JQA File No.: 400-190086-1
Issue Date : October 23, 2019

# TEST REPORT

| | | |
|---|---|---|
| **Applicant** | : | JVC KENWOOD Corporation |
| **Address** | : | 2967-3 Ishikawa-machi, Hachioji-shi, Tokyo 192-8525 Japan |
| **Products** | : | CD Receiver |
| **Model No.** | : | DPX-7200DAB |
| **Serial No.** | : | 144X0068<br>144X0069 |
| **Test Standard** | : | ETSI EN 300 328 V2.1.1(2016-11) |
| **Test Results** | : | **Passed** |
| **Date of Test** | : | October 7 ~10, 2019 |

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VLAC Lab Accreditation VLAC-001-5

- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
- The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
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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" means Equipment Under the Test.
"AE" means Associated Equipment.
"N/A" means that Not Applicable.
"N/T" means that 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 | : | JVC KENWOOD Corporation<br>2967-3, Ishikawa-machi, Hachioji-shi. Tokyo,<br>192-8525, Japan |
| 2 | Products | : | CD Receiver |
| 3 | Model No. | : | DPX-7200DAB |
| 4 | Serial No. | : | 144X0068<br>144X0069 |
| 5 | Product Type | : | Pre-Production |
| 6 | Date of Manufacture | : | July, 2019 |
| 7 | Power Rating | : | 12.0 VDC (Nominal)<br>10.5-16.0 VDC (Operating voltage range) |
| 8 | Grounding | : | None |
| 9 | Modulation Type | : | FHSS<br>Bluetooth 4.2<br>GFSK, π/4DQPSK and 8DPSK |
| 10 | Equipment Type | : | Adaptive |
| 11 | Receiver Category | : | 2 |
| 12 | Operating Frequency Range | : | 2400.0 MHz –2483.5MHz |
| 13 | Highest Frequency Used/Generated | : | 2483.5 MHz (for Transciever)<br>8.2 GHz (for Tuner IC) |
| 14 | Operating Temperature Range | : | -30°C to 70°C |
| 15 | RF Output Power | : | 0.56 dBm e.i.r.p (Measured Value) |
| 16 | Antenna Type | : | PCB antenna (Integral) |
| 17 | Antenna Gain | : | 0.25 dBi |
| 18 | Received Date of EUT | : | October 4, 2019 |

## 2 Summary of Test Results

Applied Standard : ETSI EN 300 328 V2.1.1(2016-11)
Wideband transmission systems;
Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques;
Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

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 Osawa
Deputy Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

Tested by:

Naohiko Ueno
Assistant Manager
SAFETY & EMC CENTER
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## 3 Test Procedure

ETSI EN 300 328 V2.1.1(2016-11)
Wideband transmission systems;
Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques;
Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

## 4 Test Location

Japan Quality Assurance Organization
SAFETY & EMC CENTER
Testing Dept.
EMC Testing Div.
4-4-4, Minamiosawa, Hachioji-shi, Tokyo 192-0364, Japan

## 5 Recognition of Test Laboratory

Japan Quality Assurance Organization, Safety & EMC Center Testing Dept. EMC Testing Div. is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility of Testing Division is registered by the following bodies .

VLAC Code : VLAC-001-5 (Effective through : March 30, 2020)
VCCI Registration Number : A-0001 (Effective through : March 30, 2020)
FCC Registration Number : 349652 (Effective through : March 30, 2020)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI. (Effective through : February 22, 2022)

# 6 Description of Test Setup

## 6.1 Test Configuration

The EUT consists of:

| Sign | Item | Manufacturer | Model No. | Serial No. |
|---|---|---|---|---|
| A | CD Receiver | JVC KENWOOD Corporation | DPX-7200DAB | 144X0068 *1<br>144X0069 *2 |

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

The AE used for testing:

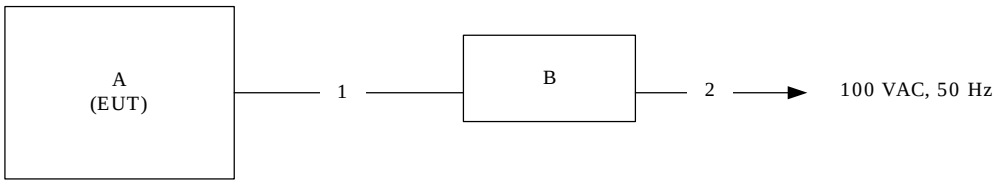
| Sign | Item | Manufacturer | Model No. | Serial No. |
|---|---|---|---|---|
| B | DC Power Supply | Kikusui Electronics Co., Ltd. | PAB 18-2.5DU | 30061305 |
| C | Speaker | - | | - |

Type of Cable:

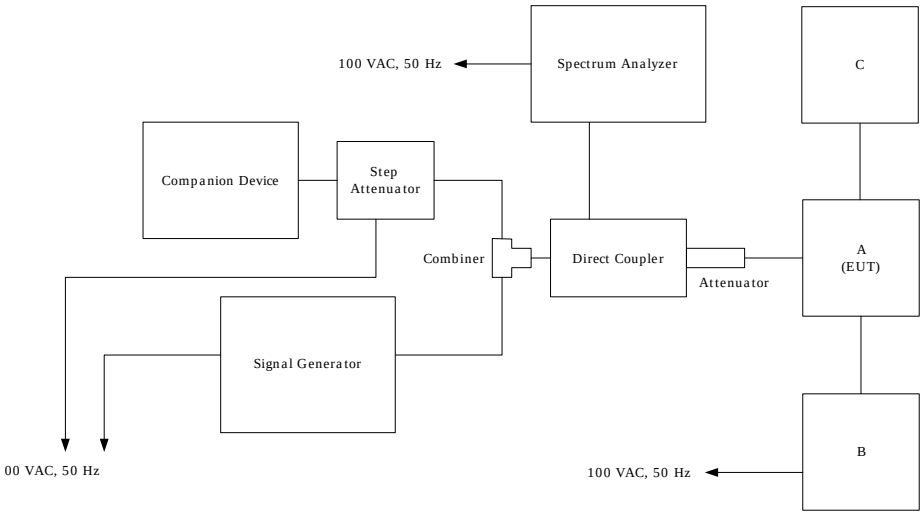
| No. | Description | Identification (Manu. Etc.) | Connector Shielded | Cable Shielded | Ferrite Core | Length (m) |
|---|---|---|---|---|---|---|
| 1 | DC Power Cable | - | No | No | No | 1.6 |
| 2 | AC Power Cable | - | No | No | No | 2.0 |

## 6.2 Test Arrangement (Drawings)

### 6.2.1 Basic Arrangement




### 6.2.2 Receiver Blocking Arrangement



## 6.3 Operating Condition

Test Voltage : 12.0 VDC

Operation Mode :
The EUT is set with the test mode, the specification of the test mode is as followings.
(1) Tx Mode (0ch : 2402MHz)
(2) Tx Mode (39ch : 2441MHz)
(3) Tx Mode (78ch : 2480MHz)
(4) Hopping Mode
(5) Rx Mode

Used application to controlled: The test mode is instructed by the applicant.

Unless otherwise stated this test report, the worst case testing settings for each mode is determined as follows, it is based on preliminary tests .(This was confirmed through separated measurement.)
All final tests in Tx mode were made at GFSK DH5.

EUT with temporary antenna port was used in conducted measurement.

## 7 Test Requirements

**Summary of the Test Results**

| Phenomenon | EN 300 328 Specification | Reference of the Test Report | Results | Remarks |
|---|---|---|---|---|
| RF Output Power | 4.3.1.2<br>4.3.2.2<br>5.4.2 | 7.1 | Pass | |
| Power Spectral Density | 4.3.2.3<br>5.4.3 | 7.2 | Not Applicable | *1 |
| Duty Cycle, Tx-sequence, Tx-gap | 4.3.1.3<br>4.3.2.4<br>5.4.2 | 7.3 | Not Applicable | *2 |
| Accumulated Transmit Time, Frequency Occupation and Hopping Sequence | 4.3.1.4<br>5.4.4 | 7.4 | Pass | |
| Hopping Frequency Separation | 4.3.1.5<br>5.4.5 | 7.5 | Pass | |
| Medium Utilization factor | 4.3.1.6<br>4.3.2.5<br>5.4.2 | 7.6 | Not Applicable | *2 |
| Adaptivity | 4.3.1.7<br>4.3.2.6<br>5.4.6 | 7.7 | Not Applicable | *2 |
| Occupied Channel Bandwidth | 4.3.1.8<br>4.3.2.7<br>5.4.7 | 7.8 | Pass | |
| Transmitter unwanted emissions in the out-of-band domain | 4.3.1.9<br>4.3.2.8<br>5.4.8 | 7.9 | Pass | |
| Transmitter unwanted emissions in the spurious domain | 4.3.1.10<br>4.3.2.9<br>5.4.9 | 7.10 | Pass | |
| Receiver spurious emissions | 4.3.1.11<br>4.3.2.10<br>5.4.10 | 7.11 | Pass | |
| Receiver Blocking | 4.3.1.12<br>4.3.2.11<br>5.4.11 | 7.12 | Pass | |
| Geo-location capability | 4.3.1.13<br>4.3.2.12 | | | *3 |

*1 : This requirement does not apply because Frequency Hopping equipment.
*2 : This requirement does not apply because the RF Output power is less than 10 dBm EIRP
*3 : This section requests for equipment specifications. There is no requirement for the test.

| | | | | |
|---|---|---|---|---|
| Uncertainty of measurement | Temperature | -40 to +100 deg | + / - 0.5 | deg |
| | Supply Voltages | DC | +/- 0.04 | % |
| | Time | | + / - 0.9 | % |

Refer to each test result for uncertainty for each test item

## 7.1 RF Output Power

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

### 7.1.1 Test Results

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

Min Limit Margin 19.44 dB

Uncertainty of measurement results +/- 0.7 dB(2σ)

Remarks :

### 7.1.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Environmental Test Chamber | PFL-3K | Espec | - | N/A | N/A |
| USB Power Sensor | U2063XA | Keysight | PM02 | 2018/12 | 1 Year |
| RF Cable | MWX322 | Junkosha | CS11 | 2018/12 | 1 Year |
| DC Power Supply | PAB 18-2.5DU | KIKUSUI | - | N/A | N/A |
| Digital Multi-meter | VOAC7413 | Iwatsu Electric | MM01 | 2019/3 | 1 Year |

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

Step 1:
- Use a fast power sensor suitable for 2,4 GHz and capable of 1 MS/s.
- Use the following settings:
  - Sample speed 1 MS/s or faster.
  - The samples must represent the power of the signal

Step 2:
- For conducted measurements on devices with one transmit chain:
  - Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.

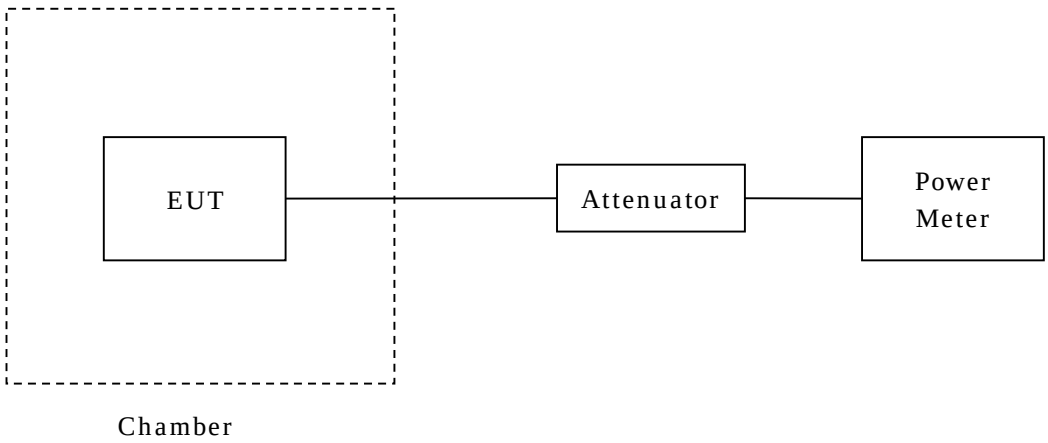
Step 3:
- Find the start and stop times of each burst in the stored measurement samples.

Step 4:
- Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these Pburst values, as well as the start and stop times for each burst.

Step 5:
- The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:
- Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.
- The RF Output Power (P) shall be calculated using the formula below:

  P = A + G



### 7.1.4 Test Data

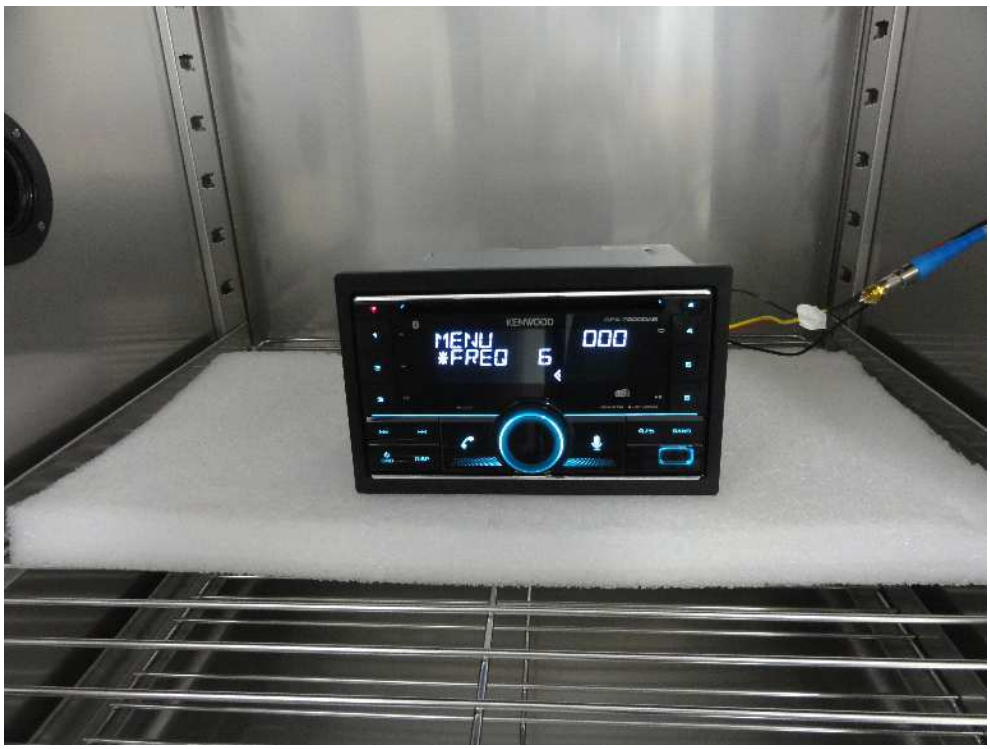
Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Tx (Hopping)
Test Port : Temporary antenna connector
Data Packet : DH5

| Temperature (℃) | Supply Voltage (VDC) | Correction Factor (dB) | Antenna Gain (dBi) | Meter Reading (dBm) | Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| -30.0 | 12.0 | 1.57 | 0.25 | -1.90 | -0.08 | 20.00 | 20.08 |
| 30.0 | 12.0 | 1.57 | 0.25 | -1.26 | 0.56 | 20.00 | 19.44 |
| 70.0 | 12.0 | 1.57 | 0.25 | -1.85 | -0.03 | 20.00 | 20.03 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The manufacturer defines the range of power supply voltage.
3) The correction facter containes the cable loss and attenuator loss.
4) The antenna gain value provided by applicant.
5) A sample calculation was made at ( -30.0 ℃, 12.0 (VDC) ).
CF + AG + MR = 1.57 + 0.25 + ( -1.90 ) = -0.08 (dBm)
CF : Correction Factor AG : Antenna Gain
MR : Meter Reading

### 7.1.5 Test Setup (photograph)



## 7.2 Power Spectral Density

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

Remarks : This requirement does not apply because Frequency Hopping Equipment.

## 7.3 Duty Cycle, Tx-sequence, Tx-gap

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

Remarks : This requirement does not apply because the RF Output power is less than 10 dBm EIRP

## 7.4 Accumulated Transmit time, Frequency Occupation & Hopping Sequence

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

### 7.4.1 Test Results

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

**[Accumulated Transmit Time]**

| | | |
|---|---|---|
| Mode of EUT: Full Hopping is | 310.4 | msec. |
| Mode of EUT: Adaptive Hopping is | 310.4 | msec. |

**[Frequency Occupation requirement]**

| | |
|---|---|
| Mode of EUT: Full Hopping is | 1 |
| Mode of EUT: Adaptive Hopping is | 1 |

**[Hopping Sequence]**

| | |
|---|---|
| Mode of EUT: Full Hopping is | 79 |
| Mode of EUT: Adaptive Hopping is | 20 |

**[Band Utilization]**

95.0 %

Uncertainty of measurement results +/- 1.2 dB(2σ)

Remarks : _____

### 7.4.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Environmental Test Chamber | PFL-3K | Espec | - | N/A | N/A |
| Test Receiver | ESW44 | Rohde & Schwarz | R04 | 2018/11 | 1 Year |
| RF Cable | MWX322 | Junkosha | CS11 | 2018/12 | 1 Year |
| DC Power Supply | PAB 18-2.5DU | KIKUSUI | - | N/A | N/A |
| Digital Multi-meter | VOAC7413 | Iwatsu Electric | MM01 | 2019/3 | 1 Year |

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

The test procedure shall be as follows:

[Accumulated Transmit Time]

Step 1:

Connect the EUT to the spectrum analyzer and use the following settings:

- Centre Frequency: Equal to the hopping frequency being investigated
- Frequency Span: 0 Hz
- Resolution BW: ~ 50 % of the Occupied Channel Bandwidth
- Video BW: ≥RBW
- Detector Mode: Peak
- Sweep time: Equal to the Dwell Time × Minimum number of hopping frequencies (N)
- Number of sweep points: 30,000 or Enough time resolution method.
- Trace mode: Clear / Write
- Trigger: Free Run

Step 2:

- Save the trace data to a file for further analysis by a computing device using an appropriate software application or program.

Step 3:

- Indentify the data points related to the frequency being investigated by applying a threshold.
- Count the number of data points identified as resulting from transmissions on the frequency being investigated and multiply this number by the time difference between two consecutive data points.

Step 4:

- The result in step 3 is the Accumulated Transmit Time which shall be recorded in the test report.

[Frequency Occupation requirement] Option 1

Step 5:

- Make the following changes on the analyzer and repeat steps 2 and 3.
  " Sweep time: 4 × Dwell Time × Actual number of hopping frequencies in use"
  The result shall be recorded in the test report.

[hopping sequence]

Step 6:

Make the following changes on the analyzer:

- Start Frequency: 2 400 MHz, Stop Frequency: 2 483,5 MHz
- Resolution BW: ~ 50 % of the Occupied Channel Bandwidth
- Video BW: ≥RBW
- Detector Mode: RMS
- Sweep time: Auto
- Trace mode: Max Hold
- Trigger: Free Run

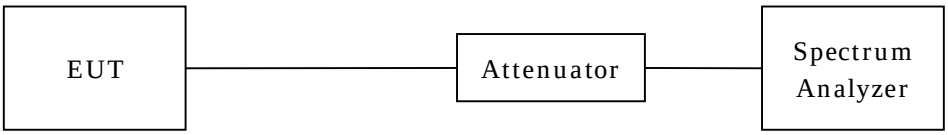
Step 7:

- When the trace has completed, indentify the number of hopping frequencies used by the hopping sequence.
- The result shall be recorded in the test report.

[hopping sequence]

Step 8:

- For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the system uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.



### 7.4.4 Test Data

**[Accumulated Transmit Time]**

Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Full Hopping
Test Port : Temporary antenna connector
Data Packet : DH5 (Worst case)

| Test Frequency (MHz) | Duration of Test (sec.) | No. of Burst (Times) | Burst Duration (msec.) | Acc. Transmit Time (msec.) | Limit (msec.) | Margin (msec.) |
|---|---|---|---|---|---|---|
| 2402.0 | 31.6 | 107 | 2.901 | 310.4 | 400.0 | 89.6 |
| 2480.0 | 31.6 | 107 | 2.901 | 310.4 | 400.0 | 89.6 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The minimum hoppingf channel(N) is 79 therefore the "duration of test" = 400 msec. * 79 = 31.6 sec.

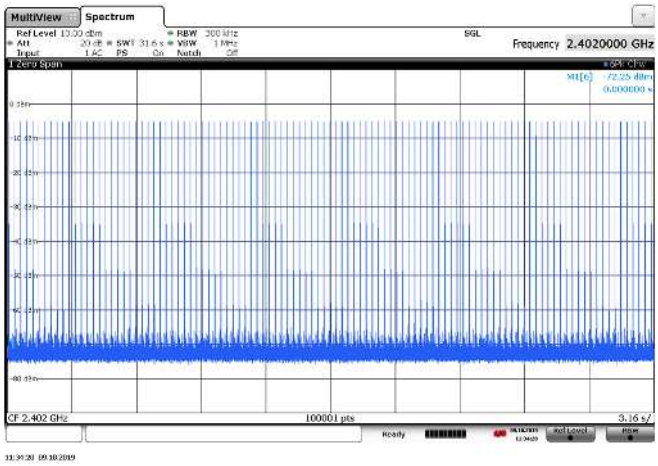
Mode of EUT : Adaptive Hopping
Test Port : Temporary antenna connector
Data Packet : DH5 (Worst case)

| Test Frequency (MHz) | Duration of Test (sec.) | No. of Burst (Times) | Burst Duration (msec.) | Acc. Transmit Time (msec.) | Limit (msec.) | Margin (msec.) |
|---|---|---|---|---|---|---|
| 2402.0 | 8.0 | 107 | 2.901 | 310.4 | 400.0 | 89.6 |
| 2480.0 | 8.0 | 106 | 2.901 | 307.5 | 400.0 | 92.5 |

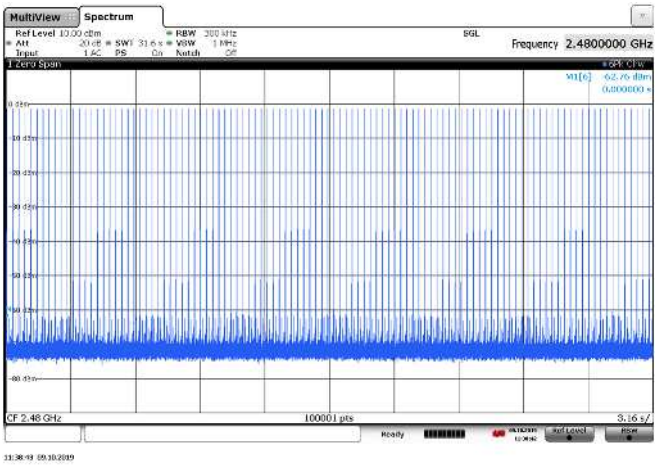
Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The minimum hoppingf channel(N) is 20 therefore the "duration of test" = 400 msec. * 20 = 8,000 msec.

**Mode of EUT: Full Hopping**

TX 2402 MHz

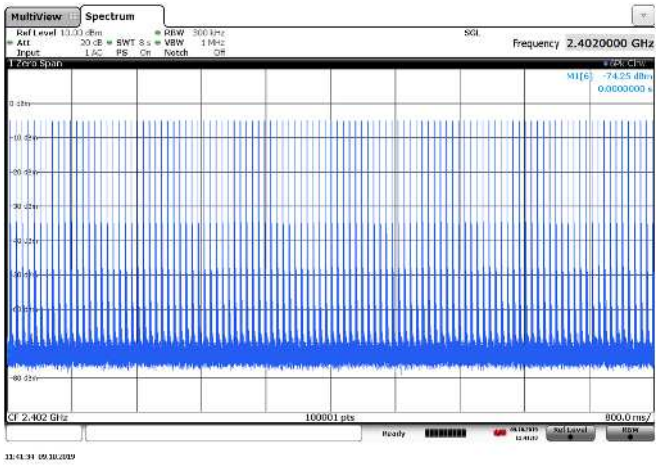



TX 2480 MHz

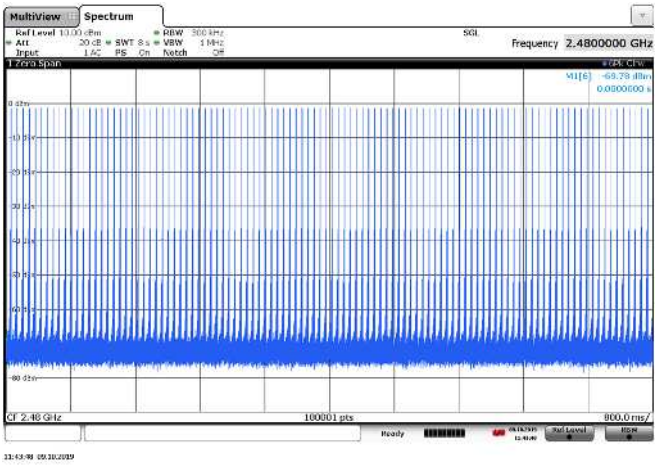



**Mode of EUT: Adaptive Hopping**

TX 2402 MHz




TX 2480 MHz



**[Frequency Occupation requirement]**

Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Full Hopping
Test Port : Temporary antenna connector
Data Packet : DH1 (Worst case)

| Test Frequency (MHz) | Dwell Time (msec.) | Duration of Test (msec.) | No. of Burst (Times) | Freq. Occupation (msec.) | Limit (msec.) |
|---|---|---|---|---|---|
| 2402.0 | 0.394 | 124.5 | 1 | 0.394 | 0.394 |
| 2480.0 | 0.394 | 124.5 | 1 | 0.394 | 0.394 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The minimum hoppingf channel(N) is 79
therefore the "duration of test"(Sweep time) = 4 * Dwell Time * 79

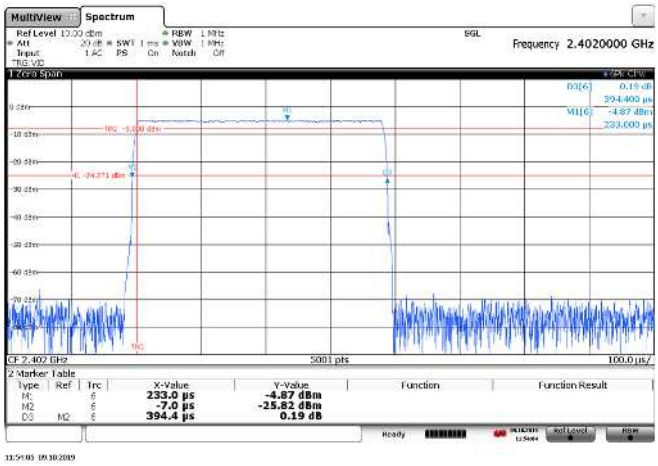
Mode of EUT : Adaptive Hopping
Test Port : Temporary antenna connector
Data Packet : DH1 (Worst case)

| Test Frequency (MHz) | Dwell Time (msec.) | Duration of Test (msec.) | No. of Burst (Times) | Freq. Occupation (msec.) | Limit (msec.) |
|---|---|---|---|---|---|
| 2402.0 | 0.395 | 31.6 | 1 | 0.395 | 0.395 |
| 2480.0 | 0.395 | 31.6 | 1 | 0.395 | 0.395 |

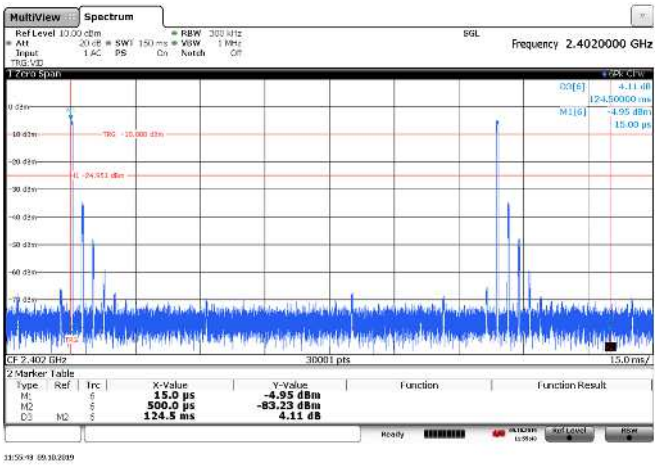
Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The minimum hoppingf channel(N) is 20
therefore the "duration of test"(Sweep time) = 4 * Dwell Time * 20

**Mode of EUT: Full Hopping**

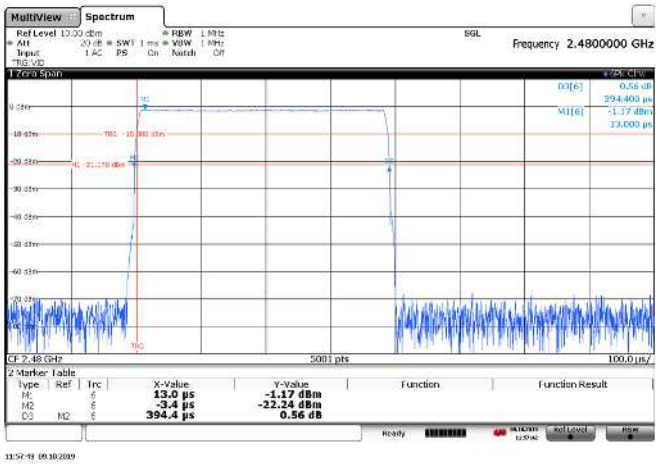
TX 2402 MHz(Transmit Time)



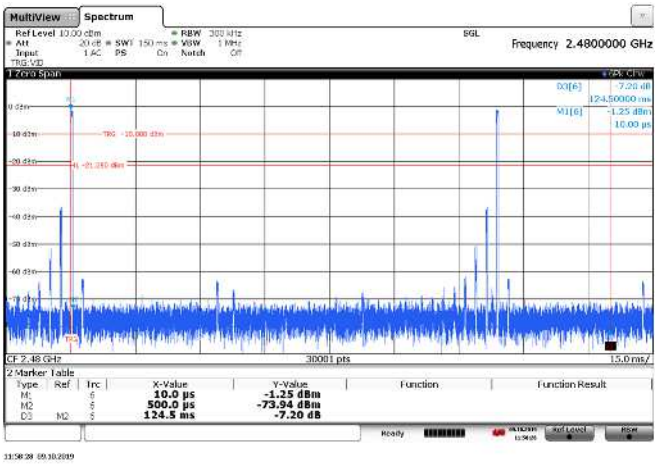

TX 2402 MHz(Frequency Occupation)




TX 2480 MHz(Transmit Time)

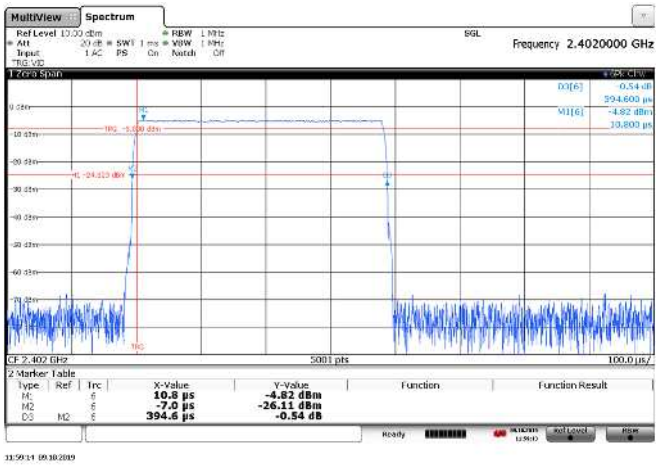



TX 2480 MHz(Frequency Occupation)

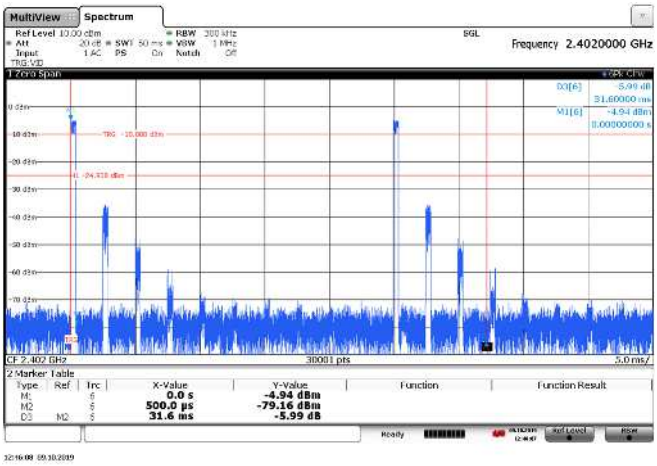


**Mode of EUT: Adaptive Hopping**

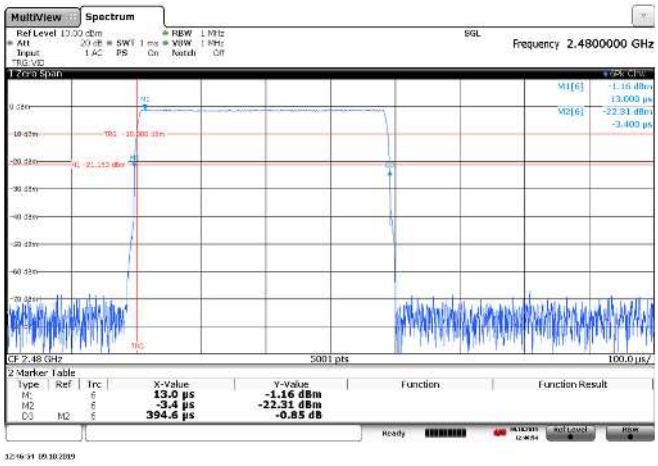
TX 2402 MHz(Transmit Time)



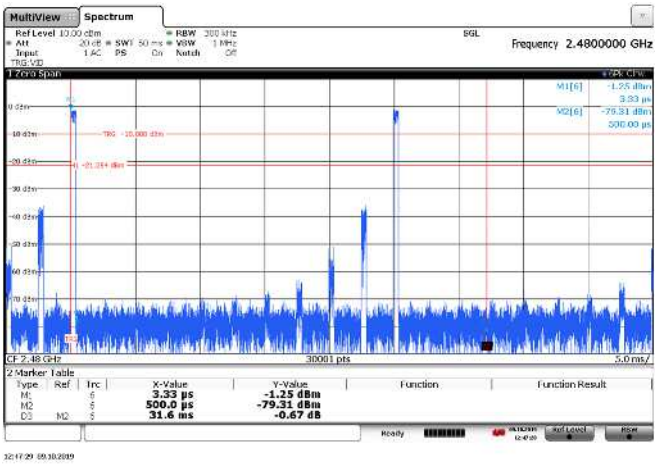

TX 2402 MHz(Frequency Occupation)




TX 2480 MHz(Transmit Time)




TX 2480 MHz(Frequency Occupation)



**[Hopping Sequence]**

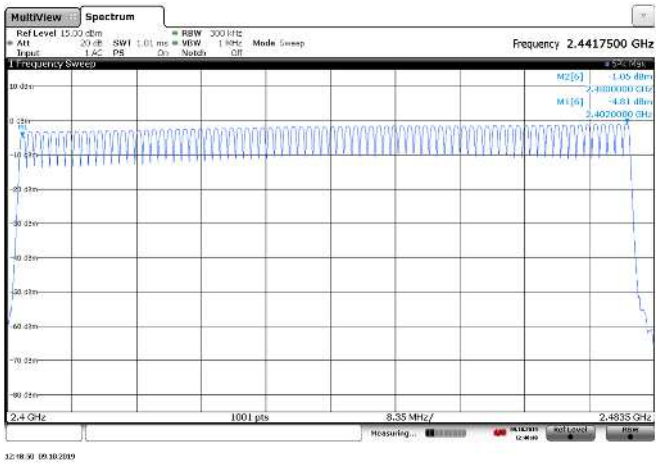
Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Full Hopping
Test Port : Temporary antenna connector
Data Packet : DH5

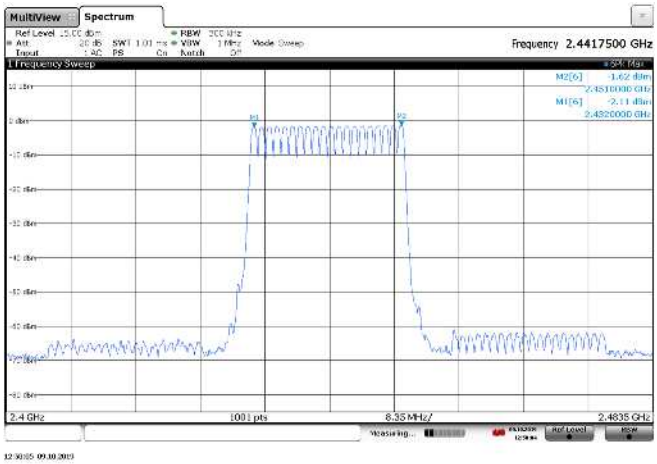
| Mode of EUT | Number of Hopping Freqencies (N) | Limit |
|---|---|---|
| Full Hopping | 79 | 15 |
| Adaptive Hopping | 20 | 15 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The hopping frequency separation is 1 MHz therefore limitation is minimum 15 hopping frequencies.

**Mode of EUT: Full Hopping**




**Mode of EUT: Adaptive Hopping**



**[Band Utilization]**

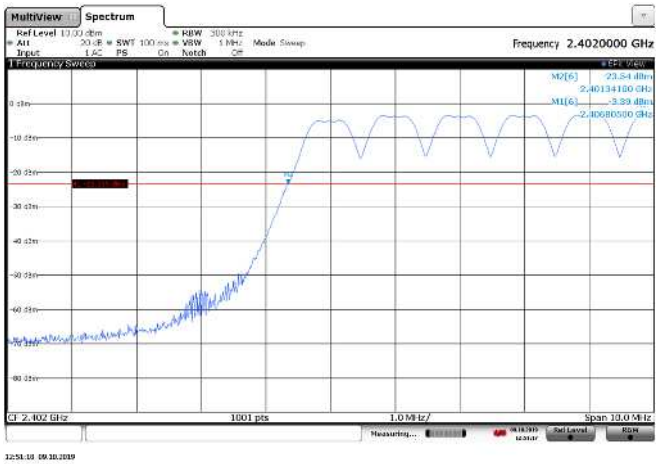
Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Adaptive Hopping
Test Port : Temporary antenna connector
Data Packet : DH5

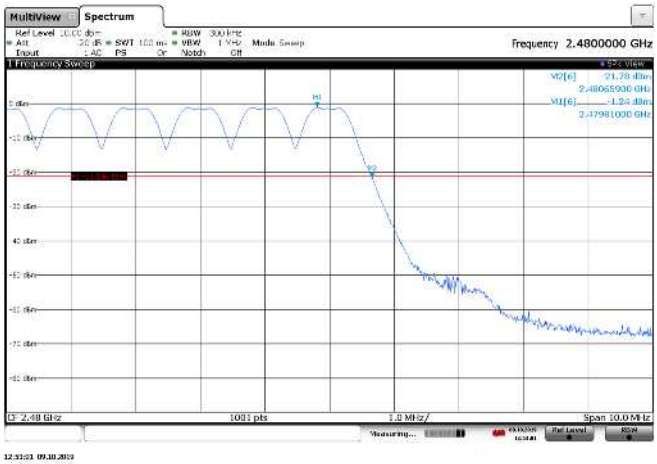
| Freq. Low Edge (MHz) | Freq. High Edge (MHz) | Band Utilization (%) | Limit (%) |
|---|---|---|---|
| 2401.3 | 2480.7 | 95.0 | 70.0 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) Band Utilization = (2480.659MHz – 2401.341MHz) / (2483.5MHz – 2400MHz) x 100 = 95(%)

Lower Band




Upper Band




### 7.4.5 Test Setup (photograph)

Refer to 7.1.5 Test Setup photograph that is same configuration for measurement.

## 7.5 Hopping Frequency Separation

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

### 7.5.1 Test Results

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

Channel Separation is

| | | |
|---|---|---|
| Mode of EUT: Full Hopping is | 999 | kHz |
| Mode of EUT: Adaptive Hopping is | 999 | kHz |

Uncertainty of measurement results +/- 1.2 dB(2σ)

Remarks : The measurements were performed in accordance with test procedure option 2

### 7.5.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Environmental Test Chamber | PFL-3K | Espec | - | N/A | N/A |
| Test Receiver | ESW44 | Rohde & Schwarz | R04 | 2018/11 | 1 Year |
| RF Cable | MWX322 | Junkosha | CS11 | 2018/12 | 1 Year |
| DC Power Supply | PAB 18-2.5DU | KIKUSUI | - | N/A | N/A |
| Digital Multi-meter | VOAC7413 | Iwatsu Electric | MM01 | 2019/3 | 1 Year |

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

The test procedure shall be selected from following 2 options. The selected option shall be stated in the test report.

**[ Option 1 ]**

(Step 1):

Connect the EUT to the spectrum analyzer and use the following settings:

- Centre Frequency: Centre of the two adjacent hopping frequencies
- Frequency Span: Sufficient to see the complete power envelope of both hopping frequencies
- Resolution BW: 1 % of the Span
- Video BW: 3 × RBW
- Detector Mode: RMS
- Sweep time: Auto
- Trace mode: Max Hold

(Step 2):

- Allow the trace to stabilize.
- Use the marker function of the analyser to define the lower- and the upper -20 dBr points for both hopping frequencies F1 and F2. This will result in F1L and F1H for hopping frequency F1 and in F2L and F2H for hopping frequency F2. These values shall be recorded in the report.

(Step 3):

- Calculate the centre frequencies F1C and F2C for both hopping frequencies using the formulas below. These values shall be recorded in the report.

- Calculate the -20 dBr channel bandwidth (BWCHAN) using the formula below. This value shall be recorded in the report.

$$BW_{CHAN} = F1_H - F1_L$$

- Calculate the Hopping Frequency Separation (FHS) using the formula below. This value shall be recorded in the report.

$$F_{HS} = F2_C - F1_C$$

- Compare the measured Hopping Frequency Separation with the limit defined in clause 4.3.1.4.2. In addition, for non-Adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal to or greater than the -20 dBr channel bandwidth or:

$$F_{HS} \geq BW_{CHAN}$$

**[ Option 2 ]**

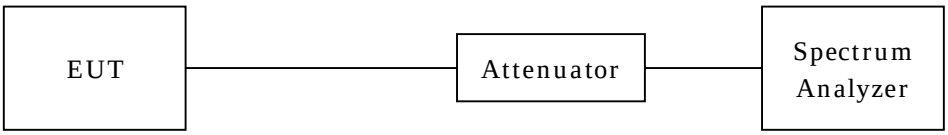
(Step 1):

Connect the EUT to the spectrum analyzer and use the following settings:

- Centre Frequency: Centre of the two adjacent hopping frequencies
- Frequency Span: Sufficient to see the complete power envelope of both hopping frequencies
- Resolution BW: 1 % of the Span
- Video BW: 3 × RBW
- Detector Mode: RMS
- Sweep time: Auto
- Trace mode: Max Hold

(Step 2):

- Allow the trace to stabilize.
- Use the marker-delta function to determine the Hopping Frequency Separation between the peaks of the two adjacent hopping frequencies. This value shall be compared with the limits and shall be recorded in the test report.



### 7.5.4 Test Data

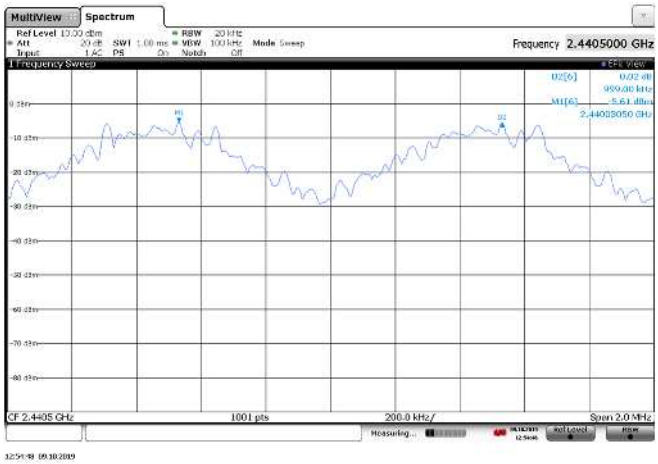
Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Full Hopping & Adaptive Hopping
Test Port : Temporary antenna connector
Data Packet : DH5

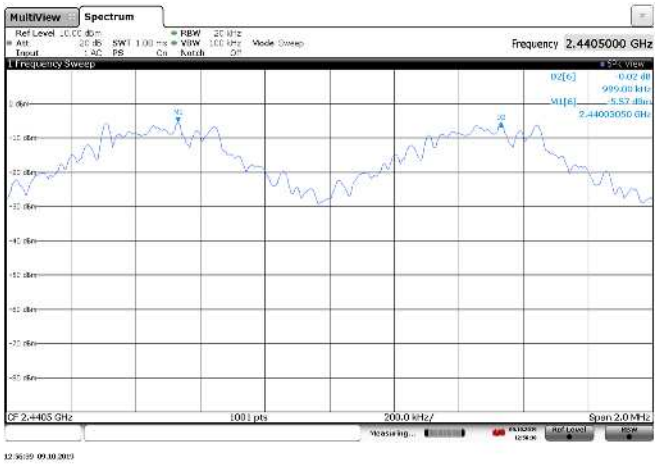
| Tx Mode | Hopping Freqency Separation (kHz) | Limit (kHz) |
|---|---|---|
| Full Hopping | 999 | 100 |
| Adaptive Hopping | 999 | 100 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The measurement was performed in accordance with the test method option 2.

**Mode of EUT: Full Hopping**




**Mode of EUT: Adaptive Hopping**




### 7.5.5 Test Setup (photograph)

Refer to 7.1.5 Test Setup photograph that is same configuration for measurement.

## 7.6 Medium Utilization Factor

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

Remarks : This requirement does not apply because the RF Output power is less than 10 dBm EIRP

## 7.7 Adaptivity

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

Remarks : This requirement does not apply because the RF Output power is less than 10 dBm EIRP

## 7.8 Occupied Channel Bandwidth

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

### 7.8.1 Test Results

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

Frequency range Lower 2401.384 MHz Upper 2480.552 MHz

Uncertainty of measurement results +/- 0.131 %

Remarks : Worst rate 2DH5

### 7.8.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Environmental Test Chamber | PFL-3K | Espec | - | N/A | N/A |
| Test Receiver | ESW44 | Rohde & Schwarz | R04 | 2018/11 | 1 Year |
| RF Cable | MWX322 | Junkosha | CS11 | 2018/12 | 1 Year |
| DC Power Supply | PAB 18-2.5DU | KIKUSUI | - | N/A | N/A |
| Digital Multi-meter | VOAC7413 | Iwatsu Electric | MM01 | 2019/3 | 1 Year |

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

Step 1:

Connect the EUT to the spectrum analyzer and use the following settings:

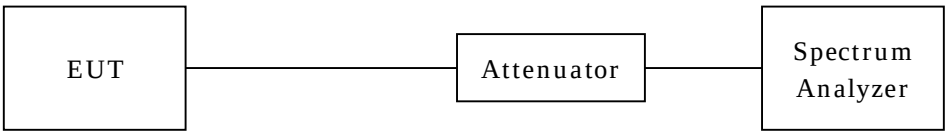
- Centre Frequency: The centre frequency of the channel under test
- Resolution BW: ~ 1 % of the span without going below 1 %
- Video BW: 3 × RBW
- Frequency Span: 2 × Occupied Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
- Detector Mode: RMS

Step 2:

Wait until the trace is completed.

Step 3:

Measure the 99 % bandwidth of the EUT.



### 7.8.4 Test Data

Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Tx
Test Port : Temporary antenna connector
Data Packet : DH5

| Tx Freqency (MHz) | Spectrum Analyzer Reading (MHz) | | 99% OBW (MHz) | Limit (MHz) | | Margin (MHz) |
|---|---|---|---|---|---|---|
| | Lower | Upper | | Lower | Upper | |
| 2402.0 | 2401.545 | 2402.412 | 0.867 | 2400.0 | 2483.5 | 1.545 |
| 2480.0 | 2479.532 | 2480.397 | 0.864 | 2400.0 | 2483.5 | 3.103 |

Mode of EUT : Tx
Test Port : Temporary antenna connector
Data Packet : 2DH5

| Tx Freqency (MHz) | Spectrum Analyzer Reading (MHz) | | 99% OBW (MHz) | Limit (MHz) | | Margin (MHz) |
|---|---|---|---|---|---|---|
| | Lower | Upper | | Lower | Upper | |
| 2402.0 | 2401.384 | 2402.553 | 1.168 | 2400.0 | 2483.5 | 1.384 |
| 2480.0 | 2479.384 | 2480.552 | 1.169 | 2400.0 | 2483.5 | 2.948 |

Mode of EUT : Tx
Test Port : Temporary antenna connector
Data Packet : 3DH5

| Tx Freqency (MHz) | Spectrum Analyzer Reading (MHz) | | 99% OBW (MHz) | Limit (MHz) | | Margin (MHz) |
|---|---|---|---|---|---|---|
| | Lower | Upper | | Lower | Upper | |
| 2402.0 | 2401.386 | 2402.551 | 1.164 | 2400.0 | 2483.5 | 1.386 |
| 2480.0 | 2479.386 | 2480.550 | 1.163 | 2400.0 | 2483.5 | 2.950 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) Setting of measuring instrument(s):

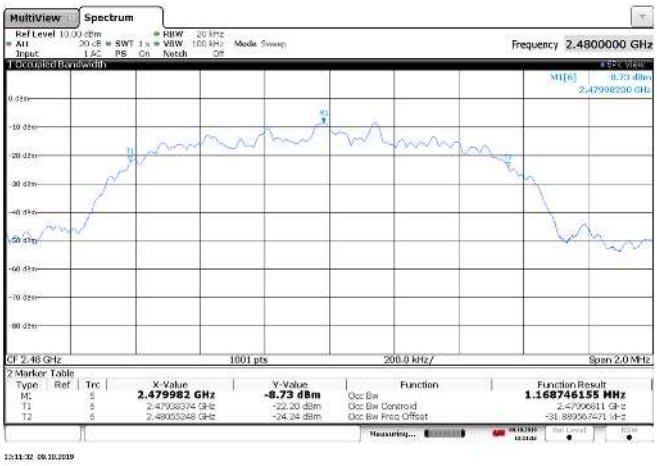
| Detector | RES B.W. | Video B.W. |
|---|---|---|
| RMS | 1% of span | 3 x RBW |

DH5 Low Channel

DH5 High Channel

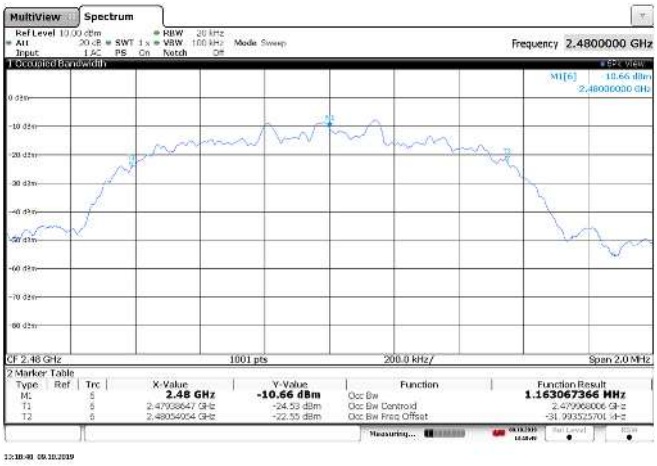
2DH5 Low Channel

2DH5 High Channel




3DH5 Low Channel

3DH5 High Channel




### 7.8.5 Test Setup (photograph)

Refer to 7.1.5 Test Setup photograph that is same configuration for measurement.

## 7.9 Transmitter unwanted emissions in the out-of-band domain

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

### 7.9.1 Test Results

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

Min Limit Margin 42.85 dB

Uncertainty of measurement results +/- 1.2 dB(2σ)

Remarks : 2483.5MHz+BW to 2483.5MHz+2BW

### 7.9.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Environmental Test Chamber | PFL-3K | Espec | - | N/A | N/A |
| Test Receiver | ESW44 | Rohde & Schwarz | R04 | 2018/11 | 1 Year |
| RF Cable | MWX322 | Junkosha | CS11 | 2018/12 | 1 Year |
| DC Power Supply | PAB 18-2.5DU | KIKUSUI | - | N/A | N/A |
| Digital Multi-meter | VOAC7413 | Iwatsu Electric | MM01 | 2019/3 | 1 Year |

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

Step 1:

Connect the EUT to the spectrum analyzer and use the following settings:

- Start/Stop Frequency: The value of the band to estimate
- Resolution BW: 1 MHz
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Continuous
- Trigger Mode: Free Run

Step 2:

Wait until the trace is completed.

Find the peak value of the trace and place the analyzer marker on this peak.

Step 3:

The analyzer is set as follows:

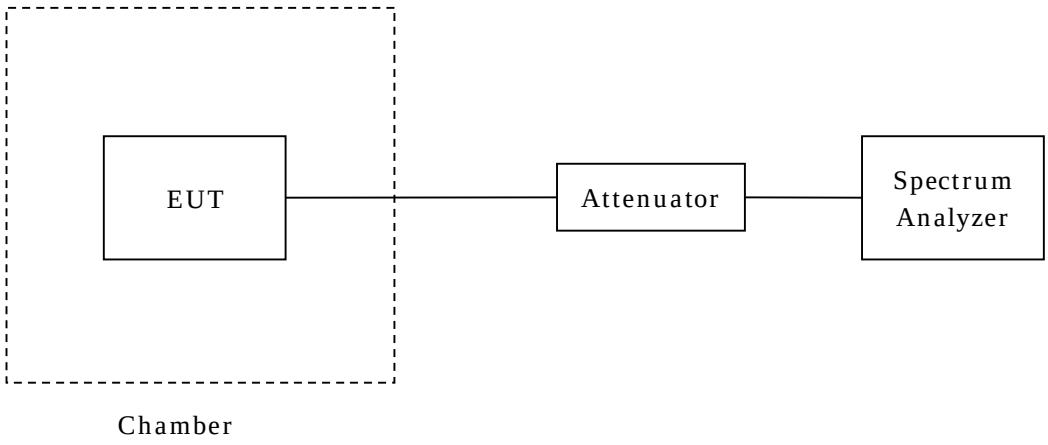
- Centre Frequency: the peak value of the step 2
- Span: 0 Hz
- Resolution BW: 1 MHz
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Clear / Write
- Sweep Mode: Continuous
- Trigger Mode: Video trigger
- Sweep Time: Suitable to capture one transmission burst

Step 4:

Adjust the trigger level to select the transmissions with the highest power level.

Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.

Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment. Compare this value with the applicable limit provided by the mask.



### 7.9.4 Test Data

Date : October 9 ,2019
Temp. : 22 ℃
Humi. : 50 %

Mode of EUT : Tx Hopping
Test Port : Temporary antenna connector
Data rate : DH5

| Measurement Band | Correction Factor (dB) | Antenna Gain (dBi) | Meter Reading (dBm/MHz) | Power (dBm/MHz) e.i.r.p | Limit (dBm/MHz) e.i.r.p | Margin (dB) |
|---|---|---|---|---|---|---|
| 2400MHz - BW to 2400MHz | 1.57 | 0.25 | -69.36 | -67.54 | -10.00 | 57.54 |
| 2400MHz - 2BW to 2400MHz - BW | 1.57 | 0.25 | -72.23 | -70.41 | -20.00 | 50.41 |

Mode of EUT : Tx Hopping
Test Port : Temporary antenna connector
Data rate : DH5

| Measurement Band | Correction Factor (dB) | Antenna Gain (dBi) | Meter Reading (dBm/MHz) | Power (dBm/MHz) e.i.r.p | Limit (dBm/MHz) e.i.r.p | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.5MHz to 2483.5MHz + BW | 1.57 | 0.25 | -66.59 | -64.77 | -10.00 | 54.77 |
| 2483.5MHz + BW to 2483.5MHz + 2BW | 1.57 | 0.25 | -64.67 | -62.85 | -20.00 | 42.85 |

Note : 1) The measurement was carried out with EUT with temporary antenna port.
2) The manufacturer defines the range of power supply voltage.
3) The correction facter containes the cable loss and attenuator loss.
4) The antenna gain value provided by applicant.
5) Setting of measuring instrument(s):

| Detector | RES B.W. | Video B.W. |
|---|---|---|
| RMS | 1 MHz | 3 MHz |

6) A sample calculation was made at Low Band Edge
CF + AG + M/R = 1.57 + 0.25 + -69.36 = -67.54 (dBm/MHz e.i.r.p.)
CF : Correction Factor AG : Antenna Gain
M/R : Meter Reading

### 7.9.5 Test Setup (photograph)

Refer to 7.1.5 Test Setup photograph that is same configuration for measurement.

## 7.10 Transmitter unwanted emissions in the spurious domain

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

### 7.10.1 Test Results

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

Min Limit Margin 31.5 dB at 4960.000 MHz

Uncertainty of measurement results 30MHz - 1 GHz +/- 1.2 dB(2σ)
1GHz - 26.5 GHz +/- 2.5 dB(2σ)

Remarks : The worst case of actual measurement is above,
There was a margin of more than 21.0dB at 30MHz-12.75GHz.

### 7.10.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Anechoic Chamber | -- | TDK | A-1 | 2019/6 | 1 Year |
| Test Receiver | ESW44 | Rohde & Schwarz | R04 | 2018/11 | 1 Year |
| Dipole Antenna | KBA-522 | Kyoritsu | AD03 | 2019/6 | 1 Year |
| Dipole Antenna | KBA-511A | Kyoritsu | AD01 | 2019/6 | 1 Year |
| Dipole Antenna | KBA-611 | Kyoritsu | AD02 | 2019/6 | 1 Year |
| Biconical Antenna | VHA9103/BBA9106 | Schwarzbeck | AB01 | 2019/8 | 1 Year |
| Log-periodic Antenna | VULP9118A | Schwarzbeck | AL04 | 2019/8 | 1 Year |
| RF Cable | MWX122 | Junkosha Inc. | CS12 | 2019/9 | 1 Year |
| RF Cable | MWX211 | Junkosha Inc. | CS02 | 2019/9 | 1 Year |
| Power Meter | ML2495A | Anritsu | PM01 | 2019/6 | 1 Year |
| Power Sensor | MA2491A | Anritsu | PM01-S1 | 2019/6 | 1 Year |
| Signal Generator | SMB100B | Rohde & Schwarz | SG10 | 2019/6 | 1 Year |
| Log-periodic Antenna | HL050 | Rohde & Schwarz | AL03 | 2019/2 | 1 Year |
| RF Cable | MWX211 | Junkosha Inc. | CS10 | 2019/7 | 1 Year |
| RF Cable | F130-S1S1-394 | MEGA PHASE | CS08 | 2019/10 | 1 Year |
| Attenuator | 43KC-20 | Anritsu | ATT02 | 2019/10 | 1 Year |
| RF Amplifier | MLA-100M26-B02 | Techno Science Japan | PA07 | 2019/1 | 1 Year |
| Band Rejection Filter | BRM12294 | MICRO-TRONICS | F03 | 2018/10 | 1 Year |
| Horn Antenna | 3115 | ETS LINGGREN | AH05 | 2019/6 | 1 Year |

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

According to description of EN 300 328 V2.1.1(2016-11) Annex C, the radiated emissions measurement were carried out. The preliminary radiated measurements were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

**-Test Method-**

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 1.5 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.

Step 2)

A) Up to 1 GHz

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 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 power of the signal generator is adjusted until the same level is obtained in the step1.
Then the RF power into the substitution antenna was P (dBm).

The ERP is calculated in the following equation.
ERP(dBm) = P (dBm) + (Gain of the half-wave dipole antenna (dBi)) - 2.15(dB)

B) Above 1 GHz

The EIRP is calculated from the maximum emission level by the following formula.

$$\frac{e^2}{120\pi} = \frac{eirp}{4\pi d^2}$$

Where, $e[V/m]$: Field Strength at measuring distance(d=3m)

$eirp[W]$: Equivalent Isotropic Radiated Power

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

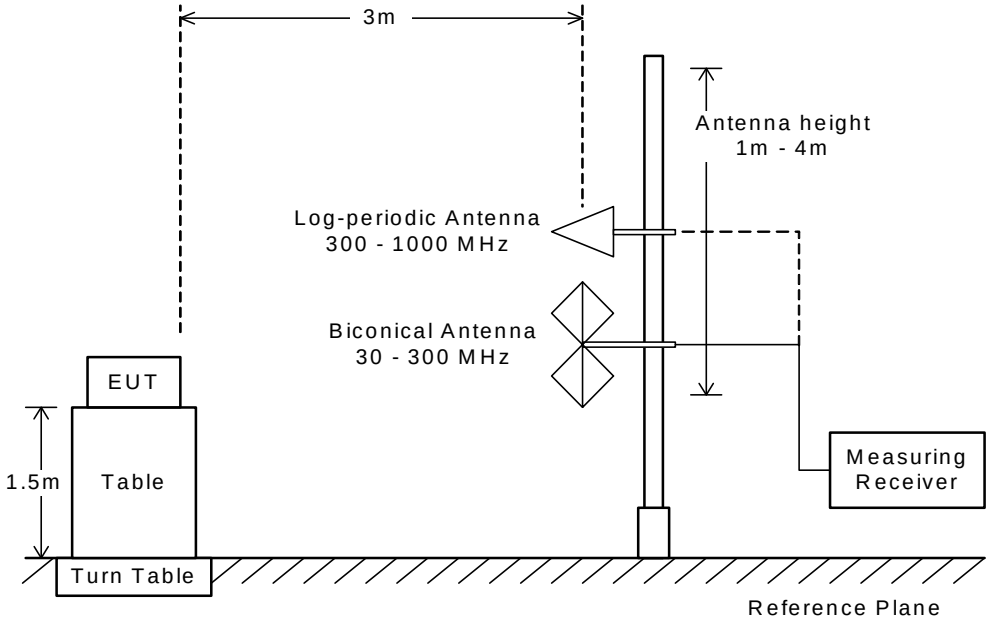
$$\therefore 10\log(eirp) = 20\log(e) + 10\log(3/10) = 20\log(e) - 5.23$$

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

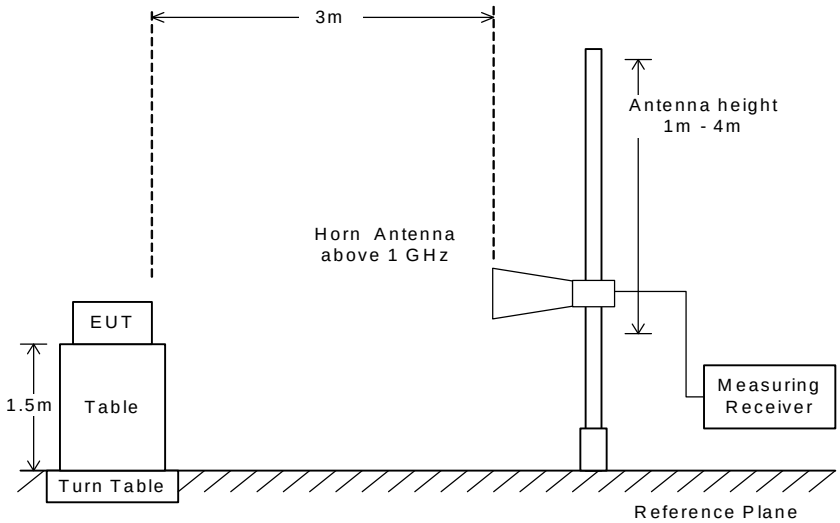
$$20\log(e) = E[dB(\mu V/m)] - 120$$

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

Radiated Emission 30 MHz to 1000 MHz

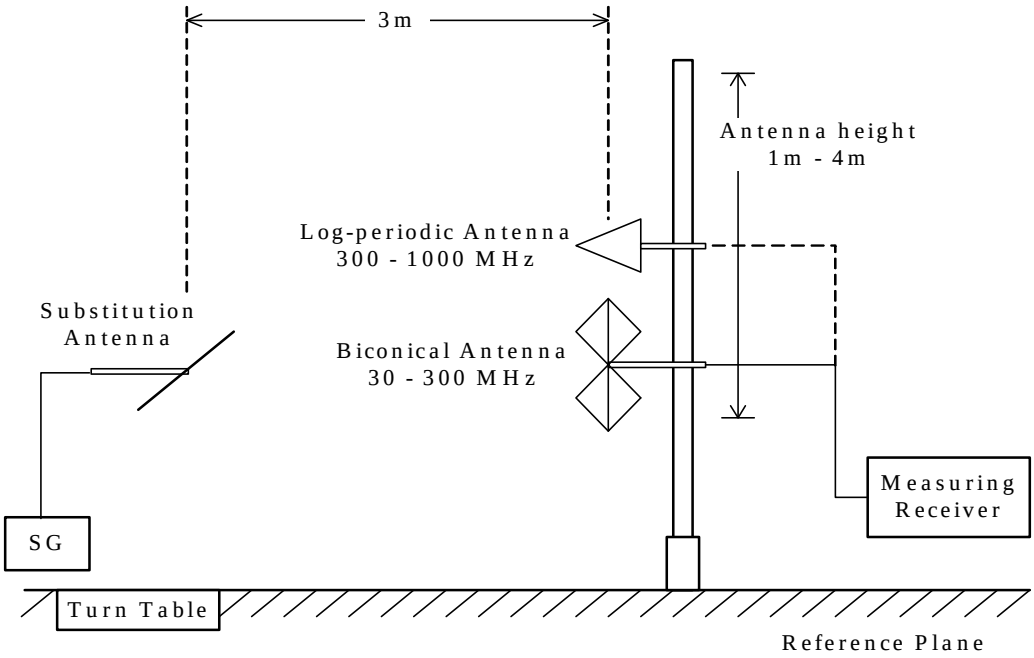



Radiated Emission above 1 GHz




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

Radiated Emission 30 to 1000 MHz – Substitution Method

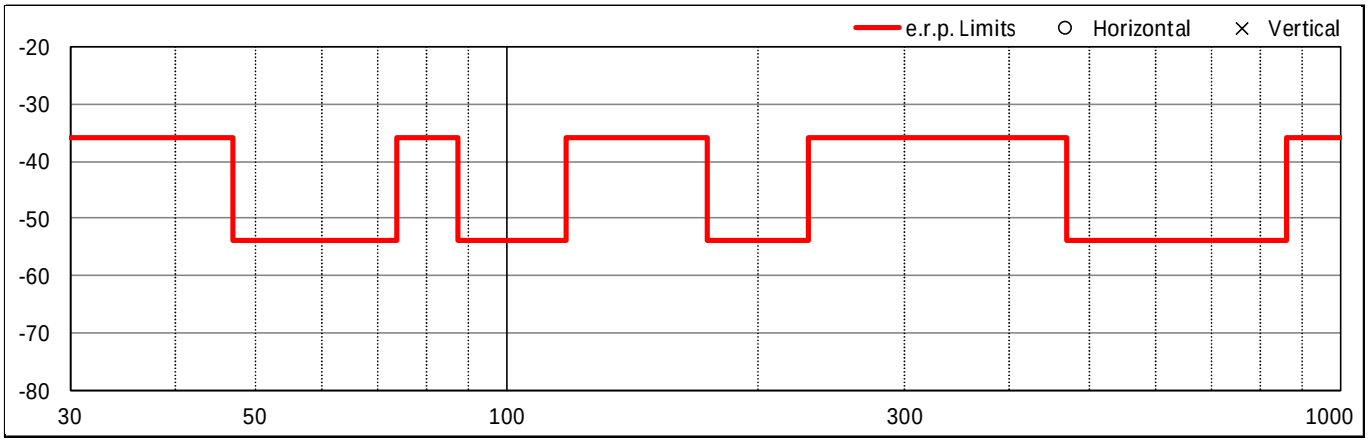


### 7.10.4 Test Data

Mode of EUT : Tx Mode
Test Port : Enclosure

Date : October 10 ,2019
Temp. : 23 ℃
Humi. : 46 %

| Freqency (MHz) | Emission Levels e.r.p (dBm) Horizontal | Vertical | Limits (dBm) | Margin (dB) Horizontal | Vertical |
|---|---|---|---|---|---|
| 59.370 | < -75.0 | < -75.0 | -54.0 | > 21.0 | > 21.0 |
| 71.610 | < -75.0 | < -75.0 | -54.0 | > 21.0 | > 21.0 |
| 83.850 | < -75.0 | < -75.0 | -36.0 | > 39.0 | > 39.0 |
| 104.250 | < -75.0 | < -75.0 | -54.0 | > 21.0 | > 21.0 |
| 282.620 | < -75.0 | < -75.0 | -36.0 | > 39.0 | > 39.0 |
| 442.370 | < -75.0 | < -75.0 | -36.0 | > 39.0 | > 39.0 |
| 565.250 | < -75.0 | < -75.0 | -54.0 | > 21.0 | > 21.0 |
| 786.440 | < -75.0 | < -75.0 | -54.0 | > 21.0 | > 21.0 |



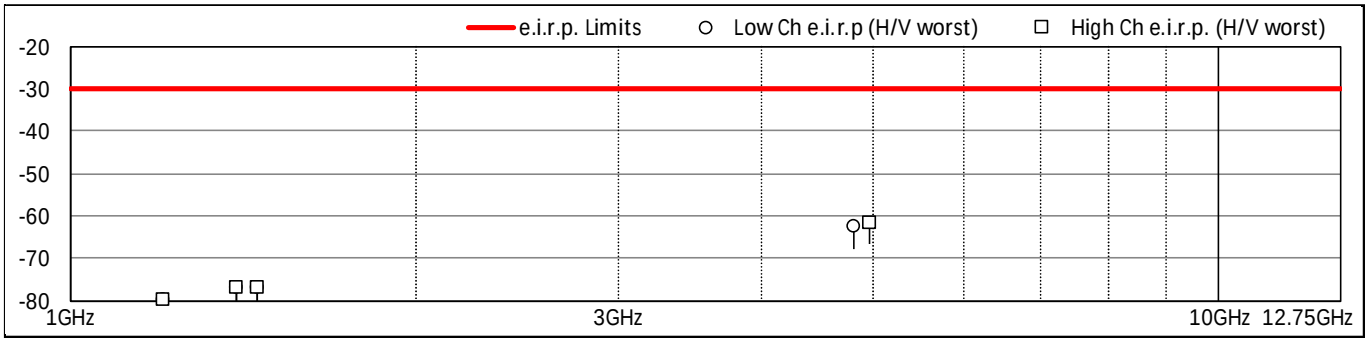

NOTES
1) The spectrum was checked from 30 MHz to 1000 MHz.
2) The symbol of "<" means "or less".
3) The symbol of ">" means "or greater".
4) Measuring Instrument Setting :

| Detector Function | Resolution Bandwidth | Video Bandwidth |
|---|---|---|
| RMS | 100kHz | 300kHz |

Mode of EUT : Tx Mode
Test Port : Enclosure

Date : October 10 ,2019
Temp. : 23 ℃
Humi. : 46 %

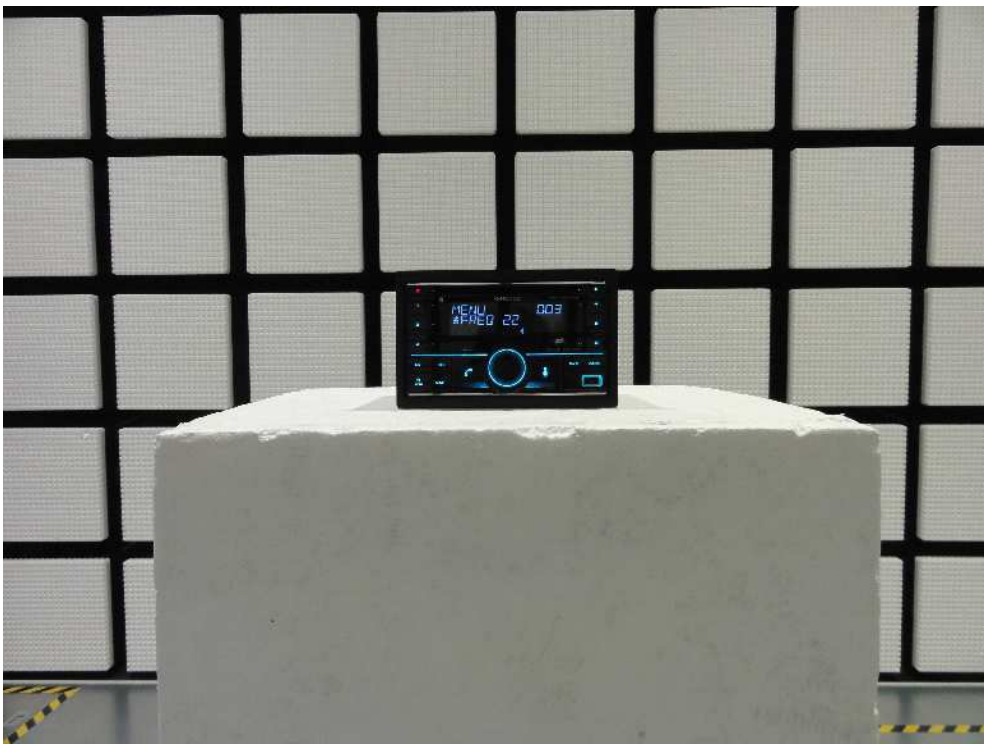
| Freqency (MHz) | Emission Levels e.i.r.p (dBm) Horizontal | Vertical | Limits (dBm) | Margin (dB) Horizontal | Vertical |
|---|---|---|---|---|---|
| Low Channel : 0 ch (2402 MHz) | | | | | |
| 1206.300 | -79.8 | -80.6 | -30.0 | 49.8 | 50.6 |
| 1395.100 | -79.0 | -77.0 | -30.0 | 49.0 | 47.0 |
| 1454.000 | -79.4 | -77.1 | -30.0 | 49.4 | 47.1 |
| 4804.000 | -63.1 | -62.7 | -30.0 | 33.1 | 32.7 |
| 7206.000 | < -63.7 | < -63.7 | -30.0 | > 33.7 | > 33.7 |
| 9608.000 | < -59.6 | < -59.6 | -30.0 | > 29.6 | > 29.6 |
| 12010.000 | < -56.4 | < -56.4 | -30.0 | > 26.4 | > 26.4 |
| High Channel : 79 ch (2480 MHz) | | | | | |
| 1206.300 | -79.8 | -80.7 | -30.0 | 49.8 | 50.7 |
| 1395.100 | -78.8 | -76.8 | -30.0 | 48.8 | 46.8 |
| 1454.000 | -79.4 | -76.8 | -30.0 | 49.4 | 46.8 |
| 4960.000 | -61.6 | -61.5 | -30.0 | 31.6 | 31.5 |
| 7440.000 | < -63.2 | < -63.2 | -30.0 | > 33.2 | > 33.2 |
| 9920.000 | < -58.4 | < -58.4 | -30.0 | > 28.4 | > 28.4 |
| 12400.000 | < -55.8 | < -55.8 | -30.0 | > 25.8 | > 25.8 |



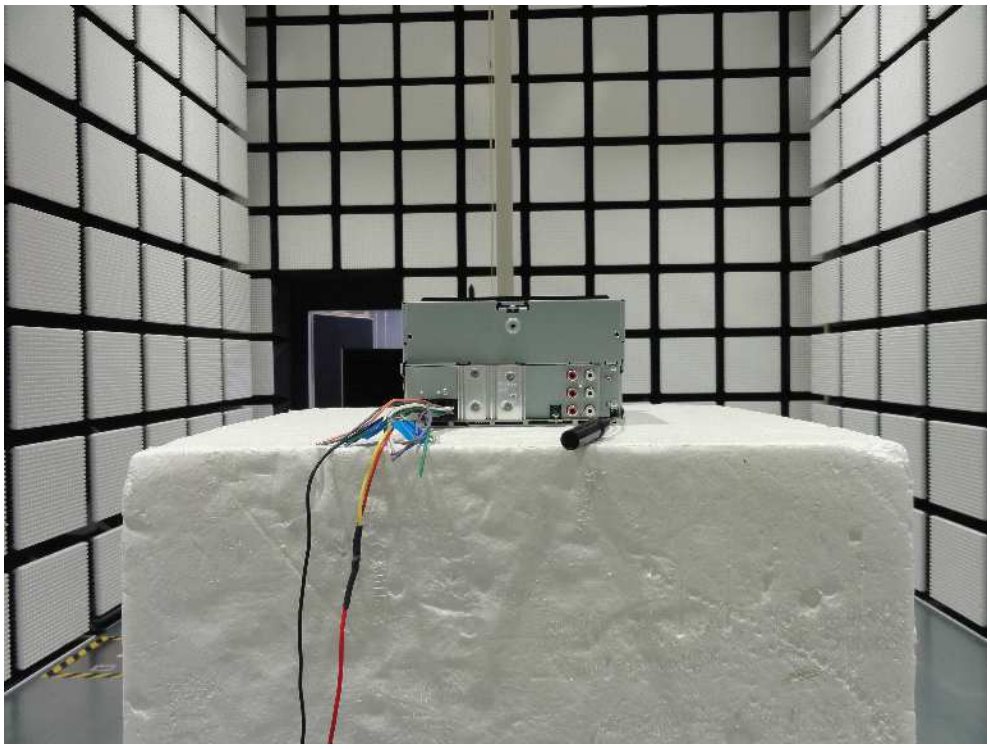

NOTES
1) The spectrum was checked from 1GHz to 12.75GHz.
2) The symbol of "<" means "or less".
3) The symbol of ">" means "or greater".
4) Measuring Instrument Setting :

| Detector Function | Resolution Bandwidth | Video Bandwidth |
|---|---|---|
| RMS | 1MHz | 3MHz |

### 7.10.5 Test Setup (photograph)




– Front View –



– Rear View –

Photograph present configuration with maximum emission

## 7.11 Receiver spurious emissions

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

### 7.11.1 Test Results

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

Min Limit Margin 13.2 dB at 7822.000 MHz

Uncertainty of measurement results 30MHz - 1 GHz +/- 1.2 dB(2σ)
1GHz - 26.5 GHz +/- 2.5 dB(2σ)

Remarks : The worst case of actual measurement is above,
There was a margin of more than 11.4dB at 30MHz-12.75GHz.

### 7.11.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Anechoic Chamber | -- | TDK | A-1 | 2019/6 | 1 Year |
| Test Receiver | ESW44 | Rohde & Schwarz | R04 | 2018/11 | 1 Year |
| Dipole Antenna | KBA-522 | Kyoritsu | AD03 | 2019/6 | 1 Year |
| Dipole Antenna | KBA-511A | Kyoritsu | AD01 | 2019/6 | 1 Year |
| Dipole Antenna | KBA-611 | Kyoritsu | AD02 | 2019/6 | 1 Year |
| Biconical Antenna | VHA9103/BBA9106 | Schwarzbeck | AB01 | 2019/8 | 1 Year |
| Log-periodic Antenna | VULP9118A | Schwarzbeck | AL04 | 2019/8 | 1 Year |
| RF Cable | MWX122 | Junkosha Inc. | CS12 | 2019/9 | 1 Year |
| RF Cable | MWX211 | Junkosha Inc. | CS02 | 2019/9 | 1 Year |
| Power Meter | ML2495A | Anritsu | PM01 | 2019/6 | 1 Year |
| Power Sensor | MA2491A | Anritsu | PM01-S1 | 2019/6 | 1 Year |
| Signal Generator | SMB100B | Rohde & Schwarz | SG10 | 2019/6 | 1 Year |
| Log-periodic Antenna | HL050 | Rohde & Schwarz | AL03 | 2019/2 | 1 Year |
| RF Cable | MWX211 | Junkosha Inc. | CS10 | 2019/7 | 1 Year |
| RF Cable | F130-S1S1-394 | MEGA PHASE | CS08 | 2019/10 | 1 Year |
| Attenuator | 43KC-20 | Anritsu | ATT02 | 2019/10 | 1 Year |
| RF Amplifier | MLA-100M26-B02 | Techno Science Japan | PA07 | 2019/1 | 1 Year |
| Band Rejection Filter | BRM12294 | MICRO-TRONICS | F03 | 2018/10 | 1 Year |
| Horn Antenna | 3115 | ETS LINGGREN | AH05 | 2019/6 | 1 Year |

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

According to description of EN 300 328 V2.1.1(2016-11) Annex C, the radiated emissions measurement were carried out. The preliminary radiated measurements were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.

**-Test Method-**

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 1.5 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.

Step 2)

A) Up to 1 GHz

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 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 power of the signal generator is adjusted until the same level is obtained in the step1.
Then the RF power into the substitution antenna was P (dBm).

The ERP is calculated in the following equation.
ERP(dBm) = P (dBm) + (Gain of the half-wave dipole antenna (dBi)) - 2.15(dB)

B) Above 1 GHz

The EIRP is calculated from the maximum emission level by the following formula.

$$\frac{e^2}{120\pi} = \frac{eirp}{4\pi d^2}$$

Where, $e[V/m]$: Field Strength at measuring distance(d=3m)

$eirp[W]$: Equivalent Isotropic Radiated Power

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

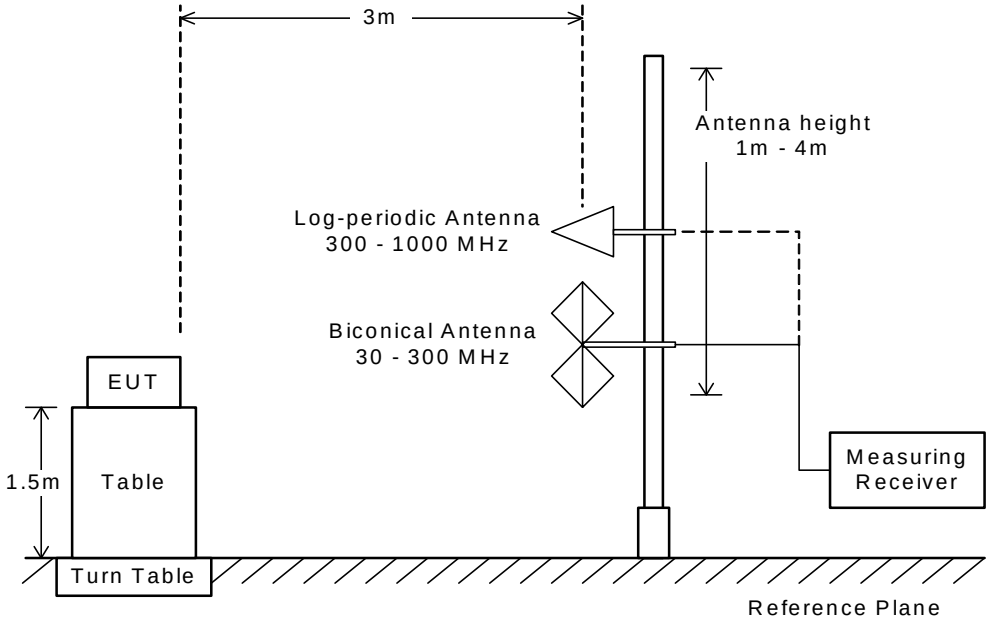
$$\therefore 10\log(eirp) = 20\log(e) + 10\log(3/10) = 20\log(e) - 5.23$$

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

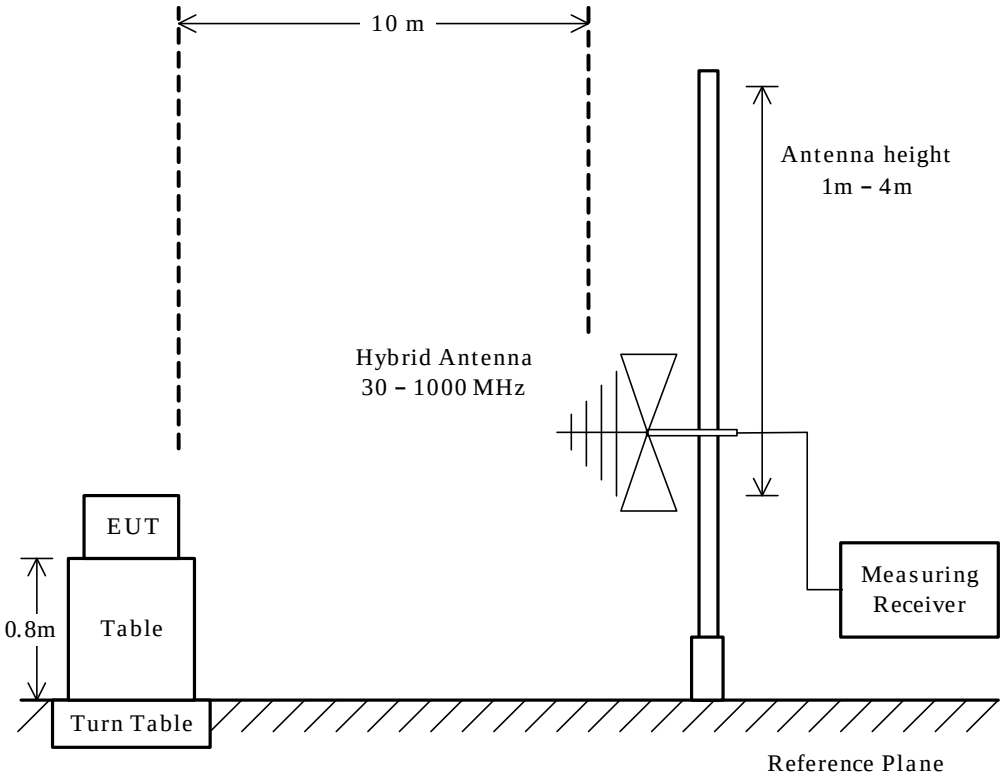
$$20\log(e) = E[dB(\mu V/m)] - 120$$

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

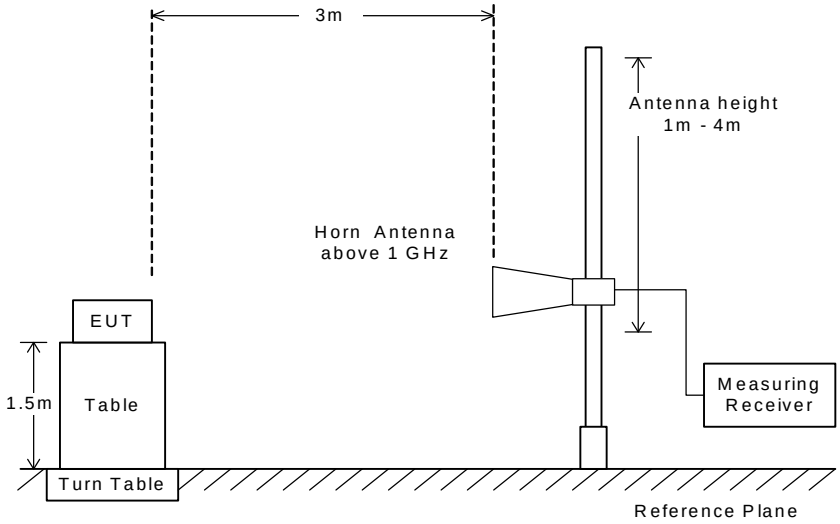
Radiated Emission 30 MHz to 1000 MHz




In the case where the plug-in radio device is totally integrated and cannot operate independently, radiated emissions for the combination shall be tested using the most appropriate harmonized standard with the radio part in receive mode. (i.e. : EN55022)

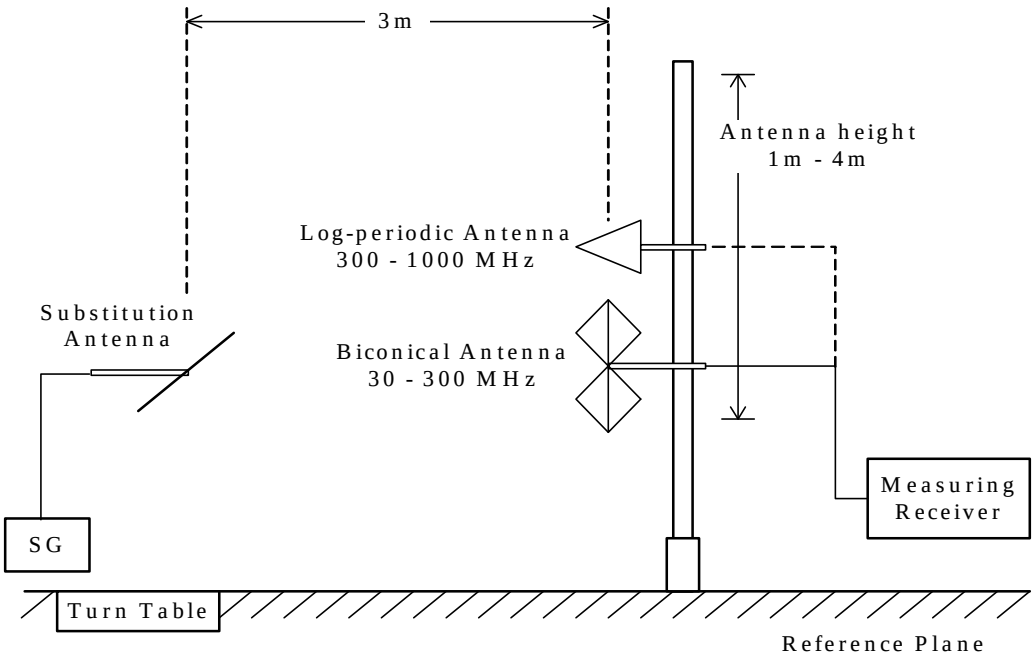


Radiated Emission above 1 GHz




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

Radiated Emission 30 to 1000 MHz – Substitution Method

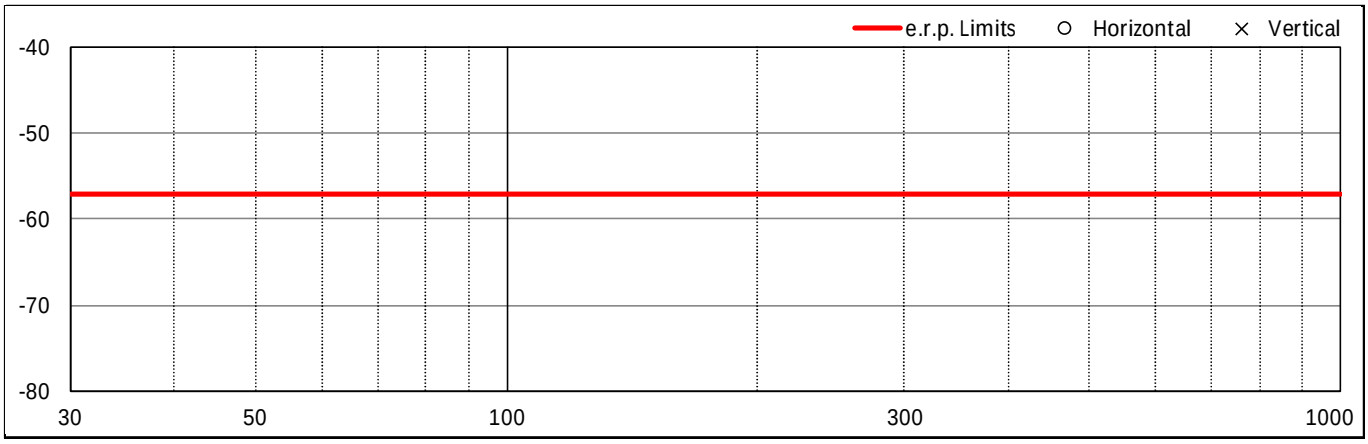


### 7.11.4 Test Data

Mode of EUT : Rx Mode
Test Port : Enclosure

Date : October 10 ,2019
Temp. : 23 ℃
Humi. : 46 %

| Freqency (MHz) | Emission Levels e.r.p (dBm) Horizontal | Vertical | Limits (dBm) | Margin (dB) Horizontal | Vertical |
|---|---|---|---|---|---|
| 59.370 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 71.610 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 83.850 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 104.250 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 282.620 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 442.370 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 565.250 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |
| 786.440 | < -75.0 | < -75.0 | -57.0 | > 18.0 | > 18.0 |



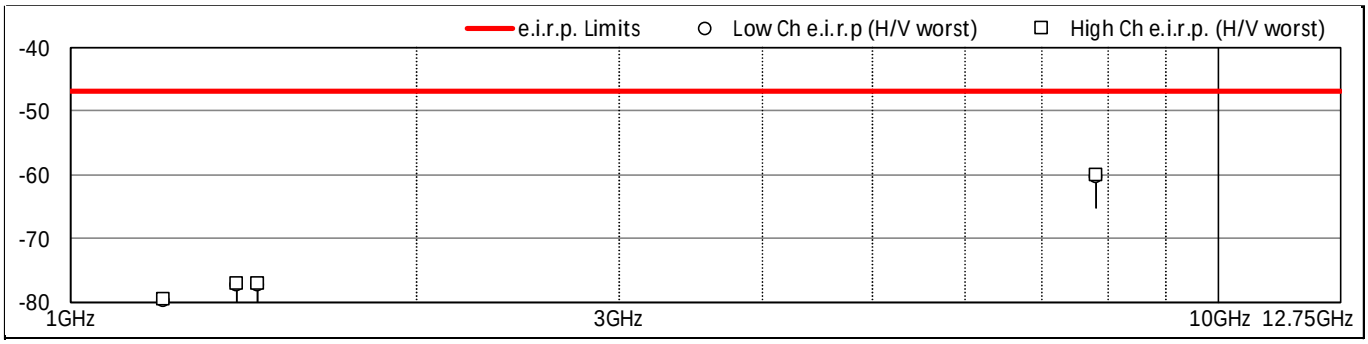

NOTES
1) The spectrum was checked from 30 MHz to 1000 MHz.
2) The symbol of "<" means "or less".
3) The symbol of ">" means "or greater".
4) Measuring Instrument Setting :

| Detector Function | Resolution Bandwidth | Video Bandwidth |
|---|---|---|
| RMS | 100kHz | 300kHz |

Mode of EUT : Rx Mode
Test Port : Enclosure

Date : October 10 ,2019
Temp. : 23 ℃
Humi. : 46 %

| Freqency (MHz) | Emission Levels e.i.r.p (dBm) Horizontal | Vertical | Limits (dBm) | Margin (dB) Horizontal | Vertical |
|---|---|---|---|---|---|
| Low Channel : 0 ch (2402 MHz) | | | | | |
| 1206.300 | -79.9 | -81.1 | -47.0 | 32.9 | 34.1 |
| 1395.100 | -79.8 | -77.4 | -47.0 | 32.8 | 30.4 |
| 1454.000 | -78.8 | -77.3 | -47.0 | 31.8 | 30.3 |
| 2402.000 | < -76.1 | < -76.1 | -47.0 | > 29.1 | > 29.1 |
| 4804.000 | < -68.3 | < -68.3 | -47.0 | > 21.3 | > 21.3 |
| 7206.000 | < -63.7 | < -63.7 | -47.0 | > 16.7 | > 16.7 |
| 7822.000 | -62.4 | -60.3 | -47.0 | 15.4 | 13.3 |
| 9608.000 | < -59.6 | < -59.6 | -47.0 | > 12.6 | > 12.6 |
| High Channel : 79 ch (2480 MHz) | | | | | |
| 1206.300 | -79.7 | -80.5 | -47.0 | 32.7 | 33.5 |
| 1395.100 | -78.9 | -77.0 | -47.0 | 31.9 | 30.0 |
| 1454.000 | -79.3 | -77.1 | -47.0 | 32.3 | 30.1 |
| 2480.000 | < -75.8 | < -75.8 | -47.0 | > 28.8 | > 28.8 |
| 4960.000 | < -68.0 | < -68.0 | -47.0 | > 21.0 | > 21.0 |
| 7440.000 | < -63.2 | < -63.2 | -47.0 | > 16.2 | > 16.2 |
| 7822.000 | -62.2 | -60.2 | -47.0 | 15.2 | 13.2 |
| 9920.000 | < -58.4 | < -58.4 | -47.0 | > 11.4 | > 11.4 |




NOTES
1) The spectrum was checked from 1GHz to 12.75GHz.
2) The symbol of "<" means "or less".
3) The symbol of ">" means "or greater".
4) Measuring Instrument Setting :

| Detector Function | Resolution Bandwidth | Video Bandwidth |
|---|---|---|
| RMS | 1MHz | 3MHz |

### 7.11.5 Test Setup (photograph)

Refer to 7.10.5 Test Setup photograph that is same configuration for measurement

## 7.12 Receiver Blocking

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

### 7.12.1 Test Results

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

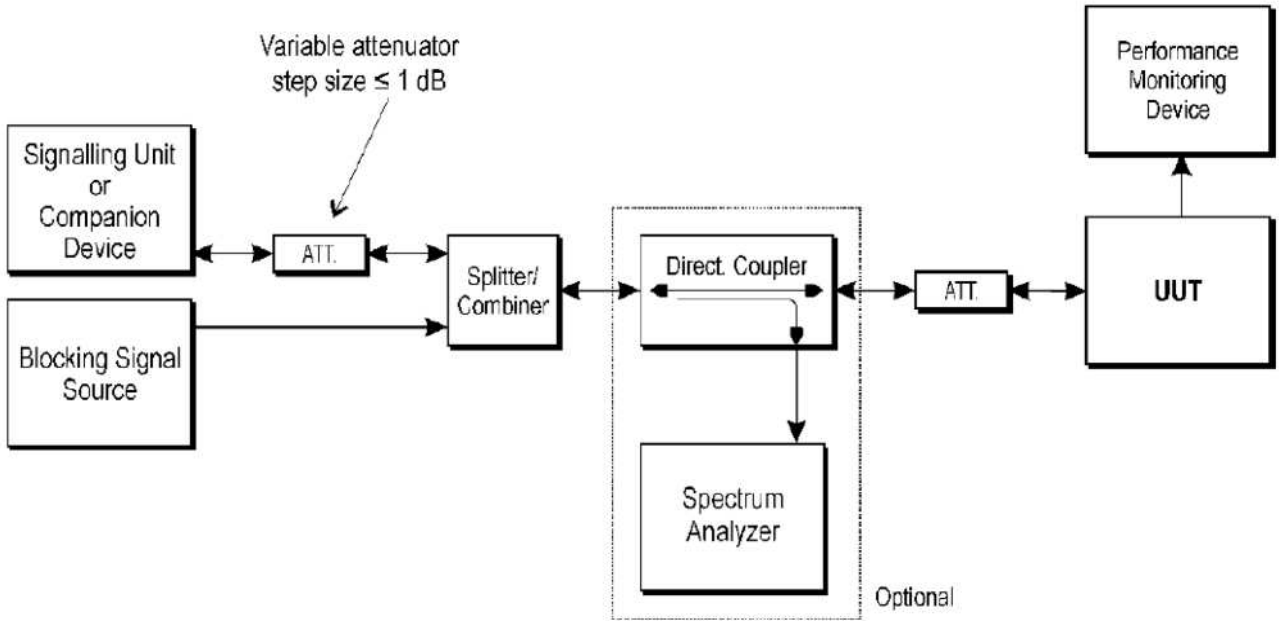
Remarks : The Equipment was Receiver Category 2,
The reason for category selection is as follows
- Adaptive Equipment
- RF output Power less than 10dBm The measured value was 0.56 dBm

### 7.12.2 Test Instruments

| Type | Model | Manufacturer | ID No. | Last Cal. | Interval |
|---|---|---|---|---|---|
| Shield Room | -- | TDK | M-1 | - | - |
| Signal Generator | SMBV100A | Rohde & Schwarz | SG06 | 2018/12 | 1 Year |
| Direct Coupler | 3292-1 | narda | - | 2019/9 | 1 Year |
| Step Attenuator | 8494B | Keysight | - | 2018/12 | 1 Year |
| Step Attenuator | 8496B | Keysight | - | 2018/12 | 1 Year |
| Combiner | 1575 | Weuschel | R-31 | 2019/10 | 1 Year |
| Spectrum Analyzer | U3751 | Advantest | SA03 | 2019/4 | 1 Year |
| RF Cable | MWX221 | Junkosha | CS03 | 2019/3 | 1 Year |
| RF Cable | MWX221 | Junkosha | CS10 | 2019/7 | 1 Year |

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

Step 1:
For non-frequency hopping equipment, the UUT shall be set to the lowest operating channel.
Step 2:
The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.
Step 3:
With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure.
The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria
The resulting level for the wanted signal at the input of the UUT is Pmin.
This signal level (Pmin) is increased by the value provided in the table corresponding to the receiver category
and type of equipment.
Step 4:
The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category
and type of equipment. It shall be verified and recorded in the test report that the performance criteria
Step 5:
Repeat step 4 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.
Step 6:
For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.



### 7.12.4 Test Data

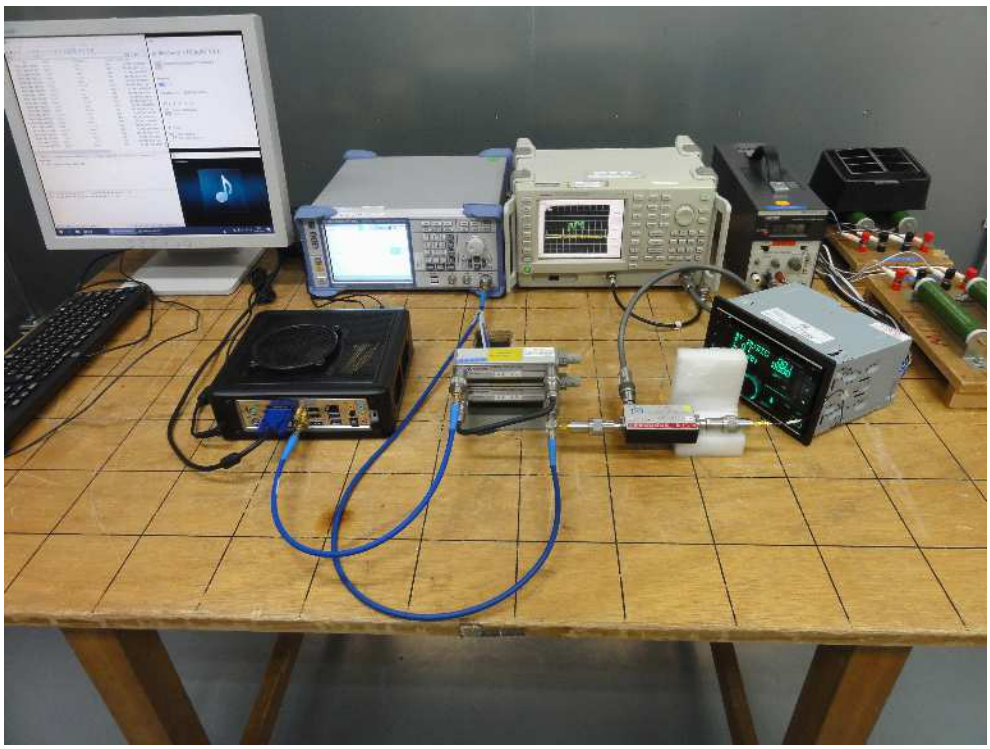
Tested Date : October 7, 2019
Climatic Conditions : Ambient Temperature : 22 ℃
Relative Humidity : 52 %

| Wanted signal mean Power from companion device (dBm) | Blocking signal Frequency (MHz) | Blocking signal Power (dBm) | Type of blocking signal | Result |
|---|---|---|---|---|
| $P_{min}$ + 6dB | 2380 | -57 | CW | Pass |
| | 2503.5 | -57 | CW | Pass |
| $P_{min}$ + 6dB | 2300 | -47 | CW | Pass |
| | 2583.5 | -47 | CW | Pass |

* Using alternative Criteria
* $P_{min}$ : -89.02 dBm
(Measured the minimum level of the signal required to meet the minimum performance criteria.)

Performance Criteria
Confirmed profiles: HFP, A2DP
I reproduced sound of 1 kHz from companion device,
and confirmed that there was no loss of link and no sound interruption.

### 7.12.5 Test Setup (photograph)



## Appendix A: Similar Models

The EUT has the following similar models.
The similar model details are shown as follow table;

| Model | Brand | Difference |
|---|---|---|
| DPX-7200DAB | KENWOOD | Base |
| DPX794BH | KENWOOD | None LW,Non DAB, Destination |