FCC Test Report

Report No: WD-RF-R-230056-E0

Product Name	**:**	R230 5MP Microdome Camera
Model Name	**:**	R230
Series Model Name	**:**	R230-XXXXX (XXXXX = 128GB, 256GB, 512GB, 1TB, space or blank)
FCC ID	**:**	2AZ3JR230
Applicant	**:**	Rhombus Systems, Inc
Received Date	**:**	Oct. 05, 2022
Tested Date	**:**	Mar. 20, 2023 ~ Apr. 14, 2023
Applicable Standard	**:**	47 CFR FCC Part 15, Subpart C (Section 15.31) 47 CFR FCC Part 2, Subpart J (Section 2.947(f)) ANSI C63.10 : 2013

Testing Laboratory
2965

Wendell Industrial Co., Ltd
Wendell EMC & RF Laboratory

Test Report

Issued Date: April 14, 2023

Project No.: 22Q080501

Product Name	R230 5MP Microdome Camera
Trade Name	rhombus systems
Model Name	R230
Series Model Name	R230-XXXXX (XXXXX = 128GB, 256GB, 512GB, 1TB, space or blank)
FCC ID	2AZ3JR230
Applicant	Rhombus Systems, Inc
Manufacturer	Dynacolor Inc.
EUT Rated Voltage	POE 42.5V ~ 57V
EUT Test Voltage	AC Conduction：AC 120V / 60Hz、RSE：POE 48V
EUT Supports Radios Application	WLAN 802.11a/b/g WLAN 802.11n (HT20/HT40) WLAN 802.11ac (VHT20/VHT40/VHT80) Bluetooth BR/EDR/LE
Applicable Standard	47 CFR FCC Part 15, Subpart C (Section 15.31) 47 CFR FCC Part 2, Subpart J (Section 2.947(f)) ANSI C63.10 : 2013
Test Result	Complied

Documented : Emma Lu

(Specialist / Emma Lu)

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Approved : Gary Wu

(Project Manager / Gary Wu)

Table of Contents

Document Revision History

Report No.	Issue date	Description
WD-RF-R-230056-E0	April 14, 2023	Initial report

Summary of Test Result

Ref. Std. Clause	Test Items	Result
15.247(d)	Radiated Spurious Emission	Pass
15.207	AC Conducted Emission	Pass

1 Generation Information

1.1 Applicant

Rhombus Systems, Inc
1920 20th Street Sacramento, CA 95811

1.2 Manufacturer

Dynacolor Inc.
9F., No.209, Nanyang St., Xizhi Dist., New Taipei City 221, Taiwan

1.3 Description of Equipment under Test

Product Name	R230 5MP Microdome Camera
Model No.	R230
Series Model Name	R230-XXXXX (XXXXX = 128GB, 256GB, 512GB, 1TB, space or blank)
Model Difference	Secure Digital Memory Card specifications are different.
FCC ID	2AZ3JR230
Frequency Range	802.11b/g/n-20MHz: 2412~2462MHz Bluetooth: 2402-2480MHz
Data Rate	802.11b: 1-11Mbps 802.11g: 6-54Mbps 802.11n: up to 72.2Mbps
Type of Modulation	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) Bluetooth: GFSK(1Mbps) /π/4DQPSK(2Mbps) / 8DPSK(3Mbps)
Antenna Information	Refer to the table “Antenna List”
EUT Supports Radios Application	WLAN 802.11a/b/g WLAN 802.11n (HT20/HT40) WLAN 802.11ac (VHT20/VHT40/VHT80) Bluetooth BR/EDR/LE
EUT Rated Voltage	POE 42.5V ~ 57V
EUT Test Voltage	AC Conduction：AC 120V / 60Hz、RSE：POE 48V

Antenna List

No.	Manufacturer	Model No.	Antenna Type	Peak Gain
1	INPAQ Technology Co.,Ltd.	RFMTA341200NNLB004	Metal Stamping Antenna	1.47 dBi for 2.4GHz

1.4 Test Mode Applicability

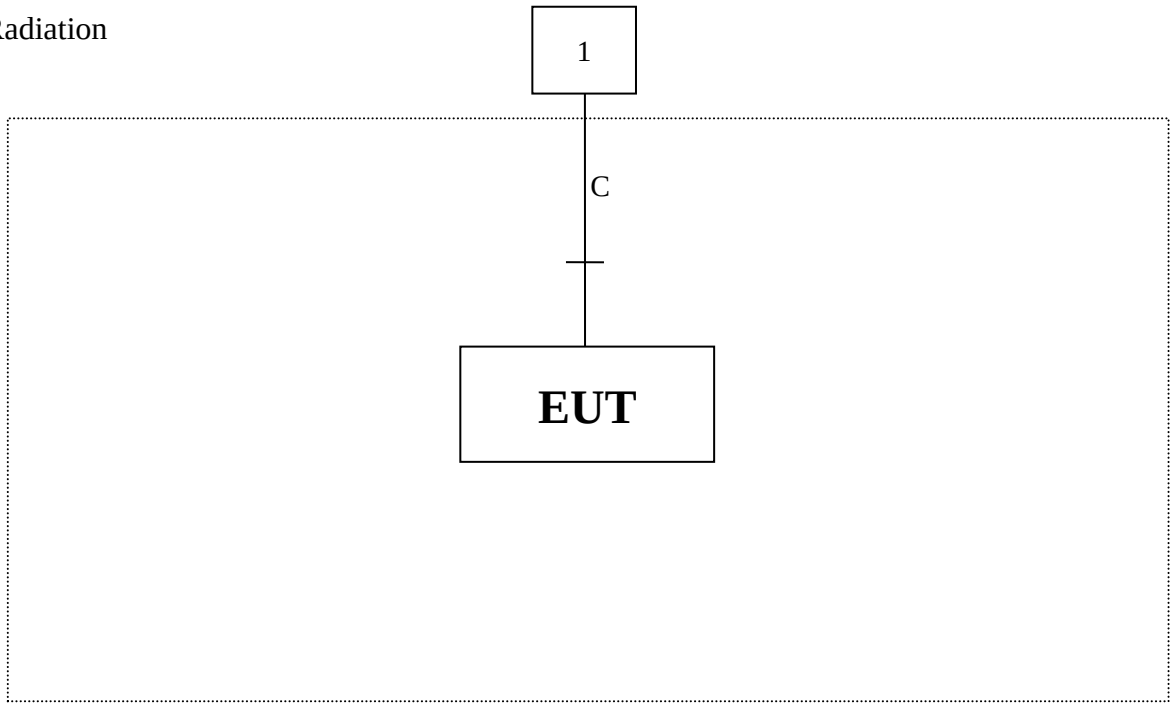
1. These tests were performed on equipment samples to demonstrate compliance with the 15.31(k) chapter simultaneous launch requirements.
2. Select the combination of the highest power transmission mode, only the worst case is shown in the report.
3. The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report.

Test Mode

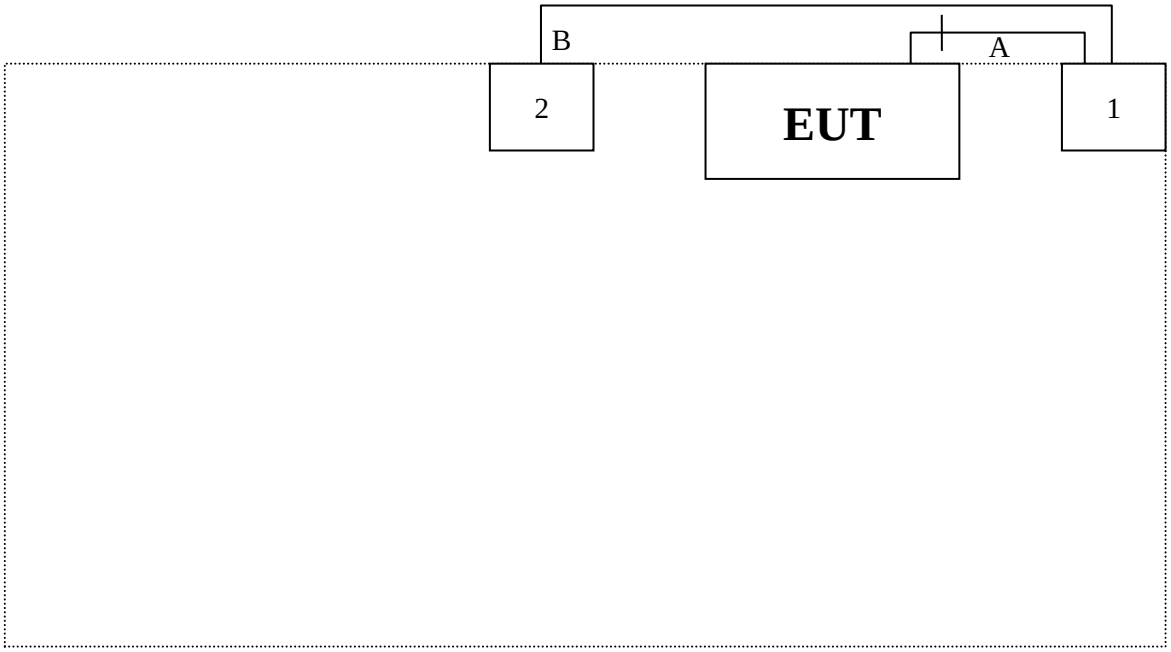
Mode 1: Bluetooth BT + WIFI 2.4GHz

1.5 Configuration of Tested System

Radiation



AC Conduction



1.6 EUT Exercise Software

1. Setup the EUT as shown in Section 1.6
2. Configure the test mode, the test channel, and the data rate.
3. Press “OK” to start the continuous transmit.
4. Verify that the EUT works properly.

1.7 Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

No.	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	POE	Microsemi	PD-9501GR/AC	N/A	N/A
2	Notebook PC	acer	N16Q1	NXVF4TA023742254147600	N/A

No.	Signal Cable Type	Signal cable Description
A	LAN Cable	Non-shielded, Non-Core, 1.5m
B	LAN Cable	Non-shielded, Non-Core, 1.6m

1.8 Test Facility

Items	Required (IEC 60068-1)
Temperature (°C)	15-35
Humidity (% RH)	25-75
Barometric pressure (mbar)	860-1060

Description: Accredited by TAF
Accredited Number: 2965

Issued by: Wendell Industrial Co., Ltd

Lab Address: 6F/6F-1, No.188, Baoqiao Rd., Xindian Dist.,
New Taipei City 23145, Taiwan R.O.C

Test Lab: Wendell EMC & RF Laboratory

Test Location: No.67-9, Shimen Rd., Tucheng Dist.,
New Taipei City 236, Taiwan R.O.C

Designation Number: TW0025

Test Firm Registration Number: 665221

1.9 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence (level based on a coverage factor K=2)

Measurement Project	Condition	Expended Uncertainty
AC Conducted Emission	0.150 ~ 30 MHz	± 2.64 dB
Radiated Emission	0.009 ~ 30 MHz	± 3.7 dB
	30 ~ 1000 MHz	± 3.9 dB
	1000 ~ 18000 MHz	± 4.5 dB
	18000 ~ 40000 MHz	± 4.3 dB
RF Power, Conducted	Conducted Measuring	± 0.75 dB
Occupied Bandwidth	Conducted Measuring	± 2.4 %
Power Density	Conducted Measuring	± 1.2 dB
Duty Cycle and Dwell Time	Conducted Measuring	± 0.9 %
Conducted Unwanted Emission Strength	Conducted Measuring	± 1.4 dB
DC Power Supply	--	± 0.062 ppm
Temperature	--	± 2.0 %
Humidity	--	± 0.55 °C

Note: Please note that the measurement uncertainty are provided for informational purpose only and are not used in determining the Pass/Fail results.

1.10 List of Test Equipment

For AC Conduction measurements / Conducted Room

Equipment		Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
✓	EMI Test Receiver	R&S	ESR3	102309	2022/6/15	2023/6/14
✓	2-Line V-Network LISN	R&S	ENV216	101185	2022/6/20	2023/6/19
✓	LISN	SCHWARZBECK	NSLK 8127RC	05028	2022/6/20	2023/6/19
✓	Transient Limiter	EM Electronics Corporation	EM-7600	857	2022/6/20	2023/6/19
✓	50ohm Cable	EMCI	EMCCFD300-BM-BM-5000	170612	2022/6/17	2023/6/16
✓	50 ohm terminal impedance	HUBER+SUHNER	50 ohm terminal impedance	CT-1-109-1	2022/6/17	2023/6/16

Remark:

1. All equipments are calibrated every one year.
2. The test instruments marked with "✓" are used to measure the final test results.
3. Test Software version: FARAD EZ-EMC Ver.EMC-CON 3A1

For Radiated measurements / 9x6x6 Semi Anechoic Room

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
✓	EMI Receiver	Keysight	N9038A	MY51210173	2022/08/17	2023/08/16
✓	Spectrum Analyzer	Keysight	N9010A	MY52220228	2022/08/16	2023/08/15
✓	Loop Antenna	EMCI	LPA600	277	2022/08/22	2023/08/21
✓	TRILOG super broad Antenna	Schwarzbeck	VULB 9168	VULB 9168-700 & 20E03	2022/08/12	2023/08/11
✓	Horn Antenna	Schwarzbeck	BBHA 9120D	01767	2022/08/24	2023/08/23
✓	Horn Antenna	Schwarzbeck	BBHA 9170	703	2022/08/29	2023/08/28
✓	Pre-Amplifier	EMEC	EMC330	060774	2022/08/17	2023/08/16
✓	Pre-Amplifier	EMEC	EM01G18G	060648	2022/08/18	2023/08/17
✓	Pre-Amplifier	JPT	JPA0118-55-303K	1910001800055003	2022/08/18	2023/08/17
✓	Pre-Amplifier	EMCI	EMC184045SE	980515	2022/08/18	2023/08/17
✓	Cable	EMEC	EM-CB400	105060103	2022/08/18	2023/08/17
✓	Cable	EMEC	EM-CB400	105060102	2022/08/18	2023/08/17
✓	Cable	EMEC	EM-CB400	105060101	2022/08/18	2023/08/17
✓	RF Cable	HUBER+SUHNER	SF102	MY2752/2	2022/08/17	2023/08/16
✓	RF Cable	MVE	280280.LL266.1200	B60028C	2022/08/17	2023/08/16
✓	RF Cable	EMCI	EMC102-KM-KM-600	190646	2022/08/17	2023/08/16
✓	RF Cable	MVE	140140.LL404.700	B90014C	2022/07/28	2023/07/27
✓	RF Cable	MVE	140140.LL404.300	B90006C	2022/08/17	2023/08/16
✓	RF Filter	EMEC	BRF-2400-2500	002	2022/08/17	2023/08/16
✓	RF Filter	EMEC	BRF-5150-5350	104	2022/08/17	2023/08/16
✓	RF Filter	EMEC	BRF-5470-5725	092	2022/08/17	2023/08/16
✓	RF Filter	EMEC	BRF-5725-5875	091	2022/08/17	2023/08/16
✓	RF Filter	EMEC	HPF-2800	002	2022/08/17	2023/08/16
✓	RF Filter	EMEC	HPF-5850	059	2022/08/17	2023/08/16
	SMA Notch Filter	MVE	MFN-902.928.S1	190604001	2022/08/17	2023/08/16

Remark:

1. All equipments are calibrated every one year.

2. The test instruments marked with "✓" are used to measure the final test results.
3. Test Software version: FARAD EZ-EMC Ver.WD-03A1-1

2 Test Result

2.1 Spurious Emission Measurement

2.1.1 Limit

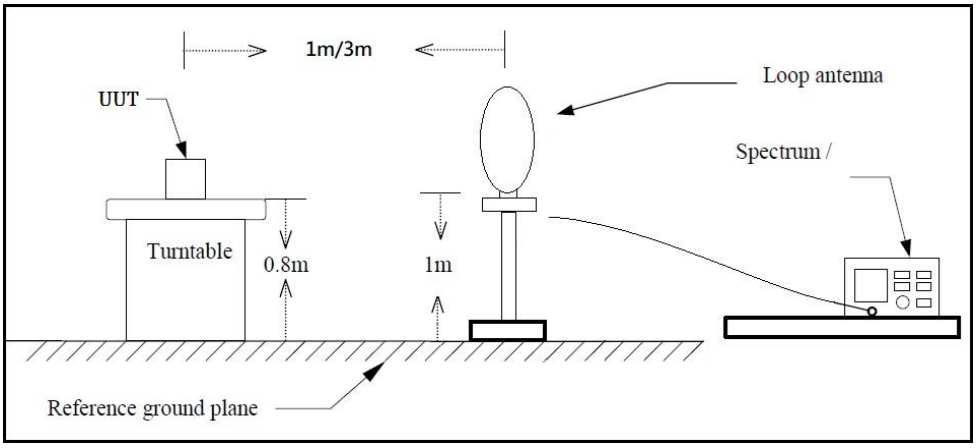
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

Remarks:

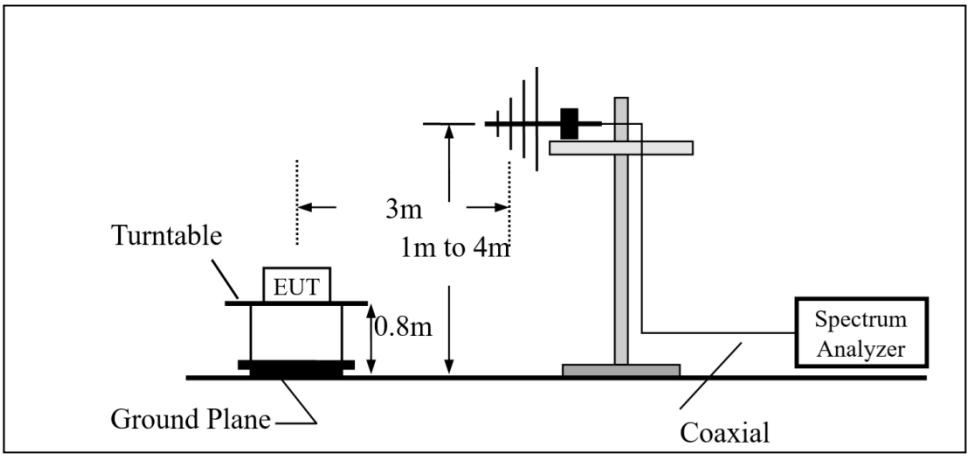
1. RF Voltage (dBuV) = 20 log RF Voltage(uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

2.1.2 Test Setup

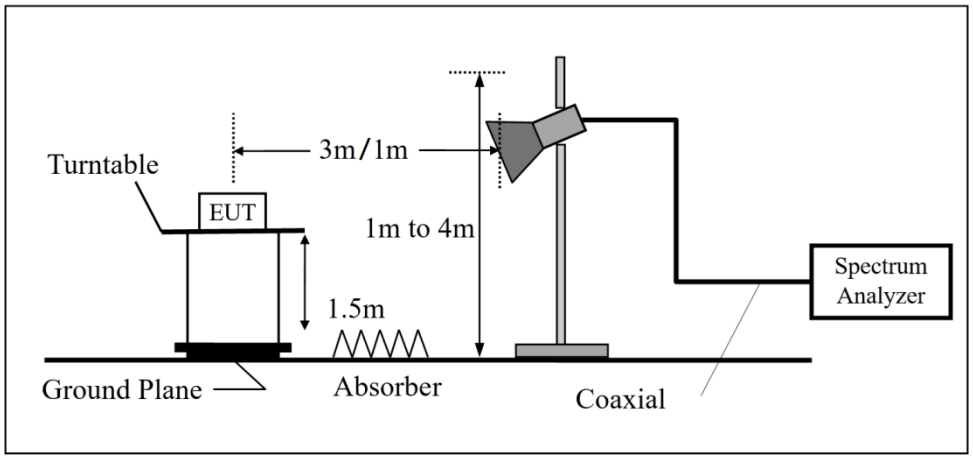
Below 30MHz



30MHz~1GHz



Above 1GHz



2.1.3 Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

For Radiated emission below 30MHz

(1) The EUT was placed on the top of a rotating table 0.8 meters above the ground in a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

(2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

(3) Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

(4) 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.

(5) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

For Radiated emission Above 30MHz

(1) The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for the test. The table was rotated 360 degrees to determine the position of the highest radiation.

(2) The EUT was set 3 meters away from the interference-receiving antenna, the height of the antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength.

(3) Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

(4) 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.

(5) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

(6) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets the average limit, measurement with the average detector is unnecessary.

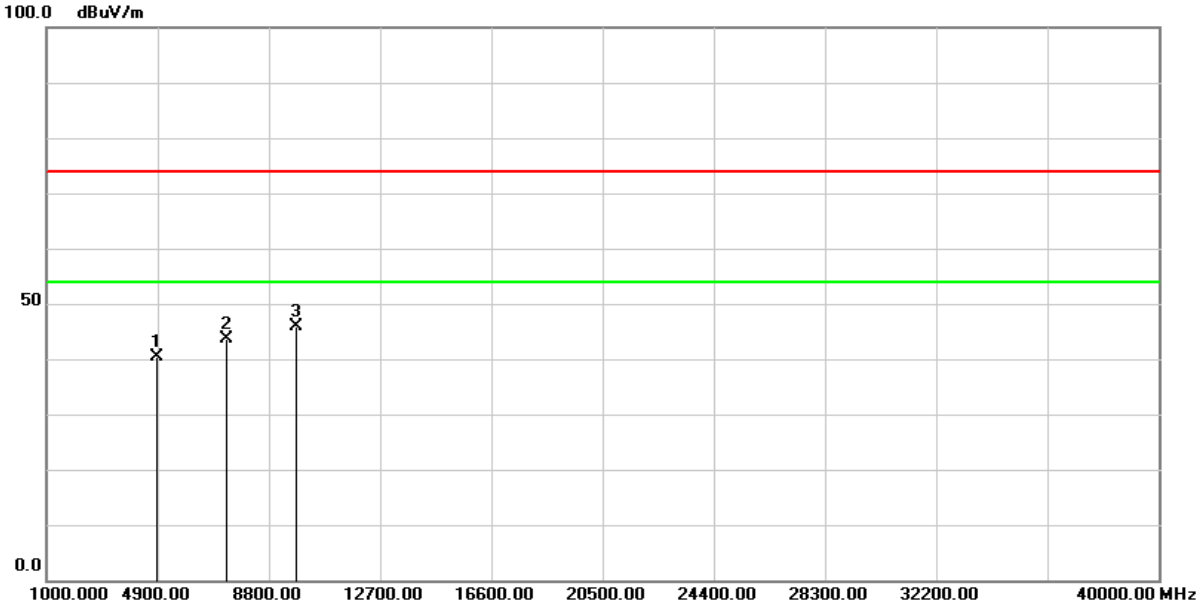
2.1.4 Test Result of Radiated Spurious Emission Measurement

(1) The radiation measurement frequency is 9kHz ~ 30MHz. The interference value of this frequency range is less than the limit value of 20 dB. It is considered that the background noise value is not recorded.

(2) The following table shows the radiation measurement frequency from 30MHz to 26.5G/40GHz, pre-scanning in the X, Y and Z axes. The worst case (X-axis) is documented in this report.

Above 1GHz Data

Test Mode :	Mode 1: Bluetooth BT + WIFI 2.4GHz	Test Date :	2023/03/27
Test Voltage :	AC 120V/60Hz	Temperature :	22.5 °C
Polarization :	Horizontal	Relative Humidity :	61 %

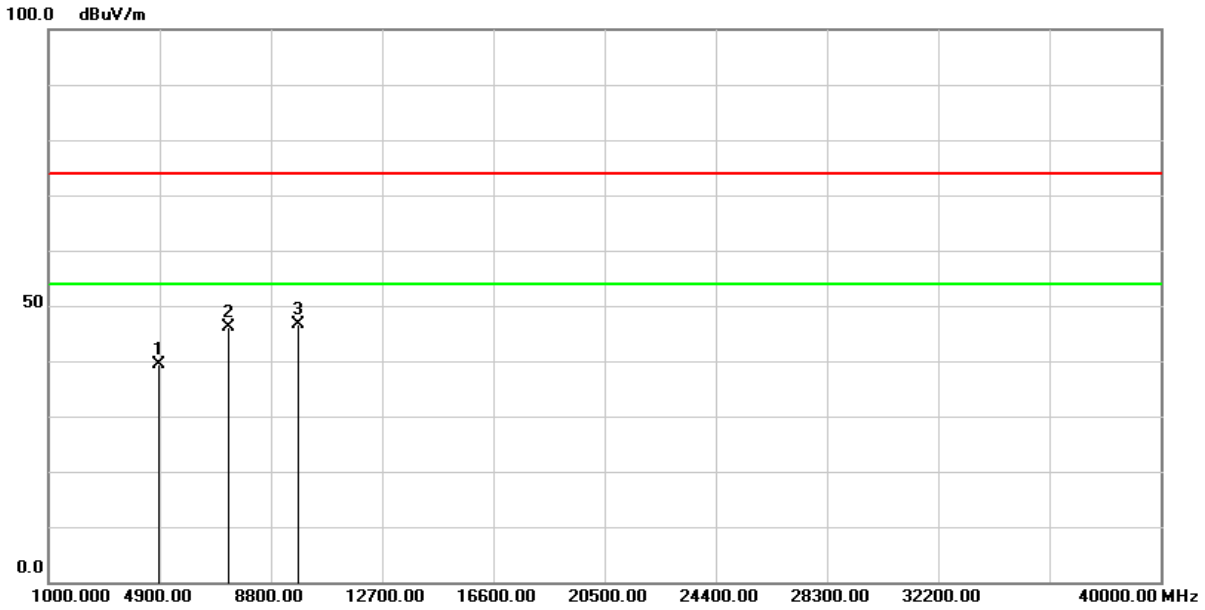


No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4874.000	60.78	-20.41	40.37	74.00	-33.63	peak
2	7311.000	58.05	-14.30	43.75	74.00	-30.25	peak
3	9748.000	56.19	-10.29	45.90	74.00	-28.10	peak

Remark：

1. Correction Factor = Antenna factor + Cable loss – Amplifier gain
2. Result Value = Reading Level + Correct Factor
3. Margin Level = Result Value – Limit Value
4. The other emission levels were very low against the limit

Test Mode :	Mode 1: Bluetooth BT + WIFI 2.4GHz	**Test Date :**	2023/03/27
Test Voltage :	AC 120V/60Hz	**Temperature :**	22.5 ℃
Polarization :	Vertical	**Relative Humidity :**	61 %



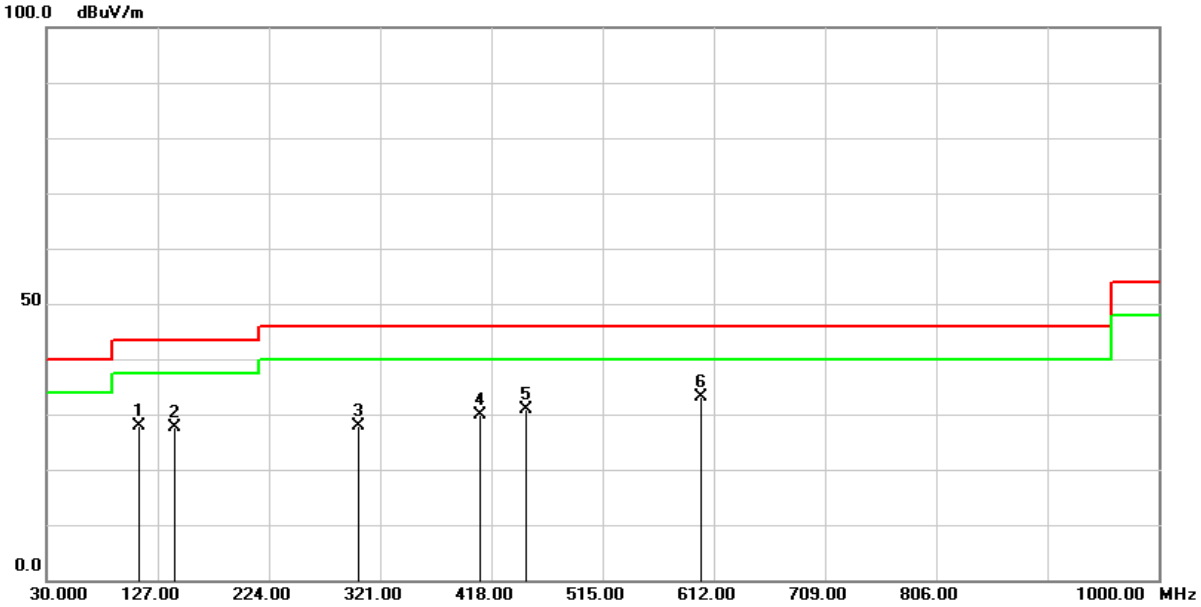
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4874.000	59.78	-20.41	39.37	74.00	-34.63	peak
2	7311.000	60.43	-14.30	46.13	74.00	-27.87	peak
3	9748.000	56.81	-10.29	46.52	74.00	-27.48	peak

Remark：

1. Correction Factor = Antenna factor + Cable loss – Amplifier gain
2. Result Value = Reading Level + Correct Factor
3. Margin Level = Result Value – Limit Value
4. The other emission levels were very low against the limit

Below 1GHz Data

Test Mode :	Mode 1: Bluetooth BT + WIFI 2.4GHz	Test Date :	2023/03/29
Test Voltage :	AC 120V/60Hz	Temperature :	22.5 °C
Polarization :	Horizontal	Relative Humidity :	61 %

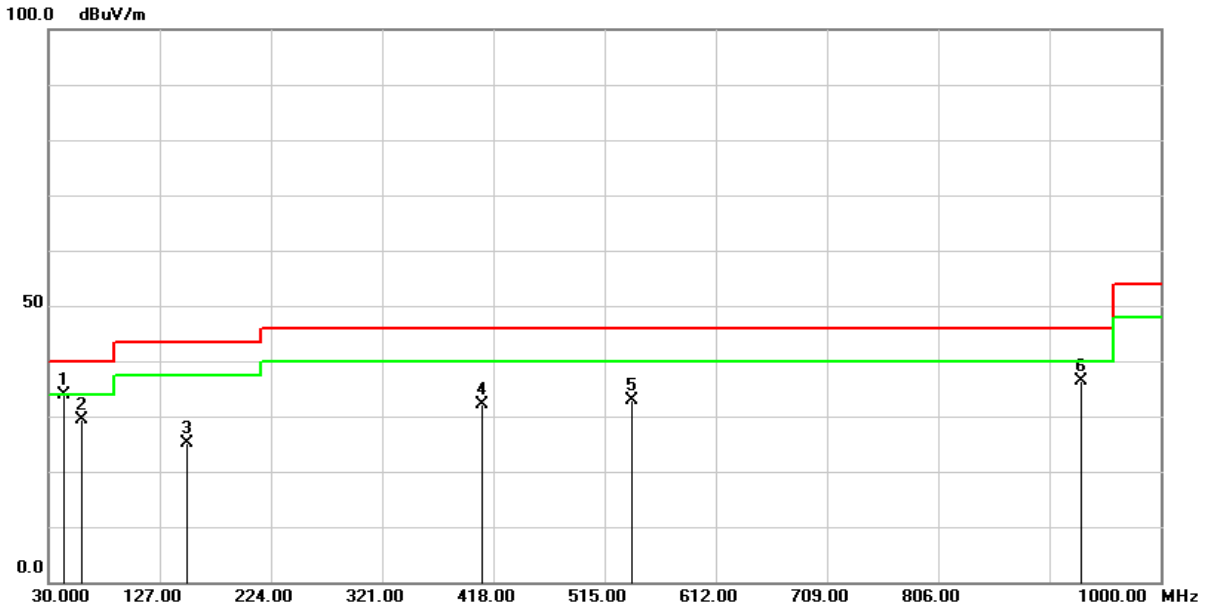


No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	110.5100	42.15	-14.32	27.83	43.50	-15.67	QP
2	141.5500	39.15	-11.48	27.67	43.50	-15.83	QP
3	301.6000	37.95	-10.04	27.91	46.00	-18.09	QP
4	408.3000	36.84	-7.00	29.84	46.00	-16.16	QP
5	448.0700	36.60	-5.66	30.94	46.00	-15.06	QP
6	600.3600	35.20	-2.01	33.19	46.00	-12.81	QP

Remark：

1. Correction Factor = Antenna factor + Cable loss – Amplifier gain
2. Result Value = Reading Level + Correct Factor
3. Margin Level = Result Value – Limit Value
4. The other emission levels were very low against the limit

Test Mode :	Mode 1: Bluetooth BT + WIFI 2.4GHz	Test Date :	2023/03/29
Test Voltage :	AC 120V/60Hz	Temperature :	22.5 °C
Polarization :	Vertical	Relative Humidity :	61 %



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	43.5800	45.34	-11.37	33.97	40.00	-6.03	QP
2	59.1000	41.07	-11.57	29.50	40.00	-10.50	QP
3	151.2500	36.08	-11.00	25.08	43.50	-18.42	QP
4	408.3000	39.07	-7.00	32.07	46.00	-13.93	QP
5	538.2800	36.92	-3.96	32.96	46.00	-13.04	QP
6	931.1300	32.36	3.97	36.33	46.00	-9.67	QP

Remark：

1. Correction Factor = Antenna factor + Cable loss – Amplifier gain
2. Result Value = Reading Level + Correct Factor
3. Margin Level = Result Value – Limit Value
4. The other emission levels were very low against the limit

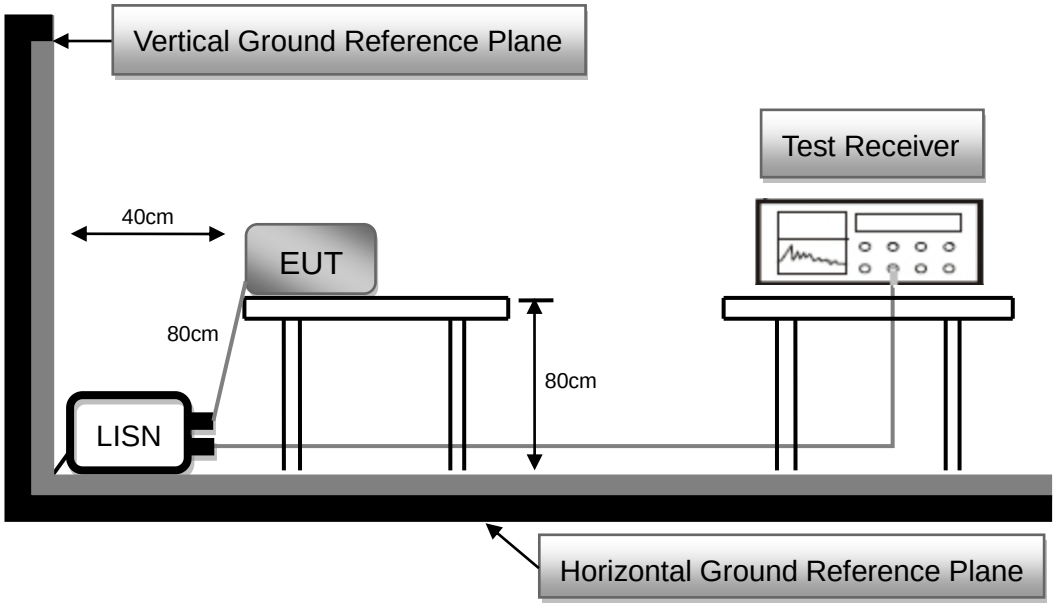
2.2 AC Conducted Emissions Measurement

2.2.1 Limit

Frequency (MHz)	FCC Part 15 Subpart C Paragraph 15.207 (dBμV) Limit	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50

*Decreases with the logarithm of the frequency

2.2.2 Test Setup

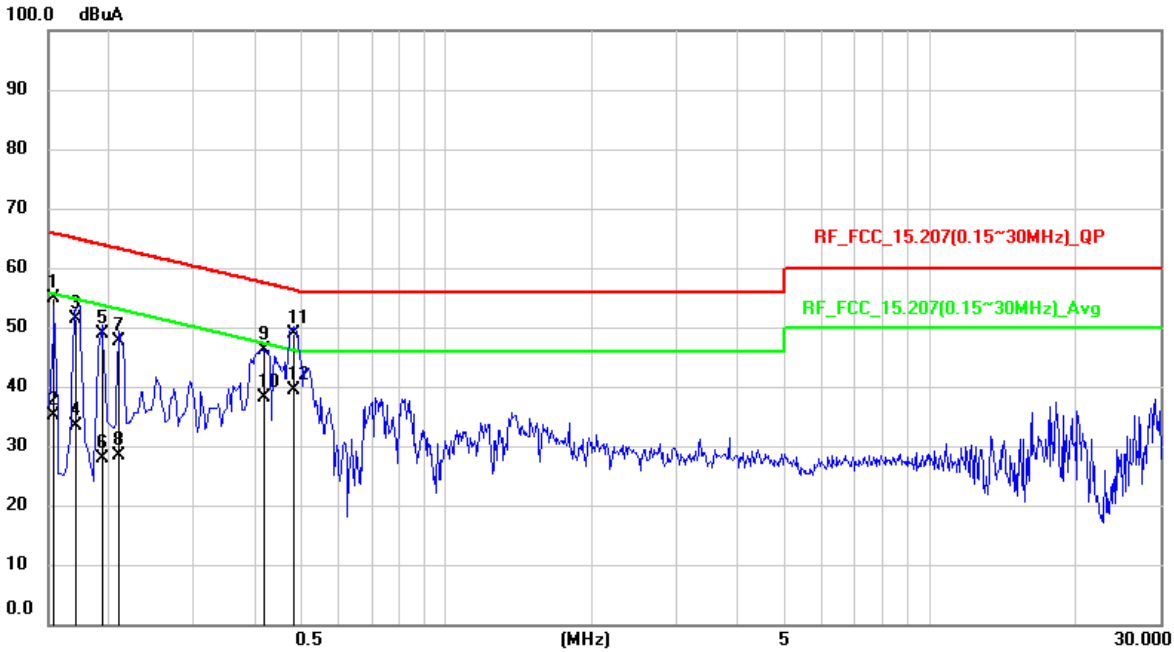


2.2.3 Test Procedure

1. The EUT was placed 0.8 meter height wooden table from the horizontal ground plane with EUT being connected to power source through a line impedance stabilization network (LISN). The LISN at least be 80 cm from nearest chassis of EUT.
2. The line impedance stabilization network (LISN) provides 50 ohm/50uH of coupling impedance for the measuring instrument. All other support equipments powered from additional LISN(s).
3. Interrelating cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle. All I/O cables were positioned to simulate typical usage.
4. All I/O cables that are not connected to a peripheral shall be bundle in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
5. The EMI test receiver connected to LISN powering the EUT. The actual test configuration, please refer to EUT test photos.
6. The receiver scanned from 150kHz to 30MHz for emissions in each of test modes. A scan was taken on both power lines, Line and Neutral, recording at least six highest emissions.
7. The EUT and cable configuration of the above highest emission levels were recorded. The test data of the worst case was recorded.

2.2.4 Test Result

Test Voltage :	120Vac, 60Hz	**Frequency Range:**	0.15-30 MHz
Test Mode :	Mode 1: Bluetooth BT + WIFI 2.4GHz	**6dB Bandwidth :**	9 kHz
Test Date :	2022/03/20	**Phase :**	L
Temperature :	26℃	**Humidity :**	52 %

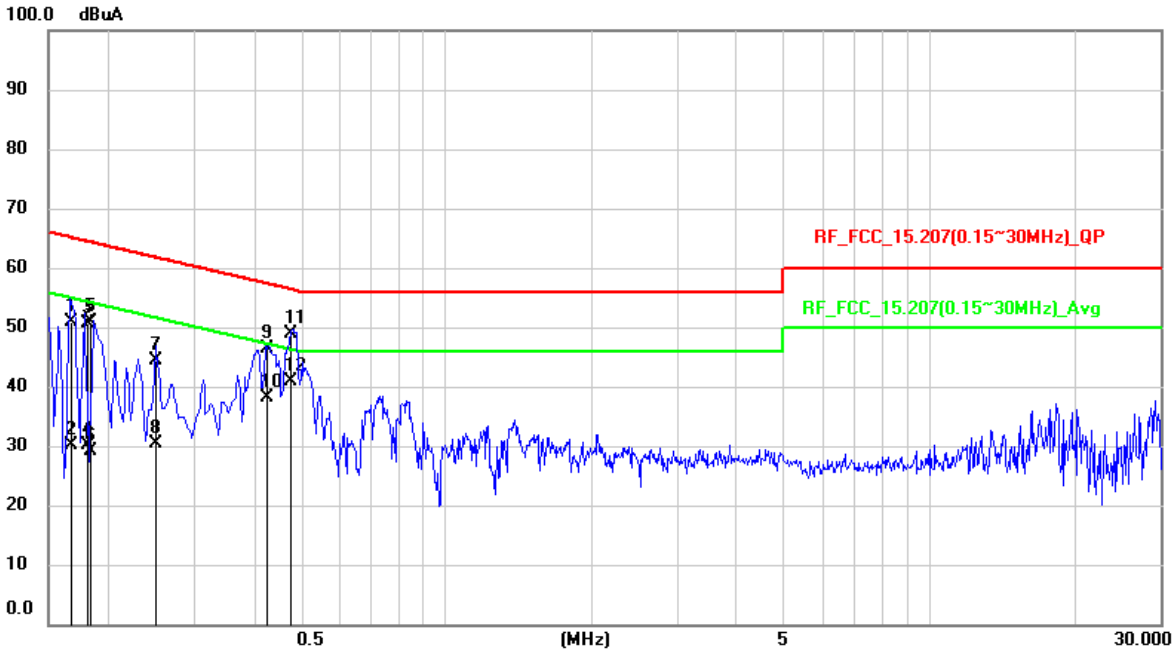


No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1525	44.93	9.83	54.76	65.86	-11.1	QP
2	0.1525	25.18	9.83	35.01	55.86	-20.85	AVG
3	0.1706	41.59	9.83	51.42	64.93	-13.51	QP
4	0.1706	23.53	9.83	33.36	54.93	-21.57	AVG
5	0.1927	39.06	9.82	48.88	63.92	-15.04	QP
6	0.1927	18.18	9.82	28	53.92	-25.92	AVG
7	0.209	37.82	9.82	47.64	63.24	-15.6	QP
8	0.209	18.66	9.82	28.48	53.24	-24.76	AVG
9	0.421	36.27	9.82	46.09	57.43	-11.34	QP
10	0.421	28.42	9.82	38.24	47.43	-9.19	AVG
11	0.4822	39.04	9.83	48.87	56.3	-7.43	QP
12	0.4822	29.6	9.83	39.43	46.3	-6.87	AVG

Remark:

1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value –Limit Value

Test Voltage :	120Vac, 60Hz	Frequency Range:	0.15-30 MHz
Test Mode :	Mode 1: Bluetooth BT + WIFI 2.4GHz	6dB Bandwidth :	9 kHz
Test Date :	2022/03/20	Phase :	N
Temperature :	26℃	Humidity :	52 %



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1669	41.05	9.81	50.86	65.11	-14.25	QP
2	0.1669	20.3	9.81	30.11	55.11	-25	AVG
3	0.1806	40.95	9.8	50.75	64.46	-13.71	QP
4	0.1806	20.24	9.8	30.04	54.46	-24.42	AVG
5	0.183	40.98	9.8	50.78	64.35	-13.57	QP
6	0.183	19.24	9.8	29.04	54.35	-25.31	AVG
7	0.251	34.56	9.8	44.36	61.72	-17.36	QP
8	0.251	20.46	9.8	30.26	51.72	-21.46	AVG
9	0.424	36.65	9.8	46.45	57.37	-10.92	QP
10	0.424	28.3	9.8	38.1	47.37	-9.27	AVG
11	0.4778	39.18	9.81	48.99	56.38	-7.39	QP
12	0.4778	31.07	9.81	40.88	46.38	-5.5	AVG

Remark:

1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value –Limit Value

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