# FCC RADIO TEST REPORT

| | | |
|---|---|---|
| Applicant | : | Ubiquiti Networks, Inc. |
| Address | : | 685 Third Avenue, 27th Floor New York, New York 10017 USA |
| Equipment | : | AMPLIFI INSTANT |
| Model No. | : | AFi-INS-R, AFi-INS-R-G |
| Trade Name | : | AMPLIFI |
| FCC ID. | : | SWX-AFIR |

**I HEREBY CERTIFY THAT :**

**The sample was received on Aug. 12, 2017 and the testing was carried out on Jul. 30, 2018 at Cerpass Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of Cerpass Technology Corp., the test report shall not be reproduced except in full.**

Approved by:

Mark Liao / Assistant Manager

Tested by:

Spree Yei / Engineer

Laboratory Accreditation:

Cerpass Technology Corporation Test Laboratory

# Contents

History of this test report

| Report No. | Issue Date | Description |
|---|---|---|
| TEFB1807303 | Aug. 06, 2018 | Original |
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# 1. Summary of Test Procedure and Test Results

## 1.1 Applicable Standards

**ANSI C63.4:2014**

**ANSI C63.10:2013**

**FCC Rules and Regulations Part 15 Subpart C §15.247**

| FCC Rule | . Description of Test | Result |
|---|---|---|
| 15.203 | . Antenna Requirement | Pass |
| 15.207 | . AC Power Line Conducted Emission | Pass |
| 15.209<br>15.205 | . Radiated Spurious Emission | Pass |
| 15.247(d) | . Conducted Spurious Emission | Pass |
| 15.247(a)(1) | . Channel Carrier Frequencies Separation | Pass |
| 15.247(a)(1) | . 20dB Bandwidth | Pass |
| 15.247(a)(1) | . Dwell Time | Pass |
| 15.247(b) | . Number of Hopping Channels | Pass |
| 15.247(b) | . Peak Output Power Measurement Data | Pass |

This EUT has been also tested and compiled with the requirement of FCC Part 15, Subpart B, recorded in a separate test report.

# 2. Test Configuration of Equipment under Test

## 2.1 Feature of Equipment under Test

| | |
|---|---|
| Modulation Type | DSSS, OFDM, FHSS, GFSK, π/4-DQPSK, 8DPSK |
| Frequency Range | 802.11b/g/n: 2412-2462MHz<br>802.11a/an/ac: 5150-5250MHz, 5725-5850MHz<br>Bluetooth: 2402-2480MHz<br>BLE: 2402-2480MHz |
| Data Rate | WLAN:<br>802.11b: 1, 2, 5.5, 11Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11n: MCS0 – MCS15, HT20/40<br>802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11ac: MCS0 – MCS9, VHT 20/40/80<br>Bluetooth:<br>GFSK: 1Mbit/s<br>π/4-DQPSK: 2Mbit/s<br>8DPSK: 3Mbit/s<br>BLE:<br>GFSK: 1Mbit/s |
| Antenna Type | Internal Antenna |
| Antenna Gain | 2.4G: ANT A/B: 3.0dBi<br>5G: ANT A/B: 4.0dBi<br>Bluetooth: ANT A: 1.0dBi<br>BLE: ANT A: 1.0dBi |

## 2.2 The Difference of Model No.

The differences between all model numbers as below:

| Model No. | Remark |
|---|---|
| AFi-INS-R | The difference between the two model numbers is color. The gain, pattern, circuit design and layout between of both model numbers are the same. |
| AFi-INS-R-G | |

## 2.3 Carrier Frequency of Channels

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| ***00** | **2402** | 20 | 2422 | 40 | 2442 | 60 | 2462 |
| 01 | 2403 | 21 | 2423 | 41 | 2443 | 61 | 2463 |
| 02 | 2404 | 22 | 2424 | 42 | 2444 | 62 | 2464 |
| 03 | 2405 | 23 | 2425 | 43 | 2445 | 63 | 2465 |
| 04 | 2406 | 24 | 2426 | 44 | 2446 | 64 | 2466 |
| 05 | 2407 | 25 | 2427 | 45 | 2447 | 65 | 2467 |
| 06 | 2408 | 26 | 2428 | 46 | 2448 | 66 | 2468 |
| 07 | 2409 | 27 | 2429 | 47 | 2449 | 67 | 2469 |
| 08 | 2410 | 28 | 2430 | 48 | 2450 | 68 | 2470 |
| 09 | 2411 | 29 | 2431 | 49 | 2451 | 69 | 2471 |
| 10 | 2412 | 30 | 2432 | 50 | 2452 | 70 | 2472 |
| 11 | 2413 | 31 | 2433 | 51 | 2453 | 71 | 2473 |
| 12 | 2414 | 32 | 2434 | 52 | 2454 | 72 | 2474 |
| 13 | 2415 | 33 | 2435 | 53 | 2455 | 73 | 2475 |
| 14 | 2416 | 34 | 2436 | 54 | 2456 | 74 | 2476 |
| 15 | 2417 | 35 | 2437 | 55 | 2457 | 75 | 2477 |
| 16 | 2418 | 36 | 2438 | 56 | 2458 | 76 | 2478 |
| 17 | 2419 | 37 | 2439 | 57 | 2459 | 77 | 2479 |
| 18 | 2420 | 38 | 2440 | 58 | 2460 | ***78** | **2480** |
| 19 | 2421 | ***39** | **2441** | 59 | 2461 | --- | --- |

Note: Channels remarked * are selected to perform test.

## 2.4 Test Mode & Test Software

a. During testing, the interface cables and equipment positions were varied according to ANSI C63.4

b. The complete test system included remote workstation and EUT for RF test. The remote workstation included Notebook.

c. An executive program, ”RTL819x 3.0-2014.0930” under WIN 7 was executed to transmit and receive data via Bluetooth.

d. The following test modes were performed for the test:

| Conducted Emissions from the AC mains power ports | |
|---|---|
| Test Mode | Operating Description |
| 1 | GFSK (1Mbit/s) |
| 2 | $\pi$/4-DQPSK (2Mbit/s) |
| 3 | 8DPSK (3Mbit/s) |
| caused “Test Mode 3” generated the worst case, it was reported as the final data. | |
| Radiation Emissions (30MHz ~ 1GHz) | |
| Test Mode | Operating Description |
| 1 | GFSK (1Mbit/s) |
| 2 | $\pi$/4-DQPSK (2Mbit/s) |
| 3 | 8DPSK (3Mbit/s) |
| caused “Test Mode 3” generated the worst case, it was reported as the final data. | |
| Radiation Emissions (1GHz ~ 25GHz) | |
| Test Mode | Operating Description |
| 1 | GFSK (1Mbit/s) |
| 2 | $\pi$/4-DQPSK (2Mbit/s) |
| 3 | 8DPSK (3Mbit/s) |
| caused “Test Mode 1,3” generated the worst case, these were reported as the final data. | |

## 2.5 Description of Test System

<For conduction & radiation test (below 1GHz) Test>

| Device | Manufacturer | Model No. | Description |
|---|---|---|---|
| Remote workstation | | | |
| Notebook | DELL | LatitudeE5450/5450 | Power Cable, Unshielding, 1.8m |

Use Cable:

| Cable | Quantity | Description |
|---|---|---|
| Network | 1 | Unshielding, 15m |

<For radiation test (above 1GHz) & Others Test>

| Device | Manufacturer | Model No. | Description |
|---|---|---|---|
| Remote workstation | | | |
| Notebook | DELL | INSPIRON 510m | Power Cable, Unshielding, 1.8m |

Use Cable:

| Cable | Quantity | Description |
|---|---|---|
| Network | 1 | Unshielding, 15m |

## 2.6 General Information of Test

| | | |
|---|---|---|
| Test Site | **Cerpass Technology Corporation Test Laboratory**<br>Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.)<br>Tel:+886-3-3226-888<br>Fax:+886-3-3226-881<br>Address: No.68-1, Shihbachongsi, Shihding Township, New Taipei City 223, Taiwan, R.O.C.<br>Tel: +886-2-2663-8582 | |
| | FCC | TW1079, TW1061, TW1439 |
| | IC | 4934E-1, 4934E-2 |
| | VCCI | T-2205 for Telecommunication Test<br>C-4663 for Conducted emission test<br>R-4399, R-4218 for Radiated emission test<br>G-10812, G-10813 for radiated disturbance above 1GHz |
| Frequency Range Investigated: | Conducted: from 150kHz to 30 MHz<br>Radiation: from 30 MHz to 25,000MHz | |
| Test Distance: | The test distance of radiated emission from antenna to EUT is 3 M. | |

## 2.7 Measurement Uncertainty

| Measurement Item | Uncertainty |
|---|---|
| Radiated Spurious Emission(9KHz~30MHz) | ±5.007dB |
| Radiated Spurious Emission(30MHz~1GHz) | ±5.157dB |
| Radiated Spurious Emission(1GHz~18GHz) | ±6.383dB |
| Radiated Spurious Emission(18GHz~40GHz) | ±6.648dB |
| Conducted Spurious Emission | ±1.253dB |
| 6dB Bandwidth | ±6.89% |
| Power Spectral Density | ±0.630dB |
| 26 dB Occupied Bandwidth | ±6.10% |
| Frequency Stability | ±375KHz |
| Channel Frequencies Separation | ±6.10% |
| 20dB Bandwidth | ±6.12% |
| Dwell Time | ±1.34% |
| Peak Output Power(Conducted Power Meter) | ±0.86dB |
| Temperature | ±1.2°C |
| Humidity | ±2.7% |
| Channel Move Time | ±4.53% |
| Channel Closing Transmission Time | ±6.61% |
| Threshold | ±0.631dB |
| Non occupancy period | ±1.17% |

# 3. Test Equipment and Ancillaries Used for Tests

<For radiation test (above 1GHz) & Others Test>

| Instrument | Manufacturer | Model No. | Serial No. | Calibration Date | Valid Date |
|---|---|---|---|---|---|
| EMI Receiver | R&S | ESCI3 | 100443 | 2017/03/07 | 2018/03/06 |
| LISN | Schwarzbeck | NSLK 8127 | 8127-740 | 2016/08/30 | 2017/08/29 |
| LISN | Schwarzbeck | NSLK 8127 | 8127-516 | 2016/09/06 | 2017/09/05 |
| Pulse Limiter | R&S | ESH3-Z2 | 101934 | 2017/02/14 | 2018/02/13 |
| Bilog Antenna | Schwarzbeck | VULB9168 | 369 | 2017/03/15 | 2018/03/14 |
| Active Loop Antenna | EMCO | 6507 | 40855 | 2017/05/15 | 2018/05/14 |
| Horn Antenna | EMCO | 3115 | 31601 | 2016/09/05 | 2017/09/04 |
| Horn Antenna | EMCO | 3116 | 31970 | 2017/03/29 | 2018/03/28 |
| EXA Signal Analyzer | KEYSIGHT | N9010A | MY54200207 | 2017/03/17 | 2018/03/16 |
| Preamplifier | EM | EM330 | 60660 | 2017/02/25 | 2018/02/24 |
| Preamplifier | EMC INSTRUMENTS | EMC051845SE | 980333 | 2016/09/13 | 2017/09/12 |
| Preamplifier | Agilent | 8449B | 3008A01954 | 2017/02/09 | 2018/02/08 |
| Preamplifier | EMC INSTRUMENTS | EMC184045 | 980065 | 2016/11/04 | 2017/11/03 |
| MXG MW Analog Signal Generator | KEYSIGHT | N5183A | MY50142931 | 2017/03/17 | 2018/03/16 |
| Spectrum Analyzer | R&S | FSP40 | 100219 | 2016/09/01 | 2017/08/31 |
| BLUETOOTH TESTER | R&S | CBT | 101133 | 2017/03/10 | 2018/03/09 |
| Attenuator | KEYSIGHT | 8491B | MY39250703 | 2017/03/07 | 2018/03/06 |
| Rotary Attenuator | Agilent | 8495B | MY42146680 | 2017/03/13 | 2018/03/12 |
| Temp & Humi chamber | T-MACHINE | TMJ-9712 | T-12-040111 | 2016/09/05 | 2017/09/04 |
| Series Power Meter | Anritsu | ML2495A | 1224005 | 2017/03/01 | 2018/02/28 |
| Power Sensor | Anritsu | MA2411B | 1207295 | 2017/03/01 | 2018/02/28 |
| Cable | HUBER SUHNER | SUCOFLEX 102 | 28422/2 | 2017/02/25 | 2018/02/24 |
| Cable | HUBER SUHNER | SUCOFLEX 102 | 28418/2 | 2017/02/25 | 2018/02/24 |
| Software | Farad | Ez-EMC | ver.ct3a1 | N/A | N/A |
| Software | AUDIX | E3 | V8.2014-8-6 | N/A | N/A |
| Software | Keysight | N7607B Signal Studio | v2.0.0.1 | N/A | N/A |
| Software | Keysight | Inservice MonitorUtility | N/A | N/A | N/A |

<For conduction & radiation test (below 1GHz) Test>

| Instrument | Manufacturer | Model No. | Serial No. | Calibration Date | Valid Date |
|---|---|---|---|---|---|
| EMI Receiver | R&S | ESCI3 | 100821 | 2017/09/08 | 2018/09/07 |
| LISN | Schwarzbeck | NSLK 8127 | 8127-568 | 2018/02/26 | 2019/02/25 |
| Pulse Limiter | R&S | ESH3-Z2 | 101934 | 2018/02/22 | 2019/02/21 |
| Bilog Antenna | Schwarzbeck | VULB9168 | 275 | 2017/08/31 | 2018/08/30 |
| Active Loop Antenna | EMCO | 6507 | 40855 | 2018/05/22 | 2019/05/21 |
| Horn Antenna | EMCO | 3115 | 31601 | 2017/09/11 | 2018/09/10 |
| Horn Antenna | EMCO | 3116 | 31970 | 2018/03/23 | 2019/03/22 |
| Preamplifier | EM | EM330 | 60658 | 2017/09/08 | 2018/09/07 |
| Preamplifier | EMC INSTRUMENTS | EMC051845SE | 980333 | 2017/09/20 | 2018/09/19 |
| Preamplifier | EMC INSTRUMENTS | EMC184045 | 980065 | 2017/11/10 | 2018/11/09 |
| MXG MW Analog Signal Generator | KEYSIGHT | N5183A | MY50142931 | 2018/04/10 | 2019/04/09 |
| Spectrum Analyzer | R&S | FSP40 | 100219 | 2018/07/03 | 2019/07/02 |
| BLUETOOTH TESTER | R&S | CBT | 101133 | 2018/04/02 | 2019/04/01 |
| Attenuator | KEYSIGHT | 8491B | MY39250705 | 2017/09/04 | 2018/09/03 |
| Rotary Attenuator | Agilent | 8495B | MY42146680 | 2018/03/29 | 2019/03/28 |
| Temp & Humi chamber | T-MACHINE | TMJ-9712 | T-12-040111 | 2017/09/04 | 2018/09/03 |
| Series Power Meter | Anritsu | ML2495A | 1224005 | 2018/03/23 | 2019/03/22 |
| Power Sensor | Anritsu | MA2411B | 1207295 | 2018/03/23 | 2019/03/22 |
| Software | Farad | Ez-EMC | ver.ct3a1 | N/A | N/A |
| Software | AUDIX | E3 | V8.2014-8-6 | N/A | N/A |
| Software | Keysight | N7607B Signal Studio | V3.0.0.0 | N/A | N/A |
| Software | Keysight | Inservice MonitorUtility | N/A | N/A | N/A |

# 4. Antenna Requirements

## 4.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

## 4.2 Antenna Construction and Directional Gain

| | |
|---|---|
| Antenna Type | Internal Antenna |
| Antenna Gain | 1.0 dBi |

# 5. Test of AC Power Line Conducted Emission

## 5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

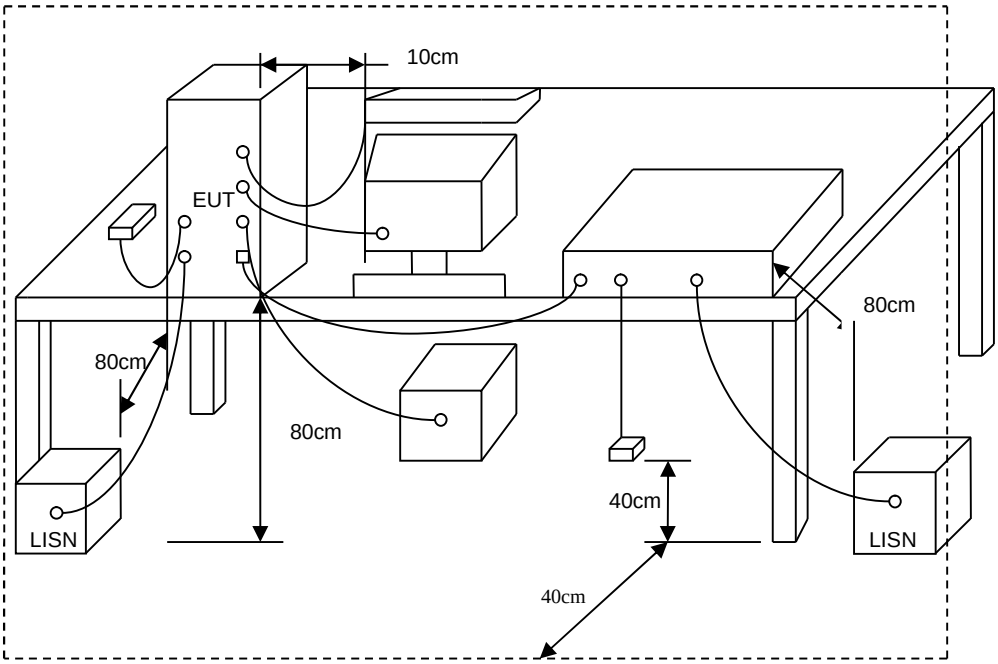
| Frequency (MHz) | Quasi Peak (dB μ V) | Average (dB μ V) |
|---|---|---|
| 0.15 – 0.5 | 66-56* | 56-46* |
| 0.5 – 5.0 | 56 | 46 |
| 5.0 – 30.0 | 60 | 50 |

*Decreases with the logarithm of the frequency.

## 5.2 Test Procedures

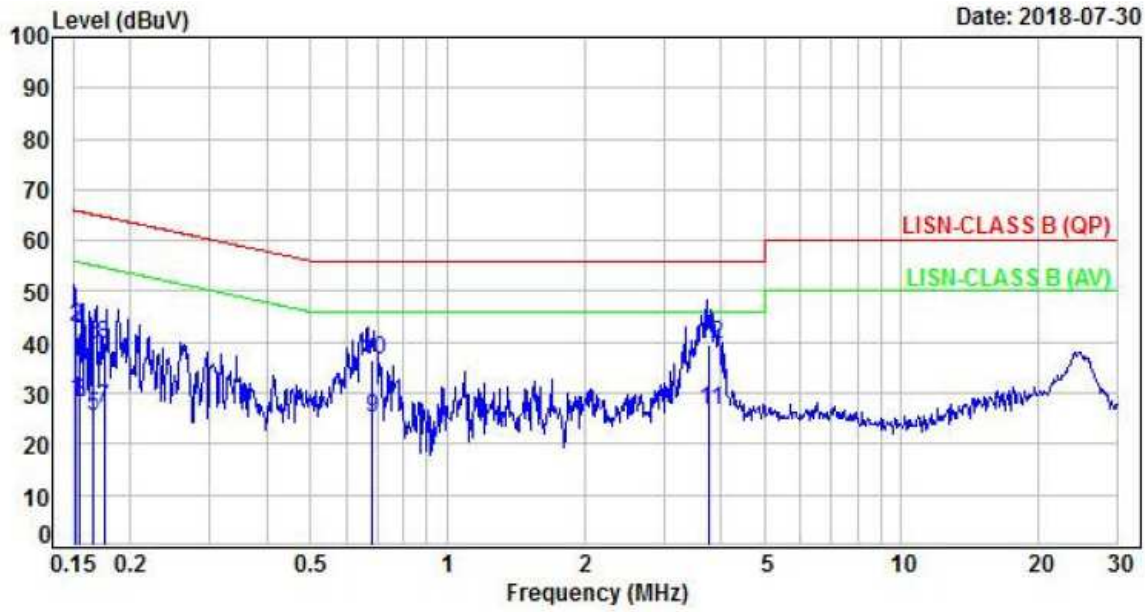
a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
c. All the support units are connecting to the other LISN.
d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
f. Both sides of AC line were checked for maximum conducted interference.
g. The frequency range from 150 kHz to 30 MHz was searched.
h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

## 5.3 Typical Test Setup



## 5.4 Test Result and Data

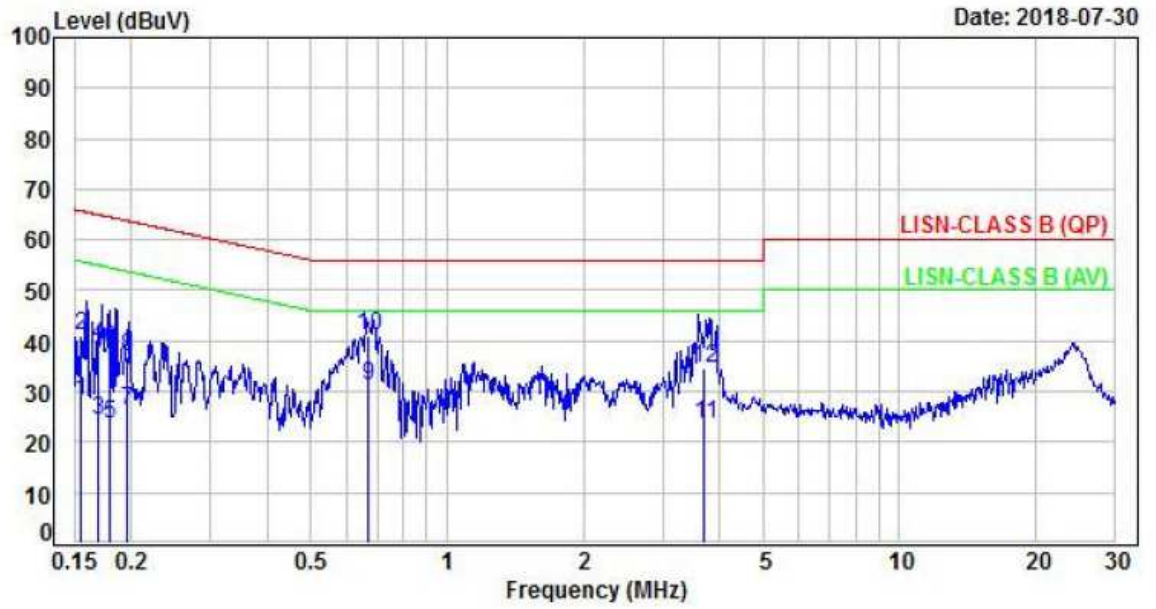
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | LINE |
| Test Mode | : | Mode 3 | Temperature | : | 20 °C |
| Test date | : | Jul. 30, 2018 | Humidity | : | 40 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.15 | 9.94 | 18.61 | 28.55 | 55.93 | -27.38 | Average | P |
| 2 | 0.15 | 9.94 | 33.13 | 43.07 | 65.93 | -22.86 | QP | P |
| 3 | 0.15 | 9.94 | 18.35 | 28.29 | 55.75 | -27.46 | Average | P |
| 4 | 0.15 | 9.94 | 31.71 | 41.65 | 65.75 | -24.10 | QP | P |
| 5 | 0.17 | 9.94 | 15.37 | 25.31 | 55.19 | -29.88 | Average | P |
| 6 | 0.17 | 9.94 | 29.56 | 39.50 | 65.19 | -25.69 | QP | P |
| 7 | 0.18 | 9.94 | 17.21 | 27.15 | 54.71 | -27.56 | Average | P |
| 8 | 0.18 | 9.94 | 29.60 | 39.54 | 64.71 | -25.17 | QP | P |
| 9 | 0.69 | 9.97 | 15.19 | 25.16 | 46.00 | -20.84 | Average | P |
| 10 | 0.69 | 9.97 | 26.63 | 36.60 | 56.00 | -19.40 | QP | P |
| 11 | 3.79 | 10.12 | 16.51 | 26.63 | 46.00 | -19.37 | Average | P |
| 12 | 3.79 | 10.12 | 29.49 | 39.61 | 56.00 | -16.39 | QP | P |

Note: Level = Reading + Factor
Margin = Level – Limit
Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss+ Attenuator

| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | NEUTRAL |
| Test Mode | : | Mode 3 | Temperature | : | 20 °C |
| Test date | : | Jul. 30, 2018 | Humidity | : | 40 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | P/F |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.16 | 9.94 | 18.13 | 28.07 | 55.72 | -27.65 | Average | P |
| 2 | 0.16 | 9.94 | 31.27 | 41.21 | 65.72 | -24.51 | QP | P |
| 3 | 0.17 | 9.94 | 14.55 | 24.49 | 55.03 | -30.54 | Average | P |
| 4 | 0.17 | 9.94 | 29.41 | 39.35 | 65.03 | -25.68 | QP | P |
| 5 | 0.18 | 9.94 | 13.78 | 23.72 | 54.48 | -30.76 | Average | P |
| 6 | 0.18 | 9.94 | 28.50 | 38.44 | 64.48 | -26.04 | QP | P |
| 7 | 0.20 | 9.94 | 16.43 | 26.37 | 53.80 | -27.43 | Average | P |
| 8 | 0.20 | 9.94 | 26.82 | 36.76 | 63.80 | -27.04 | QP | P |
| 9 | 0.67 | 9.97 | 21.22 | 31.19 | 46.00 | -14.81 | Average | P |
| 10 | 0.67 | 9.97 | 30.95 | 40.92 | 56.00 | -15.08 | QP | P |
| 11 | 3.70 | 10.12 | 13.39 | 23.51 | 46.00 | -22.49 | Average | P |
| 12 | 3.70 | 10.12 | 24.51 | 34.63 | 56.00 | -21.37 | QP | P |

Note: Level = Reading + Factor
Margin = Level – Limit
Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss+ Attenuator

# 6. Test of Radiated Spurious Emission

## 6.1 Test Limit

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2014. The EUT was placed, 0.8 meter above the ground plane, as shown in section 5.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions
For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency (MHz) | Distance Meters | Radiated (μ V / M) | Radiated (dB μ V/ M) |
|---|---|---|---|
| 30-88 | 3 | 100 | 40.0 |
| 88-216 | 3 | 150 | 43.5 |
| 216-960 | 3 | 200 | 46.0 |
| Above 960 | 3 | 500 | 54.0 |

For unintentional device, according to CISPR PUB.22, for Class B digital devices, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 10 meters shall not exceed the above table.

| Frequency (MHz) | Distance Meters | Radiated (dB μ V/ M) |
|---|---|---|
| 30-230 | 10 | 30 |
| 230-1000 | 10 | 37 |

## 6.2 Test Procedures

a. The EUT was placed on a rotatable table top 0.8 meter above ground.

b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.

c. The table was rotated 360 degrees to determine the position of the highest radiation.

d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.

e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.

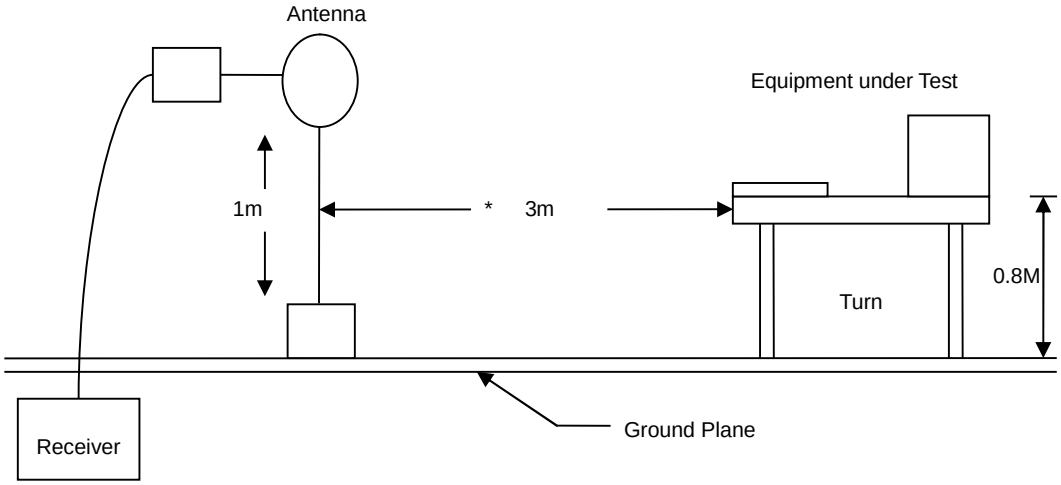
f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.

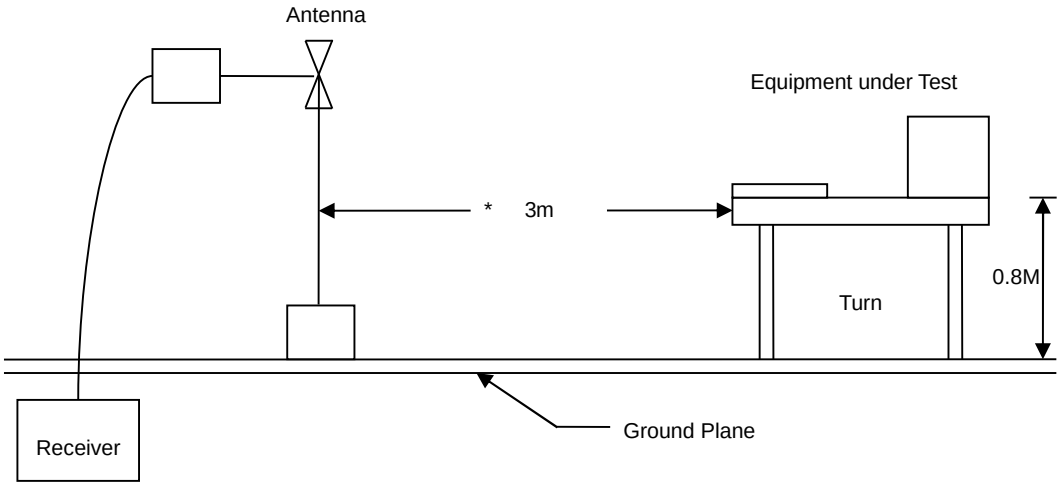
h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

## 6.3 Typical Test Setup

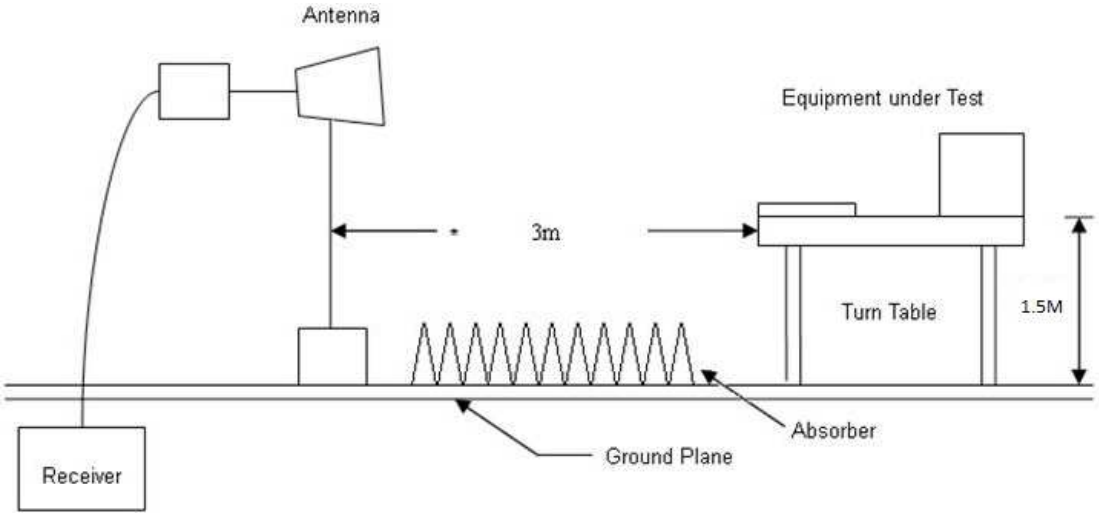
Below 30MHz test setup




30MHz- 1GHz Test Setup




Above 1GHz Test Setup

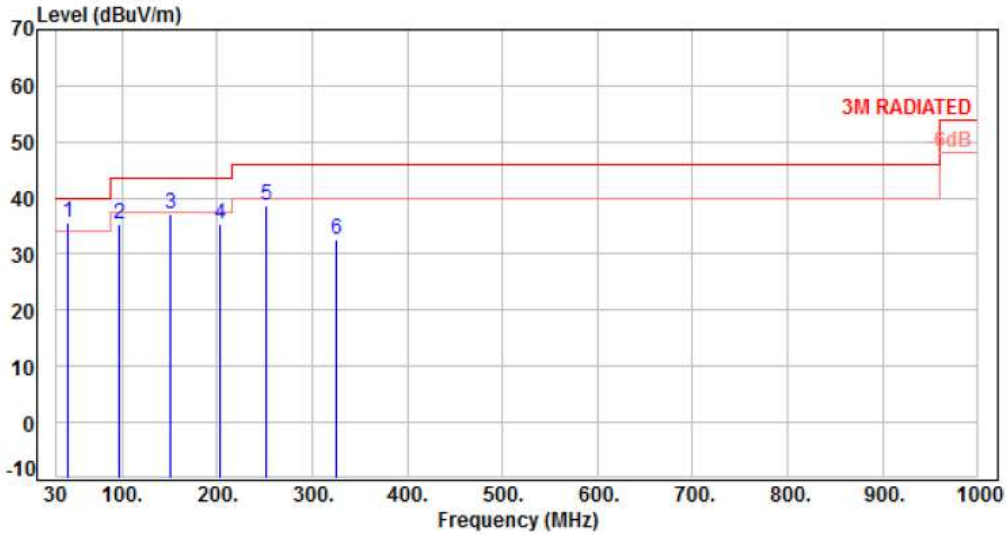


## 6.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz-30MHz spurious emission is under limit 20dB more.

## 6.5 Test Result and Data (30MHz ~ 1GHz)

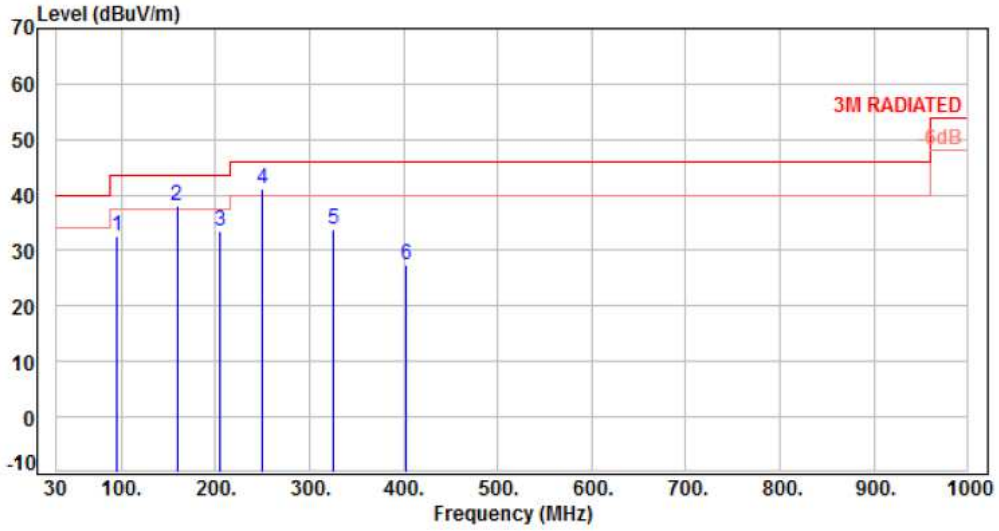
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 3 | Temperature | : | 23 °C |
| Test Date | : | Jul. 27, 2018 | Humidity | : | 62 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 43.58 | -10.86 | 46.42 | 35.56 | 40.00 | -4.44 | Peak | 400 | 0 | P |
| 2 | 96.93 | -16.15 | 51.56 | 35.41 | 43.50 | -8.09 | Peak | 400 | 0 | P |
| 3 | 151.25 | -11.04 | 48.16 | 37.12 | 43.50 | -6.38 | Peak | 400 | 0 | P |
| 4 | 203.63 | -13.00 | 48.22 | 35.22 | 43.50 | -8.28 | Peak | 400 | 0 | P |
| 5 | 252.13 | -11.59 | 50.31 | 38.72 | 46.00 | -7.28 | Peak | 400 | 0 | P |
| 6 | 324.88 | -9.22 | 41.73 | 32.51 | 46.00 | -13.49 | Peak | 400 | 0 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 3 | Temperature | : | 23 °C |
| Test Date | : | Jul. 27, 2018 | Humidity | : | 62 % |

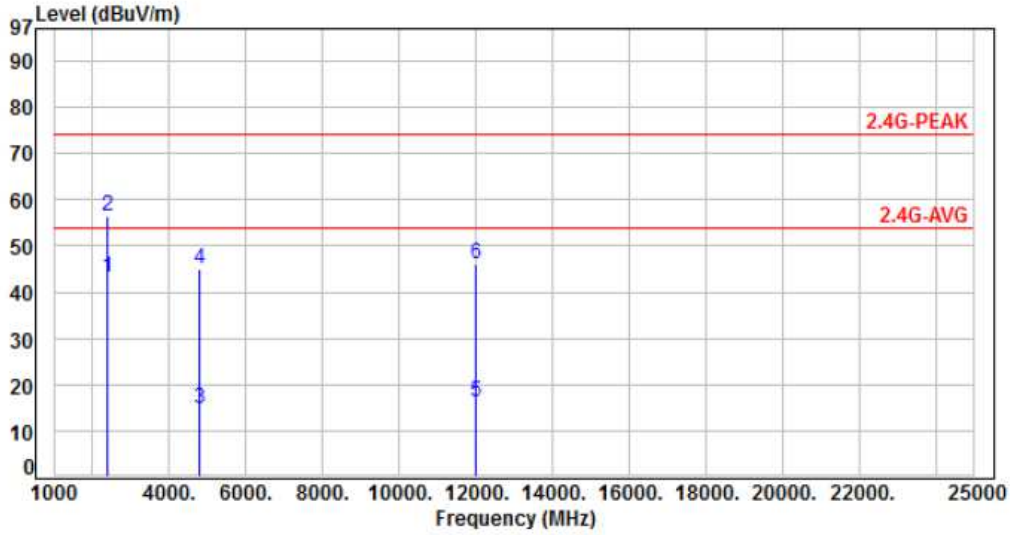



| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 95.96 | -16.23 | 48.92 | 32.69 | 43.50 | -10.81 | Peak | 100 | 0 | P |
| 2 | 159.01 | -10.86 | 49.01 | 38.15 | 43.50 | -5.35 | Peak | 100 | 0 | P |
| 3 | 204.60 | -12.98 | 46.58 | 33.60 | 43.50 | -9.90 | Peak | 100 | 0 | P |
| 4 | 249.22 | -11.66 | 52.74 | 41.08 | 46.00 | -4.92 | Peak | 100 | 0 | P |
| 5 | 324.88 | -9.22 | 43.15 | 33.93 | 46.00 | -12.07 | Peak | 100 | 0 | P |
| 6 | 403.45 | -7.01 | 34.50 | 27.49 | 46.00 | -18.51 | Peak | 100 | 0 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

## 6.6 Test Result and Data (1GHz ~ 25GHz)

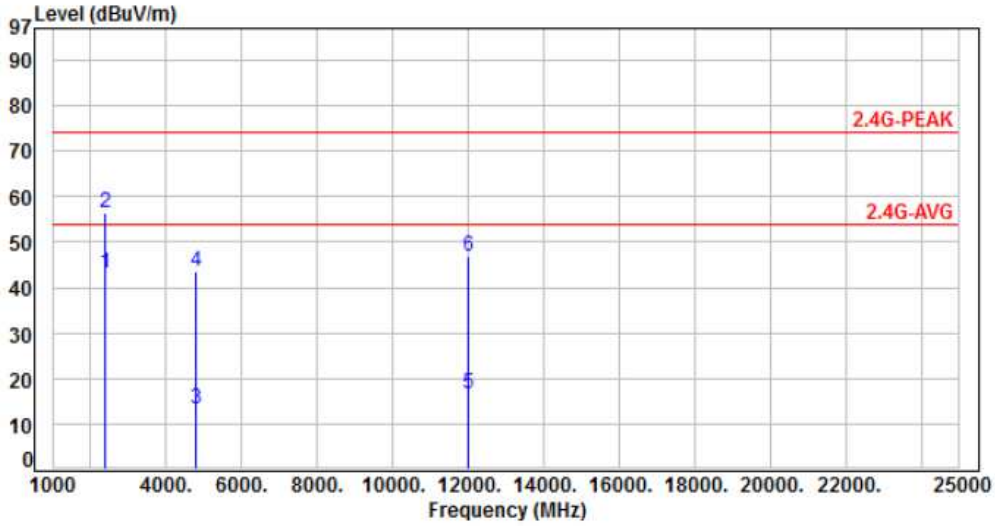
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 1, CH00 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.14 | 43.11 | 54.00 | -10.89 | Average | 168 | 302 | P |
| 2 | 2390.00 | -19.03 | 75.37 | 56.34 | 74.00 | -17.66 | Peak | 168 | 302 | P |
| 3 | 4804.00 | -13.36 | 28.15 | 14.79 | 54.00 | -39.21 | Average | 177 | 340 | P |
| 4 | 4804.00 | -13.36 | 58.25 | 44.89 | 74.00 | -29.11 | Peak | 177 | 340 | P |
| 5 | 12010.00 | -6.08 | 22.17 | 16.09 | 54.00 | -37.91 | Average | 149 | 288 | P |
| 6 | 12010.00 | -6.08 | 52.27 | 46.19 | 74.00 | -27.81 | Peak | 149 | 288 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

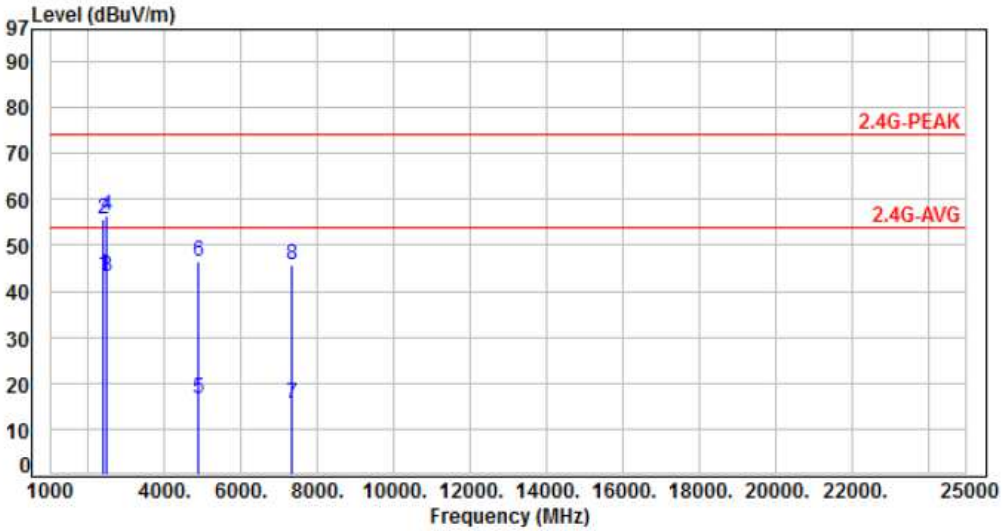
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 1, CH00 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.25 | 43.22 | 54.00 | -10.78 | Average | 102 | 247 | P |
| 2 | 2390.00 | -19.03 | 75.55 | 56.52 | 74.00 | -17.48 | Peak | 102 | 247 | P |
| 3 | 4804.00 | -13.36 | 26.81 | 13.45 | 54.00 | -40.55 | Average | 371 | 33 | P |
| 4 | 4804.00 | -13.36 | 56.91 | 43.55 | 74.00 | -30.45 | Peak | 371 | 33 | P |
| 5 | 12010.00 | -6.08 | 22.67 | 16.59 | 54.00 | -37.41 | Average | 161 | 245 | P |
| 6 | 12010.00 | -6.08 | 52.77 | 46.69 | 74.00 | -27.31 | Peak | 161 | 245 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

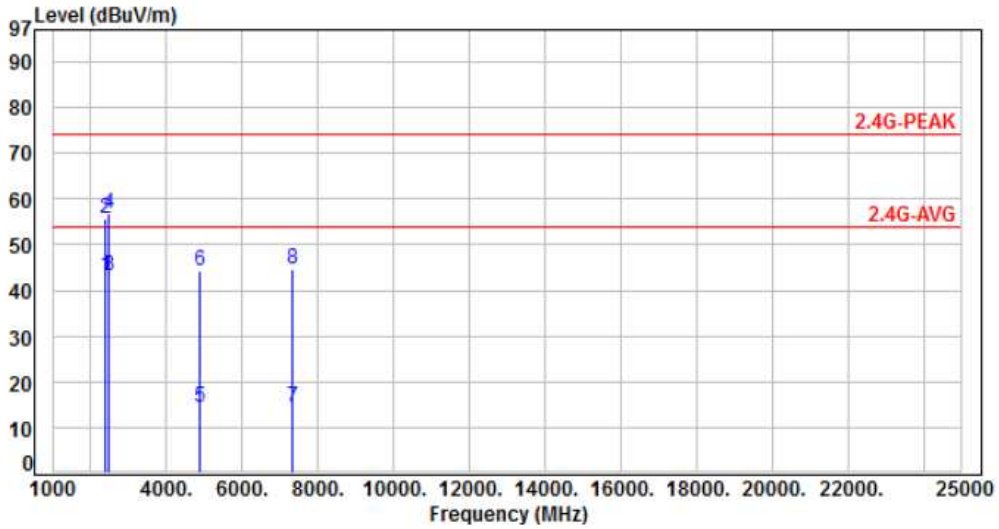
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 1, CH39 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.43 | 43.40 | 54.00 | -10.60 | Average | 124 | 283 | P |
| 2 | 2390.00 | -19.03 | 74.90 | 55.87 | 74.00 | -18.13 | Peak | 124 | 283 | P |
| 3 | 2483.50 | -18.81 | 61.87 | 43.06 | 54.00 | -10.94 | Average | 124 | 283 | P |
| 4 | 2483.50 | -18.81 | 75.14 | 56.33 | 74.00 | -17.67 | Peak | 124 | 283 | P |
| 5 | 4882.00 | -13.21 | 29.73 | 16.52 | 54.00 | -37.48 | Average | 178 | 336 | P |
| 6 | 4882.00 | -13.21 | 59.83 | 46.62 | 74.00 | -27.38 | Peak | 178 | 336 | P |
| 7 | 7323.00 | -10.16 | 25.66 | 15.50 | 54.00 | -38.50 | Average | 164 | 297 | P |
| 8 | 7323.00 | -10.16 | 55.76 | 45.60 | 74.00 | -28.40 | Peak | 164 | 297 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

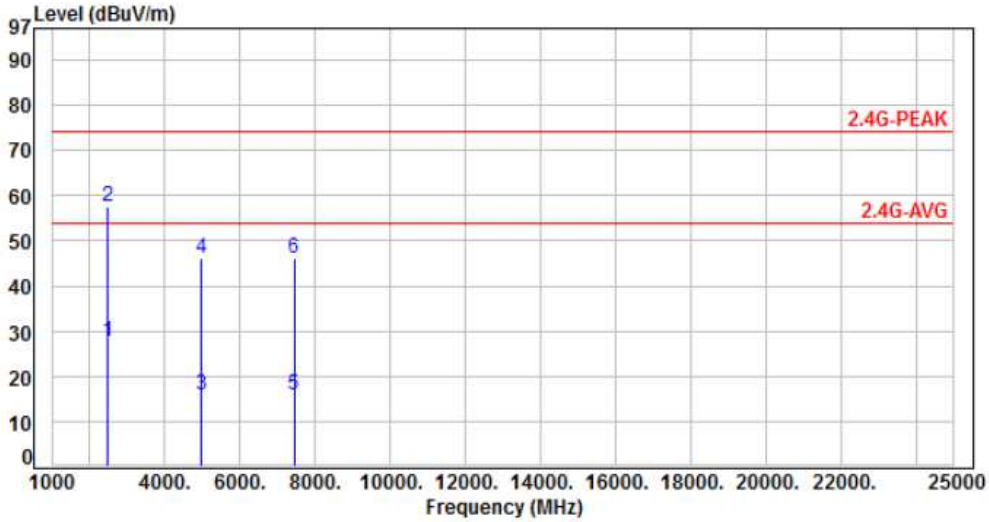
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 1, CH39 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.25 | 43.22 | 54.00 | -10.78 | Average | 100 | 291 | P |
| 2 | 2390.00 | -19.03 | 74.74 | 55.71 | 74.00 | -18.29 | Peak | 100 | 291 | P |
| 3 | 2483.50 | -18.81 | 61.82 | 43.01 | 54.00 | -10.99 | Average | 100 | 291 | P |
| 4 | 2483.50 | -18.81 | 75.66 | 56.85 | 74.00 | -17.15 | Peak | 100 | 291 | P |
| 5 | 4882.00 | -13.21 | 27.54 | 14.33 | 54.00 | -39.67 | Average | 323 | 37 | P |
| 6 | 4882.00 | -13.21 | 57.64 | 44.43 | 74.00 | -29.57 | Peak | 323 | 37 | P |
| 7 | 7323.00 | -10.16 | 24.63 | 14.47 | 54.00 | -39.53 | Average | 121 | 102 | P |
| 8 | 7323.00 | -10.16 | 54.73 | 44.57 | 74.00 | -29.43 | Peak | 121 | 102 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

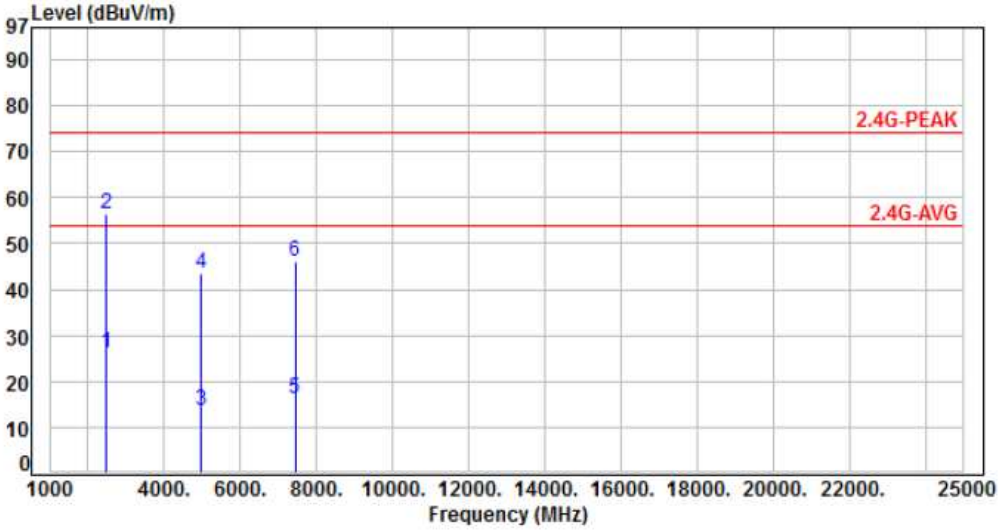
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 1, CH78 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.50 | -18.81 | 46.33 | 27.52 | 54.00 | -26.48 | Average | 152 | 235 | P |
| 2 | 2483.50 | -18.81 | 76.43 | 57.62 | 74.00 | -16.38 | Peak | 152 | 235 | P |
| 3 | 4960.00 | -13.06 | 29.08 | 16.02 | 54.00 | -37.98 | Average | 203 | 340 | P |
| 4 | 4960.00 | -13.06 | 59.18 | 46.12 | 74.00 | -27.88 | Peak | 203 | 340 | P |
| 5 | 7440.00 | -9.88 | 25.72 | 15.84 | 54.00 | -38.16 | Average | 167 | 288 | P |
| 6 | 7440.00 | -9.88 | 55.82 | 45.94 | 74.00 | -28.06 | Peak | 167 | 288 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

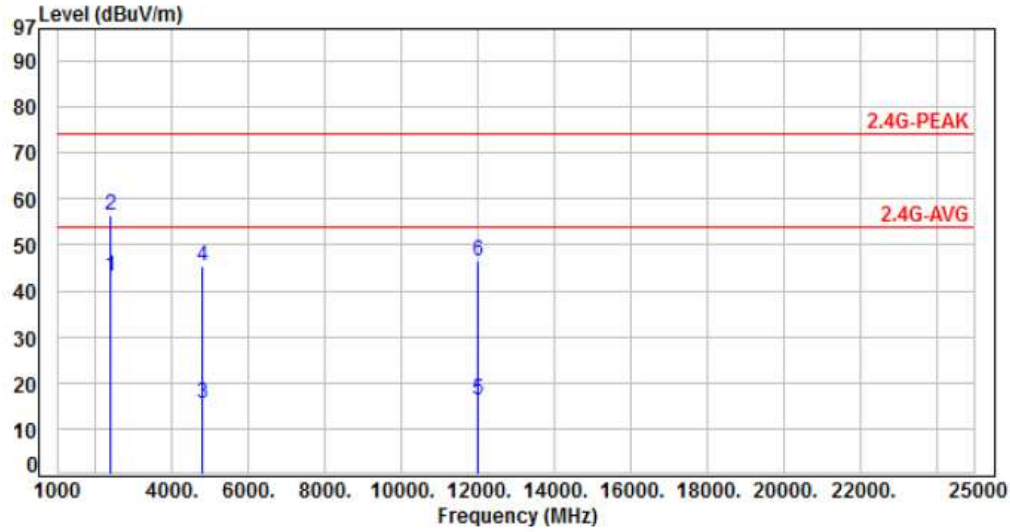
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 1, CH78 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.50 | -18.81 | 45.12 | 26.31 | 54.00 | -27.69 | Average | 100 | 294 | P |
| 2 | 2483.50 | -18.81 | 75.22 | 56.41 | 74.00 | -17.59 | Peak | 100 | 294 | P |
| 3 | 4960.00 | -13.06 | 26.66 | 13.60 | 54.00 | -40.40 | Average | 368 | 38 | P |
| 4 | 4960.00 | -13.06 | 56.76 | 43.70 | 74.00 | -30.30 | Peak | 368 | 38 | P |
| 5 | 7440.00 | -9.88 | 26.06 | 16.18 | 54.00 | -37.82 | Average | 129 | 113 | P |
| 6 | 7440.00 | -9.88 | 56.16 | 46.28 | 74.00 | -27.72 | Peak | 129 | 113 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

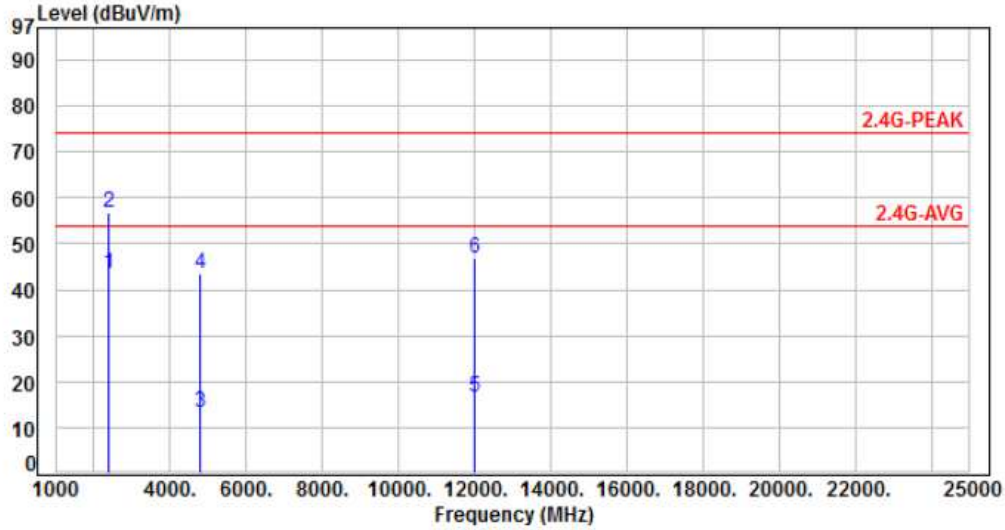
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 3, CH00 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.27 | 43.24 | 54.00 | -10.76 | Average | 172 | 313 | P |
| 2 | 2390.00 | -19.03 | 75.57 | 56.54 | 74.00 | -17.46 | Peak | 172 | 313 | P |
| 3 | 4804.00 | -13.36 | 28.76 | 15.40 | 54.00 | -38.60 | Average | 178 | 339 | P |
| 4 | 4804.00 | -13.36 | 58.86 | 45.50 | 74.00 | -28.50 | Peak | 178 | 339 | P |
| 5 | 12010.00 | -6.08 | 22.45 | 16.37 | 54.00 | -37.63 | Average | 151 | 286 | P |
| 6 | 12010.00 | -6.08 | 52.55 | 46.47 | 74.00 | -27.53 | Peak | 151 | 286 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

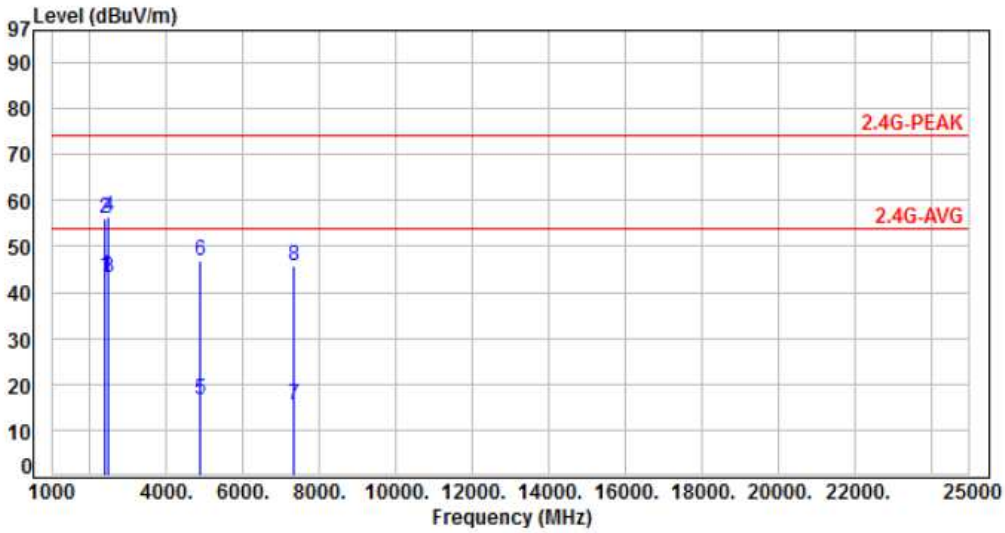
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 3, CH00 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.41 | 43.38 | 54.00 | -10.62 | Average | 100 | 245 | P |
| 2 | 2390.00 | -19.03 | 75.79 | 56.76 | 74.00 | -17.24 | Peak | 100 | 245 | P |
| 3 | 4804.00 | -13.36 | 26.74 | 13.38 | 54.00 | -40.62 | Average | 368 | 35 | P |
| 4 | 4804.00 | -13.36 | 56.84 | 43.48 | 74.00 | -30.52 | Peak | 368 | 35 | P |
| 5 | 12010.00 | -6.08 | 22.82 | 16.74 | 54.00 | -37.26 | Average | 164 | 241 | P |
| 6 | 12010.00 | -6.08 | 52.92 | 46.84 | 74.00 | -27.16 | Peak | 164 | 241 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

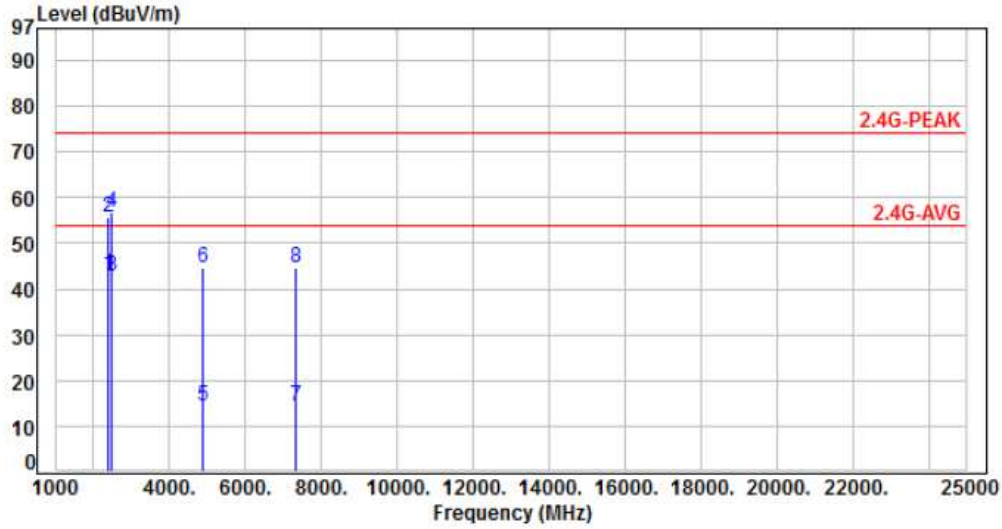
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 3, CH39 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.57 | 43.54 | 54.00 | -10.46 | Average | 126 | 278 | P |
| 2 | 2390.00 | -19.03 | 74.96 | 55.93 | 74.00 | -18.07 | Peak | 126 | 278 | P |
| 3 | 2483.50 | -18.81 | 61.94 | 43.13 | 54.00 | -10.87 | Average | 126 | 278 | P |
| 4 | 2483.50 | -18.81 | 75.33 | 56.52 | 74.00 | -17.48 | Peak | 126 | 278 | P |
| 5 | 4882.00 | -13.21 | 29.77 | 16.56 | 54.00 | -37.44 | Average | 181 | 345 | P |
| 6 | 4882.00 | -13.21 | 59.87 | 46.66 | 74.00 | -27.34 | Peak | 181 | 345 | P |
| 7 | 7323.00 | -10.16 | 25.72 | 15.56 | 54.00 | -38.44 | Average | 165 | 298 | P |
| 8 | 7323.00 | -10.16 | 55.82 | 45.66 | 74.00 | -28.34 | Peak | 165 | 298 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

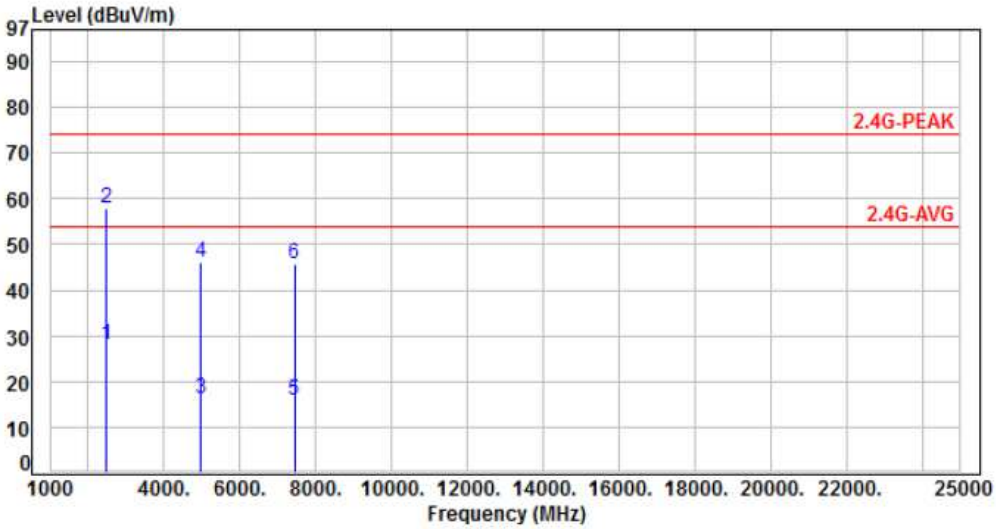
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 3, CH39 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | -19.03 | 62.34 | 43.31 | 54.00 | -10.69 | Average | 100 | 288 | P |
| 2 | 2390.00 | -19.03 | 74.85 | 55.82 | 74.00 | -18.18 | Peak | 100 | 288 | P |
| 3 | 2483.50 | -18.81 | 61.76 | 42.95 | 54.00 | -11.05 | Average | 100 | 288 | P |
| 4 | 2483.50 | -18.81 | 75.58 | 56.77 | 74.00 | -17.23 | Peak | 100 | 288 | P |
| 5 | 4882.00 | -13.21 | 27.62 | 14.41 | 54.00 | -39.59 | Average | 321 | 38 | P |
| 6 | 4882.00 | -13.21 | 57.72 | 44.51 | 74.00 | -29.49 | Peak | 321 | 38 | P |
| 7 | 7323.00 | -10.16 | 24.54 | 14.38 | 54.00 | -39.62 | Average | 127 | 104 | P |
| 8 | 7323.00 | -10.16 | 54.64 | 44.48 | 74.00 | -29.52 | Peak | 127 | 104 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

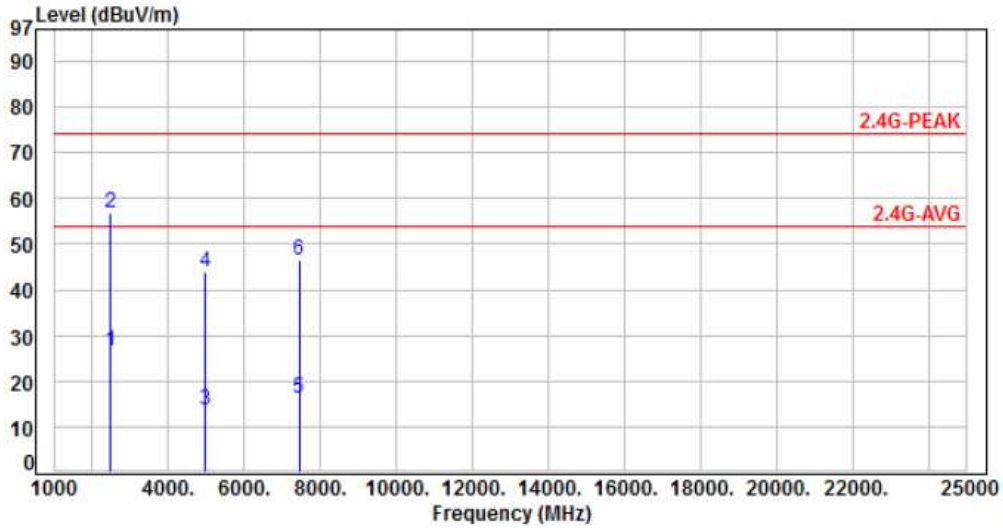
| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | VERTICAL |
| Test Mode | : | Mode 3, CH78 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.50 | -18.81 | 46.67 | 27.86 | 54.00 | -26.14 | Average | 148 | 232 | P |
| 2 | 2483.50 | -18.81 | 76.77 | 57.96 | 74.00 | -16.04 | Peak | 148 | 232 | P |
| 3 | 4960.00 | -13.06 | 29.24 | 16.18 | 54.00 | -37.82 | Average | 205 | 342 | P |
| 4 | 4960.00 | -13.06 | 59.34 | 46.28 | 74.00 | -27.72 | Peak | 205 | 342 | P |
| 5 | 7440.00 | -9.88 | 25.68 | 15.80 | 54.00 | -38.20 | Average | 164 | 285 | P |
| 6 | 7440.00 | -9.88 | 55.78 | 45.90 | 74.00 | -28.10 | Peak | 164 | 285 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

| | | | | | |
|---|---|---|---|---|---|
| Power | : | AC 120V | Pol/Phase | : | HORIZONTAL |
| Test Mode | : | Mode 3, CH78 | Temperature | : | 24 °C |
| Test Date | : | Aug. 12, 2017 | Humidity | : | 68 % |




| No. | Frequency (MHz) | Factor (dB) | Reading (dBuV) | Level (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Height (cm) | Azimuth (deg) | P/F |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.50 | -18.81 | 45.48 | 26.67 | 54.00 | -27.33 | Average | 100 | 291 | P |
| 2 | 2483.50 | -18.81 | 75.58 | 56.77 | 74.00 | -17.23 | Peak | 100 | 291 | P |
| 3 | 4960.00 | -13.06 | 26.84 | 13.78 | 54.00 | -40.22 | Average | 355 | 40 | P |
| 4 | 4960.00 | -13.06 | 56.94 | 43.88 | 74.00 | -30.12 | Peak | 355 | 40 | P |
| 5 | 7440.00 | -9.88 | 26.28 | 16.40 | 54.00 | -37.60 | Average | 131 | 112 | P |
| 6 | 7440.00 | -9.88 | 56.38 | 46.50 | 74.00 | -27.50 | Peak | 131 | 112 | P |

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

## 6.7 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.09000 – 0.11000 | 16.42000 – 16.42300 | 399.9 – 410.0 | 4.500 – 5.250 |
| 0.49500 – 0.505** | 16.69475 – 16.69525 | 608.0 – 614.0 | 5.350 – 5.460 |
| 2.17350 – 2.19050 | 16.80425 – 16.80475 | 960.0 – 1240.0 | 7.250 – 7.750 |
| 4.12500 – 4.12800 | 25.50000 – 25.67000 | 1300.0 – 1427.0 | 8.025 – 8.500 |
| 4.17725 – 4.17775 | 37.50000 – 38.25000 | 1435.0 – 1626.5 | 9.000 – 9.200 |
| 4.20725 – 4.20775 | 73.00000 – 74.60000 | 1645.5 – 1646.5 | 9.300 – 9.500 |
| 6.21500 – 6.21800 | 74.80000 – 75.20000 | 1660.0 – 1710.0 | 10.600 – 12.700 |
| 6.26775 – 6.26825 | 108.00000 – 121.94000 | 1718.8 – 1722.2 | 13.250 – 13.400 |
| 6.31175 – 6.31225 | 123.00000 – 138.00000 | 2200.0 – 2300.0 | 14.470 – 14.500 |
| 8.29100 – 8.29400 | 149.90000 – 150.05000 | 2310.0 – 2390.0 | 15.350 – 16.200 |
| 8.36200 – 8.36600 | 156.52475 – 156.52525 | 2483.5 – 2500.0 | 17.700 – 21.400 |
| 8.37625 – 8.38675 | 156.70000 – 156.90000 | 2655.0 – 2900.0 | 22.010 – 23.120 |
| 8.41425 – 8.41475 | 162.01250 – 167.17000 | 3260.0 – 3267.0 | 23.600 – 24.000 |
| 12.29000 – 12.29300 | 167.72000 – 173.20000 | 3332.0 – 3339.0 | 31.200 – 31.800 |
| 12.51975 – 12.52025 | 240.00000 – 285.00000 | 3345.8 – 3358.0 | 36.430 – 36.500 |
| 12.57675 – 12.57725 | 322.00000 – 335.40000 | 3600.0 – 4400.0 | Above 38.6 |
| 13.36000 – 13.41000 | | | |

**: Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

# 7. Test of Conducted Spurious Emission

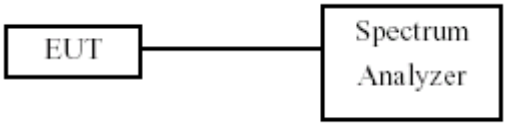
## 7.1 Test Limit

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

## 7.2 Test Procedure

a. The transmitter output was connected to the spectrum analyzer via a low lose cable.
b. Set both RBW and VBW of spectrum analyzer to 100 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
c. The band edges was measured and recorded.

## 7.3 Test Setup Layout

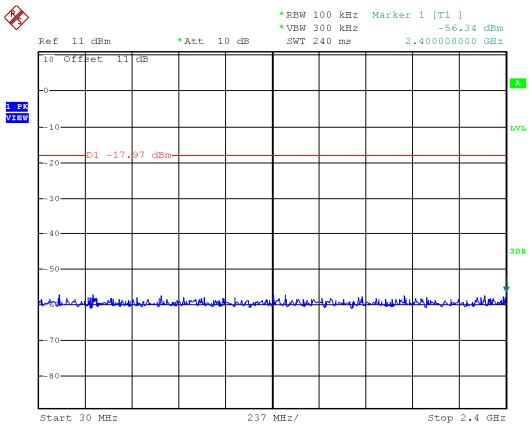


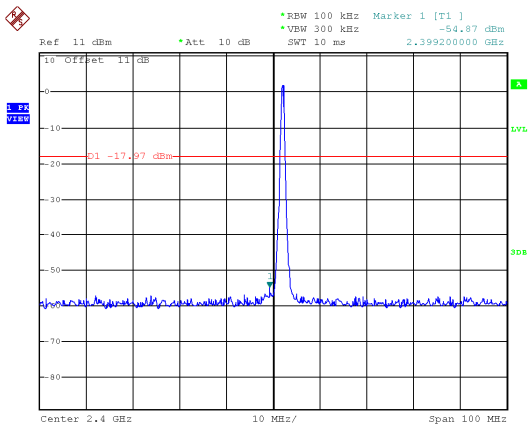

## 7.4 Test Result and Data

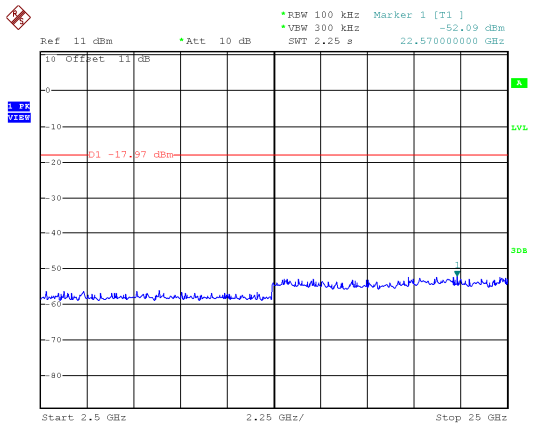
| | | | | | |
|---|---|---|---|---|---|
| Test Result | : | PASS | Temperature | : | 21°C |
| Test Date | : | Aug. 17, 2017 | Humidity | : | 64% |

Note: Test plots refer to the following pages.

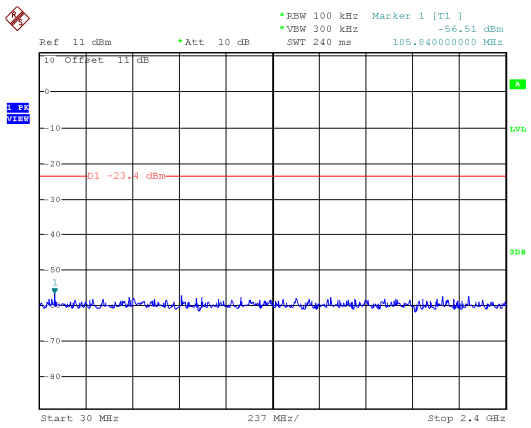
Modulation Type: GFSK, CH00

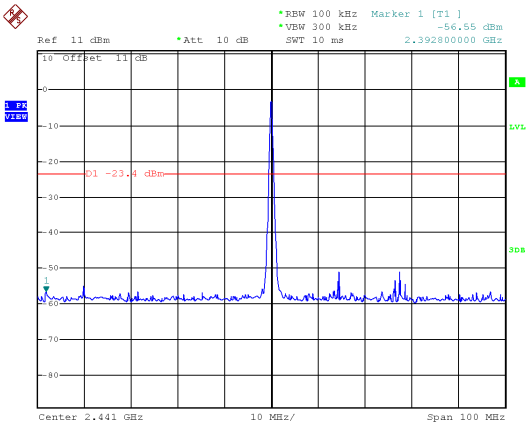


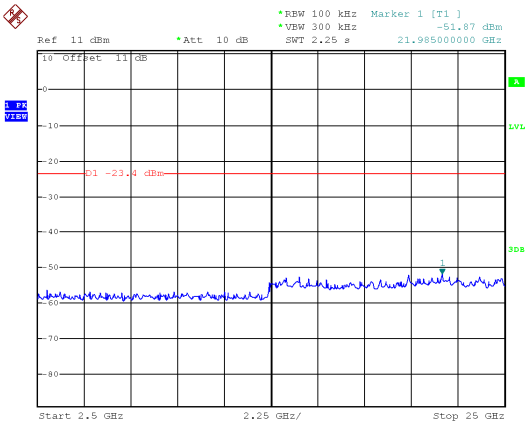



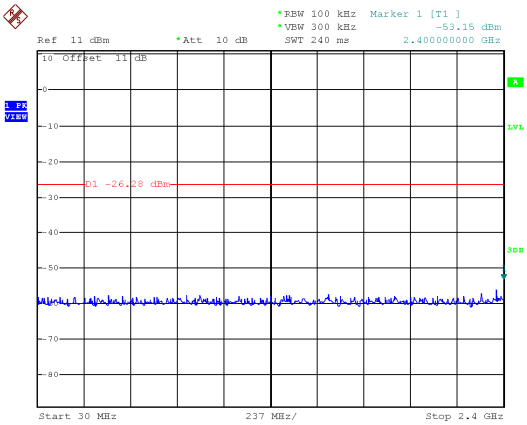

Modulation Type: GFSK, CH39



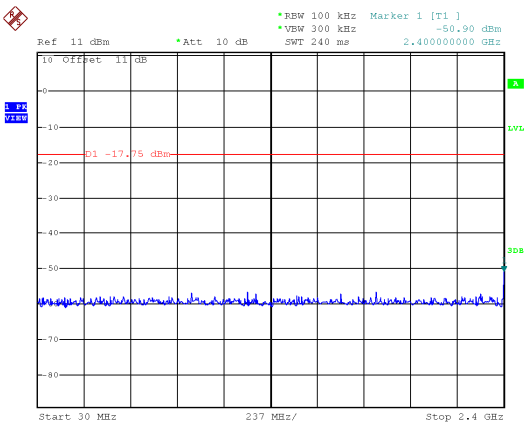



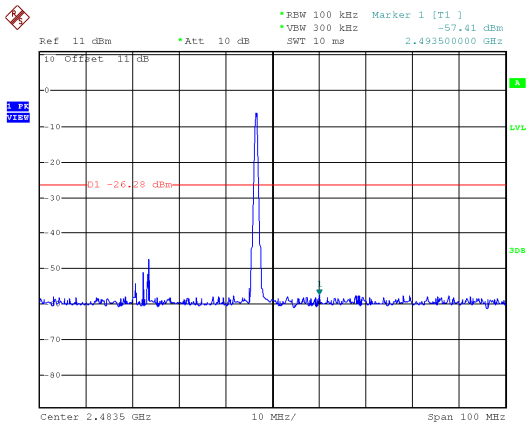



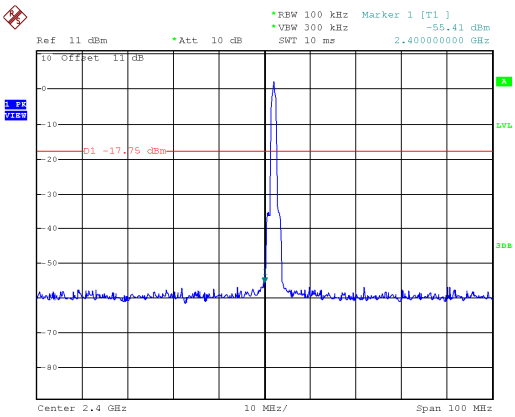
Modulation Type: GFSK, CH78

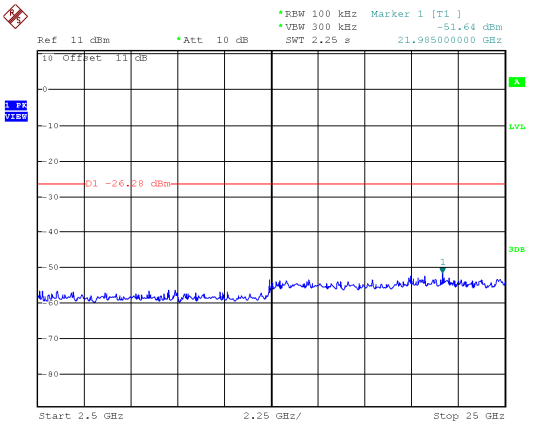


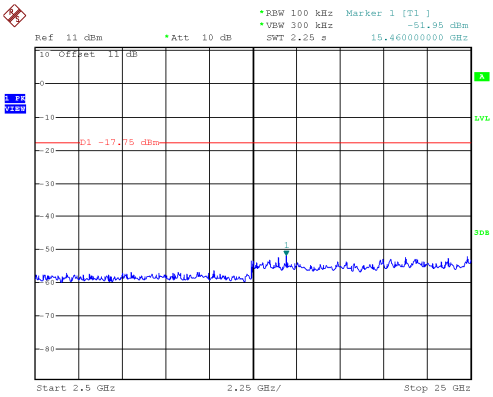

Modulation Type: π/4-DQPSK, CH00



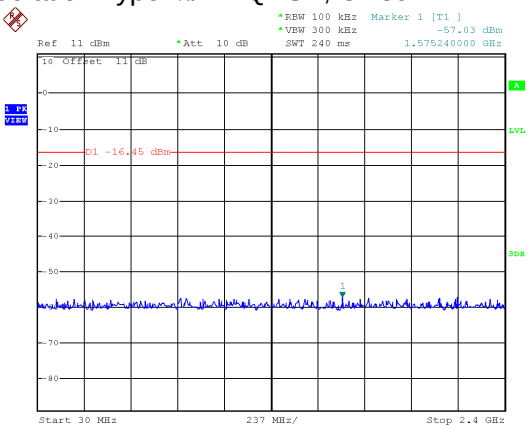



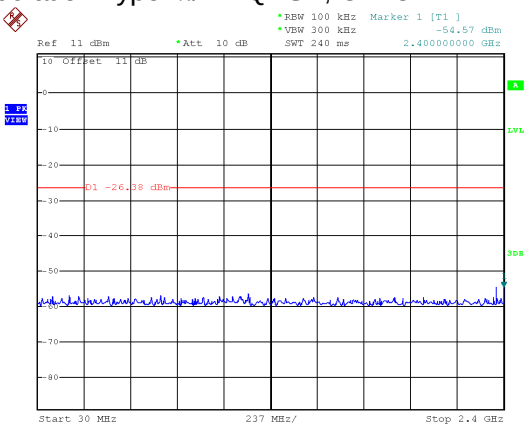



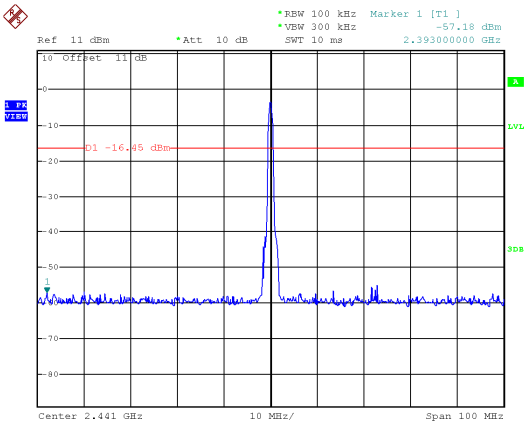



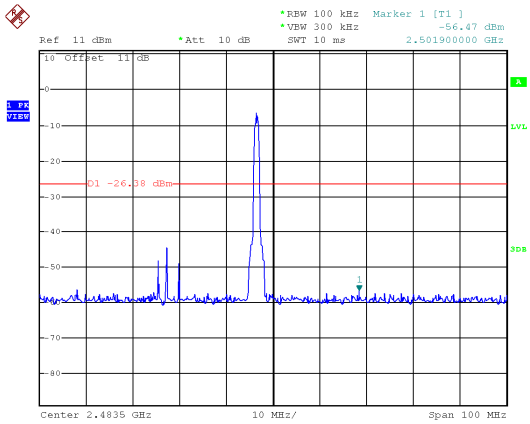
Modulation Type: π/4-DQPSK, CH39

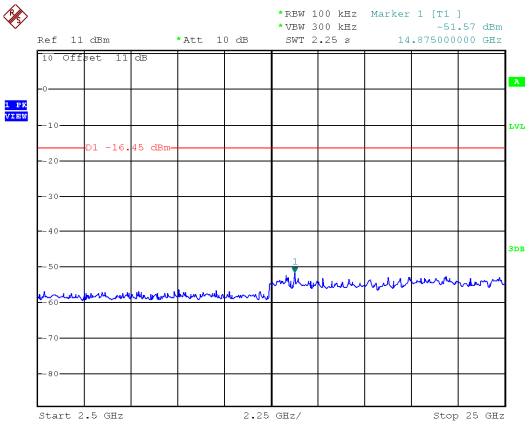


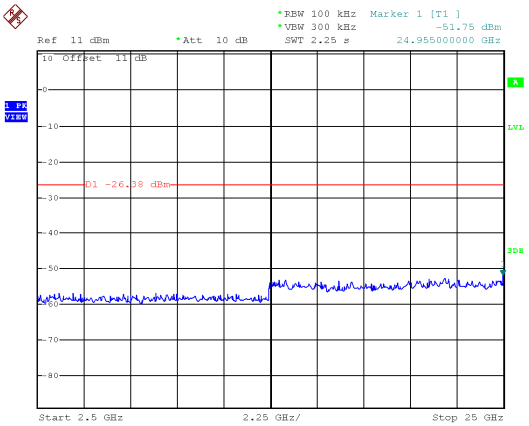

Modulation Type: π/4-DQPSK, CH78



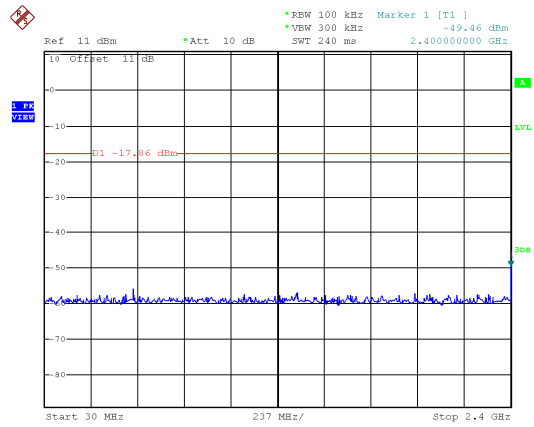



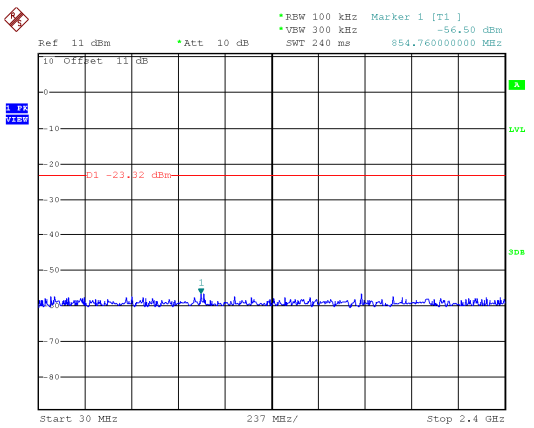



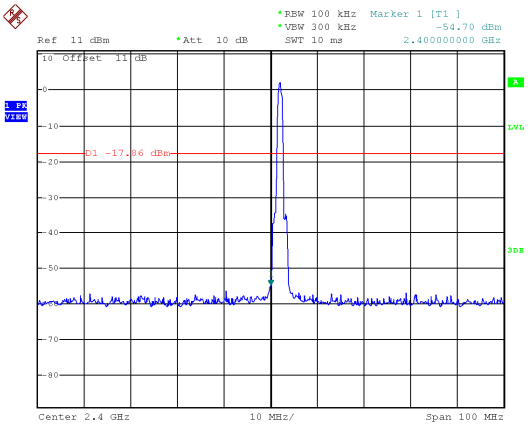



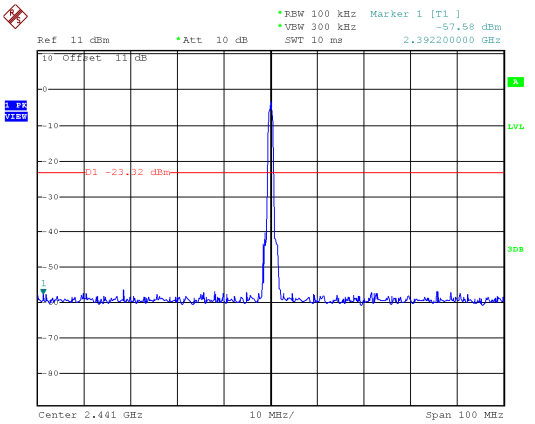
Modulation Type: 8DPSK, CH00

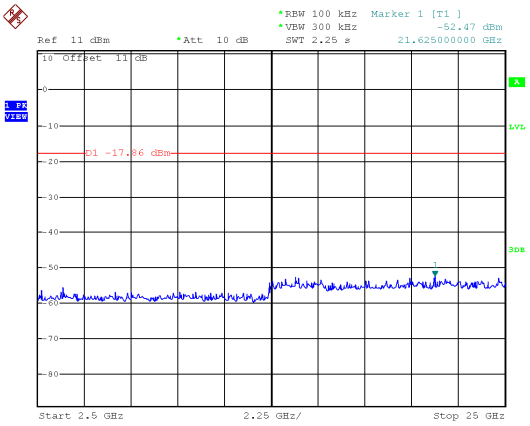


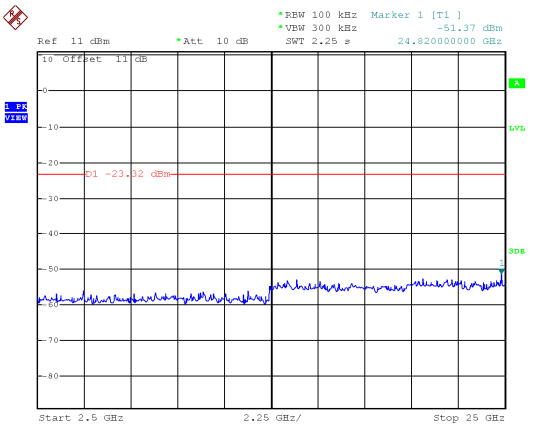

Modulation Type: 8DPSK, CH39



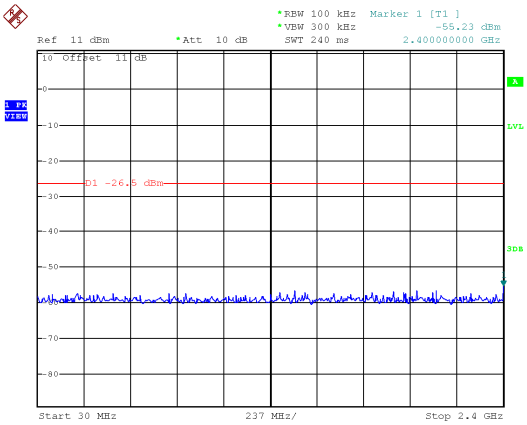



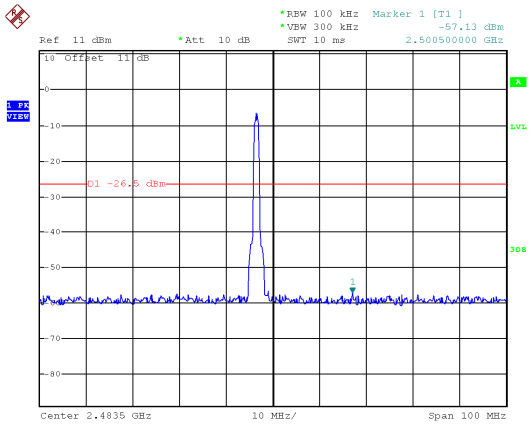



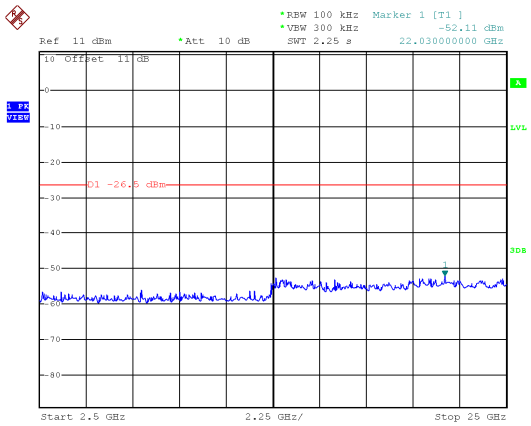



Modulation Type: 8DPSK, CH78

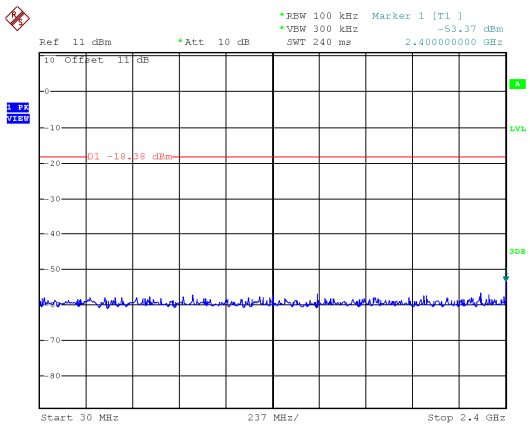


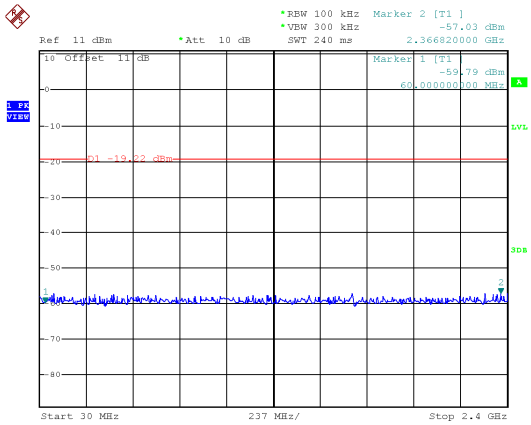



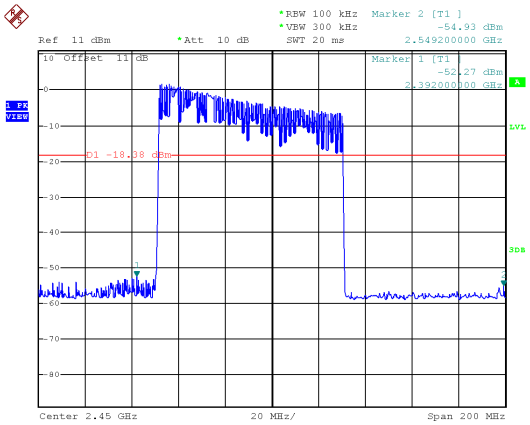
Hopping Mode:

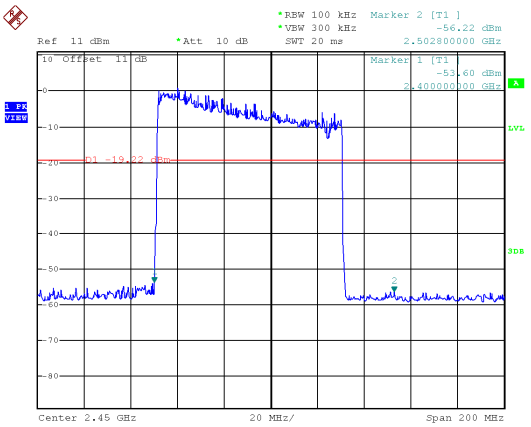
Modulation Type: GFSK

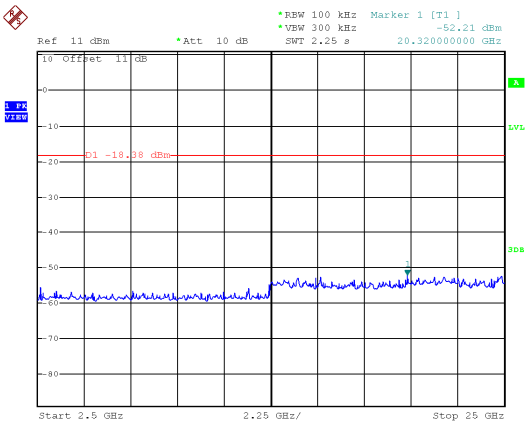


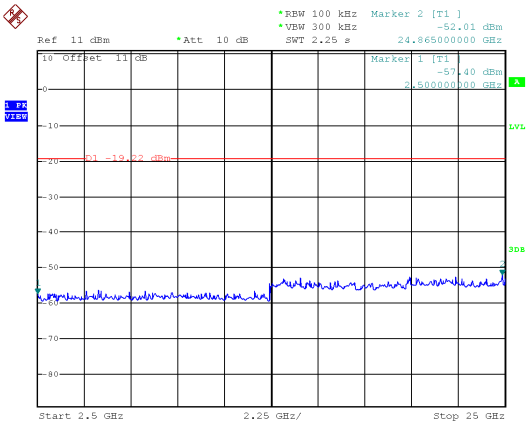

Modulation Type: π/4-DQPSK



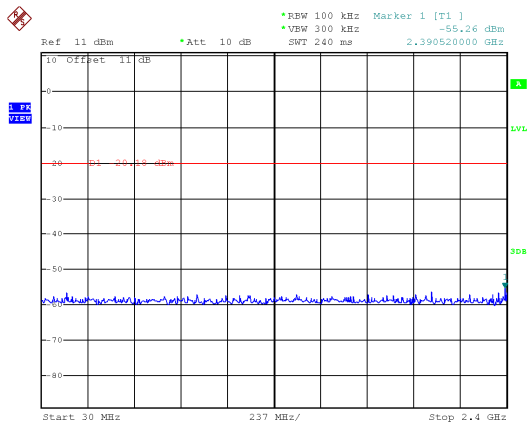



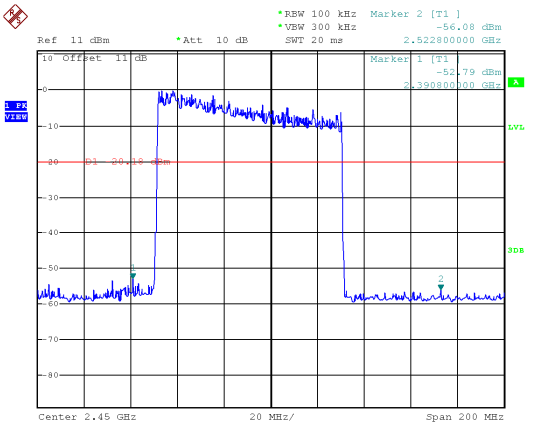



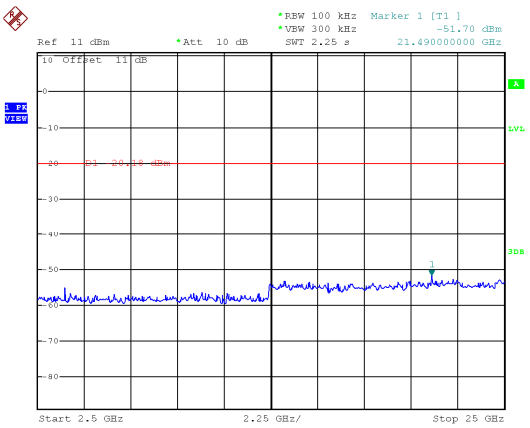



Modulation Type: 8DPSK



# 8. 20dB Bandwidth Measurement Data

## 8.1 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than125 mW.

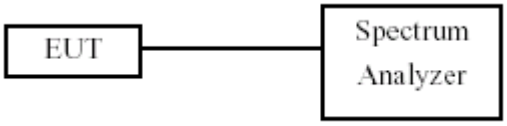
## 8.2 Test Procedures

a. The transmitter output was connected to the spectrum analyzer.

b. Set RBW of spectrum analyzer to 30 KHz and VBW to 100 KHz.

c. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

## 8.3 Test Setup Layout

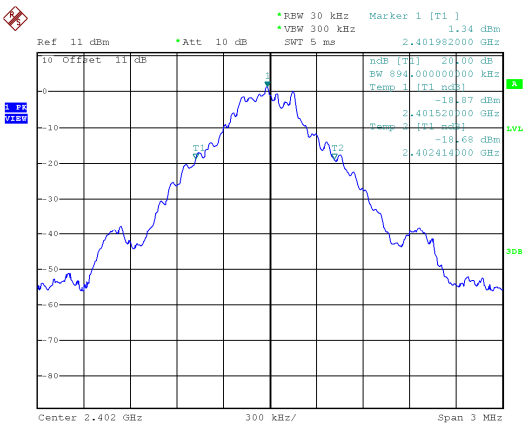



## 8.4 Test Result and Data

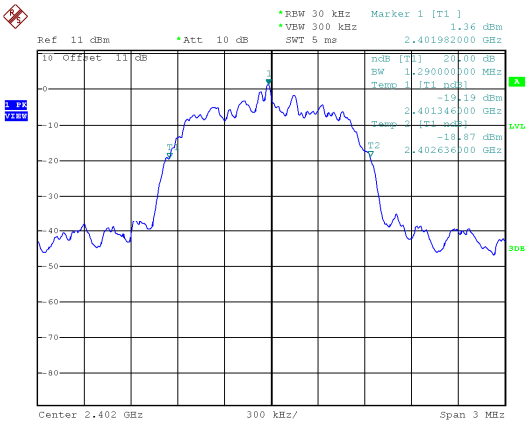
| | | | | | |
|---|---|---|---|---|---|
| Test Result | : | PASS | Temperature | : | 21°C |
| Test Date | : | Aug. 17, 2017 | Humidity | : | 64% |

| Modulation Type | Channel | Frequency (MHz) | 20dB Bandwidth (MHz) | 2/3 20dB Bandwidth (MHz) |
|---|---|---|---|---|
| GFSK | 00 | 2402 | 0.894 | 0.596 |
| | 39 | 2441 | 0.888 | 0.592 |
| | 78 | 2480 | 0.840 | 0.560 |
| π/4-DQPSK | 00 | 2402 | 1.290 | 0.860 |
| | 39 | 2441 | 1.290 | 0.860 |
| | 78 | 2480 | 1.290 | 0.860 |
| 8DPSK | 00 | 2402 | 1.290 | 0.860 |
| | 39 | 2441 | 1.296 | 0.864 |
| | 78 | 2480 | 1.296 | 0.864 |

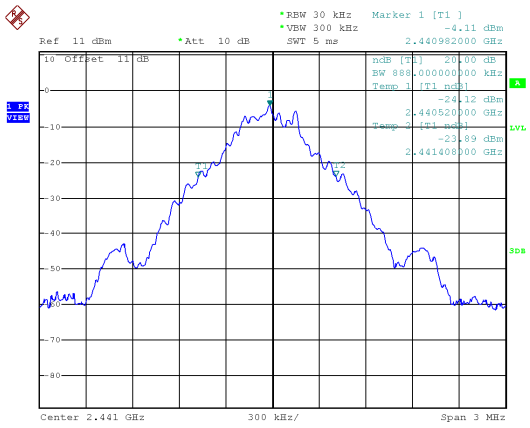
Modulation Type: GFSK
CH00



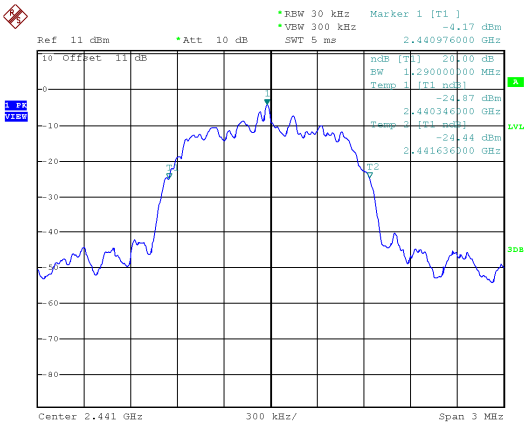

Modulation Type: π/4-DQPSK
CH00



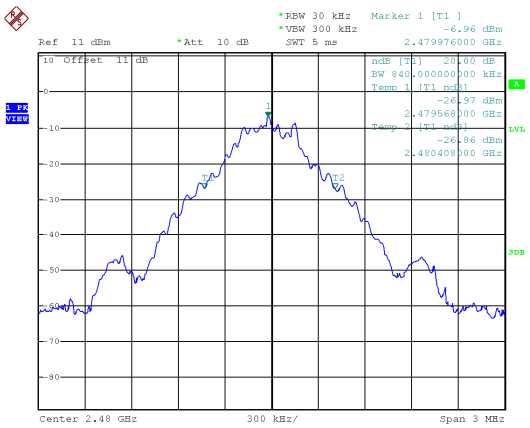

CH39



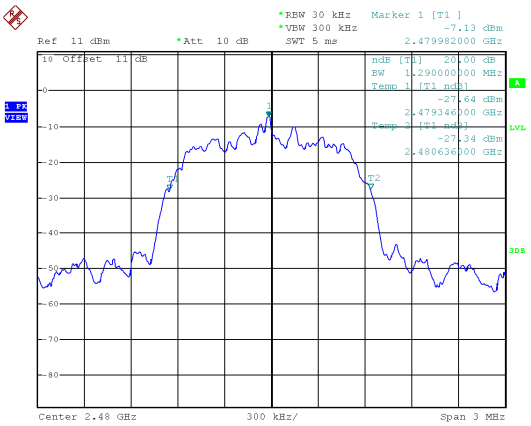

CH39



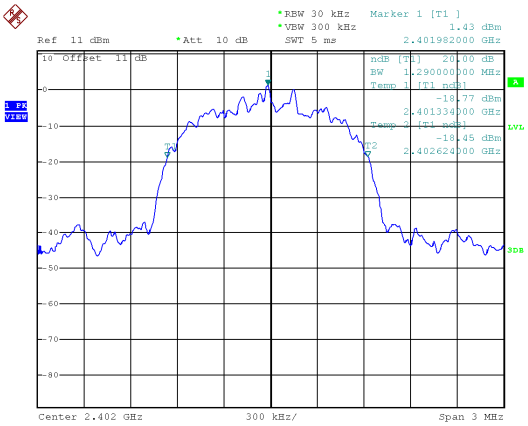

CH78



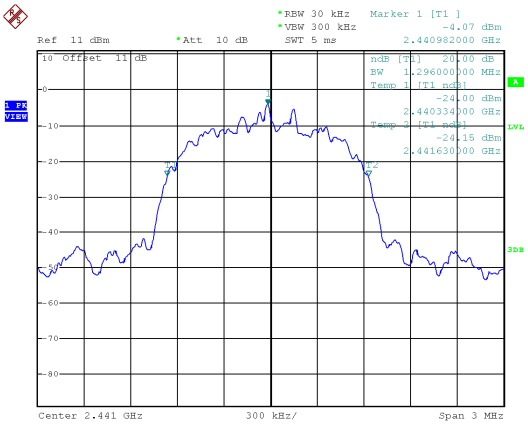

CH78



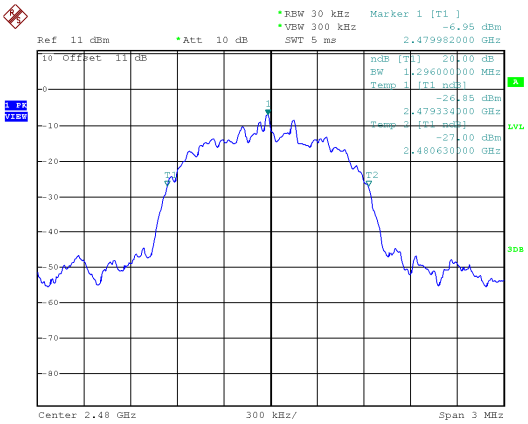
Modulation Type: 8DSPK
CH00




CH39




CH78



# 9. Frequencies Separation

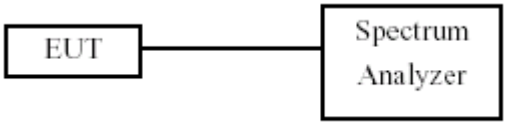
## 9.1 Test Limit

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

## 9.2 Test Procedures

a. The transmitter output was connected to the spectrum analyzer.
b. Set RBW of spectrum analyzer to 30 KHz and VBW to 100 KHz.
c. By using the MaxHold function record the separation of two adjacent channels.
d. Measure the frequency difference of these two adjacent channels.

## 9.3 Test Setup Layout

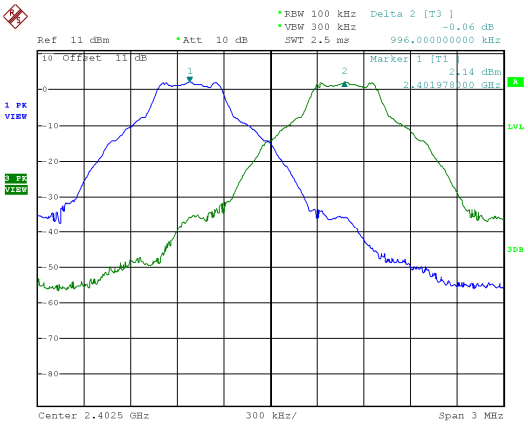



## 9.4 Test Result and Data

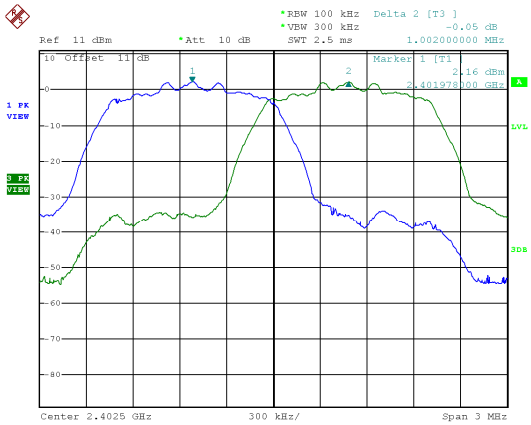
Test Result : PASS
Test Date : Aug. 17, 2017
Temperature : 21°C
Humidity : 64%

| Modulation Type | Channel | Frequency (MHz) | Channel Separation (MHz) | Limit (MHz) |
|---|---|---|---|---|
| GFSK | 00 | 2402 | 0.996 | 0.596 |
| | 39 | 2441 | 1.002 | 0.592 |
| | 78 | 2480 | 1.002 | 0.56 |
| π/4-DQPSK | 00 | 2402 | 1.002 | 0.86 |
| | 39 | 2441 | 1.002 | 0.86 |
| | 78 | 2480 | 1.002 | 0.86 |
| 8DPSK | 00 | 2402 | 1.002 | 0.86 |
| | 39 | 2441 | 1.002 | 0.864 |
| | 78 | 2480 | 1.002 | 0.864 |

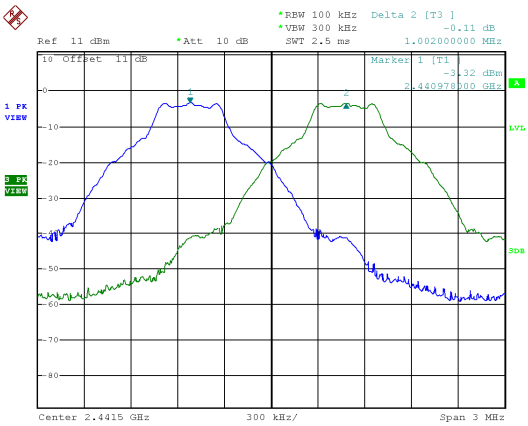
Modulation Type: GFSK
CH00



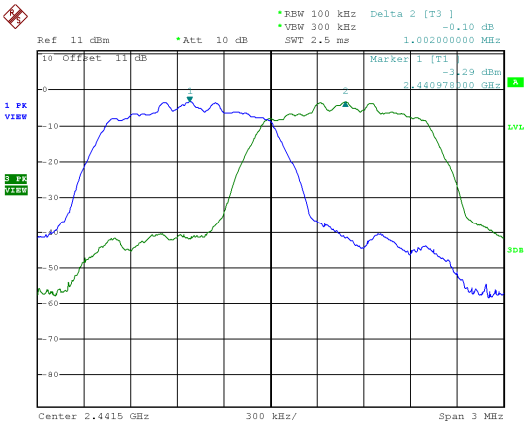

Modulation Type: π/4-DQPSK
CH00



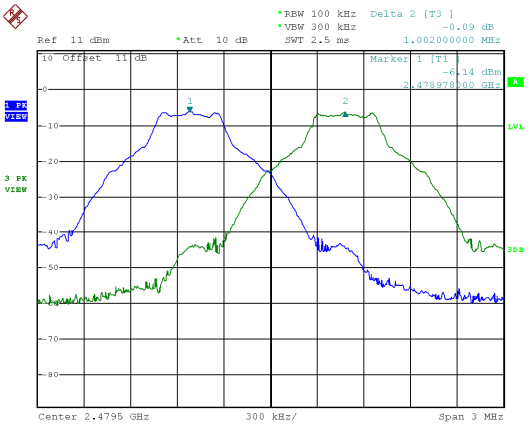

CH39



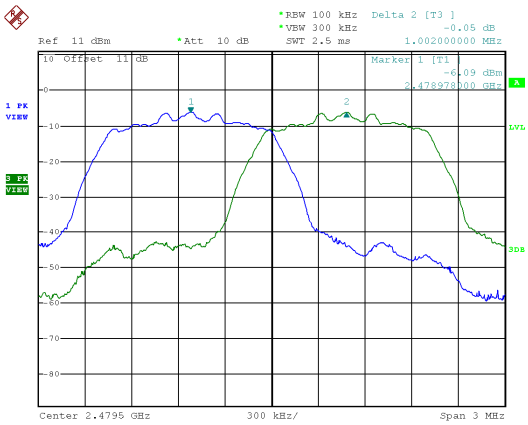

CH39



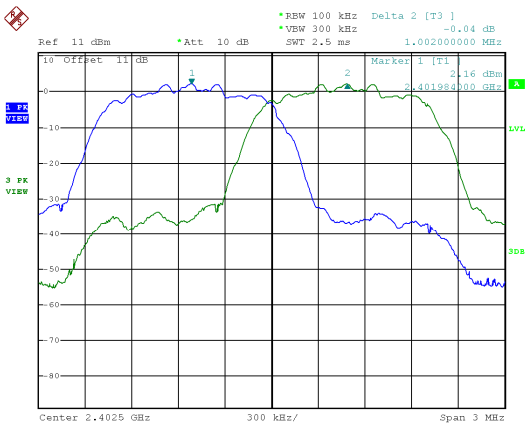

CH78



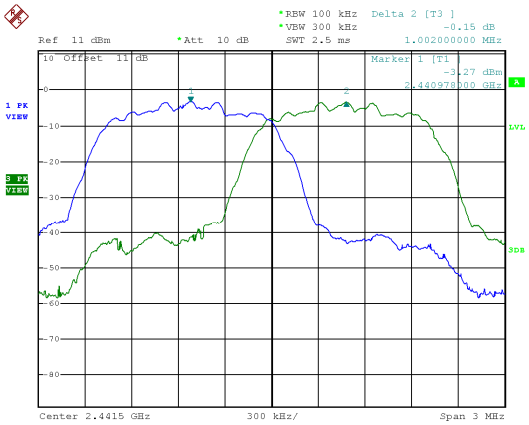

CH78



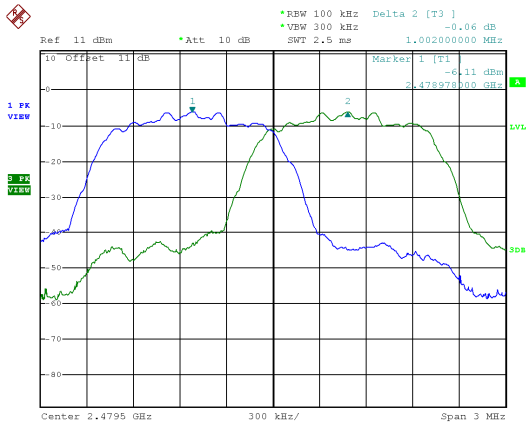
Modulation Type: 8DSPK
CH00




CH39




CH78



# 10. Dwell Time on each channel

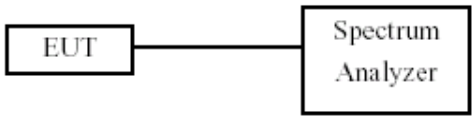
## 10.1 Test Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

## 10.2 Test Procedures

1. The transmitter output was connected to the spectrum analyzer.
2. Adjust the center frequency to measure frequency, then set zero span mode.
2. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz.
4. Measure the time duration of one transmission on the measured frequency.

## 10.3 Test Setup Layout




## 10.4 Test Result and Data

Test Result : PASS Temperature : 21°C

Test Date : Aug. 17, 2017 Humidity : 64%

Test Period = 0.4 (second/ channel) x 79 Channel = 31.6 sec

| Modulation Type | Frequency (MHz) | Length of transmission time (ms) | Number of transmission in a 31.6 (79 Hopping*0.4) | Dwell Time (ms) | Limit (ms) |
|---|---|---|---|---|---|
| GFSK (DH1) | 2402 | 0.428 | 320.10 | 137.00 | 400 |
| GFSK (DH3) | 2402 | 1.720 | 159.90 | 275.03 | 400 |
| GFSK (DH5) | 2402 | 2.950 | 106.81 | 315.09 | 400 |
| π/4-DQPSK (DH1) | 2402 | 0.426 | 320.10 | 136.36 | 400 |
| π/4-DQPSK (DH3) | 2402 | 1.706 | 159.90 | 272.79 | 400 |
| π/4-DQPSK (DH5) | 2402 | 3.006 | 106.81 | 321.07 | 400 |
| 8DPSK (DH1) | 2402 | 0.440 | 320.10 | 140.84 | 400 |
| 8DPSK (DH3) | 2402 | 1.720 | 159.90 | 275.03 | 400 |
| 8DPSK (DH5) | 2402 | 2.980 | 106.81 | 318.29 | 400 |

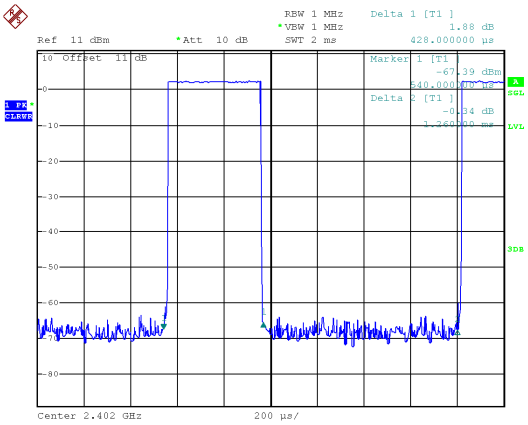
Test Result : PASS Temperature : 26°C

Test Date : Sep. 25, 2018 Humidity : 61%

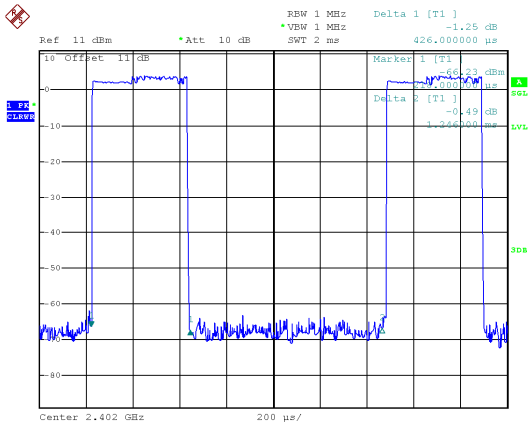
Test Period = 0.4 (second/ channel) x 20 Channel = 8 sec

| Modulation Type | Frequency (MHz) | Length of transmission time (ms) | Number of transmission in a 8 (20 Hopping*0.4) | Dwell Time (ms) | Limit (ms) |
|---|---|---|---|---|---|
| AFH (DH5) | 2402-2421 | 2.950 | 53.33 | 157.32 | 400 |

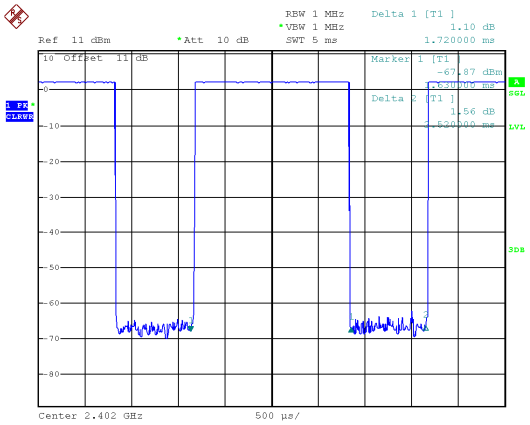
Modulation Type: GFSK(DH1)



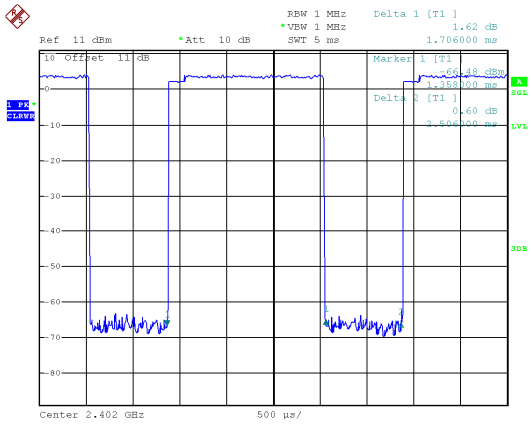

Modulation Type: π/4-DQPSK (DH1)



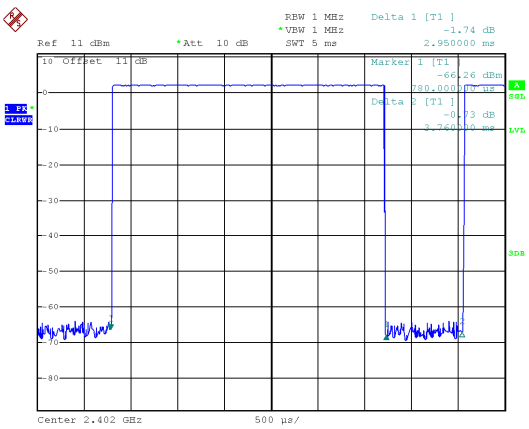

Modulation Type: GFSK(DH3)



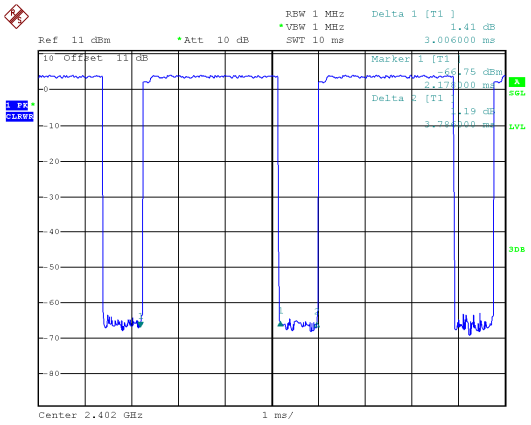

Modulation Type: π/4-DQPSK (DH3)



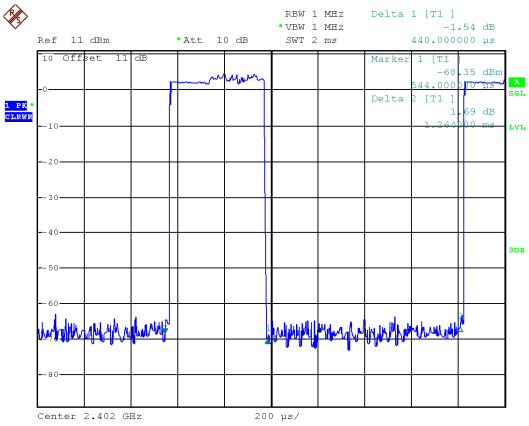

Modulation Type: GFSK(DH5)



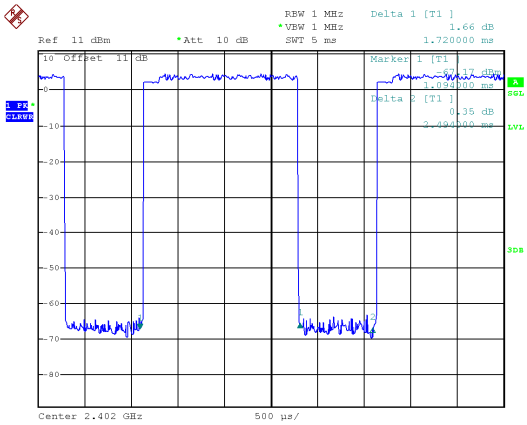

Modulation Type: π/4-DQPSK (DH5)



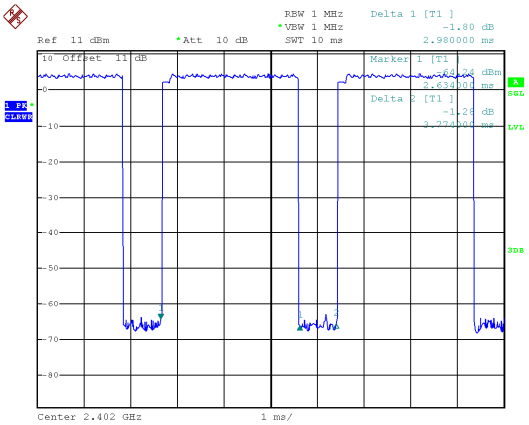
Modulation Type: 8DSPK (DH1)




Modulation Type: 8DSPK (DH3)




Modulation Type: 8DSPK (DH5)



# 11. Number of Hopping Channels

## 11.1 Test Limit

Frequency hopping systems in the 2400 ~ 2483.5 MHz band shall use at least 15 channels.

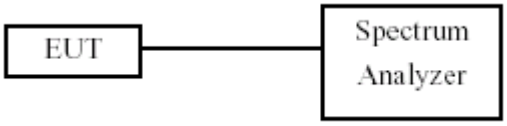
## 11.2 Test Procedures

a. The transmitter output was connected to the spectrum analyzer.

b. 2. Set RBW of spectrum analyzer to 100 KHz and VBW to 100 KHz.

c. 3. Set the MaxHold function, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been record.

## 11.3 Test Setup Layout

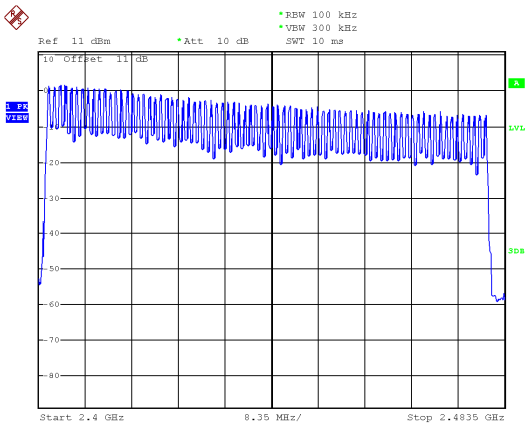



## 11.4 Test Result and Data

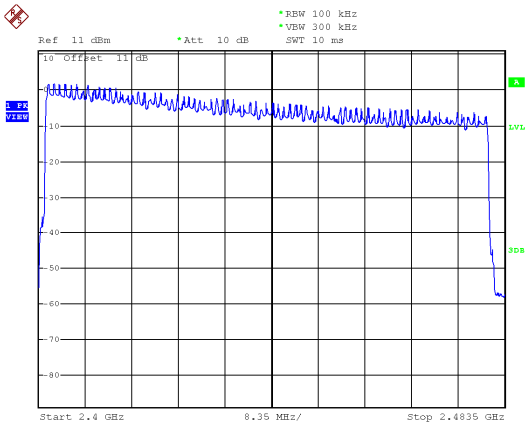
| | | | | | |
|---|---|---|---|---|---|
| Test Result | : | PASS | Temperature | : | 21°C |
| Test Date | : | Aug. 17, 2017 | Humidity | : | 64% |

| Modulation Type | Hopping Channels |
|---|---|
| GFSK | 79 |
| π/4-DQPSK | 79 |
| 8DPSK | 79 |

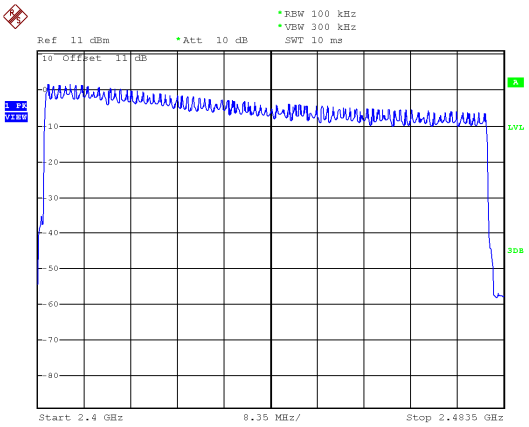
Modulation Type: GFSK




Modulation Type: π/4-DQPSK




Modulation Type: 8DPSK



# 12. Maximum Peak Output Power

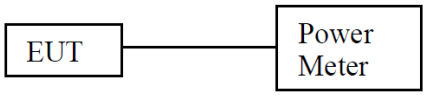
## 12.1 Test Limit

The Maximum Peak Output Power Measurement is 30dBm.

## 12.2 Test Procedures

The antenna port( RF output )of the EUT was connected to the input( RF input )of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

## 12.3 Test Setup Layout



## 12.4 Test Result and Data

Test Result : PASS Temperature : 21°C
Test Date : Aug. 17, 2017 Humidity : 64%

| Modulation Type | Channel | Frequency (MHz) | Peak Output Power (dBm) | Peak Output Power (mW) |
|---|---|---|---|---|
| GFSK | 00 | 2402 | 2.89 | 1.945 |
| | 39 | 2441 | -2.02 | 0.628 |
| | 78 | 2480 | -4.72 | 0.337 |
| π/4-DQPSK | 00 | 2402 | 5.31 | 3.396 |
| | 39 | 2441 | 0.45 | 1.109 |
| | 78 | 2480 | -2.38 | 0.578 |
| 8DPSK | 00 | 2402 | 5.74 | 3.750 |
| | 39 | 2441 | 0.95 | 1.245 |
| | 78 | 2480 | -1.95 | 0.638 |

| Modulation Type | Channel | Frequency (MHz) | Average Output Power (dBm) | Average Output Power (mW) |
|---|---|---|---|---|
| GFSK | 00 | 2402 | 2.50 | 1.778 |
| | 39 | 2441 | -2.53 | 0.558 |
| | 78 | 2480 | -5.43 | 0.286 |
| π/4-DQPSK | 00 | 2402 | 2.76 | 1.888 |
| | 39 | 2441 | -2.24 | 0.597 |
| | 78 | 2480 | -5.19 | 0.303 |
| 8DPSK | 00 | 2402 | 2.76 | 1.888 |
| | 39 | 2441 | -2.21 | 0.601 |
| | 78 | 2480 | -5.18 | 0.303 |

Note: Average power is for reference only.

Test Result : PASS Temperature : 26°C
Test Date : Sep. 25, 2018 Humidity : 61%

| Modulation Type | Channel | Frequency (MHz) | Peak Output Power (dBm) | Peak Output Power (mW) |
|---|---|---|---|---|
| AFH | 0-19 | 2402-2421 | 2.34 | 1.714 |

| Modulation Type | Channel | Frequency (MHz) | Average Output Power (dBm) | Average Output Power (mW) |
|---|---|---|---|---|
| AFH | 0-19 | 2402-2421 | 2.01 | 1.589 |

Note: Average power is for reference only.