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A				12.05.2015	M. Reuben	S. Cohen

EMC Laboratory

WipAir 8000 5X

**Manufactured by
WaveIP LTD.**

FCC ID: QQ2-WA8K 5X

EMC Test Report - Part 1

According to FCC Part 15.247

	Fonction/Title	Name	Signature	Date
Prepared by:	Technical Writer	M. Reuben		05.01.2015
Checked by:	Test Engineer	I. Arbitman		11.05.2015
Approved By:	EMC Lab. Manager	S. Cohen		19-May-15

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1. ADMINISTRATIVE DATA

1.1. Scope

This document describes the measurement procedures and tests for Radiated and conducted emission testing of the WipAir 8000 5X manufactured by WaveIP Ltd.

2. GENERAL INFORMATION

2.1. Description of equipment Under Test

Equipment Under Test	WipAir 8000 5X
FCCID	QQ2-WA8K 5X
Manufacturer	WaveIP Ltd.
Serial Numbers	041A04000100
Mode of Operation	Tranceiver MODE
Receiver operating frequency	5725 MHz – 5850 MHz
Year of Manufacture	2014

2.2. Applicant Information:

Applicant	WaveIP Ltd
Applicant Address	Teradion Industrial park, Misgav 20179, Israel
Telephone	+972-4-9027000
FAX	+972-4-9990324
The testing was observed by	AMIT ARAZI

2.3. Test Performance:

Dates of testing	January 2015
Test Laboratory Location	Elbit Systems Land and C ⁴ I Ltd., EMC LAB, Hashoftim 26 Holon 58102 ISRAEL Tel: 972-3-5574476 Fax: 972-3-5575320
Applicable EMC Specification	Federal Communication Commission (FCC), FCC Part 15: Radio Frequency Devices, Sections 15.209, 15.207 & 15.247

3. TEST SUMMARY AND SIGNATURES.

Elbit Systems Land and C⁴I Ltd., EMC Laboratory has completed testing of E.U.T in accordance with the requirements of the FCC Part 15 Regulations for Class B equipment.

The E.U.T was found to comply with the requirements of the FCC Part 15 Regulations given below

Test	Test Description	Section	PASS/FAIL
1	6 dB Bandwidth	15.247 (a)(2), RSS-210 section A8.2(a)	PASS
2	Peak Output Power	15.247 (b)(3), RSS-210 section A8.4(4)	PASS
3	Conducted Spurious Emissions	15.247 (d), RSS-210 section A8.5	PASS
4	Radiation Spurious Emission	15.247 (d), RSS-210 section A8.5	PASS
5	Peak Power Density	15.247 (e), RSS-210 section A8.2(b)	PASS
6	Conducted Emission	15.247 (a), RSS-210 section 7.2.2	PASS
7	RF Exposure	15.247 (i), RSS-General section 5.5	PASS
8	Antenna Requirement	15.203, RSS-210 section 7.1.4	PASS

3.1. Test performed by:

I. Arbitman



3.2. Test Report prepared by:

M. Reuben



3.3. Test Report Approved by:

Mr. Samuel Cohen EMC Lab. Manager



4. E.U.T INFORMATION

4.1. E.U.T description

WipAir 8000 5X is WaveIP's wireless point-to-point and point to multi point broadband wireless communication system. The system uses dual or single radio channels, (defined by software) in the 5GHz bands, utilizing 5, 10, 20, 40 MHz channels, OFDM modulation, and TDD Spectrum Management.

The total conducted output power is up to 1Watt (sum of both channels), with dynamic range of ~ 45 dB.

WipAir_8000 uses two RF ports (MIMO), hence WipAir 8000 5X was tested.

Antennas used during tests:

Type	MFG	MODLE	GAIN
Flat panel, dual polarization, integrated	WaveIP	MT-485048/CVH/A	23
Dish dual polarization, detached	WaveIP	DP-5X-285D-005	28.5

EUT Technical characteristics

Transmitter characteristics		Notes
Assigned frequency	5725-5850MHZ	
Operating Frequency range	5730-5845MHZ	5MHz Channel
	5735-5840MHZ	10MHz Channel
	5735-5840MHZ	20MHz Channel
	5745-5830MHZ	40MHz Channel
Antenna Ports	TNC	For detached option only
Modulations type	BPSK, QPSK, 16QAM, 64QAM	
Multiplexing type	OFDM	
Modulating Test Signal	PRBS 100% Duty Cycle	

4.2. E.U.T Test Configuration

E.U T. test configuration is shown in figure below:

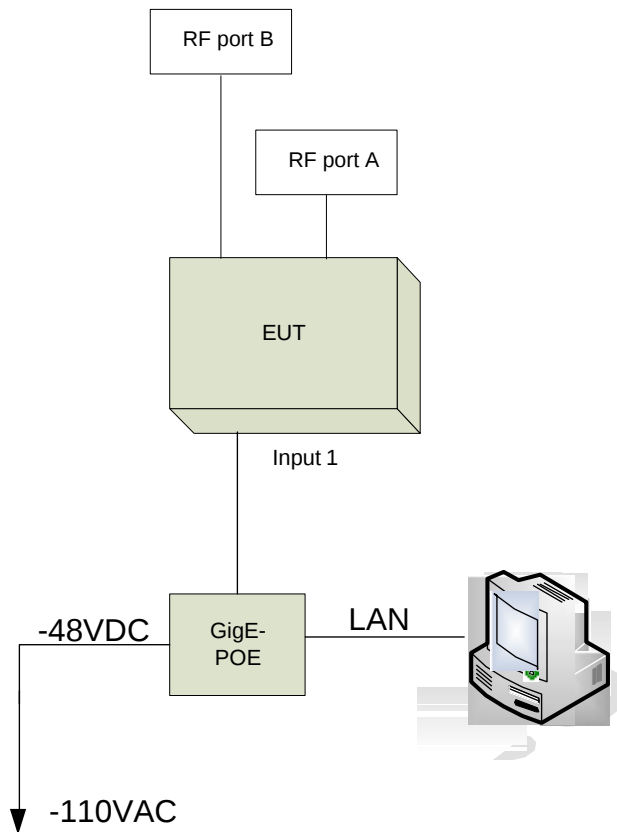


Figure 1: EUT Test Configuration

5. OCCUPIED BANDWIDTH

Equipment Under Test	WipAir 8000 5X
Test Method	FCC New Guidance on Measurements for DTS in section 15.247(a) (2).
Date	01.01.2015
Relative Humidity	40%
Ambient Temperature	25 ⁰ C
Air Pressure	1010 hPa
Test Setup	Figure 2

Testing Engineer: I. Arbitman 

Date 01.01.2015

5.1. Test Results Summary & Conclusions

The E.U.T was found in compliance with Bandwidth of the emission fundamental frequency requirement.

5.2. Limits of bandwidth

The test unit shall meet the limits of Table 1

Table 1: Bandwidth Limits

Assigned Frequency (MHz)	Modulation Envelope Reference Points* (dBc)	Minimum Bandwidth Limits (kHz)
902.0 – 928.0	6.0	500.0
2400.0 – 2483.5		
5725.0 – 5850.0		

*: Attenuation below the peak of modulated carrier.

5.3. Test Instrumentation and Equipment

Table 2: Test Instrumentation and Equipment

Item	Model	Manufacturer	P/N	Next Date of Calibration
Spectrum Analyzer	N9020A	Agilent	20041738908	04.04.2015
20 dB Attenuator	8343-206	TENULINE		13.03.2016

5.4. Procedure

The EUT was set to transmit at 100% duty cycle, at highest transmitting power.

Occupied bandwidth measurements were performed for top, middle and bottom frequencies, for each channel, BW 5, 10, 20 and 40 MHz.

The EUT was connected to the spectrum analyzer through an appropriate attenuator and accounted for cable loss in the settings

The automatic 99% bandwidth measurement capability of a spectrum analyzer was employed.

Each port was measured separately at RBW 100 kHz and VBW>RBW

5.5. Test Setup

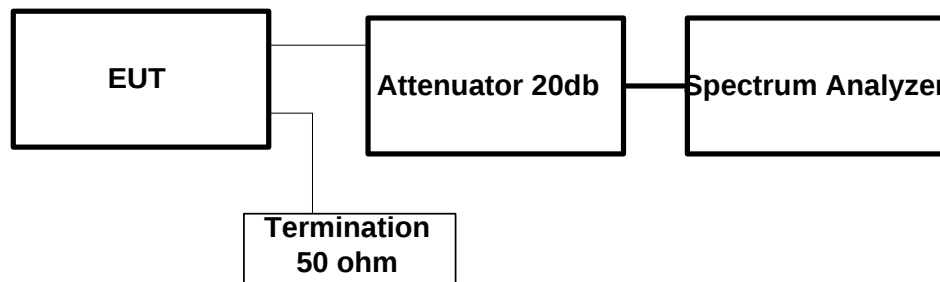


Figure 2: Measurement test setup

5.6. Results for Port A

Table 3: 5 MHz Bandwidth Test Result

Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5730	4.4795	0.5	1	Pass
Middle - 5785	4.4875	0.5	2	Pass
High - 5845	4.4847	0.5	3	Pass

Table 4: 10 MHz Bandwidth Test Result

Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5735	8.7596	0.5	4	Pass
Middle - 5785	8.7868	0.5	5	Pass
High - 5845	8.7777	0.5	6	Pass

Table 5: 20 MHz Bandwidth Test Result

Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5735	17.618	0.5	7	Pass
Middle - 5785	17.656	0.5	8	Pass
High - 5840	17.647	0.5	9	Pass

Table 6: 40 MHz Bandwidth Test Result

Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5745	36.213	0.5	10	Pass
Middle - 5785	36.077	0.5	11	Pass
High - 5830	36.124	0.5	12	Pass

5.7. Results for Port B

Table 7: 5 MHz Bandwidth Test Result

Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5730	4.4975	0.5	13	Pass
Middle - 5785	4.4901	0.5	14	Pass
High - 5845	4.4860	0.5	15	Pass

Table 8: 10 MHz Bandwidth Test Result

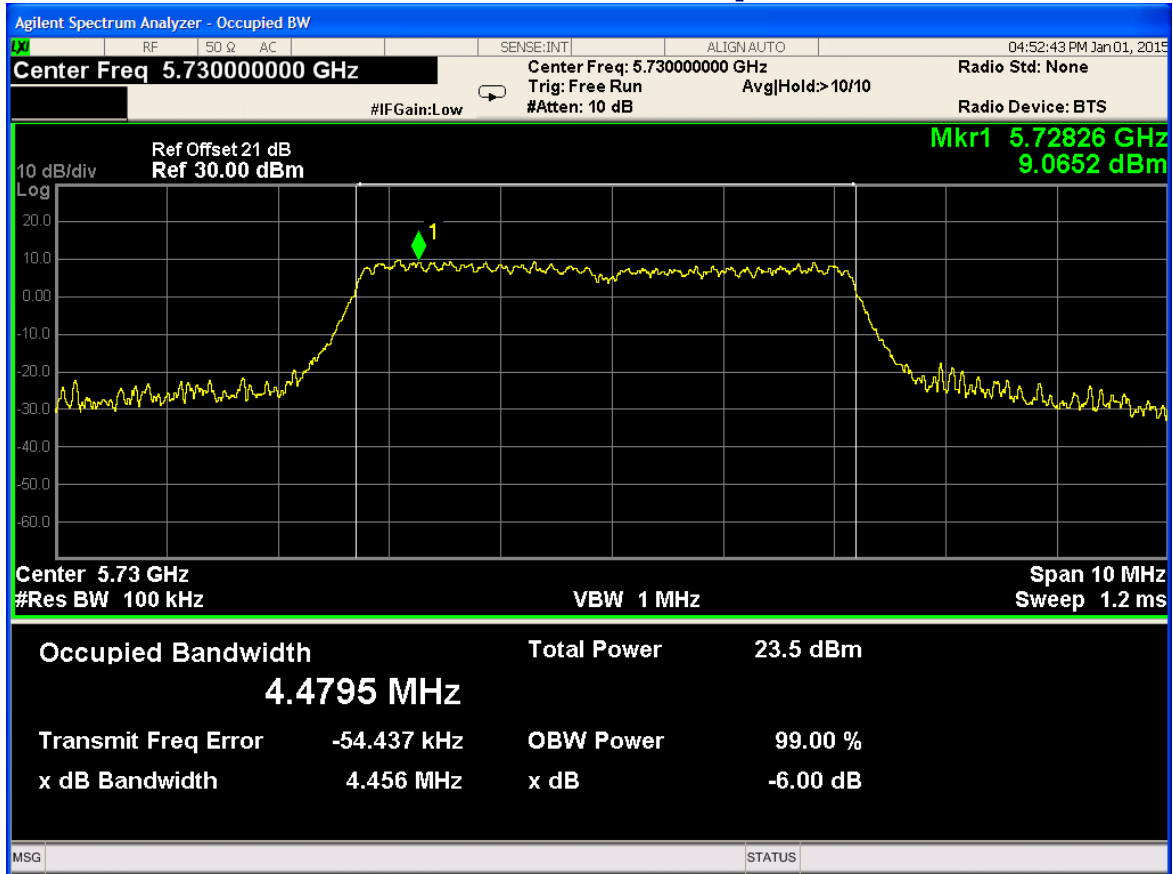
Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5735	8.7832	0.5	16	Pass
Middle - 5785	8.7654	0.5	17	Pass
High - 5840	8.7958	0.5	18	Pass

Table 9: 20 MHz Bandwidth Test Result

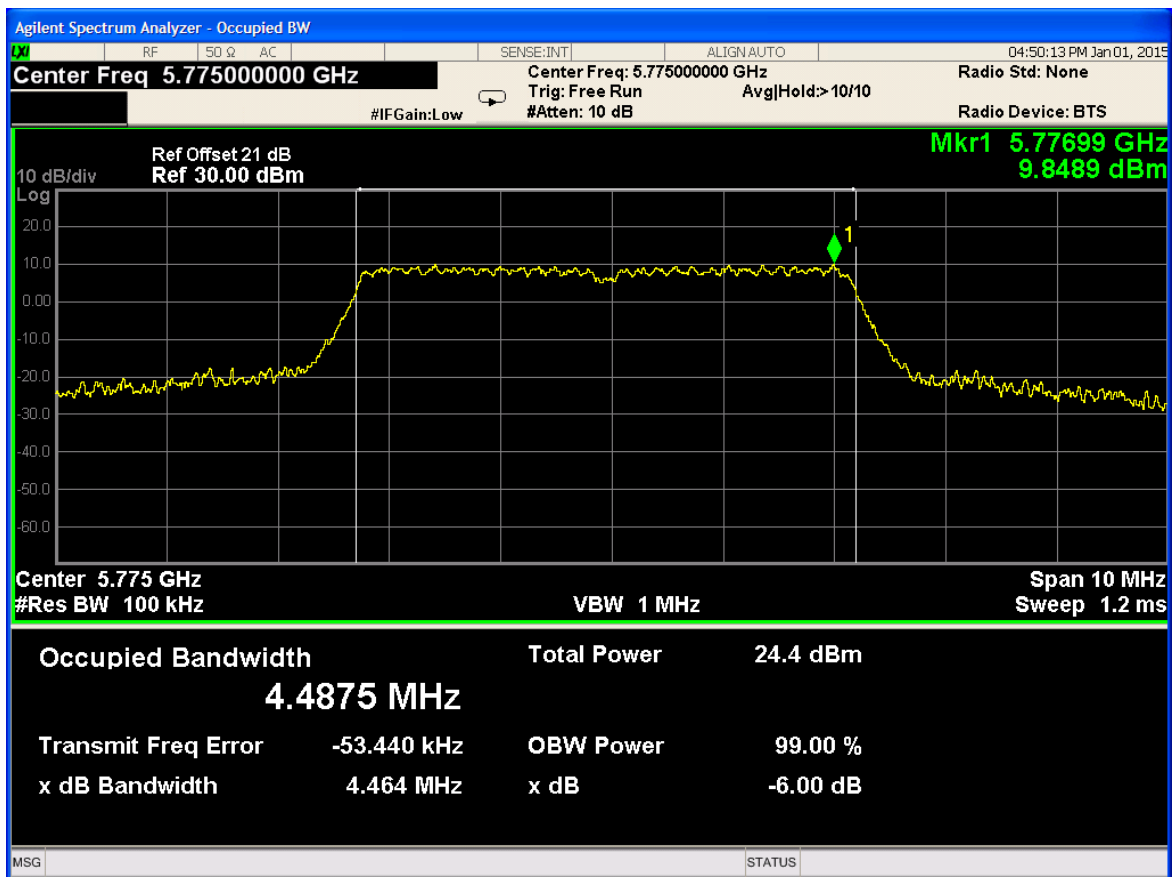
Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5735	17.655	0.5	19	Pass
Middle - 5785	17.664	0.5	20	Pass
High - 5840	17.659	0.5	21	Pass

Table 10: 40 MHz Bandwidth Test Result

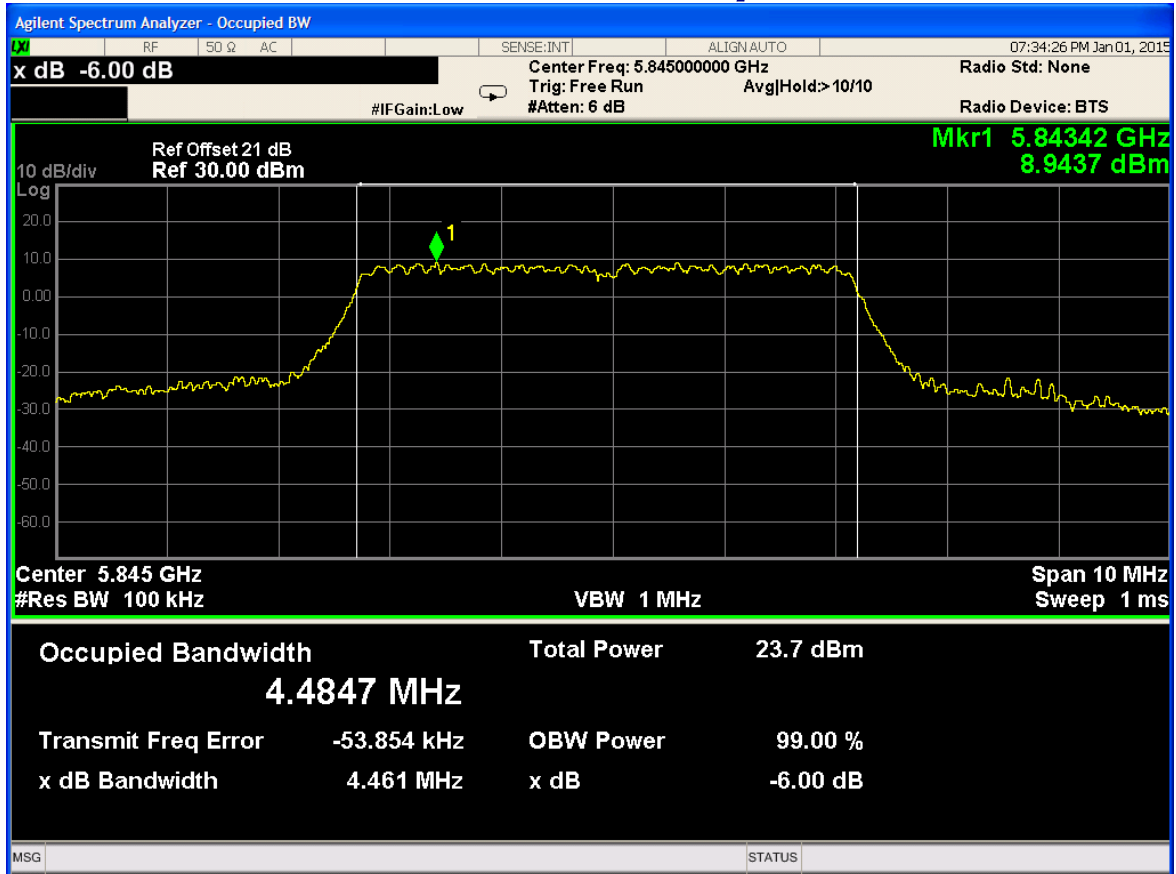
Frequency (MHz)	Bandwidth (MHz)	Limits (MHz)	Plot No	PASS/FAIL
Low - 5745	36.114	0.5	22	Pass
Middle - 5785	36.150	0.5	23	Pass
High - 5830	36.155	0.5	24	Pass



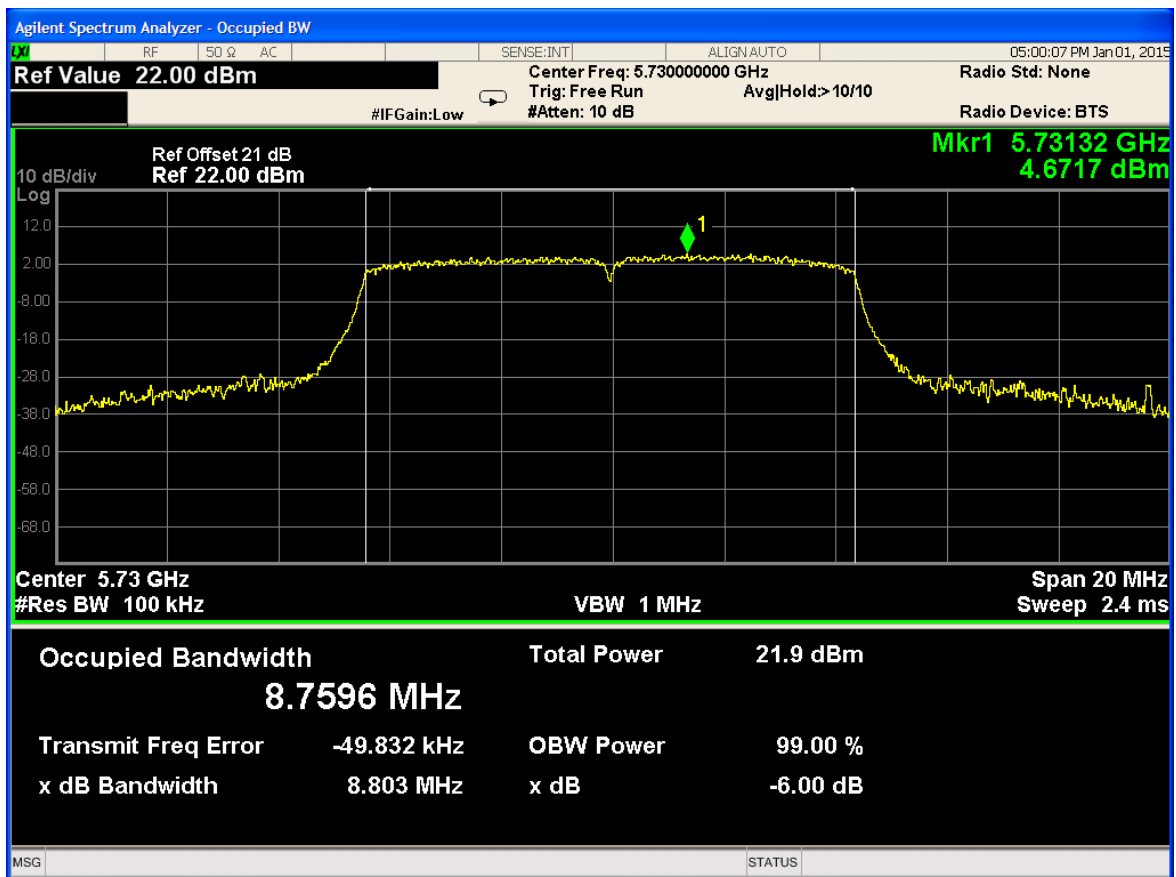
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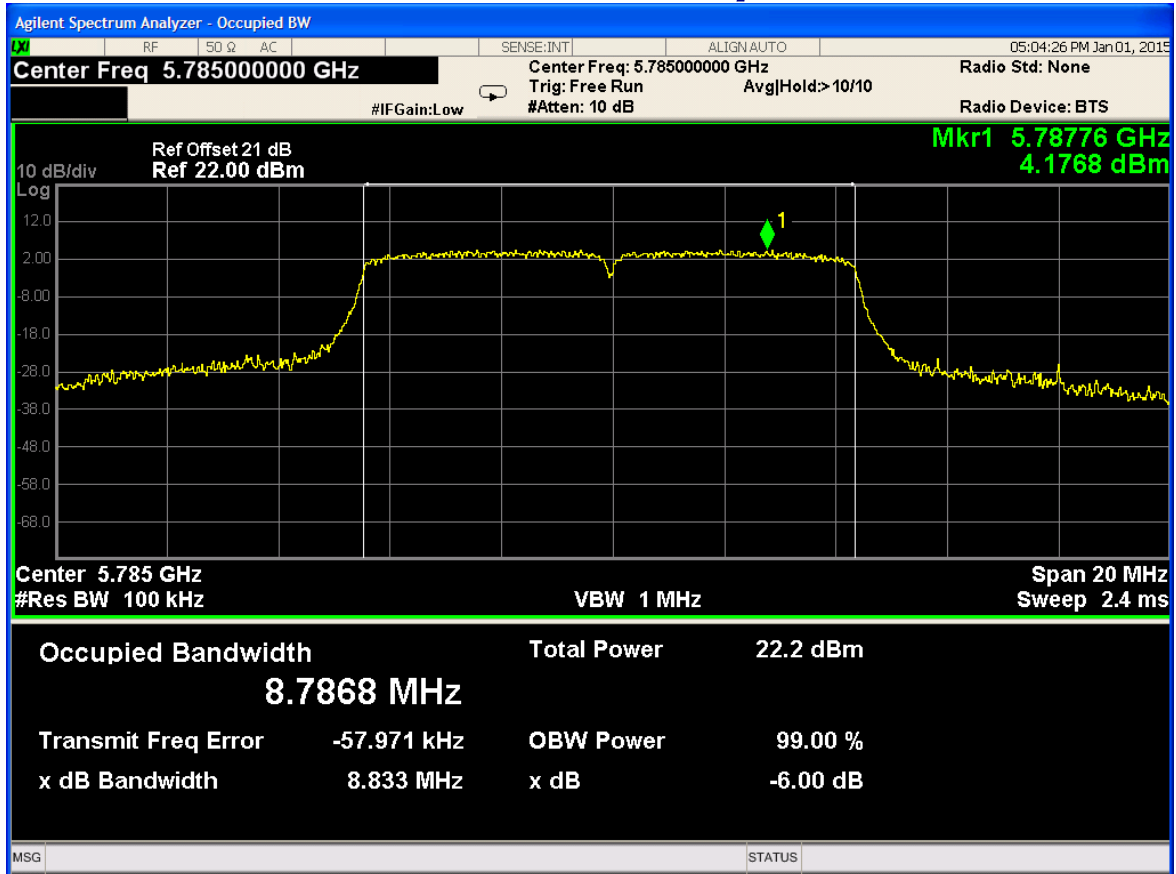
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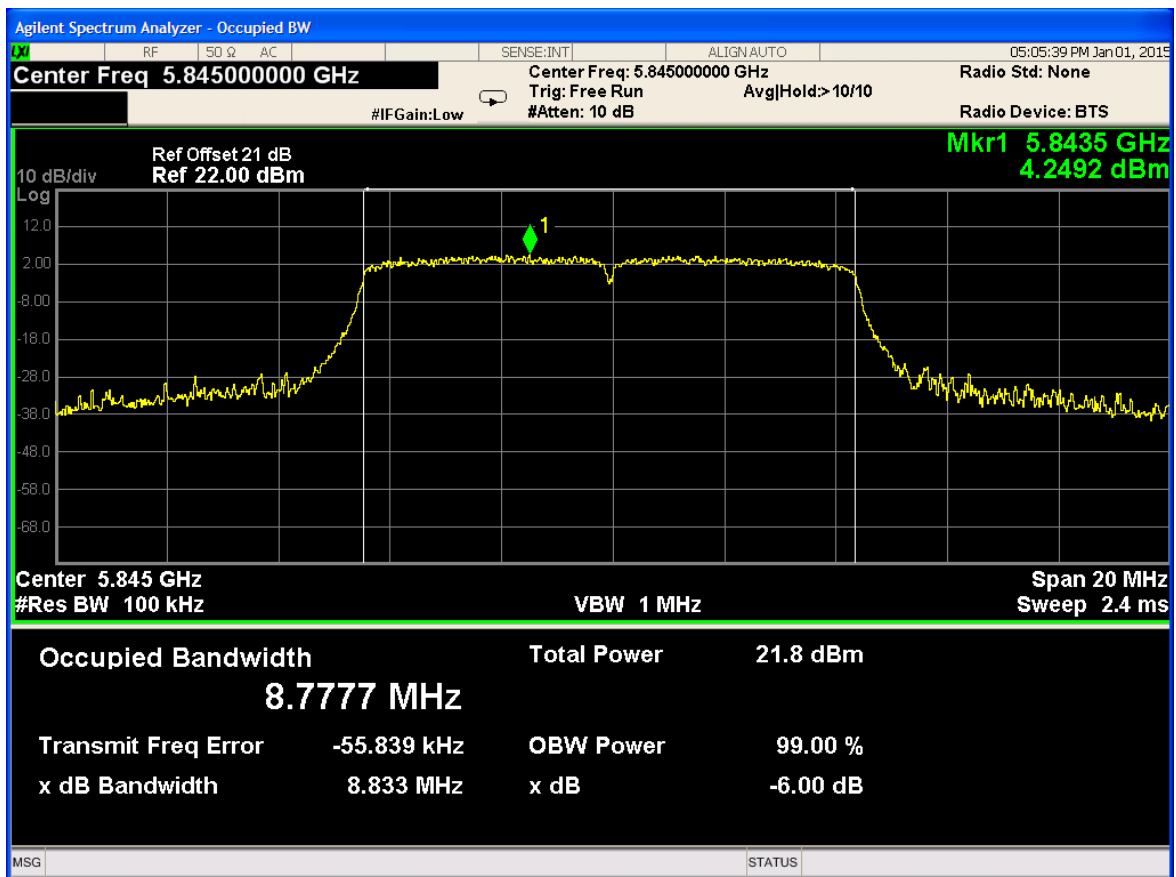
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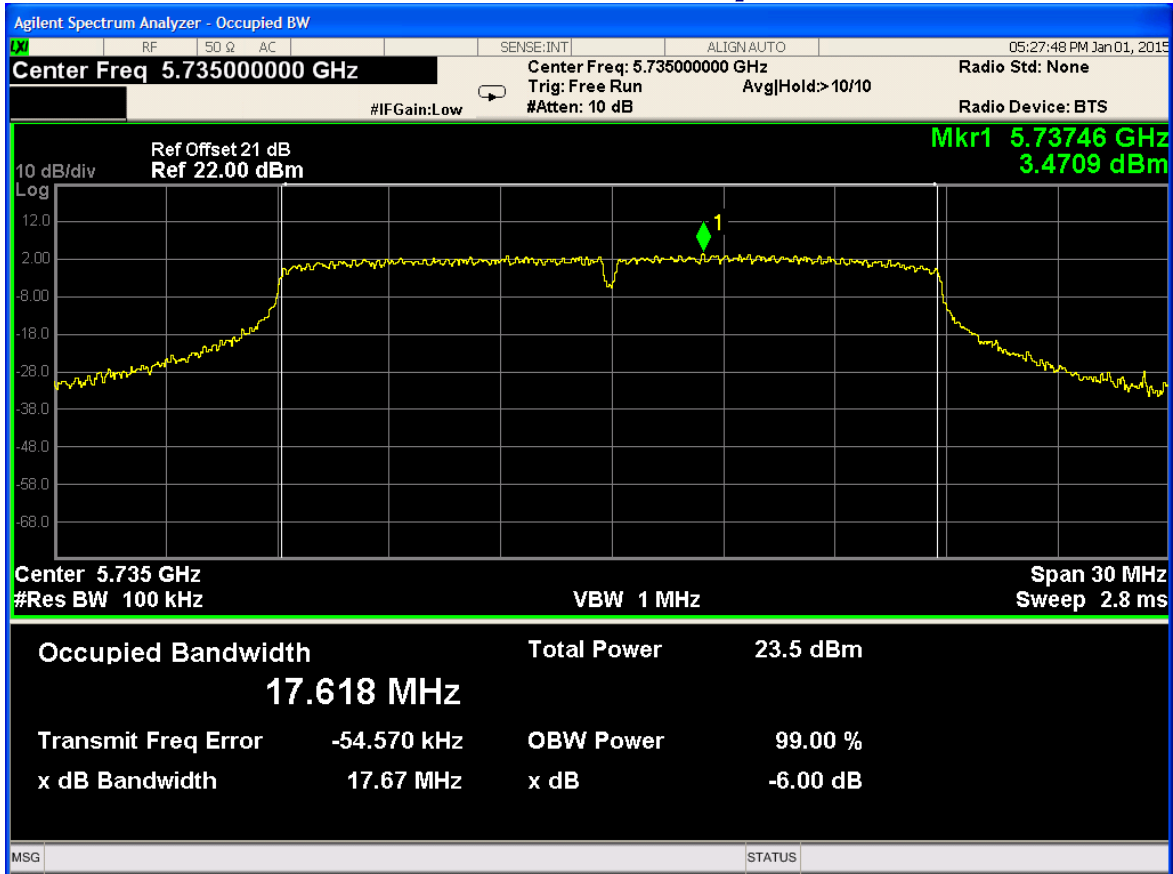
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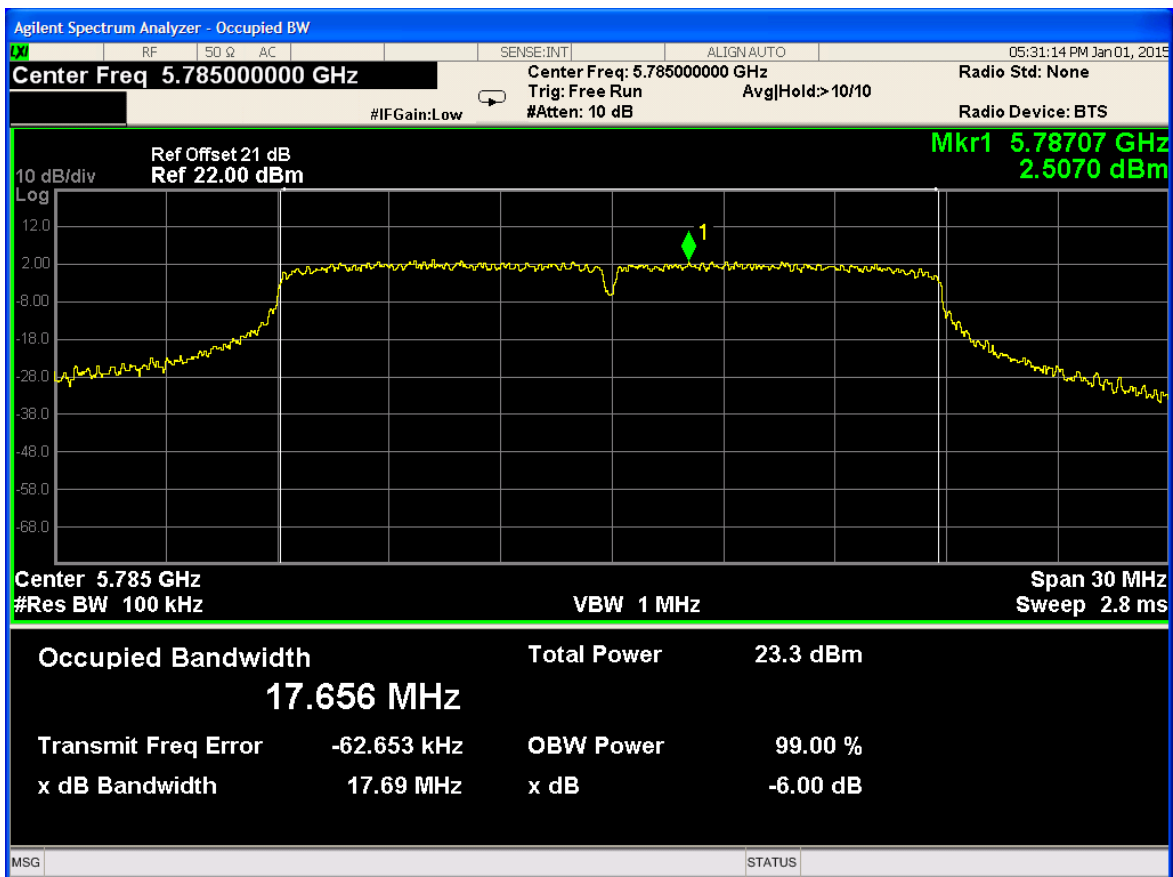
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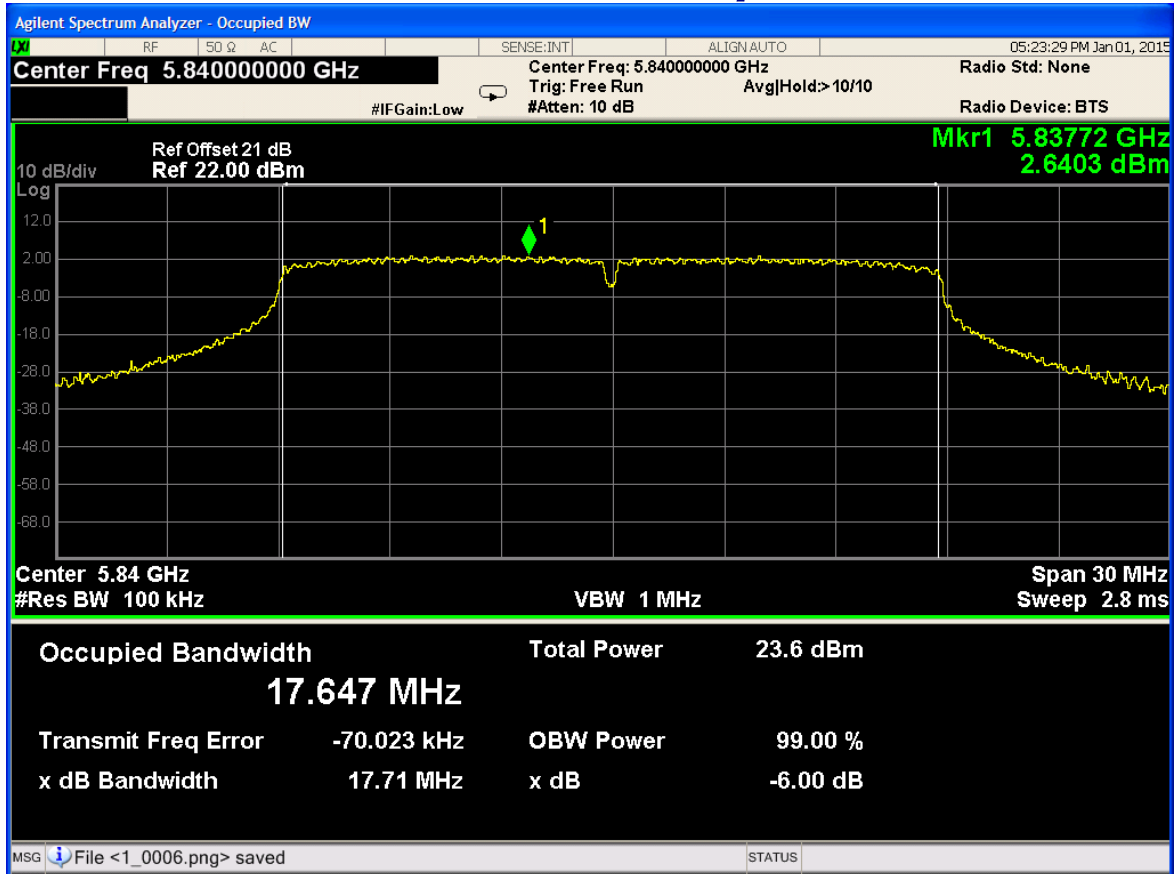
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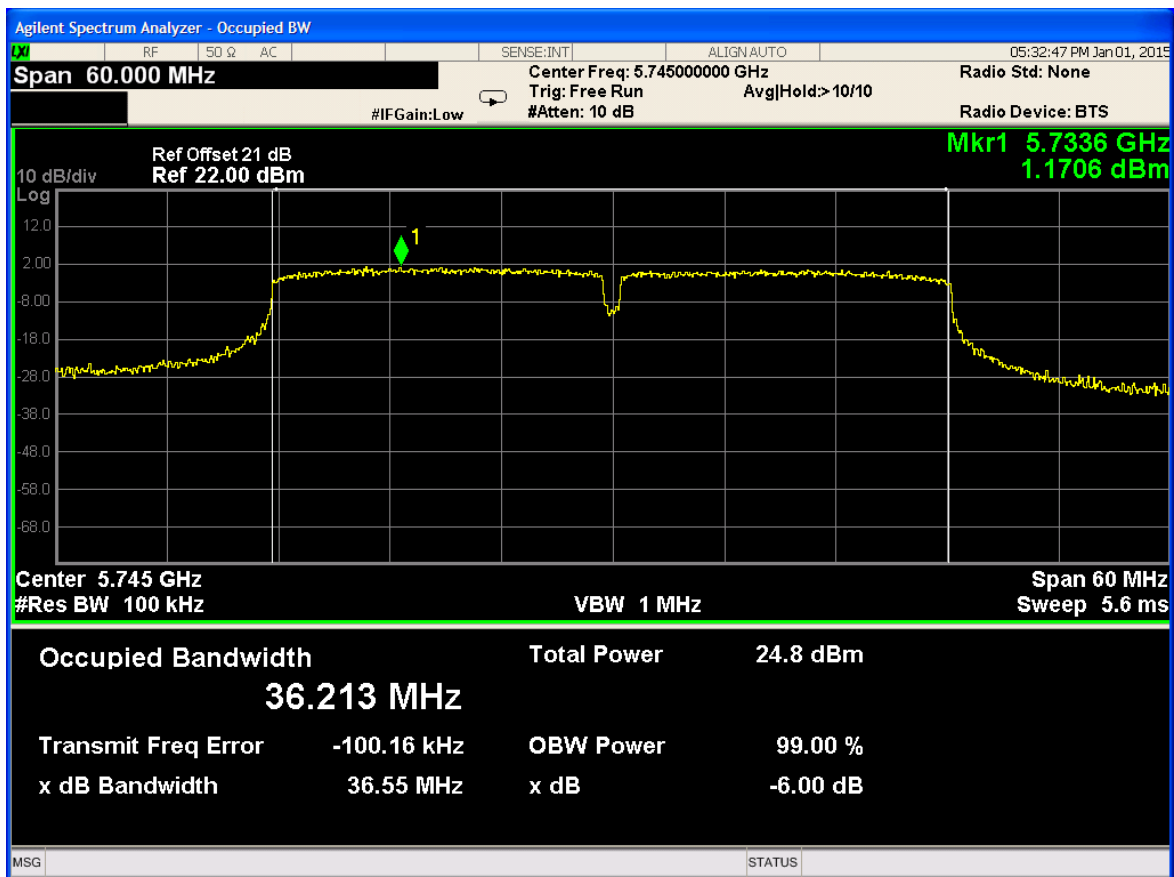
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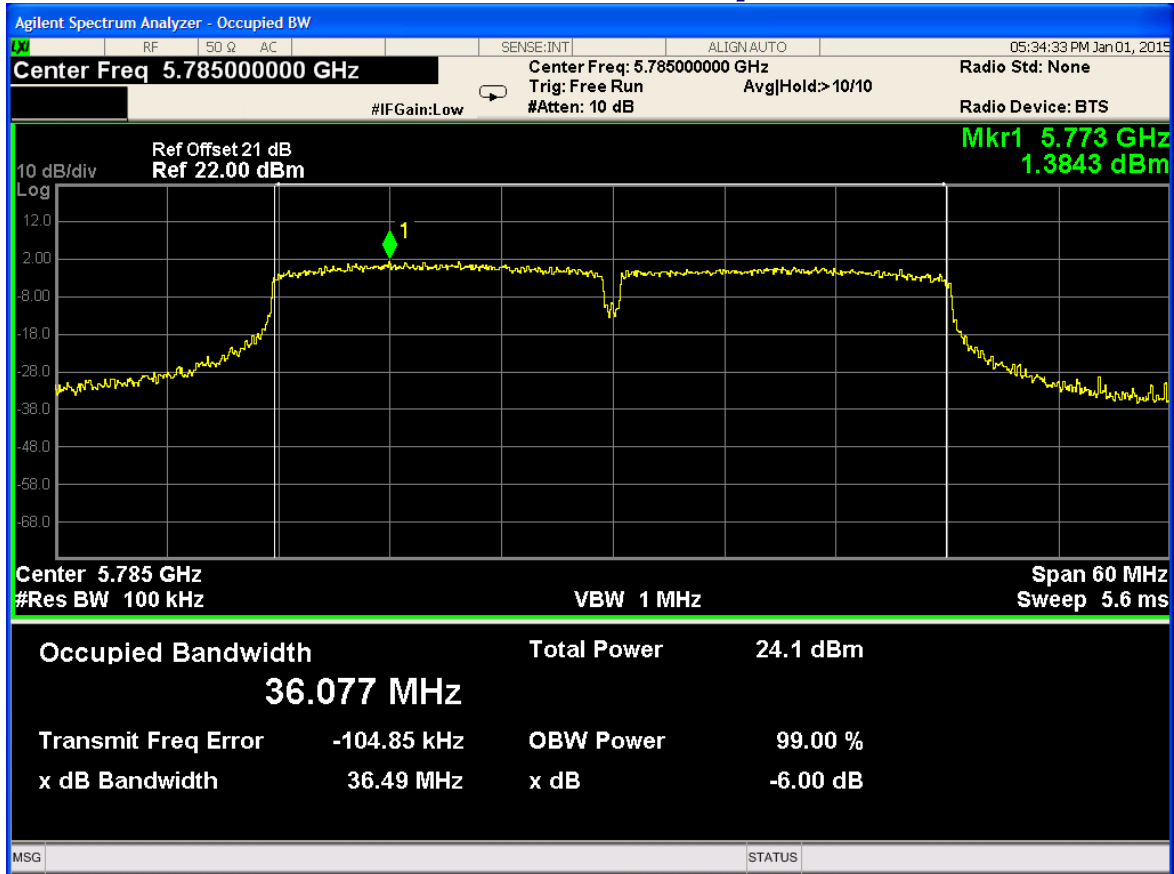
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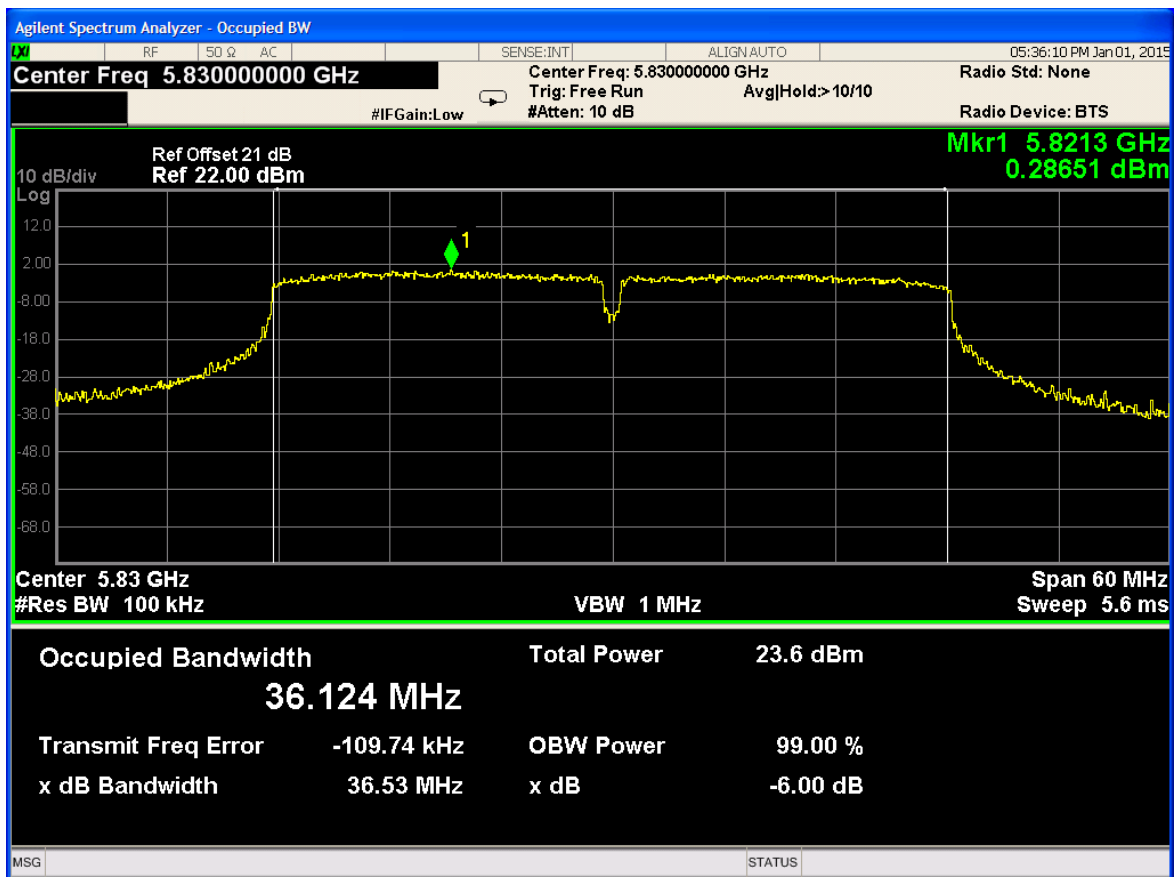
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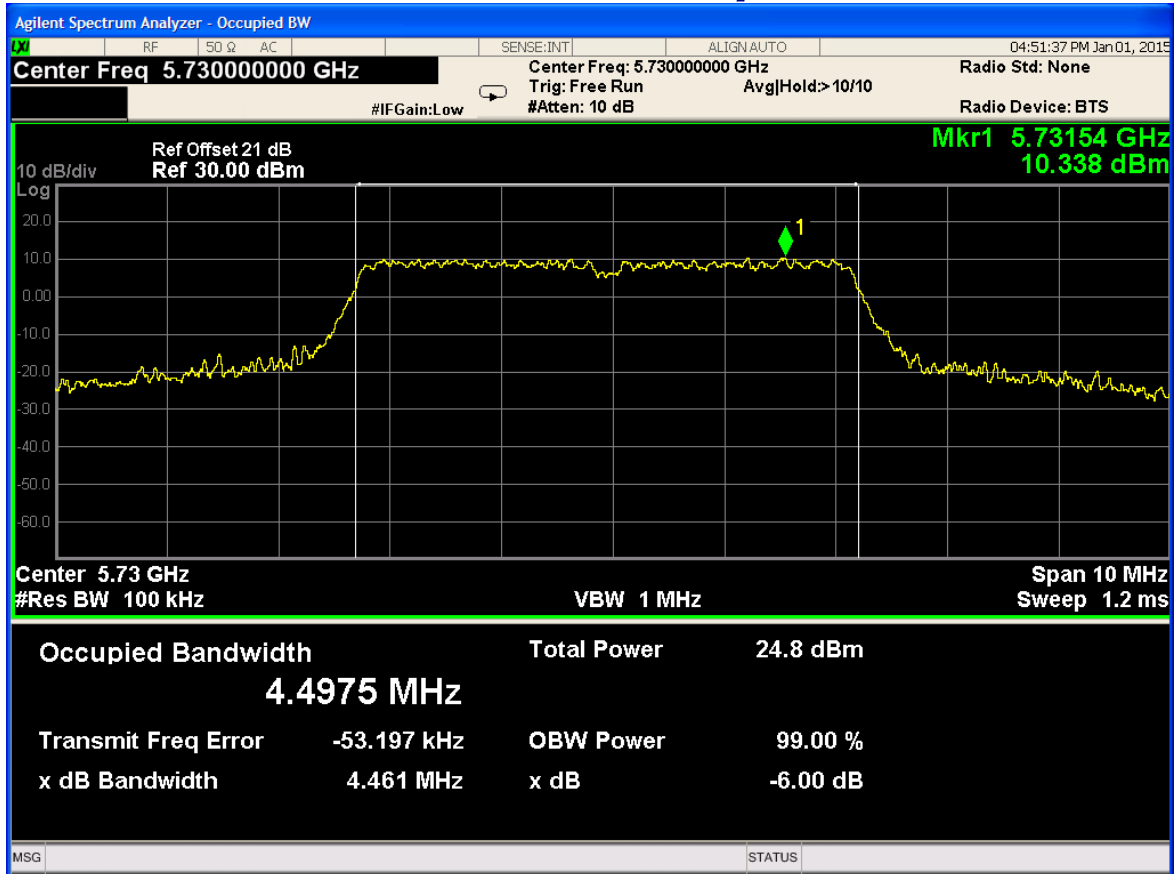
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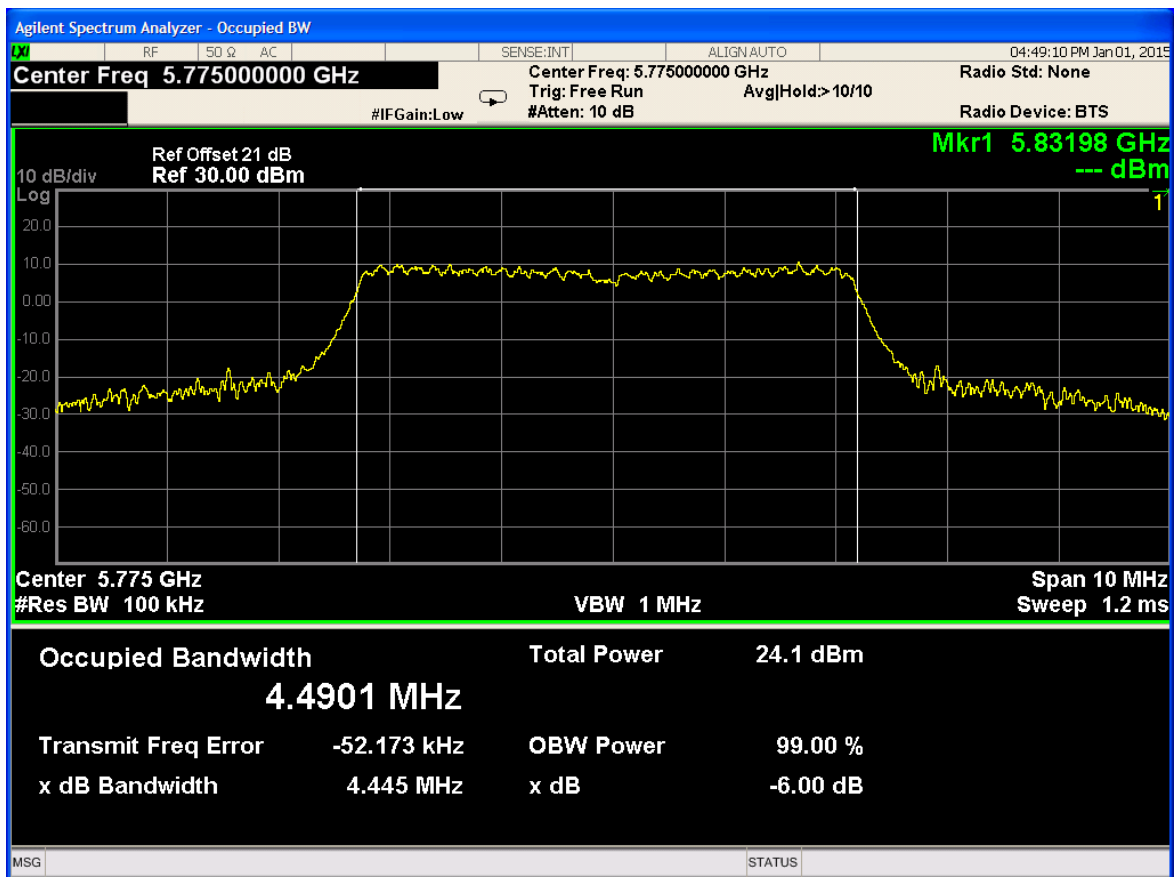
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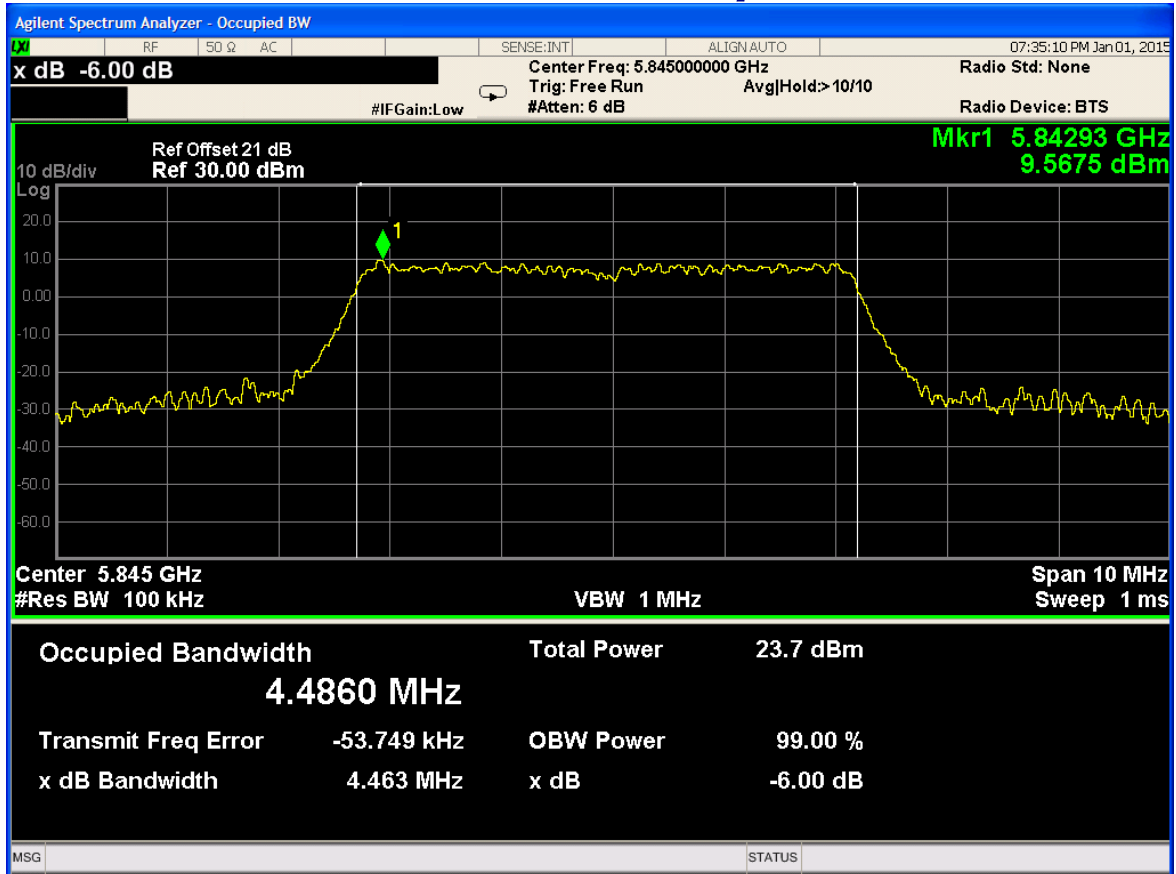
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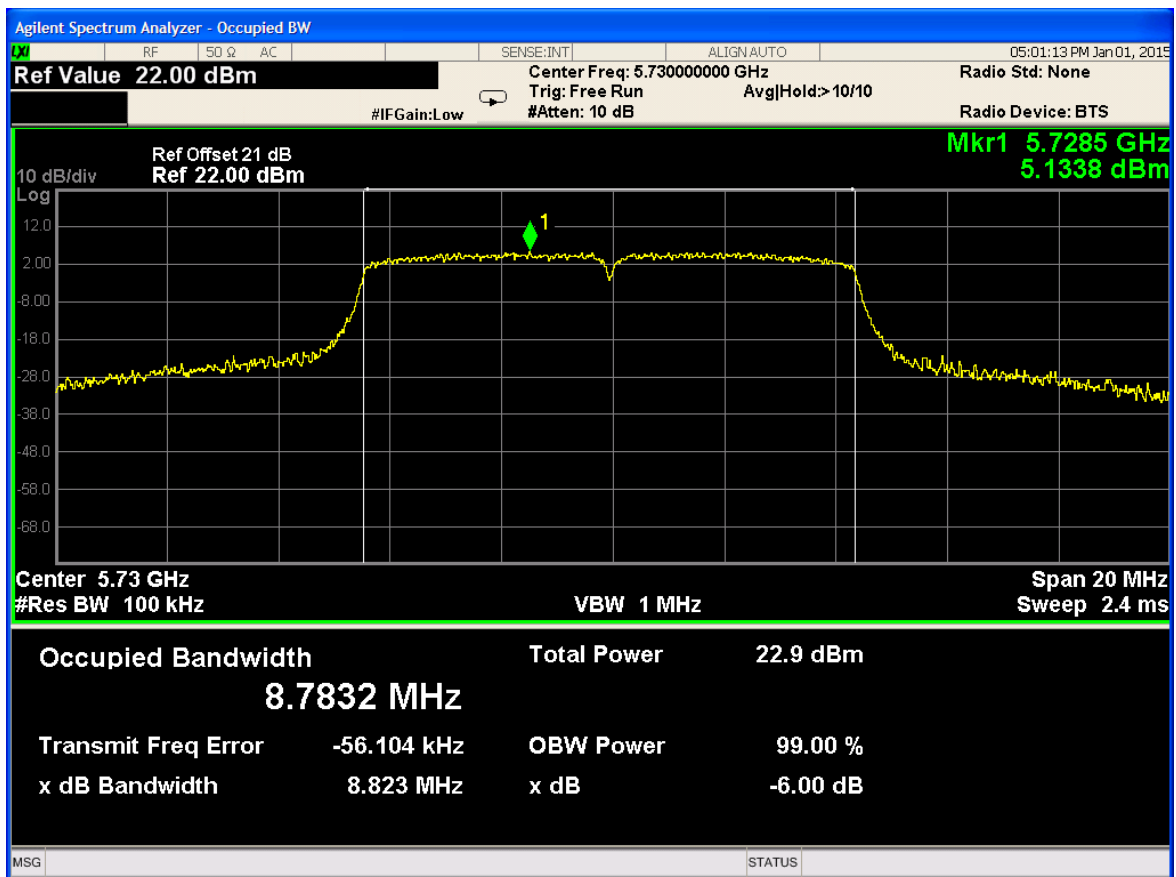
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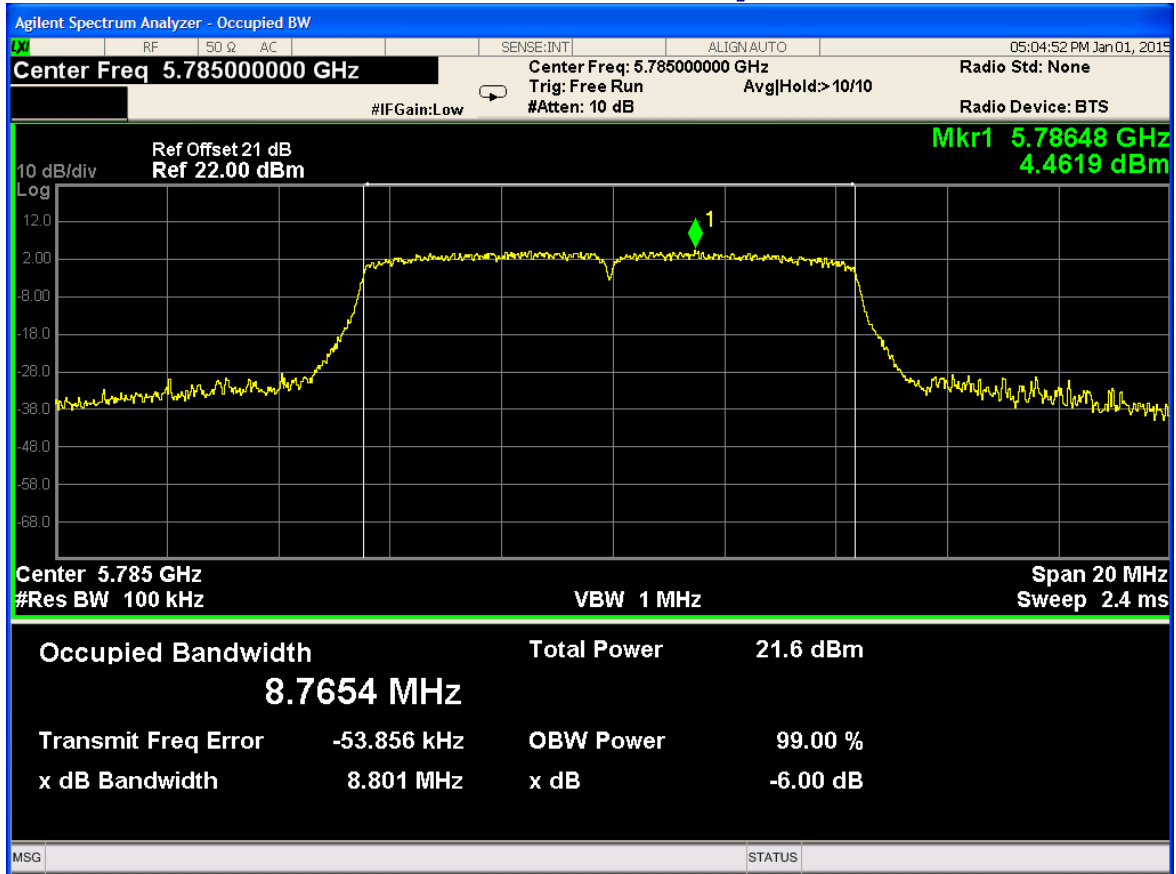
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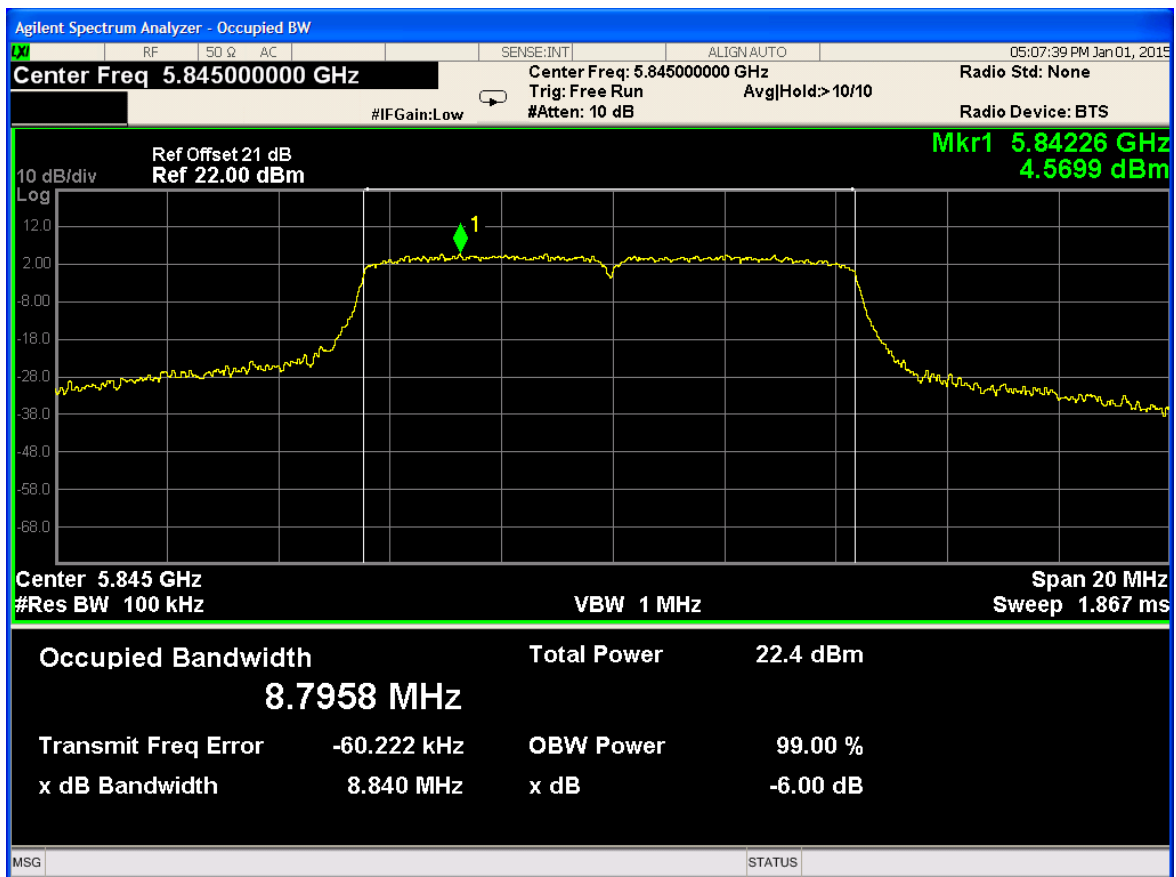
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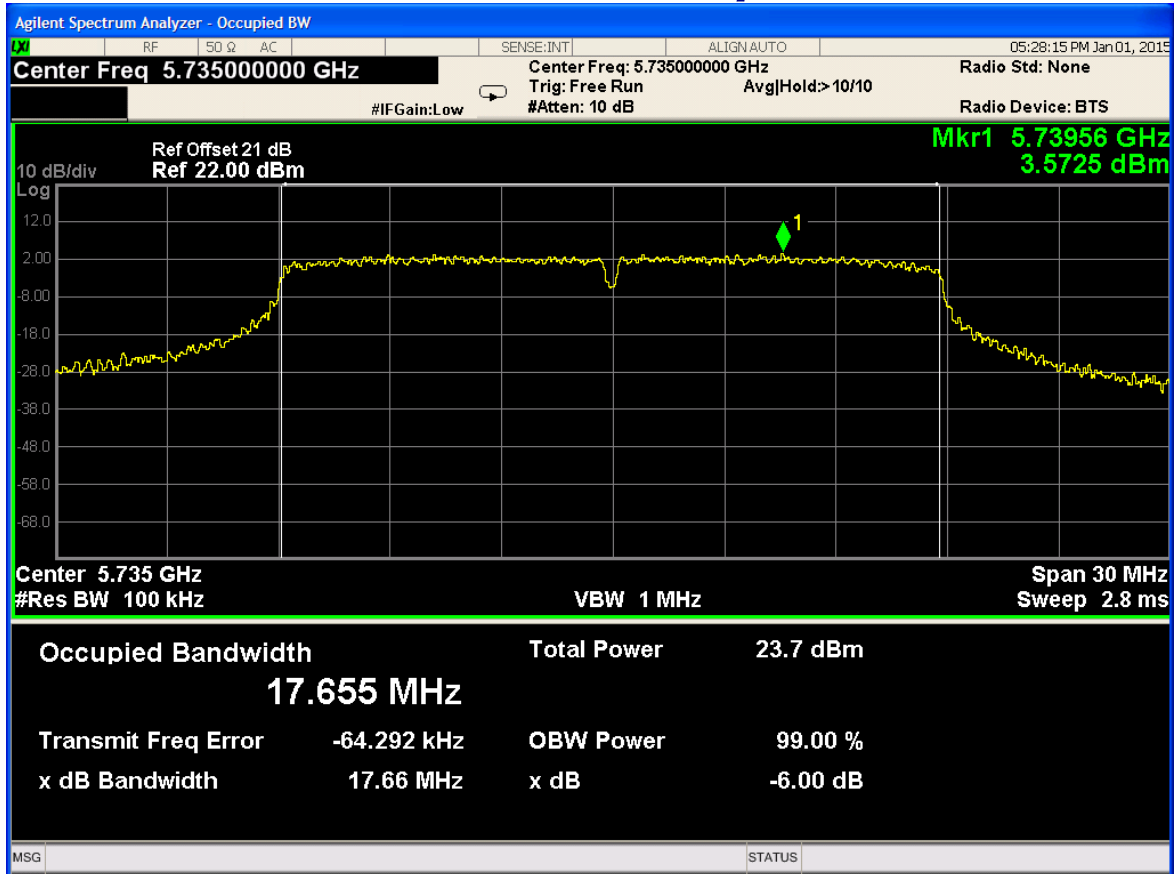
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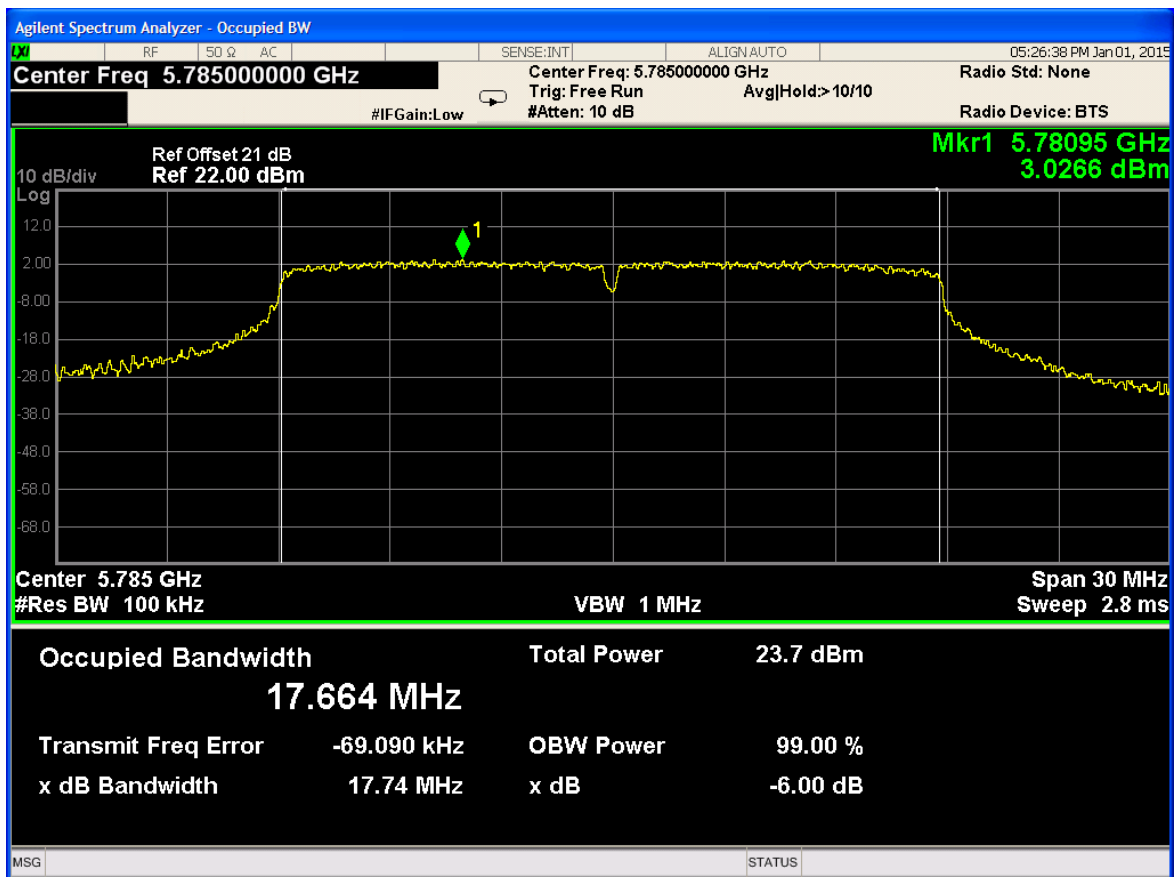
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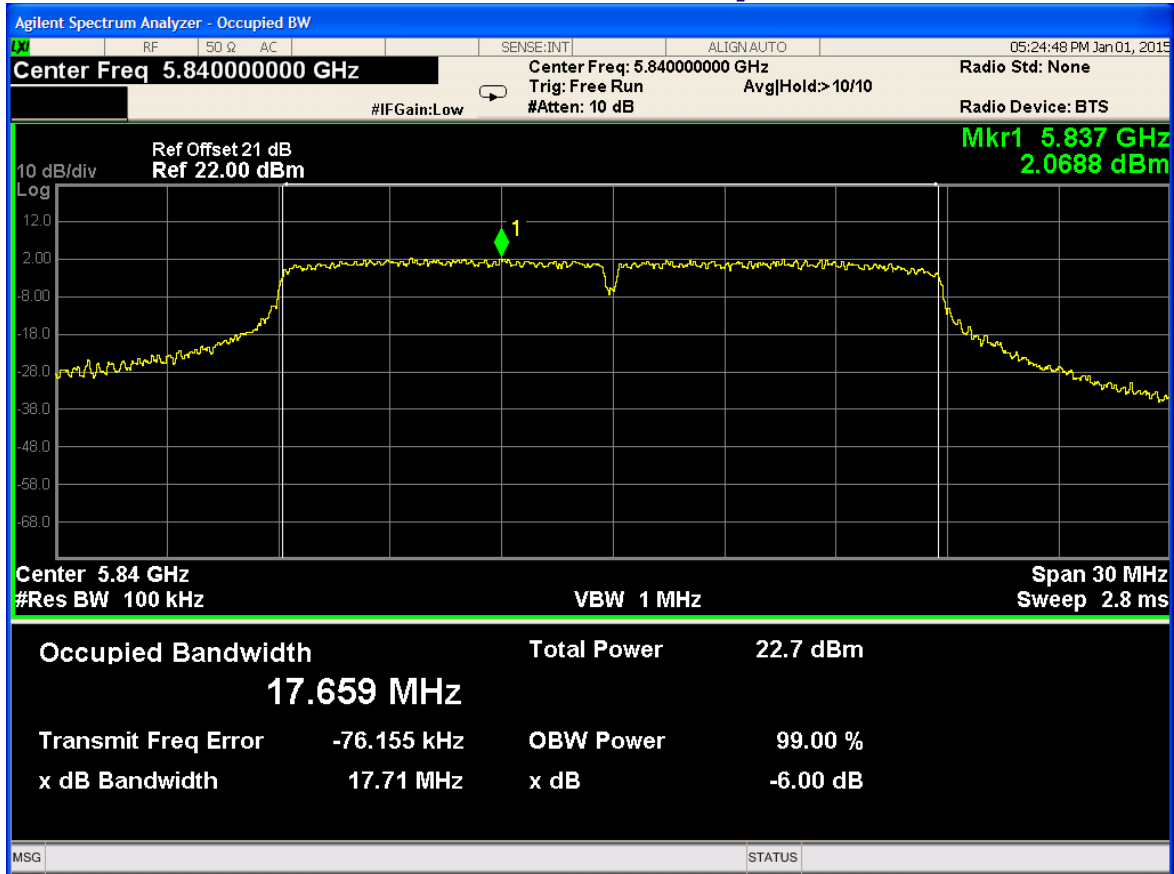
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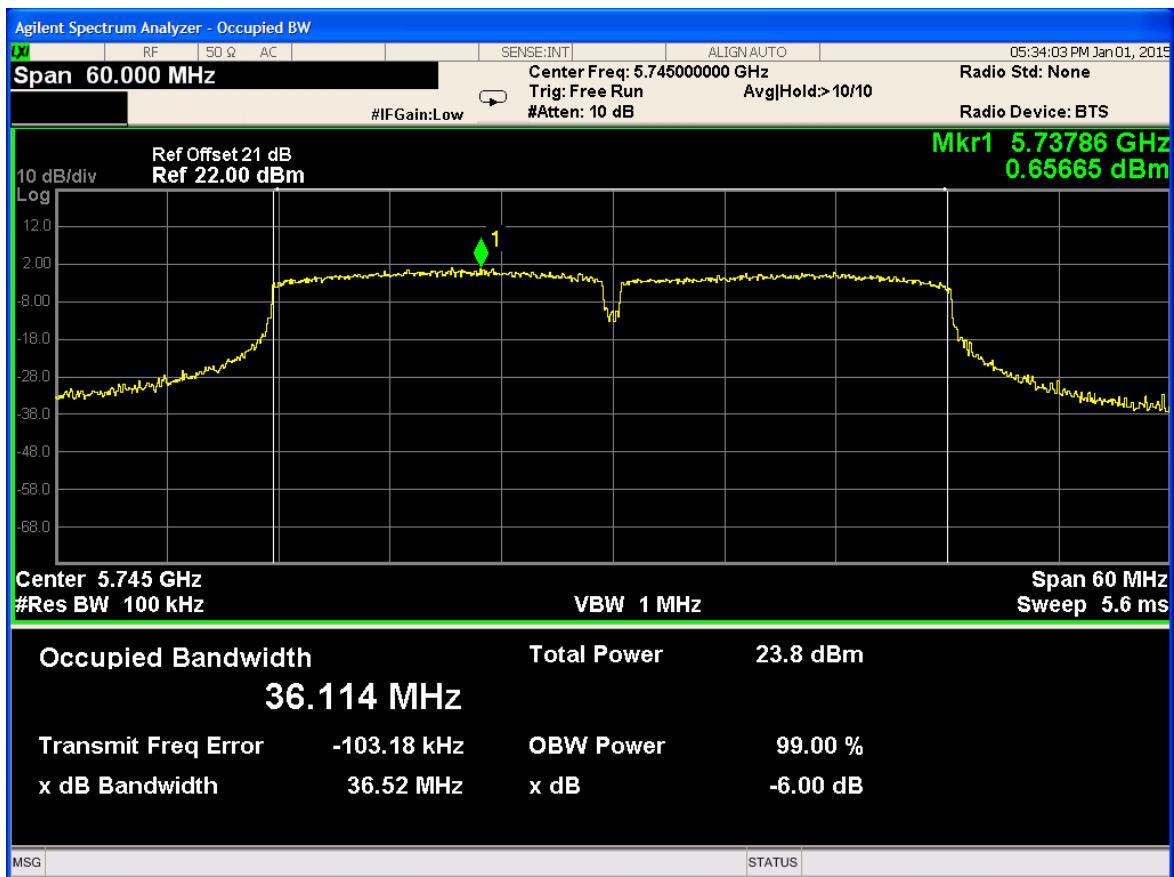
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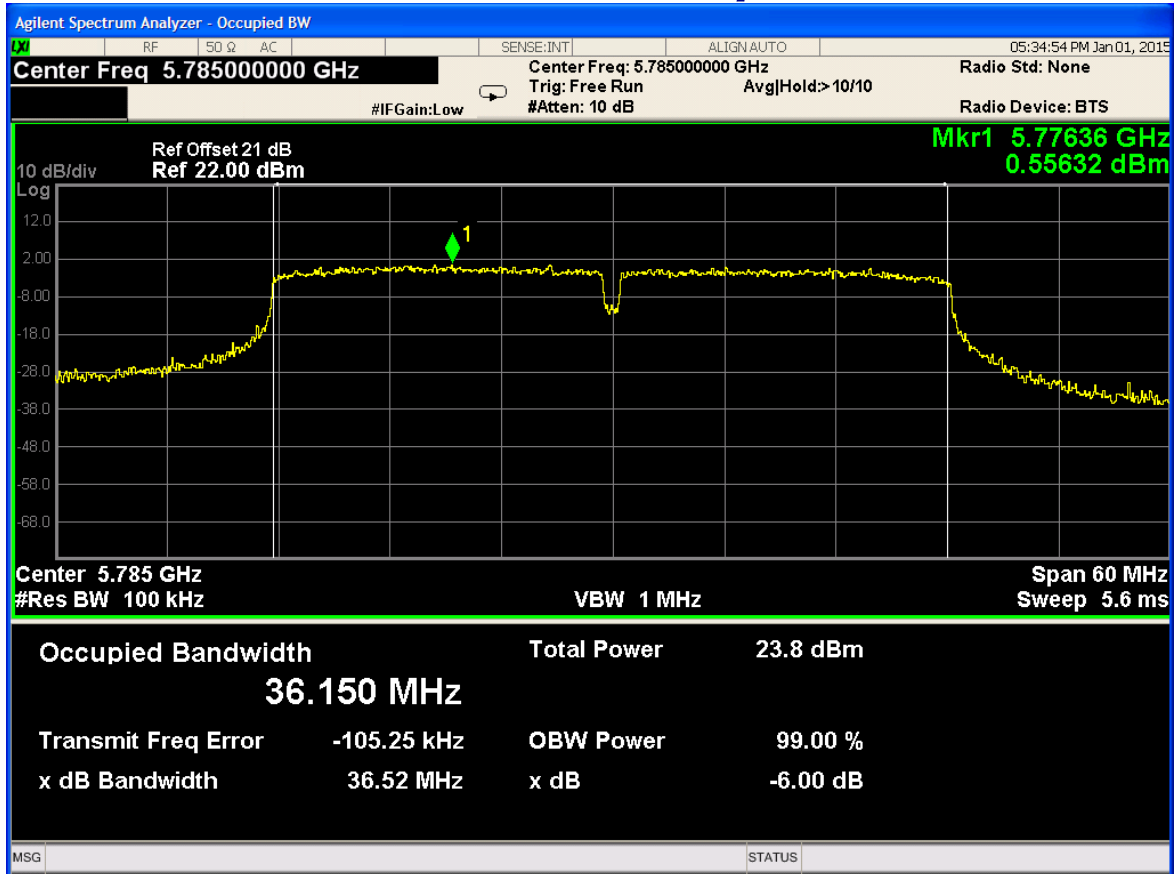
Plot Occupied BW 6dB/ 20



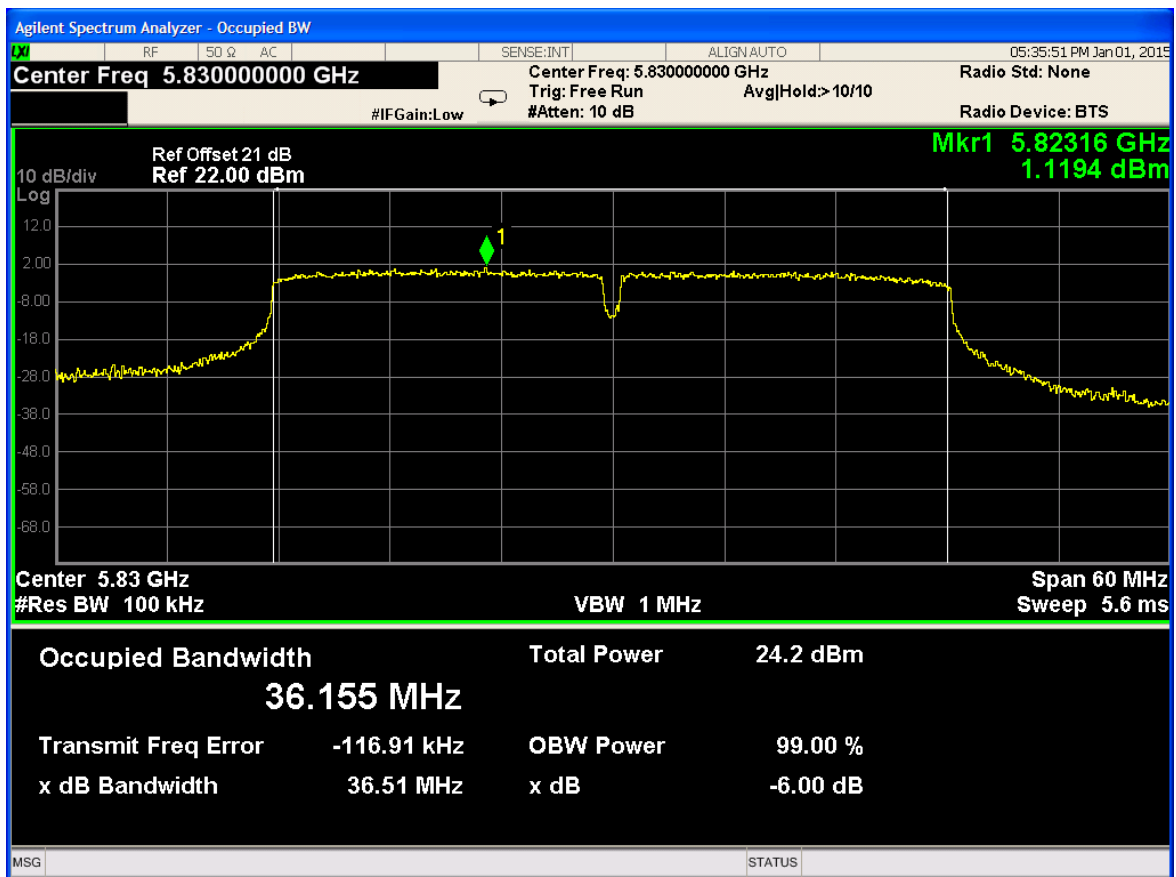
Plot Occupied BW 6dB/ 21



Plot Occupied BW 6dB/ 22



Plot Occupied BW 6dB/ 23



Plot Occupied BW 6dB/ 24

6. PEAK OUTPUT POWER

Equipment Under Test	WipAir 8000 5X
Test Method	FCC New Guidance on Measurements for DTS in section 15.247(b), Option 2, Method #3.
Date	02.01.2015
Relative Humidity	40%
Ambient Temperature	25 ⁰ C
Air Pressure	1010 hPa
Test Setup	Figure 2

Testing Engineer: I. Arbitman 

Date 02.01.2015

6.1. Test Results Summary & Conclusions

The E.U.T was found in compliance with Peak Output Power requirements

6.2. Limits of Peak Output Power according to 15.247 (b)

The test unit shall meet the limits of Table 11.

Table 11: Limits for Fundamental

Assigned Frequency (MHz)	Modulation Envelope Reference Points* (dBi)	Peak Output Power	
		W	dBm
902.0 – 928.0	6.0	1.0	30.0
2400.0 – 2483.5			
5725.0 – 5850.0			

*: If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the .stated value as follows:

- By 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point to point transmitters operate in 2400 – 2483.5 MHz band.
- Without any corresponding reduction for fixed-point-to-point transmitters operate in 5725 – 5850 MHz band;
- By the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

6.3. Test Instrumentation and Equipment

Table 12: Test Instrumentation and Equipment

Item	Model	Manufacturer	P/N	Next Date of Calibration
Spectrum Analyzer	N9020A	Agilent	20041738908	04.04.2015
20 dB Attenuator	8343-206	TENULINE		13.03.2016

6.4. Test Procedure

The EUT was set to transmit at 100% duty cycle, at highest transmitting power.

Power measurements were performed for top, middle and bottom frequencies, for each channel, BW 5, 10, 20 and 40 MHz

The EUT was connected to the spectrum analyzer through an appropriate attenuator and accounted for cable loss in the settings.

Note: The 20dB attenuator has been considered in the measurements results.

The automatic Peak Power measurement capability of a spectrum analyzer was employed.

Each port was measured separately at RBW 1 MHz and VBW $\geq$ RBW.

Total output power was calculated as a sum of 'Peak output power Channel A + Peak output power Channel B

6.5. Test Setup

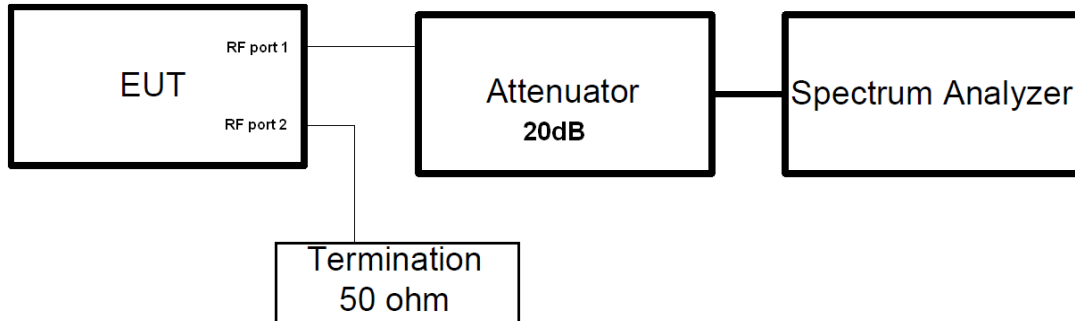


Figure 3: Field strength of fundamental test setup

6.6. Results for Port A

Table 13: 5 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5730	25.6	4.4	30	1	Pass
Middle - 5785	26.4	3.6	30	2	Pass
High - 5845	25.5	4.5	30	3	Pass

Table 14: 10 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5735	26.1	3.9	30	4	Pass
Middle - 5785	26.2	3.8	30	5	Pass
High - 5845	26.2	3.8	30	6	Pass

Table 15: 20 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5735	24.9	5.1	30	7	Pass
Middle - 5785	25.2	4.8	30	8	Pass
High - 5840	24.7	5.3	30	9	Pass

Table 16: 40 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5745	25.6	4.4	30	10	Pass
Middle - 5785	25.8	4.2	30	11	Pass
High - 5830	26.0	4.0	30	12	Pass

6.7. Results for Port B

Table 17: 5 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5730	26.9	3.1	30	13	Pass
Middle - 5785	26.3	3.7	30	14	Pass
High - 5845	25.6	4.4	30	15	Pass

Table 18: 10 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5735	26.6	3.4	30	16	Pass
Middle - 5785	26.6	3.4	30	17	Pass
High - 5840	25.7	4.3	30	18	Pass

Table 19: 20 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5735	24.9	5.1	30	19	Pass
Middle - 5785	24.8	5.2	30	20	Pass
High - 5840	24.7	5.3	30	21	Pass

Table 20: 40 MHz Bandwidth Test Result

Frequency (MHz)	Measured Peak Output Power (dBm)	Margin (dBm)	Limit (dBm)	Plot No	PASS/FAIL
Low - 5745	26.2	3.8	30	22	Pass
Middle - 5785	26.5	3.5	30	23	Pass
High - 5830	25.6	4.4	30	24	Pass

6.8. Calculated Results for Both Ports

Table 21: 5 MHz BW Test Results

Frequency (MHz)	Peak Output Power (dBm)		Calculated Peak Output Power (dBm)	Limit (dBm)	Pass/Fail
	Port A	Port B			
5730	25.6	26.9	29.308	30	Pass
5785	26.4	26.3	29.361	30	Pass
5845	25.5	25.6	28.560	30	Pass

Table 22: 10 MHz BW Test Results

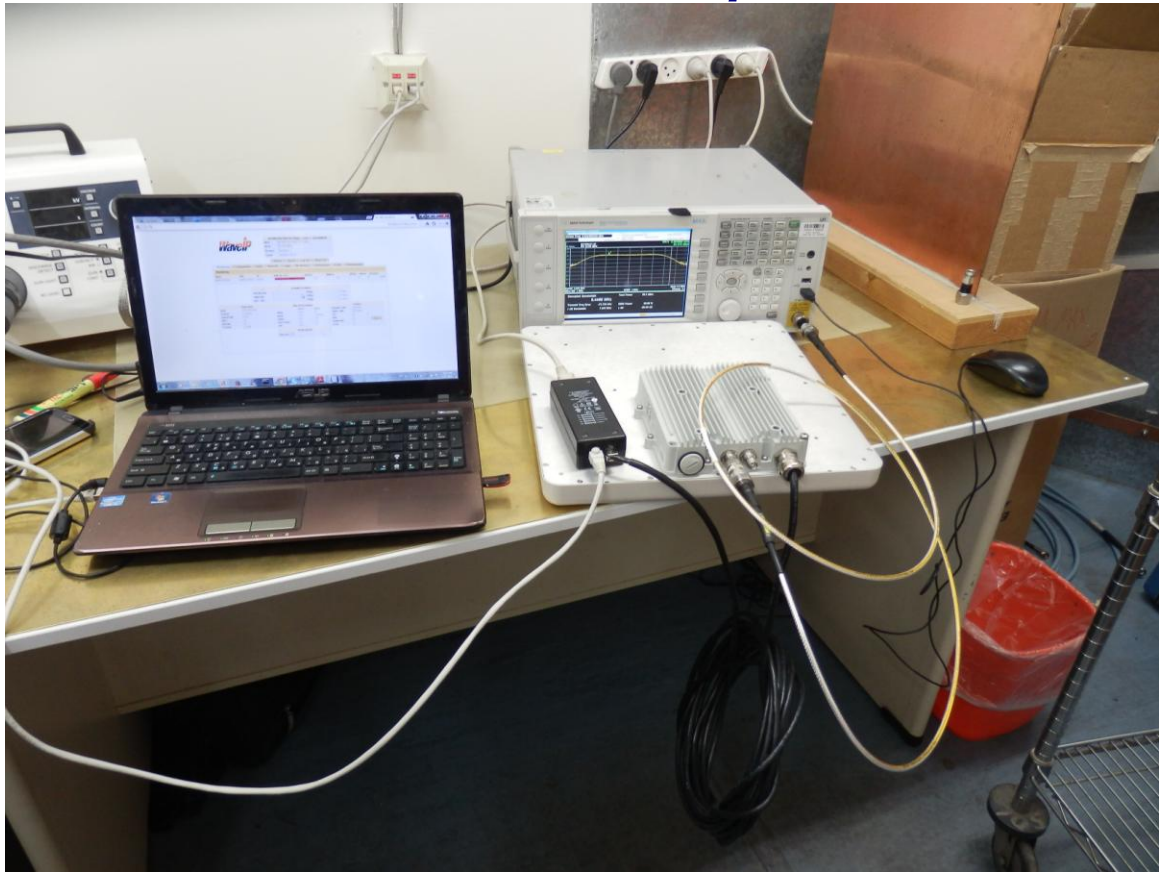
Frequency (MHz)	Peak Output Power (dBm)		Calculated Peak Output Power (dBm)	Limit (dBm)	Pass/Fail
	Port A	Port B			
5730	26.1	26.6	29.367	30	Pass
5785	26.2	26.6	29.414	30	Pass
5845	26.2	25.7	28.967	30	Pass

Table 23: 20 MHz BW Test Results

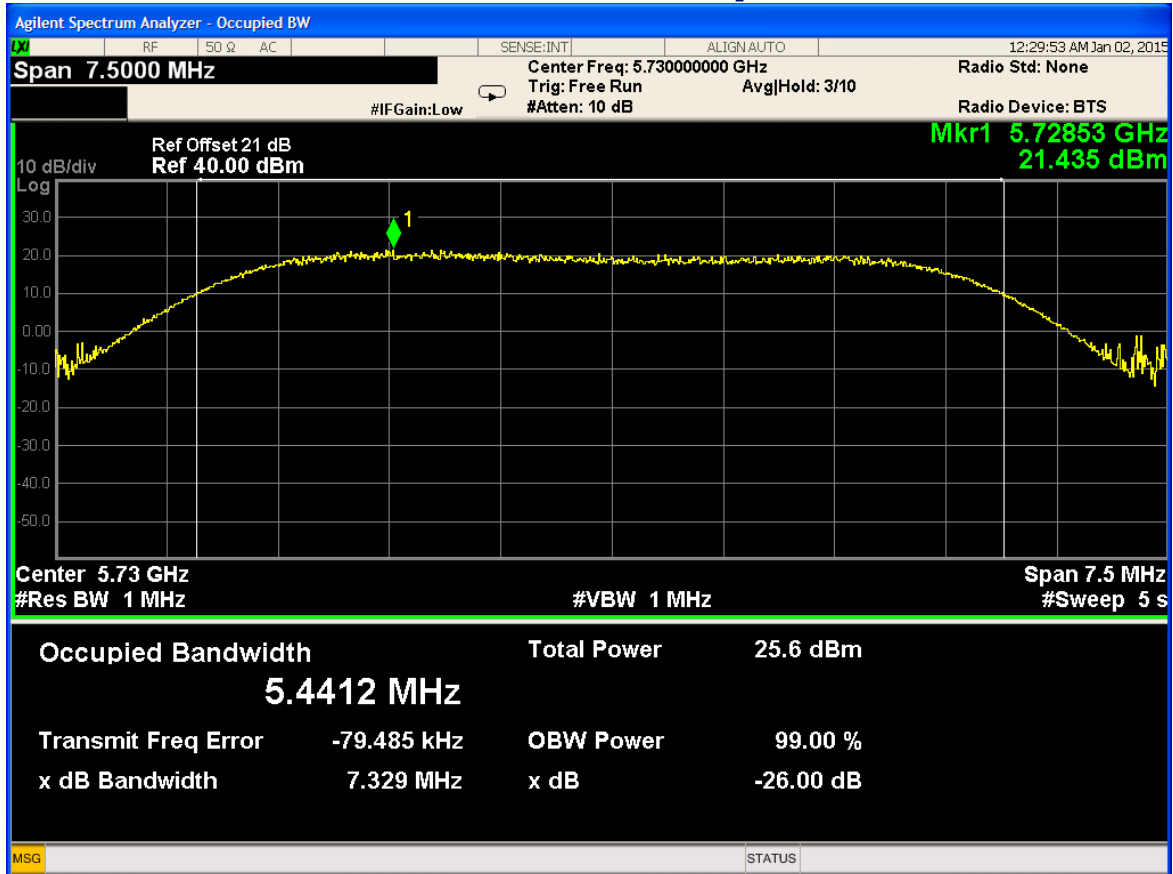
Frequency (MHz)	Peak Output Power (dBm)		Calculated Peak Output Power (dBm)	Limit (dBm)	Pass/Fail
	Port A	Port B			
5730	24.9	24.9	27.910	30	Pass
5785	25.2	24.8	28.014	30	Pass
5845	24.7	24.7	27.710	30	Pass

Table 24: 40 MHz BW Test Results

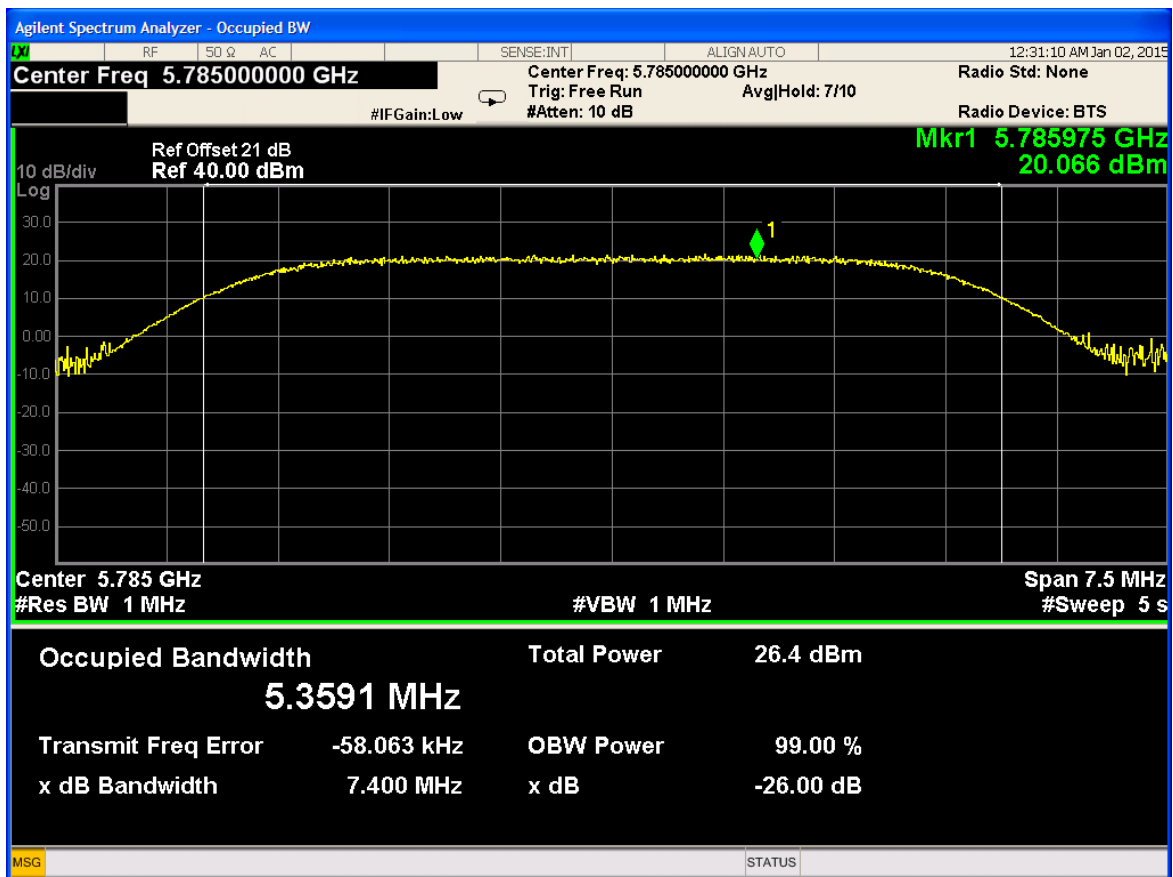
Frequency (MHz)	Peak Output Power (dBm)		Calculated Peak Output Power (dBm)	Limit (dBm)	Pass/Fail
	Port A	Port B			
5730	25.6	26.2	28.920	30	Pass
5785	25.8	26.5	29.174	30	Pass
5845	26.0	25.6	28.814	30	Pass



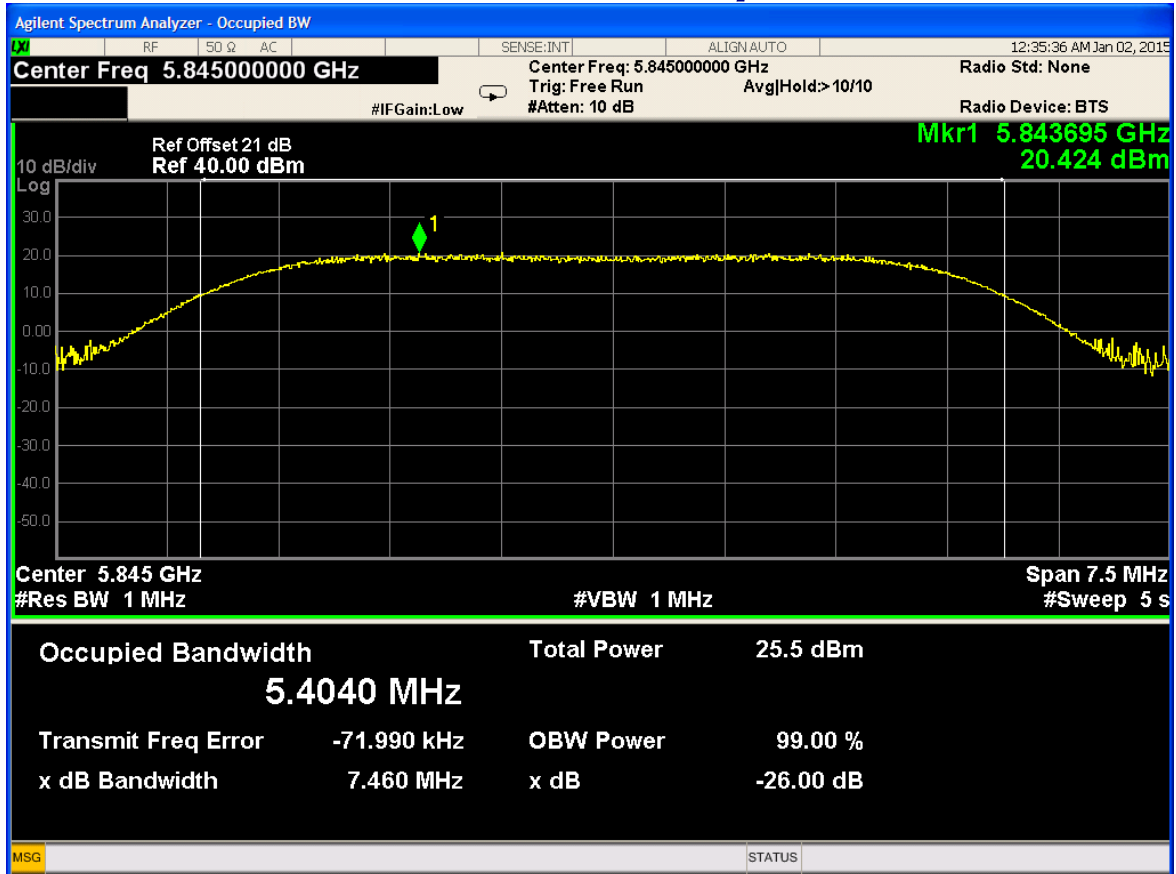
Photograph for Conducted Measurement Test Setup/ 1



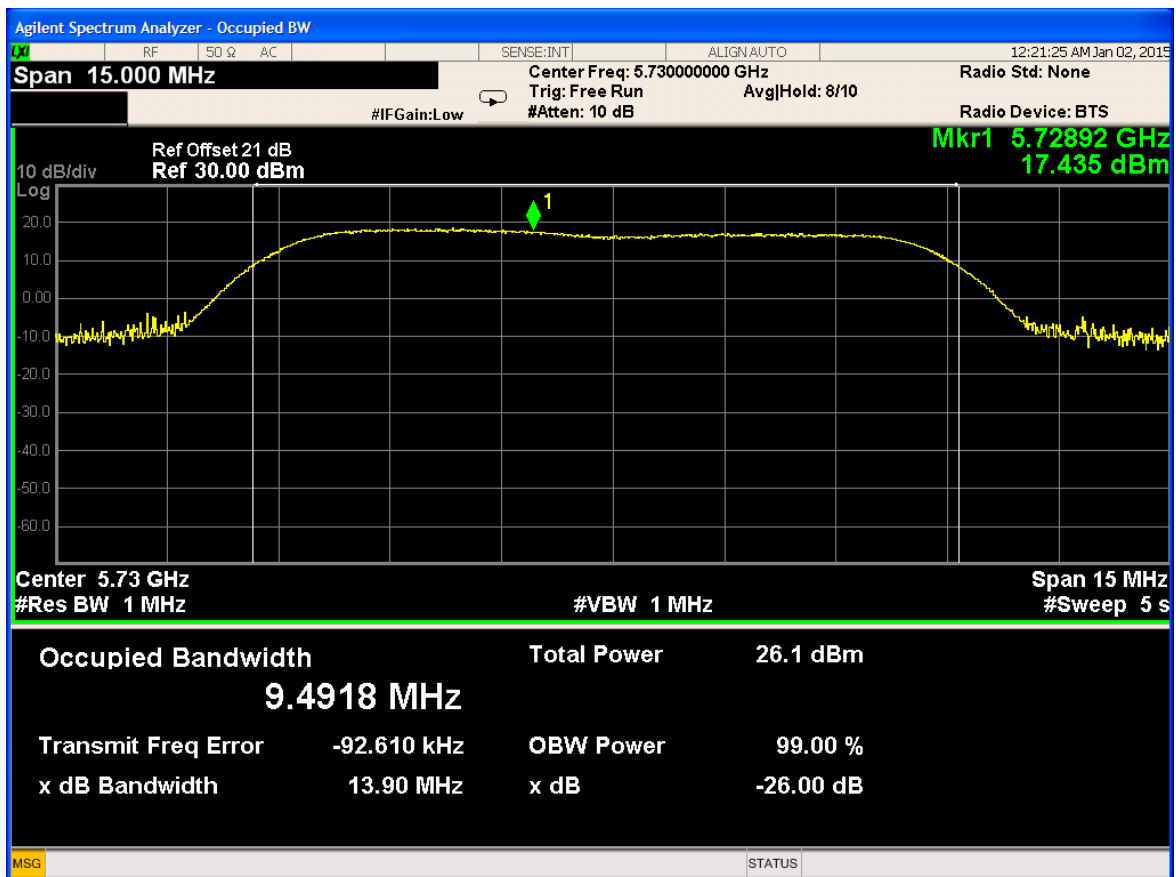
Plot Peak Output Power/ 1



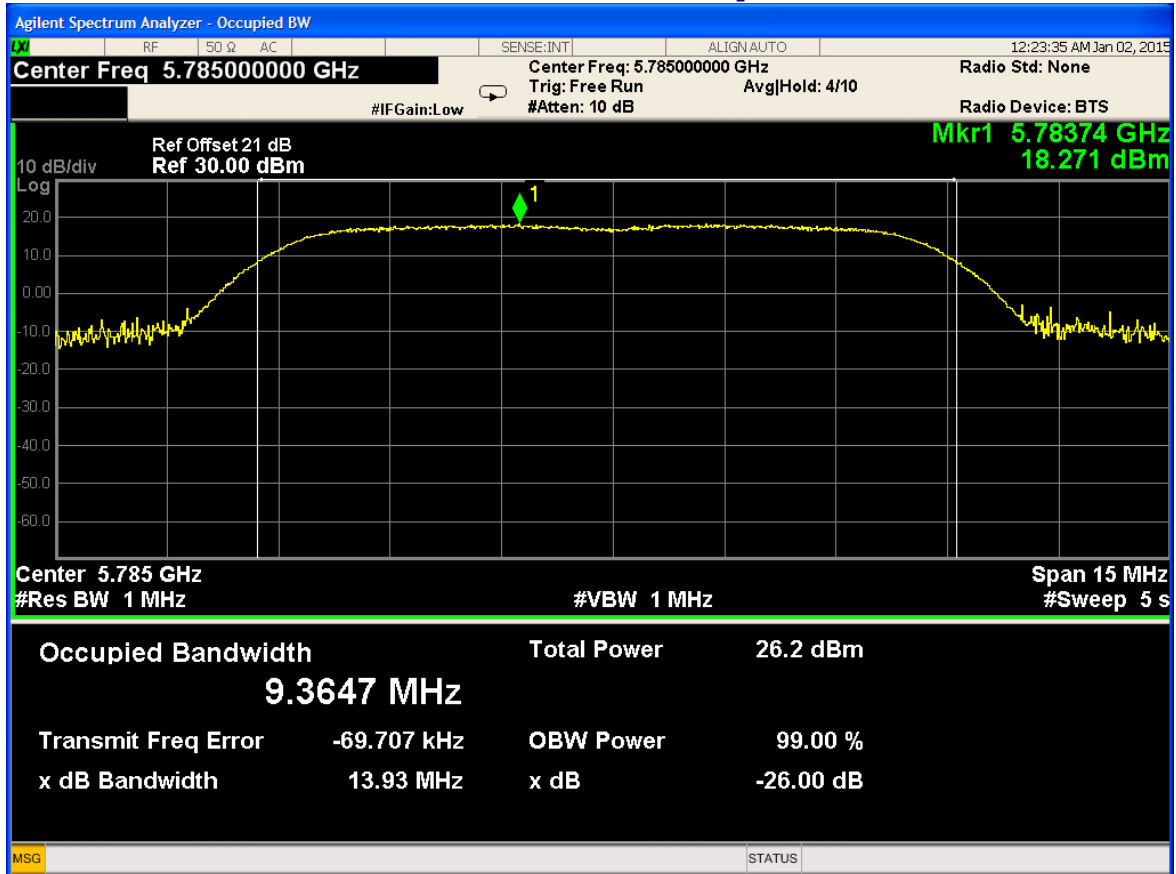
Plot Peak Output Power/ 2



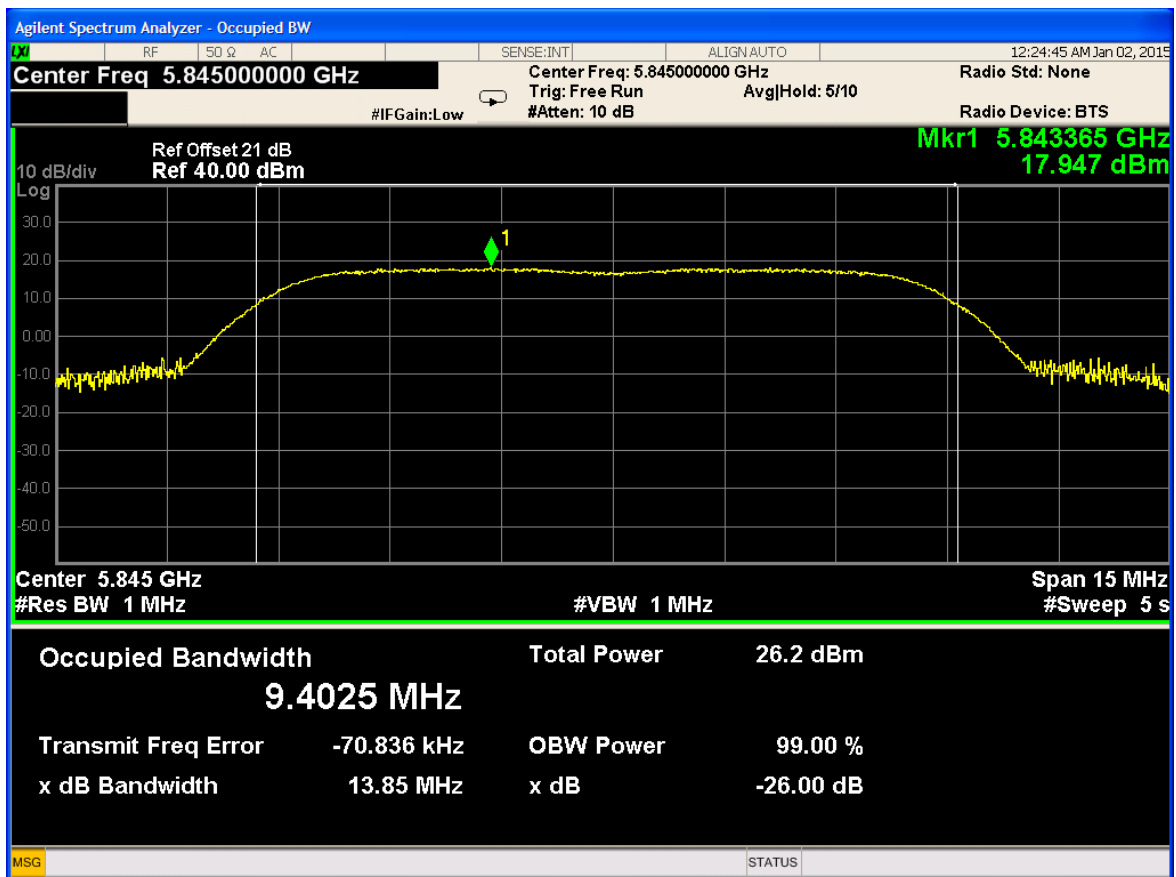
Plot Peak Output Power/ 3



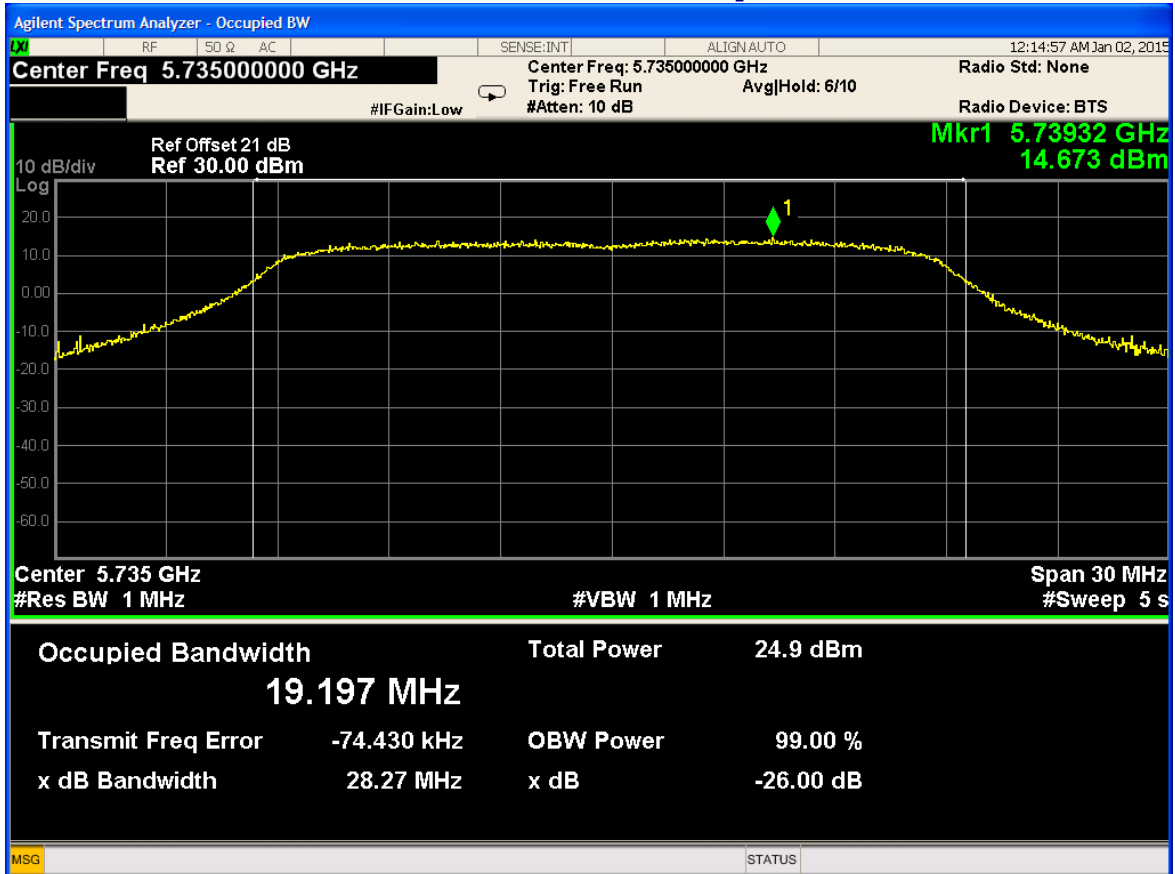
Plot Peak Output Power/ 4



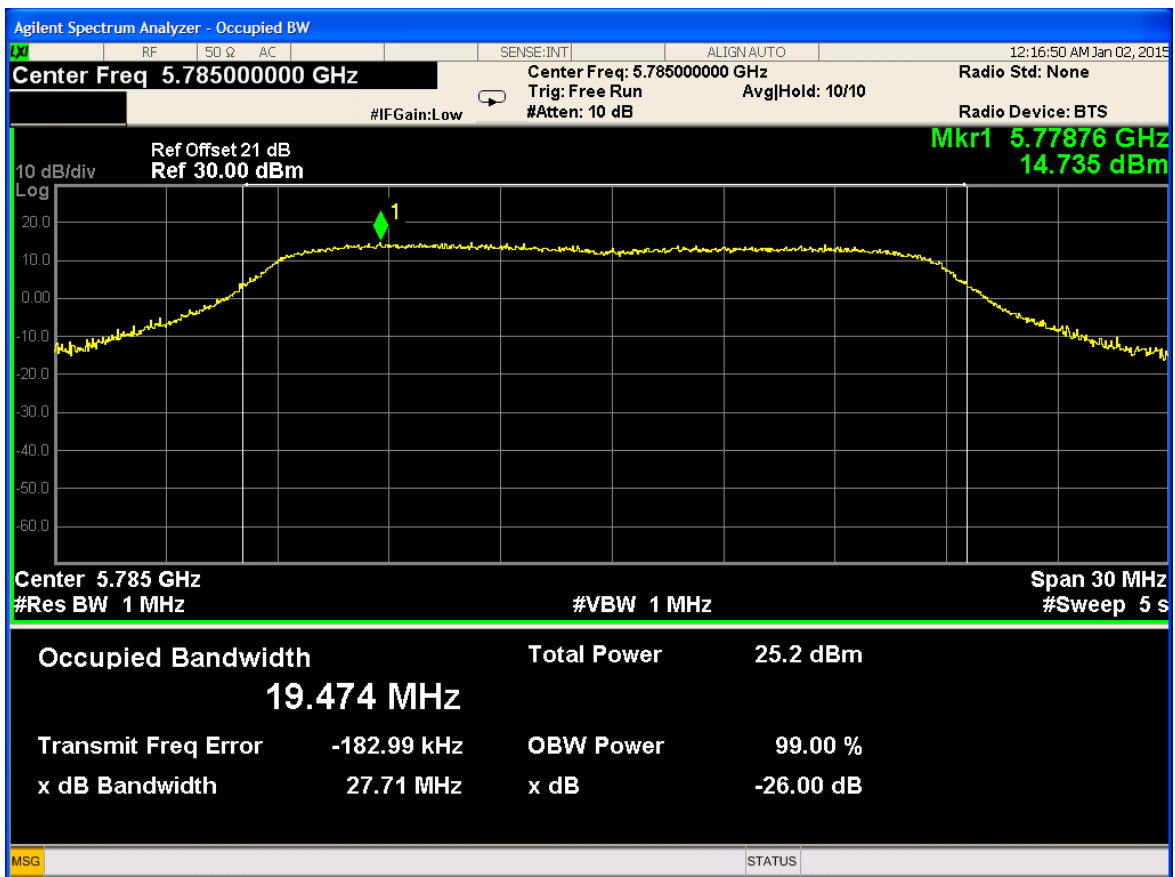
Plot Peak Output Power/ 5



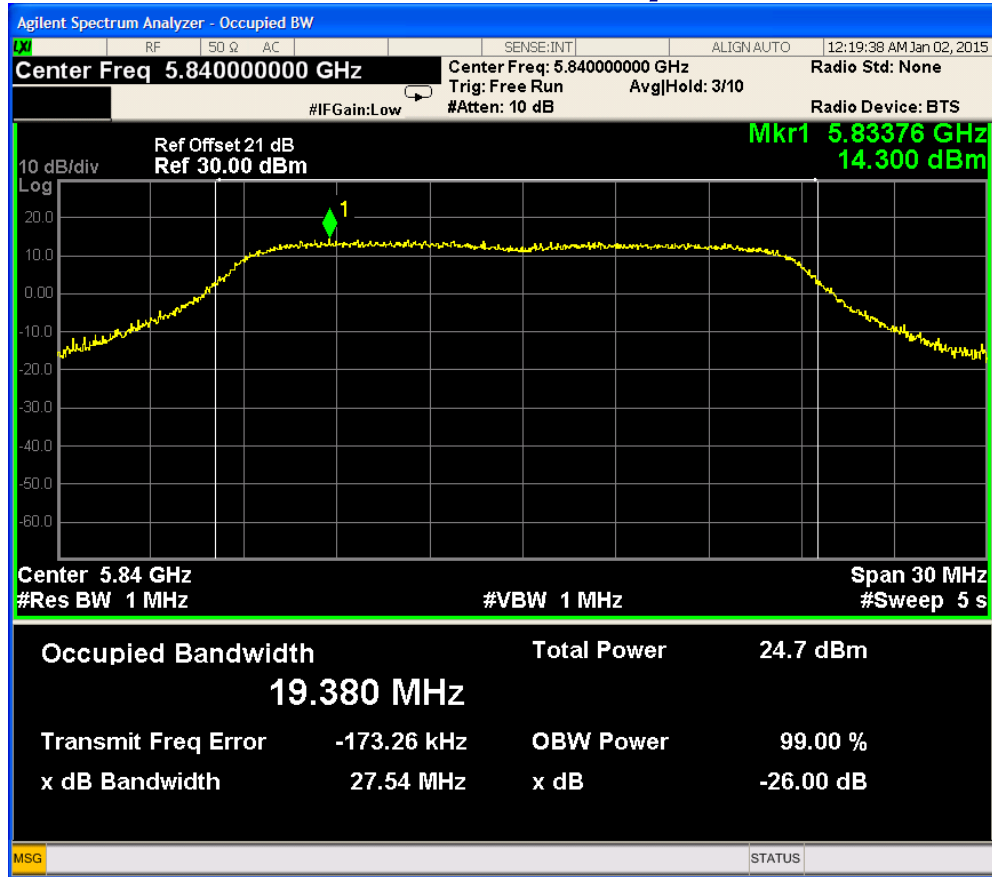
Plot Peak Output Power/ 6



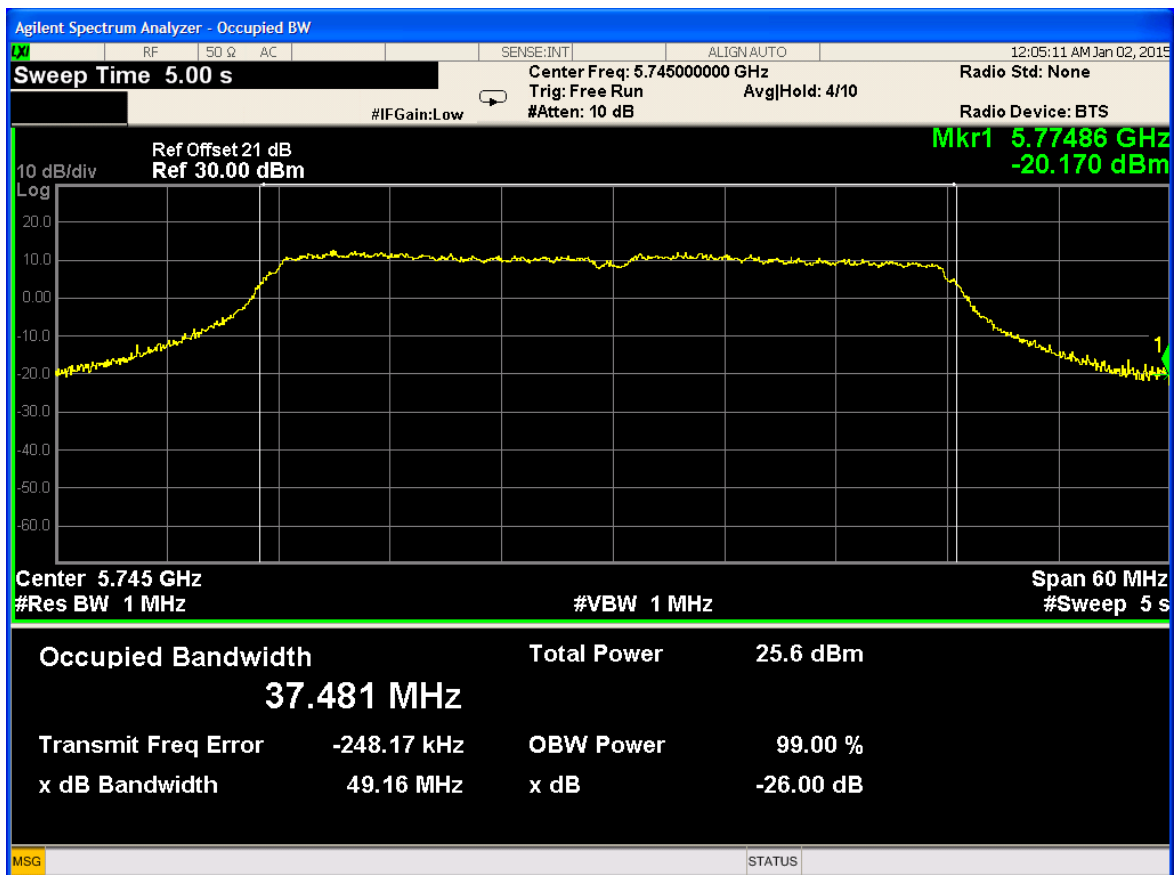
Plot Peak Output Power/ 7



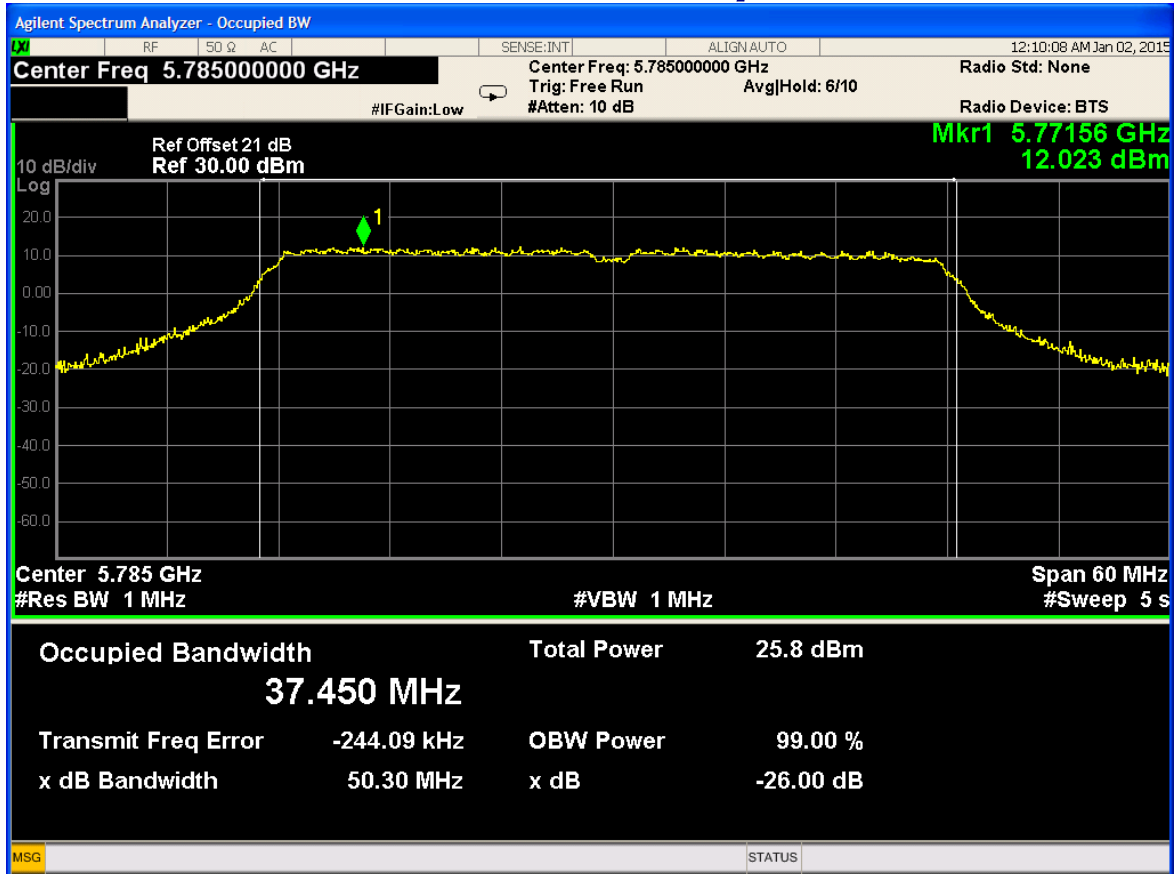
Plot Peak Output Power/ 8



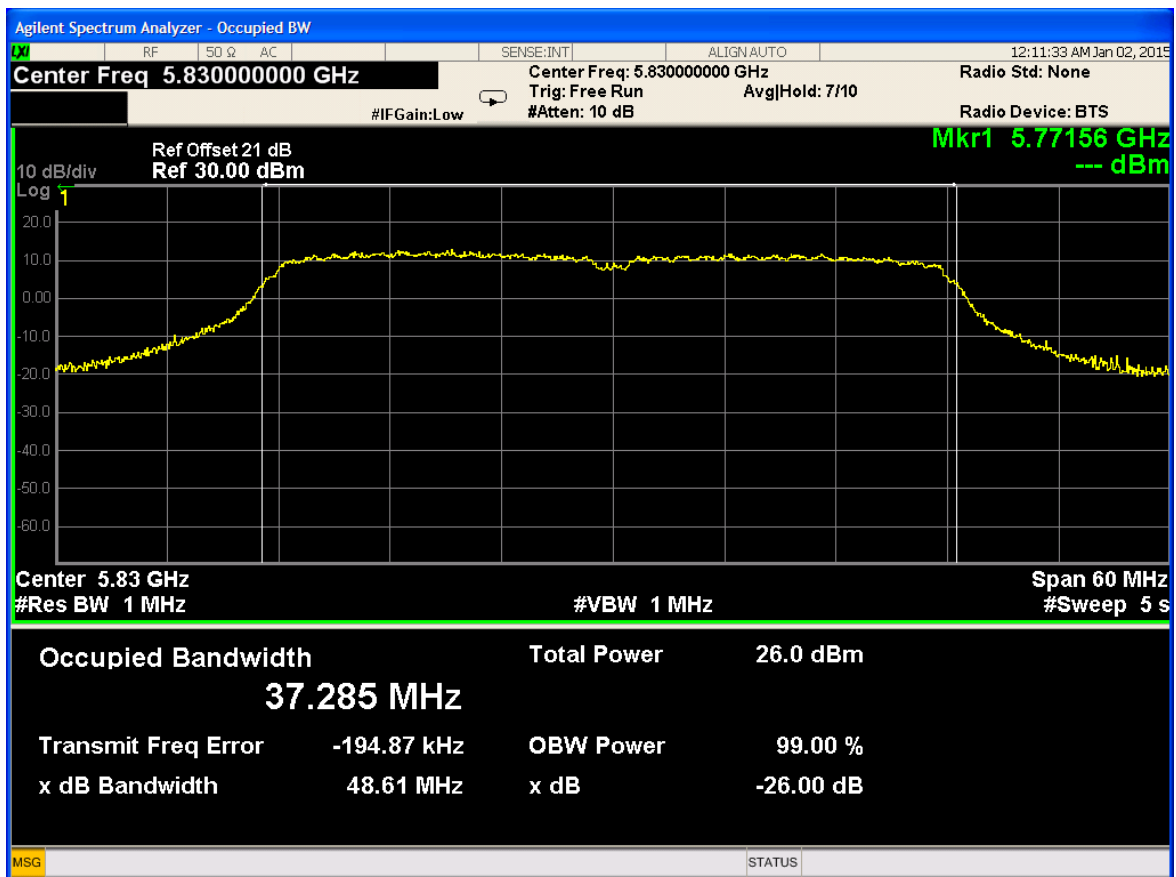
Plot Peak Output Power/ 9



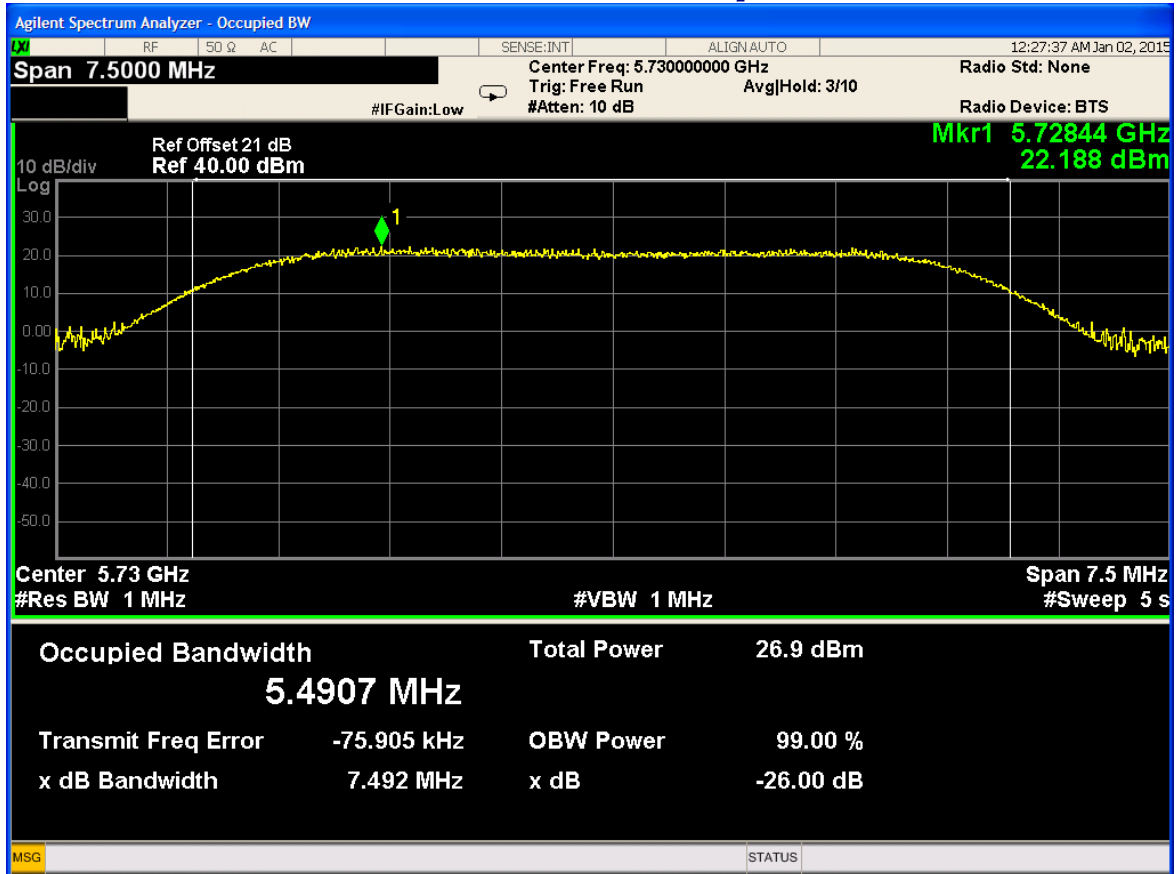
Plot Peak Output Power/ 10



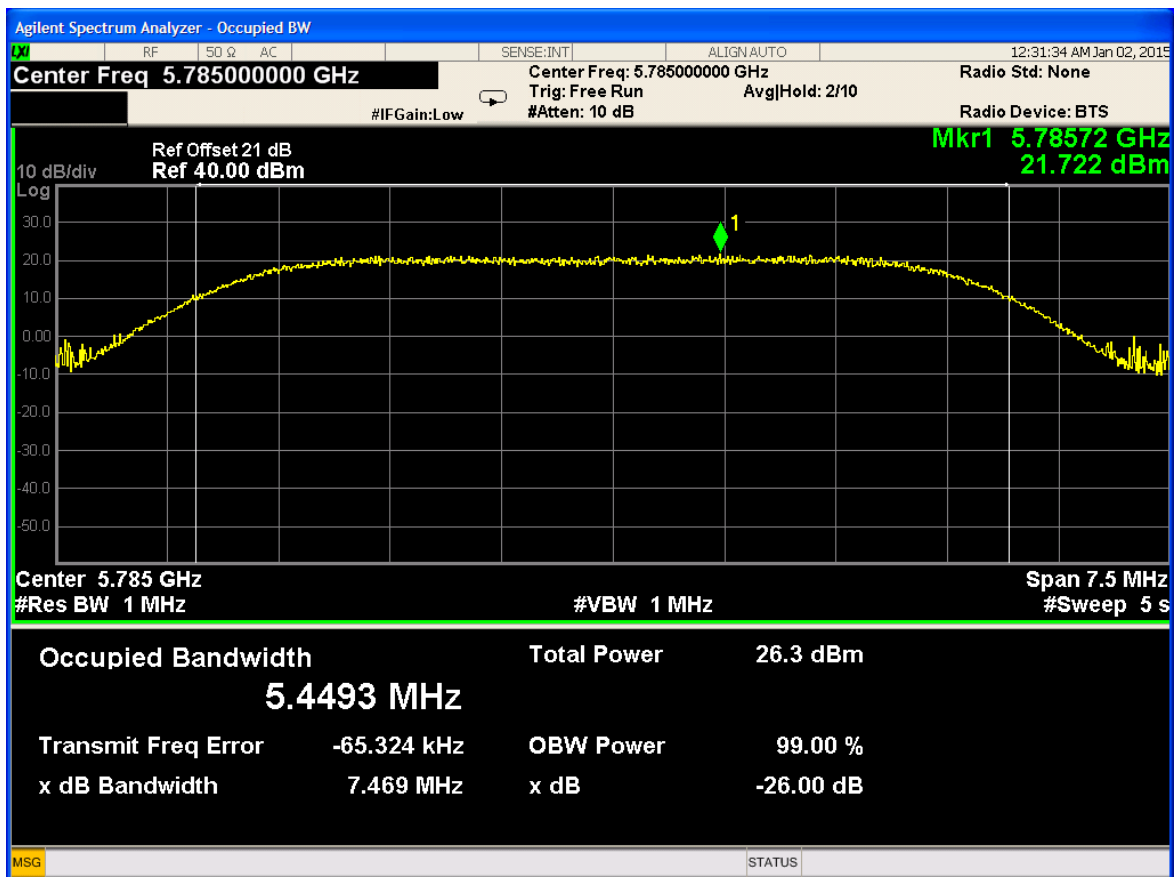
Plot Peak Output Power/ 11



Plot Peak Output Power/ 12



Plot Peak Output Power/ 13



Plot Peak Output Power/ 14