JQA File No. : KL80160286
Issue Date : August 9, 2016

TEST REPORT

Applicant	:	SHARP CORPORATION, Consumer Electronics Company, Communication Systems Division
Address	:	2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
Products	:	Cellular Phone
Model No.	:	HR241
Serial No.	:	004401/11/587375/0 004401/11/587367/7
FCC ID	:	APYHRO00241
Test Standard	:	CFR 47 FCC Rules and Regulations Part 24
Test Results	:	**Passed**
Date of Test	:	July 17 ~ August 3, 2016

ilac-MRA VLAC Lab Accreditation VLAC-001-2

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
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, Consumer Electronics Company, Communication Systems Division 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
2.	Products	:	Cellular Phone
3.	Model No.	:	HR241
4.	Serial No.	:	004401/11/587375/0 004401/11/587367/7
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	June, 2016
7.	Power Rating	:	4.0VDC (Lithium-ion Battery SHBGC1 1800mAh)
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	:	245KGXW
12.	Max. RF Output Power	:	1.413 W(EIRP)
13.	Category	:	Broadband PCS
14.	EUT Authorization	:	Certification
15.	Received Date of EUT	:	July 14, 2016

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:

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

Tested by:

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, 2016)
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	Cellular Phone	Sharp	HR241	004401/11/587375/0 *1) 004401/11/587367/7 *2)	APYHRO00241
B	AC Adapter	Sharp	SHCEJ1	--	N/A
C	Earphone (Including Conversion cable)	Softbank	ZTCAA1	--	N/A

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

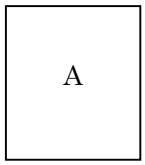
The auxiliary equipment used for testing :
None

Type of Cable:

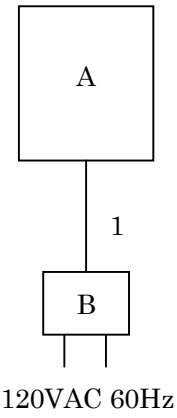
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	USB conversion cable	--	--	NO	NO	1.5
2	Earphone Cable	--	--	NO	NO	0.6

6.2 Test Arrangement (Drawings)

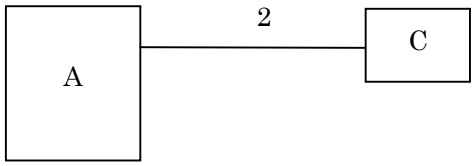
a) Single Unit



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 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

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 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	Passed	-
Spurious Emissions at Antenna Terminals	Section 24.238	Section 7.5	Passed	-
Band-Edge Emission	Section 24.238	Section 7.6	Passed	-
Field Strength of Spurious Radiation	Section 24.238	Section 7.7	Passed	-
Frequency Stability	Section 24.235	Section 7.8	Passed	-

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 1006.9 mW at 1909.800 MHz

Uncertainty of Measurement Results ± 0.9 dB(2σ)

Remarks : _____

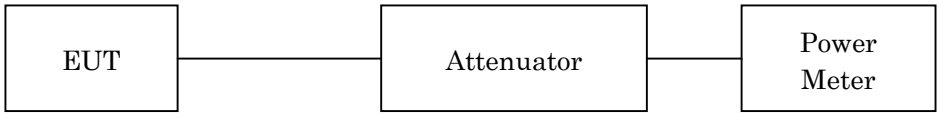
7.1.2 Test Instruments

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	2016/08/16

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: July 17, 2016
Temp.: 26 °C, Humi: 68 %

Transmitting Frequency		Correction Factor	Meter Reading (Peak)	Results (Peak)	
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]
512	1850.200	20.32	9.40	29.72	937.6
661	1880.000	20.32	9.46	29.78	950.6
810	1909.800	20.32	9.71	30.03	1006.9

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

	Correction Factor	=	20.32	dB
+)	Meter Reading	=	9.71	dBm
	Result	=	30.03	dBm = 1006.9 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 1.5 dB at 1909.800 MHz

Uncertainty of Measurement Results ± 1.8 dB(2σ)

Remarks : The maximum EIRP is 1.413 W at 1909.8 MHz. Y-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	2017/04/27
Signal Generator	E8257D	MY45140309 (B-39)	Agilent	2016/08/10
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	2016/11/19
Attenuator (RX)	2-10	BF7557 (D-80)	Weinschel	2016/11/19
RF Cable (RX)	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2017/01/06
RF Cable (TX)	SUCOFLEX102E	6683/2E (C-70)	HUBER+SUHNER	2016/11/19

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

7.2.3 Test Method and Test Setup (Diagrammatic illustration)

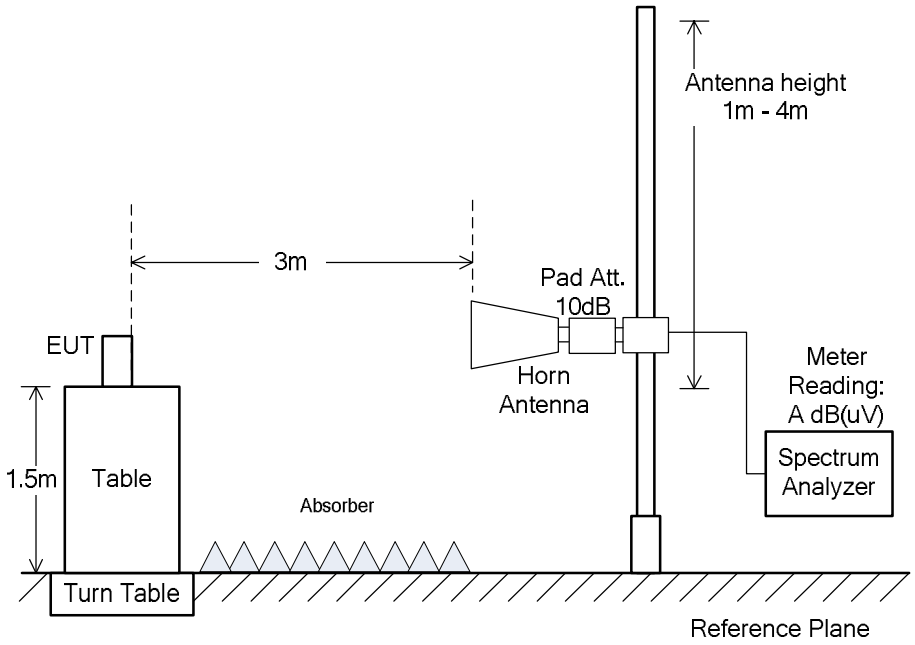
Step 1:
In order to obtain the maximum emission, the EUT was placed at the height 1.5 m on the non-conducted support and was varying at three orthogonal axes, at the distance 3 m from the receiving antenna and rotated around 360 degrees.
The receiving antenna height was varied from 1 m to 4 m.
The EUT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

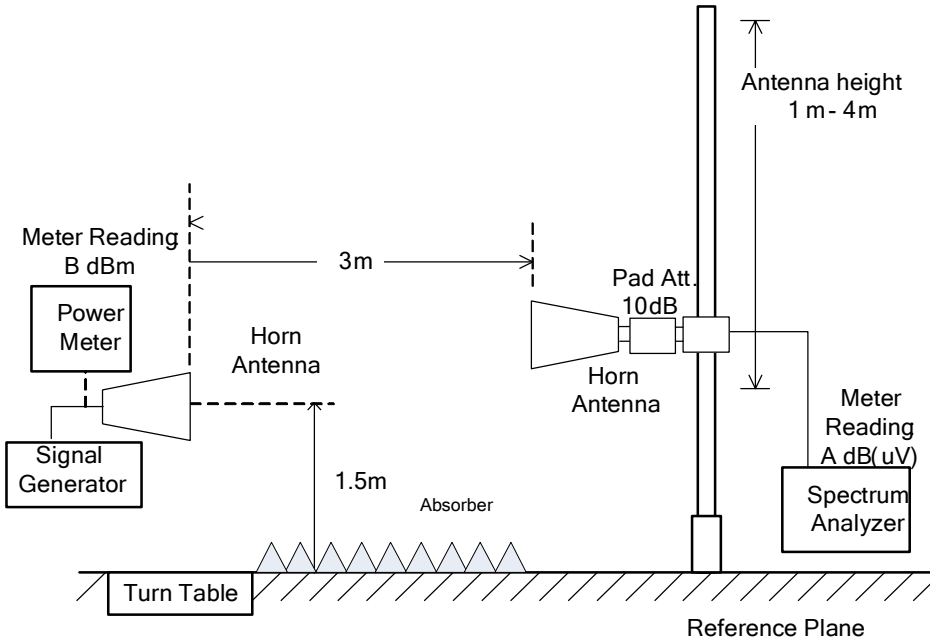
The ERP/EIRP output power was calculated in the following equation.

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

7.2.4 Test Data

(GSM-PCS1900)

Test Date: July 21, 2016
Temp.: 25 °C, Humi: 68 %

1. Measurement Results

Transmitting Frequency		Emission Measurement [dB(uV)]		Substitution Measurement [dB(uV)]		Supplied Power to Substitution Antenna	Gain of Substitution Antenna
CH	[MHz]	Hori. (Mh)	Vert. (Mv)	Hori. (Msh)	Vert. (Msv)	[dBm]	[dBi]
512	1850.200	93.2	92.7	72.1	72.3	- 5.0	14.3
661	1880.000	93.3	92.8	72.4	72.6	- 5.0	14.4
810	1909.800	94.4	94.6	72.6	72.6	- 5.0	14.5

2. Calculation Results

Transmitting Frequency		Peak EIRP [dBm]		Maximum Peak EIRP	Limits	Margin
CH	[MHz]	Hori. (EIRPh)	Vert. (EIRPv)	[W]	[dBm]	[dB]
512	1850.200	30.4	29.7	1.096	33.0	+ 2.6
661	1880.000	30.3	29.6	1.072	33.0	+ 2.7
810	1909.800	31.3	31.5	1.413	33.0	+ 1.5

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

Emission Measurment (Mv)	=	94.6	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)	=	31.5	dBm = 1.413 W

Minimum Margin: 33.0 - 31.5 = 1.5 (dB)

NOTE : Setting of measuring instrument(s) :

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

7.3 Modulation Characteristics (§2.1047)

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

7.4 Occupied Bandwidth (§2.1049)

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

7.4.1 Test Results

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

The 99% Bandwidth is	244.6	kHz	at	1909.800	MHz
The 26dB Bandwidth is	320.4	kHz	at	1880.000	MHz

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : _____

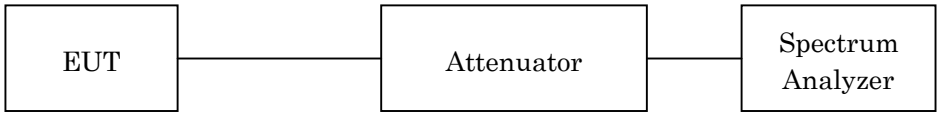
7.4.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
Attenuator	43KC-20	1418003 (D-41)	Anritsu	2017/07/10
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16

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

7.4.3 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

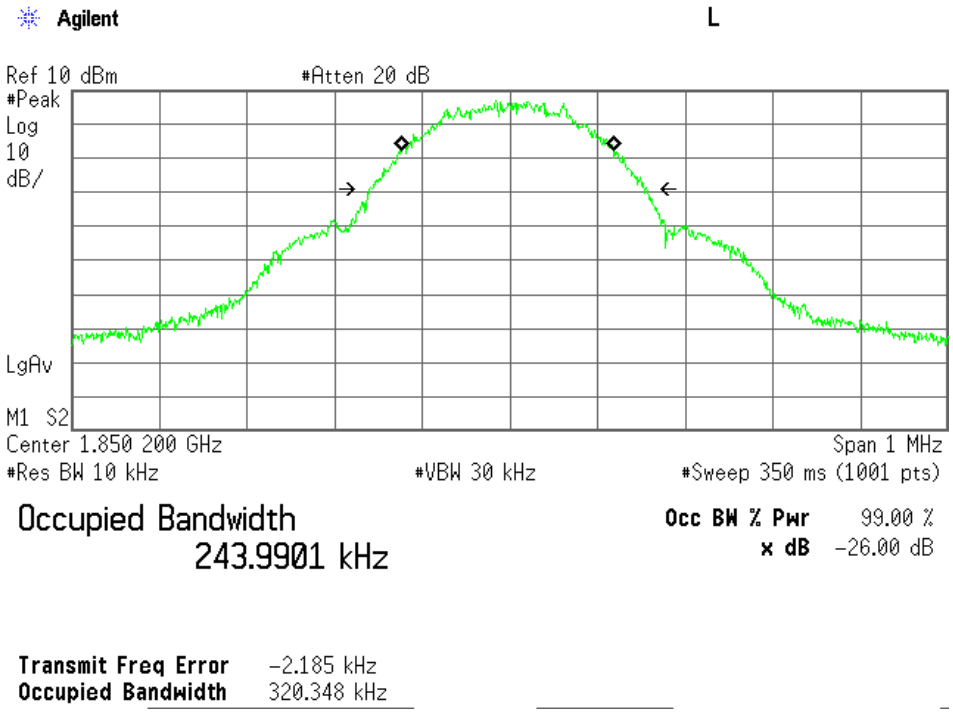
7.4.4 Test Data

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.

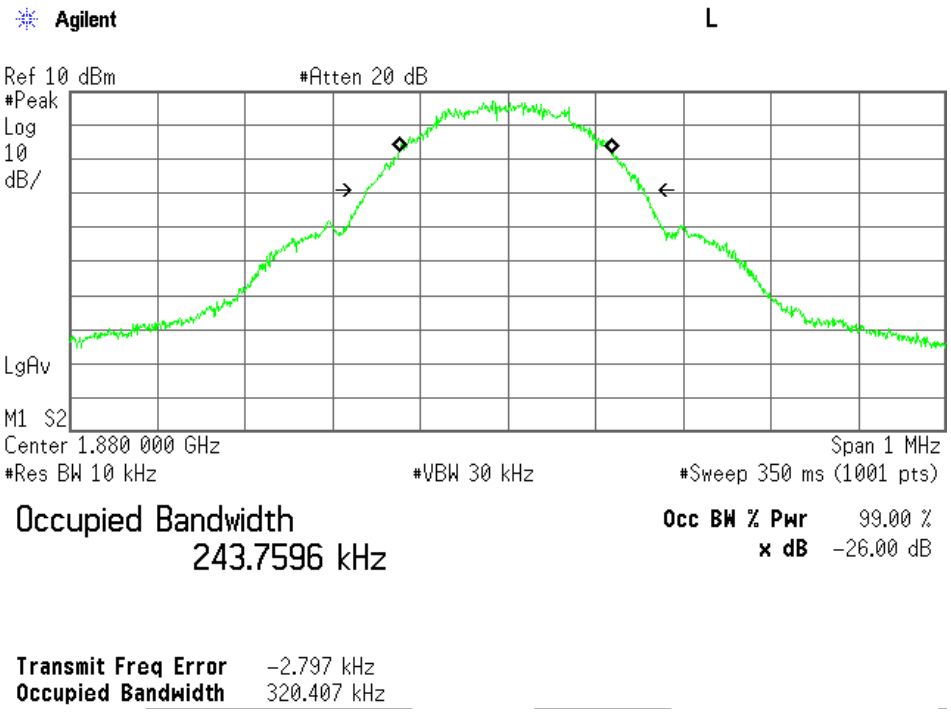
Test Date :July 17, 2016
Temp.:26°C, Humi:68%

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-26dBc Bandwidth (kHz)
512	1850.200	244.0	320.3
661	1880.000	243.8	320.4
810	1909.800	244.6	316.7

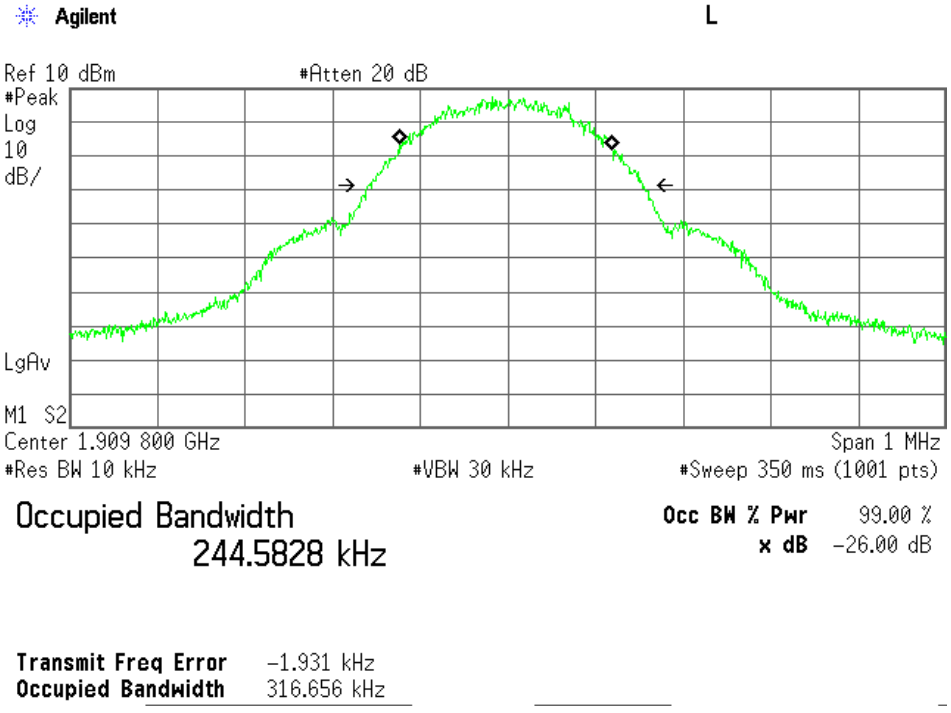
Low Channel



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

7.5.1 Test Results

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

Min. Limit Margin 19.5 dB at 7639.200 MHz

Uncertainty of Measurement Results

9 kHz – 1 GHz	± 1.4	dB(2σ)
1 GHz – 18 GHz	± 1.7	dB(2σ)
18 GHz – 40 GHz	± 2.3	dB(2σ)

Remarks :

7.5.2 Test Instruments

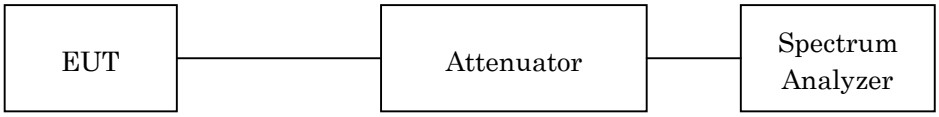
Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
Attenuator	43KC-20	1418003 (D-41)	Anritsu	2017/07/10
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16
High Pass Filter	HPM13899	001 (D-96)	MICRO-TRONICS	2017/02/17

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

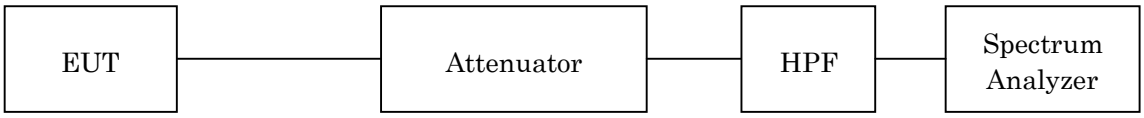
7.5.3 Test Method and Test Setup (Diagrammatic illustration)

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

a) Frequency Range: 9 kHz – 2 GHz



b) Frequency Range: 2 GHz – 20 GHz



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

7.5.4 Test Data

(GSM-PCS1900)

Test Date: July 17, 2016
Temp.: 26 °C, Humi: 68 %

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	21.3	-62.1	-13.0	-40.8	+27.8	C
		5550.600	21.4	-65.9	-13.0	-44.5	+31.5	C
		7400.800	21.5	-57.5	-13.0	-36.0	+23.0	C
		9251.000	21.7	-62.4	-13.0	-40.7	+27.7	C
		11101.200	21.9	-68.2	-13.0	-46.3	+33.3	C
		12951.400	22.2	< -70.0	-13.0	< -47.8	> +34.8	C
		14801.600	22.4	< -70.0	-13.0	< -47.6	> +34.6	C
		16651.800	22.8	< -70.0	-13.0	< -47.2	> +34.2	C
		18502.000	23.1	< -70.0	-13.0	< -46.9	> +33.9	C
661	1880.000	3760.000	21.3	-63.0	-13.0	-41.7	+28.7	C
		5640.000	21.4	-69.7	-13.0	-48.3	+35.3	C
		7520.000	21.5	-55.5	-13.0	-34.0	+21.0	C
		9400.000	21.7	-62.2	-13.0	-40.5	+27.5	C
		11280.000	21.9	-63.3	-13.0	-41.4	+28.4	C
		13160.000	22.2	< -70.0	-13.0	< -47.8	> +34.8	C
		15040.000	22.5	< -70.0	-13.0	< -47.5	> +34.5	C
		16920.000	22.8	< -70.0	-13.0	< -47.2	> +34.2	C
		18800.000	23.1	< -70.0	-13.0	< -46.9	> +33.9	C
810	1909.800	3819.600	21.3	-58.9	-13.0	-37.6	+24.6	C
		5729.400	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		7639.200	21.5	-54.0	-13.0	-32.5	+19.5	C
		9549.000	21.7	-60.8	-13.0	-39.1	+26.1	C
		11458.800	21.9	-69.5	-13.0	-47.6	+34.6	C
		13368.600	22.2	< -70.0	-13.0	< -47.8	> +34.8	C
		15278.400	22.6	< -70.0	-13.0	< -47.4	> +34.4	C
		17188.200	22.9	< -70.0	-13.0	< -47.1	> +34.1	C
		19098.000	23.2	< -70.0	-13.0	< -46.8	> +33.8	C

Calculated result at 7639.2 MHz, as the worst point shown on underline:

	Corr. Factor	=	21.5 dB
+)	Meter Reading	=	-54.0 dBm
	Result	=	-32.5 dBm

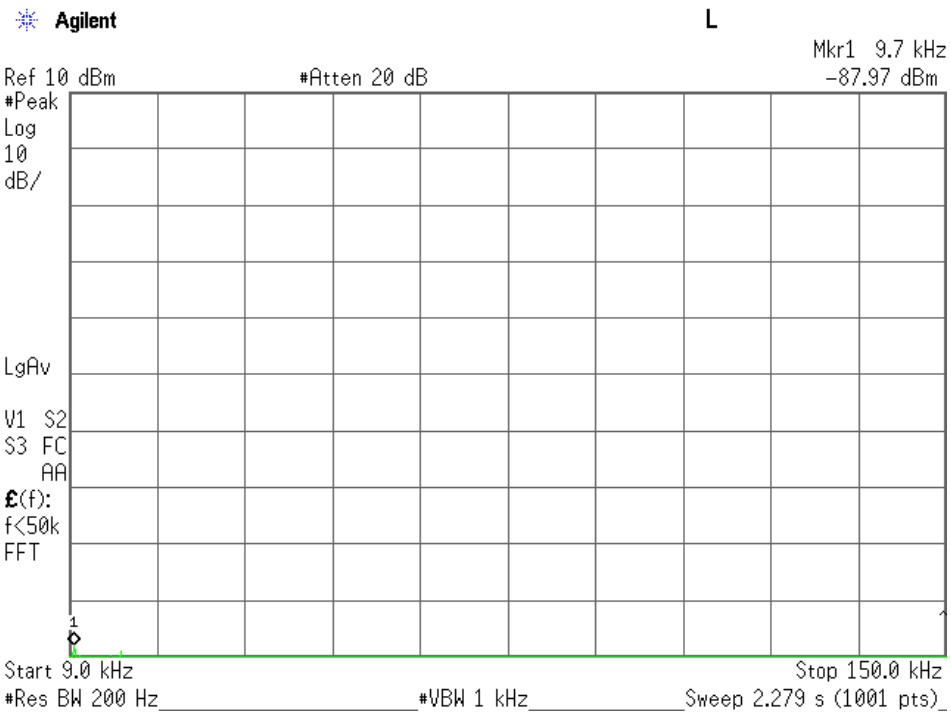
Minimum Margin: -13.0 - (-32.5) = 19.5 (dB)

NOTES

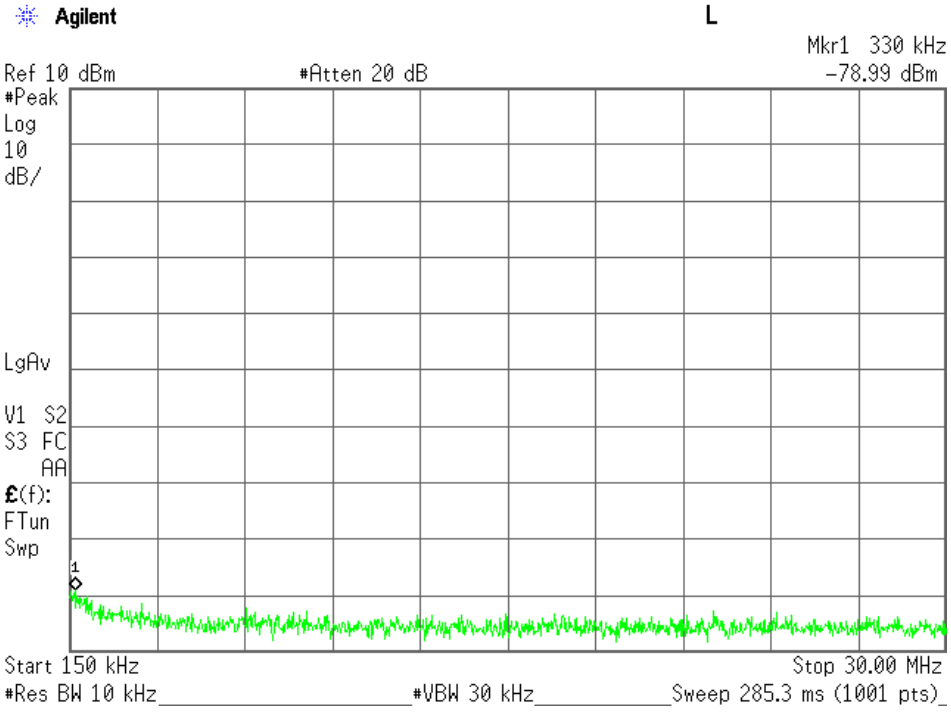
1. The spectrum was checked from 9 kHz to 20 GHz.
2. Applied limits : -13.0 [dBm] = 10log(TP[mW]) - (43 + 10log(tp[W])) = 10log(TP[mW]) - (43 + (10 log(TP[mW]) - 30))
   where, tp[W] = TP[mW] / 1000 : Transmitter power at anttena terminal
3. The correction factor is shown as follows:
   Corr. Factor [dB] = Cable Loss + Pad Att. [dB] (9 kHz - 2 GHz)
   Corr. Factor [dB] = Cable Loss + Pad Att. + High Pass Filter Loss [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

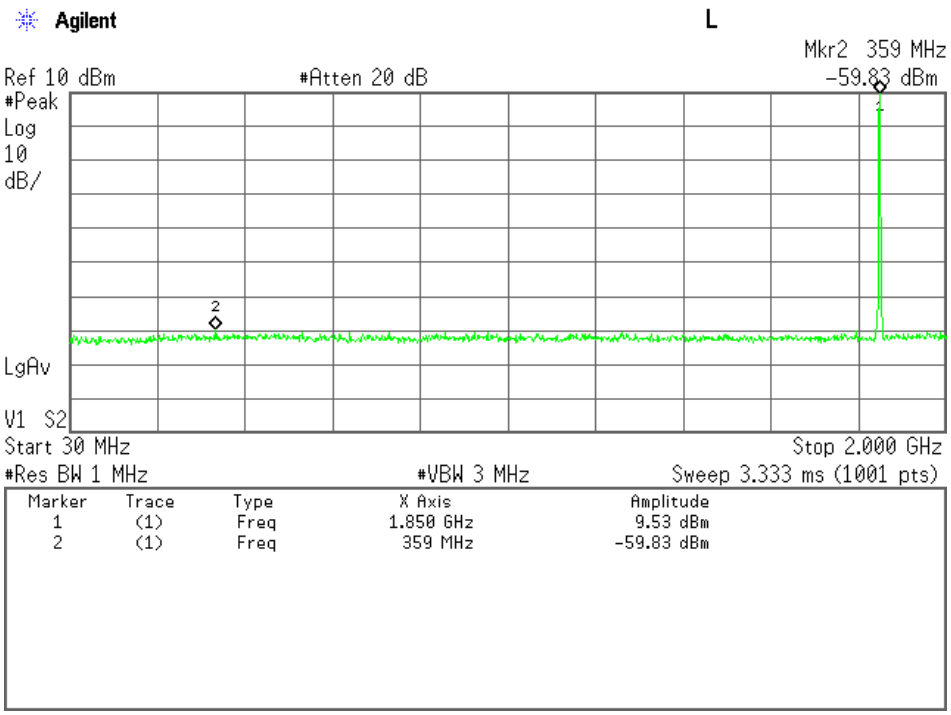
Low Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



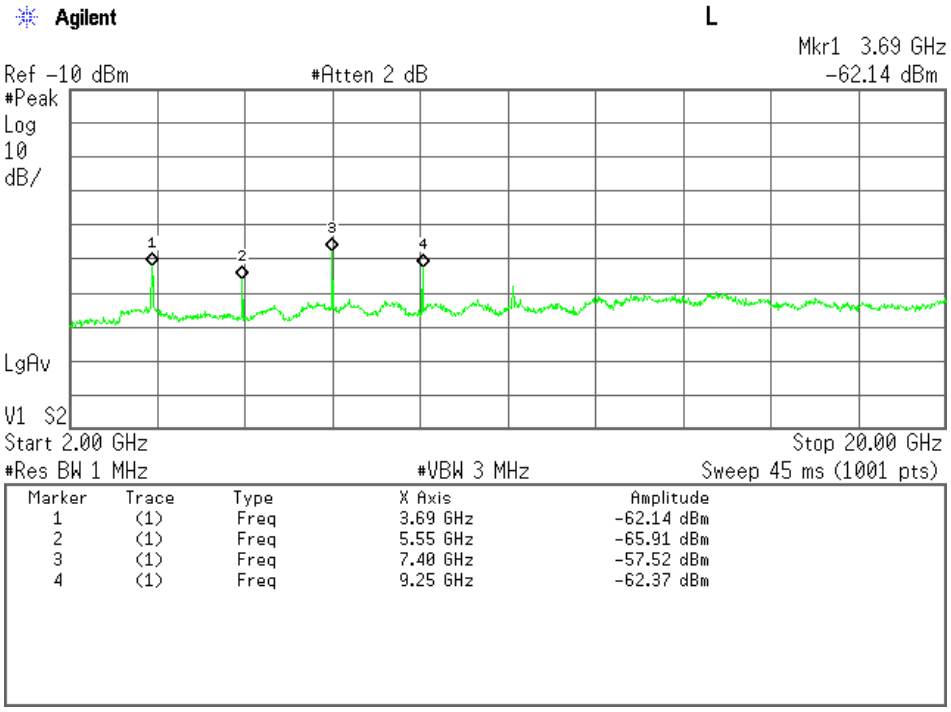
Low Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



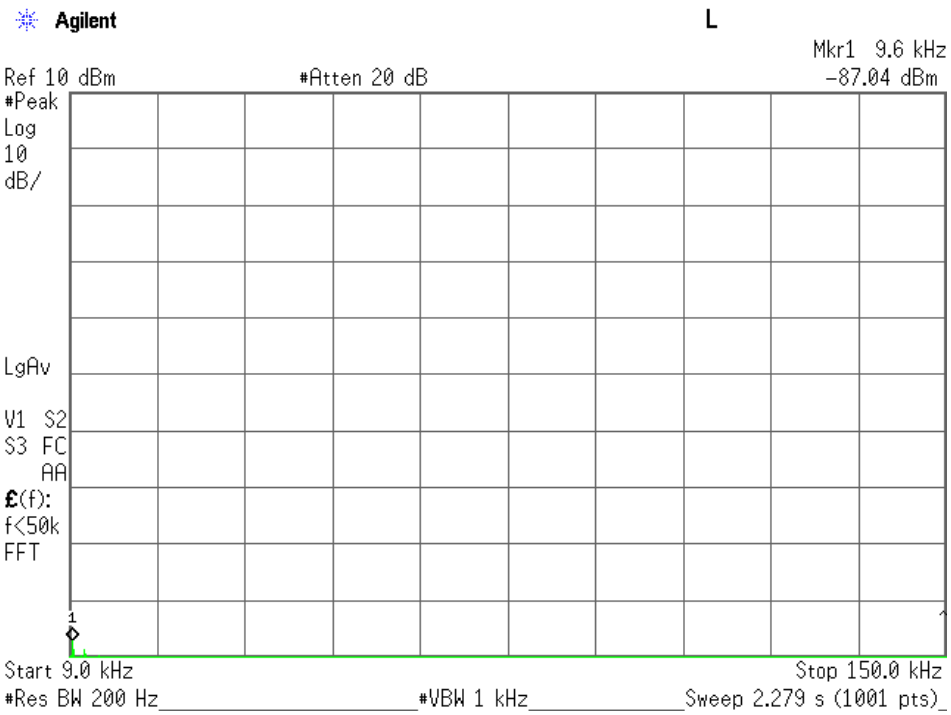
Low Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



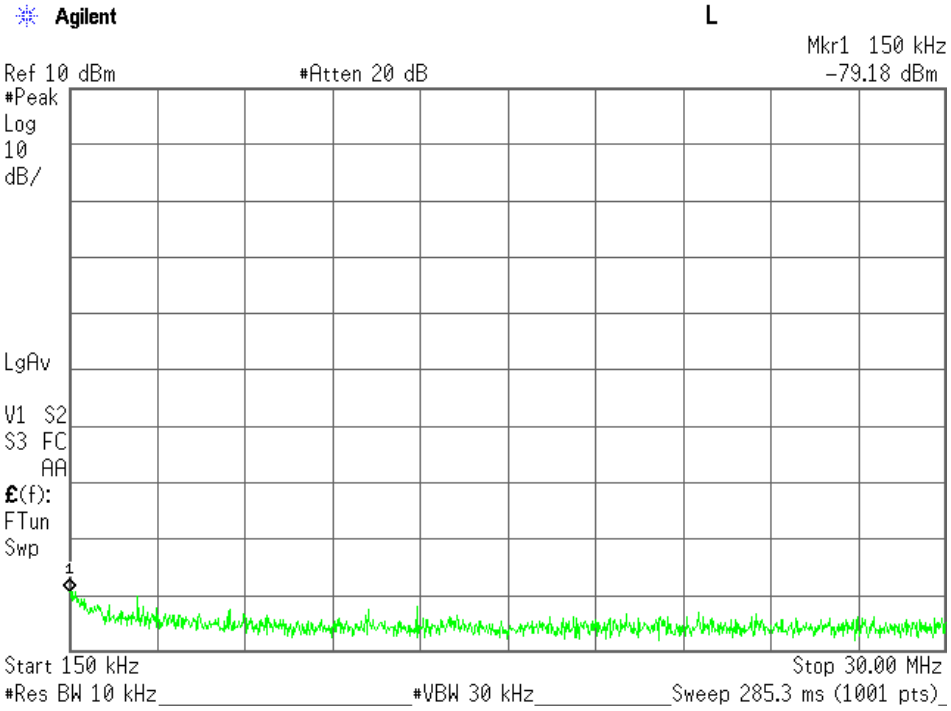
Low Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



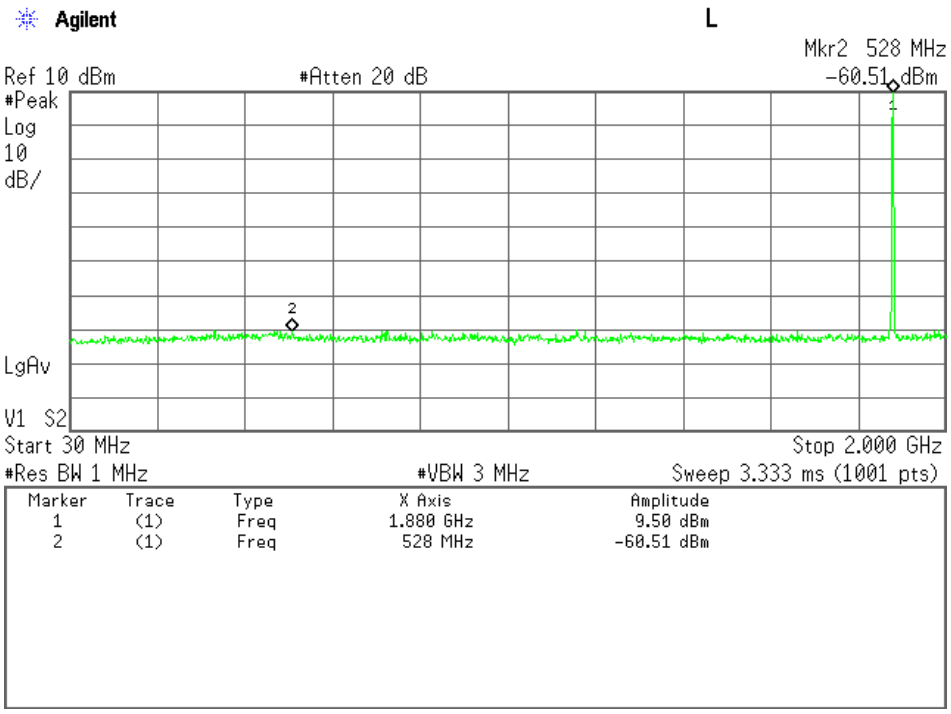
Middle Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



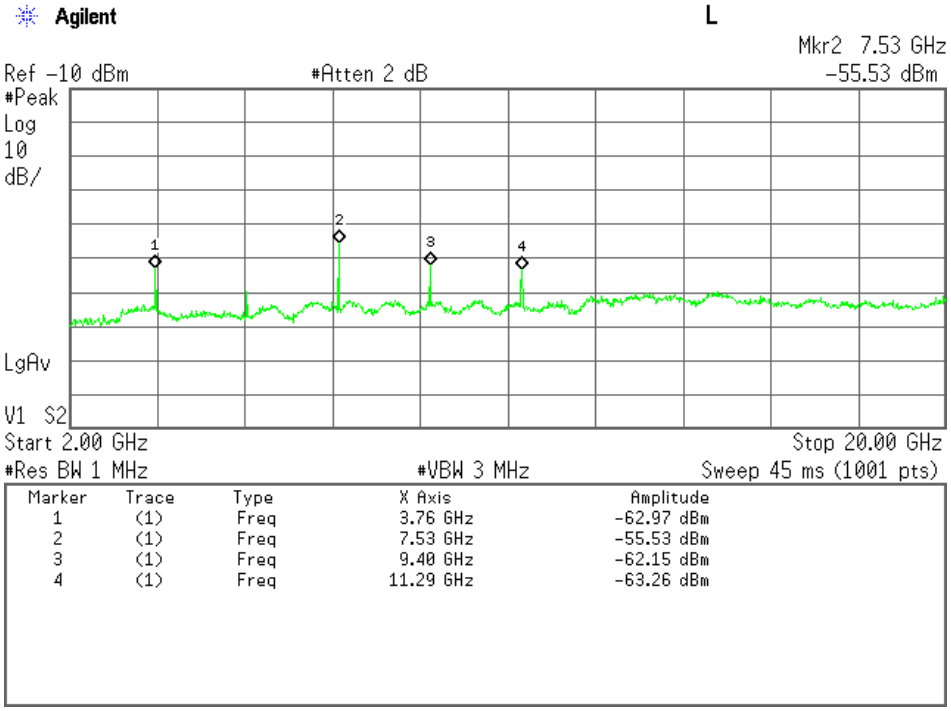
Middle Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



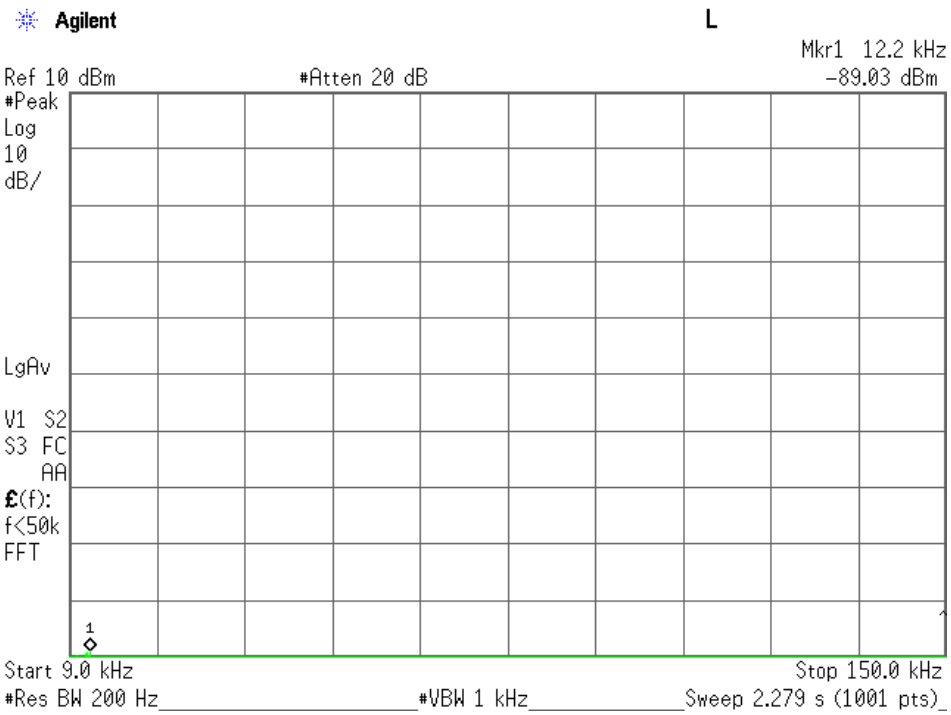
Middle Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



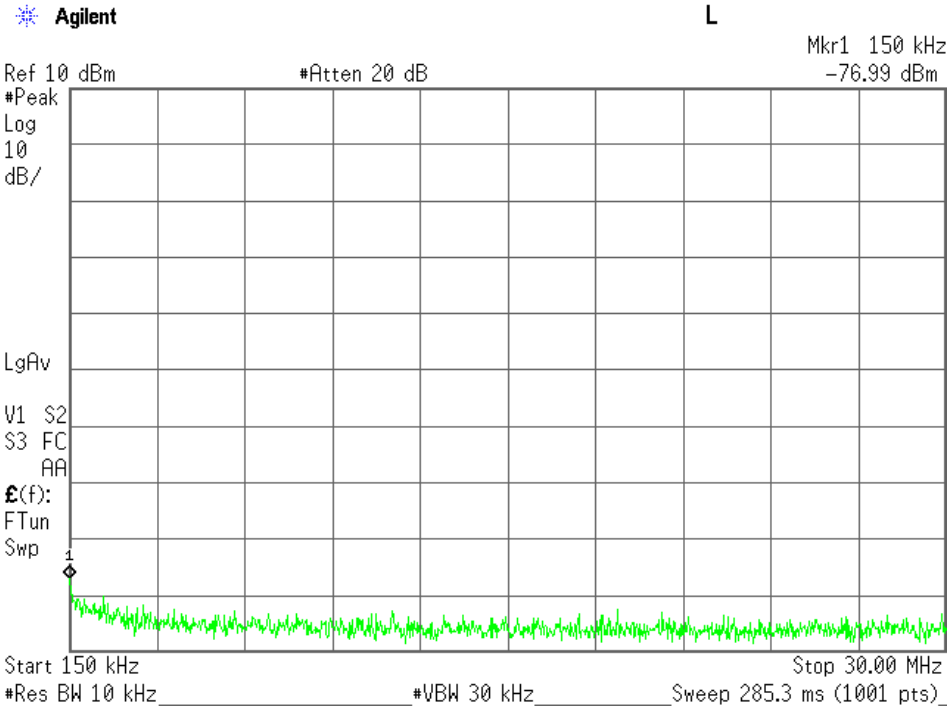
Middle Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



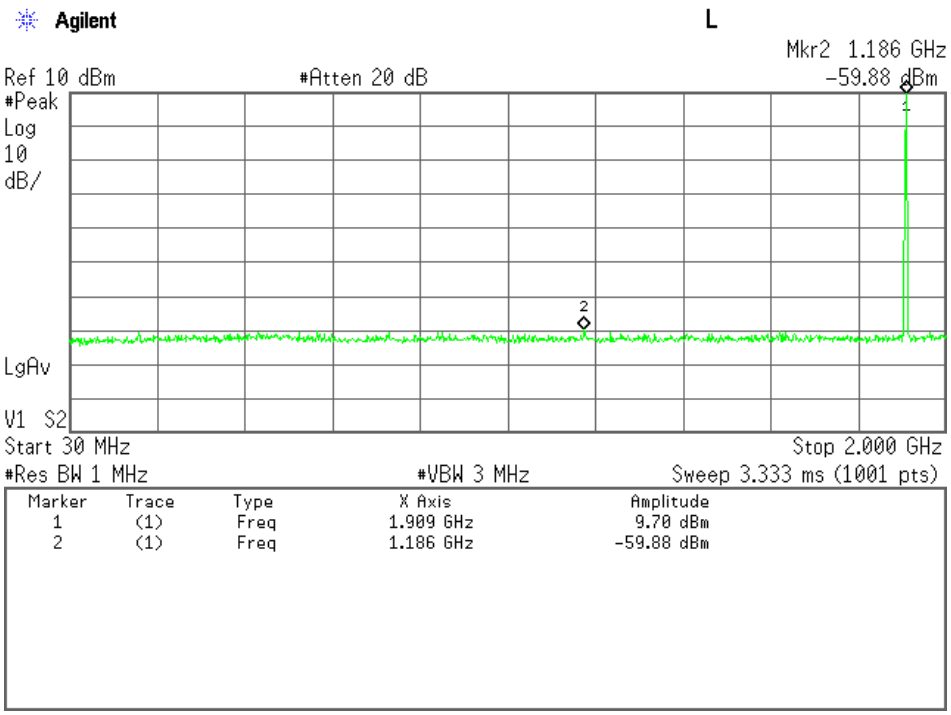
High Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



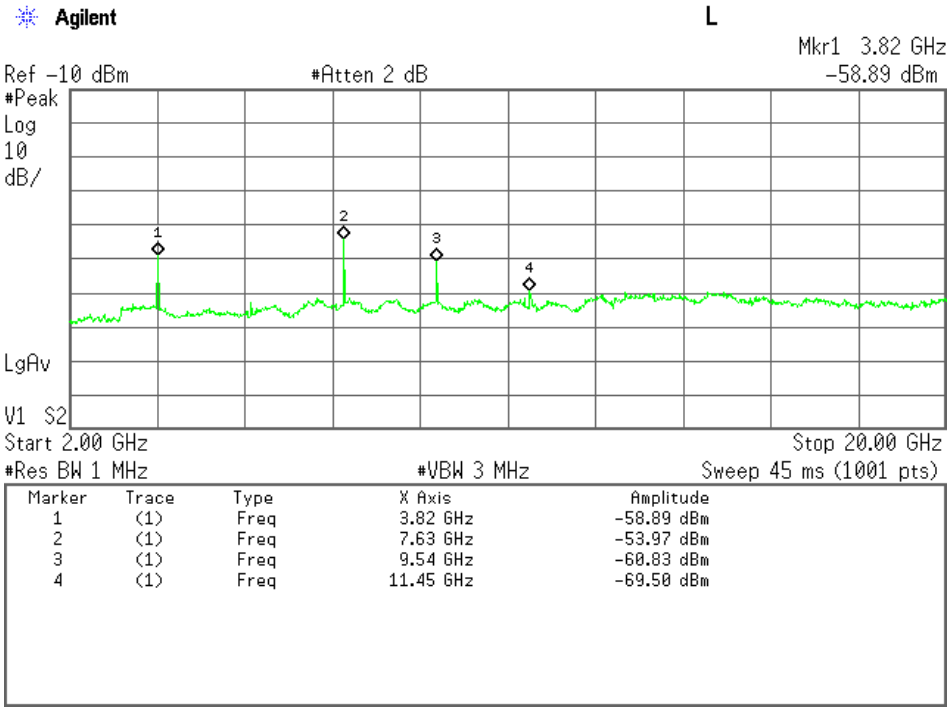
High Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



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

7.6.1 Test Results

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

Min. Limit Margin 2.1 dB at 1910.0 MHz

The Band-Edge level is -15.1 dBm at 1910.0 MHz

Uncertainty of Measurement Results ± 1.7 dB(2σ)

Remarks :

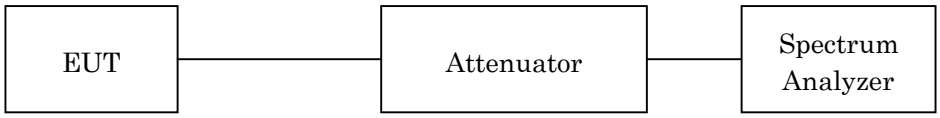
7.6.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
Attenuator	43KC-20	1418003 (D-41)	Anritsu	2017/07/10
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16

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

7.6.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

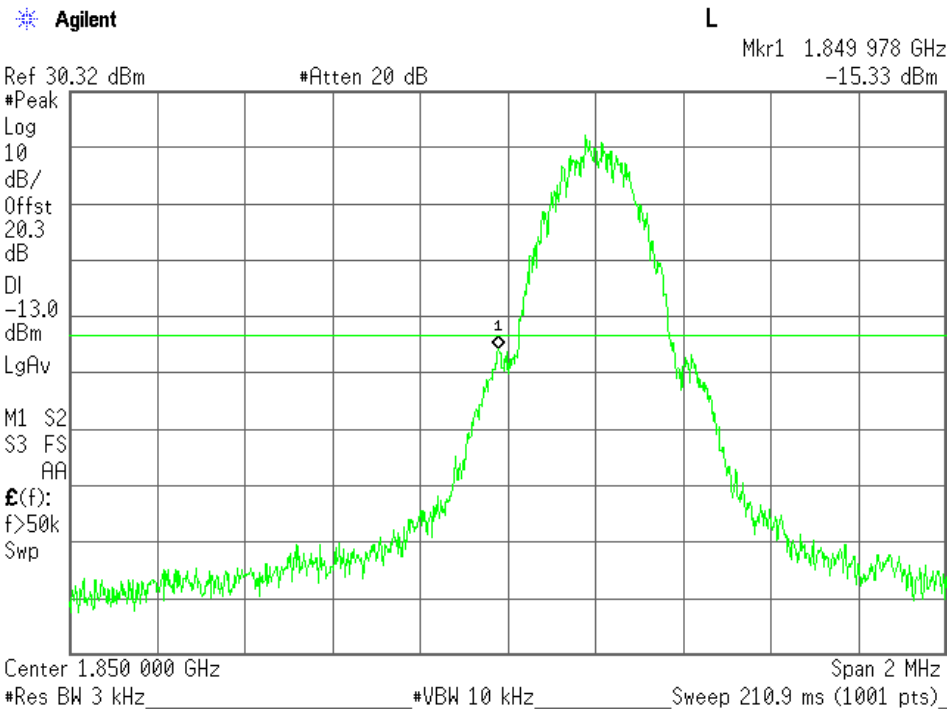
TX Frequency	1850.20 MHz / 1909.80 MHz
Band-Edge Frequency	1850.00 MHz / 1910.00 MHz
Res. Bandwidth	3 kHz
Video Bandwidth	10 kHz
Span	2 MHz
Sweep Time	AUTO
Trace	Maxhold

7.6.4 Test Data

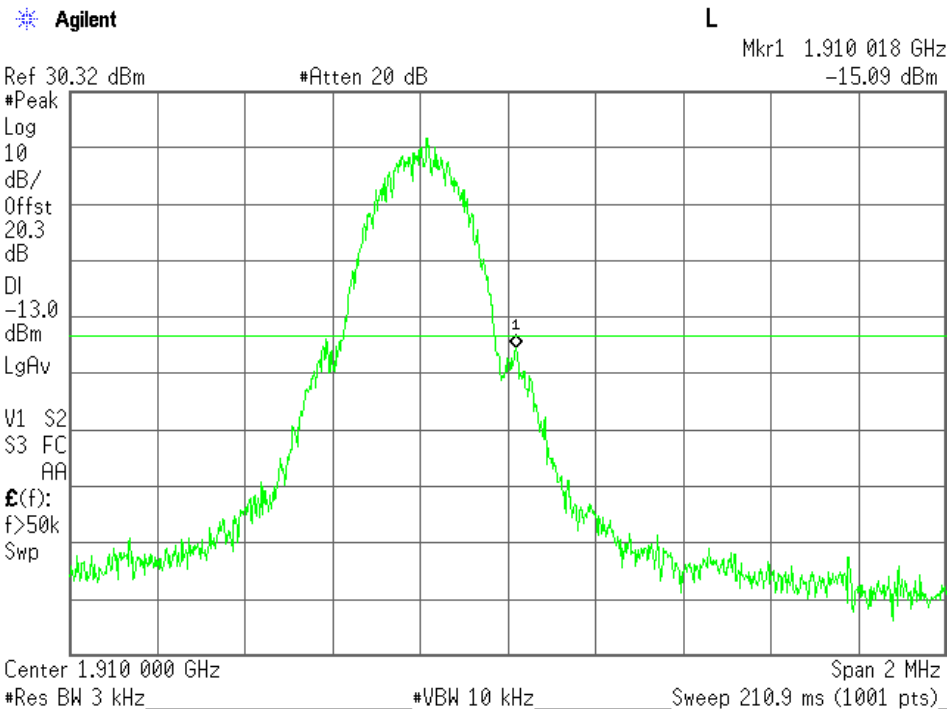
Test Date :July 17, 2016
Temp.:26°C, Humi:68%

Channel	Frequency (MHz)	Band-Edge Frequency (MHz)	Band-Edge Level (dBm)	Limits (dBm)	Margin (dB)
512	1850.200	1850.00	-15.3	-13.0	+2.3
810	1909.800	1910.00	-15.1	-13.0	+2.1

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

7.7.1 Test Results

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

Min. Limit Margin >21.2 dB at 17188.200 MHz

Uncertainty of Measurement Results		
30 MHz – 1000 MHz	± 1.6	dB(2σ)
1 GHz – 18 GHz	± 1.8	dB(2σ)
18 GHz – 40 GHz	± 2.7	dB(2σ)

Remarks :

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	2017/04/27
Signal Generator	E8257D	MY45140309 (B-39)	Agilent	2016/08/10
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	2017/04/03
Pre-Amplifier	TPA0118-36	1010 (A-37)	TOYO	2017/05/17
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	2016/10/12
Attenuator	54A-10	W5713 (D-29)	Weinschel	2016/08/16
Attenuator	2-10	BA6214 (D-79)	Weinschel	2016/11/19
RF Cable	SUCOFLEX102E	6683/2E (C-70)	HUBER+SUHNER	2016/11/19
RF Cable	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2017/01/06
RF Cable	SUCOFLEX104	267414/4 (C-67)	HUBER+SUHNER	2017/01/06
RF Cable	SUCOFLEX102EA	3041/2EA (C-69)	HUBER+SUHNER	2017/01/06
High Pass Filter	HPM13899	001 (D-96)	MICRO-TRONICS	2017/02/17

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.

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

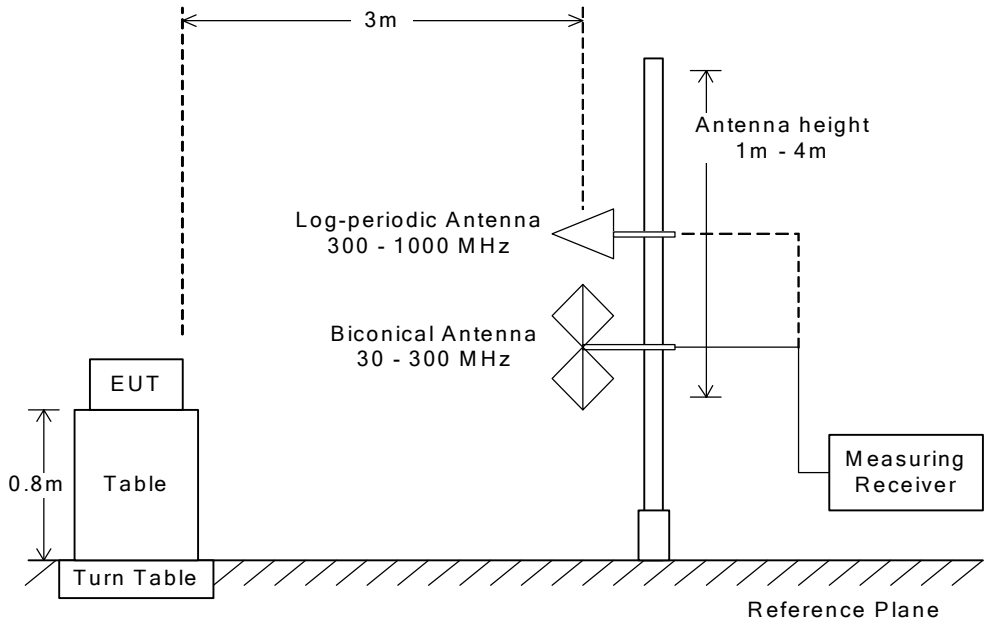
$$erp = eirp - Gd \quad \text{----(Eq.2)}$$

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)

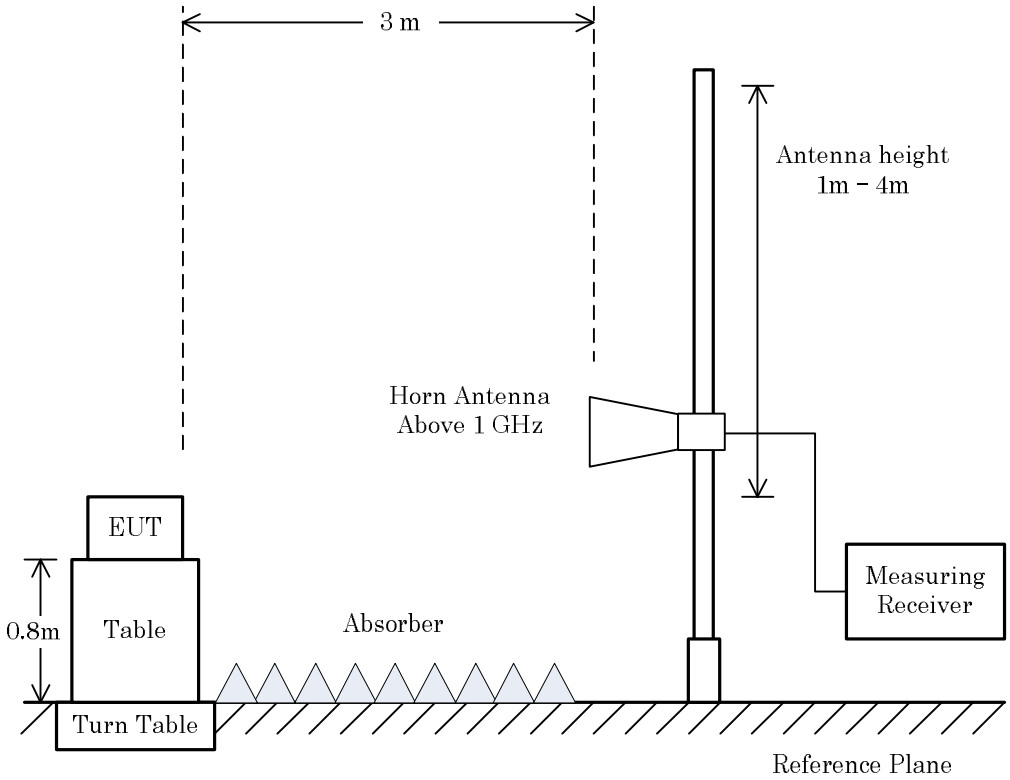
$$eirp = \frac{(de)^2}{30} = \frac{3}{10}e^2$$
$$\therefore 10\log(eirp) = 20\log(e) + 10\log(3/10) = 20\log(e) - 5.23$$
$$10\log(eirp) = EIRP[dBm] - 30$$
$$20\log(e) = E[dB(\mu V/m)] - 120$$
$$\therefore EIRP = E - 120 + 30 - 5.23 = E - 95.23$$
$$\therefore ERP[dBm] = EIRP - 2.15 = E - 97.38$$

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 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

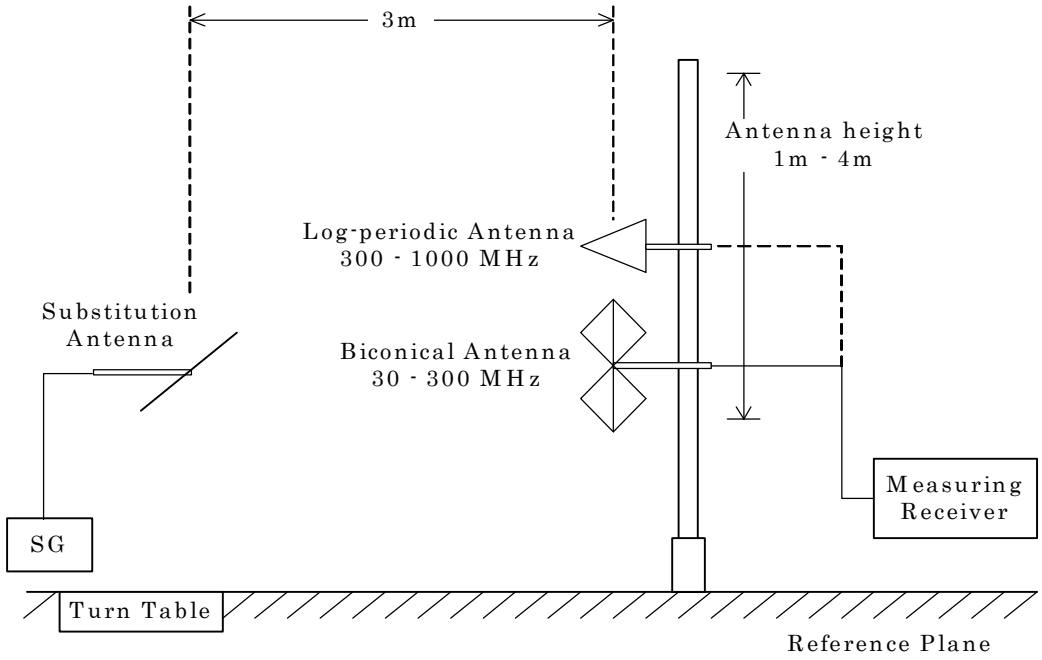


Radiated Emission above 1 GHz



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: July 21, 2016
Temp.: 25 °C, Humi: 68 %

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	-47.0	-49.0	-13.0	+34.0	C
		5550.600	< -47.1	< -47.1	-13.0	> +34.1	C
		7400.800	< -45.5	< -45.5	-13.0	> +32.5	C
		9251.000	< -41.8	< -41.8	-13.0	> +28.8	C
		11101.200	< -40.3	< -40.3	-13.0	> +27.3	C
		12951.400	< -38.7	< -38.7	-13.0	> +25.7	C
		14801.600	< -37.5	< -37.5	-13.0	> +24.5	C
		16651.800	< -35.8	< -35.8	-13.0	> +22.8	C
		18502.000	< -40.0	< -40.0	-13.0	> +27.0	C
661	1880.000	3760.000	-49.3	-50.3	-13.0	+36.3	C
		5640.000	< -47.0	< -47.0	-13.0	> +34.0	C
		7520.000	-42.9	-42.7	-13.0	+29.7	C
		9400.000	< -41.7	< -41.7	-13.0	> +28.7	C
		11280.000	< -40.3	< -40.3	-13.0	> +27.3	C
		13160.000	< -38.8	< -38.8	-13.0	> +25.8	C
		15040.000	< -37.5	< -37.5	-13.0	> +24.5	C
		16920.000	< -35.0	< -35.0	-13.0	> +22.0	C
		18800.000	< -39.9	< -39.9	-13.0	> +26.9	C
810	1909.800	3819.600	-50.0	-51.5	-13.0	+37.0	C
		5729.400	< -47.1	< -47.1	-13.0	> +34.1	C
		7639.200	-41.6	-40.6	-13.0	+27.6	C
		9549.000	< -41.6	< -41.6	-13.0	> +28.6	C
		11458.800	< -40.3	< -40.3	-13.0	> +27.3	C
		13368.600	< -38.7	< -38.7	-13.0	> +25.7	C
		15278.400	< -37.4	< -37.4	-13.0	> +24.4	C
		17188.200	< -34.2	< -34.2	-13.0	> +21.2	C
		19098.000	< -39.8	< -39.8	-13.0	> +26.8	C

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

NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 30 MHz to the tenth harmonic of the highest fundamental frequency.
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 Test Results

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

The Frequency Stability level is +0.02 ppm at 1880.000 MHz

Uncertainty of Measurement Results ± 0.03 ppm(2σ)

Remarks : _____

7.8.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Base Station Simulator	CMU200	103210 (B-21)	Rohde & Schwarz	2017/05/29
Environmental Chamber	SH-641	92010990 (F-32)	ESPEC	2017/07/13
DC Voltage Meter	2011	02247S (B-33)	YOKOGAWA	2017/04/05
DC Power Supply	NL035-10	35883293 (F-4)	TAKASAGO	N/A

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

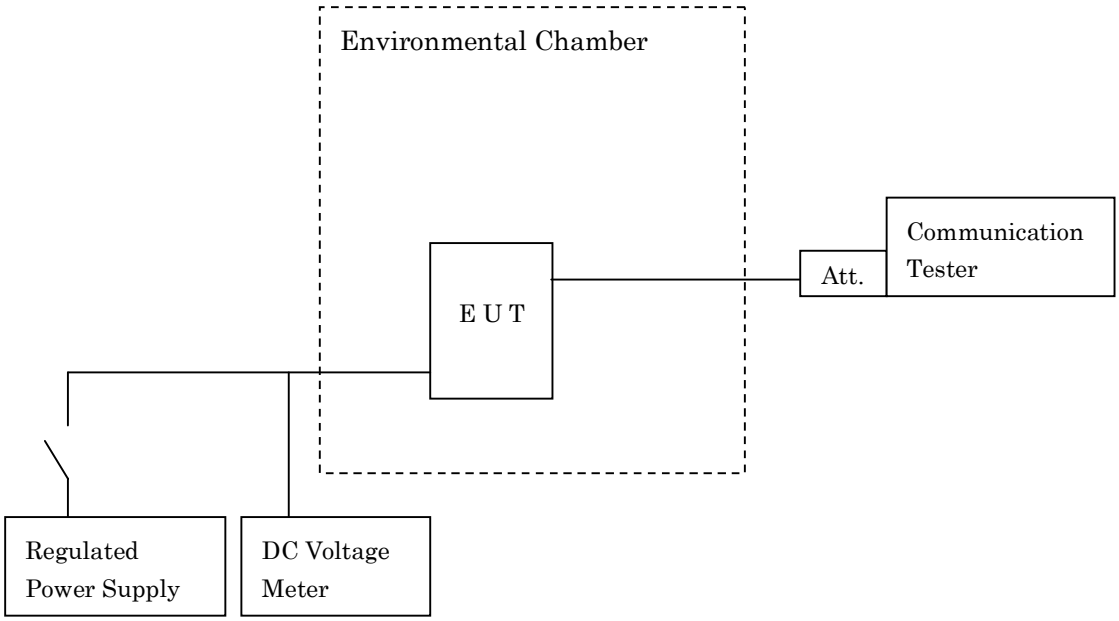
7.8.3 Test Method and Test Setup (Diagrammatic illustration)

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.



7.8.4 Test Data

(GSM-PCS1900)

Test Date: August 3, 2016

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	+ 0.02	+ 0.01	+ 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	+ 0.00	N/A	N/A
0	+ 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
20	- 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A
30	- 0.01	- 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	- 0.01	- 0.01	- 0.01	- 0.01	N/A	N/A
3.7(Ending)	+ 0.01	+ 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.