

RADIO PERFORMANCE TEST REPORT

Test Report No. : OT-243-RWD-013

Reception No. : 2402000496

Applicant : AMOSENSE

Address : 19-1BL, 90, 4Sandan 5 gil, Jiksan-eup, Cheonan-Si, Chungcheongnam-Do, South Korea

Manufacturer : AMOSENSE

Address : 19-1BL, 90, 4Sandan 5 gil, Jiksan-eup, Cheonan-Si, Chungcheongnam-Do, South Korea

Type of Equipment : ATOZ R3

FCC ID. : 2AS9T-SB530-SW

Model Name : SB530-SW

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 33 pages (including this page)

Date of Incoming : January 19, 2024

Date of issue : March 12, 2024

SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART C Section 15.247**

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.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.



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OTC-TRF-RF-001(0)

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※ Please refer to the Annex section for All test plots

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-243-RWD-013	March 12, 2024	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : AMOSENSE
Address : 19-1BL, 90, 4Sandan 5 gil, Jiksan-eup, Cheonan-Si, Chungcheongnam-Do, South Korea
Contact Person : Jaeho Hong / Diretor
Telephone No. : +82-31-277-0598
FCC ID : 2AS9T-SB530-SW
Model Name : SB530-SW
Brand Name : -
Serial Number : N/A
Date : March 12, 2024

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	ATOZ R3
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 C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05r02
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.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Conducted(average) Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Average Power Spectral Density	Met the Limit / PASS
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / 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 C Section 15.247.

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-20122/ C-14617/ G-10666/ T-11842

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

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The AMOSENSE, Model SB530-SW (referred to as the EUT in this report) is a ATOZ R3. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	ATOZ R3	
Temperature Range	-20 °C ~ +60 °C	
OPERATING FREQUENCY	SigFox	902.137 5 MHz ~ 904.662 5 MHz
	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
	WLAN 5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a)
	WLAN 5 250 MHz ~ 5 350 MHz Band	5 260 MHz ~ 5 320 MHz (802.11a)
	WLAN 5 470 MHz ~ 5 725 MHz Band	5 500 MHz ~ 5 720 MHz (802.11a)
	WLAN 5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a)
MODULATION TYPE	SigFox	DBPSK
	Bluetooth LE	GFSK
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK) 802.11g/n(HT20): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
	WLAN 5 GHz	802.11a: OFDM Modulation(BPSK/QPSK/16QAM/64QAM)

RF OUTPUT POWER	SigFox	18.95 dBm
	Bluetooth LE	-4.61 dBm
	WLAN 2.4 GHz	5.81 dBm(802.11b) 3.00 dBm(802.11g) 2.85 dBm(802.11n_HT20)
	WLAN 5 150 MHz ~ 5 250 MHz Band	3.69 dBm(802.11a)
	WLAN 5 250 MHz ~ 5 350 MHz Band	3.63 dBm(802.11a)
	WLAN 5 470 MHz ~ 5 725 MHz Band	4.64 dBm(802.11a)
	WLAN 5 470 MHz ~ 5 725 MHz Band (Straddle)	3.76 dBm(802.11a)
	WLAN 5 725 MHz ~ 5 850 MHz Band	5.59 dBm(802.11a)
	WLAN 5 725 MHz ~ 5 850 MHz Band (Straddle)	-4.07 dBm(802.11a)
ANTENNA TYPE	Chip Antenna	
ANTENNA GAIN	SigFox	1.06 dBi
	Bluetooth LE	0.13 dBi
	WLAN 2.4 GHz	0.13 dBi
	WLAN 5 150 MHz ~ 5 250 MHz Band	-0.05 dBi
	WLAN 5 250 MHz ~ 5 350 MHz Band	-0.05 dBi
	WLAN 5 470 MHz ~ 5 725 MHz Band	-0.75 dBi
	WLAN 5 725 MHz ~ 5 850 MHz Band	0.00 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		32 MHz, 40 MHz

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	AMOSENSE	ATOZ R3 Rev10	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
SB530-SW	AMOSENSE	ATOZ R3 (EUT)	-
IdeaPad L340	LENOVO	Notebook PC	EUT
U0181-KV	Dongguan Citiland Electronics Co., Ltd	Adapter	-

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting mode is programmed.

-. Frequency / Channel Operations

Channel	Frequency
1	2 412
2	2 417
3	2 422
4	2 427
5	2 432
6	2 437
7	2 442
8	2 447
9	2 452
10	2 457
11	2 462

-. Middle Channel

Modulation	DATA RATE	OUTPUT POWER[dBm]
802.11 b	1 Mbps	5.05
	2 Mbps	5.03
	5.5 Mbps	4.99
	11 Mbps	4.97
802.11 g	6 Mbps	2.23
	9 Mbps	2.16
	12 Mbps	2.13
	18 Mbps	2.09
	24 Mbps	2.07
	36 Mbps	2.05
	48 Mbps	2.03
	54 Mbps	2.01
802.11 HT20	6.5 Mbps	2.06
	13 Mbps	2.04
	19.5 Mbps	2.03
	26 Mbps	2.02
	39 Mbps	1.00
	52 Mbps	0.59
	58.5 Mbps	0.54
	65 Mbps	0.52

- The worse case data rate for each modulation is determined 1 Mbps for IEEE 802.11b, 6 Mbps for IEEE 802.11g, 6.5 Mbps for HT20.
- To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis.

-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
802.11 b	-	-	100.00	-
802.11 g	-	-	100.00	-
802.11 HT20	-	-	100.00	-

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

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

5.4 Configuration of Test System

Line Conducted Test: The EUT was tested in a Charging & Transmitting mode. The EUT was connected to USB and the Power of USB was Connected to DC Adaptor. 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 Semi Anechoic Chamber.

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 Chip Antenna on the main board in the EUT, so no consideration of replacement by the user.

6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Output Power	0.68
Conducted Spurious Emission < 26.5 GHz	1.60
Power Spectral Density	1.55
Line Conducted Disturbance (150 kHz ~ 30 MHz)	2.00
Radiated Disturbance (9 kHz ~ 30 MHz)	4.09
Radiated Disturbance (30 MHz ~ 1 GHz)	3.98
Radiated Disturbance (1 GHz ~ 18 GHz)	5.56
Radiated Disturbance (18 GHz ~ 40 GHz)	5.65

7. PRELIMINARY TEST

7.1 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)
Charging & Transmitting Mode	X

7.2 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

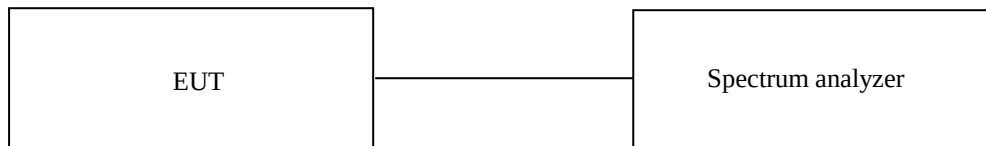
8. MINIMUM 6 dB BANDWIDTH

8.1 Operating environment

Temperature : 23 °C
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 Date

January 19, 2024 ~ February 22, 2024

8.4 Test data for 802.11b WLAN Mode

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	9.09	0.50	8.59
Middle	2 437.00	9.09	0.50	8.59
High	2 462.00	9.09	0.50	8.59

Remark. Margin = Measured Value - Limit

8.5 Test data for 802.11g WLAN Mode

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	16.03	0.50	15.53
Middle	2 437.00	16.28	0.50	15.78
High	2 462.00	16.08	0.50	15.58

Remark. Margin = Measured Value - Limit

8.6 Test data for 802.11n_HT20 WLAN Mode

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	LIMIT (MHz)	Margin (MHz)
Low	2 412.00	17.28	0.50	16.78
Middle	2 437.00	16.88	0.50	16.38
High	2 462.00	16.33	0.50	15.83

Remark. Margin = Measured Value - Limit

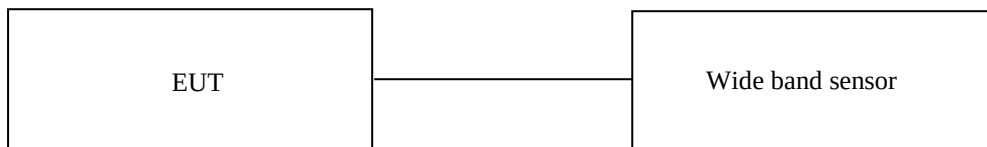
9. MAXIMUM CONDUCTED (AVERAGE) OUTPUT POWER

9.1 Operating environment

Temperature : 23 °C
Relative humidity : 46 % R.H.

9.2 Test set-up

The maximum peak output power was measured with the wide band sensor connected to the antenna output of the EUT.
The Wide Band Sensor is measured when the EUT is transmitting at the appropriate center frequency its maximum power control level as described in Section 8.3(558074 D01 15.247 Meas Guidance v05r02).
Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.



9.3 Test Date

January 19, 2024 ~ February 22, 2024

9.4 Test data for 802.11b WLAN Mode

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	4.55	30.00	25.45
MIDDLE	2 437.00	5.05	30.00	24.95
HIGH	2 462.00	5.81	30.00	24.19

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

9.5 Test data for 802.11g WLAN Mode

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	1.63	30.00	28.37
MIDDLE	2 442.00	2.23	30.00	27.77
HIGH	2 462.00	3.00	30.00	27.00

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

9.6 Test data for 802.11n_HT20 WLAN Mode

-. Test Result : Pass

-. Duty Cycle : > 98 %

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	1.49	30.00	28.51
MIDDLE	2 442.00	2.06	30.00	27.94
HIGH	2 462.00	2.85	30.00	27.15

Remark : Margin = Limit – Measured Value (=Power Sensor Reading + Cable Loss)

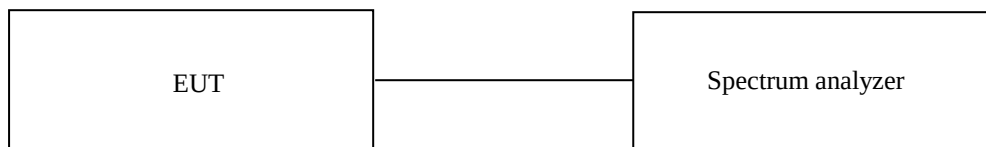
10. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

10.1 Operating environment

Temperature : 23 °C
Relative humidity : 46 % R.H.

10.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



10.3 Test set-up for radiated measurement

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.

10.4 Test Date

January 19, 2024 ~ February 22, 2024

10.5 Test data

For Test data for Annex. Section

10.6 Test data for radiated emission

10.6.1 Radiated Emission which fall in the Restricted Band

10.6.1.1 Test data for 802.11b WLAN Mode

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	ATT (dB)	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel											
2 315.660	52.23	Peak	H	27.81	4.62	42.57	6.12	-	48.21	74.00	25.79
2 383.930	41.28	Average	H	27.53	4.65	42.55	6.12	-	37.03	54.00	16.97
2 388.000	52.16	Peak	V	27.52	4.65	42.54	6.11	-	47.90	74.00	26.10
2 372.410	41.12	Average	V	27.56	4.63	42.55	6.11	-	36.87	54.00	17.13
Test Data for High Channel											
2 484.760	52.79	Peak	H	27.53	4.83	42.51	6.13	-	48.77	74.00	25.23
2 499.530	41.82	Average	H	27.50	4.93	42.50	6.11	-	37.86	54.00	16.14
2 495.460	52.56	Peak	V	27.51	4.93	42.50	6.11	-	48.61	74.00	25.39
2 499.910	41.94	Average	V	27.50	4.93	42.50	6.11	-	37.98	54.00	16.02

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

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

Total Level = Reading + Antenna Factor + Cable Loss – AMP Gain + ATT + Duty Factor

10.6.1.2 Test data for 802.11g WLAN Mode

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	ATT (dB)	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel											
2 357.940	51.90	Peak	H	27.58	4.63	42.56	6.11	-	47.66	74.00	26.34
2 390.040	41.46	Average	H	27.52	4.65	42.54	6.11	-	37.20	54.00	16.80
2 363.450	52.73	Peak	V	27.57	4.63	42.55	6.11	-	48.49	74.00	25.51
2 389.530	41.62	Average	V	27.52	4.65	42.54	6.11	-	37.36	54.00	16.64
Test Data for High Channel											
2 492.350	52.52	Peak	H	27.52	4.88	42.50	6.11	-	48.53	74.00	25.47
2 483.620	41.13	Average	H	27.53	4.83	42.51	6.13	-	37.11	54.00	16.89
2 487.300	52.71	Peak	V	27.53	4.88	42.51	6.11	-	48.72	74.00	25.28
2 484.070	41.92	Average	V	27.53	4.83	42.51	6.13	-	37.90	54.00	16.10

Tabulated test data for Restricted Band

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{AMP Gain} + \text{ATT} + \text{Duty Factor}$$

10.6.1.3 Test data for 802.11n_HT20 WLAN Mode

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- Video bandwidth : 3 MHz for Peak and Average Mode
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	ATT (dB)	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel											
2 348.770	51.68	Peak	H	27.61	4.58	42.56	6.09	-	47.40	74.00	26.60
2 367.010	40.66	Average	H	27.57	4.63	42.55	6.11	-	36.42	54.00	17.58
2 364.570	52.45	Peak	V	27.57	4.63	42.55	6.11	-	48.21	74.00	25.79
2 383.720	41.41	Average	V	27.53	4.65	42.55	6.12	-	37.16	54.00	16.84
Test Data for High Channel											
2 491.290	52.25	Peak	H	27.52	4.88	42.50	6.11	-	48.26	74.00	25.74
2 497.970	41.21	Average	H	27.50	4.93	42.50	6.11	-	37.25	54.00	16.75
2 485.330	52.44	Peak	V	27.53	4.83	42.51	6.13	-	48.42	74.00	25.58
2 493.680	41.67	Average	V	27.51	4.88	42.50	6.11	-	37.67	54.00	16.33

Tabulated test data for Restricted Band

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{AMP Gain} + \text{ATT} + \text{Duty Factor}$$

10.6.2 Spurious & Harmonic Radiated Emission

10.6.2.1 Test data for 802.11b WLAN Mode

- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
4 824.050	54.38	Peak	H	31.25	6.60	41.84	-	50.39	74.00	23.61
4 824.050	50.09	Average	H	31.25	6.60	41.84	-	46.10	54.00	7.90
4 824.000	52.74	Peak	V	31.25	6.60	41.84	-	48.75	74.00	25.25
4 824.000	48.23	Average	V	31.25	6.60	41.84	-	44.24	54.00	9.76
Test Data for Middle Channel										
4 874.100	54.22	Peak	H	31.30	6.69	41.83	-	50.38	74.00	23.62
4 874.150	50.48	Average	H	31.30	6.69	41.83	-	46.64	54.00	7.36
4 874.250	51.84	Peak	V	31.30	6.69	41.83	-	48.00	74.00	26.00
4 874.100	46.43	Average	V	31.30	6.69	41.83	-	42.59	54.00	11.41
Test Data for High Channel										
4 924.200	56.34	Peak	H	31.25	6.70	41.82	-	52.47	74.00	21.53
4 924.050	52.88	Average	H	31.25	6.70	41.82	-	49.01	54.00	4.99
4 923.950	53.73	Peak	V	31.25	6.70	41.82	-	49.86	74.00	24.14
4 924.050	48.95	Average	V	31.25	6.70	41.82	-	45.08	54.00	8.92

Remark: "H": Horizontal, "V": Vertical

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

Total Level = Reading + Antenna Factor + Cable Loss – AMP Gain + Duty Factor

10.6.2.2 Test data for 802.11g WLAN Mode

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
4 821.960	53.77	Peak	H	31.24	6.60	41.84	-	49.77	74.00	24.23
4 824.660	40.84	Average	H	31.25	6.60	41.84	-	36.85	54.00	17.15
4 818.090	51.91	Peak	V	31.24	6.60	41.84	-	47.91	74.00	26.09
4 825.700	39.35	Average	V	31.25	6.59	41.83	-	35.36	54.00	18.64
Test Data for Middle Channel										
4 873.800	52.38	Peak	H	31.30	6.69	41.83	-	48.54	74.00	25.46
4 876.660	39.89	Average	H	31.30	6.70	41.82	-	36.07	54.00	17.93
4 873.300	51.13	Peak	V	31.30	6.69	41.83	-	47.29	74.00	26.71
4 874.620	38.90	Average	V	31.30	6.69	41.83	-	35.06	54.00	18.94
Test Data for High Channel										
4 922.700	53.93	Peak	H	31.25	6.70	41.82	-	50.06	74.00	23.94
4 923.460	40.68	Average	H	31.25	6.70	41.82	-	36.81	54.00	17.19
4 924.000	52.24	Peak	V	31.25	6.70	41.82	-	48.37	74.00	25.63
4 922.400	38.98	Average	V	31.26	6.70	41.82	-	35.12	54.00	18.88

Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{AMP Gain} + \text{Duty Factor}$$

10.6.2.3 Test data for 802.11n_HT20 WLAN Mode

- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	AMP Gain	Duty Factor (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel										
4 824.780	50.76	Peak	H	31.25	6.60	41.84	-	46.77	74.00	27.23
4 823.460	39.15	Average	H	31.25	6.60	41.84	-	35.16	54.00	18.84
4 817.550	50.06	Peak	V	31.24	6.60	41.84	-	46.06	74.00	27.94
4 824.980	37.92	Average	V	31.25	6.60	41.84	-	33.93	54.00	20.07
Test Data for Middle Channel										
4 873.38	51.24	Peak	H	31.30	6.69	41.83	-	47.40	74.00	26.60
4 874.72	38.80	Average	H	31.30	6.69	41.83	-	34.96	54.00	19.04
4 871.34	49.59	Peak	V	31.30	6.69	41.83	-	45.75	74.00	28.25
4 873.70	37.44	Average	V	31.30	6.69	41.83	-	33.60	54.00	20.40
Test Data for High Channel										
4 921.80	52.04	Peak	H	31.26	6.70	41.82	-	48.18	74.00	25.82
4 923.22	39.18	Average	H	31.25	6.70	41.82	-	35.31	54.00	18.69
4 921.34	50.23	Peak	V	31.26	6.70	41.82	-	46.37	74.00	27.63
4 923.74	38.25	Average	V	31.25	6.70	41.82	-	34.38	54.00	19.62

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

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{AMP Gain} + \text{Duty Factor}$$

11. AVERAGE POWER SPECTRUL DENSITY

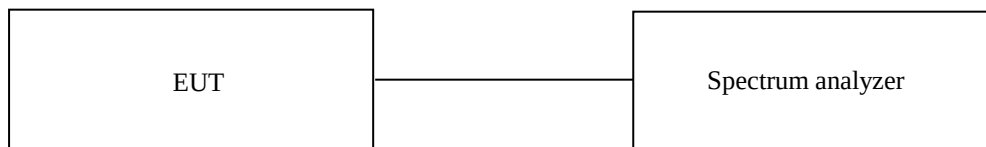
11.1 Operating environment

Temperature : 23 °C
Relative humidity : 46 % R.H.

11.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$, the video bandwidth is set to 3 times the resolution bandwidth.



11.3 Test Date

January 19, 2024 ~ February 22, 2024

11.4 Test data for 802.11b WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-28.93	8.00	36.93
Middle	2 437.00	-28.25	8.00	36.25
High	2 462.00	-27.70	8.00	35.70

Remark. Margin = Limit – Measured value

11.5 Test data for 802.11g WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-32.23	8.00	40.23
Middle	2 437.00	-31.66	8.00	39.66
High	2 462.00	-30.86	8.00	38.86

Remark. Margin = Limit – Measured value

11.6 Test data for 802.11n_HT20 WLAN Mode

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-32.64	8.00	40.64
Middle	2 437.00	-32.01	8.00	40.01
High	2 462.00	-31.29	8.00	39.29

Remark. Margin = Limit – Measured value

12. RADIATED EMISSION TEST

12.1 Operating environment

Temperature : 23 °C
Relative humidity : 46 % R.H.

12.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on 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.

12.3 Test Date

January 19, 2024 ~ February 22, 2024

12.4 Test data for 30 MHz ~ 1 000 MHz

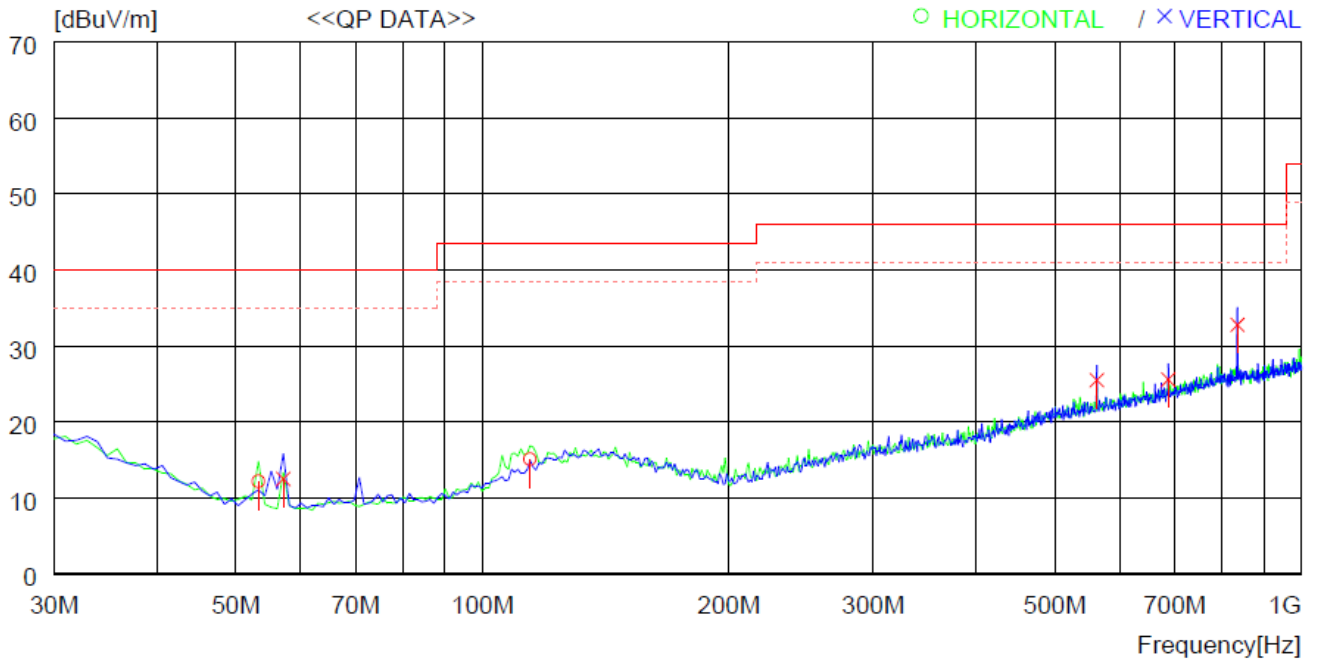
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : ATOZ R3

Test mode : Worst case (b mode / High CH)

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	53.280	30.6	12.6	1.1	32.1	12.2	40.0	27.8	200	0
2	114.390	27.9	17.7	1.6	32.1	15.1	43.5	28.4	300	145
----- Vertical -----										
3	57.160	31.2	12.3	1.1	32.1	12.5	40.0	27.5	300	163
4	562.529	30.4	23.7	3.7	32.3	25.5	46.0	20.5	100	208
5	687.655	28.8	25.2	4.0	32.4	25.6	46.0	20.4	200	0
6	835.091	33.3	27.2	4.5	32.2	32.8	46.0	13.2	200	0

12.5 Test data for Below 30 MHz

- . 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

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)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

12.6 Test data for above 1 GHz

- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

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)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

13. CONDUCTED EMISSION TEST

13.1 Operating environment

Temperature : 23 °C
Relative humidity : 46 % R.H.

13.2 Test set-up

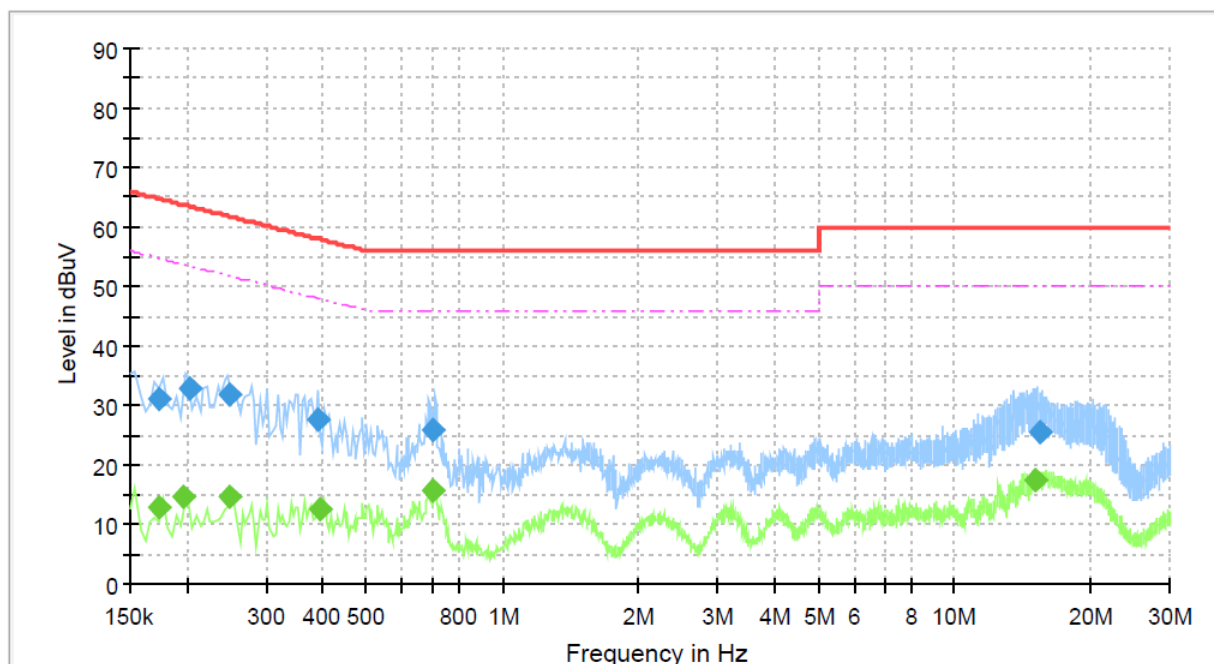
The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μ H + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

13.3 Test Date

January 19, 2024 ~ February 22, 2024

13.4 Test data

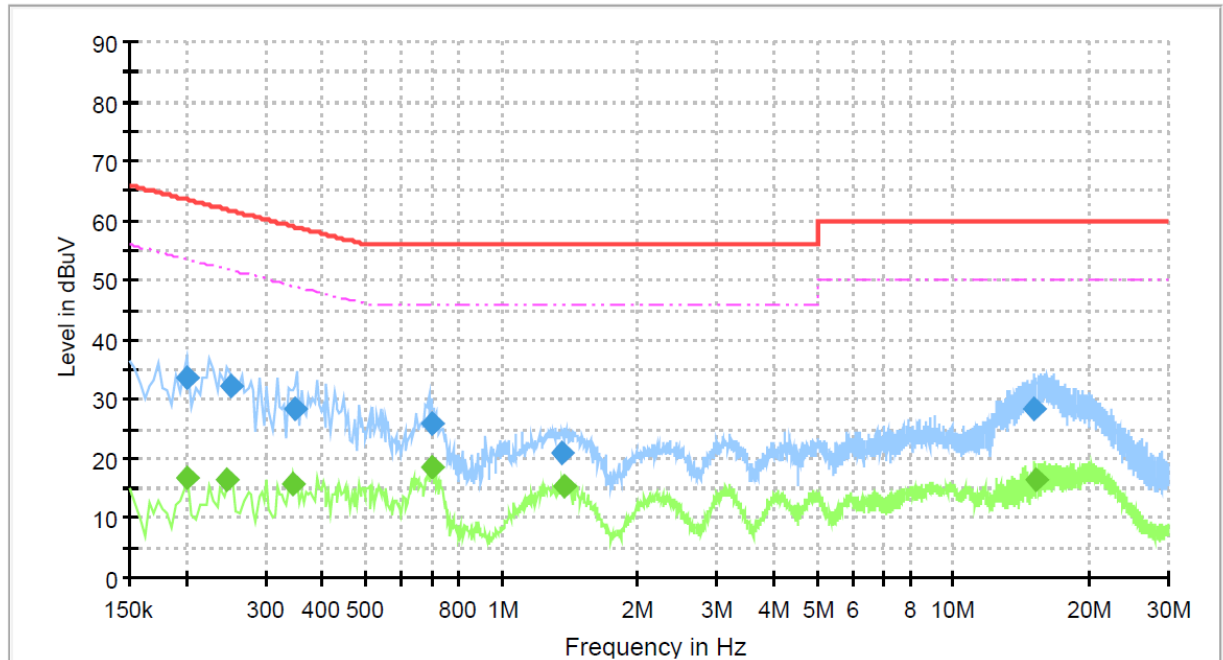
- . Resolution bandwidth : 9 kHz
- . Frequency range : 0.15 MHz ~ 30 MHz
- . Test mode : Worst case (b mode / High CH)
- . Tested Line : HOT LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.174	---	12.96	54.79	41.83	3000.0	9.0	L1	10.23
0.174	31.14	---	64.79	33.65	3000.0	9.0	L1	10.23
0.198	---	14.62	53.72	39.10	3000.0	9.0	L1	10.22
0.203	32.82	---	63.51	30.68	3000.0	9.0	L1	10.22
0.249	31.77	---	61.77	30.01	3000.0	9.0	L1	10.21
0.250	---	14.63	51.77	37.15	3000.0	9.0	L1	10.21
0.389	27.67	---	58.07	30.40	3000.0	9.0	L1	10.22
0.393	---	12.64	47.99	35.35	3000.0	9.0	L1	10.22
0.703	25.90	---	56.00	30.10	3000.0	9.0	L1	10.24
0.703	---	15.74	46.00	30.26	3000.0	9.0	L1	10.24
15.122	---	17.41	50.00	32.59	3000.0	9.0	L1	10.91
15.390	25.41	---	60.00	34.59	3000.0	9.0	L1	10.92

-. Tested Line : NEUTRAL LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.202	---	16.75	53.55	36.79	3000.0	9.0	N	10.24
0.202	33.47	---	63.55	30.08	3000.0	9.0	N	10.24
0.246	---	16.37	51.91	35.54	3000.0	9.0	N	10.22
0.251	32.05	---	61.74	29.69	3000.0	9.0	N	10.22
0.346	---	15.84	49.07	33.23	3000.0	9.0	N	10.22
0.350	28.29	---	58.97	30.68	3000.0	9.0	N	10.22
0.697	25.95	---	56.00	30.05	3000.0	9.0	N	10.24
0.703	---	18.64	46.00	27.36	3000.0	9.0	N	10.24
1.364	21.11	---	56.00	34.89	3000.0	9.0	N	10.28
1.368	---	15.49	46.00	30.51	3000.0	9.0	N	10.28
15.123	28.50	---	60.00	31.50	3000.0	9.0	N	10.94
15.255	---	16.52	50.00	33.48	3000.0	9.0	N	10.95

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.

14. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSV40-N	Rohde & Schwarz	Signal Analyzer	102196	Jan. 15, 2024 (1Y)
FSV40-N	Rohde & Schwarz	Signal Analyzer	101651	Jan. 15, 2024 (1Y)
H-3005D	FinePower	DC POWER SUPPLY	FP09092008	Jan. 15, 2024 (1Y)
ESR	Rohde & Schwarz	EMI Test Receiver	101470	Jun. 16, 2023 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 14, 2023 (1Y)
SCU18	Rohde & Schwarz	Pre-Amplifier	102266	Jul. 11, 2023 (1Y)
SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Jan. 23, 2024 (1Y)
DT3000	Innco System	Turn Table	DT3000/093	N/A
MA4000-EP	Innco System	Antenna Master	MA4000/332/27030611/L	N/A
CO3000	Innco System	Controller	CO3000/904/37211215/L	N/A
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2022 (2Y)
HLP-2008	TDK	Hybrid Antenna	131316	Mar. 07, 2022 (2Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1349	Jul. 04, 2023 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 04, 2024 (1Y)
WRCT 890/960-5/40-8SSK	Wainwright Instruments GmbH	Tunable Band Reject Filter	7	Jul. 11, 2023 (1Y)
F-40-10.0-RF	RLC Electronis	High Pass Filter	0427	Jan. 15, 2024 (1Y)
HPF 3GHz	Rohde & Schwarz	High Pass Filter	N/A	Jan. 15, 2024 (1Y)
HPF 1.5GHz	Rohde & Schwarz	High Pass Filter	N/A	Jan. 15, 2024 (1Y)
10 dB Attenuator	Rohde & Schwarz	10 dB Attenuator	14100882-4	Jul. 11, 2023 (1Y)
8493C	HP	6 dB Attenuator	01925	Jul. 11, 2023 (1Y)
ESR 3	Rohde & Schwarz	EMI TEST RECEIVER	102602	Mar. 15, 2023 (1Y)
NSLK8126	Schwarzbeck	LISN	8126404	Mar. 15, 2023 (1Y)
3825/2	EMCO	AMN	9109-1869	Mar. 15, 2023 (1Y)
VTSD 9561-F	Schwarzbeck	PULSE LIMITER	01337	Nov. 23, 2023 (1Y)
QFA1802-26-6-S	Qualwave	6 dB Attenuator	225338	Jan. 17, 2024 (1Y)
QPD2-0-26500-2-S	Qualwave	Divider	22175074	Jan. 17, 2024 (1Y)
QPD2-0-26500-2-S	Qualwave	Divider	22175075	Jan. 17, 2024 (1Y)
8494B	Agilent	Manual Attenuator	MY42143102	Jan. 15, 2024 (1Y)
8495B	Agilent	70dB ATTENUATOR	MY42141151	Jan. 15, 2024 (1Y)
SH-242	ESPEC	Temperature & Humidity Chamber	0093011138	Jan. 16, 2024 (1Y)
NRP-Z81	Rohde & Schwarz	Wideband Power Sensor	104811	Jan. 17, 2024 (1Y)
SMBV100A	Rohde & Schwarz	VECTOR SIGNAL GENERATOR	260423	Jan. 17, 2024 (1Y)
RT-AX88U	ASUS	Router	N/A	N/A