



TEST REPORT nr. R14026601
Federal Communication Commission (FCC)

Test item

Description: TRANSCEIVER UNIT

Trademark: ELCA

Model/Type: AR BRAVO-FUNK-915

Test Specification

Standard: FCC Rules & Regulations, Title 47:2013
Part 15 paragraph(s): 203, 204, 207, 209 and 247

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

Address: Via del Commercio, 7/B – 36065 Mussolente (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: 30.09.14

Contents: 57 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.



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	6
7. MEASUREMENT UNCERTAINTY	7
8. REFERENCE DOCUMENTS	8
9. DEVIATION FROM TEST SPECIFICATION	9
10. TEST CASE VERDICTS	9
11. RESULTS	10
11.1 ANTENNA REQUIREMENTS	11
11.2 CONDUCTED EMISSIONS	12
11.3 RADIATED EMISSIONS	16
11.4 20 DB BANDWIDTH	28
11.5 CHANNEL SEPARATION	33
11.6 NUMBER OF HOPPING CHANNELS	36
11.7 TIME OF OCCUPANCY	39
11.8 BAND EDGE	43
11.9 PEAK OUTPUT POWER – CONDUCTED	49
11.10 SPURIOUS EMISSION	54
11.11 MAXIMUM PERMISSIBLE EXPOSURE	57



1. Summary

Standard:

FCC Rules & Regulations, Title 47:2013
Part 15 paragraph(s): 203, 204, 207, 209 and 247

<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	6	Complies
Part 15.209	Radiated emissions	2	Complies
Part 15.247	20dB Bandwidth	3	Complies
Part 15.209 and 15.247	Peak Output Power	7	Complies
Part 15.247	Band edge	4	Complies
Part 15.209	Spurious emission	5	Complies

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



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

Nominal frequency : 902 – 928 MHz

FCC ID : 2ABS7-ARBRFU915

36016 Thiene (VI) – ITALY

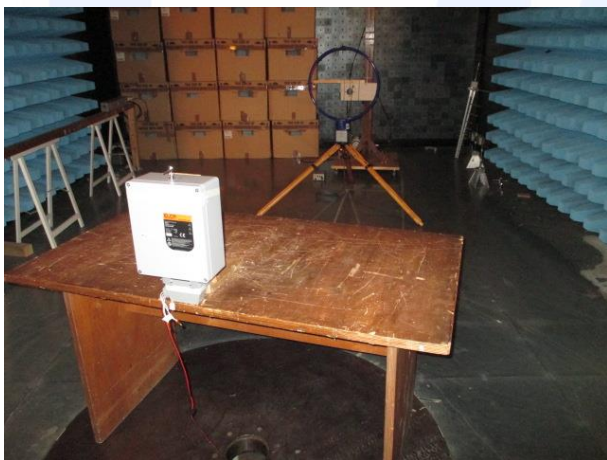
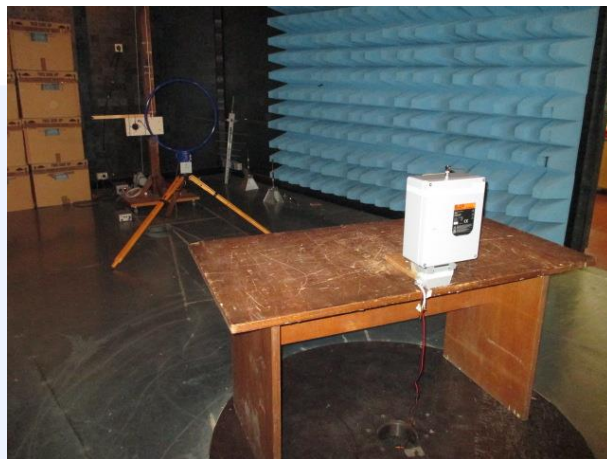
Sampling procedure.	: Equipment used for testing was picked up by the manufacturer, at the end of the production process with random criterion
Internal identification	: adhesive label with the product number P140155

EUI exercising: EUI in continuous transmission at maximum power



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 '14	January '15
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 '14	January '15
CMC S200	Schwarzbeck	NSLK 8128	V-LISN	8128-273	January '14	January '15
CMC S227	Rohde & Schwarz	ESR7	EMI Test Receiver 7GHz	101121	January '14	January '15



7. Measurement uncertainty

Test	Expanded Uncertainty	note
Conducted Emission		
(50 Ω /50 μ H AMN) - (9 kHz – 150 kHz)	± 3.8 dB	1
(50 Ω /50 μ H AMN) - (150 kHz – 30 MHz)	± 3.3 dB	1
(Voltage probe) - (150 kHz – 30 MHz)	± 3.3 dB	1
(50 Ω /5 μ H AMN) - (150 kHz – 108 MHz)	± 2.8 dB	1
Discontinuous Conducted Emission		
Conducted Emission (50 Ω /50 μ H AMN) - (150 kHz – 30 MHz)	± 3.3 dB	1
Disturbance Power (30 MHz – 300 MHz)		
	± 3.9 dB	1
Radiated Emission		
(0,150 MHz – 30 MHz)	± 4.3 dB	1
(30 MHz – 1000 MHz)	± 4.4 dB	1
(1 GHz – 6 GHz)	± 4.6 dB	1
Electromagnetic field EMF		
	± 15.0 %	1
Harmonic current emissions test		
	± 2.7 %	1
Voltage fluctuation and flicker test		
	± 2.9 %	1
Insertion loss test		
	± 2.7 dB	1
Radiated electromagnetic disturbance test (loop antenna)		
	± 2.7 dB	1
Radiated electromagnetic field immunity test		
	0.77 V/m at 3V/m	1
Pulse modulated radiated electromagnetic field immunity test		
	0.77 V/m at 3V/m	1
Injected currents immunity test		
	0.48 V at 3V	1
Bulk current		
	5.3 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)		
	± 4.4 dB	1
Effective radiated power (F > 1GHz)		
	± 3.9 dB	1
Frequency error		
	$< 1 \times 10^{-7}$	1
Modulation bandwidth		
	$< 1 \times 10^{-7}$	1
Adjacent channel power		
	± 2.6 dB	1
Blocking		
	± 2.6 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 15:2013	--
RSS-210 Issue 8 – December 2010	Low-power licence-exempt radiocommunication devices (all frequency bands): Category I Equipment
ANSI C63.4: 2003	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.

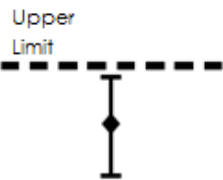
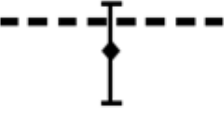
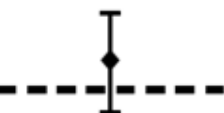


11. Results

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 is Complies.	The sample is Complies.	The sample is Not Complies.	The sample is Not Complies.
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	98	49

Result

Antenna Type	External R.F. power amplifier	Gain	Remarks	Results
Dedicated	Not Present	2 dBi	Antenna connector: MMCX	Complies

Result: The requirements are met



11.2 Conducted emissions

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.207
- Internal procedure PM001
- See clause 4 of this test report

Test configuration and test method

Test site:
Shielded chamber

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S010, CMC S200, CMC S227
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Main port
Frequency range: 150 kHz – 30 MHz

Environmental conditions

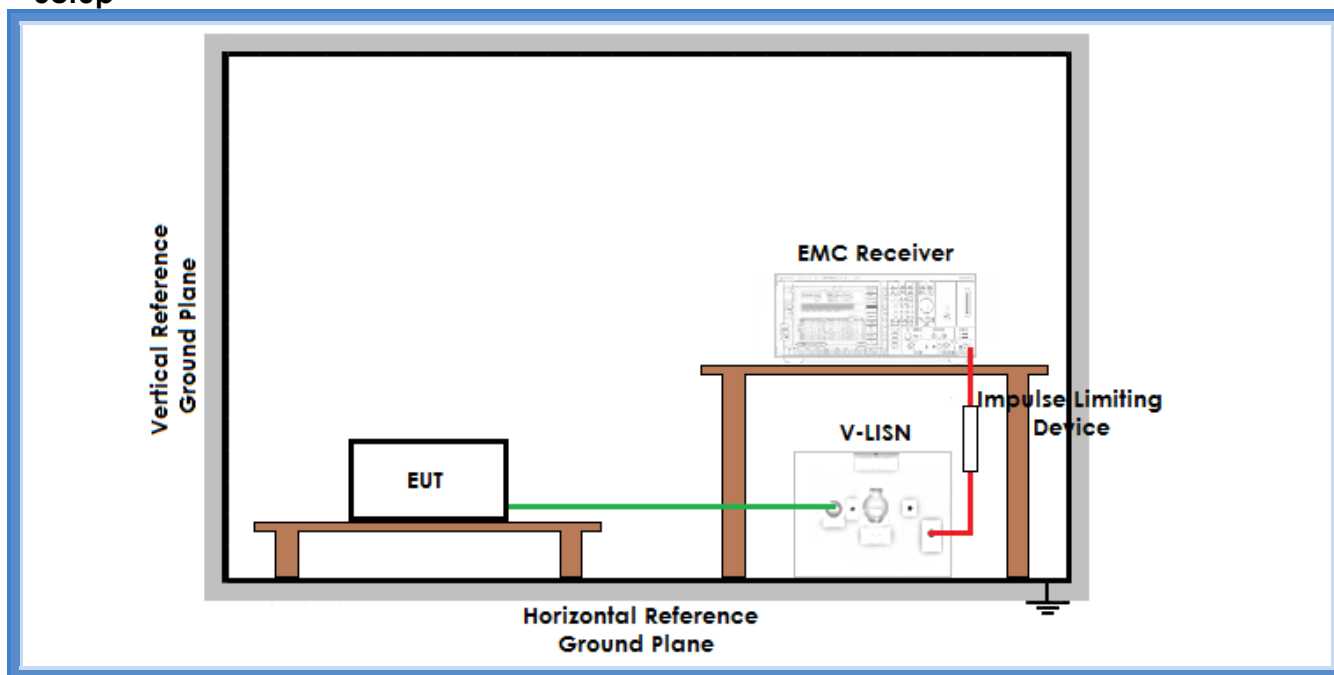
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)

Acceptance limits

Frequency range (MHz)	dB(μV) Quasi-peak	dB(μV) Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50



Setup



Result

Line	Graphs	Remarks	Result
N	G14026650	--	Complies
L1	G14026651	--	Complies
Remarks: --			

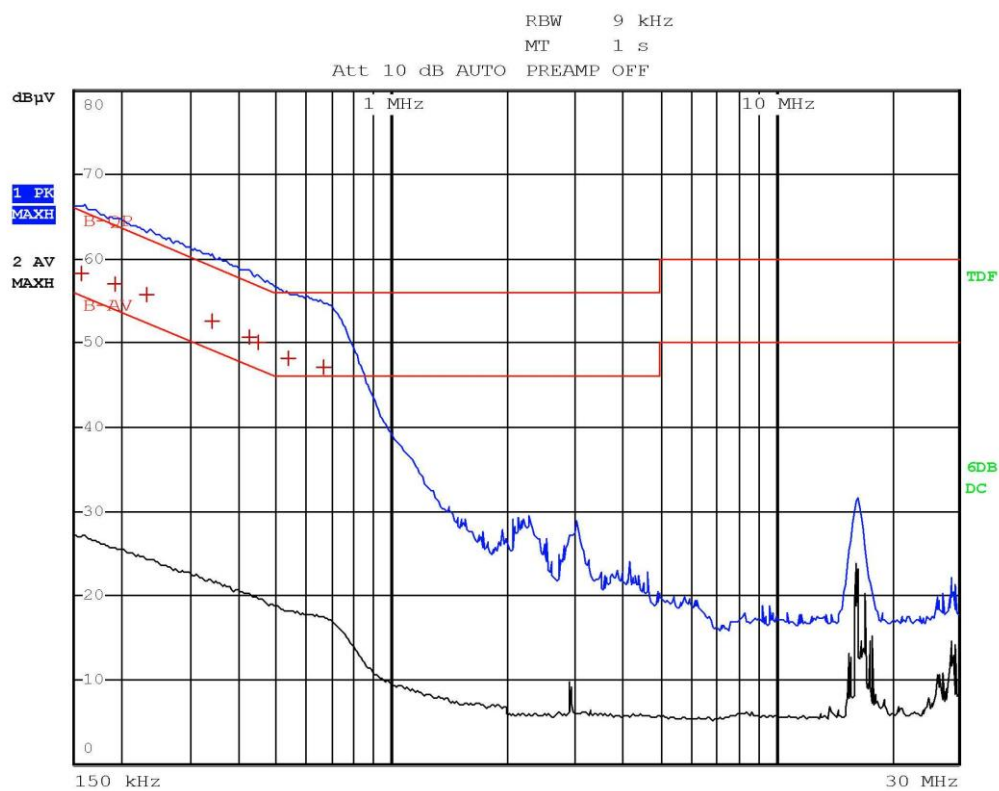
Graphs Legend

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

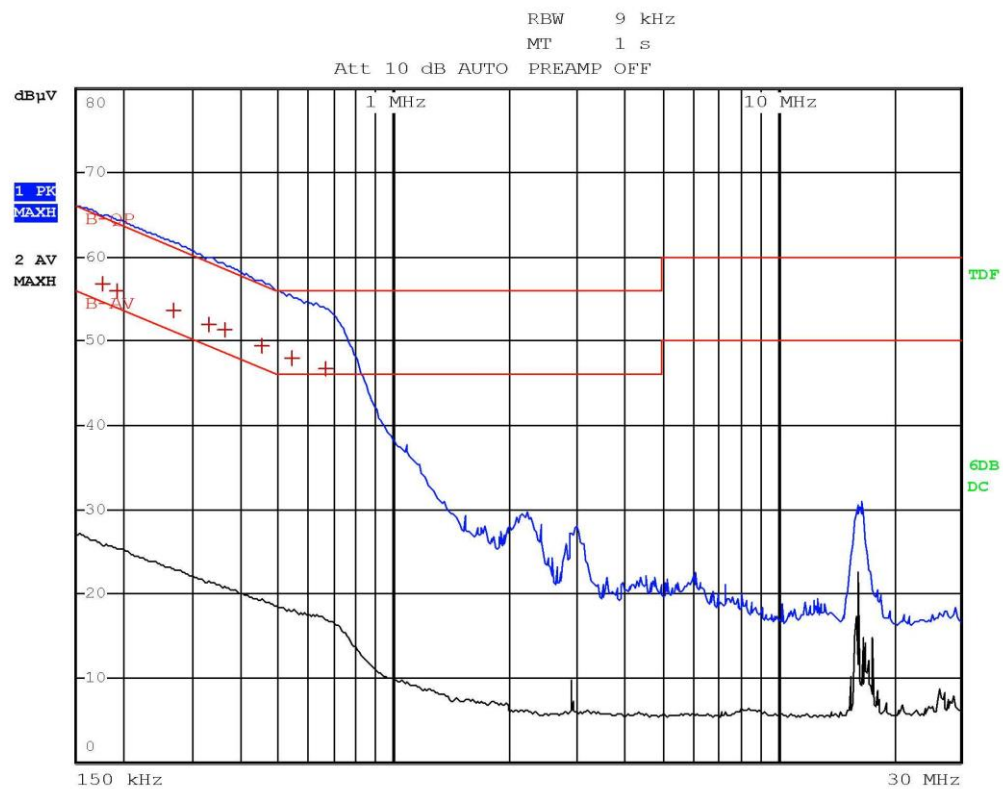
G14026650



Gandini 14026650-Line N (-)-Tx-Rx



G14026651



Gandini 14026651-Line L (+)-Tx-Rx

Result: The requirements are met



11.3 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 (%)
21	99	50

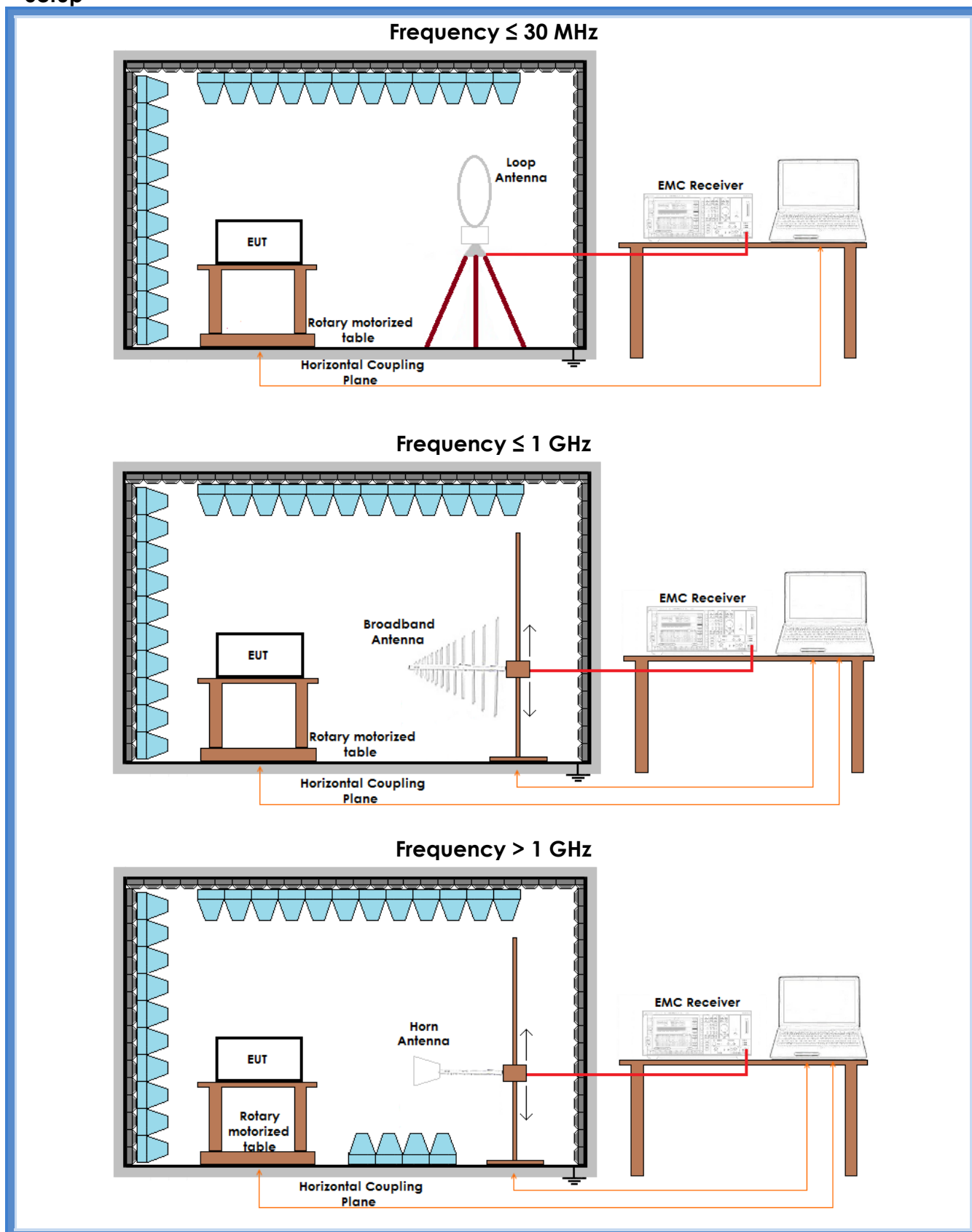
Acceptance limits

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

Channel	Polarization	Frequency Range (MHz)	Graphs	Remarks	Result
--	Loop	0,009 – 30	G14026601	--	Complies
915,050	H	30 – 1000	G14026626	--	Complies
915,050	V	30 – 1000	G14026627	--	Complies
921,000	V	30 – 1000	G14026628	--	Complies
921,000	H	30 – 1000	G14026629	--	Complies
927,950	V	30 – 1000	G14026624	--	Complies
927,950	H	30 – 1000	G14026625	--	Complies
927,950	V	1000 – 10000	G14026632	--	Complies
927,950	H	1000 – 10000	G14026633	--	Complies

Remarks: --

Graphs Legend

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

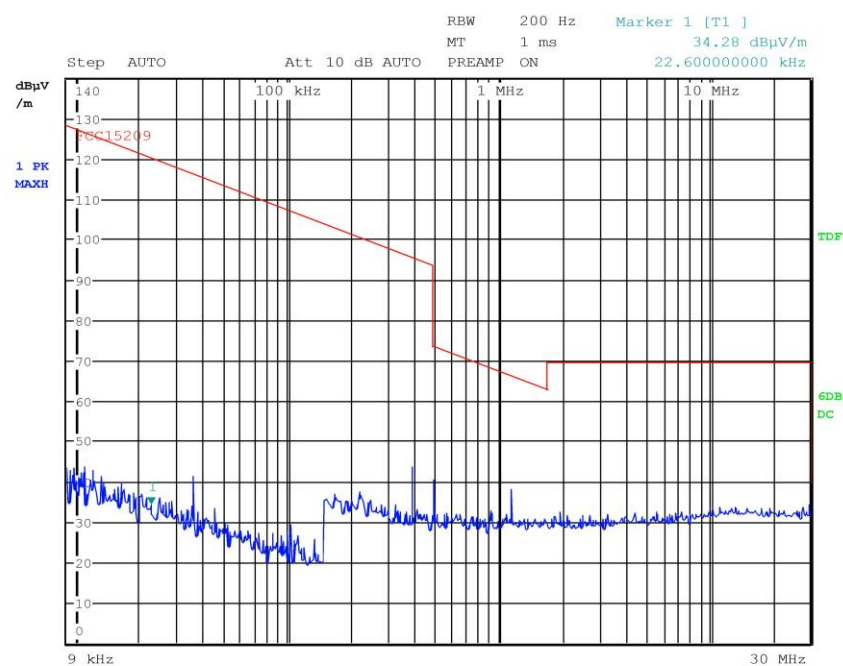
AV: Average; AV [1s] (average at 1 second) values are marked with a x



Graphs

G14026601

Meas Type Emission 0.009-30MHz
Equipment under Test
Manufacturer
OP Condition Tx
Operator Gandini 14026601
Test Spec
Loop



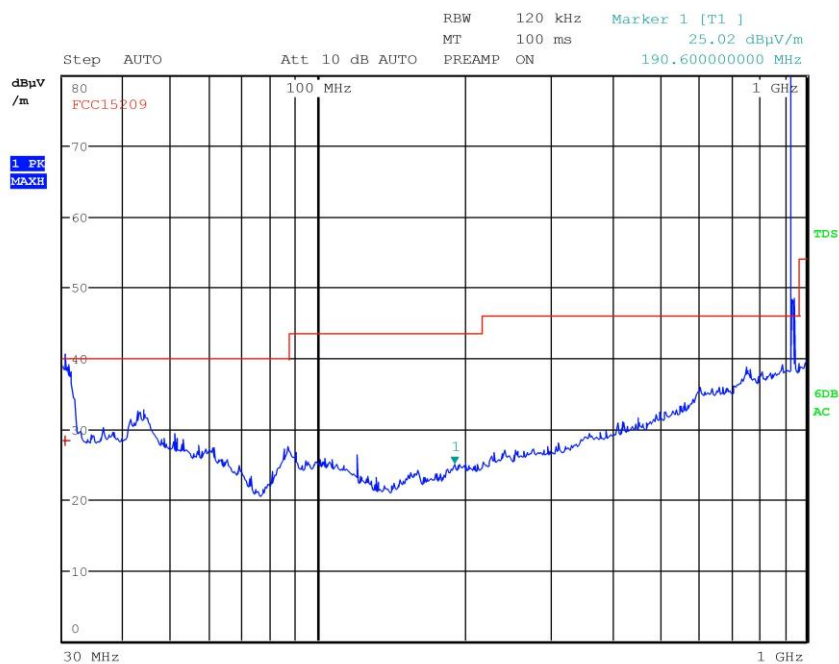
Final Measurement

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



G14026624

Meas Type Emission 30-1000MHz
Equipment under Test
Manufacturer
OP Condition Tx-RX Fmax
Operator Gandini 14026624
Test Spec
Vert



Final Measurement

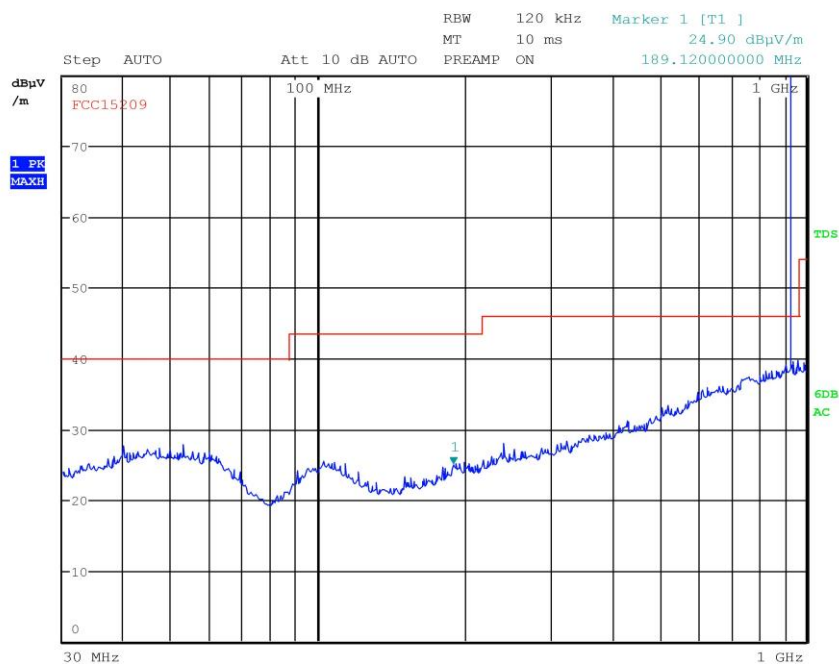
Meas Time: 1 s
Margin: 6 dB
Subranges: 1

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	30.360000000 MHz	28.32	Quasi Peak	-11.68



G14026625

Meas Type Emission 30-1000MHz
Equipment under Test
Manufacturer
OP Condition Tx-RX Fmax
Operator Gandini 14026625
Test Spec
Horiz



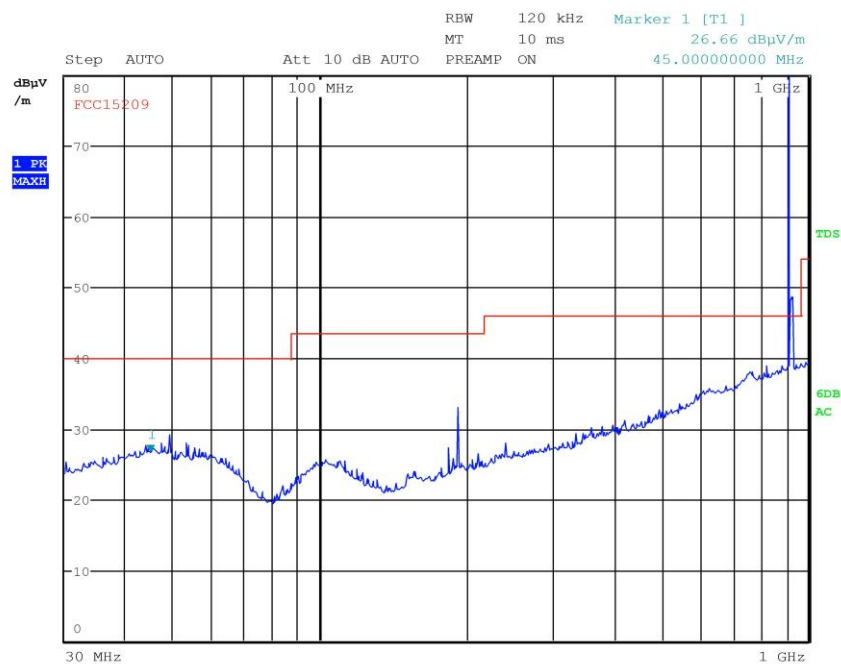
Final Measurement

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



G14026626

Meas Type Emission 30-1000MHz
Equipment under Test
Manufacturer
OP Condition Tx-RX Fmin
Operator Gandini 14026626
Test Spec
Horiz



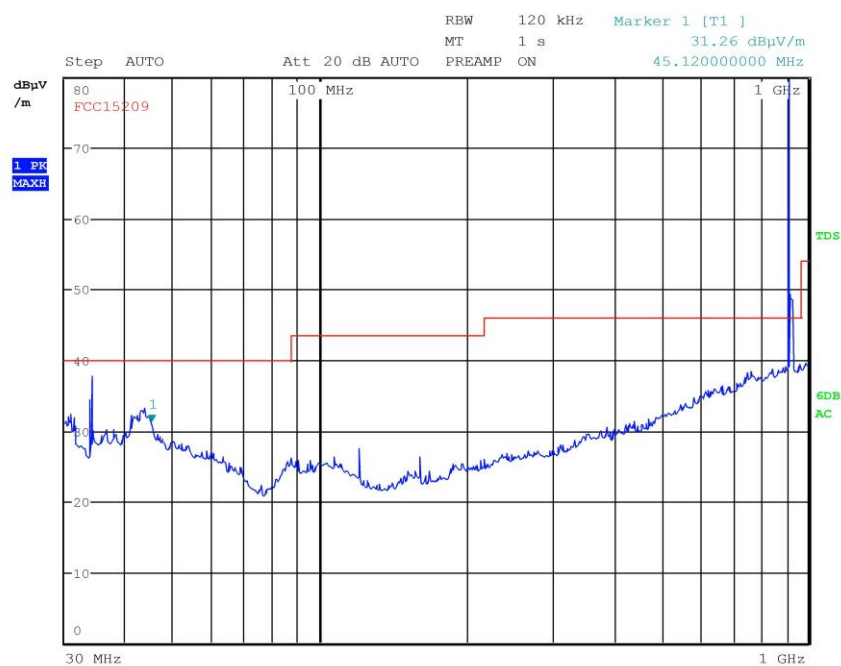
Final Measurement

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



G14026627

Meas Type Emission 30-1000MHz
Equipment under Test
Manufacturer
OP Condition Tx-RX Fmin
Operator Gandini 14026627
Test Spec
Vert.



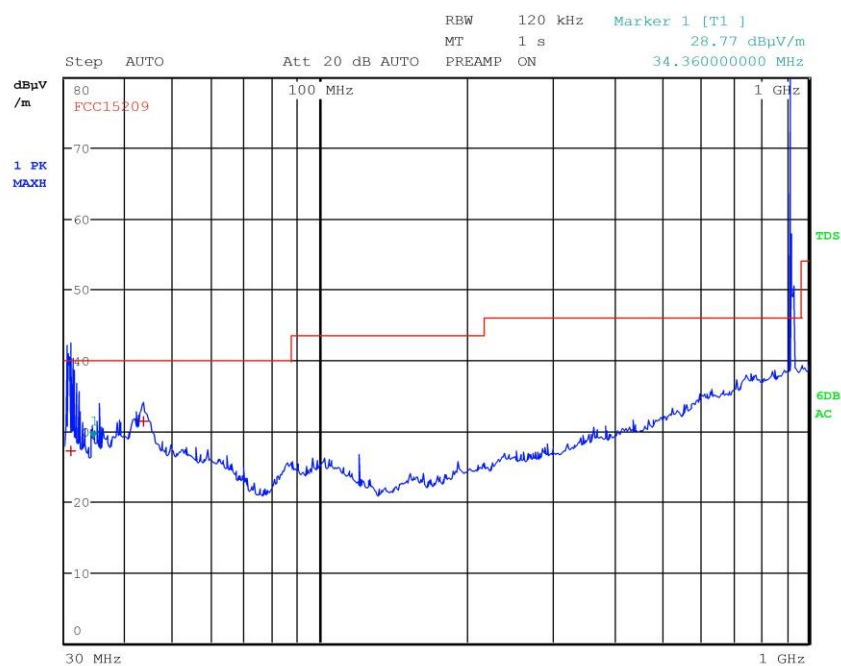
Final Measurement

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



G14026628

Meas Type Emission 30-1000MHz
Equipment under Test
Manufacturer
OP Condition Tx-RX Fmed
Operator Gandini14022628
Test Spec
Vert.



Final Measurement

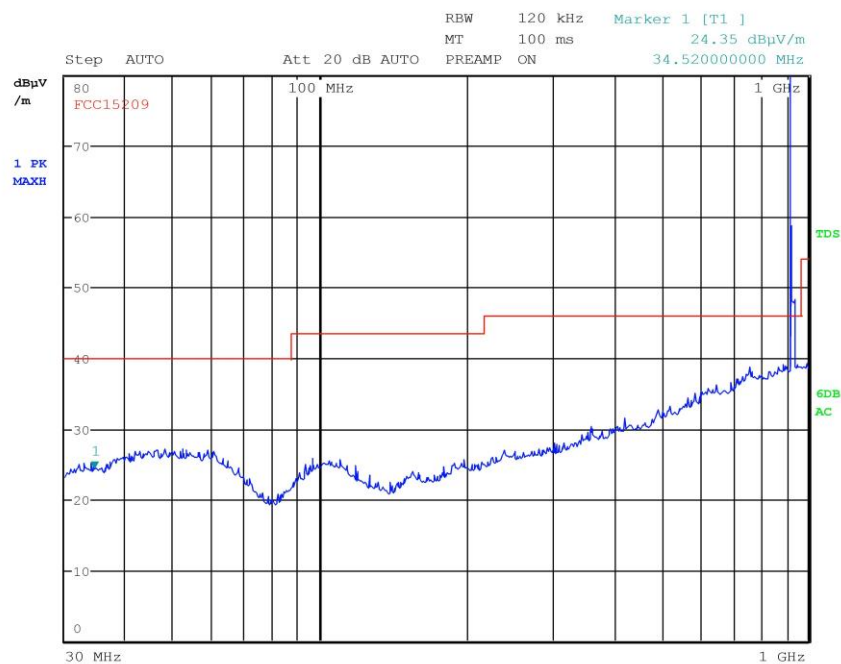
Meas Time: 1 s
Margin: 6 dB
Subranges: 2

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	30.840000000 MHz	27.12	Quasi Peak	-12.88
1	43.400000000 MHz	31.26	Quasi Peak	-8.74



G14026629

Meas Type Emission 30-1000MHz
Equipment under Test
Manufacturer
OP Condition Tx-RX Fmed
Operator Gandini14022629
Test Spec
Horiz.



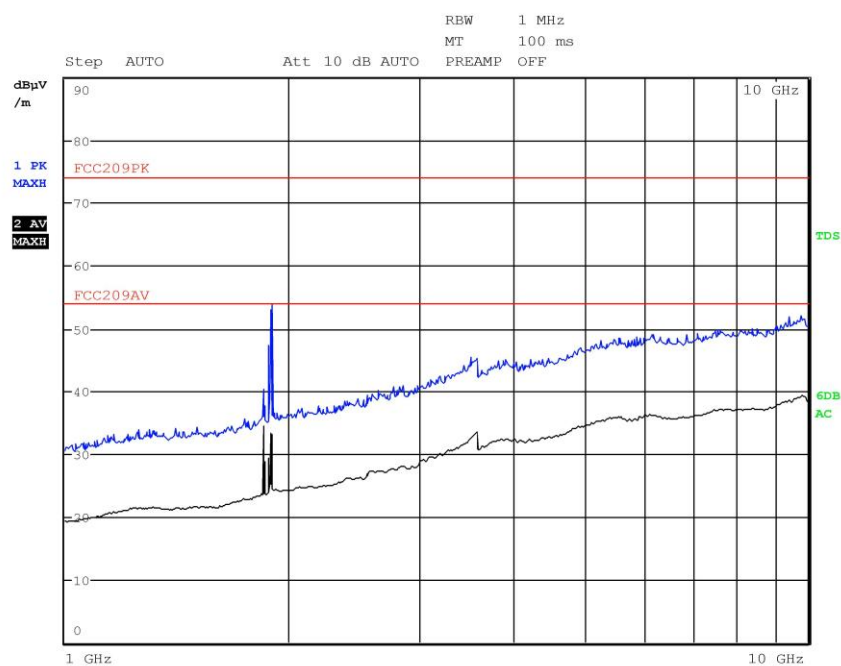
Final Measurement

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



G14026632

Meas Type Emission 1000-10000MHz
Equipment under Test
Manufacturer
OP Condition Tx-Rx
Operator Gandini 14026632
Test Spec
Vert



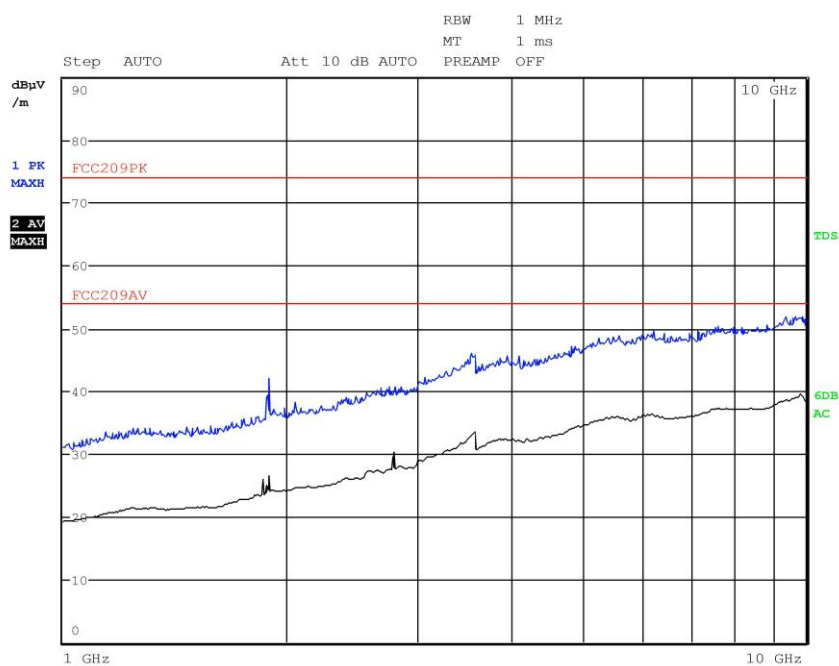
Final Measurement

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



G14026633

Meas Type Emission 1000-10000MHz
Equipment under Test
Manufacturer
OP Condition Tx-Rx
Operator Gandini 14026633
Test Spec
Horiz



Final Measurement

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

Result: The requirements are met



11.4 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 S164
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

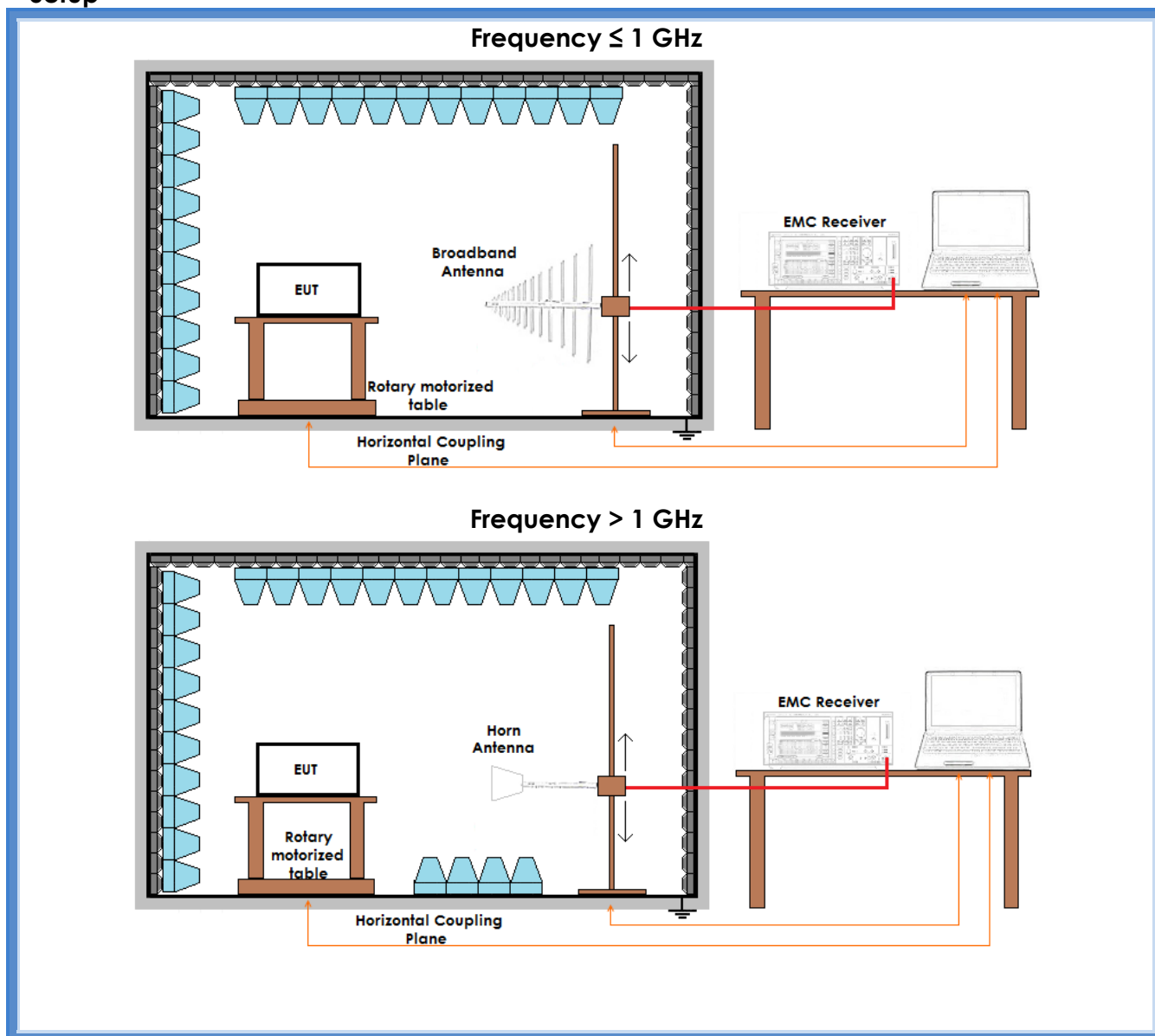
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	98	49

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



Setup



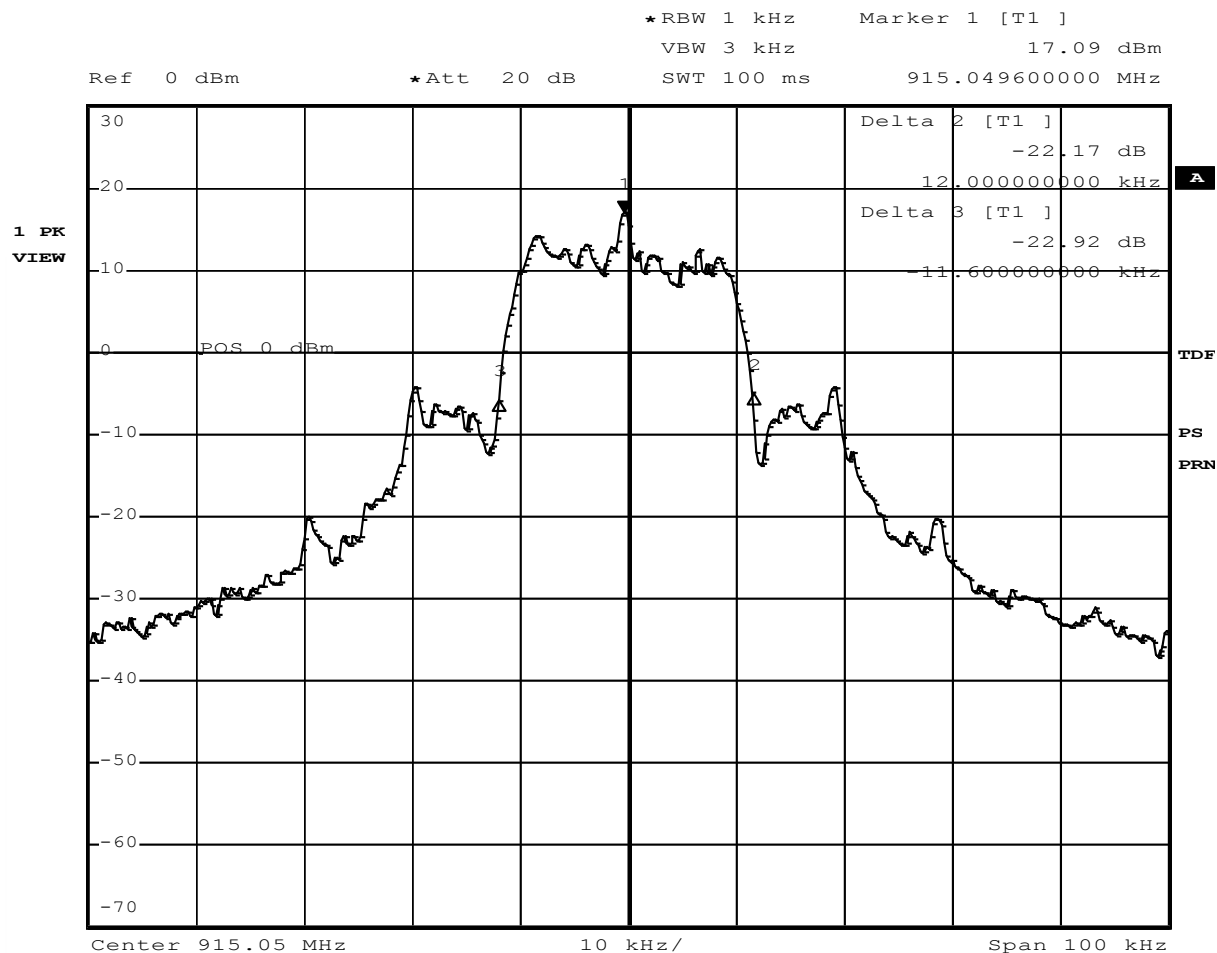
Result

Frequency (MHz)	Graphs	20 dB bandwidth (kHz)	Results
915,05	G14026607	23,6	Complies
921,50	G14026610	23,4	Complies
927,95	G14026612	23,6	Complies



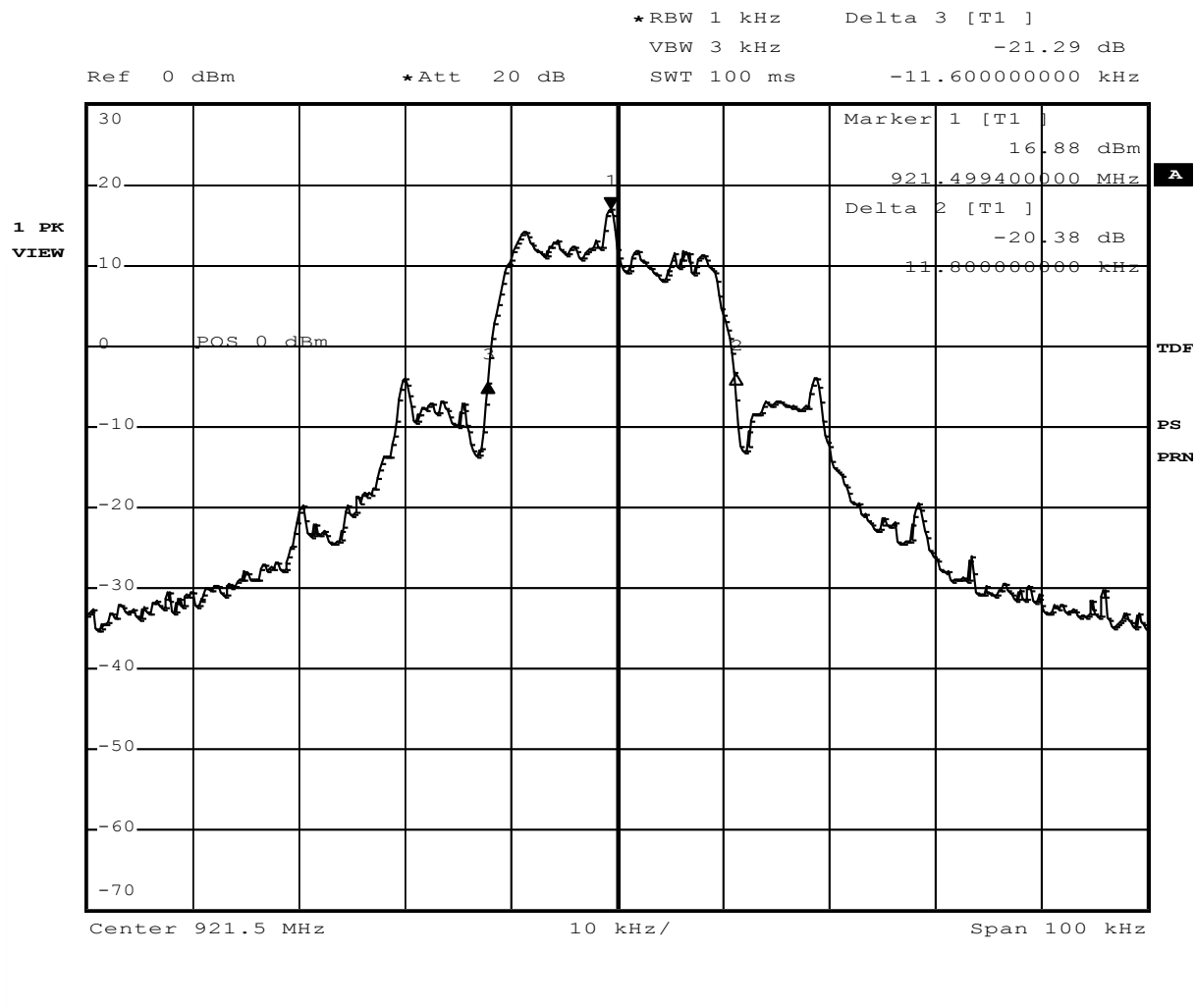
Graphs

G14026607



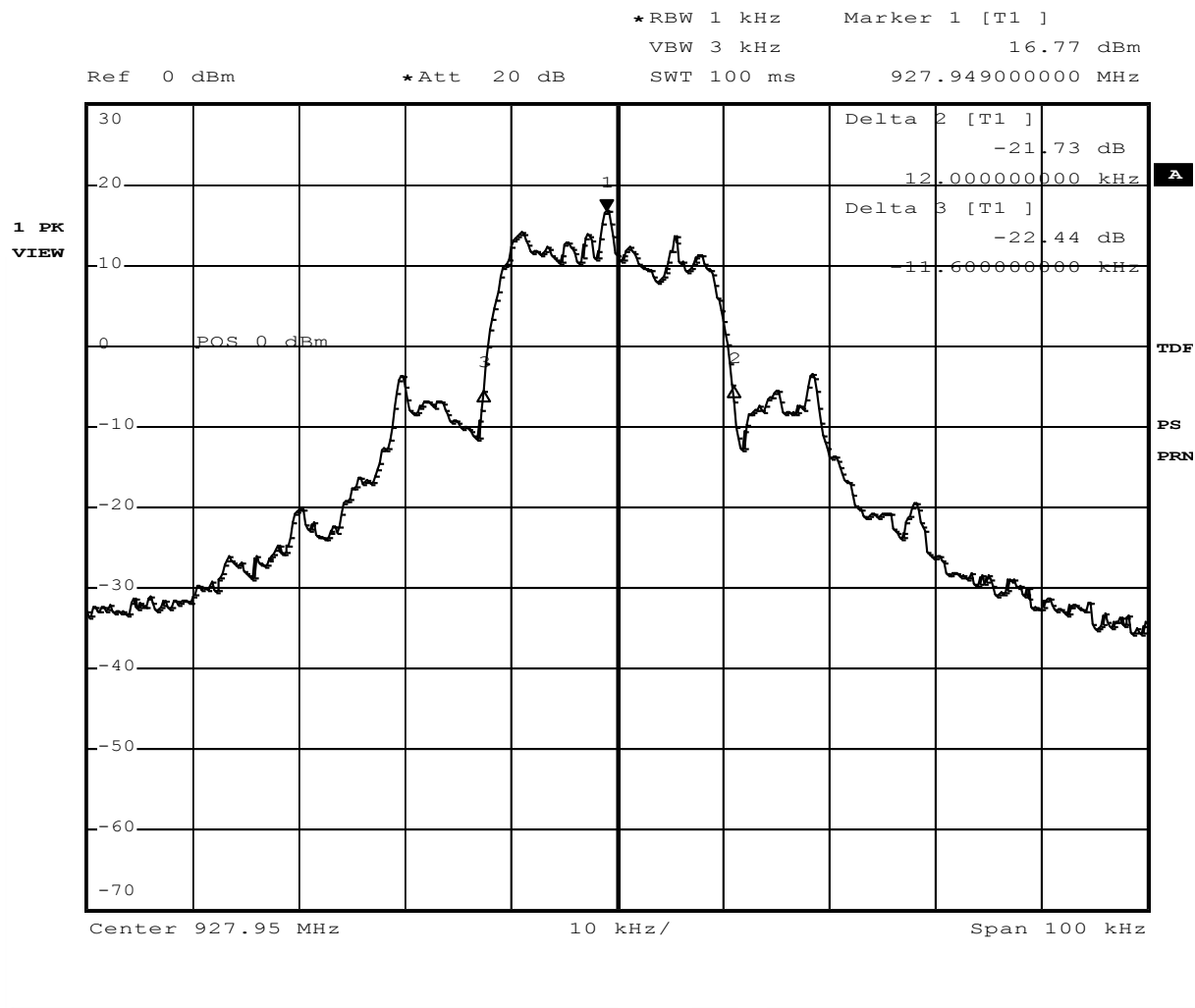


G14026610





G14026612



Result: The requirements are met



11.5 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 S164
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

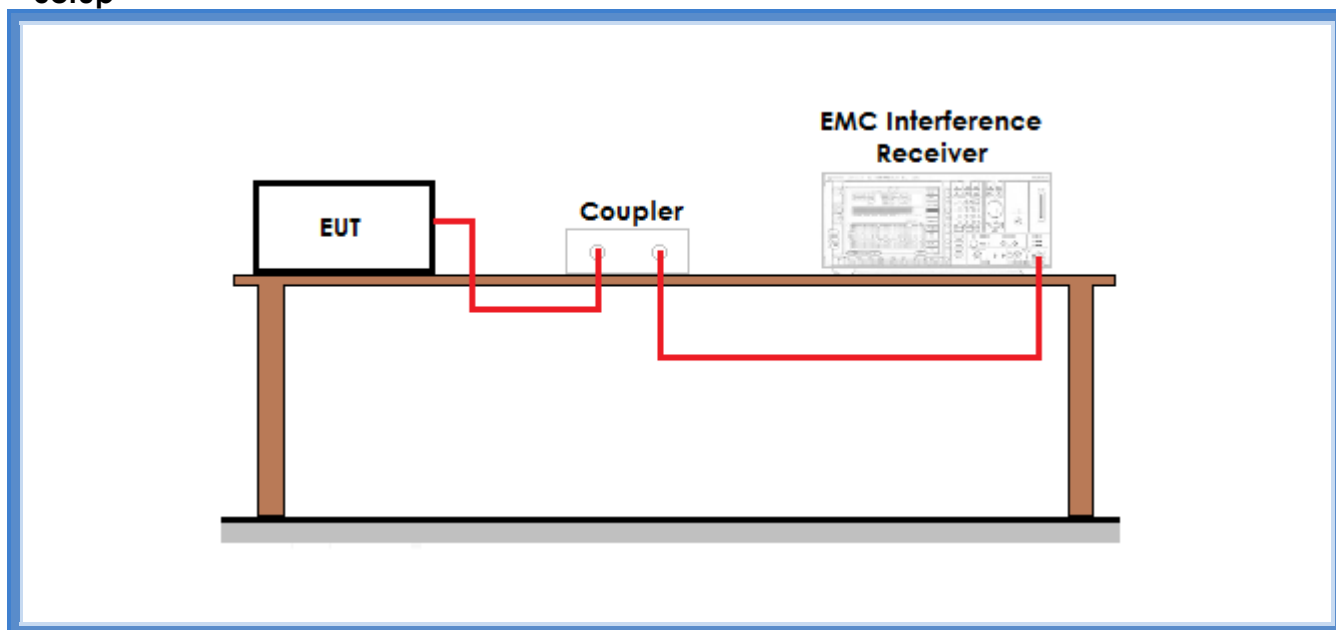
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	99	50

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

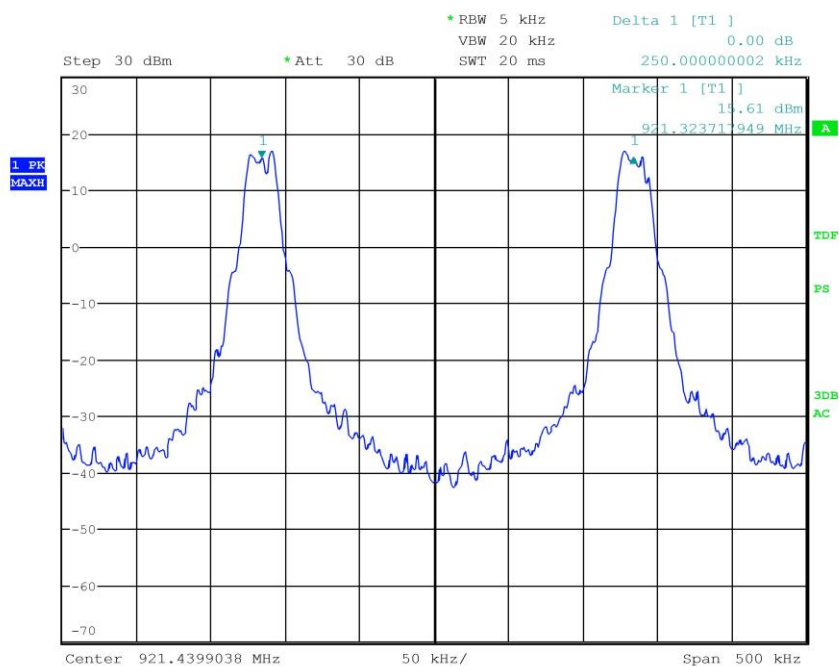
Frequency band (MHz)	Graphs	Channel separation (kHz)	Results
902 – 928	G14026621	250	Complies



Graphs

G14026621

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Gandini 14026621
Test Spec



Result: The requirements are met