

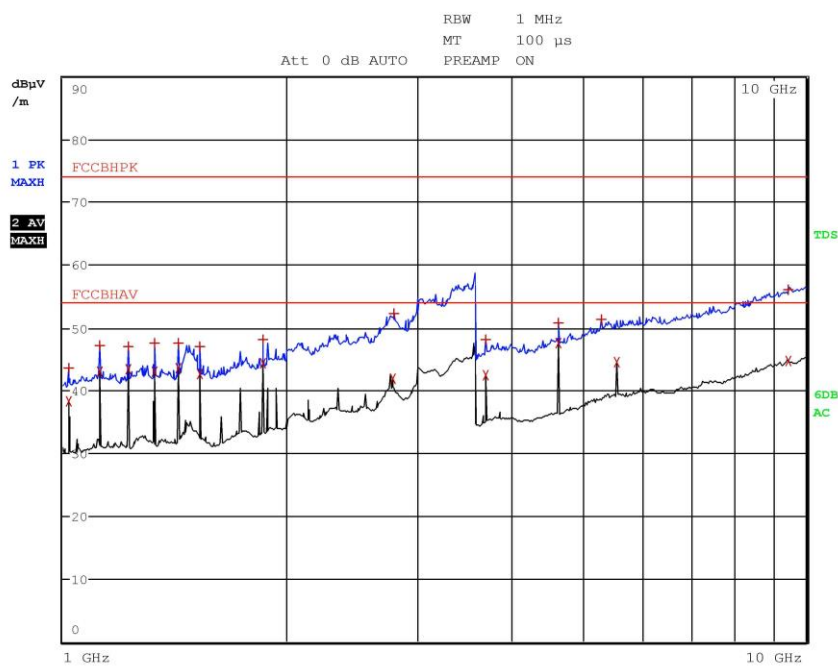


CMC
Centro Misure Compatibilità S.r.l.
Via della Fisica, 20
36016 Thiene (VI)



LAB N° 0168

Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx - Fmax
Operator Gandini 17057449
Test Spec
Vert





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx - Fmax
Operator Gandini 17057449
Test Spec
Vert

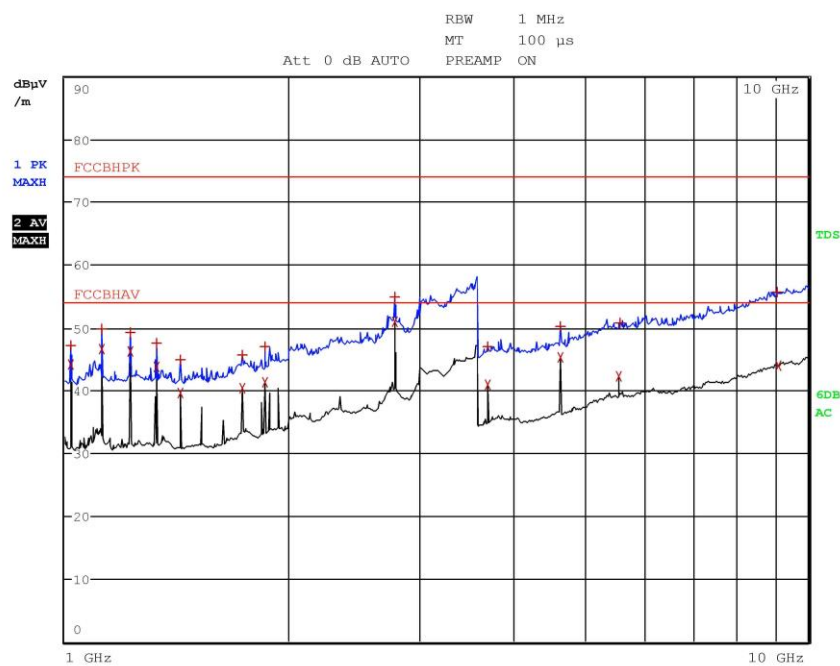
Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 24

Trace	Frequency	Level (dBµV/m)	Detector	Delta Limit/dB
1	1.020000000 GHz	43.57	Max Peak	-30.41
2	1.020000000 GHz	38.30	Average	-15.68
1	1.122000000 GHz	47.11	Max Peak	-26.87
2	1.122000000 GHz	43.10	Average	-10.88
1	1.224000000 GHz	46.96	Max Peak	-27.02
2	1.224000000 GHz	43.49	Average	-10.49
1	1.326000000 GHz	47.60	Max Peak	-26.38
2	1.326000000 GHz	43.06	Average	-10.92
1	1.428000000 GHz	47.51	Max Peak	-26.47
2	1.428000000 GHz	43.50	Average	-10.48
1	1.530000000 GHz	46.96	Max Peak	-27.02
2	1.530000000 GHz	42.59	Average	-11.39
2	1.855600000 GHz	44.25	Average	-9.73
1	1.855600000 GHz	48.12	Max Peak	-25.86
2	2.783600000 GHz	41.82	Average	-12.16
1	2.791600000 GHz	52.21	Max Peak	-21.77
1	3.711200000 GHz	48.21	Max Peak	-25.77
2	3.711600000 GHz	42.51	Average	-11.47
2	4.639200000 GHz	47.62	Average	-6.36
1	4.639200000 GHz	50.75	Max Peak	-23.23
1	5.310400000 GHz	51.30	Max Peak	-22.68
2	5.567200000 GHz	44.61	Average	-9.37
1	9.465600000 GHz	56.00	Max Peak	-17.98
2	9.476800000 GHz	44.69	Average	-9.29



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx - Fmax
Operator Gandini 17057450
Test Spec
Horiz





Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx - Fmax
Operator Gandini 17057450
Test Spec
Horiz

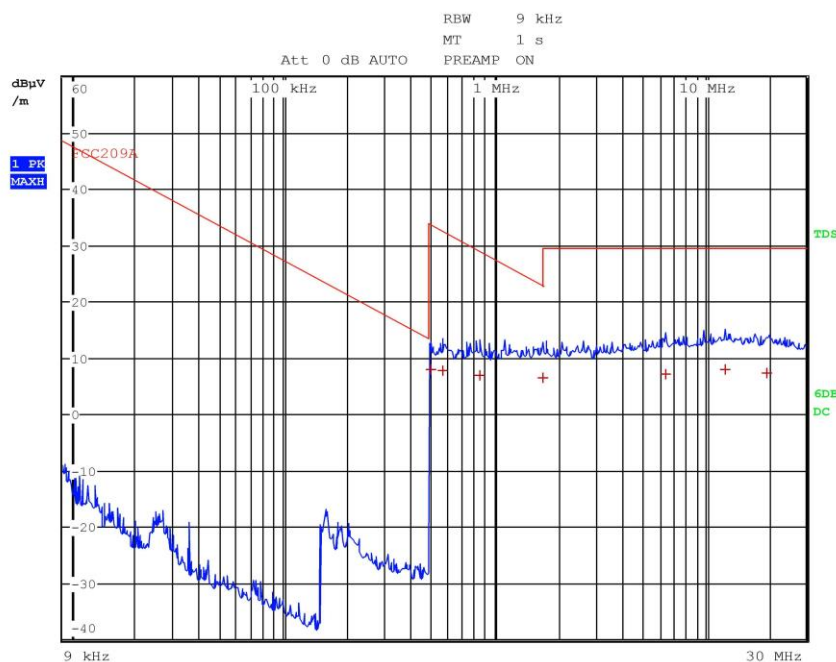
Final Measurement

Meas Time: 1 s
Margin: 20 dB
Subranges: 24

Trace	Frequency	Level (dBµV/m)	Detector	Delta Limit/dB
1	1.020000000 GHz	47.19	Max Peak	-26.79
2	1.020000000 GHz	44.12	Average	-9.86
1	1.122000000 GHz	49.81	Max Peak	-24.17
2	1.122000000 GHz	46.61	Average	-7.37
1	1.224000000 GHz	49.31	Max Peak	-24.67
2	1.224000000 GHz	46.31	Average	-7.67
1	1.326000000 GHz	47.64	Max Peak	-26.34
2	1.326000000 GHz	43.83	Average	-10.15
1	1.428000000 GHz	44.97	Max Peak	-29.01
2	1.428000000 GHz	39.55	Average	-14.43
1	1.734000000 GHz	45.70	Max Peak	-28.28
2	1.734000000 GHz	40.34	Average	-13.64
2	1.855600000 GHz	41.33	Average	-12.65
1	1.855600000 GHz	46.93	Max Peak	-27.05
2	2.783600000 GHz	50.92	Average	-3.06
1	2.783600000 GHz	54.92	Max Peak	-19.06
2	3.711600000 GHz	41.02	Average	-12.96
1	3.711600000 GHz	46.90	Max Peak	-27.08
2	4.639200000 GHz	45.37	Average	-8.61
1	4.639200000 GHz	50.26	Max Peak	-23.72
2	5.567200000 GHz	42.33	Average	-11.65
1	5.584000000 GHz	50.70	Max Peak	-23.28
1	9.096400000 GHz	55.61	Max Peak	-18.37
2	9.105200000 GHz	43.95	Average	-10.03



Meas Type Emission
Equipment under Test
Manufacturer
OP Condition Tx
Operator Gandini 17057451
Test Spec
Loop



Final Measurement

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

Trace	Frequency	Level (dBμV/m)	Detector	Delta Limit/dB
1	498.000000000 kHz	8.05	Quasi Peak	-25.61
1	566.000000000 kHz	7.86	Quasi Peak	-24.69
1	846.000000000 kHz	7.02	Quasi Peak	-22.03
1	1.698000000 MHz	6.51	Quasi Peak	-16.49
1	6.430000000 MHz	7.12	Quasi Peak	-22.42
1	12.378000000 MHz	8.05	Quasi Peak	-21.49
1	19.474000000 MHz	7.31	Quasi Peak	-22.23

Result: The requirements are met



11.3 20 dB bandwidth

Test set-up and execution

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

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

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

Test specification

See FCC Part 15.247

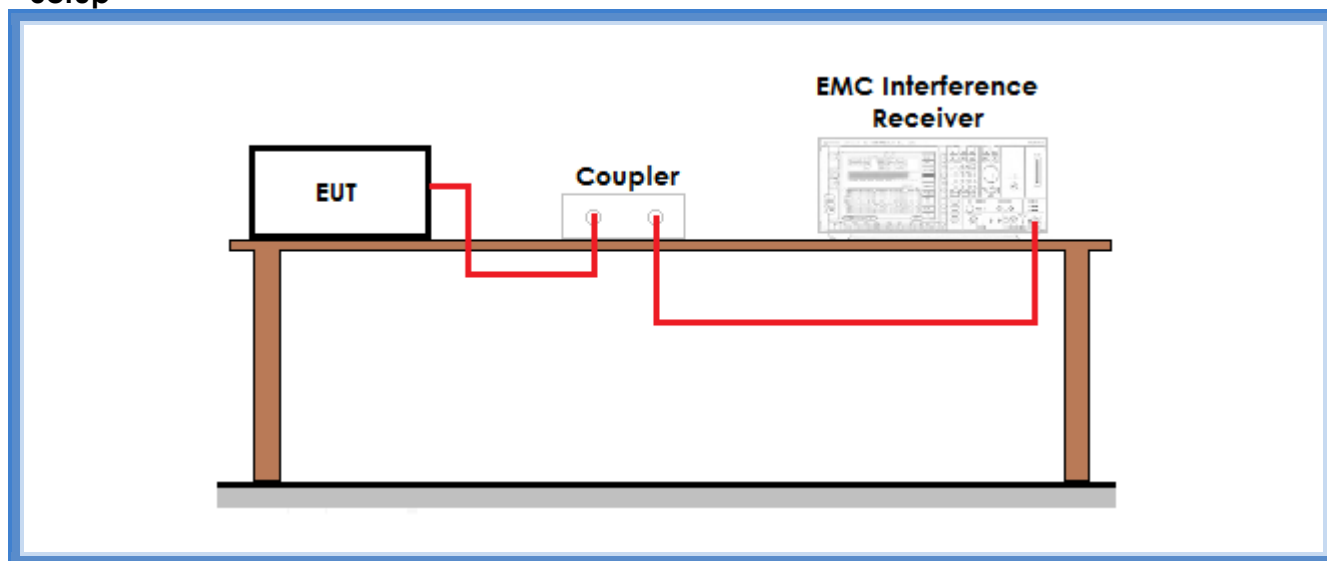
Environmental conditions

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

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



Setup



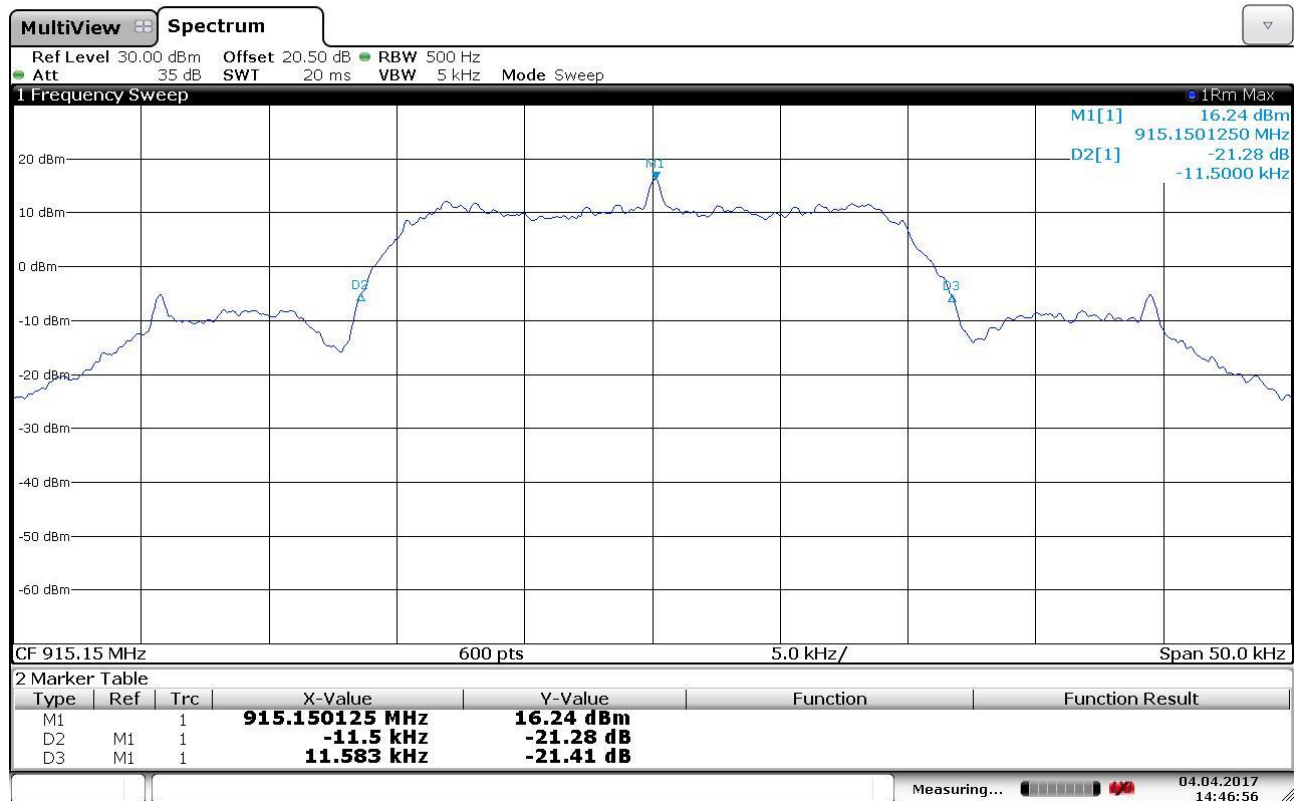
Result

Frequency (MHz)	Graphs	20 dB bandwidth (kHz)	Maximum 20 dB bandwidth allowed (kHz)	Results
915,15	G17057401	23,083	500	Complies
921,50	G17057406	23,083	500	Complies
927,85	G17057409	23,166	500	Complies



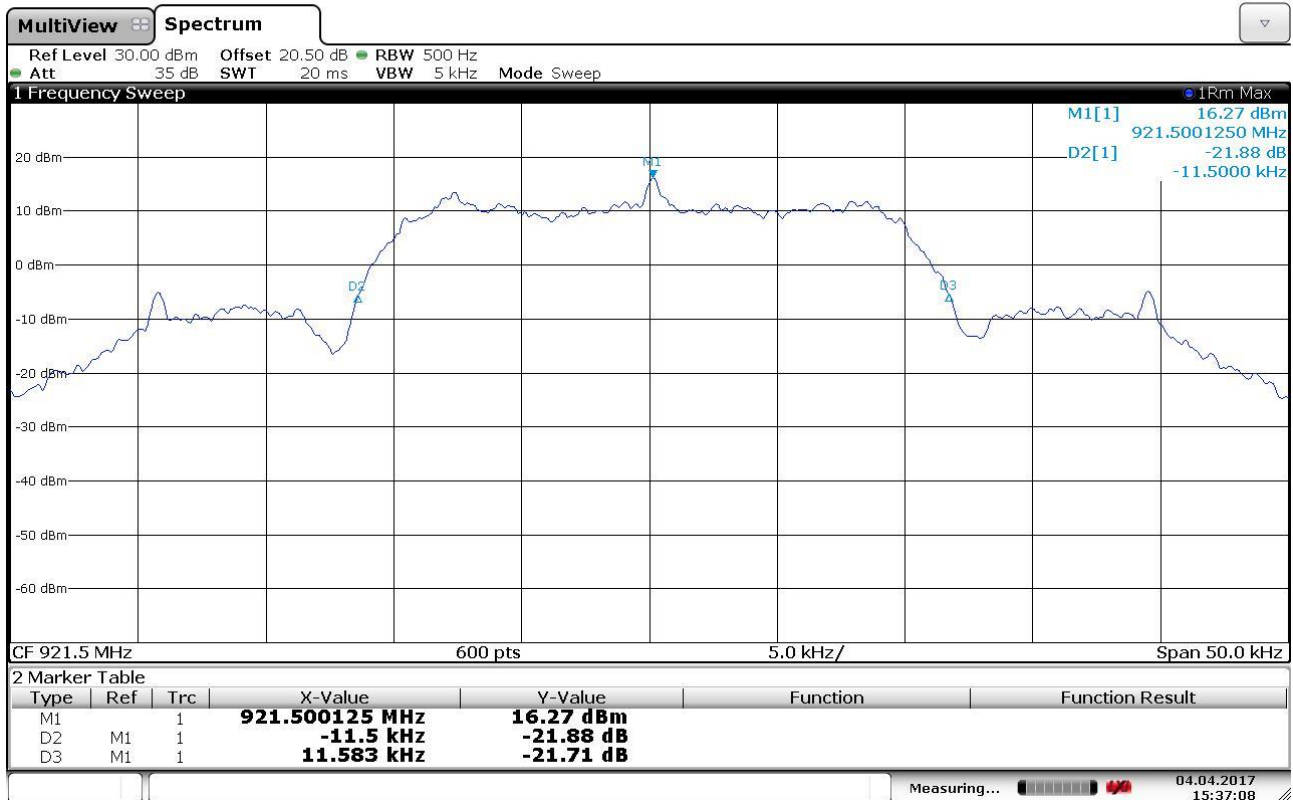
Graphs

Gandini 17057401



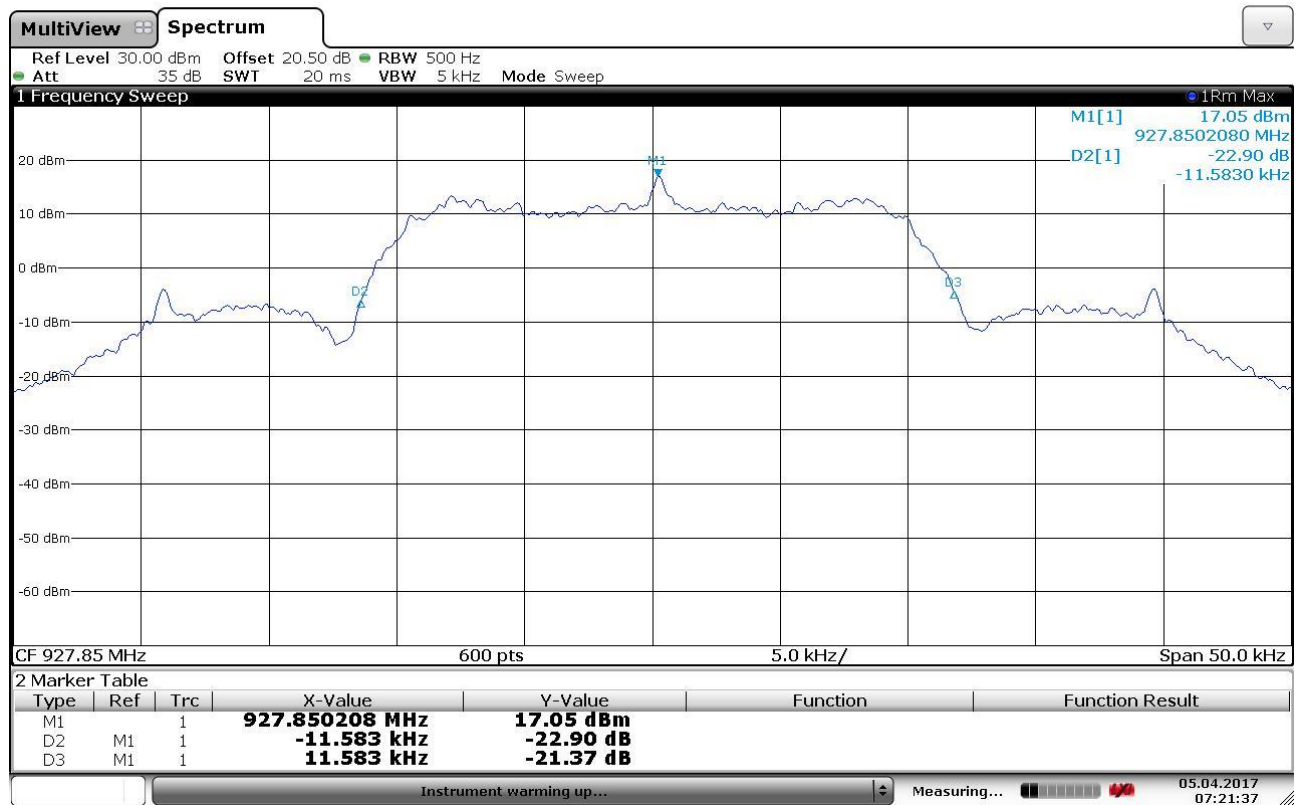


Gandini 17057405





Gandini 17057409



Result: The requirements are met



11.4 Channel separation

Test set-up and execution

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

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

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

Test specification

See FCC Part 15.247

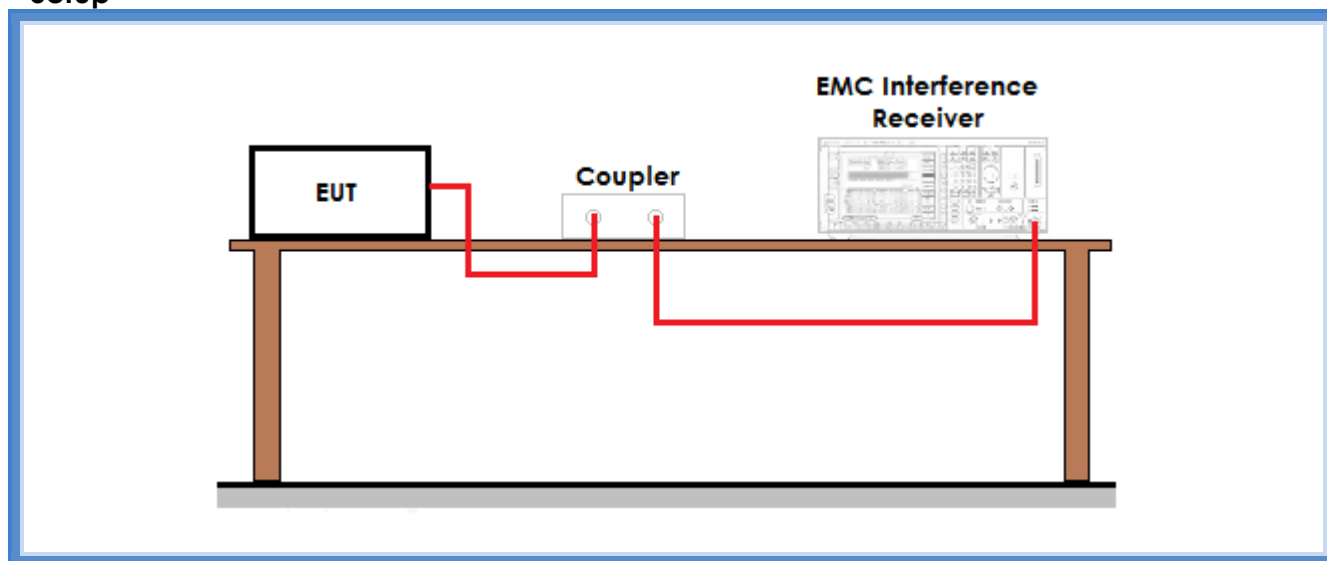
Environmental conditions

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

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



Setup

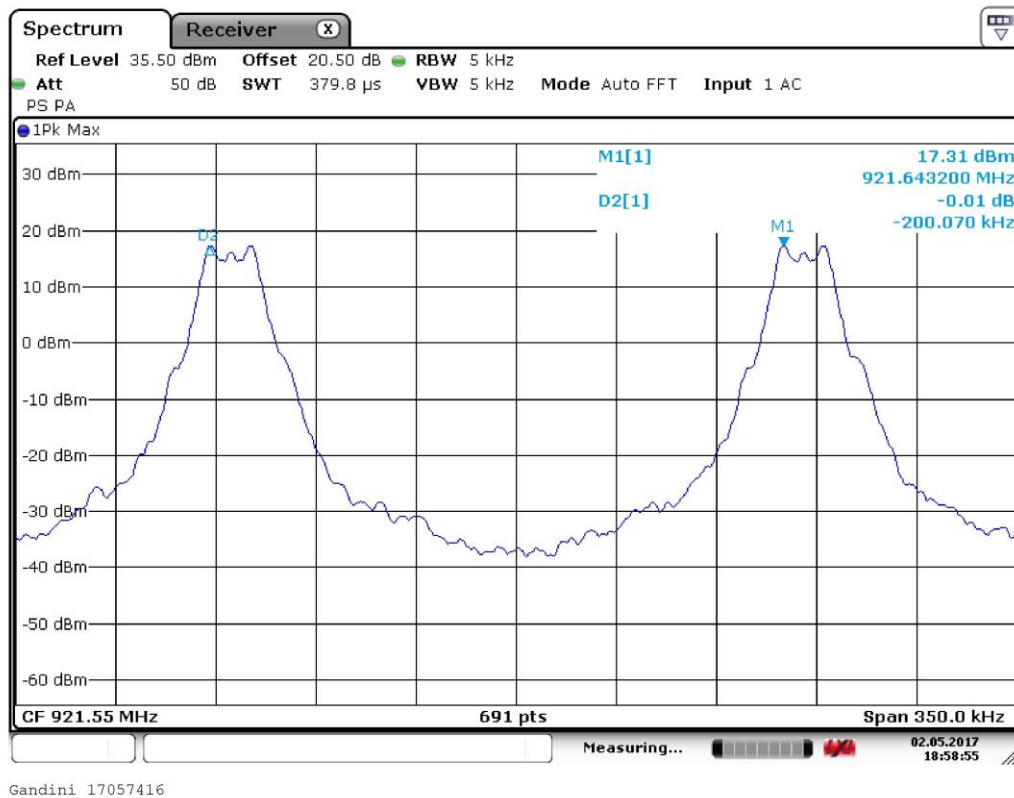


Result

Frequency band (MHz)	Graphs	Channel separation (kHz)	Minimum channel separation required (kHz)	Results
902 – 928	G17057416	200,07	25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater	Complies



Graphs



Result: The requirements are met



11.5 Number of hopping channels

Test set-up and execution

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

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

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

Test specification

See FCC Part 15.247

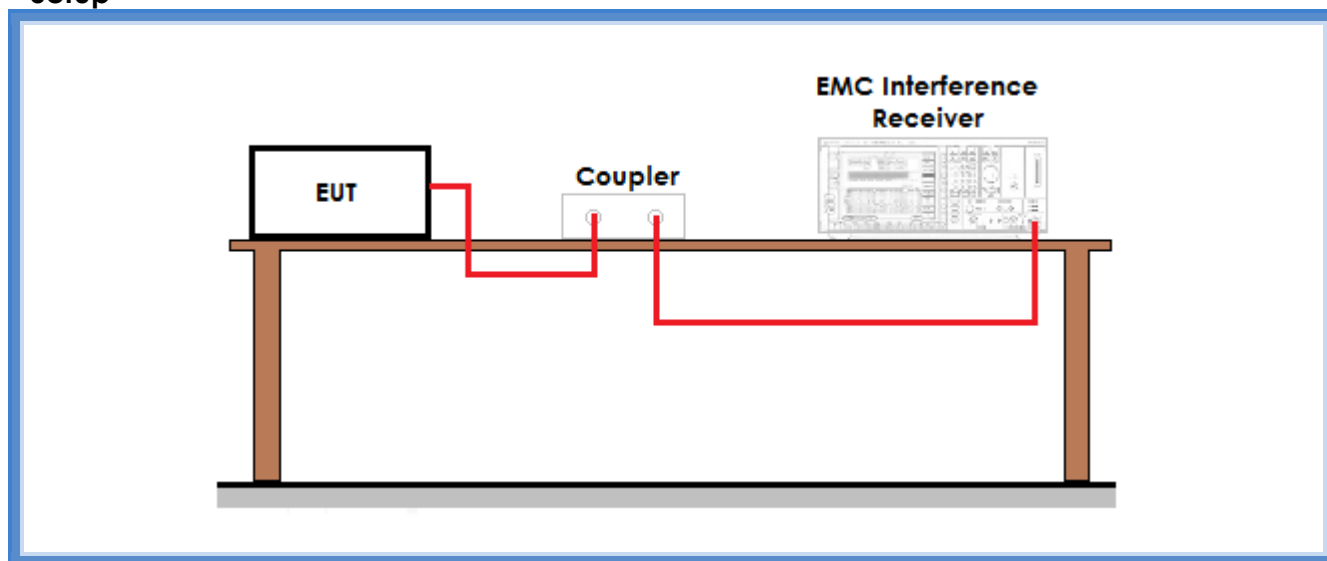
Environmental conditions

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

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



Setup

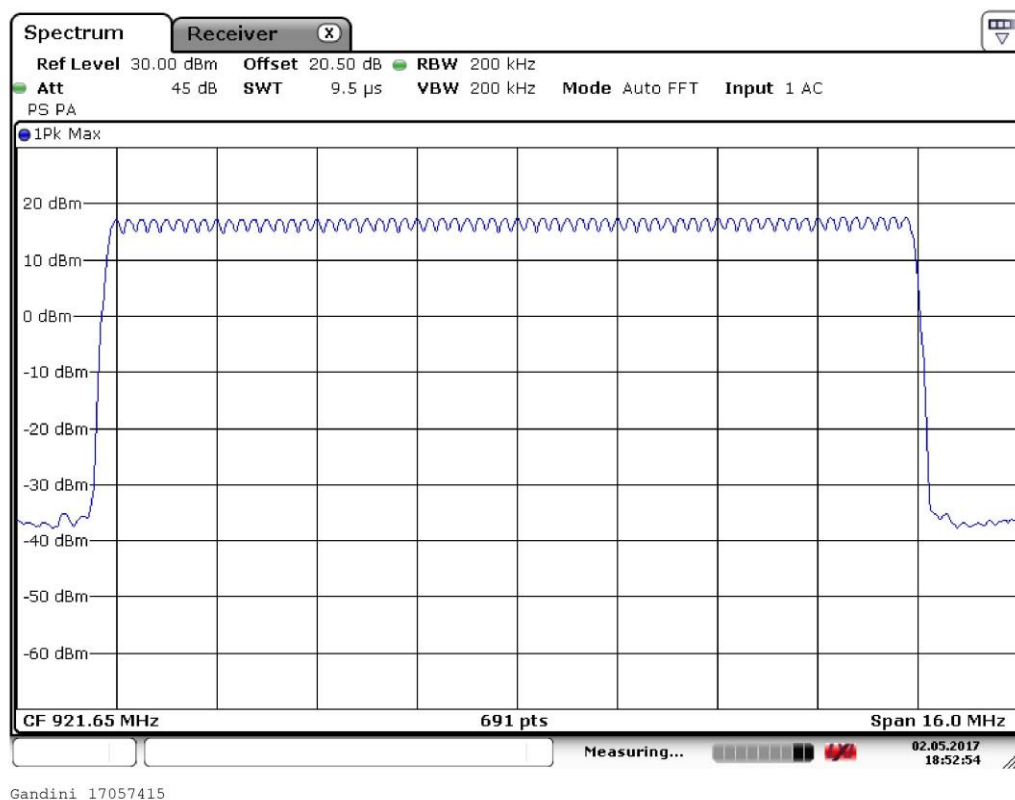


Result

Frequency band (MHz)	Graphs	Number of hopping channels	Minimum number of hopping channels required	Results
902 – 928	G17057415	64	50 if the 20 dB bandwidth is less than 250 kHz 25 if the 20 dB bandwidth is 250 kHz or greater	Complies



Graphs



Result: The requirements are met



11.6 Time of occupancy

Test set-up and execution

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

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

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

Test specification

See FCC Part 15.247

Environmental conditions

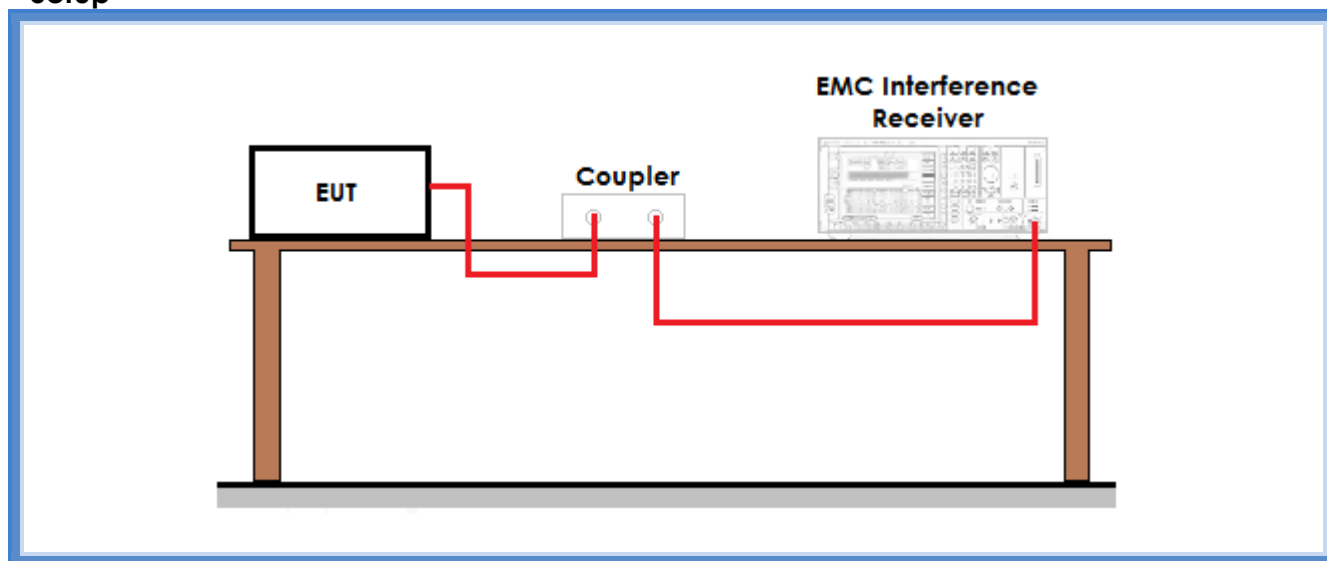
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	42

Acceptance limits:

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



Setup



Result

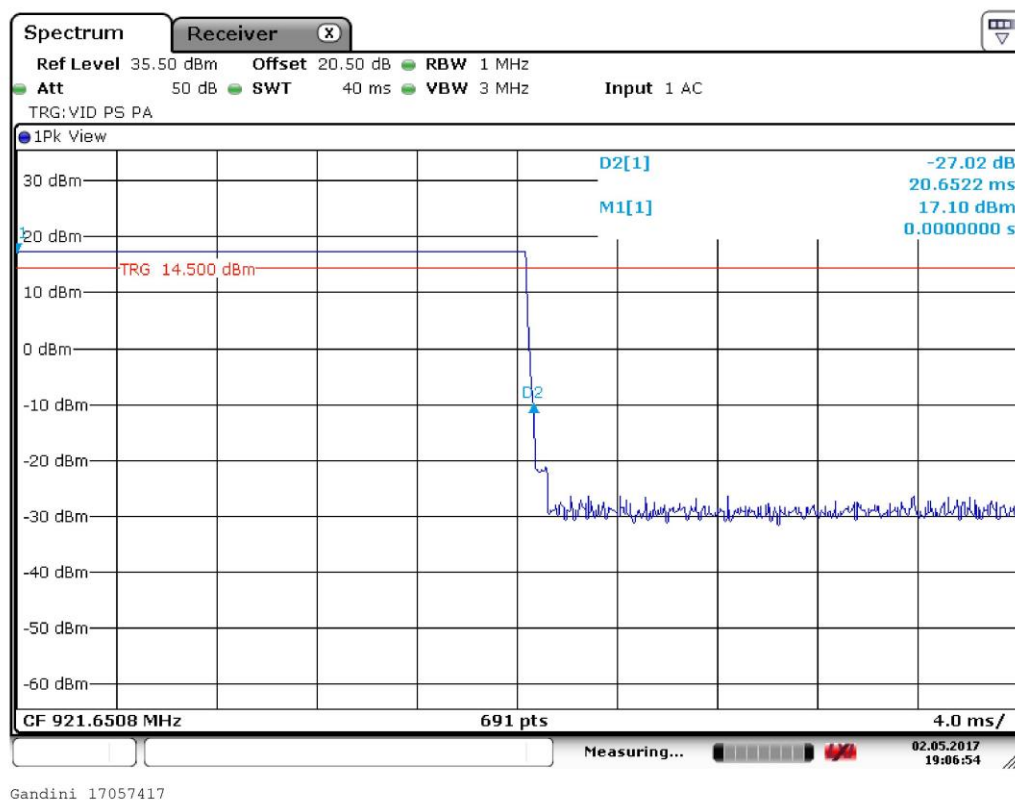
Frequency (MHz)	Graphs	Dwell time (ms)
921,6508	G17057417	20,6522

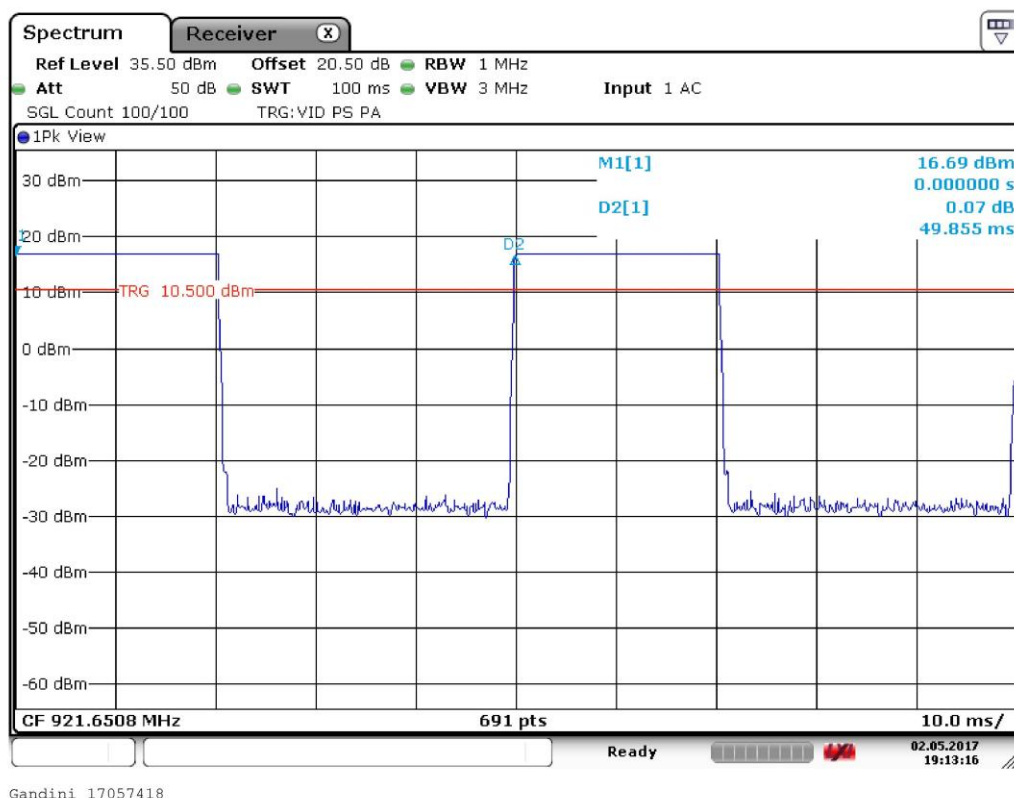
Frequency (MHz)	Time between 2 transmission on different channels		Number of transmissions on a period of 20 s
921,6508	G17057418	49,855	20 s / 49,855 ms / 64 = 6,27

Time of occupancy (Dwell time x Nr. transmissions)	Maximum time of occupancy	Results
129,49 ms	0,4 s	Complies



Graphs





Result: The requirements are met



11.7 Band edge

Test set-up and execution

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

Test configuration and test method

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

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

Test specification

See FCC Part 15.247

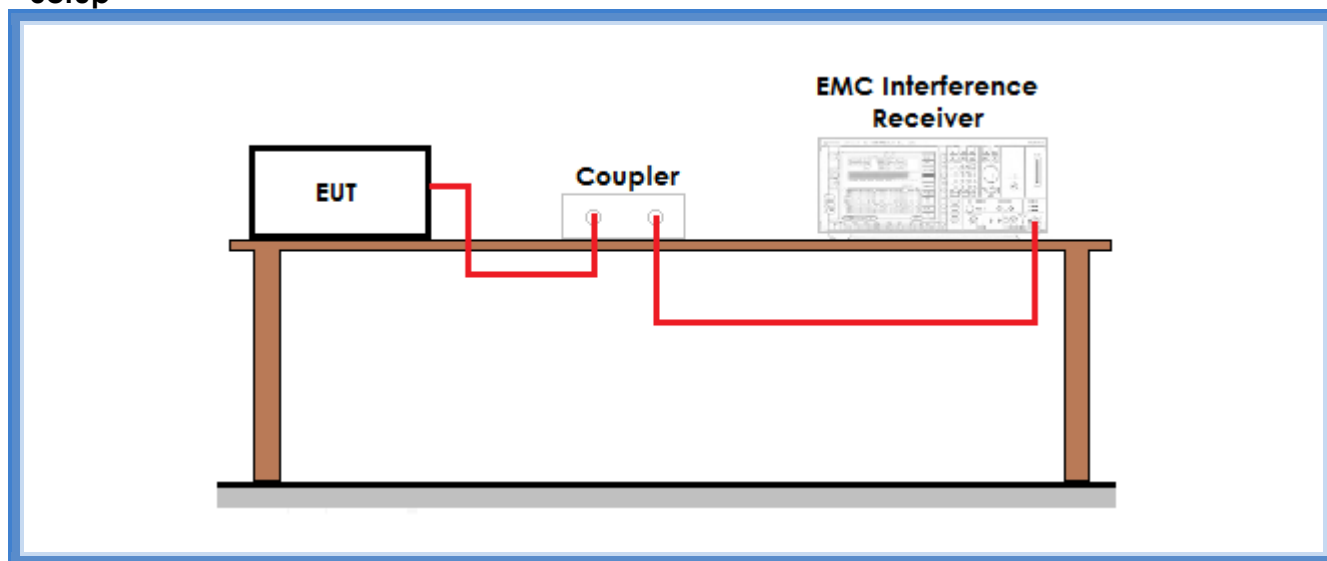
Environmental conditions

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

Acceptance limits: operation within the band 902 – 928 MHz



Setup



Result

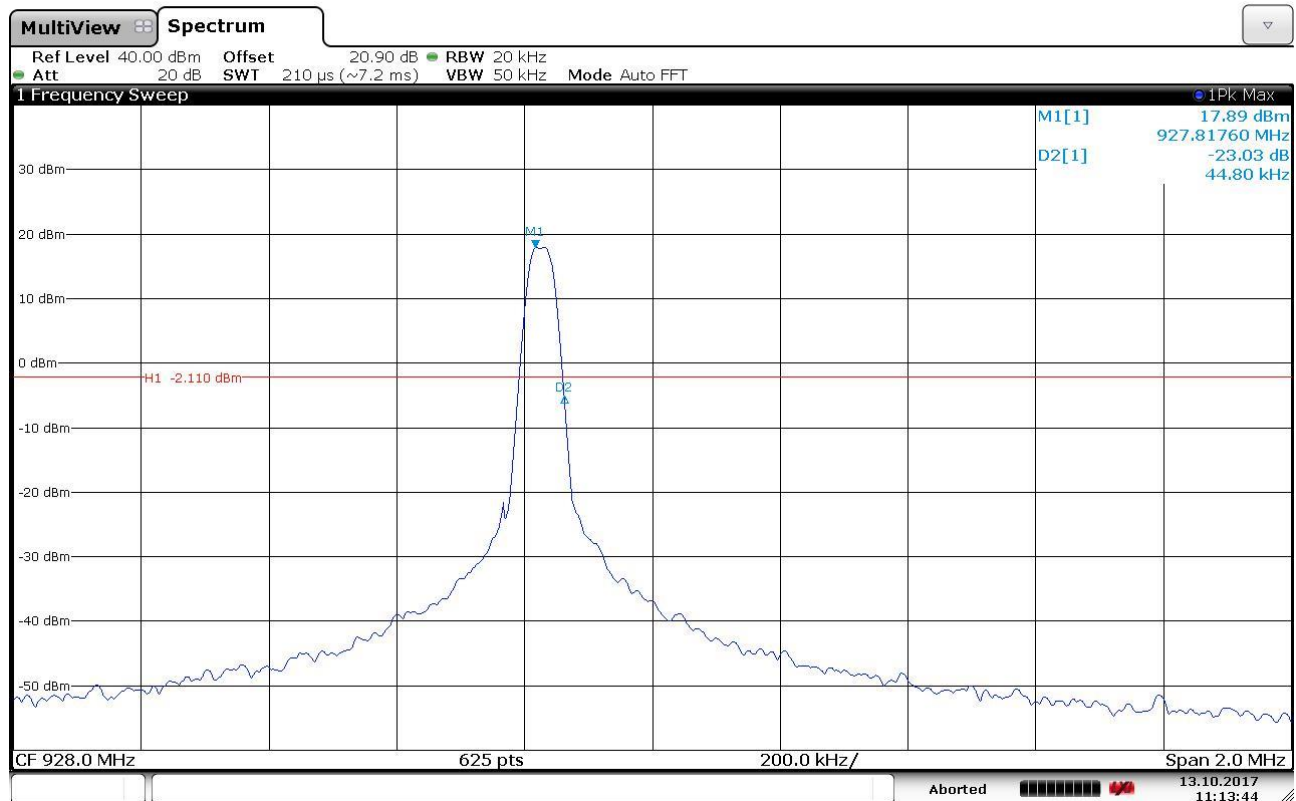
Frequency (MHz)	Graph(s) – Hopping	Results	
915,075	G17057474	F _L : 915,0517 MHz	Complies
927,825	G17057473	F _H : 927,8598 MHz	Complies

Frequency (MHz)	Graph(s) – No hopping	Results	
915,075	G17057476	F _L : 915,0418 MHz	Complies
927,825	G17057470	F _H : 927,8624 MHz	Complies



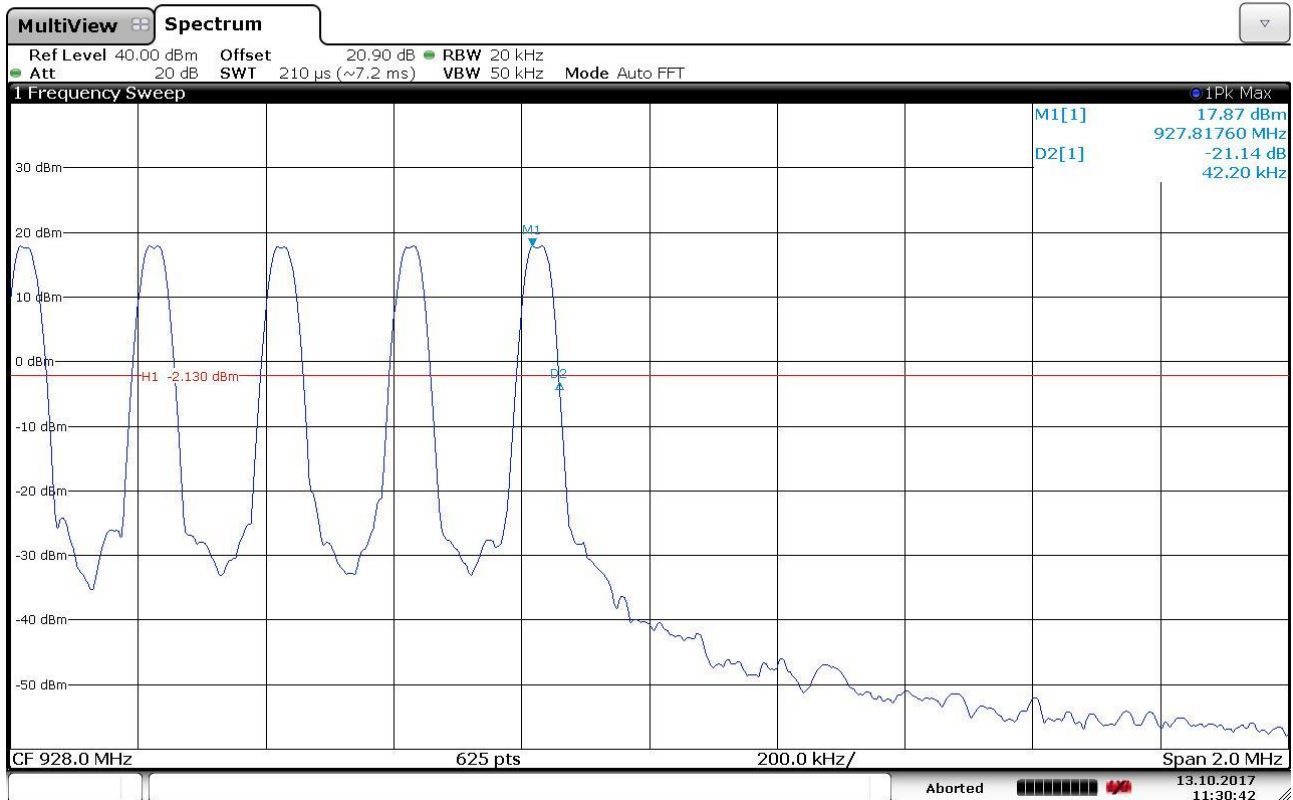
Graphs

Gandini 17057470



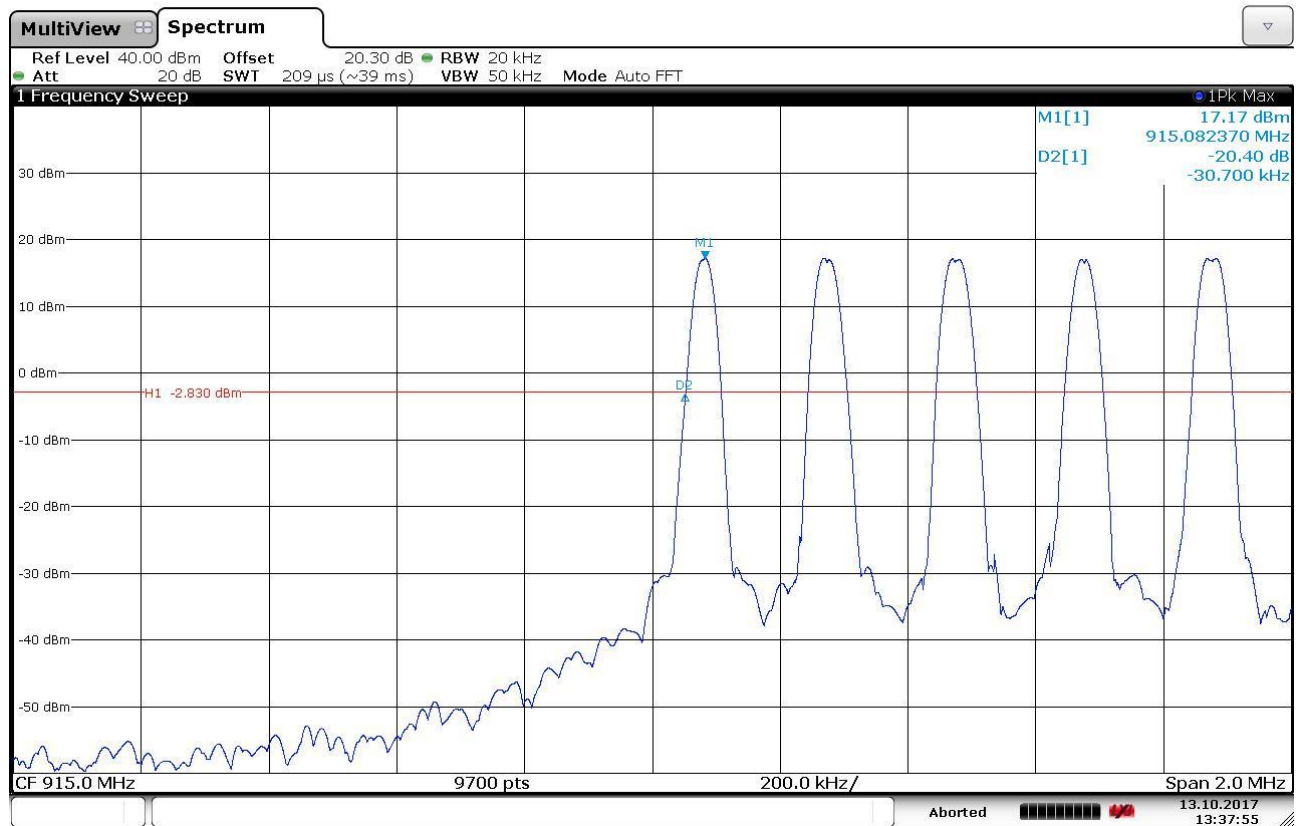


Gandini 17057473



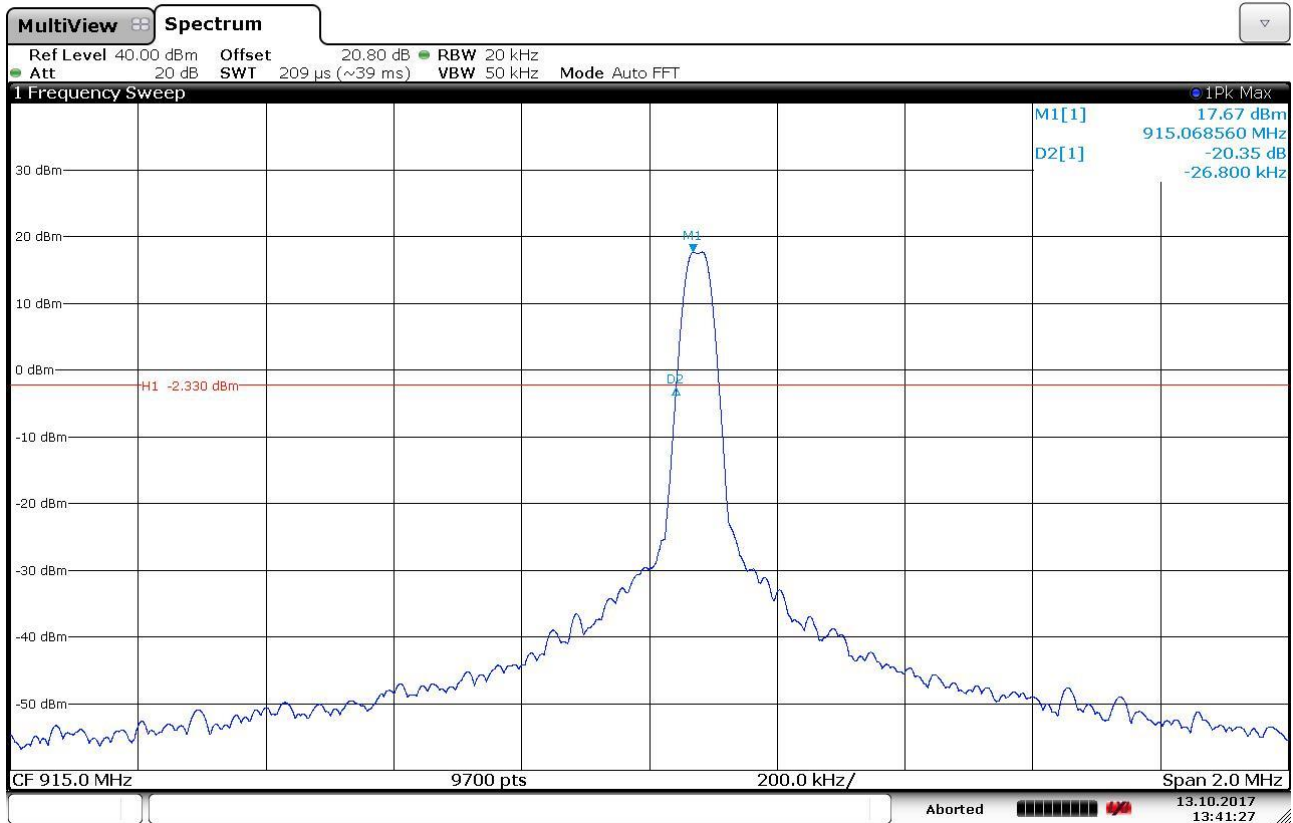


Gandini 17057474





Gandini 17057476



Result: The requirements are met



11.8 Peak Output Power

Test set-up and execution

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

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

Port: Antenna

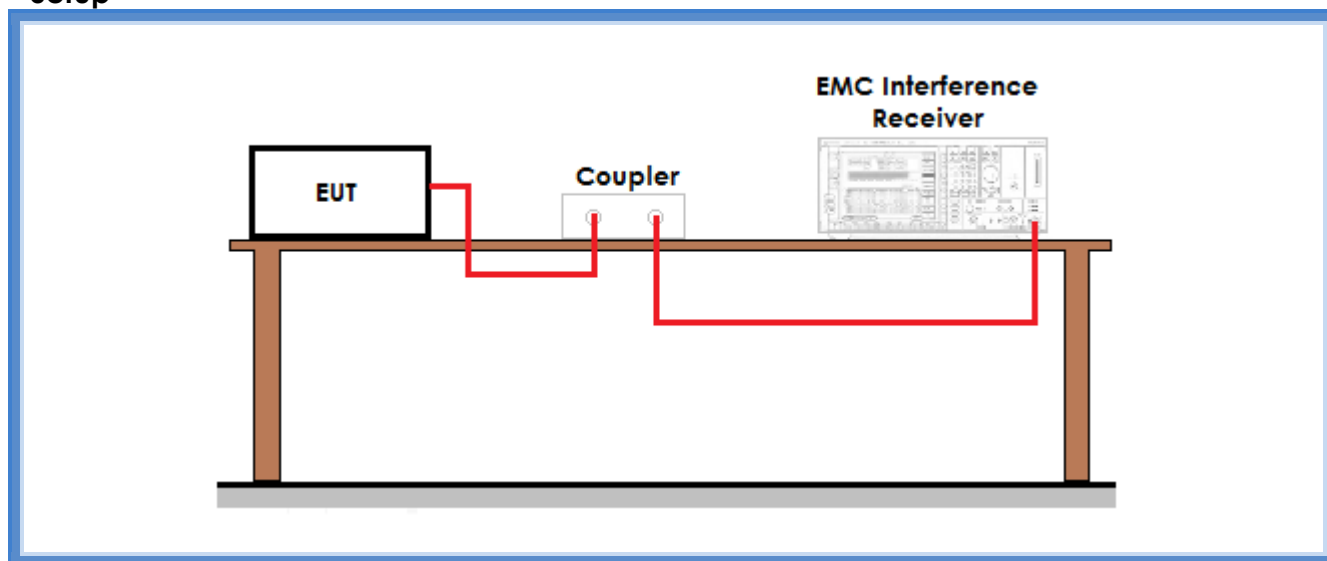
Environmental conditions

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

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



Setup



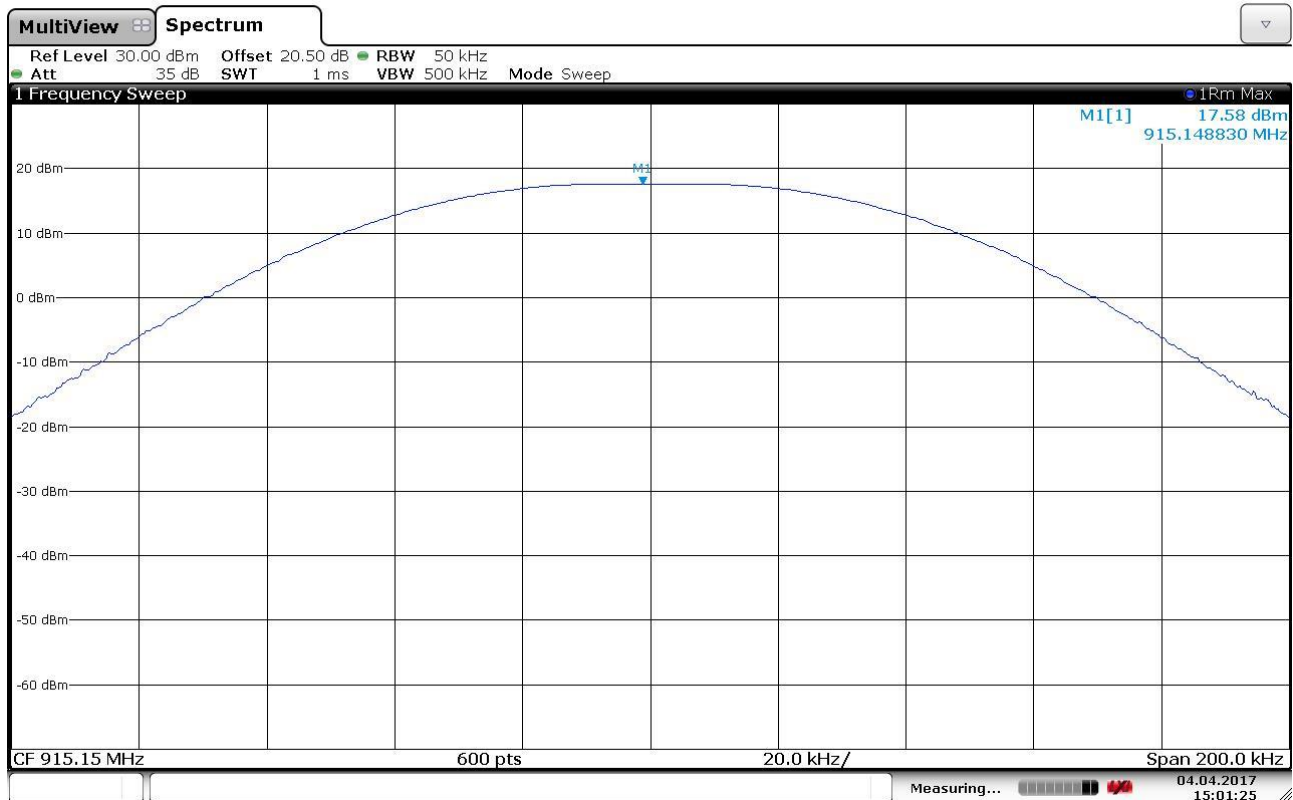
Result

Frequency (MHz)	Graphs	Conducted measured level (dBm)	Conducted power level (mW)	Calculated radiated level (dBμV/m)
915,148830	G17057403	17,58	57,28	114,81
921,494830	G17057408	17,59	57,41	114,82
927,850210	G17057411	18,12	64,86	115,35



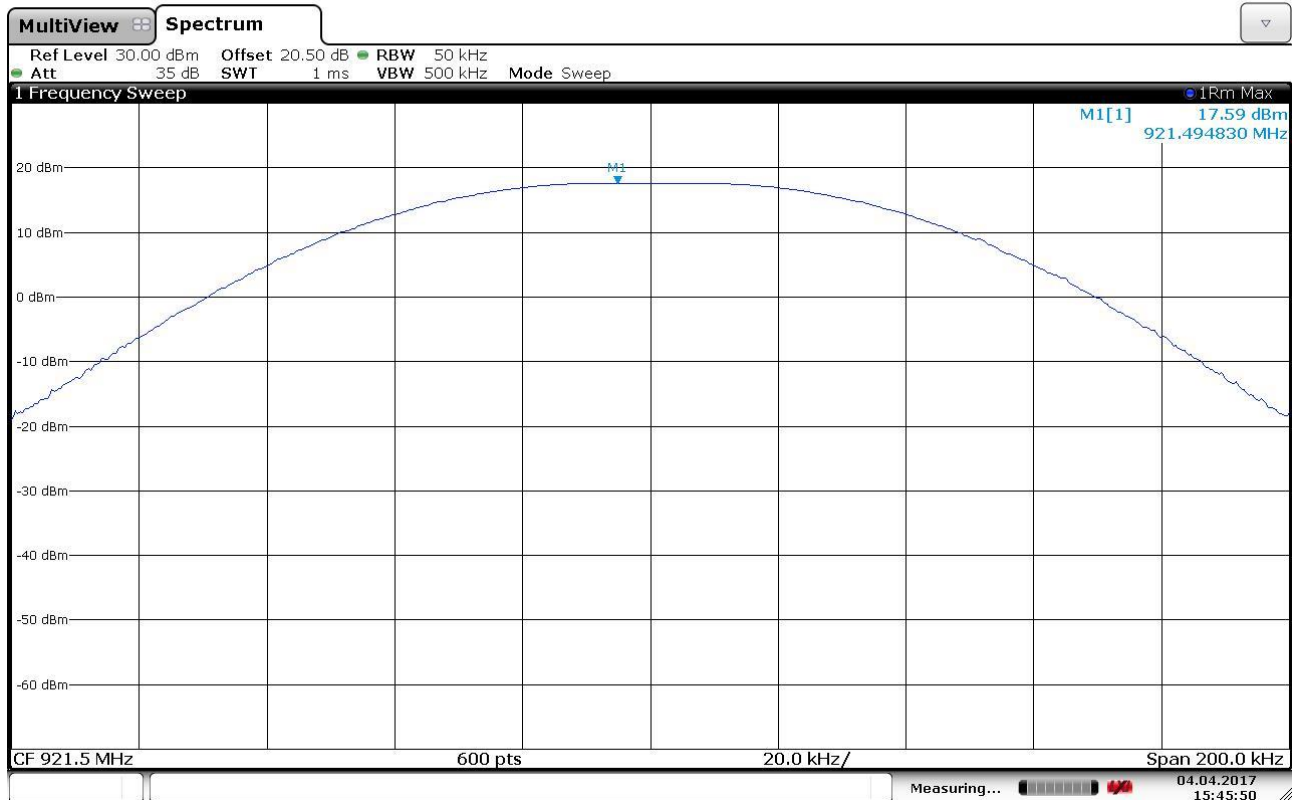
Graphs

Gandini 17057403



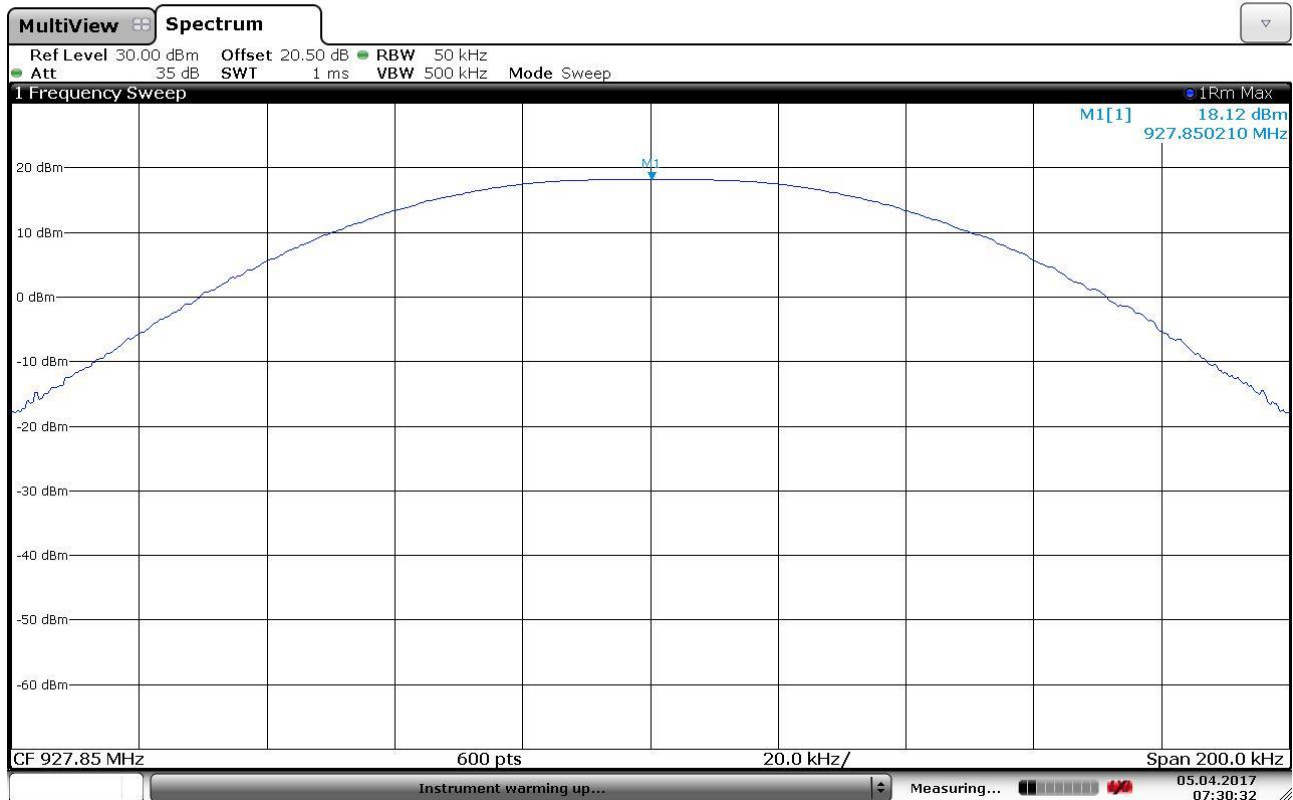


Gandini 17057408





Gandini 17057411



Result: The requirements are met



11.9 Spurious Emission

Test set-up and execution

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

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
Frequency range: 0,009 MHz – 10000 MHz
Antenna polarization: Horizontal (H) – Vertical (V)
10 m for frequencies ≤ 30 MHz
3 m for frequencies > 30 MHz

Environmental conditions

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

Acceptance limits

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



The restricted frequency bands are listed in the following table

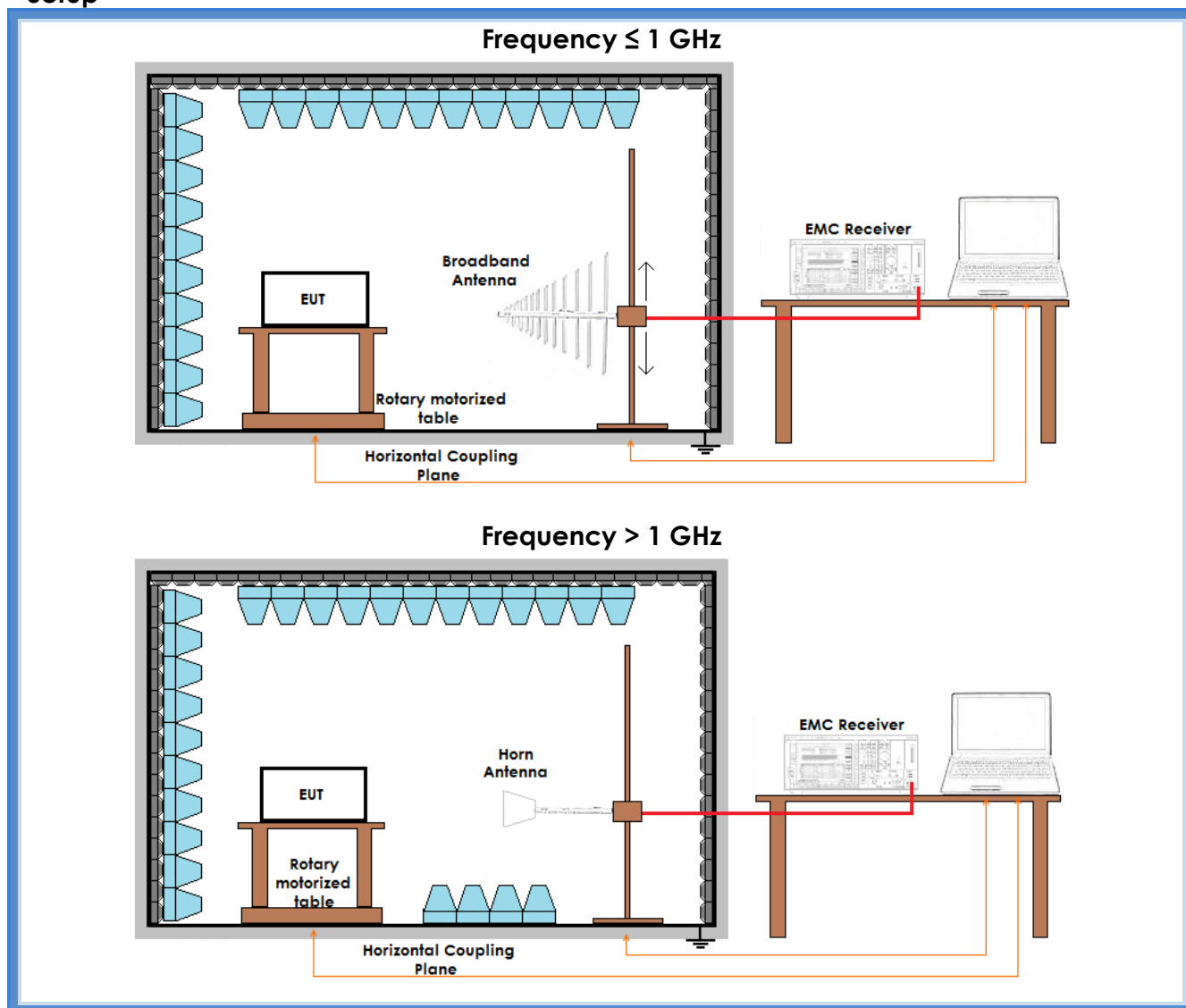
MHz	MHz	MHz	GHz
0,090 – 0,110	16,42 – 16,423	399,9 – 410	4,5 – 5,15
0,495 – 0,505	16,69475 – 16,69525	608 – 614	5,35 – 5,46
2,1735 – 2,1905	16,80425 – 16,80475	960 – 1240	7,25 – 7,75
4,125 – 4,128	25,5 – 25,67	1300 – 1427	8,025 – 8,5
4,17725 – 4,17775	37,5 – 38,25	1435 – 1626,5	9,0 – 9,2
4,20725 – 4,20775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

Acceptance limits for emissions in non-restricted frequency bands

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



Setup





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	44,98	54,00	47,72	54,00	44,25	54,00	Complies
III	43,08	54,00	46,34	54,00	50,92	54,00	Complies
IV	43,24	54,00	43,78	54,00	42,51	54,00	Complies
V	45,41	54,00	46,90	54,00	47,62	54,00	Complies
VI	47,34	54,00	44,24	54,00	42,33	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	48,76	74,00	50,59	74,00	48,12	74,00	Complies
III	52,21	74,00	52,30	74,00	54,92	74,00	Complies
IV	47,81	74,00	48,32	74,00	48,21	74,00	Complies
V	50,05	74,00	51,63	74,00	50,75	74,00	Complies
VI	52,39	74,00	52,12	74,00	50,70	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.							



11.10 Maximum permissible exposure

Test set-up and execution

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

Test configuration

Test site:
Laboratory

Auxiliary equipment:
See clause 4 of this test report

EUT exercising

See clause 4 of this test report

Test equipment used

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

Test specification

Port: Antenna

Acceptance limits

1 mW/cm² max at 20 cm of distance

Result

Power Density Limit (mW/cm ²)	Maximum Output Power (mW)	Antenna Gain (G)	Power Density at 20 cm (mW/cm ²)	Remarks
1,00	64,86	1,585 (2 dBi)	2,05E-02	--

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

Result: The requirements are met