FCC PART 15C
TEST REPORT
No.I19Z70351-IOT05

for

Client name: Samsung Electronics. Co., Ltd.

Product name: Mobile phone

Model name: SM-S111DL,SM-A015U1

With

FCC ID: ZCASMS111DL

Hardware Version: REV3.0

Software Version: S111DL.001(S111DLUDE0ATB3),

A015U1.001(A015U1UEE0ATC2)

Issued Date: 2020-03-23

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

CTTL-Telecommunication Technology Labs, CAICT

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512, Fax:+86(0)10-62304633-2504

Email: cttl_terminals@caict.ac.cn, website: www.caict.ac.cn

REPORT HISTORY

Report Number	Revision	Description	Issue Date
I19Z70351-IOT05	Rev.0	1st edition	2020-03-23

CONTENTS

1. TEST LATORATORY

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

Conducted testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China100191

Radiated testing Location: CTTL(BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology Development Area, Beijing, P. R. China 100176

1.3. TestingEnvironment

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

1.4. Project date

Testing Start Date: 2019-10-18

Testing End Date: 2020-03-19

1.5. Signature

Xie Xiuzhen

(Prepared this test report)

Zheng Wei

(Reviewed this test report)

Hu Xiaoyu

(Approved this test report)

2. CLIENT INFORMATION

2.1. Applicant Information

Company Name:	Samsung Electronics. Co., Ltd.
Address:	19 Chapin Rd.,Building D Pine Brook, NJ 07058
Contact Person:	Jenni Chun
Contact Email:	j1.chun@samsung.com
Telephone:	+1-201-937-4203
Fax:	/

2.2. Manufacturer Information

Company Name:	Samsung Electronics. Co., Ltd.
Address:	Samsung R5, Maetan dong 129, Samsung ro Youngtong gu, Suwon city 443 742, Korea
Contact Person:	JP KIM
Contact Email:	jp426.kim@samsung.com
Telephone:	+82-10-4376-0326
Fax:	/

3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT(AE)

3.1. About EUT

Description	Mobile phone
Model name	SM-S111DL,SM-A015U1
FCC ID	ZCASMS111DL
WLAN Frequency Range	ISM Band: 5725MHz~5850MHz
Type of modulation	OFDM
Voltage	3.85V

Note: Photographs of EUT are shown in ANNEX C of this test report. Components list, please refer to documents of the manufacturer; it is also included in the original test record of Telecommunication Metrology Center of MIIT of People's Republic of China.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version
EUT1	/	REV3.0	S111DL.001(S111DLUDE0ATB3), A015U1.001(A015U1UEE0ATC2)
EUT2	/	REV3.0	S111DL.001(S111DLUDE0ATB3), A015U1.001(A015U1UEE0ATC2)
EUT3	/	REV3.0	S111DL.001(S111DLUDE0ATB3), A015U1.001(A015U1UEE0ATC2)

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Type	SN
AE1	Battery	/	Inbuilt
AE3	Charger	/	/
AE6	USB Cable	/	/

AE1

Model	QL1695
Manufacturer	Ningde Amperex Technology Limited
Capacitance	/
Nominal voltage	3.85 V

AE3

Model	EP-TA50JWE
Manufacturer	DongYang E&P Inc.
Length of cable	/

AE6

Model	ECB-DU68WE
Manufacturer	SHENGHUA
Length of cable	/

*AE ID: is used to identify the test sample in the lab internally.

3.4. General Description

Equipment Under Test (EUT) is a model of Mobile phone with integrated antenna. It consists of normal options: Battery and Charger.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the Client.

4. REFERENCE DOCUMENTS

4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

FCC Part15	FCC CFR 47, Part 15, Subpart C and E: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.407 General technical requirements	2018
ANSI C63.10	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2013
UNII: KDB 789033 D02	General U-NII Test Procedures New Rules v02r01	2017-12
KDB 558074 D01	Federal Communications Commission Office of Engineering and Technology Laboratory Division GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES	2019

5. LABORATORY ENVIRONMENT

Conducted RF performance testing is performed in shielding room.

EMC performance testing is performed in Semi-anechoic chamber.

6. SUMMARY OF TEST RESULTS

6.1. Summary of Test Results

SUMMARY OF MEASUREMENT RESULTS	Sub-clause of Part15C	Sub-clause of IC	Verdict
Maximum Peak Output Power	15.407 (a)	/	BR
Peak Power Spectral Density	15.407 (a)	/	BR
Occupied 6dB Bandwidth	15.407 (e)	/	BR
Band Edges Compliance - Conducted& Radiated	15.407 (b)	/	BR
Transmitter Spurious Emission - Conducted	15.407	/	BR
Transmitter Spurious Emission - Radiated	15.407, 15.205, 15.209	/	BR
AC Powerline Conducted Emission	15.107, 15.207	/	BR

Please refer to **ANNEX A** for detail.

Terms used in Verdict column

P	Pass, The EUT complies with the essential requirements in the standard.
NM	Not measured, The test was not measured by CTTL
BR	Re-use test data from basic model report.
NA	Not Applicable, The test was not applicable
F	Fail, The EUT does not comply with the essential requirements in the standard

6.2. Statements

CTTL has evaluated the test cases requested by the client/manufacturer as listed in section 6.1 of this report for the EUT specified in section 3 according to the standards or reference documents listed in section 4.1.

This report only deals with the WLAN function among the features described in section 3.

6.3. Explanation of re-use of test data

The Equipment Under Test (EUT) model SM-S111DL,SM-A015U1 (FCC ID: ZCASMS111DL) is a variant product of SM-A015T1 (FCC ID: ZCASMA015T1), according to the declaration of changes provided by the applicant and FCC KDB publication 484596 D01, spot check measurements were performed on this device, all the test results are derived from test report No.I19Z70327-IOT05.

For detail differences between two models please refer the Declaration of Changes document.

For this report, all the test cases are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

Temperature	26℃
Voltage	3.85V
Humidity	44%

7. TEST EQUIPMENTS UTILIZED

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ40	200089	Rohde & Schwarz	1 year	2020-05-15
2	LISN	ENV216	101200	Rohde & Schwarz	1 year	2020-03-14
3	Test Receiver	ESCI	100344	Rohde & Schwarz	1 year	2020-02-14
4	Shielding Room	S81	/	ETS-Lindgren	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100235	Rohde & Schwarz	1 year	2020-03-01
2	BiLog Antenna	VULB9163	9163-1222	Schwarzbeck	1 year	2020-03-14
3	Dual-Ridge Waveguide Horn Antenna	3115	6914	ETS-Lindgren	1year	2021-01-03
4	EMI Antenna	3116	2661	ETS-Lindgren	1 Year	2020-10-14
5	Vector Signal Analyzer	FSV40	101047	Rohde & Schwarz	1 year	2020-05-16

8. Measurement Uncertainty

8.1. Transmitter Output Power

Measurement Uncertainty: 0.387dB,k=1.96

8.2. Peak Power Spectral Density

Measurement Uncertainty: 0.705dB,k=1.96

8.3. Occupied 6dB Bandwidth

Measurement Uncertainty: 60.80Hz,k=1.96

8.4. Band Edges Compliance

Measurement Uncertainty : 0.62dB,k=1.96

8.5. Spurious Emissions

Conducted (k=1.96)

Frequency Range	Uncertainty(dB)
30MHz ≤ f ≤ 2GHz	1.22
2GHz ≤ f ≤3.6GHz	1.22
3.6GHz ≤ f ≤8GHz	1.22
8GHz ≤ f ≤12.75GHz	1.51
12.75GHz ≤ f ≤26GHz	1.51
26GHz ≤ f ≤40GHz	1.59

Radiated (k=2)

Frequency Range	Uncertainty(dB)
9kHz-30MHz	/
30MHz ≤ f ≤ 1GHz	5.40
1GHz ≤ f ≤18GHz	4.32
18GHz ≤ f ≤40GHz	5.26

8.6. AC Power-line Conducted Emission

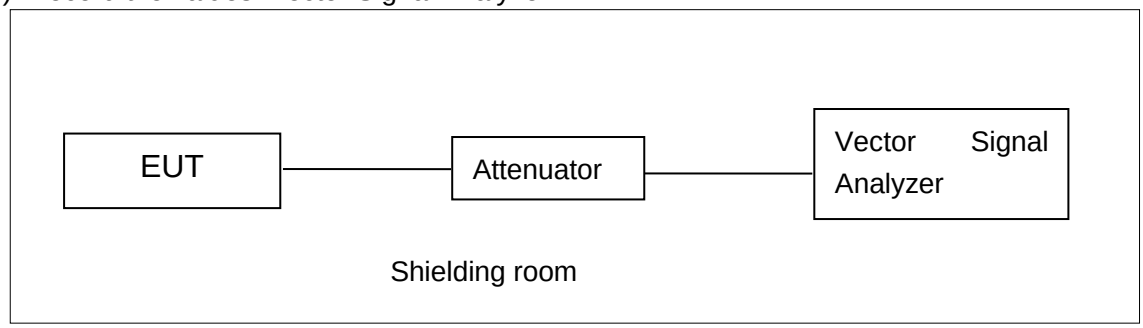
Measurement Uncertainty : 3.38dB,k=2

ANNEX A: MEASUREMENT RESULTS

A.1. Measurement Method

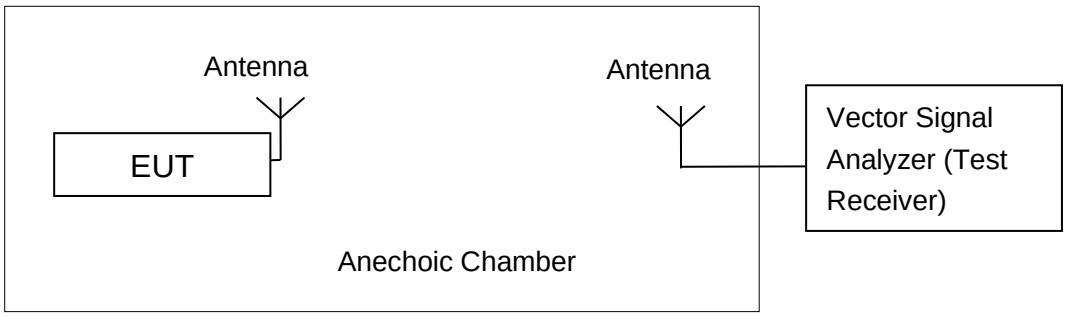
A.1.1. Conducted Measurements

1). Connect the EUT to the test system correctly.
2). Set the EUT to the required work mode.
3). Set the EUT to the required channel.
4). Set the spectrum analyzer to start measurement.
5). Record the values. Vector Signal Analyzer



A.1.2. Radiated Emission Measurements

In the case of radiated emission, the used settings are as follows,
Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;
Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 10Hz;



The measurement is made according to ANSI C63.10.
The radiated emission test is performed in semi-anechoic chamber. The distance from the EUT to the reference point of measurement antenna is 3m. The test is carried out on both vertical and horizontal polarization and only maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result.

A.2. Maximum Peak Output Power

Measurement Limit and Method:

Standard	Limit (dBm)
FCC CRF Part 15.407(a)	< 30

A.2.1 Antenna Gain

Antenna gain is -1dBi and the value is supplied by the applicant or manufacturer.

A.2.2. Maximum Peak Output Power-conducted

Measurement Results:

802.11a mode

Mode	Data Rate (Mbps)	Test Result (dBm)		
		5745MHz (Ch149)	5785MHz (Ch157)	5825MHz (Ch165)
802.11a	6	23.86	/	/
	9	23.89	/	/
	12	23.77	/	/
	18	23.58	/	/
	24	24.14	24.18	24.05
	36	23.70	/	/
	48	23.39	/	/
	54	23.41	/	/

The data rate 24Mbps is selected as worse condition, and the following cases are performed with this condition.

802.11n-HT20 mode

Mode	Data Rate (Index)	Test Result (dBm)		
		5745MHz (Ch149)	5785MHz (Ch157)	5825MHz (Ch165)
802.11n (20MHz)	MCS0	24.00		
	MCS1	23.87	/	/
	MCS2	23.79	/	/
	MCS3	24.19	24.35	24.13
	MCS4	23.75	/	/
	MCS5	23.41	/	/
	MCS6	22.55	/	/
	MCS7	22.51	/	/

The data rate MCS3 is selected as worse condition, and the following cases are performed with this condition.

802.11n-HT40 mode

Mode	Data Rate (Index)	Test Result (dBm)	
		5755MHz	5795MHz

		(Ch151)	(Ch159)
802.11n (40MHz)	MCS0	23.88	/
	MCS1	23.82	/
	MCS2	23.88	/
	MCS3	24.33	24.38
	MCS4	23.27	/
	MCS5	22.89	/
	MCS6	22.37	/
	MCS7	21.97	/

The data rate MCS3 is selected as worse condition, and the following cases are performed with this condition.

The spot check is 23.87 (802.11n-HT40 ch159 MCS3).

Conclusion: PASS

A.2.3. Maximum Average Output Power-Conducted

Method of Measurement: See ANSI C63.10-clause 12.3.2.2 Method SA-1

Duty Cycle

802.11a	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
	99%	99%	99%	99%	99%	98%	97%	97%
802.11n(HT20)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
	99%	99%	99%	98%	98%	97%	97%	97%
802.11n(HT40)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
	98%	96%	95%	93%	90%	86%	86%	85%

802.11a mode

Mode	Test Result (dBm)		
	5745MHz (Ch149)	5785MHz (Ch157)	5825MHz (Ch165)
802.11a	15.47	15.45	15.29

802.11n-HT20 mode

Mode	Test Result (dBm)		
	5745MHz (Ch149)	5785MHz (Ch157)	5825MHz(Ch165)
802.11n(20MHz)	15.64	15.63	15.46

802.11n-HT40 mode

Mode	Test Result (dBm)	
	5755MHz (Ch151)	5795MHz(Ch159)
802.11n(40MHz)	15.10	15.29

Conclusion: PASS

A.3. Peak Power Spectral Density

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.407(a)	< 30 dBm/500 kHz

The measurement is made according to ANSI C63.10 and KDB789033 D02

Measurement Uncertainty:

Measurement Uncertainty	0.75dB

Measurement Results:

Mode	Channel	Power Spectral Density (dBm/500kHz)	Conclusion
802.11a	149	3.73	P
	157	3.90	P
	165	3.86	P
802.11n HT20	149	3.67	P
	157	3.64	P
	165	3.54	P
802.11n HT40	151	1.65	P
	159	1.89	P

Conclusion: PASS

A.4. Occupied 6dB Bandwidth

Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.407 (e)	≥ 500

The measurement is made according to KDB789033 D02 .

Measurement Uncertainty:

Measurement Uncertainty	60.80Hz

Measurement Result:

Mode	Channel	Occupied 6dB Bandwidth (MHz)		conclusion
802.11a	149	Fig.1	16.45	P
	157	Fig.2	16.55	P
	165	Fig.3	16.50	P
802.11n HT20	149	Fig.4	17.75	P
	157	Fig.5	17.70	P
	165	Fig.6	17.70	P
802.11n HT40	151	Fig.7	36.32	P
	159	Fig.8	36.24	P

Conclusion: PASS

Test graphs as below:

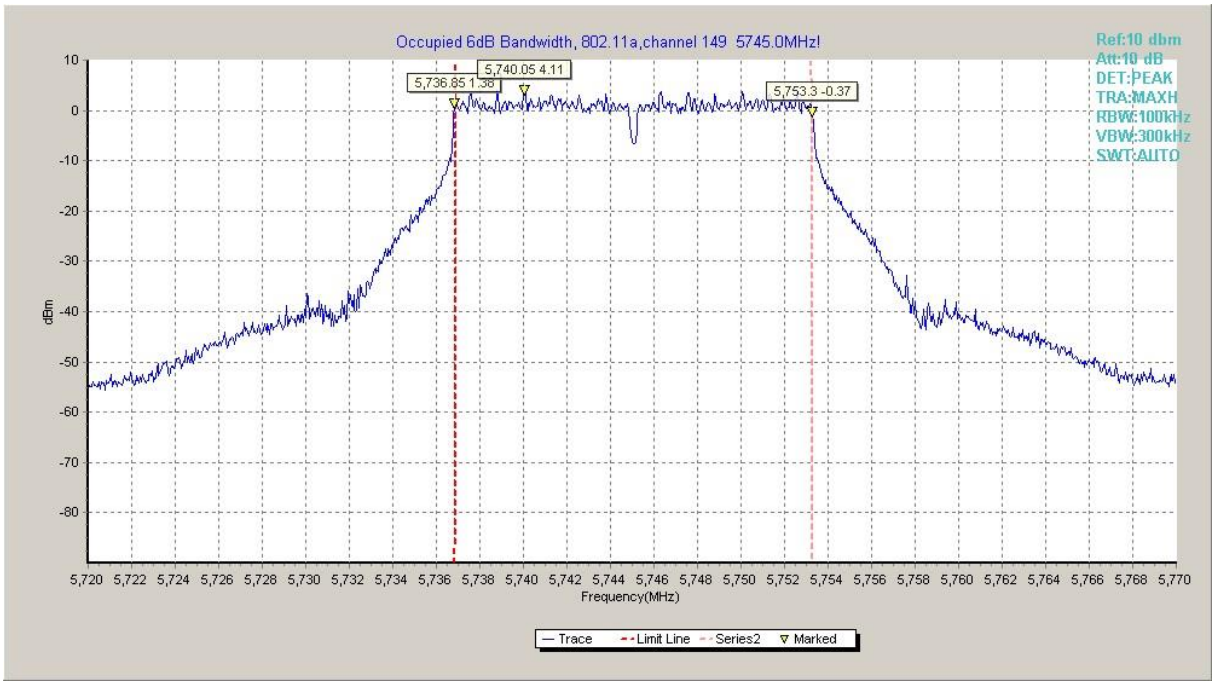


Fig. 1 Occupied 6dB Bandwidth (802.11a, Ch 149)

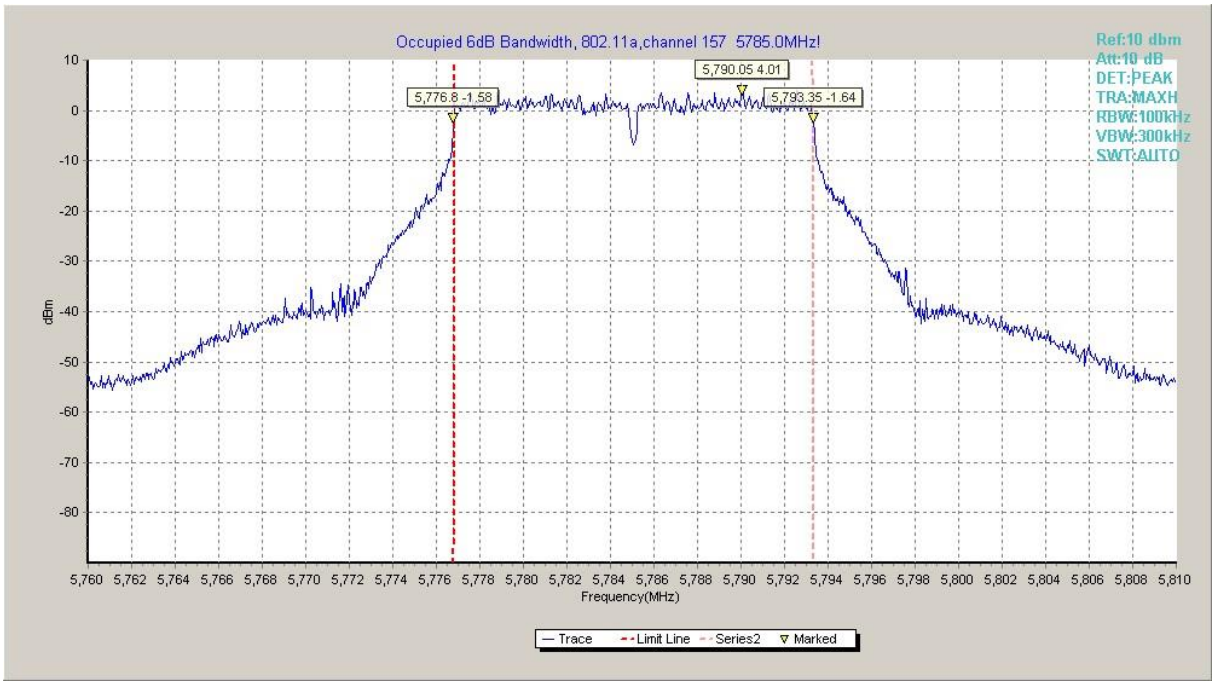


Fig. 2 Occupied 6dB Bandwidth (802.11a, Ch 157)

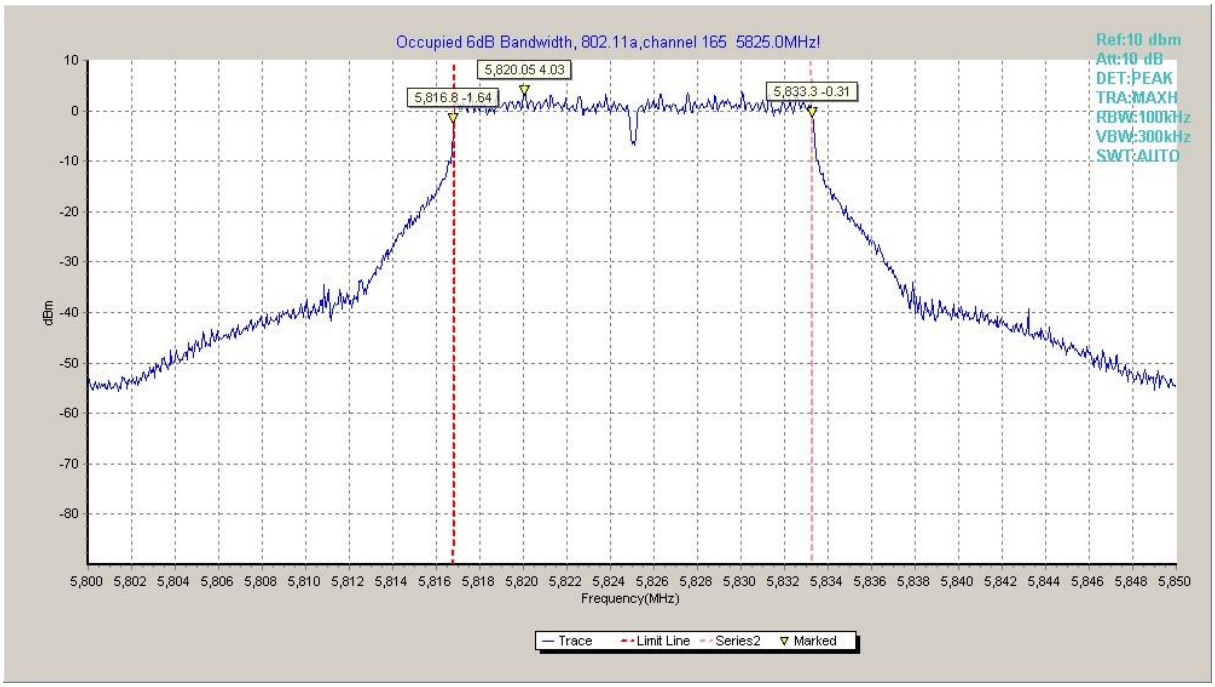


Fig. 3 Occupied 6dB Bandwidth (802.11a, Ch 165)

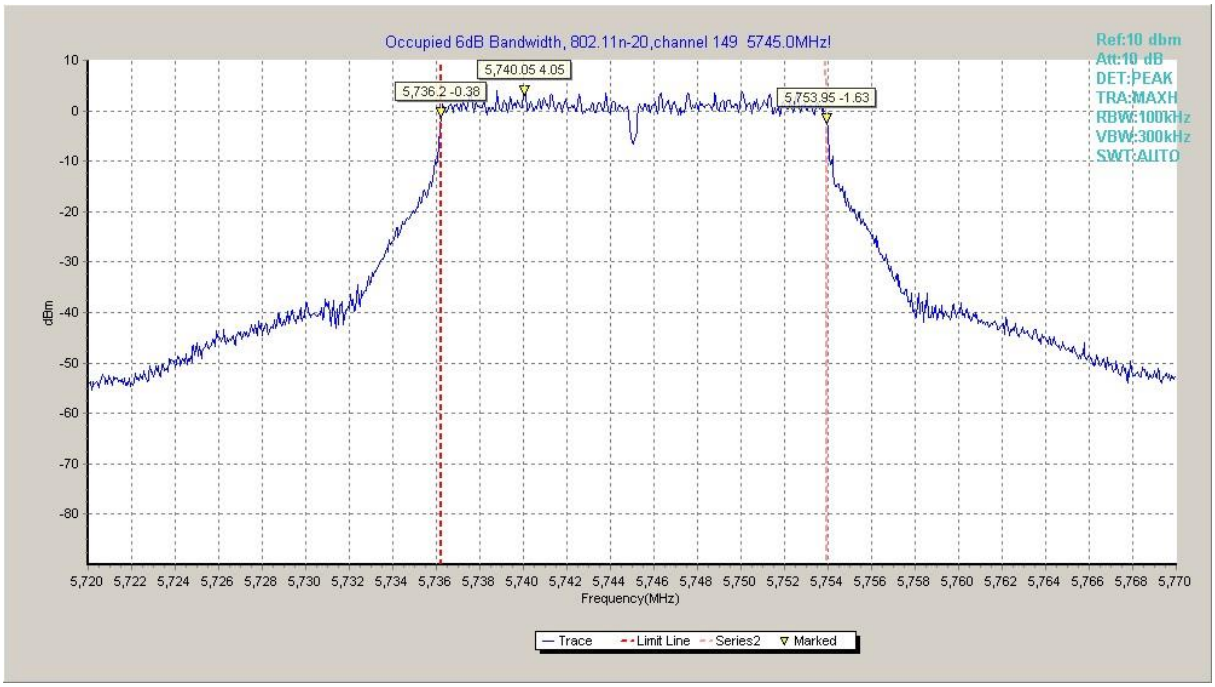


Fig. 4 Occupied 6dB Bandwidth (802.11n-HT20, Ch 149)

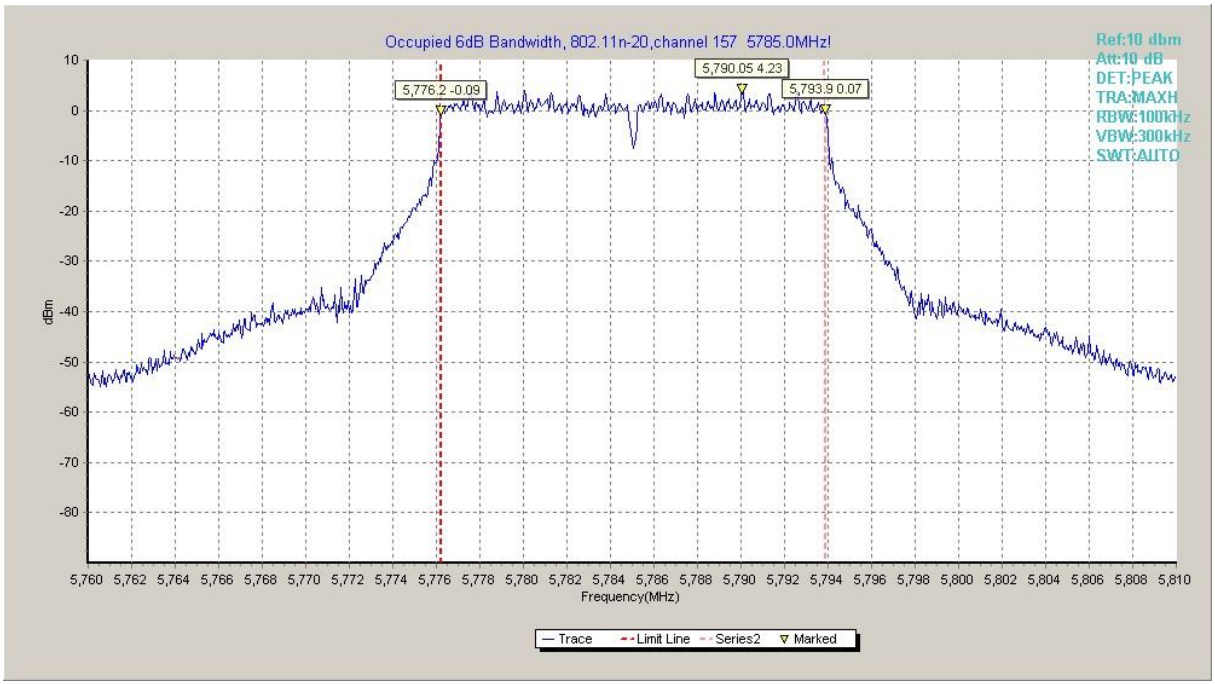


Fig. 5 Occupied 6dB Bandwidth (802.11n-HT20, Ch 157)

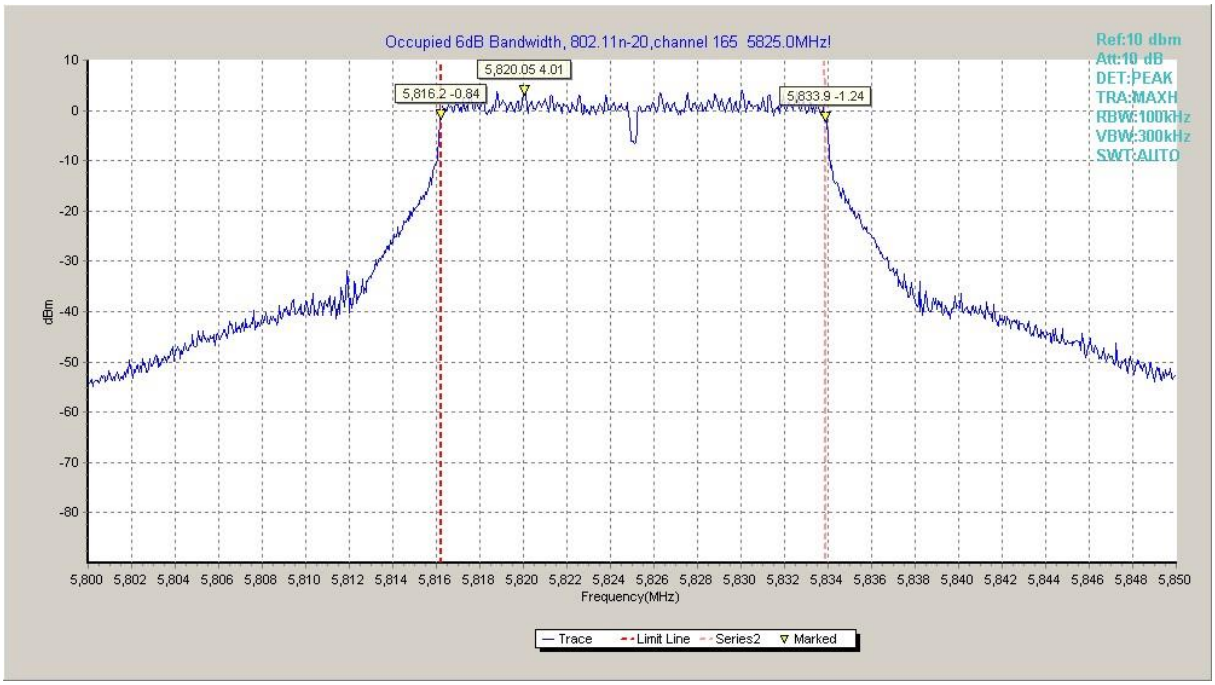


Fig. 6 Occupied 6dB Bandwidth (802.11n-HT20, Ch 165)

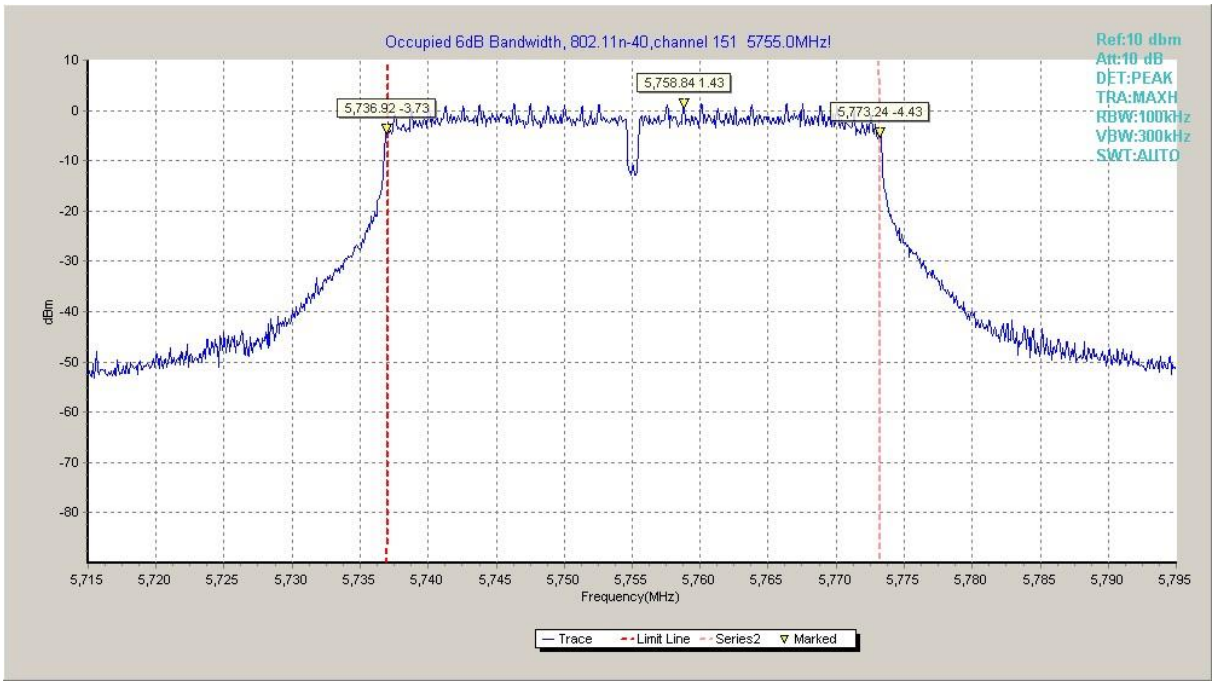


Fig. 7 Occupied 6dB Bandwidth (802.11n-HT40, Ch 151)

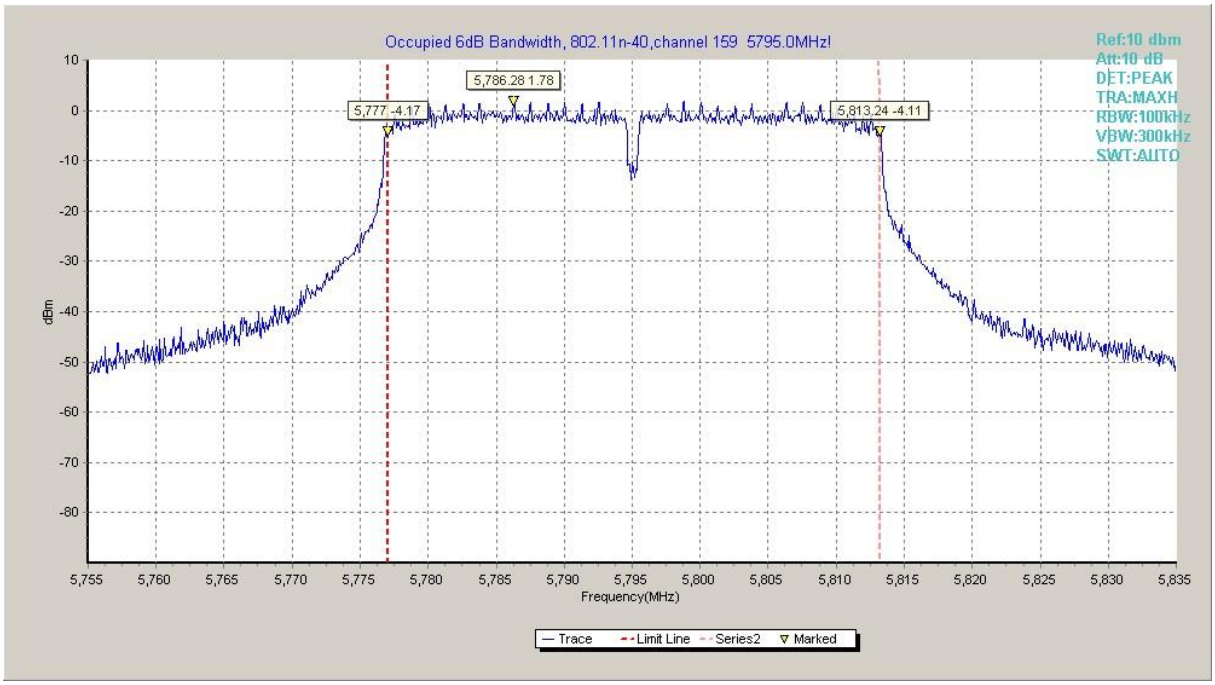


Fig. 8 Occupied 6dB Bandwidth (802.11n-HT40, Ch 159)

A.5. Transmitter Spurious Emission

Measurement Limit:

Standard	Frequency (MHz)	Limit (dBm/MHz)
FCC 47 CFR Part 15.407	5725MHz~5850MHz	< -27

The measurement is made according to ANSI C63.10 .

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Measurement Uncertainty:

Frequency Range	Uncertainty(dB)
30MHz ≤ f ≤ 2GHz	0.63
2GHz ≤ f ≤3.6GHz	0.82
3.6GHz ≤ f ≤8GHz	1.55
8GHz ≤ f ≤20GHz	1.86
20GHz ≤ f ≤22GHz	1.90
22GHz ≤ f ≤26GHz	2.20

A.5.1 Transmitter Spurious Emission - Conducted

Measurement Results:

802.11a mode

MODE	Channel	Frequency Range	Test Results	Conclusion
802.11a	149	30 MHz ~ 1 GHz	Fig.9	P
		1 GHz ~ 12 GHz	Fig.10	P
		12 GHz ~ 25 GHz	Fig.11	P
		25 GHz ~ 40 GHz	Fig.12	P
	157	30 MHz ~ 1 GHz	Fig.13	P
		1 GHz ~ 12 GHz	Fig.14	P
		12 GHz ~ 25 GHz	Fig.15	P
		25 GHz ~ 40 GHz	Fig.16	P
	165	30 MHz ~ 1 GHz	Fig.17	P
		1 GHz ~ 12 GHz	Fig.18	P
		12 GHz ~ 25 GHz	Fig.19	P
		25 GHz ~ 40 GHz	Fig.20	P

802.11n-HT20 mode

MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n HT20	149	30 MHz ~ 1 GHz	Fig.21	P
		1 GHz ~ 12 GHz	Fig.22	P
		12 GHz ~ 25 GHz	Fig.23	P
		25 GHz ~ 40 GHz	Fig.24	P
	157	30 MHz ~ 1 GHz	Fig.25	P
		1 GHz ~ 12 GHz	Fig.26	P
		12 GHz ~ 25 GHz	Fig.27	P
		25 GHz ~ 40 GHz	Fig.28	P
	165	30 MHz ~ 1 GHz	Fig.29	P
		1 GHz ~ 12 GHz	Fig.30	P
		12 GHz ~ 25 GHz	Fig.31	P
		25 GHz ~ 40 GHz	Fig.32	P

802.11n-HT40 mode

MODE	Channel	Frequency Range	Test Results	Conclusion
802.11n HT40	151	30 MHz ~ 1 GHz	Fig.33	P
		1 GHz ~ 12 GHz	Fig.34	P
		12 GHz ~ 25 GHz	Fig.35	P
		25 GHz ~ 40 GHz	Fig.36	P
	159	30 MHz ~ 1 GHz	Fig.37	P
		1 GHz ~ 12 GHz	Fig.38	P
		12 GHz ~ 25 GHz	Fig.39	P
		25 GHz ~ 40 GHz	Fig.40	P

Conclusion: PASS

Test graphs as below:

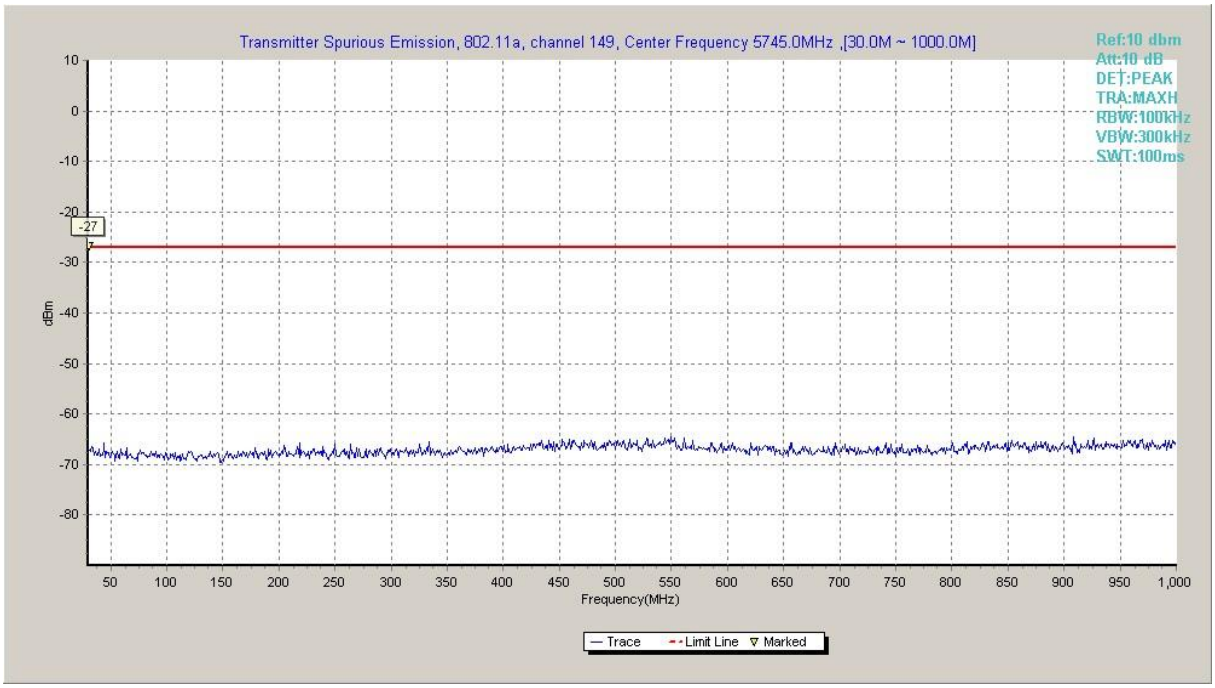


Fig. 9 Conducted Spurious Emission (802.11a, Ch149, 30 MHz-1 GHz)

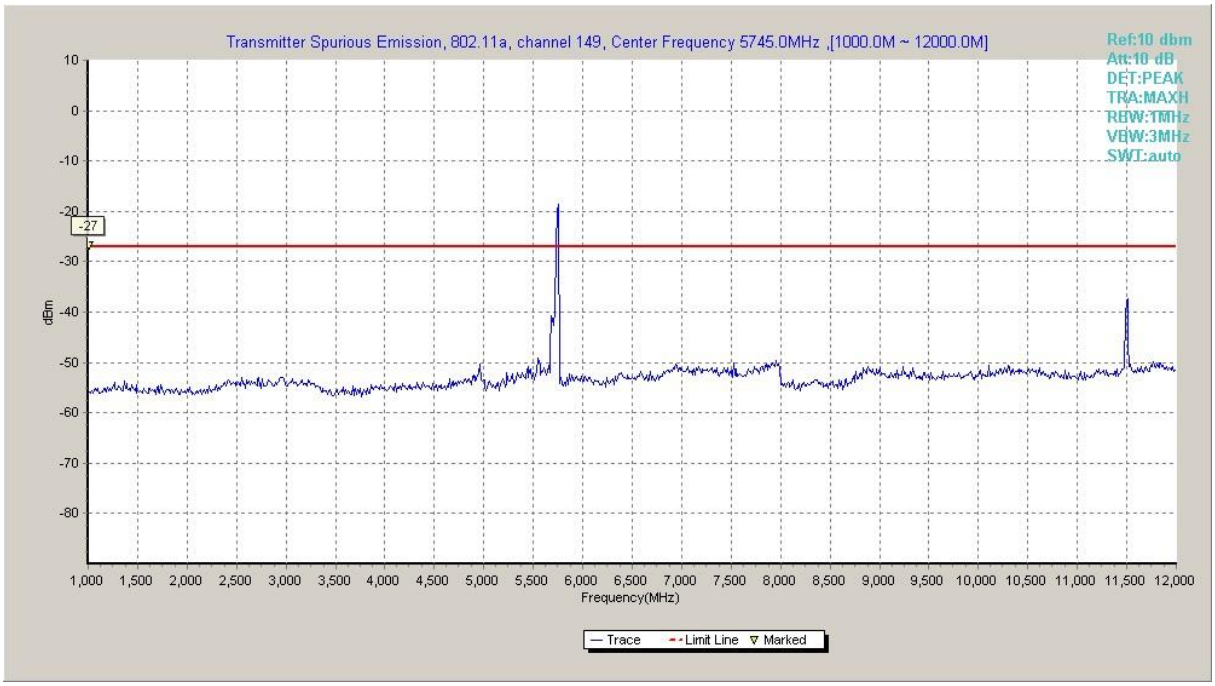


Fig. 10 Conducted Spurious Emission (802.11a, Ch149, 1 GHz -12 GHz)

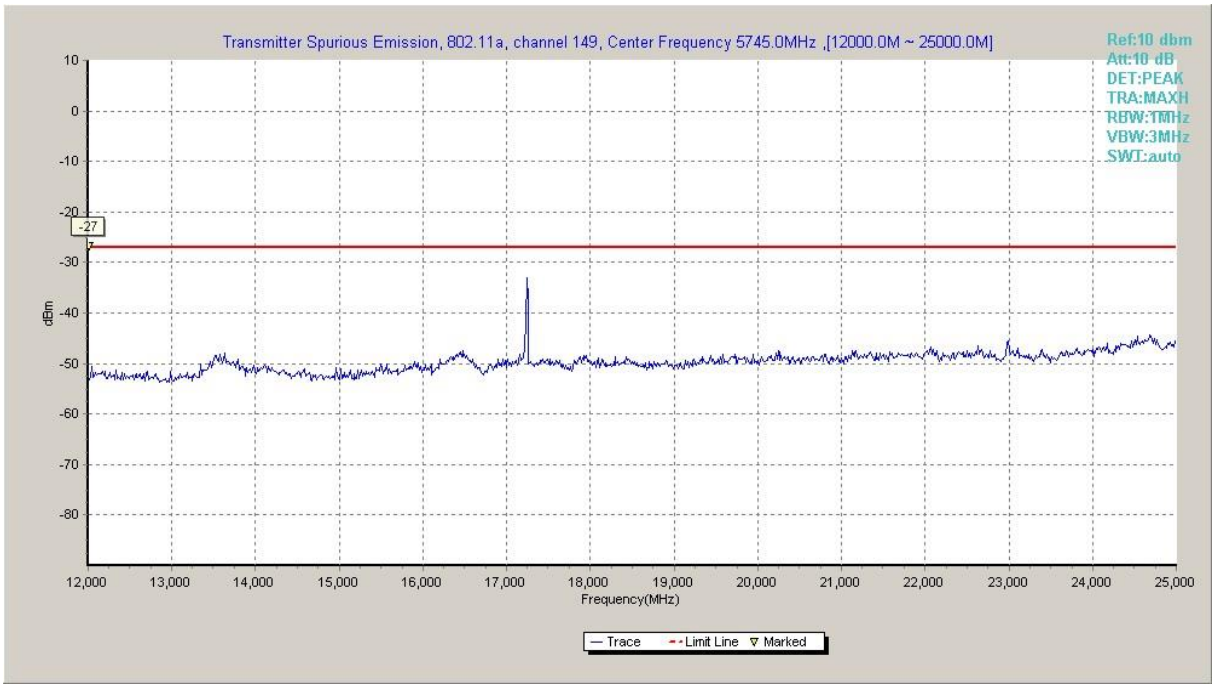


Fig. 11 Conducted Spurious Emission (802.11a, Ch149, 12 GHz-25 GHz)

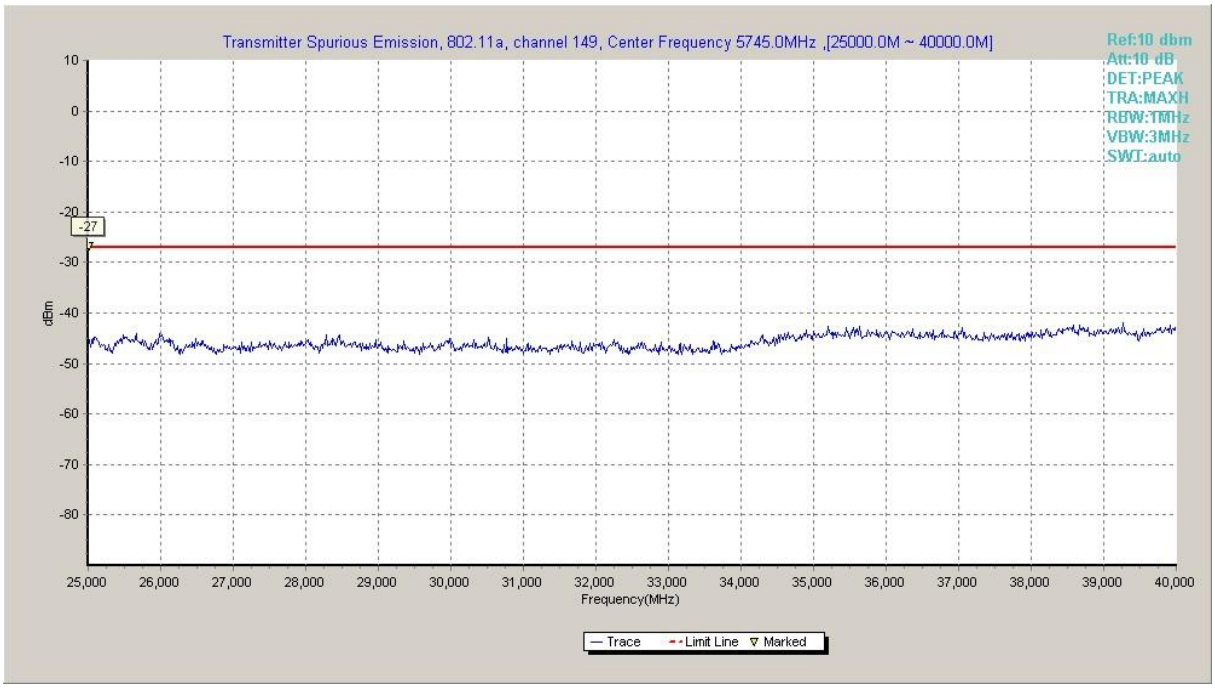


Fig. 12 Conducted Spurious Emission (802.11a, Ch149, 25 GHz-40 GHz)

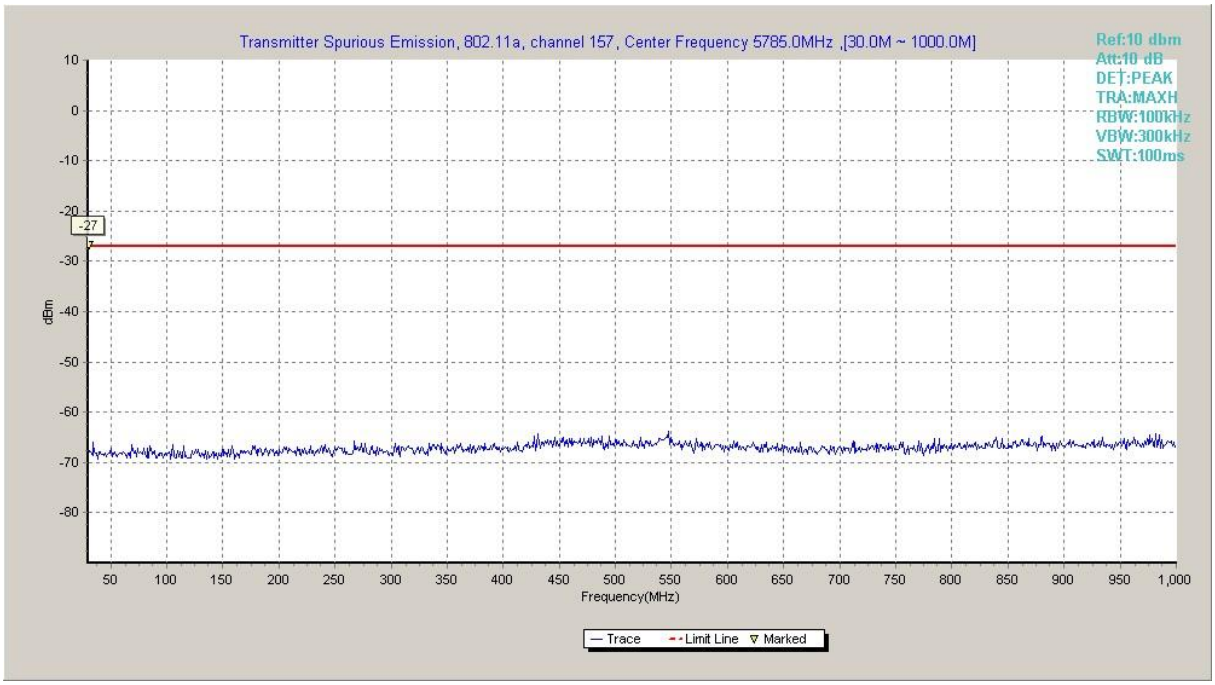


Fig. 13 Conducted Spurious Emission (802.11a, Ch157, 30 MHz-1 GHz)

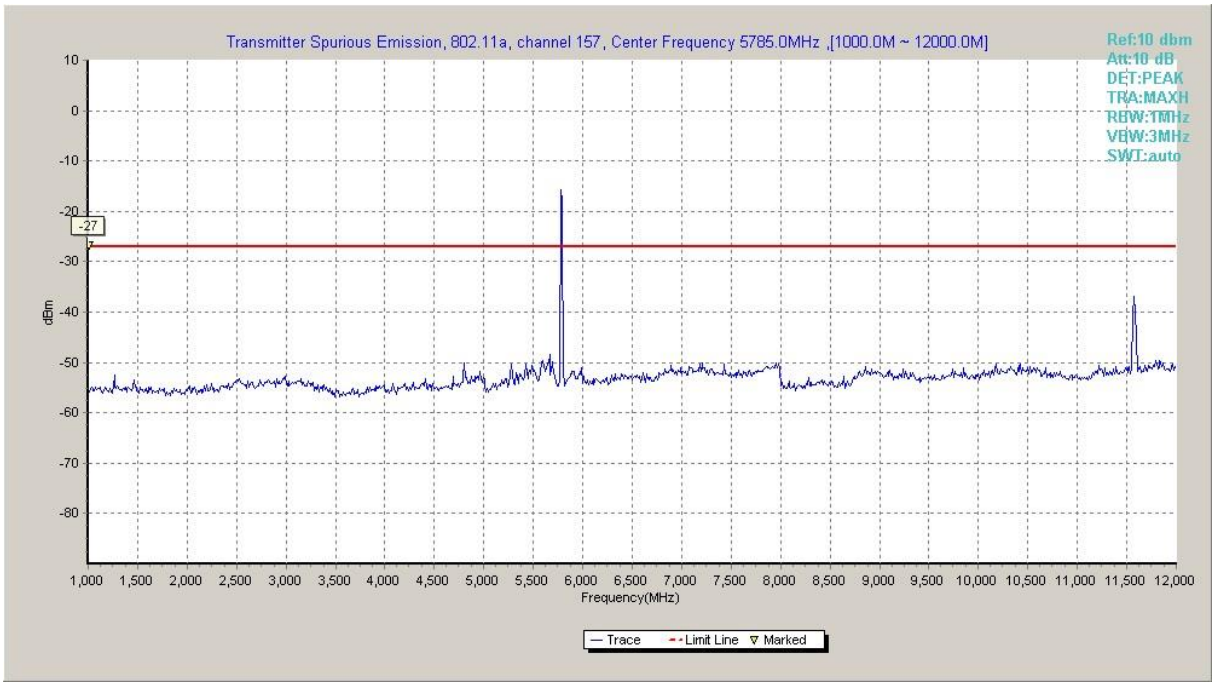


Fig. 14 Conducted Spurious Emission (802.11a, Ch157, 1 GHz -12 GHz)

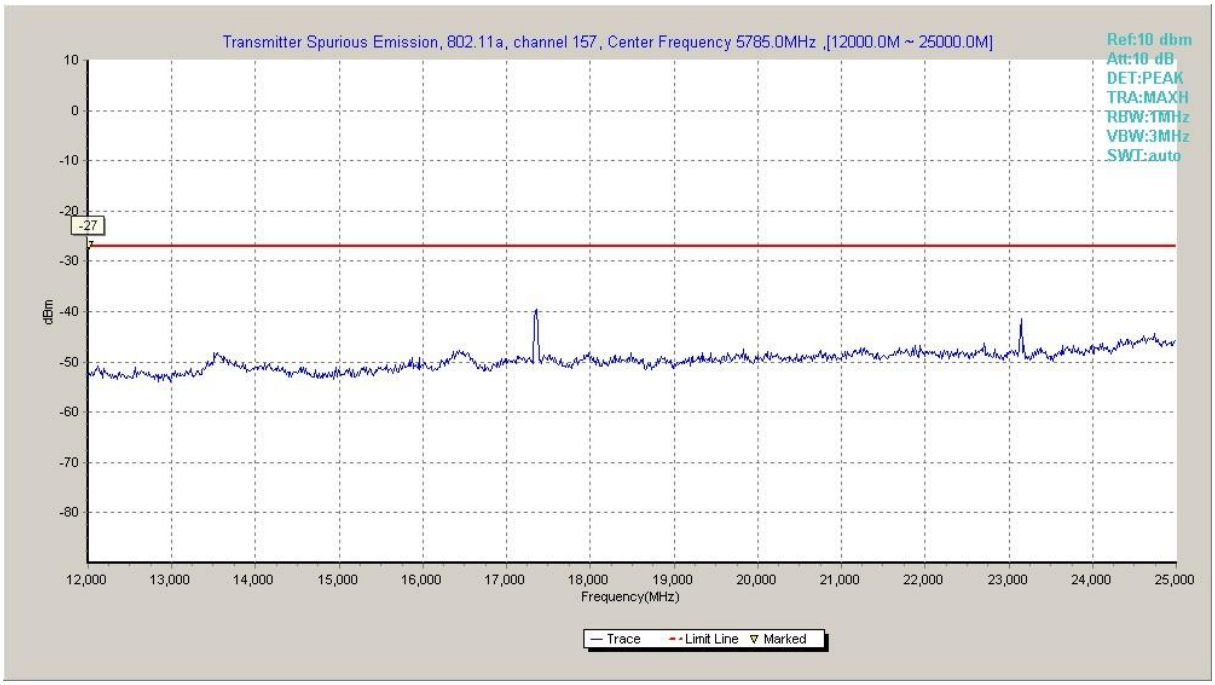


Fig. 15 Conducted Spurious Emission (802.11a, Ch157, 12 GHz-25 GHz)

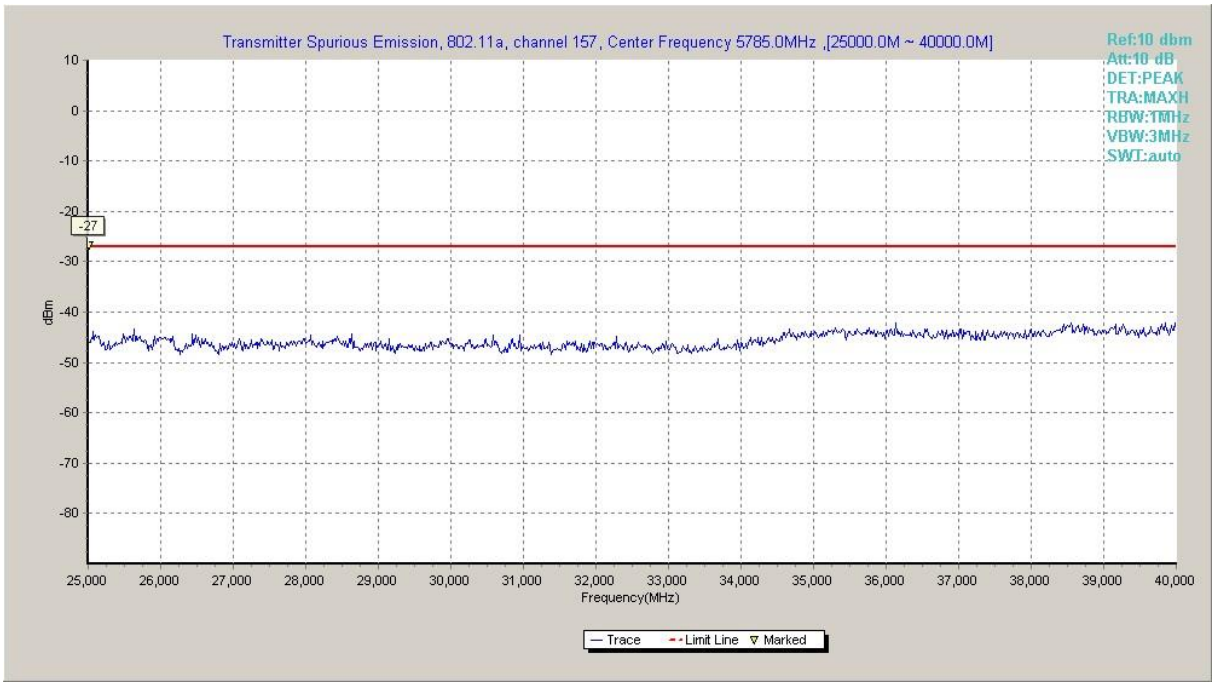


Fig. 16 Conducted Spurious Emission (802.11a, Ch157, 25 GHz-40 GHz)

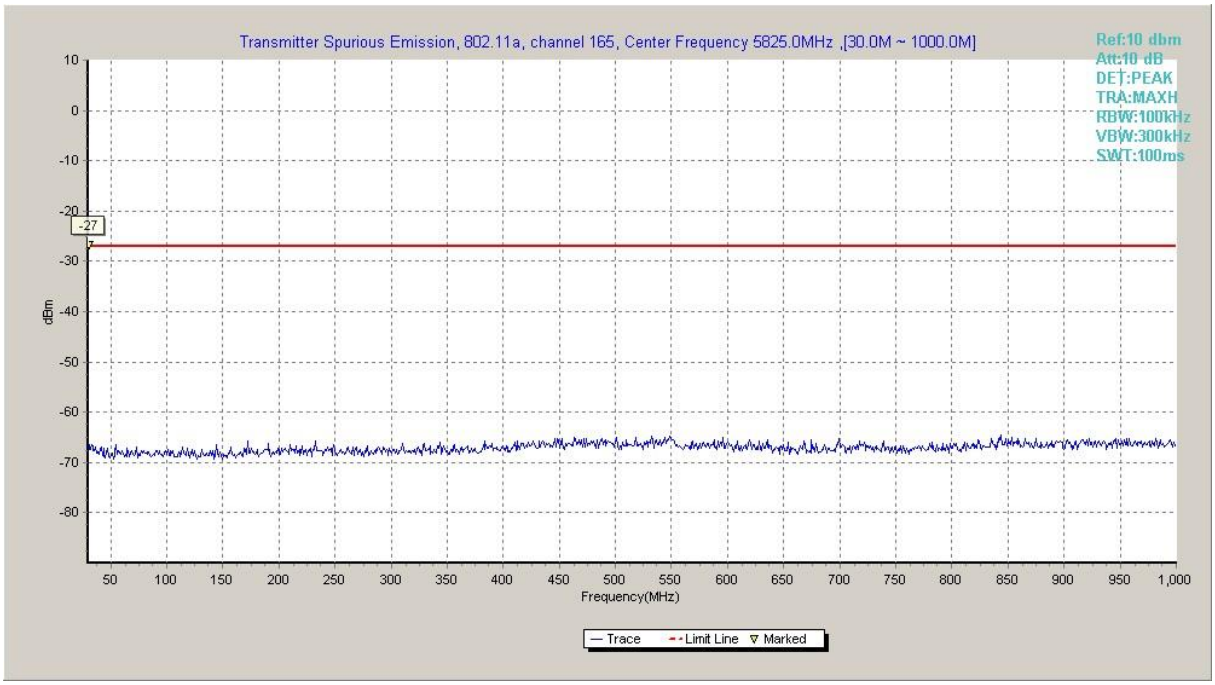


Fig. 17 Conducted Spurious Emission (802.11a, Ch165, 30 MHz-1 GHz)

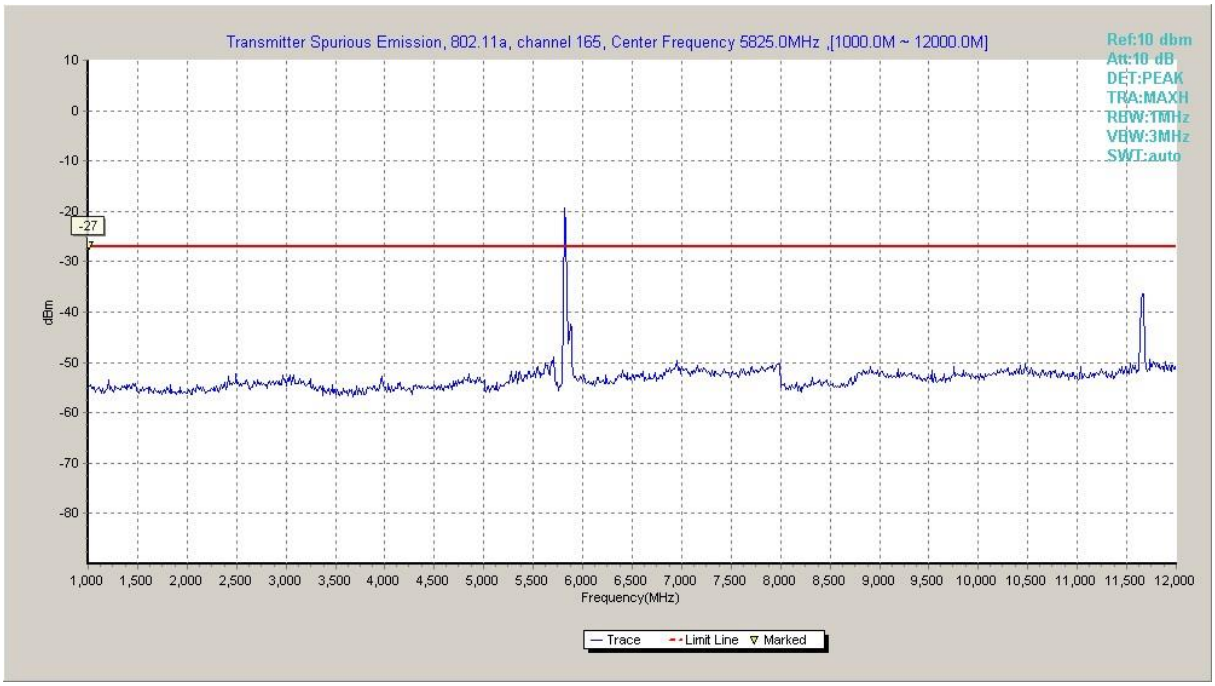


Fig. 18 Conducted Spurious Emission (802.11a, Ch165, 1 GHz -12 GHz)

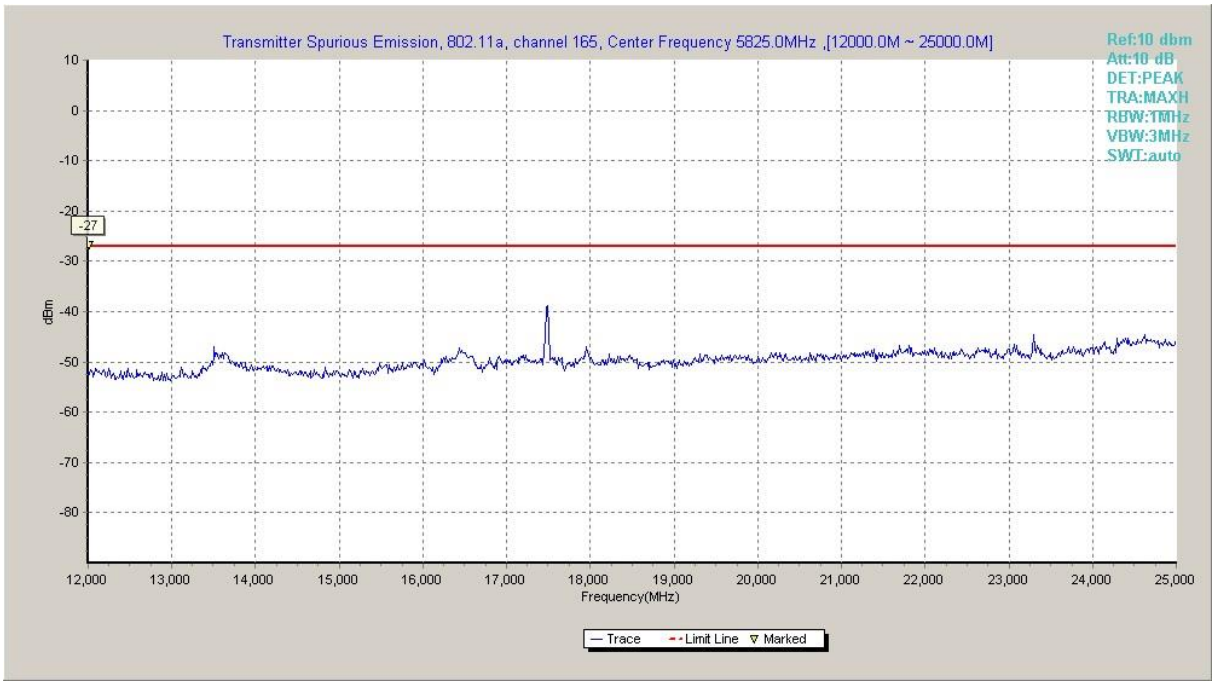


Fig. 19 Conducted Spurious Emission (802.11a, Ch165, 12 GHz-25 GHz)

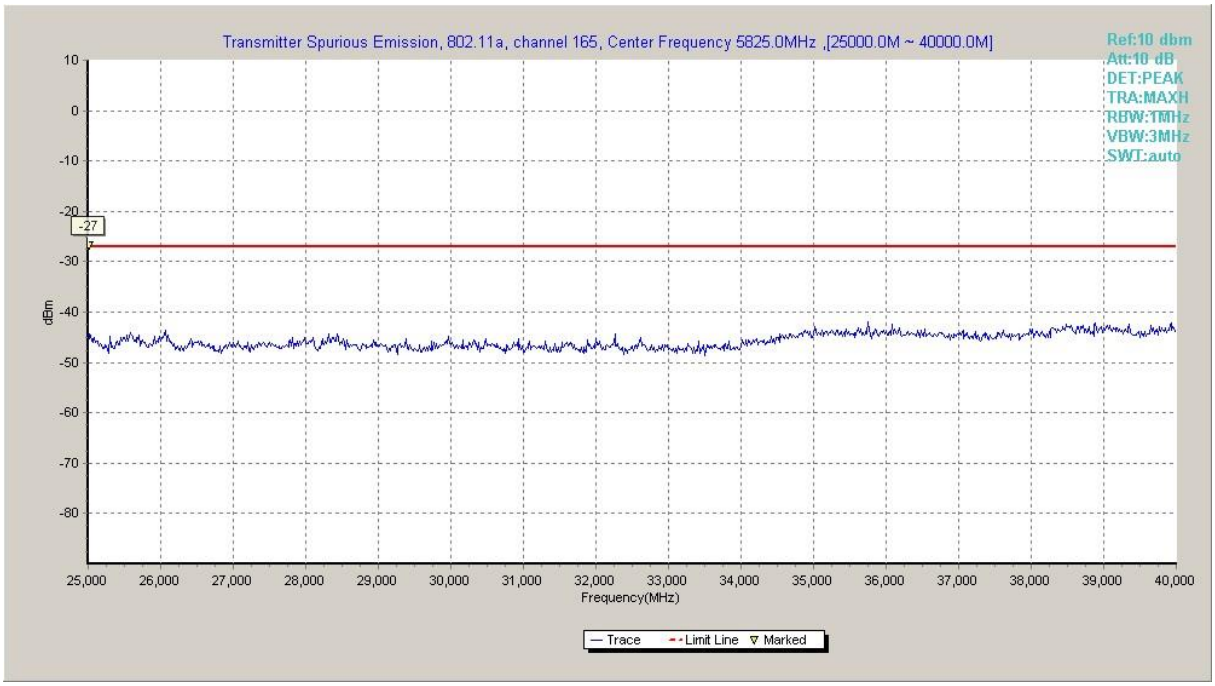


Fig. 20 Conducted Spurious Emission (802.11a, Ch165, 25 GHz-40 GHz)

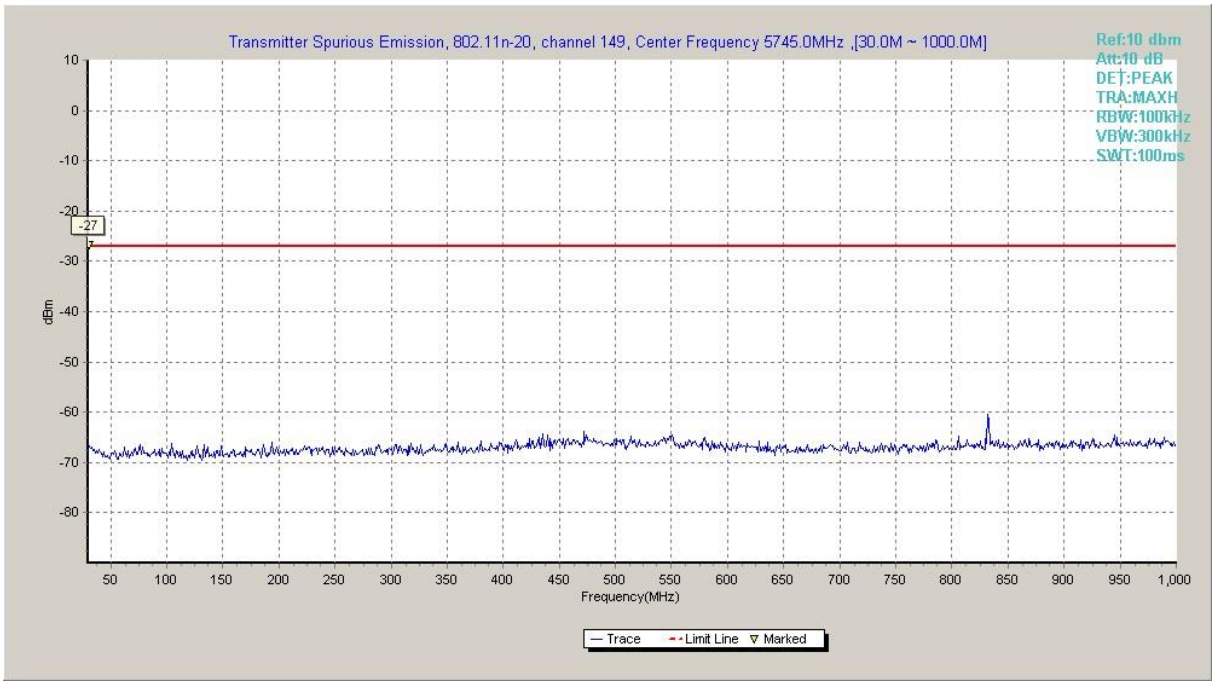


Fig. 21 Conducted Spurious Emission (802.11n-HT20, Ch149, 30 MHz-1 GHz)

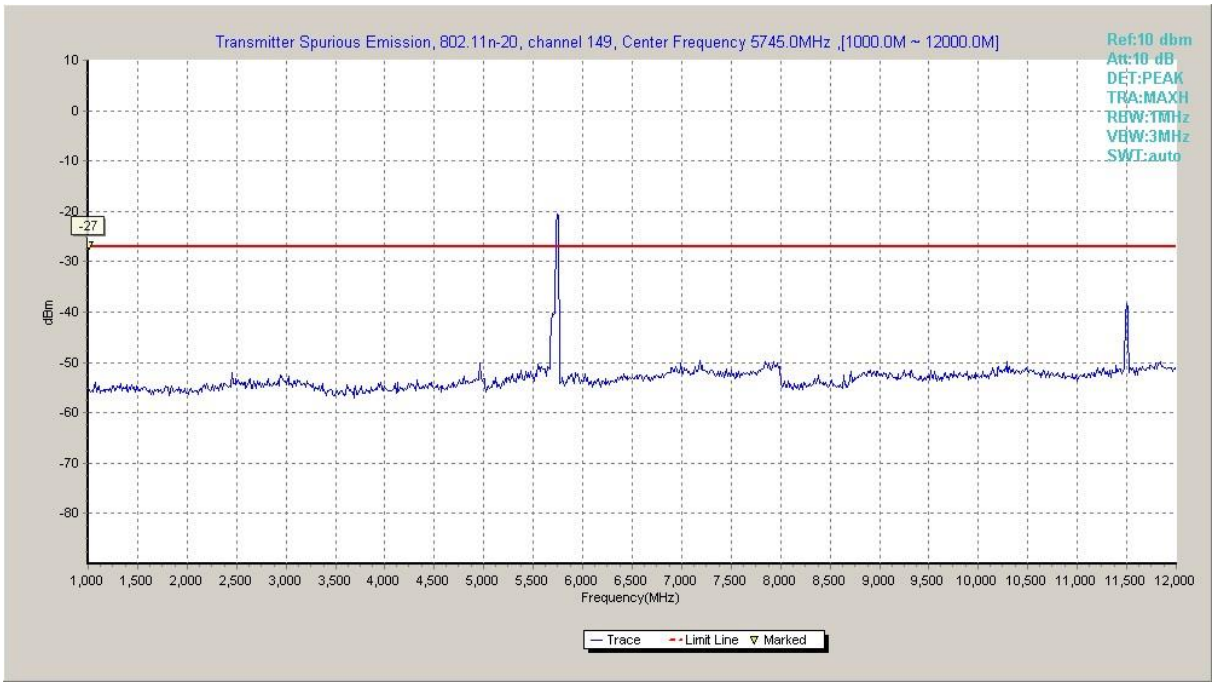


Fig. 22 Conducted Spurious Emission (802.11n-HT20, Ch149, 1 GHz -12 GHz)

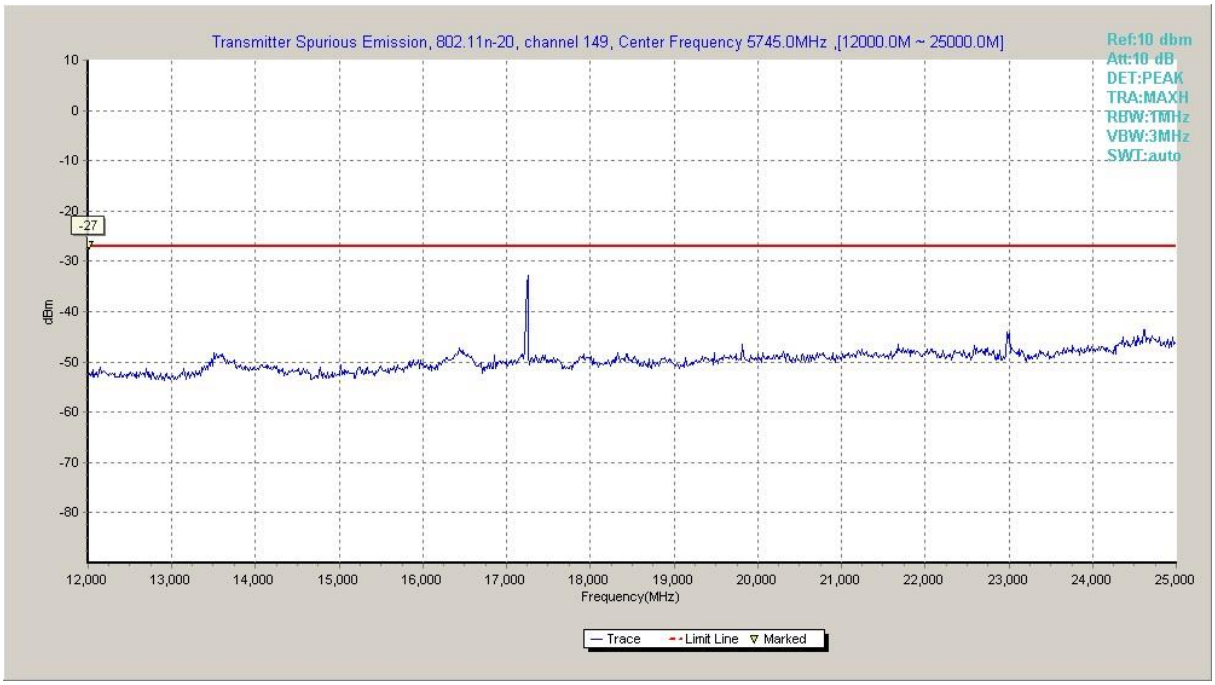


Fig. 23 Conducted Spurious Emission (802.11n-HT20, Ch149, 12 GHz-25 GHz)

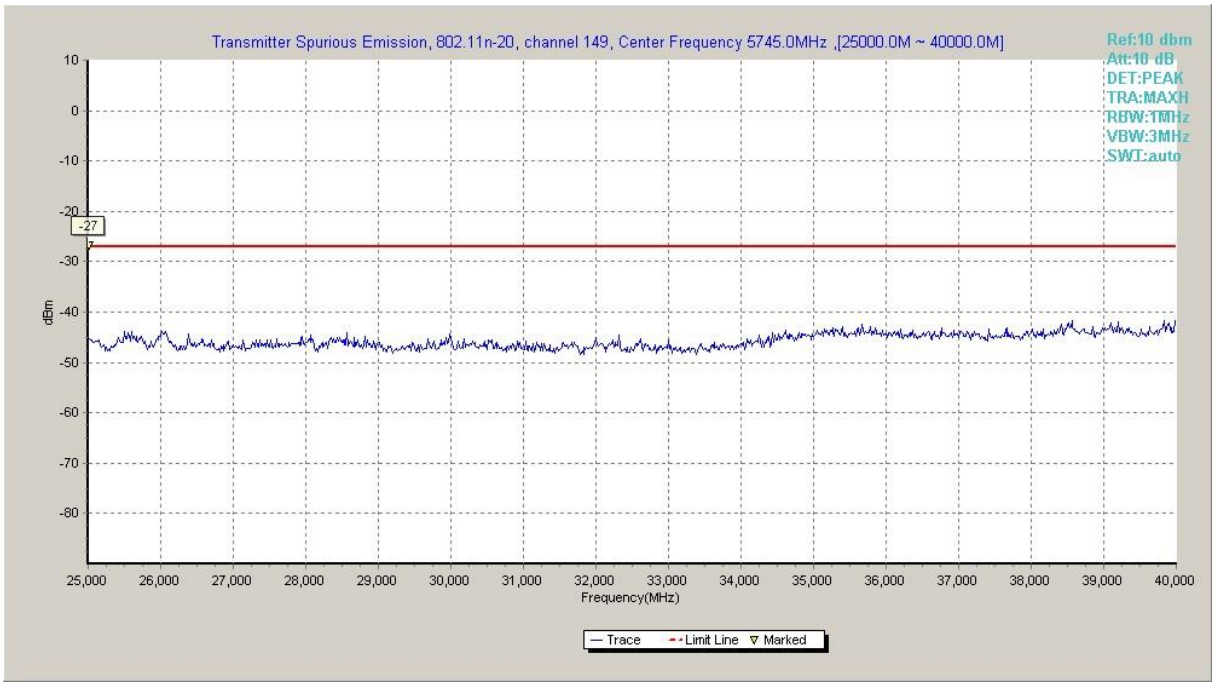


Fig. 24 Conducted Spurious Emission (802.11n-HT20, Ch149, 25 GHz-40 GHz)

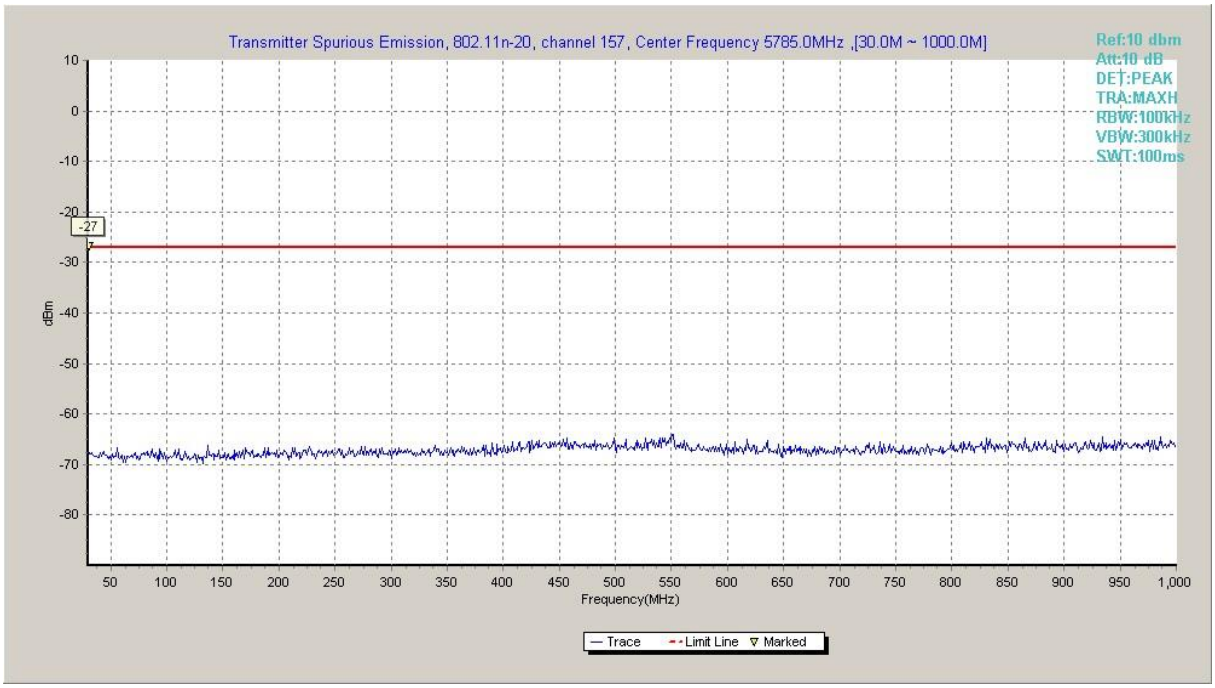


Fig. 25 Conducted Spurious Emission (802.11n-HT20, Ch157, 30 MHz-1 GHz)

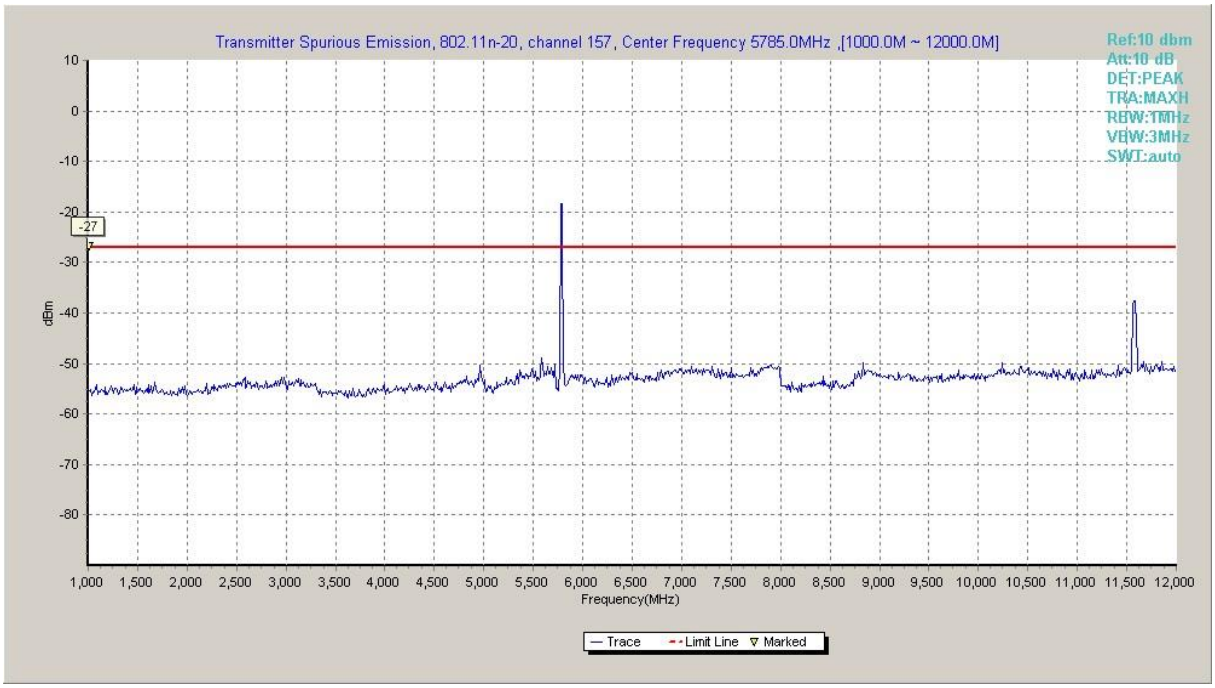


Fig. 26 Conducted Spurious Emission (802.11n-HT20, Ch157, 1 GHz -12 GHz)

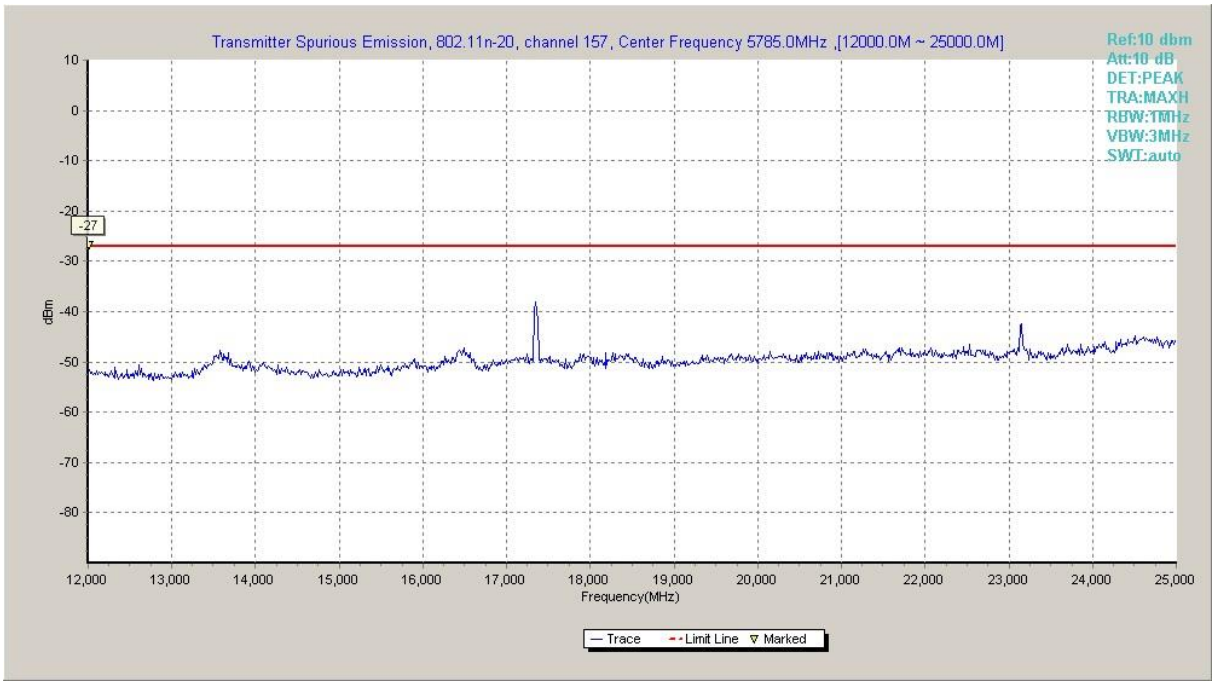


Fig. 27 Conducted Spurious Emission (802.11n-HT20, Ch157, 12 GHz-25 GHz)

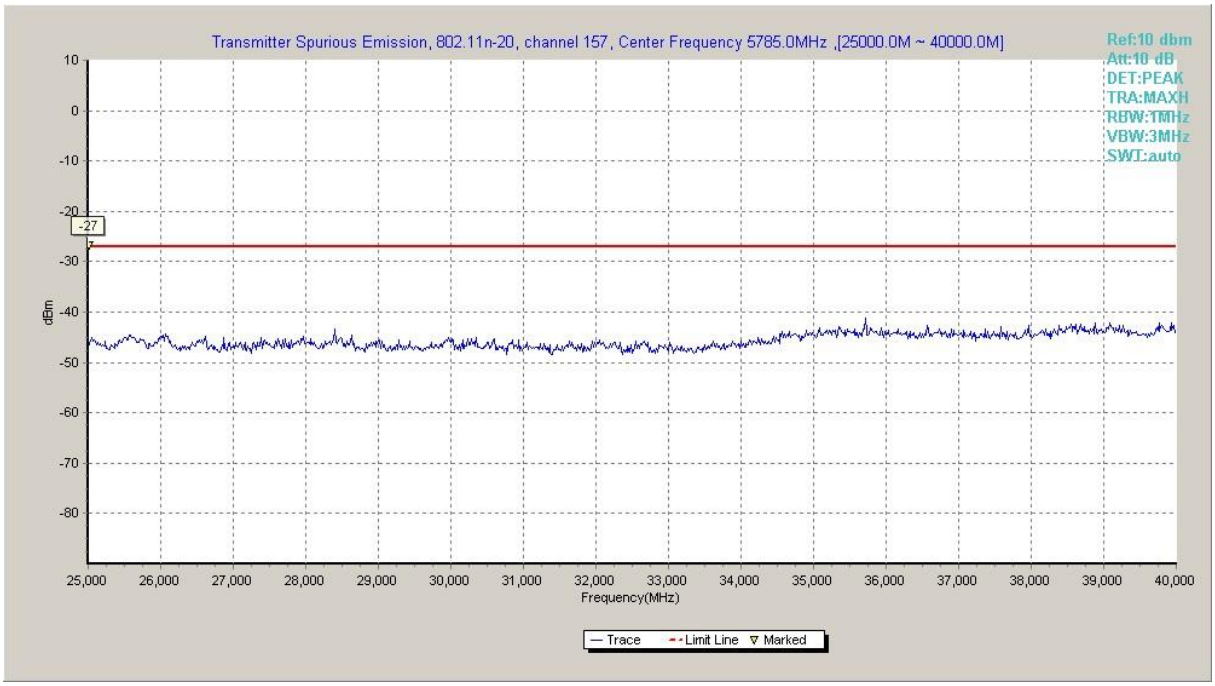


Fig. 28 Conducted Spurious Emission (802.11n-HT20, Ch157, 25 GHz-40 GHz)

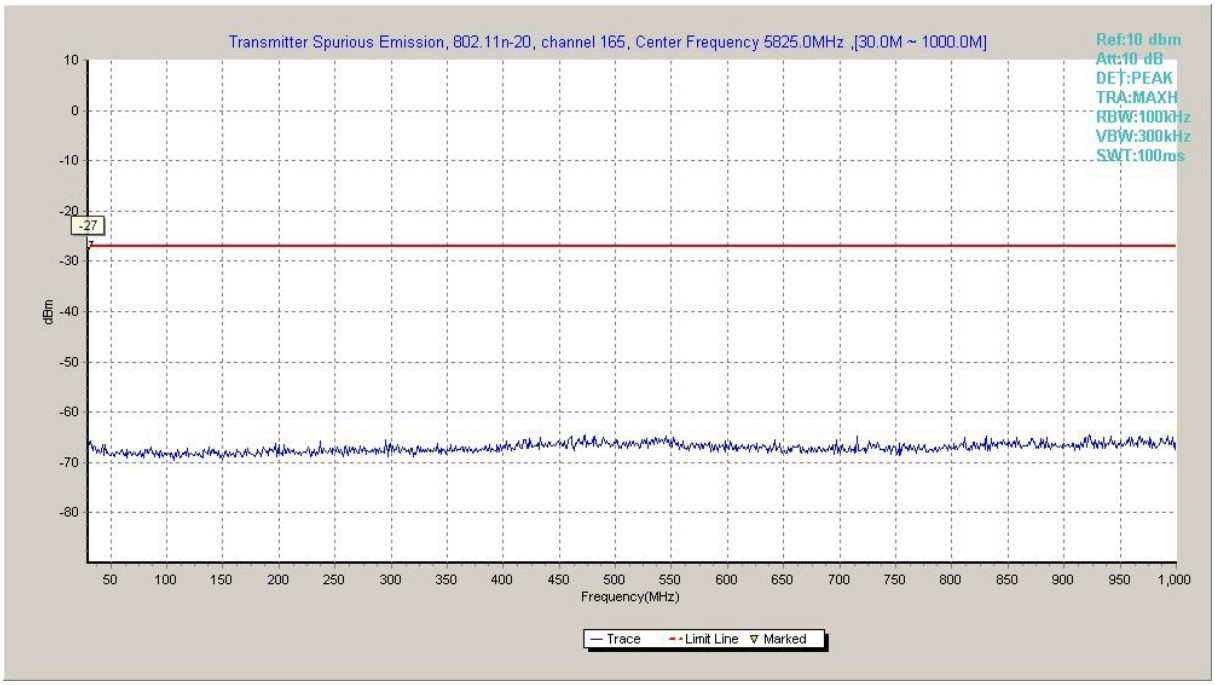


Fig. 29 Conducted Spurious Emission (802.11n-HT20, Ch165, 30 MHz-1 GHz)

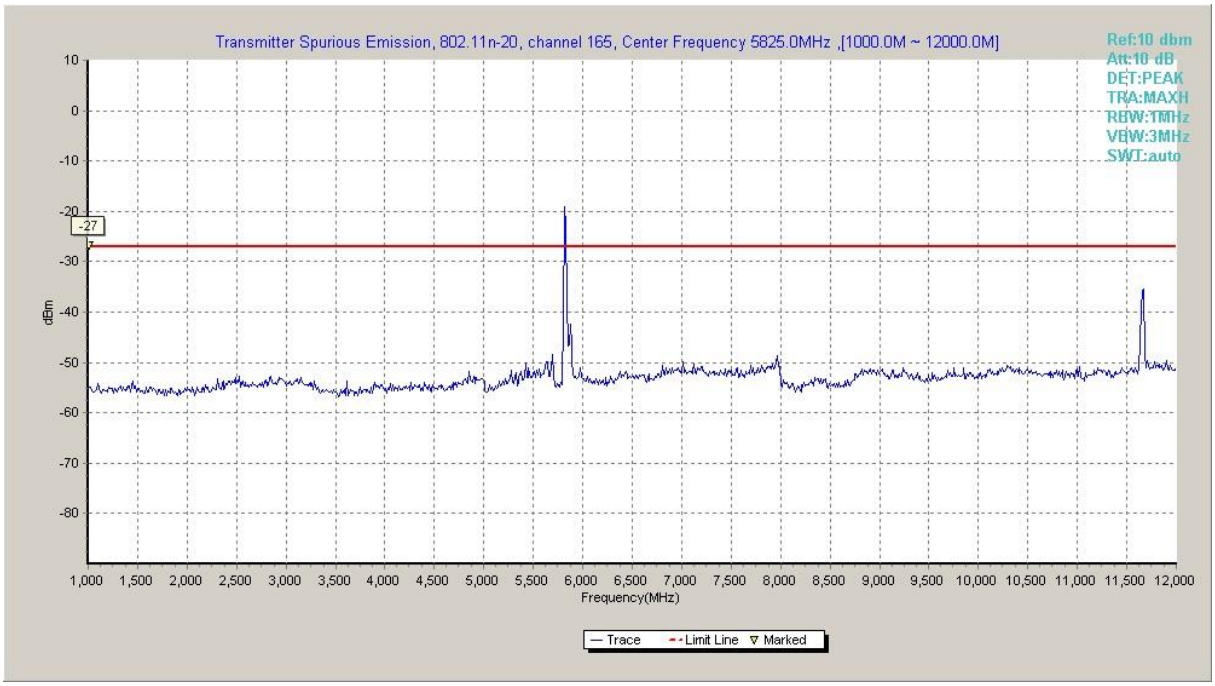


Fig. 30 Conducted Spurious Emission (802.11n-HT20, Ch165, 1 GHz -12 GHz)

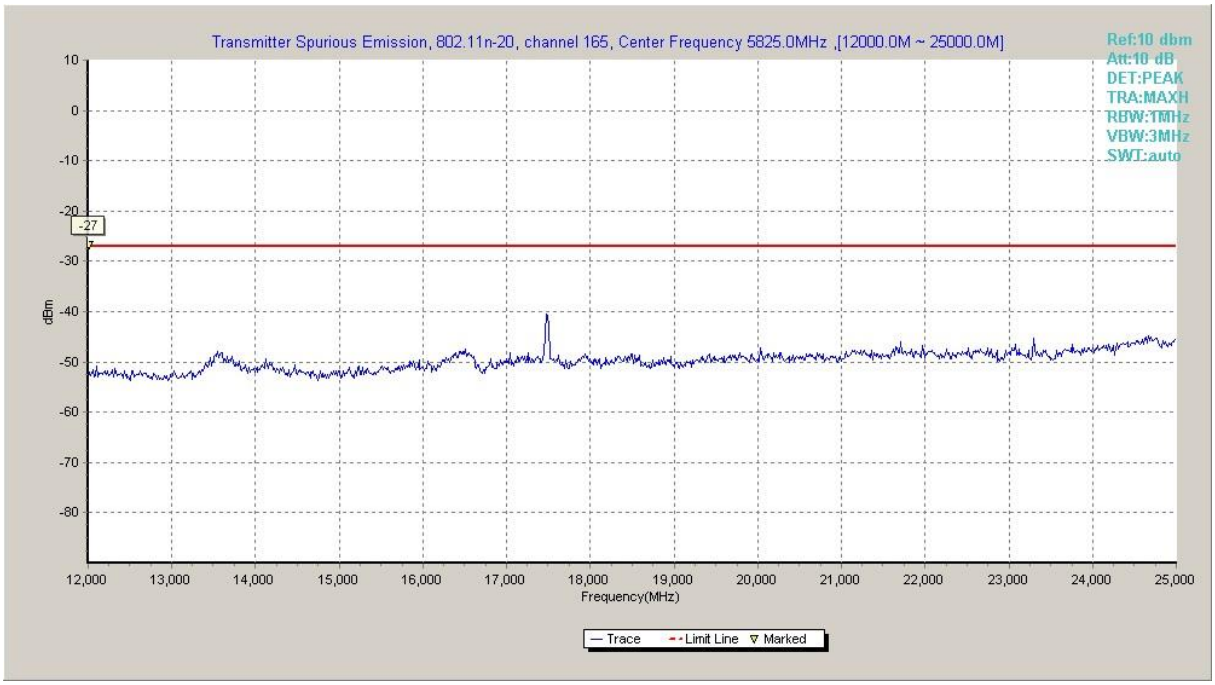


Fig. 31 Conducted Spurious Emission (802.11n-HT20, Ch165, 12 GHz-25 GHz)

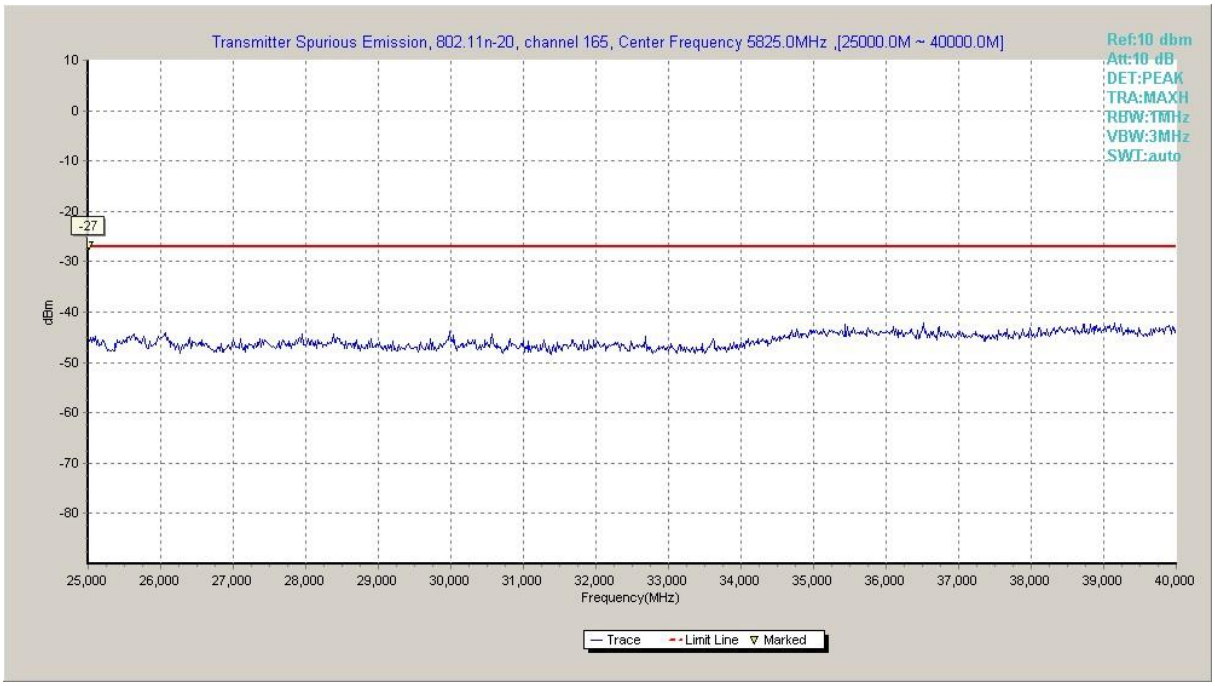


Fig. 32 Conducted Spurious Emission (802.11n-HT20, Ch165, 25 GHz-40 GHz)

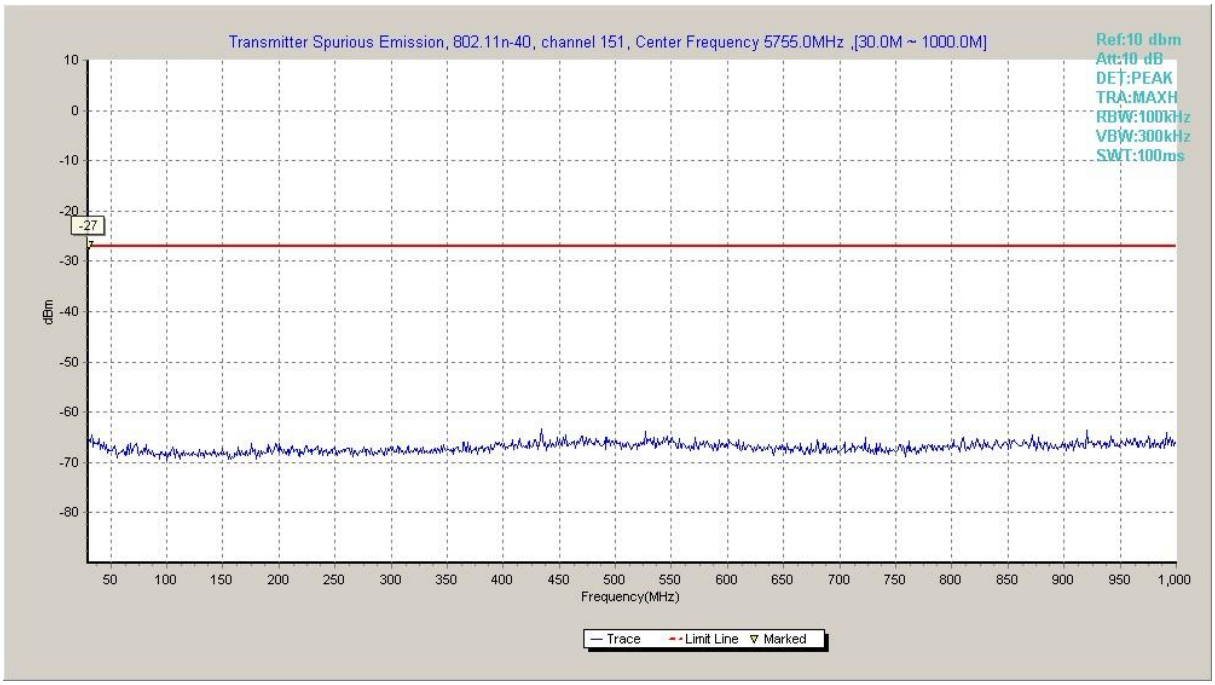


Fig. 33 Conducted Spurious Emission (802.11n-HT40, Ch151, 30 MHz-1 GHz)

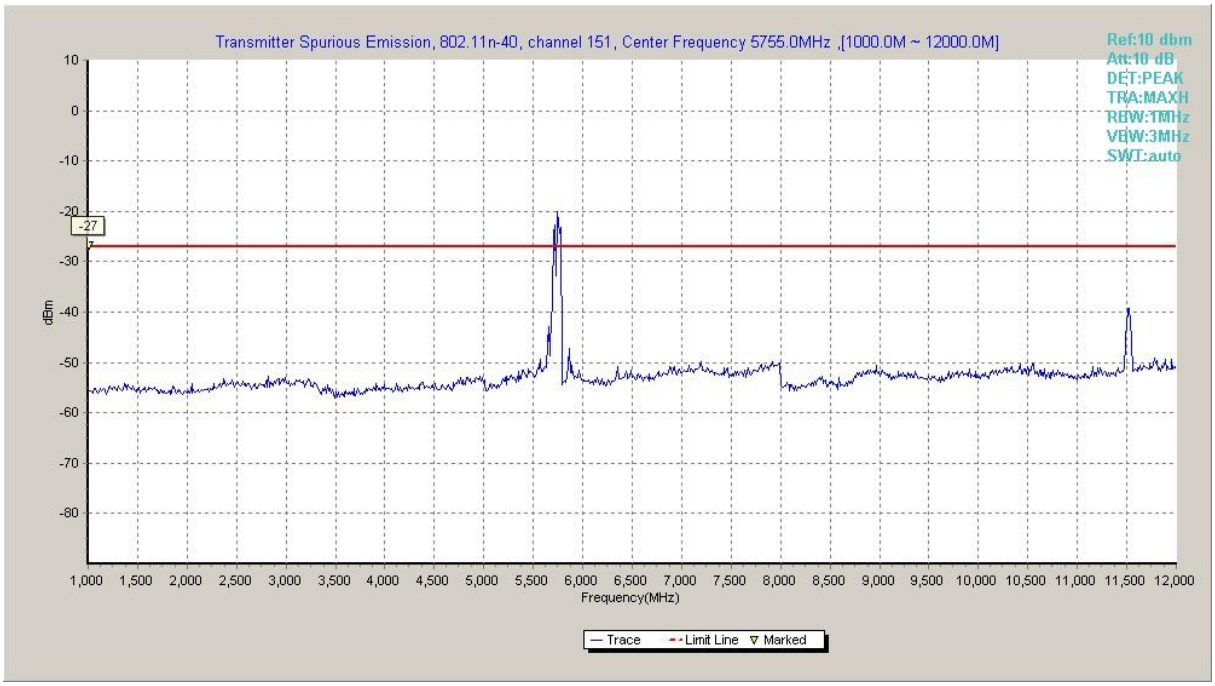


Fig. 34 Conducted Spurious Emission (802.11n-HT40, Ch151, 1 GHz -12 GHz)

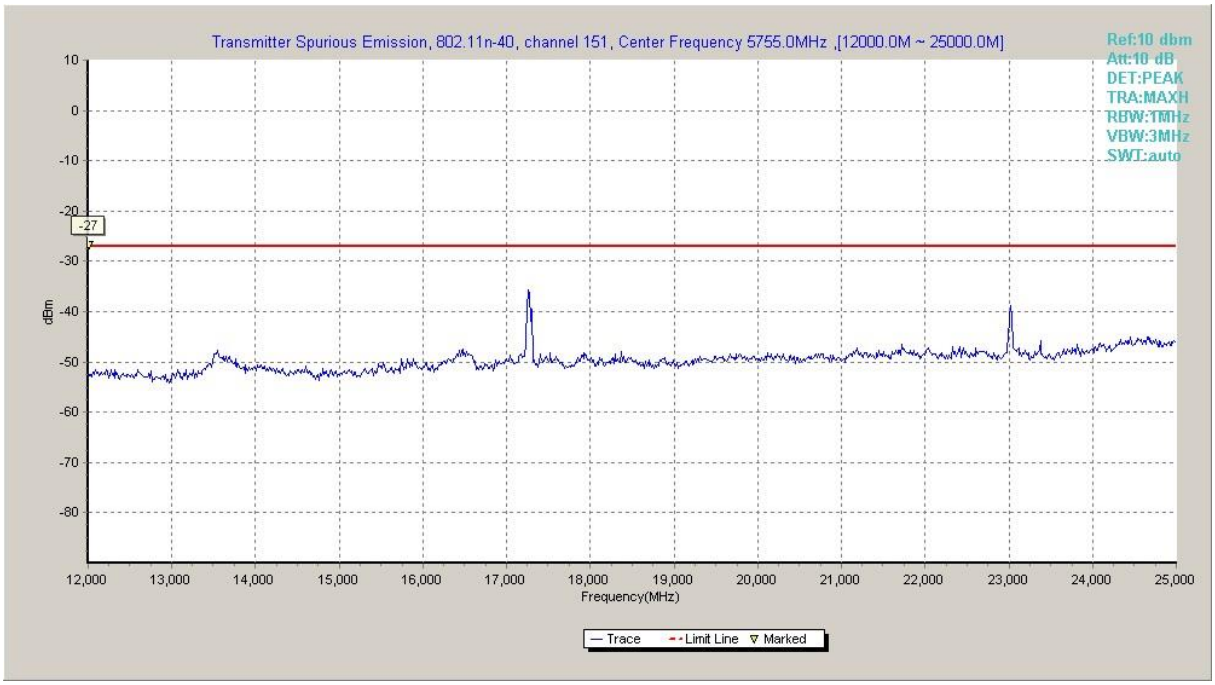


Fig. 35 Conducted Spurious Emission (802.11n-HT40, Ch151, 12 GHz-25 GHz)

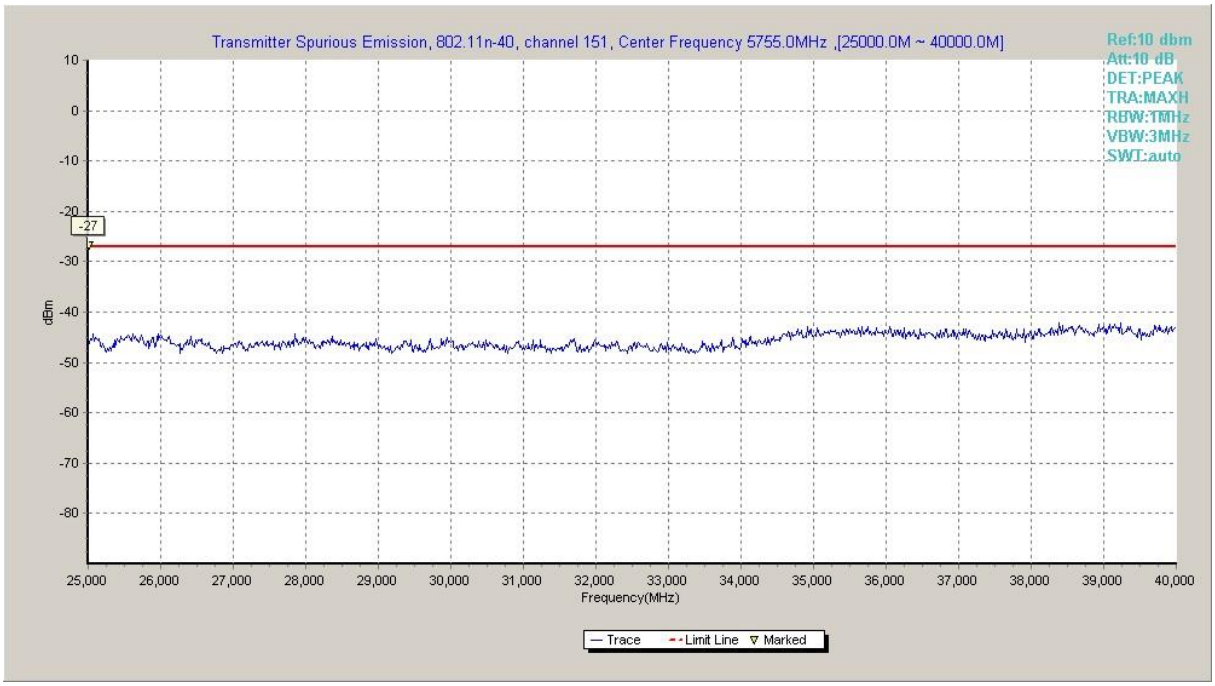


Fig. 36 Conducted Spurious Emission (802.11n-HT40, Ch151, 25 GHz-40 GHz)

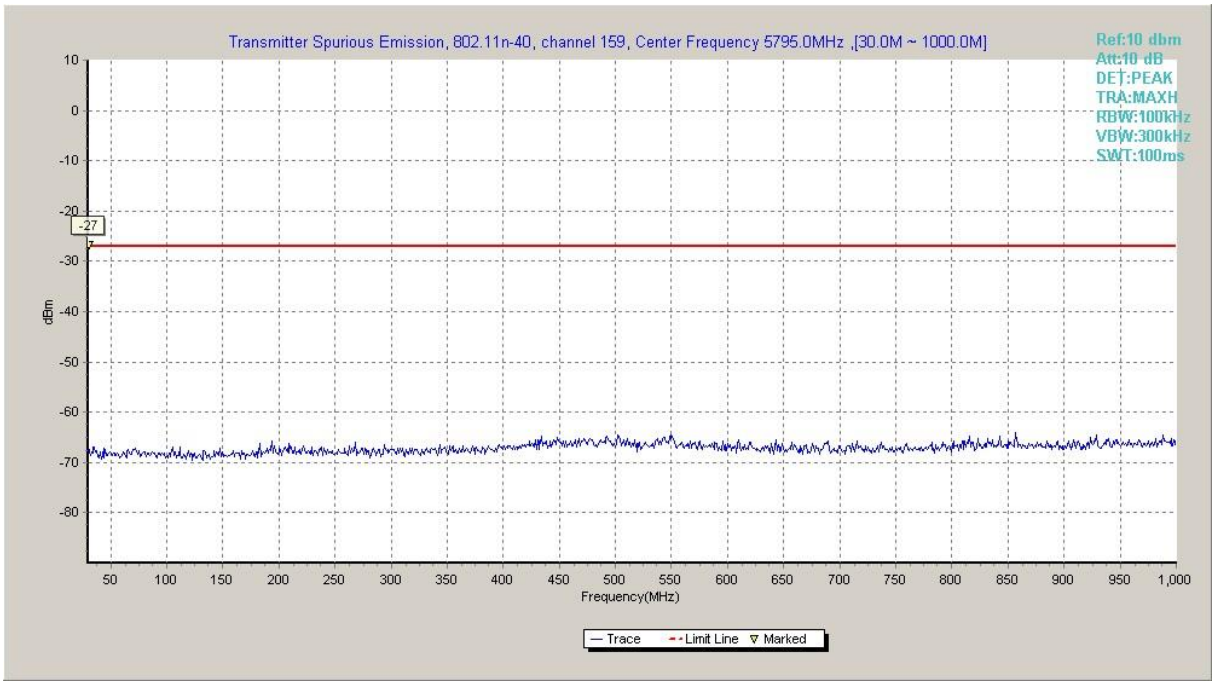


Fig. 37 Conducted Spurious Emission (802.11n-HT40, Ch159, 30 MHz-1 GHz)

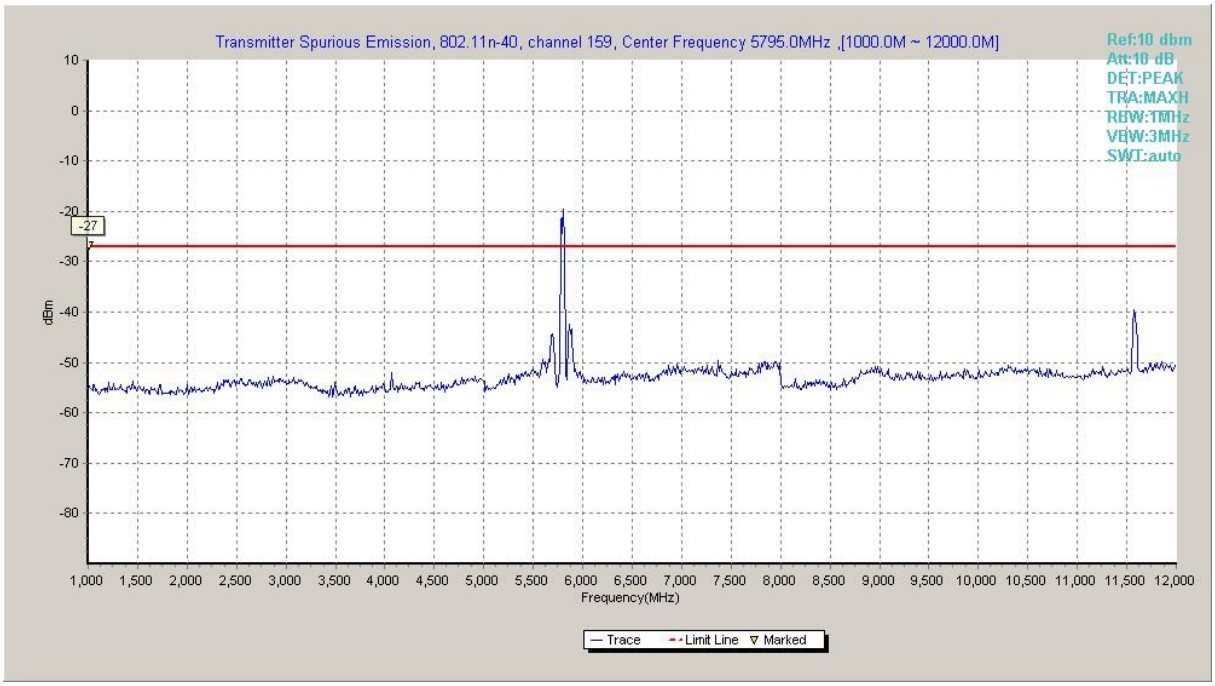


Fig. 38 Conducted Spurious Emission (802.11n-HT40, Ch159, 1 GHz -12 GHz)

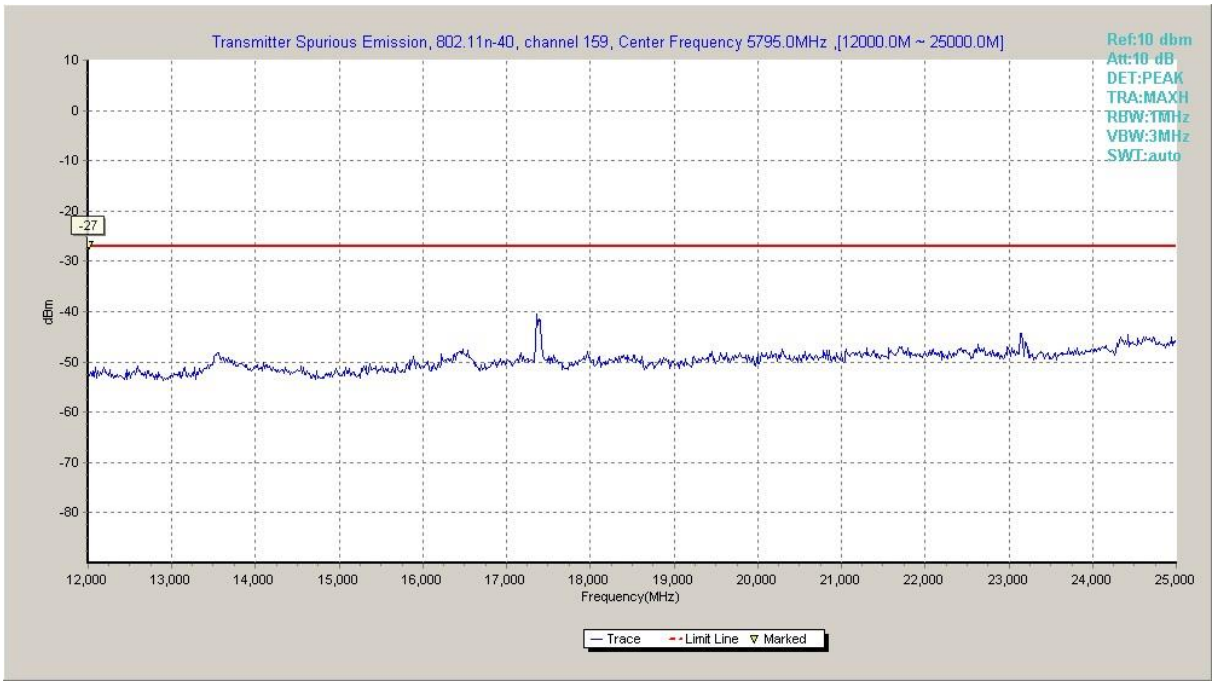


Fig. 39 Conducted Spurious Emission (802.11n-HT40, Ch159, 12 GHz-25 GHz)

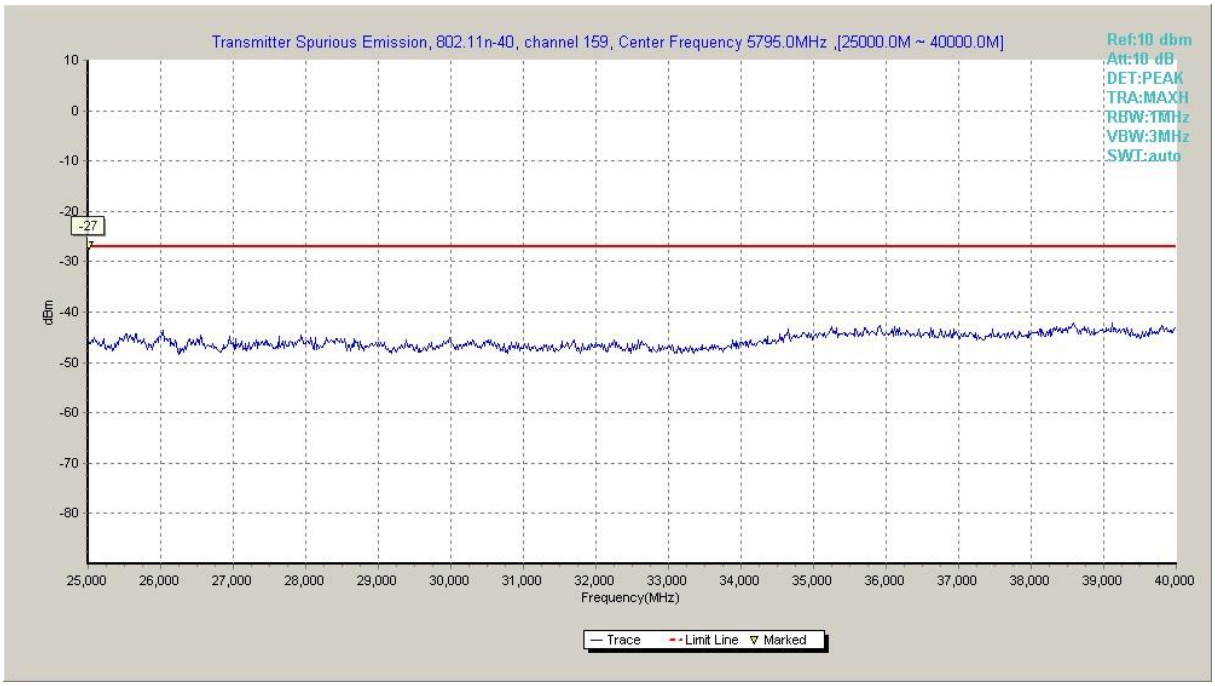


Fig. 40 Conducted Spurious Emission (802.11n-HT40, Ch159, 25 GHz-40 GHz)

A.5.2 Transmitter Spurious Emission - Radiated

Measurement Limit:

Standard	Frequency (MHz)	Limit (dBm/MHz)
FCC 47 CFR Part 15.407	5725MHz~5850MHz	< -27

The measurement is made according to ANSI C63.10 .

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit in restricted band:

Frequency of emission (MHz)	Field strength (uV/m)	Field strength (dBμV/m)	Measurement distance(m)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Measurement Results:

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of “reference path loss”, and including the cable loss(the gain of the preamplifier), the gain of receive antenna.

P_{Mea} is the field strength recorded from the instrument.

The measurement results are obtained as described below:

Result=P_{Mea}+$A_{Rpl=}$ P_{Mea}+Cable Loss+Antenna Factor

Average Results：

802.11a

Ch149

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17973.6	36.1	-25.5	43.4	18.2	V	48.0	11.9
17948.3	36.0	-25.5	43.4	18.1	V	48.0	12.0
17967.0	36.0	-25.5	43.4	18.1	H	48.0	12.0
17972.5	36.0	-25.5	43.4	18.1	V	48.0	12.0
17982.4	36.0	-25.5	43.4	18.1	V	48.0	12.0
5724.9	51.0	-16.3	34.2	33.1	H	102.0	51.0

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Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17984.6	36.4	-25.5	43.4	18.5	H	48.0	11.6
17973.6	36.3	-25.5	43.4	18.4	V	48.0	11.7
17992.3	36.2	-25.5	43.4	18.3	V	48.0	11.8
17976.9	36.1	-25.5	43.4	18.2	V	48.0	11.9
17981.3	36.1	-25.5	43.4	18.2	V	48.0	11.9
17986.8	36.1	-25.5	43.4	18.2	H	48.0	11.9

Ch165

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17993.4	36.3	-25.5	43.4	18.4	V	48.0	11.7
17986.8	36.2	-25.5	43.4	18.3	V	48.0	11.8
17901.0	36.1	-25.5	43.4	18.2	V	48.0	11.9
17948.3	36.1	-25.5	43.4	18.2	V	48.0	11.9
17960.4	36.1	-25.5	43.4	18.2	V	48.0	11.9
5850.6	44.7	-16.2	34.2	26.7	H	48.0	3.3

802.11n-HT20

Ch149

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17976.9	36.3	-25.5	43.4	18.4	H	48.0	11.7
17981.3	36.3	-25.5	43.4	18.4	V	48.0	11.7
17974.7	36.2	-25.5	43.4	18.3	V	48.0	11.8
17978.0	36.2	-25.5	43.4	18.3	H	48.0	11.8
17979.1	36.2	-25.5	43.4	18.3	V	48.0	11.8
5724.9	41.7	-16.3	34.2	23.8	V	48.0	6.3

Ch157

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17975.8	36.4	-25.5	43.4	18.5	H	48.0	11.6
17970.3	36.2	-25.5	43.4	18.3	V	48.0	11.8
17987.9	36.2	-25.5	43.4	18.3	H	48.0	11.8
17978.0	36.1	-25.5	43.4	18.2	V	48.0	11.9
17982.4	36.1	-25.5	43.4	18.2	V	48.0	11.9
17986.8	36.1	-25.5	43.4	18.2	V	48.0	11.9

Ch165

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17886.7	36.2	-25.5	43.4	18.3	V	48.0	11.8
17980.2	36.2	-25.5	43.4	18.3	V	48.0	11.8
17990.1	36.2	-25.5	43.4	18.3	V	48.0	11.8
17994.5	36.2	-25.5	43.4	18.3	V	48.0	11.8
17997.8	36.2	-25.5	43.4	18.3	V	48.0	11.8
5876.9	38.0	-16.2	34.2	20	H	48.0	10.0

802.11n-HT40

Ch151

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17987.9	36.3	-25.5	43.4	18.4	V	48.0	11.7
17994.5	36.3	-25.5	43.4	18.4	H	48.0	11.7
17973.6	36.2	-25.5	43.4	18.3	V	48.0	11.8
17982.4	36.2	-25.5	43.4	18.3	H	48.0	11.8
17957.1	36.1	-25.5	43.4	18.2	H	48.0	11.9
5722.4	58.3	-16.3	34.2	40.4	H	95.0	36.7

Ch159

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17948.3	36.2	-25.5	43.4	18.3	V	48.0	11.8
17969.2	36.2	-25.5	43.4	18.3	H	48.0	11.8
17975.8	36.2	-25.5	43.4	18.3	V	48.0	11.8
17976.9	36.2	-25.5	43.4	18.3	H	48.0	11.8
17982.4	36.2	-25.5	43.4	18.3	V	48.0	11.8
5850.1	44.5	-16.2	34.2	26.5	H	48.0	3.5

Peak Results：

802.11a

Ch149

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17947.2	48.7	-25.5	43.4	30.8	V	68.0	19.3
17883.4	48.2	-25.5	43.4	30.3	H	68.0	19.8
17939.5	47.9	-25.5	43.4	30.0	V	68.0	20.1
17942.8	47.9	-25.5	43.4	30.0	V	68.0	20.1
17973.6	47.8	-25.5	43.4	29.9	V	68.0	20.2
5724.9	70.5	-16.3	34.2	52.6	V	122.0	51.5

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Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17941.7	48.5	-25.5	43.4	30.6	H	68.0	19.5
17972.5	48.0	-25.5	43.4	30.1	V	68.0	20.0
17797.6	47.9	-25.5	43.4	30.0	H	68.0	20.1
17857.0	47.9	-25.5	43.4	30.0	V	68.0	20.1
17925.2	47.8	-25.5	43.4	29.9	H	68.0	20.2
17965.9	47.8	-25.5	43.4	29.9	H	68.0	20.2

Ch165

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17983.5	48.1	-25.5	43.4	30.2	H	68.0	19.9
17711.8	48.0	-25.7	43.4	30.3	V	68.0	20.0
17862.5	48.0	-25.5	43.4	30.1	V	68.0	20.0
17895.5	48.0	-25.5	43.4	30.1	V	68.0	20.0
17964.8	48.0	-25.5	43.4	30.1	V	68.0	20.0
5851.3	64.9	-16.2	34.2	46.9	V	68.0	3.1

802.11n-HT20

Ch149

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17997.8	48.5	-25.5	43.4	30.6	V	68.0	19.5
17958.2	48.0	-25.5	43.4	30.1	H	68.0	20.0
17762.4	47.9	-25.5	43.4	30.0	V	68.0	20.1
17836.1	47.9	-25.5	43.4	30.0	H	68.0	20.1
17934.0	47.9	-25.5	43.4	30.0	H	68.0	20.1
5724.3	60.6	-16.3	34.2	42.7	V	68.0	7.4

Ch157

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17864.7	48.6	-25.5	43.4	30.7	V	68.0	19.4
17973.6	48.6	-25.5	43.4	30.7	H	68.0	19.4
17962.6	48.4	-25.5	43.4	30.5	H	68.0	19.6
17916.4	48.3	-25.5	43.4	30.4	V	68.0	19.7
17971.4	48.1	-25.5	43.4	30.2	H	68.0	19.9
17976.9	47.9	-25.5	43.4	30.0	V	68.0	20.1

Ch165

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17898.8	48.5	-25.5	43.4	30.6	V	68.0	19.5
17982.4	48.1	-25.5	43.4	30.2	V	68.0	19.9
17994.5	48.1	-25.5	43.4	30.2	V	68.0	19.9
17865.8	48.0	-25.5	43.4	30.1	V	68.0	20.0
17462.1	47.9	-26.9	43.4	31.4	H	68.0	20.1
5908.6	49.9	-16.4	34.2	32.1	H	68.0	18.1

802.11n-HT40

Ch151

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17894.4	48.3	-25.5	43.4	30.4	H	68.0	19.7
17997.8	47.8	-25.5	43.4	29.9	H	68.0	20.2
17840.5	47.7	-25.5	43.4	29.8	V	68.0	20.3
17946.1	47.7	-25.5	43.4	29.8	V	68.0	20.3
17321.3	47.6	-25.9	40.1	33.4	V	68.0	20.4
5724.8	76.9	-16.3	34.2	59.0	H	122.0	45.1

Ch159

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)	Limit (dBμV/m))	Margin (dB)
17990.1	48.3	-25.5	43.4	30.4	V	68.0	19.7
17843.8	48.2	-25.5	43.4	30.3	H	68.0	19.8
17982.4	48.2	-25.5	43.4	30.3	V	68.0	19.8
17902.1	48.1	-25.5	43.4	30.2	H	68.0	19.9
17863.6	48.0	-25.5	43.4	30.1	H	68.0	20.0
5850.5	63.4	-16.2	34.2	45.4	H	68.0	4.6

Conclusion: PASS

A.6. Band Edges Compliance

A6.1 Band Edges - conducted

Measurement Limit:

Standard	Limit (dBm/MHz)
FCC 47 CFR Part 15.407(b)(4)	All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

The measurement is made according to KDB 789033 D02

Measurement Uncertainty:

Measurement Uncertainty	0.75dB

Measurement Result:

Mode	Channel	Test Results	Conclusion
802.11a	5745 MHz	Fig.41	P
	5825 MHz	Fig.42	P
802.11n HT20	5745 MHz	Fig.43	P
	5825 MHz	Fig.44	P
802.11n HT40	5755 MHz	Fig.45	P
	5795 MHz	Fig.46	P

Conclusion: PASS

Test graphs as below:

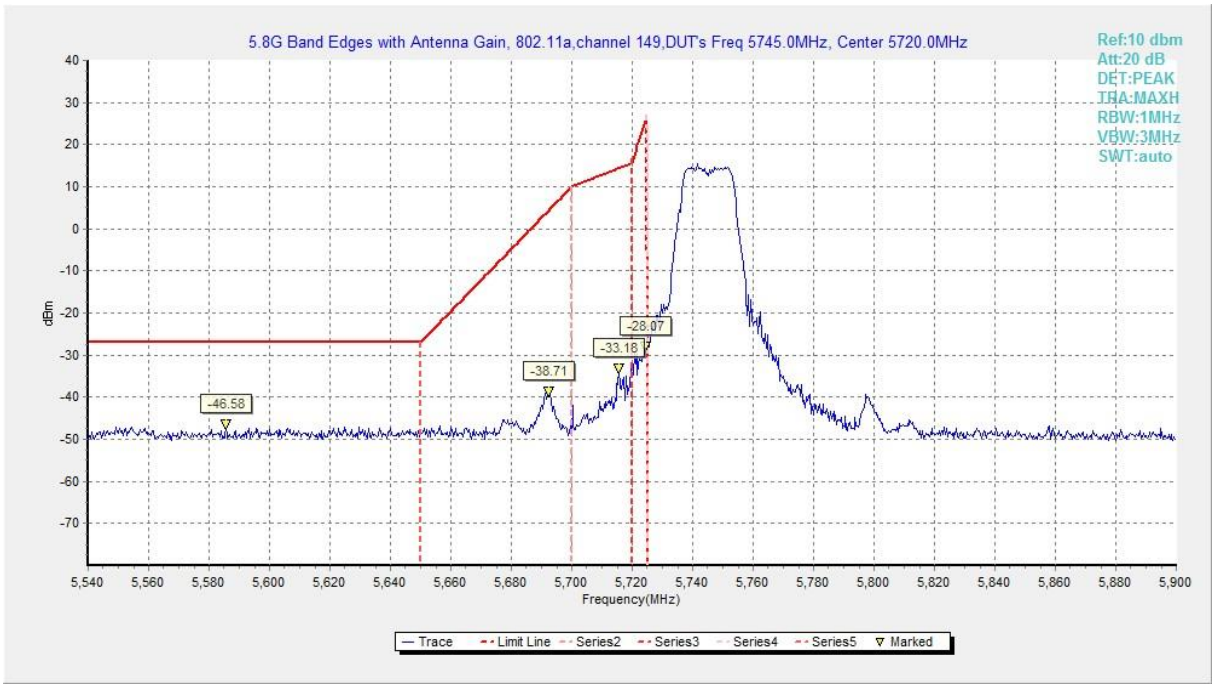

Fig. 41 Band Edges (802.11a, 5745MHz)

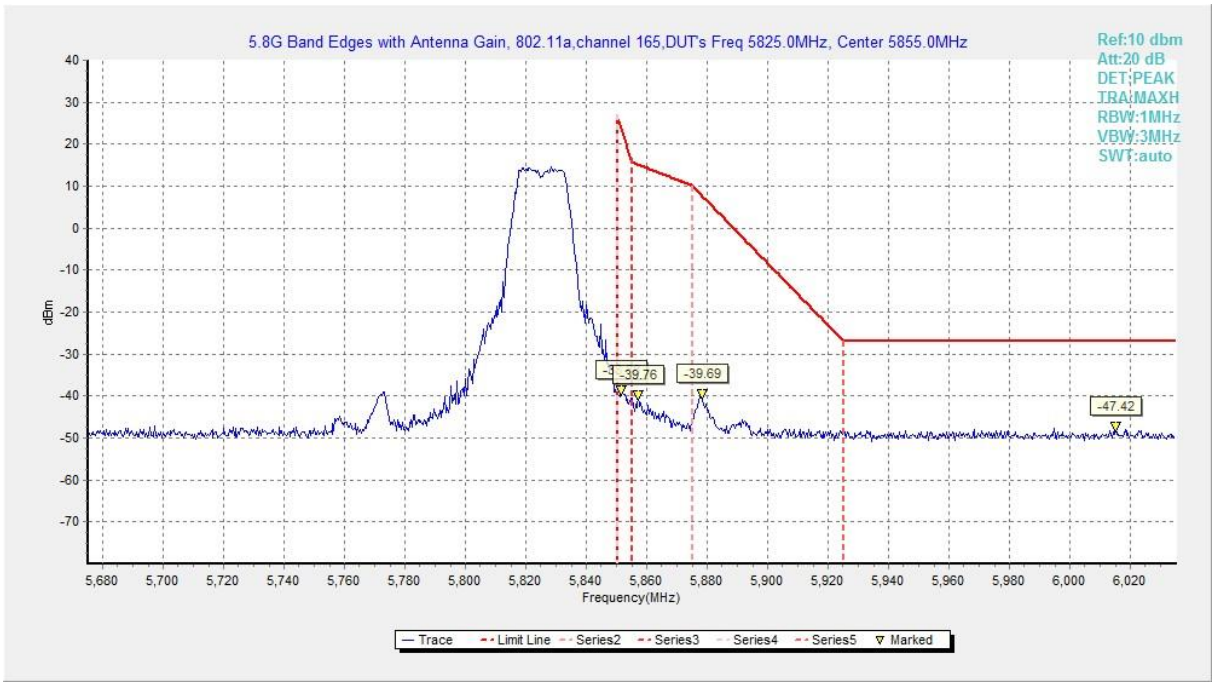

Fig. 42 Band Edges (802.11a, 5825MHz)

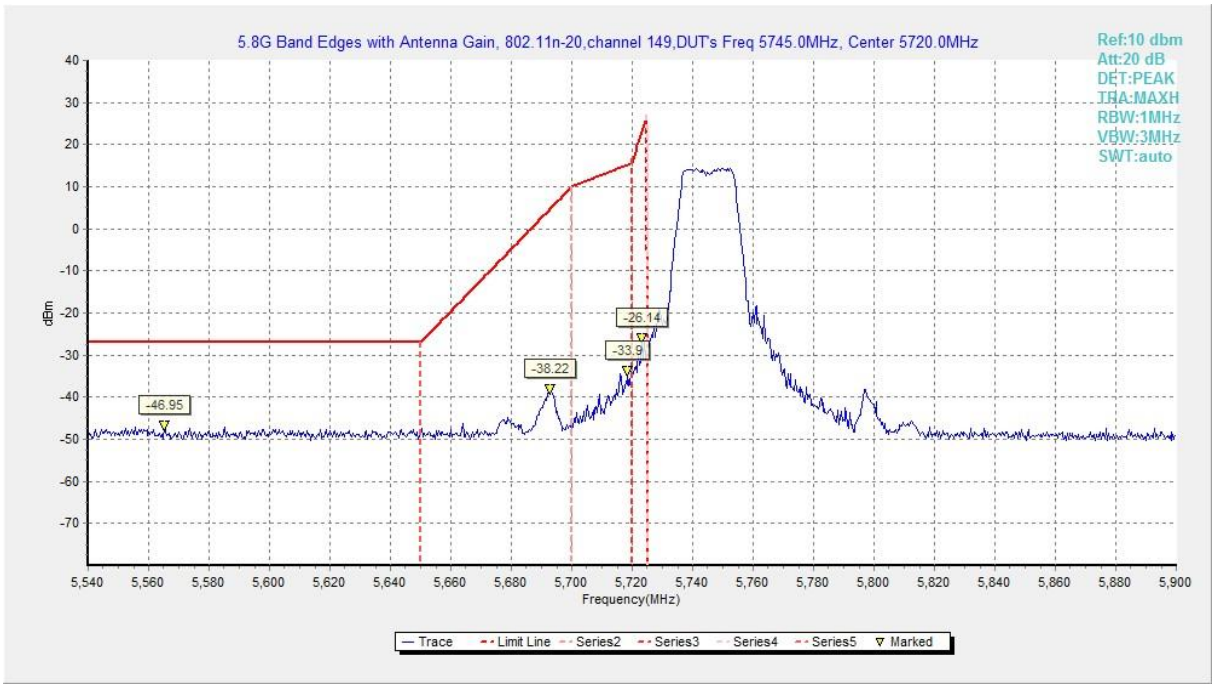

Fig. 43 Band Edges (802.11n-HT20, 5745MHz)

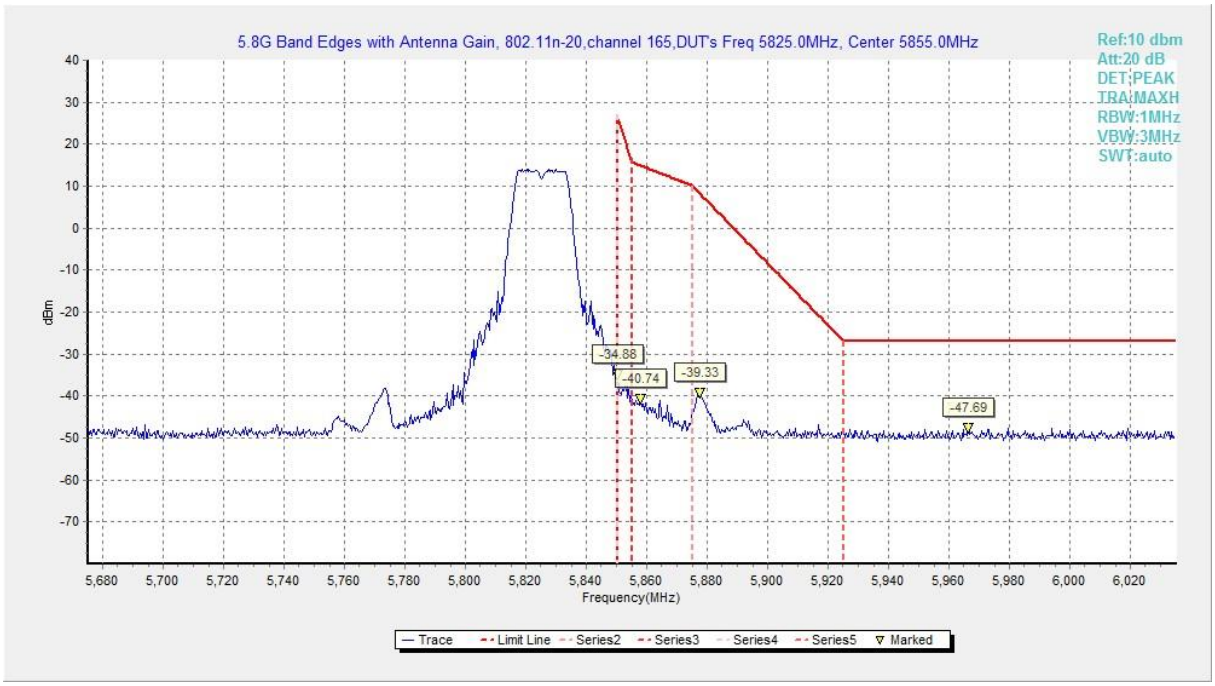

Fig. 44 Band Edges (802.11n-HT20, 5825MHz)

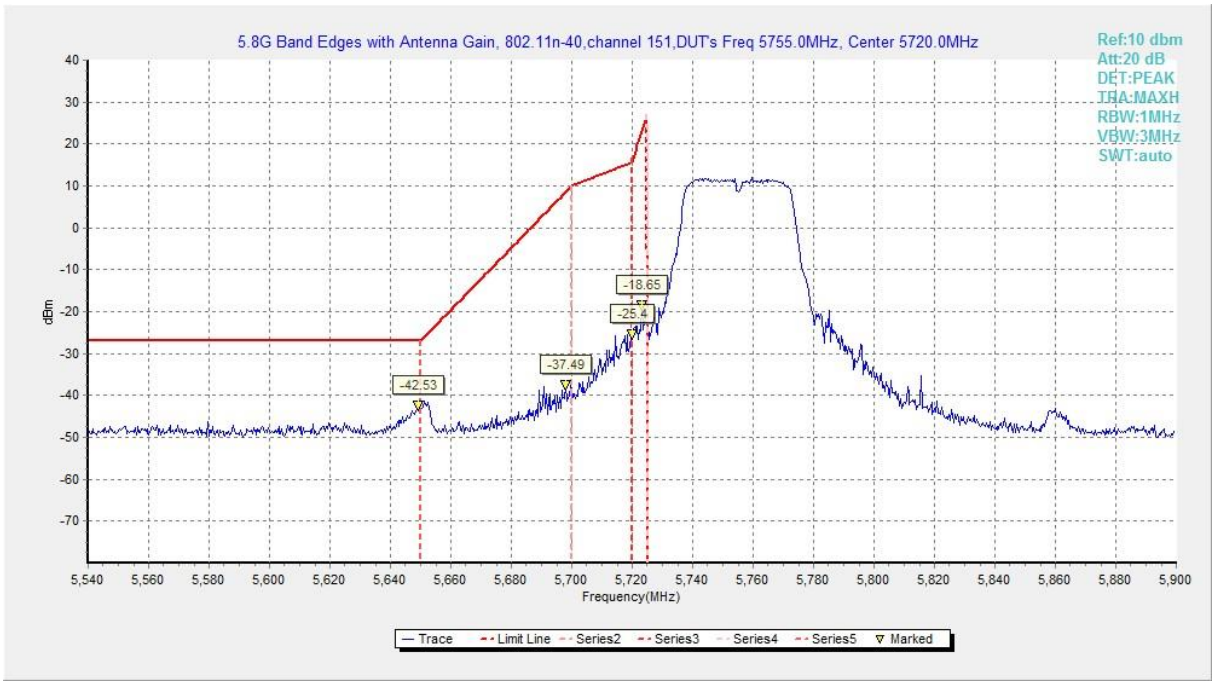

Fig. 45 Band Edges (802.11n-HT40, 5755MHz)

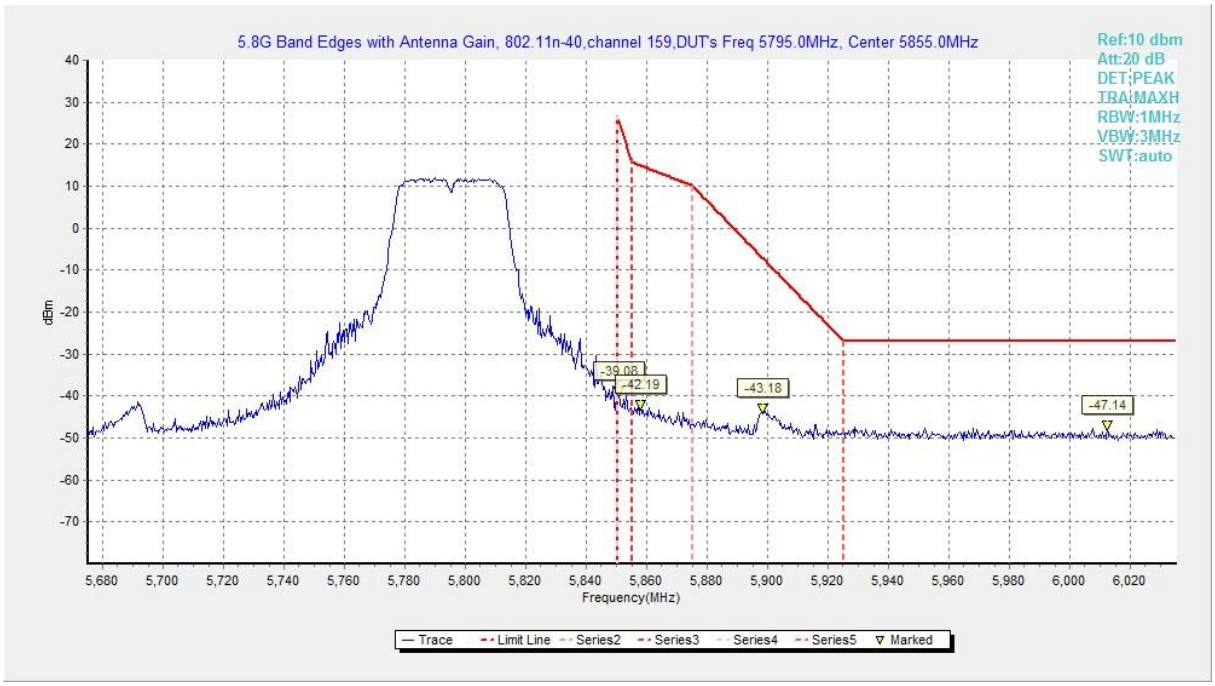

Fig. 46 Band Edges (802.11n-HT40, 5795MHz)

A6.2 Band Edges - Radiated

Measurement Limit:

Standard	Limit (dBm/MHz)	
FCC 47 CFR Part 15.407	at the band edge	27
	at 5 MHz above or below the band edge	15.6
	at 25 MHz above or below the band edge	10
	at 75 MHz or more above or below the band edge	-27
	Note：increasing linearly from point to point.	

The measurement is made according to KDB 789033 D02

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Measurement Result:

Mode	Channel	Test Results	Conclusion
802.11a	5745 MHz	Fig.47	P
	5825 MHz	Fig.48	P
802.11n HT20	5745 MHz	Fig.49	P
	5825 MHz	Fig.50	P
802.11n HT40	5755 MHz	Fig.51	P
	5795 MHz	Fig.52	P

Conclusion: PASS

Test graphs as below:

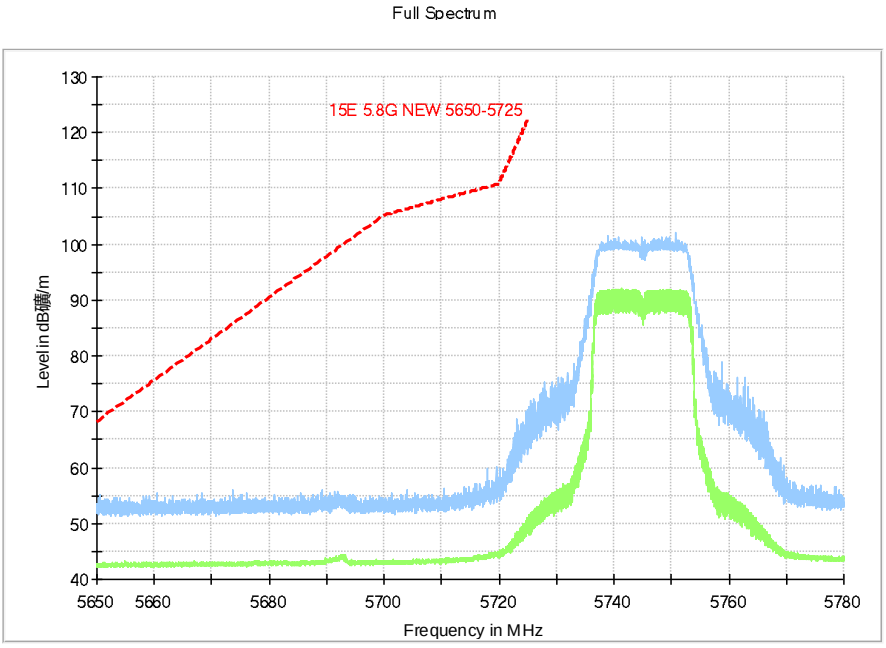

Fig. 47 Band Edges (802.11a, 5745MHz)

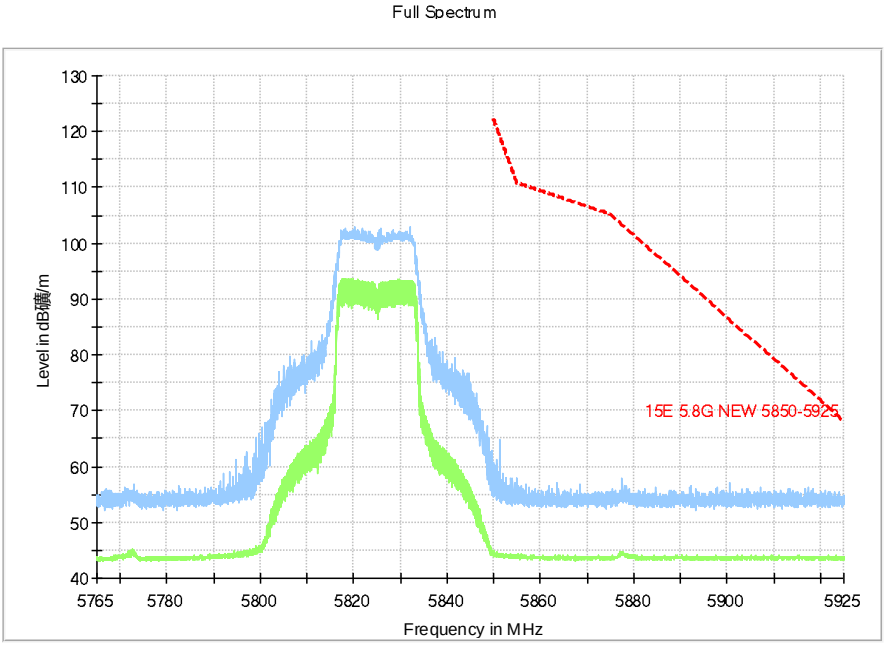

Fig. 48 Band Edges (802.11a, 5825MHz)

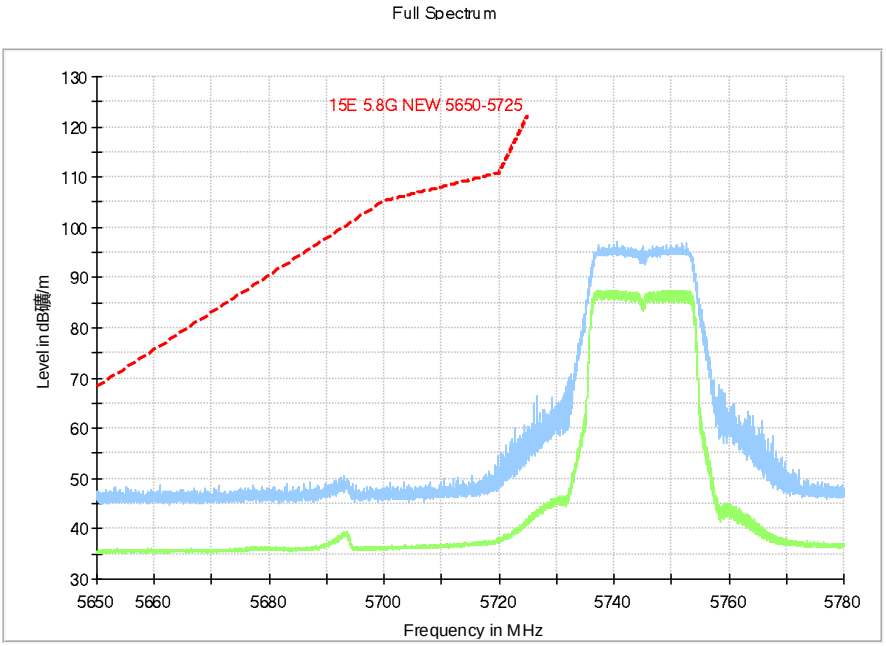

Fig. 49 Band Edges (802.11n-HT20, 5745MHz)

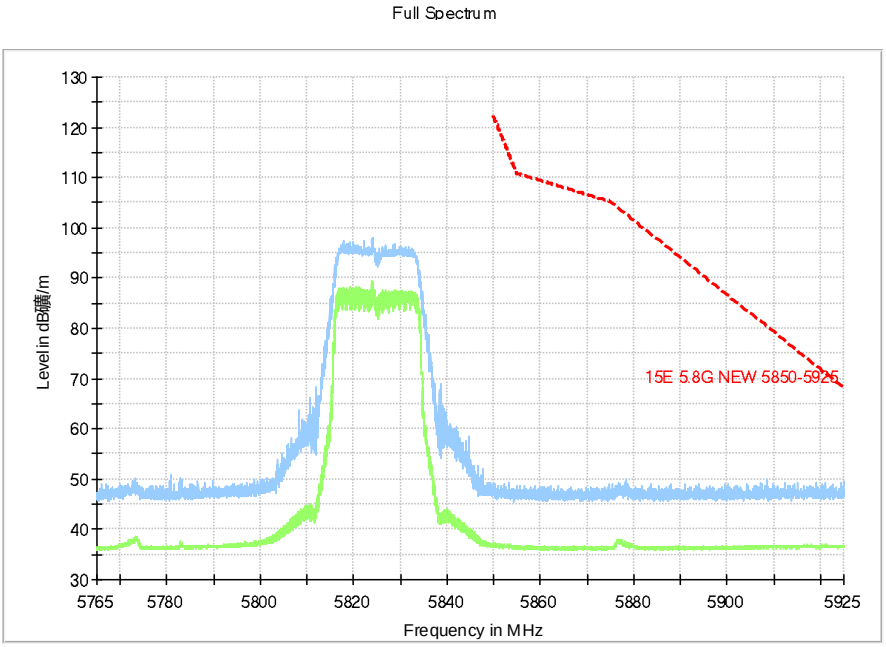

Fig. 50 Band Edges (802.11n-HT20, 5825MHz)

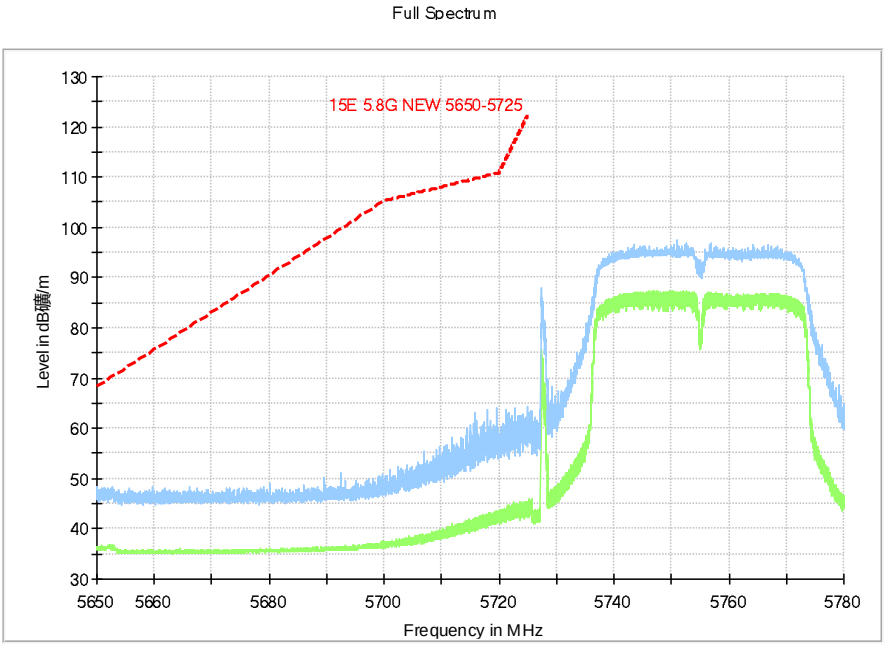

Fig. 51 Band Edges (802.11n-HT40, 5755MHz)

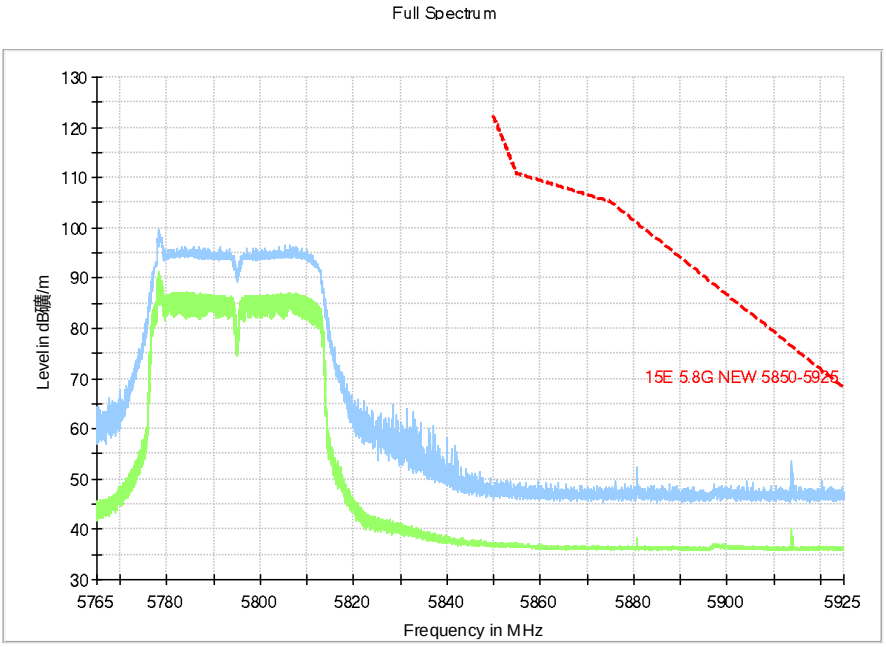

Fig. 52 Band Edges (802.11n-HT40, 5795MHz)

A.7. AC Powerline Conducted Emission

Test Condition:

Voltage（V）	Frequency（Hz）
120	60

Measurement uncertainty:

Expanded measurement uncertainty for this test item is U =3.2dB, k=2.

Measurement Result and limit:

WLAN (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		With charger		
		802.11a	Idle	
0.15 to 0.5	66 to 56	Fig.53	Fig.54	P
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

WLAN (Average Limit)

Frequency range (MHz)	Average Limit (dBμV)	Result (dBμV)		Conclusion
		With charger		
		802.11a	Idle	
0.15 to 0.5	56 to 46	Fig.53	Fig.54	P
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

The measurement is made according to ANSI C63.10 .

Conclusion: PASS

Test graphs as below:

Result for traffic:

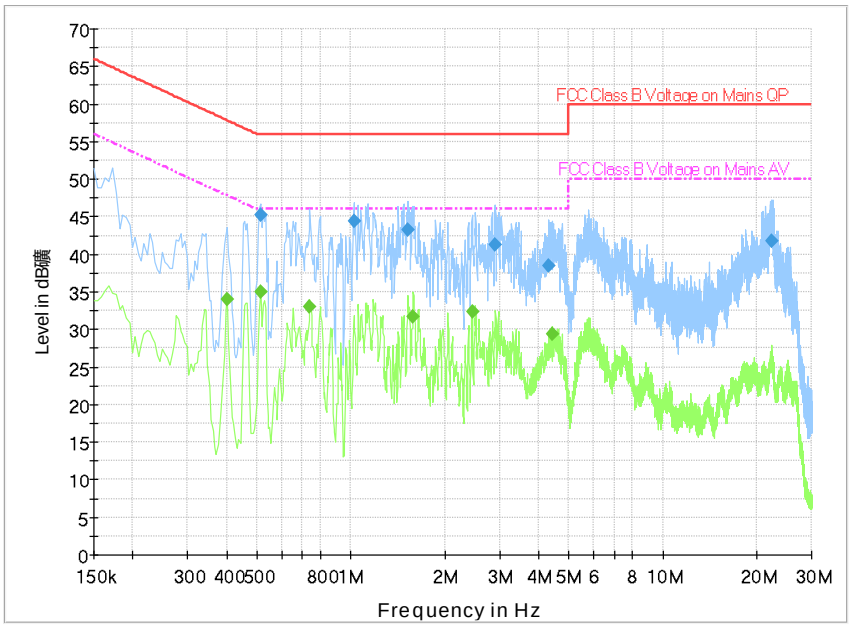

Fig. 53 AC Powerline Conducted Emission-802.11a

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.514500	45.2	2000.0	9.000	On	L1	19.8	10.8	56.0	
1.023000	44.4	2000.0	9.000	On	L1	19.7	11.6	56.0	
1.522500	43.2	2000.0	9.000	On	L1	19.6	12.8	56.0	
2.895000	41.2	2000.0	9.000	On	L1	19.6	14.8	56.0	
4.299000	38.5	2000.0	9.000	On	L1	19.6	17.5	56.0	
22.308000	41.8	2000.0	9.000	On	N	19.9	18.2	60.0	

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.402000	34.0	2000.0	9.000	On	L1	19.8	13.8	47.8	
0.514500	34.9	2000.0	9.000	On	L1	19.8	11.1	46.0	
0.739500	33.0	2000.0	9.000	On	L1	19.8	13.0	46.0	
1.585500	31.7	2000.0	9.000	On	L1	19.6	14.3	46.0	
2.449500	32.4	2000.0	9.000	On	L1	19.6	13.6	46.0	
4.438500	29.4	2000.0	9.000	On	L1	19.6	16.6	46.0	

Result for Idle:

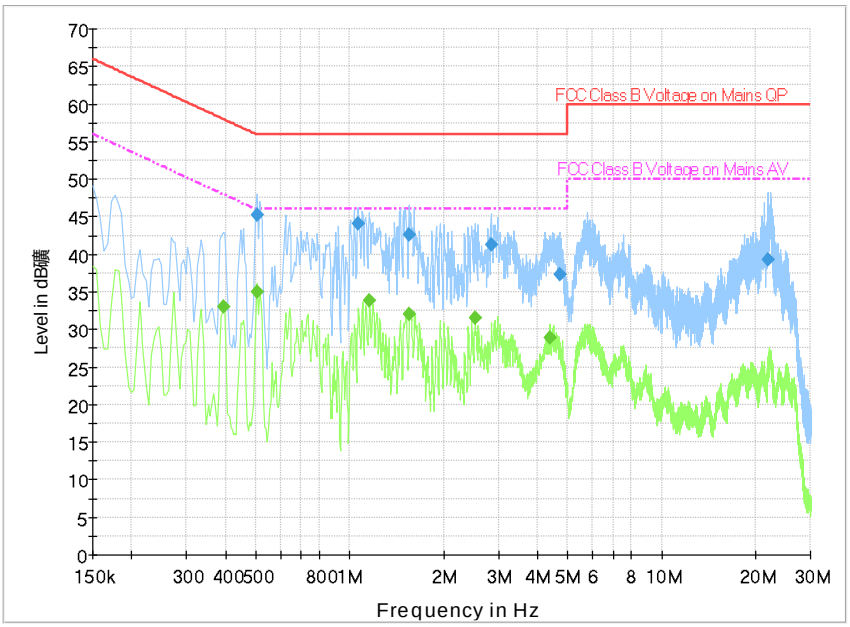

Fig. 54 AC Powerline Conducted Emission-Idle

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.505500	45.3	2000.0	9.000	On	L1	19.8	10.7	56.0	
1.063500	44.0	2000.0	9.000	On	L1	19.7	12.0	56.0	
1.554000	42.6	2000.0	9.000	On	L1	19.6	13.4	56.0	
2.836500	41.2	2000.0	9.000	On	L1	19.6	14.8	56.0	
4.704000	37.3	2000.0	9.000	On	L1	19.6	18.7	56.0	
21.903000	39.3	2000.0	9.000	On	N	19.9	20.7	60.0	

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.393000	33.0	2000.0	9.000	On	L1	19.8	15.0	48.0	
0.505500	35.1	2000.0	9.000	On	L1	19.8	10.9	46.0	
1.158000	33.9	2000.0	9.000	On	L1	19.7	12.1	46.0	
1.554000	32.0	2000.0	9.000	On	L1	19.6	14.0	46.0	
2.526000	31.6	2000.0	9.000	On	L1	19.6	14.4	46.0	
4.402500	28.9	2000.0	9.000	On	L1	19.6	17.1	46.0	

ANNEX B: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2019-09-26 through 2020-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

***** END OF REPORT BODY *****