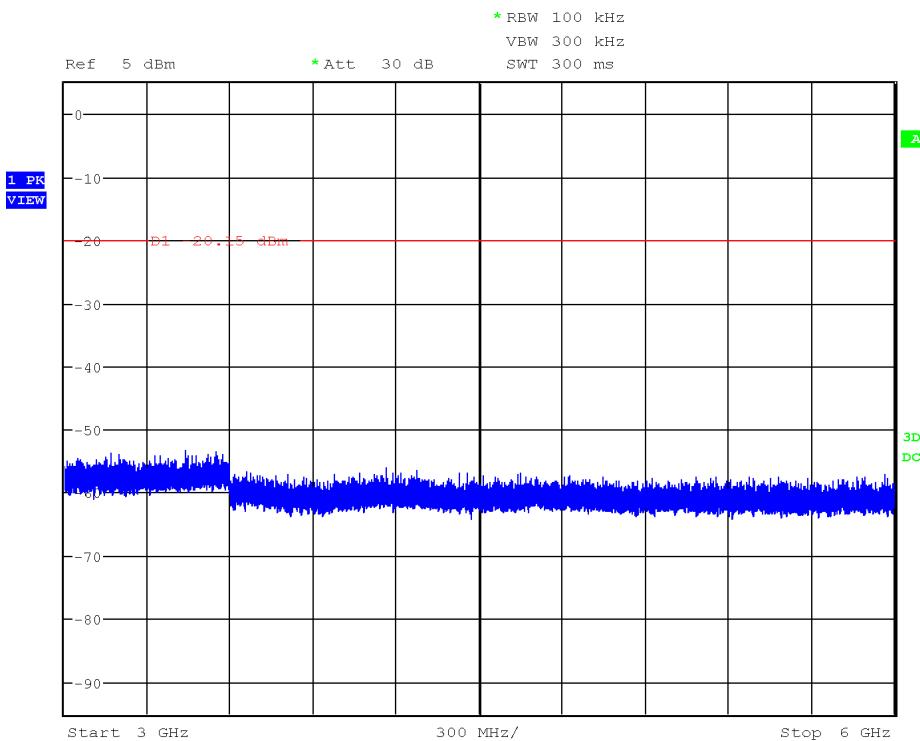
Number of sweep points: 30,001.

Plot 30 MHz to 3 GHz:

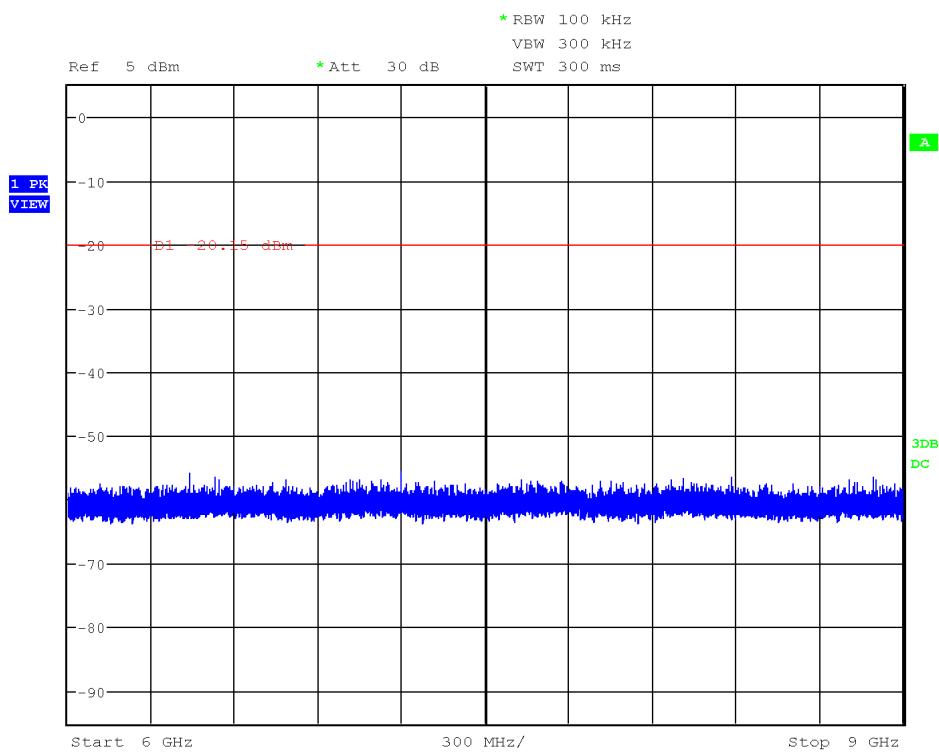


Note: The peak above the limit is the carrier frequency.

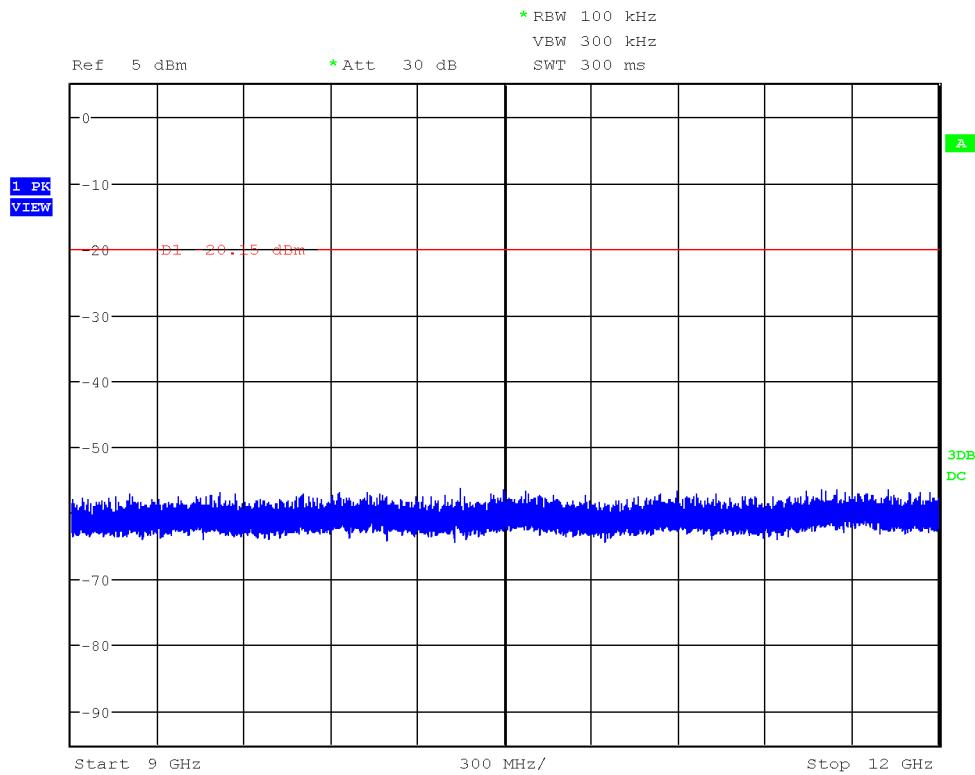
Plot 3 GHz to 6 GHz:



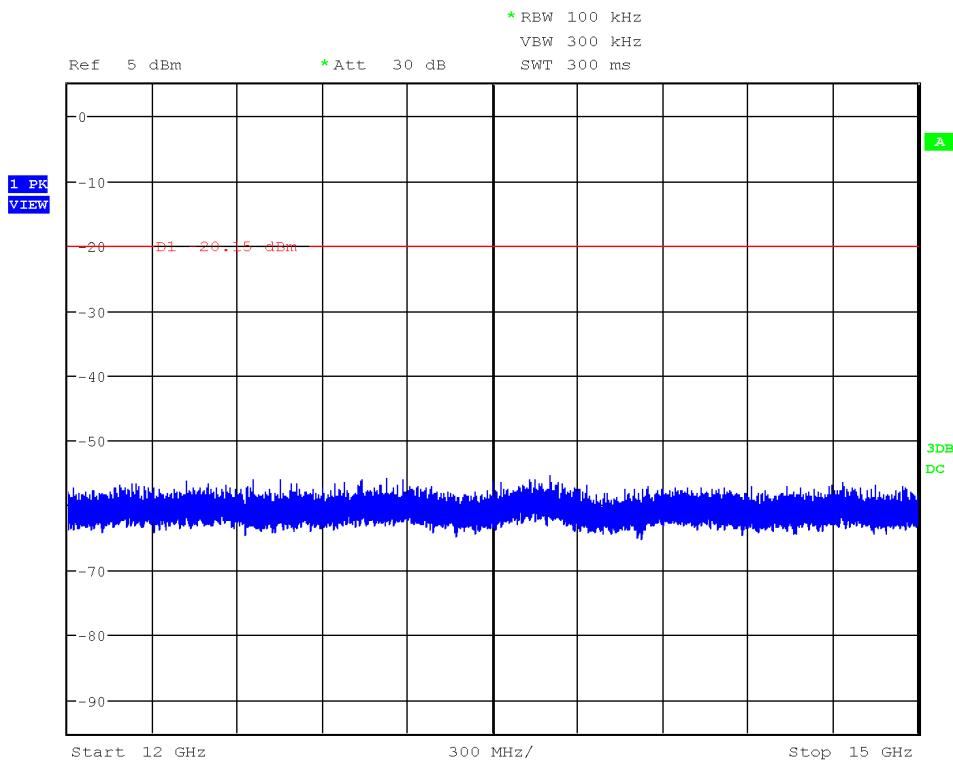
Plot 6 GHz to 9 GHz:



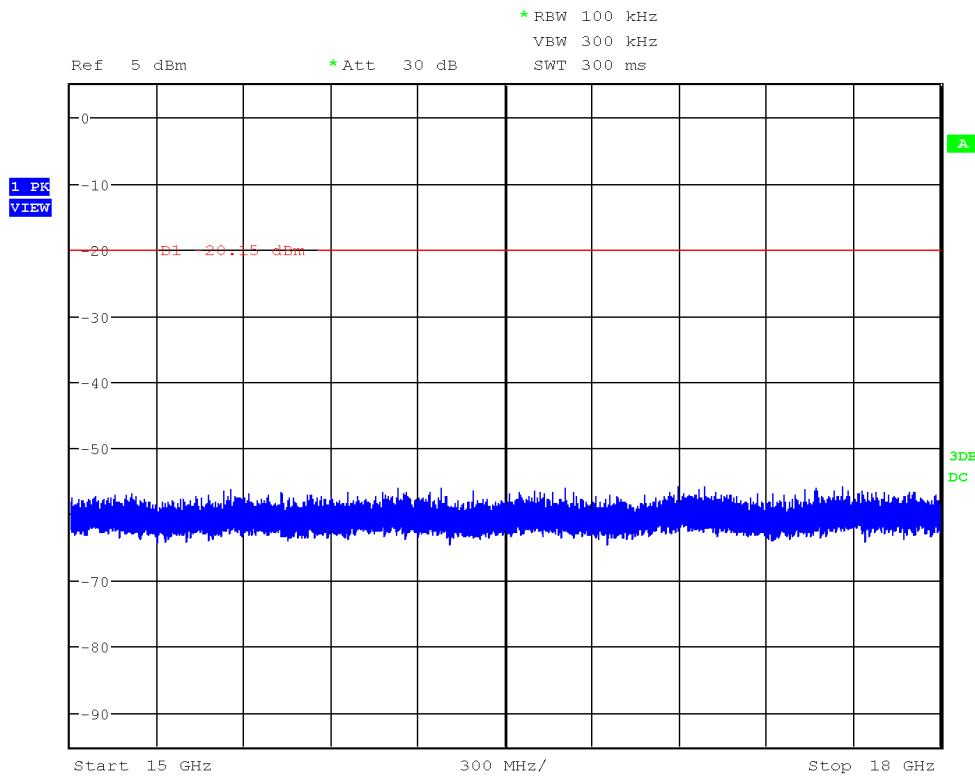
Plot 9 GHz to 12 GHz:



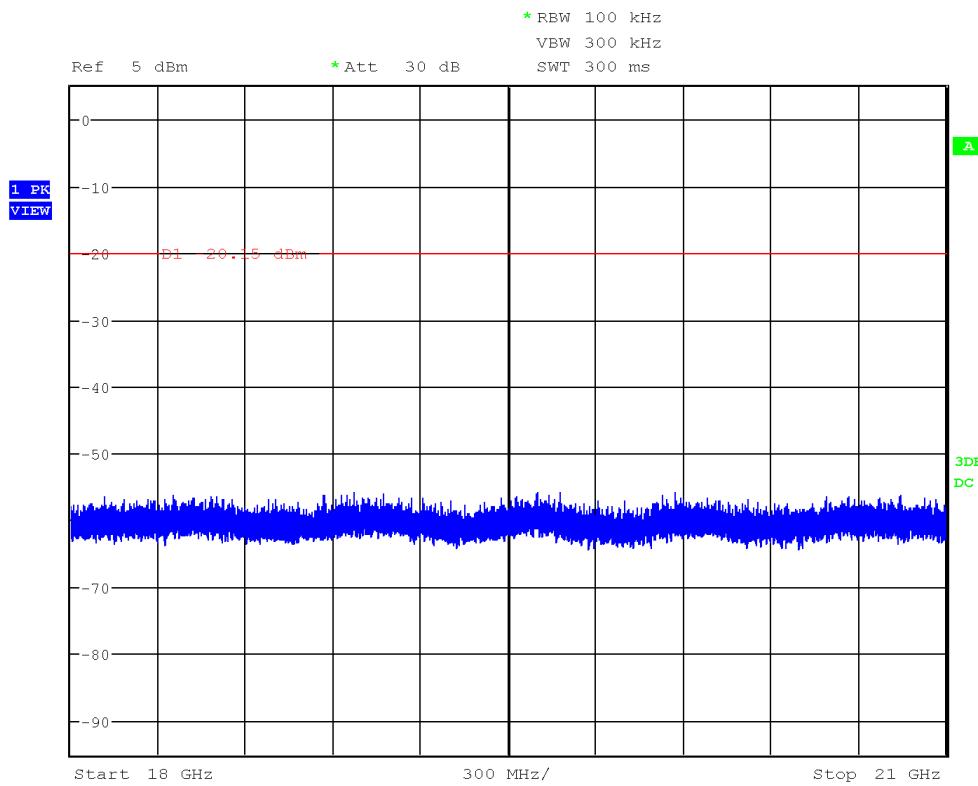
Plot 12 GHz to 15 GHz:



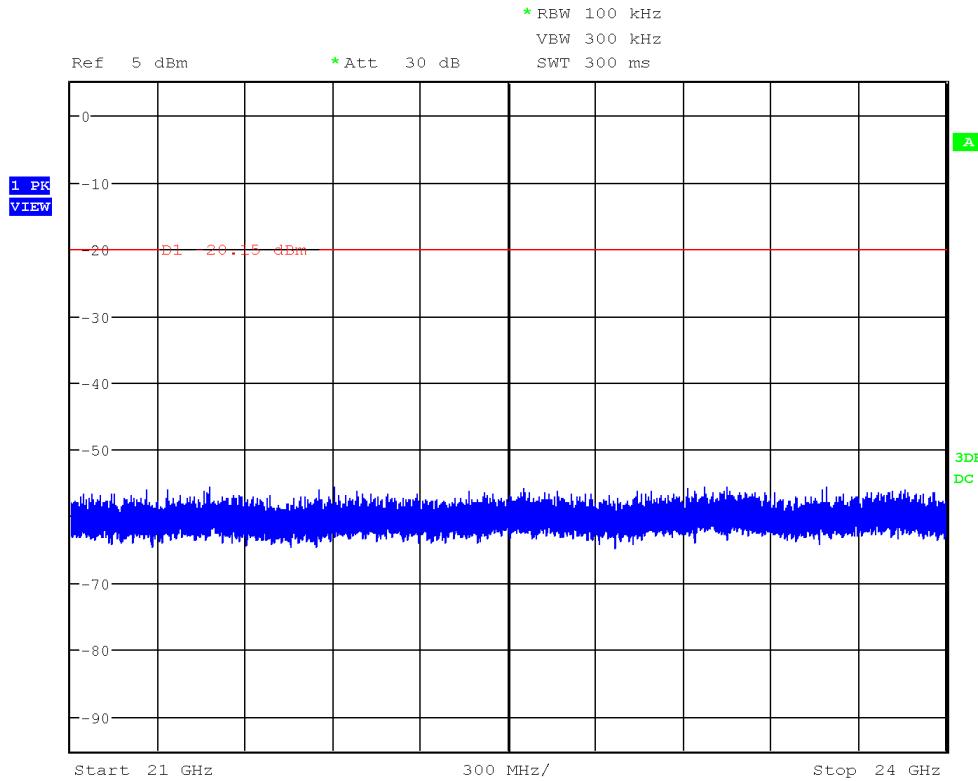
Plot 15 GHz to 18 GHz:



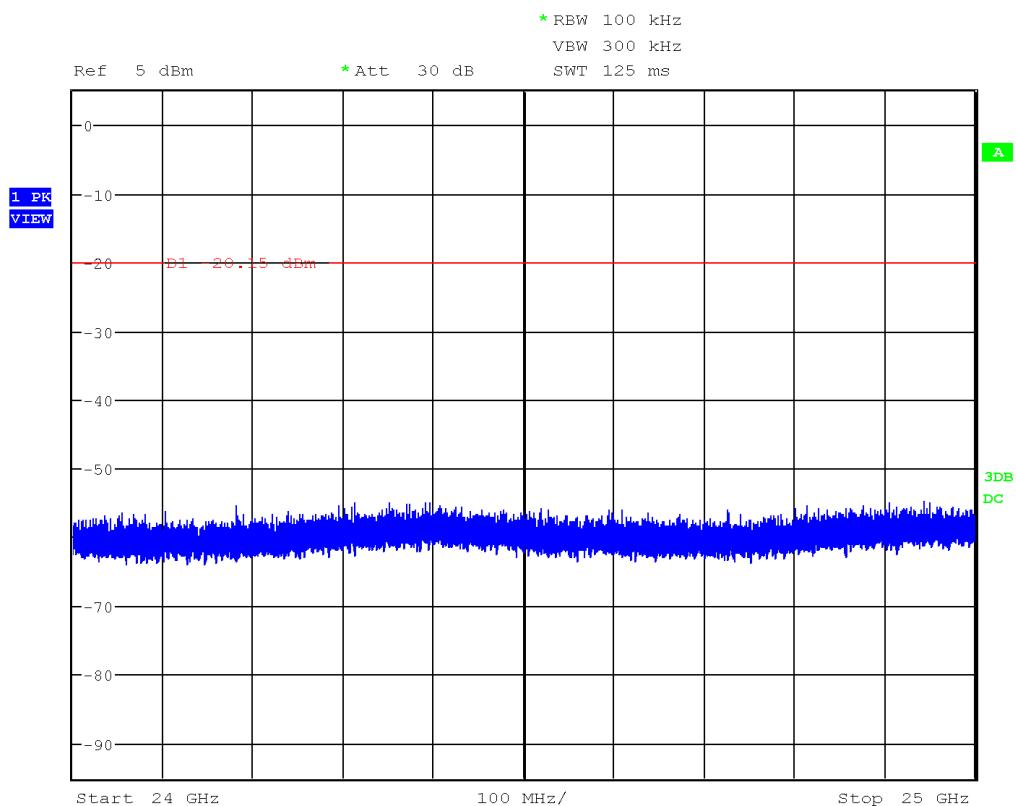
Plot 18 GHz to 21 GHz:



Plot 21 GHz to 24 GHz:



Plot 24 GHz to 25 GHz:



Section 15.247 Subclause (d) / RSS-210 A8.5. Band-edge emissions compliance (Transmitter)

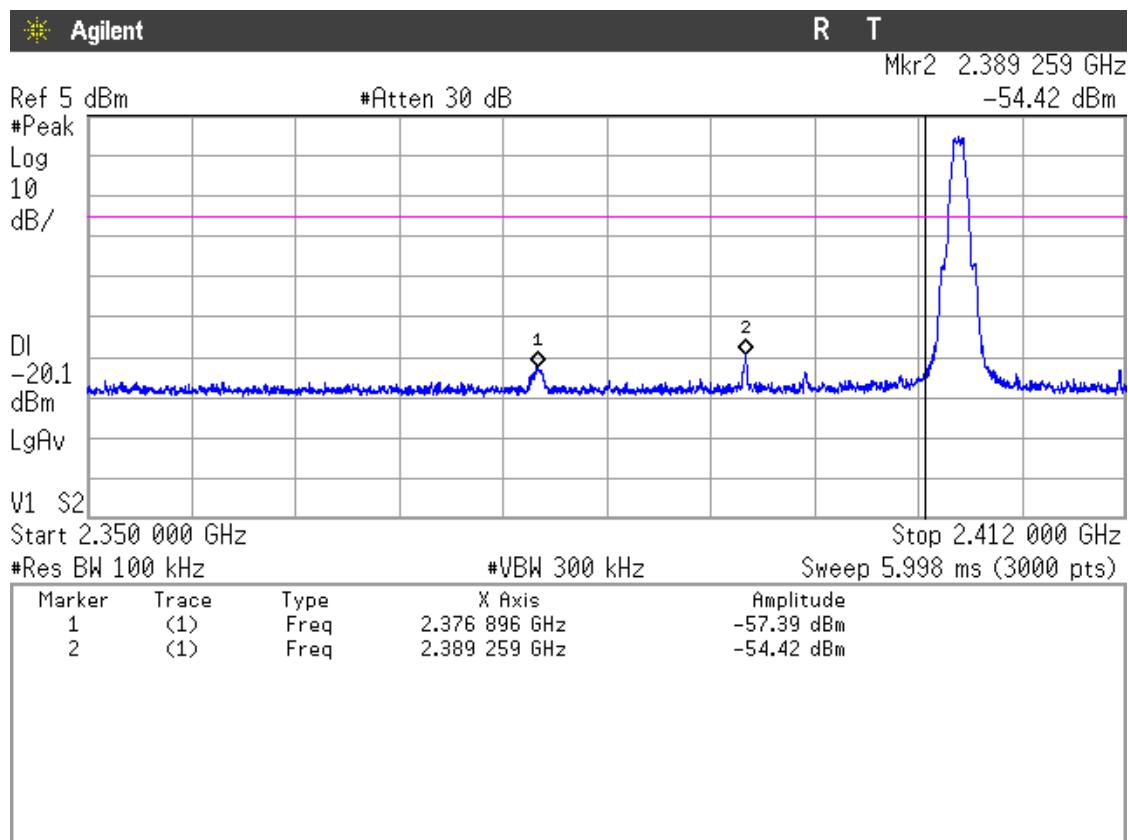
SPECIFICATION

Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20dB below the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

RESULTS:

1. LOW FREQUENCY SECTION. CONDUCTED.

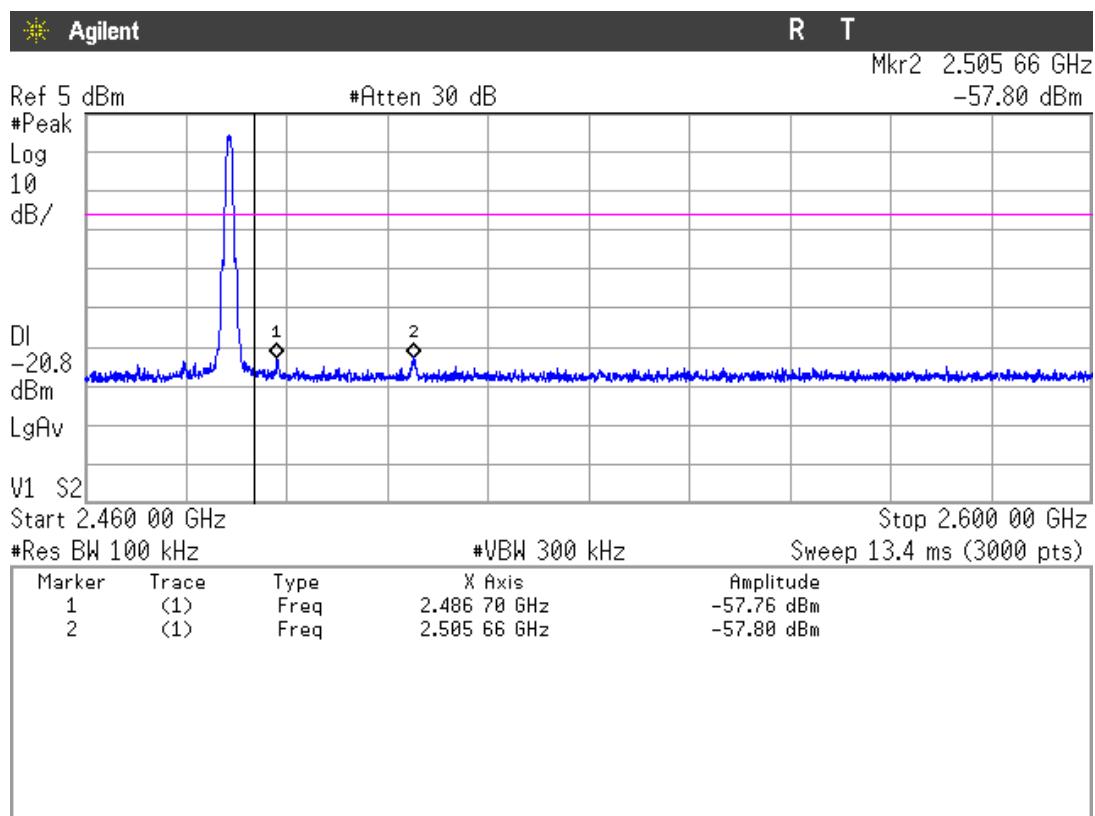
See next plot.



Verdict: PASS

2. HIGH FREQUENCY SECTION. CONDUCTED.

See next plot.



Verdict: PASS

Section 15.247 Subclause (e) / RSS-210 A8.5. Power spectral density

SPECIFICATION

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.

RESULTS

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 10.2. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 558074 D01 DTS Meas Guidance v03 dated 08/04/2013.

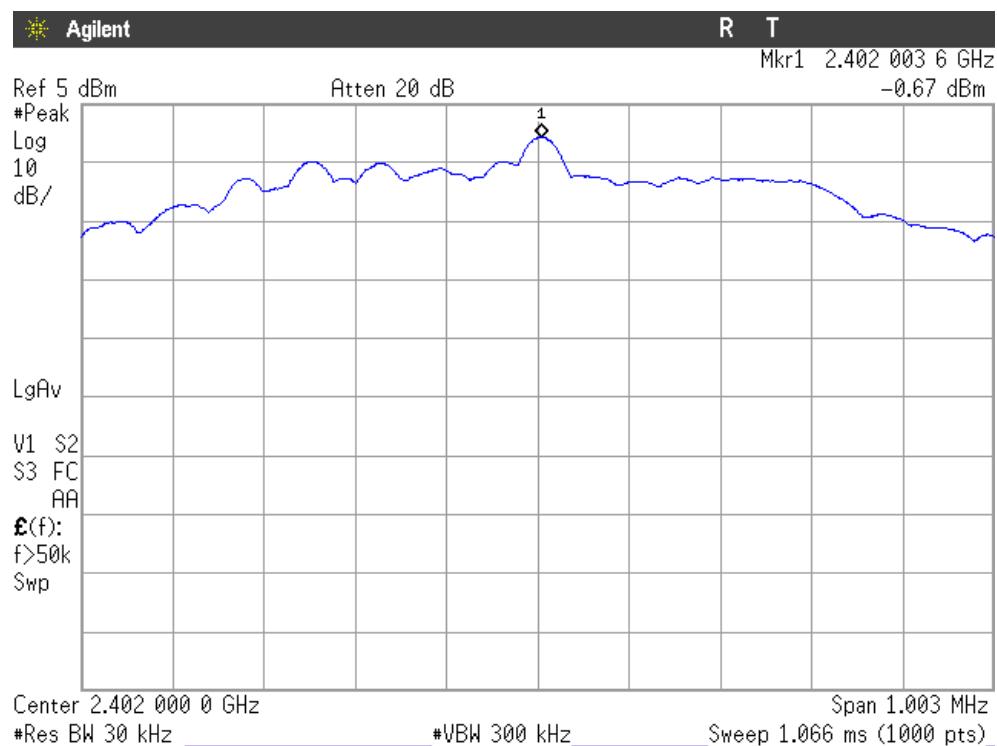
Power spectral density (see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Power spectral density (dBm)	-0.67	-1.25	-1.20
Measurement uncertainty (dB)	± 1.5		

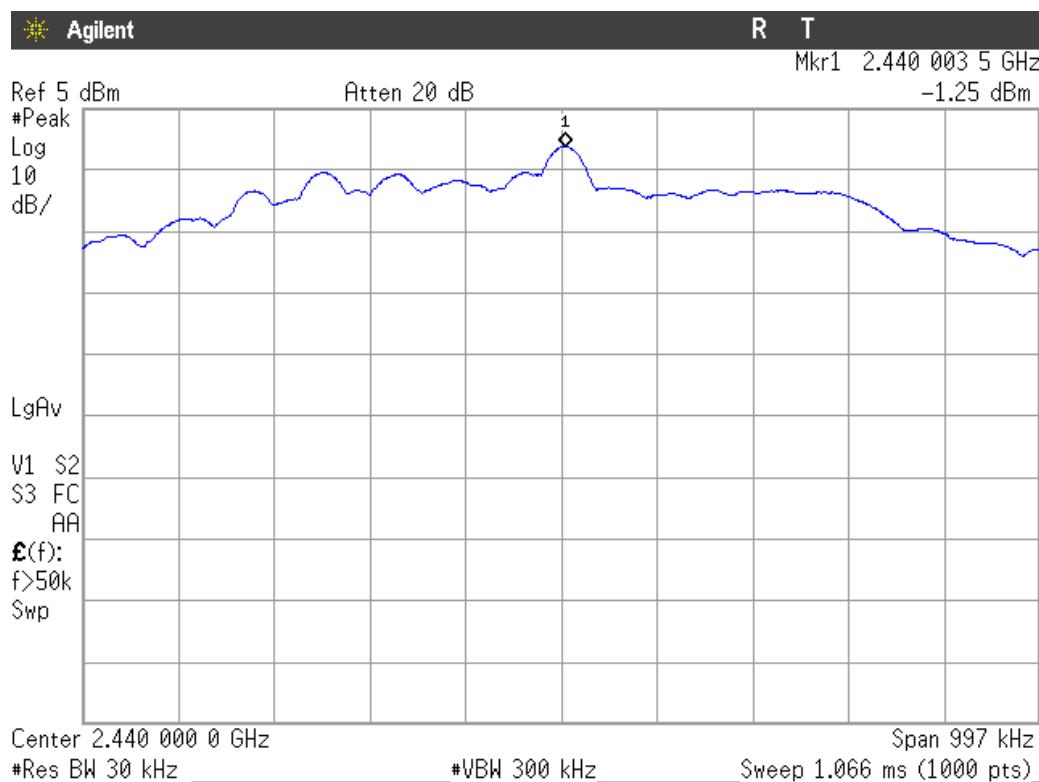
Verdict: PASS

Power spectral density.

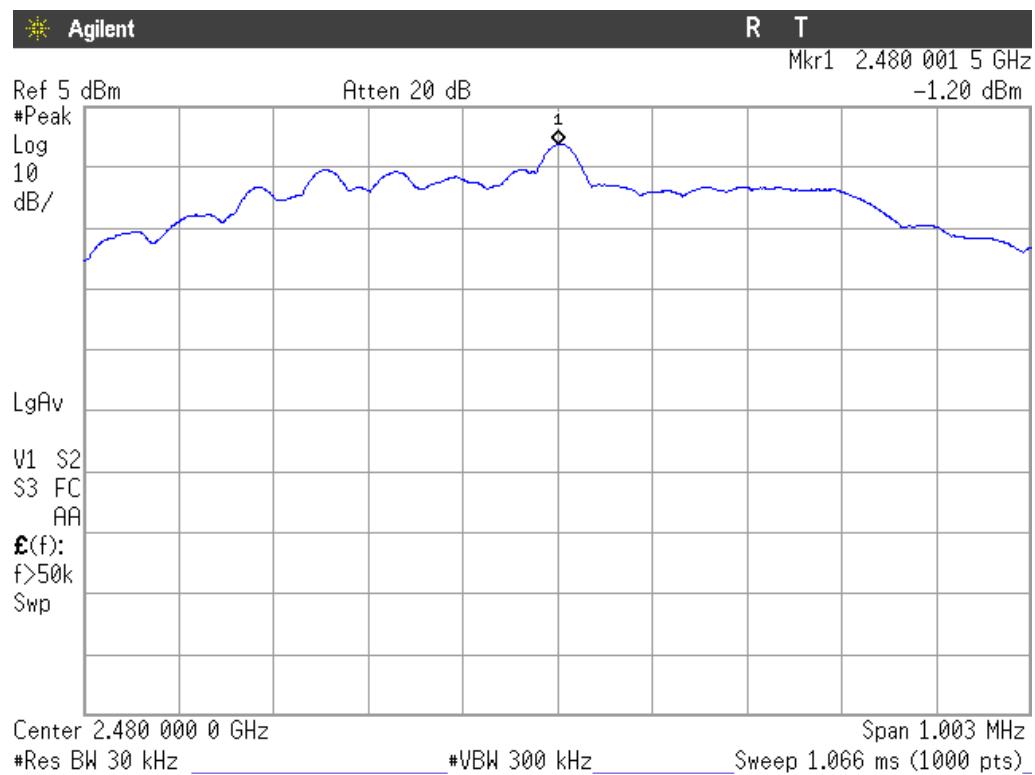
Lowest Channel



Middle Channel



Highest Channel



Section 15.247 Subclause (d) / RSS-210 A8.5. Emission limitations radiated (Transmitter)

SPECIFICATION

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz-1000 MHz.

The spurious signals detected do not depend on either the operating channel or the modulation mode.

See test results in Appendix A for details.

Frequency range 1 GHz-25 GHz

1. CHANNEL: LOWEST (2402 MHz). All maximized peak levels are below the average limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.35176	V	Peak	47.90	\pm 4.09
2.37672	V	Peak	48.74	\pm 4.09

2. CHANNEL: MIDDLE (2440 MHz). All maximized peak levels are below the average limit.

No peaks were found.

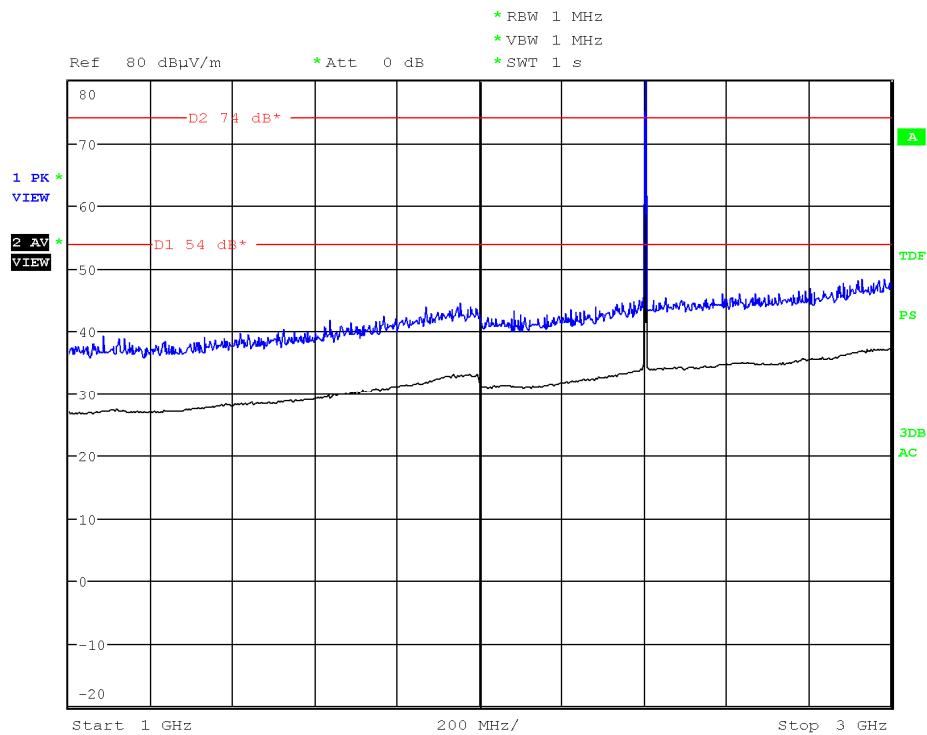
3. CHANNEL: HIGHEST (2480 MHz). All maximized peak levels are below the average limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.483500	V	Peak	48.33	\pm 4.09

Verdict: PASS

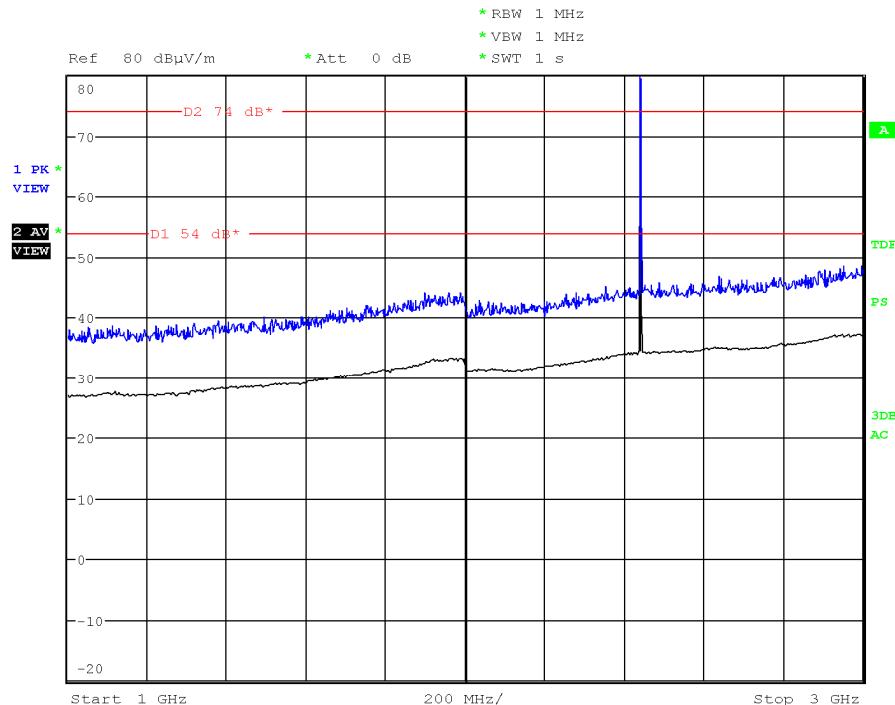
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2402 MHz).



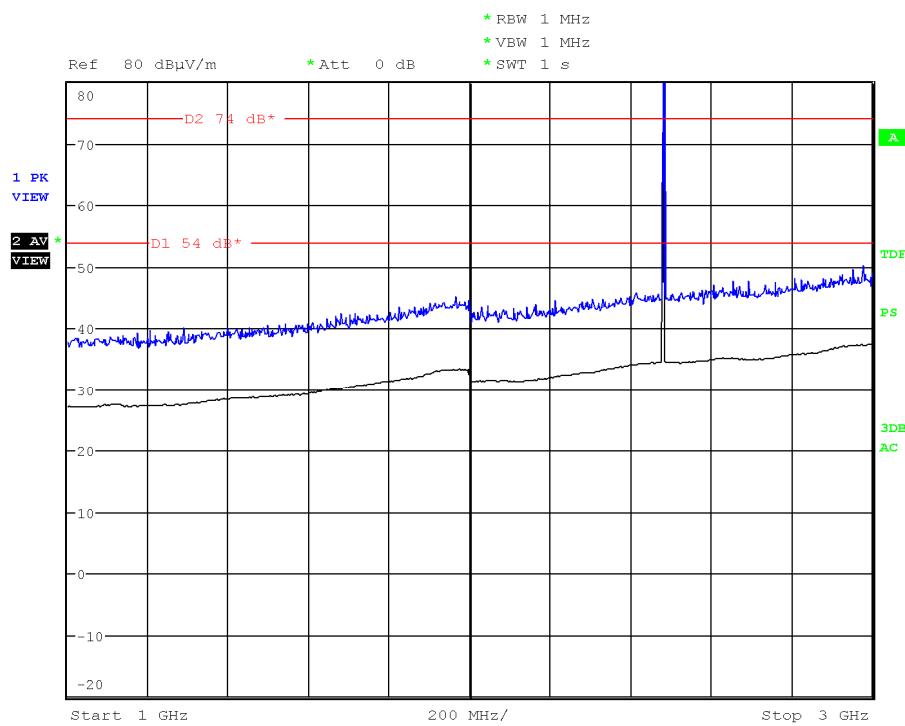
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Middle (2440 MHz).



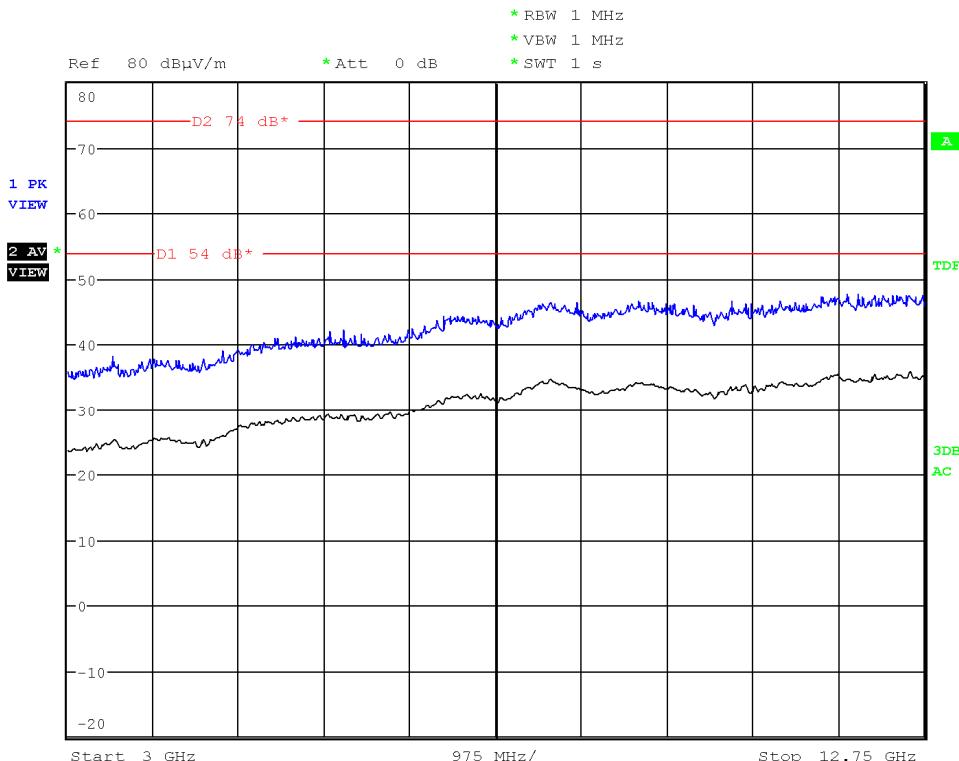
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Highest (2480 MHz).



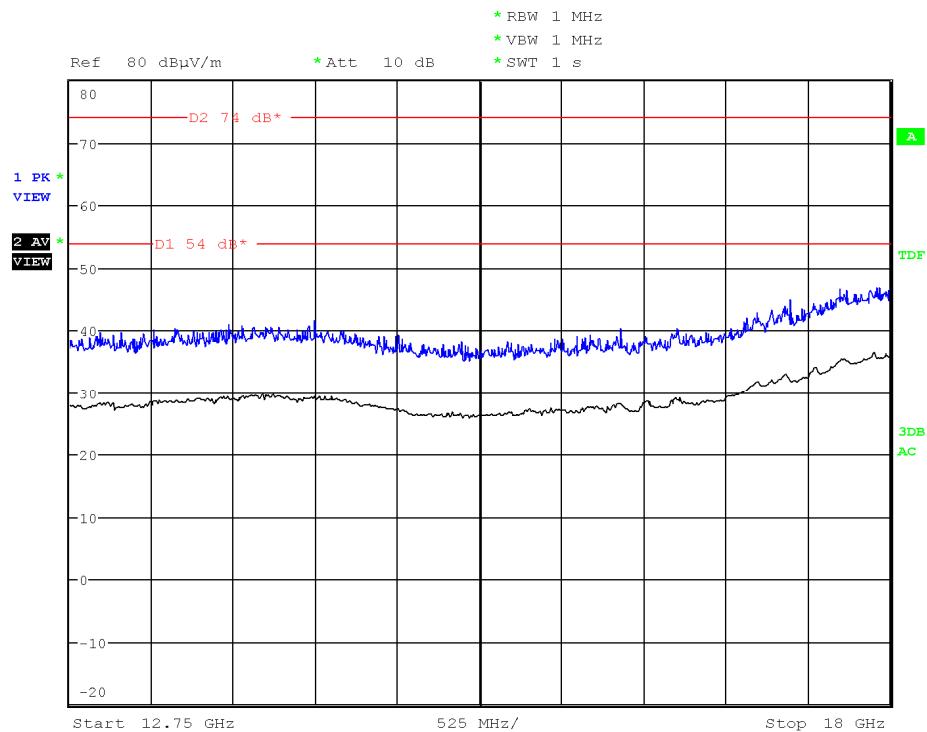
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 12.75 GHz.



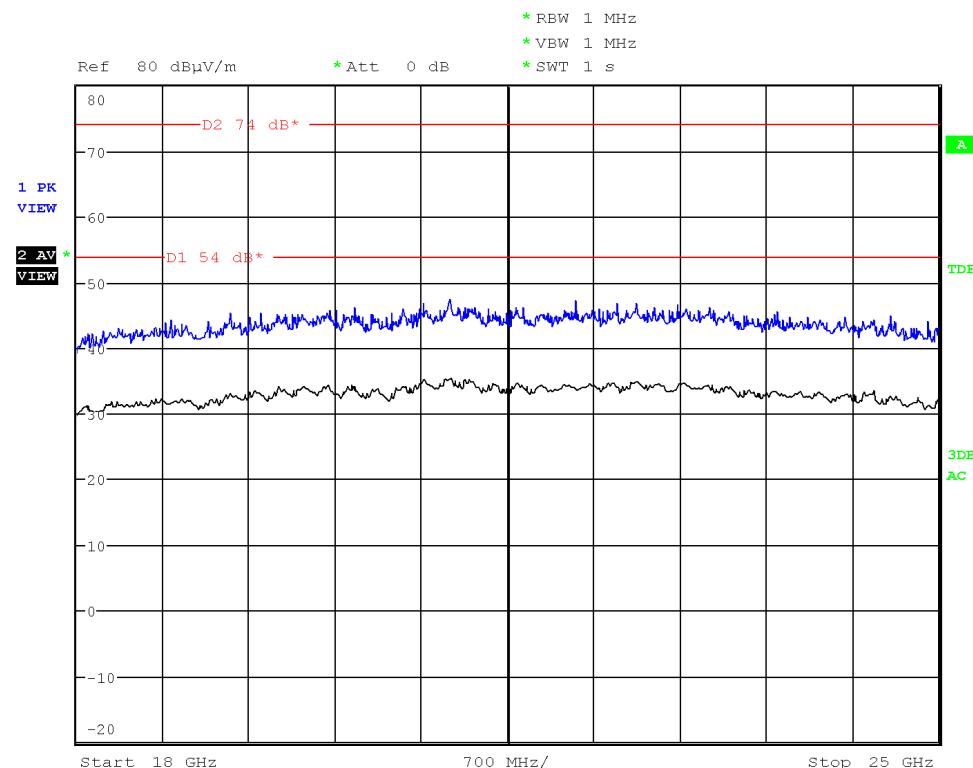
(This plot is valid for all three channels).

FREQUENCY RANGE 12.75 GHz to 18 GHz.



(This plot is valid for all three channels).

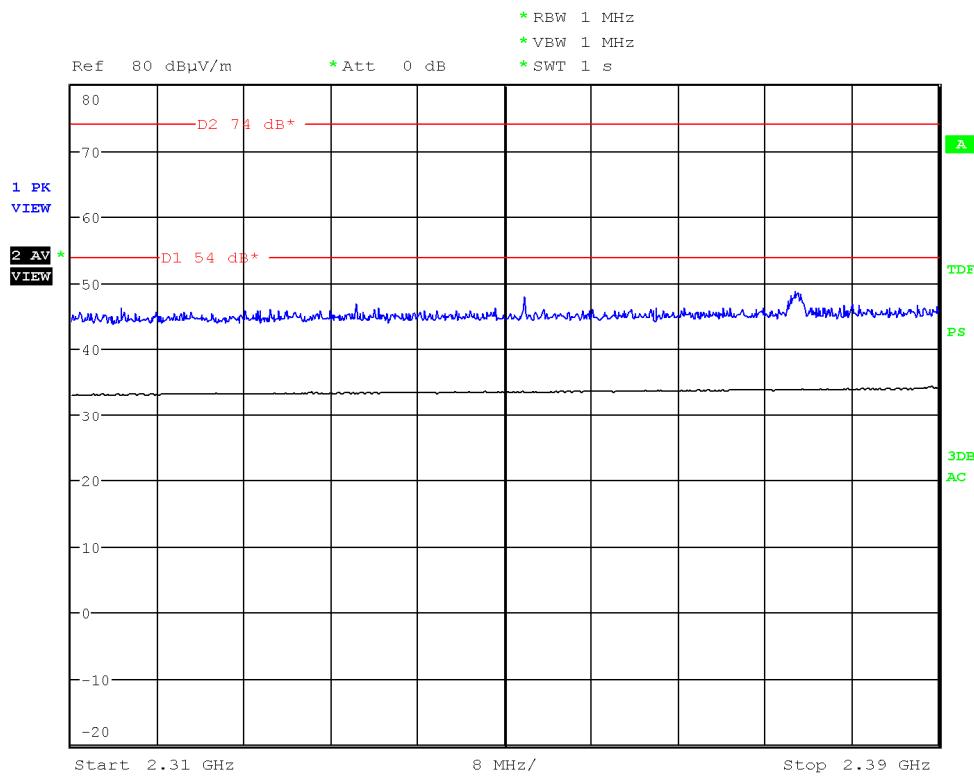
FREQUENCY RANGE 18 GHz to 25 GHz.



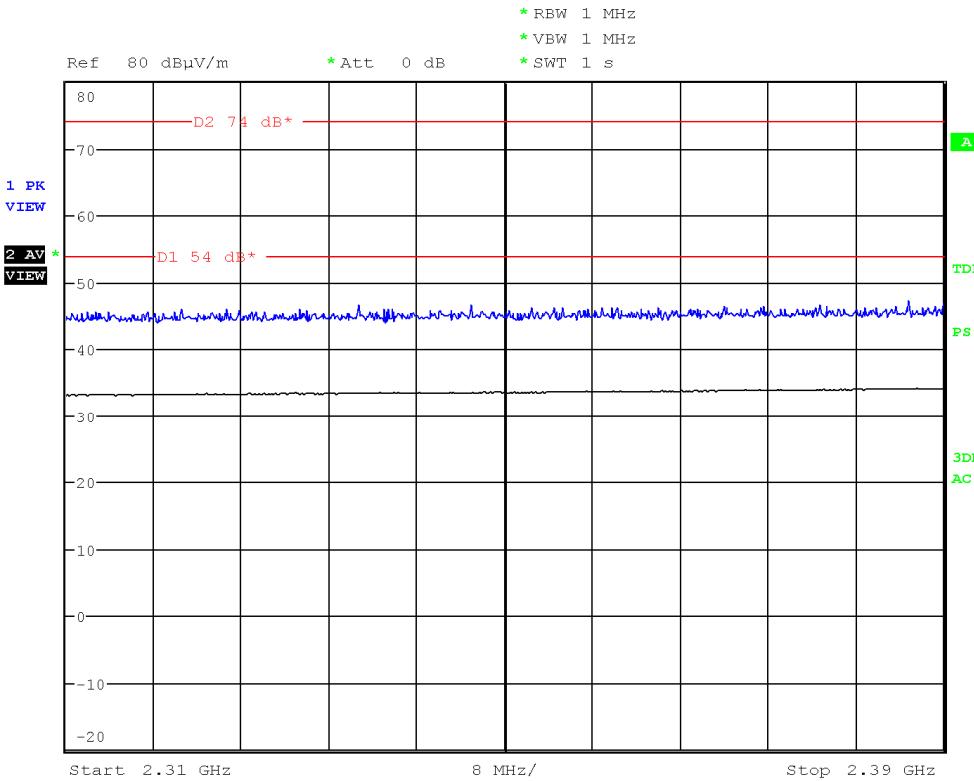
(This plot is valid for all three channels).

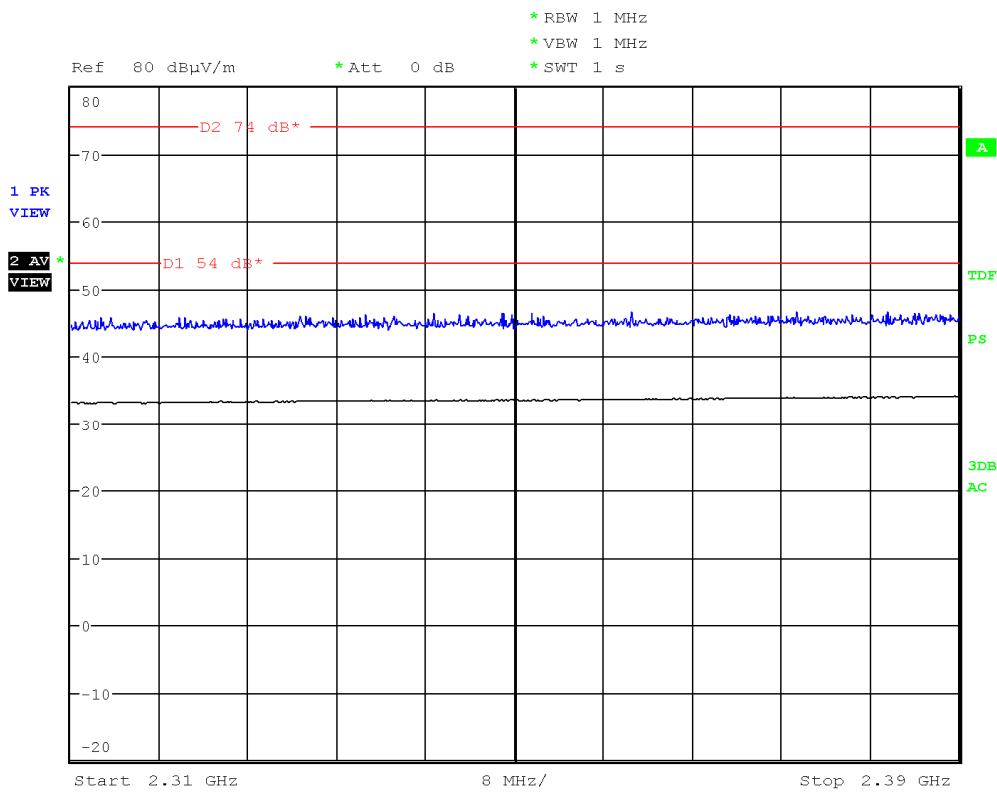
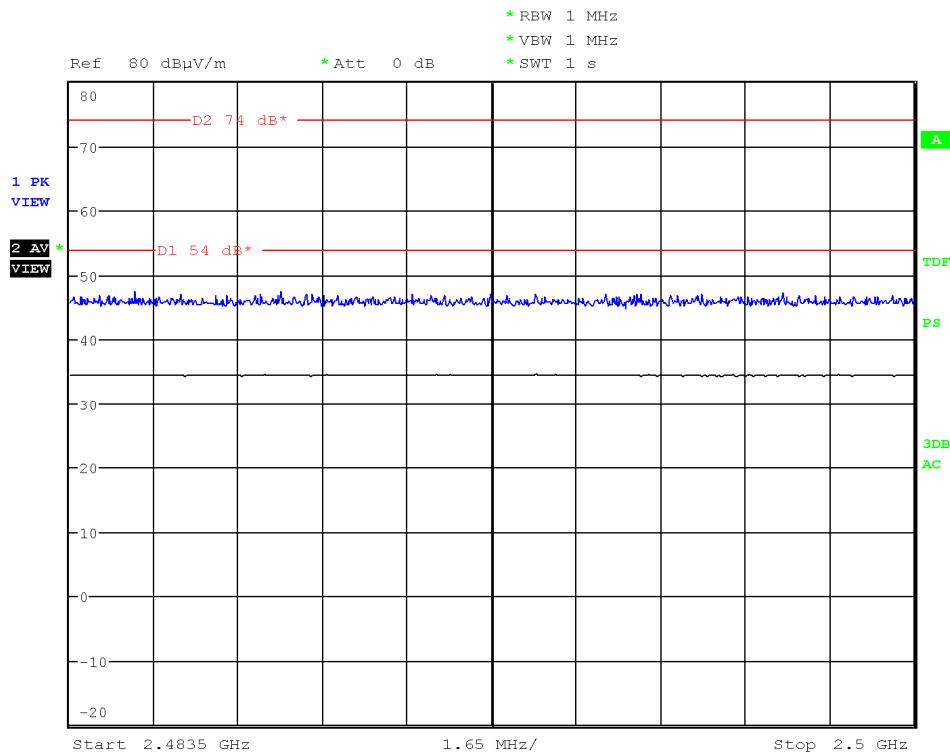
FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

CHANNEL: Lowest (2402 MHz).

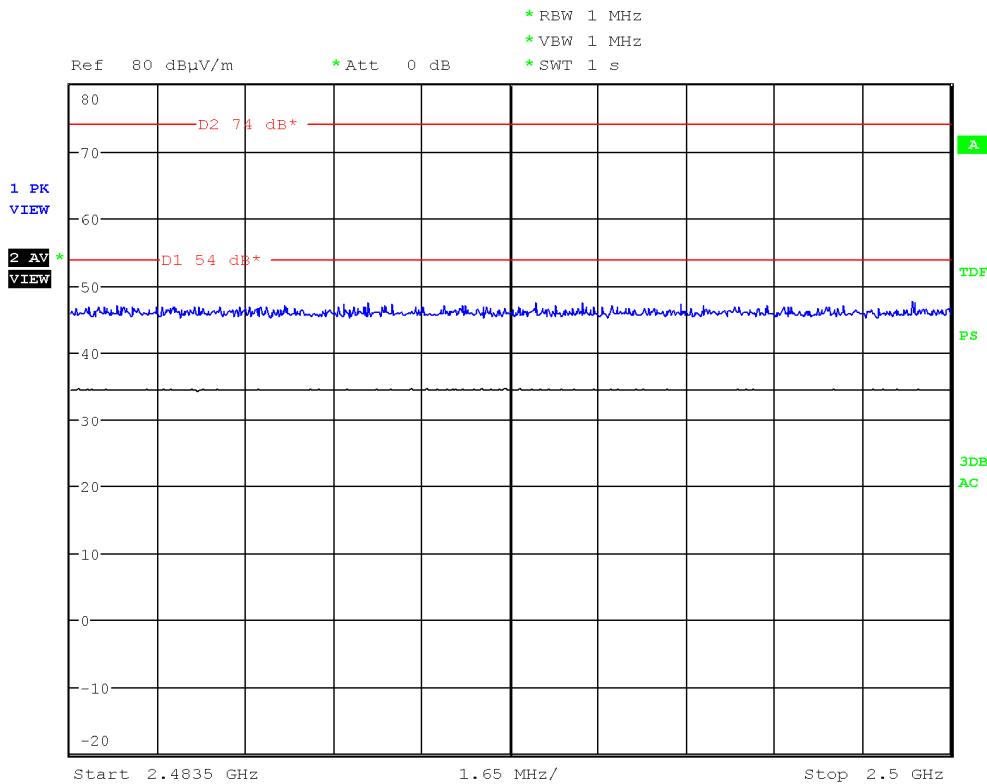


CHANNEL: Middle (2440 MHz).

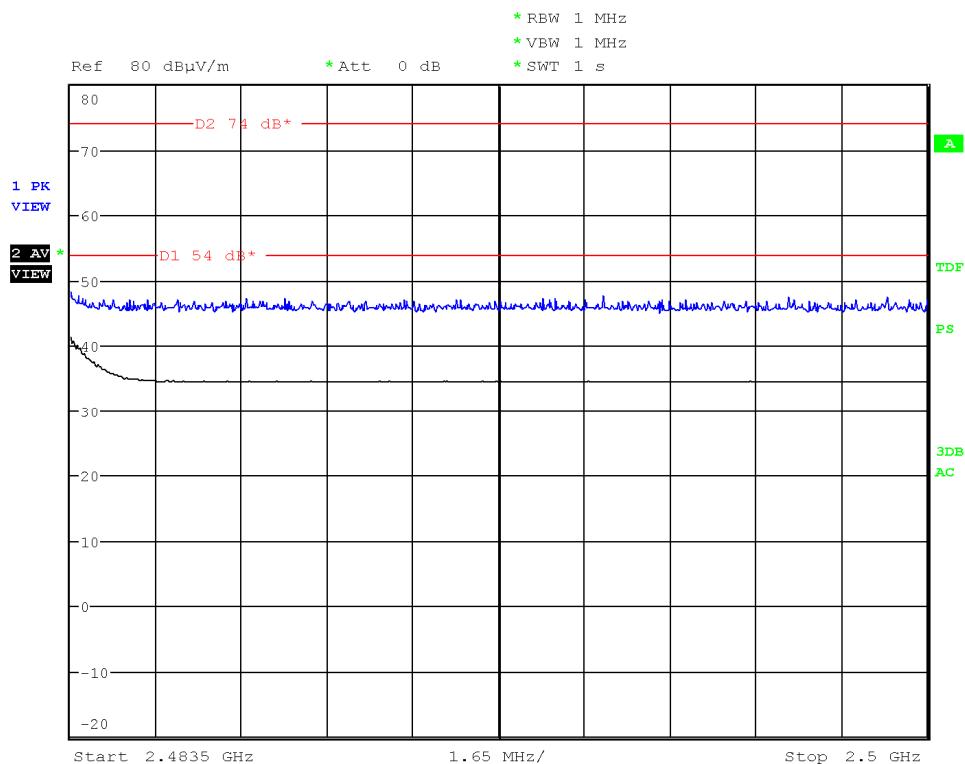


CHANNEL: Highest (2480 MHz).

FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)
CHANNEL: Lowest (2402 MHz).


CHANNEL: Middle (2440 MHz).



CHANNEL: Highest (2480 MHz).



APPENDIX C: Measuring results for electromagnetic conducted emission

CONTENT:

DESCRIPTION OF THE OPERATION MODES.....	101
CONTINUOUS CONDUCTED EMISSION ON POWER LEADS	102

DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

In the following table appears the operation modes used by the samples tested to that it refers the present test report.

OPERATION MODE	DESCRIPTION
OM#01	EUT ON. Equipment charging battery by USB port.
OM#02	EUT ON. Equipment charging battery by USB port. WiFi in communication mode.

CONTINUOUS CONDUCTED EMISSION ON POWER LEADS

LIMITS:	Product standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-12 ED)
	Test standard :	FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-12 ED)

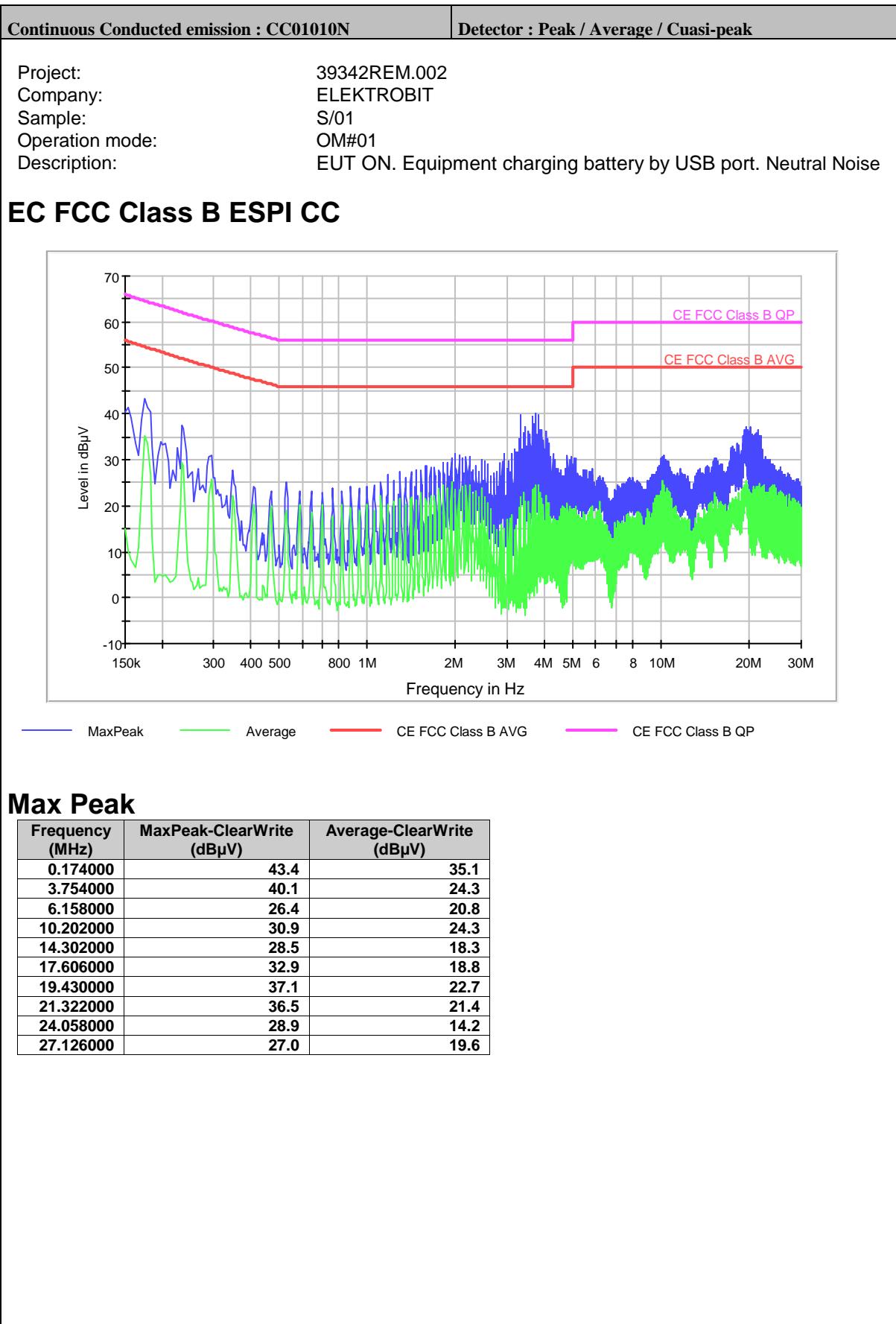
CLASS B

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B & IC RSS-Gen Issue 2, June 2007 in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0,15 to 0,5	66-56	56-46
0,5 to 5	56	46
5 to 30	60	50

TESTED SAMPLES:	S/01
TESTED OPERATION MODES:	OM#01, 02
TEST RESULTS :	CCmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire

CCmnnhh	Description	Result
CC01010N	Neutral wire noise	P
CC0101L1	Phase wire noise	P
CC01020N	Neutral wire noise	P
CC0102L1	Phase wire noise	P

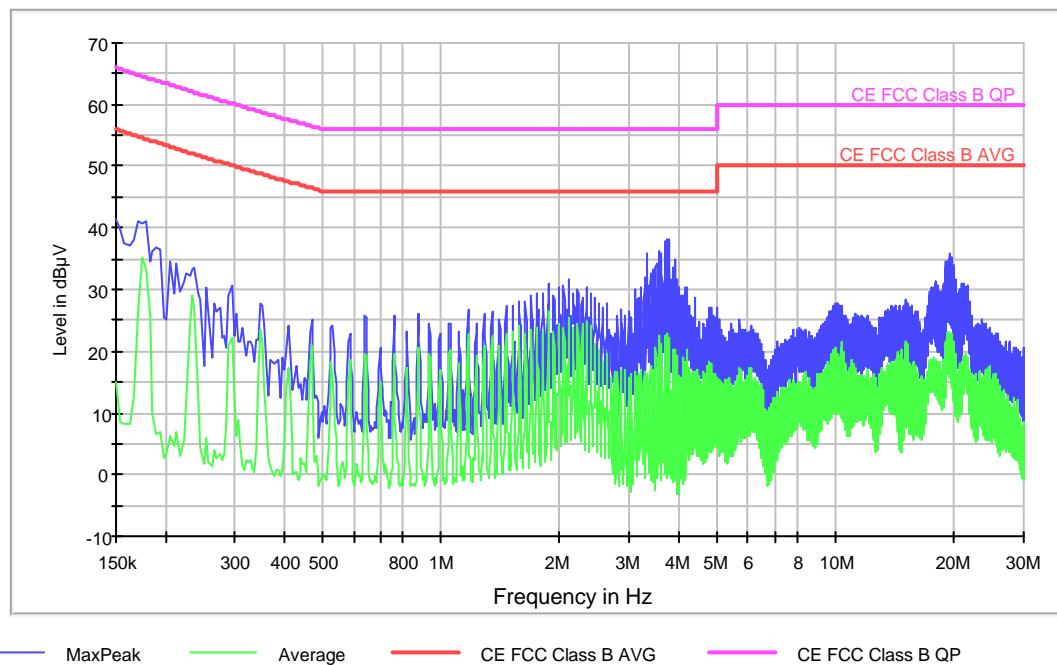


Continuous Conducted emission : CC0101L1

Detector : Peak / Average / Cuasi-peak

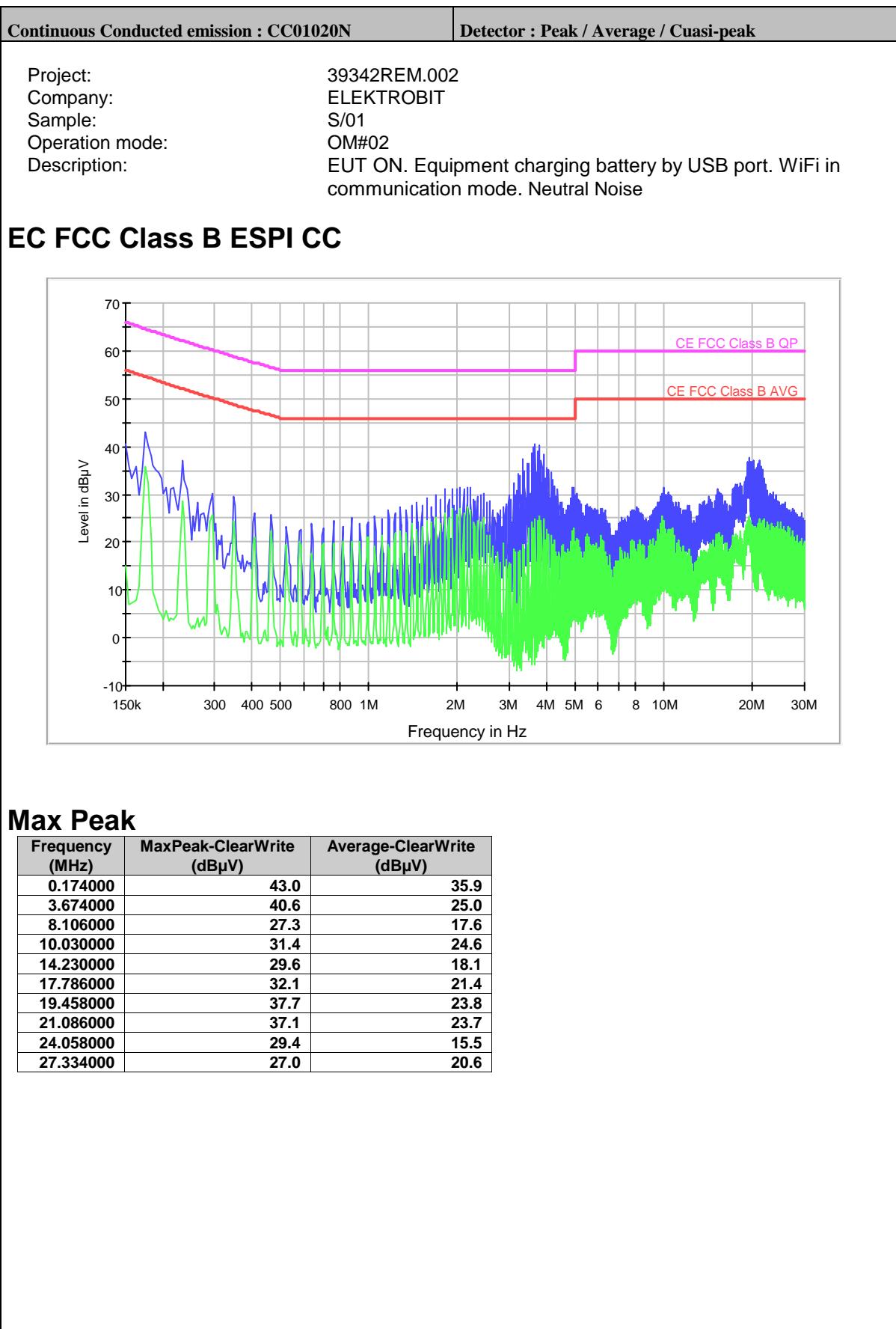
Project: 39342REM.002
 Company: ELEKTROBIT
 Sample: S/01
 Operation mode: OM#01
 Description: EUT ON. Equipment charging battery by USB port. Phase Noise

EC FCC Class B ESPI CC



Max Peak

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V)	Average-ClearWrite (dB μ V)
0.150000	41.5	15.0
3.802000	38.0	22.3
8.066000	23.7	15.1
10.114000	27.8	18.0
13.794000	27.5	18.3
17.842000	31.3	18.7
19.398000	35.9	19.9
21.150000	31.0	18.2
24.586000	23.9	13.9
27.734000	21.7	7.2

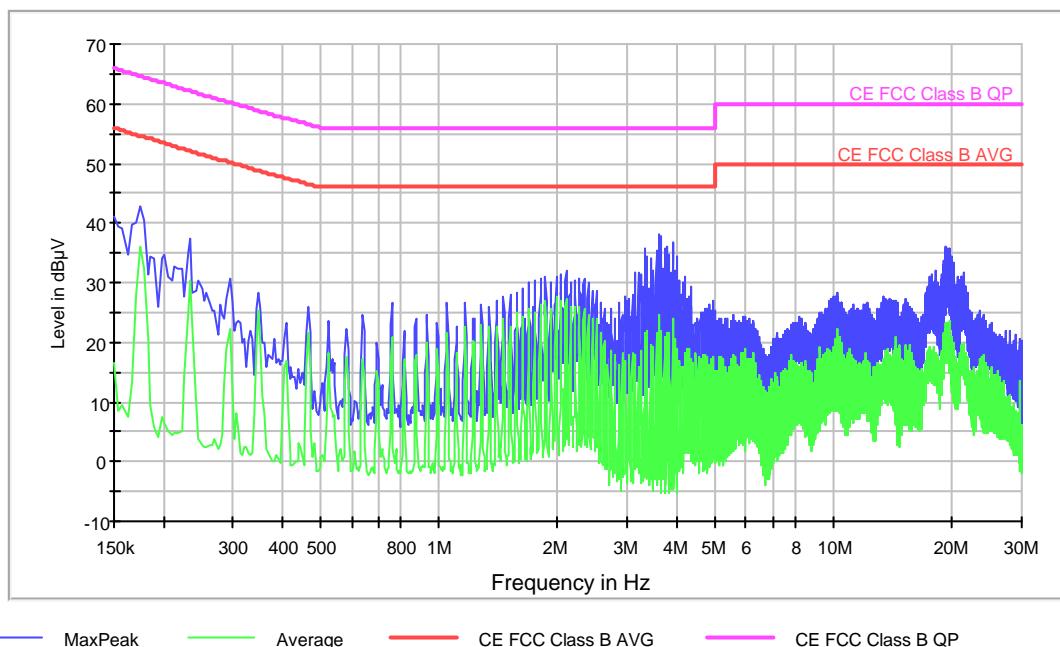


Continuous Conducted emission : CC0102L1

Detector : Peak / Average / Cuasi-peak

Project: 39342REM.002
 Company: ELEKTROBIT
 Sample: S/01
 Operation mode: OM#02
 Description: EUT ON. Equipment charging battery by USB port. WiFi in communication mode. Phase Noise

EC FCC Class B ESPI CC



Max Peak

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V)	Average-ClearWrite (dB μ V)
0.174000	42.6	36.0
3.610000	38.0	24.5
8.154000	24.2	15.8
10.190000	28.4	22.4
13.334000	27.6	16.6
17.746000	31.4	17.4
19.270000	36.0	22.1
21.302000	31.7	20.1
24.094000	23.9	14.3
27.294000	21.9	10.2