



CMC Centro Misure Compatibilità S.r.l.

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L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

Independent Testing Laboratory
Accredited by ACCREDIA according to UNI CEI EN ISO/IEC 17025 cert. nr. 0168

TEST REPORT nr. R16077401

Federal Communication Commission (FCC)

Test item

Description: TRANSCEIVER UNIT

Trademark: AUTEC

Model/Type.....: Model FJR Type NF022

FCC ID: OQA-FJRNF022

Test Specification

Standard.....: FCC Rules & Regulations, Title 47:2014
Part 15 paragraph(s): 203, 204, 207, 209 and 247

Client's name: AUTEC S.r.l.

Address.....: Via Pomaroli, 65 – 36030 Caldognو (VI) – ITALY

Manufacturer's name: Same as client

Address.....: --

Report

Tested by: G. Gandini – Technician

G. Gandini

Approved by: R. Beghetto – Laboratory Manager

R. Beghetto

Date of issue: 09.09.16

Contents: 68 pages

This test report shall not be reproduced except in full without the written approval of CMC.
The test results presented in this report relate only to the item tested.



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Index

1. SUMMARY	3
2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	4
2.1 TEST SITE.....	4
3. TESTING AND SAMPLING	4
4. OPERATIVE CONDITIONS	4
5. PHOTOGRAPH(S) OF EUT	5
5.1 PHOTOGRAPH(S) OF EUT	5
6. EQUIPMENT LIST.....	9
7. MEASUREMENT UNCERTAINTY	10
8. REFERENCE DOCUMENTS	11
9. DEVIATION FROM TEST SPECIFICATION	12
10. TEST CASE VERDICTS	12
11. RESULTS.....	13
11.1 ANTENNA REQUIREMENTS.....	14
11.2 RADIATED EMISSIONS	16
11.3 20 dB BANDWIDTH	30
11.4 CHANNEL SEPARATION.....	35
11.5 NUMBER OF HOPPING CHANNELS	38
11.6 TIME OF OCCUPANCY.....	41
11.7 BAND EDGE	45
11.8 PEAK OUTPUT POWER	55
11.9 SPURIOUS EMISSION	64
11.10 MAXIMUM PERMISSIBLE EXPOSURE.....	68



1. Summary

Standard:

FCC Rules & Regulations, Title 47:2014
Part 15 paragraph(s): 203, 204, 207, 209 and 247

Test specifications	Environmental Phenomena	Tests sequence	Result
Part 15.203	Antenna requirements	1	Complies
Part 15.207	Conducted emissions	--	N.A. (+)
Part 15.209	Radiated emissions	2	Complies
Part 15.247	20 dB Bandwidth	3	Complies
Part 15.247	Channel Separation	5	Complies
Part 15.247	Number of Hopping Channel	6	Complies
Part 15.247	Time of occupancy	7	Complies
Part 15.247	Band edge	8	Complies
Part 15.209 and 15.247	Peak Output Power	9	Complies
Part 15.209	Spurious emission	10	Complies
Part 1.1310	Maximum permissible exposure	11	Complies

(+) Devices which only employ battery power. See FCC Part 15.207 (c)

The Test Report was given to the Client representatives for necessary documentation of ratification of the tested equipment and it is valid for the FCC certification



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2. Description of Equipment under test (EUT)

Power supply : 7,2 Vdc from battery

Serial Number : --

Type of equipment : Transmitter Unit

Receiver Unit

Type of station : Fixed station
 Portable station
 Mobile station

Frequency band : F_L: 915,05 MHz F_M: 921,50 MHz F_H: 927,95 MHz

2.1 Test Site

Company : CMC Centro Misure Compatibilità S.r.l.

Address : Via della Fisica, 20
36016 Thiene (VI) – ITALY

Test site facility's FCC registration number : 271947

3. Testing and sampling

Date of receipt of test item : 12.04.16

Testing start date : 12.04.16

Testing end date : 12.05.16

Samples tested nr. : 1

Sampling procedure : Equipment used for testing was picked up by the manufacturer, at the end of the production process with random criterion

Internal identification : adhesive label with the product number P160444

4. Operative conditions

EUT exercising : EUT in continuous transmission at maximum power



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5. Photograph(s) of EUT

5.1 Photograph(s) of EUT



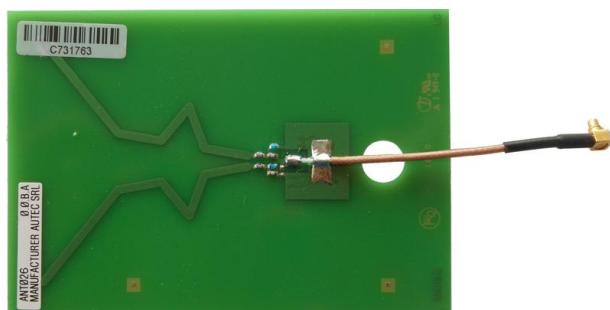
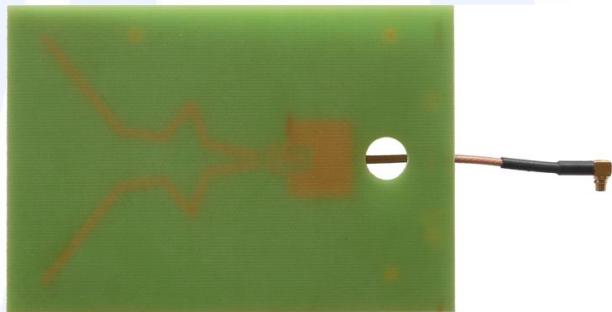


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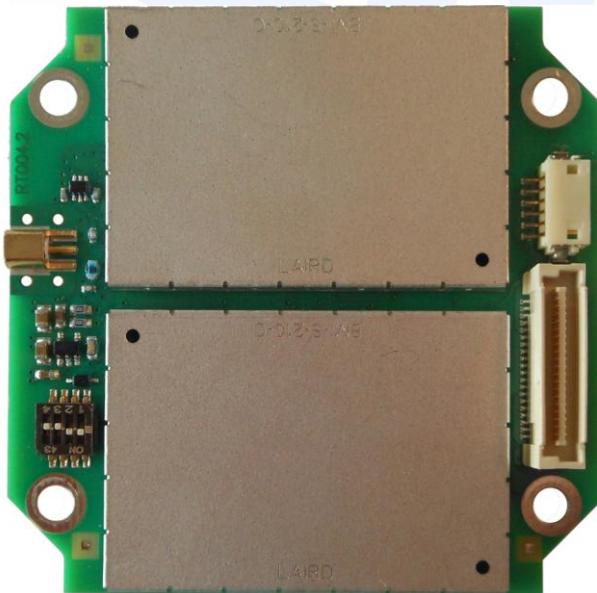
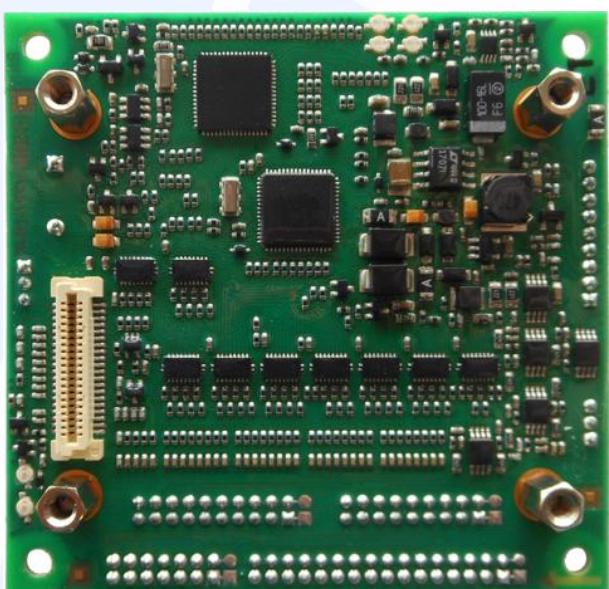
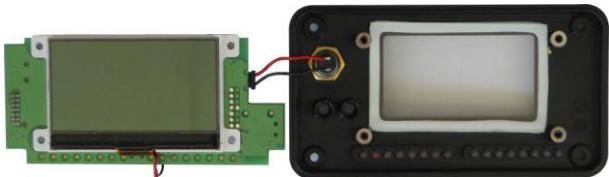


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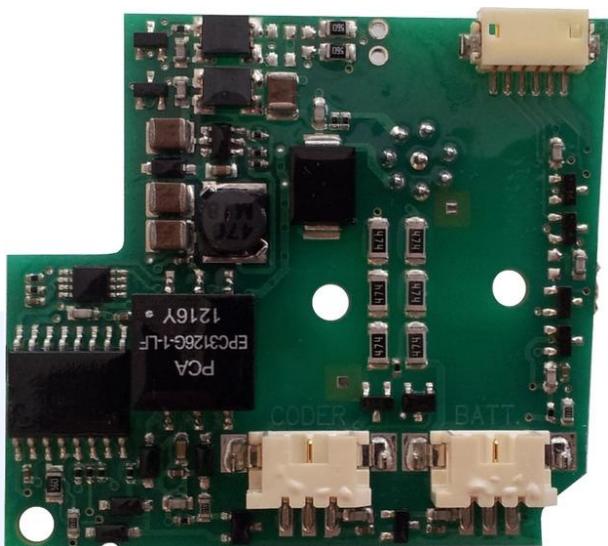
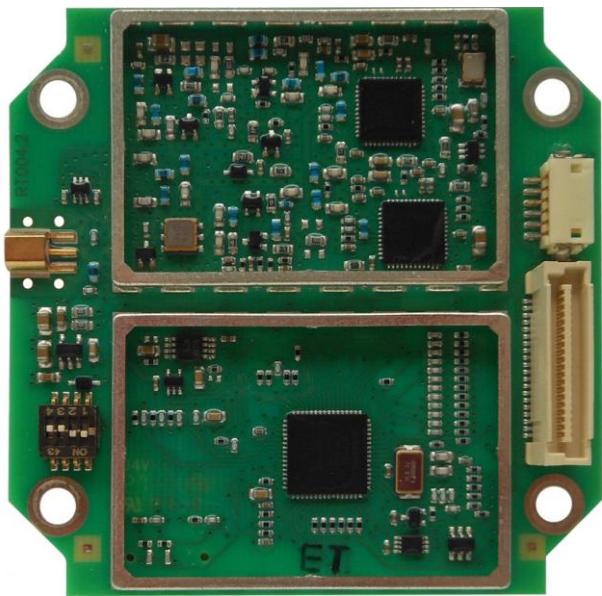


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6. Equipment list

Id. number	Manufacturer	Model	Description	Serial number	Last calibration	Due date calibration
CMC S010	Rohde & Schwarz	ESH3-Z2	Impulses Limiting Device	---	January '16	January '17
CMC S108	EMCO	3115	Horn Antenna	9811-5622	May '16	May '19
CMC S127	Schaffner	HLA6120	Loop Antenna	1191	January '16	January '19
CMC S129	Rohde & Schwarz	ESPI7	Receiver	836.914/004	January '16	January '17
CMC S136	Schwarzbeck	VULB 9163	Broadband Antenna	9136-205	May '16	May '19
CMC S164	Rohde & Schwarz	ESU26	EMC interference receiver	100052	January '16	January '17
CMC S200	Schwarzbeck	NSLK 8128	V-LISN	8128-273	January '16	January '17
CMC S227	Rohde & Schwarz	ESR7	EMI Test Receiver 7GHz	101121	January '16	January '17
CMC S260	CMC	Wfr_N	Shielded Cable	Wfr_ant10-1	November '15	November '16
CMC S261	CMC	Wfr_N	Shielded Cable	Wfr_ant20-1	November '15	November '16
CMC S262	CMC	Wfr_N_fix	Shielded Cable	Wfr_fix32-1	November '15	November '16
CMC S263	CMC	Wfr_N_fix	Shielded Cable	Wfr_fix31-1	November '15	November '16
CMC S264	CMC	Wfr_N	Shielded Cable	Wfr_ext03-1	November '15	November '16
CMC S288	CMC	W_sma_white	Joint Shielded Cable	W_001	November '15	November '16



7. Measurement uncertainty

Test	Expanded Uncertainty	note
Conducted Emission		
(50Ω/50μH AMN) - (9 kHz – 150 kHz)	±3.6 dB	1
(50Ω/50μH AMN) - (150 kHz – 30 MHz)	±3.0 dB	1
(Voltage probe) - (150 kHz – 30 MHz)	±2.9 dB	1
(50Ω/5μH AMN) - (150 kHz – 108 MHz)	±2.6 dB	1
Discontinuous Conducted Emission		
Conducted Emission (50Ω/50μH AMN) - (150 kHz – 30 MHz)	±3.0 dB	1
Disturbance Power (30 MHz – 300 MHz)		
Radiated Emission		
(0,150 MHz – 30 MHz)	±3.8 dB	1
(30 MHz – 1000 MHz)	±3.8 dB	1
(1 GHz – 6 GHz)	±4.3 dB	1
Electromagnetic field EMF		
Harmonic current emissions test		
Voltage fluctuation and flicker test		
Insertion loss test		
Radiated electromagnetic disturbance test (loop antenna)		
Radiated electromagnetic field immunity test		
Pulse modulated radiated electromagnetic field immunity test	0.81 V/m at 3V/m	1
Injected currents immunity test	0.45 V at 3V	1
Bulk current	3.7 mA at 60 mA	1
Power frequency magnetic field immunity test	0.23 A/m at 10 A/m	1
Effective radiated power (F < 1GHz)		
Effective radiated power (F > 1GHz)	±3.8 dB	1
Frequency error	< 1x10-7	1
Modulation bandwidth	< 1x10-7	1
Conducted RF power and spurious emission	±0.7 dB	1
Adjacent channel power	±1.2 dB	1
Blocking	±1.2 dB	1
Electrostatic discharge immunity test		
Electrical fast transients / burst immunity test		
Surge immunity test		
Pulse magnetic field immunity test		
Damped oscillatory magnetic field immunity test		
Short interruption immunity test		
Voltage transient emission test		
Voltage transient emission test	±2.2 %	1
Transient immunity test		
Rev_16_01 date 09/02/2016		2

Note 1:

The expanded uncertainty reported according to EN55016-4-2:2011 is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of p = 95%

Note 2:

It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95% confidence, covering factor k = 2.



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8. Reference documents

Reference no.	Description
FCC Rules and Regulation Title 47 part 15:2014	--
ANSI C63.4:2014	American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Internal Procedure PM001 rev. 2.0 (Quality Manual)	Measure Procedure
Internal procedure INC_M rev. 8.2 (Quality Manual)	Measurement uncertainty calculation



9. Deviation from test specification

In agreement with the client, emission tests were performed with peak detector.

At the frequencies where the measures exceed the limit or within 6 dB from it, the test was repeated with quasi-peak detector and/or average detector.

10. Test case verdicts

Test case does not apply to the test object.....: N.A.

Test item does meet the requirement: Complies

Test item does not meet the requirement.....: Does not comply

Test not performed: N.E.



11. Results

In this clause tests results are reported.

Measurement uncertainty is in accordance with document CMC INC_M rev. 8.2.

Judgement of compliance:

Case 1	Case 2	Case 3	Case 4
 The sample complies with the requirement. The measurement result is within the specification limit when the measurement uncertainty is taken into account.	 The sample complies with the requirement. It is not possible to state compliance using a 95% coverage probability for the expanded uncertainty although the measurement result is below the limit.	 The sample does not comply with the requirement. It is not possible to state compliance using a 95% coverage probability for the expanded uncertainty also the measurement result is upper the limit.	 The sample does not comply with the requirement. The measurement result is outside the specification limit when the measurement uncertainty is taken into account.

In agreement with ILAC-G8: 03/2009 Guidelines on the Reporting of Compliance with Specification.



11.1 Antenna requirements

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.203 and 15.204
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

--
Measurement uncertainty: See clause 7 of this test report

Test specification

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, § 15.213,

§ 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance

sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded

Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
20	100	45

Result

Antenna Type	External R.F. power amplifier	Gain	Remarks	Results
Integral antenna	Not Present	2 dBi	--	Complies



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LAB N° 0168

Result: The requirements are met



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11.2 Radiated emissions

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.209
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test configuration and test method

Test site:
Semi-anechoic chamber

Auxiliary equipment:
See clause 4 of this test report

Test equipment used

CMC S108, CMC S127, CMC S136, CMC S164
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Enclosure

Frequency range: 0,009 MHz – 1000 MHz

Antenna polarization: Horizontal (H) – Vertical (V)

EUT – Antenna distance:

10 m for frequencies ≤ 1000 MHz

3 m for frequencies > 1000 MHz

Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	45

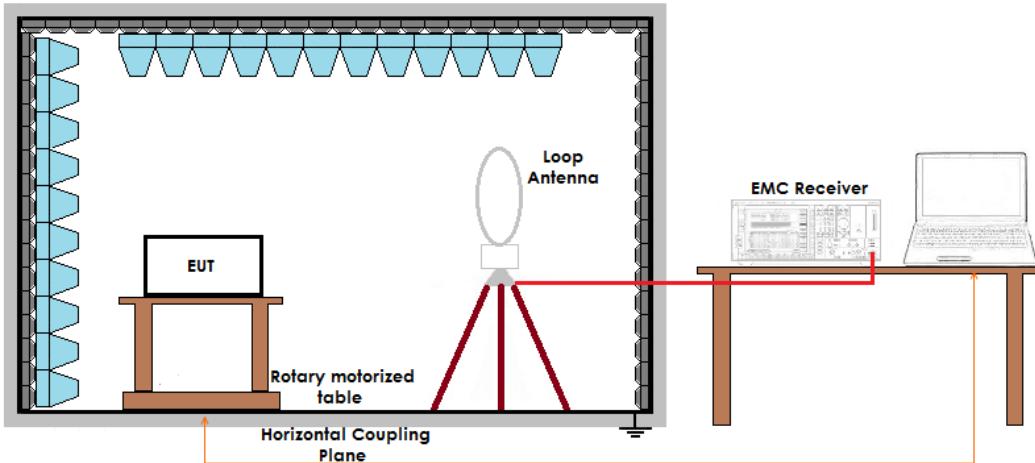
Acceptance limits

Frequency range (MHz)	Limits [dB(µV/m)]
0,009 to 0,490	107,60 to 72,89
0,490 to 1,705	52,89 to 42,05
1,705 to 30	48,63
30 to 88	40
88 to 216	43,52
216 to 960	46,02
Above 960	53,98
Above 1000	53,98

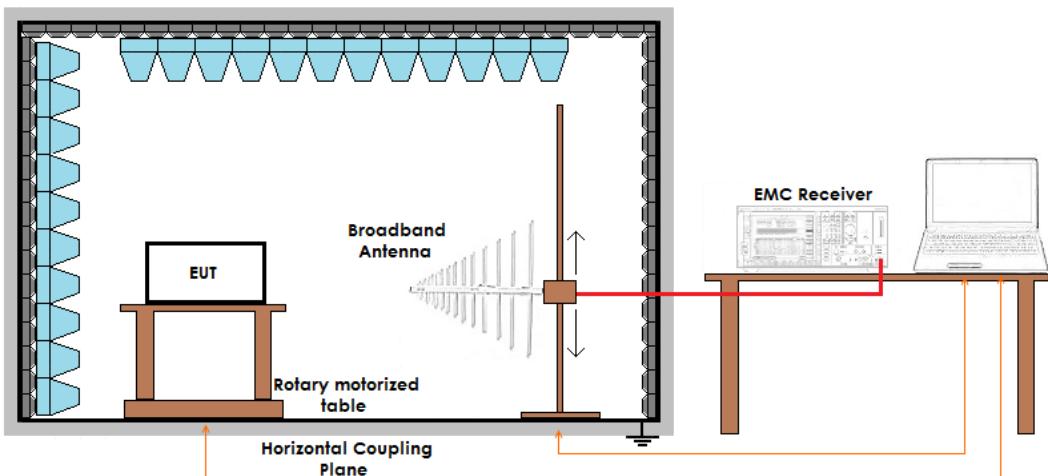
Remarks: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Setup

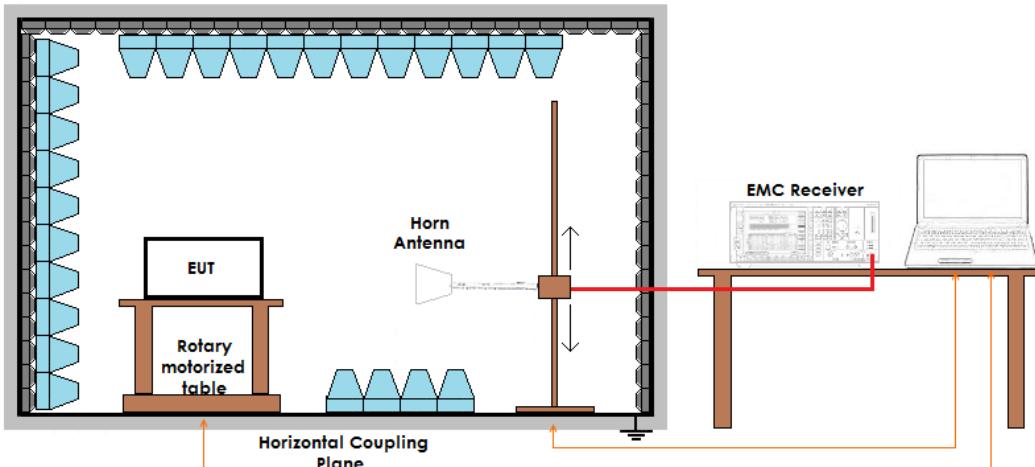
Frequency \leq 30 MHz



Frequency \leq 1 GHz



Frequency $>$ 1 GHz





Result

Polarization	Frequency Range (MHz)	Graphs	Remarks	Result
Loop	0,009 – 30	G16077407	Worst case	Complies
V	30 – 1000	G16077402	Lowest frequency	Complies
H	30 – 1000	G16077401	Lowest frequency	Complies
V	30 – 1000	G16077403	Medium frequency	Complies
H	30 – 1000	G16077404	Medium frequency	Complies
V	30 – 1000	G16077406	Highest frequency	Complies
H	30 – 1000	G16077405	Highest frequency	Complies
V	1000 – 10000	G16077409	Worst case	Complies
H	1000 – 10000	G16077408	Worst case	Complies

Remarks: Peaks above the limits are due to the main transmitting frequencies

Graphs Legend

PK: Peak; QP [1s] (quasi-peak at 1 second) values are marked with a +

AV: Average; AV [1s] (average at 1 second) values are marked with a x



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Graphs

G16077401

Meas Type Emission

Equipment under Test

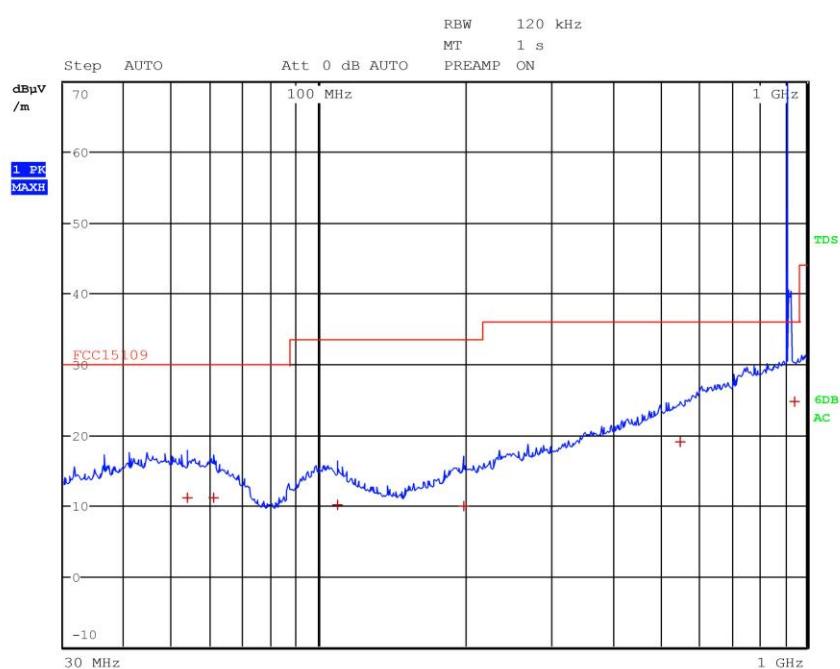
Manufacturer

OP Condition Tx-Rx - Fmin

Operator Gandini 16077401

Test Spec

Horiz



Final Measurement

Meas Time: 1 s

Margin: 20 dB

Subranges: 6

Trace	Frequency	Level (dB μ V/m)	Detector	Delta Limit/dB
1	53.680000000 MHz	11.06	Quasi Peak	-18.94
1	60.880000000 MHz	11.09	Quasi Peak	-18.91
1	109.080000000 MHz	10.09	Quasi Peak	-23.43
1	198.600000000 MHz	9.91	Quasi Peak	-23.61
1	552.440000000 MHz	18.91	Quasi Peak	-17.11
1	947.200000000 MHz	24.70	Quasi Peak	-11.32



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G16077402

Meas Type Emission

Equipment under Test

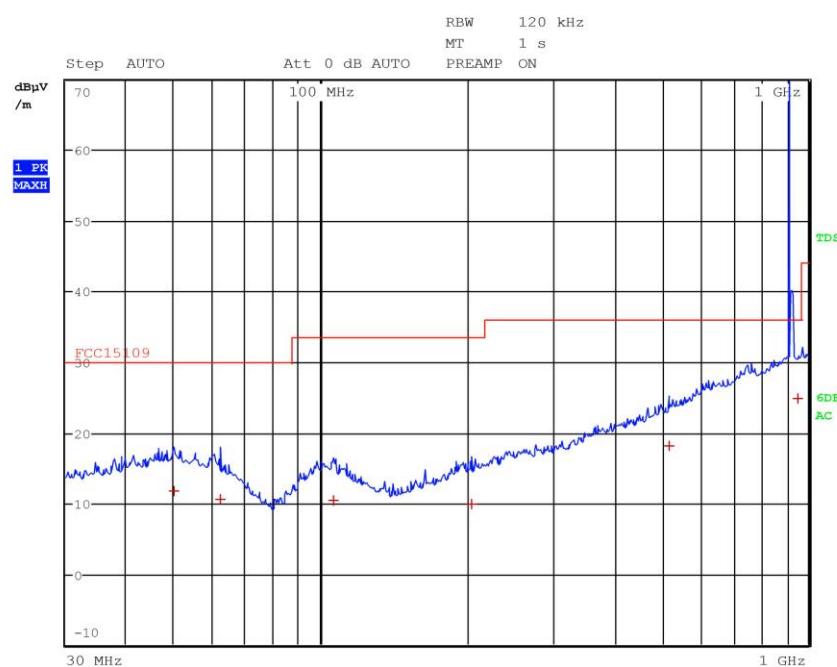
Manufacturer

OP Condition Tx-Rx - Fmin

Operator Gandini 16077402

Test Spec

Vert



Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 6

Trace	Frequency	Level (dB _{PtV} /m)	Detector	Delta Limit/dB
1	50.120000000 MHz	11.69	Quasi Peak	-18.31
1	62.200000000 MHz	10.52	Quasi Peak	-19.48
1	106.000000000 MHz	10.36	Quasi Peak	-23.16
1	204.000000000 MHz	9.92	Quasi Peak	-23.60
1	519.560000000 MHz	18.22	Quasi Peak	-17.80
1	952.560000000 MHz	24.80	Quasi Peak	-11.22



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G16077403

Meas Type Emission

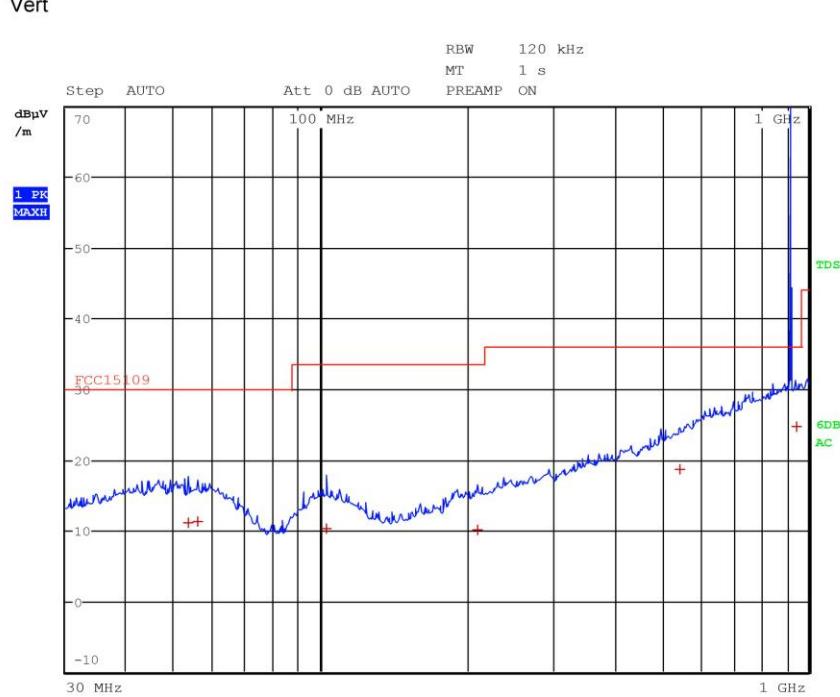
Equipment under Test

Manufacturer

OP Condition Tx-Rx - Fmid

Operator Gandini 16077403

Test Spec.



Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 6

Trace	Frequency	Level (dB μ V/m)	Detector	Delta Limit/dB
1	53.520000000 MHz	11.13	Quasi Peak	-18.87
1	55.800000000 MHz	11.34	Quasi Peak	-18.66
1	102.920000000 MHz	10.21	Quasi Peak	-23.31
1	210.000000000 MHz	10.02	Quasi Peak	-23.50
1	544.760000000 MHz	18.70	Quasi Peak	-17.32
1	947.880000000 MHz	24.73	Quasi Peak	-11.29



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Meas Type Emission

Equipment under Test

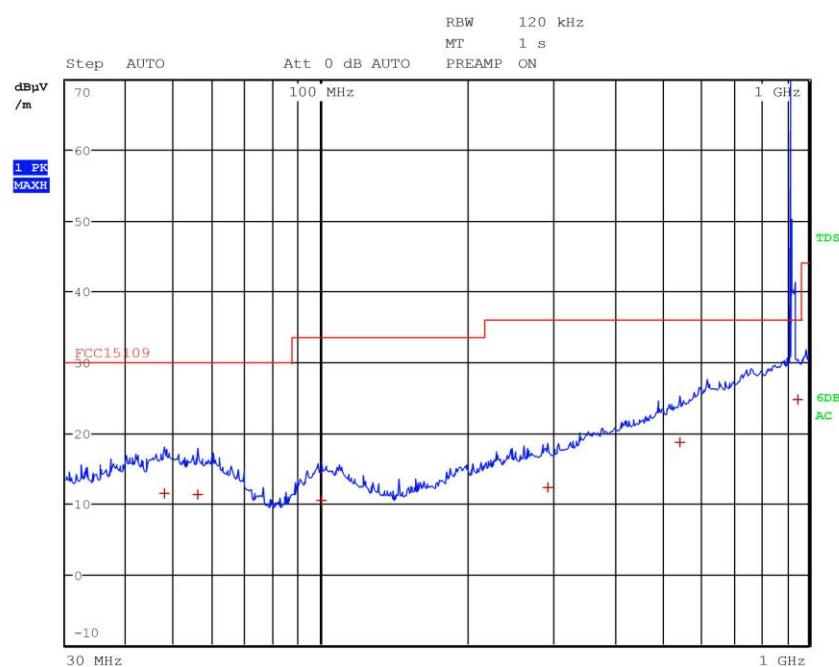
Manufacturer

OP Condition Tx-Rx - Fmid

Operator Gandini 16077404

Test Spec

Horiz



Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 6

Trace	Frequency	Level (dB _{PuV/m})	Detector	Delta Limit/dB
1	47.680000000 MHz	11.47	Quasi Peak	-18.53
1	55.960000000 MHz	11.33	Quasi Peak	-18.67
1	100.120000000 MHz	10.47	Quasi Peak	-23.05
1	291.560000000 MHz	12.32	Quasi Peak	-23.70
1	544.360000000 MHz	18.68	Quasi Peak	-17.34
1	952.720000000 MHz	24.79	Quasi Peak	-11.23



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Meas Type Emission

Equipment under Test

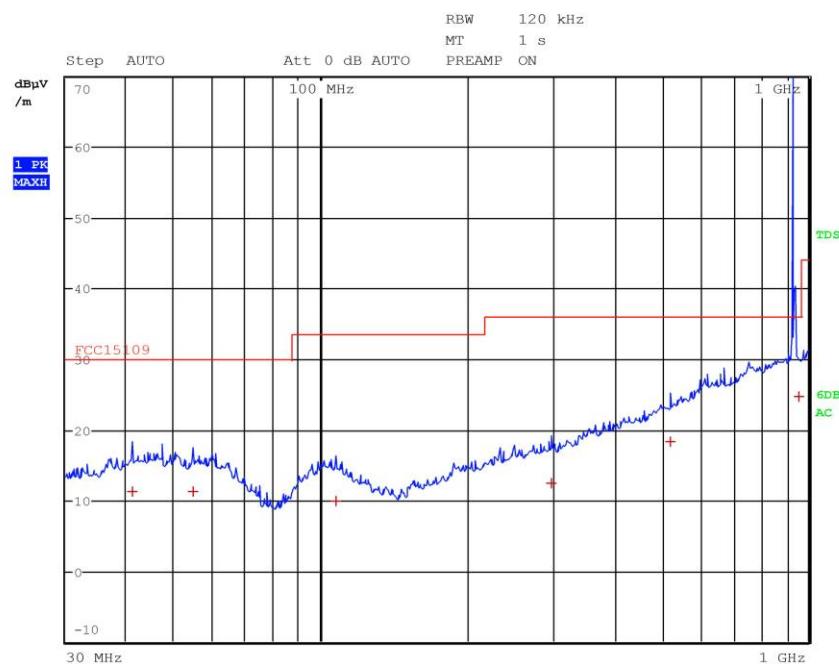
Manufacturer

OP Condition Tx-Rx - Fmax

Operator Gandini 16077405

Test Spec

Horiz



Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 6

Trace	Frequency	Level (dB _{PtV} /m)	Detector	Delta Limit/dB
1	41.000000000 MHz	11.30	Quasi Peak	-18.70
1	54.680000000 MHz	11.24	Quasi Peak	-18.76
1	107.680000000 MHz	9.94	Quasi Peak	-23.58
1	297.280000000 MHz	12.40	Quasi Peak	-23.62
1	522.480000000 MHz	18.34	Quasi Peak	-17.68
1	955.120000000 MHz	24.75	Quasi Peak	-11.27



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G16077406

Meas Type Emission

Equipment under Test

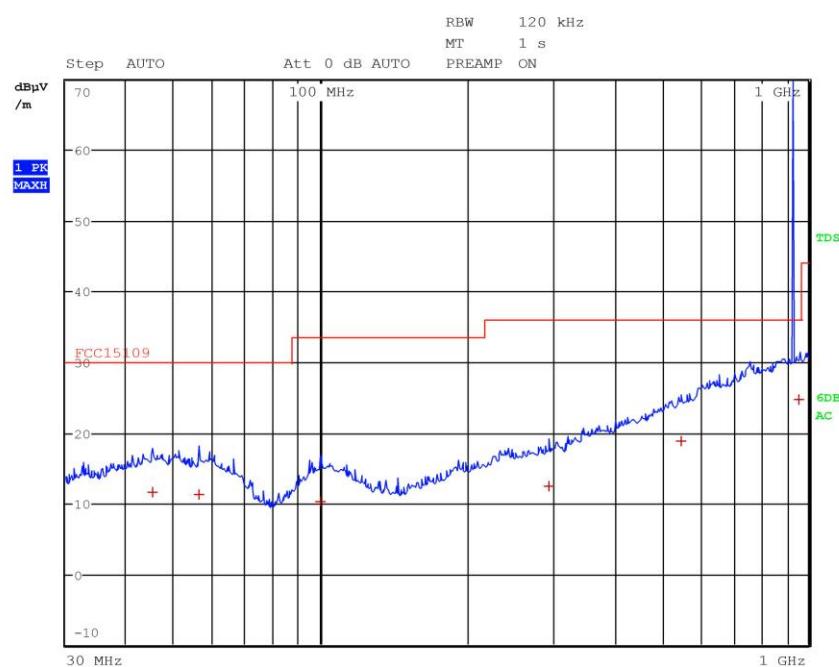
Manufacturer

OP Condition Tx-Rx - Fmax

Operator Gandini 16077406

Test Spec

Vert



Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 7

Trace	Frequency	Level (dB _{PtV} /m)	Detector	Delta Limit/dB
1	45.160000000 MHz	11.64	Quasi Peak	-18.36
1	56.240000000 MHz	11.32	Quasi Peak	-18.68
1	99.560000000 MHz	10.26	Quasi Peak	-23.26
1	293.040000000 MHz	12.49	Quasi Peak	-23.53
1	548.000000000 MHz	18.82	Quasi Peak	-17.20
1	928.040000000 MHz	74.92	Quasi Peak	38.90
1	954.320000000 MHz	24.78	Quasi Peak	-11.24



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Meas Type Emission

Equipment under Test

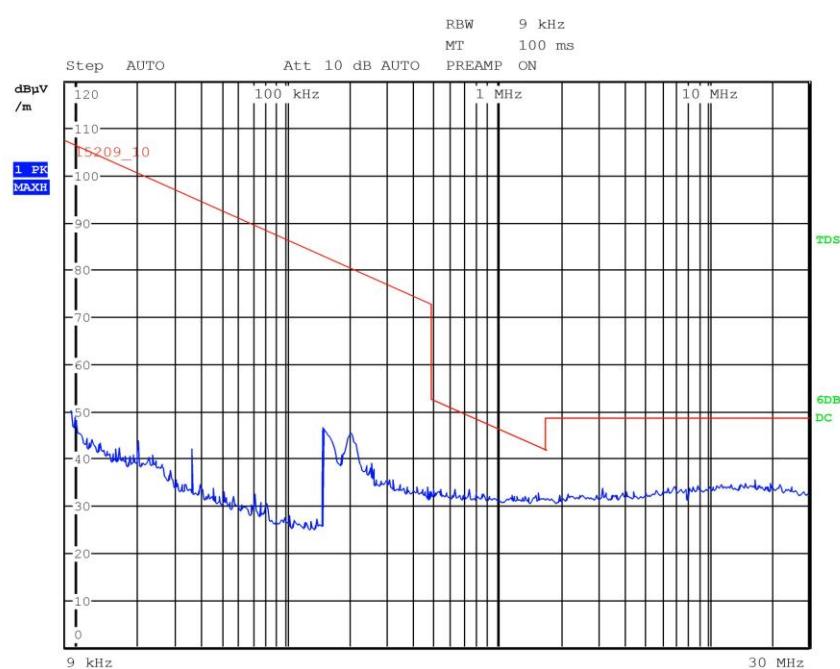
Manufacturer

OP Condition Tx-Rx

Operator Gandini 16077407

Test Spec

Loop



Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 0



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Meas Type Emission

Equipment under Test

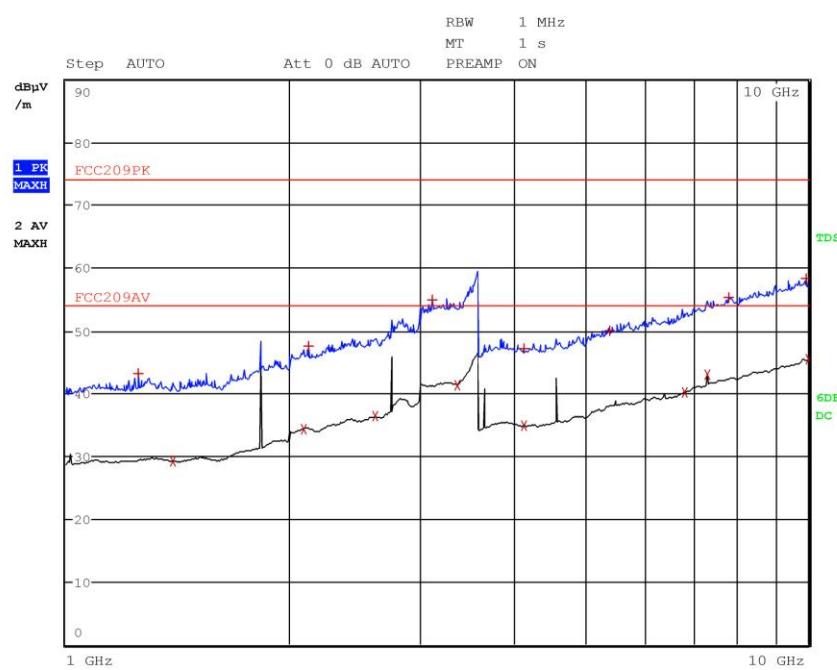
Manufacturer

OP Condition Tx-Rx

Operator Gandini 16077408

Test Spec

Horiz





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Via della Fisica, 20
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

Meas Type Emission

Equipment under Test

Manufacturer

OP Condition Tx-Rx

Operator Gandini 16077408

Test Spec

Horiz

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 15

Trace	Frequency	Level (dB μ V/m)	Detector	Delta Limit/dB
1	1.253200000 GHz	43.27	Max Peak	-30.73
2	1.393600000 GHz	29.15	Average	-24.85
2	2.088800000 GHz	34.26	Average	-19.74
1	2.121600000 GHz	47.52	Max Peak	-26.48
2	2.606800000 GHz	36.37	Average	-17.63
1	3.115600000 GHz	55.02	Max Peak	-18.98
2	3.361600000 GHz	41.35	Average	-12.65
1	4.139200000 GHz	47.11	Max Peak	-26.89
2	4.140000000 GHz	34.85	Average	-19.15
1	5.404800000 GHz	49.99	Max Peak	-24.01
2	6.810800000 GHz	40.26	Average	-13.74
2	7.320400000 GHz	42.99	Average	-11.01
1	7.799600000 GHz	55.37	Max Peak	-18.63
1	9.930400000 GHz	58.30	Max Peak	-15.70
2	9.986000000 GHz	45.46	Average	-8.54



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G16077409

Meas Type Emission

Equipment under Test

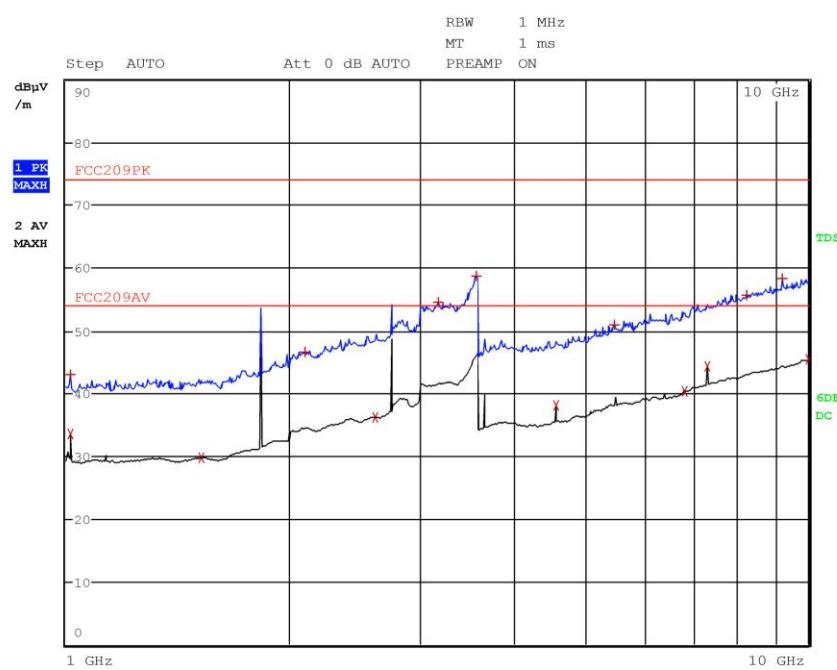
Manufacturer

OP Condition Tx-Rx

Operator Gandini 16077409

Test Spec

Vert





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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

Meas Type Emission

Equipment under Test

Manufacturer

OP Condition Tx-Rx

Operator Gandini 16077409

Test Spec

Vert

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 14

Trace	Frequency	Level (dB μ V/m)	Detector	Delta Limit/dB
2	1.014000000 GHz	33.47	Average	-20.53
1	1.014400000 GHz	42.96	Max Peak	-31.04
2	1.521200000 GHz	29.79	Average	-24.21
1	2.099600000 GHz	46.65	Max Peak	-27.35
2	2.606800000 GHz	36.30	Average	-17.70
1	3.172000000 GHz	54.47	Max Peak	-19.53
1	3.573600000 GHz	58.70	Max Peak	-15.30
2	4.575200000 GHz	38.09	Average	-15.91
1	5.477200000 GHz	50.88	Max Peak	-23.12
2	6.812800000 GHz	40.39	Average	-13.61
2	7.320400000 GHz	44.42	Average	-9.58
1	8.247200000 GHz	55.75	Max Peak	-18.25
1	9.208800000 GHz	58.31	Max Peak	-15.69
2	9.993200000 GHz	45.42	Average	-8.58

Result: The requirements are met



11.3 20 dB bandwidth

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S227
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

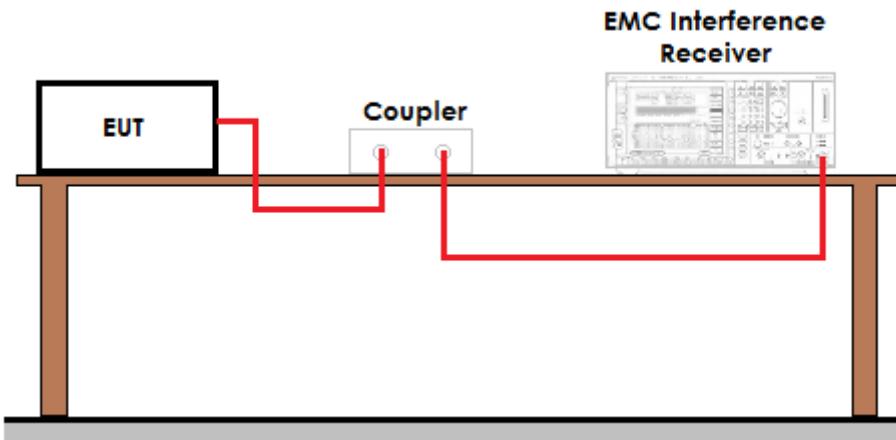
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	45

Acceptance limits: The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz



Setup



Result

Frequency (MHz)	Graphs	20 dB bandwidth (kHz)	Maximum 20 dB bandwidth allowed (kHz)	Results
915,05	G16077410	22,70	500	Complies
921,50	G16077420	21,95	500	Complies
927,95	G16077415	22,62	500	Complies



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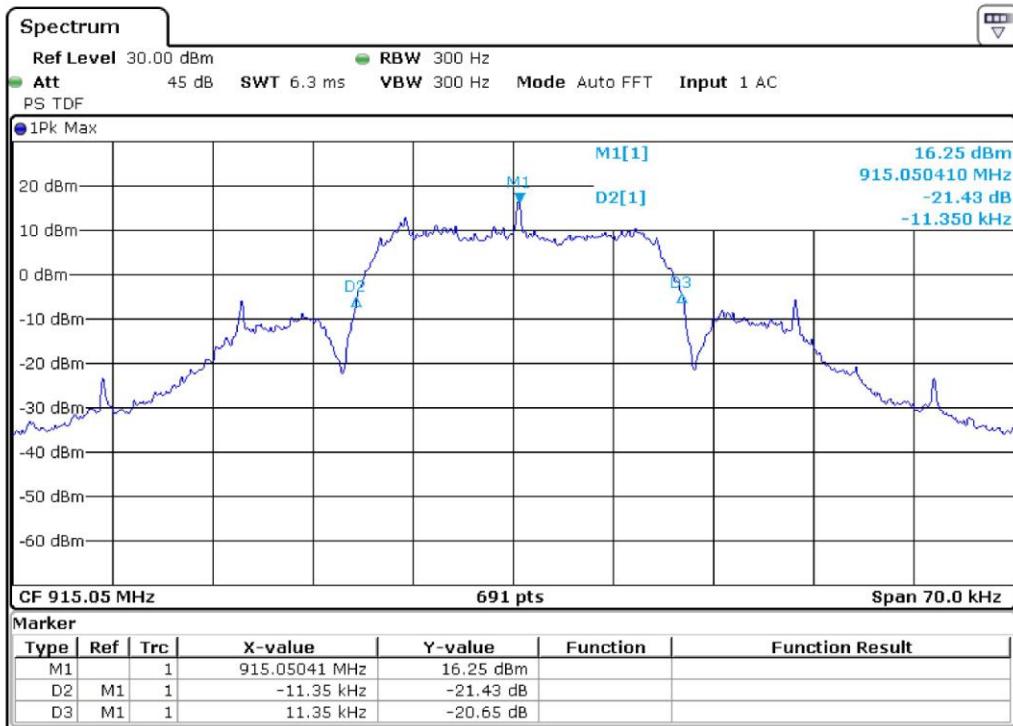


ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

Graphs

G16077410



Gandini 16077410-F min



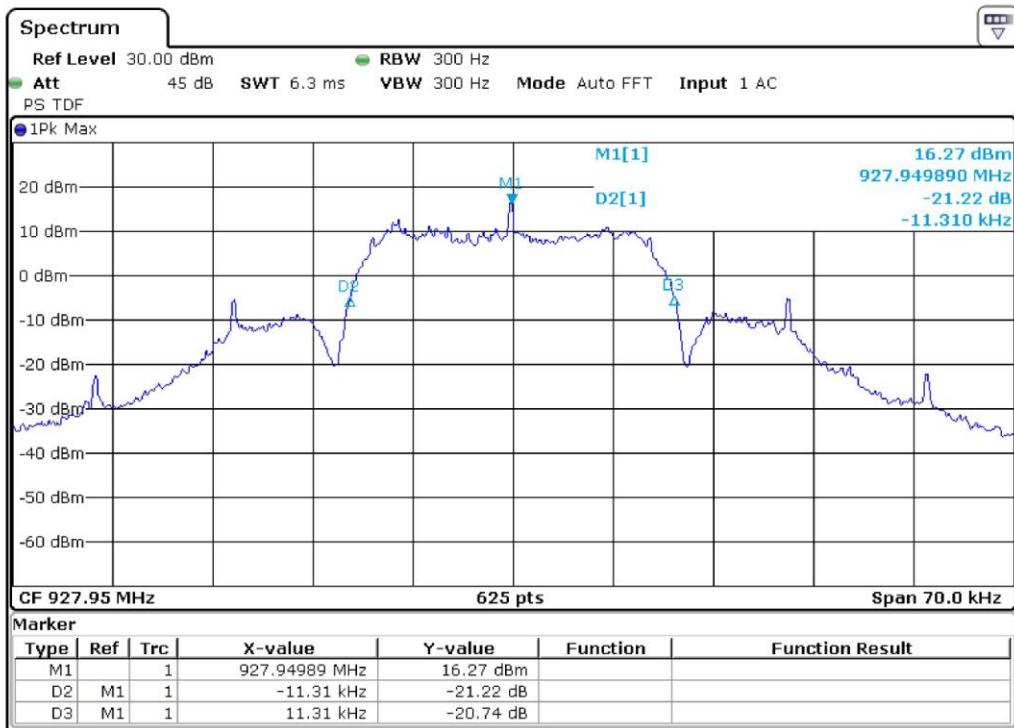
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077415



Gandini 16077415-F max



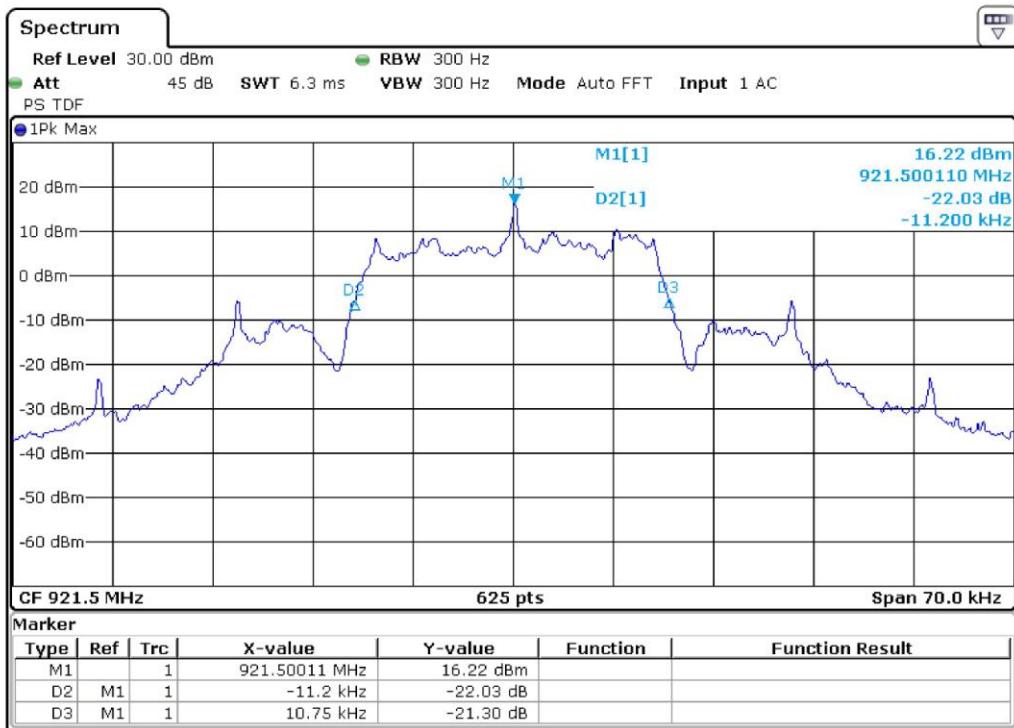
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077420



Gandini 16077420-F mid

Result: The requirements are met



11.4 Channel separation

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S227
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

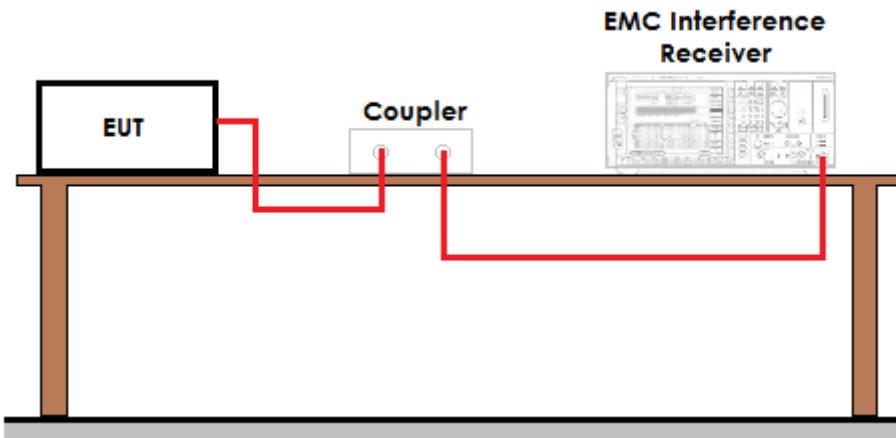
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
20	100	42

Acceptance limits: frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483,5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW



Setup



Result

Frequency band (MHz)	Graphs	Channel separation (kHz)	Minimum channel separation required (kHz)	Results
902 – 928	G16077424	200,48	25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater	Complies



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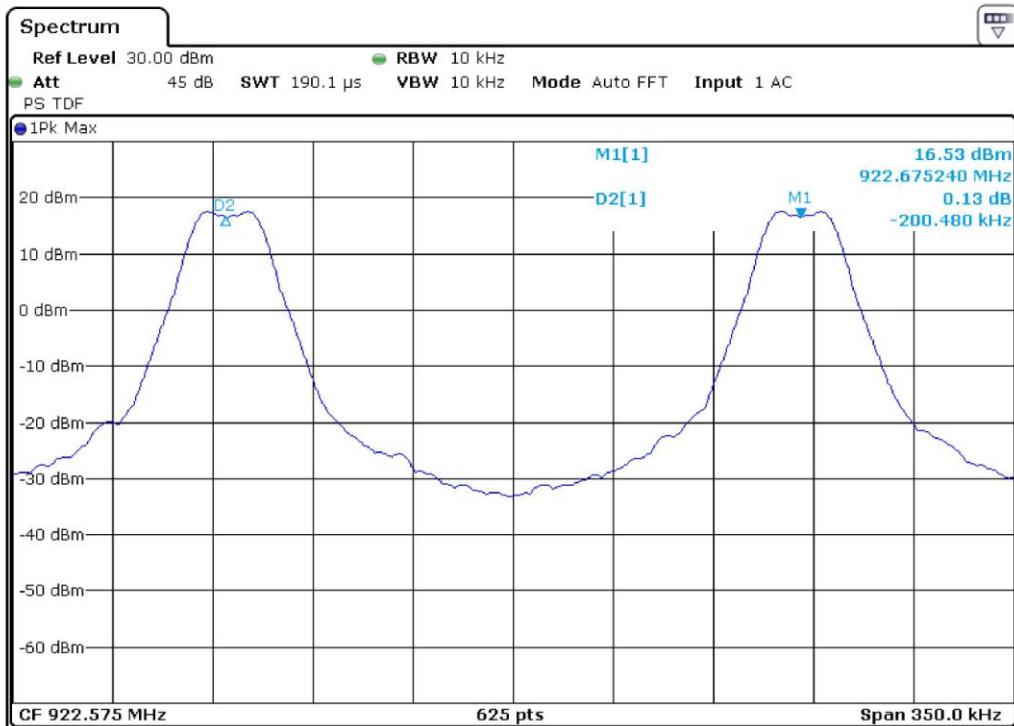


ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

Graphs

G16077424



Gandini 16077424-F hopping

Result: The requirements are met



11.5 Number of hopping channels

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test specification

See FCC Part 15.247

Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
20	100	42

Acceptance limits: for frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies. Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test configuration and test method

Test site:
Laboratory

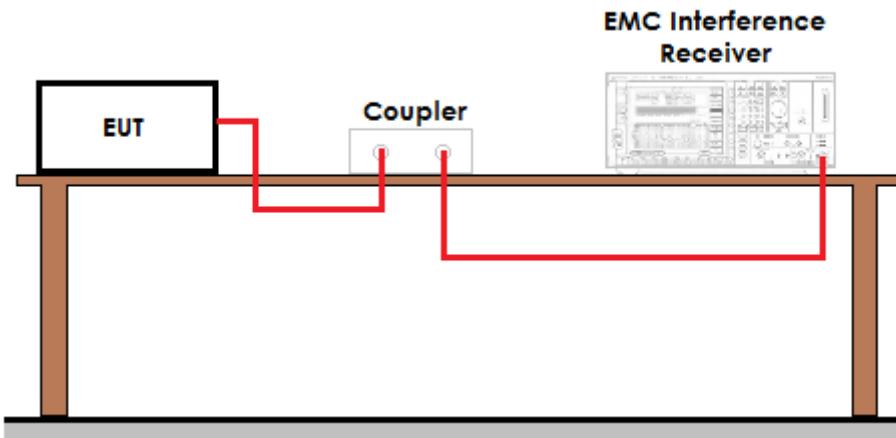
Auxiliary equipment:
See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S227
Measurement uncertainty: See clause 7 of this test report



Setup



Result

Graphs	Number of hopping channels	Minimum number of hopping channels required	Results
G16077423	64	50 if the 20 dB bandwidth is less than 250 kHz 25 if the 20 dB bandwidth is 250 kHz or greater	Complies



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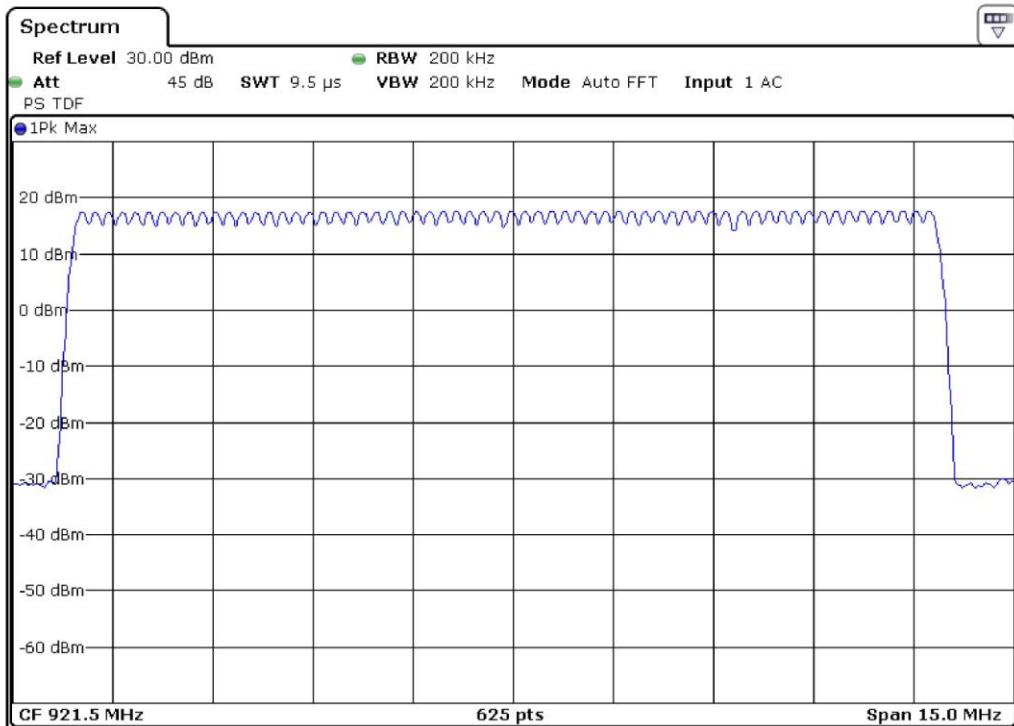


ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

Graphs

G16077423



Gandini 16077423-F hopping

Result: The requirements are met



11.6 Time of occupancy

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S227
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

Environmental conditions

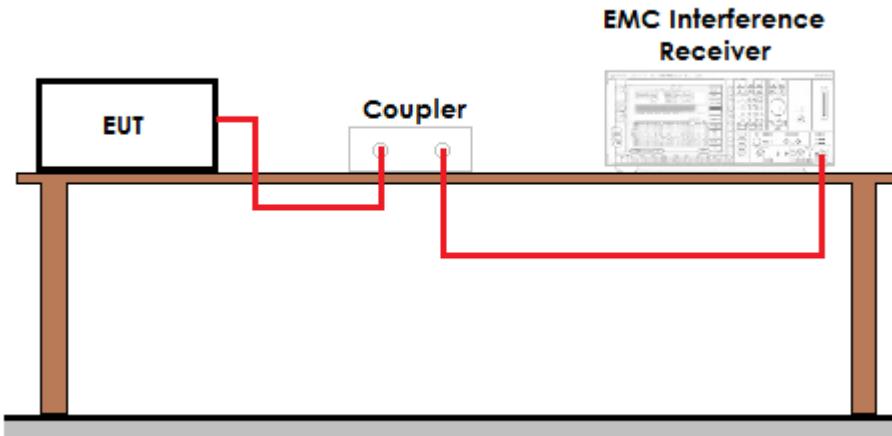
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	42

Acceptance limits:

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0,4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0,4 seconds within a 10 second period



Setup



Result

Dwell time of transmission

Frequency (MHz)	Graphs	Dwell time (ms)
921,25	G16077429	20,7051

Number of transmissions per period (20 s)

Frequency (MHz)	Time between 2 transmission on different channels		Number of transmissions
921,25	G16077430	49,86 ms	6,27

Time of occupancy (Dwell time x Number of transmissions)	129,82 ms
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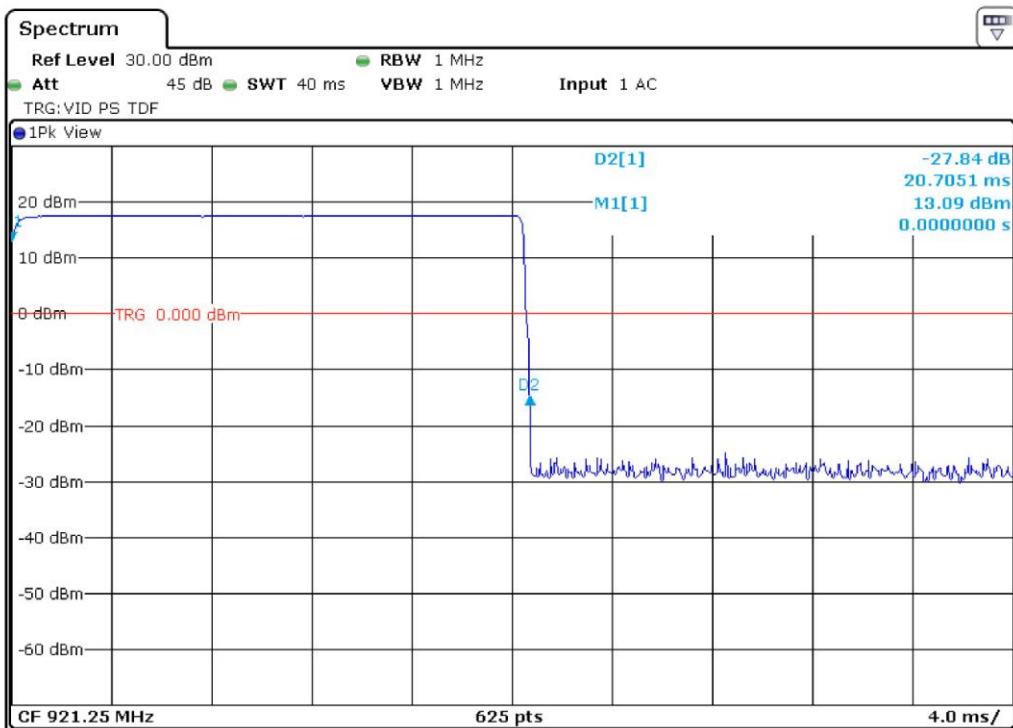


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LAB N° 0168

Graphs

G16077429



Gandini 16077429-F hopping



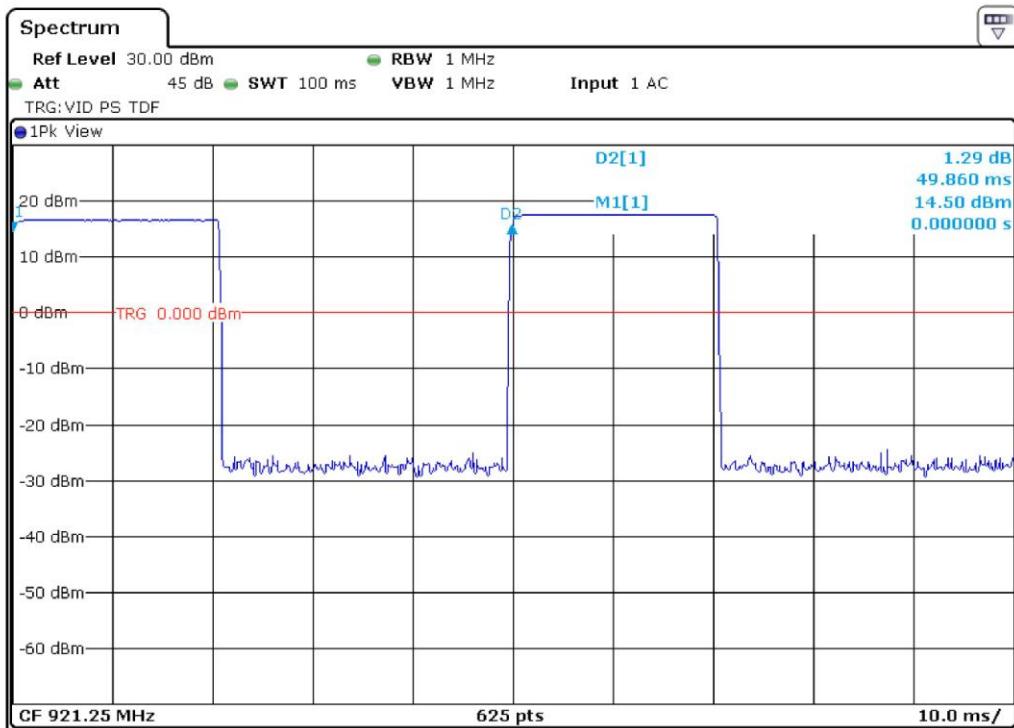
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077430



Gandini 16077430-F hopping

Result: The requirements are met



11.7 Band edge

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S227
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

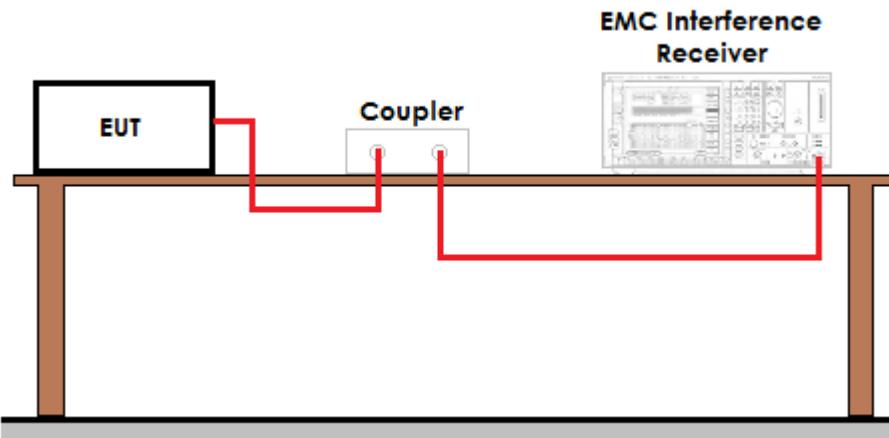
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	45

Acceptance limits: operation within the band 902 – 928 MHz



Setup



Result

Frequency (MHz)	Graph(s) – Hopping	Results	
915,05	G16077425	F_L : 915,0266 MHz	Complies
	G16077426		
927,95	G16077427	F_H : 927,9748 MHz	Complies
	G16077428		

Frequency (MHz)	Graph(s) – No hopping	Results	
915,05	G16077413	F_L : 915,0272 MHz	Complies
	G16077414		
927,95	G16077419	F_H : 927,9744 MHz	Complies
	G16077418		



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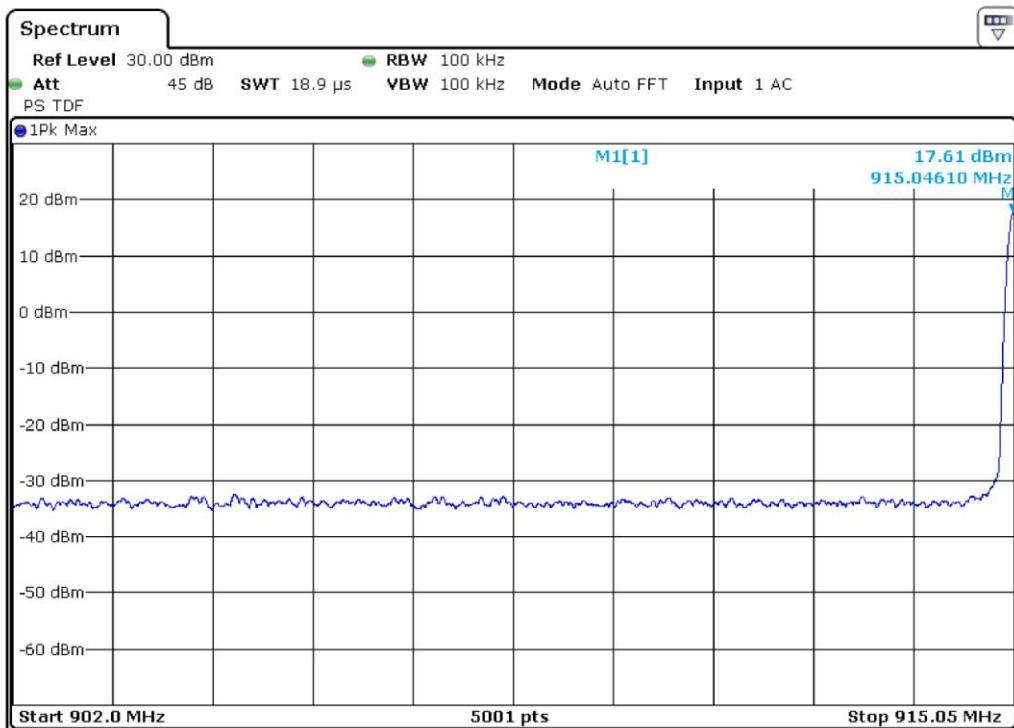


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LAB N° 0168

Graphs

G16077413



Gandini 16077413-F min



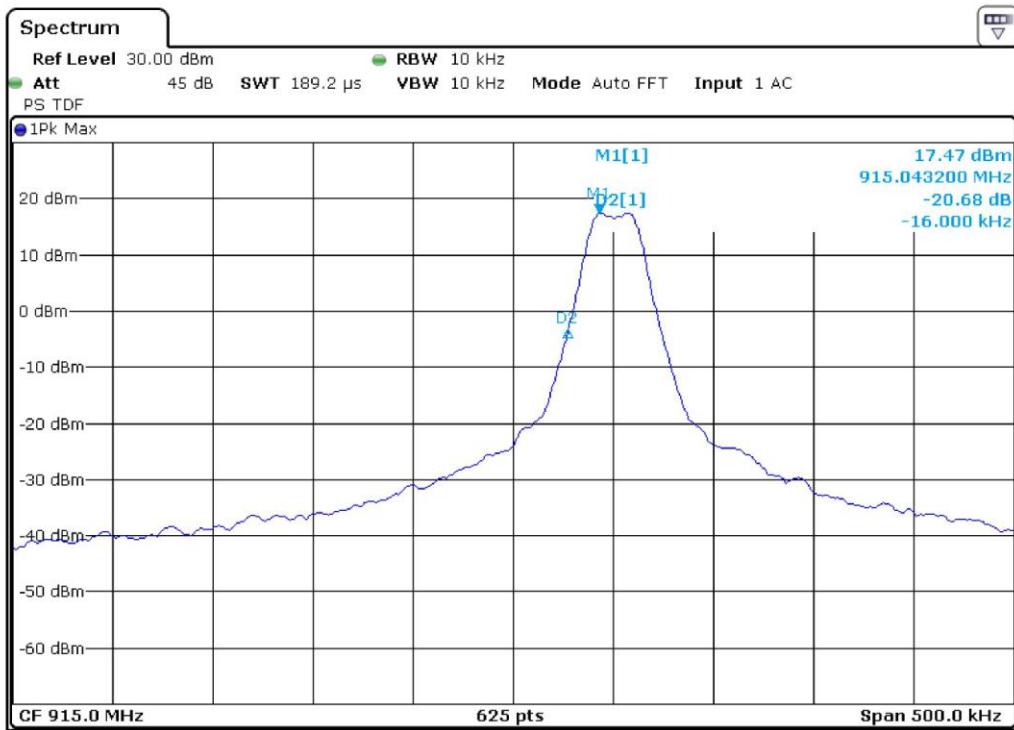
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077414



Gandini 16077414-F min



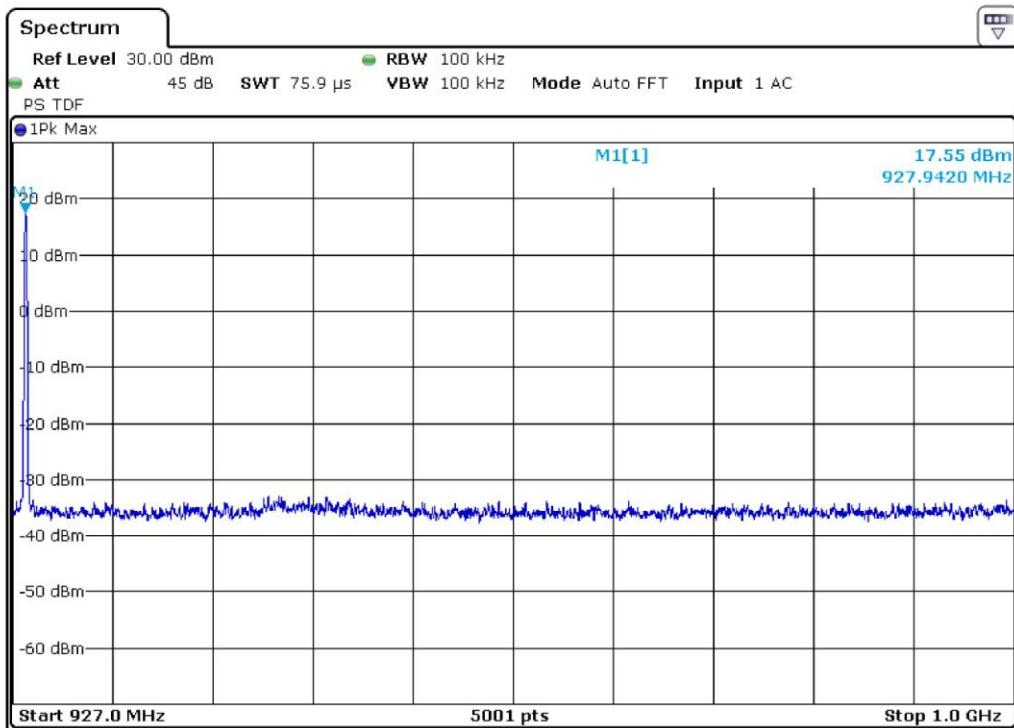
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077418



Gandini 16077418-F max





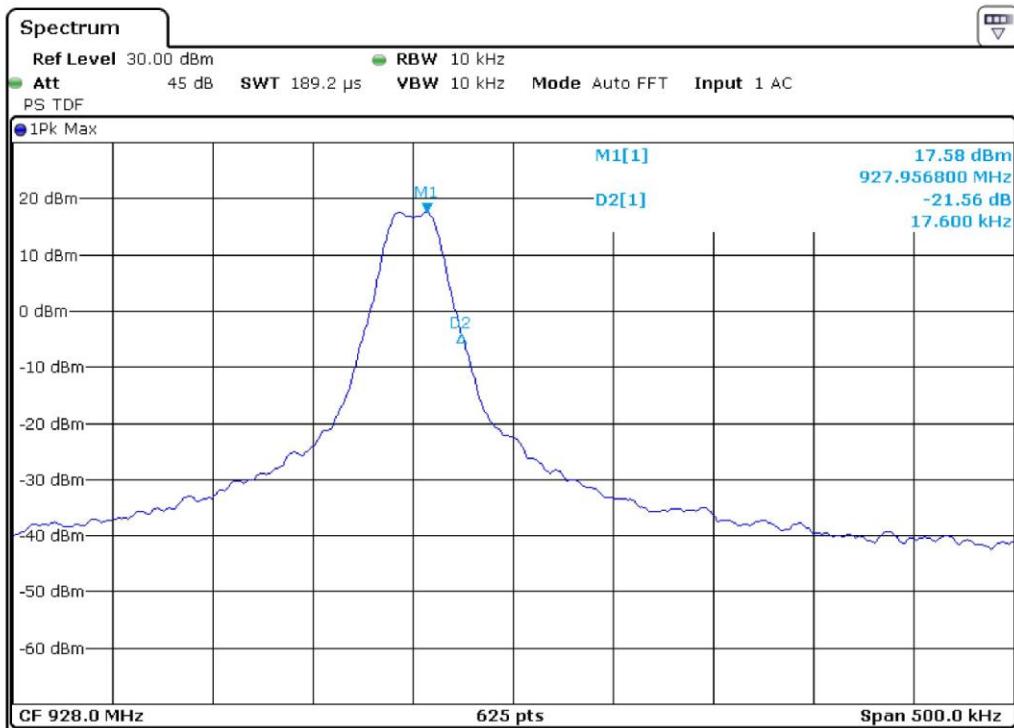
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077419



Gandini 16077419-F max





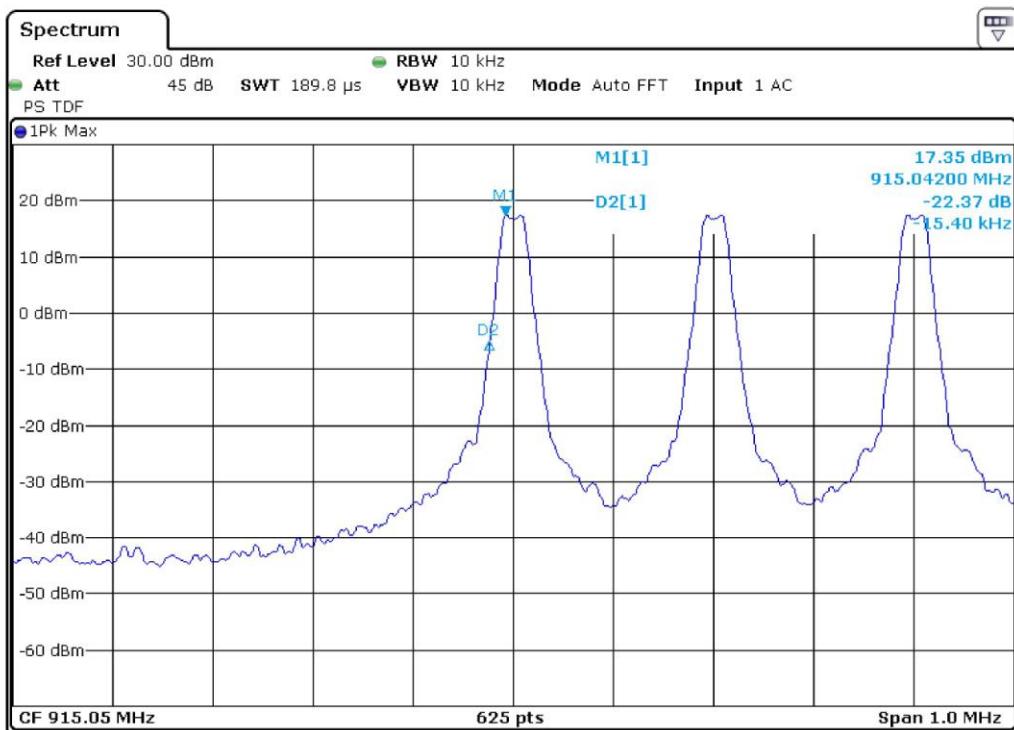
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LAB N° 0168

G16077425



Gandini 16077425-F hopping



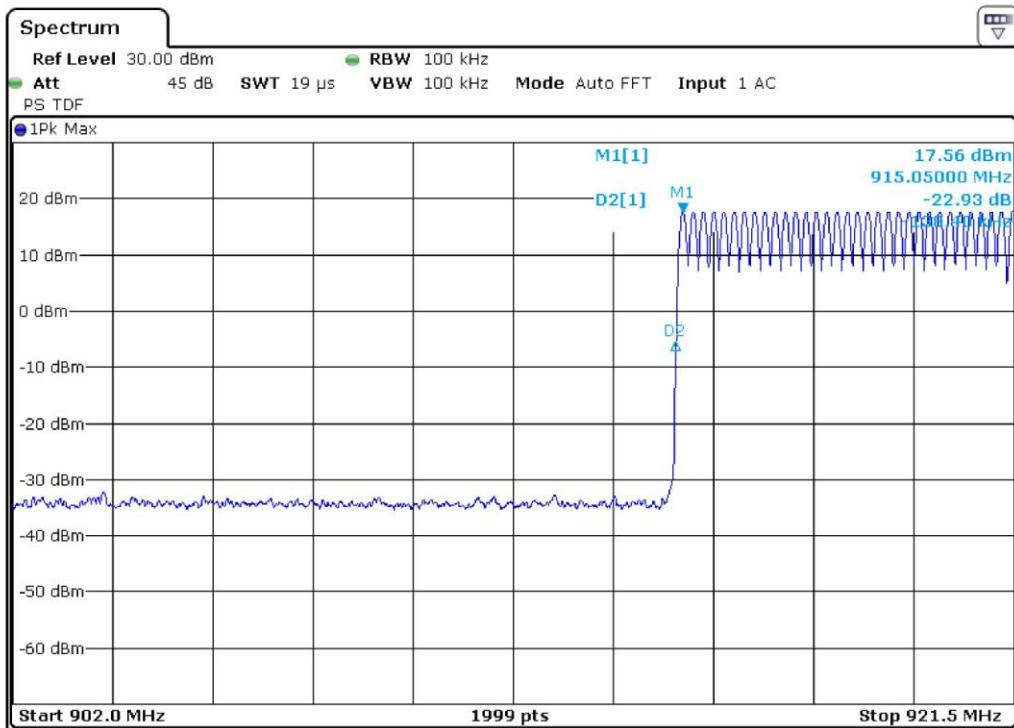
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ACCREDIA
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LAB N° 0168

G16077426



Gandini 16077426-F hopping





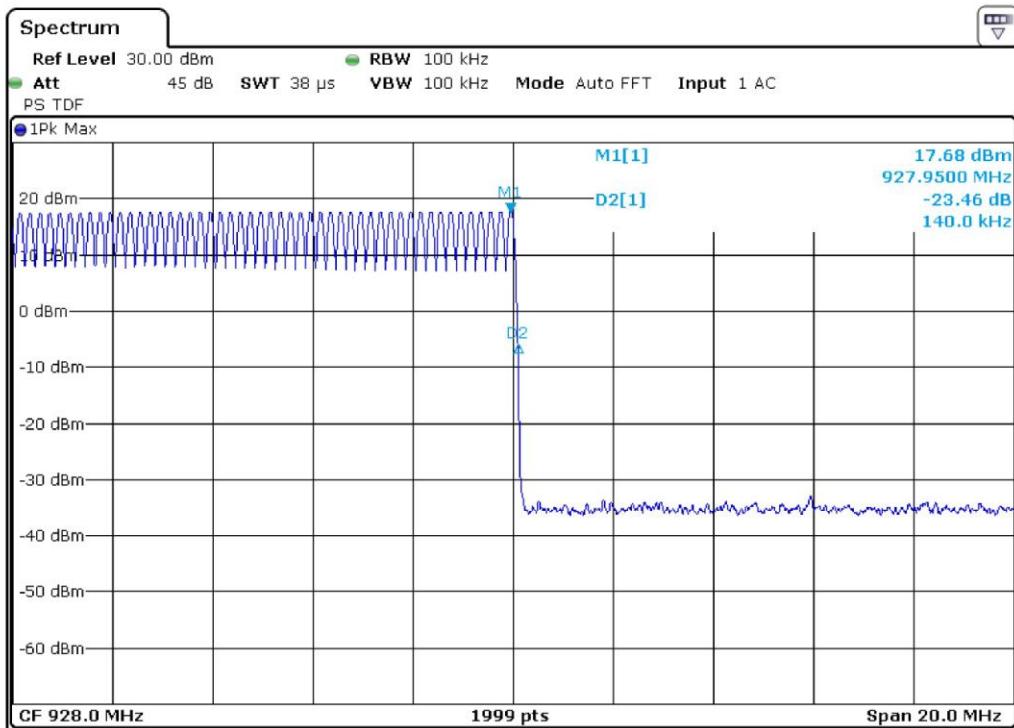
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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077427



Gandini 16077427-F hopping



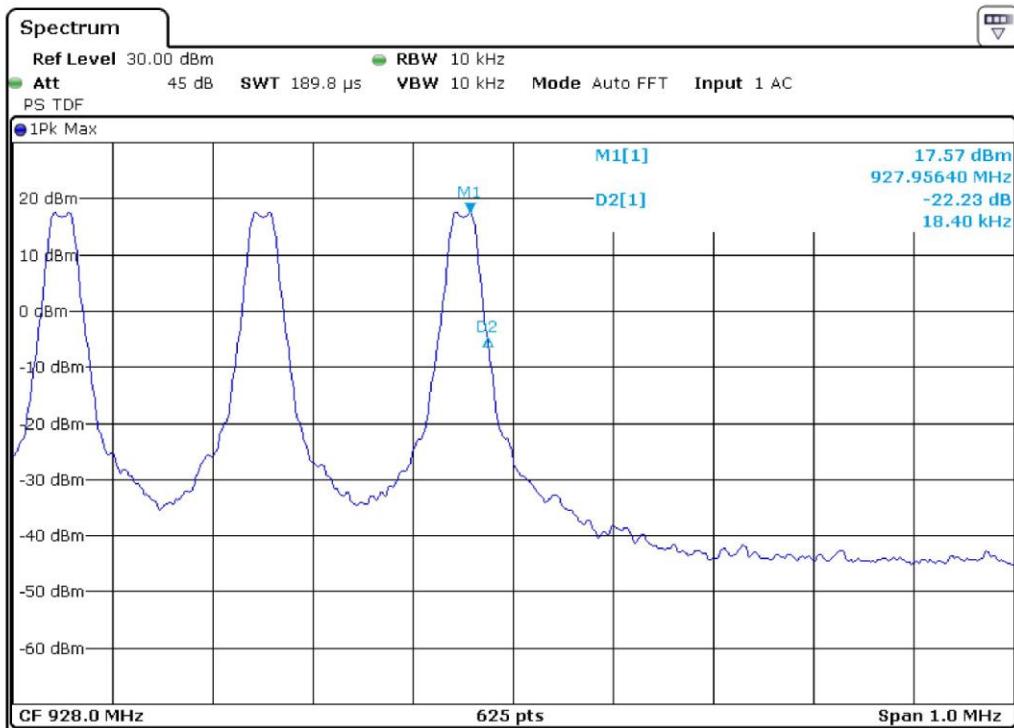
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LAB N° 0168

G16077428



Gandini 16077428-F hopping

Result: The requirements are met



11.8 Peak Output Power

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S164
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Enclosure

Antenna polarization: Horizontal (H) – Vertical (V)

EUT – Antenna distance: 3 m

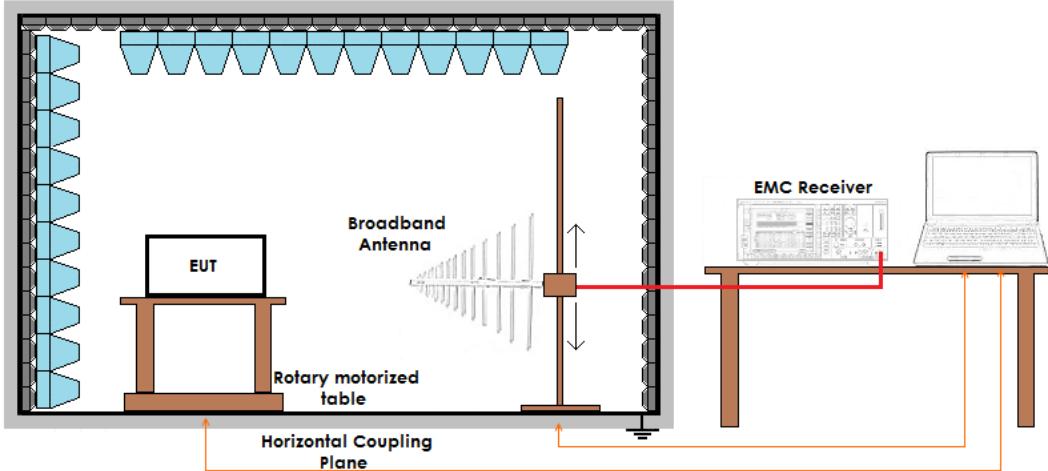
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
20	100	45

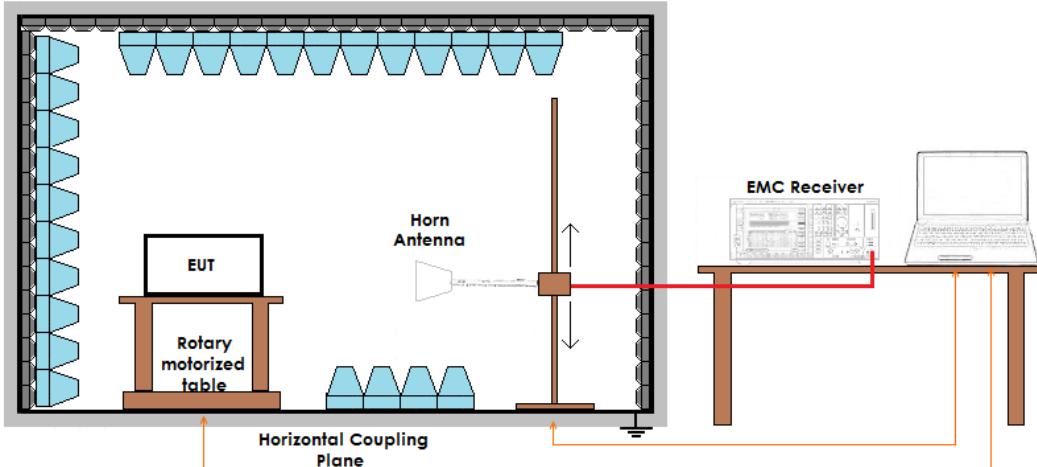
For frequency hopping systems operating in the 2400–2483,5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483,5 MHz band: 0,125 watts. For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0,25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

Setup

Frequency ≤ 1 GHz



Frequency > 1 GHz



Result

Frequency (MHz)	Polarization	Graphs	Measured QP level (dB μ V/m)	Peak Output Power (mW)	Remarks
915,058814	Horizontal	G16077449	99,11	1,54	--
915,045192	Vertical	G16077450	108,40	13,10	--
921,494391	Horizontal	G16077446	99,26	1,60	--
921,508013	Vertical	G16077444	107,43	10,47	--
927,956410	Horizontal	G16077441	99,52	1,69	--
927,941987	Vertical	G16077442	107,16	9,84	--

Remarks

$$P = (E \times d)^2 / (30 \times G)$$



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Where:

E = the measured maximum fundamental field strength in V/m

G = the numeric gain of the transmitting antenna: 1,58 (2 dBi)

d = the distance in meters from which the field strength was measured (3 m)

P = the power in watts



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LAB N° 0168

Graphs

G16077441

Meas Type Emission

Equipment under Test

Manufacturer

OP Condition Tx - Fmax

Operator Gandini 16077441

Test Spec

Horiz

* RBW 100 kHz Marker 1 [T1]
VBW 300 kHz 99.52 dB μ V/m
SWT 2.5 ms 927.956410256 MHz





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G16077442

Meas Type Emission

Equipment under Test

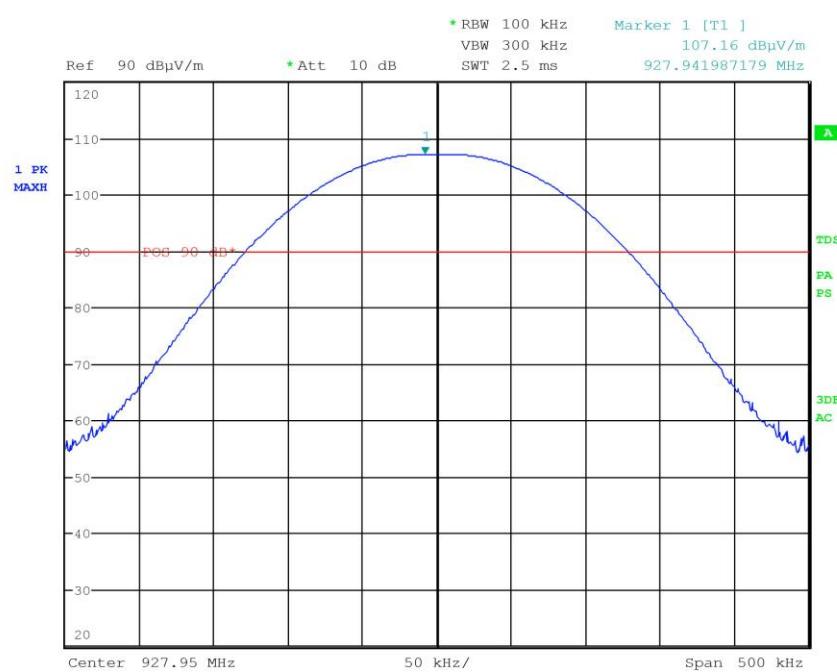
Manufacturer

OP Condition Tx - Fmax

Operator Gandini 16077442

Test Spec

Vert





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LAB N° 0168

G16077444

Meas Type Emission

Equipment under Test

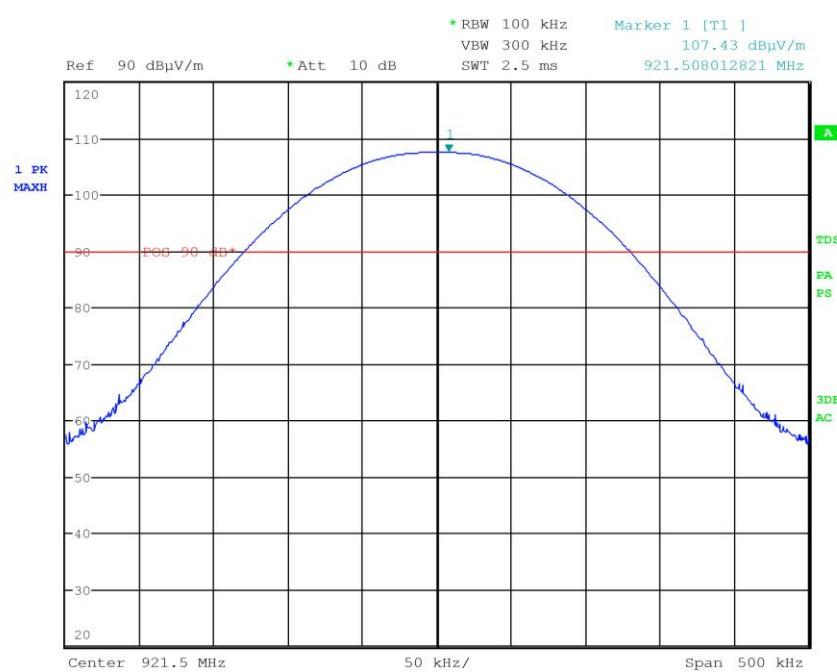
Manufacturer

OP Condition Tx - Fmid

Operator Gandini 16077444

Test Spec

Vert





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ACCREDIA
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LAB N° 0168

G16077446

Meas Type Emission

Equipment under Test

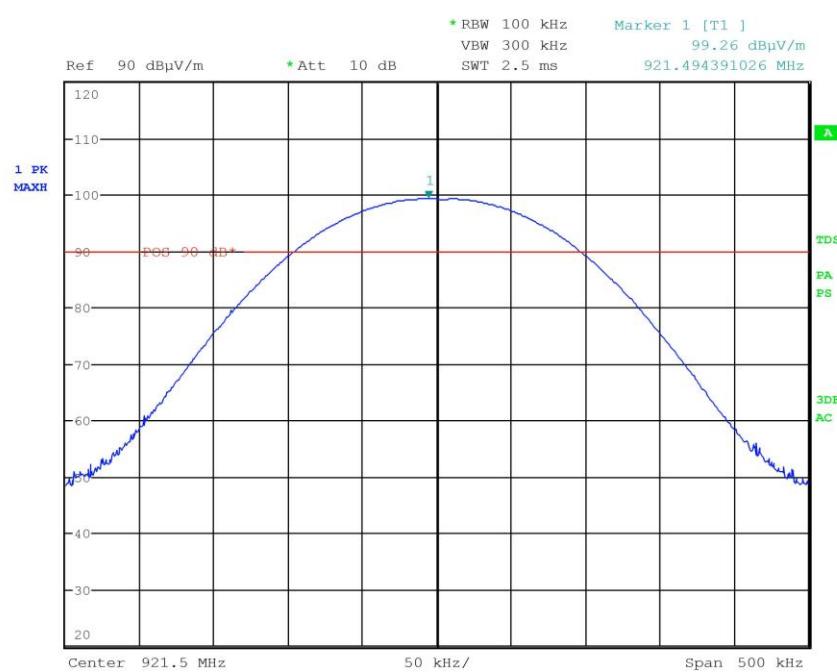
Manufacturer

OP Condition Tx - Fmid

Operator Gandini 16077446

Test Spec

Horiz





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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077449

Meas Type Emission

Equipment under Test

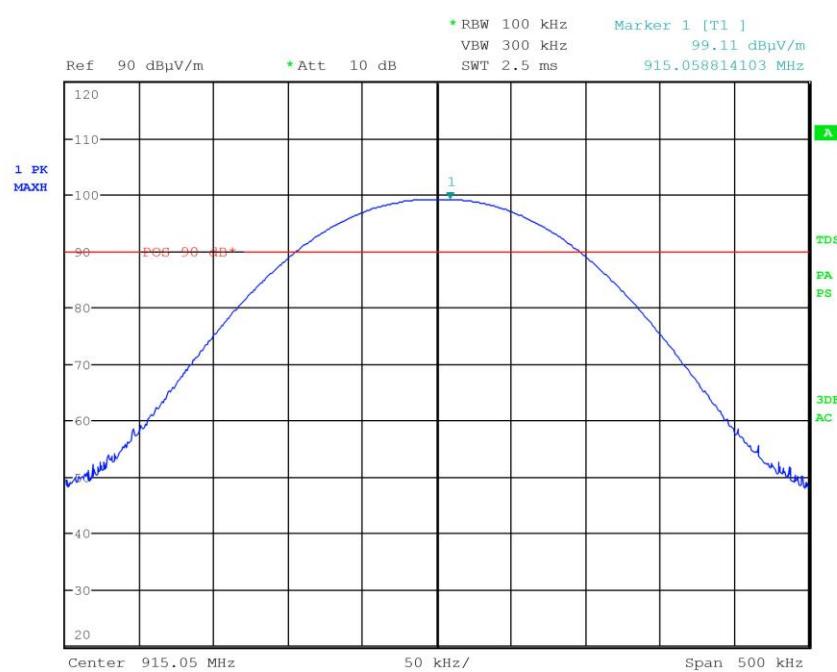
Manufacturer

OP Condition Tx - Fmin

Operator Gandini 16077449

Test Spec

Horiz





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ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

LAB N° 0168

G16077450

Meas Type Emission

Equipment under Test

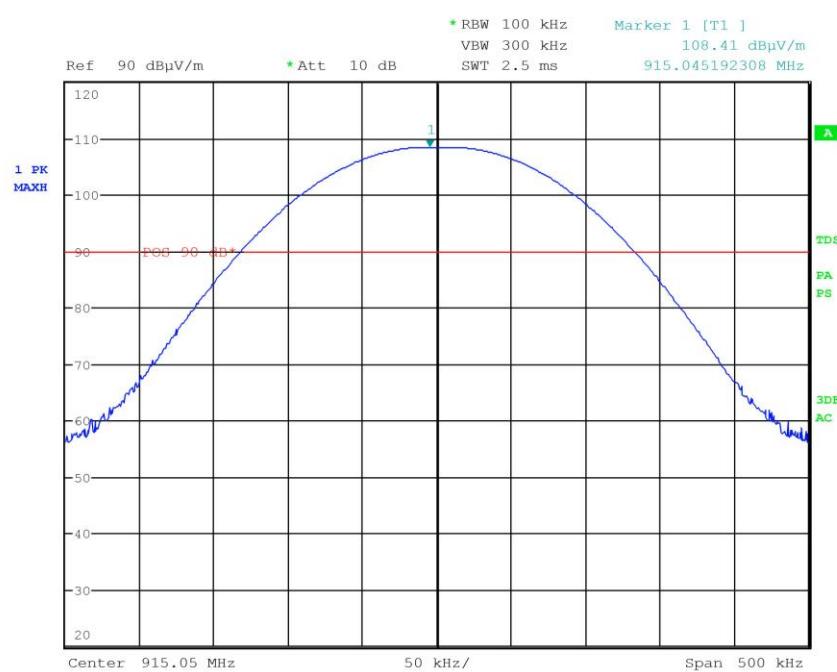
Manufacturer

OP Condition Tx - Fmin

Operator Gandini 16077450

Test Spec

Vert



Result: The requirements are met



11.9 Spurious Emission

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.209
- DA 00-705
- Internal procedure PM001
- See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test configuration and test method

Test site:
Semi-anechoic chamber

Auxiliary equipment:
See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S164
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Enclosure

Antenna polarization: Horizontal (H) – Vertical (V)

EUT – Antenna distance: 3 m

Detector AV + Peak

Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	45

Acceptance limits

Acceptance limits for emissions in restricted frequency bands		
Frequency (MHz)	AV limits [dB(µV/m)]	Peak limits [dB(µV/m)]
> 1000	54	74



The restricted frequency bands are listed in the following table

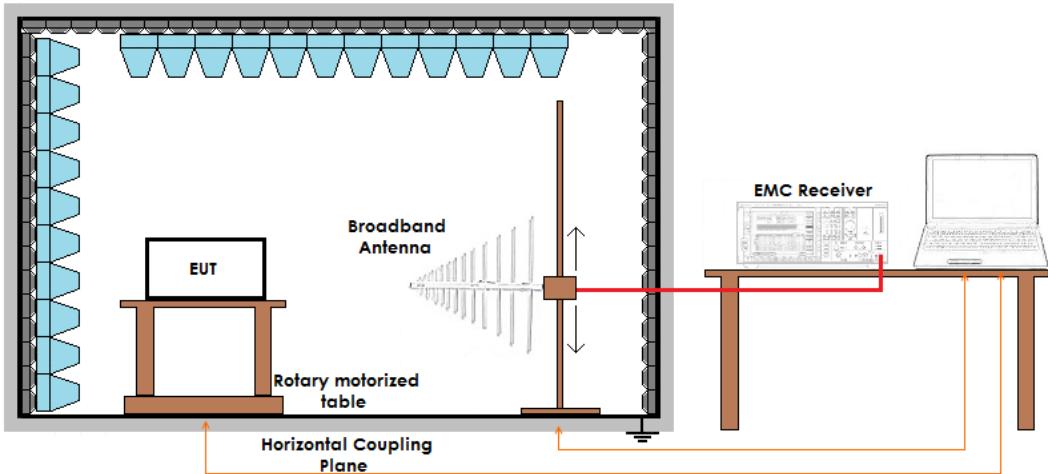
MHz	MHz	MHz	GHz
0,090 – 0,110	16,42 – 16,423	399,9 – 410	4,5 – 5,15
0,495 – 0,505	16,69475 – 16,69525	608 – 614	5,35 – 5,46
2,1735 – 2,1905	16,80425 – 16,80475	960 – 1240	7,25 – 7,75
4,125 – 4,128	25,5 – 25,67	1300 – 1427	8,025 – 8,5
4,17725 – 4,17775	37,5 – 38,25	1435 – 1626,5	9,0 – 9,2
4,20725 – 4,20775	73 – 74,6	1645,5 – 1646,5	9,3 – 9,5
6,215 – 6,218	74,8 – 75,2	1660 – 1710	10,6 – 12,7
6,26775 – 6,26825	108 – 121,94	1718,8 – 1722,2	13,25 – 13,4
6,31175 – 6,31225	123 – 138	2200 – 2300	14,47 – 14,5
8,291 – 8,294	149,9 – 150,05	2310 – 2390	15,35 – 16,2
8,362 – 8,366	156,52475 – 156,52525	2483,5 – 2500	17,7 – 21,4
8,37625 – 8,38675	156,7 – 156,9	2690 – 2900	22,01 – 23,12
8,41425 – 8,41475	162,0125 – 167,17	3260 – 3267	23,6 – 24,0
12,29 – 12,293	167,72 – 173,2	3332 – 3339	31,2 – 31,8
12,51975 – 12,52025	240 – 285	3345,8 – 3358	36,43 – 36,5
12,57675 – 12,57725	322 – 335,4	3600 – 4400	Above 38,6
13,36 – 13,41			

Acceptance limits for emissions in non-restricted frequency bands

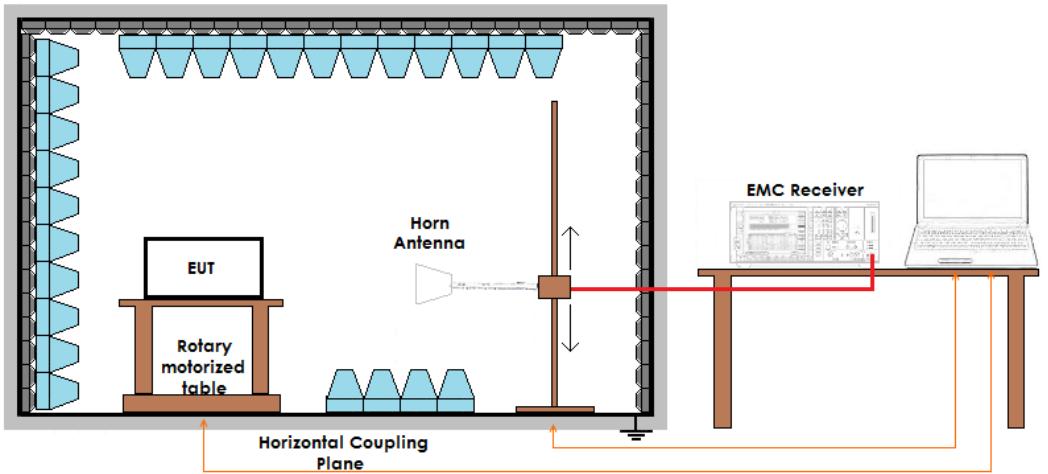
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

Setup

Frequency \leq 1 GHz



Frequency $>$ 1 GHz





Result – AV detector

Harmonic	Lowest channel		Medium channel		Highest channel		Results
	Level (dB μ V/m)	Limits (dB μ V/m)	Level (dB μ V/m)	Limits (dB μ V/m)	Level (dB μ V/m)	Limits (dB μ V/m)	
II	53,60*	54,00	52,50*	54,00	50,20*	54,00	Complies
III	45,00	54,00	48,50	54,00	49,10	54,00	Complies
IV	50,30	54,00	49,00	54,00	47,70	54,00	Complies
V	46,50	54,00	46,30	54,00	44,70	54,00	Complies
VI	42,40*	54,00	42,50*	54,00	40,90*	54,00	Complies
VII	More than 20 dB below limit*	54,00	More than 20 dB below limit*	54,00	42,30*	54,00	Complies
VIII	44,40	54,00	45,20	54,00	42,50	54,00	Complies
IX	More than 20 dB below limit	54,00	More than 20 dB below limit	54,00	More than 20 dB below limit	54,00	Complies
X	More than 20 dB below limit	54,00	More than 20 dB below limit	54,00	More than 20 dB below limit	54,00	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. The emission values marked with * have been detected in non-restricted frequency bands. In these bands the limits have been always considered 54 dB μ V/m as worst case.

Result – Peak detector

Harmonic	Lowest channel		Medium channel		Highest channel		Results
	Level (dB μ V/m)	Limits (dB μ V/m)	Level (dB μ V/m)	Limits (dB μ V/m)	Level (dB μ V/m)	Limits (dB μ V/m)	
II	55,80*	74,00	56,20*	74,00	54,40*	74,00	Complies
III	49,20	74,00	51,10	74,00	53,60	74,00	Complies
IV	52,90	74,00	53,30	74,00	50,70	74,00	Complies
V	51,00	74,00	49,80	74,00	48,60	74,00	Complies
VI	45,60*	74,00	46,30*	74,00	44,90*	74,00	Complies
VII	More than 20 dB below limit*	74,00	More than 20 dB below limit*	74,00	46,80*	74,00	Complies
VIII	48,50	74,00	50,20	74,00	46,30	74,00	Complies
IX	More than 20 dB below limit	74,00	More than 20 dB below limit	74,00	More than 20 dB below limit	74,00	Complies
X	More than 20 dB below limit	74,00	More than 20 dB below limit	74,00	More than 20 dB below limit	74,00	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values. The emission values marked with * have been detected in non-restricted frequency bands. In these bands the limits have been always considered 54 dB μ V/m as worst case.

Result: The requirements are met



11.10 Maximum permissible exposure

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 1.1310
- Internal procedure PM001
- See clause 4 of this test report

Test configuration

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S108, CMC S136, CMC S164
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Antenna

Acceptance limits	1 mW/cm ² max at 20 cm of distance
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Result

Power Density Limit (mW/cm ²)	Maximum Output Power (mW)	Antenna Gain (G)	Power Density at 20 cm (mW/cm ²)	Remarks
1,00	13,10	--	0,00413	Measured

Remarks: Power Density = $(P \times G) / (4\pi R^2)$

Result: The requirements are met