Wireless test report – 392986-3TRFWL

Applicant:

Eurotech SpA

Product name:

DYGATE-20-30

Model:

DynaGATE-20-30-22

Model variant:

DynaGATE-20-30-00, DynaGATE-20-30-10, DynaGATE-20-30-20

FCC ID:

UKMDG2030

IC Registration number:

21442-DG2030

Specifications:

- FCC 47 CFR Part 15 Subpart E, §15.407 (Partial test)
  Unlicensed National Information Infrastructure Devices
- RSS-247, Issue 2, Feb 2017, Section 6 (Partial test)
  Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
  5) Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz

Date of issue: July 07, 2020

Tested by (name, function and signature)	D. Guarnone	(project handler)	Signature:	
Reviewed by (name, function and signature)	P. Barbieri	(verifier)	Signature:	

Test location

Company name	Nemko Spa
Address	Via del Carroccio, 4
City	Biassono
Province	MB
Postal code	20853
Country	Italy
Telephone	+39 039 220 12 01
Facsimile	+39 039 220 12 21
Website	www.nemko.com
Site number	FCC: 682159; IC: 9109A (10 m semi anechoic chamber)

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Spa ISO/IEC 17025 accreditation.

Copyright notification

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Eurotech SpA
Address	Via Fratelli Solari 3/a 33020 Amaro, UD, Italy

1.2 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407 RSS-247, Issue 2, February 2017	Unlicensed National Information Infrastructure Devises Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

789033 D02 General UNII Test Procedures New Rules v02r01 (Dec 14, 2017)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen Issue 5 (April 2018), Amendment 1 (March 2019)	General Requirements for Compliance of Radio Apparatus

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Date of issue	Details of changes made to test report
392986-3TRFWL	July 7, 2020	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.31(e)	Variation of power source	Pass[1]
§15.203	Antenna requirement	Pass[2]

Notes: [1]Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

[2]The Antennas uses a unique coupling to the intentional radiator.

2.2 FCC Part 15 Subpart E, test results

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Pass
§15.407(a)(1)	Power and density limits within 5.15–5.25 GHz band	Pass
§15.407(a)(2)	Power and density limits within 5.25–5.35 GHz and 5.47–5.725 GHz bands	Pass
§15.407(a)(3)	Power and density limits within 5.725–5.85 GHz band	Pass
§15.407(b)(1)	Undesirable emission limits for 5.15–5.25 GHz band	Pass
§15.407(b)(2)	Undesirable emission limits for 5.25–5.35 GHz band	Pass
§15.407(b)(3)	Undesirable emission limits for 5.47–5.725 GHz bands	Pass
§15.407(b)(4)	Undesirable emission limits for 5.725–5.85 GHz band	Pass
§15.407(b)(6)	Conducted limits for U-NII devices using an AC power line	Pass
§15.407(e)	Minimum 6 dB bandwidth of U-NII devices within the 5.725-5.85 GHz band	Pass
§15.407(g)	Frequency stability	Not performed
§15.407(h)(1)[1]	Transmit power control (TPC)	Not performed
§15.407(h)(2)[1]	Dynamic Frequency Selection (DFS)	Not performed

Note: [1]DFS and TPC requirements are only applicable to 5.25–5.35 GHz and 5.47–5.725 GHz bands

2.3 IC RSS-GEN, Issue 5, Mar 2019, Amendment 1, test results

Part	Test description	Verdict
6.6	Occupied Bandwidth	Pass
7.1.2[1]	Receiver radiated emission limits	Not applicable
7.1.3[1]	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Pass
8.11[2]	Frequency stability	Not performed

Notes: [1]According to sections 5.2 and 5.3 of RSS-Gen, Issue 5, Amendment 1: if EUT does not have a stand-alone receiver neither scanner receiver, then it exempt from receiver requirements.

[2]According to section 8.11 of RSS-Gen, Issue 5, Amendment 1: if the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required

2.4 IC RSS-247, Issue 2, test results

Section	Test description	Verdict
6.1[1]	Types of Modulation	Pass
6.2.1.1	Power limits for 5150–5250 MHz band	Pass
6.2.2.1	Power limits for 5250–5350 MHz band	Pass
6.2.3.1	Power limits for 5470–5600 MHz and 5650–5725 MHz bands	Pass
6.2.4.1	Power limits for 5725–5850 MHz band	Pass
6.2.4.1	Minimum 6 dB bandwidth	Pass
6.2.1.2	Unwanted emission limits for 5150–5250 MHz band	Pass
6.2.2.2	Unwanted emission limits for 5250–5350 MHz band	Pass
6.2.2.2	TPC requirements for devices with a maximum e.i.r.p. greater than 500 mW	Not applicable
6.2.2.3	e.i.r.p. at different elevations restrictions for 5250–5350 MHz band	Not applicable
6.2.3.2	Unwanted emission limits for 5470–5600 MHz and 5650–5725 MHz bands	Pass
6.2.4.2	Unwanted emission limits for 5725–5850 MHz band	Pass
6.3	Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz	Not applicable

Notes: [1] The EUT employs digital modulation: 802.11a/n

2.5 Sample information

Receipt date	May 18, 2020
Nemko sample ID number	392986 sample 1/12 and sample 1/1

2.6 EUT information

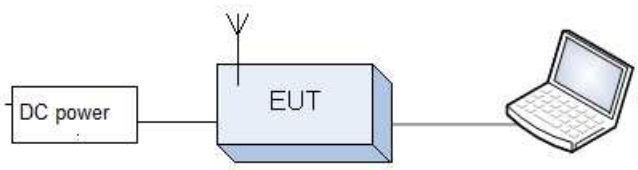
Product name	DYGATE-20-30
Model	DynaGATE-20-30-22
Model variant	DynaGATE-20-30-00, DynaGATE-20-30-10, DynaGATE-20-30-20
Serial number	H120CRA0003, H120CRA0005

2.7 Technical information

RSS number and Issue number	RSS-247 Issue 2, Section 6, February 2017
Frequency bands	5180-5240 / 5260-5320 / 5500-5720 / 5745-5825 MHz
Frequency Min (MHz)	5150
Frequency Max (MHz)	5850
RF power Min (W), Conducted	18.9 dBm (77.6 mW) @5180-5240 MHz / 18.8 dBm (75.9 mW) @5260-5320 MHz / 17.1 dBm (51.3 mW) @5500-5720 MHz / 15.4 dBm (34.7 mW) @5745-5825 MHz
RF power Max (W), Conducted	19.5 dBm (89.1 mW) @5180-5240 MHz / 19.2 dBm (83.2 mW) @5260-5320 MHz / 19.0 dBm (79.4 mW) @5500-5720 MHz / 18.1 dBm (64.6 mW) @5745-5825 MHz
Measured BW (MHz) (26 dB)	802.11 a/n (HT20): 35.09 @5180-5240 MHz / 33.0 @5260-5320 MHz / 34.45 @5500-5720 MHz / 30.77 @5745-5825 MHz 802.11 n (HT40): 67.28 @5190-5230 MHz / 68.63 @5270-5310 MHz / 66.23 @5510-5710 MHz / 66.68 @5755-5815 MHz
Measured BW (MHz) (99%)	802.11 a/n (HT20): 18.8 @5180-5240 MHz / 18.15 @5260-5320 MHz / 18.85 @5500-5720 MHz / 17.91 @5745-5825 MHz 802.11 n (HT40): 36.99 @5190-5230 MHz / 36.80 @5270-5310 MHz / 37.26 @5510-5710 MHz / 36.69 @5755-5815 MHz
Type of modulation	802.11 a/n

Emission classification (F1D, G1D, D1D)	802.11 a/n (HT20): 18M8W7D @5180-5240 MHz / 18M2W7D @5260-5320 MHz / 18M9W7D @5500-5720 MHz / 17M9W7D @5745-5825 MHz 802.11 n (HT40): 37M0W7D @5190-5230 MHz / 36M8W7D @5270-5310 MHz / 37M3W7D @5510-5710 MHz / 36M7W7D @5755-5815 MHz
Transmitter spurious, dBµV/m @3 m	43.1 (@201.9900 MHz)
Power requirements	24 $V_{DC,}$
Antenna information	The EUT uses a unique antenna coupling, peak gain 2.3 dBi

2.8 EUT setup diagram



2.9 Product description and theory of operation

The EUT is an IoT Edge Gateway, E-Mark certified, that addresses the challenges of the next-generation applications for smart transportation and fleet management. It combines hardware, software and connectivity to bridge the vehicle with leading Cloud services.

It provides protected USB 2.0 and 3.0, one configurable RS-232/422/485, DI/DOs, and dual CAN bus interfaces - plus, a wide range of connectivity capabilities including two Gigabit Ethernet on M12, up to two LTE Cat 4/6 cellular modem, Wi-Fi, Bluetooth Low Energy, and a GPS with Untethered Dead Reckoning

Radio modules:
WiFi-Bluetooth module Eurotech DG2030
GPS module, U45 U-BLOX, NEO-M8U-0-10
LTE module: QUECTEL, EG25-G

2.10 EUT sub assemblies

Table 2.10-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number

2.11 EUT exercise details

EUT was set to continuously transmit mode during tests, by test software provided by client.
The EUT runs a Linux operating system which allows for the testing to be performed using engineering test tools and scripts. Communication with the EUT is via a serial console or Ethernet connection which provides a Linux command line interface for execution of the test tools/scripts. These tools/scripts configure the radio modules to enable continuous transmission with the ability to adjust modulation, frequency and output power as required.

Section 3. Engineering considerations

3.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

3.2 Technical judgment

The EUT has two WIFI standard and two channel bandwidths; 802.11a with 20 MHz bandwidth standard is chosen to be the representative worst-case due to higher output power.

3.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 4. Test conditions

4.1 Atmospheric conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

Temperature	18 – 33 °C
Relative humidity	25 – 70 %
Air pressure	860 – 1060 mbar

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model no.	Asset no.	Cal date	Next cal.
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305	2019-01	2021-01
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	2019-01	2021-01
Barometer	Castle	GPB 3300	072015	2019-12	2020-12

4.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 5. Measurement uncertainty

5.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Receiver	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Section 6. Test equipment

6.1 Test equipment list

Table 6.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	2020-01	2021-01
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESW44	101620	2019-08	2020-08
Trilog Antenna (30 MHz ÷ 7 GHz)	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	2018-07	2021-07
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718	9718-137	2019-09	2020-09
Horn antenna (18 ÷ 40 GHz)	A.H. System	SAS-574	558	2020-01	2023-01
Preamplifier (18 ÷ 40 GHz)	Miteq	JS44-18004000-35-8P-R	1.627	2019-09	2020-09
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2019-09	2021-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
LISN three phase (9 kHz ÷30 MHz)	Rohde & Schwarz	ESH2-Z5	872 460/041	2019-09	2020-09
Shielded room	Siemens	Conducted emission test room	1862	NCR	NCR

Note: NCR - no calibration required, VOU - verify on use

Section 7. Testing data

7.1 FCC 15.403(i) Emission bandwidth

7.1.1 Definitions and limits

15.403(i) For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

7.1.2 Test summary

Test start date	

7.1.3 Observations, settings and special notes

Spectrum analyzer settings:

Resolution bandwidth	approximately 1% of EBW
Video bandwidth	> RBW
Detector mode	Peak
Trace mode	Max Hold

7.1.4 Test data

See output power measurements

7.2 RSS-Gen 6.6 Occupied bandwidth

7.2.1 Definitions and limits

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

7.2.2 Test summary

Test start date	

7.2.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	1 % to 5 % of OBW
Video bandwidth:	≥3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

7.2.4 Test data

Table 7.2-1: *99% bandwidth results*

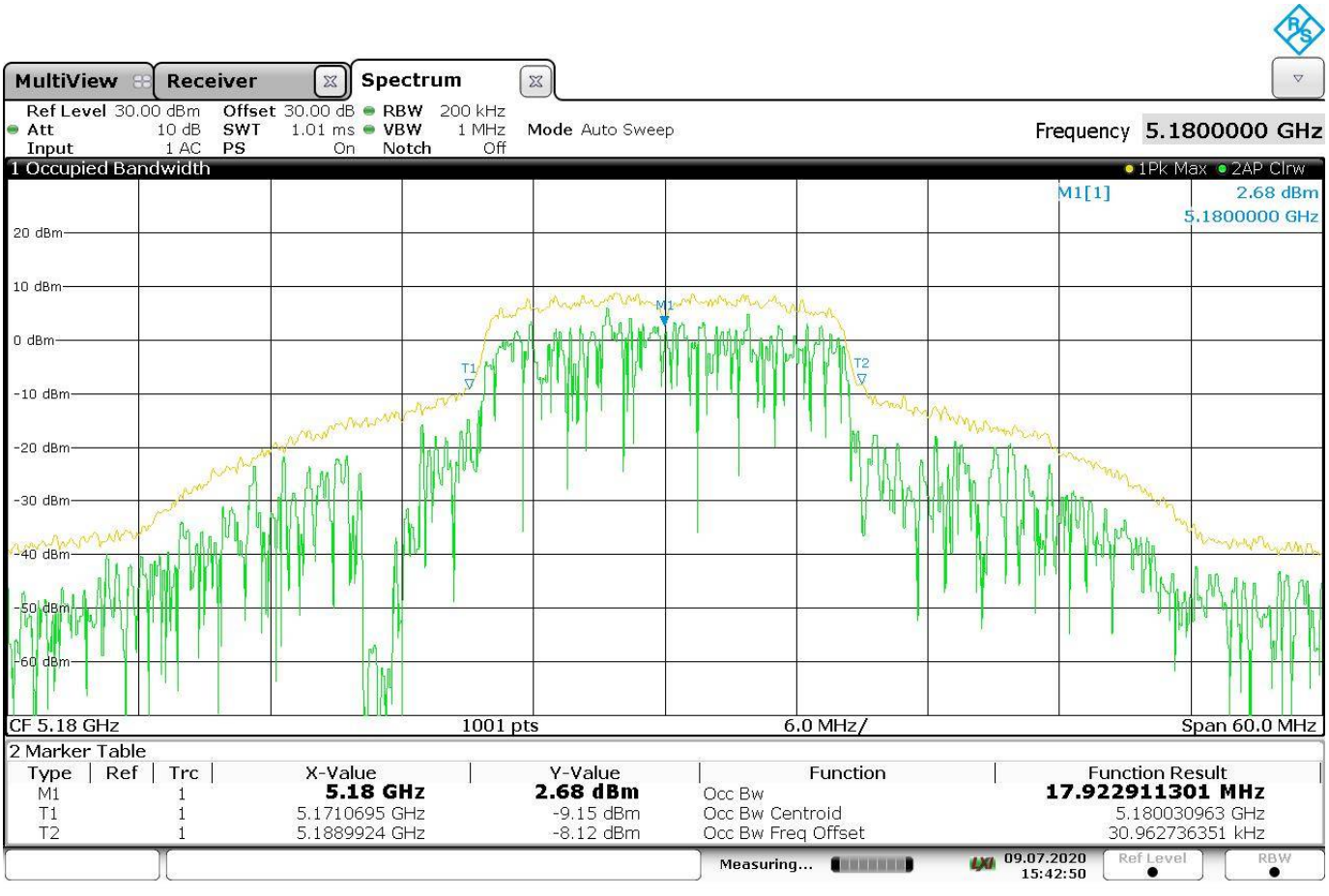
Modulation	Frequency, MHz	99% bandwidth, MHz
802.11a		

Modulation	Frequency, MHz	99% bandwidth, MHz
802.11a		

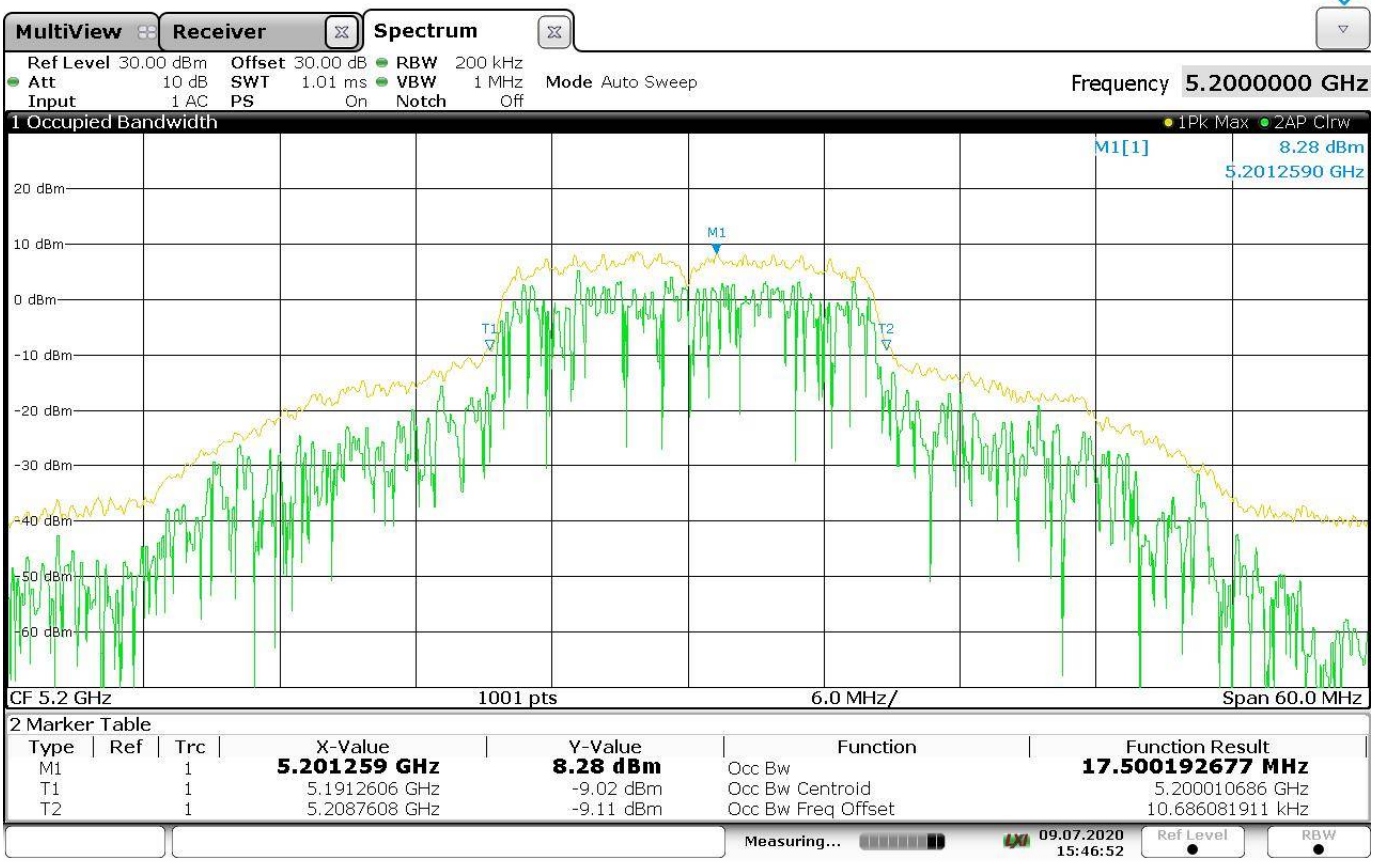
Modulation	Frequency, MHz	99% bandwidth, MHz
802.11a		

Modulation	Frequency, MHz	99% bandwidth, MHz
802.11a		

7.2.4 Test data, continued



802.11a, 6Mbps



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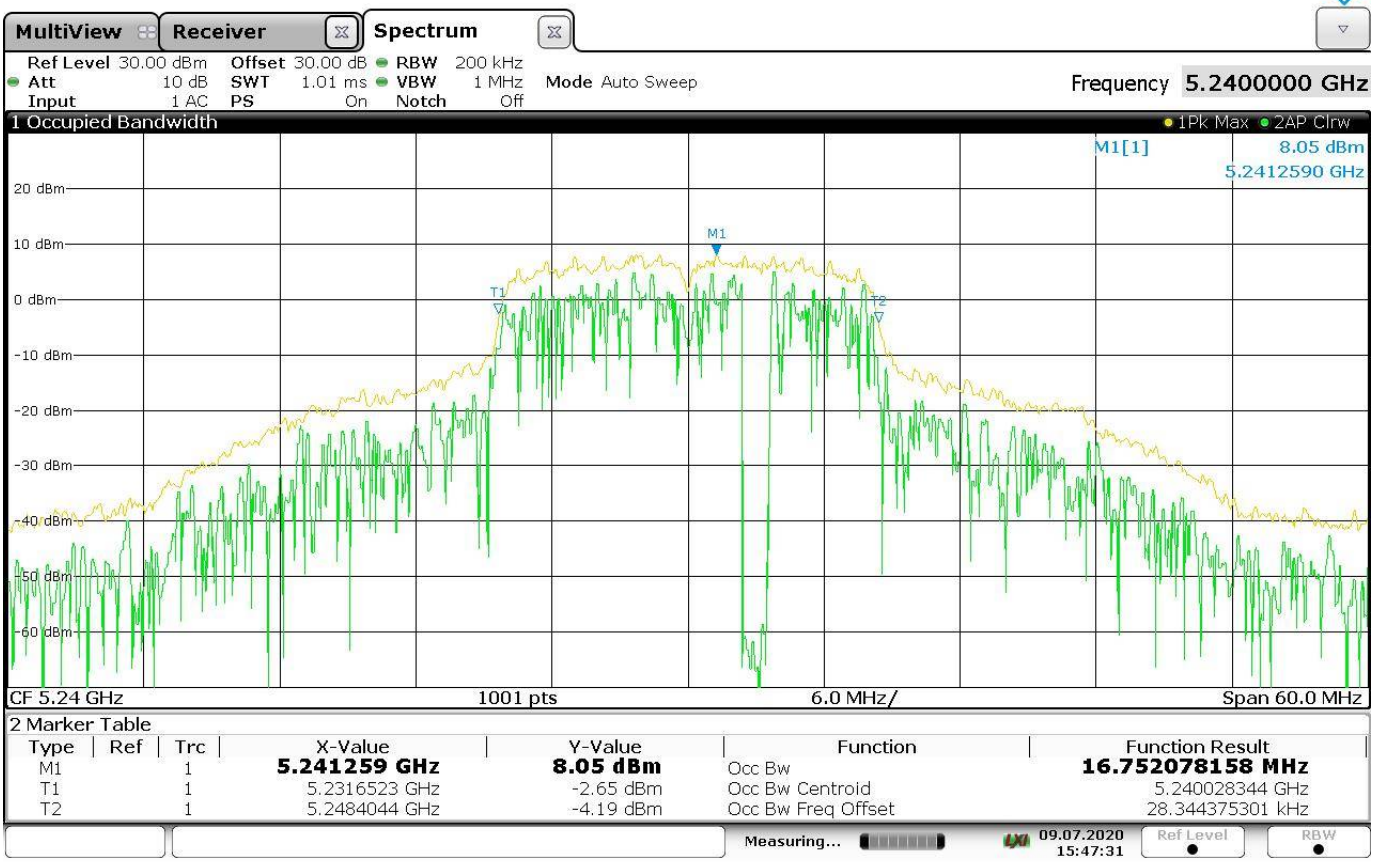

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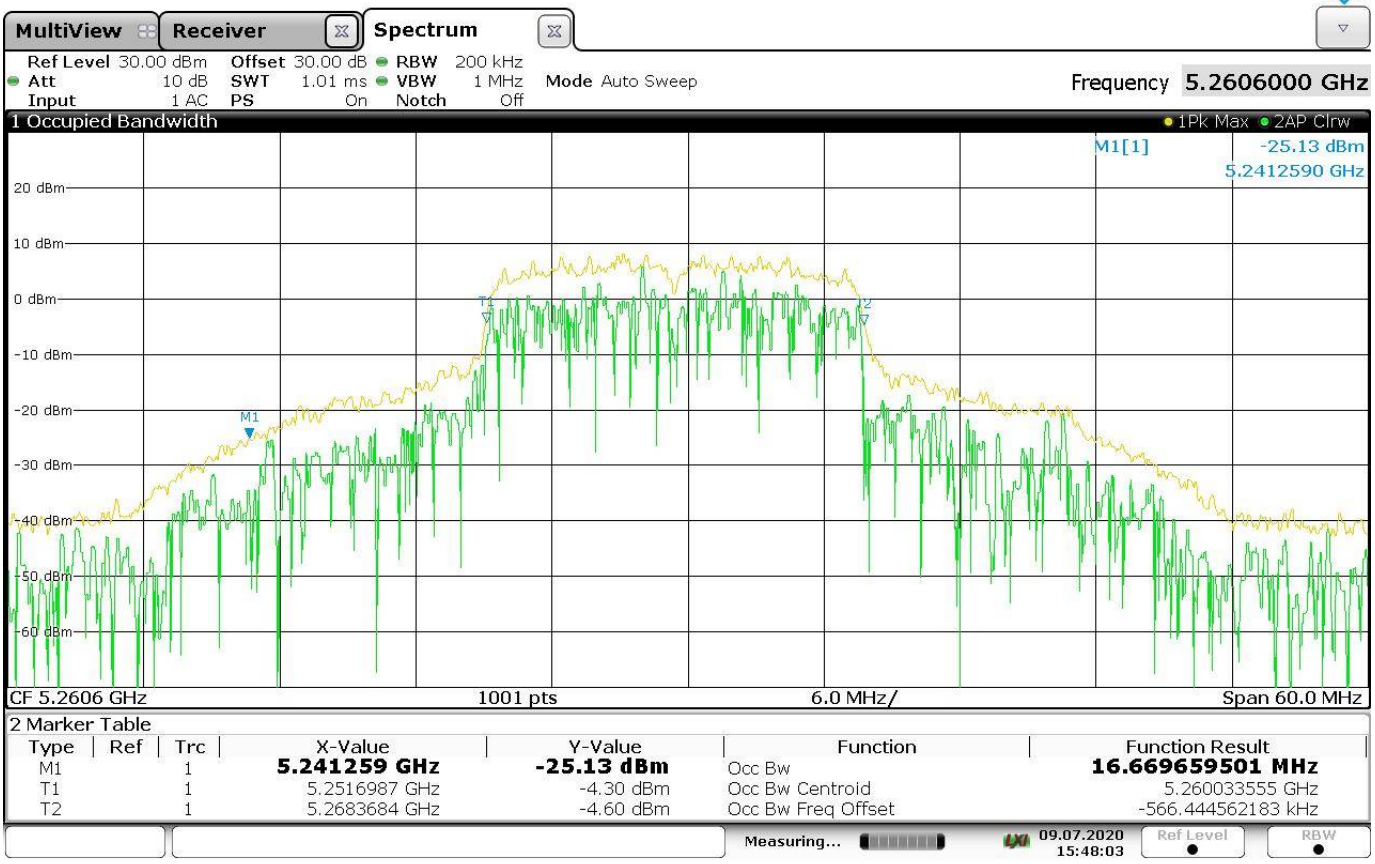

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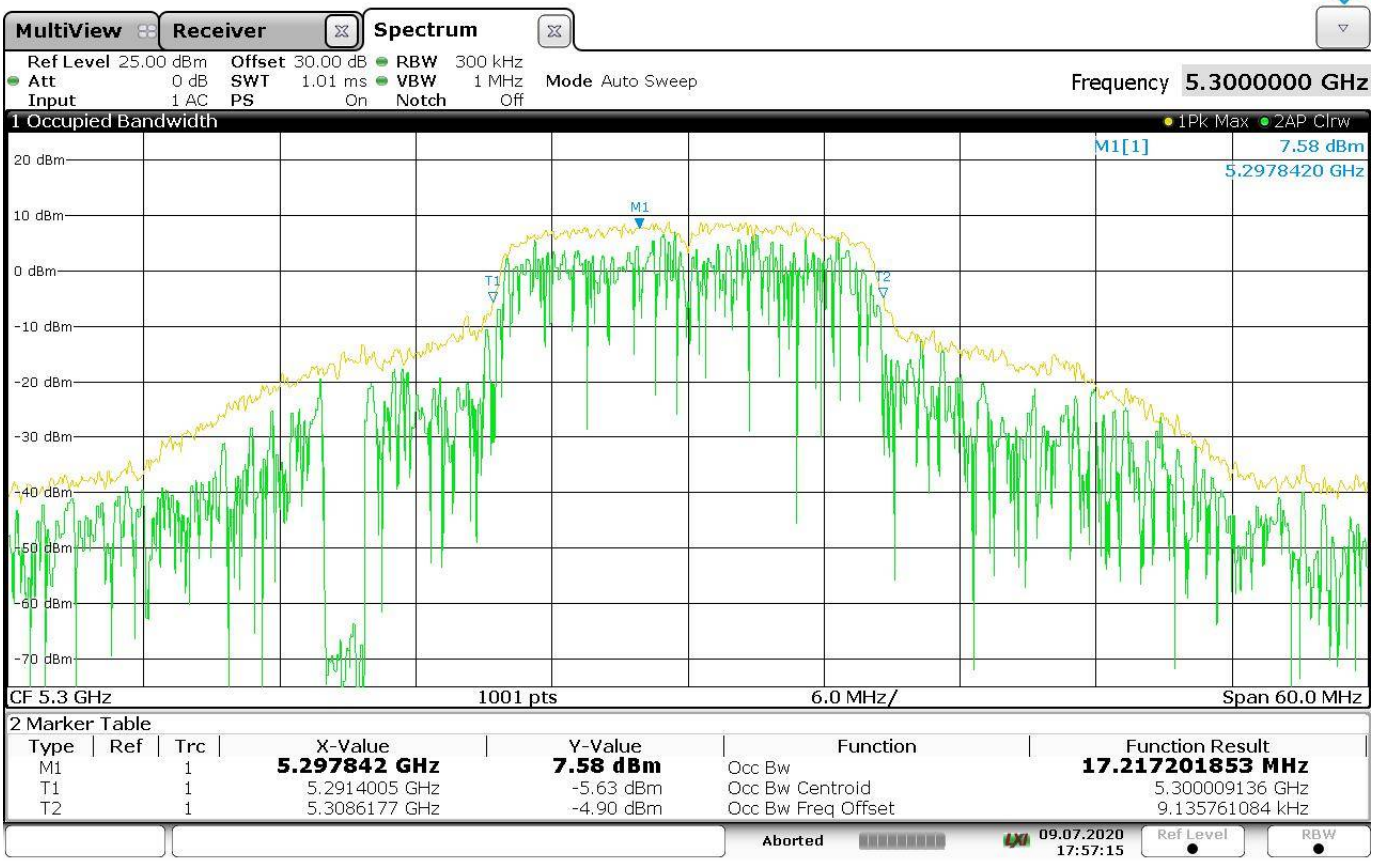

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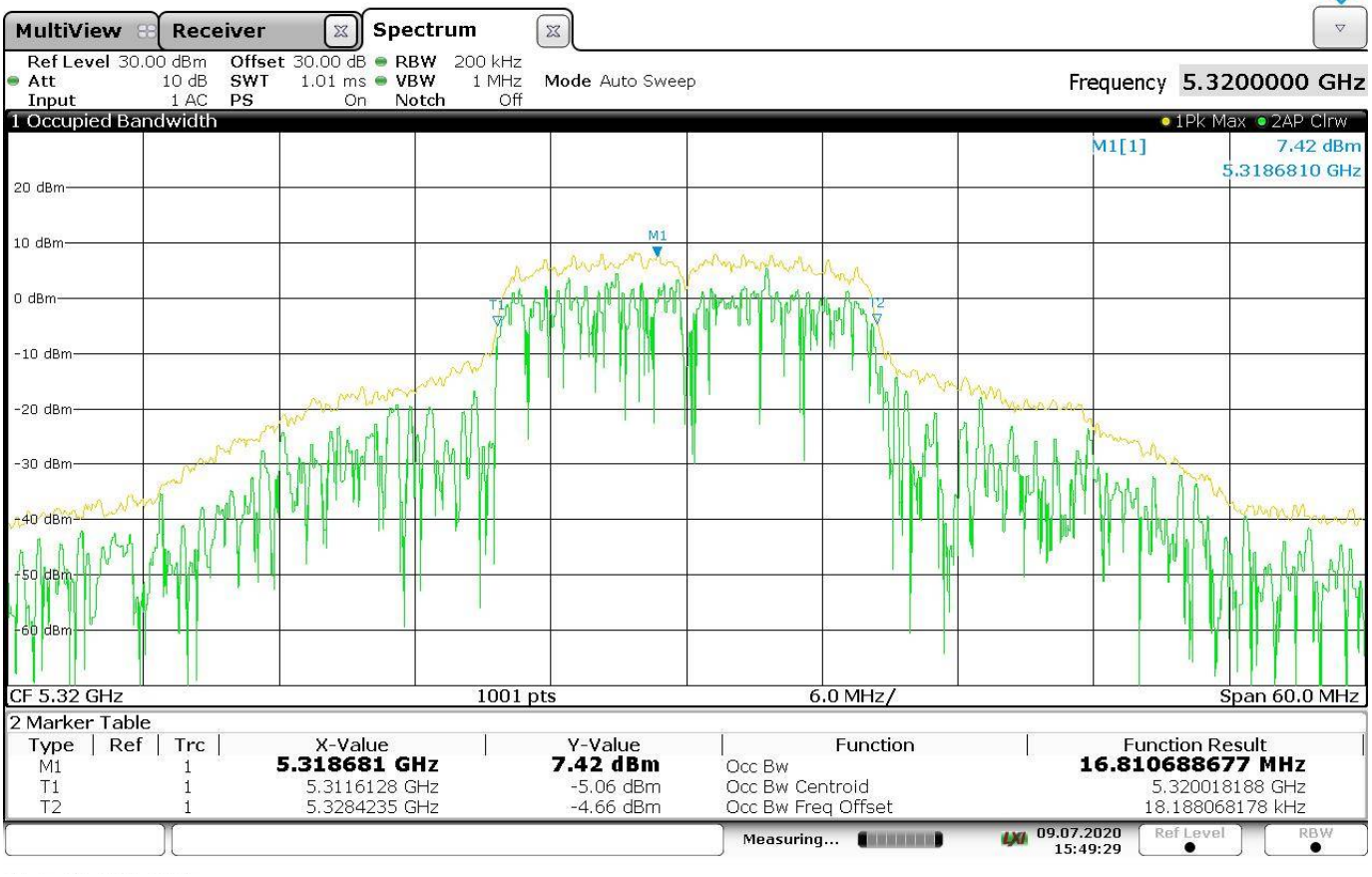

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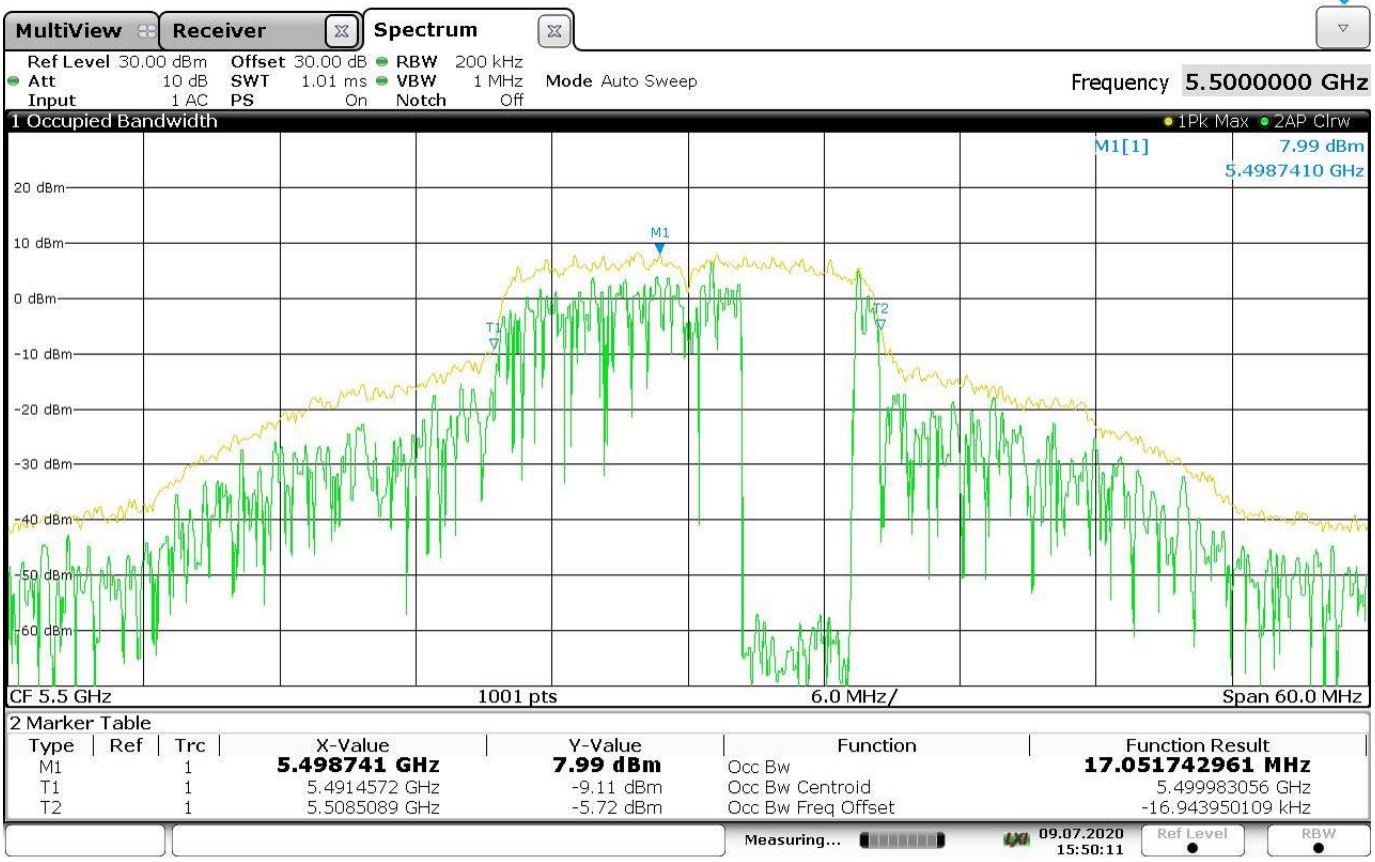

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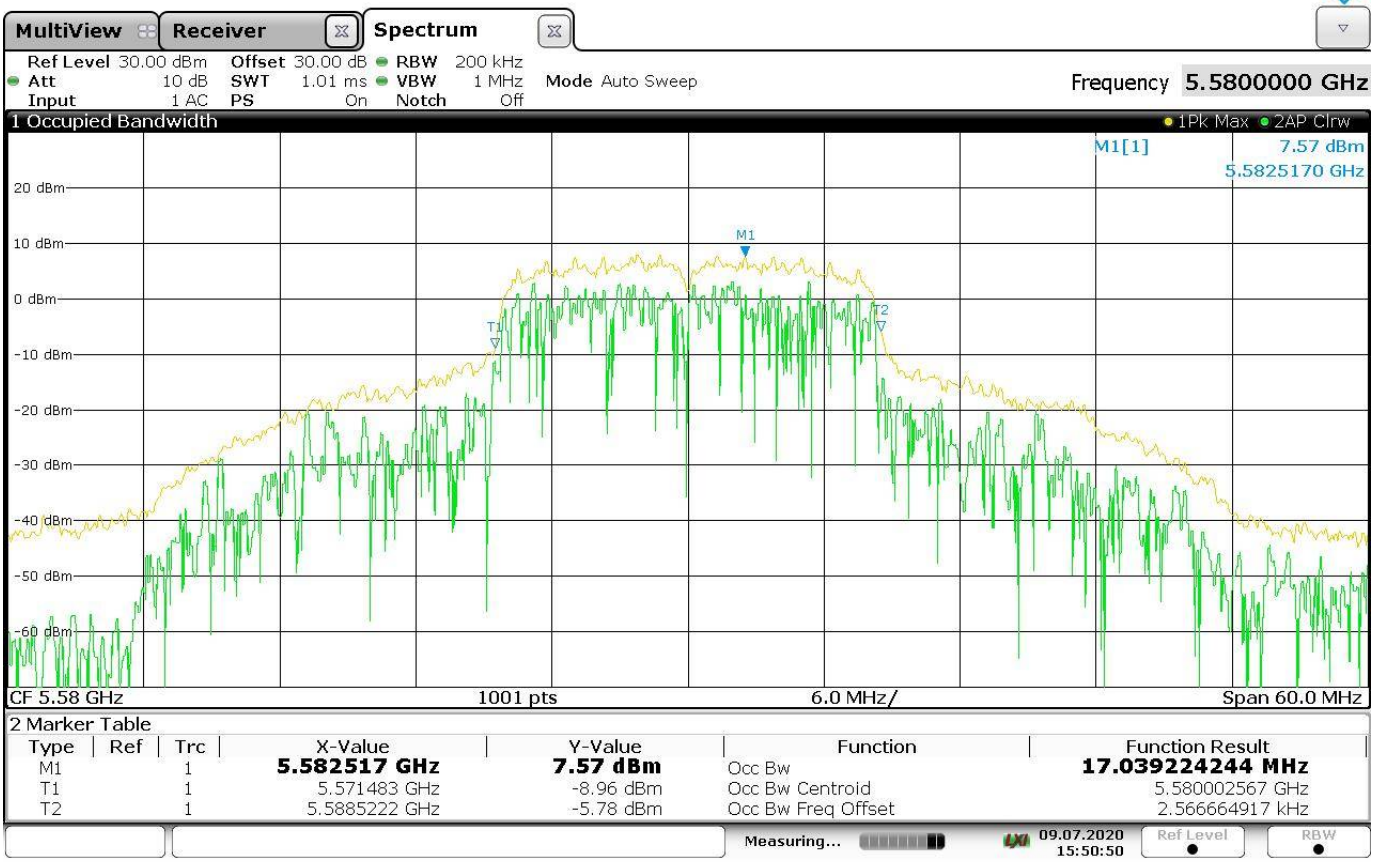

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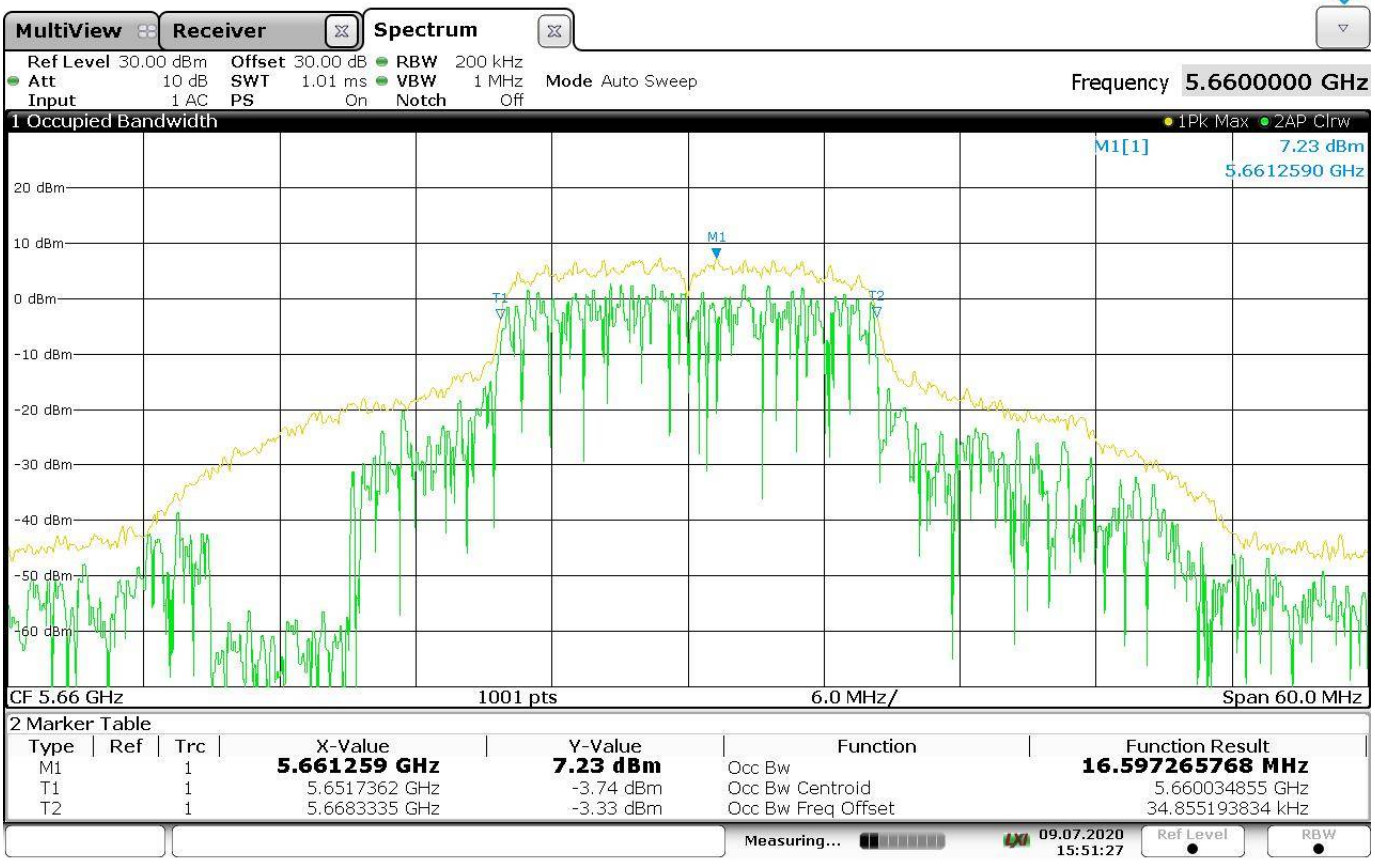

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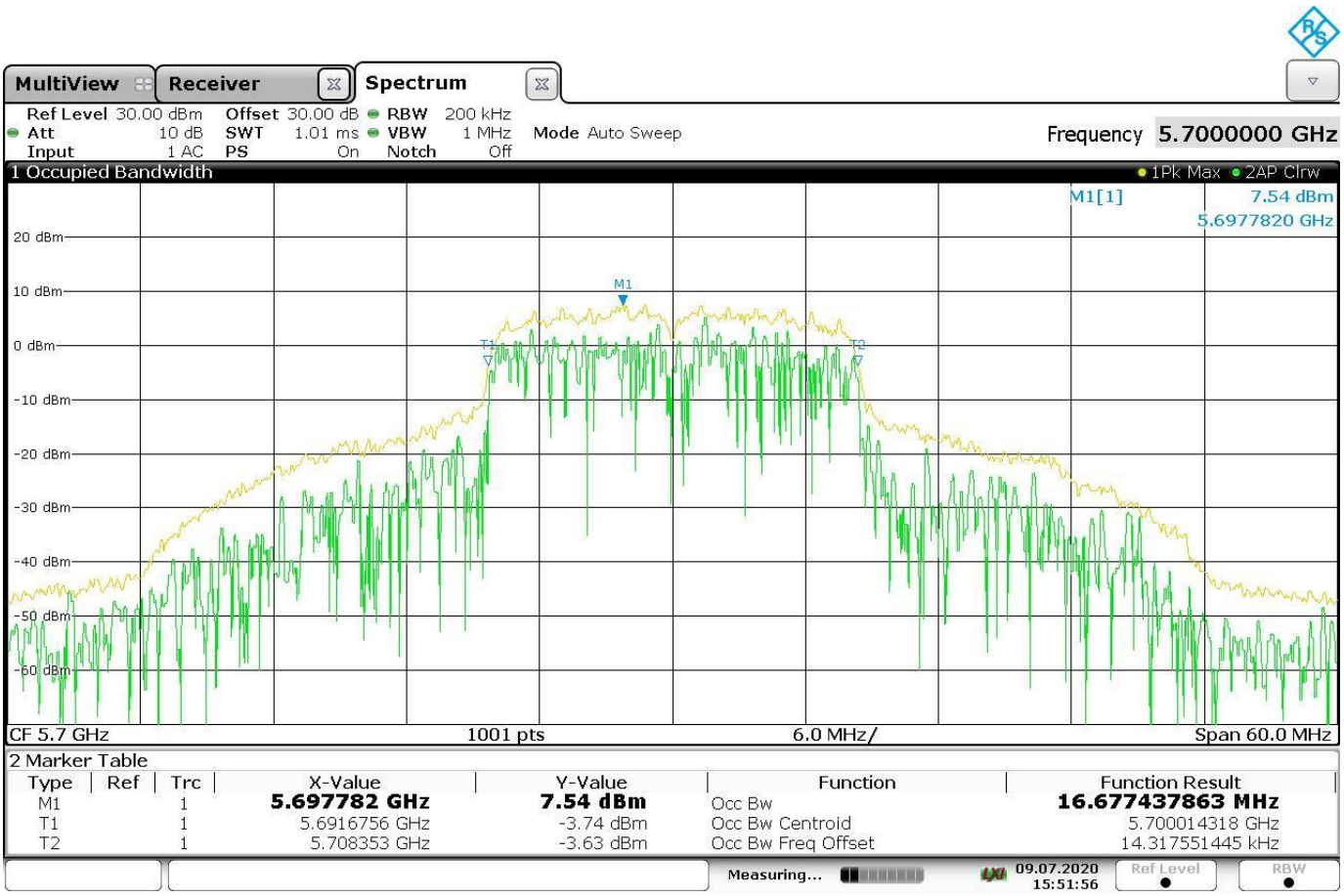

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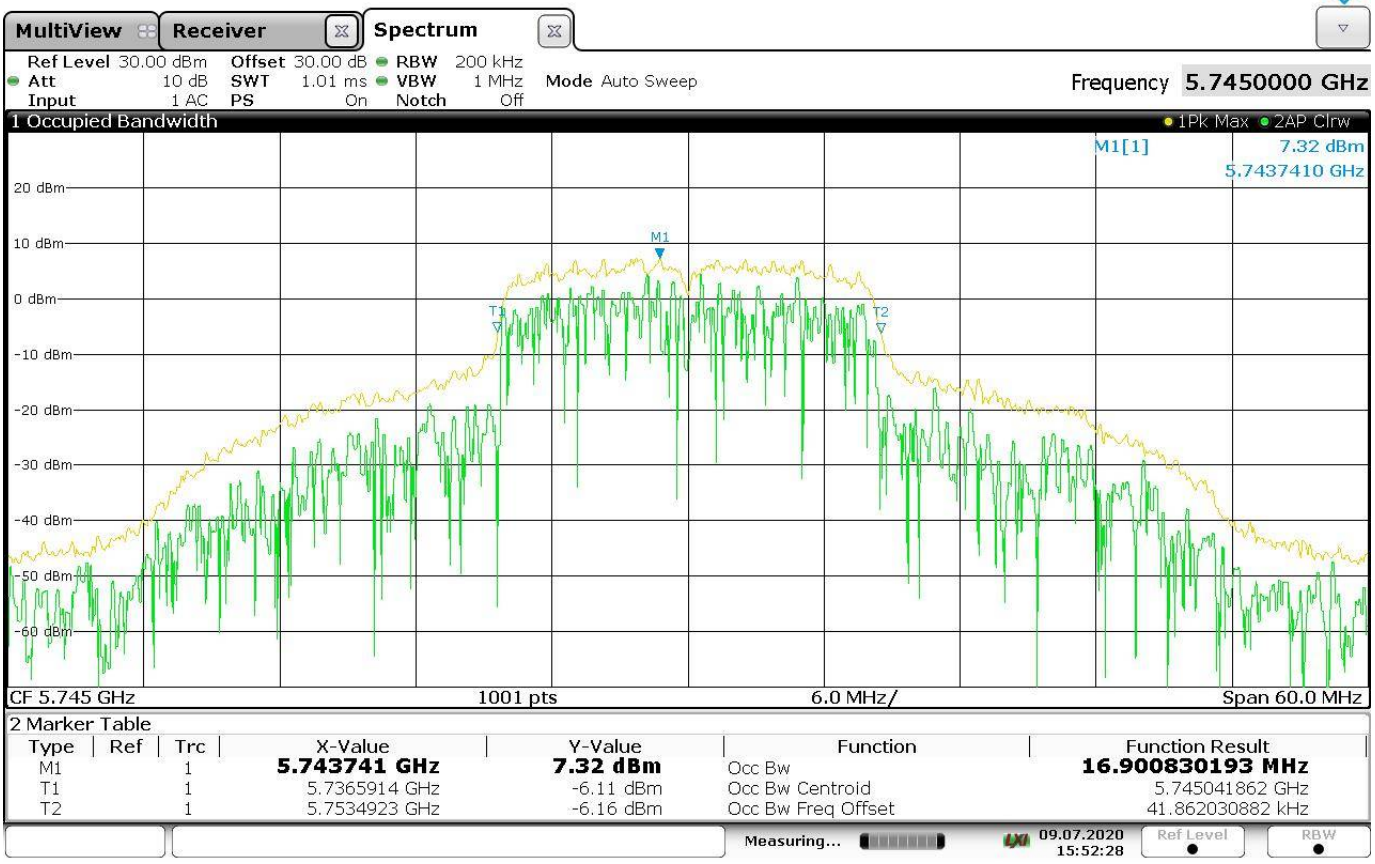

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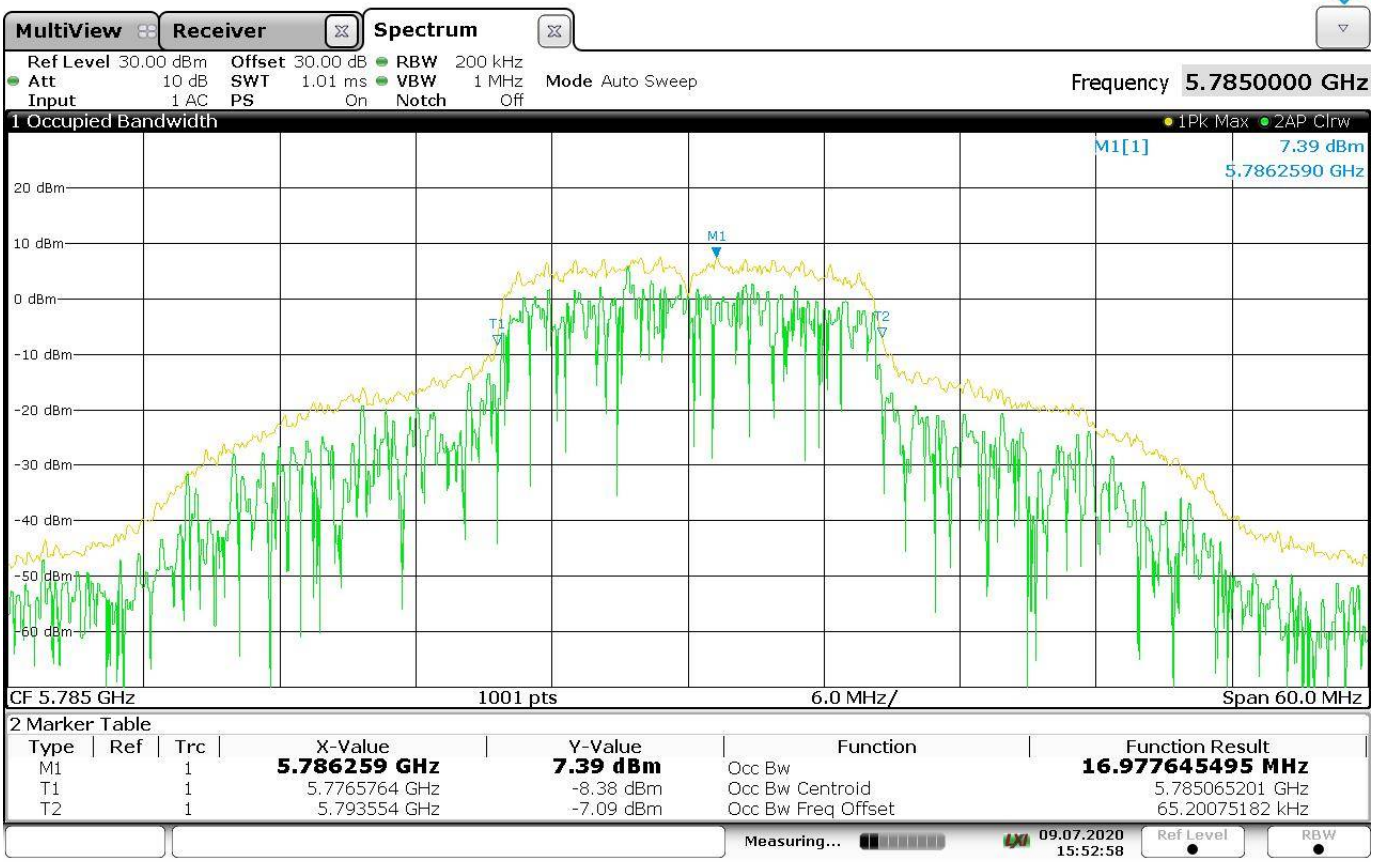
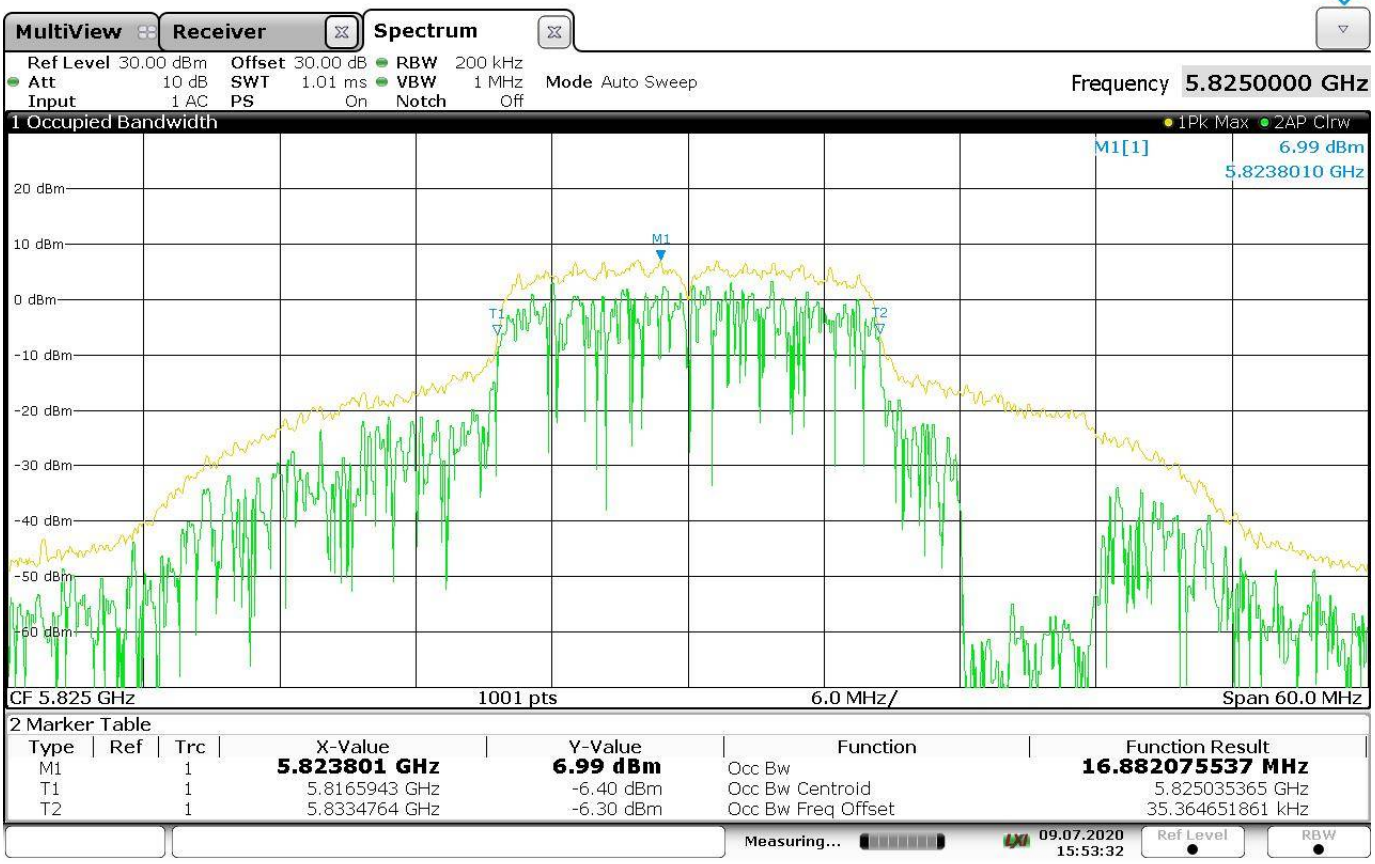
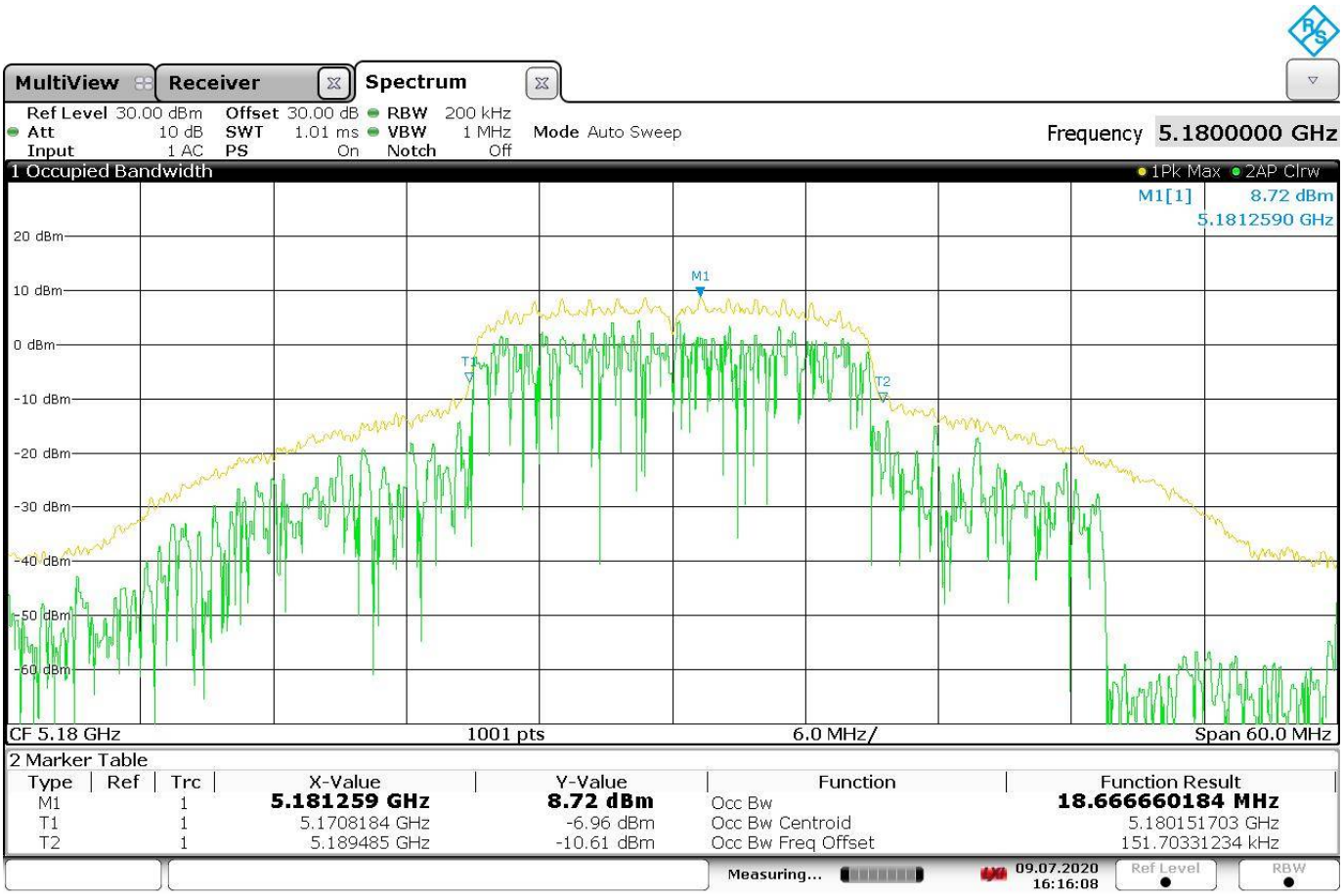


802.11a, 6Mbps



802.11a, 6Mbps



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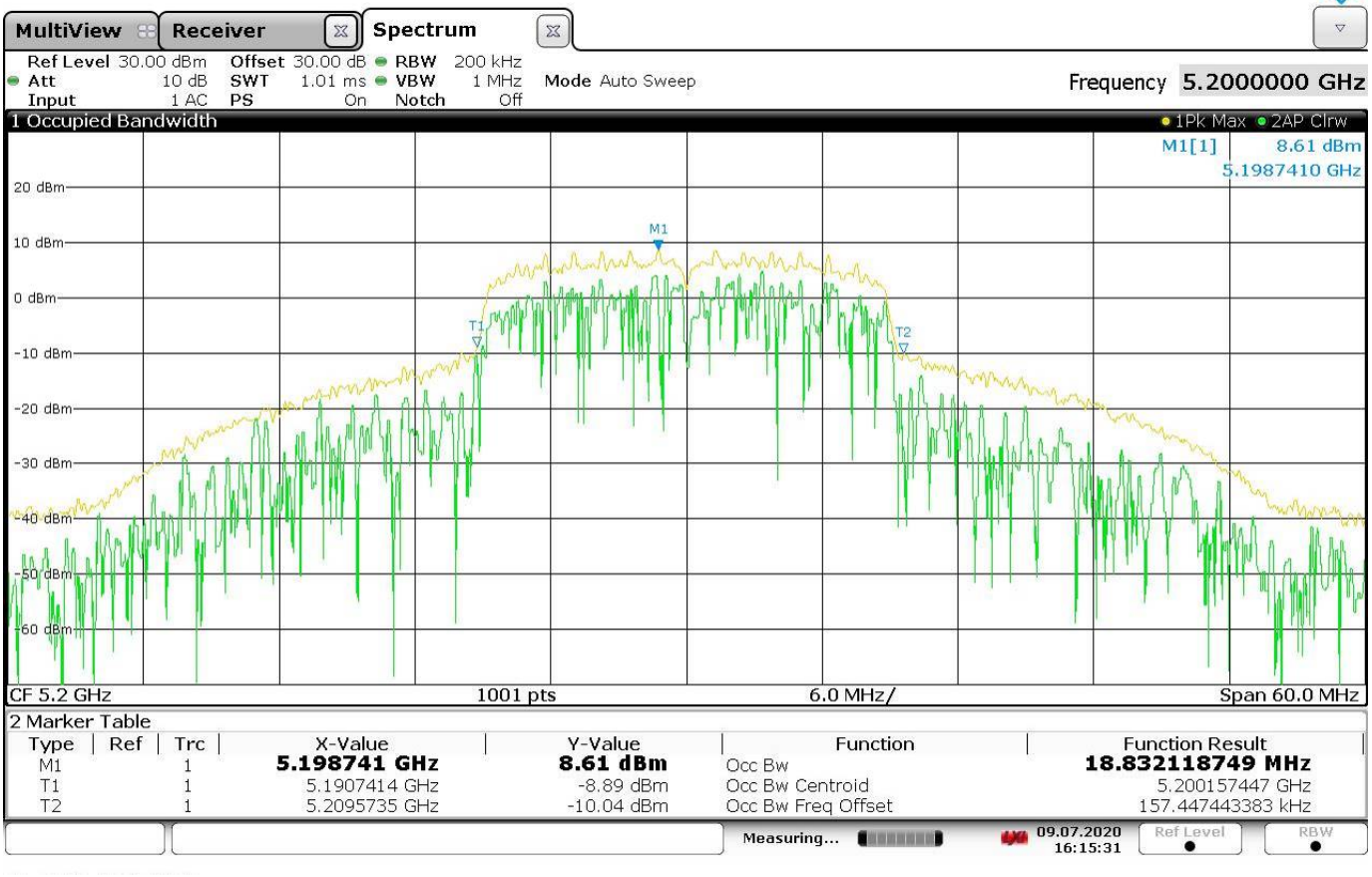
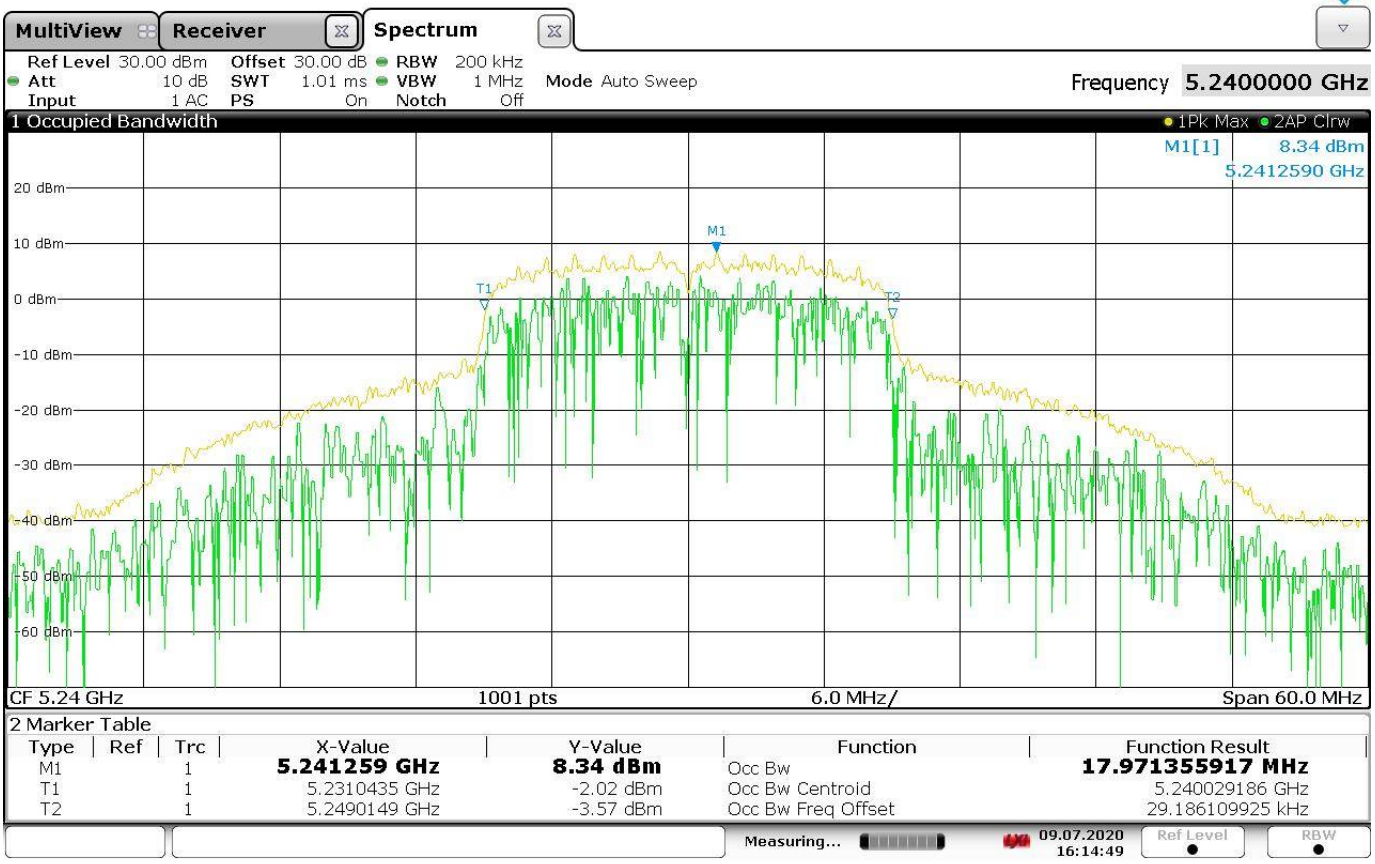
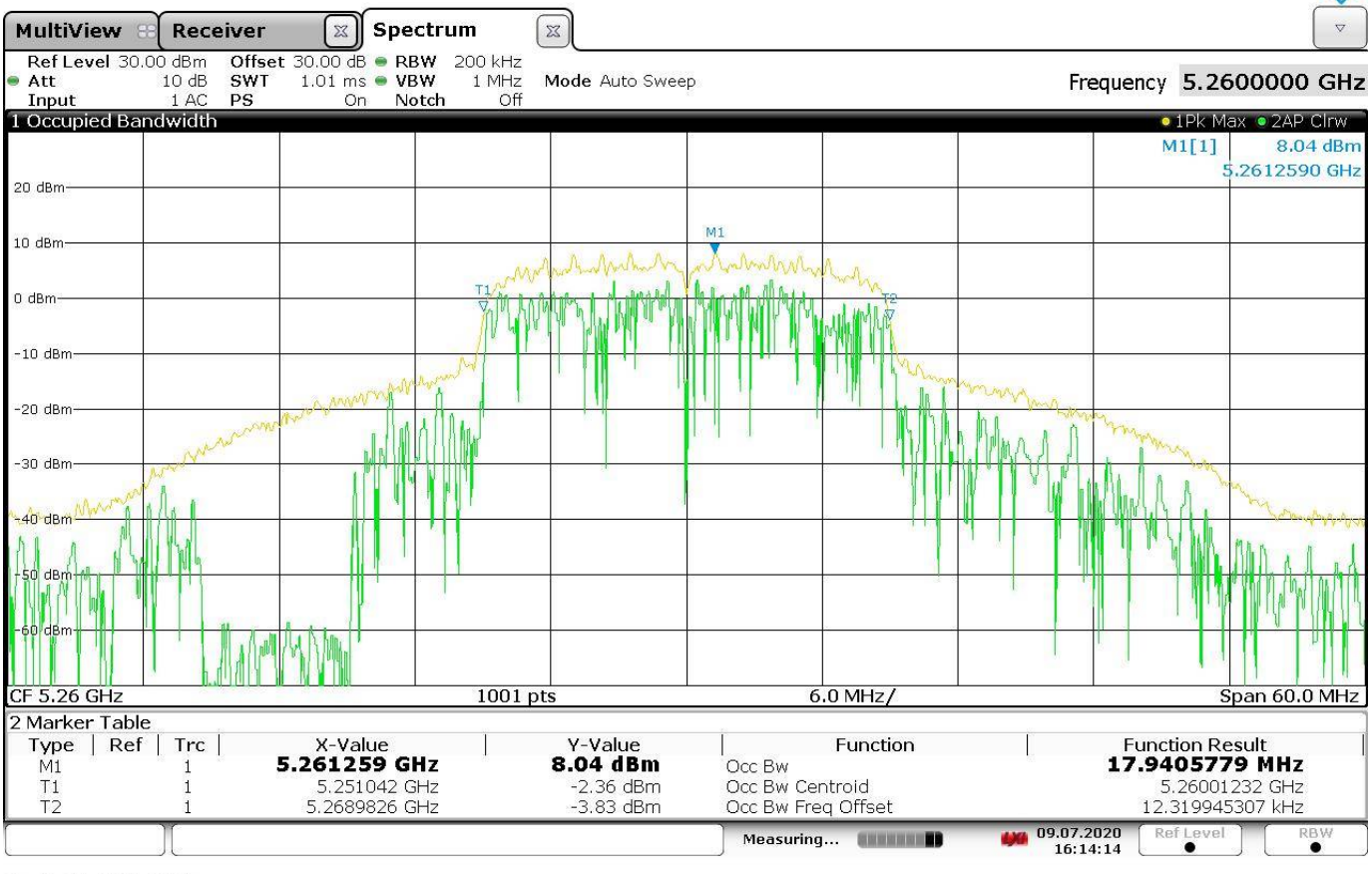


802.11n (HT20), 6.5Mbps,



802.11n (HT20), 6.5Mbps,



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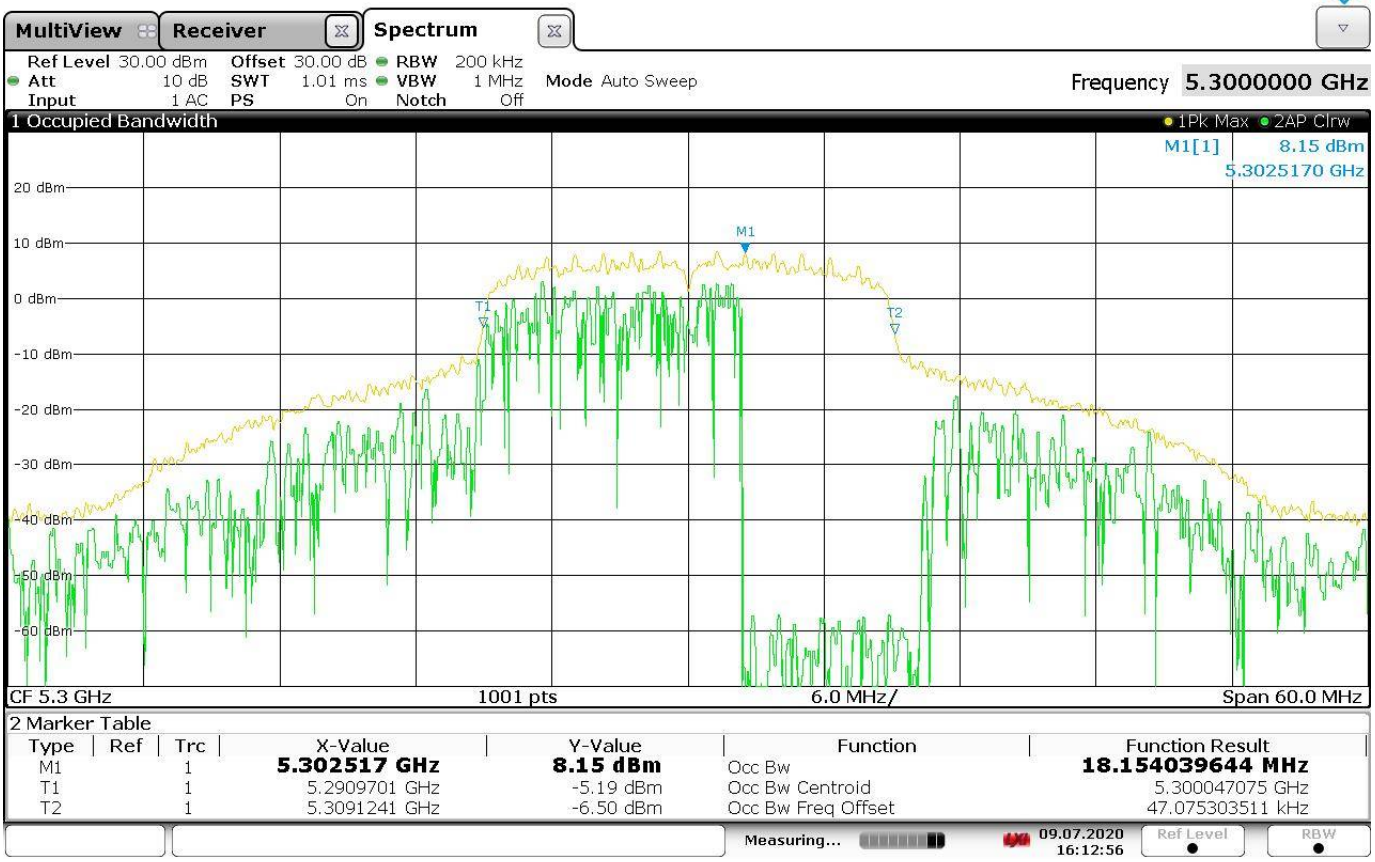

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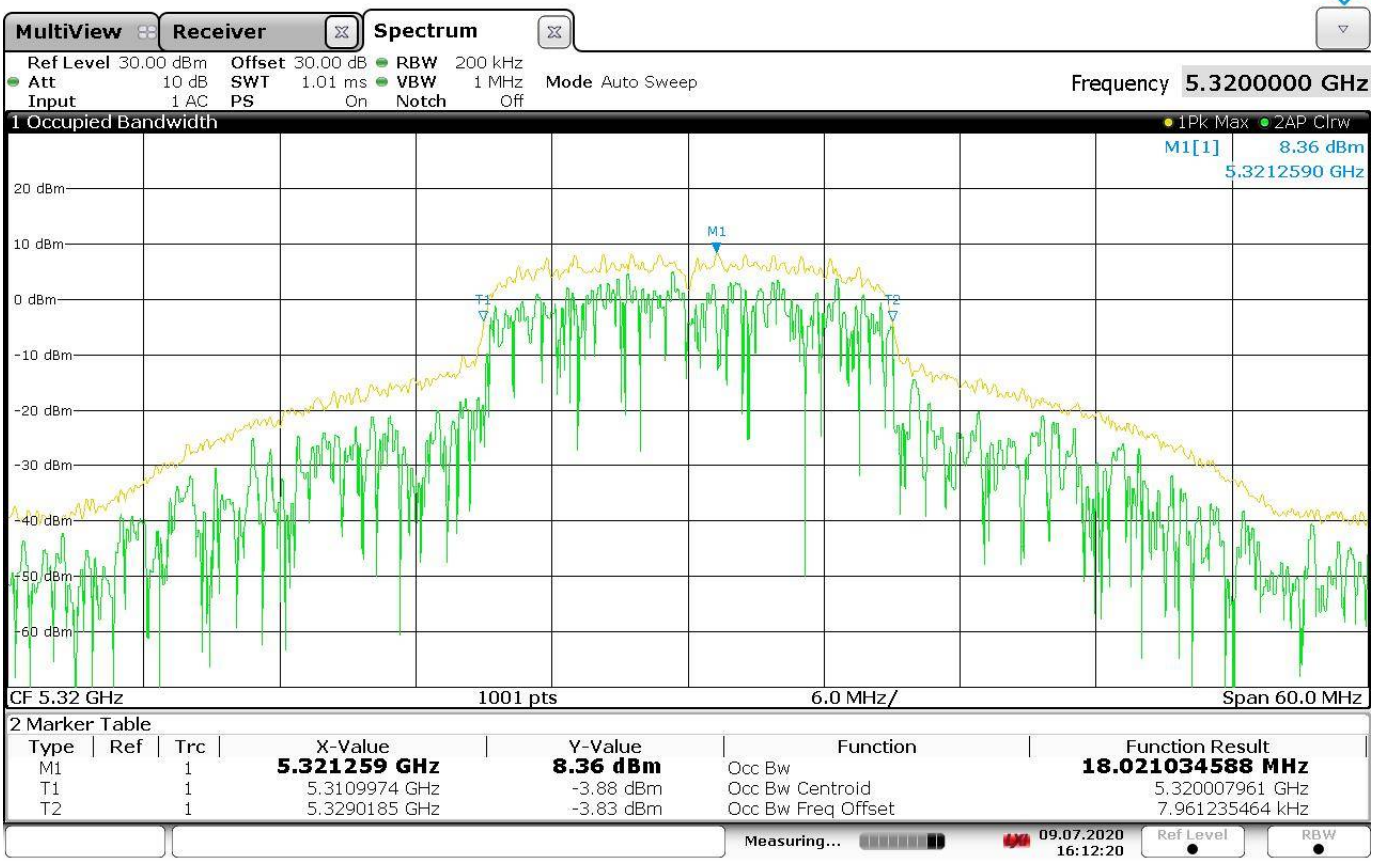

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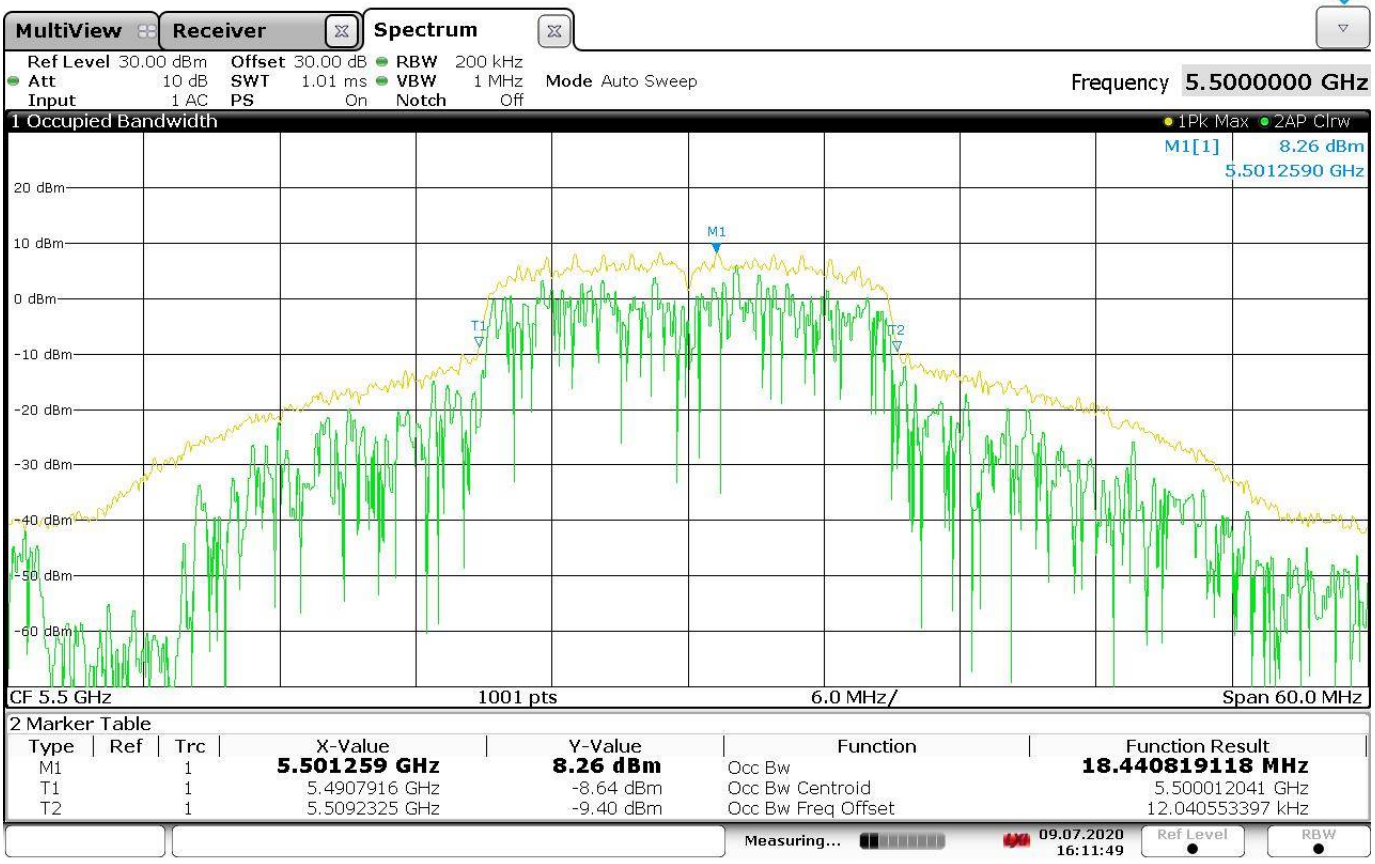

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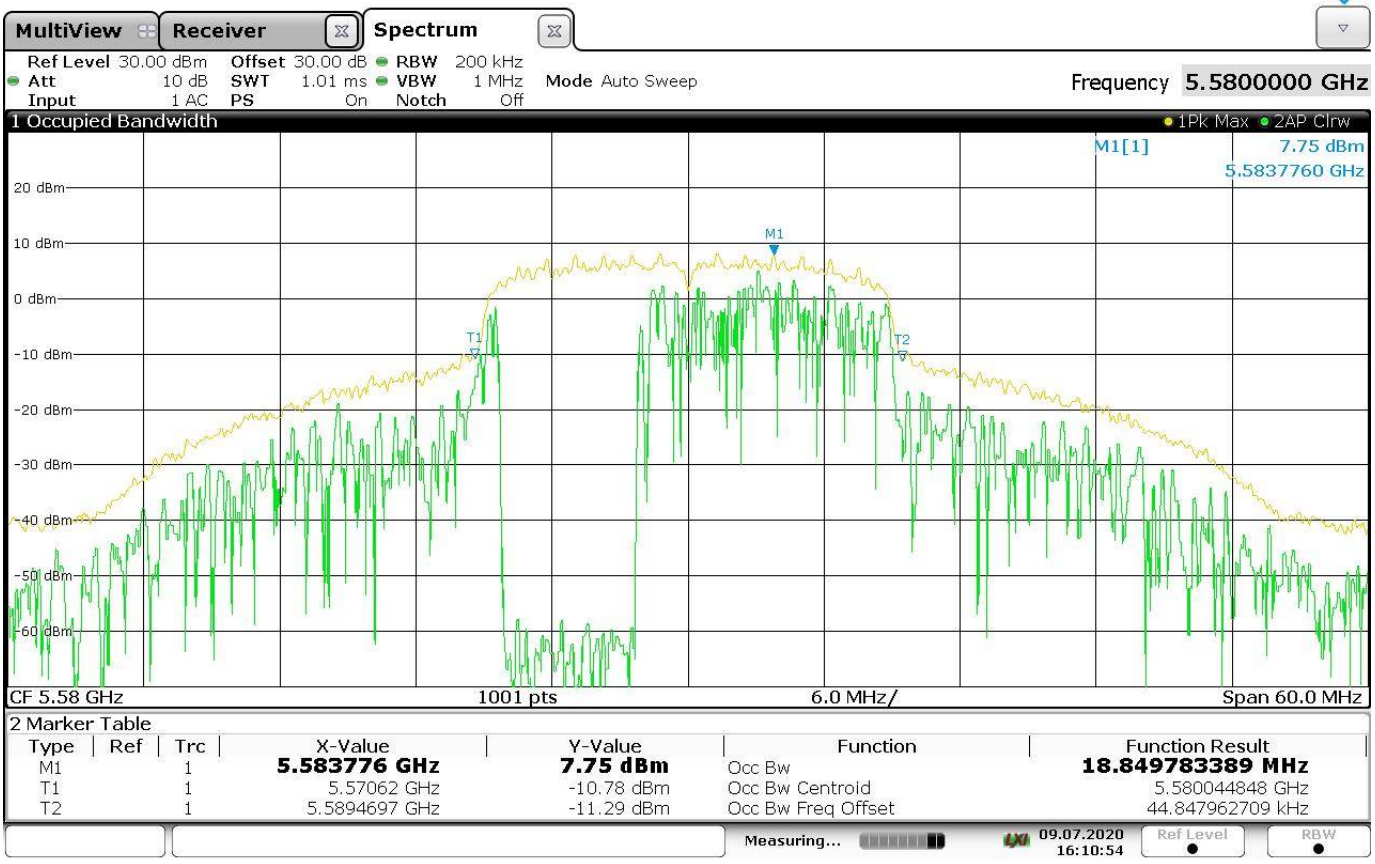

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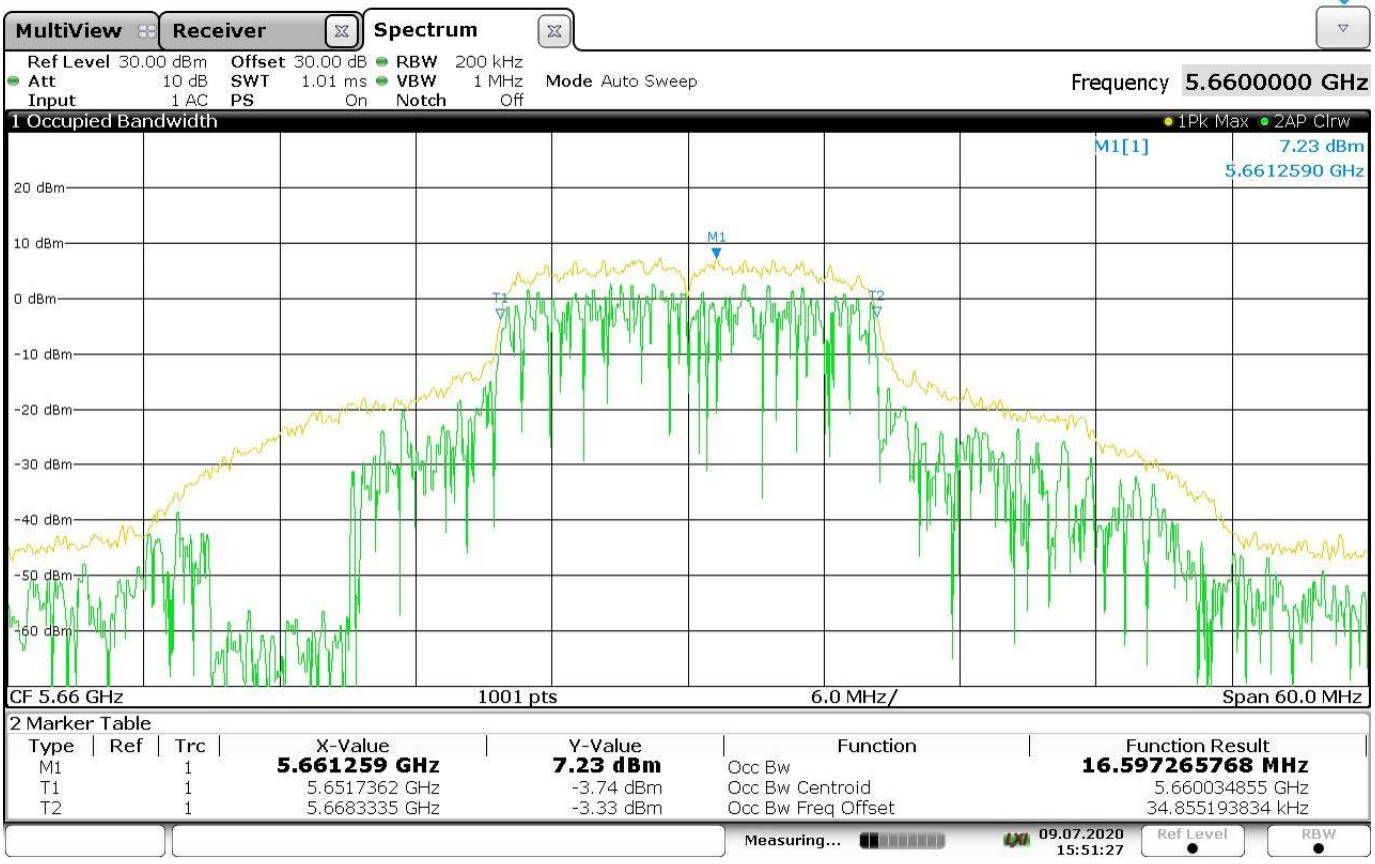
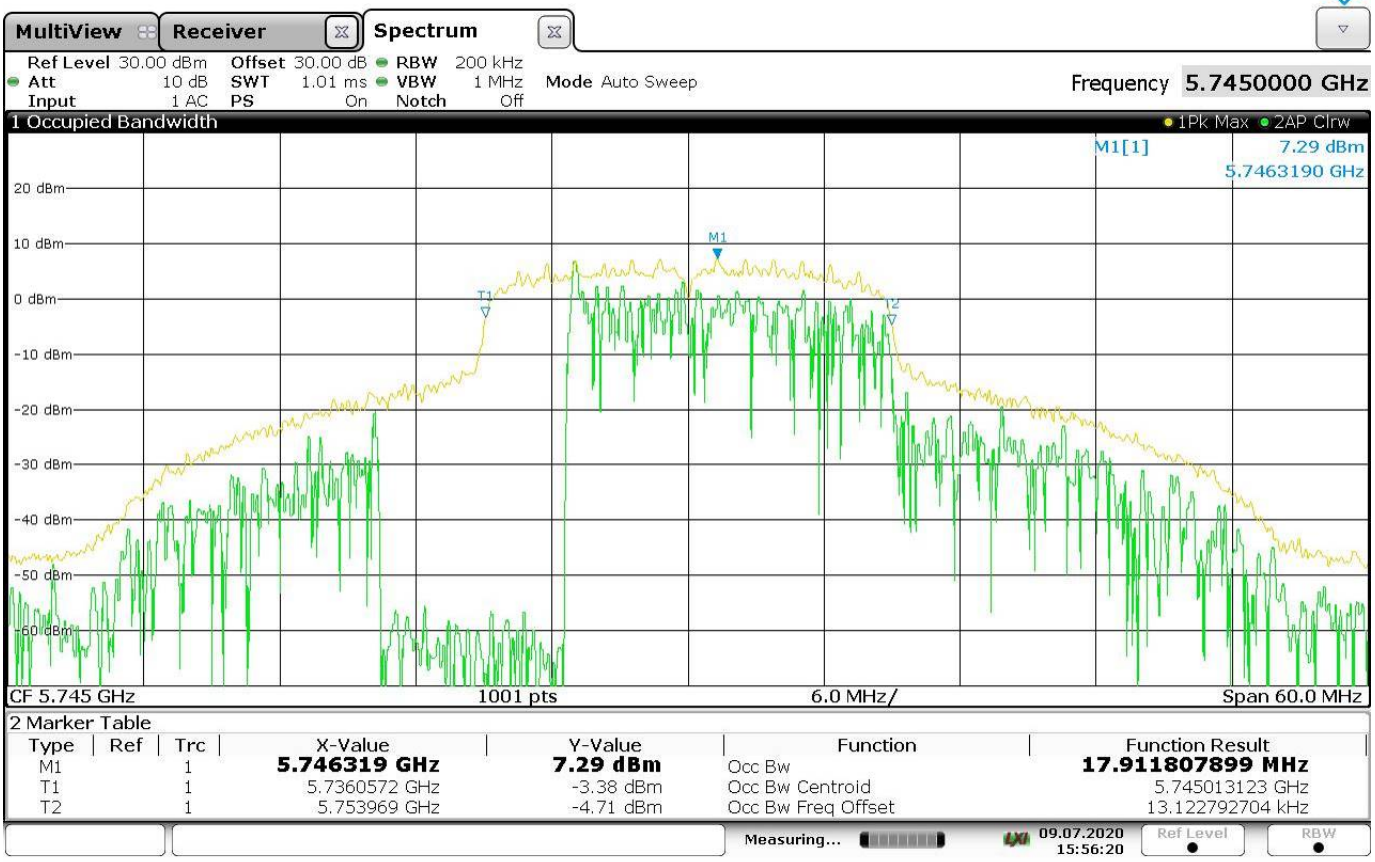


802.11n (HT20), 6.5Mbps,

802.11n (HT20), 6.5Mbps,



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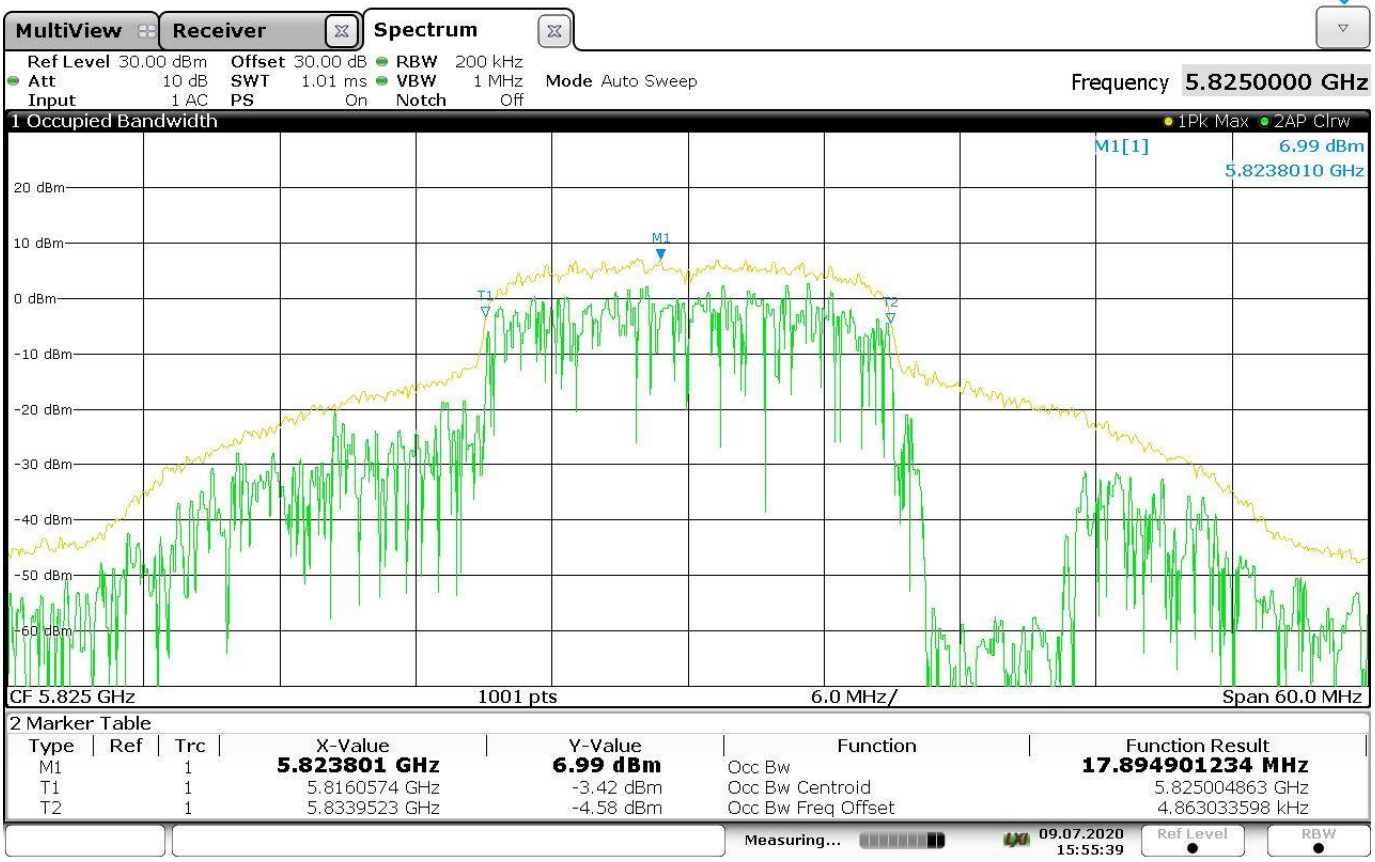
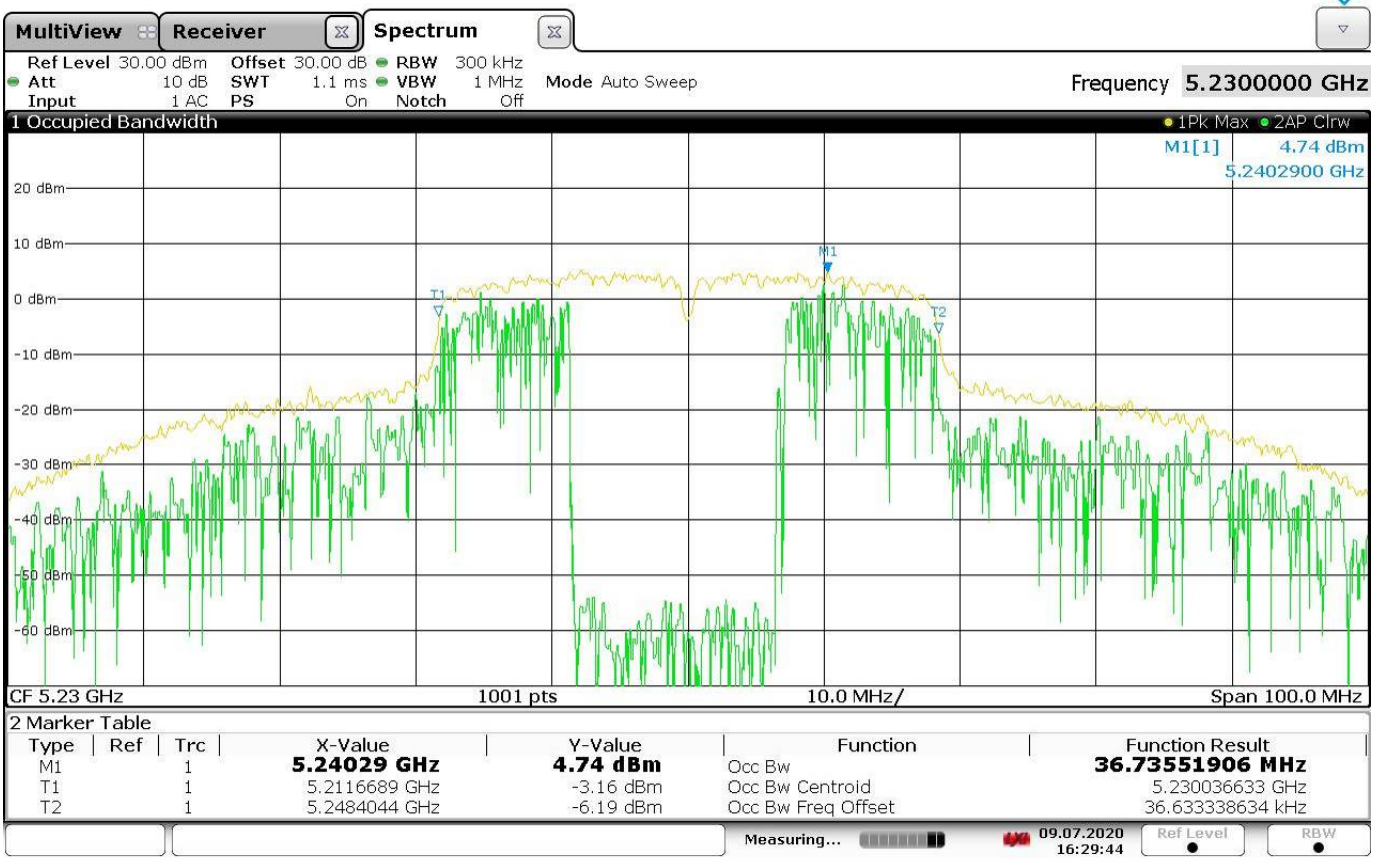
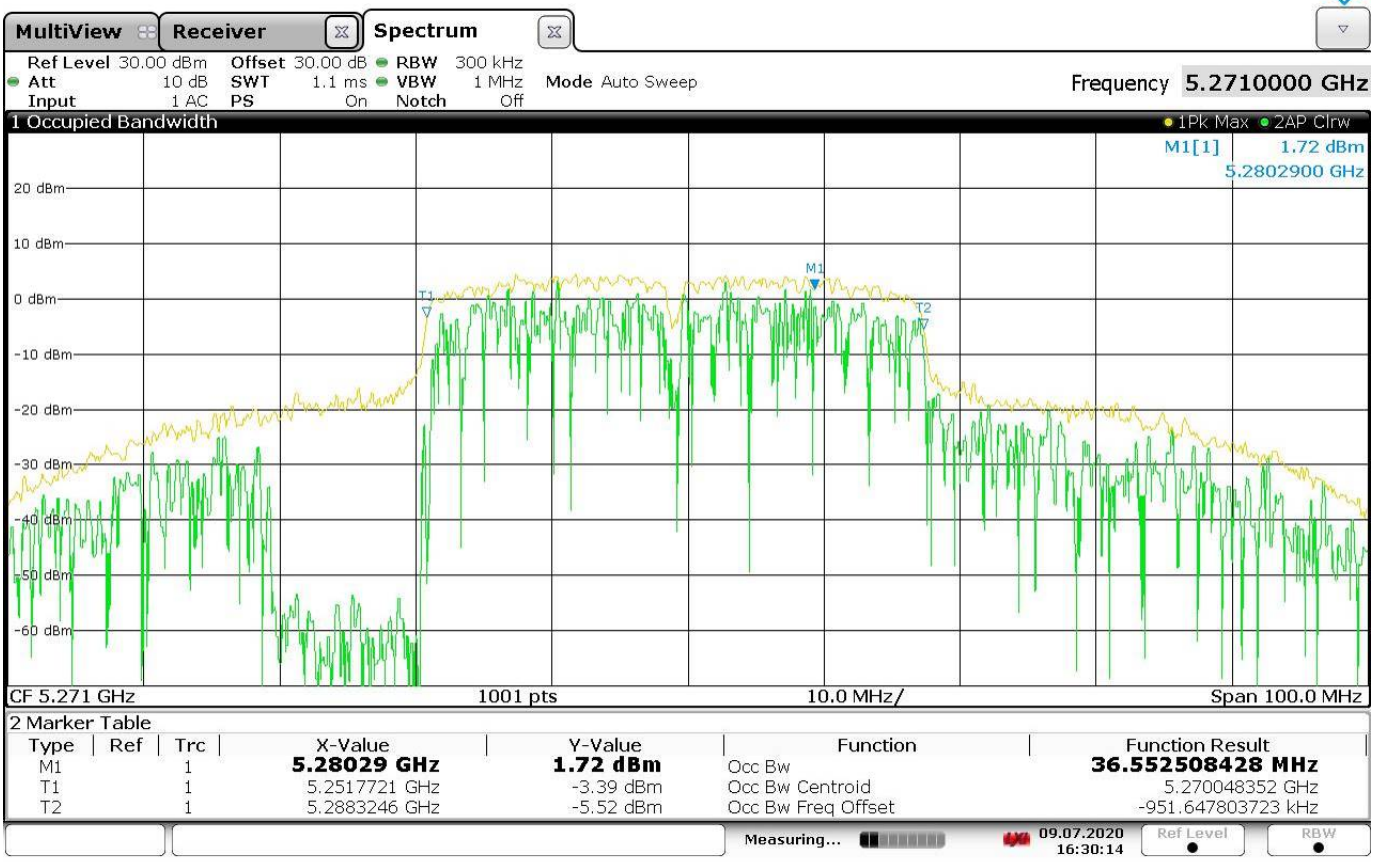


802.11n (HT20), 6.5Mbps,

802.11n (HT40), 13.5 Mbps,



802.11n (HT40), 13.5 Mbps,



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