

**TEST REPORT****Nr. R20091701****Federal Communication Commission (FCC)**

Report Reference No.	R20091701
Date of issue:	22.07.2020
Total number pages:	81
Applicant's name	Autec S.r.l.
Address	Via Pomaroli, 65 – 36030 Caldogno (VI) – Italy
Test specification:	
Standards	FCC Rules & Regulations, Title 47:2019 Part 15 paragraph(s): 203, 204, 205, 207, 209, 215 and 247
Non-standard test method	N/A
Test Report Form No.	15-247_HoppingCMC
Test Report Form(s) Originator ..	CMC Centro Misure Compatibilità S.r.l.
Master TRF	2020-04
General disclaimer:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of CMC Centro Misure Compatibilità S.r.l.	
Test item description	Transceiver unit
Trademark	Autec
Manufacturer	Autec S.r.l.
Model / Type reference	Model J2F Type NZ222
FCC ID	OQA-J2FNZ222
Rating(s)	7,4 Vdc from battery
Report	
Tested by (name + signature)	G. Gandini
Approved by (name + signature)	R. Beghetto



1 Summary

1	Summary.....	2
2	Reference standard	3
3	List of attachments.....	3
4	Deviation(s) from test specification.....	3
5	Testing location.....	3
6	General description of test item(s).....	5
6.1	Photos of the test item.....	6
7	Verdict summary section	10
8	Test conditions.....	12
8.1	General	12
9	Test results	13
9.1	Antenna requirements	13
9.2	Emissions in restricted frequency bands and in unrestricted frequency bands	14
9.3	20 dB bandwidth.....	57
9.4	Channel separation.....	60
9.5	Number of hopping channels.....	63
9.6	Time of occupancy.....	66
9.7	Band edge	69
9.8	Peak Output Power.....	75



2	Reference standard
FCC Rules and Regulation Title 47 part 15:2019	--
3	List of attachments
Attachment 1: Instruments list, measurement uncertainty, judgement of compliance and quality manual references	
4	Deviation(s) from test specification
None	
5	Testing location
CMC Centro Misure Compatibilità S.r.l. Via della Fisica, 20 – 36016 Thiene (VI) – Italy Test site facility's FCC registration number: 182474	

Revision index	Date	Change history
1.0	22.07.2020	--



Testing and sampling:	
Date of receipt of test item	25.05.2020
Testing start date	03.06.2020
Testing end date	17.07.2020
Sampling procedure.....	Equipment used for testing was picked up by the manufacturer, at the end of the production process with random criterion. The results relate to the sample as it has been received.
Internal identification	Adhesive label with the product number P200479
General remarks:	
This 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 object tested. “(see appended table)”: refers to a table appended to the report. Throughout this report a comma is used as the decimal separator.	
Possible test case verdicts:	
Test case does not apply to the test object:	N/A (Not Applicable)
Test object does meet the requirement:	P (Pass)
Test object does not meet the requirement:	F (Fail)
Test object does not performed:	N/E (Not Executed)
Definition of symbols used in this test report:	
☒ Indicates that the listed condition, standard or equipment is applicable for this report. ☐ Indicates that the listed condition, standard or equipment is not applicable for this report.	



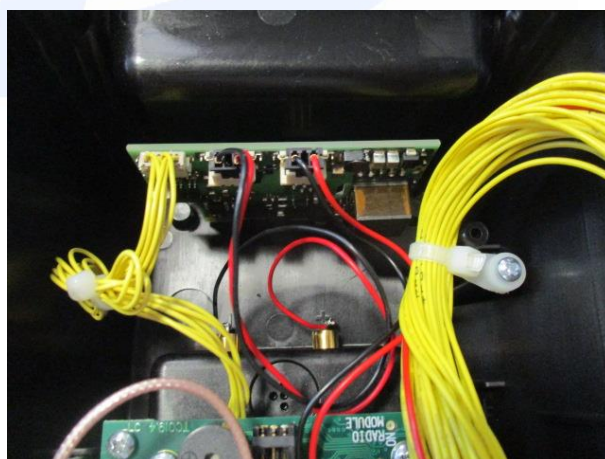
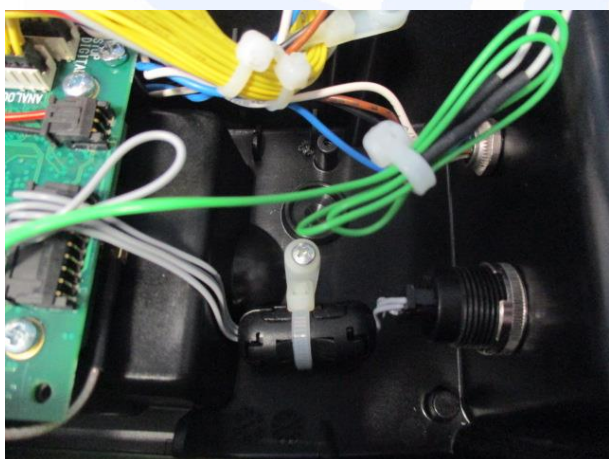
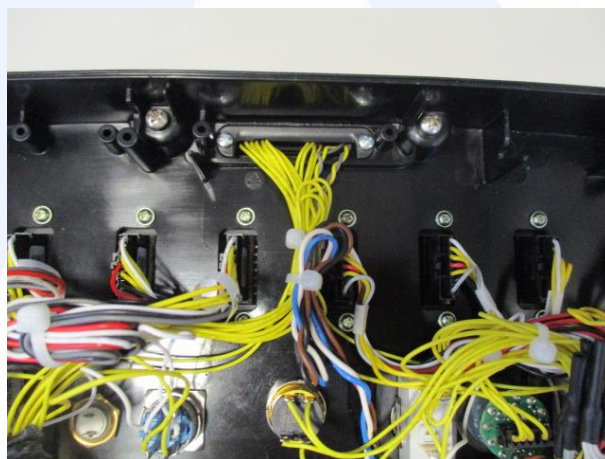
6 General description of test item(s)

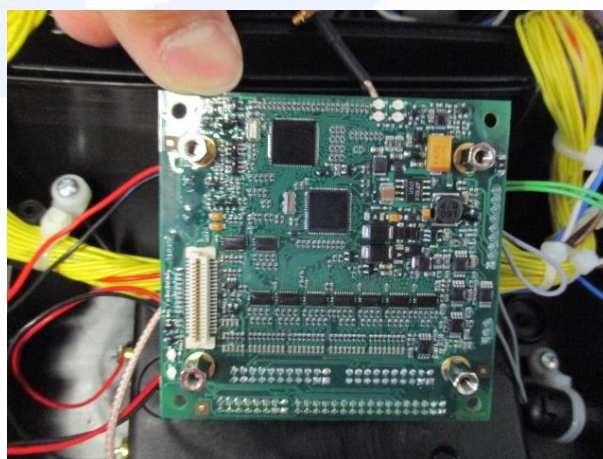
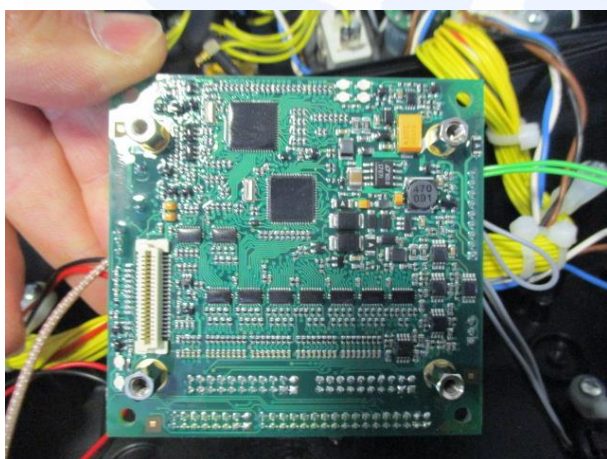
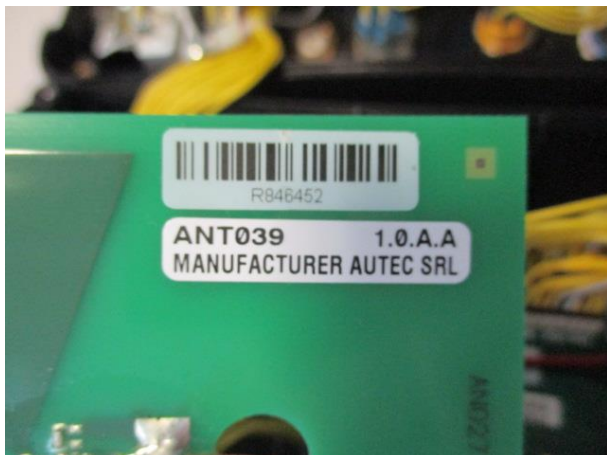
Description	Transceiver unit						
Model Number	Model J2F Type NZ222						
FCC ID	OQA-J2FNZ222						
Serial Number	--						
Brand name	Autec						
Frequency band	902 – 928 MHz						
Nominal frequencies	F _L : 915,075 MHz		F _M : 921,425 MHz		F _H : 927,825 MHz		
Rated power supply		Voltage and Frequency	Reference poles				
			N	L1	L2	L3	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 7,4 V from battery					☐
Pseudo randomly ordered list of hopping frequencies	See document j2f_nz222_operational_description-rev0						
Test configuration	☐	Table top equipment					
	☐	Floor standing equipment					
	☒	Hand-held equipment					
Type of equipment	☒	Transmitter unit					
	☒	Receiver unit					
Type of station	☐	Fixed station					
	☒	Portable station					
	☐	Mobile station					
Operating modes	No.	Operating mode of test item					
	1	EUT in continuous transmission at maximum power					

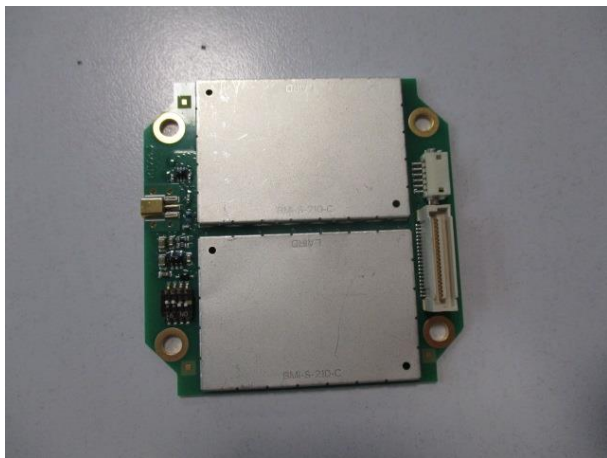


6.1 Photos of the test item











7 Verdict summary section

FCC Rules & Regulations, Title 47:2019 Part 15 paragraph(s): 203, 204, 205, 207, 209, 215 and 247			
Clause	Requirement – Test case	Basic standard	Verdict
Part 15.247 (a) (1)	Pseudo randomly ordered list of hopping frequencies	--	P
Part 15.203	Antenna requirements	ANSI C63.10	P
Part 15.207	Conducted emissions	ANSI C63.10	N/A (+)
Part 15.209	Radiated emissions and spurious emission	ANSI C63.10	P
Part 15.247	20 dB Bandwidth	ANSI C63.10	P
Part 15.247	Channel Separation	ANSI C63.10	P
Part 15.247	Number of Hopping Channel	ANSI C63.10	P
Part 15.247	Time of occupancy	ANSI C63.10	P
Part 15.247	Band edge	ANSI C63.10	P
Part 15.209 and 15.247	Peak Output Power	ANSI C63.10	P

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



Normative references	
Reference no.	Description
FCC Rules and Regulation Title 47 part 15:2019	--
KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices operating under section 15.247 of the FCC rules
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



8 Test conditions

8.1 General

Environmental reference conditions.....:	The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:		
	Temperature	Humidity	Atmospheric pressure
	15 °C – 35 °C	30 % - 60 %	800 hPa – 1060 hPa
	If explicitly required in the basic standard or applied product standard the climatic values are recorded and documented separately in this test report.		
Measurement uncertainties	Attachment 1		



9 Test results

9.1 Antenna requirements

Tested by	G. Gandini	
Test date	03.06.2020	
Reference standards	FCC Rules and Regulation; Titles 47 Part. 15.203 and 15.204	
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, 15.221, or § 15.236. 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	
Antenna type.....	☐	Integral antenna
	☐	External antenna
	☒	Dedicated antenna
Antenna gain.....	2 dBi	
External R.F. power amplifier	Not Present	



9.2 Emissions in restricted frequency bands and in unrestricted frequency bands

Tested by	G. Gandini	
Test date	03.06.2020	
Test location (stand)	Semi-anechoic chamber (CMC A070)	
Reference standards	FCC Rules and Regulation; Titles 47 Part. 15.209 ANSI C63.10 cl. 6.3, 6.4, 6.5 and 6.6	
Test set-up description	☒	Table top equipment set-up (80 cm above the reference ground plane)
	☐	Floor standing equipment set-up (insulating material up to 12 mm thick)
	☐	False floor installation equipment set-up (insulating material up to 34 cm above the reference ground plane)
Supplementary test set-up description	--	
Test method applied	☒	SAC with measurement distance [m]: 10 m at frequencies ≤ 1 GHz 3 m at frequencies > 1 GHz
Supplementary information	--	

Acceptance limits

Acceptance limits for emissions in restricted frequency bands ($f < 1000$ MHz)		
Frequency range (MHz)	Test distance (m)	Limits [dB(μ V/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
960 to 1000	3	54

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 and 110–490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector. The results have been extrapolated to the specified distance using an extrapolation factor

Acceptance limits for emissions in restricted frequency bands ($f \geq 1000$ MHz)			
Frequency (MHz)	Test distance (m)	AV limits [dB(μ V/m)]	Peak limits [dB(μ V/m)]
> 1000	3	54	74



The restricted frequency bands are listed in the following table

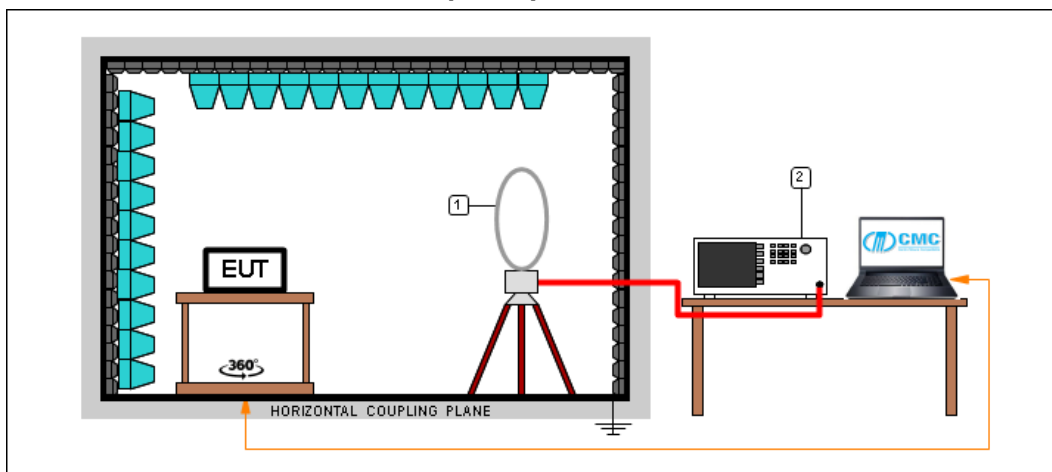
MHz	MHz	MHz	GHz
0,090 – 0,110	16,42 – 16,423	399,9 – 410	4,5 – 5,15
0,495 – 0,505	16,69475 – 16,69525	608 – 614	5,35 – 5,46
2,1735 – 2,1905	16,80425 – 16,80475	960 – 1240	7,25 – 7,75
4,125 – 4,128	25,5 – 25,67	1300 – 1427	8,025 – 8,5
4,17725 – 4,17775	37,5 – 38,25	1435 – 1626,5	9,0 – 9,2
4,20725 – 4,20775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

Acceptance limits for emissions in non-restricted frequency bands

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test setup

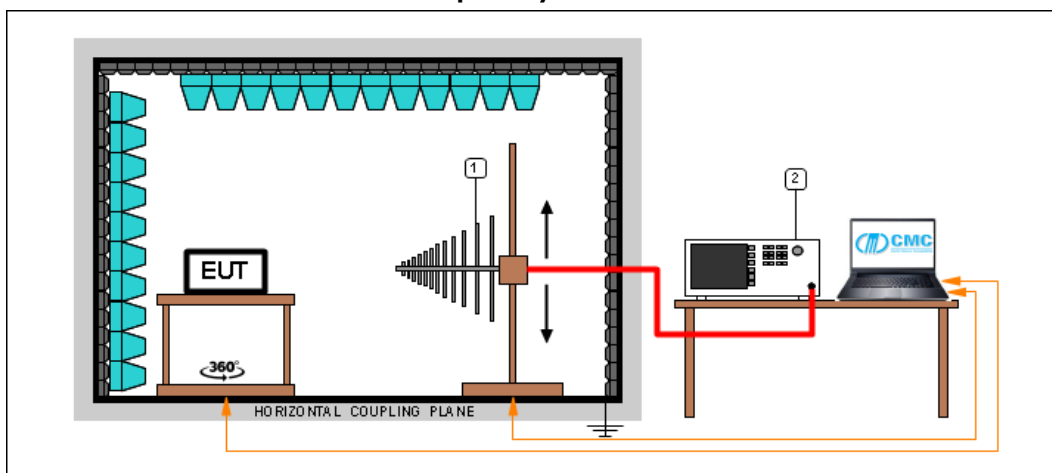
Frequency ≤ 30 MHz



Test setup PE004_01

Nr.	Id. Number	Manufacturer	Model	Description
2	CMC S164	Rohde & Schwarz	ESU26	Receiver 20 Hz - 26.5 GHz
1	CMC S127	Schaffner	HLA6120	Loop Antenna 9kHz - 30MHz

Frequency ≤ 1 GHz



Test setup PE004_02

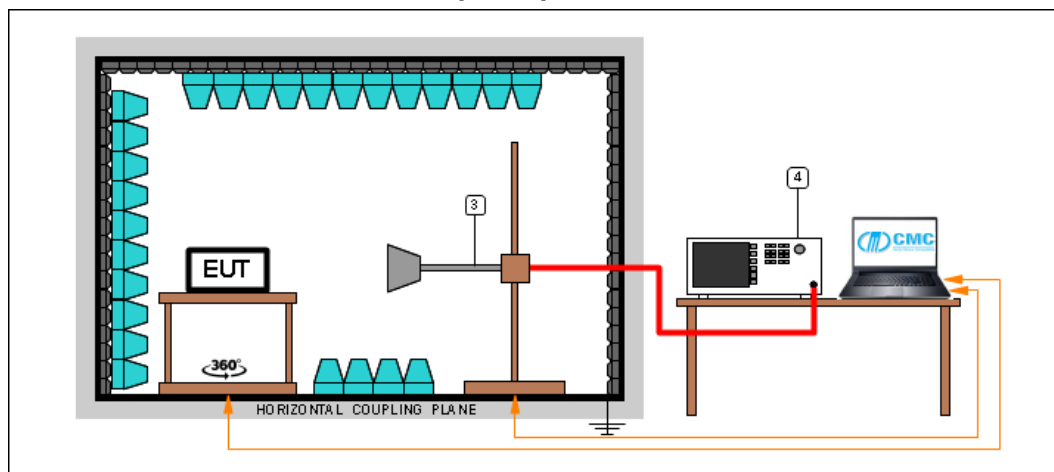
Nr.	Id. Number	Manufacturer	Model	Description
2	CMC S164	Rohde & Schwarz	ESU26	Receiver 20 Hz - 26.5 GHz
1	CMC S271	Schwarzbeck	BBA 9106 + VHBB 9124	Broadband Antenna

Test setup PE004_03

Nr.	Id. Number	Manufacturer	Model	Description
2	CMC S164	Rohde & Schwarz	ESU26	Receiver 20 Hz - 26.5 GHz
1	CMC S287	Schwarzbeck	VUSLP 9111B	Broadband Antenna



Frequency > 1 GHz



Test setup PE004_04

Nr.	Id. Number	Manufacturer	Model	Description
4	CMC S164	Rohde & Schwarz	ESU26	Receiver 20 Hz - 26.5 GHz
3	CMC S108	Emco	3115	Waveguide antenna



Result

Polarization	Frequency Range (MHz)	Graphs	Remarks	Result
H	30 – 300	G20091701	Lowest channel	P
V	30 – 300	G20091702	Lowest channel	P
V	30 – 300	G20091703	Medium channel	P
H	30 – 300	G20091704	Medium channel	P
H	30 – 300	G20091705	Highest channel	P
V	30 – 300	G20091706	Highest channel	P
V	300 – 1000	G20091707	Lowest channel	P
H	300 – 1000	G20091708	Lowest channel	P
H	300 – 1000	G20091709	Medium channel	P
V	300 – 1000	G20091710	Medium channel	P
H	1000 – 10000	G20091711	Lowest channel	P
V	1000 – 10000	G20091712	Lowest channel	P
V	1000 – 10000	G20091713	Medium channel	P
H	1000 – 10000	G20091714	Medium channel	P
H	1000 – 10000	G20091715	Highest channel	P
V	1000 – 10000	G20091716	Highest channel	P
Loop	0,009 – 30	G20091717	Worst case	P
H	300 – 1000	G20091718	Highest channel	P
V	300 – 1000	G20091719	Highest channel	P

Remarks: 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. Measured values have been corrected with conversion factor $40\log(\text{test distance}/10)$ 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. Measured values have been corrected with conversion factor $20\log(\text{test distance}/10)$ based on the measuring distance provided by the standard.

Peaks above the limits are caused by the nominal transmitting frequencies

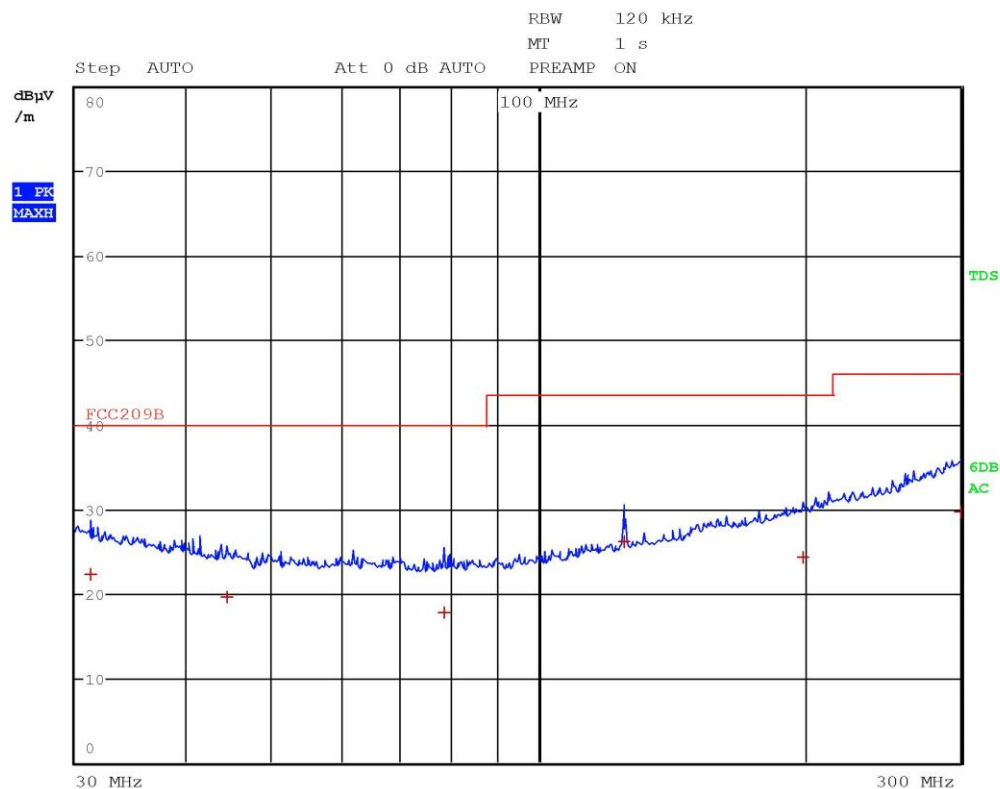
Graphs Legend

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

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



Graphs

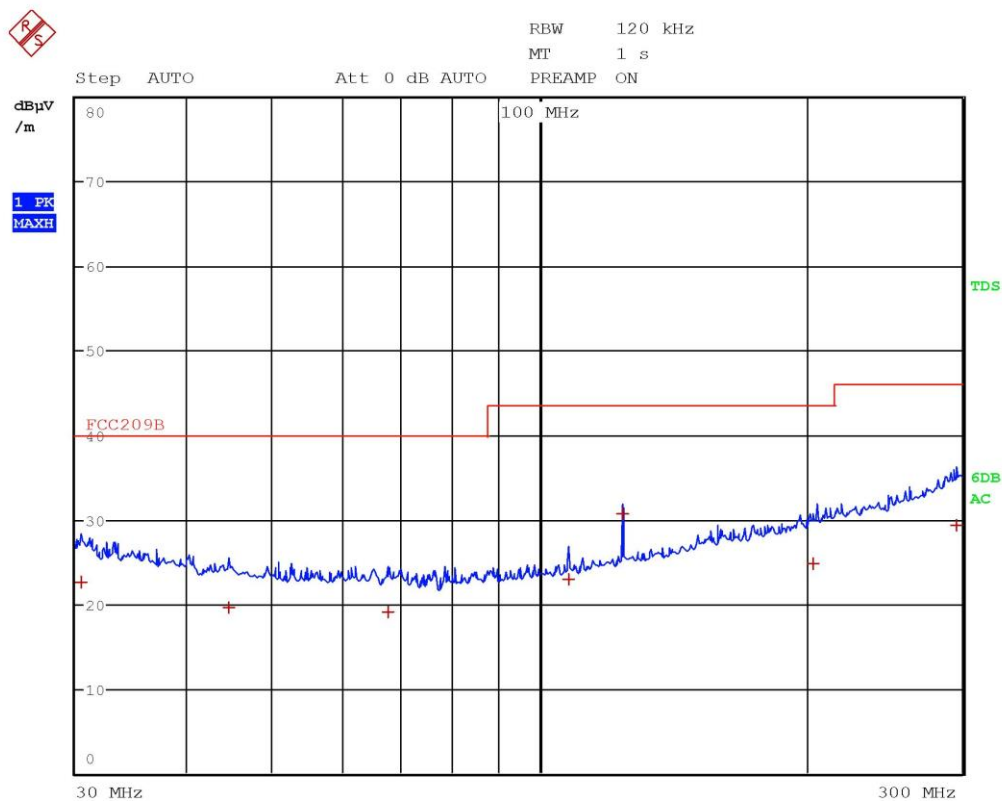


Gandini 20091701



EDIT PEAK LIST (Final Measurement Results)			
Trace1:	FCC209B		
Trace2:	---		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
1 Quasi Peak	31.16 MHz	22.27	-17.73
1 Quasi Peak	44.52 MHz	19.52	-20.47
1 Quasi Peak	78.32 MHz	17.72	-22.27
1 Quasi Peak	125 MHz	26.05	-17.46
1 Quasi Peak	199.08 MHz	24.36	-19.15
1 Quasi Peak	299.8 MHz	29.72	-16.29

Gandini 20091701

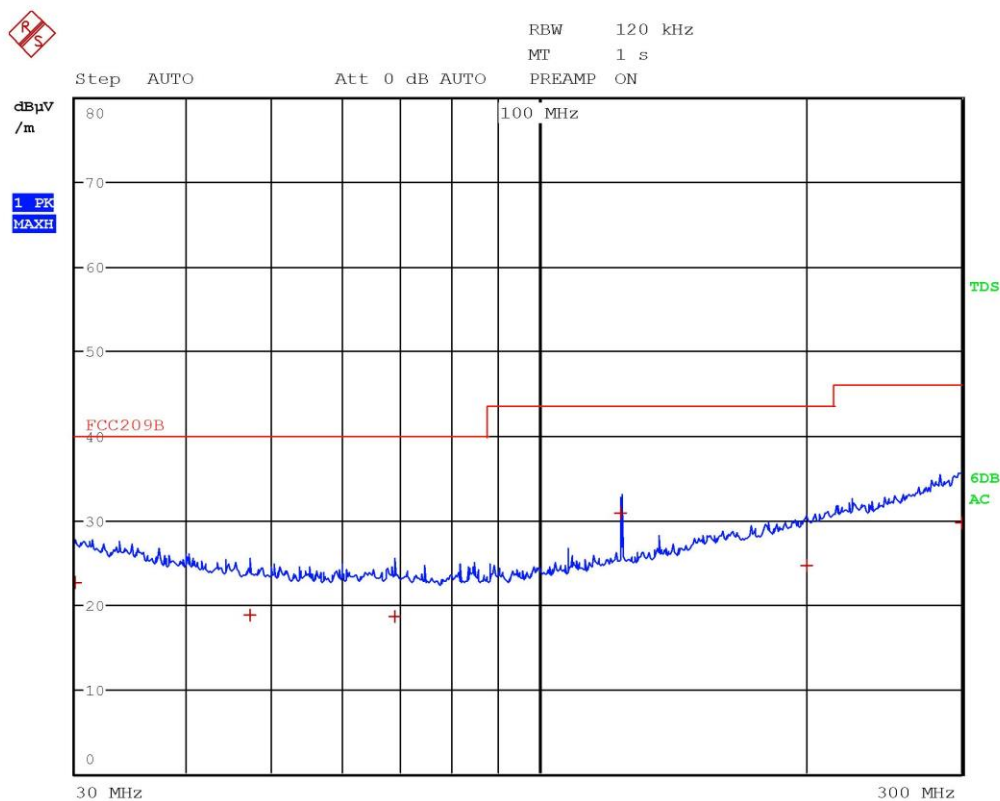


Gandini 20091702



EDIT PEAK LIST (Final Measurement Results)			
Trace1:	FCC209B		
Trace2:	---		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
1 Quasi Peak	30.4 MHz	22.61	-17.38
1 Quasi Peak	44.6 MHz	19.54	-20.45
1 Quasi Peak	67.48 MHz	19.01	-20.98
1 Quasi Peak	108 MHz	22.92	-20.59
1 Quasi Peak	124.116410256 MHz	30.73	-12.78
1 Quasi Peak	203.96 MHz	24.76	-18.75
1 Quasi Peak	295.24 MHz	29.40	-16.61

Gandini 20091702

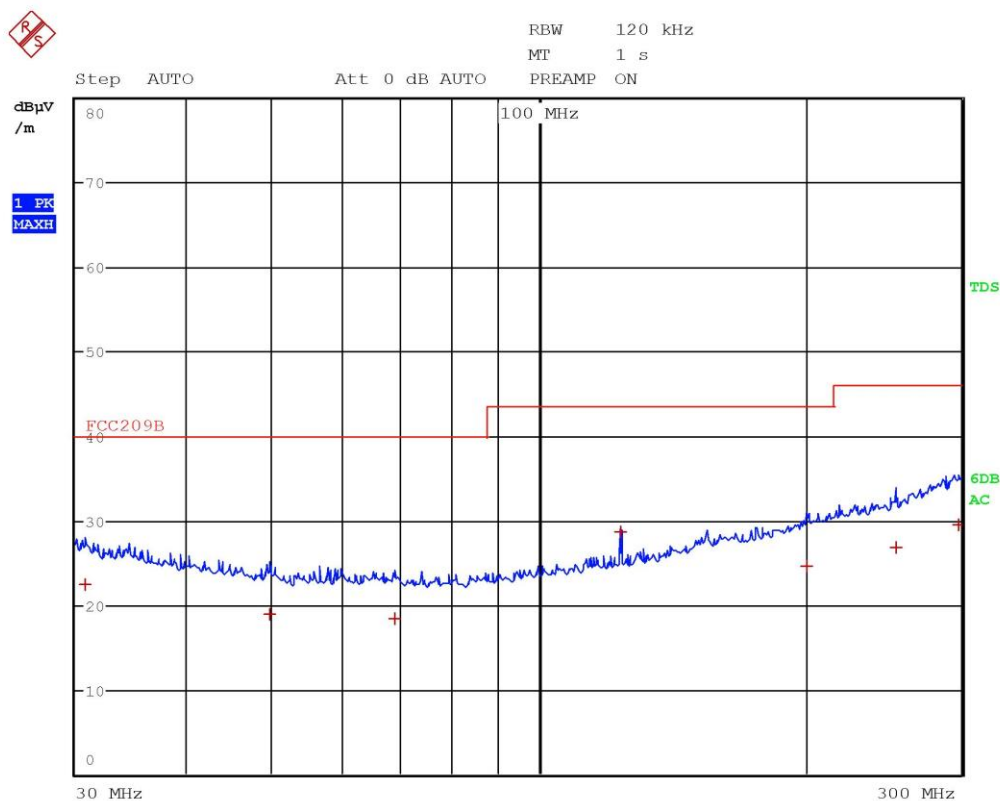


Gandini 20091703



EDIT PEAK LIST (Final Measurement Results)			
Trace1:	FCC209B		
Trace2:	---		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
1 Quasi Peak	30 MHz	22.53	-17.46
1 Quasi Peak	47.24 MHz	18.75	-21.24
1 Quasi Peak	68.88 MHz	18.50	-21.49
1 Quasi Peak	123.951858974 MHz	30.92	-12.59
1 Quasi Peak	200.72 MHz	24.59	-18.92
1 Quasi Peak	299.68 MHz	29.73	-16.28

Gandini 20091703

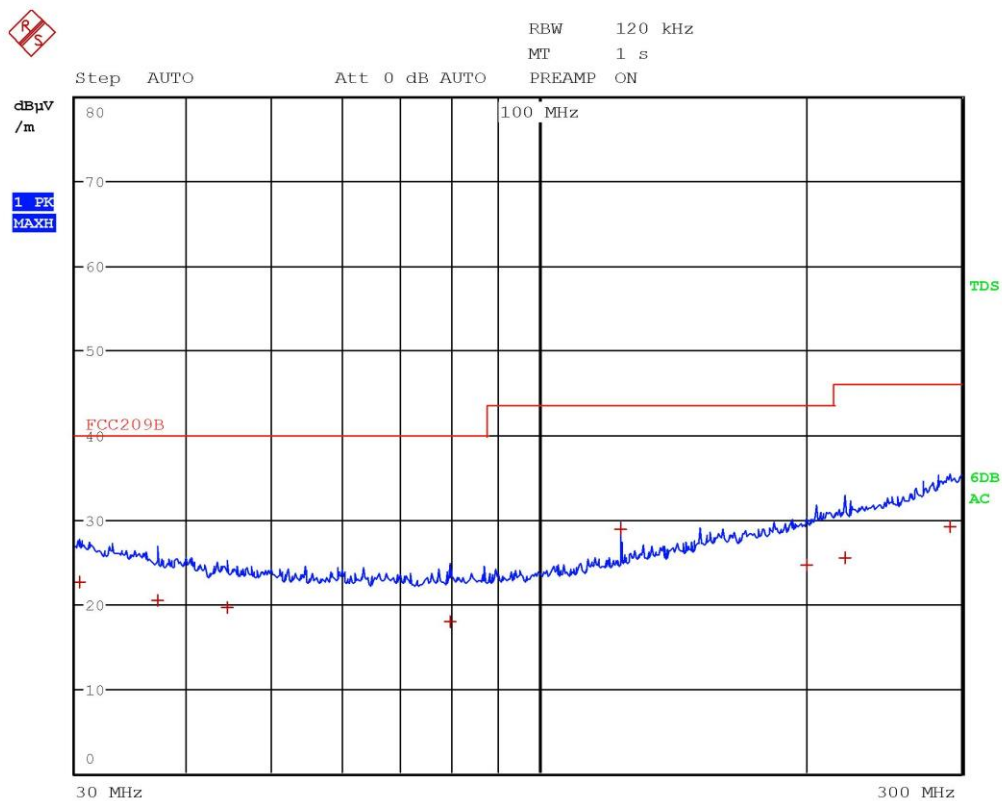


Gandini 20091704



EDIT PEAK LIST (Final Measurement Results)			
Trace1:	FCC209B		
Trace2:	---		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
1 Quasi Peak	30.8 MHz	22.49	-17.50
1 Quasi Peak	49.76 MHz	18.84	-21.15
1 Quasi Peak	68.76 MHz	18.45	-21.54
1 Quasi Peak	123.847884615 MHz	28.60	-14.91
1 Quasi Peak	200.92 MHz	24.57	-18.94
1 Quasi Peak	253.24 MHz	26.80	-19.21
1 Quasi Peak	297.36 MHz	29.46	-16.55

Gandini 20091704



Gandini 20091705