

FCC LISTED, REGISTRATION
NUMBER: 720267

Informe de ensayo nº:
Test report No:

NIE: 48834RRF.006

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	ZONING CONTROL SYSTEM
Marca Trade	AIRZONE
Modelo y/o referencia tipo Model and /or type reference	AZxxxTHINKRx
Other identification of the product	FCC ID: SVS-006-ZTS
Final HW version	1.2
Final SW version	3.0.0
Características Features	914.8 – 917.2 MHz frequency range. GFSK. 3.0 Vdc power supply
Fabricante Manufacturer	CORPORACION EMPRESARIAL ALTRA, S.L. C/ Marie Curie, 21 PTA 29.590 – Málaga (SPAIN)
Método de ensayo solicitado, norma..... Test method requested, standard	USA FCC Part 15.249 10-1-15 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 10-1-15 Edition: Radiated emission limits; general requirements. 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 
Fecha de realización	2018-04-26 Date of issue
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Competences and guarantees

DEKRA Testing and Certification 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: 720267.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification 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 DEKRA Testing and Certification at the time of performance of the test.

DEKRA Testing and Certification 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.

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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.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Usage of samples

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

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
48834C/032	Zoning control system with integral antenna	AZxxxTHINKRx	F006M27	2016-02-09

1. Sample S/01 has undergone the following test(s).
All radiated tests indicated in appendix A.

Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
48834C/102	Zoning control system with antenna connector	AZxxxTHINKRx	---	2016-03-10

1. Sample S/02 has undergone following test(s).
All conducted tests indicated in appendix A.

Test sample description

The test sample consists of a zoning control system for air conditioning.

Identification of the client

CORPORACION EMPRESARIAL ALTRA, S.L.
C/ Marie Curie, 21 PTA 29.590 – Málaga (SPAIN)

Testing period

The performed test started on 2016-02-12 and finished on 2016-03-10.
The tests have been performed at DEKRA Testing and Certification.

Environmental conditions

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 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. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

1: Used instrumentation:

Conducted Measurements

		Last Cal. date	Cal. due date
1.	Spectrum analyser Agilent PSA E4440A	2015/10	2017/10
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.	EMI Test Receiver R&S ESU 40	2016/02	2018/02
6.	Spectrum analyser Rohde & Schwarz FSW50	2015/12	2017/12
7.	RF pre-amplifier 10 MHz-6 GHz SCHWARZBECK BBV9743	2015/03	2016/03
8.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A	2015/05	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 (d)	Emissions radiated outside of the specific frequency bands		P		

Appendix 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 from battery

Type of antenna = Integral antenna

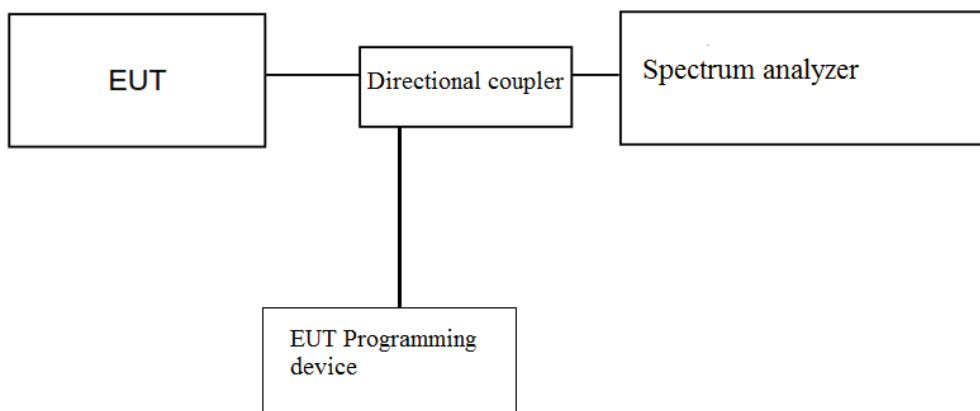
TEST FREQUENCIES:

Lowest channel: 915 MHz

Highest channel: 917 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyzer through a calibrated directional coupler. The reading of the spectrum analyzer is compensated with the directional coupler loss.



RADIATED MEASUREMENTS

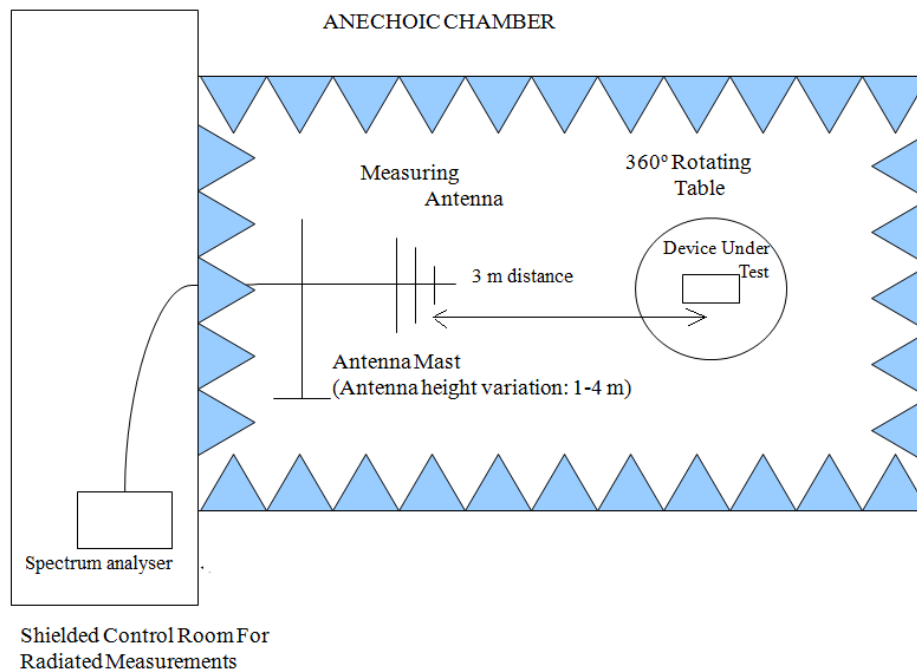
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-10 GHz (1 GHz-18 GHz Double ridge horn antenna).

For radiated emissions in the range 1 GHz-10 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.

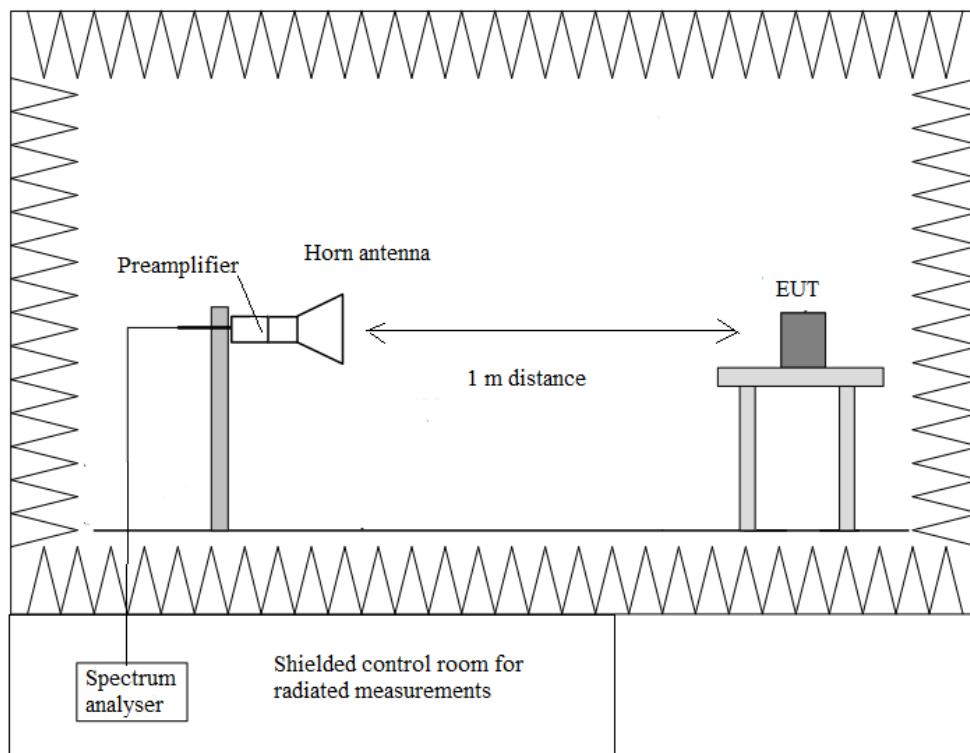
The equipment under test was set up on a non-conductive (wooden) platform 1.5 meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



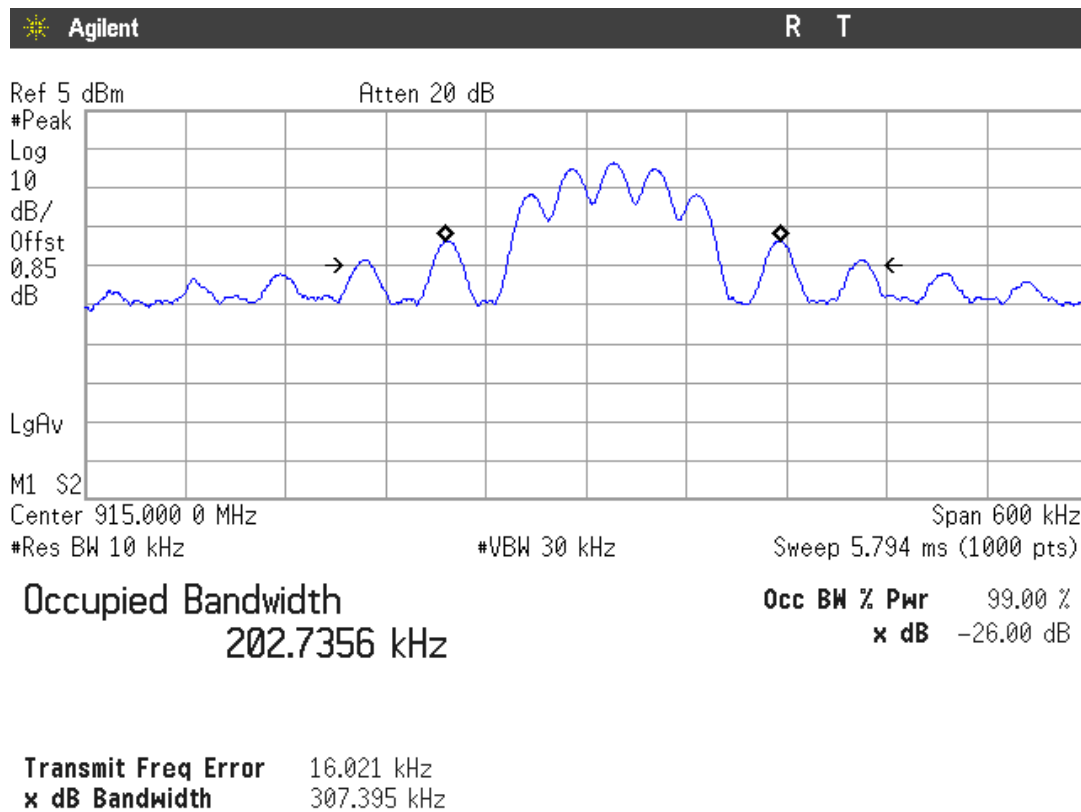
Occupied Bandwidth

RESULTS

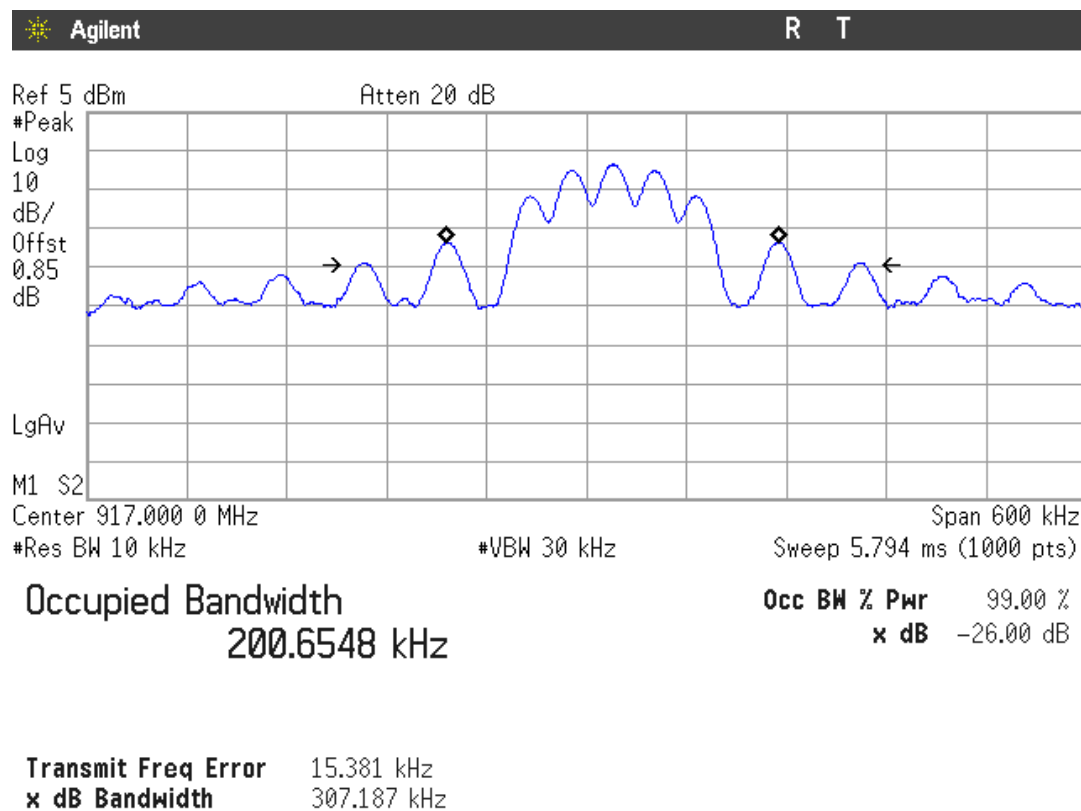
(see next plots).

	Lowest frequency 915 MHz	Highest frequency 917 MHz
99% bandwidth (kHz)	202.74	200.65
-26 dBc bandwidth (kHz)	307.39	307.19
Measurement uncertainty (kHz)	<±2.30	

Lowest 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.

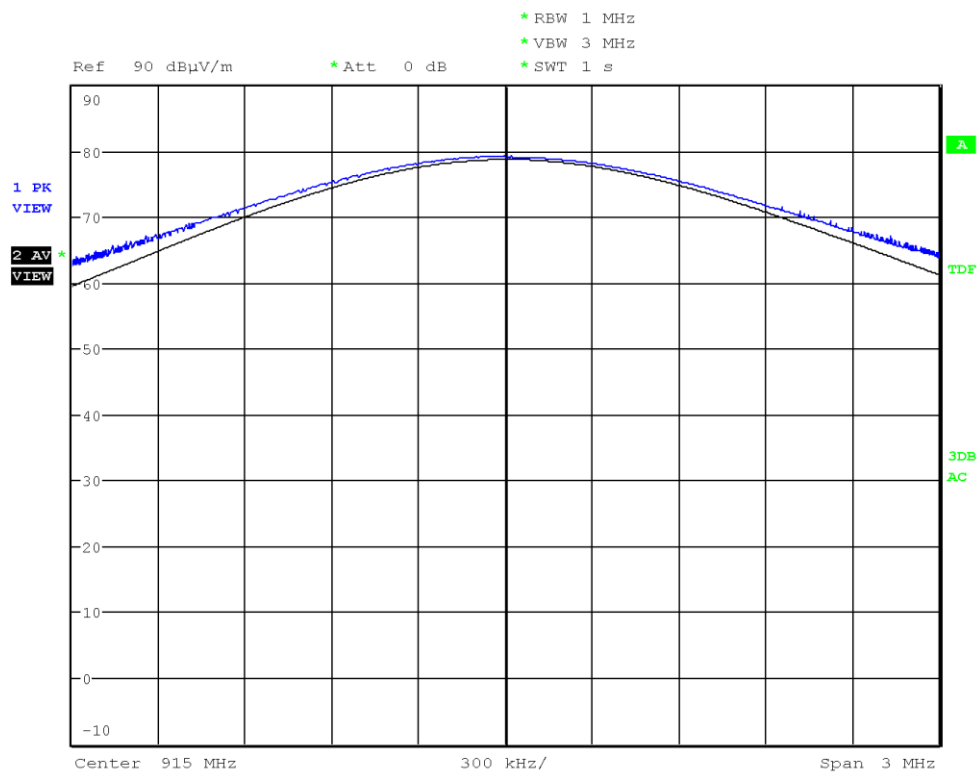
RESULTS (see next plot)

	Lowest frequency 915 MHz	Highest frequency 917 MHz
Field strength (dB μ V/m) average	78.69	75.26
Field strength (dB μ V/m) peak	79.30	79.19
Measurement uncertainty (dB)	< $\pm$ 3.88	

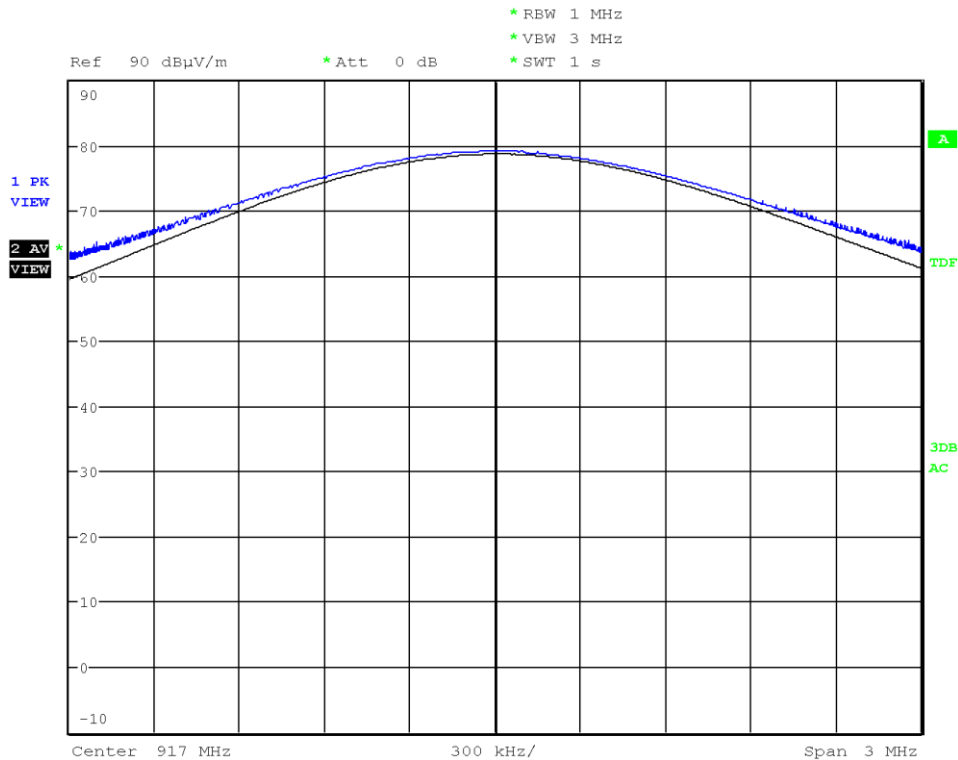
Verdict: PASS

FIELD STRENGTH

Lowest Channel



Highest 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	$2400/F(\text{kHz})$	-	300
0.490-1.705	$24000/F(\text{kHz})$	-	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-10 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.

Lowest Channel

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
890.487	V	Quasi-Peak	31.63	< $\pm$ 3.88
939.666	H	Quasi-Peak	28.53	< $\pm$ 3.88

Highest Channel

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
892.427	V	Quasi-Peak	31.20	< $\pm$ 3.88
941.606	V	Quasi-Peak	30.02	< $\pm$ 3.88

Frequency range 1 GHz-10 GHz.

Lowest Channel

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
1.82995	H	Peak	38.39	< $\pm$ 4.69
		Average	36.65	< $\pm$ 4.69
2.74449	V	Peak	44.68	< $\pm$ 4.69
		Average	43.59	< $\pm$ 4.69
3.65995	V	Peak	44.36	< $\pm$ 4.69
		Average	43.22	< $\pm$ 4.69
4.57525	H	Peak	45.86	< $\pm$ 4.69
		Average	43.92	< $\pm$ 4.69
5.48995	H	Peak	51.16	< $\pm$ 4.69
		Average	49.66	< $\pm$ 4.69
6.40495	H	Peak	43.26	< $\pm$ 4.69
		Average	38.90	< $\pm$ 4.69

Highest Channel

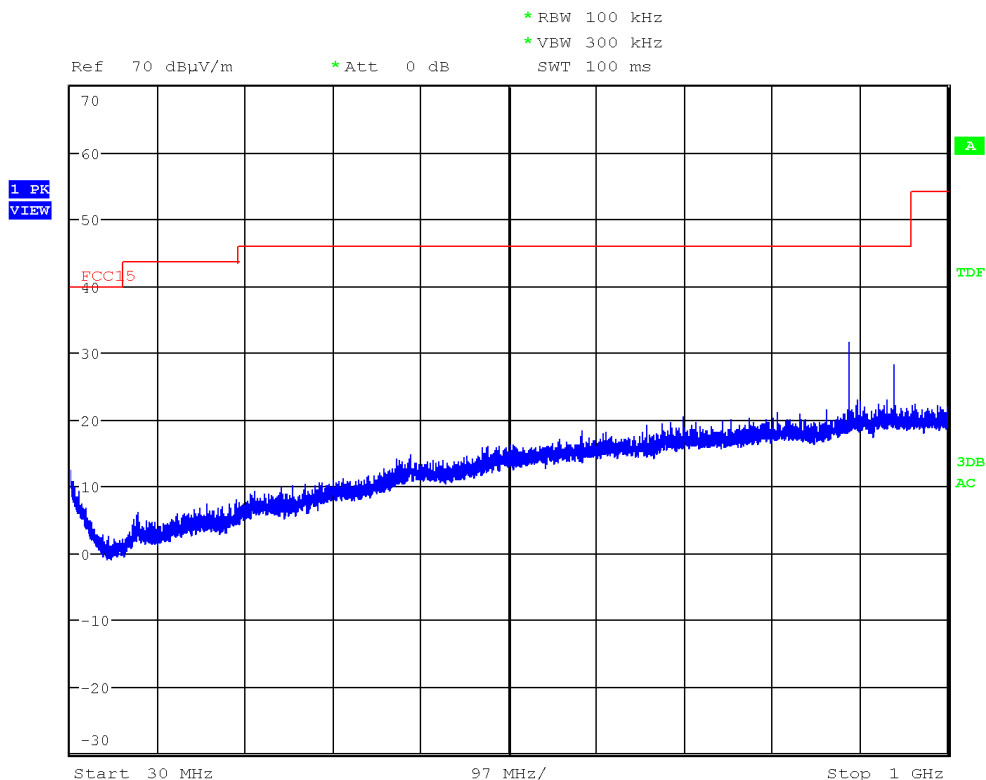
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
1.83415	V	Peak	37.60	< $\pm$ 4.69
		Average	35.82	< $\pm$ 4.69
2.75095	H	Peak	45.11	< $\pm$ 4.69
		Average	44.03	< $\pm$ 4.69
3.66805	H	Peak	45.17	< $\pm$ 4.69
		Average	44.16	< $\pm$ 4.69
4.58515	V	Peak	45.53	< $\pm$ 4.69
		Average	43.91	< $\pm$ 4.69
5.50195	V	Peak	51.36	< $\pm$ 4.69
		Average	50.00	< $\pm$ 4.69
6.41905	V	Peak	43.03	< $\pm$ 4.69
		Average	38.92	< $\pm$ 4.69

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

Verdict: PASS

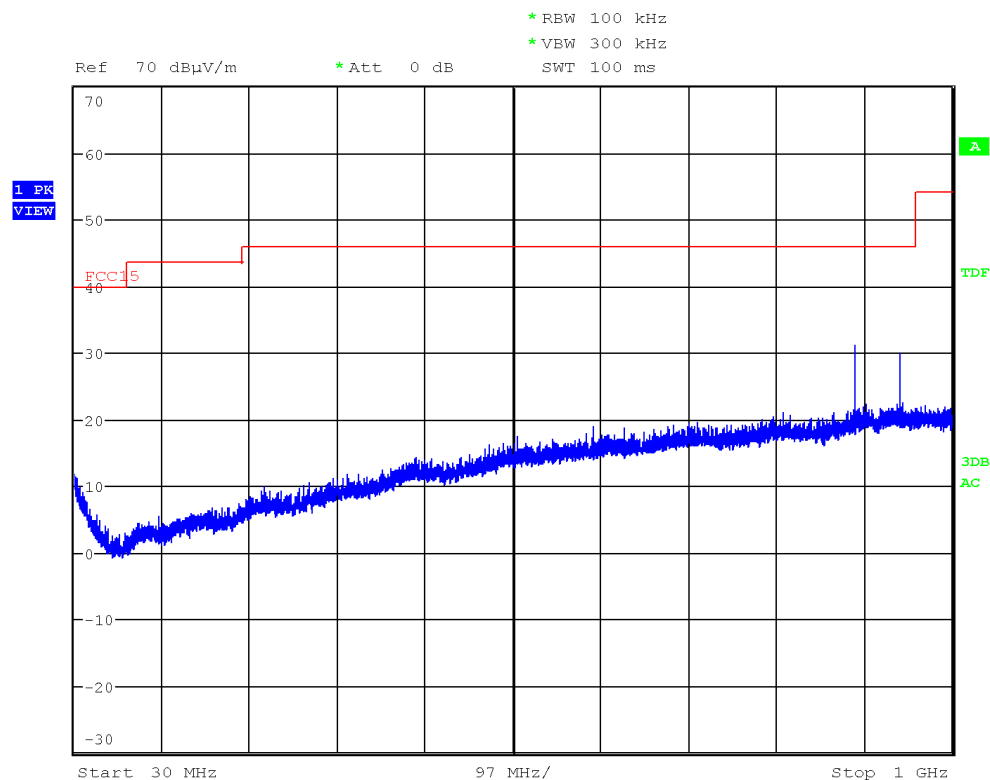
FREQUENCY RANGE 30 MHz-1000 MHz.

Lowest Channel



Note: The carrier was attenuated using a Notch filter.

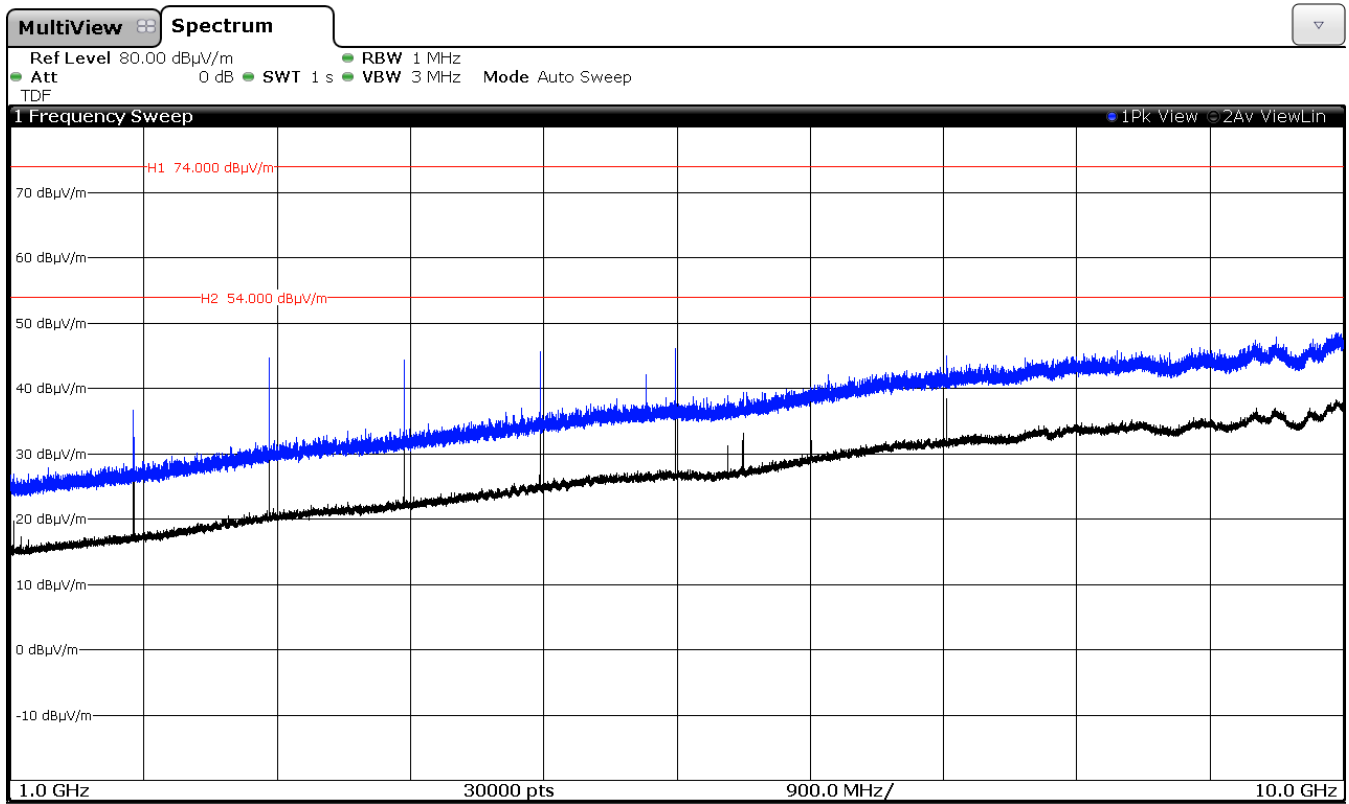
Highest channel



Note: The carrier was attenuated using a Notch filter.

FREQUENCY RANGE 1 GHz - 10 GHz.

Lowest Channel



Highest channel

