AT4 wireless, S.A.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
www.at4wireless.com · C.I.F. A29 507 456

FCC LISTED, REGISTRATION NUMBER: 720267

Informe de ensayo nº:
Test report No:

NIE: 44727RRF.001

Test report

USA FCC Part 15.249 & 15.209

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

Identificación del objeto ensayado.....: Identification of item tested	Wireless sensor.
Marca .....: Trade	GoGogate
Modelo y/o referencia tipo .....: Model and /or type reference	GGG2-TWS
Other identification of the product .....:	Commercial name: TILT AND TEMPERATURE WIRELESS SENSOR FCC ID: 2AD3LGGG2-TWS
Final HW version .....:	V1
Final SW version .....:	V1
Serial number .....:	1
Características .....: Features	Worldwide 2.4 GHz ISM band operation. Indoor use. Range 50 m. Battery type 2 x AAA cell. Dimensions (mm) (W x L x H): 27 x 70 x 24. Door status detection: TILT
Peticionario .....: Applicant	REMSOL EUROPE S.L. PONENT nº 8. Sant Pau de Ordal. 08739. Barcelona. SPAIN. CIF: B66104704 Contact person: Joan Llopart Masana Telephone: +34 938994162 / e-mail: jllopart@gogogate.com
Método de ensayo solicitado, norma.....: Test method requested, standard	USA FCC Part 15.249 (10-1-13 Edition). USA FCC Part 15.209 (10-1-13 Edition). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Resultado.....: Summary	IN COMPLIANCE
Aprobado por (nombre / cargo y firma) .....: Approved by (name / position & signature)	A. Llamas RF Lab. Manager Firmado digitalmente por Alejandro Llamas Rodríguez Fecha: 2015.02.06 09:20:51 +01'00'
Fecha de realización .....: Date of issue	2015-02-06
Formato de informe No. .....: Report template No	FDT08_15

Index

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 conjuction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance program 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.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of AT4 wireless.

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 composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
44727B/001	Wireless sensor	GGG2-TWS	1	2015-01-20

1. Sample M/01 has undergone following test(s).

   All tests indicated in appendix A.

Test sample description

The test sample consists of a tilt and temperature wireless sensor.

Test samples supplier

REMSOL EUROPE S.L.

PONENT nº 8. Sant Pau de Ordal. 08739. Barcelona. SPAIN.

CIF: B66104704

Contact person: Joan Llopart Masana

Telephone: +34 938994162 / e-mail: jllopart@gogogate.com

Testing period

The performed test started on 2015-01-30 and finished on 2015-02-03.

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. = 20.4 ºC Max. = 22.6 ºC
Relative humidity	Min. = 42.3 % Max. = 47.7 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 22.1 ºC Max. = 22.3 ºC
Relative humidity	Min. = 44.8 % Max. = 46.1 %
Air pressure	Min. = 1010 mbar Max. = 1012 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. = 21.7 ºC Max. = 21.2 ºC
Relative humidity	Min. = 47.7 % Max. = 48.9 %
Air pressure	Min. = 1012 mbar Max. = 1013 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 0,5 Ω

Remarks and comments

1: Used instrumentation:

Conducted Measurements

		Last Cal. date	Cal. due date
1.	Spectrum Analyzer Agilent E4440A	2014/05	2016/05
2.	DC power supply R&S NGPE 40/40	2014/11	2017/11

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	BiconicalLog antenna ETS LINDGREN 3142E	2014/03	2017/03
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2013/11	2016/11
5.	Double-ridge Guide Horn antenna 14-40 GHz SCHWARZBECK BBHA 9170	2014/03	2017/03
6.	EMI Test Receiver R&S ESU 26	2013/08	2015/08
7.	Spectrum analyser Rohde & Schwarz FSW50	2013/10	2015/10
8.	RF pre-amplifier 10 MHz-6 GHz SCHWARZBECK BBV9743	2014/02	2015/02
9.	RF pre-amplifier Miteq AFS5-04001300-15-10P-6.	2014/05	2016/05
10.	RF pre-amplifier BONN BLMA 1840-1M 18-40 GHz.	2014/02	2016/02
11.	RF pre-amplifier Miteq JS4-12002600-30-5A.	2014/05	2016/05

Testing verdicts

Not applicable ..... :	N/A
Pass ..... :	P
Fail ..... :	F
Not measured ..... :	N/M

FCC PART 15 PARAGRAPH		VERDICT			
		NA	**P**	**F**	**NM**
FCC 15.249 Subclause (a)	Field strength of fundamental and harmonics emissions.		P		
FCC 15.249 Subclause (a) and (d)	Emissions radiated outside of the specific frequency bands		P		

Appendix A – Test result

INDEX

TEST CONDITIONS

Power supply (V):

$V_{nominal}$ = 3.0 Vdc

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

Type of antenna = Integral antenna

TEST FREQUENCY:

The Equipment Under Test only operates in a single frequency: 2400 MHz

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 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

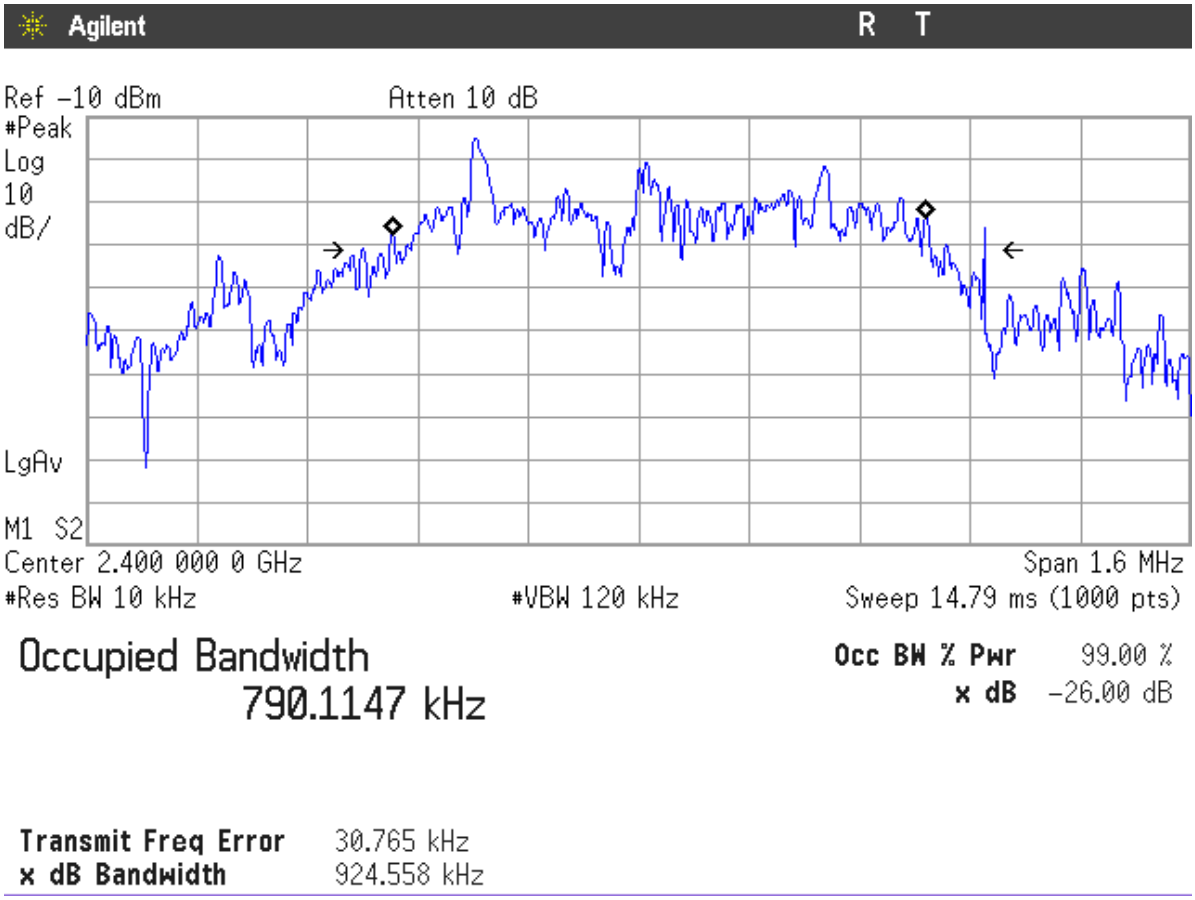
Measurements were made in both horizontal and vertical planes of polarization.

Occupied Bandwidth

RESULTS

(see next plot).

99% Occupied bandwidth (kHz)	790.1147
-26 dB Spectrum bandwidth (kHz)	924.558
Measurement uncertainty (kHz)	±11



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 (dBµV/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

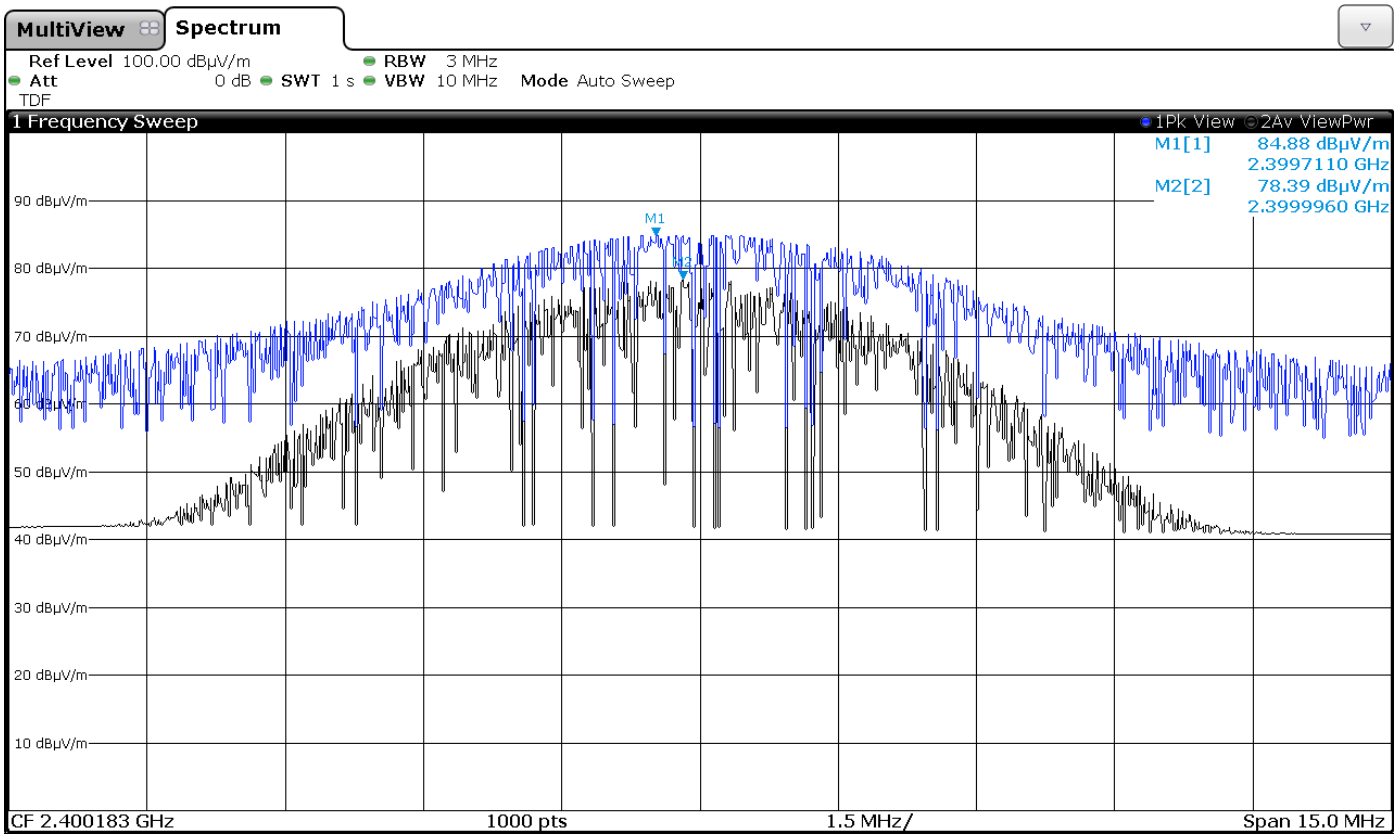
for frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS (see next plot)

Field strength (dBµV/m) average	78.39
Field strength (dBµV/m) peak	84.88
Measurement uncertainty (dB)	±4.0

Verdict: PASS

FIELD STRENGTH



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 (µV/m)	Field strength of harmonics (dBµV/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 (µV/m)	Field strength (dBµV/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 360º 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.

All peaks are more than 20 dB below the limit.

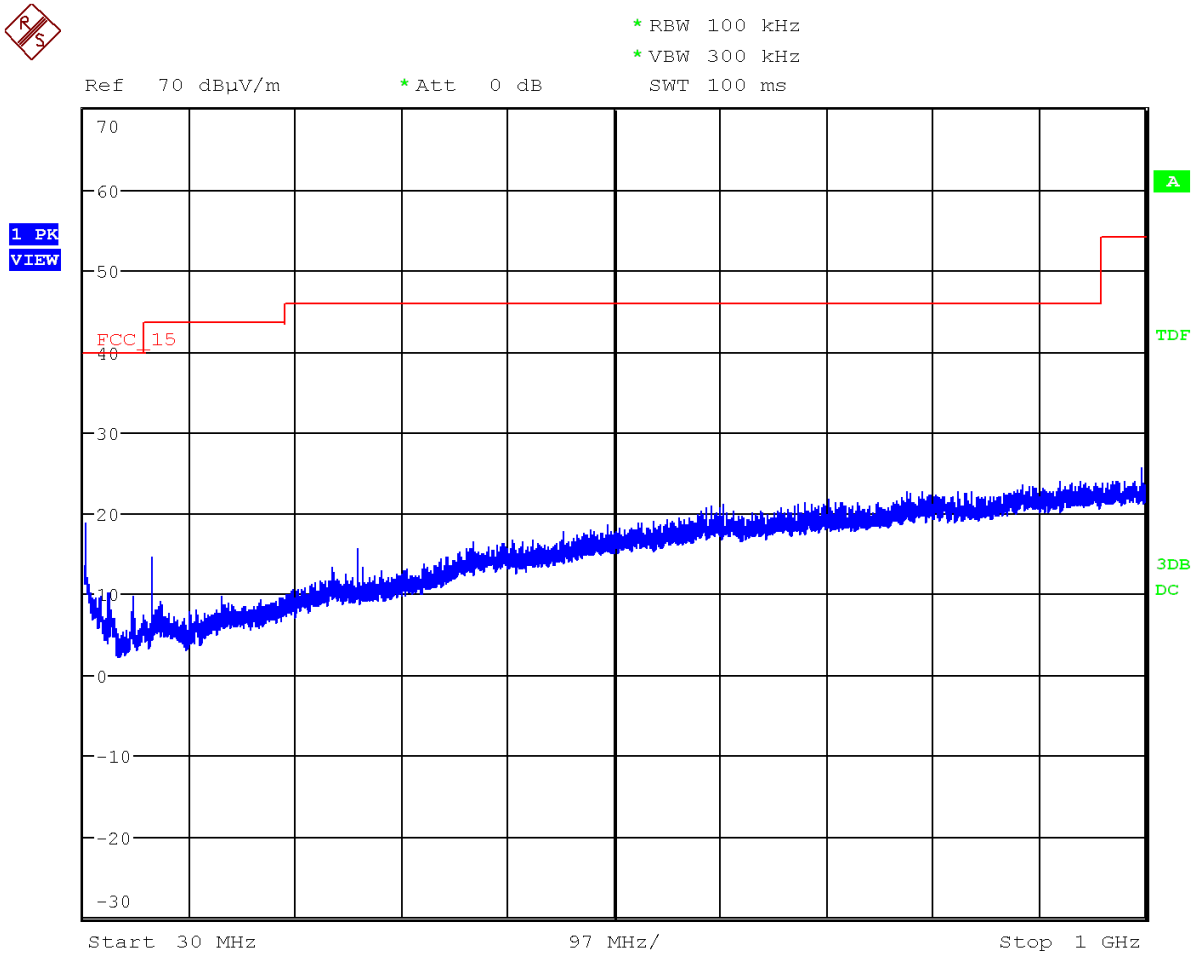
Frequency range 1 GHz-25 GHz

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.5589	V	Peak	51.65	± 4.0
		Average	34.89	± 4.0

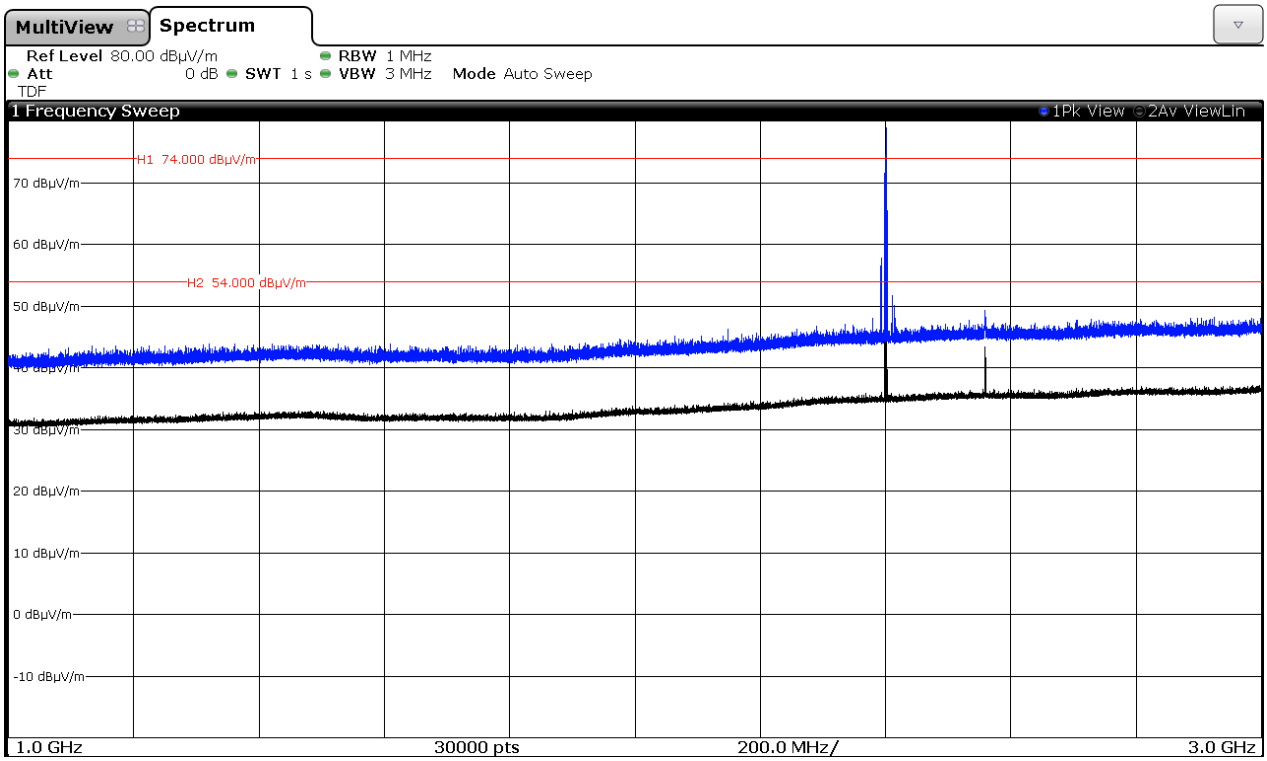
All other peaks are more than 20 dB below the limit.

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

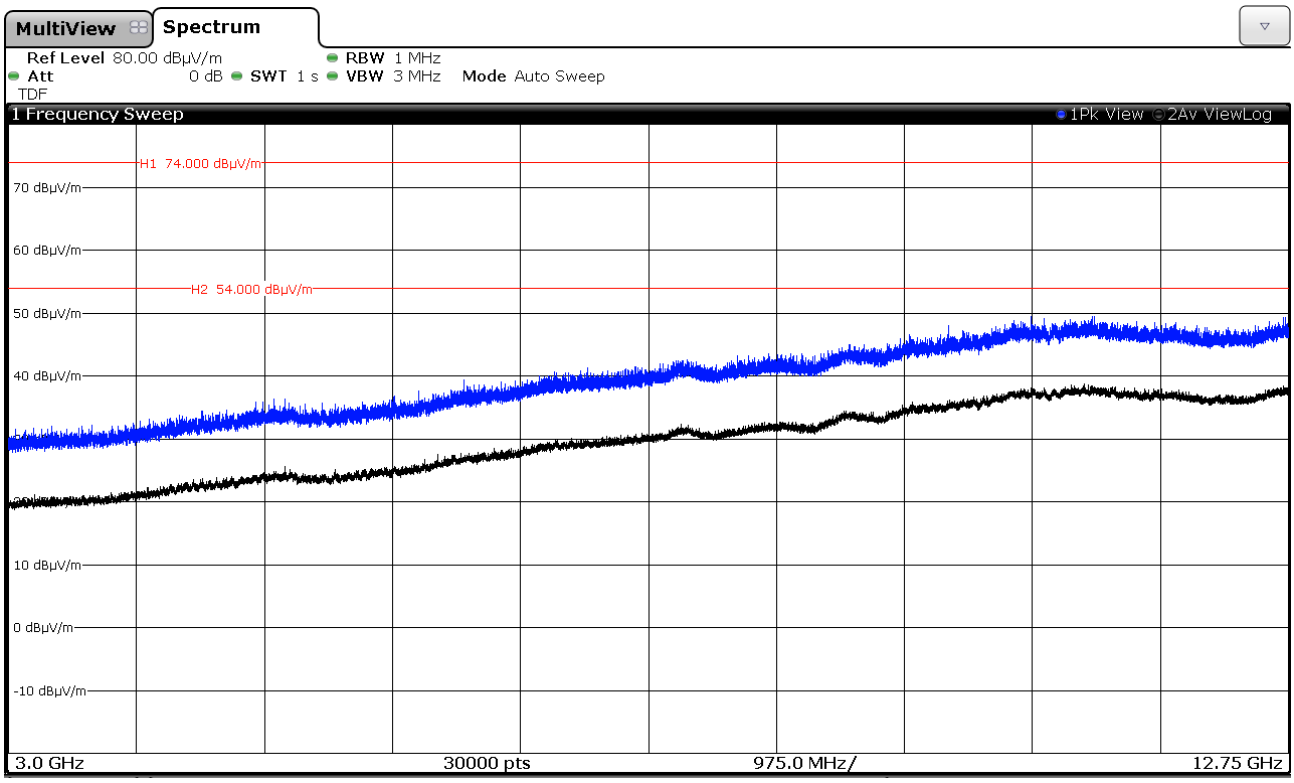


FREQUENCY RANGE 1 GHz - 3 GHz.

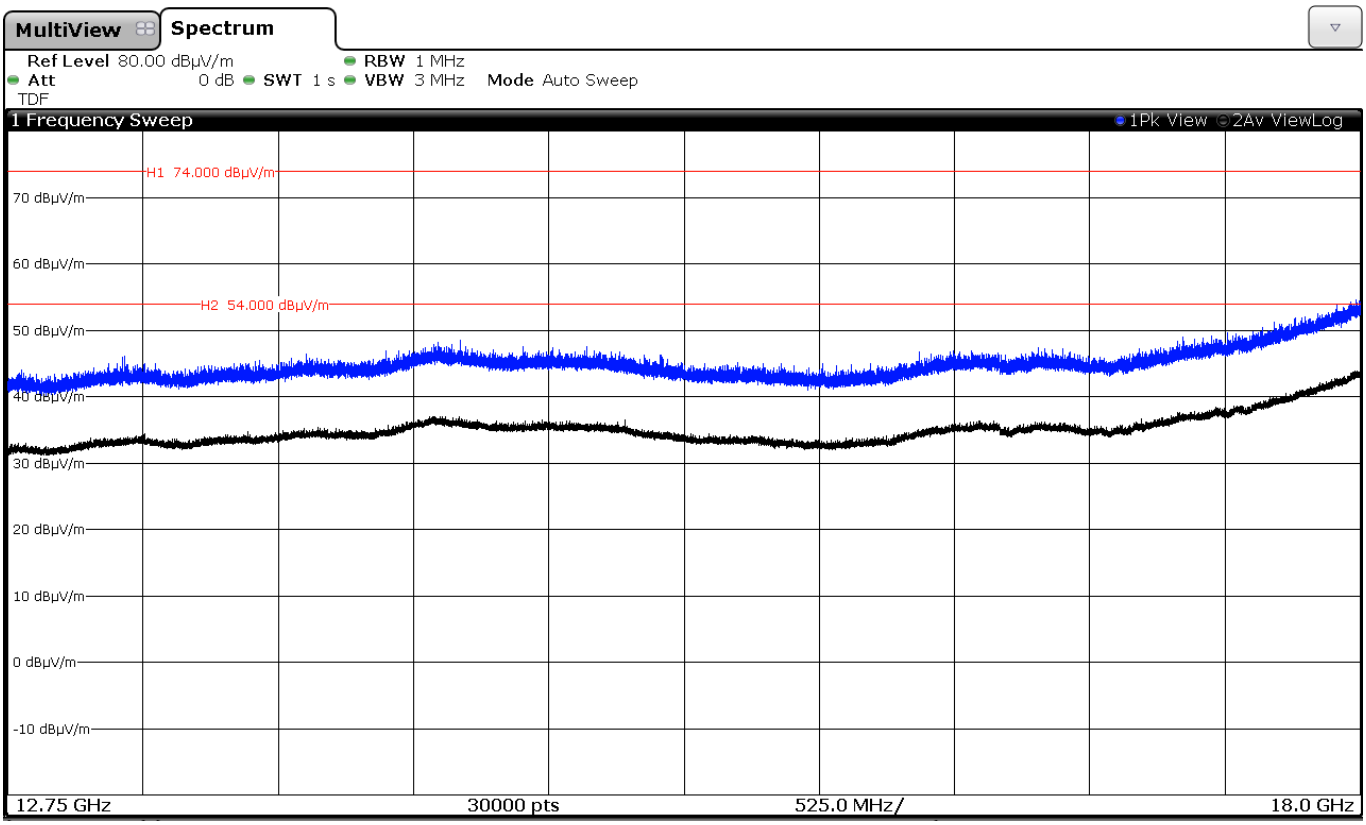


Note: The peak shown in the plot is the carrier frequency.

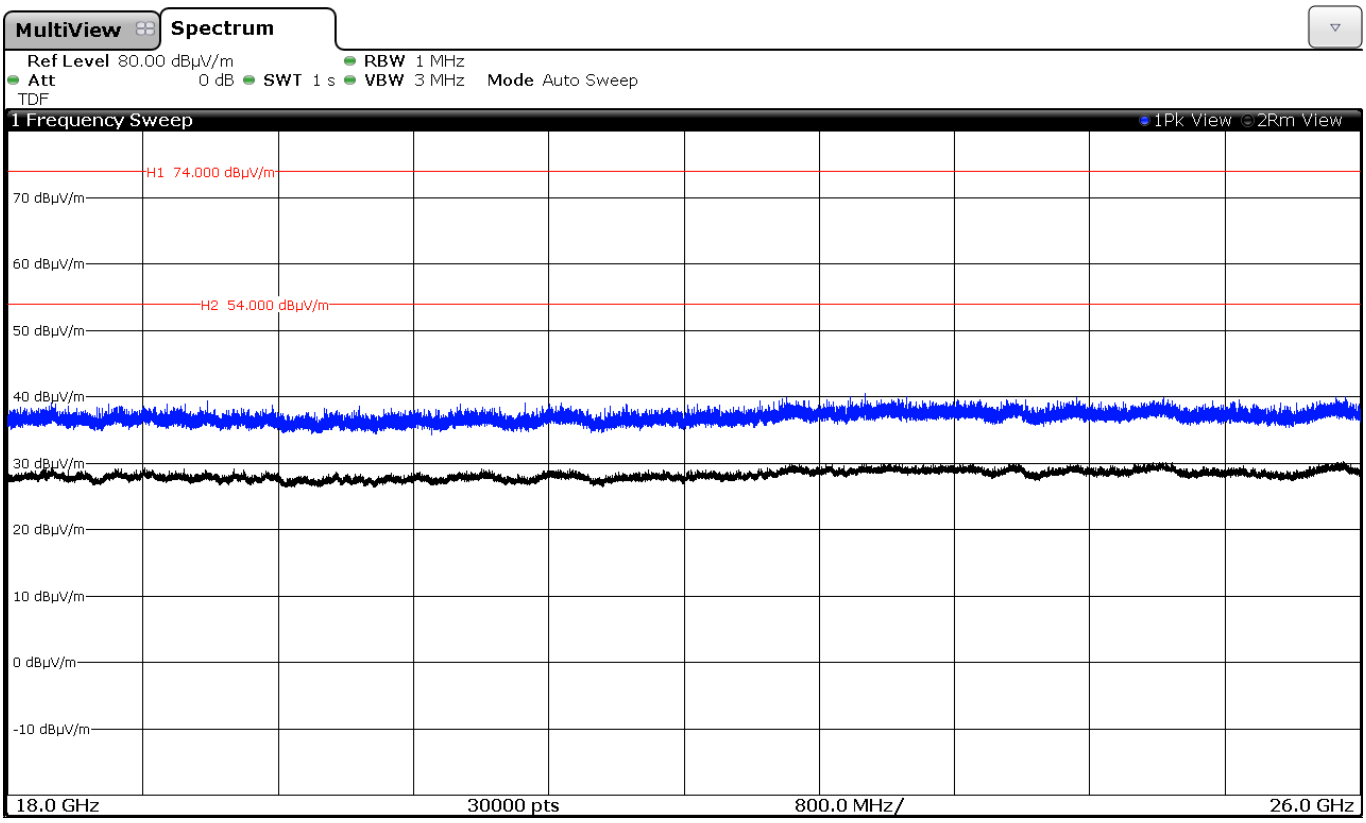
FREQUENCY RANGE 3 GHz to 12.75 GHz.



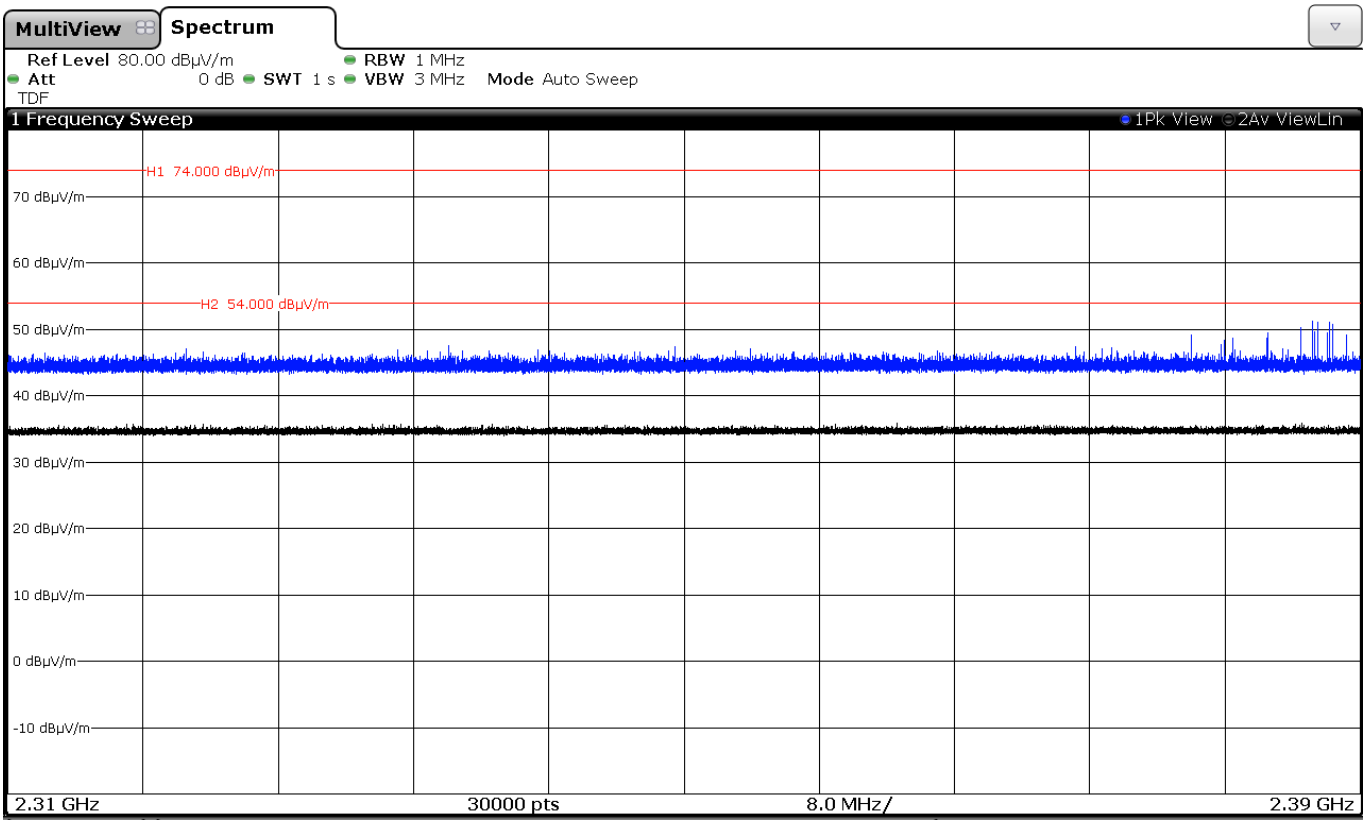
FREQUENCY RANGE 12.75 GHz to 18 GHz.



FREQUENCY RANGE 18 GHz to 26 GHz.



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



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