# RADIO TEST REPORT

| | | |
|---|---|---|
| **Product** | : | Wire-Free Keypad |
| **Model Name** | : | KB1001 |
| **FCC ID** | : | 2APLE18300419 |
| **Test Regulation** | : | FCC 47 CFR Part 15 Subpart C (Section 15.247) |
| **Received Date** | : | 2023/4/27 |
| **Test Date** | : | 2023/5/29 ~ 2023/6/7 |
| **Issued Date** | : | 2023/6/16 |
| **Applicant** | : | Arlo Technologies Inc<br>2200 Faraday Avenue, Suite 150, Carlsbad, CA 92008, USA |
| **Issued By** | : | Underwriters Laboratories Taiwan Co., Ltd.<br>Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,<br>Zhudong Township, Hsinchu County, Taiwan |

Testing Laboratory
3398

**The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.**

# REVISION HISTORY

## Original Test Report No.: 4790614816-US-R1-V0

| Rev. | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| Original | 4790614816-US-R1-V0 | 2023/6/16 | - | Initial issue |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

# Table of Contents

# 1. Attestation of Test Results

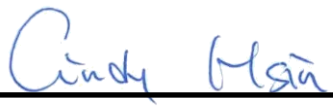
| | |
|---|---|
| **APPLICANT:** | Arlo Technologies Inc<br>2200 Faraday Avenue, Suite 150, Carlsbad, CA 92008, USA |
| **MANUFACTURER:** | Funing Precision Component co., Ltd<br>Lot B, Que vo Industrial Zone.Nam Son Ward, Bac Ninh city, Bac Ninh province, Viet Nam |
| **EUT DESCRIPTION:** | Wire-Free Keypad |
| **BRAND:** | Arlo |
| **MODEL:** | KB1001 |
| **SAMPLE STAGE:** | Engineering Verification Test sample |
| **DATE of TESTED:** | 2023/5/29 ~ 2023/6/7 |

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **Test Results** |
| FCC 47 CFR PART 15 Subpart C (Section 15.247) | PASS |

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Cindy Hsin Date : 2023/6/16
Project Handler

Approved and Authorized By:

Eric Lee Date : 2023/6/16
Senior Laboratory Engineer

## 2. Summary of Test Results

| Summary of Test Results | | |
|---|---|---|
| **FCC Clause** | **Test Items** | **Result** |
| 15.247(a)(2) | 6dB Bandwidth | PASS |
| 15.247(b) | Conducted Output Power | PASS |
| 15.247(e) | Power Spectral Density | PASS |
| 15.247(d) | Antenna Port Emission | PASS |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions and Band Edge Measurement | PASS |
| 15.207 | AC Power Conducted Emission | PASS |
| 15.203 | Antenna Requirement | PASS |

# 3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

# 4. Facilities and Accreditation

| | |
|---|---|
| **Test Location** | Underwriters Laboratories Taiwan Co., Ltd. |
| **Address** | Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |
| **Accreditation Certificate** | Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. |

# 5. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 4.3.4 of ISO Guide 115) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

| Measurement | Frequency | Uncertainty |
|---|---|---|
| Conducted disturbance at mains terminals ports | 150kHz ~ 30MHz | ±3.1 dB |
| RF Conducted | 9 kHz - 40GHz | ±2.3 dB |
| Radiated disturbance below 30MHz | 9 kHz - 30 MHz | ±3.2 dB |
| Radiated disturbance below 1 GHz | 30MHz ~ 1GHz | ±6.1 dB |
| Radiated disturbance above 1 GHz | 1GHz ~ 40GHz | ±5.1 dB |

# 6. Equipment under Test

## 6.1. Description of EUT

| | |
|---|---|
| **Product** | Wire-Free Keypad |
| **Brand Name** | Arlo |
| **Model Name** | KB1001 |
| **Operating Frequency** | 904 MHz ~ 926MHz |
| **Modulation** | O-QPSK |
| **Transfer Rate** | 250Kbps |
| **Number of Channel** | 12 |
| **Maximum Output Power** | 20.05 dBm |
| **Normal Voltage** | 5Vac from adapter<br>6Vdc from battery |
| **Sample ID** | Conducted Test: 6092730<br>Radiated Test: 6092730 |

Note:

1. The EUT incorporates a SISO function. Physically, the EUT provides one completed transmitters and one receivers.

| Modulation Mode | Tx,Rx Function |
|---|---|
| Sub-G | 1TX,1RX |

2. The EUT contains following accessory devices:

| Product | Brand | Model | Description |
|---|---|---|---|
| Battery | Duracell | MX1500 | 1.5Vdc x 4 |
| USB cable | Nienyi | 322-50018-01 | Length: 2.5 m |

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.

## 6.2. Channel List

12 channels are provided for Sub-G:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|
| 1 | 904 | 7 | 916 |
| 2 | 906 | 8 | 918 |
| 3 | 908 | 9 | 920 |
| 4 | 910 | 10 | 922 |
| 5 | 912 | 11 | 924 |
| 6 | 914 | 12 | 926 |

## 6.3. Test Condition

| Test Item | Test Site No. | Environmental Condition | Input Power | Test Date | Tested by |
|---|---|---|---|---|---|
| Antenna Port Conducted Measurement | SR4 | 21~28°C/ 52~69%RH | 5Vdc | 2023/05/29~ 2023/06/07 | Rex Chen |
| Radiated Spurious Emission | 966-2 | 21~28°C/ 52~69%RH | 5Vdc | 2023/05/29~ 2023/06/07 | Rex Chen |
| AC power Line Conducted Emission | SR1 | 21~28°C/ 52~69%RH | 5Vdc | 2023/05/29~ 2023/06/07 | Rex Chen |

FCC Test Firm Registration Number: 498077

### Sample Calculation:

Antenna Port Conducted Measurement:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBm) = Reading Value (dBm) +Attenuator Factor (dB) + Cable Loss (dB).
  Example: Result Value (10dBm) = Reading Value (-2dBm) +Attenuator Factor (10dB) + Cable Loss(2dB).
  *Test plot only shown the “Result Value”.

Radiated Spurious Emission:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBuV/m) = Reading Value (dBuV) + Correction Factor (dB/m).
  Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
  Example: Result Value (34.5dBuV/m) = Reading Value (40.1dBV) + Antenna Factor (18.7dB/m) + Cable Loss (4.2dB) - Preamp Factor (28.5dB).

AC power Line Conducted Emission:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBuV) = Reading Value (dBuV) + Correction Factor (dB).
  Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).
  Example: Result Value (53.7dBuV) = Reading Value (35.1dBm) + Insertion loss(18.1dB) + Cable loss(0.5dB).

## 6.4. Description of Available Antennas

| Ant. No. | Transmitter Circuit | Brand Name | Model Name | Ant. Type | Maximum Gain (dBi) |
|---|---|---|---|---|---|
| 1 | Chain (0) | Whayu | C107-512024-A | PIFA | 0.28 |

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible..

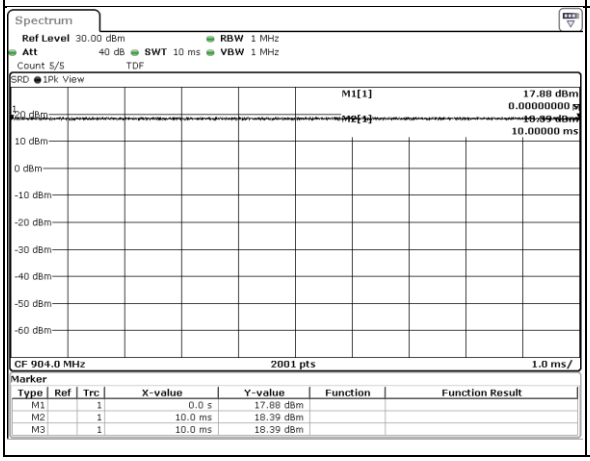
## 6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that X-Y plane was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Y plane.
- The EUT has two power source types: 6Vdc from battery and 5Vdc from adapter, above two types was pre-tested, the worst case was found in the 5Vdc from adapter. Therefore only the test data of the 5Vdc from adapter was recorded in this report.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.

| Test Item | Modulation Type | Available Channel | Test Channel | Packet Type |
|---|---|---|---|---|
| Radiated Emissions (Above 1GHz) | O-QPSK | 1 to 12 | 1,6,12 | 250kbps |
| Radiated Emissions (Below 1GHz) | O-QPSK | 1 to 12 | 1,6,12 | 250kbps |
| AC Power Line Conducted Emission | O-QPSK | 1 to 12 | 1,6,12 | 250kbps |
| Antenna Port Conducted Measurement | O-QPSK | 1 to 12 | 1,6,12 | 250kbps |

## 6.6. Duty cycle

| Mode | On Time (ms) | On+Off Time (ms) | Duty Cycle | Duty Factor (dB) | VBW Set (above 1GHz) |
|---|---|---|---|---|---|
| SubG | 10.000 | 10.000 | 1.0000 | N/A | 10Hz |

| SubG | |
|---|---|
|  | |

# 7. Test Equipment

| Test Equipment List | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal. Date** | **Expired date** |
| **Radiated Spurious Emission** | | | | | |
| Spectrum Analyzer | Keysight | N9010A | MY56070834 | 2022/10/24 | 2023/10/23 |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101754 | 2022/12/13 | 2023/12/12 |
| Loop Antenna | ETS lindgren | 6502 | 00213440 | 2023/1/4 | 2024/1/3 |
| Trilog-Broadband Antenna with 5dB Attenuator | Schwarzbeck & EMCI | VULB 9168 & N-6-05 | 774 & AT-N0538 | 2023/2/13 | 2024/2/12 |
| Horn Antenna (1-18 GHz) | Schwarzbeck | BBHA 9120 D | 01690 | 2022/12/21 | 2023/12/20 |
| Horn Antenna (18-40 GHz) | Schwarzbeck | BBHA 9170 | 781 | 2022/12/30 | 2023/12/29 |
| Preamplifier (30-1000 MHz) | EMCI | EMC330E | 980404 | 2023/5/24 | 2024/5/23 |
| Preamplifier (1-18 GHz) | EMCI | EMC051835BE | 980406 | 2023/2/17 | 2024/2/16 |
| Preamplifier (18-40GHz) | EMCI | EMC184040SEE | 980426 | 2023/5/9 | 2024/5/8 |
| Cables | Hanyitek | K1K50-UP0264-K1K50-2500 | 170214-4 & 170425-2 | 2022/12/1 | 2023/11/30 |
| Cables | Hanyitek | K1K50-UP0264-K1K50-2500 | 170214-1 & 170214-2 | 2022/12/1 | 2023/11/30 |

| Test Equipment List | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal. Date** | **Expired date** |
| **Antenna Port Conducted Measurement** | | | | | |
| Spectrum Analyzer | Keysight | N9010A | MY56070834 | 2022/9/12 | 2023/9/11 |
| Attenuator | EMCI | EMC-40ATK2W10 | 17002 | 2022/12/9 | 2023/12/8 |
| Pulse Power Sensor | Anritsu | MA2411B | 1531202 | 2023/1/4 | 2024/1/3 |
| Power Meter | Anritsu | ML2495A | 1645002 | 2023/1/4 | 2024/1/3 |
| **AC power Line Conducted Emission** | | | | | |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101753 | 2022/11/10 | 2023/11/9 |
| Two-Line V-Network | Rohde & Schwarz | ENV216 | 102136 | 2022/8/29 | 2023/8/28 |
| Impuls-Begrenzer Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 102219-Qt | 2022/8/30 | 2023/8/29 |
| Cables | TITAN | CFD200 | T0732ACFD2 0020A300-2 | 2023/5/23 | 2024/5/22 |

| UL Software | | |
|---|---|---|
| **Description** | **Name** | **Version** |
| Radiated measurement | e3 | 6.191211 (V6) |
| Conducted measurement | RF-Conducted-FCC 15247 | ver 1.0 |
| AC power Line Conducted Emission | EZ_EMC | UL-3A1.2 |

# 8. Description of Test Setup

## Support Equipment

| ID | Equipment | Brand Name | Model Name | S/N | Remark |
|---|---|---|---|---|---|
| A | USB Adapter | Arlo | AD2158 | NA | Supplied by client |
| B | Test Tool | NA | NA | NA | Supplied by client |
| C | Laptop | Lenovo | T460 | PC0FWU5Y | Provided by Lab |
| D | Battery*4 | Duracell | MX1500 | NA | Provided by Lab |

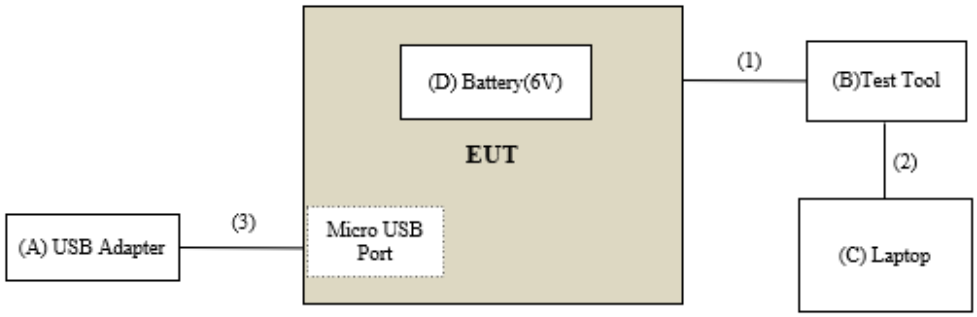
## I/O Cables

| ID | Equipment | Brand Name | Model Name | Length (m) | Remark |
|---|---|---|---|---|---|
| 1 | FPC cable | NA | NA | 0.2 | Supplied by client |
| 2 | Micro USB Cable | Nienyi | 322-50018-01 | 1.99 | Supplied by client |
| 3 | Micro USB Cable | Nienyi | 322-50018-01 | 1.99 | Supplied by client |

## Test Setup

Controlled using a bespoke application (Typing RF command by terminal tool (V4.75)) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

## Setup Diagram for Test



# 9. Test Results

## 9.1. 6dB Bandwidth

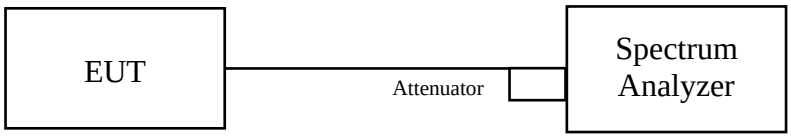
**Requirements**

The minimum 6 dB bandwidth shall be at least 500 kHz.

**Test procedure**

a. Set resolution bandwidth (RBW) = 100kHz.
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**Test Setup**

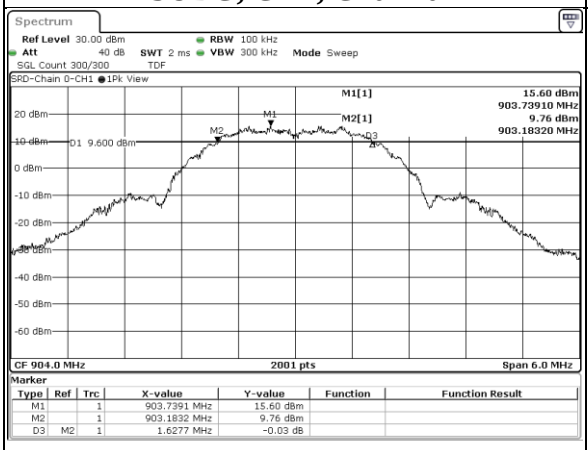



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

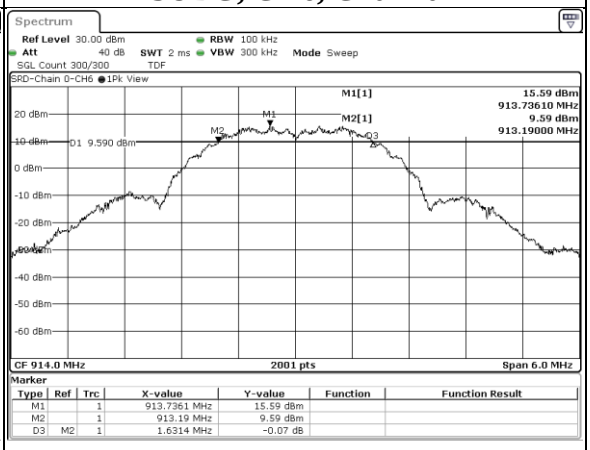
## Test Data

| Mode | CH | Freq (MHz) | 6dB BW (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| SubG | 1 | 904 | 1.628 | 0.5 | PASS |
| SubG | 6 | 914 | 1.631 | 0.5 | PASS |
| SubG | 11 | 926 | 1.639 | 0.5 | PASS |

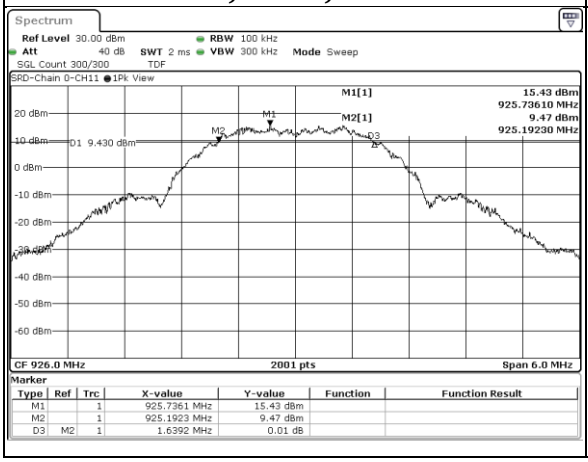
**SUBG, CH1, Chain 0**




**SUBG, CH6, Chain 0**




**SUBG, CH11, Chain 0**



## 9.2. Conducted Output Power

### Requirements

For systems using digital modulation in the 902-928 MHz bands: 1 Watt.

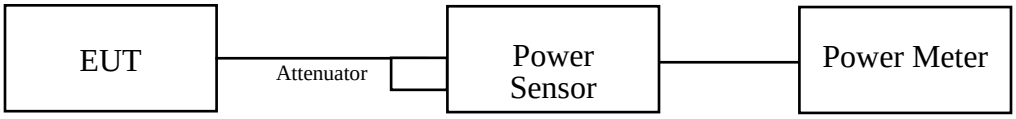
Note:
1. Directional Gain = $G_{ant}$ + 10 log (Nant) dBi.

   N*a*nt: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas (Same for Each Antenna)

### Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

### Test Setup




The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.

# Test Data

## Peak Power

### Sub-G

| Channel | Frequency (MHz) | Peak Power (mW) | Peak Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|
| 1 | 904 | 101.158 | 20.05 | 30 | PASS |
| 6 | 914 | 100.693 | 20.03 | 30 | PASS |
| 12 | 926 | 99.77 | 19.99 | 30 | PASS |

## Average Power (Reference Only)

### Sub-G

| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 1 | 904 | 99.77 | 19.99 |
| 6 | 914 | 99.312 | 19.97 |
| 12 | 926 | 99.083 | 19.96 |

## 9.3. Power Spectral Density

### Requirements

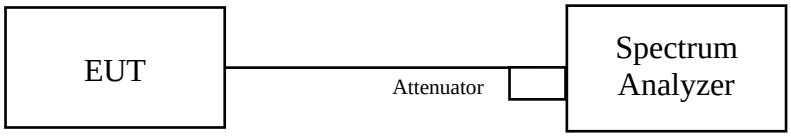
The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz (If $G_{TX}$ > 6 dBi, then PSD = 8 – ($G_{TX}$ – 6)).

Note:
1. PSD = power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz.
2. $G_{TX}$ = the maximum transmitting antenna directional gain in dBi.

### Test procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

### Test Setup

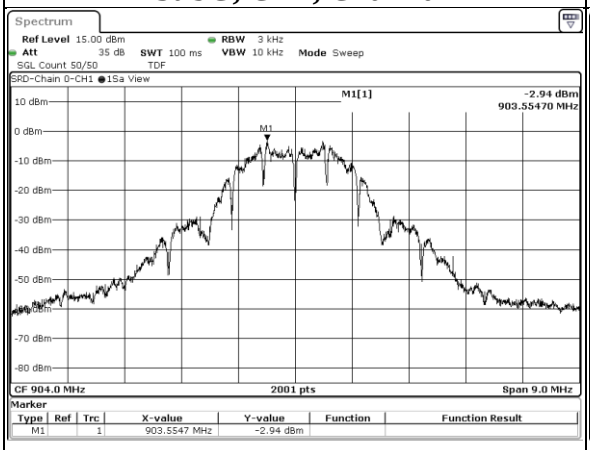



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

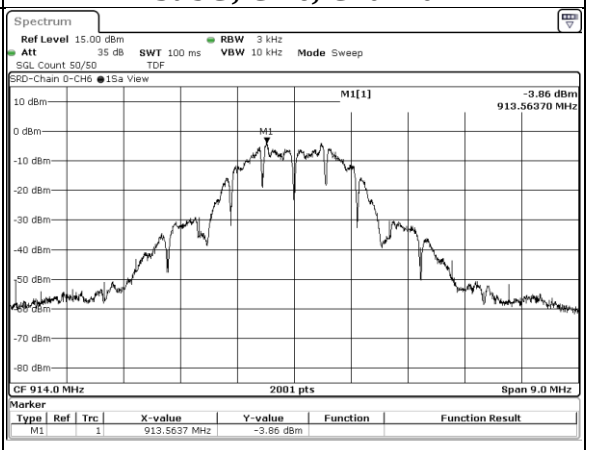
## Test Data

| Mode | CH | Freq (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Result |
|---|---|---|---|---|---|
| SubG | 1 | 904 | -2.94 | 8 | PASS |
| SubG | 6 | 914 | -3.86 | 8 | PASS |
| SubG | 11 | 926 | -4.11 | 8 | PASS |

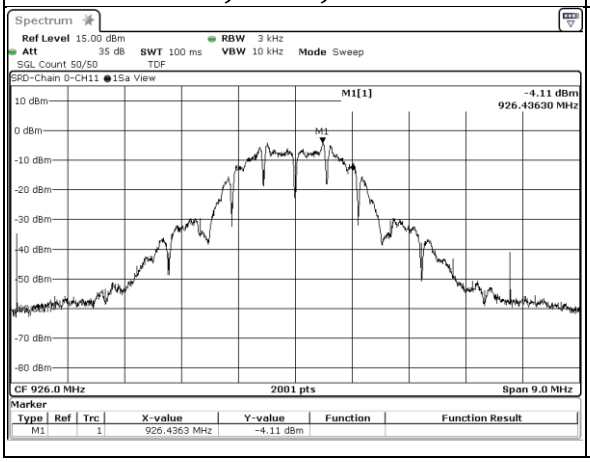
**SubG, CH1, Chain 0**




**SubG, CH6, Chain 0**




**SubG, CH11, Chain 0**



## 9.4. Conducted Out of Band Emission

### Requirements

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b) (3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209 (a) is not required.

### Test procedure

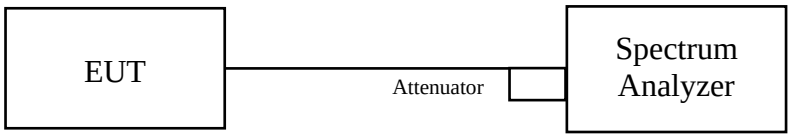
Measurement Procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

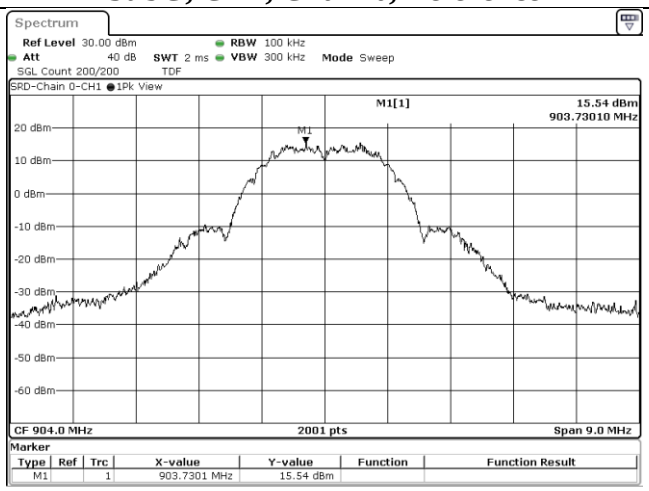
### Test Setup



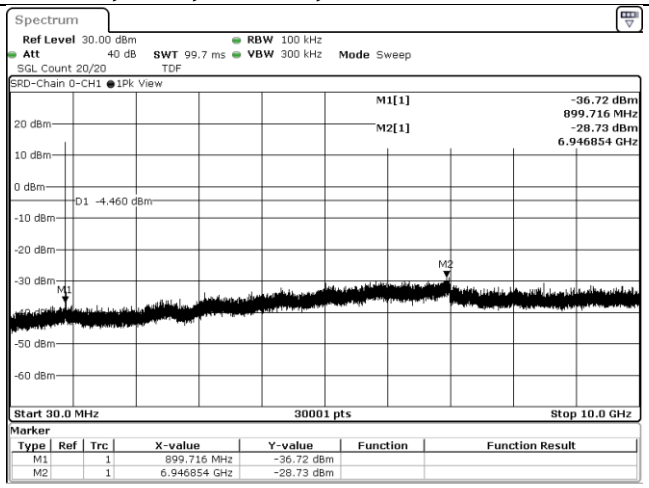

The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

## Test Data

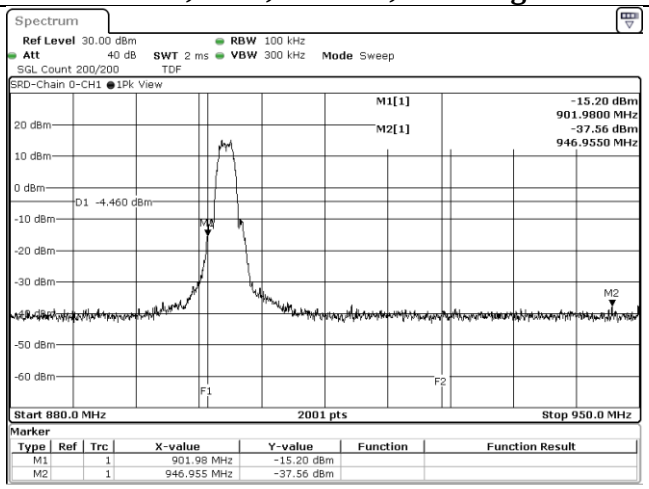
### SubG, CH1, Chain 0, Reference



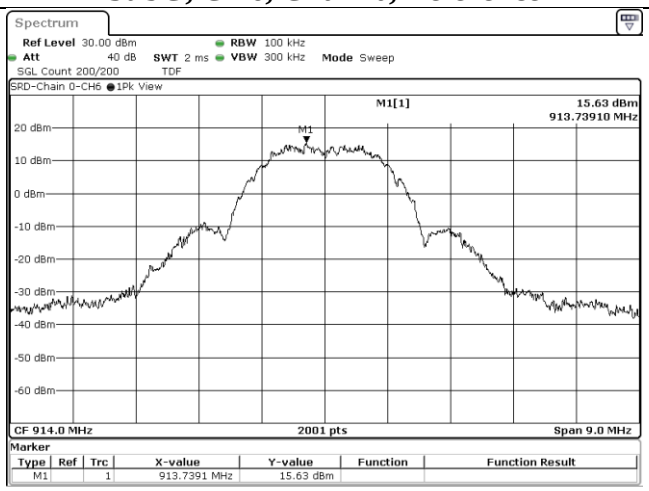

### SubG, CH1, Chain 0, Conducted Emission



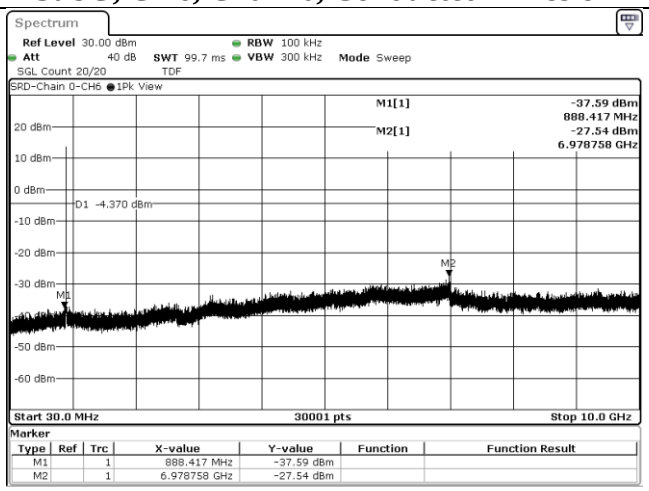

### SubG, CH1, Chain 0, Bandedge



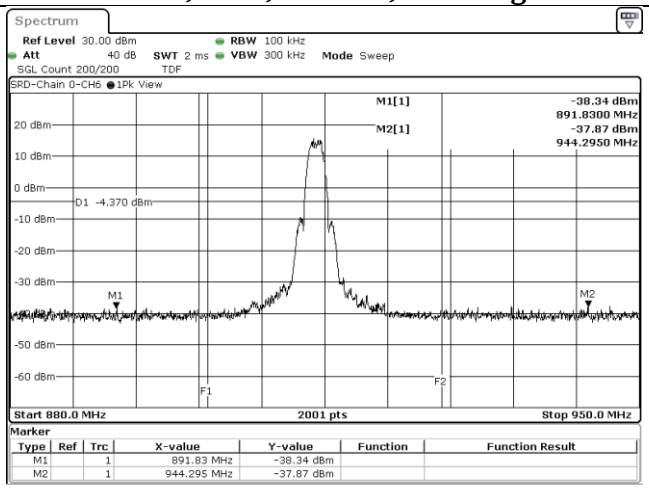
## SubG, CH6, Chain 0, Reference



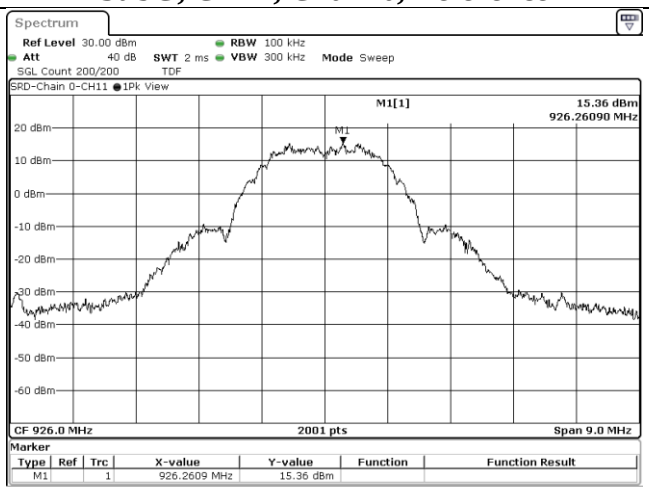

## SubG, CH6, Chain 0, Conducted Emission



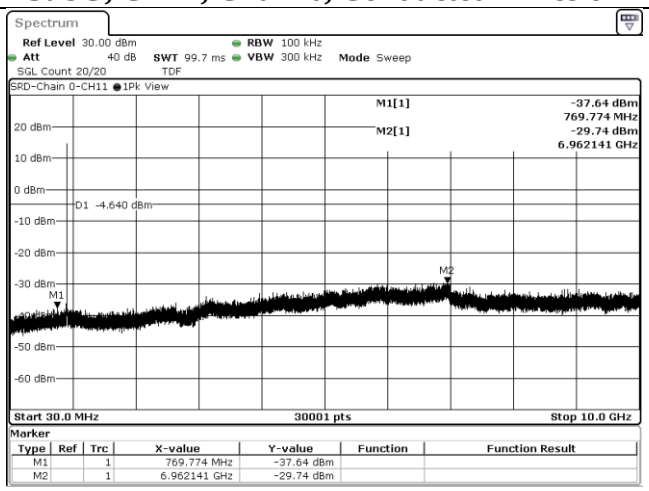

## SubG, CH6, Chain 0, Bandedge



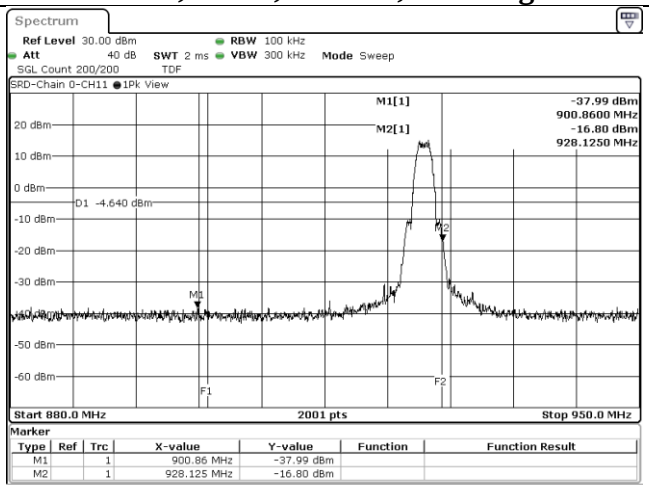
## SubG, CH11, Chain 0, Reference



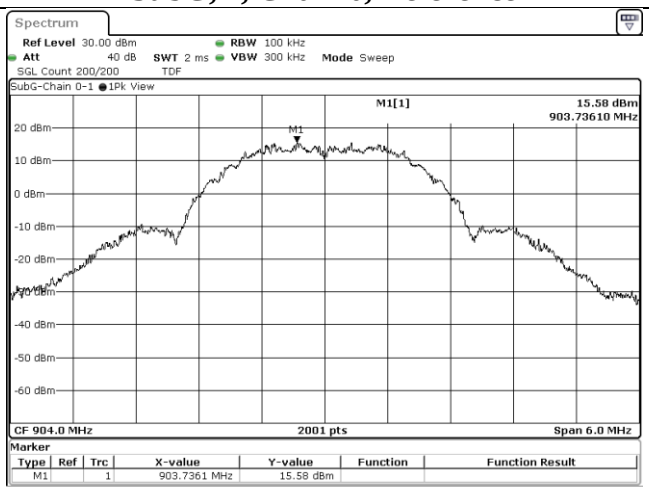

## SubG, CH11, Chain 0, Conducted Emission



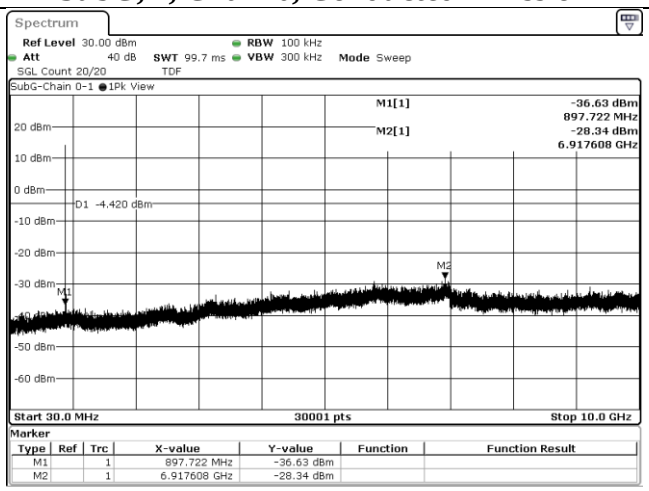

## SubG, CH11, Chain 0, Bandedge



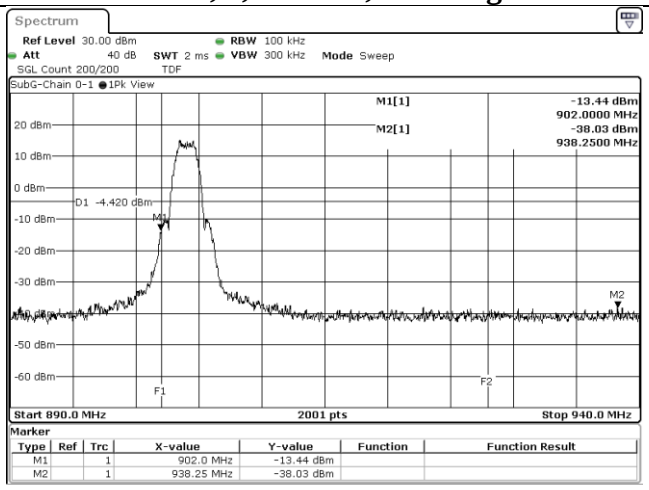
## SubG, 1, Chain 0, Reference




## SubG, 1, Chain 0, Conducted Emission




## SubG, 1, Chain 0, Bandedge



## 9.5. Radiated Spurious Emission

### Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

| Frequency(MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

## Test Procedures

[For 9 kHz ~ 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

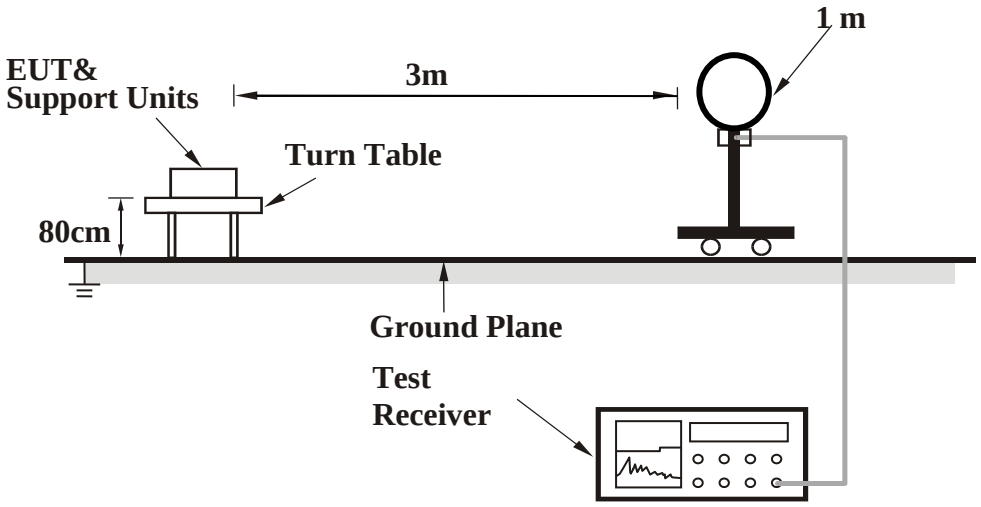
a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.

| Configuration | Average | |
|---|---|---|
| | RBW | VBW |
| Sub-G | 1MHz | Refer to section 6.6 for duty cycle. |

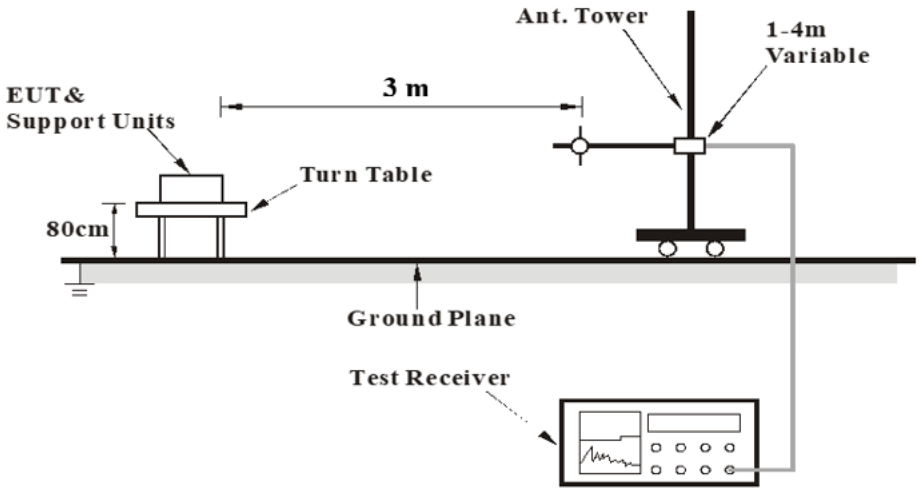
d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
e. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
f. Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
g. Test data of Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
h. Test data of Notation "@" = Fundamental Frequency
i. Test data of Notation " * " = The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

## Test Setup

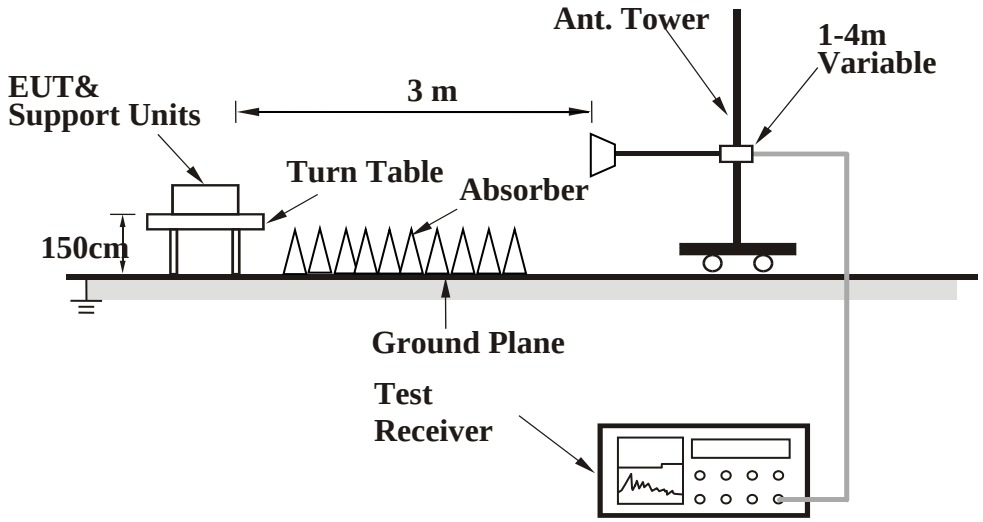
<Frequency Range 9 kHz ~ 30 MHz>




<Frequency Range 30 MHz ~ 1 GHz >



<Frequency Range above 1 GHz>




For the actual test configuration, please refer to the Setup Configurations.

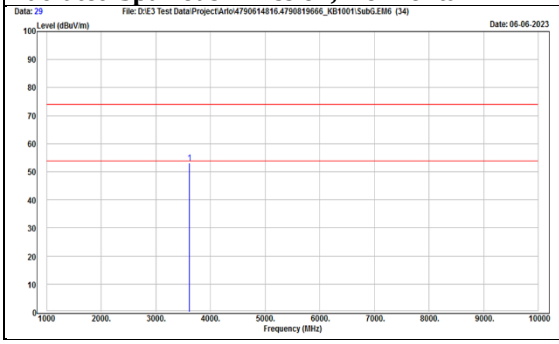
## Test Data

### Above 1 GHz

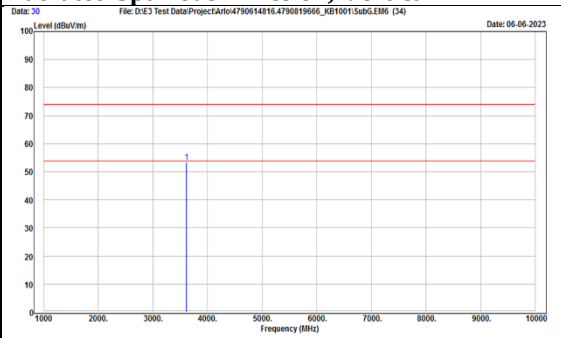
| Mode | SubG | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | * | 3616 | 54.15 | -1.04 | 53.11 | 74 | -20.89 | PK |
| Vertical | * | 3616 | 54.5 | -1.04 | 53.46 | 74 | -20.54 | PK |

**TX, SubG (Ch 1)**
**Radiated Spurious Emission, Horizontal**



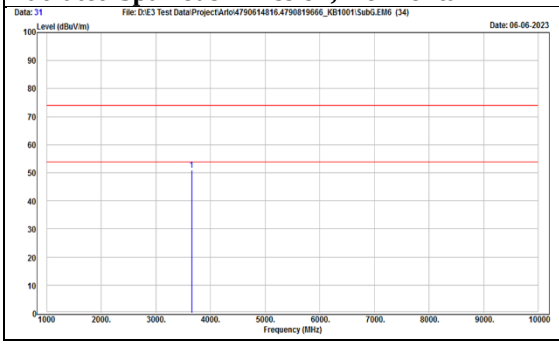

**TX, SubG (Ch 1)**
**Radiated Spurious Emission, Vertical**



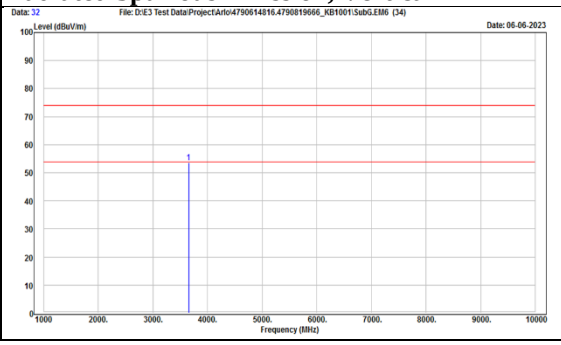
| Mode | SubG | Channel | 6 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | * | 3656 | 51.88 | -0.94 | 50.94 | 74 | -23.06 | PK |
| Vertical | * | 3656 | 54.63 | -0.94 | 53.69 | 74 | -20.31 | PK |

**TX, SubG (Ch 6)**
**Radiated Spurious Emission, Horizontal**



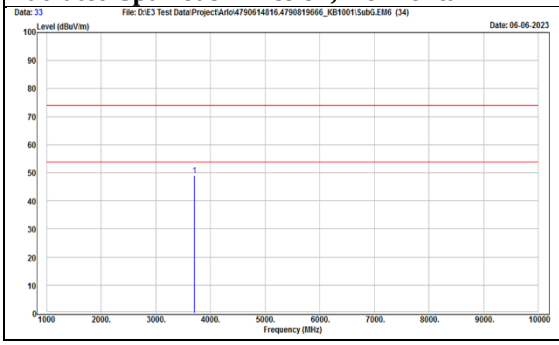

**TX, SubG (Ch 6)**
**Radiated Spurious Emission, Vertical**



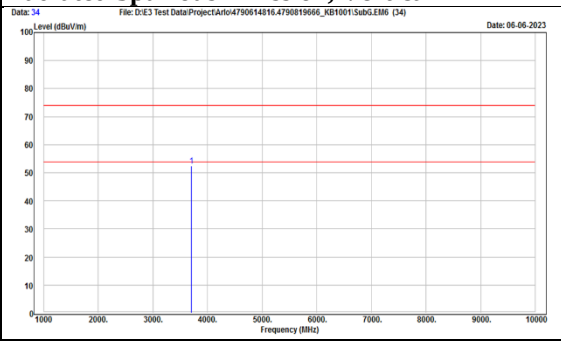
| Mode | SubG | Channel | 12 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | * | 3704 | 49.93 | -0.98 | 48.95 | 74 | -25.05 | PK |
| Vertical | * | 3704 | 53.32 | -0.98 | 52.34 | 74 | -21.66 | PK |

**TX, SubG (Ch 12)**
**Radiated Spurious Emission, Horizontal**




**TX, SubG (Ch 12)**
**Radiated Spurious Emission, Vertical**

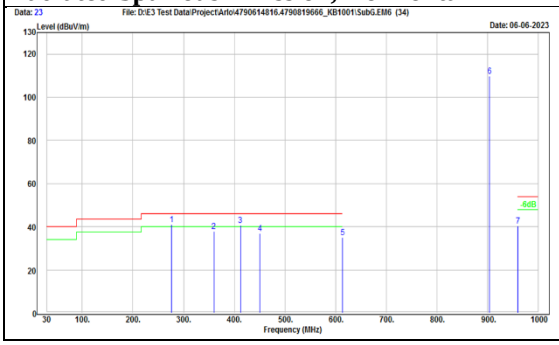


## Below 1 GHz

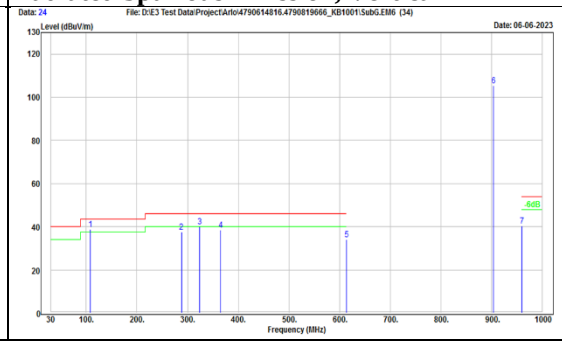
| Mode | SubG | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 276.38 | 50.89 | -9.93 | 40.96 | 46 | -5.04 | PK |
| | | 359.8 | 45.67 | -7.86 | 37.81 | 46 | -8.19 | PK |
| | | 412.18 | 47.02 | -6.18 | 40.84 | 46 | -5.16 | PK |
| | | 450.98 | 41.54 | -4.7 | 36.84 | 46 | -9.16 | PK |
| | | 614 | 35.72 | -0.68 | 35.04 | 46 | -10.96 | PK |
| | @ | 904 | 105.83 | 3.88 | 109.71 | N/A | N/A | PK |
| | | 960 | 35.58 | 4.83 | 40.41 | 54 | -13.59 | PK |
| Vertical | | 108.57 | 52.3 | -13.63 | 38.67 | 43.5 | -4.83 | PK |
| | | 288.02 | 47.22 | -9.52 | 37.7 | 46 | -8.3 | PK |
| | | 323.91 | 48.37 | -8.41 | 39.96 | 46 | -6.04 | PK |
| | | 365.62 | 45.99 | -7.58 | 38.41 | 46 | -7.59 | PK |
| | | 614 | 34.9 | -0.68 | 34.22 | 46 | -11.78 | PK |
| | @ | 904 | 101.64 | 3.88 | 105.52 | N/A | N/A | PK |
| | | 960 | 35.63 | 4.83 | 40.46 | 54 | -13.54 | PK |

**TX, SubG (Ch 1)**
**Radiated Spurious Emission, Horizontal**



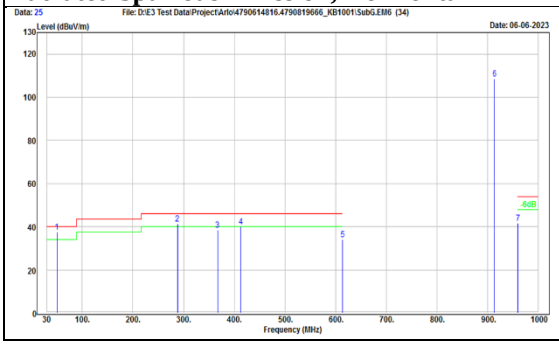

**TX, SubG (Ch 1)**
**Radiated Spurious Emission, Vertical**



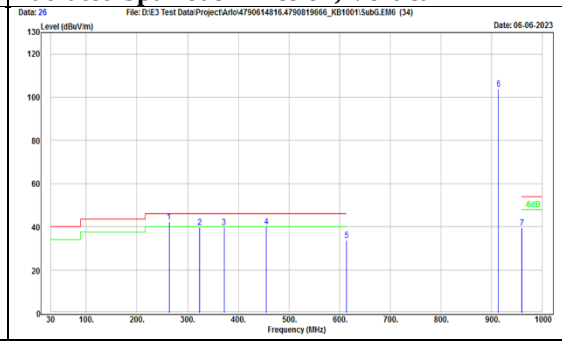
| Mode | SubG | Channel | 6 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 50.37 | 48.23 | -10.75 | 37.48 | 40 | -2.52 | PK |
| | | 288.02 | 50.95 | -9.52 | 41.43 | 46 | -4.57 | PK |
| | | 367.56 | 45.91 | -7.47 | 38.44 | 46 | -7.56 | PK |
| | | 413.15 | 46.07 | -6.14 | 39.93 | 46 | -6.07 | PK |
| | | 614 | 34.85 | -0.68 | 34.17 | 46 | -11.83 | PK |
| | @ | 914 | 104.53 | 4.02 | 108.55 | N/A | N/A | PK |
| | | 960 | 36.87 | 4.83 | 41.7 | 54 | -12.3 | PK |
| Vertical | | 263.77 | 52.64 | -10.5 | 42.14 | 46 | -3.86 | PK |
| | | 323.91 | 48.31 | -8.41 | 39.9 | 46 | -6.1 | PK |
| | | 372.41 | 46.99 | -7.19 | 39.8 | 46 | -6.2 | PK |
| | | 455.83 | 44.49 | -4.57 | 39.92 | 46 | -6.08 | PK |
| | | 614 | 34.54 | -0.68 | 33.86 | 46 | -12.14 | PK |
| | @ | 914 | 99.8 | 4.02 | 103.82 | N/A | N/A | PK |
| | | 960 | 34.63 | 4.83 | 39.46 | 54 | -14.54 | PK |

**TX, SubG (Ch 6)**
**Radiated Spurious Emission, Horizontal**



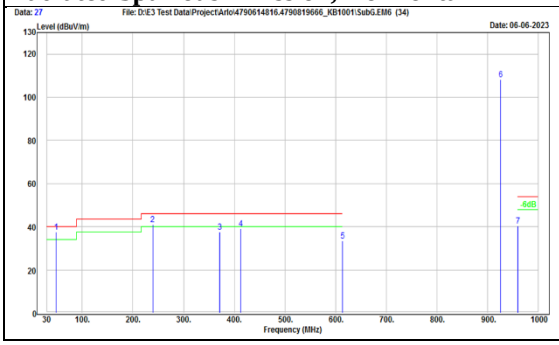

**TX, SubG (Ch 6)**
**Radiated Spurious Emission, Vertical**



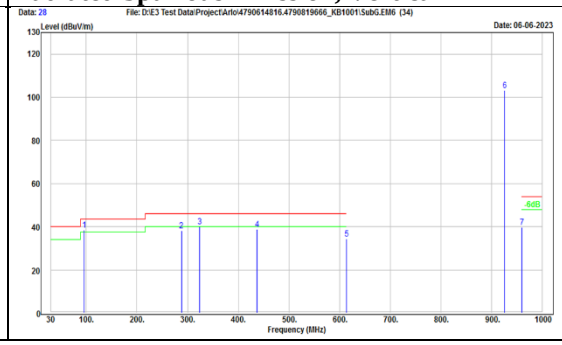
| Mode | SubG | Channel | 12 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 48.43 | 48.23 | -10.82 | 37.41 | 40 | -2.59 | PK |
| | | 239.52 | 52.53 | -11.48 | 41.05 | 46 | -4.95 | PK |
| | | 371.44 | 44.66 | -7.23 | 37.43 | 46 | -8.57 | PK |
| | | 413.15 | 45.32 | -6.14 | 39.18 | 46 | -6.82 | PK |
| | | 614 | 34.09 | -0.68 | 33.41 | 46 | -12.59 | PK |
| | @ | 926 | 103.8 | 4.29 | 108.09 | N/A | N/A | PK |
| | | 960 | 35.54 | 4.83 | 40.37 | 54 | -13.63 | PK |
| Vertical | | 95.96 | 54.18 | -15.83 | 38.35 | 43.5 | -5.15 | PK |
| | | 288.02 | 47.63 | -9.52 | 38.11 | 46 | -7.89 | PK |
| | | 323.91 | 48.34 | -8.41 | 39.93 | 46 | -6.07 | PK |
| | | 437.4 | 44.05 | -5.1 | 38.95 | 46 | -7.05 | PK |
| | | 614 | 35.07 | -0.68 | 34.39 | 46 | -11.61 | PK |
| | @ | 926 | 98.77 | 4.29 | 103.06 | N/A | N/A | PK |
| | | 960 | 34.85 | 4.83 | 39.68 | 54 | -14.32 | PK |

**TX, SubG (Ch 12)**
**Radiated Spurious Emission, Horizontal**




**TX, SubG (Ch 12)**
**Radiated Spurious Emission, Vertical**



**9 kHz ~ 30 MHz Data:**

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

**KDB 414788 D01 OATS and Chamber Correlation Justification**

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

## 9.6. AC Power Line Conducted Emission

### Requirements

| Frequency (MHz) | Conducted limit (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |

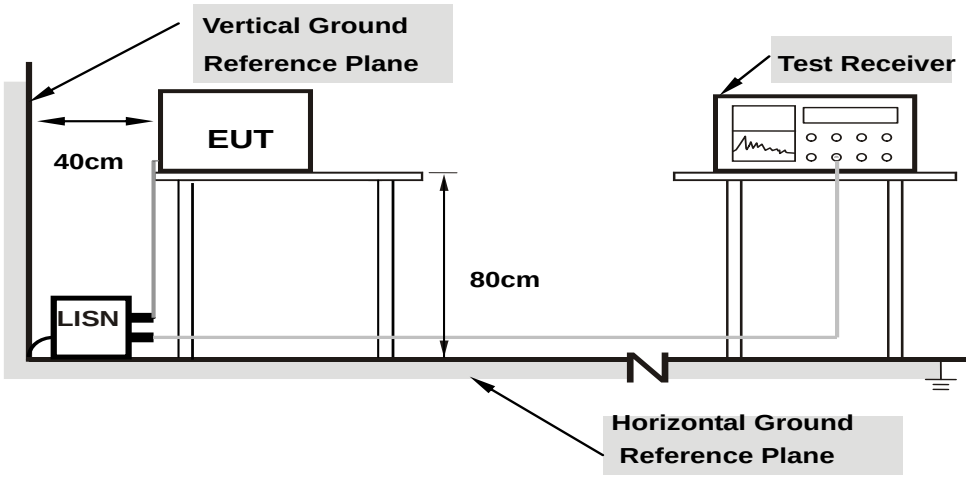
Note:
1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
2. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
3. Test data of Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
4. Test data of Margin(dB) = Result value (dBuV) - Limit value (dBuV).
5. Test data of Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).

## Test Setup



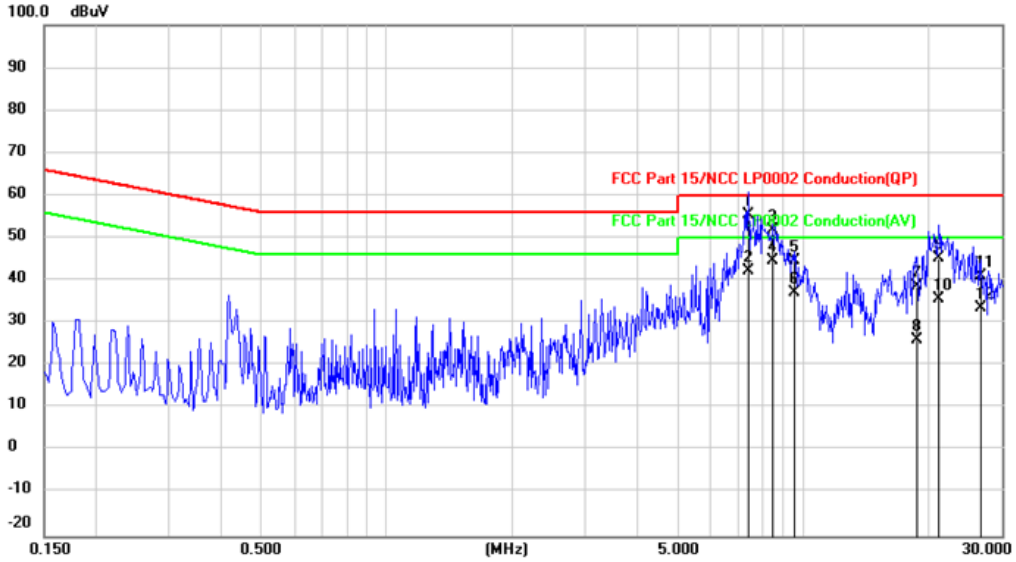

**Note: 1.Support units were connected to second LISN.**

For the actual test configuration, please refer to the Setup Configurations.

## Test Data

| Mode | SubG_TX904 | Channel | N/A |
|---|---|---|---|

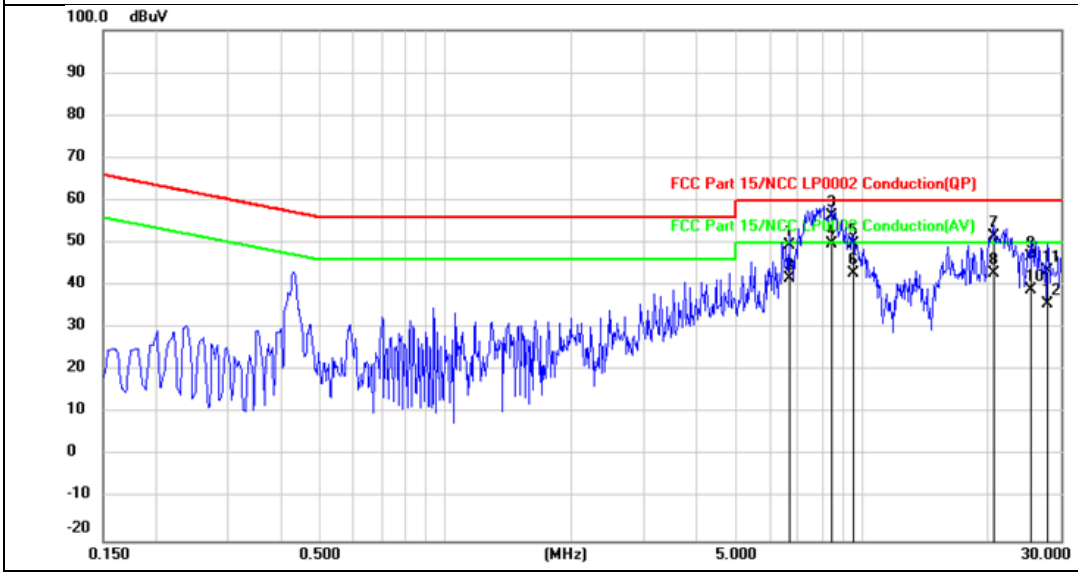
**Phase: Line**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 7.3934 | 45.12 | 10.23 | 55.35 | 60.00 | -4.65 | QP |
| 2 | 7.3934 | 32.11 | 10.23 | 42.34 | 50.00 | -7.66 | AVG |
| 3 | 8.4494 | 41.69 | 10.26 | 51.95 | 60.00 | -8.05 | QP |
| 4 | 8.4494 | 34.41 | 10.26 | 44.67 | 50.00 | -5.33 | AVG |
| 5 | 9.5051 | 34.26 | 10.30 | 44.56 | 60.00 | -15.44 | QP |
| 6 | 9.5051 | 26.77 | 10.30 | 37.07 | 50.00 | -12.93 | AVG |
| 7 | 18.7423 | 28.10 | 10.51 | 38.61 | 60.00 | -21.39 | QP |
| 8 | 18.7423 | 15.53 | 10.51 | 26.04 | 50.00 | -23.96 | AVG |
| 9 | 21.2240 | 34.68 | 10.54 | 45.22 | 60.00 | -14.78 | QP |
| 10 | 21.2240 | 24.98 | 10.54 | 35.52 | 50.00 | -14.48 | AVG |
| 11 | 26.7204 | 30.54 | 10.65 | 41.19 | 60.00 | -18.81 | QP |
| 12 | 26.7204 | 23.01 | 10.65 | 33.66 | 50.00 | -16.34 | AVG |

| Mode | SubG_TX904 | Channel | N/A |
|---|---|---|---|

**Phase: Neutral**




| No. | Frequency (MHz) | Reading (dBuV) | Correct (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 6.6894 | 39.39 | 10.20 | 49.59 | 60.00 | -10.41 | QP |
| 2 | 6.6894 | 31.60 | 10.20 | 41.80 | 50.00 | -8.20 | AVG |
| 3 | 8.4497 | 46.01 | 10.26 | 56.27 | 60.00 | -3.73 | QP |
| 4 | 8.4497 | 39.46 | 10.26 | 49.72 | 50.00 | -0.28 | AVG |
| 5 | 9.5054 | 39.40 | 10.30 | 49.70 | 60.00 | -10.30 | QP |
| 6 | 9.5054 | 32.55 | 10.30 | 42.85 | 50.00 | -7.15 | AVG |
| 7 | 20.7529 | 40.93 | 10.57 | 51.50 | 60.00 | -8.50 | QP |
| 8 | 20.7529 | 32.32 | 10.57 | 42.89 | 50.00 | -7.11 | AVG |
| 9 | 25.5485 | 35.96 | 10.68 | 46.64 | 60.00 | -13.36 | QP |
| 10 | 25.5485 | 28.26 | 10.68 | 38.94 | 50.00 | -11.06 | AVG |
| 11 | 27.8963 | 32.82 | 10.74 | 43.56 | 60.00 | -16.44 | QP |
| 12 | 27.8963 | 25.03 | 10.74 | 35.77 | 50.00 | -14.23 | AVG |

## END OF REPORT