JQA File No. : KL80150043
Issue Date : May 19, 2015

TEST REPORT

Applicant	:	Sharp Corporation, Communication Systems Division
Address	:	2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
Products	:	Smart Phone
Model No.	:	404SH
Serial No.	:	004401/11/549690/9 004401/11/549842/6
FCC ID	:	APYHRO00220
Test Standard	:	CFR 47 FCC Rules and Regulations Part 24
Test Results	:	**Passed**
Date of Test	:	April 24 ~ May 8, 2015

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

VLAC Lab Accreditation VLAC-001-2

- 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.

TABLE OF CONTENTS

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	:	Smart Phone
3.	Model No.	:	404SH
4.	Serial No.	:	004401/11/549690/9
		:	004401/11/549842/6
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	February, 2015
7.	Power Rating	:	4.0VDC (Lithium-ion Battery UBATIA258AFN1 3000mAh)
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	:	0.794 W(EIRP)
13.	Category	:	Broadband PCS
14.	EUT Authorization	:	Certification
15.	Received Date of EUT	:	April 20, 2015

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 C63.4–2003, TIA/EIA–603-C-2004
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, 2016)
VCCI Registration No.	:	A-0002 (Expiry date : March 30, 2016)
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, 2016)

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	404SH	004401/11/549690/9 *1) 004401/11/549842/6 *2)	APYHRO00220
B	AC Adapter	Sharp	SHCEJ1	--	N/A
C	Earphone	Softbank Mobile	ZTCAA1	--	N/A
D	DTV Antenna	Sharp	--	--	N/A

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

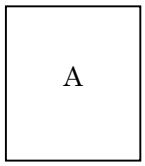
The auxiliary equipment used for testing :
None

Type of Cable:

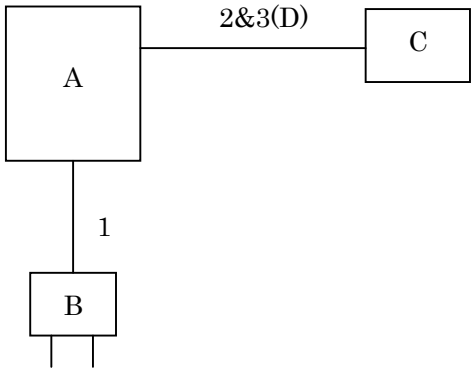
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	DC Power Cord	--	--	NO	NO	1.5
2	Earphone Cable	--	--	NO	NO	0.5
3	DTV Antenna Cable	--	--	NO	NO	0.1

6.2 Test Arrangement (Drawings)

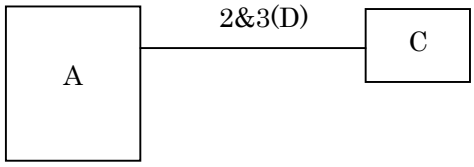
a) Single Unit



b) AC Adapter used



c) Earphone used



6.3 Operating Condition

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, 48MHz, 12MHz, 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 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 22.235	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 Worst Point and Measurement Uncertainty

Transmitter Power is 977.2 mW at 1850.200 MHz

Uncertainty of Measurement Results at Amplitude +/-0.9 dB(2σ)

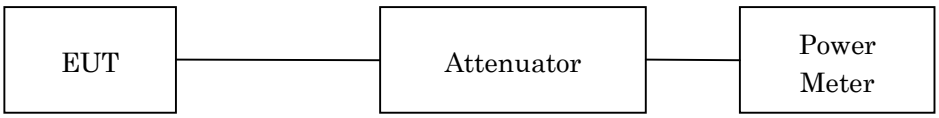
Remarks : _____

7.1.2 Test Instruments

Shielded Room S4					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
Power Meter	N1911A	Agilent	B-63	2014/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2014/7	1 Year
Attenuator	43KC-20	Anritsu	D-41	2014/6	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year

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 7, 2015
Temp.: 23 °C, Humi: 48 %

Transmitting Frequency		Correction Factor	Meter Reading (Peak)	Results (Peak)	
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]
512	1850.200	20.23	9.67	29.90	977.2
661	1880.000	20.23	9.30	29.53	897.4
810	1909.800	20.23	9.37	29.60	912.0

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

	Correction Factor	=	20.23	dB
+)	Meter Reading	=	9.67	dBm
	Result	=	29.90	dBm = 977.2 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

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

7.2.1 Worst Point and Measurement Uncertainty

Min. Limit Margin 4.0 dB at 1909.800 MHz

Uncertainty of Measurement Results +/-1.8 dB(2σ)

Remarks : X-axis position. The maximum EIRP is 0.794 W at 1909.800 MHz.

7.2.2 Test Instruments

Anechoic Chamber A2					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
Test Receiver	ESU 26	Rohde & Schwarz	A-6	2015/4	1 Year
Signal Generator	E8257D	Agilent	B-39	2014/8	1 Year
Power Meter	N1911A	Agilent	B-63	2014/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2014/7	1 Year
Attenuator(RX)	2-10	Weinschel	D-79	2014/11	1 Year
Attenuator(TX)	2-10	Weinschel	D-80	2014/11	1 Year
RF Cable(RX)	SUCOFLEX104	SUHNER	C-66	2015/1	1 Year
RF Cable(TX)	SUCOFLEX 102/E	SUHNER	C-70	2014/11	1 Year
Horn Antenna(TX)	91889-2	EATON	C-40-2	2014/6	1 Year
Horn Antenna(RX)	91889-2	EATON	C-41-2	2014/7	1 Year

7.2.3 Test Method and Test Setup (Diagrammatic illustration)

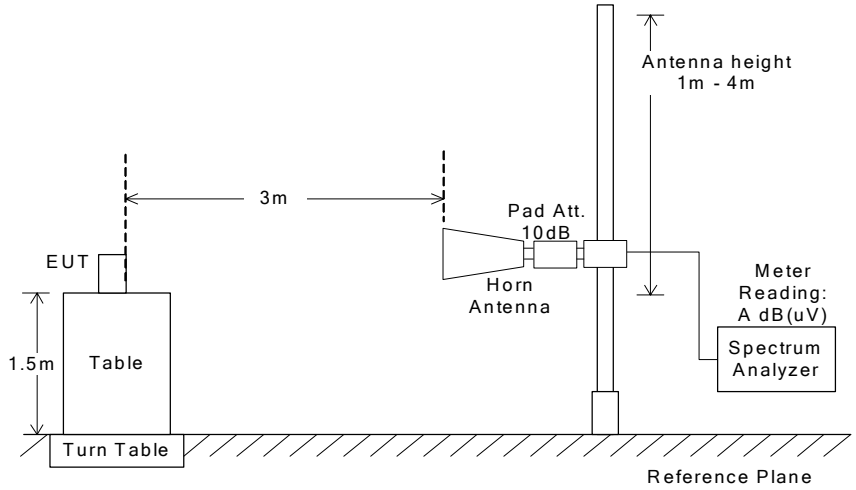
Step 1:
In order to obtain the maximum emission, the EUT was placed at the height 1.5 m on the non-conducted support and was varying at three orthogonal axes, at the distance 3 m from the receiving antenna and rotated around 360 degrees.
The receiving antenna height was varied from 1 m to 4 m.
The EUT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

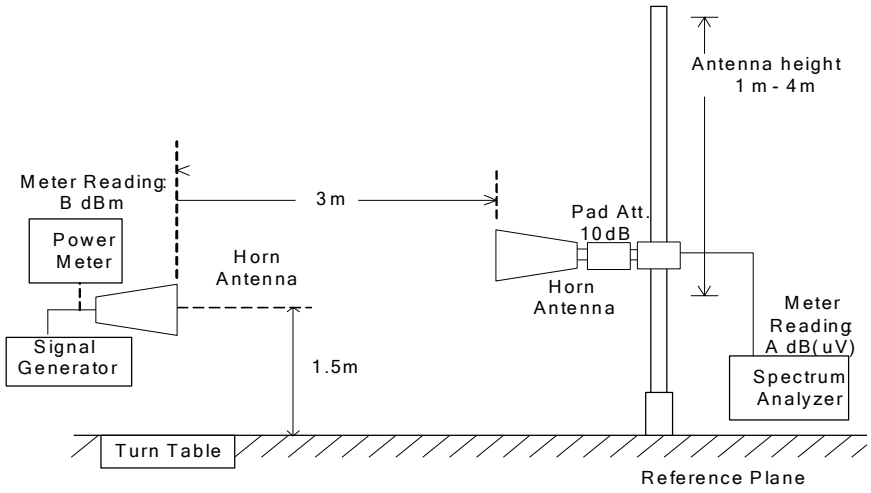
The ERP/EIRP output power was calculated in the following equation.

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: April 24, 2015
Temp.: 24 °C, Humi: 45 %

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	90.2	90.0	72.1	72.4	- 5.0	14.4
661	1880.000	91.4	91.5	72.3	72.6	- 5.0	14.3
810	1909.800	92.2	91.4	72.5	72.6	- 5.0	14.3

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	27.5	27.0	0.562	33.0	+ 5.5
661	1880.000	28.4	28.2	0.692	33.0	+ 4.6
810	1909.800	29.0	28.1	0.794	33.0	+ 4.0

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

	Emission Measurment (Mh)	=	92.2 dB(uV)
	Substitution Measurement (Msh)	=	-72.5 dB(uV)
	Supplied Power to Substitution Antenna	=	-5.0 dBm
+)	Gain of Substitution Antenna	=	14.3 dB
	Result (EIRPh)	=	29.0 dBm = 0.794 W

Minimum Margin: 33.0 - 29.0 = 4.0 (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

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	244.8	kHz	at	1880.000 MHz
The 26dB Bandwidth is	317.4	kHz	at	1909.800 MHz

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

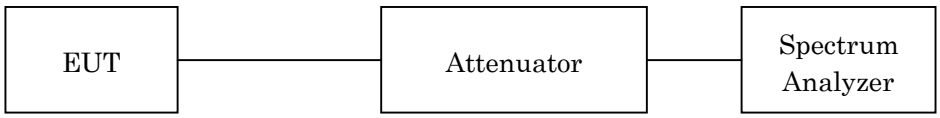
Remarks :

7.4.2 Test Instruments

Shielded Room S4					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
Spectrum Analyzer	E4446A	Agilent	A-39	2014/9	1 Year
Attenuator	43KC-20	Anritsu	D-41	2014/7	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year

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

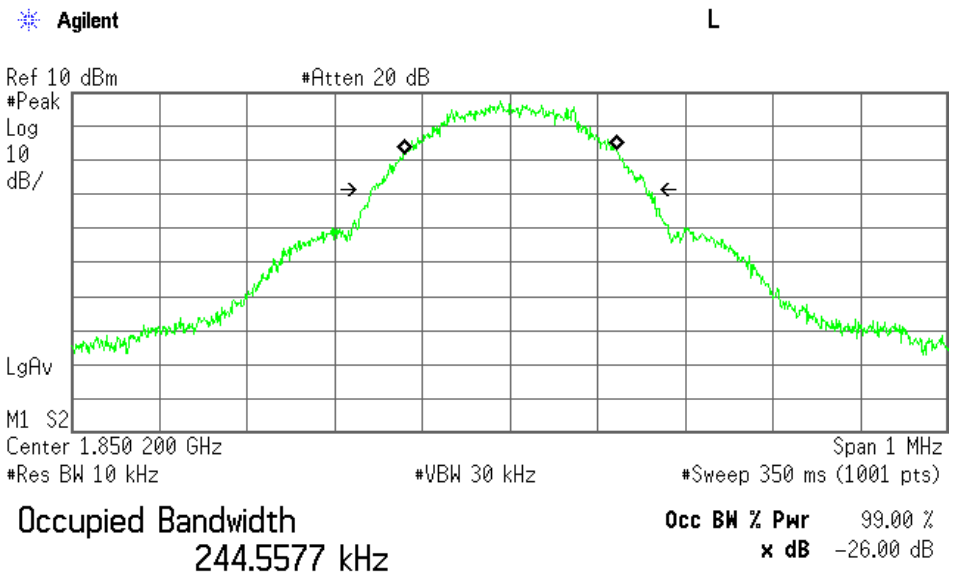
7.4.4 Test Data

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.

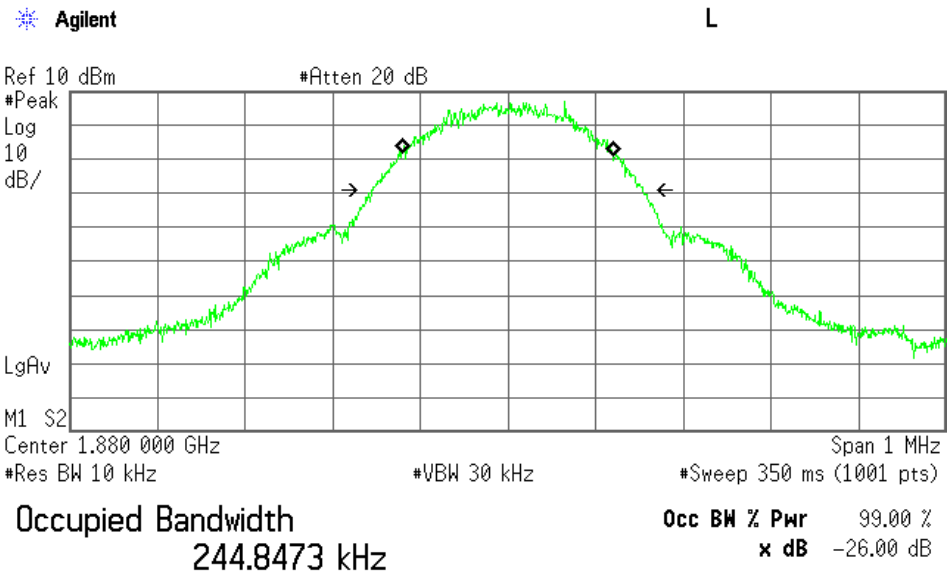
Test Date : May 7, 2015
Temp.:23°C, Humi:48%

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-26dBc Bandwidth (kHz)
512	1850.200	244.6	317.2
661	1880.000	244.8	313.5
810	1909.800	244.1	317.4

Low Channel

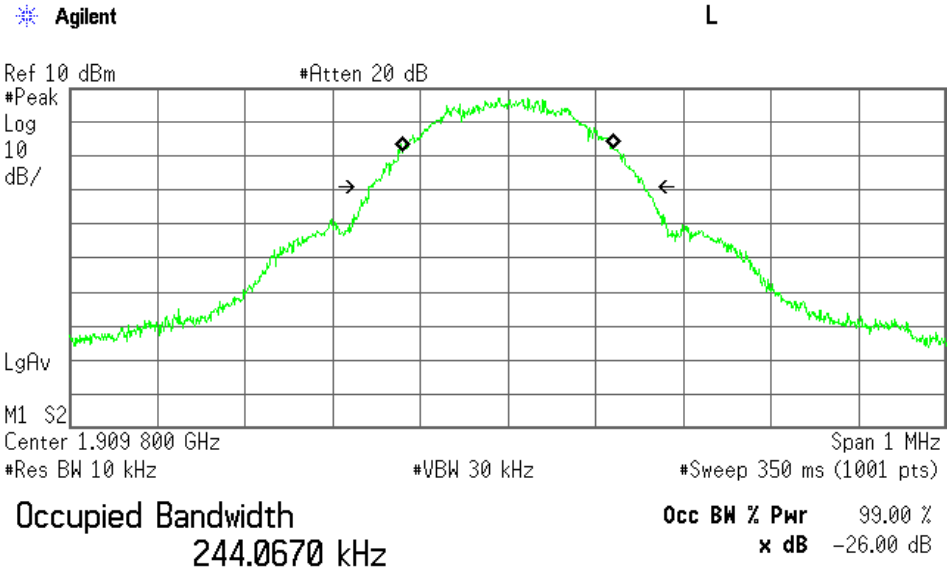


Middle Channel



Transmit Freq Error	-181.796 Hz
Occupied Bandwidth	313.480 kHz

High Channel



Transmit Freq Error	801.769 Hz
Occupied Bandwidth	317.378 kHz

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 32.4 dB at 14801.6/15278.4 MHz

Uncertainty of Measurement Results

9 kHz – 1GHz	+/-1.4	dB(2σ)
1GHz – 18GHz	+/-1.7	dB(2σ)
18GHz – 40GHz	+/-2.3	dB(2σ)

Remarks :

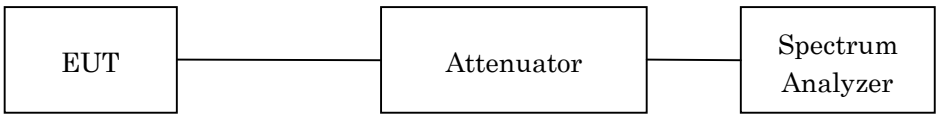
7.5.2 Test Instruments

Shielded Room S4					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
Spectrum Analyzer	E4446A	Agilent	A-39	2014/9	1 Year
Attenuator	43KC-20	Anritsu	D-41	2014/7	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year
HPF	HPM13899	MICRO-TRONICS	D-96	2015/2	1 Year

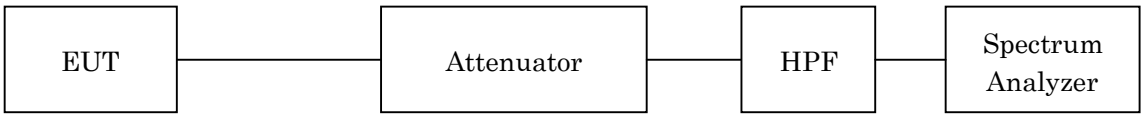
7.5.3 Test Method and Test Setup (Diagrammatic illustration)

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

a) Frequency Range: 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: May 7, 2015
Temp.: 23 °C, Humi: 48 %

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	< -70.0	-13.0	< -48.7	> +35.7	C
		5550.600	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		7400.800	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		9251.000	21.7	< -70.0	-13.0	< -48.3	> +35.3	C
		11101.200	22.0	< -70.0	-13.0	< -48.0	> +35.0	C
		12951.400	22.2	< -70.0	-13.0	< -47.8	> +34.8	C
		14801.600	22.6	-68.0	-13.0	-45.4	+32.4	C
		16651.800	22.9	< -70.0	-13.0	< -47.1	> +34.1	C
		18502.000	23.3	< -70.0	-13.0	< -46.7	> +33.7	C
661	1880.000	3760.000	21.3	< -70.0	-13.0	< -48.7	> +35.7	C
		5640.000	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		7520.000	21.6	< -70.0	-13.0	< -48.4	> +35.4	C
		9400.000	21.7	< -70.0	-13.0	< -48.3	> +35.3	C
		11280.000	22.0	< -70.0	-13.0	< -48.0	> +35.0	C
		13160.000	22.3	< -70.0	-13.0	< -47.7	> +34.7	C
		15040.000	22.6	-69.1	-13.0	-46.5	+33.5	C
		16920.000	22.9	< -70.0	-13.0	< -47.1	> +34.1	C
		18800.000	23.4	< -70.0	-13.0	< -46.6	> +33.6	C
810	1909.800	3819.600	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		5729.400	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		7639.200	21.6	< -70.0	-13.0	< -48.4	> +35.4	C
		9549.000	21.8	< -70.0	-13.0	< -48.2	> +35.2	C
		11458.800	22.0	< -70.0	-13.0	< -48.0	> +35.0	C
		13368.600	22.3	< -70.0	-13.0	< -47.7	> +34.7	C
		15278.400	22.7	-68.1	-13.0	-45.4	+32.4	C
		17188.200	23.1	< -70.0	-13.0	< -46.9	> +33.9	C
		19098.000	23.4	< -70.0	-13.0	< -46.6	> +33.6	C

Calculated result at 15278.4 MHz, as the worst point shown on underline:

	Corr. Factor	=	22.7 dB
+)	Meter Reading	=	-68.1 dBm
	Result	=	-45.4 dBm

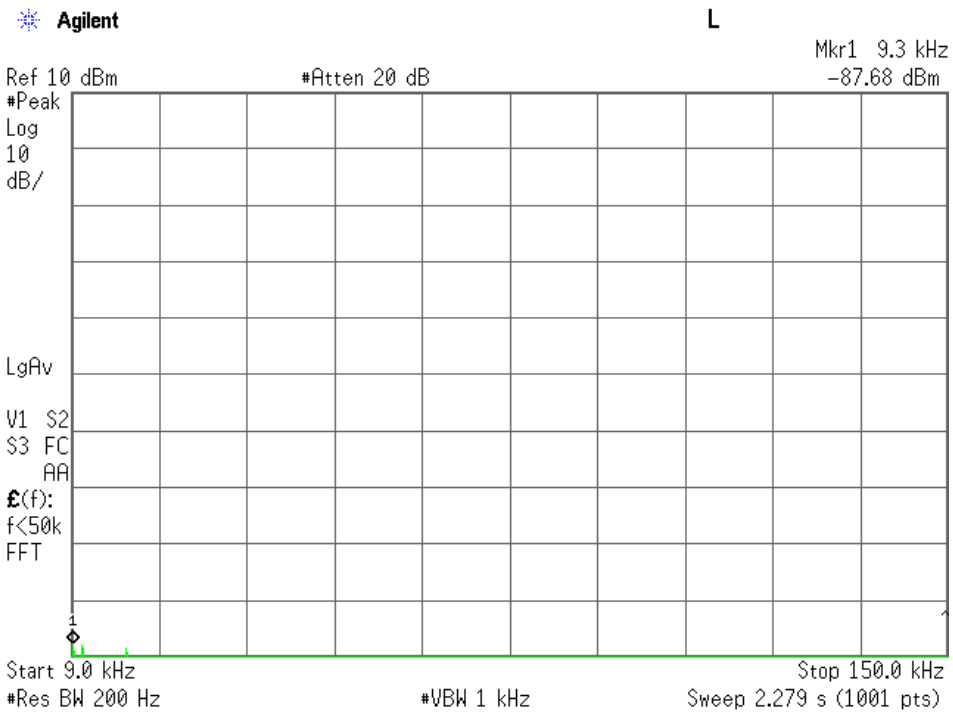
Minimum Margin: -13.0 - (-45.4) = 32.4 (dB)

NOTES

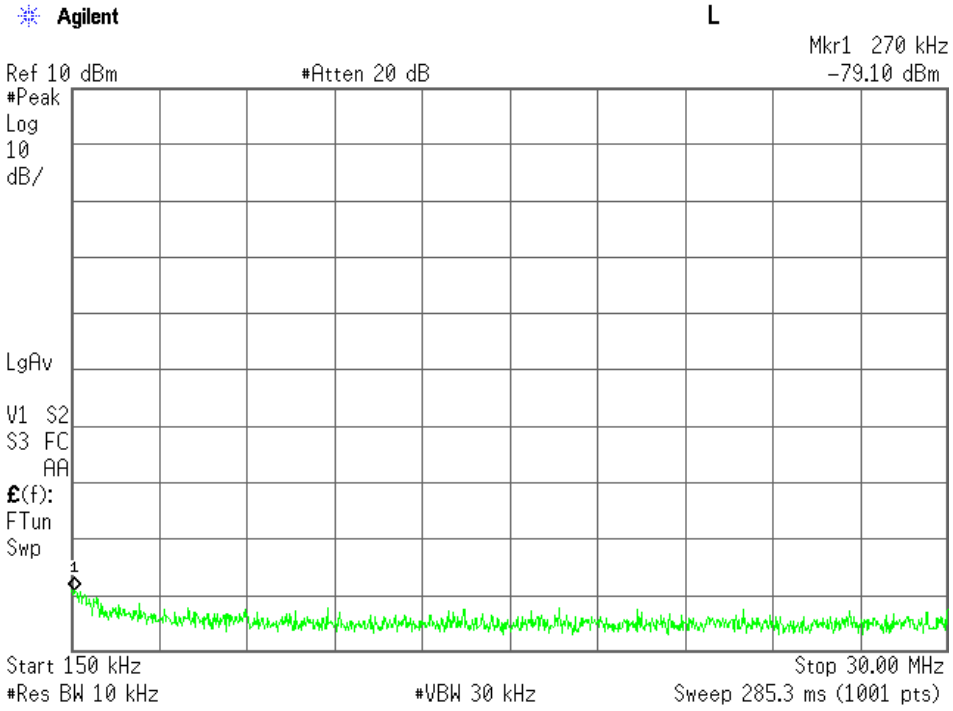
1. The spectrum was checked from 9 kHz to 20 GHz.
2. Applied limits : -13.0 [dBm] = 10log(TP[mW]) - (43 + 10log(tp[W])) = 10log(TP[mW]) - (43 + (10 log(TP[mW]) - 30))
   where, tp[W] = TP[mW] / 1000 : Transmitter power at anttena terminal
3. The correction factor is shown as follows:
   Corr. Factor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

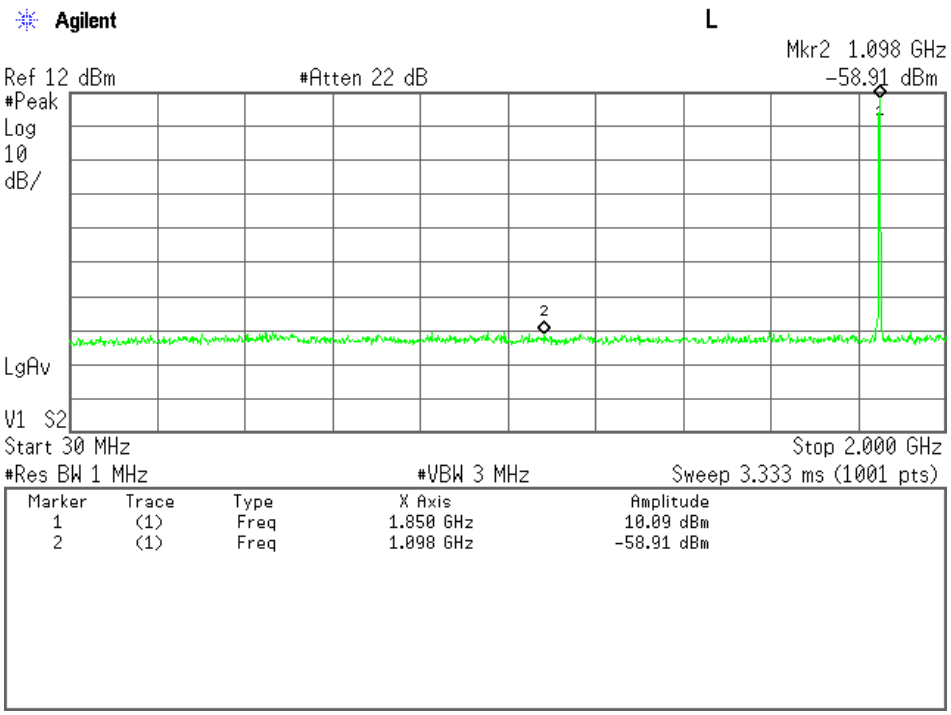
Low Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



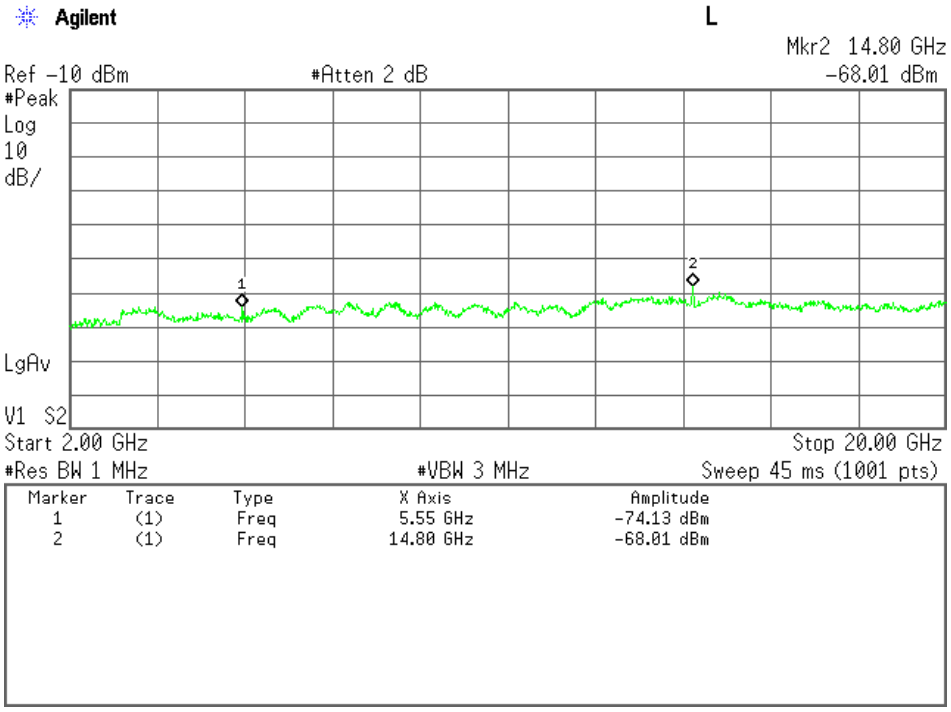
Low Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



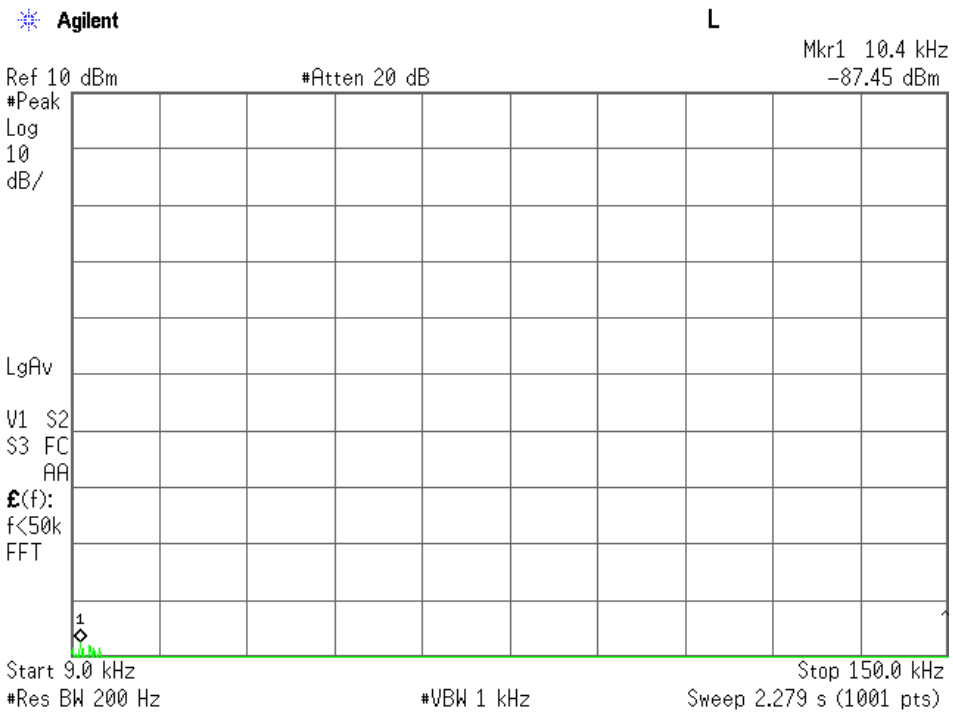
Low Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



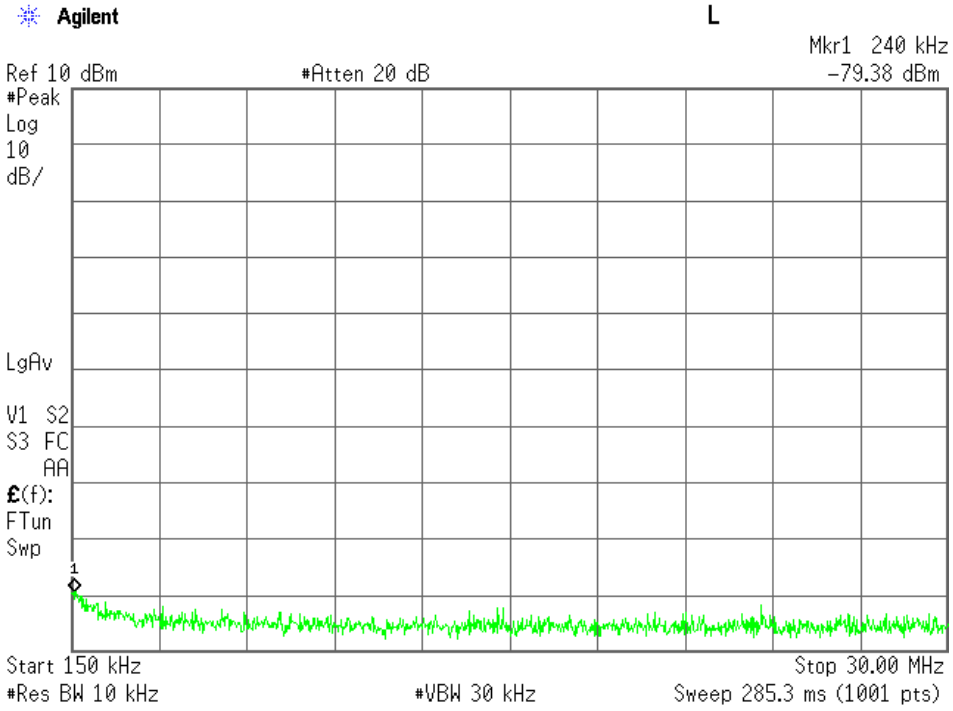
Low Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



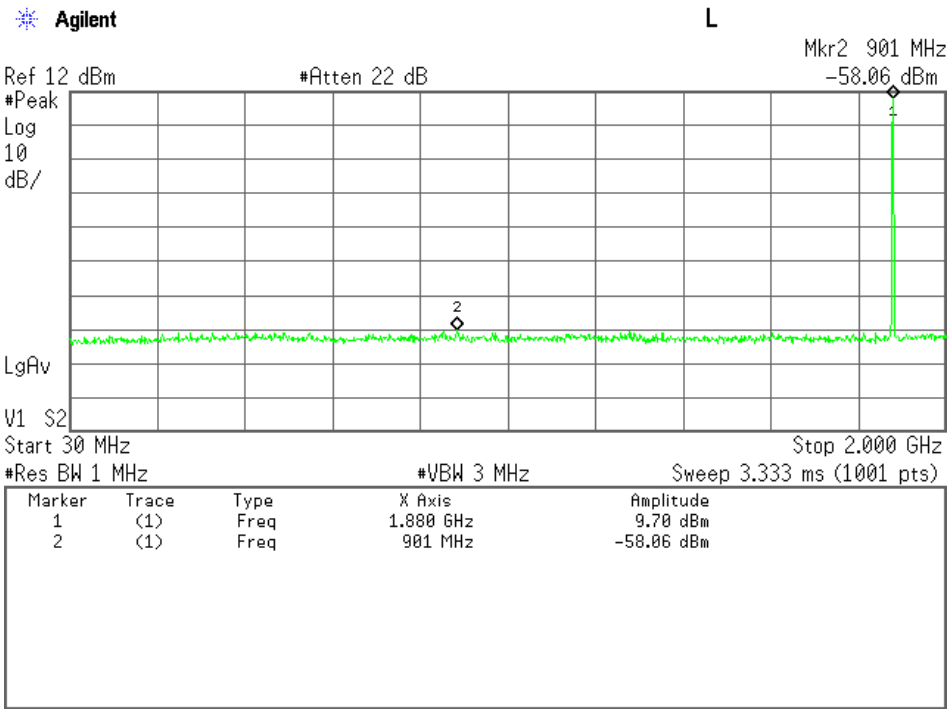
Middle Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



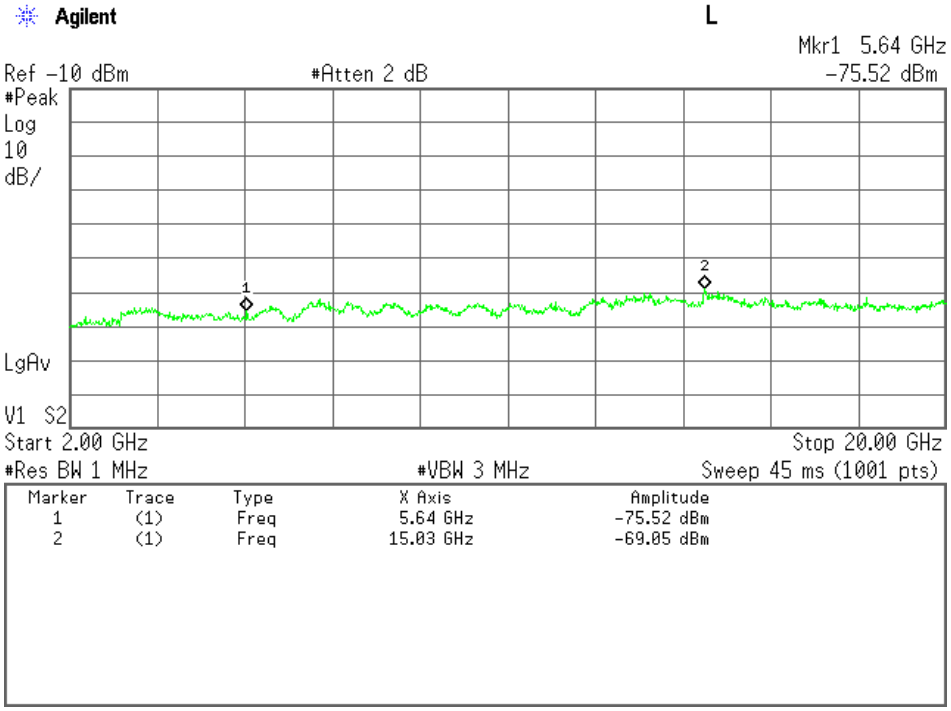
Middle Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



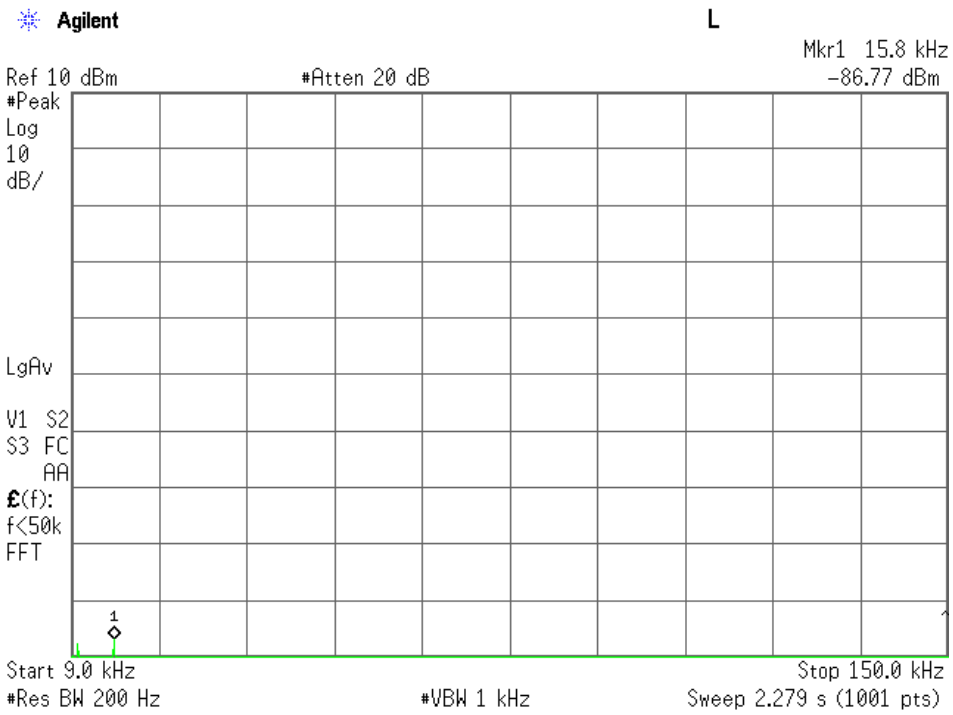
Middle Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



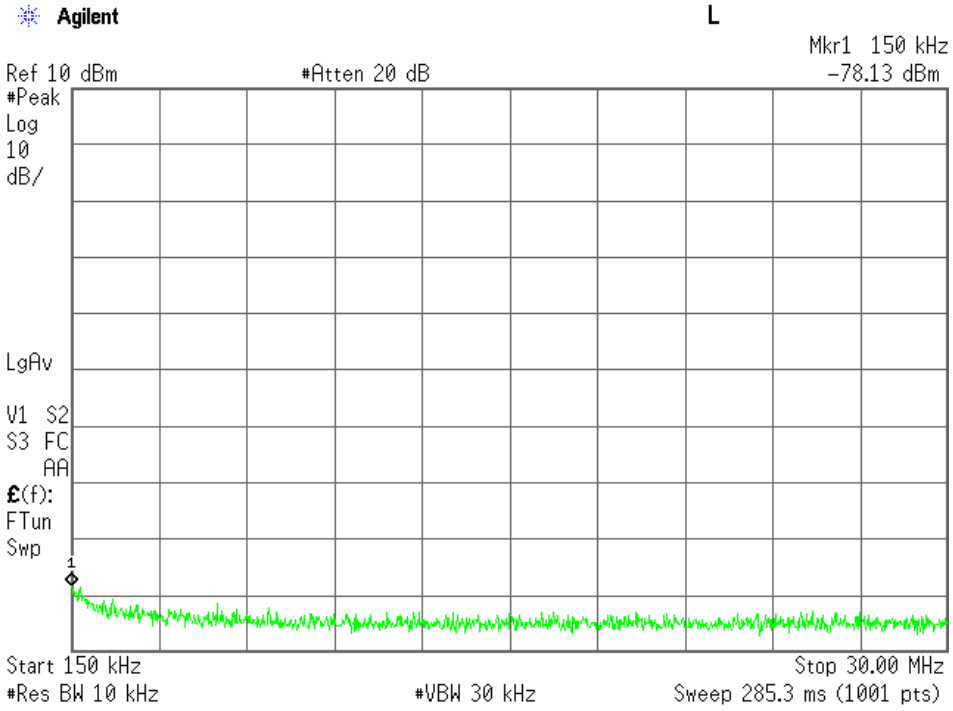
Middle Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



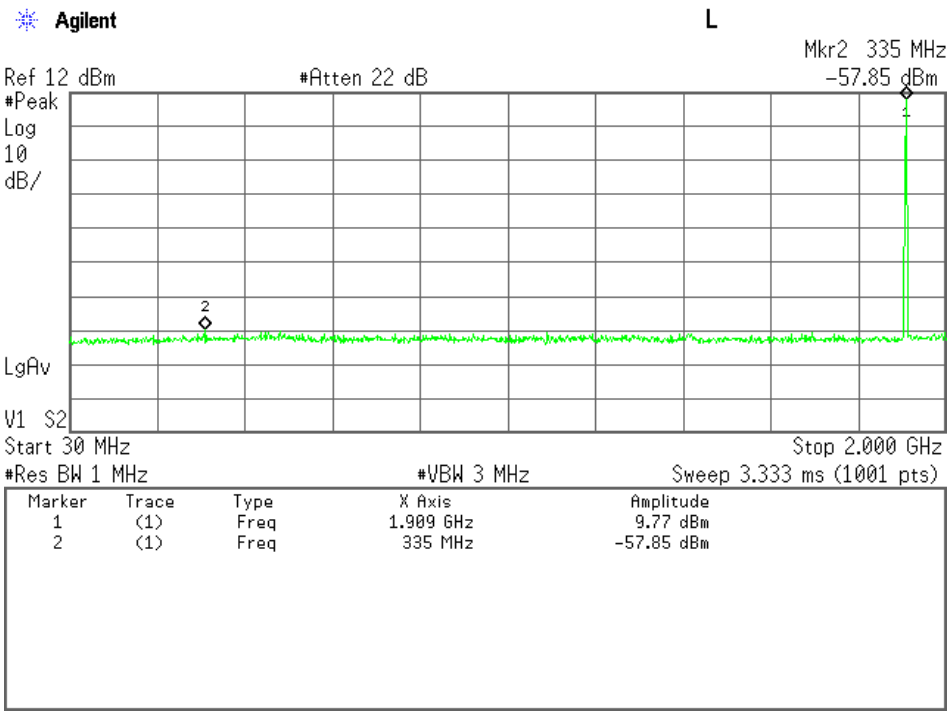
High Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



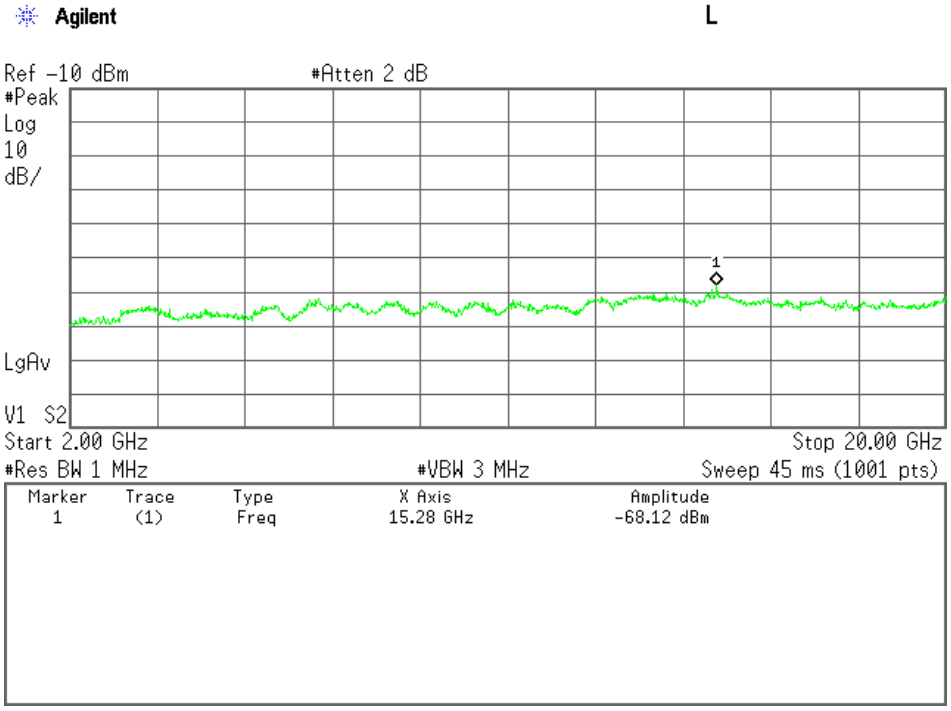
High Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



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

Min. Limit Margin 1.5 dB at 1850.0 MHz

The Band-Edge level is -14.5 dBm at 1850.0 MHz

Uncertainty of Measurement Results +/-1.7 dB(2σ)

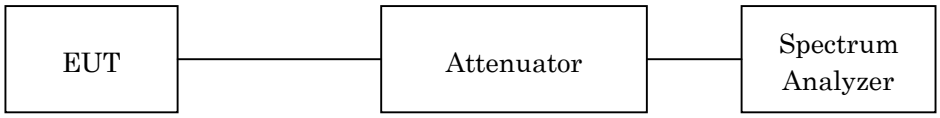
Remarks : The measurement result is within the range of measurement uncertainty.

7.6.2 Test Instruments

Shielded Room S4					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
Spectrum Analyzer	E4446A	Agilent	A-39	2014/9	1 Year
Attenuator	43KC-20	Anritsu	D-41	2014/7	1 Year
RF Cable	SUCOFLEX102	SUHNER	C-52	2014/8	1 Year

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:

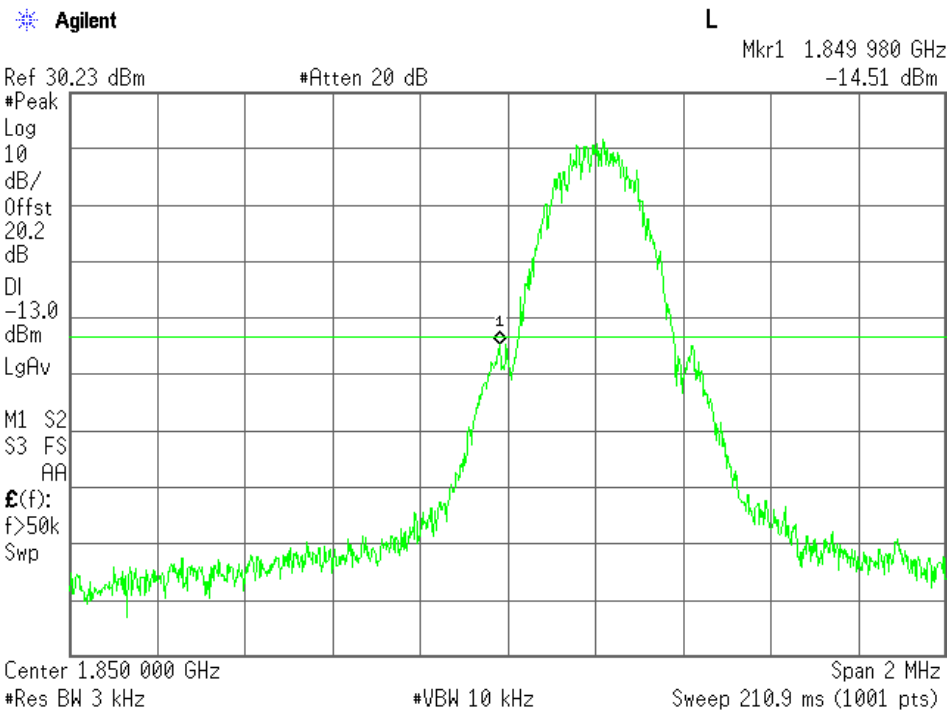
TX Frequency	1850.20 MHz / 1909.80 MHz
Band-Edge Frequency	1850.00 MHz / 1910.00 MHz
Res. Bandwidth	3 kHz
Video Bandwidth	10 kHz
Span	2 MHz
Sweep Time	AUTO
Trace	Maxhold

7.6.4 Test Data

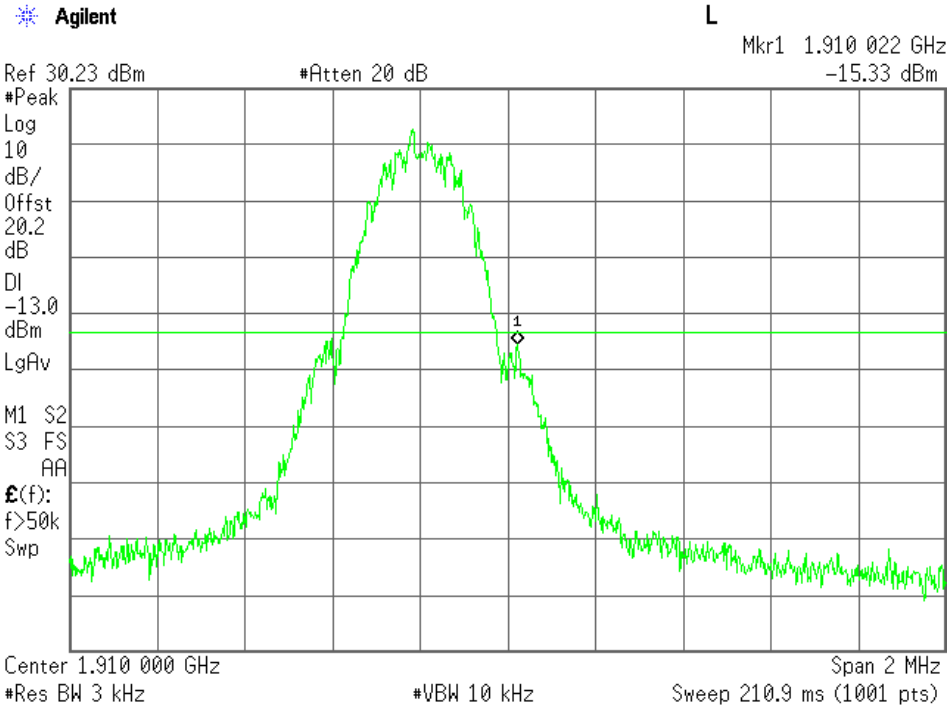
Test Date : May 7, 2015
Temp.:23°C, Humi:48%

Channel	Frequency (MHz)	Band-Edge Frequency (MHz)	Band-Edge Level (dBm)	Limits (dBm)	Margin (dB)
512	1850.200	1850.00	-14.5	-13.0	+1.5
810	1909.800	1910.00	-15.3	-13.0	+2.3

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 >20.7 dB at 17188.200 MHz

Uncertainty of Measurement Results

30 MHz – 1000 MHz	+/-1.6	dB(2σ)
1 GHz – 18GHz	+/-1.8	dB(2σ)
18GHz – 40GHz	+/-2.7	dB(2σ)

Remarks :

7.7.2 Test Instruments

Anechoic Chamber A2					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
Test Receiver	ESU26	Rohde & Schwarz	A-6	2015/4	1 Year
Signal Generator	E8257D	Agilent	B-39	2014/8	1 Year
Power Meter	N1911A	Agilent	B-63	2014/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2014/7	1 Year
Horn Antenna(TX)	91889-2	EATON	C-40-2	2014/6	1 Year
Horn Antenna	91888-2	EATON	C-41-1	2014/7	1 Year
Horn Antenna(RX)	91889-2	EATON	C-41-2	2014/7	1 Year
Horn Antenna	3160-04	EMCO	C-55	2014/6	1 Year
Horn Antenna	3160-05	EMCO	C-56	2014/6	1 Year
Horn Antenna	3160-06	EMCO	C-57	2014/6	1 Year
Horn Antenna	3160-07	EMCO	C-58	2014/6	1 Year
Horn Antenna	3160-08	EMCO	C-59	2014/6	1 Year
Horn Antenna)	3160-09	EMCO	C-48	2014/7	1 Year
RF Cable(TX)	SUCOFLEX102E	SUHNER	C-70	2014/11	1 Year
RF Cable(RX)	SUCOFLEX102E	SUHNER	C-75	2015/2	1 Year
RF Cable(RX)	SUCOFLEX104	SUHNER	C-66	2015/1	1 Year
RF Cable(RX)	SUCOFLEX104	SUHNER	C-67	2015/1	1 Year
RF Cable(RX)	SUCOFLEX102EA	SUHNER	C-69	2015/1	1 Year
Attenuator(TX)	2-10	Weinschel	D-40	2014/10	1 Year
Attenuator(RX)	2-10	Weinschel	D-79	2014/11	1 Year
Attenuator(RX)	54-10	Weinschel	D-29	2014/9	1 Year
Pre-Amplifier	TPA0118-36	TOYO	A-37	2014/5	1 Year
Pre-Amplifier	RP1826G-45H	EMCS	A-53	2014/7	1 Year
HPF	HPM13899	MICRO-TRONICS	D-96	2015/2	1 Year

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 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.

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

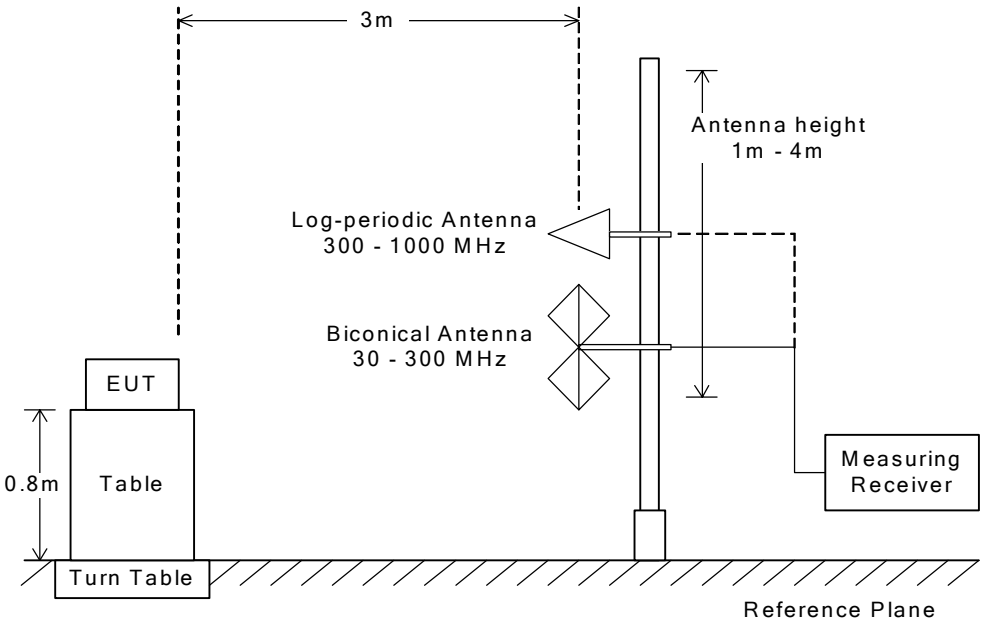
$$erp = eirp - Gd \quad \text{----(Eq.2)}$$

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)

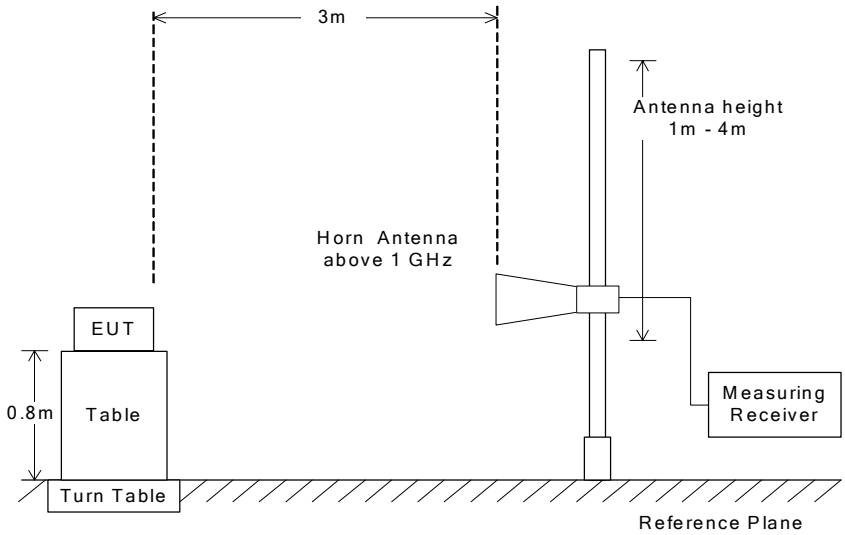
$$eirp = \frac{(de)^2}{30} = \frac{3}{10}e^2$$
$$\therefore 10\log(eirp) = 20\log(e) + 10\log(3/10) = 20\log(e) - 5.23$$
$$10\log(eirp) = EIRP[dBm] - 30$$
$$20\log(e) = E[dB(\mu V/m)] - 120$$
$$\therefore EIRP = E - 120 + 30 - 5.23 = E - 95.23$$
$$\therefore ERP[dBm] = EIRP - 2.15 = E - 97.38$$

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

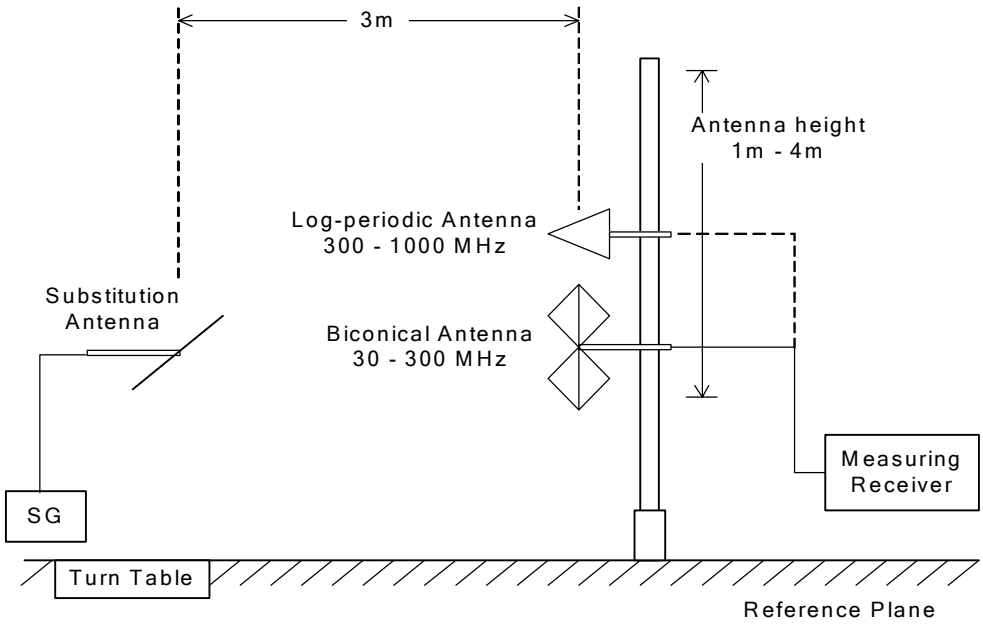


Radiated Emission above 1 GHz



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

Radiated Emission 30 to 1000 MHz – Substitution Method



7.7.4 Test Data

(GSM-PCS1900)

Test Date: April 24, 2015
Temp.: 24 °C, Humi: 45 %

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	< -52.3	< -52.3	-13.0	> +39.3	C
		5550.600	< -47.4	< -47.4	-13.0	> +34.4	C
		7400.800	< -45.8	< -45.8	-13.0	> +32.8	C
		9251.000	< -42.0	< -42.0	-13.0	> +29.0	C
		11101.200	< -40.5	< -40.5	-13.0	> +27.5	C
		12951.400	< -38.9	< -38.9	-13.0	> +25.9	C
		14801.600	< -37.8	< -37.8	-13.0	> +24.8	C
		16651.800	< -36.0	< -36.0	-13.0	> +23.0	C
		18502.000	< -39.9	< -39.9	-13.0	> +26.9	C
661	1880.000	3760.000	< -52.1	< -52.1	-13.0	> +39.1	C
		5640.000	< -47.2	< -47.2	-13.0	> +34.2	C
		7520.000	< -45.8	< -45.8	-13.0	> +32.8	C
		9400.000	< -41.9	< -41.9	-13.0	> +28.9	C
		11280.000	< -40.5	< -40.5	-13.0	> +27.5	C
		13160.000	< -39.0	< -39.0	-13.0	> +26.0	C
		15040.000	< -37.8	< -37.8	-13.0	> +24.8	C
		16920.000	< -34.8	< -34.8	-13.0	> +21.8	C
		18800.000	< -39.9	< -39.9	-13.0	> +26.9	C
810	1909.800	3819.600	< -52.0	< -52.0	-13.0	> +39.0	C
		5729.400	< -47.3	< -47.3	-13.0	> +34.3	C
		7639.200	< -45.8	< -45.8	-13.0	> +32.8	C
		9549.000	< -41.9	< -41.9	-13.0	> +28.9	C
		11458.800	< -40.5	< -40.5	-13.0	> +27.5	C
		13368.600	< -38.9	< -38.9	-13.0	> +25.9	C
		15278.400	< -37.8	< -37.8	-13.0	> +24.8	C
		17188.200	< -33.7	< -33.7	-13.0	> +20.7	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 - (<-33.7) = >20.7 (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 +0.04 ppm at 1880.000 MHz

Uncertainty of Measurement Results +/-0.03 ppm(2σ)

Remarks : _____

7.8.2 Test Instruments

Type	Model	Manufacturer	ID No.	Last Cal.	Interval
Universal Radio Communication Tester	CMU200	Rohde & Schwarz	B-21	2014/5	1 Year
DC Voltage Meter	2011-39	YEW	B-33	2014/6	1 Year
Environmental Chamber	SH-641	ESPEC	F-32	2014/7	1 Year
DC Power Supply	NL035-10	TAKASAGO	F-4	N/A	N/A

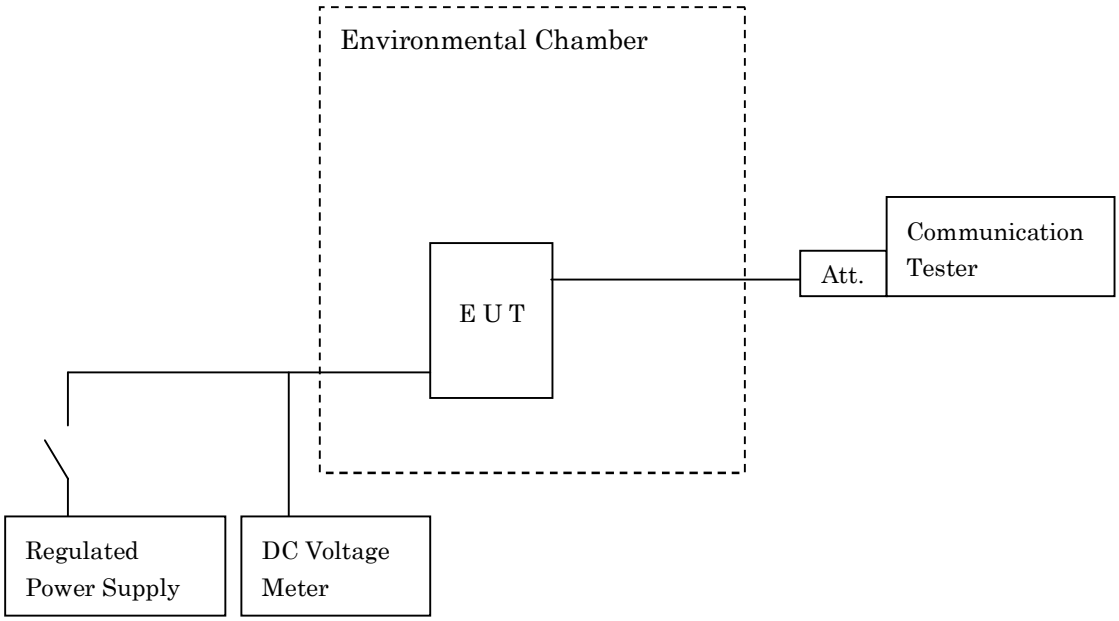
7.8.3 Test Method and Test Setup (Diagrammatic illustration)

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: May 8, 2015

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	+ 0.03	+ 0.03	+ 0.03	N/A	N/A
-20	+ 0.03	**+ 0.04**	+ 0.03	+ 0.03	N/A	N/A
-10	+ 0.03	+ 0.03	+ 0.03	+ 0.03	N/A	N/A
0	+ 0.03	+ 0.03	+ 0.03	+ 0.03	N/A	N/A
10	+ 0.03	+ 0.02	+ 0.02	+ 0.02	N/A	N/A
20	**+ 0.04**	+ 0.03	+ 0.03	+ 0.02	N/A	N/A
30	+ 0.03	+ 0.03	+ 0.03	+ 0.03	N/A	N/A
40	+ 0.03	+ 0.03	+ 0.03	+ 0.03	N/A	N/A
50	+ 0.03	+ 0.03	+ 0.03	+ 0.03	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	**+ 0.04**	+ 0.03	+ 0.03	+ 0.02	N/A	N/A
3.7(Ending)	+ 0.03	+ 0.03	+ 0.02	+ 0.03	N/A	N/A

Test condition example as the maximum deviation point shown on underline:
Ambient Temperature : -20 °C / 2 minutes
DC Supply Voltage : 4 VDC

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