JQA File No.：KL80150337
Issue Date：September 15, 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.	:	SH-01H
Serial No.	:	004401115521631 004401115521664
FCC ID	:	APYHRO00225
Test Standard	:	CFR 47 FCC Rules and Regulations Part 22
Test Results	:	**Passed**
Date of Test	:	August 24 ~ September 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-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.
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- VLAC does not approve, certify or warrant the product by this test report.

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DEFINITIONS FOR ABBREVIATION AND SYMBOLS USED IN THIS TEST REPORT

EUT	: Equipment Under Test	**EMC**	: Electromagnetic Compatibility
AE	: Associated Equipment	**EMI**	: Electromagnetic Interference
N/A	: Not Applicable	**EMS**	: Electromagnetic Susceptibility
N/T	: Not Tested		

☑ - indicates that the listed condition, standard or equipment is applicable for this report.
☐ - indicates that the listed condition, standard or equipment is not applicable for this report.

1 Description of the Equipment Under Test

1.	Manufacturer	:	Sharp Corporation, Communication Systems Division 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
2.	Products	:	Smart Phone
3.	Model No.	:	SH-01H
4.	Serial No.	:	004401115521631 004401115521664
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	July, 2015
7.	Power Rating	:	4.0VDC (Lithium-ion Battery LIS1613SPPC(SY6) 3100mAh)
8.	Grounding	:	None
9.	Transmitting Frequency	:	824.2 MHz(128CH) – 848.8 MHz(251CH)
10.	Receiving Frequency	:	869.2 MHz(128CH) – 893.8 MHz(251CH)
11.	Emission Designations	:	245KGXW
12.	Max. RF Output Power	:	0.759W (ERP)
13.	Category	:	GSM850
14.	EUT Authorization	:	Certification
15.	Received Date of EUT	:	August 21, 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) $= 824.2 + 0.2 \times (n - 128)$
where, n : channel number ($128 \leq n \leq 251$)

Receiving Frequency (in MHz) $= 869.2 + 0.2 \times (n - 128)$
where, n : channel number ($128 \leq n \leq 251$)

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 22
Subpart H – Cellular Radiotelephone Service

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
Assistant 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 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	SH-01H	004401115521631 *1) 004401115521664 *2)	APYHRO00225
B	AC Adapter	Fujitsu Corporation	05	XEA	N/A
C	Stereo Handsfree	Sharp	SHLDL1	--	N/A
D	DTV Antenna	Sharp	SH01	--	N/A

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

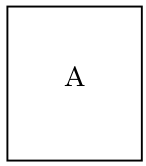
The auxiliary equipment used for testing :
None

Type of Cable:

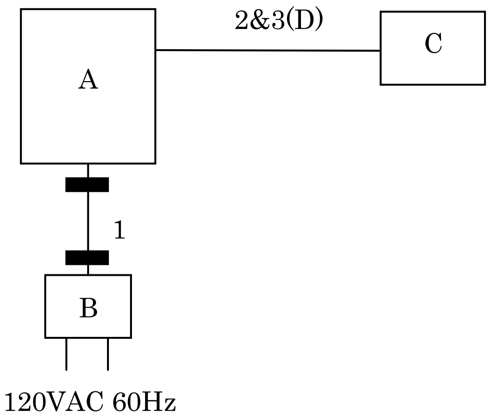
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	USB conversion cable	--	--	NO	YES	1.2
2	Handsfree Cable	--	--	NO	NO	1.5
3	DTV Antenna Cable	--	--	NO	NO	0.3

6.2 Test Arrangement (Drawings)

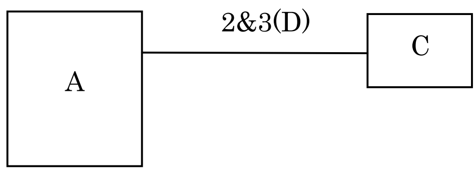
a) Single Unit



b) AC Adapter used



c) Earphone used



: Ferrite Core

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, 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 22.913(a)(2)	Section 7.1	Passed	-
ERP / EIRP RF Power Output	Section 22.913(a)(2)	Section 7.2	Passed	-
Modulation Characteristics	-	-	-	-
Occupied Bandwidth	Section 22.917	Section 7.4	Passed	-
Spurious Emissions at Antenna Terminals	Section 22.917	Section 7.5	Passed	-
Band-Edge Emission	Section 22.917	Section 7.6	Passed	-
Field Strength of Spurious Radiation	Section 22.917	Section 7.7	Passed	-
Frequency Stability	Section 22.355	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 1811.3 mW at 836.400 MHz

Uncertainty of Measurement Results ± 0.9 dB(2σ)

Remarks : ______________________________

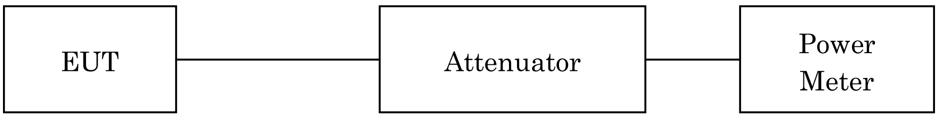
7.1.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2016/07/16
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2016/07/16
Attenuator	43KC-20	1418003 (D-41)	Anritsu	2016/07/05
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

(GSM850)

Test Date: August 24, 2015
Temp.: 27 °C, Humi: 64 %

Transmitting Frequency		Correction Factor	Meter Reading (Peak)	Results (Peak)	
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]
128	824.200	20.35	12.20	32.55	1798.9
189	836.400	20.35	12.23	32.58	1811.3
251	848.800	20.35	12.21	32.56	1803.0

Calculated result at 836.400 MHz, as the maximum level point shown on underline:

	Correction Factor	=	20.35	dB
+)	Meter Reading	=	12.23	dBm
	Result	=	32.58	dBm = 1811.3 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 9.7 dB at 848.800 MHz

Uncertainty of Measurement Results ± 1.6 dB(2σ)

Remarks : The maximum ERP is 0.759 W at 848.800 MHz.

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	2016/04/25
Signal Generator	E8257D	MY45140309 (B-39)	Agilent	2016/08/10
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2016/07/16
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2016/07/16
Log-periodic Antenna	UHALP9108-A1	0694 (C-31)	Schwarzbeck	2016/05/24
Attenuator (TX)	2-10	BA6214 (D-79)	Weinschel	2015/11/18
Dipole Antenna (TX)	KBA-611	0-248-2 (C-20)	Kyoritsu	2016/05/20

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

7.2.3 Test Method and Test Setup (Diagrammatic illustration)

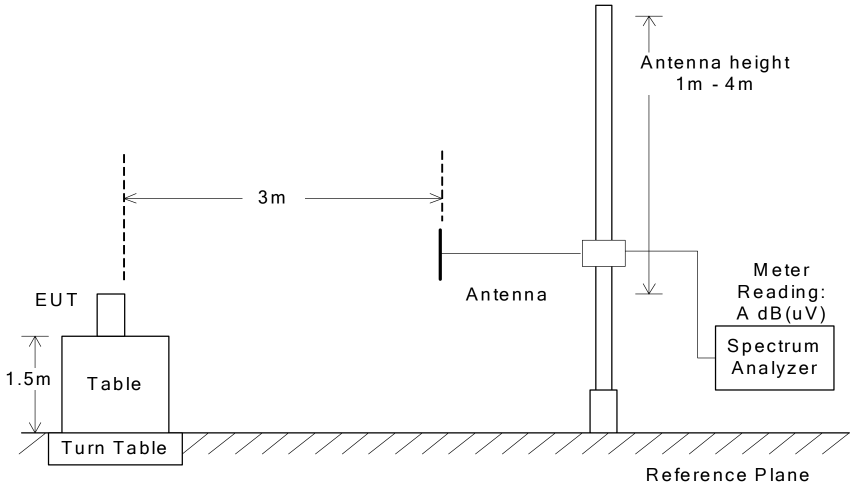
Step 1:
In order to obtain the maximum emission, the EUT was placed at the height 1.5 m on the non-conducted support and was varying at three orthogonal axes, at the distance 3 m from the receiving antenna and rotated around 360 degrees.
The receiving antenna height was varied from 1 m to 4 m.
The EUT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

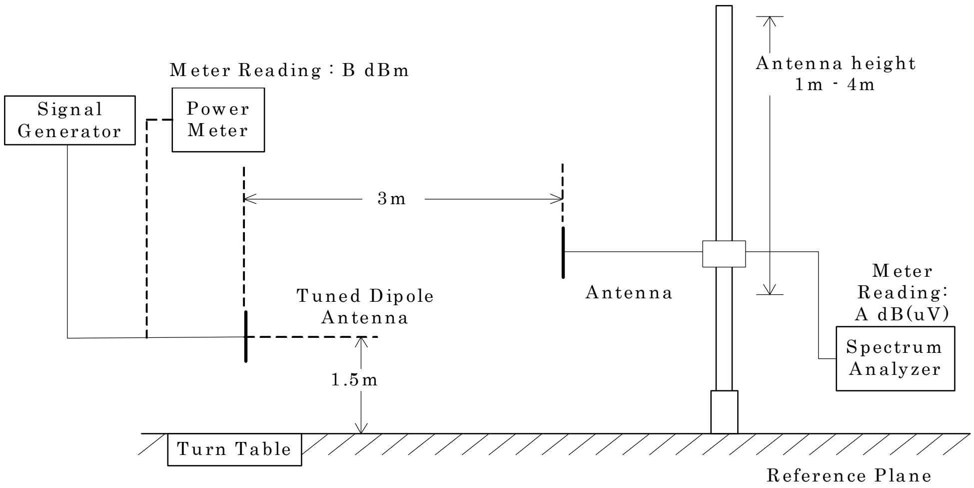
The ERP/EIRP output power was calculated in the following equation.

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 Half-wave Dipole
Antenna

7.2.4 Test Data

(GSM850)

Test Date: August 31, 2015
Temp.: 26 °C, Humi: 75 %

1. Measurement Results

Transmitting Frequency		Emission Measurement [dB(uV)]		Substitution Measurement [dB(uV)]		Supplied Power to Substitution Antenna	Balun Loss of Substitution Antenna
CH	[MHz]	Hori. (Mh)	Vert. (Mv)	Hori. (Msh)	Vert. (Msv)	[dBm]	[dB]
128	824.200	101.5	100.9	67.3	66.0	- 5.0	1.3
189	836.400	100.9	100.3	66.8	65.8	- 5.0	1.4
251	848.800	100.7	100.1	66.8	64.8	- 5.0	1.5

2. Calculation Results

Transmitting Frequency		Peak ERP [dBm]		Maximum Peak ERP	Limits	Margin
CH	[MHz]	Hori. (ERPh)	Vert. (ERPv)	[W]	[dBm]	[dB]
128	824.200	27.9	28.6	0.724	38.5	+ 9.9
189	836.400	27.7	28.1	0.646	38.5	+10.4
251	848.800	27.4	28.8	0.759	38.5	+ 9.7

Calculated result at 848.800 MHz, as the worst point shown on underline:

Emission Measurment (Mv)	=	100.1	dB(uV)
Substitution Measurement (Msv)	=	-64.8	dB(uV)
Supplied Power to Substitution Antenna	=	-5.0	dBm
+) Balun Loss of Substitution Antenna	=	-1.5	dB
Result (ERPv)	=	28.8	dBm = 0.759 W

Minimum Margin: 38.5 - 28.8 = 9.7 (dB)

NOTE : Setting of measuring instrument(s) :

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

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	848.800	MHz
The 26dB Bandwidth is	321.3	kHz	at	836.400	MHz

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : ____________________

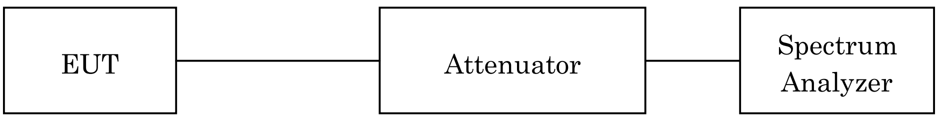
7.4.2 Test Instruments

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	2016/07/05
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

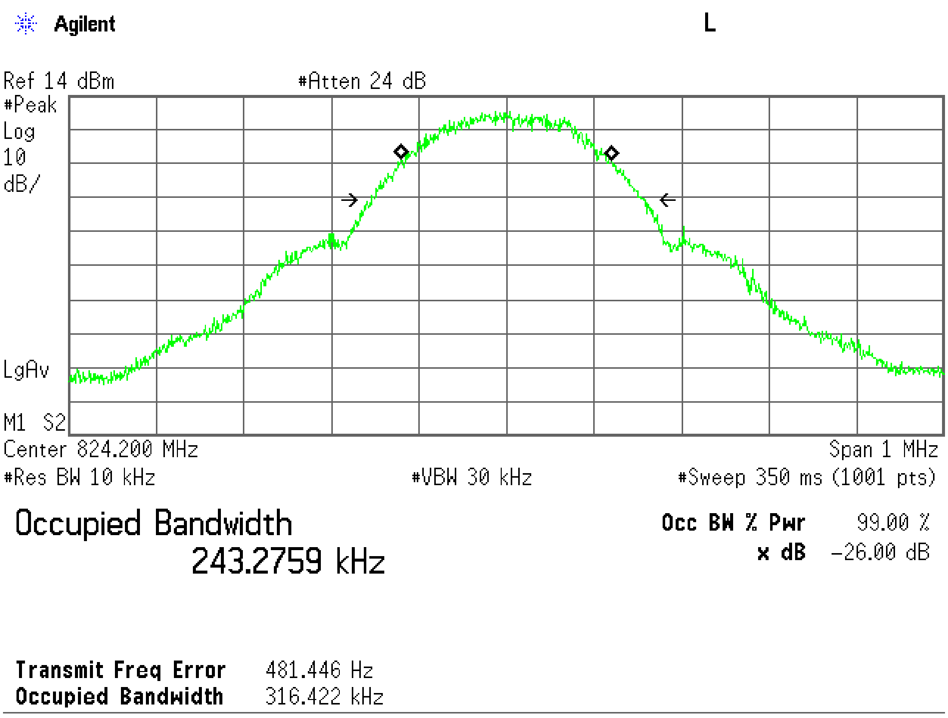
7.4.4 Test Data

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.

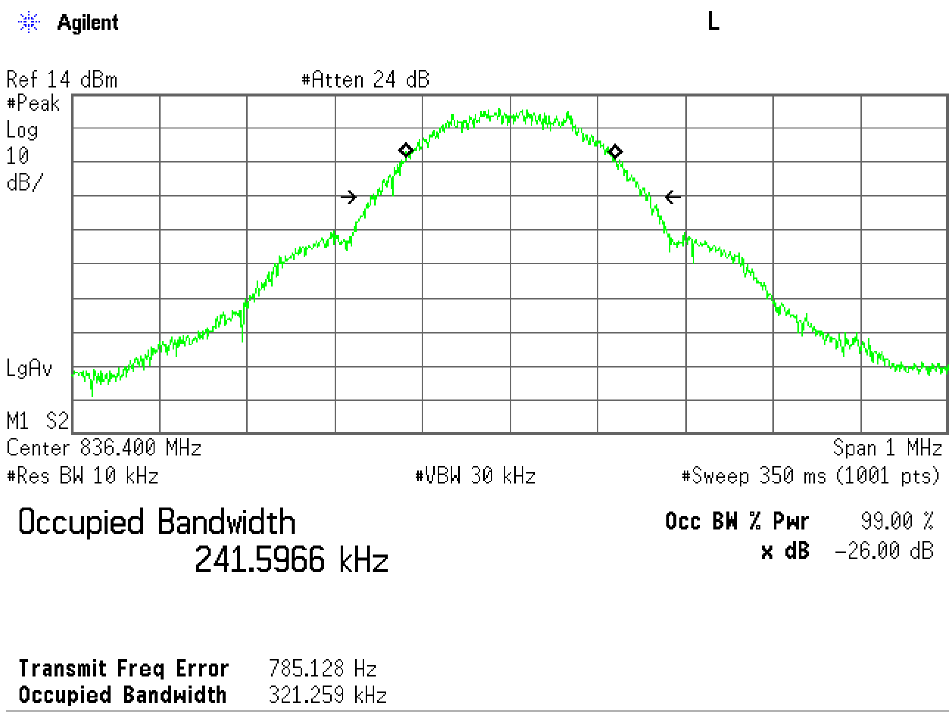
Test Date :August 24 2015
Temp.:27°C, Humi:64%

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-26dBc Bandwidth (kHz)
128	824.20	243.3	316.4
189	836.40	241.6	321.3
251	848.80	244.6	313.1

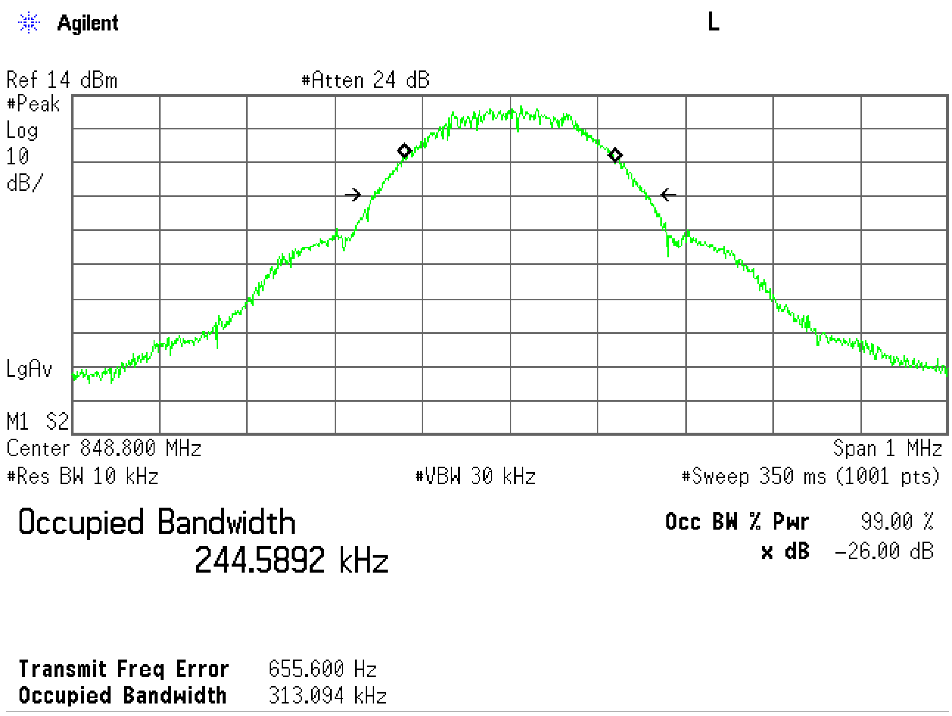
Low Channel



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 >34.9 dB at 8242/8364/8488 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

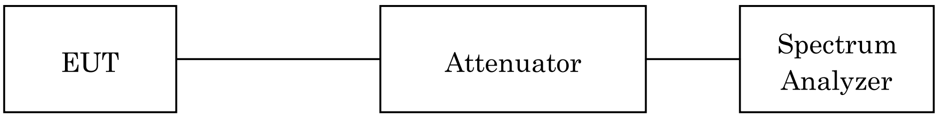
Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
Attenuator	43KC-20	1418003 (D-41)	Anritsu	2016/07/05
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16
High Pass Filter	HPM50108	010 (D-94)	MICRO-TRONICS	2016/02/08

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

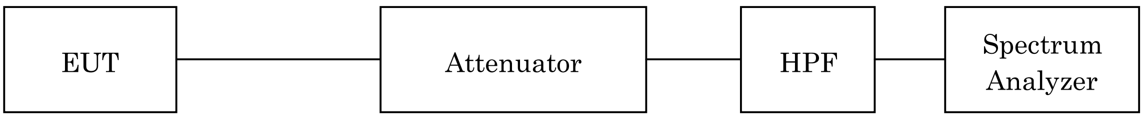
7.5.3 Test Method and Test Setup (Diagrammatic illustration)

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

a) Frequency Range: 9 kHz – 1.2 GHz



b) Frequency Range: 1.2 GHz – 10 GHz



The setting of the spectrum analyzer are shown as follows:

Frequency Range	9 kHz - 150 kHz	150 kHz - 30 MHz	30 MHz - 10 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

(GSM850)

Test Date: August 24, 2015
Temp.: 27 °C, Humi: 64 %

CH	Transmitting Frequency [MHz]	Measured Frequency [MHz]	Corr. Factor [dB]	Meter Readings [dBm]	Limits [dBm]	Results [dBm]	Margin [dB]	Remarks
128	824.200	1648.400	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		2472.600	21.2	< -70.0	-13.0	< -48.8	> +35.8	C
		3296.800	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		4121.000	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		4945.200	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		5769.400	21.6	< -70.0	-13.0	< -48.4	> +35.4	C
		6593.600	21.7	< -70.0	-13.0	< -48.3	> +35.3	C
		7417.800	21.9	< -70.0	-13.0	< -48.1	> +35.1	C
		8242.000	22.1	< -70.0	-13.0	< -47.9	> +34.9	C
189	836.400	1672.800	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		2509.200	21.2	< -70.0	-13.0	< -48.8	> +35.8	C
		3345.600	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		4182.000	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		5018.400	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		5854.800	21.6	< -70.0	-13.0	< -48.4	> +35.4	C
		6691.200	21.7	< -70.0	-13.0	< -48.3	> +35.3	C
		7527.600	21.9	< -70.0	-13.0	< -48.1	> +35.1	C
		8364.000	22.1	< -70.0	-13.0	< -47.9	> +34.9	C
251	848.800	1697.600	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		2546.400	21.2	< -70.0	-13.0	< -48.8	> +35.8	C
		3395.200	21.4	< -70.0	-13.0	< -48.6	> +35.6	C
		4244.000	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		5092.800	21.5	< -70.0	-13.0	< -48.5	> +35.5	C
		5941.600	21.6	< -70.0	-13.0	< -48.4	> +35.4	C
		6790.400	21.8	< -70.0	-13.0	< -48.2	> +35.2	C
		7639.200	21.9	< -70.0	-13.0	< -48.1	> +35.1	C
		8488.000	22.1	< -70.0	-13.0	< -47.9	> +34.9	C

Calculated result at 8242.0 MHz, as the worst point shown on underline:

	Corr. Factor	=	22.1 dB
+)	Meter Reading	=	<-70.0 dBm
	Result	=	<-47.9 dBm

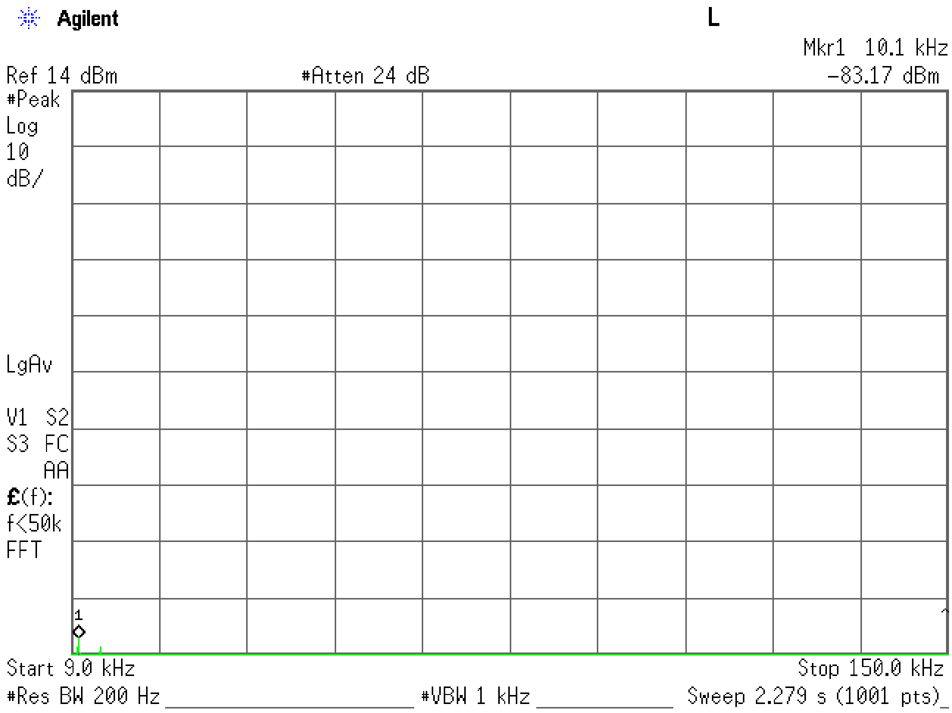
Minimum Margin: -13.0 - (<-47.9) = >34.9 (dB)

NOTES

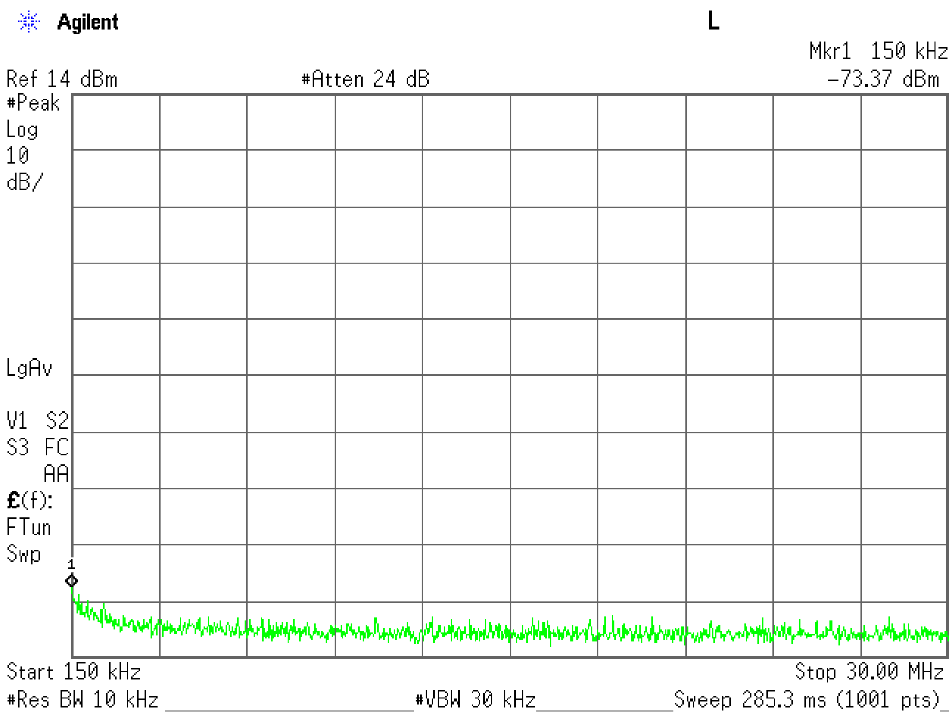
1. The spectrum was checked from 9 kHz to 10 GHz.
2. Applied limits : -13.0 [dBm] = 10log(TP[mW]) - (43 + 10log(tp[W])) = 10log(TP[mW]) - (43 + (10 log(TP[mW]) - 30))
   where, tp[W] = TP[mW] / 1000 : Transmitter power at anttena terminal
3. The correction factor is shown as follows:
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. [dB] (9 kHz - 1.2 GHz)
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. + High Pass Filter Loss (D-94) [dB] (over 1.2 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

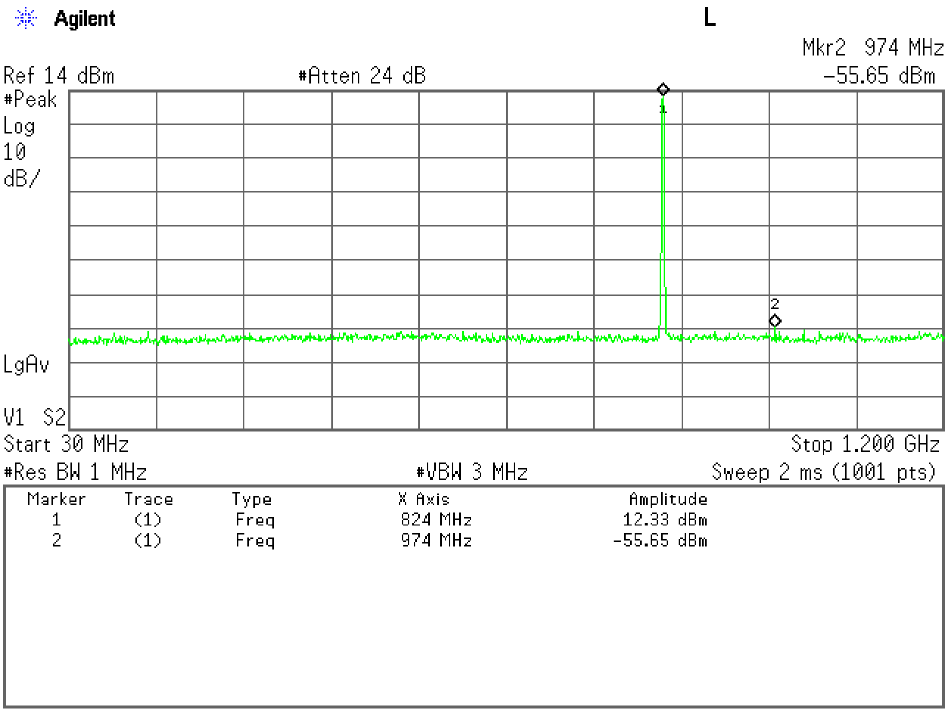
Low Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



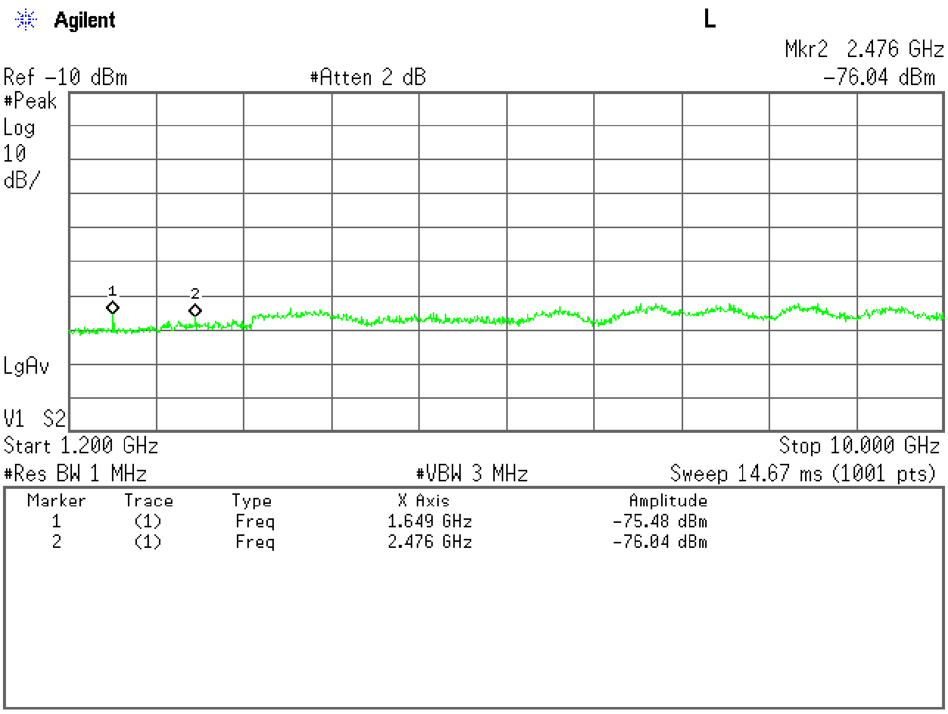
Low Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



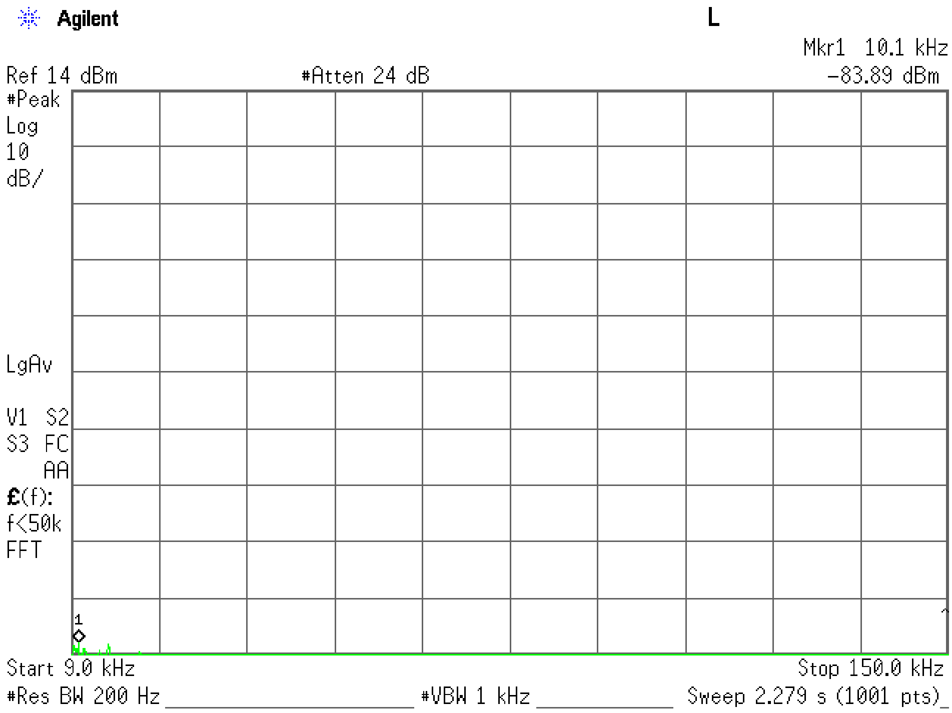
Low Channel, Out-Of-Band Emissions (30 MHz – 1.2 GHz)



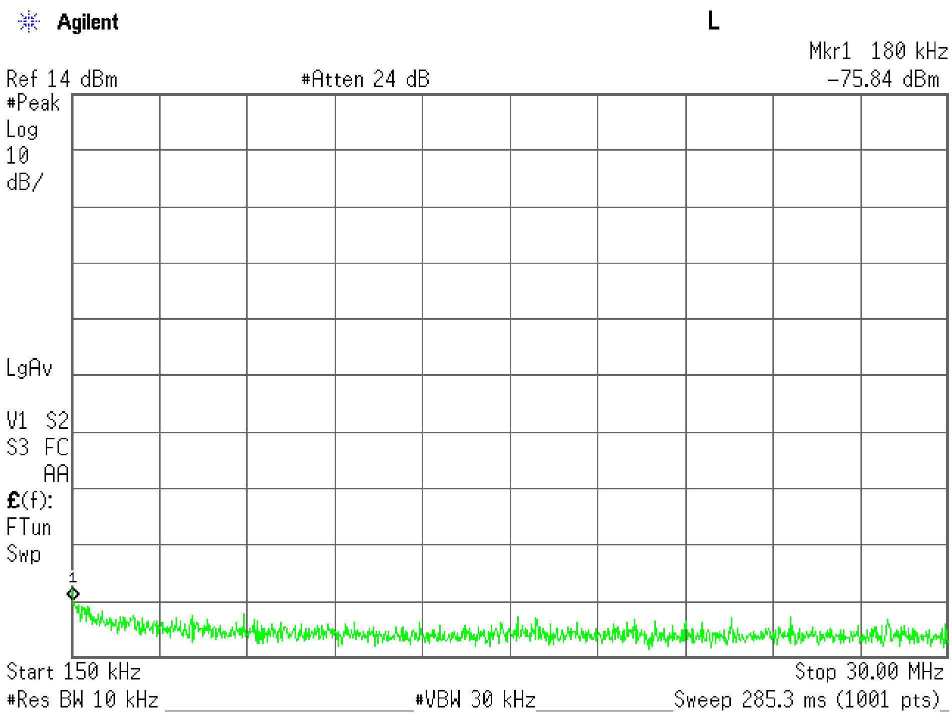
Low Channel, Out-Of-Band Emissions (1.2 GHz – 10 GHz)



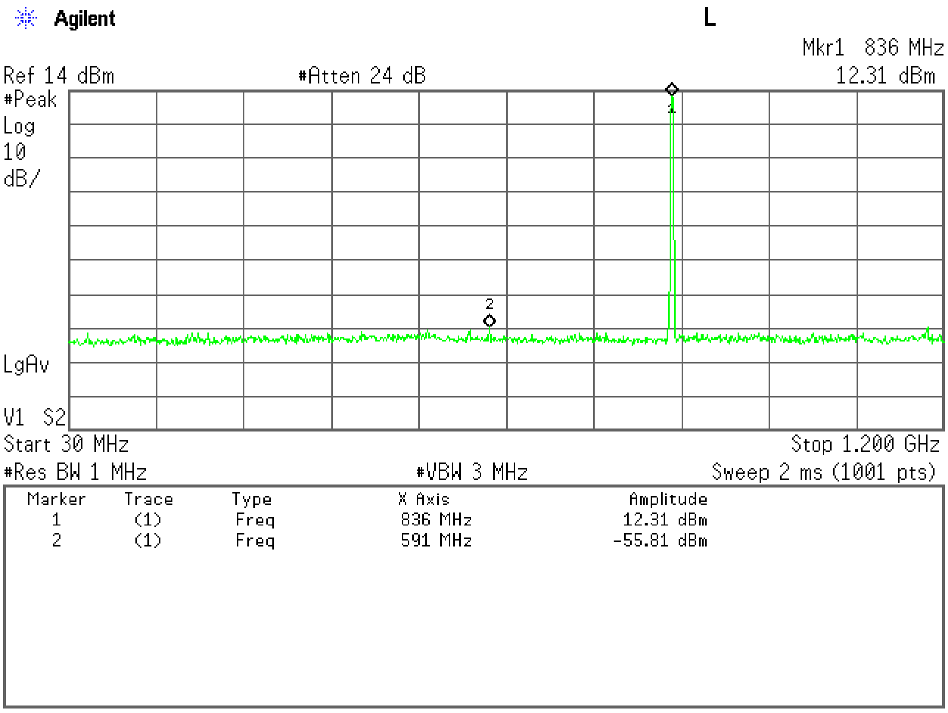
Middle Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



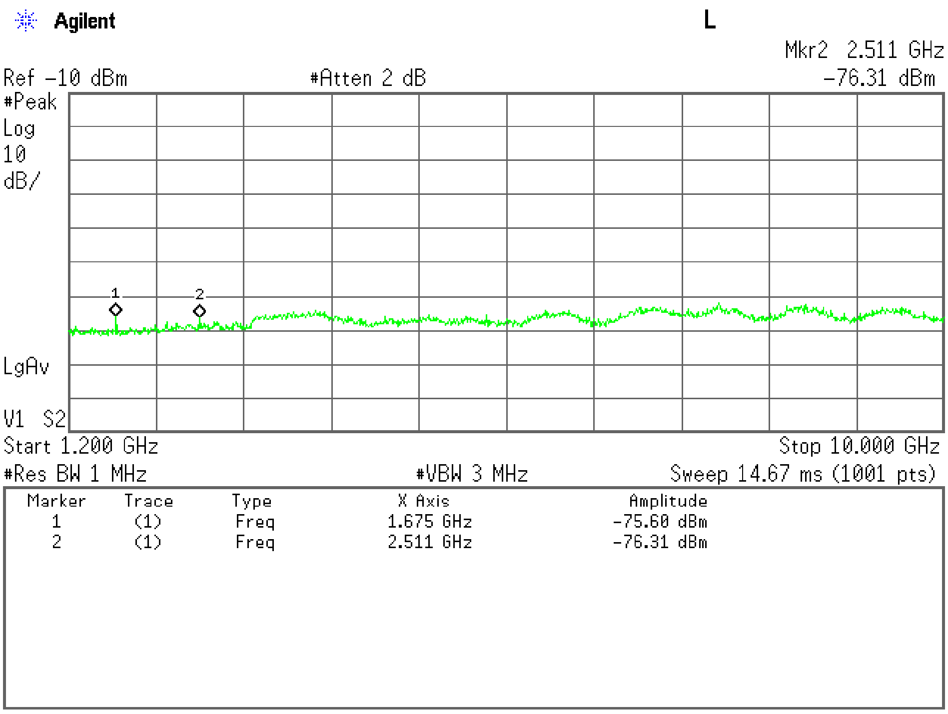
Middle Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



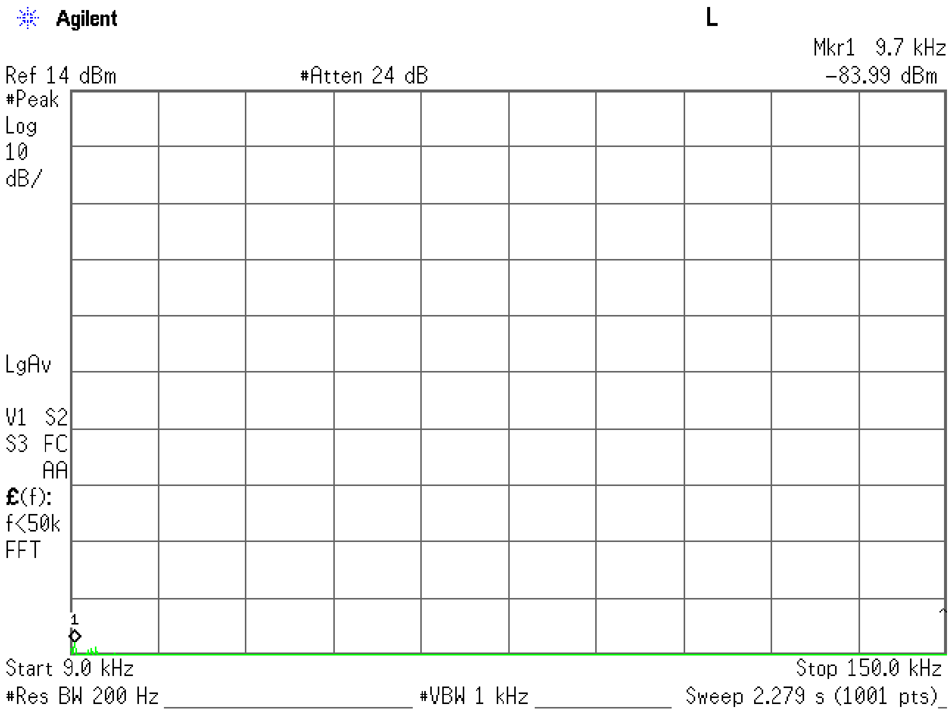
Middle Channel, Out-Of-Band Emissions (30 MHz – 1.2 GHz)



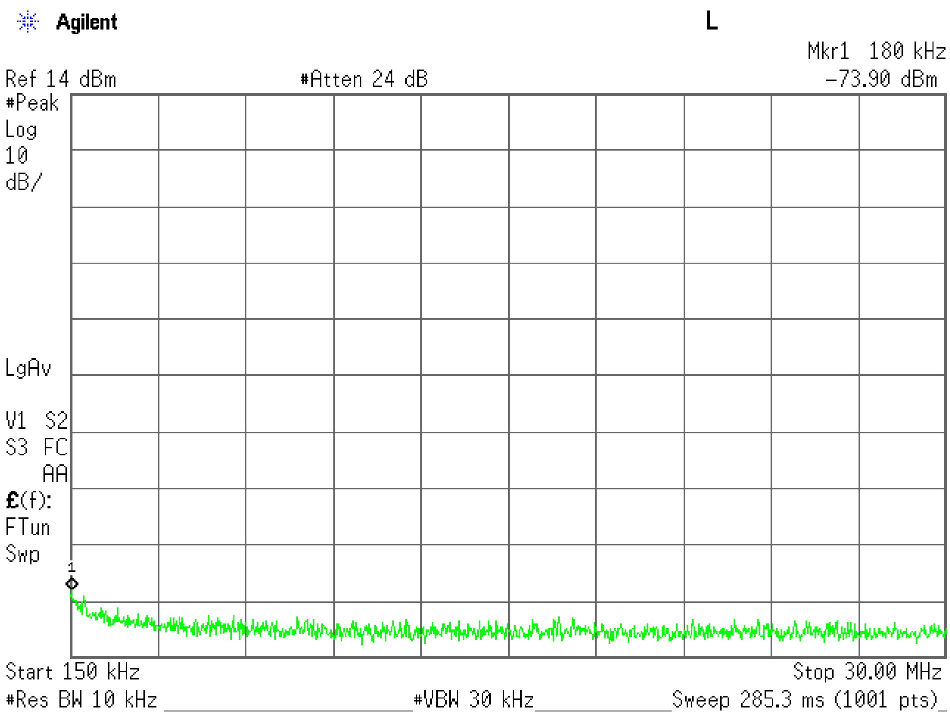
Middle Channel, Out-Of-Band Emissions (1.2 GHz – 10 GHz)



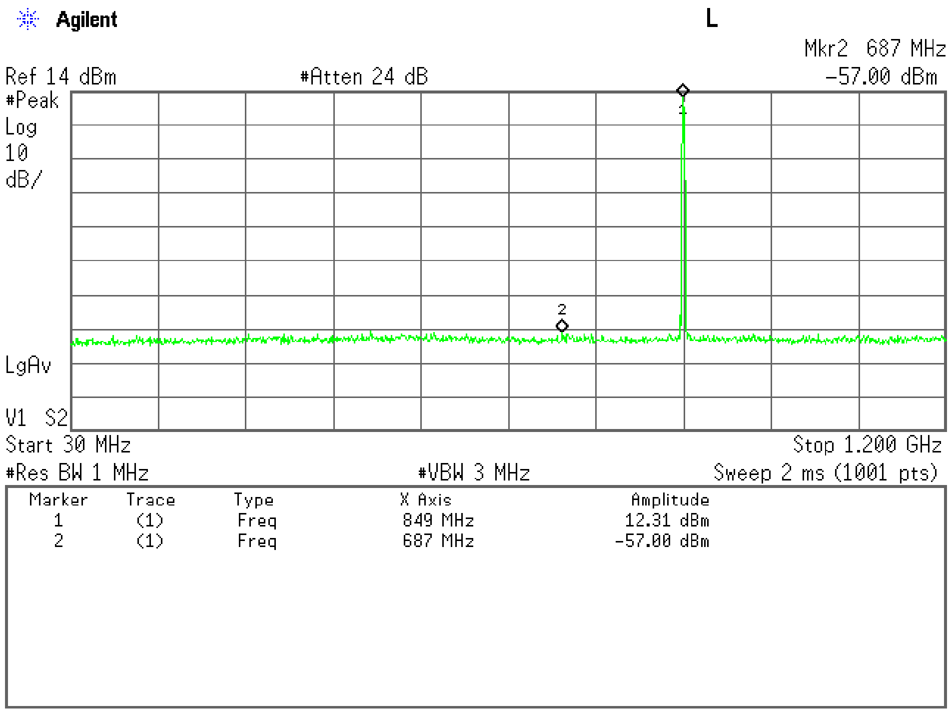
High Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



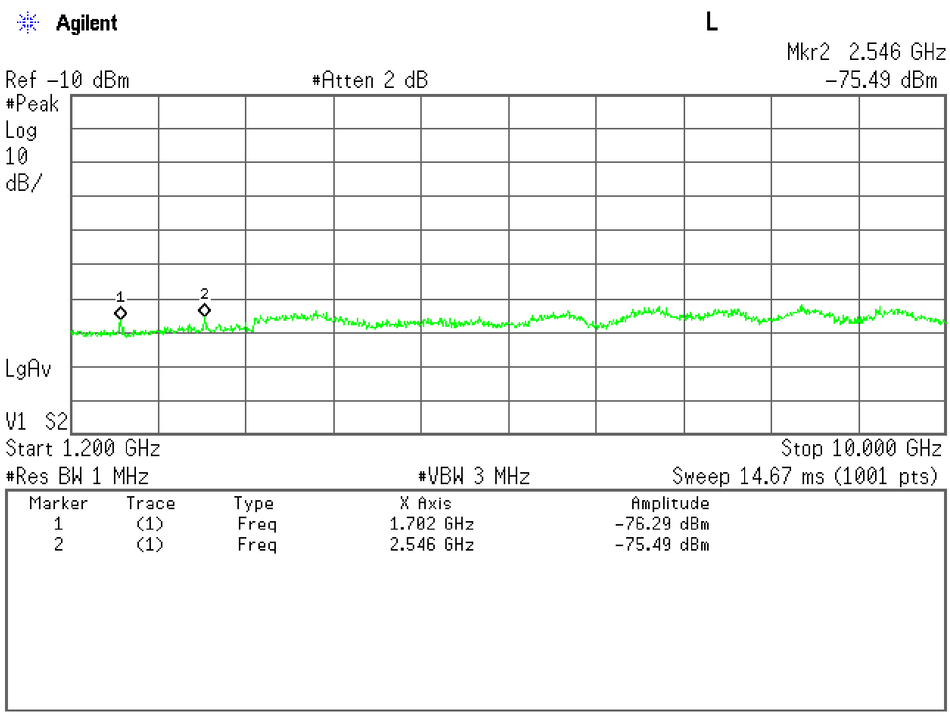
High Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



High Channel, Out-Of-Band Emissions (30 MHz – 1.2 GHz)



High Channel, Out-Of-Band Emissions (1.2 GHz – 10 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 0.9 dB at 849.0 MHz

The Band-Edge level is -13.9 dBm at 849.0 MHz

Uncertainty of Measurement Results ± 1.4 dB(2σ)

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

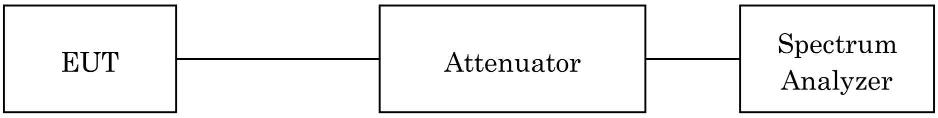
7.6.2 Test Instruments

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	2016/07/05
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:

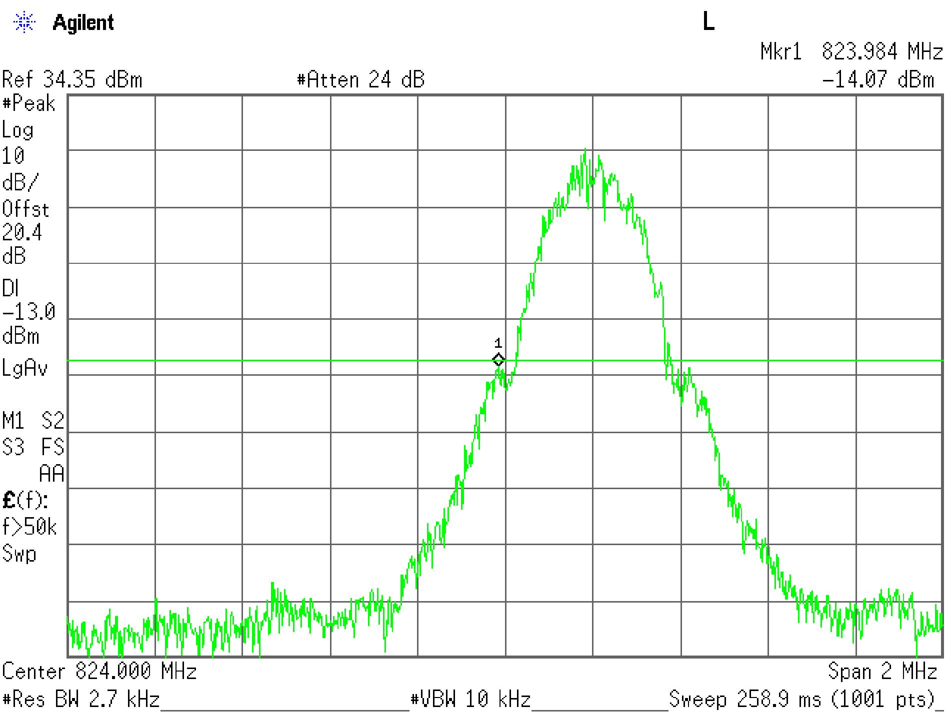
TX Frequency	824.20 MHz / 848.80 MHz
Band-Edge Frequency	824.00 MHz / 849.00 MHz
Res. Bandwidth	2.7 kHz
Video Bandwidth	10 kHz
Span	2 MHz
Sweep Time	AUTO
Trace	Maxhold

7.6.4 Test Data

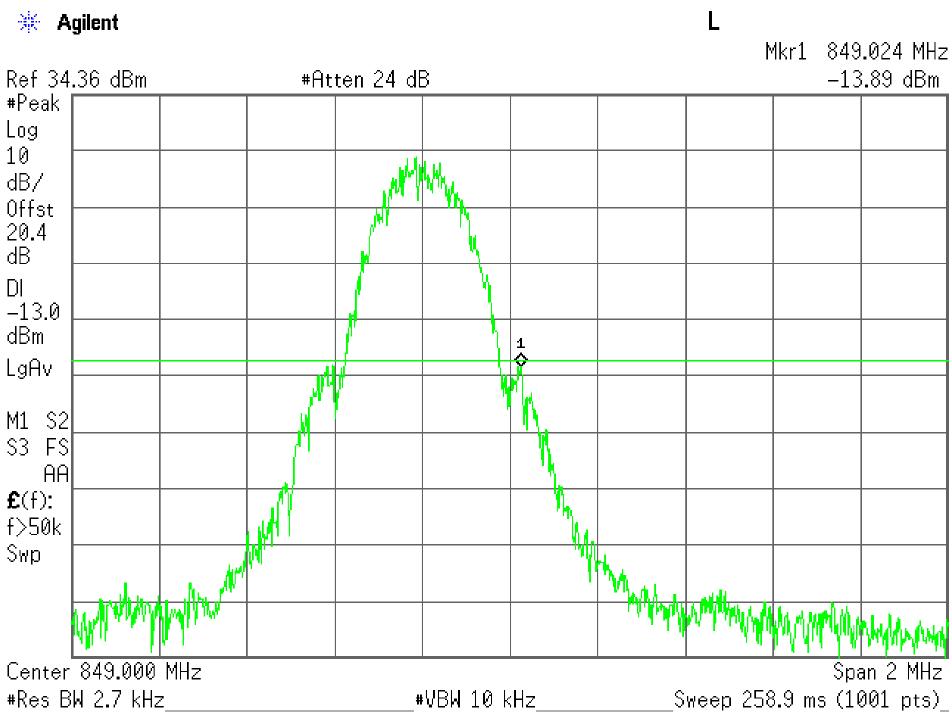
Test Date : August 24, 2015
Temp.:27°C, Humi:64%

Channel	Frequency (MHz)	Band-Edge Frequency (MHz)	Band-Edge Level (dBm)	Limits (dBm)	Margin (dB)
128	824.2	824.0	-14.1	-13.0	+1.1
251	848.8	849.0	-13.9	-13.0	+0.9

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

7.7.1 Test Results

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

Min. Limit Margin >29.7 dB at 8242/8364/8488 MHz

Uncertainty of Measurement Results 30 MHz – 1000 MHz ± 1.6 dB(2σ)
1 GHz – 18 GHz ± 1.8 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	2016/04/25
Signal Generator	E8257D	MY45140309 (B-39)	Agilent	2016/08/10
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2016/07/16
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2016/07/16
Biconical Antenna	VHA9103/BBA9106	2355 (C-30)	Schwarzbeck	2016/05/24
Log-periodic Antenna	UHALP9108-A1	0694 (C-31)	Schwarzbeck	2016/05/24
Dipole Antenna (TX)	KBA-511A	0-273-2 (C-17)	Kyoritsu	2016/05/20
Dipole Antenna (TX)	KBA-611	0-248-2 (C-20)	Kyoritsu	2016/05/20
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2016/04/15
Pre-Amplifier	TPA0118-36	1010 (A-37)	TOYO	2016/05/11
Horn Antenna	91888-2	562 (C-41-1)	EATON	2016/06/16
Horn Antenna	91889-2	568 (C-41-2)	EATON	2016/06/16
Horn Antenna	3160-04	9903-1053 (C-55)	EMCO	2016/06/29
Horn Antenna	3160-05	9902-1061 (C-56)	EMCO	2016/06/29
Horn Antenna	3160-06	9712-1045 (C-57)	EMCO	2016/06/29
Horn Antenna	3160-07	9902-1113 (C-58)	EMCO	2016/06/29
Attenuator	2-10	AW7937 (D-40)	Weinschel	2015/10/26
Attenuator	54A-10	W5713 (D-29)	Weinschel	2016/08/16
Attenuator	2-10	BA6214 (D-79)	Weinschel	2015/11/18
RF Cable	SUCOFLEX102E	6683/2E (C-70)	HUBER+SUHNER	2015/11/18
RF Cable	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2016/01/19
RF Cable	SUCOFLEX104	267414/4 (C-67)	HUBER+SUHNER	2016/01/19
High Pass Filter	HPM50108	010 (D-94)	MICRO-TRONICS	2016/02/08

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)

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

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

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

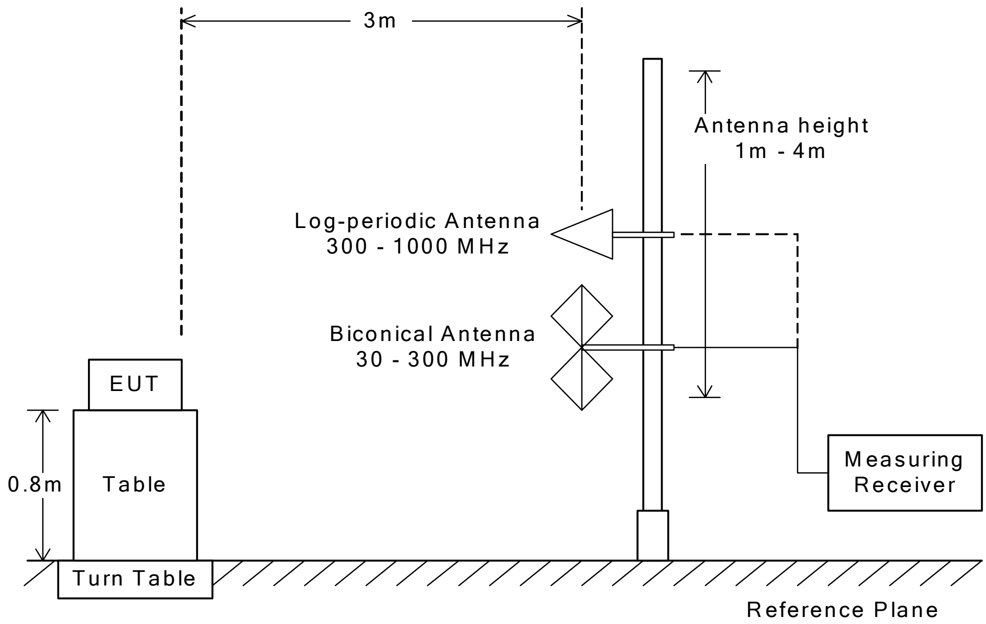
$$20\log(e) = E[dB(\mu V/m)] - 120$$

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

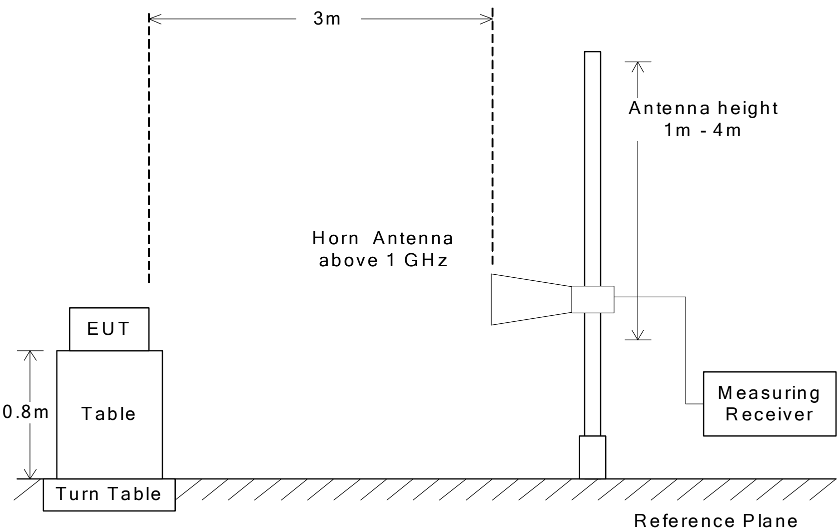
$$\therefore ERP[dBm] = EIRP - 2.15 = E - 97.38$$

The respective calculated ERP of the spurious and harmonics were compared with the ERP of fundamental frequency by specified attenuation limits, 43+10log$_{10}$ (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

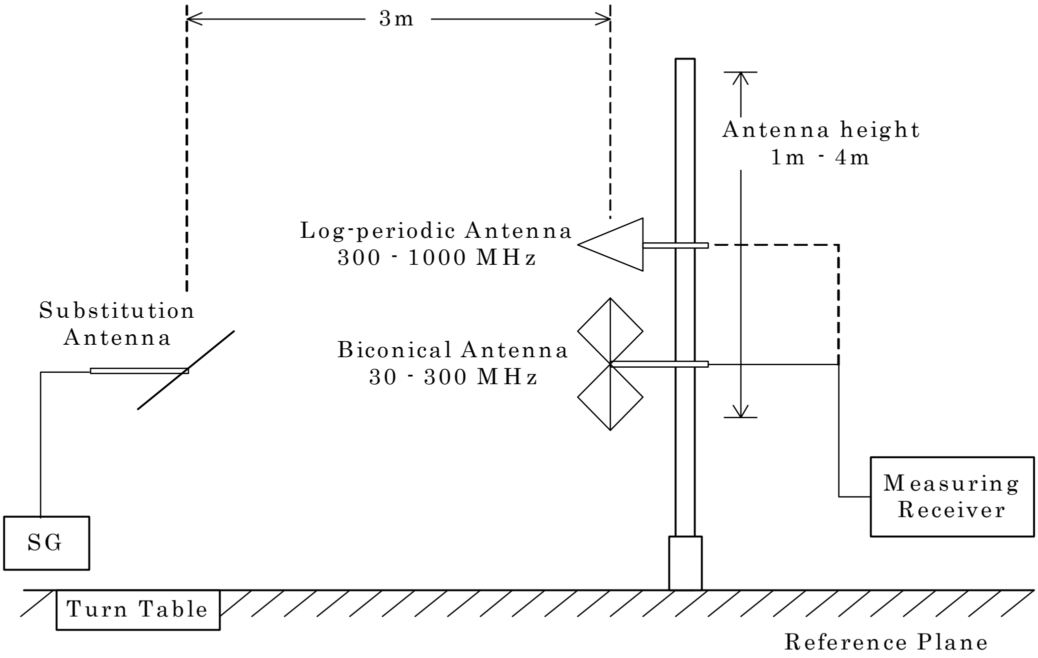


Radiated Emission above 1 GHz



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

(GSM850)

Test Date: August 31, 2015
Temp.: 26 °C, Humi: 75 %

Test Configuration : Single Unit

CH	Transmitting Frequency [MHz]	Measured Frequency [MHz]	ERP [dBm] Hori.	ERP [dBm] Vert.	Limits [dBm]	Margin [dB]	Remarks
128	824.200	1648.400	-53.1	-55.4	-13.0	+40.1	C
		2472.600	-53.1	-54.9	-13.0	+40.1	C
		3296.800	< -55.1	< -55.1	-13.0	> +42.1	C
		4121.000	< -48.6	< -48.6	-13.0	> +35.6	C
		4945.200	< -47.9	< -47.9	-13.0	> +34.9	C
		5769.400	< -47.5	< -47.5	-13.0	> +34.5	C
		6593.600	< -45.7	< -45.7	-13.0	> +32.7	C
		7417.800	< -45.9	< -45.9	-13.0	> +32.9	C
		8242.000	< -42.7	< -42.7	-13.0	> +29.7	C
189	836.400	1672.800	-53.2	-55.1	-13.0	+40.2	C
		2509.200	-54.4	-53.5	-13.0	+40.5	C
		3345.600	< -55.1	< -55.1	-13.0	> +42.1	C
		4182.000	< -48.6	< -48.6	-13.0	> +35.6	C
		5018.400	< -47.9	< -47.9	-13.0	> +34.9	C
		5854.800	< -45.2	< -45.2	-13.0	> +32.2	C
		6691.200	< -45.9	< -45.9	-13.0	> +32.9	C
		7527.600	< -45.9	< -45.9	-13.0	> +32.9	C
		8364.000	< -42.7	< -42.7	-13.0	> +29.7	C
251	848.800	1697.600	-54.3	-54.7	-13.0	+41.3	C
		2546.400	-53.9	-52.8	-13.0	+39.8	C
		3395.200	< -54.7	< -54.7	-13.0	> +41.7	C
		4244.000	< -48.6	< -48.6	-13.0	> +35.6	C
		5092.800	< -47.8	< -47.8	-13.0	> +34.8	C
		5941.600	< -45.3	< -45.3	-13.0	> +32.3	C
		6790.400	< -45.8	< -45.8	-13.0	> +32.8	C
		7639.200	< -45.9	< -45.9	-13.0	> +32.9	C
		8488.000	< -42.7	< -42.7	-13.0	> +29.7	C

Calculated result at 8242.0 MHz, as the worst point shown on underline:
Minimum Margin: -13.0 - (<-42.7) = >29.7 (dB)

NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 30 MHz to 10 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 Test Results

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

The Frequency Stability level is +0.08 ppm at 836.400 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	2016/06/02
Environmental Chamber	SH-641	92010990 (F-32)	ESPEC	2016/07/06
DC Voltage Meter	2011	02247S (B-33)	YOKOGAWA	2016/04/07
DC Power Supply	NL035-10	35883293 (F-4)	TAKASAGO	N/A

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

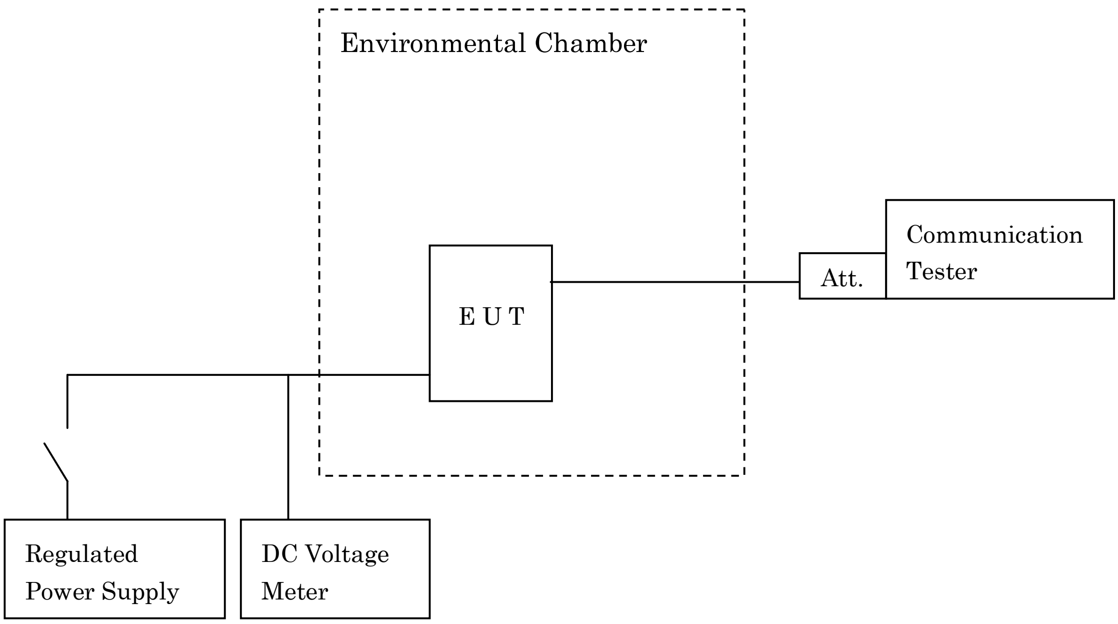
7.8.3 Test Method and Test Setup (Diagrammatic illustration)

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

(GSM850)

Test Date: September 7, 2015
- September 8, 2015

1. Frequency Stability Measurement versus Temperature

Transmitting Frequency : **836.400 MHz (189 ch)**
DC Supply Voltage : **4.0 VDC**

Ambient Temperature [°C]	Startup	Deviation [ppm] 2 minutes	5 minutes	10 minutes	Limits [ppm]	Margin [ppm]
-30	**+ 0.08**	+ 0.05	+ 0.04	+ 0.04	2.50	2.42
-20	+ 0.05	+ 0.05	+ 0.05	+ 0.04	2.50	2.45
-10	+ 0.04	+ 0.04	+ 0.04	+ 0.04	2.50	2.46
0	+ 0.05	+ 0.04	+ 0.04	+ 0.04	2.50	2.45
10	+ 0.04	+ 0.04	+ 0.04	+ 0.04	2.50	2.46
20	+ 0.05	+ 0.04	+ 0.04	+ 0.05	2.50	2.45
30	+ 0.05	+ 0.05	+ 0.05	+ 0.04	2.50	2.45
40	+ 0.05	+ 0.05	+ 0.05	+ 0.04	2.50	2.45
50	+ 0.04	+ 0.04	+ 0.04	+ 0.04	2.50	2.46

2. Frequency Stability Measurement versus Power Supply Voltage

Transmitting Frequency : **836.400 MHz (189 ch)**
Ambient Temperature: : **20 °C**

DC Supply Voltage [V]	Startup	Deviation [ppm] 2 minutes	5 minutes	10 minutes	Limits [ppm]	Margin [ppm]
4.0	+ 0.05	+ 0.04	+ 0.04	+ 0.05	2.50	2.45
3.7(Ending)	+ 0.04	+ 0.05	+ 0.05	+ 0.05	2.50	2.45

Test condition example as the maximum deviation point shown on underline:
Ambient Temperature : -30 °C / Startup
DC Supply Voltage : 4 VDC
Minimum Margin: 2.50 - 0.08 = 2.42 (ppm)
NOTE : The measurement were made after all of components of the oscillator sufficiently stabilized at each temperature.