

RF TEST REPORT

Test Equipment : 27MHz Remote control
Model Name : FGHRC540A-TT-01
FCC ID : YI5HRC540ATT01
Date of receipt : 2024-02-29
Test duration : 2024-04-04 ~ 2024-04-19
Date of issue : 2024-04-22

Applicant : Celadon, Inc.
58 Paul Drive, Suite D, San Rafael, CA 94903 United States

Test Laboratory : Lab-T, Inc.
2182-42, Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si
Gyeonggi-do 17036, Korea (Republic of)

Test specification : FCC Part 15 Subpart C 15.227
RF Output Power : 40.80 dBμV/m
Test result : Pass

The above equipment was tested by Lab-T Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose.
This test report shall not be reproduced except in full, without the written approval of Lab-T, Inc.
This test report is not related to KOLAS.

Tested by:



Engineer
HyunWoo Lee

Reviewed by:



Technical Manager
SangHoon Yu

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1. Revision history

Test Report No.	Date	Description
TRRFCC24-0010	2024-04-22	Initial issue

2. Information

2.1 Applicant Information

Applicant name	Celadon, Inc.
Address	58 Paul Drive, Suite D, San Rafael, CA 94903 United States
Telephone No.	415-472-1177 x101
Person in charge	Robert Retzlaff / retzlaff@celadon.com
Manufacturer	Hyun Seung I&C Co., Ltd
Address	1301,402 Dong Bucheon Techno-Park, 655, Pyeongcheon-ro, Bucheon-si Gyeonggi-do, Republic of Korea

2.2 Test Laboratory information

Corporate name	Lab-T, Inc.
Representative	Duke (Jongyoung) Kim
Address	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Telephone	+82-31-322-6767
Fax	+82-31-322-6768
E-mail	info@lab-t.net
FCC Designation No.	KR0159

2.3 Test Site

Test Site	used	Address
Building L	☒	2182-40 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building T	☒	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building A	☐	2182-44 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)

3. Information About Test Equipment

3.1 Equipment Information

Equipment type	27MHz Remote control
Model name	FGHRC540A-TT-01
Variant model name	-
Frequency	27.145 MHz
Modulation type	OOK
Power supply	DC 3.0 V
H/W version	Ver0.2A
S/W version	REV02

NOTE1: The above EUT information was declared by the manufacturer.

3.2 Antenna Information

Type	Model No.	Gain	Note.
Helical Antenna	EM-27H-ANT	0.7 dBi	-

3.3 Test Frequency

Test mode	Test frequency (MHz)		
	Lowest frequency	Middle frequency	Highest frequency
OOK	-	27.145	-

3.4 Operating conditions for the EUT

Firmware state	REV02	
Test software name(version)	Used native test mode(-)	
Test power setting	default	
Serial number (Setup mode)	EUT #1	#1 (Conducted Emission)
	EUT #2	#2 (Radiated Emission)

4. Test Report

4.1 Summary

FCC Part 15			
FCC Rule	Parameter	Clause	Status
Transmitter Requirements			
15.203	Antenna Requirement	4.3.1	C
15.227(a)	Field Strength of Emissions	4.3.2	C
15.215(c)	Emission Bandwidth	4.3.3	C
15.227(b) 15.209(a)	Radiated Spurious Emission	4.3.4	C
15.207(a)	Conducted Emissions	4.3.5	N/A ^{Note2}
-	Duty cycle	4.3.6	-
Note 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable Note 2 : This device gets power supply from only battery(DC 3.0V)			

* The general test methods used to test this device is ANSI C63.10:2020

4.2 Measurement Uncertainty

Measurement items	Expanded Uncertainty	
Occupied Channel Bandwidth	6.80 kHz	(The confidence level is about 95 %, k=2)
Conducted Spurious Emissions	0.71 dB	(The confidence level is about 95 %, k=2)
Radiated Spurious Emissions (1 GHz under)	4.84 dB	(The confidence level is about 95 %, k=2)

4.3 Transmitter Requirements

4.3.1 Antenna Requirement

4.3.1.1 Regulation

According to §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. 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 a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

4.3.1.2 Result

Comply

(The transmitter has a Helical Antenna. The directional peak gain of the antenna is 0.7 dBi.)

4.3.2 Field Strength of Emissions

4.3.2.1 Regulation

According to §15.227(a) The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in § 15.35 for limiting peak emissions apply.

4.3.2.2 Measurement Procedure

ANSI C63.10 § 4.1.4 FFT-based measurement instrument

ANSI C63.10 § 6.4 Radiated emissions from unlicensed wireless devices below 30 MHz

4.3.2.3 Result

Comply

4.3.2.4 Measurement data

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Duty factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
27.145	PK	H	26.20	8.80	-	35.00	100.00	65.00
	AV	H	26.20	8.80	-33.22	1.78	80.00	78.22
27.145	PK	V	32.00	8.80	-	40.80	100.00	59.20
	AV	V	32.00	8.80	-33.22	7.58	80.00	72.42

Note 1 : Measured distance : 3 m

Note 2 : Peak Result : Peak Reading + Factor

Duty factor : $20 \times \log(\text{Duty cycle})$ dB, refer to 4.3.6

Average Result : Peak Reading + Factor + Duty factor

4.3.3 Emission Bandwidth

4.3.3.1 Regulation

According to §15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.3.3.2 Measurement Procedure

ANSI C63.10 § 6.9.2 Occupied bandwidth-relative measurement procedure
ANSI C63.10 § 6.9.2 Occupied bandwidth-power bandwidth (99%) measurement procedure

4.3.3.3 Result

Comply

4.3.3.4 Measurement data

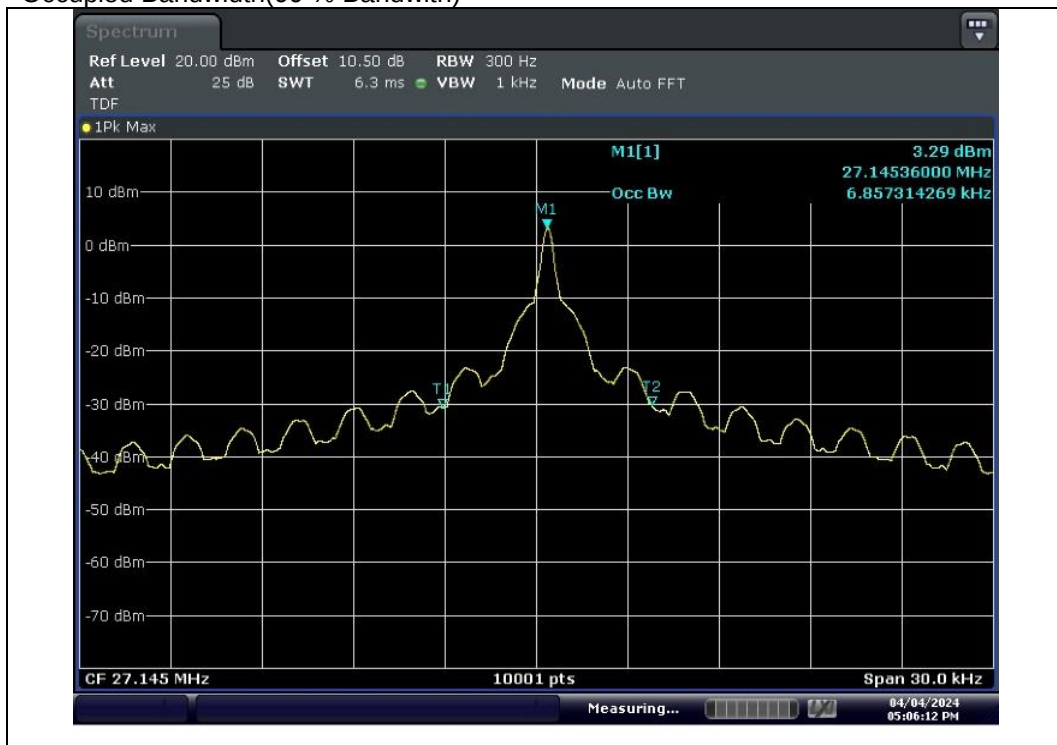
Frequency (MHz)	20 dB Bandwidth (kHz)	Occupied Bandwidth (99 % Bandwidth)(kHz)
27.145	1.909	6.857

4.3.3.5 Test Plot

20 dB Bandwidth



Occupied Bandwidth(99 % Bandwidth)



4.3.4 Radiated Spurious Emission

4.3.4.1 Regulation

According to §15.227(b) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in § 15.209.

According to §15.209(a) Except as provided elsewhere in this subpart, 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	2 400/F(kHz)	300
0.490 - 1.705	24 000/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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

4.3.4.2 Measurement Procedure

ANSI C63.10 § 6.4 Radiated emissions from unlicensed wireless devices below 30 MHz
ANSI C63.10 § 6.5 Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz

4.3.4.3 Result

Comply (measurement data : refer to the next page)

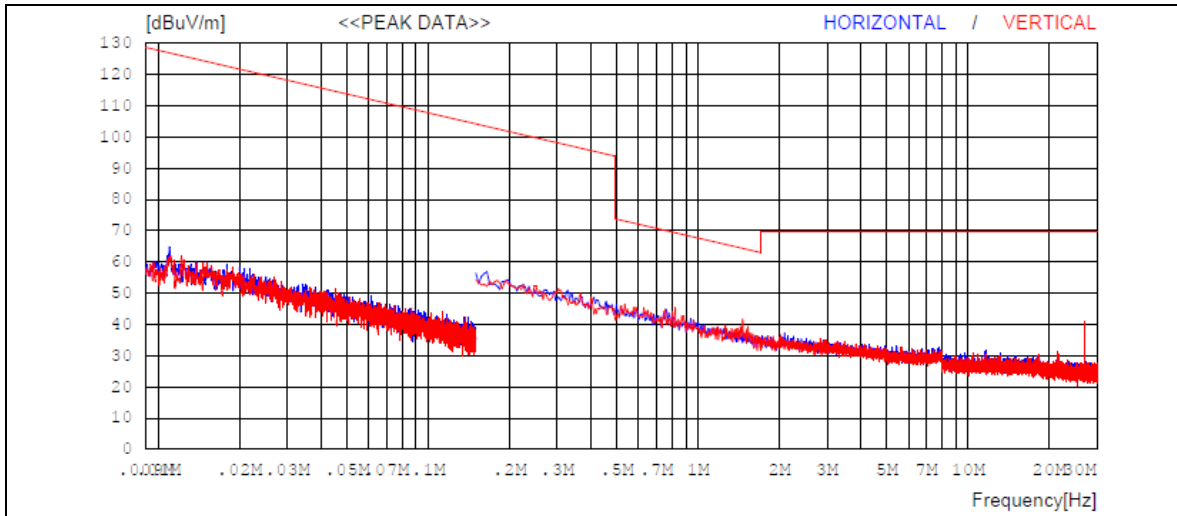
4.3.4.4 Measurement data

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Factor (dB)	Duty factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
920.901	QP	H	24.80	3.50	-	28.30	46.00	17.70
945.399	QP	V	25.40	3.90	-	29.30	46.00	16.70

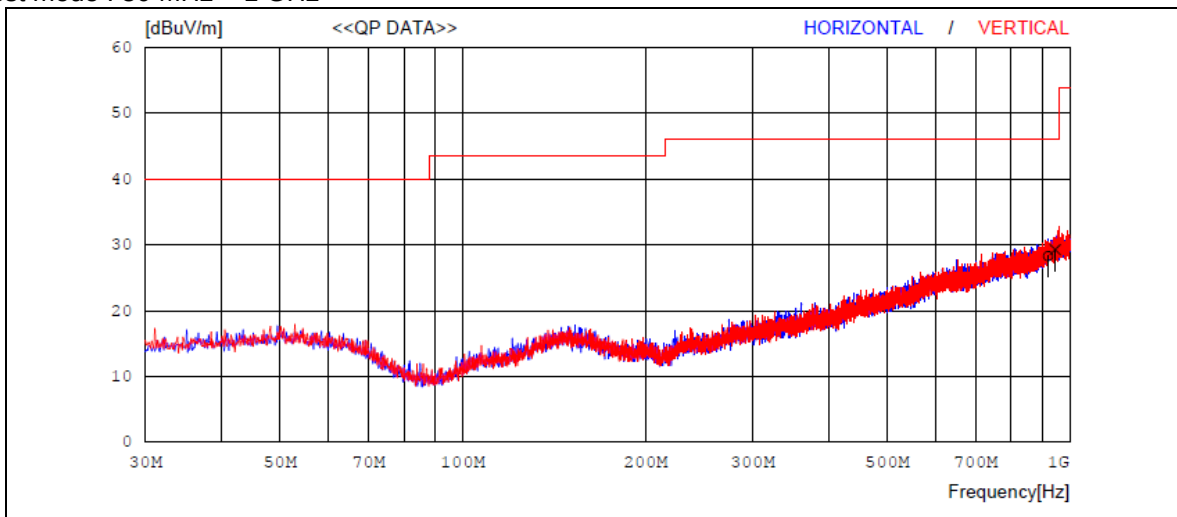
- NOTE1 : The resolution bandwidth of test receiver/spectrum analyzer is 200 Hz for Quasi-peak detection (QP) at frequency below 150 kHz.
- NOTE2 : The resolution bandwidth of test receiver/spectrum analyzer is 9 kHz for Quasi-peak detection (QP) at frequency 150 kHz to 30 MHz.
- NOTE3 : The resolution bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
- NOTE4 : EUT height : 0.8 m is for below 1 GHz testing
- NOTE5 : Below 1 GHz Measured distance : 3 m
- NOTE6 : Factor : Ant Factor + Cable loss - Amp gain
Result : Reading + Factor

4.3.4.5 Measurement Plot

Test mode : 9 kHz ~ 30 MHz



Test mode : 30 MHz ~ 1 GHz



4.3.5 Conducted Emission

4.3.5.1 Regulation

According to §15.207(a) for an intentional radiator 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, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

4.3.5.2 Measurement Procedure

- 1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.
- 2) Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASIPeAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

4.3.5.3 Result

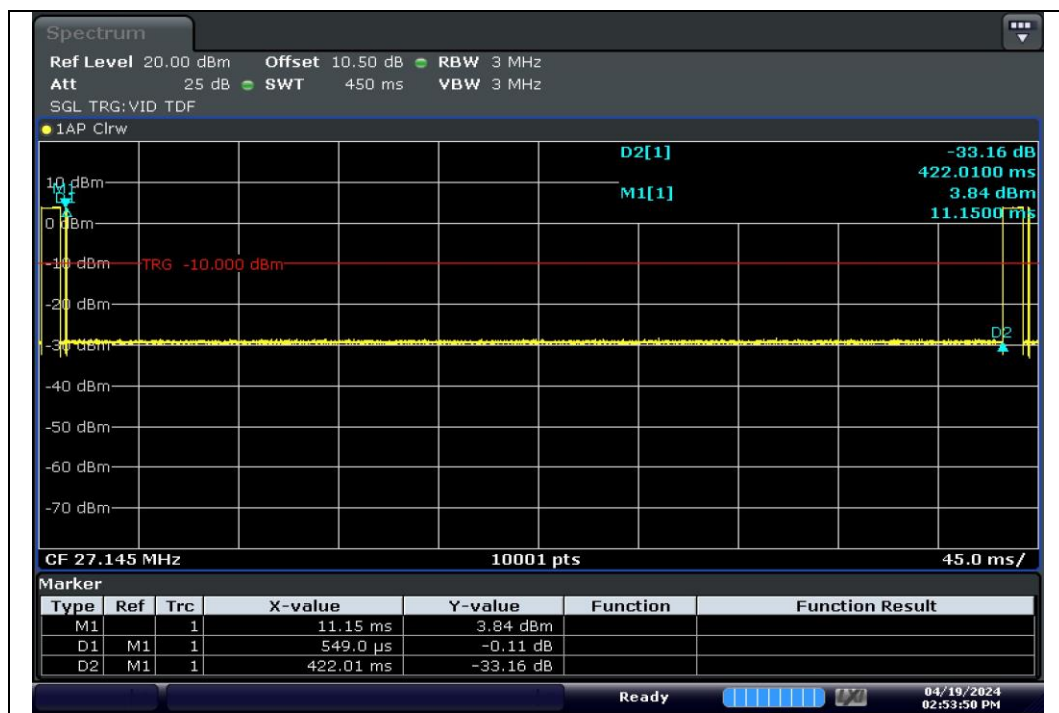
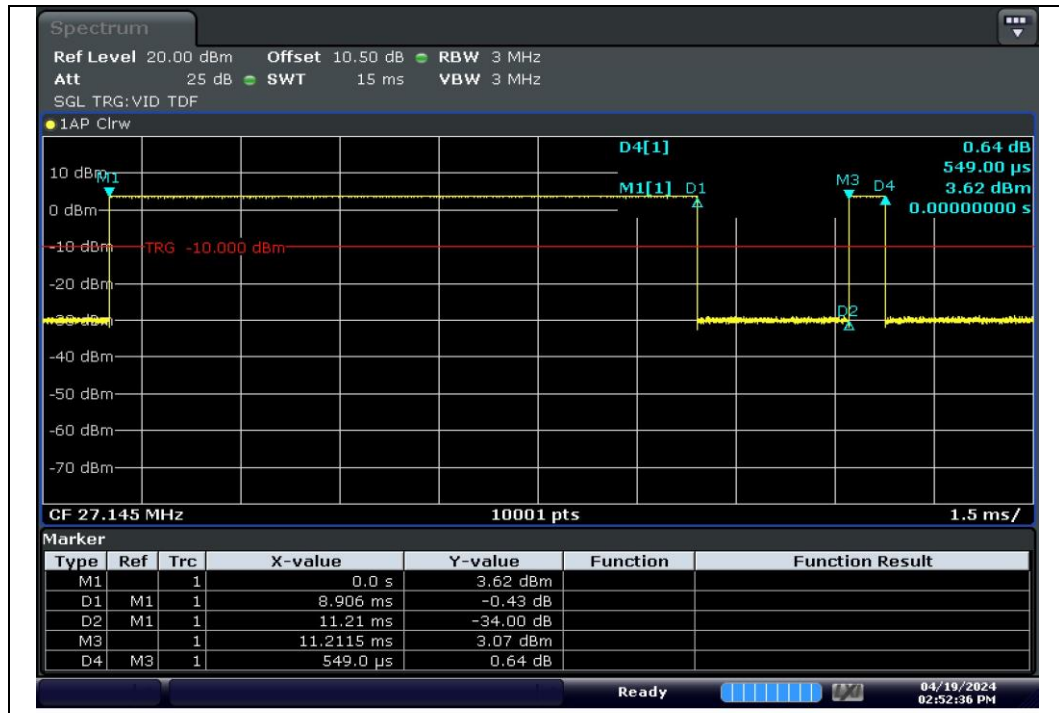
Not Applicable (This device gets power supply from only battery(DC 3.0V))

4.3.6 Duty cycle

The duty cycle de-rating factor used in the calculation of average radiated limits (per CFR 15.209 and 15.35(c)) is described below.

Period(ms)	Ontime(ms)	Duty cycle(%)	Duty cycle factor(dB)
433.220	9.455	2.18	-33.22

Duty cycle factor(dB) : 20log(on time/period)



APPENDIX I

TEST EQUIPMENT USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Equipment	Manufacturer	Model	Serial No.	Cal. Date (yy.mm.dd)	Next Cal.Date (yy.mm.dd)
FSV Signal Analyzer	ROHDE&SCHWARZ	FSV40	101010	2024-04-01	2025-04-01
Dynamic Measurement DC Source	HP	66332A	US37471465	2024-01-04	2025-01-04
ATTENUATOR	WEINSCHEL	54A-10	69685	2023-10-11	2024-10-11
EMI Test Receiver	ROHDE&SCHWARZ	ESU40	100445	2023-09-05	2024-09-05
BiLog Antenna	Schwarzbeck	VULB9168	00821	2023-03-29	2025-03-29
Attenuator	JFW	50F-006	6 dB-3	2024-04-01	2025-04-01
Preamplifier	TSJ	MLA-10k01- b01-27	1870367	2024-04-01	2025-04-01
Antenna Mast(10 m)	TOKIN	5977	-	-	-
Controller(10 m)	TOKIN	5909L	141909L-1	-	-
Turn Table(10 m)	TOKIN	5983-1.5	-	-	-
Active Loop H-Field	ETS	6502	00150598	2023-06-27	2025-06-27

-End-