

**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 15.249

CANADA RSS-210, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

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

General Requirements and Information for the Certification of Radio Apparatus.

NIE..... :	39402RRF.002
Approved by (name / position & signature)	A. Llamas/RF Lab. Manager
Elaboration date	2013-07-02
Identification of item tested	Speed/ Cadence Sensor Bluetooth Smart
Trademark	Polar
Model and/or type reference	Y6
Serial number	---
Other identification of the product	Commercial name: Polar Speed Sensor Bluetooth Smart Polar Cadence Sensor Bluetooth Smart HW version: 3.0 / SW version: RC-6 FCC ID: INWY6 IC: 6248A-Y6
Features	Bluetooth Low Energy V. 4.0 speed and Cadence profile. 3 V Lithium battery
Description	Polar Speed Sensor Bluetooth Smart is designed to measure speed and distance when cycling. Polar Cadence Sensor Bluetooth Smart is designed to measure cadence, i.e. crank revolutions per minute, when cycling. No other use is intended or implied.
Applicant	POLAR ELECTRO OY.
Address..... :	Professorintie 5, 90440 Kempele, FINLAND
CIF/NIF/Passport..... :	VAT FI02099112
Contact person:	Antti Häggman
Telephone / Fax..... :	+358 8 5202100
e-mail:	antti.haggman@polar.com
Test samples supplier	Same as applicant
Manufacturer	Same as applicant

Test method requested

Standard USA FCC Part 15.249 (10-1-11 Edition).
 CANADA RSS-210 Issue 8 (December 2010).
 CANADA RSS-Gen Issue 3 (December 2010).

Test procedure PERF010

Non-standardized test method N/A

Used instrumentation

		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 R&S ESU40	2012/03	2014/03
12.	RF pre-amplifier Miteq AFS5-04001300-15-10P-6.	2012/07	2014/07
13.	RF pre-amplifier Schaffner CPA 9232.	2011/06	2013/06

Report template No. FDT08_14

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Competences and guarantees

AT4 wireless, S.A. 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, S.A. 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 document PODT000.

Usage of samples

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

Sample M/01 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
39402/22	Speed/ Cadence sensor bluetooth smart with integral antenna (2402 MHz)	Y6	---	27/05/2013
39402/18	Speed/ Cadence sensor bluetooth smart with integral antenna (2440 MHz)	Y6	---	27/05/2013
39402/14	Speed/ Cadence sensor bluetooth smart with integral antenna (2480 MHz)	Y6	---	27/05/2013

Sample M/02 is formed by the following elements:

<u>Control No.</u>	<u>Description</u>	<u>Model</u>	<u>Serial No.</u>	<u>Date of reception</u>
39402/05	Speed/ Cadence sensor bluetooth smart with antenna connector (2402 MHz)	Y6	---	27/05/2013
39402/06	Speed/ Cadence sensor bluetooth smart with antenna connector (2440 MHz)	Y6	---	27/05/2013
39402/08	Speed/ Cadence sensor bluetooth smart with antenna connector (2480 MHz)	Y6	---	27/05/2013

1. Sample M/01 has undergone following test(s).
Radiated tests indicated in appendix A.
2. Sample M/03 has undergone following test(s).
Conducted tests indicated in appendix A.

Testing period

The performed test started on 2013-06-06 and finished on 2013-06-28.

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. = 22.4 °C Max. = 23.7 °C
Relative humidity	Min. = 47.5 % Max. = 50.2 %
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. = 19.0 °C Max. = 19.7 °C
Relative humidity	Min. = 44 % Max. = 45 %
Air pressure	Min. = 1020 mbar Max. = 1020 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. = 26.8 °C Max. = 27.6 °C
Relative humidity	Min. = 44.3 % Max. = 48.0 %
Air pressure	Min. = 1019mbar Max. = 1019 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 Part 15.249 / RSS-210, the item/s 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

FCC PART 15 PARAGRAPH / RSS-210		VERDICT			
		NA	P	F	NM
FCC 15.249 Subclause (a) / RSS-210 A.2.9. (a)	Field strength of fundamental and harmonics emissions.	P			
FCC 15.249 Subclause (d) / RSS-210 A.2.9. (b)	Emissions radiated outside of the specific frequency bands	P			

APPENDIX A: Test result

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 3.0 \text{ Vdc}$$

Type of power supply = DC voltage supplied by Lithium battery

Type of antenna = Integral antenna

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

The test set-up was made in accordance to the general provisions of ANSI C63.4: 2009.

CONDUCTED MEASUREMENTS

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

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.

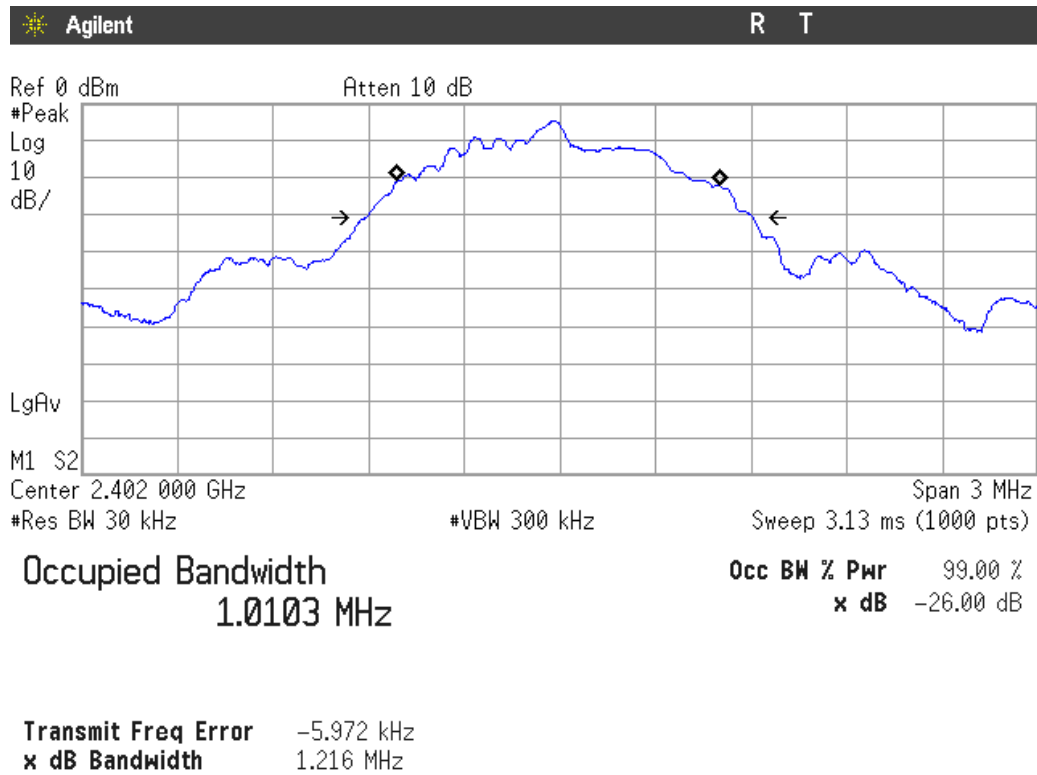
Occupied Bandwidth

RESULTS

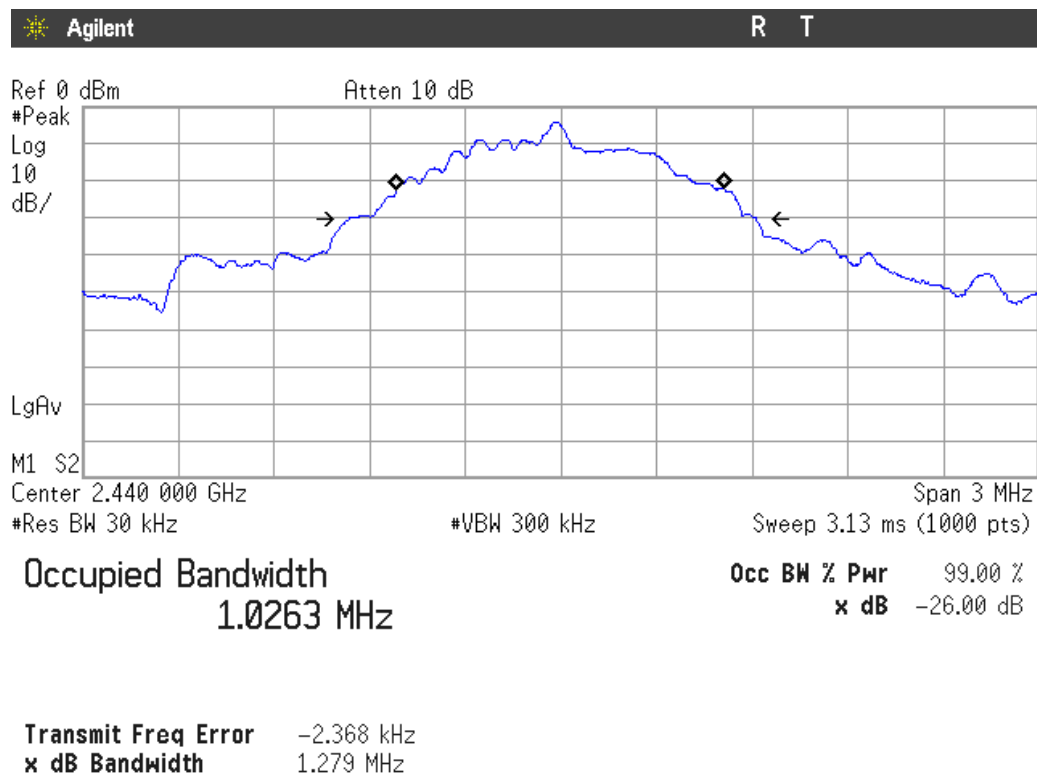
(see next 3 plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% Occupied bandwidth (MHz)	1.010	1.026	1.497
-26 dB Spectrum bandwidth (MHz)	1.216	1.279	1.651
Measurement uncertainty (kHz)	±11		

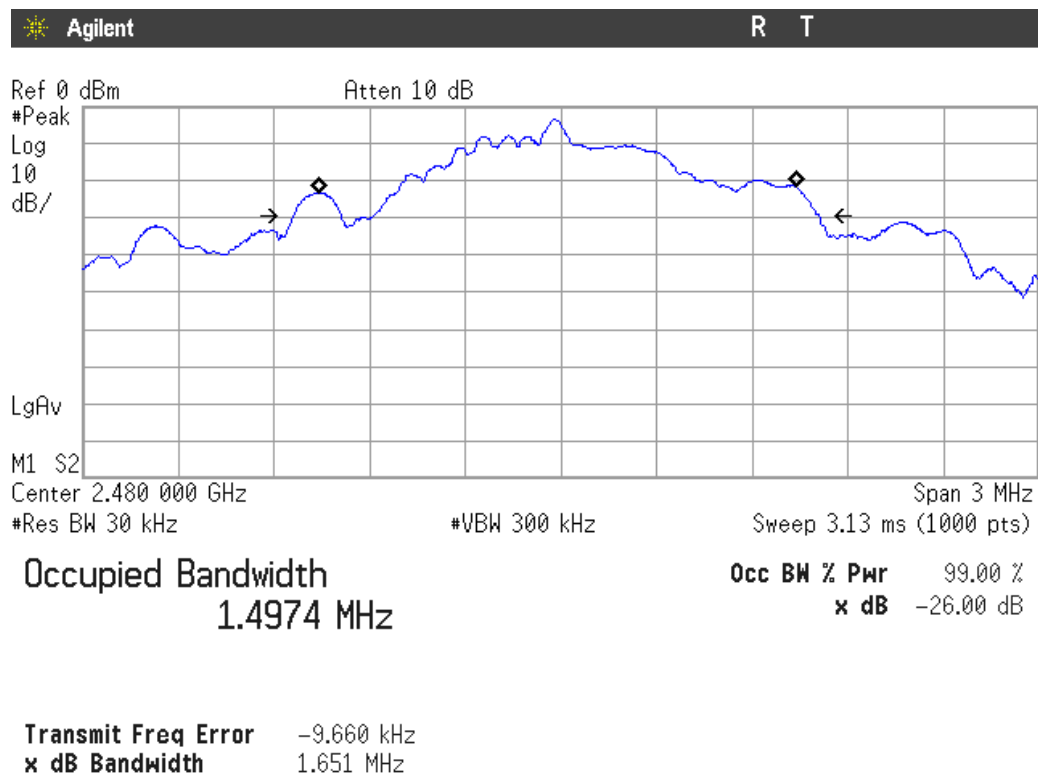
Lowest Channel



Middle Channel



Highest Channel



Section 15.249 Subclause (a). Field strength of Fundamental

SPECIFICATION

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dB μ V/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

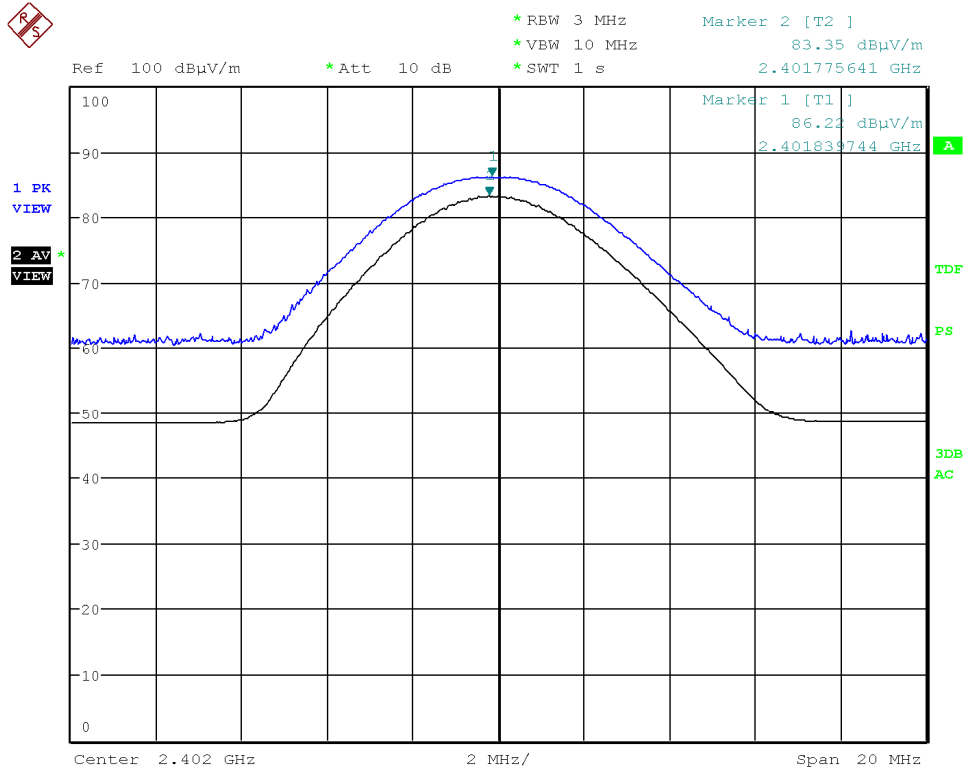
RESULTS

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Field strength (dB μ V/m) average	83.35	85.45	86.67
Field strength (dB μ V/m) peak	86.22	88.33	89.48
Measurement uncertainty (dB)	±4.0		

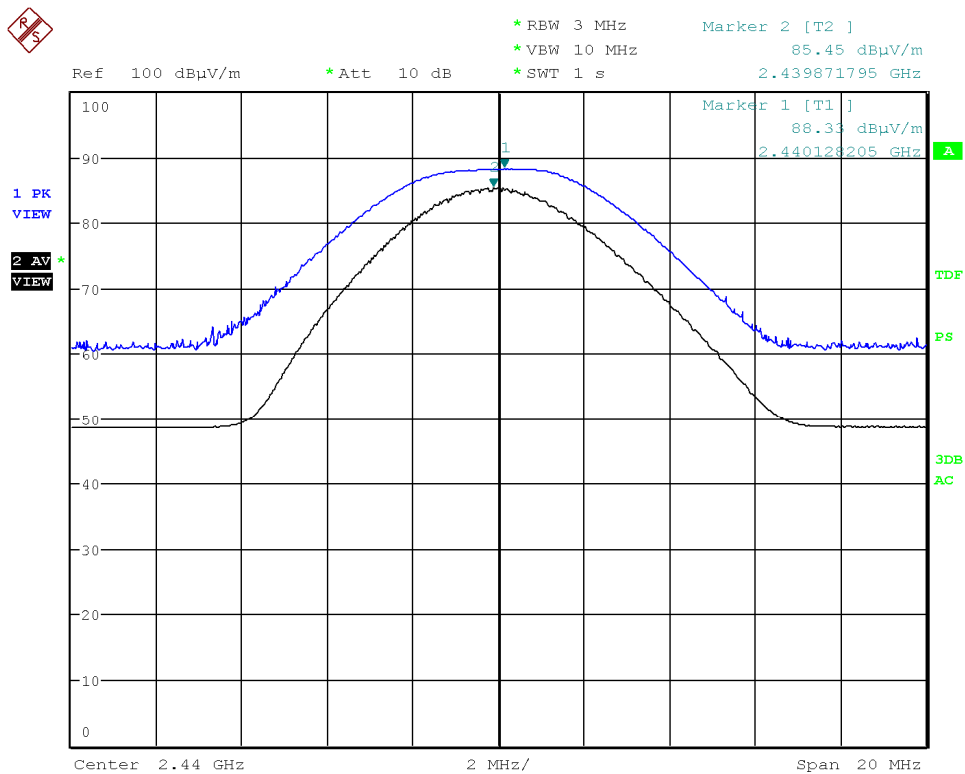
Verdict: PASS

FIELD STRENGTH

Lowest Channel



Middle Channel



Section 15.249 Subclause (a) and (d). Radiated emissions (Transmitter)

SPECIFICATION

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics ($\mu\text{V/m}$)	Field strength of harmonics ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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

Whichever is the lesser attenuation

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 analyser. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Frequency range 30 MHz-1000 MHz.

No spurious signals were found at less than 20 dB respect to the limit.

Frequency range 1 GHz-25 GHz

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
4.804725	V	Peak	49.17	± 4.0
4.804725	V	Average	41.24	± 4.0

Maximum level inside the restricted bands 2431-2439MHz and 2483.5-2500 MHz:

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.38872	H	Peak	45.05	± 4.0
2.38872	H	Average	33.95	± 4.0
2.48355	H	Peak	45.50	± 4.0
2.48355	H	Average	33.97	± 4.0

2. CHANNEL: MIDDLE (2440 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
4.87988	V	Peak	46.14	± 4.0
4.87988	V	Average	42.54	± 4.0

Maximum level inside the restricted bands 2431-2439MHz and 2483.5-2500 MHz:

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.38976	H	Peak	45.16	± 4.0
2.38976	H	Average	33.92	± 4.0
2.488268	H	Peak	46.06	± 4.0
2.488268	H	Average	34.59	± 4.0

3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
4.95975	V	Peak	44.75	± 4.0
4.95975	V	Average	37.12	± 4.0

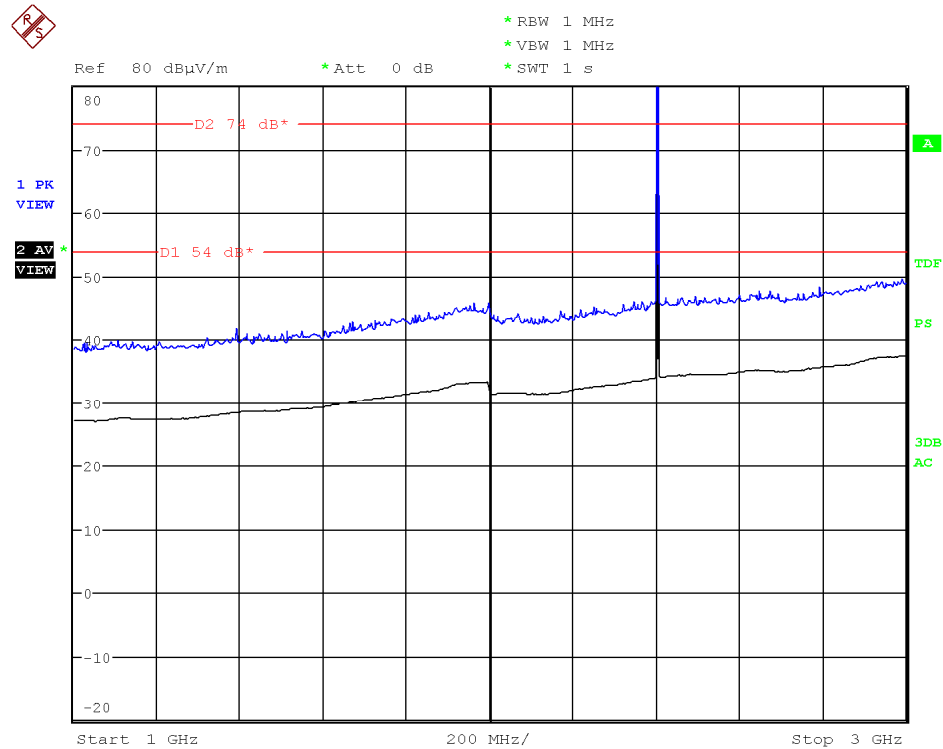
Maximum level inside the restricted bands 2431-2439MHz and 2483.5-2500 MHz:

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.386720	H	Peak	45.12	± 4.0
2.386720	H	Average	33.91	± 4.0
2.48350	H	Peak	63.36	± 4.0
2.48350	H	Average	45.90	± 4.0

Verdict: PASS

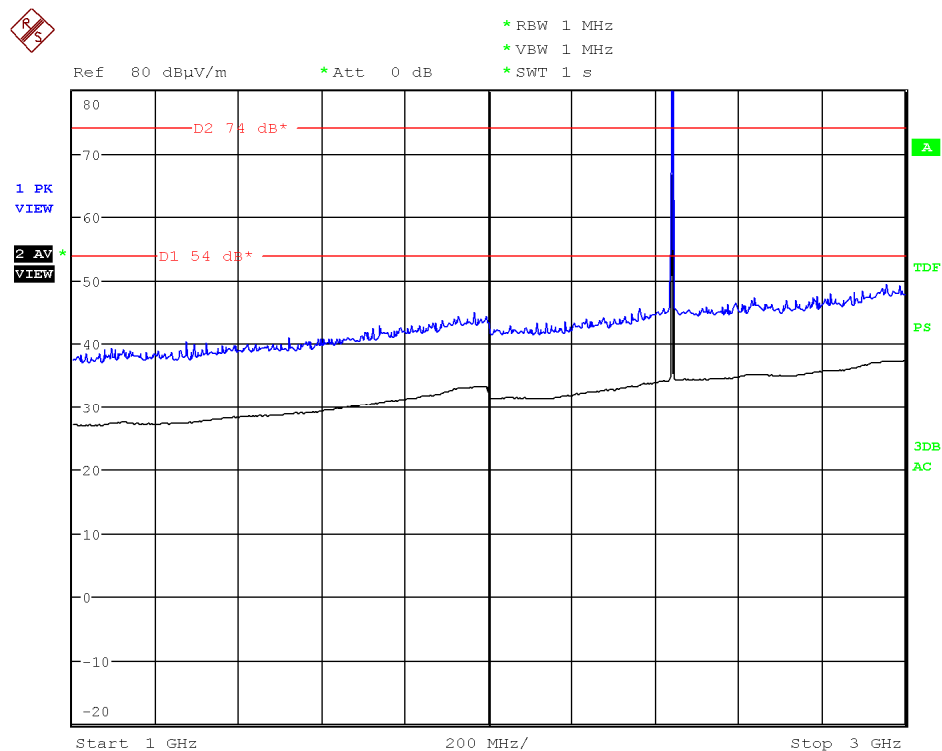
FREQUENCY RANGE 1 GHz - 3 GHz.

CHANNEL: Lowest



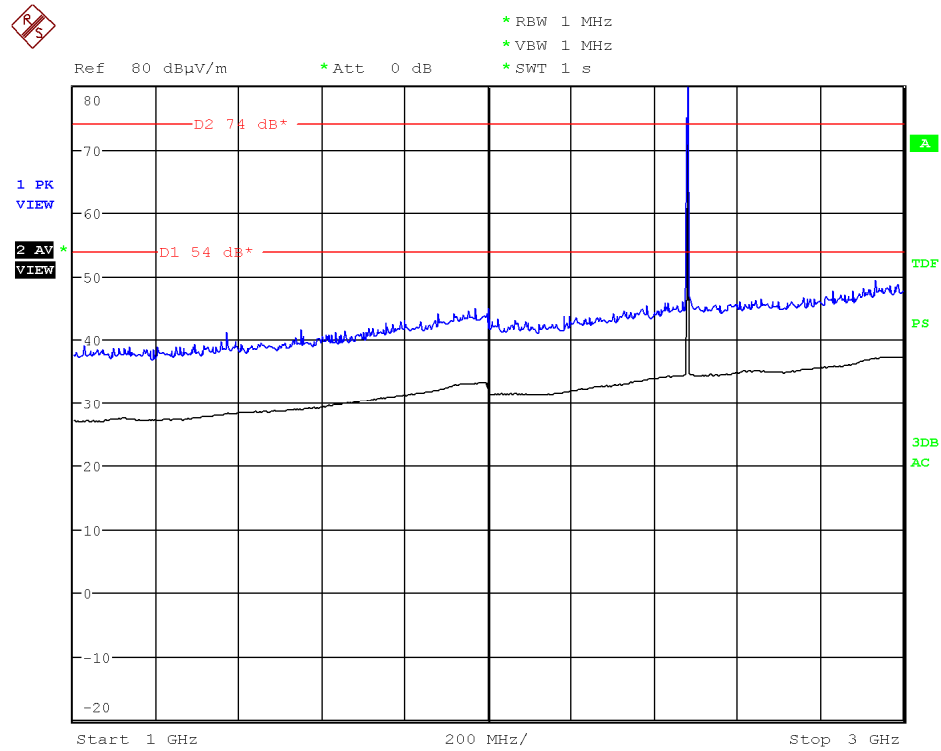
Note: The peak shown in the plot is the carrier frequency.

CHANNEL: Middle



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

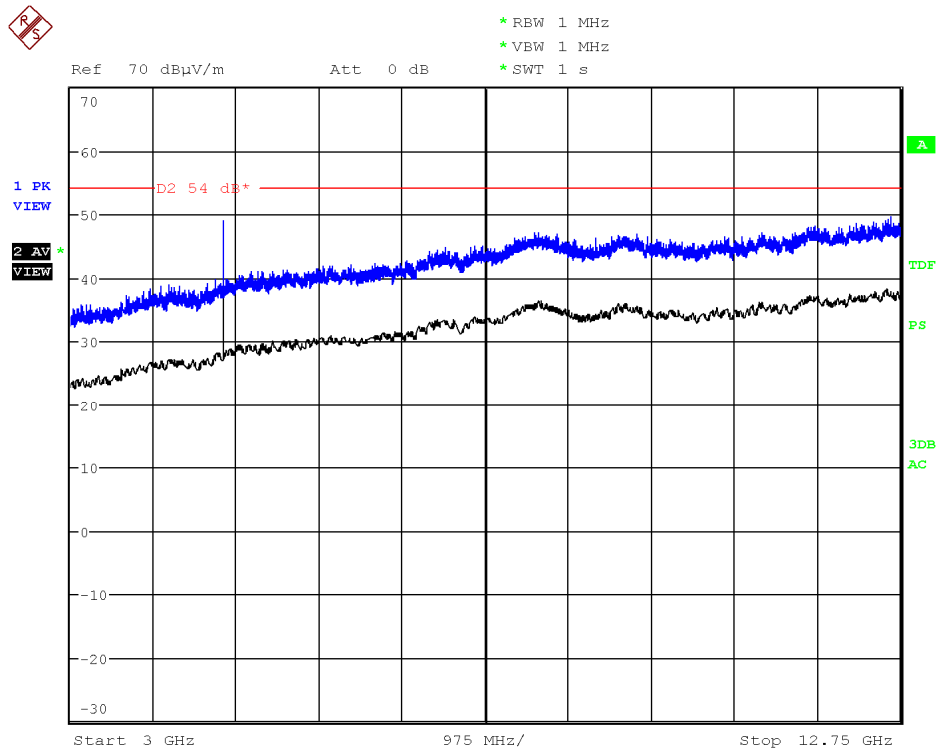
CHANNEL: Highest



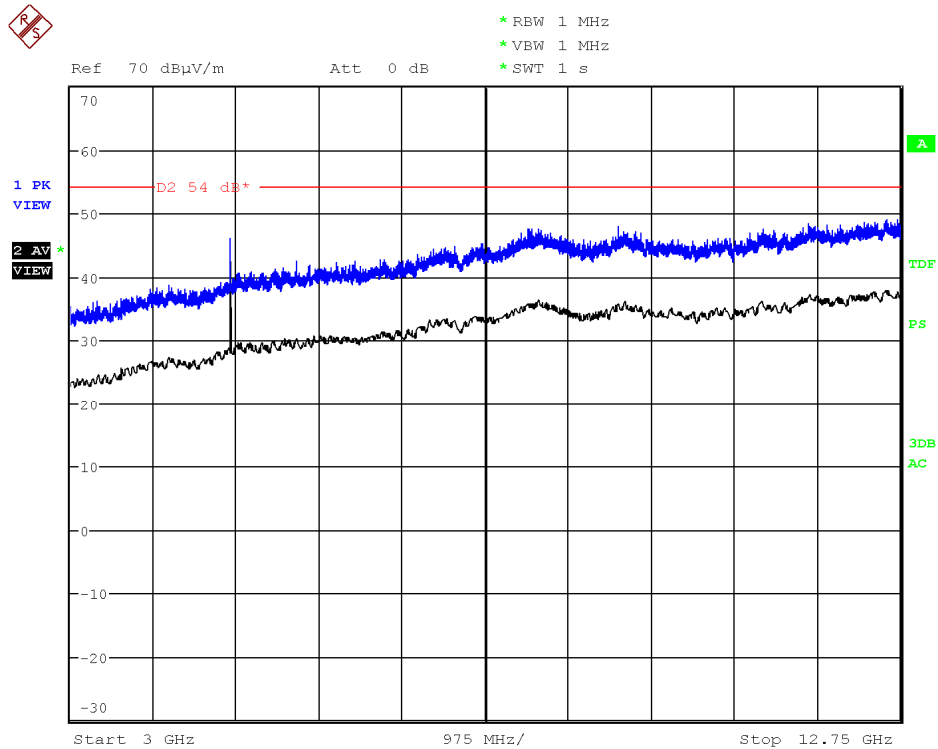
Note: The peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 3 GHz to 12.75 GHz.

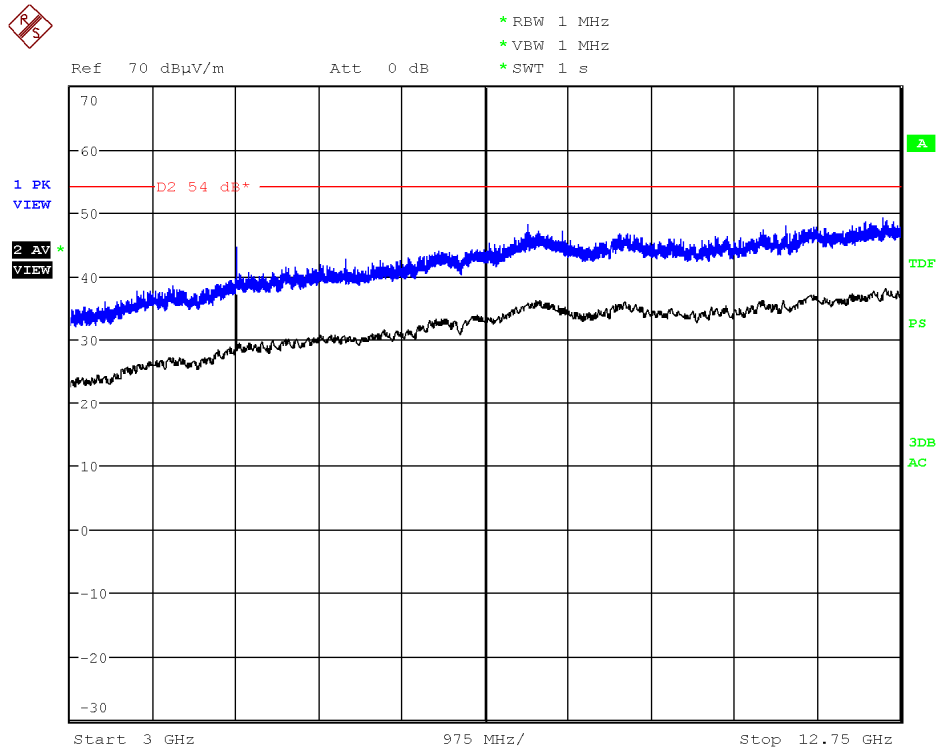
CHANNEL: Lowest



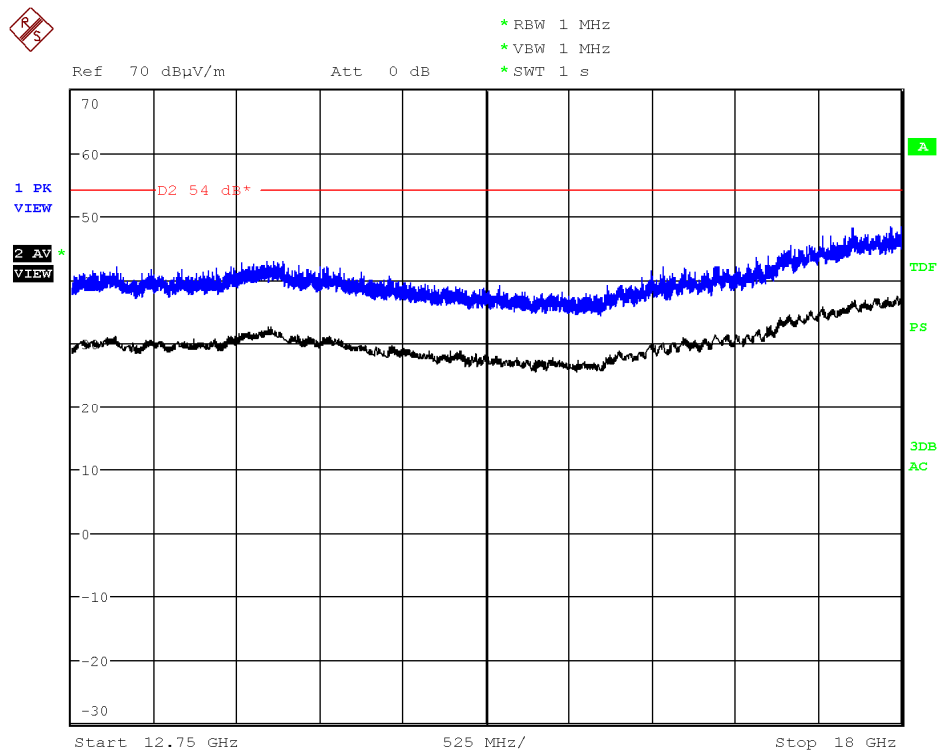
CHANNEL: Middle



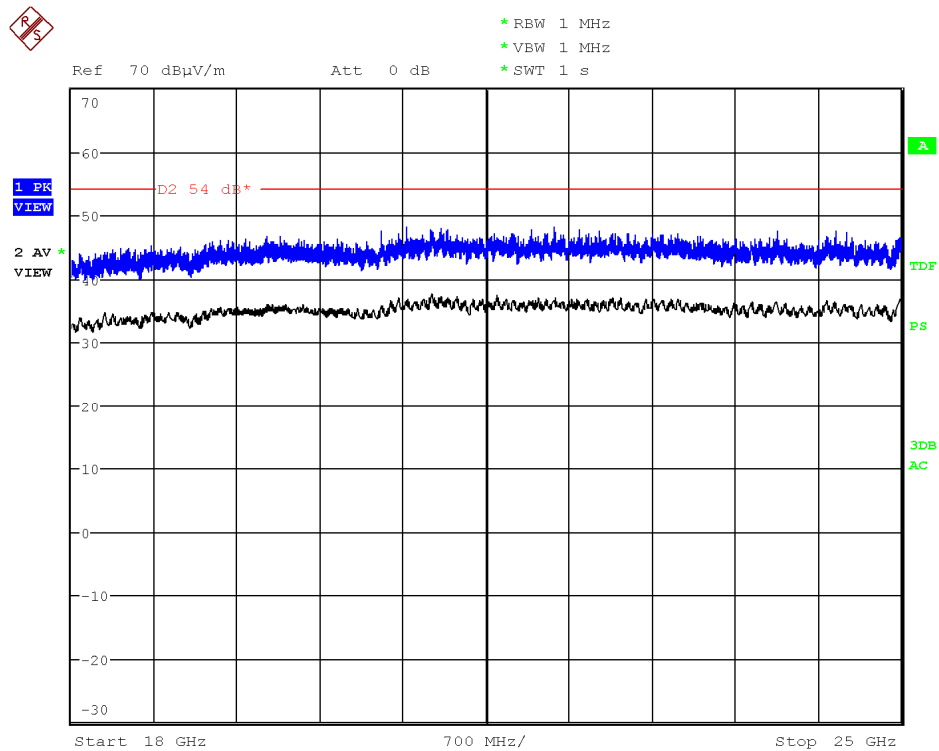
CHANNEL: Highest



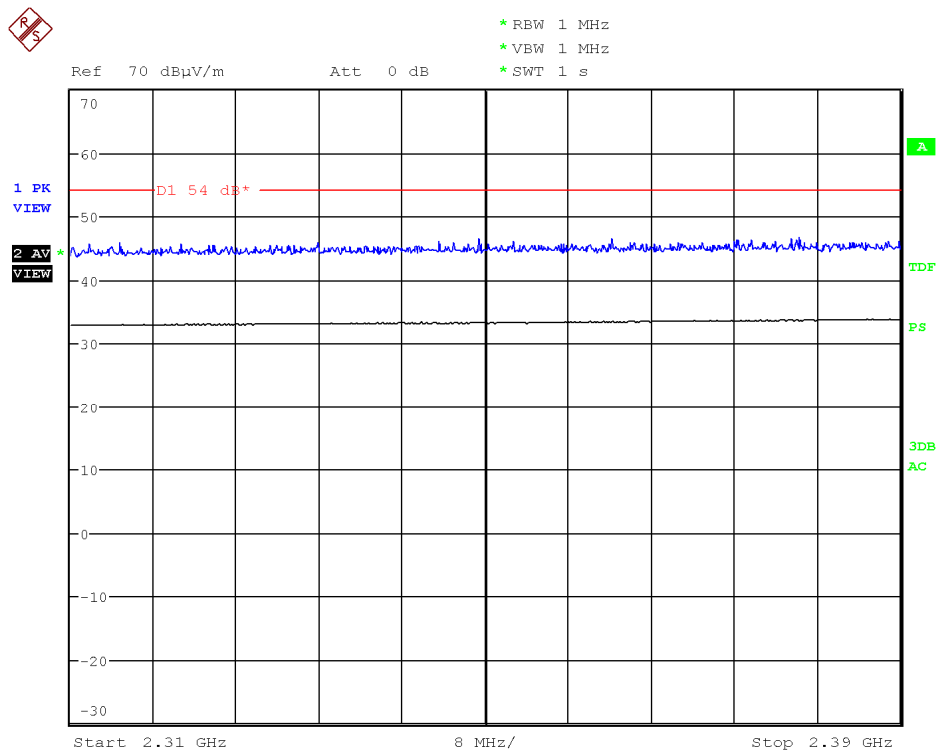
FREQUENCY RANGE 12.75 GHz to 18 GHz.



FREQUENCY RANGE 18 GHz to 25 GHz.

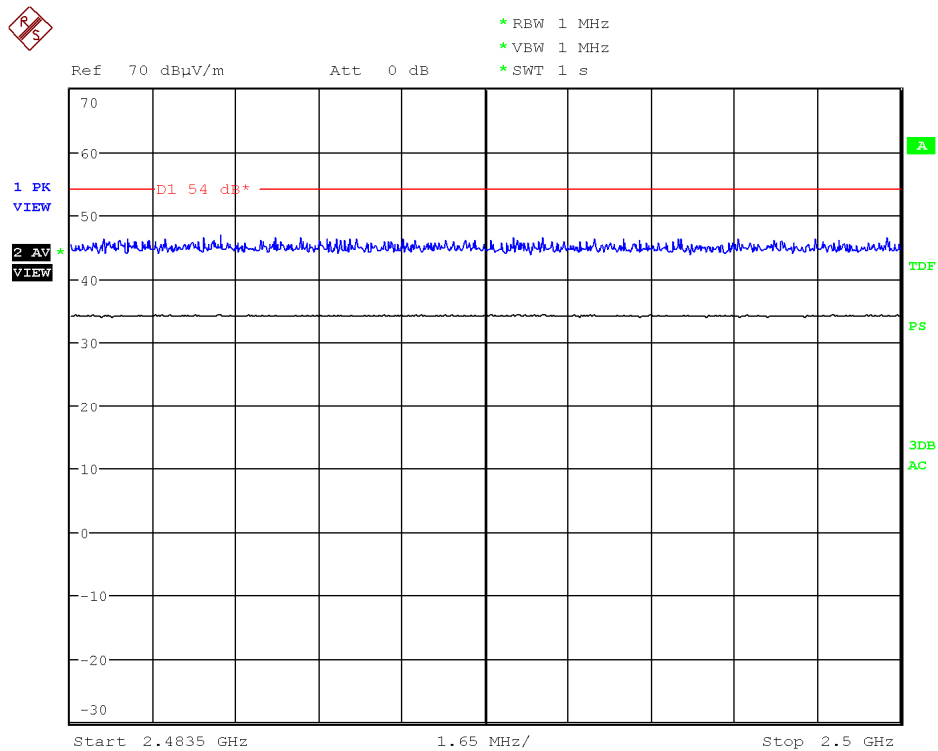


CHANNEL: Highest



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

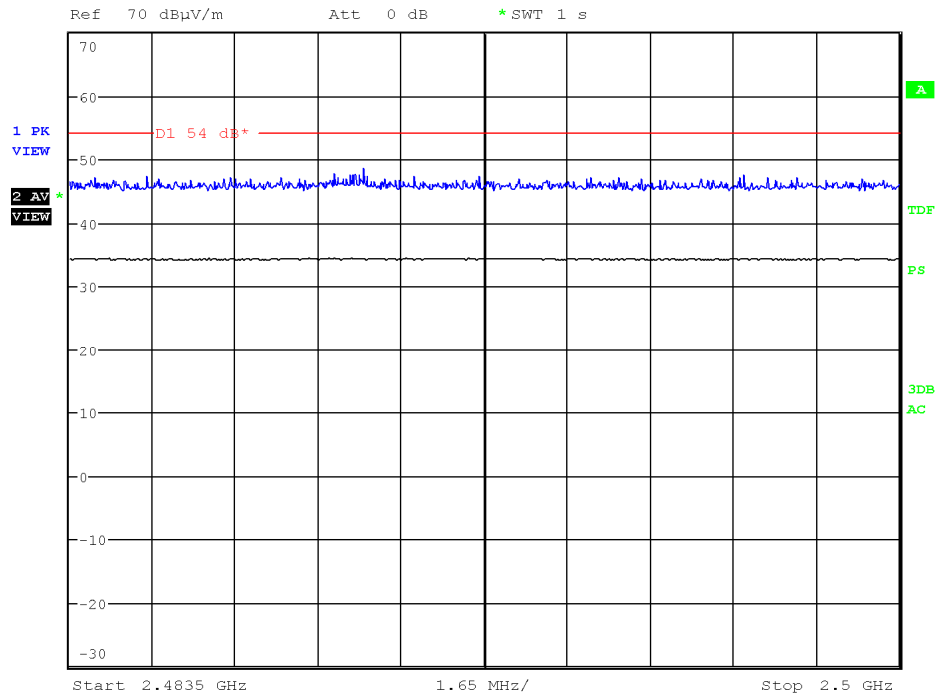
CHANNEL: Lowest



CHANNEL: Middle



* RBW 1 MHz
 * VBW 1 MHz
 * SWT 1 s



CHANNEL: Highest



* RBW 1 MHz
 * VBW 1 MHz
 * SWT 1 s

