



TEST REPORT nr. R16082601

Federal Communication Commission (FCC)

Test item

Description.....: WIRELESS RELAY MODULE
Trademark.....: CARLO GAVAZZI
Model/Type: SHJWRE10AE
FCC ID: SNJWRE

Test Specification

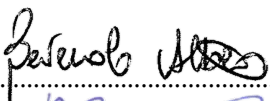
Standard.....: FCC Rules & Regulations, Title 47:2016
Part 15 paragraph(s): 203, 207, 209 and 247

Client's name: CARLO GAVAZZI CONTROLS S.p.A.
Address: Via Safforze, 8 – 32100 Belluno (BL) – ITALY

Manufacturer's name : Same as client
Address: --

Report

Tested by: A. Bertezolo
Approved by: R. Beghetto – Laboratory Manager
Date of issue: 12.02.19
Contents.....: 69 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	5
4. OPERATIVE CONDITIONS	5
5. PHOTOGRAPH(S) OF EUT	6
5.1 PHOTOGRAPH(S) OF EUT	6
6. EQUIPMENT LIST	8
7. MEASUREMENT UNCERTAINTY	9
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 CONDUCTED EMISSIONS	15
11.3 EMISSIONS IN RESTRICTED FREQUENCY BANDS AND IN UNRESTRICTED FREQUENCY BANDS	21
11.4 DTS BANDWIDTH	49
11.5 BAND EDGE	53
11.6 FUNDAMENTAL EMISSION OUTPUT POWER	58
11.7 MAXIMUM POWER SPECTRAL DENSITY LEVEL IN THE FUNDAMENTAL EMISSION	62
11.8 SPURIOUS EMISSION	66



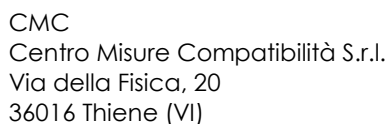
1. Summary

Standard:

FCC Rules & Regulations, Title 47:2016
Part 15 paragraph(s): 203, 207, 209 and 247

Test specifications	Environmental Phenomena	Tests sequence	Result
Part 15.203	Antenna requirements	1	Complies
Part 15.207	Conducted emissions	2	Complies
Part 15.209	Emissions in restricted frequency bands and in unrestricted frequency bands	3	Complies
Part 15.247 (a) (2)	DTS bandwidth	4	Complies
Part 15.247 (d)	Band edge	5	Complies
Part 15.209 and 15.247	Fundamental emission output power	6	Complies
Part 15.209 and 15.247	Maximum power spectral density level in the fundamental emission	7	Complies
Part 15.209	Spurious emission	8	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



LAB N° 0168

EUT description: Wireless relay module

Power supply: 120 V ~ 60 Hz single-phase

Software release tested into equipment FW rev.3

Type of equipment: ☒ Transmitter Unit
☒ Receiver Unit

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

Frequency band.....: F_L: 2405 MHz F_M: 2455 MHz F_H: 2475 MHz

Company: CMC Centro Misure Compatibilità S.r.l.
Address: Via della Fisica, 20
36016 Thiene (VI) – ITALY
Test site facility's FCC registration number: 182474



3. Testing and sampling

Date of receipt of test item for radiated measurements : 24.03.16

Date of receipt of test item for conducted measurements : 13.11.18

Testing start date : 28.04.16

Testing end date : 07.12.18

Samples tested nr. : 2

Sample #2 for antenna port conducted measurements

Sample #1 for all other measurements

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 numbers

P160477 for sample #1

P181419 for sample #2

4. Operative conditions

EUT exercising : EUT in continuous transmission at maximum power. The manufacturer provides 2 different samples set to operate at max output power, the test lab had no ability to change the power setting.

No modifications have been made on tested samples



5. Photograph(s) of EUT

5.1 Photograph(s) of EUT







6. Equipment list

Calibration information for DTS bandwidth, Band edge, Fundamental emission output power and Maximum power spectral density level in the fundamental emission tests reported on cl. 11.4, 11.5, 11.6 and 11.7 of this Test Report. Tests have been performed on December 2018

<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 S295	Rohde & Schwarz	FSW43	Spectrum Analyzer 43GHz	104059	November '16	November '19
20 dB attenuator					Calibrated before the tests	

Calibration information for Conducted emissions test reported on cl. 11.2 of this Test Report. Test has been performed on February 2018

<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 '18	January '19
CMC S200	Schwarzbeck	NSLK 8128	V-LISN	8128-273	January '18	January '19
CMC S206	Rohde & Schwarz	ESCI 7	EMC Receiver	100781	January '18	January '19

Calibration information for tests that have been performed on July 2016

<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 S108	EMCO	3115	Horn Antenna	9811-5622	June '16	June '19
CMC S127	Schaffner	HLA6120	Loop Antenna	1191	November '15	November '18
CMC S136	Schwarzbeck	VULB 9163	Broadband Antenna	9163-205	June '16	June '19
CMC S164	Rohde & Schwarz	ESU26	EMC interference receiver	100052	January '16	January '17
CMC S287	Schwarzbeck	VUSLP 9111B	Log-periodic Antenna (200 MHz-3GHz)	9111B-203	June '16	June '19
CMC S290	Schwarzbeck	BBHA 9170	Horn Antenna (15-40 GHz)	733	July '16	July '19



7. Measurement uncertainty

Test	Test Setup	Expanded uncertainty	Note
Conducted emission CISPR 16 LISN 50uH 0,009-0,0150MHz	PE001_01	3,4 dB	1
Conducted emission CISPR 16 LISN 50uH 0,150-30,0MHz	PE001_01	2,8 dB	1
Conducted emission CISPR 16 Voltage Probe 0,15-30MHz	PE001_02	2,6 dB	1
Conducted emission CISPR 16 Current Probe 0,15-30MHz	PE001_03	2,2 dB	1
Conducted emission CISPR 16 ISN 0,15-30MHz	PE001_04	4,5 dB	1
Clic CISPR 16 LISN 50uH 0,150-30,0MHz	PE001_05	2,8 dB	1
Disturbance Power 30-300 MHz	PE002_01	3,4 dB	1
Radiated Emission LAS 0,15-30MHz	PE003_01	1,5 dB	1
Radiated Emission CISPR 16 Loop Ant. 0,15-30MHz	PE004_01	3,8 dB	1
Radiated Emission CISPR 16 Bicon. Ant. 30-300MHz	PE004_02	3,3 dB	1
Radiated Emission CISPR 16 LogP. Ant. 300-1000MHz	PE004_03	3,2 dB	1
Radiated Emission CISPR 16 Horn Ant. 1-18GHz	PE004_04	3,6 dB	1
Human Exposure to electromagnetic fields	PE005_01	10,5 %	1
Harmonic current emissions test	PE006_01	10 mA + 1,6 %	1
Voltage fluctuation and flicker test	PE007_01	3,9 %	1
Radiated Immunity 80MHz-6GHz	PE102_XX	2,1 dB 0,81 V/m a 3V/m	1
Conducted Immunity 0,15-230MHz	PE105_XX	1,2 dB 0,44 V a 3V	1
AC Magnetic field	PE106_01	1,55 % 0,15 A/m a 10A/m	1
Pulse Magnetic field	PE107_01	6,22 % 18,6 A/m a 300A/m	1
Dumped Magnetic field	PE108_01	6,22 % 1,86 A/m a 30A/m	1
Common mode conducted immunity	PE112_01	2,12 % 0,21 V a 10V	1



Test	Test Setup	Expanded uncertainty	Note
Power/Spurious 9kHz-30MHz	PR001_01	3,8 dB	1
Power/Spurious ERP 30-1000MHz d=10m	PR001_02+03	4,3 dB	1
Misura della potenza EIRP 1-18GHz d=3m	PR001_04	4,3 dB	1
Misura della potenza EIRP 18-40GHz d=3m	PR001_05	5,5 dB	1
Frequency error	PR002_01+02	< 1x10 ⁻⁷	1
Timing zero span (1001pts.)	PR002_01+02	0,2 % SWT	1
Modulation bandwidth	PR002_01+02	< 1x10 ⁻⁷	1
Conducted RF power and spurious emission	PR002_01+02	1,2 dB	1
Adjacent channel power	PR002_01+02	1,2 dB	1
Blocking	PR002_01+02	1,2 dB	1

Test	Test Setup	Expanded uncertainty	Note
Electrostatic discharge immunity test	PE101_0X		2
Electrical fast transients / burst immunity test	PE103_0X		2
Surge immunity test	PE104_0X		2
Short interruption immunity test	PE109_01		2
Rev_17_01 date 20/03/2017			

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 15:2016	--
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
KDB 558074 D01 DTS Meas Guidance v05	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under § 15.247
Internal Procedure PM001 rev. 3.0 (Quality Manual)	Measure Procedure
Internal procedure INC_M rev. 9.1 (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.

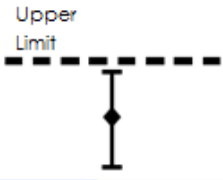
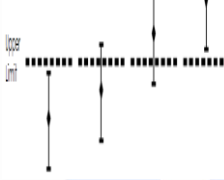
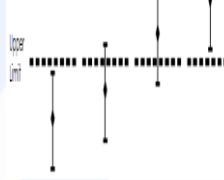
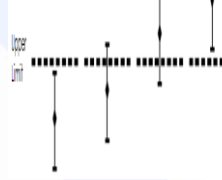


11. Results

In this clause tests results are reported.

Measurement uncertainty is in accordance with document CMC INC_M rev. 9.1.

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
- 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

--
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 (%)
23	100	42

Manufacturer declaration

Antenna Type	External R.F. power amplifier	Gain	Remarks
Integral antenna	Not Present	-2,5 dBi	--

Result: The requirements are met



11.2 Conducted emissions

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.207
- ANSI C63.10 cl. 6.2
- Internal procedure PM001
- See clause 4 of this test report
- Test date: 22 February 2018
- Technician: A. Bertezolo

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 S206
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Main port
Frequency range: 150 kHz – 30 MHz
EUT – LISN distance: 80 cm
EUT – reference ground plane distance: 40 cm

Environmental conditions

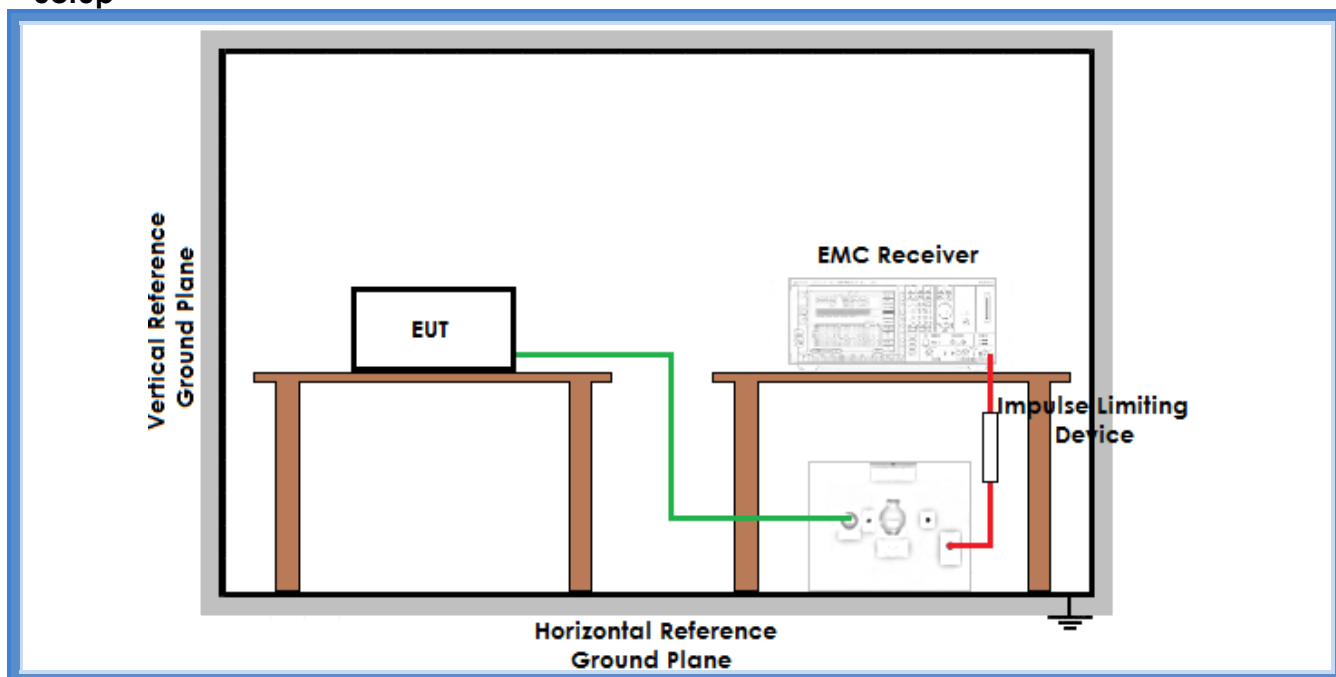
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
21	98	46

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	G16082642	--	Complies
L1	G16082643	--	Complies
Remarks: Tests performed on sample #1			

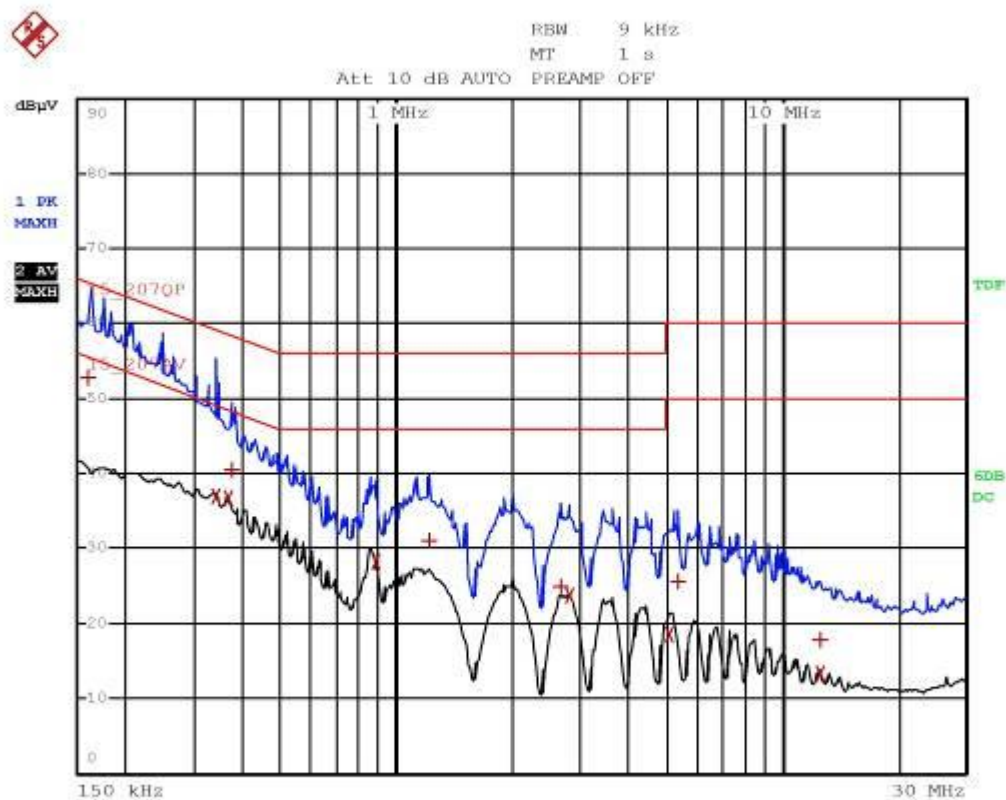
Graphs Legend

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

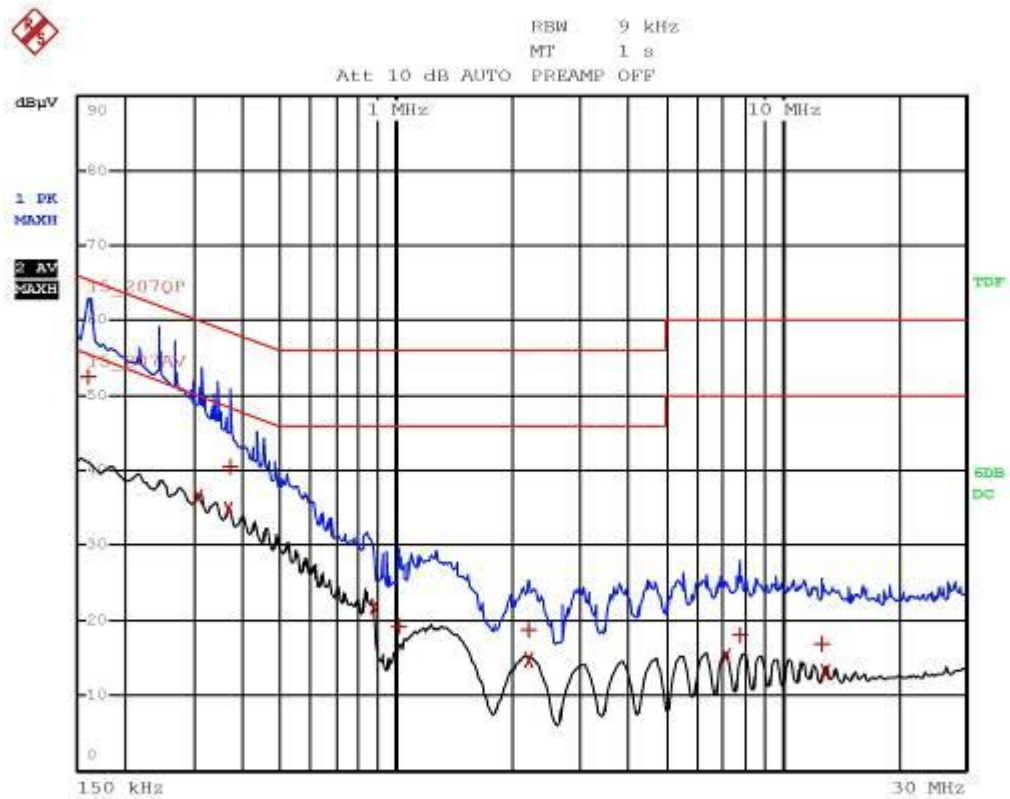


Gandini 16082642-Line N



EDIT PEAK LIST (Final Measurement Results)			
Trace1:	15_207QP		
Trace2:	15_207AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV	DELTA LIMIT dB
1 Quasi Peak	162 kHz	52.89	-12.46
2 Average	338 kHz	36.95	-12.29
2 Average	366 kHz	36.69	-11.89
1 Quasi Peak	374 kHz	40.58	-17.82
2 Average	882 kHz	28.19	-17.80
1 Quasi Peak	1.214 MHz	31.17	-24.82
1 Quasi Peak	2.662 MHz	25.01	-30.99
2 Average	2.81 MHz	23.85	-22.14
2 Average	5.13 MHz	18.43	-31.56
1 Quasi Peak	5.358 MHz	25.71	-34.28
1 Quasi Peak	12.538 MHz	17.92	-42.07
2 Average	12.578 MHz	13.34	-36.65

Gandini 16082642-Line N



Gandini 16082643-Line L



EDIT PEAK LIST (Final Measurement Results)			
Trace1:	15_207QP		
Trace2:	15_207AV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1 Quasi Peak	162 kHz	52.55	-12.80
2 Average	310 kHz	36.61	-13.35
2 Average	366 kHz	34.87	-13.72
1 Quasi Peak	370 kHz	40.54	-17.95
2 Average	878 kHz	21.77	-24.22
1 Quasi Peak	1.014 MHz	19.15	-36.84
2 Average	2.206 MHz	14.87	-31.12
1 Quasi Peak	2.214 MHz	18.71	-37.28
2 Average	7.194 MHz	15.21	-34.79
1 Quasi Peak	7.834 MHz	18.11	-41.08
1 Quasi Peak	12.738 MHz	16.77	-43.22
2 Average	12.946 MHz	13.22	-36.77

Gandini 16082643-Line L

Result: The requirements are met



11.3 Emissions in restricted frequency bands and in unrestricted frequency bands

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.209
- KDB 558074 D01 DTS Meas Guidance v05 cl. 8.6
- ANSI C63.10 cl. 11.12.1
- Internal procedure PM001
- See clause 4 of this test report
- Test date: 11 May 2016
- Technician: A. Bertezolo

Test configuration

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, CMC S290
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: Enclosure
Frequency range: 0,009 MHz – 26000 MHz
Antenna polarization: Horizontal (H) – Vertical (V)
EUT height about the floor:
80 cm for frequencies $\leq$ 1000 MHz
150 cm for frequencies $>$ 1000 MHz
EUT – Antenna distance:
10 m for frequencies $\leq$ 1000 MHz
3 m for frequencies $>$ 1000 MHz

Environmental conditions

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

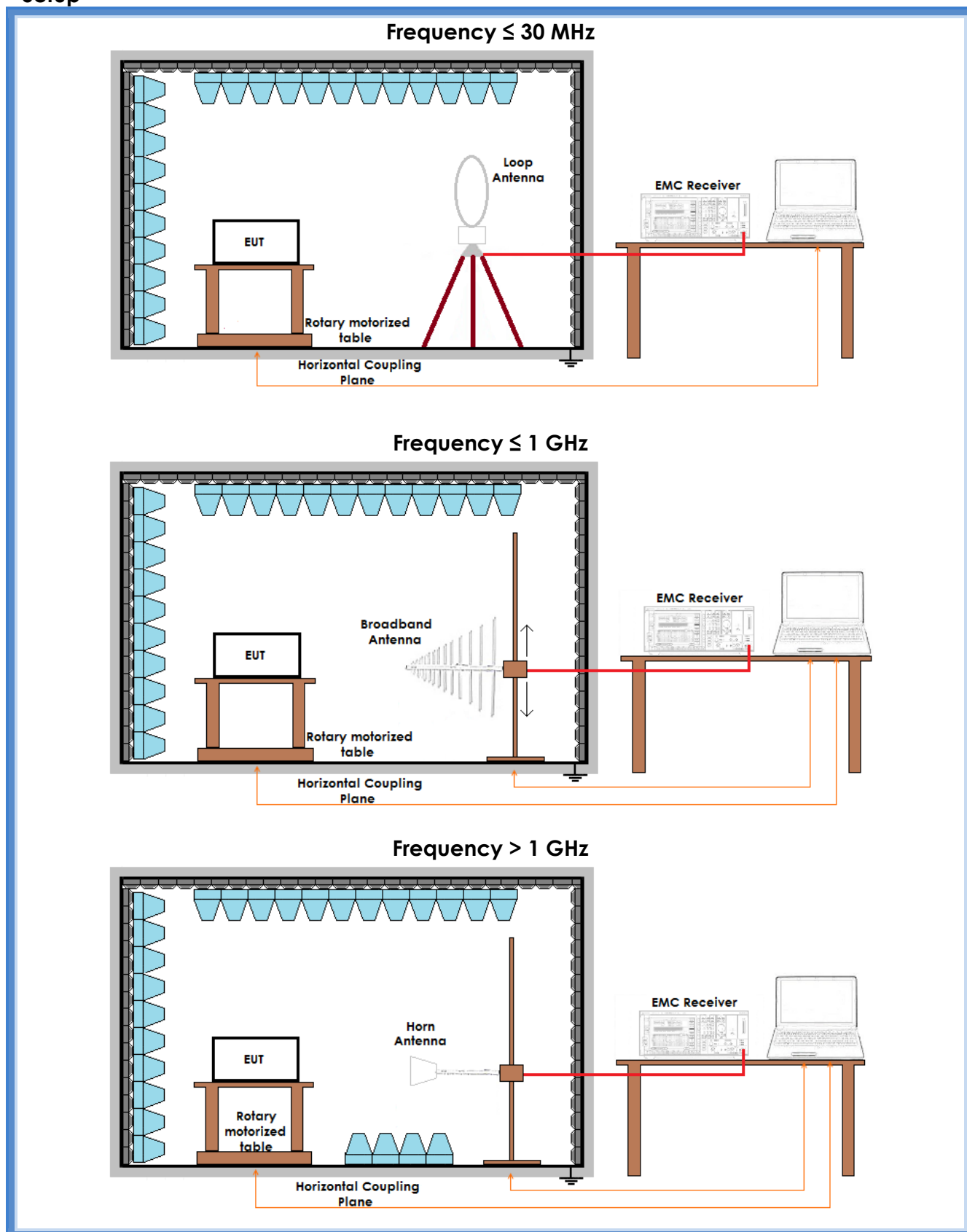


Acceptance limits

Frequency range (MHz)	Test distance (m)	Limits [dB(μV/m)]	
0,009 to 0,490	300	48,5 to 13,8	
0,490 to 1,705	30	33,8 to 22,9	
1,705 to 30	30	29,5	
30 to 88	3	40	
88 to 216	3	43,5	
216 to 960	3	46,0	
Above 960	3	53,9	
	Test distance (m)	Linear average detector [dB(μV/m)]	Peak detector [dB(μV/m)]
Above 1000	3	53,9	73,9

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. The results have been extrapolated to the specified distance using an extrapolation factor

Setup





Result

Polarization	Frequency Range (MHz)	Graphs	Remarks	Result
Loop	0,009 – 30 *	G16082624	Worst case	Complies
V	30 – 1000	G16082625	Worst case	Complies
H	30 – 1000	G16082626	Worst case	Complies
H	1000 – 10000	G16082620	Lowest channel	Complies
V	1000 – 10000	G16082621	Lowest channel	Complies
V	1000 – 10000	G16082618	Medium channel	Complies
H	1000 – 10000	G16082619	Medium channel	Complies
H	1000 – 10000	G16082629	Highest channel	Complies
V	1000 – 10000	G16082630	Highest channel	Complies
V	10000 – 18000	G16082631	Worst case	Complies
H	10000 – 18000	G16082632	Worst case	Complies
V	18000 – 26000	G16082644	Worst case	Complies
H	18000 – 26000	G16082645	Worst case	Complies

Remarks:

*: these test was performed at a site other than an OATS, adequate comparison measurements have been made against an OATS. The semi-anechoic chamber results are generally slightly higher than OATS. This mean that if the measurement passes in the semi-anechoic chamber, it will pass with a higher margin on an open field test site.

EUT was tested in 3 orthogonal planes, graphs are related to the highest detected levels.

Measurements at frequencies lower than 30 MHz have been performed with an EUT – antenna distance of 10 m. Limits have been corrected with conversion factor $\text{Limits} + 40\log(\text{test distance}/10)$ based on the measuring distance provided by the standard.

Measurements at frequencies higher than 30 MHz and lower than 1000 MHz have been performed with an EUT – antenna distance of 10 m. Limits have been corrected with conversion factor $\text{Limits} + 20\log(3/10)$ based on the measuring distance provided by the standard.

Peaks above the limits are caused by the nominal transmitting frequencies.

Tests performed on sample #1

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

Meas Type Emission

Equipment under Test

Manufacturer

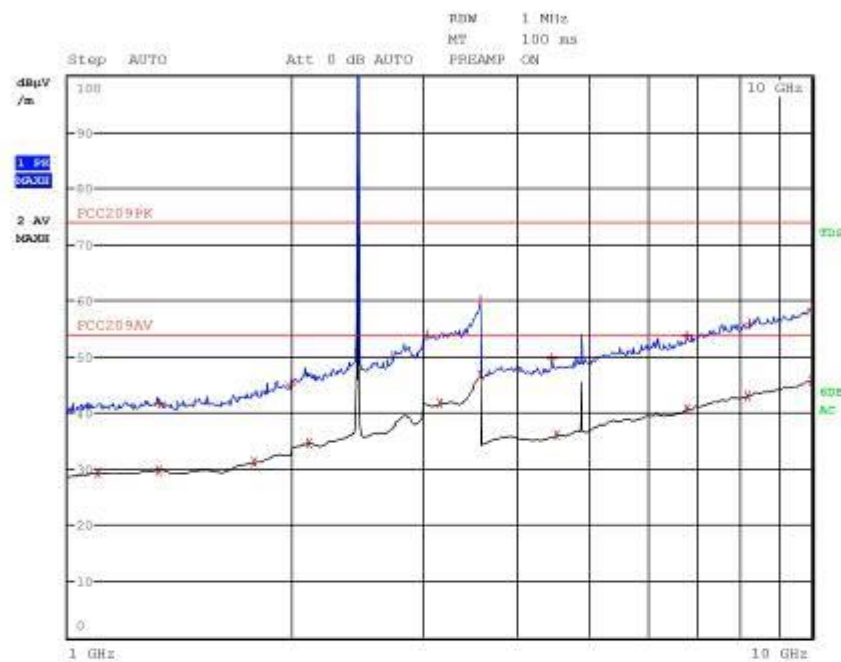
OP Condition

Operator

Bertezzo 16082618

Test Spec

Vert





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082618
Test Spec
Vert

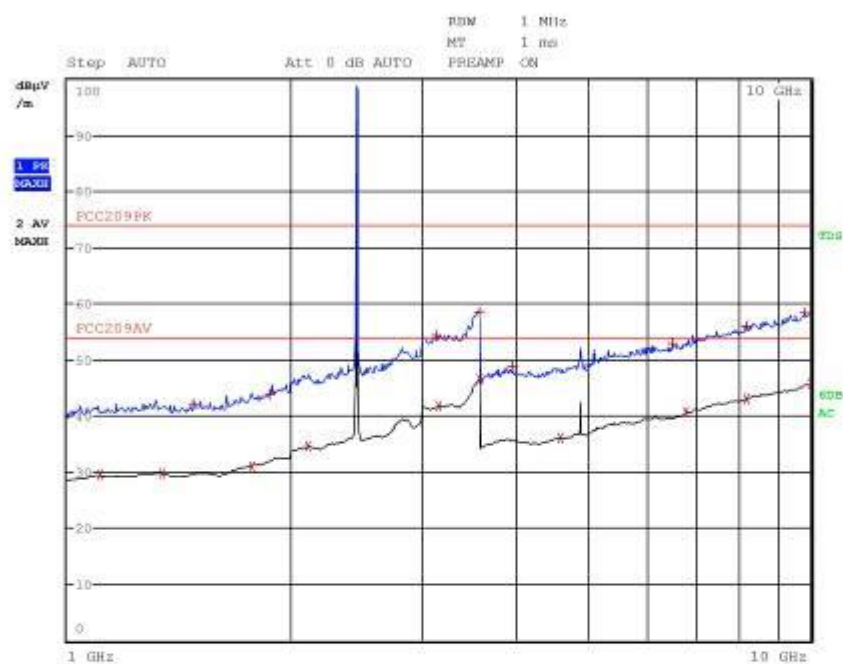
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Subranges: 18

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
2	1.097200000 GHz	29.40	Average	
2	1.323200000 GHz	29.77	Average	
1	1.326400000 GHz	41.65	Max Peak	-12.35
2	1.778000000 GHz	31.12	Average	
1	1.992800000 GHz	45.03	Max Peak	-8.97
2	2.107600000 GHz	34.57	Average	
1	3.035200000 GHz	53.82	Max Peak	-0.18
2	3.160400000 GHz	41.74	Average	
2	3.590400000 GHz	46.71	Average	
1	3.594800000 GHz	59.92	Max Peak	5.92
1	4.473600000 GHz	49.58	Max Peak	-4.42
2	4.542000000 GHz	36.13	Average	
2	6.779600000 GHz	40.60	Average	
1	6.787200000 GHz	53.70	Max Peak	-0.30
2	8.208000000 GHz	43.05	Average	
1	8.240400000 GHz	55.85	Max Peak	1.85
2	9.988400000 GHz	45.69	Average	
1	9.990400000 GHz	58.51	Max Peak	4.51



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082619
Test Spec
Horiz





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082619
Test Spec
Horiz

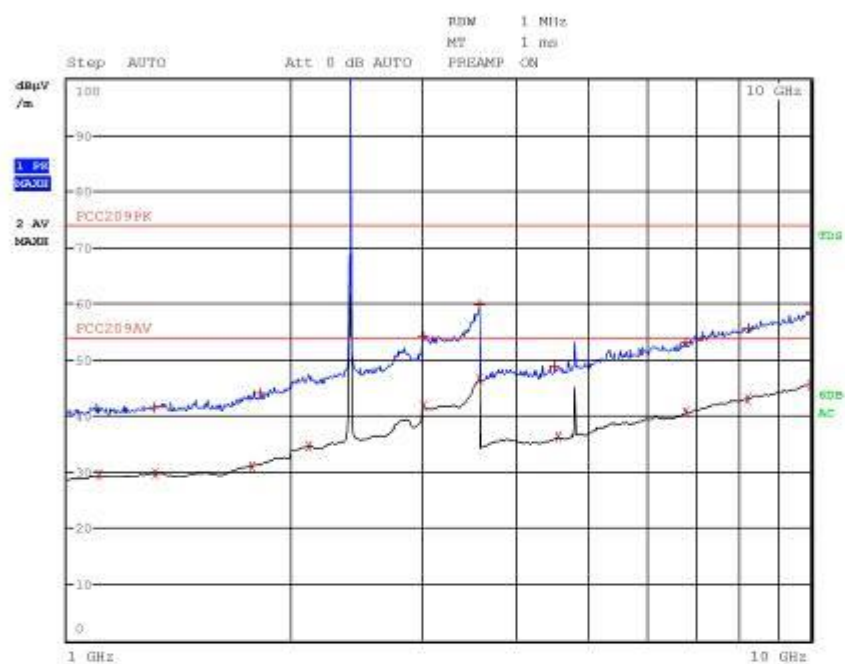
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Subranges: 18

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
2	1.106800000 GHz	29.53	Average	
2	1.342800000 GHz	29.75	Average	
1	1.480800000 GHz	42.03	Max Peak	-11.97
2	1.772400000 GHz	31.03	Average	
1	1.869600000 GHz	43.89	Max Peak	-10.11
2	2.110400000 GHz	34.53	Average	
1	3.138400000 GHz	54.40	Max Peak	0.40
2	3.156400000 GHz	41.68	Average	
1	3.580800000 GHz	58.45	Max Peak	4.45
2	3.599200000 GHz	46.53	Average	
1	3.968400000 GHz	48.77	Max Peak	-5.23
2	4.613600000 GHz	36.06	Average	
1	6.525200000 GHz	52.86	Max Peak	-1.14
2	6.781200000 GHz	40.60	Average	
2	8.189600000 GHz	43.04	Average	
1	8.198400000 GHz	55.91	Max Peak	1.91
1	9.828000000 GHz	58.26	Max Peak	4.26
2	9.991600000 GHz	45.62	Average	



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082620
Test Spec
Horiz





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082620
Test Spec
Horiz

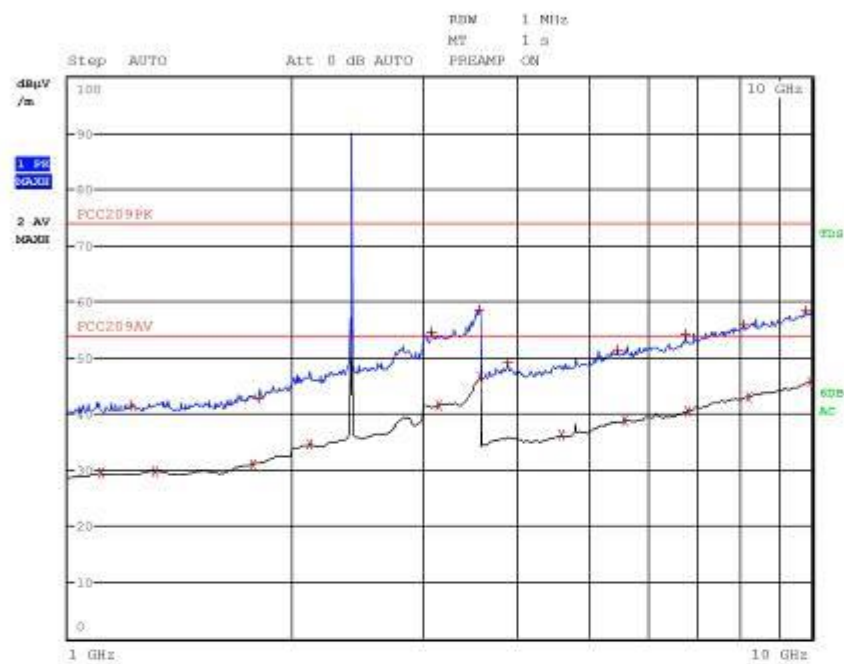
Final Measurement

Meas Time: 1 s
Margin: 6 dB
Subranges: 18

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
2	1.104400000 GHz	29.46	Average	
1	1.307200000 GHz	41.44	Max Peak	-12.56
2	1.315600000 GHz	29.80	Average	
2	1.772000000 GHz	31.03	Average	
1	1.814800000 GHz	43.94	Max Peak	-10.06
2	2.116800000 GHz	34.62	Average	
1	3.014000000 GHz	54.18	Max Peak	0.18
2	3.016000000 GHz	41.62	Average	
2	3.598000000 GHz	46.64	Average	
1	3.599600000 GHz	59.80	Max Peak	5.80
1	4.515600000 GHz	48.83	Max Peak	-5.17
2	4.581200000 GHz	36.14	Average	
2	6.778800000 GHz	40.74	Average	
1	6.780800000 GHz	52.98	Max Peak	-1.02
2	8.228400000 GHz	43.05	Average	
1	8.241200000 GHz	55.55	Max Peak	1.55
1	9.985600000 GHz	58.49	Max Peak	4.49
2	10.000000000 GHz	45.58	Average	



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082621
Test Spec
Vert



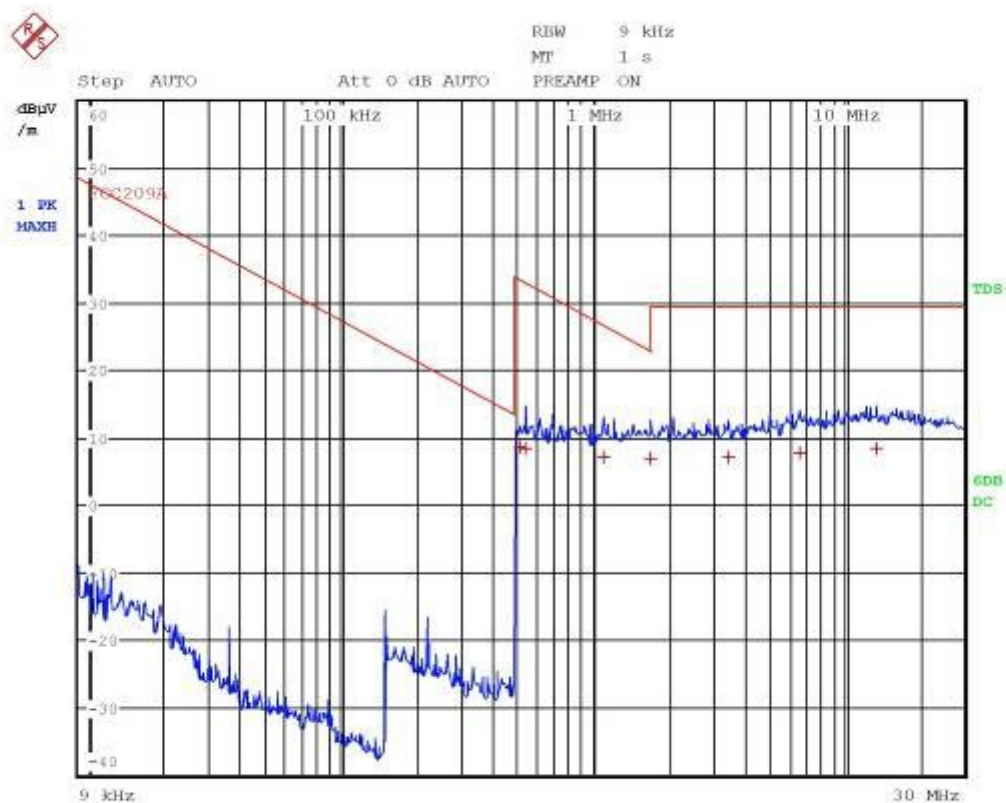


Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082621
Test Spec
Vert

Final Measurement

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

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
2	1.106800000 GHz	29.41	Average	
1	1.217600000 GHz	41.54	Max Peak	-12.46
2	1.310800000 GHz	29.72	Average	
2	1.771600000 GHz	31.07	Average	
1	1.804400000 GHz	42.81	Max Peak	-11.19
2	2.113600000 GHz	34.61	Average	
1	3.085600000 GHz	54.52	Max Peak	0.52
2	3.154800000 GHz	41.60	Average	
1	3.572400000 GHz	58.60	Max Peak	4.60
2	3.593600000 GHz	46.51	Average	
1	3.905600000 GHz	49.10	Max Peak	-4.90
2	4.613600000 GHz	36.20	Average	
1	5.486800000 GHz	51.42	Max Peak	-2.58
2	5.611600000 GHz	38.80	Average	
1	6.754000000 GHz	54.00	Max Peak	0.00
2	6.812000000 GHz	40.50	Average	
1	8.090400000 GHz	55.86	Max Peak	1.86
2	8.209200000 GHz	43.06	Average	
1	9.834400000 GHz	58.31	Max Peak	4.31
2	9.969600000 GHz	45.65	Average	



Bertezzo 16082624

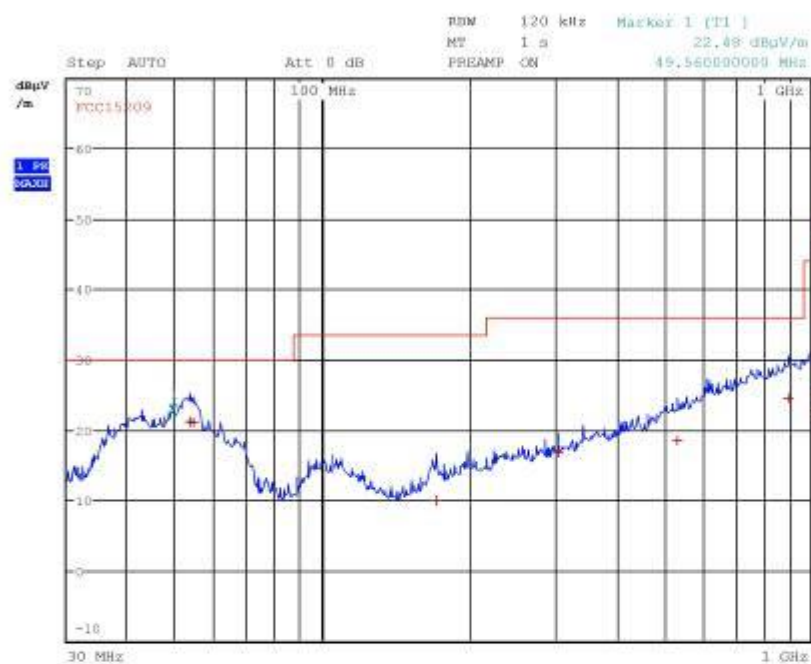


EDIT PEAK LIST (Final Measurement Results)			
Trace1:	FCC209A		
Trace2:	---		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	506 kHz	8.69	-24.82
1 Quasi Peak	538 kHz	8.45	-24.53
1 Quasi Peak	1.106 MHz	7.09	-19.63
1 Quasi Peak	1.682 MHz	6.95	-16.13
1 Quasi Peak	3.462 MHz	7.15	-22.38
1 Quasi Peak	6.614 MHz	7.89	-21.64
1 Quasi Peak	13.47 MHz	8.38	-21.15

Bertezzolo 16082624



Meas Type Emission 10m
Equipment under Test
Manufacturer
OP Condition
Operator Gandini 16082625
Test Spec



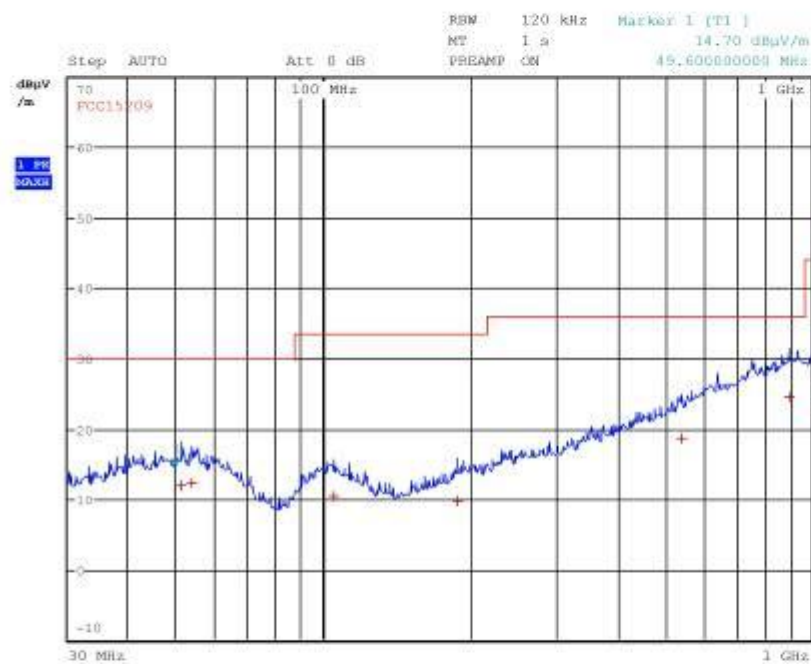
Final Measurement

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

Trace	Frequency	Level (dBuV/m)	Detector	Delta Limit/dB
1	53.440000000 MHz	21.13	Quasi Peak	-8.87
1	54.240000000 MHz	20.95	Quasi Peak	-9.05
1	171.200000000 MHz	9.84	Quasi Peak	-23.68
1	303.000000000 MHz	16.89	Quasi Peak	-19.13
1	532.560000000 MHz	18.46	Quasi Peak	-17.56
1	900.480000000 MHz	24.57	Quasi Peak	-11.45



Meas Type Emission 10m
Equipment under Test
Manufacturer
OP Condition
Operator Gandini 16082626
Test Spec



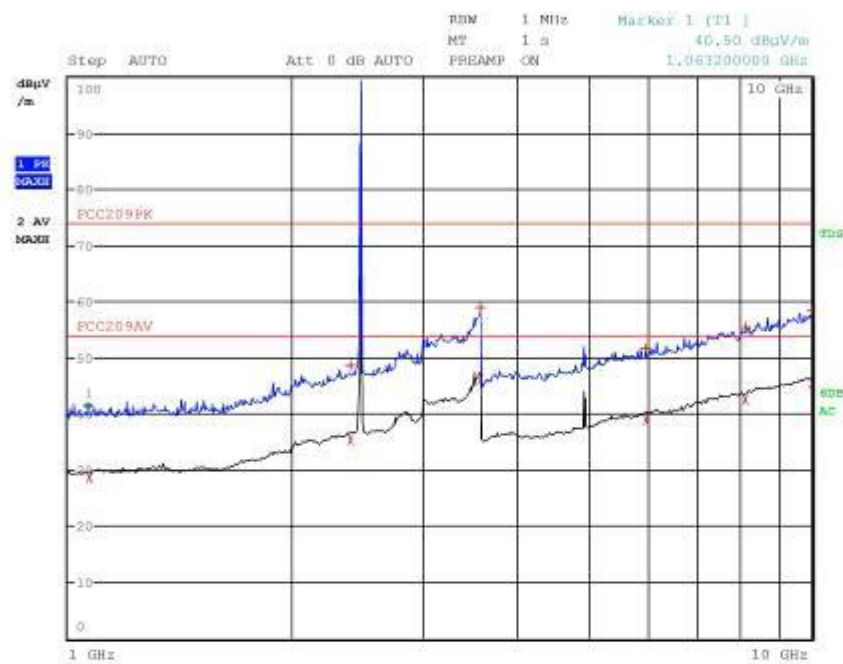
Final Measurement

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

Trace	Frequency	Level (dBuV/m)	Detector	Delta Limit/dB
1	51.00000000 MHz	11.86	Quasi Peak	-18.14
1	53.88000000 MHz	12.19	Quasi Peak	-17.81
1	105.20000000 MHz	10.38	Quasi Peak	-23.14
1	188.32000000 MHz	9.79	Quasi Peak	-23.73
1	542.64000000 MHz	18.60	Quasi Peak	-17.42
1	896.36000000 MHz	24.53	Quasi Peak	-11.49



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082629
Test Spec





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082629
Test Spec

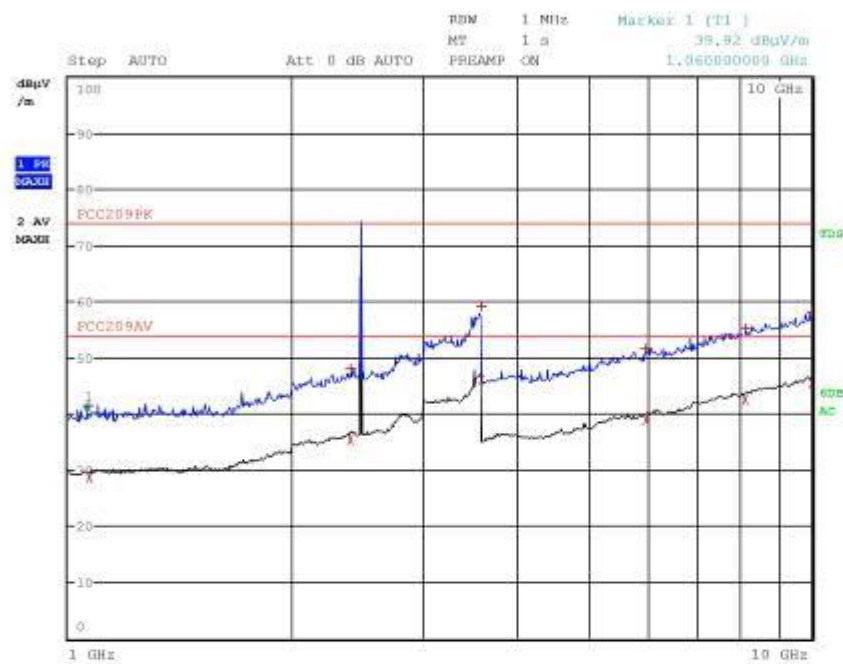
Final Measurement

Meas Time: 1 s
Margin: 20 dB
Peaks: 12

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	1.063200000 GHz	41.25	Max Peak	-32.75
2	1.069200000 GHz	28.74	Average	-25.26
2	2.400400000 GHz	35.40	Average	-18.60
1	2.400400000 GHz	48.71	Max Peak	-25.29
2	3.596800000 GHz	46.18	Average	-7.82
1	3.598400000 GHz	58.86	Max Peak	-15.14
1	5.965600000 GHz	51.68	Max Peak	-22.32
2	5.997600000 GHz	39.00	Average	-15.00
2	8.140000000 GHz	42.52	Average	-11.48
1	8.146800000 GHz	55.27	Max Peak	-18.73
1	9.989600000 GHz	58.27	Max Peak	-15.73
2	9.992800000 GHz	45.39	Average	-8.61



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezzo 16082630
Test Spec





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082630
Test Spec

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Peaks: 12

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	1.063200000 GHz	41.52	Max Peak	-32.48
2	1.069200000 GHz	28.74	Average	-25.26
2	2.400400000 GHz	35.40	Average	-18.60
1	2.400400000 GHz	48.00	Max Peak	-26.00
2	3.596800000 GHz	46.19	Average	-7.81
1	3.598400000 GHz	59.10	Max Peak	-14.90
1	5.965600000 GHz	51.67	Max Peak	-22.33
2	5.997600000 GHz	39.00	Average	-15.00
2	8.140000000 GHz	42.53	Average	-11.47
1	8.146800000 GHz	55.21	Max Peak	-18.79
1	9.989600000 GHz	58.06	Max Peak	-15.94
2	9.992800000 GHz	45.39	Average	-8.61



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082631
Test Spec





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082631
Test Spec

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Peaks: 12

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	11.673200000 GHz	53.16	Max Peak	-20.84
2	11.752400000 GHz	39.81	Average	-14.19
2	13.677200000 GHz	45.29	Average	-8.71
1	13.685200000 GHz	57.88	Max Peak	-16.12
2	15.130800000 GHz	39.30	Average	-14.70
1	15.147200000 GHz	51.36	Max Peak	-22.64
1	16.667600000 GHz	52.03	Max Peak	-21.97
2	16.741200000 GHz	39.32	Average	-14.68
2	17.112000000 GHz	41.40	Average	-12.60
1	17.169600000 GHz	53.11	Max Peak	-20.89
1	17.890000000 GHz	56.59	Max Peak	-17.41
2	17.900800000 GHz	43.23	Average	-10.77



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082632
Test Spec



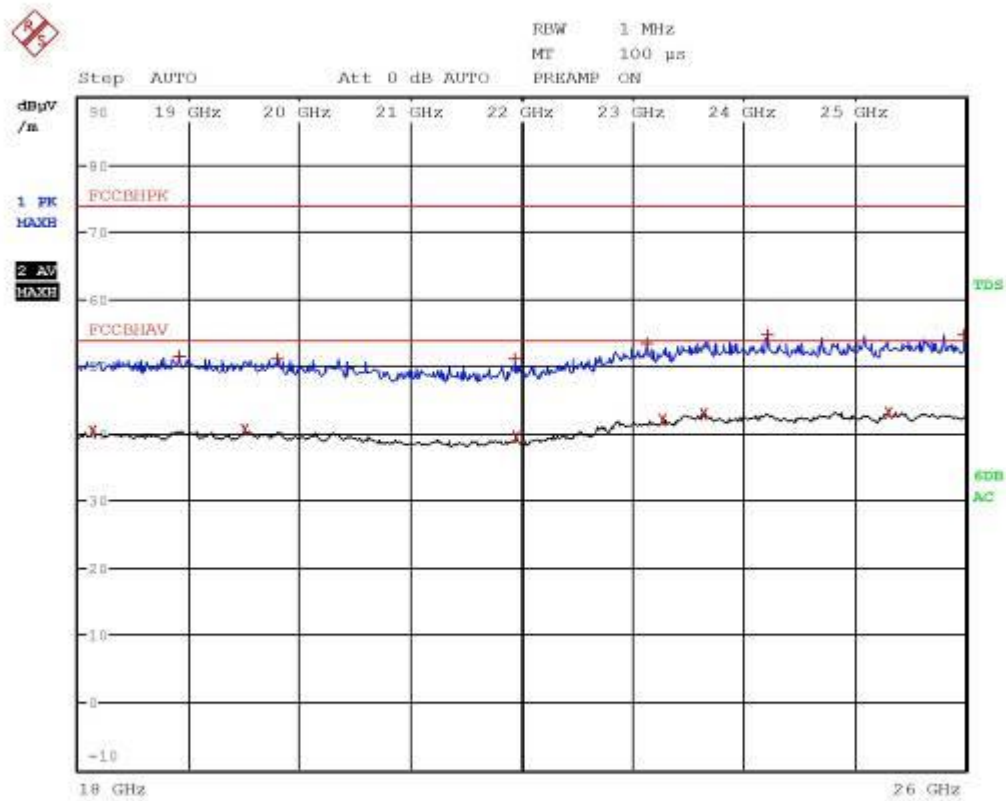


Meas Type Emission
Equipment under Test
Manufacturer
OP Condition
Operator Bertezolo 16082632
Test Spec

Final Measurement

Meas Time: 1 s
Margin: 20 dB
Peaks: 12

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	11.673200000 GHz	52.79	Max Peak	-21.21
2	11.752400000 GHz	39.74	Average	-14.26
2	13.677200000 GHz	45.27	Average	-8.73
1	13.685200000 GHz	58.47	Max Peak	-15.53
2	15.130800000 GHz	39.27	Average	-14.73
1	15.147200000 GHz	51.83	Max Peak	-22.17
1	16.667600000 GHz	51.96	Max Peak	-22.04
2	16.741200000 GHz	39.30	Average	-14.70
2	17.112000000 GHz	41.37	Average	-12.63
1	17.169600000 GHz	53.81	Max Peak	-20.19
1	17.890000000 GHz	57.00	Max Peak	-17.00
2	17.900800000 GHz	43.24	Average	-10.76

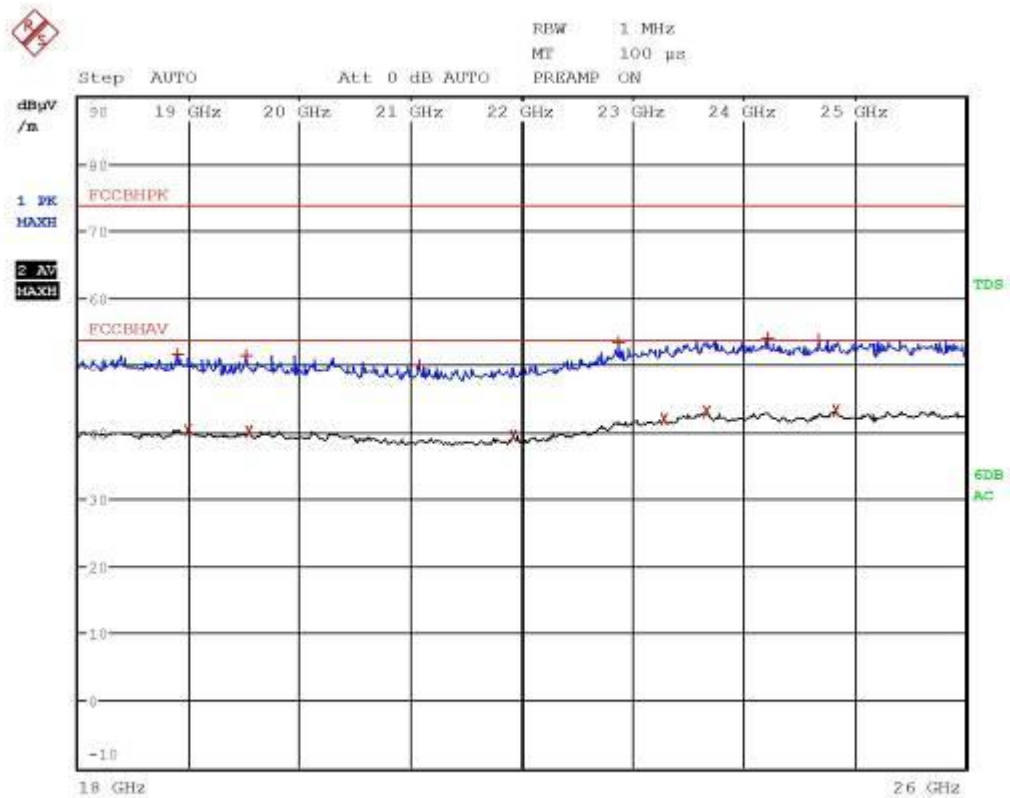


Gandini 16082644-Vert



EDIT PEAK LIST (Prescan Results)			
Trace1:	FCCBHPK		
Trace2:	FCCBHAV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
2 Average	18.1264 GHz	40.41	-13.56
1 Max Peak	18.9116 GHz	51.36	-22.61
2 Average	19.4976 GHz	40.43	-13.54
1 Max Peak	19.7992 GHz	51.11	-22.86
1 Max Peak	21.9352 GHz	51.04	-22.93
2 Average	21.9448 GHz	39.49	-14.48
1 Max Peak	23.126 GHz	53.38	-20.59
2 Average	23.2692 GHz	41.99	-11.98
2 Average	23.6384 GHz	42.93	-11.04
1 Max Peak	24.2204 GHz	54.54	-19.43
2 Average	25.3052 GHz	43.12	-10.85
1 Max Peak	25.9848 GHz	54.65	-19.32

Gandini 16082644-Vert



Gandini 16082645-Horiz



EDIT PEAK LIST (Prescan Results)			
Trace1:	FCCBHPK		
Trace2:	FCCBHAV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Max Peak	18.9012 GHz	51.68	-22.29
2 Average	18.9896 GHz	40.31	-13.66
1 Max Peak	19.5132 GHz	51.53	-22.44
2 Average	19.5328 GHz	40.14	-13.83
1 Max Peak	21.0736 GHz	50.02	-23.95
2 Average	21.9232 GHz	39.46	-14.51
1 Max Peak	22.8732 GHz	53.42	-20.56
2 Average	23.2848 GHz	42.02	-11.95
2 Average	23.6612 GHz	42.94	-11.03
1 Max Peak	24.2188 GHz	54.02	-19.95
1 Max Peak	24.6732 GHz	53.66	-20.31
2 Average	24.83 GHz	43.17	-10.80

Gandini 16082645-Horiz

Result: The requirements are met



11.4 DTS bandwidth

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247 (a) (2)
- ANSI C63.10 cl. 11.8
- KDB 558074 D01 DTS Meas Guidance v05 cl. 8.2
- Internal procedure PM001
- See clause 4 of this test report
- Test date: 07 December 2018
- Technician: A. Bertezolo

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 S295, 20 dB attenuator
Measurement uncertainty: See clause 7 of this test report

Test specification

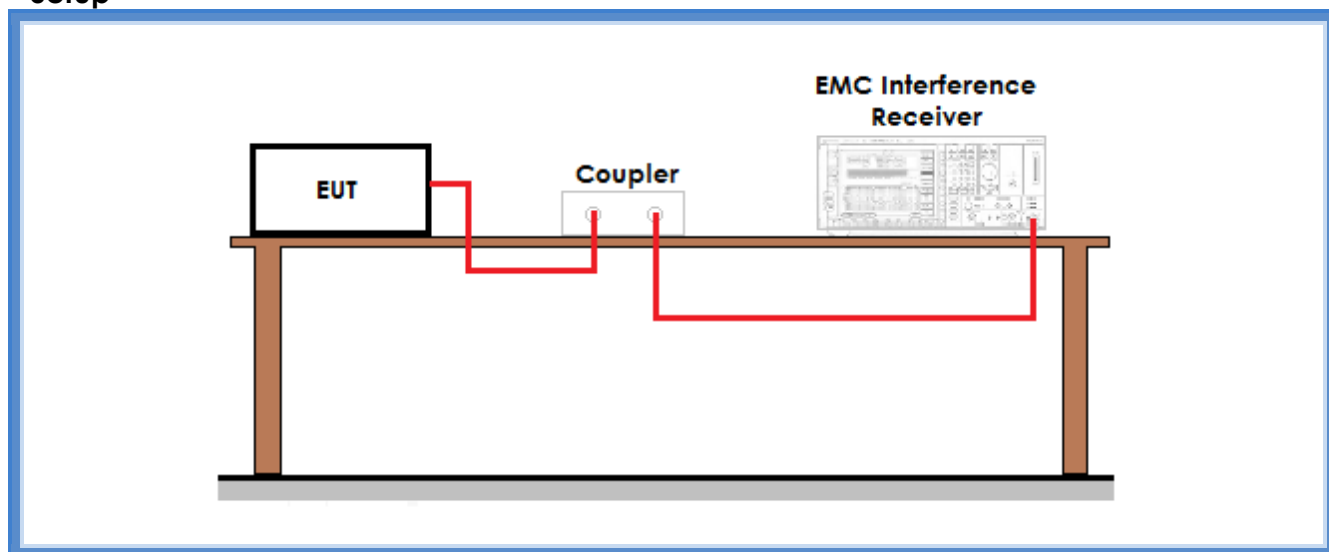
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Environmental conditions

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



Setup



Result

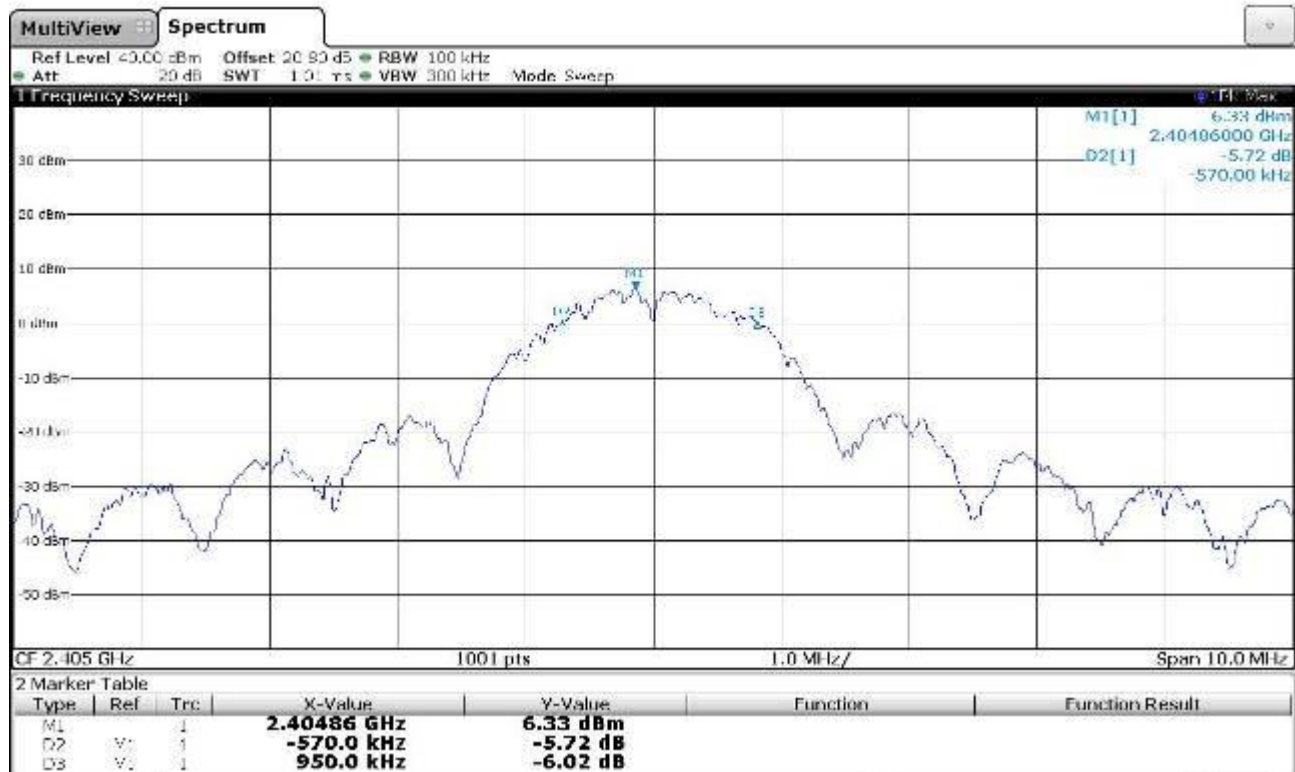
Sample	Channel	Graphs	6 dB bandwidth (kHz)	Limits (kHz)	Results
#2	Lowest	G182558001	1520	At least 500	Complies
#2	Medium	G182558002	1550	At least 500	Complies
#2	Highest	G182558003	1511	At least 500	Complies

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan



Graphs

Bertezzo 182558001



Bertezzo 182558002





Bertezzo 182558003



Result: The requirements are met



11.5 Band edge

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.205, 15.209, 15.247 (d)
- ANSI C63.10 cl. 11.11.1 and 11.12.1
- KDB 558074 D01 DTS Meas Guidance v05 cl. 8.5 and 8.6
- Internal procedure PM001
- See clause 4 of this test report
- Test date:
24 July 2016 for test on sample #1
07 December 2018 for test on sample #2
- Technician: A. Bertezolo

Test configuration

Test site:

Semi-anechoic chamber for test on sample #1
Laboratory for test on sample #2

Auxiliary equipment:

See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

CMC S164, CMC S287 for test on sample #1
CMC S295, 20 dB attenuator for test on sample #2
Measurement uncertainty: See clause 7 of this test report

Test specification

See FCC Part 15.247

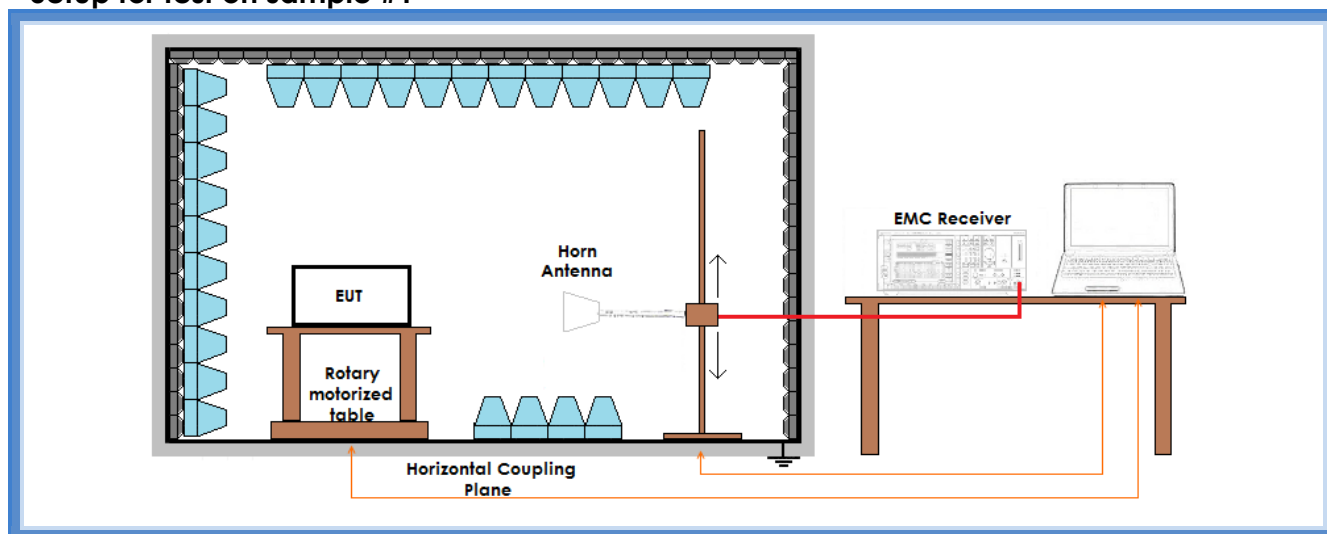
Environmental conditions

Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
21	100	45

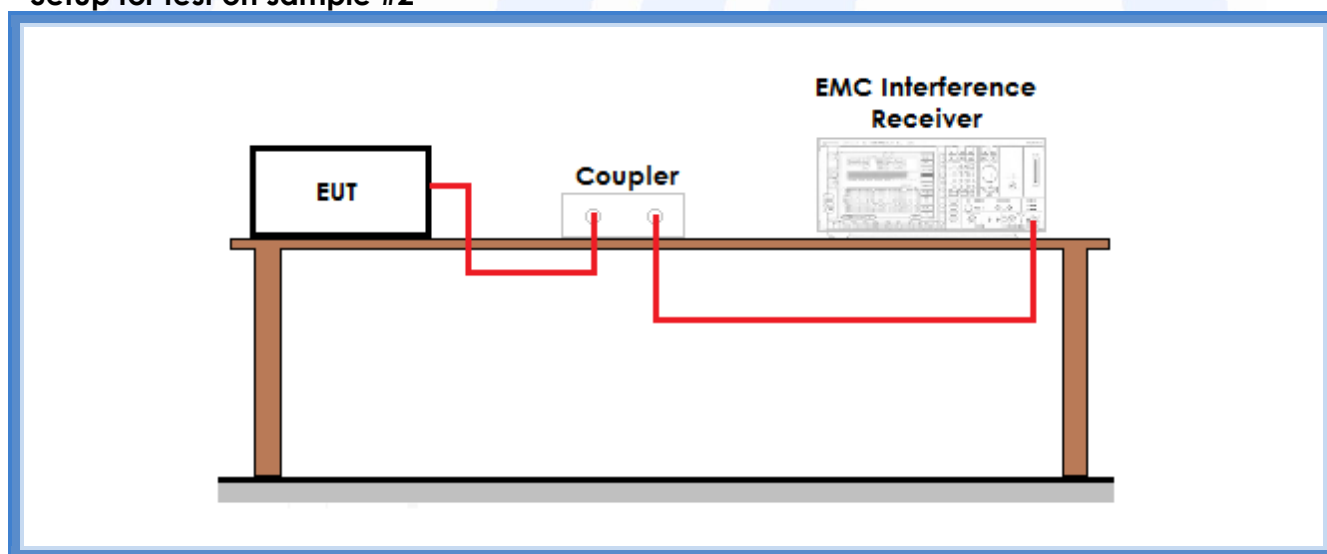
Acceptance limits: operation within the band 2400 – 2483,5 MHz



Setup for test on sample #1



Setup for test on sample #2



Result

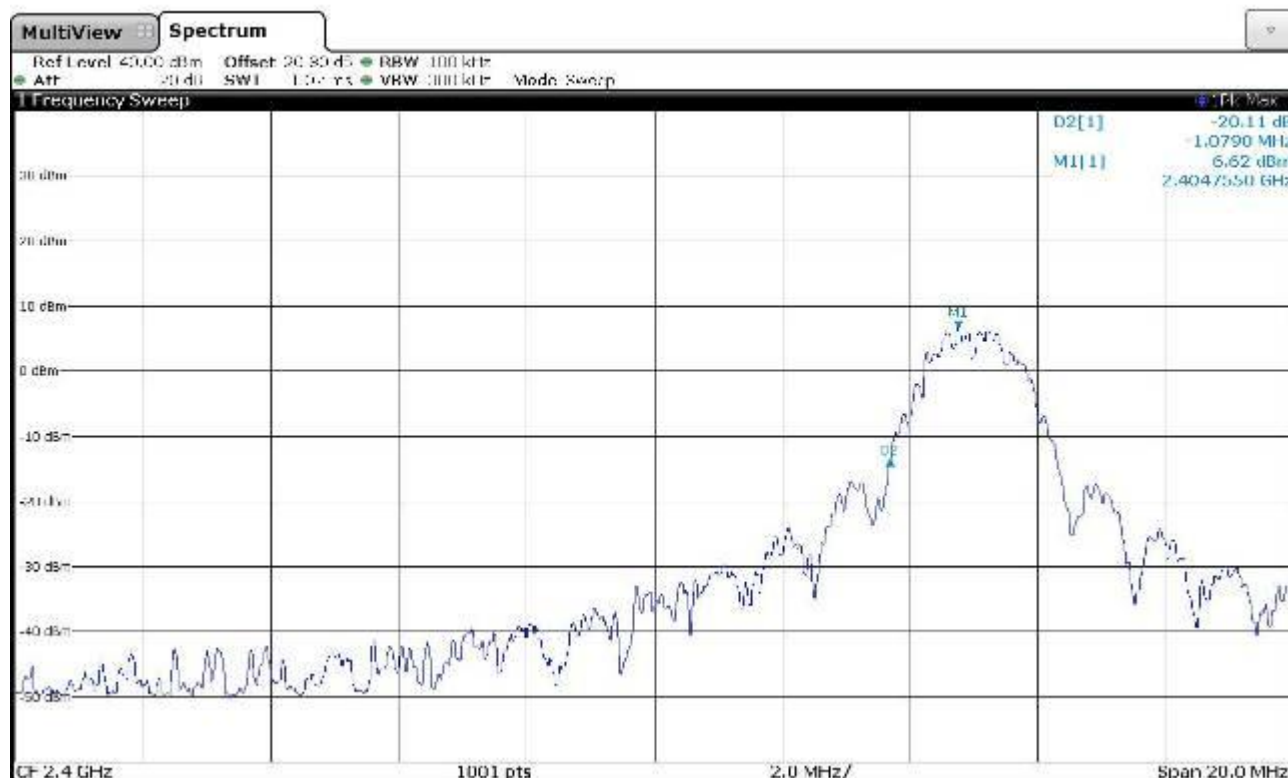
Sample	Channel	Bandwidth	Graph(s)	Results	
#2	Lowest	100 kHz	G182558007	2403,676 MHz	Complies
#1	Highest	1 MHz	G16082628	2482,097 MHz	Complies
#1	Lowest	1 MHz	G16082650*	--	Complies

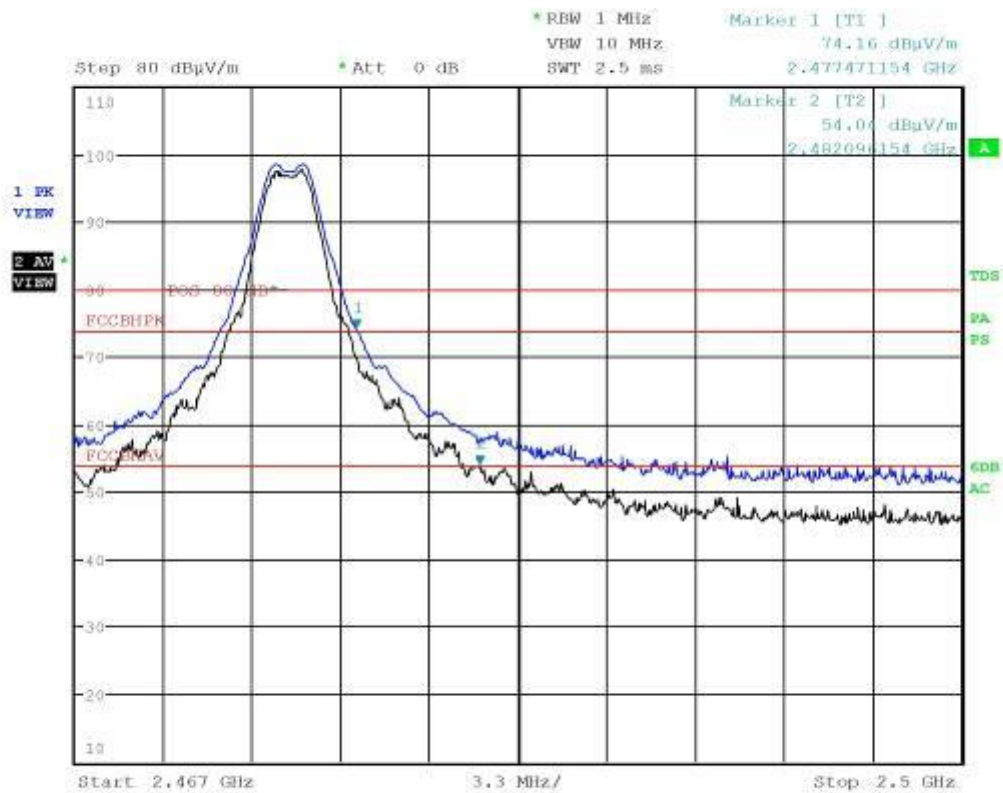
*: this graph shows the emissions in 2310 – 2390 MHz restricted band



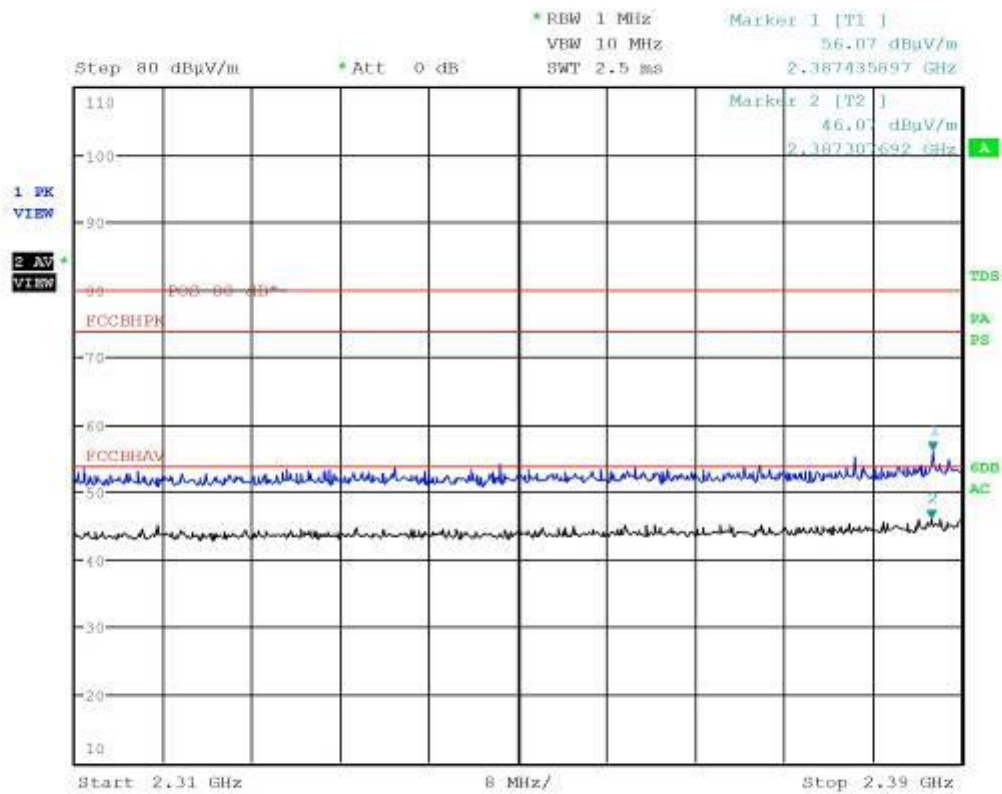
Graphs

Bertezzo 182558007





Bertezzolo 16082628 Center frequency 2483,5 MHz



Bertezzolo 16082650

Result: The requirements are met



11.6 Fundamental emission output power

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247 (b) (3)
- ANSI C63.10 cl. 11.9.1.1
- KDB 558074 D01 DTS Meas Guidance v05 cl. 8.3.1.1
- Internal procedure PM001
- See clause 4 of this test report
- Test date: 11 May 2016
- Technician: A. Bertezolo

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 S295, 20 dB attenuator
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: antenna connector

Environmental conditions

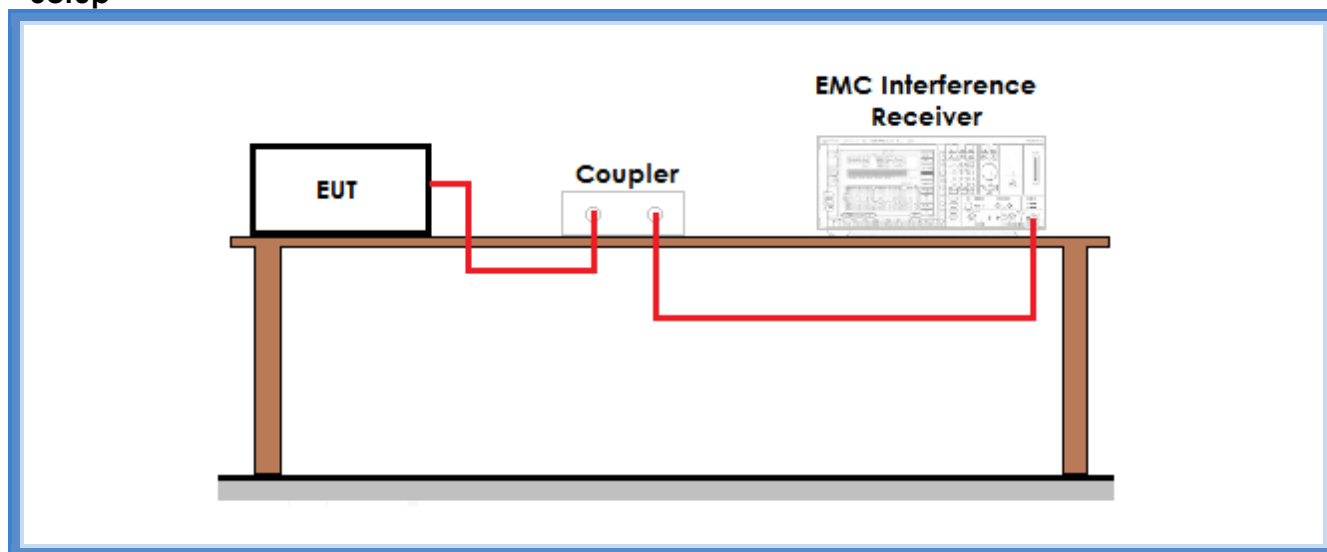
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	42

Acceptance limits:

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt



Setup



Result

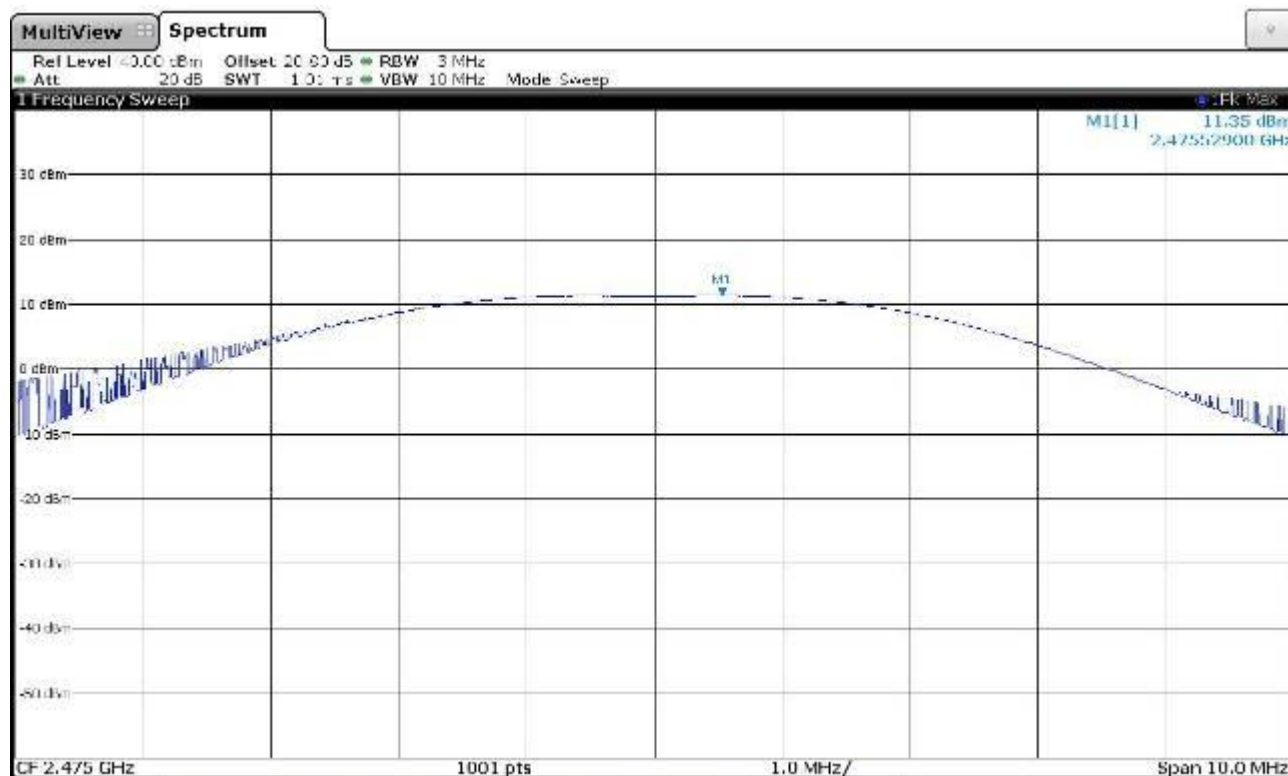
Sample	Channel	Graphs	Measured level (dBm)	Calculated level (W)
#2	Highest	G182558009	11,35	0,0136
#2	Medium	G182558010	11,18	0,0131
#2	Lowest	G182558011	10,47	0,0111

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

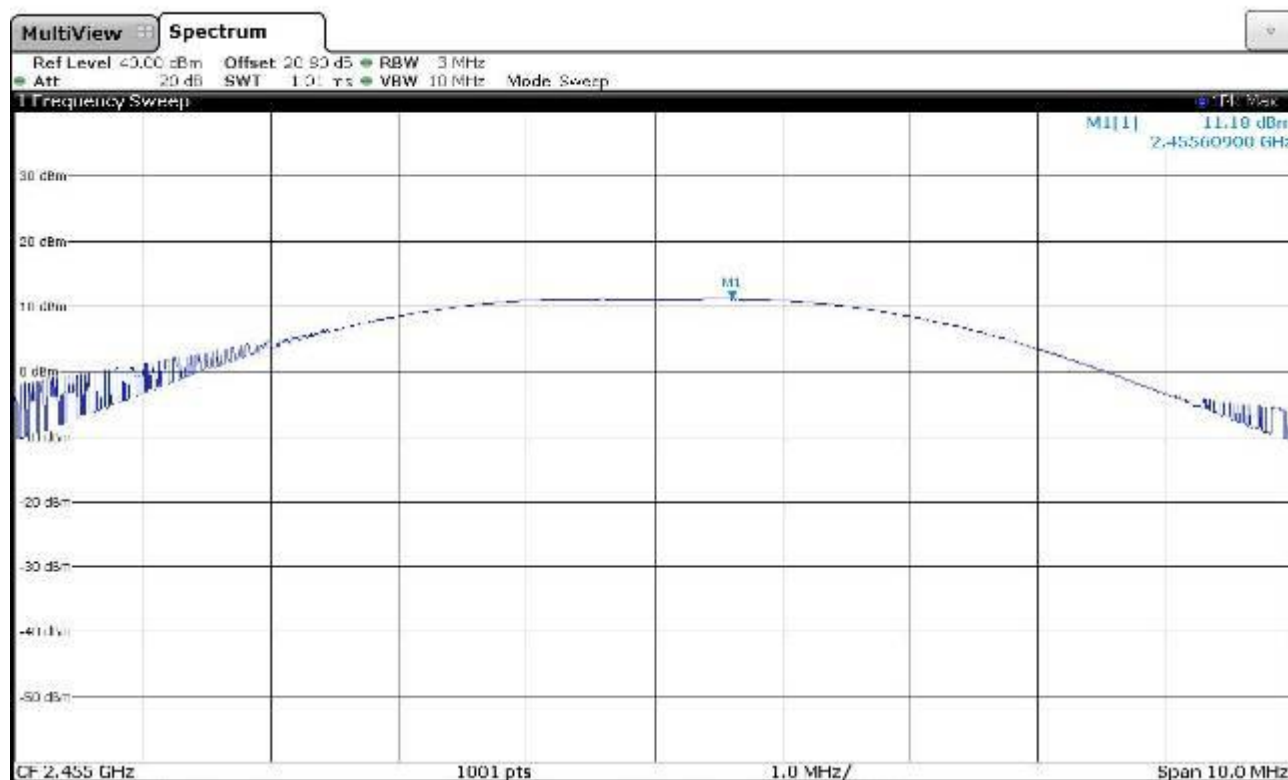


Graphs

Bertezzo 182558009

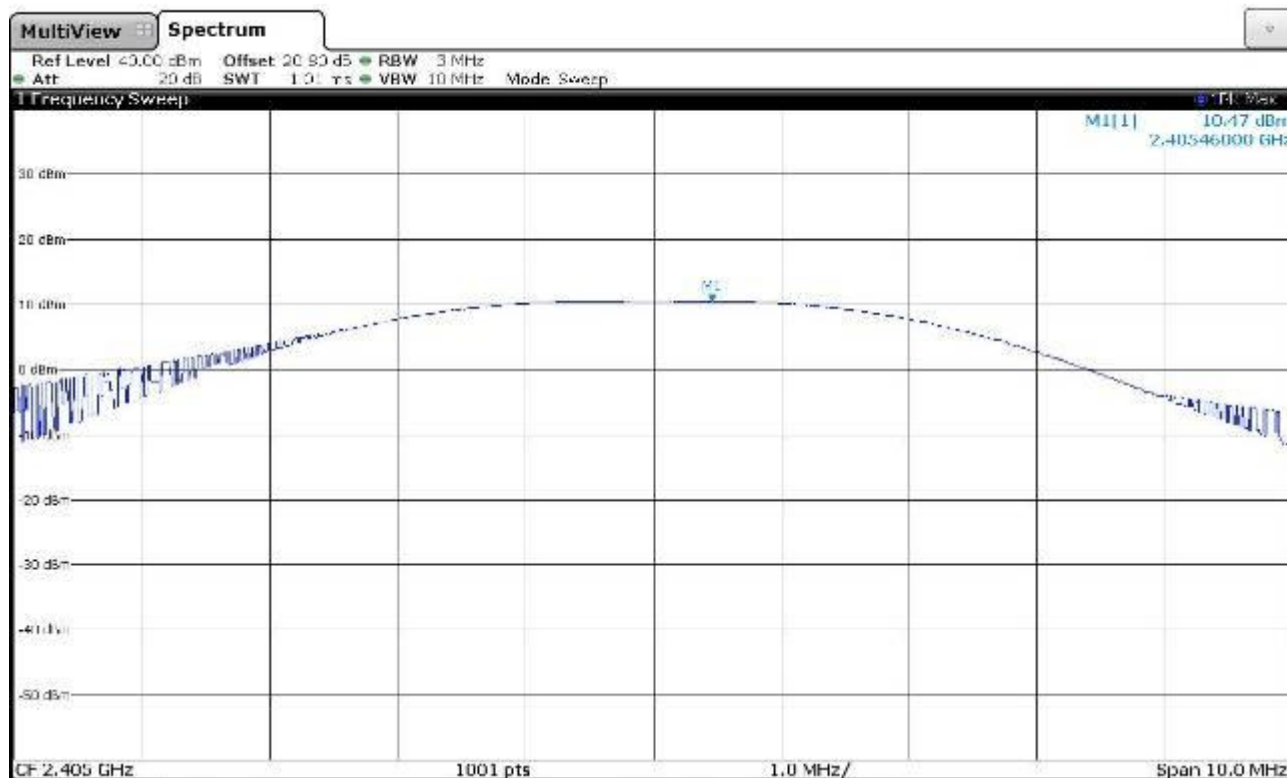


Bertezzo 182558010





Bertezzo 182558011



Result: The requirements are met



11.7 Maximum power spectral density level in the fundamental emission

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part 15.247 (e)
- ANSI C63.10 cl. 11.10.2
- KDB 558074 D01 DTS Meas Guidance v05 cl. 8.4
- Internal procedure PM001
- See clause 4 of this test report
- Test date: 07 December 2018
- Technician: A. Bertezolo

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 S295, 20 dB attenuator
Measurement uncertainty: See clause 7 of this test report

Test specification

Port: antenna connector

Environmental conditions

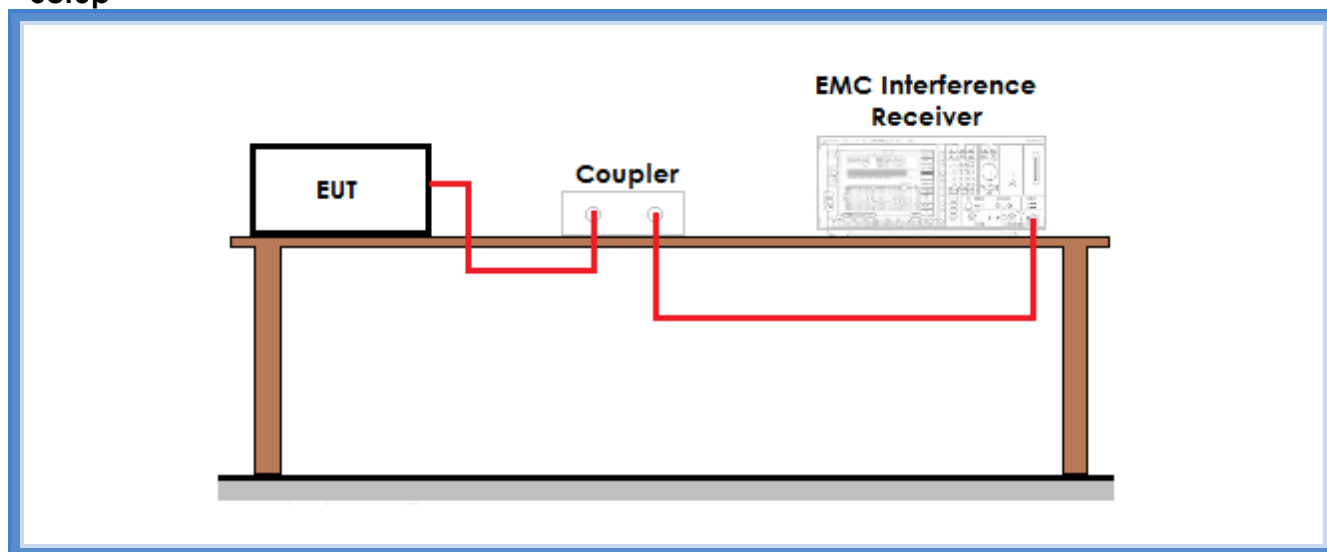
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	42

Acceptance limits:

Frequency Range	Power Spectral Density
2400 – 2483,5 MHz	8 dBm/3 kHz 6,31 mW/3 kHz



Setup



Result

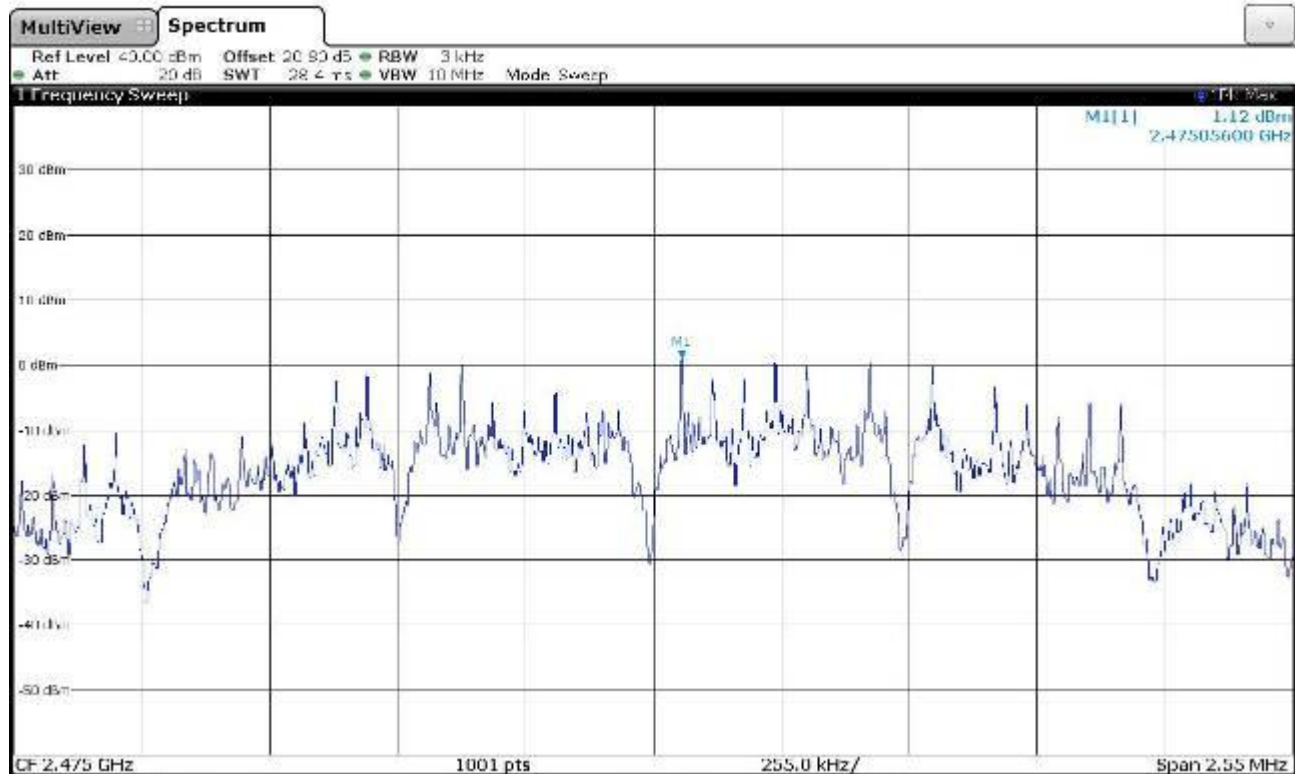
Sample	Channel	Graphs	Measured level (dBm/3 kHz)
#2	Lowest	G182558012	1,12
#2	Medium	G182558013	1,36
#2	Highest	G182558014	1,52

Remarks: the total attenuation value is due to the 20 dB attenuator and the cable provided by the manufacturer calibrated before the test. The measured value has been obtained by considering the attenuation value directly during the scan

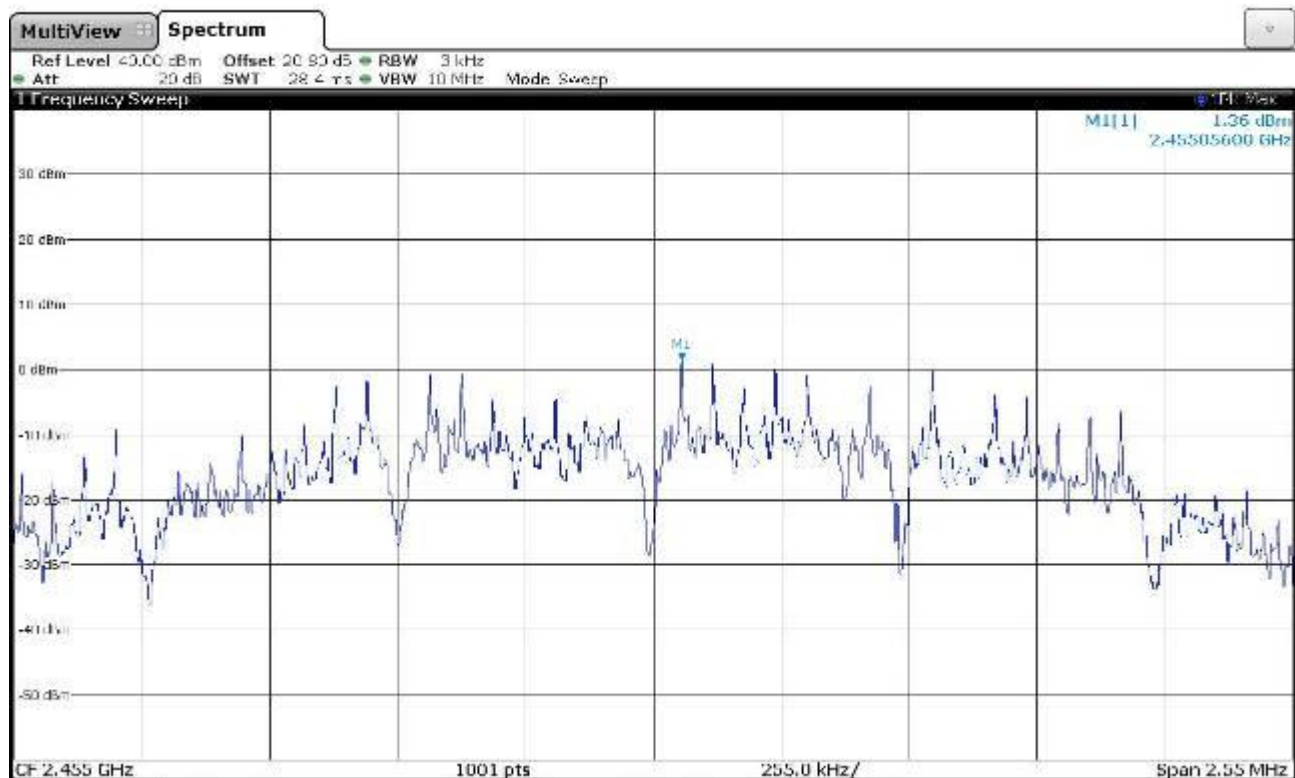


Graphs

Bertezzo 182558012

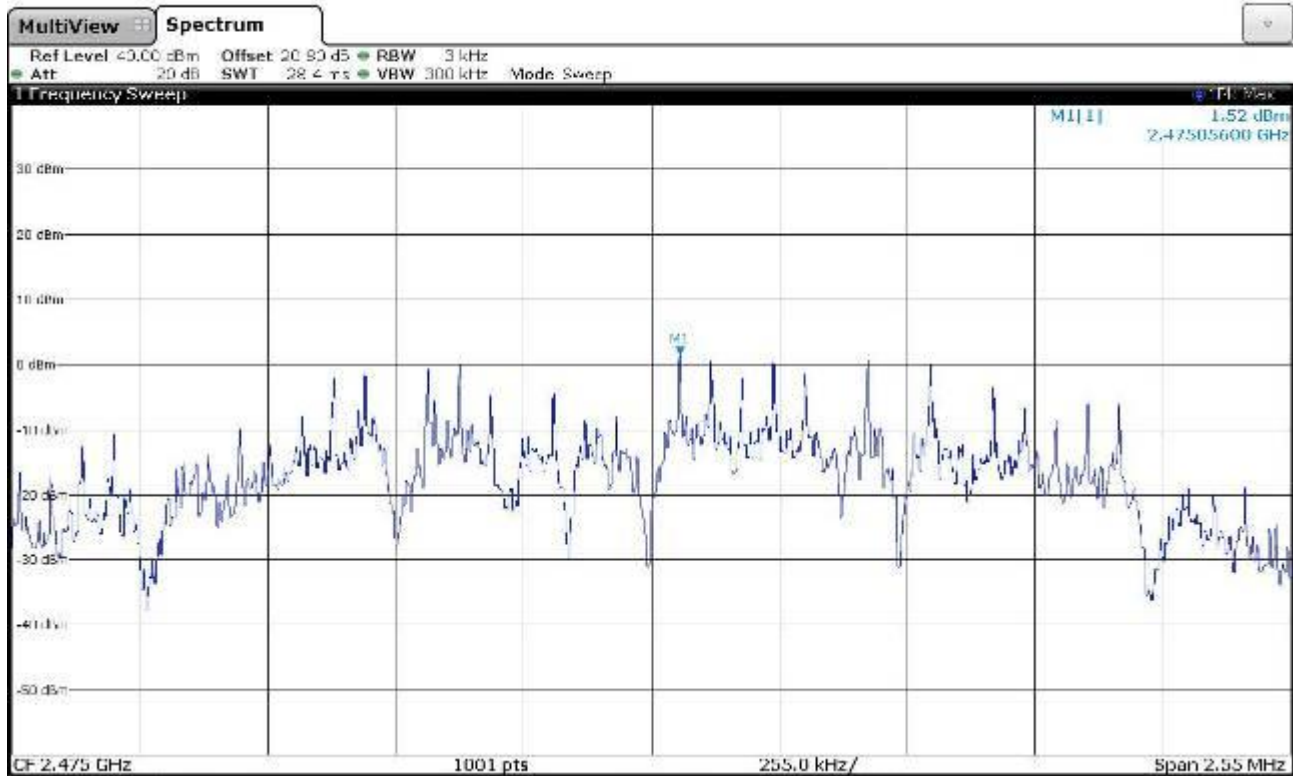


Bertezzo 182558013





Bertezzo 182558014



Result: The requirements are met



11.8 Spurious Emission

Test set-up and execution

- FCC Rules and Regulation; Titles 47 Part. 15.247 (d)
- KDB 558074 D01 DTS Meas Guidance v05 cl. 8.5 and 8.6
- ANSI C63.10 cl. 11.11, 11.12.1
- Internal procedure PM001
- See clause 4 of this test report
- Test date: 11 May 2016
- Technician: A. Bertezolo

Test configuration

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 height about the floor: 150 cm
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 (according FCC Part 15.209)		
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 (according to FCC Part 15.205)

MHz	MHz	MHz	GHz
0,09 – 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
8,41425 – 8,41475	162,0125 – 167,17	3260 – 3267	23,6 – 24
12,29 – 12,293	167,72 – 173,2	3332 – 3339	31,2 – 31,8
12,57675 – 12,57725	322 – 335,4	3600 – 4400	Above 38,6
13,36 – 13,41			

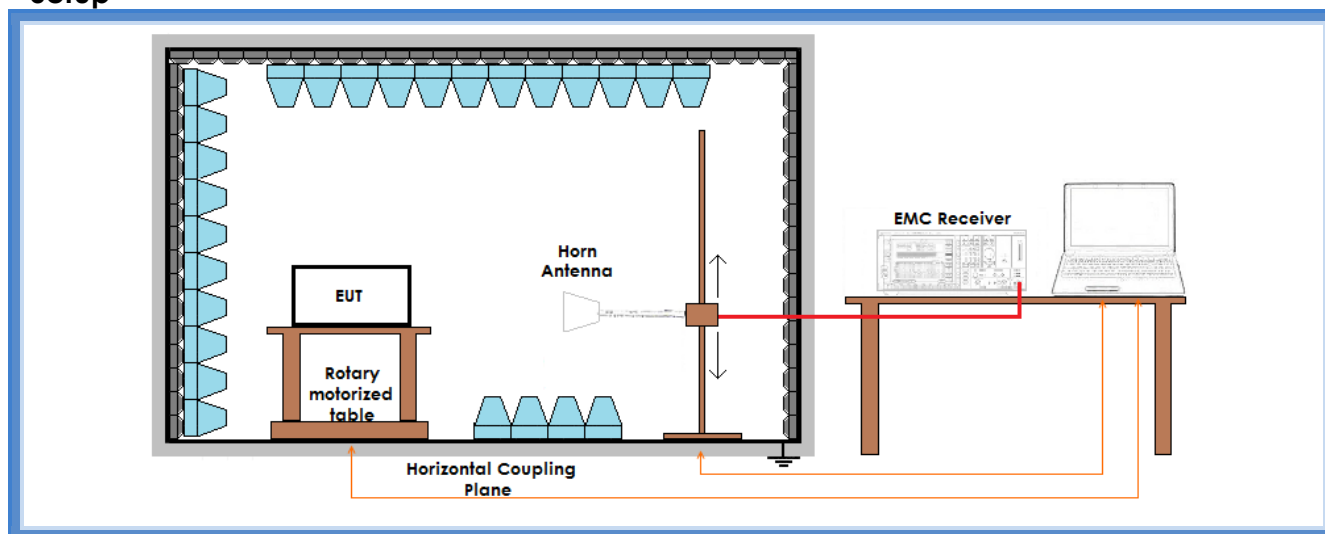
Acceptance limits for emissions in non-restricted frequency bands (according to ANSI C63.10 cl. 11.11.1)

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

- If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz
- If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.
- In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required



Setup



Remarks: reference graphs are reported on cl. 11.3 of this Test Report

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	45,20	54,00	44,80	54,00	43,30	54,00	Complies
III	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
IV	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
V	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
VI	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
VII	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
VIII	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
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. No spurious other than harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 54 dB μ V/m as a worse 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	52,90	74,00	54,00	74,00	52,80	74,00	Complies
III	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
IV	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
V	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
VI	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
VII	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
VIII	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
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. No spurious other than harmonics have been found. The results have been extrapolated to the specified distance using an extrapolation factor. For all harmonics it was considered the limit of 74 dB μ V/m as a worse case.

Result: The requirements are met