

Test Report

IEC 60945

Trade Name : FURUNO
System : Navtex
Model : NAVTEX RECEIVER
Type : NX-900

Report Number : LIC 12-23-027

Date of Issue : 10 April 2023

Labotech International Co., Ltd.

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Testing Laboratory Status

Labotech International Co., Ltd. (hereafter called "LIC") has been holding the following status after having been assessed according to the provisions of ISO/IEC 17025 and/or the relevant rules:

- (1) JAB Accredited Testing Laboratory:
 - accredited by Japan Accreditation Board (JAB)
 - Laboratory accreditation number: RTL03220 (Date of initial accreditation: 14 January 2011 (*))
 - Scope of accreditation: Electrical testing - EMC, Climatic, Vibration and Radio tests
- (2) Telefication Listed Testing Laboratory:
 - listed by Telefication B. V., (The Netherlands)
 - Laboratory assignment number: L116 (Date of initial listing: 26 July 1999 (*))
 - for testing the following product categories/ test standards: EN 60945, IEC 61162-1/-2, IEC/EN 61162-450, IEC 62288, ETSI EN 301 843-1 / -2, ETSI EN 301 489-1 / -3 / -17
- (3) TÜV Appointed EMC Test Laboratory:
 - appointed by TÜV Rheinland Japan Ltd.
 - Laboratory assignment number: UA 50046428 (Date of initial appointment: 21 December 1998 (*))
 - for carrying out the tests of EMC emission and immunity
- (4) RMRS Recognized Testing Laboratory:
 - recognized by Russian Maritime Register of Shipping (Russia)
 - Laboratory recognition number: 17.13259.170 (Date of initial recognition: 27 January 2009 (*))
 - for carrying out testing in the field of:
Electrical measurements and tests, EMC tests, Mechanical measurements and tests, Equipment protection degree tests, and Climatic tests for Ship's radio and navigational equipment and IEC 60945: 2002
- (5) RRR Recognized Test Laboratory:
 - recognized by Russian River Register (Russia)
 - Certificate number: 131927 (Date of initial recognition: 31 May 2013 (*))
 - for carrying out of tests of ships radio and navigation equipment
- (6) DNV Recognized Environmental Test Laboratory:
 - recognized by Det Norske Veritas AS
 - Recognition certificate number: 262.1-015854-J-12 (Date of initial recognition: 12 July 2013 (*))
 - Scope of recognition: Testing according to the standards IEC 60945, IEC 61162-1/-2/-450, IEC 62288, IEC 62388 and IEC 62252 Annex E
 - Application: Provisions of Environmental, interface and safety testing
- (7) CCS Recognized Test Agency:
 - recognized by China Classification Society
 - Recognition certificate number: DB13A00001 (Date of initial recognition: 29 January 2014 (*))
 - Scope of recognition: Performance/Environmental/EMC/Special purpose/Safety precautions tests for Electrical & Electronic Product including Maritime Navigation and Radio-communication Equipment & Systems
- (8) SABS EMC A-Lab program Laboratory:
 - recognized by South African Bureau of Standards
 - Assigned Lab number: SABS/A-LAB/0042/2018 (Date of initial recognition: 5 July 2018 (*))
 - Approved List of EMC Standards : SANS 211 / 214-1 / 214-2 / 222 / 2332 / 2335, CISPR 11 / 14-1 / 14-2 / 22 / 32 / 35, SANS/IEC 60601-1-2, SANS/IEC 61326-1, IEC 61326-2-6, SANS/IEC 61000-3-2 / -3-3 / -4-2 / -4-3 / -4-4 / -4-5 / -4-6 / -4-8 / -4-11 / -6-1 / -6-2 / -6-3 / -6-4
- (9) A2LA accredited Testing Laboratory:
 - accredited by American Association of Laboratory Accreditation (A2LA)
 - Certificate number: 5241.01 (Date of initial accreditation: 17 July 2019 (*))
 - Scope of accreditation: Electrical testing - Emissions - Radiated and Conducted, Radio - Maritime Radio Systems, Stations in the maritime services, Private land mobile radio service, Radio / Intentional radiators, RF Exposure and EMC - Automotive Electronic Devices (AED), Machine and Vehicle

(*) The latest certification status may be found on the LIC website (<https://www.labotech-intl.co.jp/>).

1 Report Summary

LIC project number	: LIC 04-22-0401		
Customer	: FURUNO ELECTRIC CO., LTD. 9-52 Ashihara-cho, Nishinomiya City, Hyogo. 662-8580, Japan		
Manufacturer	: FURUNO ELECTRIC CO., LTD. 9-52 Ashihara-cho, Nishinomiya City, Hyogo. 662-8580, Japan		
Trade name	: FURUNO		
System	: Navtex		
Model	: NAVTEX RECEIVER		
Type	: NX-900		
Serial number	: See Clause 2.1 of this report.		
Product function and intended use	: To receive Navtex frequency and local frequency at the same time		
Date of receipt of samples	: 16 January 2023		
Test period	: From 16 January 2023 to 22 March 2023		
Test standard(s)/ Test specification(s)	: IEC 60945: 2002 (ed. 4), Clause 9.2, 9.3, 10.3, 10.4, 10.5, 10.8 and 10.9, including IEC 60945 Corrigendum 1 (2008) IEC 60945: 1996 (ed. 3), Clause 10.2 and 10.3		
Reference standard(s)	: CISPR 16-1-1 (2006)	: CISPR 16-1-2 (2006)	: CISPR 16-1-4 (2007)
	: IEC 61000-4-2 (2001)	: IEC 61000-4-3 (2006)	: IEC 61000-4-4 (2004)
	: IEC 61000-4-6 (2006)	: IEC 61000-4-11 (2004)	
Test results/Compliance	: Passed. The test results of this report relate only to the samples tested.		

Place of test : Labotech International Co., Ltd.
 - LABOTECH EMC Center
 1-16, Fukazu-cho, Nishinomiya-shi, Hyogo, 663-8203 Japan
 - Nishinomiya-Hama Lab.
 2-20, Nishinomiya-Hama, Nishinomiya-shi, Hyogo, 662-0934 Japan

Approved by : Tadayuki Ekawa
 Title: Manager, Testing & Facilities Control Section, Technical Department,
 Labotech International Co., Ltd.
 Signature:



Approved Date : 10 April 2023

Note1: The following abbreviations and symbols are used in this report.

-- None
 NA Not applicable
 NP Not performed
 P Power
 S Signal/control

Note2: The results of immunity tests in Clause 4.X.2 are reported as follows.

Unit	Port type	Port name	Performance criterion	Result	
XXX	P	XXX	A (*1)	A (*2)	Passed.

(*1) Required performance criterion

(*2) Performance criterion that tested units passed.

Revision History

Version	Date	Page	Item	Description/ Reason of the change
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Disclaimer:

The test results of this report relate only to the samples tested.

LIC has no responsibility for the followings except for the requirements of test standards.

- The thing(s) in association with the test and information pertaining to it/them, which are provided by the customer; information described in Clause 2 (except for Clause 2.9) of this report and information of the cable(s) used.
- The matter(s) specified by the customer; Test standard(s) applied, test item(s), test conditions, criteria, object(s) to be tested or excluded, operation mode(s) and connection/configuration.

2 Principal Information

2.1 Equipment under test (EUT)

Name	Type	Serial number	Category	Installation mounting
Main Unit	NX-900	1001-6400-0001	Protected	Table top Flush-mounting Overhead-mounting
Antenna Unit	NX-9HE	000001 (*1)	Exposed	Mast-mounting
		000003 (*2)		
Printer	PP-900	000003	Protected	Table top Flush-mounting Overhead-mounting
Junction Box	IF-900	000003	Protected	Wall-mounting Floor-standing

(*1) Used for Conducted emissions, Radiated emissions, Electrical fast transient/Burst immunity and Electrostatic discharge immunity.

(*2) Used for Conducted low frequency immunity, Conducted radio frequency immunity, Radio frequency electromagnetic field immunity and Power supply failure immunity.

2.2 Configuration of EUT unit (s)

Name	Dimensions (W × H × D, or φ × H) (mm)	Mass (kg)	Power rating
Main Unit	210 × 203 × 104	1	12/24 VDC, 0.8/0.4 A
Antenna Unit	156 × 116 × 156	0.48	9.5 VDC, 0.15 A
Printer	150 × 175 × 115	0.9	12/24 VDC, 1.1/0.5 A
Junction Box	232 × 213 × 50	0.8	12/24 VDC, 1.9/1.0 A

2.3 Associated Units (AU)

No Associated Units (AU) used.

2.4 Auxiliary Equipment (AE)

Name	Type	Serial number	Manufacturer	Date of last calibration	Calibration cycle
Signal Generator 1	SMC100A	108657	Rohde&Schwarz	July 2022	1 year
Signal Generator 2	SMC100A	104000	Rohde&Schwarz	October 2022	1 year
PC	Latitude 3520	FCMZT93	DELL	NA	NA
NAVTEX Simulator 1 (*1)	NX-700B	0003	FEC	NA	NA
NAVTEX Simulator 2 (*2)	NX-700B	013721	FEC	NA	NA
DC power supply	P50-12-N	--	COSEL	NA	NA
Conversion Box	CONV-BOX	0001	FEC	NA	NA
LED Box	LED-BOX	0003	FEC	NA	NA
RS-232C/USB converter	BSUSRC0610BS	A01109	BUFFALO	NA	NA
RF attenuator	BW-N30W20+	--	Mini Circuits	NA	NA
RF attenuator	23-30-34	--	Weinschel	NA	NA
Coupling antenna	--	--	FEC	NA	NA

(*1) Used for Conducted low frequency immunity, Conducted radio frequency immunity, Radio frequency electromagnetic field immunity, Electrical fast transient/Burst immunity and Electrostatic discharge immunity.

(*2) Used for Power supply failure immunity.

2.5 Software contained in EUT and AE

Category	Contained in	Program name	Version number
EUT	Main unit	0850202	01.01
AE	PC	UDP Debugger	23.181130
AE	PC	NX-700_TEST_SIM	20120912

2.6 The EUT product documentation used for the tests

No EUT product documentation used.

2.7 EUT Operation mode and Performance test / Performance check

2.7.1 EUT Operation mode

(1) Continuous test mode: Continuous operation (Communicating and printing)

Conducted emissions and Radiated emissions

Item	Settings
LAN port	Connected to PC (AE). NX-900 (EUT) outputs random signals.
COM1/2 port	Baud rate: 38400 bps
	Quality Test
ALM port	Quality Test
Printer	Quality Test
ANT port	Receiving NAVTEX message: No
LCD	LCD brilliance: MAX
	Key backlight brilliance: MAX
	Quality Test

(2) RX check and Continuous test mode:

Continuous operation (Communicating and printing) + Checking receiver sensitivity

Other than Conducted emissions, Radiated emissions, Electrical fast transient/Burst immunity and Electrostatic discharge immunity

Item	Settings
LAN port	Receive LAN communication checking signal from UDP Debugger operating in PC (AE) every second.
COM1/2 port	Baud rate: 38400 bps
	Quality Test
ALM port	Quality Test
Printer	Quality Test
ANT port	NAVTEX Simulator 1/2 (AE) inputs test messages via Signal Generator 1/2 (AE) instructed by PC (AE). (*1)
	RF output level of Signal Generator 1/2(AE): -101 dBm (for Performance check)
	RF frequency: - 518 kHz (Signal Generator 1(AE)) - 4209.5 kHz (Signal Generator 2(AE)) Receives at the same time.
LCD	LCD brilliance: MAX
	Key backlight brilliance: MAX
	Quality Test

Electrical fast transient/Burst immunity and Electrostatic discharge immunity

Item	Settings
LAN port	Receive LAN communication checking signal from UDP Debugger operating in PC (AE) every second.
COM1/2 port	Baud rate: 38400 bps
	Quality Test
ALM port	Quality Test
Printer	Quality Test
ANT port	NAVTEX Simulator 1 (AE) inputs test messages via Signal Generator 1/2 (AE) instructed by PC (AE). (*1)
	NAVTEX Simulator 1 (AE) inputs test messages via Signal Generator 1/2 (AE). (*2)
	RF output level of Signal Generator 1/2 (AE): -101 dBm (for Performance check)
	RF frequency: - 518 kHz (Signal Generator 1 (AE)) - 4209.5 kHz (Signal Generator 2 (AE)) Receives at the same time.
LCD	LCD brilliance: MAX
	Key backlight brilliance: MAX
	Quality Test

(*1) Applied to the test of Electrical fast transient/Burst immunity for the following ports;

EUT	Power supply condition	Port
NX-900	24 VDC	J2, J3, J4
NX-9HE	24 VDC	J1
PP-900	24 VDC	J2
IF-900	12 VDC	TB1/TB2/TB3, TB4
	24 VDC	TB1/TB2/TB3, TB4, TB6 (COM1), TB6 (COM2)/TB7(COM2), TB8

(*2) Applied to the test of Electrical fast transient/Burst immunity for the following ports;

EUT	Power supply condition	Port
NX-900	24 VDC	J1
IF-900	24 VDC	TB7(COM1), TB7(ALM)

2.7.2 Performance test

Electrical fast transient/Burst immunity and Electrostatic discharge immunity

Item	Criteria
Receiver call sensitivity test	Checked before and after the test. The error rate of the contents printed by Printer (EUT) should be 4% or less. The difference between the minimum receiver sensitivity measured before and after the test should be within ± 2 dBm.

Other tests

Item	Criteria
Receiver call sensitivity test	Checked before and after the test. The error rate of the contents printed by Printer (EUT) should be 4% or less. The minimum receiver sensitivity should be -107 dBm or less.

2.7.3 Performance check

Item	Criteria
LAN port check	During the test, input sentences (\$PFEC,pireq: highlighted in light blue) and output sentences (\$PFEC,pidat,0,NX-900: highlighted in yellow) should be displayed with 1 second-cycle on “UDP Debugger” operating in PC (AE).
	After the test, the number of input sentences (\$PFEC,pireq) and output sentences (\$PFEC,pidat,0,NX-900) logged by “UDP Debugger” operating in PC (AE) should be same.
COM1/2 port check	During the test, the test result of COM1 and COM2 should be “OK” on “Quality Test” displayed in Main Unit (EUT).
Memory check	During the test, the test result of ROM1, ROM2 and RAM should be “OK” on “Quality Test” displayed in Main Unit (EUT).
ALM port check	During the test, LED-Box (AE) should flash with 1 second-cycle.
Print check	During the test, Printer (EUT) should keep printing.
	After the test, the printed characters should not be faint and cut off.
Display check	During the test, no disturbances should appear on “Quality Test” displayed in Main Unit (EUT).
	During the test, “Indicator mark” on displayed top-right of Main Unit (EUT) should keep rotating.
	During the test, an indication of printing should appear on Main Unit (EUT) while Printer (EUT) is printing.
Buzzer check	During the test, the buzzer of Main Unit (EUT) should not be activated.
Receiver call sensitivity check	During the test, “y” of the following sentences should be shown as “OK” on “UDP Debugger” operating in PC (AE). - \$PFEC,nxcom,10,R,21,0,x.x,y (518 kHz) - \$PFEC,nxcom,10,R,21,2,x.x,y (4209.5 kHz)

2.8 Observation and comments

- (1) Test items to be conducted and test conditions to be applied were specified by the customer.
- (2) Operation modes applied to each test were specified by the customer.
- (3) The following test frequencies were excluded at the customer’s request for Conducted radio frequency immunity and Radio frequency electromagnetic field immunity;
 - 490 kHz to 546 kHz
 - 462 kHz to 518 kHz
 - 3969 kHz to 4449 kHz
- (4) Surge immunity and power supply short term variation immunity were not applicable to the EUTs because the EUTs are DC powered equipment.

2.9 Measurement uncertainties

No.	Test item	Measurement uncertainty (*)
1	Conducted emissions	±2.6 dB
2	Radiated emissions	±3.4 dB (0.15 MHz to 30 MHz)
		±5.0 dB (30 MHz to 300 MHz)
		±4.3 dB (300 MHz to 1 GHz)
		±4.4 dB (1 GHz to 2 GHz)
3	Conducted low frequency immunity	±0.2%
4	Conducted radio frequency immunity	±1.2 dB (for CDN, 10 kHz to 230 MHz)
		±3.1 dB (for EM Clamp, 10 kHz to 230 MHz)
5	Radio frequency electromagnetic field immunity	±1.4 dB
6	Electrical fast transient/Burst immunity	±3.2%
7	Power supply failure immunity	--
8	Electrostatic discharge immunity	±5.3%

(*) confidence level = 95%, coverage factor $k = 2$

2.10 Modification made to the EUT

No modifications were made to the EUT during testing.

3 Test Results Summary

No.	Test item	Result	Test engineer
1	Conducted emissions	Passed.	N. Yasuda
2	Radiated emissions	Passed.	M. Sawayanagi
3	Conducted low frequency immunity	Passed.	R. Matsuura
4	Conducted radio frequency immunity	Passed.	S. Yabushita
5	Radio frequency electromagnetic field immunity	Passed.	N. Yasuda
6	Electrical fast transient/Burst immunity	Passed.	N. Yasuda
7	Power supply failure immunity	Passed.	N. Yasuda
8	Electrostatic discharge immunity	Passed.	N. Yasuda

4 Test Results

4.1 Conducted emissions

4.1.1 Test conditions

Test frequency range	10 kHz – 30 MHz
Input power supply (*)	12 VDC 24 VDC

(*) Specified by the customer.

4.1.2 Test result

Unit	Port type	Port name	Power supply	Result
NX-900	P (DC)	J1 (PWR)	12 VDC	Passed.
			24 VDC	Passed.
NX-9HE (S/N: 000001)	--	--	--	NA (*)
PP-900	P (DC)	J1 (PWR IN)	12 VDC	Passed.
			24 VDC	Passed.
IF-900	P (DC)	TB5 (PWR IN)	12 VDC	Passed.
			24 VDC	Passed.

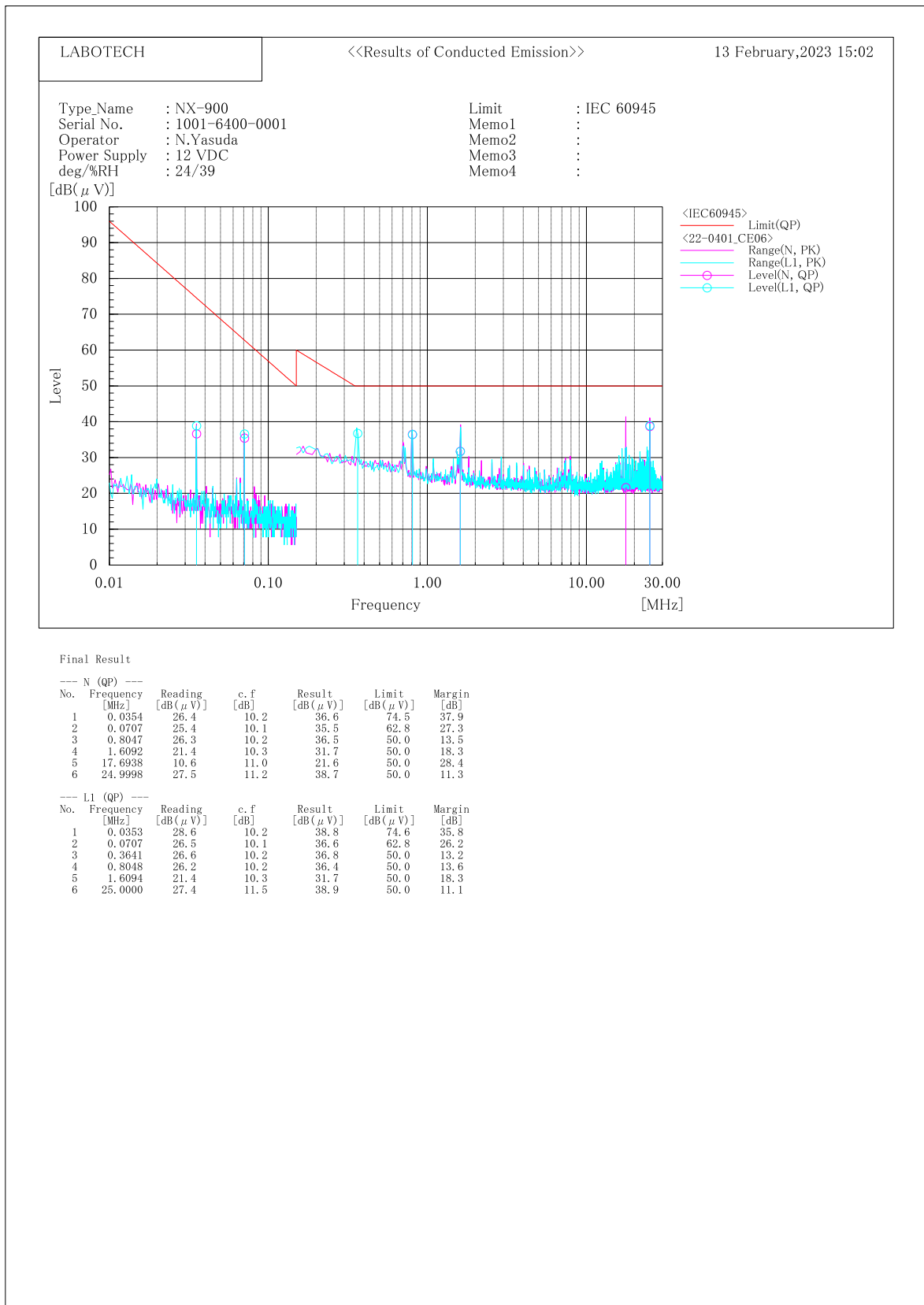
(*) Not applicable because this unit has no power port.

4.1.3 Environmental conditions during testing

Date of test		Before-test	After-test
13 February 2023	Temperature	24°C	24°C
	Humidity	39%RH	39%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC

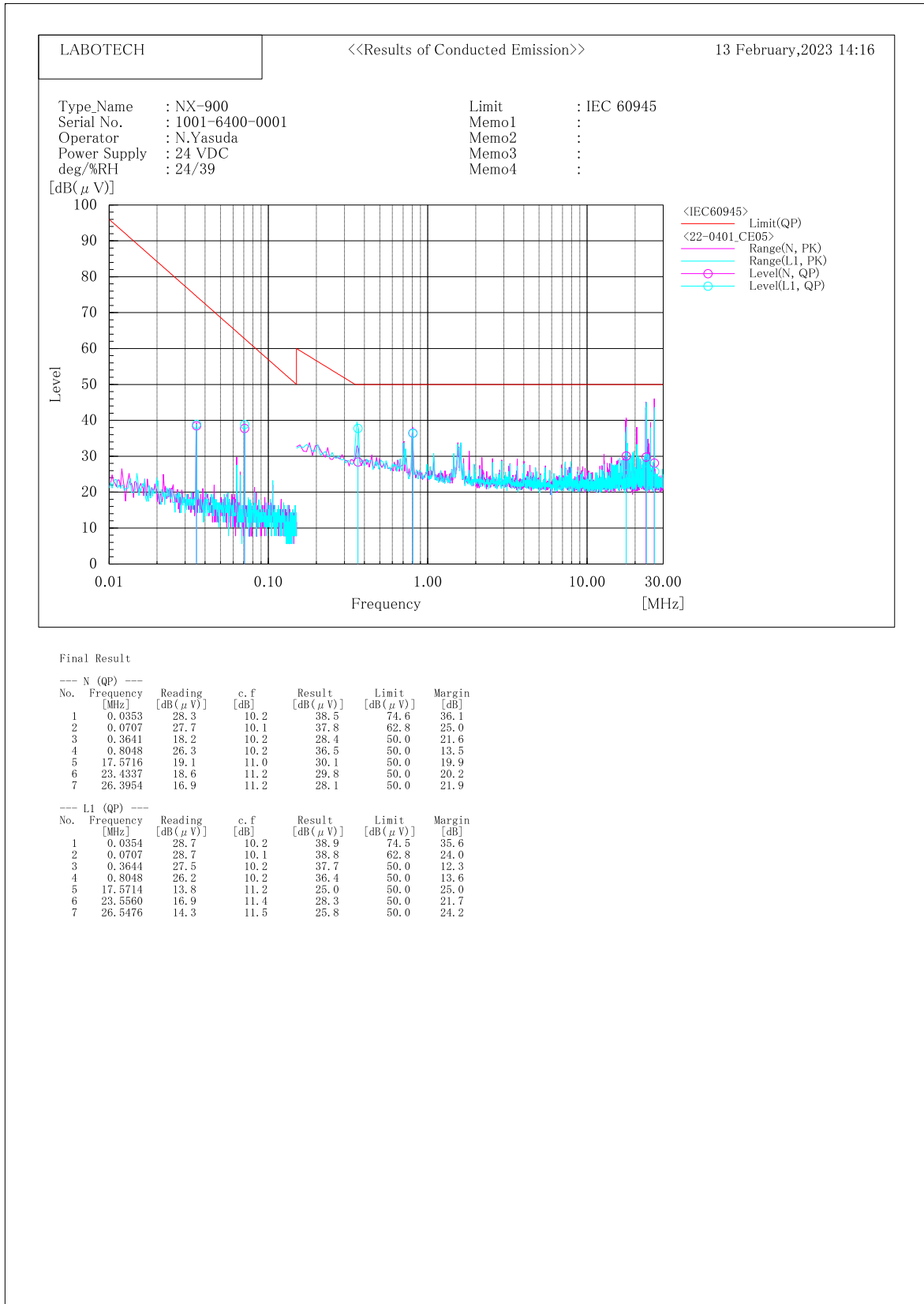
4.1.4 Measurement results

NX-900
12 VDC



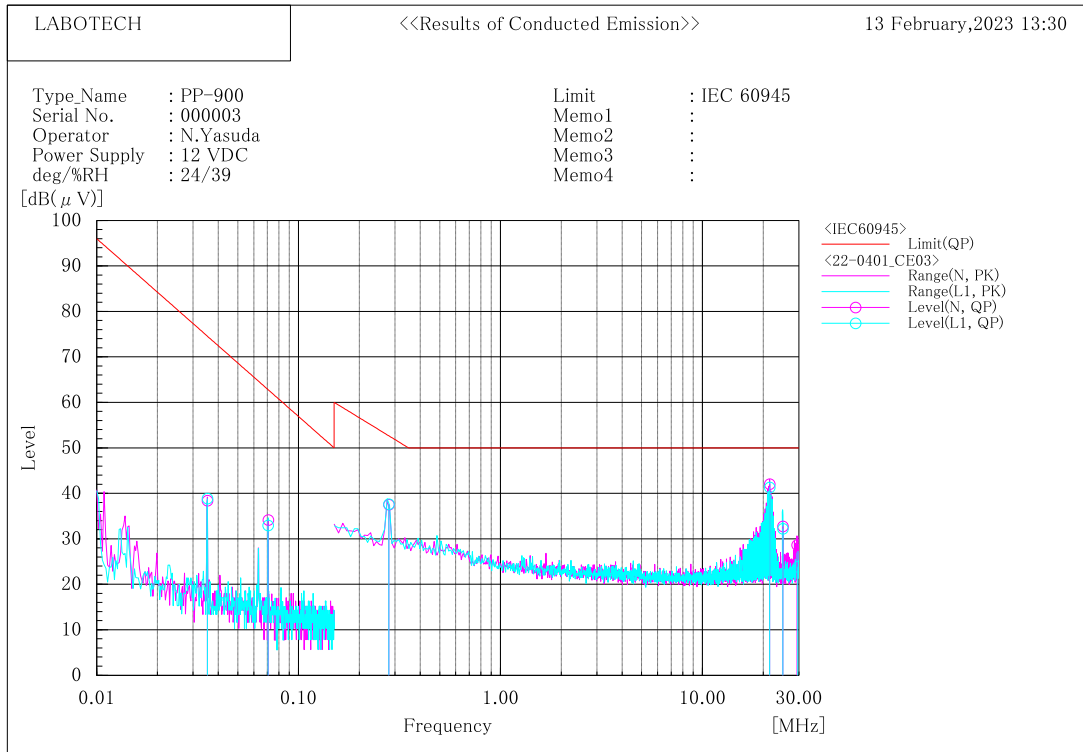
Note: Result = Reading + c.f. (Correction Factor).

24 VDC



Note: Result = Reading + c.f. (Correction Factor).

PP-900
12 VDC



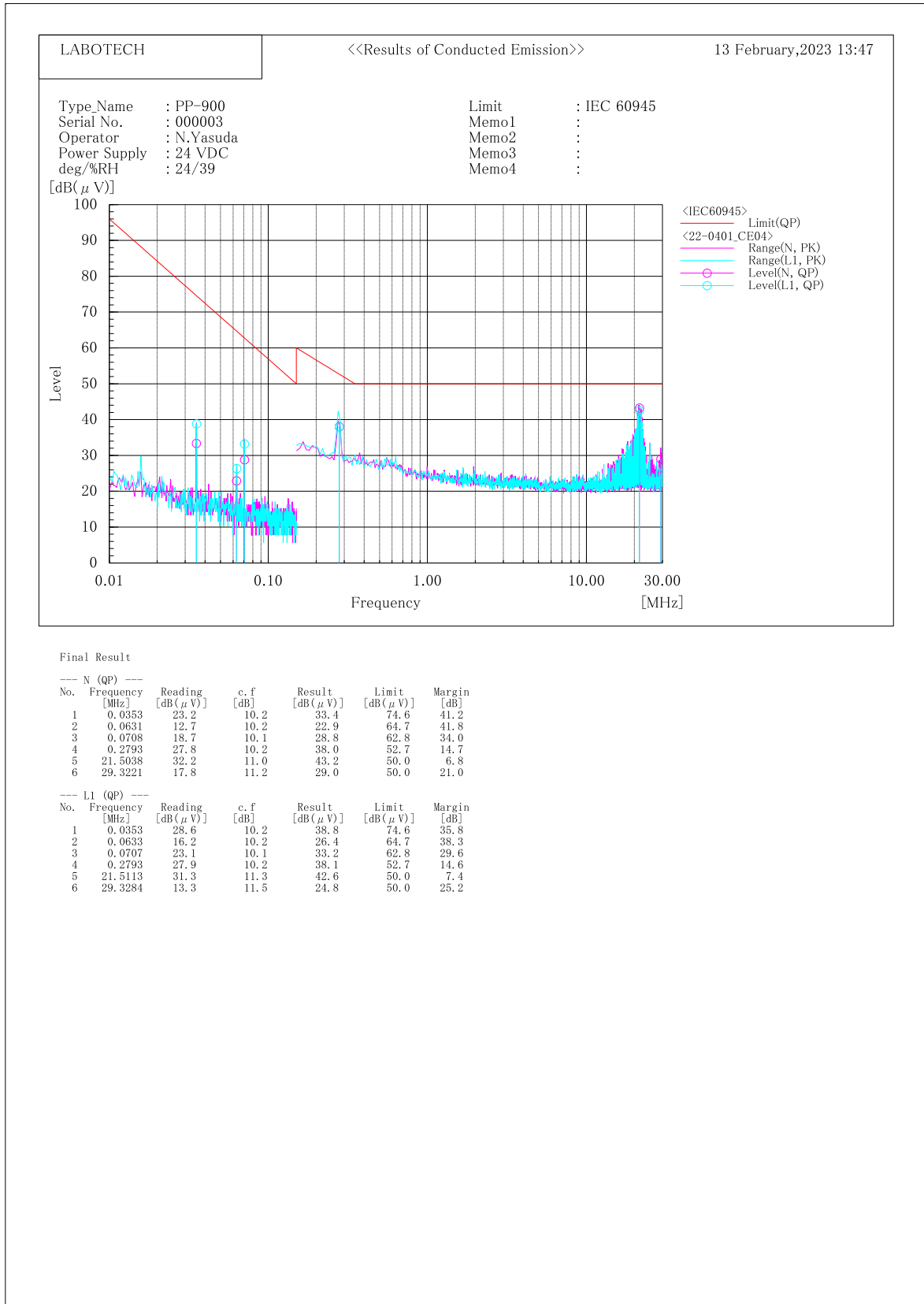
Final Result

--- N (QP) ---						
No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB]	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]
1	0.0354	28.2	10.2	38.4	74.5	36.1
2	0.0707	24.0	10.1	34.1	62.8	28.7
3	0.2797	27.3	10.2	37.5	52.6	15.1
4	21.5361	31.0	11.0	42.0	50.0	8.0
5	25.0000	21.5	11.2	32.7	50.0	17.3
6	29.3663	17.4	11.2	28.6	50.0	21.4

--- L1 (QP) ---						
No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB]	Result [dB(μV)]	Limit [dB(μV)]	Margin [dB]
1	0.0354	28.7	10.2	38.9	74.5	35.6
2	0.0707	22.9	10.1	33.0	62.8	29.8
3	0.2796	27.4	10.2	37.6	52.6	15.0
4	21.5370	30.0	11.3	41.3	50.0	8.7
5	25.0000	20.7	11.5	32.2	50.0	17.8
6	29.6519	12.4	11.5	23.9	50.0	26.1

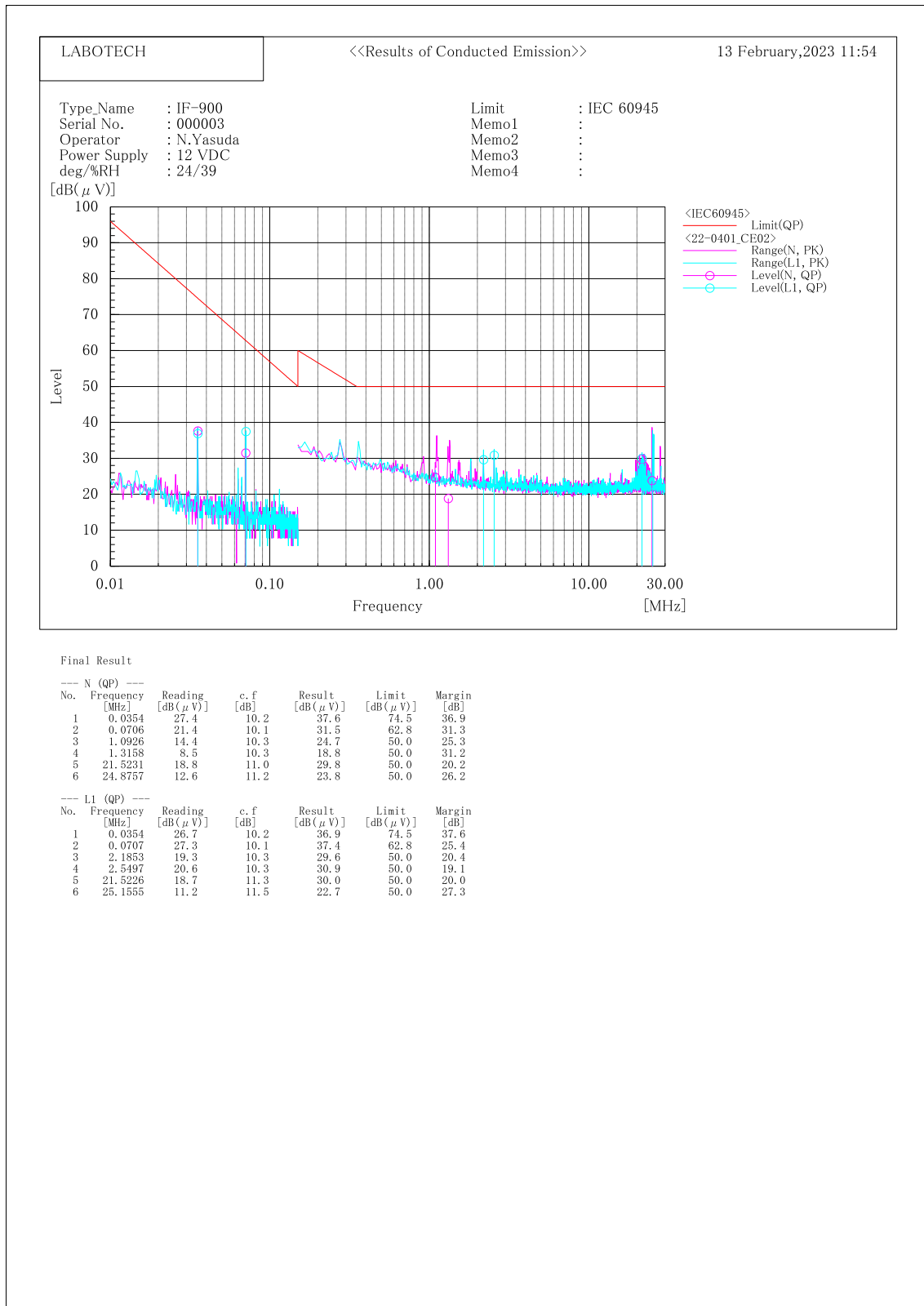
Note: Result = Reading + c.f. (Correction Factor).

24 VDC



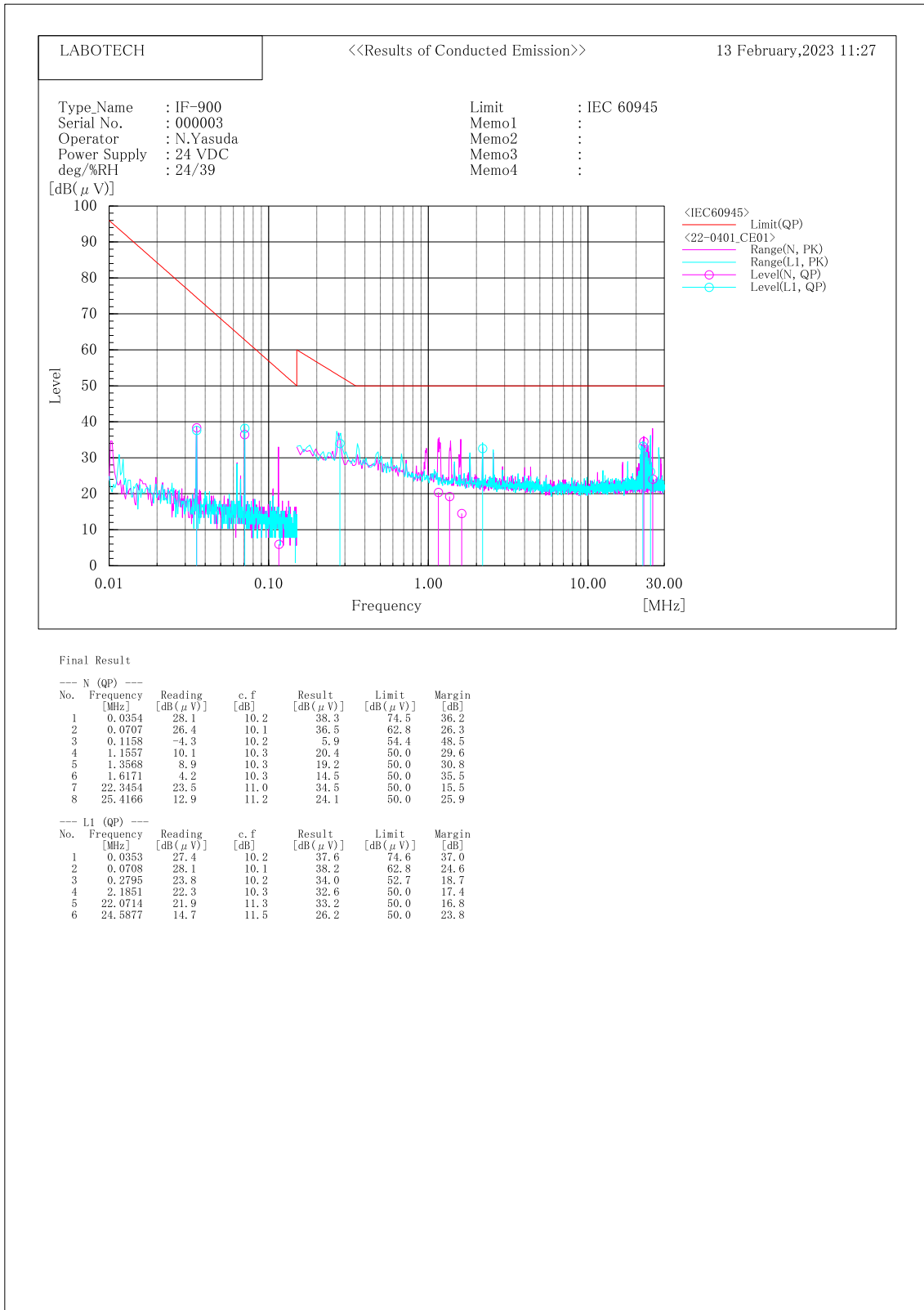
Note: Result = Reading + c.f. (Correction Factor).

IF-900
12 VDC



Note: Result = Reading + c.f. (Correction Factor).

24 VDC



Note: Result = Reading + c.f. (Correction Factor).

4.2 Radiated emissions

4.2.1 Test conditions

Test frequency range	0.15 MHz – 2 GHz
Input power supply (*)	12 VDC 24 VDC

(*) Specified by the customer.

4.2.2 Test result

12 VDC

Unit	Port	Result
NX-900	Enclosure	Passed.
NX-9HE (S/N: 000001)		
PP-900		
IF-900		

Note: The height of the receive antenna was fixed at 1 m for the test frequency range of 1 GHz to 2 GHz, because the top of the EUT was included in the 3 dB beamwidth of the antenna.

24 VDC

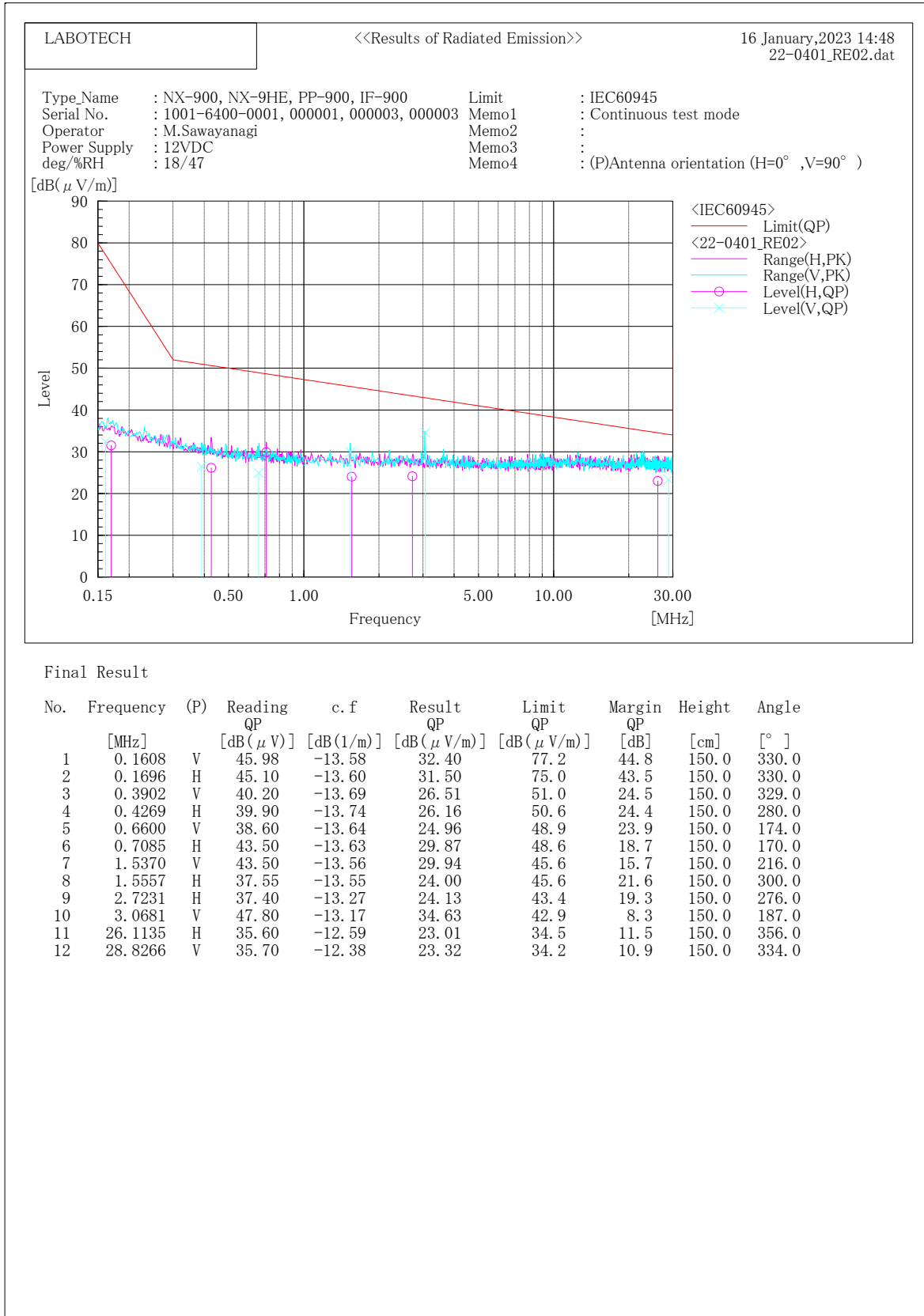
Unit	Port	Result
NX-900	Enclosure	Passed.
NX-9HE (S/N: 000001)		
PP-900		
IF-900		

Note: The height of the receive antenna was fixed at 1 m for the test frequency range of 1 GHz to 2 GHz, because the top of the EUT was included in the 3 dB beamwidth of the antenna.

4.2.3 Environmental conditions during testing

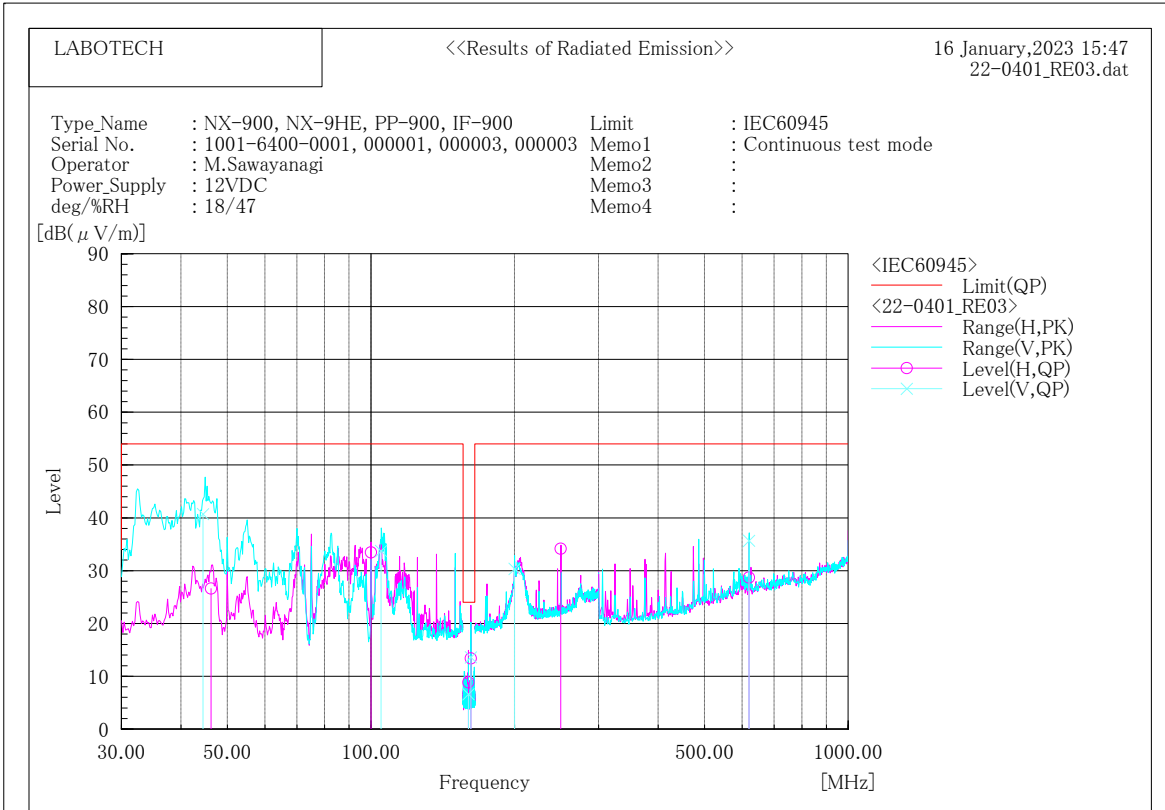
Date of test		Before-test	After-test
16 January 2023	Temperature	18°C	18°C
	Humidity	47%RH	47%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC
17 January 2023	Temperature	19°C	19°C
	Humidity	52%RH	52%RH
	Input power supply	24 VDC	24 VDC

4.2.4 Measurement results
12 VDC
0.15 MHz to 30 MHz (3 m method)



Note: Result = Reading + c. f. (Correction Factor).

30 MHz to 1 GHz (3 m method)

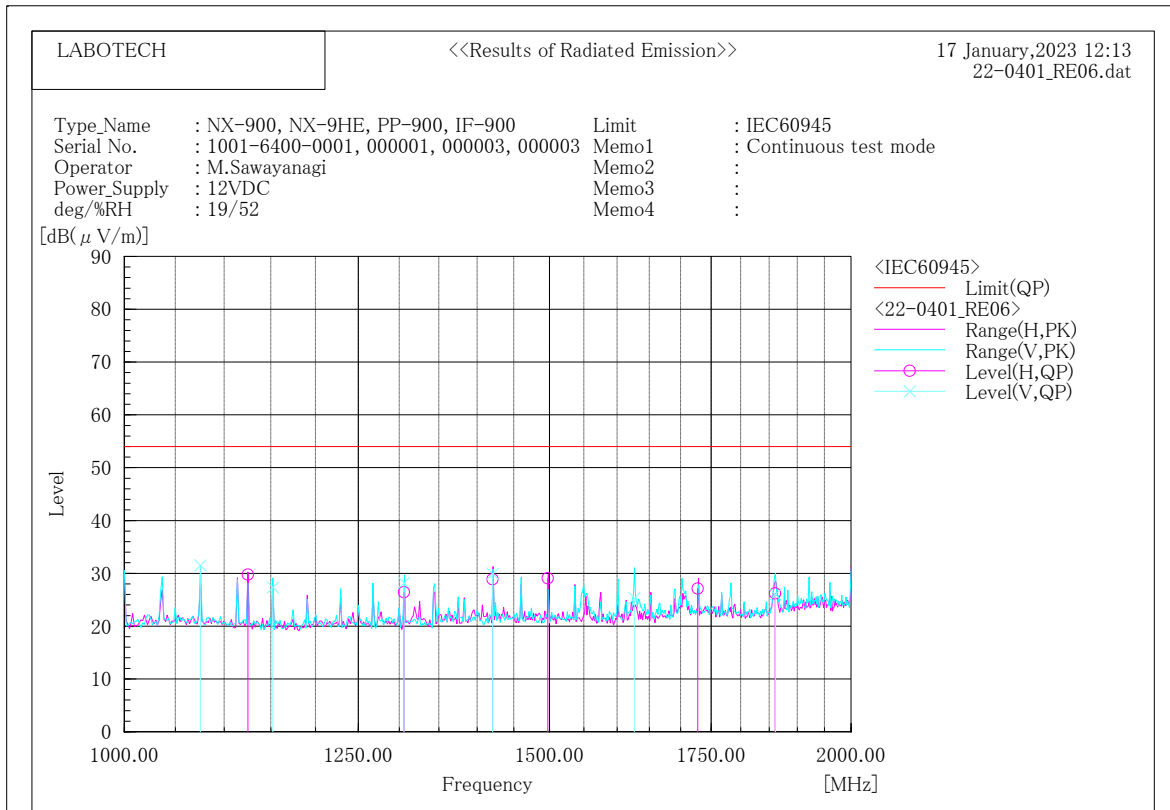


Final Result

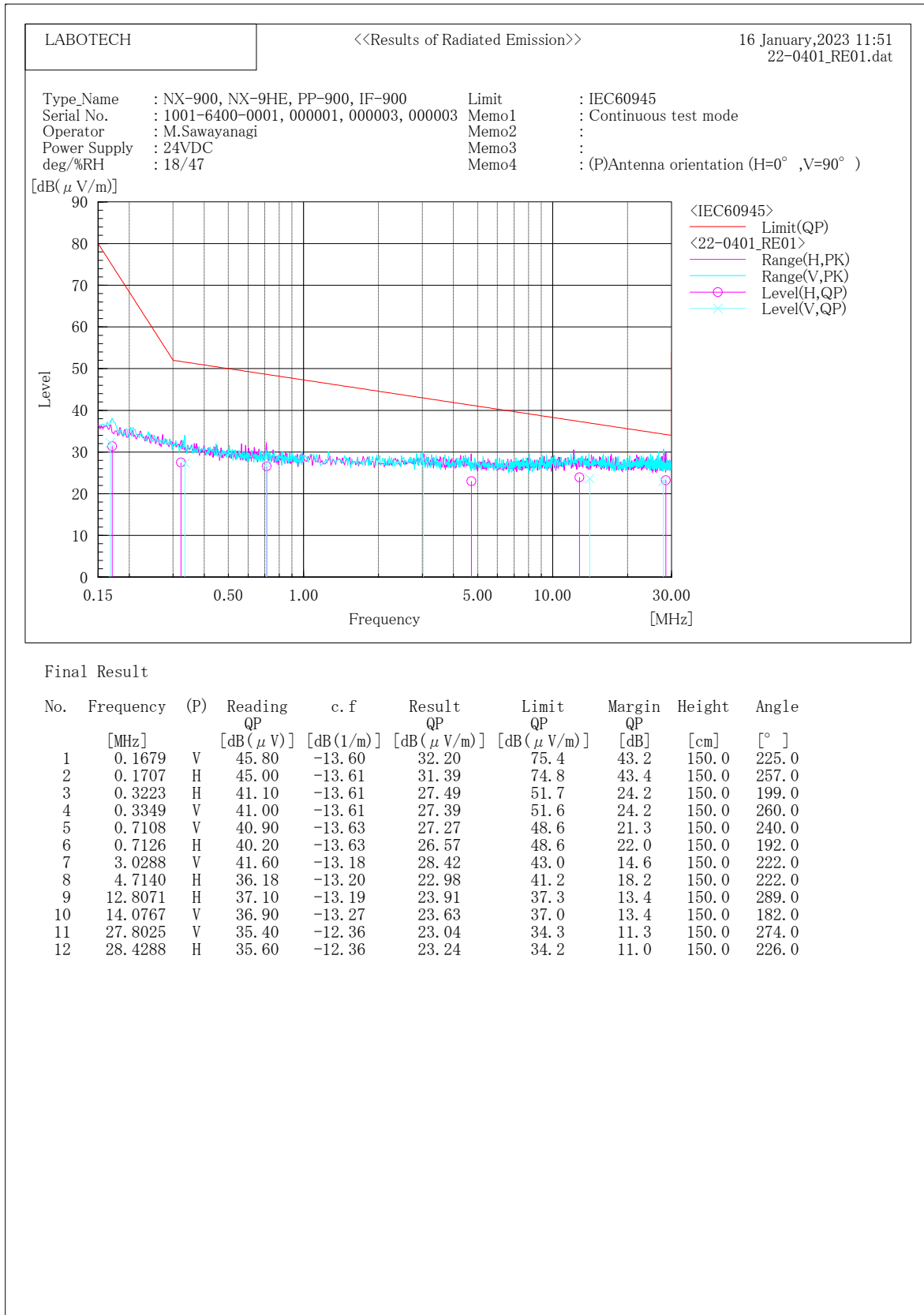
No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	44.472	V	55.86	-15.16	40.70	54.0	13.3	100.0	266.0
2	46.217	H	41.96	-15.35	26.61	54.0	27.4	391.0	195.0
3	99.995	H	48.38	-14.91	33.47	54.0	20.5	345.0	263.0
4	105.018	V	48.29	-14.55	33.74	54.0	20.3	100.0	130.0
5	160.000	H	21.09	-12.24	8.85	24.0	15.1	399.0	225.0
6	160.000	V	18.85	-12.24	6.61	24.0	17.4	100.0	277.0
7	161.997	H	25.47	-12.07	13.40	24.0	10.6	296.0	251.0
8	161.997	V	25.67	-12.07	13.60	24.0	10.4	101.0	176.0
9	200.011	V	40.21	-9.85	30.36	54.0	23.6	100.0	287.0
10	249.998	H	42.18	-8.04	34.14	54.0	19.9	135.0	86.0
11	619.981	V	39.77	-4.08	35.69	54.0	18.3	107.0	329.0
12	620.071	H	32.78	-4.08	28.70	54.0	25.3	307.0	135.0

Note: Result = Reading + c. f. (Correction Factor).

1 GHz to 2 GHz (3 m method)

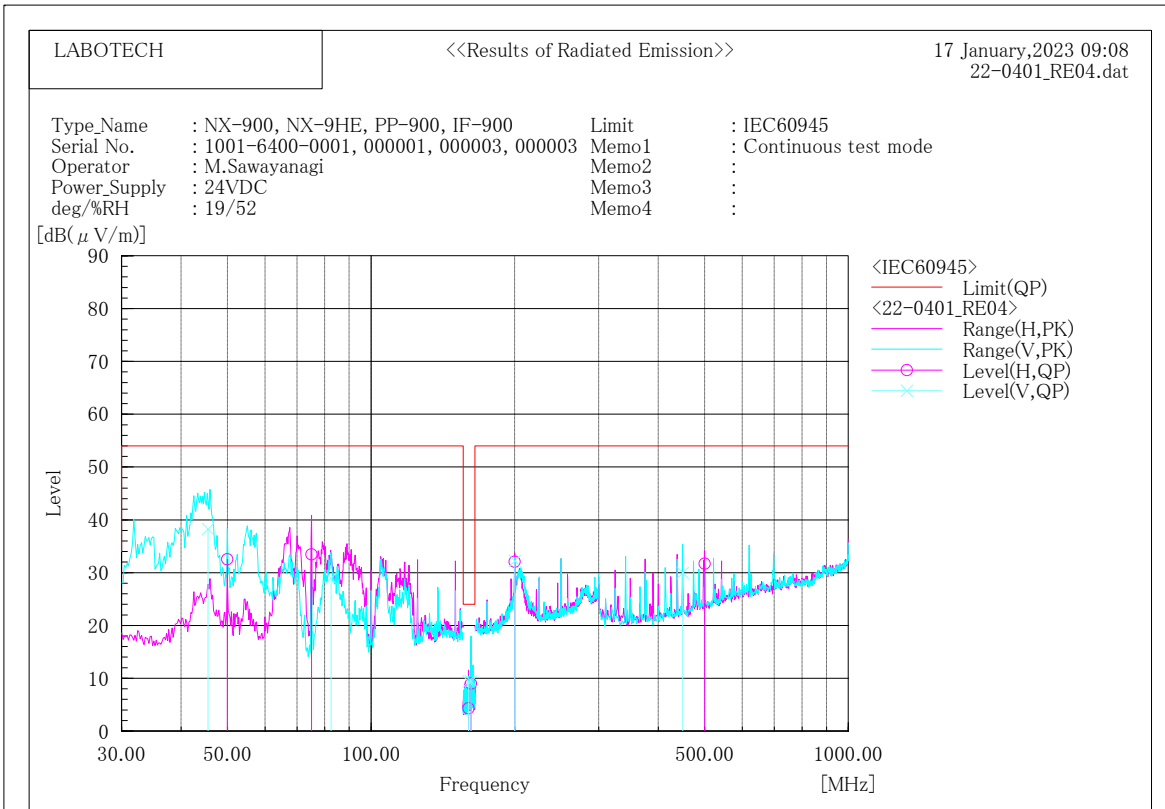


24 VDC
0.15 MHz to 30 MHz (3 m method)



Note: Result = Reading + c.f. (Correction Factor).

30 MHz to 1 GHz (3 m method)

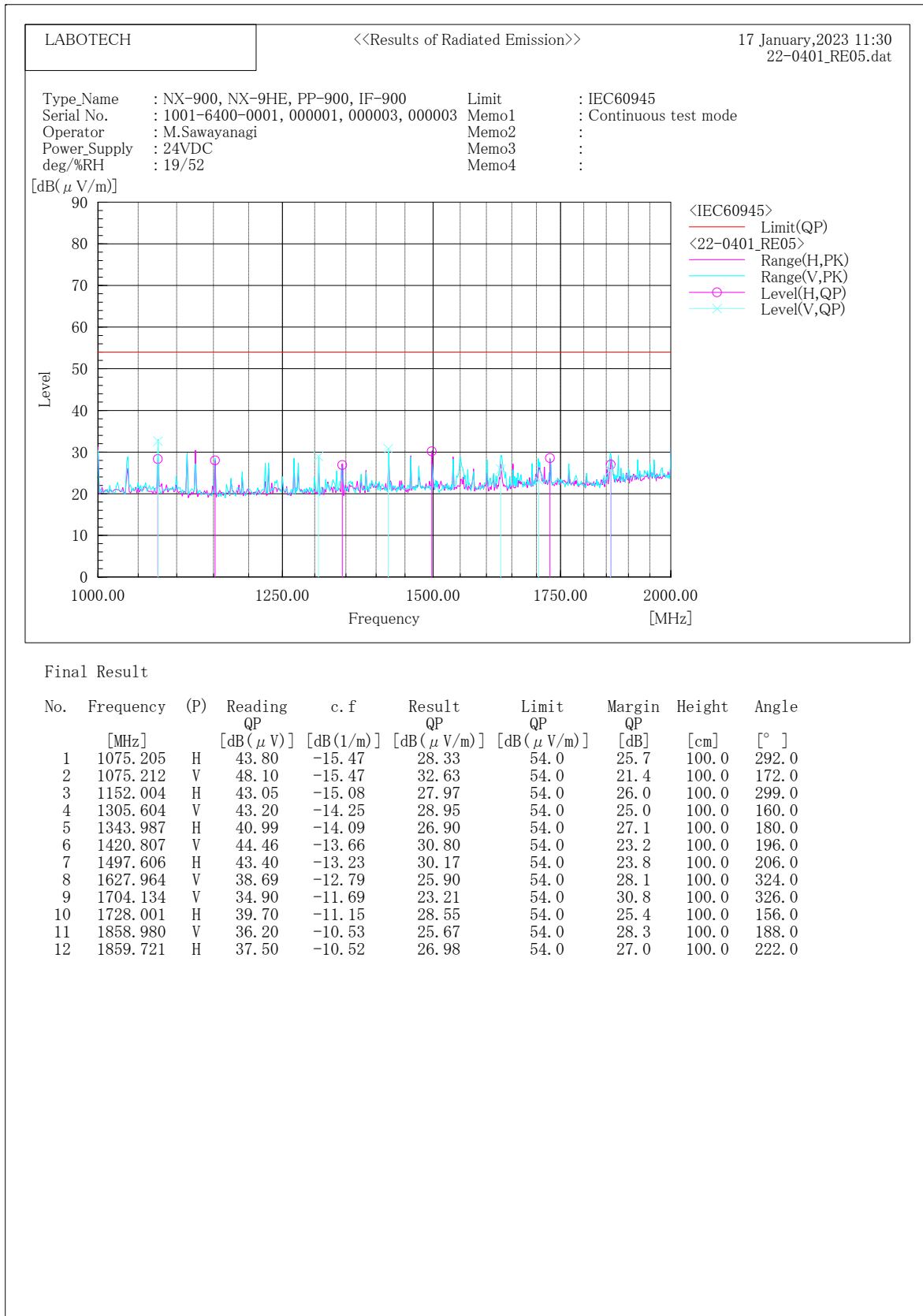


Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	45.552	V	53.57	-15.29	38.28	54.0	15.7	100.0	357.0
2	49.990	H	48.10	-15.57	32.53	54.0	21.5	399.0	98.0
3	75.004	H	49.60	-16.17	33.43	54.0	20.6	280.0	326.0
4	82.490	V	45.18	-16.22	28.96	54.0	25.0	100.0	343.0
5	160.000	V	21.62	-12.24	9.38	24.0	14.6	100.0	226.0
6	160.001	H	16.53	-12.24	4.29	24.0	19.7	198.0	219.0
7	162.002	V	21.50	-12.07	9.43	24.0	14.6	100.0	55.0
8	162.004	H	21.05	-12.07	8.98	24.0	15.0	292.0	252.0
9	199.996	V	42.11	-9.85	32.26	54.0	21.7	100.0	276.0
10	200.003	H	41.91	-9.85	32.06	54.0	21.9	175.0	143.0
11	450.006	V	37.96	-7.97	29.99	54.0	24.0	139.0	268.0
12	500.005	H	38.31	-6.59	31.72	54.0	22.3	100.0	74.0

Note: Result = Reading + c.f. (Correction Factor).

1 GHz to 2 GHz (3 m method)



Note: Result = Reading + c.f. (Correction Factor).

4.3 Conducted low frequency immunity

4.3.1 Test conditions

Test frequency range	50 Hz – 10 kHz
Frequency step	1%
Test level	Max. 2 W
Input power supply (*)	12 VDC 24 VDC

(*) Specified by the customer.

4.3.2 Test result

Unit	Port type	Port name	Power supply	Performance criterion	Result	
NX-900	P (DC)	J1 (PWR)	12 VDC	A	A	Passed.
			24 VDC	A	A	Passed.
NX-9HE (S/N: 000003)	--	--	--	--	--	NA (*)
PP-900	P (DC)	J1 (PWR IN)	12 VDC	A	A	Passed.
			24 VDC	A	A	Passed.
IF-900	P (DC)	TB5 (PWR IN)	12 VDC	A	A	Passed.
			24 VDC	A	A	Passed.

(*) Not applicable because this unit has no power port.

4.3.3 Environmental conditions during testing

Date of test		Before-test	After-test
8 February 2023	Temperature	22°C	23°C
	Humidity	36%RH	52%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC

4.4 Conducted radio frequency immunity

4.4.1 Test conditions

Test frequency range	10 kHz – 150 kHz	150 kHz – 80 MHz
Frequency step	1.5 kHz (*)	1%
Spot frequency	2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz	
Test level	3 Vrms (10 V rms for the spot frequencies)	
Modulation	400 Hz, 80%AM	
Dwell time	3 sec	
Input power supply (*)	12 VDC 24 VDC	

(*) Specified by the customer.

4.4.2 Test result

Unit	Port type	Port name	CDN/Clamp	Power supply (*1)	Performance criterion	Result	
NX-900	P (DC)	J1 (PWR)	CDN	12 VDC	A	A	Passed.
				24 VDC	A	A	Passed.
	S	J1 (COM/ALM)	Clamp	24 VDC	A	A	Passed.
	S	J2 (ANT)	Clamp	24 VDC	A	A	Passed.
	S	J3 (PRINT)	Clamp	24 VDC	A	A	Passed.
NX-9HE (S/N: 000003)	S	J4 (LAN)	Clamp	24 VDC (*2)	A	A	Passed.
PP-900	P (DC)	J1 (PWR IN)	CDN	12 VDC	A	A	Passed.
				24 VDC	A	A	Passed.
IF-900	P (DC)	TB5 (PWR IN)	CDN	12 VDC	A	A	Passed.
				24 VDC	A	A	Passed.
	S	TB1/TB2/TB3	Clamp	12 VDC	A	A	Passed.
				24 VDC	A	A	Passed.
	S	TB4	Clamp	12 VDC	A	A	Passed.
				24 VDC	A	A	Passed.
	S	TB6(COM1)	Clamp	24 VDC	A	A	Passed.
	S	TB6(COM2)/ TB7(COM2)	Clamp	24 VDC	A	A	Passed.
	S	TB7(ALM)	Clamp	24 VDC	A	A	Passed.
	S	TB7(COM1)	Clamp	24 VDC	A	A	Passed.
S	TB8	Clamp	24 VDC	A	A	Passed.	

(*1) Specified by the customer.

(*2) The power supplied to IF-900.

4.4.3 Environmental conditions during testing

Date of test		Before-test	After-test
2 February 2023	Temperature	20°C	23°C
	Humidity	40%RH	52%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC
3 February 2023	Temperature	21°C	24°C
	Humidity	42%RH	53%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC
6 February 2023	Temperature	18°C	23°C
	Humidity	44%RH	52%RH
	Input power supply	24 VDC	24 VDC
7 February 2023	Temperature	23°C	23°C
	Humidity	52%RH	52%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC

4.5 Radio frequency electromagnetic field immunity

4.5.1 Test conditions

Test frequency range	80 MHz – 1 GHz	1 GHz – 2 GHz
Antenna-to-EUT distance	2.0 m	2.4 m
Frequency step	1%	0.3%
Test level	10 V/m	
Modulation	400 Hz, 80%AM	
Dwell time	3 sec	
EUT orientation	0° / 90° / 180° / 270° / top side / bottom side	
Input power supply (*)	24 VDC	

(*) Specified by the customer.

4.5.2 Test result

Unit	Port	Performance criterion	Result	
NX-900	Enclosure	A	A	Passed.
NX-9HE (S/N: 000003)				
PP-900				
IF-900				

4.5.3 Environmental conditions during testing

Date of test		Before-test	After-test
18 January 2023	Temperature	20°C	20°C
	Humidity	32%RH	32%RH
	Input power supply	24 VDC	24 VDC
19 January 2023	Temperature	23°C	23°C
	Humidity	38%RH	38%RH
	Input power supply	24 VDC	24 VDC
20 January 2023	Temperature	23°C	23°C
	Humidity	38%RH	38%RH
	Input power supply	24 VDC	24 VDC

4.6 Electrical fast transient/Burst immunity

4.6.1 Test conditions

Test level	Signal / Control	±1.0 kV
Repetition rate	5 kHz	
Burst duration	15 ms	
Burst period	300 ms	
Dwell time	3 minutes per polarity	
Input power supply (*)	12 VDC 24 VDC	

(*) Specified by the customer.

4.6.2 Test result

Unit	Port type	Port name	CDN/Clamp	Power supply (*1)		Performance criterion		Result
NX-900	P (DC)	J1 (PWR)	CDN	12 VDC	--	--	NA (*2)	
				24 VDC	--	--	NA (*2)	
	S	J1 (COM/ALM)	Clamp	24 VDC	B	A	Passed.	
	S	J2 (ANT)	Clamp	24 VDC	B	A	Passed.	
	S	J3 (PRINT)	Clamp	24 VDC	B	A	Passed.	
NX-9HE (S/N: 000001)	S	J1 (ANT)	Clamp	24 VDC (*2)		B	A	Passed.
PP-900	P (DC)	J1 (PWR IN)	CDN	12 VDC	--	--	NA (*3)	
				24 VDC	--	--	NA (*3)	
IF-900	P (DC)	TB5 (PWR IN)	CDN	12 VDC	--	--	NA (*3)	
				24 VDC	--	--	NA (*3)	
	S	TB1/TB2/TB3	Clamp	12 VDC	B	A	Passed.	
				24 VDC	B	A	Passed.	
	S	TB4	Clamp	12 VDC	B	A	Passed.	
				24 VDC	B	A	Passed.	
	S	TB6(COM1)	Clamp	24 VDC	B	A	Passed.	
	S	TB6(COM2)/ TB7(COM2)	Clamp	24 VDC	B	A	Passed.	
	S	TB7(ALM)	Clamp	24 VDC	B	A	Passed.	
	S	TB7(COM1)	Clamp	24 VDC	B	A	Passed.	
S	TB8	Clamp	24 VDC	B	A	Passed.		

(*1) Specified by the customer.

(*2) The power supplied to IF-900.

(*3) Not applicable to DC power port.

4.6.3 Environmental conditions during testing

Date of test		Before-test	After-test
24 January 2023	Temperature	24°C	24°C
	Humidity	39%RH	39%RH
	Input power supply	24 VDC	24 VDC
10 February 2023	Temperature	21°C	21°C
	Humidity	34%RH	34%RH
	Input power supply	24 VDC 12 VDC	24 VDC 12 VDC

4.7 Power supply failure immunity

4.7.1 Test conditions

Test time	60 sec
Number of discharges	3 times
Input power supply	12 VDC 24 VDC

4.7.2 Test results

Unit	Port type	Port name	Power supply	Performance criterion	Result	
NX-900	P (DC)	J1 (PWR)	12 VDC	--	--	NP (*1)
			24 VDC	--	--	NP (*1)
NX-9HE (S/N: 000003)	--	--	--	--	--	NA (*2)
PP-900	P (DC)	J1 (PWR IN)	12 VDC	--	--	NP (*1)
			24 VDC	--	--	NP (*1)
IF-900	P (DC)	TB5 (PWR IN)	12 VDC	C	C	Passed.
			24 VDC	C	C	Passed.

(*1) Not performed as per the customer's instructions.

(*2) Not applicable because this unit has no power port.

4.7.3 Environmental conditions during testing

Date of test		Before-test	After-test
22 March 2023	Temperature	24°C	24°C
	Humidity	39%RH	39%RH
	Input power supply	12 VDC 24 VDC	12 VDC 24 VDC

(*) The power supplied to IF-900.

4.8 Electrostatic discharge immunity

4.8.1 Test conditions

Test level	Contact discharge	Direct	±2 kV, ±4 kV, ±6 kV
		Indirect	±2 kV, ±4 kV, ±6 kV
	Air discharge	±2 kV, ±4 kV, ±8 kV	
Discharge interval	1 sec		
Number of discharges	10 times per polarity		
Input power supply (*)	24 VDC		

(*) Specified by the customer.

4.8.2 Test result

Unit	Port	Performance criterion	Result	
NX-900	Enclosure	B	A	Passed.
NX-9HE (S/N: 000001)	--	--	--	NA (*)
PP-900	Enclosure	B	A	Passed.
IF-900	Enclosure	B	A	Passed.

(*) Not applicable because there is no part to be accessible after the installation and in its normal operation.

4.8.3 Environmental conditions during testing

Date of test		Before-test	After-test
25 January 2023	Temperature	26°C	26°C
	Humidity	45%RH	45%RH
	Input power supply	24 VDC	24 VDC

5 List of Measuring/Test Instruments

Measuring/Test instruments have been appropriately calibrated/maintained according to the LIC programs/procedures and ISO/IEC 17025. Measuring/Test instruments used for the tests are listed below.

5.1 Conducted emissions

C/N	Instrument	Type	S/N	Manufacturer
HT365	Semi-anechoic chamber	3mSAC	D-002	Riken
HT1080	EMI test receiver (20 Hz to 8 GHz)	ESU8	100093	Rohde & Schwarz
HT1273	Test software	EP9/CE	Ver.4.4.010	Toyo
HT502	Artificial mains network (LISN)	ESH3-Z5	100122	Rohde & Schwarz
HT599	Artificial mains network (LISN)	ENV216	100178	Rohde & Schwarz
HT885	Test table	W1500-D1000-H800	No.03	JSE
HT1024	Digital multimeter	233	27230019	Fluke

5.2 Radiated emissions

C/N	Instrument	Type	S/N	Manufacturer
HT365	Semi-anechoic chamber	3mSAC	D-002	Riken
HT1080	EMI test receiver (20 Hz to 8 GHz)	ESU8	100093	Rohde & Schwarz
HT1193	Test software	EP5/RE	Ver.6.0.112	Toyo
HT565	Loop antenna (9 kHz to 30 MHz)	HFH2-Z2	100093	Rohde & Schwarz
HT1285	Biconical antenna (30 MHz to 300 MHz)	VHBB9124/BBA9106	01288	Schwarzbeck
HT331	Log.-Per. antenna (300 MHz to 1 GHz)	UHALP9107	91071214	Schwarzbeck
HT467	Double-ridged waveguide horn antenna (1 GHz to 6 GHz)	3115	6520	ETS-Lindgren
HT568	Pre-amp. (9 kHz to 1 GHz, Gain 32 dB)	310N	250607	Sonoma Instrument
HT1267	Pre-amp. (1 GHz to 6 GHz)	00-T1885	BBB1952285	NoiseKen
HT885	Test table	W1500-D1000-H800	No.03	JSE
HT1024	Digital multimeter	233	27230019	Fluke

5.3 Conducted low frequency immunity

C/N	Instrument	Type	S/N	Manufacturer
HT177	Screened room	USC-26	D-003	USC
HT909	Test software	TEPTO-CS101/FLI	Ver.2.0.28	TSJ
HT868	Multifunction generator	WF1973	9138978	NF
HT1235	Digital multimeter	VOAC7520H	AB187100719	Iwatsu
HT237	Isolation transformer	7032-1	9	Solar Electronics
HT238	AF transformer unit	6220-2	8	Cornes
HT1155	Bipolar DC power supply	BP4620	9065949	NF
HT832	Digital multimeter	115	15540245	Fluke

5.4 Conducted radio frequency immunity

C/N	Instrument	Type	S/N	Manufacturer
HT177	Screened room	USC-26	D-003	USC
HT996-1	Test software	NETS-EMS	Ver.4.21	NoiseKen
HT901-2	EXG analog signal generator	N5171B-501	MY51350004	Agilent
HT901-3	Dual directional coupler	C5086-10	98386	Werlatone
HT901-4	Avg. power meter	N1914A	MY52280009	Agilent
HT901-5	Avg. power sensor	E9304A	MY52230017	Agilent
HT901-6	Avg. power sensor	E9304A	MY52230018	Agilent
HT901-9	RF power-amp. (9 kHz to 250 MHz, 75 W)	BSA0125-75	128959	Bonn
HT901-10	Attenuator (6 dB, 100 W)	50FH-006-100 N	H688	JFW
HT902	50 Ω terminator	50T-473-1.0	23881	JFW
HT903	50 Ω terminator	50T-473-1.0	23882	JFW
HT896	CDN-M1 (10 kHz to 80 MHz)	CDN M1-10	34538	Teseq
HT897	CDN-M1 (10 kHz to 80 MHz)	CDN M1-10	34539	Teseq
HT1319	CDN-M1 (10 kHz to 80 MHz)	CDN M1-10	59345	Teseq
HT1320	CDN-M1 (10 kHz to 80 MHz)	CDN M1-10	59346	Teseq
HT1321	CDN-M1 (10 kHz to 80 MHz)	CDN M1-10	59347	Teseq
HT542	CDN-M2 (10 kHz to 150 MHz)	FCC-801-M2-16A/4-16	03018	FCC
HT819	CDN-M2 (10 kHz to 230 MHz)	F-101112-1004-2	110309	FCC
HT820	CDN-M2 (10 kHz to 230 MHz)	F-101112-1004-2	110310	FCC
HT543	CDN-M3 (10 kHz to 150 MHz)	FCC-801-M3-16A/4-16	03020	FCC
HT821	CDN-M3 (10 kHz to 230 MHz)	F-101112-1004-3	110311	FCC
HT822	CDN-M3 (10 kHz to 230 MHz)	F-101112-1004-3	110312	FCC
HT1016	EM injection clamp	F-203I-A-32mm	141060	FCC
HT832	Digital multimeter	115	15540245	Fluke

5.5 Radio frequency electromagnetic field immunity

C/N	Instrument	Type	S/N	Manufacturer
HT368	Anechoic chamber	3mAC	D-001	Riken
HT1008	Test software	NETS-EMS	Ver.4.21	NoiseKen
HT673	Signal generator	SMB100A	101824	Rohde & Schwarz
HT665	Dual directional coupler (10 kHz to 250 MHz)	DC2600A	0330005	Amplifier Research
HT1337	Power sensor	NRV-Z51/02	839376/048	Rohde & Schwarz
HT671	Power sensor	NRV-Z51/02	101771	Rohde & Schwarz
HT672	Dual channel power meter	NRVD	102098	Rohde & Schwarz
HT882	Log.-Per. broadband antenna (80 MHz to 1 GHz)	VULP9118E	9118E893	Schwarzbeck
HT481	Double-ridged waveguide horn antenna (1 GHz to 18 GHz)	3115	6553	EMCO
HT340	Power-amp. (10 kHz to 220 MHz)	M423/M5300	222-0595	Instruments For Industry
HT922	Power-amp. (80 MHz to 1 GHz)	80RF-1000-1000	1052070	MILMEGA
HT840	Power-amp. (1 GHz to 4 GHz)	AS0104-200/200	1041467	MILMEGA
HT809	Dual directional coupler (80 MHz to 1 GHz)	C3908-10	93913	Werlatone
HT667	Dual directional coupler (800 MHz to 4.2 GHz)	DC7144A	0329868	Amplifier Research
HT884	Test table	W1500-D1000-H800	No.02	JSE
HT1013	Digital multimeter	115	27930252WS	Fluke

5.6 Electrical fast transient/Burst immunity

C/N	Instrument	Type	S/N	Manufacturer
HT368	Anechoic chamber	3mAC	D-001	Riken
HT177	Screened room	USC-26	D-003	USC
HT974	EMC immunity test system	NSG3060	1663	Teseq
HT974-1	Burst generator	EFT3425	3003	Teseq
HT975	1 phase coupling/decoupling network	CDN3061	198	Teseq
HT1066	Capacitive coupling clamp	CDN3425	1975	Teseq
HT893	Attenuation clamp	KEMA801	33168	Teseq
HT1013	Digital multimeter	115	27930252WS	Fluke
HT832	Digital multimeter	115	15540245	Fluke

5.7 Power supply failure immunity

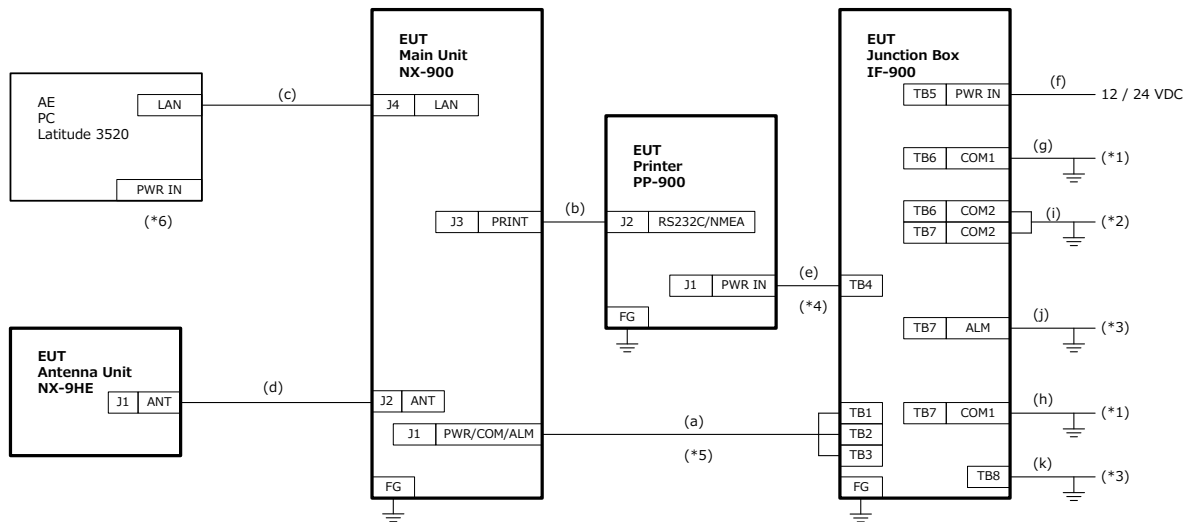
C/N	Instrument	Type	S/N	Manufacturer
HT177	Screened room	USC-26	D-003	USC
HT974	EMC immunity test system	NSG3060	1663	Teseq
HT975	1 phase coupling/decoupling network	CDN3061	198	Teseq
HT975-1	Power quality test generator	PQM3403	539	Teseq
HT832	Digital multimeter	115	15540245	Fluke

5.8 Electrostatic discharge immunity

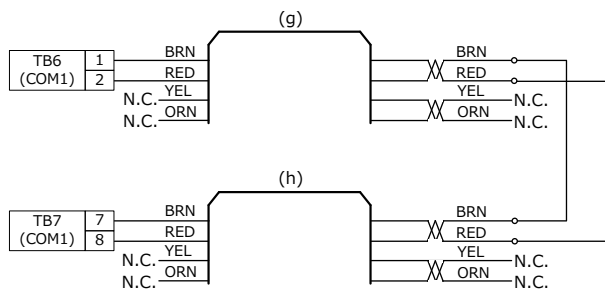
C/N	Instrument	Type	S/N	Manufacturer
HT368	Anechoic chamber	3mAC	D-001	Riken
HT1211	Electrostatic discharge simulator	ESS-B3011A	ESS1796836	NoiseKen
HT1211-1	Electrostatic discharge GUN	GT-30RA	ESS1796872	NoiseKen
HT1211-2	CR unit 150 pF - 330 Ω	06-00073B	ESS1796777	NoiseKen
HT700	HCP	0.8 m x 1.6 m x 0.002 m	01	LIC
HT258	VCP (for Table-top)	0.5 m x 0.5 m x 0.002 m	--	Cornes
HT884	Test table	W1500-D1000-H800	No.02	JSE
HT1013	Digital multimeter	115	27930252WS	Fluke

6 EUT Setup/Test Arrangement

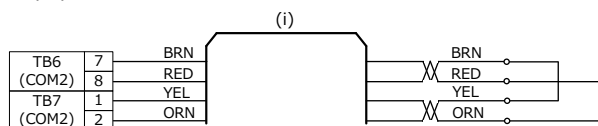
Conducted emissions and Radiated emissions



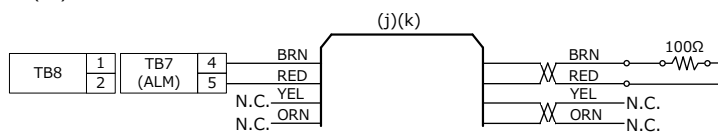
(*1)



(*2)



(*3)

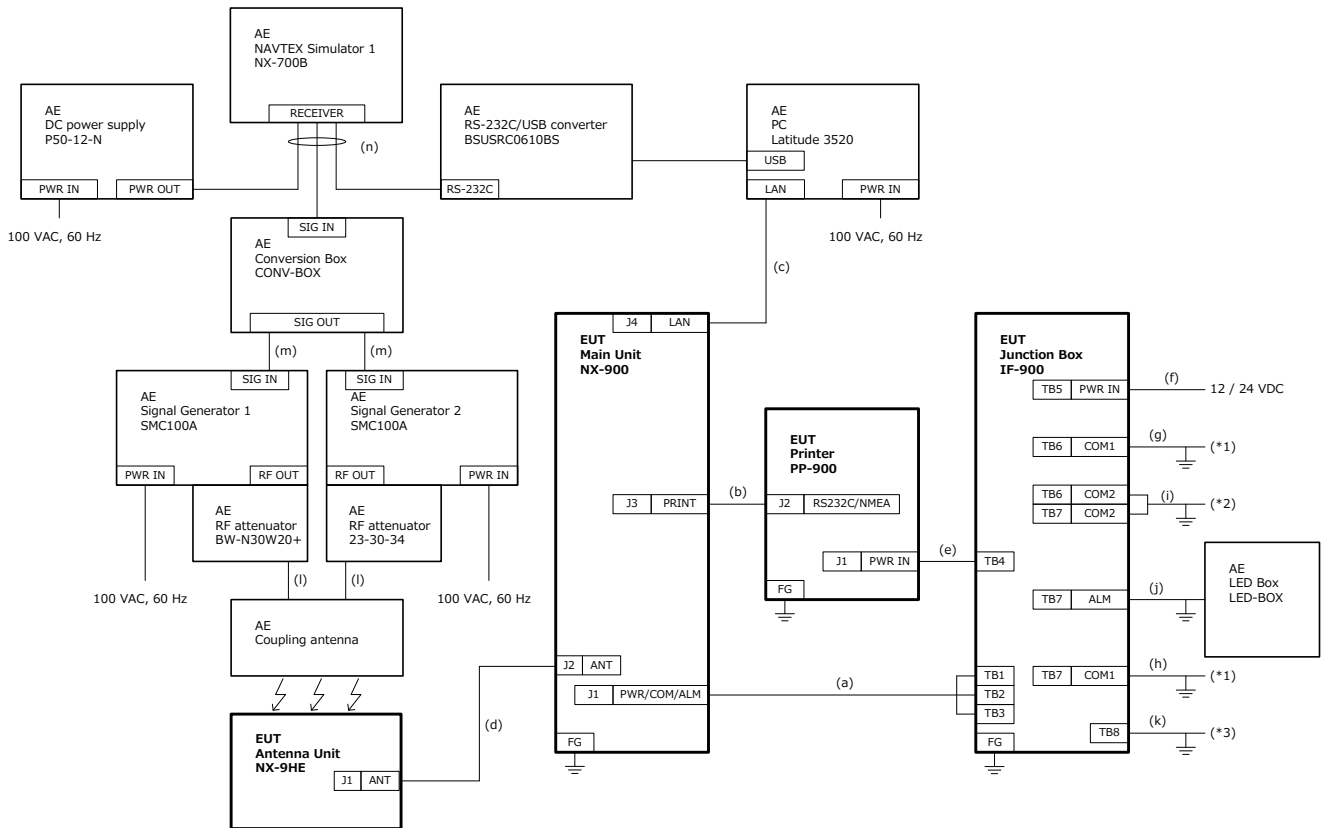


(*4) For Conducted emissions, when Printer (EUT) was tested, 12/24 VDC was directly supplied to Printer (EUT), not via Junction Box (EUT).

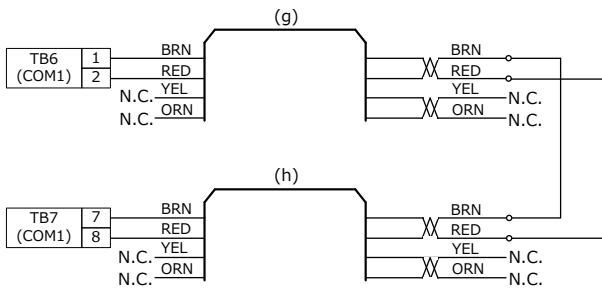
(*5) For Conducted emissions, when Main Unit (EUT) was tested, 12/24 VDC was directly supplied to Main Unit (EUT), not via Junction Box (EUT).

(*6) Powered by a battery.

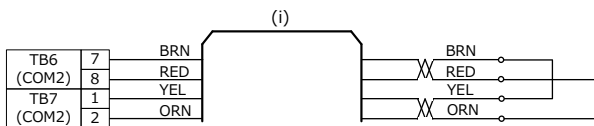
Electrical fast transient/Burst immunity and Electrostatic discharge immunity



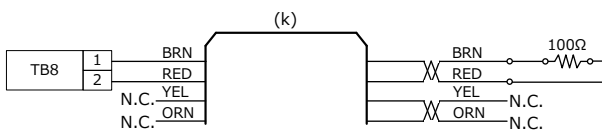
(*1)



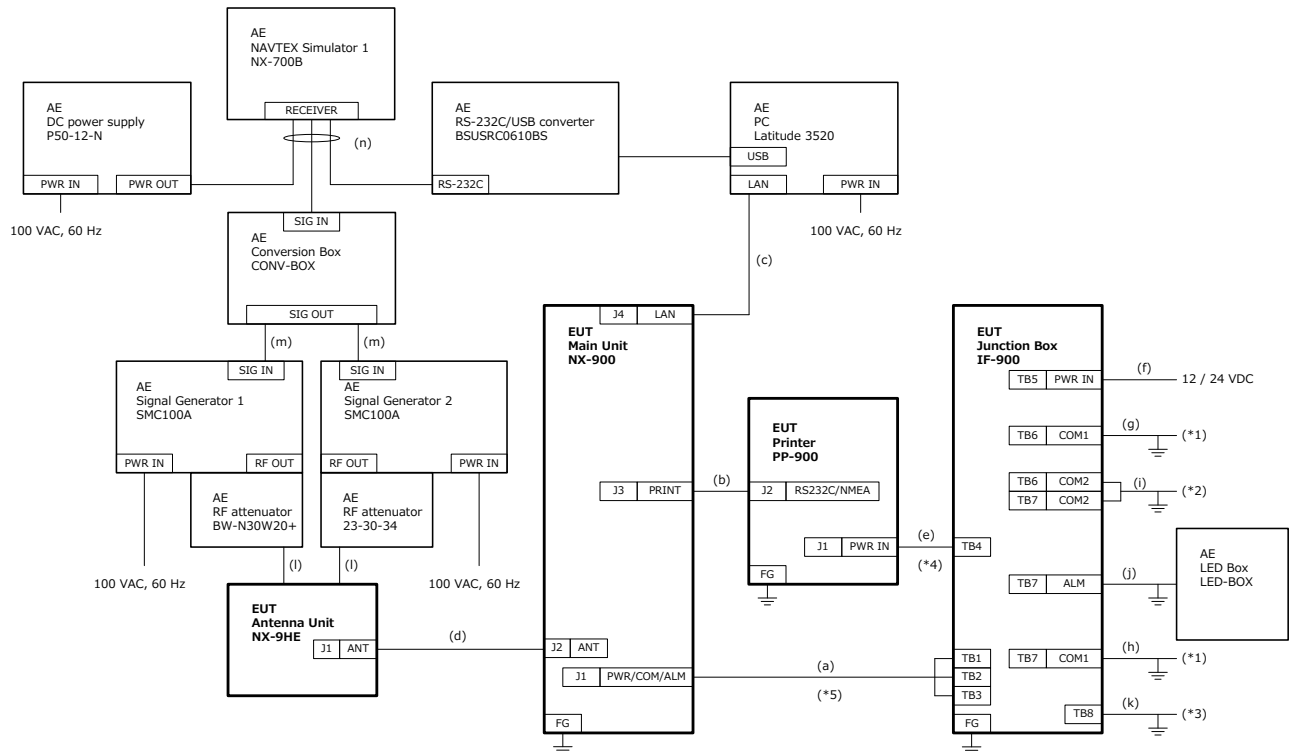
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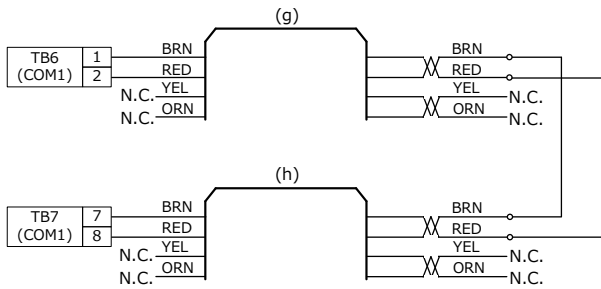
(*3)



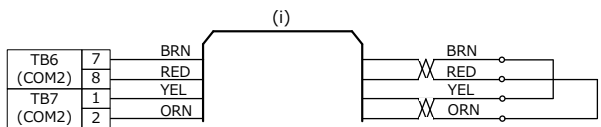
Conducted low frequency immunity, Conducted radio frequency immunity, and Radio frequency electromagnetic field immunity



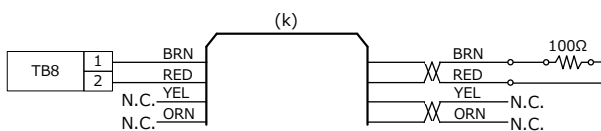
(*1)



(*2)



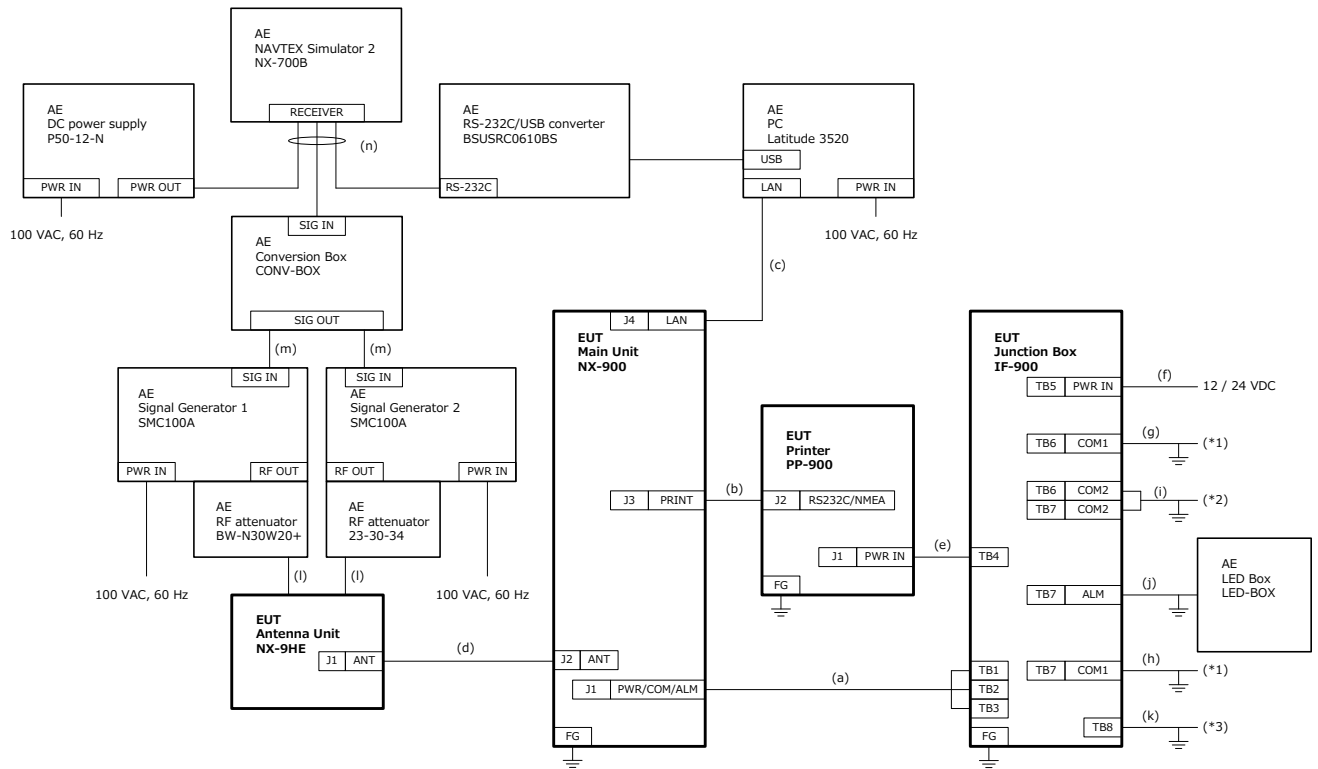
(*3)



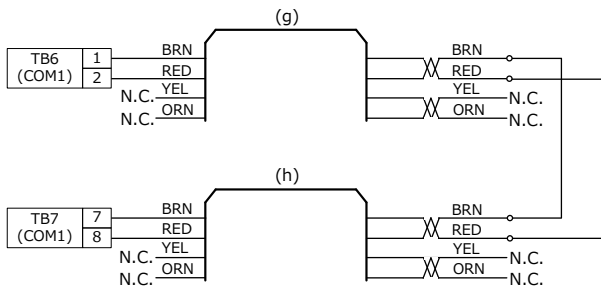
(*4) When Printer (EUT) was tested, 12/24 VDC was directly supplied to Printer (EUT), not via Junction Box (EUT).

(*5) When Main Unit (EUT) was tested, 12/24 VDC was directly supplied to Main Unit (EUT), not via Junction Box (EUT).

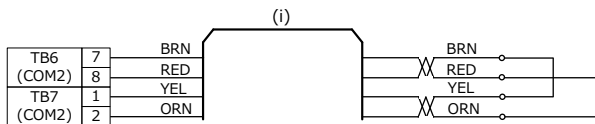
Power supply failure immunity



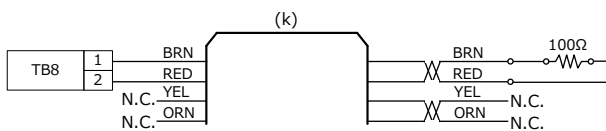
(*1)



(*2)



(*3)



List of cables used

No.	Category	Cable name	Type	Length (m)	Number of cables used	Cable shielded Yes/No
a	P	Power/Signal cable	FRU-CF-F01-C03	10	1	Yes
b	S	Signal cable	MJ-A6SPF0021A-050+	5	1	Yes
c	S	LAN cable	KB-STP-20LBN	20	1	Yes
d	S	Coaxial cable	TNCP-TNCP-3DHR-L20M	20	1	Yes
e	P	Power cable	MJ-A3SPF0013A-050C	5	1	Yes
f	P	Power cable	FA-DPYC-1.5	20	1	Yes
g	S	Signal cable	COSPEVVSBC 2PX0.2LF	20	1	Yes
h	S	Signal cable	COSPEVVSBC 2PX0.2LF	20	1	Yes
i	S	Signal cable	COSPEVVSBC 2PX0.2LF	20	1	Yes
j	S	Signal cable	COSPEVVSBC 2PX0.2LF	20	1	Yes
k	S	Signal cable	COSPEVVSBC 2PX0.2LF	20	1	Yes
l	S	Coaxial cable	1.5D-QEV	8	2	Yes
m	S	Coaxial cable	--	0.5	2	Yes
n	P	Power/Signal cable	FEC-CABLE-001	0.7	1	No

7 Photographs of the EUT(s)

NX-900



NX-9HE (S/N: 000001)



NX-9HE (S/N: 000003)



PP-900



IF-900

