

TEST REPORT

Applicant : SHARP CORPORATION, IoT Communication BU
Address : 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima,
739-0192, Japan

Products : Smart Phone
Model No. : 606SH
Serial No. : 004401/11/612130/8
004401/11/612129/0

FCC ID : APYHRO00250

Test Standard : CFR 47 FCC Rules and Regulations Part 24

Test Results : **Passed**

Date of Test : May 16 ~ 22, 2017



Kousei Shibata
Manager
Japan Quality Assurance Organization
KITA-KANSAI Testing Center
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

-
- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
 - The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
 - The test results presented in this report relate only to the offered test sample.
 - The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
 - This test report shall not be reproduced except in full without the written approval of JQA.
 - VLAC does not approve, certify or warrant the product by this test report.

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DEFINITIONS FOR ABBREVIATION AND SYMBOLS USED IN THIS TEST REPORT**EUT** : Equipment Under Test**EMC** : Electromagnetic Compatibility**AE** : Associated Equipment**EMI** : Electromagnetic Interference**N/A** : Not Applicable**EMS** : Electromagnetic Susceptibility**N/T** : Not Tested - indicates that the listed condition, standard or equipment is applicable for this report. - indicates that the listed condition, standard or equipment is not applicable for this report.

1 Description of the Equipment Under Test

1. Manufacturer : SHARP CORPORATION, IoT Communication BU
2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima,
739-0192, Japan
2. Products : Smart Phone
3. Model No. : 606SH
4. Serial No. : 004401/11/612130/8
004401/11/612129/0
5. Product Type : Pre-production
6. Date of Manufacture : April, 2017
7. Power Rating : 4.0VDC (Lithium-ion Battery UBATIA270AFN1 3010mAh)
8. Grounding : None
9. Transmitting Frequency : 1850.2 MHz(512CH) – 1909.8MHz(810CH)
10. Receiving Frequency : 1930.2 MHz(512CH) – 1989.8MHz(810CH)
11. Emission Designations : 244KGXW
12. Max. RF Output Power : 1.514 W(EIRP)
13. Category : Broadband PCS
14. EUT Authorization : Certification
15. Received Date of EUT : May 15, 2017

16. Channel Plan

The carrier spacing is 200 kHz.

The carrier frequency is designated by the absolute frequency channel number (ARFCN).

The carrier frequency is expressed in the equation shown as follows:

$$\text{Transmitting Frequency (in MHz)} = 1850.2 + 0.2 \times (n - 512)$$

$$\text{Receiving Frequency (in MHz)} = 1930.2 + 0.2 \times (n - 512)$$

where, n : channel number ($512 \leq n \leq 810$)

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 24
Subpart E - Broadband PCS

The EUT described in clause 1 was tested according to the applied standard shown above.
Details of the test configuration is shown in clause 6.

The conclusion for the test items of which are required by the applied standard is indicated under the test result.

- The test result was **passed** for the test requirements of the applied standard.
- The test result was **failed** for the test requirements of the applied standard.
- The test result was **not judged** the test requirements of the applied standard.

In the approval of test results,

- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by:

Tested by:



Shigeru Kinoshita
Assistant Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch



Shigeru Osawa
Deputy Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

3 Test Procedure

Test Requirements : CFR 47 FCC Rules and Regulations Part 2
§2.1046, §2.1047, §2.1049, §2.1051, §2.1053, §2.1055 and §2.1057

Test Procedure : ANSI/TIA-603-D-2010
FCC KDB 971168 D01 Power Meas License Digital Systems v02r02,
released October 17, 2014

4 Test Location

Japan Quality Assurance Organization (JQA)
KITA-KANSAI Testing Center
7-7, Ishimaru, 1-chome, Minoh-shi, Osaka, 562-0027, Japan
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Recognition of Test Laboratory

JQA KITA-KANSAI Testing Center SAITO EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No. : VLAC-001-2 (Expiry date : March 30, 2018)

VCCI Registration No. : A-0002 (Expiry date : March 30, 2018)

BSMI Registration No. : SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006
(Expiry date : September 14, 2019)

IC Registration No. : 2079E-3, 2079E-4 (Expiry date : July 16, 2017)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI.
(Expiry date : February 22, 2019)

6 Description of Test Setup

6.1 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
A	Smart Phone	Sharp	606SH	004401/11/612130/8 *1) 004401/11/612129/0 *2)	APYHRO00250
B	AC Adapter	Sharp	SHCEJ1	--	N/A
C	Stereo Handsfree	Sharp	--	--	N/A
D	DTV Antenna	Sharp	--	--	N/A

*1) Used for Field Strength of Spurious Emission

*2) Used for Antenna Conducted Emission

The auxiliary equipment used for testing :

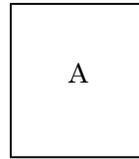
None

Type of Cable:

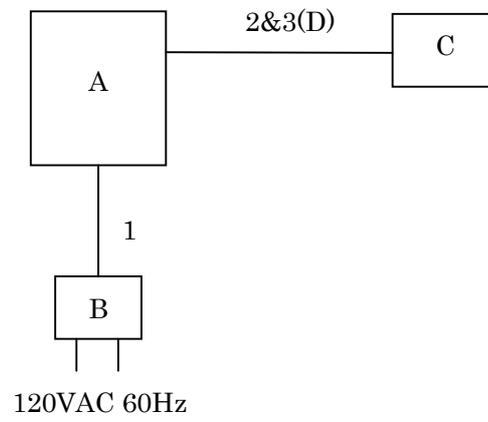
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	USB conversion cable	--	--	NO	NO	1.5
2	Handsfree Cable	--	--	NO	NO	1.5
3	DTV Antenna Cable	--	--	NO	NO	0.1

6.2 Test Arrangement (Drawings)

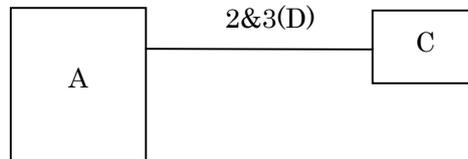
a) Single Unit



b) AC Adapter used



c) Earphone used



6.3 Operating Condition

Power Supply Voltage : 4.0 VDC (for Battery)
120 VAC, 60 Hz (For AC Adapter)

The test were carried under one modulation type shown as follows:

Modulation Burst Signal : DATA TSC 5 in accordance with GSM 05.02.
(Maximum Power Setting)

The tests were carried under the worst channel (maximum power).

(Ref. JQA File number: KL80160047R, FCC ID: APYHRO00237)

1. Conducted: 1850.200 MHz (512 ch)
2. Radiated: 1909.800 MHz (810 ch)

The Radiated Emission test were carried under 3 test configurations shown in clause 6.2.
In all tests, the fully charged battery is used for the EUT.

Other Clock Frequency

19.2MHz, 27MHz, 27.12MHz

The EUT was rotated through three orthogonal axis (X, Y and Z axis) in radiated measurement.
The EUT with temporary antenna port was used in conducted measurement.

7 Test Requirements

7.0 Re-use of Measured Data

7.0.1 Introduction

This application re-use data collected on a similar device. The subjected device of this application (Model No.: 606SH, FCC ID: APYHRO00250) is electrically identical to the reference device (Model No.: 507SH, FCC ID: APYHRO00237) for the portions of the circuitry corresponding to the data being re-used.

The FCC ID: APYHRO00237 test data shall remain representative of FCC ID: APYHRO00250.

A statement that the applicant takes full responsibility that the test data as referenced in this section represent compliance for this FCC ID: APYHRO00250.

7.0.2 Difference Section

The device of this application is electrically identical to the reference device other than the FeliCa Block. Please refer to the Comparison List Between 507SH and 606SH.

7.0.3 Spot Check Verification Data Section

The spot check verification tests were carried under the worst channel (maximum power).

(Ref. JQA File number: KL80160047R, FCC ID: APYHRO00237)

1. Conducted: 1850.200 MHz (512 ch)
2. Radiated: 1909.800 MHz (810 ch)

Test Item	Reference Model (FCC ID: APYHRO00237)	Spot Check Model (FCC ID: APYHRO00250)
RF Power Output	1052.0 mW (at 1850.2 MHz)	849.2 mW (at 1850.2 MHz)
EIRP RF Power Output	1.698 W (at 1909.8 MHz)	1.514 W (at 1909.8 MHz)
Field Strength of Spurious Radiation	<-34.0 dBm (at 17188.2 MHz)	<-34.2 dBm (at 17188.2 MHz)

Summary of the Test Results

Test Item	FCC Specification	Reference of the Test Report	Results	Remarks
RF Power Output	Section 24.232(c)	Section 7.1	Passed	-
ERP / EIRP RF Power Output	Section 24.232(c)	Section 7.2	Passed	-
Modulation Characteristics	-	-	-	-
Occupied Bandwidth	Section 24.238	Section 7.4	Not Tested	-
Spurious Emissions at Antenna Terminals	Section 24.238	Section 7.5	Not Tested	-
Band-Edge Emission	Section 24.238	Section 7.6	Not Tested	-
Field Strength of Spurious Radiation	Section 24.238	Section 7.7	Passed	-
Frequency Stability	Section 24.235	Section 7.8	Not Tested	-

7.0.4 Reference Detail Section

Equipment Class	FCC ID	Test Report Title	Report Section
PCE (PCS1900)	APYHRO00250	APYHRO00237_TestReport_KL80160047R (PCE)	All sections applicable

7.1 RF Power Output (§2.1046)

For the requirements, - Applicable [- Tested. - Not tested by applicant request.]
 - Not Applicable

7.1.1 Test Results

For the standard, - **Passed** - **Failed** - **Not judged**

Transmitter Power is 849.2 mW at 1850.200 MHz

Uncertainty of Measurement Results ± 0.9 dB(2 σ)

Remarks : _____

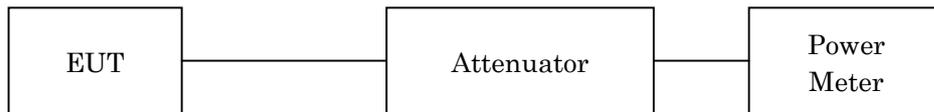
7.1.2 Test Instruments

Shielded Room S4				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2017/07/10
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2017/07/10
Attenuator	43KC-20	1418003 (D-41)	Anritsu	2017/07/10
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2017/08/02

NOTE : The calibration interval of the above test instruments is 12 months.

7.1.3 Test Method and Test Setup (Diagrammatic illustration)

The Conducted RF Power Output was measured with a power meter, one attenuator and a short, low loss cable.



7.1.4 Test Data

(GSM-PCS1900)

Test Date: May 16, 2017
Temp.: 25 °C, Humi: 43 %

Transmitting Frequency CH	[MHz]	Correction Factor [dB]	Meter Reading (Peak) [dBm]	Results (Peak) [dBm]	[mW]
512	1850.200	20.39	8.90	29.29	849.2

Calculated result at 1850.200 MHz, as the maximum level point shown on underline:

Correction Factor	=	20.39	dB
+) Meter Reading	=	8.90	dBm
Result	=	29.29	dBm = 849.2 mW

NOTE : The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.

7.2 ERP / EIRP RF Power Output

For the requirements, - Applicable [- Tested. - Not tested by applicant request.]
 - Not Applicable

7.2.1 Test Results

For the standard, - Passed - Failed - Not judged

Min. Limit Margin 1.2 dB at 1909.8 MHz

Uncertainty of Measurement Results ± 1.8 dB(2σ)

Remarks : The maximum EIRP is 1.514 W at 1909.8 MHz. X-axis position. The measurement result is within the range of measurement uncertainty.

7.2.2 Test Instruments

Anechoic Chamber A2				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2018/02/28
Signal Generator	E8257D	MY45140309 (B-39)	Agilent	2017/08/08
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2017/07/10
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2017/07/10
Horn Antenna (TX)	91888-2	560 (C-40-1)	EATON	2017/06/12
Horn Antenna (RX)	91888-2	562 (C-41-1)	EATON	2017/06/12
Attenuator (TX)	2-10	BA6214 (D-79)	Weinschel	2017/11/21
Attenuator (RX)	2-10	BF7557 (D-80)	Weinschel	2017/11/21
RF Cable (RX)	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2018/01/10
RF Cable (TX)	SUCOFLEX102E	6683/2E (C-70)	HUBER+SUHNER	2017/11/21

NOTE : The calibration interval of the above test instruments is 12 months.

7.2.3 Test Method and Test Setup (Diagrammatic illustration)

Step 1:

In order to obtain the maximum emission, the EUT was placed at the height 1.5 m on the non-conducted support and was varying at three orthogonal axes, at the distance 3 m from the receiving antenna and rotated around 360 degrees.

The receiving antenna height was varied from 1 m to 4 m.

The EUT on the table was placed to be maximum emission against at the receiving antenna polarized (vertical and horizontal).

Then the meter reading of the spectrum analyzer at the maximum emission was A dB(μ V).

Step 2:

The EUT was replaced to substitution antenna at the same polarized under the same condition as step 1.

The RF power was fed to the transmitting antenna through the RF amplifier from the signal generator.

In order to obtain the maximum emission level, the height of the receiving antenna was varied from 1 m to 4 m.

The level of maximum emission was A dB(μ V), same as the recorded level in the step 1.

Then the RF power into the substitution horn antenna was P (dBm).

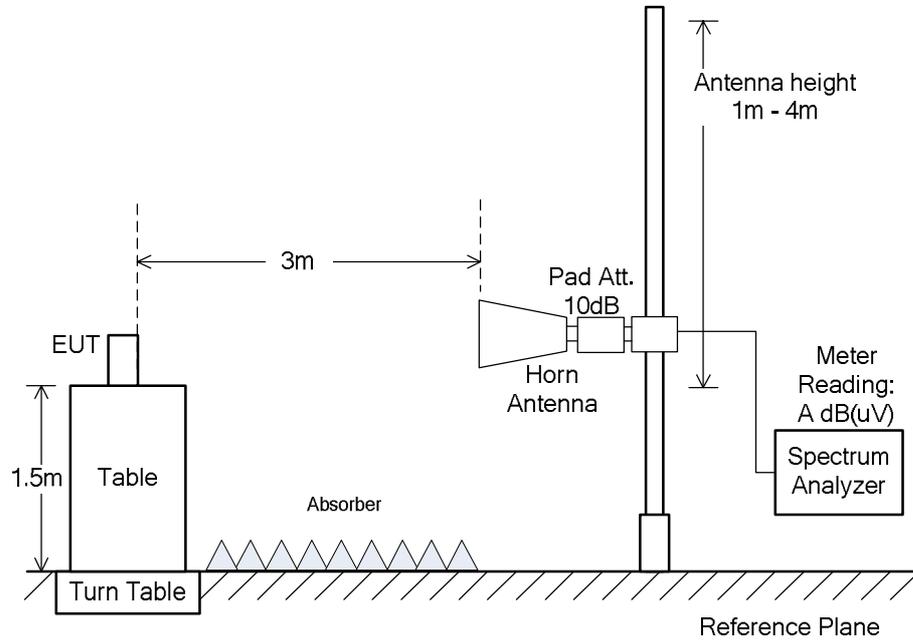
The ERP/EIRP output power was calculated in the following equation.

$$\text{ERP (dBm)} = \text{P (dBm)} - \text{Balun loss of the tuned dipole antenna (dB)} + \text{Cable loss (dB)}$$

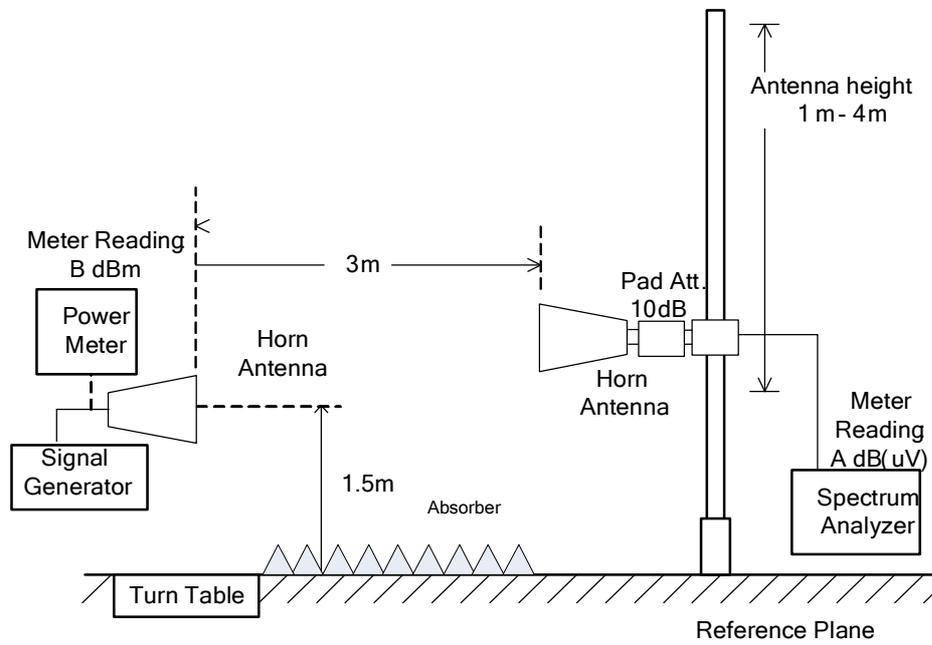
$$\text{EIRP (dBm)} = \text{P (dBm)} + \text{Gh (dBi)}$$

where, Gh (dBi) : Gain of the substitution horn antenna.

– Side View –



(a)EUT



(b) Substitution Horn Antenna

7.2.4 Test Data

(GSM-PCS1900)

Test Date: May 22, 2017
Temp.: 25 °C, Humi: 47 %

1. Measurement Results

CH	Transmitting Frequency [MHz]	Emission Measurement [dB(uV)]		Substitution Measurement [dB(uV)]		Supplied Power to Substitution Antenna [dBm]	Gain of Substitution Antenna [dBi]
		Hori. (Mh)	Vert. (Mv)	Hori. (Msh)	Vert. (Msv)		
810	1909.800	94.7	94.9	72.6	72.6	- 5.0	14.5

2. Calculation Results

CH	Transmitting Frequency [MHz]	Peak EIRP [dBm]		Maximum Peak EIRP [W]	Limits [dBm]	Margin [dB]
		Hori. (EIRPh)	Vert. (EIRPv)			
810	1909.800	31.6	31.8	1.514	33.0	+ 1.2

Calculated result at 1909.800 MHz, as the worst point shown on underline:

Emission Measurement (Mv)	=	94.9 dB(uV)
Substitution Measurement (Msv)	=	-72.6 dB(uV)
Supplied Power to Substitution Antenna	=	-5.0 dBm
+) Gain of Substitution Antenna	=	14.5 dB
Result (EIRPv)	=	31.8 dBm = 1.514 W

Minimum Margin: 33.0 - 31.8 = 1.2 (dB)

NOTE : Setting of measuring instrument(s) :

Detector Function	Resolution B.W.	V.B.W.	Sweep Time
Peak	1 MHz	3 MHz	20 msec.

7.7.2 Test Instruments

Anechoic Chamber A2				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2018/02/28
Signal Generator	E8257D	MY45140309 (B-39)	Agilent	2017/08/08
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2017/07/10
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2017/07/10
Biconical Antenna	VHA9103/BBA9106	2355 (C-30)	Schwarzbeck	2017/05/18
Log-periodic Antenna	UHALP9108-A1	0694 (C-31)	Schwarzbeck	2017/05/18
Dipole Antenna (TX)	KBA-511A	0-273-2 (C-17)	Kyoritsu	2017/05/24
Dipole Antenna (TX)	KBA-611	0-248-2 (C-20)	Kyoritsu	2017/05/24
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2018/04/02
Pre-Amplifier	TPA0118-36	1010 (A-37)	TOYO	2018/05/14
Horn Antenna	91888-2	562 (C-41-1)	EATON	2017/06/12
Horn Antenna	91889-2	568 (C-41-2)	EATON	2017/06/12
Horn Antenna	3160-04	9903-1053 (C-55)	EMCO	2017/06/13
Horn Antenna	3160-05	9902-1061 (C-56)	EMCO	2017/06/13
Horn Antenna	3160-06	9712-1045 (C-57)	EMCO	2017/06/13
Horn Antenna	3160-07	9902-1113 (C-58)	EMCO	2017/06/13
Horn Antenna	3160-08	9904-1099 (C-59)	EMCO	2017/06/13
Horn Antenna	3160-09	9808-1117 (C-48)	EMCO	2017/06/15
Attenuator	2-10	AW7937 (D-40)	Weinschel	2017/10/24
Attenuator	54A-10	W5713 (D-29)	Weinschel	2017/08/02
Attenuator	2-10	BA6214 (D-79)	Weinschel	2017/11/21
RF Cable	SUCOFLEX102E	6683/2E (C-70)	HUBER+SUHNER	2017/11/21
RF Cable	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2018/01/10
RF Cable	SUCOFLEX104	267414/4 (C-67)	HUBER+SUHNER	2018/01/10
RF Cable	SUCOFLEX102EA	3041/2EA (C-69)	HUBER+SUHNER	2018/01/10
High Pass Filter	HPM13899	001 (D-96)	MICRO-TRONICS	2018/02/14

NOTE : The calibration interval of the above test instruments is 12 months.

7.7.3 Test Method and Test Setup (Diagrammatic illustration)

Step 1) The spurious radiation for transmitter were measured at the distance 3 m away from the EUT which was placed on a non-conducted support 0.8 m in height and was varying at three orthogonal axes. The receiving antenna was oriented for vertical polarization and varied from 1 m to 4 m until the maximum emission level was detected on the measuring instrument. The EUT was rotated 360 degrees until the maximum emission was received. The measurement was also repeated with the receiving antenna in the horizontal polarization.

This test was carried out using the half-wave dipole antenna for up to 1GHz and using the horn antenna for above 1 GHz.

Step 2)

A) Up to 1 GHz

The ERP measurement was carried out with according to Step 2 in Clause 7.2.3. Then the RF power in the substitution antenna half-wave dipole antenna for up to 1 GHz and the substitution horn antenna for above 1 GHz.

The ERP is calculated in the following equation.

$$ERP(dBm) = P (dBm) - (Balun Loss of the half-wave dipole Ant. (dB)) + Cable Loss (dB)$$

B) Above 1 GHz

The ERP is calculated from the maximum emission level by the following formula.

$$\frac{e^2}{120\pi} = \frac{eirp}{4\pi d^2} \quad \text{---(Eq.1)}$$

$$erp = eirp - Gd \quad \text{---(Eq.2)}$$

Where, $e[V/m]$: Field Strength at measuring distance($d=3m$)

$eirp[W]$: Equivalent Isotropic Radiated Power

$erp[W]$: Effective Radiated Power

$Gd(dBi)$: Gain of the substitution half-wave dipole antenna(2.15dBi)

$$eirp = \frac{(de)^2}{30} = \frac{3}{10} e^2$$

$$\therefore 10 \log(eirp) = 20 \log(e) + 10 \log(3/10) = 20 \log(e) - 5.23$$

$$10 \log(eirp) = EIRP[dBm] - 30$$

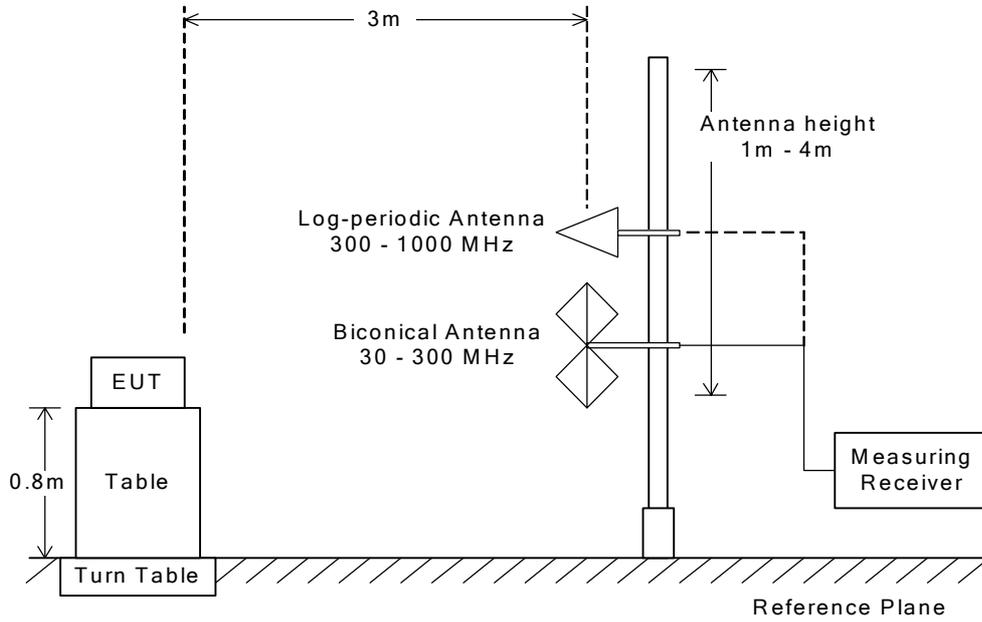
$$20 \log(e) = E[dB(\mu V/m)] - 120$$

$$\therefore EIRP = E - 120 + 30 - 5.23 = E - 95.23$$

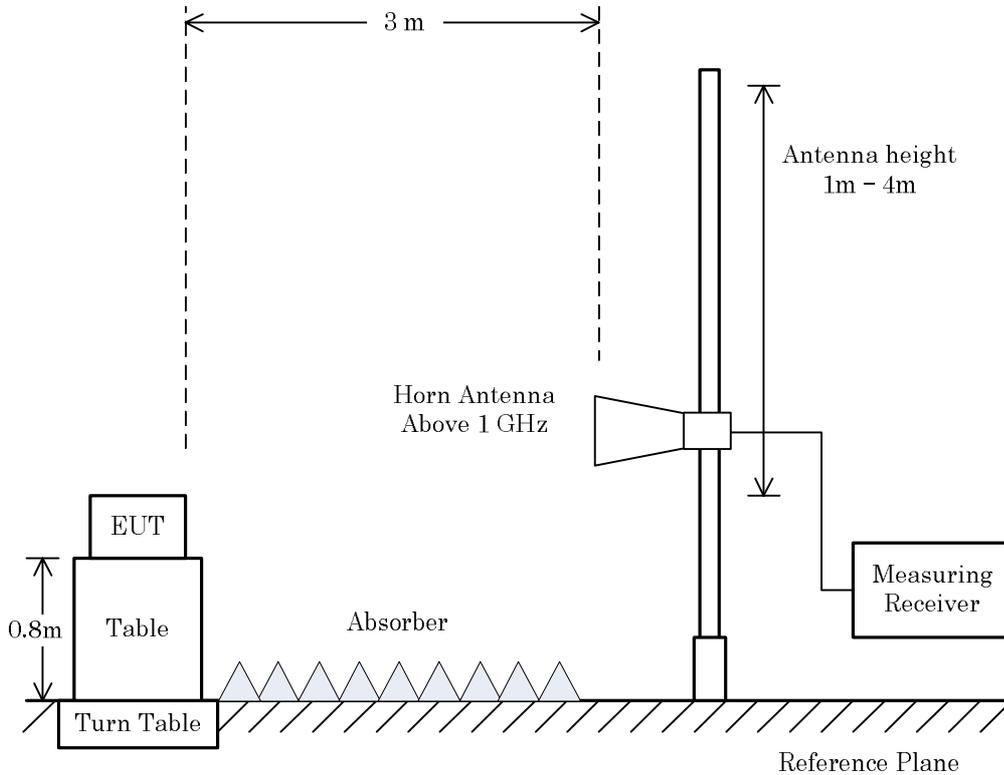
$$\therefore ERP[dBm] = EIRP - 2.15 = E - 97.38$$

The respective calculated ERP of the spurious and harmonics were compared with the ERP of fundamental frequency by specified attenuation limits, $43+10\log_{10}(TP \text{ in watt})[dB]$. Where, TP = Transmitter power at the ANT OUT under test configuration as the hands free unit used.

Radiated Emission 30 MHz to 1000 MHz



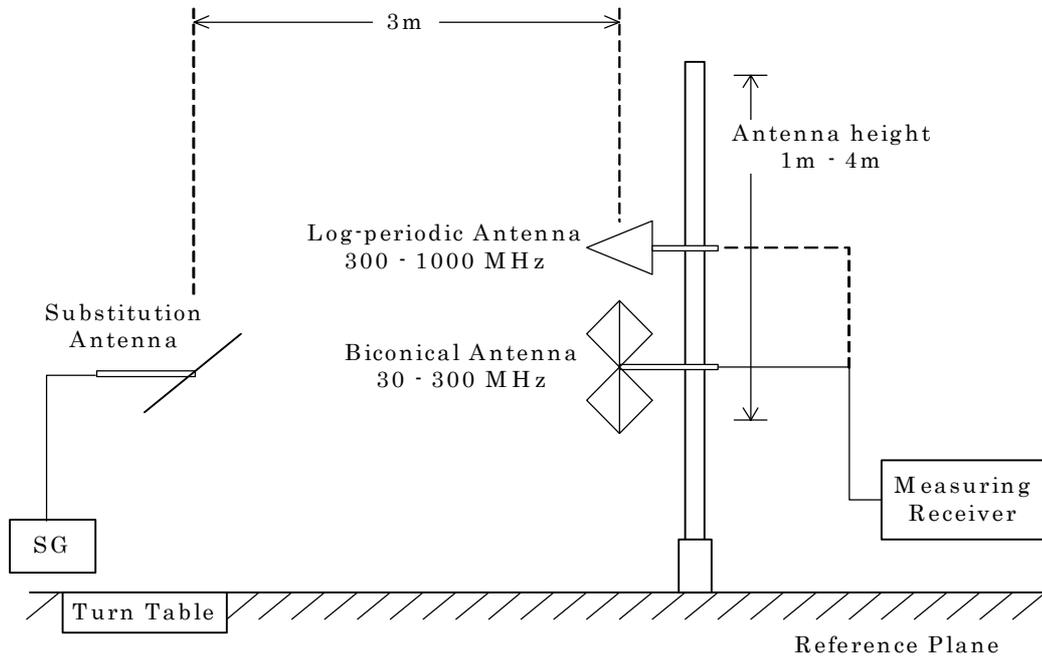
Radiated Emission above 1 GHz



NOTE

The antenna height is scanned depending on the EUT's size and mounting height.

Radiated Emission 30 to 1000 MHz – Substitution Method



7.7.4 Test Data

(GSM-PCS1900)

Test Date: May 18, 2017
 Temp.: 23 °C, Humi: 43 %
 Test Date: May 22, 2017
 Temp.: 25 °C, Humi: 47 %

Test Configuration : Single Unit

CH	Transmitting Frequency [MHz]	Measured Frequency [MHz]	ERP [dBm]		Limits [dBm]	Margin [dB]	Remarks
			Hori.	Vert.			
810	1909.800	3819.600	-41.1	-43.2	-13.0	+28.1	C
		5729.400	< -47.1	< -47.1	-13.0	> +34.1	C
		7639.200	< -45.6	< -45.6	-13.0	> +32.6	C
		9549.000	< -41.5	< -41.5	-13.0	> +28.5	C
		11458.800	< -40.2	< -40.2	-13.0	> +27.2	C
		13368.600	< -38.7	< -38.7	-13.0	> +25.7	C
		15278.400	< -37.3	< -37.3	-13.0	> +24.3	C
		17188.200	< -34.2	< -34.2	-13.0	> +21.2	C
		19098.000	< -39.9	< -39.9	-13.0	> +26.9	C

Calculated result at 17188.2 MHz, as the worst point shown on underline:
 Minimum Margin: -13.0 - (<-34.2) = >21.2 (dB)

NOTES

- Test Distance : 3 m
- The spectrum was checked from 30 MHz to the tenth harmonic of the highest fundamental frequency.
- All emissions not reported were more than 20 dB below the applied limits.
- Applied limits : -13.0 [dBm] = 10log(TP[mW]) - (43 + 10log(tp[W])) = 10log(TP[mW]) - (43 + (10 log(TP[mW]) - 30))
 where, tp[W] = TP[mW] / 1000 : Transmitter power at antenna terminal
- The symbol of "<" means "or less".
- The symbol of ">" means "more than".
- Setting of measuring instrument(s) :

	Detector Function	RES B.W.	V.B.W.	Sweep Time
A	Peak	10 kHz	30 kHz	20 msec.
B	Peak	100 kHz	300 kHz	20 msec.
C	Peak	1 MHz	3 MHz	20 msec.

7.8 Frequency Stability (§2.1055)

For the requirements, - Applicable [- Tested. - Not tested by applicant request.]
 - Not Applicable