TÜVRheinland®	***Test Report nr.*** ***28112302 007***	ilac-MRA ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO **LAB N° 1356**

Test Report

47 CFR FCC Part 15 subpart C
Intentional Radiators

Report reference no. ..... :	28112302 007	
FCC Designation Number ..... :	IT0008	Firmato da:Roberto Radice Data: 10/10/2019 10:20:38
FCC Test Firm Registration # ..... :	804595	
Tested by (name + signature)…….:	Roberto Radice \ Tester	
Approved by (name + signature)……:	Giovanni Molteni \ TM	
Date of issue ..... :	October 07, 2019	
Total number of pages ..... :	138 Pages	
Testing Laboratory ..... :	TÜV Rheinland Italia S.r.l.	
Address ..... :	Via Mattei 3 - 20010 - Pogliano Milanese (MI) – Italy	
Applicant's name ..... :	Flextronics International Sweden AB	
Address ..... :	Datalinjen 3A – SE538 30 Linköping – Sweden	
Test item description ..... :	IoT rapid prototyping platform for development within Low Power Wide Area Network Technologies.	
Trade Mark ..... :	FLEX	
Manufacturer ..... :	Flextronics	
Model/Type reference ..... :	iENBL111B	
FCC ID ..... :	2AF5R-iENBL111B	
Ratings ..... :	Internal rechargeable battery 3,7V dc	
Sample ..... :		
Samples received on ..... :	06/11/2018	
TUV reference samples ..... :	180737 (sampled by the customer)	
Samples tested n. ..... :	1	
Testing ..... :		
Start Date: ..... :	08/11/2018	
End Date: ..... :	13/11/2018	

The results in this Test Report are exclusively referred to the tested samples. Without the written authorization of TÜV Rheinland Italia S.r.l., this document can be reproduced only integrally

SUMMARY

RELEASE CONTROL RECORD		
Test report Number	**Reason of change**	**Date of Issue**
28112302 001	Original release	2018-12-17
28112302 007	Remove RF exposure test; modified KDB version.	2019-10-07

1. Reference Standards

Standard	Description
FCC Part 15 (Subpart C)	§15.247 Operation within the bands 902-928 MHz, 2400-2483,5 MHz, and 5725-5850 MHz.
FCC Part 15 (Subpart C)	§15.207 Conducted Limits
FCC Part 15 (Subpart C)	§15.209 Radiated emission limits; general requirements
FCC Part 15 (Subpart C)	§15.203 Antenna Requirement
ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard for Testing Unlicensed Wireless Devices
558074 D01 DTS Meas Guidance v05r02 - April 2,2019	Guidance for performing compliance measurements on digital transmission systems (DTS) operating under §15.247

2. Summary of testing		
§ 15.203 § 15.247 (b)(4)(i)	Antenna Requirements	PASS
§ 15.207 (a)	Power Line Conducted Emission	N.A. [1]
§ 15.209 (a) (f)	Radiated Emission	PASS
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	PASS
§ 15.247 (d)	Out-of-band emissions	PASS
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	PASS
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications	
§ 15.247(a)	20 dB Bandwidth	PASS
§ 15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	PASS
§ 15.247(a)(1)(iii)	Number of Hopping Channels Used	PASS
§ 15.247(a)(1)(iii)	Time occupancy (Dwell Time) of Each Ch. within a 0,4 x Nch (sec) Period	PASS
§ 15.247(a)(2)	6dB Minimum Bandwidth	PASS
§ 15.247(b)	Maximum Peak Output Power	
§ 15.247(b) (1)	Peak Output Power (conducted)	PASS
§ 15.247(b) (3)	RF power output (conducted)	PASS
§ 15.247(b) (4)	Antenna gain	
§ 15.247I	Operation with directional antenna gains greater than 6 dBi	N.A. [2]
§ 15.247 I	Power Spectral Density	PASS
§ 15.247 (f)	Hybrid systems	PASS
§ 15.247 (g)	FHSS Transmission characteristics	PASS
§ 15.247 (h)	Recognition of occupied channel and multiple transmission system	N.A

Note 1	Equipment supplied with internal battery; no connection to AC Main Power.
Note 2	Antenna Gain <6dBi

Possible test case verdicts:

- test case does not apply to the test object ....: N/A
- test object does meet the requirement .....: PASS
- test object does not meet the requirement ....: FAIL

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

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"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma is used as the decimal separator.

3. General product information
IoT rapid prototyping platform for development within Low Power Wide Area Network Technologies.
4. General Chipset information
Chipset type: Semtech SX1276
5. General Antennas information
Planar inverted F-antenna (PCB trace); Gain: -0,03 dBi

6. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	IoT rapid prototyping platform for development within Low Power Wide Area Network Technologies.	FLEX	iENBL111B	---
AE	PC	DELL	---	Used to set LORA Module

Note:

* Use :

EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

No other Auxiliary/Associated Equipment was connected/installed on the EUT

7. Input/Output Ports

CONNECTIONS

Port		Description	Connection	Cable lenght
1	Enclosure	Non conductive surface	Closed by 4 metallic screws	---
2	AC Power Port	Port not present		
3	DC Power Port	DC	Internal rechargeable battery 3,7V	---

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
WN = Wired Network

8. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	3,7 dc	---	---	DC	---	---

9. EUT Operation Modes	
Operation mode	**Description**
#1	Continuous LORA Modulation RF Transmission (DSS) RF setting during tests: Frequency: 902,3MHz (low channel); 908,7MHz (mid channel); 914,9MHz (high channel); Modulation: LORA; Bandwidth: 125kHz; Spreading Factor (SF): 7, 8, 9 and 10
#2	Continuous LORA Modulation RF Transmission (DSS) RF setting during tests: Frequency: Hopping mode from channel 1 (902,3MHz) to channel 64 (914,9MHz)
#3	Continuous LORA Modulation RF Transmission (DTS) RF setting during tests: Frequency: 903MHz (low channel); 907,8MHz (mid channel); 914,2MHz (high channel); Modulation: LORA; Bandwidth: 500kHz; Spreading Factor (SF): 8

LORA frequency (Transmission) DSS – Declared by applicant

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	**902,3 MHz**	2	902,5 MHz	3	902,7 MHz	4	902,9 MHz
5	903,1 MHz	6	903,3 MHz	7	903,5 MHz	8	903,7 MHz
9	903,9 MHz	10	904,1 MHz	11	904,3 MHz	12	904,5 MHz
13	904,7 MHz	14	904,9 MHz	15	905,1 MHz	16	905,3 MHz
17	905,5 MHz	18	905,7 MHz	19	905,9 MHz	20	906,1 MHz
21	906,3 MHz	22	906,5 MHz	23	906,7 MHz	24	906,9 MHz
25	907,1 MHz	26	907,3 MHz	27	907,5 MHz	28	907,7 MHz
29	907,9 MHz	30	908,1 MHz	31	908,3 MHz	32	908,5 MHz
33	**908,7 MHz**	34	908,9 MHz	35	909,1 MHz	36	909,3 MHz
37	909,5 MHz	38	909,7 MHz	39	909,9 MHz	40	910,1 MHz
41	910,3 MHz	42	910,5 MHz	43	910,7 MHz	44	910,9 MHz
45	911,1 MHz	46	911,3 MHz	47	911,5 MHz	48	911,7 MHz
49	911,9 MHz	50	912,1 MHz	51	912,3 MHz	52	912,5 MHz
53	912,7 MHz	54	912,9 MHz	55	913,1 MHz	56	913,3 MHz
57	913,5 MHz	58	913,7 MHz	59	913,9 MHz	60	914,1 MHz
61	914,3 MHz	62	914,5 MHz	63	914,7 MHz	64	**914,9 MHz**

LORA frequency (Transmission) DTS – Declared by applicant

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	**903,0 MHz**	2	904,6 MHz	3	906,2 MHz	4	**907,8 MHz**
5	909,4 MHz	6	911,0 MHz	7	912,6 MHz	8	**914,2 MHz**

10. EUT Configuration Modes

Description
iENBL111B supplied with internal battery (fully charged)

Par.	test	EUT Operation Modes
§ 15.203 § 15.247 (b)(4)(i)	Antenna Requirements	#1 #2 #3
§ 15.209 (a) (f)	Radiated Emission 9kHz-30MHz	#1 #3
§ 15.209 (a) (f)	Radiated Emission 30MHz-1GHz	#1 #3
§ 15.209 (a) (f)	Radiated Emission 1GHz-10GHz	#1 #3
§ 15.215 (a) (b) (c)	Additional provisions to the general radiated emission limitations	#1 #3
§ 15.247 (d)	Out-of-band emissions	#1 #3
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	#1 #2 #3
§ 15.247 (a)	Frequency Hopping Spread Spectrum Specifications	
§ 15.247(a)	20 dB Bandwidth	#1
§ 15.247(a)(2)	6 dB minimum Bandwidth	#3
§ 15.247(a)(1)	Carrier frequency (Hopping Channel) Separation	#2
§ 15.247(a)(1)(iii)	Number of Hopping Channels Used	#2
§ 15.247(a)(1)(iii)	Time occupancy (Dwell Time) of Each Ch. within a 0,4 x Nch (sec) Period	#2
§ 15.247(b) (1)	Peak Output Power (conducted)	#1
§ 15.247(b) (3)	Peak Output Power (conducted)	#3
§ 15.247 I	Power Spectral Density	#3
§ 15.247 (g)	FHSS Transmission characteristics	#2

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBµV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBµV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

11. Test Conditions and Results

11.1 TEST: Antenna requirements			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	56%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	Enclosure	
Equipment mode:	Operation mode	#1 #2 #3	
FCC Standard	§15.203 § 15.247 (B)(4)(I)		

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 Sections 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 Section 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 specifications	
N° of authorized antenna types	1
Antenna type	Planar inverted F-antenna (PCB trace)
Maximum total gain	-0.03 dBi
External power amplifiers	Not present

11.2 TEST: Radiated Emission		**PASS**
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C
	Relative Humidity (%)	54%
	Air pressure (hPa)	1020
—	Power Supply / Frequency	Application Point
Fully configured sample tested at the power line frequency	+3,7V dc	Enclosure
Equipment mode:	Operation mode	#1 #3
FCC Standard	§15.205; §15.209; §15.247	

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

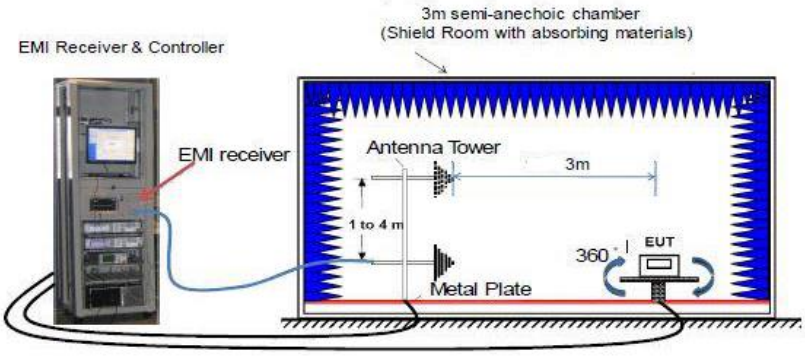
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

Remark: In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is:Extrapolation (dB) = 40log (300meter / 3meter) = +80db Extrapolation (dB) = 40log (30meter / 3meter) = +40db

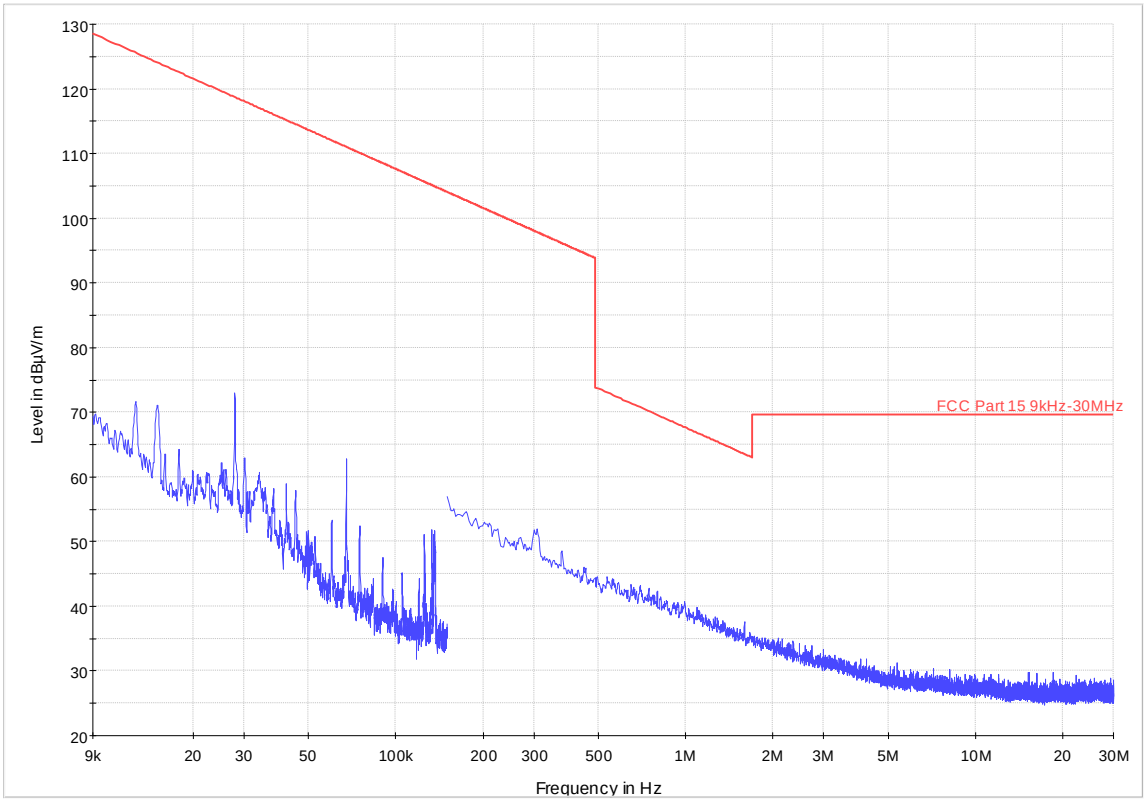
Further information to test setup.

For frequencies above 1GHz, the anechoic material is also placed on the metallic floor between EUT and Antenna

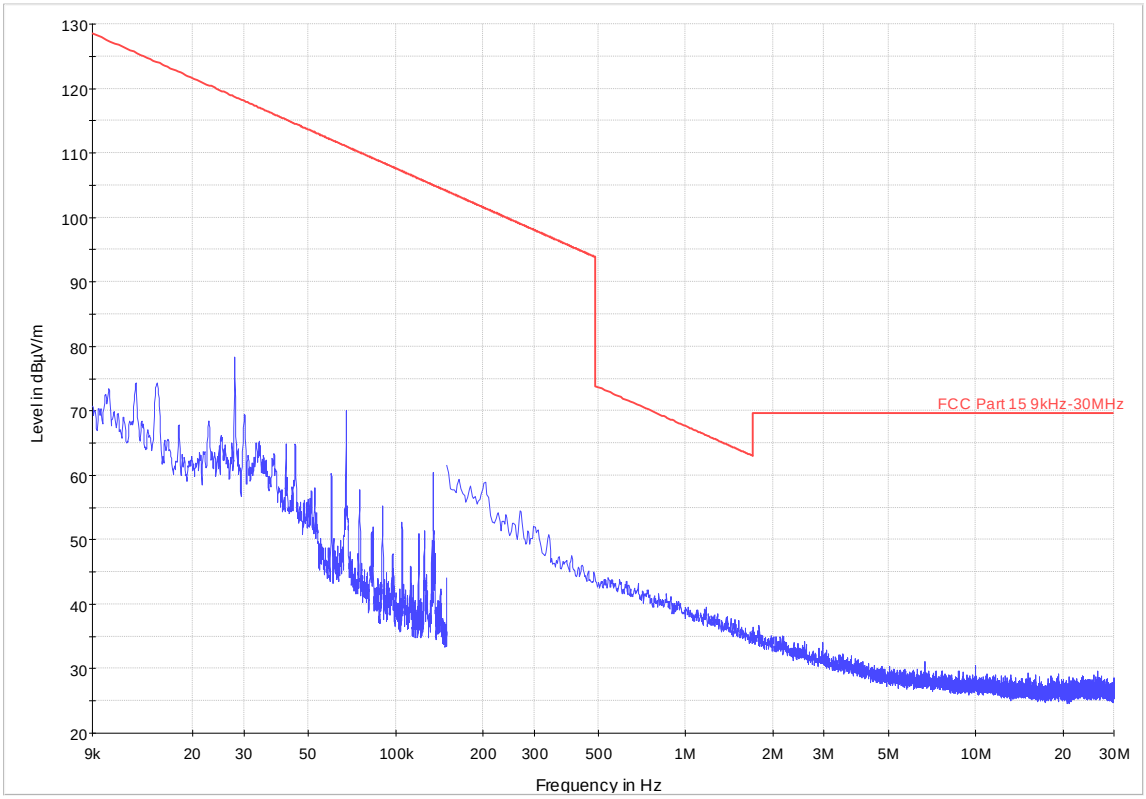


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	05/2017	05/2019
EMI Test Receiver	R&S	ESW44	87020967	06/2018	06/2019
Loop Antenna	EMCO	6512	87020465	02/2017	02/2020
Antenna BiConiLog	ETS Lindgren	3124E-PA	87020457	04/2017	04/2020
Antenna Horn with Preamplifier	ETS Lindgren	3117-PA	87020458	04/2017	04/2020
Highpass Filter	Wainwright Instr.	WHKX10-1170-1300	87020800	05/2018	05/2019
Stabilized Power Supply	Elettrotest	TPS/T 20KW	87010277	09/2018	09/2021

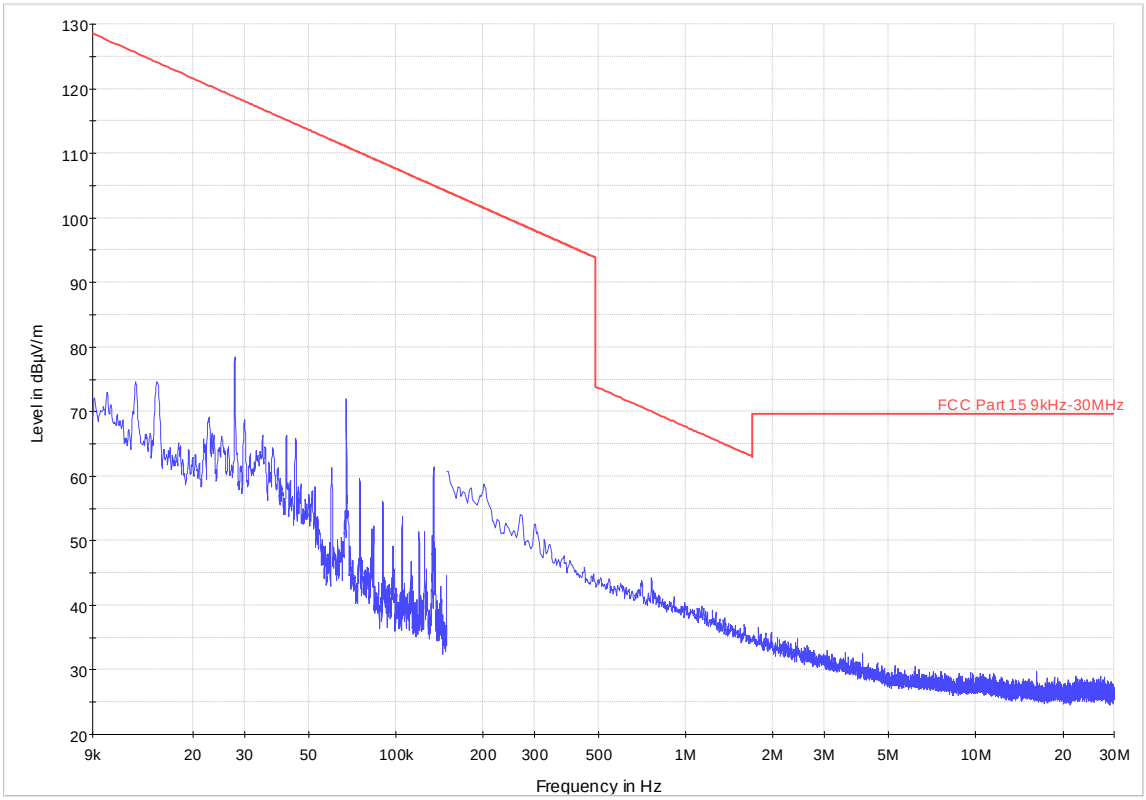
Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 7 (worst case)
Frequency: 9kHz – 30MHz



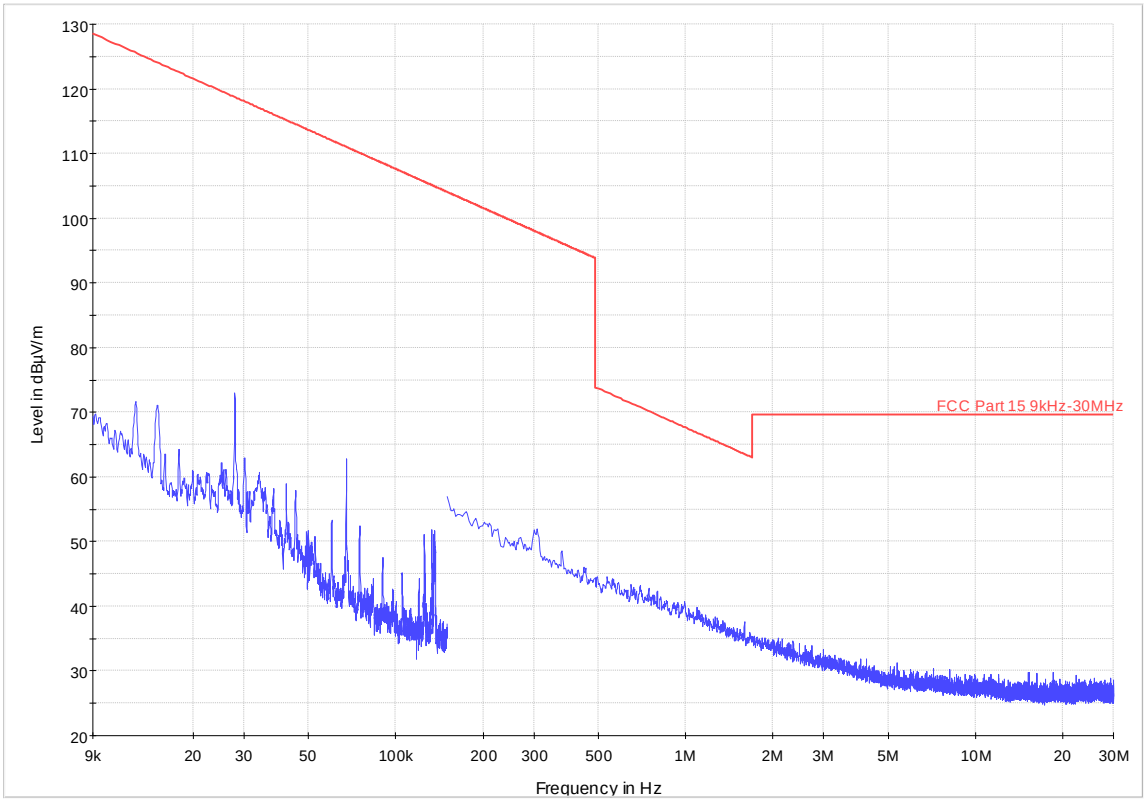
Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 7 (worst case)
Frequency: 9kHz – 30MHz



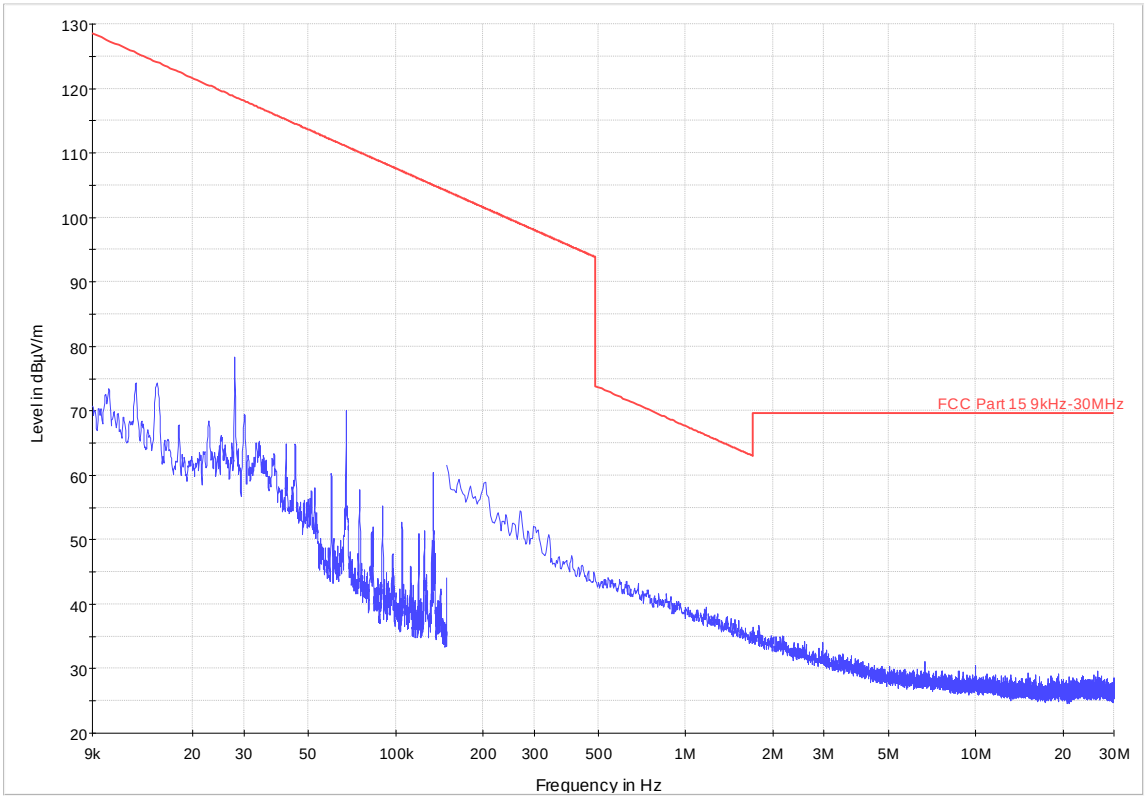
Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 7 (worst case)
Frequency: 9kHz – 30MHz



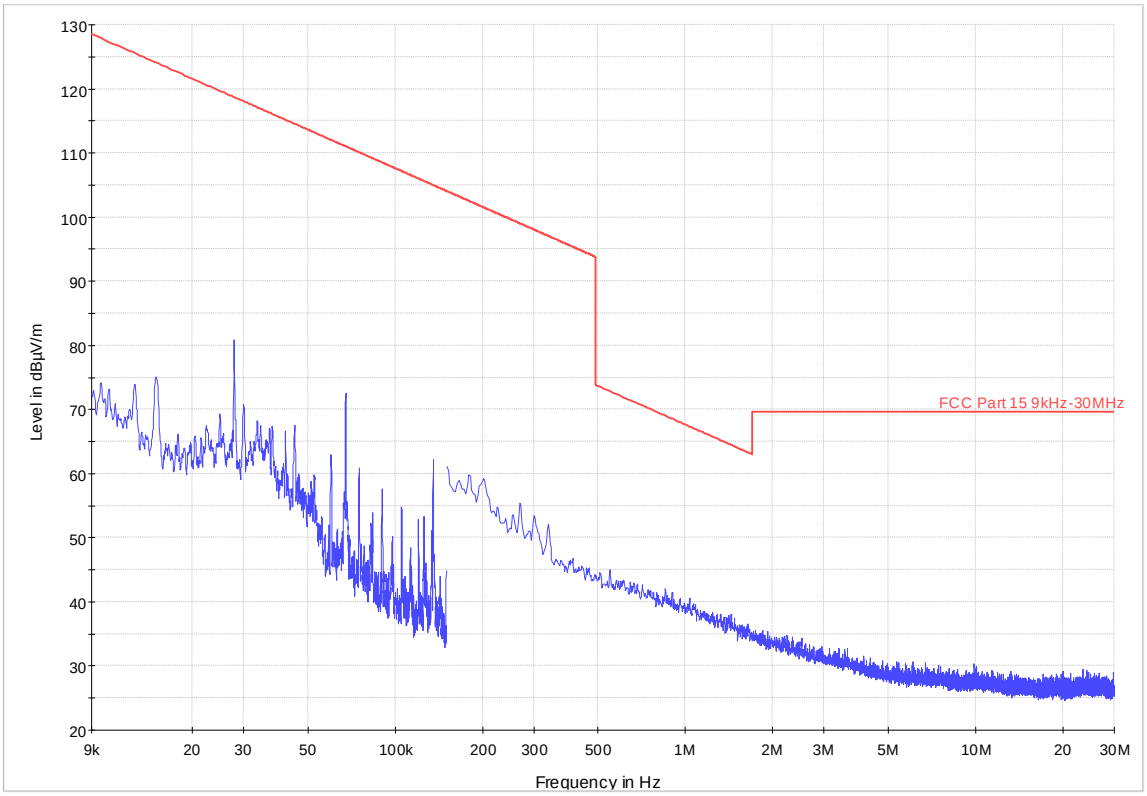
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Low Channel (903,0 MHz) – SF 8
Frequency: 9kHz – 30MHz



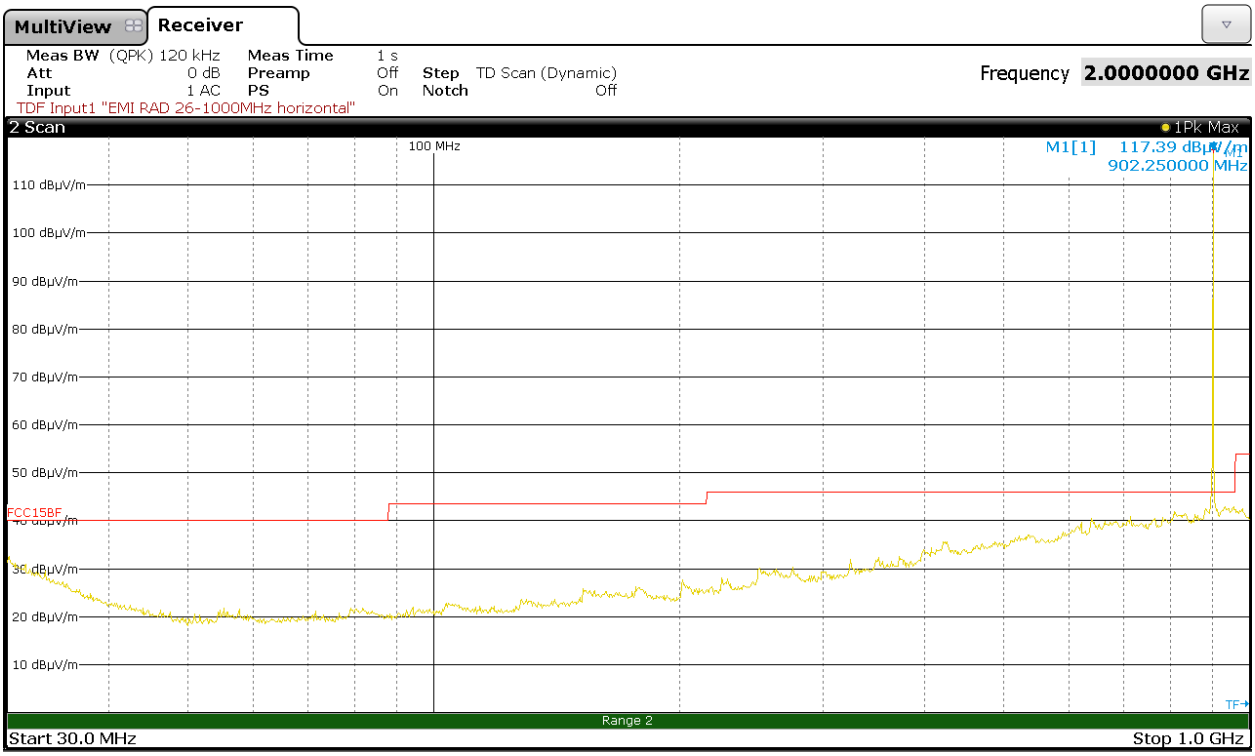
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Middle Channel (907,8 MHz) – SF 8
Frequency: 9kHz – 30MHz



Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – High Channel (914,2 MHz) – SF 8
Frequency: 9kHz – 30MHz

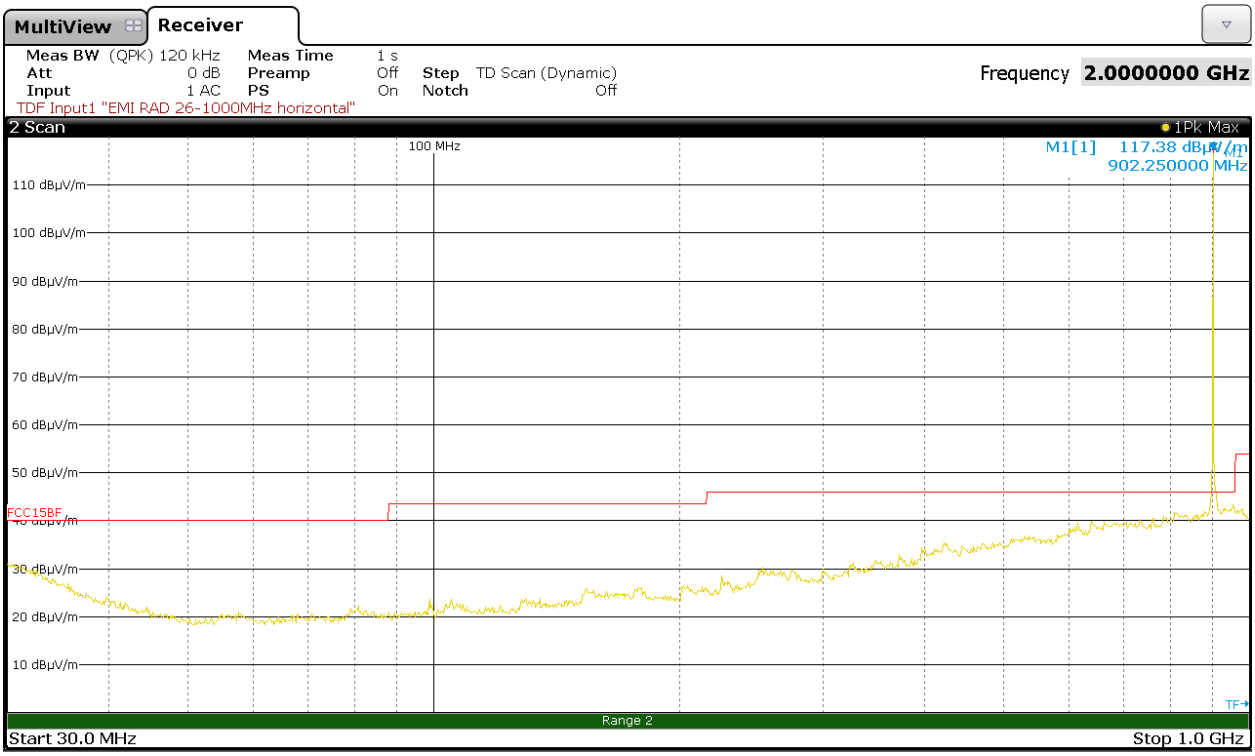


Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 7
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



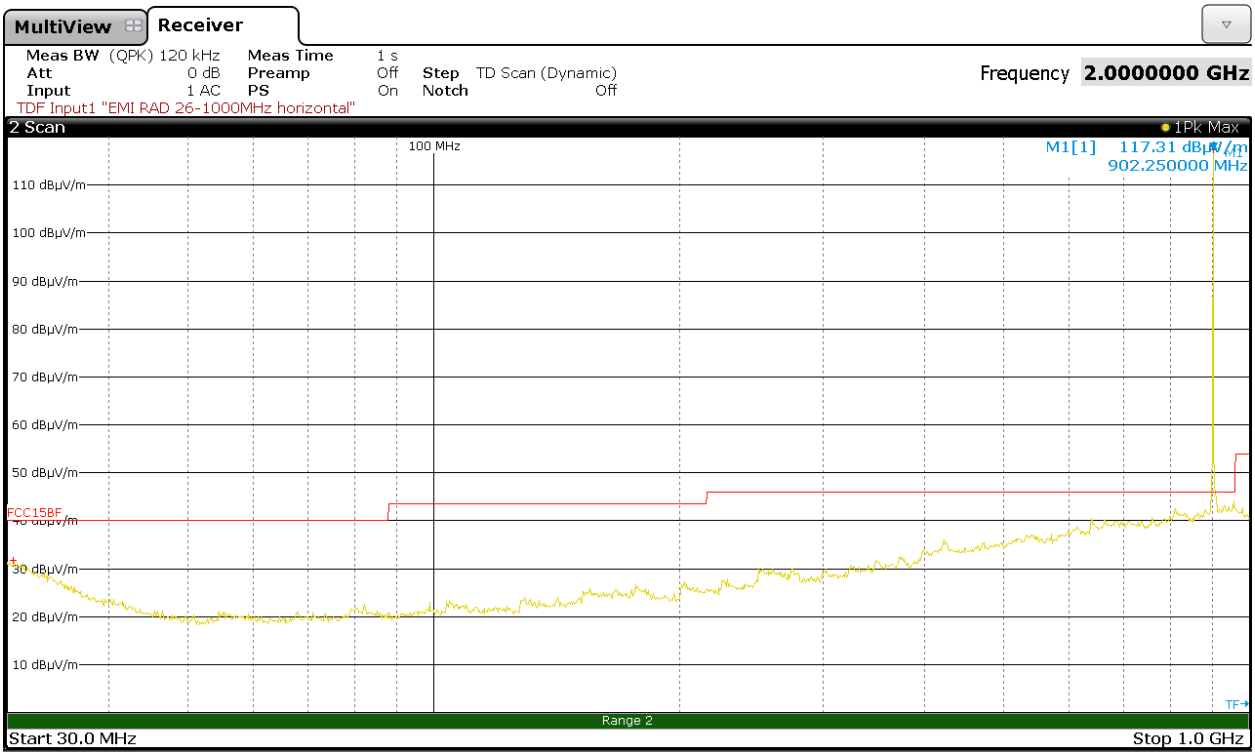
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
902,25 (fundamental)	90,15	23,77	3,47	Not present	**117,39**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 8
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



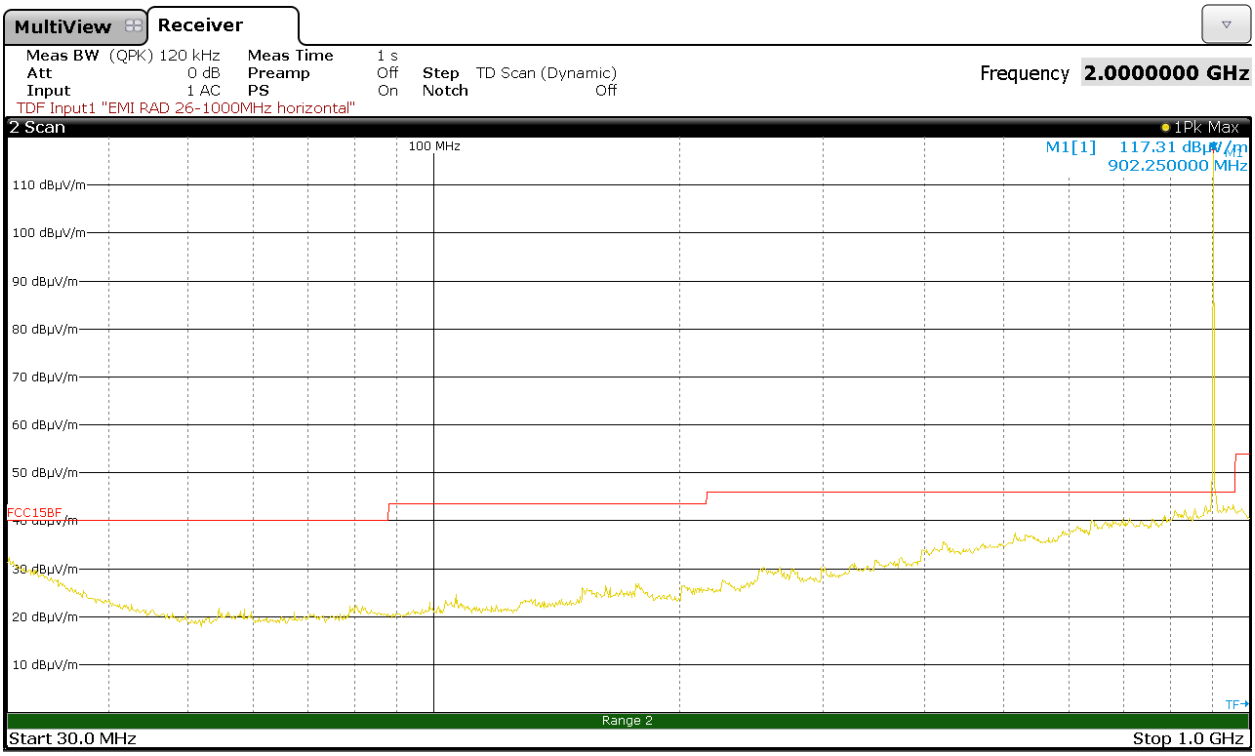
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
902,25 (fundamental)	90,14	23,77	3,47	Not present	**117,38**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 9
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



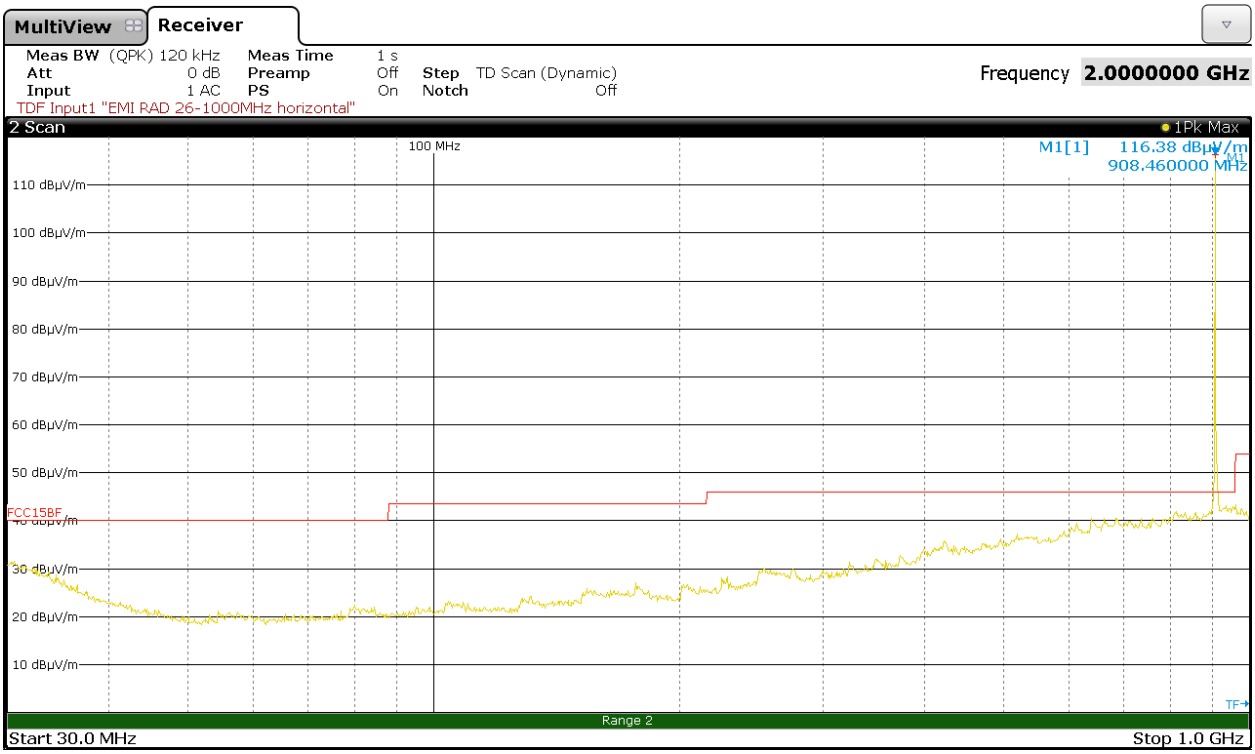
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
902,25 (fundamental)	90,07	23,77	3,47	Not present	**117,31**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 10
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



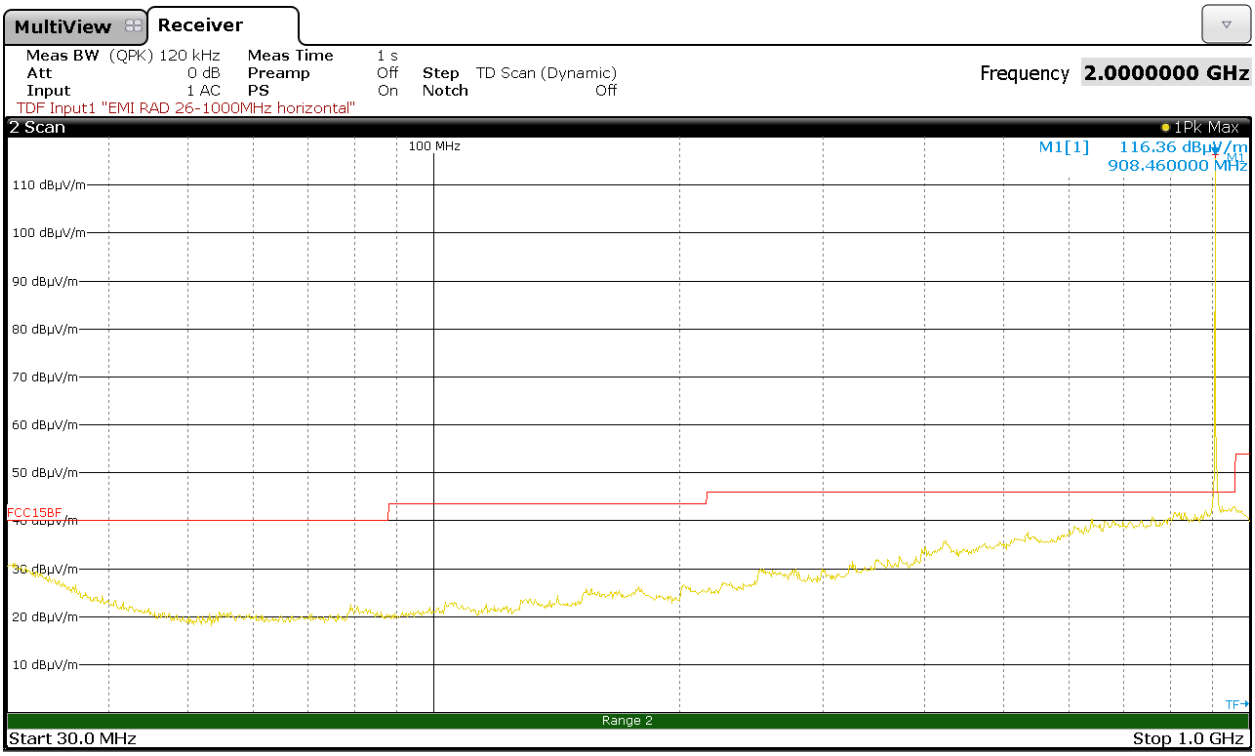
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
902,25 (fundamental)	90,07	23,77	3,47	Not present	**117,31**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 7
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



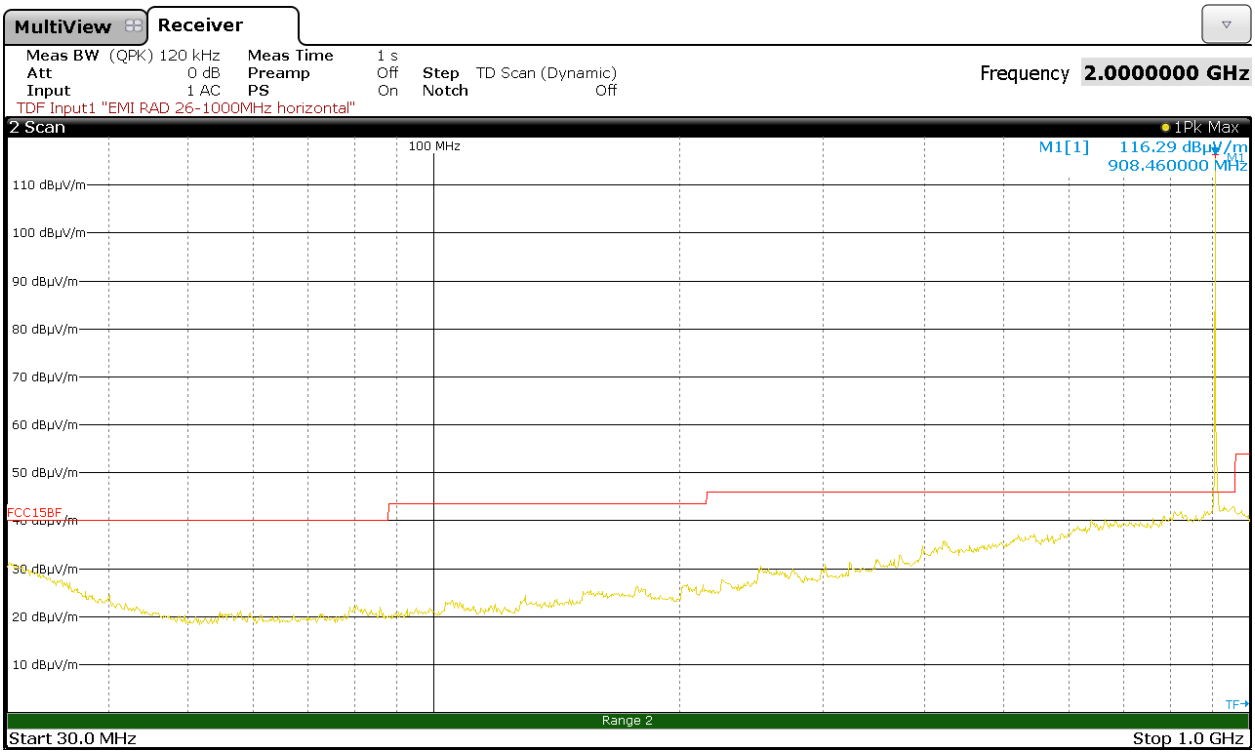
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
908,46 (fundamental)	88,85	24,06	3,47	Not present	**116,38**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 8
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



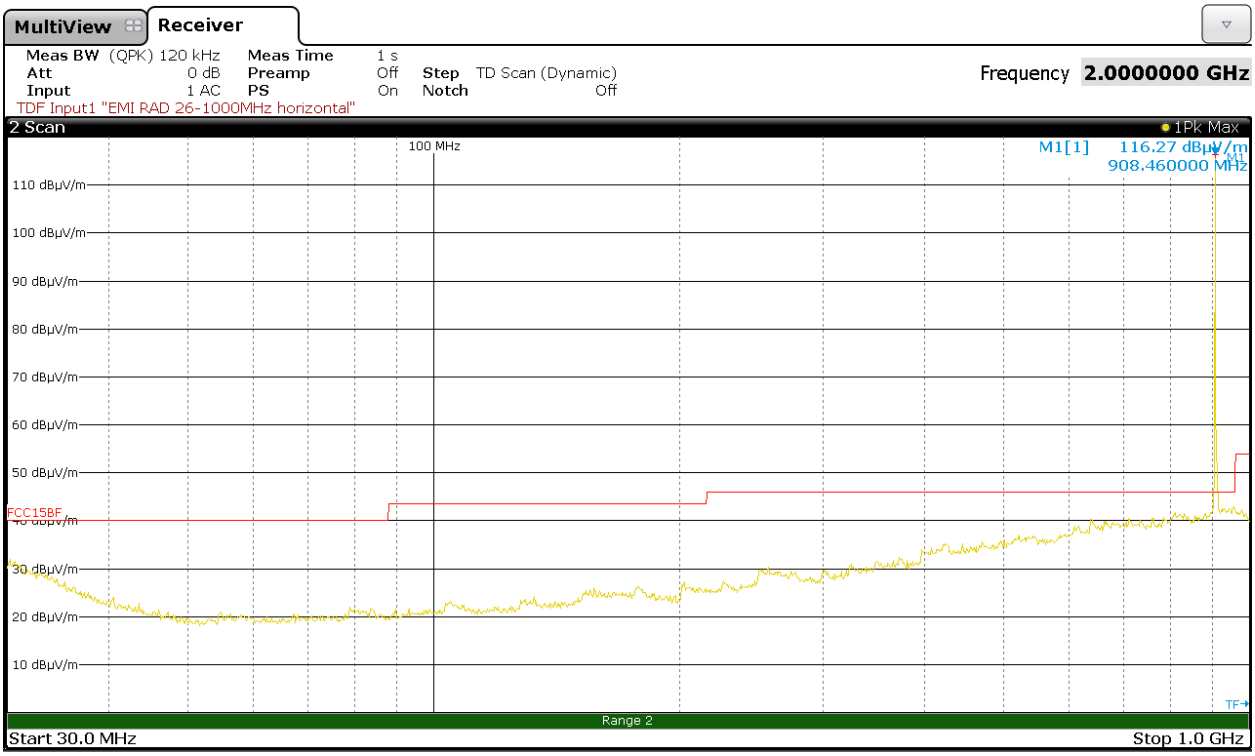
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
908,46 (fundamental)	88,83	24,06	3,47	Not present	**116,36**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 9
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



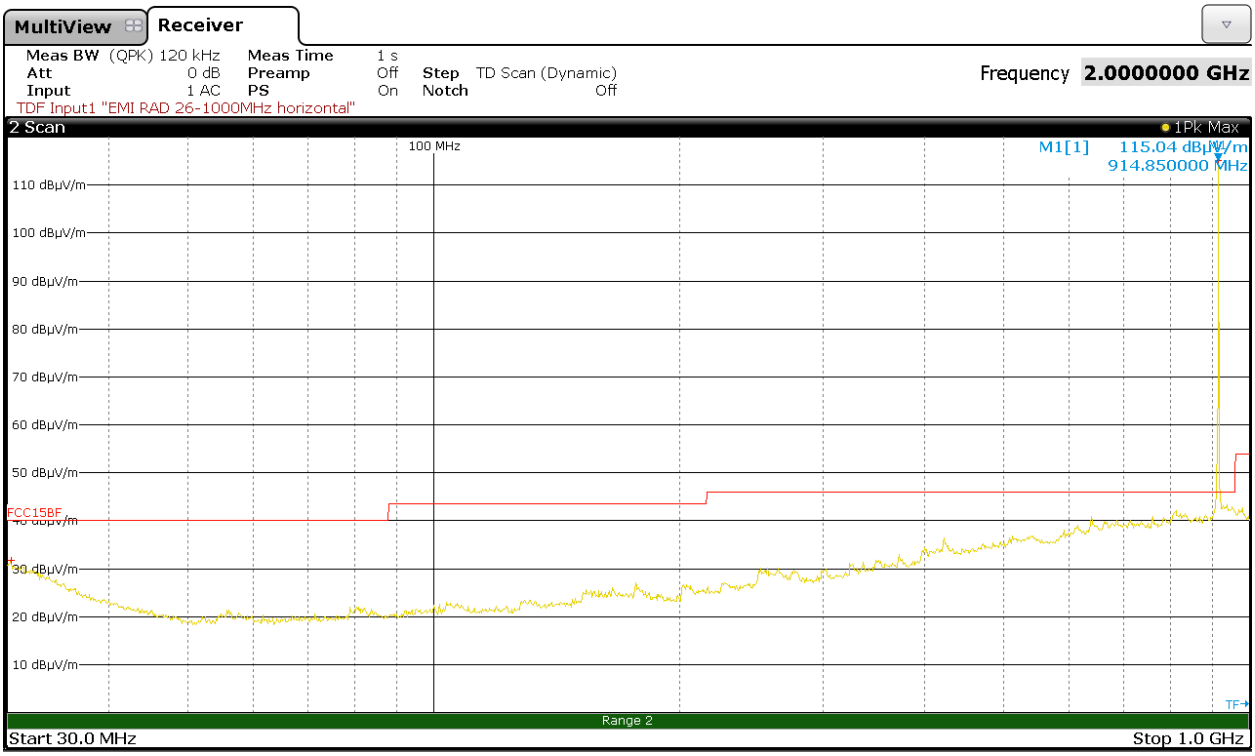
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
908,46 (fundamental)	88,76	24,06	3,47	Not present	**116,29**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 10
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



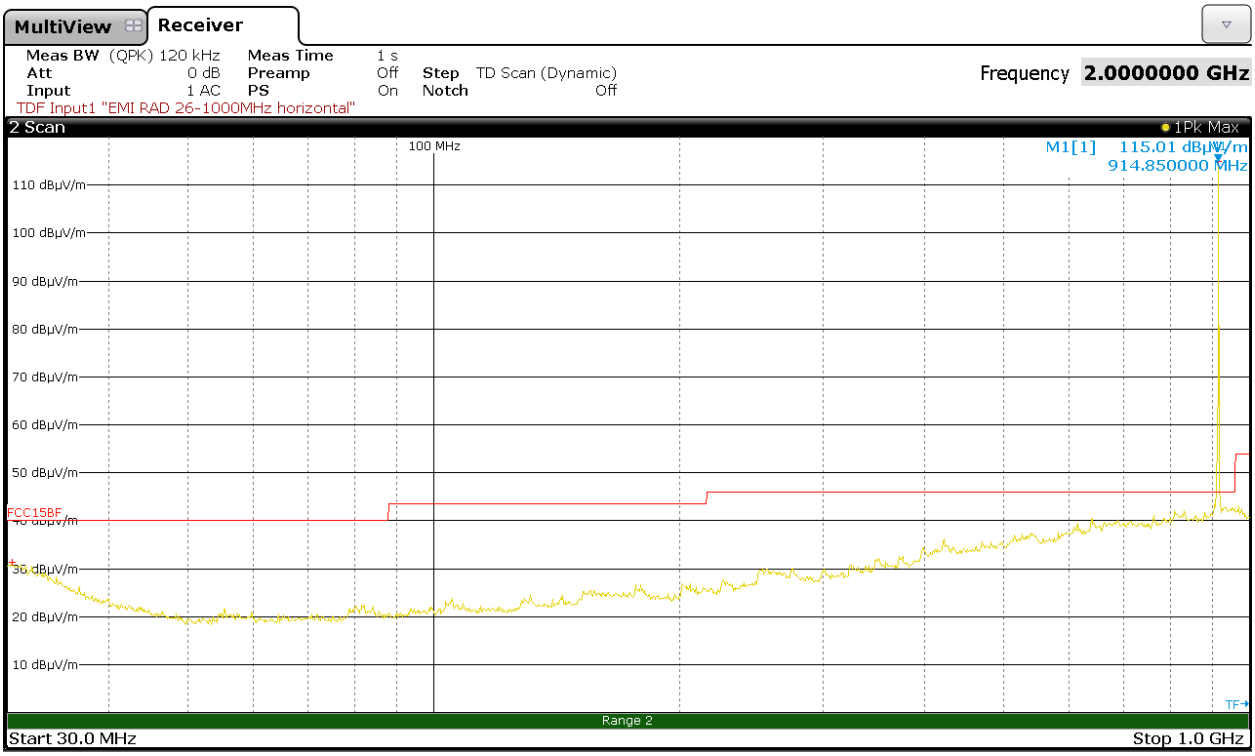
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
908,46 (fundamental)	88,74	24,06	3,47	Not present	**116,27**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 7
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



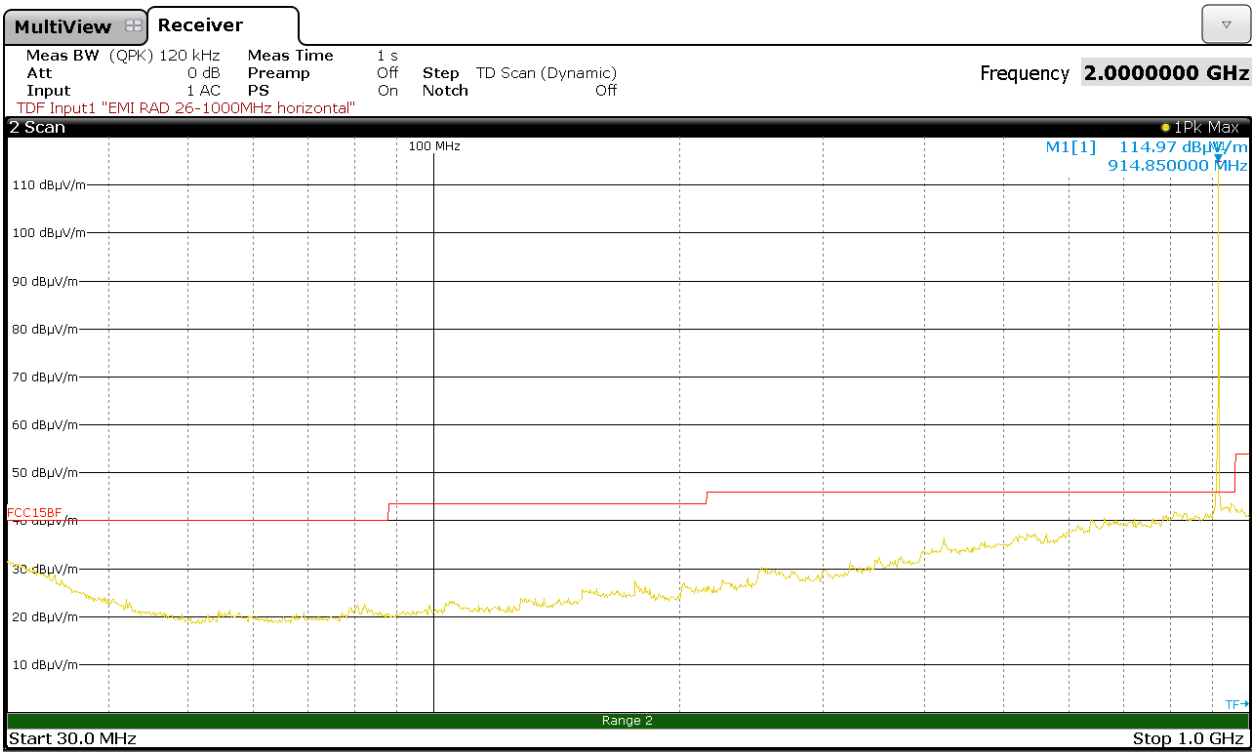
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
914,85 (fundamental)	87,09	24,47	3,48	Not present	**115,04**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 8
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



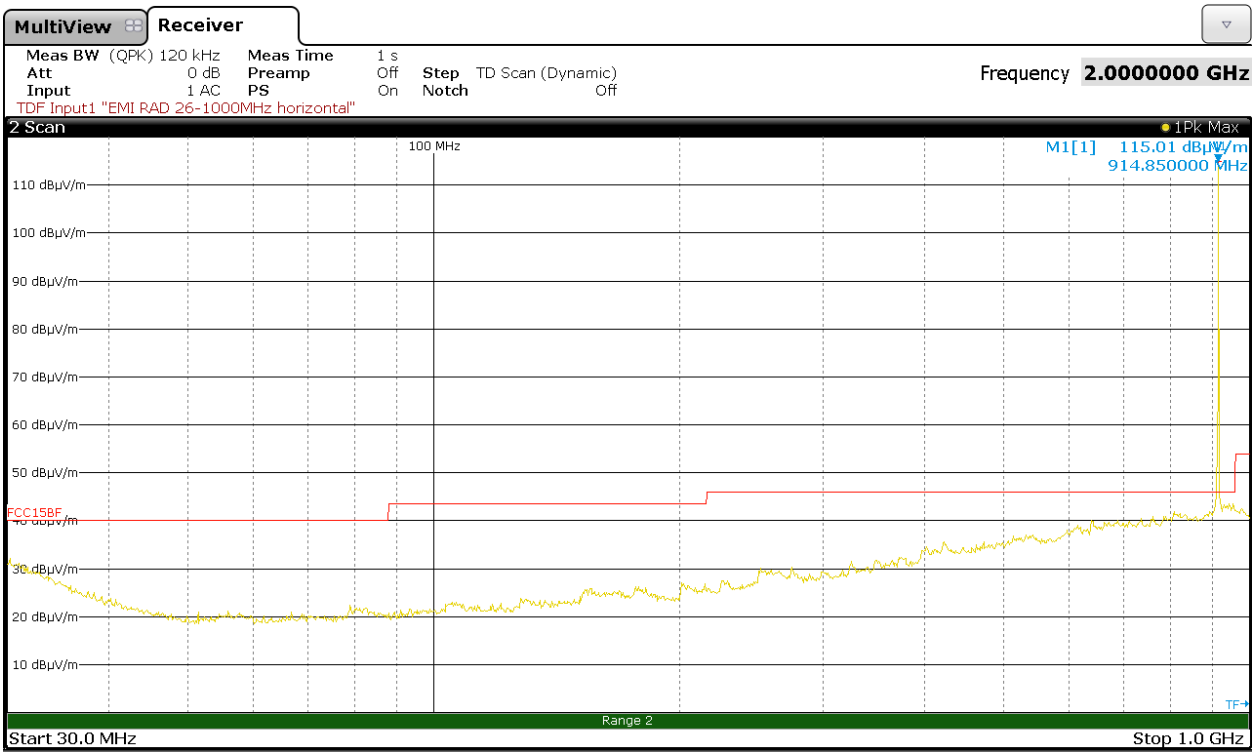
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
914,85 (fundamental)	87,06	24,47	3,48	Not present	**115,01**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 9
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



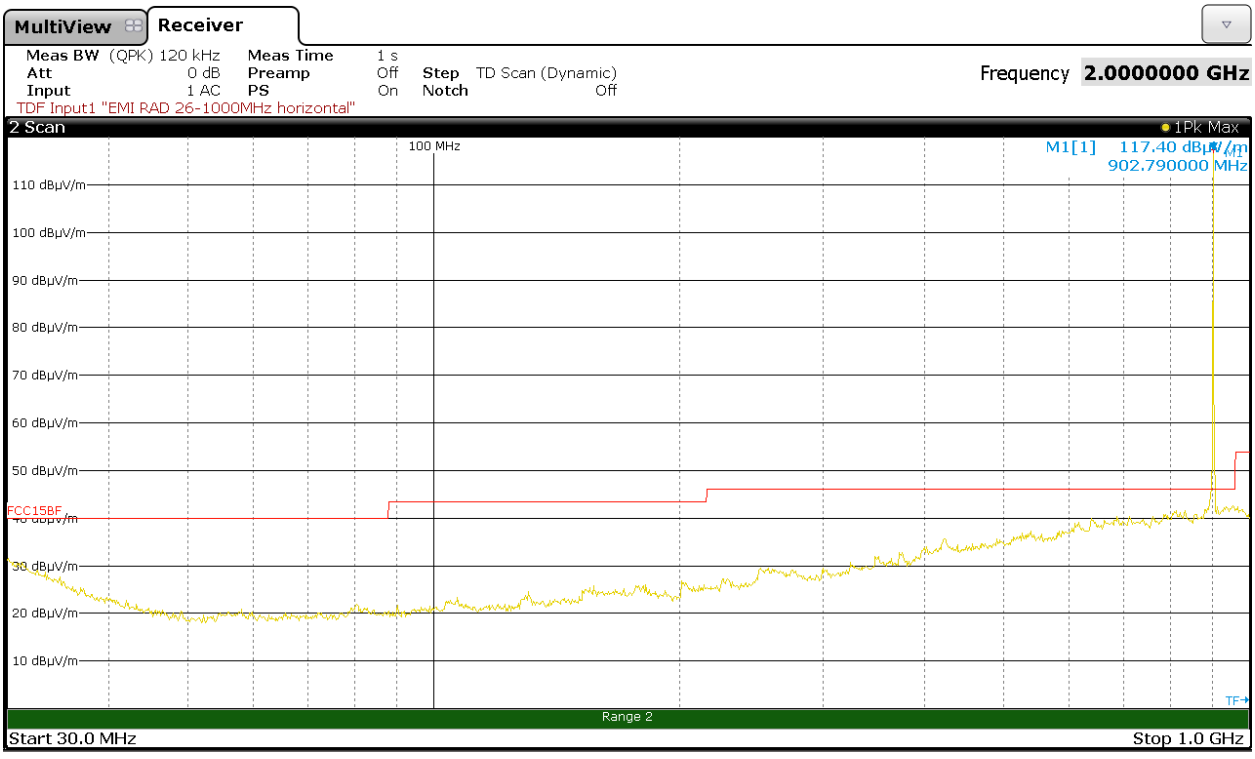
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
914,85 (fundamental)	87,02	24,47	3,48	Not present	**114,97**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 10
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



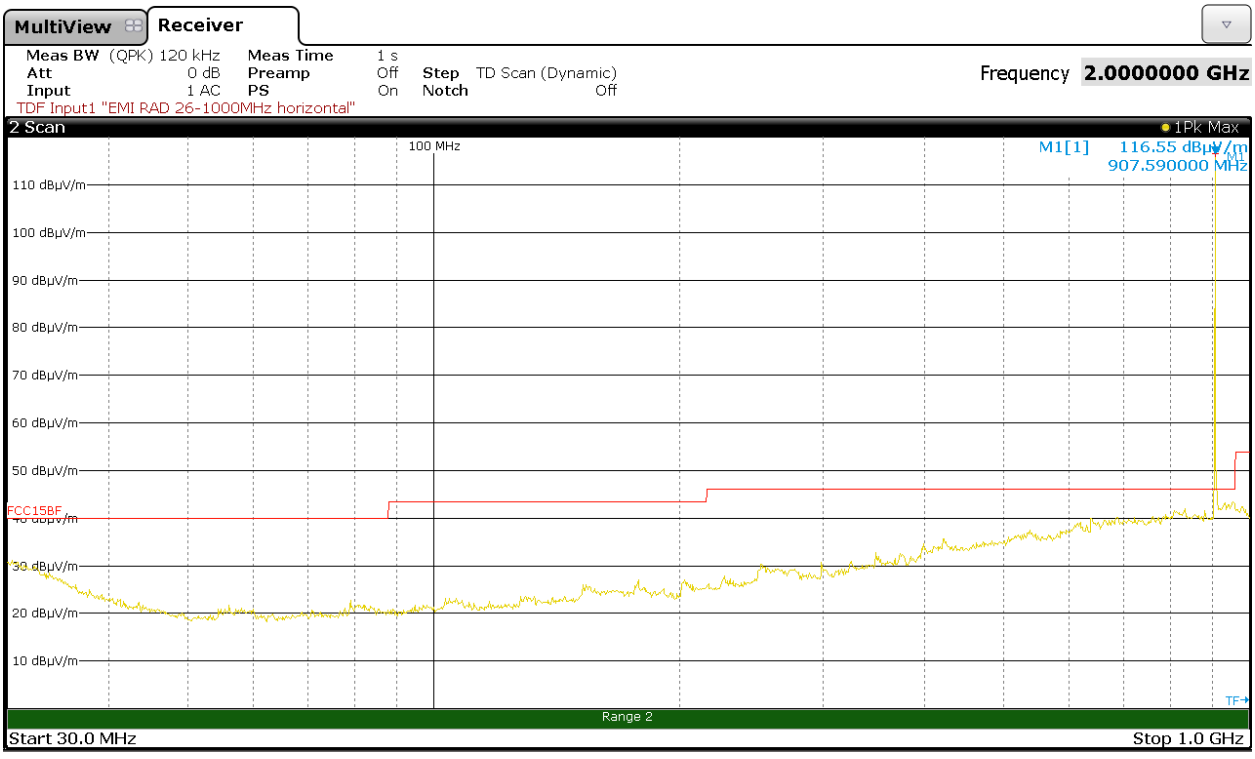
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
914,85 (fundamental)	87,06	24,47	3,48	Not present	**115,01**

Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Low Channel (903,0 MHz) – SF 8
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



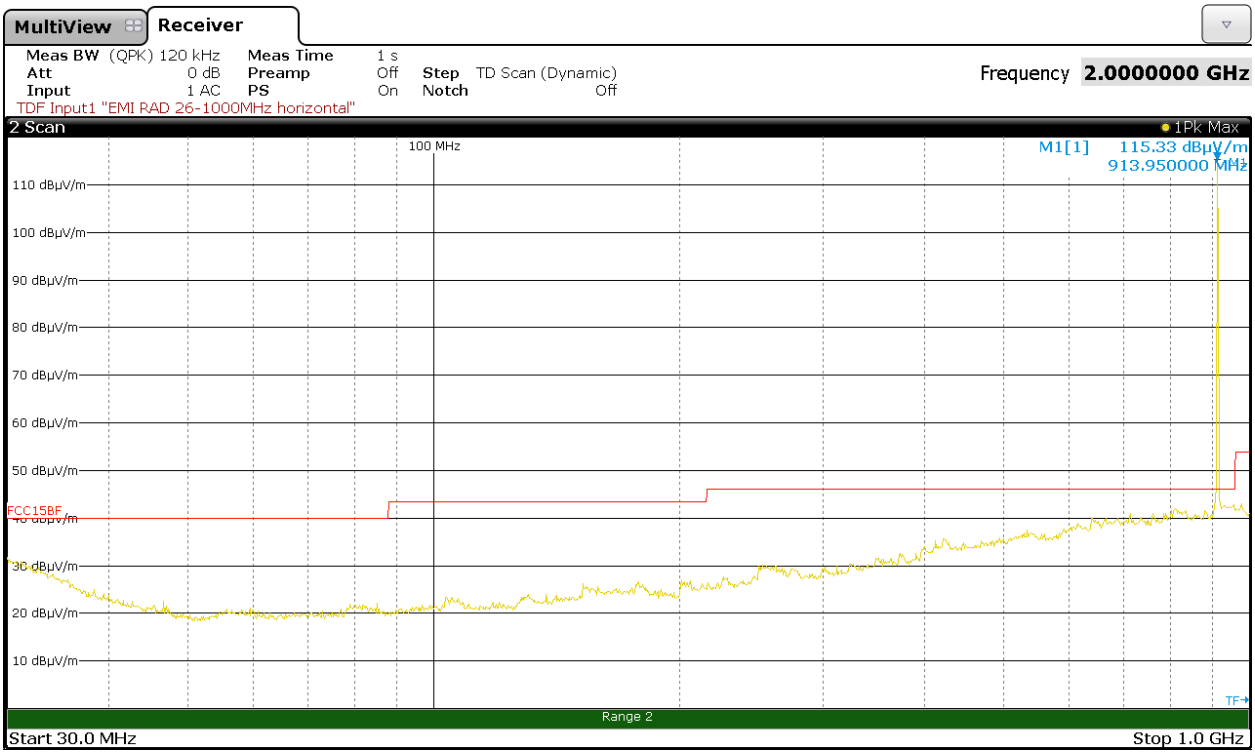
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
902,79 (fundamental)	90,16	23,77	3,47	Not present	**117,40**

Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Middle Channel (907,8 MHz) – SF 8
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



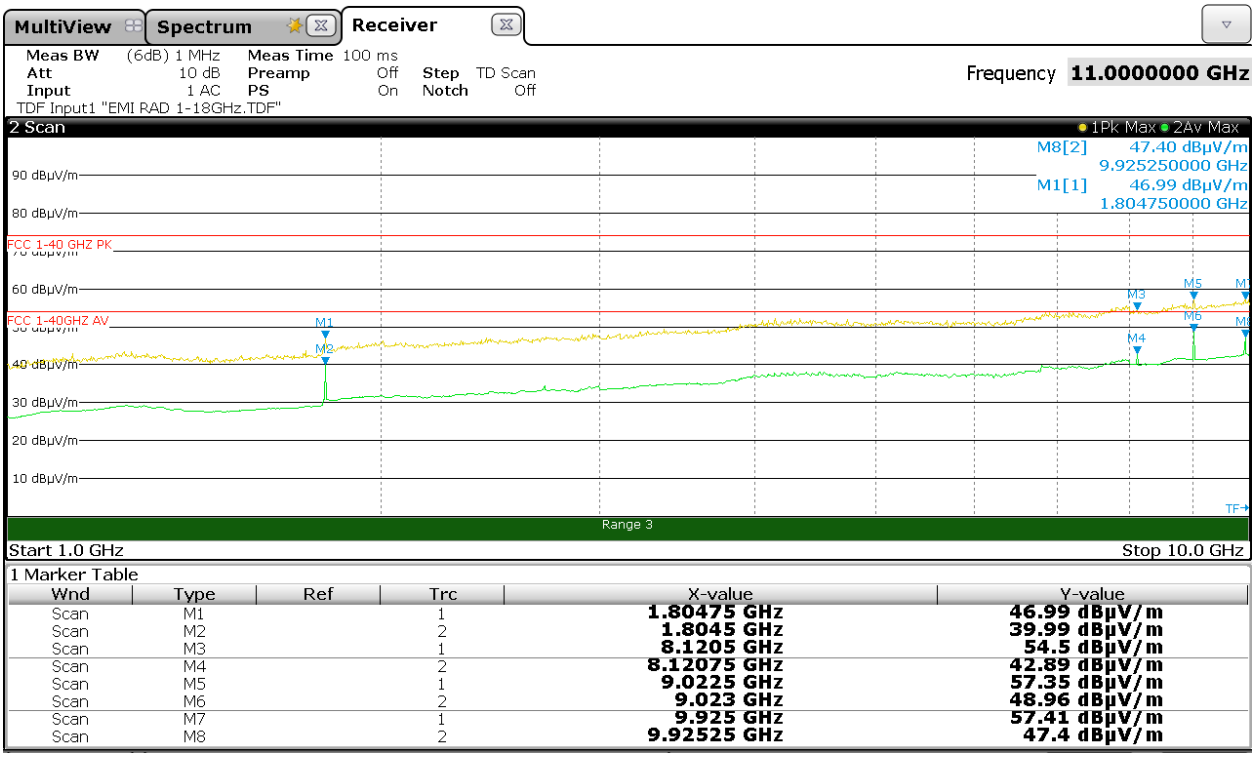
QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
907,59 (fundamental)	89,02	24,06	3,47	Not present	**116,55**

Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – High Channel (914,2 MHz) – SF 8
Frequency: 30MHz – 1GHz
Antenna Polarization: Horizontal (worst case with EUT on X,Y and Z axis)



QUASI-PEAK RESULT (RBW=120kHz)					
Frequency	**Reading value**	**Antenna Factor**	**Cable Loss**	**Pre-Amp. Gain**	**Correcting reading**
(MHz)	**(dBµV)**	**(dB3/m)**	**(dB)**	**(dB)**	**(dBµV/m)**
913,95 (fundamental)	87,38	24,47	3,48	Not present	**115,33**

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 7 (worst case 30-1000MHz)
Frequency: 1GHz – 10GHz
Antenna Polarization: Vertical



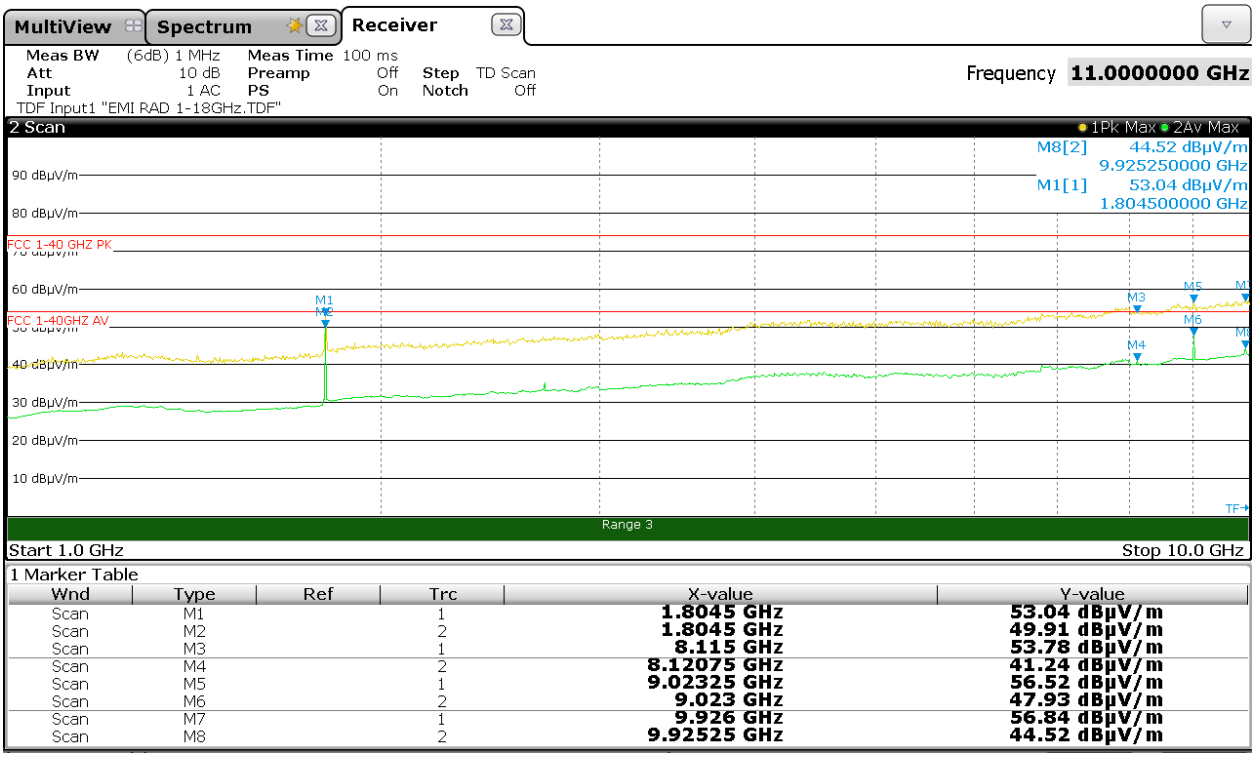
1 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	1.80475 GHz	46.99 dBµV/m
Scan	M2		2	1.8045 GHz	39.99 dBµV/m
Scan	M3		1	8.1205 GHz	54.5 dBµV/m
Scan	M4		2	8.12075 GHz	42.89 dBµV/m
Scan	M5		1	9.0225 GHz	57.35 dBµV/m
Scan	M6		2	9.023 GHz	48.96 dBµV/m
Scan	M7		1	9.925 GHz	57.41 dBµV/m
Scan	M8		2	9.92525 GHz	47.4 dBµV/m

PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1804,75	57,35	-14,61	4,25	**46,99**	no	74,00	27,01
8120,50	53,49	-8,15	9,16	**54,50**	yes	74,00	19,50
9022,50	54,31	-7,05	10,09	**57,35**	yes	74,00	16,65

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1804,50	50,35	-14,61	4,25	**39,99**	no	54,00	14,01
8120,75	41,88	-8,15	9,16	**42,89**	yes	54,00	11,11
9023,00	45,92	-7,05	10,09	**48,96**	yes	54,00	5,04

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 7 (worst case 30-1000MHz)
Frequency: 1GHz – 10GHz
Antenna Polarization: Horizontal



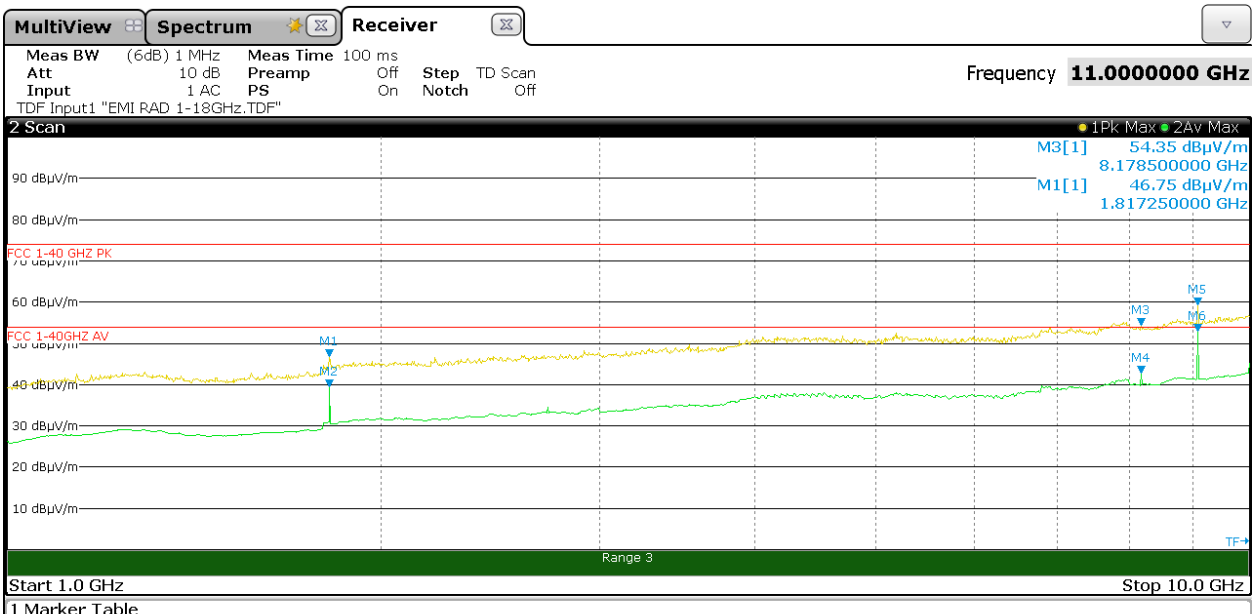
1 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	1.8045 GHz	53.04 dBµV/m
Scan	M2		2	1.8045 GHz	49.91 dBµV/m
Scan	M3		1	8.115 GHz	53.78 dBµV/m
Scan	M4		2	8.12075 GHz	41.24 dBµV/m
Scan	M5		1	9.02325 GHz	56.52 dBµV/m
Scan	M6		2	9.023 GHz	47.93 dBµV/m
Scan	M7		1	9.926 GHz	56.84 dBµV/m
Scan	M8		2	9.92525 GHz	44.52 dBµV/m

PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1804,50	63,4	-14,61	4,25	**53,04**	no	74,00	20,96
8115,00	52,77	-8,15	9,16	**53,78**	yes	74,00	20,22
9023,25	53,48	-7,05	10,09	**56,52**	yes	74,00	17,48

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1804,50	60,27	-14,61	4,25	**49,91**	no	54,00	4,09
8120,75	40,23	-8,15	9,16	**41,24**	yes	54,00	12,76
9023,00	44,89	-7,05	10,09	**47,93**	yes	54,00	6,07

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 7 (worst case 30-1000MHz)
Frequency: 1GHz – 10GHz
Antenna Polarization: Vertical



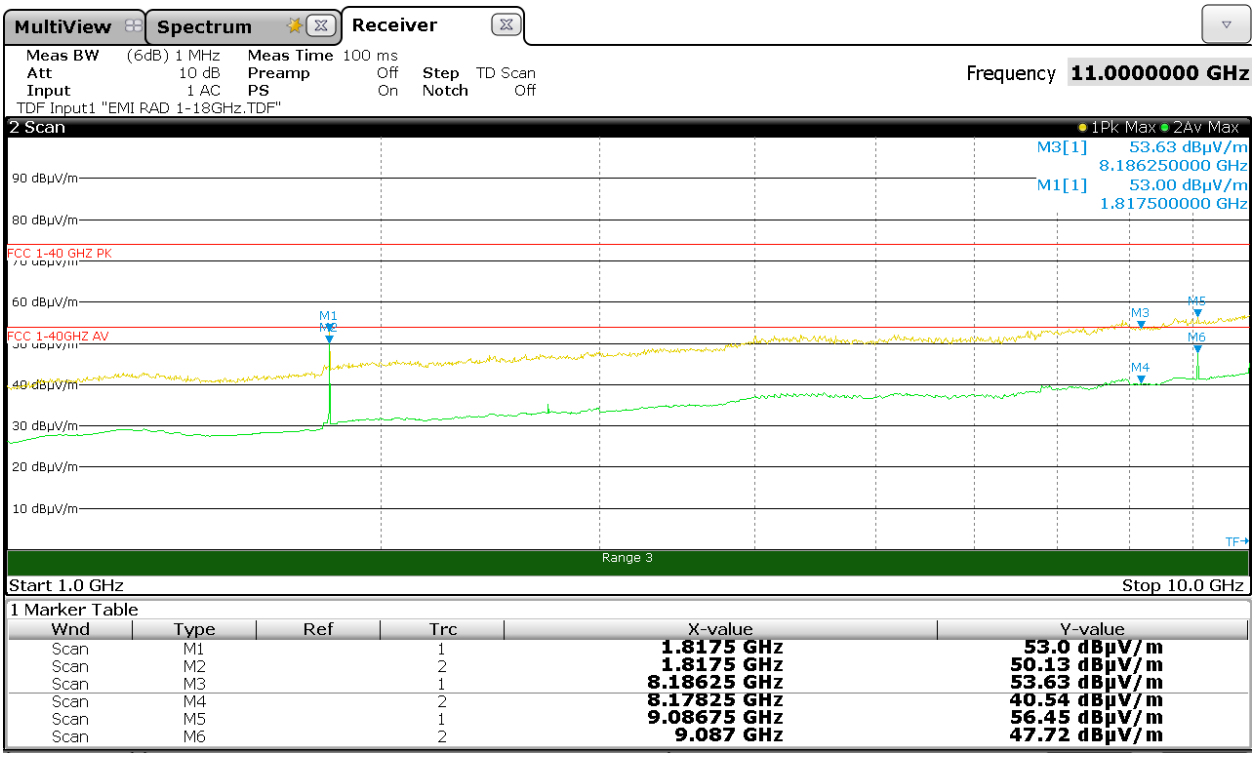
1 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	1.81725 GHz	46.75 dBµV/m
Scan	M2		2	1.8175 GHz	39.39 dBµV/m
Scan	M3		1	8.1785 GHz	54.35 dBµV/m
Scan	M4		2	8.17825 GHz	42.67 dBµV/m
Scan	M5		1	9.087 GHz	59.33 dBµV/m
Scan	M6		2	9.087 GHz	52.93 dBµV/m

PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1817,25	57,01	-14,51	4,25	**46,75**	no	74,00	27,25
8178,50	53,36	-8,17	9,16	**54,35**	yes	74,00	19,65
9087,00	56,16	-6,92	10,09	**59,33**	yes	74,00	14,67

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1817,50	49,65	-14,51	4,25	**39,39**	no	54,00	14,61
8178,25	41,68	-8,17	9,16	**42,67**	yes	54,00	11,33
9087,00	49,76	-6,92	10,09	**52,93**	yes	54,00	1,07

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 7 (worst case 30-1000MHz)
Frequency: 1GHz – 10GHz
Antenna Polarization: Horizontal



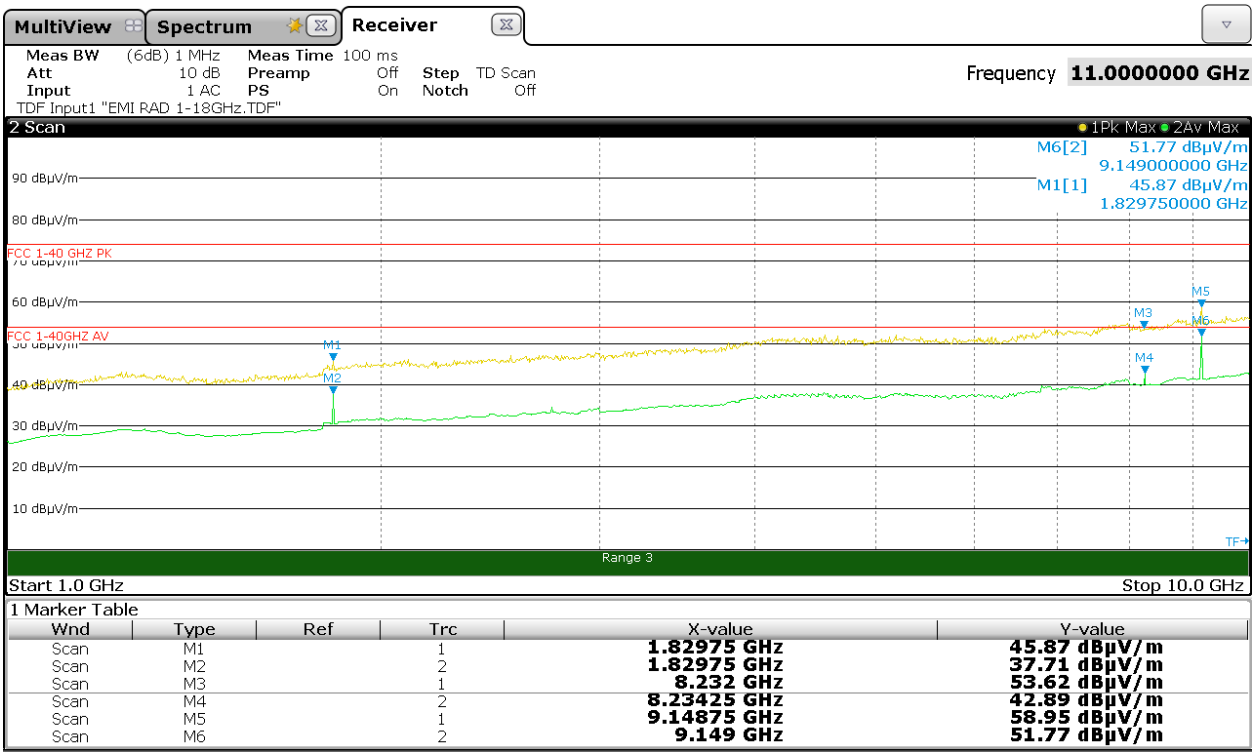
1 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	**1.8175 GHz**	**53.0 dBµV/m**
Scan	M2		2	**1.8175 GHz**	**50.13 dBµV/m**
Scan	M3		1	**8.18625 GHz**	**53.63 dBµV/m**
Scan	M4		2	**8.17825 GHz**	**40.54 dBµV/m**
Scan	M5		1	**9.08675 GHz**	**56.45 dBµV/m**
Scan	M6		2	**9.087 GHz**	**47.72 dBµV/m**

PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1817,50	63,26	-14,51	4,25	**53,00**	no	74,00	21,00
8186,25	52,64	-8,17	9,16	**53,63**	yes	74,00	20,37
9086,75	53,28	-6,92	10,09	**56,45**	yes	74,00	17,55

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1817,50	60,39	-14,51	4,25	**50,13**	no	54,00	3,87
8178,25	39,55	-8,17	9,16	**40,54**	yes	54,00	13,46
9087,00	44,55	-6,92	10,09	**47,72**	yes	54,00	6,28

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 7 (worst case 30-1000MHz)
Frequency: 1GHz – 10GHz
Antenna Polarization: Vertical



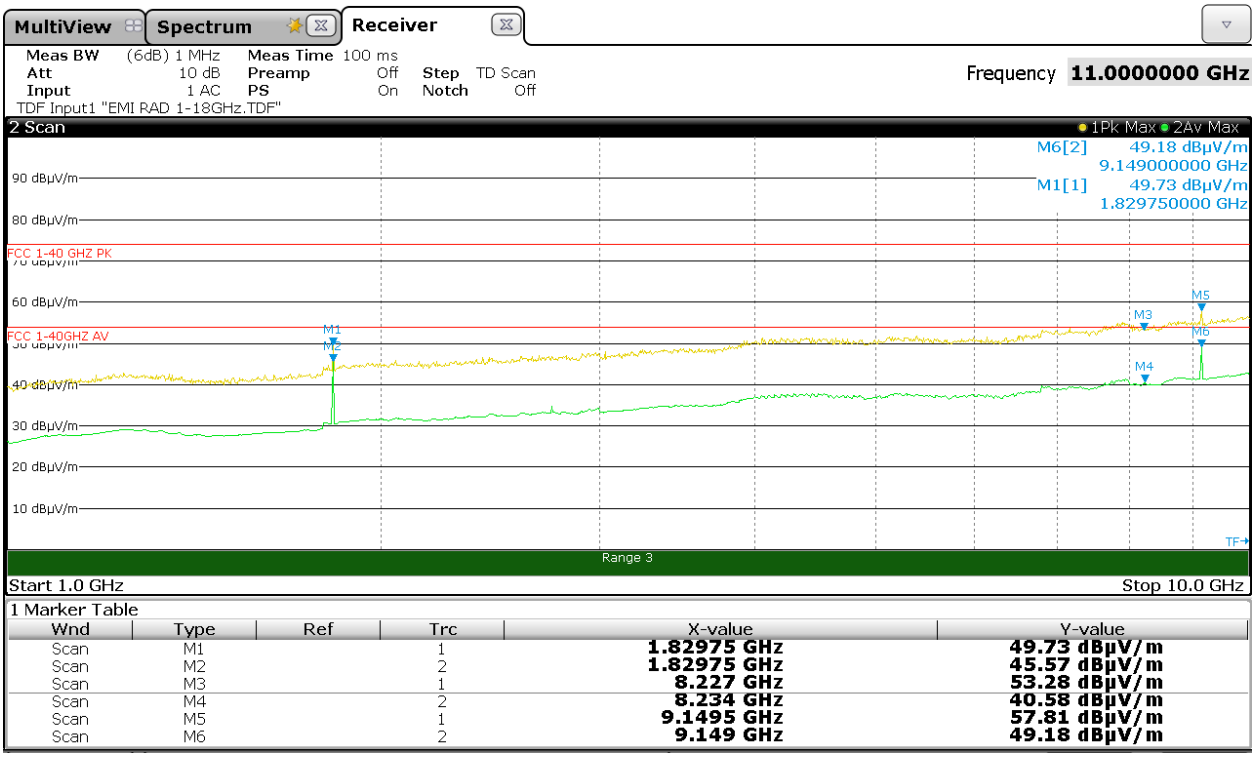
1 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	1.82975 GHz	45.87 dBµV/m
Scan	M2		2	1.82975 GHz	37.71 dBµV/m
Scan	M3		1	8.232 GHz	53.62 dBµV/m
Scan	M4		2	8.23425 GHz	42.89 dBµV/m
Scan	M5		1	9.14875 GHz	58.95 dBµV/m
Scan	M6		2	9.149 GHz	51.77 dBµV/m

PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1829,75	55,99	-14,40	4,28	**45,87**	no	74,00	28,13
8232,00	52,47	-8,19	9,34	**53,62**	yes	74,00	20,38
9148,75	55,23	-6,80	10,52	**58,95**	yes	74,00	15,05

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1829,75	47,83	-14,40	4,28	**37,71**	no	54,00	16,29
8234,25	39,74	-8,19	9,34	**40,89**	yes	54,00	13,11
9149,00	48,05	-6,80	10,52	**51,77**	yes	54,00	2,23

Graphical representation of Radiated Emission Measurement
Operation Mode: #1 – High Channel (914,9 MHz) – SF 7 (worst case 30-1000MHz)
Frequency: 1GHz – 10GHz
Antenna Polarization: Horizontal



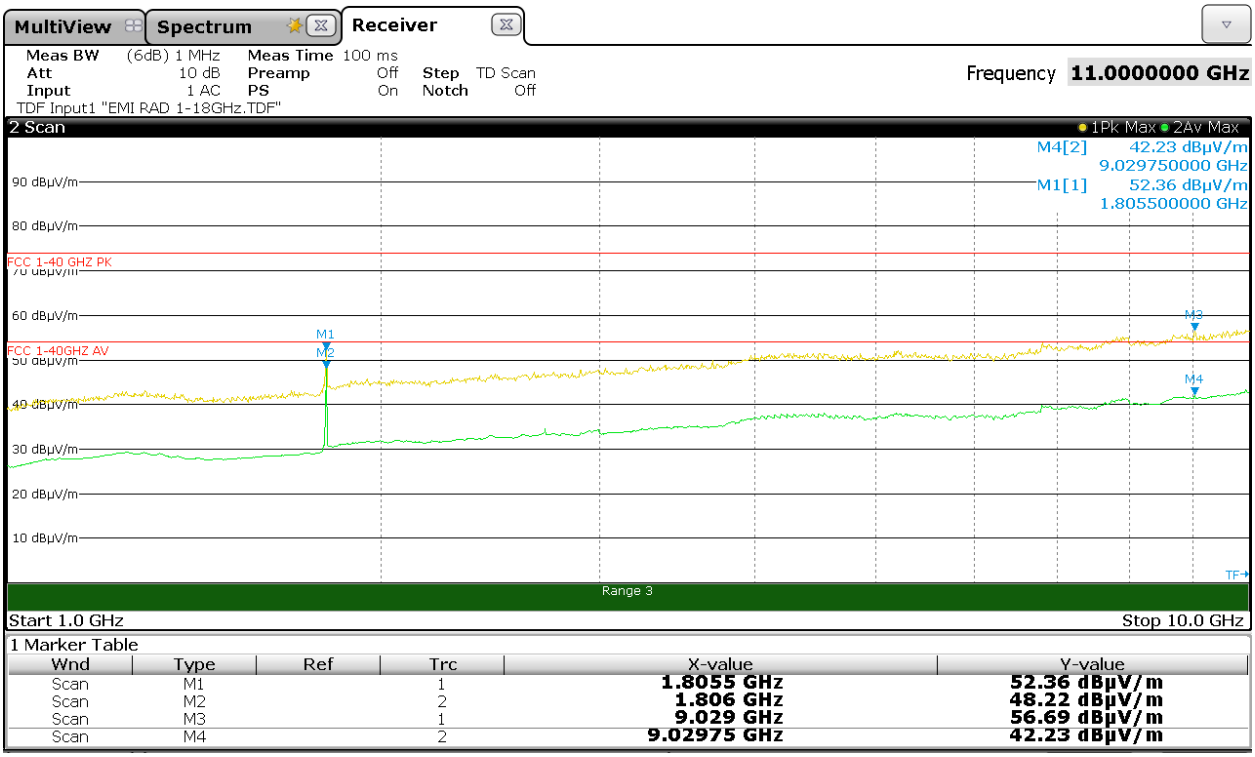
1 Marker Table

Wnd	Type	Ref	Trc	X-value	Y-value
Scan	M1		1	1.82975 GHz	49.73 dBµV/m
Scan	M2		2	1.82975 GHz	45.57 dBµV/m
Scan	M3		1	8.227 GHz	53.28 dBµV/m
Scan	M4		2	8.234 GHz	40.58 dBµV/m
Scan	M5		1	9.1495 GHz	57.81 dBµV/m
Scan	M6		2	9.149 GHz	49.18 dBµV/m

PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1829,75	59,85	-14,40	4,28	**49,73**	no	74,00	24,27
8227,00	52,13	-8,19	9,34	**53,28**	yes	74,00	20,72
9149,50	54,09	-6,80	10,52	**57,81**	yes	74,00	16,19

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1829,75	55,69	-14,40	4,28	**45,57**	no	54,00	8,43
8234,00	39,43	-8,19	9,34	**40,58**	yes	54,00	13,42
9149,00	45,46	-6,80	10,52	**49,18**	yes	54,00	4,82

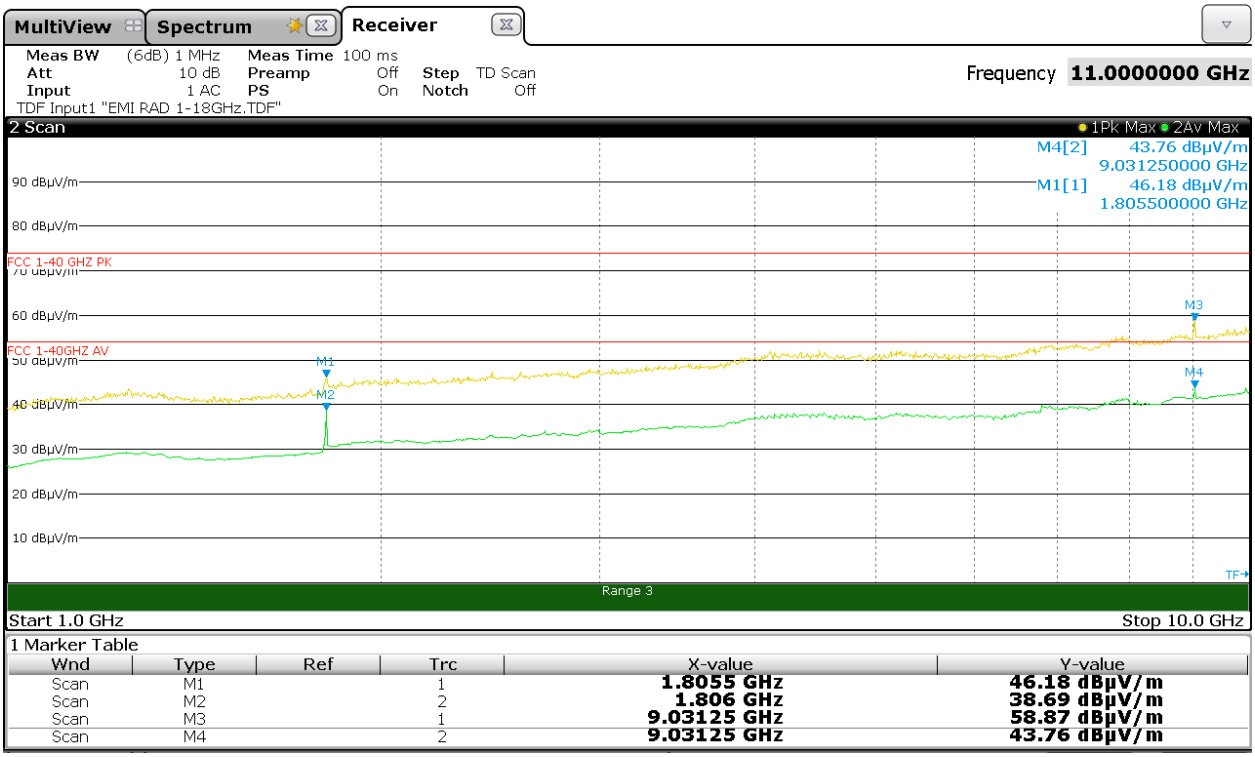
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Low Channel (903,0 MHz) – SF 8
Frequency: 1GHz – 10GHz
Antenna Polarization: Horizontal



PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1805,50	62,72	-14,61	4,25	**52,36**	no	74,00	21,64
9029,00	53,65	-7,05	10,09	**56,69**	yes	74,00	17,31

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1806,00	58,58	-14,61	4,25	**48,22**	no	54,00	5,78
9029,75	39,19	-7,05	10,09	**42,23**	yes	54,00	11,77

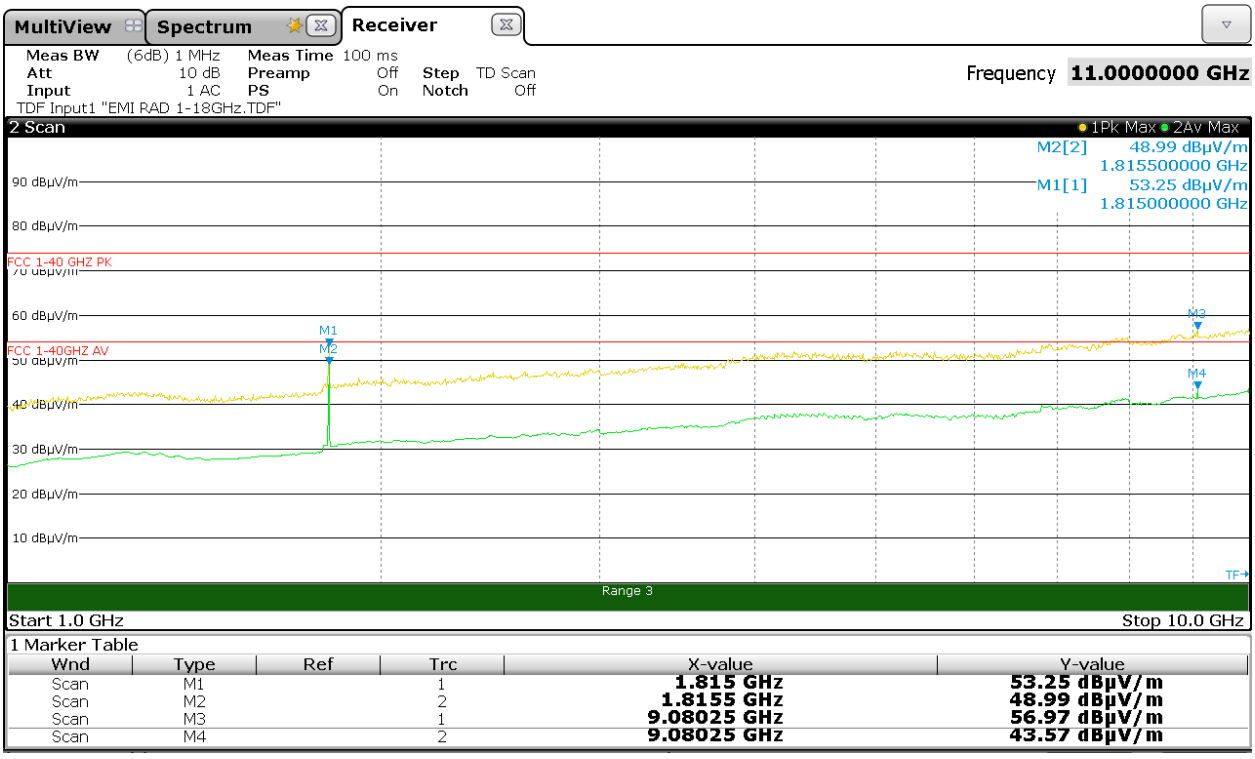
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Low Channel (903,0 MHz) – SF 8
Frequency: 1GHz – 10GHz
Antenna Polarization: Vertical



PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1805,50	56,54	-14,61	4,25	**46,18**	no	74,00	27,82
9031,25	55,83	-7,05	10,09	**58,87**	yes	74,00	15,13

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1806,00	49,05	-14,61	4,25	**38,69**	no	54,00	15,31
9031,25	40,72	-7,05	10,09	**43,76**	yes	54,00	10,24

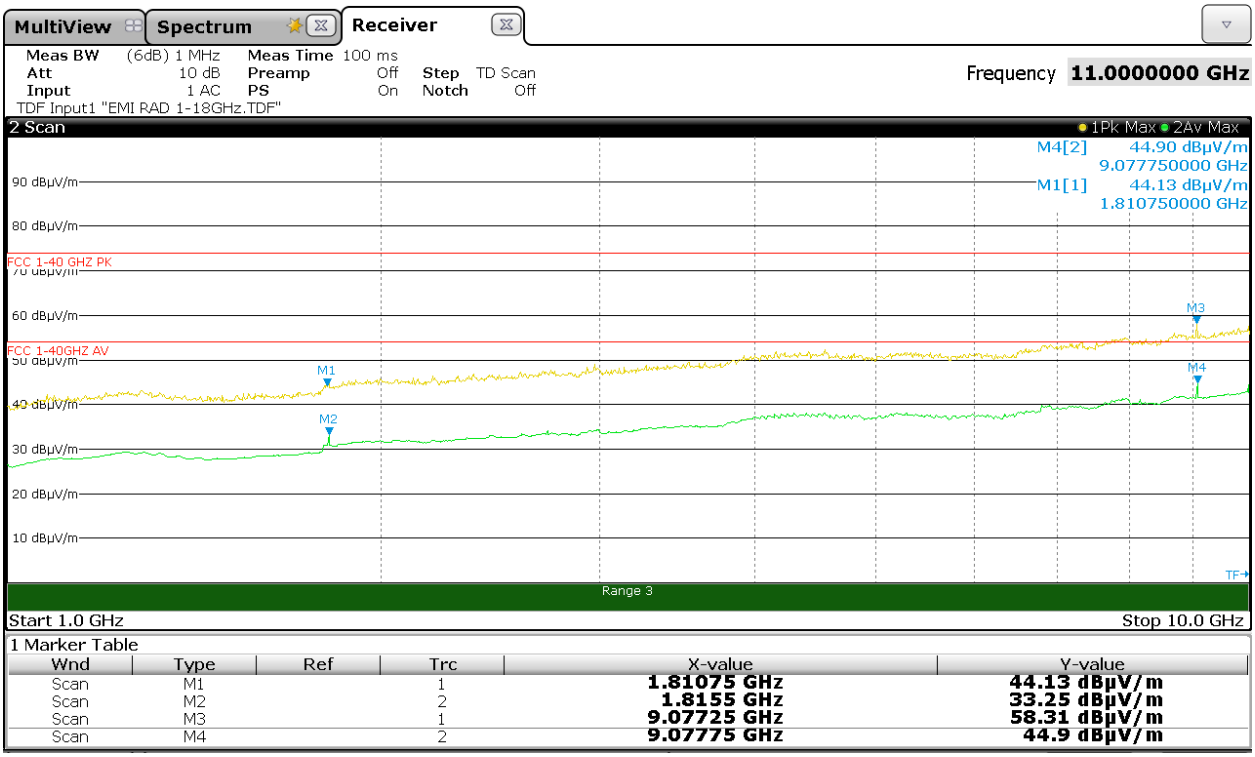
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Middle Channel (907,8 MHz) – SF 8
Frequency: 1GHz – 10GHz
Antenna Polarization: Horizontal



PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1815,00	63,51	-14,51	4,25	**53,25**	no	74,00	20,75
9080,25	53,80	-6,92	10,09	**56,97**	yes	74,00	17,03

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1815,50	59,25	-14,51	4,25	**48,99**	no	54,00	5,01
9080,25	40,40	-6,92	10,09	**43,57**	yes	54,00	10,43

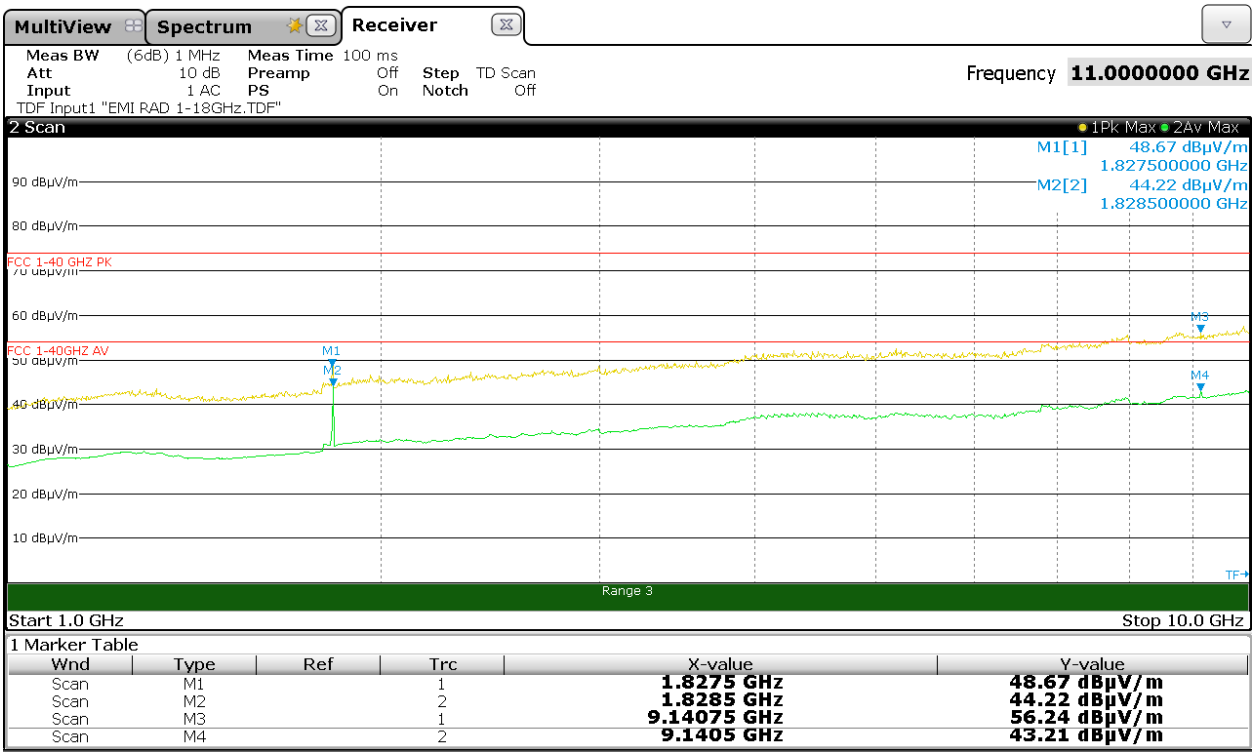
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – Middle Channel (907,8 MHz) – SF 8
Frequency: 1GHz – 10GHz
Antenna Polarization: Vertical



PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1810,75	54,39	-14,51	4,25	**44,13**	no	74,00	29,87
9077,25	55,14	-6,92	10,09	**58,31**	yes	74,00	15,69

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1815,50	43,51	-14,51	4,25	**33,25**	no	54,00	20,75
9077,25	41,73	-6,92	10,09	**44,90**	yes	54,00	9,10

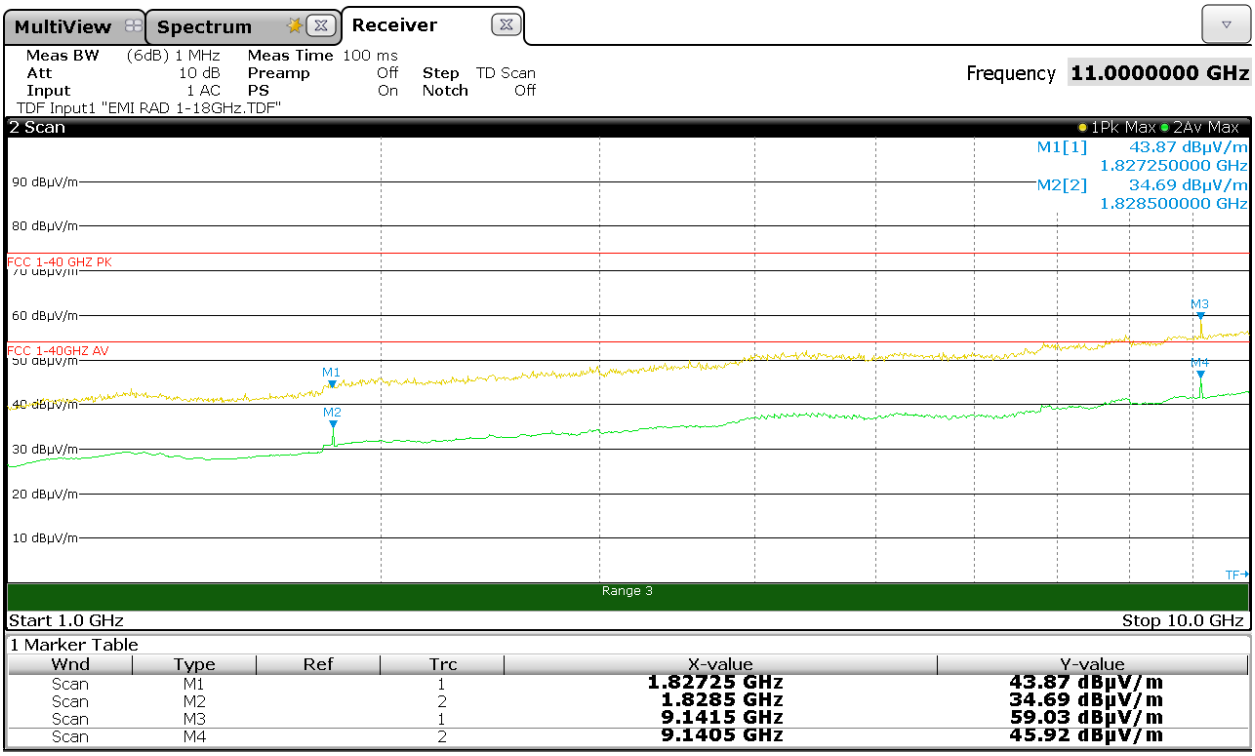
Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – High Channel (914,2 MHz) – SF 8
Frequency: 1GHz – 10GHz
Antenna Polarization: Horizontal



PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1827,50	58,79	-14,40	4,28	**48,67**	no	74,00	25,33
9140,75	52,52	-6,80	10,52	**56,24**	yes	74,00	17,76

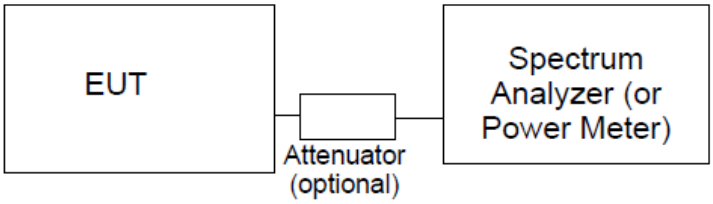
AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1828,50	54,34	-14,40	4,28	**44,22**	no	54,00	9,78
9140,50	39,49	-6,80	10,52	**43,21**	yes	54,00	10,79

Graphical representation of Radiated Emission Measurement
Operation Mode: #3 – High Channel (914,2 MHz) – SF 8
Frequency: 1GHz – 10GHz
Antenna Polarization: Vertical



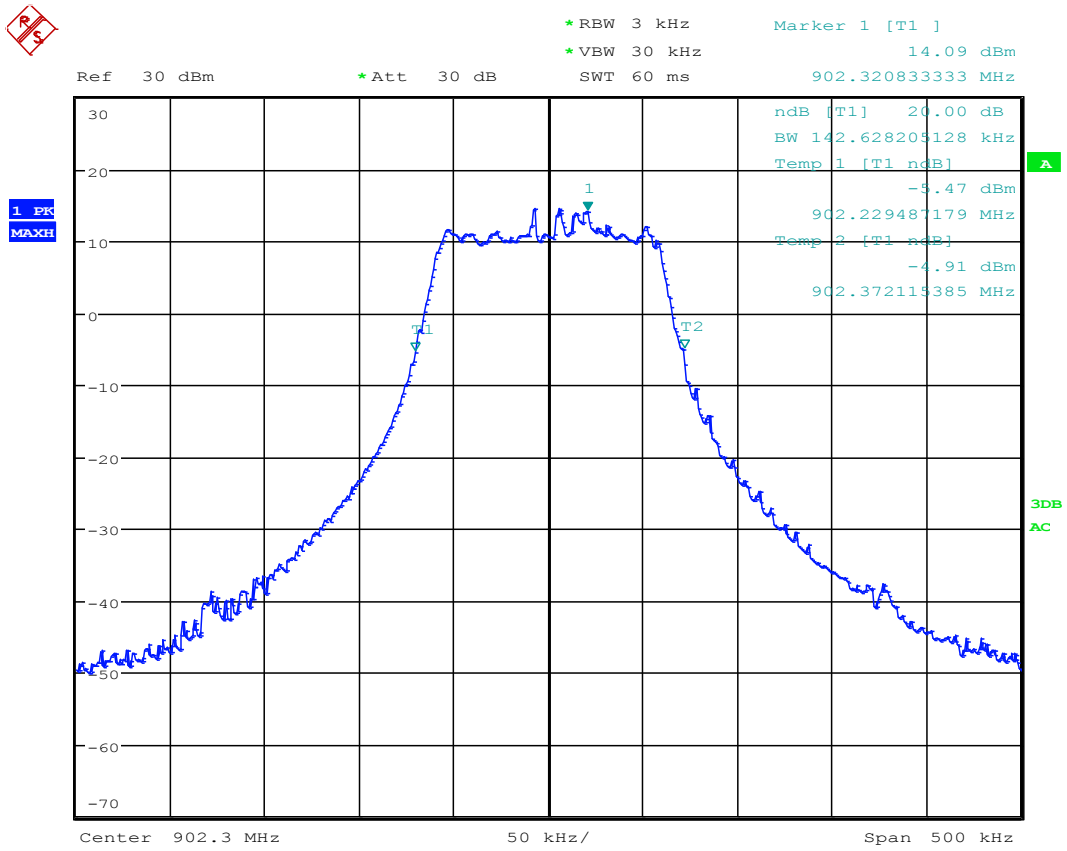
PEAK RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	PK Limit (AV Limit + 20dB)	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1827,25	53,99	-14,40	4,28	**43,87**	no	74,00	30,13
9141,50	55,31	-6,80	10,52	**59,03**	yes	74,00	14,97

AVERAGE RESULT (RBW=1MHz)							
Frequency	Reading value	Antenna Factor with Pre-Amp. Gain	Cable Loss	Correcting reading	Restricted band	AV Limit	Margin
(MHz)	(dBµV)	(dB3/m)	(dB)	(dBµV/m)	/	(dBµV/m)	(dB)
1828,50	44,81	-14,40	4,28	**34,69**	no	54,00	19,31
9140,50	42,20	-6,80	10,52	**45,92**	yes	54,00	8,08

11.3 TEST: 20dB Bandwidth			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	48%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF Connector	
Equipment mode:	Operation mode	#1	
FCC Standard	§15.247 (A)(1)(i)		
(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. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

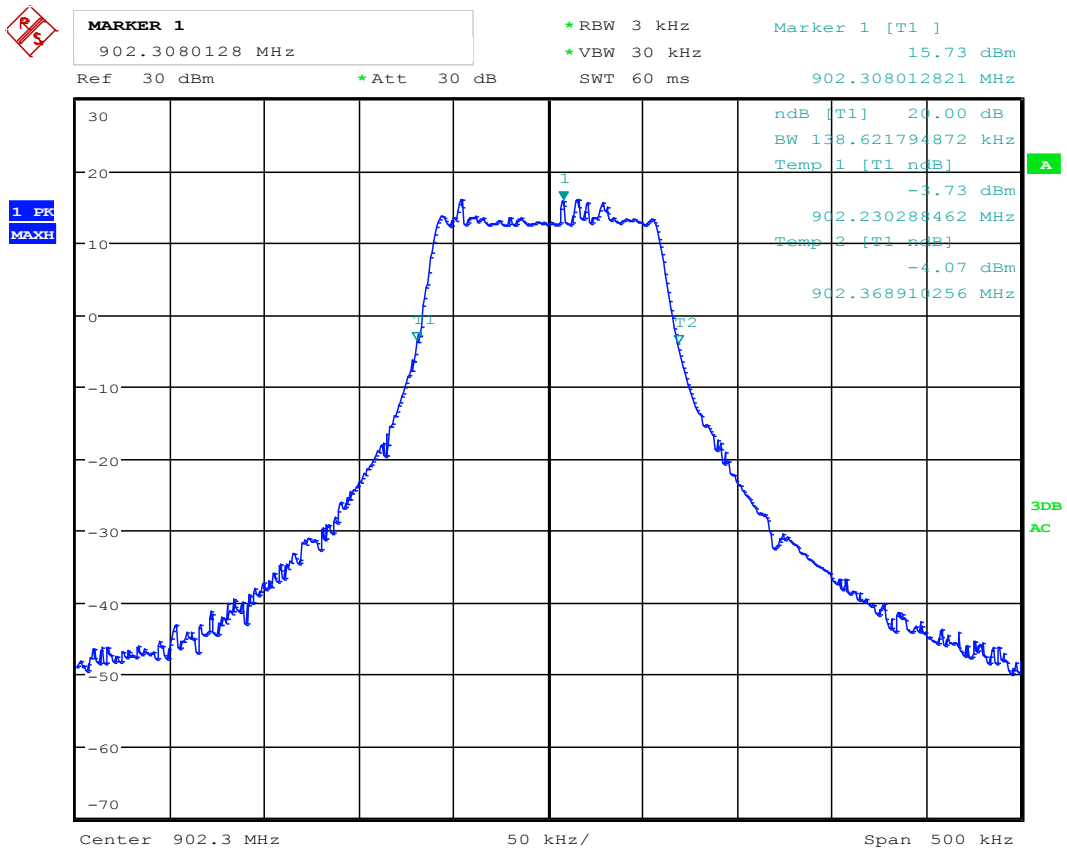
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 7
Plot n°1



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Low	**902,30**	**142,62**	**500**	**1**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**902,229 MHz**	**Fmax**	**902,372 MHz**

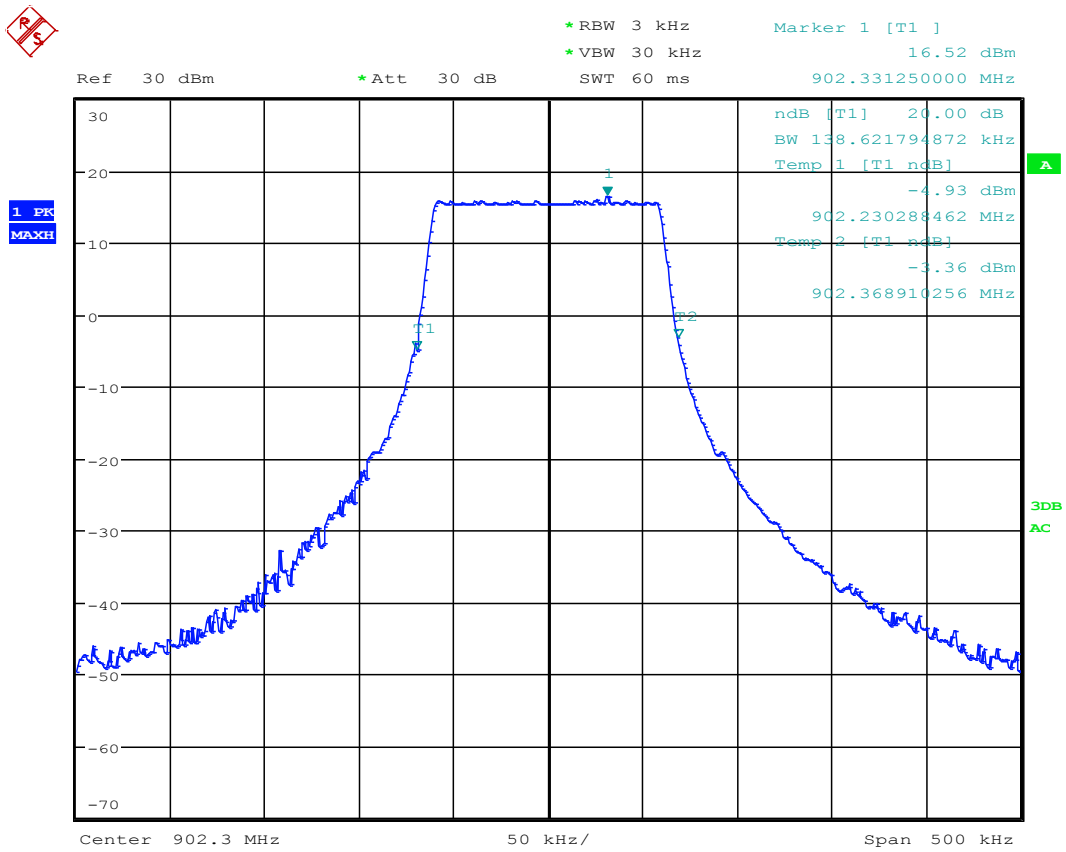
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 8
Plot n°2



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Low	902,30	138,62	500	2

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	902,230 MHz	Fmax	902,369 MHz

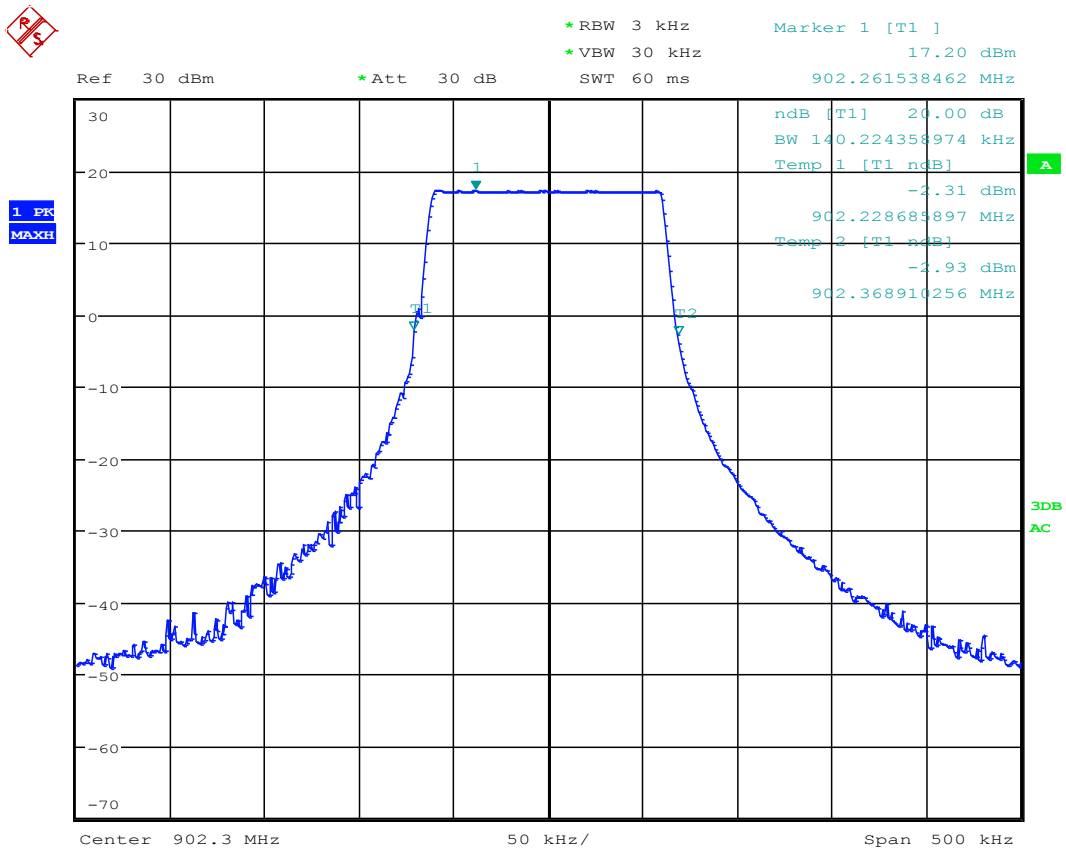
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 9
Plot n°3



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Low	902,30	138,62	500	3

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	902,230 MHz	Fmax	902,369 MHz

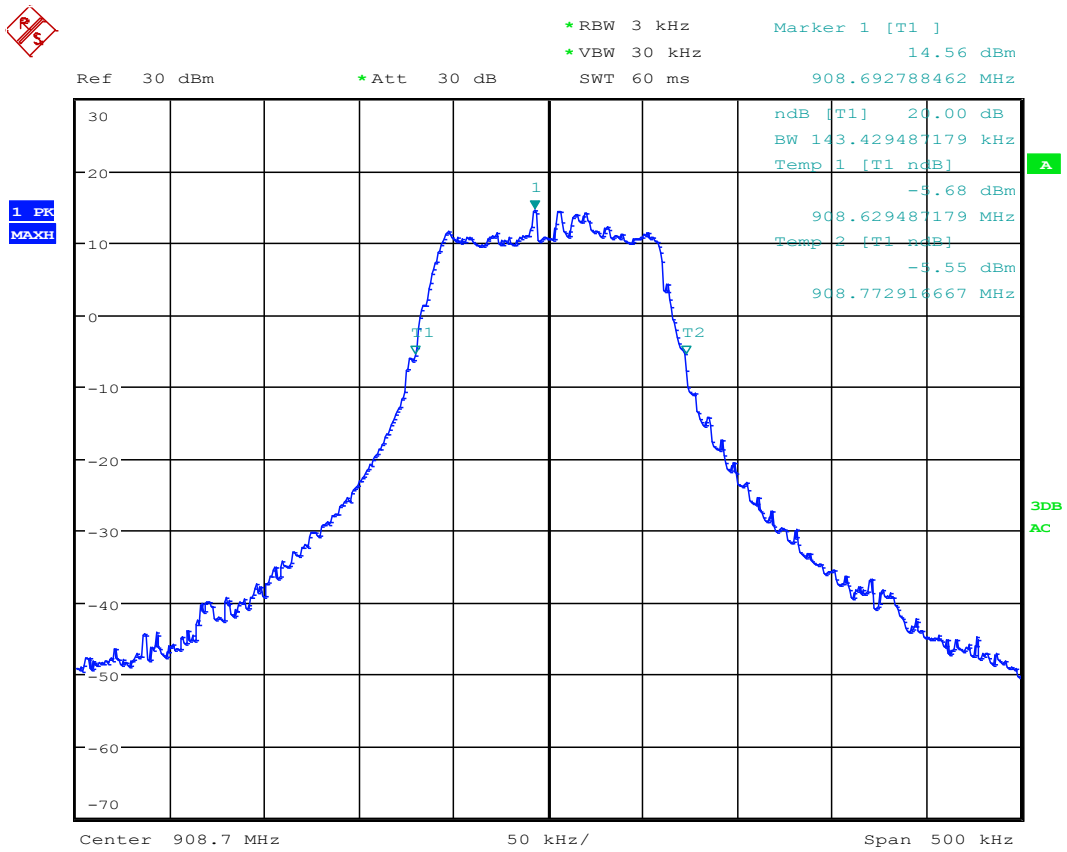
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 10
Plot n°4



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Low	**902,30**	**140,22**	**500**	**4**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**902,228MHz**	**Fmax**	**902,369 MHz**

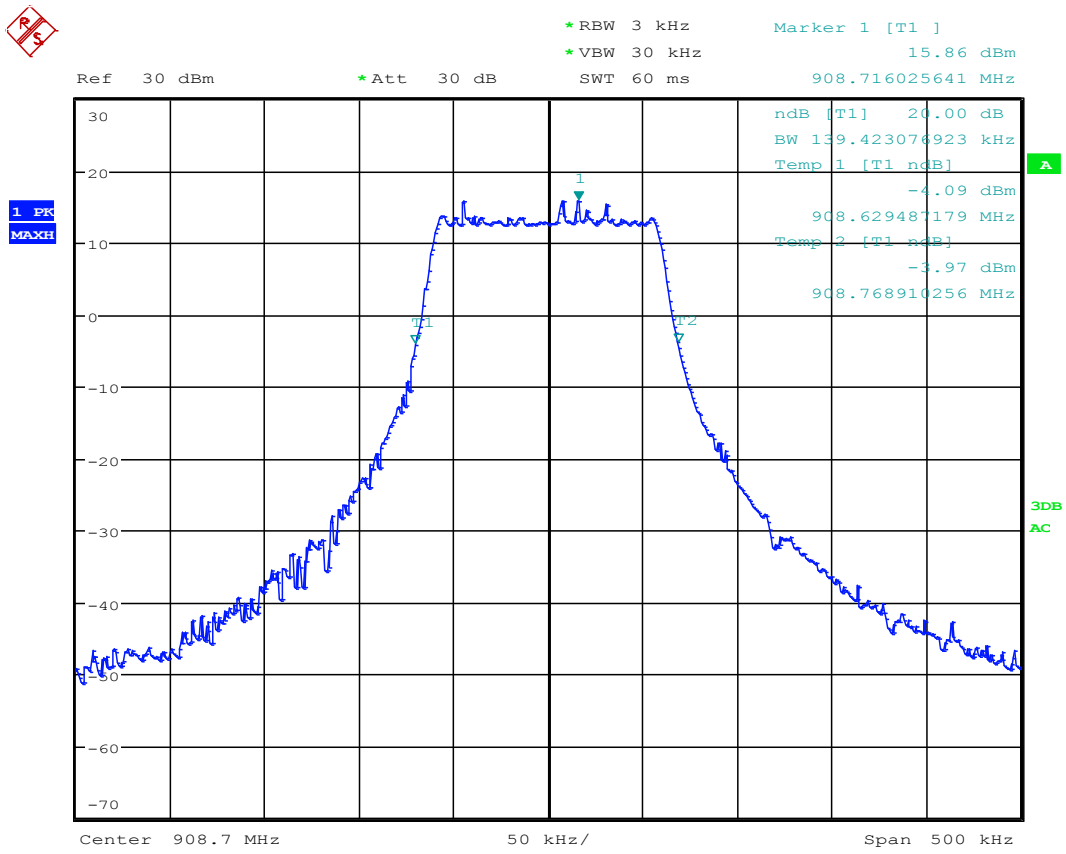
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 7
Plot n°5



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Middle	**908,70**	**143,43**	**500**	**5**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**908,629 MHz**	**Fmax**	**908,773 MHz**

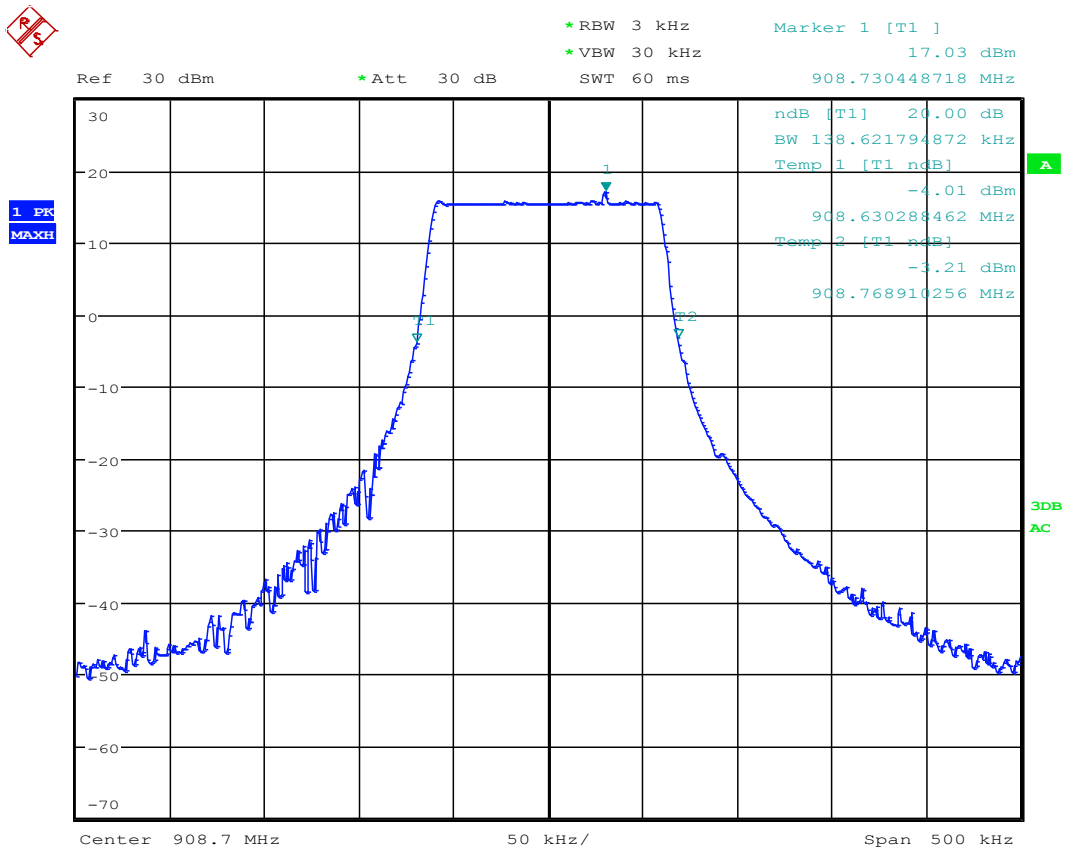
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 8
Plot n°6



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Middle	**908,70**	**139,42**	**500**	**6**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**908,629 MHz**	**Fmax**	**908,769 MHz**

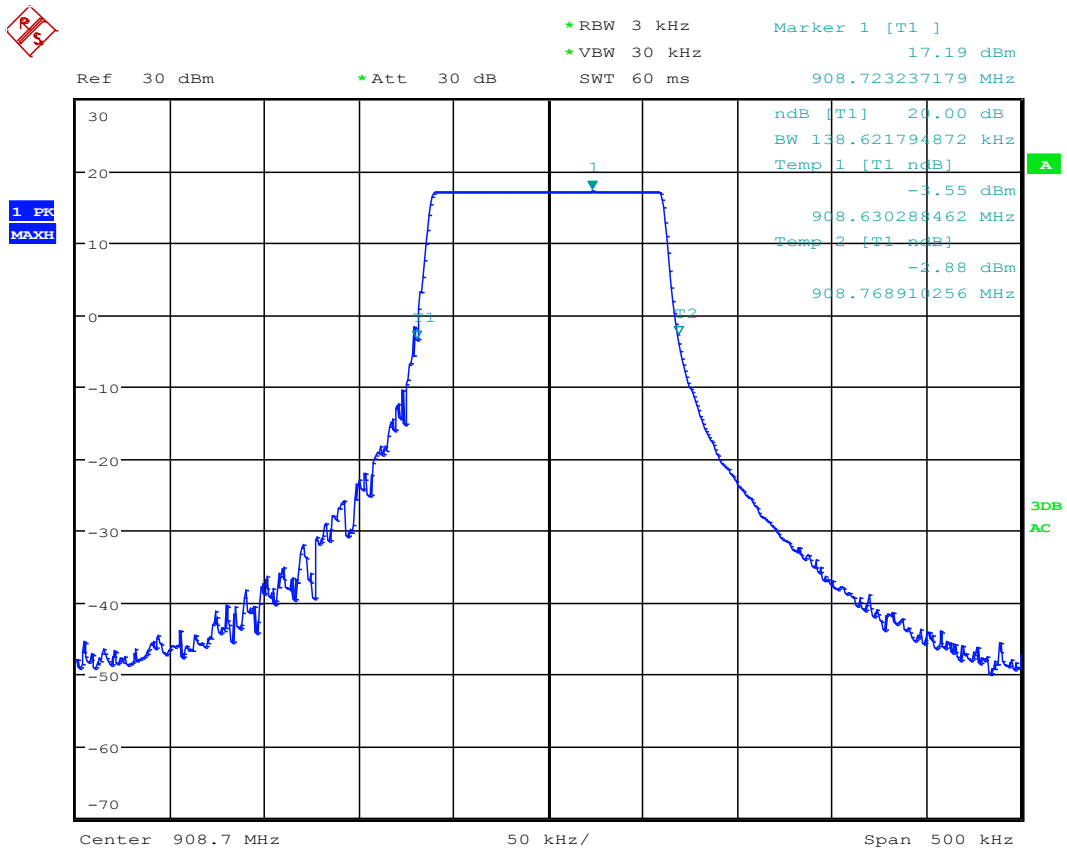
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 9
Plot n°7



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Middle	**908,70**	**138,62**	**500**	**7**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**908,630 MHz**	**Fmax**	**908,769 MHz**

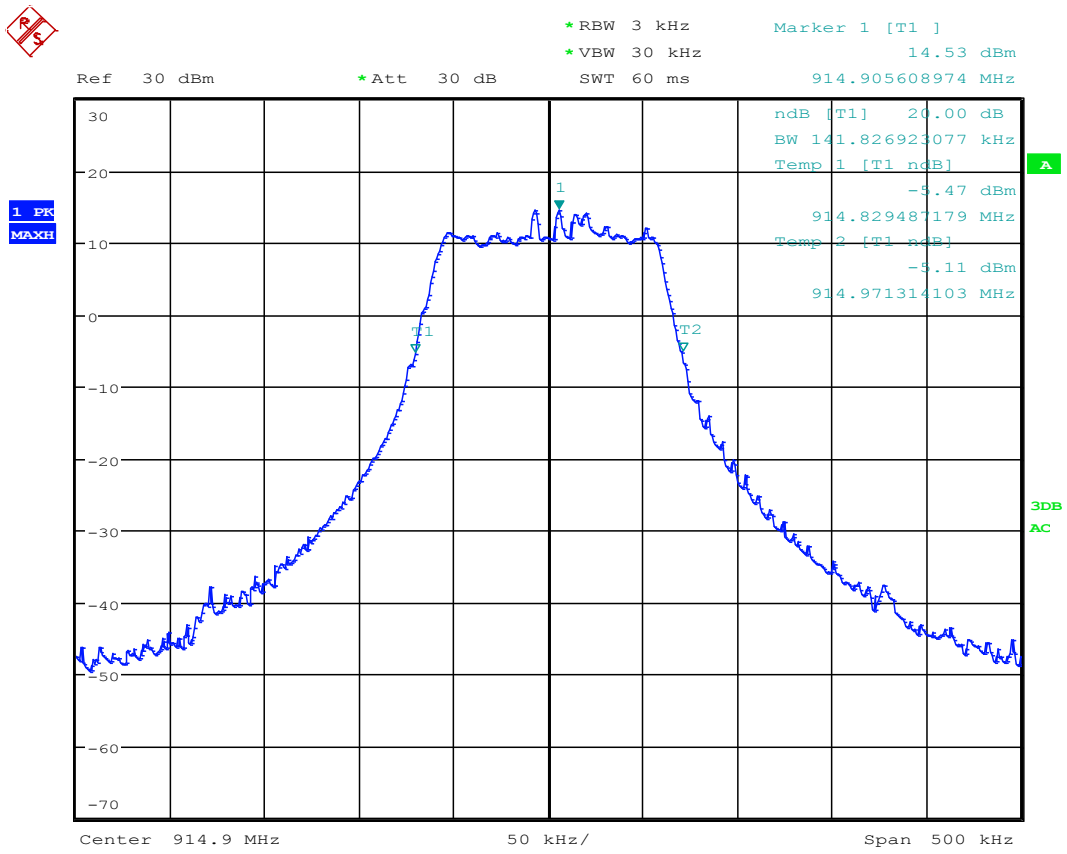
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 10
Plot n°8



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
Middle	**908,70**	**138,62**	**500**	**8**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**908,630 MHz**	**Fmax**	**908,769 MHz**

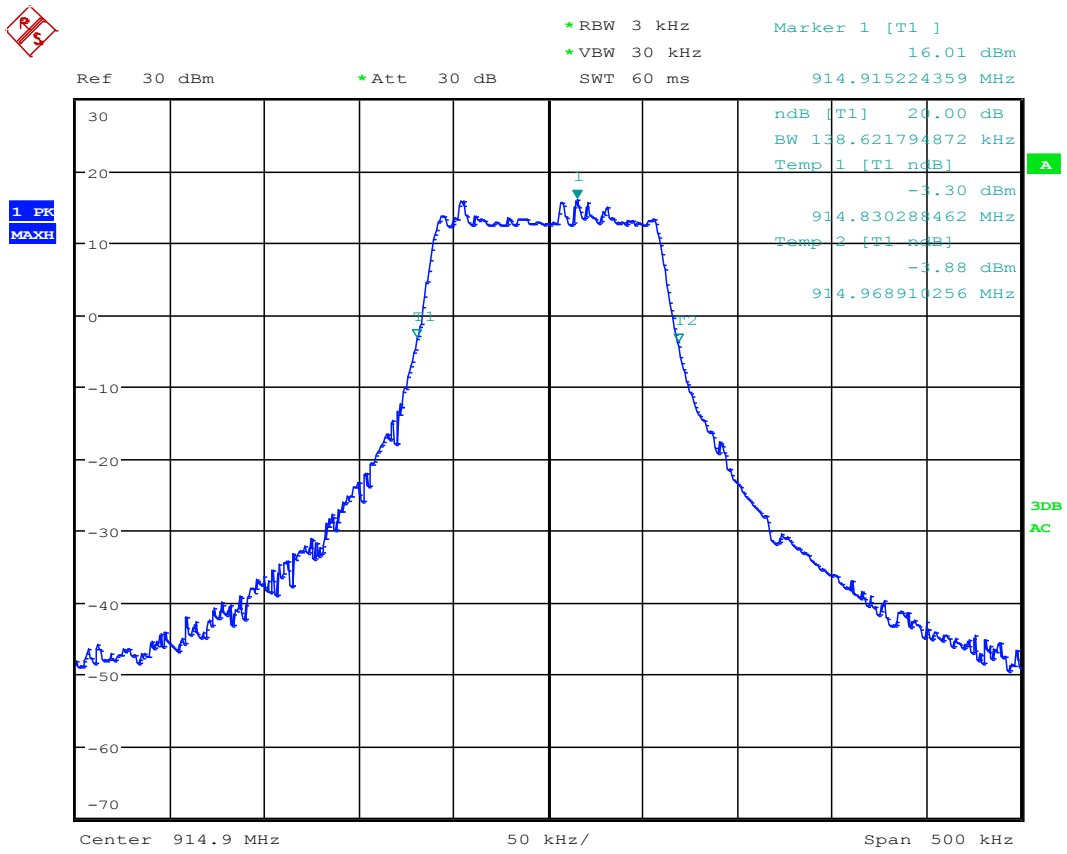
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – High Channel (914,9 MHz) – SF 7
Plot n°9



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
High	**914,90**	**141,82**	**500**	**9**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**914,829 MHz**	**Fmax**	**914,971 MHz**

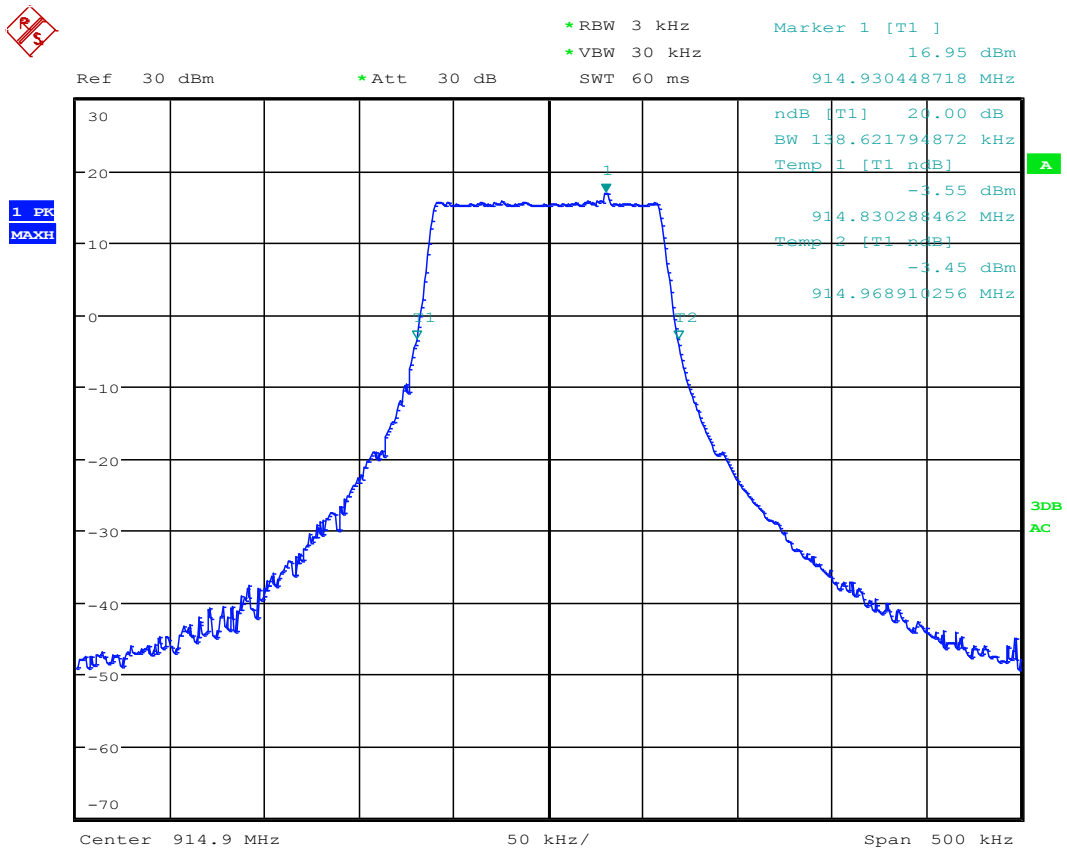
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – High Channel (914,9 MHz) – SF 8
Plot n°10



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
High	914,90	138,62	500	10

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	914,830 MHz	Fmax	914,969 MHz

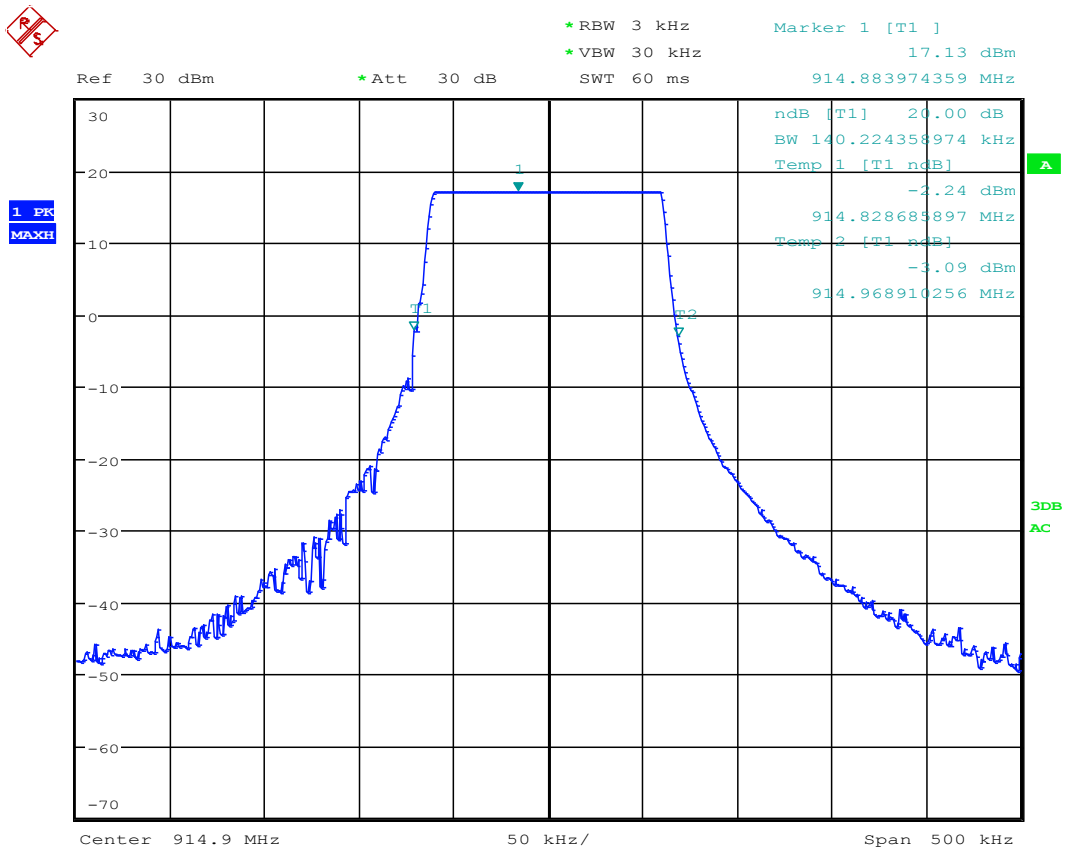
Graphical representation of 20dB Bandwidth
Operation Mode: #1 – High Channel (914,9 MHz) – SF 9
Plot n°11



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
High	**914,90**	**138,62**	**500**	**11**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**914,830 MHz**	**Fmax**	**914,969 MHz**

Graphical representation of 20dB Bandwidth
Operation Mode: #1 – High Channel (914,9 MHz) – SF 10
Plot n°12



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -20dB (kHz)	Limit (kHz)	Plot (No.)
High	**914,90**	**140,22**	**500**	**12**

Bandwidth at -20dB (Fmin and Fmax)			
Fmin	**914,828 MHz**	**Fmax**	**914,969 MHz**

11.4 TEST: RF power output, radiated (EIRP)			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22,5°C	
	Relative Humidity (%)	51%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF Connector	
Equipment mode:	Operation mode	#1 #3	
FCC Standard	§15.247 (B) (2) (3)		

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

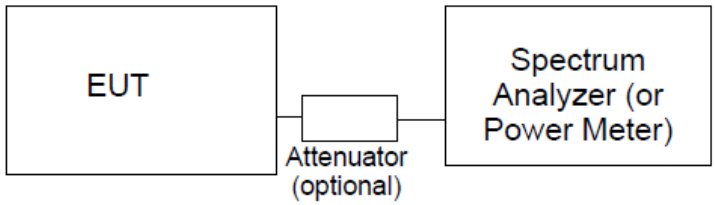
(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) 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, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Further information to test setup

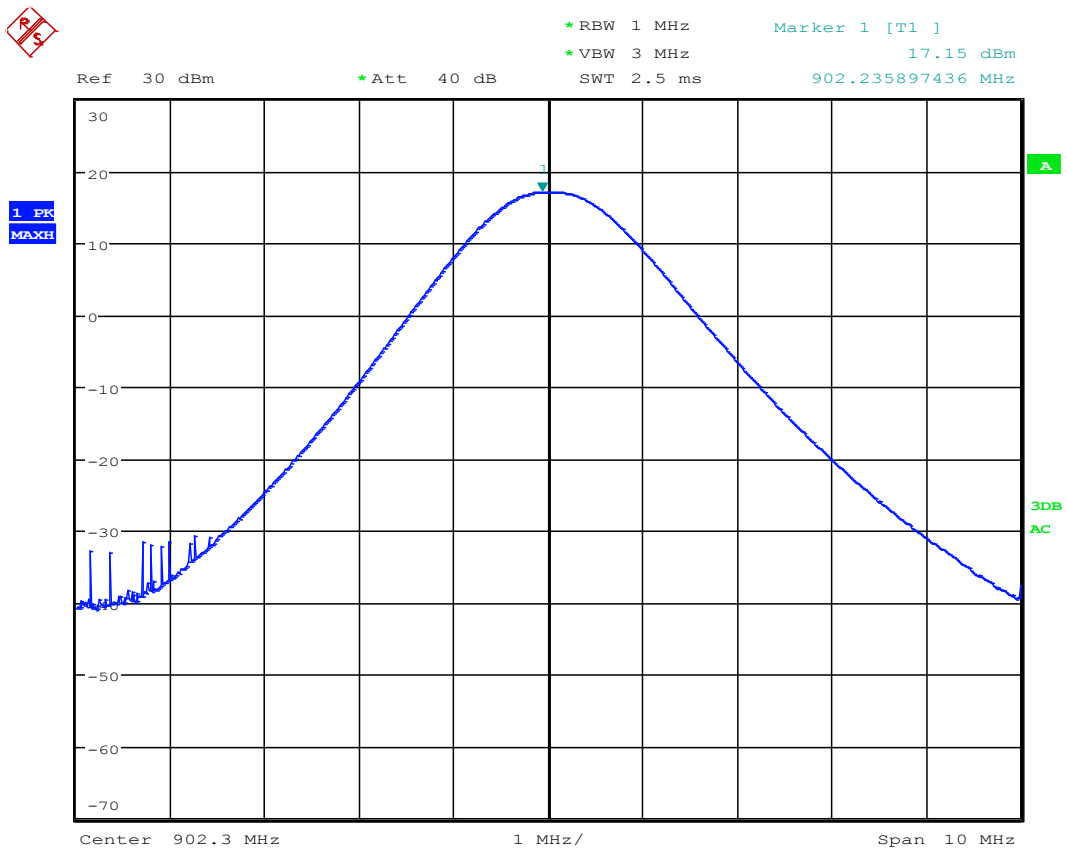


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Graphical representation of RF power output

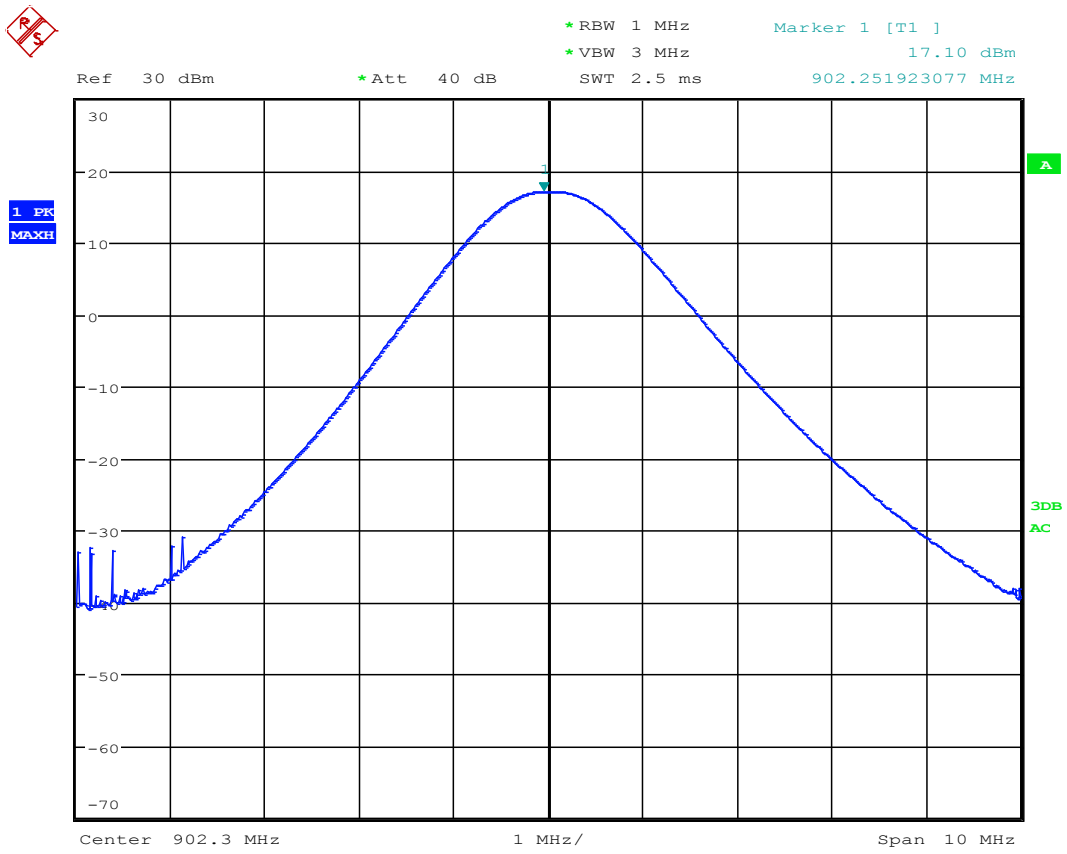
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 7

Plot n°1



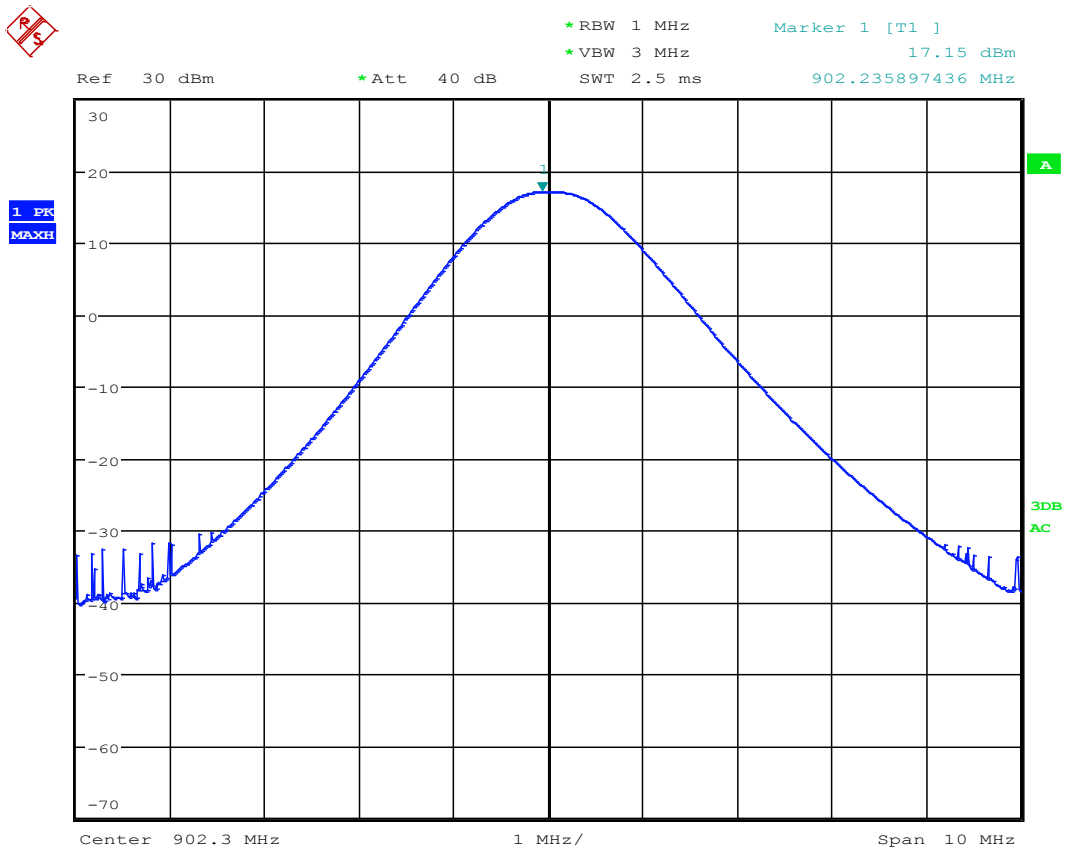
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Low	**902,30**	**17,15**	**51,88**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 8
Plot n°2



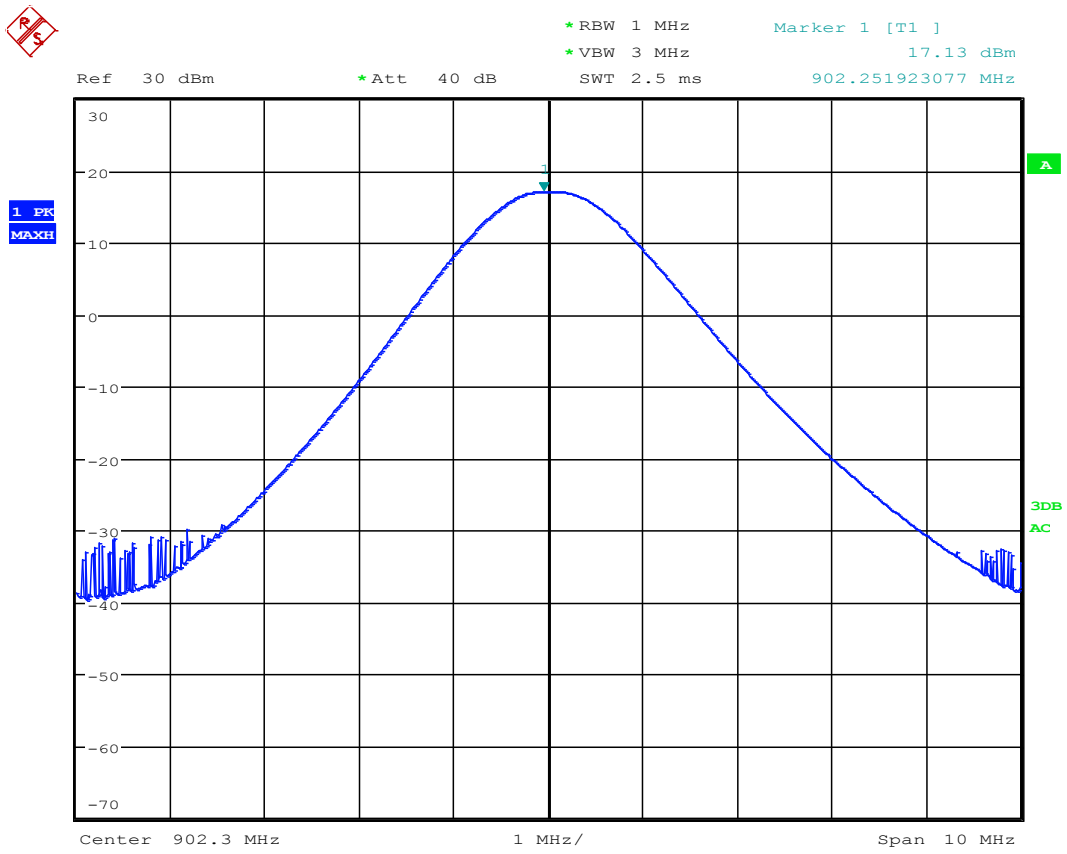
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Low	**902,30**	**17,10**	**51,29**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 9
Plot n°3



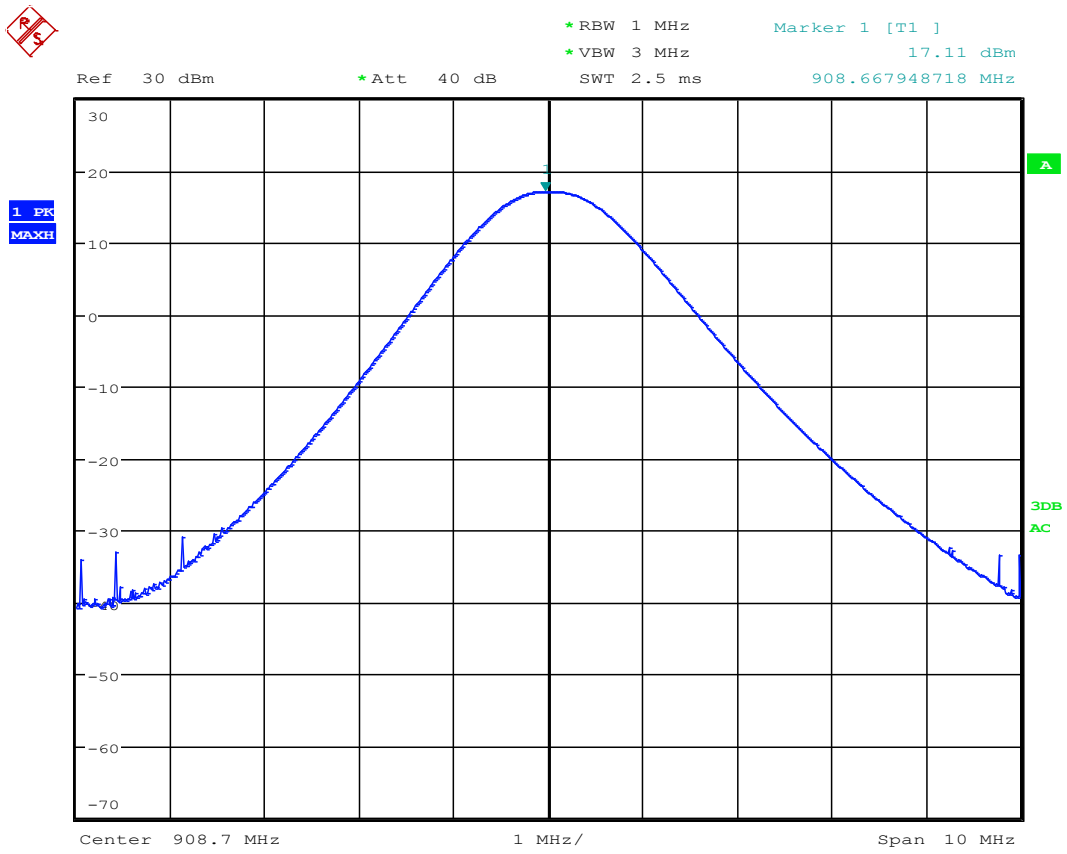
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Low	**902,30**	**17,15**	**51,88**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Low Channel (902,3 MHz) – SF 10
Plot n°4



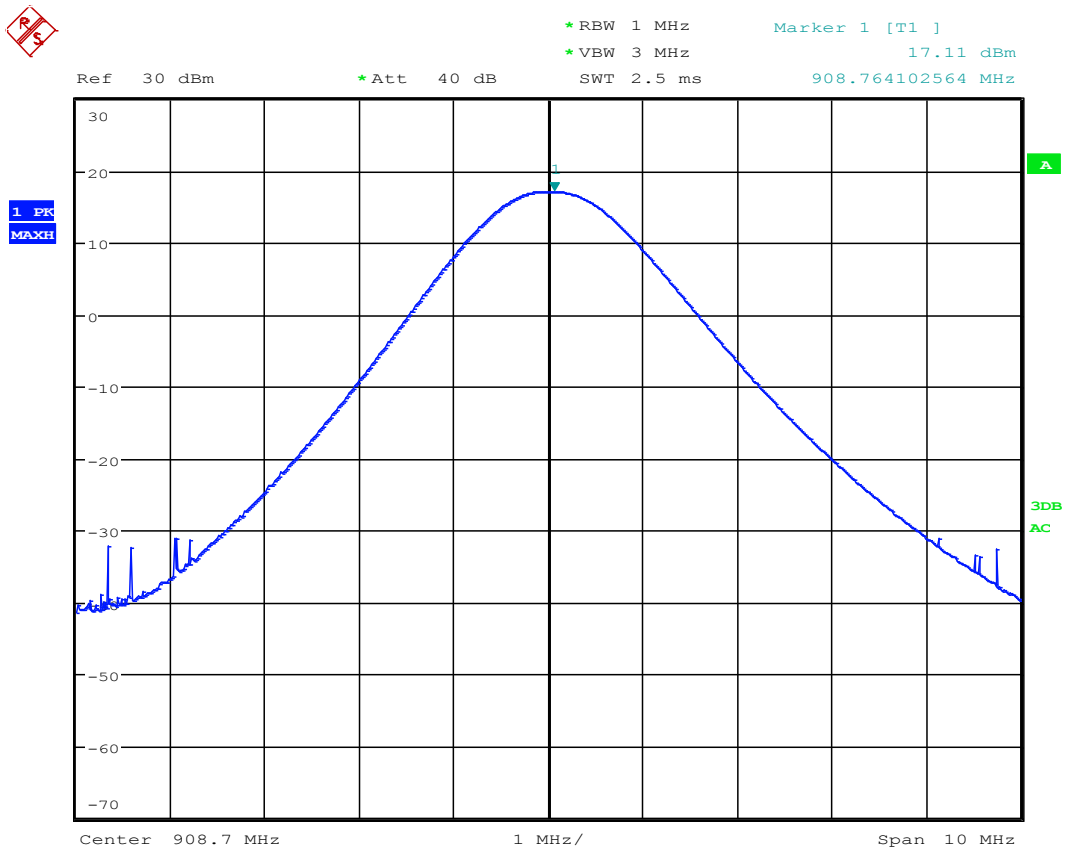
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Low	**902,30**	**17,13**	**51,64**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 7
Plot n°5



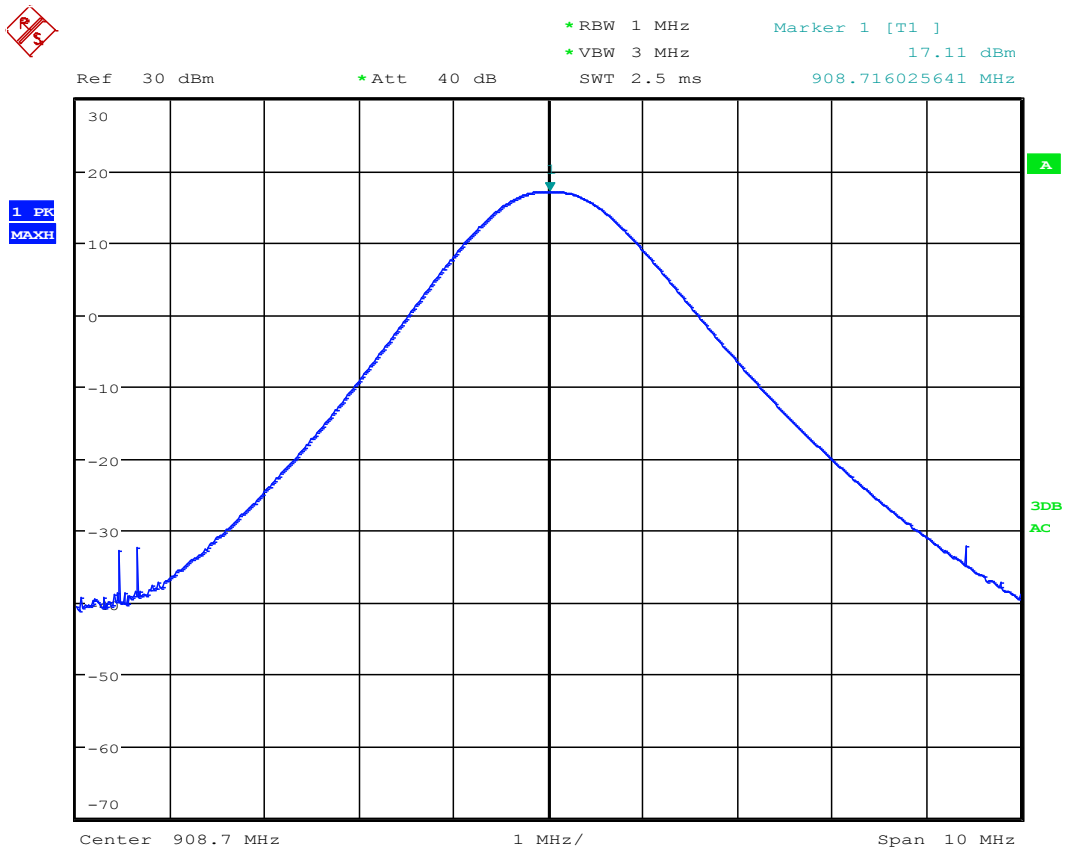
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Middle	**908,70**	**17,11**	**51,40**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 8
Plot n°6



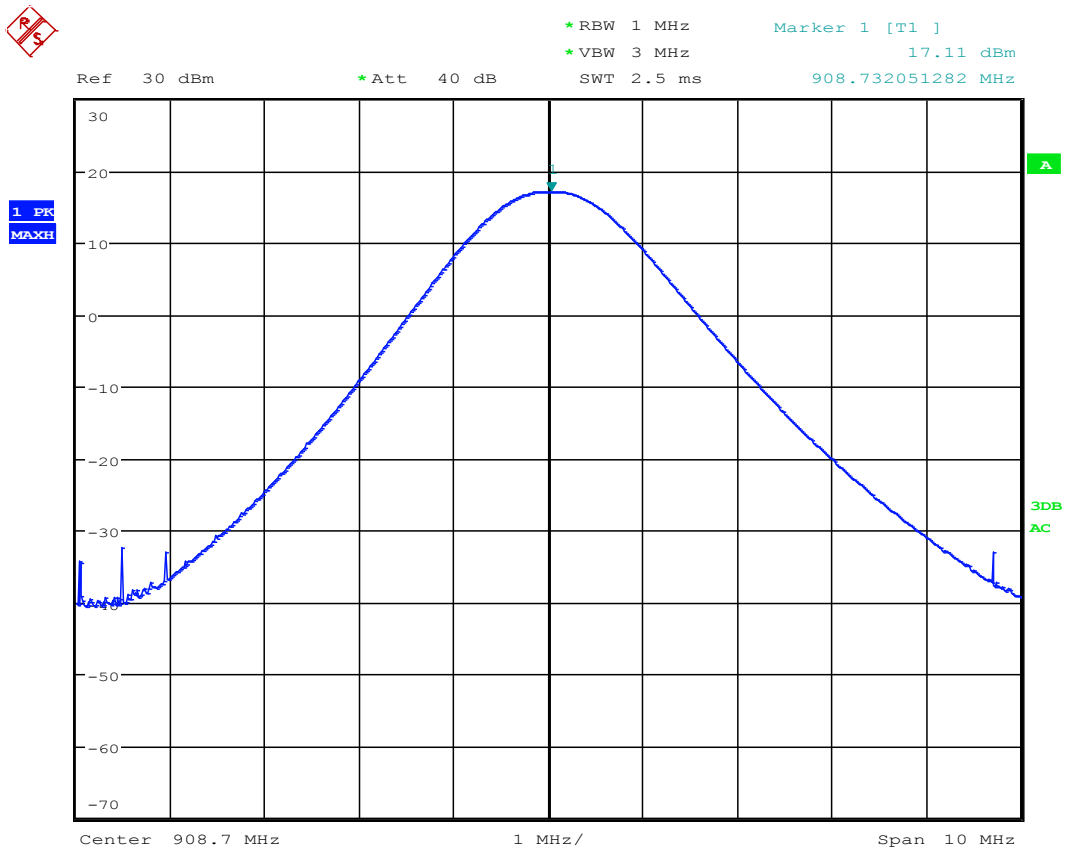
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Middle	**908,70**	**17,11**	**51,40**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 9
Plot n°7



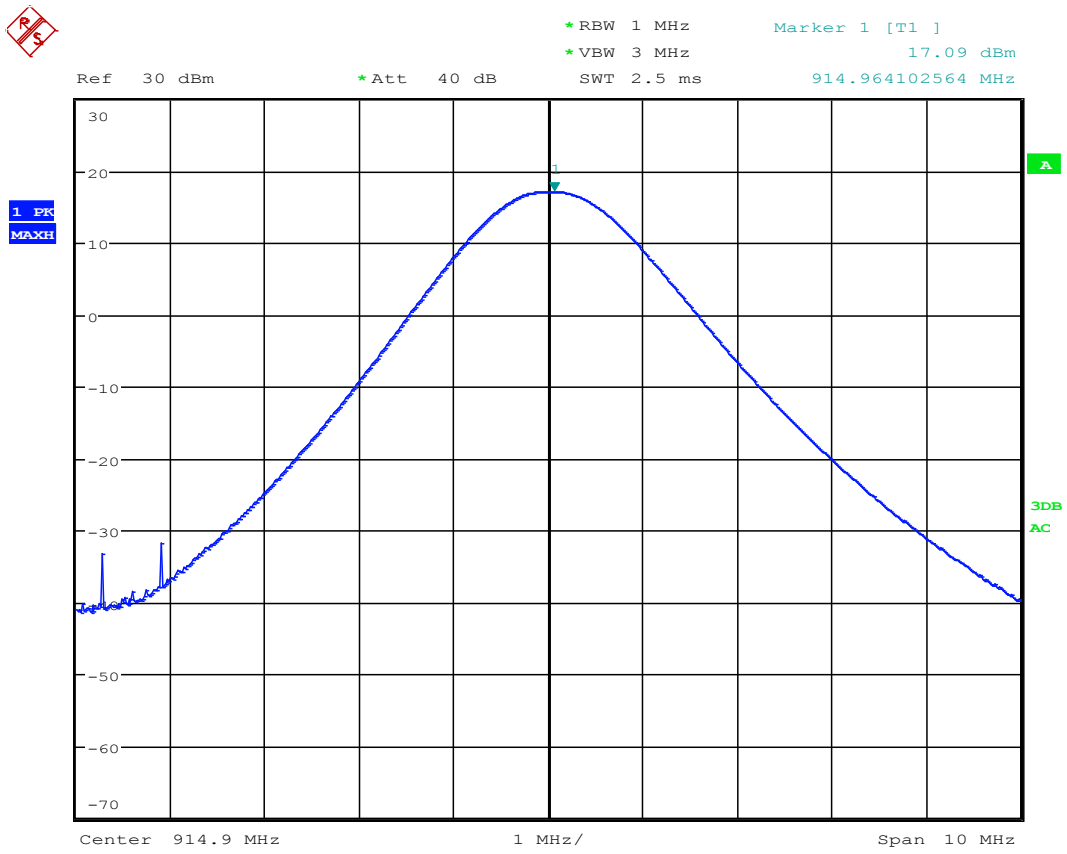
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Middle	**908,70**	**17,11**	**51,40**	**1**

Graphical representation of RF power output
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF 10
Plot n°8



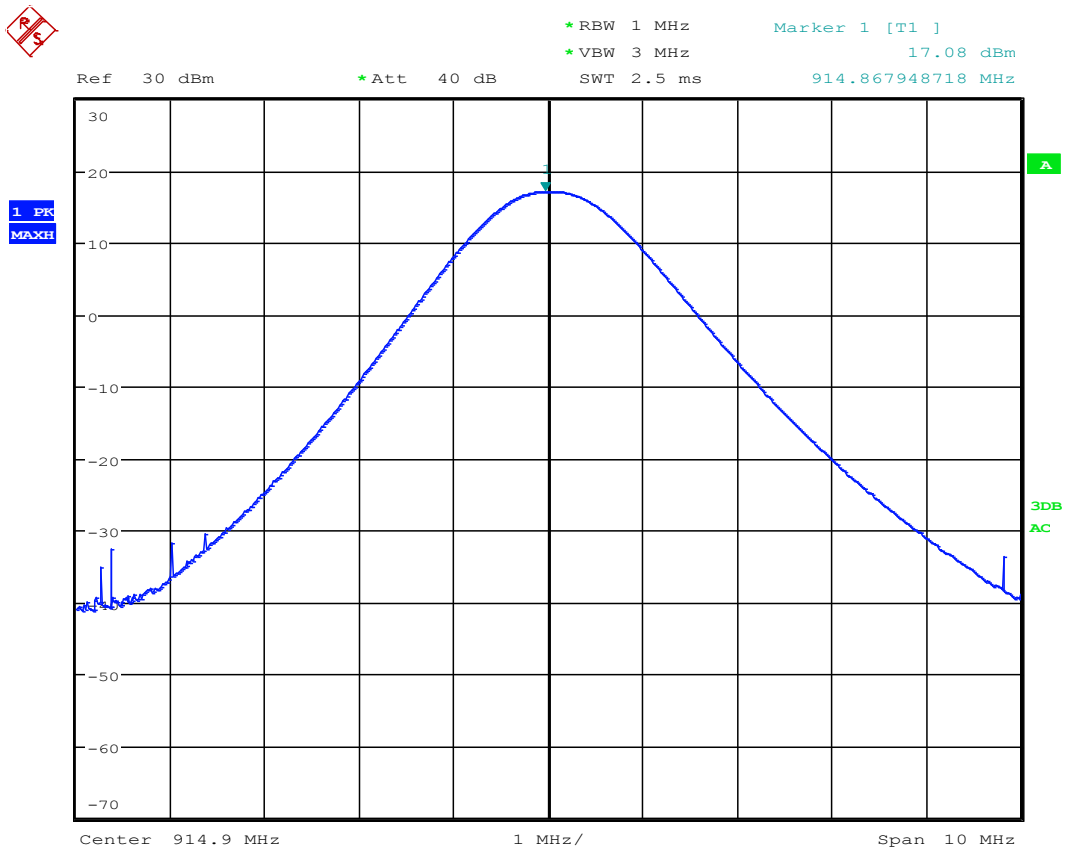
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Middle	**908,70**	**17,11**	**51,40**	**1**

Graphical representation of RF power output
Operation Mode: #1 – High Channel (914,9 MHz) – SF 7
Plot n°9



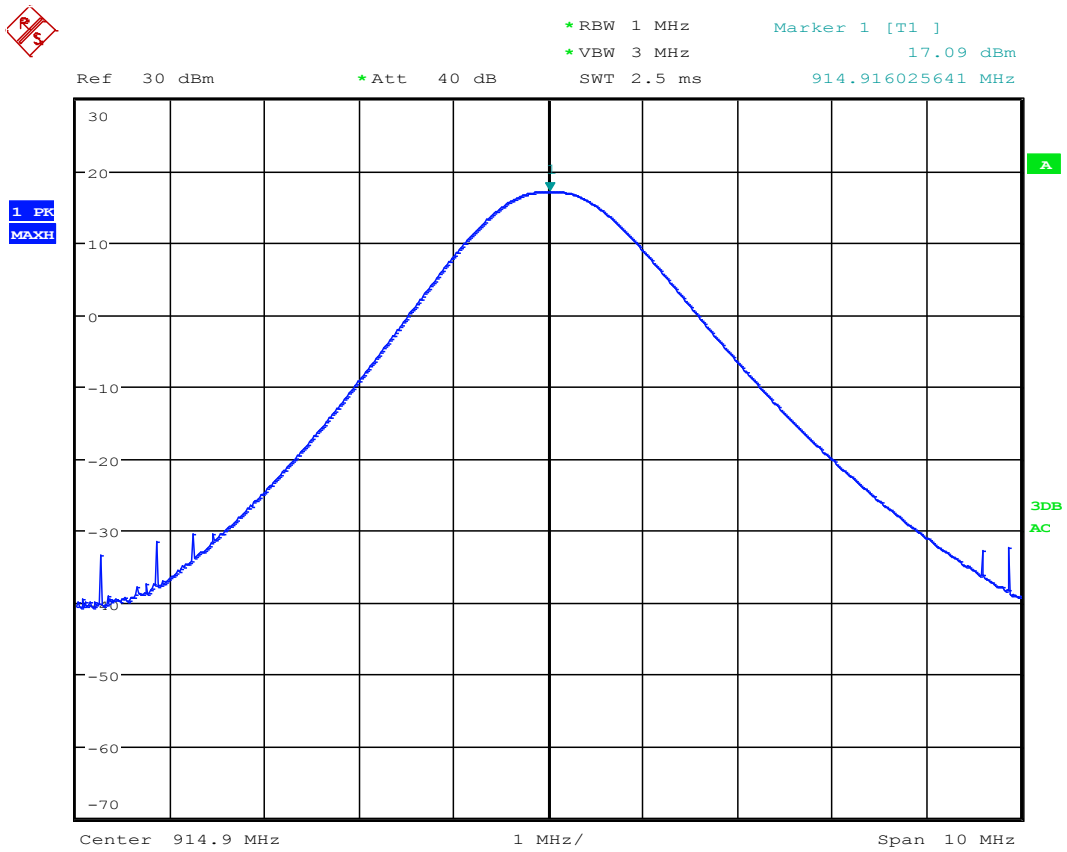
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
High	**914,90**	**17,09**	**51,17**	**1**

Graphical representation of RF power output
Operation Mode: #1 – High Channel (914,9 MHz) – SF 8
Plot n°10



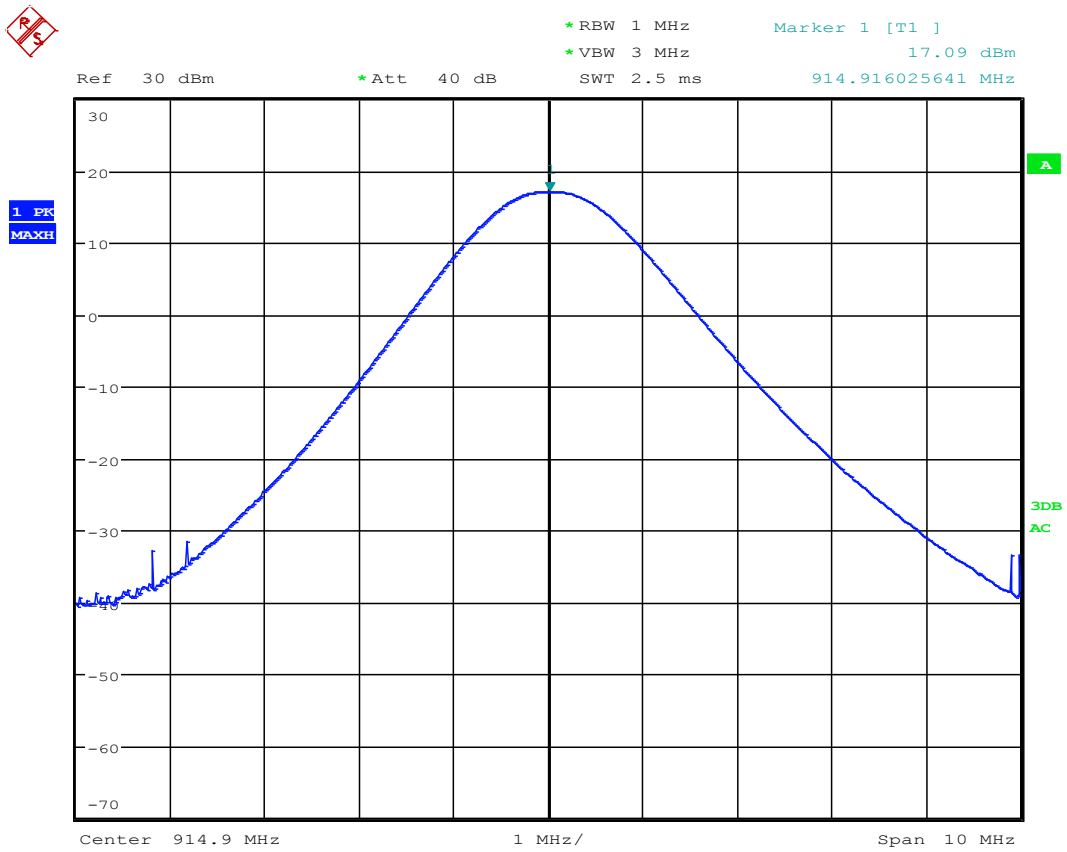
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
High	**914,90**	**17,08**	**51,05**	**1**

Graphical representation of RF power output
Operation Mode: #1 – High Channel (914,9 MHz) – SF 9
Plot n°11



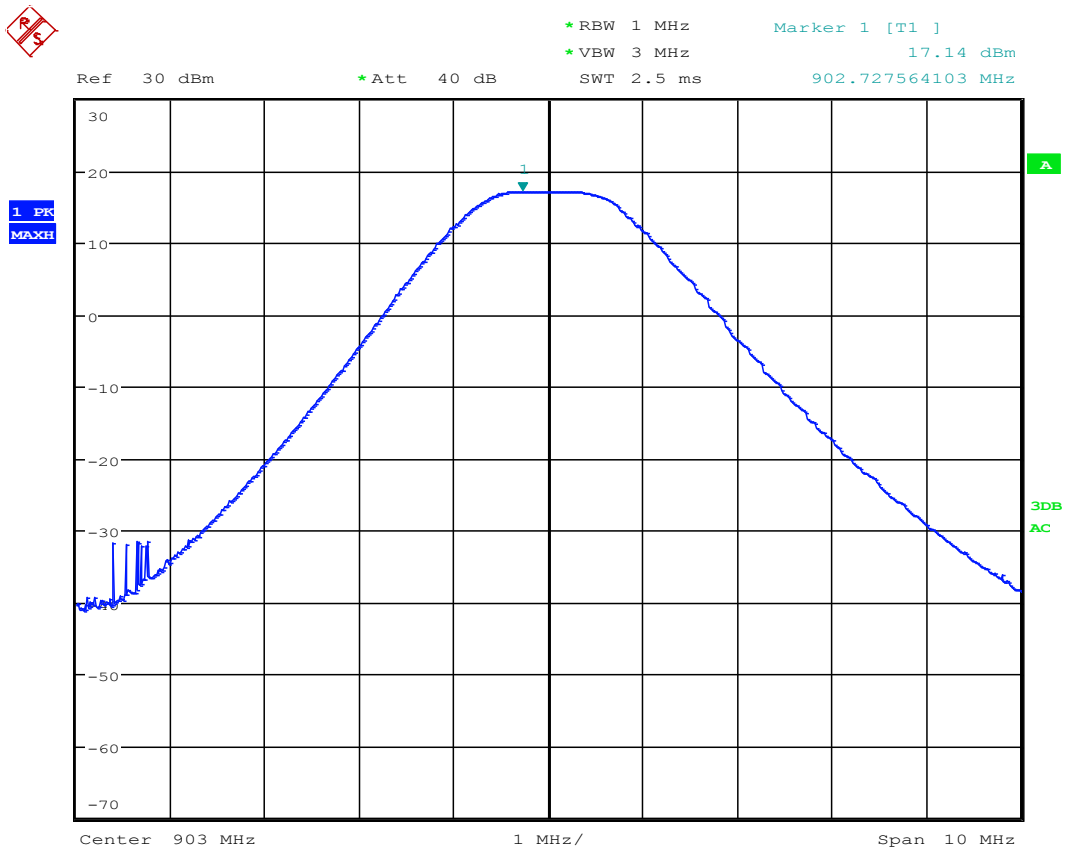
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
High	**914,90**	**17,09**	**51,17**	**1**

Graphical representation of RF power output
Operation Mode: #1 – High Channel (914,9 MHz) – SF 10
Plot n°12



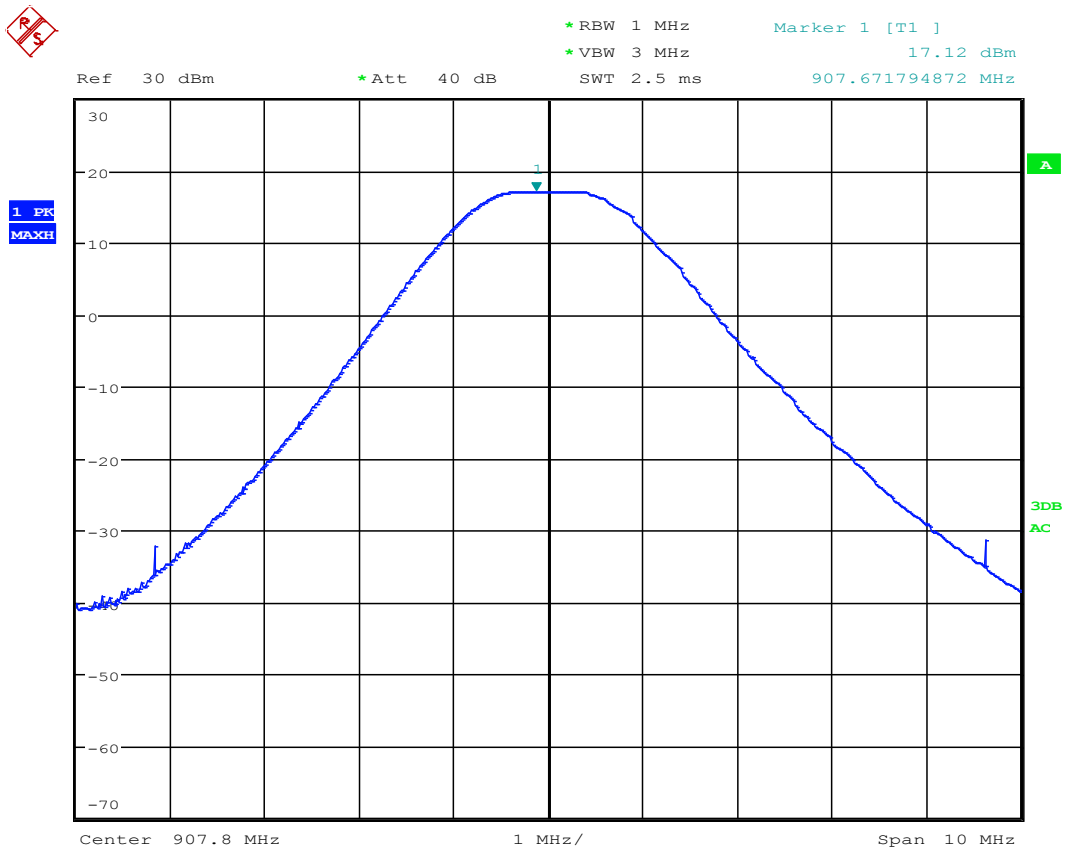
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
High	**914,90**	**17,09**	**51,17**	**1**

Graphical representation of RF power output
Operation Mode: #3 – Low Channel (903,0 MHz) – SF 8
Plot n°13



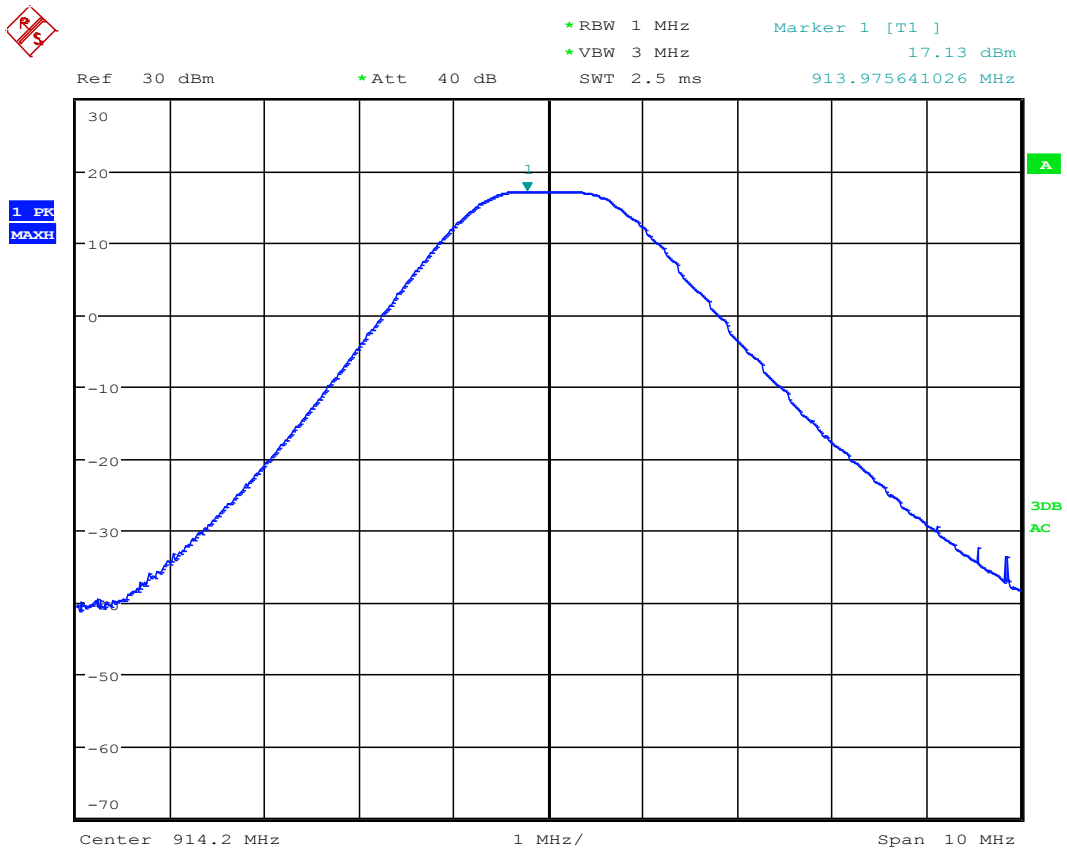
Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Low	**903,00**	**17,14**	**51,76**	**1**

Graphical representation of RF power output
Operation Mode: #3 – Middle Channel (907,8 MHz) – SF 8
Plot n°14

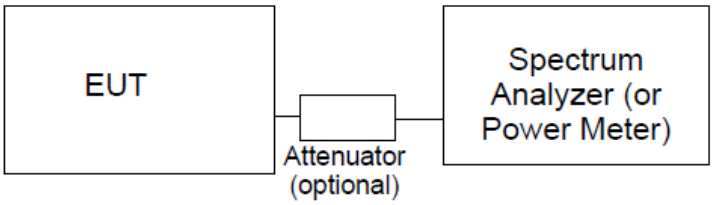


Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
Middle	**907,80**	**17,12**	**51,52**	**1**

Graphical representation of RF power output
Operation Mode: #3 – High Channel (914,2 MHz) – SF 8
Plot n°15



Channel (No.)	Frequency (MHz)	Conducted Output Power		Limit (W)
		(dBm)	(mW)	
High	**914,20**	**17,13**	**51,64**	**1**

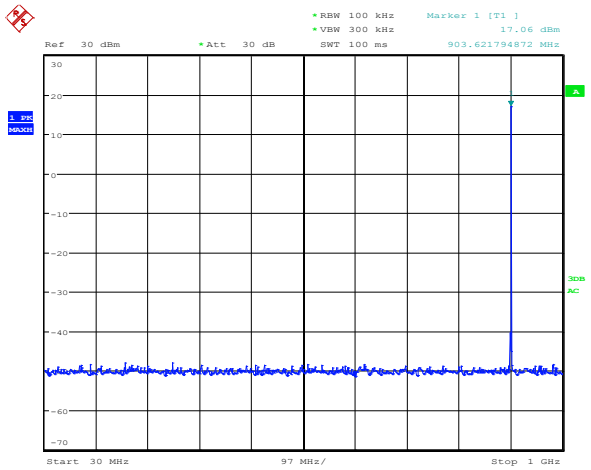
11.5 TEST: Out-of-band emissions			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C	
	Relative Humidity (%)	50%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF Connector	
Equipment mode:	Operation mode	#1 #3	
FCC Standard	§15.247 (D)		
(d) 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019
Highpass Filter	Wainwright Instr.	WHKX10-1170-1300	87020800	05/2018	05/2019

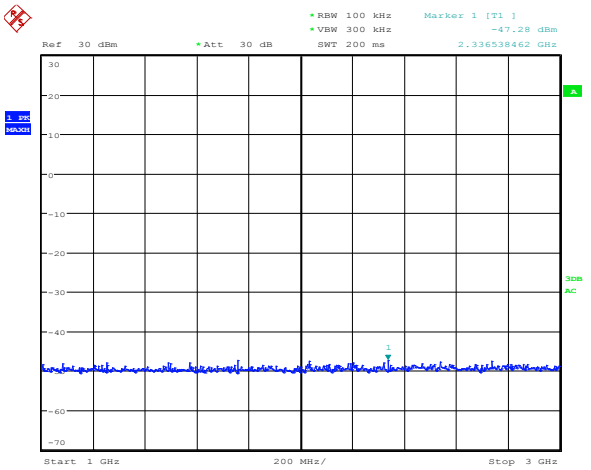
Graphical representation of Antenna Port Spurious Emission - Conducted

Operation Mode: #1 – Low Channel (902,3 MHz) – SF (Worst case)

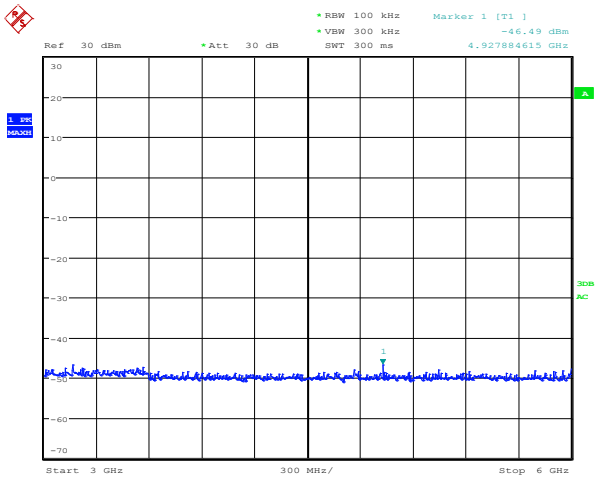
Frequency: 30MHz – 1000MHz



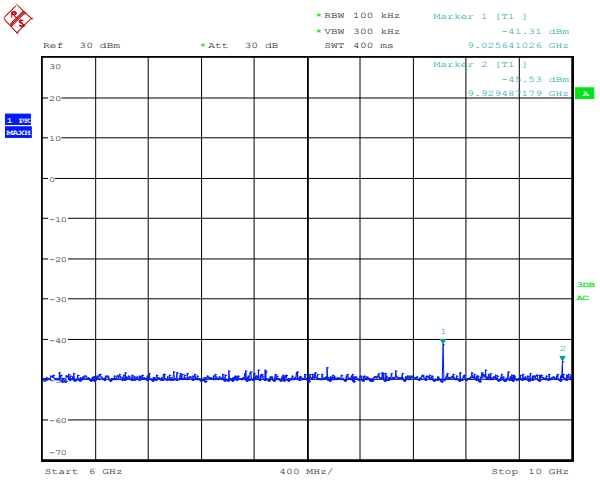
Frequency: 1GHz – 3GHz

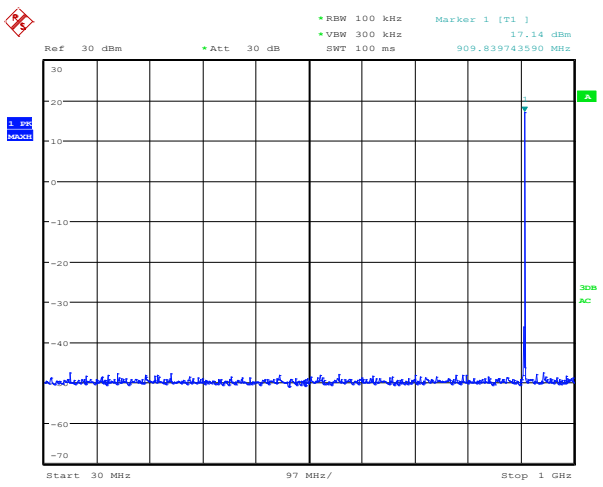
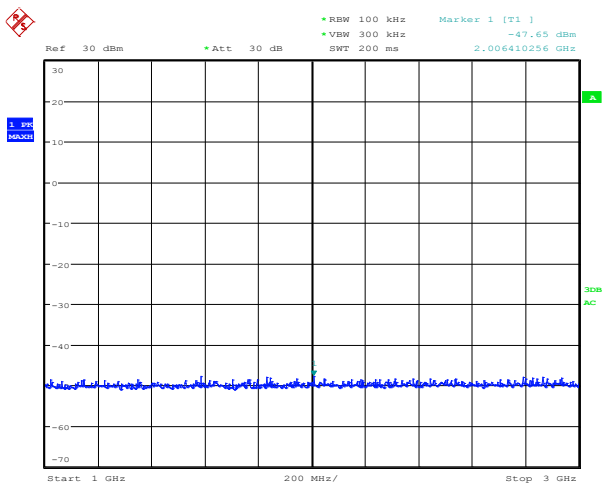
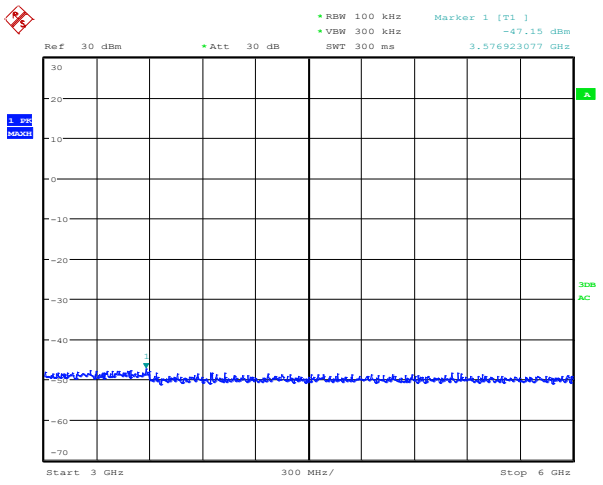
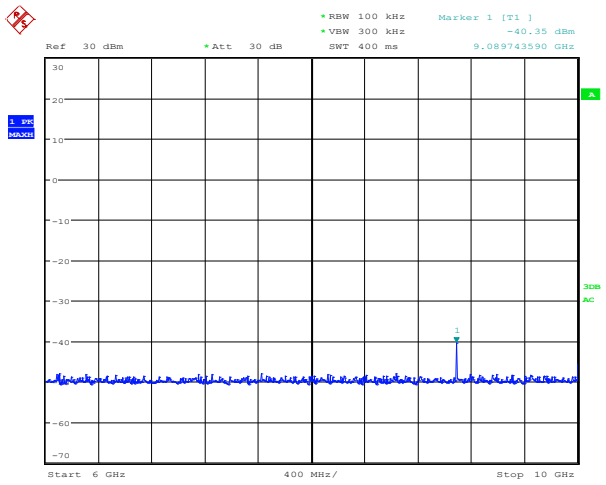


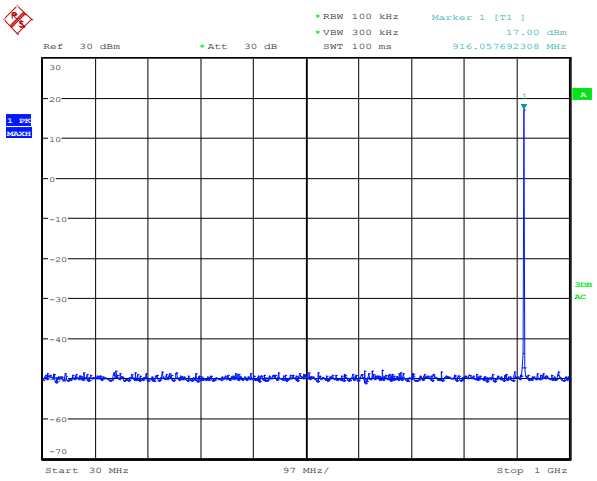
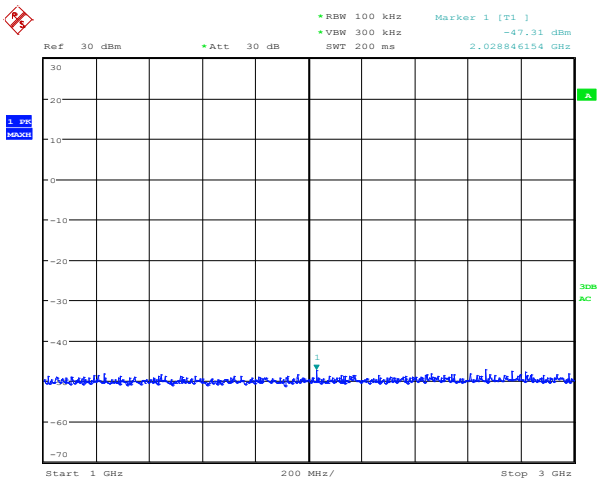
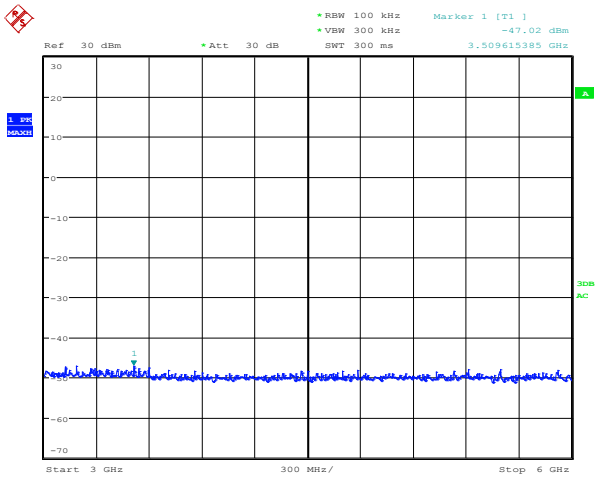
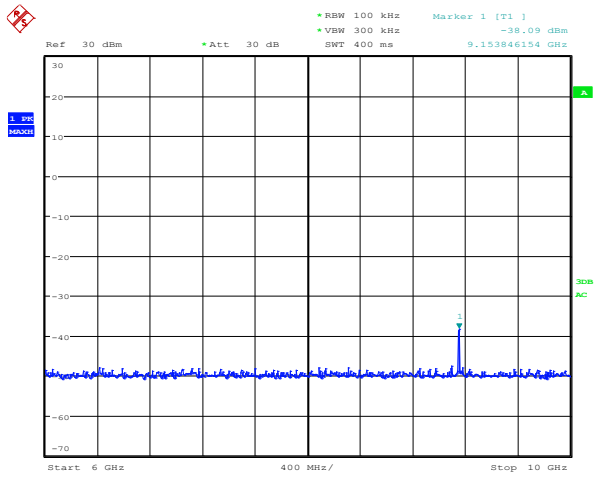
Frequency: 3GHz – 6GHz

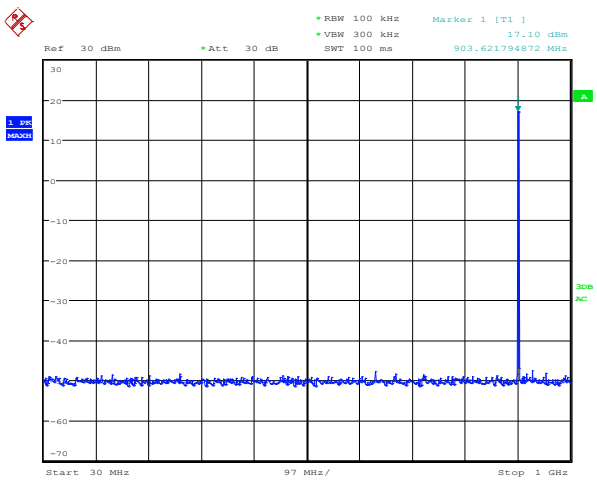
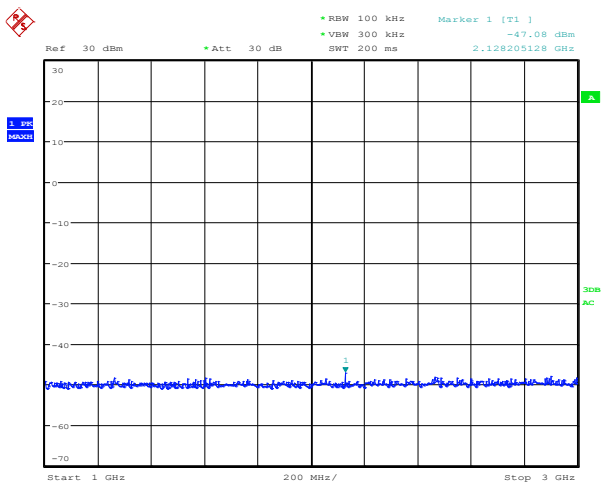
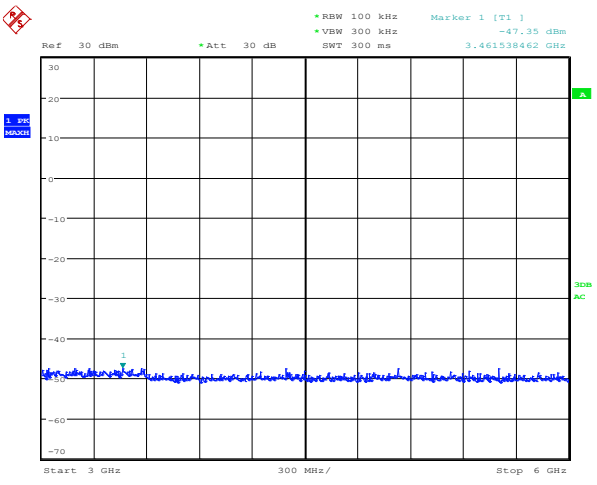
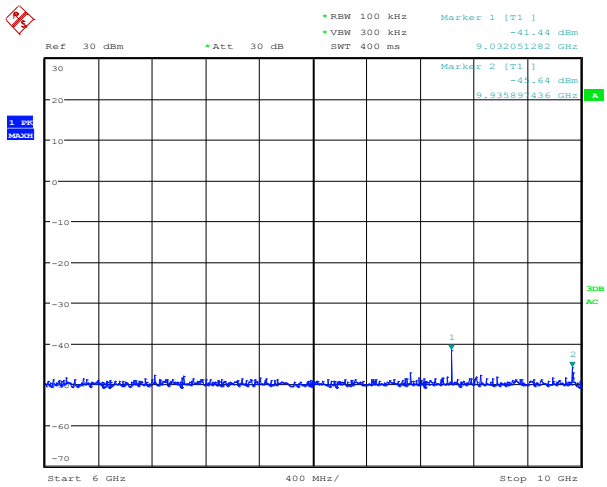


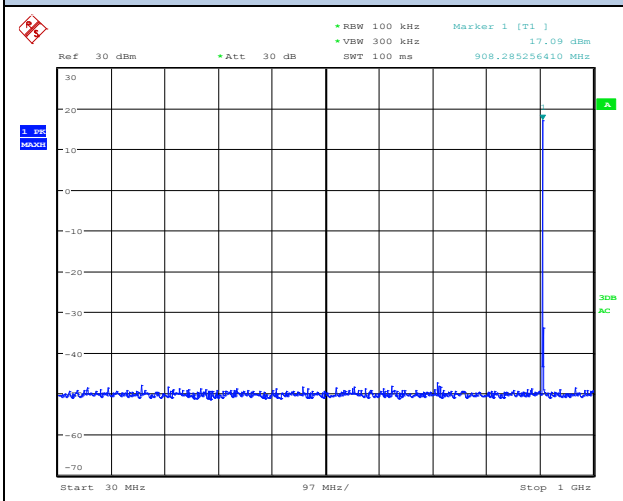
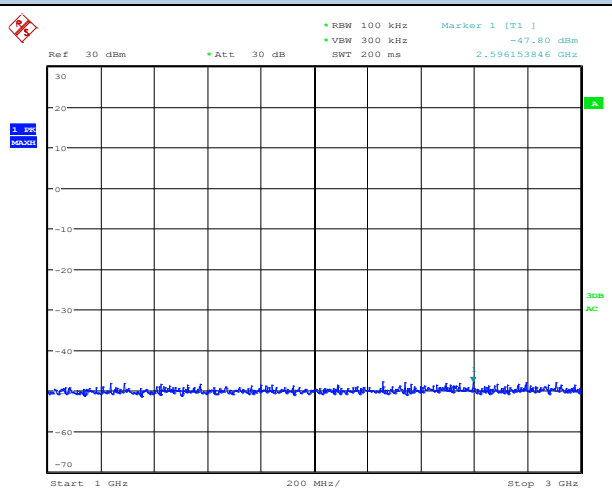
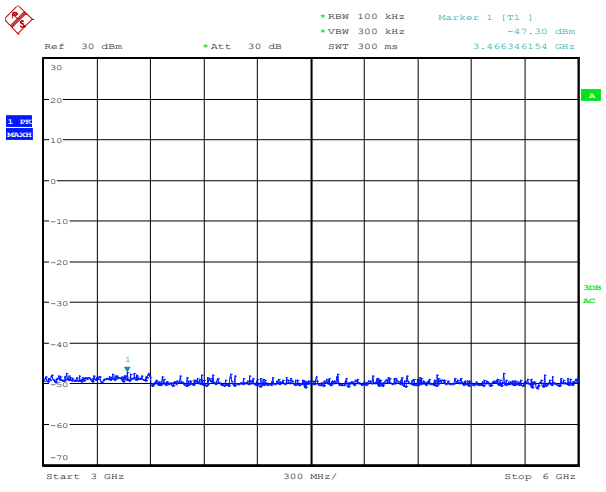
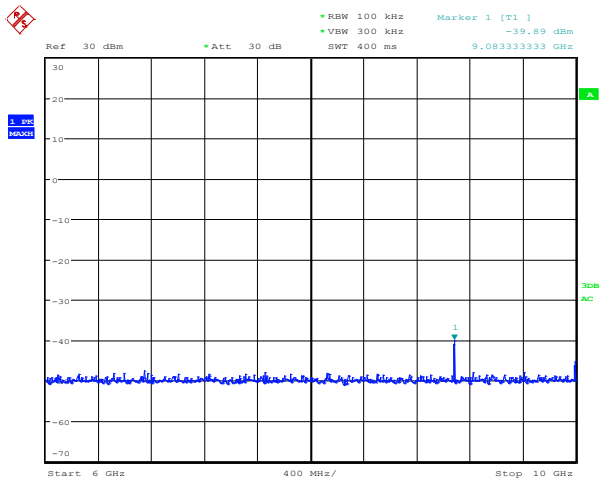
Frequency: 6GHz – 10GHz

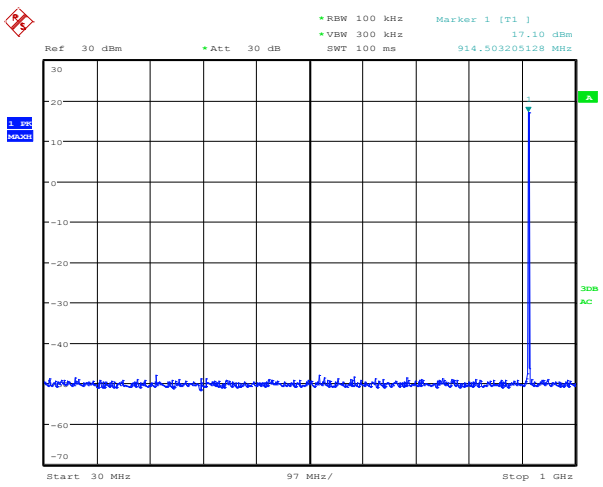
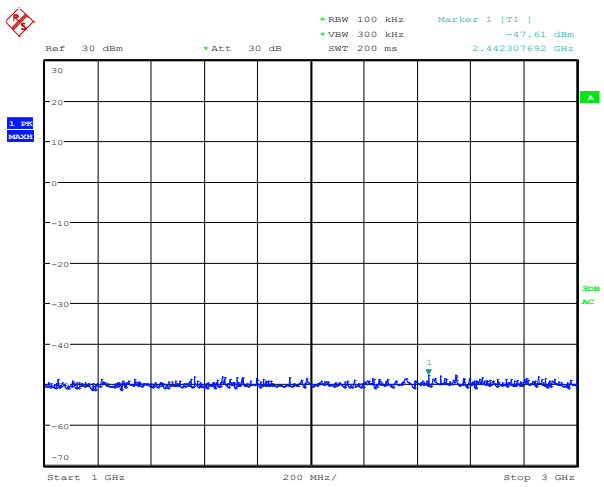
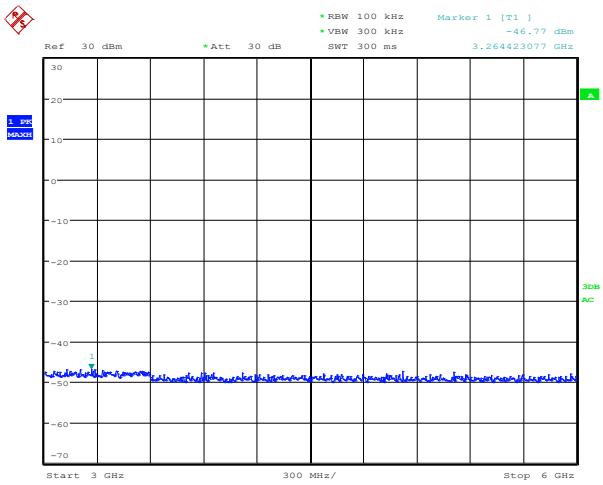
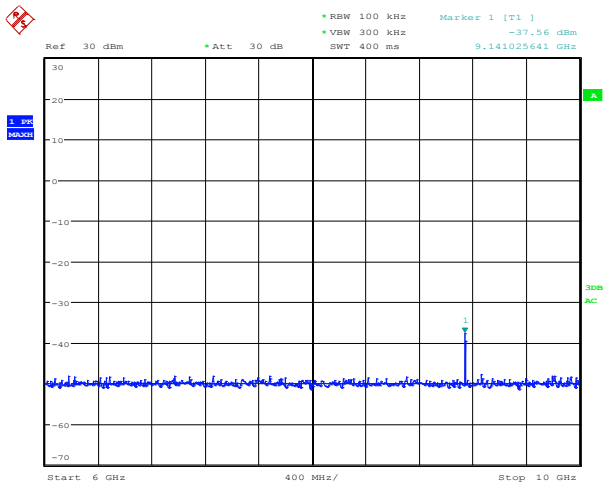


Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – Middle Channel (908,7 MHz) – SF (Worst case)	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 3GHz
	
Frequency: 3GHz – 6GHz	Frequency: 6GHz – 10GHz
	

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #1 – High Channel (914,9 MHz) – SF (Worst case)	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 3GHz
	
Frequency: 3GHz – 6GHz	Frequency: 6GHz – 10GHz
	

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #3 – Low Channel (903,8 MHz) – SF 8	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 3GHz
	
Frequency: 3GHz – 6GHz	Frequency: 6GHz – 10GHz
	

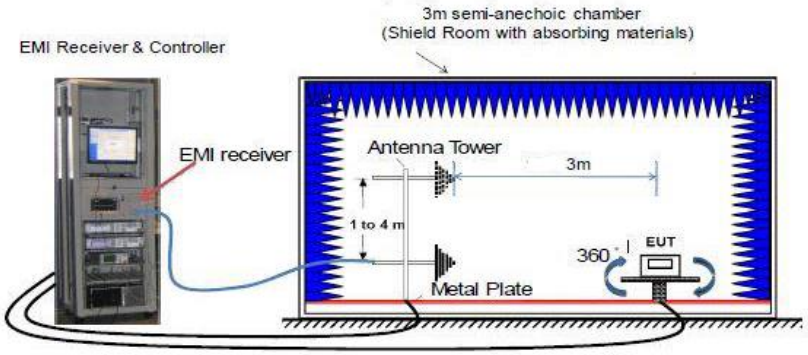
Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #3 – Middle Channel (907,8 MHz) – SF 8	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 3GHz
	
Frequency: 3GHz – 6GHz	Frequency: 6GHz – 10GHz
	

Graphical representation of Antenna Port Spurious Emission - Conducted	
Operation Mode: #3 – High Channel (914,2 MHz) – SF 8	
Frequency: 30MHz – 1000MHz	Frequency: 1GHz – 3GHz
	
Frequency: 3GHz – 6GHz	Frequency: 6GHz – 10GHz
	

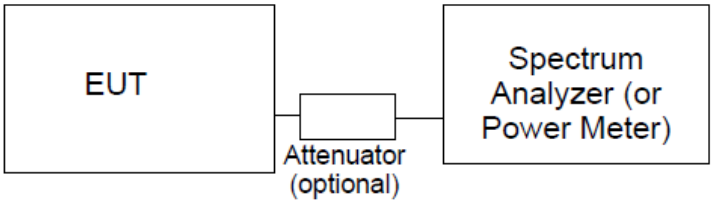
11.6 TEST: 100 kHz Bandwidth of Frequency Band Edges			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	21°C	
	Relative Humidity (%)	52%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF Connector Enclosure	
Equipment mode:	Operation mode	#1 #2 #3	
FCC Standard	§15.247 (D)		

(d) 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Further information to test setup (Radiated)



Further information to test setup (conducted)

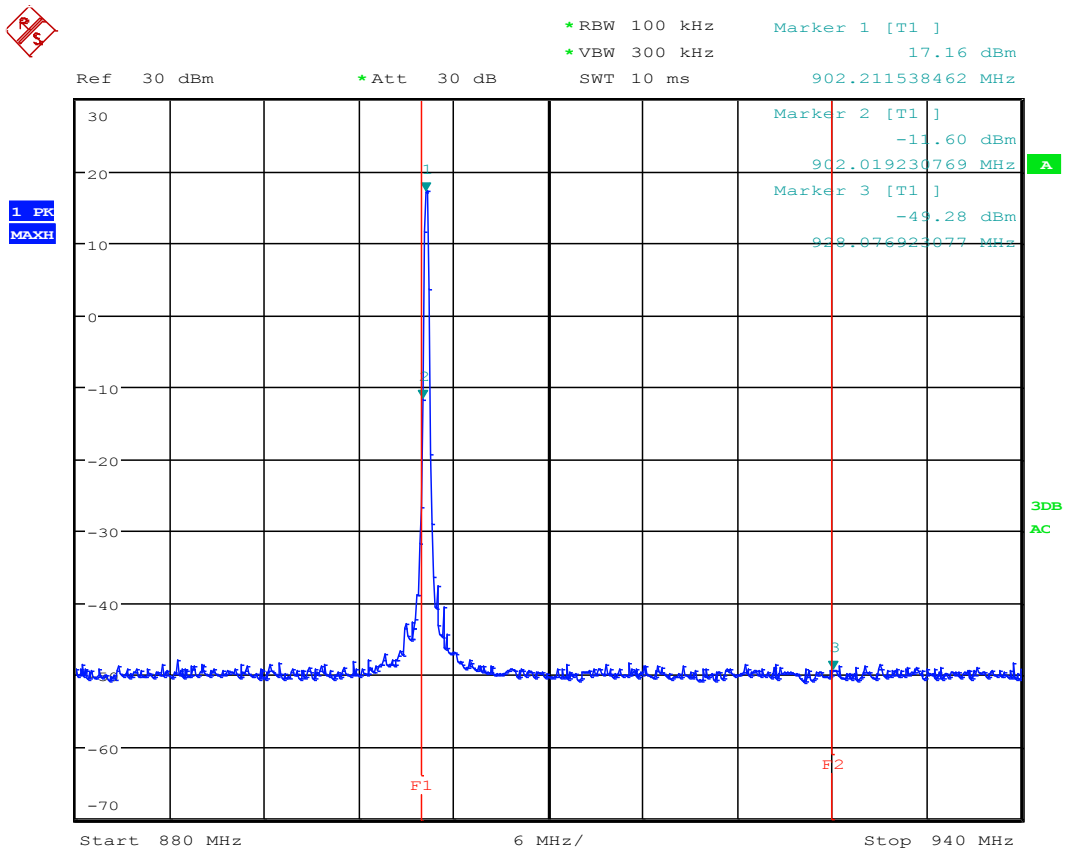


Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
CSSA	ETS Lindgren	FACT3	87020484	05/2017	05/2019
EMI Test Receiver	R&S	ESW44	87020967	06/2018	06/2019
EMI Test Receiver	R&S	ESU 40	87020455	05/2018	05/2019
Antenna BiConiLog	ETS Lindgren	3124E-PA	87020457	04/2017	04/2020

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted

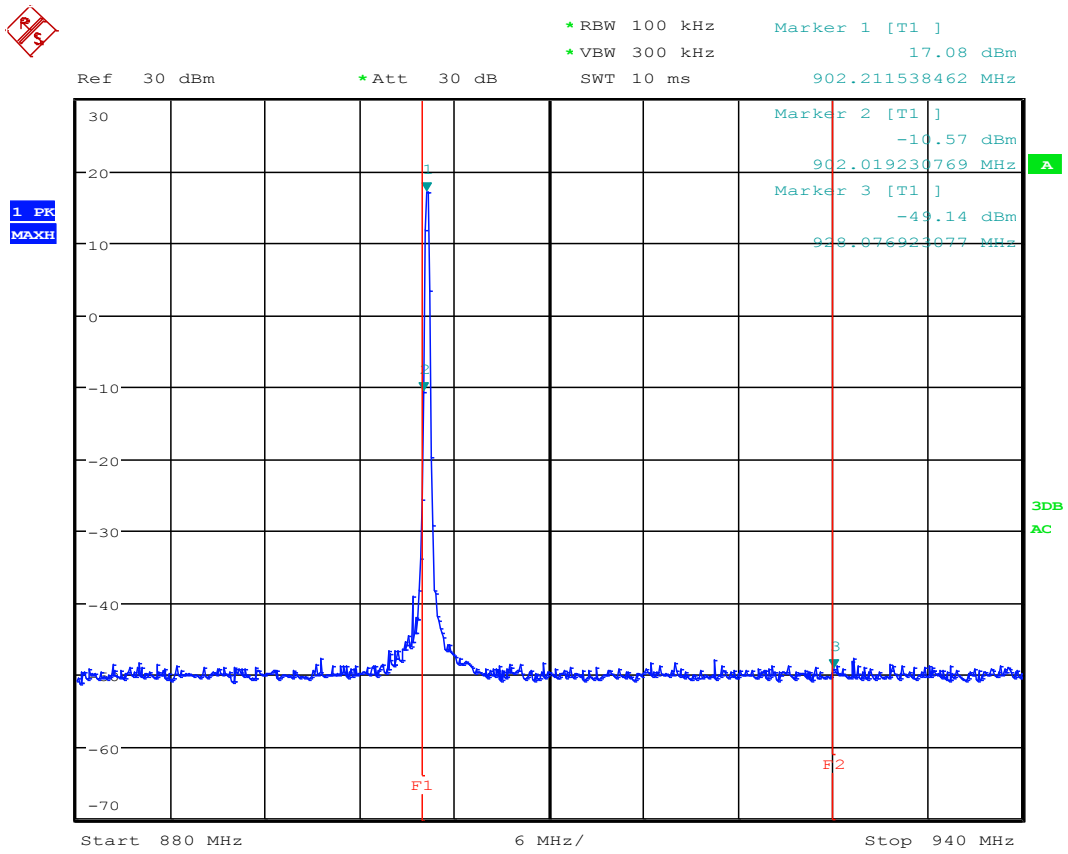
Operation Mode: #1 – Low Channel (902,3 MHz) – SF7

Plot n°1



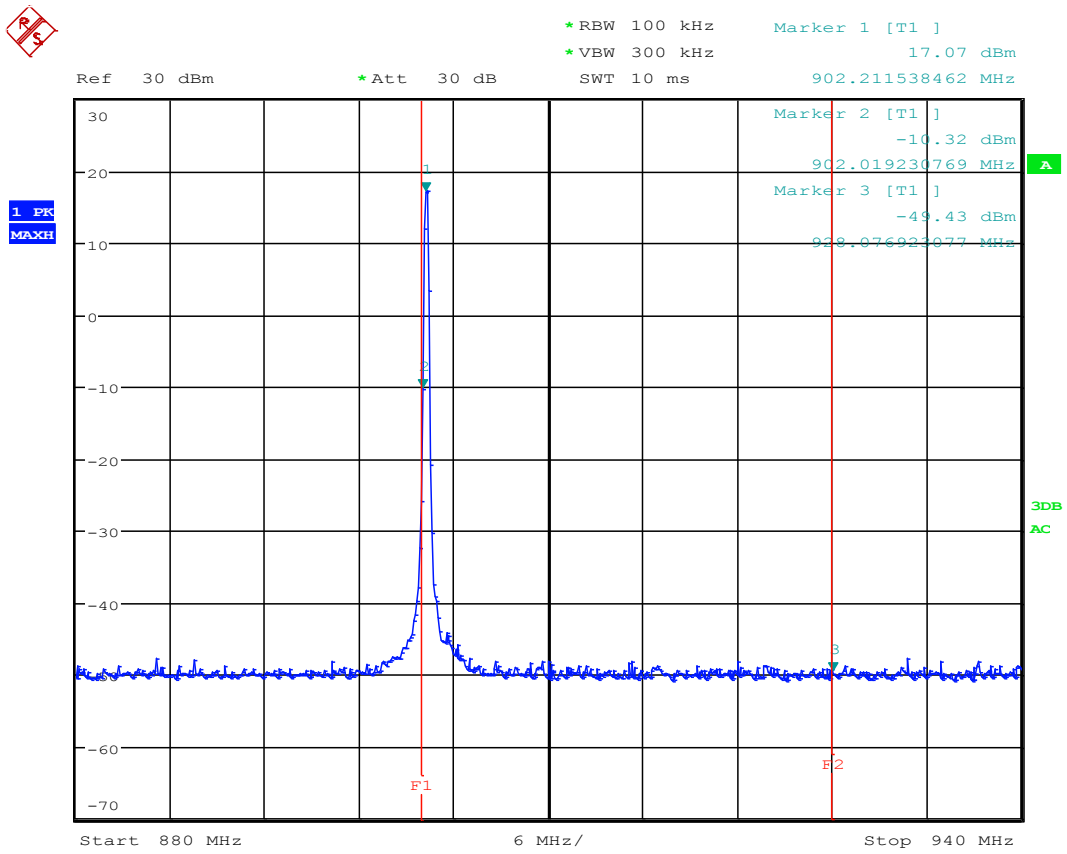
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-11,60**	**+17,16**	**28,76**	**-2,84**	**8,76**
928	**-49,28**	**+17,16**	**66,44**	**-2,84**	**46,44**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – Low Channel (902,3 MHz) – SF8
Plot n°2



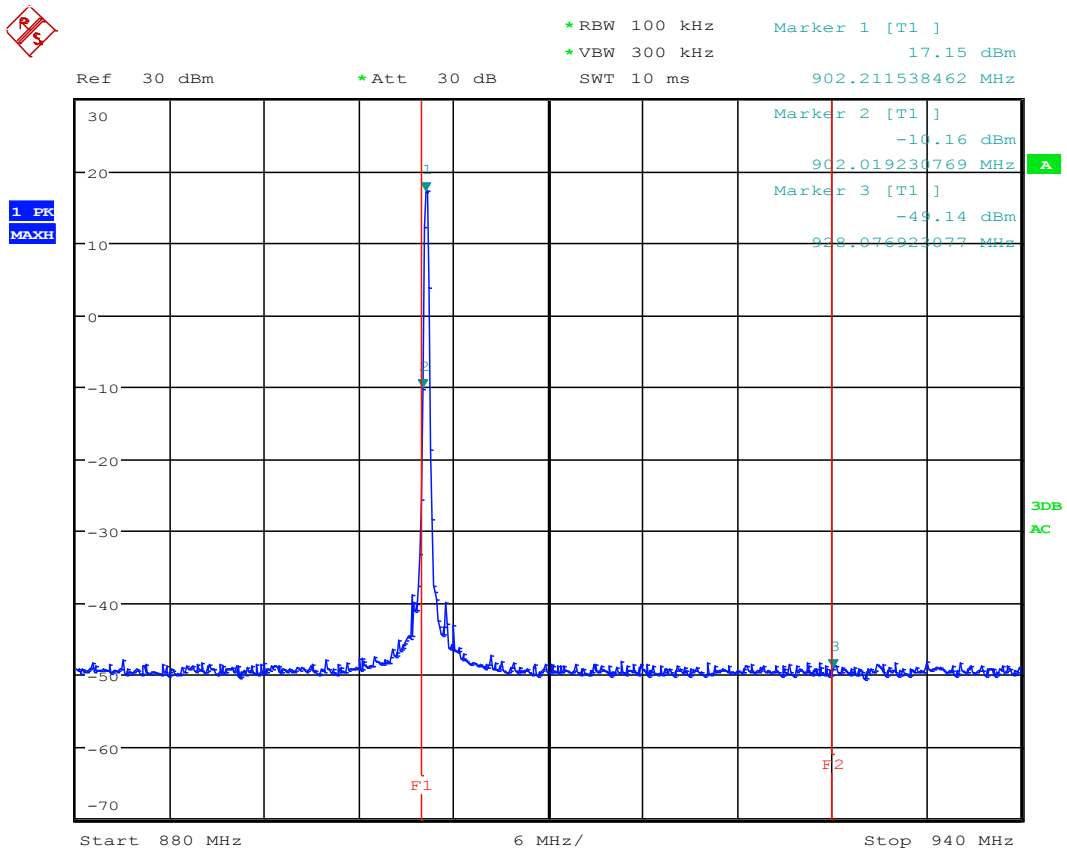
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-10,57**	**+17,08**	**27,65**	**-2,92**	**7,65**
928	**-49,14**	**+17,08**	**66,22**	**-2,92**	**46,22**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – Low Channel (902,3 MHz) – SF9
Plot n°3



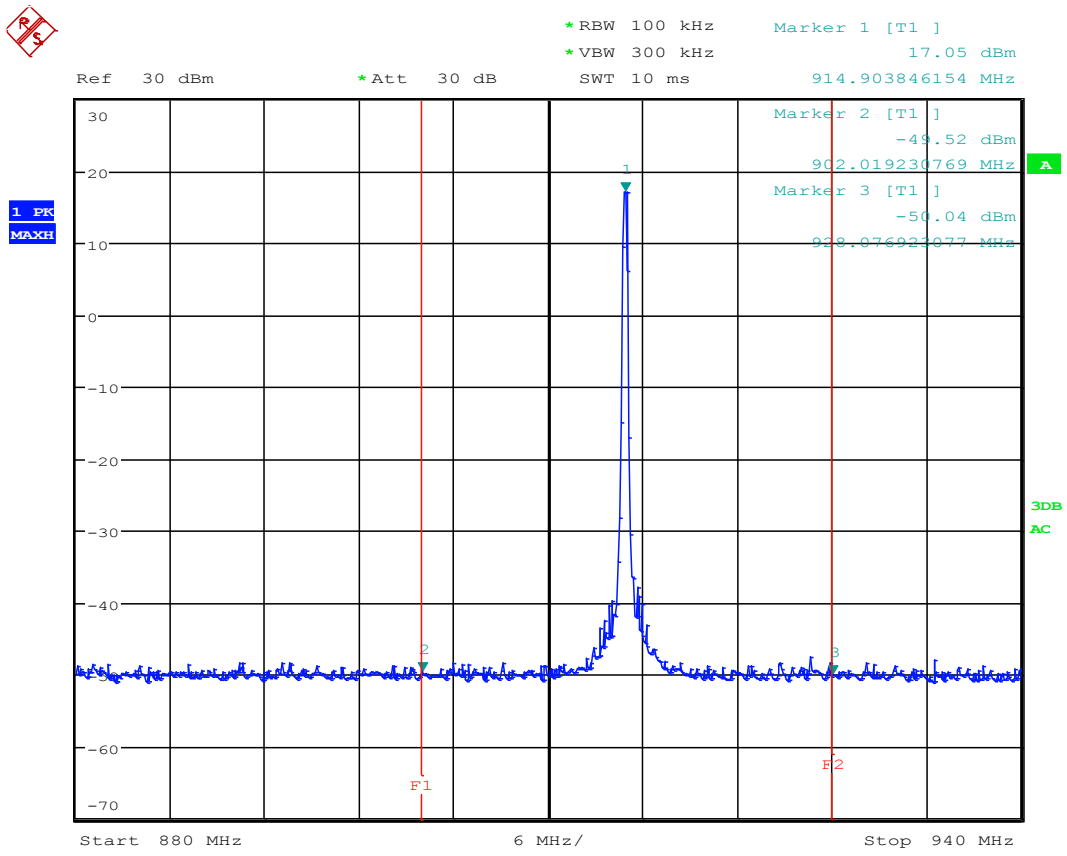
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-10,32**	**+17,07**	**27,39**	**-2,93**	**7,39**
928	**-49,43**	**+17,07**	**66,50**	**-2,93**	**46,50**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – Low Channel (902,3 MHz) – SF10
Plot n°4



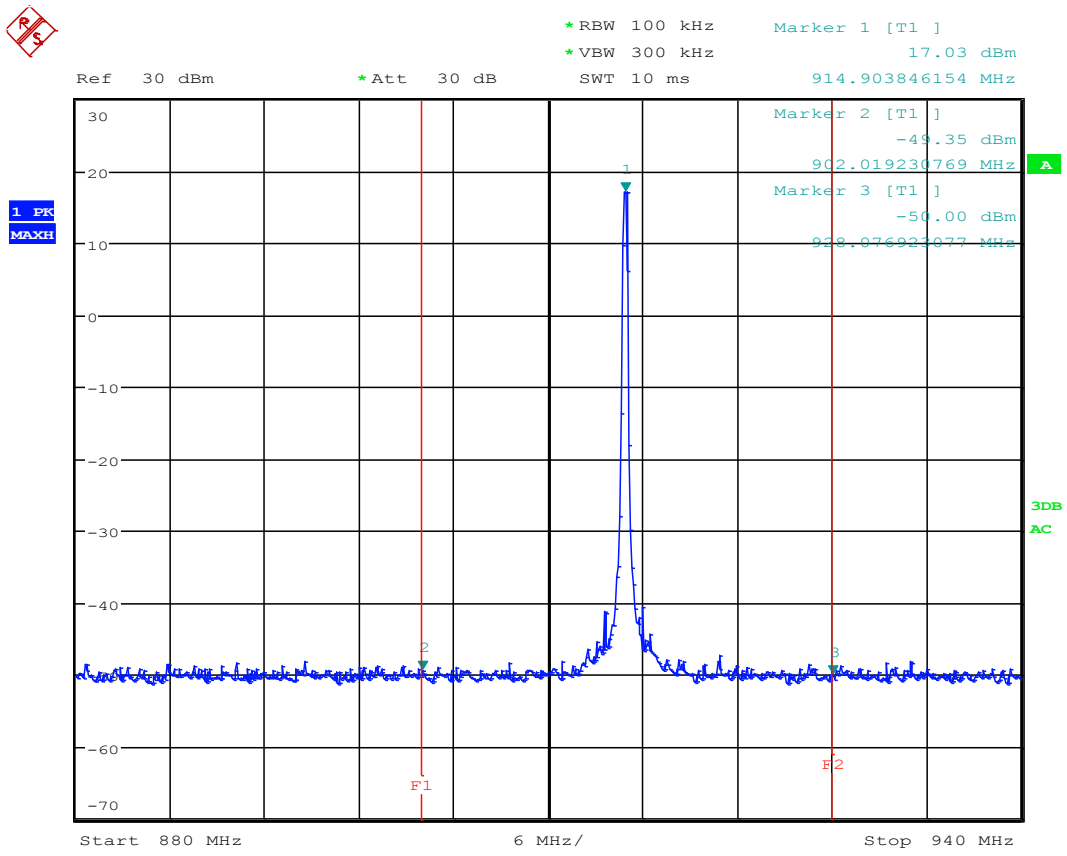
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-10,16**	**+17,15**	**27,31**	**-2,85**	**7,31**
928	**-49,14**	**+17,15**	**66,29**	**-2,85**	**46,29**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – High Channel (914,9 MHz) – SF7
Plot n°5



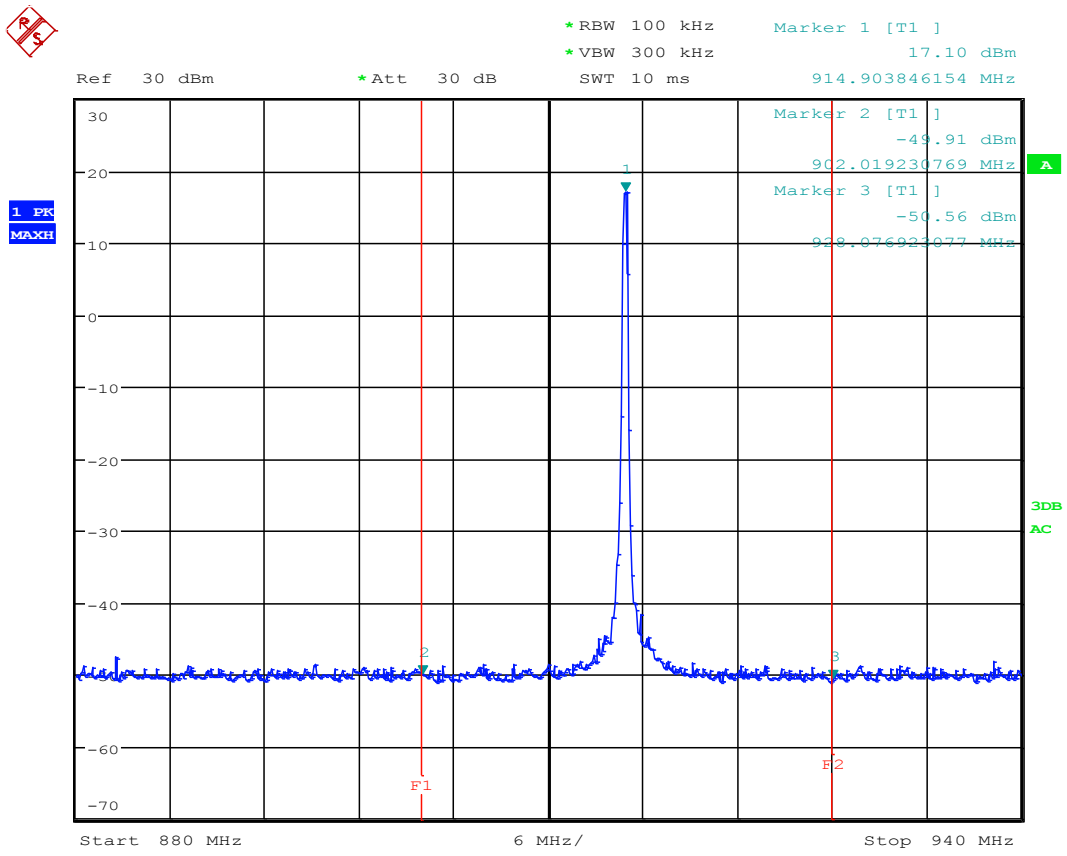
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-49,52**	**+17,05**	**66,57**	**-2,95**	**46,57**
928	**-50,04**	**+17,05**	**67,09**	**-2,95**	**47,09**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – High Channel (914,9 MHz) – SF8
Plot n°6



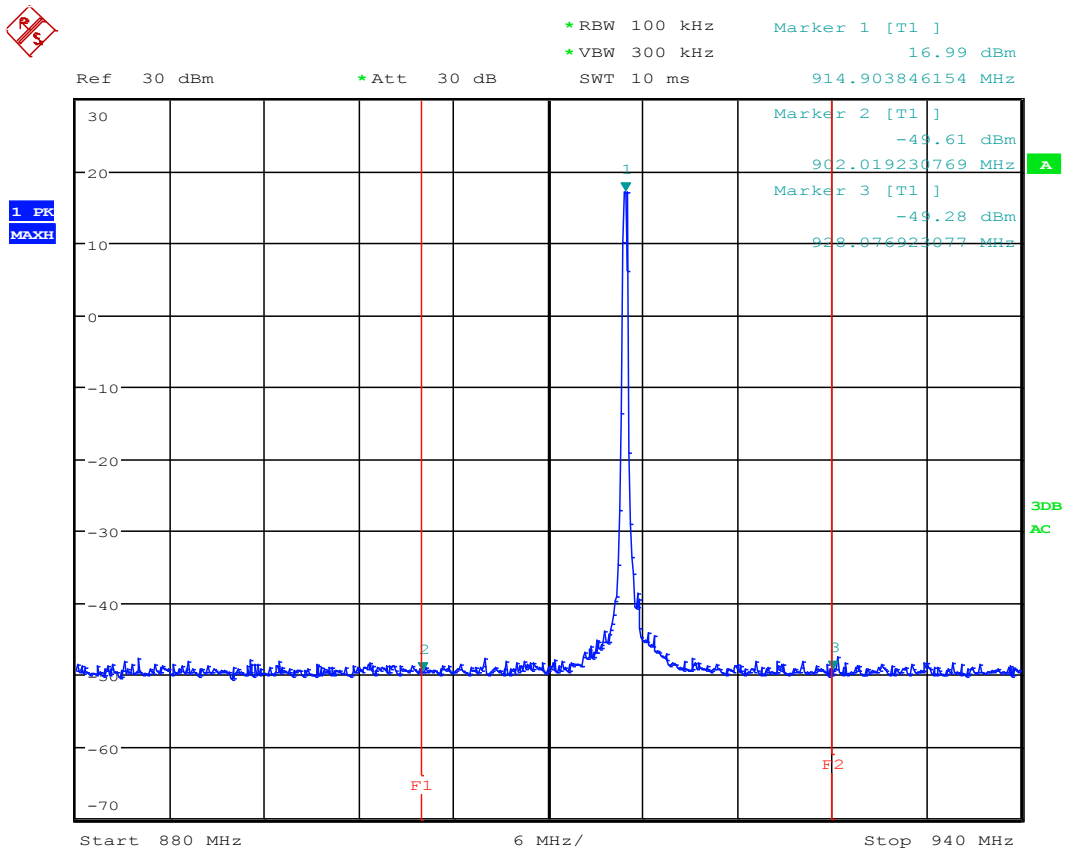
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-49,35**	**+17,03**	**66,38**	**-2,97**	**46,38**
928	**-50,00**	**+17,03**	**67,03**	**-2,97**	**47,03**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – High Channel (914,9 MHz) – SF9
Plot n°7



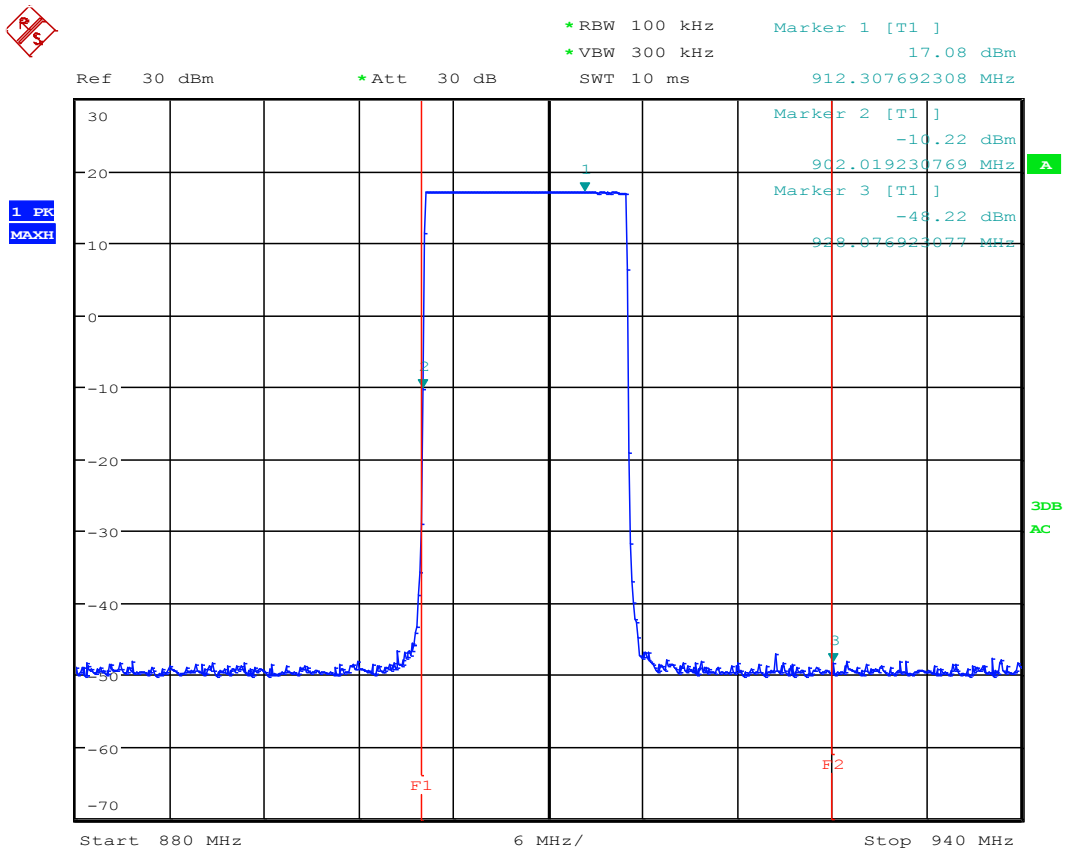
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-49,91**	**+17,10**	**67,01**	**-2,90**	**47,01**
928	**-50,56**	**+17,10**	**67,66**	**-2,90**	**47,01**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #1 – High Channel (914,9 MHz) – SF10
Plot n°8



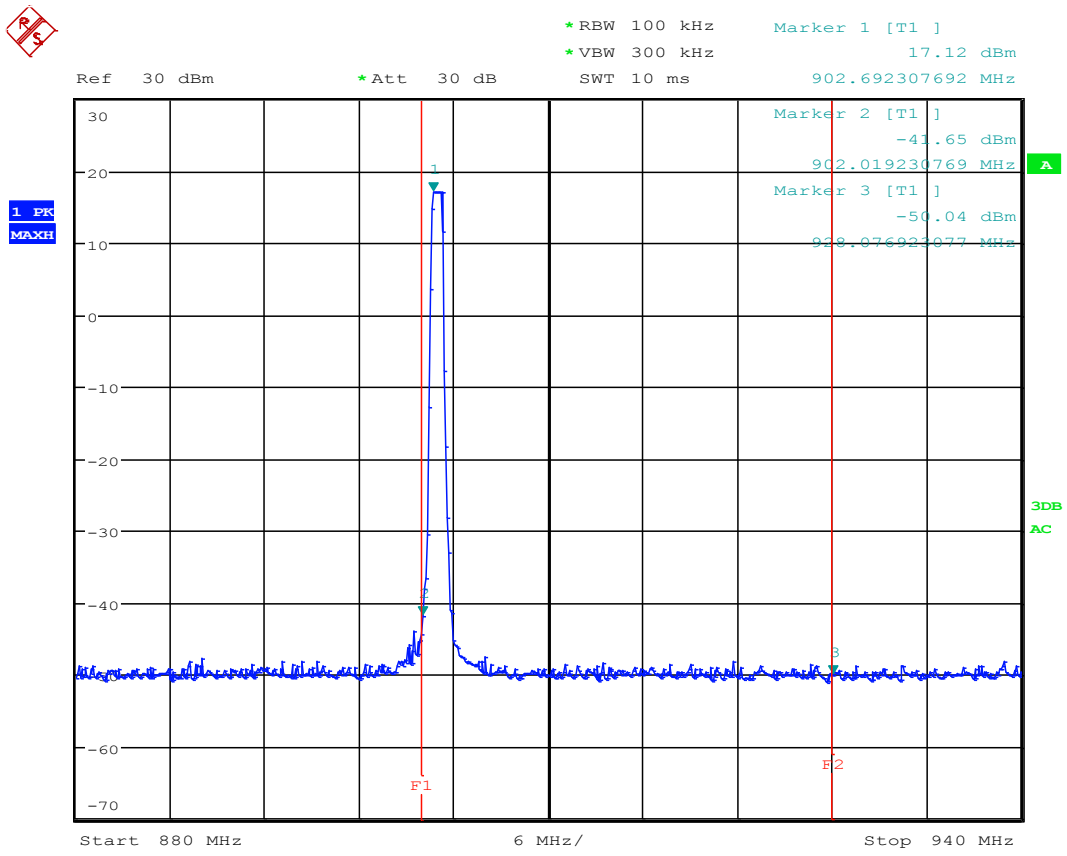
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-49,61**	**+16,99**	**66,60**	**-3,01**	**46,60**
928	**-49,28**	**+16,99**	**66,27**	**-3,01**	**46,27**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #2 – Hopping mode
Plot n°9



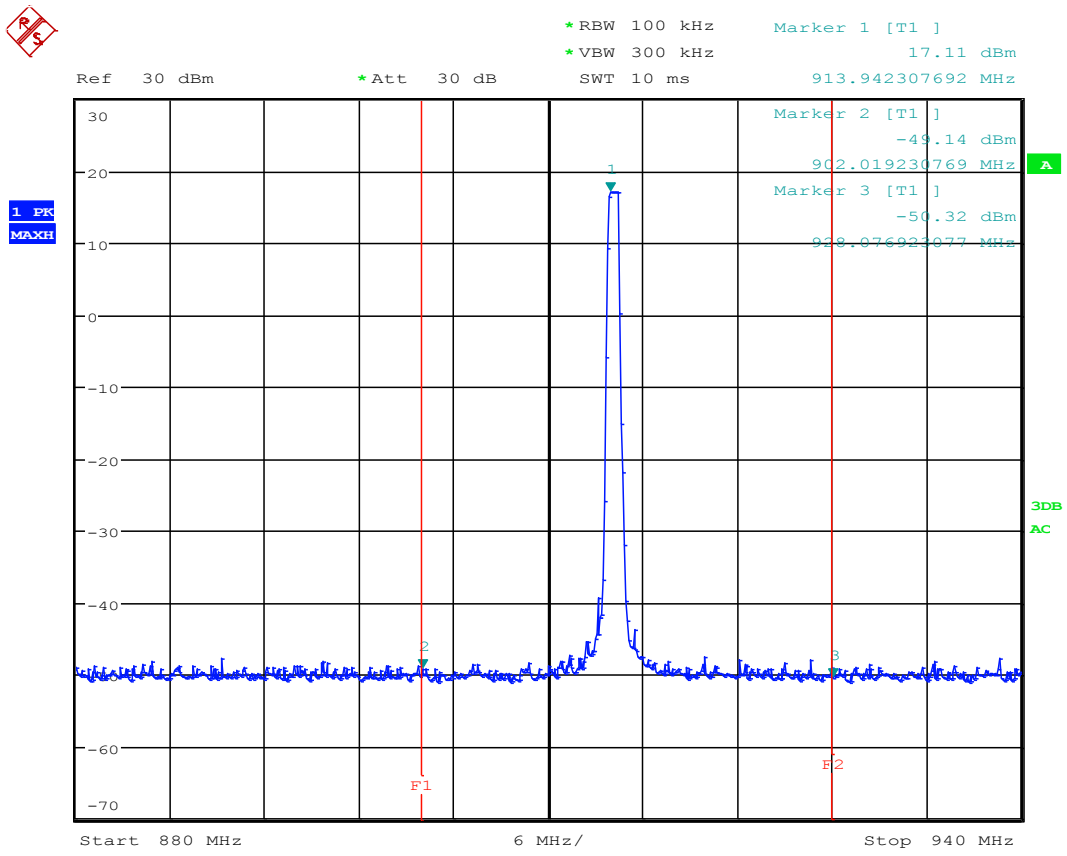
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-10,22**	**+17,08**	**27,30**	**-2,92**	**7,30**
928	**-48,22**	**+17,08**	**65,30**	**-2,92**	**45,30**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #3 – Low Channel (903,0 MHz) – SF8
Plot n°10



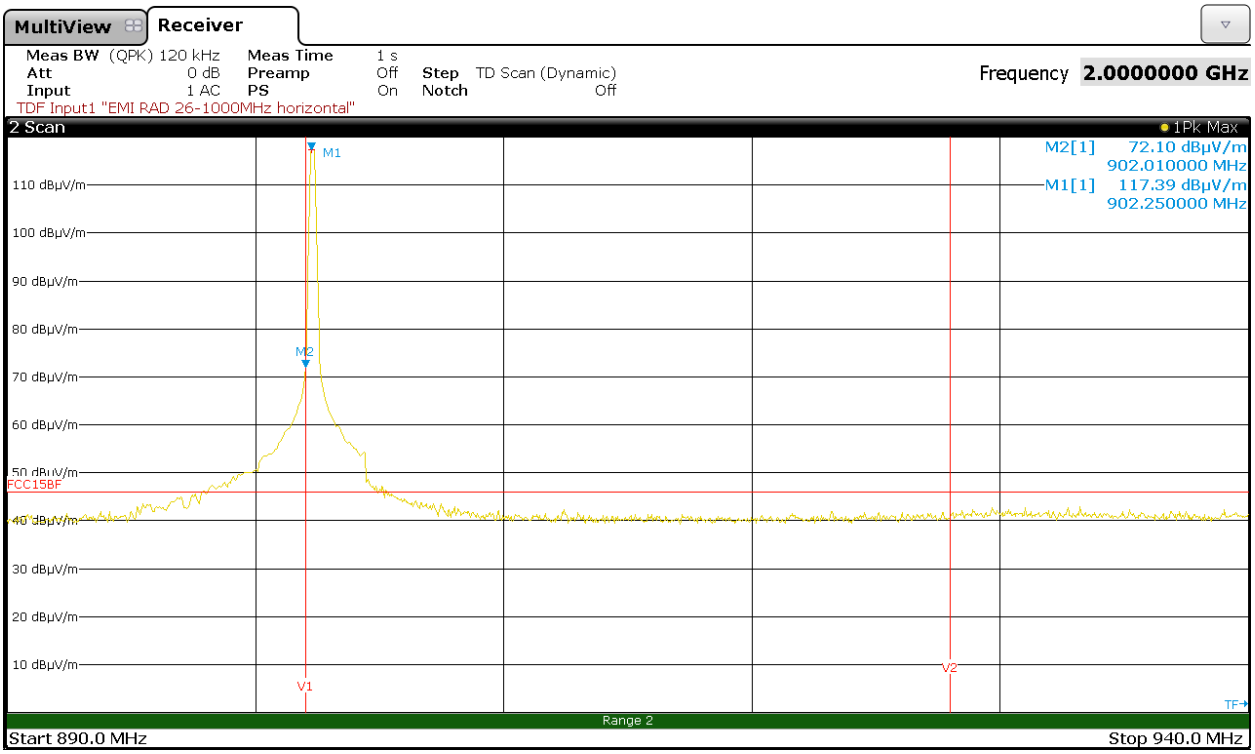
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-41,65**	**+17,12**	**58,77**	**-2,88**	**38,77**
928	**-50,04**	**+17,12**	**67,16**	**-2,88**	**47,16**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Conducted
Operation Mode: #3 – High Channel (914,2 MHz) – SF8
Plot n°11



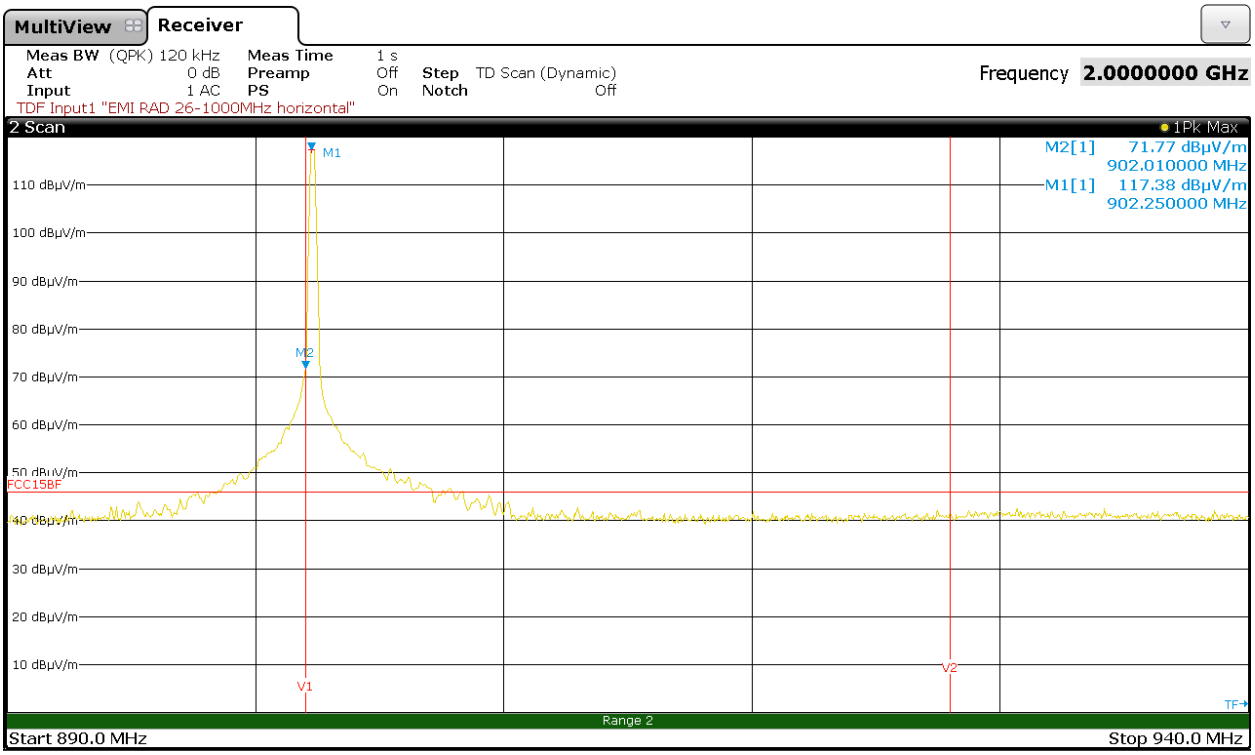
Frequency (MHz	Measured power at the band edge (dBm)	Measured peak power at fundamental frequency (dBm)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBm)	Margin (dB)
902	**-49,14**	**+17,11**	**66,25**	**-2,89**	**46,25**
928	**-50,32**	**+17,11**	**67,43**	**-2,89**	**47,43**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – Low Channel (902,3 MHz) – SF7 – Horizontal polarization (worst case)
Plot n°12



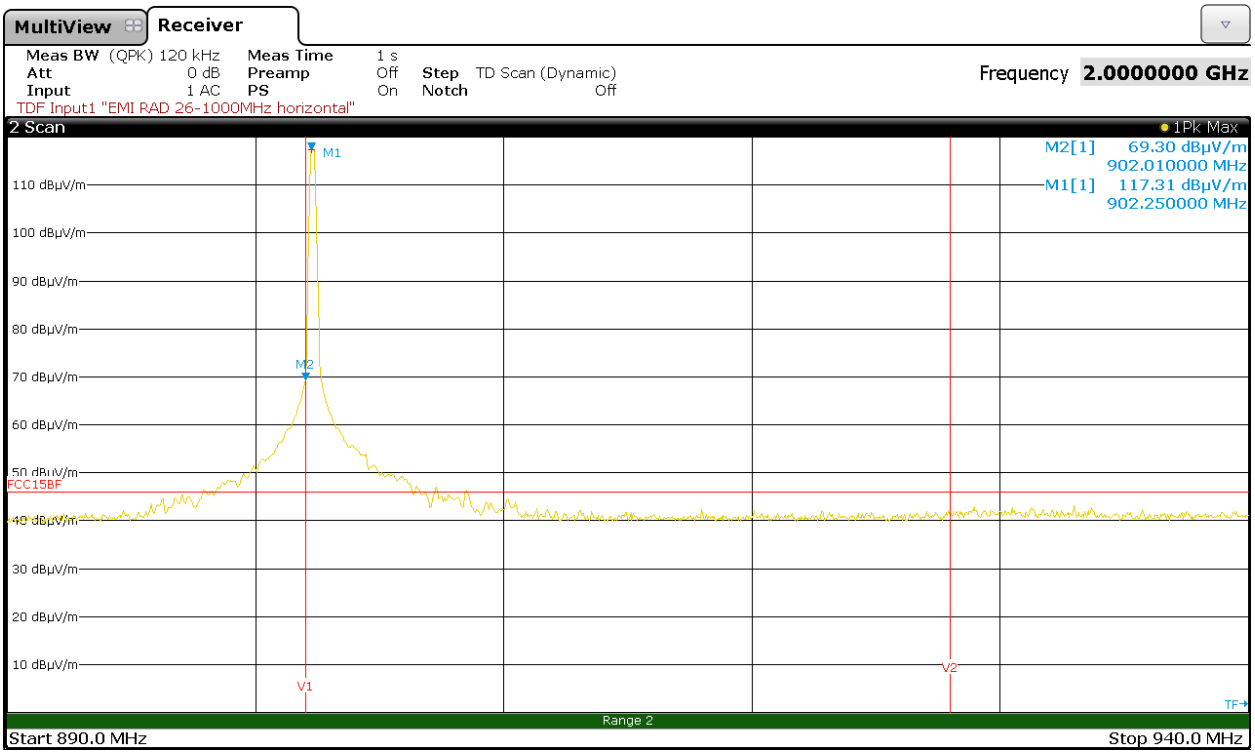
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**72,10**	**117,39**	**45,29**	**97,39**	**25,29**
928	**40,15**	**117,39**	**77,24**	**97,39**	**57,24**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – Low Channel (902,3 MHz) – SF8 – Horizontal polarization (worst case)
Plot n°13



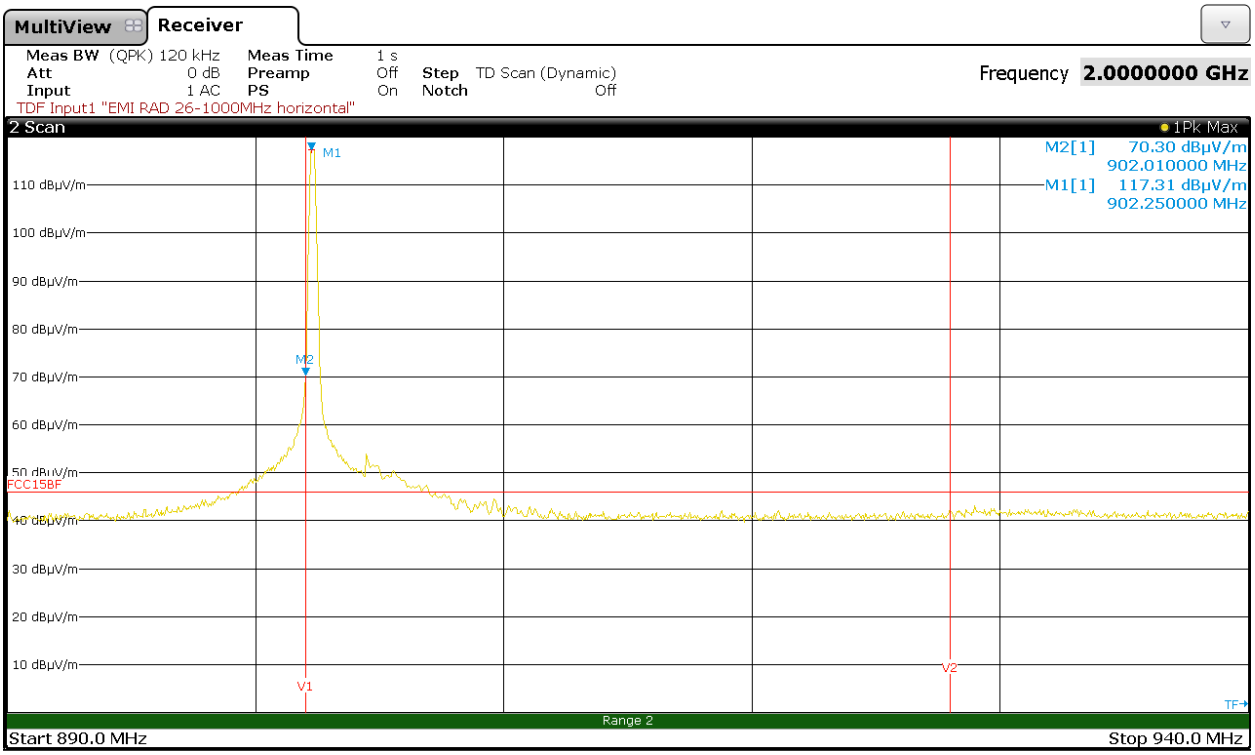
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**71,77**	**117,38**	**45,61**	**97,38**	**25,61**
928	**40,22**	**117,38**	**77,16**	**97,38**	**57,16**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – Low Channel (902,3 MHz) – SF9 – Horizontal polarization (worst case)
Plot n°14



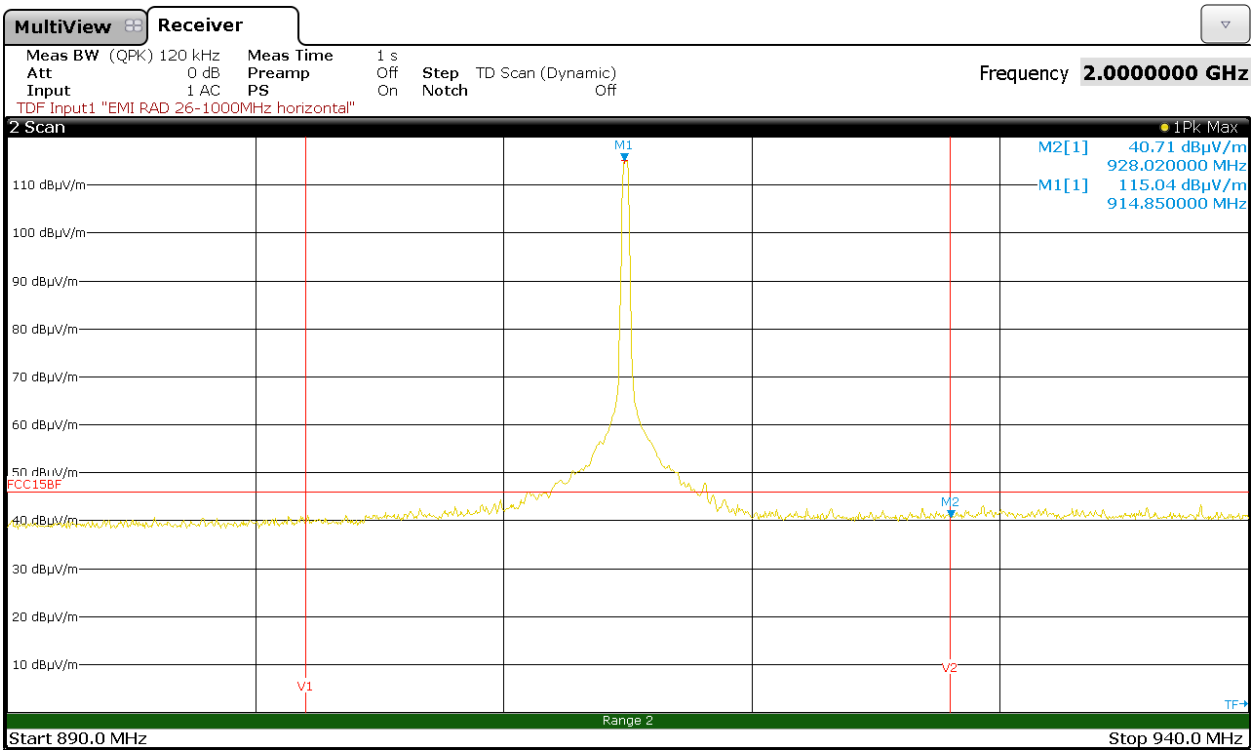
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**69,30**	**117,31**	**48,01**	**97,31**	**28,01**
928	**41,70**	**117,31**	**75,61**	**97,31**	**55,61**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – Low Channel (902,3 MHz) – SF10 – Horizontal polarization (worst case)
Plot n°15



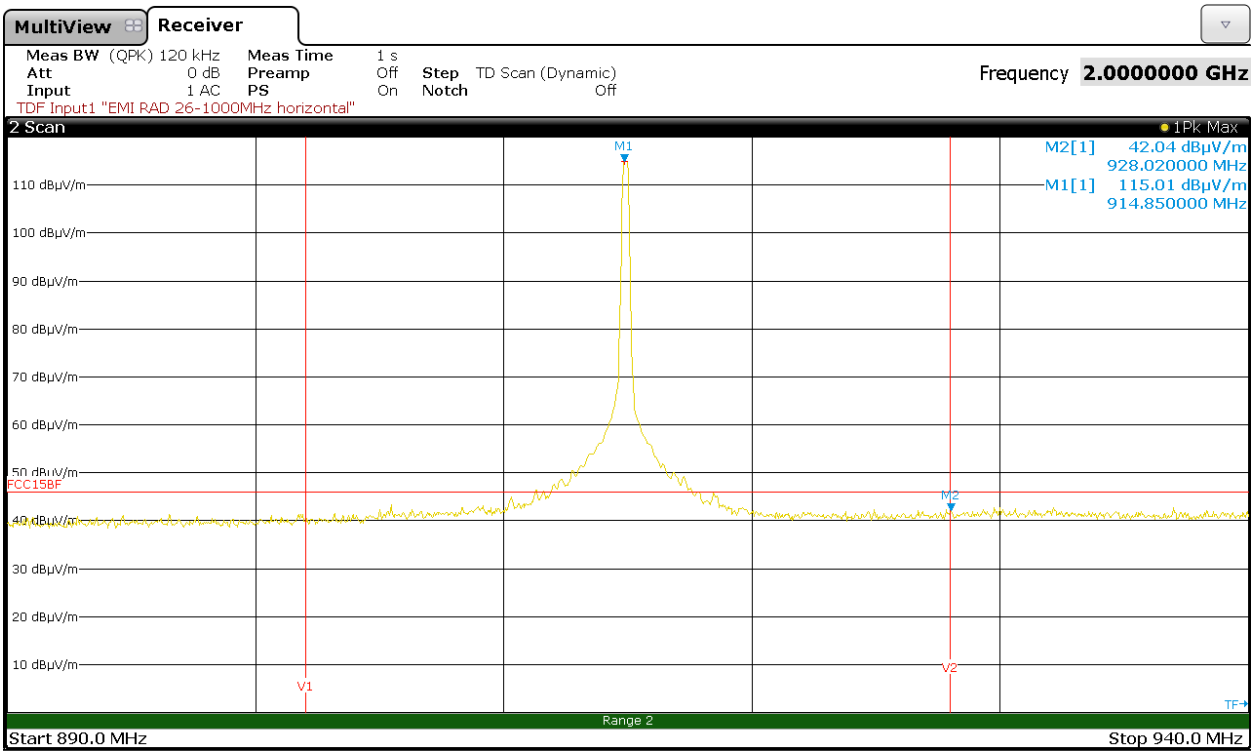
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**70,30**	**117,31**	**47,01**	**97,31**	**27,01**
928	**41,20**	**117,31**	**76,11**	**97,31**	**56,11**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – High Channel (914,9 MHz) – SF7 – Horizontal polarization (worst case)
Plot n°16



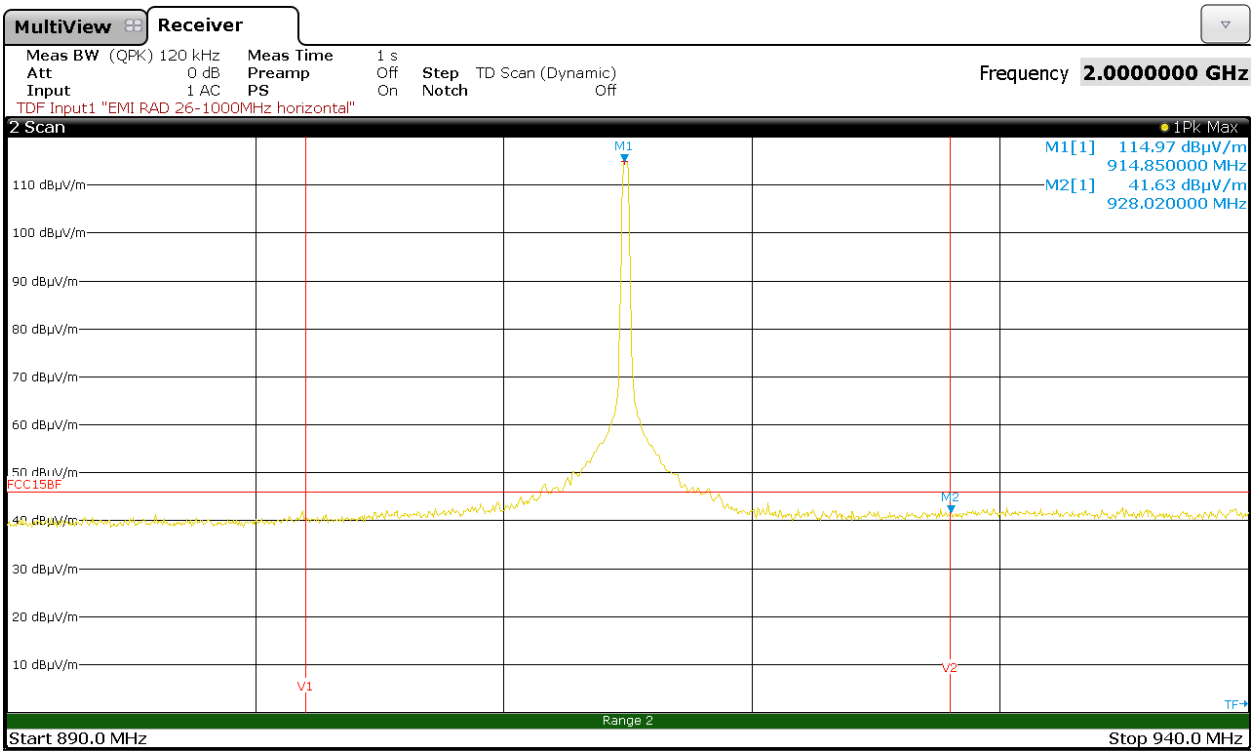
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**40,35**	**115,04**	**74,69**	**95,04**	**54,69**
928	**40,71**	**115,04**	**74,33**	**95,04**	**54,33**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – High Channel (914,9 MHz) – SF8 – Horizontal polarization (worst case)
Plot n°17



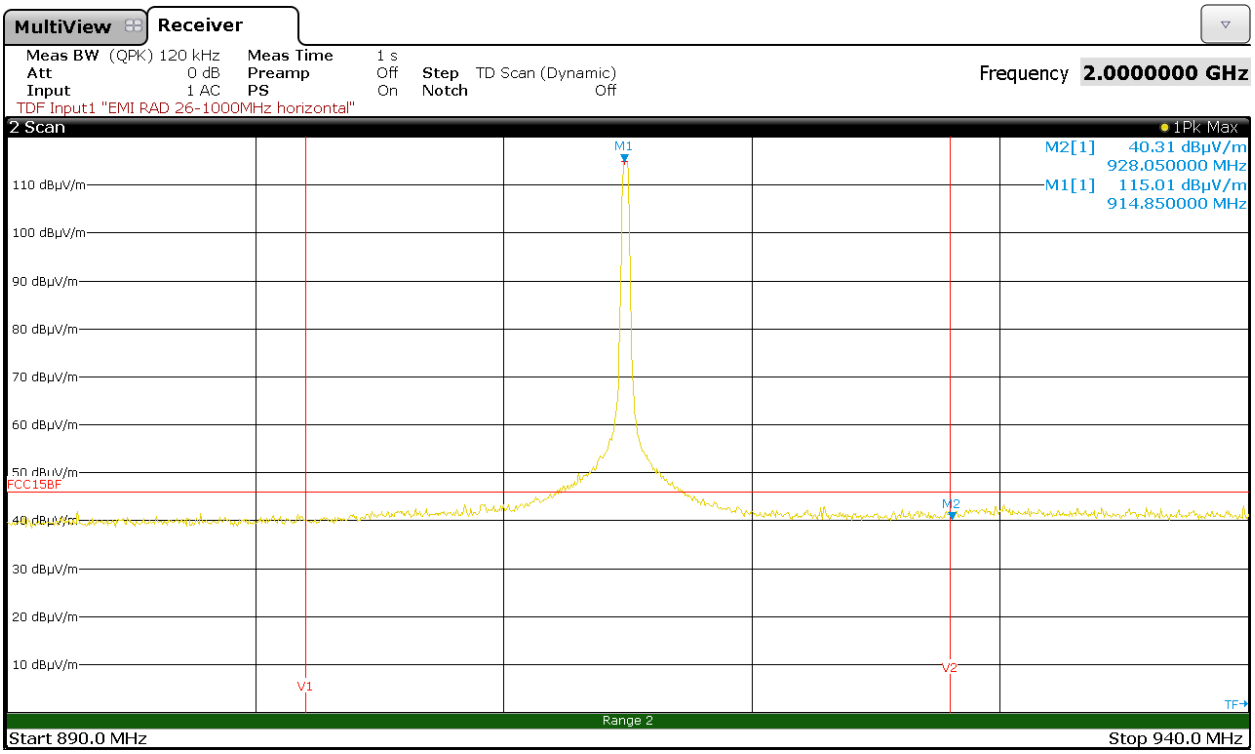
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**40,07**	**115,01**	**74,94**	**95,01**	**54,94**
928	**42,04**	**115,01**	**72,97**	**95,01**	**52,97**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – High Channel (914,9 MHz) – SF9 – Horizontal polarization (worst case)
Plot n°18



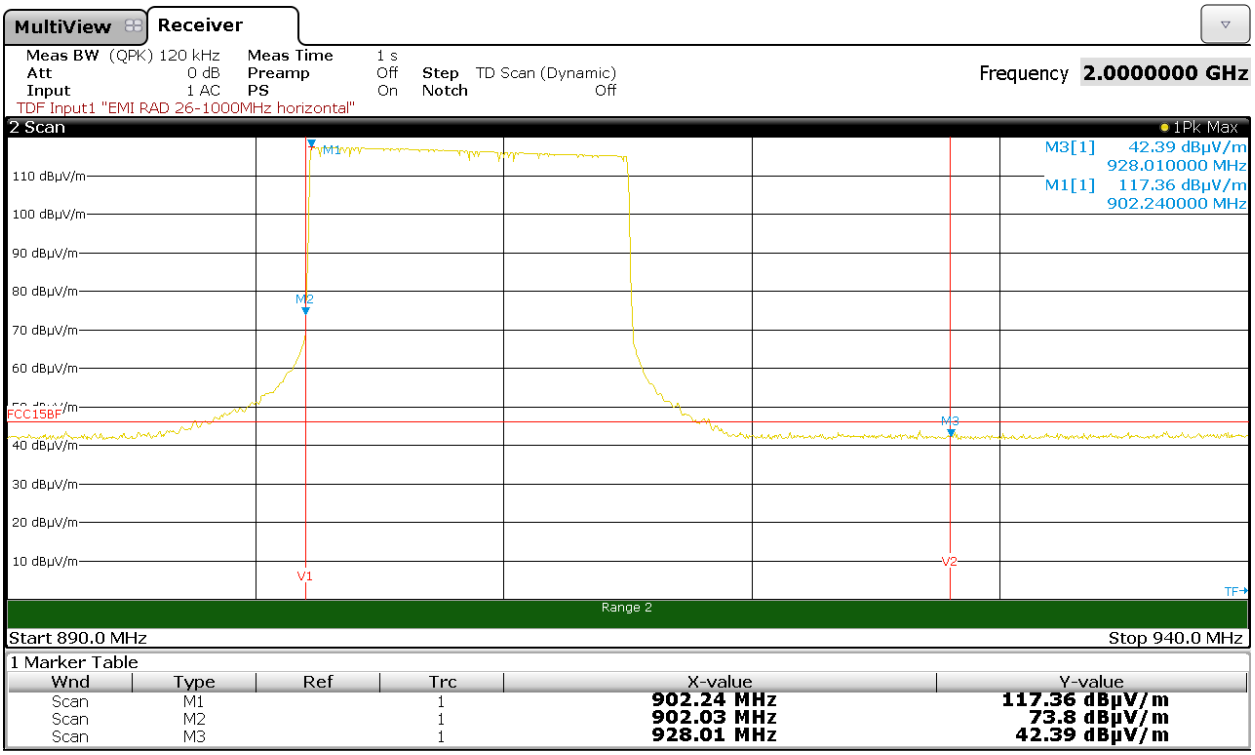
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**40,11**	**114,97**	**74,86**	**94,97**	**54,86**
928	**41,63**	**114,97**	**73,34**	**94,97**	**53,34**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #1 – High Channel (914,9 MHz) – SF10 – Horizontal polarization (worst case)
Plot n°19



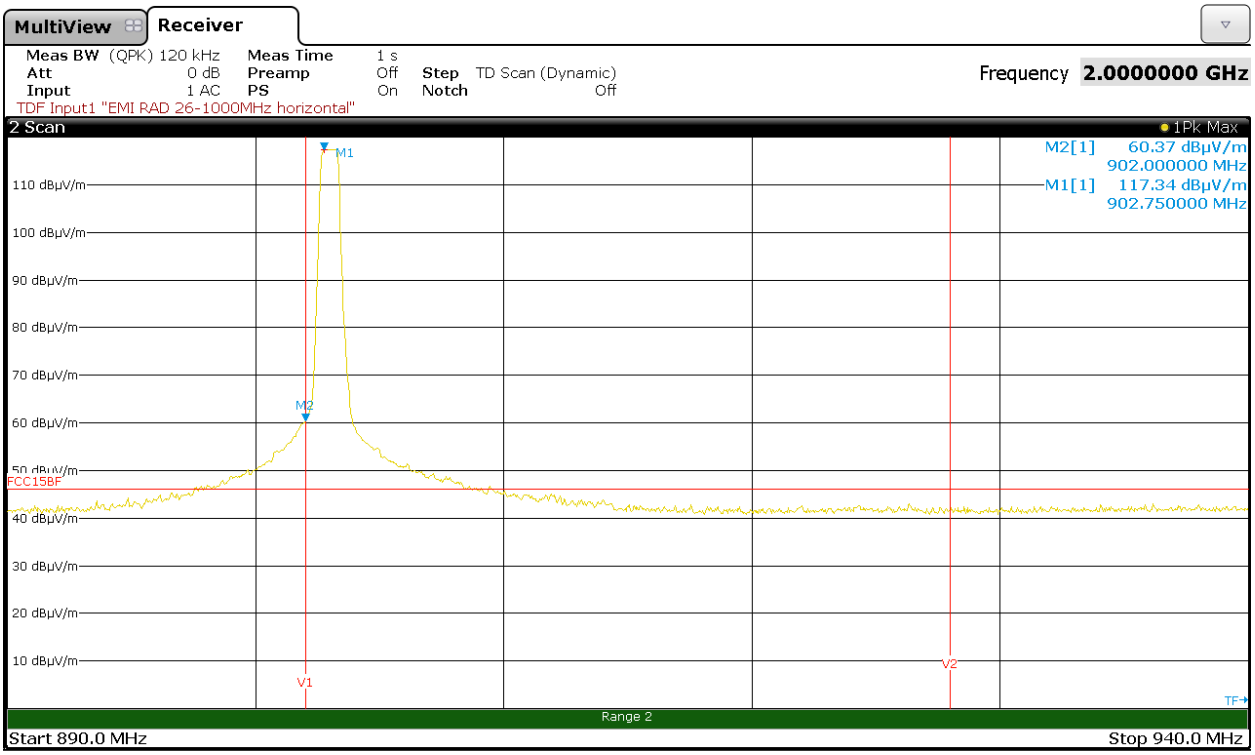
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**40,09**	**115,01**	**74,92**	**95,01**	**54,92**
928	**40,31**	**115,01**	**74,70**	**95,01**	**54,70**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #2 – Hopping mode – Horizontal polarization (worst case)
Plot n°20



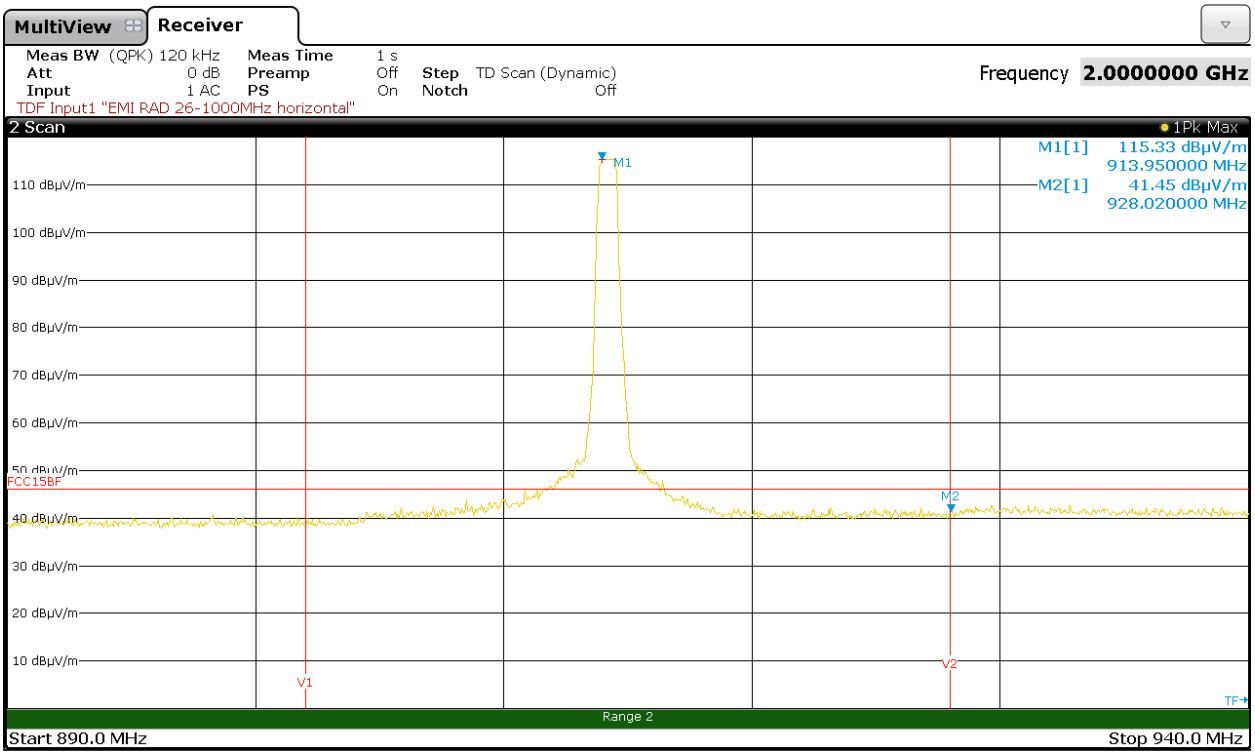
Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**73,80**	**117,36**	**43,56**	**97,36**	**23,56**
928	**42,39**	**117,36**	**74,97**	**97,36**	**54,97**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #3 – Low Channel (903 MHz) – SF8 – Horizontal polarization (worst case)
Plot n°21

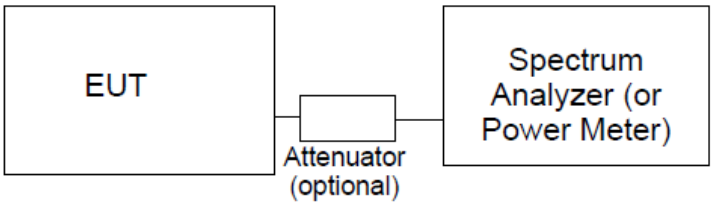


Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**60,37**	**117,34**	**56,97**	**97,34**	**36,97**
928	**41,92**	**117,34**	**75,42**	**97,34**	**55,42**

Graphical representation of 100 kHz Bandwidth of Frequency Band Edges - Radiated
Operation Mode: #3 – High Channel (914,2 MHz) – SF8 – Horizontal polarization (worst case)
Plot n°22

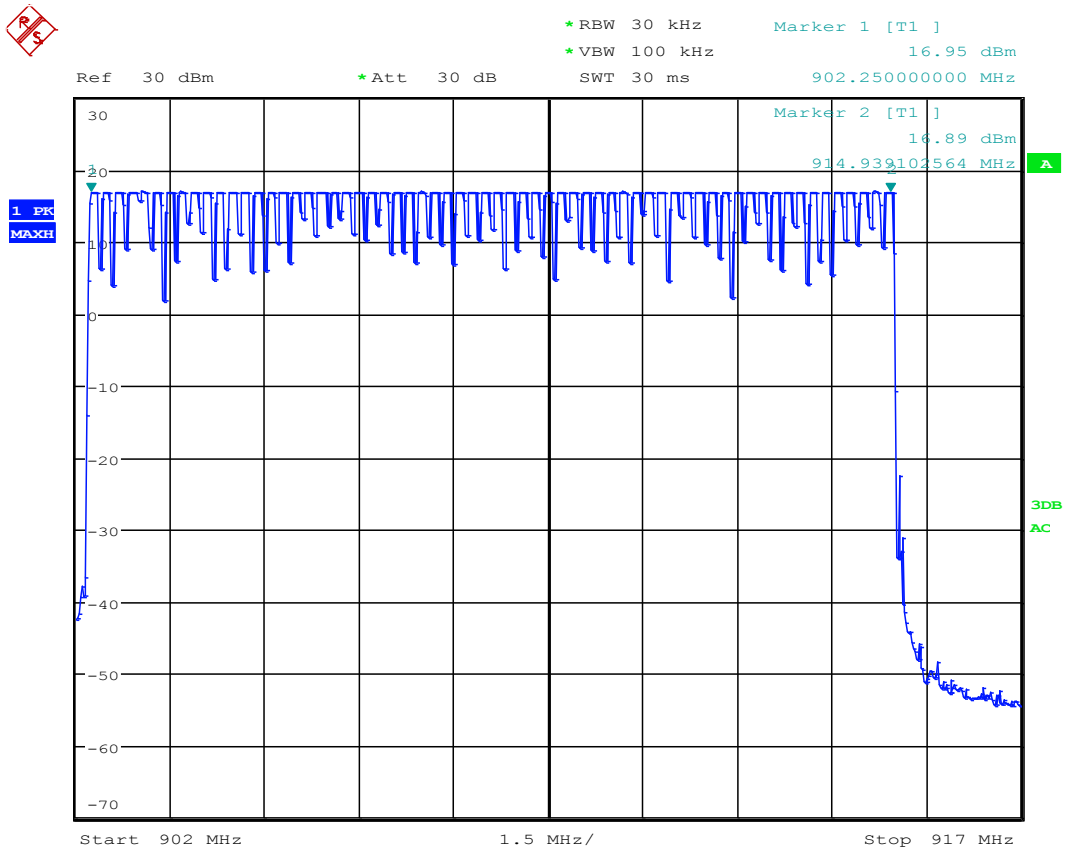


Frequency (MHz	Measured power at the band edge (dBµV/m)	Measured peak power at fundamental frequency (dBµV/m)	Difference Peak / band edge (dB)	Peak Limit at PK power –20 dB (dBµV/m)	Margin (dB)
902	**39,78**	**115,33**	**75,55**	**95,33**	**55,55**
928	**41,45**	**115,33**	**73,88**	**95,33**	**53,88**

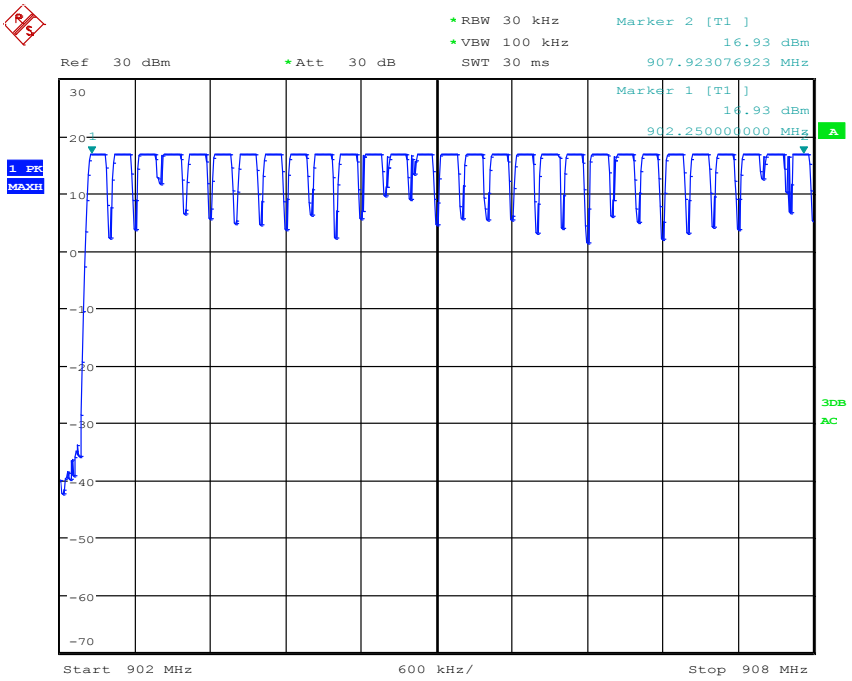
11.7 TEST: Number of Hopping frequencies		PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C
	Relative Humidity (%)	30 to 60 %
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	22°C
	Relative Humidity (%)	36%
	Air pressure (hPa)	1033
—	Power Supply / Frequency	Application Point
Fully configured sample tested at the power line frequency	+3,7V dc	RF connector
Equipment mode:	Operation mode	#2
FCC Standard	§15.247 (A) (1) (III)	
For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel 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 channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.		
Further information to test setup		

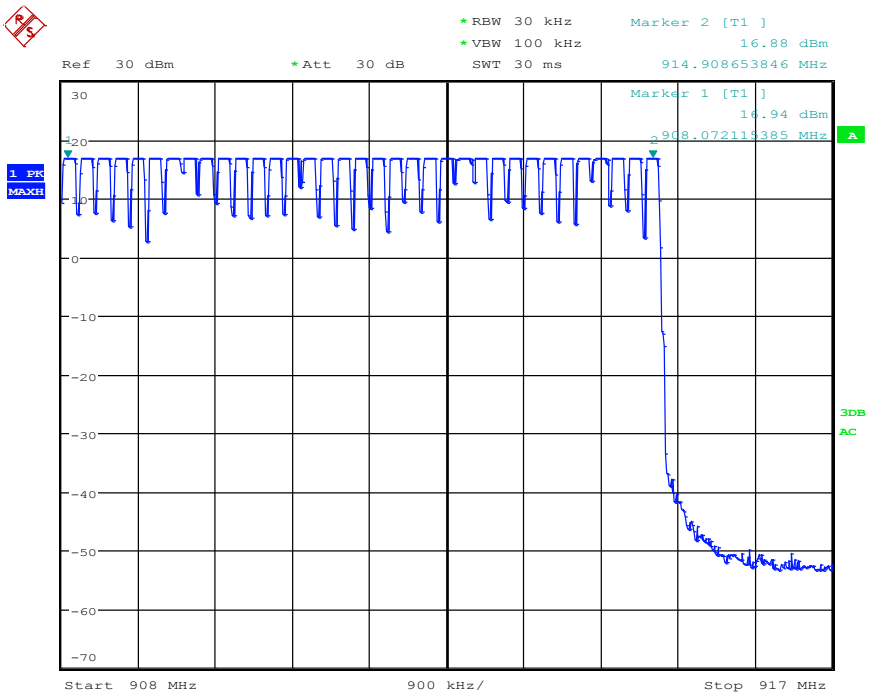
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

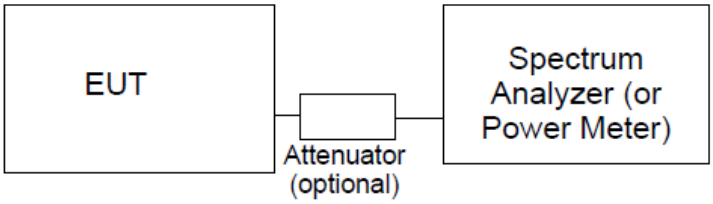
Graphical rapresentation
Operation Mode: #2
Number of Hopping Frequencies: 64
Plot n°1



Graphical rapresentation
Operation Mode: #2
Number of Hopping Frequencies: 64
Plot n°2 and 3





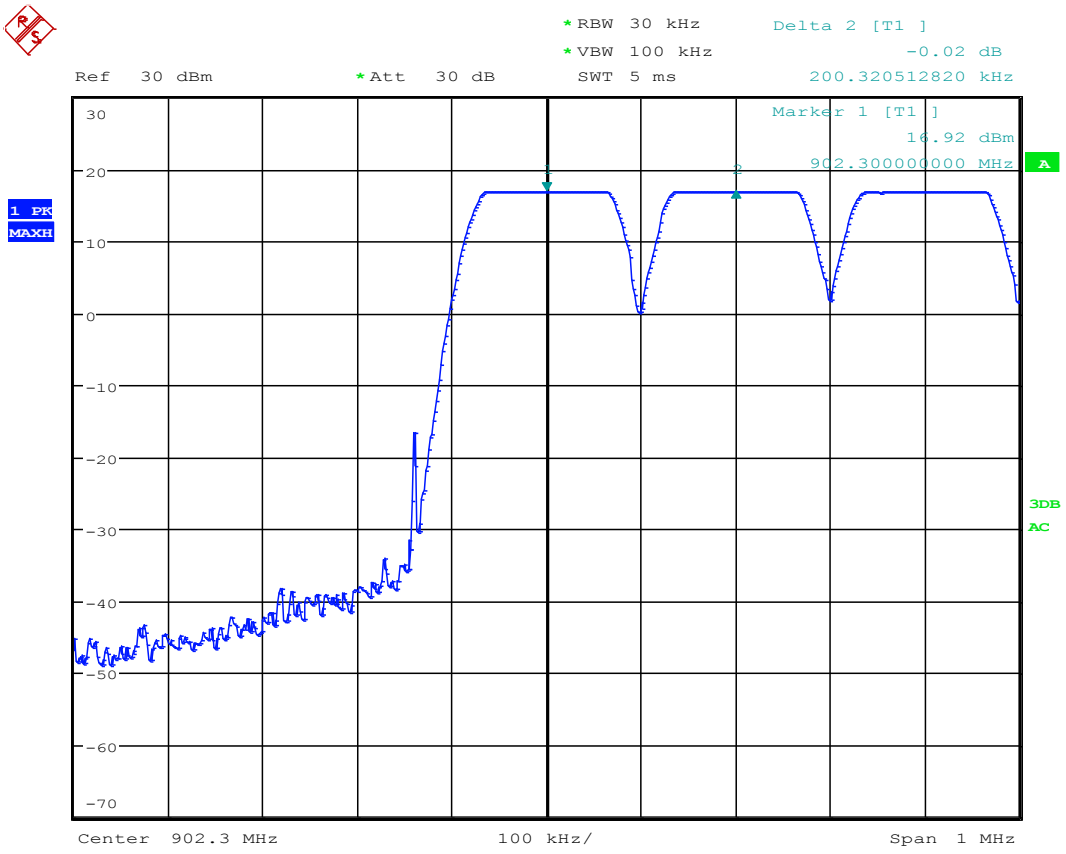
11.8 TEST: Carrier frequency separation			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	23°C	
	Relative Humidity (%)	36%	
	Air pressure (hPa)	1033	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF connector	
Equipment mode:	Operation mode	#2	
FCC Standard	§15.247 (A) (1)		
FHSs 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Graphical representation of carrier frequency separation

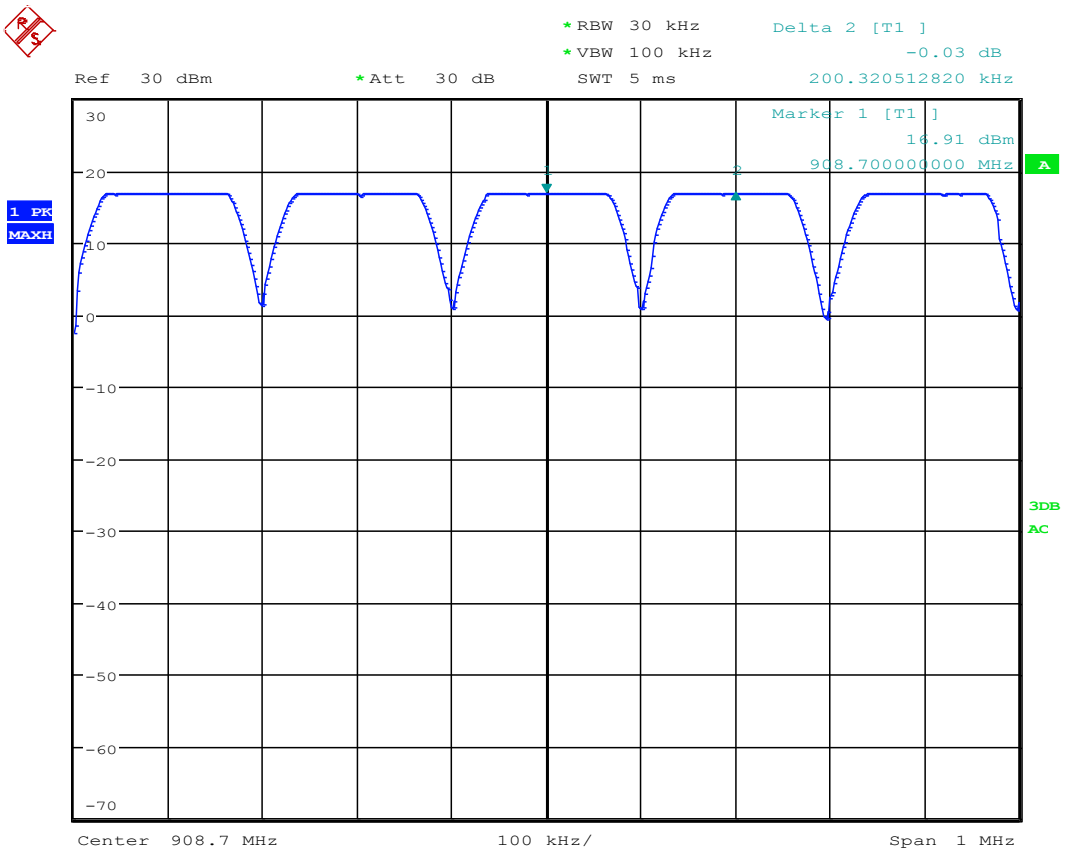
Operation Mode: #2

Plot n°1



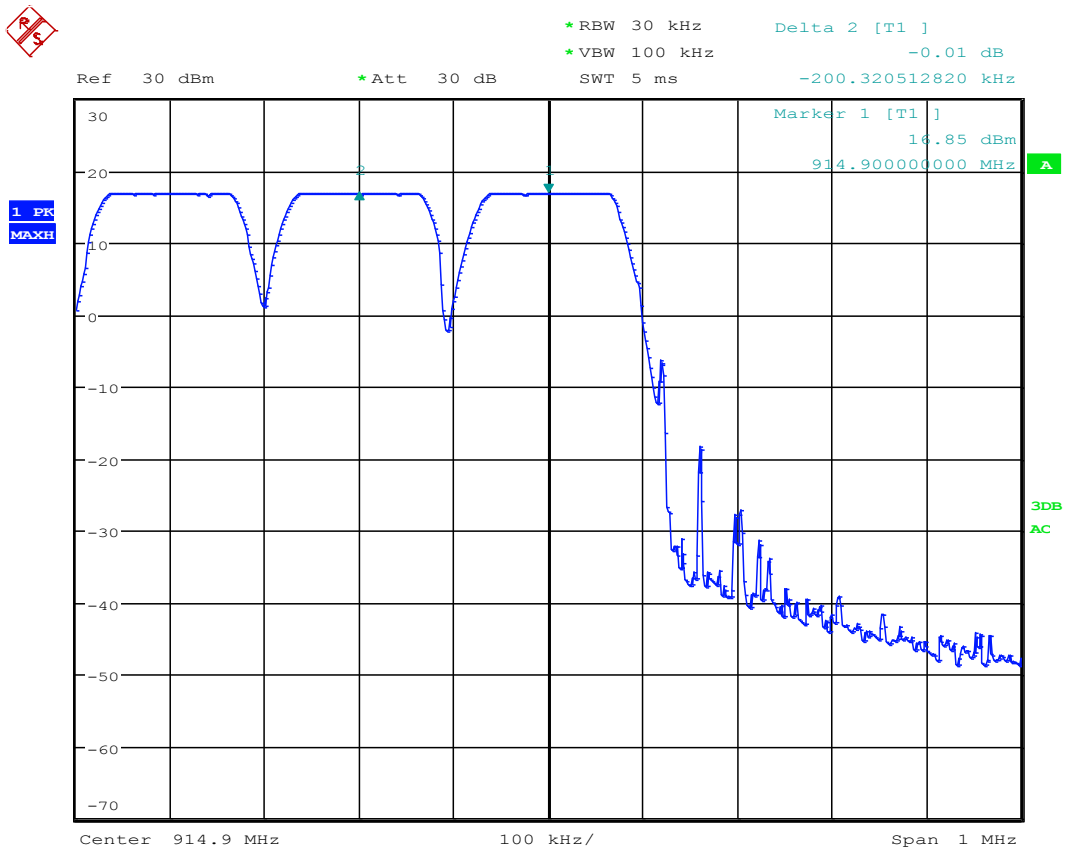
Channel (No.)	Carrier frequency separation (kHz)	Limit (kHz)	Plot (No.)
1-2 (Low)	**200,32**	**≥25kHz**	**1**

Graphical representation of carrier frequency separation
Operation Mode: #2
Plot n°2

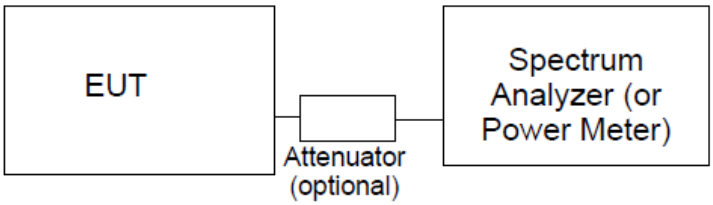


Channel (No.)	Carrier frequency separation (kHz)	Limit (kHz)	Plot (No.)
33-34 (Middle)	**200,32**	**≥25kHz**	**2**

Graphical representation of carrier frequency separation
Operation Mode: #2
Plot n°3



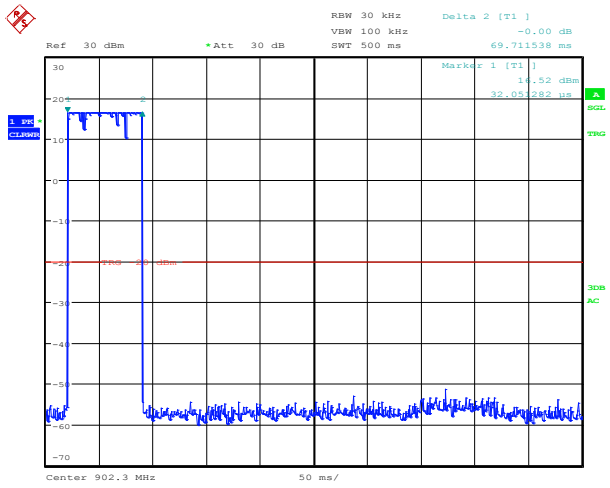
Channel (No.)	Carrier frequency separation (kHz)	Limit (kHz)	Plot (No.)
63-64 (High)	200,32	≥25kHz	3

11.9 TEST: Average time of occupancy			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	23°C	
	Relative Humidity (%)	36%	
	Air pressure (hPa)	1033	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF connector	
Equipment mode:	Operation mode	#2	
FCC Standard	§15.247 (A) (1) (III)		
For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel 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 channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.			
Further information to test setup			

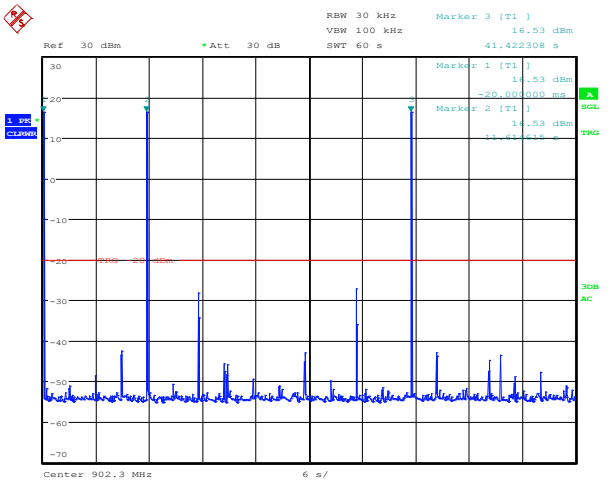
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Results				
Operation Mode: #2				
Channel (No.)	**Single packet duration (ms)**	**N° of hops in 60”**	**Limit of Average time of occupancy (ms) in a period of 20s**	**Plot (No.)**
1 (Low)	69,71	3	400	1÷2
*= (20 sec. / time between next hop) / single packet duration				

Plot n°1 and n°2



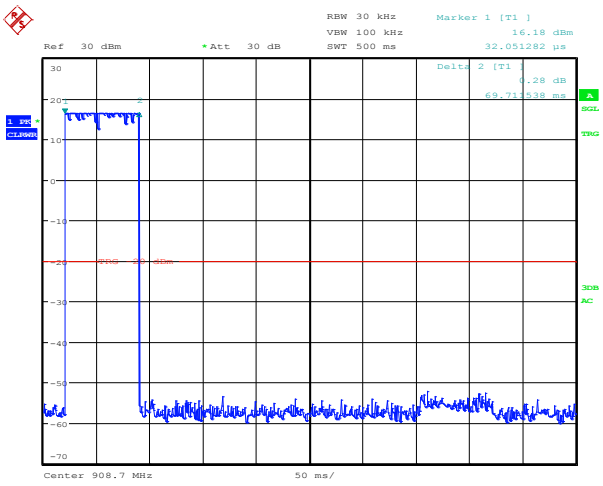
Single burst duration



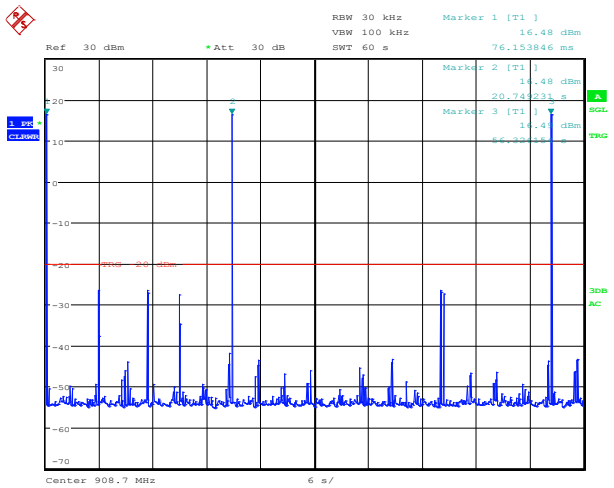
N° of bursts in 60 sec.

Results				
Operation Mode: #2				
Channel (No.)	**Single packet duration (ms)**	**N° of hops in 60”**	**Limit of Average time of occupancy (ms) in a period of 20s**	**Plot (No.)**
33 (Middle)	69,71	3	400	3÷4

Plot n°3 and n°4



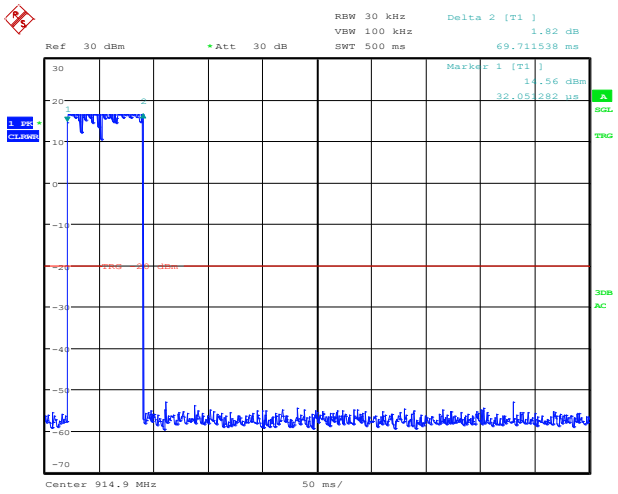
Single burst duration



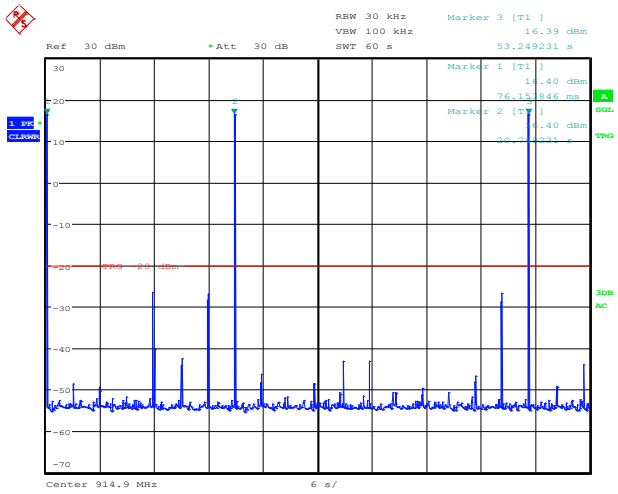
N° of bursts in 60 sec.

Results				
Operation Mode: #2				
Channel (No.)	**Single packet duration (ms)**	**N° of hops in 60”**	**Limit of Average time of occupancy (ms) in a period of 20s**	**Plot (No.)**
64 (High)	69,71	3	400	5÷6

Plot n°5 and n°6

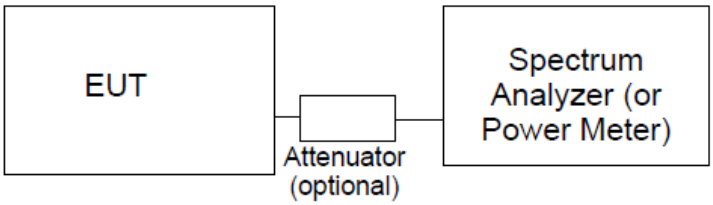


Single burst duration



N° of bursts in 60 sec.

11.10 TEST: Additional provisions to the general radiated emission limitations.			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	37%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	---------	
Equipment mode:	Operation mode	#1 #3	
FCC Standard	§15.215 (A) (B) (C)		
(A) The regulations in §§ 15.217-15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.			
(B) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in Section 15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.			VERDICT PASS
(C) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least			VERDICT PASS

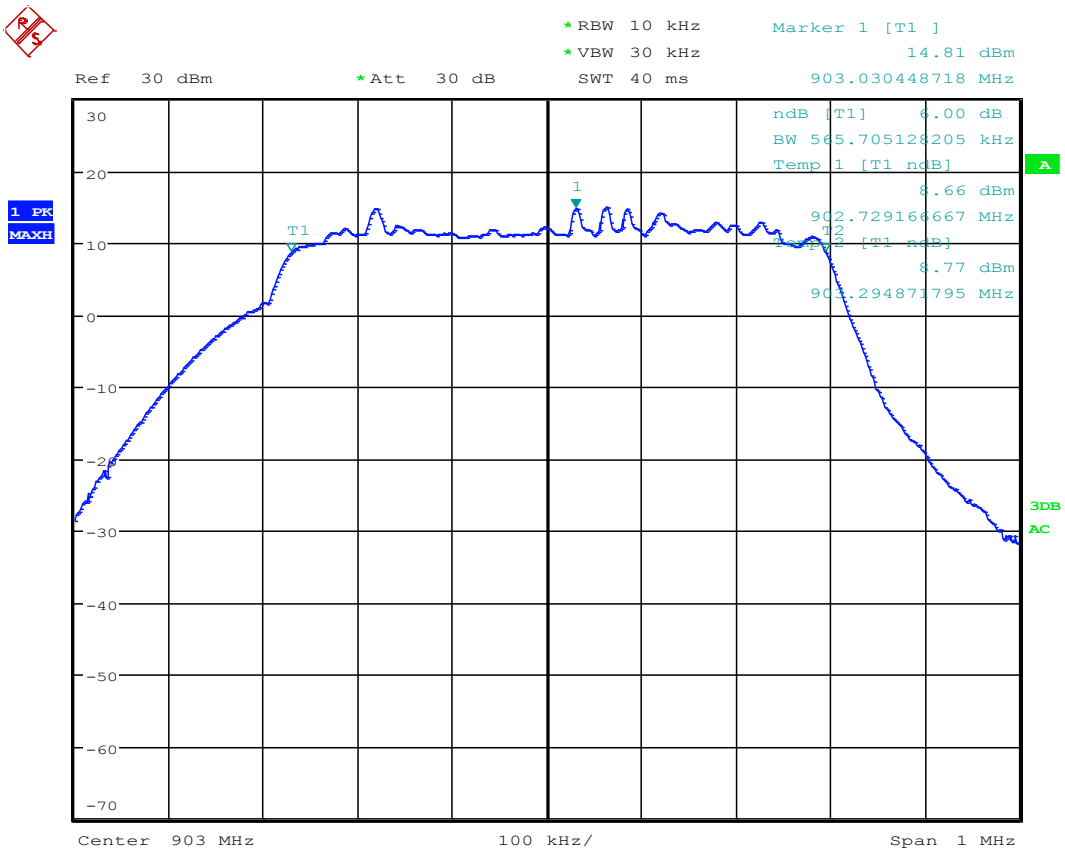
11.11 TEST: 6dB Bandwidth			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	48%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF Connector	
Equipment mode:	Operation mode	#3	
FCC Standard	§15.247 (A)(2)		
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.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Graphical representation of 6dB Bandwidth

Operation Mode: #3 – Low Channel (903 MHz)

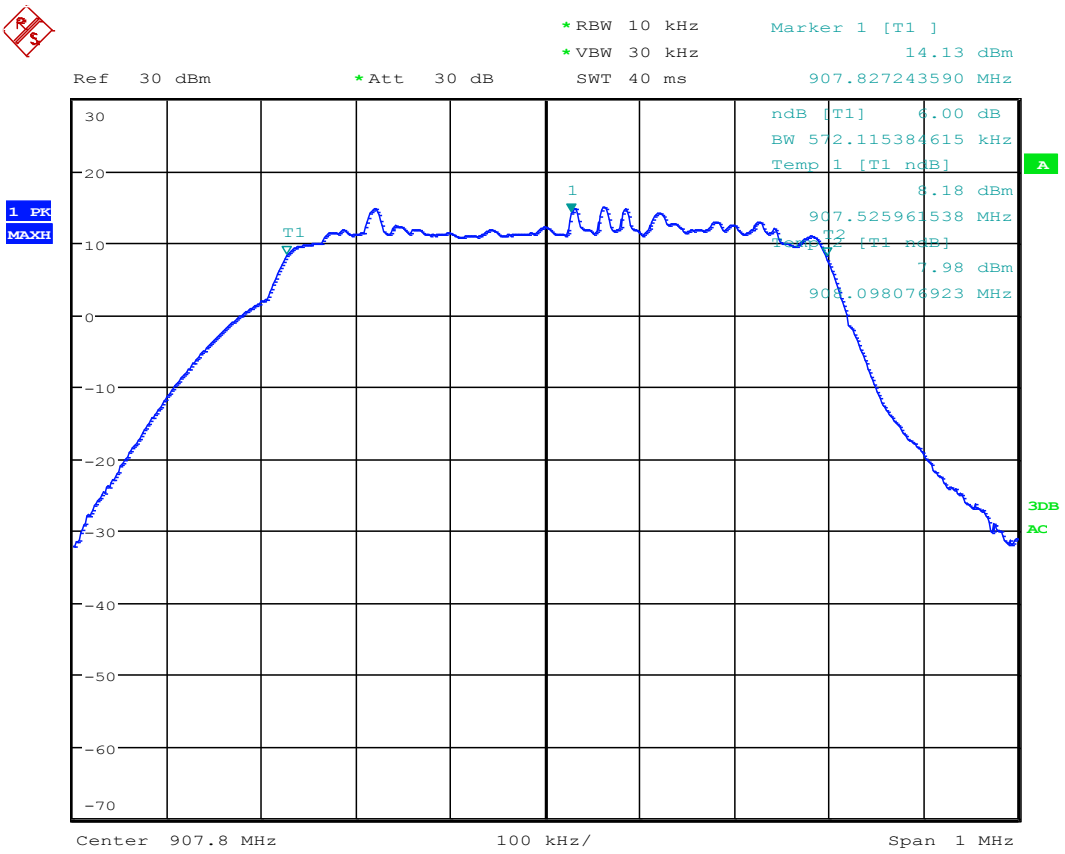
Plot n°1



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -6dB (kHz)	Limit (kHz)	Plot (No.)
Low	**903,0**	**565,705**	**≥ 500**	**1**

Bandwidth at -6dB (Fmin and Fmax)			
Fmin	**902,729 MHz**	**Fmax**	**903,294 MHz**

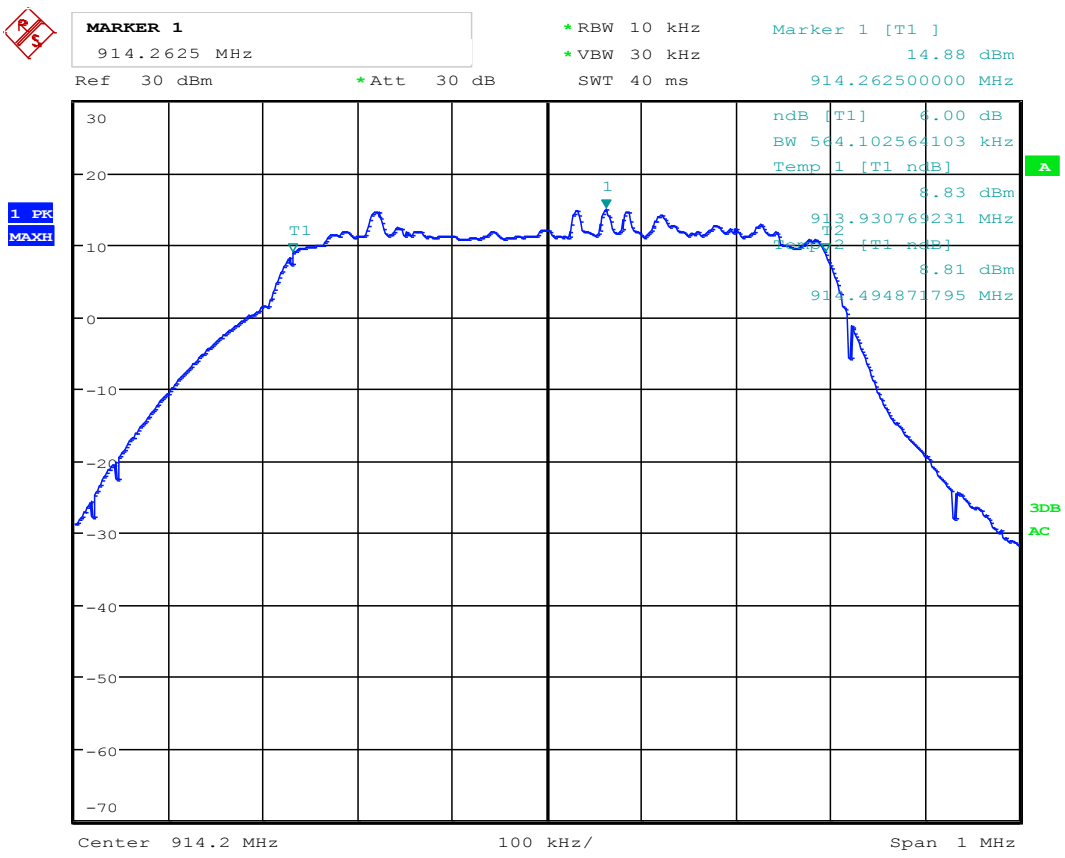
Graphical representation of 6dB Bandwidth
Operation Mode: #3 – Middle Channel (907,8 MHz)
Plot n°2



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -6dB (kHz)	Limit (kHz)	Plot (No.)
Low	**907,8**	**572,115**	**≥ 500**	**2**

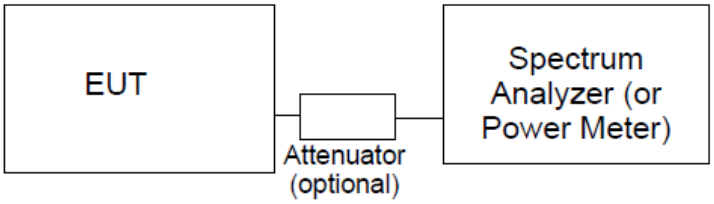
Bandwidth at -6dB (Fmin and Fmax)			
Fmin	**907,526 MHz**	**Fmax**	**908,098 MHz**

Graphical representation of 6dB Bandwidth
Operation Mode: #3 – High Channel (914,2 MHz)
Plot n°3



Channel (No.)	Frequency (MHz)	Channel Bandwidth at -6dB (kHz)	Limit (kHz)	Plot (No.)
Low	907,8	564,102	≥ 500	3

Bandwidth at -6dB (Fmin and Fmax)			
Fmin	913,930 MHz	Fmax	914,494 MHz

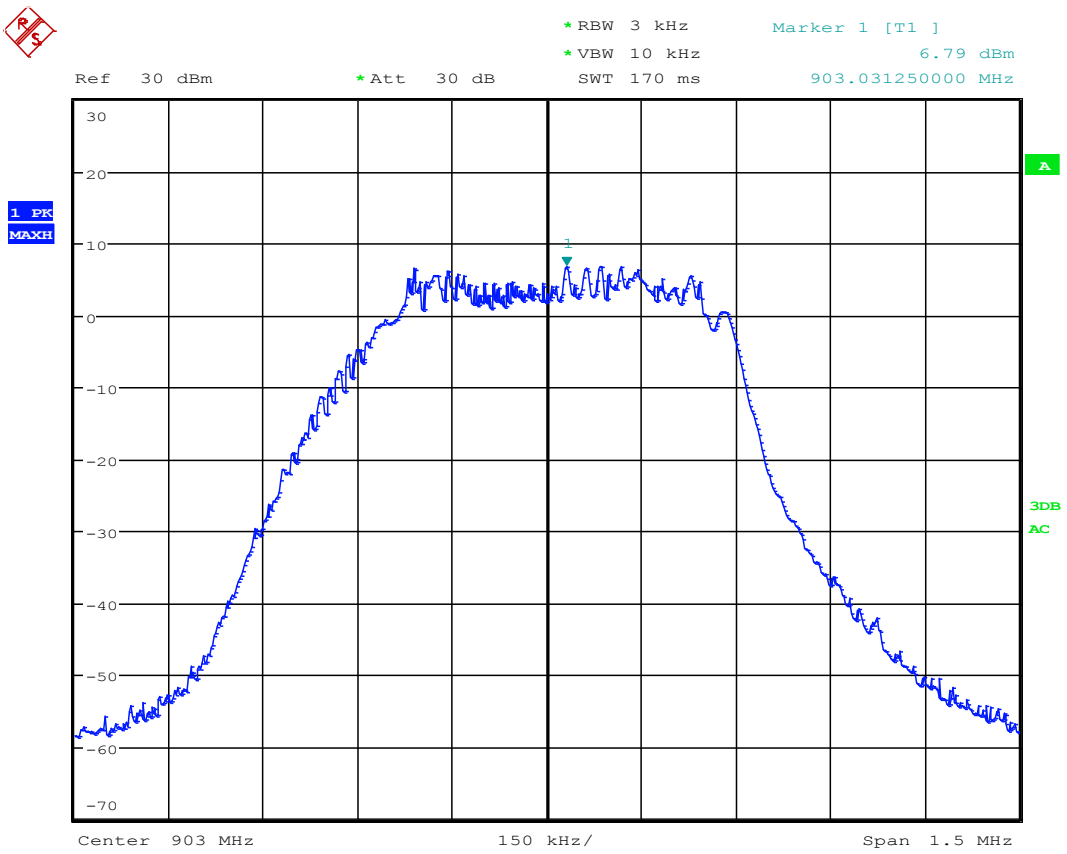
11.12 TEST: Power Spectral Density			PASS
Parameters required prior to the test	Laboratory Ambient Temperature (°C)	15 to 35 °C	
	Relative Humidity (%)	30 to 60 %	
Parameters recorded during the test	Laboratory Ambient Temperature (°C)	24°C	
	Relative Humidity (%)	37%	
	Air pressure (hPa)	1020	
—	Power Supply / Frequency	Application Point	
Fully configured sample tested at the power line frequency	+3,7V dc	RF Connector	
Equipment mode:	Operation mode	#3	
FCC Standard	§15.247 (E)		
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.			
Further information to test setup			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Calibration date	Calibration due
EMI Test Receiver	R&S	ESU40	87020455	05/2018	05/2019

Graphical representation of Power Spectral Density

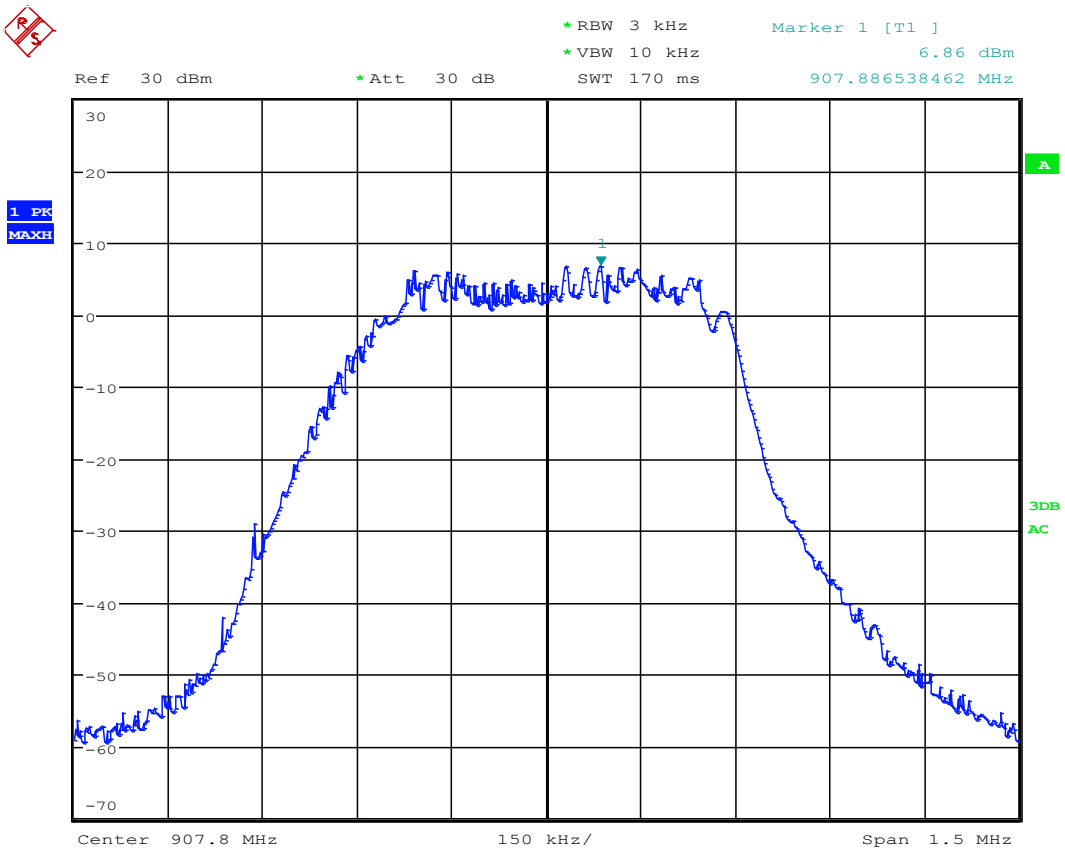
Operation Mode: #3 – Low Channel (903 MHz)

Plot n°1



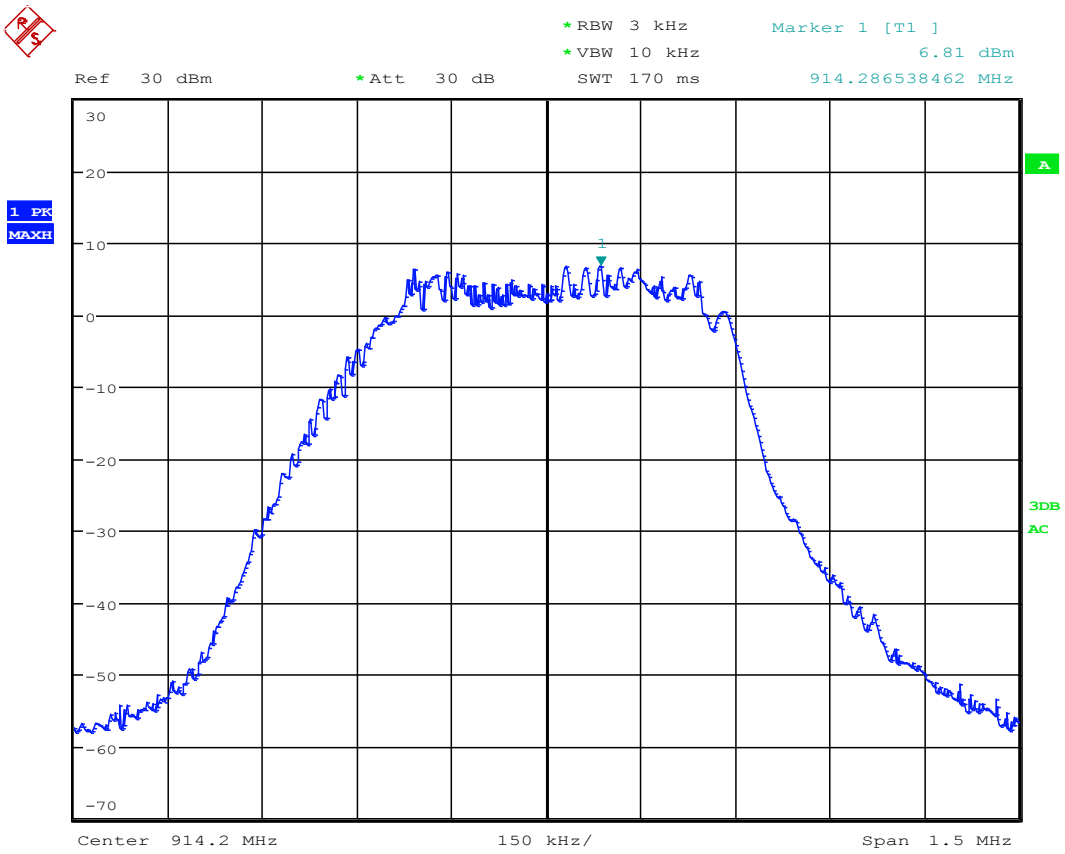
Channel (No.)	Frequency (MHz)	Conducted Power Spectral Density (dBm)	Limit (dBm)
Low	**903,0**	**6,79**	**8**

Graphical representation of Power Spectral Density
Operation Mode: #3 – Middle Channel (907,8 MHz)
Plot n°2



Channel (No.)	Frequency (MHz)	Conducted Power Spectral Density (dBm)	Limit (dBm)
Middle	**907,8**	**6,86**	**8**

Graphical representation of Power Spectral Density
Operation Mode: #3 – High Channel (914,2 MHz)
Plot n°3



Channel (No.)	Frequency (MHz)	Conducted Power Spectral Density (dBm)	Limit (dBm)
High	**914,2**	**6,81**	**8**

12. ANNEX	
Photographic Documentation	
External photo	See Report n° 28112302 009 Annex1
Internal photo	See Report n° 28112302 009 Annex2
Set-up photo	See Report n° 28112302 009 Annex3

END OF TEST REPORT