



TEST REPORT

Issued: April 2, 2015

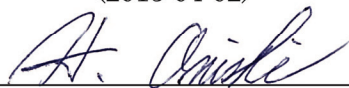
Name and Address of the Customer:	KYOCERA Document Solutions Inc. 2-28, 1-Chome, Tamatsukuri, Chuo-ku, Osaka, 540-8585, Japan
Test Item:	RFID Module
Identification:	2R6A0881
Serial No.:	1, 2
FCC ID:	E522R6A0881
IC Certification Number:	1059B-2R6A0881
Sample No.:	1
Sample Receipt Date:	February 20, 2015
Test Specification:	47 CFR Part 15 Subpart C RSS-210 Issue 8, RSS-Gen Issue 4
Period of Testing:	February 23, 2015 - February 27, 2015
Test Result:	PASS

Representative
Test Personnel:


(2015-04-02)

T. Nakai (EMC Dept.)

Reviewed by:


(2015-04-02)

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".



Contents	Page
1. General Information.....	3
1.1 Test Methodology	3
1.2 Test Facility.....	3
1.3 Traceability	3
2. Description of the Tested Sample.....	4
2.1 Product Description	4
2.2 Antenna Description	4
2.3 EUT Description	4
3. Test Condition (Manufacturer's Specification)	5
3.1 Mode of Operation.....	5
3.2 Additional Equipment	5
3.3 Configuration	6
3.4 EUT Angle	8
4. Summary of Test Results.....	9
5. Test Result.....	10
5.1 AC Power Line Conducted Emission (15.207, RSS-Gen 8.8).....	10
5.1.1 Setting Remarks	10
5.1.2 Limit.....	10
5.1.3 Test Detail.....	11
5.2 Transmitter Spurious Emission (Radiated) (15.209, 15.225(d), RSS-Gen 8.9).....	14
5.2.1 Setting Remarks	14
5.2.2 Limit.....	15
5.2.3 Test Detail.....	15
5.3 20 dB Bandwidth (15.215(c))	23
5.3.1 Setting Remarks	23
5.3.2 Limit.....	23
5.3.3 Test Detail.....	23
5.4 Field Strength of Fundamental Emission (15.225(a) (b) (c) (d), RSS-210 A2.6).....	25
5.4.1 Setting Remarks	25
5.4.2 Limit.....	25
5.4.3 Test Detail.....	26
5.5 Frequency Stability (15.225(e), RSS-210 A2.6)	31
5.5.1 Setting Remarks	31
5.5.2 Limit.....	31
5.5.3 Test Detail.....	31
5.6 Occupied Bandwidth (RSS-Gen Annex A)	34
5.6.1 Setting Remarks	34
5.6.2 Test Detail.....	34
6. List of Test and Measurement Instruments	36
7. Appendix	38



1. General Information

1.1 Test Methodology

All measurement subject to the present test report is carried out according to the procedures in ANSI C63.10:2013.

1.2 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: A2LA Accredited Laboratory No. 2900.01
VLAC Accredited Laboratory No. VLAC-039-2
FCC Designation No. JP5182

Registration: Industry Canada Registration No. 3958B
Nemko Laboratory Authorisation. No. ELA 621

1.3 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.



2. Description of the Tested Sample

2.1 Product Description

Manufacturer	KYOCERA Document Solutions Inc.
Model (referred to as the EUT)	2R6A0881
Hardware Version	0881C
Software Version	S2R6_1000.X99.071
Type of the Equipment	☐ Stand-alone ☐ Combined Equipment ☒ Plug-in Radio Device ☐ Other ()
Transmitter Type	☐ WLAN ☐ Bluetooth () ☐ Zigbee ☒ RFID ☐ Other ()
Nominal Voltage	DC 3.3/5 V
Type of Modulation	ASK
Emission Designator	6K93K1D
Antenna Type	☒ Integral Antenna ☐ Dedicated External Antenna
Operating Frequency	13.56 MHz
Type of Power Source	☐ AC Mains ☐ Dedicated AC Adaptor ☒ DC Voltage ☐ Battery
Type of Battery (if applicable)	N/A
Thermal Limitation	-20°C to 50°C

2.2 Antenna Description

Model	Gain	Antenna Type	Remarks
Un-specified *	-53 dBi	Loop antenna	Integral

Note:

*: The antenna does not have model name, because the antenna is part of RF Module PCB.

2.3 EUT Description

Equipment under test is as follow:

Instrument	Model	Serial No.	Rating
RFID Module (EUT1)	2R6A0881	1	DC 3.3/5 V
RFID Module (EUT2)	2R6A0881	2	DC 3.3/5 V



3. Test Condition (Manufacturer's Specification)

3.1 Mode of Operation

Mode of operation: RFID Operating

Note:

The EUT makes communication emission with the maximum RF power by a special test program. "Special test program" is that duty cycle is set 100% for a test, although it is less than 10% in usual operation. The module has 4 antennas. This module outputs the power by switching 4 antennas. However, we measured the only 1 antenna which was selected by manufacturer as worst case. The test of Field Strength of Fundamental Emission was performed under the following condition:

Voltage: DC 3.3/5 V $\pm 15\%$

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

Temperature: -20°C to $+50^{\circ}\text{C}$

Voltage: DC 3.3/5 V $\pm 15\%$

3.2 Additional Equipment

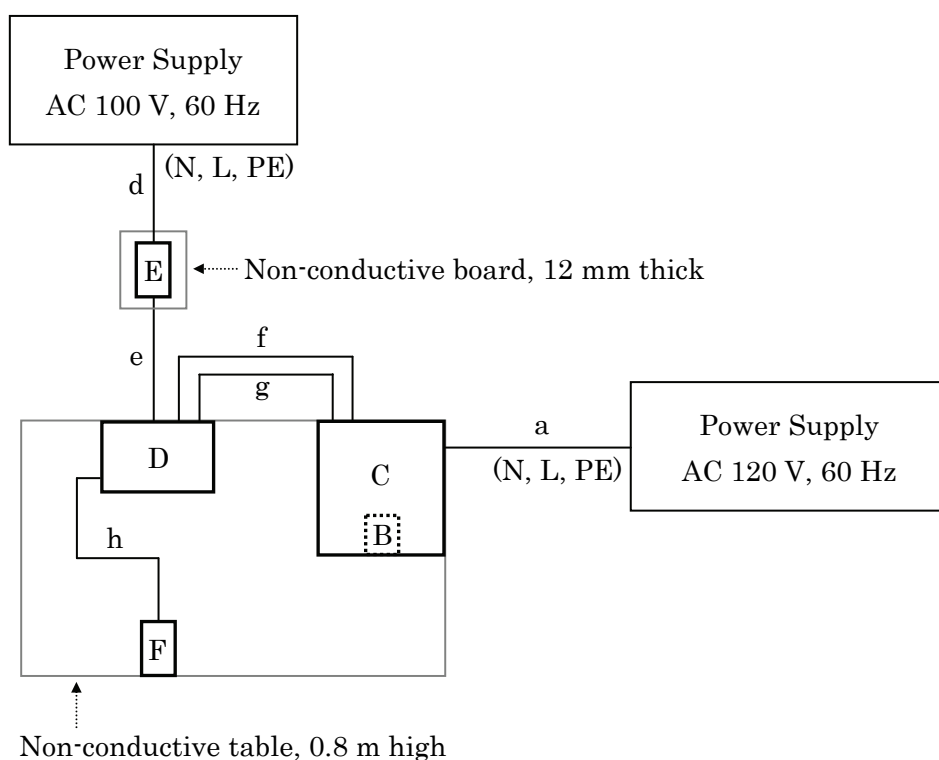
The equipment was tested together with additional peripherals.
The following peripherals were used during the tests:

Instrument	Model	Serial No.	Manufacturer
Multi-Function Printer	TASKalfa 405ci	E150220	KYOCERA Document Solutions
Personal Computer	Latitude 3440	CN-0M6N00-76206-44P-002O-A00	DELL
AC Adapter	LA65NM130	CN-0JNKWD-72438-441-4719-A01	DELL
USB Mouse	AMU1402JP	0605000678	Targus
Jig	Un-specified	Un-specified	Un-specified

3.3 Configuration

	Instrument	Model	Cable	Length	Shield
A	EUT1 (RFID Module)	2R6A0881	a AC Power Cord	2.5 m	×
B	EUT2 (RFID Module)	2R6A0881	b AC Power Cord	2.0 m	×
C	Multi-Function Printer	TASKalfa 405ci	c AC Power Cord	2.0 m	×
D	Personal Computer	Latitude 3440	d AC Power Cord	0.9 m	×
E	AC Adapter	LA65NM130	e DC Power Cord	1.9 m	○
F	USB Mouse	AMU1402JP	f LAN Cable	3.0 m	×
G	Jig	Un-specified	g USB Cable	2.0 m	○
			h USB Mouse Cable	1.6 m	○
			i Jig Cable	0.5 m	×

AC Power Line Conducted Emission



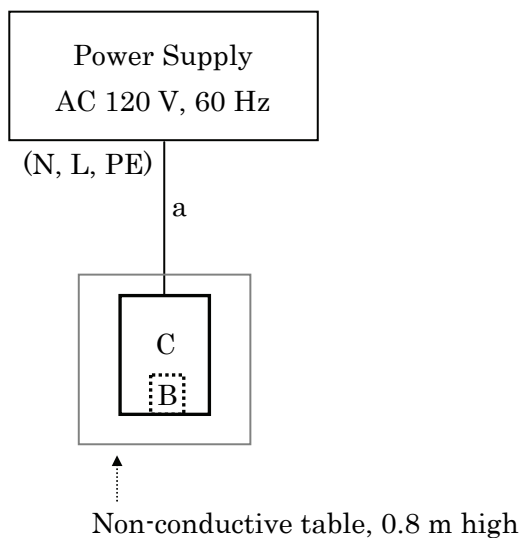
Excess cable arrangement

AC Power Line Conducted Emission

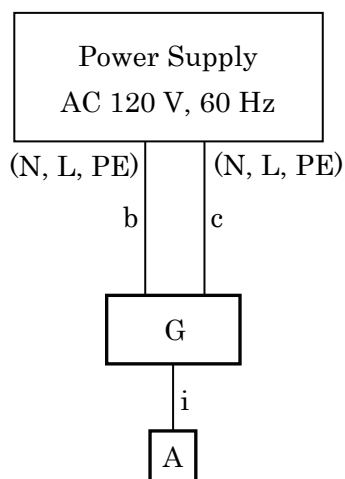
Symbol	Length	Position	Setting
a	0.3 m	Center	Bundle
f	0.4 m	Center	Bundle and Hung
g	0.35 m	Center	Bundle and Hung

3.3 Configuration (Continued)

Transmitter Spurious Emission (Radiated)
Field Strength of Fundamental Emission (normal voltage only)

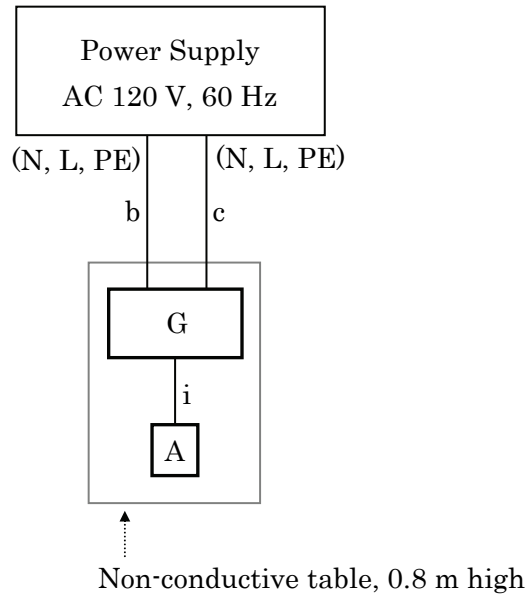


20 dB Bandwidth / Frequency Stability / Occupied Bandwidth

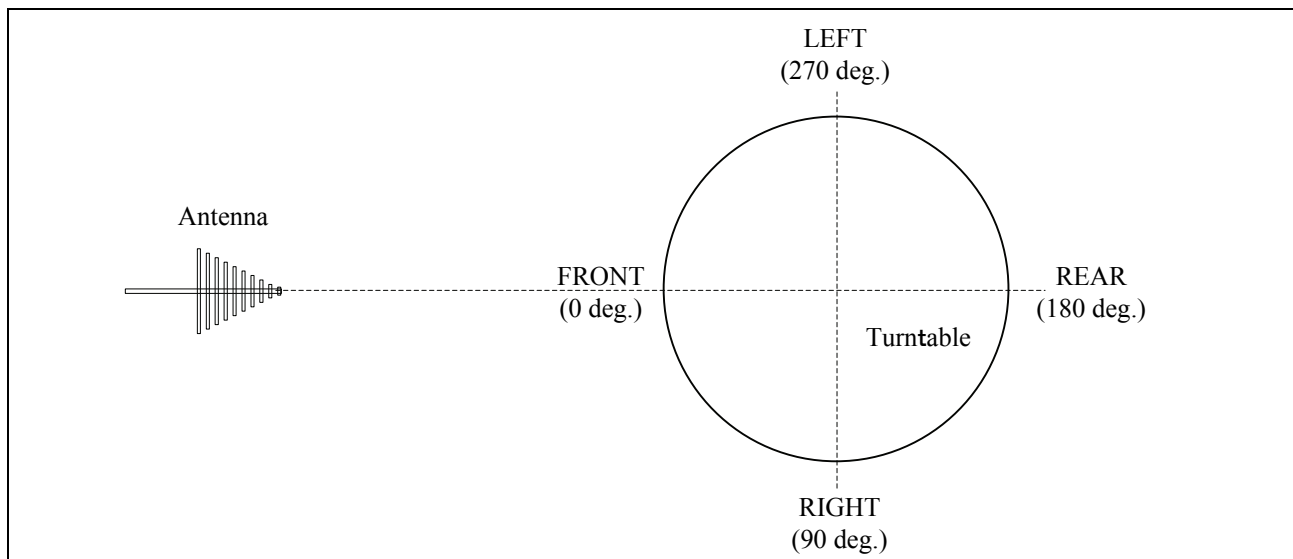


3.3 Configuration (Continued)

Field Strength of Fundamental Emission (normal and $\pm 15\%$ voltage)



3.4 EUT Angle





4. Summary of Test Results

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

FCC Section	IC Section	Test Item	FCC Result	IC Result
15.207	RSS-Gen 8.8	AC Power Line Conducted Emission	PASS	PASS
15.209, 15.225(d)	RSS-Gen 8.9	Transmitter Spurious Emission (Radiated)	PASS	PASS
15.215(c)	---	20 dB Bandwidth	PASS	---
15.225 (a) (b) (c) (d)	RSS-210 A2.6	Field Strength of Fundamental Emission	PASS	PASS
15.225(e)	RSS-210 A2.6	Frequency Stability	PASS	PASS
---	RSS-Gen Annex A	Occupied Bandwidth	---	PASS
---	RSS-Gen 7.1	Receiver Spurious Emission (Radiated)	---	N/A *

Note:

*: This item does not apply because this device receives some data only while the radio waves are transmitted.



5. Test Result

5.1 AC Power Line Conducted Emission (15.207, RSS-Gen 8.8)

Result: **PASS**

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 C63.10:2013.

The test setup was made in accordance with ANSI C63.10:2013 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.

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]	
	Quasi Peak	Average
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

Uncertainty of measurement result : ± 3.45 dB
Date of testing : February 24, 2015
Room temperature : 23°C
Relative humidity : 33%

Calculation

Result = Reading + c.f
= $35.0 + 10.3$
= 45.3

Margin = Limit - Result
= $64.0 - 45.3$
= 18.7

Note:

c.f (Correction Factor) = Cable Attenuation Factor + LISN Factor



5.1.3 Test Detail (Continued)

Test Data

***** Cosmos Corporation *****
<<Conducted Emission EP5/CE Ver 5.3.20>>

24 February, 2015 19:44
125261E CE01.dat

Limit : FCC 15.207
Model : 2R6A0881 / TASKalfa 405ci
Serial : 2 / E150220
Operator : T.Ezaki
Power : DC 3.3V, 5V / AC 120V, 60Hz
Temp., Humi. : 23deg., 33%
Mode : RFID
Remark1 :
Remark2 :
Remark3 : RBW:9kHz

Final Result

--- L1 Phase ---

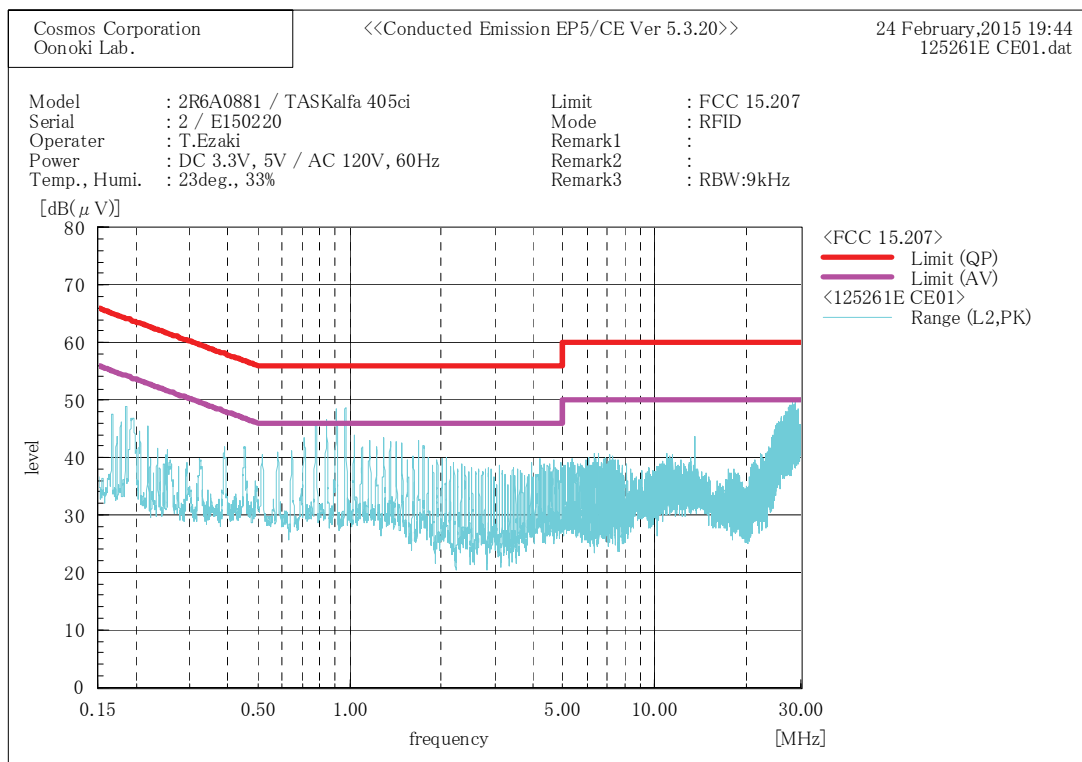
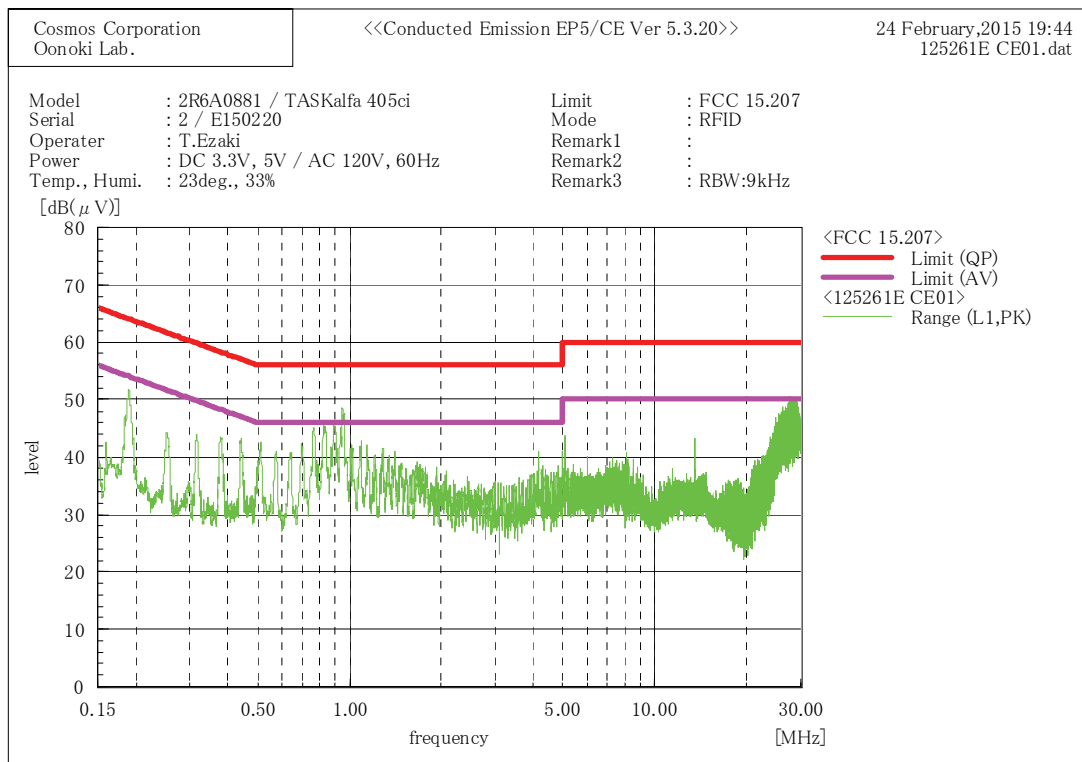
No.	Frequency	Reading QP	Reading AV	c. f	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
	[MHz]	[dB(μV)]	[dB(μV)]	[dB]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB]	[dB]
1	0.19125	35.0	32.0	10.3	45.3	42.3	64.0	54.0	18.7	11.7
2	0.4523	31.6	27.8	10.2	41.8	38.0	56.8	46.8	15.0	8.8
3	0.9673	36.0	31.1	10.1	46.1	41.2	56.0	46.0	9.9	4.8
4	5.12205	22.9	17.5	10.6	33.5	28.1	60.0	50.0	26.5	21.9
5	13.56008	30.3	28.8	10.8	41.1	39.6	60.0	50.0	18.9	10.4
6	27.6304	31.6	22.8	11.4	43.0	34.2	60.0	50.0	17.0	15.8

--- L2 Phase ---

No.	Frequency	Reading QP	Reading AV	c. f	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
	[MHz]	[dB(μV)]	[dB(μV)]	[dB]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB(μV)]	[dB]	[dB]
1	0.19113	33.5	29.0	10.3	43.8	39.3	64.0	54.0	20.2	14.7
2	0.4449	29.1	25.2	10.2	39.3	35.4	57.0	47.0	17.7	11.6
3	0.95513	37.5	32.2	10.2	47.7	42.4	56.0	46.0	8.3	3.6
4	1.46063	31.0	24.7	10.2	41.2	34.9	56.0	46.0	14.8	11.1
5	13.55925	31.0	29.1	10.8	41.8	39.9	60.0	50.0	18.2	10.1
6	28.399	34.2	24.5	11.4	45.6	35.9	60.0	50.0	14.4	14.1

5.1.3 Test Detail (Continued)

Test Data





5.2 Transmitter Spurious Emission (Radiated) (15.209, 15.225(d), RSS-Gen 8.9)

Result: **PASS**

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 C63.10:2013.

The test setup was made in accordance with ANSI C63.10:2013 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 $40\log(30\text{ m}/3\text{ m})$.

Setting Condition of Test receiver

Frequency range	Detector	RBW
9 kHz to 90 kHz	Peak	200 Hz
	Average	200 Hz
90 kHz to 110 kHz	Quasi Peak	200 Hz
110 kHz to 150 kHz	Peak	200 Hz
	Average	200 Hz
150 kHz to 490 kHz	Peak	9 kHz
	Average	9 kHz
490 kHz to 30 MHz	Quasi Peak	9 kHz

5.2.2 Limit

The emission limits shown in the following table are based on measurements employing a CISPR Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz, 110 kHz to 490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an Average detector. The limit on Peak radio frequency emissions is 20 dB above the maximum permitted Average emission limit applicable to the equipment under test.

Frequency range	Field Strength (Distance)	
	[μ V/m]	[dB μ V/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

Uncertainty of measurement result : ± 5.08 dB
 Date of testing : February 23, 2015
 Room temperature : 21°C, 18°C
 Relative humidity : 47%, 53%

Calculation

Result = Reading + c.f
 = 50.0 + 20.7
 = 70.7

Margin = Limit - Result
 = 136.5 - 70.7
 = 65.8

Note:

[Below 30 MHz]

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

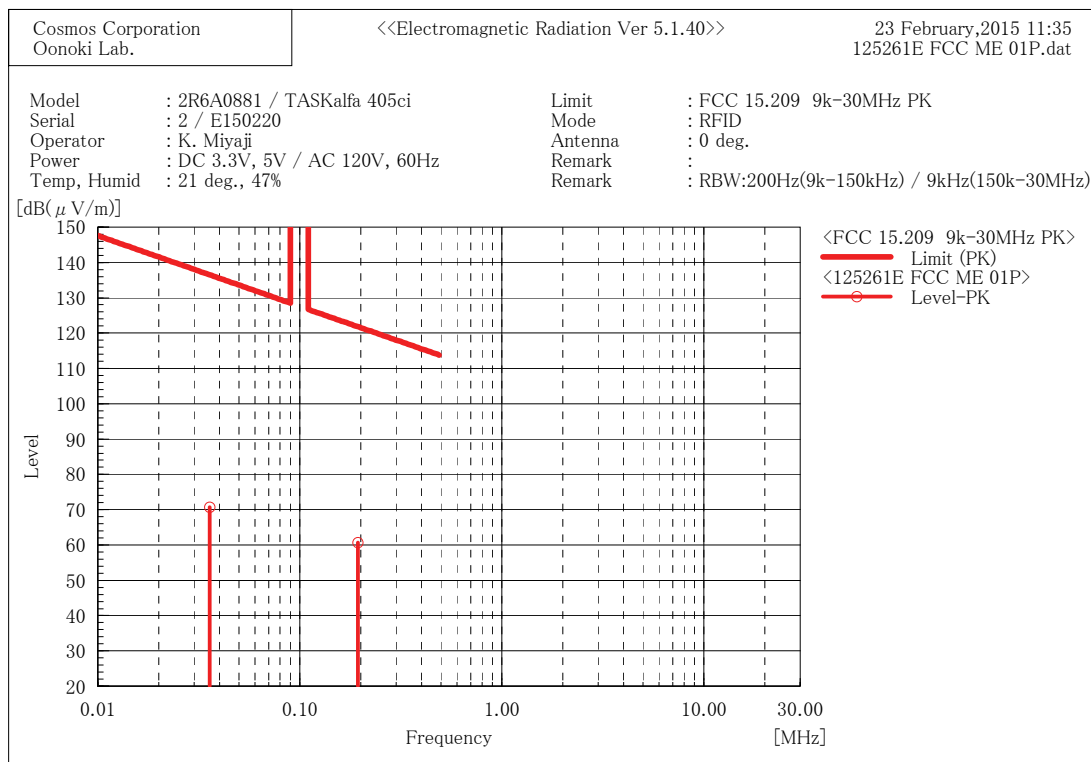
[Above 30 MHz]

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



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Antenna: 0°, Detector: Peak)



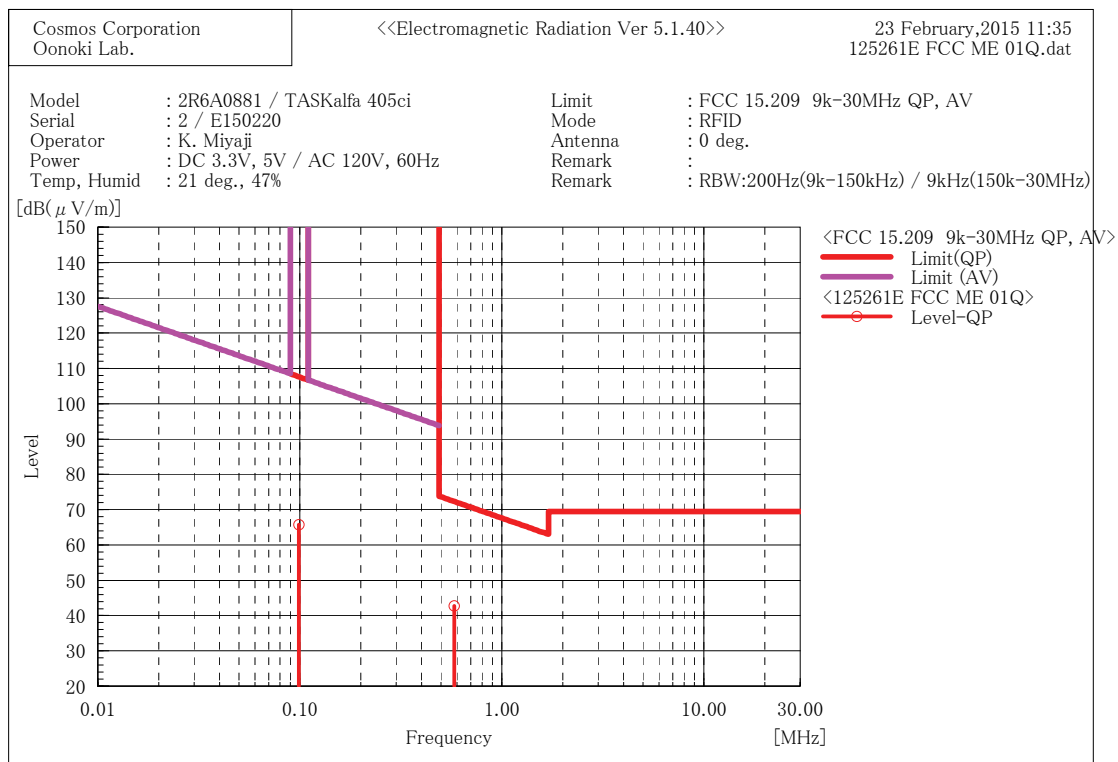
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	0.03575	50.0	20.7	70.7	136.5	65.8	121.0
2	0.193916	40.2	20.5	60.7	121.8	61.1	252.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Antenna: 0°, Detector: Quasi Peak)

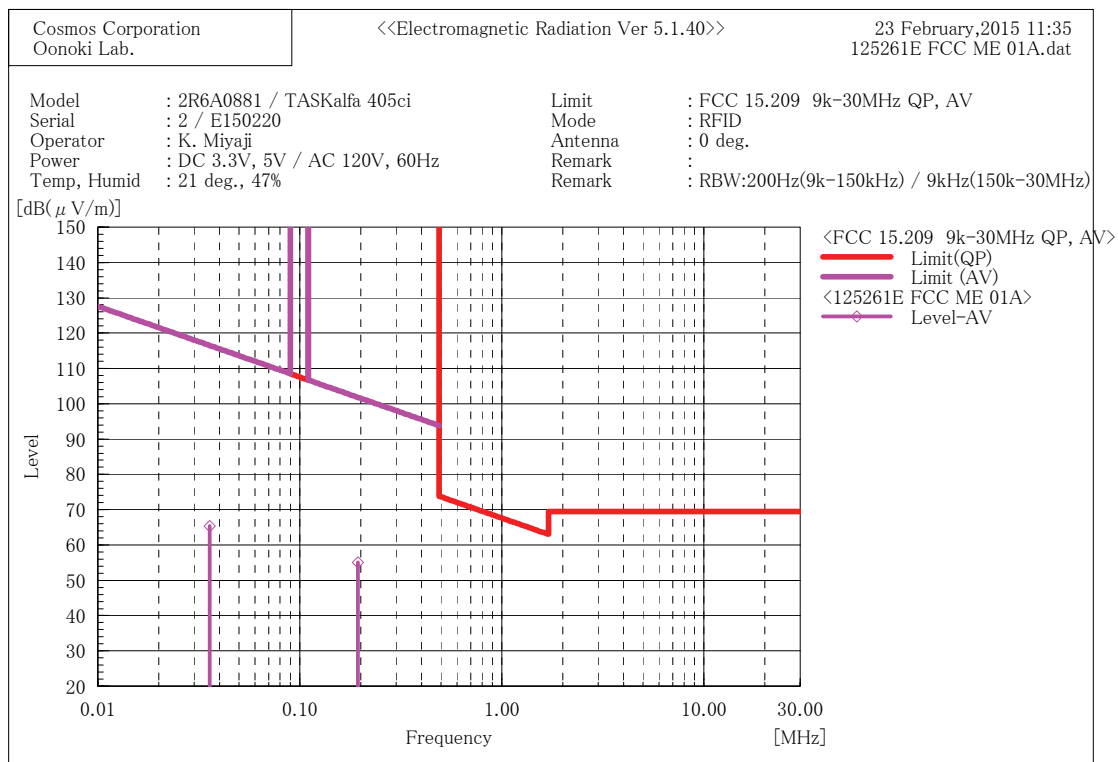


Final Result

No.	Frequency [MHz]	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Angle [°]
1	0.099099	45.1	20.6	65.7	107.6	41.9	255.0
2	0.580699	22.2	20.6	42.8	72.3	29.5	248.0

5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Antenna: 0°, Detector: Average)



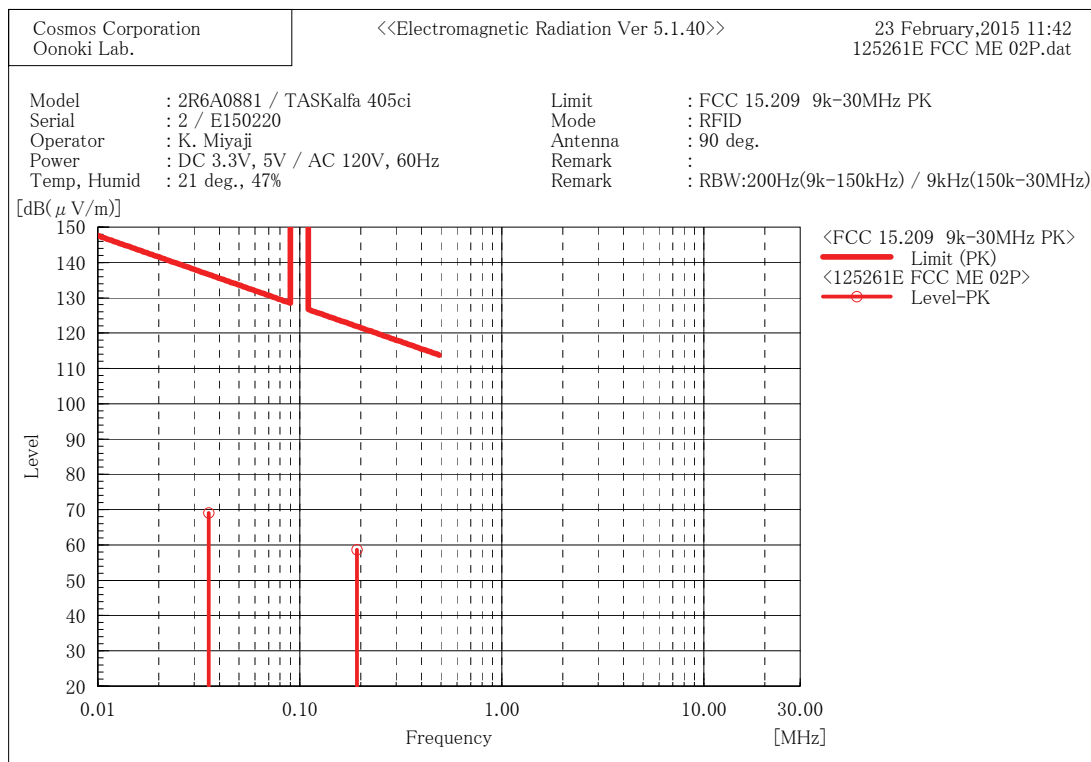
Final Result

No.	Frequency [MHz]	Reading AV [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin AV [dB]	Angle [°]
1	0.03575	44.6	20.7	65.3	116.5	51.2	121.0
2	0.193916	34.5	20.5	55.0	101.8	46.8	252.0



5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Antenna: 90°, Detector: Peak)



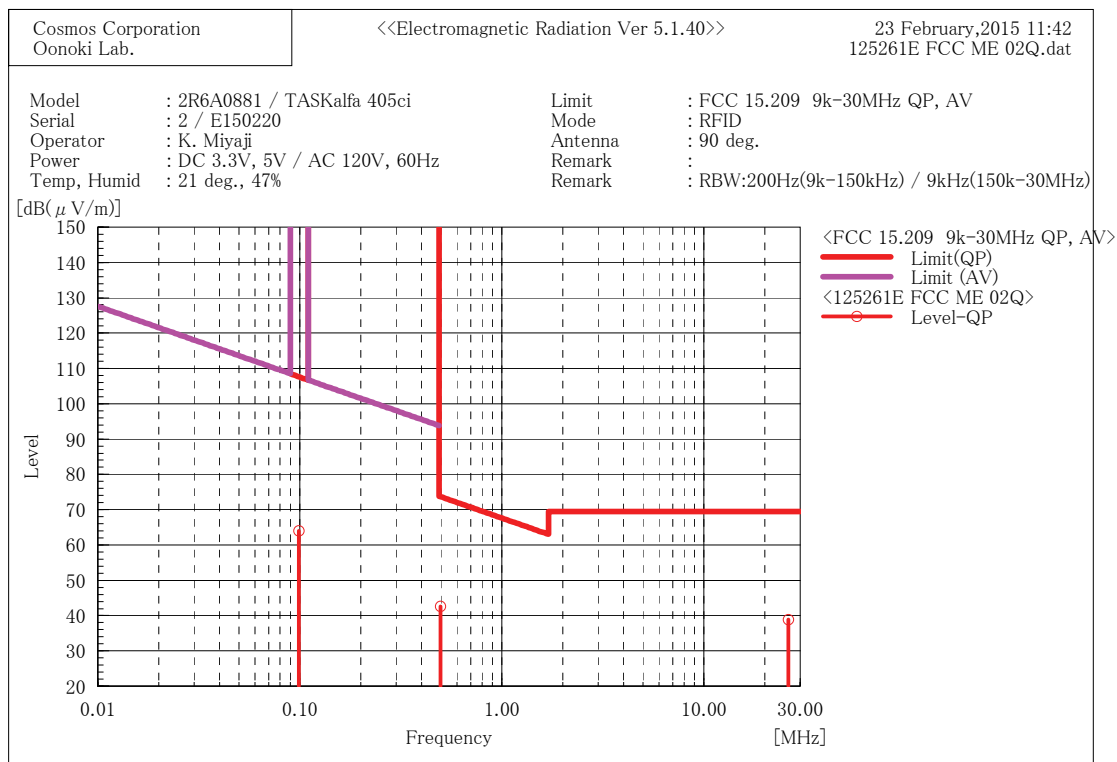
Final Result

No.	Frequency	Reading	c. f	Result	Margin	Angle
	[MHz]	[dB(μ V)]	[dB(1/m)]	[dB(μ V/m)]	[dB]	[°]
1	0.035433	48.4	20.7	69.1	-69.1	181.0
2	0.191709	38.2	20.5	58.7	-58.7	174.0

5.2.3 Test Detail (Continued)

<Below 30 MHz>

Test Data (Antenna: 90°, Detector: Quasi Peak)

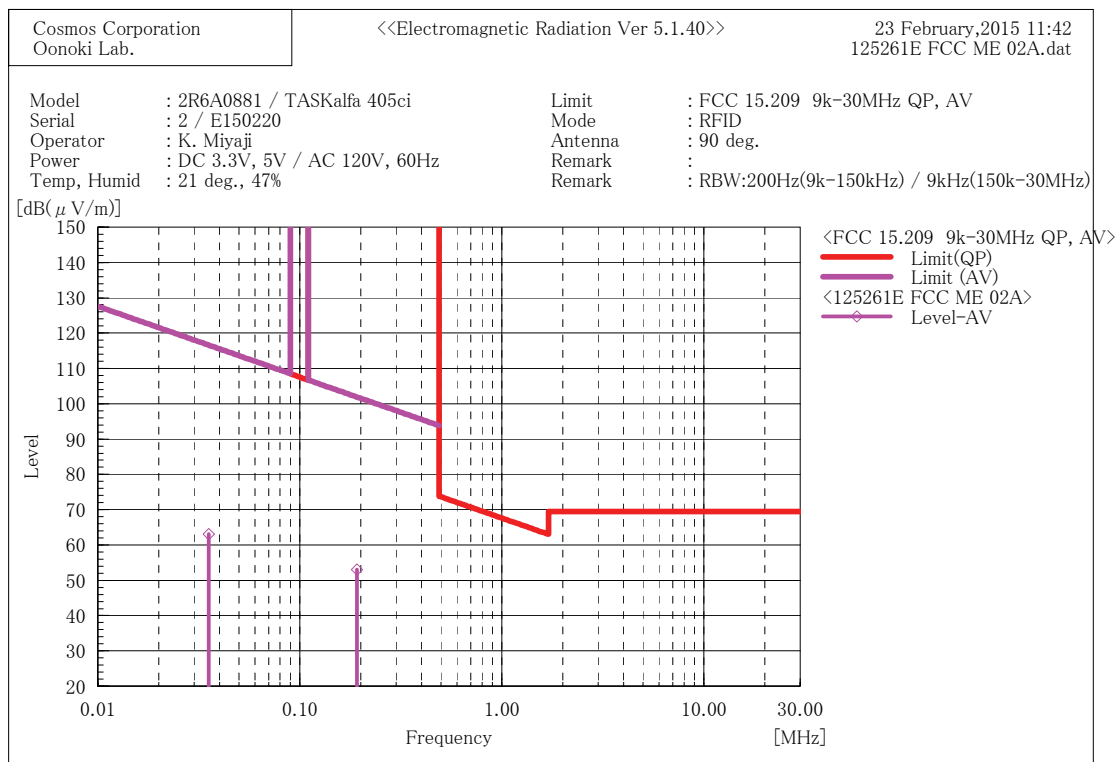


Final Result

No.	Frequency [MHz]	Reading QP [dB(μV)]	c. f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Angle [°]
1	0.099031	43.4	20.6	64.0	107.6	43.6	184.0
2	0.496098	21.9	20.7	42.6	73.7	31.1	186.0
3	26.21754	15.6	23.3	38.9	69.5	30.6	121.0

5.2.3 Test Detail (Continued)

<Below 30 MHz>
Test Data (Antenna: 90°, Detector: Average)



Final Result

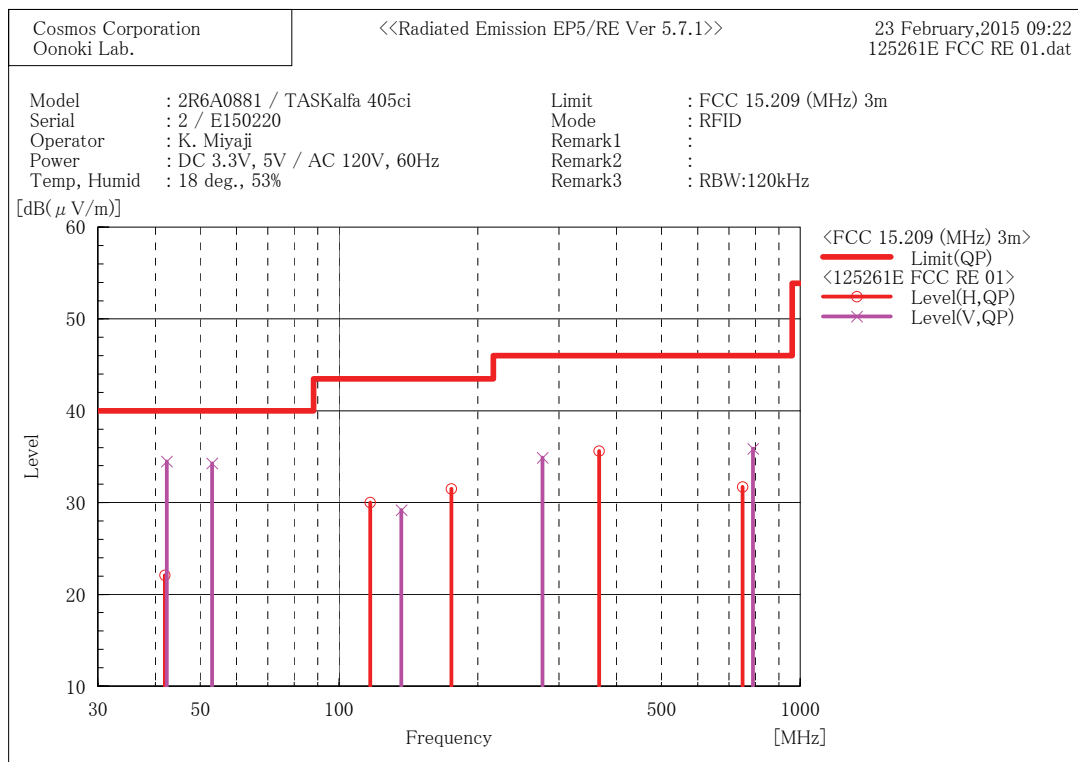
No.	Frequency [MHz]	Reading AV [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin AV [dB]	Angle [°]
1	0.035433	42.3	20.7	63.0	116.6	53.6	181.0
2	0.191709	32.6	20.5	53.1	101.9	48.8	174.0



5.2.3 Test Detail (Continued)

<Above 30 MHz>

Test Data



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	41.907	35.3	-13.2	22.1	40.0	17.9	400.0	212.0
2	116.930	42.4	-12.4	30.0	43.5	13.5	163.0	348.0
3	175.380	40.7	-9.2	31.5	43.5	12.0	100.0	1.0
4	366.122	41.0	-5.4	35.6	46.0	10.4	182.0	12.0
5	749.995	30.3	1.4	31.7	46.0	14.3	197.0	133.0

--- 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	42.305	47.7	-13.2	34.5	40.0	5.5	100.0	96.0
2	53.014	47.7	-13.4	34.3	40.0	5.7	100.0	22.0
3	136.394	40.4	-11.2	29.2	43.5	14.3	100.0	196.0
4	276.482	38.7	-3.8	34.9	46.0	11.1	185.0	354.0
5	789.630	33.8	2.1	35.9	46.0	10.1	192.0	187.0



5.3 20 dB Bandwidth (15.215(c))

Result: **PASS**

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.

The spectrum analyzer is set as following:

·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.

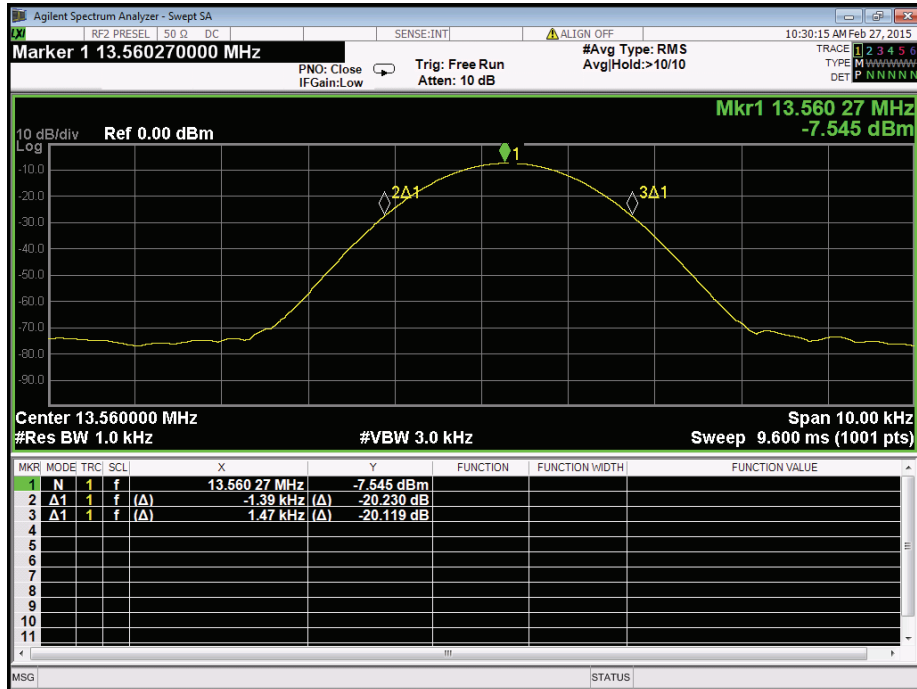
5.3.3 Test Detail

Uncertainty of measurement result	: $\pm 0.011\%$
Date of testing	: February 27, 2015
Room temperature	: 20°C
Relative humidity	: 36%



5.3.3 Test Detail (Continued)

Test Data





5.4 Field Strength of Fundamental Emission (15.225(a) (b) (c) (d), RSS-210 A2.6)

Result: **PASS**

5.4.1 Setting Remarks

The test setup was made in accordance with ANSI C63.10:2013 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 $40\log(30\text{ m}/3\text{ m})$.

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

Uncertainty of measurement result : ± 4.64 dB
Date of testing : February 23, 2015
Room temperature : Refer to Test Data

Calculation

Result = Reading + c.f
= $15.3 + 22.7$
= 38.0

Margin = Limit - Result
= $123.9 - 38.0$
= 85.9

Result (3 m) = Reading + c.f
= $38.2 + 22.7$
= 60.9

Result (30 m) = Result (3 m) - Conversion Factor
= $60.9 - 40.0$
= 20.9

Margin = Limit - Result (30 m)
= $83.9 - 20.9$
= 63.0

Note:

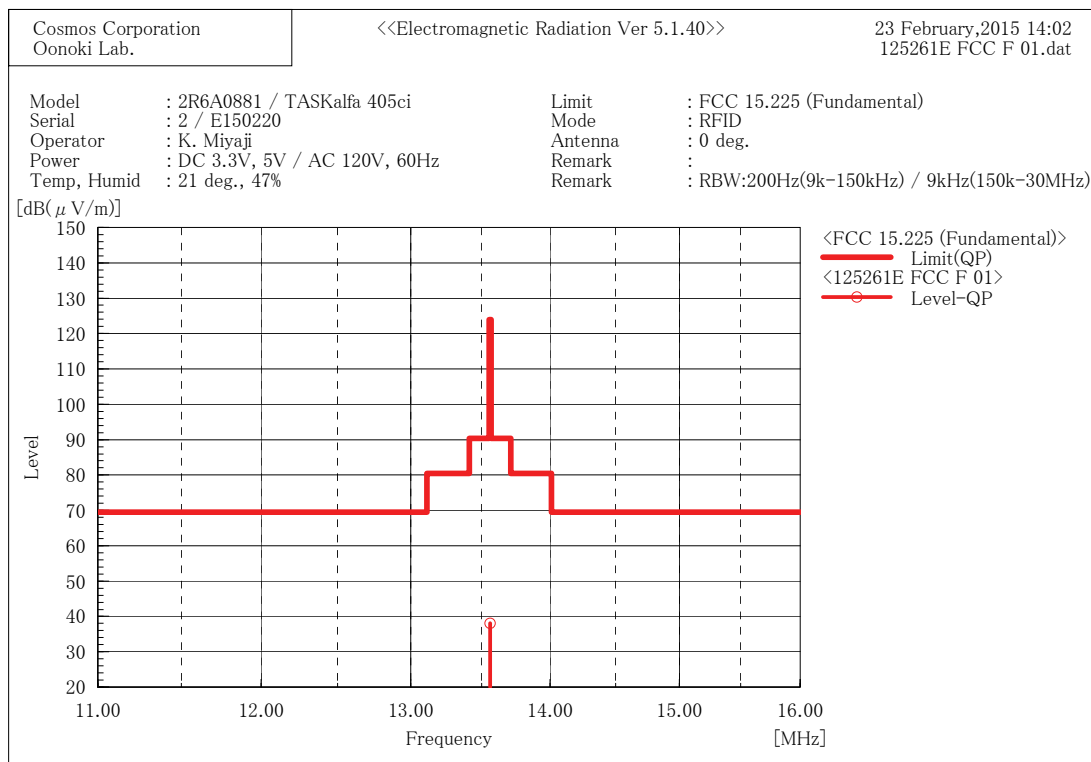
c.f (Correction Factor) = Cable Attenuation Factor + Antenna Factor



5.4.3 Test Detail (Continued)

[Test data of the module with the printer]

Test Data (Antenna: 0°)



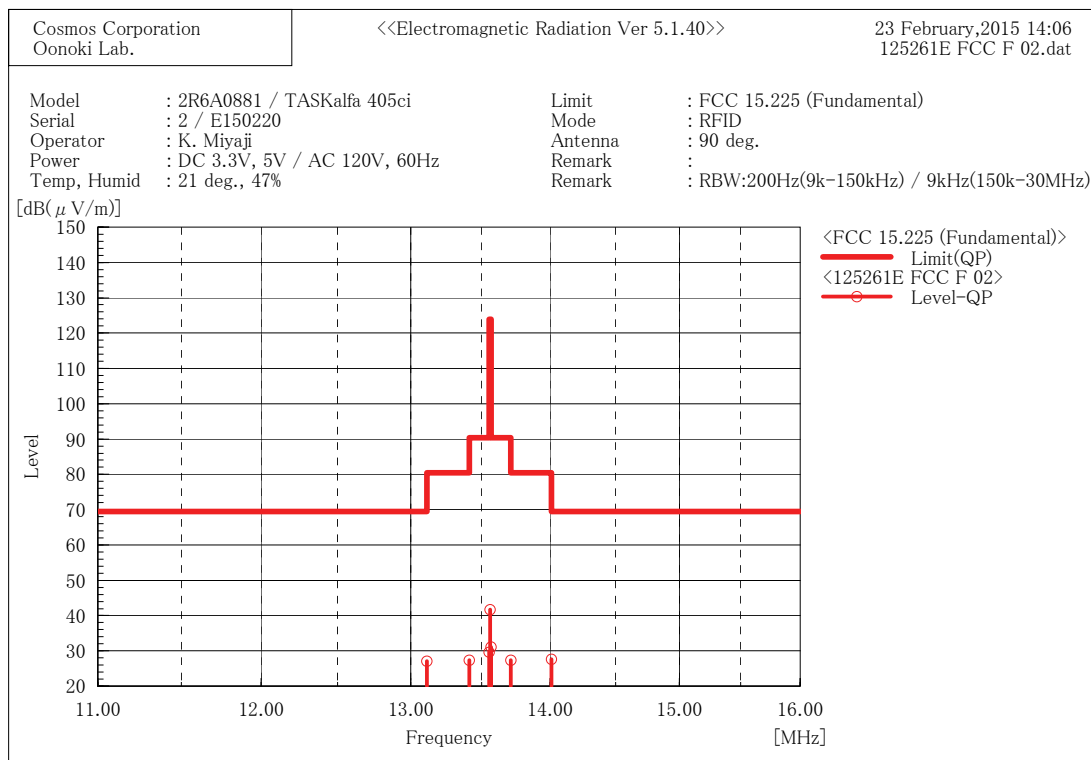
Final Result

No.	Frequency	Reading	c. f	Result	Limit	Margin	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[°]
1	13.5602	15.3	22.7	38.0	123.9	85.9	333.0



5.4.3 Test Detail (Continued)

Test Data (Antenna: 90°)



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	13.110	4.6	22.5	27.1	69.5	42.4	333.0
2	13.410	4.6	22.7	27.3	80.5	53.2	333.0
3	13.553	6.9	22.7	29.6	90.4	60.8	333.0
4	13.5602	18.9	22.7	41.6	123.9	82.3	333.0
5	13.567	8.3	22.8	31.1	90.4	59.3	333.0
6	13.710	4.6	22.8	27.4	80.5	53.1	333.0
7	14.010	4.6	23.0	27.6	69.5	41.9	333.0



5.4.3 Test Detail (Continued)

[Test data of the module only]

Test Data (Frequency Range: 13.553 MHz to 13.567 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dBμV]	c.f. [dBS/m]	Result [dBμV/m] (3m)	Conversion Factor [dB]	Result [dBμV/m] (30m)	Limit [dBμV/m]	Margin [dB]
13.553 - 13.567	19	13.560	2.805	4.25	90	38.2	22.7	60.9	40.0	20.9	83.9	63.0
		13.560		5.00	90	39.4	22.7	62.1	40.0	22.1	83.9	61.8
		13.560		5.75	90	40.4	22.7	63.1	40.0	23.1	83.9	60.8
		13.560	3.300	4.25	90	38.1	22.7	60.8	40.0	20.8	83.9	63.1
		13.560		5.00	90	39.7	22.7	62.4	40.0	22.4	83.9	61.5
		13.560		5.75	90	38.0	22.7	60.7	40.0	20.7	83.9	63.2
		13.560	3.795	4.25	90	38.3	22.7	61.0	40.0	21.0	83.9	62.9
		13.560		5.00	90	39.7	22.7	62.4	40.0	22.4	83.9	61.5
		13.560		5.75	90	40.8	22.7	63.5	40.0	23.5	83.9	60.4

Test Data (Frequency Range: 13.410 MHz to 13.553 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dBμV]	c.f. [dBS/m]	Result [dBμV/m] (3m)	Conversion Factor [dB]	Result [dBμV/m] (30m)	Limit [dBμV/m]	Margin [dB]
13.410 - 13.553	19	13.553	2.805	4.25	90	25.1	22.7	47.8	40.0	7.8	50.4	42.6
		13.553		5.00	90	26.3	22.7	49.0	40.0	9.0	50.4	41.4
		13.553		5.75	90	27.2	22.7	49.9	40.0	9.9	50.4	40.5
		13.553	3.300	4.25	90	24.8	22.7	47.5	40.0	7.5	50.4	42.9
		13.553		5.00	90	26.4	22.7	49.1	40.0	9.1	50.4	41.3
		13.553		5.75	90	24.8	22.7	47.5	40.0	7.5	50.4	42.9
		13.553	3.795	4.25	90	25.0	22.7	47.7	40.0	7.7	50.4	42.7
		13.553		5.00	90	26.4	22.7	49.1	40.0	9.1	50.4	41.3
		13.553		5.75	90	27.4	22.7	50.1	40.0	10.1	50.4	40.3

Test Data (Frequency Range: 13.567 MHz to 13.710 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dBμV]	c.f. [dBS/m]	Result [dBμV/m] (3m)	Conversion Factor [dB]	Result [dBμV/m] (30m)	Limit [dBμV/m]	Margin [dB]
13.567 - 13.710	19	13.567	2.805	4.25	90	25.9	22.8	48.7	40.0	8.7	50.4	41.7
		13.567		5.00	90	27.1	22.8	49.9	40.0	9.9	50.4	40.5
		13.567		5.75	90	28.0	22.8	50.8	40.0	10.8	50.4	39.6
		13.567	3.300	4.25	90	25.9	22.8	48.7	40.0	8.7	50.4	41.7
		13.567		5.00	90	27.4	22.8	50.2	40.0	10.2	50.4	40.2
		13.567		5.75	90	25.8	22.8	48.6	40.0	8.6	50.4	41.8
		13.567	3.795	4.25	90	26.2	22.8	49.0	40.0	9.0	50.4	41.4
		13.567		5.00	90	27.6	22.8	50.4	40.0	10.4	50.4	40.0
		13.567		5.75	90	28.6	22.8	51.4	40.0	11.4	50.4	39.0



5.4.3 Test Detail (Continued)

Test Data (Frequency Range: 13.110 MHz to 13.410 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dB μ V]	c.f. [dBBS/m]	Result [dB μ V/m] (3m)	Conversion Factor [dB]	Result [dB μ V/m] (30m)	Limit [dB μ V/m]	Margin [dB]
13.110 - 13.410	19	13.410	2.805	4.25	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410		5.00	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410		5.75	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410	3.300	4.25	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410		5.00	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410		5.75	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410	3.795	4.25	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410		5.00	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2
		13.410		5.75	90	4.6	22.7	27.3	40.0	-12.7	40.5	53.2

Test Data (Frequency Range: 13.710 MHz to 14.010 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dB μ V]	c.f. [dBBS/m]	Result [dB μ V/m] (3m)	Conversion Factor [dB]	Result [dB μ V/m] (30m)	Limit [dB μ V/m]	Margin [dB]
13.710 - 14.010	19	13.710	2.805	4.25	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710		5.00	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710		5.75	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710	3.300	4.25	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710		5.00	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710		5.75	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710	3.795	4.25	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710		5.00	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1
		13.710		5.75	90	4.6	22.8	27.4	40.0	-12.6	40.5	53.1

Test Data (Frequency Range: 12.660 MHz to 13.110 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dB μ V]	c.f. [dBBS/m]	Result [dB μ V/m] (3m)	Conversion Factor [dB]	Result [dB μ V/m] (30m)	Limit [dB μ V/m]	Margin [dB]
12.660 - 13.110	19	13.110	2.805	4.25	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110		5.00	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110		5.75	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110	3.300	4.25	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110		5.00	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110		5.75	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110	3.795	4.25	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110		5.00	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4
		13.110		5.75	90	4.6	22.5	27.1	40.0	-12.9	29.5	42.4

Test Data (Frequency Range: 14.010 MHz to 14.460 MHz)

Frequency Range [MHz]	Temp. [deg.]	Measurement Frequency [MHz]	Power Supply Voltage [V]	Power Supply Voltage [V]	Antenna Polarization [deg.]	Reading [dB μ V]	c.f. [dBBS/m]	Result [dB μ V/m] (3m)	Conversion Factor [dB]	Result [dB μ V/m] (30m)	Limit [dB μ V/m]	Margin [dB]
14.010 - 14.460	19	14.010	2.805	4.25	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010		5.00	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010		5.75	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010	3.300	4.25	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010		5.00	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010		5.75	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010	3.795	4.25	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010		5.00	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9
		14.010		5.75	90	4.6	23.0	27.6	40.0	-12.4	29.5	41.9



5.5 Frequency Stability (15.225(e), RSS-210 A2.6)

Result: **PASS**

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 ±15% of rated voltage at 20°C.

5.5.2 Limit

The frequency stability of the carrier signal shall be maintained within ±0.01% of the operating frequency.

5.5.3 Test Detail

Uncertainty of measurement result : ±0.0021 Hz
Date of testing : February 26 and 27, 2015
Room temperature : Refer to Test Data

Calculation

Deviation [Hz] = Measured Frequency - Center Frequency
= 13560122.2 - 13560000
= 122.2

Deviation [ppm] = |Deviation [Hz]| ÷ Center Frequency × 1000000
= |122.2| ÷ 13560000 × 1000000
= 9.0

Margin = Limit - Deviation [ppm]
= 100 - 9.0
= 91.0



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	13560122.2	122.2	9.0	100	91.0
	2 min	13560119.3	119.3	8.8	100	91.2
	5 min	13560118.6	118.6	8.7	100	91.3
	10 min	13560118.5	118.5	8.7	100	91.3
40	Startup	13560159.8	159.8	11.8	100	88.2
	2 min	13560154.9	154.9	11.4	100	88.6
	5 min	13560154.4	154.4	11.4	100	88.6
	10 min	13560153.6	153.6	11.3	100	88.7
30	Startup	13560206.3	206.3	15.2	100	84.8
	2 min	13560200.5	200.5	14.8	100	85.2
	5 min	13560199.9	199.9	14.7	100	85.3
	10 min	13560199.7	199.7	14.7	100	85.3
20	Startup	13560250.8	250.8	18.5	100	81.5
	2 min	13560246.2	246.2	18.2	100	81.8
	5 min	13560245.2	245.2	18.1	100	81.9
	10 min	13560245.0	245.0	18.1	100	81.9
10	Startup	13560284.9	284.9	21.0	100	79.0
	2 min	13560281.5	281.5	20.8	100	79.2
	5 min	13560281.1	281.1	20.7	100	79.3
	10 min	13560280.9	280.9	20.7	100	79.3
0	Startup	13560302.7	302.7	22.3	100	77.7
	2 min	13560301.6	301.6	22.2	100	77.8
	5 min	13560301.4	301.4	22.2	100	77.8
	10 min	13560301.4	301.4	22.2	100	77.8
-10	Startup	13560295.6	295.6	21.8	100	78.2
	2 min	13560297.6	297.6	21.9	100	78.1
	5 min	13560298.0	298.0	22.0	100	78.0
	10 min	13560298.0	298.0	22.0	100	78.0
-20	Startup	13560256.7	256.7	18.9	100	81.1
	2 min	13560262.9	262.9	19.4	100	80.6
	5 min	13560264.0	264.0	19.5	100	80.5
	10 min	13560264.1	264.1	19.5	100	80.5



5.5.3 Test Detail (Continued)

Test Data

Supply Voltage [V]	Supply Voltage [V]	Measured Frequency [Hz]	Deviation [Hz]	Deviation [ppm]	Limit [ppm]	Margin [ppm]
2.805	4.25	13560197.3	197	14.6	100	85.4
	5.00	13560195.6	196	14.4	100	85.6
	5.75	13560193.5	194	14.3	100	85.7
3.300	4.25	13560246.2	246	18.2	100	81.8
	5.00	13560245.0	245	18.1	100	81.9
	5.75	13560242.5	243	17.9	100	82.1
3.795	4.25	13560275.3	275	20.3	100	79.7
	5.00	13560274.9	275	20.3	100	79.7
	5.75	13560272.8	273	20.1	100	79.9

Test Data

Temp [°C]	Supply Voltage [V]	Supply Voltage [V]	Measured Frequency [Hz]	Deviation [Hz]	Deviation [ppm]	Limit [ppm]	Margin [ppm]
50	3.300	5.00	13560118.5	-126.5	9.3	100	90.7
20			13560245.0	reference value			
-20			13560264.1	19.1	1.4	100	98.6
20	2.805	4.25	13560197.3	-47.7	3.5	100	96.5
		5.00	13560195.6	-49.4	3.6	100	96.4
		5.75	13560193.5	-51.5	3.8	100	96.2
	3.300	4.25	13560246.2	1.2	0.1	100	99.9
		5.75	13560242.5	-2.5	0.2	100	99.8
	3.795	4.25	13560275.3	30.3	2.2	100	97.8
		5.00	13560274.9	29.9	2.2	100	97.8
		5.75	13560272.8	27.8	2.1	100	97.9



5.6 Occupied Bandwidth (RSS-Gen Annex A)

Result: **PASS**

5.6.1 Setting Remarks

EUT directly connects to the spectrum analyzer via calibrated coaxial cable and 10 dB attenuator.
The spectrum analyzer is set-up as following;

·Resolution Bandwidth	: Approx. 1% of the span
·Video Bandwidth	: $3 \times \text{RBW}$
·Sweep	: Auto
·Detector Mode	: RMS
·Trace Mode	: Max Hold

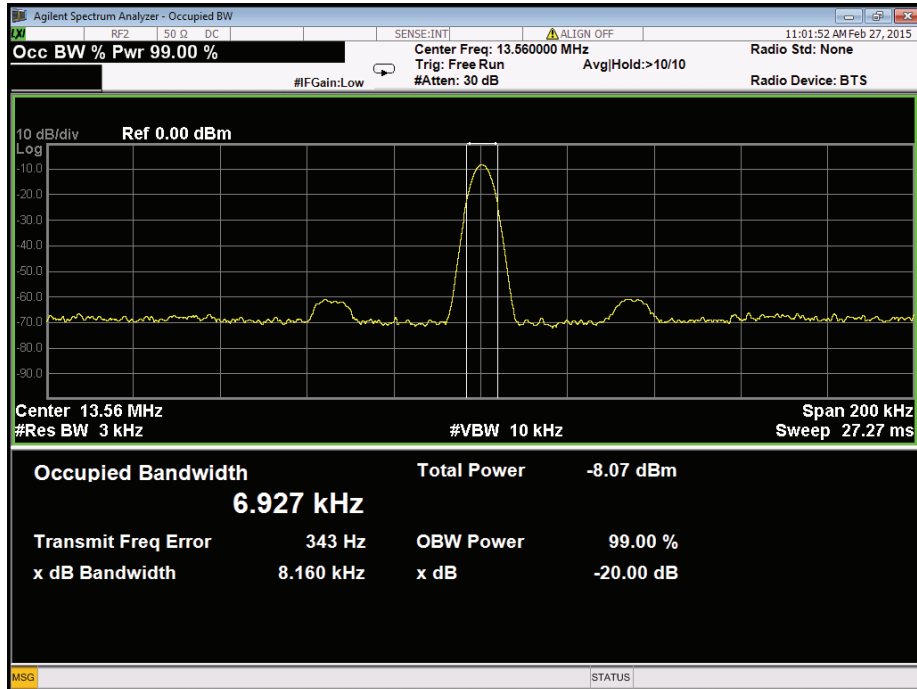
5.6.2 Test Detail

Uncertainty of measurement result	: $\pm 0.011\%$
Date of testing	: February 27, 2015
Room temperature	: 20°C
Relative humidity	: 36%



5.6.2 Test Detail (Continued)

Test Data



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	2014/11/27 2015/11/26
Artificial-Mains Network (for peripheral)	Kyoritsu	KNW-341C (F)	8-1659-1	2015/01/27 2016/01/26
Artificial-Mains Network (for EUT) /Highpass Filter /Attenuator 10 dB	Kyoritsu /Kyoritsu /TAMAGAWA	KNW-244C (F) /KFL-007 /CFA-03	8-1657-1 /8-1741-1 /---	2014/09/03 2015/09/02
RF Cable	Fujikura	3D-2W	OC01	2014/04/07 2015/04/06
	SUHNER	RG223/U	OC02 OC04	
RF Selector	TSJ	RFM-E221	3148	2014/04/07 2015/04/06
50Ω Terminator	RES-NET MICROWAVE	RCX6BM	---	2014/06/20 2015/06/19
Software	TOYO	EP5/CE (ver5.3.20)	---	---

Transmitter Spurious Emission (Radiated) (Below 30 MHz)

Instruments	Manufacturer	Model	Serial No.	Calibrated Date/Until
EMI Test Receiver	ROHDE& SCHWARZ	ESIB40	100211	2014/03/24 2015/03/23
Loop Antenna (9 kHz to 30 MHz)	SCHAFFNER	HLA6120	1137	2014/10/05 2015/10/04
Anechoic Chamber 3 m	JSE	COAC3M-01	---	2014/05/19 2015/05/18
RF Cable (9 kHz to 30 MHz)	Fujikura	5D-2W	OC09	2014/10/08 2015/10/07
	SUHNER	RG223/U	OC10 OC11 OC12	
RF Selector	TSJ	RFM-E121	03149	2014/10/08 2015/10/07
Software	TOYO	EP5/ME (ver 5.1.40)	---	---



6. List of Test and Measurement Instruments (Continued)

Transmitter Spurious Emission (Radiated) (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 (30 MHz to 1 GHz)	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 (30 MHz to 1 GHz)	Fujikura	8D-2W	OC14	2014/05/22 2015/05/21
	SUHNER	RG223/U	OC11	
		RG214/U	OC15 OC16	
		RG400/U	OC17	
RF Selector	TSJ	RFM-E121	03149	2014/05/22 2015/05/21
Software	TOYO	EP5/RE (ver 5.7.1)	---	---

20 dB Bandwidth / Frequency Stability / Occupied Bandwidth

Instruments	Manufacturer	Model	Serial No.	Calibrated Date/Until
EMI Test Receiver	Agilent Technologies	N9038A	MY54130015	2014/06/13 2015/06/12
Thermostatic Chamber	ESPEC	PU-2KP	14010409	2014/08/21 2015/08/20



6. List of Test and Measurement Instruments (Continued)

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
Loop Antenna (9 kHz to 30 MHz)	SCHAFFNER	HLA6120	1137	2014/10/05 2015/10/04
Anechoic Chamber 3 m	JSE	COAC3M-01	---	2014/05/19 2015/05/18
RF Cable (9 kHz to 30 MHz)	Fujikura	5D-2W	OC09	2014/10/08 2015/10/07
	SUHNER	RG223/U	OC10	
			OC11	
			OC12	
RF Selector	TSJ	RFM-E121	03149	2014/10/08 2015/10/07
Software	TOYO	EP5/ME (ver 5.1.40)	---	---

7. Appendix

Refer to separated files for the following appendixes.

Appendix 1: Photographs of EUT

Appendix 2: External Photographs

Appendix 3: EUT Photographs (RFID Module)

Appendix 4: Photographs of the Test Setup