

TEST REPORT

Report Number: 103224477MPK-002A

Project Number: G103224477

October 18, 2017

Testing performed on the

FIBERGATEWAY

Model: GR240BG

FCC ID: 2ACJF-FGW-GR240BG

to

FCC Part 15 Subpart C (15.247)

FCC Part 15, Subpart B

For

Altice Labs, SA

Test Performed by:

Intertek

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Menlo Park, CA 94025 USA

Test Authorized by:

Altice Labs, SA

Rua Eng. Ferreira Pinto Basto

3810-106 Aveiro, Portugal

Prepared by:



Minh Ly

Date: October 18, 2017

Reviewed by:



Krishna K Vemuri

Date: October 18, 2017

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Report No. 103224477MPK-002A

Equipment Under Test:	FIBERGATEWAY
Trade Name:	Altice Labs, SA
Model Number:	GR240BG
Applicant:	Altice Labs, SA
Contact:	Ricardo Cunha
Address:	Altice Labs, SA Rua Eng. Ferreira Pinto Basto 3810-106 Aveiro
Country	Portugal
Tel. Number:	351234403200
Email:	Rcunha@ptinovacao.pt
Applicable Regulation:	FCC Part 15 Subpart C (15.247) FCC Part 15, Subpart B
Date of Test:	September 20 – October 11, 2017

We attest to the accuracy of this report:



Minh Ly
Project Engineer



Krishna K Vemuri
Engineering Team Lead

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1.0 Summary of Tests

Test	Reference FCC	Result
RF Output Power	15.247(b)(3)	Complies
6 dB Bandwidth	15.247(a)(2)	Complies
Power Density	15.247(e)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	Complies
AC Line Conducted Emission	15.207	Complies
Antenna Requirement	15.203	Complies (Unique Connector & Internal Antenna)
RF Exposure	15.247(i), 2.1093(d)	Complies
Radiated Emissions	15.109	Complies
AC Line Conducted Emission	15.107	Complies

EUT receive date: September 18, 2017

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: September 20, 2017

Test completion date: October 11, 2017

The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

Altice Labs, SA supplied the following description of the EUT:

The FiberGateway GR240BG is an ONT (Optical Network Terminal) solution based on Rec. ITU-T G.984.x that supports triple play services (high speed internet, voice and video) which are deployed over Ethernet and Wi-Fi interfaces. GEM (GPON encapsulation method) is employed to adapt technologies. This system can be used in triple play service delivery network solutions. It includes Home Gateway functionalities, 4 GbE ports and Wi-Fi Dual-Band Concurrent (2.4 GHz bgn 4x4 + 5 GHz anac 4x4) for internet access and IPTV, 2 FXS ports for voice and 1 USB 2.0 port.

For more information, see user's manual provided by the manufacturer.

This test report covers only the 2.4GHz WiFi radio.

Information about the WiFi radio is presented below:

The EUT supports a wide range of data rates in the 2.4GHz band:

IEEE 802.11b
IEEE 802.11g
IEEE 802.11n 20MHz
IEEE 802.11n 40MHz

Applicant	Altice Labs, SA
Model Number	GR240BG
FCC Identifier	2ACJF-FGW-GR240BG
Modulation Technique	DSSS (CCK), OFDM (BPSK, QPSK, 16QAM, 64QAM)
Rated RF Output	802.11b: 29.98 dBm 802.11g: 29.19 dBm 802.11n 20MHz: 28.90 dBm 802.11n 40MHz: 28.56 dBm
Frequency Range	2412 – 2462 MHz, 802.11b/g/n
Type of modulation	BPSK, QPSK, 16QAM, 64QAM
Number of Channel(s)	11 for 802.11b/g/n
Antenna(s) & Gain	Internal Antenna, calculated peak gain: 3.9dBi Ant 0 – DB1: 4.0dBi, Vertical Ant 1 – DB2: 3.6dBi, Horizontal Ant 2 – DB3: 2.4dBi, Horizontal Ant 3 – DB4: 3.8dBi, Vertical
Applicant Name & Address	Altice Labs, SA Rua Eng. Ferreira Pinto Basto 3810-106 Aveiro Portugal

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the FCC documents “Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247” (KDB 558074 D01 DTS MEAS GUIDANCE V04, KDB 662911 D01 Multiple Transmitter Output v02r01), and

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this report.

2.4 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)			
	0.15 MHz – 30MHz	30 – 200 MHz	200 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	4.6	5.1 dB
AC mains conducted emissions	2.1 dB	-	-	-

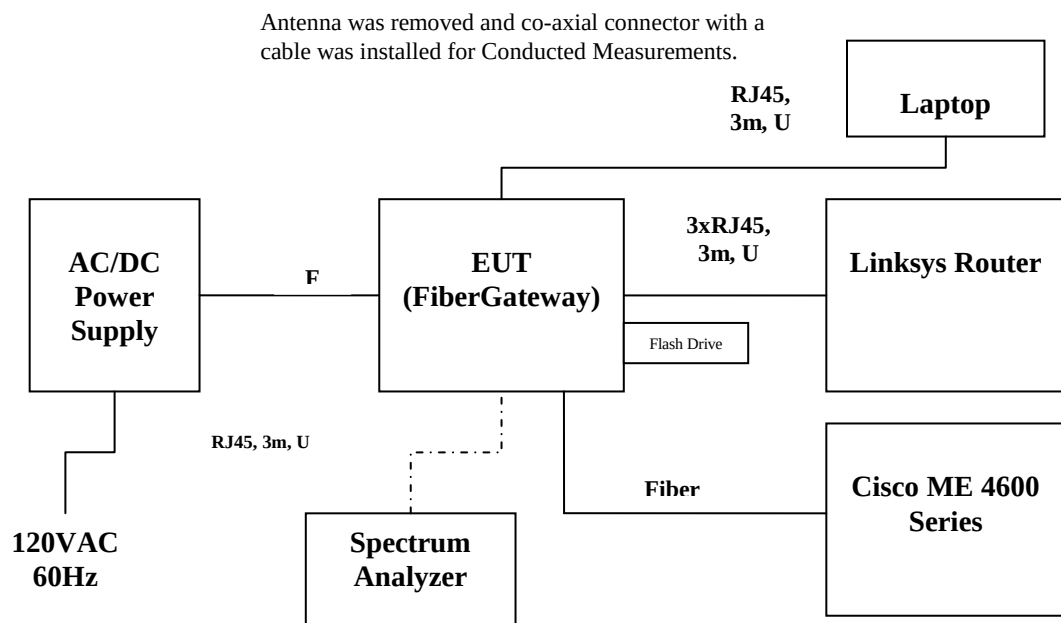
3.0 System Test Configuration

3.1 Support Equipment and description

Description	Manufacturer	Model No./ Part No.
Laptop	HP	EliteBook 8470p
Optical Line Termination	Cisco	Cisco ME 4600 Series
Flash Drive	Kingston	DT101G2 8GB
Telephone	TKT	1700137823
Telephone	Alcatel	N/A
Router	Linksys	BEFSR81

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
FiberGateway (Radiated Unit)	Altice Labs, SA	GR240BG	5054494E912154CF
AC/DC Power Adapter	Airline mechanical Co Ltd	EOSA+4B120-4000	AB1708240092570
FiberGateway (Conducted Unit)	Altice Labs, SA	GR240BG	5054494E9121874F



U = Unshielded	F = With Ferrite M = Meter
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3.3 Justification

Preliminary testing was performed for all modulation/data rate modes. The worse-case data rate with highest power and widest spectrum were selected for final measurements:

CCK 2 Mbps – for 802.11b (Power setting on test firmware: 24)
OFDM 6 Mbps – for 802.11g (Power setting on test firmware: 24)
OFDM MCS0 – for 802.11n 20MHz (Power setting on test firmware: 24)
OFDM MCS0 – for 802.11n 40MHz (Power setting on test firmware: 24)

According to the manufacture, the FiberGateway utilizes cross-polarized antennas with two vertical (Ant 1 & Ant 4) and two Horizontal (Ant 2 & Ant 3). Per FCC KDB “662911 D01 Multiple Transmitter Output v02r01”, the directional gain of the antenna is calculated as below:

Directional gain = $10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10})/N_{ANT}]$ dBi
Vertical Gain = $10 \log[(10^{(4/10)} + 10^{(3.8/10)})/2] = 3.9\text{dBi}$
Horizontal Gain = $10 \log[(10^{(3.6/10)} + 10^{(2.4/10)})/2] = 3.0\text{dBi}$

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously using the maximum RF power setting provided by the manufacturers via test scripts. Their corresponding output power in dBm can be found in section 4.2 of this report.

3.5 Modifications Required for Compliance

The following modification was made by the manufacturer to the EUT in order to bring the EUT into compliance:

- Added a ferrite with double loop (Manufacture: Wurth Electronics, Part Number: 74271633S) at the DC input of the FiberGateway (See below).



3.6 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

4.0 Measurement Results

4.1 6-dB Bandwidth and 99% Occupied Bandwidth FCC Rule: 15.247(a)(2)

4.1.1 Requirement

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

4.1.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter.

For FCC 6dB Channel Bandwidth the Procedure described in the FCC Publication 558074 D01 DTS Meas Guidance v04 was used to determine the DTS occupied bandwidth. Section 8.1 Option 1 was used.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

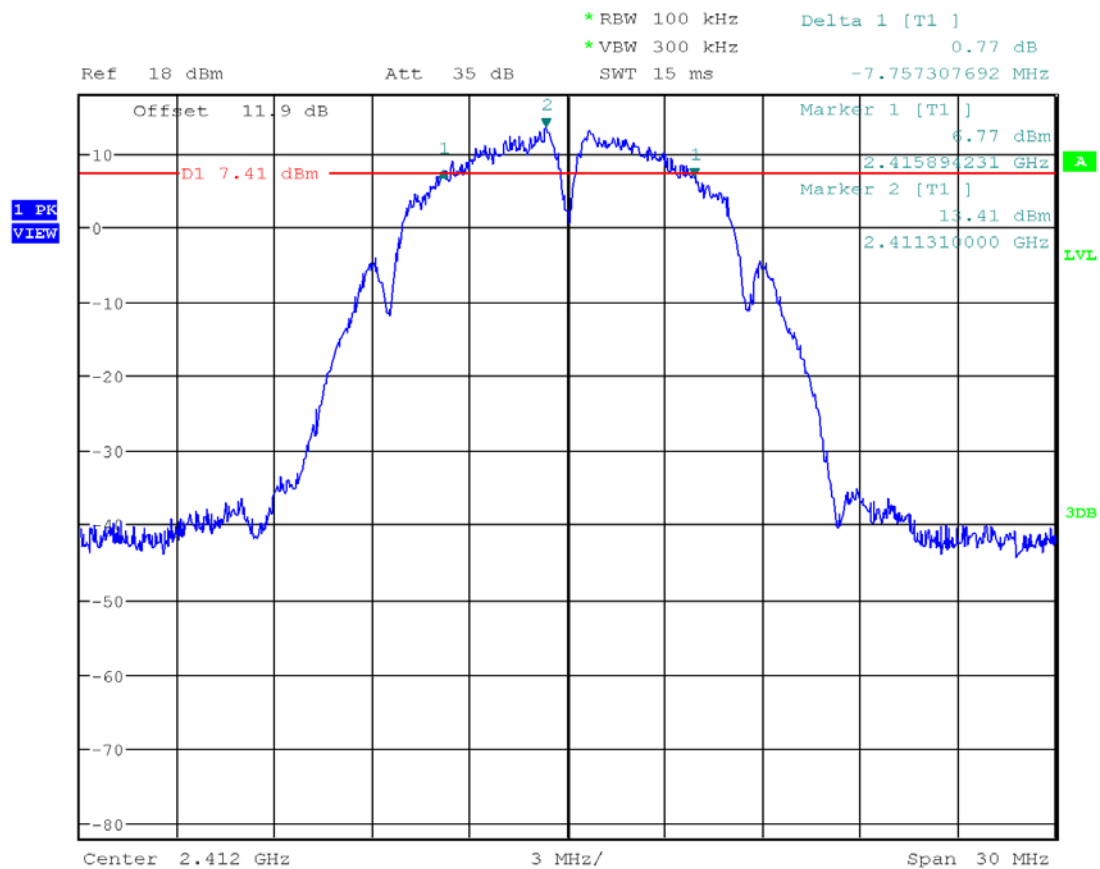
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

Test Date:	September 22, 2017
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4.1.3 Test Result

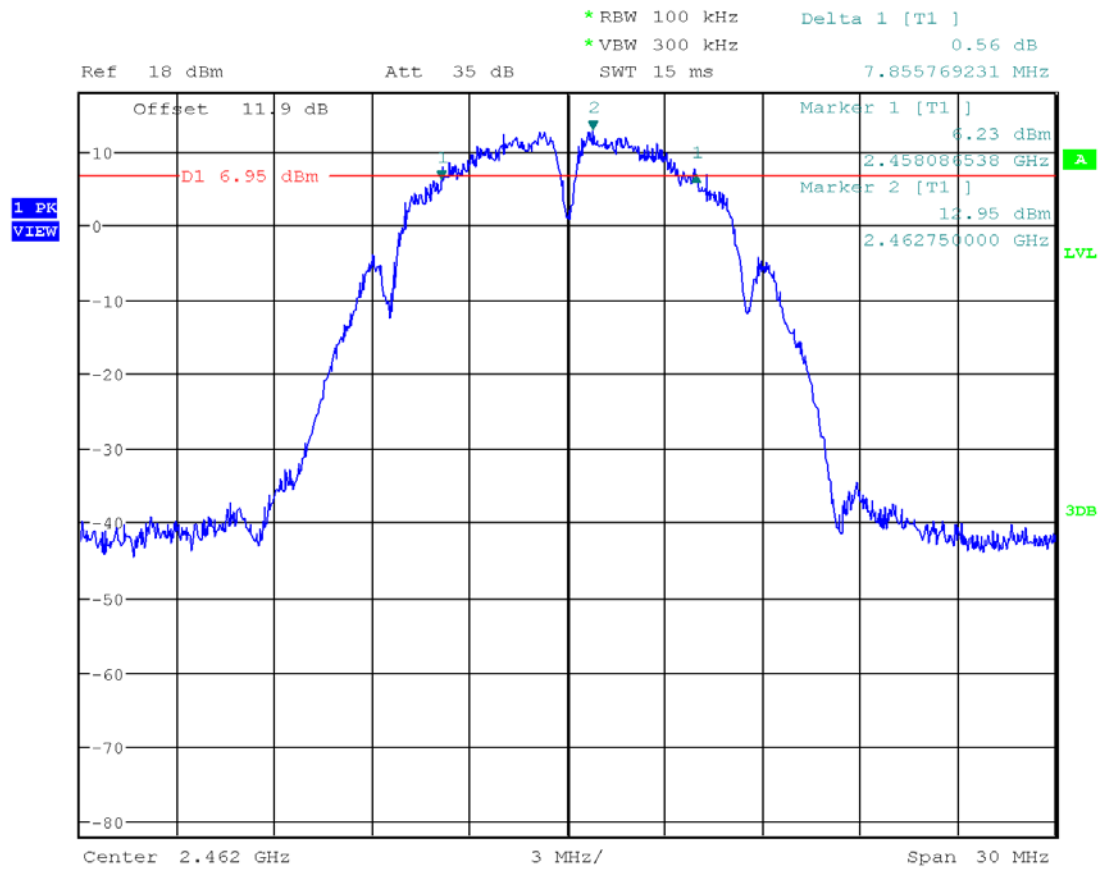
Frequency MHz	Ch.	Frequency MHz	6 dB FCC Bandwidth, MHz	Plot #	99% Bandwidth, MHz	Plot #
802.11b	1	2412	7.757	1.1	10.384	1.13
	6	2437	8.039	1.2	10.384	1.14
	11	2462	7.855	1.3	10.432	1.15
802.11g	1	2412	15.096	1.4	16.538	1.16
	6	2437	15.096	1.5	16.634	1.17
	11	2462	15.096	1.6	16.586	1.18
802.11n 20MHz	1	2412	15.625	1.7	17.644	1.19
	6	2437	15.048	1.8	17.788	1.20
	11	2462	15.124	1.9	17.692	1.21
802.11n 40MHz	3	2422	36.137	1.10	36.923	1.22
	6	2437	36.233	1.11	37.307	1.23
	9	2452	36.474	1.12	37.019	1.24

Plot 1.1 – 6dB Bandwidth (FCC)



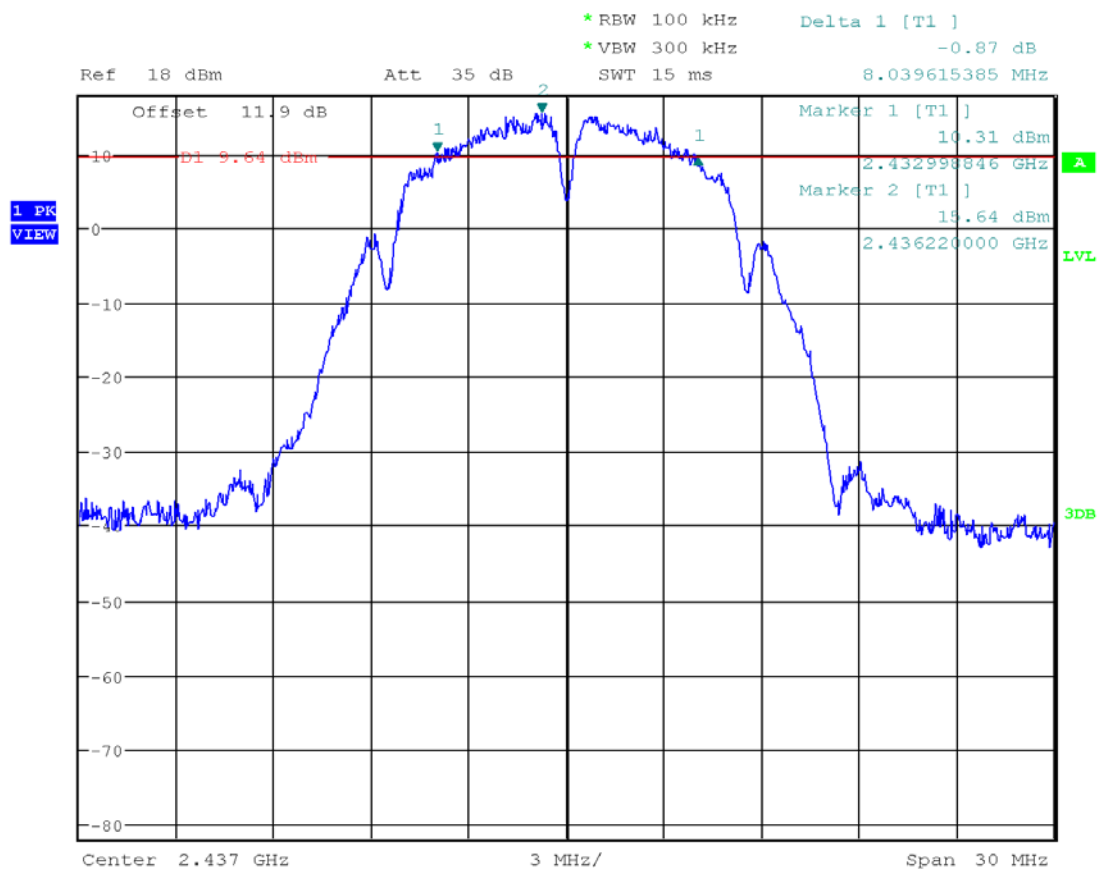
Date: 29.SEP.2017 16:57:29

Plot 1.2 – 6dB Bandwidth (FCC)



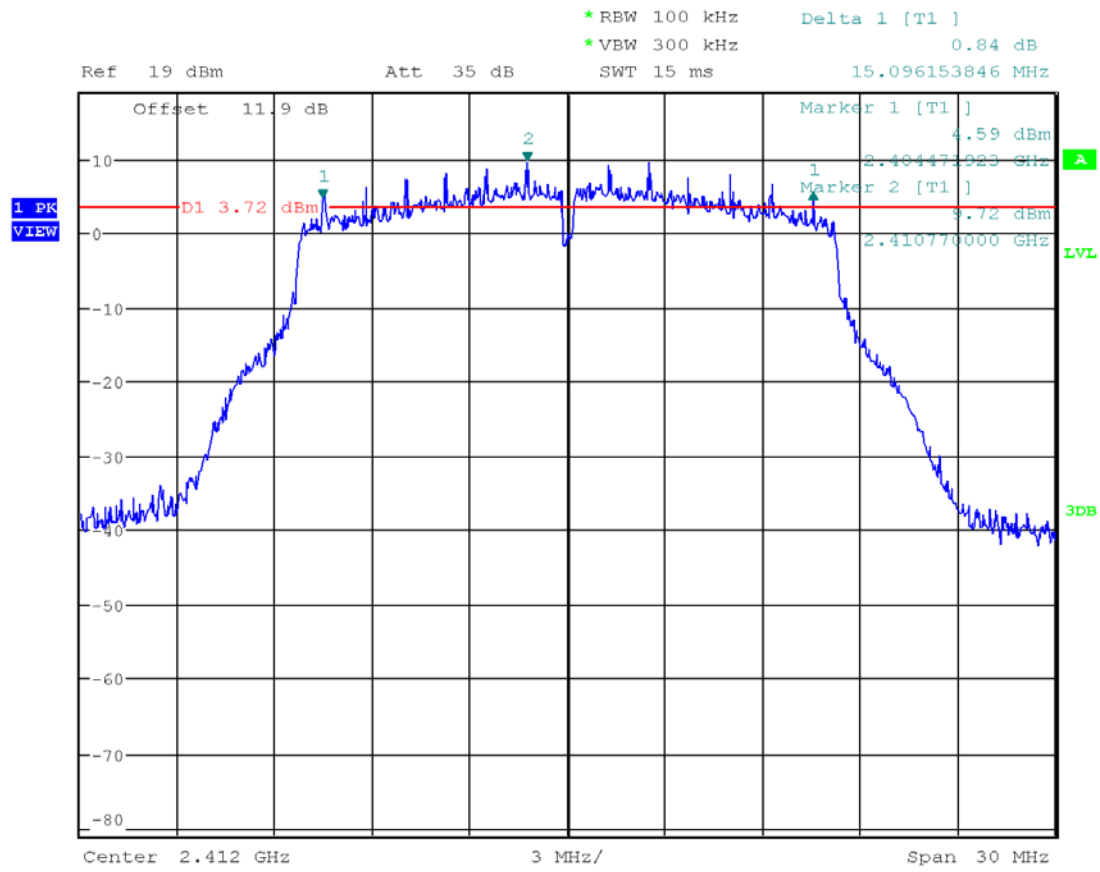
Date: 29.SEP.2017 17:00:48

Plot 1 3 – 6dB Bandwidth (FCC)



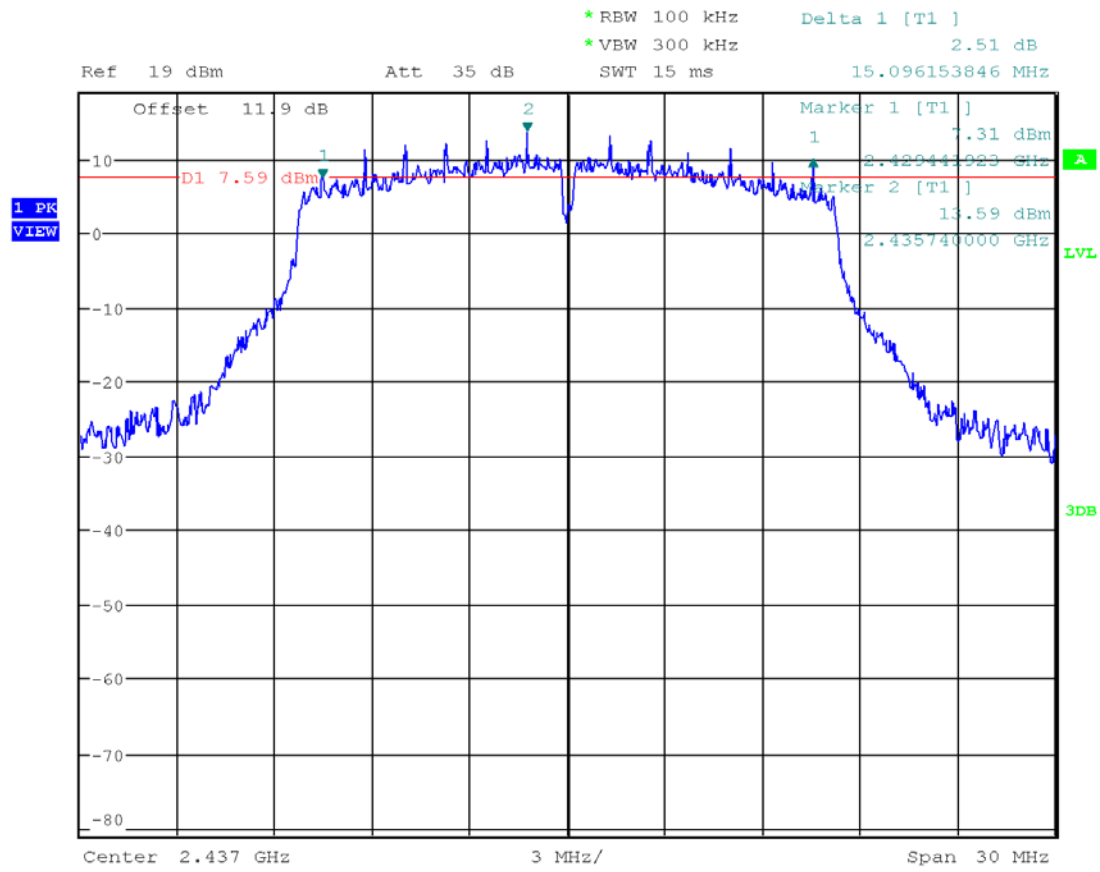
Date: 29.SEP.2017 16:59:20

Plot 1.4 – 6dB Bandwidth (FCC)



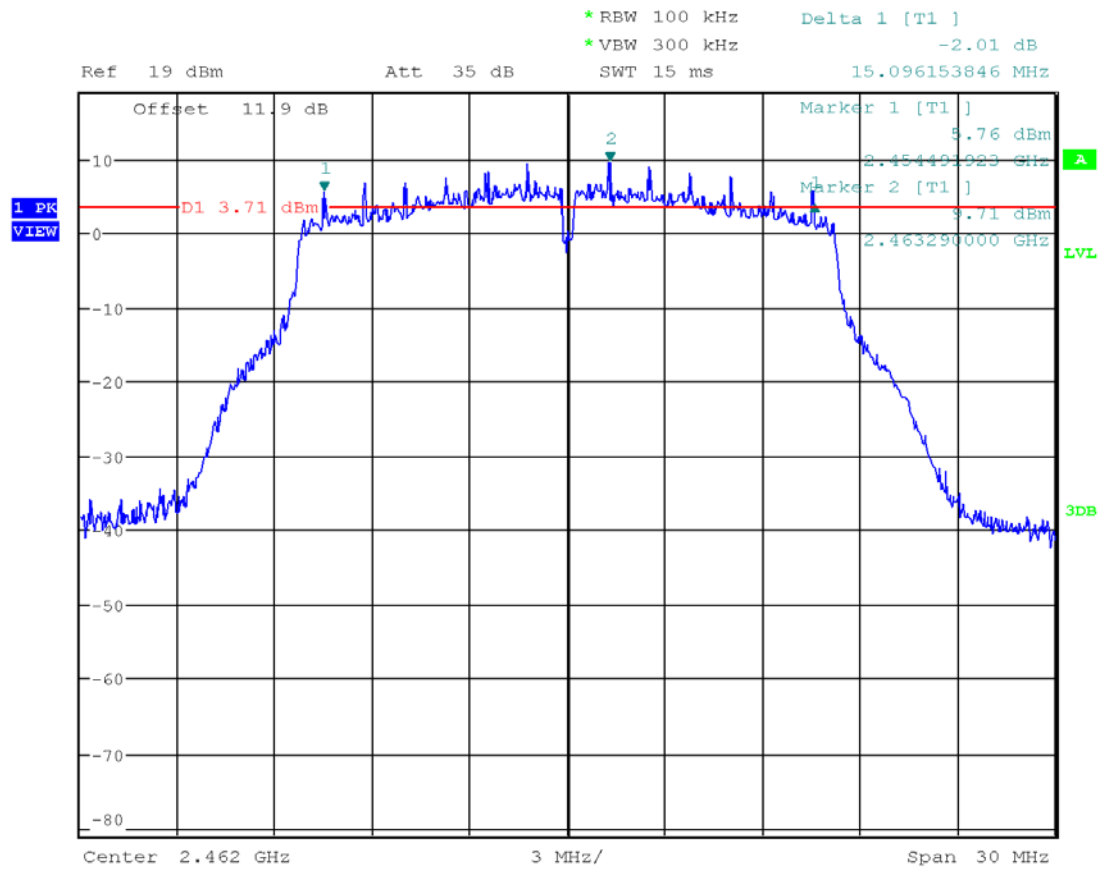
Date: 29.SEP.2017 17:23:46

Plot 1.5 – 6dB Bandwidth (FCC)



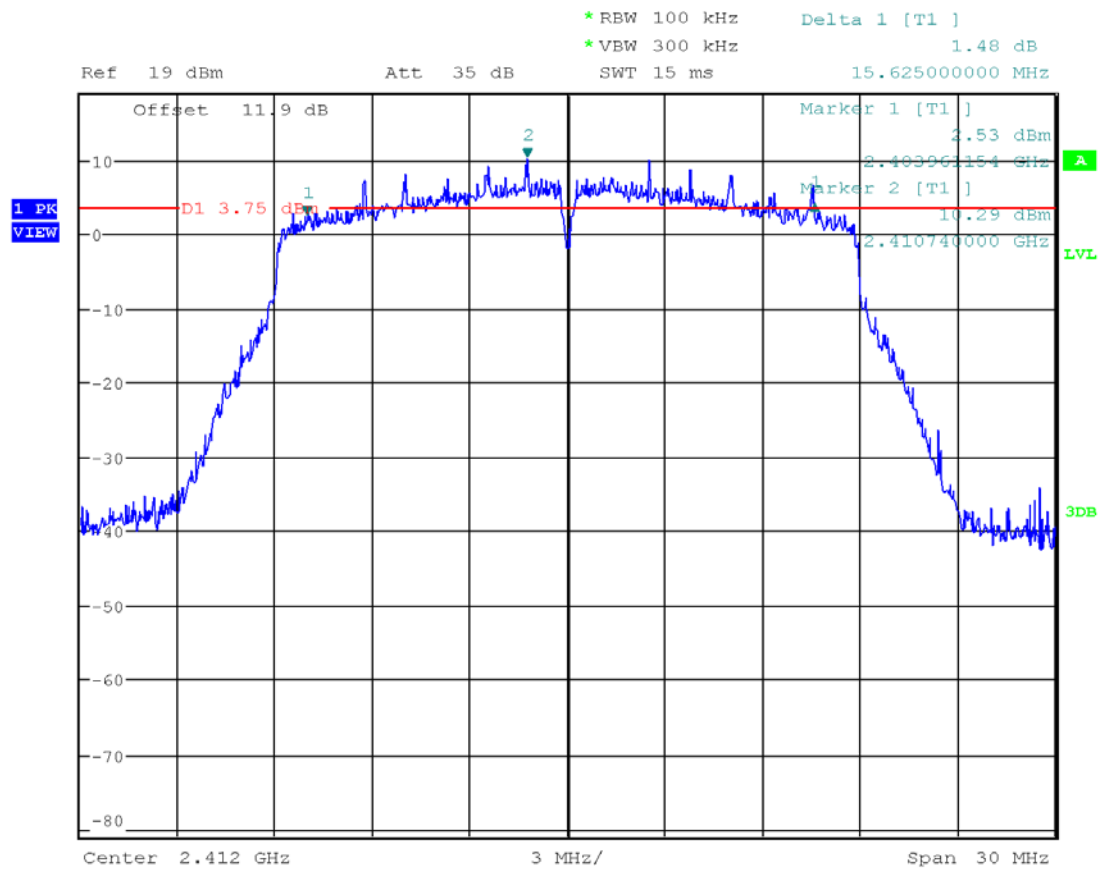
Date: 29.SEP.2017 17:25:07

Plot 1.6 – 6dB Bandwidth (FCC)



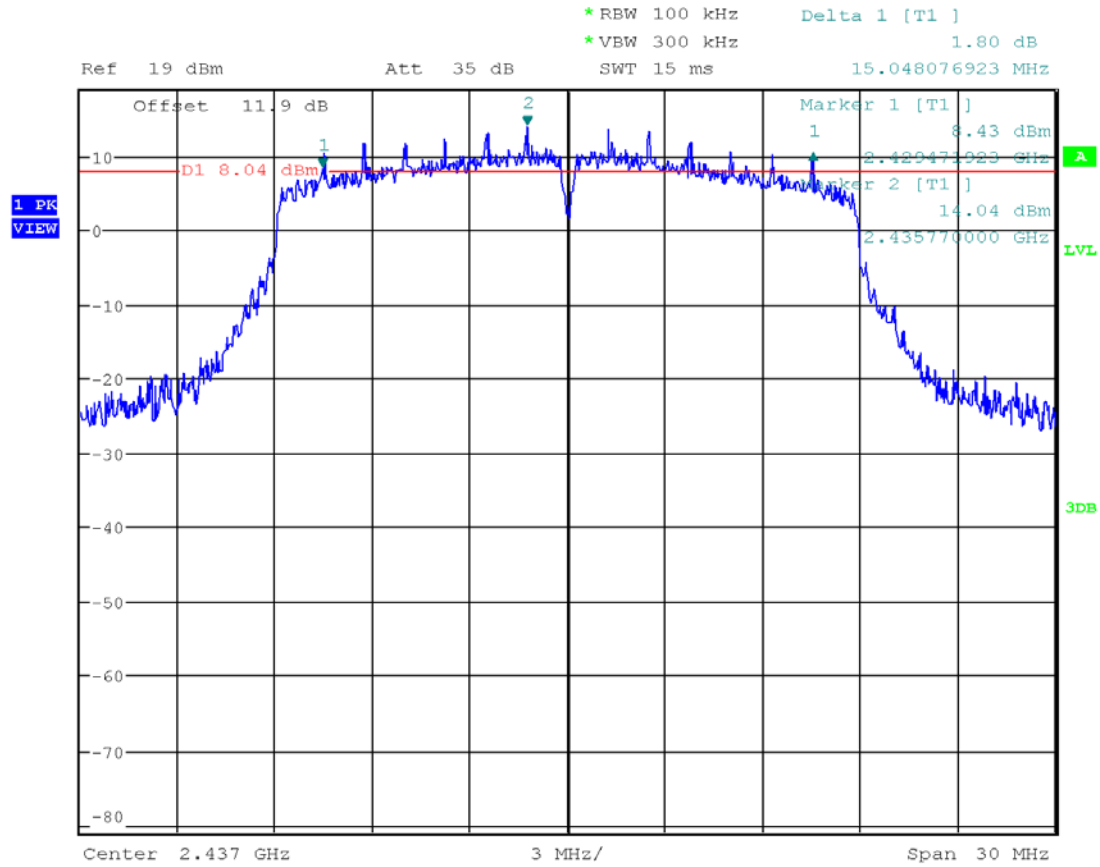
Date: 29.SEP.2017 17:26:48

Plot 1.7 – 6dB Bandwidth (FCC)



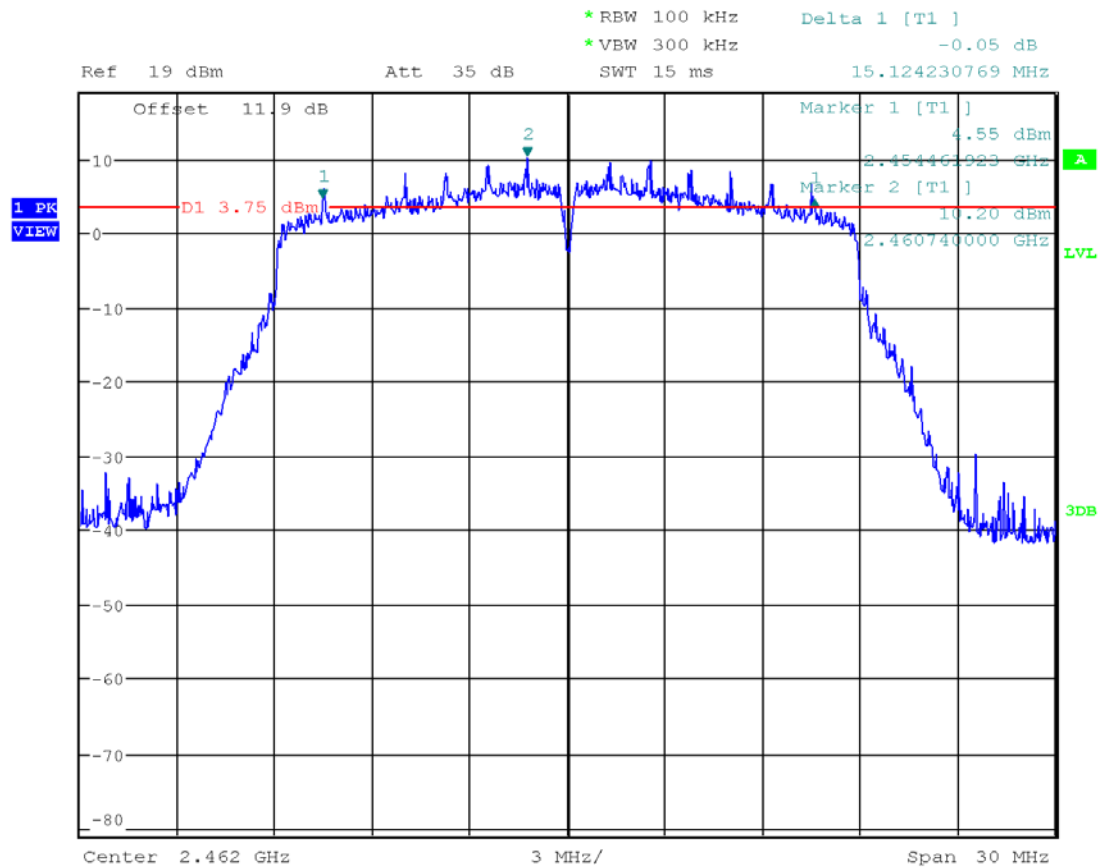
Date: 29.SEP.2017 17:59:12

Plot 1.8 – 6dB Bandwidth (FCC)



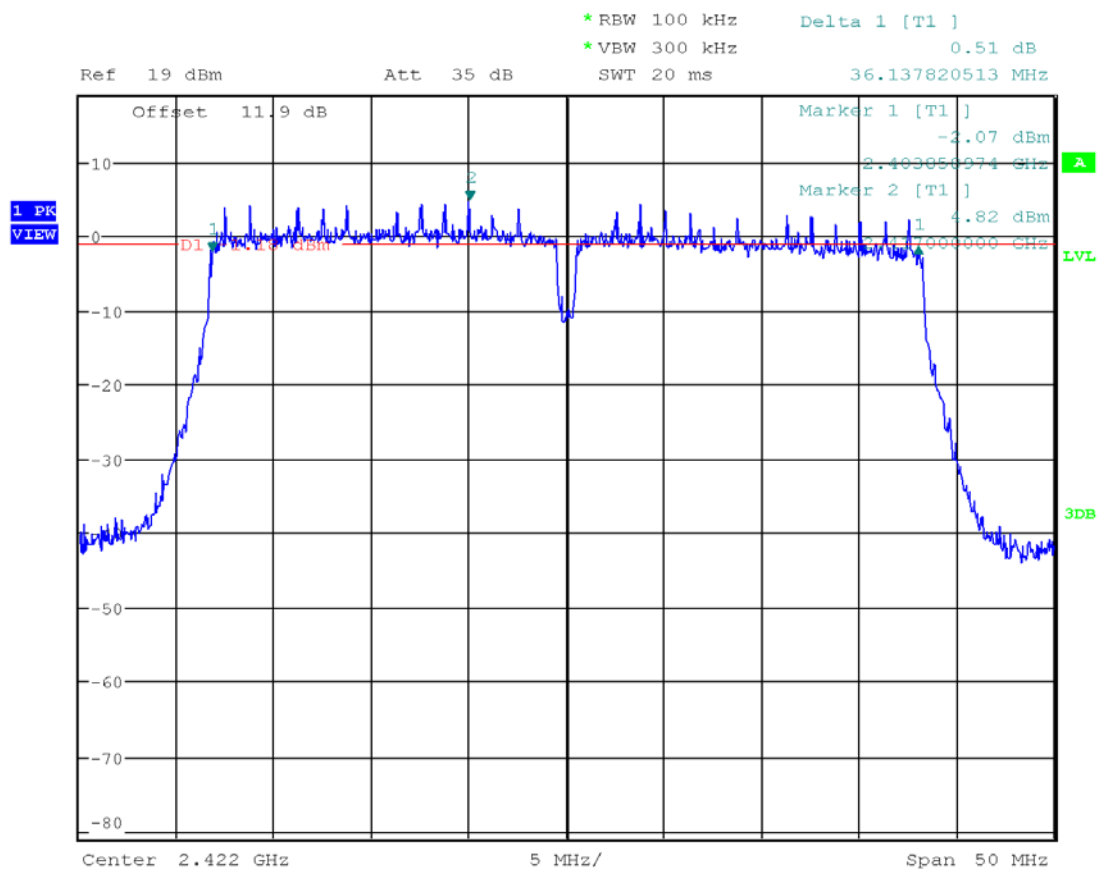
Date: 29.SEP.2017 18:00:15

Plot 1.9 – 6dB Bandwidth (FCC)



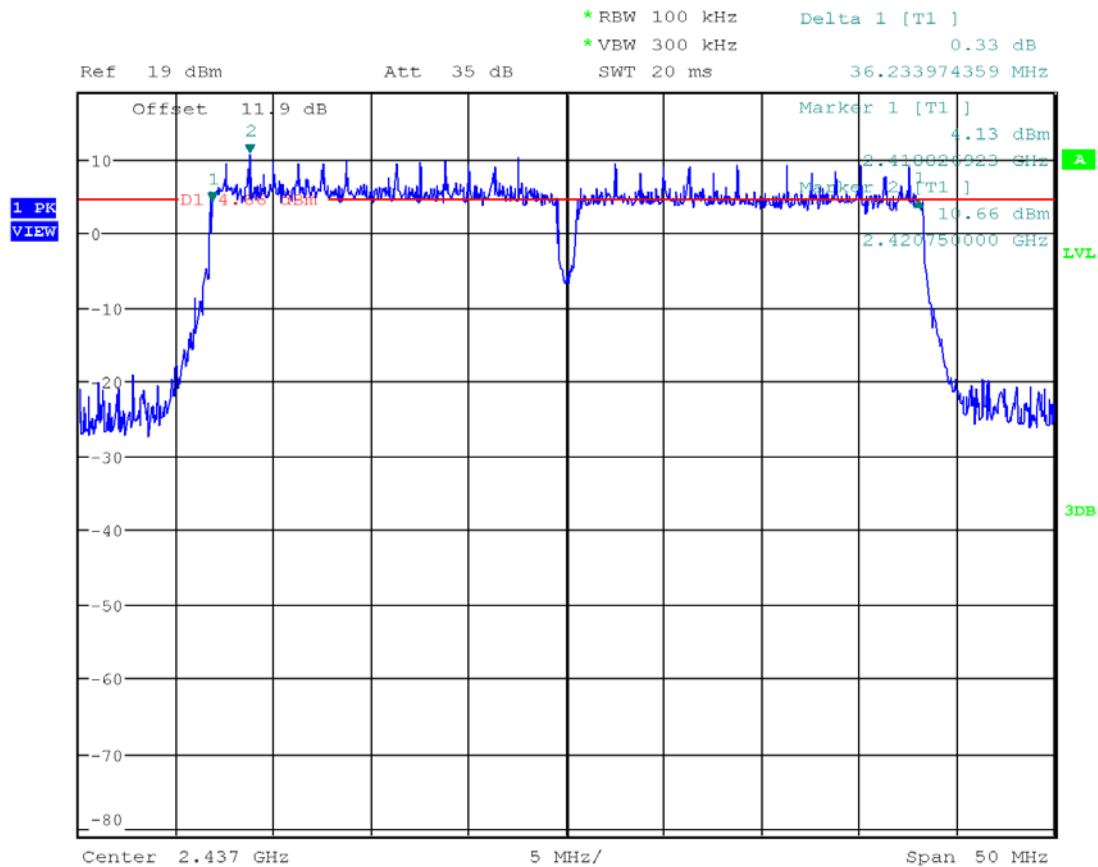
Date: 29.SEP.2017 17:57:47

Plot 1.10 – 6dB Bandwidth (FCC)



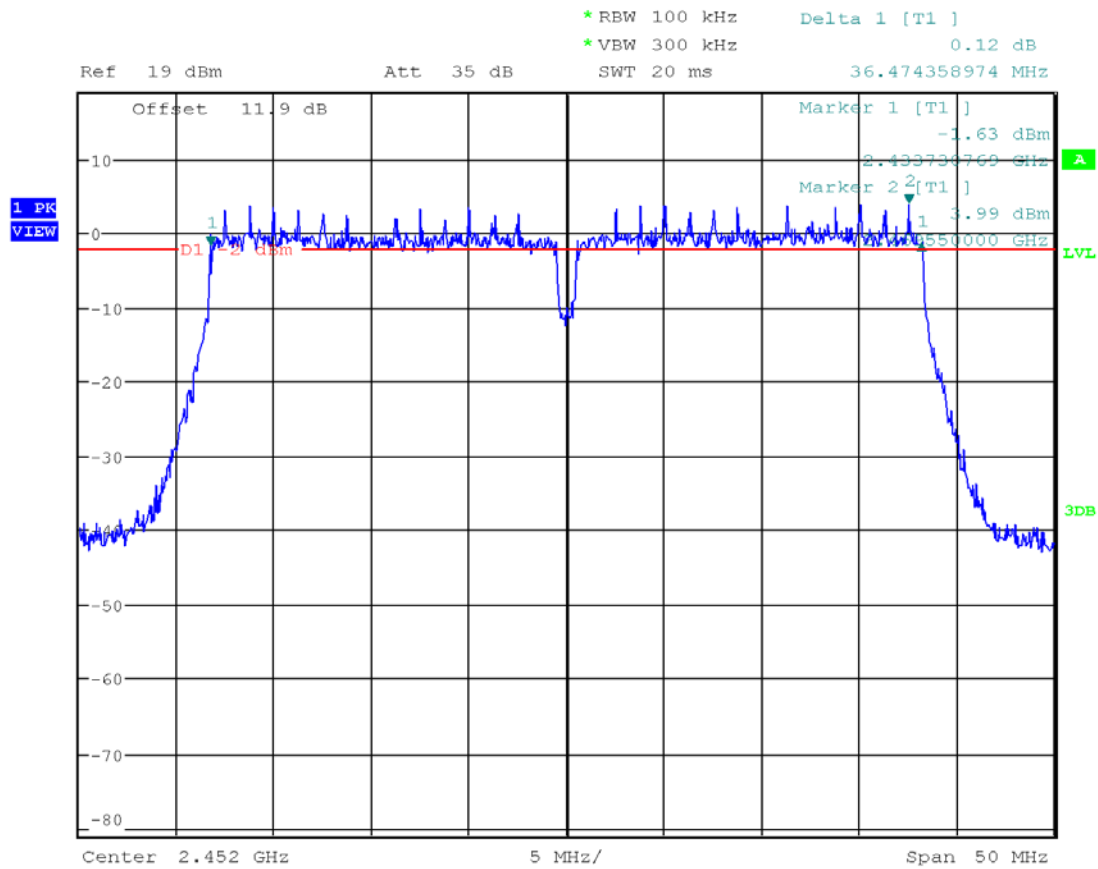
Date: 29.SEP.2017 18:22:42

Plot 1.11 – 6dB Bandwidth (FCC)



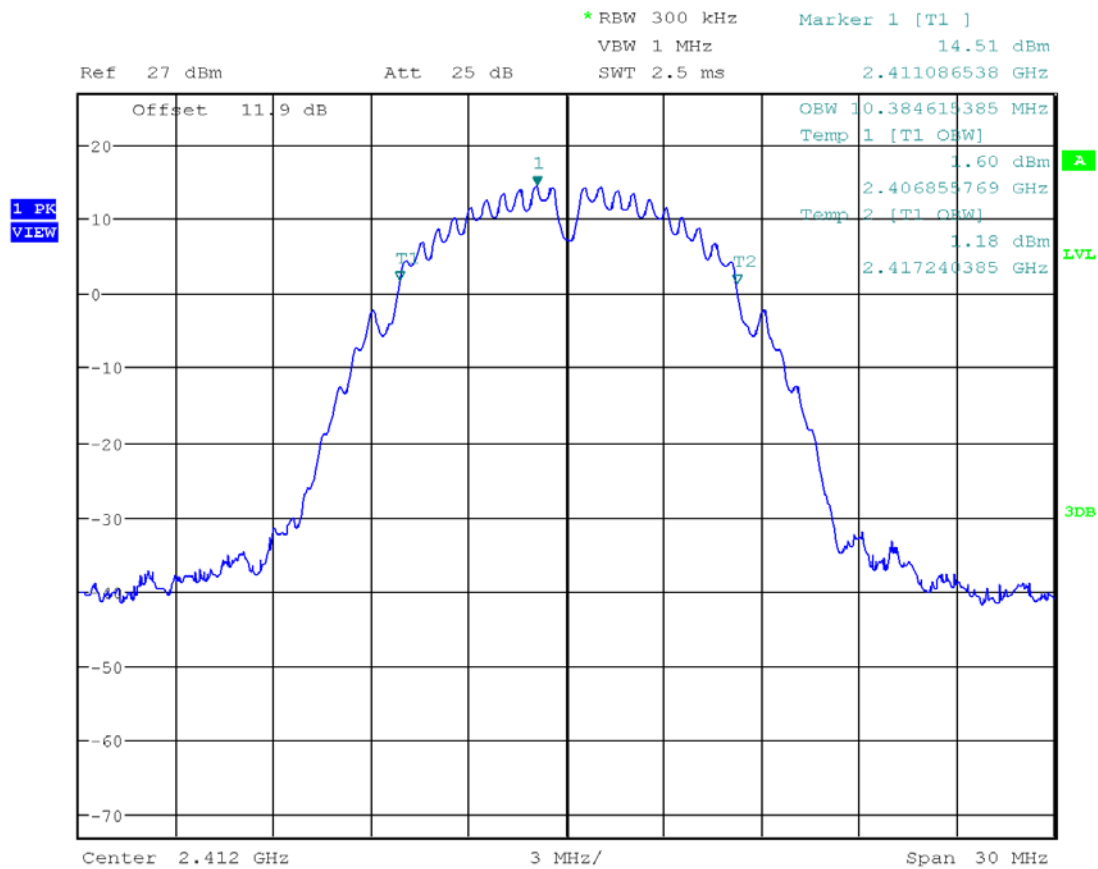
Date: 29.SEP.2017 18:23:49

Plot 1.12 – 6dB Bandwidth (FCC)



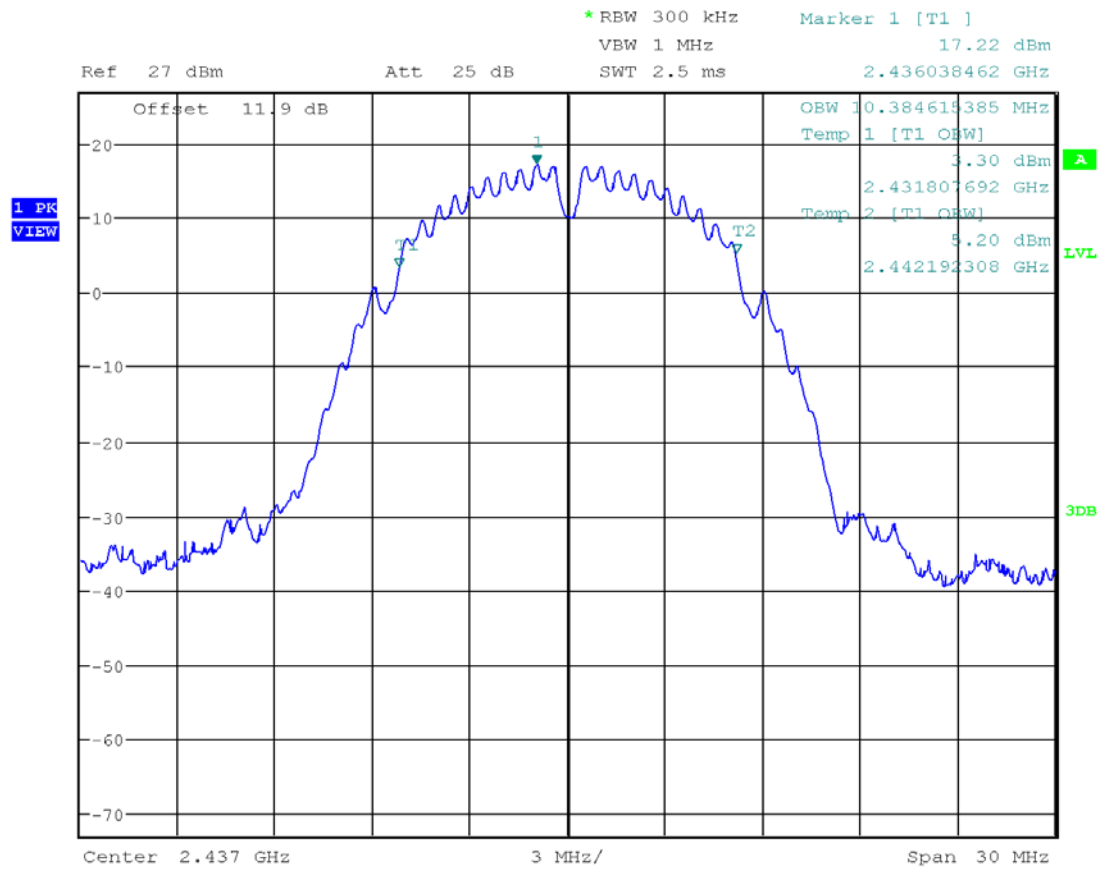
Date: 29.SEP.2017 18:24:57

Plot 1.13 – 99% Bandwidth



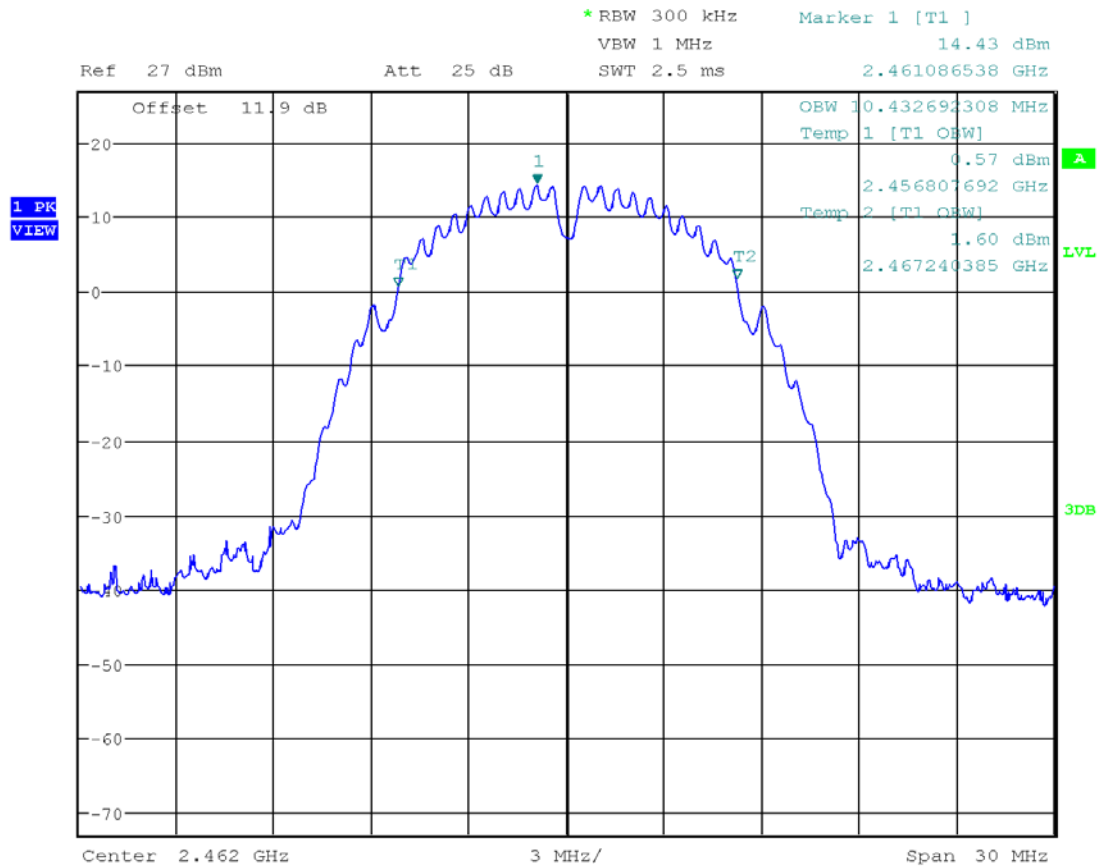
Date: 22.SEP.2017 12:27:01

Plot 1.14 – 99% Bandwidth



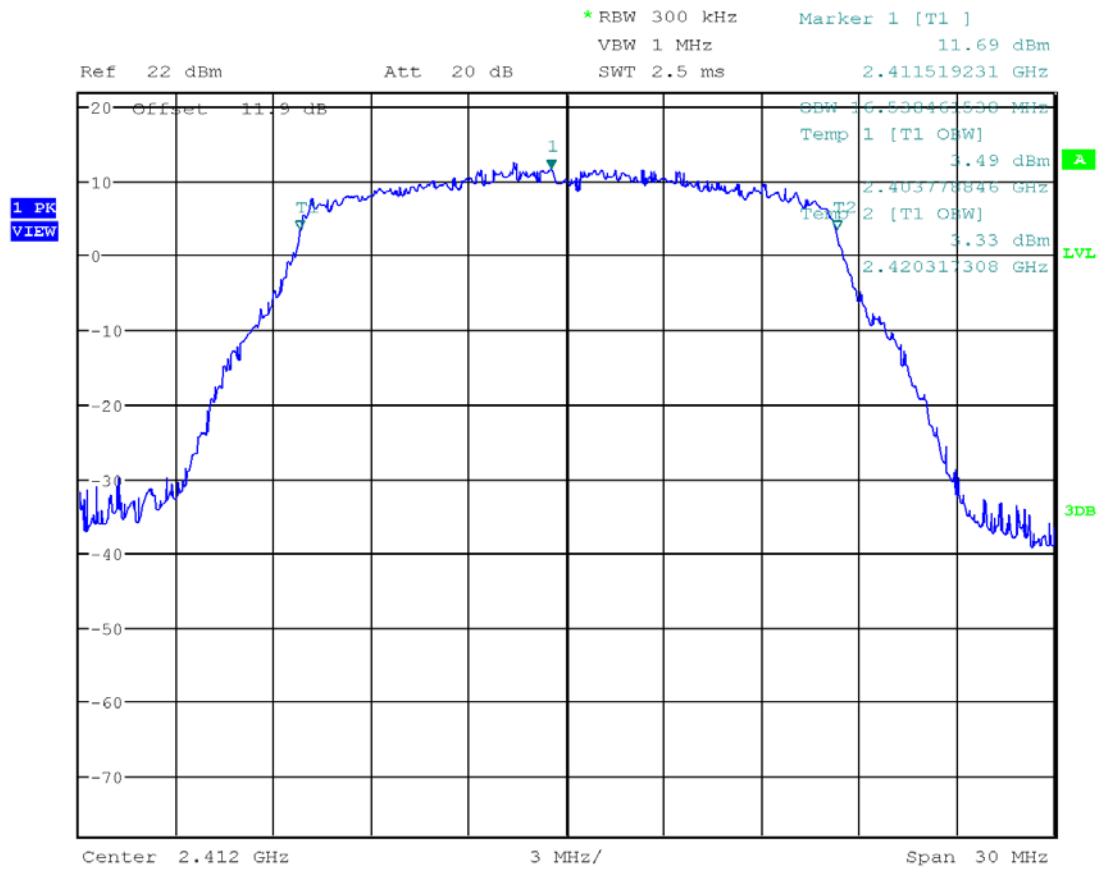
Date: 22.SEP.2017 12:28:06

Plot 1.15 – 99% Bandwidth



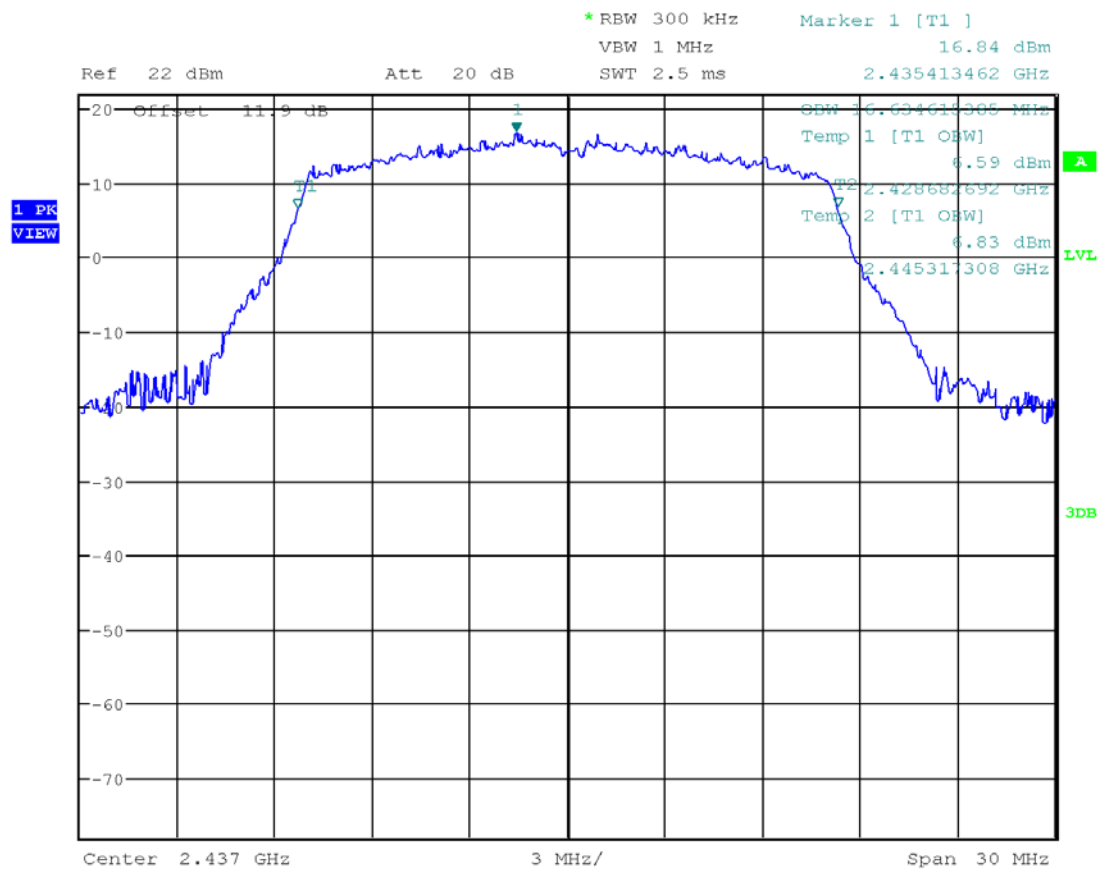
Date: 22.SEP.2017 12:29:10

Plot 1.16 – 99% Bandwidth



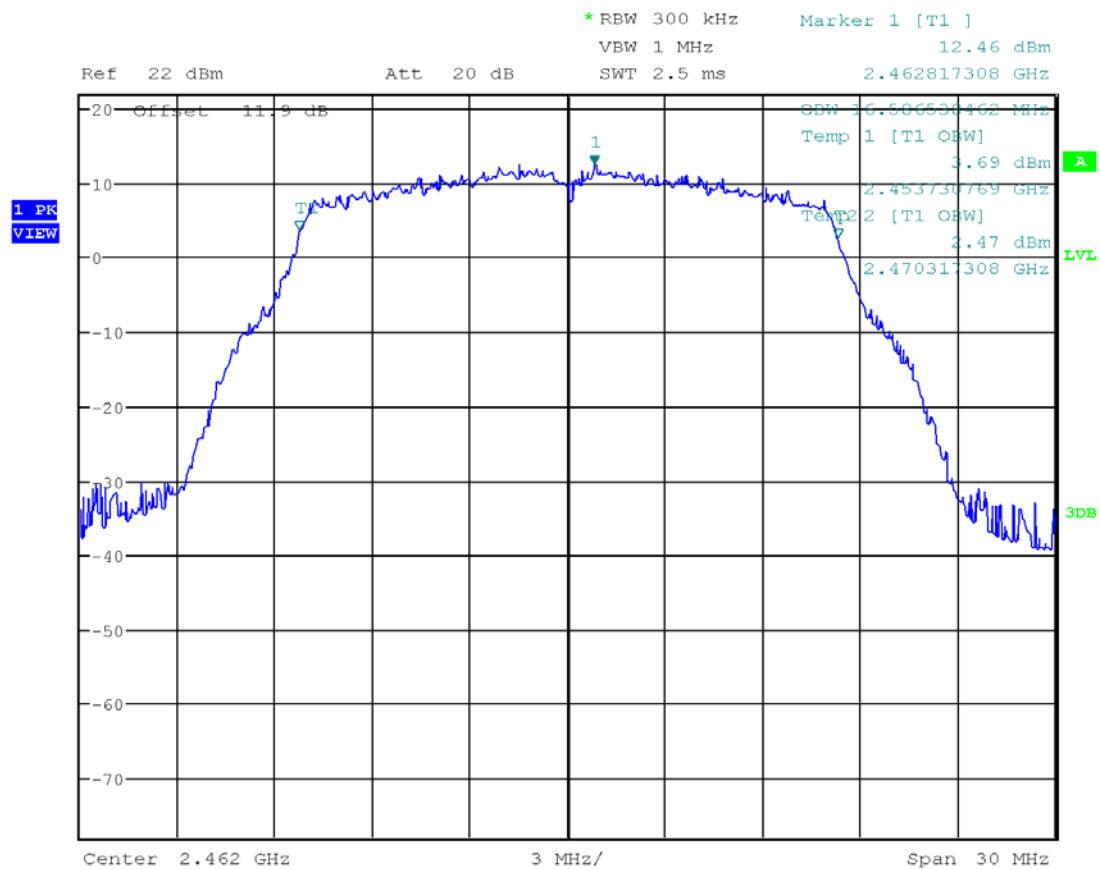
Date: 22.SEP.2017 14:10:45

Plot 1.17 – 99% Bandwidth



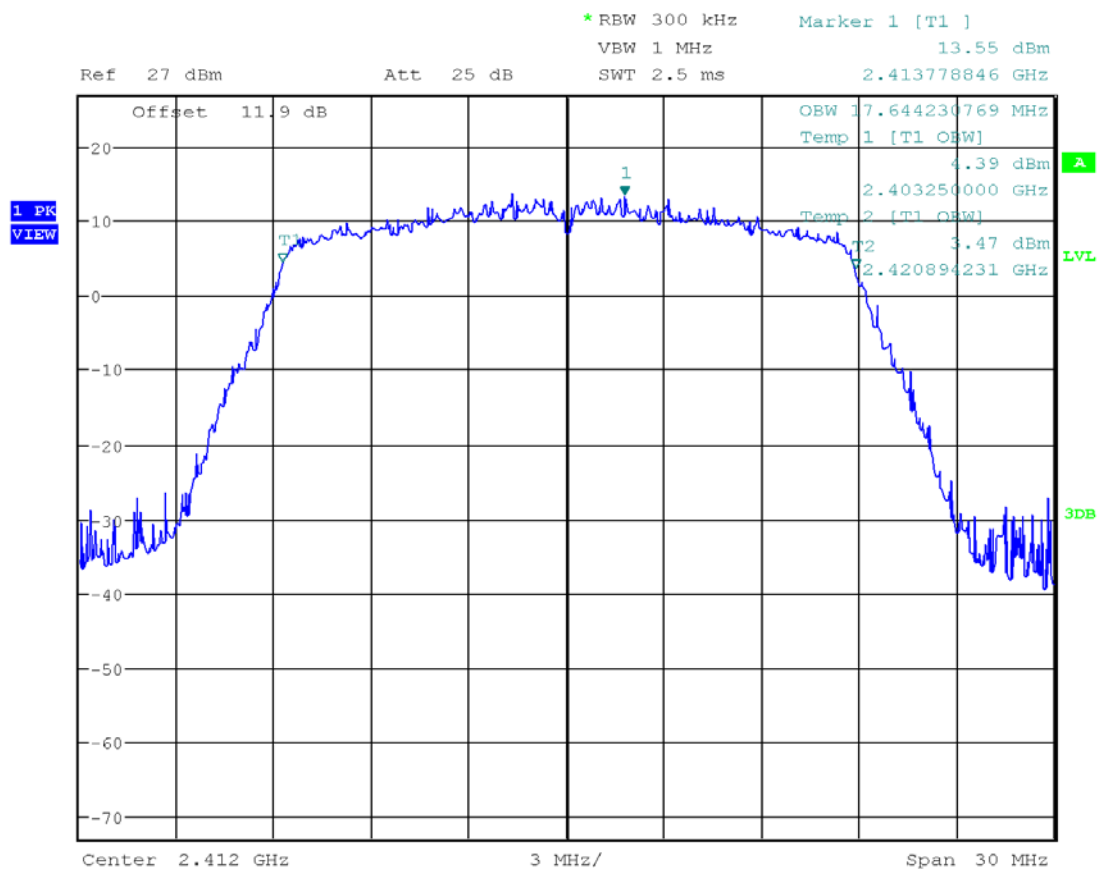
Date: 22.SEP.2017 14:11:33

Plot 1.18 – 99% Bandwidth



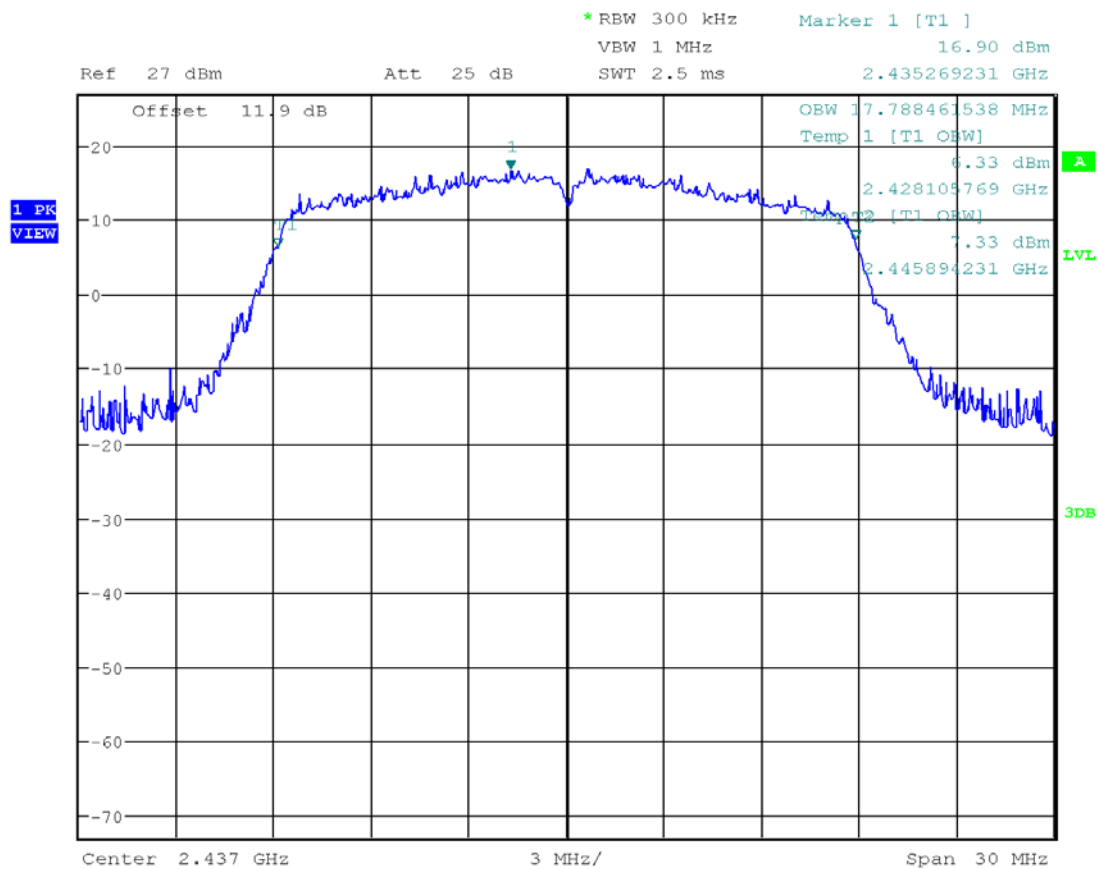
Date: 22.SEP.2017 14:12:32

Plot 1.19 – 99% Bandwidth



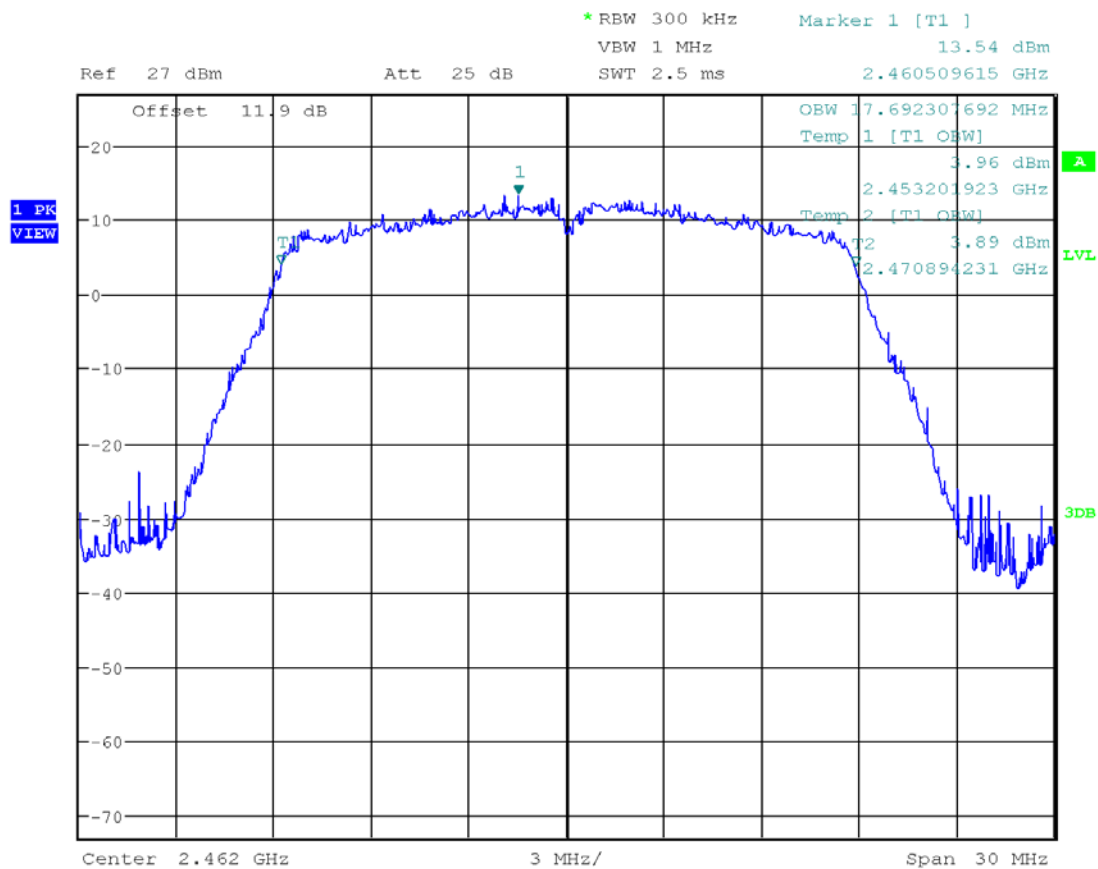
Date: 22.SEP.2017 15:12:32

Plot 1.20 – 99% Bandwidth



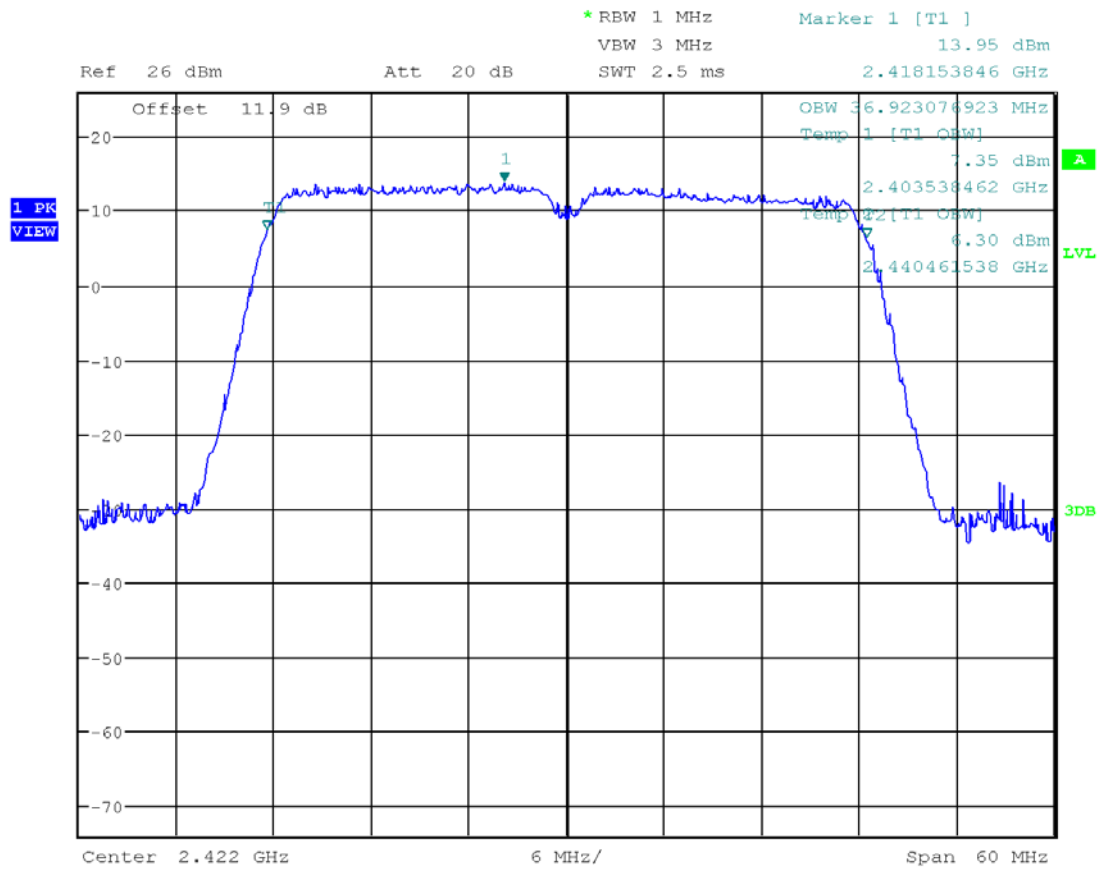
Date: 22.SEP.2017 15:13:34

Plot 1.21 – 99% Bandwidth



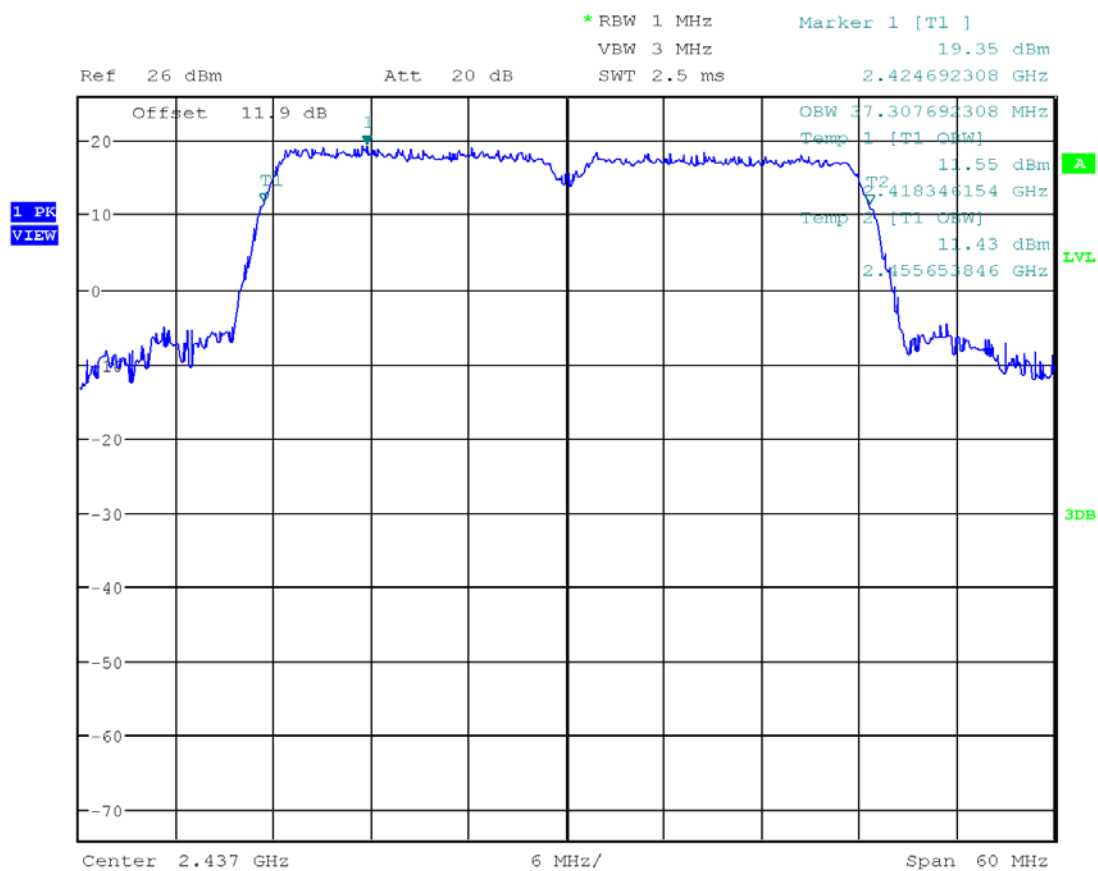
Date: 22.SEP.2017 15:14:12

Plot 1.22 – 99% Bandwidth



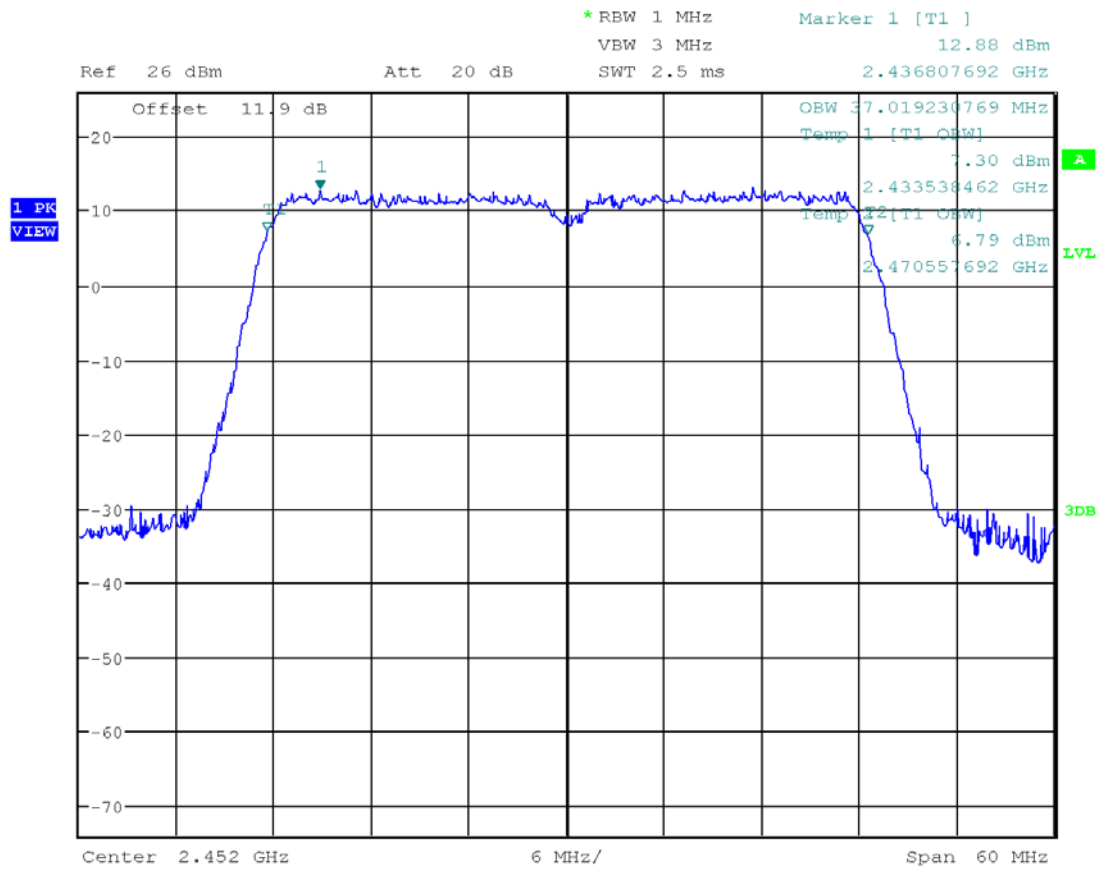
Date: 22.SEP.2017 15:48:53

Plot 1.23 – 99% Bandwidth



Date: 22.SEP.2017 15:50:39

Plot 1.24 – 99% Bandwidth



Date: 22.SEP.2017 15:51:26

4.2 Maximum Conducted Output Power at Antenna Terminals FCC Rule 15.247(b)(3)

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).
For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Maximum Conducted Transmitter Output Power. The offset programmed on the analyzer is corrected to include cable loss, attenuator and duty cycle correction.

The procedure described in FCC Publication 558074 D01 DTS Meas Guidance v04 was used. Specifically, section 9.2.2.2 Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep).

1. Set span to at least $1.5 \times \text{OBW}$.
2. Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
3. Set VBW $\geq 3 \times \text{RBW}$.
4. Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This gives bin-to-bin spacing $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = Auto
6. Set detector = RMS.
7. If transmit duty cycle <98%, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously or at duty cycle $\geq 98\%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
8. Trace average at least 100 traces in power averaging mode.
9. Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Test Date:	September 22 to 25, 2017
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4.2.3 Test Result

Refer to the following plots for the test result:

802.11b (2Mbps) – Conducted Average Power

CH	Frequency MHz	Ant 0 – DB1 (dBm)	Plot #	Ant 1 – DB2 (dBm)	Plot #	Ant 2 – DB3 (dBm)	Plot #	Ant 3 – DB4 (dBm)	Plot #
1	2412	21.31	2.1	21.05	2.4	21.52	2.7	21.27	2.10
6	2437	24.00	2.2	23.83	2.5	24.19	2.8	23.79	2.11
11	2462	21.26	2.3	21.20	2.6	21.50	2.9	21.26	2.12

802.11g (6Mbps) – Conducted Average Power

CH	Frequency MHz	Ant 0 – DB1 (dBm)	Plot #	Ant 1 – DB2 (dBm)	Plot #	Ant 2 – DB3 (dBm)	Plot #	Ant 3 – DB4 (dBm)	Plot #
1	2412	19.42	2.13	19.10	2.16	19.54	2.19	19.26	2.22
6	2437	23.10	2.14	23.14	2.17	23.28	2.20	23.16	2.23
11	2462	19.42	2.15	19.10	2.18	19.51	2.21	19.13	2.24

802.11n 20MHz (MCS0) – Conducted Average Power

CH	Frequency MHz	Ant 0 – DB1 (dBm)	Plot #	Ant 1 – DB2 (dBm)	Plot #	Ant 2 – DB3 (dBm)	Plot #	Ant 3 – DB4 (dBm)	Plot #
1	2412	19.03	2.25	18.99	2.28	19.17	2.31	18.91	2.34
6	2437	22.94	2.26	22.77	2.29	23.02	2.32	22.77	2.35
11	2462	19.07	2.27	18.76	2.30	19.04	2.33	19.00	2.36

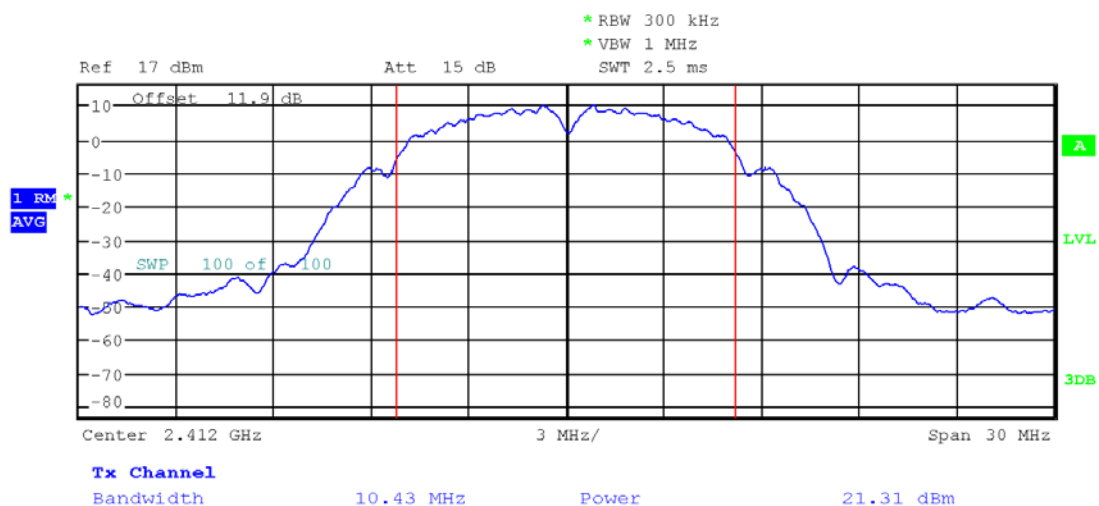
802.11n 40MHz (MCS0) – Conducted Average Power

CH	Frequency MHz	Ant 0 – DB1 (dBm)	Plot #	Ant 1 – DB2 (dBm)	Plot #	Ant 2 – DB3 (dBm)	Plot #	Ant 3 – DB4 (dBm)	Plot #
3	2422	16.48	2.37	16.39	2.40	16.90	2.43	16.53	2.46
6	2437	22.59	2.38	22.43	2.41	22.67	2.44	22.45	2.47
9	2452	16.51	2.39	16.24	2.42	16.71	2.45	16.56	2.48

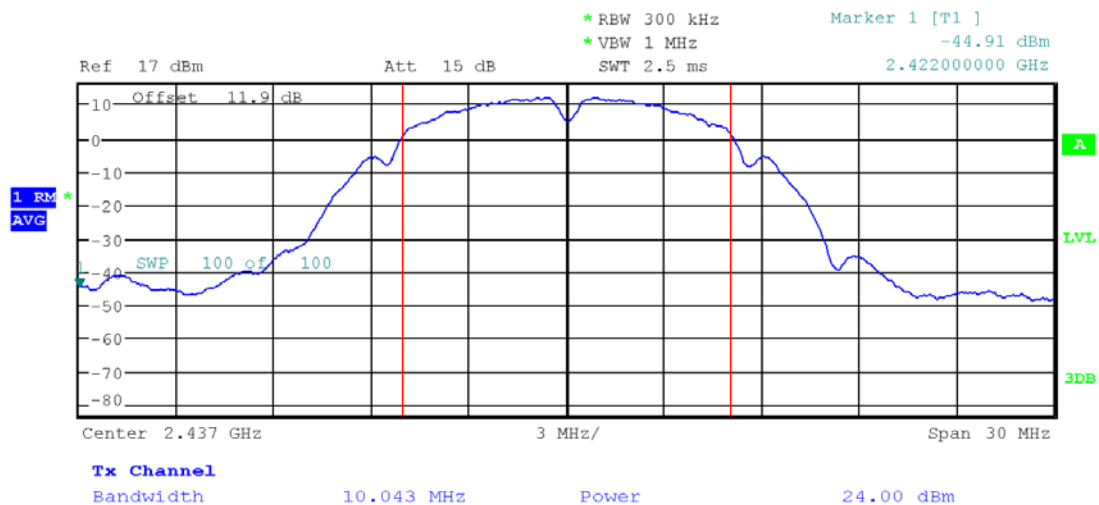
MIMO - Conducted Average Power

CH	Frequency (MHz)	Summed power (dBm)	Summed power (W)
802.11b			
1	2412	27.31	0.538
6	2437	29.98	0.994
11	2462	27.33	0.540
802.11g			
1	2412	25.35	0.343
6	2437	29.19	0.830
11	2462	25.31	0.340
802.11n 20MHz			
1	2412	25.05	0.320
6	2437	28.90	0.776
11	2462	24.99	0.315
802.11n 40MHz			
3	2422	22.60	0.182
6	2437	28.56	0.717
9	2452	22.53	0.179

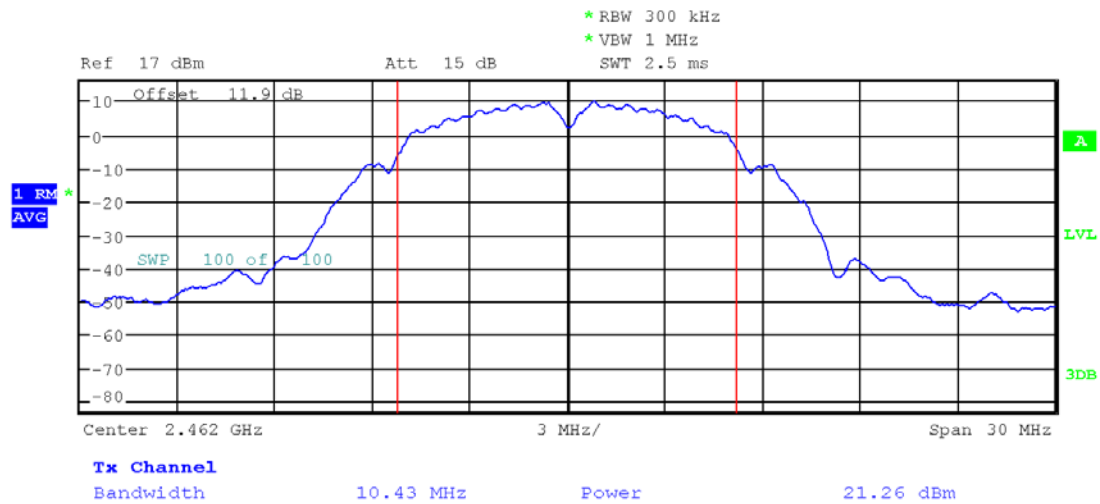
Plot 2. 1



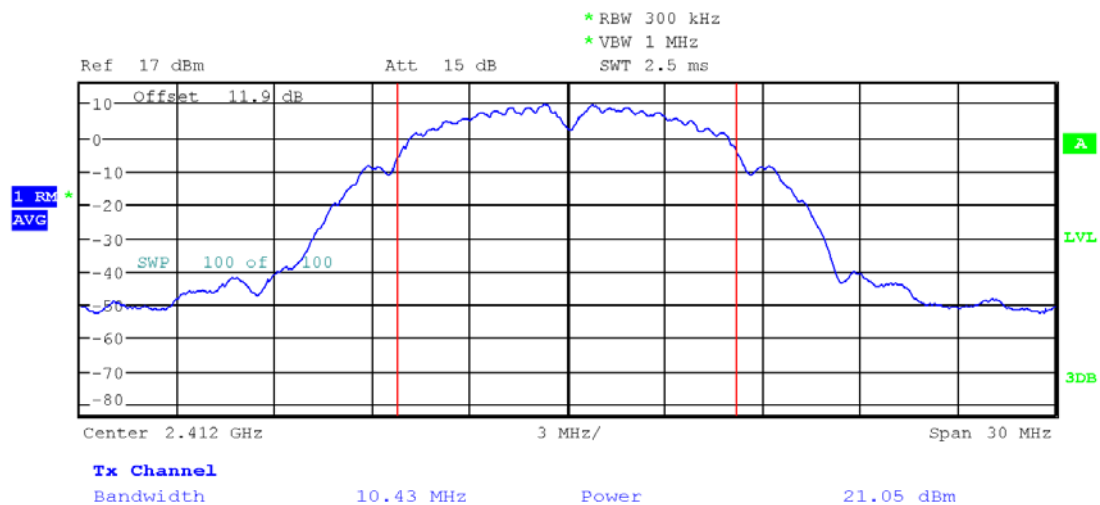
Plot 2. 2



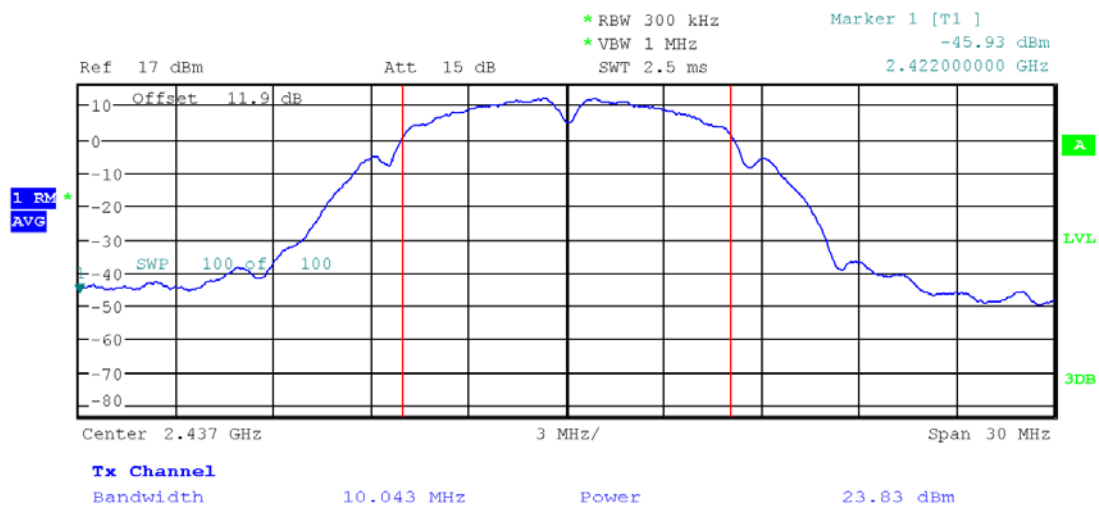
Plot 2.3



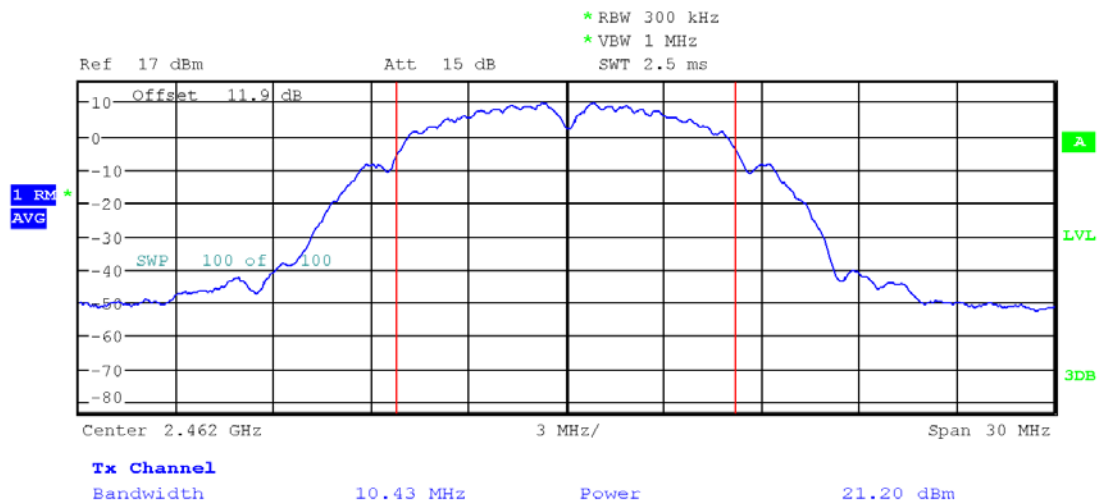
Plot 2.4



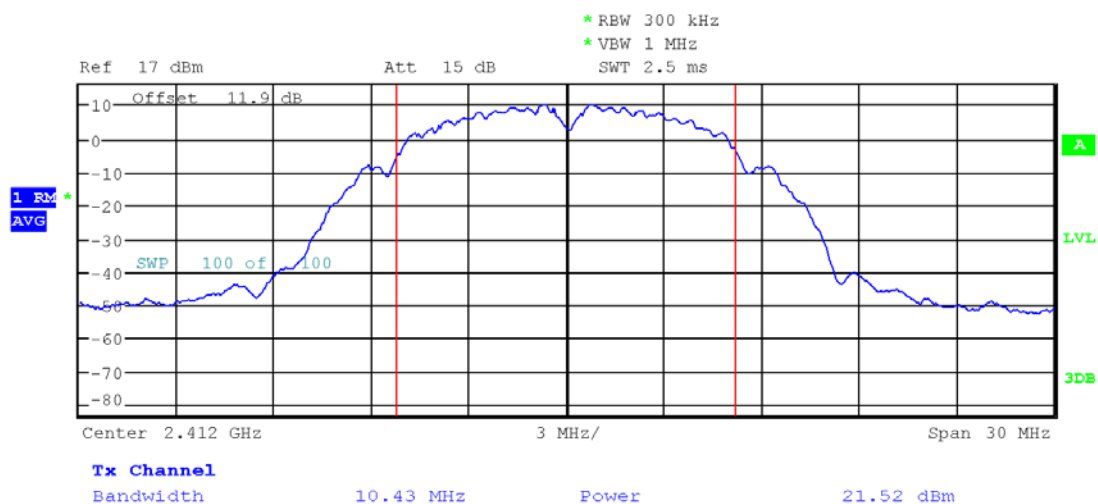
Plot 2.5



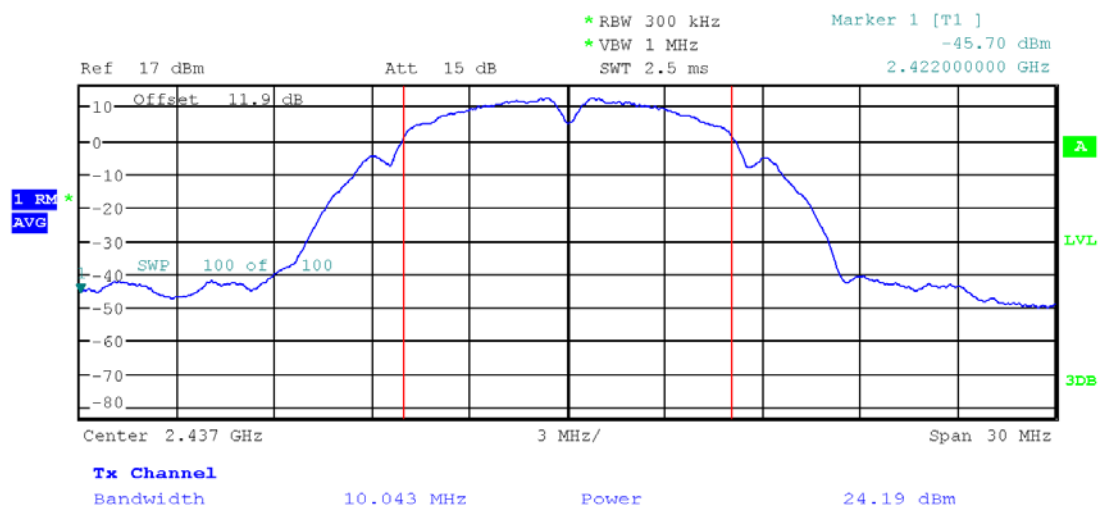
Plot 2.6



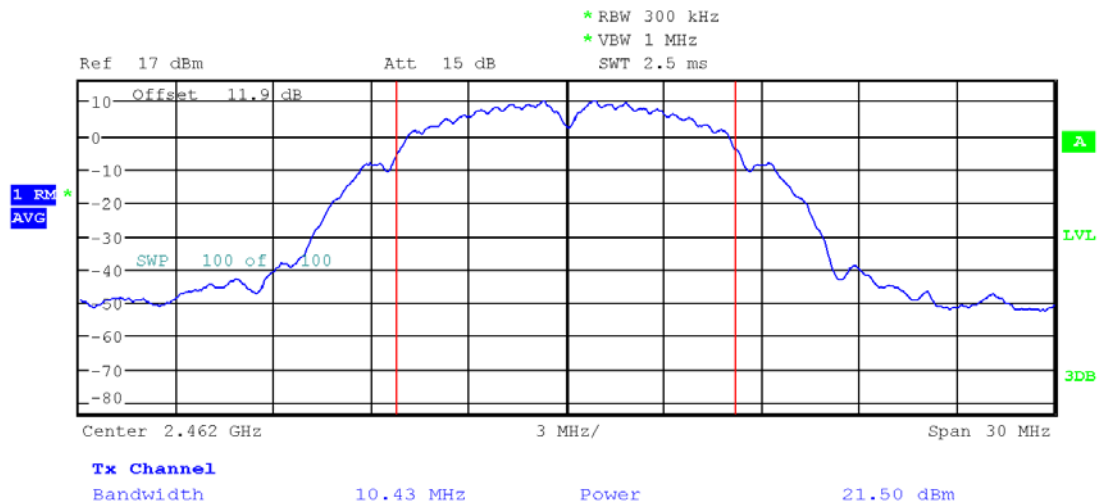
Plot 2.7



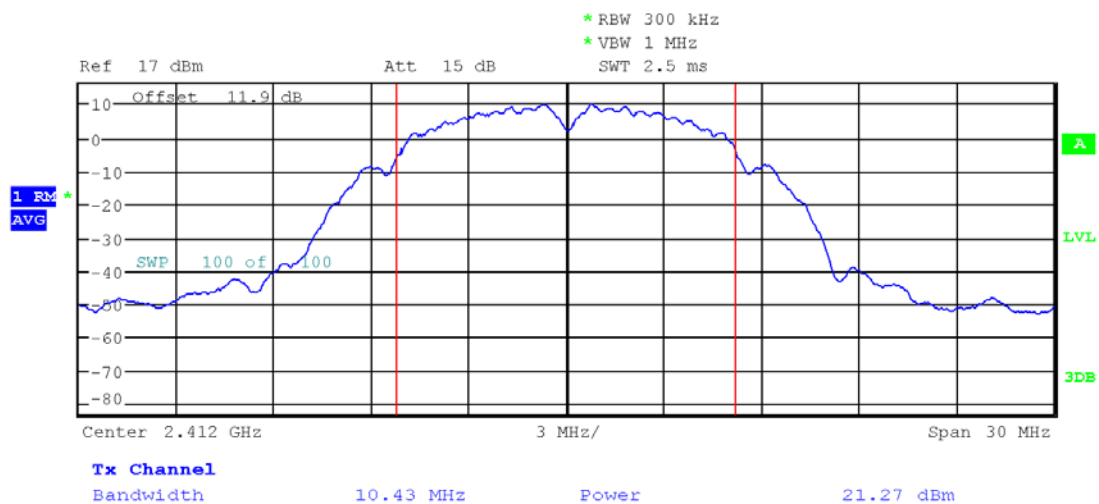
Plot 2.8



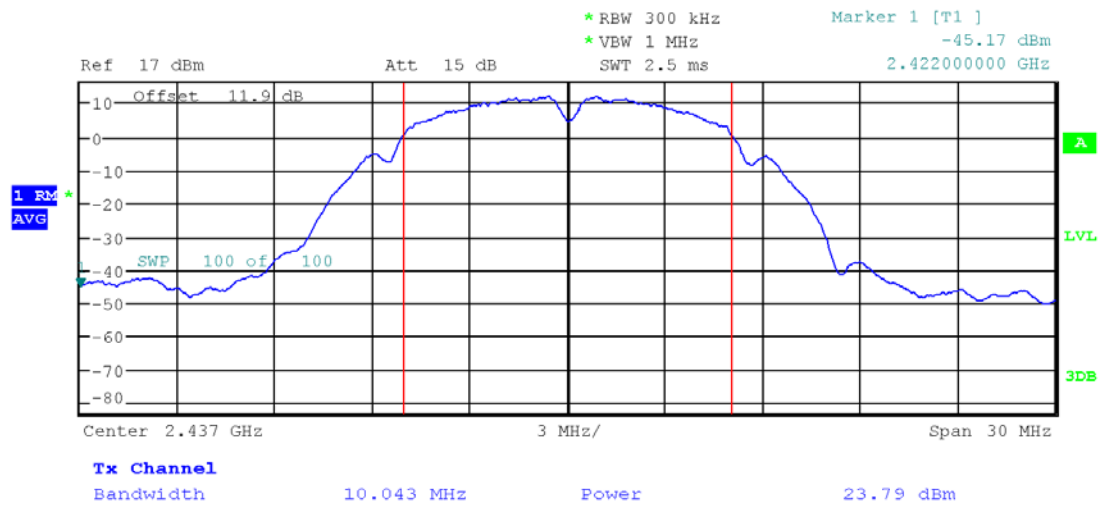
Plot 2. 9



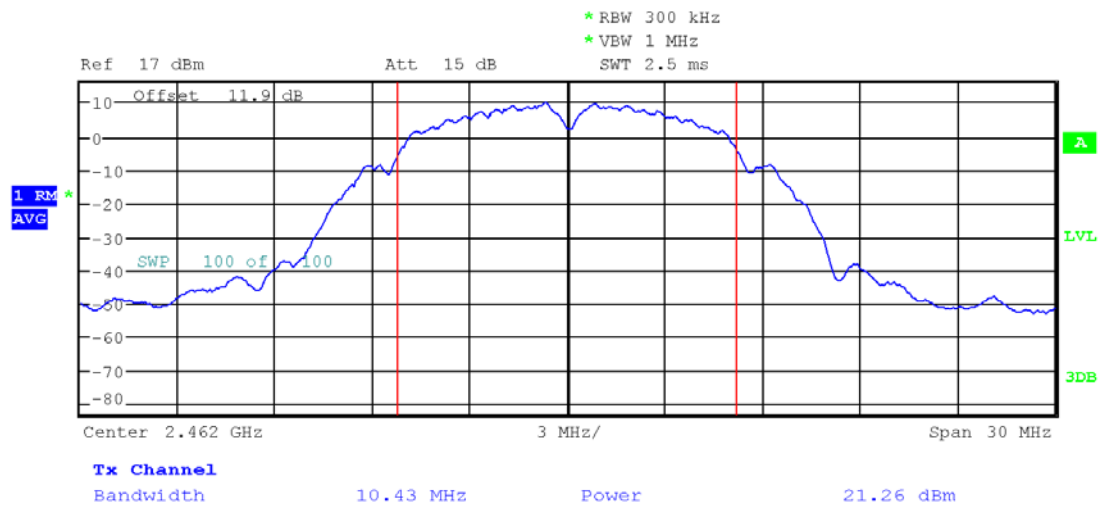
Plot 2. 10



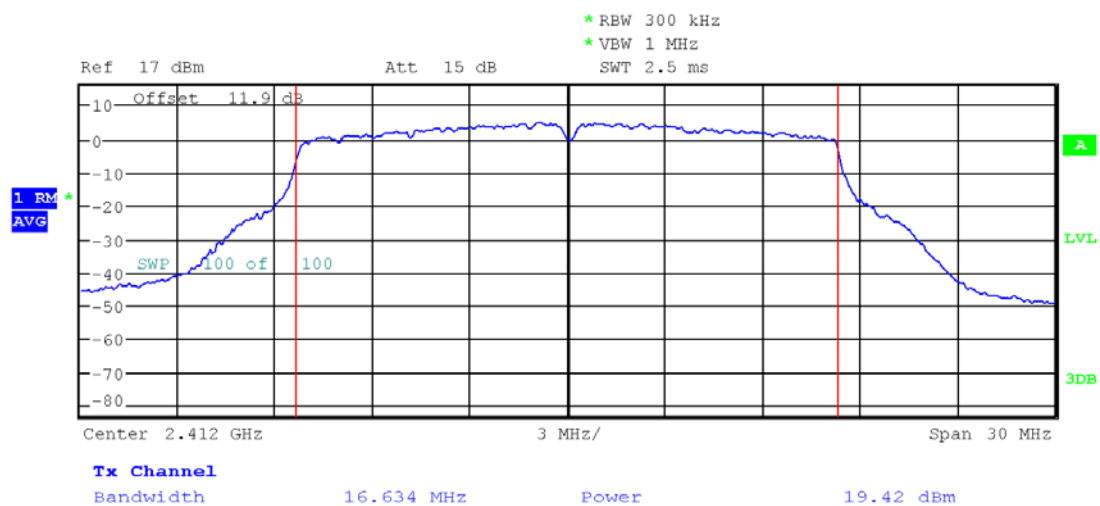
Plot 2. 11



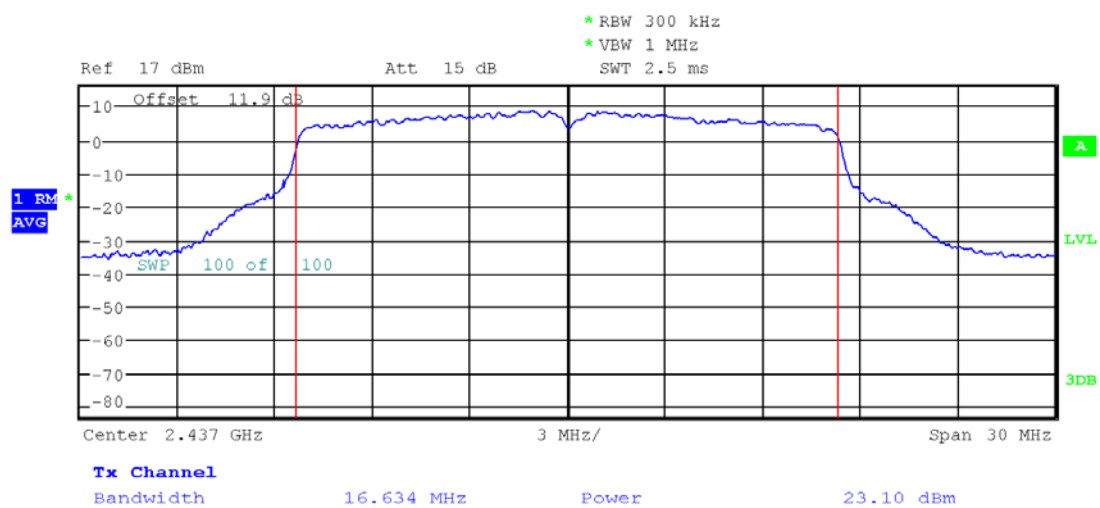
Plot 2. 12



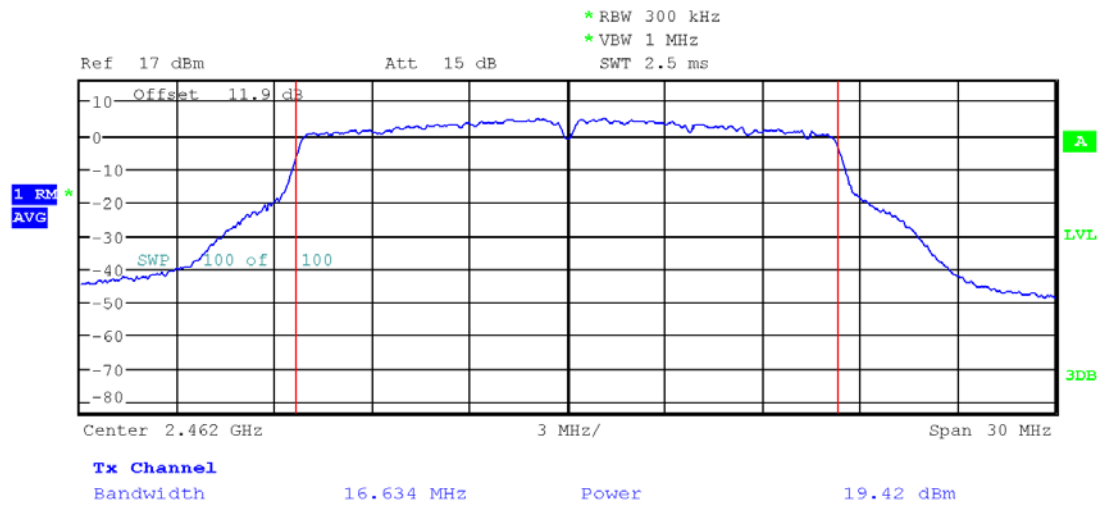
Plot 2. 13



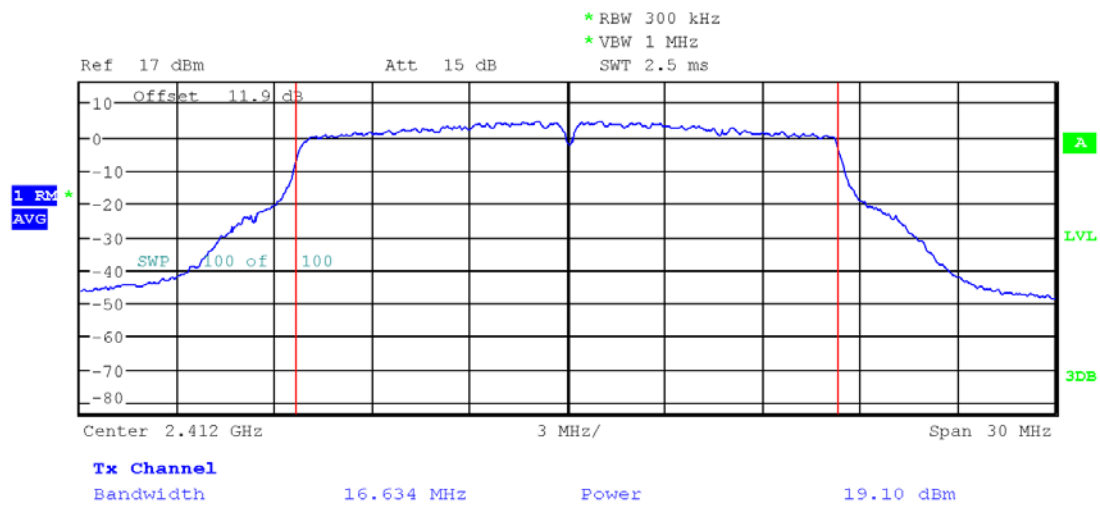
Plot 2. 14



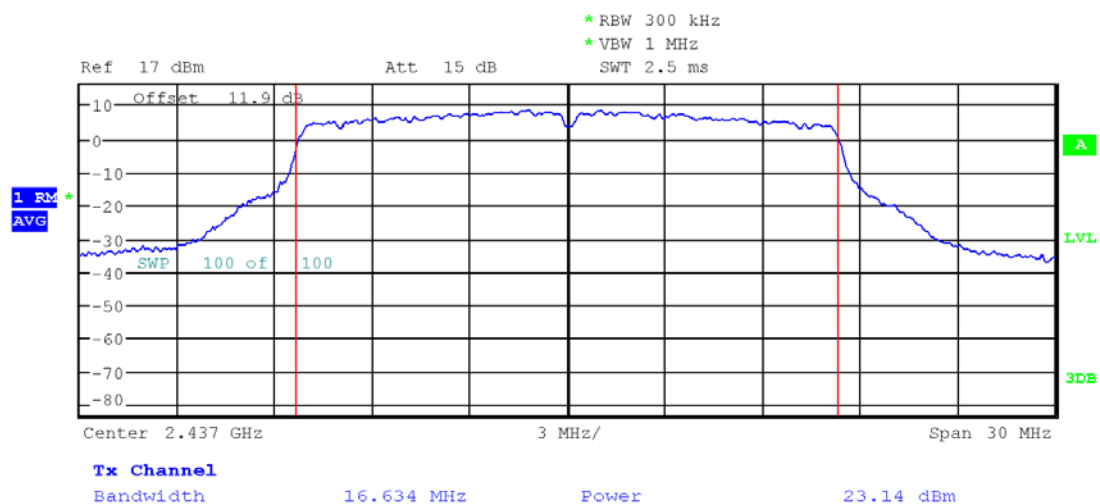
Plot 2. 15



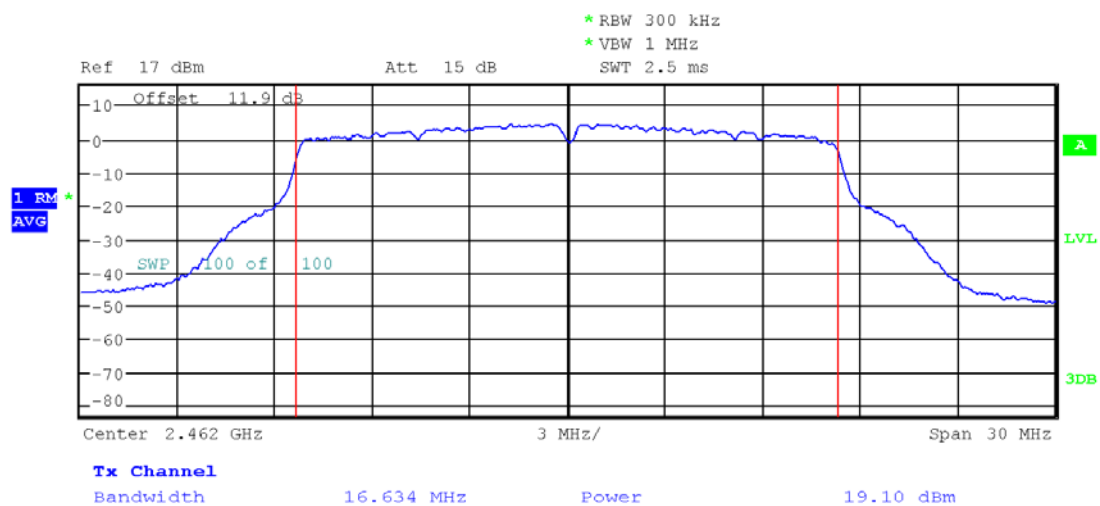
Plot 2. 16



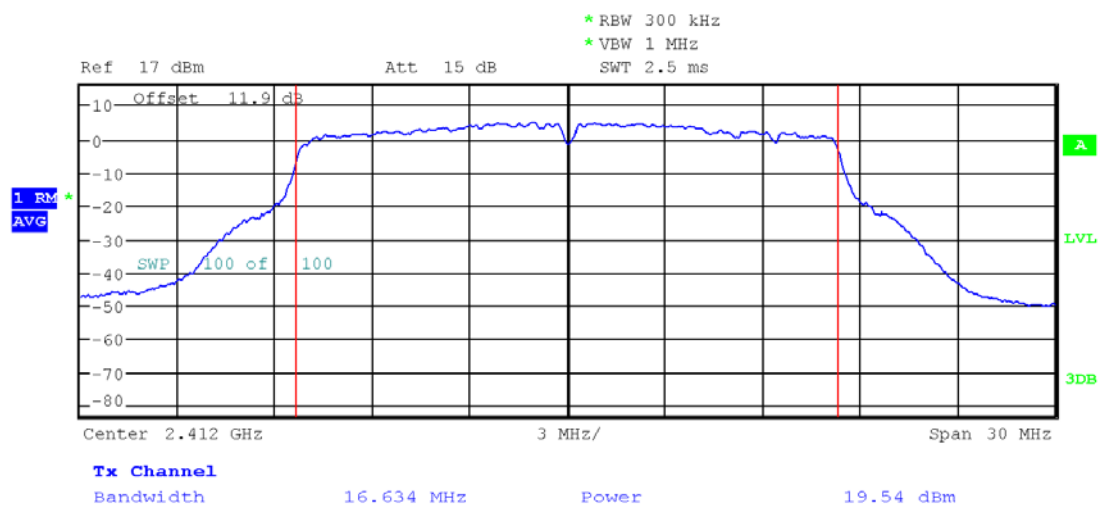
Plot 2. 17



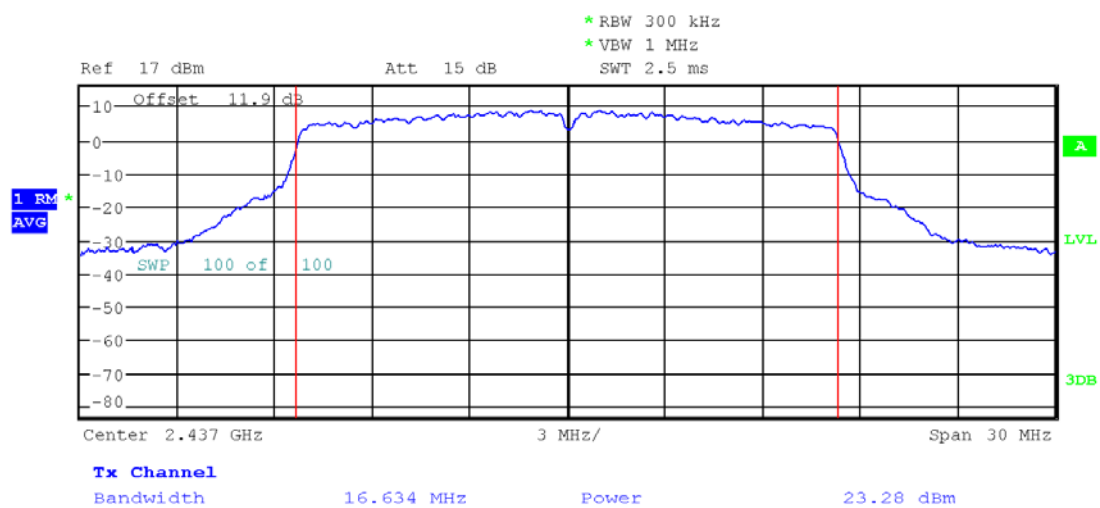
Plot 2. 18



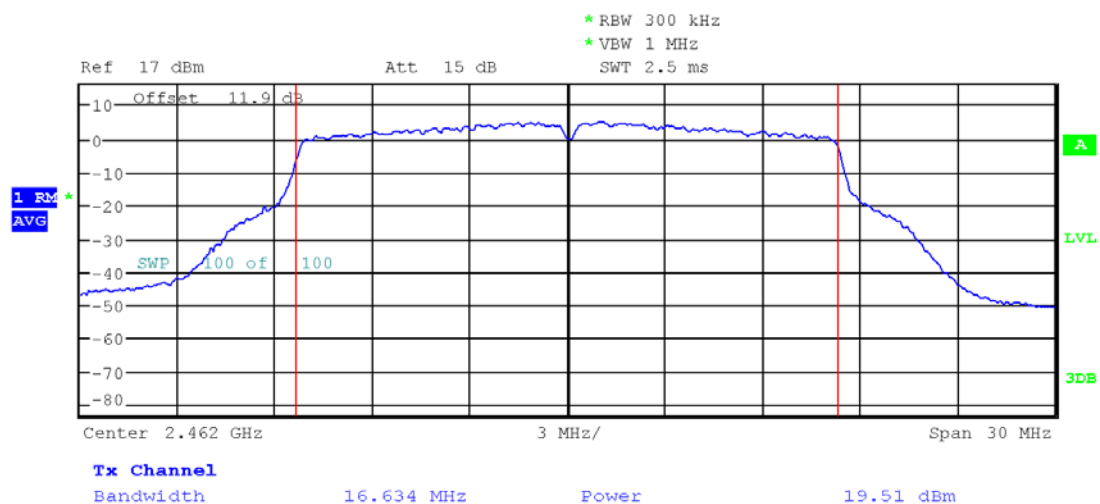
Plot 2. 19



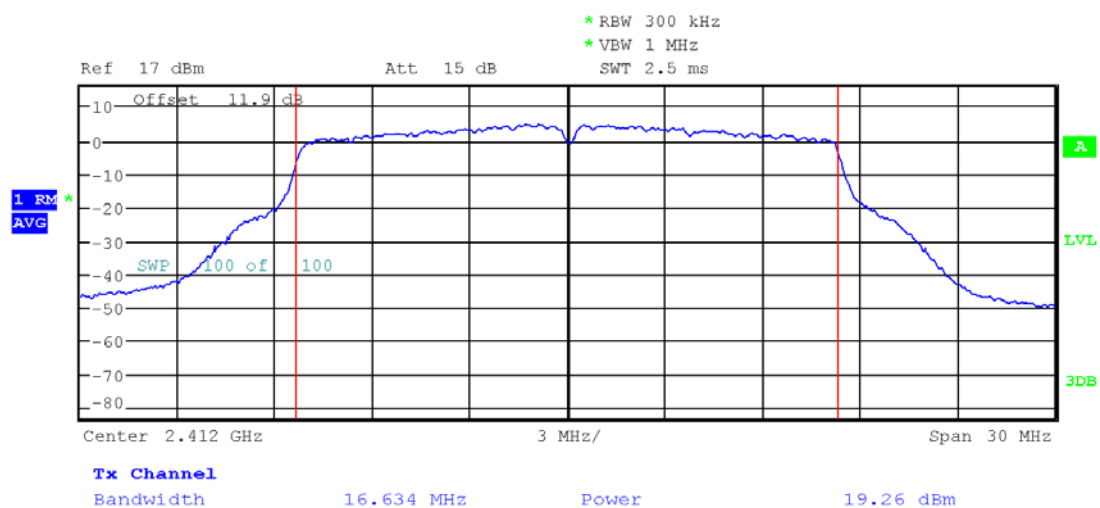
Plot 2. 20



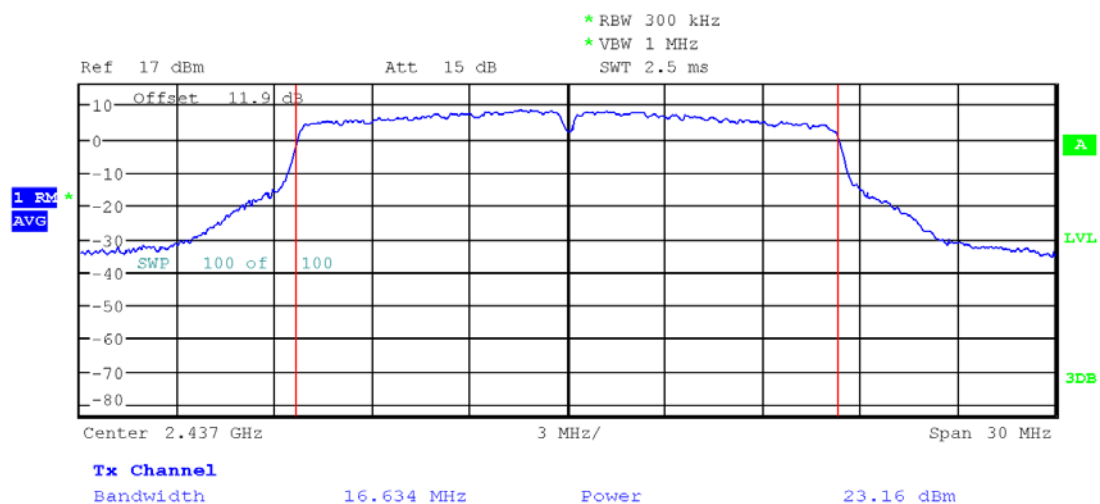
Plot 2. 21



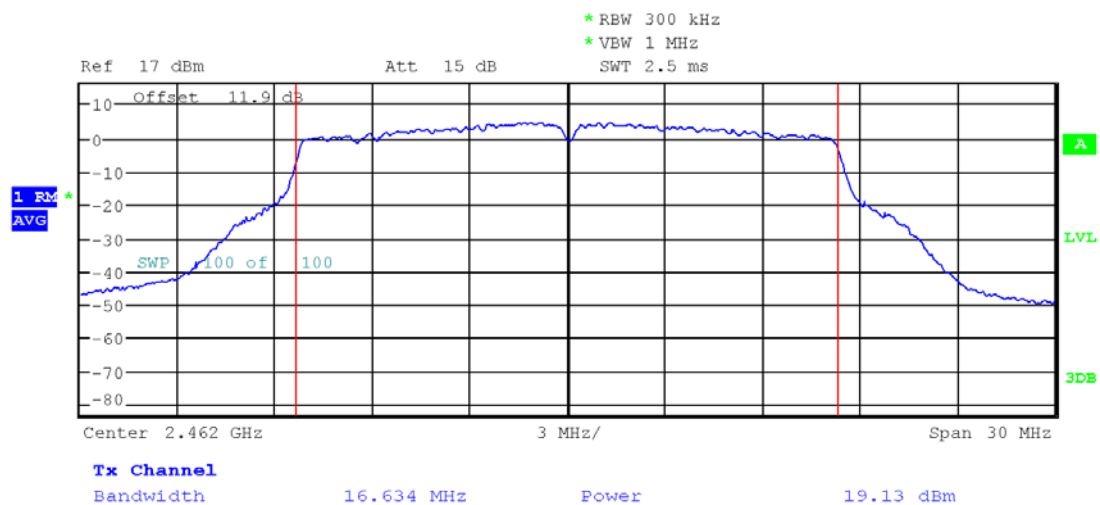
Plot 2. 22



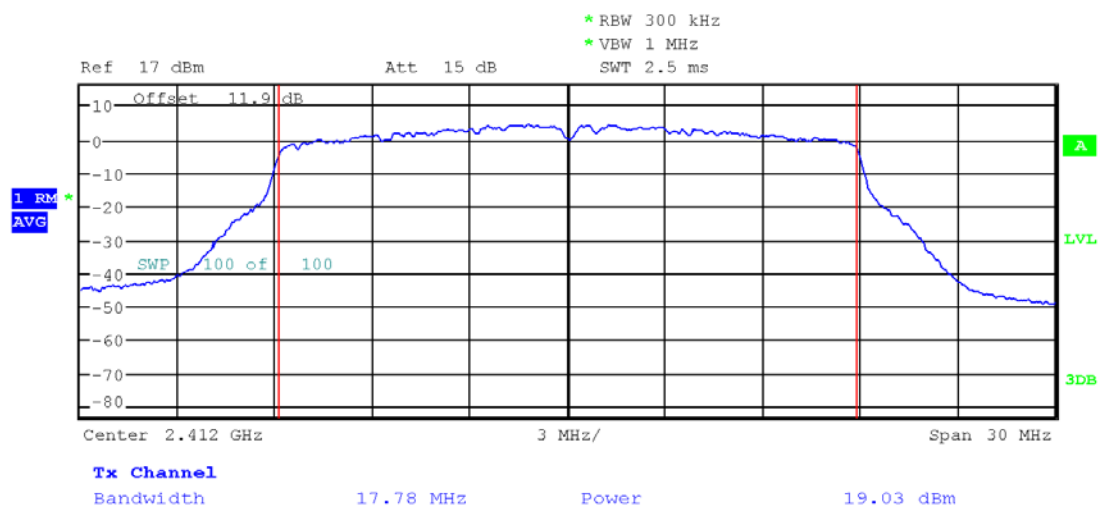
Plot 2. 23



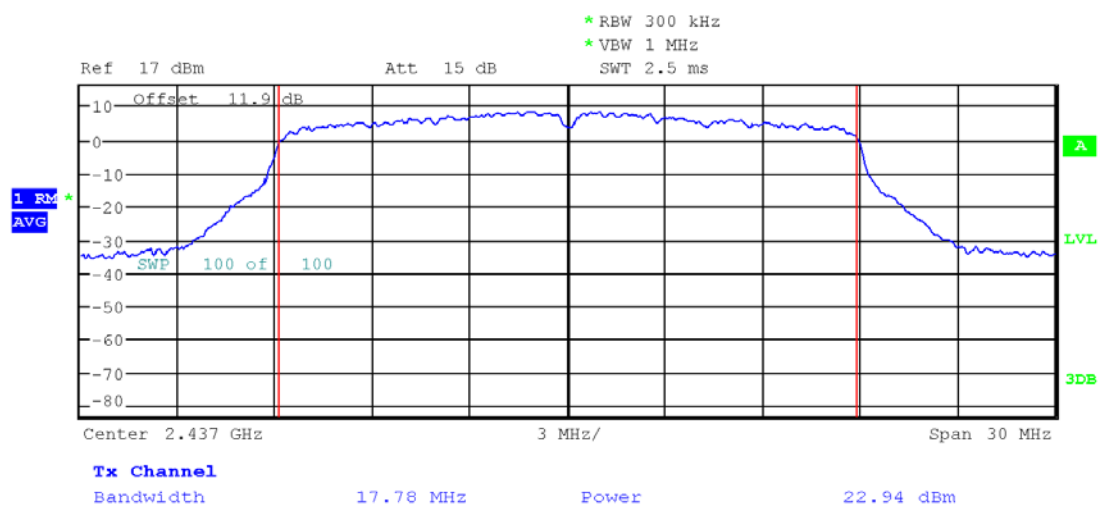
Plot 2. 24



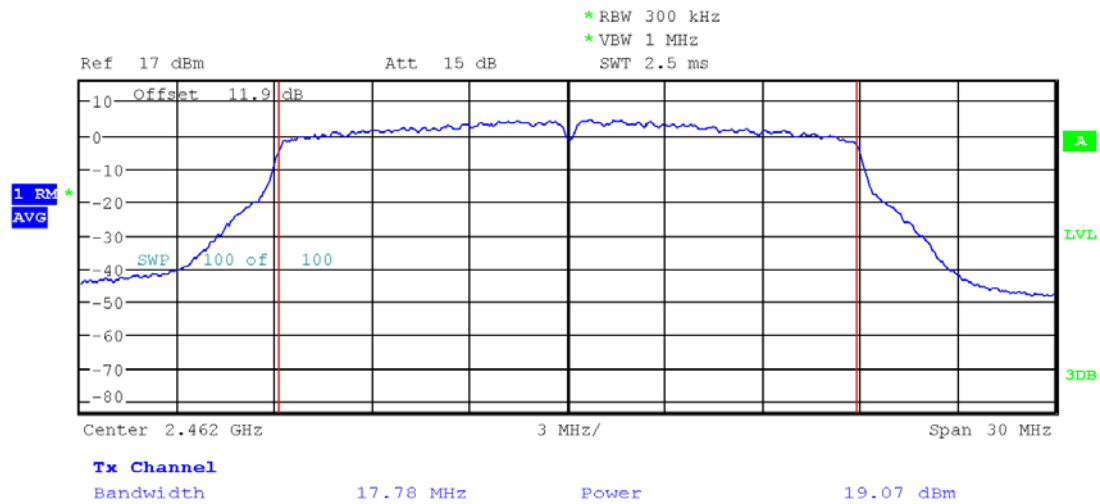
Plot 2. 25



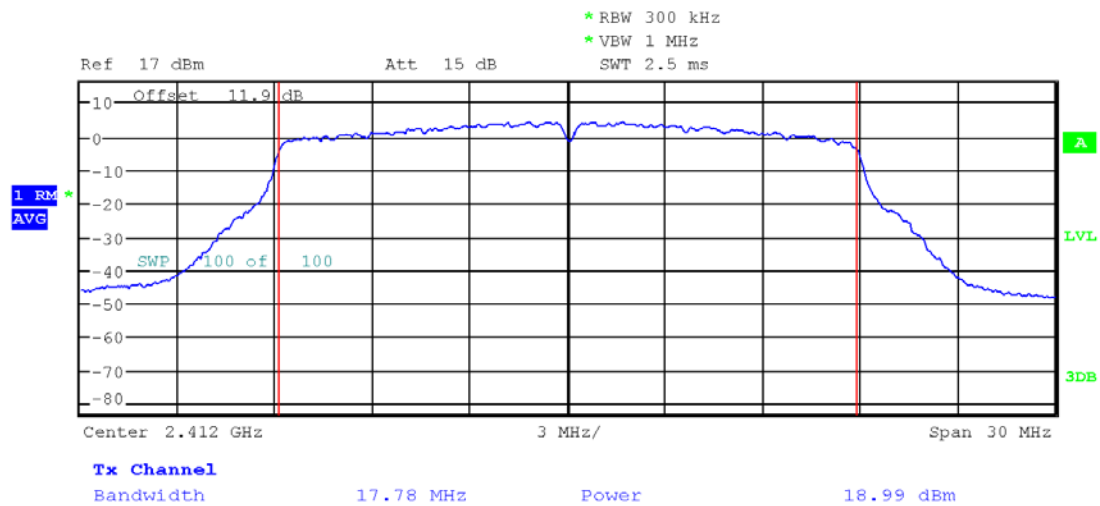
Plot 2. 26



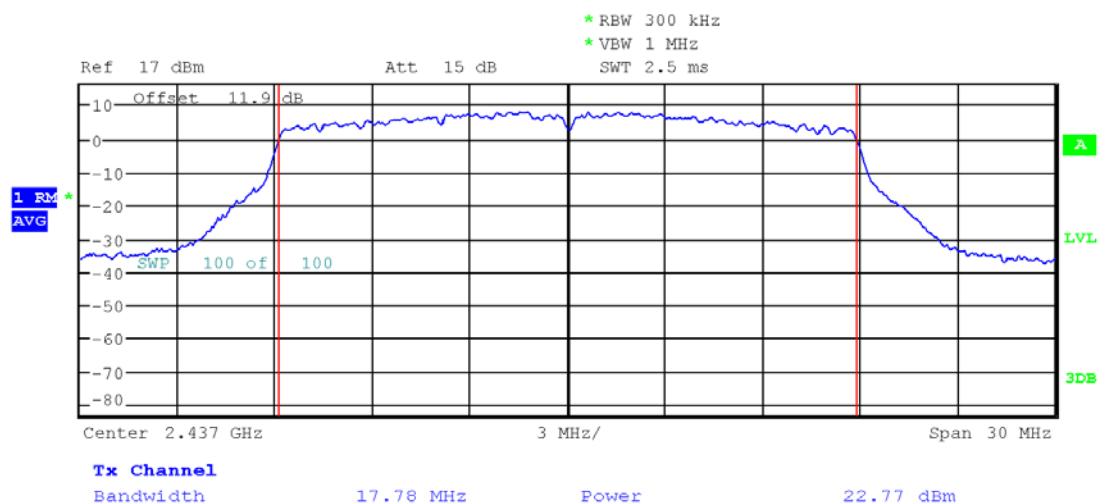
Plot 2. 27



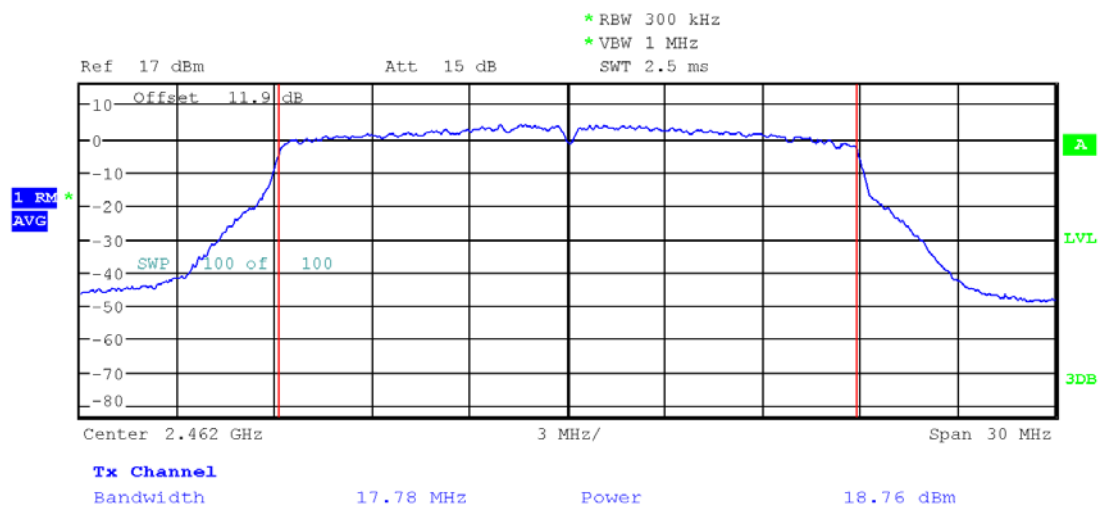
Plot 2. 28



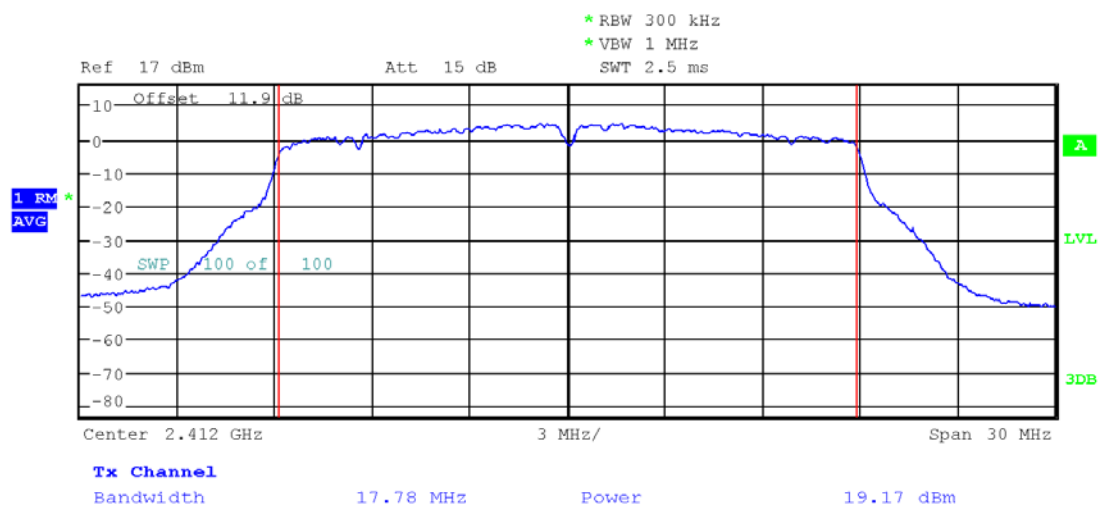
Plot 2. 29



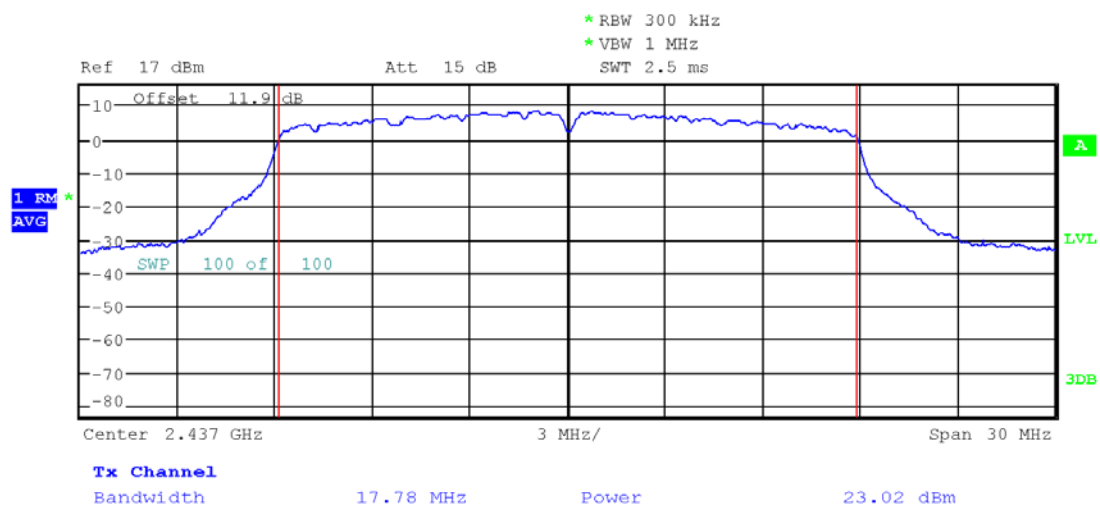
Plot 2. 30



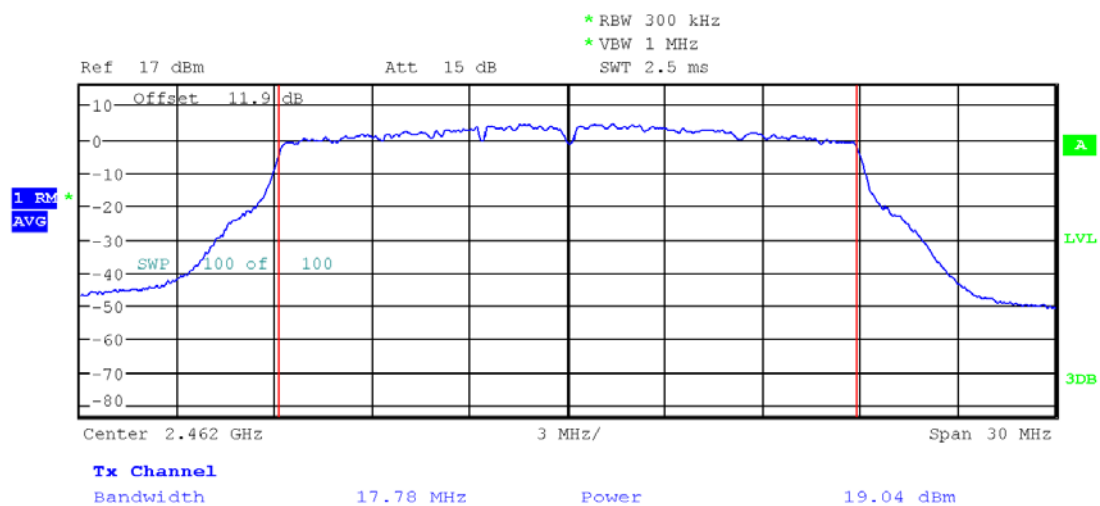
Plot 2. 31



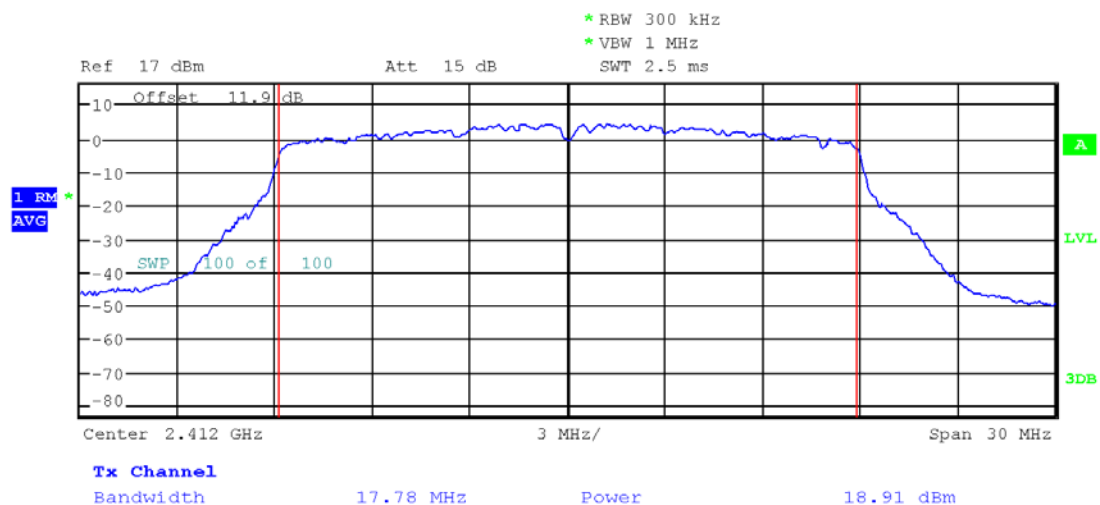
Plot 2. 32



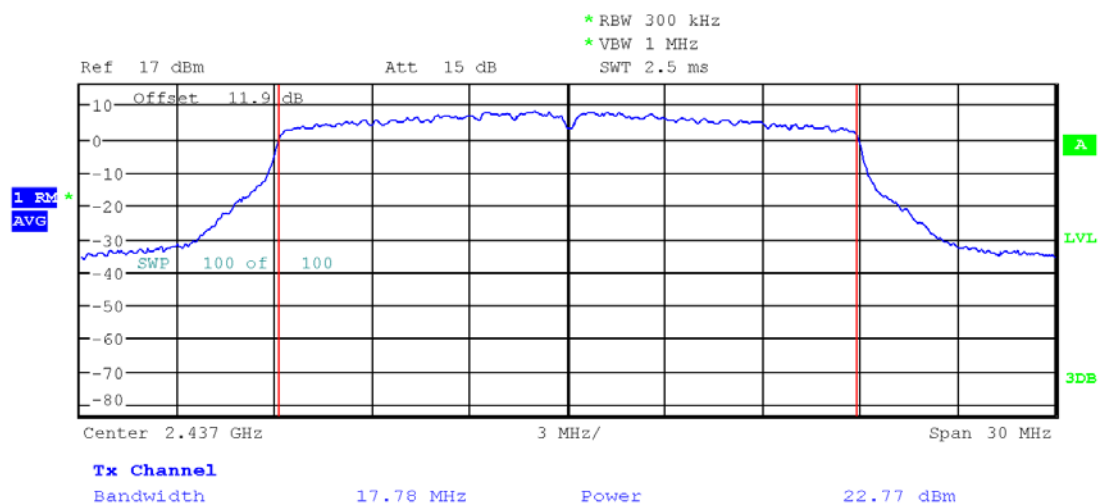
Plot 2. 33



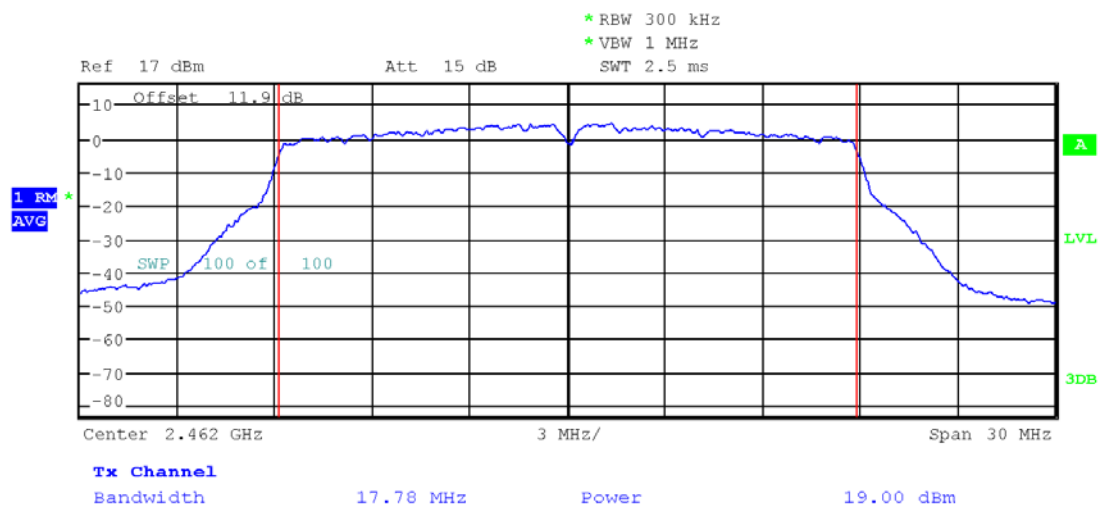
Plot 2. 34



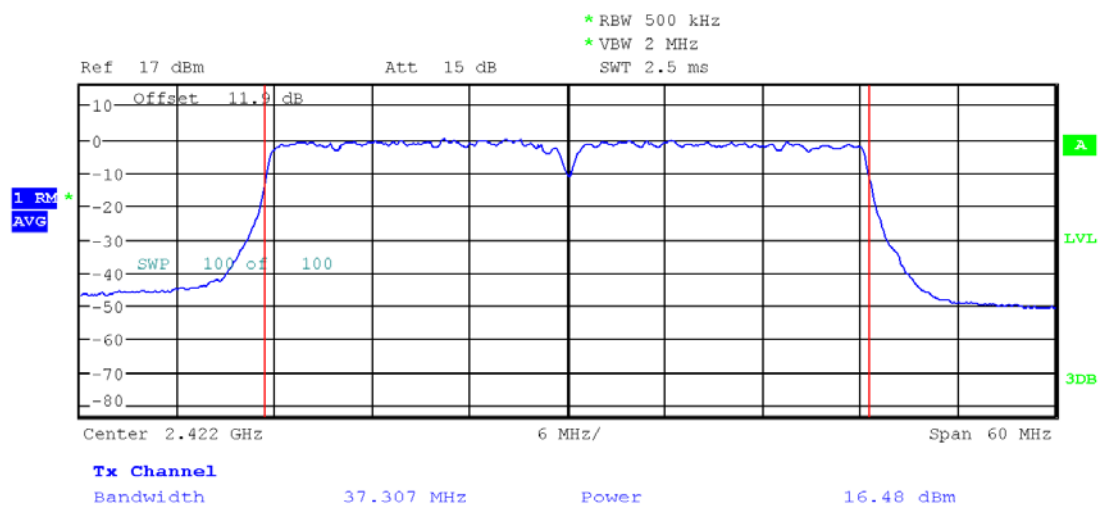
Plot 2. 35



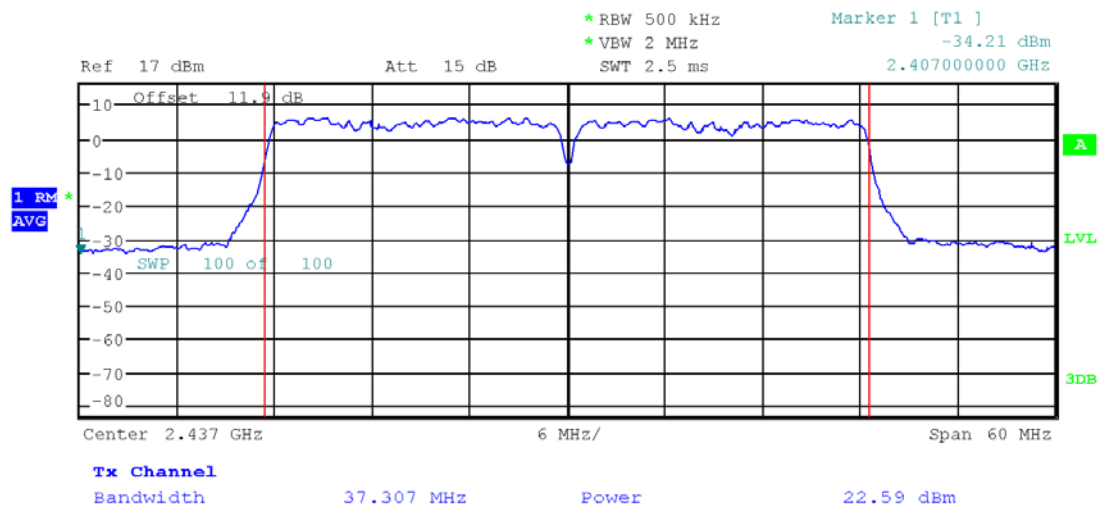
Plot 2. 36



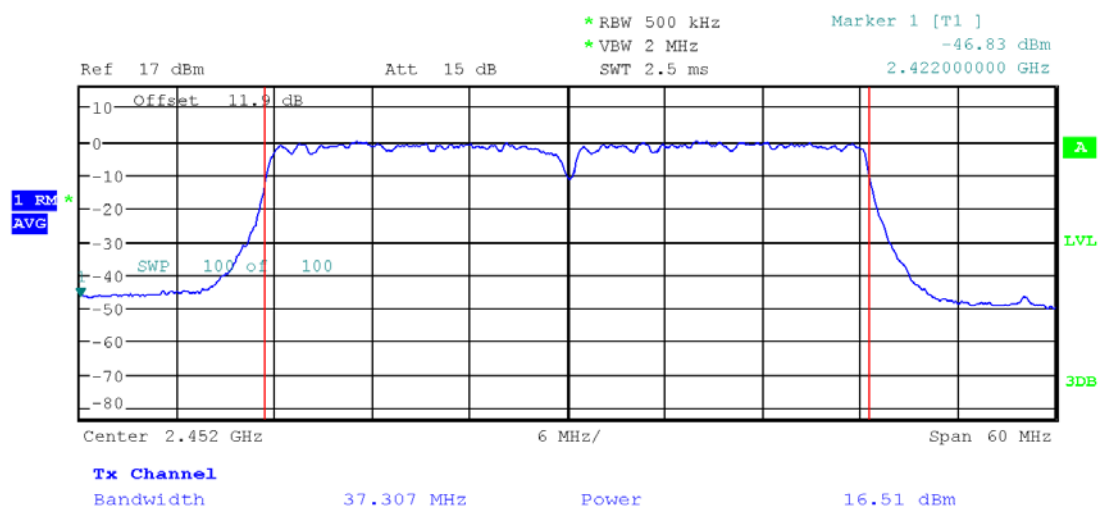
Plot 2. 37



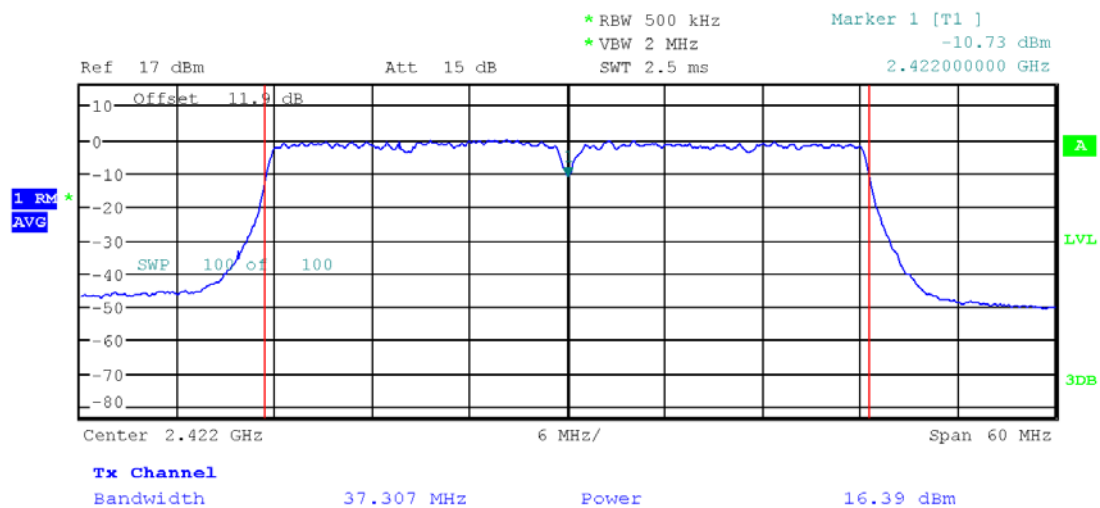
Plot 2. 38



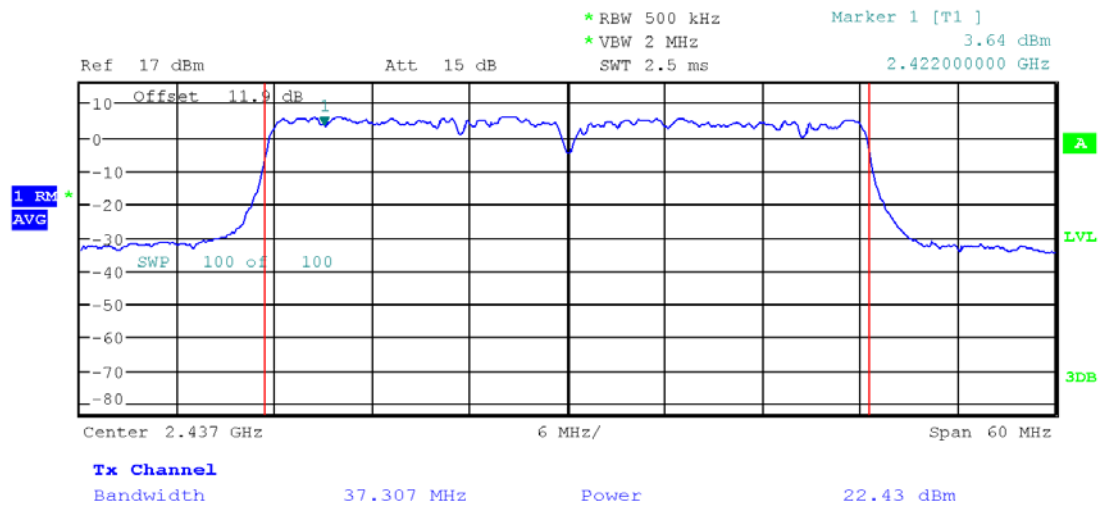
Plot 2. 39



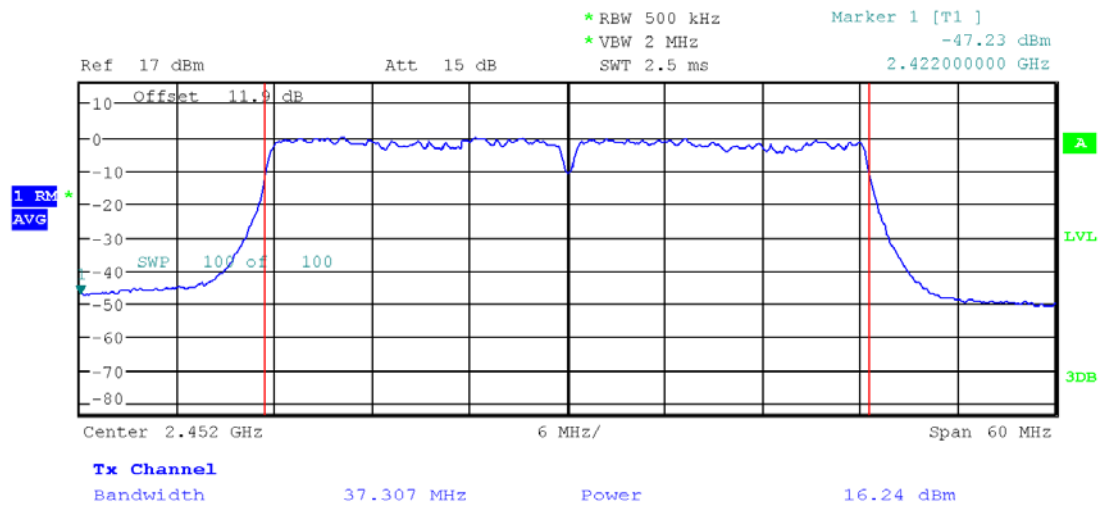
Plot 2. 40



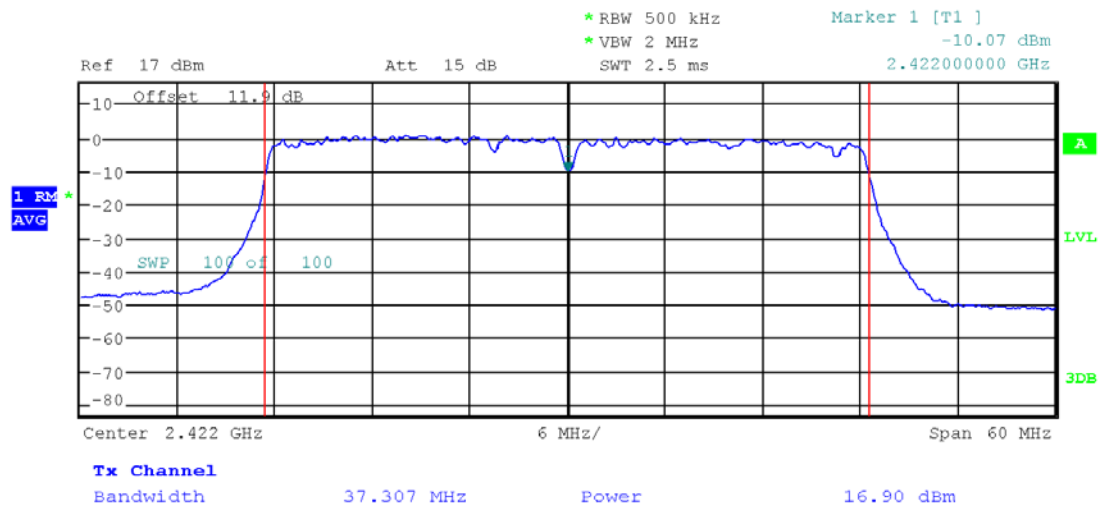
Plot 2. 41



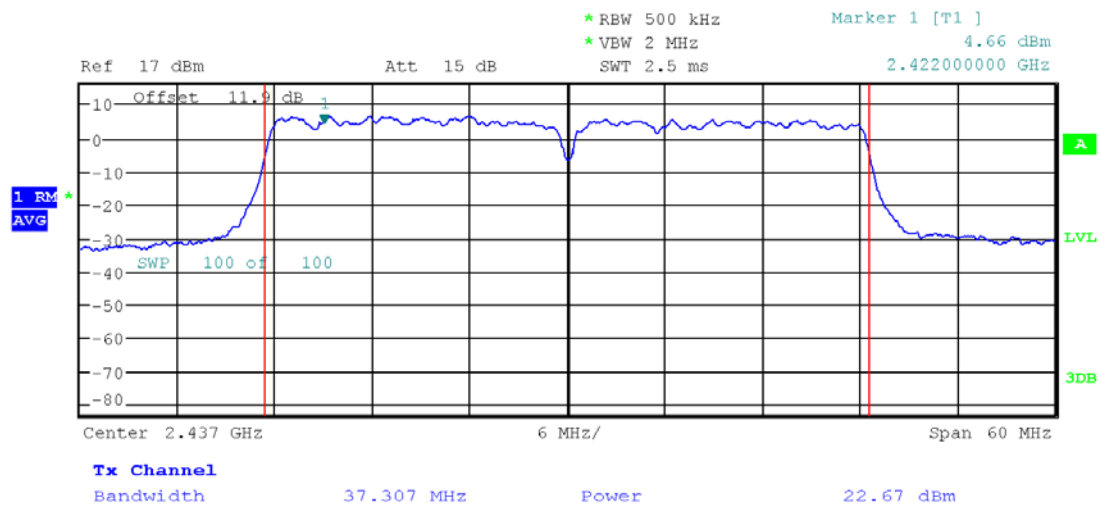
Plot 2. 42



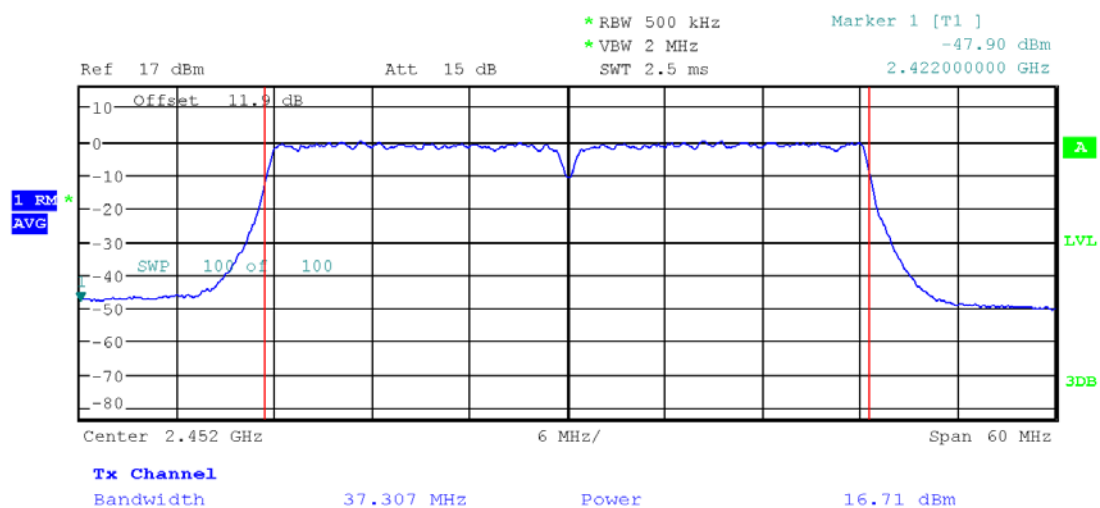
Plot 2. 43



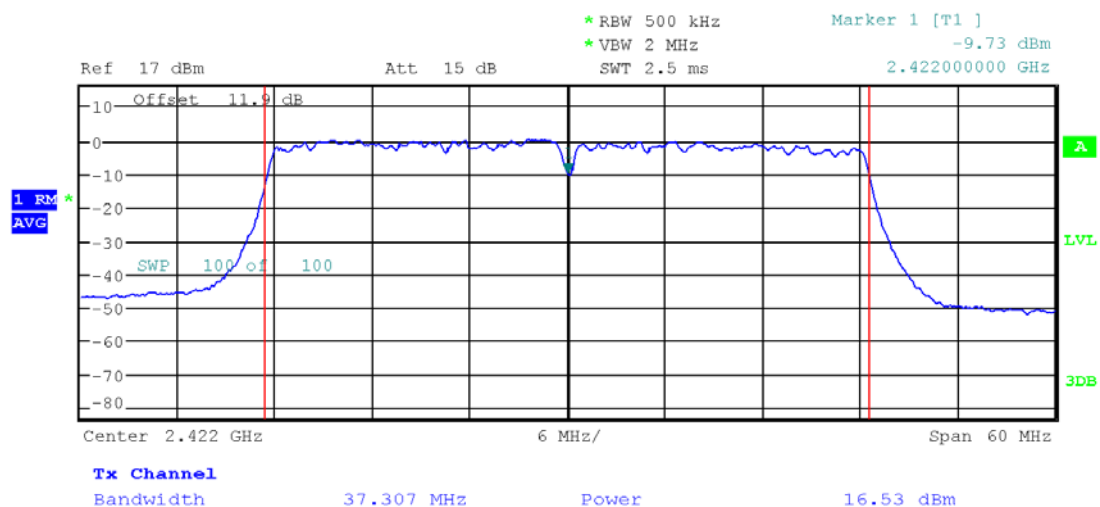
Plot 2. 44



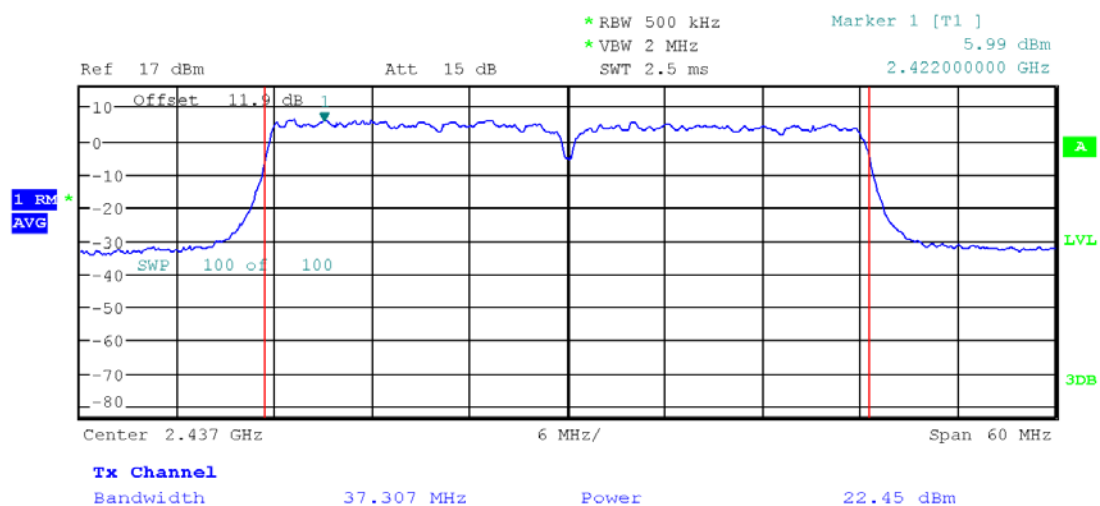
Plot 2. 45



Plot 2. 46



Plot 2. 47



Plot 2. 48

