# TEST REPORT

**CTK Co., Ltd.**
**(Ho-dong), 113, Yejik-ro, Cheoin-gu,**
**Yongin-si, Gyeonggi-do, Korea**
**Tel: +82-31-339-9970**
**Fax: +82-31-624-9501**

Report No.:
CTK-2017-02095


## 1. Client

◦ Name : BIXOLON Co.,Ltd.

◦ Address : 7th~8th FL, MiraeAsset Venture Tower, 20, Pangyoyeok-ro 241beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

◦ Date of Receipt : 2017-10-19

## 2. Manufacturer

◦ Name : BIXOLON Co.,Ltd.

◦ Address : 7th~8th FL, MiraeAsset Venture Tower, 20, Pangyoyeok-ro 241beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

**3. Use of Report :** For FCC Certification

**4. Test Sample / Model:** Thermal Label Printer / SLP-TX40xyz

**5. Date of Test :** 2017-10-26 to 2017-10-31

**6. Test Standard(method) used :** FCC 47 CFR part 15 subpart C 15.247

**7. Testing Environment:** Temp.: (23 ± 1) ℃, Humidity: (48 ± 3) % R.H.

**8. Test Results :** Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

| | | |
|---|---|---|
| Affirmation | Tested by<br>Bongseok, Kim: (Signature) | Technical Manager<br>Young-taek, Lee: (Signature) |

2017-11-07

Republic of KOREA **CTK Co., Ltd.**

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# REPORT REVISION HISTORY

| Date | Revision | Page No |
|---|---|---|
| 2017-11-07 | Issued (CTK-2017-02095) | all |
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# 1. General Product Description

## 1.1 Client Information

| | |
|---|---|
| **Company** | BIXOLON Co.,Ltd. |
| **Contact Point** | 7th~8th FL, MiraeAsset Venture Tower, 20, Pangyoyeok-ro 241beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea |
| **Contact Person** | Name : JiSung Shin<br>E-mail : jsshin@bixolon.kr<br>Tel : +82-31-218-5582<br>Fax : +82-31-218-5589 |

## 1.2 Product Information

| | |
|---|---|
| **FCC ID** | U5MSLP-TX400R |
| **Product Description** | Thermal Label Printer |
| **Model name** | SLP-TX40xyz<br>(x : alphanumeric, yz : blank or alphanumeric) |
| **Operating Band** | 902 MHz - 928 MHz |
| **Frequency Range** | 902.75 MHz - 927.25 MHz |
| **RF Output Power** | 28.902 dBm (0.777 W) |
| **Antenna Specification** | Antenna type : PIFA<br>Gain : -4.6 dBi |
| **Number of channels** | 50 |
| **Channel Spacing** | 500 kHz |
| **Type of Modulation** | ASK |
| **Power Source** | DC 24 V(Adapter, Input : 100-240 Vac, Output : 24 Vdc) |

## 1.3 Peripheral Devices

| Device | Manufacturer | Model No. | Serial No. |
|---|---|---|---|
| Test Jig | ATID CO.,Ltd | Test Jig | - |
| Smart Phone(Test App) | Samsung Electronics Co., Ltd. | SHV-E250L | R33D11JBB1J |

# 2. Facility and Accreditations

## 2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

## 2.2 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation | Registration Number | Logo |
|---|---|---|---|---|
| USA | **FCC** | FCC Part 15 & 18<br>EMI (Electromagnetic Interference / Emission) | 805871 | |
| CANADA | **IC** | IC<br>EMI (3/10m test site) | 8737A-2 | |
| JAPAN | **VCCI** | VCCI V-3<br>EMI (Electromagnetic Interference / Emission) | C-986<br>T-1843<br>R-3627<br>G-387 | |
| KOREA | **MSIP** | EMI (Electromagnetic Interference / Emission)<br>EMS (Electromagnetic Susceptibility / Immunity) | KR0025 | |

## 2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

# 3. Test Specifications

## 3.1 Standards

| Section in FCC | Requirement(s) | Status (Note 1) | Test Condition |
|---|---|---|---|
| 15.247(a)(1) | Carrier Frequency Separation | C | Conducted |
| 15.247(a)(1)(i) | Number of Hopping Frequencies | C | |
| 15.247(a) | 20 dB Bandwidth | C | |
| 15.247(a)(1)(i) | Time of occupancy | C | |
| 15.247(b)(2) | Maximum peak conducted output power | C | |
| 15.247(d) | Unwanted emission | C | |
| 15.209 | Radiated emission | C | Radiated |
| 15.207(a) | AC Conducted Emission | C | Line Conducted |
| 15.247(a)(1) | Frequency Hopping Sequence | C | - |
| 15.247(g),(h) | Frequency Hopping System | C | - |
| *Note 1*: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable | | | |
| *Note 2*: The data in this test report are traceable to the national or international standards. | | | |
| *Note 3*: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013 | | | |

## 3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments.
During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation modes were tests.
The results are only attached worst cases.

**Test Frequency**

| Lowest frequency | Middle frequency | Highest frequency |
|---|---|---|
| 902.75 MHz | 914.75 MHz | 927.25 MHz |

**Test mode**

| |
|---|
| Hopping mode |
| Modulated single hop mode |

## 3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor $k$ = 2, Confidence levels of 95 %

| Description | Uncertainty |
|---|---|
| Conducted RF Output Power | 1.5 dB |
| Occupied Bandwidth | 0.1 MHz |
| Unwanted Emission(conducted) | 3.0 dB |
| Radiated Emissions (f ≤ 1 GHz) | 4.0 dB |
| Radiated Emissions (f > 1 GHz) | 5.0 dB |

# 4. Technical Characteristic Test

## 4.1 Carrier Frequency Separation

### Test Procedures(ANSI C63.10-2013 7.8.2)

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.
After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:
Span : wide enough to capture the peaks of two adjacent channels
RBW : approximately 30% of the channel spacing;
adjust as necessary to best indentify the center of each individual channel.
VBW ≥ RBW Sweep : auto
Detector function = peak Trace = max hold


Figure 1 : Measurement setup for the carrier frequency separation

### Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

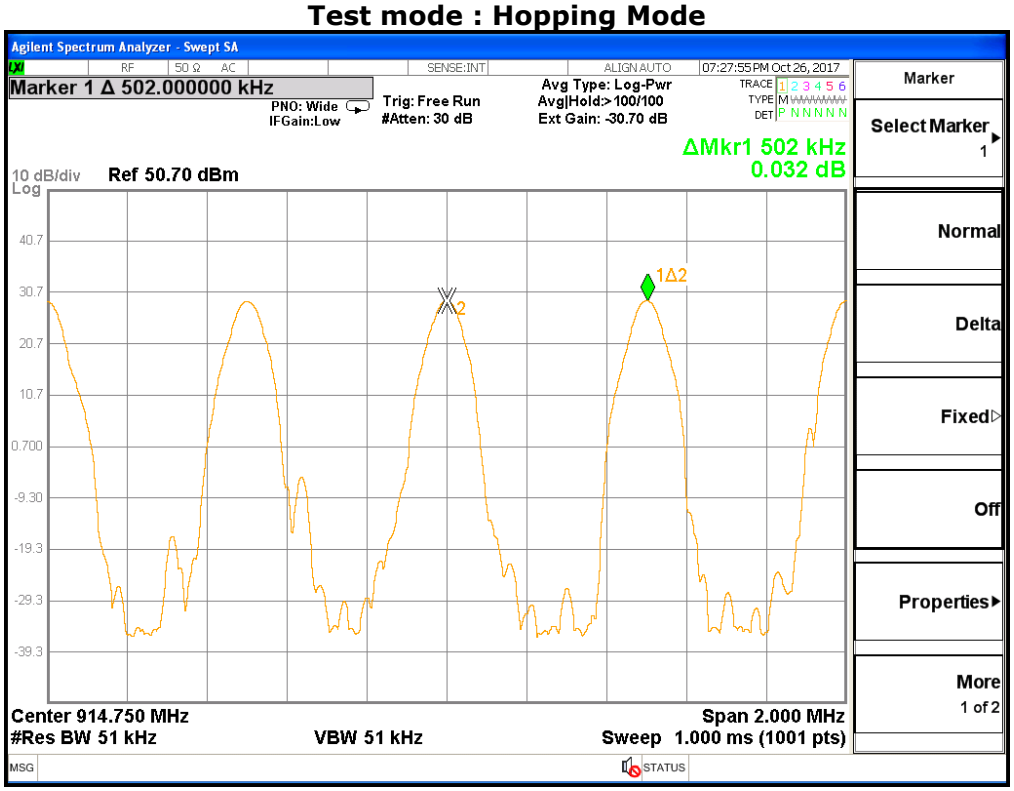
### Test Results

Test mode : Hopping mode

| Channel | Adjacent Hopping Channel Separation [kHz] | 20dB bandwidth [kHz] | Minimum Bandwidth [kHz] | Result |
|---|---|---|---|---|
| Middle | 502 | 87.82 | 25 | Complies |

See follow for actual measured spectrum plots.

**Test mode : Hopping Mode**



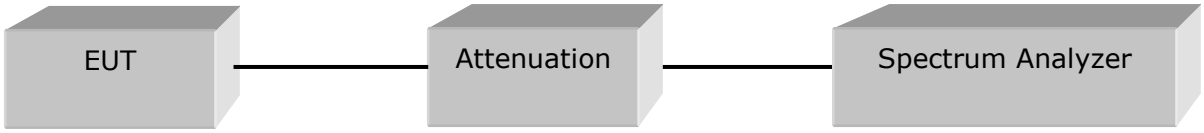
## 4.2 Number of Hopping Frequencies

### Test Procedures(ANSI C63.10-2013 7.8.3)

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

RBW : To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW ≥ RBW Sweep = auto
Detector function = peak Trace = max hold




### Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.

### Test Results

Test mode : Hopping Mode

| Total number of Hopping Channels | Result |
|---|---|
| 50 | Complies |

See follow for actual measured spectrum plots.

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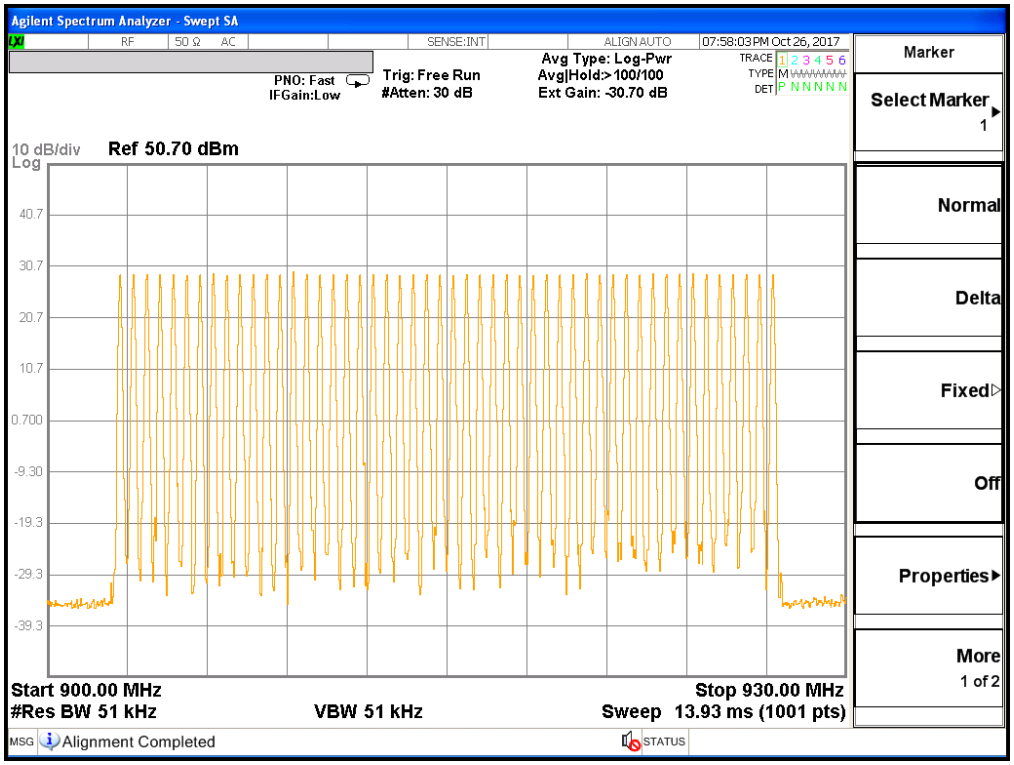
## Test Mode : Hopping Mode

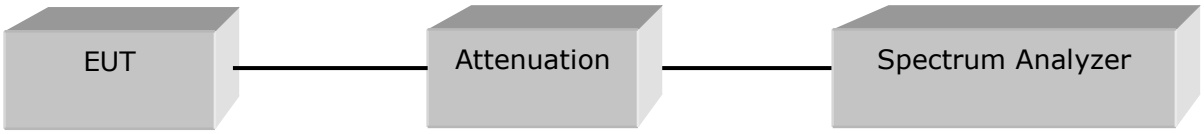


## 4.3 20 dB bandwidth

### Test Procedures(ANSI C63.10-2013 6.9.2)

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

The spectrum analyzer is set to:
Center frequency = the highest, middle and the lowest channels
Span = between 2 times and 5 times the OBW
RBW = 1% to 5% of the OBW
VBW : approximately 3 times RBW
Trace = max hold
Sweep = auto
Detector function = peak




### Limit

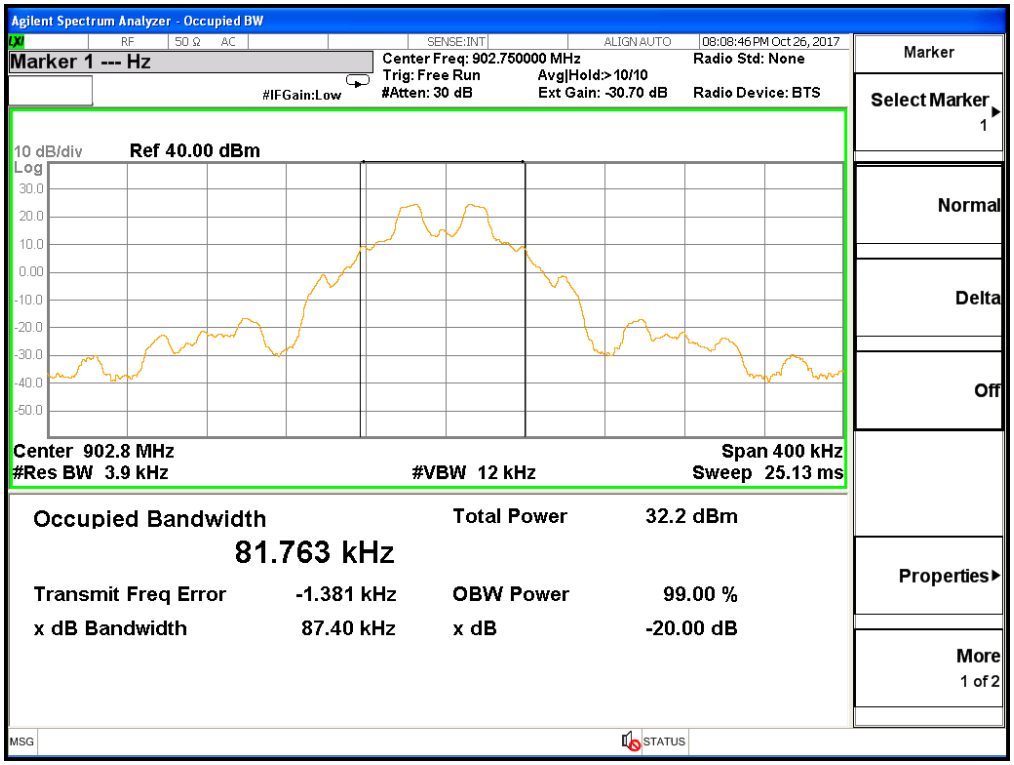
Limit : N/A

## Test Results

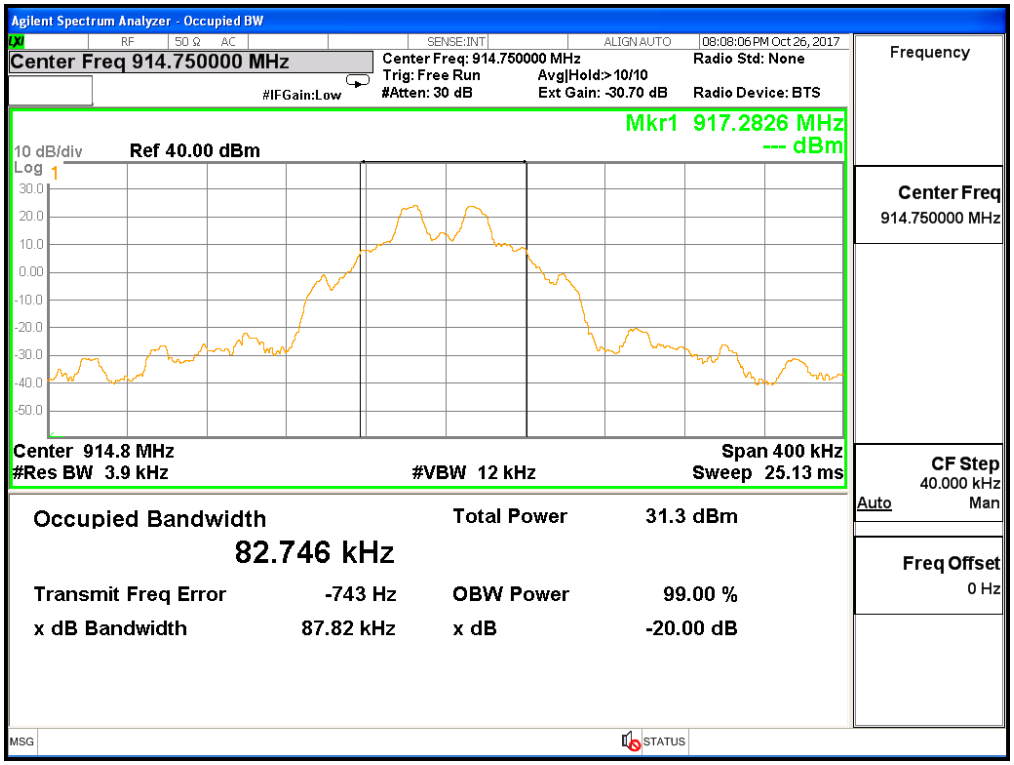
| Channel | Frequency [MHz] | 20 dB Bandwidth [KHz] | 99% Bandwidth [KHz] | Result |
|---|---|---|---|---|
| Lowest | 902.75 | 87.40 | 81.76 | Complies |
| Middle | 914.75 | 87.82 | 82.75 | Complies |
| Highest | 927.25 | 89.69 | 85.15 | Complies |

See follow for actual measured spectrum plots.

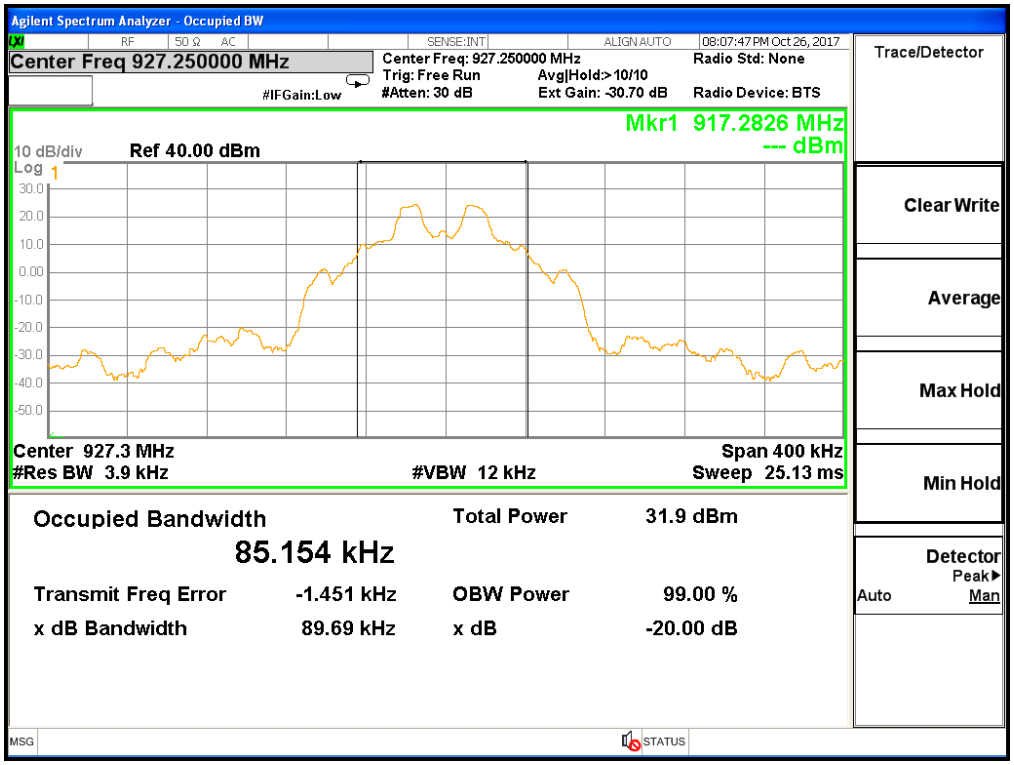
### 20 dB Bandwidth - Lowest Frequency



## 20 dB Bandwidth - Middle Frequency




## 20 dB Bandwidth - Highest Frequency



## 4.4 Time of Occupancy

### Test Procedures(ANSI C63.10-2013 7.8.4)

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

Number of hops in the period specified in the requirements =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)


### Limit

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

## Test Results

| Number of hops channels within a 20 second period | Transmit time per hop(msec) | Result (msec) | Limit (msec) |
|---|---|---|---|
| 1 | 51 | **51** | 400 |

See follow for actual measured spectrum plots.

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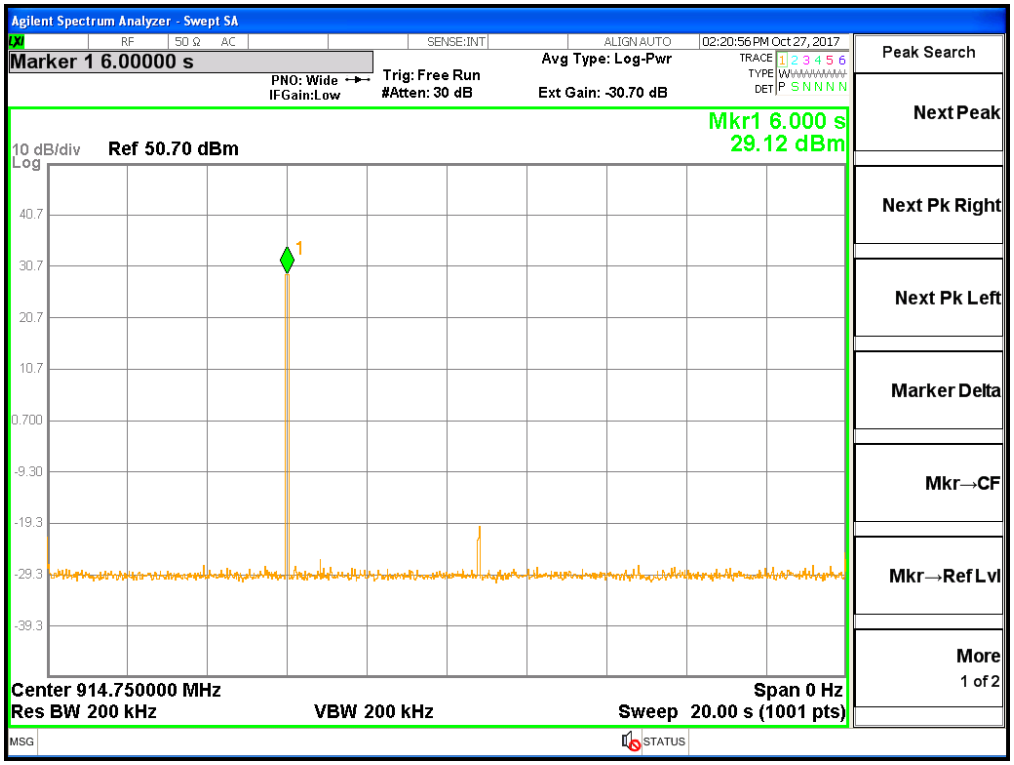
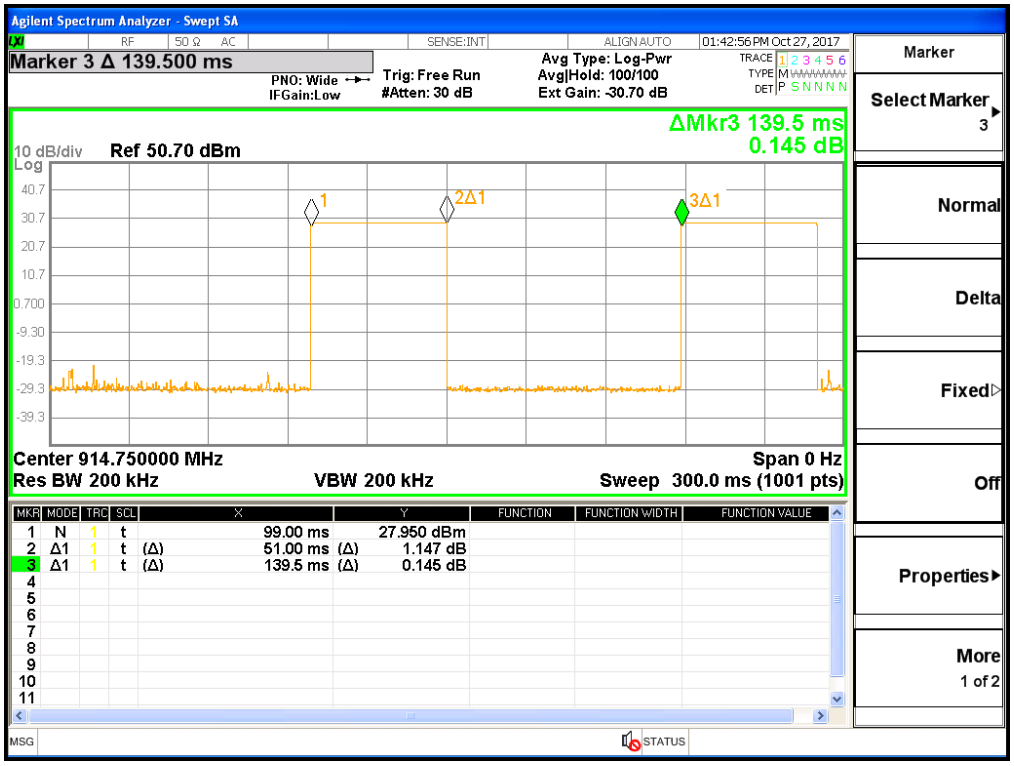
## Number of hops channels within a 20 second period




## Transmit time per hop

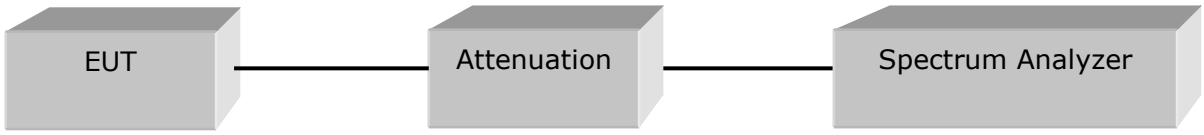


## 4.5 Maximum peak Conducted Output Power

### Test Procedures(ANSI C63.10-2013 7.8.5)

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test.

The spectrum analyzer is set to:
Center frequency = the highest, middle, and the lowest channels
Span = approximately 5 times of the 20 dB bandwidth
RBW > 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Detector function = peak
Trace = max hold
Sweep = auto




### Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels

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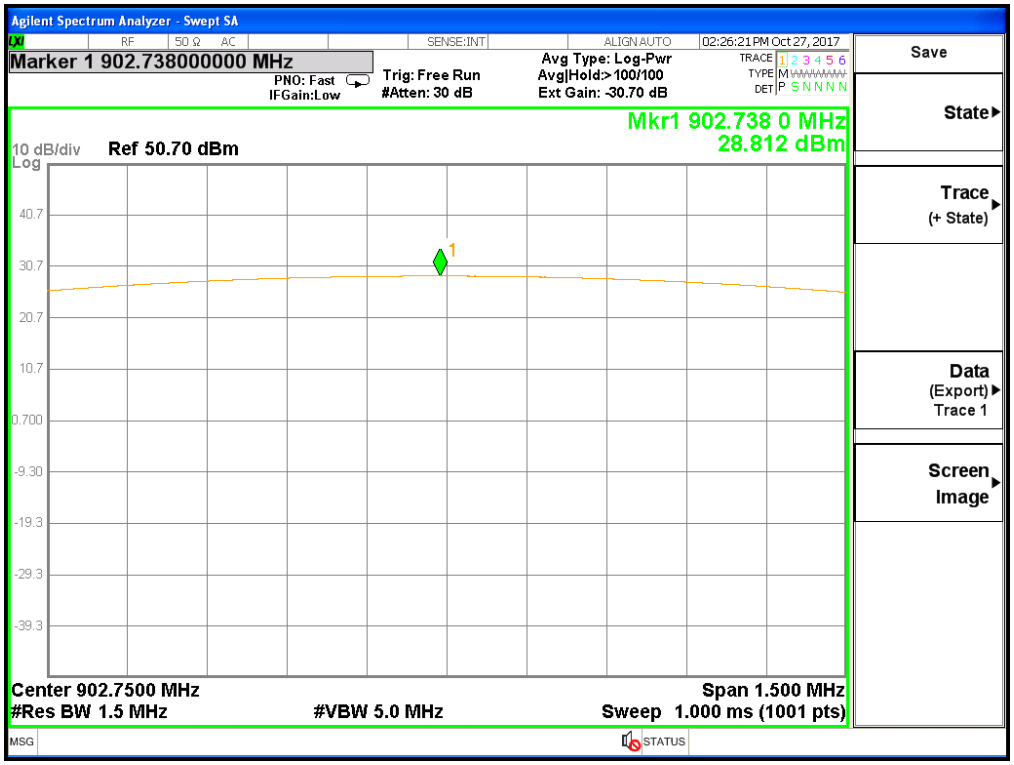
## Test Results

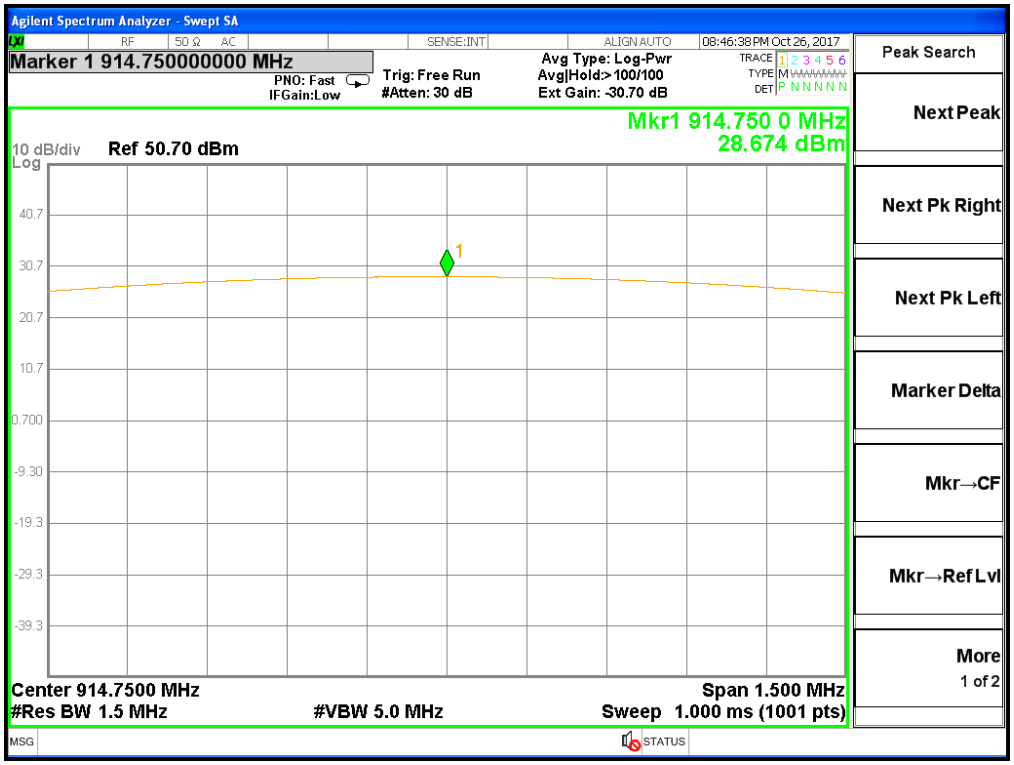
| Channel | Frequency [MHz] | Output Power [dBm] | Output power [mW] | Result |
|---|---|---|---|---|
| Lowest | 902.75 | 28.812 | 760.68 | Complies |
| Middle | 914.75 | 28.674 | 736.89 | Complies |
| Highest | 927.25 | 28.902 | 776.60 | Complies |

See follow for actual measured spectrum plots.

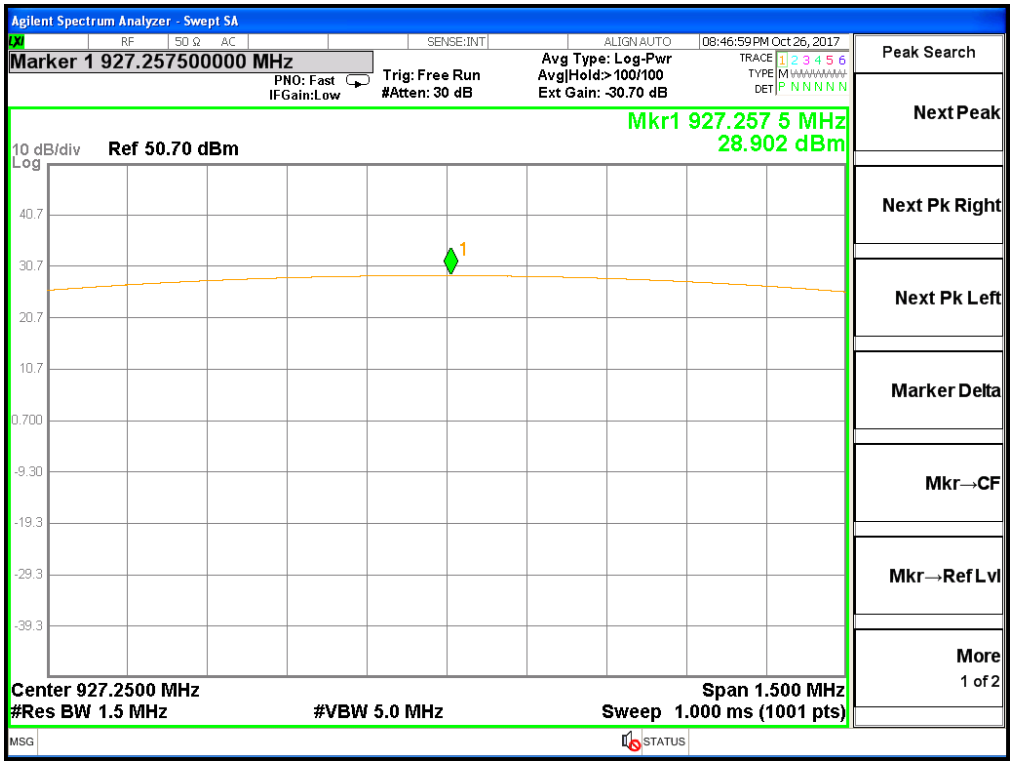
### Output Power - Lowest Frequency



## Output Power - Middle frequency




## Output Power - Highest frequency



## 4.6 Unwanted Emissions (Conducted)

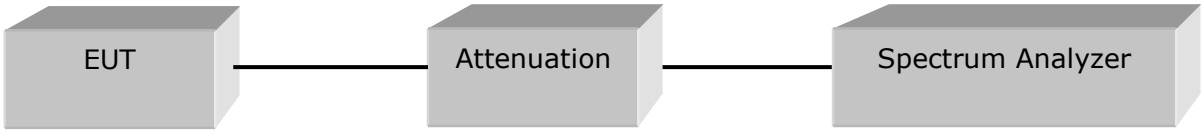
### Test Procedures(ANSI C63.10-2013 7.8.6 / ANSI C63.10-2013 7.8.8)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB.

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

RBW : 100 kHz VBW : 300 kHz
Span : 30 MHz to 10 times the operating frequency in GHz
Detector function = peak
Trace : max hold Sweep = auto




### Limit

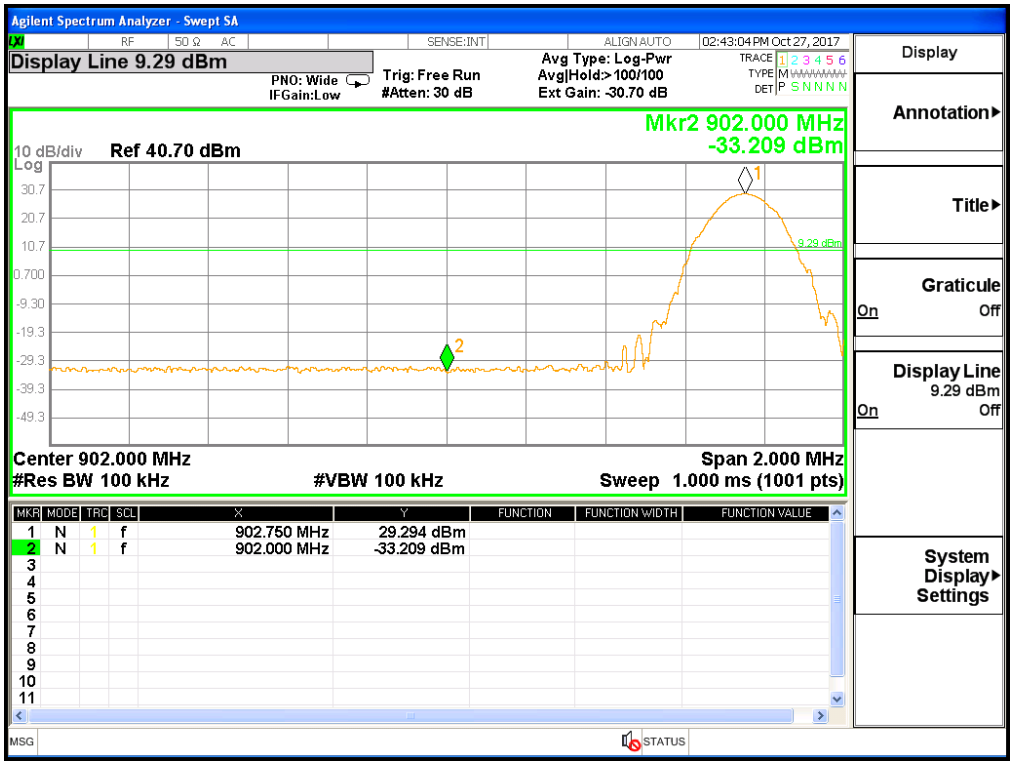
> 20 dBc

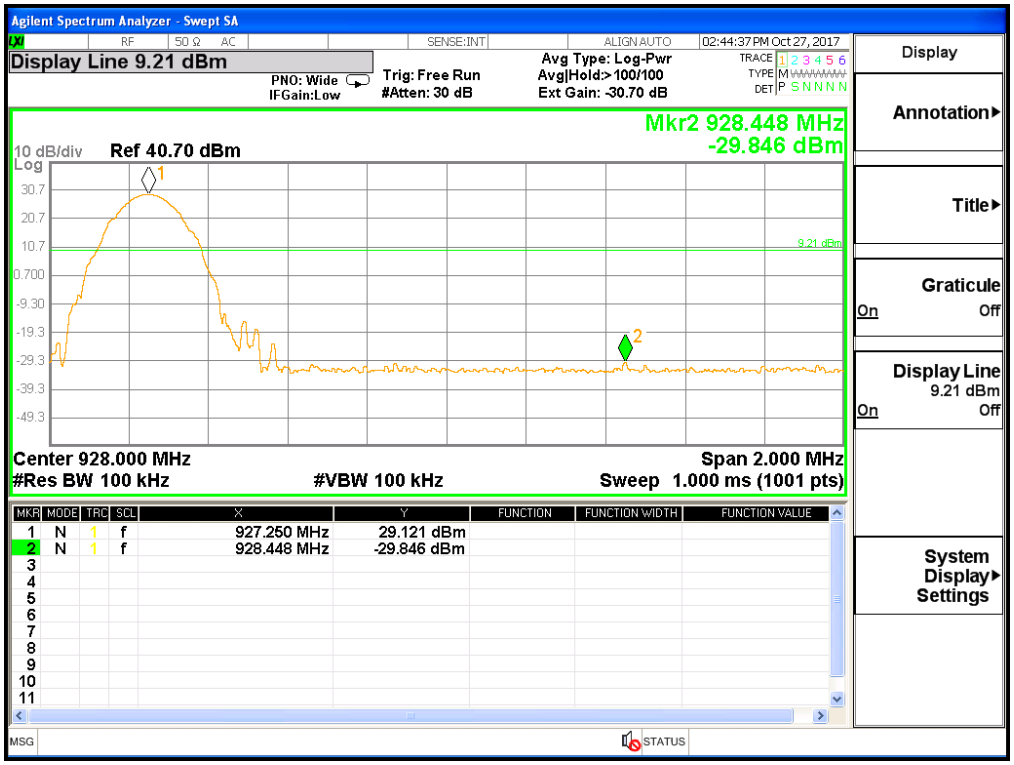
### Test Results

All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest level of the in-band spectral density.
Therefore the applying equipment meets the requirement.

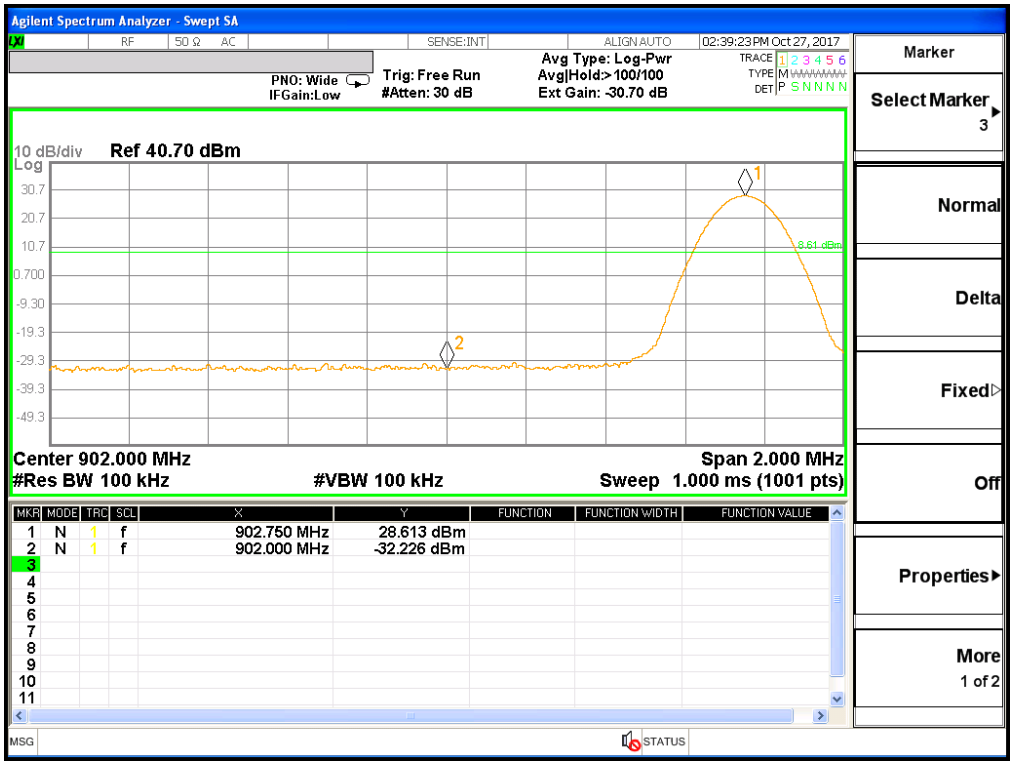
See follow for actual measured spectrum plots.

## Band Edge - Hopping mode

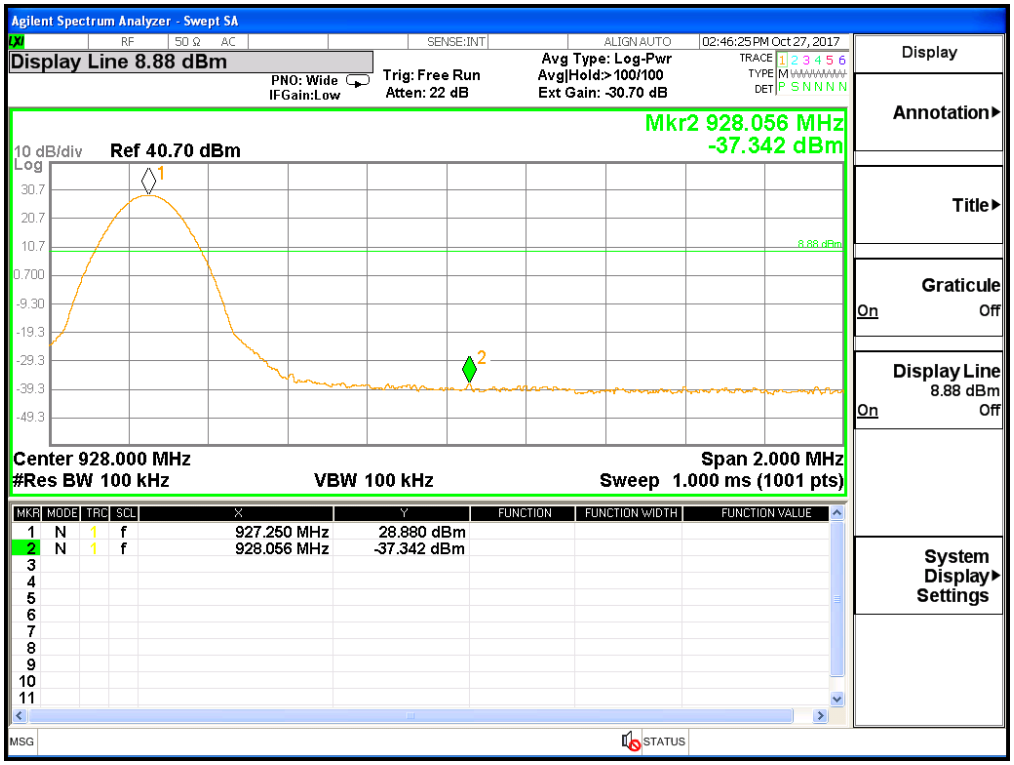


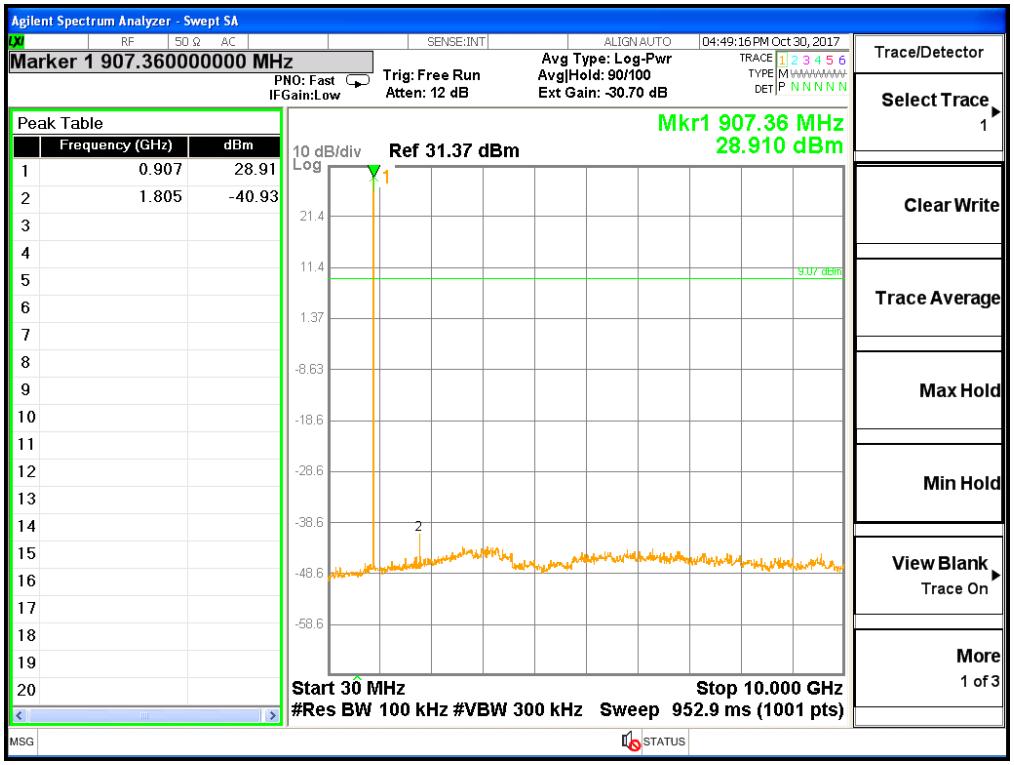
## Band Edge - Lowest frequency



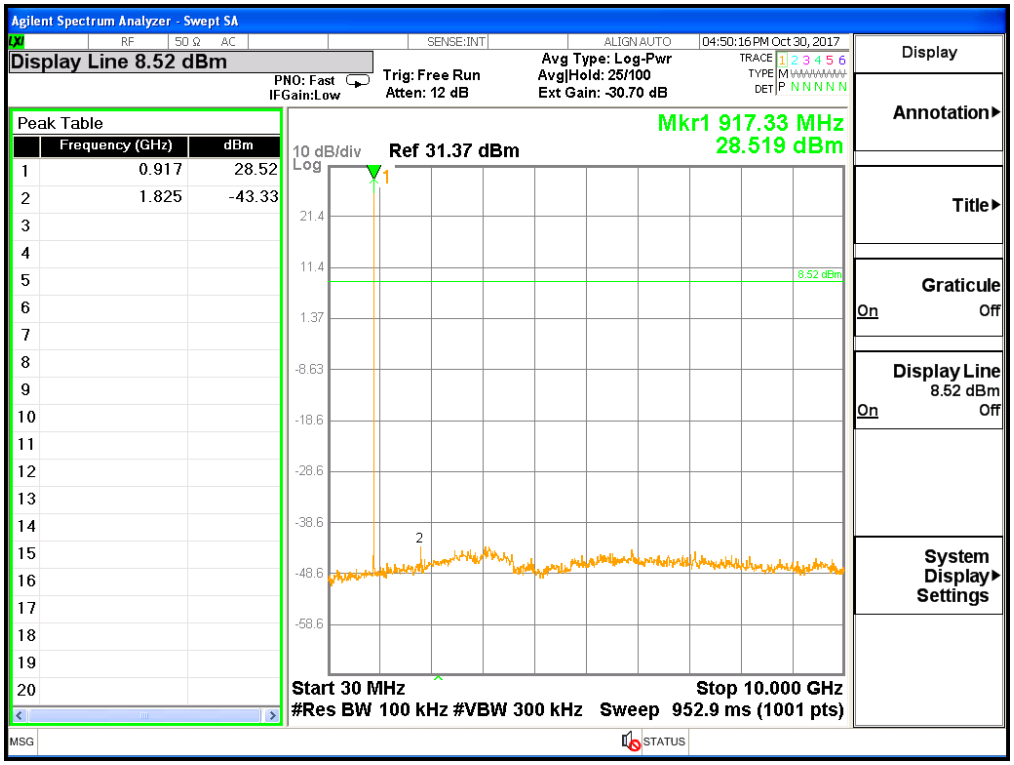

## Band Edge - Highest frequency



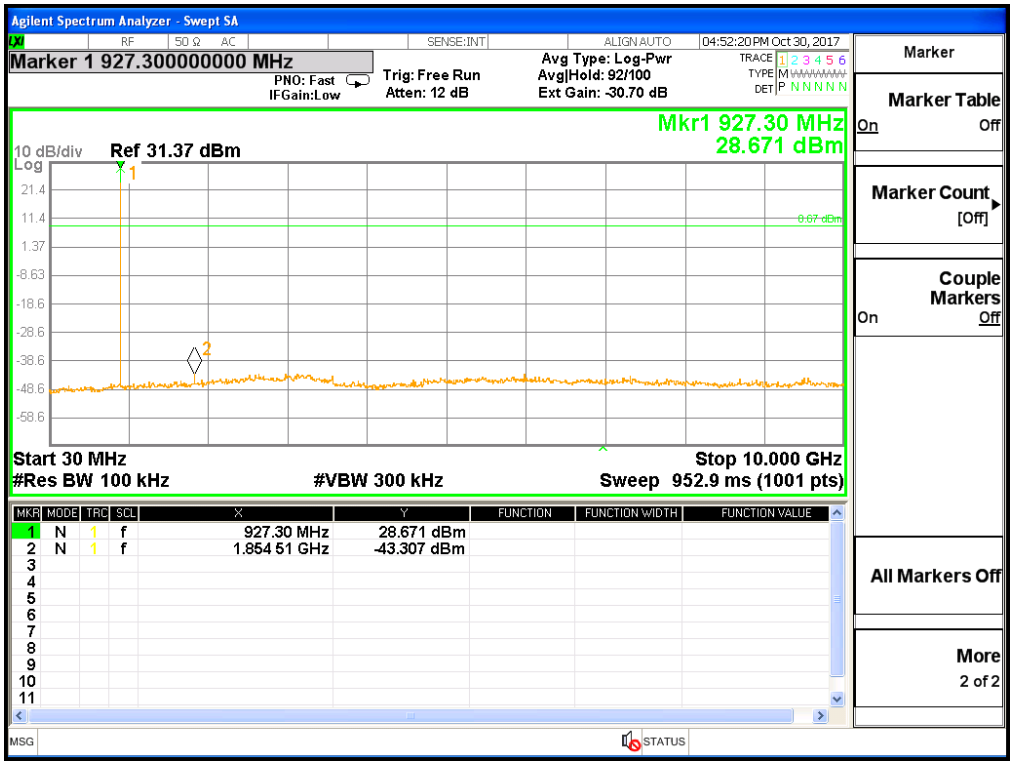
## Spurious Emission - Lowest frequency




## Spurious Emission - Middle frequency



## Spurious Emission - Highest frequency



## 4.7 Radiated Emission

### Test Location

☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)
☒ 3 m SAC (test distance : 3 m)

### Test Procedures

1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
2) In the frequency rage above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

### Instrument Settings

Frequency Range = 9 kHz ~ 10 GHz (900 MHz $10^{th}$ harmonic)

a) RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz

b) VBW ≥ RBW

c) Sweep time = auto couple

**Limit :**

Unwanted emissions that do not fall within the restricted frequency bands of Table 1 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

FCC Part 15 § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

**Table 1. Restricted Frequency Bands**

| MHz | MHz | MHz | MHz | MHz | GHz |
|---|---|---|---|---|---|
| 0.09-0.11 | 8.37626-8.38675 | 73-74.6 | 399.9-410 | 2690-2900 | 10.6-12.7 |
| [1]0.495-0.505 | 8.41425-8.41475 | 74.8-75.2 | 608-614 | 3260-3267 | 13.25-13.4 |
| 2.1735-2.1905 | 12.29-12.293 | 108-121.94 | 960-1240 | 3332-3339 | 14.47-14.5 |
| 4.125-4.128 | 12.51975-12.52025 | 123-138 | 1300-1427 | 3345.8-3358 | 15.35-16.2 |
| 4.17725-4.17775 | 12.57675-12.57725 | 149.9-150.05 | 1435-1626.5 | 3600-4400 | 17.7-21.4 |
| 4.20725-4.20775 | 13.36-13.41 | 156.52475-156.52525 | 1645.5-1646.5 | 4500-5150 | 22.01-23.12 |
| 6.215-6.218 | 16.42-16.423 | 156.7-156.9 | 1660-1710 | 5350-5460 | 23.6-24 |
| 6.26775-6.26825 | 16.69475-16.69525 | 162.0125-167.17 | 1718.8-1722.2 | 7250-7750 | 31.2-31.8 |
| 6.31175-6.31225 | 16.80425-16.80475 | 167.72-173.2 | 2200-2300 | 8025-8500 | 36.43-36.5 |
| 8.291-8.294 | 25.5-25.67 | 240-285 | 2310-2390 | 9000-9200 | [2]Above 38.6 |
| 8.362-8.366 | 37.5-38.25 | 322-335.4 | 2483.5-2500 | 9300-9500 | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC Part 15 § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 2 Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

**Table 2. General Field Strength Limits for Licence-Exempt Transmitters**

| Frequency(MHz) | Field Strength uV/m@3m | Field Strength dBuV/m@3m | Measurement Distance (meters) |
|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 30 |
| 1.705-30 | 30 | - | 30 |
| 30-88 | 100** | 40 | 3 |
| 88-216 | 150** | 43.5 | 3 |
| 216-960 | 200** | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
3) For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement.(Duty Cycle is > 98%,)
4) Duty Cycle is < 98%, VBW setting will need to > 1/T.

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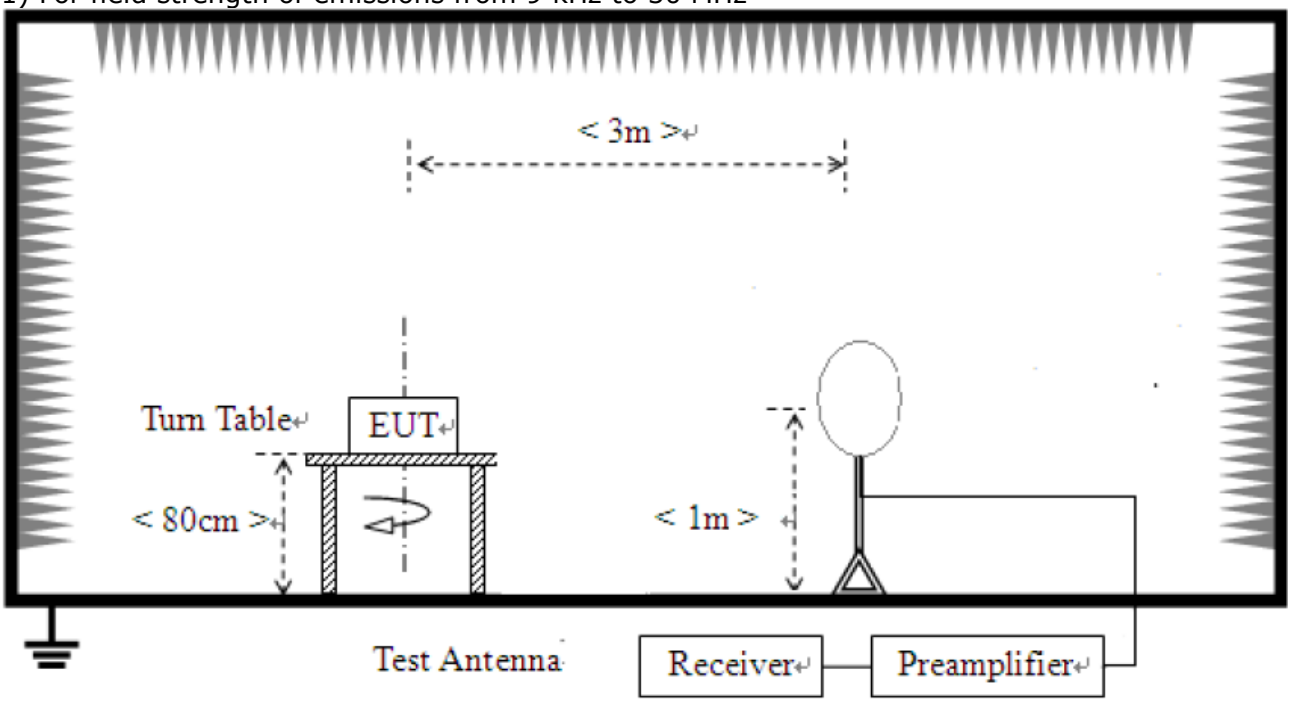
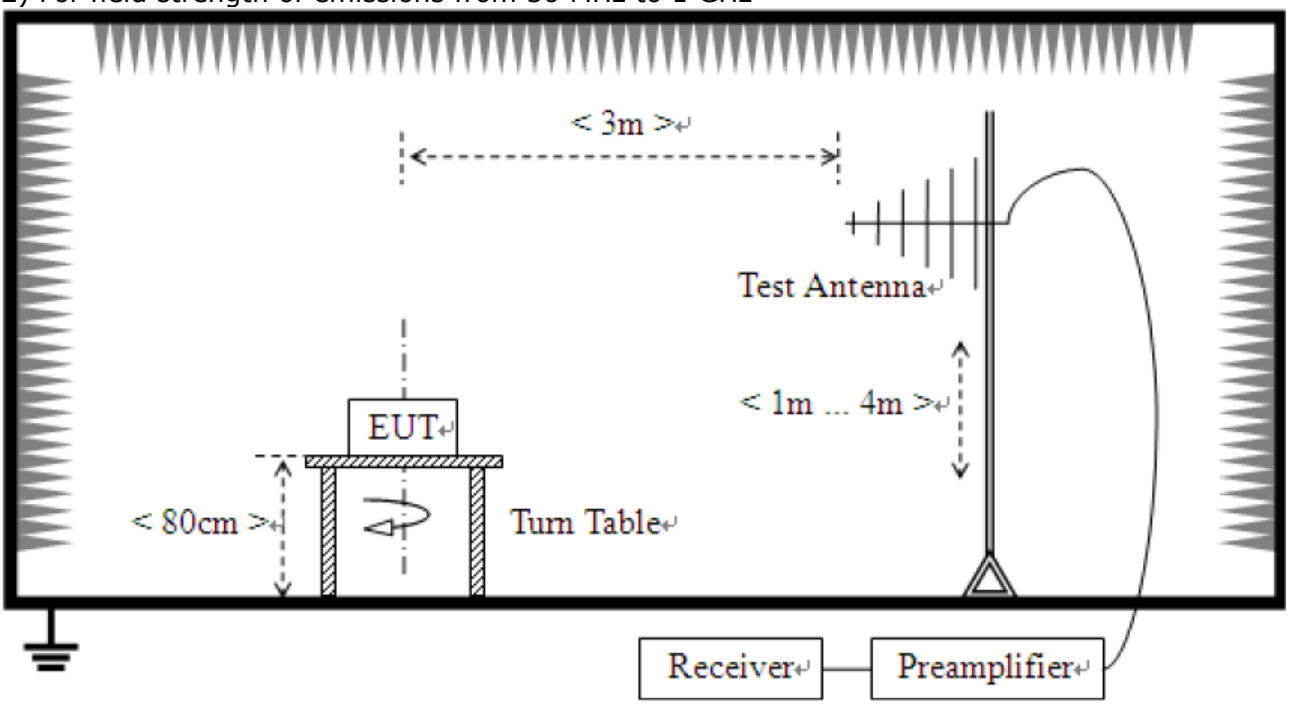
**Test Setup:**

1) For field strength of emissions from 9 kHz to 30 MHz




2) For field strength of emissions from 30 MHz to 1 GHz



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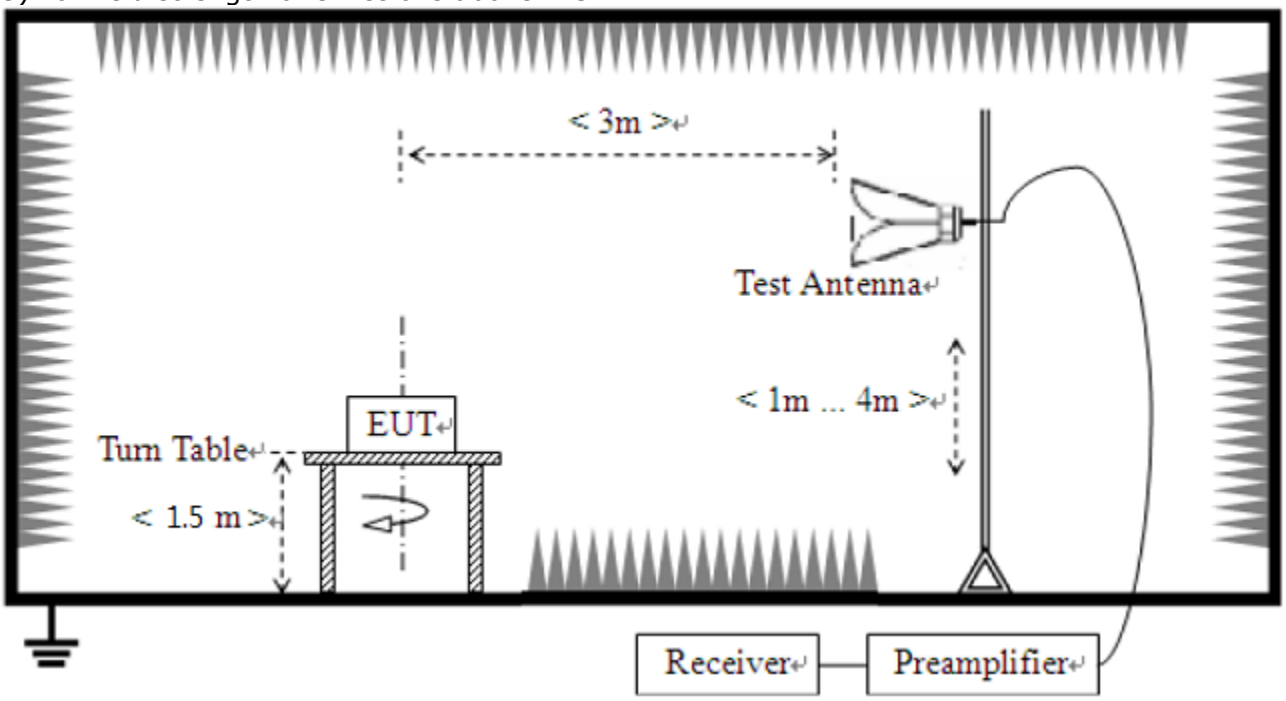
3) For field strength of emissions above 1 GHz




## Test results

### 1) 9 kHz to 30 MHz

The requirements are:
☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|
| - | - | - | See note |

**Note :**
The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

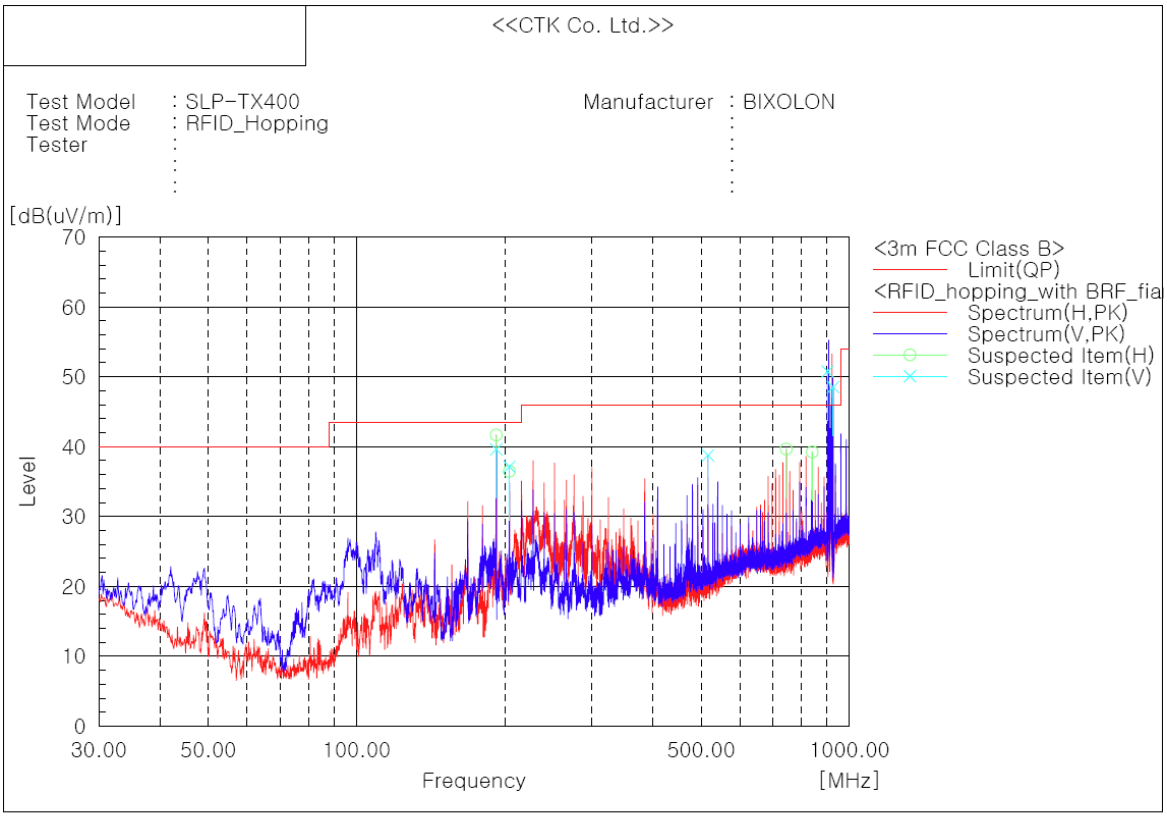
Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

## 2) 30 MHz to 1 GHz

**Test mode : Hopping Mode**

The requirements are:
☒ Complies

## Test Data




Spectrum Selection

| No. | Frequency [MHz] | (P) | Reading [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 192.111 | H | 55.8 | -14.1 | 41.7 | 43.5 | 1.8 | 100.0 | 322.0 |
| 2 | 192.111 | V | 53.7 | -14.1 | 39.6 | 43.5 | 3.9 | 101.0 | 195.0 |
| 3 | 744.769 | H | 38.3 | 1.4 | 39.7 | 46.0 | 6.3 | 100.0 | 61.0 |
| 4 | 204.236 | V | 51.0 | -13.8 | 37.2 | 43.5 | 6.3 | 200.0 | 60.0 |
| 5 | 841.041 | H | 35.8 | 3.4 | 39.2 | 46.0 | 6.8 | 100.0 | 87.0 |
| 6 | 204.236 | H | 50.3 | -13.8 | 36.5 | 43.5 | 7.0 | 100.0 | 322.0 |
| 7 | 516.576 | V | 41.3 | -2.5 | 38.8 | 46.0 | 7.2 | 101.0 | 326.0 |
| 8 | 902.757 | V | 46.1 | 4.7 | 50.8 | 46.0 | -4.8 | 101.0 | 169.0 |
| 9 | 927.371 | V | 43.3 | 5.2 | 48.5 | 46.0 | -2.5 | 200.0 | 112.0 |

**Remark** :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.
5. No.8 and No.9 are the carrier frequencies.

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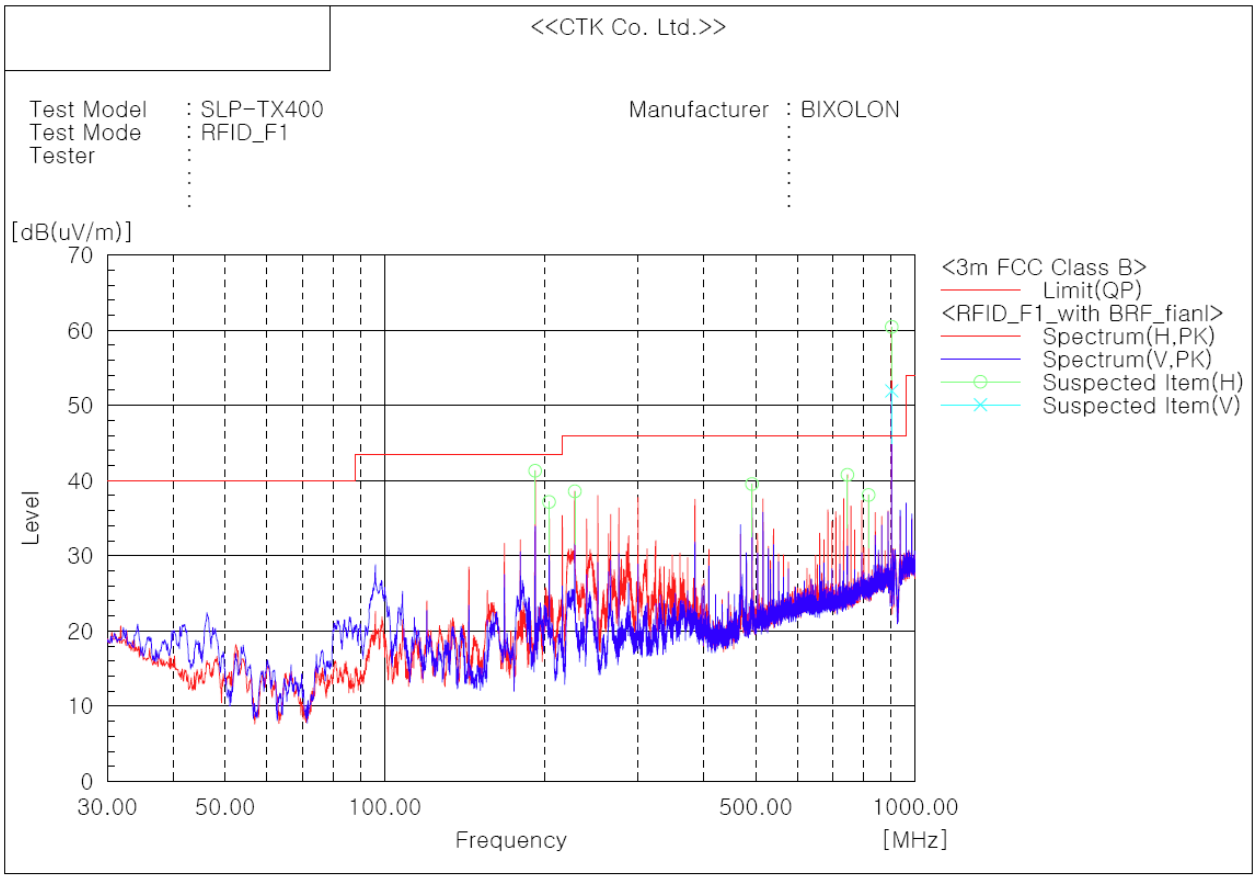
**Test mode : Lowest frequency(Worst case)**

The requirements are:
☒ Complies

## Test Data




Spectrum Selection

| No. | Frequency [MHz] | (P) | Reading [dB(uV)] | c.f [dB(1/m)] | Result PK [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 192.111 | H | 55.4 | -14.1 | 41.3 | 43.5 | 2.2 | 200.0 | 0.0 |
| 2 | 204.115 | H | 51.0 | -13.8 | 37.2 | 43.5 | 6.3 | 200.0 | 0.0 |
| 3 | 228.244 | H | 50.1 | -11.5 | 38.6 | 46.0 | 7.4 | 200.0 | 0.0 |
| 4 | 492.569 | H | 42.6 | -3.1 | 39.5 | 46.0 | 6.5 | 200.0 | 33.0 |
| 5 | 744.890 | H | 39.4 | 1.4 | 40.8 | 46.0 | 5.2 | 100.0 | 91.0 |
| 6 | 816.913 | H | 35.2 | 2.9 | 38.1 | 46.0 | 7.9 | 100.0 | 91.0 |
| 7 | 902.879 | H | 55.7 | 4.7 | 60.4 | 46.0 | -14.4 | 200.0 | 321.0 |
| 8 | 902.879 | V | 47.2 | 4.7 | 51.9 | 46.0 | -5.9 | 200.0 | 39.0 |

**Remark** :
1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
4. This data is the Peak(PK) value.
5. No.7 and No.8 are the carrier frequencies.

### 3) above 1 GHz

The requirements are:
☒ Complies

**Test Data**

**Test mode : Lowest frequency(902.75 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|
| 1 067 | V | 50.12 | -9.4 | **40.74** | 54 | 13.26 | Peak |
| 1 200 | V | 56.46 | -6.4 | **50.06** | 54 | 3.94 | Peak |

**Test mode : Middle frequency(914.75 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|
| 1 066 | V | 49.37 | -9.4 | **39.99** | 54 | 14.01 | Peak |
| 1 193 | V | 53.09 | -7.5 | **45.54** | 54 | 8.46 | Peak |
| 1 200 | V | 55.81 | -6.4 | **49.41** | 54 | 4.59 | Peak |

**Test mode : Highest frequency(927.25 MHz)**

| Frequency [MHz] | Ant. Pol. (V/H) | Reading* [dBuV/m] | c.f [dB/m] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|
| 1 066 | V | 48.19 | -9.4 | **38.81** | 54 | 15.19 | Peak |
| 1 201 | V | 57.88 | -6.4 | **51.48** | 54 | 2.52 | Peak |

**Remarks**

1. The Unwanted emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(y axis) and the worst case was recorded.
2. Result = Reading + c.f(correction factor)
3. Correction factor = Antenna factor + Cable loss - Amp Gain

* Reading data is the peak value.

## 4.8 AC Power Line Conducted Emissions

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz-30 MHz, shall not exceed the limits.

### Instrument Settings

IF Band Width: 9 kHz

### Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.
Amplitude measurements were performed with a quasi-peak detector and an average detector.

### Limit

| Frequency (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average** |
| 0.15 ~ 0.5 | 66 to 56* | 56 to 46* |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

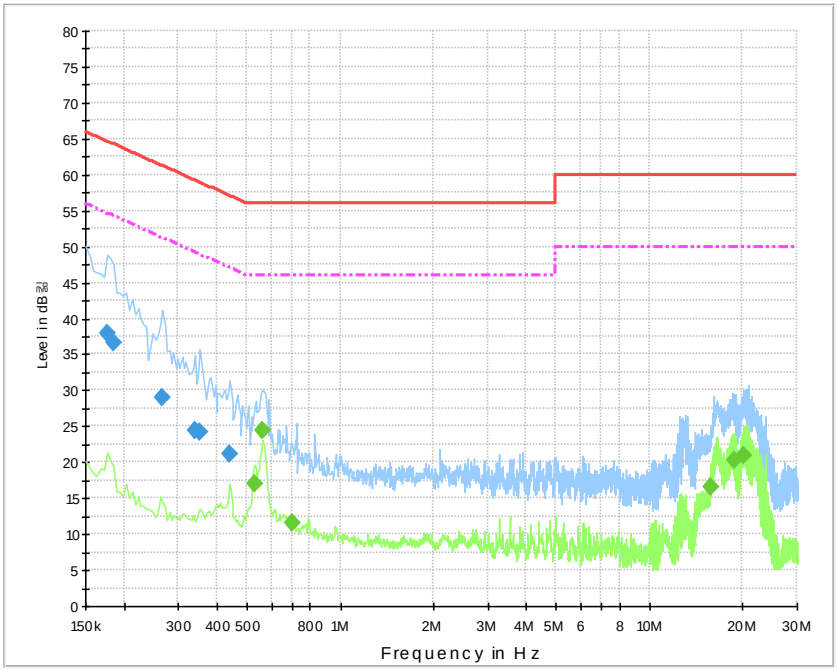
## Test Results

The requirements are:
☒ Complies

## Test Data

### Test mode : Hopping Mode, L1

Class B_L1




### Final Result 1

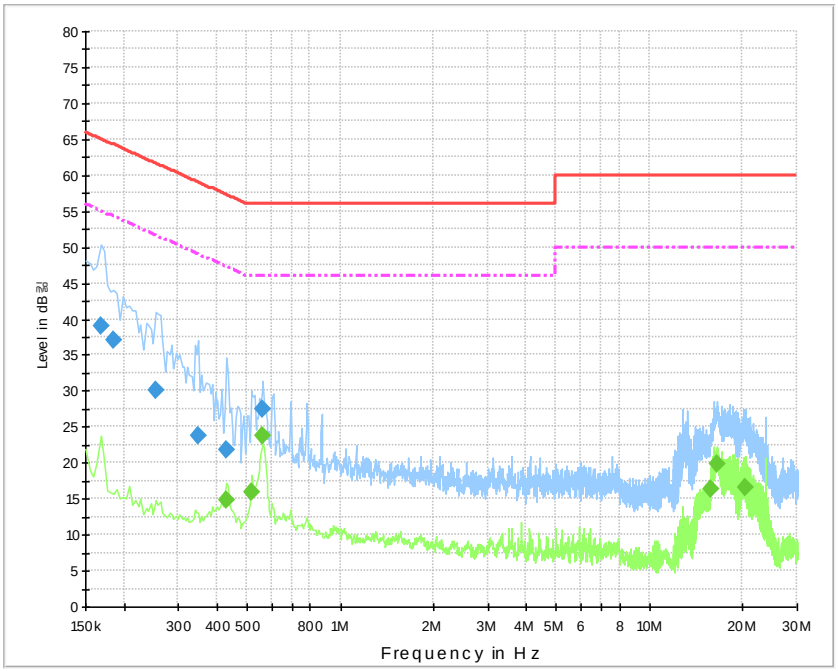
| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.177000 | 37.8 | 1000.0 | 9.000 | On | L1 | 9.8 | 26.8 | 64.6 |
| 0.186000 | 36.6 | 1000.0 | 9.000 | On | L1 | 9.9 | 27.6 | 64.2 |
| 0.267000 | 29.0 | 1000.0 | 9.000 | On | L1 | 9.7 | 32.3 | 61.2 |
| 0.339000 | 24.5 | 1000.0 | 9.000 | On | L1 | 9.8 | 34.7 | 59.2 |
| 0.352500 | 24.2 | 1000.0 | 9.000 | On | L1 | 9.8 | 34.7 | 58.9 |
| 0.438000 | 21.1 | 1000.0 | 9.000 | On | L1 | 9.9 | 36.0 | 57.1 |

### Final Result 2

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.528000 | 17.1 | 1000.0 | 9.000 | On | L1 | 9.9 | 28.9 | 46.0 |
| 0.564000 | 24.3 | 1000.0 | 9.000 | On | L1 | 9.9 | 21.7 | 46.0 |
| 0.703500 | 11.5 | 1000.0 | 9.000 | On | L1 | 9.8 | 34.5 | 46.0 |
| 15.828000 | 16.7 | 1000.0 | 9.000 | On | L1 | 9.9 | 33.3 | 50.0 |
| 18.708000 | 20.3 | 1000.0 | 9.000 | On | L1 | 9.9 | 29.7 | 50.0 |
| 20.170500 | 20.9 | 1000.0 | 9.000 | On | L1 | 10.0 | 29.1 | 50.0 |

## Test mode : Hopping Mode, NEUTRAL

Class B_N




### Final Result 1

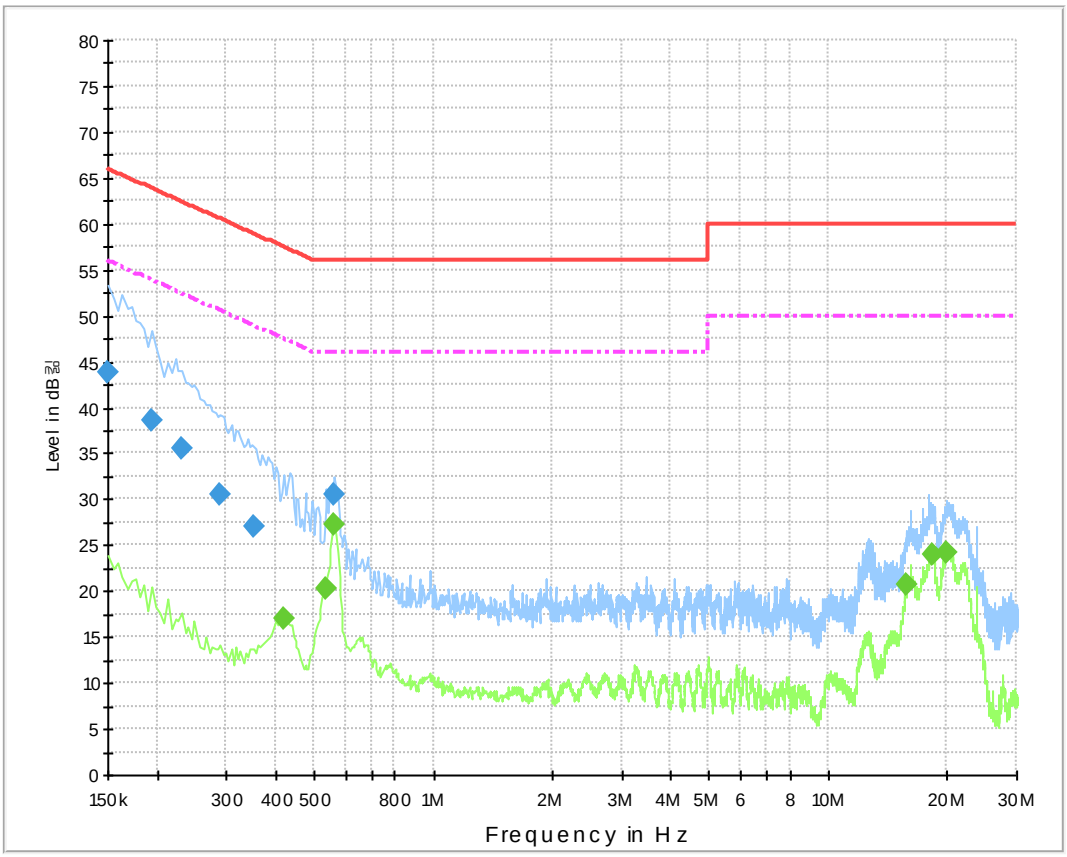
| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.168000 | 38.9 | 1000.0 | 9.000 | On | N | 9.8 | 26.1 | 65.1 |
| 0.186000 | 37.0 | 1000.0 | 9.000 | On | N | 9.9 | 27.3 | 64.2 |
| 0.253500 | 30.0 | 1000.0 | 9.000 | On | N | 9.6 | 31.6 | 61.6 |
| 0.348000 | 23.8 | 1000.0 | 9.000 | On | N | 9.8 | 35.2 | 59.0 |
| 0.429000 | 21.7 | 1000.0 | 9.000 | On | N | 9.9 | 35.6 | 57.3 |
| 0.564000 | 27.6 | 1000.0 | 9.000 | On | N | 9.9 | 28.4 | 56.0 |

### Final Result 2

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.429000 | 14.8 | 1000.0 | 9.000 | On | N | 9.9 | 32.5 | 47.3 |
| 0.519000 | 15.8 | 1000.0 | 9.000 | On | N | 9.9 | 30.2 | 46.0 |
| 0.564000 | 23.8 | 1000.0 | 9.000 | On | N | 9.9 | 22.2 | 46.0 |
| 15.805500 | 16.3 | 1000.0 | 9.000 | On | N | 10.0 | 33.7 | 50.0 |
| 16.503000 | 19.8 | 1000.0 | 9.000 | On | N | 10.0 | 30.2 | 50.0 |
| 20.503500 | 16.7 | 1000.0 | 9.000 | On | N | 10.1 | 33.3 | 50.0 |

## Test mode : Lowest frequency(Worst case), L1

Class B_L1




### Final Result 1

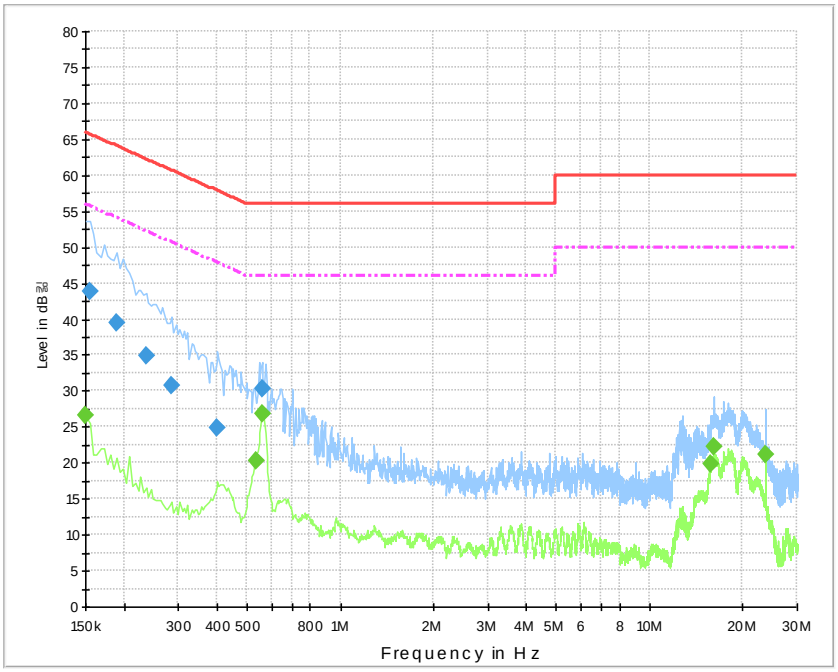
| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.150000 | 43.9 | 1000.0 | 9.000 | On | L1 | 9.7 | 22.1 | 66.0 |
| 0.195000 | 38.6 | 1000.0 | 9.000 | On | L1 | 9.9 | 25.2 | 63.8 |
| 0.231000 | 35.5 | 1000.0 | 9.000 | On | L1 | 9.7 | 26.9 | 62.4 |
| 0.289500 | 30.6 | 1000.0 | 9.000 | On | L1 | 9.7 | 29.9 | 60.5 |
| 0.352500 | 27.0 | 1000.0 | 9.000 | On | L1 | 9.8 | 31.9 | 58.9 |
| 0.564000 | 30.6 | 1000.0 | 9.000 | On | L1 | 9.9 | 25.4 | 56.0 |

### Final Result 2

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.420000 | 17.1 | 1000.0 | 9.000 | On | L1 | 9.9 | 30.4 | 47.4 |
| 0.532500 | 20.4 | 1000.0 | 9.000 | On | L1 | 9.9 | 25.6 | 46.0 |
| 0.564000 | 27.3 | 1000.0 | 9.000 | On | L1 | 9.9 | 18.7 | 46.0 |
| 15.873000 | 20.7 | 1000.0 | 9.000 | On | L1 | 9.9 | 29.3 | 50.0 |
| 18.307500 | 24.0 | 1000.0 | 9.000 | On | L1 | 9.9 | 26.0 | 50.0 |
| 20.013000 | 24.2 | 1000.0 | 9.000 | On | L1 | 10.0 | 25.8 | 50.0 |

## Test mode : Lowest frequency(Worst case), NEUTRAL

Class B_N




### Final Result 1

| Frequency (MHz) | QuasiPeak (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.154500 | 43.9 | 1000.0 | 9.000 | On | N | 9.8 | 21.9 | 65.8 |
| 0.190500 | 39.5 | 1000.0 | 9.000 | On | N | 9.9 | 24.5 | 64.0 |
| 0.235500 | 34.9 | 1000.0 | 9.000 | On | N | 9.7 | 27.4 | 62.3 |
| 0.285000 | 30.8 | 1000.0 | 9.000 | On | N | 9.7 | 29.9 | 60.7 |
| 0.402000 | 24.9 | 1000.0 | 9.000 | On | N | 9.9 | 32.9 | 57.8 |
| 0.559500 | 30.3 | 1000.0 | 9.000 | On | N | 9.9 | 25.7 | 56.0 |

### Final Result 2

| Frequency (MHz) | CAverage (dBuV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|---|---|
| 0.150000 | 26.6 | 1000.0 | 9.000 | On | N | 9.8 | 29.4 | 56.0 |
| 0.532500 | 20.3 | 1000.0 | 9.000 | On | N | 9.9 | 25.7 | 46.0 |
| 0.564000 | 26.8 | 1000.0 | 9.000 | On | N | 9.9 | 19.2 | 46.0 |
| 15.841500 | 19.8 | 1000.0 | 9.000 | On | N | 10.0 | 30.2 | 50.0 |
| 16.242000 | 22.2 | 1000.0 | 9.000 | On | N | 10.0 | 27.8 | 50.0 |
| 23.856000 | 21.2 | 1000.0 | 9.000 | On | N | 10.1 | 28.8 | 50.0 |

# 4.9 Frequency Hopping System Requirements

## Requirements

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

## Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses RFID radio which operates in 902-928 MHz band. It uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 50 bands (0.5 MHz each; centered from 902.75 to 927.25 MHz) in the range 902-928 MHz.

## EUT Pseudo random Frequency Hopping Sequence

Pseudo random Frequency Hopping Sequence Table as below:
Channel:
27,26,2,49,48,4,50,36,34,14,33,31,6,5,46,39,25,9,23,40,18,19,3,13,7,20,8,30,24,10,32,28,16,17,11,45,15,35,29,22,43,12,47,21,44,38,37,41,1,42

The system receiver has input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals

# APPENDIX A – Test Equipment Used For Tests

| | Name of Equipment | Manufacturer | Model No. | Serial No. | Date of Calibration | Due Date |
|---|---|---|---|---|---|---|
| 1 | Signal Analyzer | Agilent | N9020A | MY48011598 | 2016-11-01 | 2017-11-01 |
| 2 | Signal Generator | Rohde & Schwarz | SMB100A | 175528 | 2016-11-01 | 2017-11-01 |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESCI7 | 100814 | 2016-11-01 | 2017-11-01 |
| 4 | Bilog Antenna | Schaffner | CBL6111C | 2551 | 2016-05-13 | 2018-05-13 |
| 5 | Active Loop Antenna | SCHWARZBECK | FMZB 1513 | 1513-126 | 2016-05-25 | 2018-05-25 |
| 6 | 6dB Attenuator | Rohde & Schwarz | DNF | 272.4110.50-2 | 2017-10-25 | 2018-10-25 |
| 7 | 6dB Attenuator | Rohde & Schwarz | DNF | 272.4110.50-1 | 2017-02-03 | 2018-02-03 |
| 8 | AMPLIFIER | SONOMA | 310 | 291721 | 2017-02-02 | 2018-02-02 |
| 9 | EMI Test Receiver | Rohde & Schwarz | ESU40 | 100336 | 2017-05-12 | 2018-05-12 |
| 10 | Preamplifier | Agilent | 8449B | 3008A02011 | 2016-12-01 | 2017-12-01 |
| 11 | Horn Antenna | ETS-Lindgren | 3117 | 00154525 | 2017-09-14 | 2019-09-14 |
| 12 | EMI Test Receiver | Rohde & Schwarz | ESU40 | 100336 | 2017-05-12 | 2018-05-12 |
| 13 | LISN | Rohde & Schwarz | ENV216 | 101760 | 2017-02-03 | 2018-02-03 |
| 14 | Band Reject Filter | Wainwright Instruments GmbH | WRCG902/930-894/938-50/12SS | SN1 | 2017-02-06 | 2018-02-06 |

# APPENDIX B – EUT Photographs