SGS

Test Report

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C REQUIREMENTS

Equipment Under Test:	Sapphire Eye-radio unit
Product number:	A10095
Manufacturer:	7signal Ltd. Panuntie 6 FI-00260 HELSINKI FINLAND
Customer:	7signal Ltd. Panuntie 6 FI-00260 HELSINKI FINLAND
FCC Rule Part:	§15.247:2009

FINAS
Finnish Accreditation Service
T004 (EN ISO/IEC 17025)

Date:	29th October 2010	Date:	29th October 2010
Issued by:	Niko Tolonen RF Testing Engineer	Checked by:	Jari Merikari Technical Manager

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Equipment Under Test (EUT)

Sapphire Eye-radio Unit	
Brand:	7signal
Product number:	A10095
Type:	7signal Sapphire-Eye
Serial no:	09380002
HW version:	2.0
SW version:	3.32
FCC ID number:	YLF-2010-08-APU2

Description of the EUT

The EUT is a wireless radio unit and it is a part of 7signal Sapphire Wireless Quality Advancement (WQA) System which measures and analyzes quality of WLAN.

Classification of the device

Fixed mounted device	☐
Mobile Device (Human body distance > 20cm)	☒
Portable Device (Human body distance < 20cm)	☐

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

Ratings and declarations

Operating Frequency Range:	2400.0 - 2483.5 MHz
Channels:	11
Channel separation:	5 MHz
Channel bandwidth:	22 MHz
Effective radiated or conducted power:	<100 mW EIRP
Modulation:	OFDM, DSSS
Transmission rate:	max 11 MBit/s @ 802.11b max 54 MBit/s @ 802.11g
Antenna type and gain:	Directional plane antenna Maximum gain 7.7 dBi

Power Supply

Rated voltage:	110 V
Rated current:	1.5 A
Rated frequency:	60 Hz
Rated power:	---

Mechanical Size of the EUT

Height: 174 mm Diameter: 220mm

Cables

Cable:	Length:	Type:
Mains cable	1.2 m	Unshielded, L/N/PE
DC cable	1.2 m	Unshielded, +/-

Peripherals

Peripheral	Manufacturer	Model	S/N	Connection to the EUT
AC adapter	HIPRO	HP-O2040D43 rev. 01	---	DC input

Samples

Sample No. 1: The equipment uses its integral antenna.

Sample No. 2: Antenna was removed and measurement cable was connected to the EUT by using temporary antenna connector.

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SUMMARY OF TESTING

FCC Rules	Description of Test	Result
§15.207(a)	Conducted Emissions	PASS
§15.247(b)(3)	Maximum Peak Conducted Output Power	PASS
§15.247(a)(2)	6 dB Bandwidth	PASS
§15.247(d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§15.209(a) §15.247(d)	Radiated Emissions	PASS
§15.247(e)	Power Spectral Density	PASS

Description of Test Modes

The sample is using WLAN technology according IEEE 802.11 b/g. In preliminary tests the different data rates of 802.11b and 802.11g modes were not given much difference to measurement results. So the highest data rates of both modes were chosen to tested. There are two testing modes in the test report.

Mode A: IEEE 802.11b 11 MBit/s DSSS
Mode B: IEEE 802.11g 54 MBit/s OFDM

Test are performed on three channel in both modes

Channel	Channel Number	Frequency (MHz)
LOW	CH 1	2412.0
MID	CH 5	2437.0
HIGH	CH 11	2462.0

Test Facility

☒ Testing Location / address: FCC registration number: **90598**	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
☒ Testing Location / address: FCC registration number: **178986** Industry Canada registration number: **8708A-2**	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Photographs of the EUT

Picture 1. The EUT and test set-up for conducted emission test

Picture 2. The EUT and test set-up for radiated emission test.

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Standard:	ANSI C63.4	(2003)
Tested by:	NTO	
Date:	18.2.2010	
Humidity:	21 %	
Temperature:	22 °C	
Barometric pressure:	1011mbar	
Measurement uncertainty:	± 2.3 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.207(a)

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges

Test results

Transmitter with Mode B on middle channel

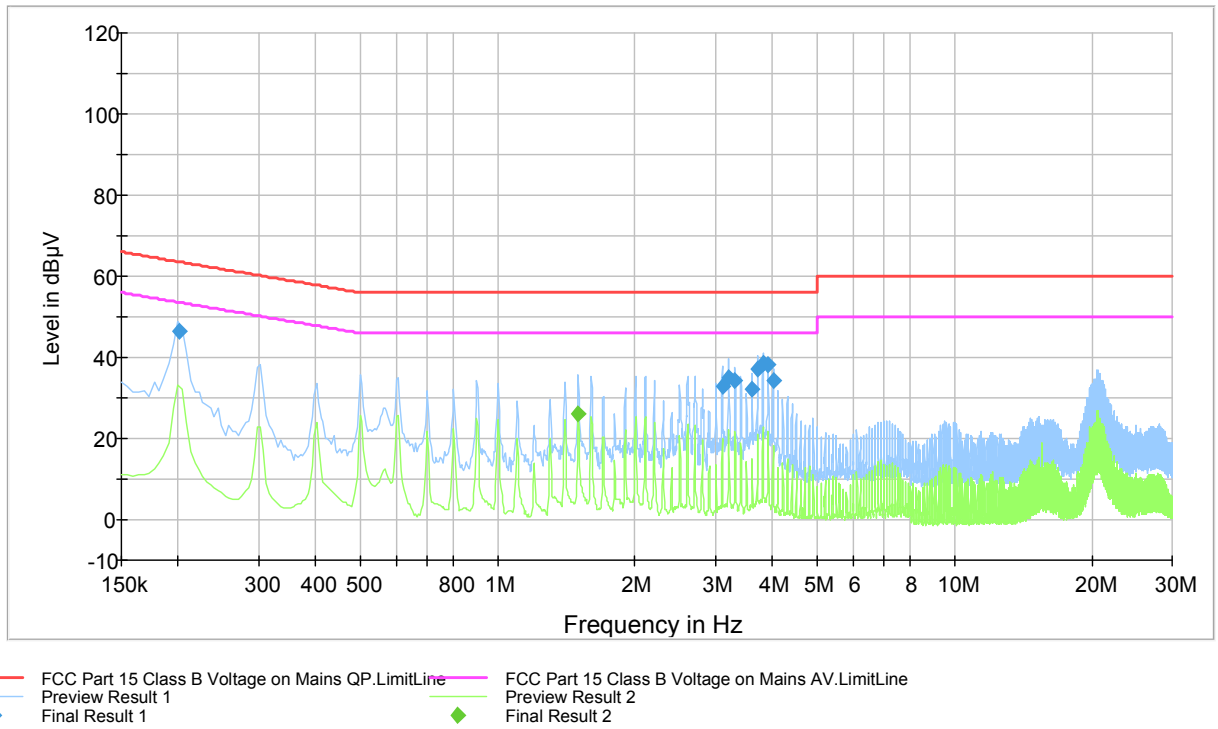


Figure 1 The measured curves with peak- and average detector

Table 1 Final measurement results with Quasi peak detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.201001	46.6	1000.0	9.000	GND	L1	10.1	17.0	63.6	
3.106501	32.8	1000.0	9.000	GND	L1	10.3	23.2	56.0	
3.208501	34.9	1000.0	9.000	GND	L1	10.3	21.1	56.0	
3.307501	34.2	1000.0	9.000	GND	L1	10.3	21.8	56.0	
3.609001	32.3	1000.0	9.000	GND	L1	10.3	23.7	56.0	
3.709501	37.0	1000.0	9.000	GND	L1	10.3	19.0	56.0	
3.810001	38.7	1000.0	9.000	GND	L1	10.3	17.3	56.0	
3.910501	38.1	1000.0	9.000	GND	L1	10.3	17.9	56.0	
4.011001	34.4	1000.0	9.000	GND	L1	10.4	21.6	56.0	

Table 2 Final measurement results with Average detector

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
1.504501	26.2	1000.0	9.000	GND	N	10.1	19.8	46.0	

Receiver with Mode B on middle channel

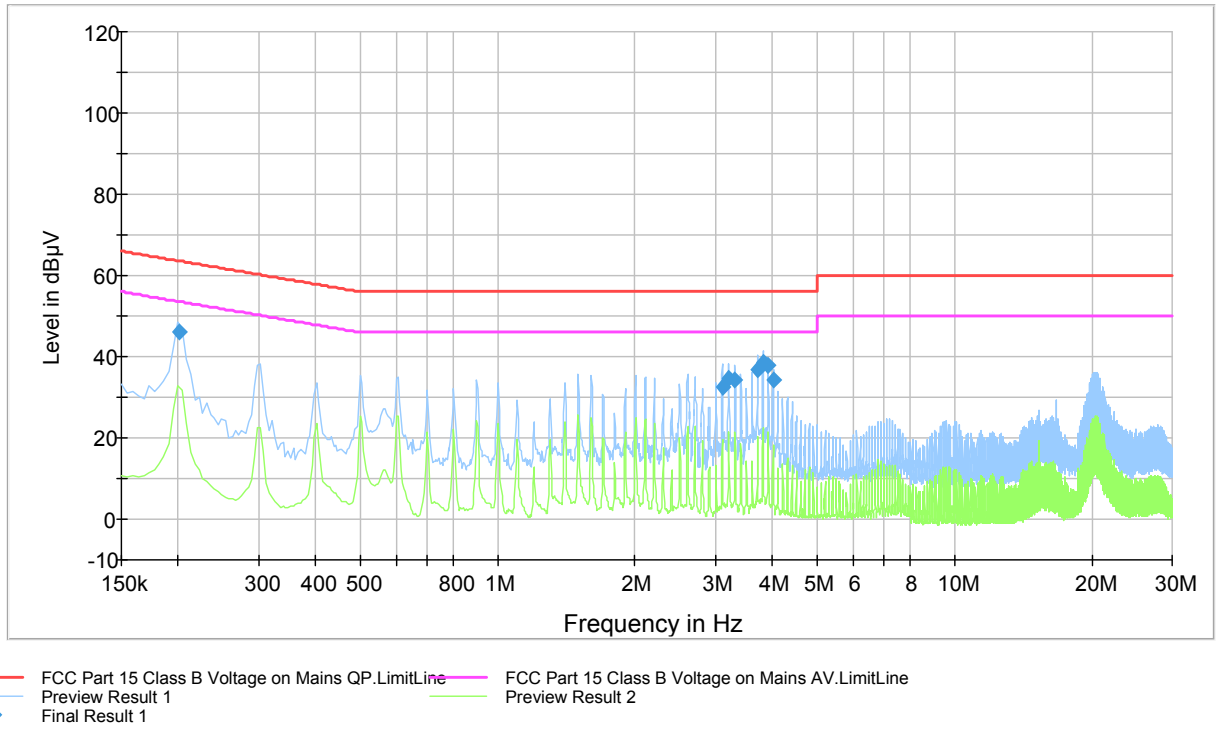


Figure 1 The measured curves with peak- and average detector

Table 3 Final measurement results with Quasi peak detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.201001	46.2	1000.0	9.000	GND	L1	10.1	17.4	63.6	
3.106501	32.7	1000.0	9.000	GND	L1	10.3	23.3	56.0	
3.207001	34.6	1000.0	9.000	GND	L1	10.3	21.4	56.0	
3.307501	34.2	1000.0	9.000	GND	L1	10.3	21.8	56.0	
3.708001	36.6	1000.0	9.000	GND	L1	10.3	19.4	56.0	
3.808501	38.5	1000.0	9.000	GND	L1	10.3	17.5	56.0	
3.909001	37.9	1000.0	9.000	GND	L1	10.3	18.1	56.0	
4.011001	34.2	1000.0	9.000	GND	L1	10.4	21.8	56.0	

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2009)
Tested by:	NTO	
Date:	1. - 2.2.2010	
Humidity:	38 - 36 %	
Temperature:	21 - 20 °C	
Barometric pressure:	1010 - 1002 mbar	
Measurement uncertainty:	± 1.23 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b) (4)

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Results: Mode A

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	6.18	28.30	22.12	PASS
Mid	4.26	28.30	24.04	PASS
High	3.20	28.30	25.10	PASS

Results: Mode B

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	5.81	28.30	22.49	PASS
Mid	4.80	28.30	23.50	PASS
High	3.77	28.30	24.53	PASS

Limit is reduced because directional gain is more than 6 dBi.

7.7 dBi - 6 dBi = 1.7 dB

Reduced limit = 30 dBm - 1.7 dB = 28.30 dBm

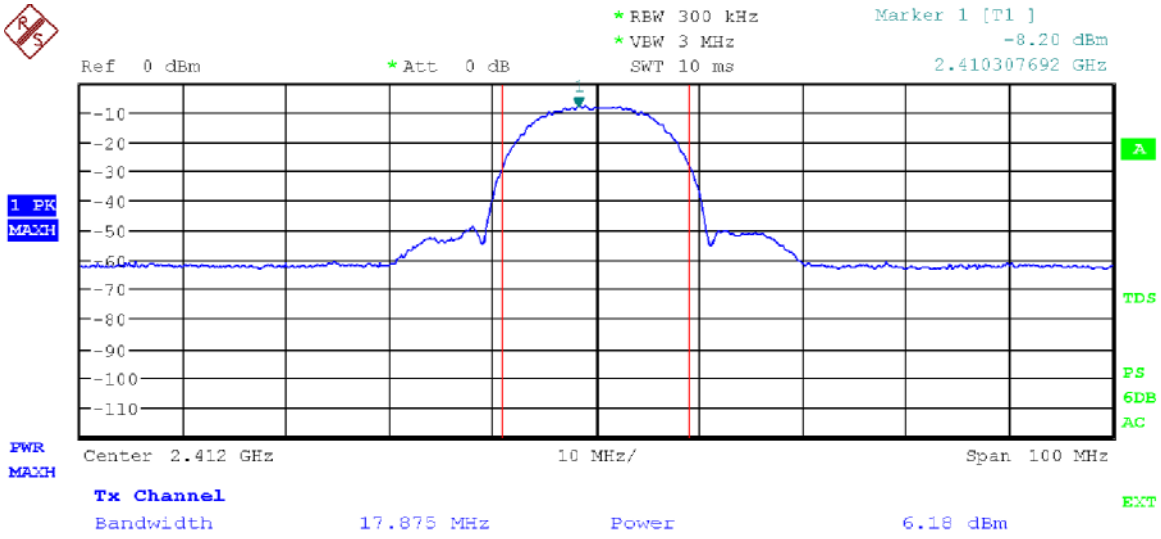


Figure 2 Mode A, Channel low.

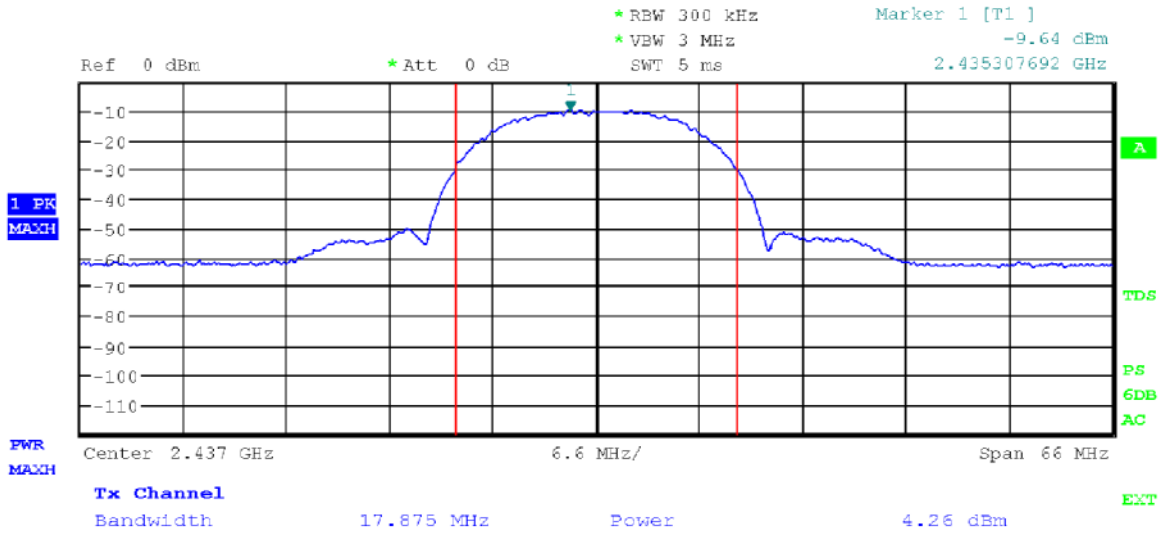


Figure 3 Mode A, Channel mid.

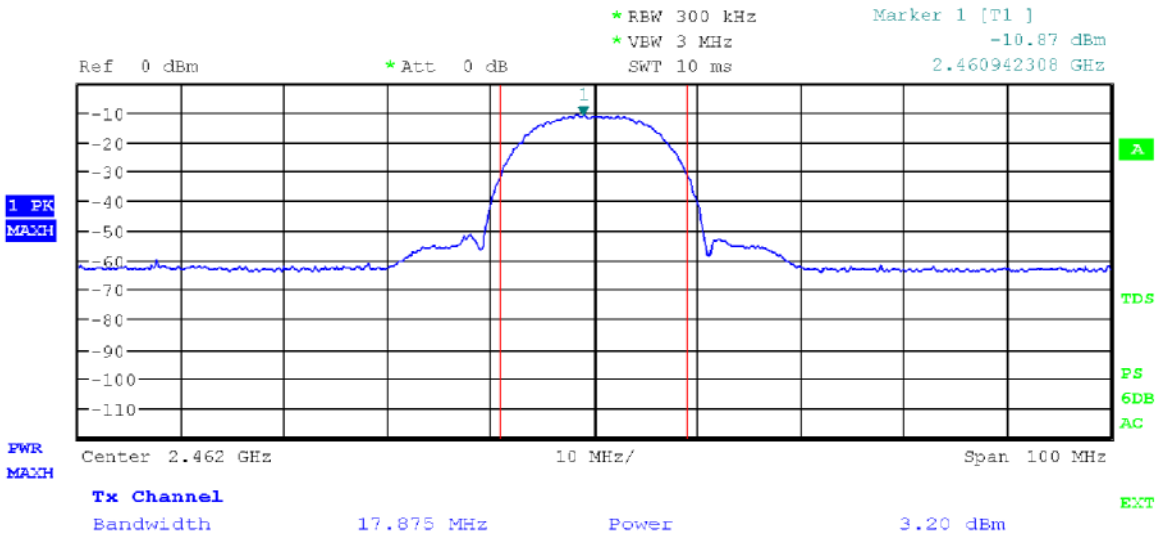


Figure 4 Mode A, Channel high.

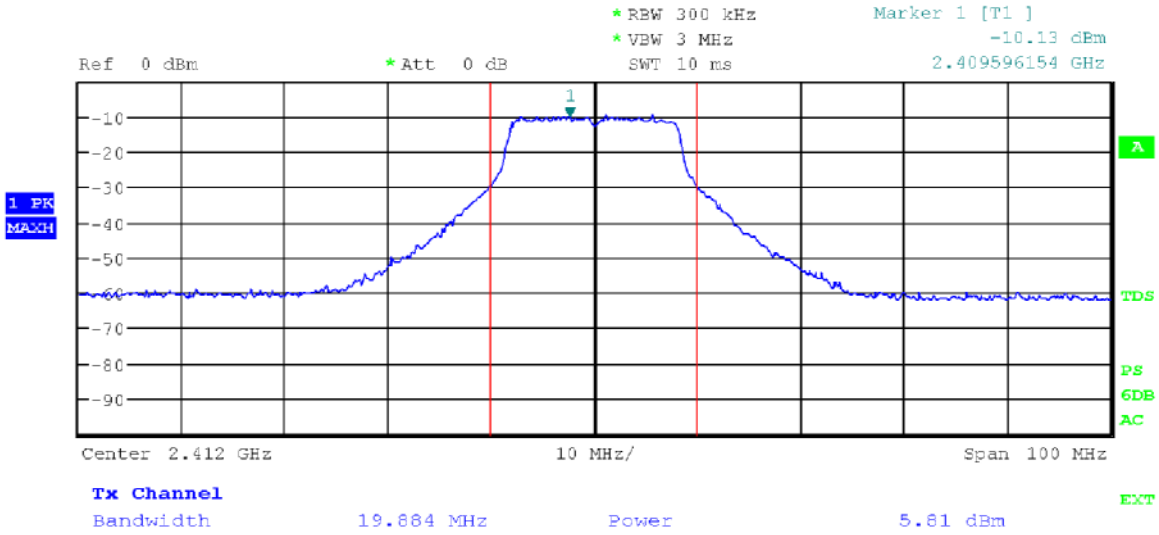


Figure 5 Mode B, Channel low.

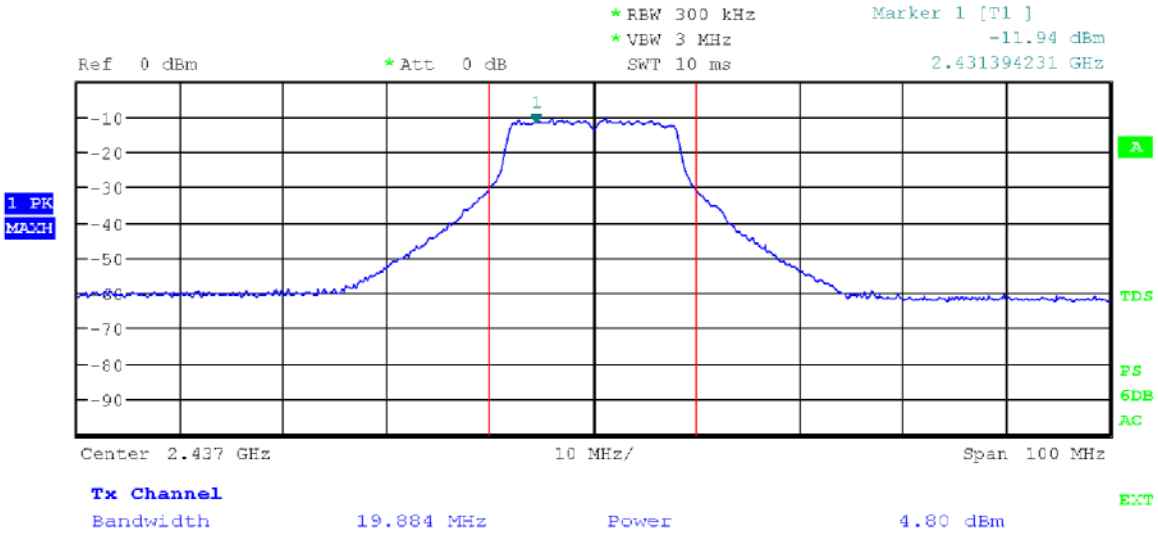


Figure 6 Mode B, Channel mid.

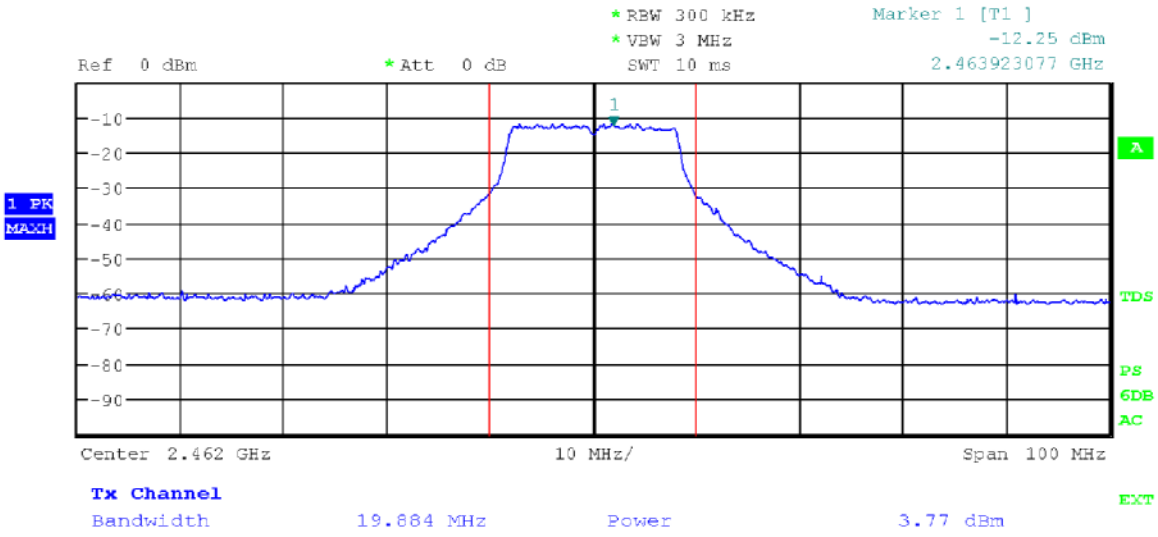


Figure 7 Mode B, Channel high

Transmitter Radiated Emissions 30 – 1000 MHz

Standard:	ANSI C63.4	(2003)
Tested by:	NTO	
Date:	15.-16.2.2010	
Humidity:	23 - 22%	
Temperature:	21 °C	
Barometric pressure:	1011 - 1012 mbar	
Measurement uncertainty:	± 5.1 dB (30 - 200 MHz) ± 4.2 dB (0.2 -1 GHz)	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a)**.**

Mode A CH LOW

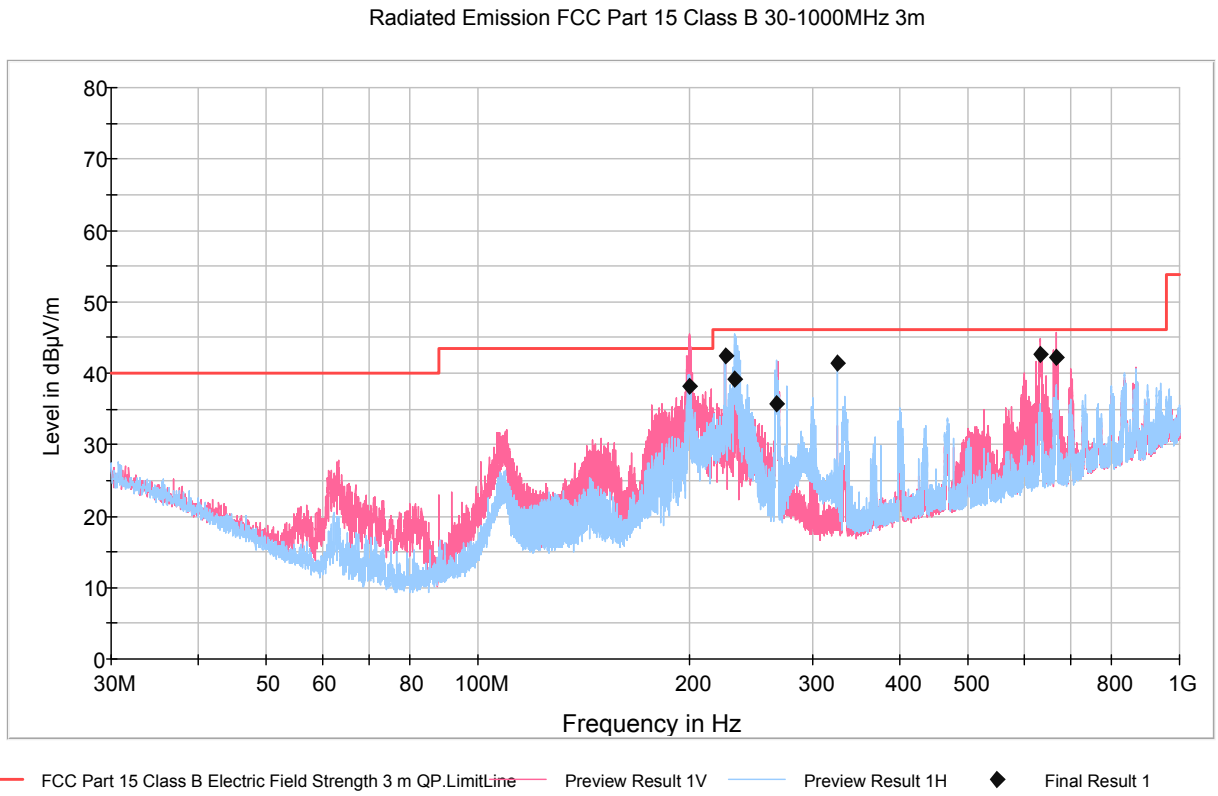


Figure 8 Measured curves with peak-detector.

Final measurements from the worst frequencies

Table 4 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
200.199667	38.2	1000.0	120.000	110.0	V	118.0	-10.9	5.3	43.5	
225.054667	42.5	1000.0	120.000	131.0	H	75.0	-8.9	3.5	46.0	
232.211333	39.2	1000.0	120.000	120.0	H	222.0	-9.1	6.8	46.0	
266.838667	35.7	1000.0	120.000	120.0	H	110.0	-8.5	10.3	46.0	
325.054000	41.5	1000.0	120.000	120.0	H	70.0	-7.0	4.5	46.0	
634.160667	42.6	1000.0	120.000	100.0	V	317.0	-0.6	3.4	46.0	
667.516333	42.2	1000.0	120.000	100.0	V	304.0	-0.2	3.8	46.0	

Mode A CH MID

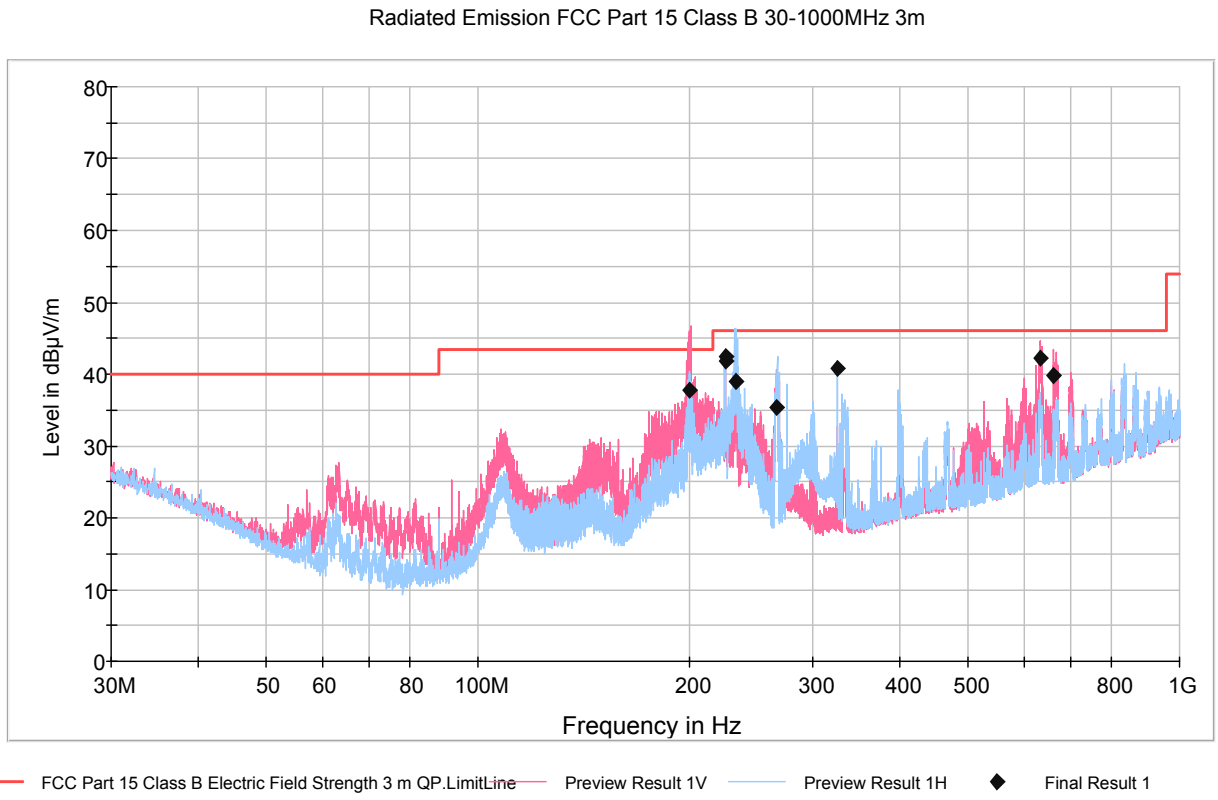


Figure 9 Measured curves with peak-detector.

Final measurements from the worst frequencies

Table 5 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
200.229667	37.8	1000.0	120.000	100.0	V	120.0	-10.9	5.7	43.5	
225.054667	42.3	1000.0	120.000	136.0	H	114.0	-8.9	3.7	46.0	
225.062333	41.7	1000.0	120.000	100.0	V	283.0	-8.9	4.3	46.0	
233.629000	39.0	1000.0	120.000	114.0	H	223.0	-9.1	7.0	46.0	
267.048000	35.3	1000.0	120.000	100.0	H	111.0	-8.5	10.7	46.0	
325.081667	40.8	1000.0	120.000	100.0	H	72.0	-7.0	5.2	46.0	
634.193000	42.3	1000.0	120.000	100.0	V	318.0	-0.6	3.7	46.0	
662.306000	39.8	1000.0	120.000	100.0	V	331.0	-0.3	6.2	46.0	

Mode A CH HIGH

Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.

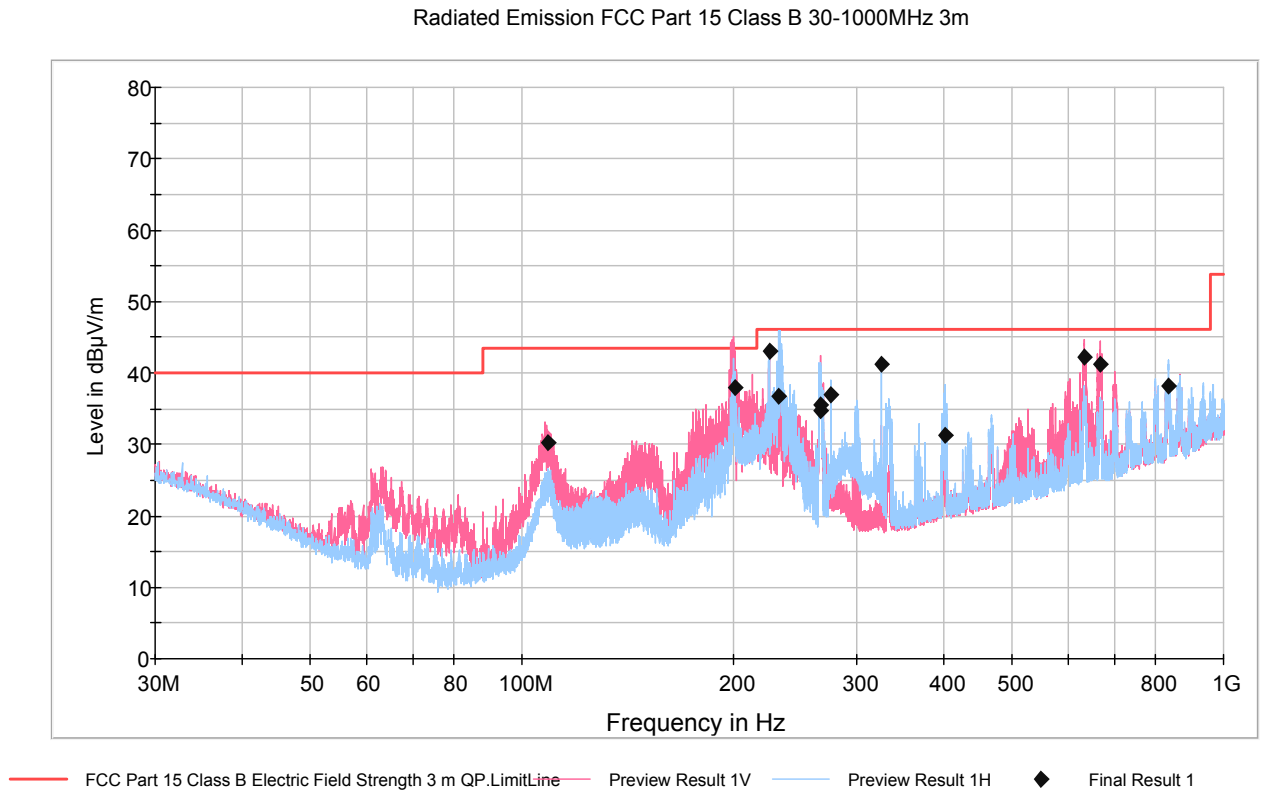


Figure 10 Measured curves with peak-detector.

Final measurements from the worst frequencies

Table 6 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
108.795667	30.2	1000.0	120.000	125.0	V	266.0	-11.7	13.3	43.5	
201.275333	38.1	1000.0	120.000	100.0	V	115.0	-10.9	5.4	43.5	
225.054667	43.1	1000.0	120.000	159.0	H	83.0	-8.9	2.9	46.0	
231.819333	36.8	1000.0	120.000	142.0	H	211.0	-9.1	9.2	46.0	
266.786333	34.7	1000.0	120.000	100.0	V	320.0	-8.5	11.3	46.0	
266.984333	35.6	1000.0	120.000	100.0	H	113.0	-8.5	10.4	46.0	
275.062000	37.0	1000.0	120.000	100.0	H	130.0	-8.5	9.0	46.0	
325.061667	41.3	1000.0	120.000	100.0	H	85.0	-7.0	4.7	46.0	
400.520000	31.3	1000.0	120.000	100.0	H	296.0	-4.8	14.7	46.0	
634.113000	42.2	1000.0	120.000	100.0	V	319.0	-0.6	3.8	46.0	
667.544000	41.2	1000.0	120.000	100.0	V	299.0	-0.2	4.8	46.0	
834.468667	38.2	1000.0	120.000	115.0	H	191.0	3.0	7.8	46.0	

Mode B CH LOW

Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.

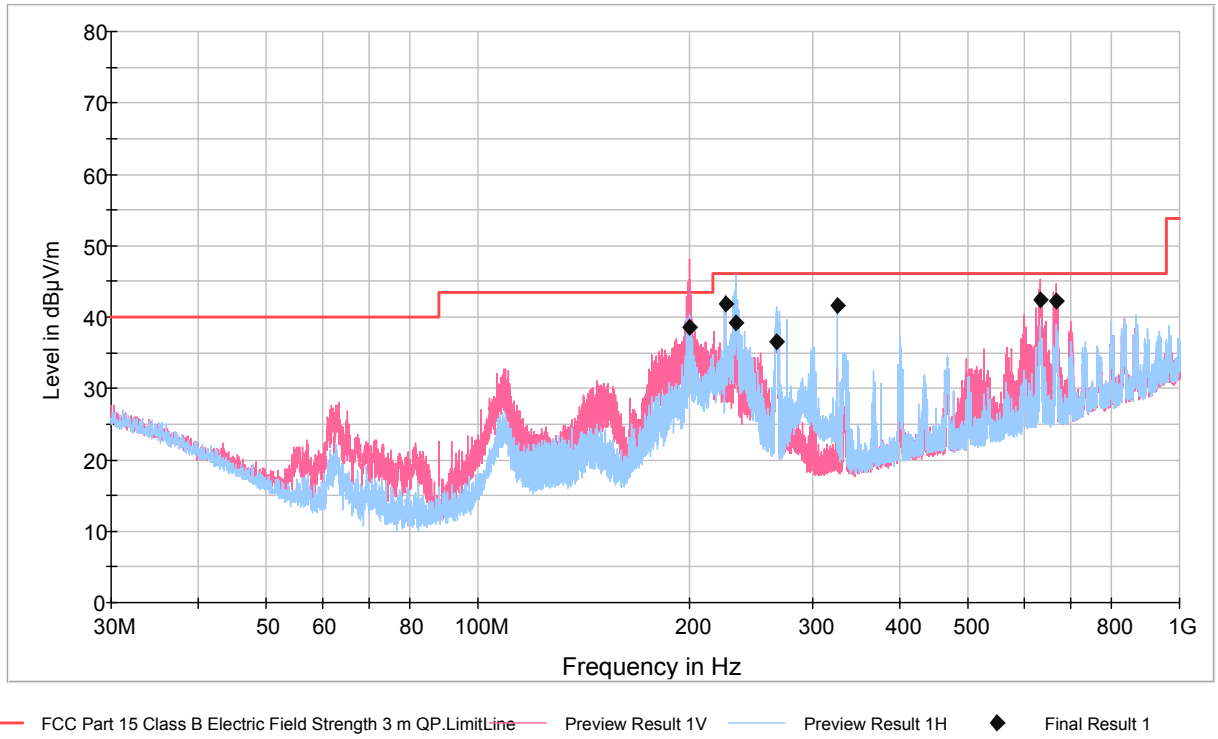


Figure 11 Measured curve with peak-detector.

Final measurements from the worst frequencies

Table 7 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
200.205667	38.5	1000.0	120.000	109.0	V	122.0	-10.9	5.0	43.5	
225.054667	41.8	1000.0	120.000	104.0	V	288.0	-8.9	4.2	46.0	
233.567667	39.2	1000.0	120.000	131.0	H	225.0	-9.1	6.8	46.0	
267.027667	36.5	1000.0	120.000	115.0	H	112.0	-8.5	9.5	46.0	
325.054000	41.6	1000.0	120.000	100.0	H	61.0	-7.0	4.4	46.0	
634.248333	42.4	1000.0	120.000	109.0	V	314.0	-0.6	3.6	46.0	
667.516333	42.3	1000.0	120.000	100.0	V	314.0	-0.2	3.7	46.0	

Mode B CH MID

Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.

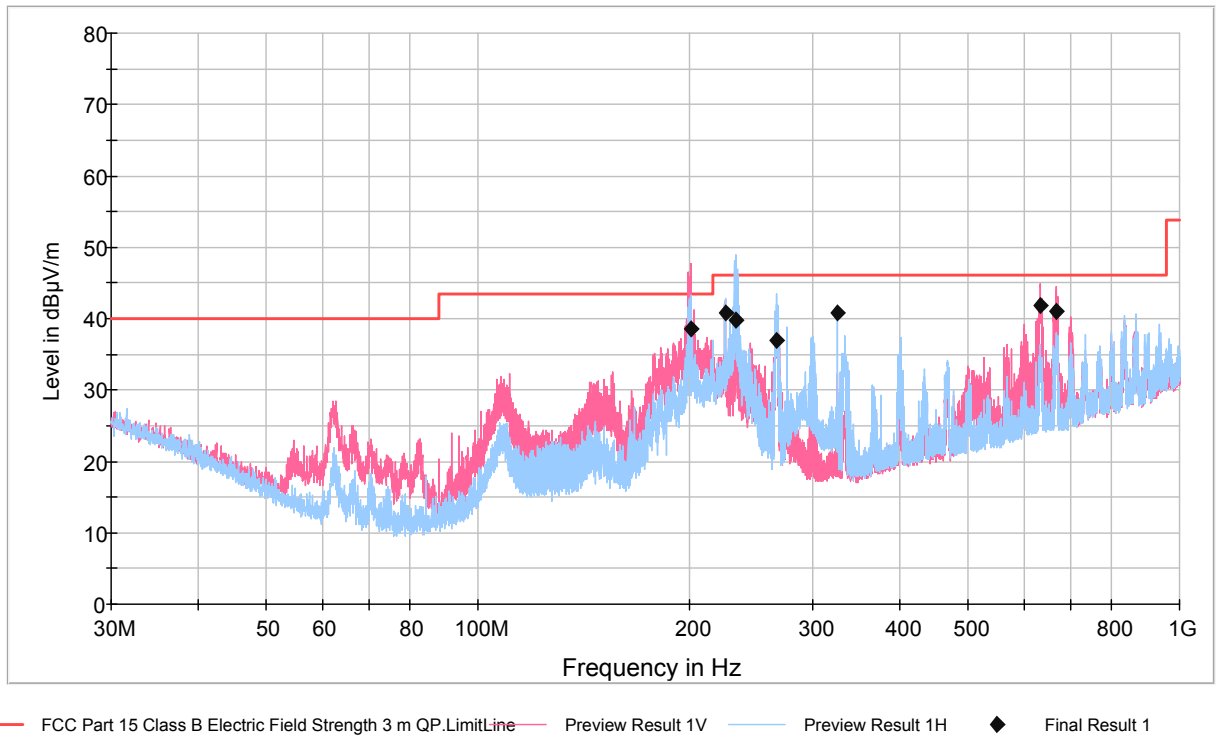


Figure 12 Measured curve with peak-detector.

Final measurements from the worst frequencies

Table 8 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
201.309667	38.6	1000.0	120.000	100.0	V	125.0	-10.9	4.9	43.5	
225.054667	40.9	1000.0	120.000	100.0	V	268.0	-8.9	5.1	46.0	
232.647333	39.8	1000.0	120.000	136.0	H	224.0	-9.1	6.2	46.0	
266.998667	36.9	1000.0	120.000	100.0	H	119.0	-8.5	9.1	46.0	
325.061667	40.9	1000.0	120.000	109.0	H	73.0	-7.0	5.1	46.0	
634.088333	41.9	1000.0	120.000	100.0	V	317.0	-0.6	4.2	46.0	
667.624000	41.1	1000.0	120.000	100.0	V	331.0	-0.2	4.9	46.0	

Mode B CH HIGH

Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.

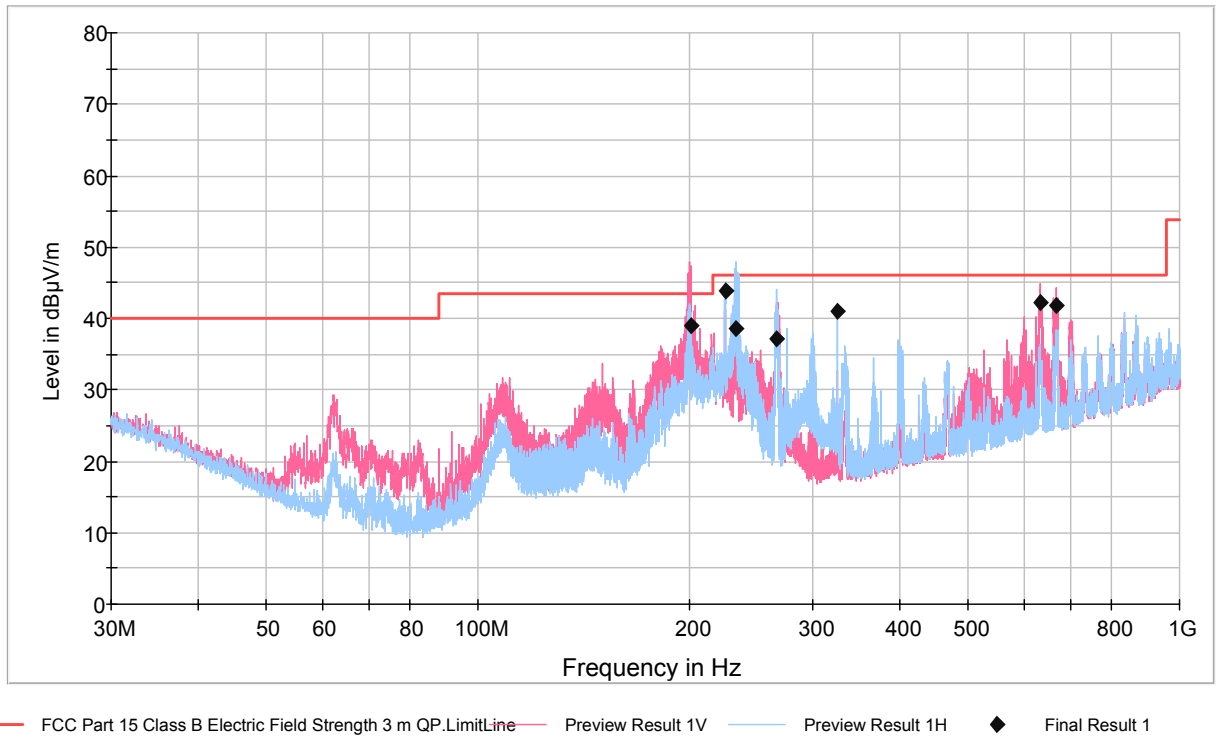


Figure 13 Measured curve with peak-detector.

Final measurements from the worst frequencies

Table 9 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
201.302667	38.9	1000.0	120.000	100.0	V	128.0	-10.9	4.6	43.5	
225.042333	43.9	1000.0	120.000	141.0	H	85.0	-8.9	2.1	46.0	
233.186000	38.6	1000.0	120.000	127.0	H	216.0	-9.1	7.4	46.0	
267.038667	37.1	1000.0	120.000	109.0	H	117.0	-8.5	8.9	46.0	
325.061667	41.0	1000.0	120.000	100.0	H	81.0	-7.0	5.0	46.0	
634.188333	42.2	1000.0	120.000	100.0	V	325.0	-0.6	3.8	46.0	
667.496333	41.9	1000.0	120.000	100.0	V	306.0	-0.2	4.1	46.0	

Transmitter Radiated Emissions 1 – 26.5 GHz

Standard:	ANSI C63.4	(2003)
Tested by:	NTO	
Date:	27.1.2010	
Humidity:	17 %	
Temperature:	20 °C	
Barometric pressure:	1030 mbar	
Measurement uncertainty:	± 3.7 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a)**.**

Mode A CH LOW

Measured Values In The Frequency Range 1 GHz – 26.5 GHz

Table 10 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
2390.0	45.28	34.41	122	V	341	28.72	74	19.59	54
2390.0	46.49	34.18	156	H	202	24.51	74	19.82	54
4824.0	---	--					74		54
7236.0	---	--					74		54
9648.0	---	--					74		54
12060.0	---	--					74		54
14472.0	---	--					74		54
16884.0	---	--					74		54
19296.0	---	--					74		54
21708.0	---	--					74		54
24120.0	---	--					74		54

--- Peak level more that 20 dB below the peak limit

-- Peak level under Average limit

Mode A CH MID

Measured Peak Values In The Frequency Range 1 GHz – 26.5 GHz.

Table 11 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
4874.0	---	--					74		54
7311.0	---	--					74		54
9748.0	---	--					74		54
12185.0	---	--					74		54
14622.0	---	--					74		54
17059.0	---	--					74		54
19496.0	---	--					74		54
21933.0	---	--					74		54
24370.0	---	--					74		54

--- Peak level more that 20 dB below the peak limit

-- Peak level under Average limit

Mode A CH HIGH

Measured Peak Values In The Frequency Range 1 GHz – 26.5 GHz.

Table 12 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
2483.5	45.62	34.49	186	V	342	28.38	74	19.51	54
2483.5	46.09	34.35	156	H	202	27.91	74	19.56	54
4924.0	---	--					74		54
7386.0	---	--					74		54
9848.0	---	--					74		54
12310.0	---	--					74		54
14772.0	---	--					74		54
17234.0	---	--					74		54
19696.0	---	--					74		54
22158.0	---	--					74		54
24620.0	---	--					74		54

--- Peak level more that 20 dB below the peak limit

-- Peak level under Average limit

Mode B CH LOW

Measured Values In The Frequency Range 1 GHz – 26.5 GHz

Table 13 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
2390.0	52.46	34.71	122	V	341	21.54	74	19.29	54
2390.0	44.94	34.18	156	H	202	29.06	74	19.82	54
4824.0	---	--					74		54
7236.0	---	--					74		54
9648.0	---	--					74		54
12060.0	---	--					74		54
14472.0	---	--					74		54
16884.0	---	--					74		54
19296.0	---	--					74		54
21708.0	---	--					74		54
24120.0	---	--					74		54

--- Peak level more that 20 dB below the peak limit

-- Peak level under Average limit

Mode B CH MID

Measured Peak Values In The Frequency Range 1 GHz – 26.5 GHz.

Table 14 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
4874.0	---	--					74		54
7311.0	---	--					74		54
9748.0	---	--					74		54
12185.0	---	--					74		54
14622.0	---	--					74		54
17059.0	---	--					74		54
19496.0	---	--					74		54
21933.0	---	--					74		54
24370.0	---	--					74		54

--- Peak level more that 20 dB below the peak limit

-- Peak level under Average limit

Mode B CH HIGH

Measured Peak Values In The Frequency Range 1 GHz – 26.5 GHz.

Table 15 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
2483.5	48.63	34.63	186	V	342	25.37	74	19.37	54
2483.5	49.59	34.41	156	H	202	24.41	74	19.59	54
4924.0	---	--					74		54
7386.0	---	--					74		54
9848.0	---	--					74		54
12310.0	---	--					74		54
14772.0	---	--					74		54
17234.0	---	--					74		54
19696.0	---	--					74		54
22158.0	---	--					74		54
24620.0	---	--					74		54

--- Peak level more that 20 dB below the peak limit

-- Peak level under Average limit

Receiver Radiated Emissions 30 – 1000 MHz

Standard:	ANSI C63.4	(2003)
Tested by:	NTO	
Date:	16.2.2010	
Humidity:	22%	
Temperature:	21 °C	
Barometric pressure:	1012 mbar	
Measurement uncertainty:	± 5.1 dB (30 - 200 MHz) ± 4.2 dB (0.2 -1 GHz)	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

Mode B CH MID

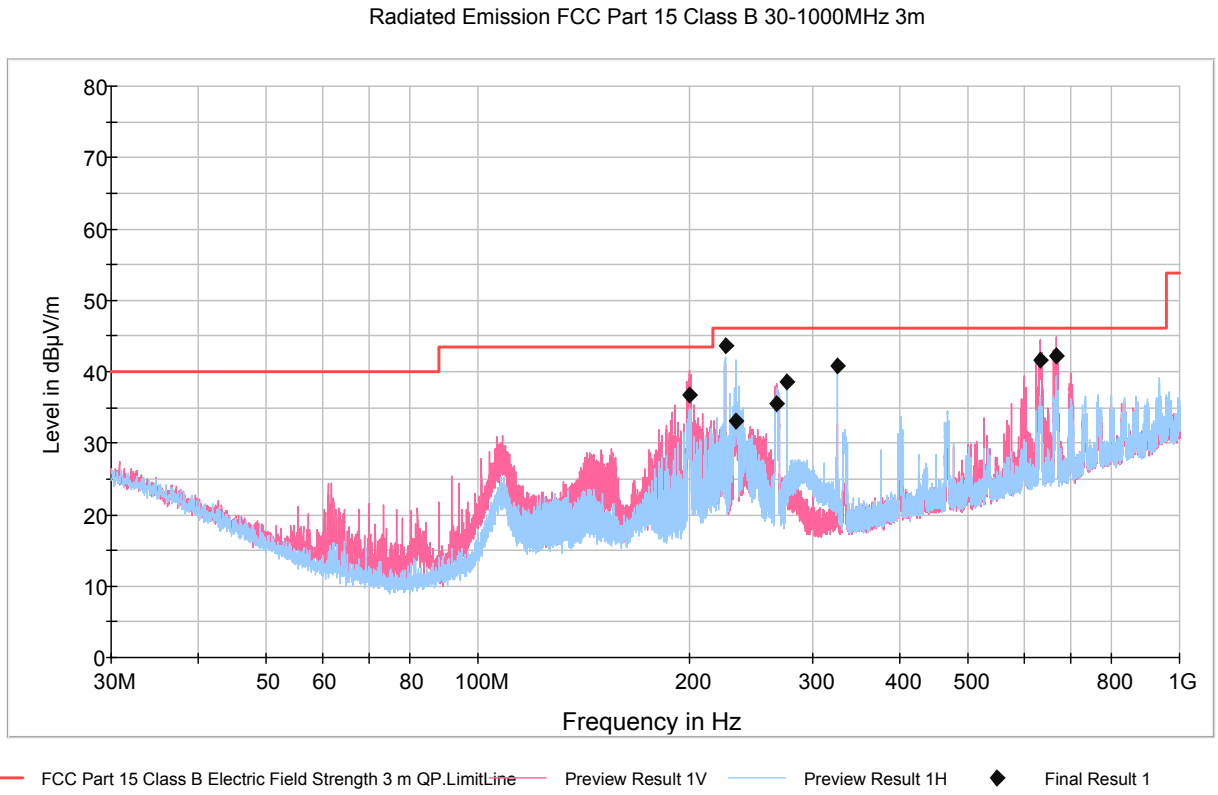


Figure 14 Measured curves with peak-detector.

Final measurements from the worst frequencies

Table 16 Final results

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
200.093333	36.7	1000.0	120.000	115.0	V	112.0	-10.9	6.8	43.5	
225.047000	43.6	1000.0	120.000	153.0	H	88.0	-8.9	2.4	46.0	
233.393333	33.1	1000.0	120.000	100.0	H	253.0	-9.1	12.9	46.0	
267.015667	35.6	1000.0	120.000	100.0	V	307.0	-8.5	10.4	46.0	
275.054333	38.5	1000.0	120.000	109.0	H	116.0	-8.5	7.5	46.0	
325.074000	40.8	1000.0	120.000	100.0	H	72.0	-7.0	5.2	46.0	
634.216000	41.6	1000.0	120.000	109.0	V	315.0	-0.6	4.4	46.0	
667.548667	42.2	1000.0	120.000	100.0	V	320.0	-0.2	3.8	46.0	

Receiver Radiated Emissions 1 – 26.5 GHz

Standard:	ANSI C63.4	(2003)
Tested by:	NTO	
Date:	22.2.2010	
Humidity:	22 %	
Temperature:	23 °C	
Barometric pressure:	1002 mbar	
Measurement uncertainty:	± 3.7 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

Mode B CH CH MID

Measured Values In The Frequency Range 1 GHz – 26.5 GHz

Table 17 Results

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Peak Margin (dB)	Peak Limit (dBµV/	Average Margin (dB)	Average Limit (dBµV/m)
4874.0	---	--						74		54
7311.0	---	--						74		54
9748.0	---	--						74		54
12185.0	---	--						74		54
14622.0	---	--						74		54
17059.0	---	--						74		54
19496.0	---	--						74		54
21933.0	---	--						74		54
24370.0	---	--						74		54

Transmitter Conducted Emissions 30 MHz – 26.5 GHz

Standard:	ANSI C63.10	(2009)
Tested by:	NTO	
Date:	1. - 2.2.2010	
Humidity:	38 - 36 %	
Temperature:	21 - 20 °C	
Barometric pressure:	1010 - 1002 mbar	
Measurement uncertainty:	± 1.23 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Mode A CH LOW

Measured Values In The Frequency Range 30 MHz – 26.5 GHz

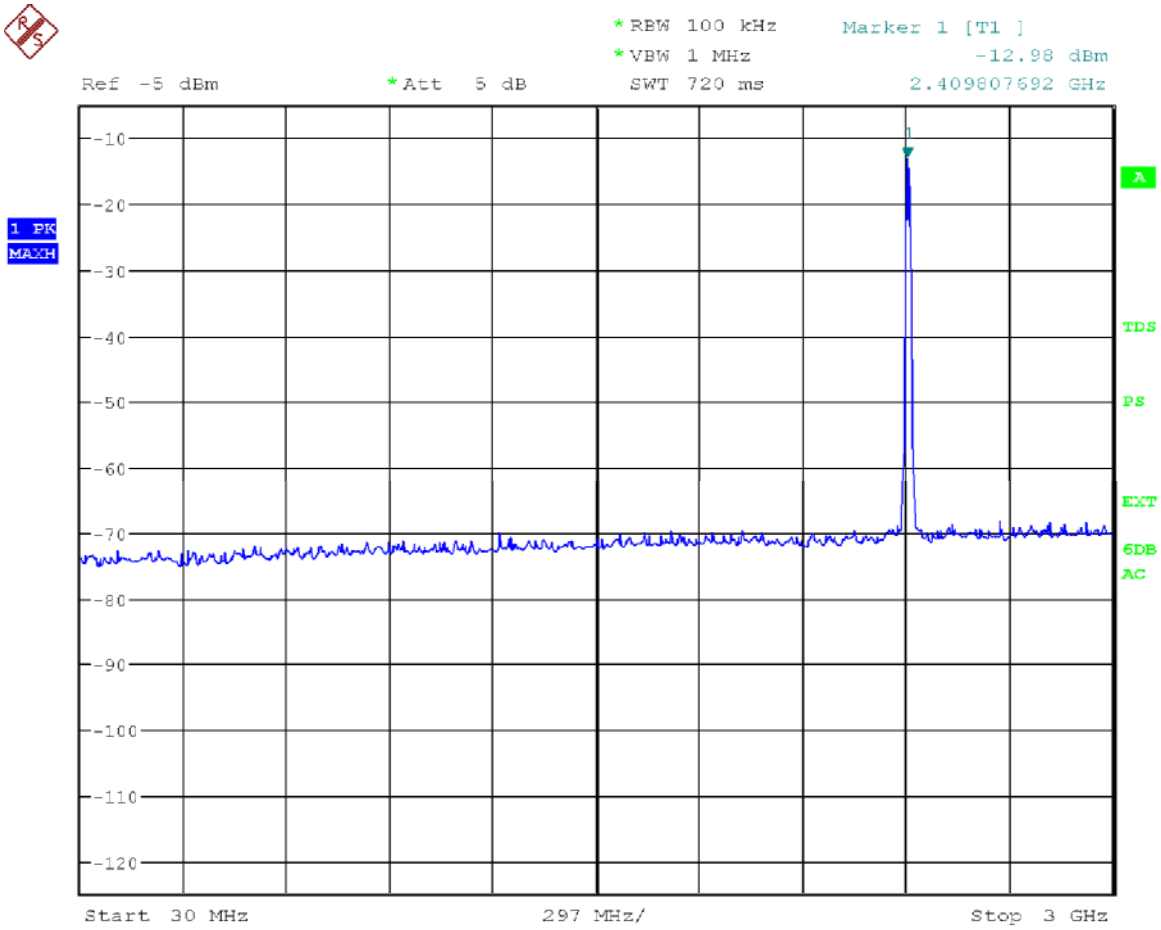


Figure 15 Frequency range 30 MHz - 3 GHz.

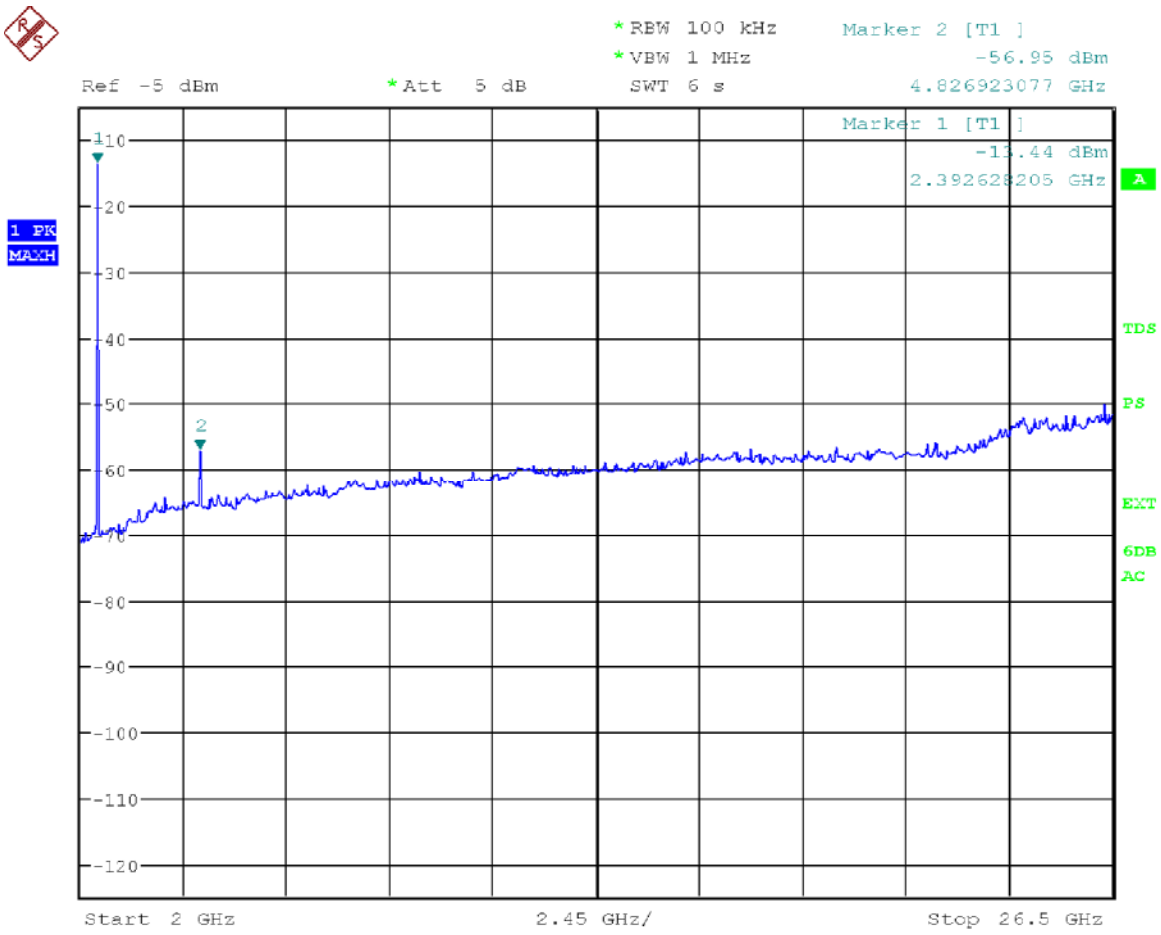


Figure 16 Frequency range 2 GHz - 26.5 GHz.

Table 18 Results

Frequency (MHz)	Peak (dBµV)	Margin (dB)	Limit (dBµV)	Comment
2392.6	-13.44	---	---	ref
4826.9	-56.95	23.51	-33.44	

Mode A CH MID

Measured Peak Values In The Frequency Range 30 MHz – 26.5 GHz.

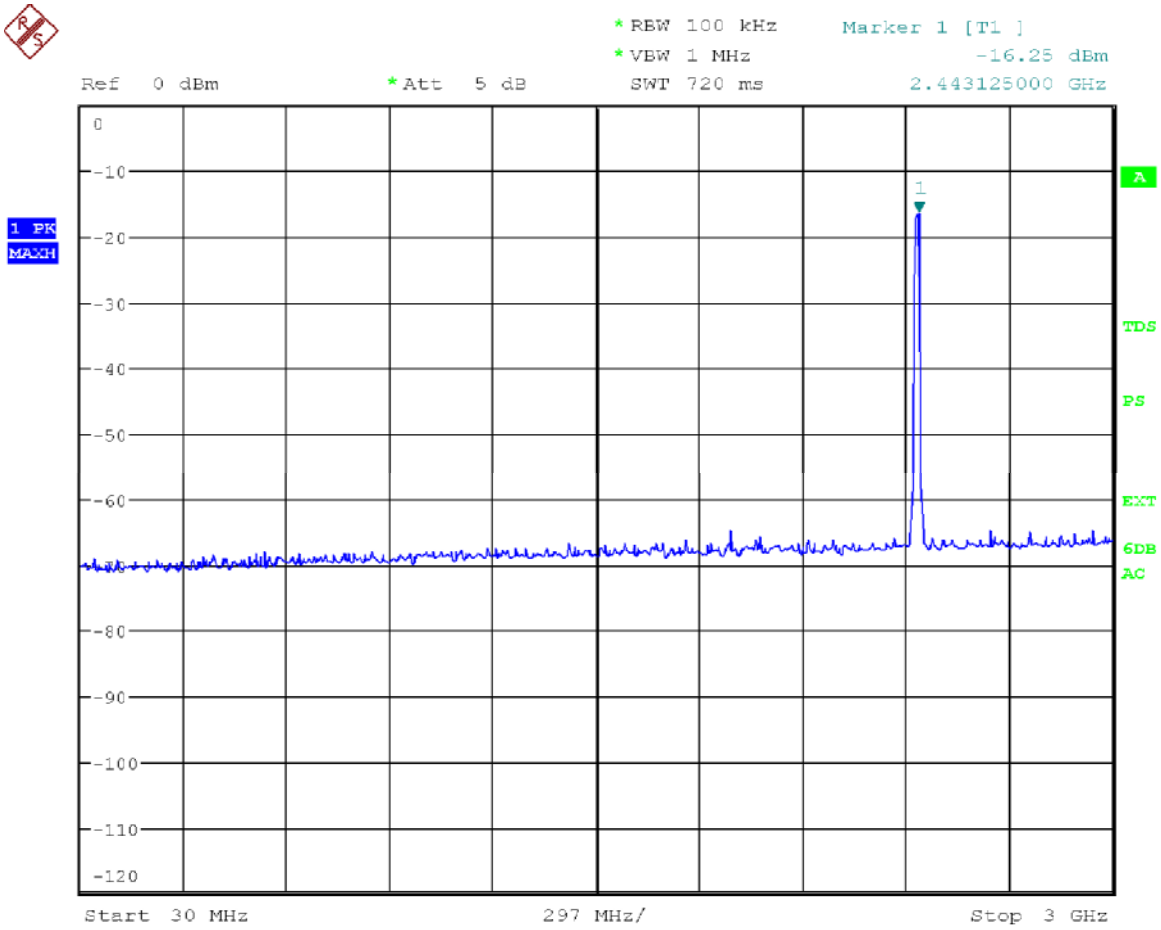


Figure 17 Frequency range 30 MHz - 3 GHz.

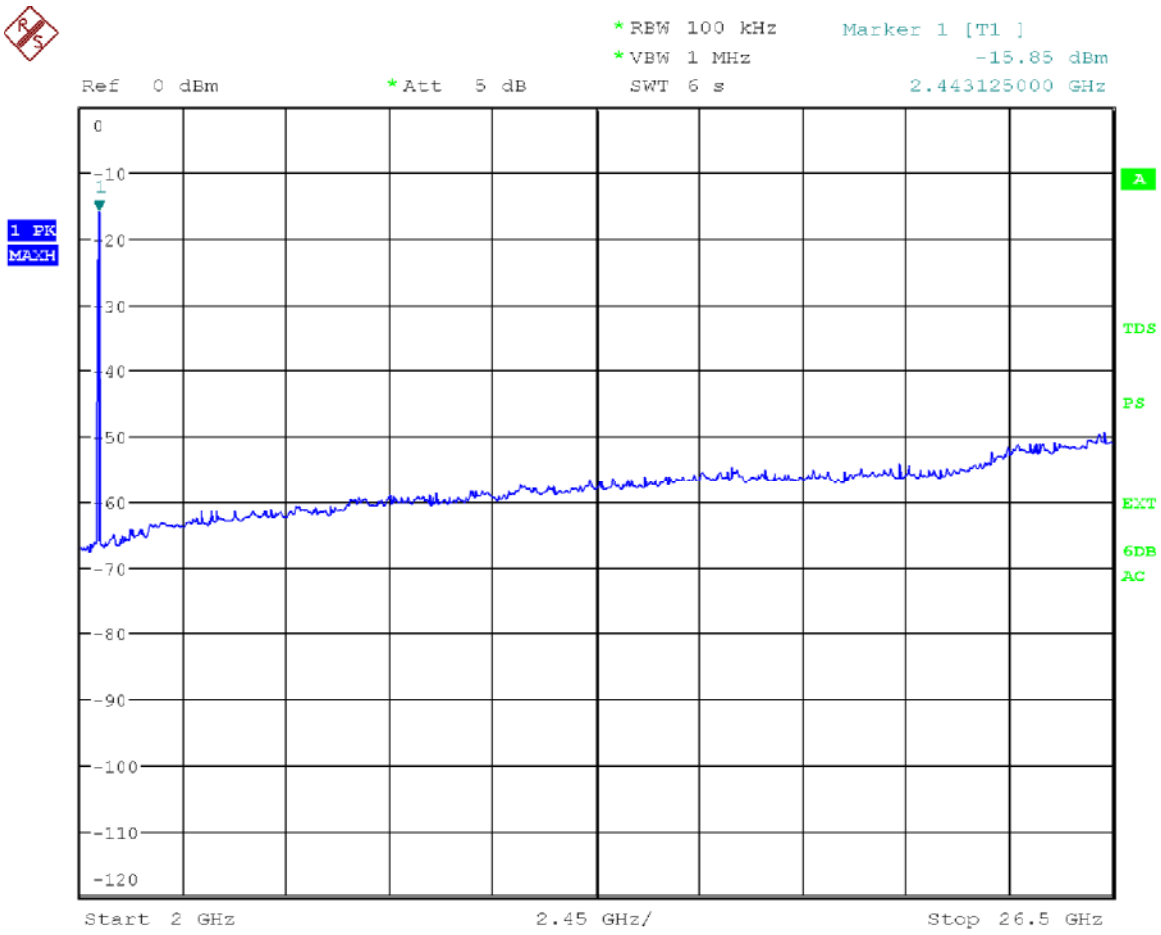


Figure 18 Frequency range 2 GHz - 26.5 GHz.

Table 19 Results

Frequency (MHz)	Peak (dBµV)	Margin (dB)	Limit (dBµV)	Comment
2443.1	-15.85	---	---	ref

Mode A CH HIGH

Measured Peak Values In The Frequency Range 30 MHz – 26.5 GHz.

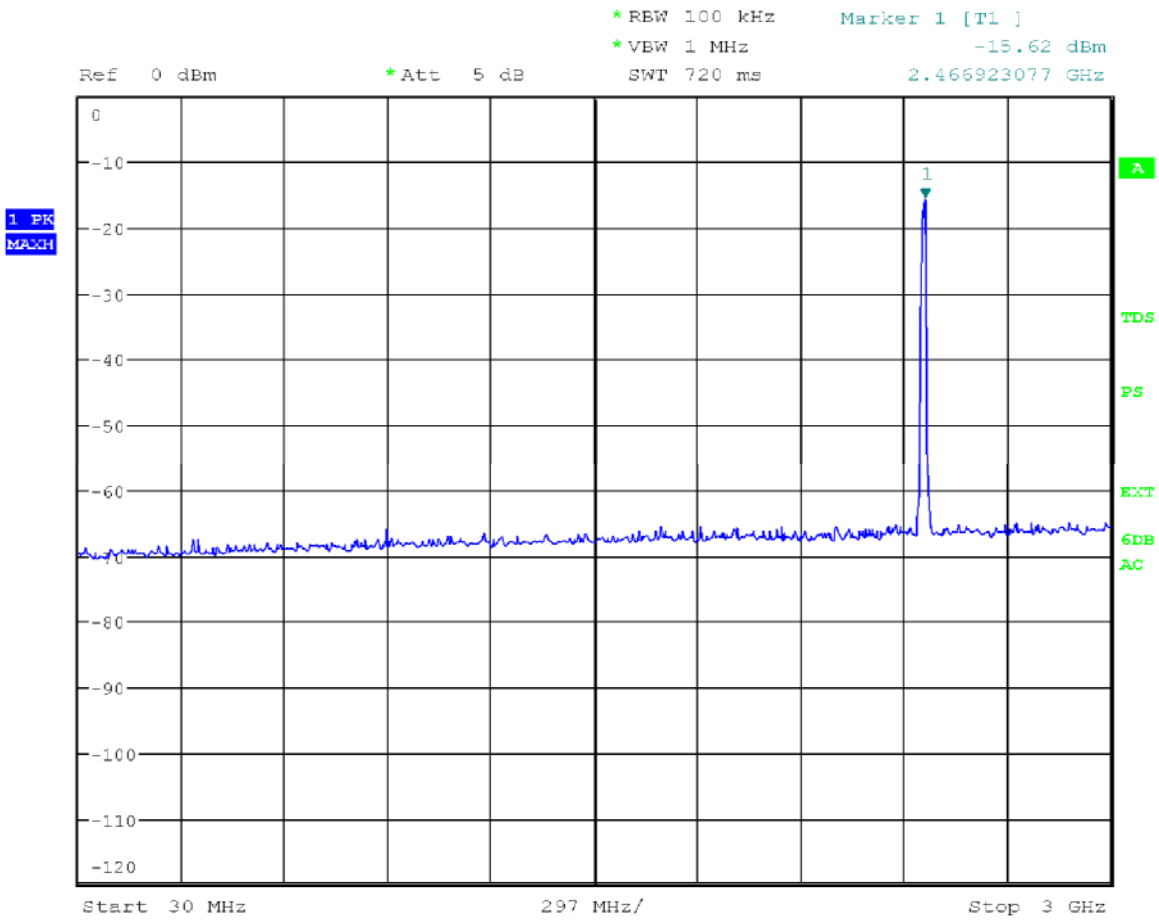


Figure 19 Frequency range 30 MHz - 3 GHz.

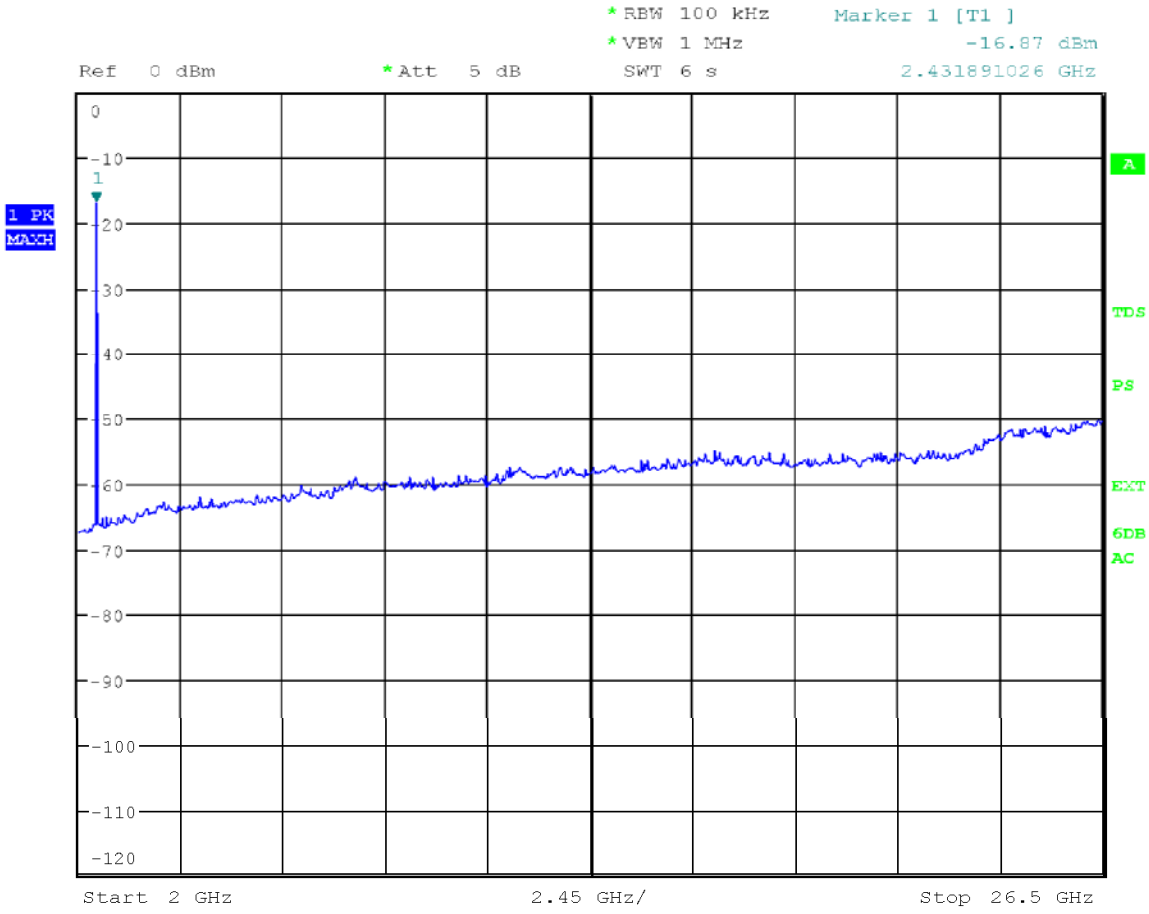


Figure 20 Frequency range 2 GHz - 26.5 GHz.

Table 20 Results

Frequency (MHz)	Peak (dBµV)	Margin (dB)	Limit (dBµV)	Comment
2431.9	-16.87	---	---	ref

Mode B CH LOW

Measured Values In The Frequency Range 30 MHz – 26.5 GHz

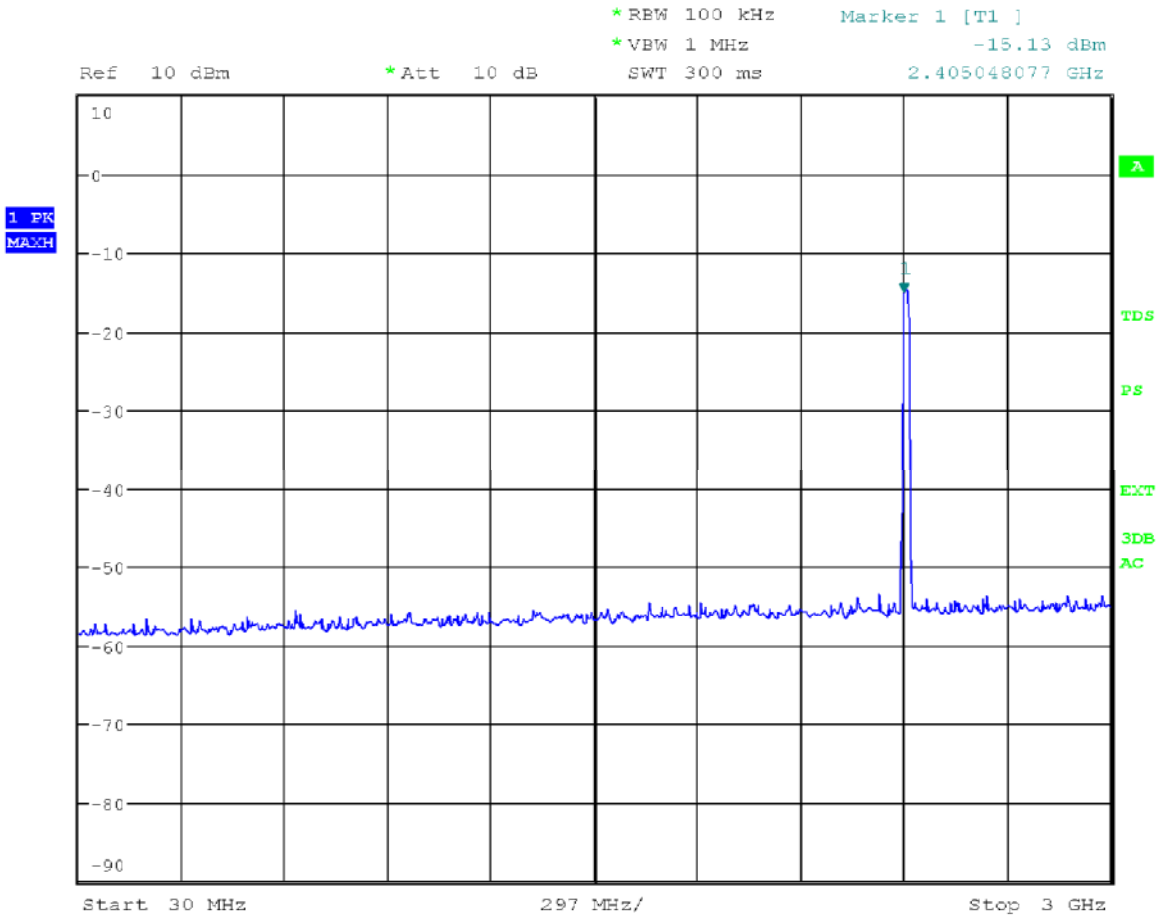


Figure 21 Frequency range 30 MHz - 3 GHz.

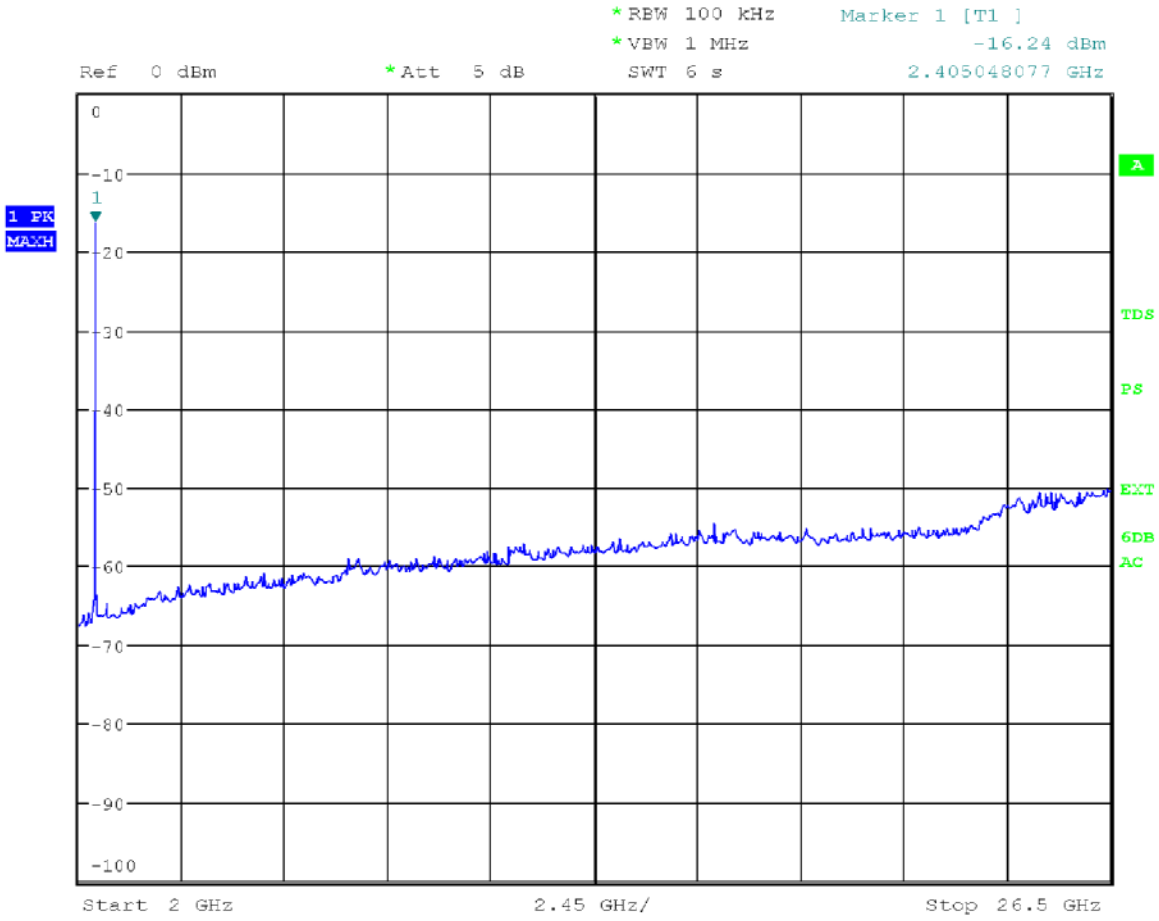


Figure 22 Frequency range 2 GHz - 26.5 GHz.

Table 21 Results

Frequency (MHz)	Peak (dBµV)	Margin (dB)	Limit (dBµV)	Comment
2405.0	-16.24	---	---	ref

Mode B CH MID

Measured Peak Values In The Frequency Range 30 MHz – 26.5 GHz.

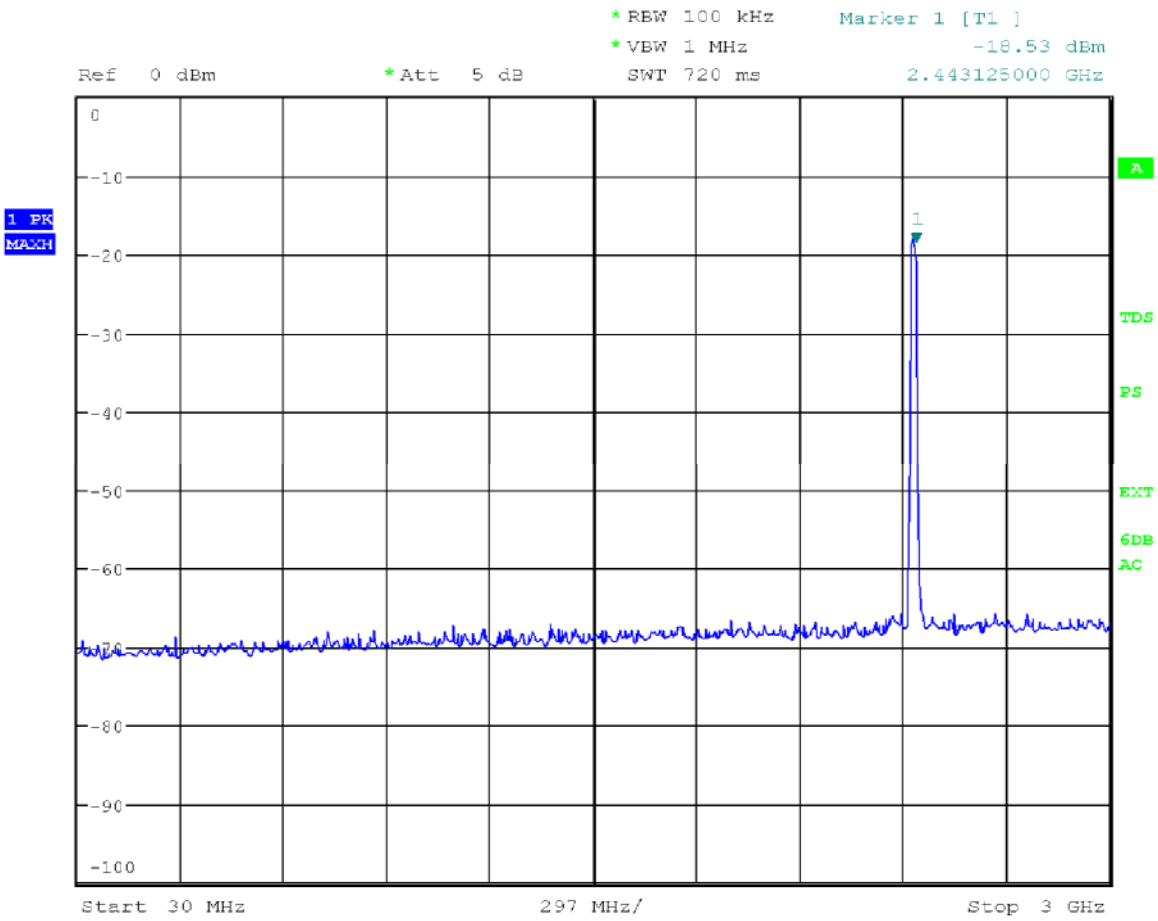


Figure 23 Frequency range 30 MHz - 3 GHz.

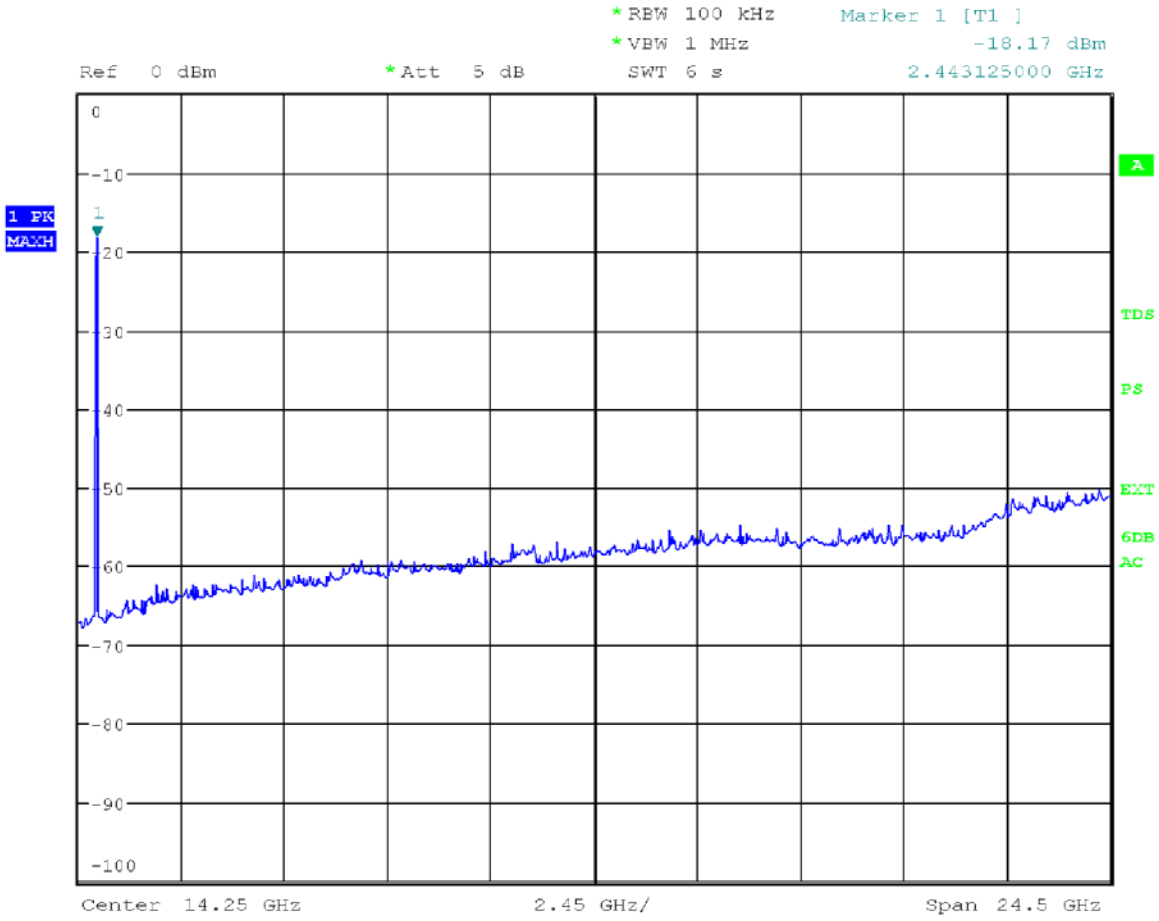


Figure 24 Frequency range 2 GHz - 26.5 GHz.

Table 22 Results

Frequency (MHz)	Peak (dBµV)	Margin (dB)	Limit (dBµV)	Comment
2443.1	-18.17	---	---	ref

Mode B CH HIGH

Measured Peak Values In The Frequency Range 30 MHz – 26.5 GHz.

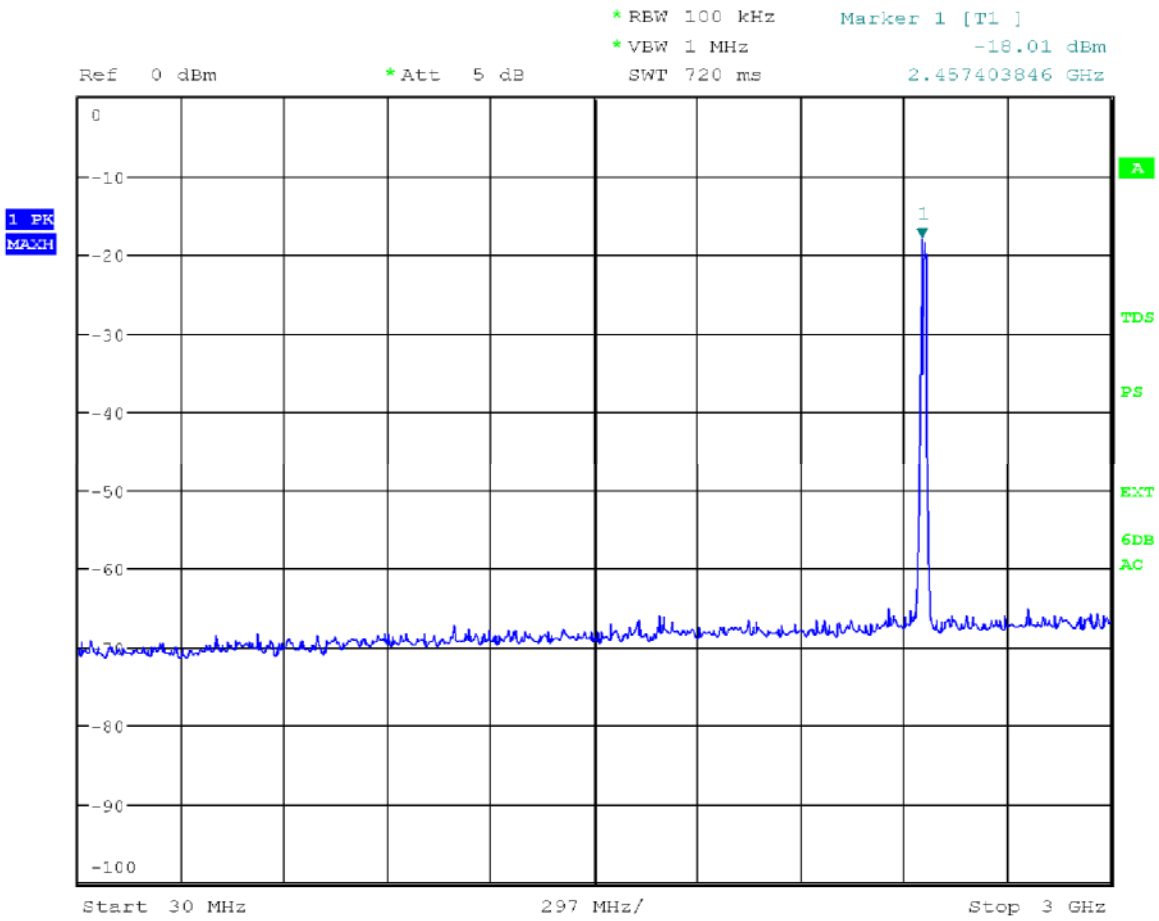


Figure 25 Frequency range 30 MHz - 3 GHz.

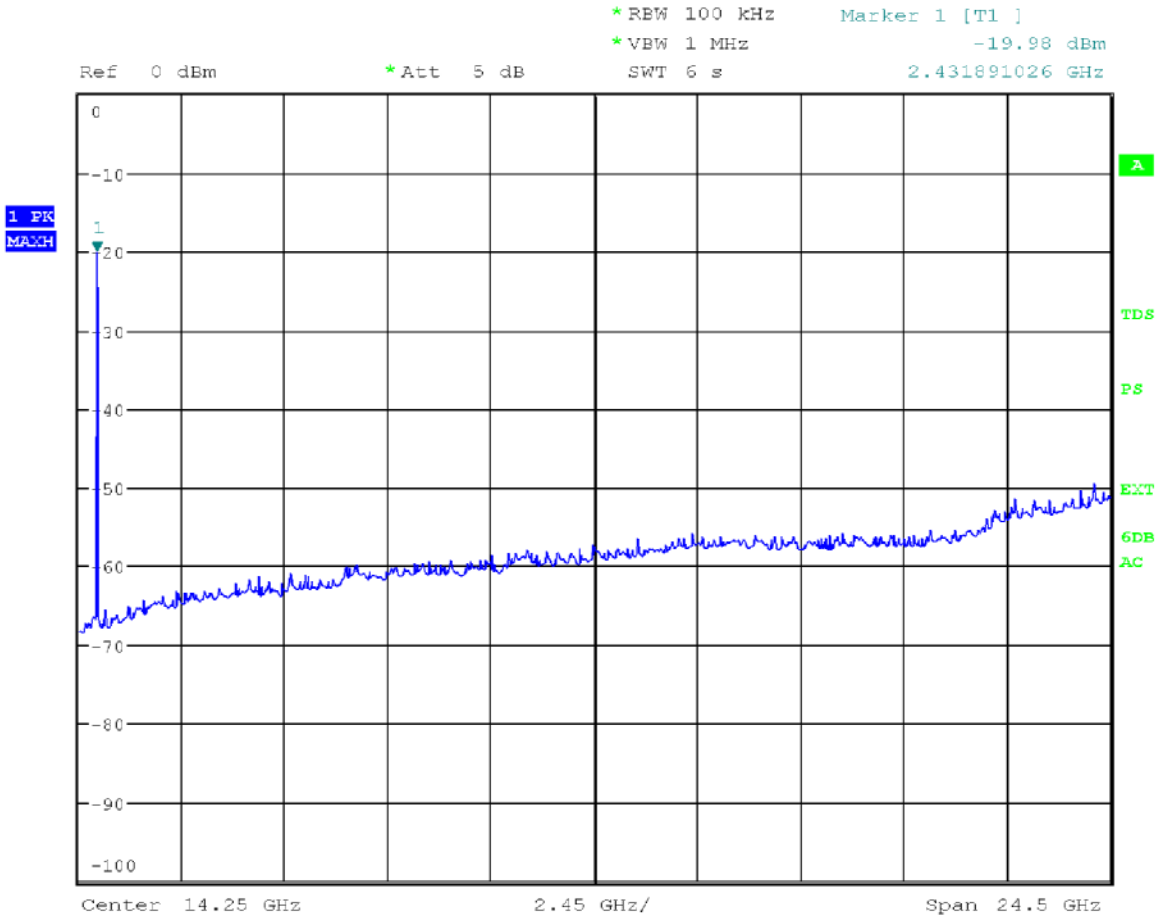


Figure 26 Frequency range 2 GHz - 26.5 GHz.

Table 23 Results

Frequency (MHz)	Peak (dBµV)	Margin (dB)	Limit (dBµV)	Comment
2431.9	-19.98	---	---	ref

Transmitter Band Edge Measurement

Standard:	ANSI C63.10	(2009)
Tested by:	NTO	
Date:	1. - 2.2.2010	
Humidity:	38 - 36 %	
Temperature:	21 - 20 °C	
Barometric pressure:	1010 - 1002 mbar	
Measurement uncertainty:	± 1.23 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Mode A

Band Edge Attenuation	
Lower Band Edge	Upper Band Edge
-57.29 dBc	-50.99 dBc
Limit: -20dB	

Mode B

Band Edge Attenuation	
Lower Band Edge	Upper Band Edge
-31.24 dBc	-46.91 dBc
Limit: -20dBc	

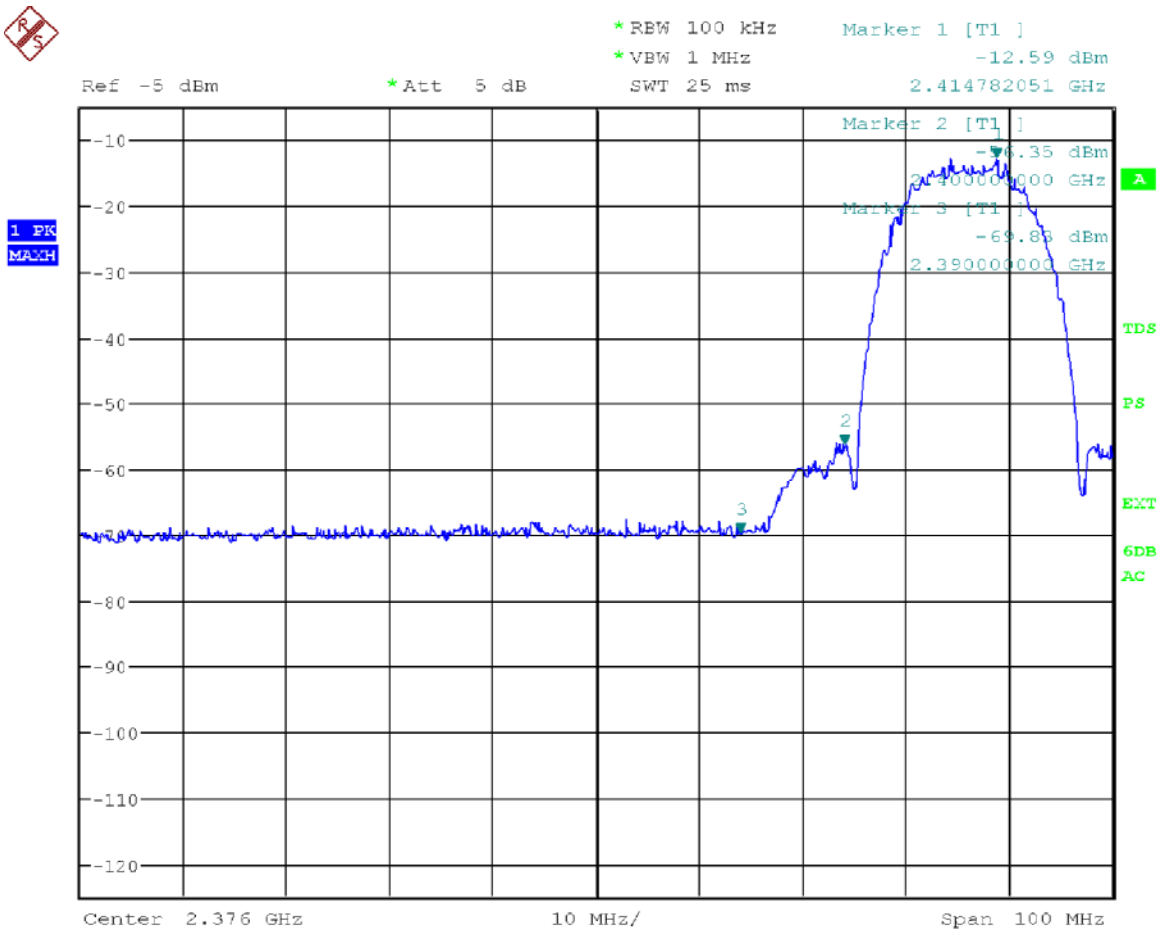


Figure 27 Mode A, Lower Band Edge.

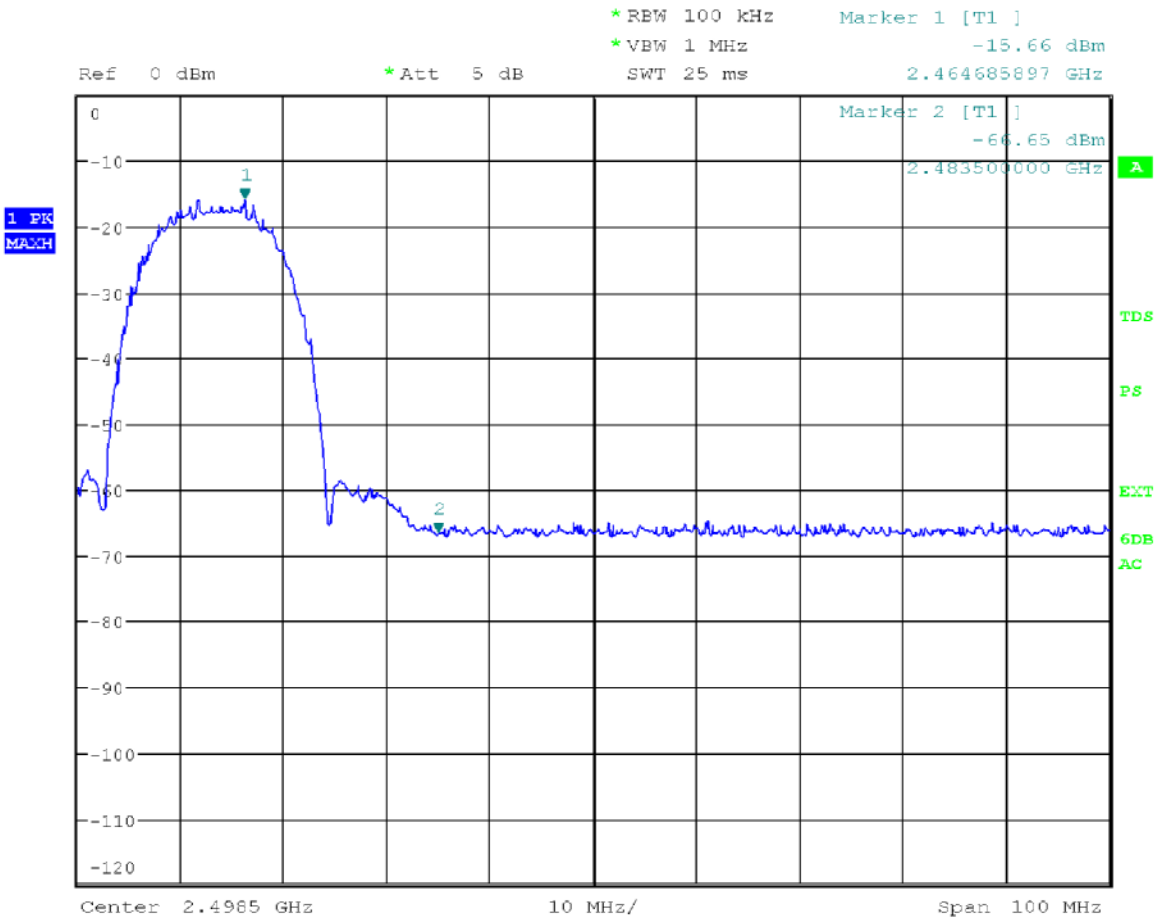


Figure 28 Mode A, Upper Band Edge.

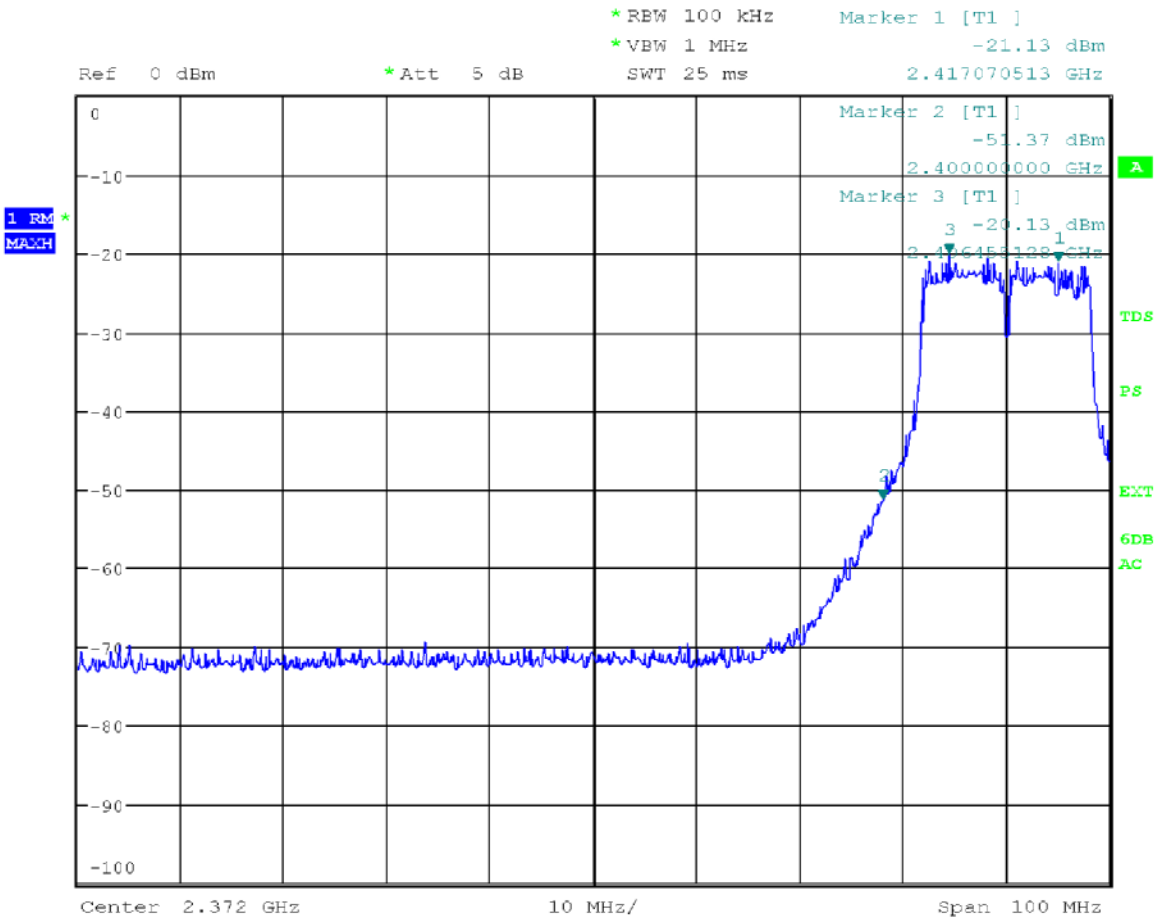


Figure 29 Mode B, Lower Band Edge.

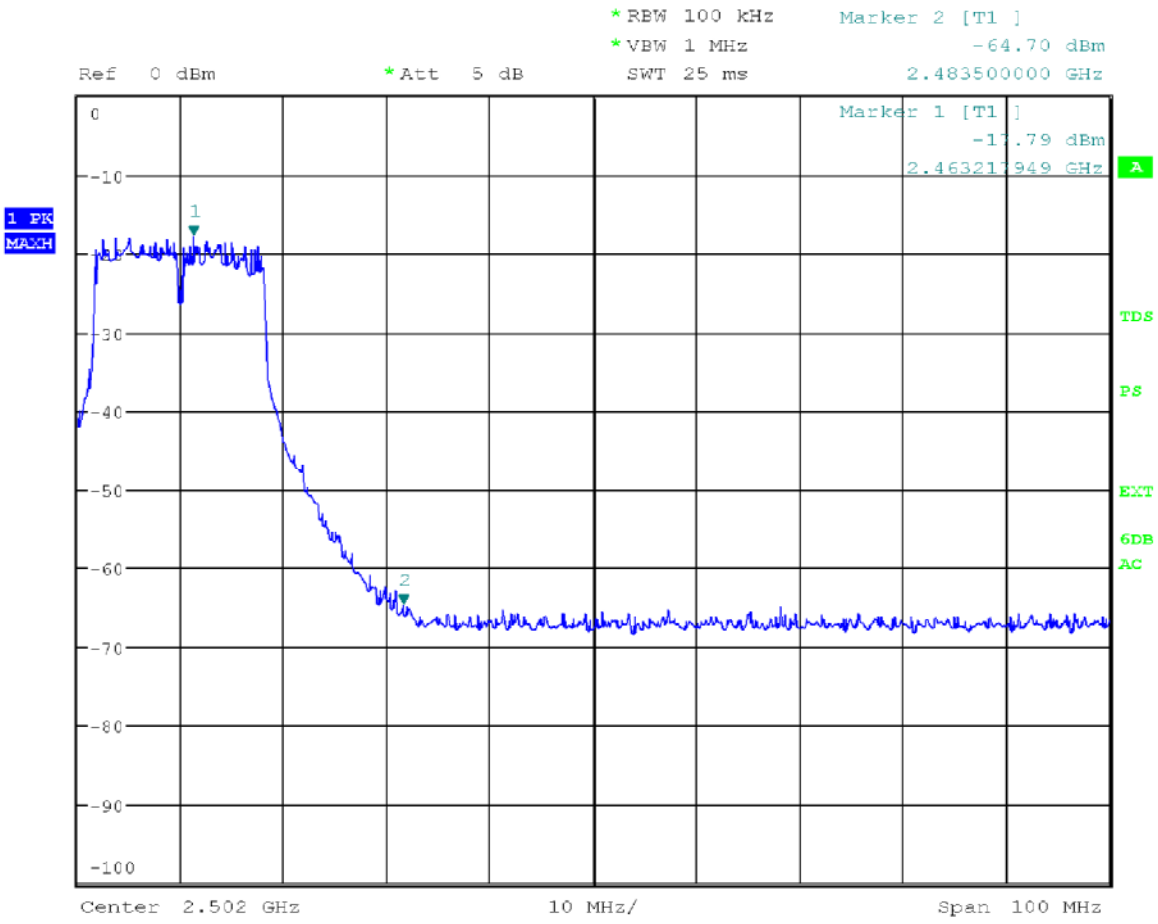


Figure 30 Mode B, Upper Band Edge.

6dB Bandwidth

Standard:	ANSI C63.10	(2009)
Tested by:	NTO	
Date:	1. - 2.2.2010	
Humidity:	38 - 36 %	
Temperature:	21 - 20 °C	
Barometric pressure:	1010 - 1002 mbar	

FCC Rule: 15.247 (a) (2)

Systems using digital modulation techniques may operate in the 2400 - 2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.

Mode A

6dB Bandwidth		
Channel low	**Channel mid**	**Channel high**
22.057 MHz	22.163 MHz	22.163 MHz

Mode B

6dB Bandwidth		
Channel low	**Channel mid**	**Channel high**
16.711 MHz	16.711 MHz	16.605 MHz

Limit: minimum 500 kHz

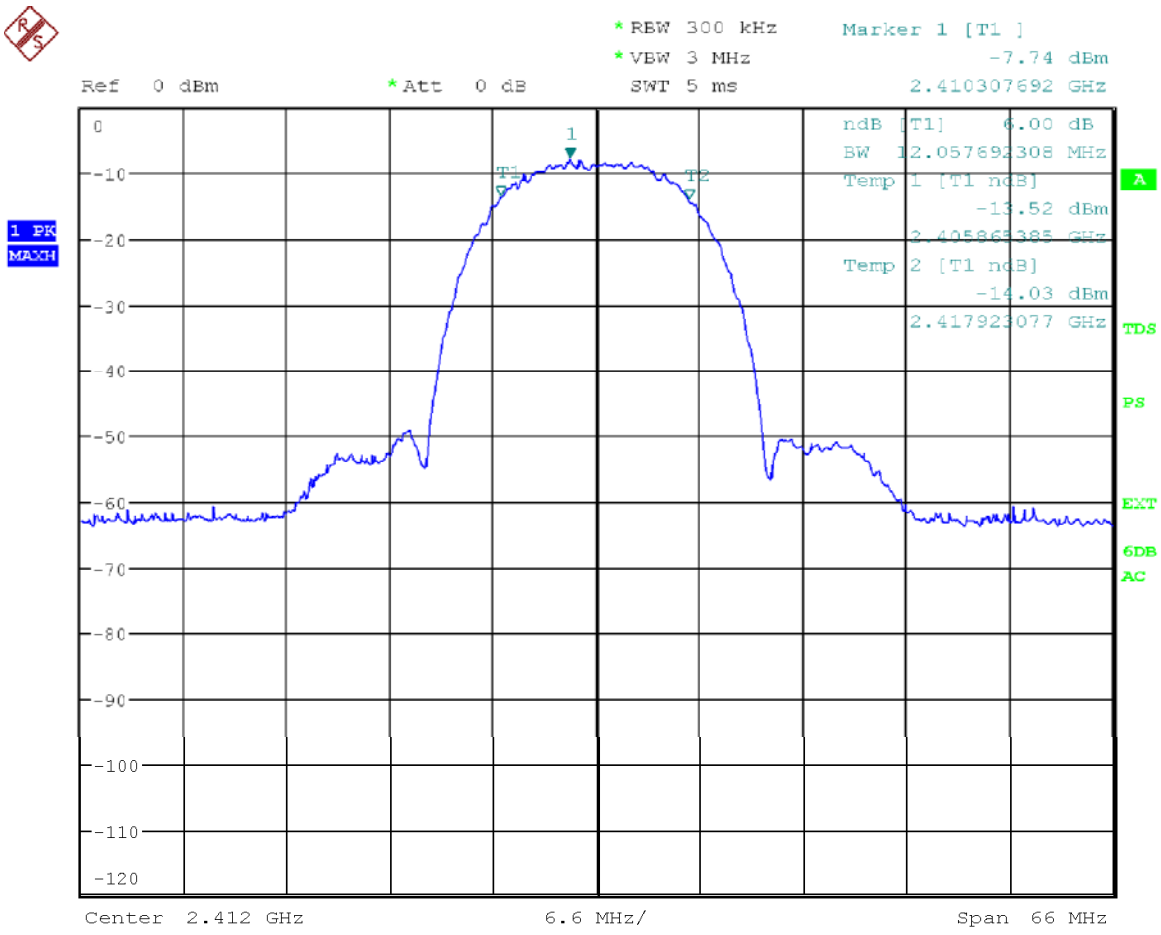
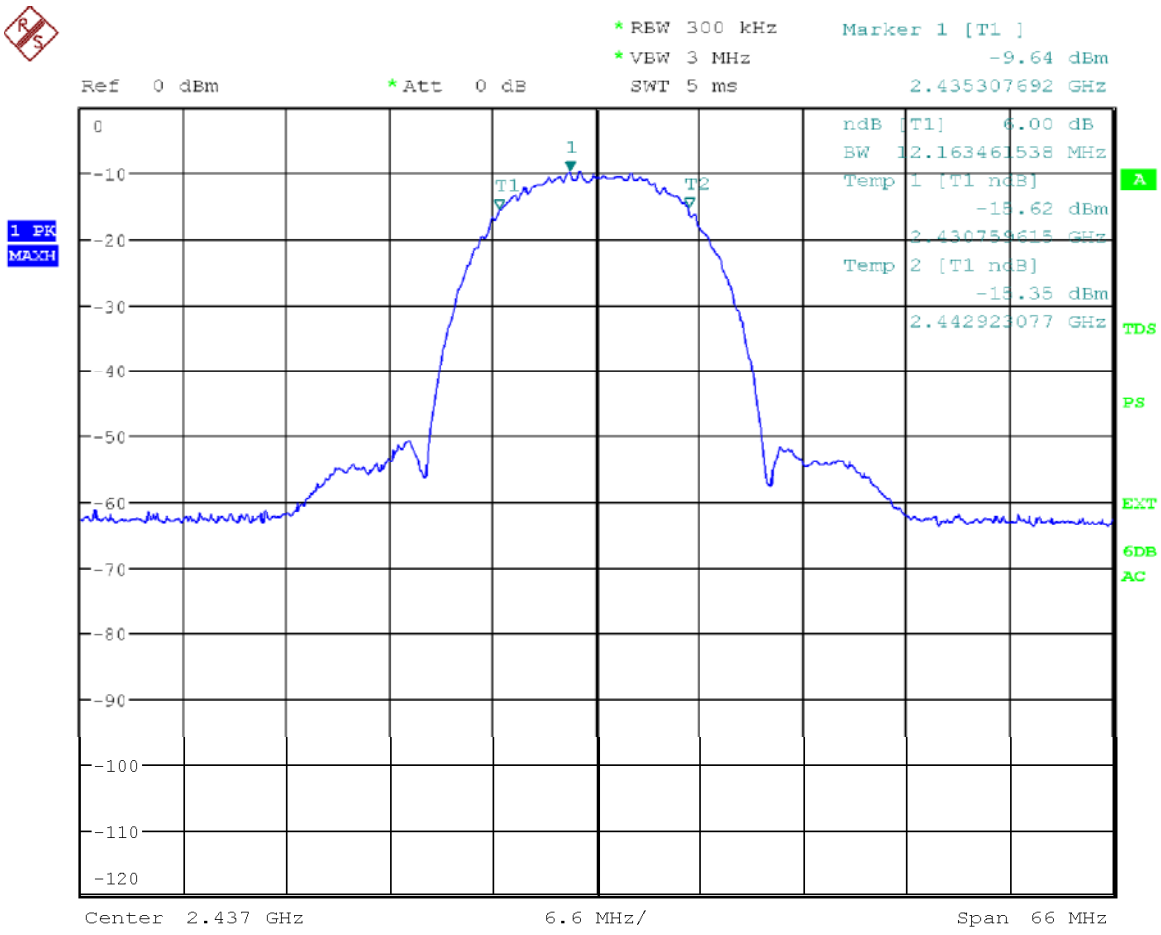
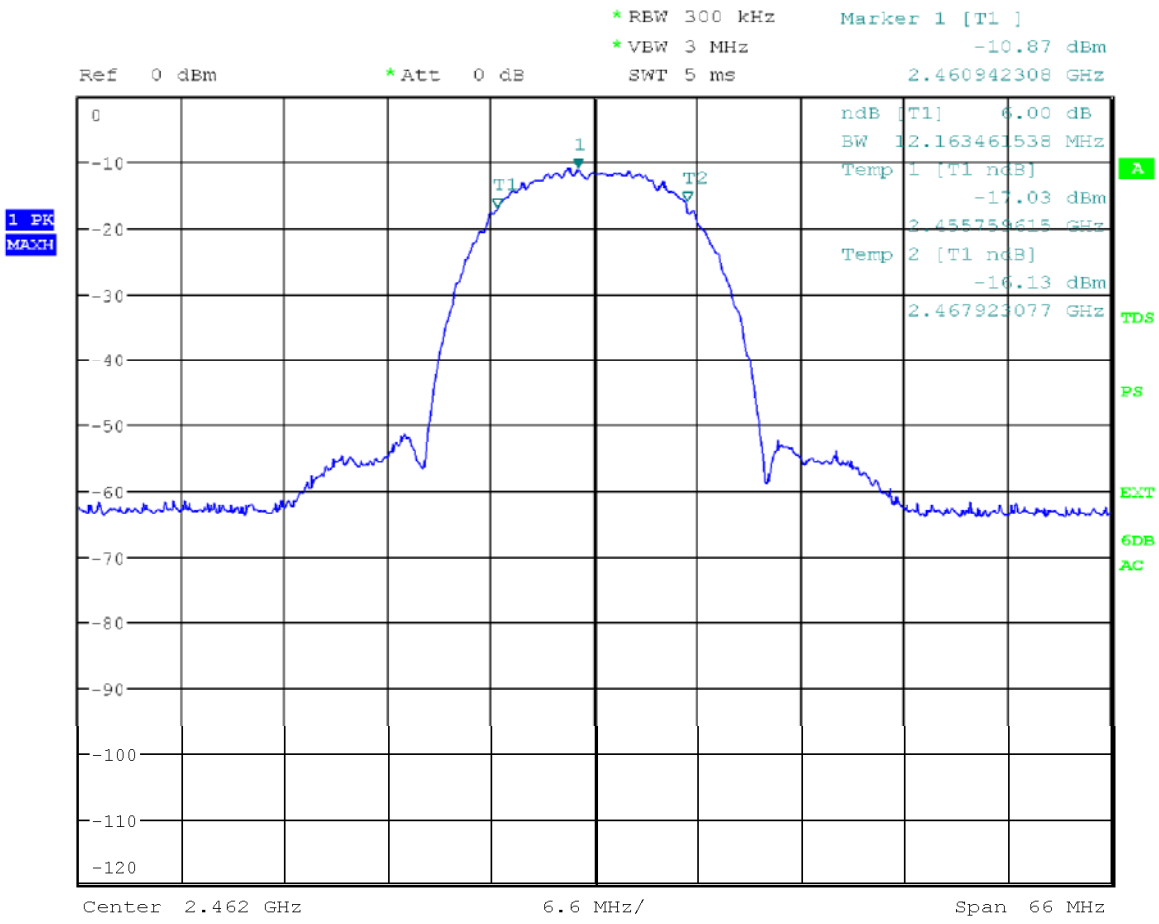


Figure 31 Mode A, Channel low.



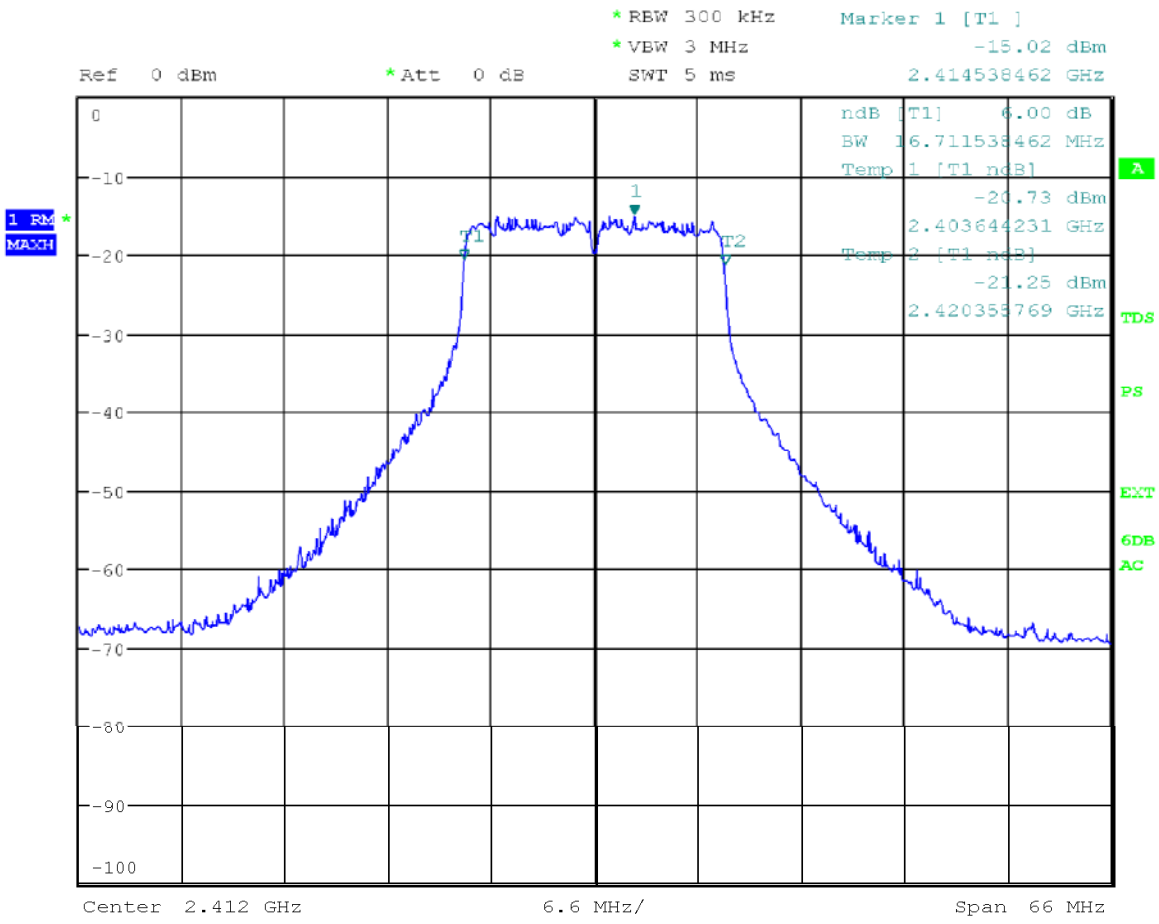
Date: 1.FEB.2010 13:49:49

Figure 32 Mode A, Channel mid.



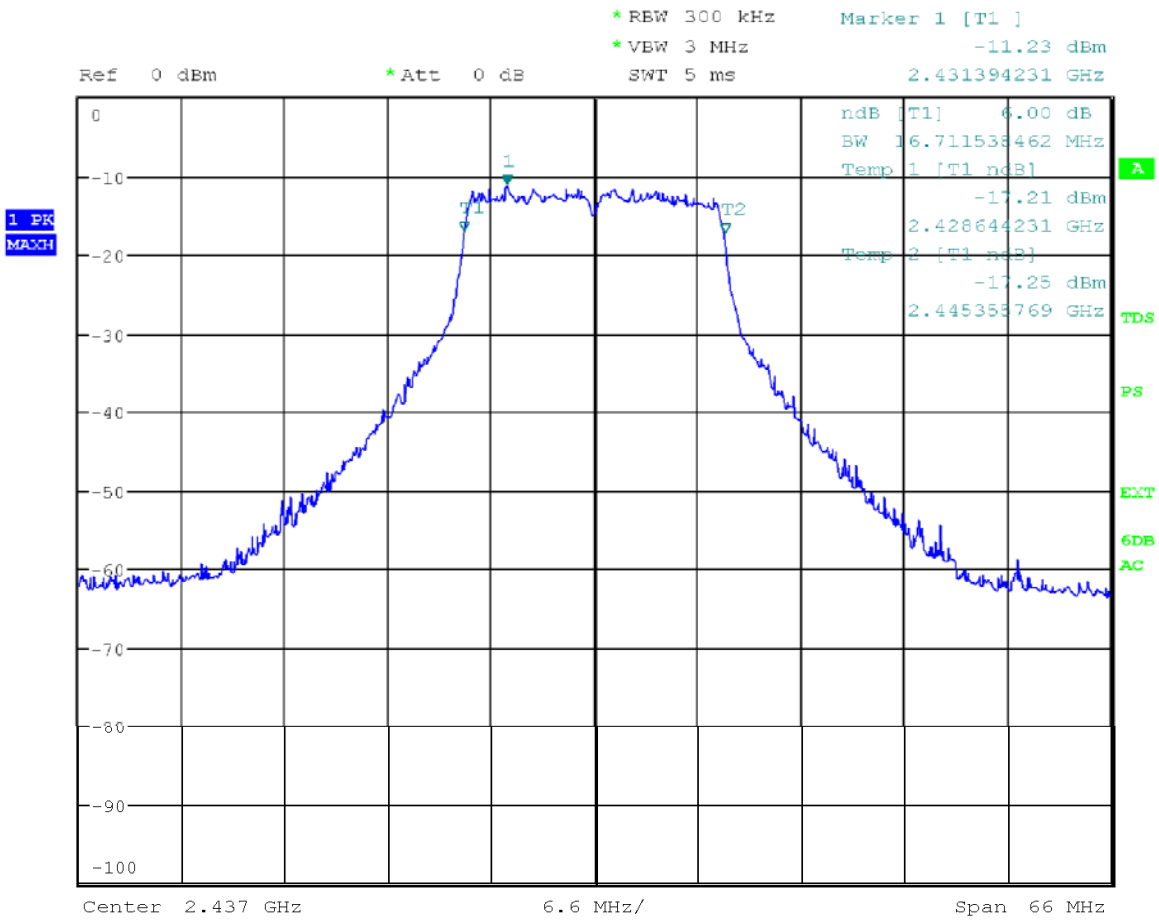
Date: 1.FEB.2010 14:23:33

Figure 33 Mode A, Channel high.



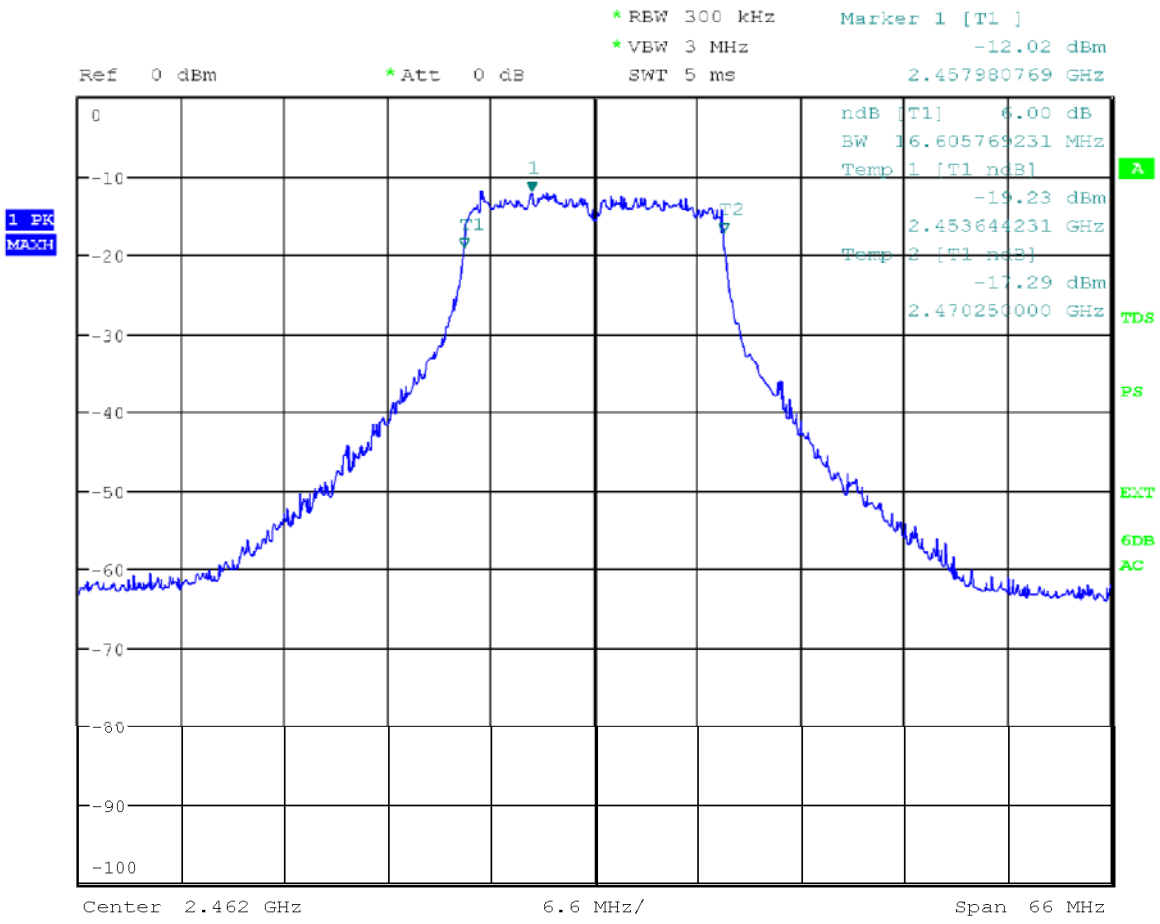
Date: 2.FEB.2010 09:45:40

Figure 34 Mode B, Channel low.



Date: 2.FEB.2010 10:07:17

Figure 35 Mode B, Channel mid.



Date: 2.FEB.2010 10:27:39

Figure 36 Mode B, Channel high.

Power Spectral Density

Test method:	KDB 558074	
Tested by:	NTO	
Date:	12.10.2010	
Humidity:	45 %	
Temperature:	20 °C	
Barometric pressure:	103 mbar	
Measurement uncertainty:	± 1.23 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(e)

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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of section 15.247. The same method of determining the conducted output power shall be used to determine the power spectral density.

Mode A

Channel	RF Power Density [dBm]	Limit [dBm]
Low	**-25.30**	**8**
Mid	**-27.49**	**8**
High	**-28.27**	**8**

Mode B

Channel	RF Power Density [dBm]	Limit [dBm]
Low	**-27.48**	**8**
Mid	**-28.50**	**8**
High	**-29.74**	**8**

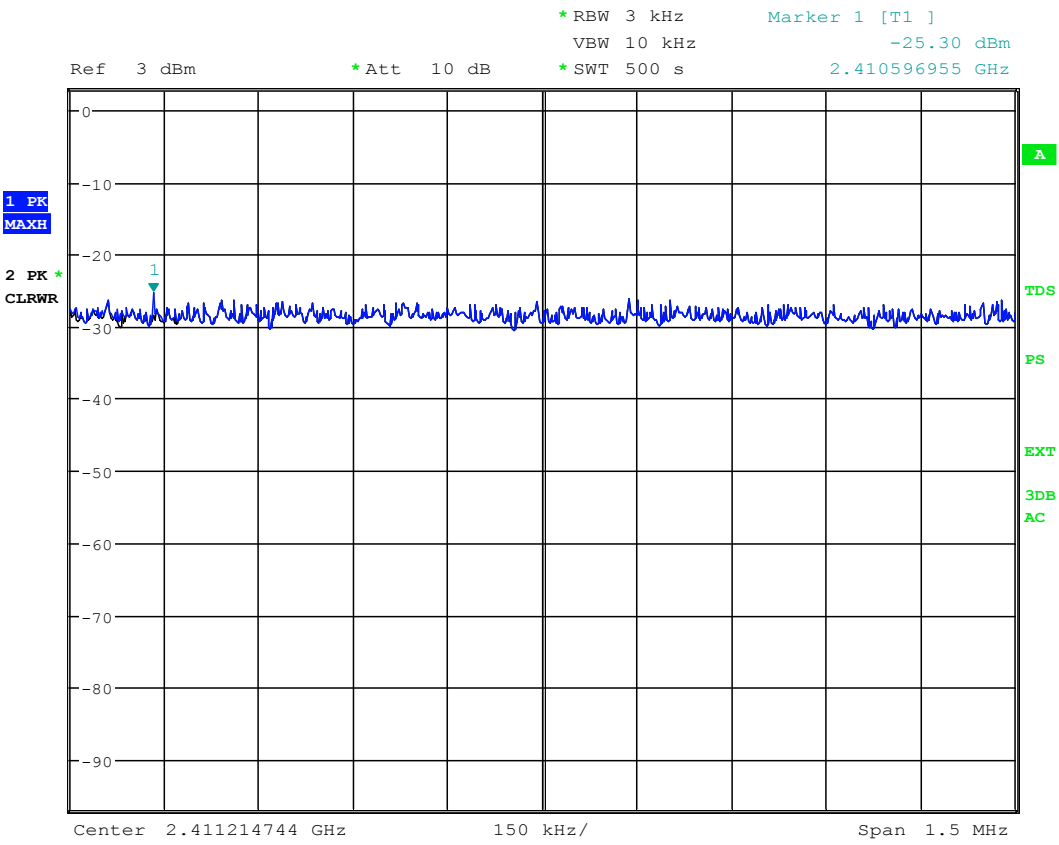


Figure 37 Mode A, Channel low.

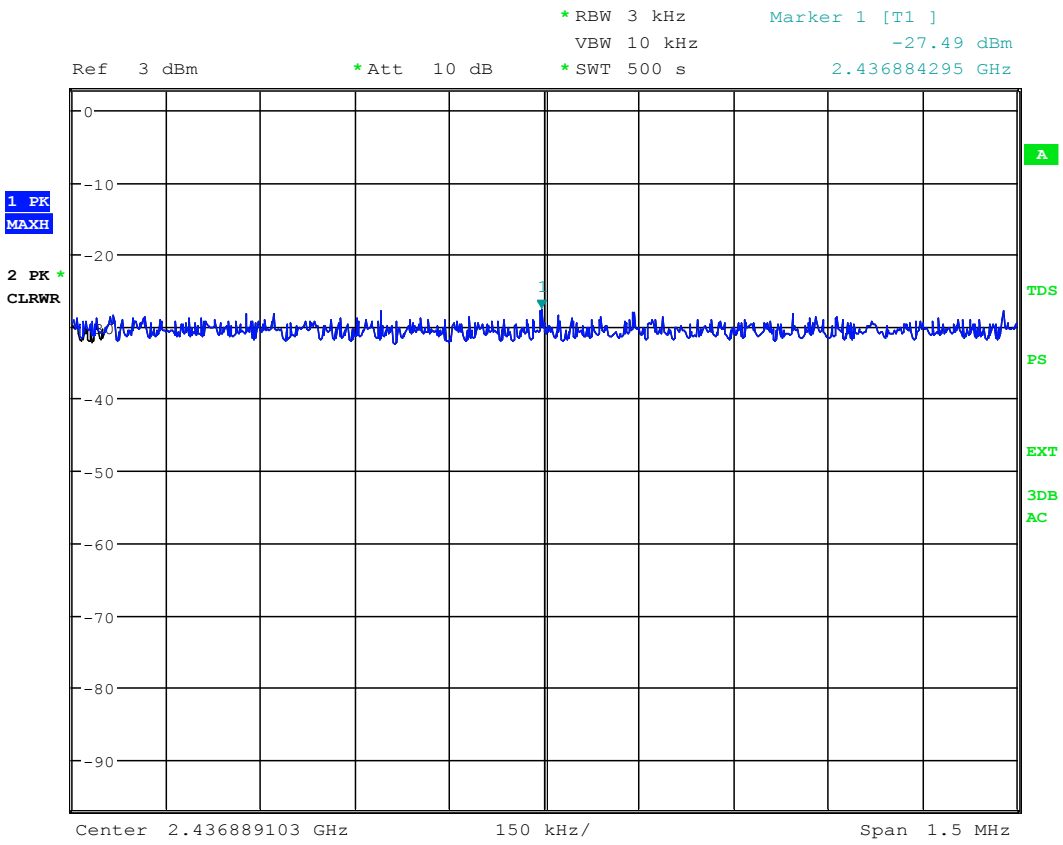


Figure 38 Mode A, Channel mid.

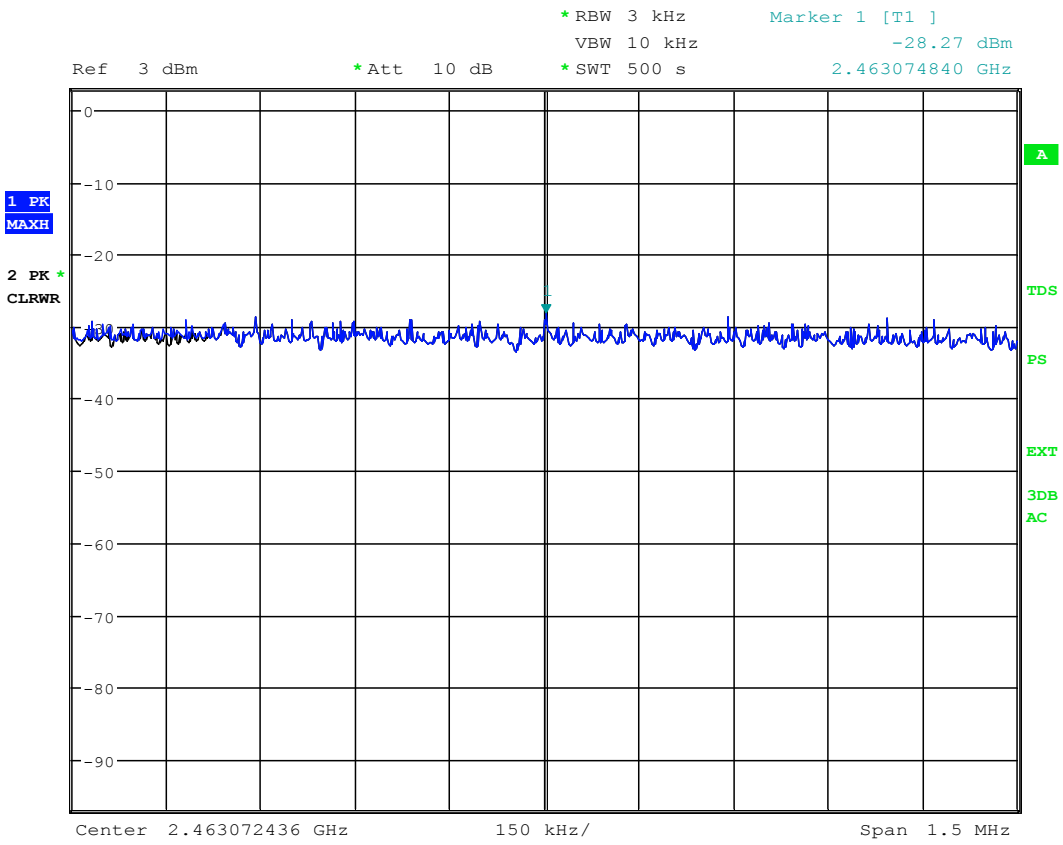


Figure 39 Mode A, Channel high.

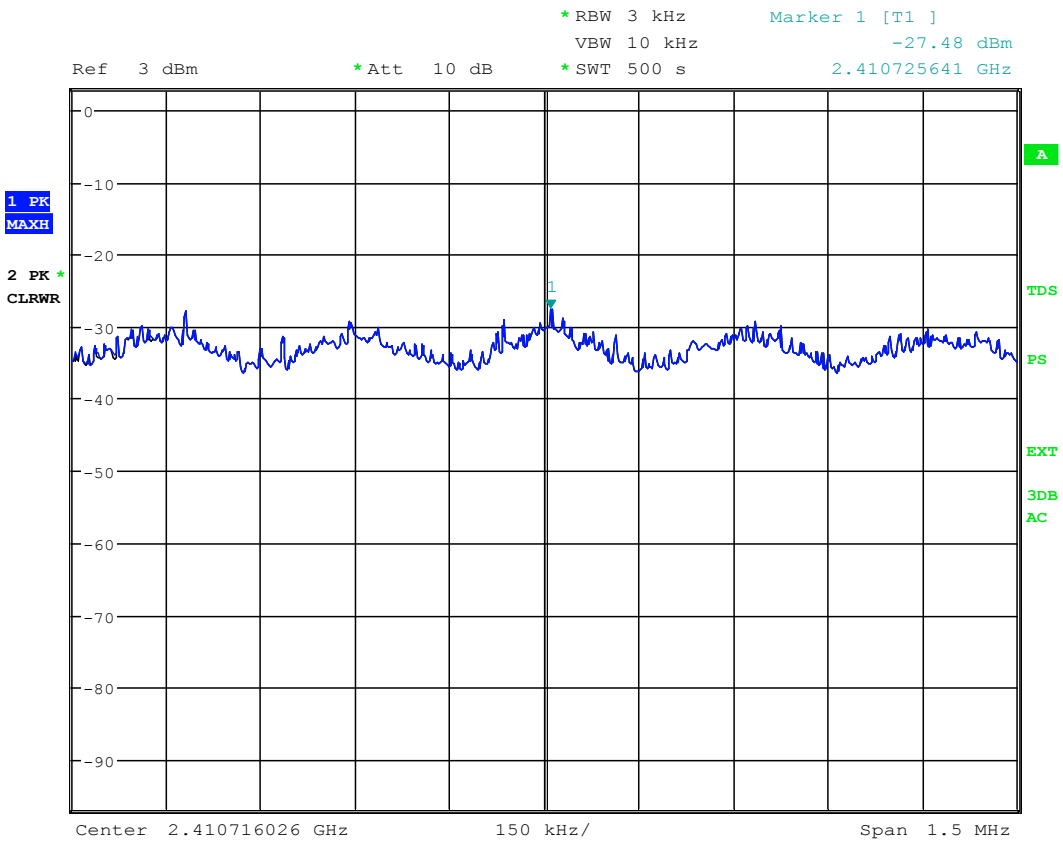


Figure 40 Mode B, Channel low.

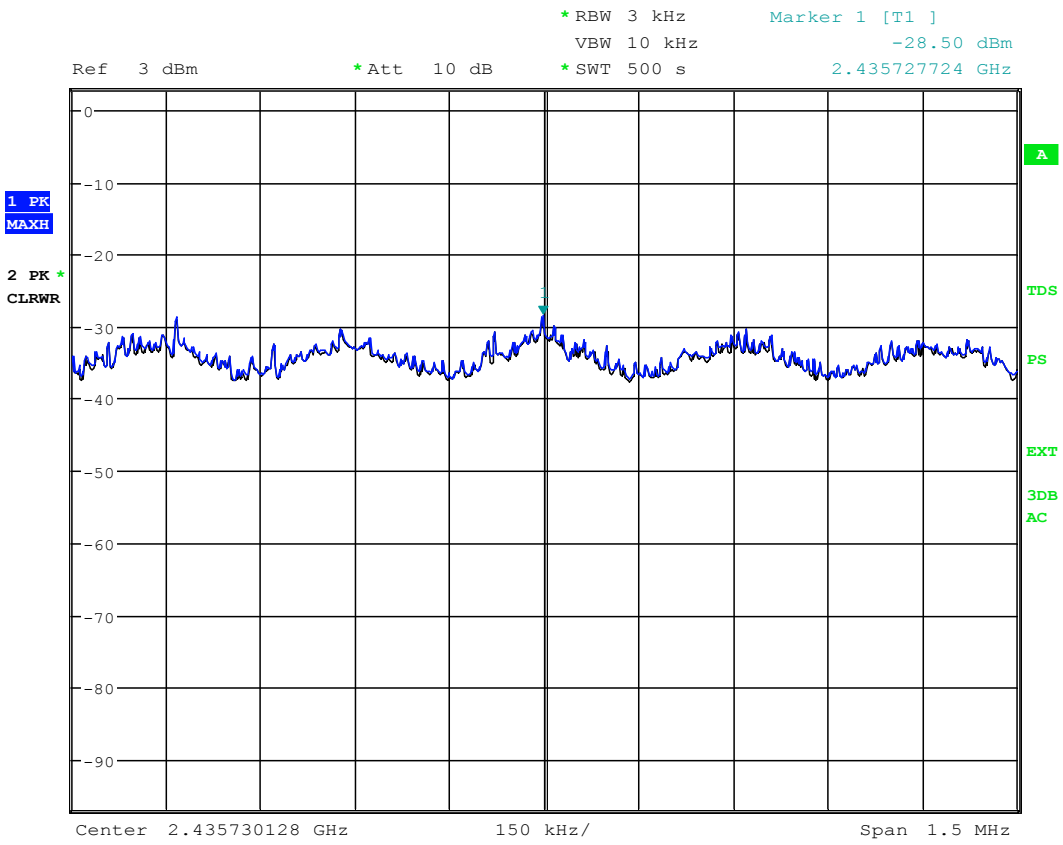


Figure 41 Mode B, Channel mid.

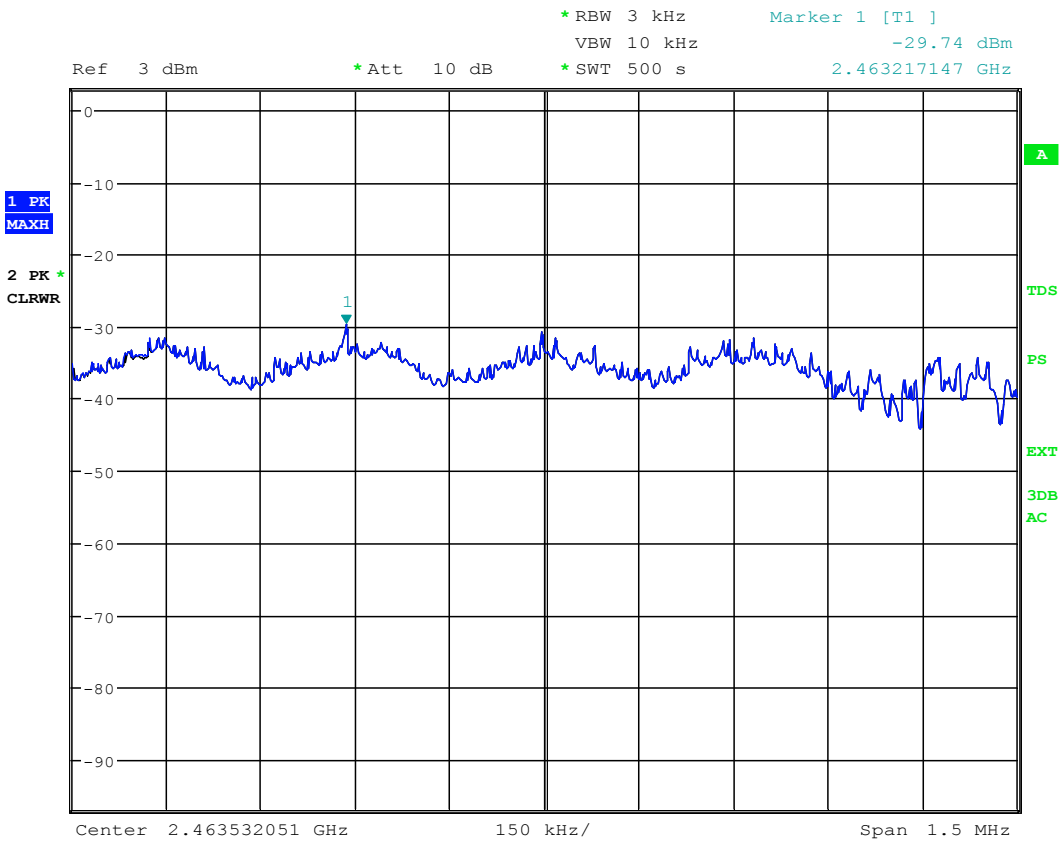


Figure 42 Mode B, Channel high

List of test equipments

Manufacturer	Type	Serial no	Inv. no	
ROHDE & SCHWARZ				
EMI Test receiver	ESIB 26	10093	5358	
EMI Test receiver	ESU 26	100185	8453	
Test software	EMC32	Version 8	-	
DAVIS				
Weather station	Vantage Pro	-	5297	
EMCO				
Antenna (30 MHz - 3 GHz)	3142C	00079895	7788	
Antenna (1 - 18 GHz)	3117	29617	7293	
Antenna (18 - 26.5 GHz)	3160-09	28535	-	
HEWLETT- PACKARD				
Microwave amplifier	83017A	3950M00102	5226	
HUBER-+ SUHNER				
Attenuator	-	-	-	
Cables	104PE	-	-	
DEISEL				
Antenna mast	MA 240 T	240/394/96	5017	
Tilt option	KE 220	220/307/96	-	
Controller	HD 100	100/413/96	5018	
Turntable	DS 420	420/420/96	5015	
WAINWRIGHT				
High Pass Filter 1GHz	WHKX1.0/15G-10SS	5	8267	
High Pass Filter 4 GHz	WHKX4.0/18G-10SS	10	8028	
Band Reject Filter 2.4 GHz Band	WRCG2400/2483-2390/2493-35/10SS		17	8027

(All equipment was within calibration at the time of the test)