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REGISTRATION
NUMBER: 905266

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REGISTRATION
NUMBER IC 4621

**CENTRO DE
TECNOLOGÍA DE LAS
COMUNICACIONES, S.A.**

Parque Tecnológico de Andalucía,
c/Severo Ochoa nº 2
29590 Campanillas/ Málaga/ España
Tel. 952 61 91 00 - Fax 952 61 91 13
MÁLAGA, C.I.F. A29 507 456
Registro Mercantil Tomo 1169 Libro 82
Folio 133 Hoja MA3729

TEST REPORT

Report No.: 28119RET.101

TEST NAME: FCC PART 15.249 RADIATED TESTING FOR 2.4 GHz BAND RADIO
DEVICE

Product : Cordless keyboard
Trade Mark : Logitech
Model/type Ref. : Y-RBN90
Manufacturer : Logitech Technology Co., LTD
Requested by : Logitech Inc.
Other identification of the product : FCC ID: DZLYRBN90
IC: 1807B-YRBN90
Standard(s) : USA FCC Part 15.249, 15.205, 15.109
CANADA RSS-210

This test report includes 2 annexes and therefore the total number of pages is 40.

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Date: 2008-07-03	Test operator J.M. Fortes 	Approved by: Date: 2008-07-03 A. Llamas RF Lab. Manager 	Page: 1 of 8 AGY-700-002451.001
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ANNEXES

ANNEX A. TEST RESULTS

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1. COMPETENCE AND GUARANTEES

Centro de Tecnología de las Comunicaciones (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.

Centro de Tecnología de las Comunicaciones (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 4621.

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

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

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

2. GENERAL CONDITIONS

1. This report only refers to the item that has undergone the test.
2. This report does not constitute or imply by 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 written approval of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of AT4 wireless and the Accreditation Bodies.

3. CHARACTERISTICS OF THE TEST

3.1 TEST REQUESTED

1. Measurements for short range radio equipment operating in the 2400 MHz -2483.5 MHz band, according to FCC Part 15.249.

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3.2 REQUIREMENTS AND METHOD

1. FCC parts 15.33, 15.35, 15.249, 15.205, 15.109.

The testing was performed according to the procedure in ANSI C63.4: 2003. Radiated testing was performed in AT4 wireless's semi-anechoic chamber. This site has been fully described in a report submitted to the FCC and was accepted in a letter dated July 25, 2002.

The instrumentation used to perform the testing is listed below:

1. Semianechoic Absorber Lined Chamber IR 11. BS.
2. Control Chamber IR 12.BC.
3. Antenna mast EM 1072 NMT.
4. Rotating table EM 1084-4. ON.
5. Multi device controller ETS 2090.
6. Hybrid Bilog antenna Sunol Sciences Corporation JB6.
7. Antenna tripod EMCO 11968C.
8. Double-ridge Guide Horn antenna 1-18 GHz HP 11966E.
9. Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J.
10. RF pre-amplifier Miteq JS4-12002600-30-5A.
11. Semianechoic Absorber Lined Chamber IR 11. BS.
12. RF pre-amplifier Miteq AFS5-04001300-15-10P-6.
13. Spectrum analyzer R&S ESIB 26.
14. Spectrum analyzer R&S ESU 40.
15. RF pre-amplifier Schaffner CPA 9231.
16. DC power supply R&S NGPE 40/40.

4. IDENTIFICATION DATA SUPPLIED BY THE APPLICANT

Identification data in this section has been supplied by the client.

4.1 APPLICANT

Name / Company: Logitech Inc.

V.A.T.: Not provided

Address: 6505 Kaiser Drive **P.C.:** CA 94555 **City:** Fremont

Country: USA

Telephone: +1-510-795 85 00 **Fax:** +1-510-792 89 01

4.2 REPRESENTATIVE

Name: Bharat Shah

4.3 TEST SAMPLES SUPPLIER

Name or Company: Logitech Europe, S.A.

V.A.T.: 203037

Address: Z.I. Moulin du Choc D **City:** Romanel Sur Morges

Postal code: 1122 **Country:** Switzerland

Telephone: +41 21 863 50 67 **Fax:** +41 21 863 29 01

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

4.4 IDENTIFICATION OF ITEM/ITEMS TESTED

Product: Cordless keyboard

Trade mark: Logitech **Model:** Y-RBN90

Manufacturer: Logitech Technology Co., LTD

Country of manufacture: China

Manufacture site: No. 3, Songshan Road, Suzhou New District

Description: Cordless keyboard for PC, Laptop operating in the 2.4 – 2.4835 GHz band

5. USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS

5.1 USAGE OF SAMPLES

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>
28119/04	Cordless keyboard with integral antenna	Y-RBN90	C/N: 00015	12/06/2008

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>
28119/01	Cordless keyboard with antenna connector	Y-RBN90	C/N: 00004	12/06/2008

1. Sample M/01 has undergone following test(s).
Radiated tests indicated in annex A.
2. Sample M/02 has undergone following test(s).
All tests indicated in annex A, except radiated tests.

5.2 PERIOD OF TESTING

The performed test started on 2008-06-16 and finished on 2008-06-23.

The tests as detailed in this report have been performed at AT4 wireless.

5.3 ENVIROMENTAL CONDITIONS

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

Temperature	Min. = 21 °C Max. = 22 °C
Relative humidity	Min. = 60 % Max. = 62 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

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

Temperature	Min. = 21 °C Max. = 22 °C
Relative humidity	Min. = 60 % Max. = 62 %
Air pressure	Min. = 1020 mbar Max. = 1020 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k Ω
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 °C Max. = 24 °C
Relative humidity	Min. = 51 % Max. = 52 %
Air pressure	Min. = 1021 mbar Max. = 1021 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 k Ω
Reference resistance to earth	< 0,5 Ω

6. TEST RESULTS

Abbreviations used in the VERDICT column of the following tables are:

P	Pass
F	Fail
NA	not applicable
NM	not measured

FCC PART 15 PARAGRAPH	VERDICT			
	NA	P	F	NM
15.249 Subclause (a). Field strength of emissions		P		
15.249 Subclause (d). Emissions radiated outside of the specific frequency bands		P		
15.109. Radiated emission limits for receiver		P		

7. REMARKS AND COMMENTS

None.

8. SUMMARY

Based on the results of the performed test, stated in annex A the item under test is **IN COMPLIANCE** with the specifications listed in section 3.1 "TEST REQUESTED".

NOTE: The results presented in this Test Report apply only to the particular item under test declared in section 4.4 "IDENTIFICATION OF ITEM/ITEMS TESTED" of this document, as presented for test on the date(s) declared in section 5, "USAGE OF SAMPLES, PERIOD OF TESTING AND ENVIRONMENTAL CONDITIONS".

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ANNEX A TEST RESULTS

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TEST CONDITIONS

Power supply (V):

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

Type of power supply = DC voltage supplied by 2 x type AA batteries

Type of antenna = Integral antenna

Maximum Declared Gain for antenna = 0 dBi

Operating Temperature Range (°C):

$$T_n = +15 \text{ to } +35$$

TEST FREQUENCIES:

Lowest channel: 2405 MHz

Close to middle channel: 2447 MHz

Highest channel: 2474 MHz

The test set-up was made in accordance to the general provisions of ANSI C63.4: 2003.

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.

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Section 15.215 Subclause (c) (1). 20 dB Bandwidth

RESULTS

20 dB Bandwidth (see next 3 plots).

	Lowest frequency 2405 MHz	Middle frequency 2447 MHz	Highest frequency 2474 MHz
20 dB Spectrum bandwidth (kHz)	1330.13	1338.14	1346.15
Measurement uncertainty (kHz)	± 11		

20 dB BANDWIDTH.

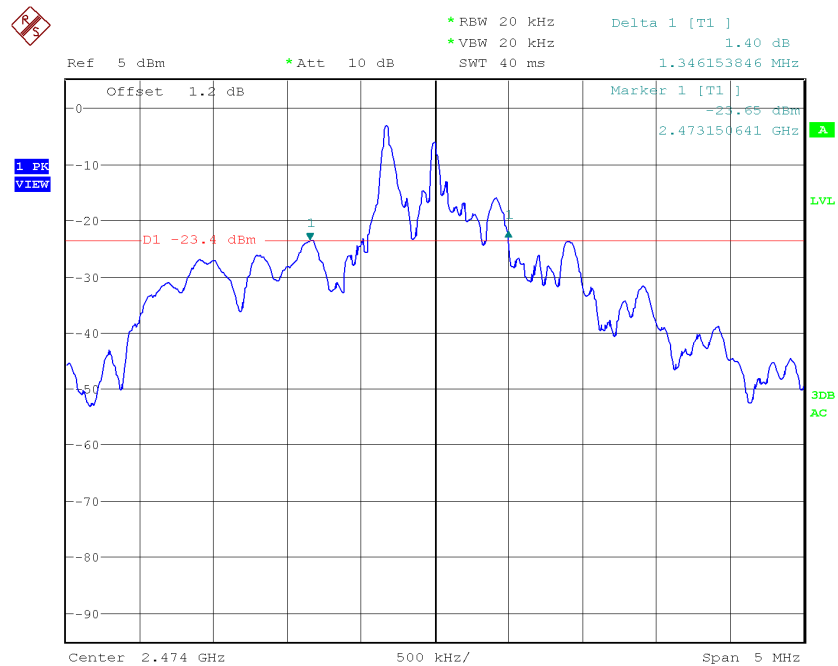
Lowest Channel: 2405 MHz.



Middle Channel: 2447 MHz.



Highest Channel: 2474 MHz.



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.

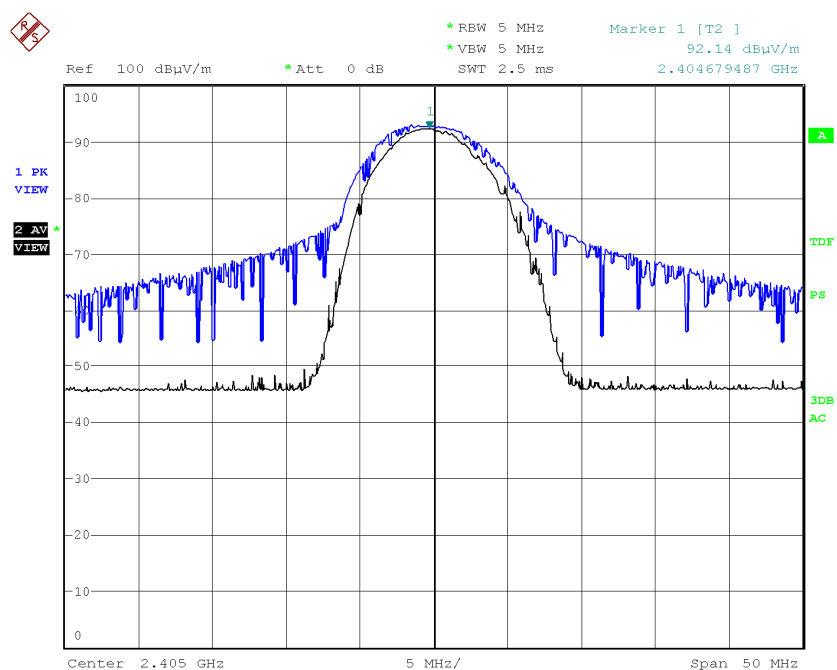
RESULTS

	Lowest frequency 2405 MHz	Middle frequency 2447 MHz	Highest frequency 2474 MHz
Field strength (dB μ V/m) average	92.14	91.30	90.93
Field strength (dB μ V/m) peak	92.98	91.61	91.50
Measurement uncertainty (dB)	± 4.0		

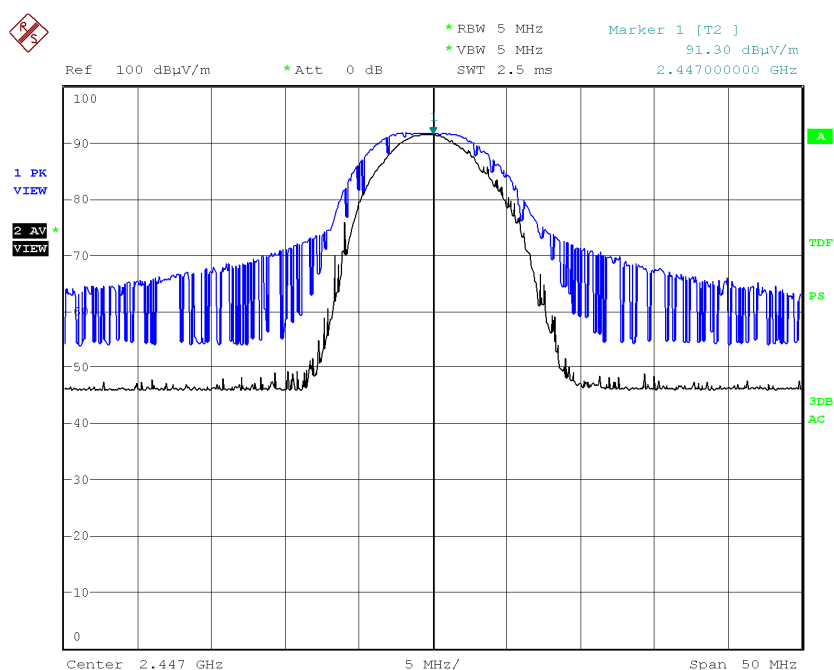
Verdict: PASS

FIELD STRENGTH

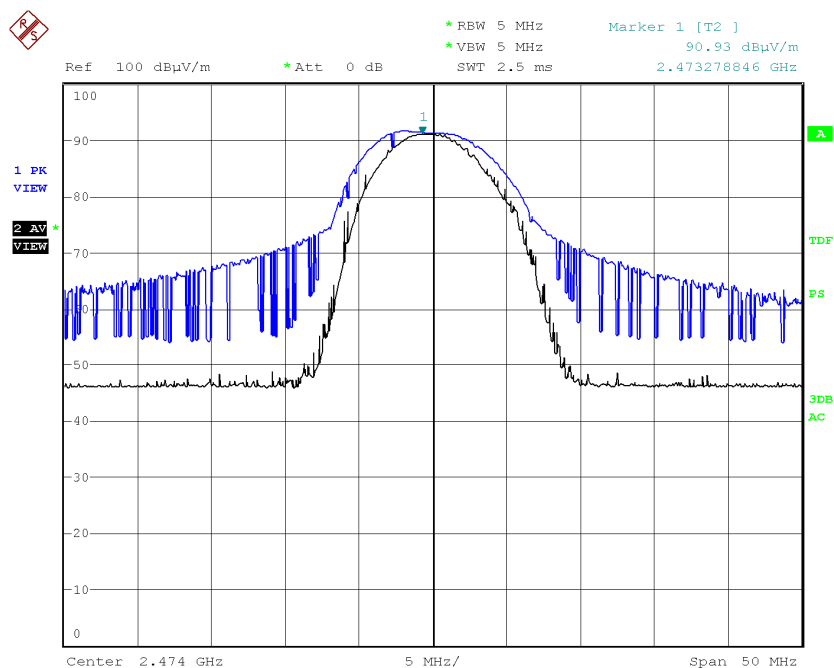
Lowest Channel: 2405 MHz.



Middle Channel: 2447 MHz.



Highest Channel: 2474 MHz.



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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 fundamental ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
902 - 928	500	53.98	3
2400 – 2483.5	500	53.98	3
5725 - 5875	500	53.98	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	$2400/\text{F(kHz)}$	-	300
0.490-1.705	$24000/\text{F(kHz)}$	-	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.

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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.

The spurious levels detected do not depend on the selected operating channel.

Spurious levels operating (radiated) closest to limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Attenuation below the fundamental in highest channel (worst case) (dB)	Measurement Uncertainty (dB)
202.2545	H	Peak	28.30	63.20	± 3.8
205.6814	H	Peak	30.44	61.06	± 3.8
210.2505	H	Peak	30.42	61.08	± 3.8
213.6774	H	Peak	30.57	60.93	± 3.8
218.2465	H	Peak	30.09	61.41	± 3.8
221.6733	H	Peak	30.11	61.39	± 3.8
226.2425	H	Peak	29.65	61.85	± 3.8
230.2405	H	Peak	29.60	61.90	± 3.8
234.2385	H	Peak	28.60	62.90	± 3.8

Frequency range 1 GHz-25 GHz

1. CHANNEL: LOWEST (2405 MHz).

Spurious levels (radiated).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
4810.1282	H	Peak	40.25	± 4.0
4810.1282	H	Average	32.06	± 4.0
7214.8654	H	Peak	53.01	± 4.0
7214.8654	H	Average	50.08	± 4.0
9619.9038	H	Peak	50.05	± 4.0
9619.9038	H	Average	43.98	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

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2. CHANNEL: MIDDLE (2447 MHz).

Spurious levels (radiated).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
4893.9679	H	Peak	40.55	± 4.0
4893.9679	H	Average	33.01	± 4.0
7340.9038	H	Peak	54.44	± 4.0
7340.9038	H	Average	51.57	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

3. CHANNEL: HIGHEST (2474 MHz).

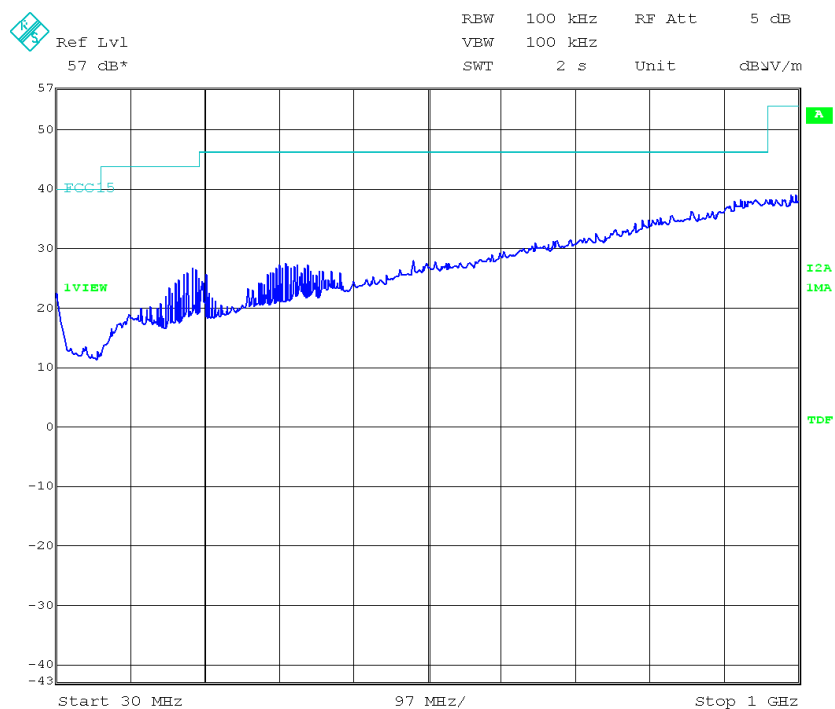
Spurious levels (radiated).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
4947.9167	H	Peak	40.64	± 4.0
4947.9167	H	Average	34.09	± 4.0
7421.9038	H	Peak	53.20	± 4.0
7421.9038	H	Average	50.15	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

Verdict: PASS

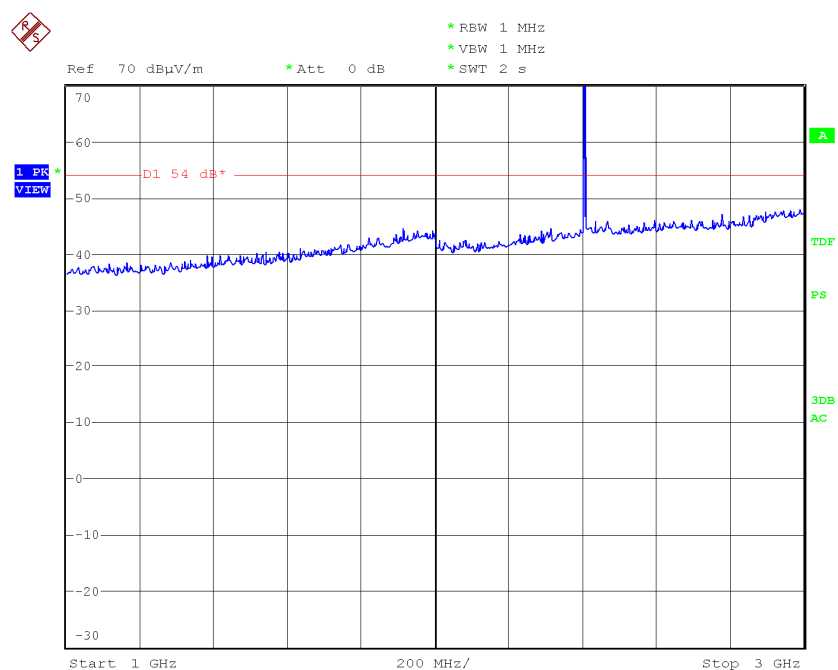
FREQUENCY RANGE 30 MHz-1000 MHz.



(This plot is valid for all three channels).

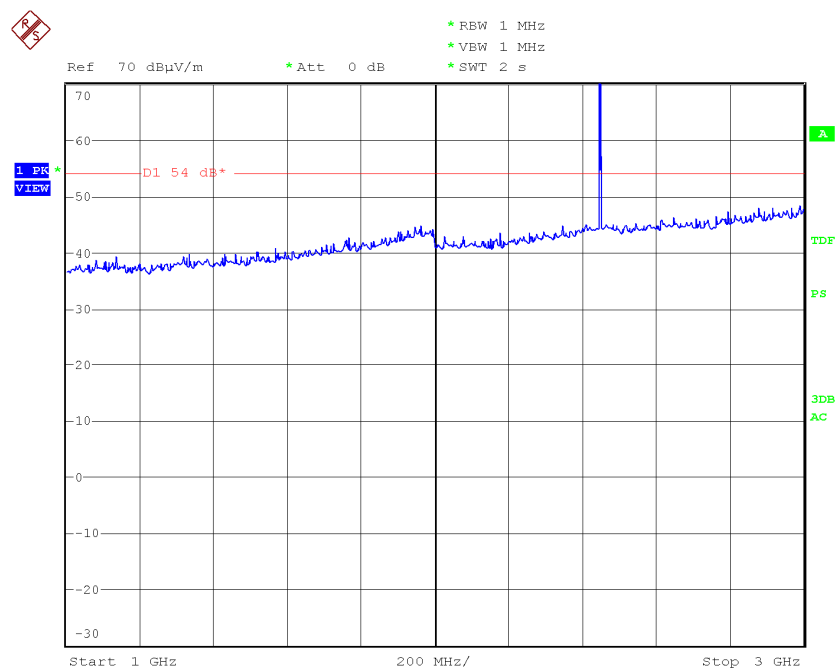
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2402 MHz).



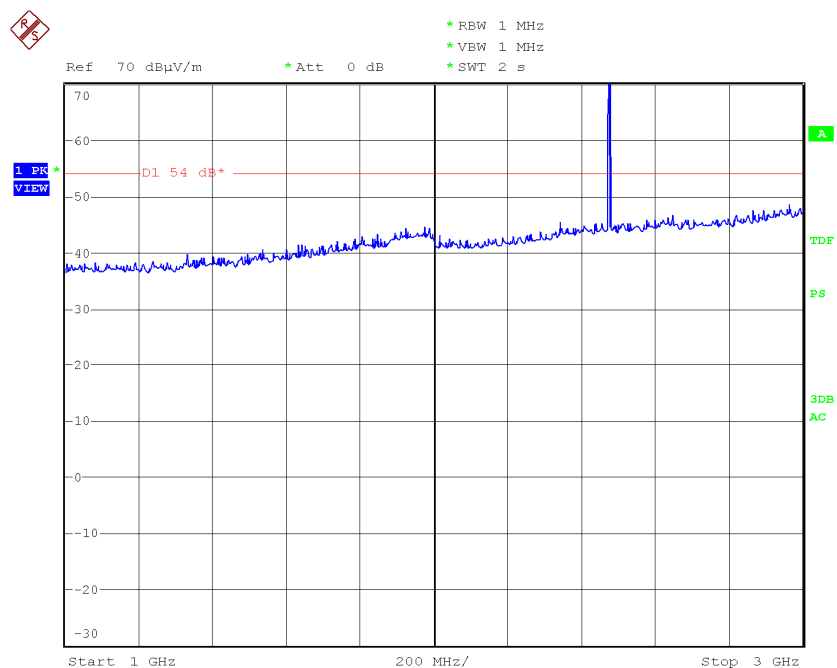
Note: The peak shown in the plot is the carrier frequency.

CHANNEL: Middle (2448 MHz).



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

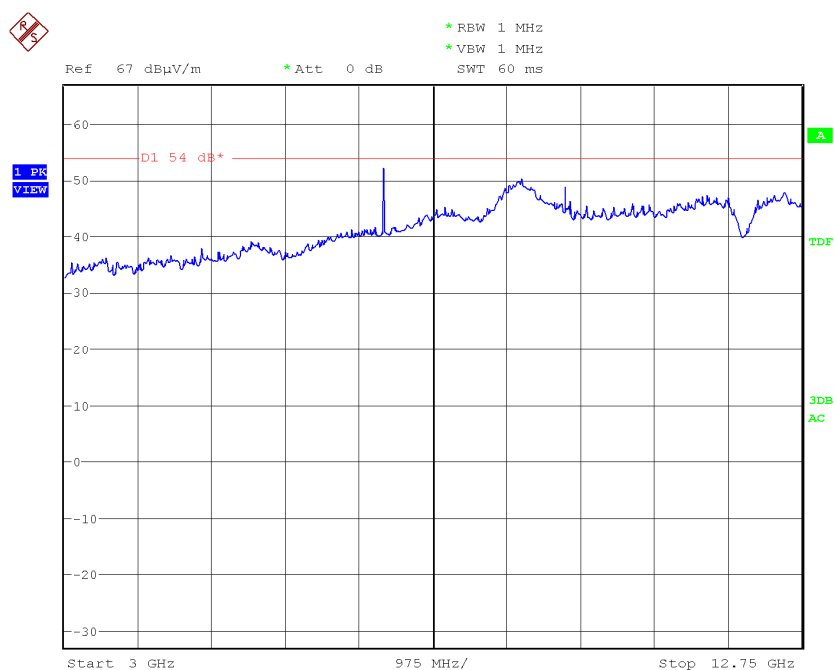
CHANNEL: Highest (2479 MHz).



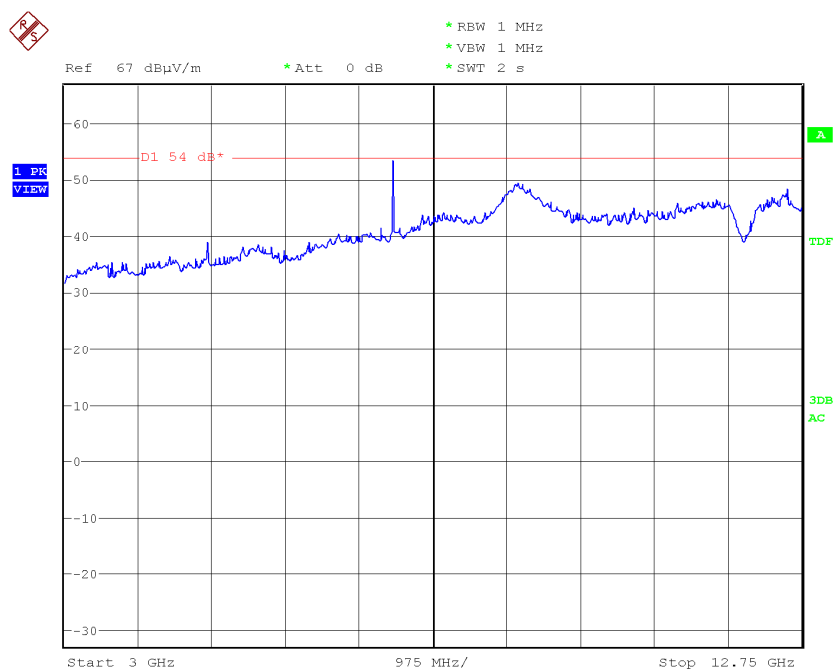
Note: The peak shown in the plot is the carrier frequency.

FREQUENCY RANGE 3 GHz to 12.75 GHz.

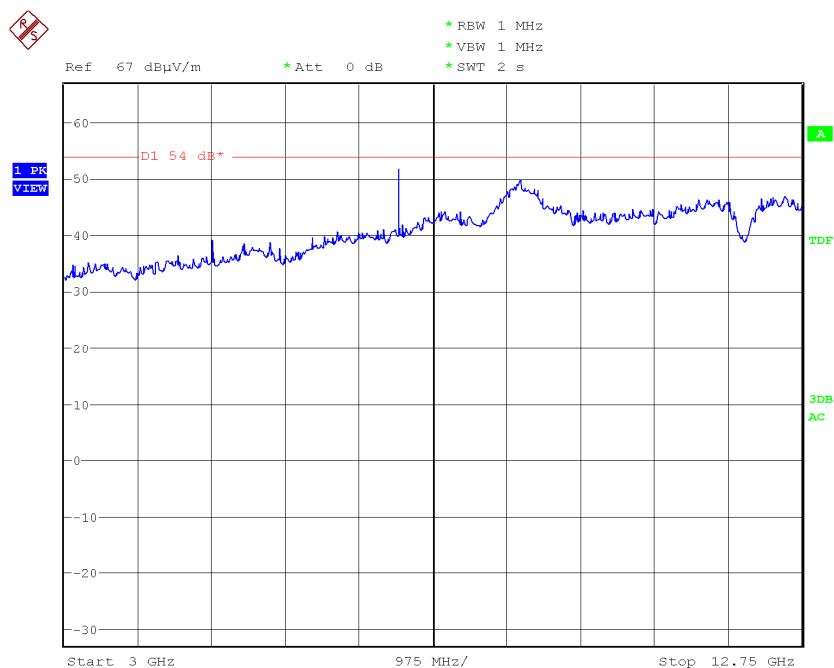
CHANNEL: Lowest (2405 MHz).



CHANNEL: Middle (2447 MHz).



CHANNEL: Highest (2474 MHz).



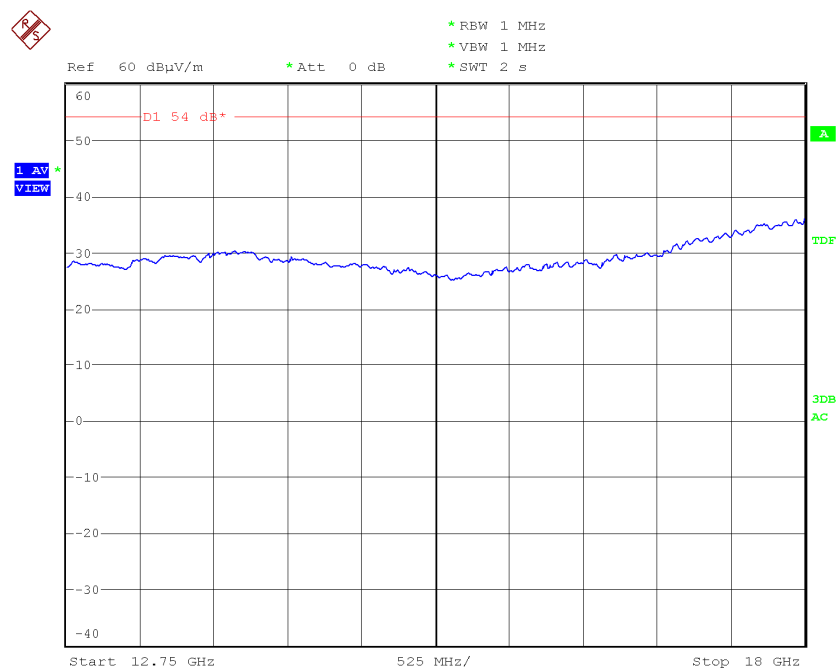
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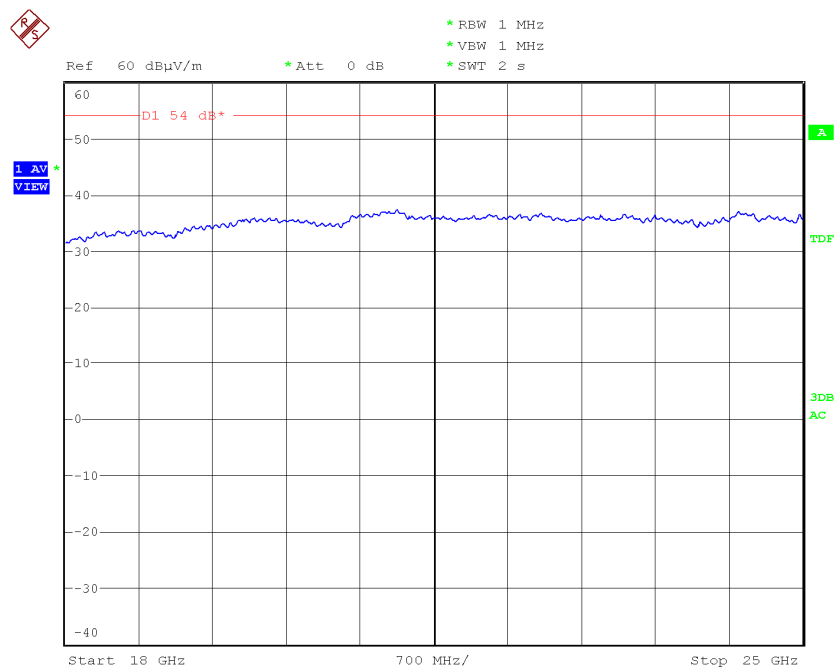
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FREQUENCY RANGE 12.75 GHz to 18 GHz.



(This plot is valid for all three channels).

FREQUENCY RANGE 18 GHz to 25 GHz.



(This plot is valid for all three channels).

Section 15.109. Receiver spurious radiation

SPECIFICATION

The field strength shall not exceed the following values:

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

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

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Frequency range 30 MHz-1000 MHz.

No spurious signals were found in the three operating channels.

Frequency range 1 GHz-25 GHz

1. CHANNEL: LOWEST (2405 MHz).

Spurious levels (radiated).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2750.7853	H	Peak	39.32	± 4.0
2750.7853	H	Average	35.08	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

2. CHANNEL: MIDDLE (2447 MHz).

Spurious levels (radiated).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2798.7980	H	Peak	39.54	± 4.0
2798.7980	H	Average	35.60	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

3. CHANNEL: HIGHEST (2474 MHz).

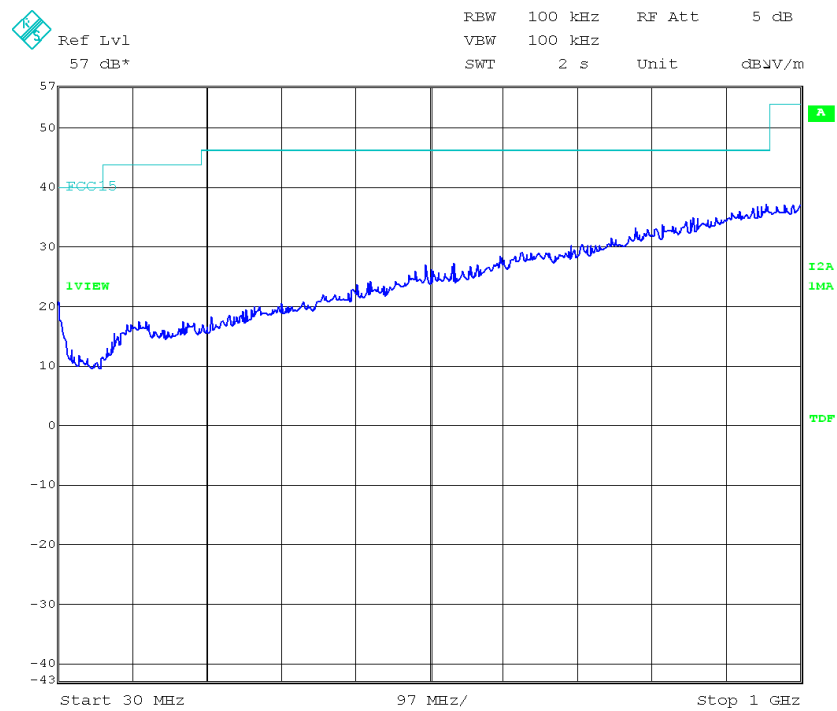
Spurious levels (radiated).

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2829.7115	H	Peak	39.08	± 4.0
2829.7115	H	Average	34.12	± 4.0

Additionally, no spurious signals were found inside the restricted bands 2310-2390 MHz and 2483.5-2500 MHz.

Verdict: PASS.

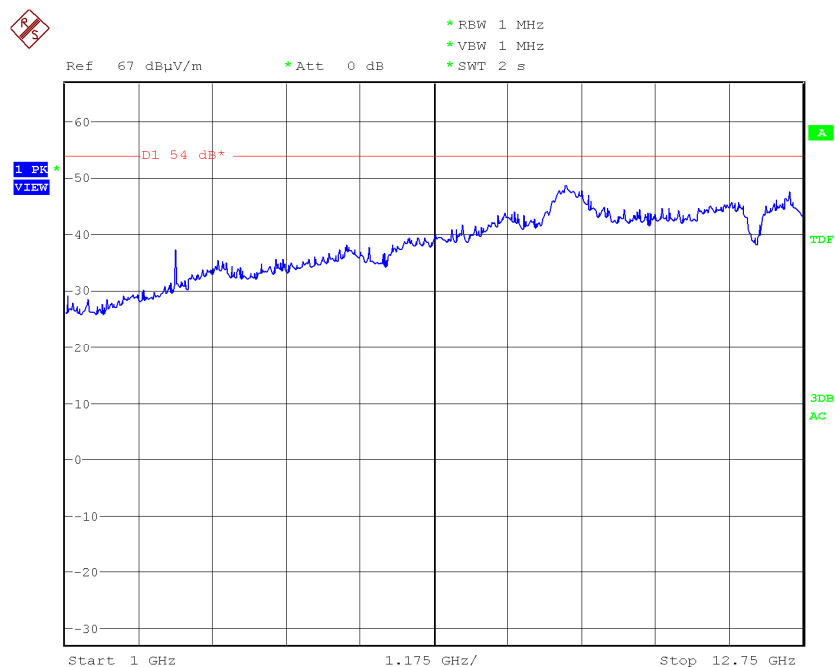
FREQUENCY RANGE 30 MHz-1000 MHz.



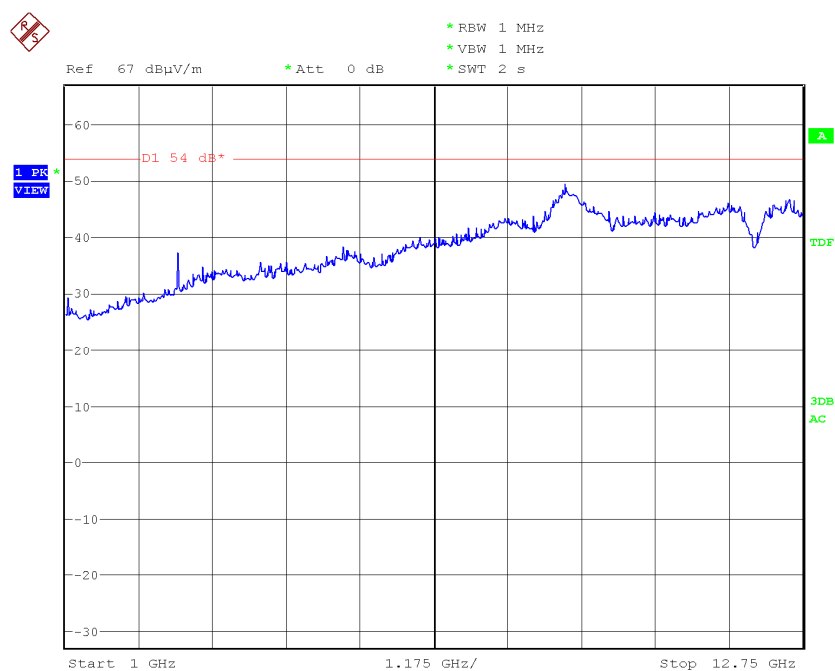
(This plot is valid for all three channels).

FREQUENCY RANGE 1 GHz-12.75 GHz.

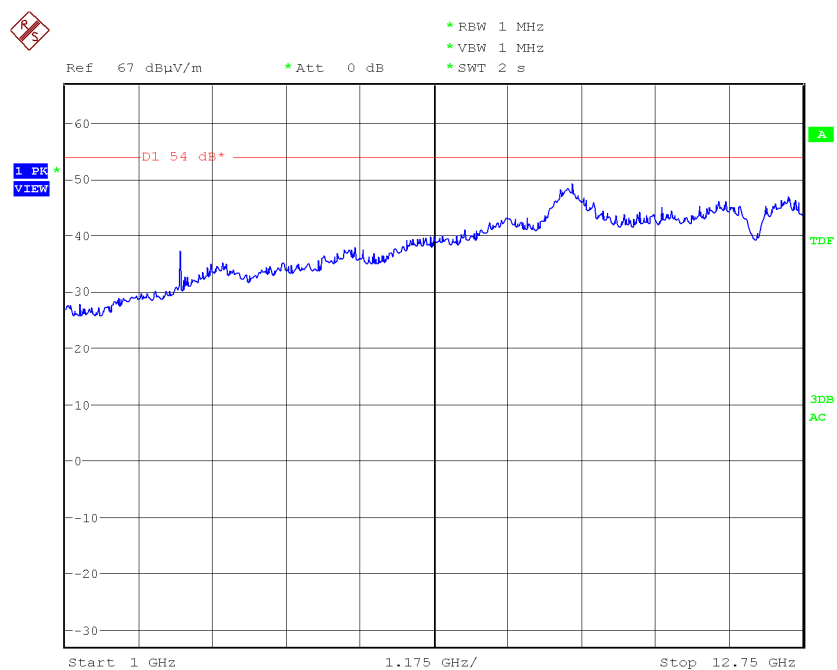
CHANNEL: Lowest (2405 MHz).



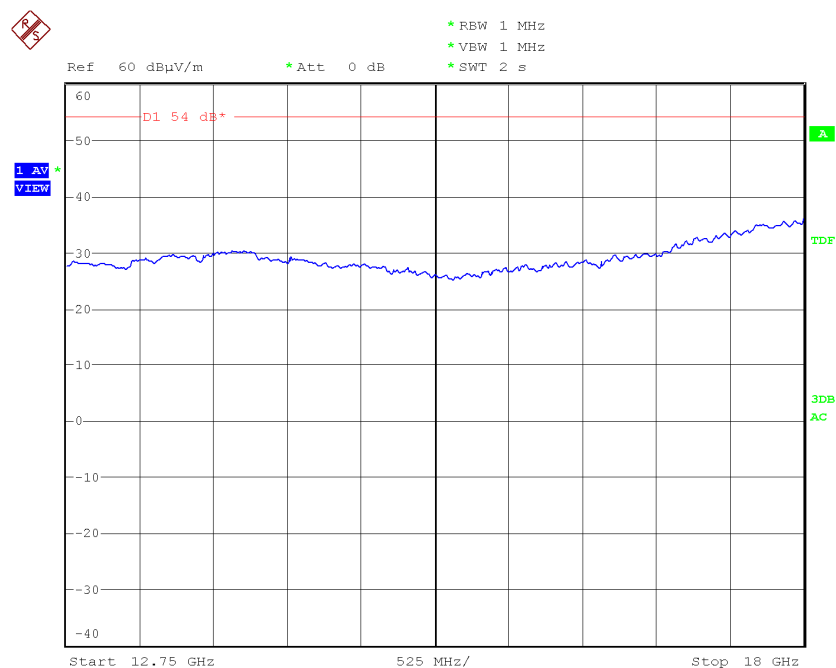
CHANNEL: Middle (2447 MHz).



CHANNEL: Highest (2474 MHz).

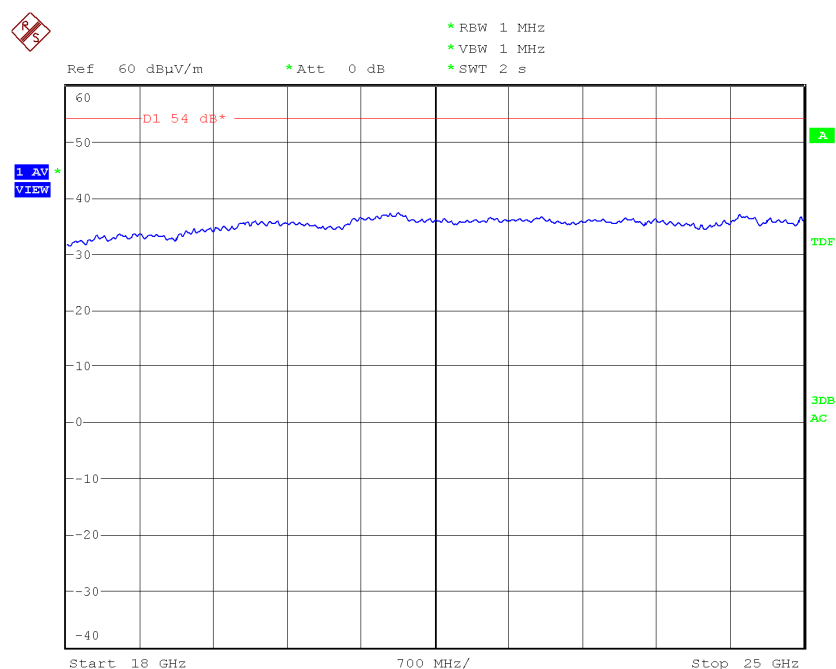


FREQUENCY RANGE 12.75 GHz-18 GHz.



(This plot is valid for all three channels).

FREQUENCY RANGE 18 GHz-25 GHz.



(This plot is valid for all three channels).