



FCC RF Test Report

APPLICANT : OnePlus Technology (Shenzhen) Co., Ltd.
EQUIPMENT : Smart Phone
BRAND NAME : ONEPLUS
MODEL NAME : LE2117
FCC ID : 2ABZ2-EF136
STANDARD : FCC Part 15 Subpart C §15.209
CLASSIFICATION : (DCD) Part 15 Low Power Transmitter
Below 1705 kHz

The product was received on Oct. 28, 2020 and testing was completed on Mar. 01, 2021. We, Sporton International (ShenZhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (ShenZhen) Inc., the test report shall not be reproduced except in full.

Reviewed by: Derreck Chen / Supervisor

Approved by: Eric Shih / Manager



Sporton International (ShenZhen) Inc.

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055

People's Republic of China



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History of this test report

Report No.	Version	Description	Issued Date
FR002801-02F	01	Initial issue of report	Jan. 15, 2021
FR002801-02F	02	Retest RSE for WPT carrier frequency	Mar. 02, 2021



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	2.1049	20dB Bandwidth	Reporting Only	-
3.1	2.1049	99% Occupied Bandwidth	Reporting Only	
3.2	15.209	Radiated Emission	Pass	Under limit 11.37 dB at 954.410 MHz
3.3	15.207	AC Conducted Emission	Pass	Under limit 12.58 dB at 2.900 MHz
3.4	15.203	Antenna Requirements	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

OnePlus Technology (Shenzhen) Co., Ltd.

18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen

1.2 Manufacturer

OnePlus Technology (Shenzhen) Co., Ltd.

18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Smart Phone
Brand Name	ONEPLUS
Model Name	LE2117
FCC ID	2ABZ2-EF136
EUT supports Radios application	CDMA/GSM/WCDMA/LTE/5G NR WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ac/ax VHT20/VHT40/HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160 Bluetooth BR / EDR / LE / ANT+ GNSS/NFC/WPT
IMEI Code	Conducted: N/A Conduction: 990017410025130 Radiation: 990017410026906
HW Version	22
SW Version	11.2.0.0.LE54CB
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Frequency Range	110 ~ 148.5kHz
Type of Modulation	ASK
Antenna Type	Loop Antenna



1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Test Location

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International (Shenzhen) Inc.		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-SZ TH01-SZ	CN1256	421272

Test Firm	Sporton International (Shenzhen) Inc.		
Test Location Site	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City Guangdong Province China 518103 TEL: +86-755-33202398		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH02-SZ	CN1256	421272

1.7 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH02-SZ	AUDIX	E3	6.2009-8-24a
2.	CO01-SZ	AUDIX	E3	6.120613b

1.8 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.209, §15.207
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

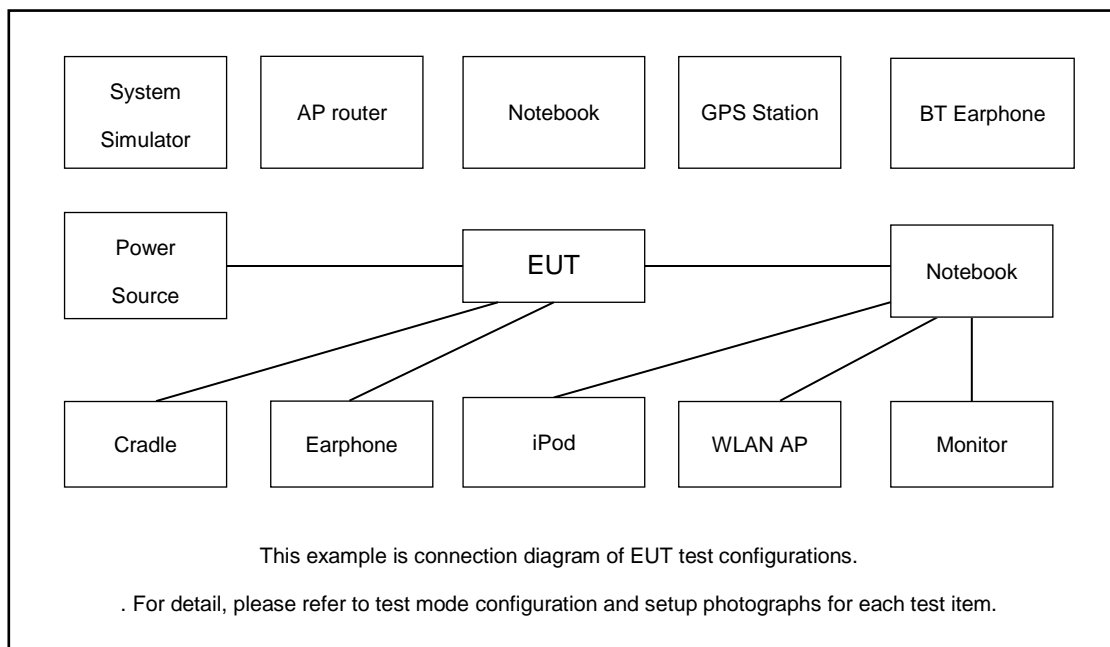
2 Test Configuration of Equipment Under Test

2.1 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 1000 MHz).
- b. AC power line Conducted Emission was tested under maximum output power.

Test Items	Function Type
AC Conducted Emission	Mode 1 : Bluetooth Idle + WLAN Idle (5G) + Camera(Front) + Battery + Charging from wireless charger
Radiated Emission	Mode 1 : WPT(Qi) Charger (charged DUT Battery 20%) Mode 2 : WPT(Qi) Charger (charged DUT Battery 50%) Mode 3 : WPT(Qi) Charger (charged DUT Battery 90%) Mode 4 : WPT(Qi) Charger (Battery 50%)(Charged DUT off status)
Remark: The worst case of radiated emission is mode 2; only the test data of it was reported.	

2.2 Connection Diagram of Test System





2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Samsung	EO-MG900	PYAHS-107W	N/A	N/A
2.	WLAN AP	Dlink	DIR-820L	KA2IR820LA1	N/A	Unshielded, 1.8m
3.	Smart Phone (WPT Load)	oneplus	N/A	N/A	N/A	N/A

3 Test Result

3.1 20dB and 99% Occupied Bandwidth Measurement

3.1.1 Limit of 20dB and 99% Occupied Bandwidth

Reporting only

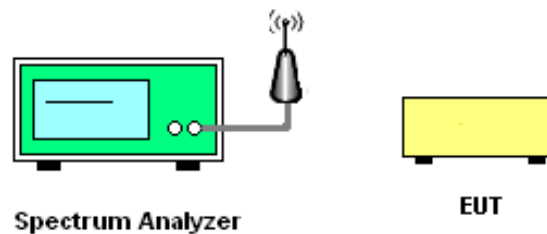
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The 20dB bandwidth is measured with a spectrum analyzer connected via a receiver antenna placed near the EUT while wirelessly charging a charging board.
2. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
For Bandwidth measurement, the RBW is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * RBW$, Sweep = auto;
3. Measure and record the results in the test report.

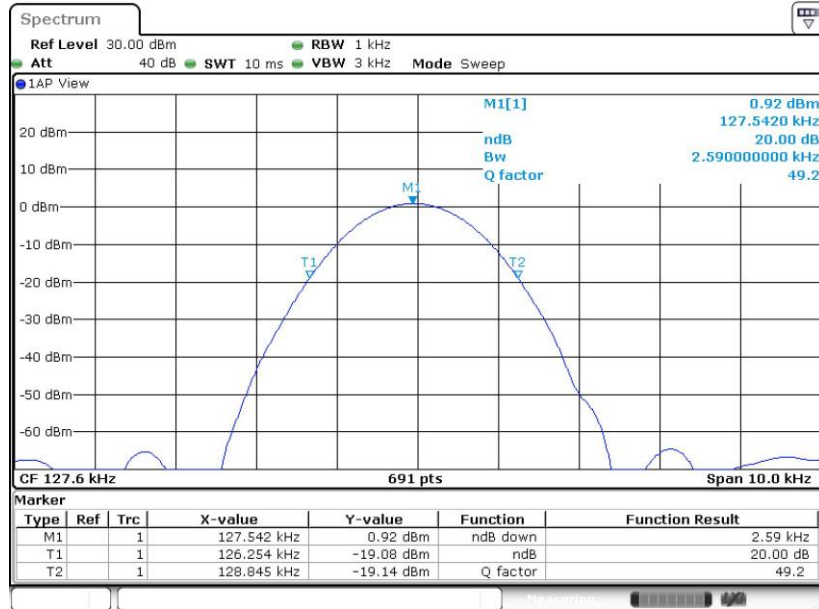
3.1.4 Test Setup





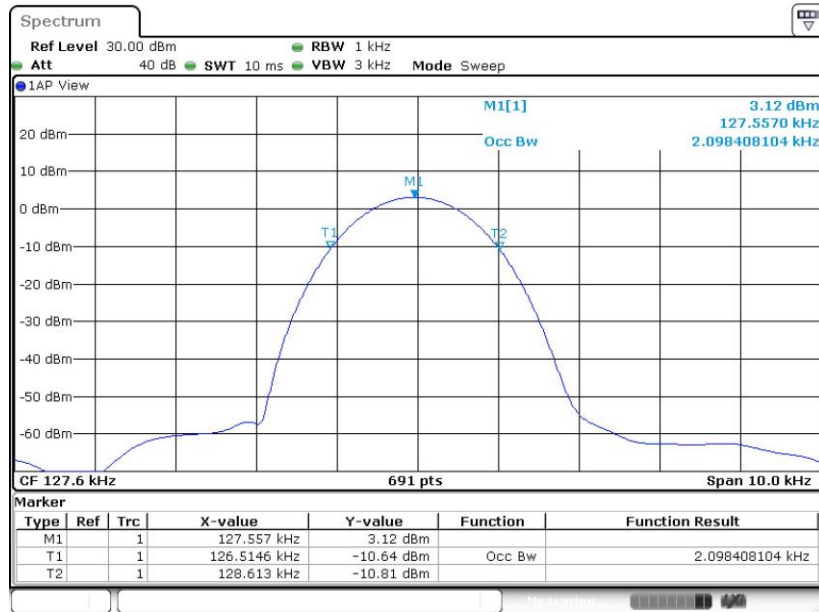
3.1.5 Test Result of 20dB and 99% Bandwidth

20 dB Bandwidth Plot



Date: 10.DEC.2020 15:07:56

99% Occupied Bandwidth Plot



Date: 10.DEC.2020 15:04:57



3.2 Radiated Emission Measurement

3.2.1 Limit of Radiated Emission

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

Receiver Parameter	Setting
Frequency Range: 9kHz~150kHz	RBW 200Hz for QP
Frequency Range: 150kHz~30MHz	RBW 9kHz for QP
Frequency Range: 30MHz~1000MHz	RBW 120kHz for Peak

Note: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For radiated emissions from 9kHz to 1GHz test distance is 3m

For 9kHz ~ 30MHz

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
3. specific line (dBµV/m) = 20 log Emission level (µV/m)
4. Limit line = specific limits (dBµV/m) + distance extrapolation factor.

3.2.2 Measuring Instruments

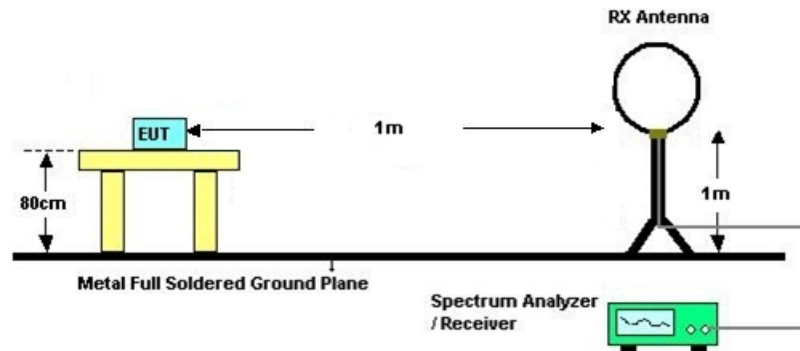
See list of measuring equipment of this test report.

3.2.3 Measuring Instrument Setting

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission for three EUT orthogonal planes, and adjusting the measurement antenna height and polarization. A pre-amp and a high pass filter are used for this test in order to get the good signal level.

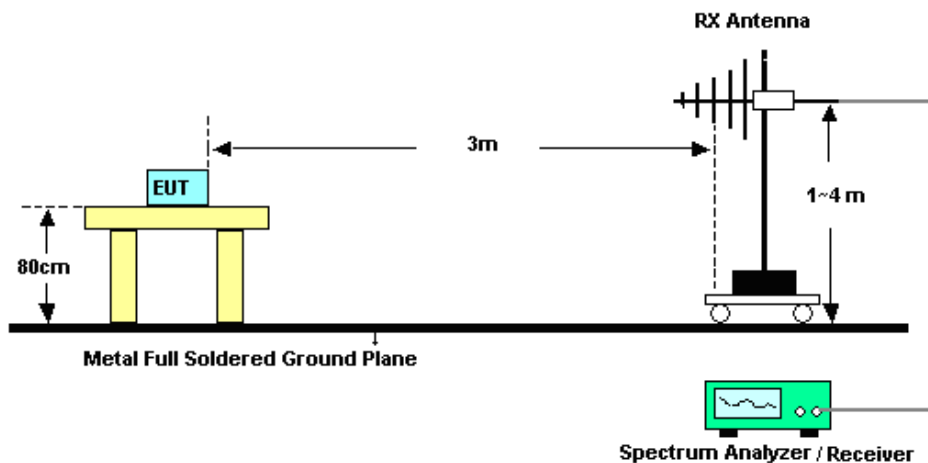
3.2.4 Test Setup of Radiated Emission

For radiated emissions below 30MHz



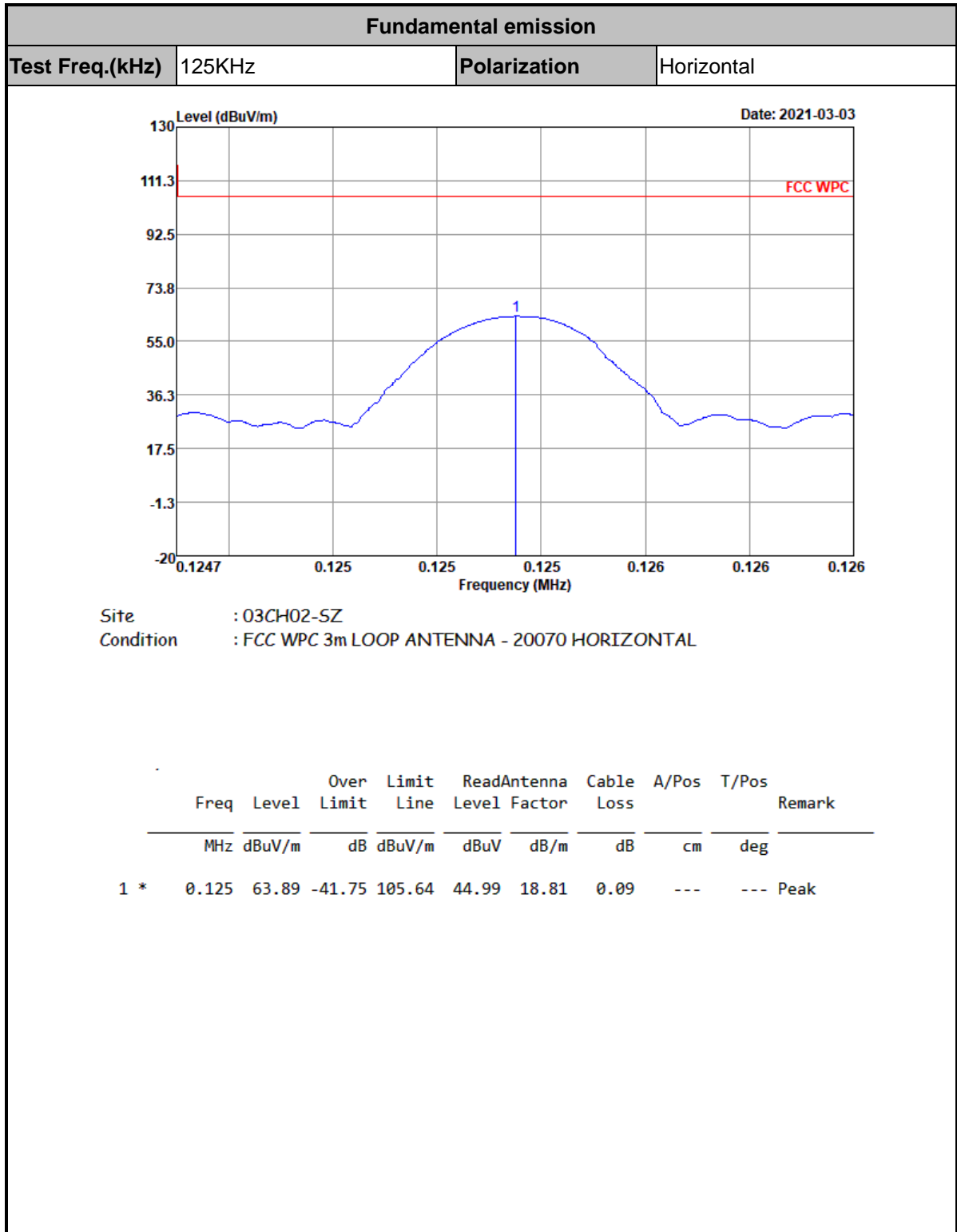
Note: There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

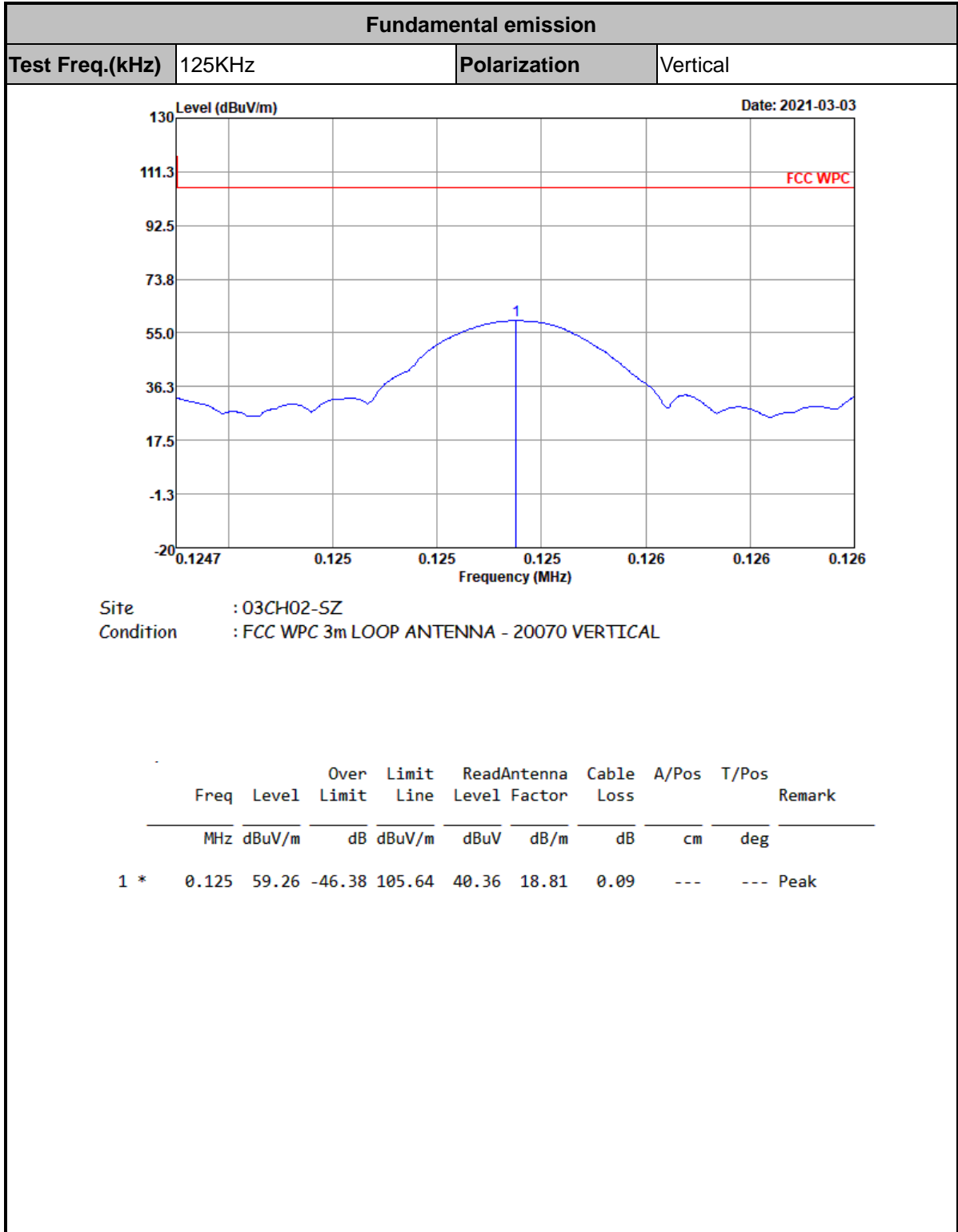
For radiated emissions above 30MHz

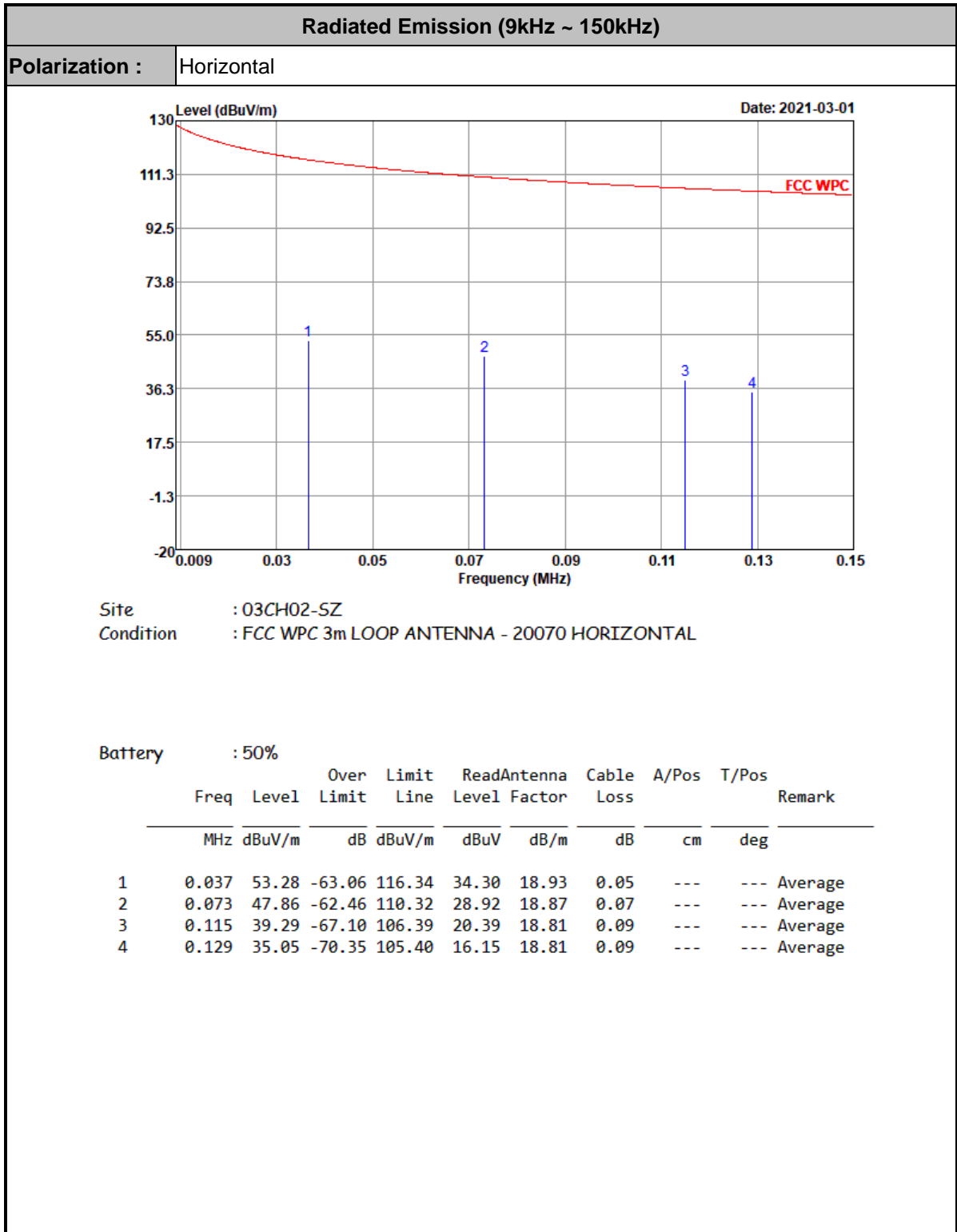


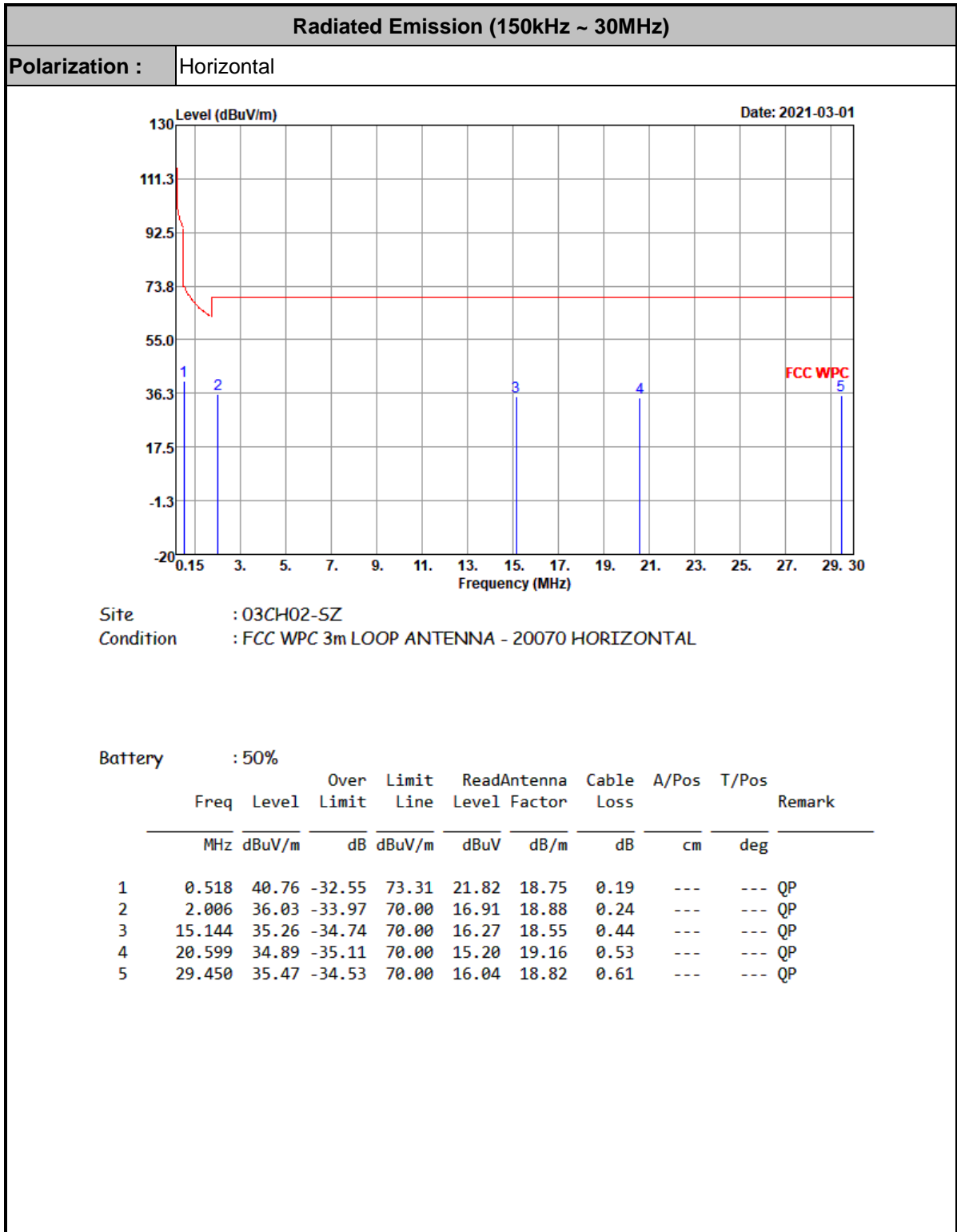


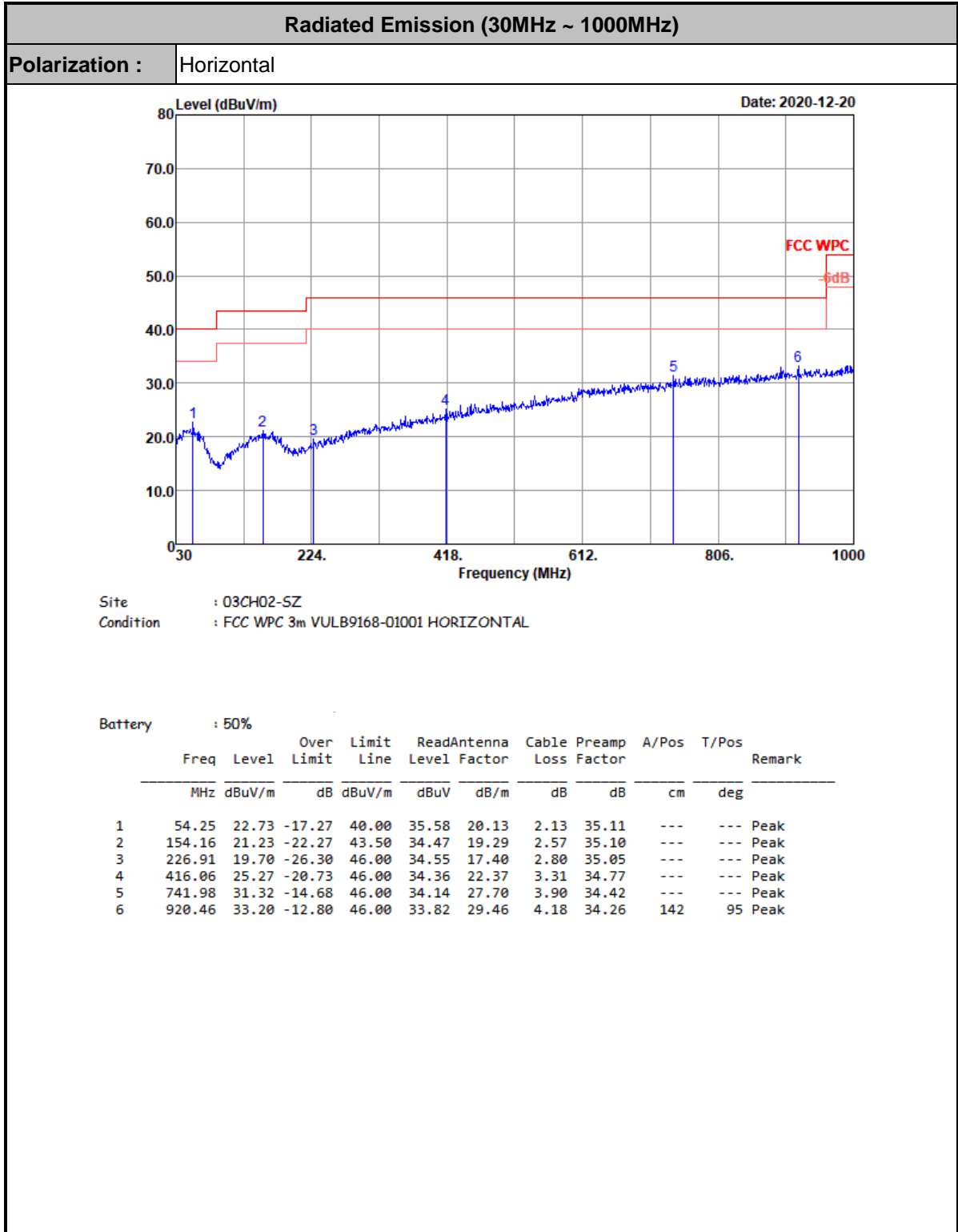
3.2.5 Test Result of Radiated Emission

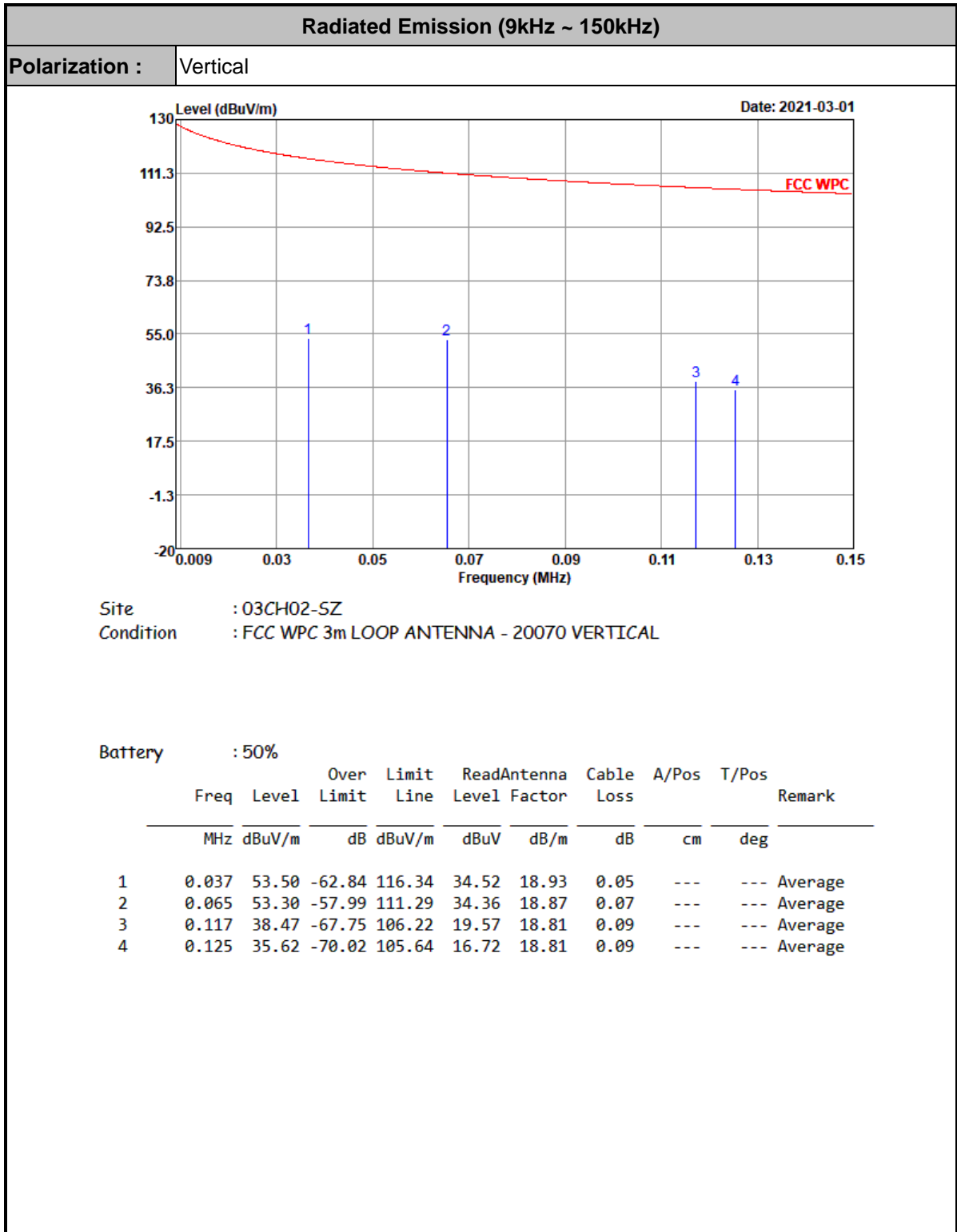


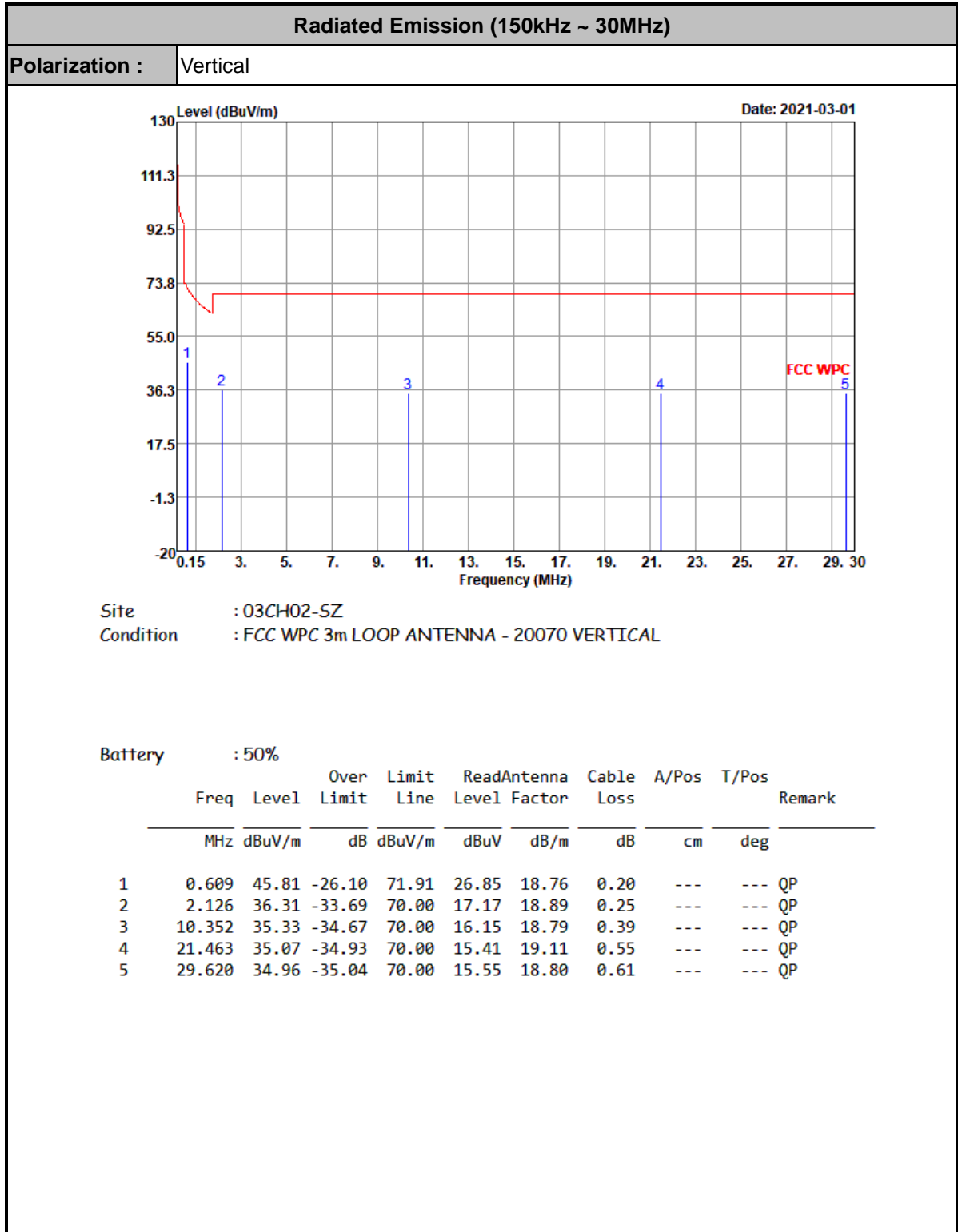


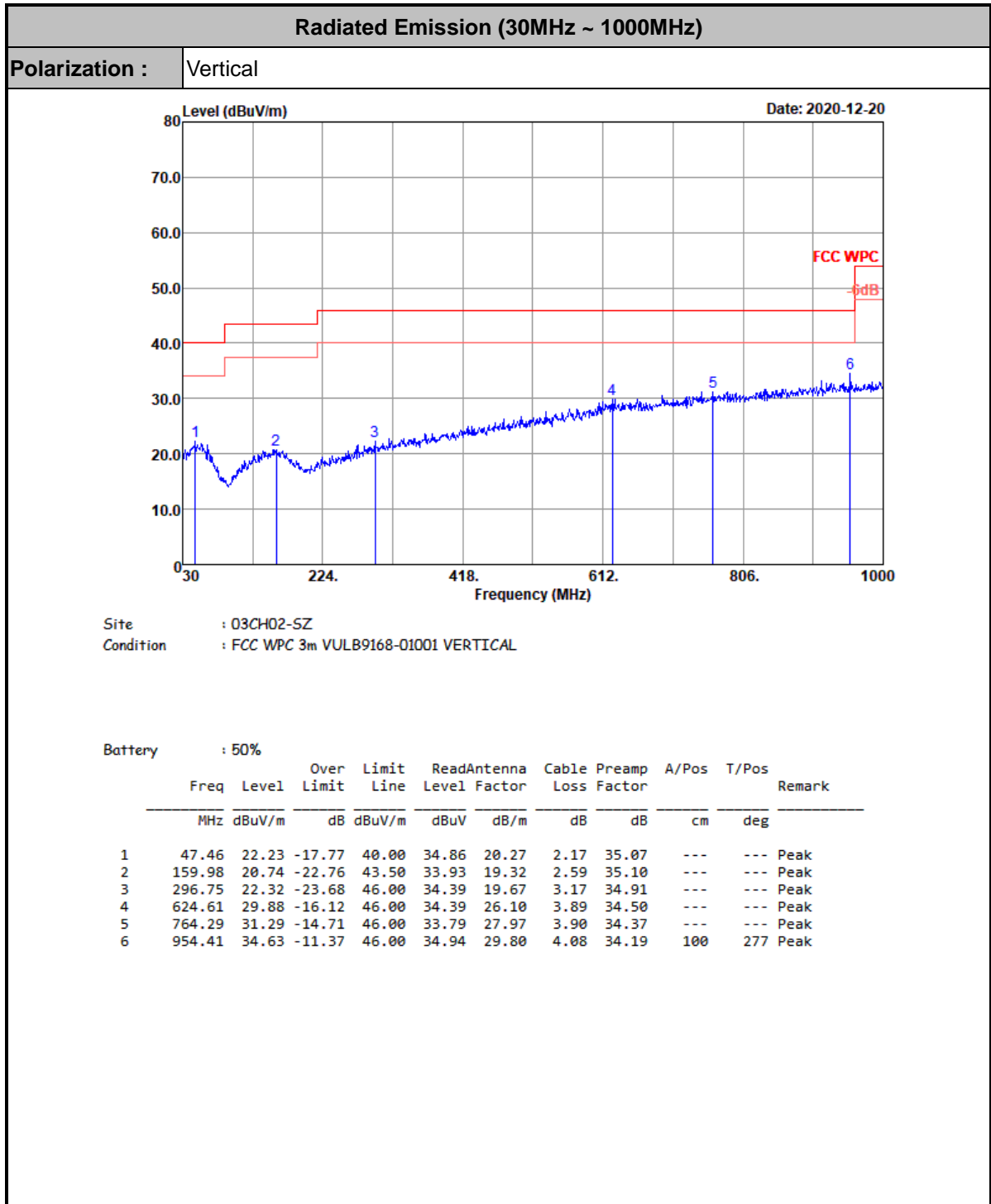












Note:

- Level(dBμV/m) = Read Level(dBμV) + Antenna Factor(dB/m) + Cable Loss(dB) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)



3.3 AC Conducted Emission Measurement

3.3.1 Limits of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

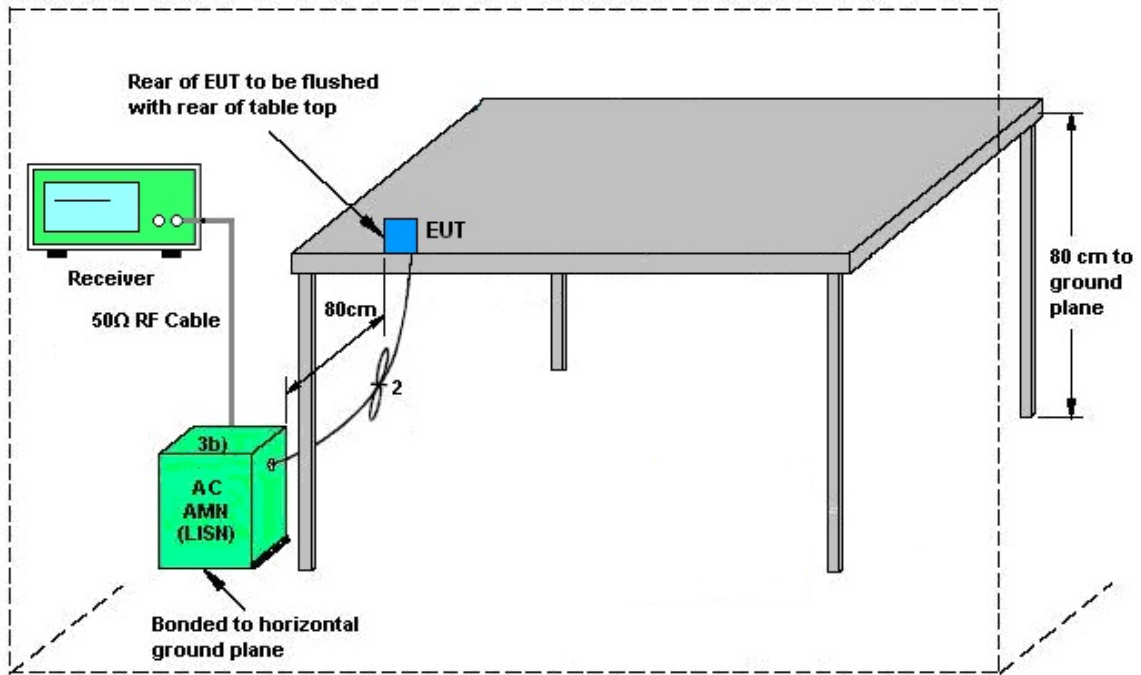
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedure

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.3.4 Test Setup

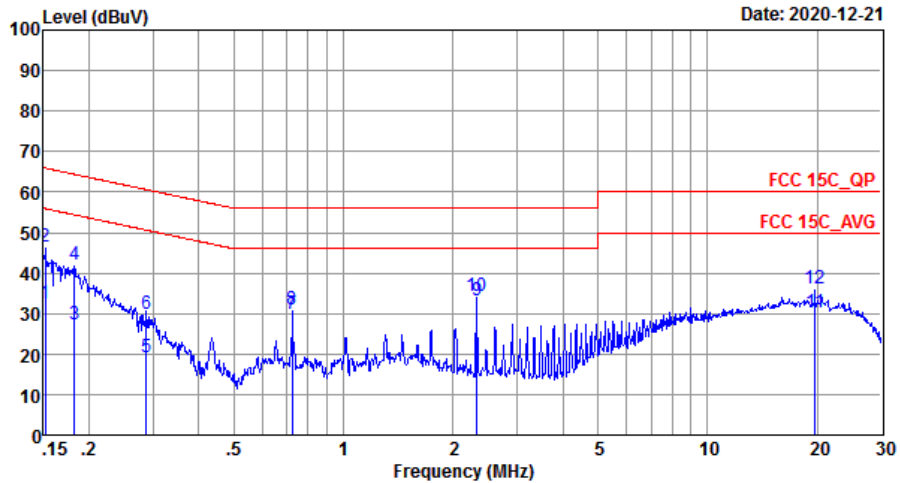


AMN = Artificial mains network (LISN)
 AE = Associated equipment
 EUT = Equipment under test
 ISN = Impedance stabilization network



3.3.5 Test Result of AC Conducted Emission

Test Engineer :	Xie YuQiang	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Line

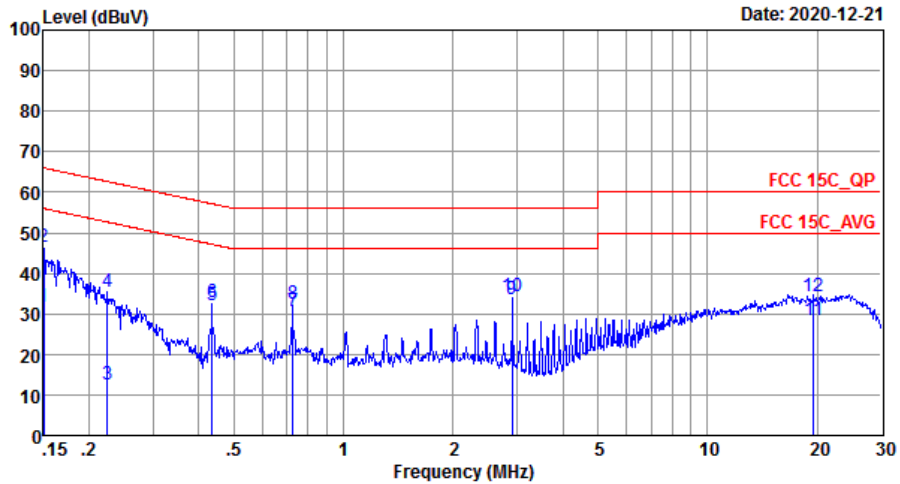


Site : CO01-SZ
 Condition: FCC 15C_QP LISN_20200719_L LINE

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.15	32.34	-23.57	55.91	22.30	0.03	10.01	Average
2	0.15	46.44	-19.47	65.91	36.40	0.03	10.01	QP
3	0.18	27.44	-26.93	54.37	17.40	0.03	10.01	Average
4	0.18	42.04	-22.33	64.37	32.00	0.03	10.01	QP
5	0.29	19.14	-31.45	50.59	9.10	0.03	10.01	Average
6	0.29	29.94	-30.65	60.59	19.90	0.03	10.01	QP
7	0.72	29.79	-16.21	46.00	19.70	0.02	10.07	Average
8	0.72	30.99	-25.01	56.00	20.90	0.02	10.07	QP
9 *	2.32	33.39	-12.61	46.00	23.20	0.13	10.06	Average
10	2.32	34.19	-21.81	56.00	24.00	0.13	10.06	QP
11	19.74	30.25	-19.75	50.00	18.70	1.26	10.29	Average
12	19.74	36.05	-23.95	60.00	24.50	1.26	10.29	QP



Test Engineer :	Xie YuQiang	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : CO01-SZ
 Condition: FCC 15C_QP LISN_20200719_N NEUTRAL

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	31.64	-24.36	56.00	21.60	0.03	10.01	Average
2	0.15	46.54	-19.46	66.00	36.50	0.03	10.01	QP
3	0.22	12.64	-40.02	52.66	2.60	0.03	10.01	Average
4	0.22	35.44	-27.22	62.66	25.40	0.03	10.01	QP
5	0.44	31.95	-15.20	47.15	21.90	0.02	10.03	Average
6	0.44	32.95	-24.20	57.15	22.90	0.02	10.03	QP
7	0.73	30.79	-15.21	46.00	20.70	0.02	10.07	Average
8	0.73	32.29	-23.71	56.00	22.20	0.02	10.07	QP
9 *	2.90	33.42	-12.58	46.00	23.30	0.03	10.09	Average
10	2.90	34.32	-21.68	56.00	24.20	0.03	10.09	QP
11	19.53	28.55	-21.45	50.00	17.70	0.56	10.29	Average
12	19.53	34.35	-25.65	60.00	23.50	0.56	10.29	QP

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)



3.4 Antenna Requirements

3.4.1 Standard Applicable

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 17, 2020	Dec. 10, 2020	Apr. 16, 2021	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	Apr. 17, 2020	Dec. 20, 2020~Mar. 01, 2021	Apr. 16, 2021	Radiation (03CH02-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jun. 22, 2020	Dec. 20, 2020~Mar. 01, 2021	Jun. 21, 2022	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	Jul. 15, 2020	Dec. 20, 2020~Mar. 01, 2021	Jul. 14, 2021	Radiation (03CH02-SZ)
LF Amplifier	Burgeon	BPA-530	102211	0.01~3000Mhz	Oct. 16, 2020	Dec. 20, 2020~Mar. 01, 2021	Oct. 15, 2021	Radiation (03CH02-SZ)
AC Power Source	Chroma	61601	616010002470	N/A	NCR	Dec. 20, 2020~Mar. 01, 2021	NCR	Radiation (03CH02-SZ)
Turn Table	Chaintek	T-200	N/A	0~360 degree	NCR	Dec. 20, 2020~Mar. 01, 2021	NCR	Radiation (03CH02-SZ)
Antenna Mast	Chaintek	MBS-400	N/A	1 m~4 m	NCR	Dec. 20, 2020~Mar. 01, 2021	NCR	Radiation (03CH02-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	Apr. 17, 2020	Dec. 20, 2020~Mar. 01, 2021	Apr. 16, 2021	Radiation (03CH02-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jun. 22, 2020	Dec. 20, 2020~Mar. 01, 2021	Jun. 21, 2022	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	Jul. 15, 2020	Dec. 20, 2020~Mar. 01, 2021	Jul. 14, 2021	Radiation (03CH02-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 27, 2019	Dec. 21, 2020	Dec. 26, 2020	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2 LISN	00103912	9kHz~30MHz	Dec. 27, 2019	Dec. 21, 2020	Dec. 26, 2020	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 15, 2020	Dec. 21, 2020	Oct. 14, 2021	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 21, 2020	Dec. 21, 2020	Jul. 20, 2021	Conduction (CO01-SZ)

NCR: No Calibration Required



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.7dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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