



Test report No. : 4790042400-US-R7-V0
Page : 1 of 49
Issued date : 2022/1/6
FCC ID : RYK-WNFQ268AXB

CO-LOCATION RADIO TEST REPORT

Product : Wi-Fi 6E BT M.2 Module
Model Name : WNFQ-268AXI(BT)
Series Model : WNFQ-268AX(BT)
FCC ID : RYK-WNFQ268AXB
Test Regulation : FCC 47 CFR PART 15 Subpart C (Section 15.247)
FCC 47 CFR PART 15 Subpart E (Section 15.407)
Received Date : 2021/9/3
Test Date : 2021/9/6 ~ 2021/11/10
Issued Date : 2022/1/6
Applicant : SparkLAN Communications, Inc.
8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City
11493, Taiwan (R.O.C.)
Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



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Doc No: 17-EM-F0876 / 6.0



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1. Attestation of Test Results

APPLICANT: SparkLAN Communications, Inc.
 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493,
 Taiwan (R.O.C.)

MANUFACTURER: SparkLAN Communications, Inc.
 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City
 11493, Taiwan (R.O.C.)

EUT DESCRIPTION: Wi-Fi 6E BT M.2 Module

BRAND: SparkLAN

MODEL: WNFQ-268AXI(BT)

SERIES MODEL: WNFQ-268AX(BT)

SAMPLE STAGE: Engineering Verification Test sample

DATE of TESTED: 2021/9/6 ~ 2021/11/10

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.247)	PASS
FCC 47 CFR PART 15 Subpart E (Section 15.407)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu Date : 2022/1/6
 Project Handler

Approved and Authorized By:

Waternil Guan Date : 2022/1/6
 Engineer

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2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.205 / 15.209 / 15.247(d) / 15.407(b) (1/2/3/4(i/ii)/9) /15.407(b)(5)(8)	Radiated Spurious Emission	PASS
15.207 15.407(b)(9)	AC Power Conducted Emission	PASS

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3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 Meas Guidance v05r02, KDB 789033 D02 General UNII Test Procedure New Rules v02r01, KDB 987594 D02 U-NII 6 GHz EMC Measurement v01r01, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

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5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	± 3.1 dB
RF Conducted	9 kHz - 40GHz	± 1.9 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	± 1.9 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	± 5.4 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	± 4.7 dB

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6. Equipment under Test

6.1. Description of EUT

Product	Wi-Fi 6E BT M.2 Module	
Brand Name	SparkLAN	
Model Name	WNFQ-268AXI(BT)	
Series Model	WNFQ-268AX(BT)	
Operating Frequency	WLAN	2.4GHz: 2412MHz ~ 2462MHz 5GHz: 5180MHz ~ 5240MHz 5260MHz ~ 5320MHz 5500MHz ~ 5720MHz 5745MHz ~ 5825MHz 6GHz: 5955MHz ~ 6415MHz 6435MHz ~ 6525MHz 6525MHz ~ 6875MHz 6875MHz ~ 7115MHz
	Bluetooth EDR	2402MHz ~ 2480MHz
	Bluetooth LE	2402MHz ~ 2480MHz
Modulation	WLAN	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDMA
	Bluetooth EDR	GFSK, $\pi/4$ -DQPSK, 8DPSK
	Bluetooth LE	GFSK
Transfer Rate	WLAN	802.11a: up to 54 Mbps 802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to MCS15 802.11ac: up to MCS9 802.11ax: up to MCS11
	Bluetooth EDR	Up to 3 Mbps
	Bluetooth LE	Up to 2 Mbps

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Number of Channel	2.4G WLAN 2412 ~ 2462 MHz	11 for 802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20) 7 for 802.11n (HT40), 802.11ax (HE40)
	5G WLAN 5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5G WLAN 5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5G WLAN 5500 ~ 5720 MHz	1 for 802.11ac (VHT160), 802.11ax (HE160)
		12 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		6 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
	5G WLAN 5745 ~ 5825 MHz	3 for 802.11ac (VHT80), 802.11ax (HE80), 1 for 802.11ac (VHT160), 802.11ax (HE160)
		5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
	Bluetooth EDR	79
Bluetooth LE	40	

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Number of Channel	6G WLAN 5925 ~ 6425MHz	24 for 802.11a, 802.11ax (HE20)
		12 for 802.11ax (HE40)
		6 for 802.11ax (HE80)
		3 for 802.11ax (HE160)
	6G WLAN 6425 ~ 6525MHz	5 for 802.11a,802.11ax (HE20)
		3 for 802.11ax (HE40)
		2 for 802.11ax (HE80)
		1 for 802.11ax (HE160)
	6G WLAN 6525 ~ 6855MHz	17 for 802.11a,802.11ax (HE20)
		8 for 802.11ax (HE40)
		3 for 802.11ax (HE80)
		1 for 802.11ax (HE160)
	6G WLAN 6875 ~ 7125MHz	13 for 802.11a,802.11ax (HE20)
		6 for 802.11ax (HE40)
		3 for 802.11ax (HE80)
		2 for 802.11ax (HE160)
Normal Voltage	3.3 Vdc	
S/N	21765J2100036	
Sample ID	4158081	

Note:

1. The models difference table as below:

Model	Difference
WNFQ-268AXI(BT)	WNFQ-268AXI(BT) Operating Temp -40~+75; WNFQ-268AX(BT) Operating Temp -10~+65 In addition, the sample has A-E key and E key versions. Only the golden finger is different.
WNFQ-268AX(BT)	

*Except above change, there is no change to technical construction that is included circuit diagram, PCB Layout, components and component layout, all electrical construction, and mechanical construction.

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2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
802.11a	2TX,2RX
802.11b	2TX,2RX
802.11g	2TX,2RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX
802.11ac (VHT20)	2TX,2RX
802.11ac (VHT40)	2TX,2RX
802.11ac (VHT80)	2TX,2RX
802.11ac (VHT160)	2TX,2RX
802.11ax (HE20)	2TX,2RX
802.11ax (HE40)	2TX,2RX
802.11ax (HE80)	2TX,2RX
802.11ax (HE160)	2TX,2RX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40 / VHT80 / VHT160 and 802.11ax mode for HE20 / HE40 / HE80 / HE160, therefore investigated worst case to representative mode in test report.

3. The EUT contains following accessory devices:

Product	Brand	Model	Description
Antenna 1	SparkLAN	AD-500AX	-
Antenna 2	SparkLAN	AD-501AX	-
Antenna 3	SparkLAN	AD-502AX	-
Antenna 4	SparkLAN	AD-503AX	-
Antenna 5	SparkLAN	2450AD18A6050	-
Antenna 6	SparkLAN	AD-504AX	-
Antenna 7	SparkLAN	AD-505AX	-

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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6.2. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Radiated Spurious Emission	966-2	23~26°C/ 60~65%RH	3.3Vdc	2021/09/06~ 2021/11/10	Mike Cai
AC power Line Conducted Emission	SR1	23~26°C/ 60~65%RH	3.3Vdc	2021/09/16~ 2021/11/10	Mike Cai

FCC Test Firm Registration Number: 498077

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6.3. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Frequency Band (MHz)	Maximum Gain (dBi)	Remark
1	Chain (0)+(1)	Sparklan	AD-500AX	Dipole	2400~2483	2.65	RP-SMA
					5150~5250	4.35	
					5250~5350	4.35	
					5470~5725	4.35	
					5725~5850	4.81	
					5925~6425	4.98	
					6425~6525	4.85	
					6525~6875	4.79	
6875~7125	4.82						
2	Chain (0)+(1)	Sparklan	AD-501AX	Dipole	2400~2483	3.7	RP-SMA
					5150~5850	5	
					5925~7125	5	
3	Chain (0)+(1)	Sparklan	AD-502AX	PIFA	2400~2483	3.5	IPEX
					5150~5850	5	
					5925~7125	3.9	
4	Chain (0)+(1)	Sparklan	AD-503AX	Dipole	2400~2483	3.7	RP-SMA
					5150~5850	5	
					5925~7125	5	
5	Chain (0)+(1)	JOHANSON	2450AD18A6050	CHIP	2400~2483	2	NA
					5150~5850	1.5	
					5925~7125	2.7	
6	Chain (0)+(1)	Sparklan	AD-504AX	Dipole	2400~2483	2.67	I-PEX
					5150~5250	4.35	
					5250~5350	3.83	
					5470~5725	4.7	
					5725~5850	4.87	
					5925~6425	4.91	
					6425~6525	4.85	
					6525~6875	4.94	
6875~7125	4.94						
7	Chain (0)+(1)	Sparklan	AD-505AX	Dipole	2400~2483	2.67	I-PEX
					5150~5250	4.35	
					5250~5350	3.83	
					5470~5725	4.7	
					5725~5850	4.87	
					5925~6425	4.91	
					6425~6525	4.85	
					6525~6875	4.94	
6875~7125	4.94						

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

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6.4. Test Mode Applicability and Tested Channel Detail

Simultaneously transmission condition:

Condition	Technology	
1	WLAN (2.4GHz)	WLAN (5GHz)
2	BT-GFSK	WLAN (5GHz)
3	WLAN (2.4GHz)	WLAN (6GHz)
4	BT-GFSK	WLAN (6GHz)

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

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7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2020/11/11	2021/11/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2020/12/11	2021/12/10
Loop Antenna	ETS lindgren	6502	00213440	2020/12/25	2021/12/24
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck	VULB 9168 & N-6-05	774 & AT-N0538	2021/1/13	2022/1/12
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck	VULB 9168 & N-6-05	773 & AT-N0539	2021/3/11	2022/3/10
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2020/12/30	2021/12/29
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01686	2020/12/23	2021/12/22
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2020/12/30	2021/12/29
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	759	2020/11/30	2021/11/29
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2021/6/8	2022/6/7
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2021/2/3	2022/2/2
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2021/5/19	2022/5/18
Signal Generator	Keysight	N5173B	MY53271122	2021/1/13	2022/1/12
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2021/1/22	2022/1/21
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2021/1/22	2022/1/21

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2020/11/17	2021/11/16
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2021/8/30	2022/8/29
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2021/8/26	2022/8/25
Cables	TITAN	CFD200	T0732ACFD20 020A300-1	2021/3/2	2022/3/1

UL Software		
Description	Name	Version
Radiated measurement	e3	6.191211 (V6)
AC power Line Conducted Emission	EZ_EMG	UL-3A1.2

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8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Laptop	Lenovo	E6430	2MMN3X1	Provide by lab
B	Mini PCI-E to ExpressCard board	SparkLAN	Card-01	001	N/A

Test Setup

Controlled using a bespoke application (QSPR_Version 5.0-00197) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

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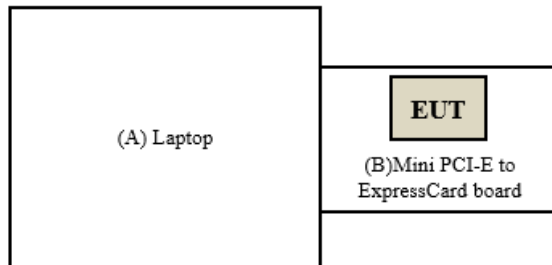
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Setup Diagram for Test



Under Table

Remote Site



9. Test Results

9.1. Radiated Spurious Emission

Following FCC KDB Guidance:

Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on antenna-port conducted measurements in conjunction with cabinet emissions tests are permitted to demonstrate compliance.

The following steps was performed:

- a. Cabinet emissions measurements. Radiated measurement was performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna was replaced by a termination matching the nominal impedance of the antenna.
- b. Conducted tests was performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT
- c. EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater
- d. EIRP adjustments for multiple outputs. (Follow the procedures specified in FCC KDB Publication 662911)

For Radiated Emission

Test Procedures

[For 9 kHz ~ 30 MHz]

- e. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- f. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- g. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- h. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- i. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

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[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported.
5. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
6. Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
7. Test data of Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
8. Test data of Notation "@" = Fundamental Frequency
9. Test data of Notation "*" = Only required peak limit or the peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

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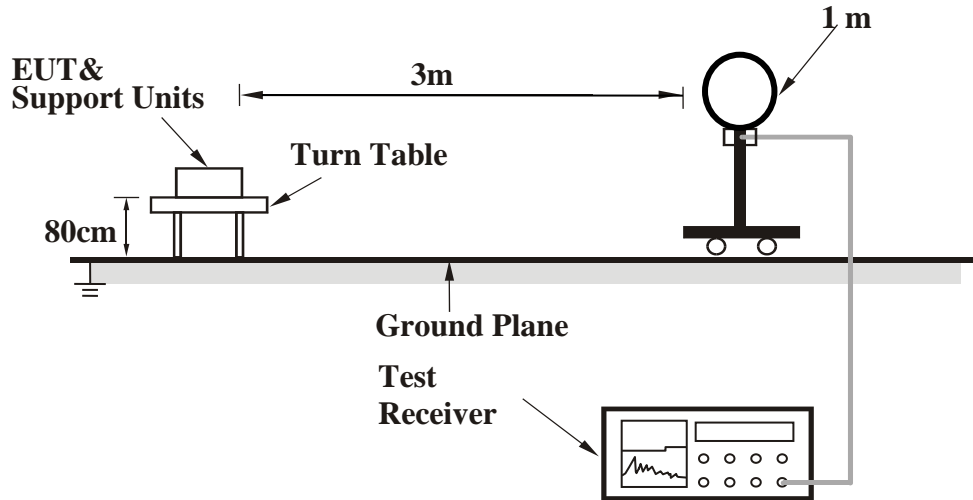
Doc No: 17-EM-F0876 / 6.0



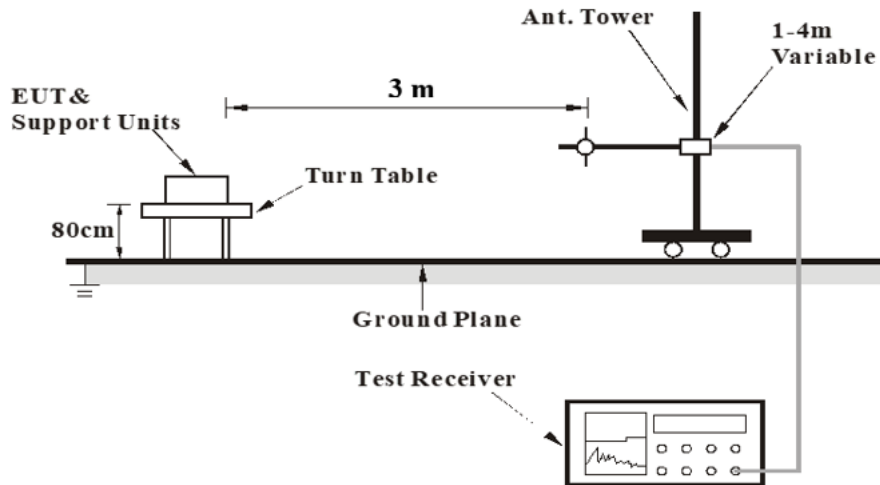
Test Setup

For Radiated Test Method:

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



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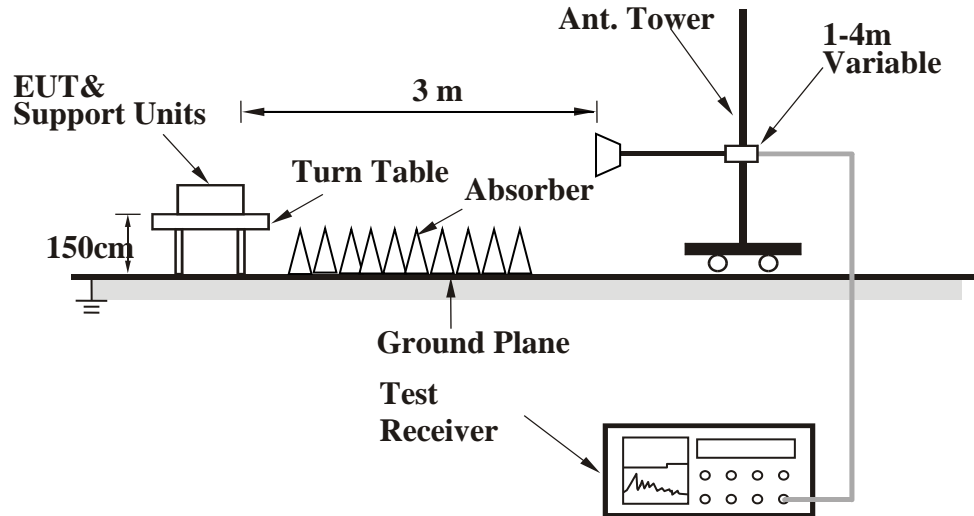
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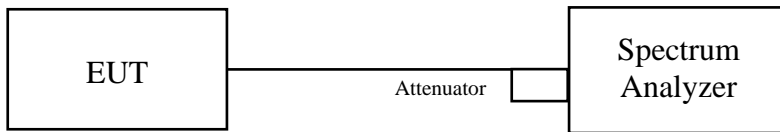
Doc No: 17-EM-F0876 / 6.0

<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.

For Conducted Test Method:



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.



Test Data

Above 1GHz Data

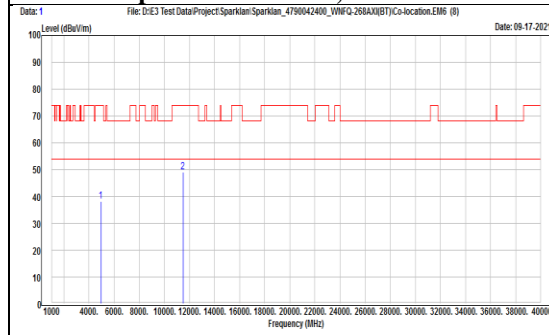
Radiated method

The level of unwanted emissions was measured when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation)

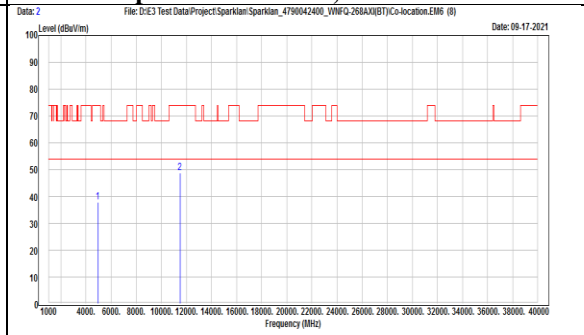
Mode	Bluetooth + WLAN 5GHz	Channel	Ch78 + Ch149
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	*	4960	35.63	2.62	38.25	74	-35.75	PK
Horizontal	*	11490	29.93	19.02	48.95	74	-25.05	PK
Vertical	*	4960	35.37	2.62	37.99	74	-36.01	PK
Vertical	*	11490	29.88	19.02	48.9	74	-25.1	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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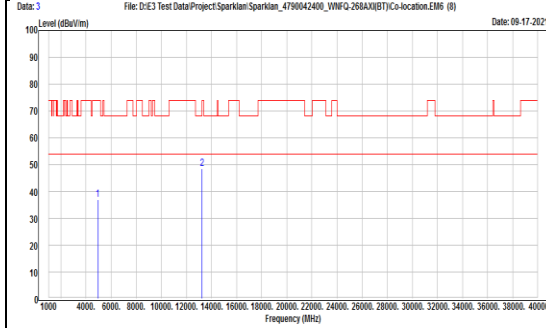
Facsimile (FAX) : +886-3-583-7948



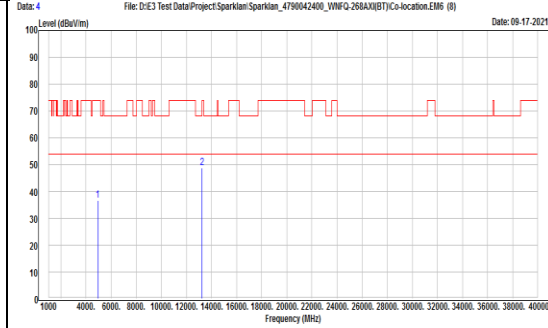
Mode	Bluetooth + WLAN 6GHz	Channel	Ch78 + Ch233
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	*	4960	34.25	2.62	36.87	74	-37.13	PK
Horizontal	*	13250	27.1	21.32	48.42	68.2	-19.78	PK
Vertical	*	4960	34.16	2.62	36.78	74	-37.22	PK
Vertical	*	13250	27.5	21.32	48.82	68.2	-19.38	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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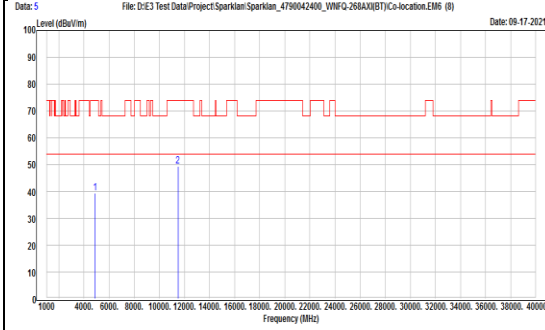
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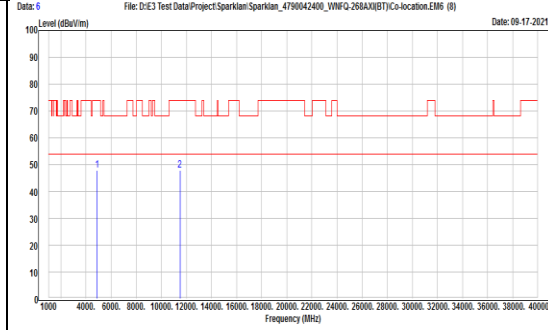
Mode	WLAN 2.4GHz + WLAN 5GHz	Channel	Ch6 + Ch149
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	*	4874	36.7	2.66	39.36	74	-34.64	PK
Horizontal	*	11490	30.44	19.02	49.46	74	-24.54	PK
Vertical	*	4874	45.09	2.66	47.75	74	-26.25	PK
Vertical	*	11490	28.73	19.02	47.75	74	-26.25	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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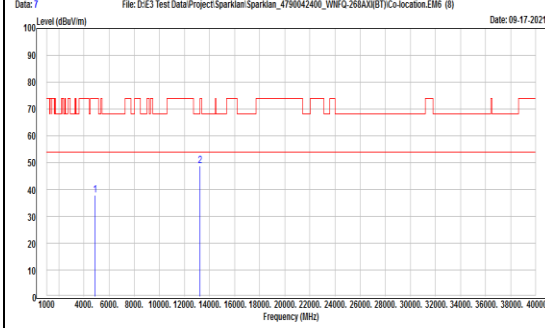
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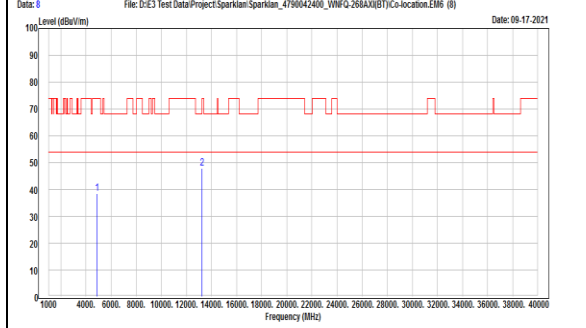
Mode	WLAN 2.4GHz + WLAN 6GHz	Channel	Ch6 + Ch233
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal	*	4874	35.36	2.66	38.02	74	-35.98	PK
Horizontal	*	13250	27.33	21.32	48.65	68.2	-19.55	PK
Vertical	*	4874	35.73	2.66	38.39	74	-35.61	PK
Vertical	*	13250	26.58	21.32	47.9	68.2	-20.3	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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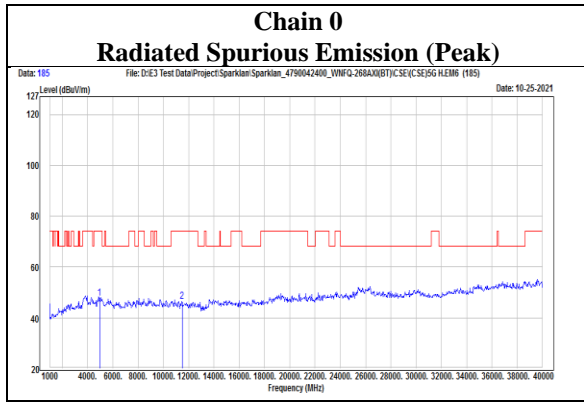
Doc No: 17-EM-F0876 / 6.0



Conducted method

Mode	Bluetooth + WLAN 5GHz	Channel	Ch78 + Ch149
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TX Chain	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Chain 0	*	4960	59.47	-11.74	47.73	74	-26.27	PK
	*	11490	58.22	-11.74	46.48	74	-27.52	PK



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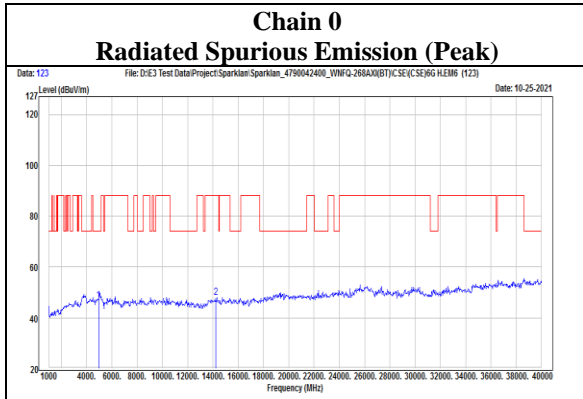
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Mode	Bluetooth + WLAN 6GHz	Channel	Ch78 + Ch233
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TX Chain	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Chain 0	*	4960	58.63	-11.74	46.89	74	-27.11	PK
	*	14230	59.67	-11.74	47.93	88.2	-40.27	PK



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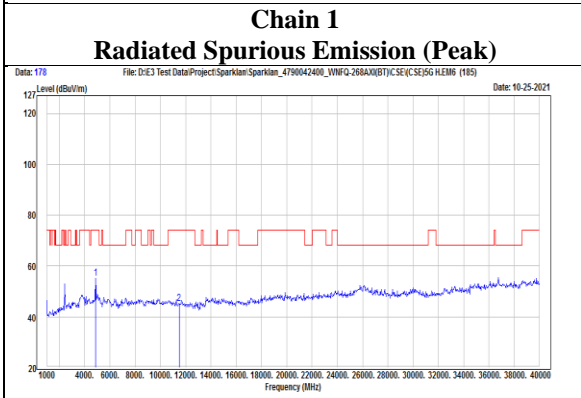
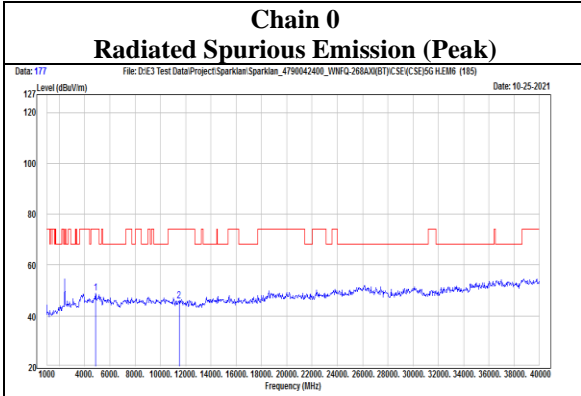
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Doc No: 17-EM-F0876 / 6.0



Mode	WLAN 2.4GHz + WLAN 5GHz	Channel	Ch6 + Ch149
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TX Chain	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Chain 0	*	4874	60.76	-11.74	49.02	74	-24.98	PK
	*	11490	57.66	-11.74	45.92	74	-28.08	PK
Chain 1	*	4874	66.92	-11.74	55.18	74	-18.82	PK
	*	11490	56.91	-11.74	45.17	74	-28.83	PK



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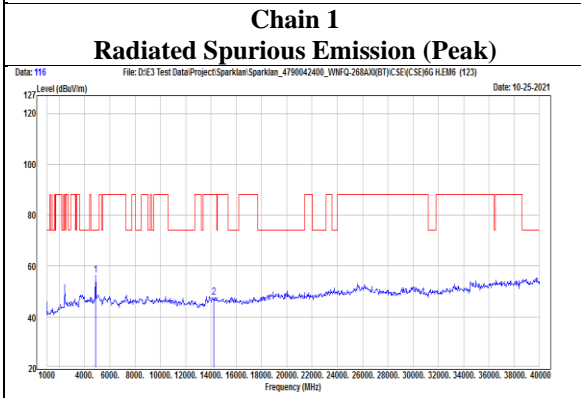
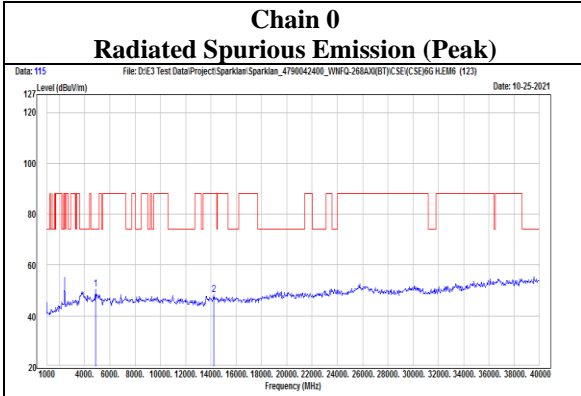
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Mode	WLAN 2.4GHz + WLAN 6GHz	Channel	Ch6 + Ch233
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TX Chain	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Chain 0	*	4874	62.08	-11.74	50.34	74	-23.66	PK
	*	14230	60.17	-11.74	48.43	88.2	-39.77	PK
Chain 1	*	4874	68.12	-11.74	56.38	74	-17.62	PK
	*	14230	59.44	-11.74	47.7	88.2	-40.5	PK



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9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.
- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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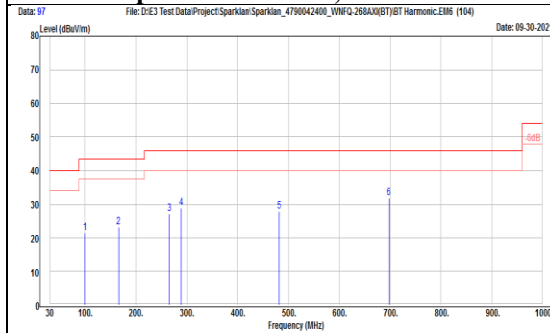
30 MHz ~ 1 GHz Data

Radiated method

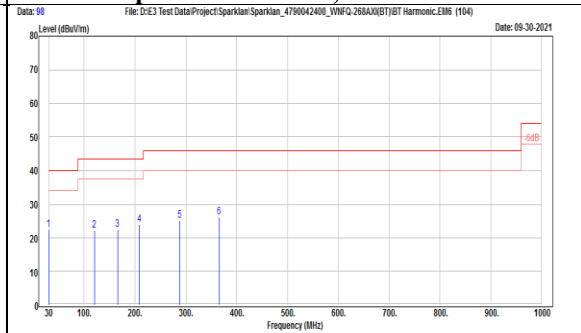
Mode	Bluetooth + WLAN 5GHz	Channel	Ch78 + Ch149
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Polarization	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Horizontal		99.84	37.82	-16.45	21.37	43.5	-22.13	PK
		165.8	34.22	-11.13	23.09	43.5	-20.41	PK
		265.71	38.39	-11.12	27.27	46	-18.73	PK
		288.99	39.32	-10.31	29.01	46	-16.99	PK
		482.02	32.97	-5.1	27.87	46	-18.13	PK
		697.36	32.36	-0.45	31.91	46	-14.09	PK
Vertical		30	34.81	-12.37	22.44	40	-17.56	PK
		120.21	36.61	-14.3	22.31	43.5	-21.19	PK
		165.8	33.49	-11.13	22.36	43.5	-21.14	PK
		208.48	37.82	-13.8	24.02	43.5	-19.48	PK
		288.02	35.49	-10.34	25.15	46	-20.85	PK
		365.62	34.08	-7.98	26.1	46	-19.9	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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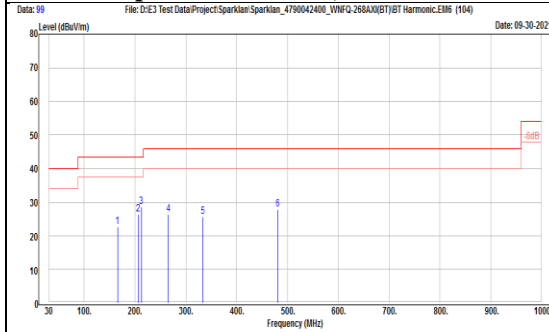
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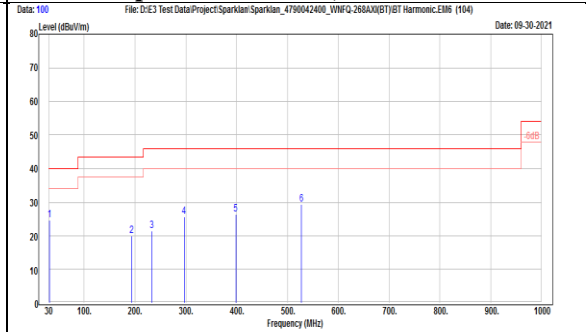
Mode	Bluetooth + WLAN 6GHz	Channel	Ch78 + Ch233
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Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		165.8	33.83	-11.13	22.7	43.5	-20.8	PK
		206.54	40.28	-13.89	26.39	43.5	-17.11	PK
		212.36	42.06	-13.52	28.54	43.5	-14.96	PK
		265.71	37.47	-11.12	26.35	46	-19.65	PK
		333.61	34.62	-8.86	25.76	46	-20.24	PK
		481.05	33.14	-5.15	27.99	46	-18.01	PK
Vertical		31.94	37.23	-12.47	24.76	40	-15.24	PK
		192.96	33.48	-13.36	20.12	43.5	-23.38	PK
		232.73	33.93	-12.4	21.53	46	-24.47	PK
		296.75	35.65	-10.08	25.57	46	-20.43	PK
		398.6	33.45	-7.06	26.39	46	-19.61	PK
		527.61	33.19	-3.78	29.41	46	-16.59	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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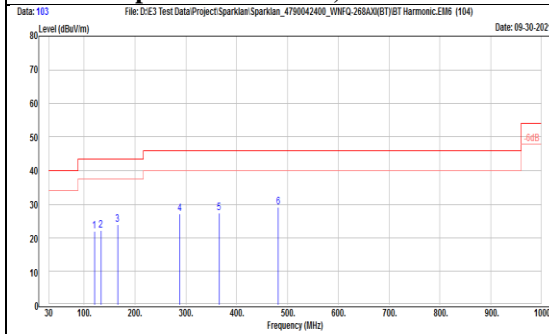
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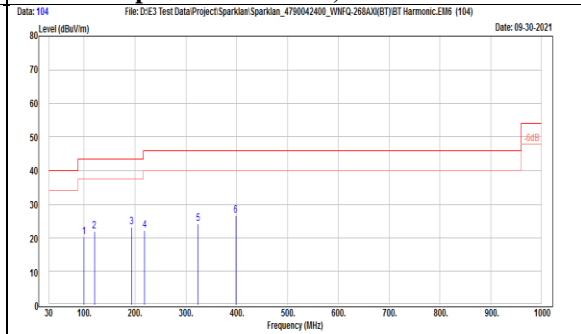
Mode	WLAN 2.4GHz + WLAN 5GHz	Channel	Ch6 + Ch149
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Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		120.21	36.29	-14.3	21.99	43.5	-21.51	PK
		132.82	35.08	-12.93	22.15	43.5	-21.35	PK
		165.8	35.18	-11.13	24.05	43.5	-19.45	PK
		288.02	37.59	-10.34	27.25	46	-18.75	PK
		365.62	35.27	-7.98	27.29	46	-18.71	PK
		482.02	34.18	-5.1	29.08	46	-16.92	PK
Vertical		99.84	36.71	-16.45	20.26	43.5	-23.24	PK
		120.21	36.3	-14.3	22	43.5	-21.5	PK
		192.96	36.68	-13.36	23.32	43.5	-20.18	PK
		219.15	35.54	-13.34	22.2	46	-23.8	PK
		323.91	33.33	-9.18	24.15	46	-21.85	PK
		398.6	33.81	-7.06	26.75	46	-19.25	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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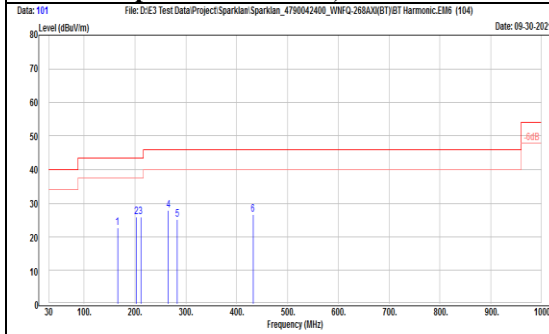
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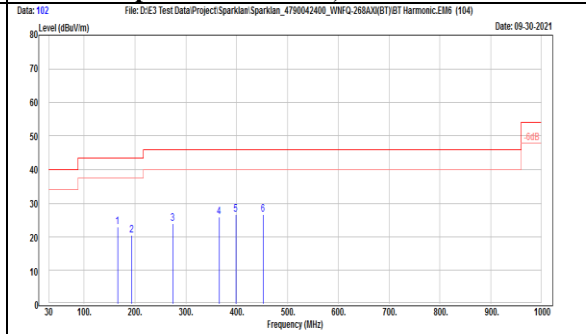
Mode	WLAN 2.4GHz + WLAN 6GHz	Channel	Ch6 + Ch233
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Polarization	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Horizontal		165.8	33.77	-11.13	22.64	43.5	-20.86	PK
		202.66	39.97	-13.94	26.03	43.5	-17.47	PK
		211.39	39.61	-13.61	26	43.5	-17.5	PK
		265.71	39.01	-11.12	27.89	46	-18.11	PK
		283.17	35.58	-10.47	25.11	46	-20.89	PK
		432.55	32.9	-6.18	26.72	46	-19.28	PK
Vertical		165.8	34.04	-11.13	22.91	43.5	-20.59	PK
		192.96	33.76	-13.36	20.4	43.5	-23.1	PK
		274.44	34.77	-10.81	23.96	46	-22.04	PK
		365.62	34.01	-7.98	26.03	46	-19.97	PK
		398.6	33.84	-7.06	26.78	46	-19.22	PK
		451.95	32.22	-5.56	26.66	46	-19.34	PK

Radiated Spurious Emission, Horizontal



Radiated Spurious Emission, Vertical



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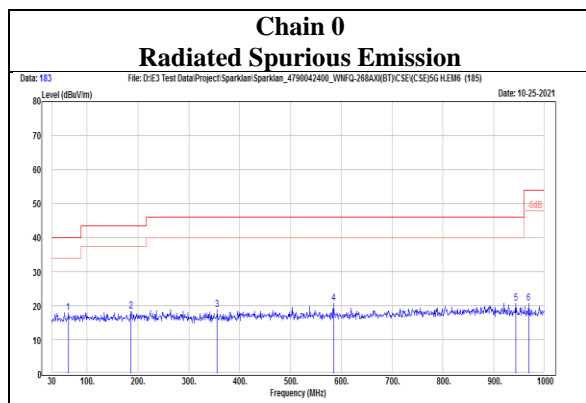
Doc No: 17-EM-F0876 / 6.0



Conducted method

Mode	Bluetooth + WLAN 5GHz	Channel	Ch78 + Ch149
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TX Chain	Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
Chain 0		62.98	24.93	-7.04	17.89	40	-22.11	PK
		186.17	25.44	-7.04	18.4	43.5	-25.1	PK
		355.92	25.78	-7.04	18.74	46	-27.26	PK
		584.84	27.76	-7.04	20.72	46	-25.28	PK
		943.74	27.8	-7.04	20.76	46	-25.24	PK
		968.96	27.64	-7.04	20.6	54	-33.4	PK



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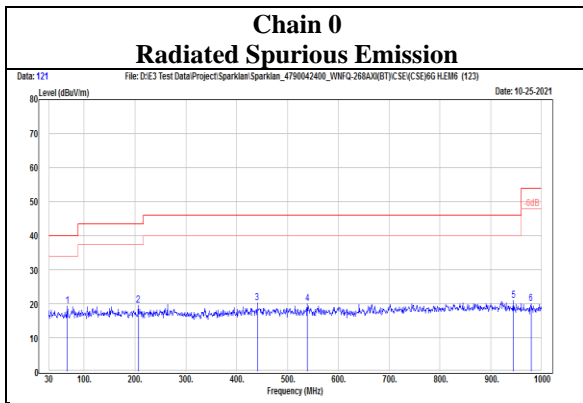
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Mode	Bluetooth + WLAN 6GHz	Channel	Ch78 + Ch233
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TX Chain	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Chain 0		66.86	26.35	-7.04	19.31	40	-20.69	PK
		206.54	26.65	-7.04	19.61	43.5	-23.89	PK
		440.31	27.38	-7.04	20.34	46	-25.66	PK
		539.25	27.14	-7.04	20.1	46	-25.9	PK
		944.71	28.06	-7.04	21.02	46	-24.98	PK
		979.63	26.99	-7.04	19.95	54	-34.05	PK



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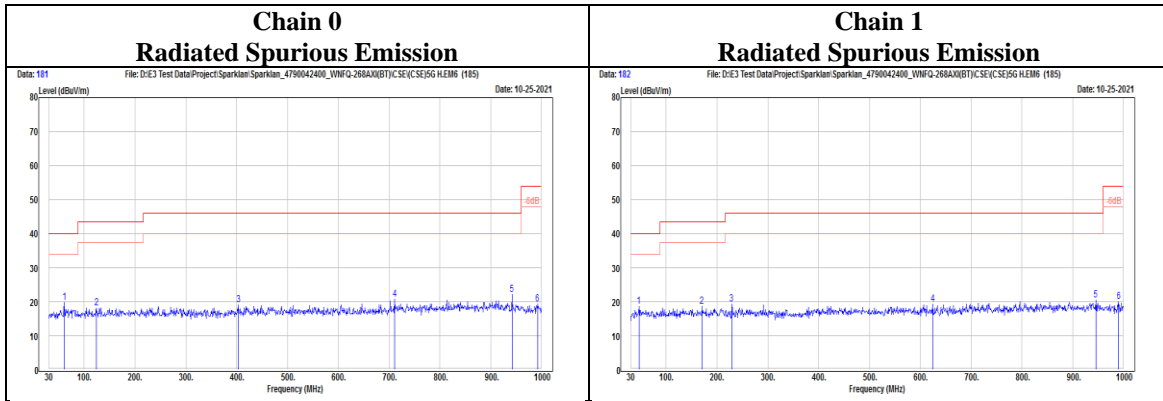
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Mode	WLAN 2.4GHz + WLAN 5GHz	Channel	Ch6 + Ch149
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TX Chain	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Chain 0		61.04	26.9	-7.04	19.86	40	-20.14	PK
		124.09	25.29	-7.04	18.25	43.5	-25.25	PK
		403.45	26.22	-7.04	19.18	46	-26.82	PK
		710.94	27.63	-7.04	20.59	46	-25.41	PK
		941.8	29.08	-7.04	22.04	46	-23.96	PK
		992.24	26.33	-7.04	19.29	54	-34.71	PK
Chain 1		46.49	25.58	-7.04	18.54	40	-21.46	PK
		170.65	25.56	-7.04	18.52	43.5	-24.98	PK
		228.85	26.27	-7.04	19.23	46	-26.77	PK
		624.61	26.43	-7.04	19.39	46	-26.61	PK
		945.68	27.53	-7.04	20.49	46	-25.51	PK
		990.3	27.12	-7.04	20.08	54	-33.92	PK



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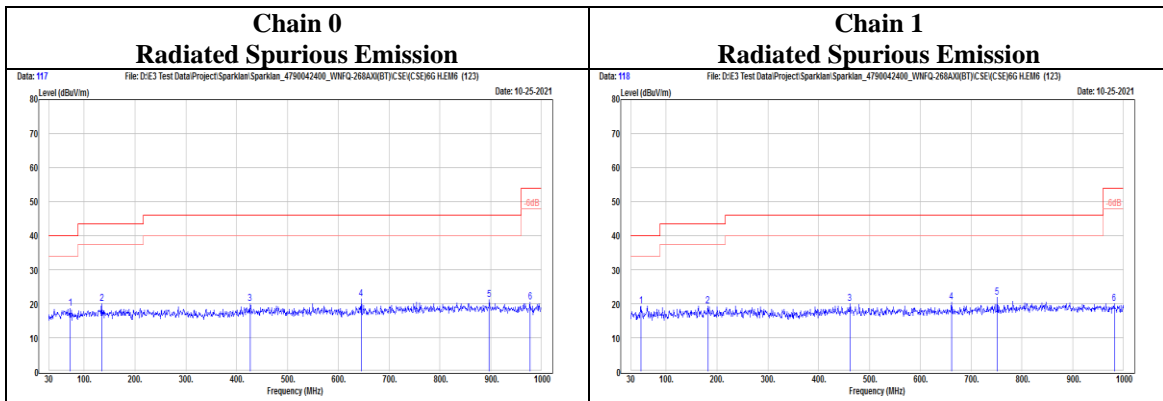
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Mode	WLAN 2.4GHz + WLAN 6GHz	Channel	Ch6 + Ch233
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TX Chain	Notation	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
Chain 0		72.68	25.71	-7.04	18.67	40	-21.33	PK
		134.76	27.02	-7.04	19.98	43.5	-23.52	PK
		426.73	26.95	-7.04	19.91	46	-26.09	PK
		644.98	28.47	-7.04	21.43	46	-24.57	PK
		897.18	28.15	-7.04	21.11	46	-24.89	PK
		977.69	27.61	-7.04	20.57	54	-33.43	PK
Chain 1		50.37	26.31	-7.04	19.27	40	-20.73	PK
		182.29	26.31	-7.04	19.27	43.5	-24.23	PK
		461.65	27.05	-7.04	20.01	46	-25.99	PK
		661.47	27.42	-7.04	20.38	46	-25.62	PK
		751.68	28.85	-7.04	21.81	46	-24.19	PK
		981.57	27.15	-7.04	20.11	54	-33.89	PK



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9.2. AC Power Line Conducted Emission

Requirements

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
2. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
3. Test data of Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
4. Test data of Margin(dB) = Result value (dBuV) - Limit value (dBuV).
5. Test data of Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).

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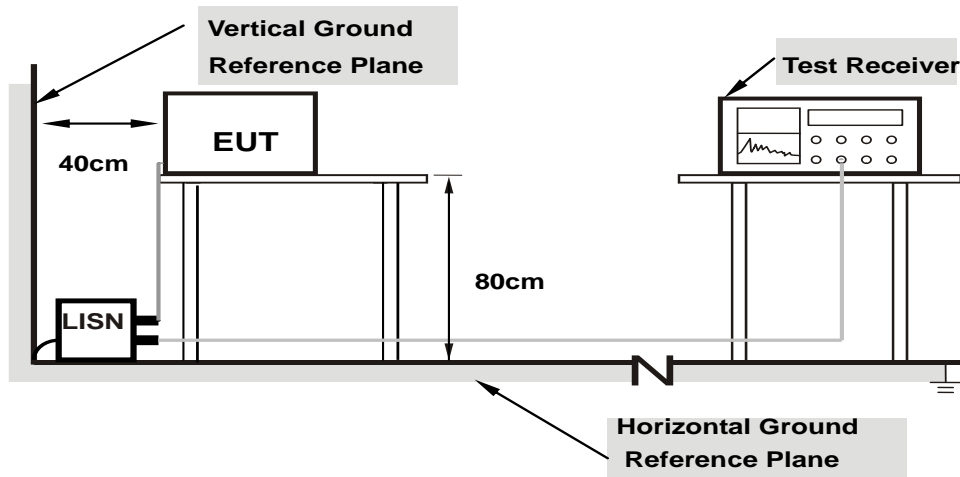
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Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the Setup Configurations.

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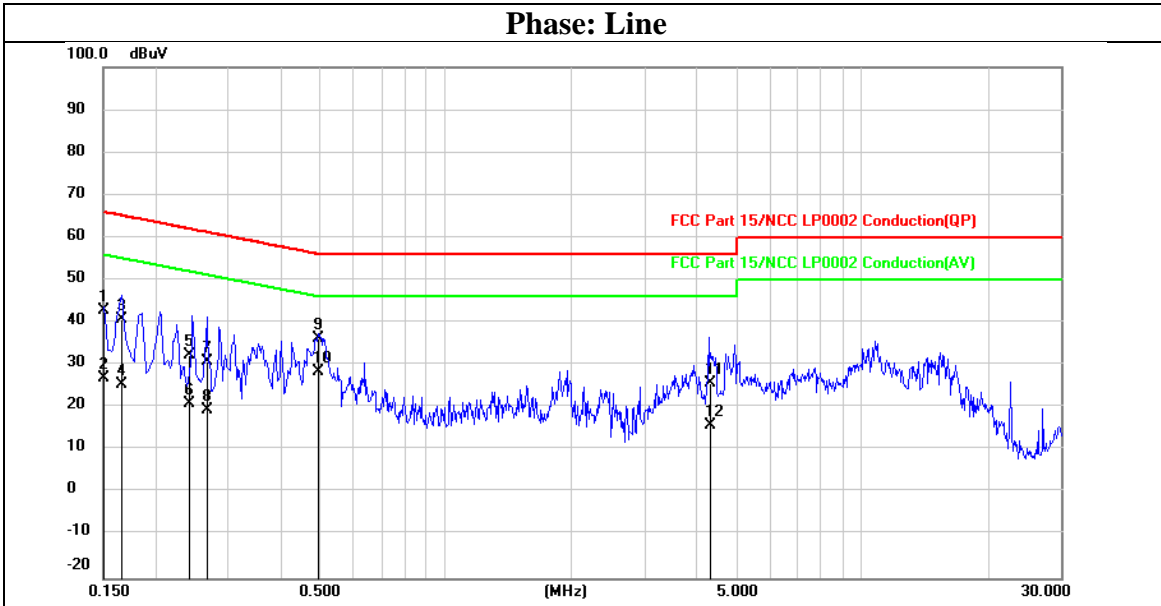
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Test Data

Mode	Bluetooth + WLAN 5GHz	Channel	Ch78 + Ch149
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1507	42.91	0.08	42.99	65.96	-22.97	QP
2	0.1507	26.80	0.08	26.88	55.96	-29.08	AVG
3	0.1655	40.59	0.08	40.67	65.18	-24.51	QP
4	0.1655	25.33	0.08	25.41	55.18	-29.77	AVG
5	0.2414	32.17	0.08	32.25	62.05	-29.80	QP
6	0.2414	20.97	0.08	21.05	52.05	-31.00	AVG
7	0.2648	30.78	0.08	30.86	61.28	-30.42	QP
8	0.2648	19.44	0.08	19.52	51.28	-31.76	AVG
9	0.4914	36.30	0.09	36.39	56.14	-19.75	QP
10	0.4914	28.33	0.09	28.42	46.14	-17.72	AVG
11	4.3082	25.67	0.21	25.88	56.00	-30.12	QP
12	4.3082	15.65	0.21	15.86	46.00	-30.14	AVG

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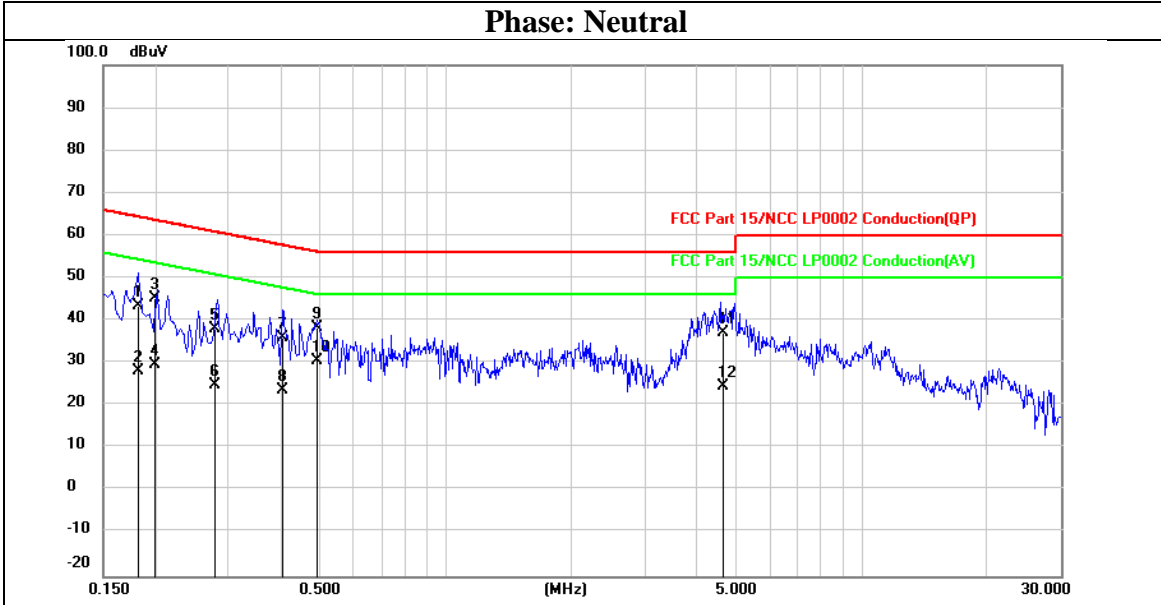
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Mode	Bluetooth + WLAN 5GHz	Channel	Ch78 + Ch149
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1817	43.38	0.07	43.45	64.41	-20.96	QP
2	0.1817	28.10	0.07	28.17	54.41	-26.24	AVG
3	0.1988	45.17	0.07	45.24	63.66	-18.42	QP
4	0.1988	29.61	0.07	29.68	53.66	-23.98	AVG
5	0.2779	38.00	0.07	38.07	60.88	-22.81	QP
6	0.2779	24.83	0.07	24.90	50.88	-25.98	AVG
7	0.4044	35.86	0.08	35.94	57.76	-21.82	QP
8	0.4044	23.54	0.08	23.62	47.76	-24.14	AVG
9	0.4865	38.28	0.08	38.36	56.23	-17.87	QP
10	0.4865	30.57	0.08	30.65	46.23	-15.58	AVG
11	4.6265	36.93	0.21	37.14	56.00	-18.86	QP
12	4.6265	24.43	0.21	24.64	46.00	-21.36	AVG

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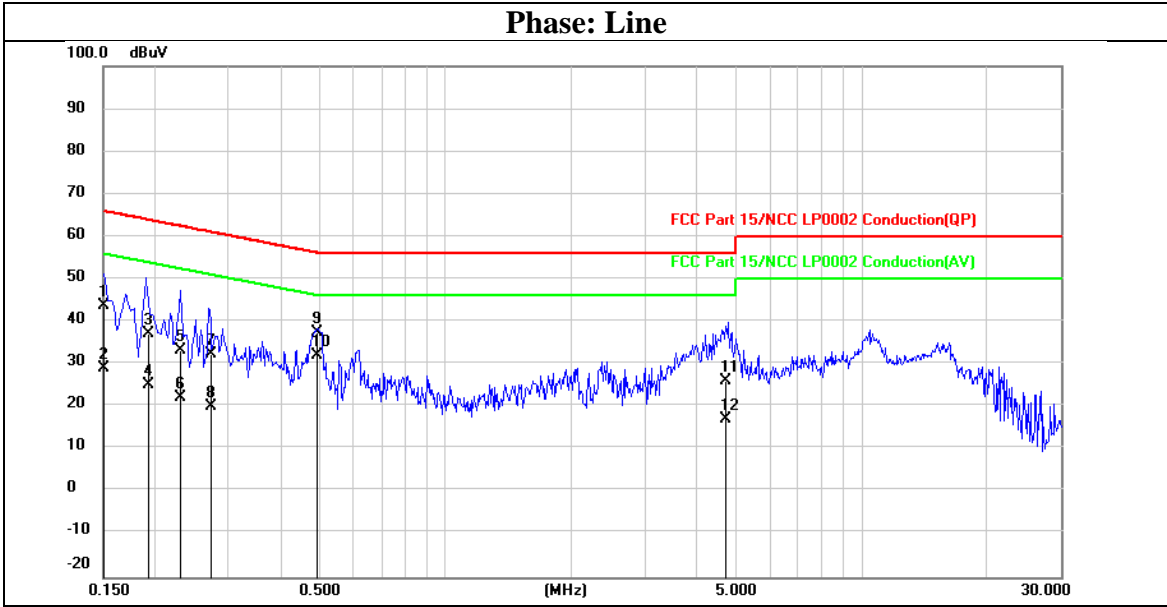
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Mode Bluetooth + WLAN 6GHz Channel Ch78 + Ch233



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1504	43.70	0.08	43.78	65.98	-22.20	QP
2	0.1504	29.03	0.08	29.11	55.98	-26.87	AVG
3	0.1932	37.04	0.08	37.12	63.90	-26.78	QP
4	0.1932	25.01	0.08	25.09	53.90	-28.81	AVG
5	0.2297	33.08	0.08	33.16	62.46	-29.30	QP
6	0.2297	22.03	0.08	22.11	52.46	-30.35	AVG
7	0.2730	32.29	0.08	32.37	61.03	-28.66	QP
8	0.2730	19.89	0.08	19.97	51.03	-31.06	AVG
9	0.4920	37.31	0.09	37.40	56.13	-18.73	QP
10	0.4920	31.84	0.09	31.93	46.13	-14.20	AVG
11	4.6969	25.90	0.22	26.12	56.00	-29.88	QP
12	4.6969	16.89	0.22	17.11	46.00	-28.89	AVG

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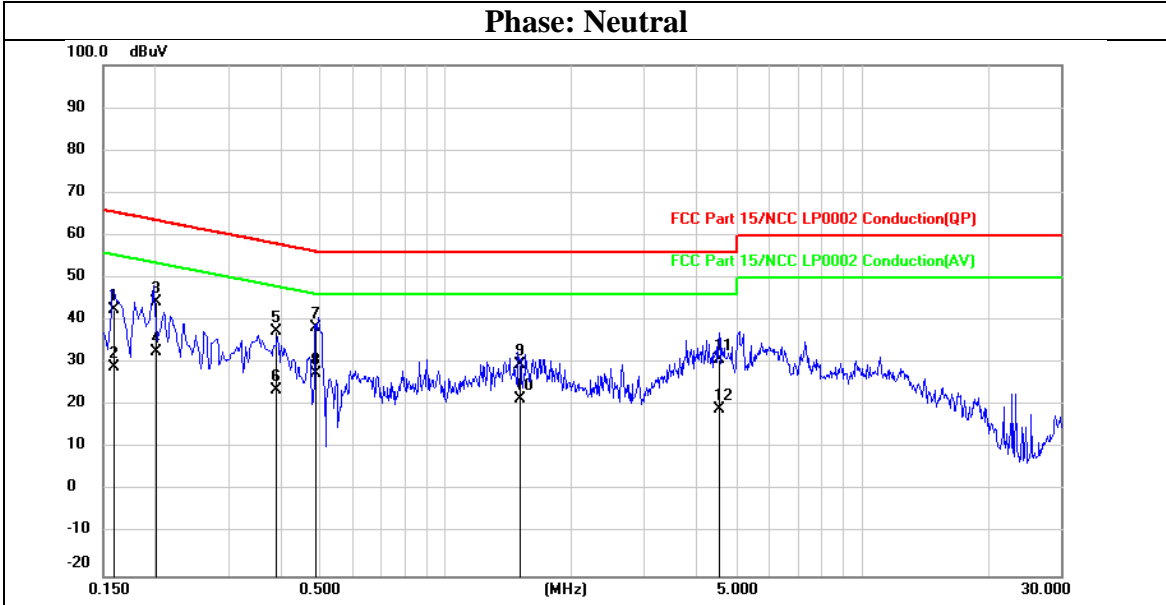
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Mode	Bluetooth + WLAN 6GHz	Channel	Ch78 + Ch233
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1596	42.62	0.06	42.68	65.48	-22.80	QP
2	0.1596	29.04	0.06	29.10	55.48	-26.38	AVG
3	0.2007	44.34	0.07	44.41	63.58	-19.17	QP
4	0.2007	32.61	0.07	32.68	53.58	-20.90	AVG
5	0.3911	37.31	0.08	37.39	58.04	-20.65	QP
6	0.3911	23.47	0.08	23.55	48.04	-24.49	AVG
7	0.4892	38.29	0.08	38.37	56.18	-17.81	QP
8	0.4892	27.42	0.08	27.50	46.18	-18.68	AVG
9	1.5058	29.52	0.12	29.64	56.00	-26.36	QP
10	1.5058	21.38	0.12	21.50	46.00	-24.50	AVG
11	4.5361	30.79	0.20	30.99	56.00	-25.01	QP
12	4.5361	19.03	0.20	19.23	46.00	-26.77	AVG

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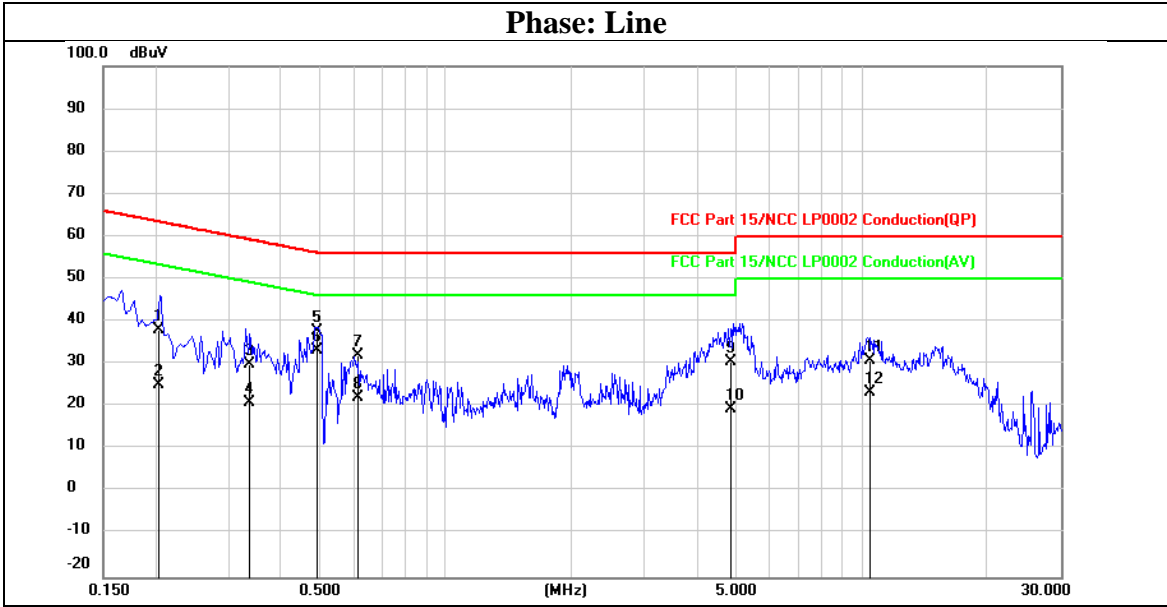
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Mode **WLAN 2.4GHz + WLAN 5GHz** Channel **Ch6 + Ch149**



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2034	38.08	0.08	38.16	63.47	-25.31	QP
2	0.2034	25.09	0.08	25.17	53.47	-28.30	AVG
3	0.3345	29.84	0.09	29.93	59.34	-29.41	QP
4	0.3345	20.79	0.09	20.88	49.34	-28.46	AVG
5	0.4889	37.72	0.09	37.81	56.19	-18.38	QP
6	0.4889	33.30	0.09	33.39	46.19	-12.80	AVG
7	0.6171	32.04	0.09	32.13	56.00	-23.87	QP
8	0.6171	22.13	0.09	22.22	46.00	-23.78	AVG
9	4.8616	30.36	0.23	30.59	56.00	-25.41	QP
10	4.8616	19.08	0.23	19.31	46.00	-26.69	AVG
11	10.4188	30.49	0.38	30.87	60.00	-29.13	QP
12	10.4188	23.00	0.38	23.38	50.00	-26.62	AVG

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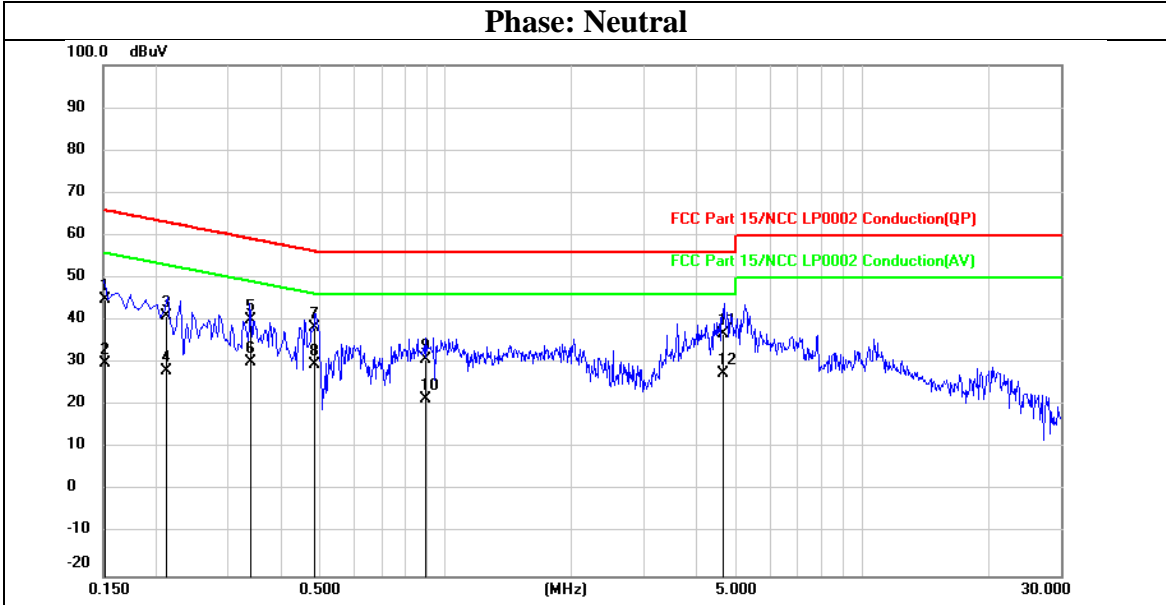
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Mode	WLAN 2.4GHz + WLAN 5GHz	Channel	Ch6 + Ch149
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1518	45.02	0.06	45.08	65.90	-20.82	QP
2	0.1518	29.82	0.06	29.88	55.90	-26.02	AVG
3	0.2122	40.92	0.07	40.99	63.12	-22.13	QP
4	0.2122	28.07	0.07	28.14	53.12	-24.98	AVG
5	0.3403	39.99	0.08	40.07	59.20	-19.13	QP
6	0.3403	30.03	0.08	30.11	49.20	-19.09	AVG
7	0.4819	38.20	0.08	38.28	56.31	-18.03	QP
8	0.4819	29.66	0.08	29.74	46.31	-16.57	AVG
9	0.8958	30.89	0.10	30.99	56.00	-25.01	QP
10	0.8958	21.34	0.10	21.44	46.00	-24.56	AVG
11	4.6162	36.77	0.21	36.98	56.00	-19.02	QP
12	4.6162	27.22	0.21	27.43	46.00	-18.57	AVG

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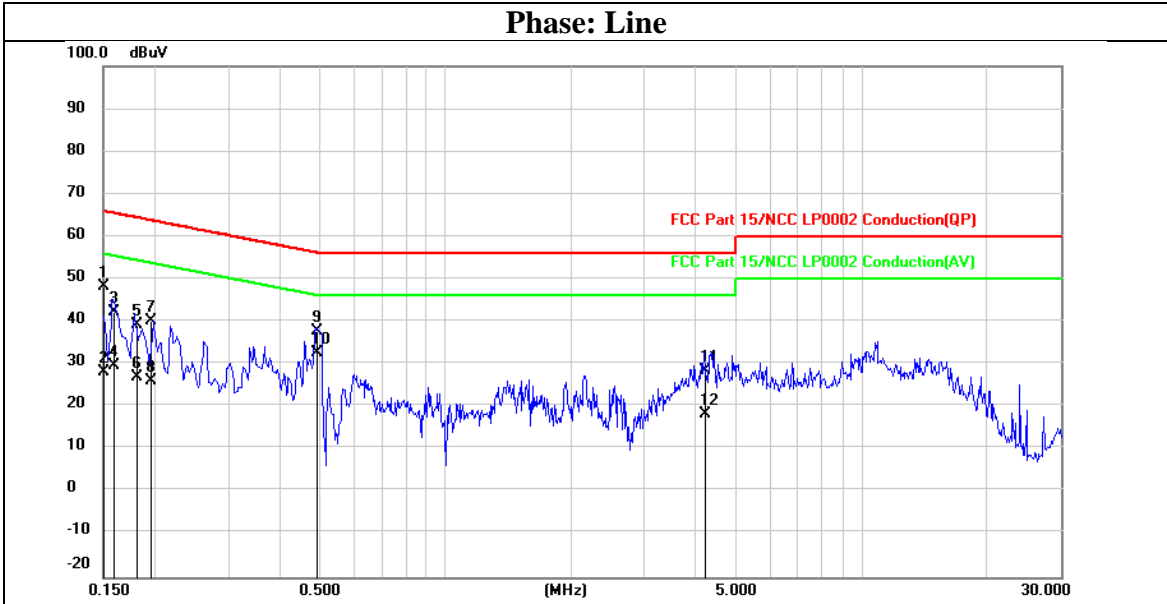
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Mode **WLAN 2.4GHz + WLAN 6GHz** Channel **Ch6 + Ch233**



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1510	48.29	0.08	48.37	65.94	-17.57	QP
2	0.1510	28.02	0.08	28.10	55.94	-27.84	AVG
3	0.1594	42.04	0.08	42.12	65.50	-23.38	QP
4	0.1594	29.44	0.08	29.52	55.50	-25.98	AVG
5	0.1810	39.11	0.08	39.19	64.44	-25.25	QP
6	0.1810	26.76	0.08	26.84	54.44	-27.60	AVG
7	0.1946	40.21	0.08	40.29	63.84	-23.55	QP
8	0.1946	25.84	0.08	25.92	53.84	-27.92	AVG
9	0.4888	37.54	0.09	37.63	56.19	-18.56	QP
10	0.4888	32.67	0.09	32.76	46.19	-13.43	AVG
11	4.1869	28.34	0.20	28.54	56.00	-27.46	QP
12	4.1869	18.14	0.20	18.34	46.00	-27.66	AVG

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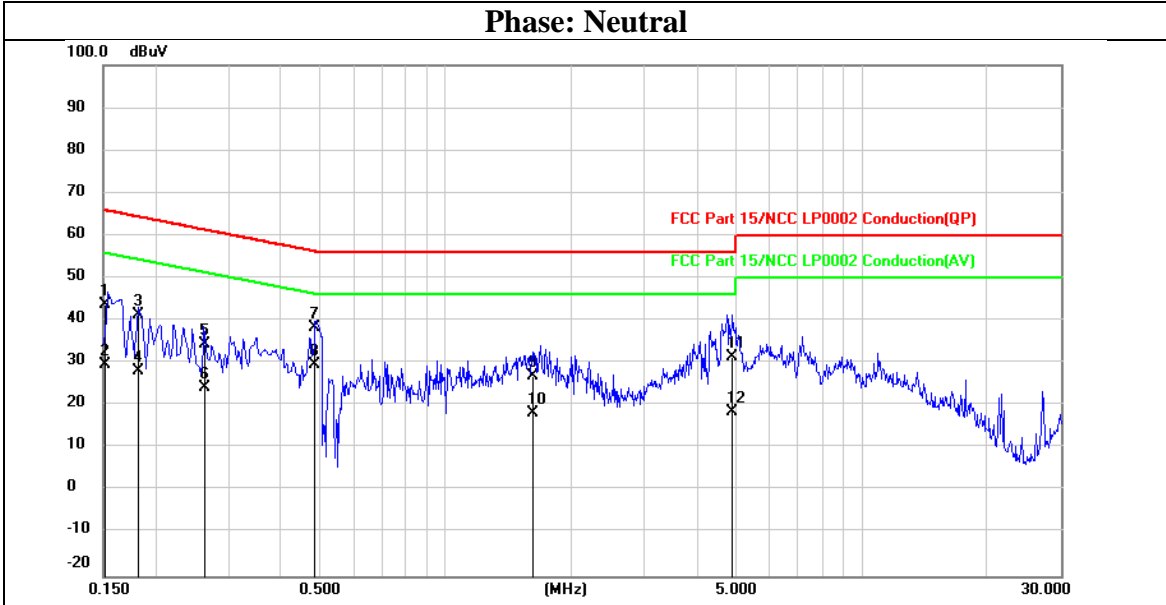
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Mode	WLAN 2.4GHz + WLAN 6GHz	Channel	Ch6 + Ch233
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1512	43.77	0.06	43.83	65.93	-22.10	QP
2	0.1512	29.67	0.06	29.73	55.93	-26.20	AVG
3	0.1808	41.36	0.07	41.43	64.45	-23.02	QP
4	0.1808	27.96	0.07	28.03	54.45	-26.42	AVG
5	0.2637	34.31	0.07	34.38	61.31	-26.93	QP
6	0.2637	24.23	0.07	24.30	51.31	-27.01	AVG
7	0.4860	38.38	0.08	38.46	56.24	-17.78	QP
8	0.4860	29.69	0.08	29.77	46.24	-16.47	AVG
9	1.6154	26.83	0.12	26.95	56.00	-29.05	QP
10	1.6154	18.16	0.12	18.28	46.00	-27.72	AVG
11	4.8435	31.15	0.22	31.37	56.00	-24.63	QP
12	4.8435	18.36	0.22	18.58	46.00	-27.42	AVG

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