

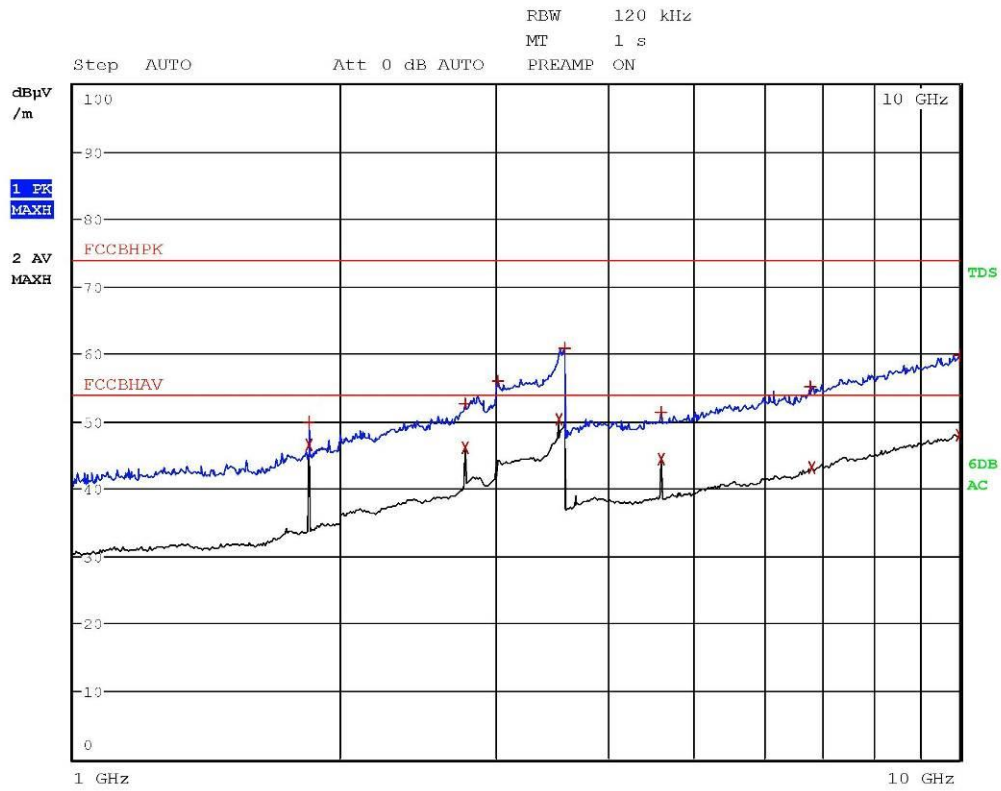
Gandini 18015217-Vert-Tx Fmax

CMC Centro Misure Compatibilità S.r.l.



EDIT PEAK LIST (Prescan Results)			
Trace1:	FCCBHPK		
Trace2:	FCCBHAV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
2 Average	1.8556 GHz	48.21	-5.76
1 Max Peak	1.8556 GHz	51.09	-22.88
1 Max Peak	3.0132 GHz	55.89	-18.08
2 Average	3.16 GHz	44.12	-9.85
2 Average	3.5256 GHz	50.10	-3.87
1 Max Peak	3.596 GHz	61.15	-12.82
1 Max Peak	4.6388 GHz	50.91	-23.06
2 Average	4.6392 GHz	44.42	-9.55
1 Max Peak	6.7816 GHz	54.62	-19.36
2 Average	6.7992 GHz	43.15	-10.82
1 Max Peak	9.7812 GHz	60.09	-13.88
2 Average	9.9876 GHz	48.01	-5.96

Gandini 18015217-Vert-Tx Fmax



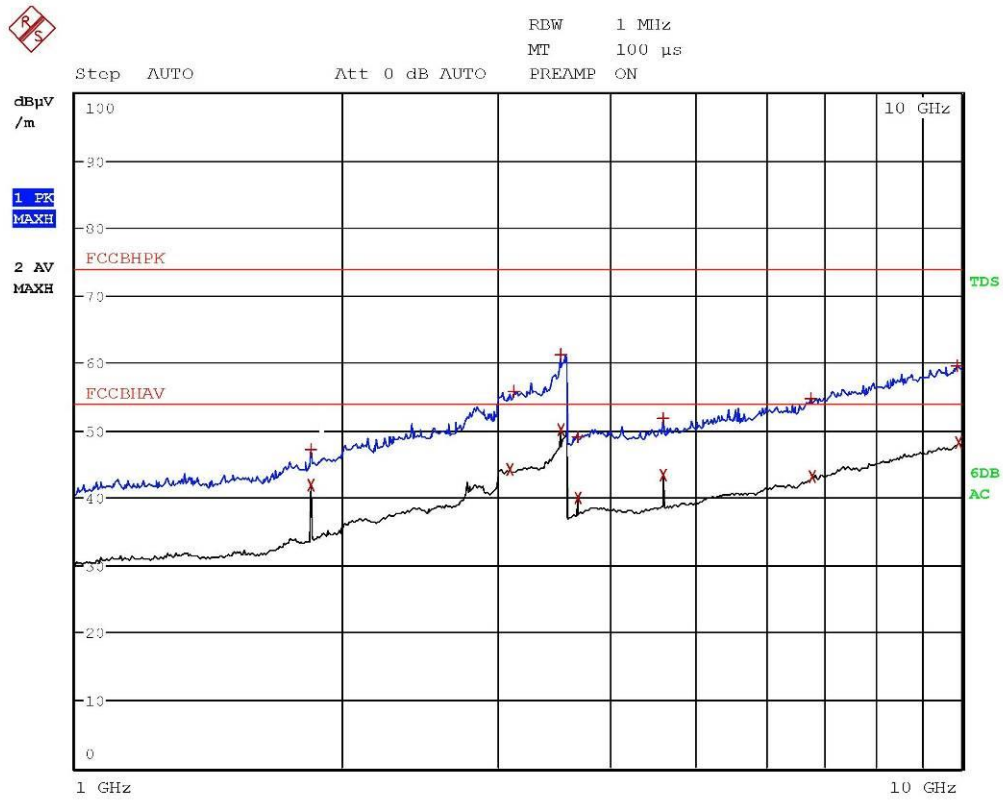
Gandini 18015246



EDIT PEAK LIST (Prescan Results)			
Trace1:	FCCBHPK		
Trace2:	FCCBHAV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
2 Average	1.8428 GHz	46.63	-7.34
1 Max Peak	1.8428 GHz	49.97	-24.01
2 Average	2.764 GHz	46.04	-7.93
1 Max Peak	2.764 GHz	52.53	-21.45
1 Max Peak	3.0184 GHz	55.91	-18.07
2 Average	3.5256 GHz	50.27	-3.70
1 Max Peak	3.5872 GHz	60.82	-13.15
1 Max Peak	4.6068 GHz	51.42	-22.55
2 Average	4.6072 GHz	44.52	-9.45
1 Max Peak	6.7904 GHz	55.18	-18.79
2 Average	6.806 GHz	43.09	-10.88
1 Max Peak	9.986 GHz	59.77	-14.20
2 Average	9.9888 GHz	47.99	-5.98

Gandini 18015246

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Gandini 18015247

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EDIT PEAK LIST (Prescan Results)			
Trace1:	FCCBHPK		
Trace2:	FCCBHAV		
Trace3:	---		
TRACE	FREQUENCY	LEVEL dBμV/m	DELTA LIMIT dB
1 Max Peak	1.8428 GHz	47.15	-26.82
2 Average	1.8428 GHz	42.01	-11.96
2 Average	3.092 GHz	44.29	-9.68
1 Max Peak	3.1308 GHz	55.86	-18.11
1 Max Peak	3.5256 GHz	61.17	-12.80
2 Average	3.5256 GHz	50.13	-3.84
2 Average	3.6856 GHz	39.93	-14.04
1 Max Peak	3.6984 GHz	49.01	-24.96
1 Max Peak	4.6072 GHz	51.81	-22.16
2 Average	4.6072 GHz	43.40	-10.57
1 Max Peak	6.7588 GHz	54.71	-19.26
2 Average	6.7784 GHz	43.08	-10.89
1 Max Peak	9.9052 GHz	59.56	-14.41
2 Average	9.9324 GHz	48.13	-5.84

Gandini 18015247

**Result:** The requirements are met

CMC Centro Misure Compatibilità S.r.l.



### 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

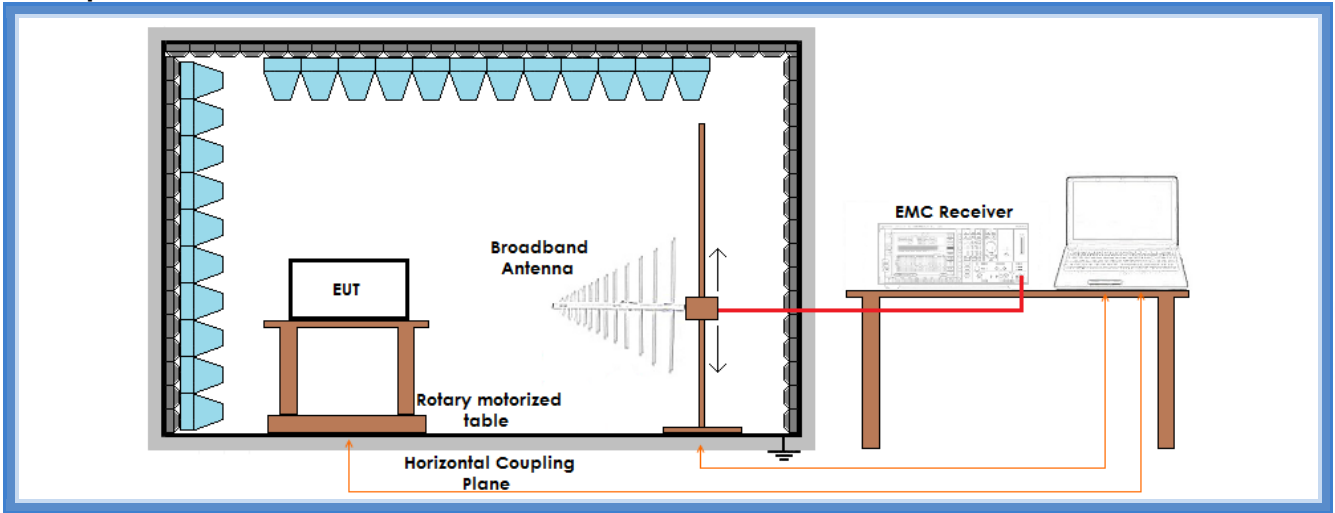
Temperature (°C)	Atmospheric pressure (kPa)	Relative humidity (%)
22	100	45

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

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### Setup



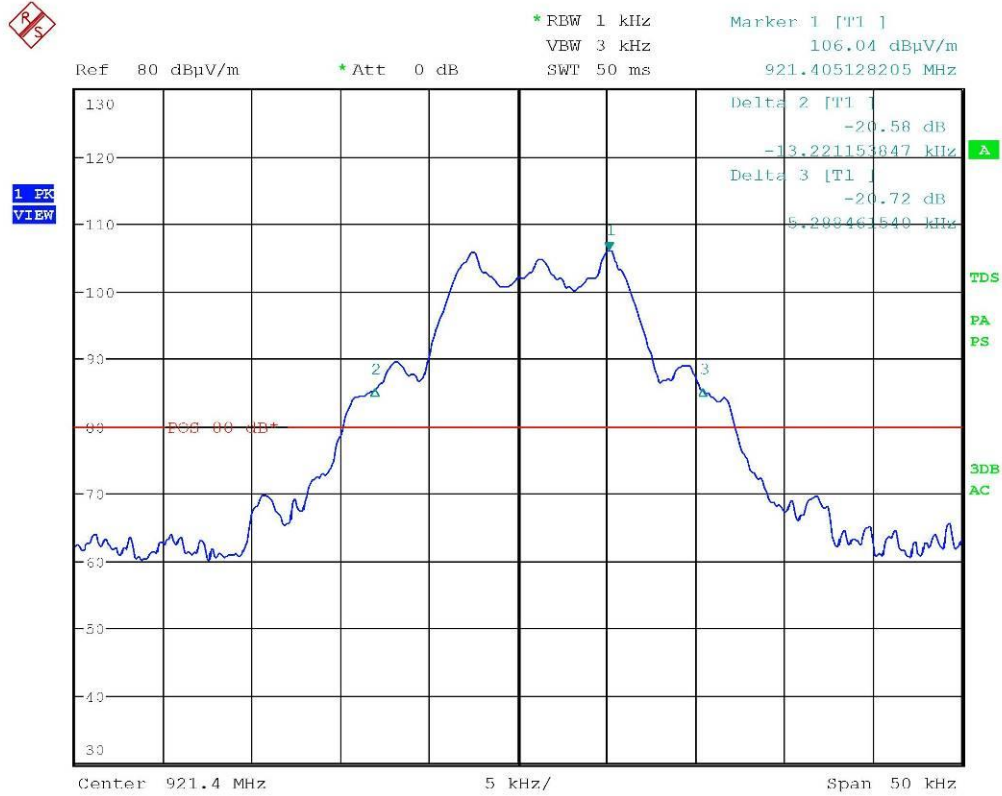
### Result

Frequency (MHz)	Graphs	20 dB bandwidth (kHz)	Maximum 20 dB bandwidth allowed (kHz)	Results
915,05	G18015231	18,26923	500	Complies
921,40	G18015219	18,50960	500	Complies
927,80	G18015225	18,89420	500	Complies

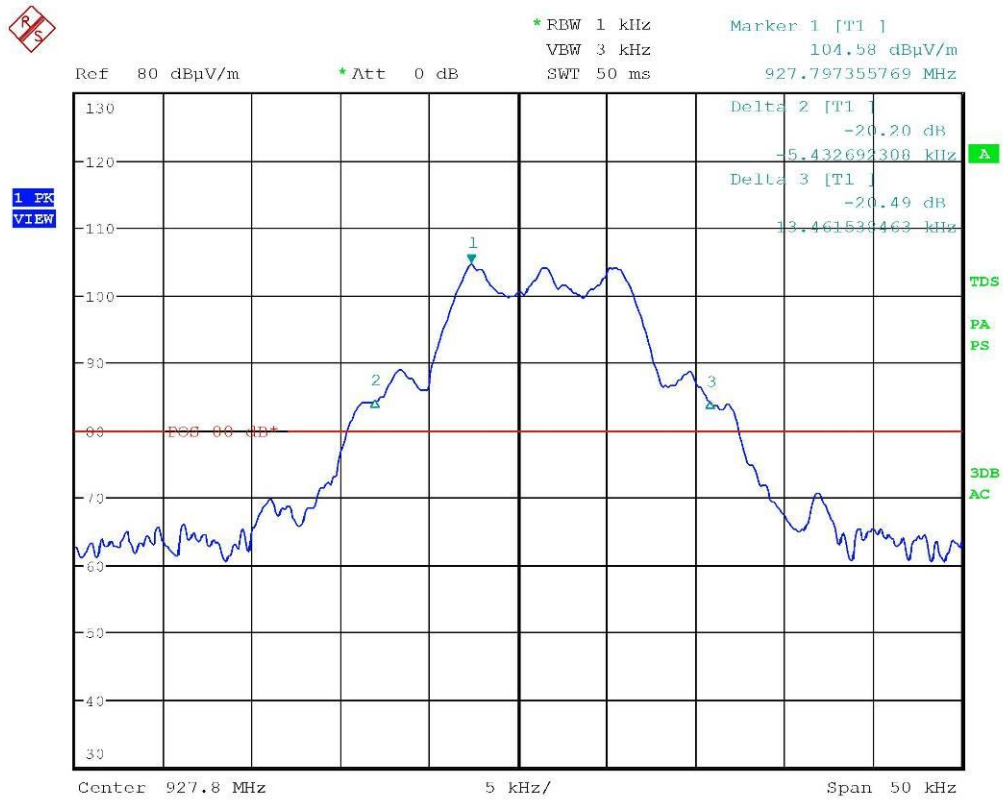




## Graphs

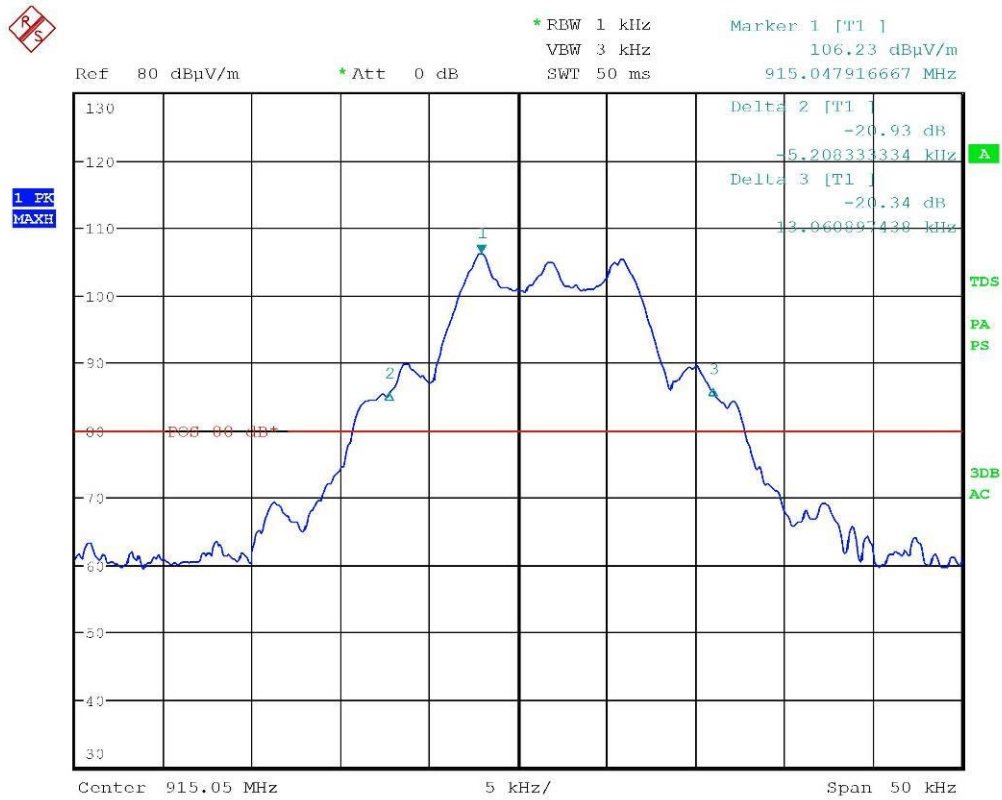


Gandini 18015219



Gandini 18015225

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Gandini 18015231

**Result:** The requirements are met

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## 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

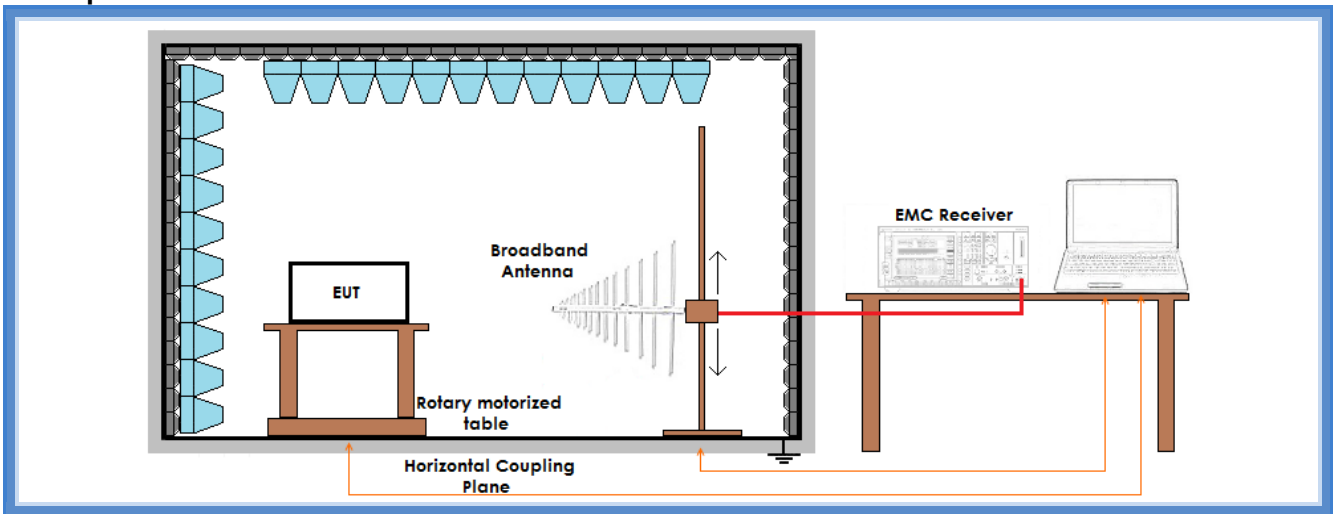
See FCC Part 15.247

### Environmental conditions

<i>Temperature (°C)</i>	<i>Atmospheric pressure (kPa)</i>	<i>Relative humidity (%)</i>
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

### Setup

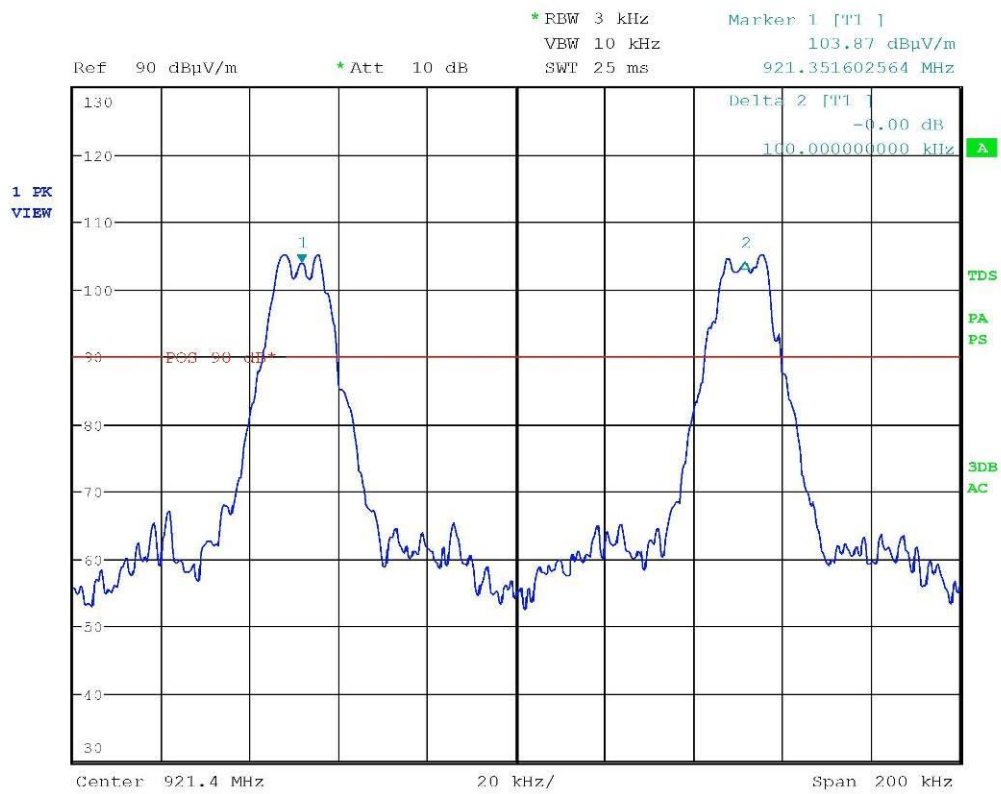


### Result

Frequency band (MHz)	Graphs	Channel separation (kHz)	Minimum channel separation required (kHz)	Results
902 – 928	G18015235	100,00	25	Complies



## Graphs



Gandini 18015235

**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

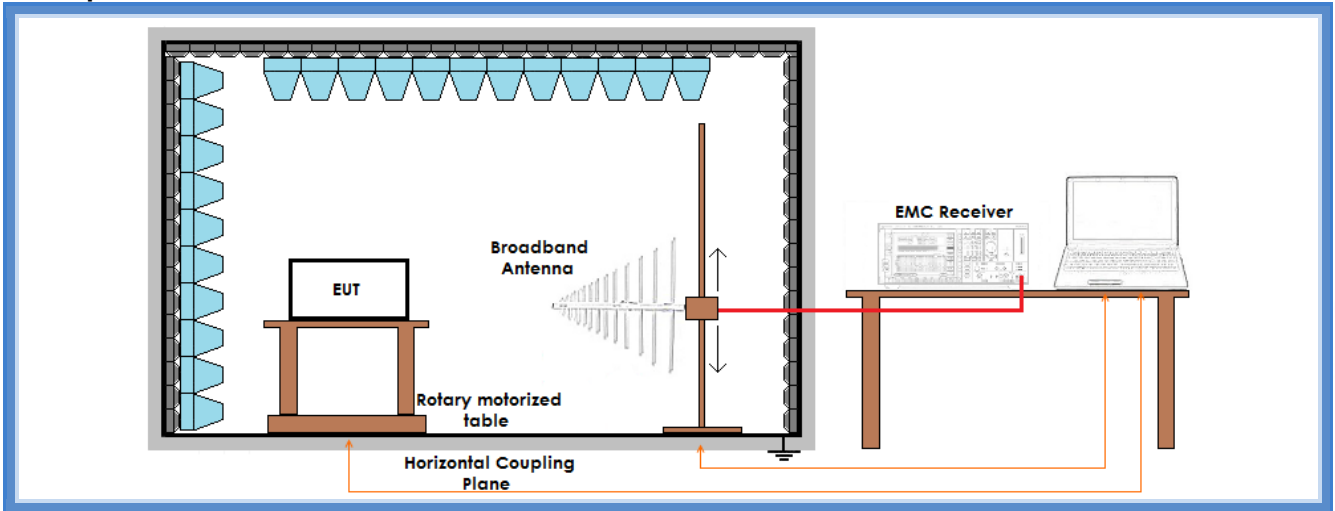
See FCC Part 15.247

### Environmental conditions

<i>Temperature (°C)</i>	<i>Atmospheric pressure (kPa)</i>	<i>Relative humidity (%)</i>
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 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 band (MHz)	Graphs	Number of hopping channels	Minimum number of hopping channels required	Results
902 – 928	G18015236	128	50	Complies

For laboratory tests at CMC, a special programming is provided; anyway we deem it representative of any real world hopping sequence that can be programmed into the devices.

First, special programming allows fixed frequency measurements at min, med and max operating frequency; this is not available for series production units, but is required for testing.

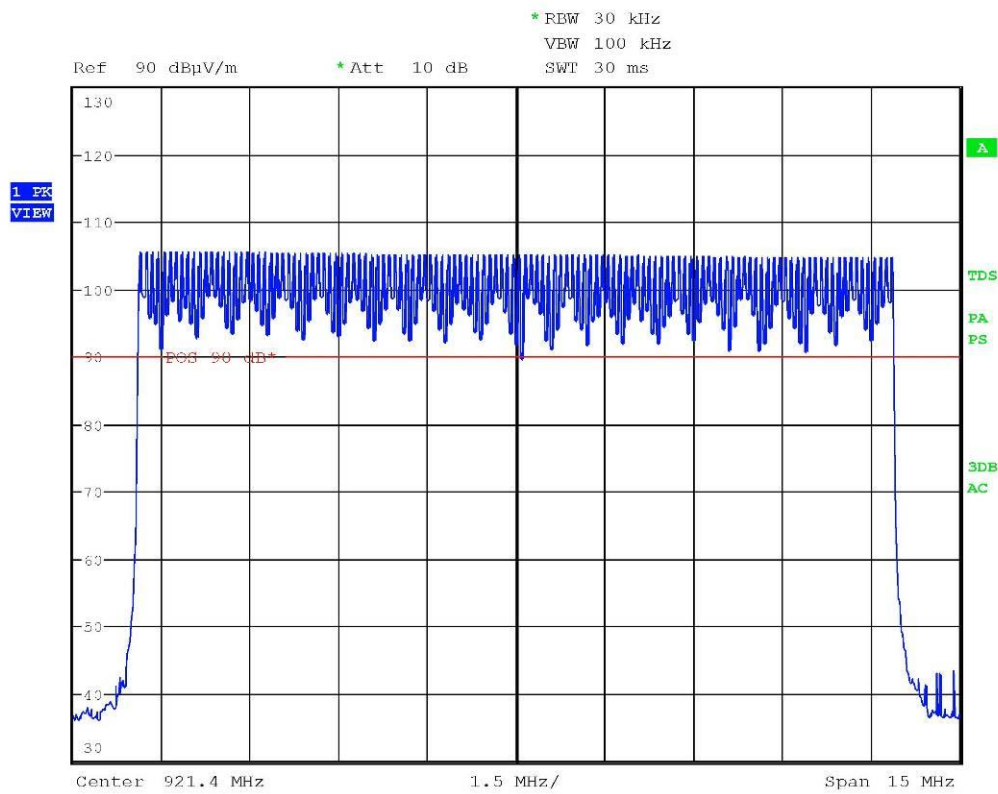
Then two evenly spaced hopping sequences of 64 channels are provided, one including the min freq channel at 915,050 MHz, the other including the max freq channel at 927,800 MHz.

Although they are not available for series production units, both these hopping sequences are suitable for valid measurements of FH timing parameters. In fact, FH Timing parameters measurements is not dependent on channel positioning





## Graphs



Gandini 18015236

**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

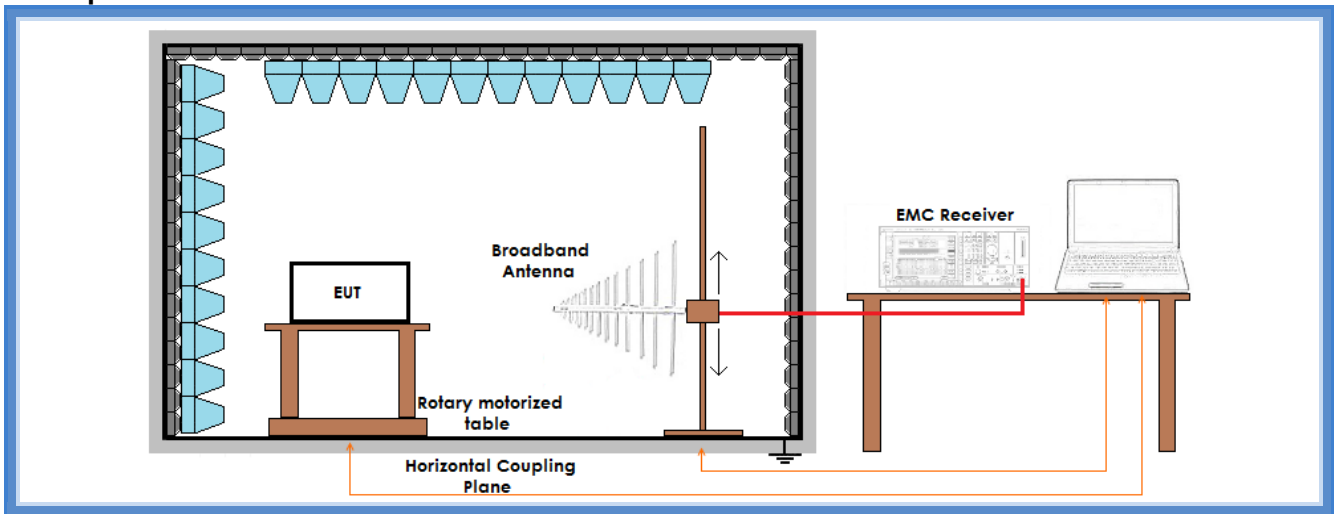
See FCC Part 15.247

### Environmental conditions

<i>Temperature (°C)</i>	<i>Atmospheric pressure (kPa)</i>	<i>Relative humidity (%)</i>
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)
927,00	G18015283	21,70

Frequency (MHz)	Graphs	Number of transmissions	Period
927,00	G18015282	5	20 s

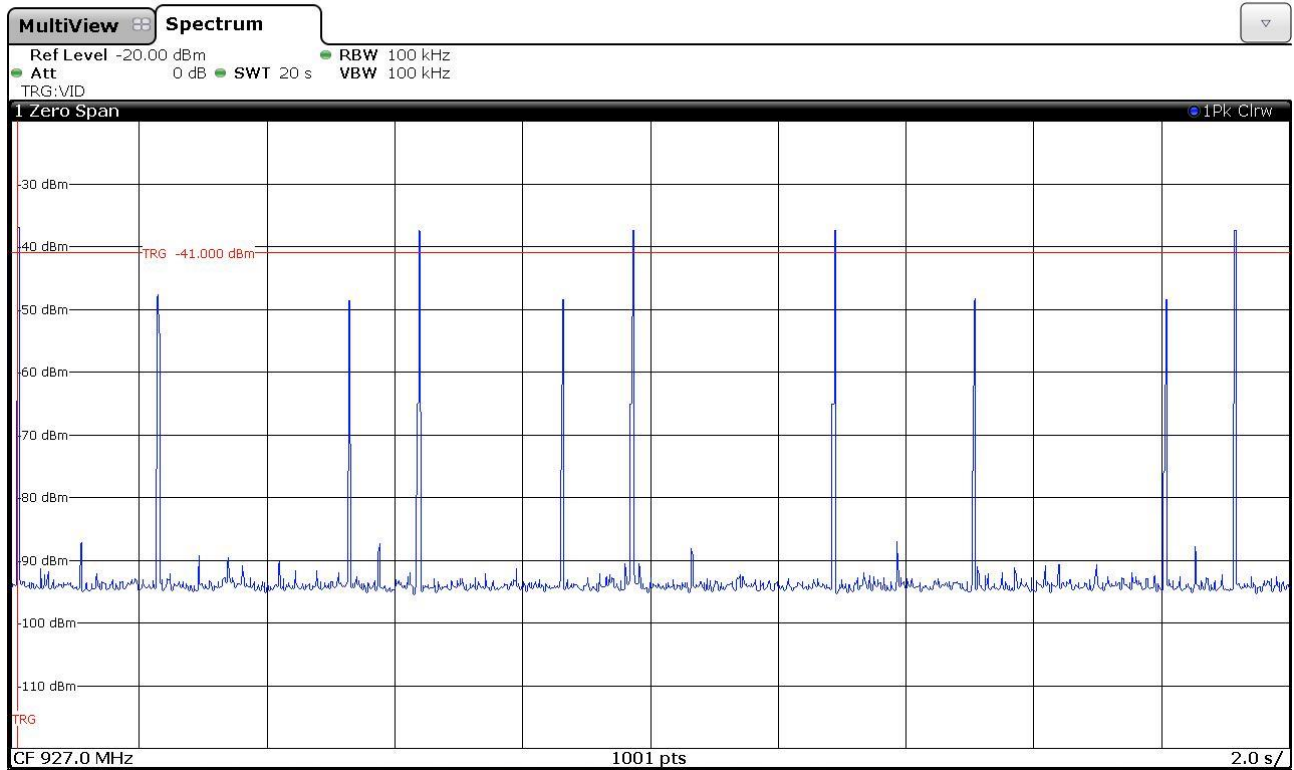
**Remarks:** only the highest peaks have been considered. The lowest peaks are due to the auxiliary receiver unit

Time of occupancy (Dwell time x Nr. transmissions)	Maximum allowed time of occupancy	Results
108,50	400 ms	Complies



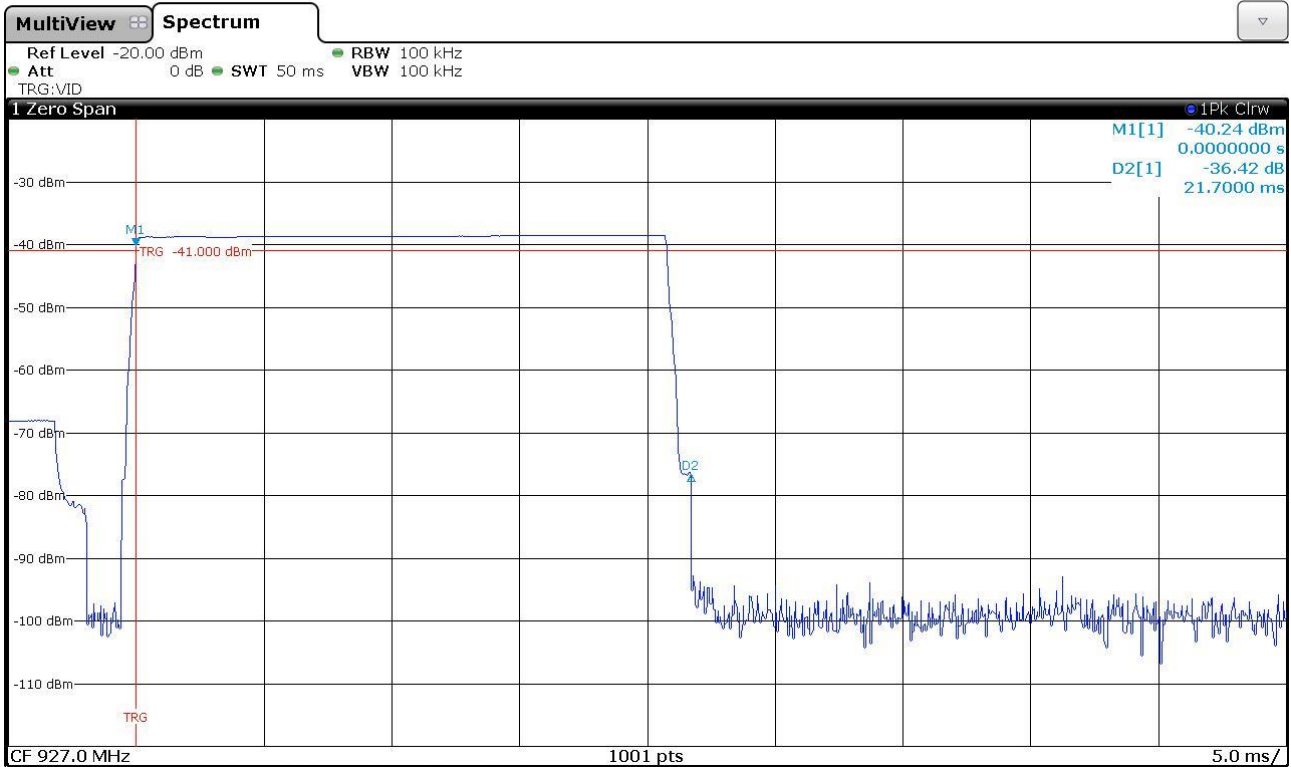
## Graphs

Gandini 18015282





Gandini 18015283



**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

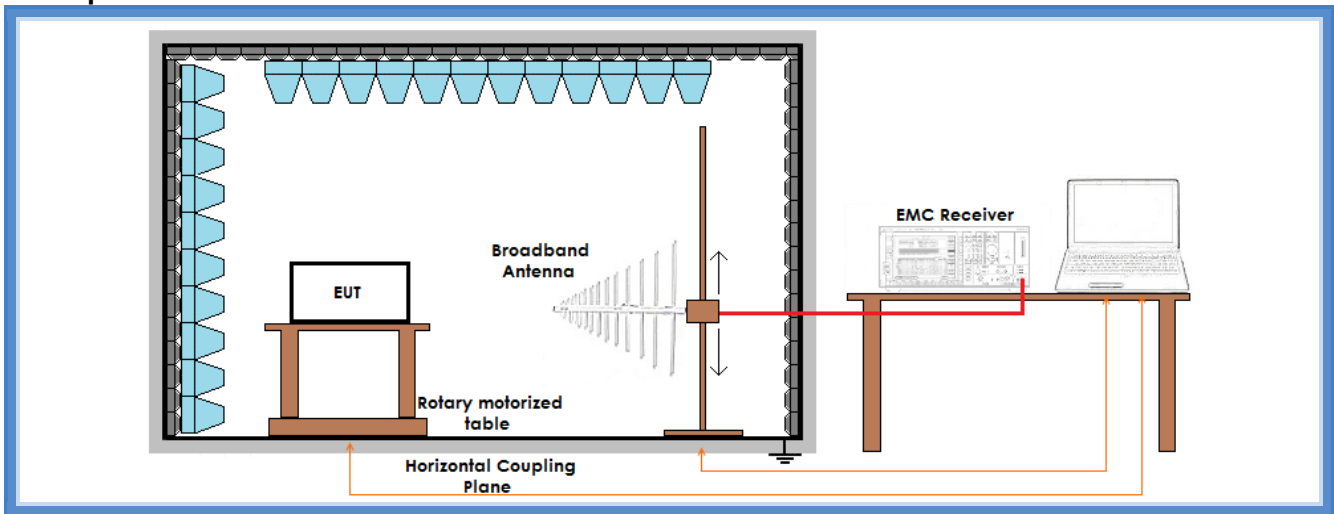
### Environmental conditions

<i>Temperature (°C)</i>	<i>Atmospheric pressure (kPa)</i>	<i>Relative humidity (%)</i>
22	100	45

**Acceptance limits:** operation within the band 900 – 928 MHz

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## Setup



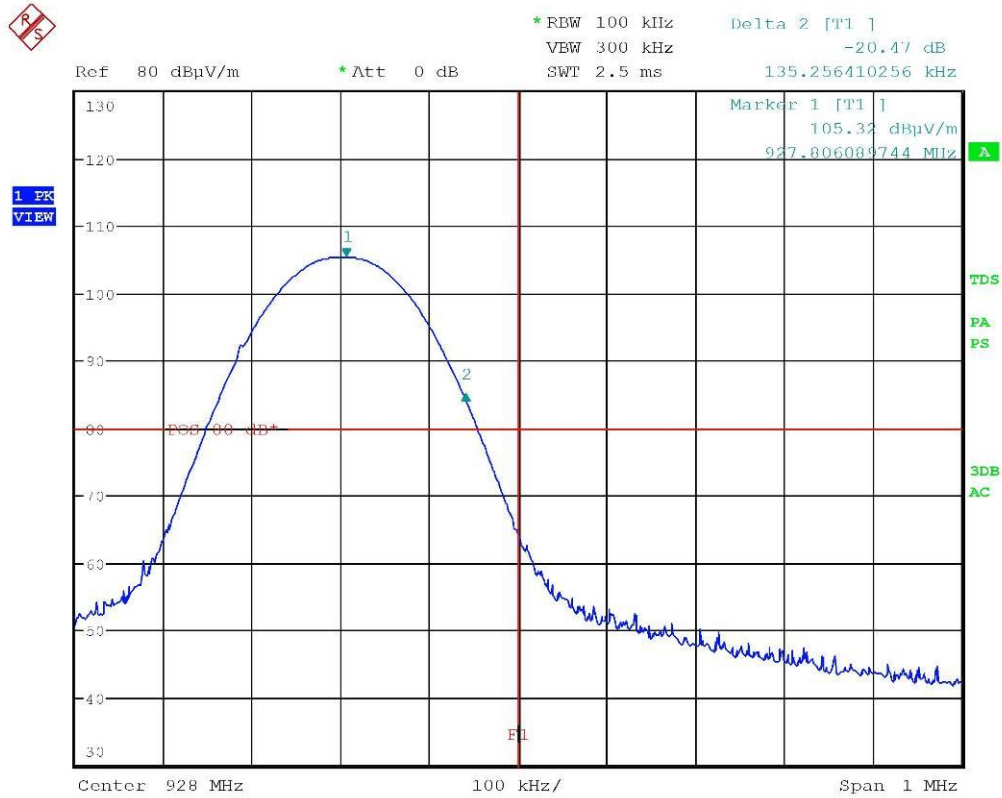
## Result

Frequency (MHz)	Graph(s) – Hopping	Results	
915,05	G18015232	F <sub>L</sub> : 914,9093 MHz	Complies
	G18015233		
	G18015234		
927,80	G18015226	F <sub>H</sub> : 928,0281 MHz	Complies
	G18015227		

Frequency (MHz)	Graph(s) – No hopping	Results	
915,05	G18015240	F <sub>L</sub> : 914,5897 MHz	Complies
	G18015241		
	G18015242		
927,80	G18015243	F <sub>H</sub> : 928,3500 MHz	Complies
	G18015244		
	G18015245		

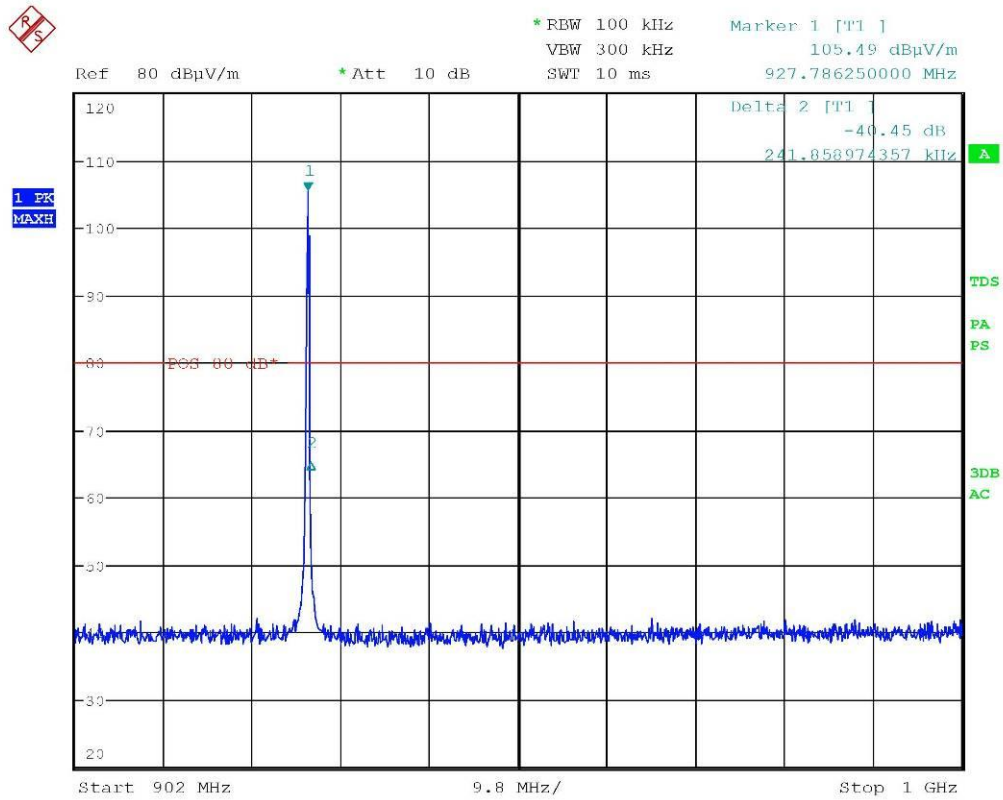


## Graphs



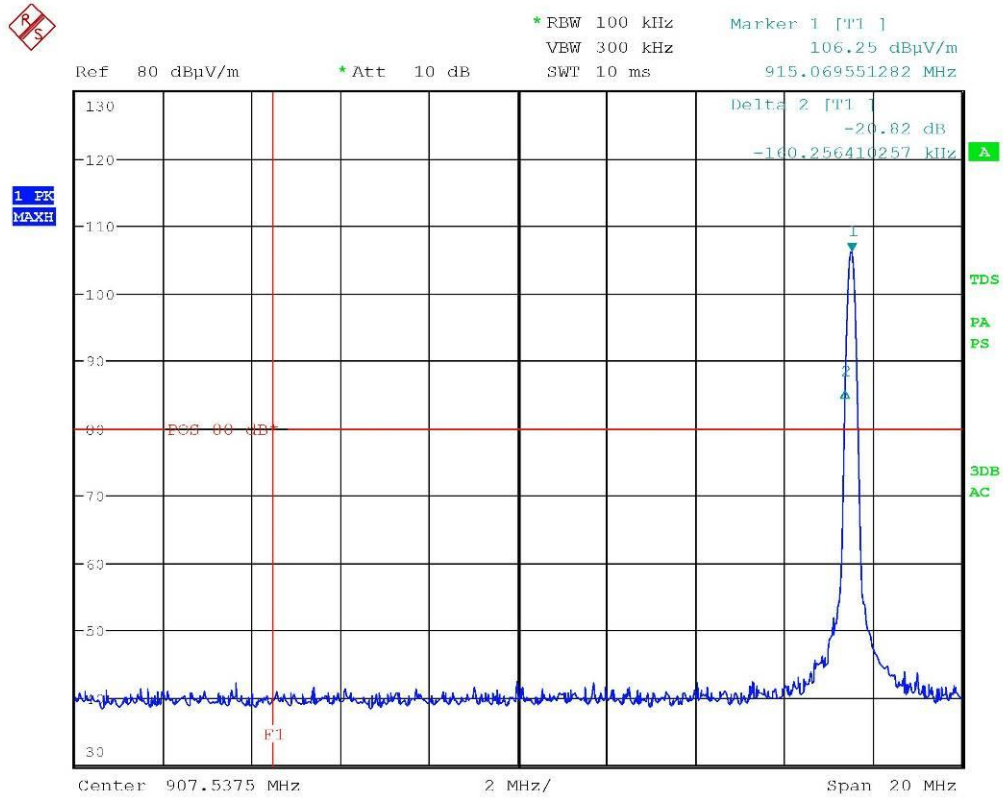
Gandini 18015226





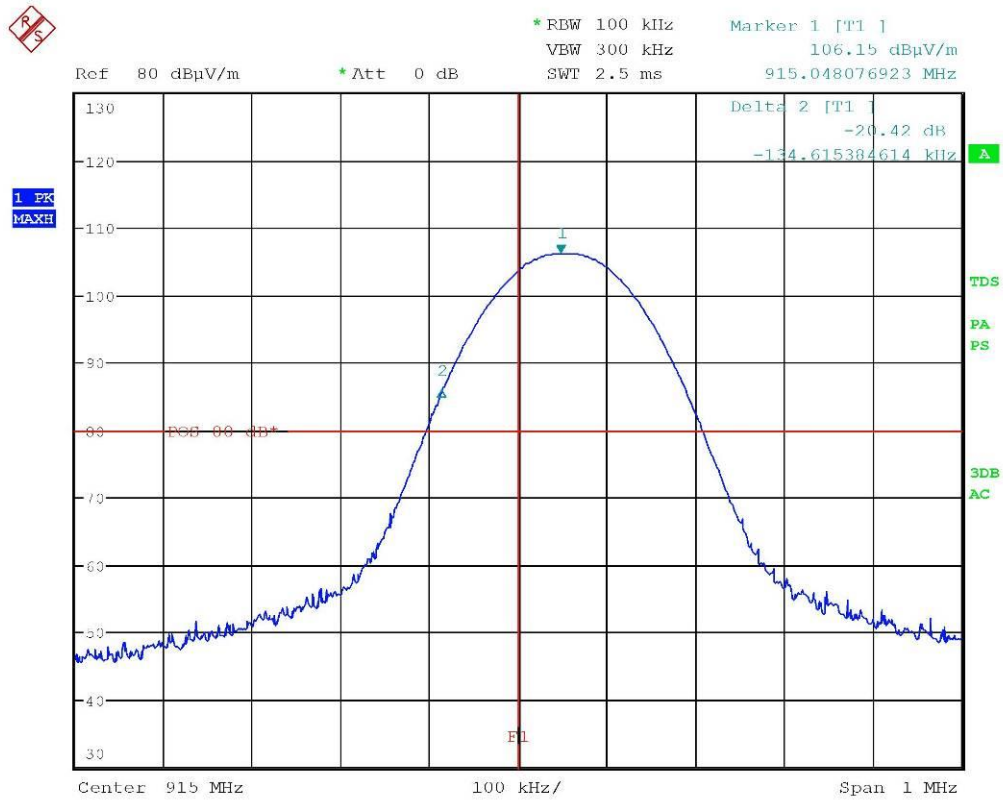
Gandini 18015227

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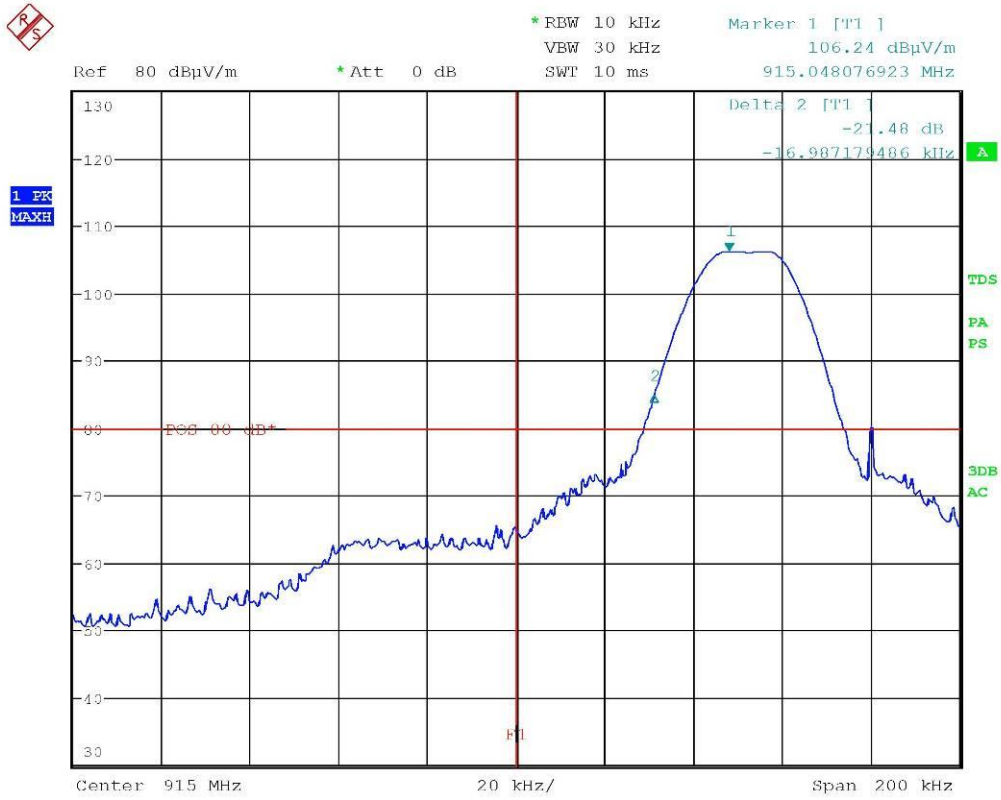
Gandini 18015232

CMC Centro Misure Compatibilità S.r.l.



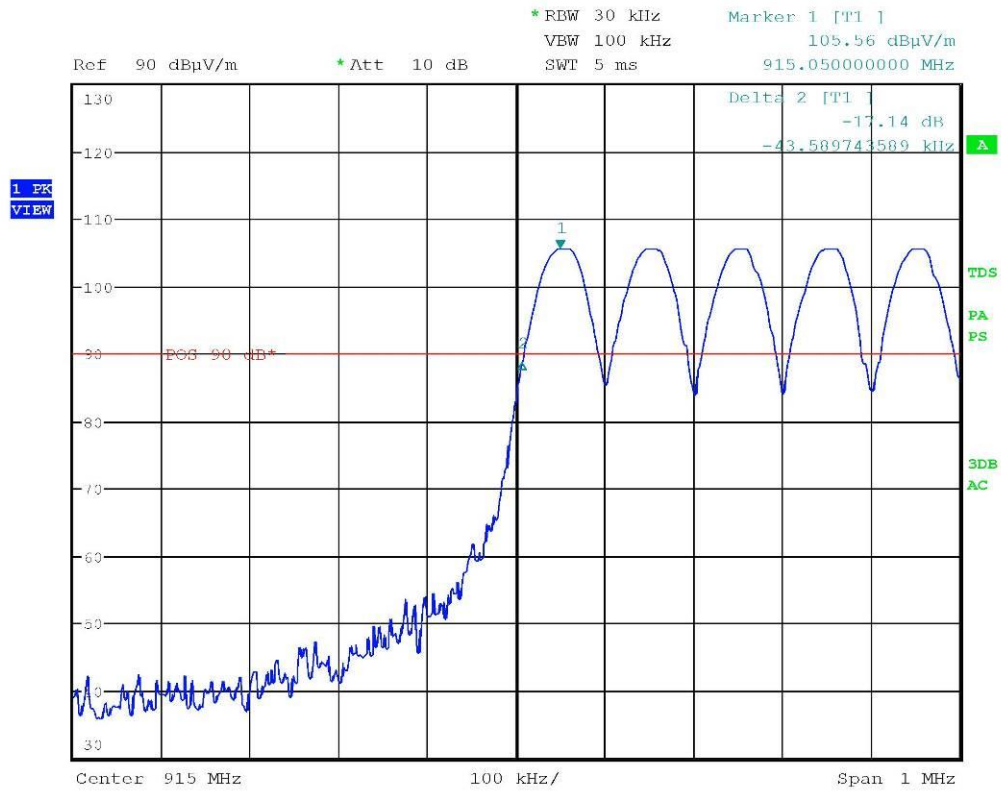
Gandini 18015233

CMC Centro Misure Compatibilità S.r.l.



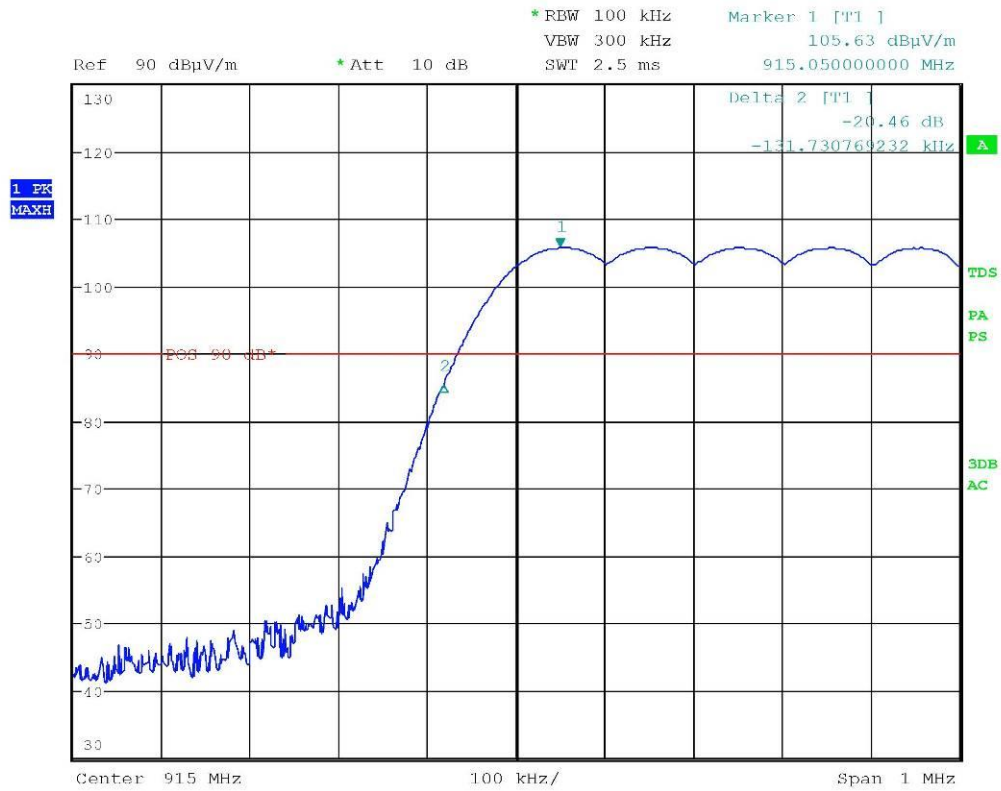
Gandini 18015234

CMC Centro Misure Compatibilità S.r.l.



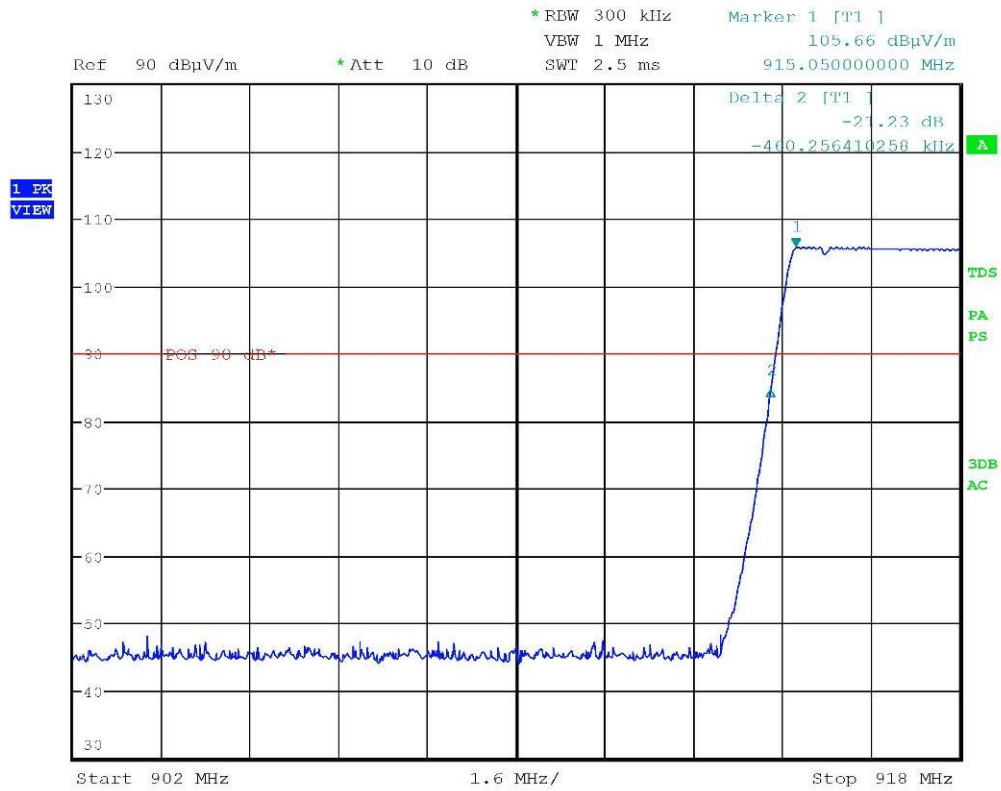
Gandini 18015240

CMC Centro Misure Compatibilità S.r.l.



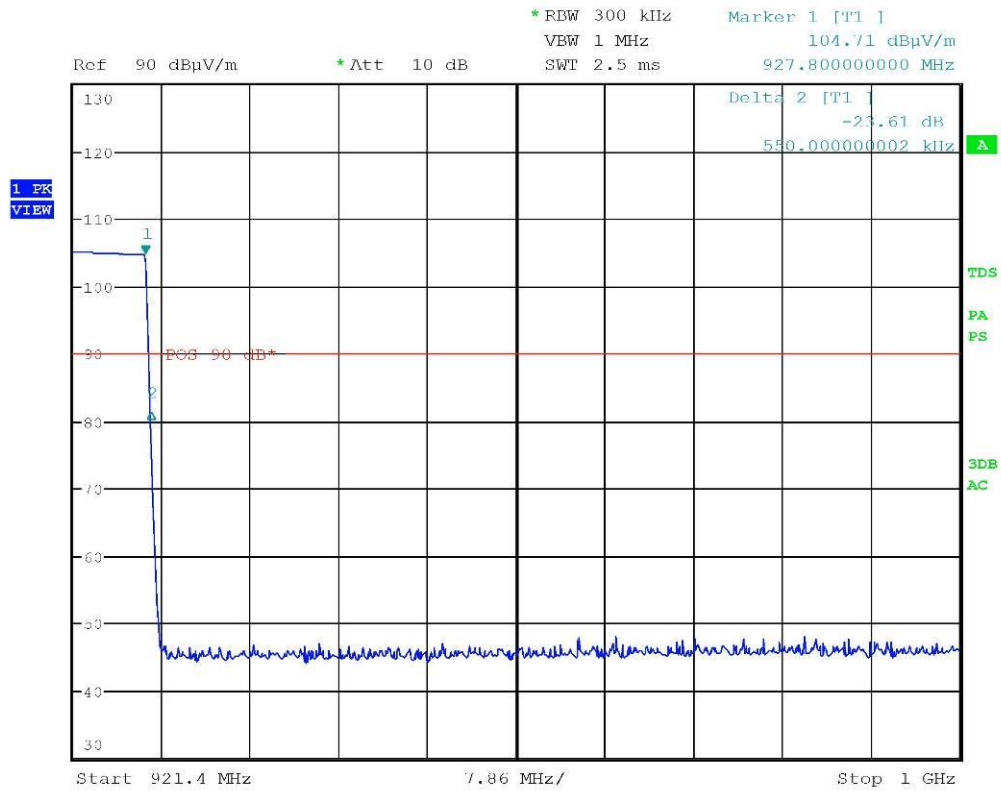
Gandini 18015241

CMC Centro Misure Compatibilità S.r.l.



Gandini 18015242

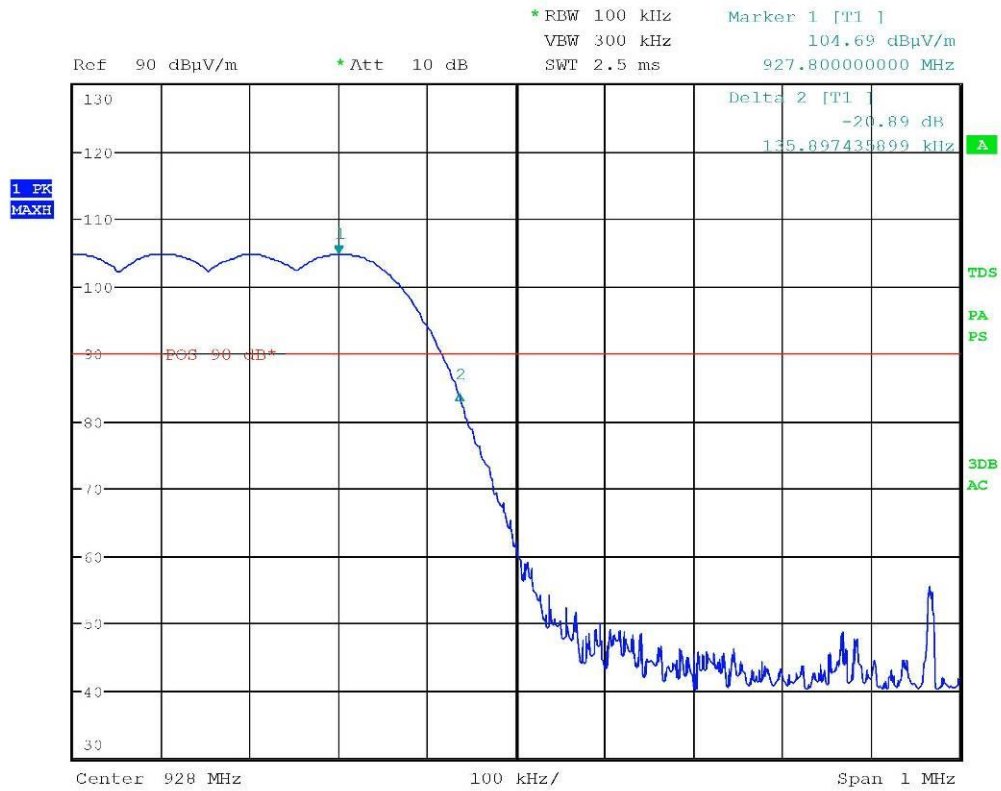
CMC Centro Misure Compatibilità S.r.l.



Gandini 18015243

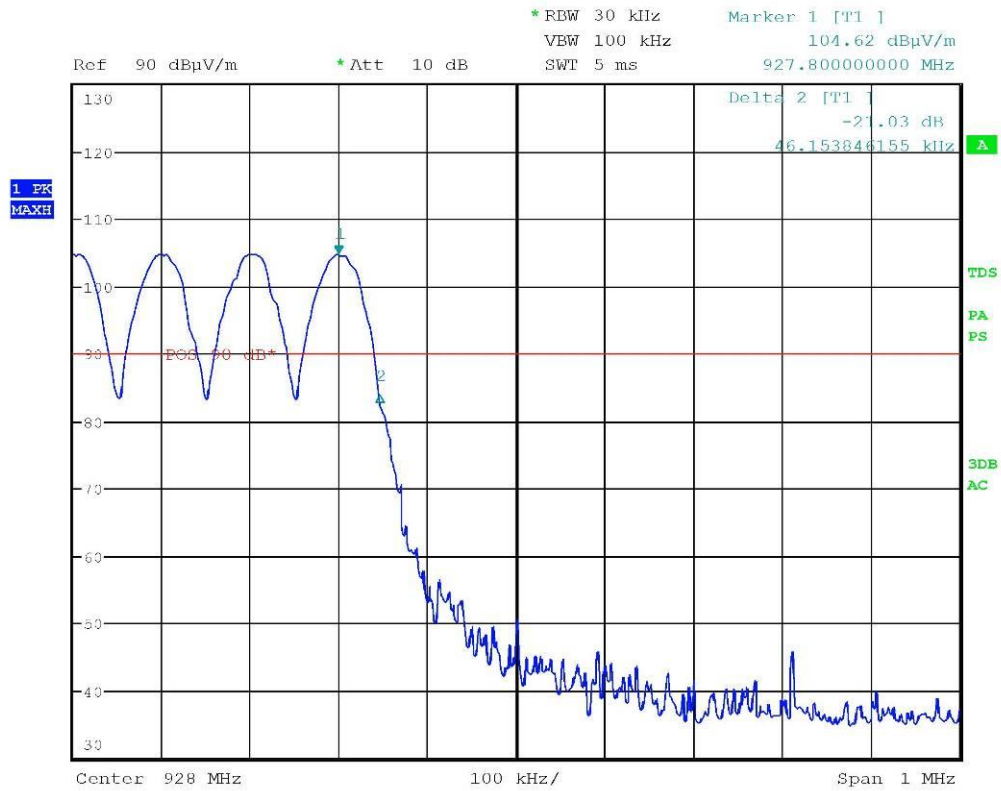
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Gandini 18015244

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Gandini 18015245

**Result:** The requirements are met

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## 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: Enclosure (conducted measurements are not applicable because the antenna connector is not available, see also cl. 3.0 of KDB 558074 D01 DTS Meas Guidance v03r02)

Antenna polarization: Horizontal (H) – Vertical (V)

EUT – Antenna distance: 10 m

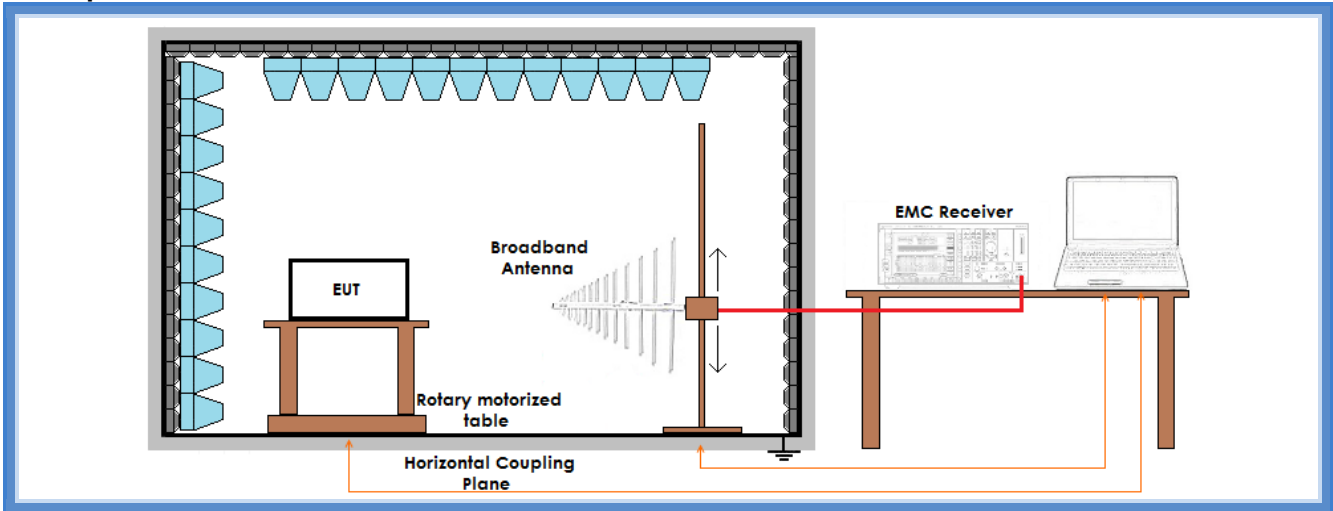
EUT height about the floor: 80 cm

### 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

Transmission channel (MHz)	Antenna polarization	Graphs	Measured level (dB $\mu$ V/m)	Peak Output Conducted Power (mW)
915,05	Worst case	G18015229	106,25	140,566
921,40	Worst case	G18015220	106,06	134,548
927,80	Worst case	G18015223	105,42	116,112

**Remarks:** the above table shows the results of radiated measurements, in agreement with cl. 3.0 of KDB 558074 D01 DTS Meas Guidance v04.

Conducted measurements are not applicable because the antenna connector is not available. The following formula, provided in document DA 00-705, has been used for the conversion between radiated to conducted values:

$$\text{Conducted value} = (E \times d)^2 / (30 \times G)$$

Where:

$E = (10^{(\text{dB}\mu\text{V}/\text{m})/20})/1000000$ , the maximum measured fundamental field strength in V/m

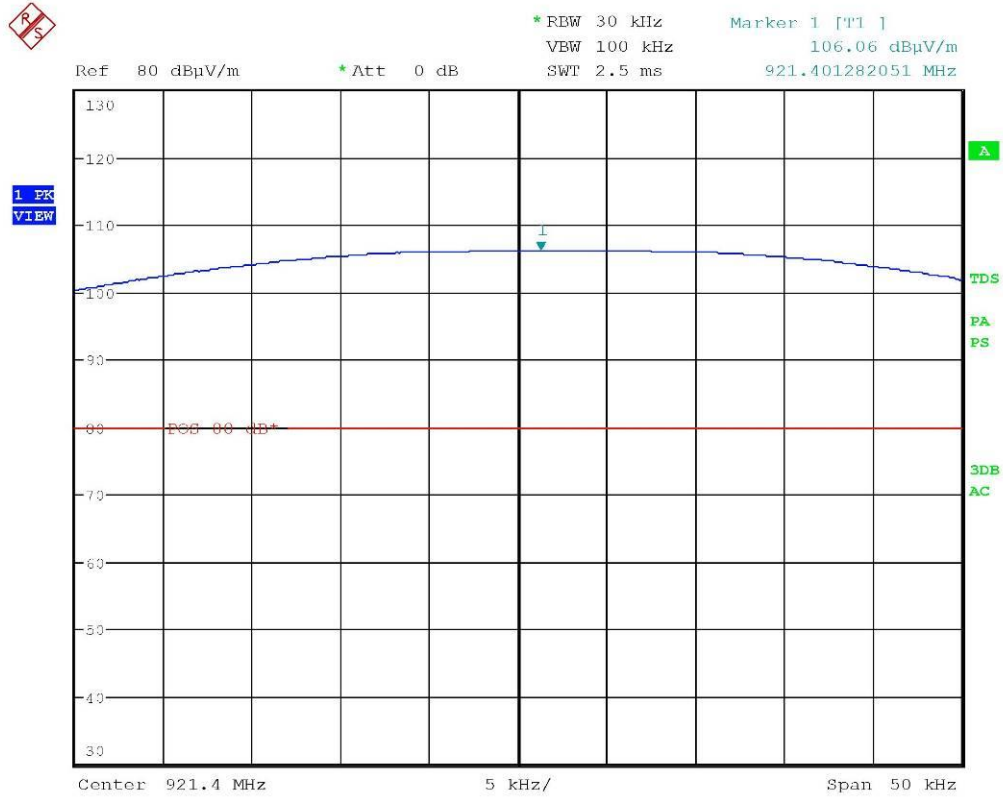
$G = 10^{\text{dBi}/10}$ , the numeric gain of the transmitting antenna: 1 (0 dBi)

$d$  = the distance in meters from which the field strength was measured (10 m)

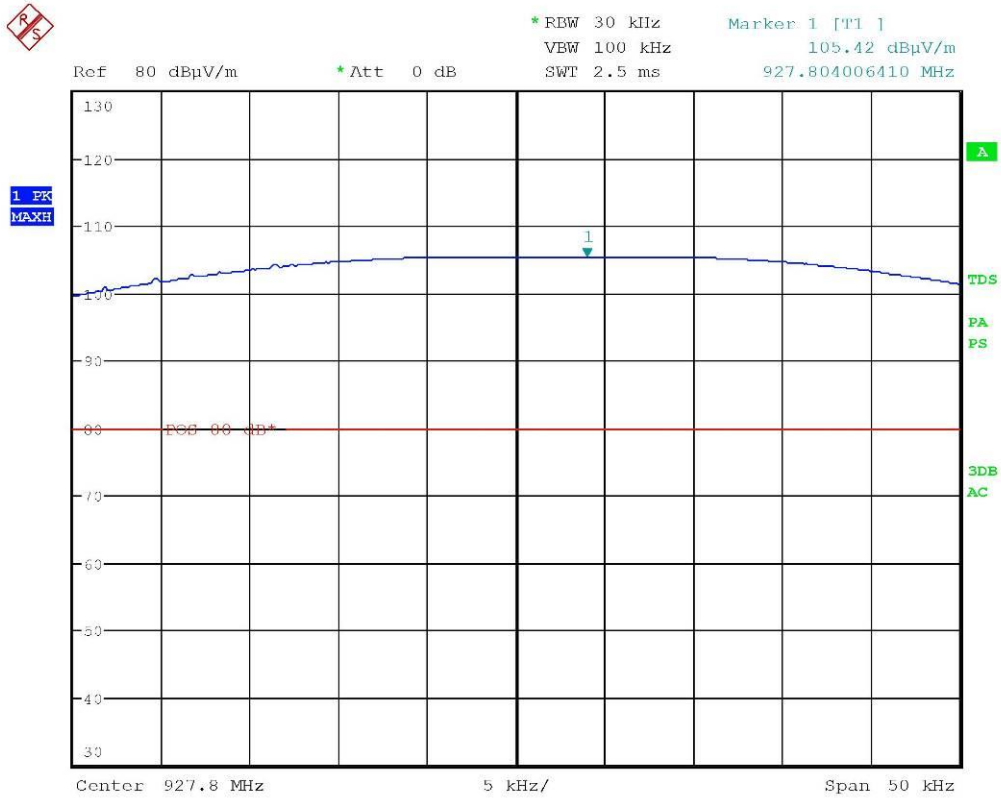
$P$  = the power in watts



## Graphs

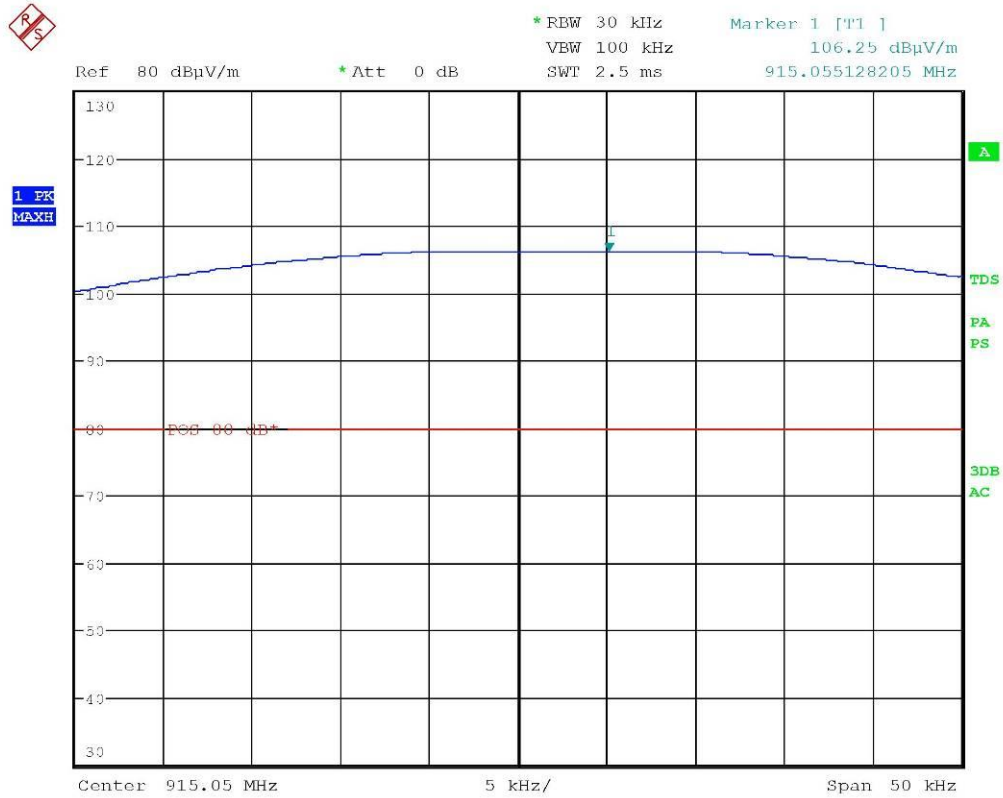


Gandini 18015220



Gandini 18015223

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Gandini 18015229

**Result:** The requirements are met

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## 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  $\leq$  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( $\mu$ V/m)]	Peak limits [dB( $\mu$ V/m)]
$>$ 1000	54	74





The restricted frequency bands are listed in the following table

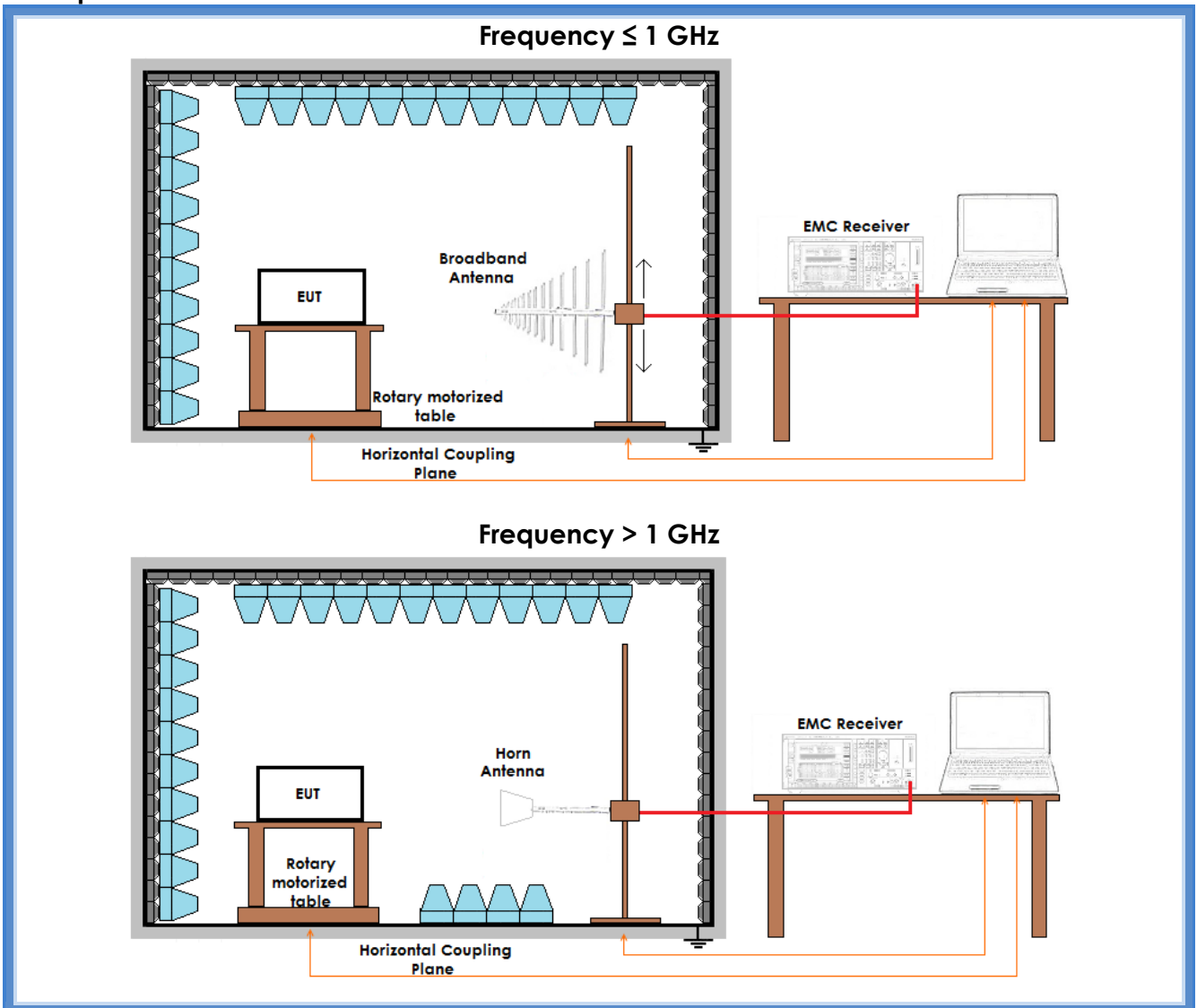
MHz	MHz	MHz	GHz
0,090 – 0,110	16,42 – 16,423	399,9 – 410	4,5 – 5,15
0,495 – 0,505	16,69475 – 16,69525	608 – 614	5,35 – 5,46
2,1735 – 2,1905	16,80425 – 16,80475	960 – 1240	7,25 – 7,75
4,125 – 4,128	25,5 – 25,67	1300 – 1427	8,025 – 8,5
4,17725 – 4,17775	37,5 – 38,25	1435 – 1626,5	9,0 – 9,2
4,20725 – 4,20775	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 $\mu$ V/m)	Limits (dB $\mu$ V/m)	Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	
II	47,25	54,00	46,63	54,00	48,21	54,00	Complies
III	42,66	54,00	46,04	54,00	More than 20 dB below limit	54,00	Complies
IV	40,54	54,00	39,93	54,00	More than 20 dB below limit	54,00	Complies
V	47,51	54,00	43,40	54,00	46,41	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 $\mu$ V/m as a worse case.



### Result – Peak detector

Harmonic	Lowest channel		Medium channel		Highest channel		Results
	Level (dBµV/m)	Limits (dBµV/m)	Level (dBµV/m)	Limits (dBµV/m)	Level (dBµV/m)	Limits (dBµV/m)	
II	50,12	74,00	49,97	74,00	51,09	74,00	Complies
III	More than 20 dB below limit	74,00	52,53	74,00	More than 20 dB below limit	74,00	Complies
IV	More than 20 dB below limit	74,00	49,01	74,00	More than 20 dB below limit	74,00	Complies
V	52,00	74,00	51,81	74,00	51,21	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 dBµV/m as a worse case.

**Result:** The requirements are met



## 11.10 RF Exposure Analysis

### Test set-up and execution

- KDB 447498 D01 cl. 4
- ANSI C63.10
- 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

Port: Enclosure

### Environmental conditions

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

### Acceptance limits:

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied

For 100 MHz to 6 GHz and test separation distances  $\leq 50$  mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. separation distance, mm})] \times \sqrt{f(\text{GHz})} \leq 3$  for 1-g SAR and  $\leq 7,5$  for 10-g SAR



MHz	5	10	15	20	25	mm
150	39	77	116	155	194	<i>SAR Test Exclusion Threshold (mW)</i>
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

10-g Extremity SAR Test Exclusion Power Thresholds are 2,5 times higher than the 1-g SAR Test Exclusion Thresholds indicated above.

## Result

Transmission channel (MHz)	Transmitting cycle duration (ms)	Transmission time (ms)	Graph	Duty cycle
927,00	59,90	23,60	G18015284	0,39

Transmission channel (MHz)	Measured QP level (dB $\mu$ V/m)	Peak Output Power (mW)	Maximum ERP Average level (mW)
915,05	106,25	140,566	54,82
921,40	106,06	134,548	52,47
927,80	105,42	116,112	45,28

**Remarks:** the maximum ERP average level is the maximum Peak Output Power level multiplied by the duty cycle value.

### Standalone 1-g head or body

Using separation distance of 20 mm with the formula above results:

$$(54,82 \text{ mW} / 20 \text{ mm}) * \sqrt{0,91505 \text{ GHz}} = 2,62 \leq 3$$

Thus for portable use the SAR exclusion condition is fulfilled and SAR evaluation is not required for separation distance of 20 mm or more



### Standalone 10-g extremity

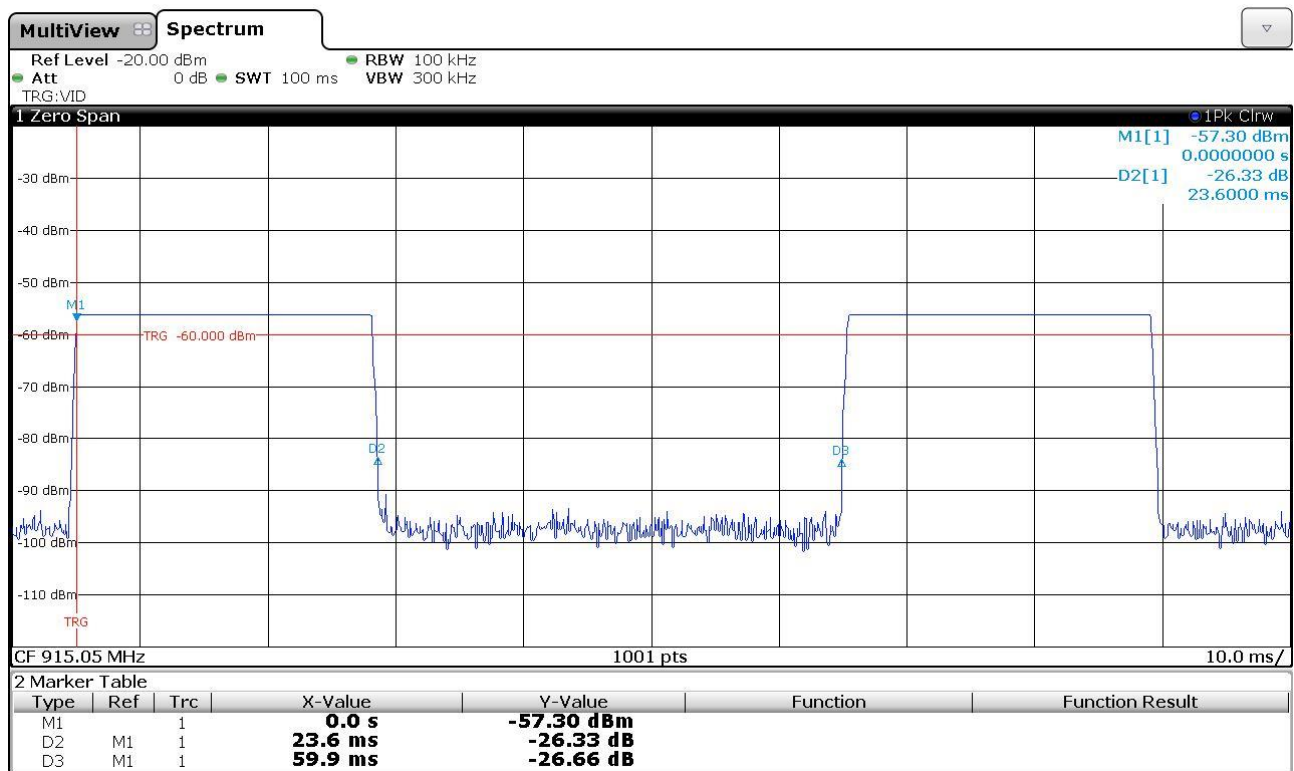
Using separation distance of 10 mm with the formula above results:

$$(54,82 \text{ mW} / 10 \text{ mm}) * \sqrt{0,91505 \text{ GHz}} = 5,24 \leq 7,5$$

Thus for portable use the SAR exclusion condition is fulfilled and SAR evaluation is not required for separation distance of 10 mm or more

### Graphs

Gandini 18015284



**Result:** The requirements are met