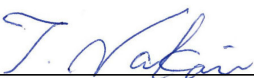




TEST REPORT

Issued: October 21, 2014

Name and Address of the Customer:	SATO Corporation 1-7-1, Shimomeguro, Meguro-ku, Tokyo 153-0064 Japan
Test Item:	RFID Module
Identification:	TR3-C302
Serial No.:	14030900(F), 14030907(F)
FCC ID:	MMFSATOTR3-C302
Sample No.:	1
Sample Receipt Date:	September 1, 9 and 10, 2014
Test Specification:	47 CFR Part 15 Subpart C
Period of Testing:	September 5, 2014 - September 24, 2014
Test Result:	PASS

Representative Test Personnel:	 (2014-10-21)	T. Nakai (EMC Dept.)
Reviewed by:	 (2014-10-21)	H. Onishi (EMC Dept.) iNARTE : EMC-003318-NT

Other Aspects:

Abbreviations:	PASS	=	passed
	FAIL	=	failed
	N/A	=	not applicable

Note:

This Test Report should not be reproduced except in full, without the written approval of Cosmos Corporation.
The test result of this Test Report is based on the tests made for sample provided, and it is not applicable to individual product identical to the sample or similar product.
The judgment of this test report validates the test item only specified in "4. Summary of Test Results".



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1. Description of the Tested Sample

1.1 Product Description

Manufacturer	TAKAYA Corporation
Model (referred to as the EUT)	TR3-C302
Type of the Equipment	☐ Stand-alone ☐ Combined Equipment ☒ Plug-in Radio Device ☐ Other ()
Transmitter Type	☐ WLAN ☐ Bluetooth () ☐ Zigbee ☒ RFID ☐ Other ()
Nominal Voltage	DC 5 V
Type of Modulation	ASK
Antenna Type	☒ Integral Antenna ☐ Dedicated External Antenna
Operating Frequency	13.56 MHz
Mode of Operation	☒ Simplex ☐ Duplex ☐ Other
Type of Power Source	☐ AC Mains ☐ Dedicated AC Adaptor ☒ DC Voltage ☐ Battery
Type of Battery (if applicable)	N/A
Type of Operation	☒ Continuous ☐ Burst ☐ Intermittent
Duty Cycle Class	Class 4
Thermal Limitation	0°C to 55°C

1.2 Antenna Description

Model	Gain	Antenna Type	Remarks
TR3-A302	-65 dBi	Loop Antenna	Integral

1.3 EUT Description

Equipment under test is as follow:

Instrument	Model	Serial No.	Rating
RFID Module (EUT1) *1	TR3-C302	14030900(F)	DC 5 V
RFID Module (EUT2) *2	TR3-C302	14030907(F)	DC 5 V

Note:

*1: This equipment was used during the following tests.

20 dB Bandwidth and Frequency Tolerance

*2: This equipment was used during the following tests.

AC Power Line Conducted Emission, Radiated Spurious Emission and Field Strength of Fundamental Emission



2. General Information

2.1 Test Methodology

All measurement subject to the present test report is carried out according to the procedures in ANSI C63.4:2003.

2.2 Test Facility

The measurement was carried out at the following facility.

Cosmos Corporation EMC Lab. Oonoki
3571-2 Oonoki, Watarai-cho, Watarai-gun, Mie-ken 516-2102, Japan

☒ Semi anechoic Chamber 3 m (COAC3M-01)

☒ Shielded Room (COSR-01)

☒ Measurement Room

Cosmos Corporation EMC Lab. Oonoki is accredited in accordance with the International Standard ISO/IEC 17025 by the following accreditation bodies and the test facility is registered by the following bodies.

Accreditation: VLAC Accredited Laboratory. No. VLAC-039-2

A2LA Accredited Laboratory. No. 2900.01

FCC Designation No. JP5182

Registration: Industry Canada Registration No. 3958B

Nemko Laboratory Authorisation. No. ELA 621

2.3 Traceability

The calibration of measurement equipment used in the test subject to the present report is designed and operated to ensure that the measurement is traceable to national standards of measurement or equivalent abroad.



3. Test Condition (Manufacturer's Specification)

3.1 Mode of Operation

Mode of operation: ISO15693 100%
: ISO15693 10%
: ISO14443 Type A (106 kbps)
: ISO18092 FeliCa (212 kbps)

Note:

The EUT makes communication emission with the maximum RF power by a special test program.
The test of Field Strength of Fundamental Emission was performed under the following condition:

Voltage: AC 120 V $\pm$ 15%

The test of Frequency Tolerance was performed under the following condition:

Temperature: -20°C to +50°C

Voltage: DC 5 V $\pm$ 15%

3.2 Additional Equipment

The equipment was tested together with additional peripherals.
The following peripherals were used during the tests:

Instrument	Model	Serial No.	Manufacturer
Barcode Printer	CL4NX	99099999	SATO
Personal Computer	PP17L	CN-0N8719-48643-57F-1500	DELL
AC Adapter	HP-OQ065B83	CN-0N2765-47890-47D-8266	DELL
USB Mouse	AMU1402JP	0605000678	Targus
Jig	Un-specified	Un-specified	SATO



3.3 Configuration

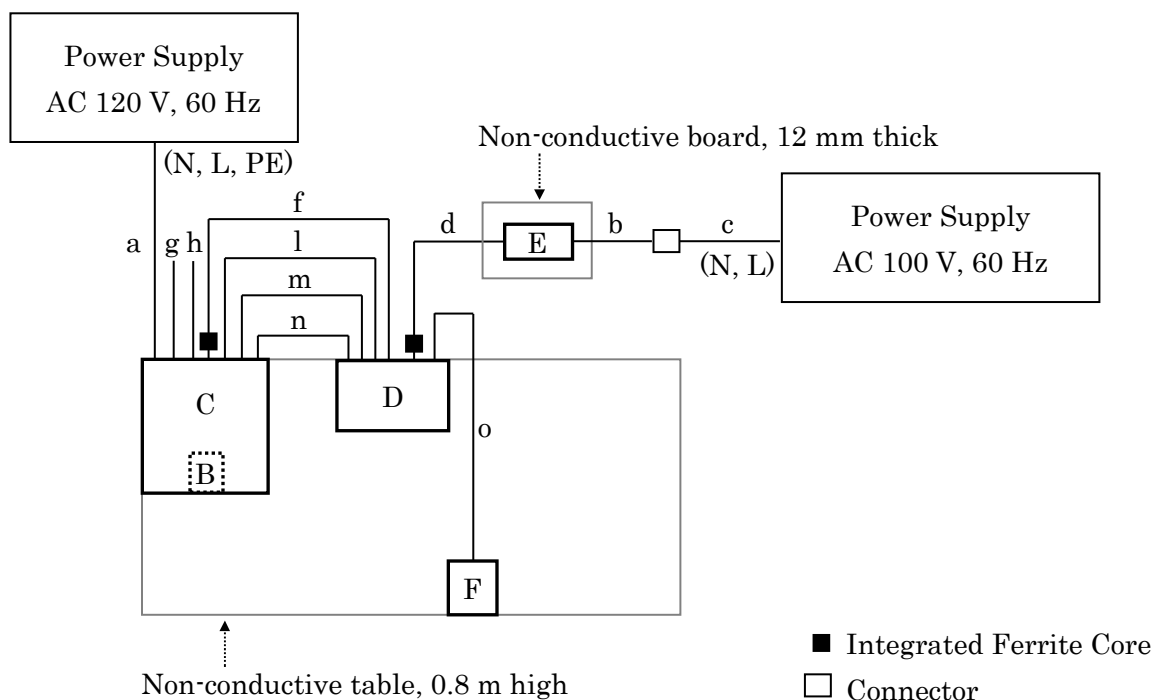
	Instrument	Model		Cable	Length	Shield
A	EUT1 (RFID Module)	TR3-C302 (Serial No.: 14030900(F))	a	AC Power Cord	3.0 m	×
			b	AC Power Cord	0.9 m	×
B	EUT2 (RFID Module)	TR3-C302 (Serial No.: 14030907(F))	c	AC Power Cord	1.1 m	×
			d	DC Power Cord	1.9 m	○
C	Barcode Printer	CL4NX	e	DC Power Cable	1.0 m	×
D	Personal Computer	PP17L	f	IEEE1284 Cable	1.6 m	○
E	AC Adapter	HP-OQ065B83	g	Jig Cable *	0.2 m	○
F	USB Mouse	AMU1402JP	h	Jig Cable *	0.3 m	×
G	Jig	Un-specified	i	Jig Cable	0.1 m	○
			j	Jig Cable	0.2 m	×
			k	Jig Cable	1.0 m	×
			l	LAN Cable (Cat.5e)	3.0 m	×
			m	RS-232C Cable	1.8 m	○
			n	USB Cable	2.0 m	○
			o	USB Mouse Cable	1.6 m	○

Note:

*: These cables were not terminated.

3.3 Configuration (Continued)

AC Power Line Conducted Emission



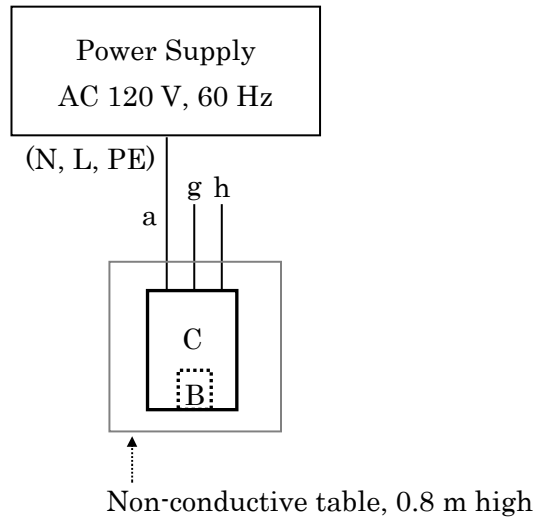
Excess cable arrangement

AC Power Line Conducted Emission

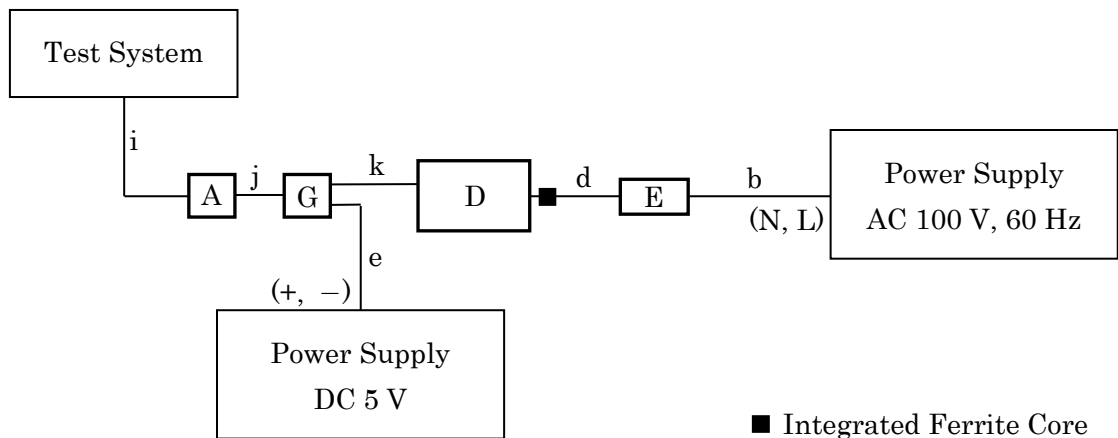
Symbol	Length	Position	Setting
a, d	0.3 m	Center	Bundle
f, m	0.3 m	Center	Bundle and Hung
l, n	0.4 m	Center	Bundle and Hung

3.3 Configuration (Continued)

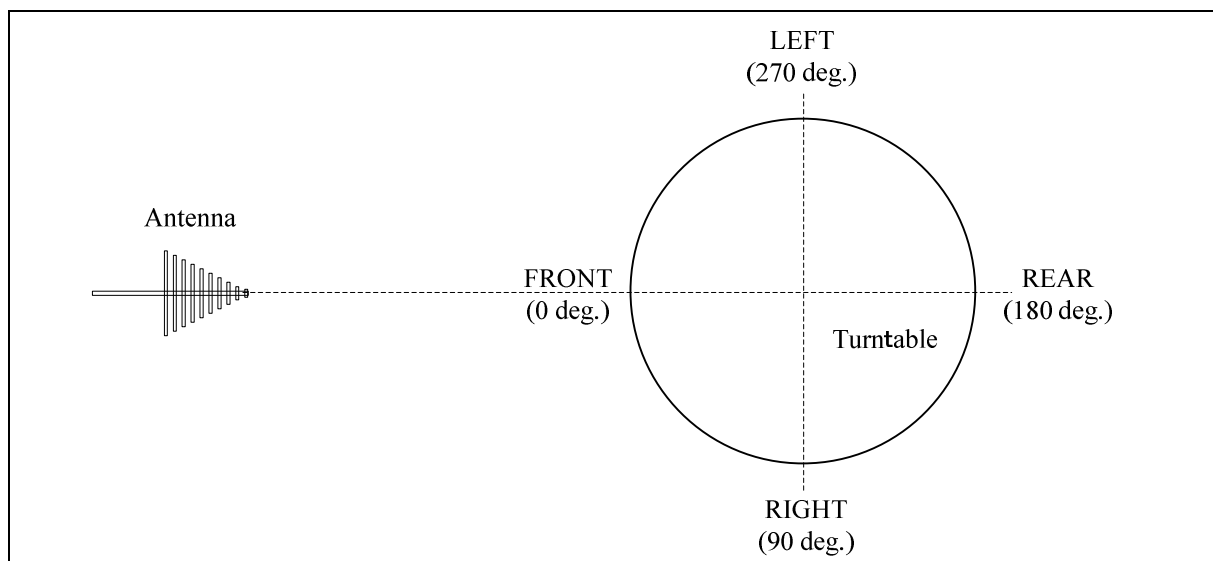
Radiated Spurious Emission / Field Strength of Fundamental Emission



20 dB Bandwidth / Frequency Tolerance



3.4 EUT Angle



4. Summary of Test Results

These test results are the test results of the condition specified with “3. Test Condition”.

Section	Test Item	Result
15.207	AC Power Line Conducted Emission	Pass
15.209, 15.225(d)	Radiated Spurious Emission	Pass
15.215(c)	20 dB Bandwidth	Pass
15.225(a)(b)(c)(d)	Field Strength of Fundamental Emission	Pass
15.225(e)	Frequency Tolerance	Pass



5. Measurement Result

5.1 15.207 AC Power Line Conducted Emission

5.1.1 Setting Remarks

The conducted disturbance voltage of AC power line in the frequency range from 150 kHz to 30 MHz was measured in accordance with ANSI C63.4:2003.

The test setup was made in accordance with ANSI C63.4:2003 on the table installed in a shielded room.

The non-conductive table, 0.8 m high, was placed on the reference ground plane, and the EUT was put on the non-conductive table.

The used Line Impedance Stabilizing Network (LISN) has a rated impedance of 50 Ω /50 μ H as specified in CISPR16-1-2.

The test receiver with Quasi Peak and Average detector is in accordance with CISPR 16-1-1.

The conducted emission level is calculated by adding Cable Attenuation Factor and Insertion Loss of LISN.

Activate the EUT System and run the software prepared for the test.

Refer to the figure of 3.3 Configuration.

Setting Condition of Test receiver

Frequency range	Detector	RBW
150 kHz to 30 MHz	Quasi-peak	9 kHz
	Average	9 kHz

5.1.2 Limit

Frequency range	Conducted Limit [dB μ V]	
	QP	AV
150 kHz to 500 kHz	66 to 56 *	56 to 46 *
500 kHz to 5 MHz	56	46
5 MHz to 30 MHz	60	50

Note:

*: Decrease with the logarithm of the frequency.

5.1.3 Test Detail

Result: PASS

Uncertainty of measurement result : ± 2.83 dB
Date of testing : September 24, 2014
Room temperature : 25°C
Relative humidity : 49%



5.1.3 Test Detail (Continued)

Calculation

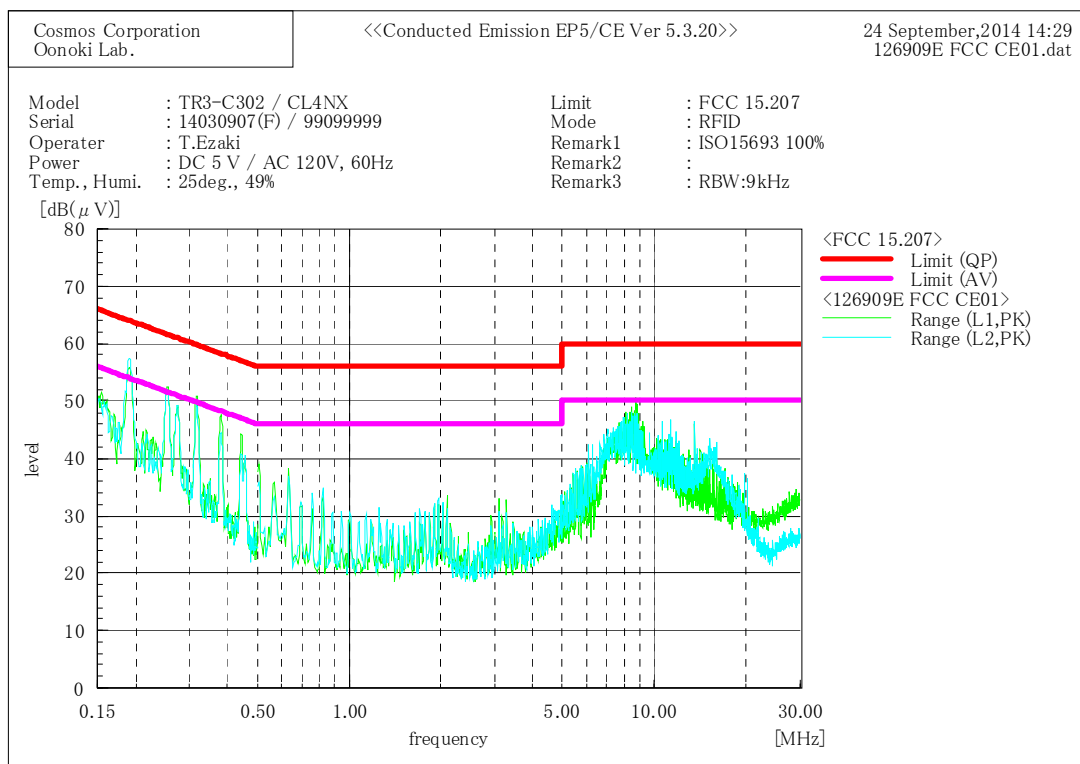
$$\begin{aligned}\text{Result} &= \text{Reading} + \text{Correction Factor} \\ &= 42.6 + 11.6 \\ &= 54.2\end{aligned}$$

$$\begin{aligned}\text{Margin} &= \text{Limit} - \text{Result} \\ &= 64.0 - 54.2 \\ &= 9.8\end{aligned}$$

Note:

c.f (Correction Factor) = Cable Attenuation Factor + Antenna Factor + Amplifier Gain

Worst Test Data (Mode: ISO15693 100%)



Final Result

--- L1 Phase ---

No.	Frequency	Reading QP	Reading AV	c.f	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV	Remark
	[MHz]	[dB(μV)]	[dB(μV)]	[dB]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB]	[dB]	
1	0.1904	42.6	39.3	11.6	54.2	50.9	64.0	54.0	9.8	3.1	
2	0.316	37.6	30.0	11.6	49.2	41.6	59.8	49.8	10.6	8.2	
3	0.5064	24.9	19.5	11.6	36.5	31.1	56.0	46.0	19.5	14.9	
4	2.0234	18.6	14.4	11.6	30.2	26.0	56.0	46.0	25.8	20.0	
5	3.301	20.5	5.5	11.6	32.1	17.1	56.0	46.0	23.9	28.9	
6	29.354	15.4	7.7	13.6	29.0	21.3	60.0	50.0	31.0	28.7	

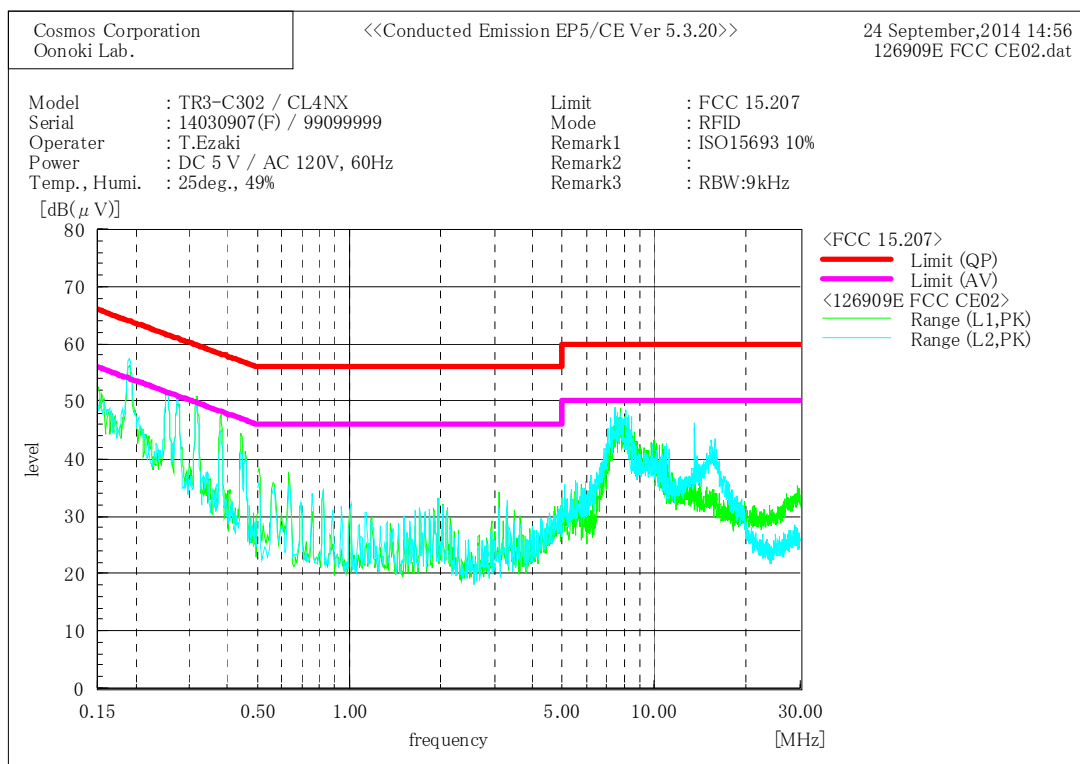
--- L2 Phase ---

No.	Frequency	Reading QP	Reading AV	c.f	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV	Remark
	[MHz]	[dB(μV)]	[dB(μV)]	[dB]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB]	[dB]	
1	0.1902	43.2	39.6	11.7	54.9	51.3	64.0	54.0	9.1	2.7	
2	0.3176	35.3	28.5	11.6	46.9	40.1	59.8	49.8	12.9	9.7	
3	0.6398	22.5	21.8	11.6	34.1	33.4	56.0	46.0	21.9	12.6	
4	1.9626	18.4	13.4	11.6	30.0	25.0	56.0	46.0	26.0	21.0	
5	3.299	17.8	4.2	11.6	29.4	15.8	56.0	46.0	26.6	30.2	
6	28.242	6.8	0.3	13.8	20.6	14.1	60.0	50.0	39.4	35.9	



5.1.3 Test Detail (Continued)

Test Data (Mode: ISO15693 10%)



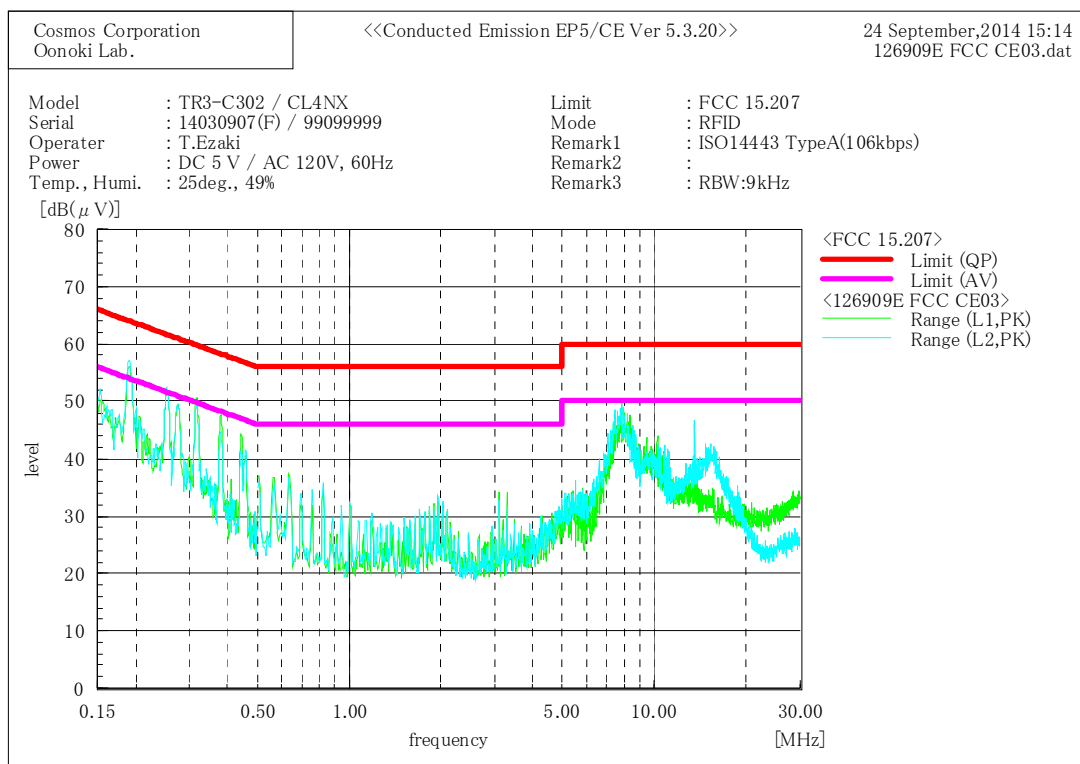
Final Result

No.	Frequency	Reading QP	Reading AV	c. f	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV	Remark
	[MHz]	[dB(μ V)]	[dB(μ V)]	[dB]	[dB(μ V)]	[dB(μ V)]	[dB(μ V)]	[dB(μ V)]	[dB]	[dB]	
1	0.1905	43.1	39.5	11.7	54.8	51.2	64.0	54.0	9.2	2.8	



5.1.3 Test Detail (Continued)

Test Data (Mode: ISO14443 Type A (106 kbps))



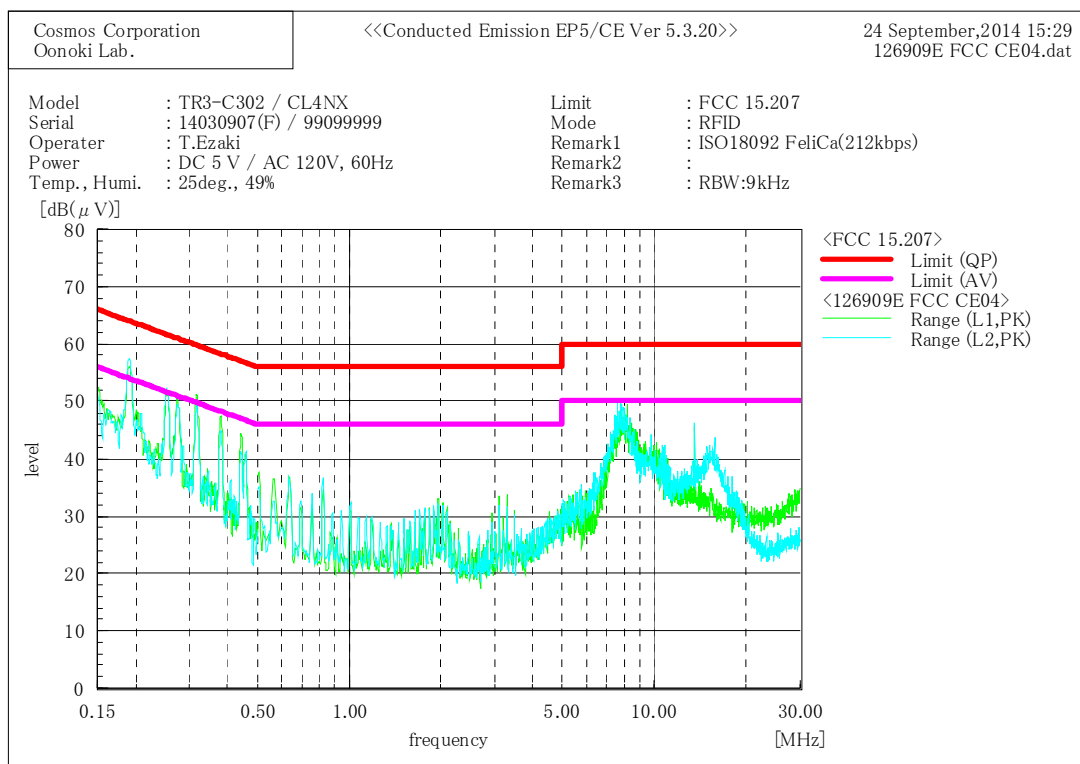
Final Result

No.	Frequency [MHz]	Reading		c.f [dB]	Result		Limit		Margin		Remark
		QP [dB(μ V)]	AV [dB(μ V)]		QP [dB(μ V)]	AV [dB(μ V)]	QP [dB(μ V)]	AV [dB(μ V)]	QP [dB]	AV [dB]	
1	0.1904	43.1	39.5	11.7	54.8	51.2	64.0	54.0	9.2	2.8	



5.1.3 Test Detail (Continued)

Test Data (Mode: ISO18092 FeliCa (212 kbps))



Final Result

No.	Frequency [MHz]	L2 Phase		c.f [dB]	Result		Limit		Margin QP [dB]	Margin AV [dB]	Remark
		Reading QP [dB(μV)]	Reading AV [dB(μV)]		Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]			
1	0.1903	43.1	39.5	11.7	54.8	51.2	64.0	54.0	9.2	2.8	



5.2 15.209, 15.225(d) Radiated Spurious Emission

5.2.1 Setting Remarks

In the frequency range from 9 kHz to 1 GHz (over 10th harmonics), the electric field strength was measured in accordance with ANSI C63.4:2003.

The test setup was made in accordance with ANSI C63.4:2003 on the table installed in a semi-anechoic chamber.

The non-conductive table, 0.8 m high, was placed on the turntable, and the EUT was put on the non-conductive table.

The EUT was measured at 1 m to 4 m height of the antenna above 30 MHz.

The turntable was fully rotated. The highest radiation from the equipment was recorded.

The measurement above 30 MHz was carried out with both horizontal and vertical antenna polarization.

The test receiver with Quasi Peak detector is in accordance with CISPR 16-1-1.

The measurement was carried out with the measuring distance of 3 m.

Then the limit of 30 m distance below 30 MHz was converted to the limit of 3 m distance with the $40\log(30\text{ m}/3\text{ m})$.

Refer to the figure of 3.3 Configuration.

Setting Condition of Test receiver

Frequency range	Detector	RBW
9 kHz to 150 kHz	Quasi-peak	200 Hz
150 kHz to 30 MHz	Quasi-peak	9 kHz
30 MHz to 1 GHz	Quasi-peak	120 kHz

5.2.2 Limit

Frequency range	Field Strength (Distance)	
	[$\mu\text{V}/\text{m}$]	[dB $\mu\text{V}/\text{m}$]
9 kHz to 490 kHz	2400/F (kHz) 266.6 to 4.89 (300 m)	128.5 to 93.8 (3 m)
490 kHz to 1.705 MHz	24000/F (kHz) 48.9 to 14.0 (30 m)	73.8 to 62.9 (3 m)
1.705 MHz to 30 MHz	30 (30 m)	69.5 (3 m)
30 MHz to 88 MHz	100 (3 m)	40.0 (3 m)
88 MHz to 216 MHz	150 (3 m)	43.5 (3 m)
216 MHz to 960 MHz	200 (3 m)	46.0 (3 m)
Above 960 MHz	500 (3 m)	53.9 (3 m)



5.2.3 Test Detail

Result: PASS

Uncertainty of measurement result	:	± 3.64 dB	
Date of testing	:	September 12, 2014	September 15, 2014
Room temperature	:	23°C	23°C
Relative humidity	:	52%	53%

Calculation

$$\begin{aligned}\text{Result} &= \text{Reading} + \text{Correction Factor} \\ &= 31.2 + 19.6 \\ &= 50.8\end{aligned}$$
$$\begin{aligned}\text{Margin} &= \text{Limit} - \text{Result} \\ &= 113.6 - 50.8 \\ &= 62.8\end{aligned}$$

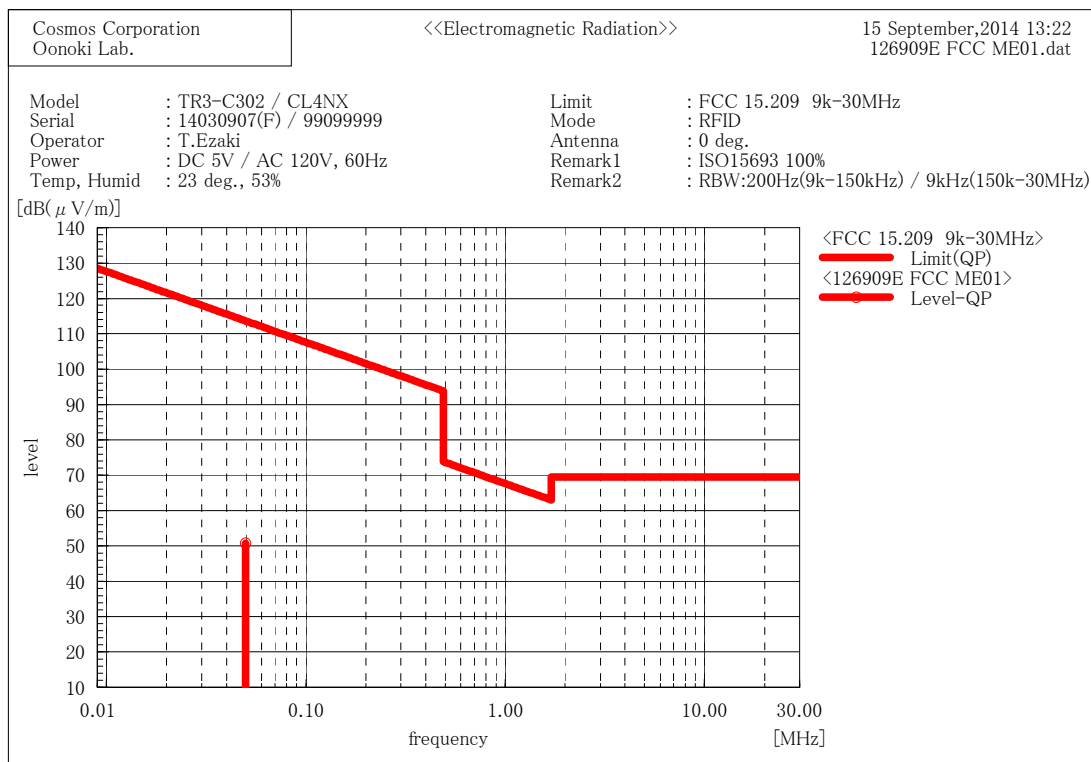
Note:

c.f (Correction Factor) = Cable Attenuation Factor + Antenna Factor + Amplifier Gain



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO15693 100%, Antenna: 0°)



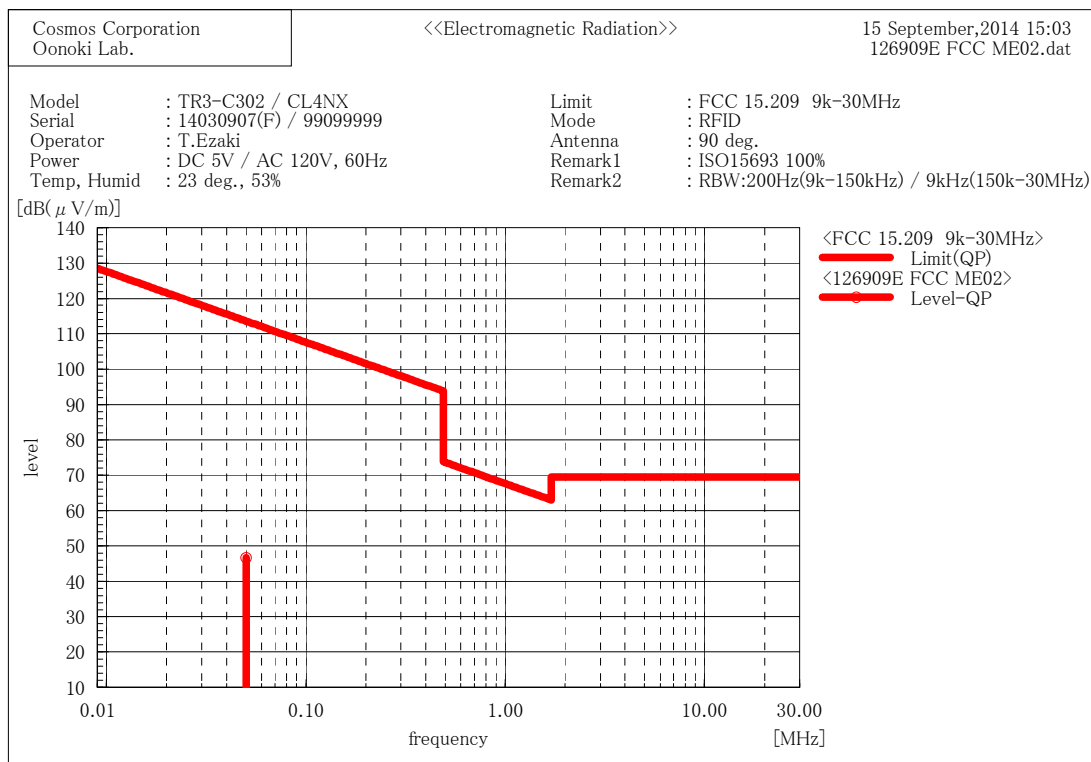
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.04995	31.2	19.6	50.8	113.6	62.8	234.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO15693 100%, Antenna: 90°)



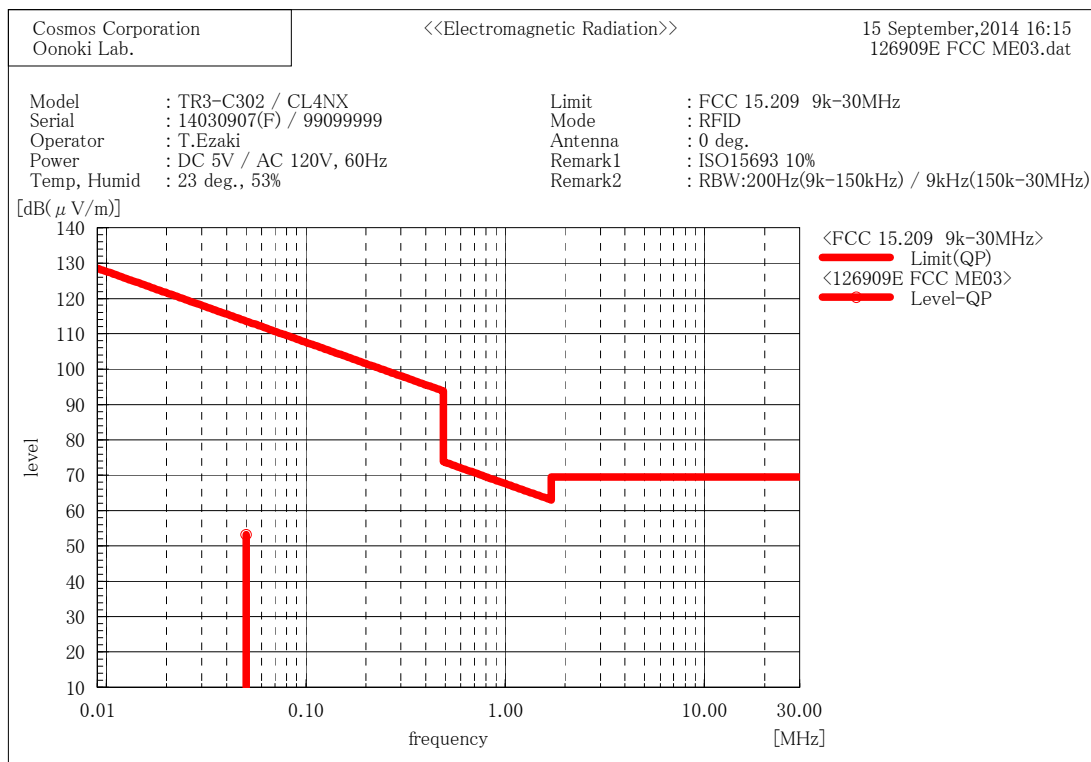
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.05002	27.1	19.6	46.7	113.6	66.9	281.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO15693 10%, Antenna: 0°)



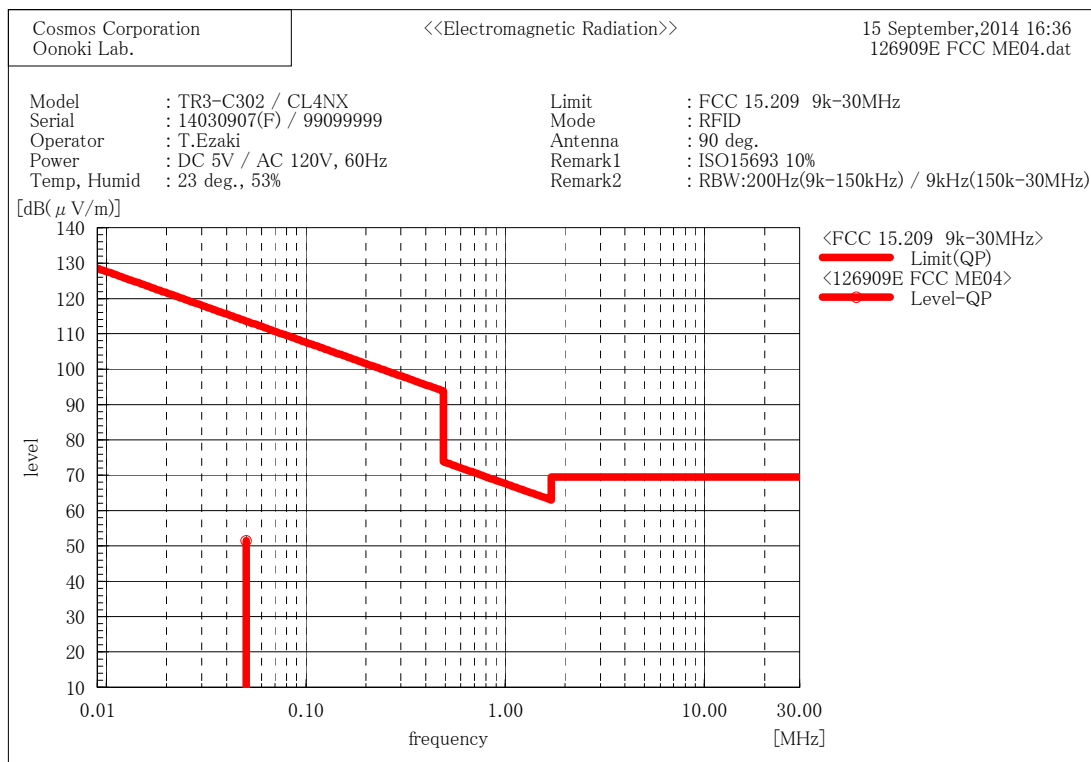
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μ V)]	[dB(1/m)]	[dB(μ V/m)]	[dB(μ V/m)]	[dB]	[°]
1	0.05006	33.6	19.6	53.2	113.6	60.4	4.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO15693 10%, Antenna: 90°)



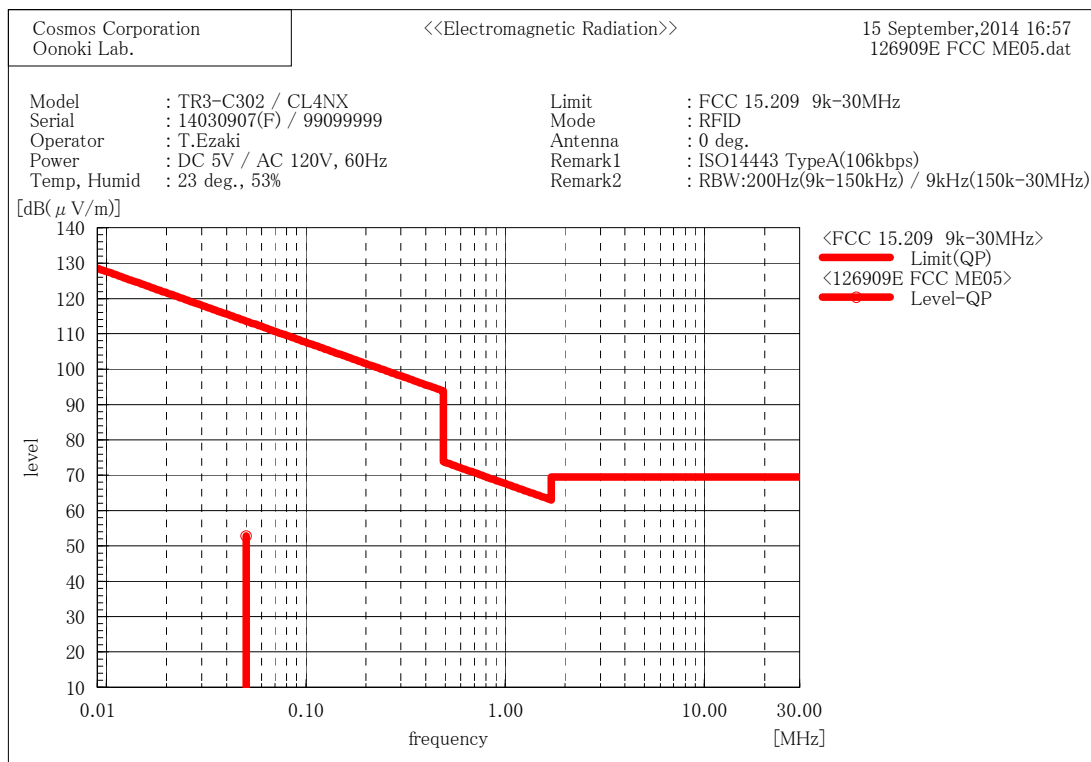
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.05005	31.8	19.6	51.4	113.6	62.2	281.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO14443 Type A (106 kbps), Antenna: 0°)



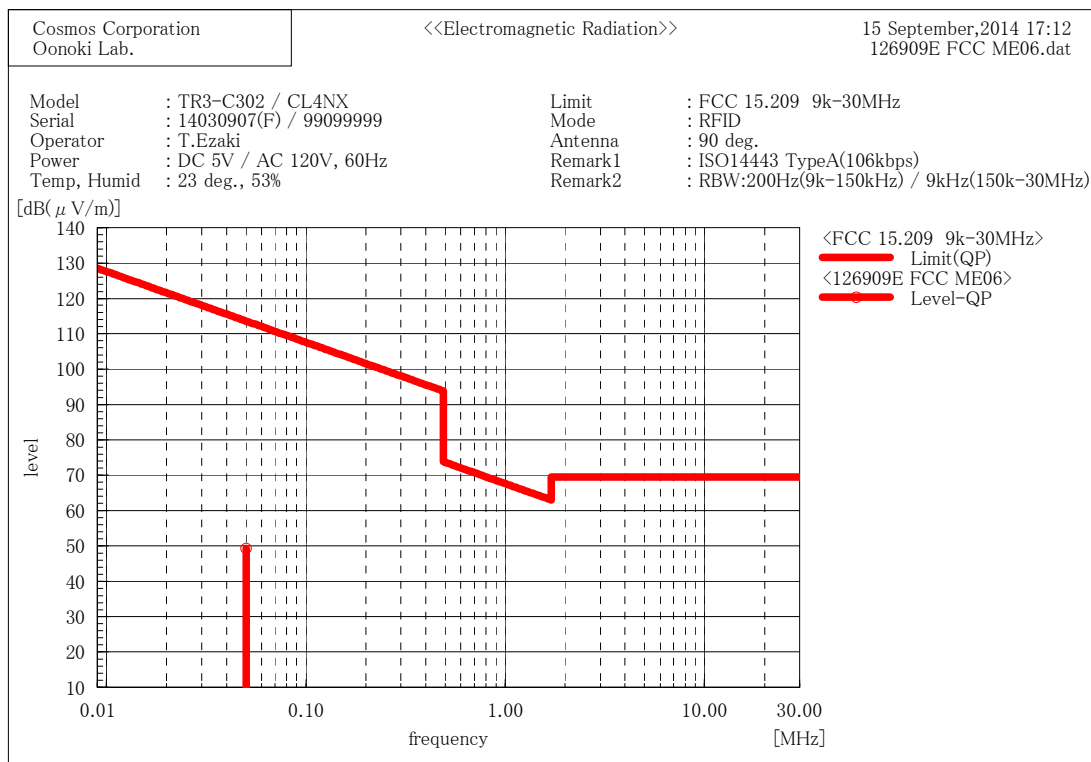
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.05006	33.2	19.6	52.8	113.6	60.8	213.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO14443 Type A (106 kbps), Antenna: 90°)



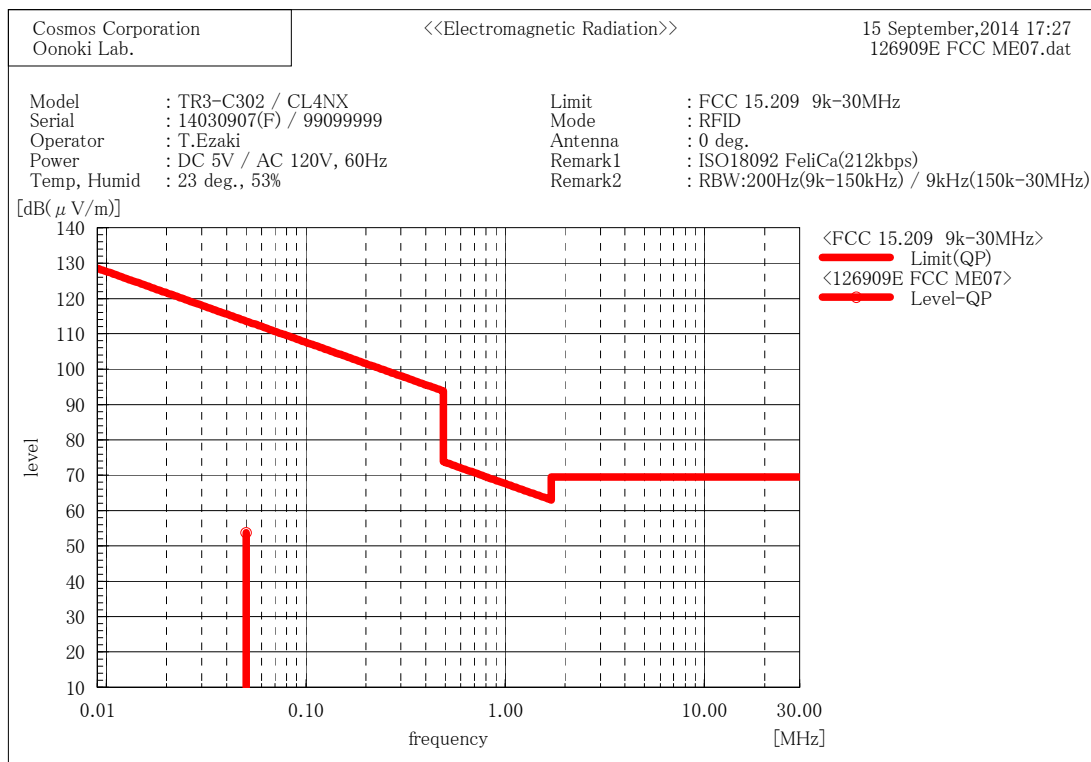
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.05008	29.7	19.6	49.3	113.6	64.3	290.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Worst Test Data (Mode: ISO18092 FeliCa (212 kbps), Antenna: 0°)



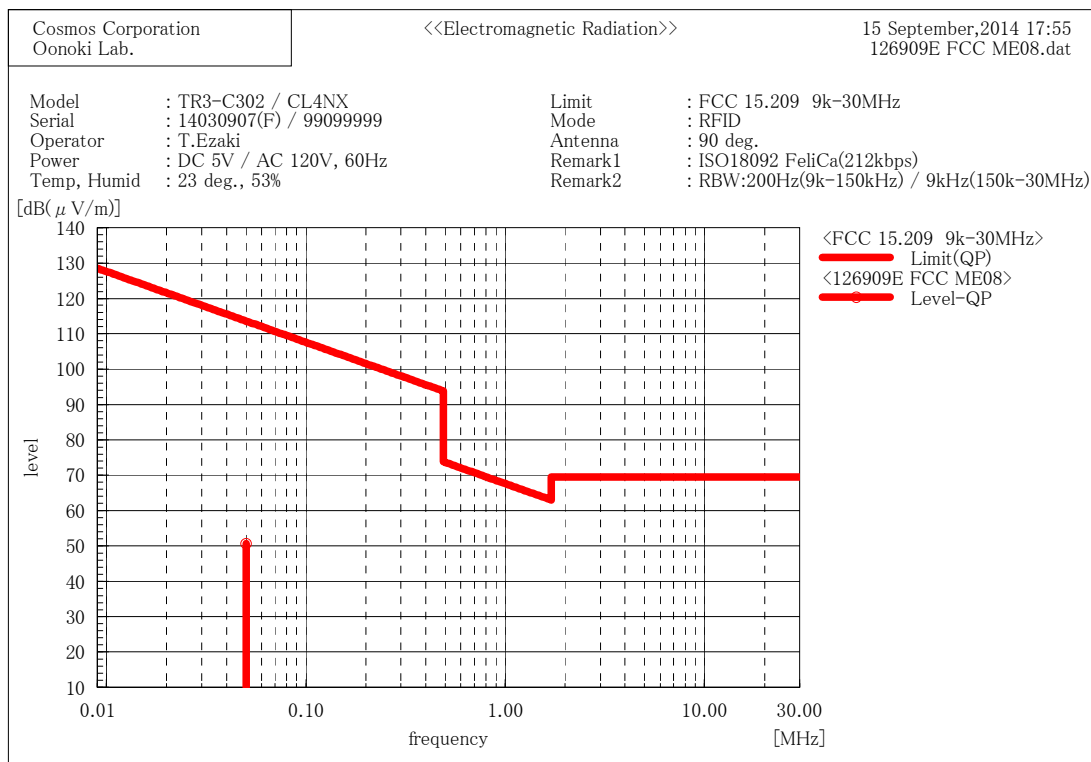
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.05007	34.1	19.6	53.7	113.6	59.9	217.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Mode: ISO18092 FeliCa (212 kbps), Antenna: 90°)



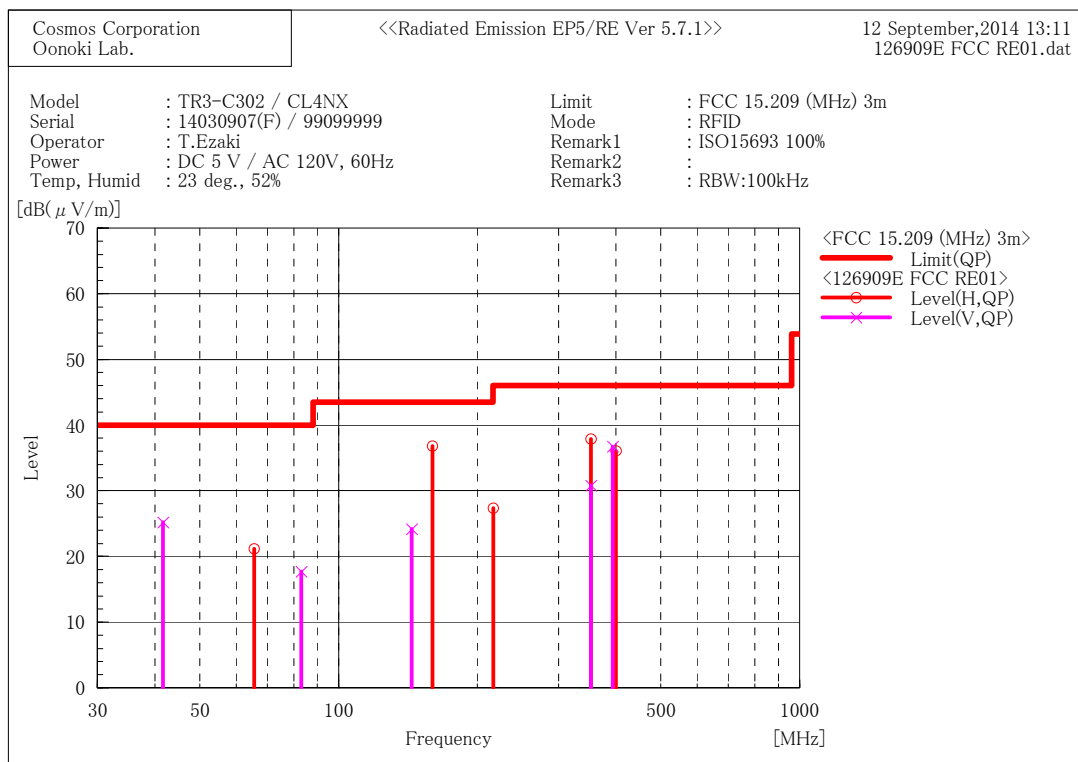
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.05007	31.0	19.6	50.6	113.6	63.0	279.0



5.2.3 Test Detail (Continued)

<Above 30 MHz>
Test Data (Mode: ISO15693 100%)



Final Result

--- Horizontal Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	65.669	35.6	-14.4	21.2	40.0	18.8	238.0	302.0
2	160.020	47.0	-10.2	36.8	43.5	6.7	130.0	319.0
3	216.834	33.3	-5.9	27.4	46.0	18.6	100.0	15.0
4	352.601	43.8	-5.9	37.9	46.0	8.1	100.0	255.0
5	400.030	40.6	-4.5	36.1	46.0	9.9	211.0	278.0

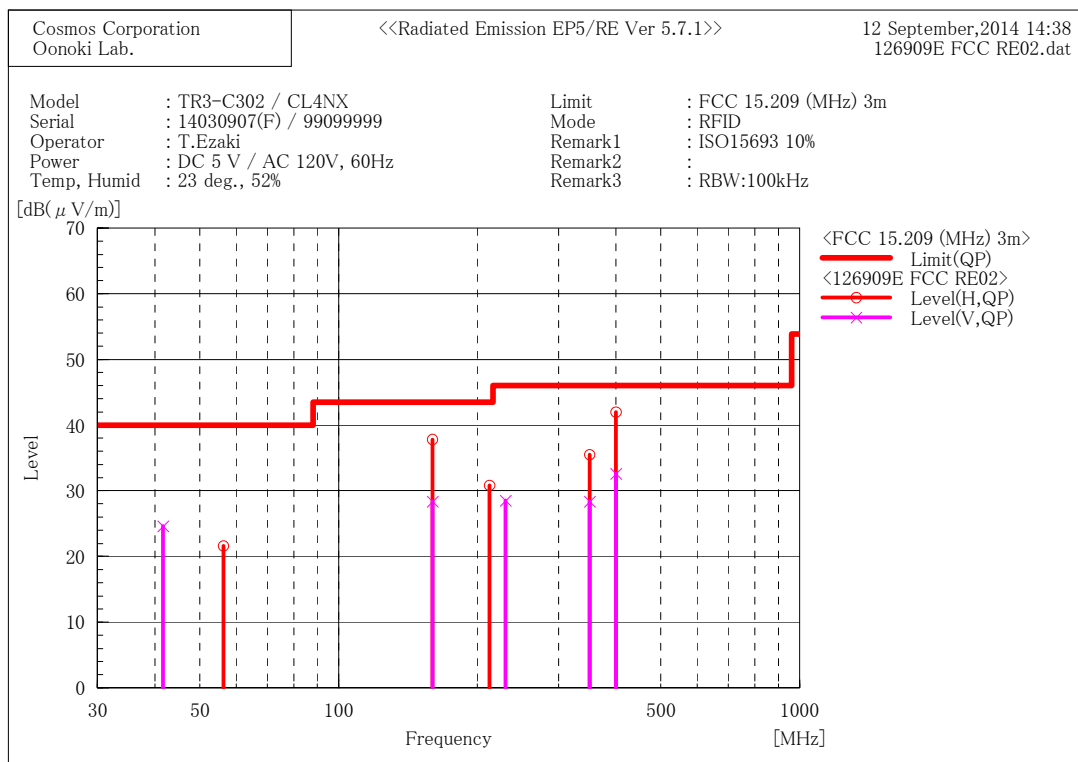
--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	41.674	38.2	-13.0	25.2	40.0	14.8	100.0	15.0
2	83.090	32.4	-14.7	17.7	40.0	22.3	100.0	229.0
3	143.970	35.0	-10.8	24.2	43.5	19.3	100.0	215.0
4	352.505	36.7	-5.9	30.8	46.0	15.2	125.0	223.0
5	393.236	41.4	-4.7	36.7	46.0	9.3	129.0	236.0



5.2.3 Test Detail (Continued)

<Above 30 MHz> Test Data (Mode: ISO15693 10%)



Final Result

--- Horizontal Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	56.307	35.4	-13.8	21.6	40.0	18.4	400.0	132.0
2	160.030	48.0	-10.2	37.8	43.5	5.7	130.0	329.0
3	212.631	36.9	-6.1	30.8	43.5	12.7	100.0	46.0
4	350.097	41.5	-6.0	35.5	46.0	10.5	100.0	318.0
5	400.009	46.5	-4.5	42.0	46.0	4.0	206.0	280.0

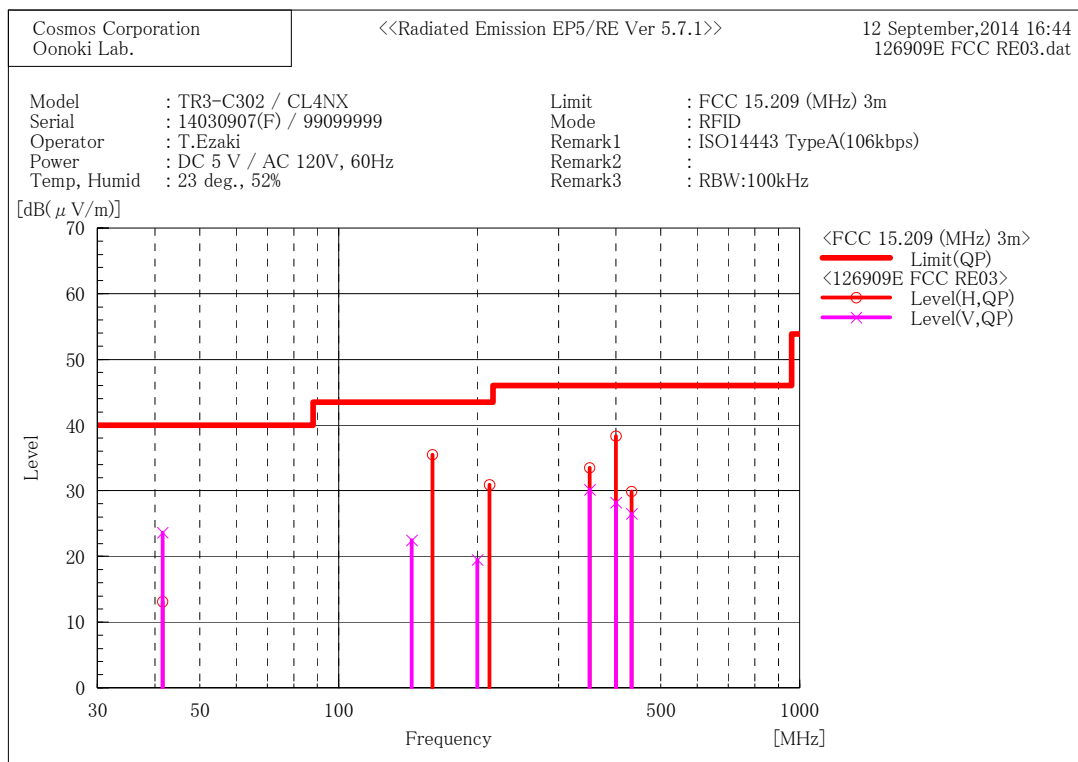
--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c.f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	41.601	37.6	-13.0	24.6	40.0	15.4	100.0	345.0
2	160.030	38.6	-10.2	28.4	43.5	15.1	100.0	252.0
3	230.531	34.1	-5.6	28.5	46.0	17.5	100.0	267.0
4	350.165	34.4	-6.0	28.4	46.0	17.6	148.0	251.0
5	400.011	37.1	-4.5	32.6	46.0	13.4	134.0	206.0



5.2.3 Test Detail (Continued)

<Above 30 MHz> Test Data (Mode: ISO14443 Type A (106 kbps))



Final Result

--- Horizontal Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	41.511	26.1	-13.0	13.1	40.0	26.9	400.0	269.0
2	160.030	45.7	-10.2	35.5	43.5	8.0	133.0	329.0
3	212.675	37.0	-6.1	30.9	43.5	12.6	100.0	15.0
4	350.076	39.5	-6.0	33.5	46.0	12.5	100.0	258.0
5	400.042	42.8	-4.5	38.3	46.0	7.7	303.0	204.0
6	432.120	33.8	-3.9	29.9	46.0	16.1	193.0	300.0

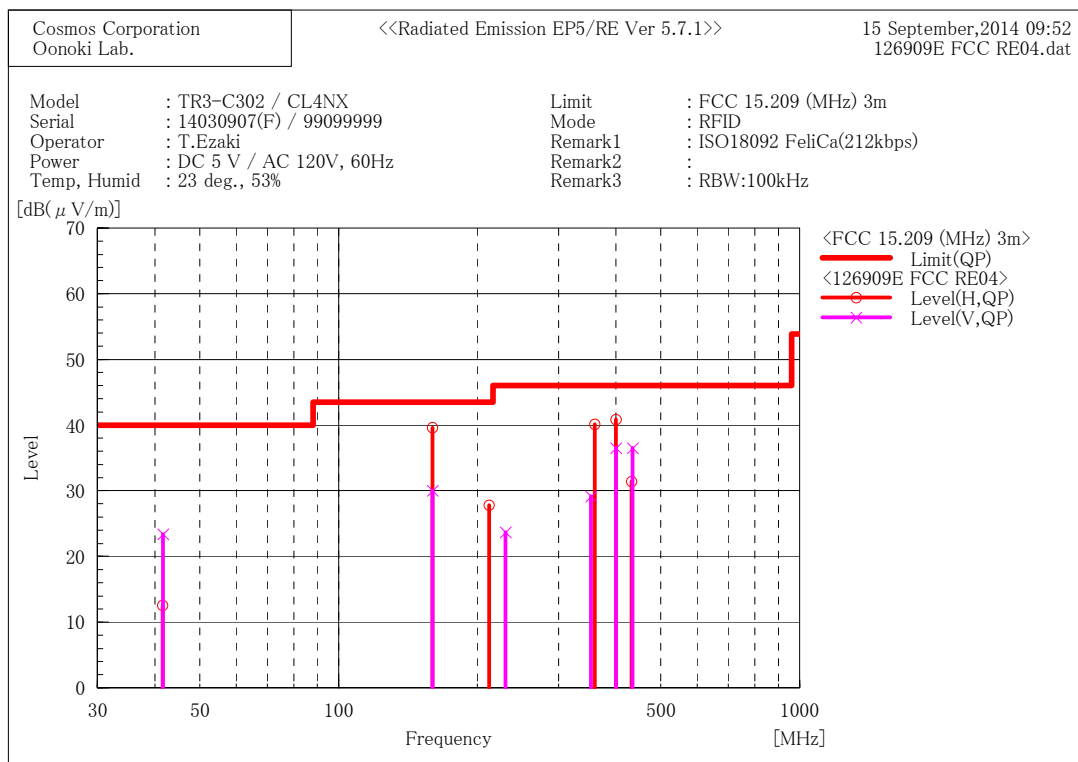
--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	41.571	36.6	-13.0	23.6	40.0	16.4	100.0	33.0
2	144.050	33.3	-10.8	22.5	43.5	21.0	100.0	233.0
3	200.030	26.4	-6.9	19.5	43.5	24.0	100.0	85.0
4	350.084	36.2	-6.0	30.2	46.0	15.8	148.0	210.0
5	400.042	32.7	-4.5	28.2	46.0	17.8	110.0	234.0
6	431.970	30.4	-3.9	26.5	46.0	19.5	106.0	193.0



5.2.3 Test Detail (Continued)

<Above 30 MHz> Worst Test Data (Mode: ISO18092 FeliCa (212 kbps))



Final Result

--- Horizontal Polarization (QP) ---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	41.533	25.5	-13.0	12.5	40.0	27.5	400.0	270.0
2	160.030	49.8	-10.2	39.6	43.5	3.9	143.0	322.0
3	212.251	33.9	-6.1	27.8	43.5	15.7	100.0	82.0
4	360.010	45.8	-5.7	40.1	46.0	5.9	100.0	254.0
5	400.030	45.3	-4.5	40.8	46.0	5.2	100.0	292.0
6	432.050	35.3	-3.9	31.4	46.0	14.6	200.0	287.0

--- Vertical Polarization (QP) ---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	41.661	36.4	-13.0	23.4	40.0	16.6	100.0	24.0
2	160.050	40.2	-10.2	30.0	43.5	13.5	100.0	226.0
3	230.587	29.3	-5.6	23.7	46.0	22.3	100.0	275.0
4	352.555	35.1	-5.9	29.2	46.0	16.8	135.0	242.0
5	400.050	41.0	-4.5	36.5	46.0	9.5	129.0	211.0
6	433.952	40.4	-3.9	36.5	46.0	9.5	124.0	211.0



5.3 15.215(c) 20 dB Bandwidth

5.3.1 Setting Remarks

The both side of 20 dB down value from peak power were measured by using 20 dB bandwidth measurement function of the spectrum analyzer.

Refer to the figure of 3.3 Configuration.

The spectrum analyzer is set as following:

·Frequency Span	: 2 × OBW
·Resolution Bandwidth	: 1% to 5% of the OBW (not less than 1 kHz)
·Video Bandwidth	: greater than RBW
·Detector Mode	: Peak
·Trace Mode	: Max Hold

5.3.2 Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

5.3.3 Test Detail

Result: PASS

Uncertainty of measurement result	: ±0.8 dB
Date of testing	: September 5, 2014
Room temperature	: 24°C
Relative humidity	: 43%

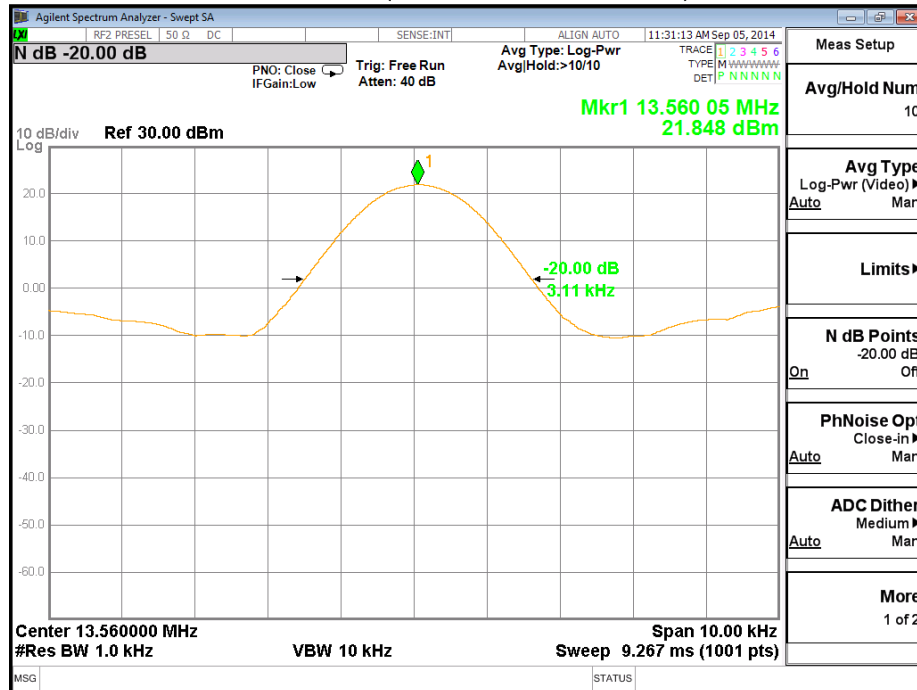
Mode	Test Detail	Result [kHz]
ISO15693 100%	Bandwidth	3.11
ISO15693 10%	Bandwidth	2.94
ISO14443 Type A (106 kbps)	Bandwidth	439.00
ISO18092 FeliCa (212 kbps)	Bandwidth	3.05

Mode	Test Detail	Result [MHz]	Limit [MHz]	Margin [kHz]
ISO14443 Type A (106 kbps)	BW Lower End	13.340	Above 13.110	230.0
	BW Higher End	13.779	Below 14.010	231.0

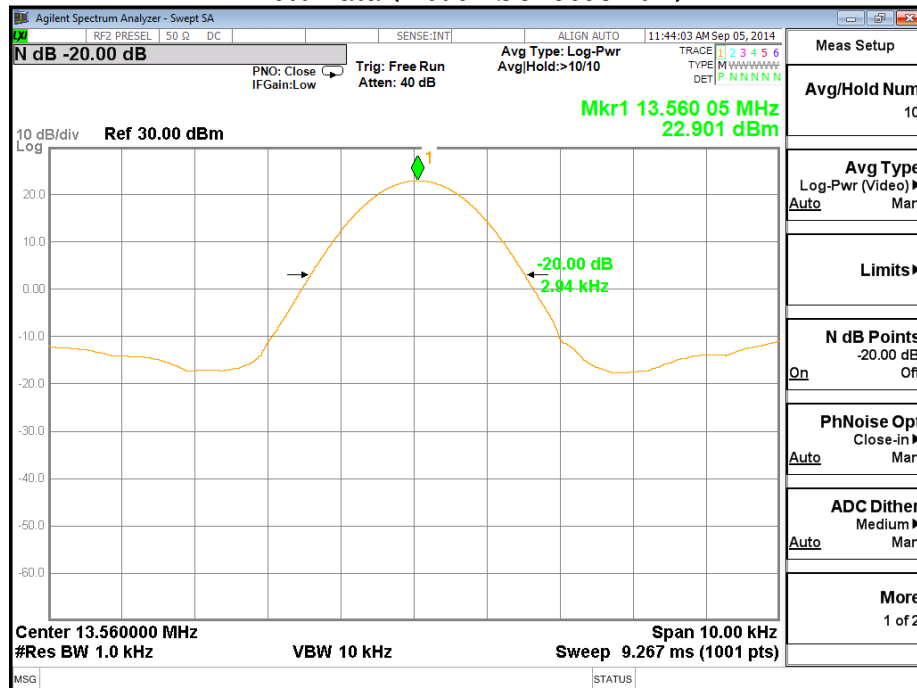


5.3.3 Test Detail (Continued)

Test Data (Mode: ISO15693 100%)



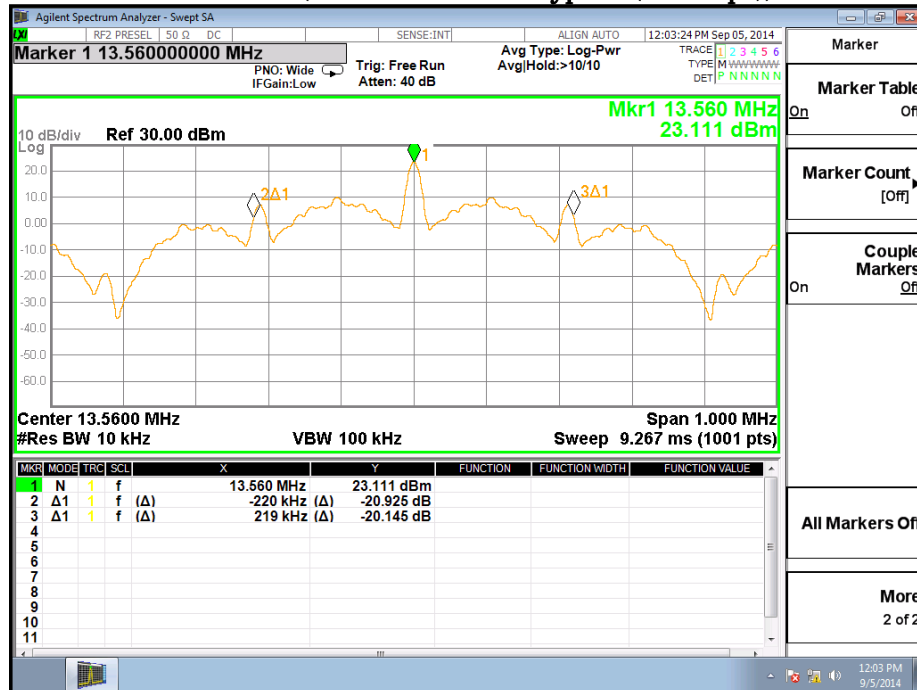
Test Data (Mode: ISO15693 10%)



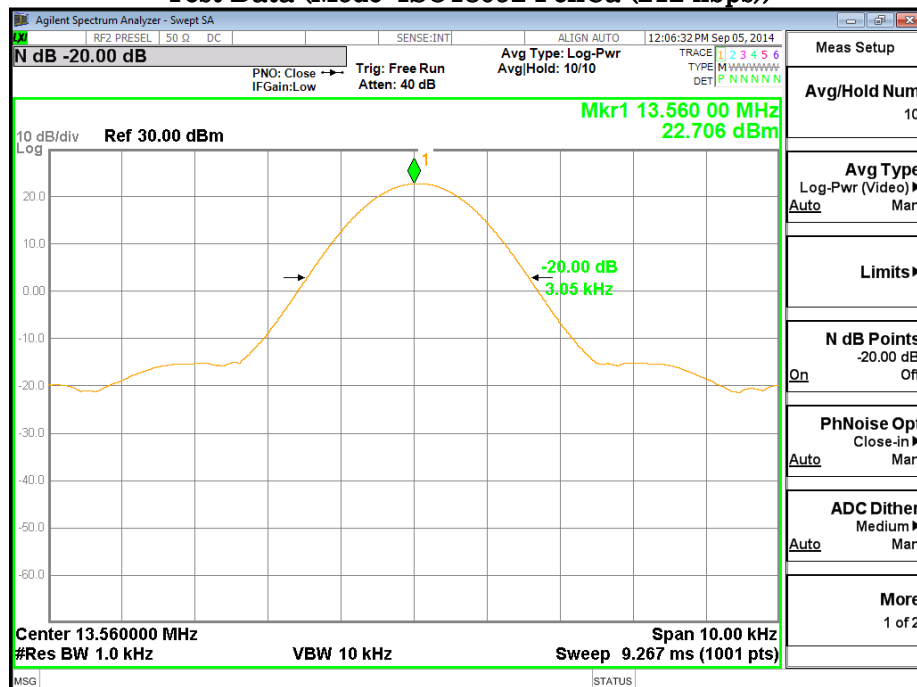


5.3.3 Test Detail (Continued)

Test Data (Mode: ISO14443 Type A (106 kbps))



Test Data (Mode: ISO18092 FeliCa (212 kbps))





5.4 15.225(a)(b)(c)(d) Field Strength of Fundamental Emission

5.4.1 Setting Remarks

The test setup was made in accordance with ANSI C63.4:2003 on the table installed in a semi-anechoic chamber.

The non-conductive table, 0.8 m high, was placed on the turntable, and the EUT was put on the non-conductive table.

The turntable was fully rotated. The highest radiation from the equipment was recorded.

The measurement was carried out with the measuring distance of 3 m.

The test receiver with Quasi Peak detector is in accordance with CISPR 16-1-1.

Then the limit of 30 m distance was converted to the limit of 3 m distance with the $40\log(30\text{ m}/3\text{ m})$.

Refer to the figure of 3.3 Configuration.

5.4.2 Limit

Frequency range	Field Strength (Distance)	
	[$\mu\text{V}/\text{m}$]	[dB $\mu\text{V}/\text{m}$]
13.553 MHz to 13.567 MHz	15848 (30 m)	123.9 (3 m)
13.410 MHz to 13.553 MHz and 13.567 MHz to 13.710 MHz	334 (30 m)	90.4 (3 m)
13.110 MHz to 13.410 MHz and 13.710 MHz to 14.010 MHz	106 (30 m)	80.5 (3 m)
Outside of 13.110 MHz to 14.010 MHz	30 (30 m)	69.5 (3 m)

5.4.3 Test Detail

Result: PASS

Uncertainty of measurement result : $\pm 3.64\text{ dB}$
Date of testing : September 15, 2014
Room temperature : 24°C
Relative humidity : 45%

Calculation

$$\begin{aligned}\text{Result} &= \text{Reading} + \text{Correction Factor} \\ &= 36.5 + 21.9 \\ &= 58.4\end{aligned}$$

$$\begin{aligned}\text{Margin} &= \text{Limit} - \text{Result} \\ &= 123.9 - 58.4 \\ &= 65.5\end{aligned}$$

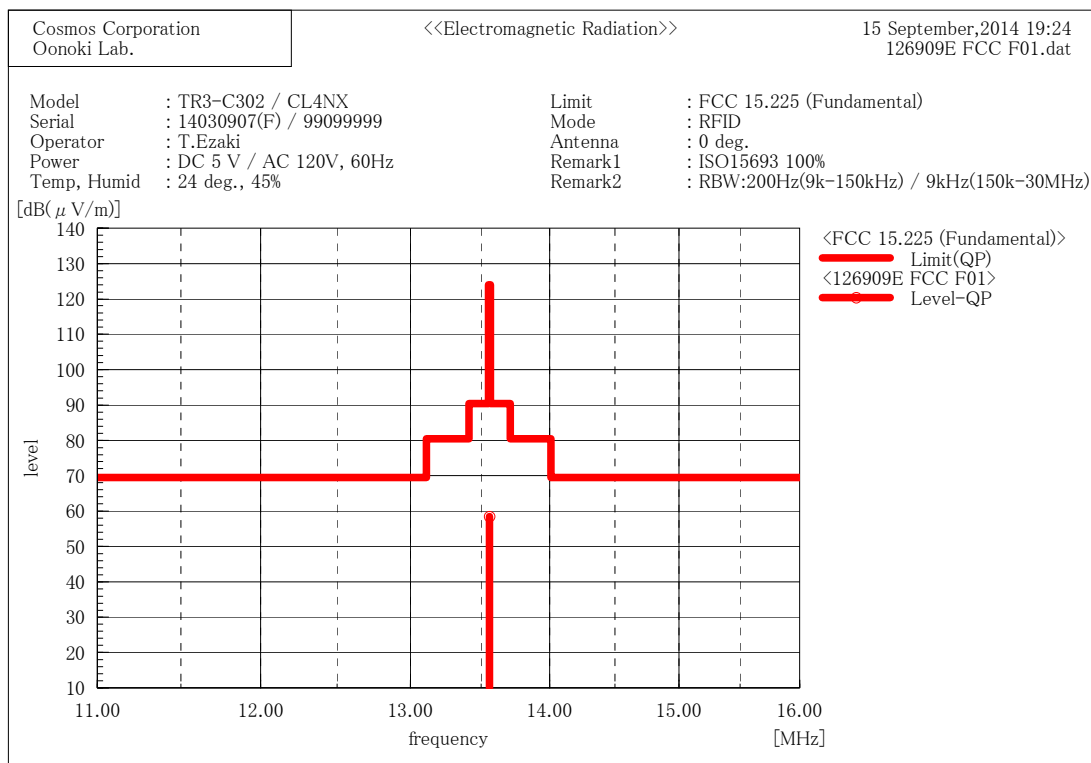
Note:

c.f (Correction Factor) = Cable Attenuation Factor + Antenna Factor + Amplifier Gain



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO15693 100%, Antenna: 0°)



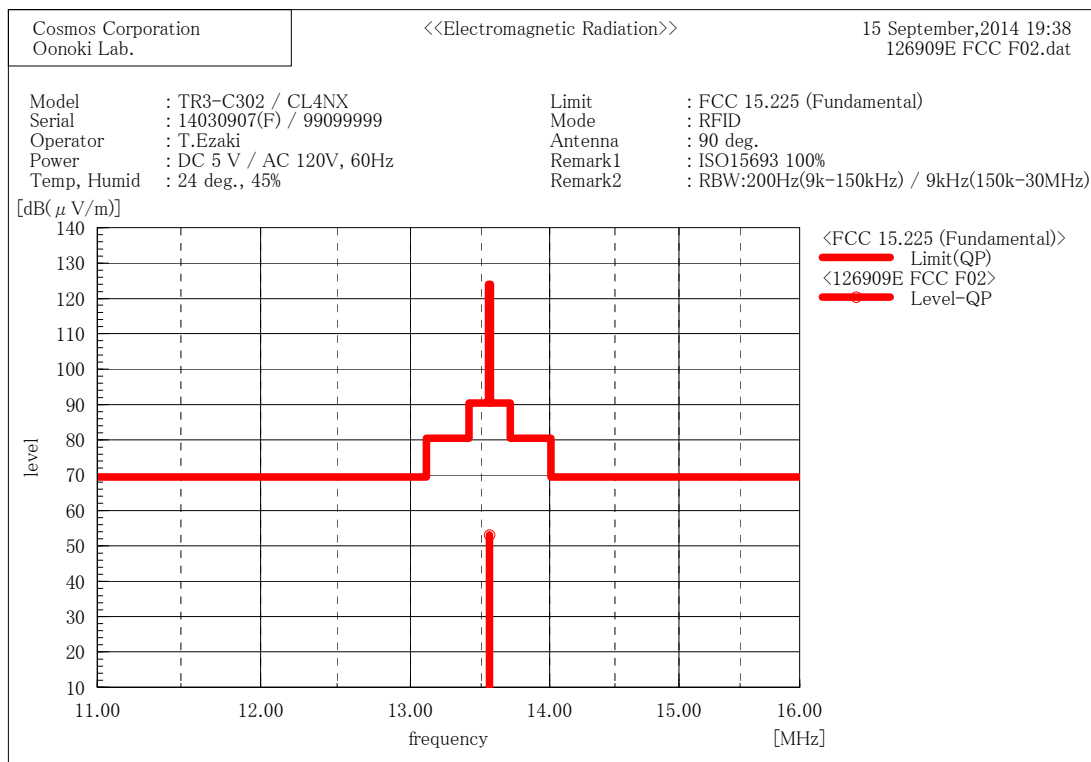
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.56122	36.5	21.9	58.4	123.9	65.5	330.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO15693 100%, Antenna: 90°)



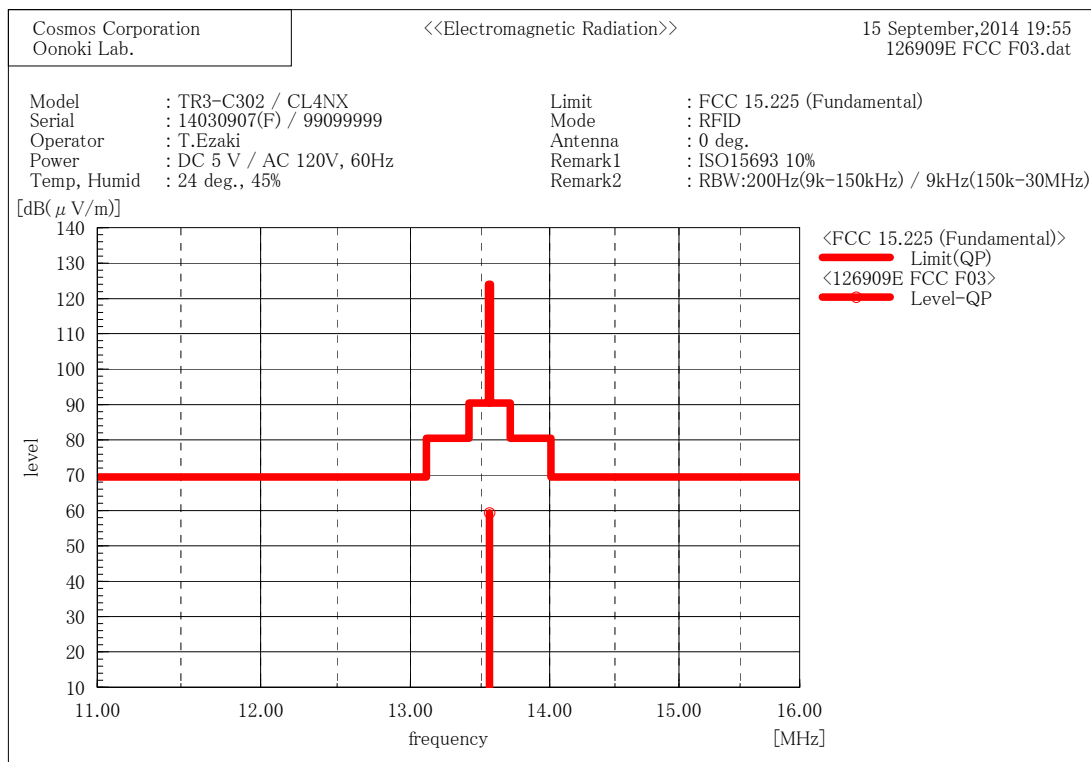
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.5607	31.2	21.9	53.1	123.9	70.8	73.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO15693 10%, Antenna: 0°)



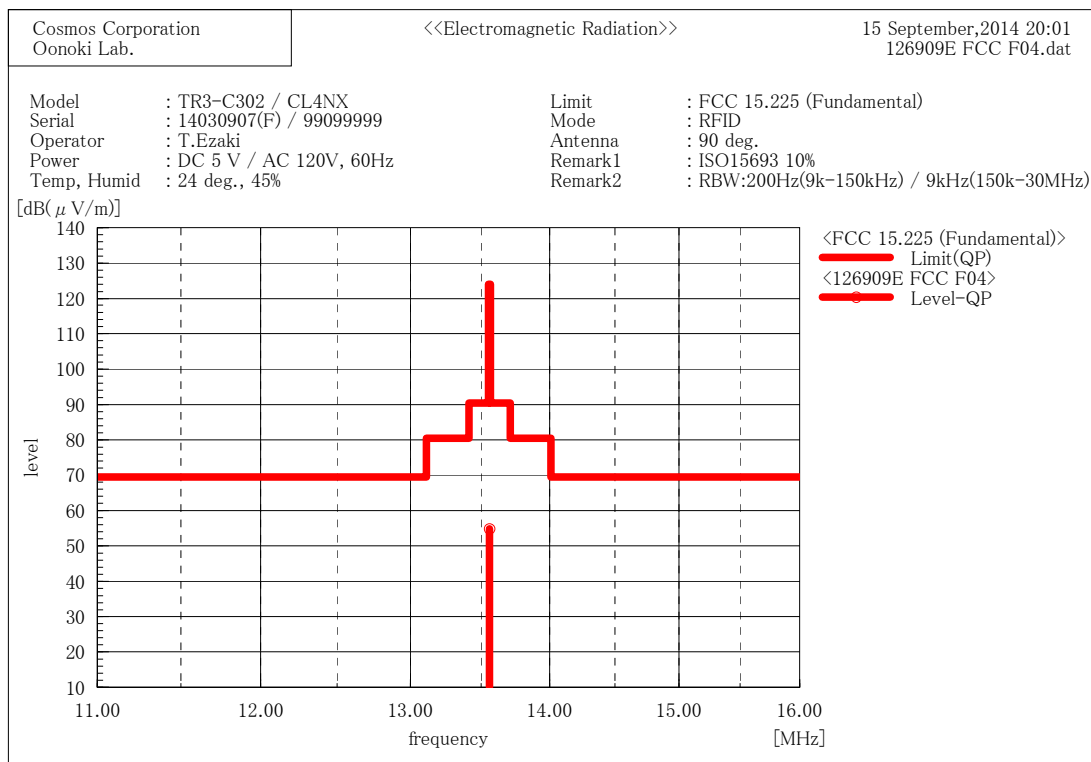
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.5607	37.4	21.9	59.3	123.9	64.6	325.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO15693 10%, Antenna: 90°)



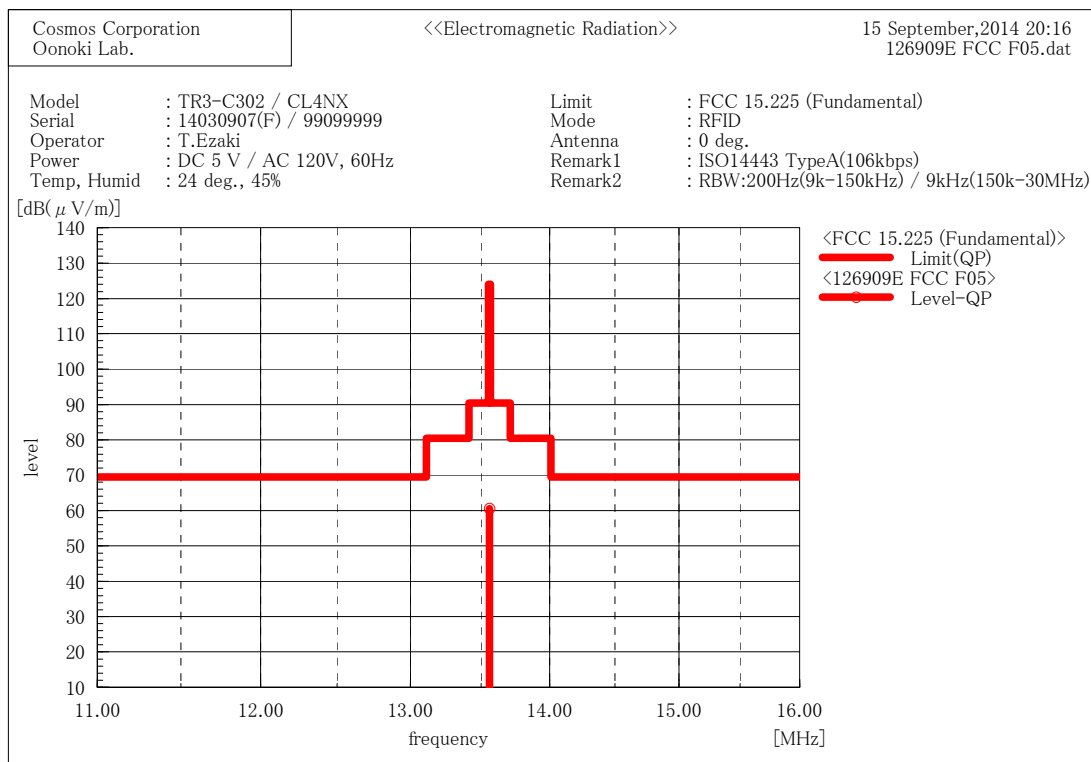
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.5607	32.9	21.9	54.8	123.9	69.1	75.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO14443 Type A (106 kbps), Antenna: 0°)



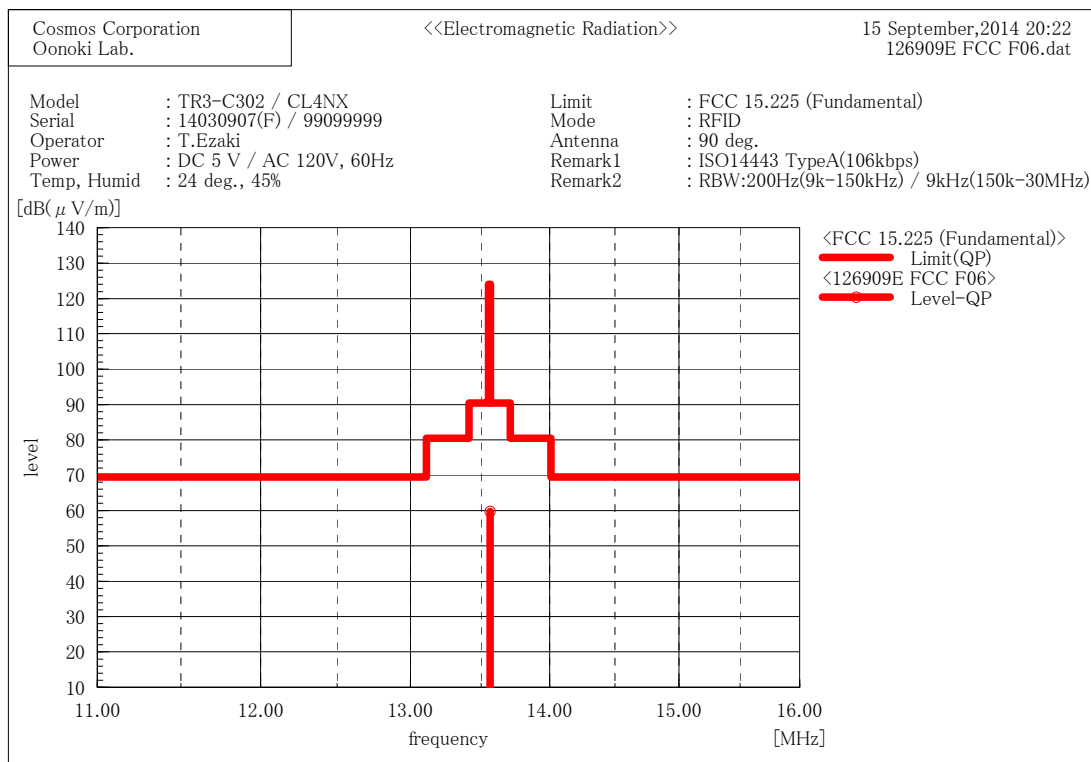
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.5607	38.7	21.9	60.6	123.9	63.3	357.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO14443 Type A (106 kbps), Antenna: 90°)



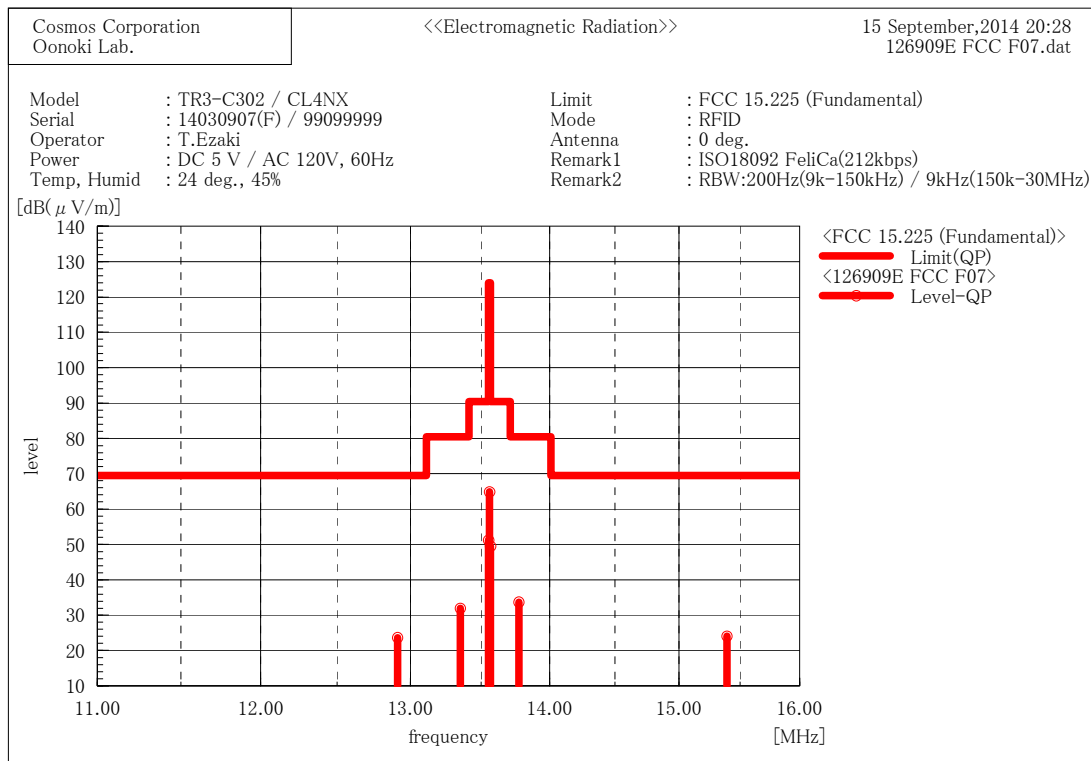
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.5623	37.8	21.9	59.7	123.9	64.2	88.0	



5.4.3 Test Detail (Continued)

Worst Test Data (Mode: ISO18092 FeliCa (212 kbps), Antenna: 0°)



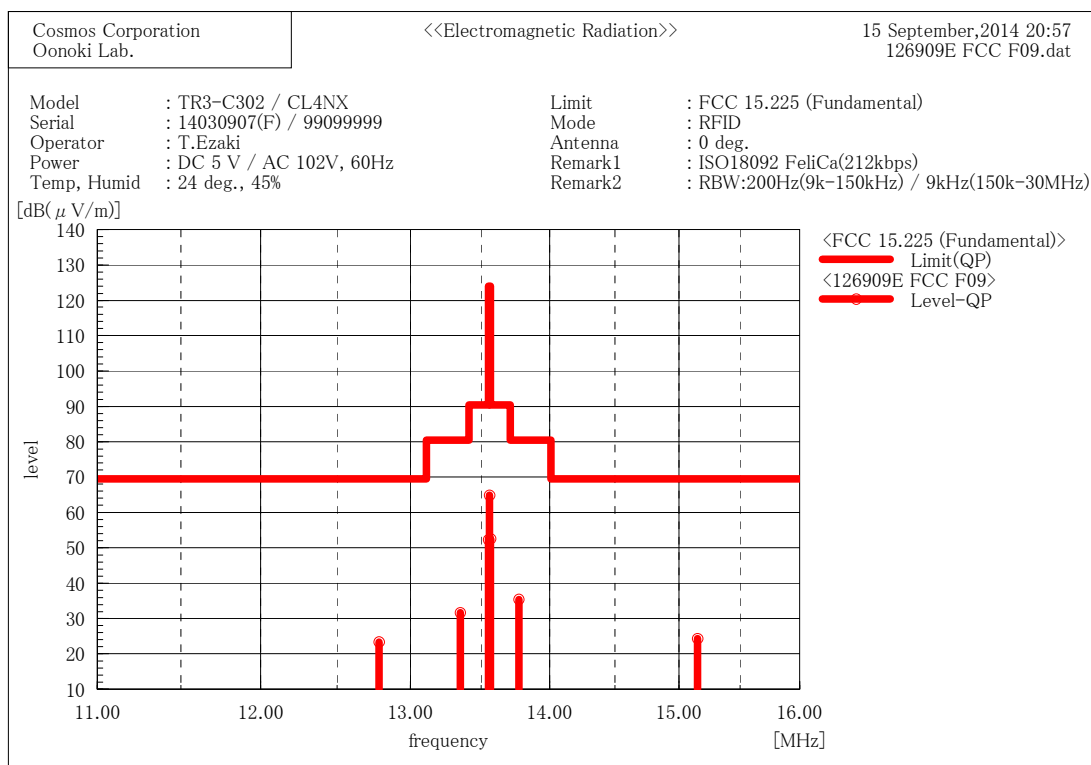
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	12.91126	1.9	21.7	23.6	69.5	45.9	357.0	
2	13.34928	10.1	21.8	31.9	80.5	48.6	357.0	
3	13.553	29.3	21.9	51.2	90.4	39.2	357.0	
4	13.5605	42.9	21.9	64.8	123.9	59.1	357.0	
5	13.56757	27.6	21.9	49.5	90.4	40.9	357.0	
6	13.77493	11.8	21.9	33.7	80.5	46.8	357.0	
7	15.39078	1.7	22.4	24.1	69.5	45.4	357.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO18092 FeliCa (212 kbps), Antenna: 0°)
(Power Supply: AC 102 V, 60 Hz)



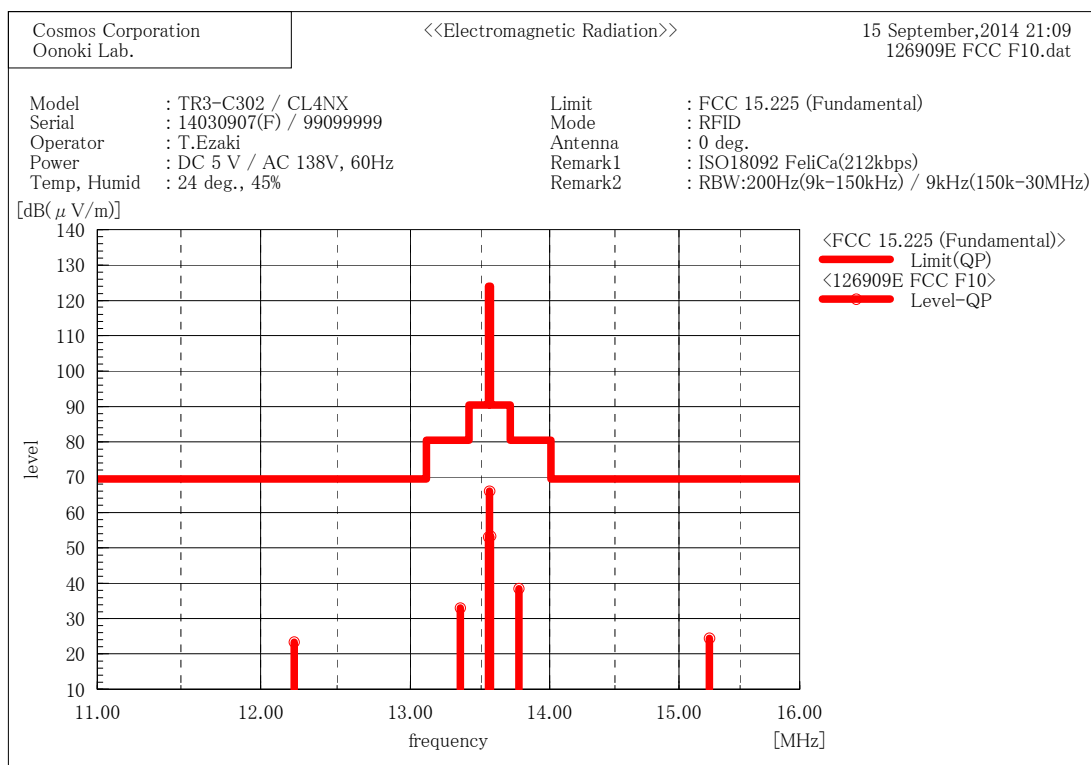
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	12.78441	1.7	21.7	23.4	69.5	46.1	356.0	
2	13.35048	9.9	21.8	31.7	80.5	48.8	356.0	
3	13.553	30.3	21.9	52.2	90.4	38.2	356.0	
4	13.5609	43.0	21.9	64.9	123.9	59.0	356.0	
5	13.567	30.6	21.9	52.5	90.4	37.9	356.0	
6	13.77493	13.5	21.9	35.4	80.5	45.1	356.0	
7	15.15455	2.0	22.3	24.3	69.5	45.2	356.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO18092 FeliCa (212 kbps), Antenna: 0) (Power Supply: AC 138 V, 60 Hz)



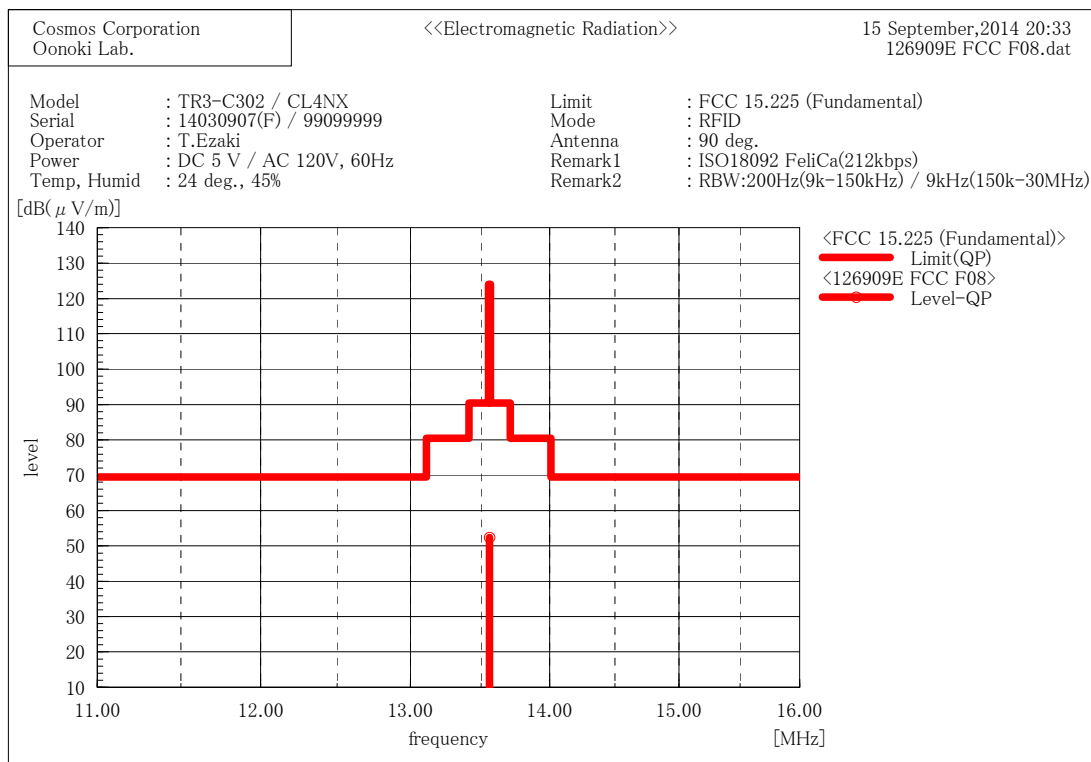
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	12.2178	1.8	21.6	23.4	69.5	46.1	1.0	
2	13.34988	11.2	21.8	33.0	80.5	47.5	1.0	
3	13.553	31.2	21.9	53.1	90.4	37.3	1.0	
4	13.5611	44.2	21.9	66.1	123.9	57.8	1.0	
5	13.567	31.4	21.9	53.3	90.4	37.1	1.0	
6	13.77252	16.6	21.9	38.5	80.5	42.0	1.0	
7	15.25026	2.1	22.4	24.5	69.5	45.0	1.0	



5.4.3 Test Detail (Continued)

Test Data (Mode: ISO18092 FeliCa (212 kbps), Antenna: 90°)



Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle	Remark
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]	
1	13.5608	30.5	21.9	52.4	123.9	71.5	302.0	



5.5 15.225(e) Frequency Tolerance

5.5.1 Setting Remarks

The EUT was placed in an environmental test chamber, exposed in extreme temperatures until its temperature is stabilized.

The measurement was carried out at every 10°C from -20°C to +50°C in the most common nominal supply voltage and the measurement was carried out at $\pm 15\%$ of rated voltage at 20°C. Refer to the figure of 3.3 Configuration.

5.5.2 Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency

5.5.3 Test Detail

Result: PASS

Uncertainty of measurement result : ± 1 Hz
Date of testing : September 5 and 8, 2014
Room temperature : Refer to Test Data

Calculation

$$\begin{aligned}\text{Deviation [Hz]} &= \text{Measured Frequency} - \text{Center Frequency} \\ &= 13560012.1 - 13560000 \\ &= 12.1\end{aligned}$$

$$\begin{aligned}\text{Deviation [ppm]} &= \text{Deviation [Hz]} \div \text{Center Frequency} \times 1000000 \\ &= 12.1 \div 13560000 \times 1000000 \\ &\doteq 0.9\end{aligned}$$

$$\begin{aligned}\text{Margin} &= \text{Limit} - \text{Deviation [ppm]} \\ &= 100 - 0.9 \\ &\doteq 99.1\end{aligned}$$



5.5.3 Test Detail (Continued)

Test Data

Temp [°C]	Operation Time	Measured Frequency [Hz]	Deviation [Hz]	Deviation [ppm]	Limit [ppm]	Margin [ppm]
50	Startup	13560012.1	12.1	0.9	100	99.1
	2 min	13560006.2	6.2	0.5	100	99.5
	5 min	13560005.7	5.7	0.4	100	99.6
	10 min	13560005.6	5.6	0.4	100	99.6
40	Startup	13560033.3	33.3	2.5	100	97.5
	2 min	13560023.3	23.3	1.7	100	98.3
	5 min	13560022.4	22.4	1.7	100	98.3
	10 min	13560022.3	22.3	1.6	100	98.4
30	Startup	13560057.1	57.1	4.2	100	95.8
	2 min	13560046.8	46.8	3.5	100	96.5
	5 min	13560042.0	42.0	3.1	100	96.9
	10 min	13560042.5	42.5	3.1	100	96.9
20	Startup	13560083.1	83.1	6.1	100	93.9
	2 min	13560073.6	73.6	5.4	100	94.6
	5 min	13560071.2	71.2	5.3	100	94.7
	10 min	13560070.7	70.7	5.2	100	94.8
10	Startup	13560099.5	99.5	7.3	100	92.7
	2 min	13560095.2	95.2	7.0	100	93.0
	5 min	13560093.6	93.6	6.9	100	93.1
	10 min	13560093.4	93.4	6.9	100	93.1
0	Startup	13560098.6	98.6	7.3	100	92.7
	2 min	13560102.6	102.6	7.6	100	92.4
	5 min	13560103.0	103.0	7.6	100	92.4
	10 min	13560103.0	103.0	7.6	100	92.4
-10	Startup	13560072.3	72.3	5.3	100	94.7
	2 min	13560089.4	89.4	6.6	100	93.4
	5 min	13560092.5	92.5	6.8	100	93.2
	10 min	13560093.0	93.0	6.9	100	93.1
-20	Startup	13560017.2	17.2	1.3	100	98.7
	2 min	13560049.7	49.7	3.7	100	96.3
	5 min	13560052.6	52.6	3.9	100	96.1
	10 min	13560052.5	52.5	3.9	100	96.1

Temp [°C]	Supply Voltage [V]	Measured Frequency [Hz]	Deviation [Hz]	Deviation [ppm]	Limit [ppm]	Margin [ppm]
20	4.25	13560067.4	67.4	5.0	100	95.0
	5.00	13560070.7	70.7	5.2	100	94.8
	5.75	13560071.8	71.8	5.3	100	94.7



6. List of Test and Measurement Instruments

AC Power Line Conducted Emission

Instruments	Manufacturer	Model	Serial No.	Calibrated Date/Until
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100413	2013/11/23 2014/11/22
Artificial-Mains Network (for EUT)	Kyoritsu	KNW-341C (F)	8-1659-1	2014/01/14 2015/01/13
Artificial-Mains Network (for peripheral)	Kyoritsu	KNW-244C (F)	8-1251-4	2014/07/17 2015/07/16
Shielded Room	JSE	COSR-01	---	---
Attenuator 10 dB	TAMAGAWA	CFA-01(BNC)	---	2014/01/14 2015/01/13
Highpass Filter	Kyoritsu	KFL-007	8-1708-10	2014/01/14 2015/01/13
RF Cable	Fujikura	3D-2W	OC01	2014/04/07 2015/04/06
RF Cable	SUHNER	RG223/U	OC02 OC04	2014/04/07 2015/04/06
RF Selector	TSJ	RFM-E221	3148	2014/04/07 2015/04/06
50Ω Terminator	RES-NET MICROWAVE	RCX6BM	---	2014/07/23 2015/07/22
Software	TOYO	EP5/CE (ver5.3.20)	---	---



6. List of Test and Measurement Instruments (Continued)

Radiated Spurious Emission (Below 30 MHz) / Field Strength of Fundamental Emission

Instruments	Manufacturer	Model	Serial No.	Calibrated Date/Until
EMI Test Receiver	ROHDE & SCHWARZ	ESIB40	100211	2014/03/24 2015/03/23
Active Loop Antenna	ROHDE & SCHWARZ / TOYO	HFH2-Z2 / HFH2-Z2P	827945 /011 / 127	2013/10/05 2014/10/04
Anechoic Chamber 3 m	JSE	COAC3M-01	---	2014/05/19 2015/05/18
RF Cable	Fujikura	5D-2W	OC09	2013/09/23 2014/09/22
RF Cable	SUHNER	RG223/U	OC10 OC11	2013/09/23 2014/09/22
RF Cable	SUHNER	RG213/U	OC13	2014/05/26 2015/05/25
RF Selector	TSJ	RFM-E121	03149	2014/05/26 2015/05/25
Software	TOYO	EP5/ME (ver 5.1.40)	---	---



6. List of Test and Measurement Instruments (Continued)

Radiated Spurious Emission (Above 30 MHz)

Instruments	Manufacturer	Model	Serial No.	Calibrated Date/Until
EMI Test Receiver	ROHDE & SCHWARZ	ESIB40	100211	2014/03/24 2015/03/23
Pre-Amplifier	HEWLETT PACKARD	8447D OPT 010	2944A 07891	2014/04/14 2015/04/13
Biconical Antenna (30 MHz to 300 MHz)	SCHWARZBECK	VHBB9124 / BBA9106	9124-311	2014/08/30 2015/08/29
Log-Periodic Antenna (300 MHz to 1 GHz)	SCHWARZBECK	UHALP9108-A	0645	2014/08/30 2015/08/29
Anechoic Chamber 3 m	JSE	COAC3M-01	---	2014/05/19 2015/05/18
Attenuator 3 dB	JFW	50FP-003-H2	---	2014/04/14 2015/04/13
RF Cable	SUHNER	RG223/U	OC11	2014/05/22 2015/05/21
RF Cable	Fujikura	8D-2W	OC14	2014/05/22 2015/05/21
RF Cable	SUHNER	RG214/U	OC15 OC16	2014/05/22 2015/05/21
RF Cable	SUHNER	RG400/U	OC17	2014/05/22 2015/05/21
RF Selector	TSJ	RFM-E121	03149	2014/05/22 2015/05/21
Software	TOYO	EP5/RE (ver 5.7.1)	---	---



6. List of Test and Measurement Instruments (Continued)

20 dB Bandwidth / Frequency Tolerance

Instruments	Manufacturer	Model	Serial No.	Calibrated Date/Until
EMI Test Receiver	Agilent Technologies	N9038A MXE	MY54130015	2014/06/13 2015/06/12
Thermostatic Chamber	ESPEC	PU-2KP	14010409	2014/08/21 2015/08/20
RF TEST SET (for ETSI)	MORITA TECH Co.,Ltd (Agilent Technologies)	MT-747	13326	2014/07/08 2015/07/07
RF Cable	HUBER + SUHNER	SUCOFULEX 102	OC30 OC34	2014/07/08 2015/07/07

7. Appendix

Refer to separated files for the following appendixes.

Appendix 1: Photograph of EUT

Appendix 2: External Photos

Appendix 3: Setup Photos