JQA File No. : KL80130335R

Issue Date : October 1, 2013

TEST REPORT

Applicant	:	Sharp Corporation, Communication Systems Division
Address	:	2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, JAPAN
Products	:	Cellular Phone
Model No.	:	SH-01F
Serial No.	:	004401114935196 004401114935162
FCC ID	:	APYHRO00197
Test Standard	:	CFR 47 FCC Rules and Regulations Part 24
Test Results	:	**Passed**
Date of Test	:	September 13 ~ 24, 2013

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 measurement values stated in Test Report was made with traceable to National Institute of Advanced Industrial Science and Technology (AIST) of Japan and National Institute of Information and Communications Technology (NICT) of Japan.
- 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
AE : Associated Equipment
N/A : Not Applicable
N/T : Not Tested
EMC : Electromagnetic Compatibility
EMI : Electromagnetic Interference
EMS : Electromagnetic Susceptibility

☒ - 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, Communication Systems Division 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, JAPAN
2.	Products	:	Cellular Phone
3.	Model No.	:	SH-01F
4.	Serial No.	:	004401114935196
		:	004401114935162
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	August, 2013
7.	Power Rating	:	4.0VDC (Lithium-ion Battery LIS1531SPPC(SY6) 3000mAh)
8.	EUT 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	:	245KGXW
12.	Max. RF Output Power	:	1.549W (EIRP)
13.	Category	:	Broadband PCS
14.	EUT Authorization	:	Certification
15.	Received Date of EUT	:	September 11, 2013

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:

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

S. Kino

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

Tested by:

Shigeru Osawa

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 C63.4–2003, TIA/EIA–603-C-2004
FCC KDB 971168 D01 Licensed DTS Guidance v02r01, released June 7, 2013

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, 2014)
VCCI Registration No. : A-0002 (Expiry date : March 30, 2014)
IC Registration No. : 2079E-3, 2079E-4 (Expiry date : July 20, 2014)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI.
(Expiry date : February 22, 2016)

6 Details of the Equipment Under Test

6.1 Operating Condition

The test were carried under one modulation type shown as follows:
Modulation Burst Signal : DATA TSC 5 in accordance with GSM 05.02.

The Radiated Emission test were carried under 3 test configurations shown in clause 6.3.
In all tests, the fully charged battery is used for the EUT.

Detailed Transmitter portion:
Transmitter frequency : 1850.2 MHz(512CH) – 1909.8 MHz(810CH)
Local frequency : 3700.4MHz(512ch) – 3819.6MHz(810ch)

Detailed Receiver portion:
Receiver frequency : 1930.2 MHz(512CH) – 1989.8 MHz(810CH)
Local frequency : 3860.4MHz(512ch) – 3979.6MHz(810ch)

Other Clock Frequency
32.768 kHz, 19.2 MHz, 27 MHz, 27.12 MHz, 37.4 MHz

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.

6.2 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
A	Cellular Phone	Sharp	SH-01F	004401114 935196 *1) 004401114 935162 *2)	APYHRO00197
B	AC Adapter	Fujitsu Corporation	04	WFA	N/A
C	Stereo Handsfree	Sharp	SHLDL1	--	N/A

*1) Used for Field Strength of Spurious Emission
*2) Used for Antenna Conducted Emission and Frequency Stability

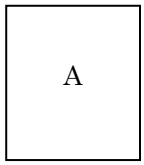
The auxiliary equipment used for testing :
None

Type of Cable:

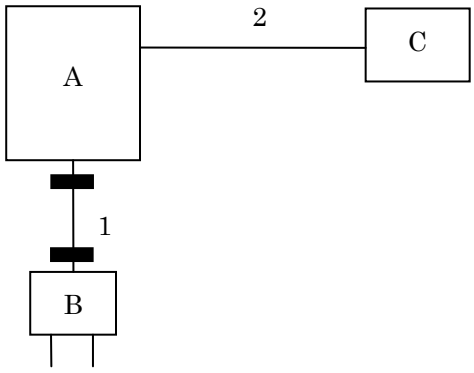
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	USB conversion cable	--	--	NO	YES	1.1
2	Handsfree Cable	--	--	NO	NO	1.5

6.3 Test Arrangement (Drawings)

a) Single Unit

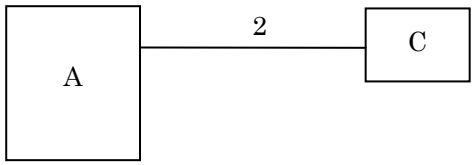


b) AC Adapter used



120VAC 60Hz

c) Handsfree used



▌: Ferrite Core

7 Details of the Test Item

7.1 RF Power Output (§2.1046)

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

7.1.1 Worst Point and Measurement Uncertainty

Transmitter Power is 961.6 mW at 1909.800 MHz

Uncertainty of Measurement Results at Amplitude +/-0.7 dB(2σ)

Remarks : _____

7.1.2 Test Site

KITA-KANSAI Testing Center

Test site : SAITO

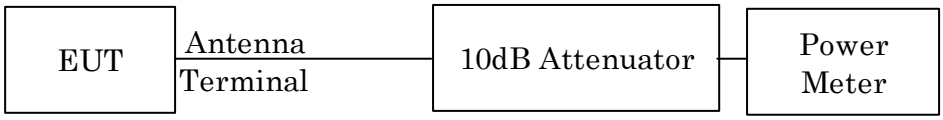
☐ - Anechoic chamber (A1)
☐ - Measurement room (M1)
☐ - Measurement room (M2)
☐ - Measurement room (M3)
☐ - Shielded room (S1)
☐ - Shielded room (S2)
☐ - Shielded room (S3)
☒ - Shielded room (S4)

7.1.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Power Meter	N1911A	Agilent	B-63	2013/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2013/7	1 Year
Attenuator	54A-10	Weinschel	D-28	2012/9	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2013/7	1 Year

7.1.4 Test Method and Test Setup (Diagrammatic illustration)

The Conducted RF Power Output was measured with a power meter, one 10dB attenuator and a short, low loss cable.



7.1.5 Test Data

(GSM-PCS1900)

Test Date: September 13, 2013
Temp.: 28 °C, Humi: 60 %

Transmitting Frequency		Correction Factor	Meter Reading (Peak)	Results (Peak)	
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]
512	1850.200	10.24	19.50	29.74	941.9
661	1880.000	10.24	19.48	29.72	937.6
810	1909.800	10.24	19.59	29.83	961.6

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

	Correction Factor	=	10.24	dB
+)	Meter Reading	=	19.59	dBm
	Result	=	29.83	dBm = 961.6 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

For the limits, ☒ - **Passed** ☐ - **Failed** ☐ - **Not judged**

7.2.1 Worst Point and Measurement Uncertainty

Min. Limit Margin 1.1 dB at 1850.200 MHz

Uncertainty of Measurement Results +/-2.2 dB(2σ)

Remarks : The maximum EIRP is 1.549 W at 1850.200 MHz. The measurement result is within the range of measurement uncertainty.

7.2.2 Test Site

KITA-KANSAI Testing Center SAITO EMC Branch

☐ - Anechoic chamber A1 ☒ - Anechoic chamber A2

7.2.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Test Receiver	ESU 26	Rohde & Schwarz	A-6	2013/4	1 Year
Signal Generator	E8257D	Agilent	B-39	2013/8	1 Year
Power Meter	N1911A	Agilent	B-63	2013/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2013/7	1 Year
Attenuator(RX)	2-10	Weinschel	D-79	2012/11	1 Year
Attenuator(TX)	2-10	Weinschel	D-80	2012/11	1 Year
RF Cable(RX)	SUCOFLEX104	SUHNER	C-66	2013/2	1 Year
RF Cable(TX)	SUCOFLEX 102/E	SUHNER	C-70	2012/11	1 Year
Horn Antenna(TX)	91889-2	EATON	C-40-2	2013/7	1 Year
Horn Antenna(RX)	91889-2	EATON	C-41-2	2013/6	1 Year

7.2.4 Test Method and Test Setup (Diagrammatic illustration)

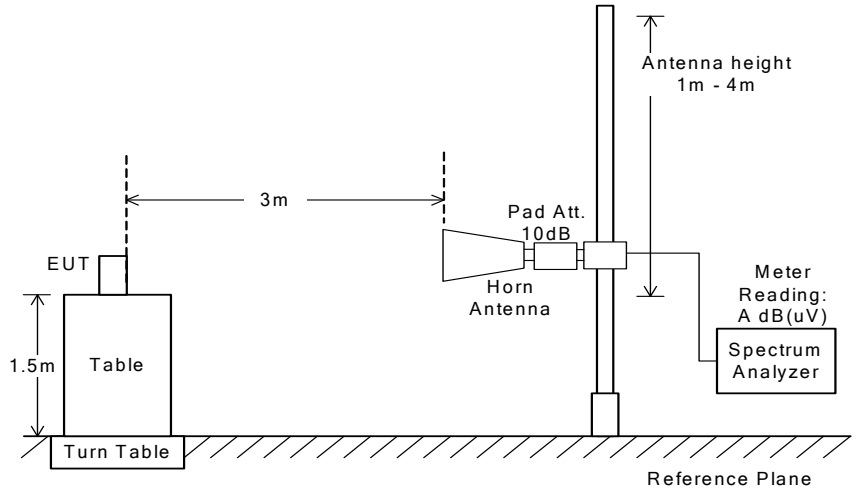
Step 1:
In order to obtain the maximum emission, the EUT was placed at the height 1.5 m on the non-conducted support and was varying at three orthogonal axes, at the distance 3 m from the receiving antenna and rotated around 360 degrees.
The receiving antenna height was varied from 1 m to 4 m.
The EUT 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(μV).

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(μV), same as the recorded level in the step 1.
Then the RF power into the substitution horn antenna was P (dBm).

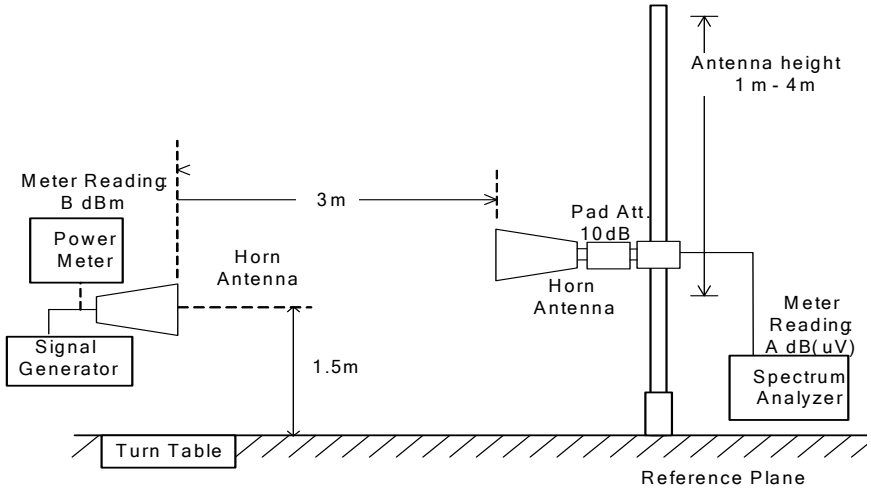
The ERP/EIRP output power was calculated in the following equation.

ERP (dBm) = P (dBm) – Balun loss of the tuned dipole antenna (dB) + Cable loss (dB)
EIRP (dBm) = P (dBm) + Gh (dBi)
where, Gh (dBi) : Gain of the substitution horn antenna.

– Side View –



(a)EUT



(b) Substitution Horn Antenna

7.2.5 Test Data

(GSM-PCS1900)

Test Date: September 17, 2013
Temp.: 25 °C, Humi: 48 %

1. Measurement Results

CH	Transmitting Frequency [MHz]	Emission Measurement [dB(uV)] Hori. (Mh)	Emission Measurement [dB(uV)] Vert. (Mv)	Substitution Measurement [dB(uV)] Hori. (Msh)	Substitution Measurement [dB(uV)] Vert. (Msv)	Supplied Power to Substitution Antenna [dBm]	Gain of Substitution Antenna [dB]
512	1850.200	94.8	93.2	72.2	72.4	- 5.0	14.3
661	1880.000	94.1	93.0	72.5	72.6	- 5.0	14.3
810	1909.800	94.4	93.6	72.7	72.7	- 5.0	14.4

2. Calculation Results

CH	Transmitting Frequency [MHz]	Peak EIRP [dBm] Hori. (EIRPh)	Peak EIRP [dBm] Vert. (EIRPv)	Maximum Peak EIRP [W]	Limits [dBm]	Margin [dB]
512	1850.200	31.9	30.1	1.549	33.0	+ 1.1
661	1880.000	30.9	29.7	1.230	33.0	+ 2.1
810	1909.800	31.1	30.3	1.288	33.0	+ 1.9

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

Emission Measurment (Mh)	=	94.8	dB(uV)
Substitution Measurement (Msh)	=	-72.2	dB(uV)
Supplied Power to Substitution Antenna	=	-5.0	dBm
+) Gain of Substitution Antenna	=	14.3	dB
Result (EIRPh)	=	31.9	dBm = 1.549 W

Minimum Margin: 33.0 - 31.9 = 1.1 (dB)

NOTE : Setting of measuring instrument(s) :

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

7.3 Modulation Characteristics (§2.1047)

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

For the limits, ☐ - **Passed** ☐ - **Failed** ☐ - **Not judged**

7.4 Occupied Bandwidth (§2.1049)

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

For the limits, ☒ - **Passed** ☐ - **Failed** ☐ - **Not judged**

7.4.1 Worst Point and Measurement Uncertainty

The 99% Bandwidth is	245.3	kHz	at	1880.000 MHz
The 26dB Bandwidth is	319.6	kHz	at	1909.800 MHz

Uncertainty of Measurement Results +/-0.9 %(2σ)

Remarks : _____

7.4.2 Test Site

KITA-KANSAI Testing Center

Test site : SAITO

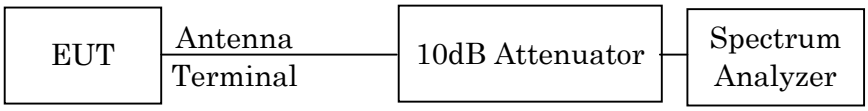
☐ - Anechoic chamber (A1) ☐ - Measurement room (M1)
☐ - Measurement room (M2) ☐ - Measurement room (M3)
☐ - Shielded room (S1) ☐ - Shielded room (S2)
☐ - Shielded room (S3) ☒ - Shielded room (S4)

7.4.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Spectrum Analyzer	E4446A	Agilent	A-39	2012/9	1 Year
Attenuator	54A-10	Weinschel	D-28	2012/9	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2013/7	1 Year

7.4.4 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

Res. Bandwidth	10 kHz
Video Bandwidth	30 kHz
Span	1 MHz
Sweep Time	AUTO
Trace	Maxhold

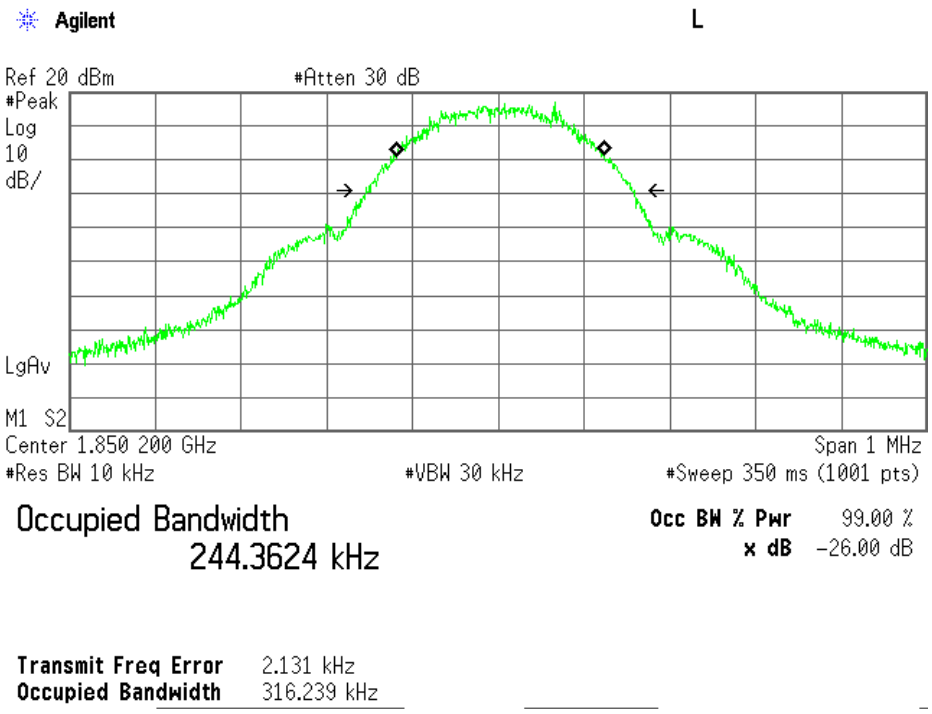
7.4.5 Test Data

The resolution bandwidth was set to about 1% of emission bandwidth, -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

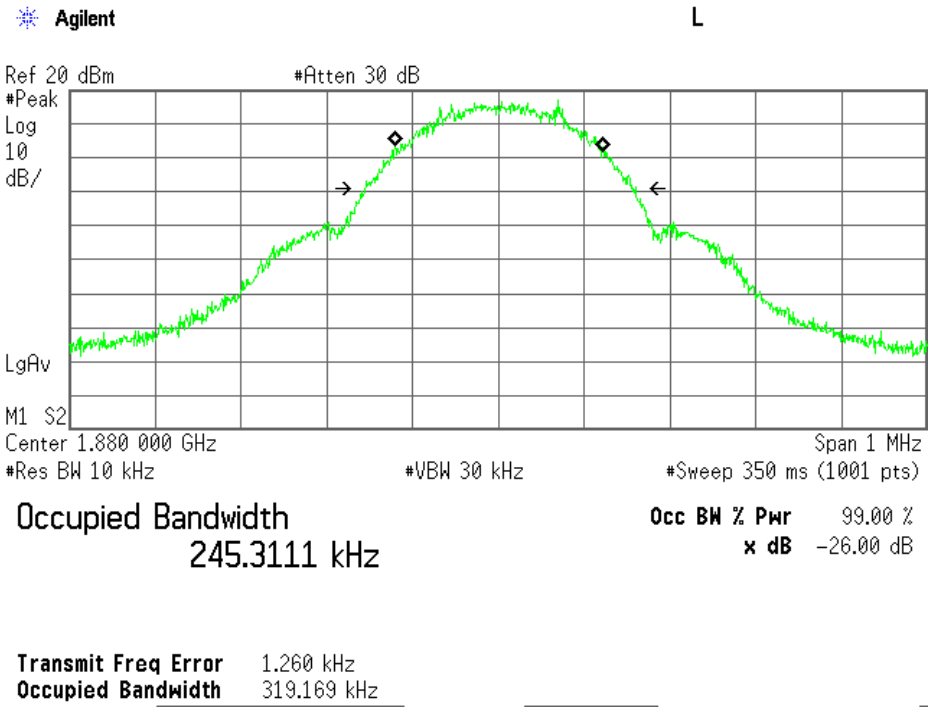
Test Date : September 13, 2013
Temp.:28°C, Humi:60%

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-26dBc Bandwidth (kHz)
512	1850.200	244.4	316.2
661	1880.000	245.3	319.2
810	1909.800	243.4	319.6

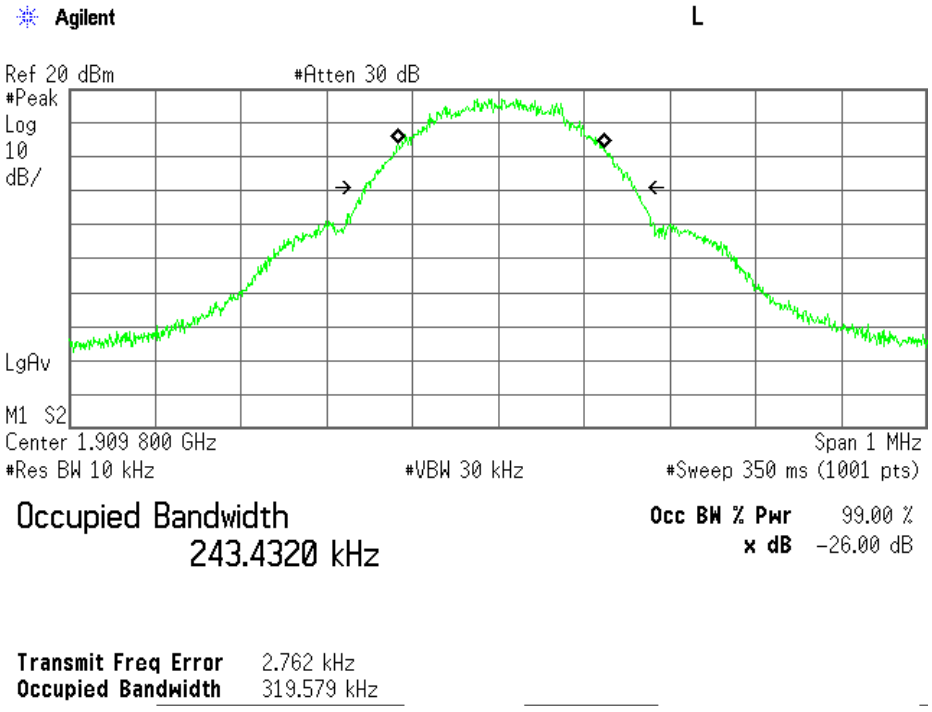
Low Channel



Middle Channel



High Channel



7.5 Spurious Emissions at Antenna Terminals (§2.1051)

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

For the limits, ☒ **- Passed** ☐ **- Failed** ☐ **- Not judged**

7.5.1 Worst Point and Measurement Uncertainty

Min. Limit Margin >32.0 dB at 19098.000 MHz

Uncertainty of Measurement Results

9 kHz – 1GHz	+/-1.0	dB(2σ)
1GHz – 18GHz	+/-1.2	dB(2σ)
18GHz – 40GHz	+/-1.6	dB(2σ)

Remarks :

7.5.2 Test Site

KITA-KANSAI Testing Center

Test site : SAITO

☐ - Anechoic chamber (A1) ☐ - Measurement room (M1)
☐ - Measurement room (M2) ☐ - Measurement room (M3)
☐ - Shielded room (S1) ☐ - Shielded room (S2)
☐ - Shielded room (S3) ☒ - Shielded room (S4)

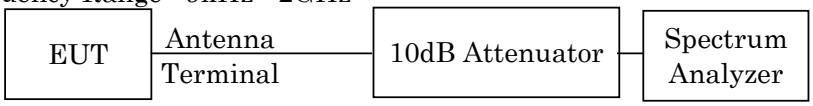
7.5.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Spectrum Analyzer	E4446A	Agilent	A-39	2012/9	1 Year
Attenuator	54A-10	Weinschel	D-28	2012/9	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2013/7	1 Year
HPF	HPM13899	MICRO-TRONICS	D-96	2013/2	1 Year

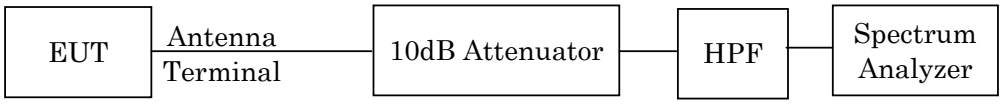
7.5.4 Test Method and Test Setup (Diagrammatic illustration)

The Antenna Conducted Emission was with a spectrum analyzer. The test system is shown as follows:

a) Frequency Range : 9kHz - 2GHz



b) Frequency Range : 2GHz - 20GHz



The setting of the spectrum analyzer are shown as follows:

Frequency Range	9 kHz - 150 kHz	150 kHz - 30 MHz	30 MHz - 20 GHz
Res. Bandwidth	200 Hz	10 kHz	1 MHz
Video Bandwidth	1 kHz	30 kHz	3 MHz
Sweep Time	AUTO	AUTO	AUTO
Trace	Maxhold	Maxhold	Maxhold

7.5.5 Test Data

(GSM-PCS1900)

Test Date: September 13, 2013
Temp.: 28 °C, Humi: 60 %

CH	Transmitting Frequency [MHz]	Measured Frequency [MHz]	Corr. Factor [dB]	Meter Readings [dBm]	Limits [dBm]	Results [dBm]	Margin [dB]	Remarks
512	1850.200	3700.400	11.4	-59.0	-13.0	-47.6	+34.6	C
		5550.600	11.6	< -63.0	-13.0	< -51.4	> +38.4	C
		7400.800	12.0	< -63.0	-13.0	< -51.0	> +38.0	C
		9251.000	12.7	< -63.0	-13.0	< -50.3	> +37.3	C
		11101.200	13.1	< -63.0	-13.0	< -49.9	> +36.9	C
		12951.400	14.9	< -63.0	-13.0	< -48.1	> +35.1	C
		14801.600	15.6	< -63.0	-13.0	< -47.4	> +34.4	C
		16651.800	16.6	< -63.0	-13.0	< -46.4	> +33.4	C
		18502.000	17.6	< -63.0	-13.0	< -45.4	> +32.4	C
661	1880.000	3760.000	11.4	-59.2	-13.0	-47.8	+34.8	C
		5640.000	11.6	< -63.0	-13.0	< -51.4	> +38.4	C
		7520.000	12.1	< -63.0	-13.0	< -50.9	> +37.9	C
		9400.000	12.8	< -63.0	-13.0	< -50.2	> +37.2	C
		11280.000	13.2	< -63.0	-13.0	< -49.8	> +36.8	C
		13160.000	15.0	< -63.0	-13.0	< -48.0	> +35.0	C
		15040.000	15.8	< -63.0	-13.0	< -47.2	> +34.2	C
		16920.000	16.7	< -63.0	-13.0	< -46.3	> +33.3	C
		18800.000	17.8	< -63.0	-13.0	< -45.2	> +32.2	C
810	1909.800	3819.600	11.4	-58.6	-13.0	-47.2	+34.2	C
		5729.400	11.6	< -63.0	-13.0	< -51.4	> +38.4	C
		7639.200	12.2	< -63.0	-13.0	< -50.8	> +37.8	C
		9549.000	12.8	< -63.0	-13.0	< -50.2	> +37.2	C
		11458.800	13.2	< -63.0	-13.0	< -49.8	> +36.8	C
		13368.600	15.1	< -63.0	-13.0	< -47.9	> +34.9	C
		15278.400	15.9	< -63.0	-13.0	< -47.1	> +34.1	C
		17188.200	16.9	< -63.0	-13.0	< -46.1	> +33.1	C
		19098.000	18.0	< -63.0	-13.0	< -45.0	> +32.0	C

Calculated result at 19098.0 MHz, as the worst point shown on underline:

	Corr. Factor	=	18.0 dB
+)	Meter Reading	=	<-63.0 dBm
	Result	=	<-45.0 dBm

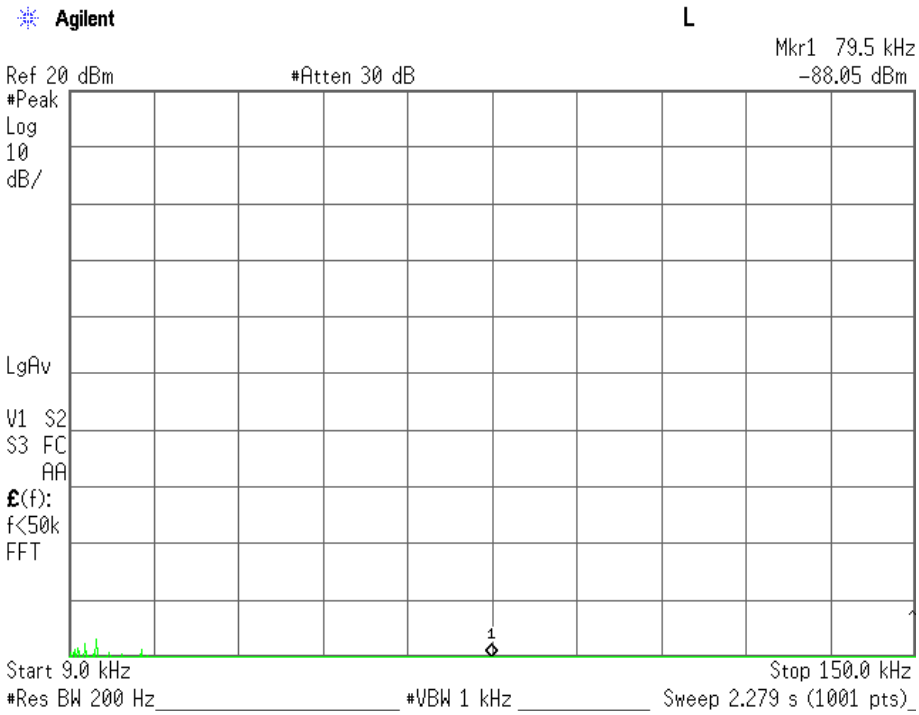
Minimum Margin: -13.0 - (<-45.0) = >32.0 (dB)

NOTES

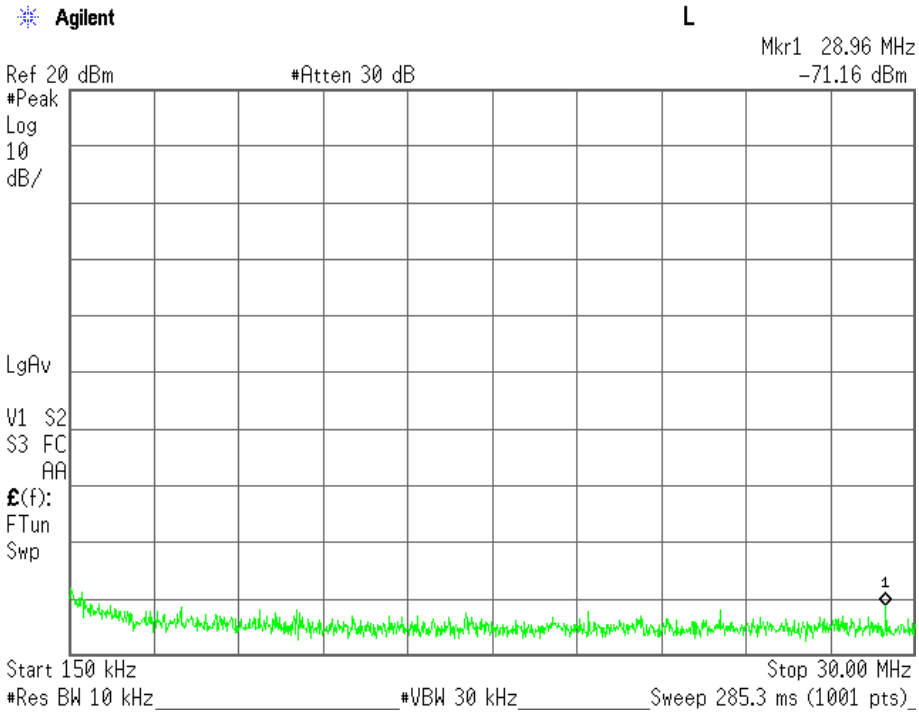
1. The spectrum was checked from 9 kHz to 20 GHz.
2. Applied limits : -13.0 [dBm] = 10log(TP[mW]) - (43 + 10log(tp[W])) = 10log(TP[mW]) - (43 + (10 log(TP[mW]) - 30))
   where, tp[W] = TP[mW] / 1000 : Transmitter power at anttena terminal
3. The correction factor is shown as follows:
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. [dB] (9 kHz - 2 GHz)
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. + High Pass Filter Loss (D-96) [dB] (over 2 GHz)
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. Setting of measuring instrument(s) :

	Detector Function	RES B.W.	V.B.W.	Sweep Time
A	Peak	200 Hz	1 kHz	AUTO
B	Peak	10 kHz	30 kHz	AUTO
C	Peak	1 MHz	3 MHz	AUTO

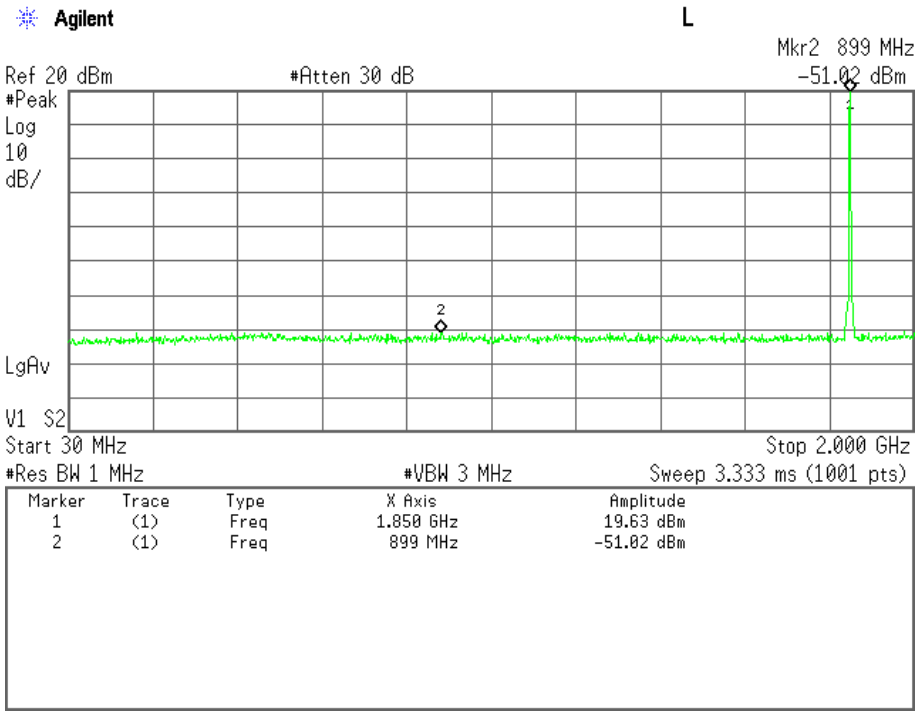
Low Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



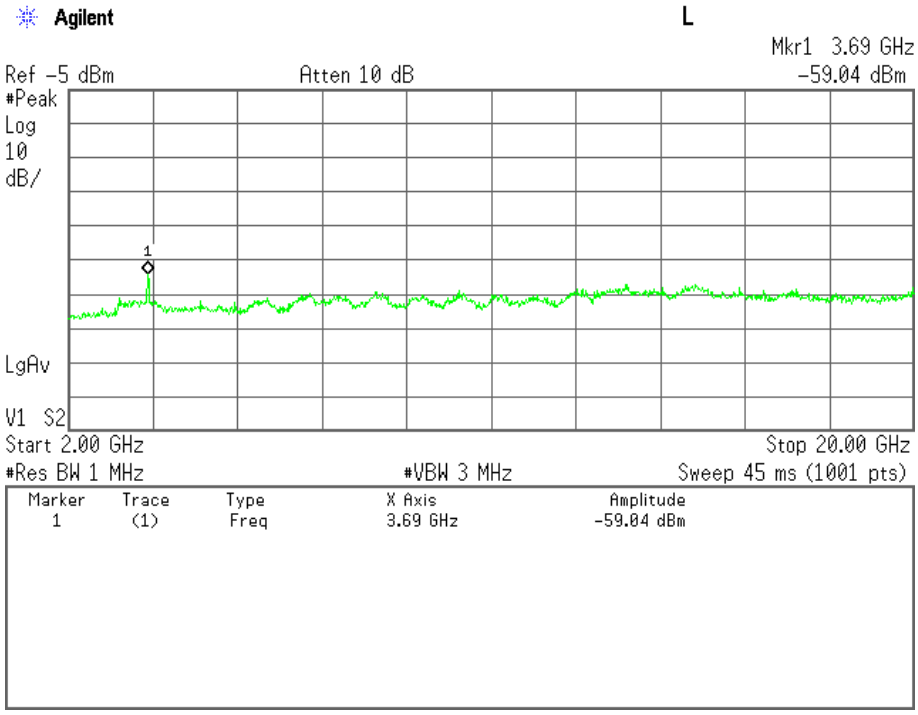
Low Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



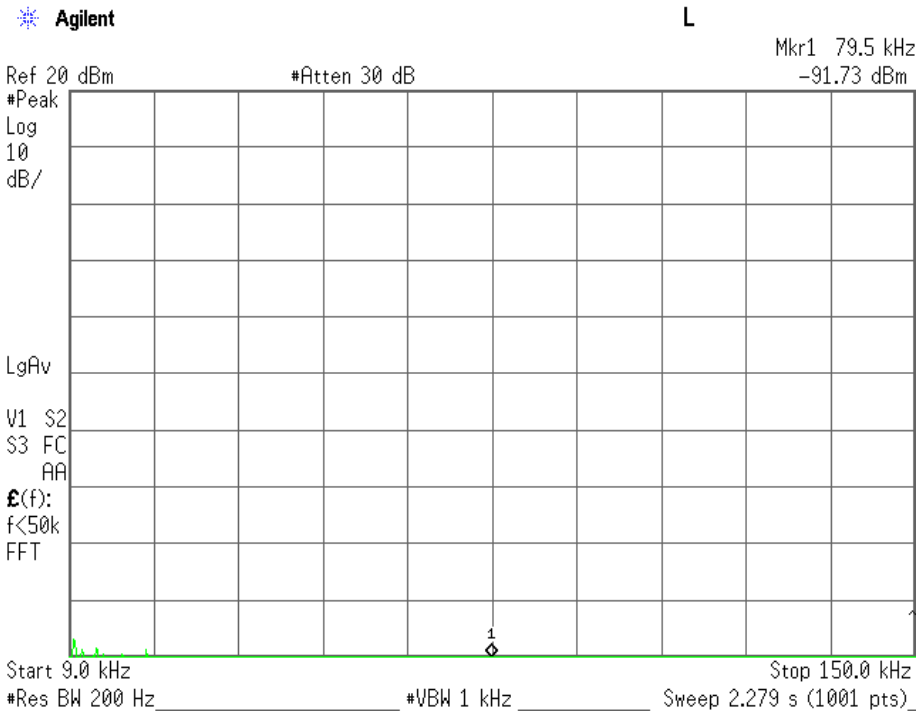
Low Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



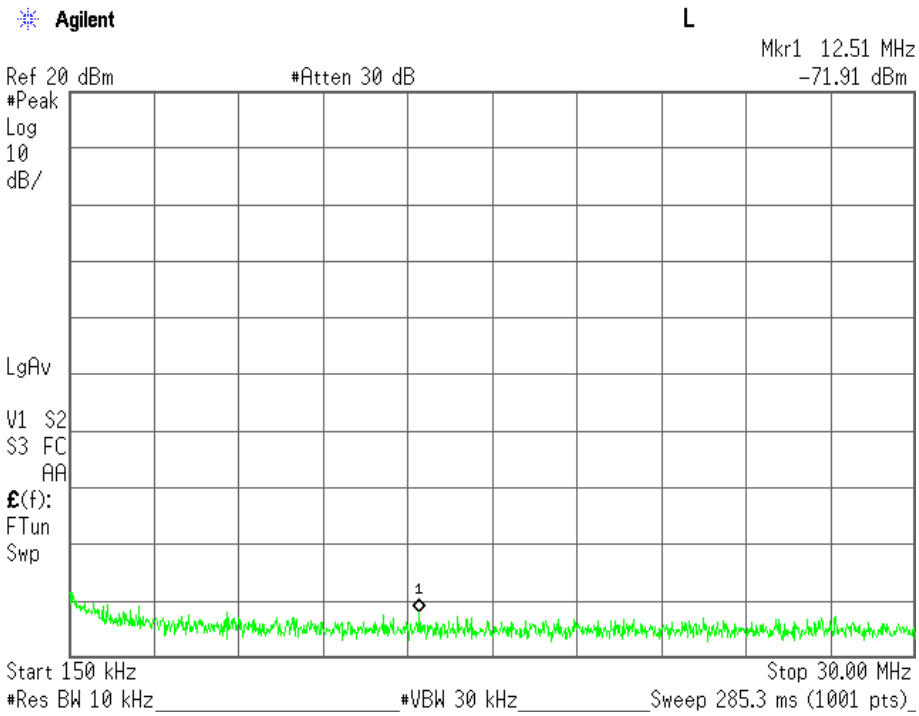
Low Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



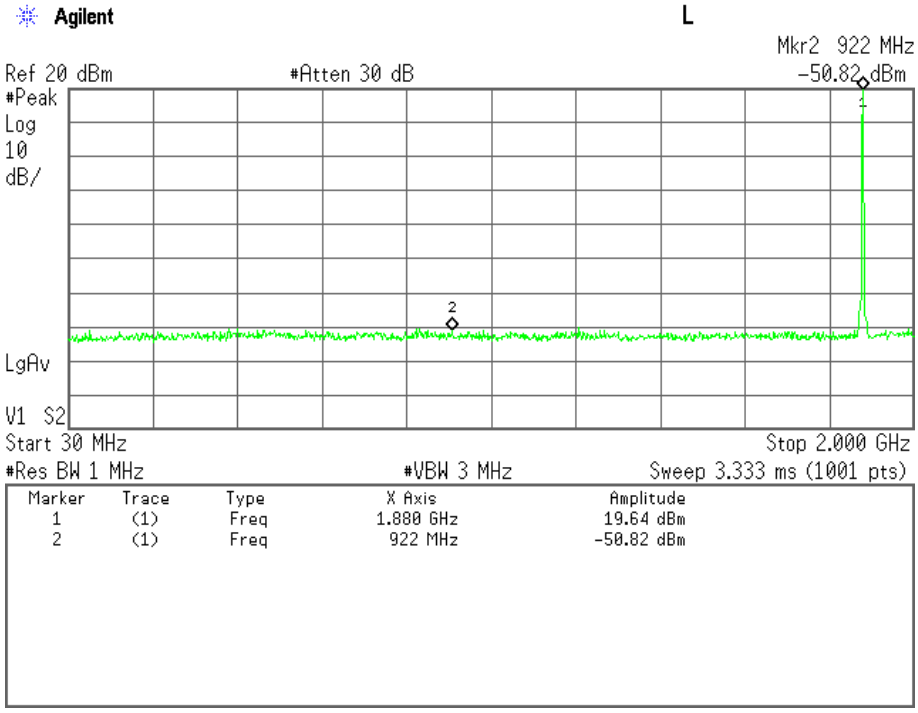
Middle Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



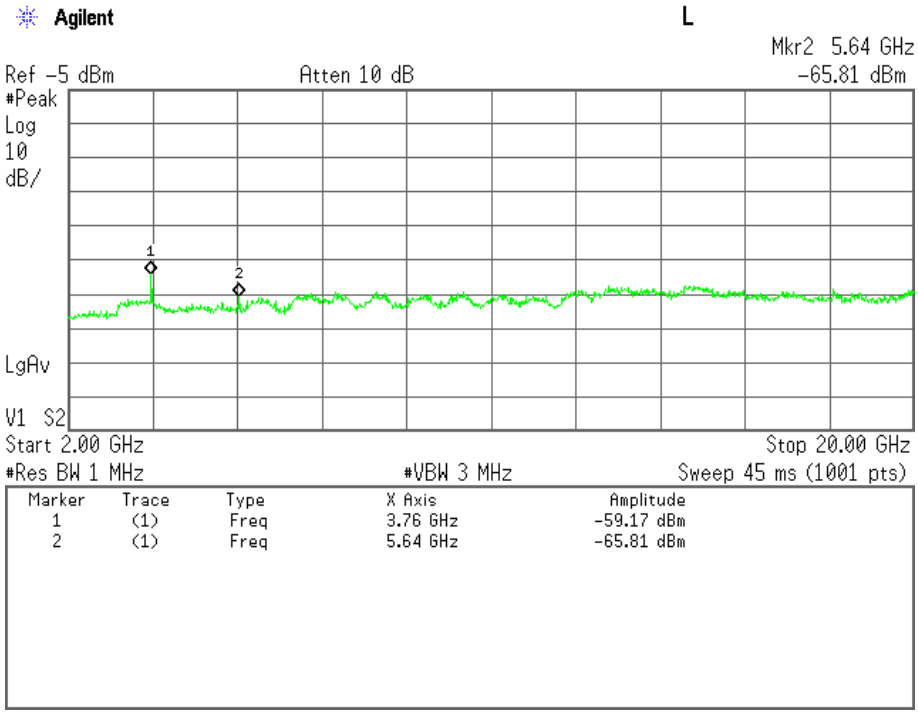
Middle Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



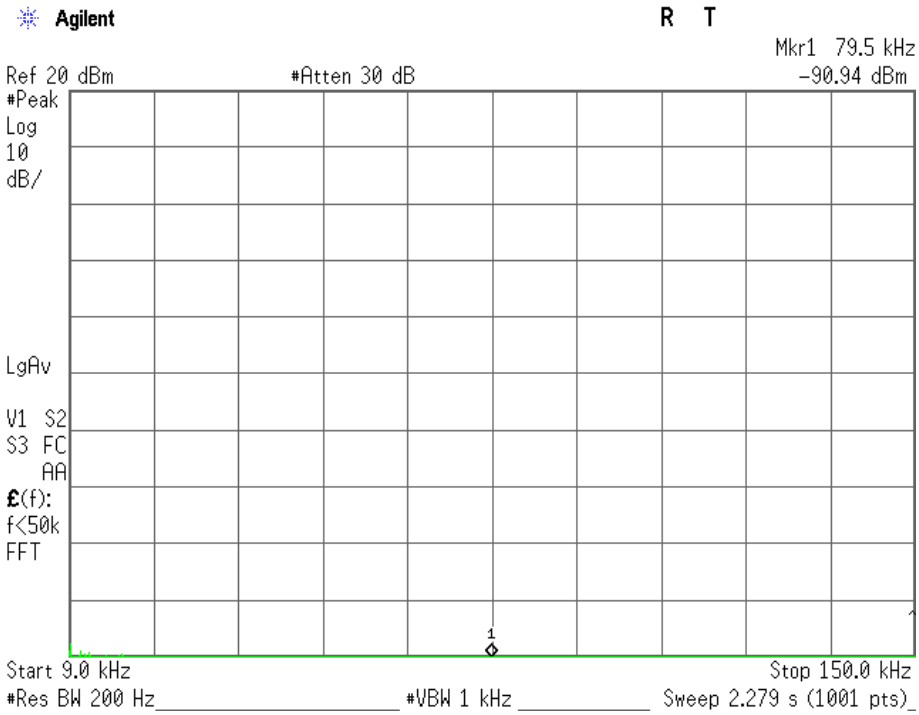
Middle Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



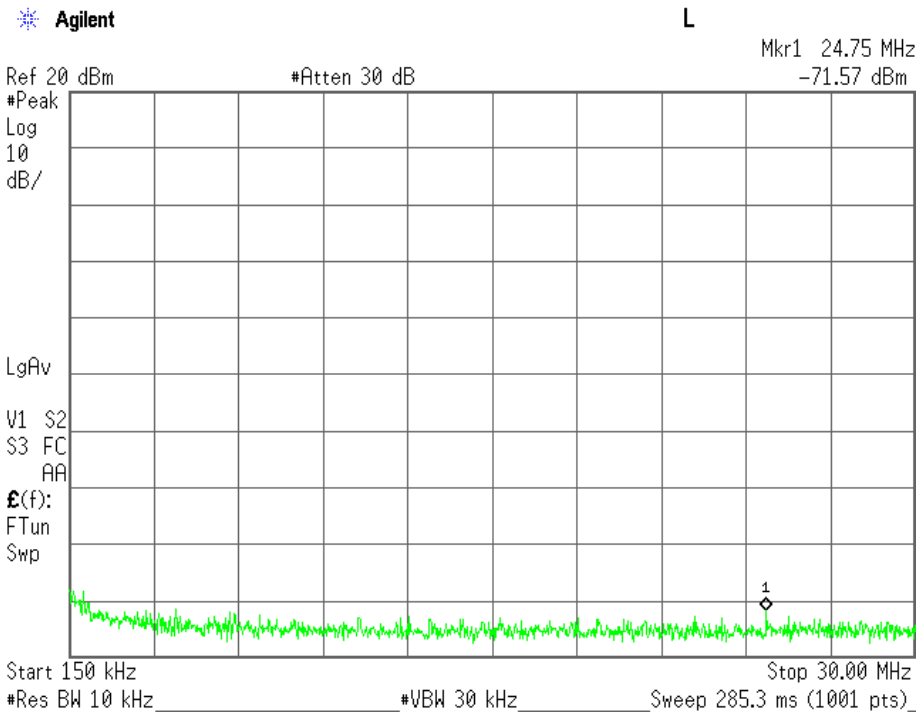
Middle Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



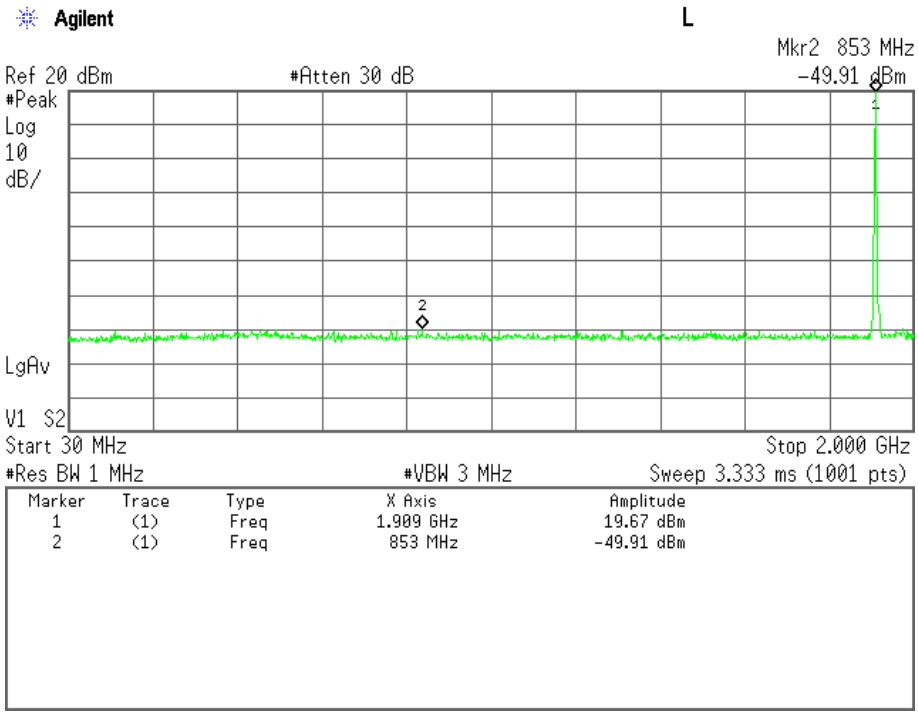
High Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



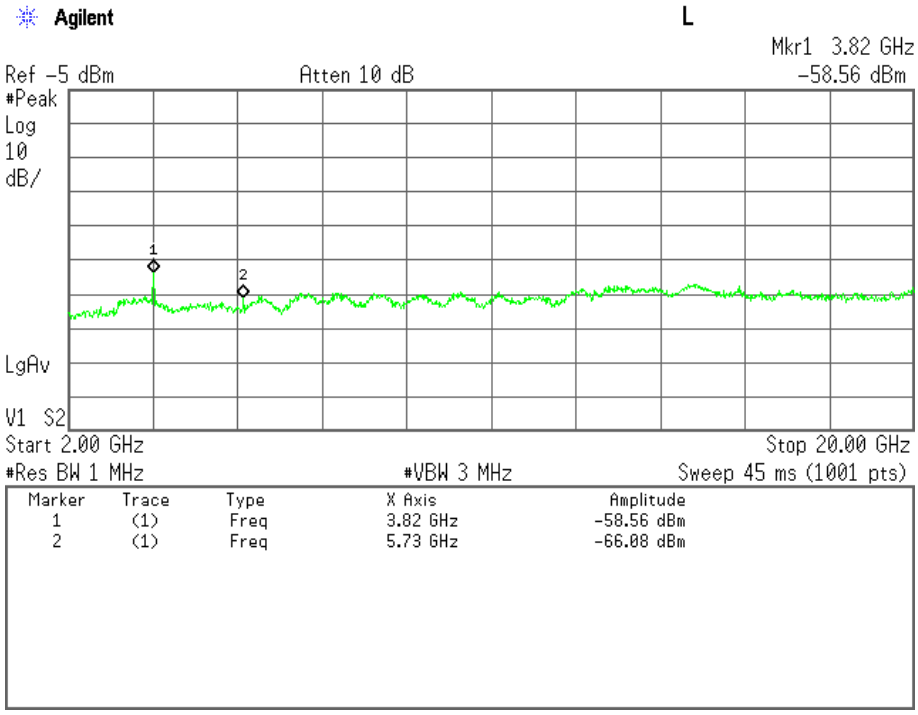
High Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



High Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



High Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



7.6 Band-Edge Emission (§2.1051)

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

For the limits, ☒ **- Passed** ☐ **- Failed** ☐ **- Not judged**

7.6.1 Worst Point and Measurement Uncertainty

The Band-Edge level is -15.9 dBm at 1850.0 MHz

Uncertainty of Measurement Results +/-1.2 dB(2σ)

Remarks :

7.6.2 Test Site

KITA-KANSAI Testing Center

Test site : SAITO

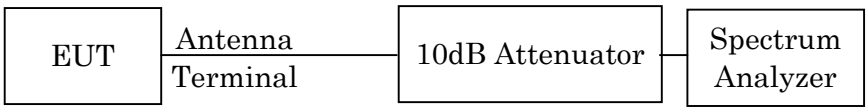
☐ - Anechoic chamber (A1)
☐ - Measurement room (M1)
☐ - Measurement room (M2)
☐ - Measurement room (M3)
☐ - Shielded room (S1)
☐ - Shielded room (S2)
☐ - Shielded room (S3)
☒ - Shielded room (S4)

7.6.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Spectrum Analyzer	E4446A	Agilent	A-39	2012/9	1 Year
Attenuator	54A-10	Weinschel	D-28	2012/9	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2013/7	1 Year

7.6.4 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

TX Frequency	1850.20 MHz / 1909.80 MHz
Band-Edge Frequency	1850.00 MHz / 1910.00 MHz
Res. Bandwidth	3 kHz
Video Bandwidth	10 kHz
Span	2 MHz
Sweep Time	AUTO
Trace	Maxhold

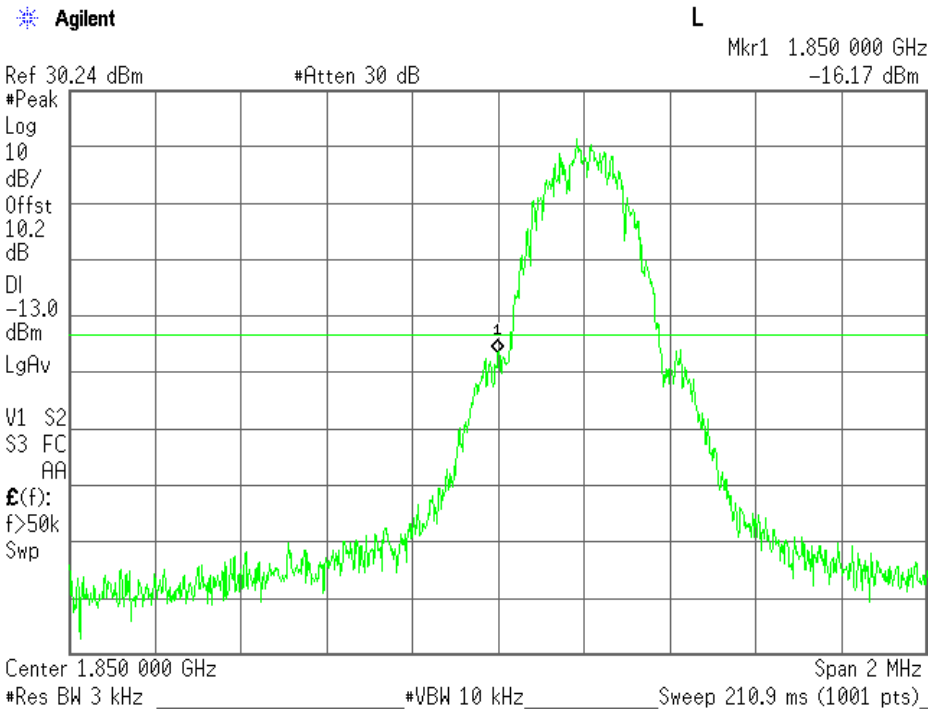
7.6.5 Test Data

Test Date : September 13, 2013
Temp.:28°C, Humi:60%

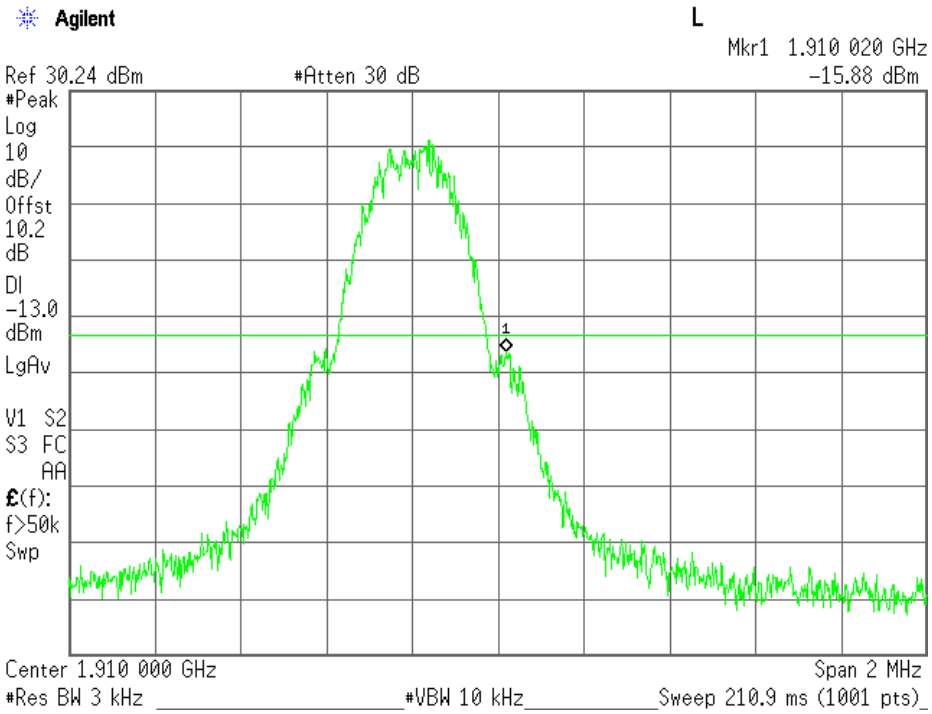
(GSM-PCS1900)

Channel	Frequency (MHz)	Band-Edge Frequency (MHz)	Band-Edge Level (dBm)
512	1850.200	1850.00	-16.2
810	1909.800	1910.00	-15.9

Low Channel, Band-Edge Emission



High Channel, Band-Edge Emission



7.7 Field Strength of Spurious Radiation (§2.1053)

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

For the limits, ☒ - **Passed** ☐ - **Failed** ☐ - **Not judged**

7.7.1 Worst Point and Measurement Uncertainty

Min. Limit Margin 19.6 dB at 7639.200 MHz

Uncertainty of Measurement Results 30 MHz – 1000 MHz +/-1.4 dB(2σ)
above 1 GHz +/-2.2 dB(2σ)

Remarks : _____

7.7.2 Test Site

KITA-KANSAI Testing Center SAITO EMC Branch

☐ - Anechoic chamber A1 ☒ - Anechoic chamber A2

7.7.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Test Receiver	ESU 26	Rohde & Schwarz	A-6	2013/4	1 Year
Signal Generator	E8257D	Agilent	B-39	2013/8	1 Year
Power Meter	N1911A	Agilent	B-63	2013/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2013/7	1 Year
Horn Antenna(TX)	91889-2	EATON	C-40-2	2013/7	1 Year
Horn Antenna	91888-2	EATON	C-41-1	2013/6	1 Year
Horn Antenna(RX)	91889-2	EATON	C-41-2	2013/6	1 Year
Horn Antenna	3160-04	EMCO	C-55	2013/7	1 Year
Horn Antenna	3160-05	EMCO	C-56	2013/7	1 Year
Horn Antenna	3160-06	EMCO	C-57	2013/7	1 Year
Horn Antenna	3160-07	EMCO	C-58	2013/7	1 Year
Horn Antenna	3160-08	EMCO	C-59	2013/7	1 Year
Horn Antenna)	3160-09	EMCO	C-48	2013/7	1 Year
RF Cable(TX)	SUCOFLEX102E	SUHNER	C-70	2012/11	1 Year
RF Cable(RX)	SUCOFLEX102E	SUHNER	C-75	2013/2	1 Year
RF Cable(RX)	SUCOFLEX104	SUHNER	C-66	2013/2	1 Year
RF Cable(RX)	SUCOFLEX104	SUHNER	C-67	2013/2	1 Year
RF Cable(RX)	SUCOFLEX102EA	SUHNER	C-69	2013/2	1 Year
Attenuator(TX)	2-10	Weinschel	D-40	2012/9	1 Year
Attenuator(RX)	2-10	Weinschel	D-79	2012/11	1 Year
Attenuator(RX)	54-10	Weinschel	D-29	2012/9	1 Year
Pre-Amplifier	WJ-6611-513	Watkins Johnson	A-23	2013/2	1 Year
Pre-Amplifier	WJ-6882-824	Watkins Johnson	A-21	2013/2	1 Year
Pre-Amplifier	DBL-0618N515	DBS Microwave	A-33	2013/2	1 Year
Pre-Amplifier	BZ1840LD1	B&Z	A-29	2013/2	1 Year
HPF	HPM13899	MICRO-TRONICS	D-96	2013/2	1 Year

7.7.4 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 1.0 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 7.2.4. 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.

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

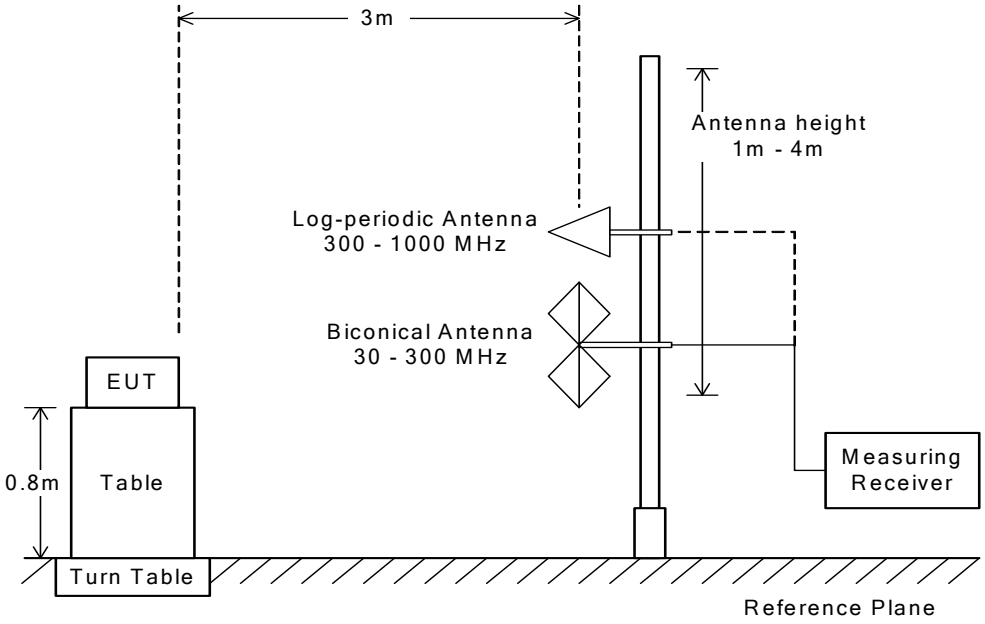
$$erp = eirp - Gd \quad \text{----(Eq.2)}$$

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)

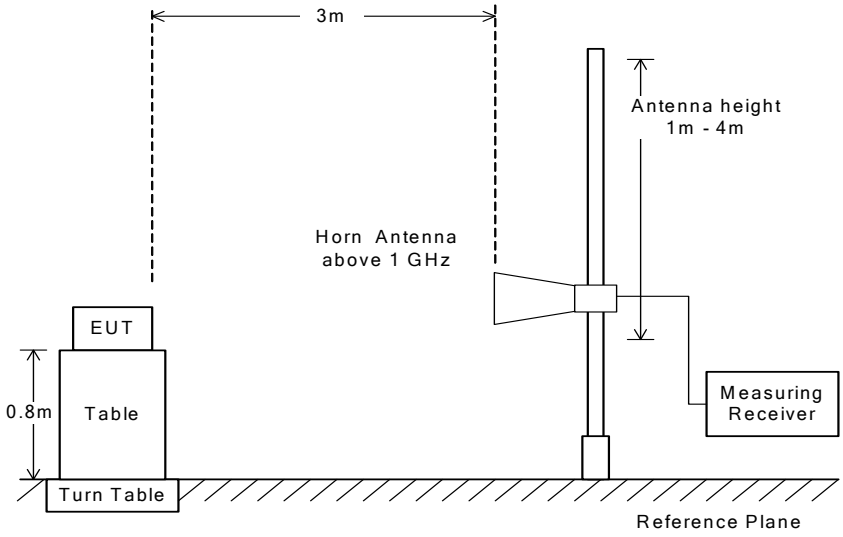
$$eirp = \frac{(de)^2}{30} = \frac{3}{10}e^2$$
$$\therefore 10\log(eirp) = 20\log(e) + 10\log(3/10) = 20\log(e) - 5.23$$
$$10\log(eirp) = EIRP[dBm] - 30$$
$$20\log(e) = E[dB(\mu V/m)] - 120$$
$$\therefore EIRP = E - 120 + 30 - 5.23 = E - 95.23$$
$$\therefore ERP[dBm] = EIRP - 2.15 = E - 97.38$$

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 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

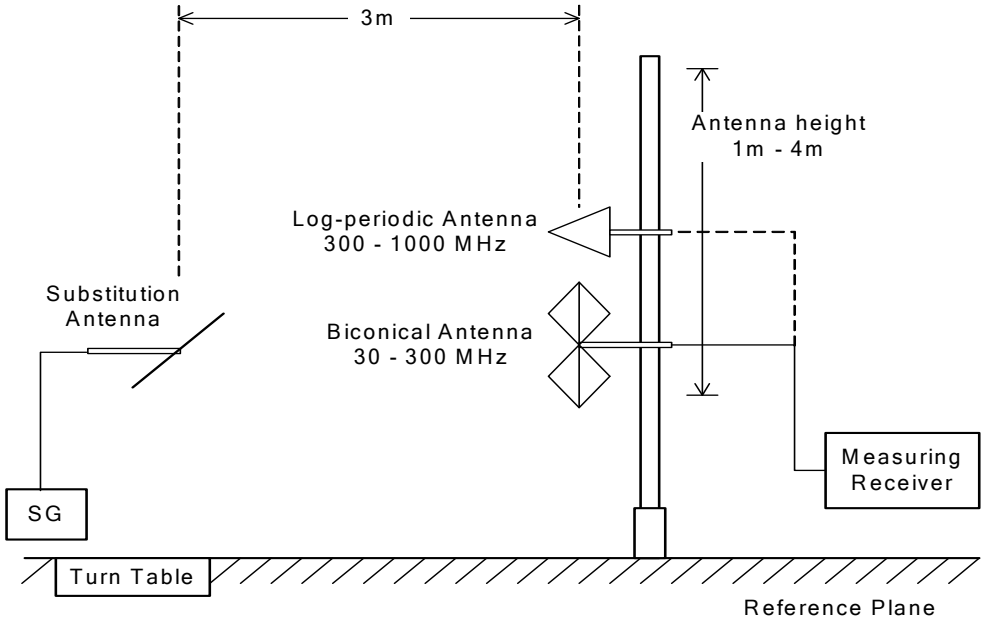


Radiated Emission above 1 GHz



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

Radiated Emission 30 to 1000 MHz – Substitution Method



7.7.5 Test Data

(GSM-PCS1900)

Test Date: September 19, 2013
Temp.: 25 °C, Humi: 59 %

Test Configuration : Single Unit

CH	Transmitting Frequency [MHz]	Measured Frequency [MHz]	ERP [dBm] Hori.	ERP [dBm] Vert.	Limits [dBm]	Margin [dB]	Remarks
512	1850.200	3700.400	-54.7	-55.5	-13.0	+41.7	C
		5550.600	-43.5	-42.7	-13.0	+29.7	C
		7400.800	-38.4	-39.3	-13.0	+25.4	C
		9251.000	< -41.1	< -41.1	-13.0	> +28.1	C
		11101.200	< -40.0	< -40.0	-13.0	> +27.0	C
		12951.400	< -36.1	< -36.1	-13.0	> +23.1	C
		14801.600	< -36.6	< -36.6	-13.0	> +23.6	C
		16651.800	< -47.7	< -47.7	-13.0	> +34.7	C
		18502.000	< -39.3	< -39.3	-13.0	> +26.3	C
661	1880.000	3760.000	-55.9	-57.3	-13.0	+42.9	C
		5640.000	-44.6	-44.8	-13.0	+31.6	C
		7520.000	-36.8	-37.8	-13.0	+23.8	C
		9400.000	< -40.9	< -40.9	-13.0	> +27.9	C
		11280.000	< -40.3	< -40.3	-13.0	> +27.3	C
		13160.000	< -36.0	< -36.0	-13.0	> +23.0	C
		15040.000	< -36.9	< -36.9	-13.0	> +23.9	C
		16920.000	< -47.8	< -47.8	-13.0	> +34.8	C
		18800.000	< -39.1	< -39.1	-13.0	> +26.1	C
810	1909.800	3819.600	-52.7	-53.5	-13.0	+39.7	C
		5729.400	-44.8	-47.1	-13.0	+31.8	C
		7639.200	-32.6	-34.6	-13.0	+19.6	C
		9549.000	< -40.7	< -40.7	-13.0	> +27.7	C
		11458.800	< -40.5	< -40.5	-13.0	> +27.5	C
		13368.600	< -35.9	< -35.9	-13.0	> +22.9	C
		15278.400	< -37.1	< -37.1	-13.0	> +24.1	C
		17188.200	< -48.1	< -48.1	-13.0	> +35.1	C
		19098.000	< -38.9	< -38.9	-13.0	> +25.9	C

Calculated result at 7639.2 MHz, as the worst point shown on underline:
Minimum Margin: -13.0 - (-32.6) = 19.6 (dB)

NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 30 MHz to 20 GHz.
3. All emissions not reported were more than 20 dB below the applied limits.
4. 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 anttena terminal
5. The symbol of "<" means "or less".
6. The symbol of ">" means "more than".
7. 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

7.8.1 Worst Point and Measurement Uncertainty

The Frequency Stability level is -0.03 ppm at 1880.000 MHz

Uncertainty of Measurement Results +/-0.02 ppm(2σ)

Remarks :

7.8.2 Test Site

KITA-KANSAI Testing Center

Test site : SAITO ☒ - Environment Testing Room
MINOH ☐ - Environment Testing Room

7.8.3 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Universal Radio Communication Tester	CMU200	Rohde & Schwarz	B-21	2013/4	1 Year
DC Voltage Meter	2011-39	YEW	B-33	2013/4	1 Year
Environmental Chamber	SH-641	ESPEC	F-32	2013/7	1 Year
DC Power Supply	NL035-10	TAKASAGO	F-4	N/A	N/A

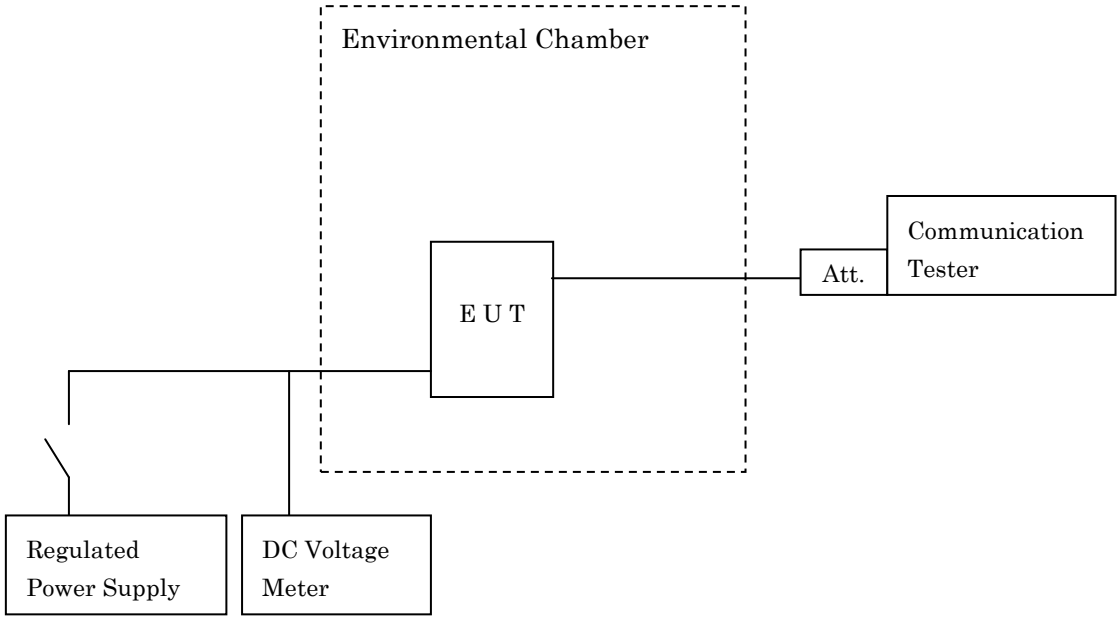
7.8.4 Test Method and Test Setup (Diagrammatic illustration)

Frequency Stability versus Temperature

The EUT was placed in an environmental chamber and was tested in the range from –30 to +50 degrees Celsius. The EUT was stabilized at each temperature. The power (4.0VDC) supplied was applied to the transmitter and allowed to stabilize for 10 minutes. The transmitting frequency was measured at startup and 2 minutes, 5 minutes and 10 minutes after startup. This procedure was repeated from –30 to +50 degrees Celsius at the interval of 10 degrees.

Frequency Stability versus Power Supply Voltage

The EUT was placed in an environmental chamber and was tested at the temperature of +20 degrees Celsius. The EUT was stabilized at the temperature. The power (4.0VDC) and the power (3.7VDC, the ending voltage) was applied to the EUT allowed to stabilize for 10 minutes. The transmitting frequency was measured at startup and 2 minutes, 5 minutes and 10 minutes after startup.



7.8.5 Test Data

(GSM-PCS1900)

Test Date: September 20, 2013
- September 24, 2013

1. Frequency Stability Measurement versus Temperature

Transmitting Frequency : 1880.000 MHz (661 ch)
DC Supply Voltage : 4.0 VDC

Ambient Temperature [°C]	Deviation [ppm] Startup	2 minutes	5 minutes	10 minutes	Limits [ppm]	Margin [ppm]
-30	**- 0.03**	- 0.02	- 0.01	- 0.01	N/A	N/A
-20	- 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A
-10	- 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A
0	+ 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A
10	- 0.02	- 0.01	- 0.01	- 0.01	N/A	N/A
20	**- 0.03**	- 0.01	- 0.01	- 0.01	N/A	N/A
30	+ 0.02	- 0.01	- 0.01	- 0.01	N/A	N/A
40	- 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A
50	- 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A

2. Frequency Stability Measurement versus Power Supply Voltage

Transmitting Frequency : 1880.000 MHz (661 ch)
Ambient Temperature: : 20 °C

DC Supply Voltage [V]	Deviation [ppm] Startup	2 minutes	5 minutes	10 minutes	Limits [ppm]	Margin [ppm]
4.0	**- 0.03**	- 0.01	- 0.01	- 0.01	N/A	N/A
3.7(Ending)	- 0.02	- 0.01	- 0.01	- 0.01	N/A	N/A

Test condition example as the maximum deviation point shown on underline:
Ambient Temperature : -30 °C / Startup
DC Supply Voltage : 4 VDC

NOTE : The measurement were made after all of components of the oscillator sufficiently stabilized at each temperature.