**JQA File No. :** KL80150404
**Issue Date :** October 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-02H |
| **Serial No.** | : | 004401115990719<br>004401115990511 |
| **FCC ID** | : | APYHRO00228 |
| **Test Standard** | : | CFR 47 FCC Rules and Regulations Part 24 |
| **Test Results** | : | **Passed** |
| **Date of Test** | : | September 25 ~ October 7 , 2015 |

VLAC Lab Accreditation VLAC-001-2

Kousei Shibata
Manager
Japan Quality Assurance Organization
KITA-KANSAI Testing Center
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- 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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## 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<br>2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan |
| 2. | Products | : | Smart Phone |
| 3. | Model No. | : | SH-02H |
| 4. | Serial No. | : | 004401115990719<br>004401115990511 |
| 5. | Product Type | : | Pre-production |
| 6. | Date of Manufacture | : | July, 2015 |
| 7. | Power Rating | : | 4.0VDC (Lithium-ion Battery 1UAF375986Z 2810mAh) |
| 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 | : | 243KGXW |
| 12. | Max. RF Output Power | : | 0.977 W(EIRP) |
| 13. | Category | : | Broadband PCS |
| 14. | EUT Authorization | : | Certification |
| 15. | Received Date of EUT | : | September 11, 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 | SH-02H | 004401115990719 *1)<br>004401115990511 *2) | APYHRO00228 |
| B | AC Adapter | Fujitsu Corporation | 05 | XEA | N/A |
| C | Stereo Handsfree | Sharp | SHLDL1 | -- | N/A |

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

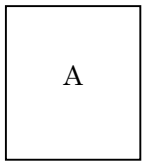
The auxiliary equipment used for testing :
None

Type of Cable:

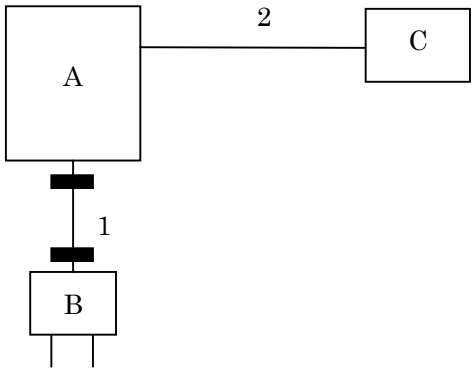
| No. | Description | Identification (Manu. etc.) | Connector Shielded | Cable Shielded | Ferrite Core | Length (m) |
|---|---|---|---|---|---|---|
| 1 | USB conversion cable | -- | -- | NO | YES | 1.2 |
| 2 | Handsfree Cable | -- | -- | NO | NO | 1.5 |

## 6.2 Test Arrangement (Drawings)

a) Single Unit

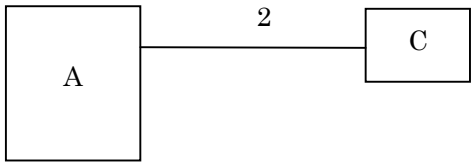



b) AC Adapter used




120VAC 60Hz

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 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 970.5 mW at 1909.800 MHz

Uncertainty of Measurement Results ± 0.9 dB(2σ)

Remarks : _____

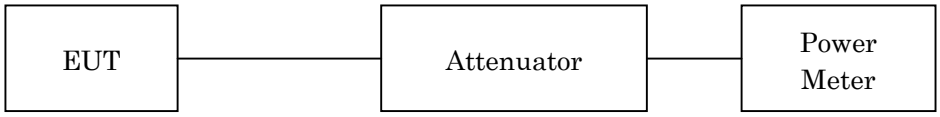
### 7.1.2 Test Instruments

| Shielded Room S4 | | | | |
|---|---|---|---|---|
| **Type** | **Model** | **Serial No. (ID)** | **Manufacturer** | **Cal. Due** |
| Power Meter | N1911A | GB45100291 (B-63) | Agilent | 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

(GSM-PCS1900)

Test Date: October 1, 2015
Temp.: 26 °C, Humi: 62 %

| Transmitting Frequency | | Correction Factor | Meter Reading (Peak) | Results (Peak) | |
|---|---|---|---|---|---|
| CH | [MHz] | [dB] | [dBm] | [dBm] | [mW] |
| 512 | 1850.200 | 20.59 | 9.01 | 29.60 | 912.0 |
| 661 | 1880.000 | 20.59 | 9.17 | 29.76 | 946.2 |
| 810 | 1909.800 | 20.59 | 9.28 | 29.87 | 970.5 |

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

| | | | | |
|---|---|---|---|---|
| | Correction Factor | = | 20.59 | dB |
| + ) | Meter Reading | = | 9.28 | dBm |
| | Result | = | 29.87 | dBm = 970.5 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 3.1 dB at 1880.000 MHz

Uncertainty of Measurement Results ± 1.8 dB(2σ)

Remarks : The maximum EIRP is 0.977 W at 1880.000 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 |
| Horn Antenna (TX) | 91888-2 | 560 (C-40-1) | EATON | 2016/06/25 |
| Horn Antenna (RX) | 91888-2 | 562 (C-41-1) | EATON | 2016/06/16 |
| Attenuator (TX) | 2-10 | BA6214 (D-79) | Weinschel | 2015/11/18 |
| Attenuator (RX) | 2-10 | BF7557 (D-80) | Weinschel | 2015/11/18 |
| RF Cable (RX) | SUCOFLEX104 | 267479/4 (C-66) | HUBER+SUHNER | 2016/01/19 |
| RF Cable (TX) | SUCOFLEX102E | 6683/2E (C-70) | HUBER+SUHNER | 2015/11/18 |

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

### 7.2.3 Test Method and Test Setup (Diagrammatic illustration)

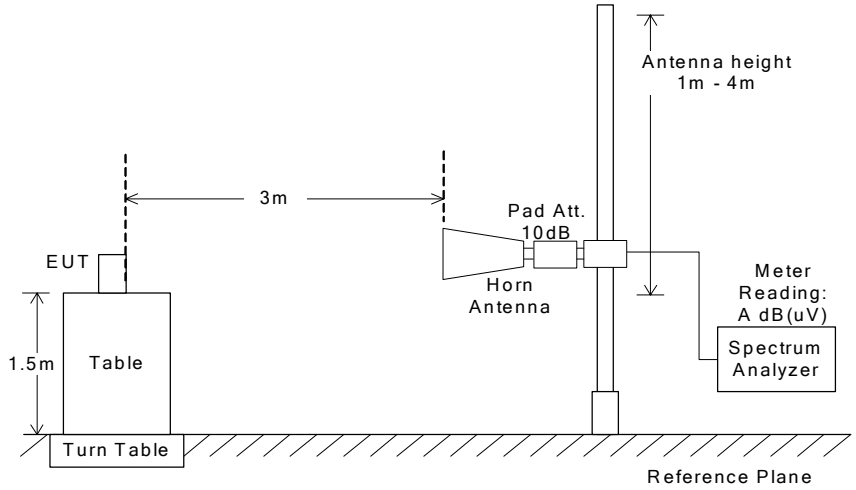
Step 1:
In order to obtain the maximum emission, the EUT was placed at the height 1.5 m on the non-conducted support and was varying at three orthogonal axes, at the distance 3 m from the receiving antenna and rotated around 360 degrees.
The receiving antenna height was varied from 1 m to 4 m.
The EUT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

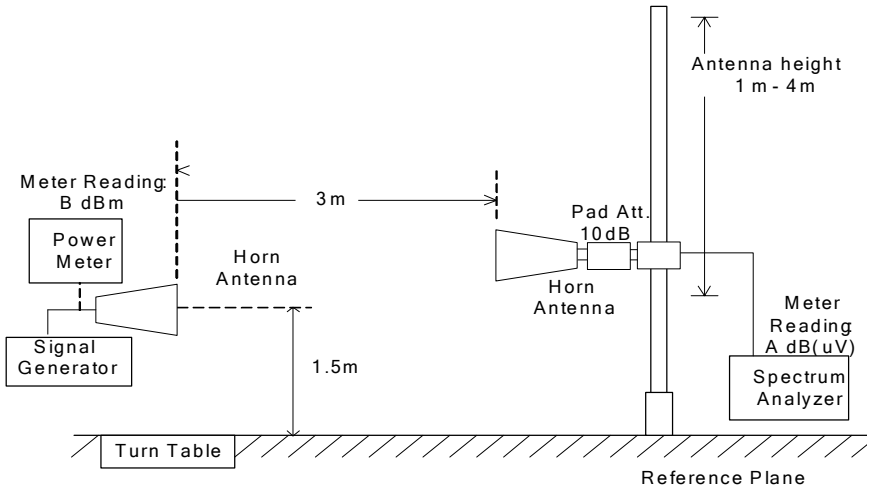
The ERP/EIRP output power was calculated in the following equation.

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: September 25, 2015
Temp.: 24 °C, Humi: 72 %

**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 [dBi] |
|---|---|---|---|---|---|---|---|
| 512 | 1850.200 | 92.8 | 92.9 | 72.1 | 72.3 | - 5.0 | 14.1 |
| 661 | 1880.000 | 93.0 | 92.8 | 72.4 | 72.6 | - 5.0 | 14.3 |
| 810 | 1909.800 | 92.8 | 92.6 | 72.6 | 72.6 | - 5.0 | 14.4 |

**2. Calculation Results**

| CH | Transmitting Frequency [MHz] | Peak EIRP [dBm] Hori. (EIRPh) | Peak EIRP [dBm] Vert. (EIRPv) | Maximum Peak EIRP [W] | Limits [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 512 | 1850.200 | 29.8 | 29.7 | 0.955 | 33.0 | + 3.2 |
| 661 | 1880.000 | 29.9 | 29.5 | 0.977 | 33.0 | + 3.1 |
| 810 | 1909.800 | 29.6 | 29.4 | 0.912 | 33.0 | + 3.4 |

Calculated result at 1880.000 MHz, as the worst point shown on underline:

| | | | |
|---|---|---|---|
| Emission Measurment (Mh) | = | 93.0 | dB(uV) |
| Substitution Measurement (Msh) | = | -72.4 | dB(uV) |
| Supplied Power to Substitution Antenna | = | -5.0 | dBm |
| + ) Gain of Substitution Antenna | = | 14.3 | dB |
| Result (EIRPh) | = | 29.9 | dBm = 0.977 W |

Minimum Margin: 33.0 - 29.9 = 3.1 (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 | 243.1 | kHz | at | 1880.000 | MHz |
| The 26dB Bandwidth is | 316.0 | kHz | at | 1850.200 | MHz |

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : _____

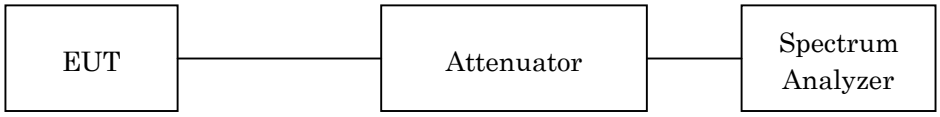
### 7.4.2 Test Instruments

| 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 |

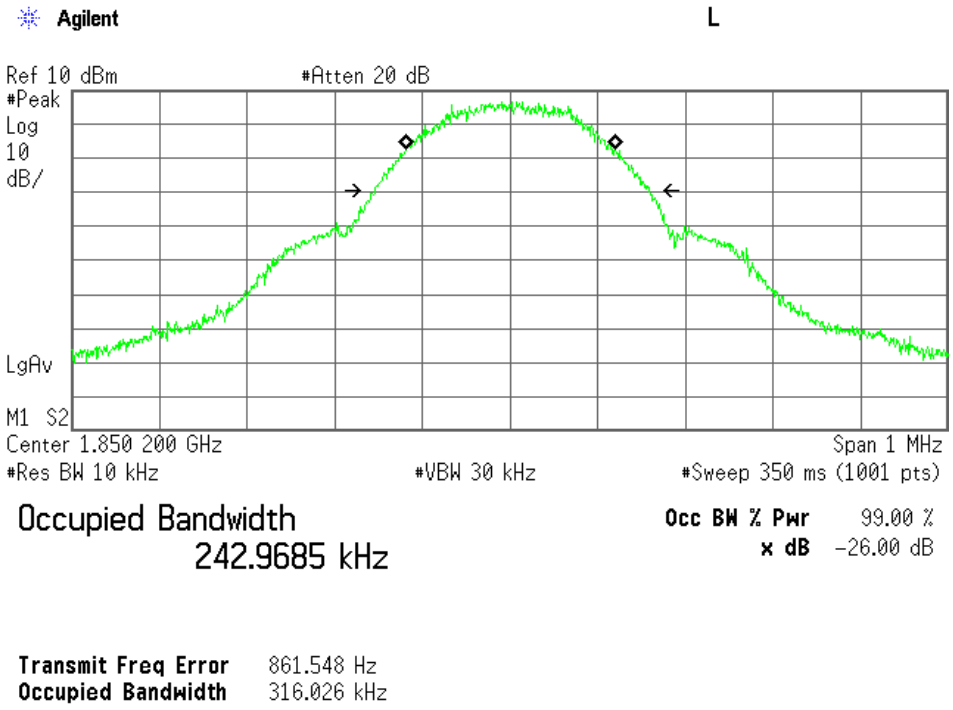
### 7.4.4 Test Data

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.

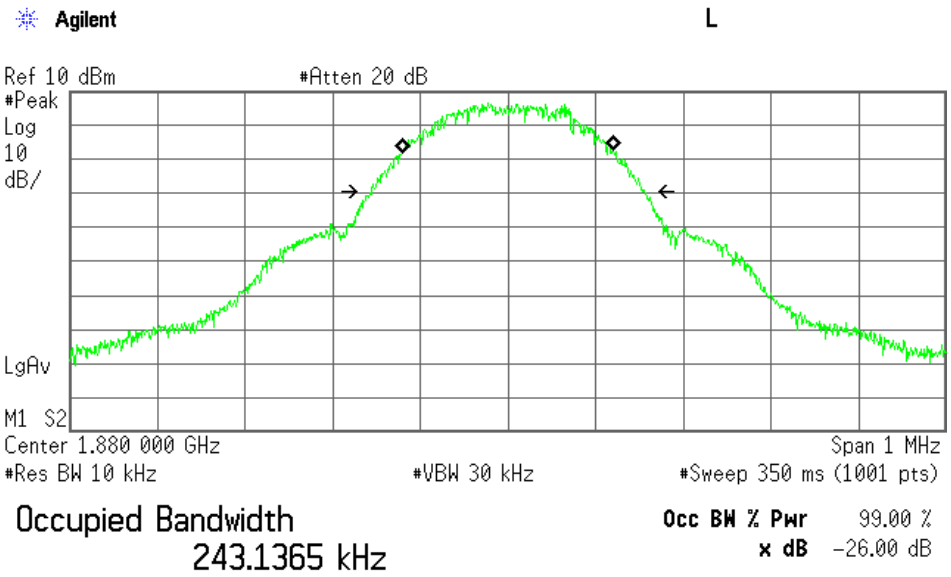
Test Date :October 1 2015
Temp.:26°C, Humi:62%

| Channel | Frequency (MHz) | 99% Bandwidth (kHz) | -26dBc Bandwidth (kHz) |
|---|---|---|---|
| 512 | 1850.200 | 243.0 | 316.0 |
| 661 | 1880.000 | 243.1 | 315.7 |
| 810 | 1909.800 | 241.7 | 313.5 |

Low Channel

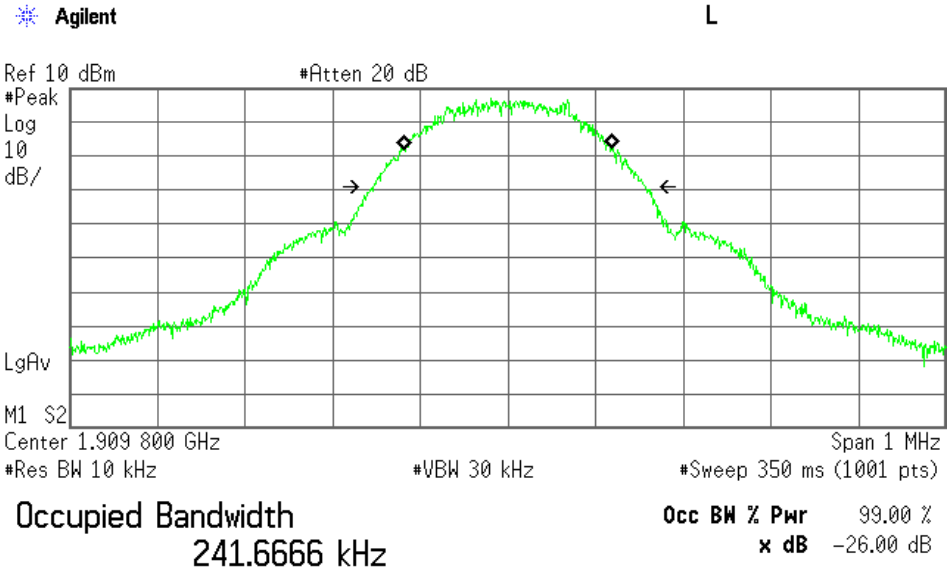


Middle Channel




| | |
|---|---|
| **Transmit Freq Error** | -87.033 Hz |
| **Occupied Bandwidth** | 315.710 kHz |

High Channel




| | |
|---|---|
| **Transmit Freq Error** | 39.923 Hz |
| **Occupied Bandwidth** | 313.540 kHz |

## 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 >29.5 dB at 19098.000 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

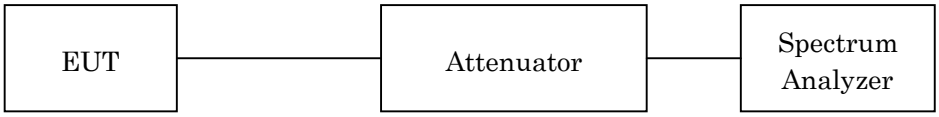
| Shielded Room S4 | | | | |
|---|---|---|---|---|
| **Type** | **Model** | **Serial No. (ID)** | **Manufacturer** | **Cal. Due** |
| Spectrum Analyzer | E4446A | US44300388 (A-39) | Agilent | 2016/08/11 |
| Attenuator | 43KC-20 | 1418003 (D-41) | Anritsu | 2016/07/05 |
| RF Cable | SUCOFLEX102 | 14253/2 (C-52) | HUBER+SUHNER | 2016/08/16 |
| High Pass Filter | HPM13899 | 001 (D-96) | MICRO-TRONICS | 2016/02/08 |

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

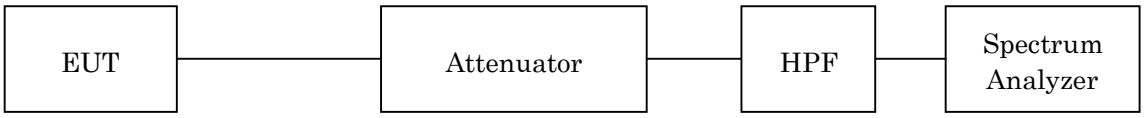
### 7.5.3 Test Method and Test Setup (Diagrammatic illustration)

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

a) Frequency Range: 9 kHz – 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: October 1, 2015
Temp.: 26 °C, Humi: 62 %

| 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 | 21.8 | < -70.0 | -13.0 | < -48.2 | > +35.2 | C |
| | | 5550.600 | 22.0 | < -70.0 | -13.0 | < -48.0 | > +35.0 | C |
| | | 7400.800 | 22.1 | -69.7 | -13.0 | -47.6 | +34.6 | C |
| | | 9251.000 | 22.4 | < -70.0 | -13.0 | < -47.6 | > +34.6 | C |
| | | 11101.200 | 22.8 | < -70.0 | -13.0 | < -47.2 | > +34.2 | C |
| | | 12951.400 | 24.5 | -69.4 | -13.0 | -44.9 | +31.9 | C |
| | | 14801.600 | 25.5 | < -70.0 | -13.0 | < -44.5 | > +31.5 | C |
| | | 16651.800 | 26.3 | < -70.0 | -13.0 | < -43.7 | > +30.7 | C |
| | | 18502.000 | 27.2 | < -70.0 | -13.0 | < -42.8 | > +29.8 | C |
| 661 | 1880.000 | 3760.000 | 21.8 | < -70.0 | -13.0 | < -48.2 | > +35.2 | C |
| | | 5640.000 | 22.0 | < -70.0 | -13.0 | < -48.0 | > +35.0 | C |
| | | 7520.000 | 22.1 | -66.5 | -13.0 | -44.4 | +31.4 | C |
| | | 9400.000 | 22.4 | < -70.0 | -13.0 | < -47.6 | > +34.6 | C |
| | | 11280.000 | 22.8 | < -70.0 | -13.0 | < -47.2 | > +34.2 | C |
| | | 13160.000 | 24.7 | < -70.0 | -13.0 | < -45.3 | > +32.3 | C |
| | | 15040.000 | 25.6 | < -70.0 | -13.0 | < -44.4 | > +31.4 | C |
| | | 16920.000 | 26.4 | < -70.0 | -13.0 | < -43.6 | > +30.6 | C |
| | | 18800.000 | 27.4 | < -70.0 | -13.0 | < -42.6 | > +29.6 | C |
| 810 | 1909.800 | 3819.600 | 21.8 | < -70.0 | -13.0 | < -48.2 | > +35.2 | C |
| | | 5729.400 | 22.0 | < -70.0 | -13.0 | < -48.0 | > +35.0 | C |
| | | 7639.200 | 22.1 | -65.0 | -13.0 | -42.9 | +29.9 | C |
| | | 9549.000 | 22.5 | < -70.0 | -13.0 | < -47.5 | > +34.5 | C |
| | | 11458.800 | 22.9 | < -70.0 | -13.0 | < -47.1 | > +34.1 | C |
| | | 13368.600 | 24.8 | < -70.0 | -13.0 | < -45.2 | > +32.2 | C |
| | | 15278.400 | 25.7 | < -70.0 | -13.0 | < -44.3 | > +31.3 | C |
| | | 17188.200 | 26.6 | < -70.0 | -13.0 | < -43.4 | > +30.4 | C |
| | | 19098.000 | 27.5 | < -70.0 | -13.0 | < -42.5 | > +29.5 | C |

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

| | | | |
|---|---|---|---|
| | Corr. Factor | = | 27.5 dB |
| + ) | Meter Reading | = | <-70.0 dBm |
| | Result | = | <-42.5 dBm |

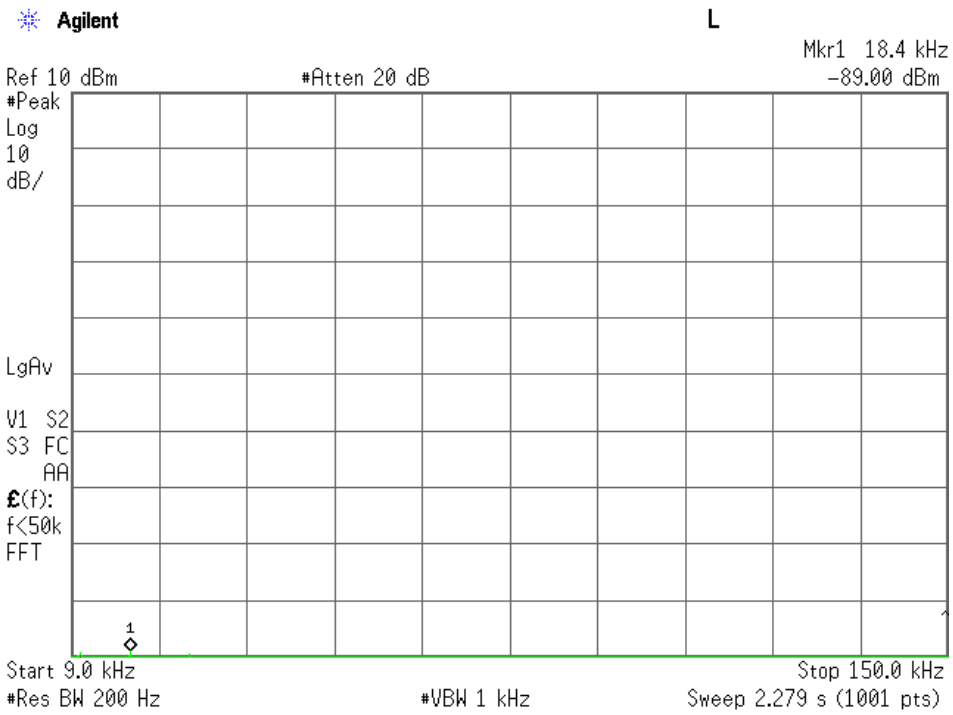
Minimum Margin: -13.0 - (<-42.5) = >29.5 (dB)

NOTES

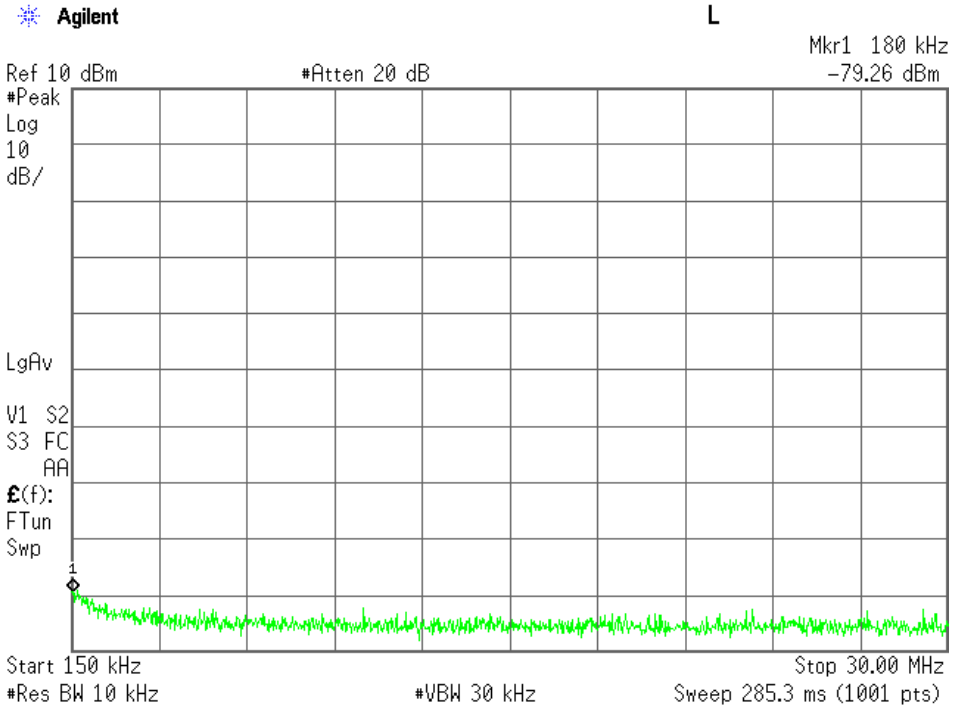
1. The spectrum was checked from 9 kHz to 20 GHz.
2. Applied limits : -13.0 [dBm] = 10log(TP[mW]) - (43 + 10log(tp[W])) = 10log(TP[mW]) - (43 + (10 log(TP[mW]) - 30))
   where, tp[W] = TP[mW] / 1000 : Transmitter power at anttena terminal
3. The correction factor is shown as follows:
   Corr. Factor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

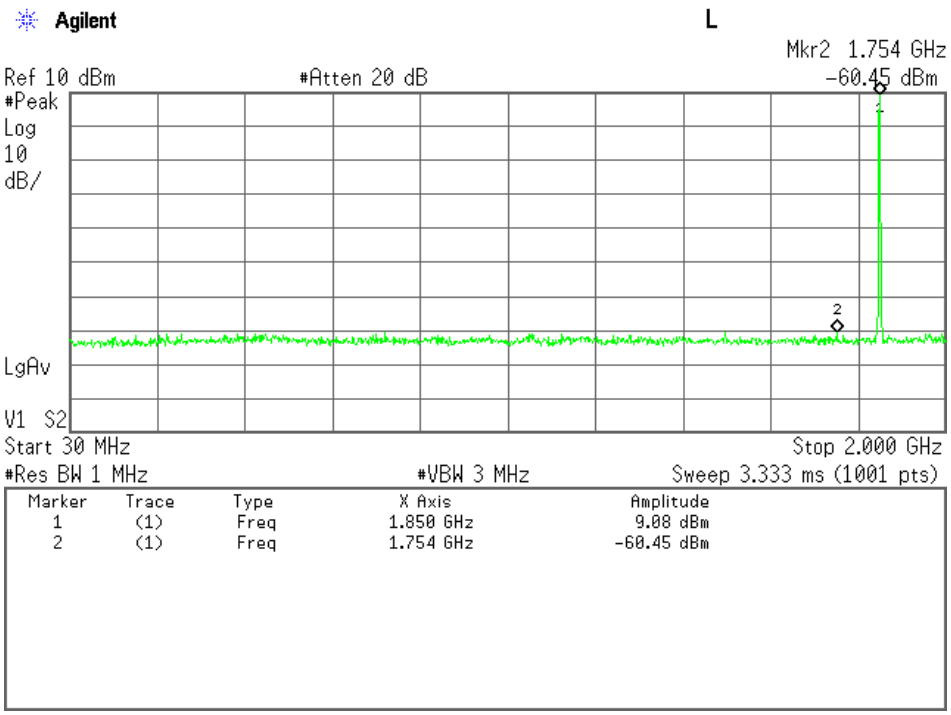
Low Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



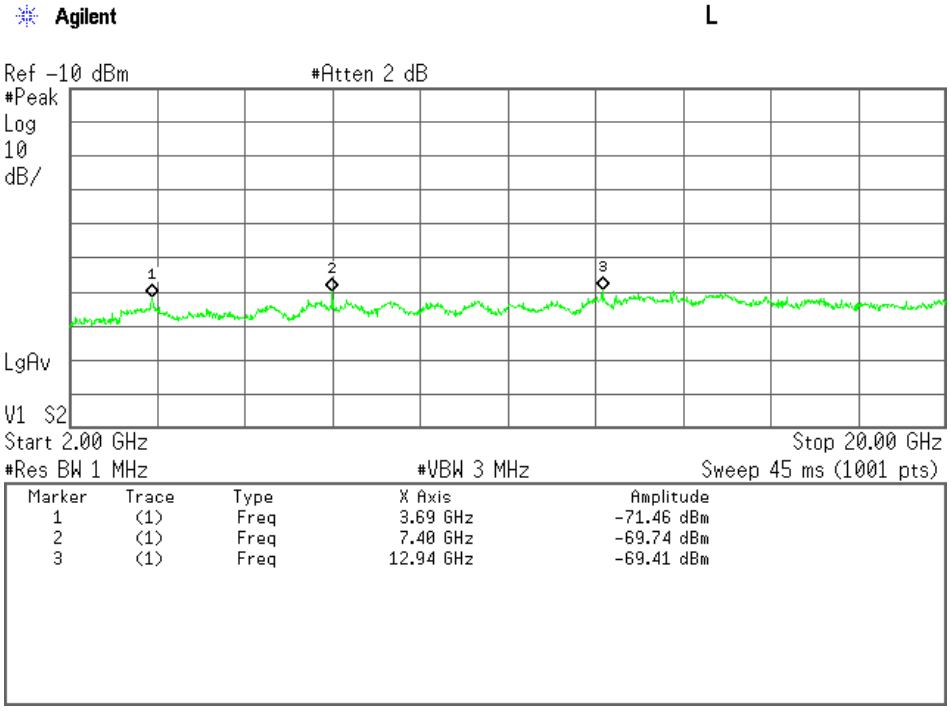

Low Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



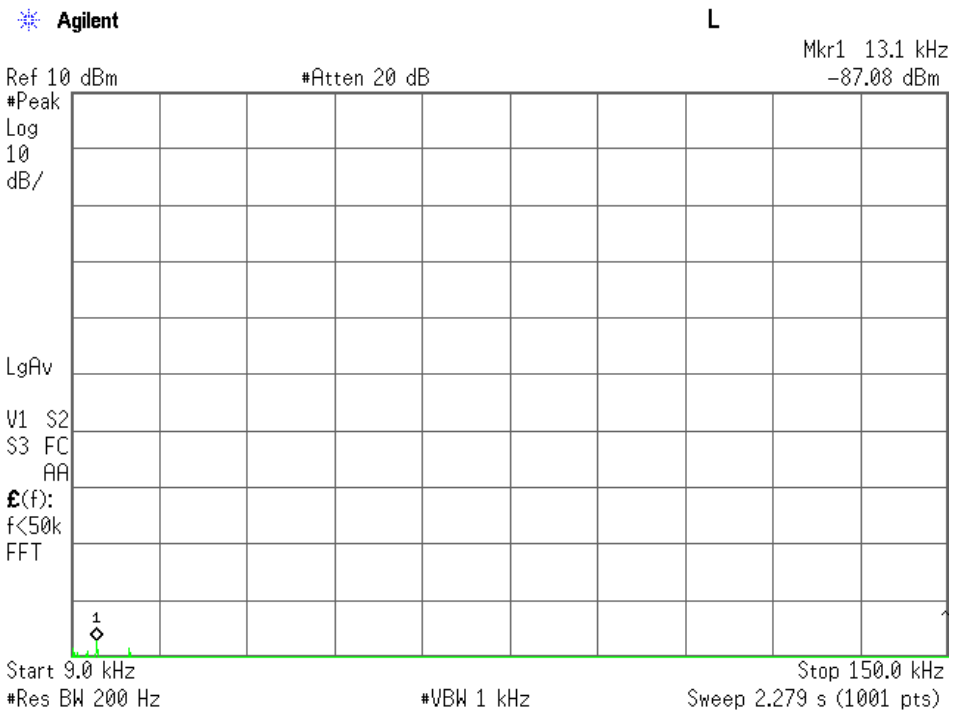
Low Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



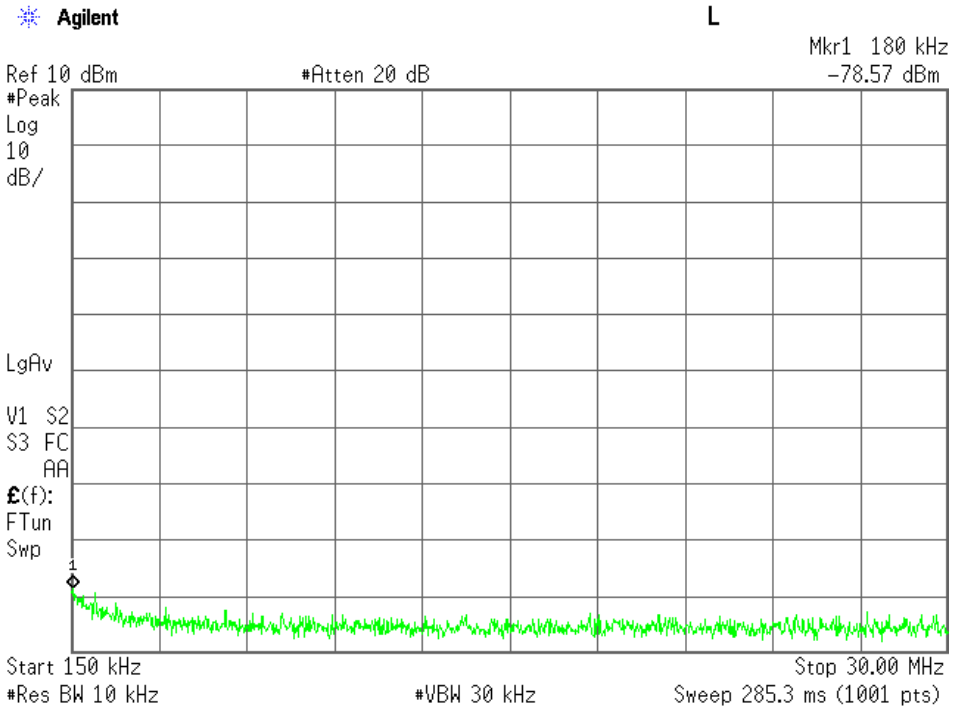

Low Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



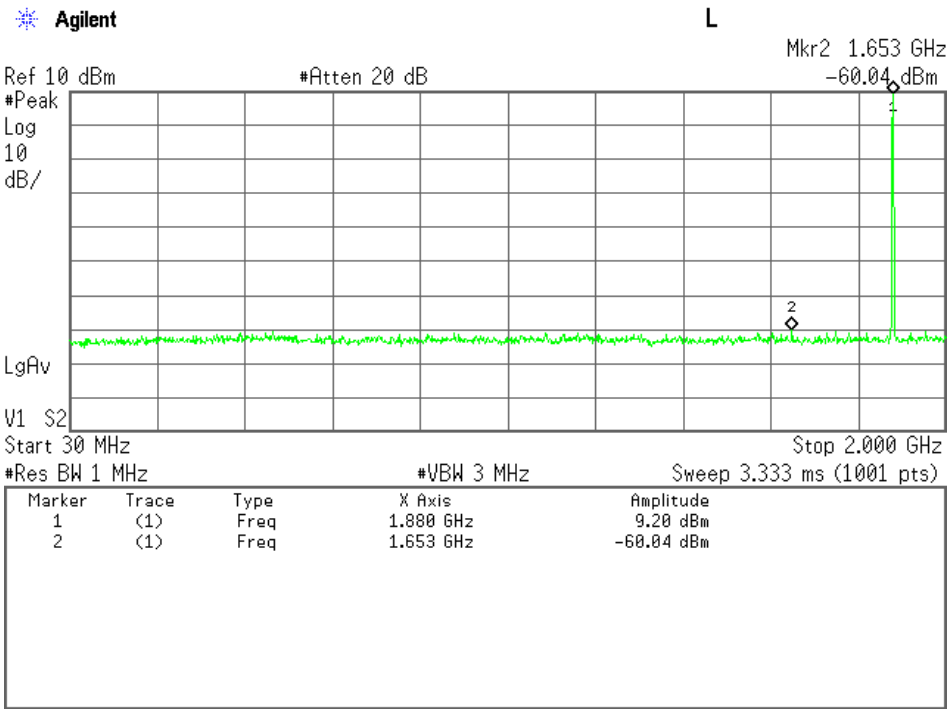
Middle Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



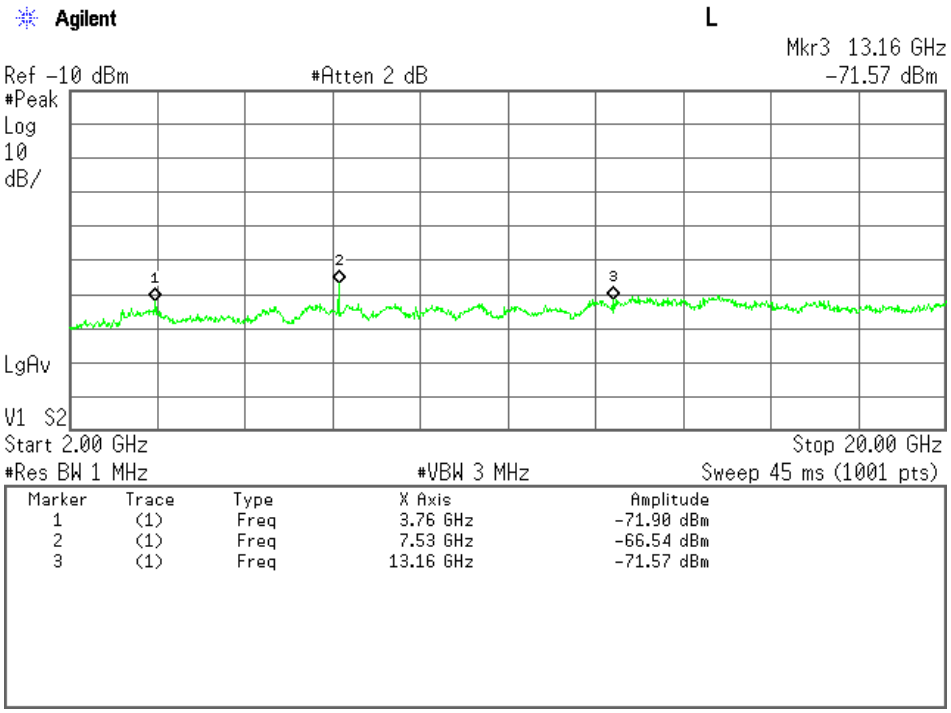

Middle Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



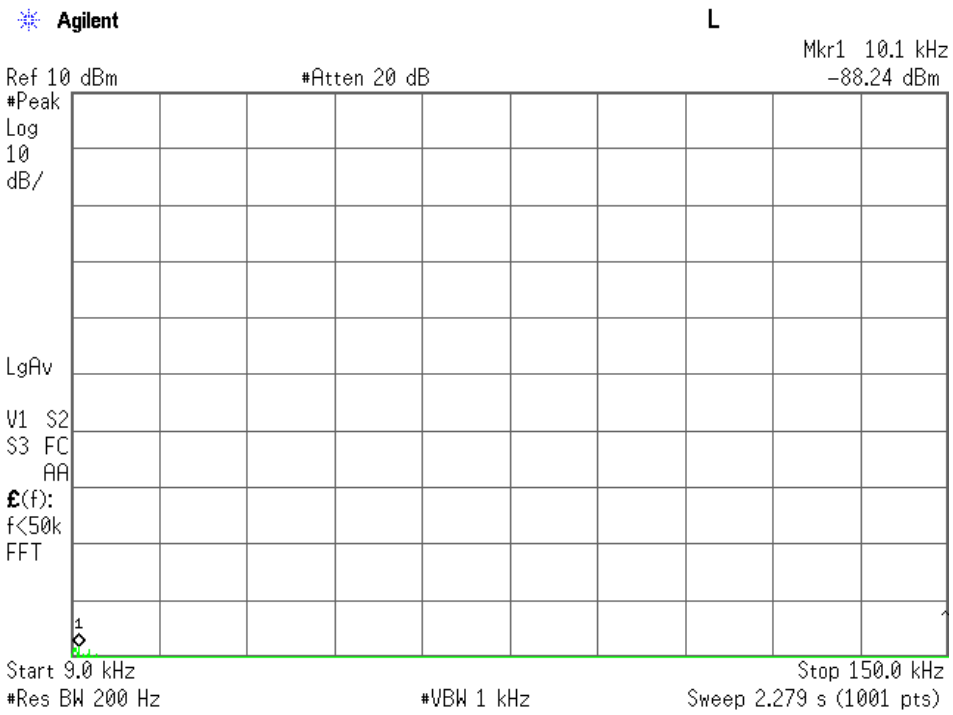
Middle Channel, Out-Of-Band Emissions (30 MHz – 2 GHz)



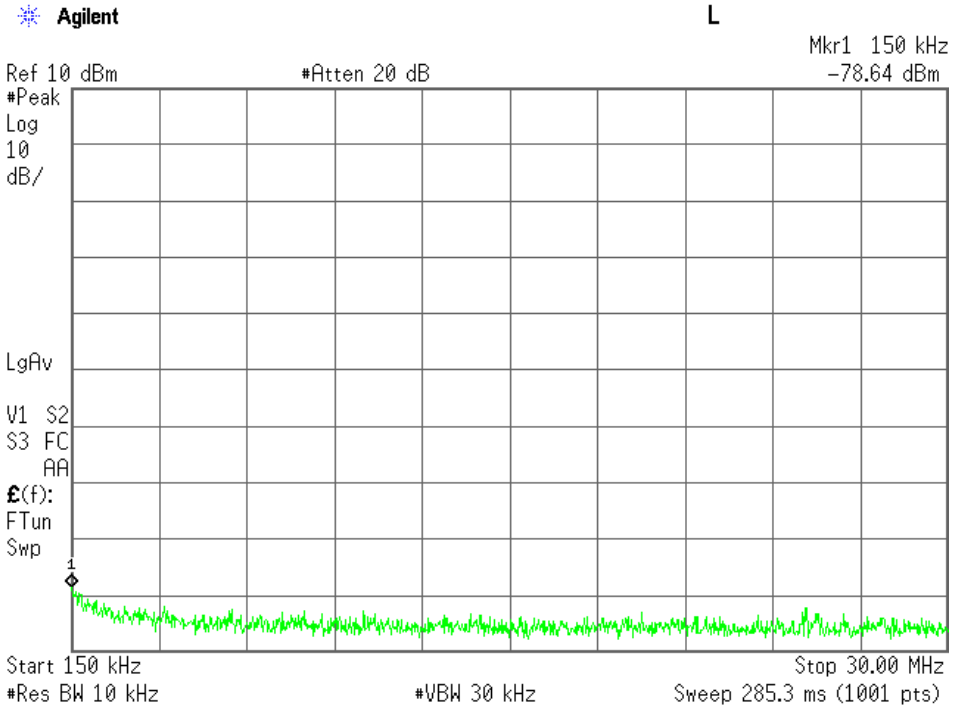

Middle Channel, Out-Of-Band Emissions (2 GHz – 20 GHz)



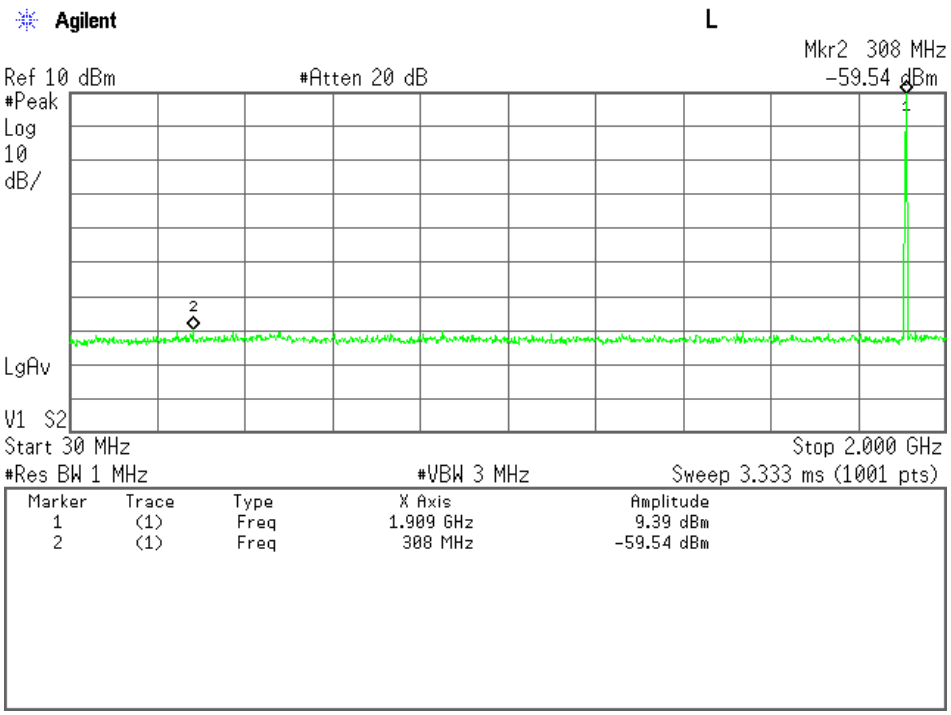
High Channel, Out-Of-Band Emissions (9 kHz – 150 kHz)



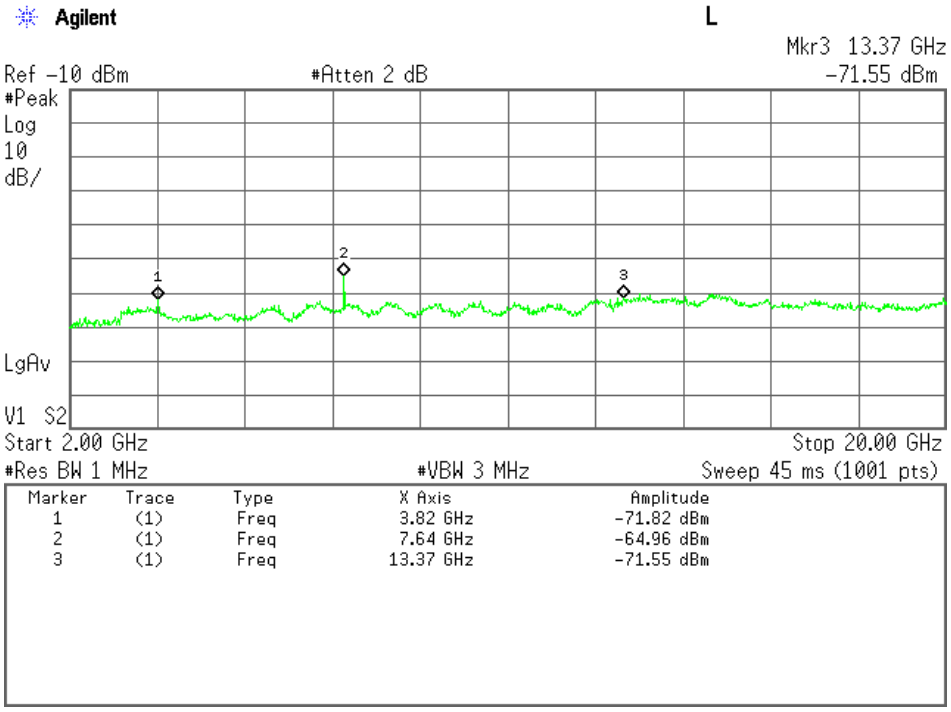

High Channel, Out-Of-Band Emissions (150 kHz – 30 MHz)



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 3.3 dB at 1910.0 MHz

The Band-Edge level is -16.3 dBm at 1910.0 MHz

Uncertainty of Measurement Results ± 1.7 dB(2σ)

Remarks :

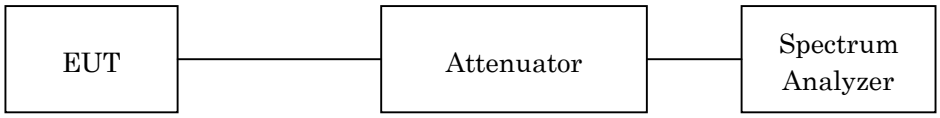
### 7.6.2 Test Instruments

| 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 | 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:

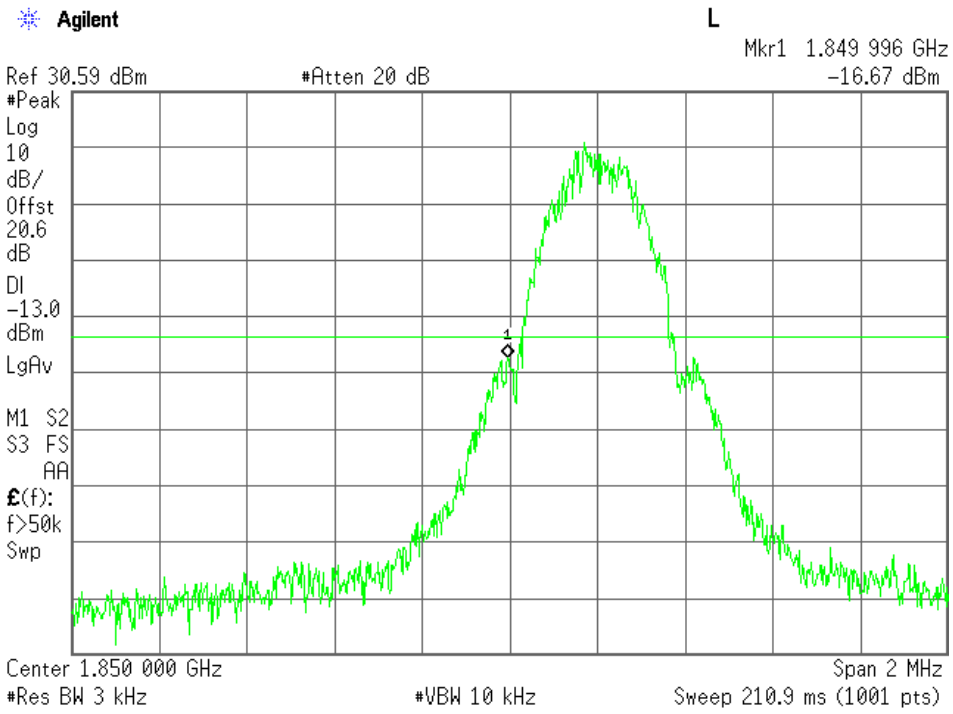
| | |
|---|---|
| TX Frequency | 1850.20 MHz / 1909.80 MHz |
| Band-Edge Frequency | 1850.00 MHz / 1910.00 MHz |
| Res. Bandwidth | 3 kHz |
| Video Bandwidth | 10 kHz |
| Span | 2 MHz |
| Sweep Time | AUTO |
| Trace | Maxhold |

### 7.6.4 Test Data

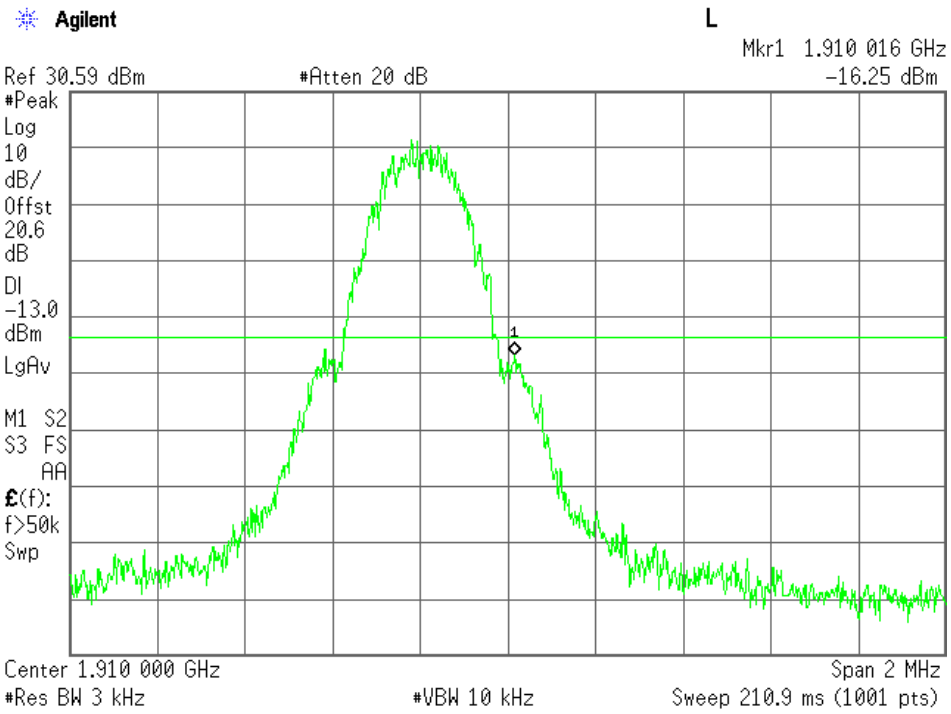
Test Date : October 1, 2015
Temp.:26°C, Humi:62%

| Channel | Frequency (MHz) | Band-Edge Frequency (MHz) | Band-Edge Level (dBm) | Limits (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 512 | 1850.200 | 1850.00 | -16.7 | -13.0 | +3.7 |
| 810 | 1909.800 | 1910.00 | -16.3 | -13.0 | +3.3 |

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

### 7.7.1 Test Results

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

Min. Limit Margin >20.8 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 | 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 |
| Horn Antenna | 3160-08 | 9904-1099 (C-59) | EMCO | 2016/06/29 |
| Horn Antenna | 3160-09 | 9808-1117 (C-48) | EMCO | 2016/06/28 |
| 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 |
| RF Cable | SUCOFLEX102EA | 3041/2EA (C-69) | HUBER+SUHNER | 2016/01/19 |
| High Pass Filter | HPM13899 | 001 (D-96) | 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.

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

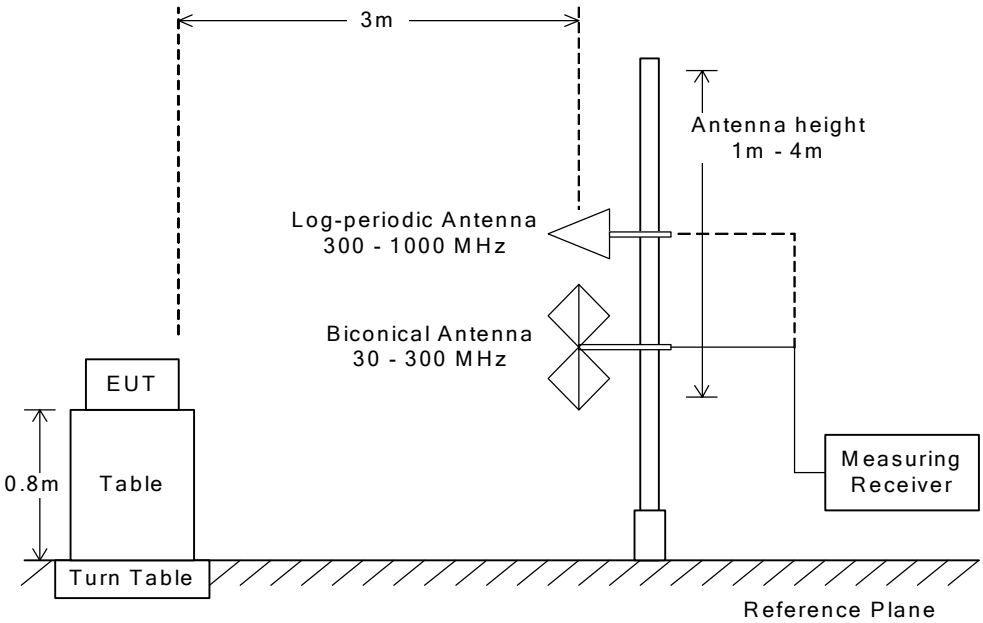
$$erp = eirp - Gd \quad \text{----(Eq.2)}$$

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)

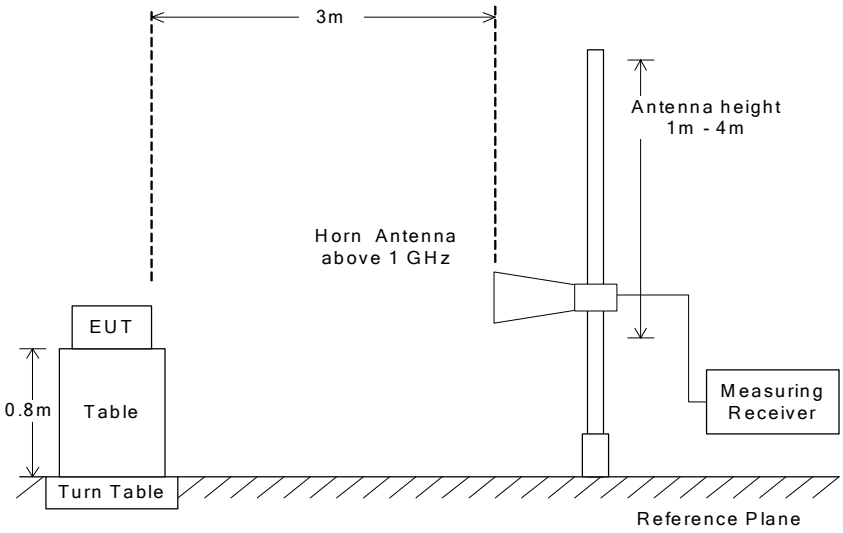
$$eirp = \frac{(de)^2}{30} = \frac{3}{10}e^2$$
$$\therefore 10\log(eirp) = 20\log(e) + 10\log(3/10) = 20\log(e) - 5.23$$
$$10\log(eirp) = EIRP[dBm] - 30$$
$$20\log(e) = E[dB(\mu V/m)] - 120$$
$$\therefore EIRP = E - 120 + 30 - 5.23 = E - 95.23$$
$$\therefore ERP[dBm] = EIRP - 2.15 = E - 97.38$$

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

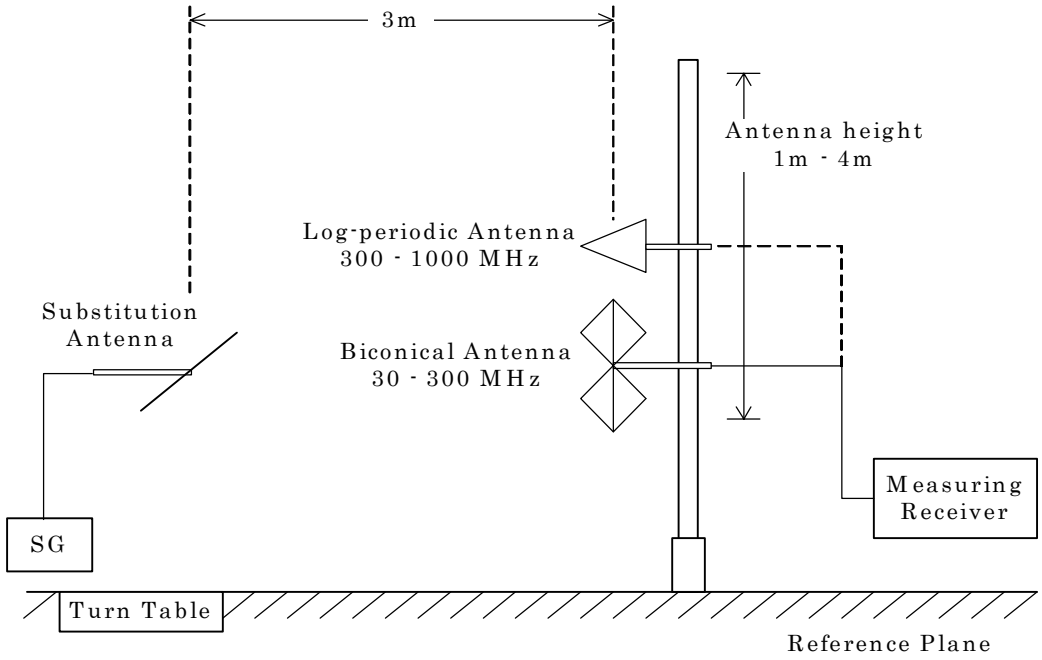



Radiated Emission above 1 GHz




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: September 25, 2015
Temp.: 24 °C, Humi: 72 %

**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 | < -52.4 | < -52.4 | -13.0 | > +39.4 | C |
| | | 5550.600 | < -47.2 | < -47.2 | -13.0 | > +34.2 | C |
| | | 7400.800 | < -45.7 | < -45.7 | -13.0 | > +32.7 | C |
| | | 9251.000 | < -42.1 | < -42.1 | -13.0 | > +29.1 | 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 | < -36.2 | < -36.2 | -13.0 | > +23.2 | 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 | < -45.7 | < -45.7 | -13.0 | > +32.7 | C |
| | | 9400.000 | < -41.9 | < -41.9 | -13.0 | > +28.9 | C |
| | | 11280.000 | < -40.4 | < -40.4 | -13.0 | > +27.4 | C |
| | | 13160.000 | < -38.9 | < -38.9 | -13.0 | > +25.9 | C |
| | | 15040.000 | < -37.9 | < -37.9 | -13.0 | > +24.9 | C |
| | | 16920.000 | < -34.9 | < -34.9 | -13.0 | > +21.9 | C |
| | | 18800.000 | < -39.8 | < -39.8 | -13.0 | > +26.8 | C |
| 810 | 1909.800 | 3819.600 | < -52.0 | < -52.0 | -13.0 | > +39.0 | C |
| | | 5729.400 | < -47.2 | < -47.2 | -13.0 | > +34.2 | C |
| | | 7639.200 | < -45.7 | < -45.7 | -13.0 | > +32.7 | C |
| | | 9549.000 | < -41.8 | < -41.8 | -13.0 | > +28.8 | 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 | < -37.9 | < -37.9 | -13.0 | > +24.9 | C |
| | | 17188.200 | < -33.8 | < -33.8 | -13.0 | > +20.8 | C |
| | | 19098.000 | < -39.6 | < -39.6 | -13.0 | > +26.6 | C |

Calculated result at 17188.2 MHz, as the worst point shown on underline:
Minimum Margin: -13.0 - (<-33.8) = >20.8 (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 Test Results

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

The Frequency Stability level is +0.06 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 | 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.

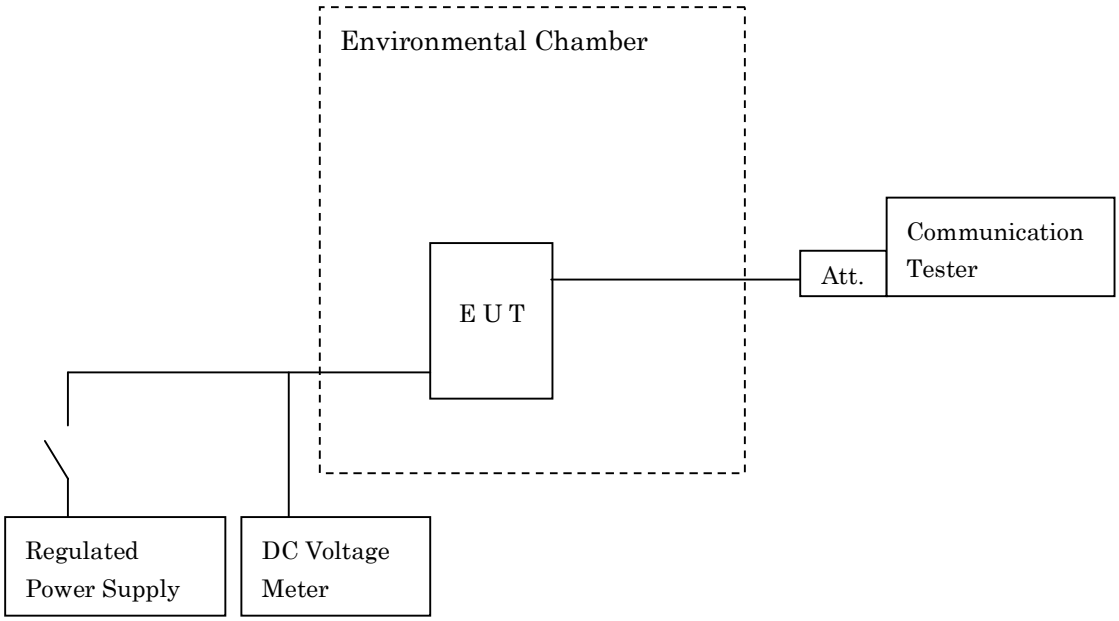
### 7.8.3 Test Method and Test Setup (Diagrammatic illustration)

**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

## (GSM-PCS1900)

Test Date: October 5, 2015
- October 7, 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 | + 0.01 | + 0.01 | + 0.01 | N/A | N/A |
| -20 | + 0.04 | + 0.02 | + 0.02 | + 0.02 | N/A | N/A |
| -10 | **+ 0.06** | + 0.03 | + 0.03 | + 0.03 | N/A | N/A |
| 0 | + 0.02 | + 0.02 | + 0.02 | + 0.02 | N/A | N/A |
| 10 | + 0.02 | + 0.02 | + 0.03 | + 0.02 | N/A | N/A |
| 20 | + 0.02 | + 0.02 | + 0.02 | + 0.02 | N/A | N/A |
| 30 | + 0.02 | + 0.02 | + 0.02 | + 0.02 | N/A | N/A |
| 40 | + 0.02 | + 0.01 | + 0.01 | + 0.01 | N/A | N/A |
| 50 | + 0.02 | + 0.02 | + 0.02 | + 0.02 | 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 | + 0.02 | + 0.02 | + 0.02 | + 0.02 | N/A | N/A |
| 3.7(Ending) | + 0.02 | + 0.02 | + 0.02 | + 0.02 | N/A | N/A |

Test condition example as the maximum deviation point shown on underline:
Ambient Temperature : -10 °C / Startup
DC Supply Voltage : 4 VDC

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