RADIO PERFORMANCE TEST REPORT

Test Report No.	**: OT-201-RWD-035**
AGR No.	**: A195A-131**
Applicant	**: LAON Technology**
Address	**: #1212, Biz Center, SK-N Technopark, 124, Sagimakgol-ro, Jungwon-Gu, Seongnam-Si, Gyeonggi-Do, Korea**
Manufacturer	**: LAON Technology**
Address	**: #1212, Biz Center, SK-N Technopark, 124, Sagimakgol-ro, Jungwon-Gu, Seongnam-Si, Gyeonggi-Do, Korea**
Type of Equipment	**: Wireless Audio RF Module**
FCC ID.	**: 2AU4Y-LAON-INTERCOM**
Model Name	**: KUM1000-MA0-03**
Serial number	**: N/A**
Total page of Report	**: 101 pages (including this page)**
Date of Incoming	**: June 10, 2019**
Date of issue	**: January 29, 2020**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART E Section 15.407***

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: Ha-Ram Lee / Assistant Manager, ONETECH Corp.

Approved by: Jae-Ho Lee / Chief Engineer, ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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REVISION HISTORY

Rev. No.	Issued Report No.	Issued Date	Revisions	Effect Section
0	OT-19O-RWD-023	October 11, 2019	Initial Issue	All
1	OT-201-RWD-019	January 17, 2020	Added Spurious emission test for added antennas Added Duty Factor and AC Conducted esmission test	13. RADIATED SPURIOUS EMISSIONS & 14. RADIATED RESTRICTED BAND EDGE MEASUREMENTS 5.3 Mode of operation during the test & 15. CONDUCTED EMISSION TEST
2	OT-201-RWD-035	January 29, 2020	Added Client mode test	7. MINIMUM 26 dB BANDWIDTH & 8. 6 dB BANDWIDTH & 9. MAXIMUM PEAK OUTPUT POWER & 10. PEAK POWER SPECTRAL DENSITY

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

1. VERIFICATION OF COMPLIANCE

Applicant : LAON Technology

Address : #1212, Biz Center, SK-N Technopark, 124, Sagimakgol-ro, Jungwon-Gu, Seongnam-Si, Gyeonggi-Do, Korea

Contact Person : Kwon Hyukjin / General Manager

Telephone No. : 82-70-8766-9396

FCC ID : 2AU4Y-LAON-INTERCOM

Model Name : KUM1000-MA0-03

Brand Name : N/A

Serial Number : N/A

Date : January 29, 2020

EQUIPMENT CLASS	NII - Unlicensed National Information Infrastructure(UNII)
E.U.T. DESCRIPTION	Wireless Audio RF Module
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART E Section 15.407 KDB 789033 D01 General UNII Test Procedures
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.407(a)	26 dB Bandwidth	PASS
	99 % Occupied Bandwidth	PASS
15.407(a)	Maximum Conducted Output Power	Met the Limit / PASS
15.407(a)	Peak Power Spectral Density	Met the Limit / PASS
15.407(a)	Peak Excursion	Met the Limit / PASS
15.407(g)	Frequency Stability	Met the Limit / PASS
15.407(b)	Undesirable Emissions	Met the Limit / PASS
15.205, 15.407(b)	General Field Strength Limits (Restricted Bandsand Radiated Emission Limits)	Met the Limit / PASS
15.207	AC Conducted Emissions	PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART E Section 15.407

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The LAON Technology, Model KUM1000-MA0-03 (referred to as the EUT in this report) is a Wireless Audio RF Module. Product specification information described herein was obtained from product data sheet or user's manual.

<table>
<tr><td>DEVICE TYPE</td><td colspan="6">Wireless Audio RF Module</td></tr>
<tr><td rowspan="4">FREQUENCY RANGE</td><td rowspan="4">WLAN
5 GHz Band
(802.11n(HT20))</td><td rowspan="2">U-NII 1</td><td>Master</td><td colspan="2">5 150 MHz ~ 5 250 MHz Band</td></tr>
<tr><td>Client</td><td colspan="2">5 150 MHz ~ 5 250 MHz Band</td></tr>
<tr><td rowspan="2">U-NII 3</td><td>Master</td><td colspan="2">5 725 MHz ~ 5 825 MHz Band</td></tr>
<tr><td>Client</td><td colspan="2">5 725 MHz ~ 5 825 MHz Band</td></tr>
<tr><td rowspan="4">MAX. RF OUTPUT POWER</td><td rowspan="4">WLAN
5 GHz Band
(802.11n(HT20))</td><td rowspan="2">U-NII 1</td><td>Master</td><td colspan="2">18.81 dBm</td></tr>
<tr><td>Client</td><td colspan="2">18.53 dBm</td></tr>
<tr><td rowspan="2">U-NII 3</td><td>Master</td><td colspan="2">19.19 dBm</td></tr>
<tr><td>Client</td><td colspan="2">18.44 dBm</td></tr>
<tr><td colspan="3">MODULATION TYPE</td><td colspan="3">OFDM Modulation(BPSK/QPSK/16QAM/64QAM)</td></tr>
<tr><td rowspan="5">ANTENNA TYPE</td><td colspan="2">Antenna 1 (Basic)</td><td colspan="3">Dipole Antenna [Model name: AE-T2450/5500DP5-RSMA]</td></tr>
<tr><td colspan="2">Antenna 2 (Additional)</td><td colspan="3">PCB Antenna [Model name: AEi-2450/5500P-IPEX35]</td></tr>
<tr><td colspan="2">Antenna 3 (Additional)</td><td colspan="3">PCB Antenna [Model name: AEi-5500DP5-IPEX100[Bottom]]</td></tr>
<tr><td colspan="2">Antenna 4 (Additional)</td><td colspan="3">PCB Antenna [Model name: AEi-RO-5500DP4-IPEX160]</td></tr>
<tr><td colspan="2">Antenna 5 (Additional)</td><td colspan="3">PCB Antenna [Model name: AEi-RO-5500DP4-IPEX250]</td></tr>
<tr><td rowspan="10">ANTENNA GAIN</td><td rowspan="2">Antenna 1</td><td rowspan="10">WLAN
5 GHz
Band</td><td>5 150 MHz ~ 5 250 MHz Band</td><td>4.299 dBi</td></tr>
<tr><td>5 725 MHz ~ 5 825 MHz Band</td><td>5.634 dBi</td></tr>
<tr><td rowspan="2">Antenna 2</td><td>5 150 MHz ~ 5 250 MHz Band</td><td>3.967 dBi</td></tr>
<tr><td>5 725 MHz ~ 5 825 MHz Band</td><td>1.119 dBi</td></tr>
<tr><td rowspan="2">Antenna 3</td><td>5 150 MHz ~ 5 250 MHz Band</td><td>1.169 dBi</td></tr>
<tr><td>5 725 MHz ~ 5 825 MHz Band</td><td>4.358 dBi</td></tr>
<tr><td rowspan="2">Antenna 4</td><td>5 150 MHz ~ 5 250 MHz Band</td><td>3.719 dBi</td></tr>
<tr><td>5 725 MHz ~ 5 825 MHz Band</td><td>6.861 dBi</td></tr>
<tr><td rowspan="2">Antenna 5</td><td>5 150 MHz ~ 5 250 MHz Band</td><td>4.290 dBi</td></tr>
<tr><td>5 725 MHz ~ 5 825 MHz Band</td><td>5.904 dBi</td></tr>
<tr><td colspan="3">List of each Osc. or crystal Freq.(Freq. >= 1 MHz)</td><td colspan="3">40 MHz</td></tr>
<tr><td colspan="3">RATED SUPPLY VOLTAGE</td><td colspan="3">DC 3.3 V</td></tr>
</table>

Note. - This EUT operates only in 802.11n (HT20) mode.
- This EUT operates one port and the other port is Diversity Port.
- This EUT operates master mode or client mode.

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3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
MAIN BOARD	N/A	N/A	-

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
BP_JIG(FPGA)_Rev01	LAON Technolgoy	Jigboard	-
AC Adapter	LITE-ON Technology	AC Adapter	-

5.3 Mode of operation during the test.

-. Duty Cycle

Band	Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
UNII 1	802.11n HT 20	0.72	3.98	15.32	8.15
UNII 3	802.11n HT 20	0.72	3.98	15.32	8.15

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

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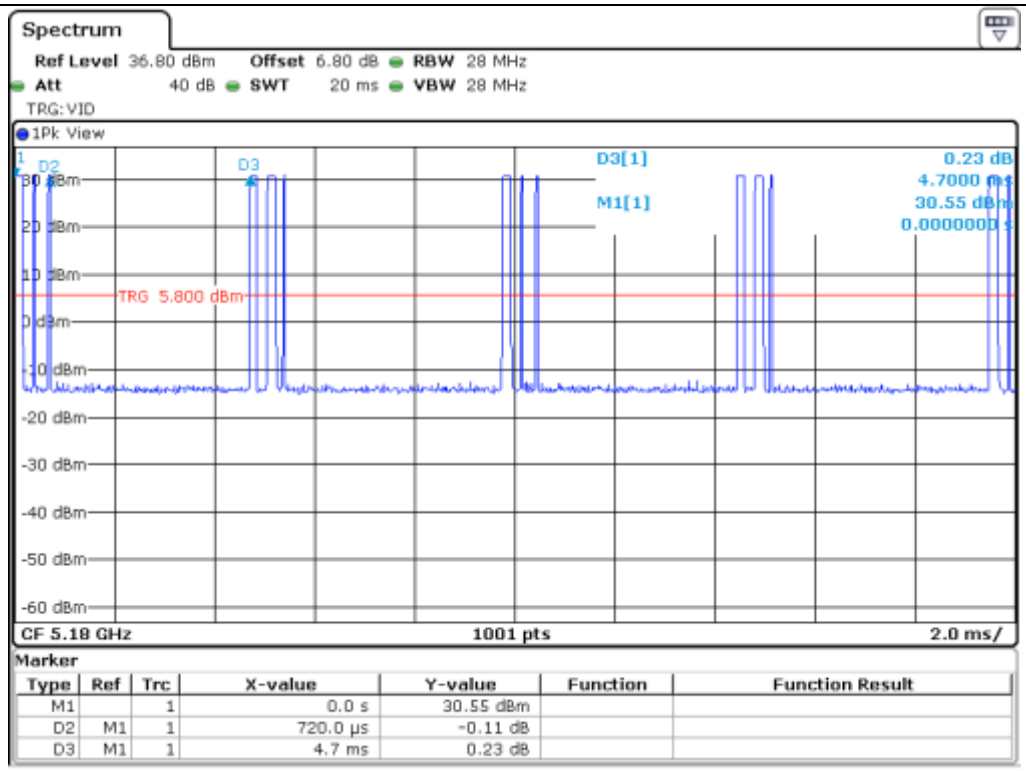
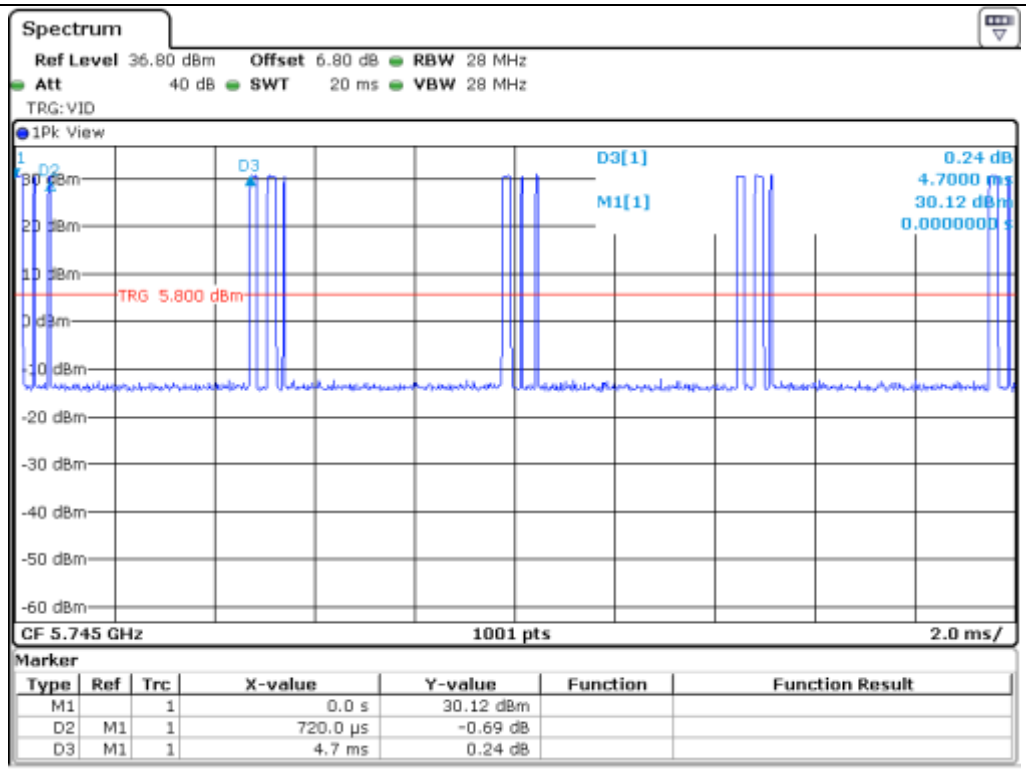
-. Test Plot



UNII 1_802.11n HT 20



UNII 3_802.11n HT 20

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5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to Jig Board and the power of Zig Board was connected to AC Adpater. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The Antenna of the EUT is a Dipole and PCB Antenna on the main board in the EUT.

Antenna connectors for each antenna are as below.

Antenna	Antenna Type	Model Name	Connector
Antenna 1 (Basic)	Dipole Antenna	AE-T2450/5500DP5-RSMA	IPEX
Antenna 2 (Additional)	PCB Antenna	AEi-2450/5500P-IPEX35	IPEX
Antenna 3 (Additional)	PCB Antenna	AEi-5500DP5-IPEX100[Bottom]	IPEX
Antenna 4 (Additional)	PCB Antenna	AEi-RO-5500DP4-IPEX160	IPEX
Antenna 5 (Additional)	PCB Antenna	AEi-RO-5500DP4-IPEX250	IPEX

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6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. MINIMUM 26 dB BANDWIDTH

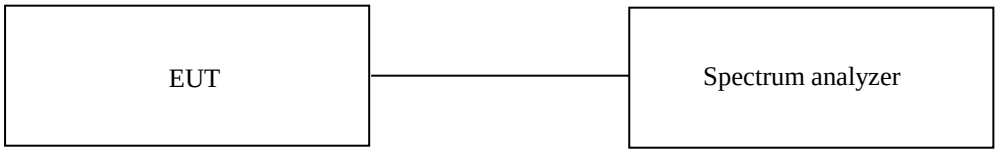
7.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 26 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

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7.4 Test data for 802.11n (HT 20) WLAN Mode (Master mode)

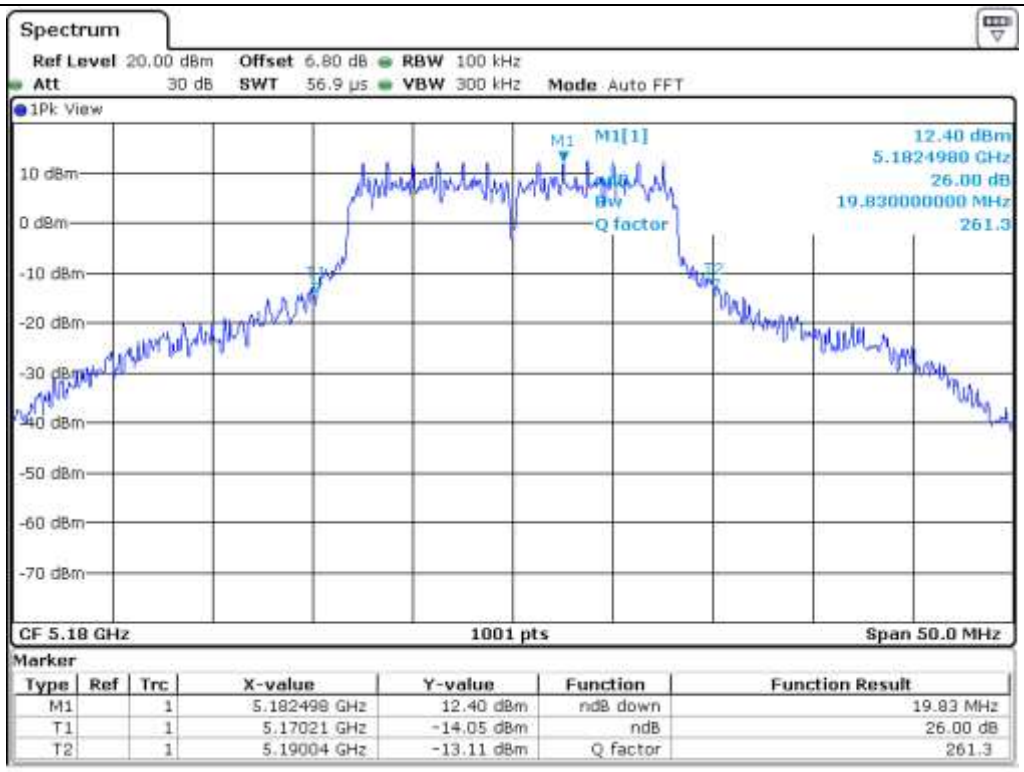
-. Test Date : June 24, 2019 ~ June 25, 2019

-. Test Result : Pass

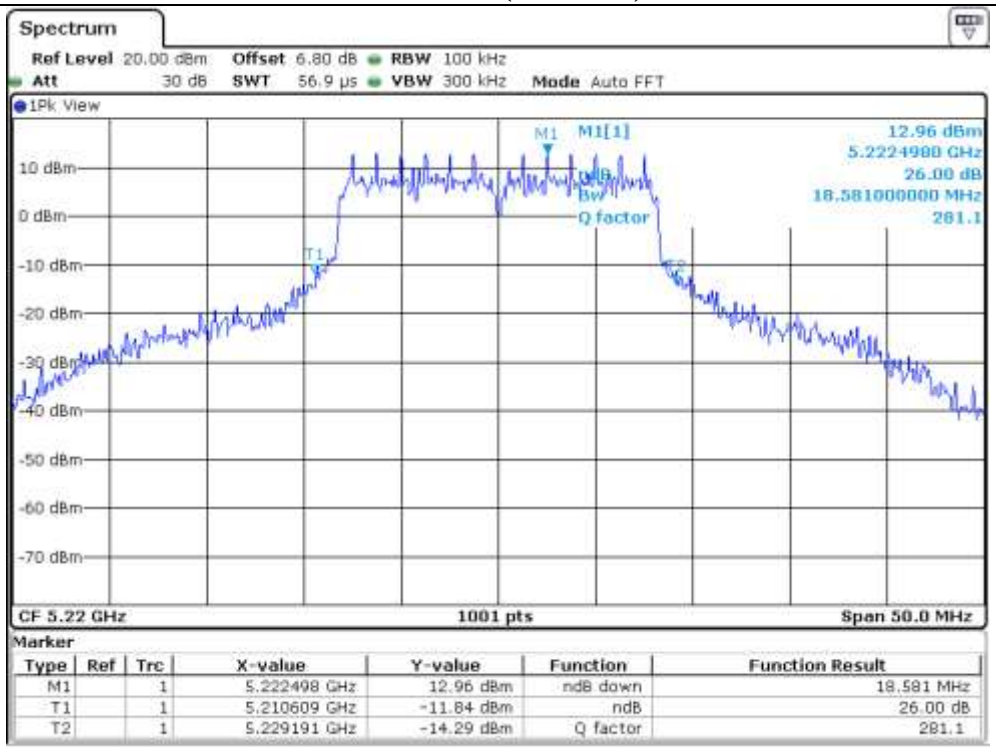
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180.00	19.83
	Middle	5 220.00	18.58
	High	5 240.00	18.23
5 725 ~ 5 825	Low	5 745.00	19.43
	Middle	5 785.00	19.98
	High	5 825.00	18.53

Remark: See next page for measurement data.

Tested by: Haram Lee / Assistant Manager



Low Channel (5 180 MHz)



Middle Channel (5 220 MHz)

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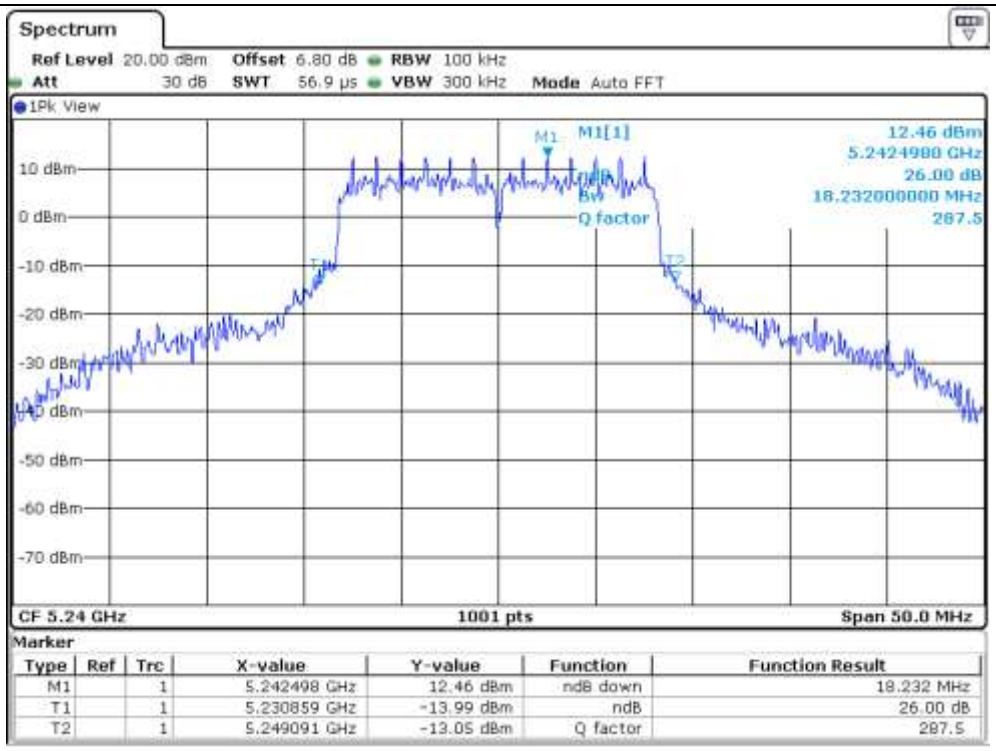
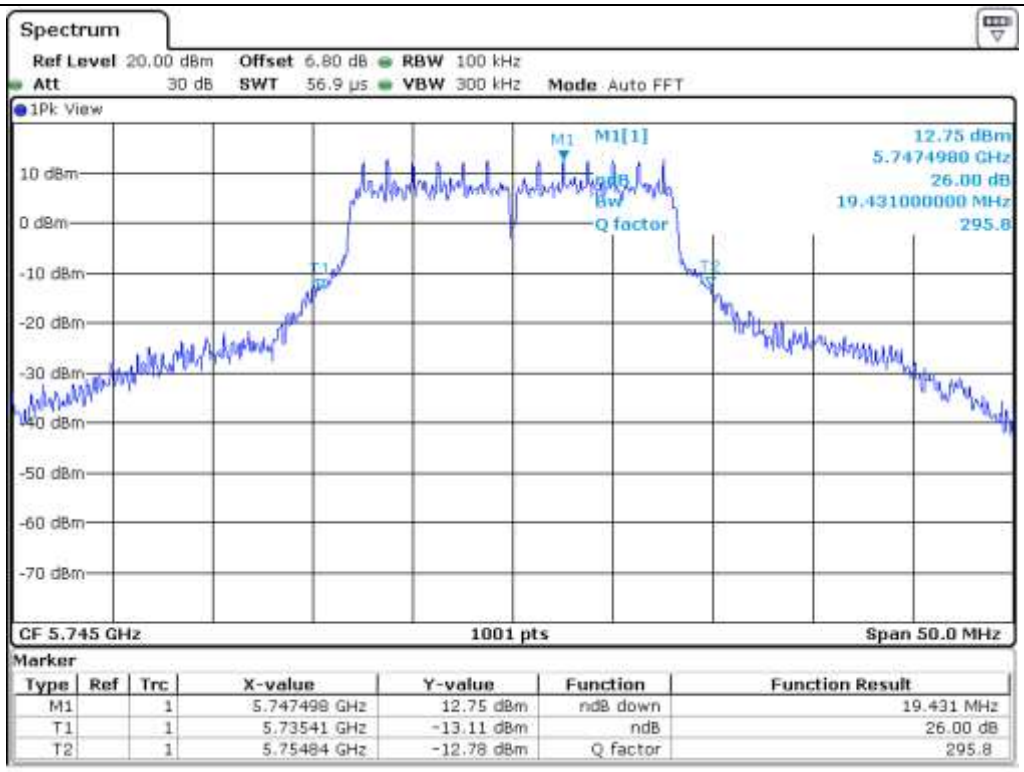
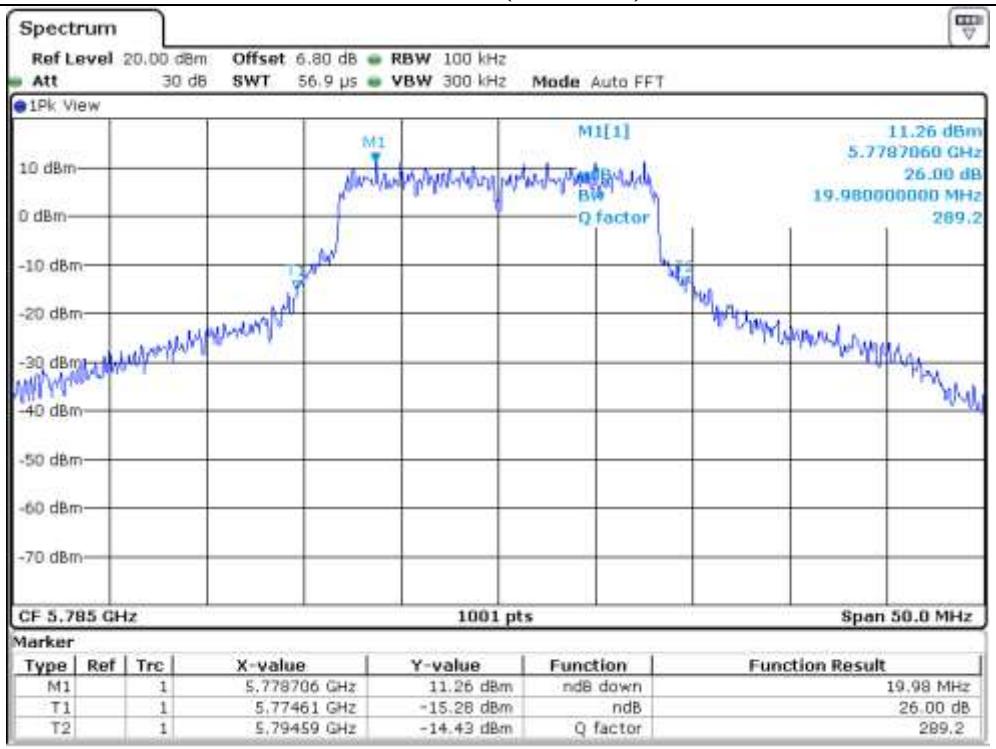


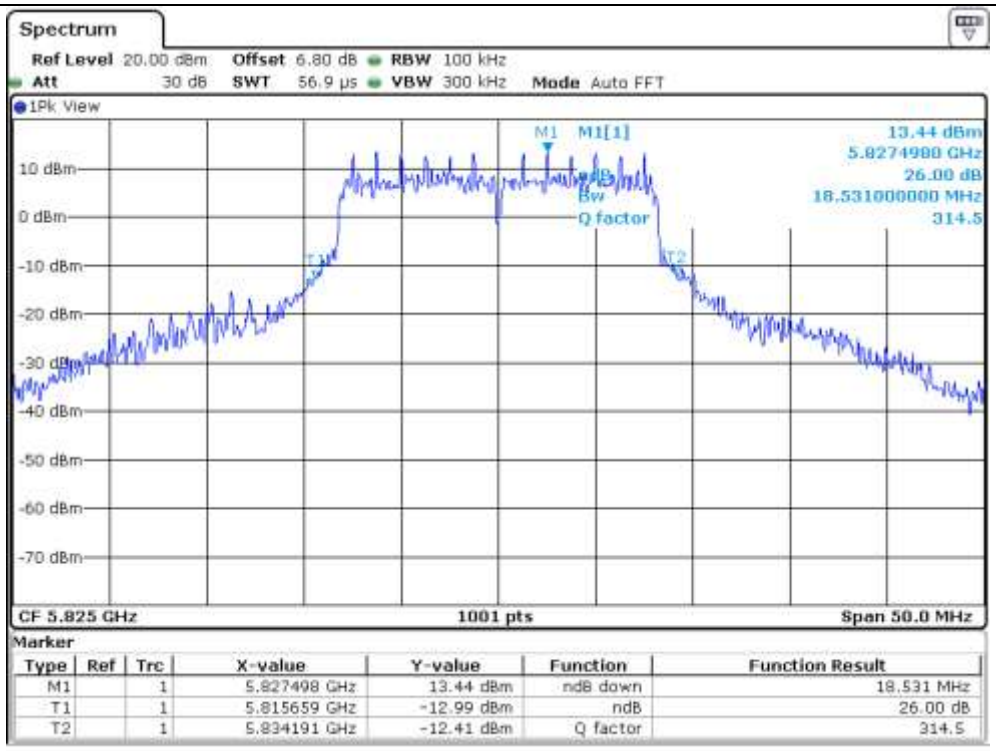
High Channel (5 240 MHz)



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



High Channel (5 825 MHz)

7.5 Test data for 802.11n (HT 20) WLAN Mode (Client mode)

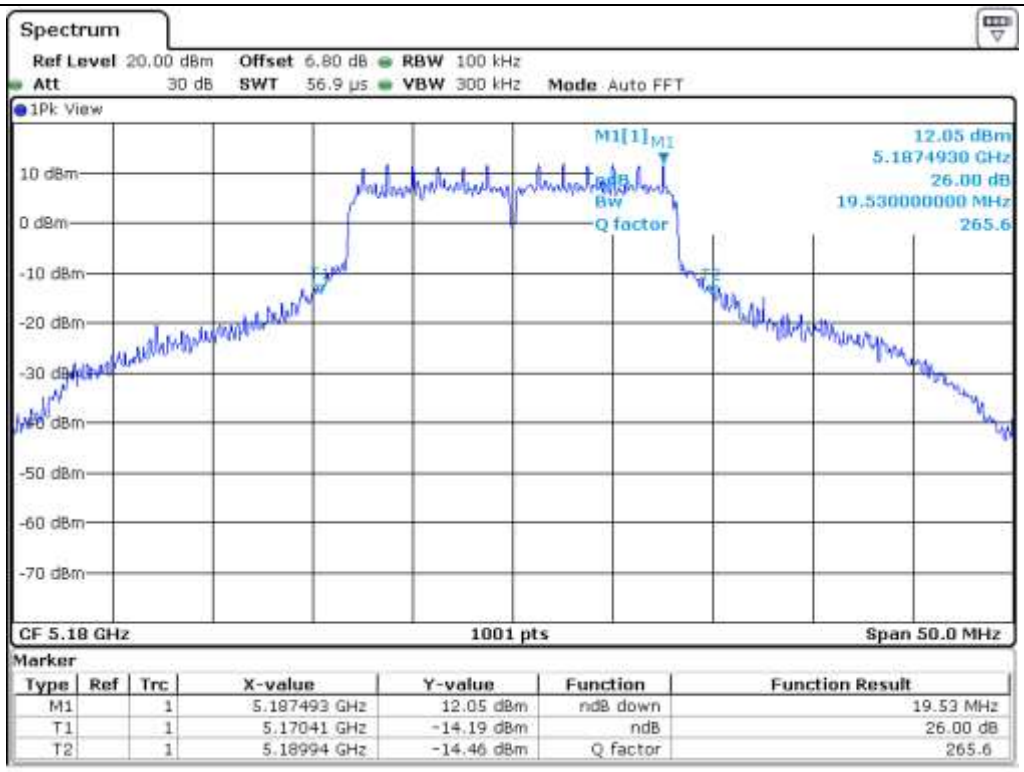
-. Test Date : January 23, 2020

-. Test Result : Pass

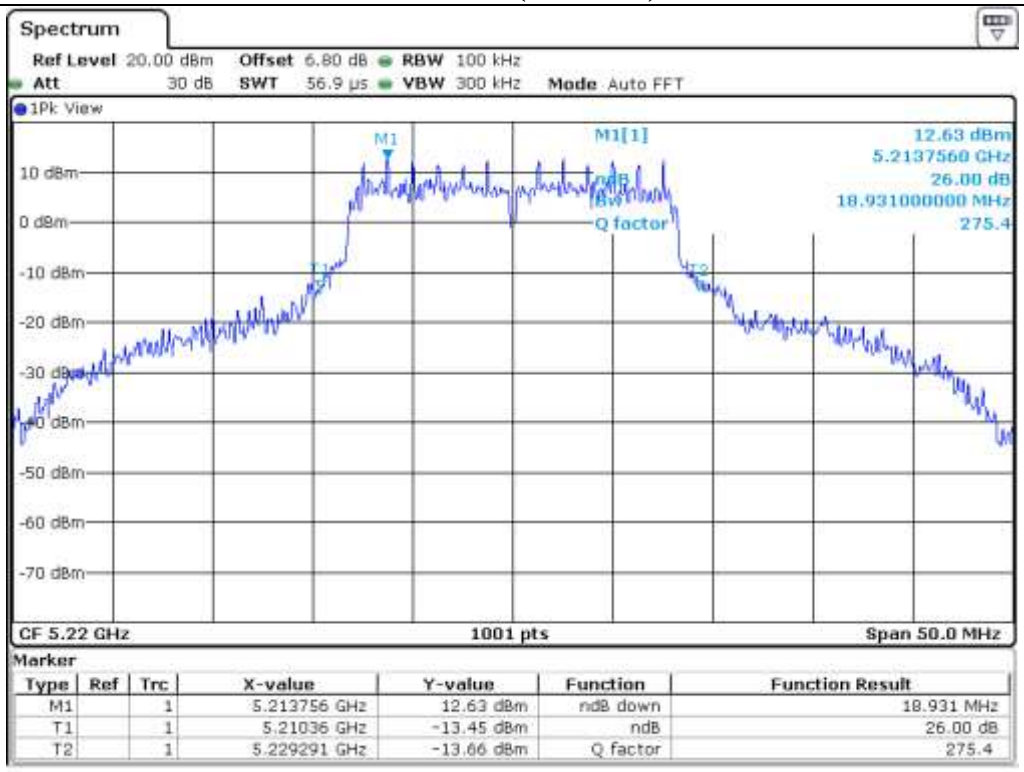
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180.00	19.53
	Middle	5 220.00	18.93
	High	5 240.00	18.73
5 725 ~ 5 825	Low	5 745.00	19.13
	Middle	5 785.00	18.83
	High	5 825.00	18.73

Remark: See next page for measurement data.

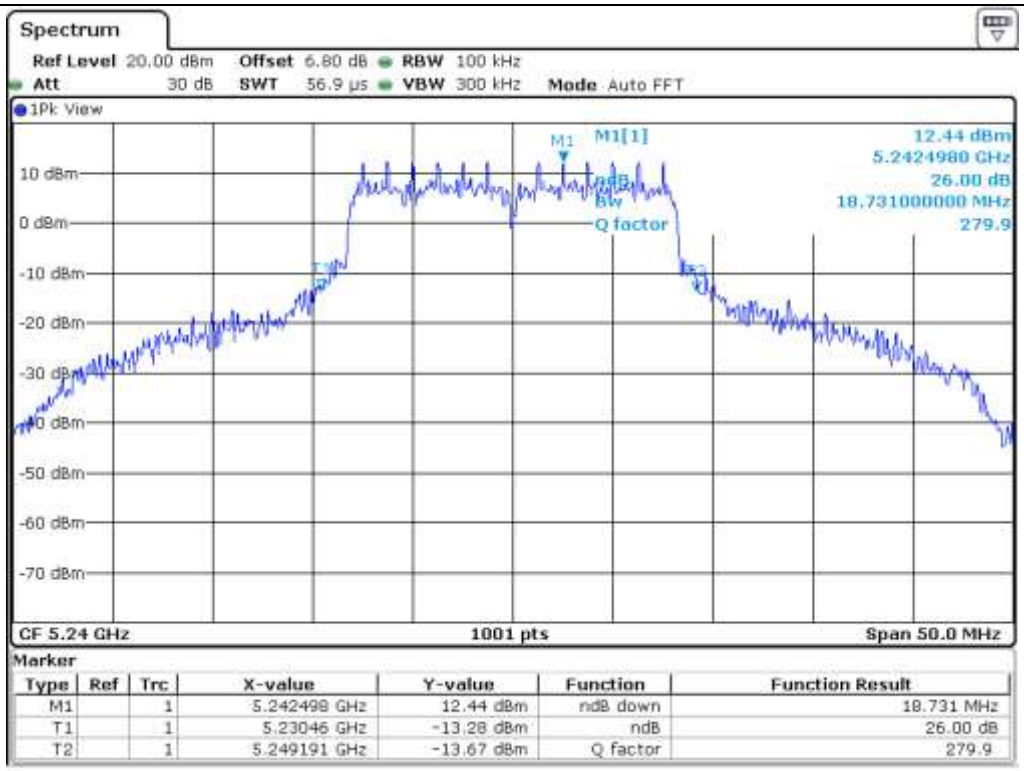
Tested by: Haram Lee / Assistant Manager



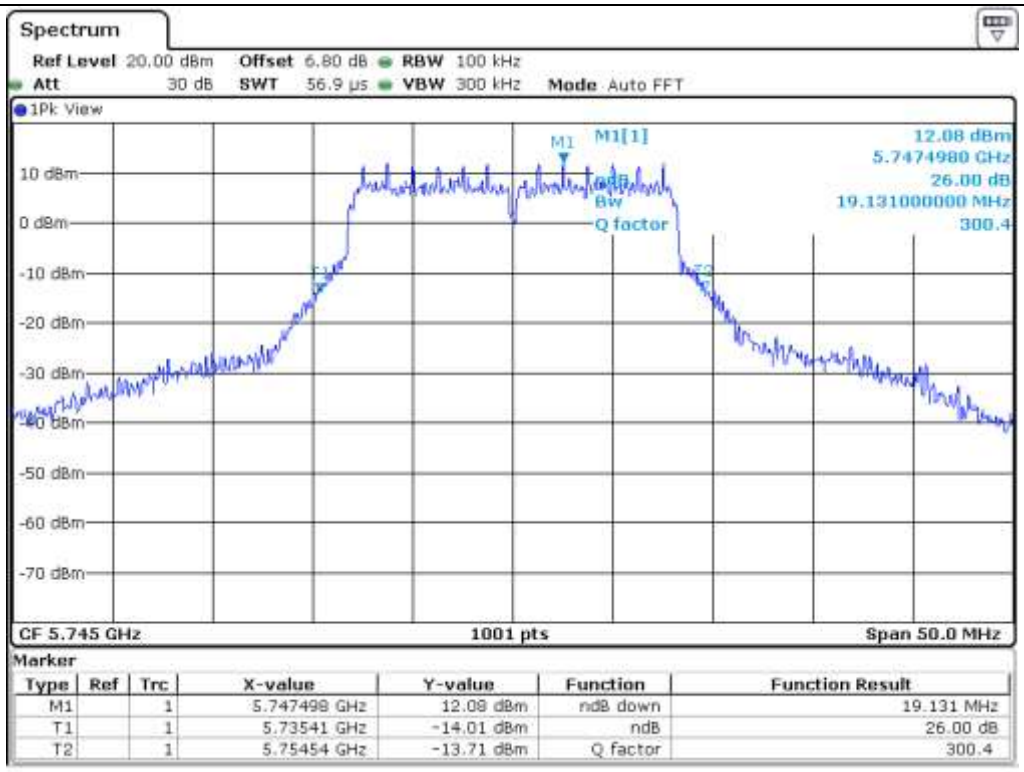
Low Channel (5 180 MHz)



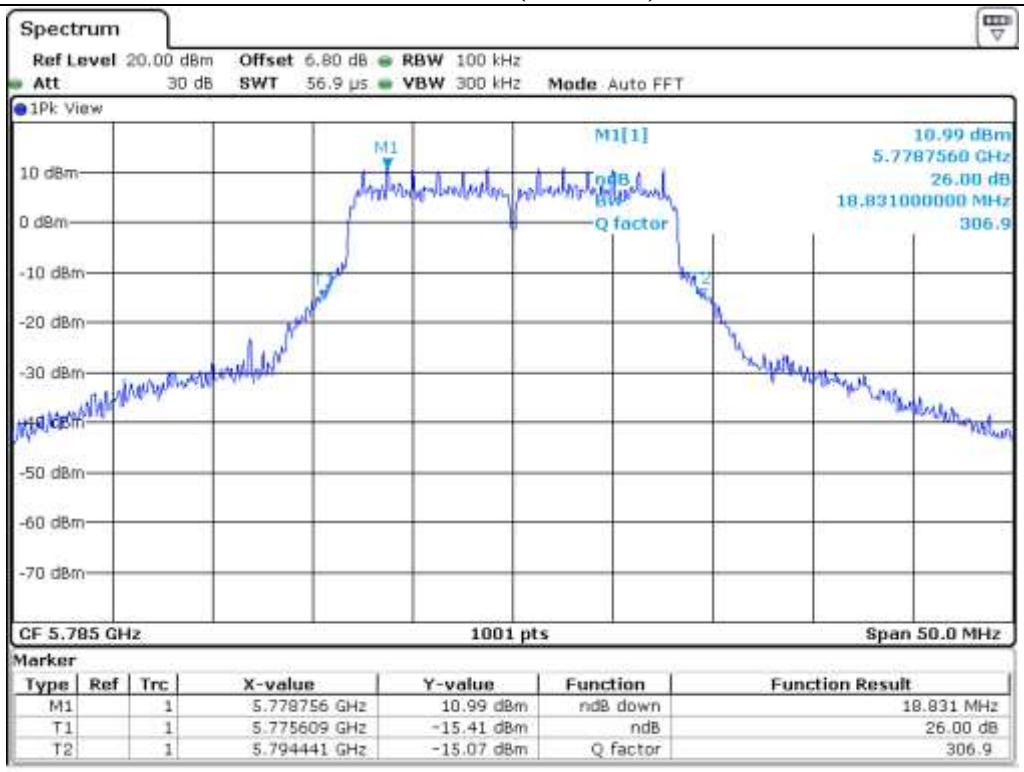
Middle Channel (5 220 MHz)



High Channel (5 240 MHz)



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)

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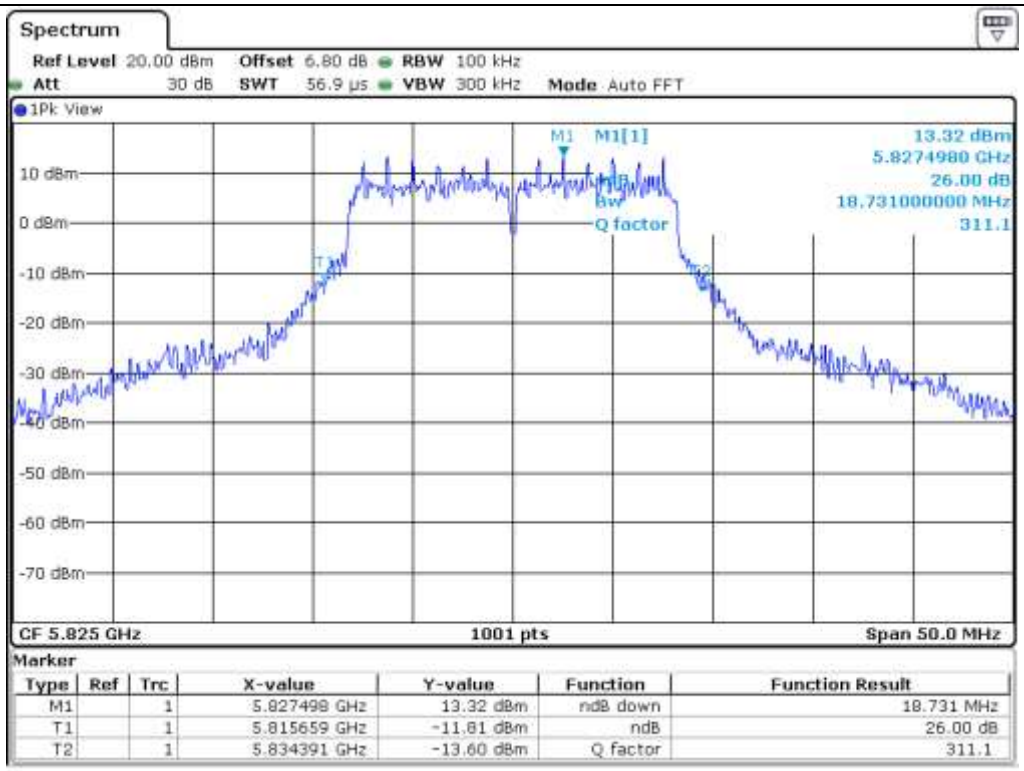


High Channel (5 825 MHz)

8. 6 dB BANDWIDTH

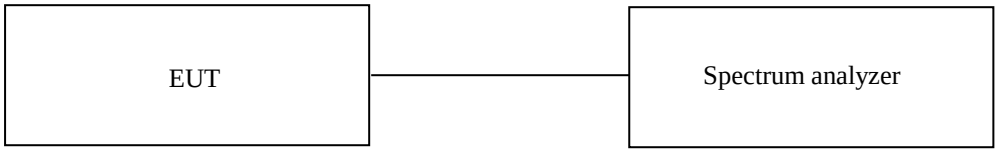
8.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

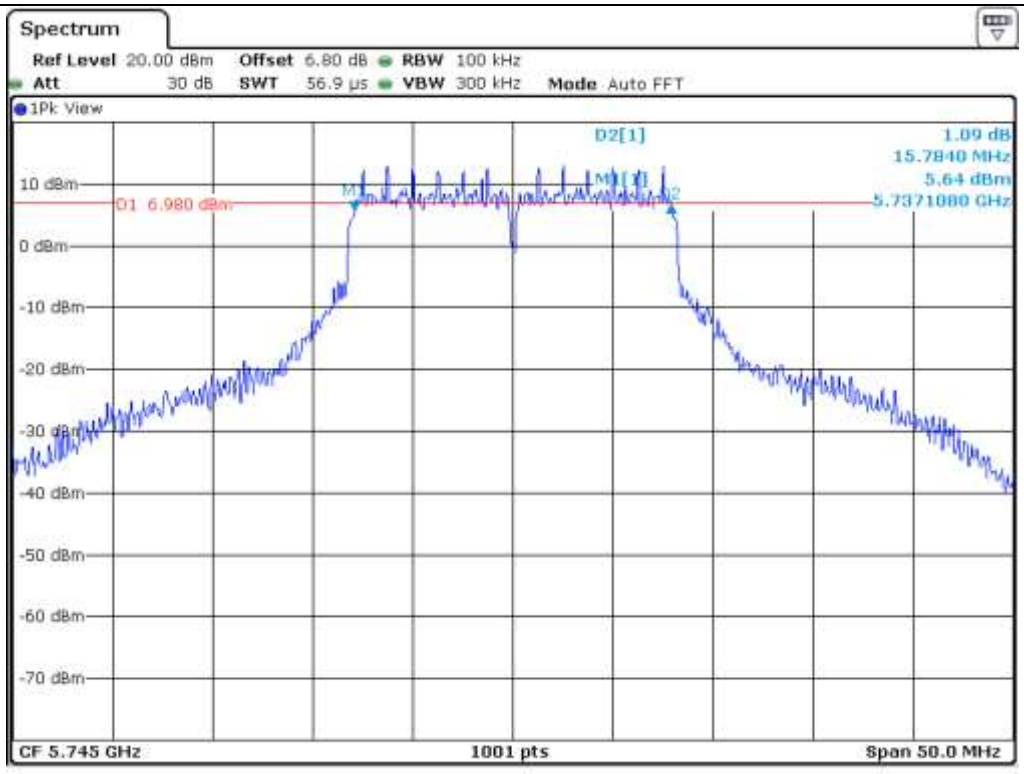
8.4 Test data for 802.11n (HT20) WLAN Mode (Master mode)

-. Test Date : June 24, 2019 ~ June 25, 2019

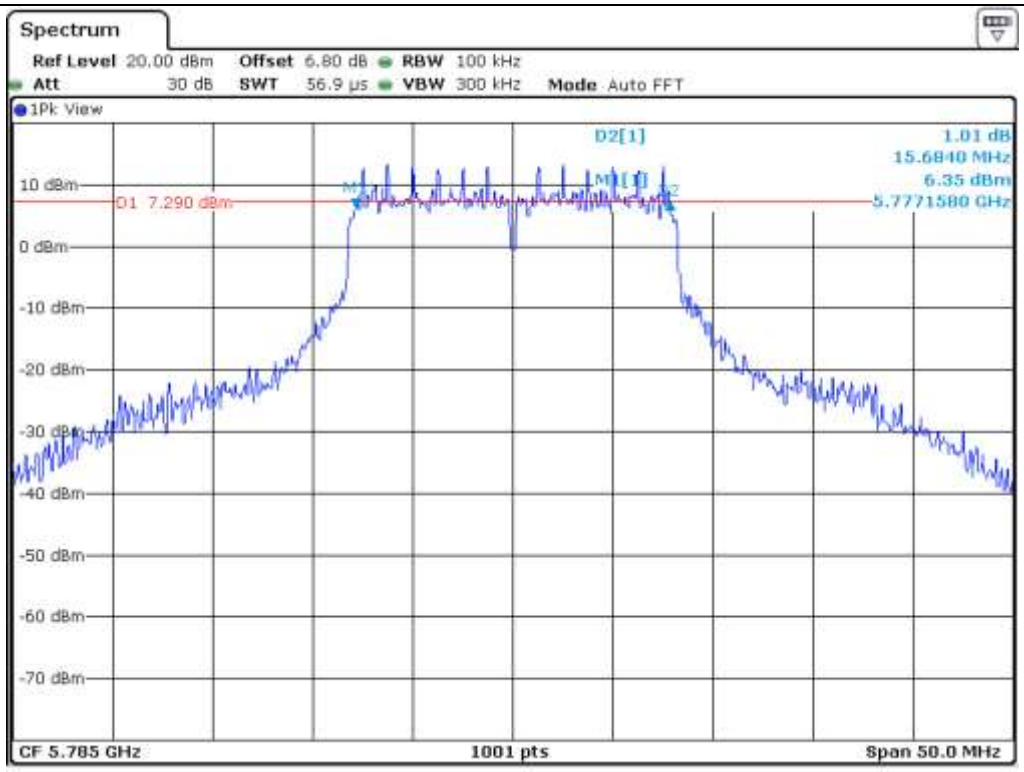
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 825	Low	5 745.00	15.78
	Middle	5 785.00	15.68
	High	5 825.00	15.44

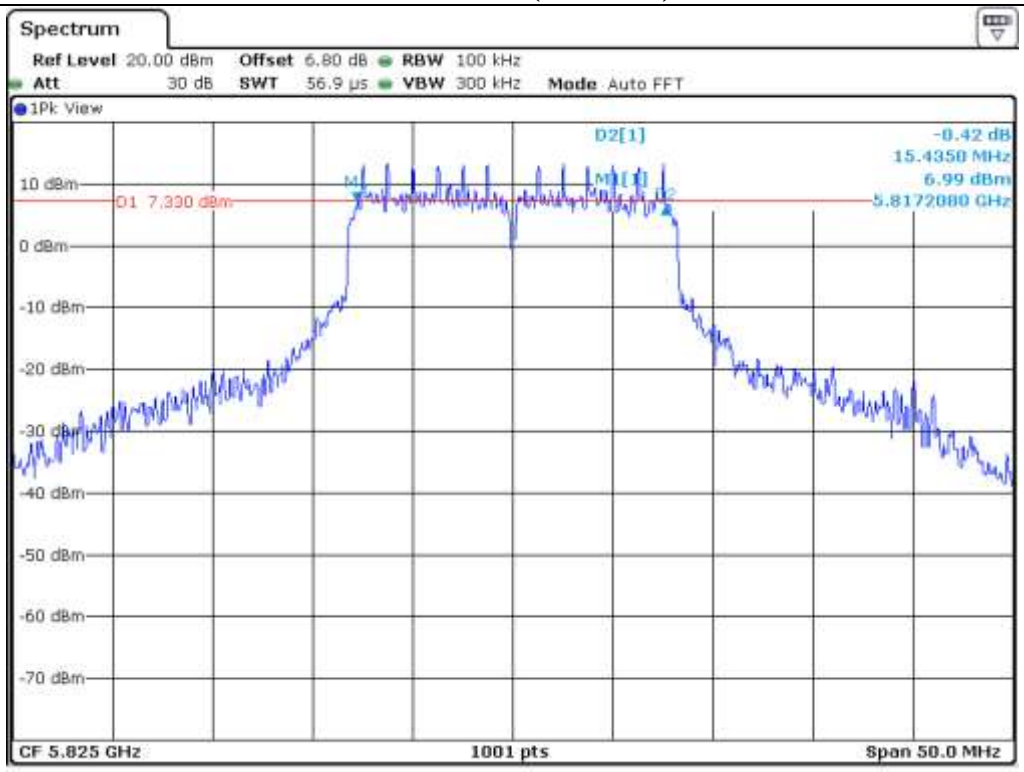
Tested by: Haram Lee / Assistant Manager



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



High Channel (5 825 MHz)

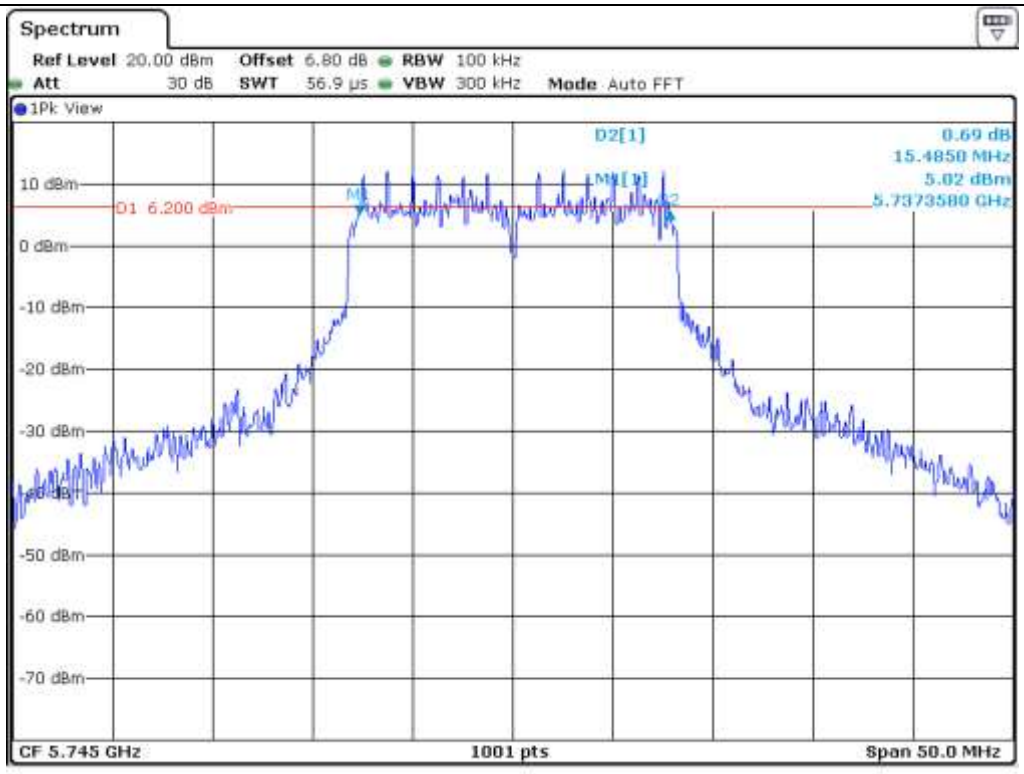
8.5 Test data for 802.11n (HT20) WLAN Mode (Client mode)

-. Test Date : January 23, 2020

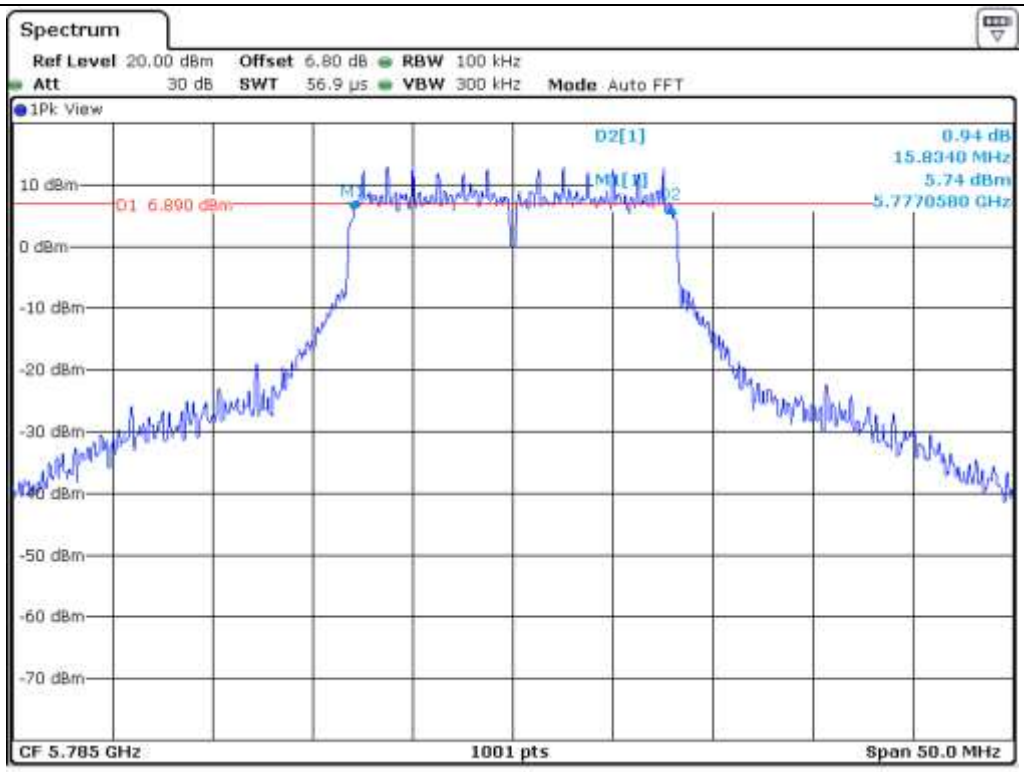
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 825	Low	5 745.00	15.49
	Middle	5 785.00	15.83
	High	5 825.00	15.78

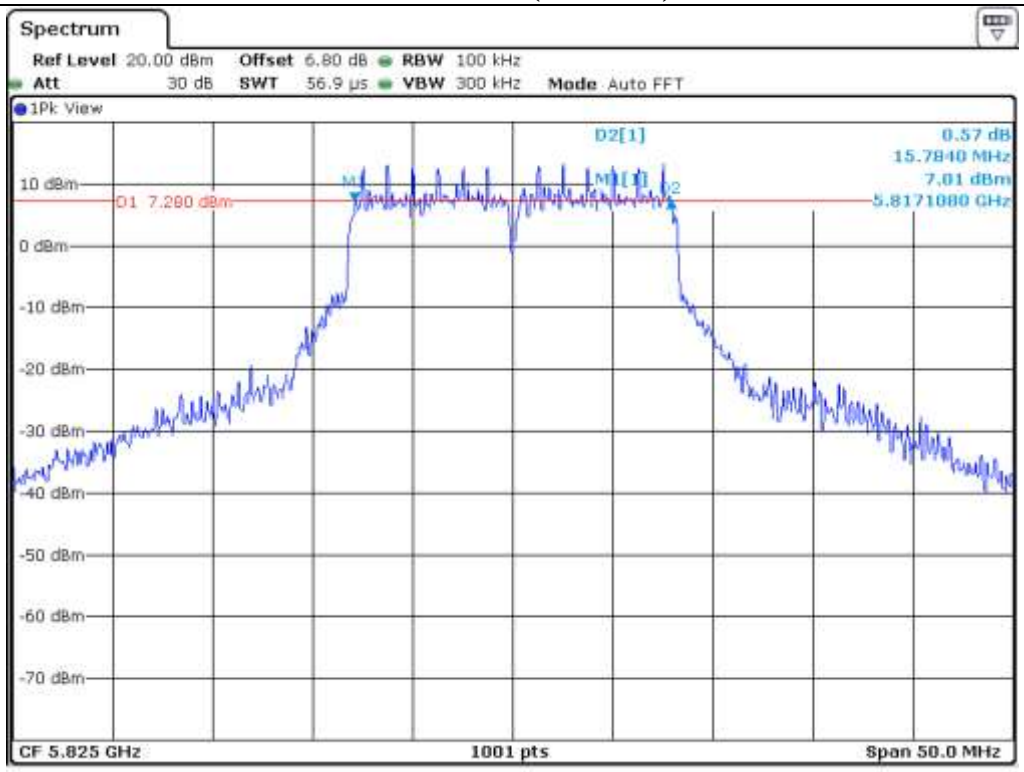
Tested by: Haram Lee / Assistant Manager



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



High Channel (5 825 MHz)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

9. MAXIMUM PEAK OUTPUT POWER

9.1 Operating environment

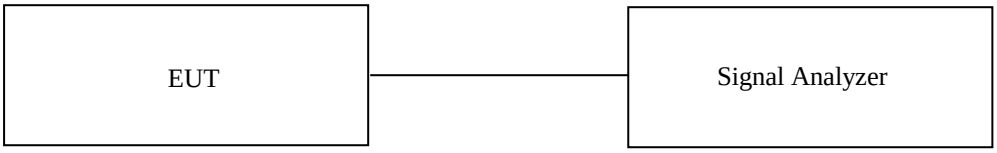
Temperature : 23 ℃

Relative humidity : 46 % R.H.

9.2 Test set-up

The maximum peak output power was measured with the Signal Analyzer connected to the antenna output of the EUT. The Signal Analyzer is measured when the EUT is transmitting at the appropriate center frequency its maximum power control level as described in Section E. 3. (KDB 789033 D02 General UNII Test Procedures New Rules v01r04).

Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.



9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

9.4 Test data for 802.11n (HT 20) WLAN Mode (Master mode)

-. Test Date : June 24, 2019 ~ June 25, 2019

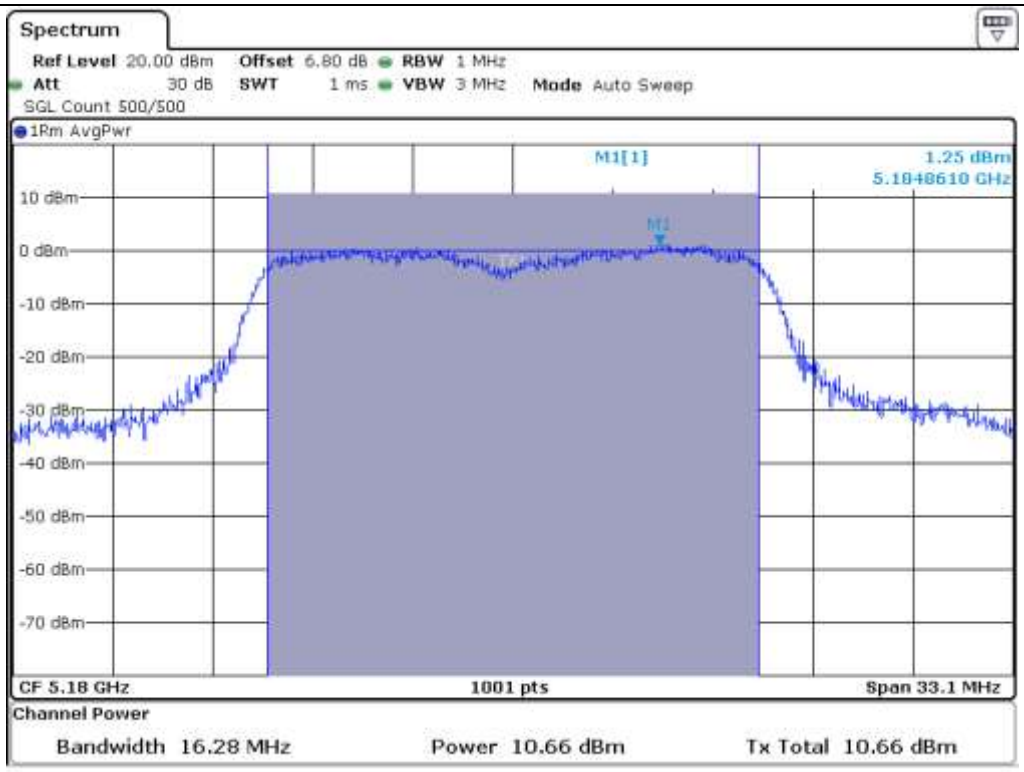
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	10.66	8.15	18.81	30.00	11.19
	Middle	5 220.00	10.62	8.15	18.77	30.00	11.23
	High	5 240.00	10.51	8.15	18.66	30.00	11.34
5 725 ~ 5 825	Low	5 745.00	10.41	8.15	18.56	29.14	10.58
	Middle	5 785.00	10.84	8.15	18.99	29.14	10.15
	High	5 825.00	11.04	8.15	19.19	29.14	9.95

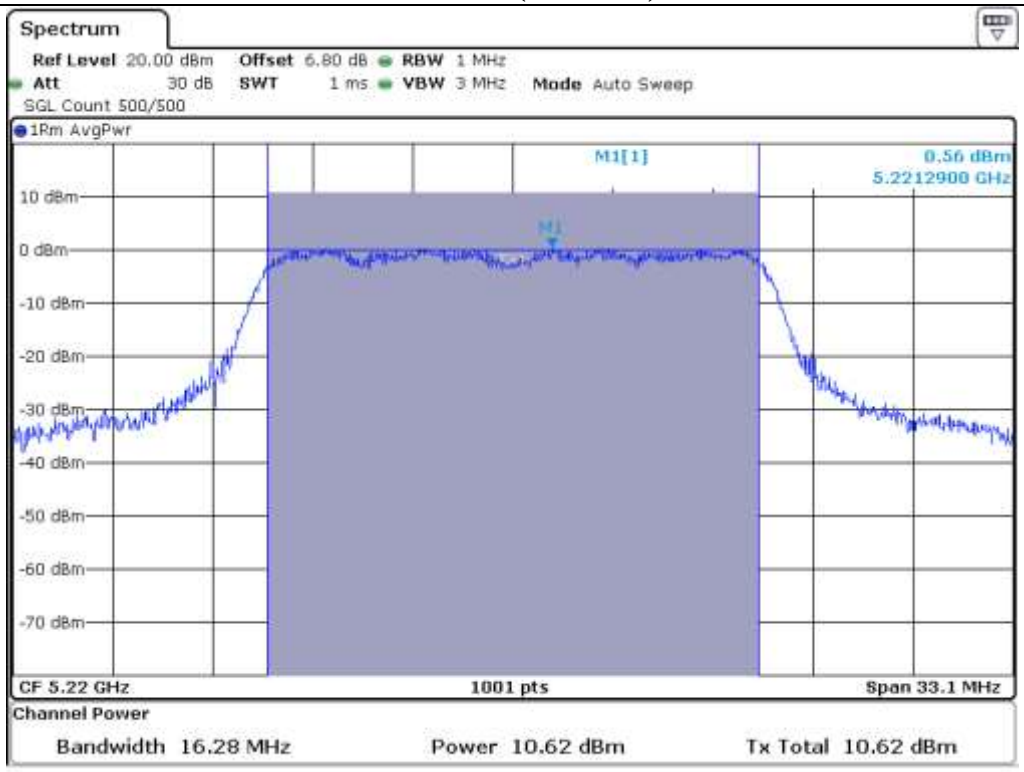
Remark : Result = Measured Value + Duty Fator

Tested by: Haram Lee / Assistant Manager

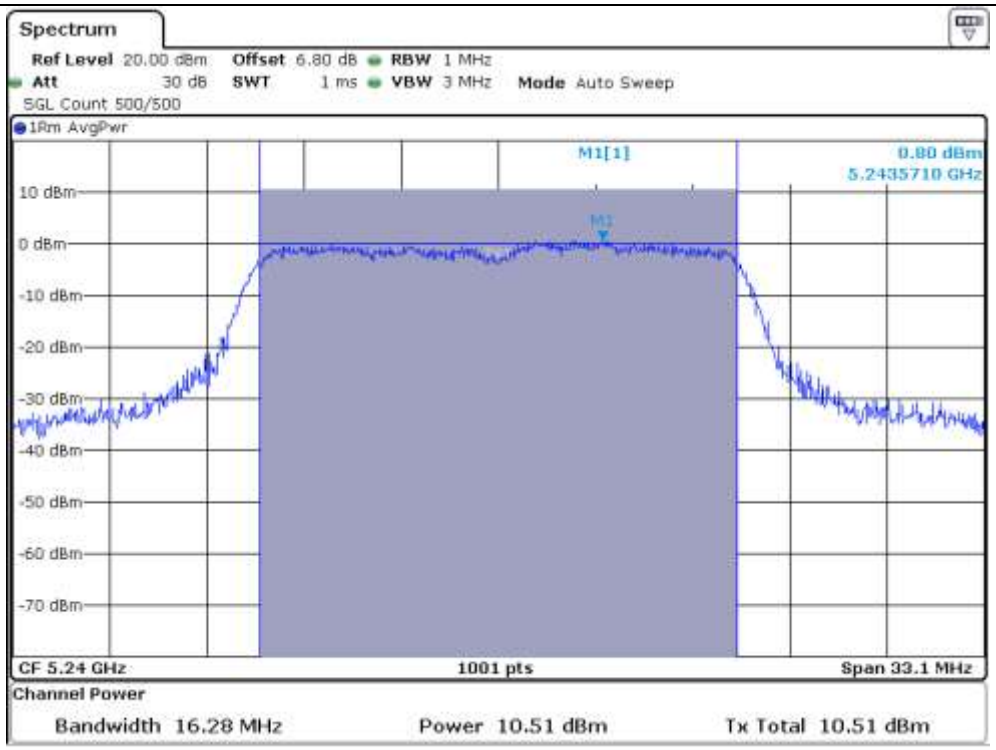
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



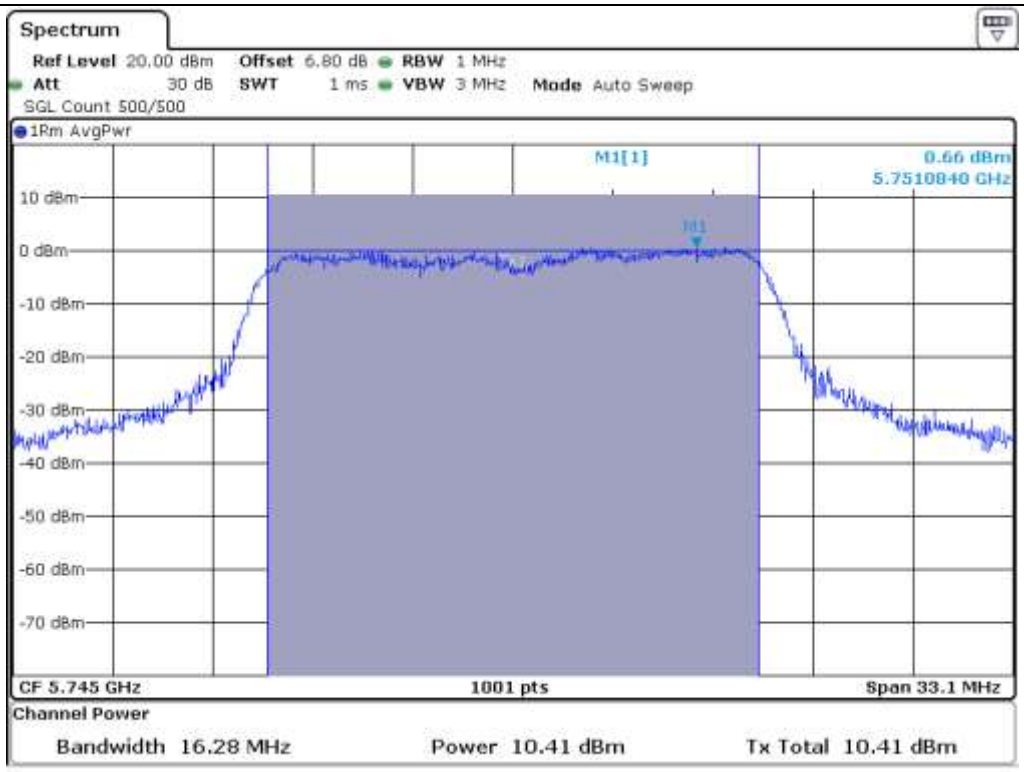
Low Channel (5 180 MHz)



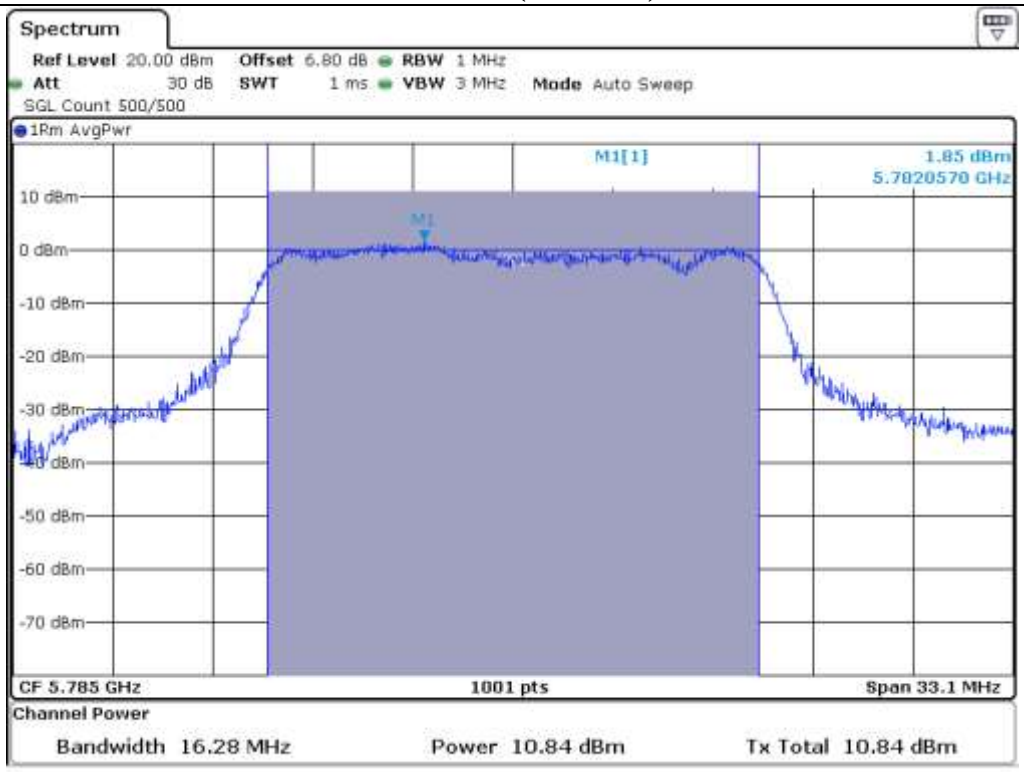
Middle Channel (5 220 MHz)



High Channel (5 240 MHz)

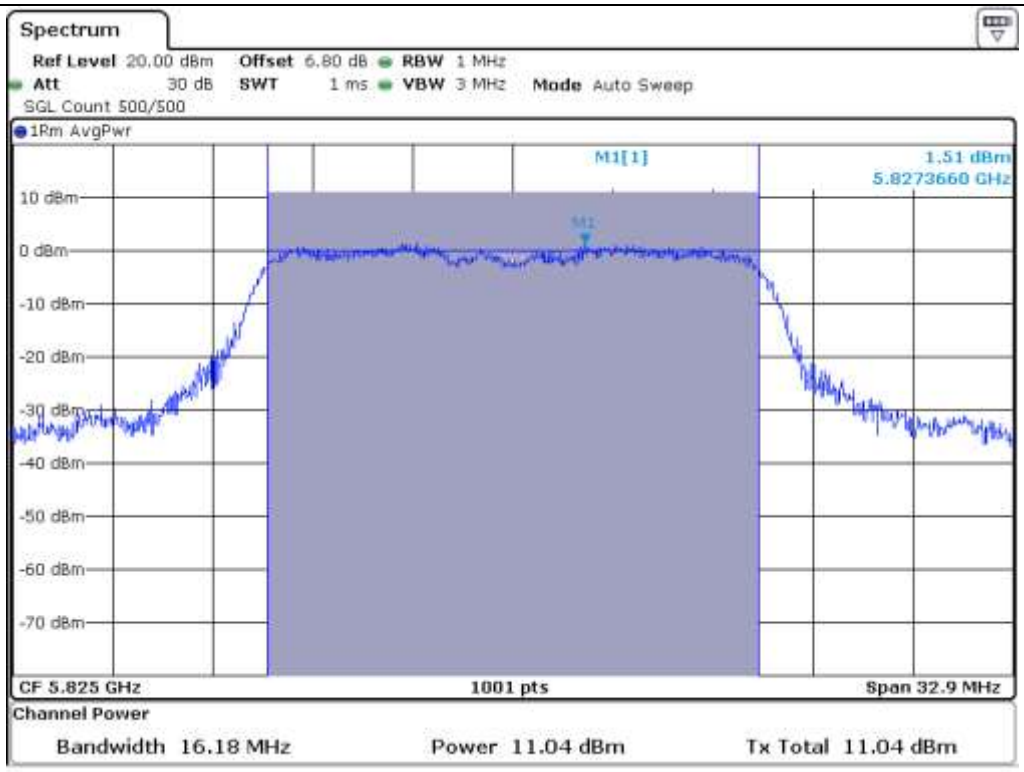


Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



High Channel (5 825 MHz)

9.5 Test data for 802.11n (HT 20) WLAN Mode (Client mode)

-. Test Date : January 23, 2020

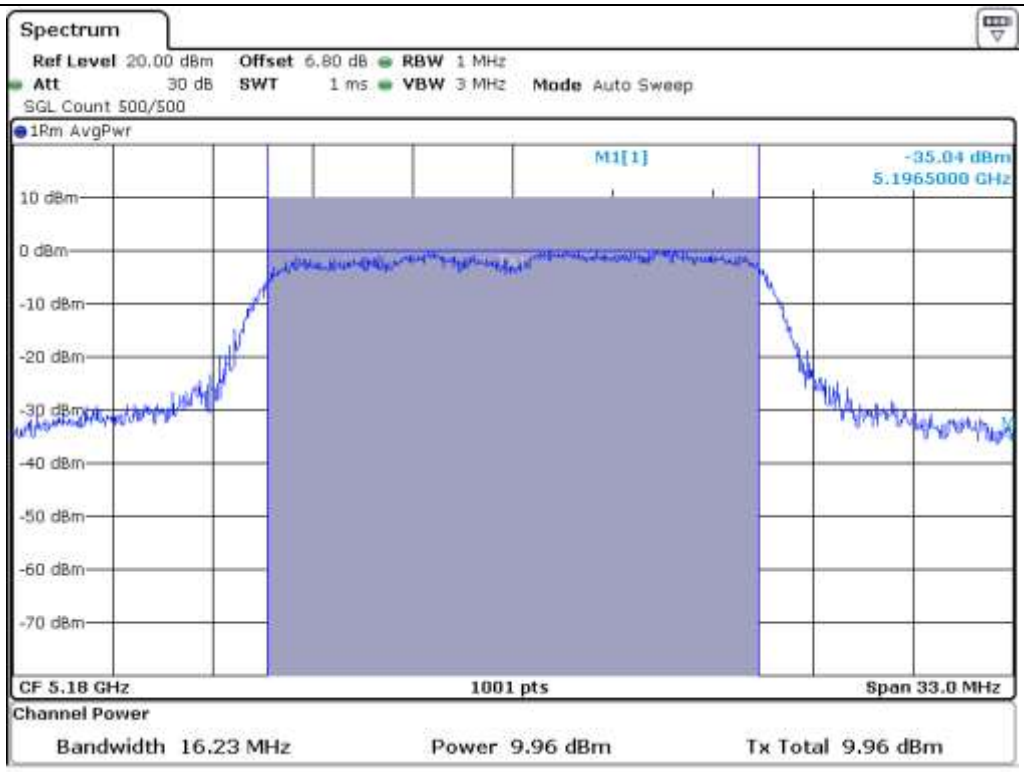
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	9.96	8.15	18.11	23.98	5.87
	Middle	5 220.00	10.38	8.15	18.53	23.98	5.45
	High	5 240.00	10.02	8.15	18.17	23.98	5.81
5 725 ~ 5 825	Low	5 745.00	9.93	8.15	18.08	29.14	11.06
	Middle	5 785.00	10.27	8.15	18.42	29.14	10.72
	High	5 825.00	10.29	8.15	18.44	29.14	10.70

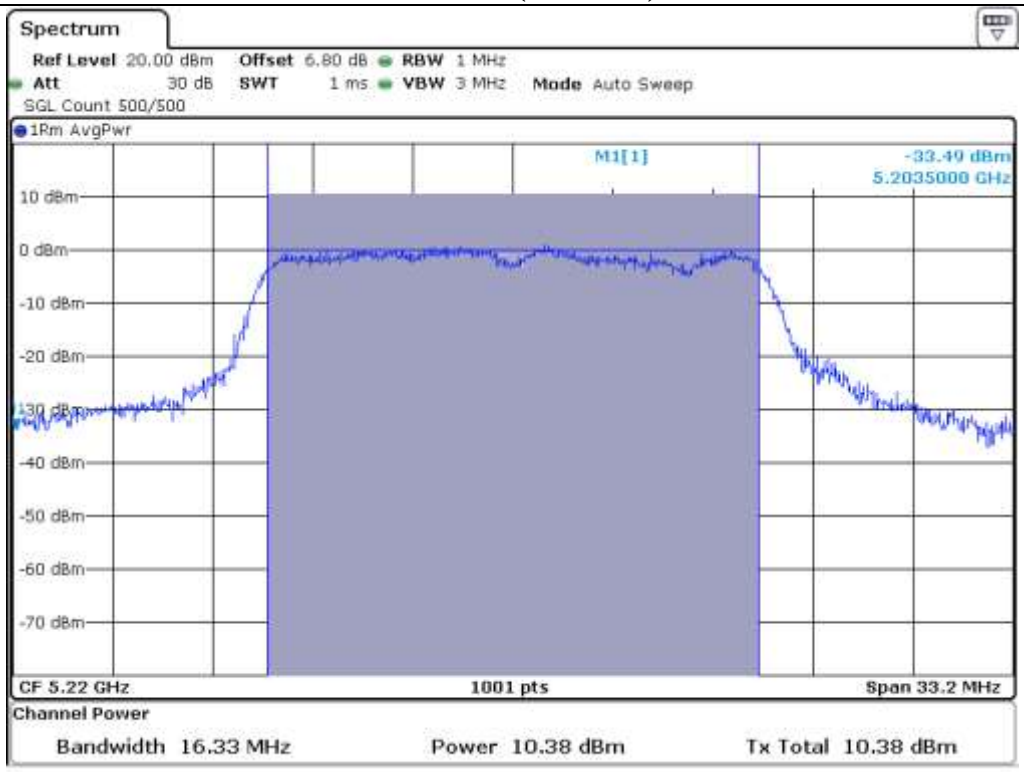
Remark : Result = Measured Value + Duty Fator

Tested by: Haram Lee / Assistant Manager

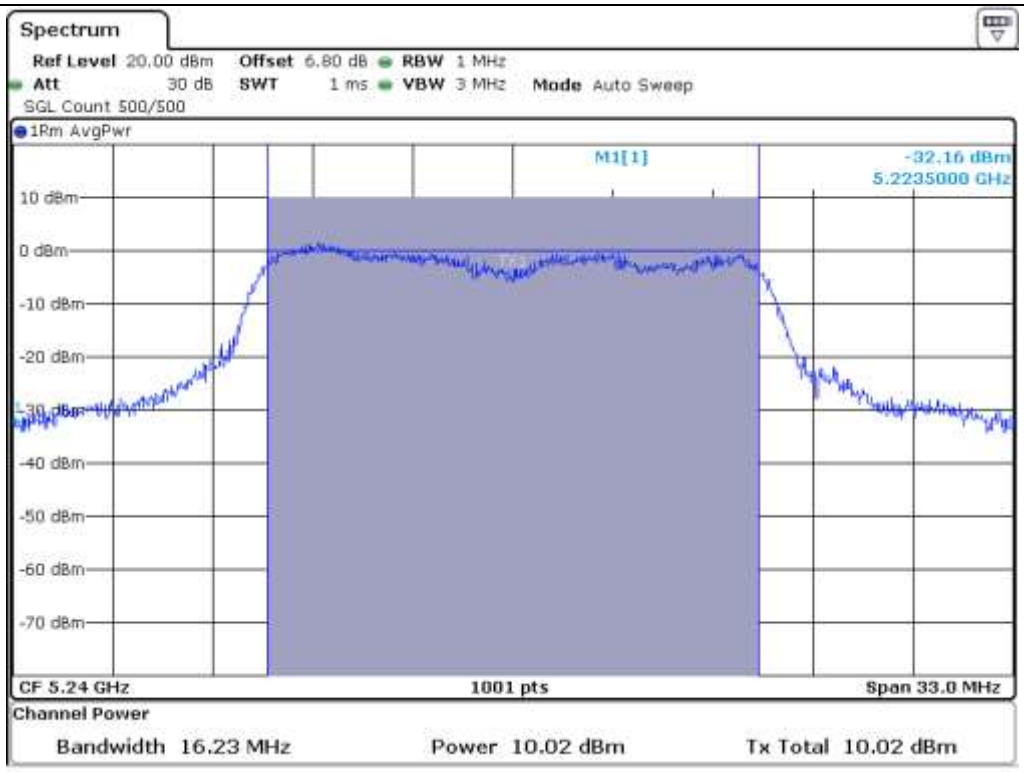
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



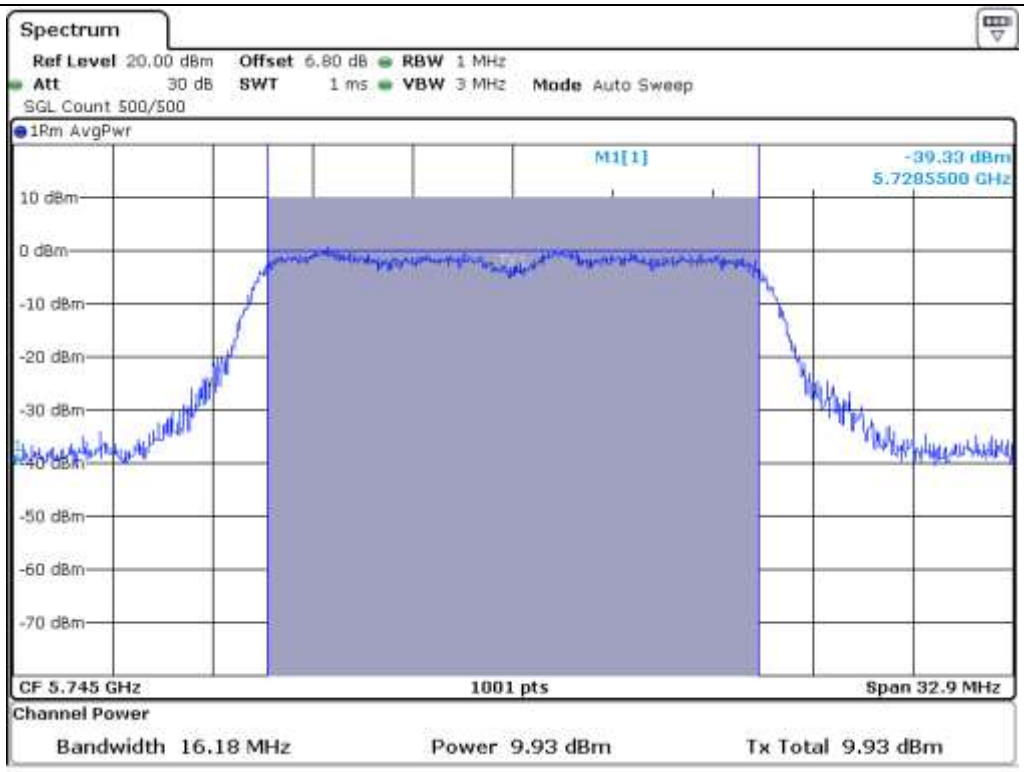
Low Channel (5 180 MHz)



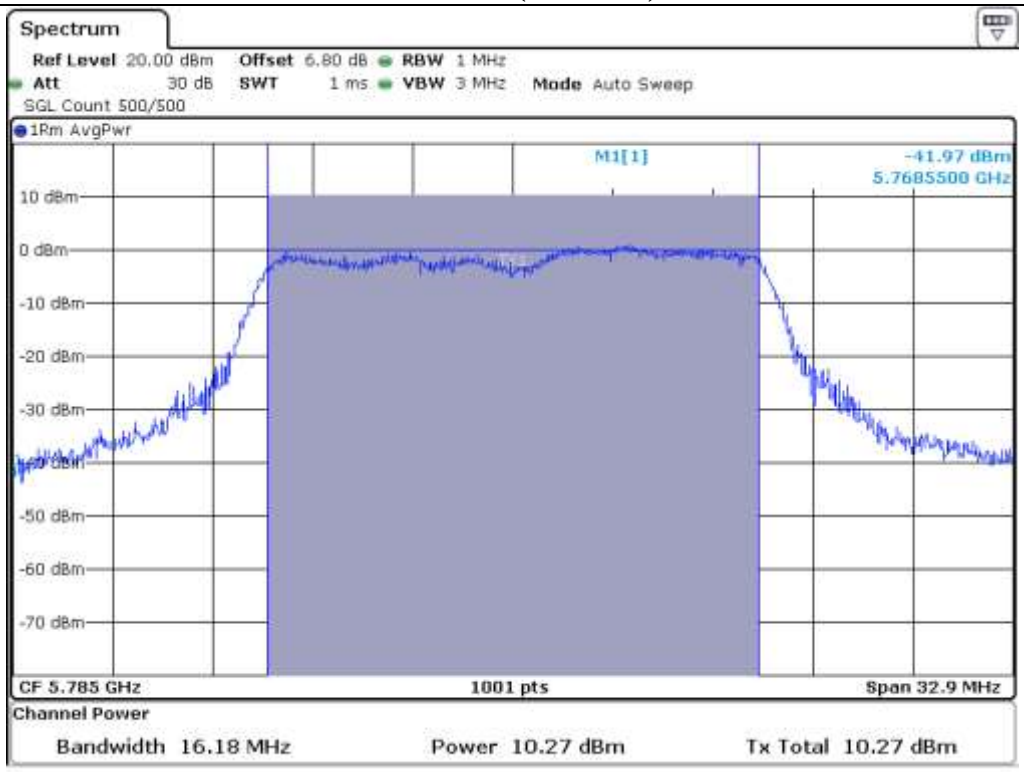
Middle Channel (5 220 MHz)



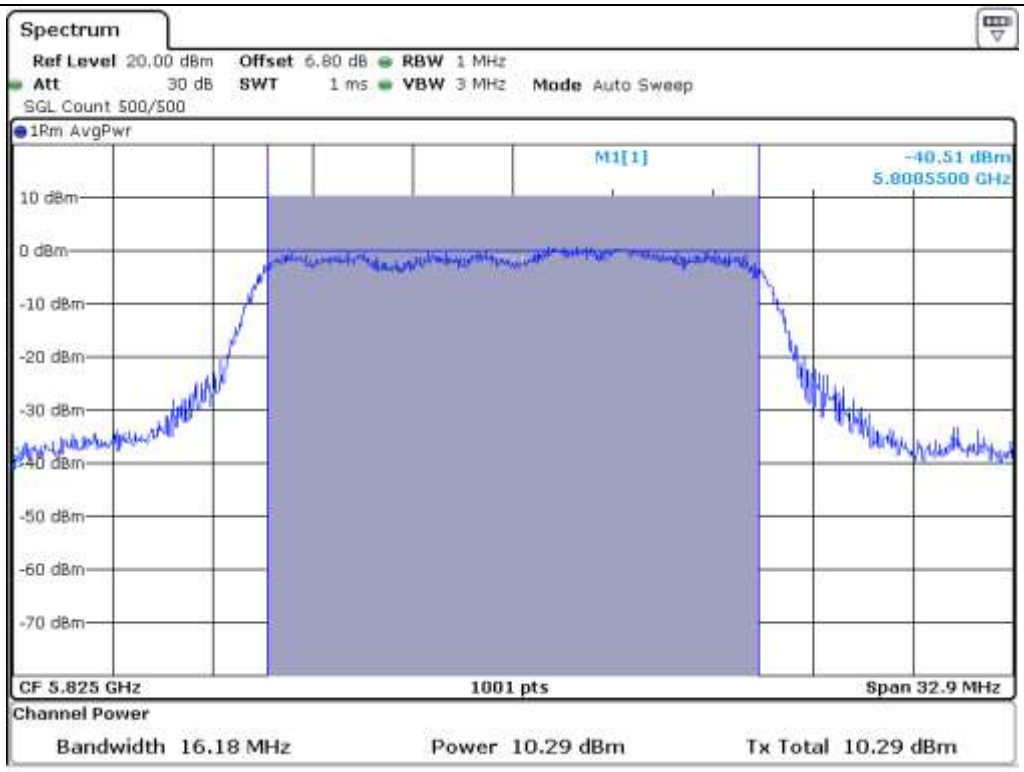
High Channel (5 240 MHz)



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



High Channel (5 825 MHz)

10. PEAK POWER SPECTRAL DENSITY

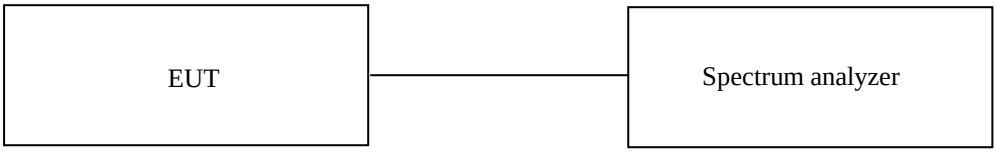
10.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 times the resolution bandwidth. The maximum level form the EUT in 1 MHz bandwidth was measured with above condition.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

10.4 Test data for 802.11n_HT20 WLAN Mode (Master mode)

-. Test Date : June 24, 2019 ~ June 25, 2019

-. Operating condition : Highest Output Power Transmitting Mode

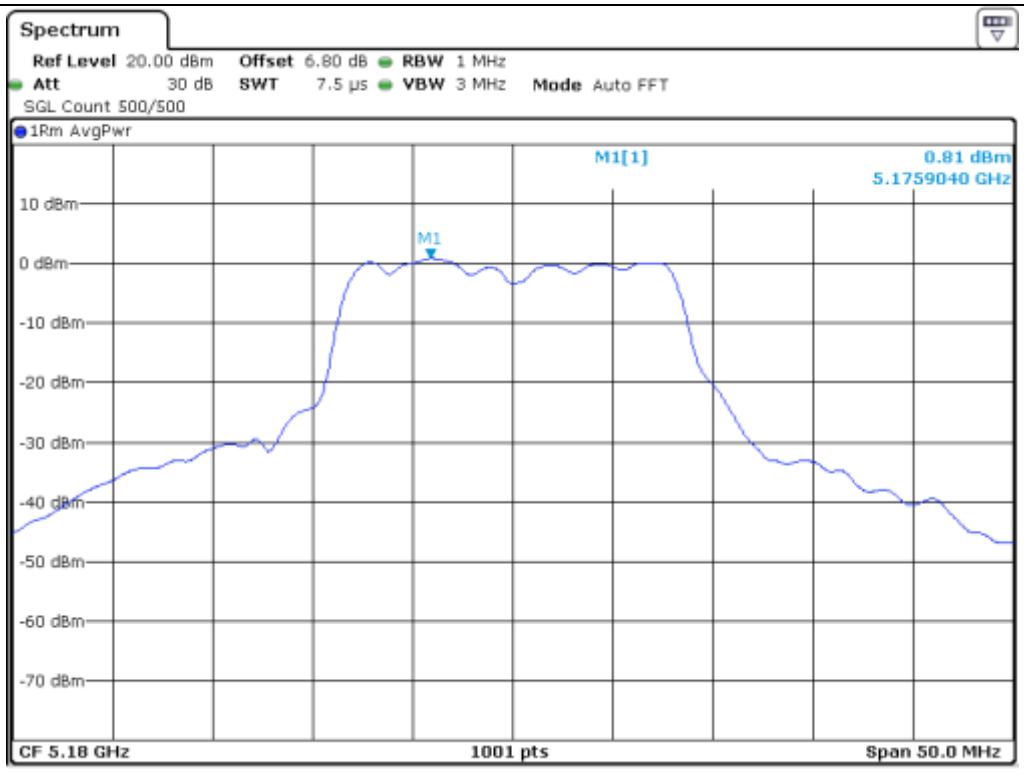
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	0.81	8.15	8.96	17.00	8.04
	Middle	5 220.00	-0.09	8.15	8.06	17.00	8.94
	High	5 240.00	-0.22	8.15	7.93	17.00	9.07
5 725 ~ 5 825	Low	5 745.00	-3.39	8.15	4.76	29.14	24.38
	Middle	5 785.00	-2.10	8.15	6.05	29.14	23.09
	High	5 825.00	-2.54	8.15	5.61	29.14	23.53

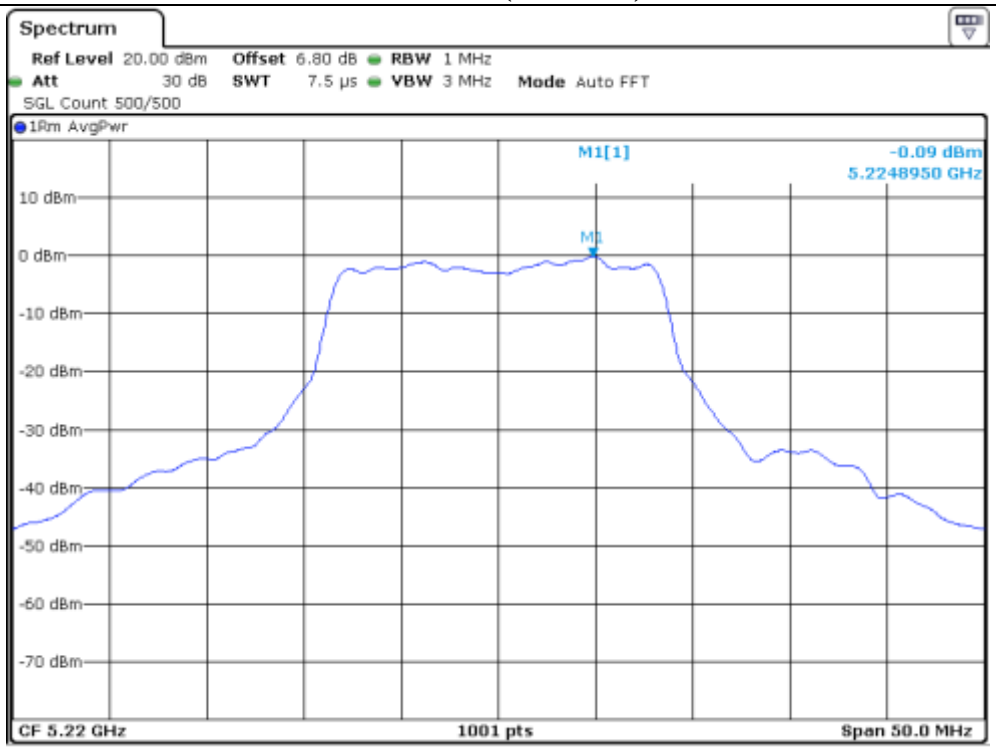
Remark: See next page for measurement data.

Tested by: Haram Lee / Assistant Manager

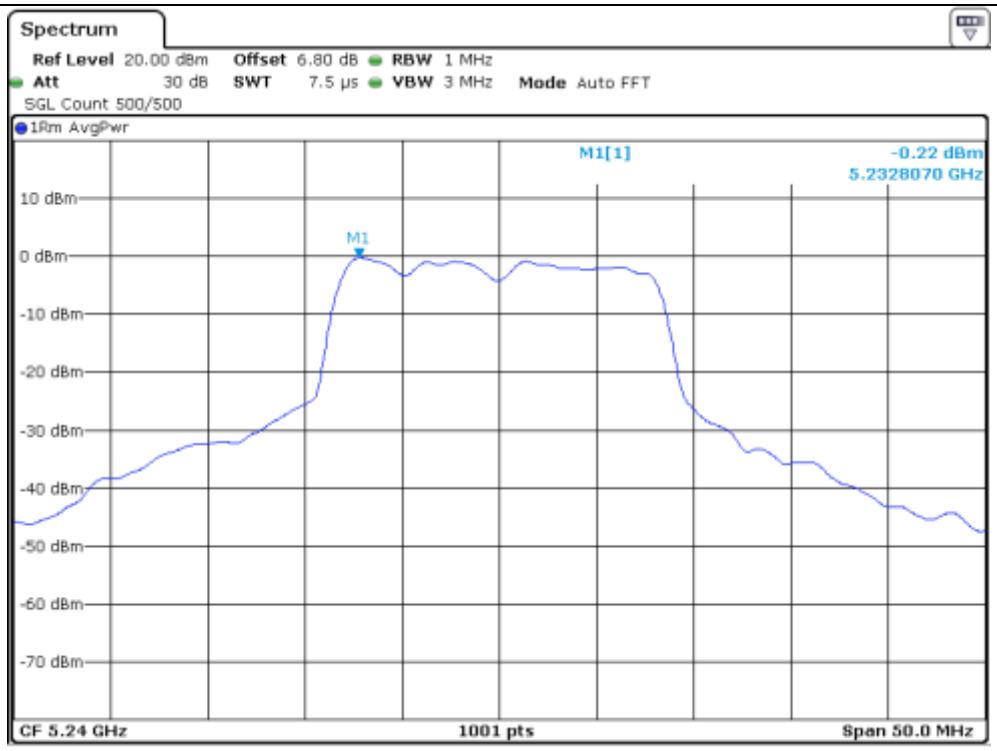
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



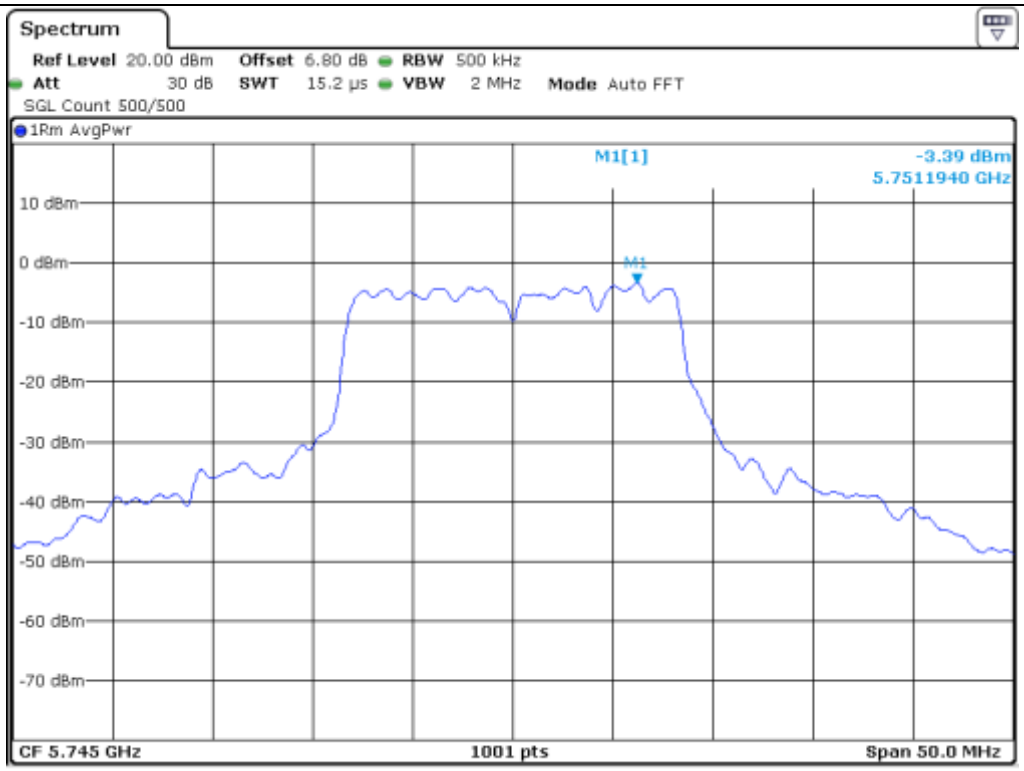
Low Channel (5 180 MHz)



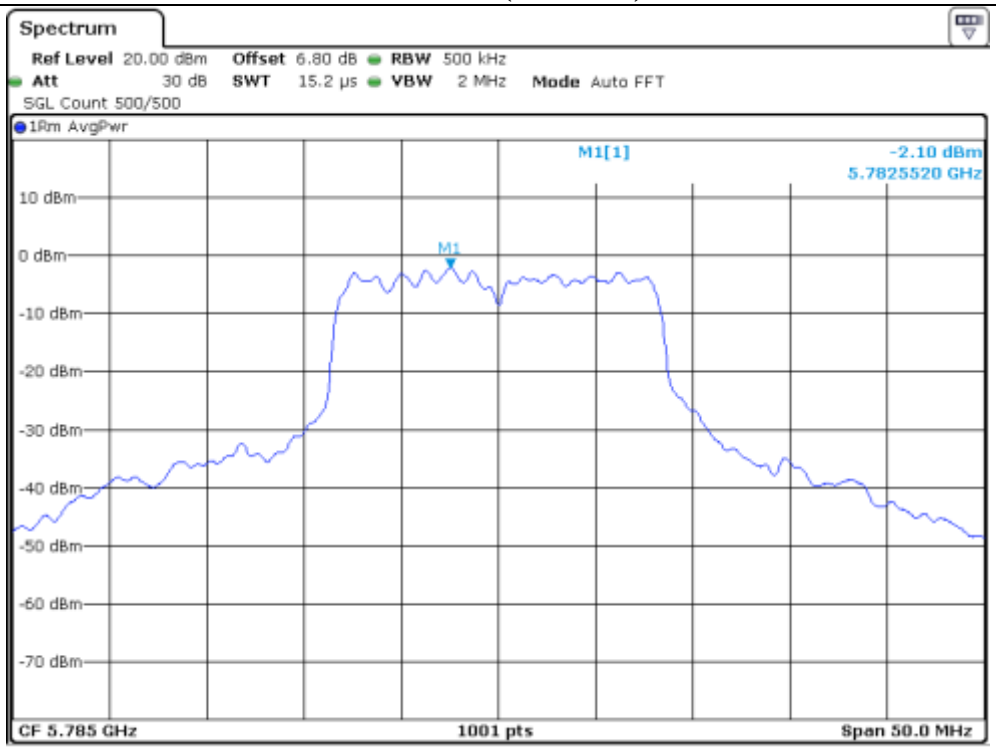
Middle Channel (5 220 MHz)



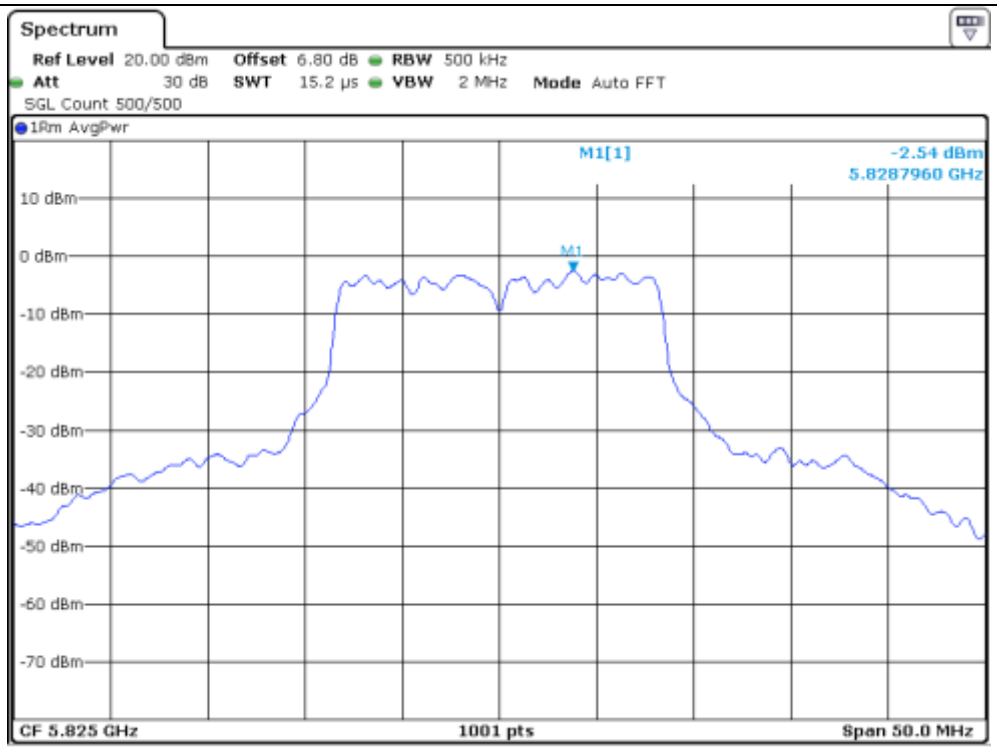
High Channel (5 240 MHz)



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



High Channel (5 825 MHz)

10.5 Test data for 802.11n_HT20 WLAN Mode (Client mode)

-. Test Date : January 23, 2020

-. Operating condition : Highest Output Power Transmitting Mode

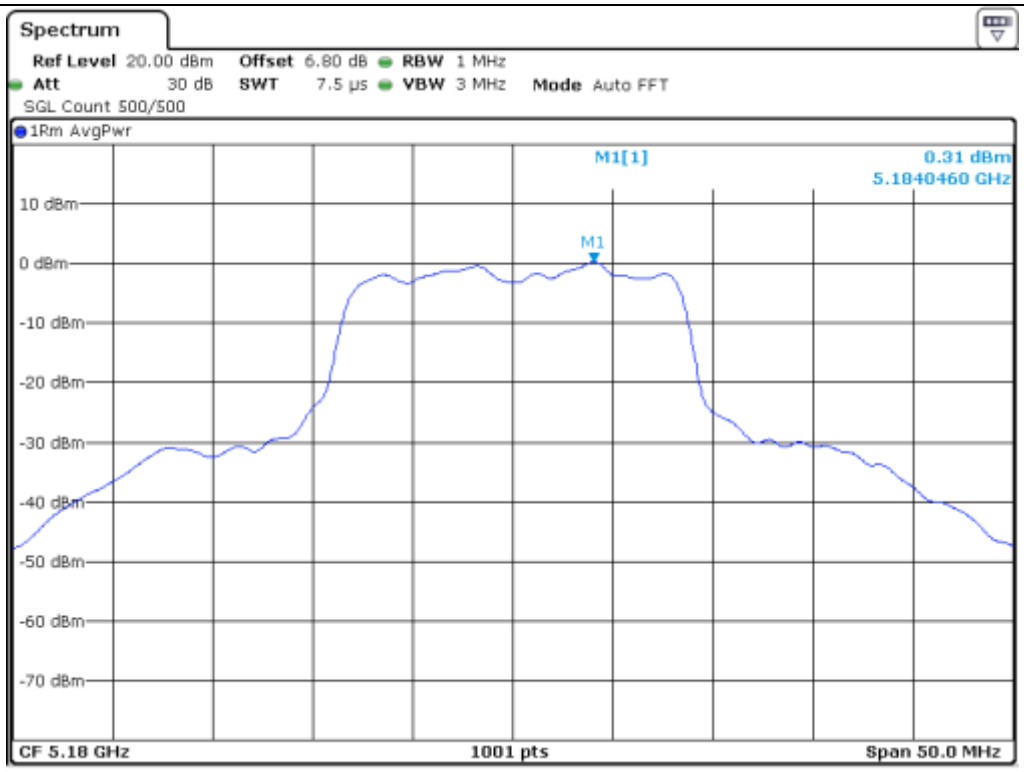
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	0.31	8.15	8.46	11.00	2.54
	Middle	5 220.00	-0.82	8.15	7.33	11.00	3.67
	High	5 240.00	-0.61	8.15	7.54	11.00	3.46
5 725 ~ 5 825	Low	5 745.00	-3.59	8.15	4.56	29.14	24.58
	Middle	5 785.00	-2.41	8.15	5.74	29.14	23.40
	High	5 825.00	-2.80	8.15	5.35	29.14	23.79

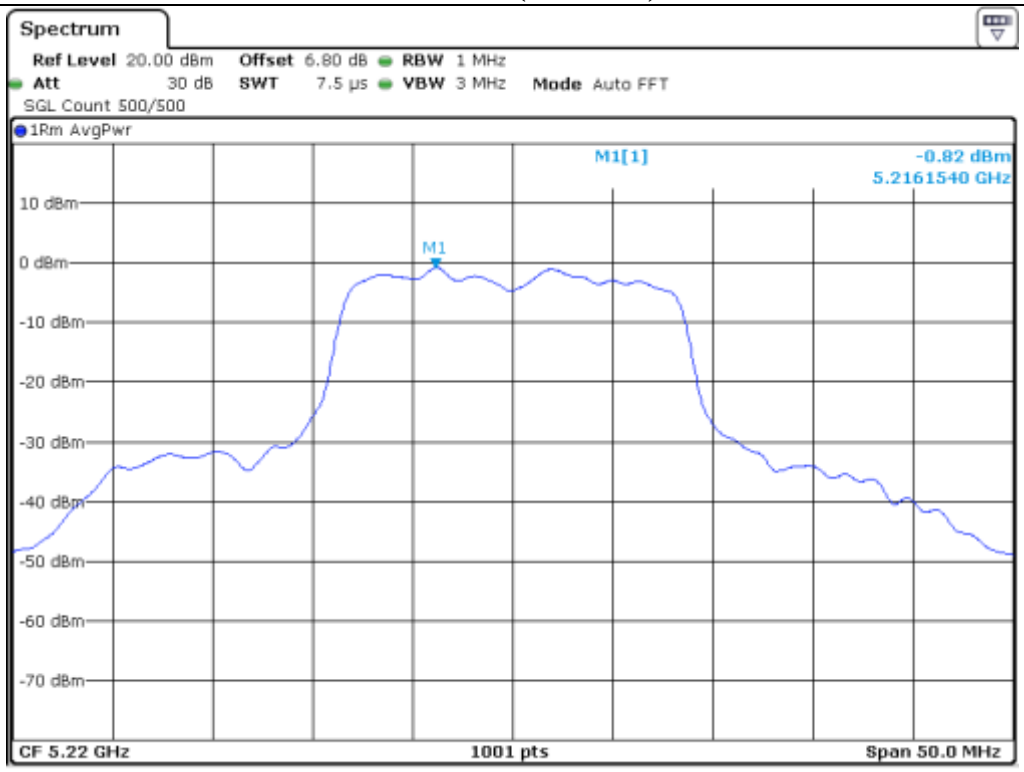
Remark: See next page for measurement data.

Tested by: Haram Lee / Assistant Manager

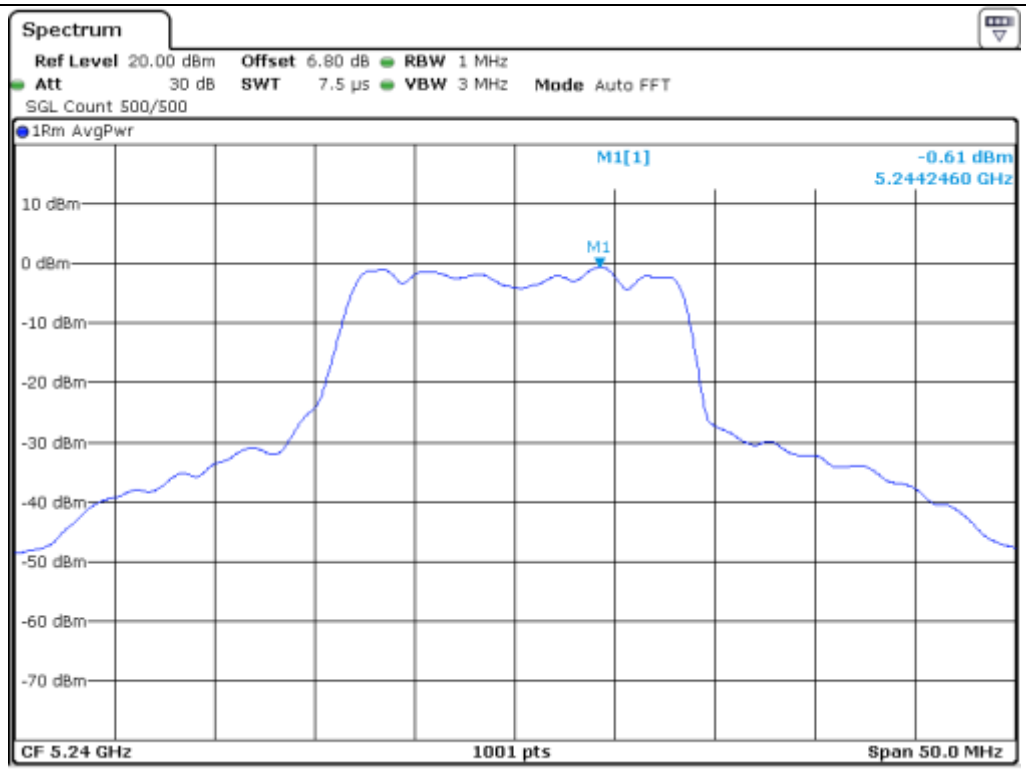
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



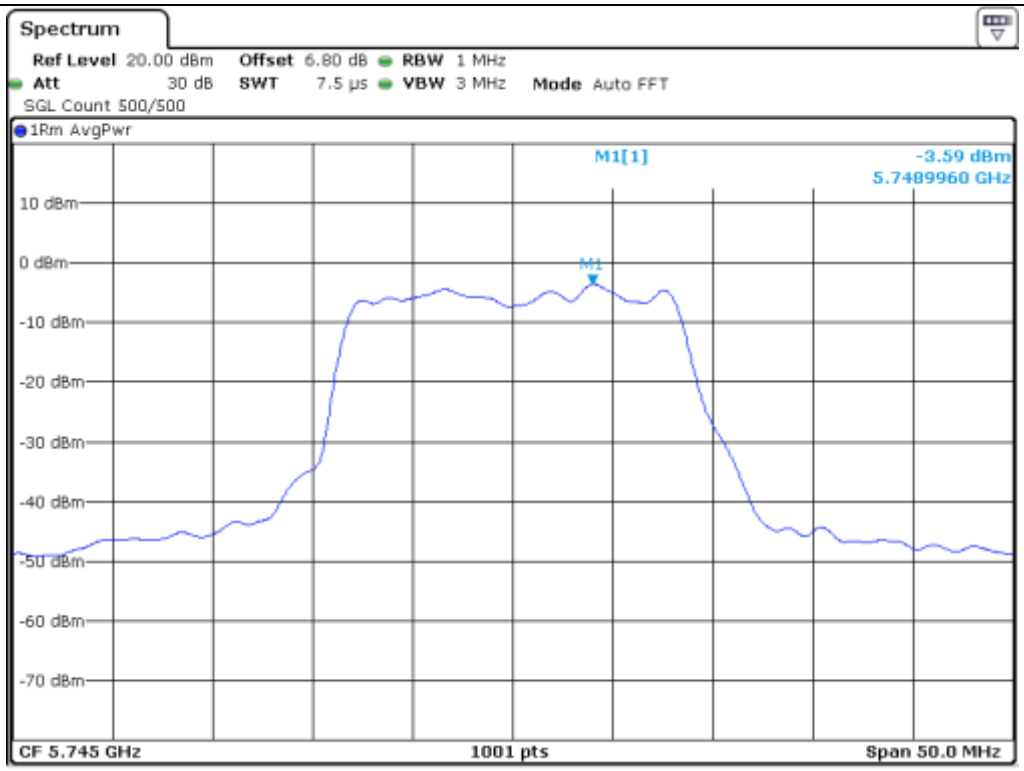
Low Channel (5 180 MHz)



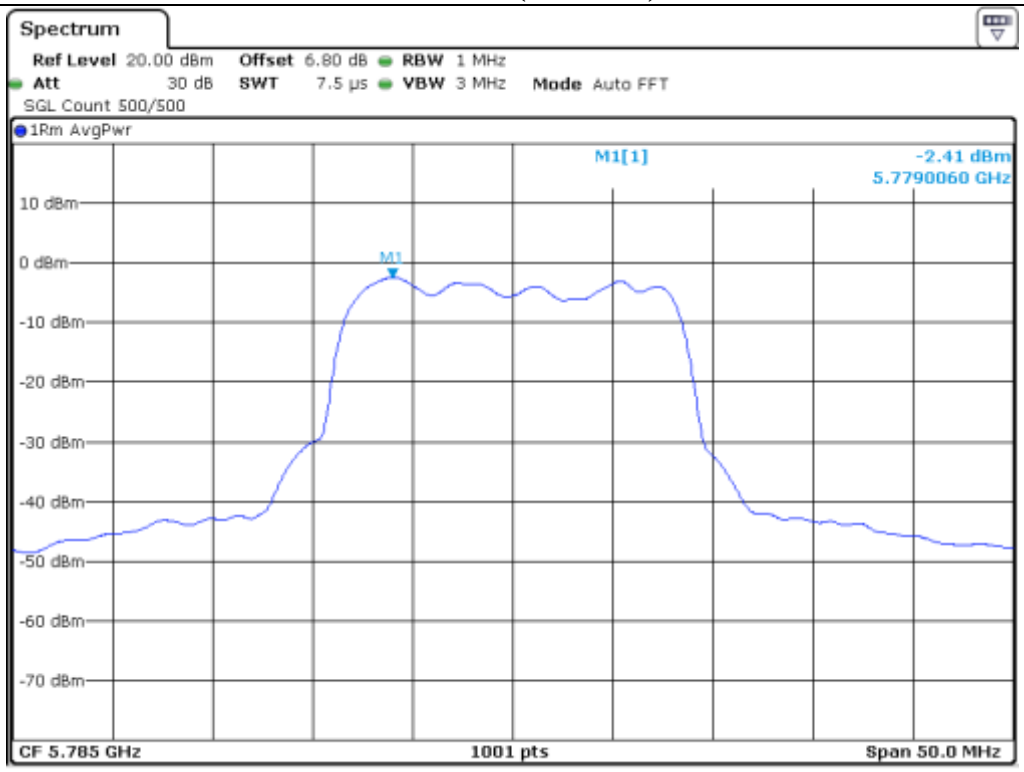
Middle Channel (5 220 MHz)



High Channel (5 240 MHz)

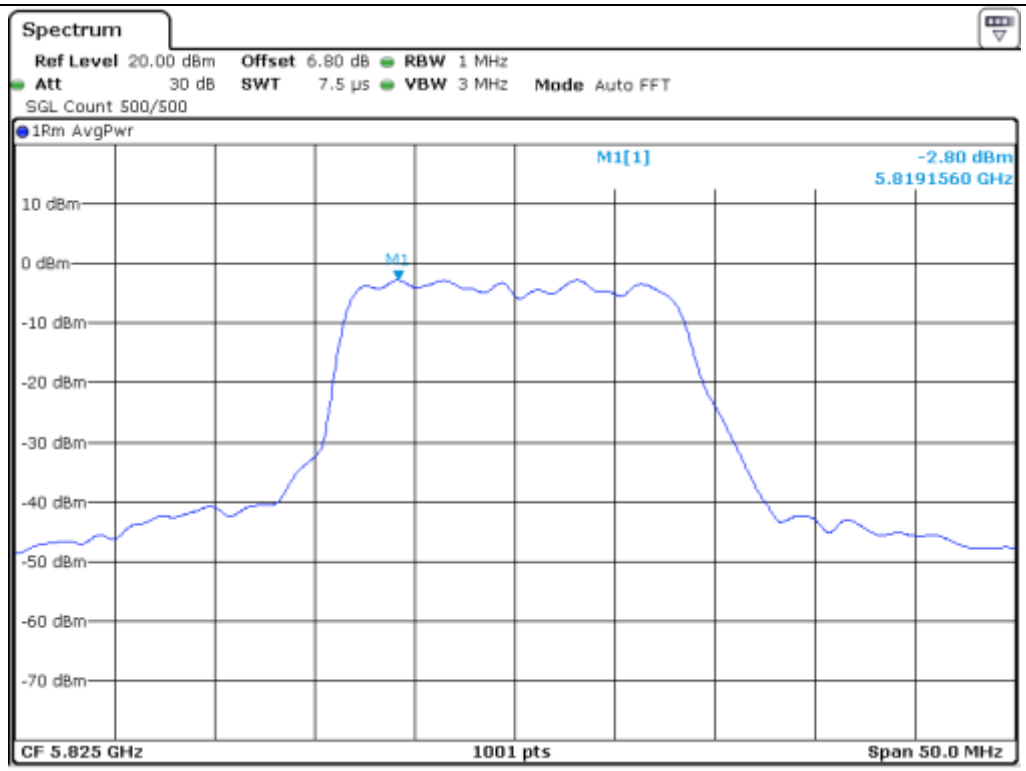


Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



High Channel (5 825 MHz)

11. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

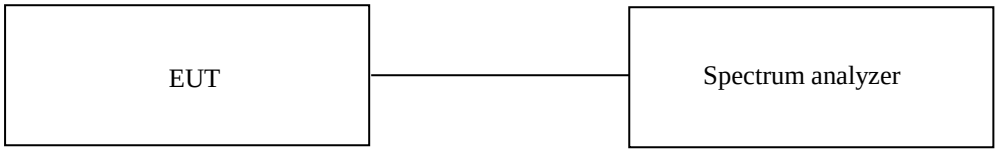
11.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

11.2 Test set-up

Turn EUT off and set chamber temperature to -20 ℃ and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 ℃ step from -20 ℃ to +50 ℃. Repeat above method for frequency measurements every 10 ℃ step and then record all measured frequencies on each temperature step.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)
■ -	PSL-2KP	ESPEC	Humidity Chamber	14009407	Feb. 22, 2019 (1Y)
■ -	H-3005D	FinePower	DC Power supply	FP09092008	Mar. 13, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

11.4 Test Data

-. Test Date : June 24, 2019 ~ June 25, 2019

-. Result : Pass

Temperature (˚C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
-20	5 180 000 000	5 179 984 642	-15.358
-10		5 179 984 533	-15.467
0		5 179 984 351	-15.649
10		5 179 984 168	-15.832
20		5 179 984 125	-15.875
30		5 179 983 995	-16.005
40		5 179 983 864	-16.136
50		5 179 983 766	-16.234
-20	5 220 000 000	5 219 984 659	-15.341
-10		5 219 984 518	-15.482
0		5 219 984 334	-15.666
10		5 219 984 204	-15.796
20		5 219 984 094	-15.906
30		5 219 983 978	-16.022
40		5 219 983 835	-16.165
50		5 219 983 747	-16.253
-20	5 240 000 000	5 239 984 488	-15.512
-10		5 239 984 468	-15.532
0		5 239 984 315	-15.685
10		5 239 984 188	-15.812
20		5 239 984 135	-15.865
30		5 239 984 037	-15.963
40		5 239 983 918	-16.082
50		5 239 983 857	-16.143
-10		5 699 984 315	-15.685
0		5 699 984 084	-15.916
10		5 699 983 925	-16.075
20		5 699 983 875	-16.125
30		5 699 983 729	-16.271
40		5 699 983 668	-16.332
50		5 699 983 643	-16.357

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Temperature (˚C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
-20	5 745 000 000	5 744 984 189	-15.811
-10		5 744 984 054	-15.946
0		5 744 983 877	-16.123
10		5 744 983 760	-16.240
20		5 744 983 665	-16.335
30		5 744 983 572	-16.428
40		5 744 983 482	-16.518
50		5 744 983 394	-16.606
-20	5 785 000 000	5 784 984 214	-15.786
-10		5 784 984 098	-15.902
0		5 784 983 884	-16.116
10		5 784 983 767	-16.233
20		5 784 983 692	-16.308
30		5 784 983 585	-16.415
40		5 784 983 497	-16.503
50		5 784 983 413	-16.587
-20	5 825 000 000	5 824 984 077	-15.923
-10		5 824 983 914	-16.086
0		5 824 983 843	-16.157
10		5 824 983 731	-16.269
20		5 824 983 658	-16.342
30		5 824 983 548	-16.452
40		5 824 983 413	-16.587
50		5 824 983 368	-16.632

Note : While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.(ANSI C63.10-2013)

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

12. FREQUENCY STABILITY WITH VOLTAGE VARIATION

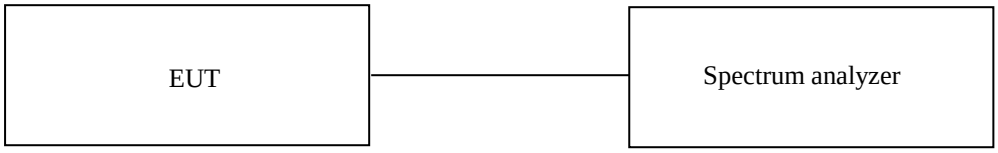
12.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

12.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)
■ -	H-3005D	FinePower	DC Power supply	FP09092008	Mar. 13, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

12.4 Test Data

-. Test Date : June 24, 2019 ~ June 25, 2019

-. Result : Pass

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
3.795	5 180 000 000	5 179 983 877	-16.123
3.300		5 179 984 135	-15.865
2.805		5 179 984 473	-15.527
3.795	5 220 000 000	5 219 983 892	-16.108
3.300		5 219 984 119	-15.881
2.805		5 219 984 365	-15.635
3.795	5 240 000 000	5 239 983 913	-16.087
3.300		5 239 984 153	-15.847
2.805		5 239 984 287	-15.713

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
3.795	5 745 000 000	5 744 983 932	-16.068
3.300		5 744 984 143	-15.857
2.805		5 744 984 467	-15.533
3.795	5 785 000 000	5 784 983 896	-16.104
3.300		5 784 984 125	-15.875
2.805		5 784 984 389	-15.611
3.795	5 825 000 000	5 824 983 953	-16.047
3.300		5 824 984 168	-15.832
2.805		5 824 984 311	-15.689

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13. RADIATED SPURIOUS EMISSIONS

13.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 22, 2019 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2019 (1Y)
☐ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Jul. 25, 2019 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)
■ -	FSW43	Rohde & Schwarz	Signal Analyzer	104544	Jul. 18, 2019 (1Y)
☐ -	BBV 9718 B	Schwarzbeck	Pre-Amplifier	009	Mar. 20, 2019 (1Y)
■ -	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
☐ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
■ -	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-419	Aug. 09, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jan. 16, 2019 (1Y)
☐ -	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.4 Test data (Ant 1 : AE-T2450/5500DP5-RSMA)

13.4.1 Test data for 30 MHz ~ 1 GHz

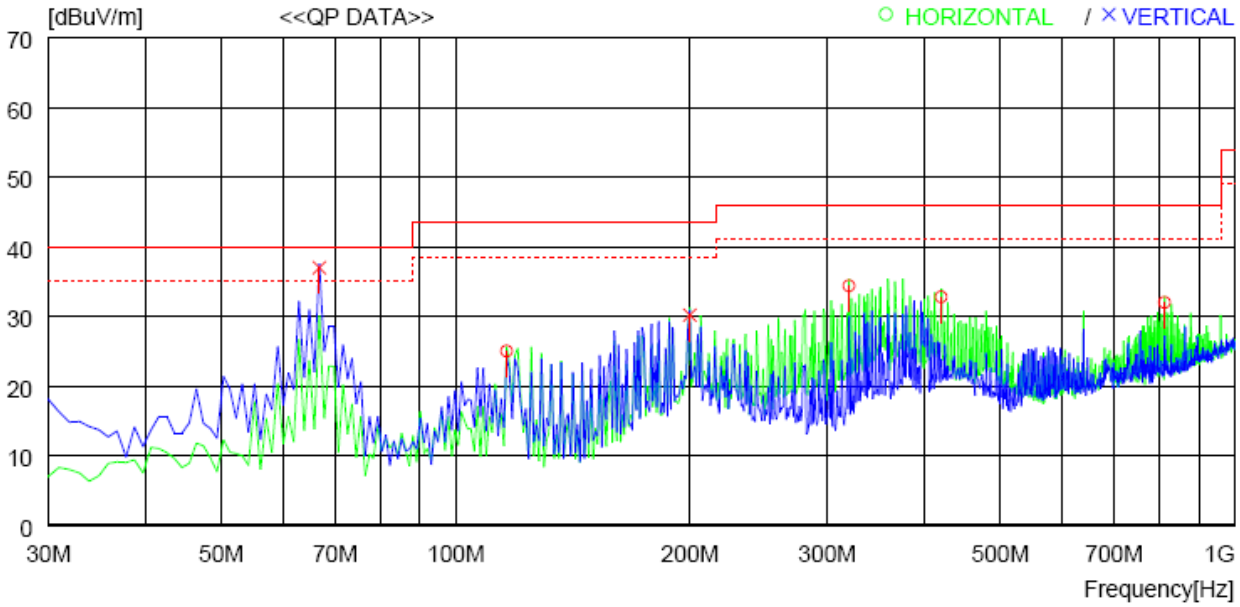
Humidity Level : 46 % R.H. Temperature: 23 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz) Date: June 23, 2019

Note : 5 GHz operating mode were tested, (802.11n (HT20) WLAN Mode) (Worst Case)



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	116.330	45.0	10.8	2.2	33.0	25.0	43.5	18.5	300	0
2	320.030	50.0	14.0	3.4	33.0	34.4	46.0	11.6	100	0
3	419.941	46.0	16.0	3.9	33.1	32.8	46.0	13.2	100	0
4	812.782	38.2	21.3	5.5	33.0	32.0	46.0	14.0	200	238
----- Vertical ------										
5	66.860	57.9	10.5	1.7	33.1	37.0	40.0	3.0	100	359
6	199.750	49.7	10.7	2.8	33.0	30.2	43.5	13.3	100	359

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.4.2 Test data for Below 30 MHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

Tested by: Haram Lee / Assistant Manager

13.4.3 Test data for 802.11n (HT 20) WLAN Mode above 1 GHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
10 360.00	15.27	Peak	H	37.66	8.60	0.00	61.53	68.20	6.67
10 360.00	15.54	Peak	V				61.80	68.20	6.40
Middle Channel									
10 440.00	14.66	Peak	H	37.84	8.63	0.00	61.13	68.20	7.07
10 440.00	14.84	Peak	V				61.31	68.20	6.89
High Channel									
10 480.00	15.55	Peak	H	38.02	8.66	0.00	62.23	68.20	5.97
10 480.00	14.92	Peak	V				61.60	68.20	6.60

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	15.09	Peak	H	38.07	8.87	0.00	62.03	74.00	11.97
11 490.00	3.40	Average	H				50.34	54.00	3.66
11 490.00	14.65	Peak	V				61.59	74.00	12.41
11 490.00	3.42	Average	V				50.36	54.00	3.64
Middle Channel									
11 570.00	15.63	Peak	H	37.78	8.80	0.00	62.21	74.00	11.79
11 570.00	3.53	Average	H				50.11	54.00	3.89
11 570.00	15.31	Peak	V				61.89	74.00	12.11
11 570.00	3.74	Average	V				50.32	54.00	3.68
High Channel									
11 650.00	15.48	Peak	H	37.49	8.71	0.00	61.68	74.00	12.32
11 650.00	3.50	Average	H				49.70	54.00	4.30
11 650.00	15.11	Peak	V				61.31	74.00	12.69
11 650.00	3.62	Average	V				49.82	54.00	4.18

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

Tested by: Haram Lee / Assistant Manager

13.5 Test data (Ant 2 : AEi-2450/5500P-IPEX35)

13.5.1 Test data for 30 MHz ~ 1 GHz

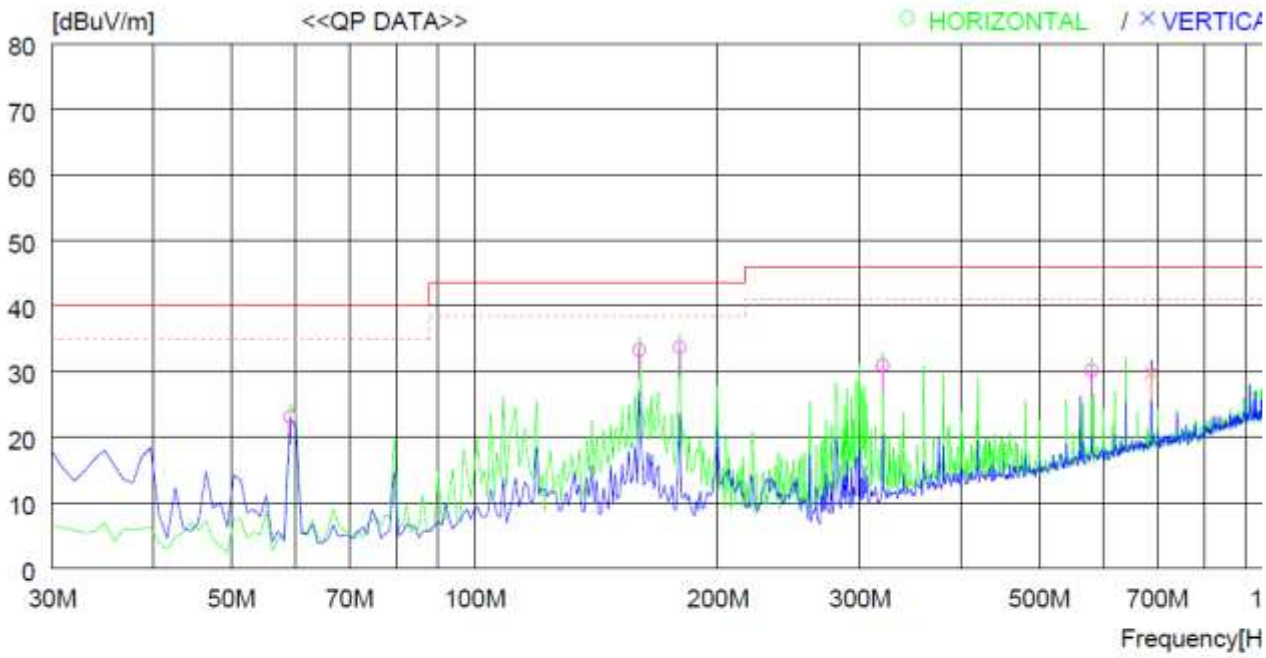
Humidity Level : 46 % R.H. Temperature: 23 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz) Date: June 23, 2019

Note : 5 GHz operating mode were tested, (802.11n (HT20) WLAN Mode) (Worst Case)



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	59.100	45.5	9.4	0.9	32.7	23.1	40.0	16.9	200	74
2	159.980	51.7	12.6	1.6	32.6	33.3	43.5	10.2	200	359
3	179.380	51.5	13.1	1.7	32.6	33.7	43.5	9.8	200	359
4	320.030	47.2	14.2	2.2	32.7	30.9	46.0	15.1	100	326
5	579.989	40.8	19.4	3.0	33.0	30.2	46.0	15.8	200	359
----- Vertical ------										
6	687.655	38.5	20.8	3.4	32.9	29.8	46.0	16.2	200	0

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.5.2 Test data for Below 30 MHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

Tested by: Haram Lee / Assistant Manager

13.5.3 Test data for 802.11n (HT 20) WLAN Mode above 1 GHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
10 360.00	16.23	Peak	H	37.66	8.60	0.00	62.49	68.20	5.71
10 360.00	15.71	Peak	V				61.97	68.20	6.23
Middle Channel									
10 440.00	16.23	Peak	H	37.84	8.63	0.00	62.70	68.20	5.50
10 440.00	15.29	Peak	V				61.76	68.20	6.44
High Channel									
10 480.00	16.36	Peak	H	38.02	8.66	0.00	63.04	68.20	5.16
10 480.00	15.30	Peak	V				61.98	68.20	6.22

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Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	15.14	Peak	H	38.07	8.87	0.00	62.08	74.00	11.92
11 490.00	3.92	Average	H				50.86	54.00	3.14
11 490.00	15.45	Peak	V				62.39	74.00	11.61
11 490.00	3.90	Average	V				50.84	54.00	3.16
Middle Channel									
11 570.00	15.68	Peak	H	37.78	8.80	0.00	62.26	74.00	11.74
11 570.00	3.50	Average	H				50.08	54.00	3.92
11 570.00	15.15	Peak	V				61.73	74.00	12.27
11 570.00	4.14	Average	V				50.72	54.00	3.28
High Channel									
11 650.00	15.37	Peak	H	37.49	8.71	0.00	61.57	74.00	12.43
11 650.00	3.91	Average	H				50.11	54.00	3.89
11 650.00	16.04	Peak	V				62.24	74.00	11.76
11 650.00	4.03	Average	V				50.23	54.00	3.77

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

Tested by: Haram Lee / Assistant Manager

13.6 Test data (Ant 3 : AEi-5500DP5-IPEX100[Bottom]])

13.6.1 Test data for 30 MHz ~ 1 GHz

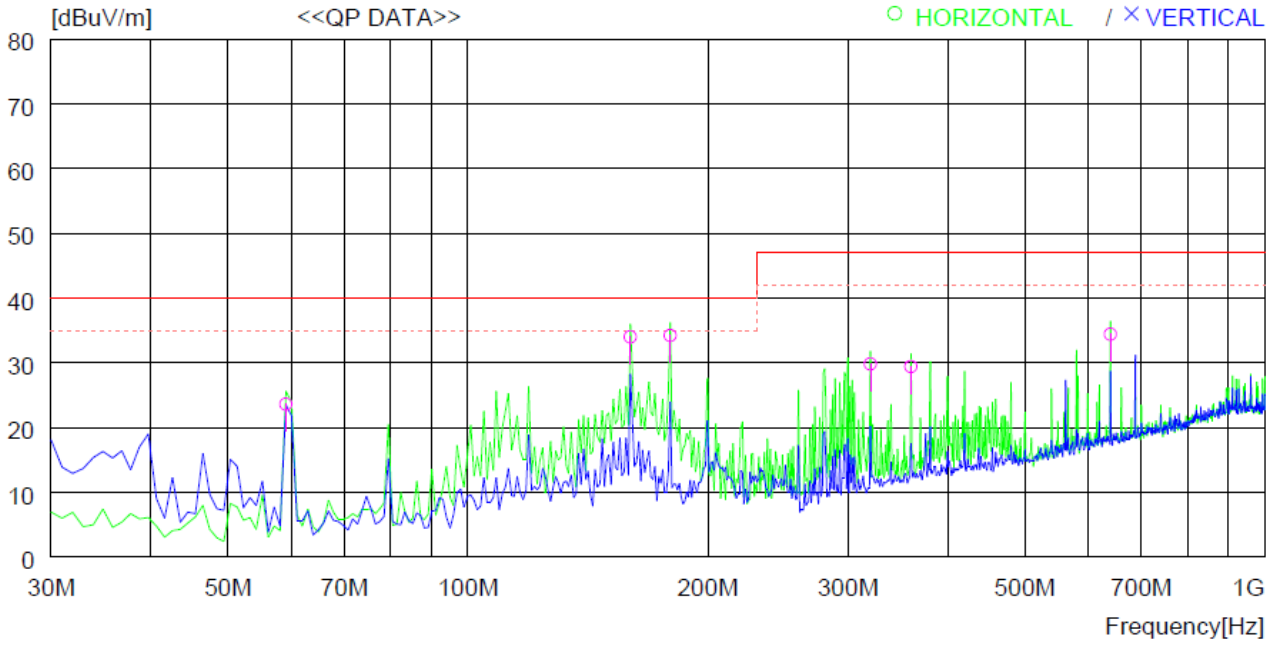
Humidity Level : 46 % R.H. Temperature: 23 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz) Date: June 23, 2019

Note : 5 GHz operating mode were tested, (802.11n (HT20) WLAN Mode) (Worst Case)



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	59.100	46.0	9.4	0.9	32.7	23.6	40.0	16.4	200	72
2	159.980	52.4	12.6	1.6	32.6	34.0	40.0	6.0	200	359
3	179.380	52.0	13.1	1.7	32.6	34.2	40.0	5.8	200	91
4	320.030	46.1	14.2	2.2	32.7	29.8	47.0	17.2	100	0
5	359.800	44.5	15.3	2.3	32.7	29.4	47.0	17.6	100	0
6	640.127	43.9	20.3	3.2	33.0	34.4	47.0	12.6	200	33

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.6.2 Test data for Below 30 MHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

Tested by: Haram Lee / Assistant Manager

13.6.3 Test data for 802.11n (HT 20) WLAN Mode above 1 GHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
10 360.00	16.09	Peak	H	37.66	8.60	0.00	62.35	68.20	5.85
10 360.00	15.28	Peak	V				61.54	68.20	6.66
Middle Channel									
10 440.00	16.42	Peak	H	37.84	8.63	0.00	62.89	68.20	5.31
10 440.00	15.13	Peak	V				61.60	68.20	6.60
High Channel									
10 480.00	15.26	Peak	H	38.02	8.66	0.00	61.94	68.20	6.26
10 480.00	15.43	Peak	V				62.11	68.20	6.09

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	16.01	Peak	H	38.07	8.87	0.00	62.95	74.00	11.05
11 490.00	3.95	Average	H				50.89	54.00	3.11
11 490.00	15.37	Peak	V				62.31	74.00	11.69
11 490.00	3.79	Average	V				50.73	54.00	3.27
Middle Channel									
11 570.00	15.43	Peak	H	37.78	8.80	0.00	62.01	74.00	11.99
11 570.00	3.84	Average	H				50.42	54.00	3.58
11 570.00	16.08	Peak	V				62.66	74.00	11.34
11 570.00	3.96	Average	V				50.54	54.00	3.46
High Channel									
11 650.00	15.89	Peak	H	37.49	8.71	0.00	62.09	74.00	11.91
11 650.00	3.93	Average	H				50.13	54.00	3.87
11 650.00	15.67	Peak	V				61.87	74.00	12.13
11 650.00	4.07	Average	V				50.27	54.00	3.73

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.7 Test data (Ant 4 : AEi-RO-5500DP4-IPEX160)

13.7.1 Test data for 30 MHz ~ 1 GHz

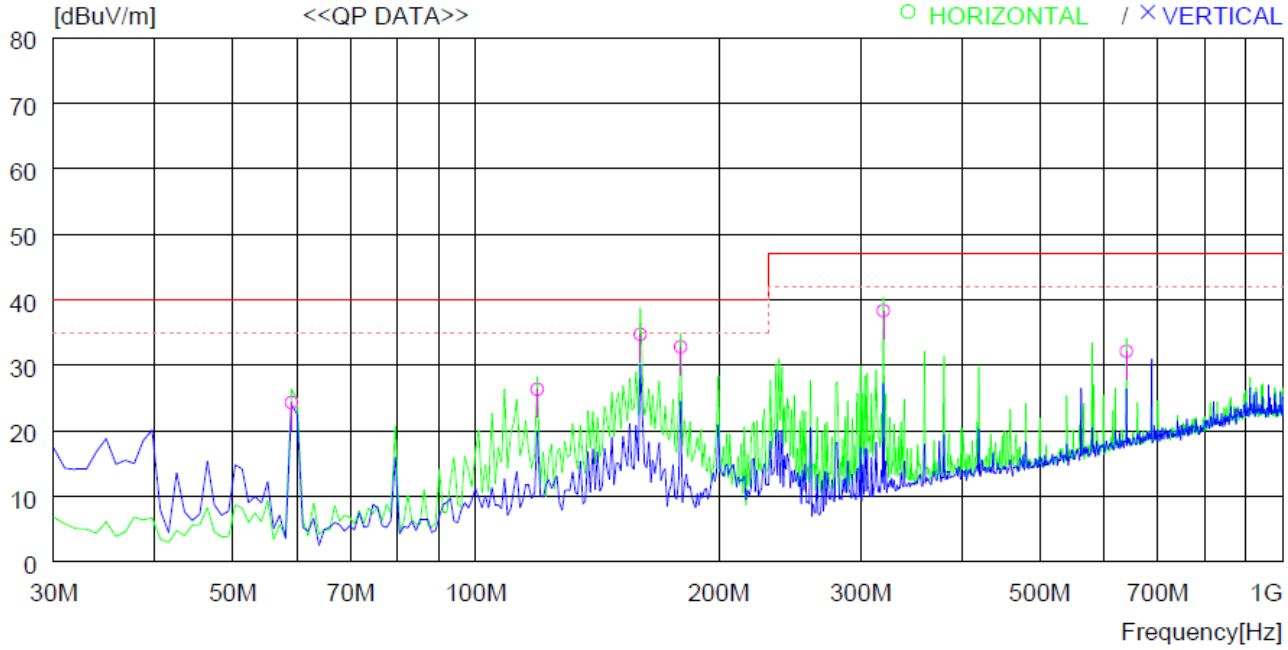
Humidity Level : 46 % R.H. Temperature: 23 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz) Date: June 23, 2019

Note : 5 GHz operating mode were tested, (802.11n (HT20) WLAN Mode) (Worst Case)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	59.100	46.7	9.4	0.9	32.7	24.3	40.0	15.7	200	88
2	119.240	46.8	10.8	1.4	32.7	26.3	40.0	13.7	200	0
3	159.980	53.1	12.6	1.6	32.6	34.7	40.0	5.3	200	359
4	179.380	50.6	13.1	1.7	32.6	32.8	40.0	7.2	200	359
5	320.030	54.6	14.2	2.2	32.7	38.3	47.0	8.7	100	0
6	640.127	41.6	20.3	3.2	33.0	32.1	47.0	14.9	200	68

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.7.2 Test data for Below 30 MHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

Tested by: Haram Lee / Assistant Manager

13.7.3 Test data for 802.11n (HT 20) WLAN Mode above 1 GHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
10 360.00	15.87	Peak	H	37.66	8.60	0.00	62.13	68.20	6.07
10 360.00	15.22	Peak	V				61.48	68.20	6.72
Middle Channel									
10 440.00	16.15	Peak	H	37.84	8.63	0.00	62.62	68.20	5.58
10 440.00	15.21	Peak	V				61.68	68.20	6.52
High Channel									
10 480.00	16.40	Peak	H	38.02	8.66	0.00	63.08	68.20	5.12
10 480.00	15.40	Peak	V				62.08	68.20	6.12

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	15.18	Peak	H	38.07	8.87	0.00	62.12	74.00	11.88
11 490.00	3.98	Average	H				50.92	54.00	3.08
11 490.00	15.81	Peak	V				62.75	74.00	11.25
11 490.00	3.48	Average	V				50.42	54.00	3.58
Middle Channel									
11 570.00	15.27	Peak	H	37.78	8.80	0.00	61.85	74.00	12.15
11 570.00	4.00	Average	H				50.58	54.00	3.42
11 570.00	15.06	Peak	V				61.64	74.00	12.36
11 570.00	3.69	Average	V				50.27	54.00	3.73
High Channel									
11 650.00	15.52	Peak	H	37.49	8.71	0.00	61.72	74.00	12.28
11 650.00	3.78	Average	H				49.98	54.00	4.02
11 650.00	15.40	Peak	V				61.60	74.00	12.40
11 650.00	4.23	Average	V				50.43	54.00	3.57

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

Tested by: Haram Lee / Assistant Manager

13.8 Test data (Ant 5 : AEi-RO-5500DP4-IPEX250)

13.8.1 Test data for 30 MHz ~ 1 GHz

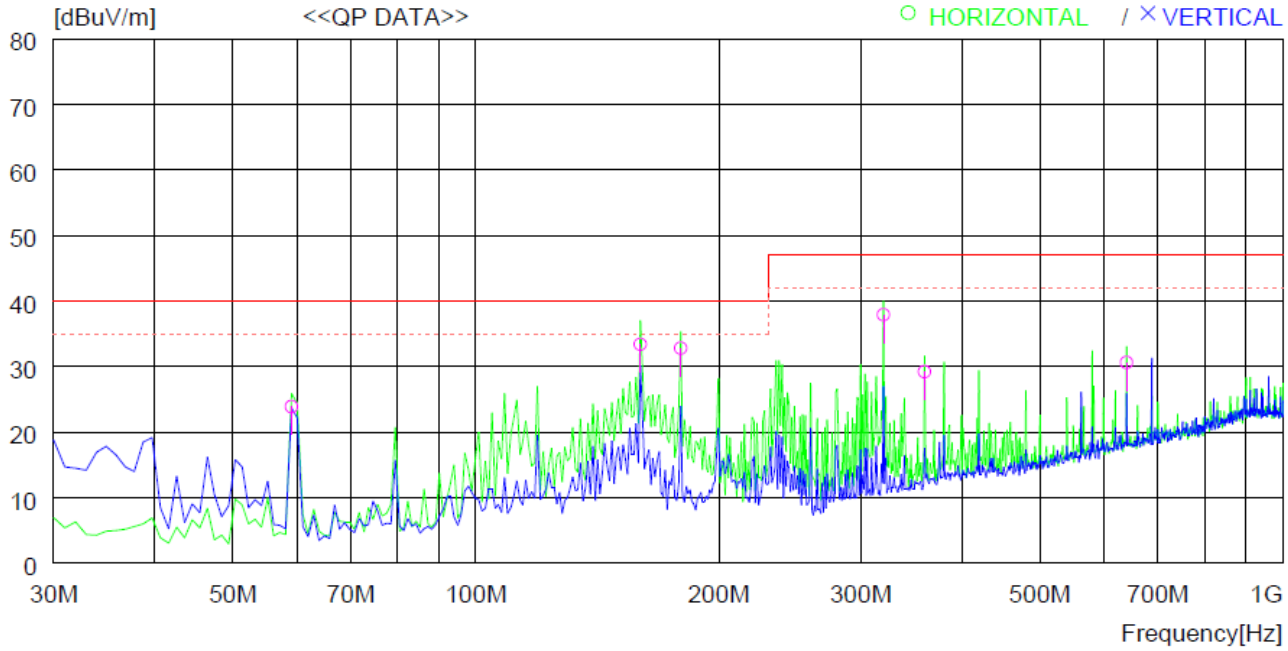
Humidity Level : 46 % R.H. Temperature: 23 ℃

Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz) Date: June 23, 2019

Note : 5 GHz operating mode were tested, (802.11n (HT20) WLAN Mode) (Worst Case)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	59.100	46.3	9.4	0.9	32.7	23.9	40.0	16.1	200	359
2	159.980	51.8	12.6	1.6	32.6	33.4	40.0	6.6	200	92
3	179.380	50.6	13.1	1.7	32.6	32.8	40.0	7.2	200	359
4	320.030	54.2	14.2	2.2	32.7	37.9	47.0	9.1	100	0
5	359.800	44.3	15.3	2.3	32.7	29.2	47.0	17.8	100	0
6	640.127	40.1	20.3	3.2	33.0	30.6	47.0	16.4	200	35

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

13.8.2 Test data for Below 30 MHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									

Tested by: Haram Lee / Assistant Manager

13.8.3 Test data for 802.11n (HT 20) WLAN Mode above 1 GHz

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode (Worst Case)

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
10 360.00	16.09	Peak	H	37.66	8.60	0.00	62.35	68.20	5.85
10 360.00	15.29	Peak	V				61.55	68.20	6.65
Middle Channel									
10 440.00	16.23	Peak	H	37.84	8.63	0.00	62.70	68.20	5.50
10 440.00	15.08	Peak	V				61.55	68.20	6.65
High Channel									
10 480.00	16.16	Peak	H	38.02	8.66	0.00	62.84	68.20	5.36
10 480.00	15.11	Peak	V				61.79	68.20	6.41

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	15.52	Peak	H	38.07	8.87	0.00	62.46	74.00	11.54
11 490.00	3.26	Average	H				50.20	54.00	3.80
11 490.00	15.88	Peak	V				62.82	74.00	11.18
11 490.00	3.87	Average	V				50.81	54.00	3.19
Middle Channel									
11 570.00	15.81	Peak	H	37.78	8.80	0.00	62.39	74.00	11.61
11 570.00	3.71	Average	H				50.29	54.00	3.71
11 570.00	15.58	Peak	V				62.16	74.00	11.84
11 570.00	4.09	Average	V				50.67	54.00	3.33
High Channel									
11 650.00	16.17	Peak	H	37.49	8.71	0.00	62.37	74.00	11.63
11 650.00	3.68	Average	H				49.88	54.00	4.12
11 650.00	15.66	Peak	V				61.86	74.00	12.14
11 650.00	4.16	Average	V				50.36	54.00	3.64

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

Tested by: Haram Lee / Assistant Manager

14. RADIATED RESTRICTED BAND EDGE MEASUREMENTS

14.1 Operating environment

Temperature : 23 ℃

Relative humidity : 46 % R.H.

14.2 Test set-up

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 22, 2019 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2019 (1Y)
☐ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Jul. 25, 2019 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)
■ -	FSW43	Rohde & Schwarz	Signal Analyzer	104544	Jul. 18, 2019 (1Y)
☐ -	BBV 9718 B	Schwarzbeck	Pre-Amplifier	009	Mar. 20, 2019 (1Y)
■ -	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
☐ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
☐ -	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-419	Aug. 09, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jan. 16, 2019 (1Y)
☐ -	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

14.4 Test data for Restricted Band (Ant 1 : AE-T2450/5500DP5-RSMA)

14.4.1 Test data for 802.11n (HT 20) WLAN Mode

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak Mode

-. Video bandwidth : 3 MHz for Peak Mode

-. Detector : Peak Mode(Peak)

-. Measurement distance : 3 m

-. Result : Pass

-.Operating mode : Transmitting mode (Worst Case)

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
4 977.60	16.97	Peak	H	31.28	7.84	0.00	56.09	74.00	17.91
4 630.19	7.62	Average	H				46.74	54.00	7.26
5 148.38	27.77	Peak	V				66.89	74.00	7.11
5 149.68	10.53	Average	V				49.65	54.00	4.35

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

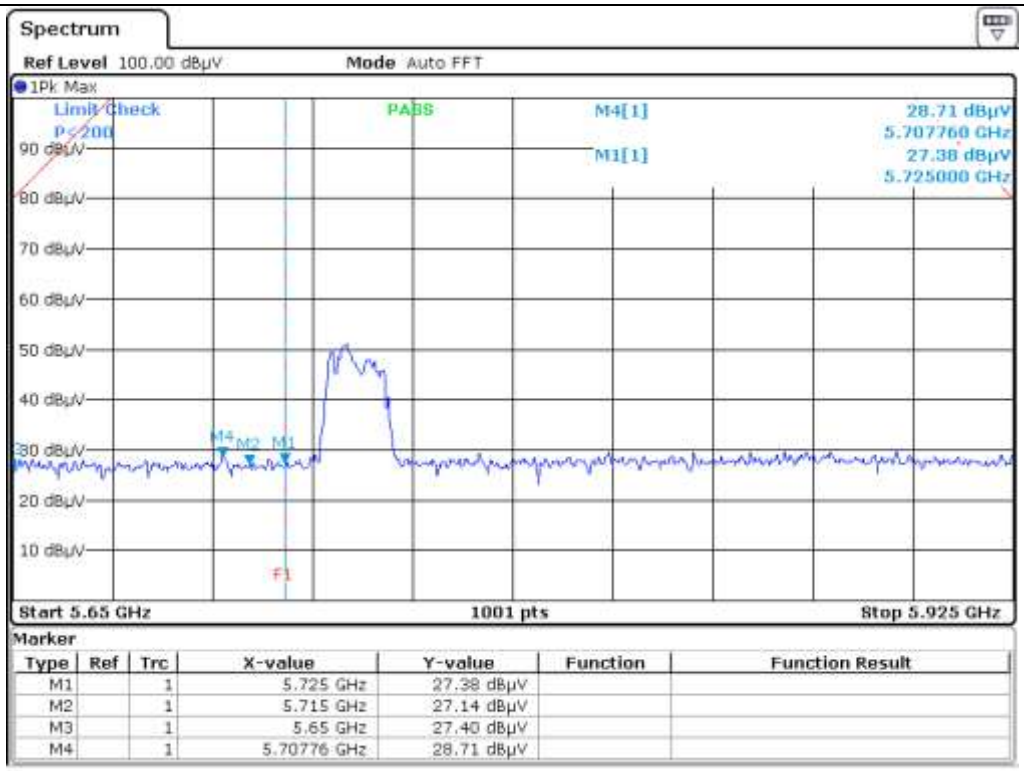
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 650.00	27.40	Peak	H	32.17	7.74	0.00	67.31	80.00	12.69
5 715.00	27.14	Peak	H				67.05	121.20	54.15
5 725.00	27.38	Peak	H				67.29	134.00	66.71
5 707.76	28.71	Peak	H				68.62	119.17	50.55
5 650.00	25.61	Peak	V				65.52	80.00	14.48
5 715.00	31.31	Peak	V				71.22	121.20	49.98
5 725.00	38.02	Peak	V				77.93	134.00	56.07
5 669.29	28.56	Peak	V				68.47	94.27	25.80
High Channel									
5 850.00	27.20	Peak	H	32.17	7.74	0.00	67.11	134.00	66.89
5 860.00	27.99	Peak	H				67.90	121.20	53.30
5 925.00	27.17	Peak	H				67.08	80.00	12.92
5 885.23	29.61	Peak	H				69.52	109.43	39.91
5 850.00	32.03	Peak	V				71.94	134.00	62.06
5 860.00	28.11	Peak	V				68.02	121.20	53.18
5 925.00	26.96	Peak	V				66.87	80.00	13.13
5 873.96	29.44	Peak	V				69.35	117.29	47.94

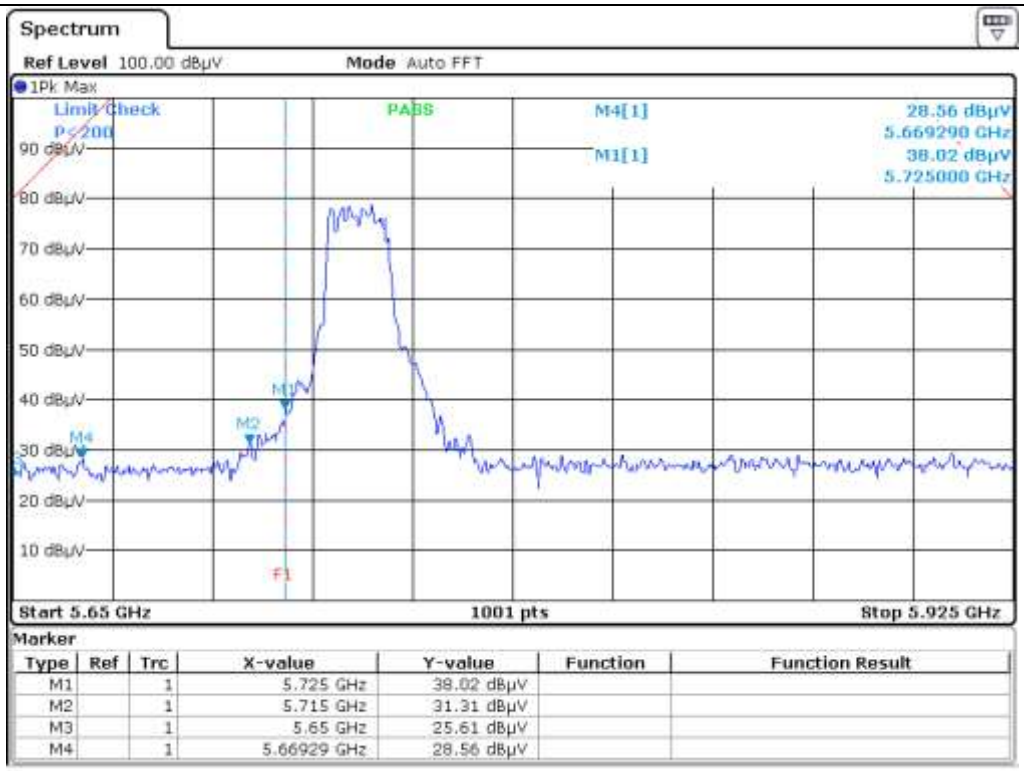
Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

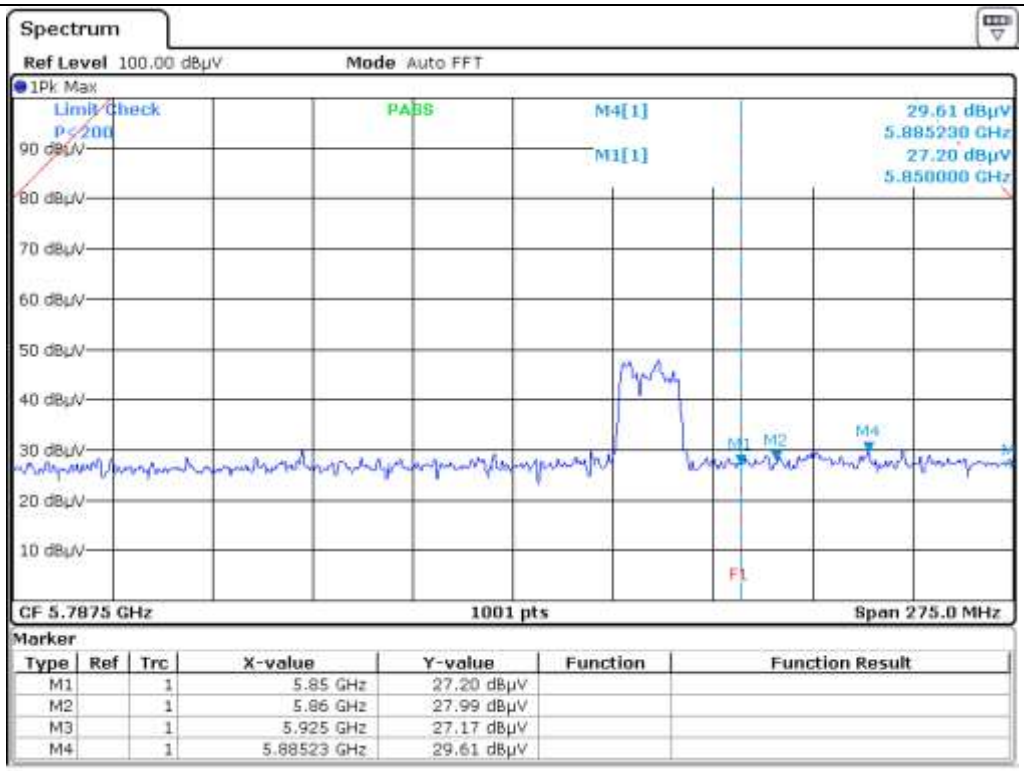
Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

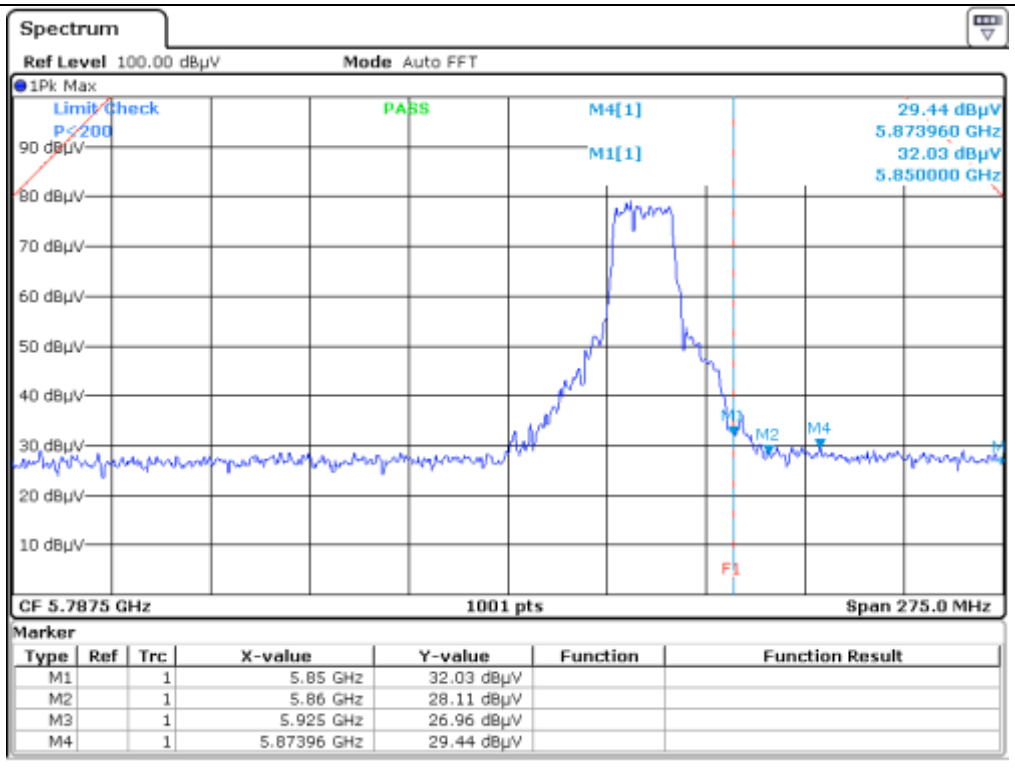
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)





ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)





Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

14.5 Test data for Restricted Band (Ant 2 : AEi-2450/5500P-IPEX35)

14.5.1 Test data for 802.11n (HT 20) WLAN Mode

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak Mode

-. Video bandwidth : 3 MHz for Peak Mode

-. Detector : Peak Mode(Peak)

-. Measurement distance : 3 m

-. Result : Pass

-.Operating mode : Transmitting mode (Worst Case)

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
5 068.51	16.36	Peak	H	31.28	7.84	0.00	55.48	74.00	18.52
4 958.77	7.83	Average	H				46.95	54.00	7.05
5 105.52	16.94	Peak	V				56.06	74.00	17.94
5 136.69	7.82	Average	V				46.94	54.00	7.06

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

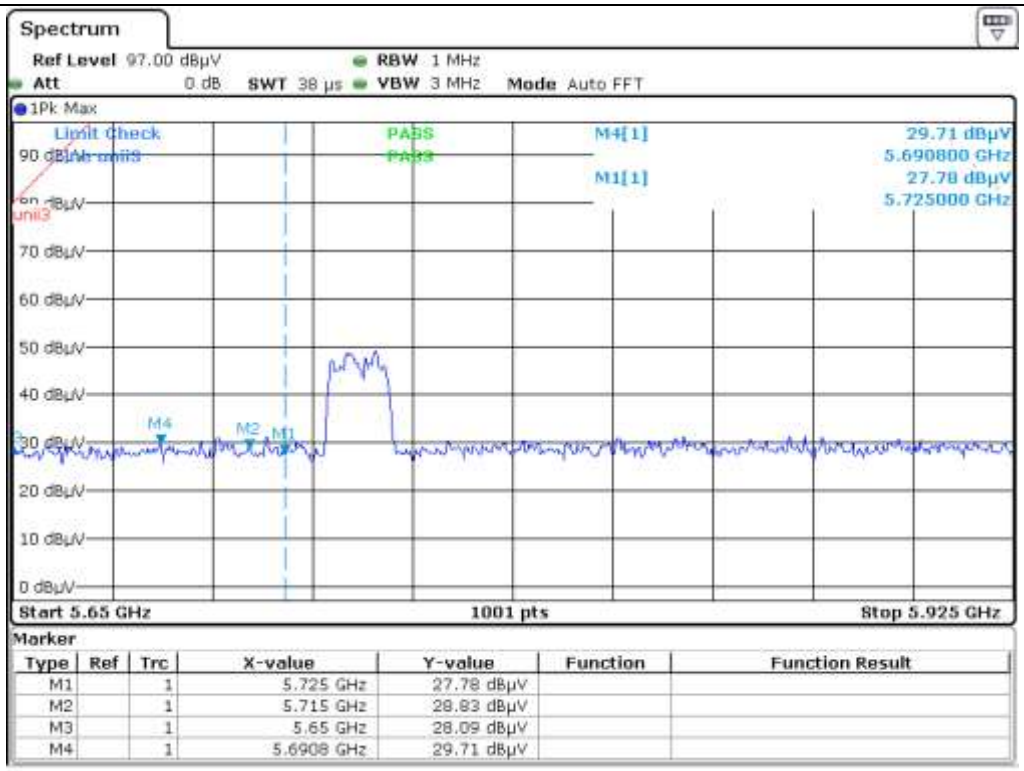
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 650.00	28.09	Peak	H	32.17	7.74	0.00	68.00	80.00	12.00
5 715.00	28.83	Peak	H				68.74	121.20	52.46
5 725.00	27.78	Peak	H				67.69	134.00	66.31
5 690.80	29.71	Peak	H				69.62	110.19	40.57
5 650.00	28.64	Peak	V				68.55	80.00	11.45
5 715.00	28.93	Peak	V				68.84	121.20	52.36
5 725.00	29.02	Peak	V				68.93	134.00	65.07
5 693.54	29.64	Peak	V				69.55	112.22	42.67
High Channel									
5 850.00	29.35	Peak	H	32.17	7.74	0.00	69.26	134.00	64.74
5 860.00	27.81	Peak	H				67.72	121.20	53.48
5 925.00	28.36	Peak	H				68.27	80.00	11.73
5 887.50	31.30	Peak	H				71.21	107.75	36.54
5 850.00	28.28	Peak	V				68.19	134.00	65.81
5 860.00	28.41	Peak	V				68.32	121.20	52.88
5 925.00	29.34	Peak	V				69.25	80.00	10.75
5 896.57	29.82	Peak	V				69.73	101.04	31.31

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

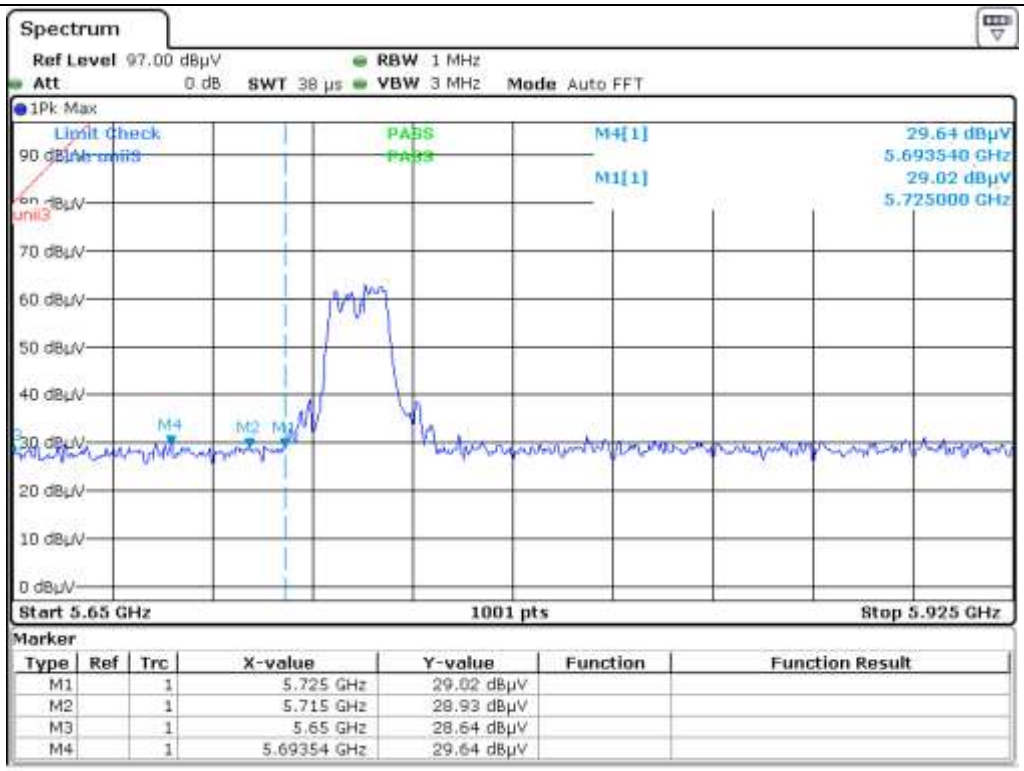
Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.725 GHz	27.78 dBµV		
M2		1	5.715 GHz	28.83 dBµV		
M3		1	5.65 GHz	28.09 dBµV		
M4		1	5.6908 GHz	29.71 dBµV		



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.725 GHz	29.02 dBµV		
M2		1	5.715 GHz	28.93 dBµV		
M3		1	5.65 GHz	28.64 dBµV		
M4		1	5.69354 GHz	29.64 dBµV		

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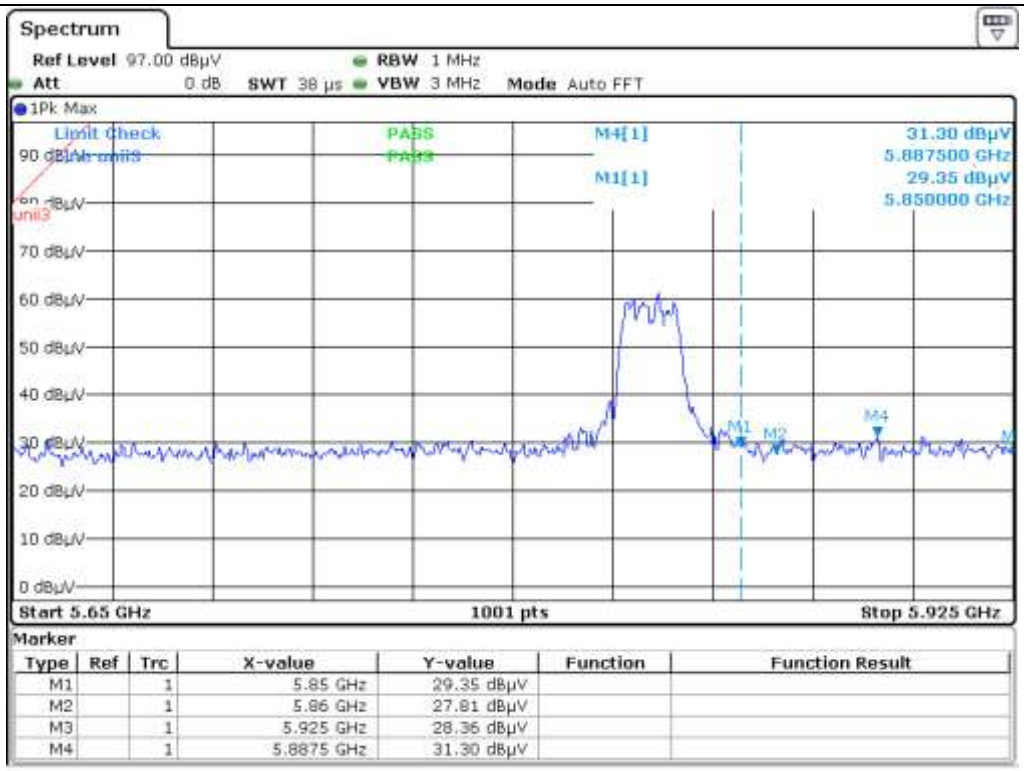

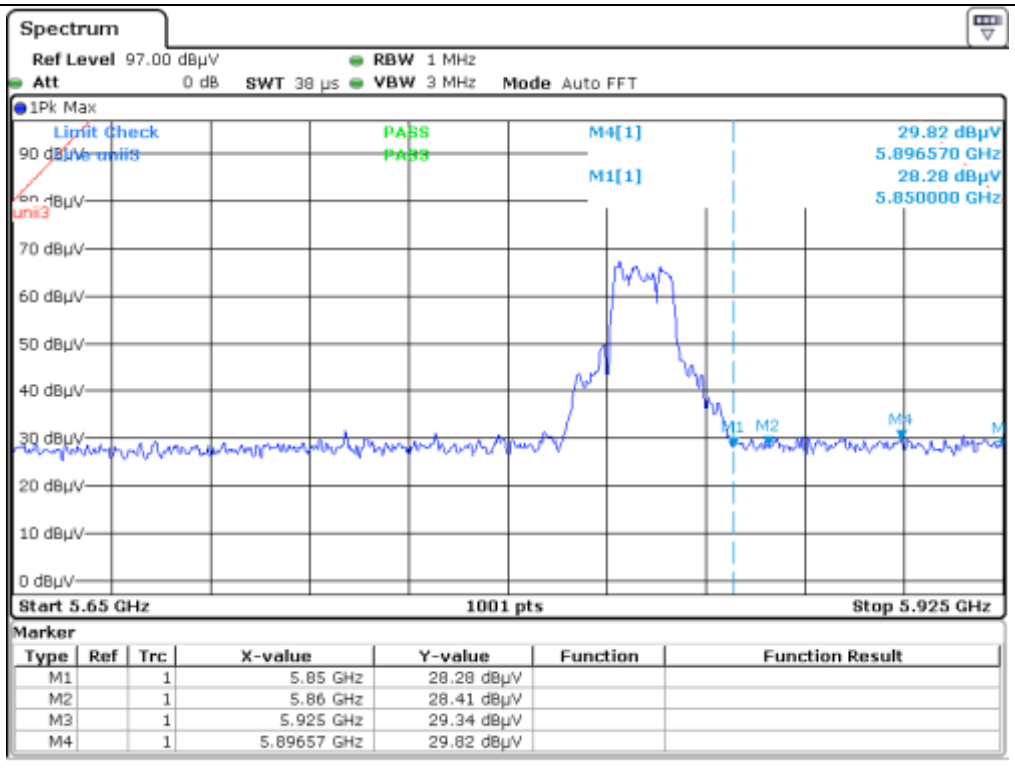

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

14.6 Test data for Restricted Band (Ant 3 : AEi-5500DP5-IPEX100[Bottom])

14.6.1 Test data for 802.11n (HT 20) WLAN Mode

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak Mode

-. Video bandwidth : 3 MHz for Peak Mode

-. Detector : Peak Mode(Peak)

-. Measurement distance : 3 m

-. Result : Pass

-.Operating mode : Transmitting mode (Worst Case)

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
5 117.86	16.16	Peak	H	31.28	7.84	0.00	55.28	74.00	18.72
4 896.43	8.02	Average	H				47.14	54.00	6.86
4 970.45	17.60	Peak	V				56.72	74.00	17.28
5 067.21	7.81	Average	V				46.93	54.00	7.07

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 650.00	26.78	Peak	H	32.17	7.74	0.00	66.69	80.00	13.31
5 715.00	27.89	Peak	H				67.80	121.20	53.40
5 725.00	31.37	Peak	H				71.28	134.00	62.72
5 696.29	29.92	Peak	H				69.83	114.25	44.42
5 650.00	27.69	Peak	V				67.60	80.00	12.40
5 715.00	28.23	Peak	V				68.14	121.20	53.06
5 725.00	40.53	Peak	V				80.44	134.00	53.56
5 660.58	30.40	Peak	V				70.31	87.83	17.52
High Channel									
5 850.00	28.51	Peak	H	32.17	7.74	0.00	68.42	134.00	65.58
5 860.00	28.51	Peak	H				68.42	121.20	52.78
5 925.00	28.58	Peak	H				68.49	80.00	11.51
5 889.15	30.55	Peak	H				70.46	106.53	36.07
5 850.00	29.41	Peak	V				69.32	134.00	64.68
5 860.00	29.08	Peak	V				68.99	121.20	52.21
5 925.00	29.75	Peak	V				69.66	80.00	10.34
5 902.88	31.35	Peak	V				71.26	96.37	25.11

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

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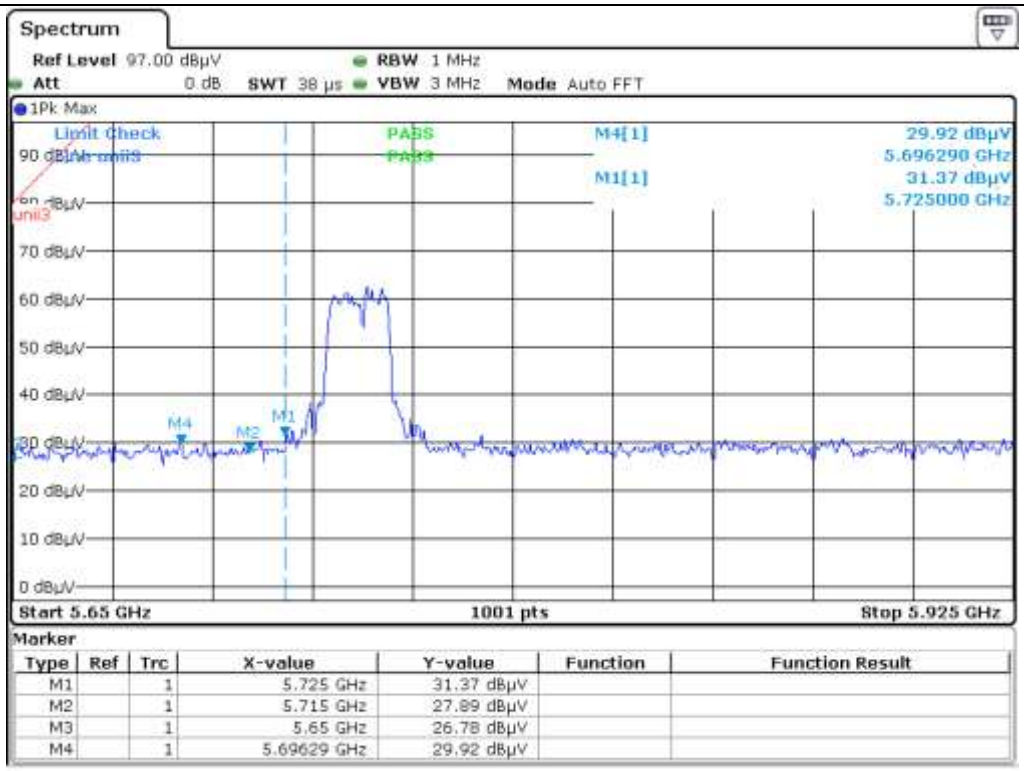
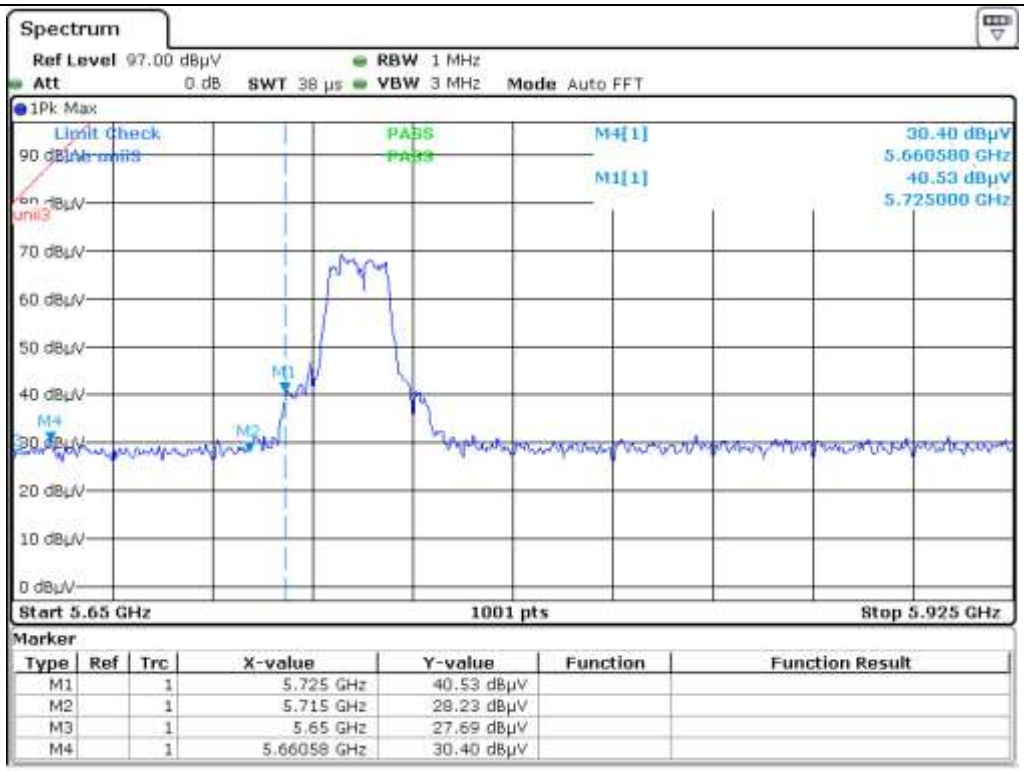


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.725 GHz	31.37 dBµV		
M2		1	5.715 GHz	27.89 dBµV		
M3		1	5.65 GHz	26.78 dBµV		
M4		1	5.69629 GHz	29.92 dBµV		



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.725 GHz	40.53 dBµV		
M2		1	5.715 GHz	28.23 dBµV		
M3		1	5.65 GHz	27.69 dBµV		
M4		1	5.66058 GHz	30.40 dBµV		

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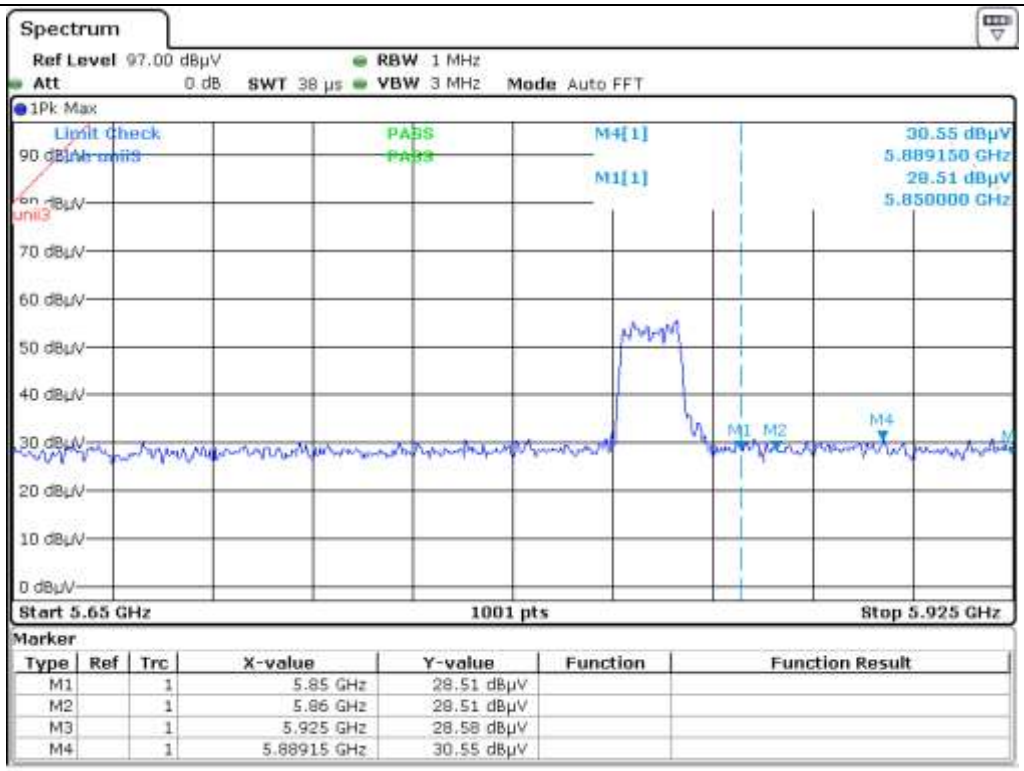

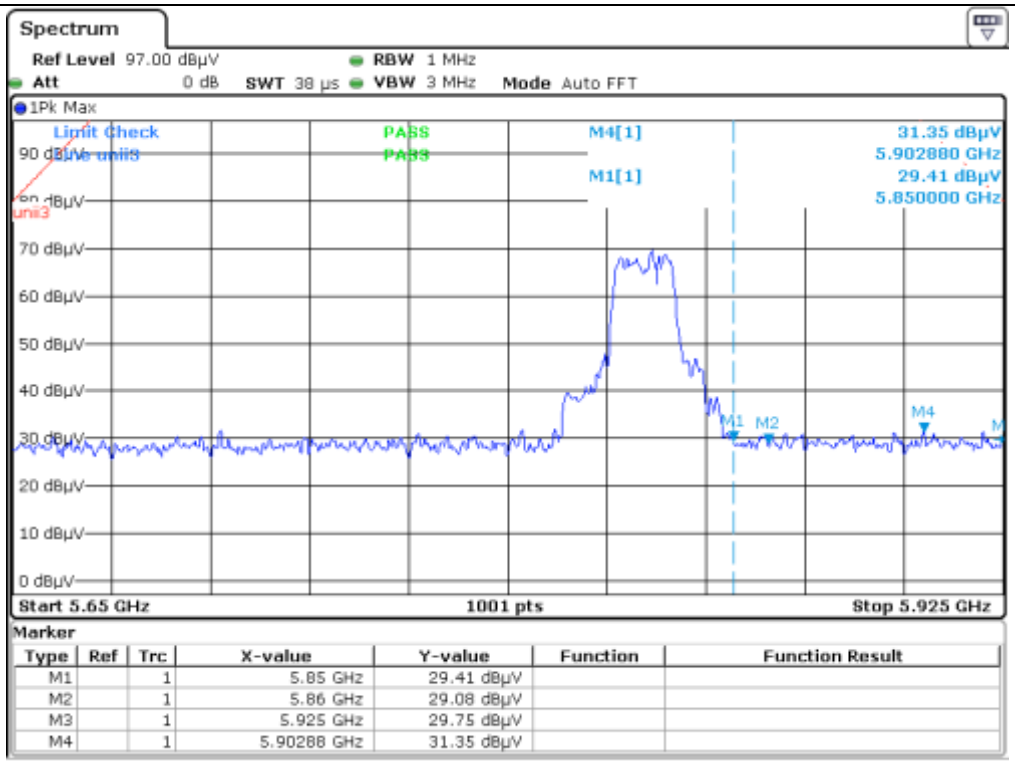

Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

14.7 Test data for Restricted Band (Ant 4 : AEi-RO-5500DP4-IPEX160)

14.7.1 Test data for 802.11n (HT 20) WLAN Mode

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak Mode

-. Video bandwidth : 3 MHz for Peak Mode

-. Detector : Peak Mode(Peak)

-. Measurement distance : 3 m

-. Result : Pass

-.Operating mode : Transmitting mode (Worst Case)

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
4 984.09	16.87	Peak	H	31.28	7.84	0.00	55.99	74.00	18.01
4 967.21	8.01	Average	H				47.13	54.00	6.87
4 841.88	17.59	Peak	V				56.71	74.00	17.29
4 970.45	8.21	Average	V				47.33	54.00	6.67

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Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 650.00	27.95	Peak	H	32.17	7.74	0.00	67.86	80.00	12.14
5 715.00	28.12	Peak	H				68.03	121.20	53.17
5 725.00	26.86	Peak	H				66.77	134.00	67.23
5 675.14	28.83	Peak	H				68.74	98.60	29.86
5 650.00	27.34	Peak	V				67.25	80.00	12.75
5 715.00	35.67	Peak	V				75.58	121.20	45.62
5 725.00	42.24	Peak	V				82.15	134.00	51.85
5 707.83	34.94	Peak	V				74.85	119.19	44.34
High Channel									
5 850.00	28.92	Peak	H	32.17	7.74	0.00	68.83	134.00	65.17
5 860.00	29.52	Peak	H				69.43	121.20	51.77
5 925.00	29.56	Peak	H				69.47	80.00	10.53
5 891.35	30.67	Peak	H				70.58	104.90	34.32
5 850.00	39.64	Peak	V				79.55	134.00	54.45
5 860.00	30.53	Peak	V				70.44	121.20	50.76
5 925.00	29.01	Peak	V				68.92	80.00	11.08
5 896.02	30.74	Peak	V				70.65	101.45	30.80

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

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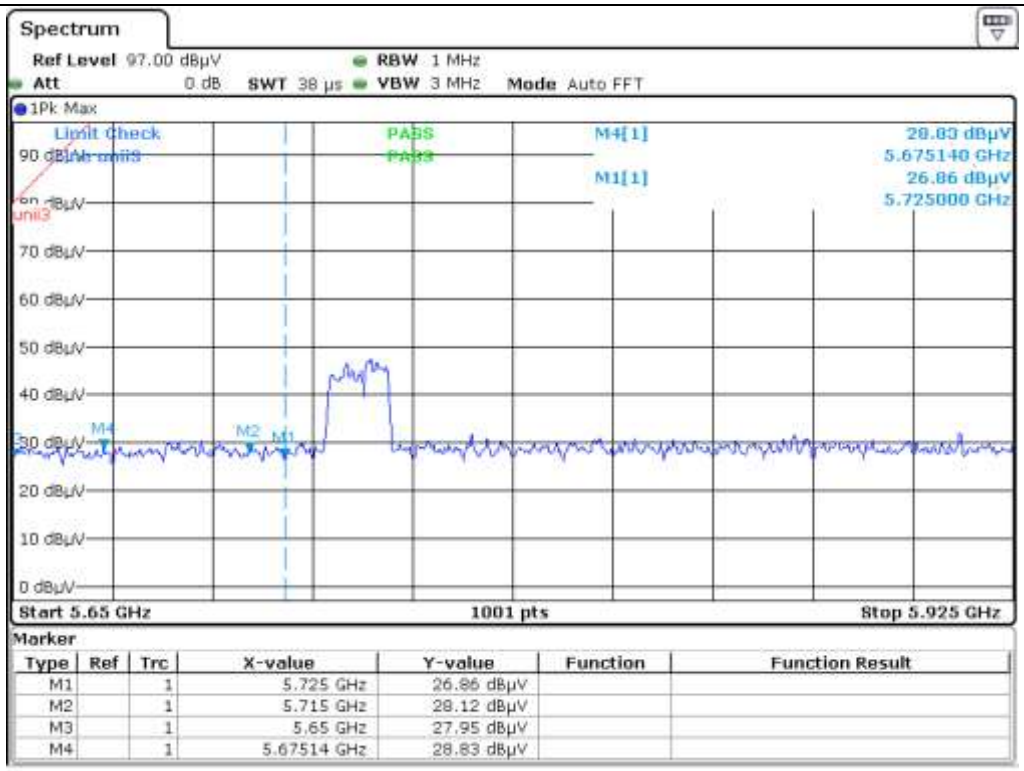

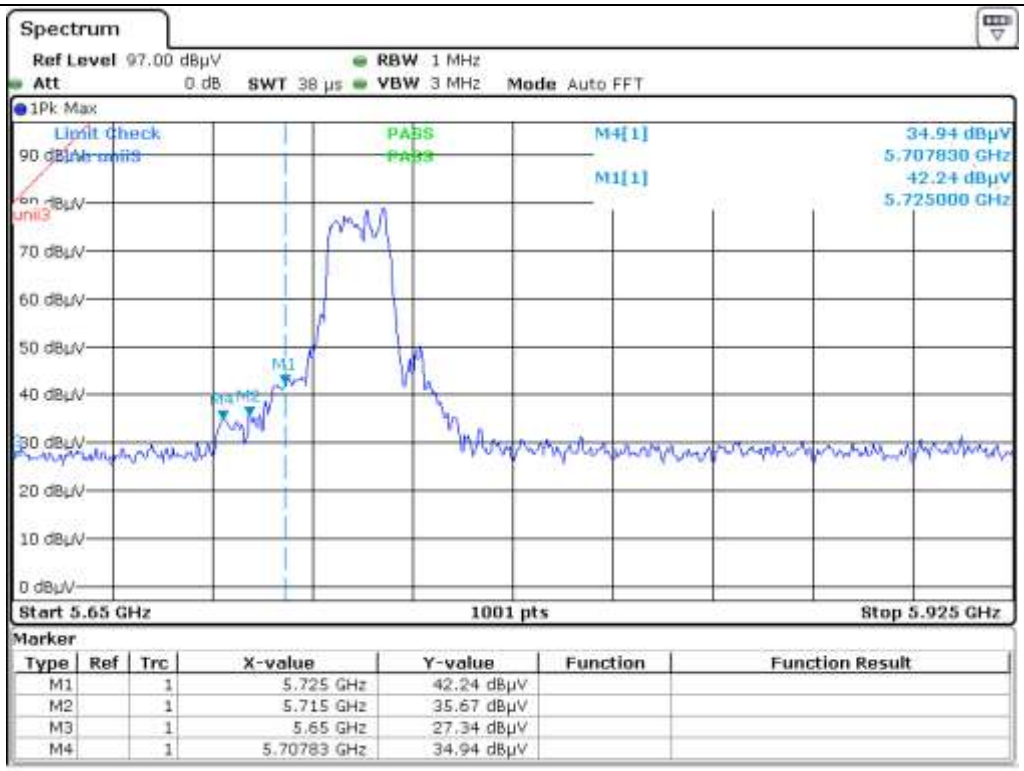

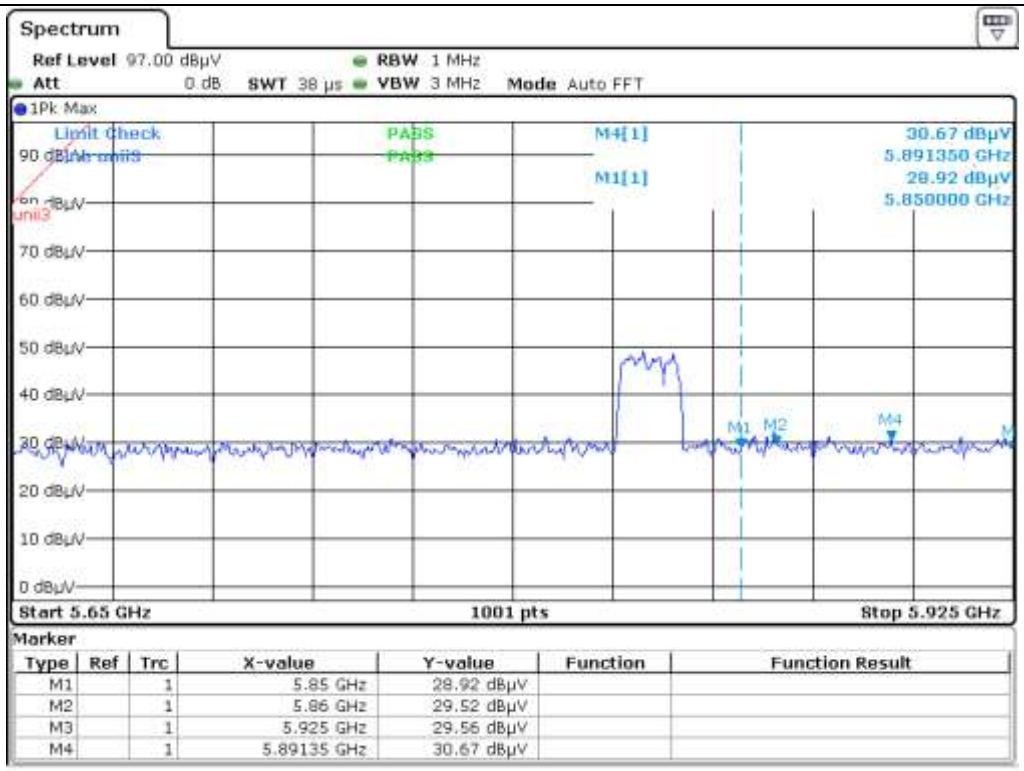

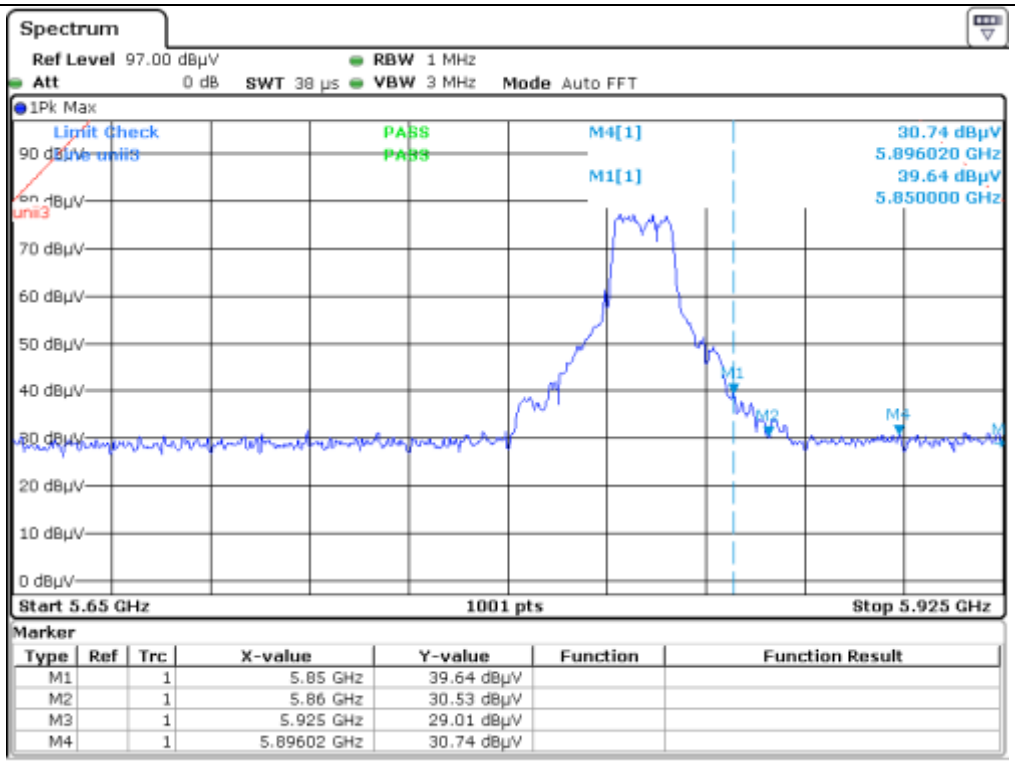

Tested by: Haram Lee / Assistant Manager

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14.8 Test data for Restricted Band (Ant 5 : AEi-RO-5500DP4-IPEX250)

14.8.1 Test data for 802.11n (HT 20) WLAN Mode

-. Test Date : June 23, 2019

-. Resolution bandwidth : 1 MHz for Peak Mode

-. Video bandwidth : 3 MHz for Peak Mode

-. Detector : Peak Mode(Peak)

-. Measurement distance : 3 m

-. Result : Pass

-.Operating mode : Transmitting mode (Worst Case)

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
4 976.30	16.47	Peak	H	31.28	7.84	0.00	55.59	74.00	18.41
5 039.94	7.68	Average	H				46.80	54.00	7.20
4 982.79	18.11	Peak	V				57.23	74.00	16.77
5 136.69	7.82	Average	V				46.94	54.00	7.06

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Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 650.00	29.28	Peak	H	32.17	7.74	0.00	69.19	80.00	10.81
5 715.00	28.51	Peak	H				68.42	121.20	52.78
5 725.00	28.91	Peak	H				68.82	134.00	65.18
5 672.66	32.42	Peak	H				72.33	96.77	24.44
5 650.00	27.72	Peak	V				67.63	80.00	12.37
5 715.00	38.29	Peak	V				78.20	121.20	43.00
5 725.00	46.36	Peak	V				86.27	134.00	47.73
5 697.66	32.31	Peak	V				72.22	115.27	43.05
High Channel									
5 850.00	29.12	Peak	H	32.17	7.74	0.00	69.03	134.00	64.97
5 860.00	28.38	Peak	H				68.29	121.20	52.91
5 925.00	29.24	Peak	H				69.15	80.00	10.85
5 877.88	30.35	Peak	H				70.26	114.87	44.61
5 850.00	33.24	Peak	V				73.15	134.00	60.85
5 860.00	30.64	Peak	V				70.55	121.20	50.65
5 925.00	28.60	Peak	V				68.51	80.00	11.49
5 886.68	30.79	Peak	V				70.70	108.36	37.66

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)

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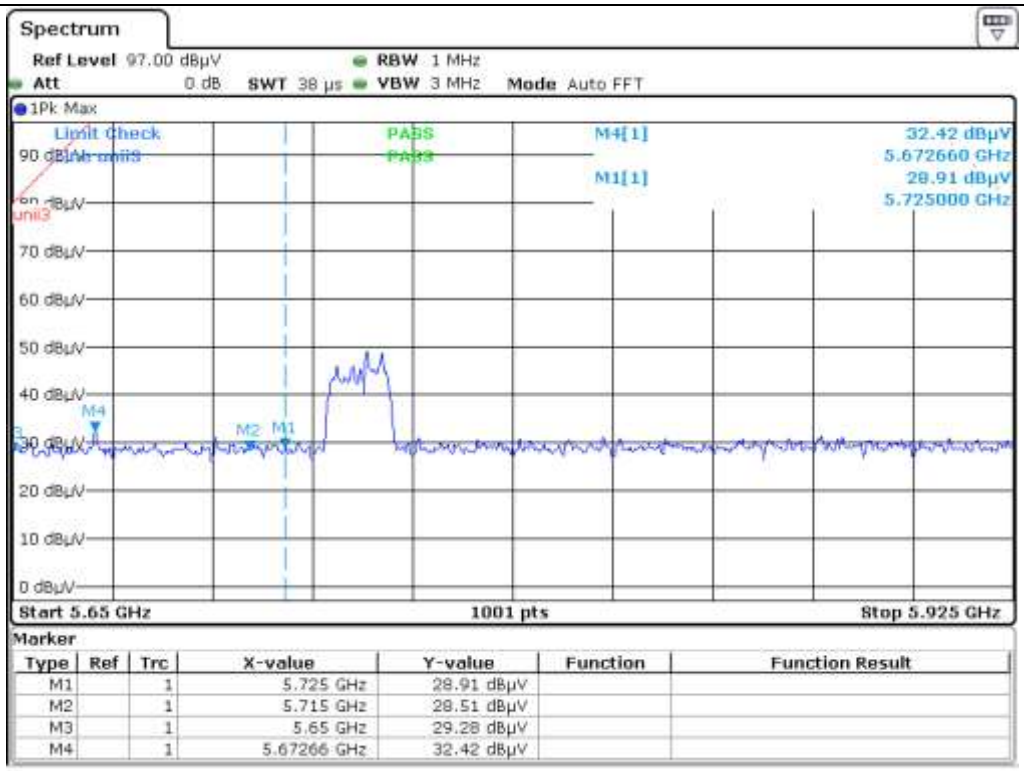

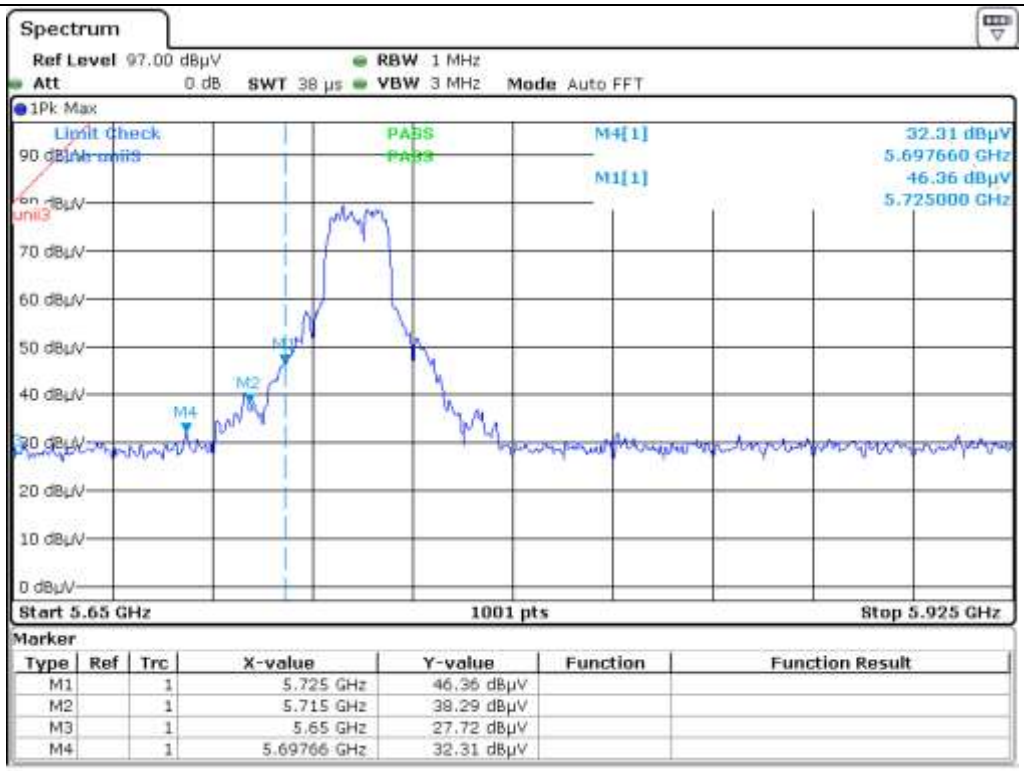

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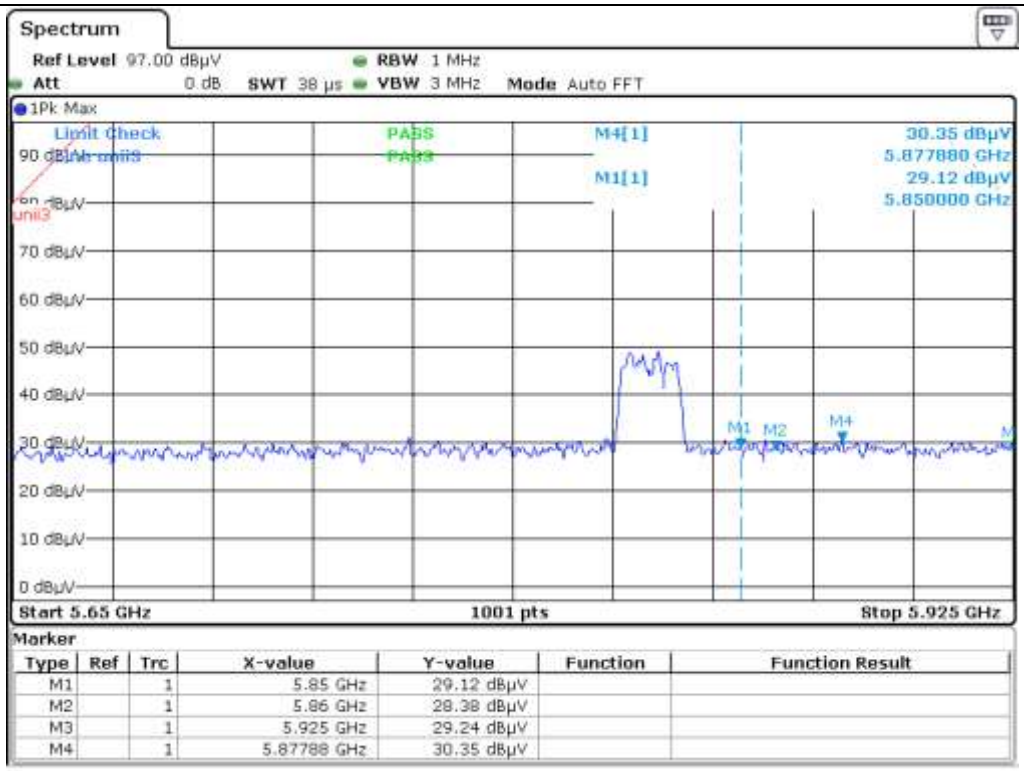
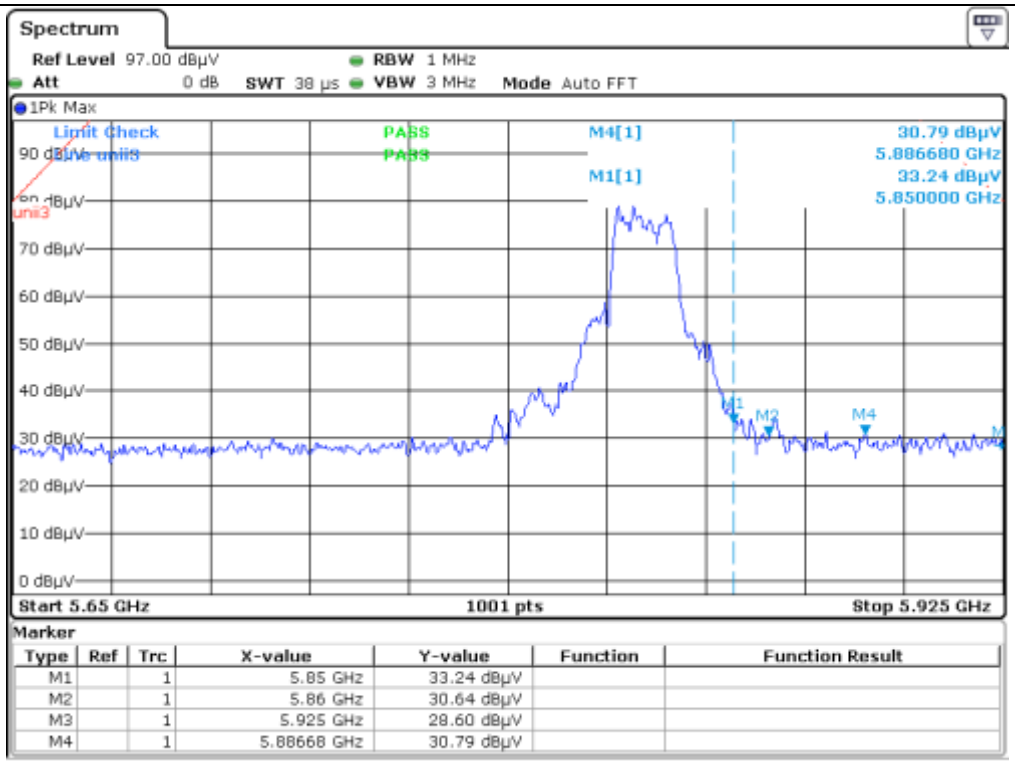




Tested by: Haram Lee / Assistant Manager

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

15. CONDUCTED EMISSION TEST

15.1 Operating environment

Temperature : 24 ℃

Relative humidity : 48 % R.H.

15.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

15.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESR	Rohde & Schwarz	Test Receiver	102602	Aug. 07, 2019 (1Y)
□ -	NSLK8126	Schwarzbeck	LISN	8128-404	Mar. 19, 2019 (1Y)
■ -	NSLK8126	Schwarzbeck	LISN	8126-479	Nov. 11, 2019 (1Y)
■ -	3825/2	EMCO	LISN	9109-1869	Mar. 19, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

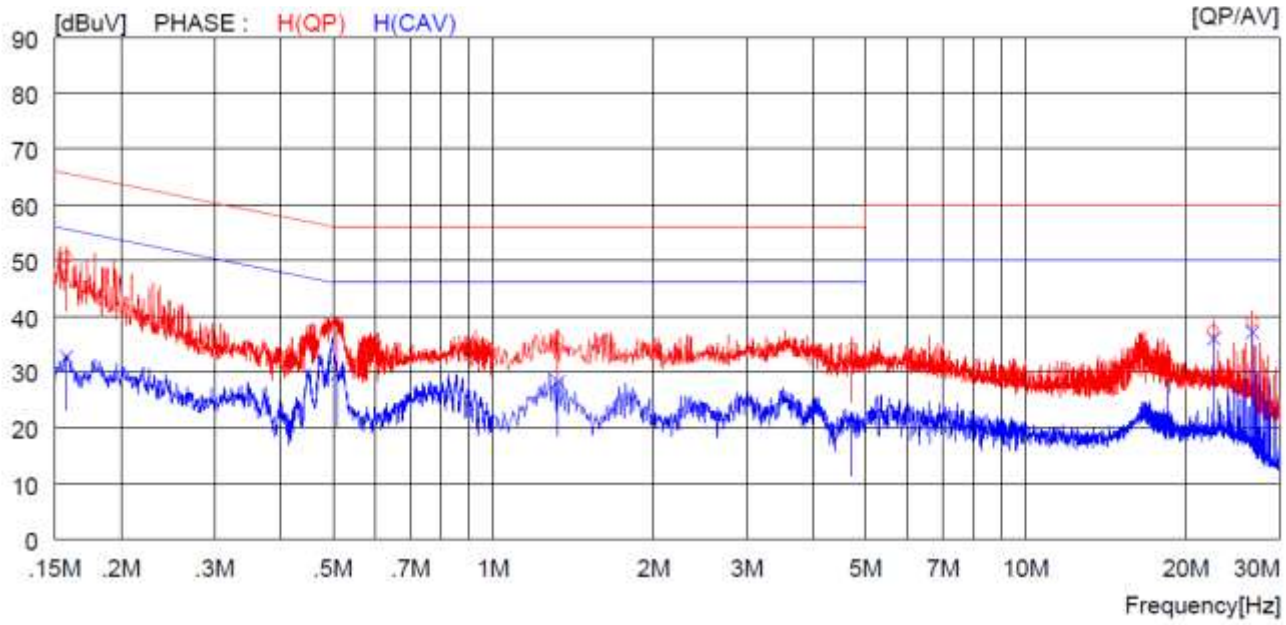
15.4 Test data

-. Test Date : January 17, 2020

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15800	40.5	----	10.0	50.5	----	65.6	----	15.1	----	H(QP)
2	0.51100	27.9	----	10.0	37.9	----	56.0	----	18.1	----	H(QP)
3	1.32400	25.7	----	10.1	35.8	----	56.0	----	20.2	----	H(QP)
4	4.72400	24.0	----	10.1	34.1	----	56.0	----	21.9	----	H(QP)
5	22.56000	26.6	----	10.7	37.3	----	60.0	----	22.7	----	H(QP)
6	26.67000	28.2	----	10.8	39.0	----	60.0	----	21.0	----	H(QP)
7	0.15800	----	22.7	10.0	----	32.7	----	55.6	----	22.9	H(CAV)
8	0.51100	----	19.7	10.0	----	29.7	----	46.0	----	16.3	H(CAV)
9	1.32400	----	18.1	10.1	----	28.2	----	46.0	----	17.8	H(CAV)
10	4.72400	----	10.8	10.1	----	20.9	----	46.0	----	25.1	H(CAV)
11	22.56000	----	25.3	10.7	----	36.0	----	50.0	----	14.0	H(CAV)
12	26.67000	----	26.3	10.8	----	37.1	----	50.0	----	12.9	H(CAV)

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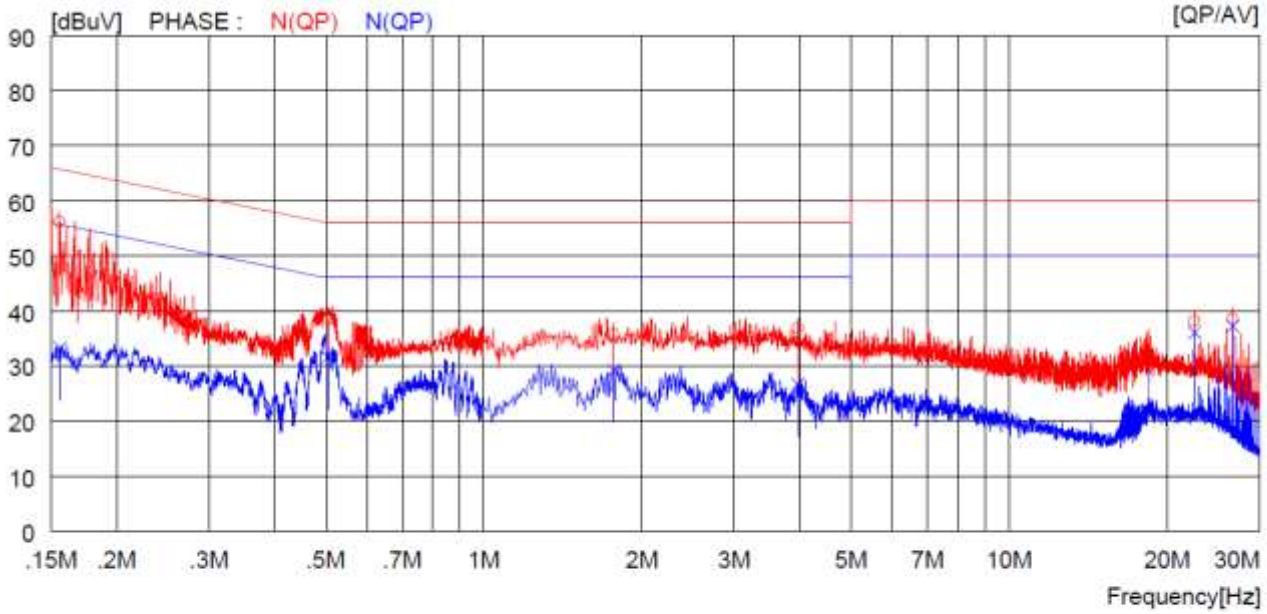
-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.15600	46.2	----	10.0	56.2	----	65.7	----	9.5	----	N(QP)
2	0.50600	28.5	----	10.0	38.5	----	56.0	----	17.5	----	N(QP)
3	1.76800	25.7	----	10.1	35.8	----	56.0	----	20.2	----	N(QP)
4	3.96400	26.7	----	10.1	36.8	----	56.0	----	19.2	----	N(QP)
5	22.56000	27.5	----	10.7	38.2	----	60.0	----	21.8	----	N(QP)
6	26.67000	27.7	----	10.8	38.5	----	60.0	----	21.5	----	N(QP)
7	0.15600	----	23.2	10.0	----	33.2	----	55.7	----	22.5	N(CAV)
8	0.50600	----	21.7	10.0	----	31.7	----	46.0	----	14.3	N(CAV)
9	1.76800	----	19.1	10.1	----	29.2	----	46.0	----	16.8	N(CAV)
10	3.96400	----	16.6	10.1	----	26.7	----	46.0	----	19.3	N(CAV)
11	22.56000	----	25.4	10.7	----	36.1	----	50.0	----	13.9	N(CAV)
12	26.67000	----	26.4	10.8	----	37.2	----	50.0	----	12.8	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Ha-Ram, Lee / Assistant Manager

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