



FCC RF Test Report

APPLICANT : Ring LLC
EQUIPMENT : Spotlight Cam Pro
BRAND NAME : Ring
MODEL NAME : 5E62E9
FCC ID : 2AEUPBHASP001
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System
TEST DATE(S) : Jan. 02, 2022 ~ Jun. 24, 2022

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (Kunshan)

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Pass	-
3.2	15.247(b)(3)	Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 30dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 9.97 dB at 985.45 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 18.86 dB at 0.151 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Ring LLC
12515 Cerise Ave, Hawthorne, CA 90250 USA

1.2 Manufacturer

Goertek Inc.
No.268 Dongfang Road High-Tech Industrial Development District, Weifang Shandong, China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Spotlight Cam Pro
Brand Name	Ring
Model Name	5E62E9
FCC ID	2AEUPBHASP001
HW Version	DVT2
SW Version	1.5.17
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	902.5 MHz ~ 926.5 MHz
Number of Channels	31
Bandwidth / Spread Factor	500kHz / 5, 7, 8, 9, 10, 11
Maximum Output Power to Antenna	LoRa DTS SF5 : 19.97 dBm (0.0993 W) LoRa DTS SF7 : 21.34 dBm (0.1361 W) LoRa DTS SF8 : 21.37 dBm (0.1371 W) LoRa DTS SF9 : 21.31 dBm (0.1352 W) LoRa DTS SF10 : 21.33 dBm (0.1358 W) LoRa DTS SF11 : 21.33 dBm (0.1358 W)
99% Occupied Bandwidth	LoRa DTS SF5 : 0.535 MHz LoRa DTS SF7 : 0.533 MHz LoRa DTS SF8 : 0.535 MHz LoRa DTS SF9 : 0.538 MHz LoRa DTS SF10 : 0.538 MHz LoRa DTS SF11 : 0.538 MHz
Antenna Type / Gain	PIFA Antenna with gain 0.95 dBi
Type of Modulation	LoRa



1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-KS 03CH06-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24al
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
902.5-926.5 MHz	1	902.5	17	915.3
	2	903.3	18	916.1
	3	904.1	19	916.9
	4	904.9	20	917.7
	5	905.7	21	918.5
	6	906.5	22	919.3
	7	907.3	23	920.1
	8	908.1	24	920.9
	9	908.9	25	921.7
	10	909.7	26	922.5
	11	910.5	27	923.3
	12	911.3	28	924.1
	13	912.1	29	924.9
	14	912.9	30	925.7
	15	913.7	31	926.5
	16	914.5		

Note: The above EUT's information was declared by manufacturer.



2.2 Test Mode

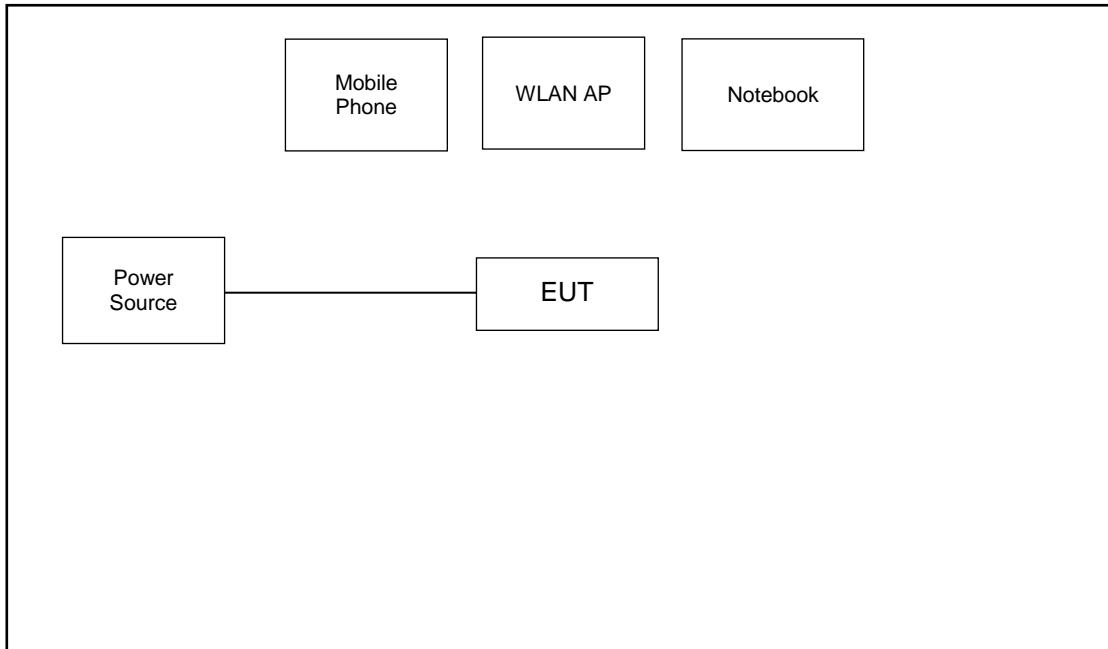
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

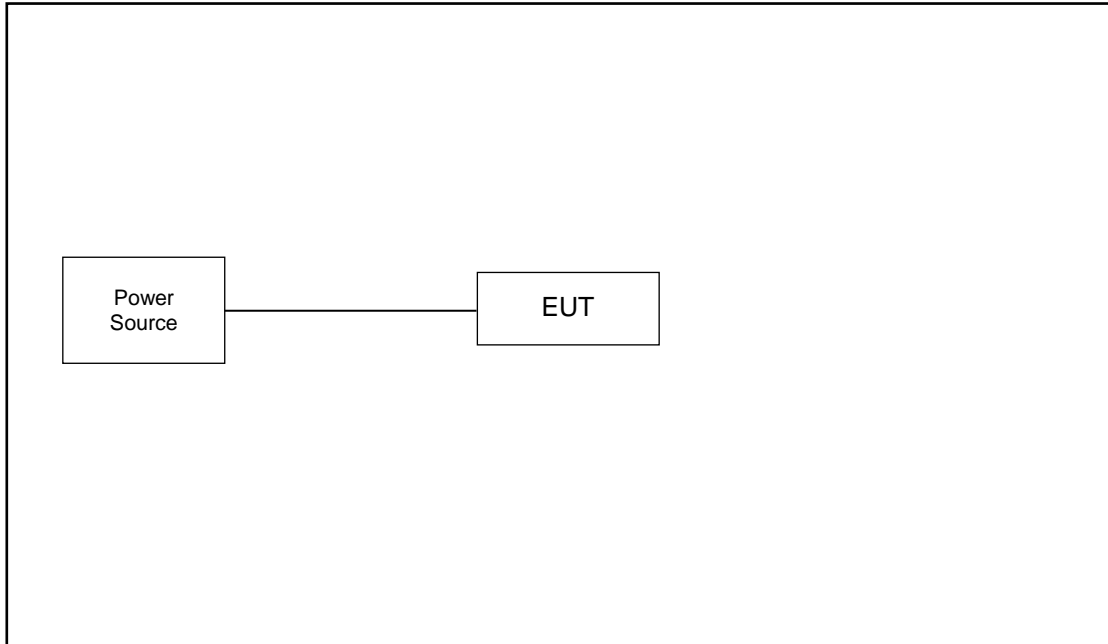
Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Lora 500KHz DTS
Conducted TCs	Mode 1: LoRa Tx CH01_902.5 MHz Mode 2: LoRa Tx CH16_914.5 MHz Mode 3: LoRa Tx CH31_926.5 MHz
Radiated TCs	Mode 1: LoRa Tx CH01_902.5 MHz Mode 2: LoRa Tx CH16_914.5 MHz Mode 3: LoRa Tx CH31_926.5 MHz
AC Conducted Emission	Mode 1 : Lora Tx + Bluetooth Link + WLAN Link(2.4G) + Adapter + 24G Radar Tx + Battery 3

2.3 Connection Diagram of Test System

For AC Conducted Emission:



For Radiated Emission:





2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
2.	Mobile Phone	N/A	N/A	N/A	N/A	N/A
3.	Notebook	Lenovo	V130-151KB005	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

For LoRa function, the engineering test program was provided and enabled to make EUT continuous transmit.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5.0 dB and 10dB attenuator.

$$\begin{aligned}
 \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\
 &= 5.0 + 10 = 15.0 \text{ (dB)}
 \end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

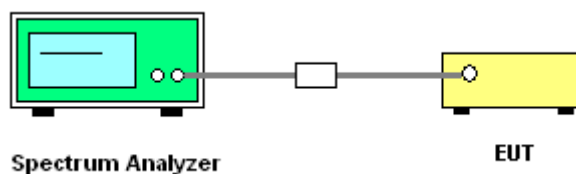
3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30kHz and set the Video bandwidth (VBW) = 100kHz.
6. Measure and record the results in the test report.

3.1.4 Test Setup



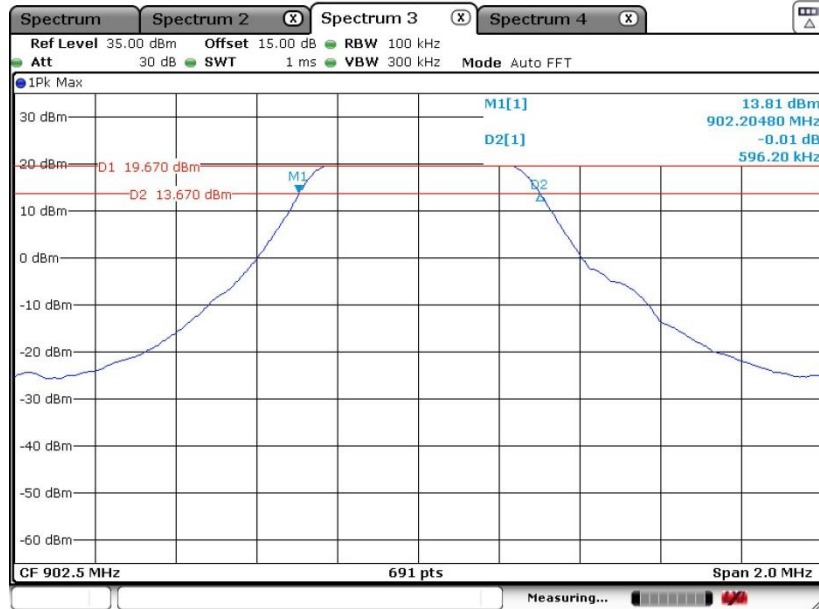


3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

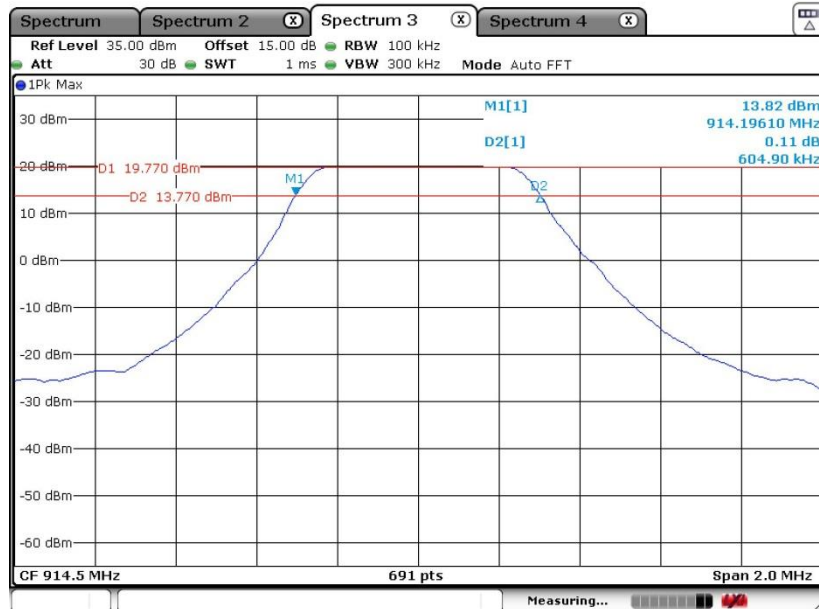
For SF5:

6 dB Bandwidth Plot on 902.5MHz



Date: 9.JUN.2022 09:42:03

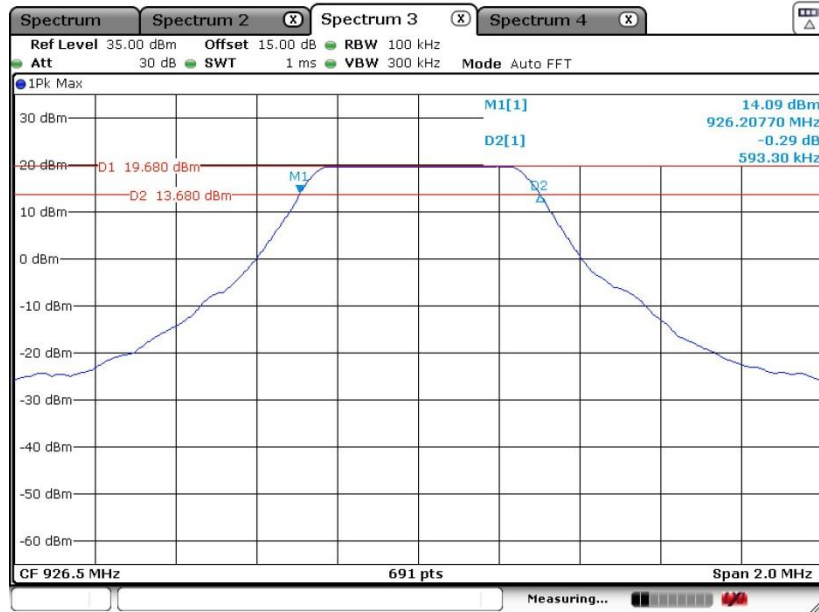
6 dB Bandwidth Plot on 914.5 MHz



Date: 9.JUN.2022 09:58:04



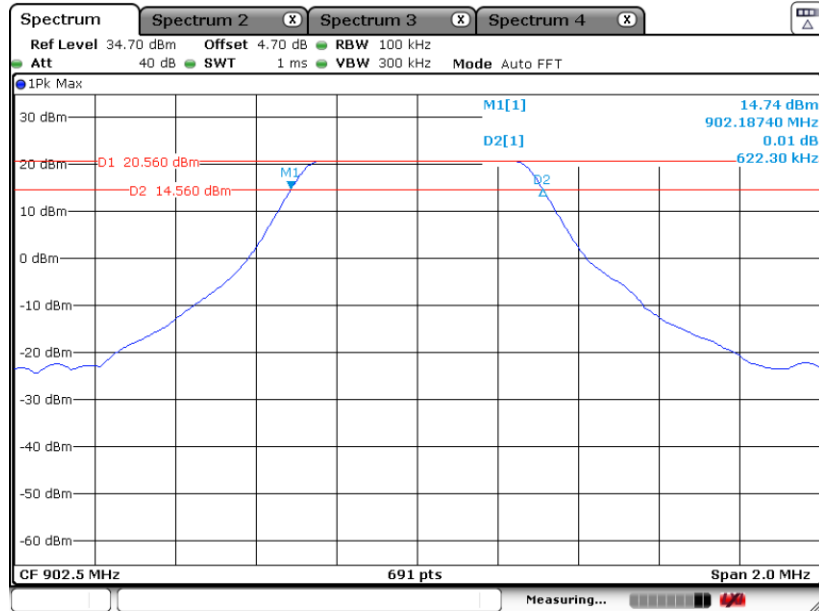
6 dB Bandwidth Plot on 926.5 MHz



Date: 9.JUN.2022 10:01:35

For SF7:

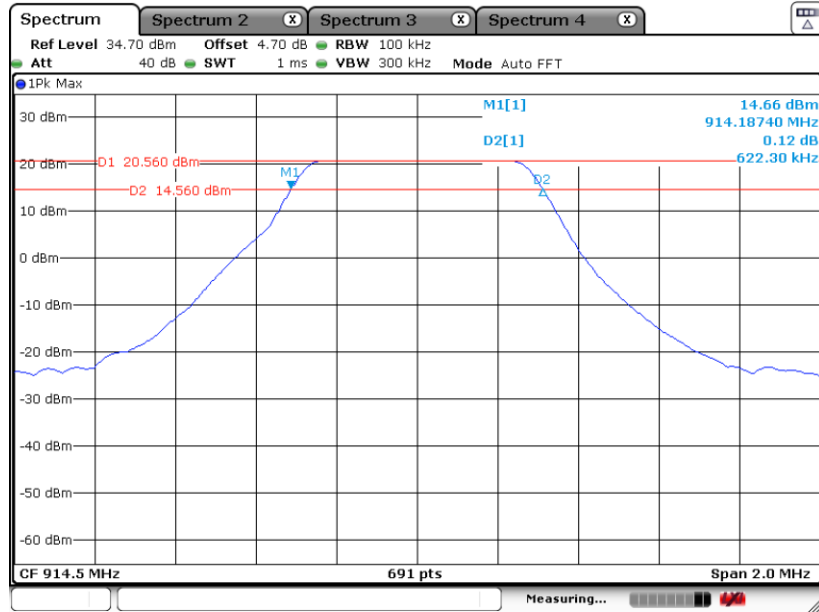
6 dB Bandwidth Plot on 902.5 MHz



Date: 8.JAN.2022 16:18:15

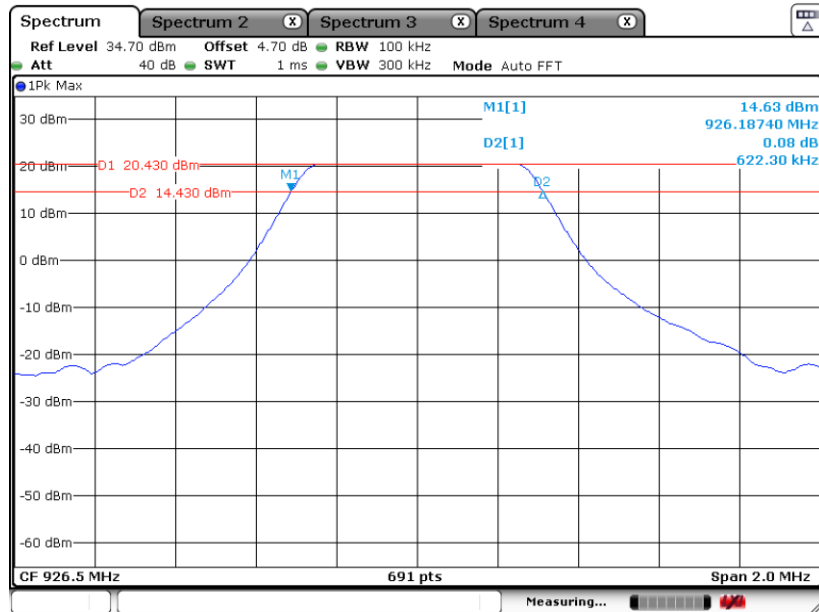


6 dB Bandwidth Plot on 914.5 MHz



Date: 8.JAN.2022 16:22:22

6 dB Bandwidth Plot on 926.5 MHz

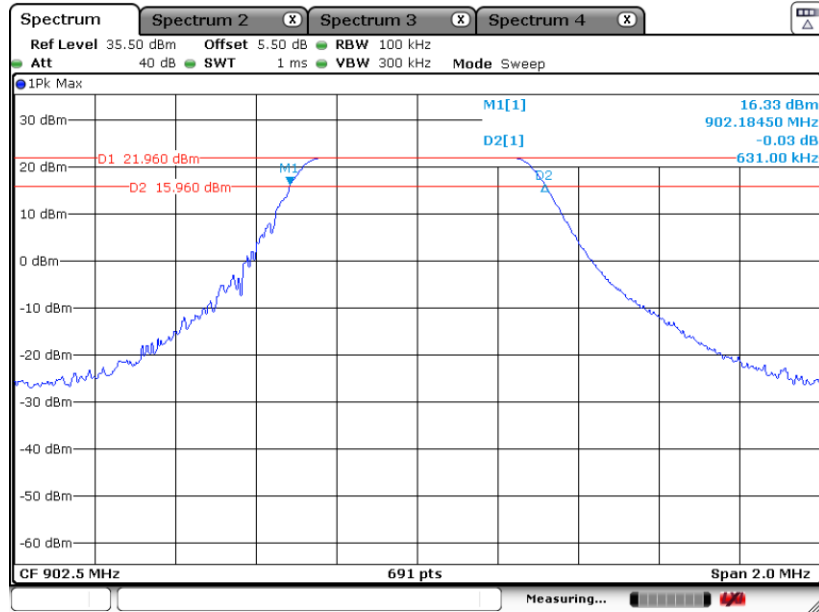


Date: 8.JAN.2022 16:24:55



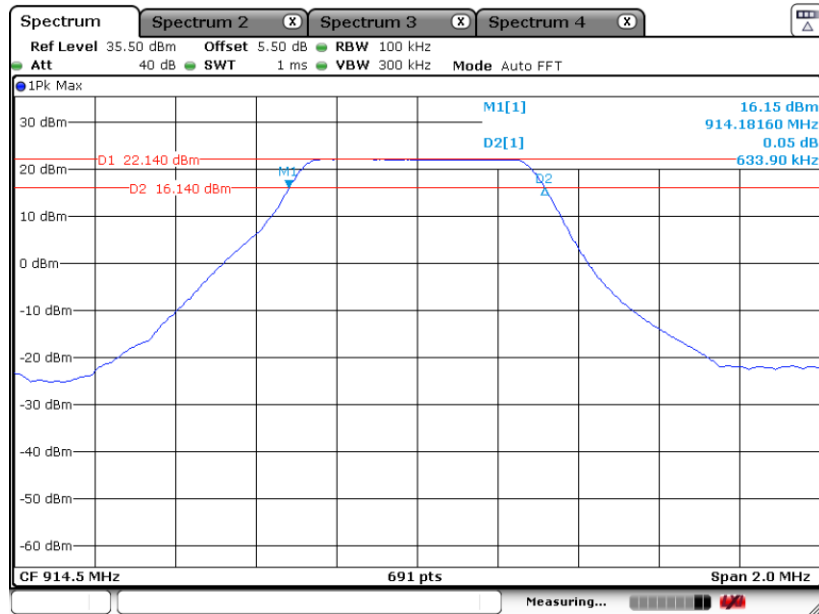
For SF8:

6 dB Bandwidth Plot on 902.5 MHz



Date: 2.JAN.2022 02:09:55

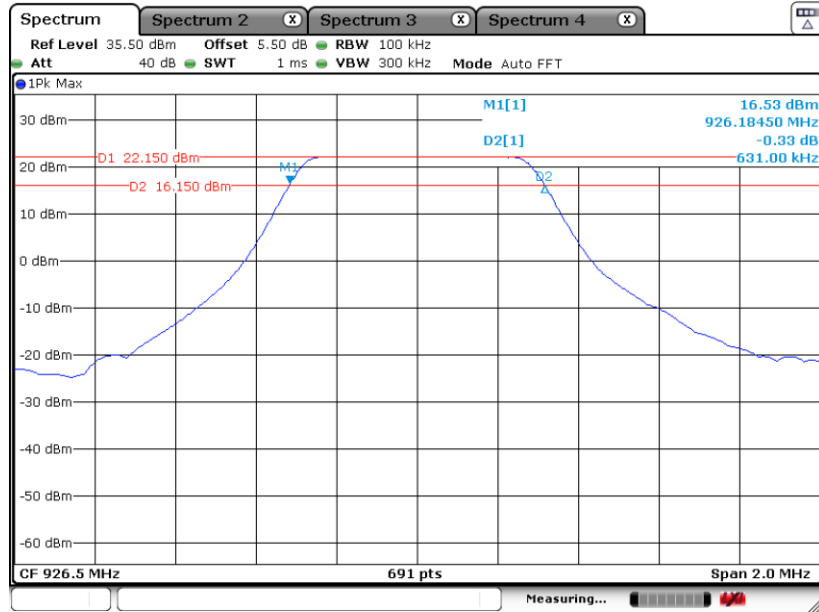
6 dB Bandwidth Plot on 914.5 MHz



Date: 2.JAN.2022 02:20:30

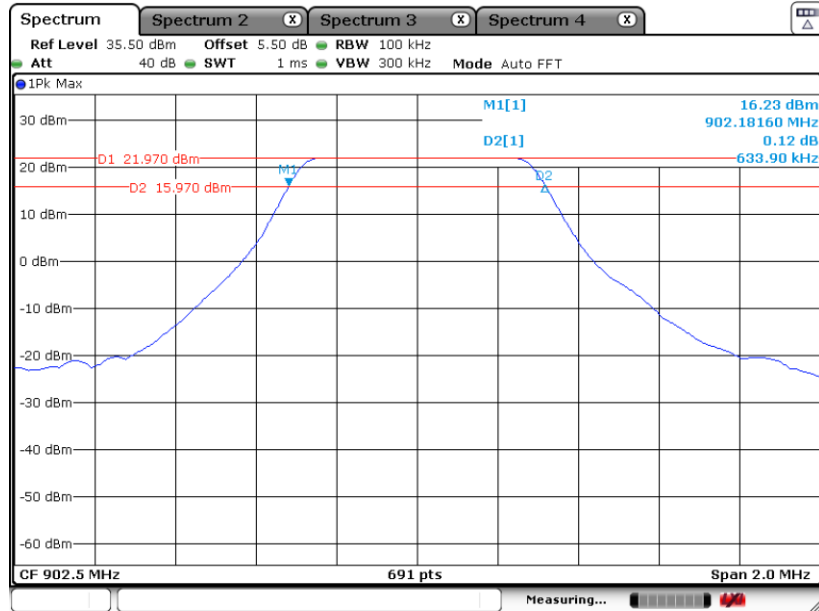


6 dB Bandwidth Plot on 926.5 MHz



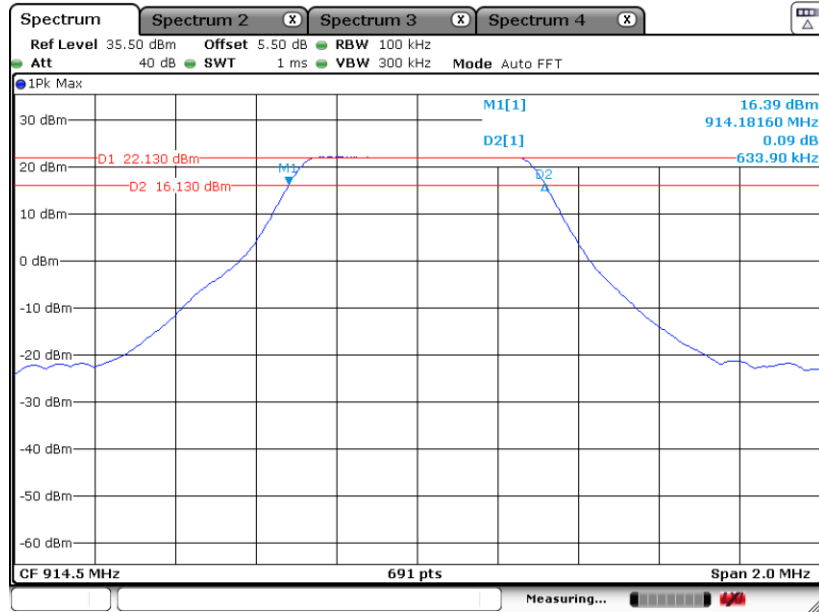
For SF9:

6 dB Bandwidth Plot on 902.5 MHz



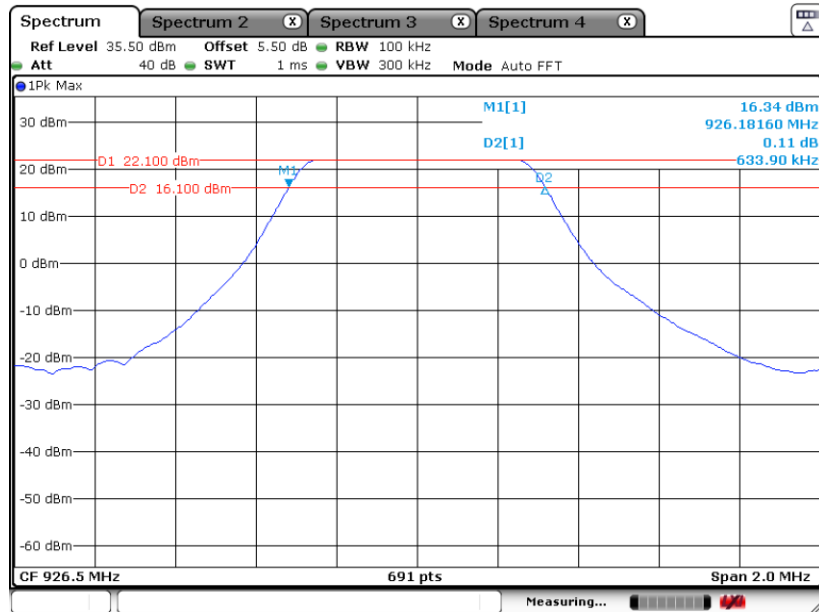


6 dB Bandwidth Plot on 914.5 MHz



Date: 2.JAN.2022 04:27:53

6 dB Bandwidth Plot on 926.5 MHz

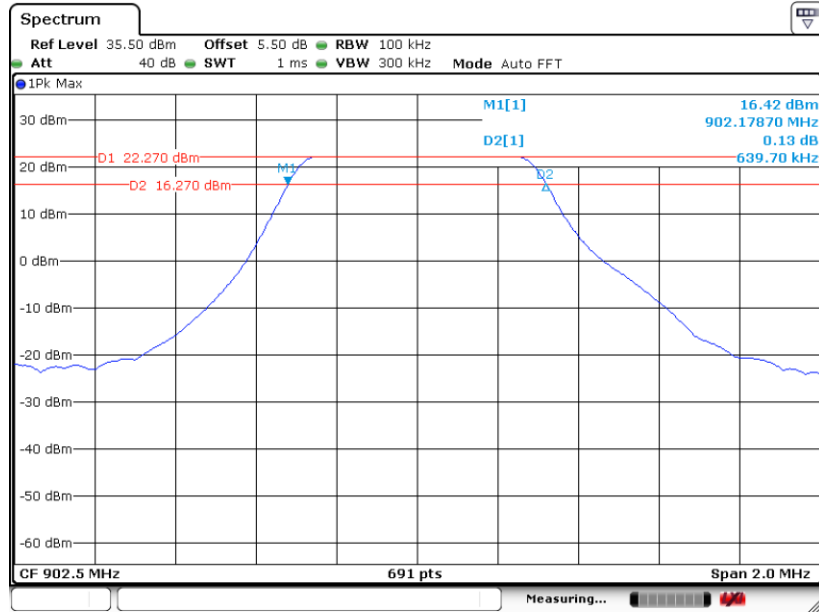


Date: 2.JAN.2022 04:30:54



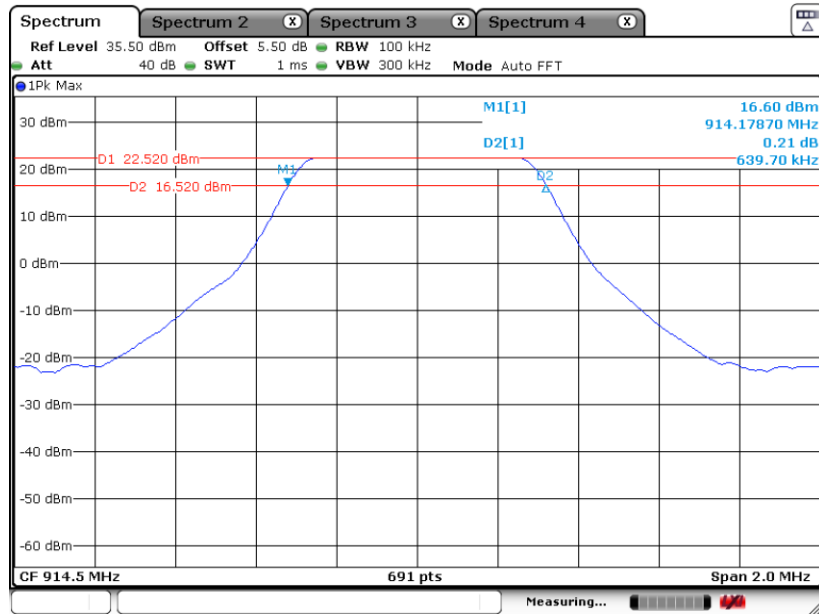
For SF10:

6 dB Bandwidth Plot on 902.5 MHz



Date: 3.JAN.2022 09:12:34

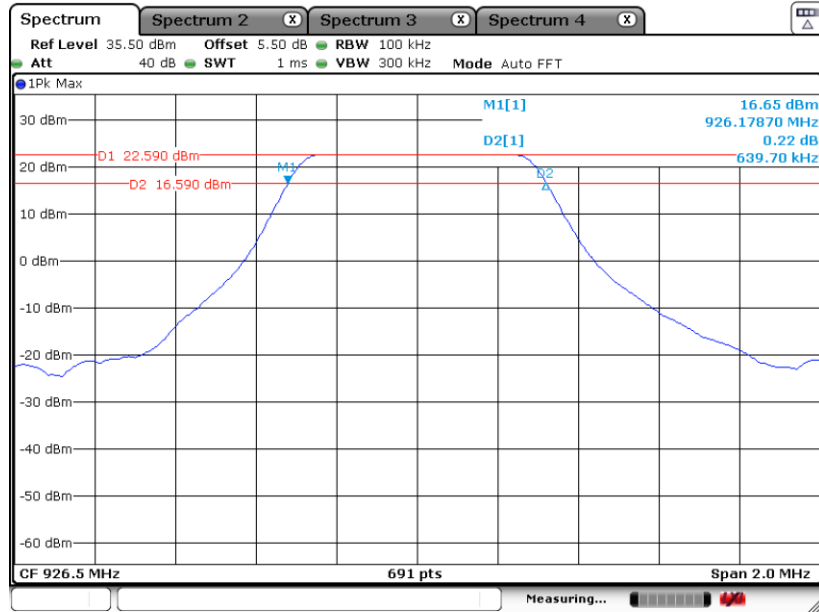
6 dB Bandwidth Plot on 914.5 MHz



Date: 3.JAN.2022 09:18:53

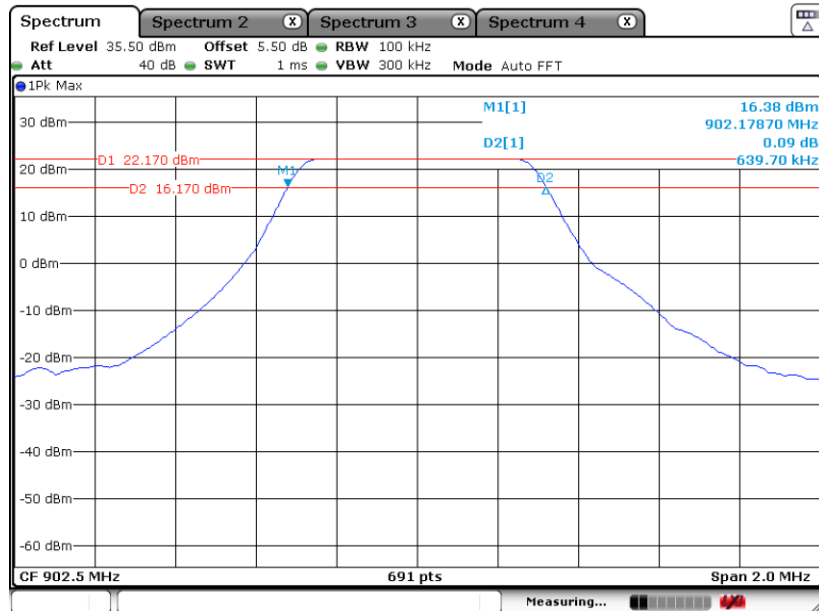


6 dB Bandwidth Plot on 926.5 MHz



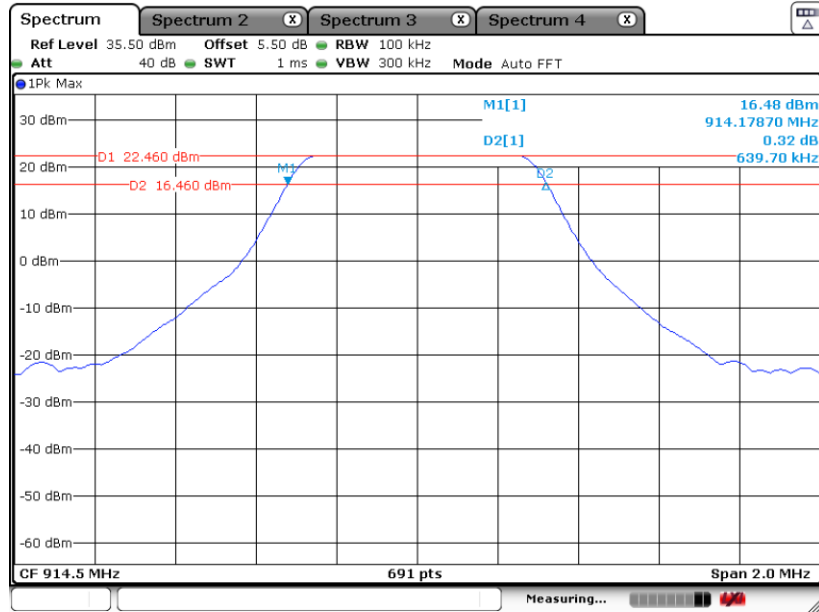
For SF11:

6 dB Bandwidth Plot on 902.5MHz

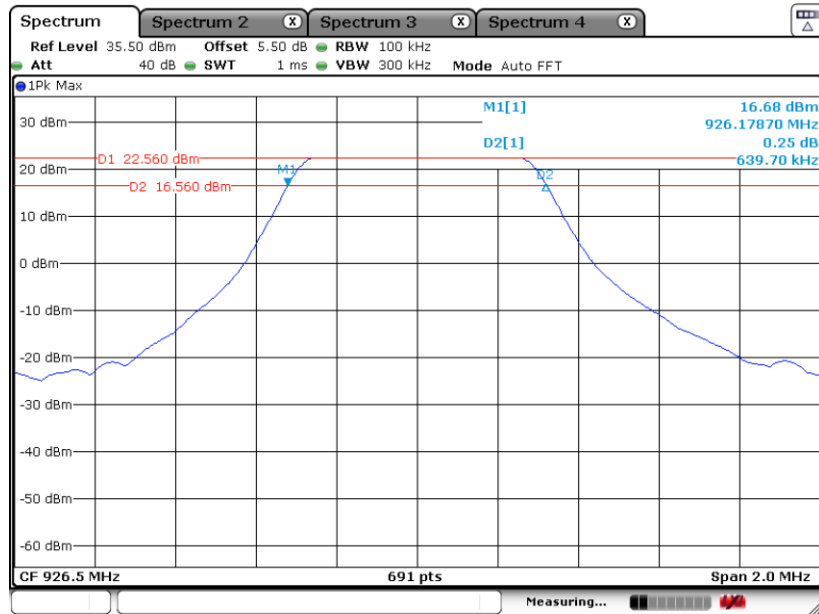




6 dB Bandwidth Plot on 914.5 MHz



6 dB Bandwidth Plot on 926.5 MHz



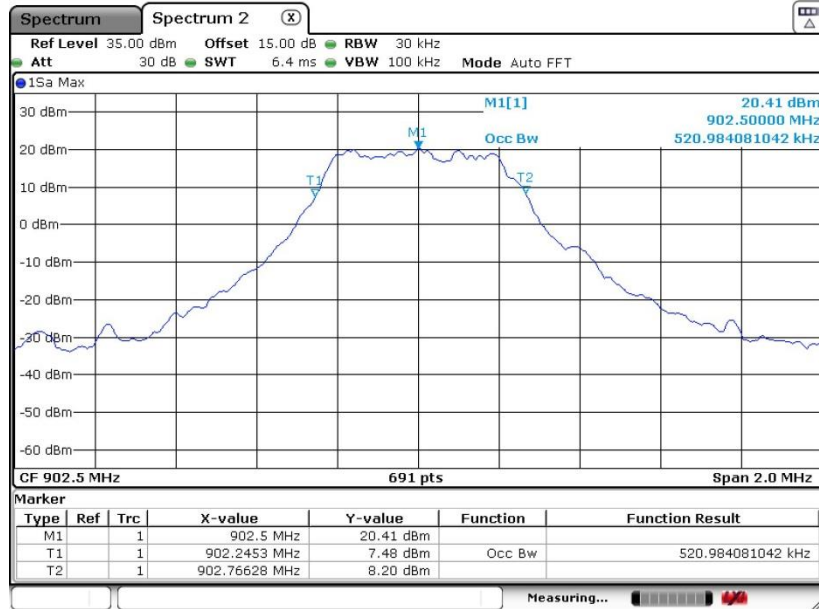


3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

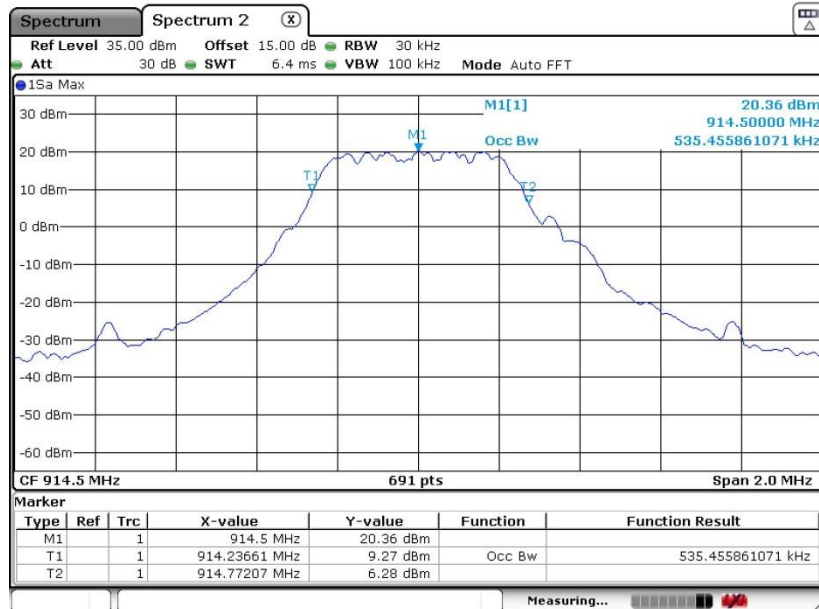
For SF5:

99% Bandwidth Plot on 902.5 MHz



Date: 7 JUN 2022 22:03:02

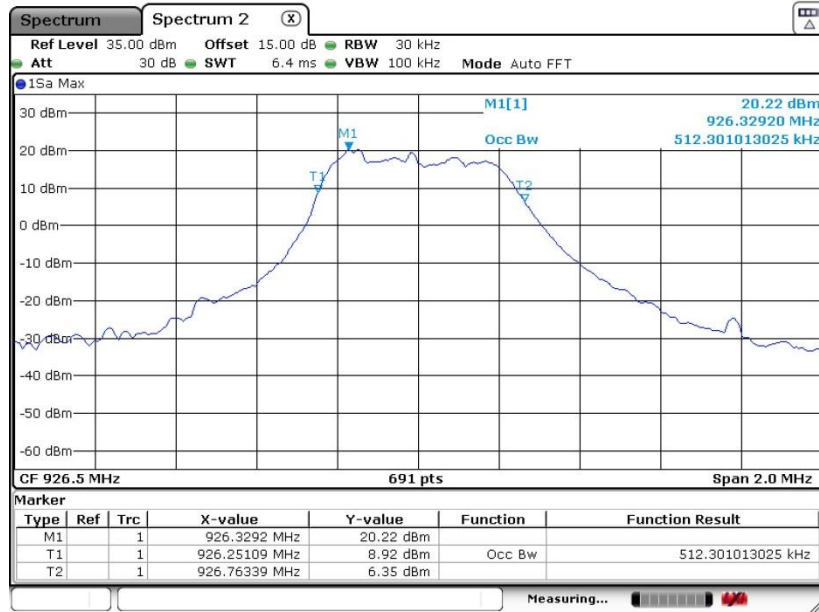
99% Occupied Bandwidth Plot on 914.5 MHz



Date: 7 JUN 2022 22:28:22



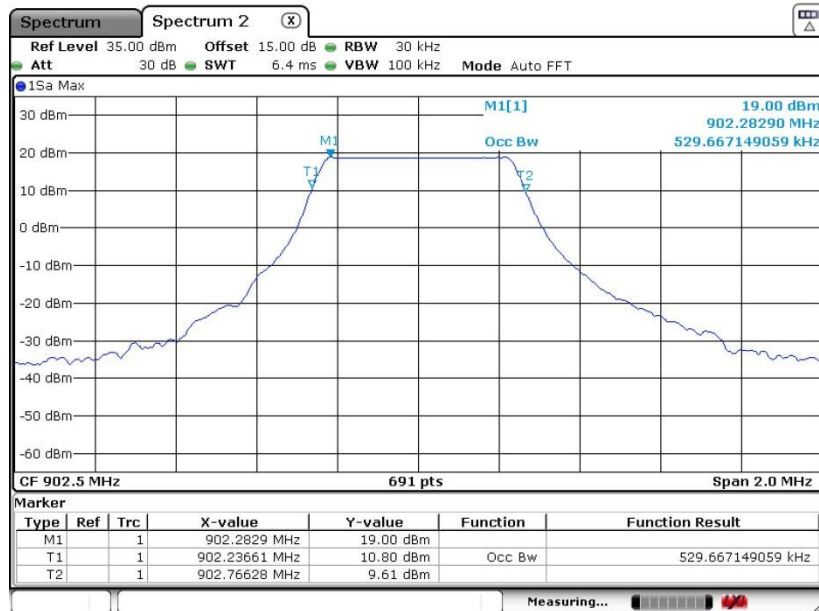
99% Occupied Bandwidth Plot on 926.5 MHz



Date: 7.JUN.2022 22:37:14

For SF7:

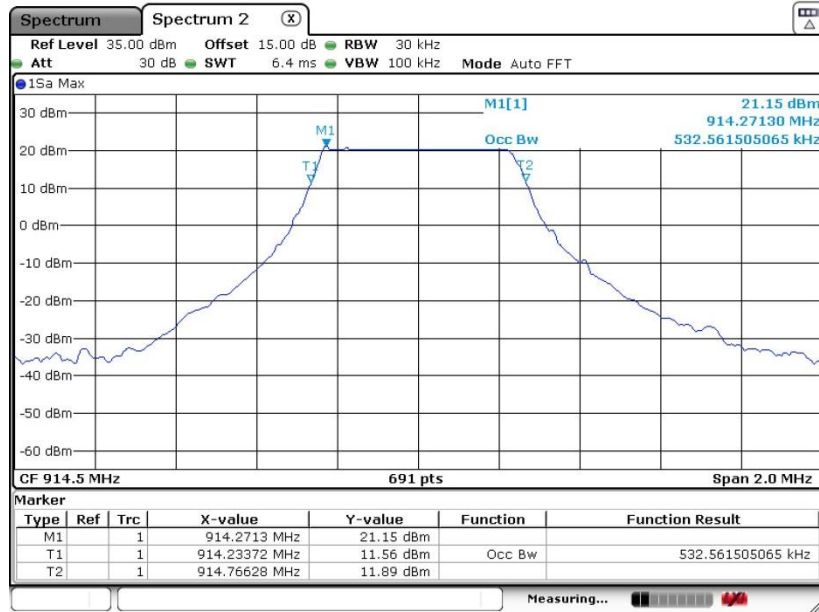
99% Bandwidth Plot on 902.5 MHz



Date: 7.JUN.2022 23:42:13

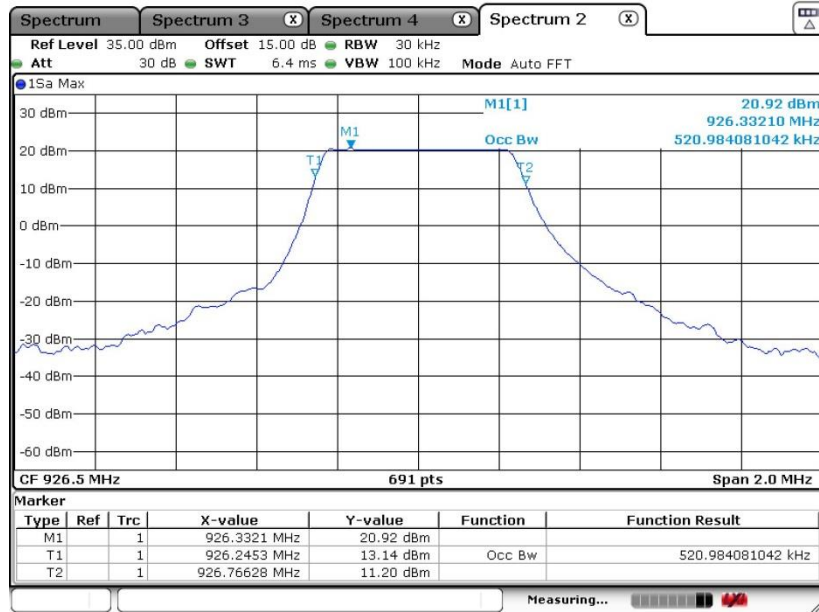


99% Occupied Bandwidth Plot on 914.5 MHz



Date: 8 JUN.2022 00:44:09

99% Occupied Bandwidth Plot on 926.5 MHz

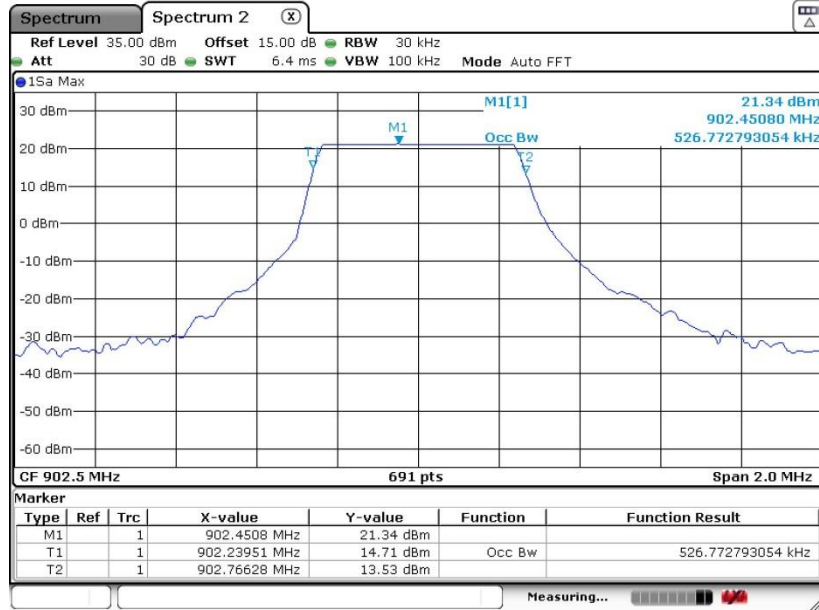


Date: 8 JUN.2022 04:44:38



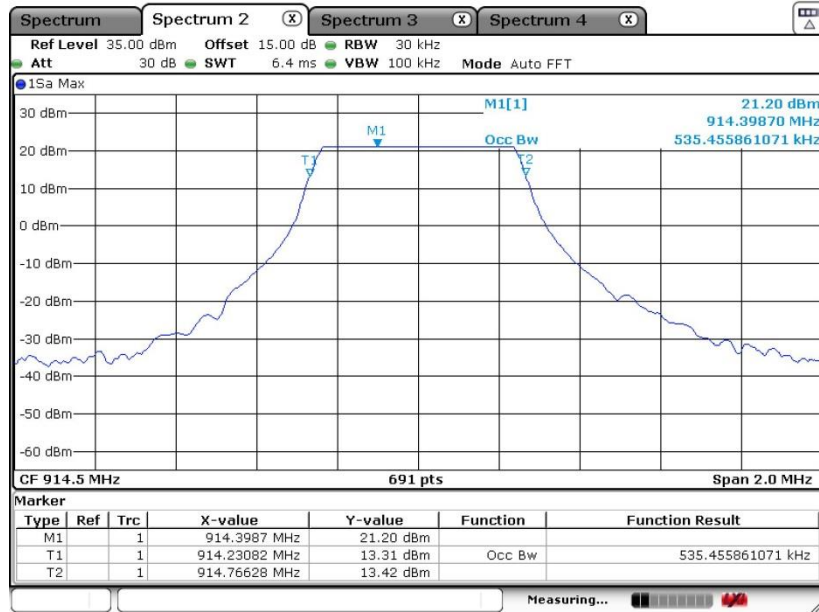
For SF8:

99% Bandwidth Plot on 902.5 MHz



Date: 8 JUN.2022 02:16:05

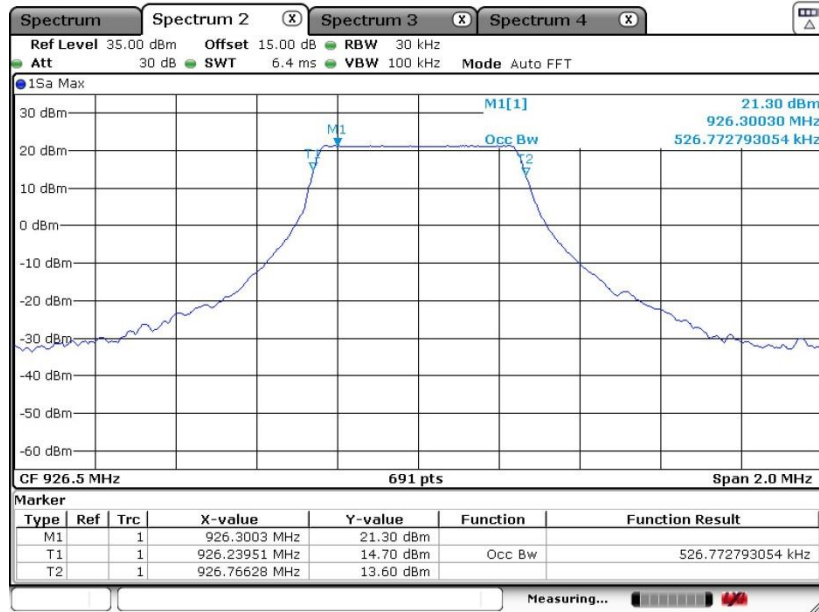
99% Occupied Bandwidth Plot on 914.5 MHz



Date: 8 JUN.2022 02:26:03



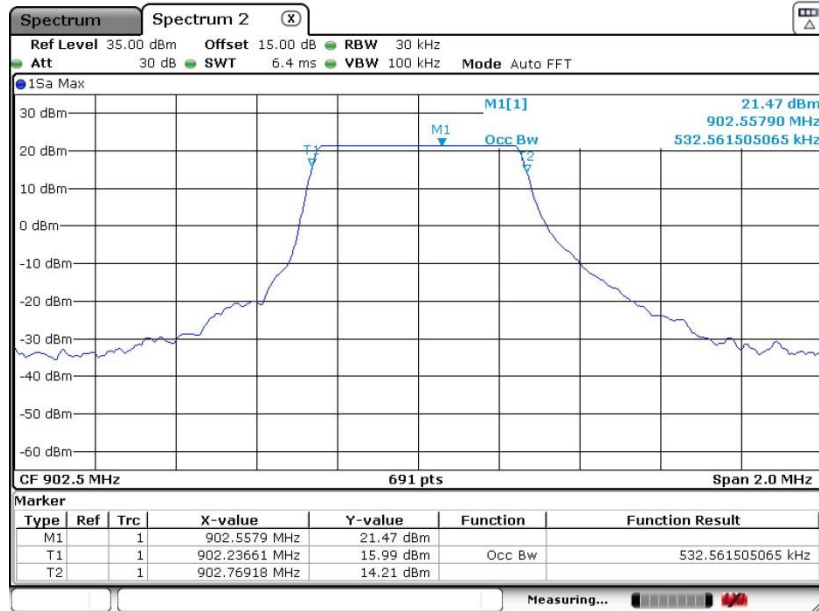
99% Occupied Bandwidth Plot on 926.5 MHz



Date: 8 JUN.2022 02:36:10

For SF9:

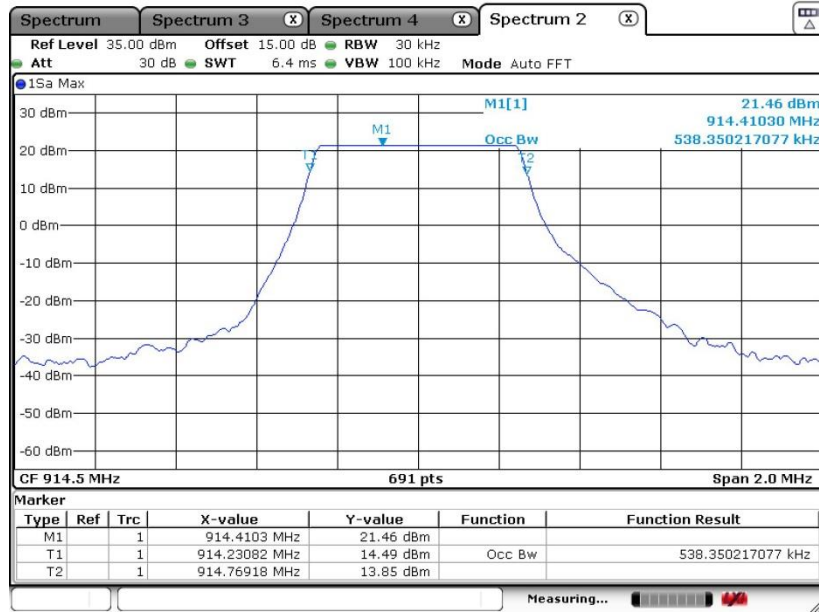
99% Bandwidth Plot on 902.5 MHz



Date: 8 JUN.2022 03:09:42

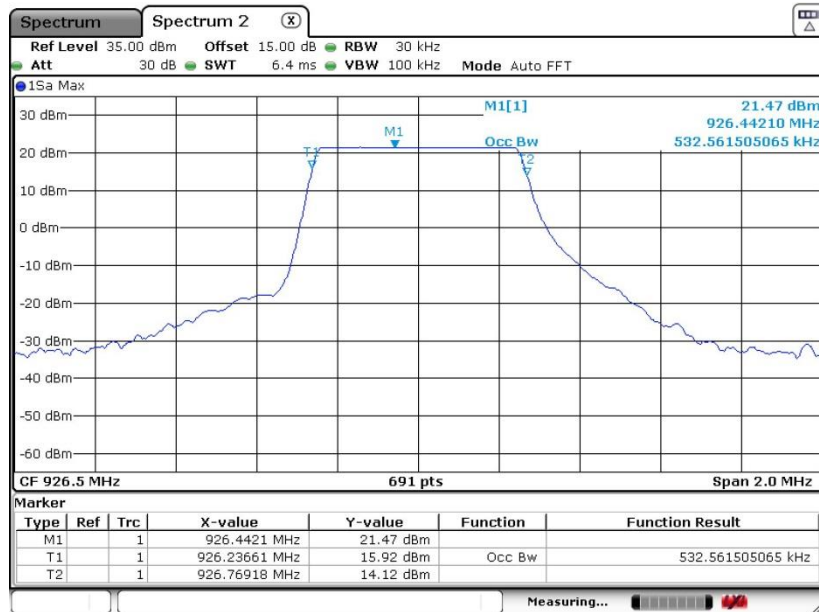


99% Occupied Bandwidth Plot on 914.5 MHz



Date: 8 JUN.2022 03:20:42

99% Occupied Bandwidth Plot on 926.5 MHz

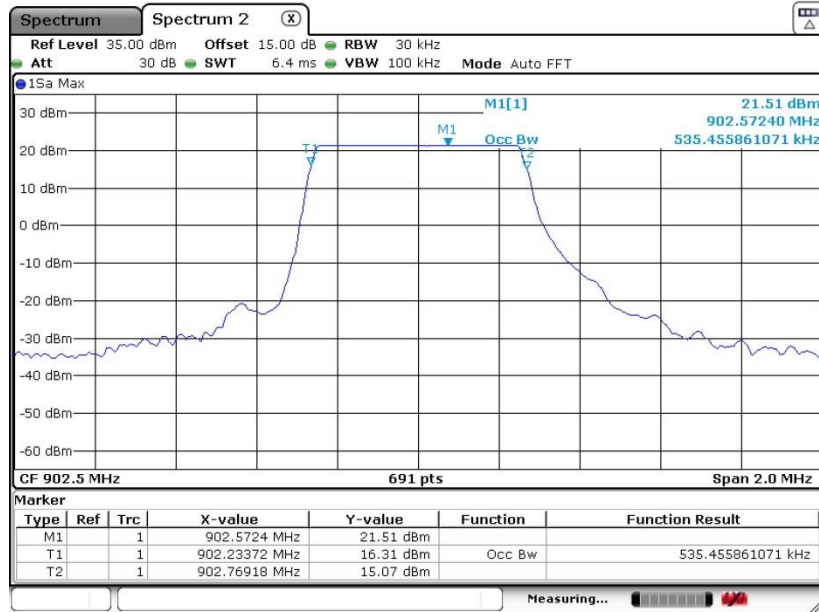


Date: 8 JUN.2022 03:28:26



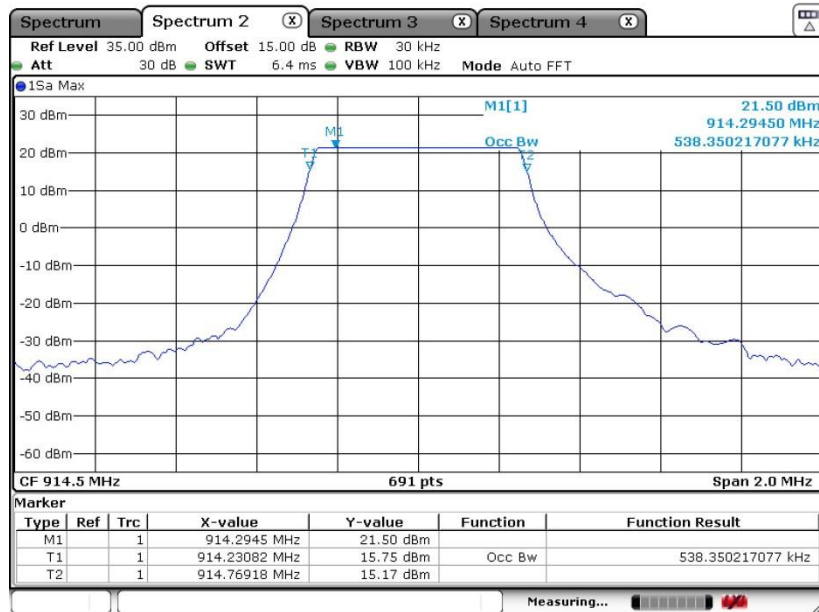
For SF10:

99% Bandwidth Plot on 902.5 MHz



Date: 8 JUN.2022 04:15:24

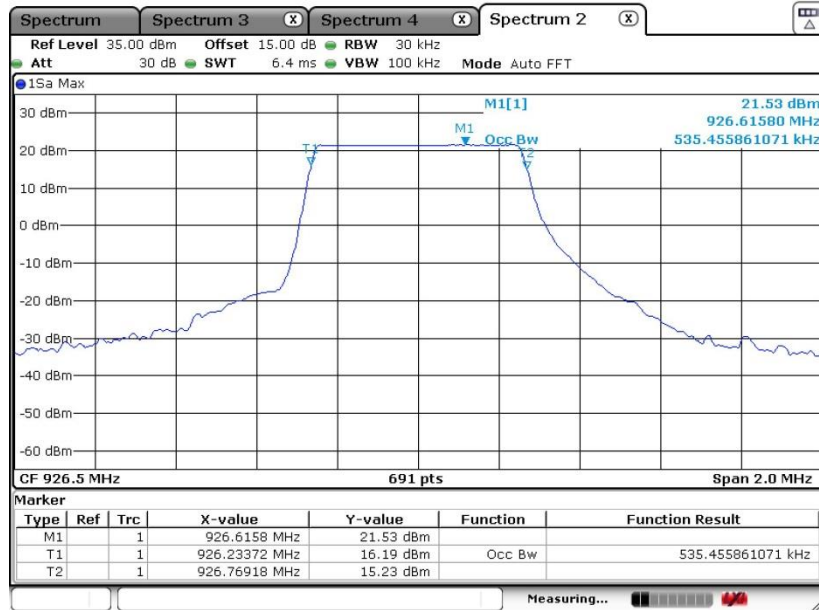
99% Occupied Bandwidth Plot on 914.5 MHz



Date: 8 JUN.2022 04:24:38



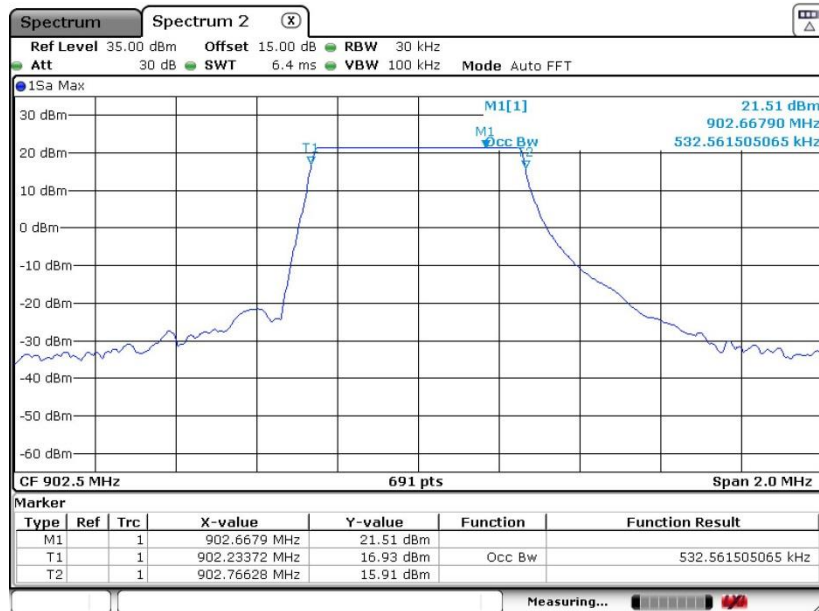
99% Occupied Bandwidth Plot on 926.5 MHz



Date: 8 JUN.2022 04:31:48

For SF11:

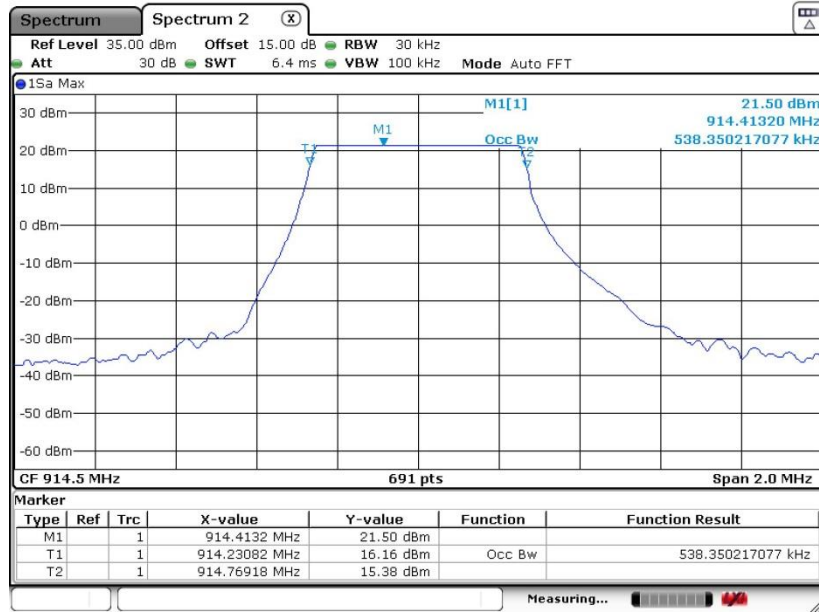
99% Bandwidth Plot on 902.5MHz



Date: 8 JUN.2022 05:09:08

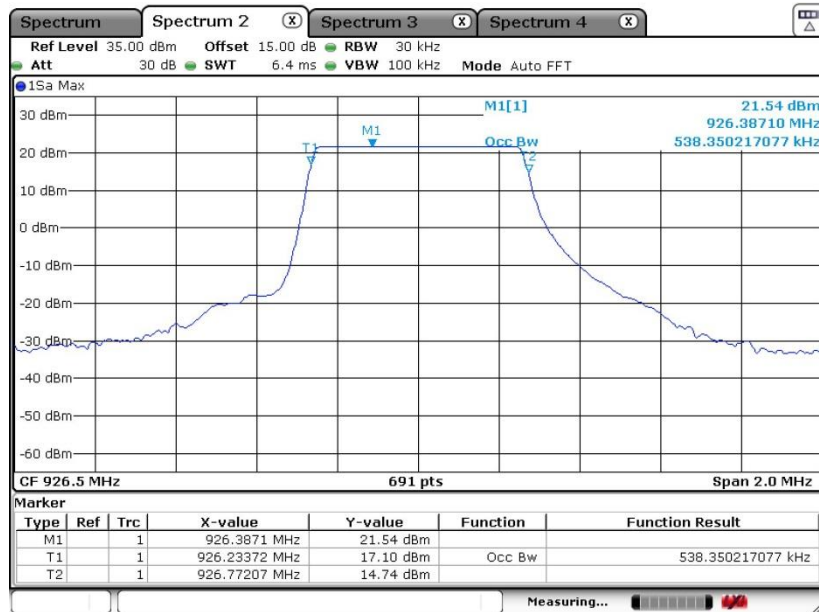


99% Bandwidth Plot on 914.5 MHz



Date: 8 JUN.2022 05:14:55

99% Bandwidth Plot on 926.5 MHz



Date: 8 JUN.2022 05:22:44

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 902-928MHz, the limit for output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

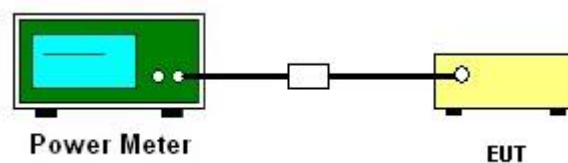
3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.2.3.2 Method AVGPM-G method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

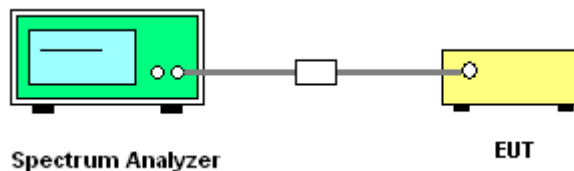
3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.5 Method AVGPSD-2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = power averaging (rms), Sweep time = auto couple. Use the peak marker function to determine the maximum power level.
6. Employ trace averaging (rms) mode over a minimum of 100 traces.
7. Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / \text{RBW}]$.
8. Measure and record the results in the test report.
9. Add $[10 \log (1 / D)]$, where D is the duty cycle.
10. The Measured power density (dBm)/ 100kHz is a reference level and used as 30dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

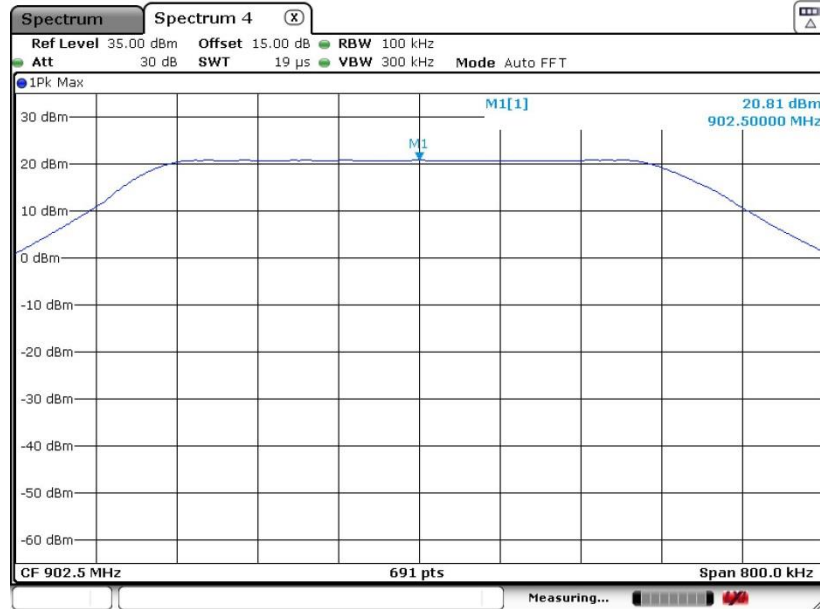
Please refer to Appendix A.



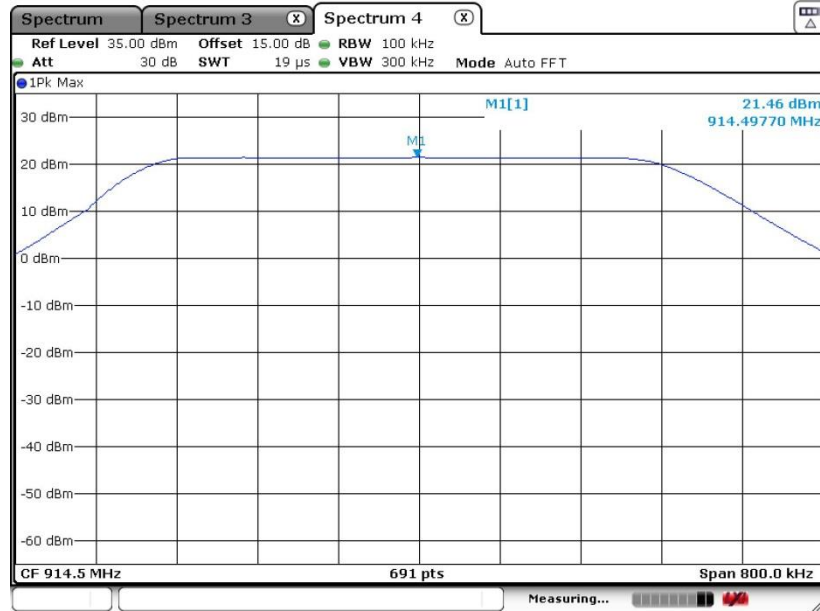
3.3.6 Test Result of Power Spectral Density Plots (100kHz)

For SF5:

PSD 100kHz Plot on 902.5 MHz

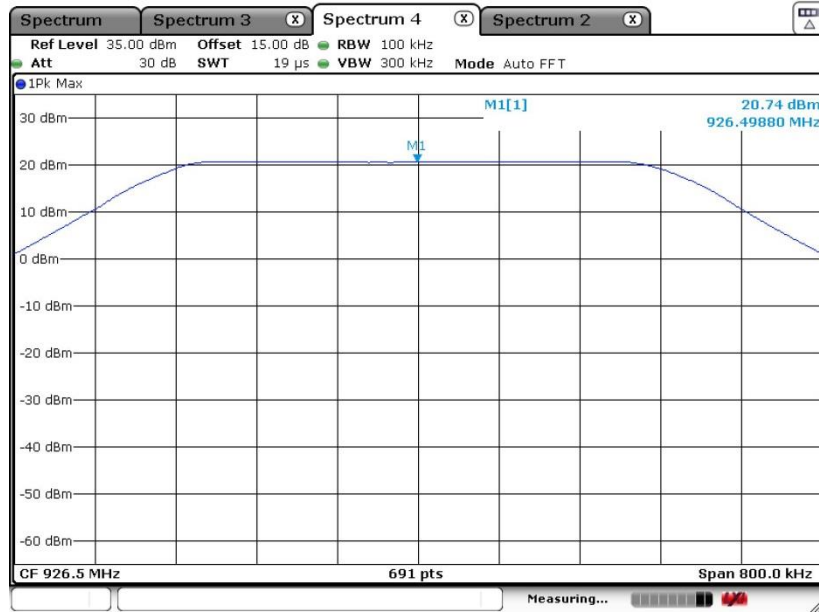


PSD 100kHz Plot on 914.5 MHz





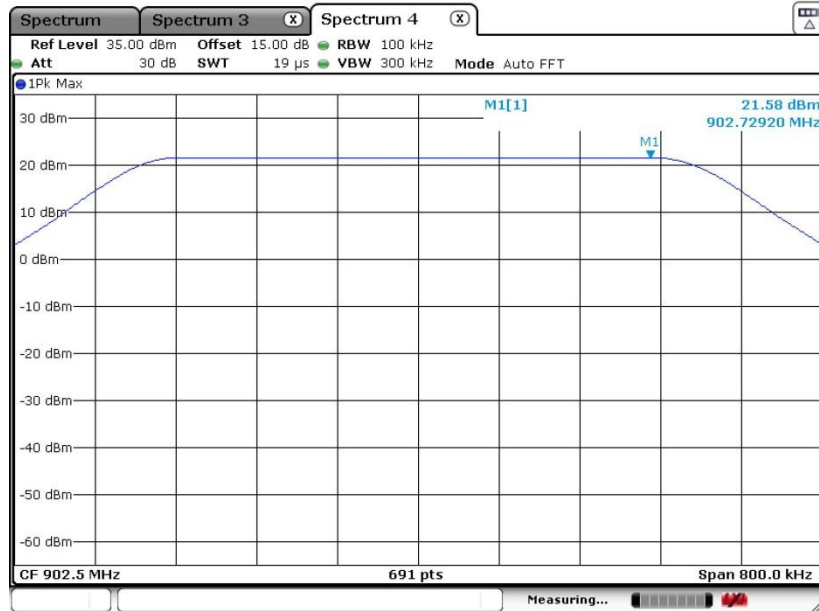
PSD 100kHz Plot on 926.5 MHz



Date: 8 JUN 2022 20:37:51

For SF7:

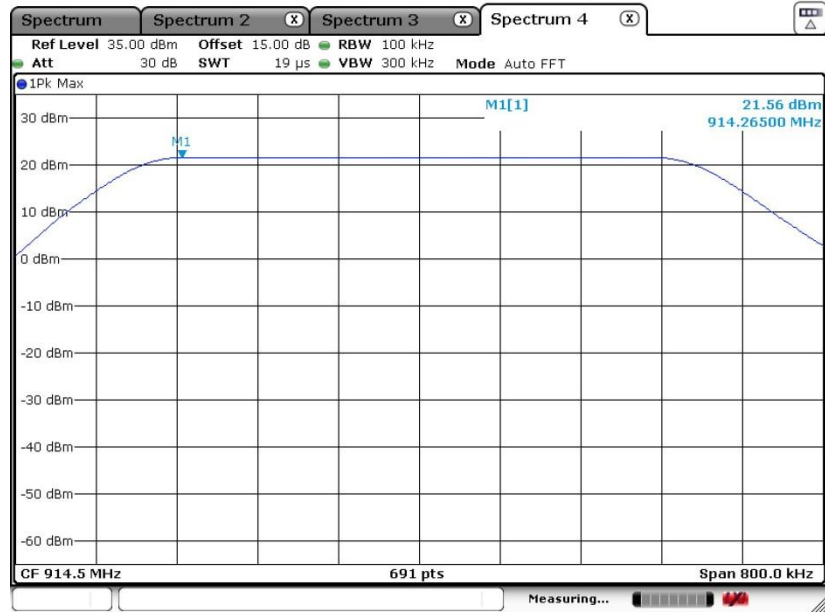
PSD 100kHz Plot on 902.5 MHz



Date: 8 JUN 2022 00:37:41

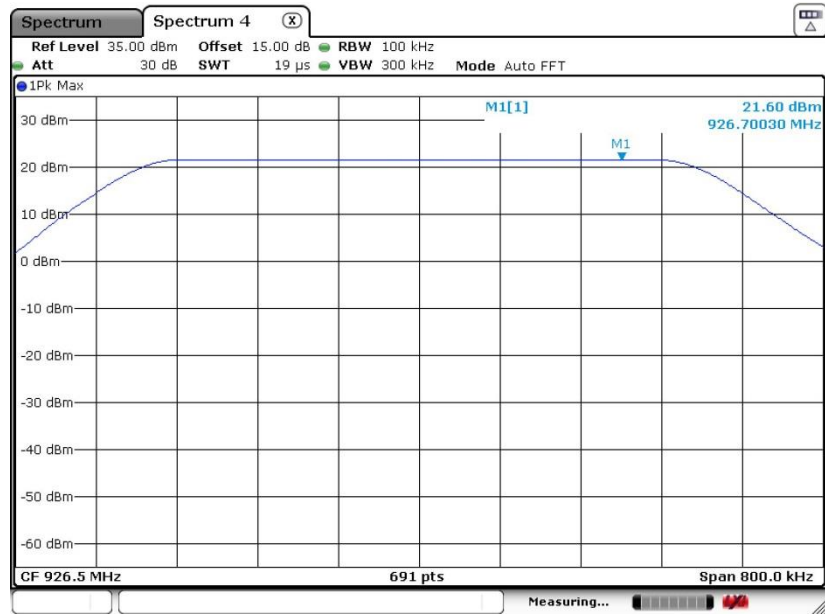


PSD 100kHz Plot on 914.5 MHz



Date: 8 JUN.2022 00:45:32

PSD 100kHz Plot on 926.5 MHz

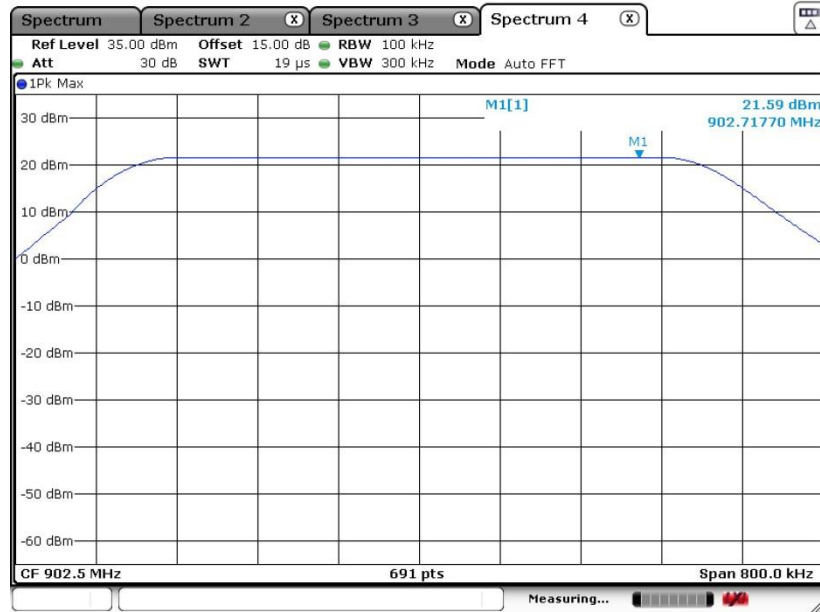


Date: 8 JUN.2022 00:52:00



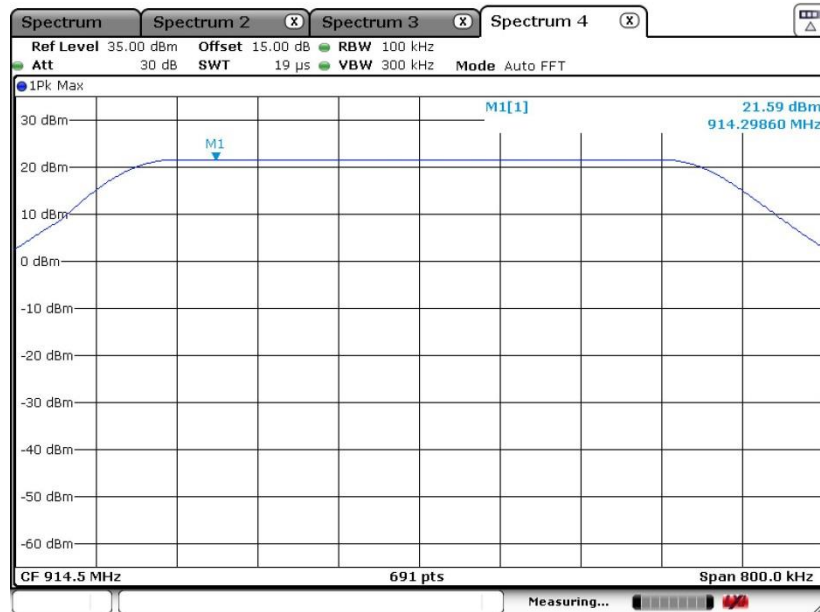
For SF8:

PSD 100kHz Plot on 902.5 MHz



Date: 8 JUN.2022 02:17:26

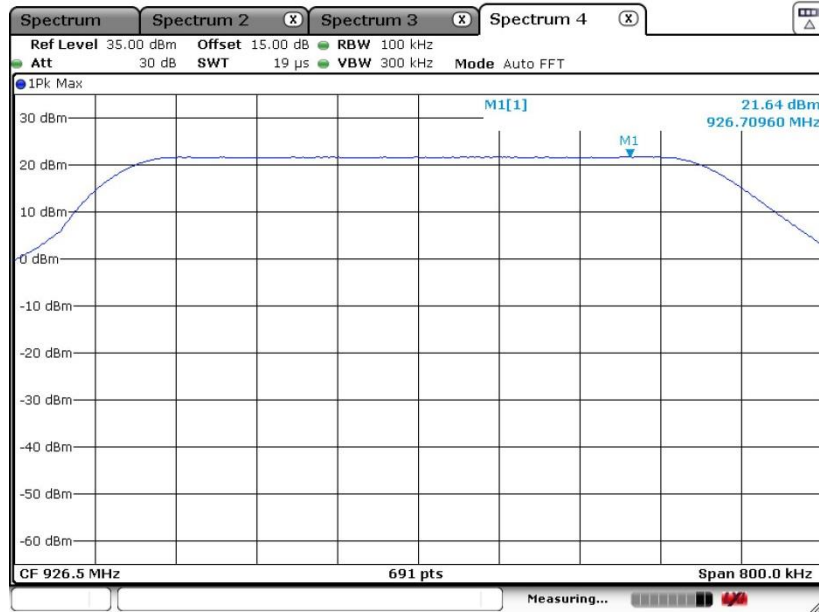
PSD 100kHz Plot on 914.5 MHz



Date: 8 JUN.2022 02:27:42



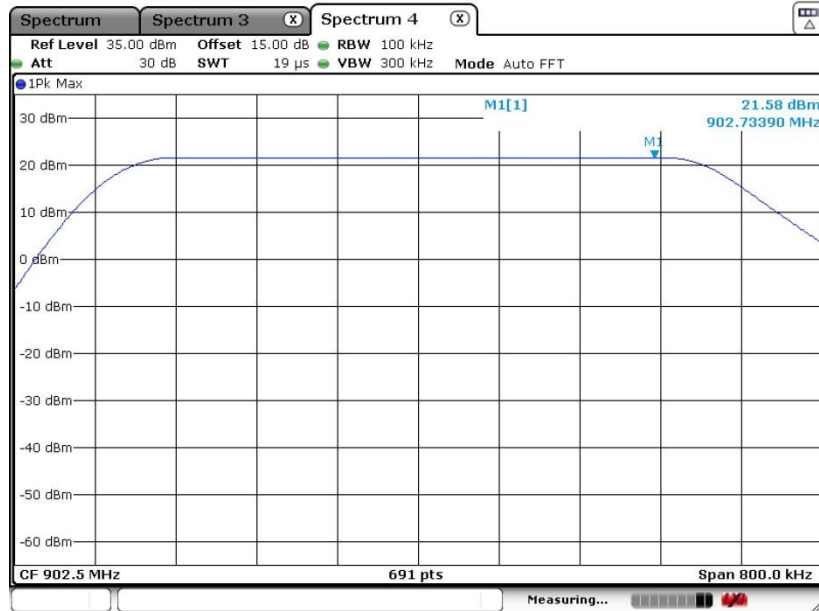
PSD 100kHz Plot on 926.5 MHz



Date: 8 JUN.2022 02:36:44

For SF9:

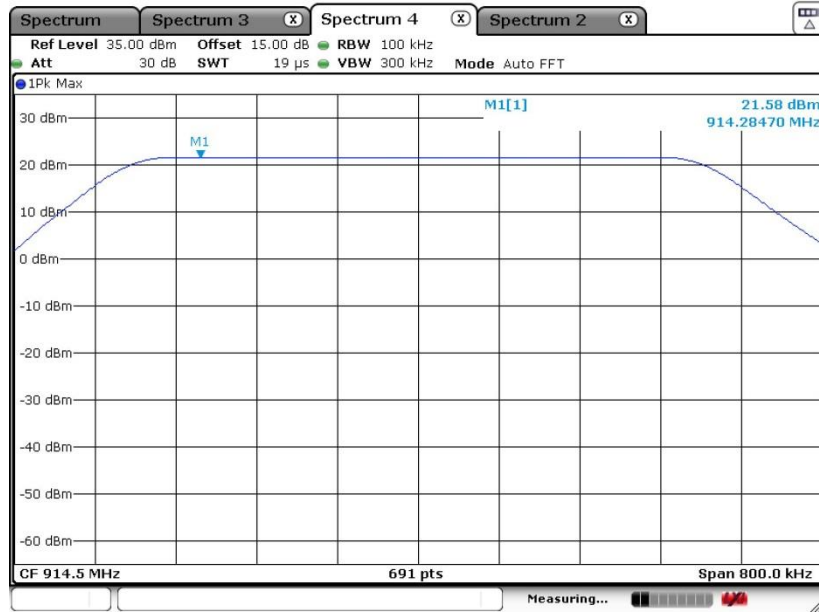
PSD 100kHz Plot on 902.5 MHz



Date: 8 JUN.2022 03:15:16

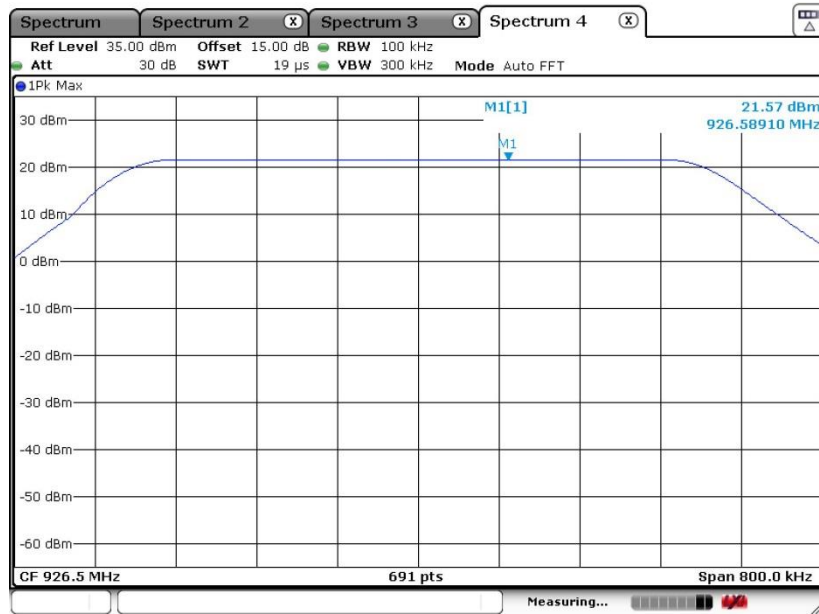


PSD 100kHz Plot on 914.5 MHz



Date: 8 JUN.2022 03:21:46

PSD 100kHz Plot on 926.5 MHz

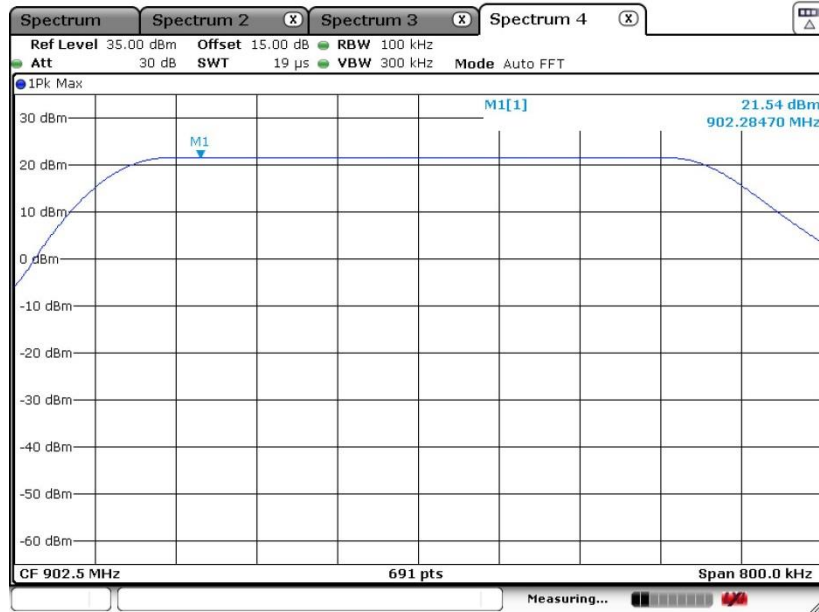


Date: 8 JUN.2022 03:29:30



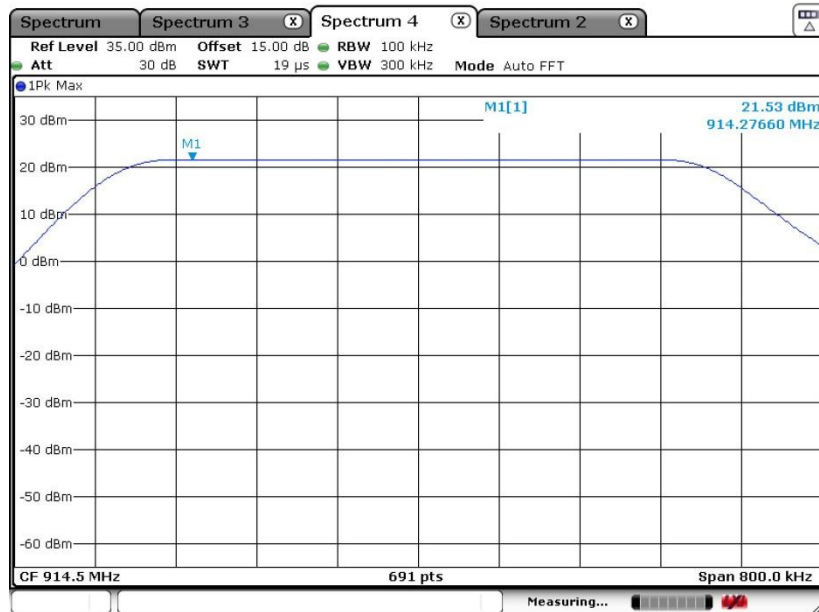
For SF10:

PSD 100kHz Plot on 902.5 MHz



Date: 8 JUN.2022 04:18:51

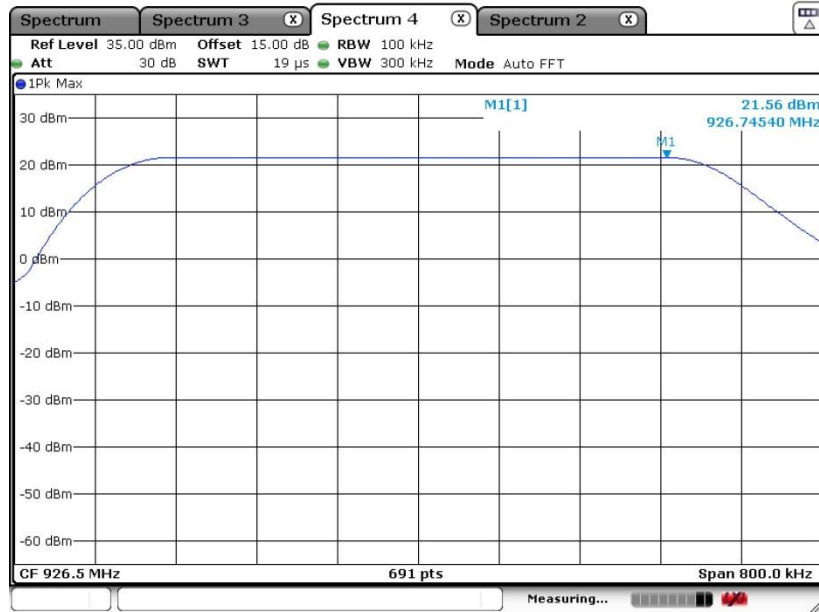
PSD 100kHz Plot on 914.5 MHz



Date: 8 JUN.2022 04:26:31



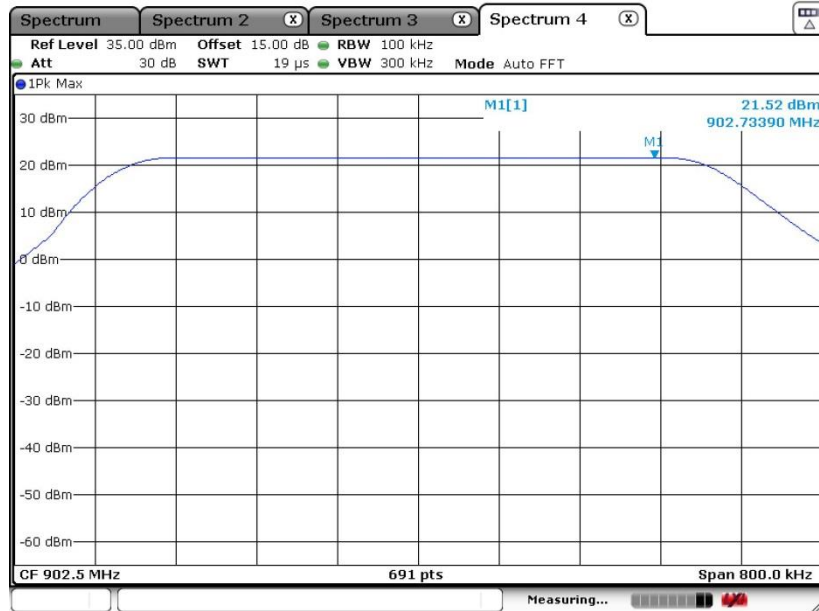
PSD 100kHz Plot on 926.5 MHz



Date: 8 JUN.2022 04:33:19

For SF11:

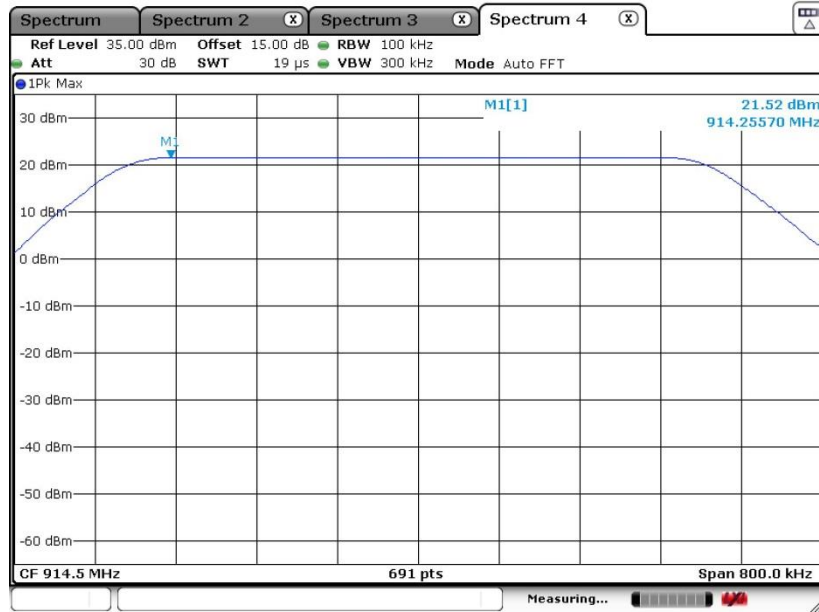
PSD 100kHz Plot on 902.5 MHz



Date: 8 JUN.2022 05:10:02

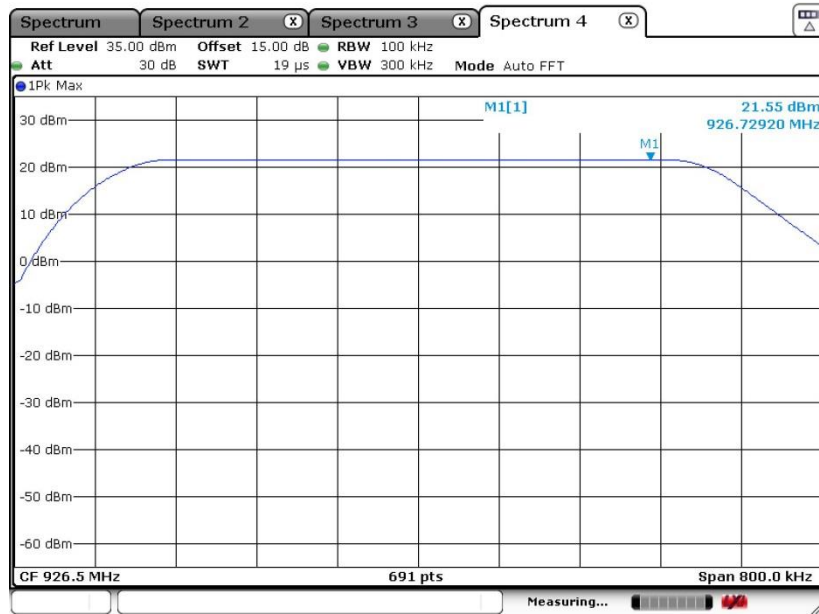


PSD 100kHz Plot on 914.5 MHz



Date: 8 JUN.2022 05:16:32

PSD 100kHz Plot on 926.5 MHz



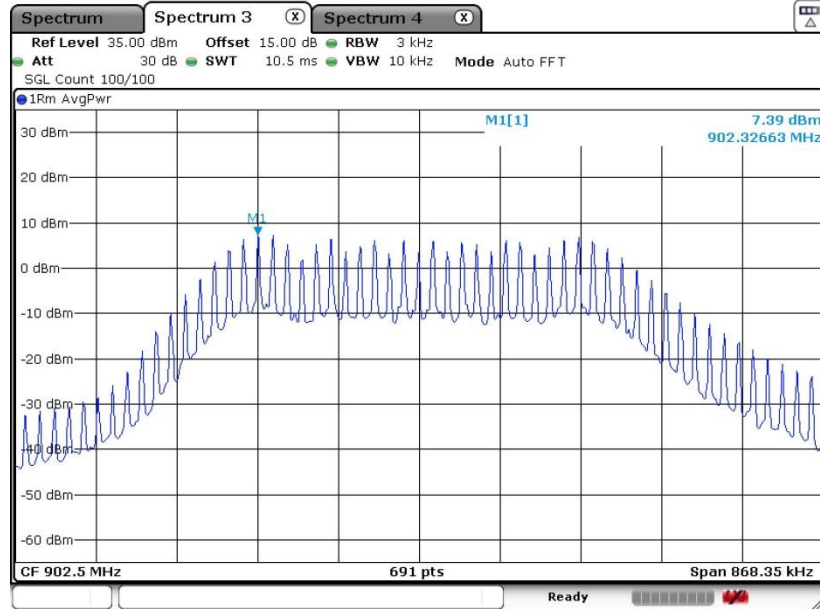
Date: 8 JUN.2022 05:23:52



3.3.7 Test Result of Power Spectral Density Plots (3kHz)

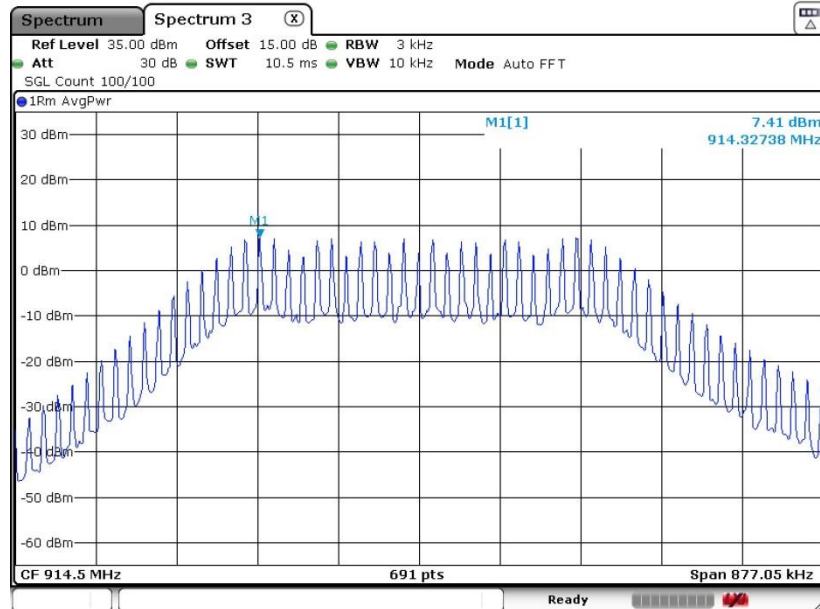
For SF5:

PSD 3kHz Plot on 902.5 MHz



Date: 8 JUN.2022 20:07:28

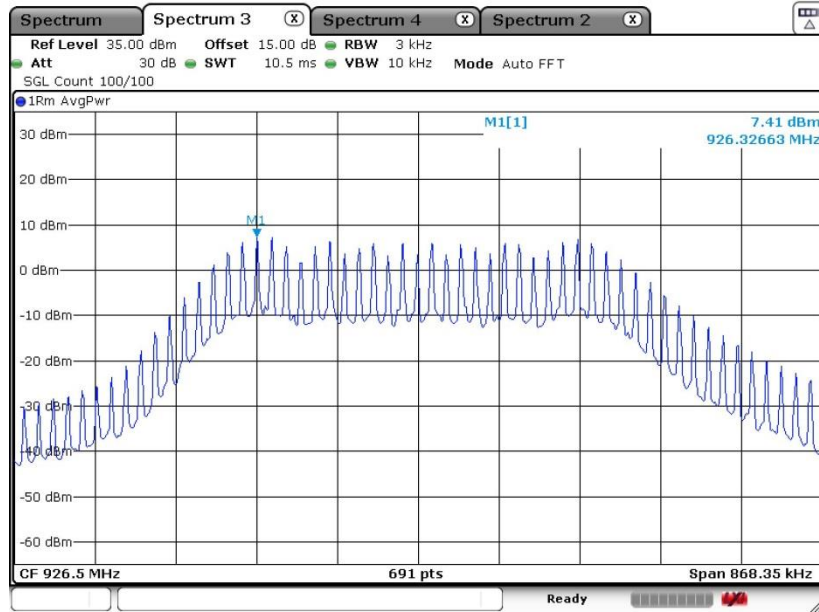
PSD 3kHz Plot on 914.5 MHz



Date: 8 JUN.2022 20:32:23



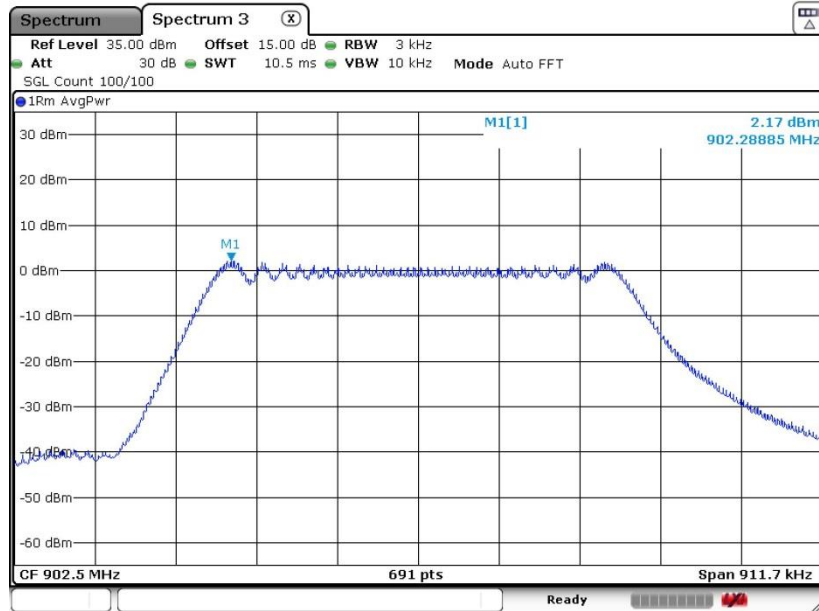
PSD 3kHz Plot on 926.5 MHz



Date: 8 JUN 2022 20:37:18

For SF7:

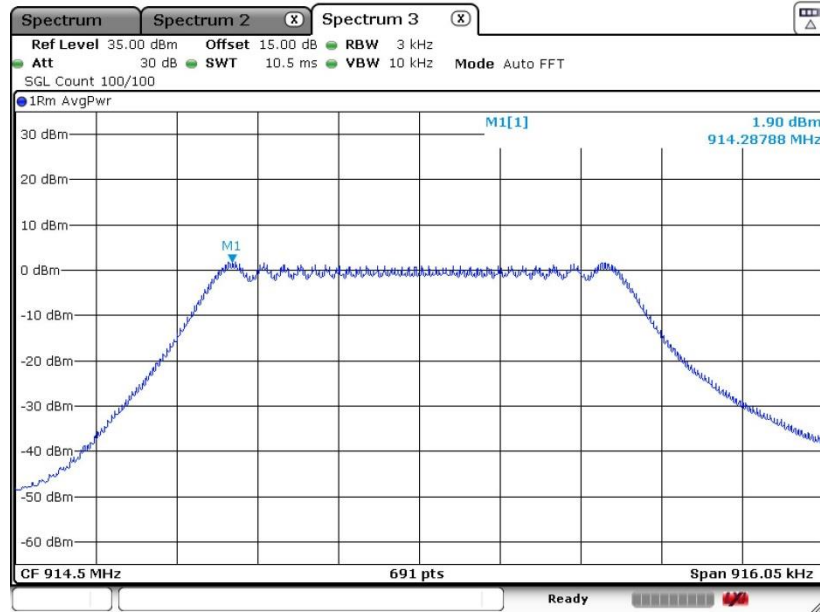
PSD 3kHz Plot on 902.5 MHz



Date: 8 JUN 2022 00:36:36

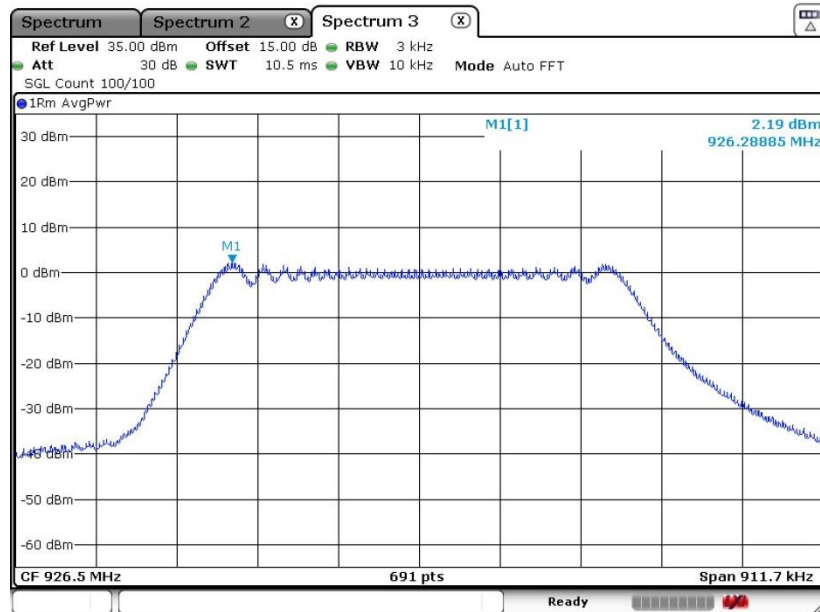


PSD 3kHz Plot on 914.5 MHz



Date: 8 JUN.2022 00:45:01

PSD 3kHz Plot on 926.5 MHz



Date: 8 JUN.2022 00:51:06



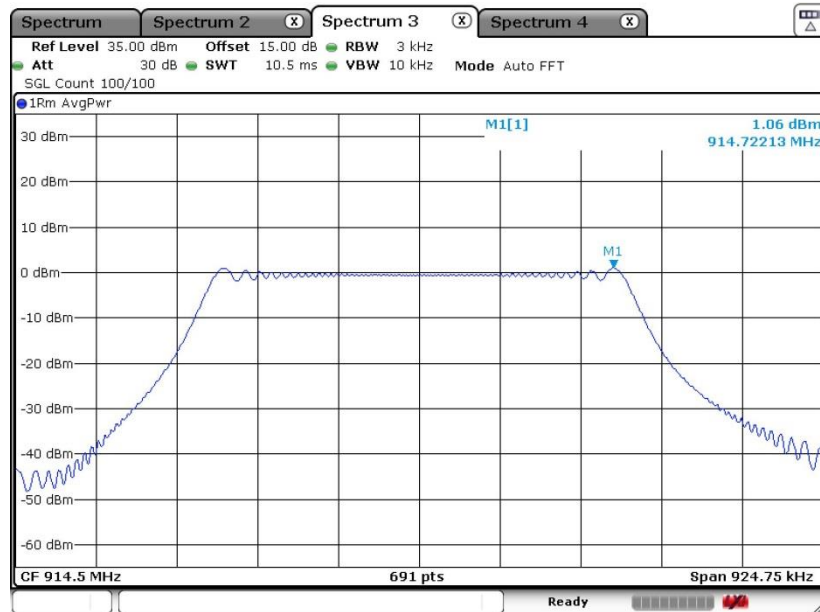
For SF8:

PSD 3kHz Plot on 902.5 MHz



Date: 8 JUN.2022 02:16:42

PSD 3kHz Plot on 914.5 MHz



Date: 8 JUN.2022 02:26:43



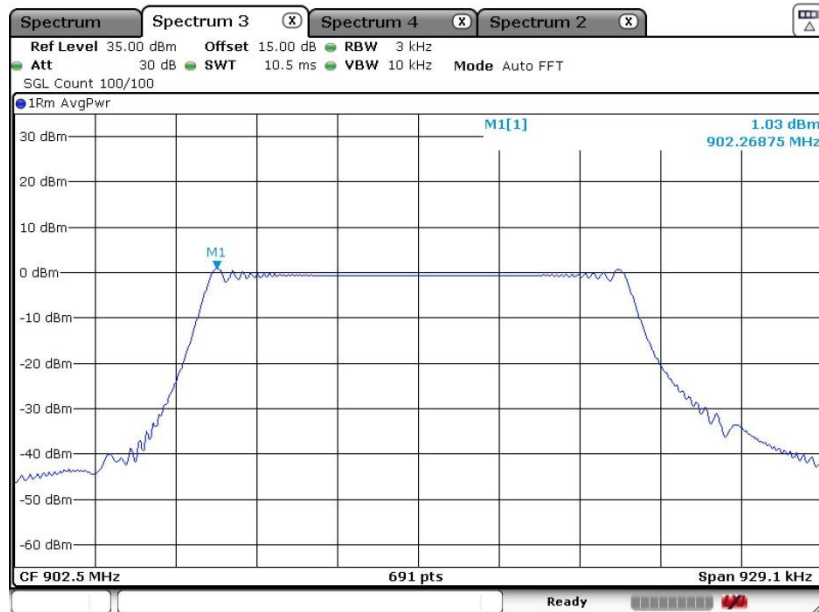
PSD 3kHz Plot on 926.5 MHz



Date: 8 JUN.2022 02:43:47

For SF9:

PSD 3kHz Plot on 902.5 MHz



Date: 8 JUN.2022 03:25:19