



FCC Test Report

Equipment : POWERFUL WIRELESS BACKHAULING
Brand Name : Fluidmesh Networks
Model No. : FM3500, FM4500, FM4500F
FCC ID : R5S-FMX500
FCC Standard : 47 CFR FCC Part 90(Y)
Operating Band : 4940 MHz – 4990 MHz
FCC Classification : TNB
Applicant : Fluidmesh Networks LLC
81 Prospect St., Brooklyn, New York 11201 United States
Manufacturer : EDIMAX TECHNOLOGY CO., LTD.
No.3, Wu-Chuan 3rd Road, Wu-Ku Industrial Park, New
Taipei City, Taiwan

The product sample received on Nov. 04, 2016 and completely tested on Jan. 24, 2017. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI/TIA-603-D-2010 shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

Phoenix Chen / Assistant Manager





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APPENDIX A. TEST PHOTOS

PHOTOGRAPHS OF EUT v01



Summary of Test Result

| Conformance Test Specifications | | | | |
|---------------------------------|------------------|--|--|----------|
| Report Clause | FCC. Std. Clause | Description | Measured | Result |
| 3.1 | 15.107 | AC Power-line Conducted Emissions | [dBuV]: 24.08 MHz 45.69 (Margin 4.31 dB) - AV 46.20 (Margin 13.80 dB) - QP | Complied |
| 1.1.2 | 2.1047 | Emission Types | D1D (OFDM - BPSK,QPSK, 16QAM, 64QAM) | Complied |
| 3.2 | 2.1049 | Emission Bandwidth | Bandwidth [MHz] 20M: 16.93 | Complied |
| 3.3 | 90.1215 | Maximum Conducted Output Power | Power [dBm] 4960-4980MHz: 31.55 | Complied |
| 3.4 | 90.1215 | Power Spectral Density | PSD [dBm/MHz] 4960-4980MHz: 20.96 | Complied |
| 3.5 | 90.1215 | Peak Excursion | 8.24 dB | Complied |
| 3.6 | 90.210 | Transmit Spectrum Mask | Device complies with spectral mask – refer to test data | Complied |
| 3.7 | 2.1051 | Transmitter Conducted Unwanted Emissions | 9kHz - 40GHz Band [dBm]: 774.70 MHz: -37.77 (Margin -12.77 dB) | Complied |
| 3.8 | 2.1053 | Transmitter Radiated Unwanted Emissions | 30MHz - 40GHz Band [dBuV/m at 3m]: 9920.00 MHz: -48.22 (Margin 23.22 dB) | Complied |
| 3.9 | 2.1055 | Frequency Stability | 7.36 ppm | Complied |



Revision History



1 General Description

1.1 Information

1.1.1 Product Details

There are six samples of EUT which model numbers are FM3500, FM4500, FM4500F. Besides, there are two brands of DDR in each model.

The difference part as below:

| SKU | Model No. | DDR | DC IN | LAN 1 / PoE Port | LAN 2 Port | Fiber |
|-----|-----------|---------|-------|------------------|------------|-------|
| 1 | FM3500 | Winbond | | ✓ | ✓ | |
| 2 | FM3500 | NANYA | | ✓ | ✓ | |
| 3 | FM4500 | Winbond | ✓ | ✓ | ✓ | |
| 4 | FM4500 | NANYA | ✓ | ✓ | ✓ | |
| 5 | FM4500F | Winbond | ✓ | ✓ | | ✓ |
| 6 | FM4500F | NANYA | ✓ | ✓ | | ✓ |

1.1.2 RF General Information

| RF General Information | | | | | | |
|------------------------|------------------|---------------------|----------------|------------------------------------|-----------------------|-------------------------|
| Frequency Range (MHz) | IEEE Std. 802.11 | Ch. Frequency (MHz) | Channel Number | Transmit Chains (N _{TX}) | RF Output Power (dBm) | Designation of Emission |
| 4940-4990 | j (20MHz) | 4960-4980 | 192-196 [2] | 2 | 31.55 | 16M9D1D |

Note 1: IEEE Std. 802.11j-2004 modulation consists of BPSK, QPSK, 16QAM and 64QAM and EUT supports 20MHz channel space.

Note 2: RF output power specifies that Conducted Output Power.

1.1.3 Antenna Information

| Antenna Category | |
|-------------------------------------|--|
| <input type="checkbox"/> | Equipment placed on the market without antennas |
| <input type="checkbox"/> | Integral antenna (antenna permanently attached) |
| <input type="checkbox"/> | <input type="checkbox"/> Temporary RF connector provided |
| | <input type="checkbox"/> No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path. |
| <input checked="" type="checkbox"/> | External antenna (dedicated antennas) |
| | <input checked="" type="checkbox"/> Single power level with corresponding antenna(s). |
| | <input type="checkbox"/> Multiple power level and corresponding antenna(s). |

| No. | Ant. Cat. | Ant. Type | Model Name | Gain (dBi) |
|-----|-----------|-----------|-----------------|------------|
| 1 | External | Sector | JHS-5159-16D90A | 9.00 |

Note: The antenna is not parts and accessories of the product itself when sale in the market.



1.1.4 Type of EUT

| Identify EUT | |
|--|---|
| EUT Serial Number | N/A |
| Presentation of Equipment | <input type="checkbox"/> Production ; <input type="checkbox"/> Pre-Production ; <input checked="" type="checkbox"/> Identical Prototype |
| Type of EUT | |
| <input checked="" type="checkbox"/> Stand-alone | |
| <input type="checkbox"/> Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.: ... | |
| <input type="checkbox"/> Plug-in radio (EUT intended for a variety of host systems) Host System - Brand Name / Model No.: ... | |
| <input type="checkbox"/> Other: | |

1.1.5 Test Signal Duty Cycle

| Operated Mode for Worst Duty Cycle | |
|---|--|
| <input type="checkbox"/> Operated normally mode for worst duty cycle | |
| <input checked="" type="checkbox"/> Operated test mode for worst duty cycle | |
| Test Signal Duty Cycle (x) | Power Duty Factor [dB] – (10 log 1/x) |
| <input checked="" type="checkbox"/> 100% - IEEE 802.11j (20M) | 0 |

1.1.6 EUT Operational Condition

| | | | |
|-------------------|---|---|---|
| Supply Voltage | <input type="checkbox"/> AC mains | <input checked="" type="checkbox"/> DC | |
| Type of DC Source | <input type="checkbox"/> External AC Adapter | <input checked="" type="checkbox"/> PoE (48V) | <input checked="" type="checkbox"/> DC Source (48V) |
| Test Voltage | <input checked="" type="checkbox"/> Vnom (48 V) | <input checked="" type="checkbox"/> Vmax (52.8 V) | <input checked="" type="checkbox"/> Vmin (43.2 V) |
| Test Climatic | <input checked="" type="checkbox"/> Thom (20°C) | <input checked="" type="checkbox"/> Tmax (55°C) | <input checked="" type="checkbox"/> Tmin (-40°C) |

1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 90(Y)
- ANSI/TIA-603-D-2010
- KDB 971168 D01 v02r02
- KDB 971168 D02
- KDB 412172 D01 v01r01
- KDB 662911 D01 v02r01



1.3 Testing Location Information

| Testing Location | | | | |
|-------------------------------------|---------------|---------------|---|----------------------|
| <input checked="" type="checkbox"/> | HWA YA | ADD | : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. | |
| | | TEL | : 886-3-327-3456 | FAX : 886-3-327-0973 |
| Test Condition | Test Site No. | Test Engineer | Test Environment | Test Date |
| AC Conduction | CO04-HY | Ryan | 22°C / 49% | 24/Jan/2017 |
| RF Conducted | TH06-HY | Gary | 25°C / 56% | 20/Jan/2017 |
| Radiated Emission | 03CH03-HY | Jeff | 22.5°C / 51.8% | 20/Jan/2017 |

Test site registered number [553509] with FCC.

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

| Measurement Uncertainty | | |
|-----------------------------------|---------------|----------|
| Test Item | Uncertainty | |
| AC power-line conducted emissions | ±2.26 dB | |
| Emission bandwidth | ±1.42 % | |
| RF output power, conducted | ±0.63 dB | |
| Unwanted emissions, conducted | 30 – 1000 MHz | ±0.51 dB |
| | 1 – 18 GHz | ±0.67 dB |
| | 18 – 40 GHz | ±0.83 dB |
| | 40 – 200 GHz | N/A |
| All emissions, radiated | 30 – 1000 MHz | ±2.56 dB |
| | 1 – 18 GHz | ±3.59 dB |
| | 18 – 40 GHz | ±3.82 dB |
| | 40 – 200 GHz | N/A |
| Temperature | ±0.8 °C | |
| Humidity | ±3 % | |
| DC and low frequency voltages | ±3 % | |
| Time | ±1.42 % | |
| Duty Cycle | ±1.42 % | |



2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

| Worst Modulation Used for Conformance Testing | | | |
|---|------------------------------|-----------|-----------------|
| Modulation Mode | Transmit Chains (N_{TX}) | Data Rate | Worst Data Rate |
| 11j-20M | 2 | 6-54 Mbps | 6 Mbps |
| Note 1: Modulation modes consist of below configuration: 11j-20M: 802.11j 20MHz bandwidth | | | |

2.2 The Worst Case Power Setting Parameter

| The Worst Case Power Setting Parameter | | | | |
|--|---------------------|----------------------|------|--------|
| Test Software Version | MT7662 QA V1.0.3.14 | | | |
| Modulation Mode | N_{TX} | Test Frequency (MHz) | | |
| | | NCB: 20MHz | | |
| | | 4960 | 4980 | |
| 11j-20M | 2 | 14, 14 | | 13, 13 |



2.3 The Worst Case Measurement Configuration

| The Worst Case Mode for Following Conformance Tests | |
|---|---|
| Tests Item | AC power-line conducted emissions |
| Condition | AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz |
| Operating Mode | Operating Mode Description |
| 1 | SKU 1 with PoE Mode |
| 2 | SKU 2 with PoE Mode |
| 3 | SKU 3 with PoE Mode |
| 4 | SKU 4 with PoE Mode |
| 5 | SKU 5 with PoE Mode |
| 6 | SKU 6 with PoE Mode |

Mode 2 configuration was pretested and found to be the worst case and measured during the test

| The Worst Case Mode for Following Conformance Tests | |
|---|--|
| Tests Item | Emission Bandwidth, Maximum Conducted Output Power, Power Spectral Density, Peak Excursion, Transmit Spectrum Mask Transmitter Conducted Unwanted Emissions, Frequency Stability |
| Test Condition | Conducted measurement at transmit chains |
| Modulation Mode | 11j-20M |



| The Worst Case Mode for Following Conformance Tests | | | |
|--|---|----------------|----------------|
| Tests Item | Transmitter Radiated Unwanted Emissions, Receiver Spurious Emissions | | |
| Test Condition | Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type. | | |
| User Position | <input type="checkbox"/> EUT will be placed in fixed position. <input checked="" type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. <input type="checkbox"/> EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions. | | |
| Operating Mode < 1GHz | <input checked="" type="checkbox"/> 1. SKU 1 with PoE Mode <input checked="" type="checkbox"/> 2. SKU 2 with PoE Mode <input checked="" type="checkbox"/> 3. SKU 3 with PoE Mode <input checked="" type="checkbox"/> 4. SKU 4 with PoE Mode <input checked="" type="checkbox"/> 5. SKU 5 with PoE Mode <input checked="" type="checkbox"/> 6. SKU 6 with PoE Mode <input checked="" type="checkbox"/> 7. SKU 3 with DC Power Supply Mode <input checked="" type="checkbox"/> 8. SKU 4 with DC Power Supply Mode <input checked="" type="checkbox"/> 9. SKU 5 with DC Power Supply Mode <input checked="" type="checkbox"/> 10. SKU 6 with DC Power Supply Mode | | |
| Mode 5 configuration was pretested and found to be the worst case and measured during the test | | | |
| Modulation Mode | 11j-20M | | |
| Orthogonal Planes of EUT | X Plane | Y Plane | Z Plane |
| | | | |
| Worst Planes of EUT | V | | |
| Worst Planes of Ant. | V | | |



2.4 Accessories and Support Equipment

| Specification of Accessory | | | | |
|-----------------------------------|--------------|---|------------|------------------|
| PoE | Brand Name | I.T.E | Model Name | GM241DA-480050BG |
| | Power Rating | I/P: 100 – 240 Vac, 50-60Hz, 0.55 A, O/P: 48 Vdc, 0.5 A | | |

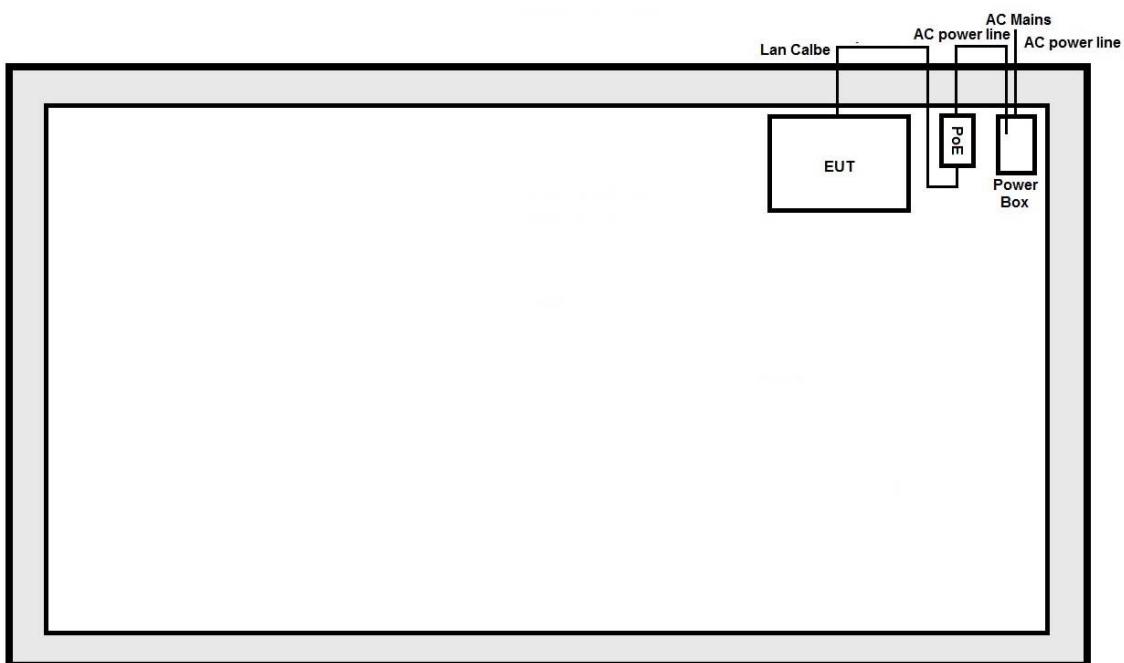
Reminder: Regarding to more detail and other information, please refer to user manual.

| Support Equipment - RF Conducted | | | | |
|---|----------------------|-------------------|-------------------|---------------|
| No. | Equipment | Brand Name | Model Name | FCC ID |
| 1 | Notebook | DELL | E5410 | DoC |
| 2 | Adapter for Notebook | DELL | HA65NM130 | DoC |

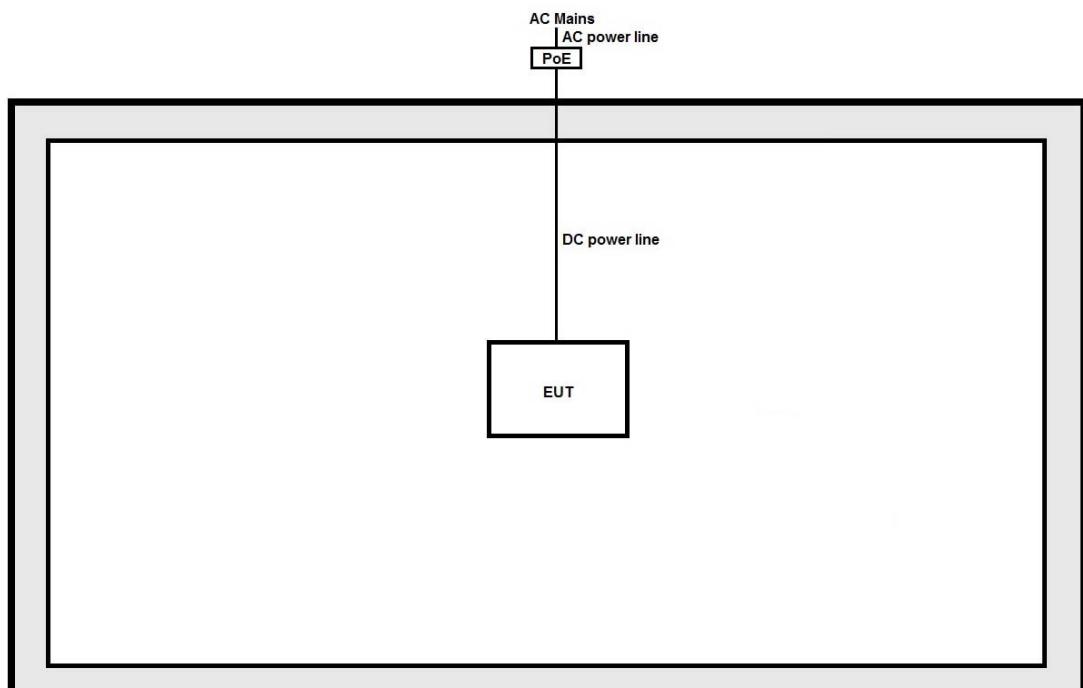
| Support Equipment - AC Conduction and Radiated Emission | | | | |
|--|------------------|-------------------|-------------------|---------------|
| No. | Equipment | Brand Name | Model Name | FCC ID |
| 1 | - | - | - | - |

2.5 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



Test Setup Diagram - Radiated Test



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

| AC Power-line Conducted Emissions Limit [Class A] | | |
|---|------------|-----------|
| Frequency Emission (MHz) | Quasi-Peak | Average |
| 0.15-0.5 | 79 | 66 |
| 0.5-30 | 73 | 60 |
| AC Power-line Conducted Emissions Limit [Class B] | | |
| Frequency Emission (MHz) | Quasi-Peak | Average |
| 0.15-0.5 | 66 - 56 * | 56 - 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Note 1: * Decreases with the logarithm of the frequency.

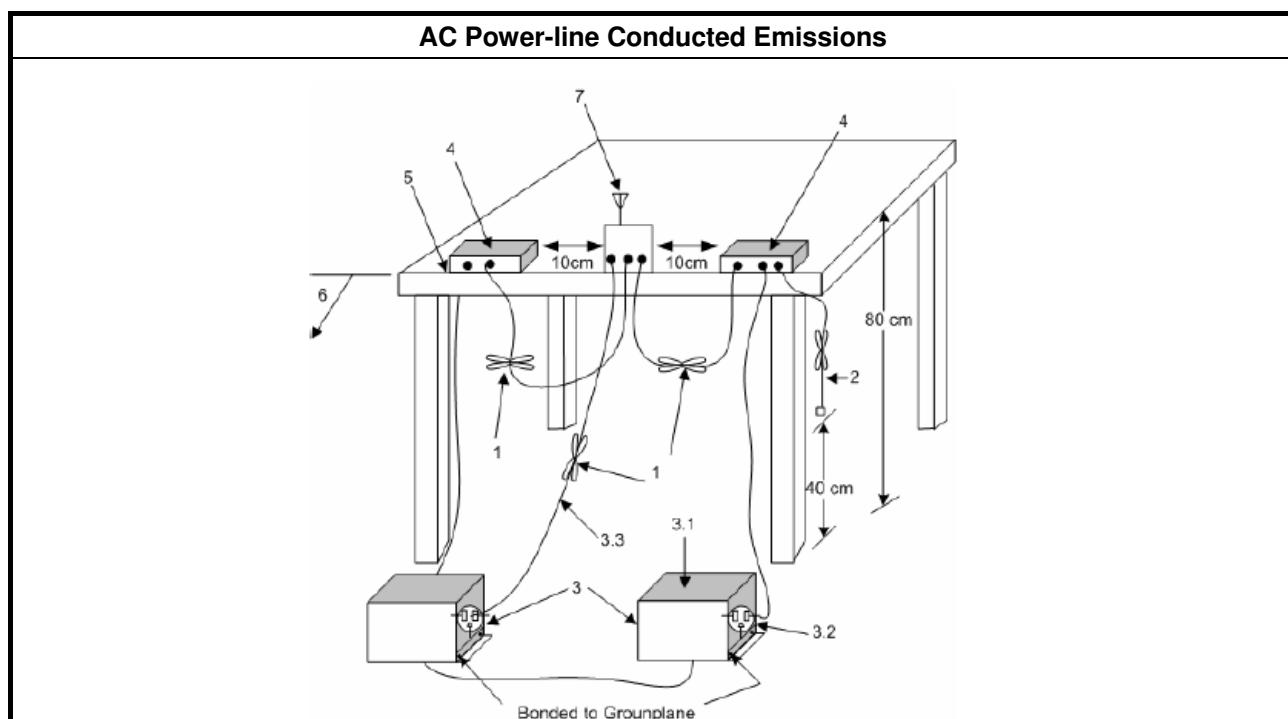
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

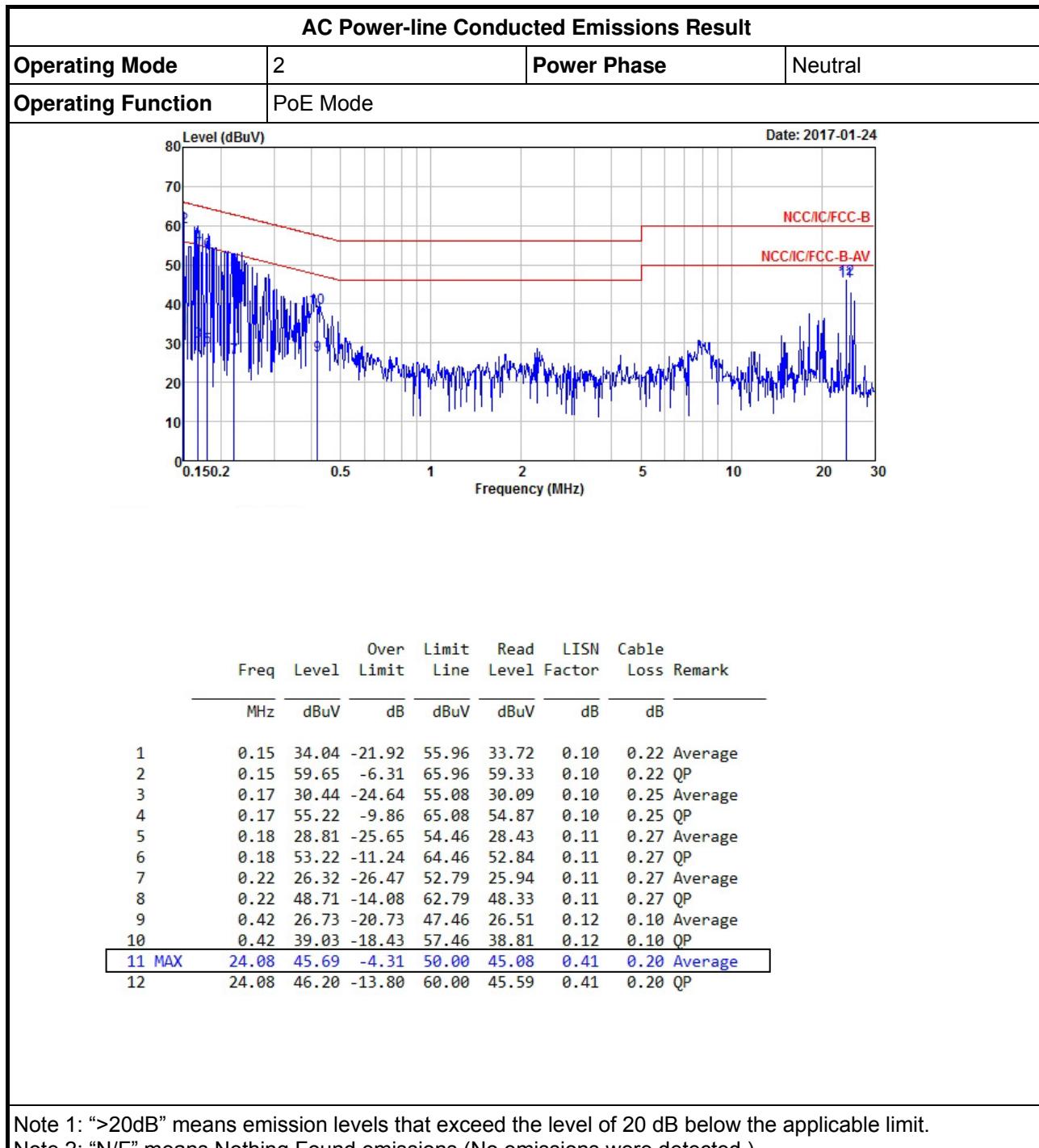
| Test Method |
|---|
| ▪ Refer as ANSI/TIA-603-D-2010, clause 6.2 for AC power-line conducted emissions. |

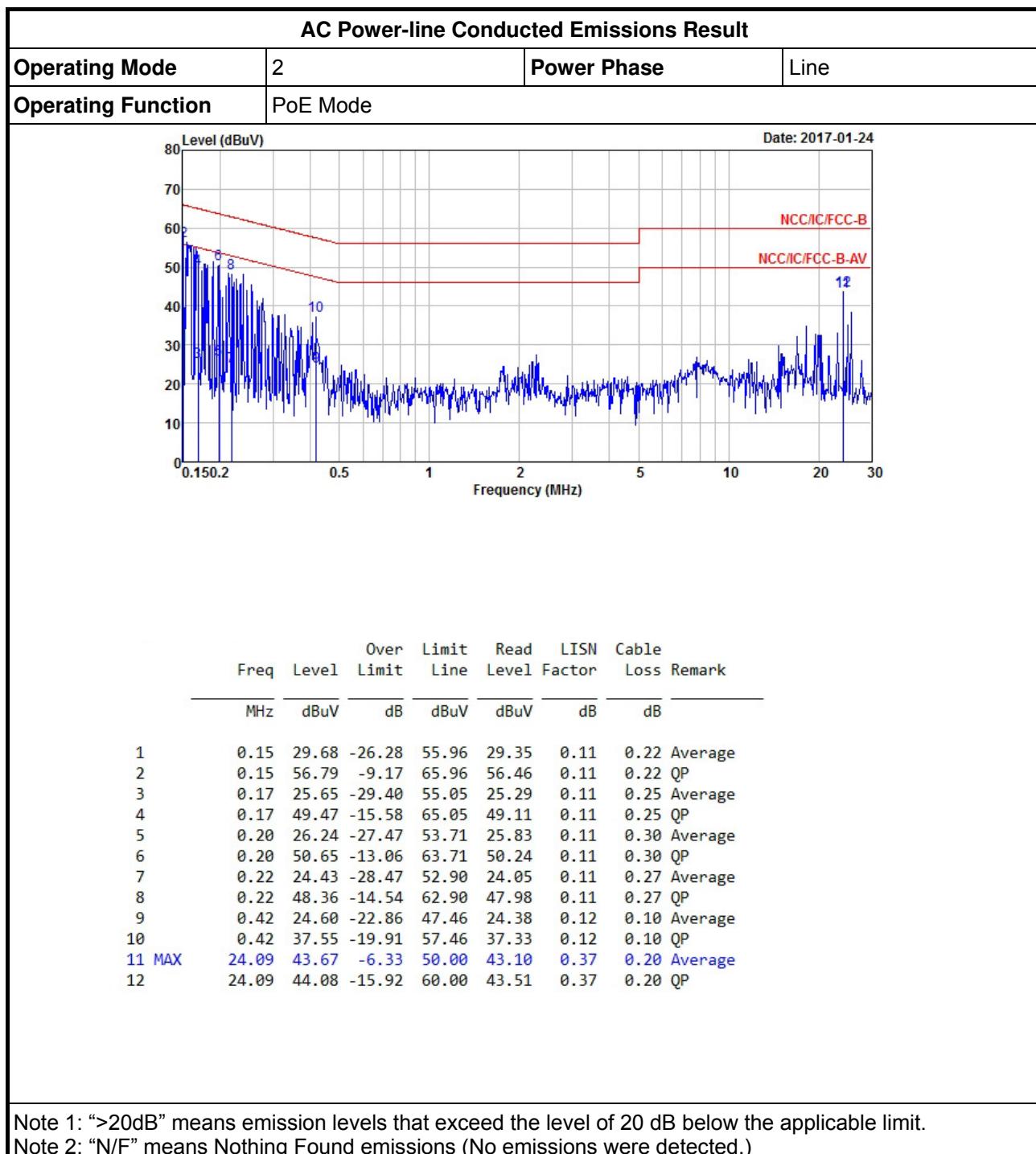
3.1.4 Test Setup





3.1.5 Test Result of AC Power-line Conducted Emissions





3.2 Emission Bandwidth

3.2.1 Emission Bandwidth Limit

| Emission Bandwidth Limit | |
|--|--|
| N/A. Information only | |
| Note 1: The 99% occupied bandwidth is the frequency bandwidth of the signal power at the 99% channel power of occupied bandwidth when resolution bandwidth should be approximately 1 % to 5 % of the occupied bandwidth (OBW). These measurements shall also be performed at normal test conditions. | |

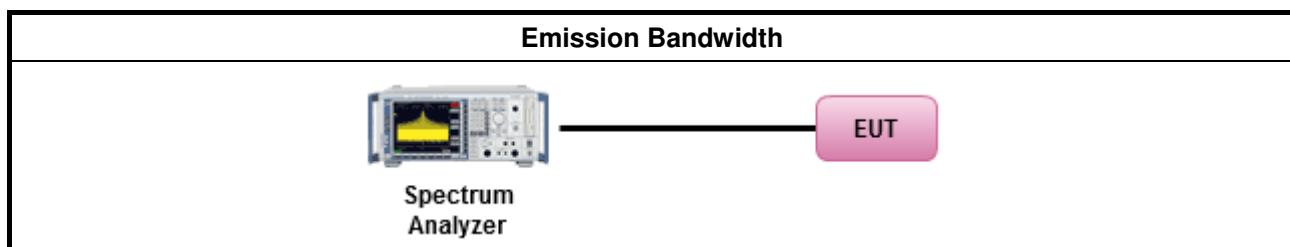
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

| Test Method | |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | For the emission bandwidth shall be measured using one of the options below: |
| <input type="checkbox"/> | Refer as ANSI/TIA-603-D, clause 1.3.4.4 for test bandwidth. |
| <input checked="" type="checkbox"/> | Refer as KDB 971168, clause 4 for signal bandwidth. |
| <input checked="" type="checkbox"/> | For conducted measurement. |
| <input type="checkbox"/> | The EUT supports single transmit chain and measurements performed on this transmit chain. |
| <input type="checkbox"/> | The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. |
| <input checked="" type="checkbox"/> | The EUT supports multiple transmit chains using options given below: |
| <input checked="" type="checkbox"/> | Option 1: Multiple transmit chains measurements need to be performed on one of the active transmit chains (antenna outputs). All measurement had be performed on transmit chains 1. |
| <input type="checkbox"/> | Option 2: Multiple transmit chains measurements need to be performed on each transmit chains individually (antenna outputs). All measurement had be performed on all transmit chains. |
| <input type="checkbox"/> | For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level. |

3.2.4 Test Setup

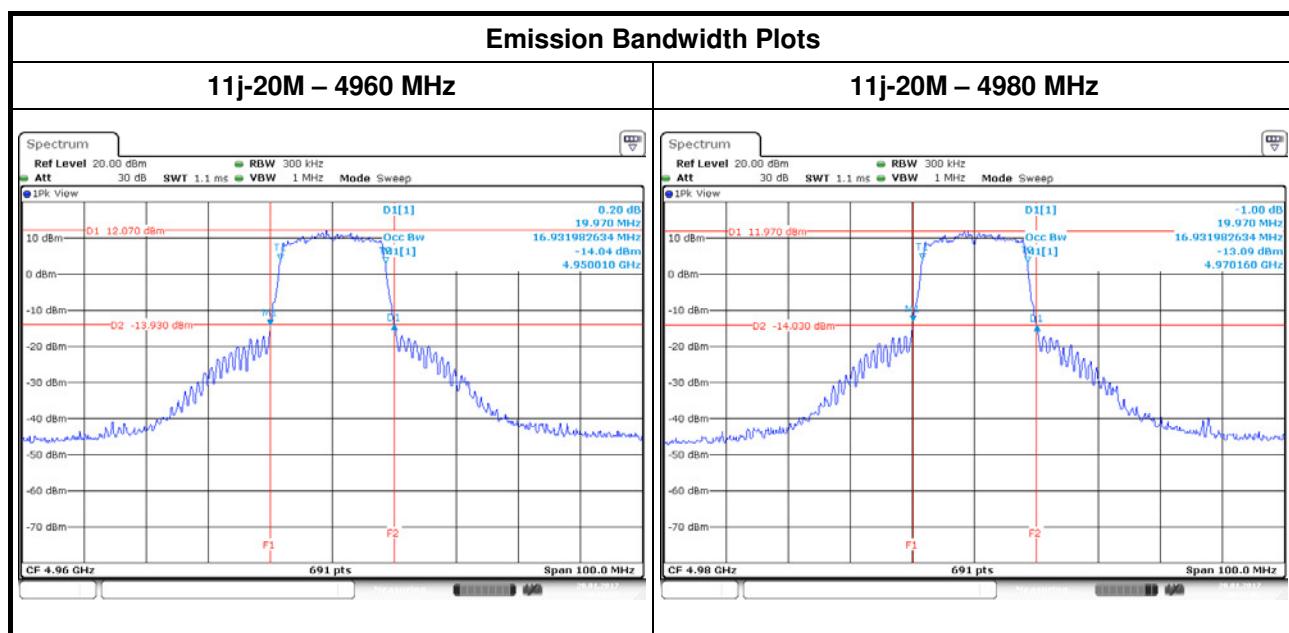




3.2.5 Test Result of Emission Bandwidth

| Emission Bandwidth Result | | |
|---------------------------|---|--------------------------|
| Condition | | Emission Bandwidth (MHz) |
| Modulation Mode | | 99% Bandwidth |
| 11j-20M | 2 | 4960 |
| 11j-20M | 2 | 4980 |
| Limit | | N/A |
| Result | | Complied |

Note 1: N_{TX} = Number of Transmit Chains





3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

| Maximum Conducted Output Power | | |
|--------------------------------|------------------------|-------------------------|
| Channel Bandwidth (MHz) | Low Power Device (dBm) | High Power Device (dBm) |
| 1 | 7 | 20 |
| 5 | 14 | 27 |
| 10 | 17 | 30 |
| 15 | 18.8 | 31.8 |
| 20 | 20 | 33 |

| Antenna Gain vs Maximum Conducted Output Power | |
|---|--|
| Low Power Device | |
| General | If $G_{TX} > 9$ dBi, then $P_{Out} = P - (G_{TX} - 9)$ dBm |
| High Power Device | |
| General | If $G_{TX} > 9$ dBi, then $P_{Out} = P - (G_{TX} - 9)$ dBm |
| point-to-point or point-to-multipoint | If $G_{TX} > 26$ dBi, then $P_{Out} = P - (G_{TX} - 26)$ dBm |
| P_{Out} = reduction maximum conducted output power limit in dBm, P = original w/o reduction maximum conducted output power limit in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi. | |

3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

| Test Method | |
|--|--|
| <input checked="" type="checkbox"/> Maximum Transmitter Power | |
| | <input checked="" type="checkbox"/> Refer as ANSI/TIA-603-D, clause 3.2.1 for power meter measurement. |
| | <input type="checkbox"/> Refer as KDB 971168, clause 4 power over the fundamental signal bandwidth. |
| <input checked="" type="checkbox"/> For conducted measurement. | |
| | <input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain. |
| | <input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. |
| | <input checked="" type="checkbox"/> The EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them. |

3.3.4 Test Setup

RF Output Power (Spectrum Analyzer)



3.3.5 Directional Gain for Power Measurement

Directional Gain (DG) Result

| Transmit Chains No. | | 1 | 2 | - | - |
|-------------------------|----------|----------|----------|------|-----------------|
| Maximum G_{ANT} (dBi) | | 9.00 | 9.00 | - | - |
| Modulation Mode | DG (dBi) | N_{TX} | N_{SS} | STBC | Array Gain (dB) |
| 11j-20M | 9.00 | 2 | 1 | - | - |

Note 1: For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:

Any transmit signals are correlated, Directional Gain = $G_{ANT} + 10 \log(N_{TX})$

All transmit signals are completely uncorrelated, Directional Gain = G_{ANT}

Note 2: For all transmitter outputs with unequal antenna gains, directional gain is to be computed as follows:

Any transmit signals are correlated, Directional Gain = $10 \log[(10^{G1/20} + \dots + 10^{GN/20})^2 / N_{TX}]$

All transmit signals are completely uncorrelated, Directional Gain = $10 \log[(10^{G1/10} + \dots + 10^{GN/10}) / N_{TX}]$

Note 3: For Spatial Multiplexing, Directional Gain (DG) = $G_{ANT} + 10 \log(N_{TX}/N_{SS})$,

where N_{SS} = the number of independent spatial streams data.

Note 4: For CDD transmissions, directional gain is calculated as power measurements:

Directional Gain (DG) = $G_{ANT} + \text{Array Gain}$, where Array Gain is as follows:

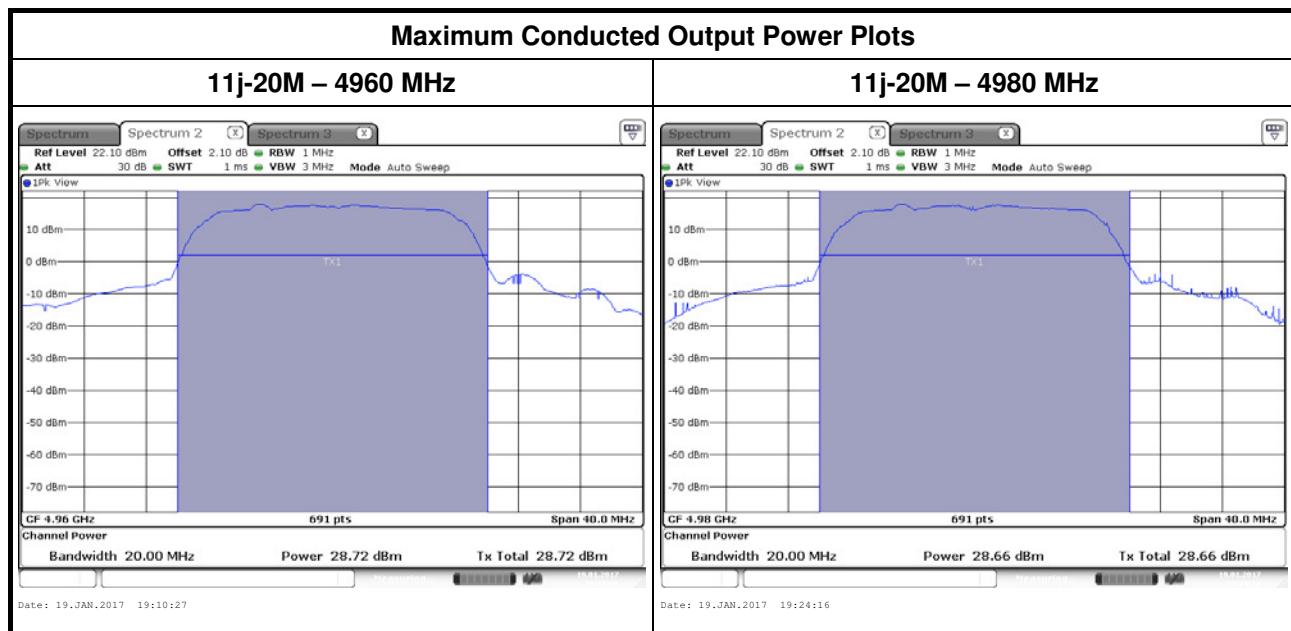
Array Gain = 0 dB (i.e., no array gain) for $N_{TX} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{TX} ;



3.3.6 Test Result of Maximum Conducted Output Power

| Maximum Conducted Output Power | | | | | | | |
|--------------------------------|-----------------|-------------|-----------------------|--------------|-----------|-------------|----------|
| Condition | | | RF Output Power (dBm) | | | | |
| Modulation Mode | N _{TX} | Freq. (MHz) | Chain Port 1 | Chain Port 2 | Sum Chain | Power Limit | DG (dBi) |
| 11j-20M | 2 | 4960 | 28.72 | 28.05 | 31.41 | 33 | 9.00 |
| 11j-20M | 2 | 4980 | 28.66 | 28.42 | 31.55 | 33 | 9.00 |
| Result | | | Complied | | | | |





3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

| Power Spectral Density | |
|----------------------------|-----------------------------|
| Low Power Device (dBm/MHz) | High Power Device (dBm/MHz) |
| 8 | 21 |

| Antenna Gain vs Power Spectral Density | |
|---|--|
| Low Power Device | |
| General | If $G_{TX} > 9$ dBi, then $PSD_{out} = PSD - (G_{TX} - 9)$ dBm |
| High Power Device | |
| General | If $G_{TX} > 9$ dBi, then $PSD_{out} = PSD - (G_{TX} - 9)$ dBm |
| point-to-point or point-to-multipoint | If $G_{TX} > 26$ dBi, then $PSD_{out} = PSD - (G_{TX} - 26)$ dBm |
| PSD_{out} = reduction peak power spectral density limit in dBm, PSD = original w/o reduction power spectral density limit in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi. | |

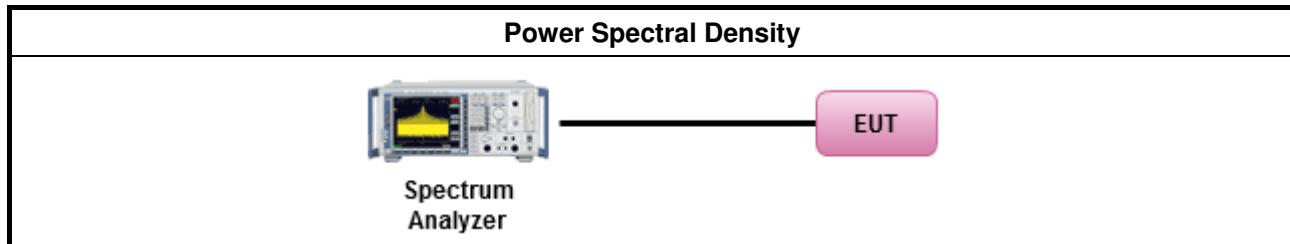
3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

| Test Method | |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | Power Spectral Density |
| <input type="checkbox"/> | Refer as KDB 971168, clause 5.3 power spectral density over the fundamental signal bandwidth. |
| <input checked="" type="checkbox"/> | For conducted measurement. |
| <input type="checkbox"/> | The EUT supports single transmit chain and measurements performed on this transmit chain. |
| <input type="checkbox"/> | The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. |
| <input checked="" type="checkbox"/> | The EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them. |

3.4.4 Test Setup



3.4.5 Directional Gain for Power Spectral Density Measurement

| Directional Gain (DG) Result | | | | | |
|------------------------------|----------|----------|----------|------|-----------------|
| Transmit Chains No. | | 1 | 2 | - | - |
| Maximum G_{ANT} (dBi) | | 9.00 | 9.00 | - | - |
| Modulation Mode | DG (dBi) | N_{TX} | N_{SS} | STBC | Array Gain (dB) |
| 11j-20M | 12.01 | 2 | 1 | - | 3.01 |

Note 1: For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:
Any transmit signals are correlated, Directional Gain = $G_{ANT} + 10 \log(N_{TX})$
All transmit signals are completely uncorrelated, Directional Gain = G_{ANT}

Note 2: For all transmitter outputs with unequal antenna gains, directional gain is to be computed as follows:
Any transmit signals are correlated, Directional Gain = $10 \log[(10^{G_{1/20}} + \dots + 10^{G_{N/20}})^2 / N_{TX}]$
All transmit signals are completely uncorrelated, Directional Gain = $10 \log[(10^{G_{1/10}} + \dots + 10^{G_{N/10}}) / N_{TX}]$

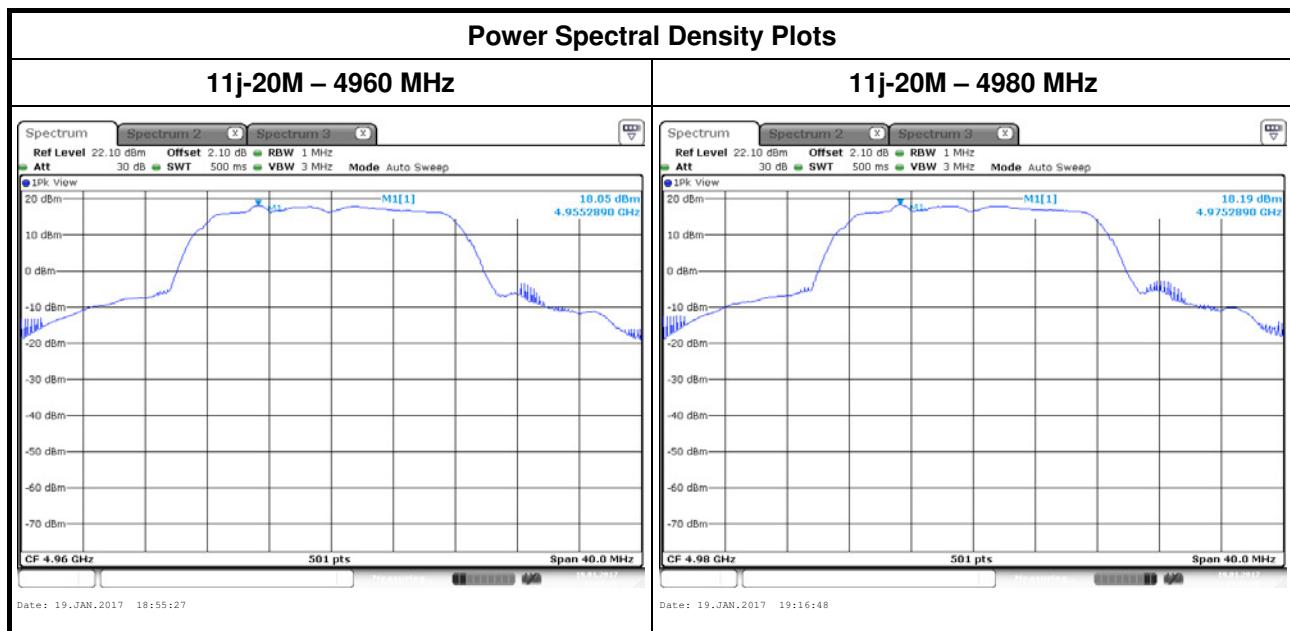
Note 3: For Spatial Multiplexing, Directional Gain (DG) = $G_{ANT} + 10 \log(N_{TX}/N_{SS})$,
where N_{SS} = the number of independent spatial streams data.

Note 4: For CDD transmissions, directional gain is calculated as power spectral density measurements:
Directional Gain (DG) = $G_{ANT} + \text{Array Gain}$, where Array Gain is as follows:
Array Gain = $10 \log(N_{TX}/N_{SS})$;



3.4.6 Test Result of Power Spectral Density

| Power Spectral Density | | | | | | | |
|------------------------|-----------------|-------------|----------------------------------|--------------|-----------|-----------|----------|
| Condition | | | Power Spectral Density (dBm/MHz) | | | | |
| Modulation Mode | N _{TX} | Freq. (MHz) | Chain Port 1 | Chain Port 2 | Sum Chain | PSD Limit | DG (dBi) |
| 11j-20M | 2 | 4960 | 18.05 | 17.38 | 20.74 | 21 | 12.01 |
| 11j-20M | 2 | 4980 | 18.19 | 17.69 | 20.96 | 21 | 12.01 |
| Result | | | Complied | | | | |



3.5 Peak Excursion

3.5.1 Peak Excursion Limit

| Peak Excursion (dB) |
|---------------------|
| 13 |

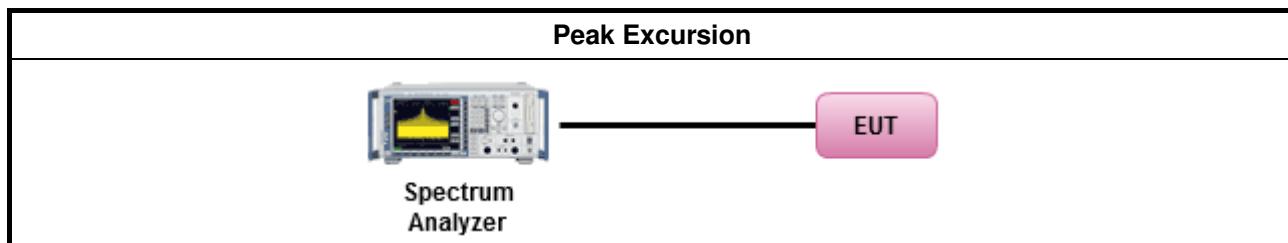
3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

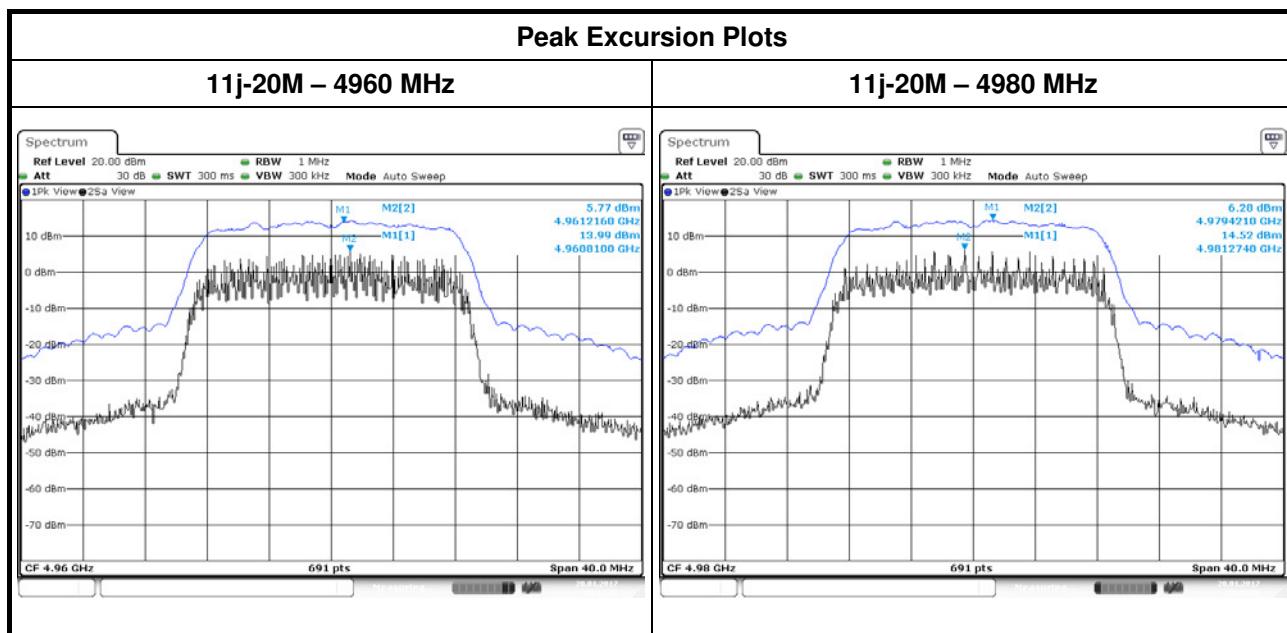
| Test Method |
|---|
| <input checked="" type="checkbox"/> Power Spectral Density |
| <input checked="" type="checkbox"/> Refer as KDB 971168, clause 5.7.2 peak-to-average power ratio (PAPR). |
| <input checked="" type="checkbox"/> For conducted measurement. |
| <input checked="" type="checkbox"/> Testing a single output port is sufficient to demonstrate compliance with the peak excursion. |

3.5.4 Test Setup



3.5.5 Test Result of Peak Excursion

| Peak Excursion Result | | | | |
|-----------------------|-----------------|-------------|---------------------|-----------|
| Modulation Mode | N _{TX} | Freq. (MHz) | Peak Excursion (dB) | Limit(dB) |
| 11j-20M | 2 | 4960 | 8.22 | 13 |
| 11j-20M | 2 | 4980 | 8.24 | 13 |
| Result | | Complied | | |



3.6 Transmit Spectrum Mask

3.6.1 Transmit Spectrum Mask Limit

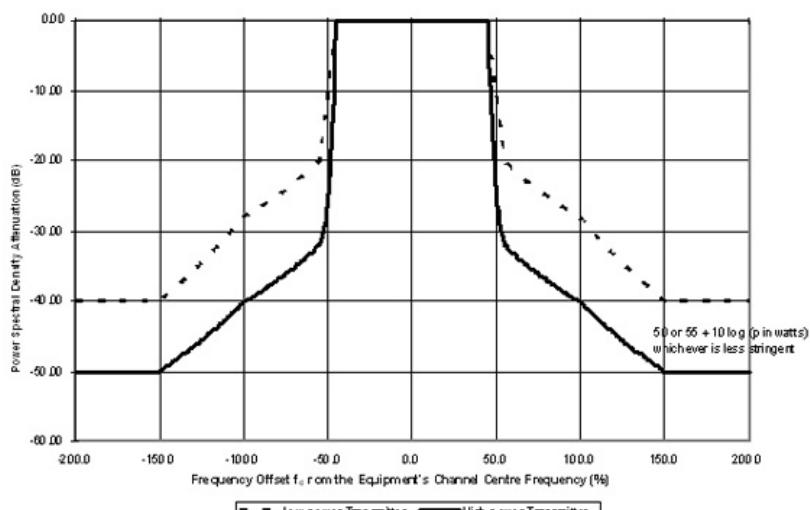
| Offset Frequency f_d (% of the Equipment's Channel Bandwidth) | Minimum Attenuation (dB) | |
|---|--------------------------|--|
| | Low Power Transmitter | High Power Transmitter |
| $0 < f_d \leq 45$ | 0 | 0 |
| $45 < f_d \leq 50$ | $219 \log (f_d/45)$ | $568 \log (f_d/45)$ |
| $50 < f_d \leq 55$ | $10 + 242 \log (f_d/50)$ | $26 + 145 \log (f_d/50)$ |
| $55 < f_d \leq 100$ | $20 + 31 \log (f_d/55)$ | $32 + 31 \log (f_d/55)$ |
| $100 < f_d \leq 150$ | $28 + 68 \log (f_d/100)$ | $40 + 57 \log (f_d/100)$ |
| $f_d > 150$ | 40 | whichever is less stringent 50 or $55 + 10 \log P$ [-25dBm] |

Where: f_d (%) = $((f-f_c)/\text{channel bandwidth}) \times 100$;

P: transmitter's output power (in watts)

The 0 dB reference level in the unwanted emission mask is the maximum in-band power spectral density measured in terms of average power in the equipment's channel bandwidth, using a resolution bandwidth of as close as possible to, without being less than 1% of the occupied bandwidth, and a video bandwidth of 30 kHz. The unwanted power spectral density emissions are also measured using the same resolution and video bandwidths used in measuring the reference in-band power spectral density.

Figure 1: Unwanted Emission Mask for Low- and High-power Transmitters



3.6.2 Measuring Instruments

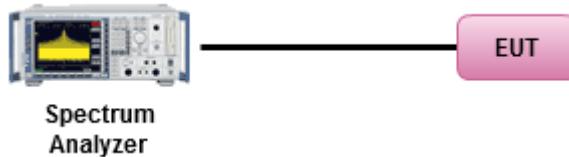
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

| Test Method |
|--|
| <input checked="" type="checkbox"/> The 0 dB level is measured relative to the highest average power of the fundamental emission. The measurements of transmit spectral density are made using resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and 30 kHz video bandwidth. |
| <input checked="" type="checkbox"/> For conducted measurement. <ul style="list-style-type: none"><input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain.<input type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.<input checked="" type="checkbox"/> The EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, when testing emissions against relative emission limits, tests may be performed on each output individually without summing or adding 10 log(N) if the measurements are made relative to the in-band emissions on the individual outputs. All measurements need only to be performed on one of the active transmit chains (antenna outputs). All measurement had be performed on transmit chains 1. |
| <input type="checkbox"/> For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level. |

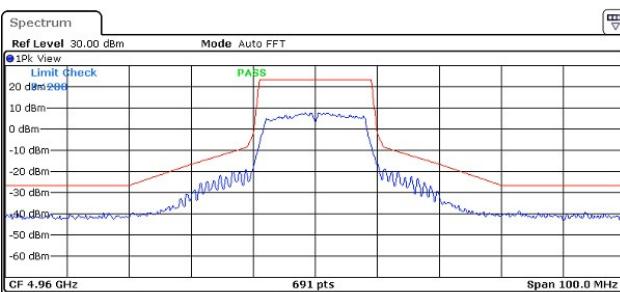
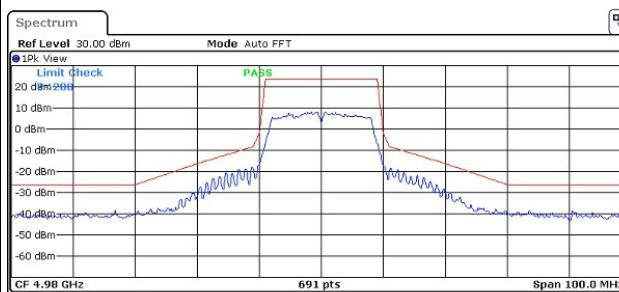
3.6.4 Test Setup

Transmit Spectrum Mask





3.6.5 Test Result of Transmit Spectrum Mask

| Transmit Spectrum Mask Result | | | | | | |
|---|-----------------|-----------------|-------------|------------------------|---------------------|----------|
| Ant. Gain (dBi) | | | 9.00 | Transmit Spectrum Mask | | |
| Condition | Modulation Mode | N _{TX} | Freq. (MHz) | Chain-Port 1 | Chain-Port 2 | Result |
| T _{nom} /V _{nom} | 11j-20M | 2 | 4960 | Under Spectral Mask | Under Spectral Mask | Complied |
| T _{nom} /V _{nom} | 11j-20M | 2 | 4980 | Under Spectral Mask | Under Spectral Mask | Complied |
| 11j-20M – 4960 MHz | | | | 11j-20M – 4980 MHz | | |
|  <p>Spectrum Ref Level: 30.00 dBm Mode: Auto FFT 1pk View Limit Check 20 dBm 0dB 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm CF: 4.96 GHz 691 pts Span: 100.0 MHz</p> <p>Spectrum Emission Mask Tx Power: 23.40 dBm Standard: None Tx Bandwidth: 20.000 MHz RBW: 300.000 kHz Range Low Range Up RBW Frequency Power Abs Power Rel ALimit -50.000 MHz -30.000 MHz 300.000 kHz 4.92674 GHz -39.71 dBm -63.11 dB -13.11 dB -30.000 MHz -20.000 MHz 300.000 kHz 4.93935 GHz -30.70 dBm -54.10 dB -13.45 dB -20.000 MHz -10.000 MHz 300.000 kHz 4.94656 GHz -29.45 dBm -47.85 dB -20.45 dB -11.000 MHz -10.000 MHz 300.000 kHz 4.95008 GHz -22.39 dBm -45.89 dB -14.19 dB -10.000 MHz -9.000 MHz 300.000 kHz 4.95008 GHz -16.37 dBm -39.77 dB -15.94 dB 9.000 MHz 10.000 MHz 300.000 kHz 4.96992 GHz -16.53 dBm -39.92 dB -16.09 dB 10.000 MHz 11.000 MHz 300.000 kHz 4.97092 GHz -20.00 dBm -43.39 dB -11.89 dB 11.000 MHz 20.000 MHz 300.000 kHz 4.97340 GHz -20.41 dBm -43.80 dB -9.67 dB 20.000 MHz 30.000 MHz 300.000 kHz 4.95920 GHz -40.19 dBm -63.59 dB -14.39 dB 30.000 MHz 50.000 MHz 300.000 kHz 4.99263 GHz -38.80 dBm -62.20 dB -12.20 dB</p> | | | | | | |
|  <p>Spectrum Ref Level: 30.00 dBm Mode: Auto FFT 1pk View Limit Check 20 dBm 0dB 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm CF: 4.98 GHz 691 pts Span: 100.0 MHz</p> <p>Spectrum Emission Mask Tx Power: 23.70 dBm Standard: None Tx Bandwidth: 20.000 MHz RBW: 300.000 kHz Range Low Range Up RBW Frequency Power Abs Power Rel ALimit -50.000 MHz -30.000 MHz 300.000 kHz 4.94674 GHz -38.45 dBm -62.15 dB -12.15 dB -30.000 MHz -20.000 MHz 300.000 kHz 4.95036 GHz -38.79 dBm -62.49 dB -12.85 dB -20.000 MHz -10.000 MHz 300.000 kHz 4.95646 GHz -38.45 dBm -62.15 dB -12.15 dB -11.000 MHz -10.000 MHz 300.000 kHz 4.95908 GHz -18.81 dBm -42.51 dB -11.09 dB -10.000 MHz -9.000 MHz 300.000 kHz 4.97008 GHz -15.61 dBm -39.31 dB -15.47 dB 9.000 MHz 10.000 MHz 300.000 kHz 4.98992 GHz -16.36 dBm -40.06 dB -16.23 dB 10.000 MHz 11.000 MHz 300.000 kHz 4.99092 GHz -19.97 dBm -43.67 dB -12.17 dB 11.000 MHz 20.000 MHz 300.000 kHz 4.99659 GHz -22.95 dBm -46.65 dB -9.69 dB 20.000 MHz 30.000 MHz 300.000 kHz 5.00964 GHz -38.54 dBm -62.24 dB -12.60 dB 30.000 MHz 50.000 MHz 300.000 kHz 5.02051 GHz -38.39 dBm -62.09 dB -12.09 dB</p> | | | | | | |

3.7 Transmitter Conducted Unwanted Emissions

3.7.1 Transmitter Conducted Unwanted Emissions Limit

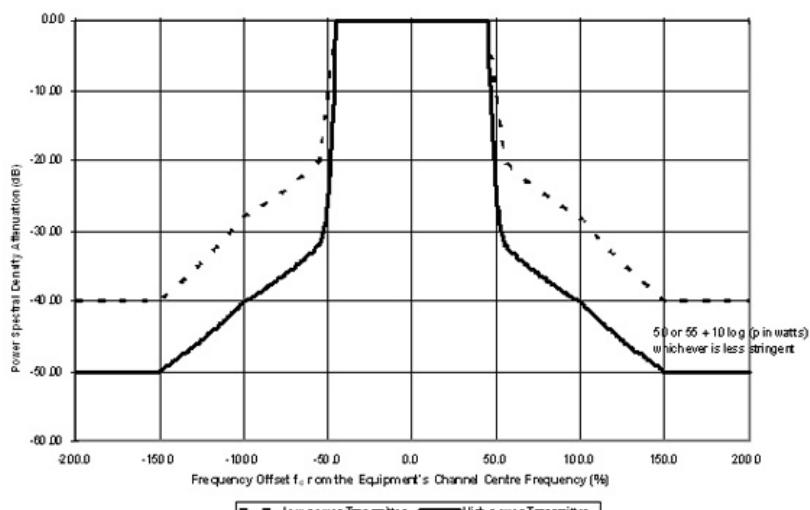
| Offset Frequency f_d (% of the Equipment's Channel Bandwidth) | Minimum Attenuation (dB) | |
|---|--------------------------|--|
| | Low Power Transmitter | High Power Transmitter |
| $0 < f_d \leq 45$ | 0 | 0 |
| $45 < f_d \leq 50$ | $219 \log (f_d/45)$ | $568 \log (f_d/45)$ |
| $50 < f_d \leq 55$ | $10 + 242 \log (f_d/50)$ | $26 + 145 \log (f_d/50)$ |
| $55 < f_d \leq 100$ | $20 + 31 \log (f_d/55)$ | $32 + 31 \log (f_d/55)$ |
| $100 < f_d \leq 150$ | $28 + 68 \log (f_d/100)$ | $40 + 57 \log (f_d/100)$ |
| $f_d > 150$ | 40 | whichever is less stringent 50 or $55 + 10 \log P$ [-25dBm] |

Where: f_d (%) = $((f-f_c)/\text{channel bandwidth}) \times 100$;

p: transmitter's output power (in watts)

The 0 dB reference level in the unwanted emission mask is the maximum in-band power spectral density measured in terms of average power in the equipment's channel bandwidth, using a resolution bandwidth of as close as possible to, without being less than 1% of the occupied bandwidth, and a video bandwidth of 30 kHz. The unwanted power spectral density emissions are also measured using the same resolution and video bandwidths used in measuring the reference in-band power spectral density.

Figure 1: Unwanted Emission Mask for Low- and High-power Transmitters



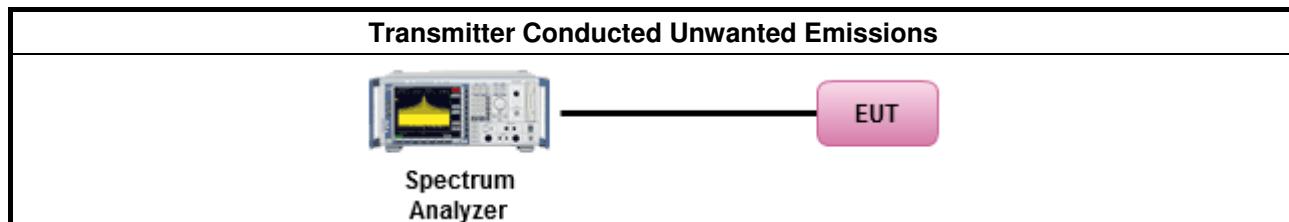
3.7.2 Measuring Instruments

Refer test equipment and calibration data list in test report clause 4.

3.7.3 Test Procedures

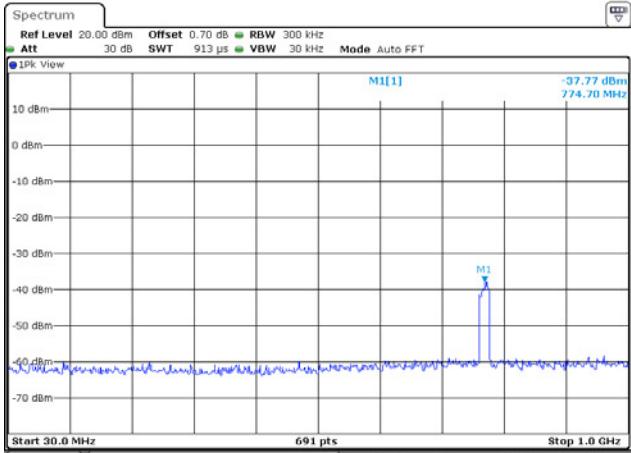
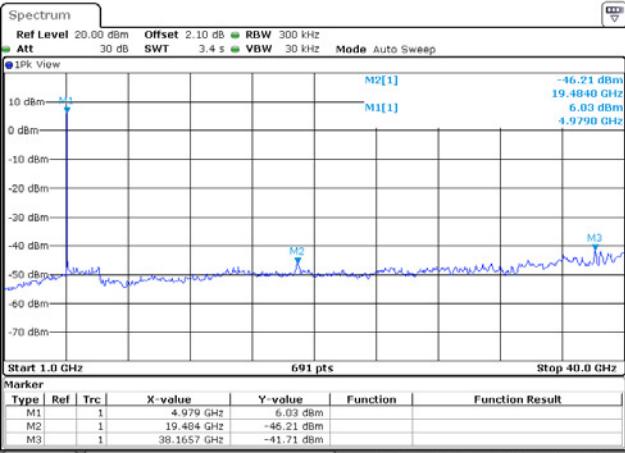
| Test Method |
|---|
| <input checked="" type="checkbox"/> Refer as ANSI/TIA-603-D-2010, clause 3.2.13 for conducted measurement. |
| <input type="checkbox"/> In case a narrower measurement bandwidth was used, the following conversion formula has to be applied: (e.g. if reference bandwidth 1 MHz and measurement bandwidth 100 kHz, then measurement bandwidth conversion factor is 10 dB) $B = A + 10 \log (BW_{ref} / BW_{measured})$ <ul style="list-style-type: none">• A is the value at the narrower measurement bandwidth;• B is the value referred to the reference bandwidth; |
| <input checked="" type="checkbox"/> For conducted measurement. <ul style="list-style-type: none"><input checked="" type="checkbox"/> For conducted measurements on devices with single transmit chain.<input type="checkbox"/> For conducted measurements on devices with multiple transmit chains using options given below:<ul style="list-style-type: none"><input type="checkbox"/> Option 1: measure and sum the spectra across the transmitter outputs.<input type="checkbox"/> Option 2: N transmitter outputs, then spurious emissions limits on each individual output. Measure and add $10 \log (N)$ dB. |

3.7.4 Test Setup





3.7.5 Test Result of Transmitter Conducted Unwanted Emissions

| Transmitter Conducted Unwanted Emissions Result | | | | | | | |
|--|-----------------|-----------------|-------------|---|-------------|-------------|-------------|
| Ant. Gain (dBi) | | | 9.00 | Transmitter Conducted Unwanted Emissions | | | |
| Condition | Modulation Mode | N _{TX} | Freq. (MHz) | Unwanted Freq. (MHz) | Level (dBm) | Margin (dB) | Limit (dBm) |
| T _{nom} V _{nom} | 11j-20M | 2 | 4960 | 753.60 | -38.85 | -13.85 | -25 |
| T _{nom} V _{nom} | 11j-20M | 2 | 4980 | 774.70 | -37.77 | -12.77 | -25 |
| Result | | | | Complied | | | |
| 11j-20M – 4980 MHz | | | | | | | |
| 30 MHz ~ 1 GHz | | | | 1 GHz ~ 40 GHz | | | |
|  | | | |  | | | |

3.8 Transmitter Radiated Unwanted Emissions

3.8.1 Transmitter Radiated Unwanted Emissions Limit

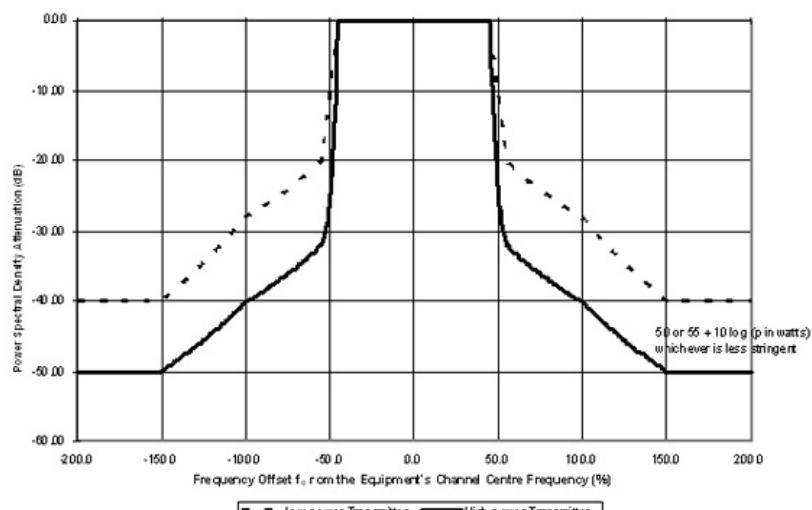
| Offset Frequency f_d (% of the Equipment's Channel Bandwidth) | Minimum Attenuation (dB) | |
|---|--------------------------|--|
| | Low Power Transmitter | High Power Transmitter |
| $0 < f_d \leq 45$ | 0 | 0 |
| $45 < f_d \leq 50$ | $219 \log (f_d/45)$ | $568 \log (f_d/45)$ |
| $50 < f_d \leq 55$ | $10 + 242 \log (f_d/50)$ | $26 + 145 \log (f_d/50)$ |
| $55 < f_d \leq 100$ | $20 + 31 \log (f_d/55)$ | $32 + 31 \log (f_d/55)$ |
| $100 < f_d \leq 150$ | $28 + 68 \log (f_d/100)$ | $40 + 57 \log (f_d/100)$ |
| $f_d > 150$ | 40 | whichever is less stringent 50 or $55 + 10 \log P$ [-25dBm] |

Where: f_d (%) = $((f-f_c)/\text{channel bandwidth}) \times 100$;

P: transmitter's output power (in watts)

The 0 dB reference level in the unwanted emission mask is the maximum in-band power spectral density measured in terms of average power in the equipment's channel bandwidth, using a resolution bandwidth of as close as possible to, without being less than 1% of the occupied bandwidth, and a video bandwidth of 30 kHz. The unwanted power spectral density emissions are also measured using the same resolution and video bandwidths used in measuring the reference in-band power spectral density.

Figure 1: Unwanted Emission Mask for Low- and High-power Transmitters



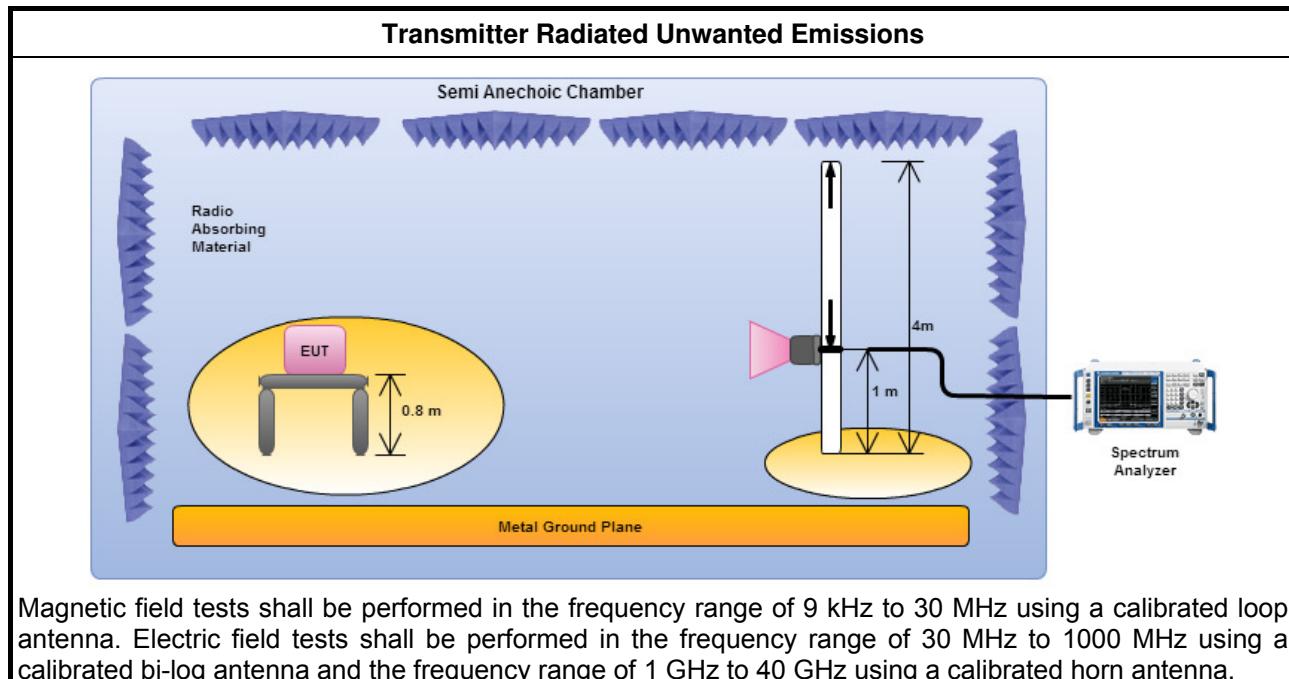
3.8.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.8.3 Test Procedures

| Test Method |
|--|
| <input checked="" type="checkbox"/> Refer as ANSI/TIA-603-D-2010, clause 3.2.12 for radiated measurement. |
| <input type="checkbox"/> In case a narrower measurement bandwidth was used, the following conversion formula has to be applied: (e.g. if reference bandwidth 1 MHz and measurement bandwidth 100 kHz, then measurement bandwidth conversion factor is 10 dB) $B = A + 10 \log (BW_{ref} / BW_{measured})$ <ul style="list-style-type: none">• A is the value at the narrower measurement bandwidth;• B is the value referred to the reference bandwidth; |
| <input checked="" type="checkbox"/> Effective Isotropic Radiated Power (EIRP) |
| <input type="checkbox"/> Refer as KDB 412172, clause 1.3.2 following as power approach. $e.i.r.p. = P_T + G_T$. |
| <input checked="" type="checkbox"/> Refer as KDB 412172, clause 1.3.1 following as field strength approach. $e.i.r.p. = (E \times d)^2 / 30$. |
| <input type="checkbox"/> For radiated measurement. |
| <input type="checkbox"/> Refer as KDB 412172, clause 2.2 following eirp can be used radiated test configuration. |
| <input checked="" type="checkbox"/> Refer as KDB 412172, clause 5 following eirp can be directly determined using the field strength. |
| <input type="checkbox"/> Refer as KDB 412172, clause 6 following eirp can be used signal/antenna substitution techniques. |

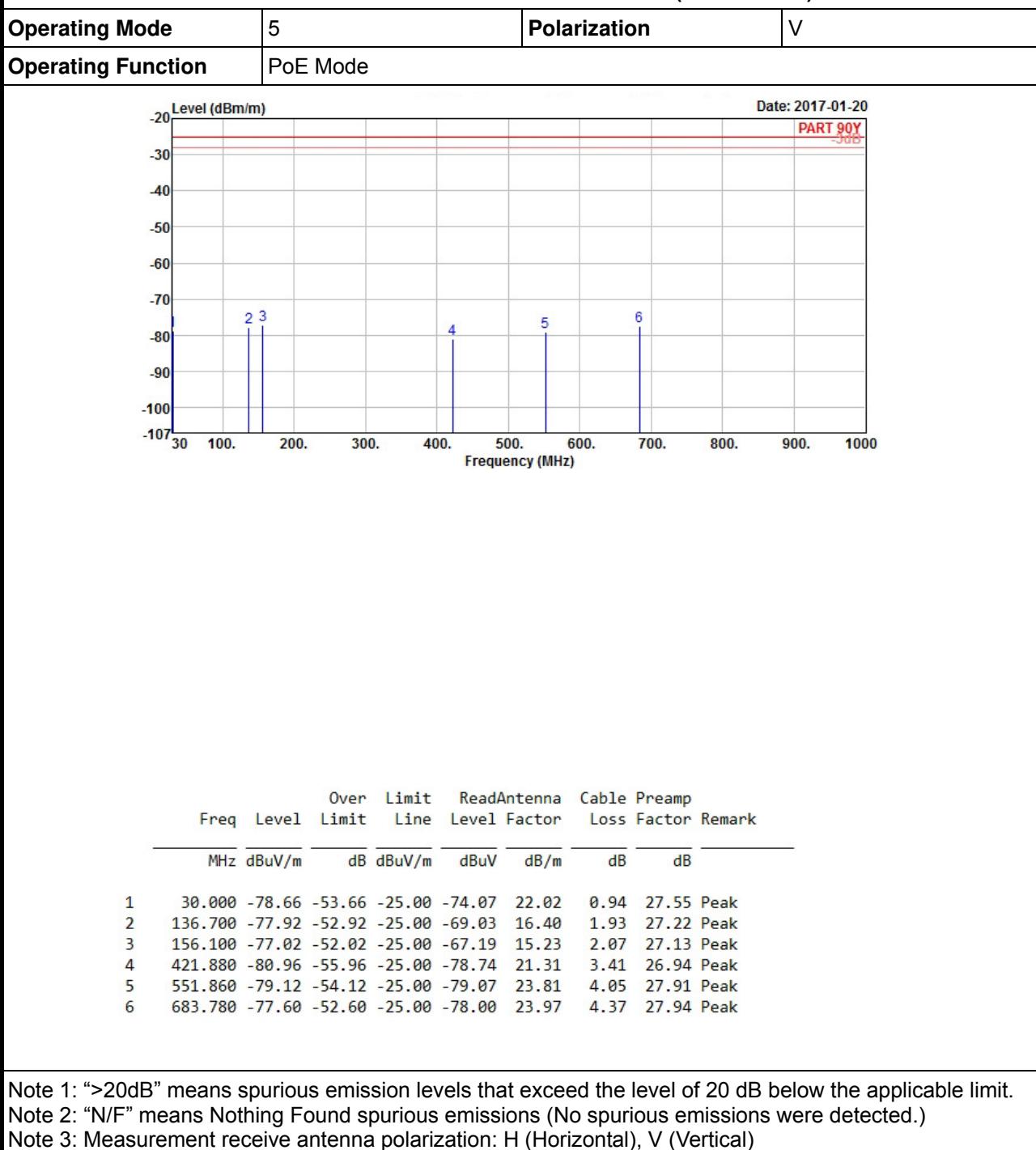
3.8.4 Test Setup

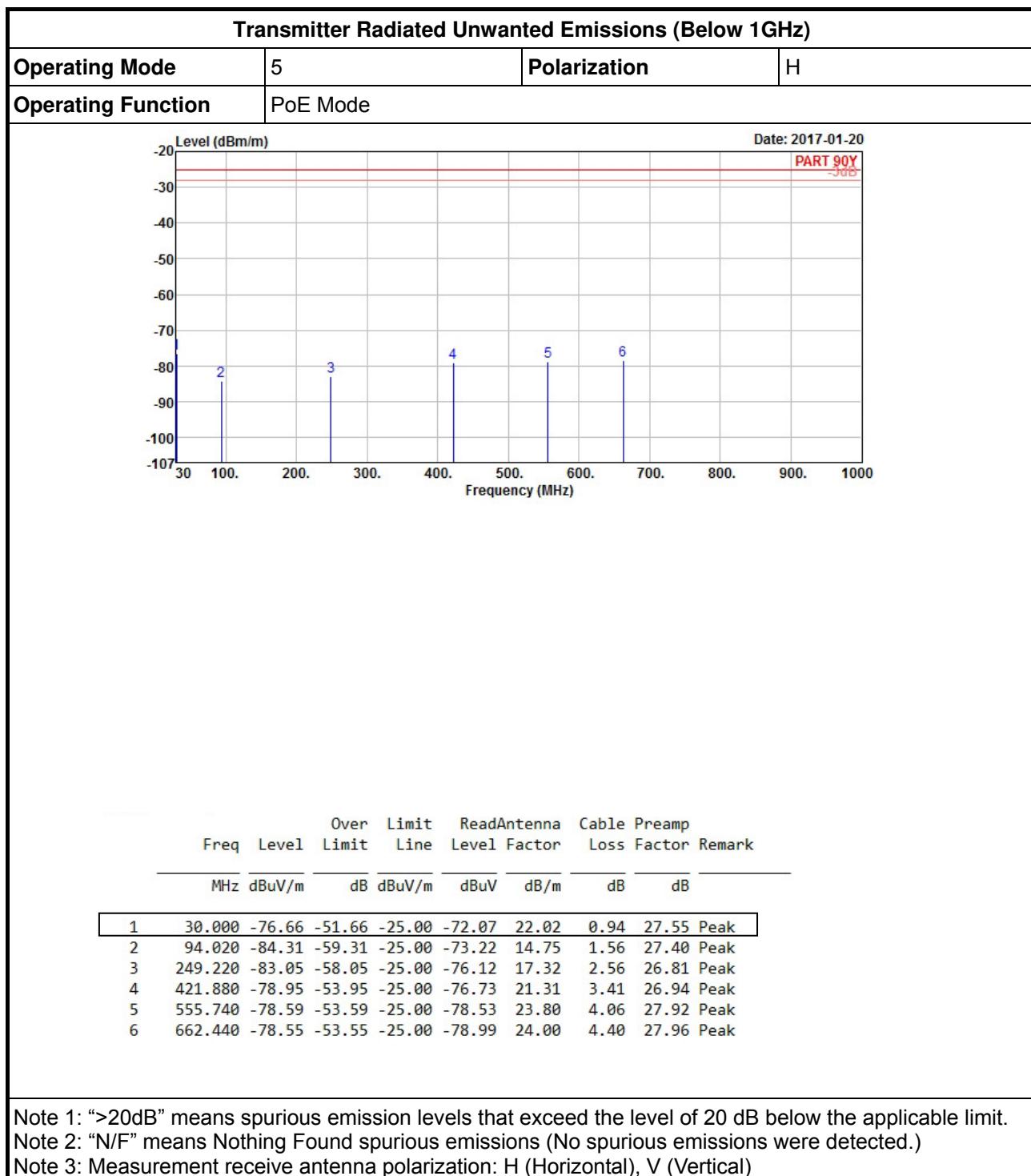




3.8.5 Test Result of Transmitter Radiated Unwanted Emissions (Below 1GHz)

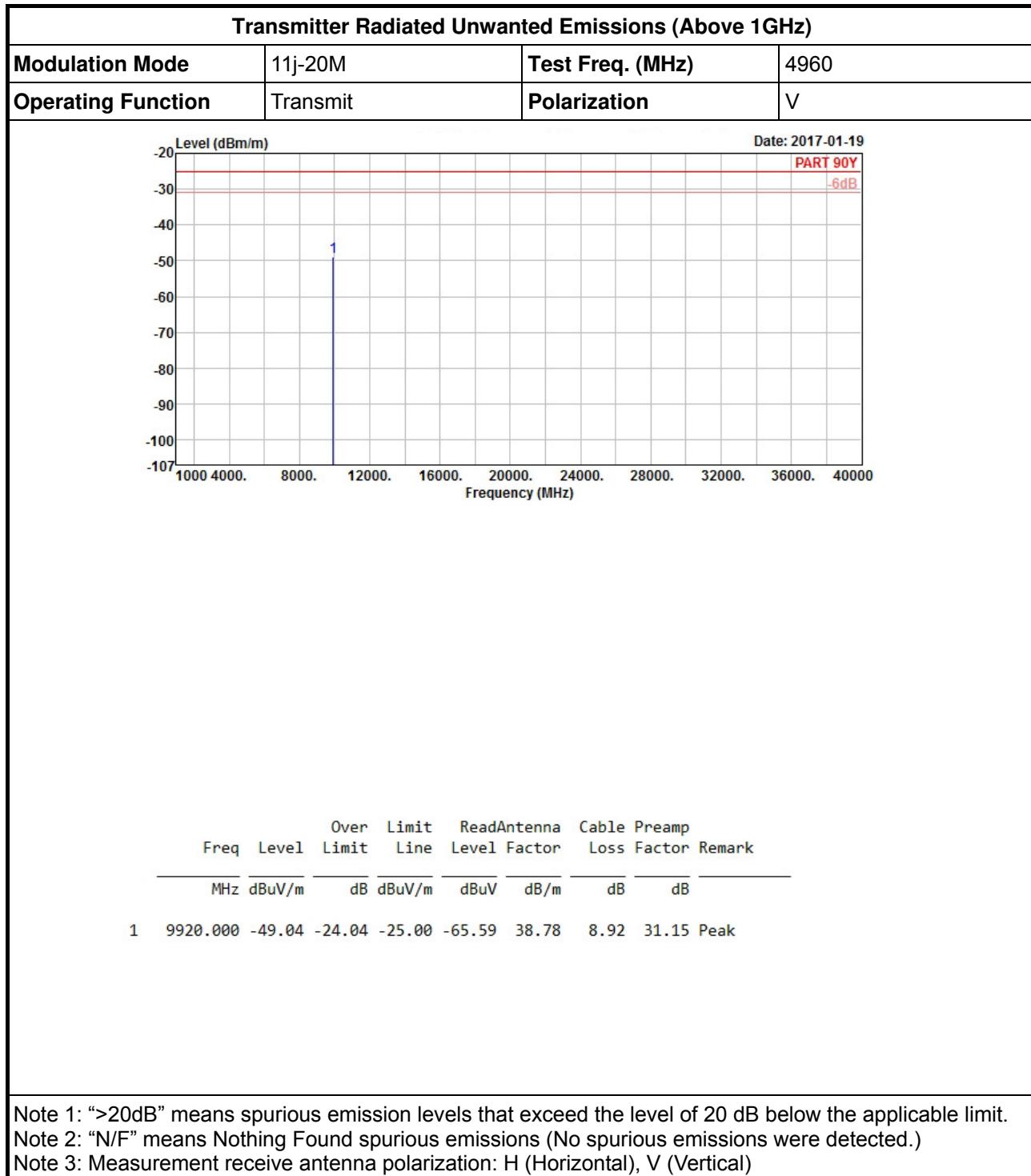
Transmitter Radiated Unwanted Emissions (Below 1GHz)

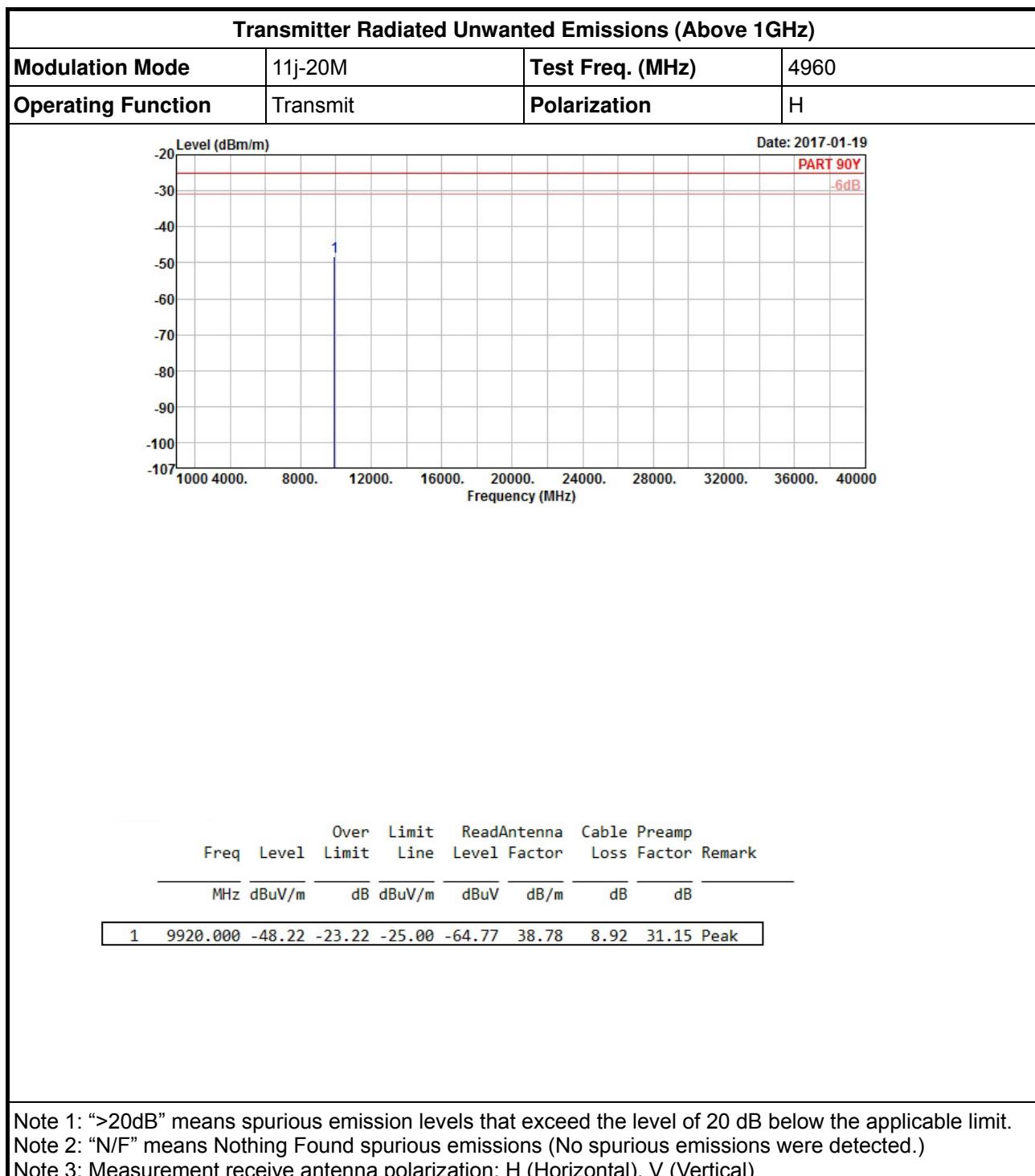


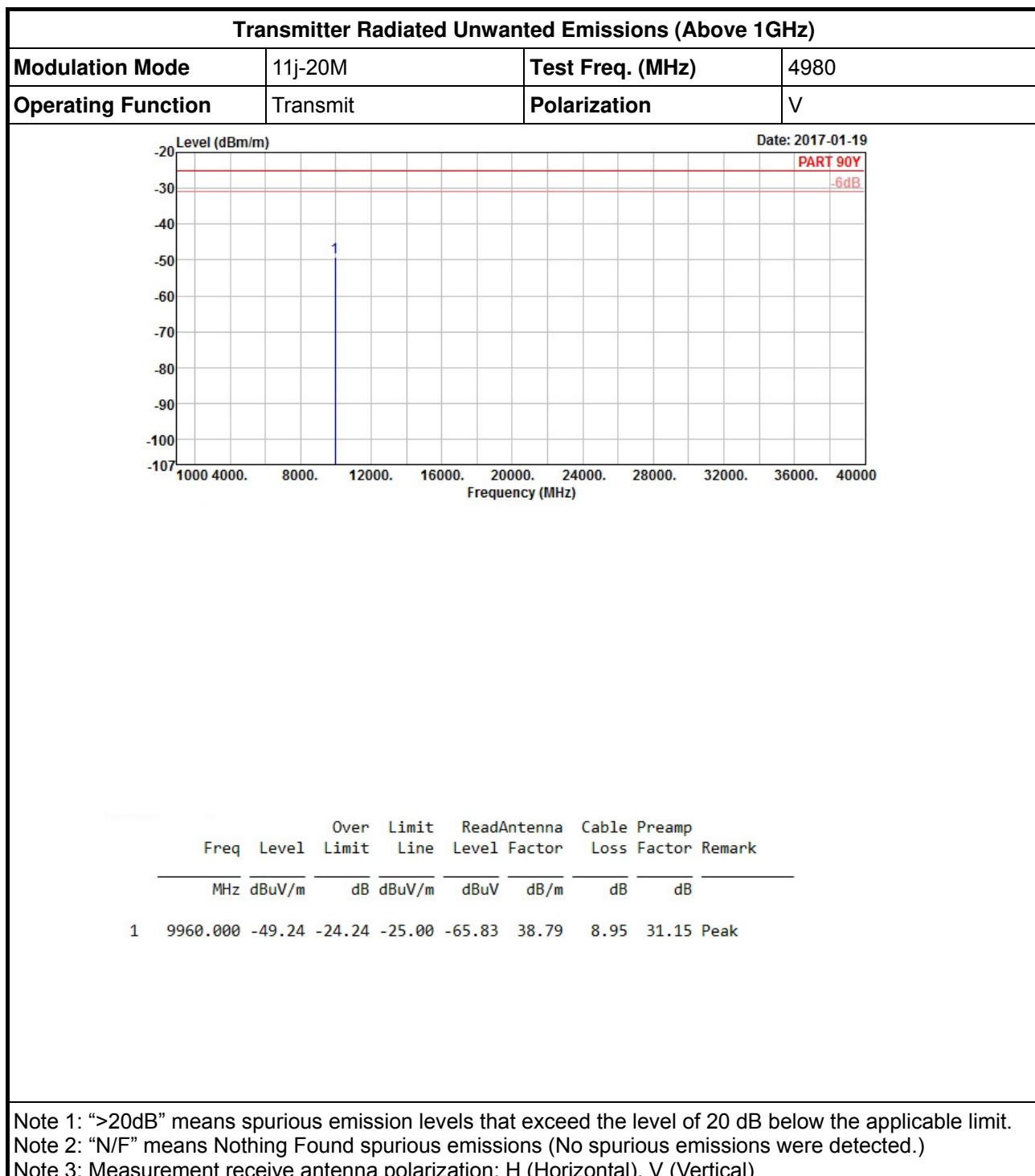


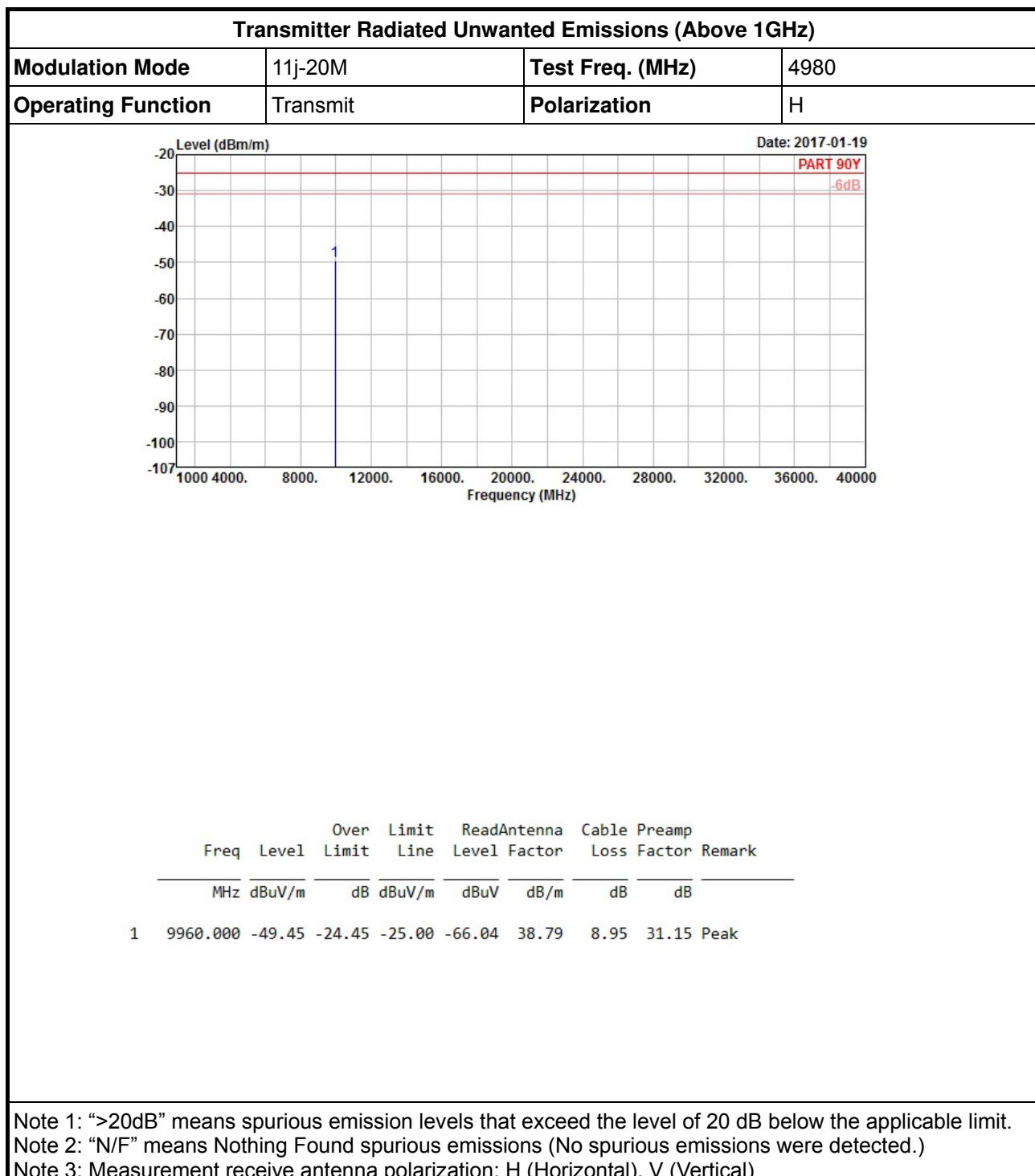


3.8.6 Transmitter Radiated Unwanted Emissions (Above 1GHz)









3.9 Frequency Stability

3.9.1 Frequency Stability Limit

| Frequency Stability Limit |
|---|
| <input checked="" type="checkbox"/> The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized frequency band. |
| Note 1: These measurements shall also be performed at normal and extreme test conditions. |
| Note 2: Refer as FCC Part 90.213. |

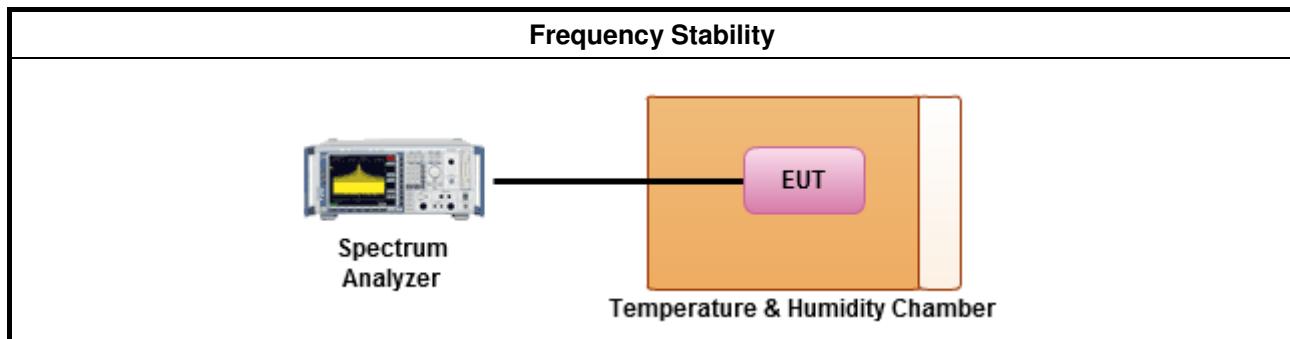
3.9.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.9.3 Test Procedures

| Test Method |
|---|
| <input checked="" type="checkbox"/> Refer as ANSI/TIA-603-D-2010, clause 3.2.2 for frequency stability tests |
| <input checked="" type="checkbox"/> Frequency stability with respect to ambient temperature |
| <input checked="" type="checkbox"/> Frequency stability when varying supply voltage |
| <input checked="" type="checkbox"/> For conducted measurement. |
| <input checked="" type="checkbox"/> For conducted measurements on devices with multiple transmit chains: Measurements need only to be performed on one of the active transmit chains (antenna outputs) |
| <input type="checkbox"/> For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level. |

3.9.4 Test Setup





3.9.5 Test Result of Frequency Stability

| Frequency Stability Result | | | |
|----------------------------|-------------|---------------------------|---------------------------|
| Mode | | Frequency Stability (ppm) | |
| Condition | Freq. (MHz) | Test Frequency (MHz) | Frequency Stability (ppm) |
| T _{20°C} Vmax | 4960 | 4959.98553 | 0.15 |
| T _{20°C} Vmin | 4960 | 4959.98553 | 2.92 |
| T _{20°C} Vnom | 4960 | 4959.98625 | 2.77 |
| T _{-40°C} Vnom | 4960 | 4960.03653 | 7.36 |
| T _{-30°C} Vnom | 4960 | 4960.03427 | 6.91 |
| T _{-20°C} Vnom | 4960 | 4960.02460 | 4.96 |
| T _{-10°C} Vnom | 4960 | 4960.01881 | 3.79 |
| T _{0°C} Vnom | 4960 | 4960.01158 | 2.33 |
| T _{10°C} Vnom | 4960 | 4959.99783 | 0.44 |
| T _{20°C} Vnom | 4960 | 4959.98625 | 2.77 |
| T _{30°C} Vnom | 4960 | 4959.97612 | 4.81 |
| T _{40°C} Vnom | 4960 | 4959.97395 | 5.25 |
| T _{50°C} Vnom | 4960 | 4959.98698 | 2.63 |
| T _{55°C} Vnom | 4960 | 4959.99132 | 1.75 |
| Limit (ppm) | | 10 | |
| Result | | Complied | |

Note 1: Measure at 85 % [Vmin] and 115 % [Vmax] of the nominal voltage [Vnom]. The nominal voltage refer test report clause 1.1.6 for EUT operational condition.



4 Test Equipment and Calibration Data

< AC Conduction >

| Instrument | Manufacturer | Model No. | Serial No. | Spec. | Calibration Date | Calibration Due Date |
|------------------------|--------------------------------|-----------|----------------|-----------------|------------------|----------------------|
| EMC Receiver | R&S | ESR3 | 102051 | 9 kHz ~ 3.6 GHz | 19/Apr/2016 | 18/Apr/2017 |
| LISN | SCHWARZBECK MESS-ELEKTRONIK | NSLK 8127 | 8127-477 | 9 kHz ~ 30 MHz | 26/Jan/2016 | 25/Jan/2017 |
| LISN (Support Unit) | R&S | ENV216 | 101295 | 9 kHz ~ 30 MHz | NCR | NCR |
| RF Cable-CON | HUBER+SUHNER | RG213/U | 07611832020001 | 9 kHz ~ 30 MHz | 24/Oct/2016 | 23/Oct/2017 |
| EMI Filter | LINDGREN | LRE-2030 | 2651 | < 450 Hz | NCR | NCR |

NCR : Non-Calibration Require

< Conducted >

| Instrument | Manufacturer | Model No. | Serial No. | Spec. | Calibration Date | Calibration Due Date |
|----------------------------|--------------|------------------|-------------|-------------------|------------------|----------------------|
| Spectrum Analyzer | R&S | FSV 40 | 101013 | 9 kHz ~ 40 GHz | 16/Feb/2016 | 15/Feb/2017 |
| Signal Generator | R&S | SMR40 | 100116 | 10 MHz ~ 40 GHz | 21/Jul/2016 | 20/Jul/2017 |
| RF Cable-0.5m | HUBER+SUHNER | SUCOFLEX_104 | MY10713/4 | 30 MHz ~ 26.5 GHz | 02/Oct/2016 | 01/Oct/2017 |
| RF Cable-0.5m | HUBER+SUHNER | SUCOFLEX_104 | MY10714/4 | 30 MHz ~ 26.5 GHz | 02/Oct/2016 | 01/Oct/2017 |
| RF Cable-0.5m | HUBER+SUHNER | SUCOFLEX_104 | MY10715/4 | 30 MHz ~ 26.5 GHz | 02/Oct/2016 | 01/Oct/2017 |
| Temp. and Humidity Chamber | Giant Force | GTH-225-40-CP-AR | MAA1611-005 | -40 ~ 100°C | 21/Nov/2016 | 20/Nov/2018 |

< Radiated >

| Instrument | Manufacturer | Model No. | Serial No. | Spec. | Calibration Date | Calibration Due Date |
|--------------------------|----------------|-------------------------|-------------|----------------------|------------------|----------------------|
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 30 MHz ~ 1 GHz 3m | 28/Nov/2016 | 27/Nov/2017 |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 1 GHz ~ 18 GHz 3m | 16/Dec/2016 | 15/Dec/2017 |
| Amplifier | HP | 8447D | 2944A08033 | 10 kHz ~ 1.3 GHz | 10/May/2016 | 09/May/2017 |
| Amplifier | Keysight | 83017A | MY53270197 | 1 GHz ~ 26.5 GHz | 29/Aug/2016 | 28/Aug/2017 |
| Amplifier | MITEQ | JS44-18004000-3 3-8P | 1840917 | 18 GHz ~ 40 GHz | 02/Jun/2015 | 01/Jun/2017 |
| Spectrum | R&S | FSV40 | 101515 | 9 kHz ~ 40 GHz | 16/Feb/2016 | 15/Feb/2017 |
| RF Cable-R03m | Jye Bao | RG142 | CB021 | 9 kHz ~ 1 GHz | 27/Oct/2016 | 26/Oct/2017 |
| RF Cable-high | SUHNER | SUCOFLEX106 | CB222 | 1 GHz ~ 40 GHz | 28/Oct/2016 | 27/Oct/2017 |
| Bilog Antenna | SCHAFFNER | CBL 6112B | 2723 | 30 MHz ~ 1 GHz | 01/Oct/2016 | 30/Sep/2017 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170154 | 18 GHz ~ 40 GHz | 29/Jan/2016 | 28/Jan/2017 |
| Horn Antenna | SCHWARZBECK | BBHA9120D | 1531 | 1 GHz ~ 18 GHz | 22/Apr/2016 | 21/Apr/2017 |
| Loop Antenna | TESEQ | HLA 6120 | 31244 | 9 kHz ~ 30 MHz | 02/Feb/2015 | 01/Feb/2017 |