



TEST REPORT nr. R15043201

Federal Communication Commission (FCC)

Test item

Description: TRANSCEIVER UNIT

Trademark: AUTEC

Model/Type: Model LKN Type LA1CM

FCC ID: OQA-LKNLA1CM

Test Specification

Standard: FCC Rules & Regulations, Title 47:2014
Part 15 paragraph(s): 203, 204, 207, 209 and 249

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

Address: Via Pomaroli, 65 – 36030 Caldogno (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: 24.08.15

Contents: 47 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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1. Summary

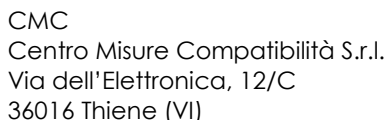
Standard:

FCC Rules & Regulations, Title 47:2014
Part 15 paragraph(s): 203, 204, 207, 209 and 249

<i>Test specifications</i>	<i>Environmental Phenomena</i>	<i>Tests sequence</i>	<i>Result</i>
Part 15.203	Antenna requirements	1	Complies
Part 15.207	Conducted emissions	--	N.A. (+)
Part 15.209	Radiated emissions	2	Complies
Part 15.209 and 15.249	Peak Output Power	4	Complies
Part 15.249 (d)	Band edge	5	Complies
Part 15.209	Spurious emission	6	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



2. Description of Equipment under test (EUT)

Serial Number.....: --

Type of station : ☐ Fixed station
☒ Portable station
☐ Mobile station

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

Test site facility's FCC registration number : 271947

3. Testing and sampling

Testing start date : 12.03.15

Samples tested nr.....: 1

Internal identification : adhesive label with the product number
P150255

4. Operative conditions

Test report R15043201



5. Photograph(s) of EUT

5.1 Photograph(s) of EUT





6. Equipment list

<i>Id. number</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Description</i>	<i>Serial number</i>	<i>Last calibration</i>	<i>Due date calibration</i>
CMC S010	Rohde & Schwarz	ESH3-Z2	Impulses Limiting Device	- - -	January '15	January '16
CMC S108	EMCO	3115	Horn Antenna	9811-5622	May '13	May '16
CMC S127	Schaffner	HLA6120	Loop Antenna	1191	January '13	January '16
CMC S136	Schwarzbeck	VULB 9163	Broadband Antenna	9136-205	May '13	May '16
CMC S164	Rohde & Schwarz	ESU26	EMC interference receiver	100052	January '15	January '16
CMC S200	Schwarzbeck	NSLK 8128	V-LISN	8128-273	January '15	January '16
CMC S227	Rohde & Schwarz	ESR7	EMI Test Receiver 7GHz	101121	January '15	January '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)	±2.8 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)		
	±3.7 dB	1
Radiated Emission		
(0,150 MHz – 30 MHz)	±4.0 dB	1
(30 MHz – 1000 MHz)	±4.3 dB	1
(1 GHz – 6 GHz)	±4.5 dB	1
Electromagnetic field EMF		
	±10.5 %	1
Harmonic current emissions test		
	±1.8 %	1
Voltage fluctuation and flicker test		
	±2.6 %	1
Insertion loss test		
	±2.0 dB	1
Radiated electromagnetic disturbance test (loop antenna)		
	±2.1 dB	1
Radiated electromagnetic field immunity test		
	0.81 V/m at 3V/m	1
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		
	0.1 A/m at 10 A/m	1
Effective radiated power (F < 1GHz)		
	±4.3 dB	1
Effective radiated power (F > 1GHz)		
	±3.7 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		
		2
Electrical fast transients / burst immunity test		
		2
Surge immunity test		
		2
Pulse magnetic field immunity test		
		2
Damped oscillatory magnetic field immunity test		
		2
Short interruption immunity test		
		2
Voltage transient emission test		
	±2.2 %	1
Transient immunity test		
		2

Notes

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.



8. Reference documents

Reference no.	Description
FCC Rules and Regulation Title 47 part 15:2014	--
ANSI C63.4:2009	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
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 sample complies with the requirement.	The sample does not comply with the requirement.	The sample does not comply with the requirement.
The measurement results is within the specification limit when the measurement uncertainty is taken into account.	It is not possible to state compliance using a 95% coverage probability for the expanded uncertainty although the measurement result is below the limit.	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 measurement results 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
- 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 (%)
22	101	42

Result

Antenna Type	External R.F. power amplifier	Gain	Remarks	Results
Integral antenna	Not Present	--	--	Complies
Embedded	Not Present	0 dBi	--	Complies

Result: The requirements are met



11.2 Radiated emissions

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.209
- Internal procedure PM001
- 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

EUT exercising

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: 3 m

Environmental conditions

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

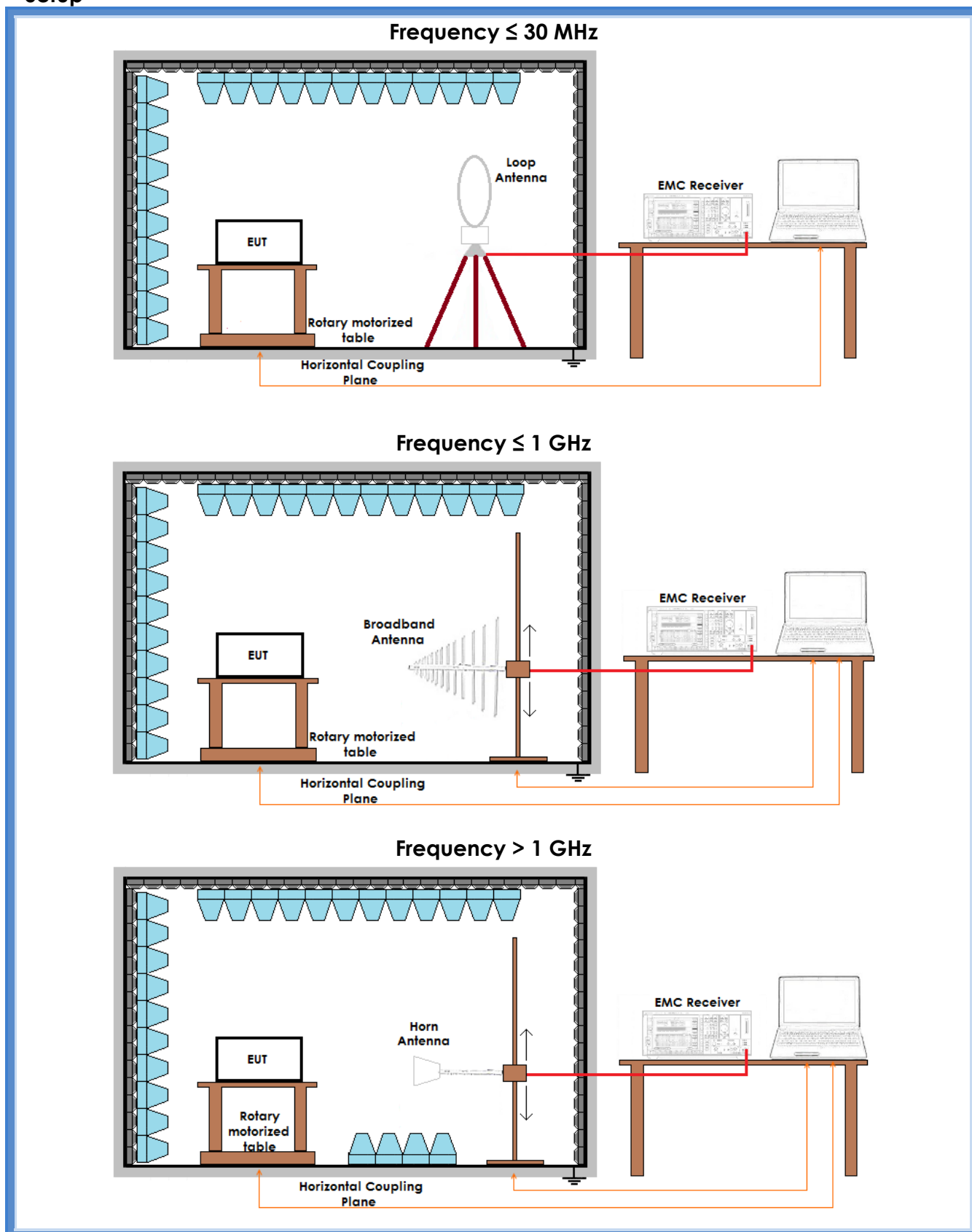
Acceptance limits

Frequency range (MHz)	Limits [dB(μV/m)]
0,009 to 0,490	128,51 to 93,80
0,490 to 1,705	73,80 to 62,97
1,705 to 30	69,54
30 to 88	40
88 to 216	43,52
216 to 960	46,02
Above 960	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





Result

Polarization	Frequency Range (MHz)	Graphs	Remarks	Result
Loop	0,009 – 30	G15043220	Worst case	Complies
V	30 – 1000	G15043215	Lowest frequency	Complies
H	30 – 1000	G15043214	Lowest frequency	Complies
V	30 – 1000	G15043216	Medium frequency	Complies
H	30 – 1000	G15043217	Medium frequency	Complies
V	30 – 1000	G15043219	Highest frequency	Complies
H	30 – 1000	G15043218	Highest frequency	Complies
V	1000 – 10000	G15043221	Worst case	Complies
H	1000 – 10000	G15043222	Worst case	Complies
Remarks: --				

Graphs Legend

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

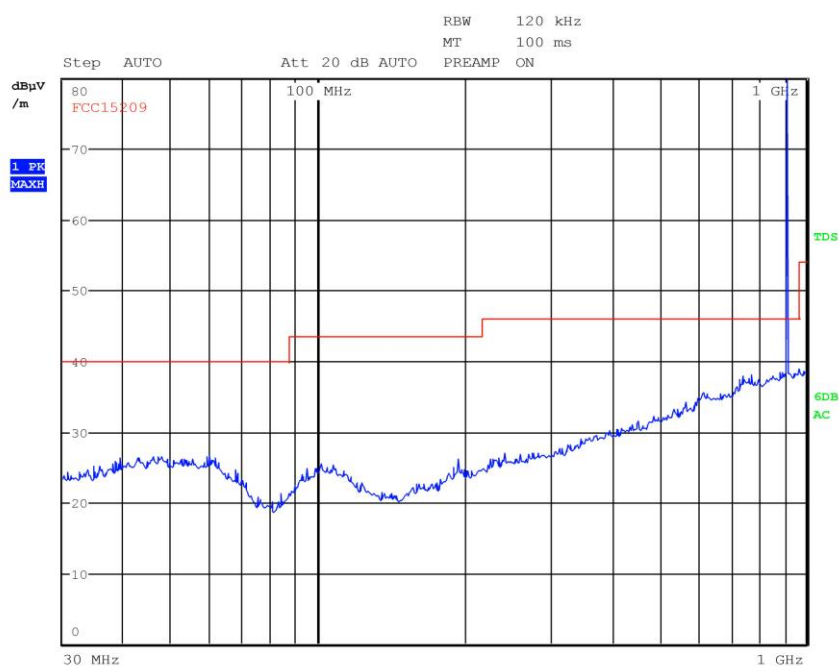
AV: Average; AV [1s] (average at 1 second) values are marked with a x



Graphs

G15043214

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043214
Test Spec
Horiz



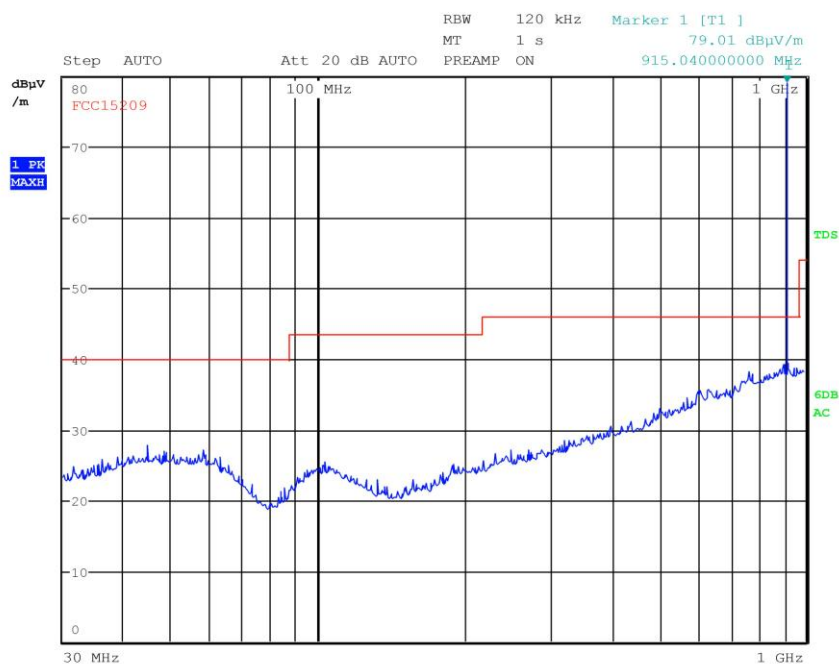
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043215

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043215
Test Spec
Vert



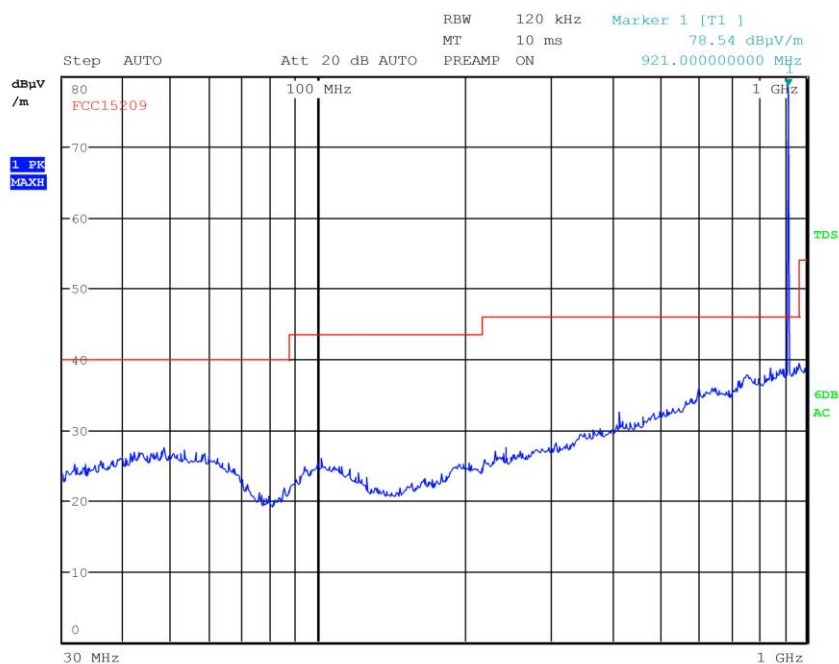
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043216

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043216
Test Spec
Vert



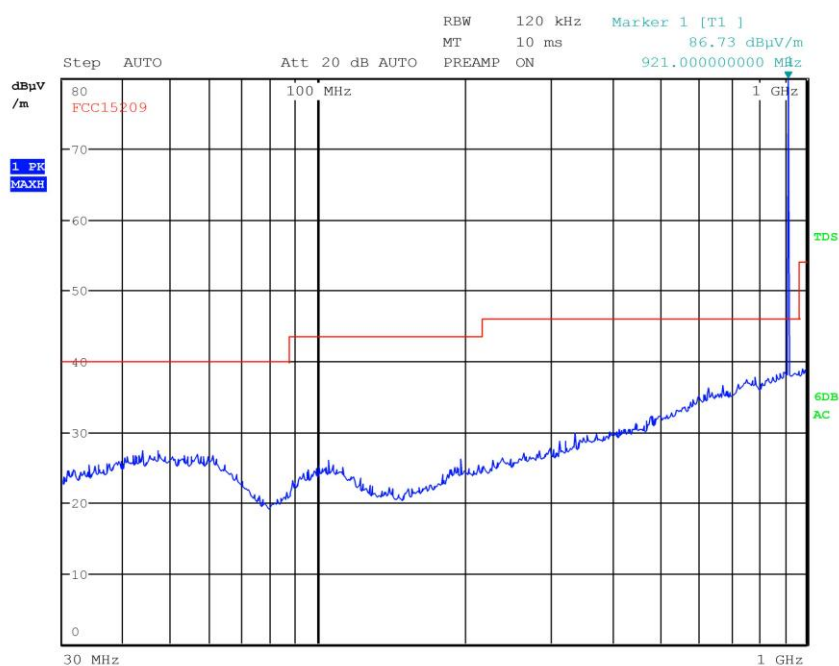
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043217

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043217
Test Spec
Horiz



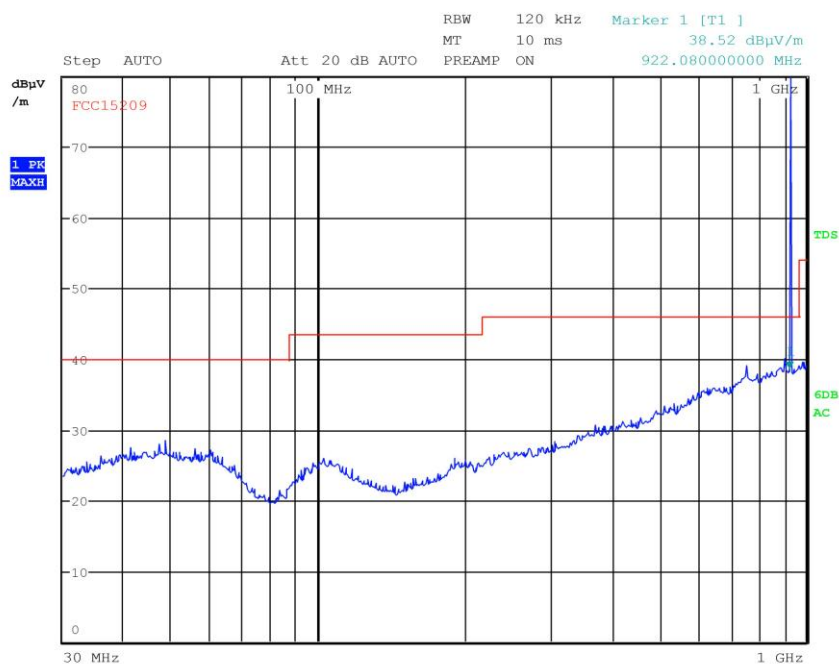
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043218

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043218
Test Spec
Horiz



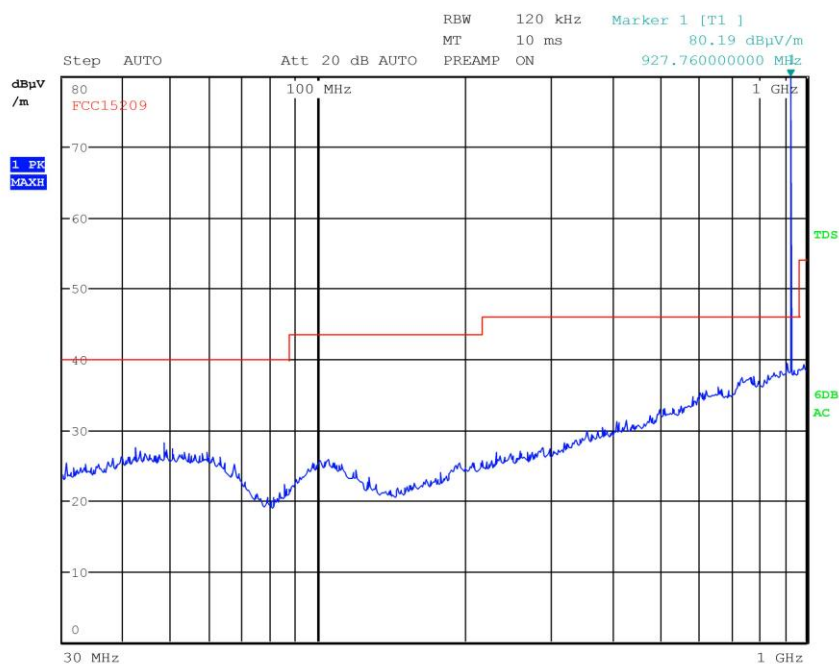
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043219

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043219
Test Spec
Vert



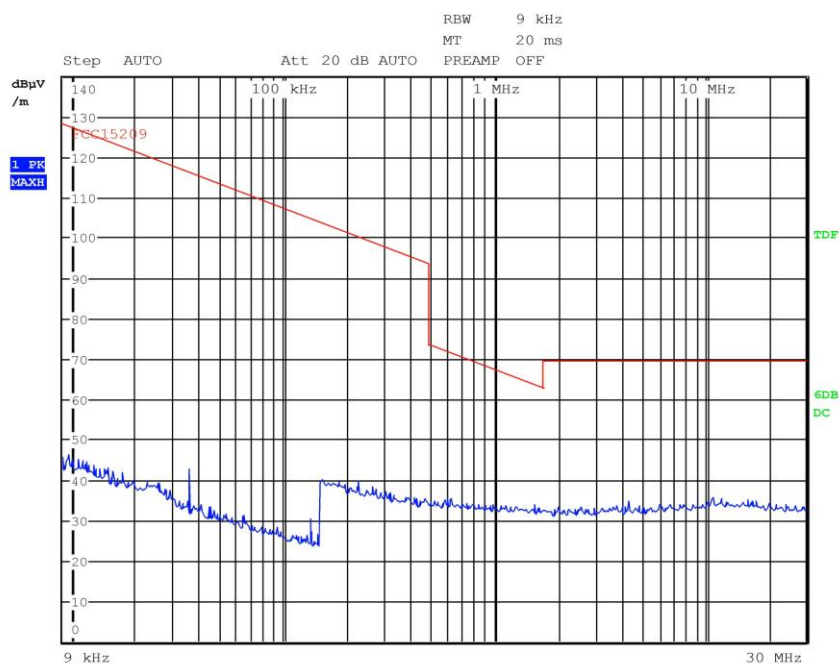
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043220

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx
Operator Gandini 15043220
Test Spec
Loop



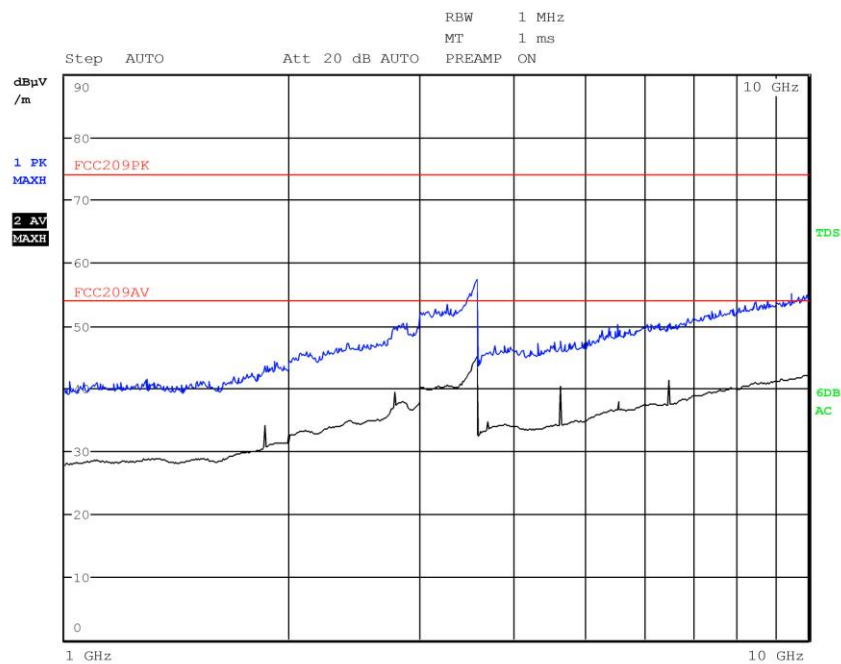
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Peaks: 0



G15043221

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx
Operator Gandini 15043221
Test Spec
Vert



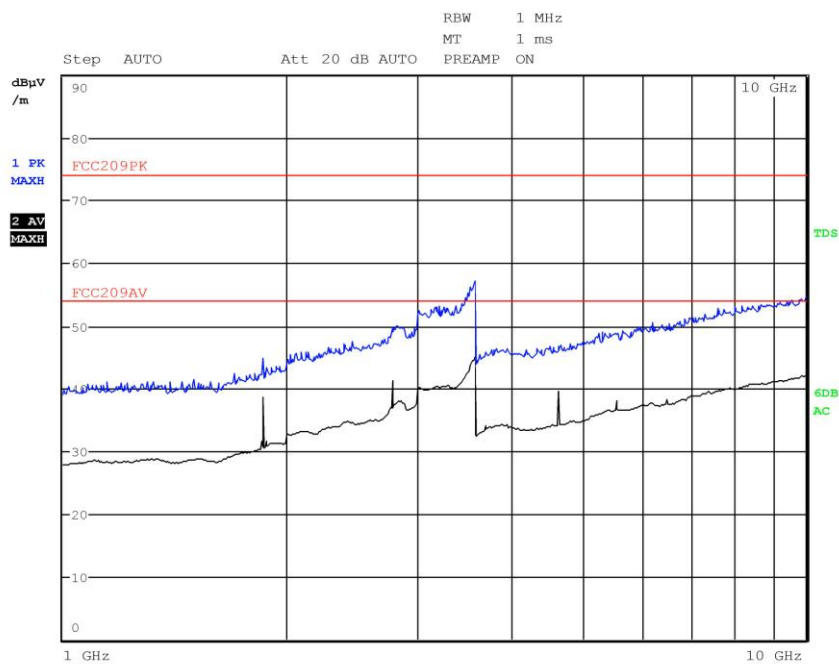
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Subranges: 0



G15043222

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx
Operator Gandini 15043222
Test Spec
Horiz



Final Measurement

Meas Time: 1 s
Margin: 6 dB
Subranges: 0

Result: The requirements are met



11.3 Peak Output Power

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.209 and Part 15.249
- Internal procedure PM001
- 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

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: Enclosure
Antenna polarization: Horizontal (H) – Vertical (V)
EUT – Antenna distance: 3 m

Environmental conditions

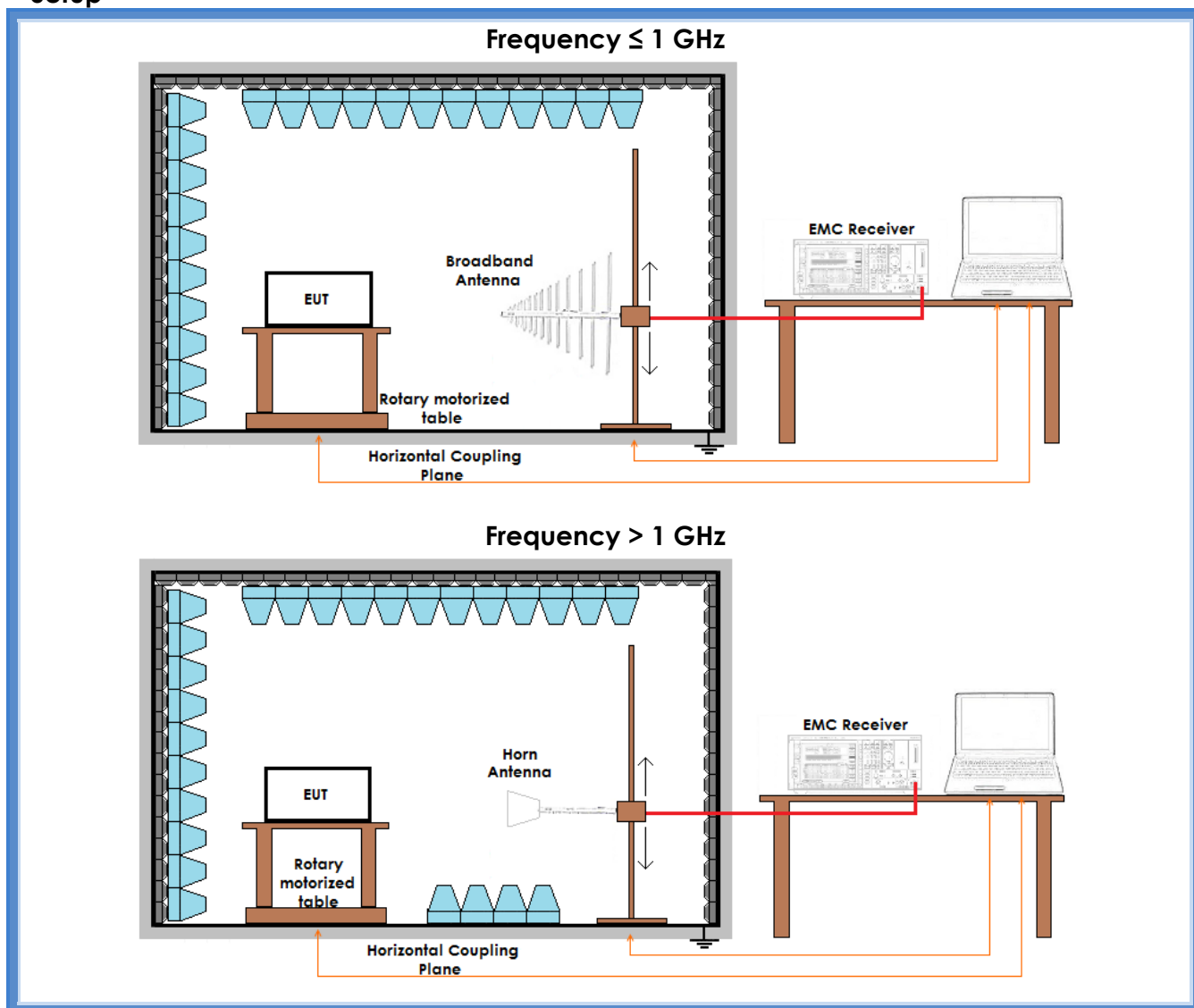
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
20	101	45

Acceptance limits

Frequency range (MHz)	RF Power Output dB(μV/m)
902 – 928	94



Setup





Result

Frequency (MHz)	Polarization	Graphs	Measured QP level (dBμV/m)	Peak Output Power (mW)	Remarks
915,056410	Horizontal	G15043202	93,91	0,738	--
915,056410	Vertical	G15043201	84,43	0,083	--
921,006410	Horizontal	G15043206	93,92	0,740	--
921,003205	Vertical	G15043208	83,41	0,066	--
927,756410	Horizontal	G15043210	93,98	0,750	--
927,746794	Vertical	G15043209	84,23	0,079	--

Remarks

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

Where:

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

G = the numeric gain of the transmitting antenna: 1 (0 dBi)

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

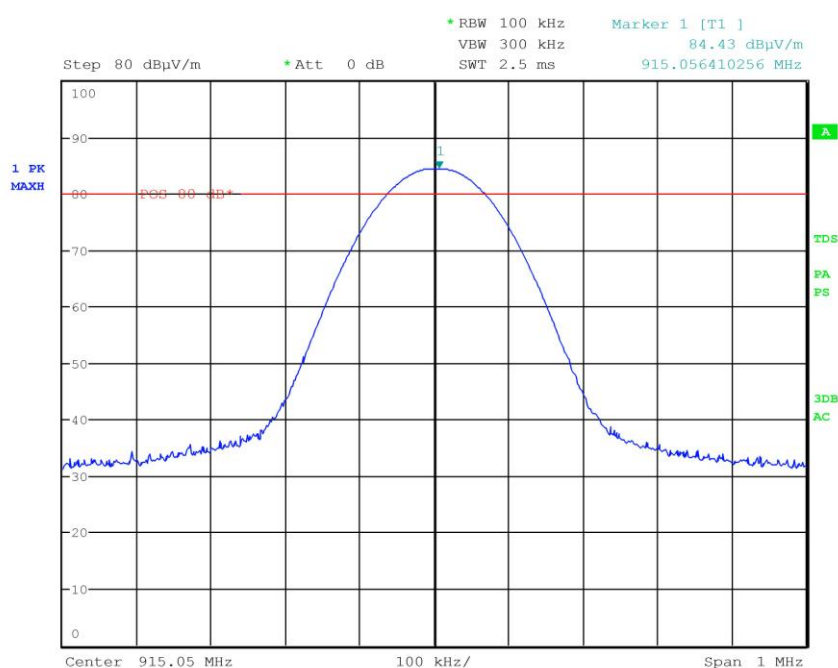
P = the power in watts



Graphs

G15043201

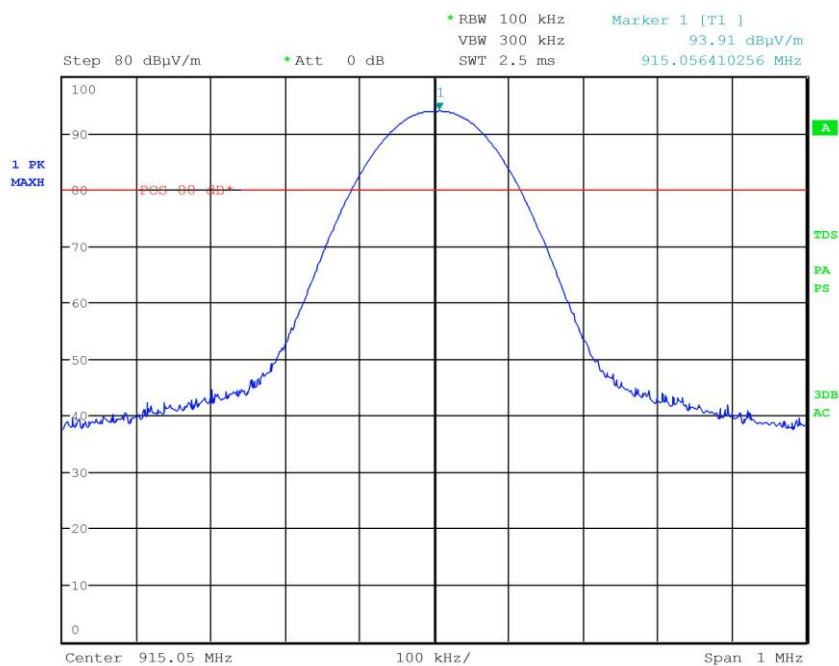
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043201
Test Spec
Vert





G15043202

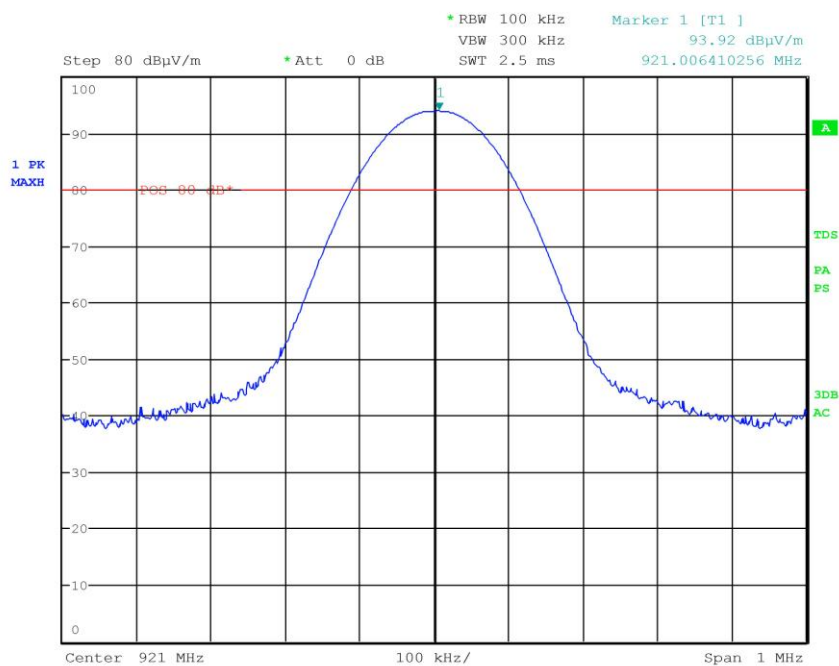
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043202
Test Spec
Horiz





G15043206

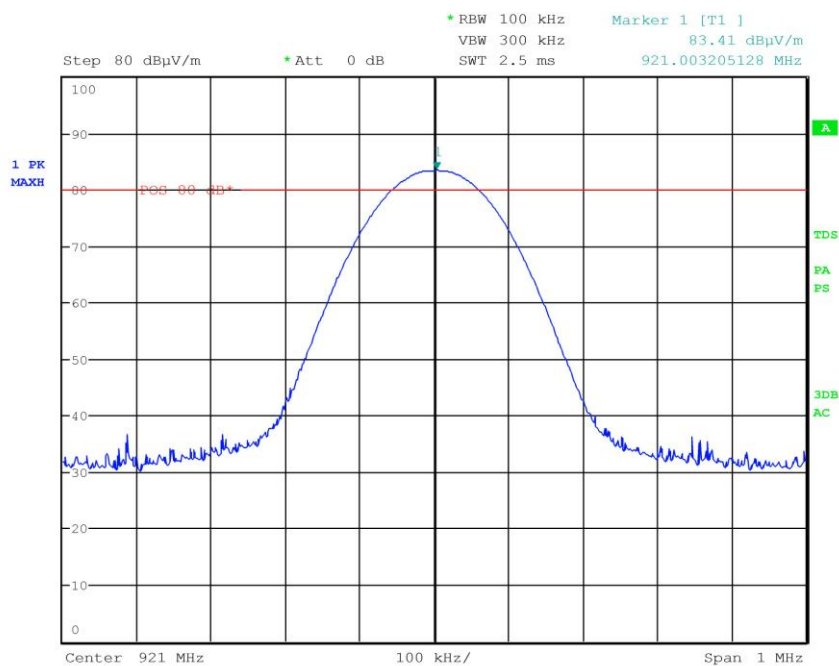
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmid
Operator Gandini 15043206
Test Spec
Horiz





G15043208

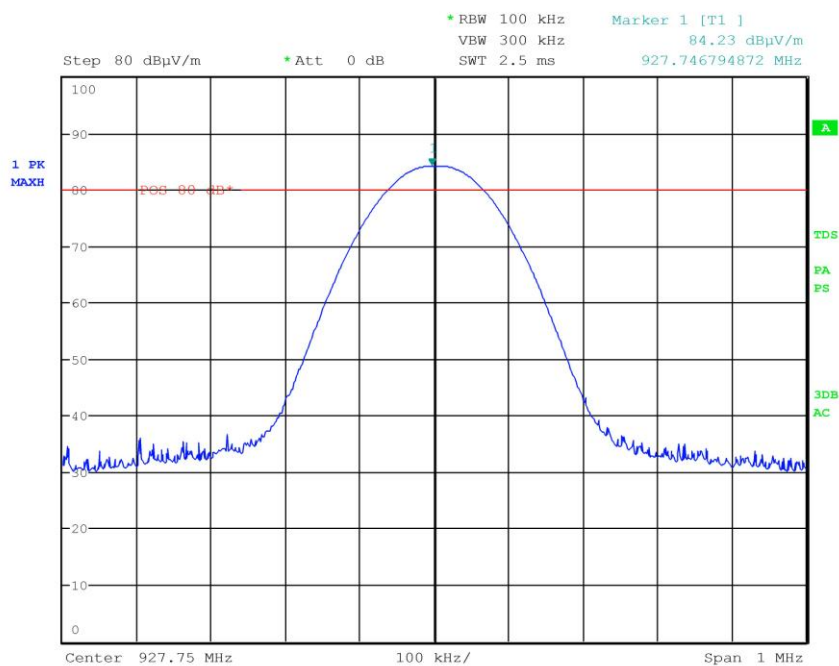
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmid
Operator Gandini 15043208
Test Spec
Vert





G15043209

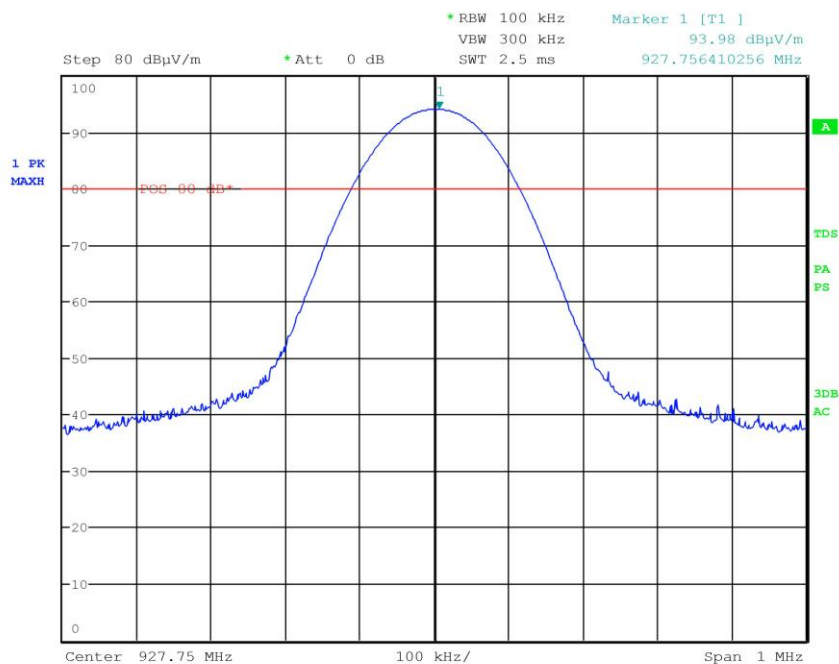
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043209
Test Spec
Vert





G15043210

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043210
Test Spec
Horiz



Result: The requirements are met



11.4 Band edge

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.249 (d)
- 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 S164
Measurement uncertainty: See clause 7 of this test report

Test specification

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation

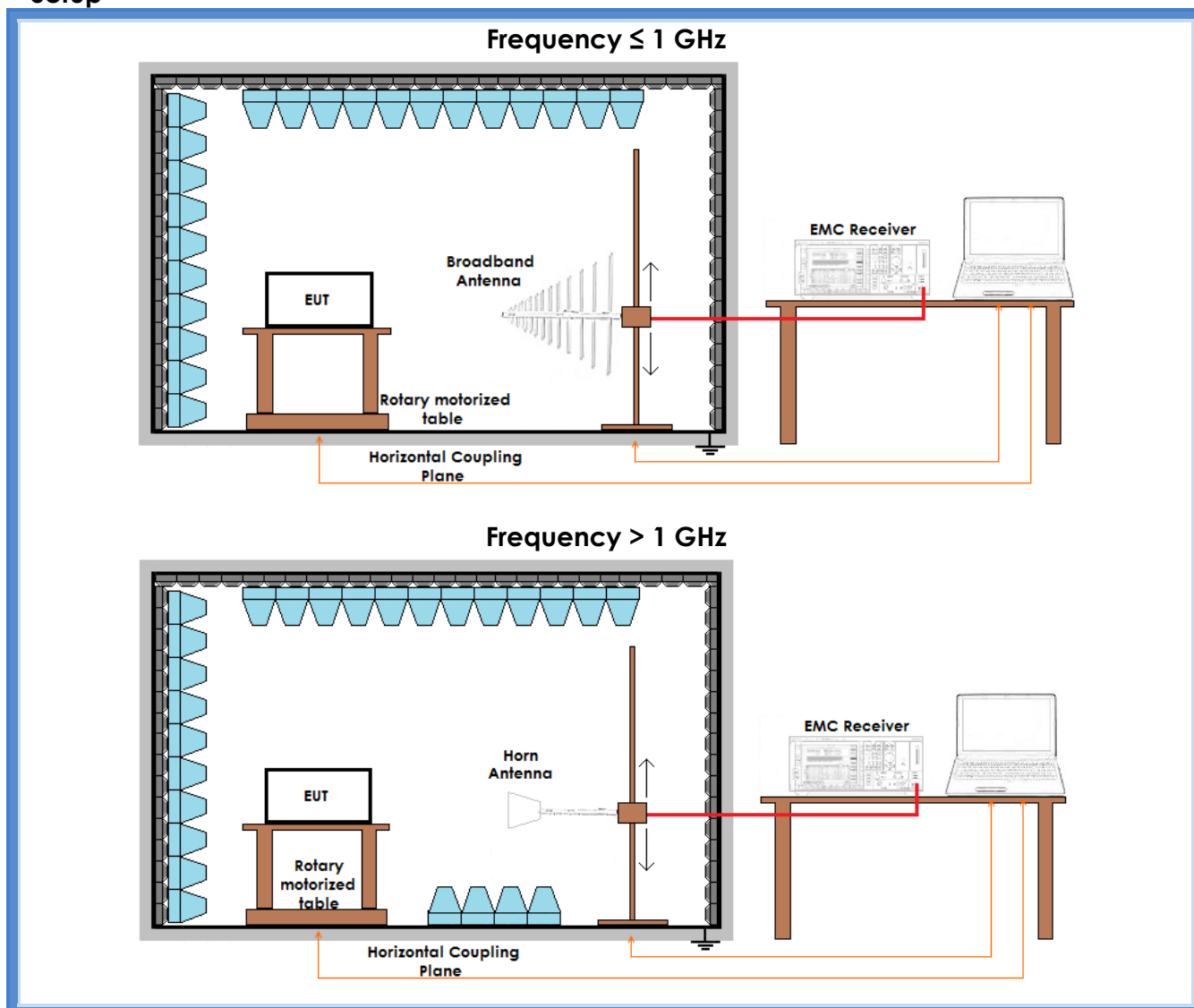
Environmental conditions

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

Acceptance limits: operation within the band 902 – 928 MHz or 2400 – 2483,5 MHz



Setup



Result

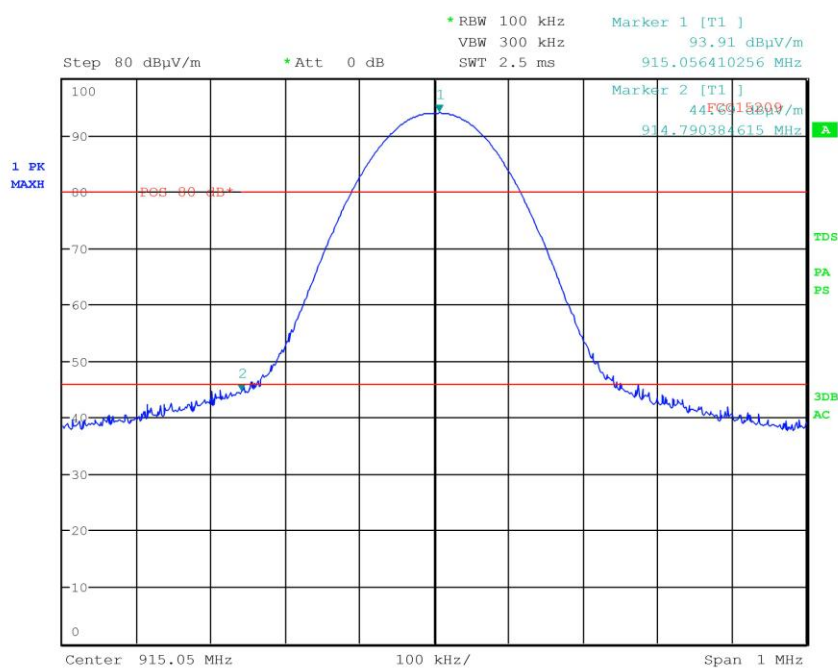
Frequency (MHz)	Graph(s)	Results	
915,050	G15043203	F _L : 914,790384	Complies
	G15043204		
927,750	G15043211	F _H : 927,98878	Complies
	G15043212		



Graphs

G15043203

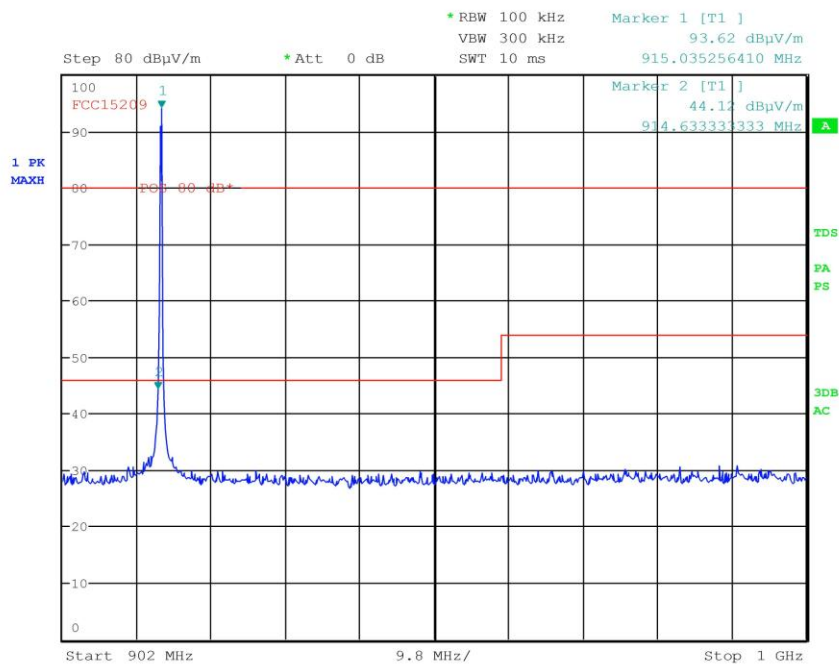
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043203
Test Spec
Horiz





G15043204

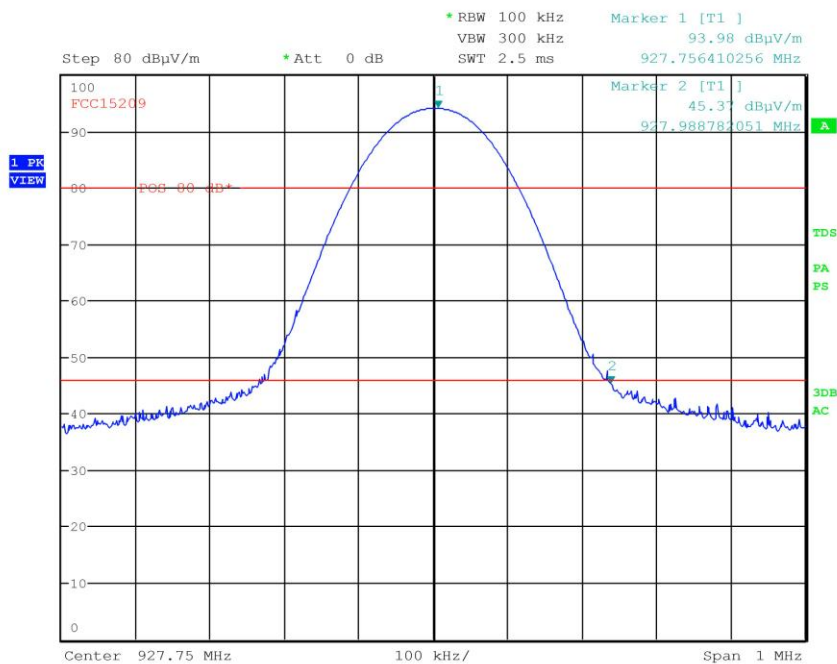
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043204
Test Spec
Horiz





G15043211

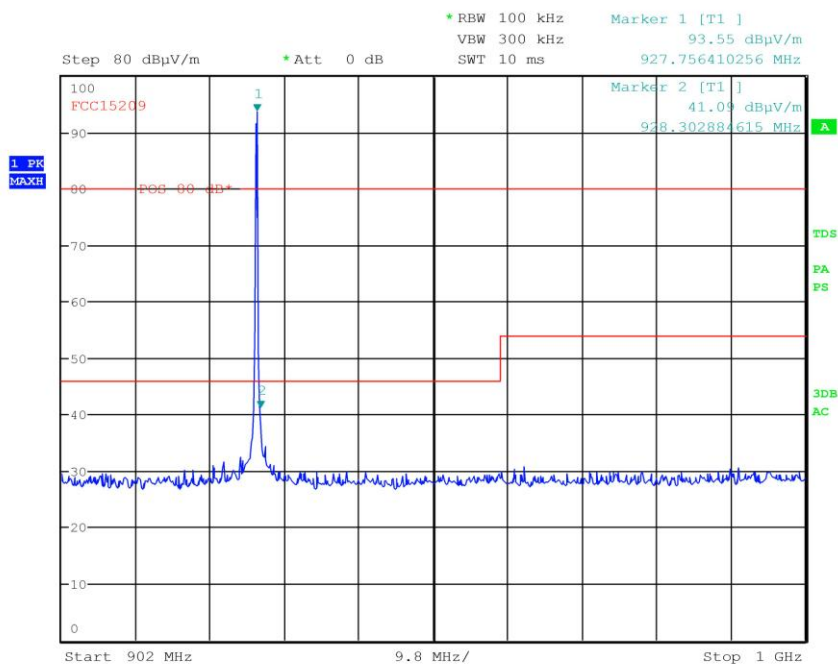
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043211
Test Spec
Horiz





G15043212

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043212
Test Spec
Horiz



Result: The requirements are met



11.5 Spurious Emission

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.209
- Internal procedure PM001
- 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

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: Enclosure
Antenna polarization: Horizontal (H) – Vertical (V)
EUT – Antenna distance: 3 m
Detector AV + Peak

Environmental conditions

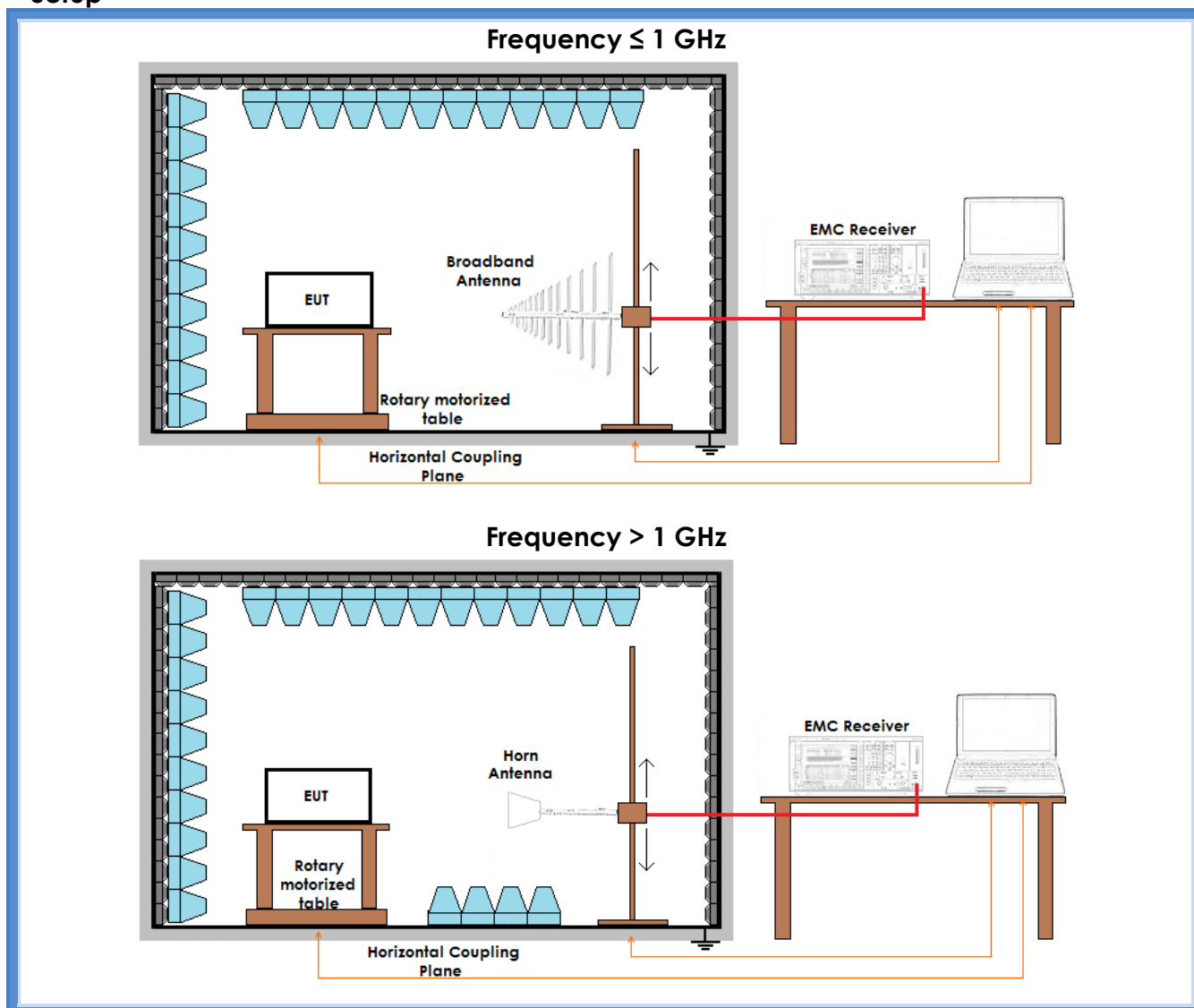
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
20	101	42

Acceptance limits

Frequency (MHz)	AV limits [dB(μV/m)]	Peak limits [dB(μV/m)]
> 1000	54	74



Setup



Frequency (MHz)	Antenna polarization	Graphs
915,05	Horizontal	G15043228
915,05	Vertical	G15043227
921,00	Horizontal	G15043225
921,00	Vertical	G15043226
927,75	Horizontal	G15043224
927,75	Vertical	G15043223



Result – AV detector

Harmonic	Limits (dB μ V/m)	Level (dB μ V/m)			Results
		915,05 MHz	921,00 MHz	927,75 MHz	
II	54	35,01	31,78	34,70	Complies
III	54	36,40	36,57	36,03	Complies
IV	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	54	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies

Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values

Result – Peak detector

Harmonic	Limits (dB μ V/m)	Level (dB μ V/m)			Results
		915,05 MHz	921,00 MHz	927,75 MHz	
II	74	41,39	40,94	41,31	Complies
III	74	44,30	44,00	44,33	Complies
IV	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
V	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VI	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
VIII	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
IX	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies
X	74	More than 20 dB below limit	More than 20 dB below limit	More than 20 dB below limit	Complies

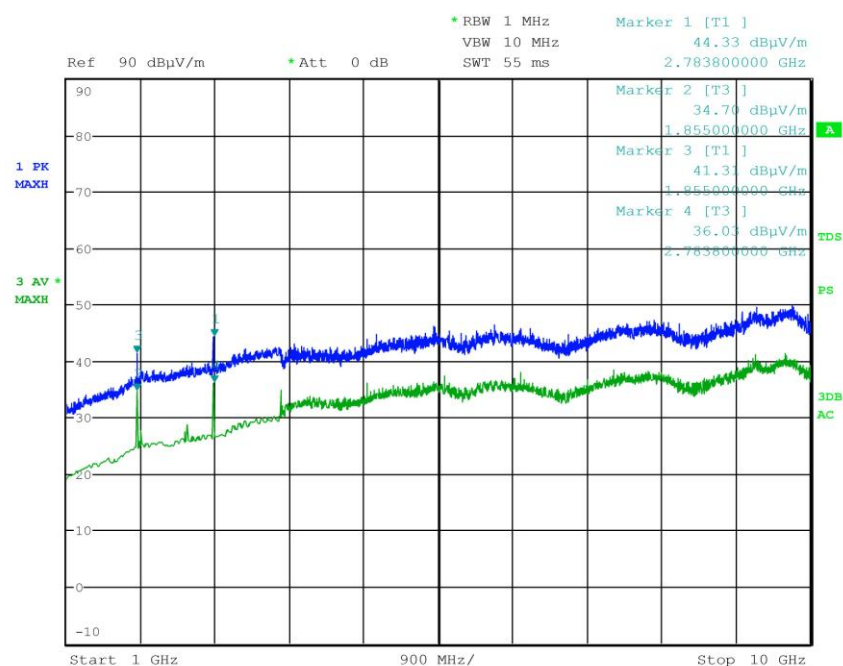
Remarks: EUT was tested in 3 orthogonal planes. The results in this table show the highest values



Graphs

G15043223

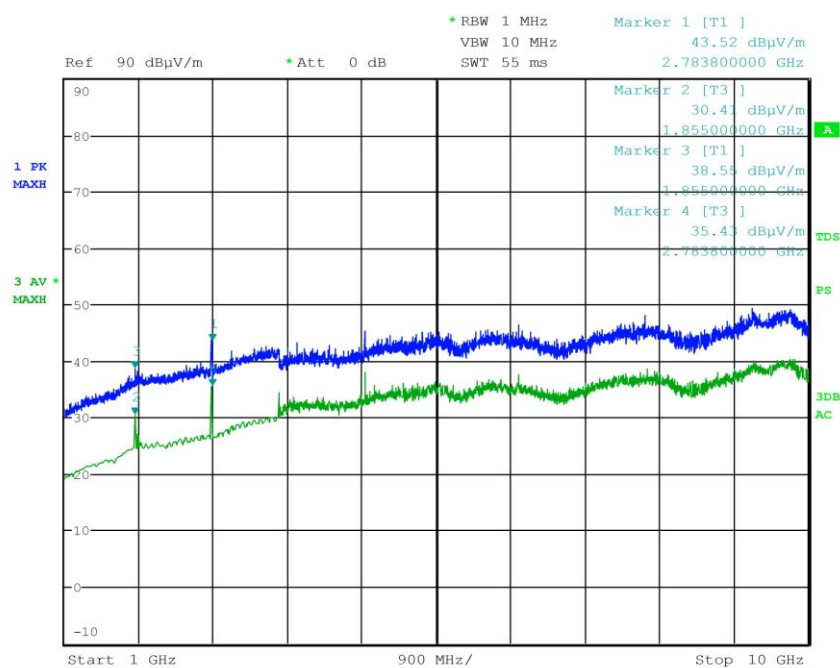
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043223
Test Spec
Vert





G15043224

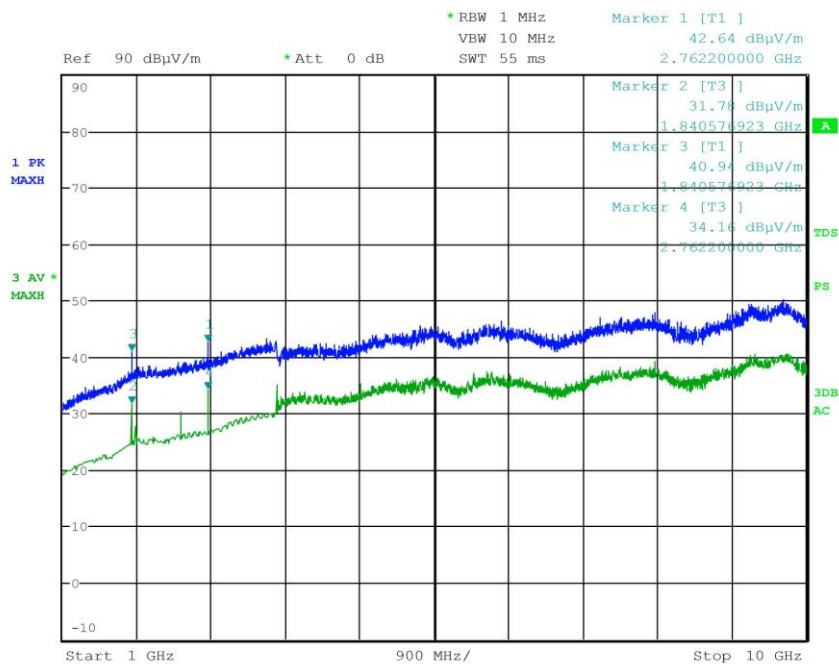
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmax
Operator Gandini 15043224
Test Spec
Horiz





G15043225

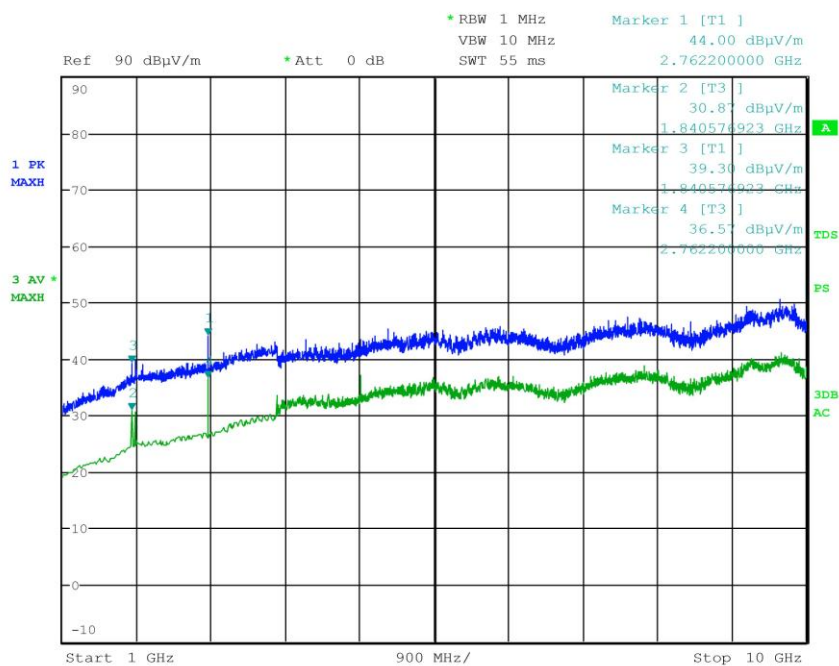
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmid
Operator Gandini 15043225
Test Spec
Horiz





G15043226

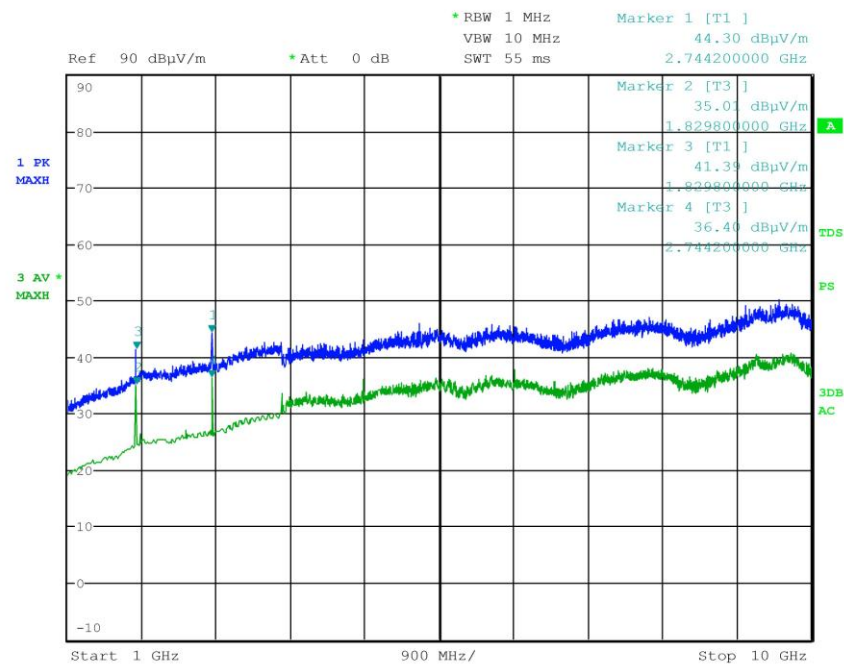
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmid
Operator Gandini 15043226
Test Spec
Vert





G15043227

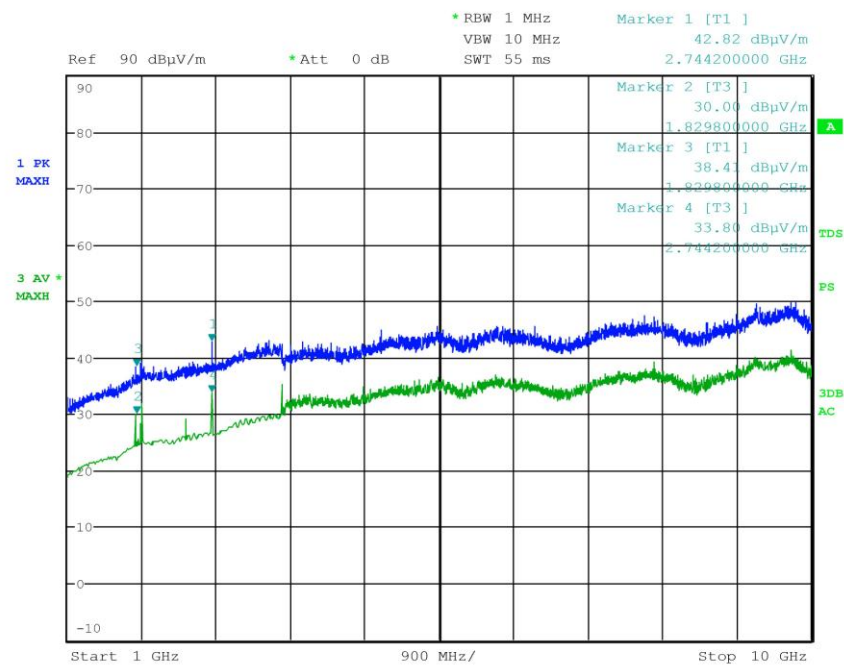
Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043228
Test Spec
Vert





G15043228

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx-Rx - Fmin
Operator Gandini 15043228
Test Spec
Horiz



Result: The requirements are met