


Electromagnetic Emission

FCC MEASUREMENT REPORT

CERTIFICATION OF COMPLIANCE

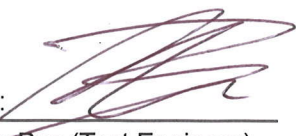
FCC Part 15 Certification Measurement


PRODUCT : Mobile Printer
MODEL/Serial No. : WSP-R350 / Proto type
MULTIPLE MODEL : -
BRAND NAME : 
FCC ID : QDDWSP-R350
APPLICANT : Woosim System Inc.
#501, Daerung Technotown 3th, 448, Gasan-dong,
Geumcheon-gu, Seoul, Korea
Attn.: Moo-Seung Lim / Assistant Manager
MANUFACTURER : Woosim System Inc.
#501, Daerung Technotown 3th, 448, Gasan-dong,
Geumcheon-gu, Seoul, Korea
FCC CLASSIFICATION : DSS (Part 15 Spread Spectrum Transmitter)
TYPE OF MODULATION : FHSS (GFSK (BDR), 8DPSK (EDR))
FREQUENCY CHANNEL : 2 402 MHz to 2 480 MHz and Channel Spacing 1 MHz (79 Ch)
AIR DATE RATE : BDR (1 Mbps), EDR (2 Mbps, 3 Mbps)
ANTENNA TYPE : Printed Monopole Antenna (Integral)
ANTENNA GAIN : 3.00 dBi max
RF POWER : 4.731 mW
RULE PART(S) : FCC Part 15 Subpart C
FCC PROCEDURE : ANSI C63.4-2009
TEST REPORT No. : ETLE140819.1210
DATES OF TEST : August 27, 2014 to September 02, 2014
REPORT ISSUE DATE : September 16, 2014
TEST LABORATORY : ETL Inc. (FCC Designation Number : KR0022)

The Mobile Printer, Model WSP-R350 has been tested in accordance with the measurement procedures specified in ANSI C63.4-2009 at the ETL Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart C section 15.247.

I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Prepared by: 
Jeong Hwan, Pyo (Test Engineer)
September 16, 2014

Reviewed by: 
Kug Kyoung, Yoon (Chief Engineer)
September 16, 2014

ETL Inc.

Head office: #371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea

Open site: #499-1, Sagot-ri, Seosin-myeon, Hwaseong-si, Gyeonggi-do, 445-882, Korea

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The test report merely corresponds to the test sample(s).

This report shall not be reproduced, in whole or in part without the written approval of ETL Inc.

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FCC MEASUREMENT REPORT

Scope – Measurement and determination of electromagnetic emission (EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)

General Information

| | |
|-----------------------|--|
| Applicant Name | : Woosim System Inc. |
| Address | : #501, Daerung Technotown 3th, 448, Gasan-dong, Geumcheon-gu, Seoul, Korea |
| Attention | : Moo-Seung Lim / Assistant Manager |

- **EUT Type** : Mobile Printer
- **Model Number** : WSP-R350
- **S/N** : NONE
- **Freq. Range** : 2 402 MHz - 2 480 MHz
- **Number of Channels** : 79
- **Modulation Technique** : FHSS (GFSK (BDR), 8DPSK (EDR))
- **Frequency Channel** : 2 402 MHz to 2 480 MHz and Channel Spacing 1 MHz (79 Ch)
- **Air Data Rate** : BDR (1 Mbps), EDR (2 Mbps, 3 Mbps)
- **Antenna Type** : Printed Monopole Antenna (Integral)
- **Antenna Gain** : 3.00 dBi max
- **RF Power** : 4.731 mW
- **Environmental of Tests** : Temperature: (24.4 ± 3.2) °C
Humidity: (59 ± 18) % R.H.
Atmospheric Pressure: (101.0 ± 0.3) kPa
- **FCC Rule Part(s)** : FCC Part 15 Subpart C
- **Test Procedure** : ANSI C63.4-2009
- **FCC Classification** : DSS (Part 15 Spread Spectrum Transmitter)
- **Place of Tests** : ETL Inc. Testing Lab. (FCC Designation Number : KR0022)

Radiated Emission test 1;
#499-1, Sagot-ri, Seosin-myeon, Hwaseong-si,
Gyeonggi-do, 445-882, Korea

Radiated Emission test 2 and Conducted Emission test;
#371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea

1. INTRODUCTION

The measurement test for radiated and conducted emission test was conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2009 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with FCC Rules according to the ANSI C63.4-2009 and registered to the Federal Communications Commission (FCC Designation Number : KR0022).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions from the Woosim System Inc. Model: WSP-R350

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the Mobile Printer (model: WSP-R350).

The model WSP-R350 is basic model that was tested.

2.2 General Specification

| Item | Specification |
|---------------------|--|
| Printing method | Direct thermal line printer |
| Characters per line | 64 cpl (MAX) |
| Character size | Eng.: 9 dots x 24 dots, 12 dots x 24 dots |
| | Kor.: 16 dots x 24 dots, [24 dots x 24 dots] |
| Optional characters | Simplified/Traditional Chinese, Arabic, Cyrillic, Russian, Turkish, Greek, Japanese, Persian, Latin9 and Other upon request. |
| Resolution | 203 dpi, 8 dots/mm |
| Print width | 3-Inch (72 mm, 576 dots) |
| Printing speed | 80 mm/sec (MAX) |
| Dimensions | 108.5 mm x 138.2 mm x 56.5 mm |
| Weight | 409 g |
| Interface | UART (RS-232C or TTL), Bluetooth Ver 2.1 + EDR |
| Paper supplied | Thermal roll paper, Label roll (80 mm wide, 50 ø) |
| Barcode supplied | 1-dimension: Code128, Code39, I2/5, Code 93 UPC, EAN, KAN, JAN, CODABAR, GS1 Databar |
| | 2-dimension: PDF417, QR Code, DATA Matrix, Mirco PDF417, Truncated PDF417, Maxicode |
| Driver | Microsoft Windows XP / VISTA / 7-32 bit / 7-64 bit Windows CE, Linux, Android OS driver compatible |
| Black mark | Support black mark detection |
| H/W Spec. | MCU: Renesas 32 bits, FLASH: 8 Mbytes, RAM: 16 MBytes |
| Receive buffer size | 1 MBytes |
| MSR | ISO 7810/7811/7812, Triple tracks (1&2&3) Reading |

| Item | Specification | |
|-----------------------------------|--|------------------------------|
| Battery | Rechargeable 7.2 V DC, 2 200 mAh (Li-ion) | |
| Battery duration | 1 hour continuous printing | |
| Battery Charger | Input: AC 100 V – 250 V, 50 Hz – 60 Hz, 0.5 A | |
| | Output: 8.4 VDC, 0.8 A, 4 hours full charge time | |
| Environment conditions | Temperature | (20 ± 30) °C (operating) |
| | | (30 ± 40) °C (storage) |
| | Humidity | (55 ± 25) % R.H. (operating) |
| | | (50 ± 40) % R.H. (storage) |
| MCBF (Mean Cycle Between failure) | Mechanical | 37 000 000 lines |
| | Head | Approximately 50 km |
| High Internal Frequency | X-tal → 26.000 MHz | |

- Frequency Channel Table

| CH | MHz | CH | MHz | CH | MHz | CH | MHz | CH | MHz | CH | MHz | CH | MHz | CH | MHz |
|----|------|----|------|----|------|----|------|----|------|----|------|----|------|----|------|
| 1 | 2402 | 11 | 2412 | 21 | 2422 | 31 | 2432 | 41 | 2442 | 51 | 2452 | 61 | 2462 | 71 | 2472 |
| 2 | 2403 | 12 | 2413 | 22 | 2423 | 32 | 2433 | 42 | 2443 | 52 | 2453 | 62 | 2463 | 72 | 2473 |
| 3 | 2404 | 13 | 2414 | 23 | 2424 | 33 | 2434 | 43 | 2444 | 53 | 2454 | 63 | 2464 | 73 | 2474 |
| 4 | 2405 | 14 | 2415 | 24 | 2425 | 34 | 2435 | 44 | 2445 | 54 | 2455 | 64 | 2465 | 74 | 2475 |
| 5 | 2406 | 15 | 2416 | 25 | 2426 | 35 | 2436 | 45 | 2446 | 55 | 2456 | 65 | 2466 | 75 | 2476 |
| 6 | 2407 | 16 | 2417 | 26 | 2427 | 36 | 2437 | 46 | 2447 | 56 | 2457 | 66 | 2467 | 76 | 2477 |
| 7 | 2408 | 17 | 2418 | 27 | 2428 | 37 | 2438 | 47 | 2448 | 57 | 2458 | 67 | 2468 | 77 | 2478 |
| 8 | 2409 | 18 | 2419 | 28 | 2429 | 38 | 2439 | 48 | 2449 | 58 | 2459 | 68 | 2469 | 78 | 2479 |
| 9 | 2410 | 19 | 2420 | 29 | 2430 | 39 | 2440 | 49 | 2450 | 59 | 2460 | 69 | 2470 | 79 | 2480 |
| 10 | 2411 | 20 | 2421 | 30 | 2431 | 40 | 2441 | 50 | 2451 | 60 | 2461 | 70 | 2471 | | |

3. DESCRIPTION OF TESTS

The tests documented in this report were performed in accordance with ANSI C63.4-2009 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 Radiated Emission Measurement

Radiated emission measurements were made in accordance with § 13 in ANSI C63.4-2009 "Measurement of Intentional radiators" The measurements were performed over the frequency range of 30 MHz to 40 GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak, Quasi-peak, Average" within a bandwidth of 120 kHz and above 1 GHz is 1 MHz.

Preliminary measurements were made at 3 m using broadband antennas, and spectrum analyzer to determine the frequency producing the maximum emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1 000 MHz using Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site or SVSWR chamber at 3 m. The test equipment was placed on a styrofoam table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8 m high nonmetallic 1.0 m x 1.5 m table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the maximum emission.

Varying the mode of operating frequencies of the EUT maximized each emission. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst-case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20 dB/decade) as per section 15.31(f).

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

3.2 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section § 13 in ANSI C63.4-2009 "measurement of intentional radiators" The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω /50 μ H LISN as the input transducer to a Spectrum Analyzer or a Test Receiver. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 9 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1 m x 1.5 m x 0.8 m wooden table which is placed 0.4 m away from the vertical wall and 1.5 m away from the side wall of the chamber room. Two LISN are bonded to the shielded room. The EUT is powered from the LISN and the support equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the LISN. Non-inductive bundling to a 1 m length shortened all interconnecting cables more than 1 m. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the EMI Test Receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 MHz to 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

3.3 FCC Part 15.205 Restricted Bands of Operations

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

| MHz | MHz | MHz | GHz |
|----------------------------|-------------------------|-------------------|------------------|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| ¹ 0.495 - 0.505 | 16.694 75 - 16.695 25 | 608 - 614 | 5.35 - 5.46 |
| 2.173 5 - 2.190 5 | 16.804 25 - 16.804 75 | 960 - 1 240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1 300 - 1 427 | 8.025 - 8.5 |
| 4.177 25 - 4.177 75 | 37.5 - 38.25 | 1 435 - 1 626.5 | 9.0 - 9.2 |
| 4.207 25 - 4.207 75 | 73 - 74.6 | 1 645.5 - 1 646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1 660 - 1 710 | 10.6 - 12.7 |
| 6.267 75 - 6.268 25 | 108 - 121.94 | 1 718.8 - 1 722.2 | 13.25 - 13.4 |
| 6.311 75 - 6.312 25 | 123 - 138 | 2 200 - 2 300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2 310 - 2 390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.524 75 - 156.525 25 | 2 483.5 - 2 500 | 17.7 - 21.4 |
| 8.376 25 - 8.386 75 | 156.7 - 156.9 | 2 690 - 2 900 | 22.01 - 23.12 |
| 8.414 25 - 8.414 75 | 162.012 5 - 167.17 | 3 260 - 3 267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3 332 - 3 339 | 31.2 - 31.8 |
| 12.519 75 - 12.520 25 | 240 - 285 | 3 345.8 - 3 358 | 36.43 - 36.5 |
| 12.576 75 - 12.577 25 | 322 - 335.4 | 3 600 - 4 400 | (²) |
| 13.36 - 13.41 | | | |

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

² Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

4. TEST CONDITION

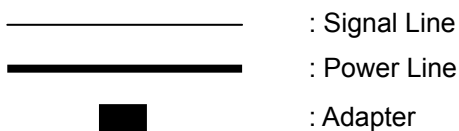
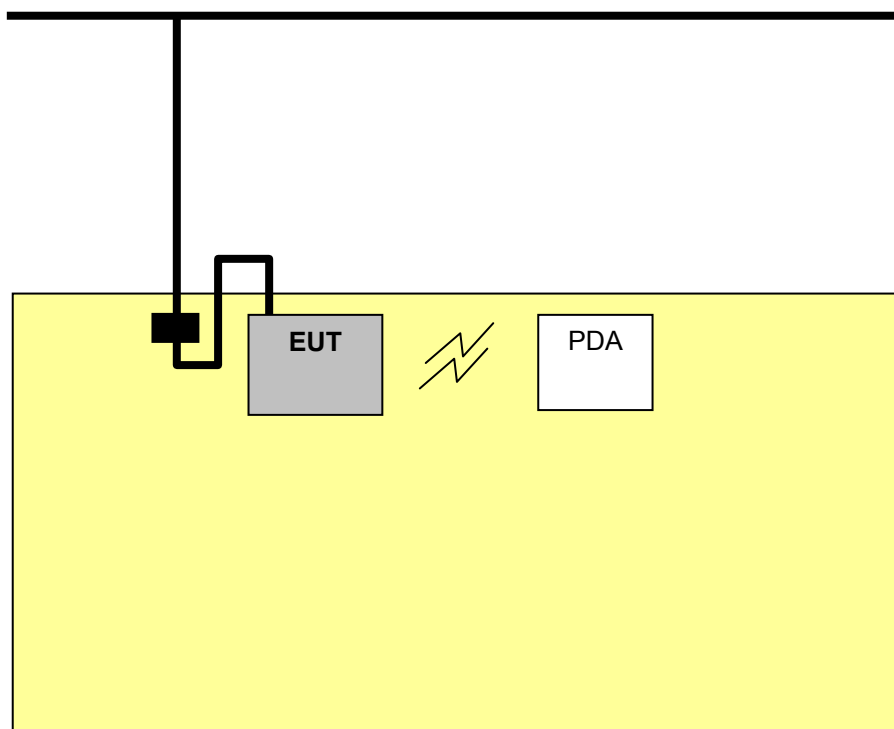
4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

4.2 Description of Test modes

Mobile Printer that has the control software.

4.3 The setup drawing(s)



5. TEST RESULTS

5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

| 47 CFR Part 15, Subpart C | Measurement Required | Result |
|---------------------------|---|--------|
| 15.247(a)(1) | Channel Bandwidth, Frequency Separation | Pass |
| 15.247(b)(3) | Maximum Peak Output Power | Pass |
| 15.247(d) | Bandwidth of Frequency Band Edges | Pass |
| 15.247(a)(1)(iii) | Number of Hopping Channels | Pass |
| 15.247(a)(1)(iii) | Time of Occupancy (Dwell time) | Pass |
| 15.209(a) | Spurious Emissions | Pass |
| 15.207 | Conducted Emissions | Pass |
| 15.247(i) 1.1307(b)(1) | RF Exposure | Pass |

The data collected shows that the **Woosim System Inc. / Mobile Printer / WSP-R350** complied with technical requirements of above rules part 15.207, 209 and 15.247 Limits.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

5.2 Channel Bandwidth and Frequency Separation

| | |
|-----------------------|---|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.247(a)(1) |
| Test Date | August 27, 2014 |
| Environmental of Test | (21.2 ± 0.0) °C, (44 ± 0) % R.H., (100.9 ± 0.0) kPa |
| Operating Condition | RF transmitting continuously during the tested. |
| Result | Passed |

5.2.1 Channel Bandwidth

| Type of Modulation | Frequency [MHz] | 20 dB Bandwidth [MHz] | Limit |
|--------------------|-----------------|-----------------------|--|
| BDR | 2 402 | 0.939 | 2/3 of the 20 dB Bandwidth < Carrier frequency separation |
| | 2 441 | 0.940 | |
| | 2 480 | 0.940 | |
| EDR | 2 402 | 1.258 | |
| | 2 441 | 1.258 | |
| | 2 480 | 1.256 | |

NOTES:

1. Measure frequency separation of relevant channel using spectrum analyzer.
2. Please see the measured plot in next page.

5.2.2 Frequency Separation

Frequency hopping systems operating in the 2 400.0 MHz - 2 483.5 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.

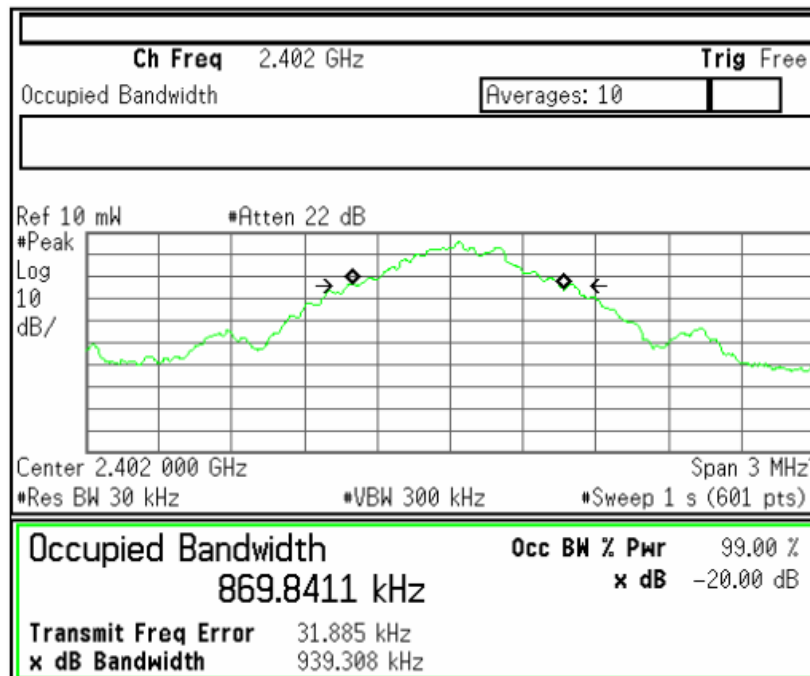
| Type of Modulation | EUT Channel Separation [MHz] | 20 dB bandwidth [MHz] | Limit |
|--------------------|------------------------------|-----------------------|---|
| BDR | 1.000 (Worst) | 0.940 (Worst) | > 25 kHz or > 2/3 of the 20 dB Bandwidth |
| EDR | 1.000 (Worst) | 1.258 (Worst) | |

NOTES:

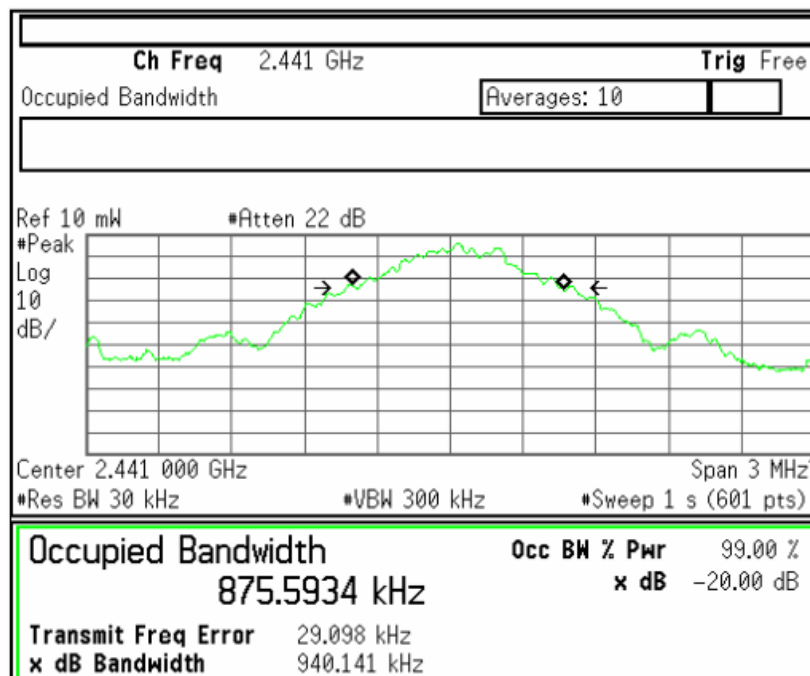
1. Measure frequency separation of relevant channel using spectrum analyzer.
2. Please see the measured plot in next page.

Plots of 20 dB Bandwidth (BDR)

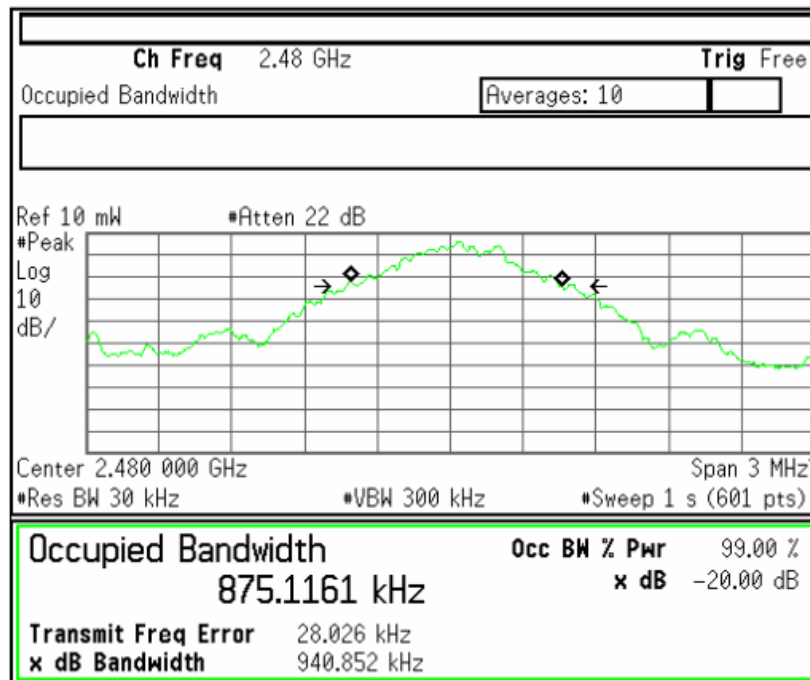
[2 402 MHz]



[2 441 MHz]

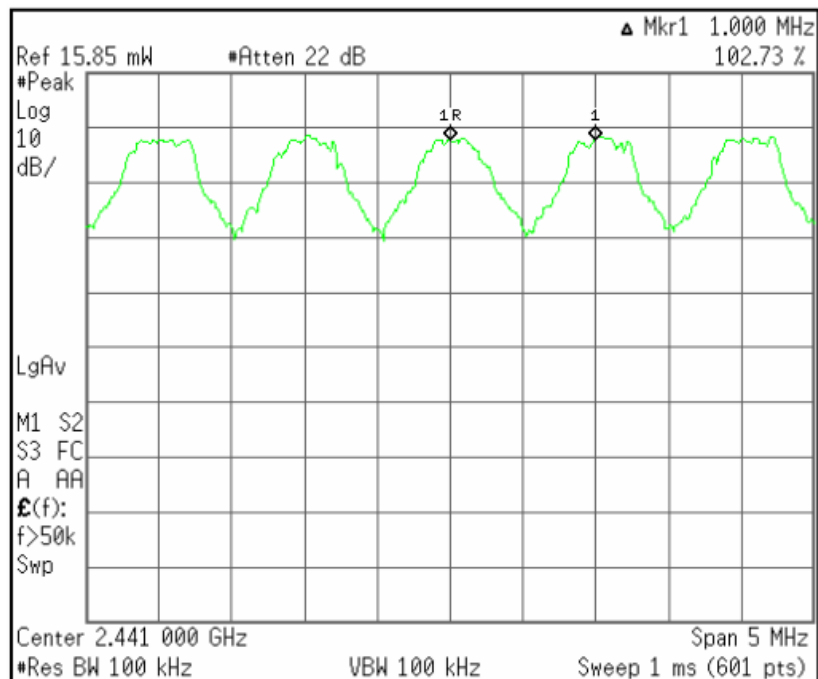


[2 480 MHz]



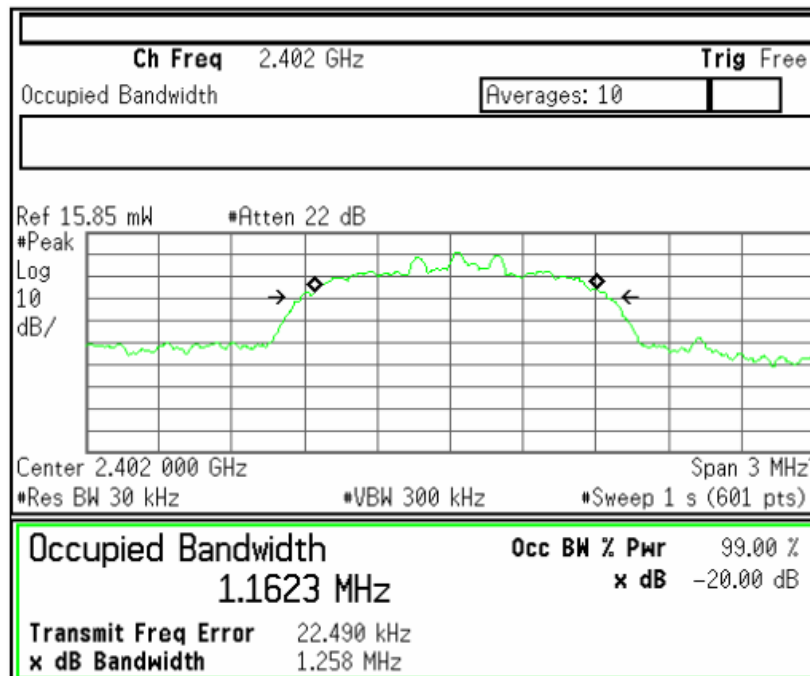
Plots of Frequency Separation (BDR)

[Channel Separation]

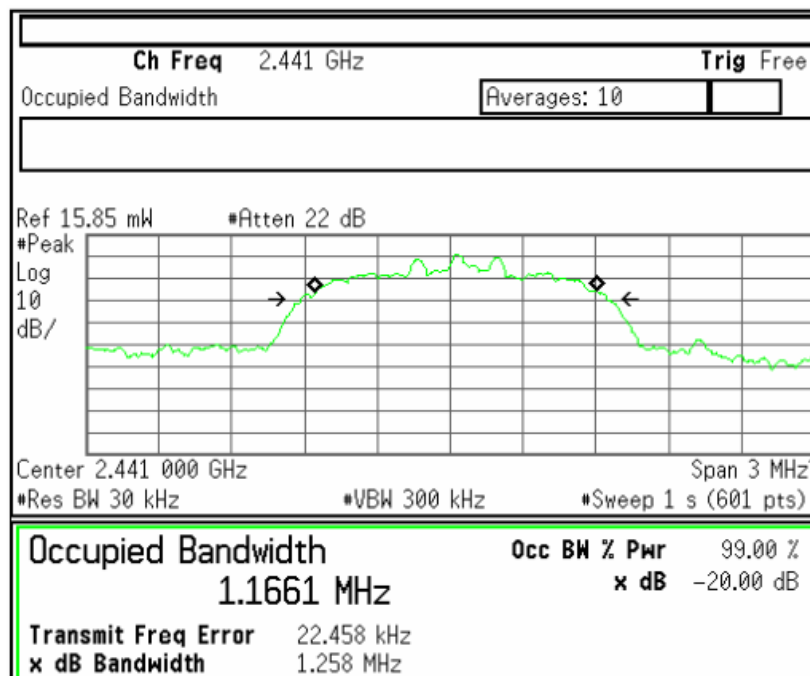


Plots of 20 dB Bandwidth (EDR)

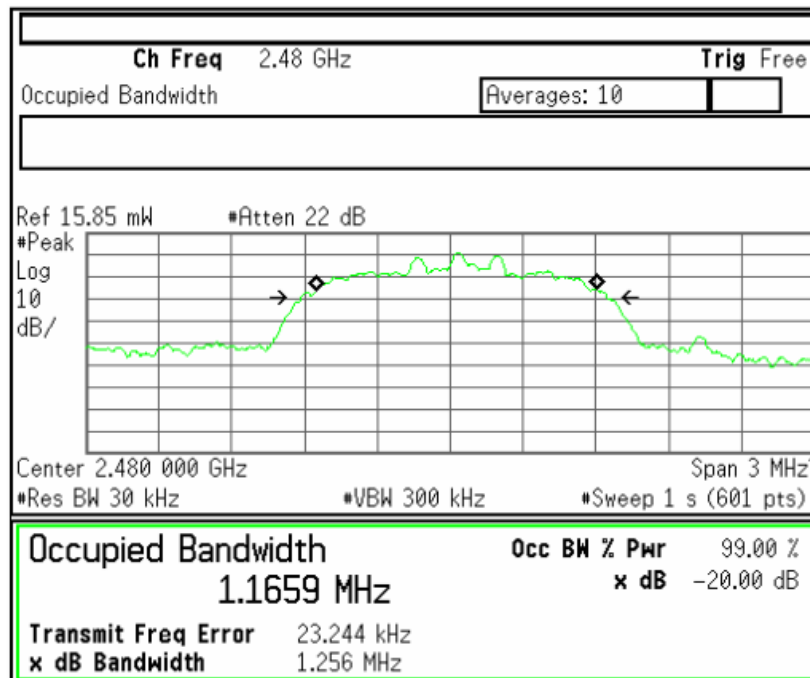
[2 402 MHz]



[2 441 MHz]

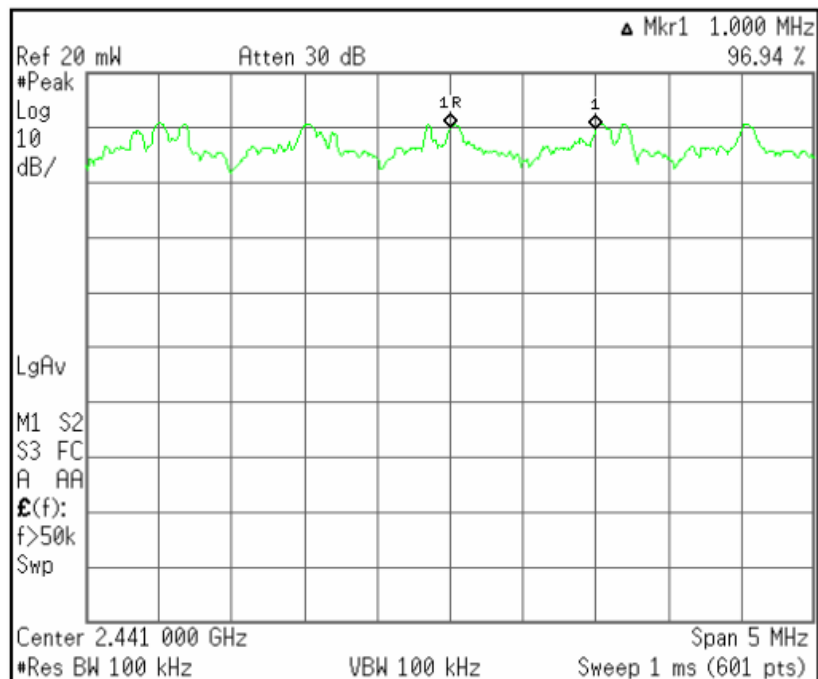


[2 480 MHz]



Plots of Frequency Separation (EDR)

[Channel Separation]



5.3 Maximum Peak Conducted Output Power

| | |
|-----------------------|---|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.247(b)(3) |
| Test Date | August 27, 2014 |
| Environmental of Test | (22.1 ± 0.1) °C, (43 ± 0) % R.H., (100.9 ± 0.0) kPa |
| Operating Condition | RF transmitting continuously during the tested. |
| Result | Passed |

Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2 400.0 MHz - 2 483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 Watt

Test Data

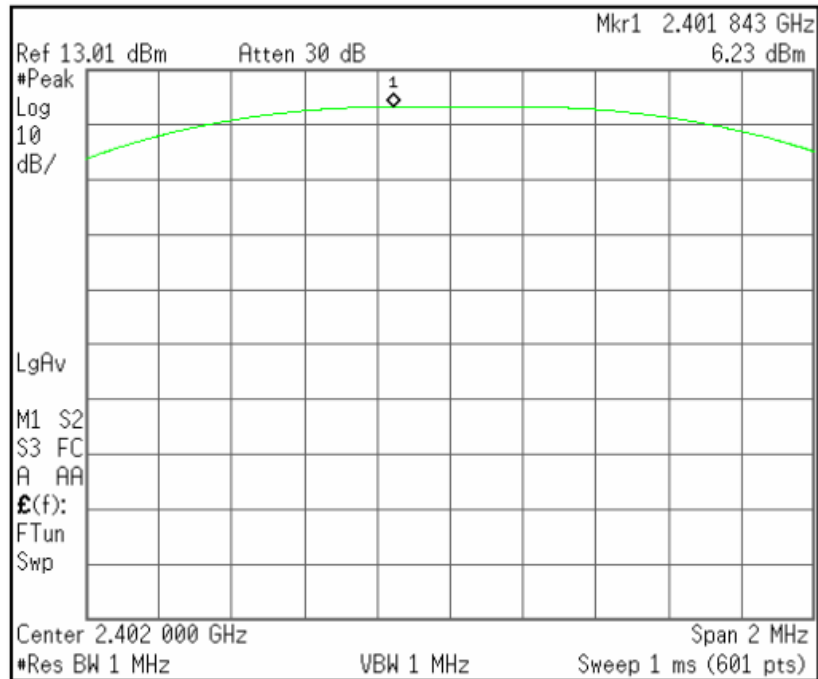
| Type of Modulation | Channel | Frequency [MHz] | Output Power [dBm] | Limit |
|--------------------|---------|-----------------|--------------------|----------------|
| BDR | Low | 2 402 | 6.23 | < 30 dBm (1 W) |
| | Mid | 2 441 | 6.49 | |
| | High | 2 480 | 6.75 | |
| EDR | Low | 2 402 | 4.65 | |
| | Mid | 2 441 | 4.73 | |
| | High | 2 480 | 4.79 | |

NOTES:

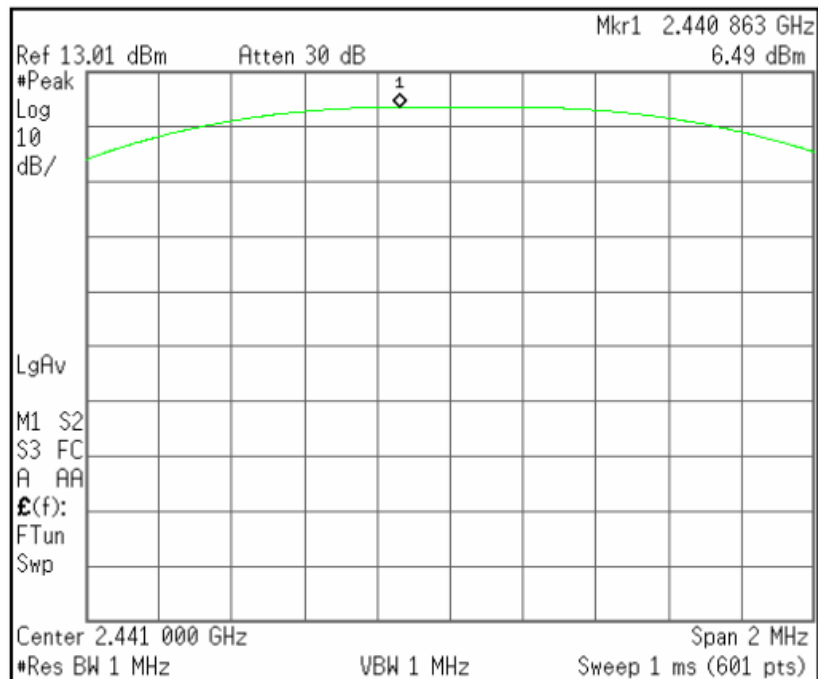
1. Measure conducted Channel power of relevant channel using Spectrum analyzer
2. RBW 1 MHz, VBW 1 MHz
3. Please see the measured plot in next page.

Plots of Maximum Peak Output Power (BDR)

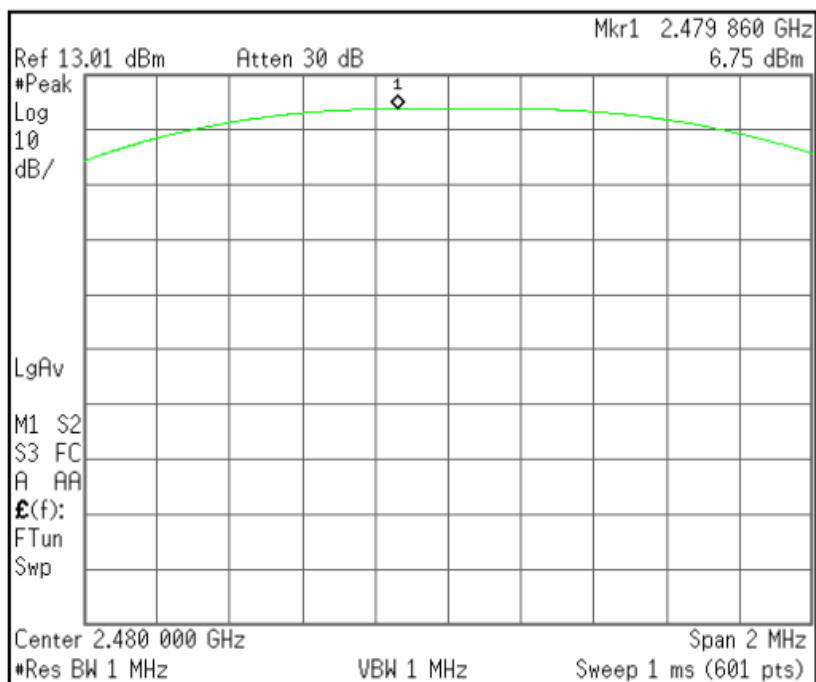
[2 402 MHz]



[2 441 MHz]

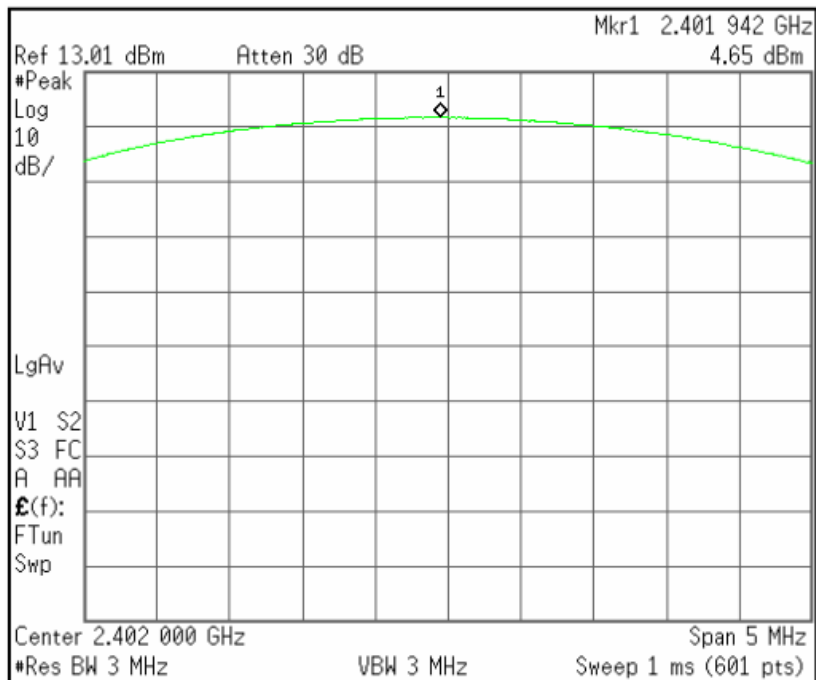


[2 480 MHz]

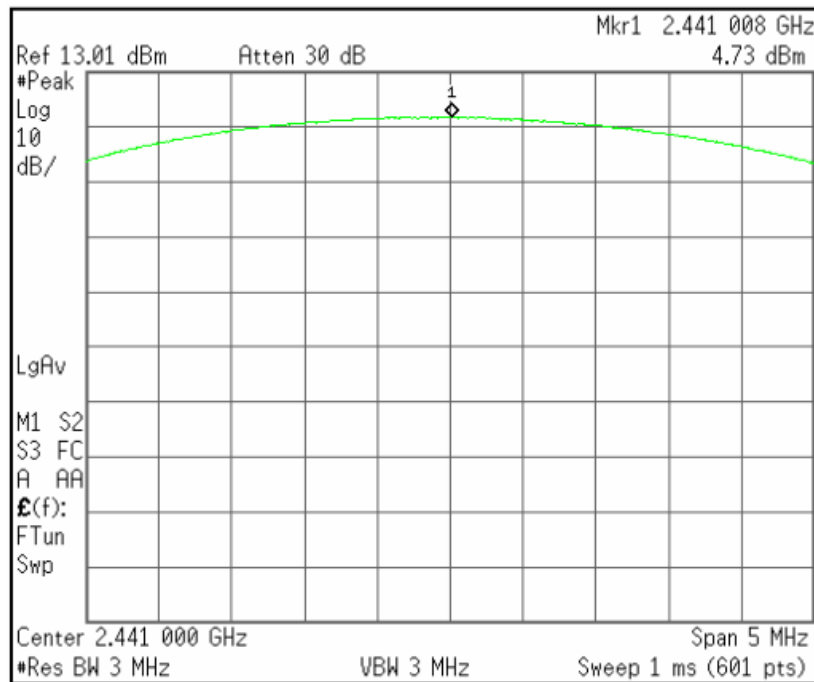


Plots of Maximum Peak Output Power (EDR)

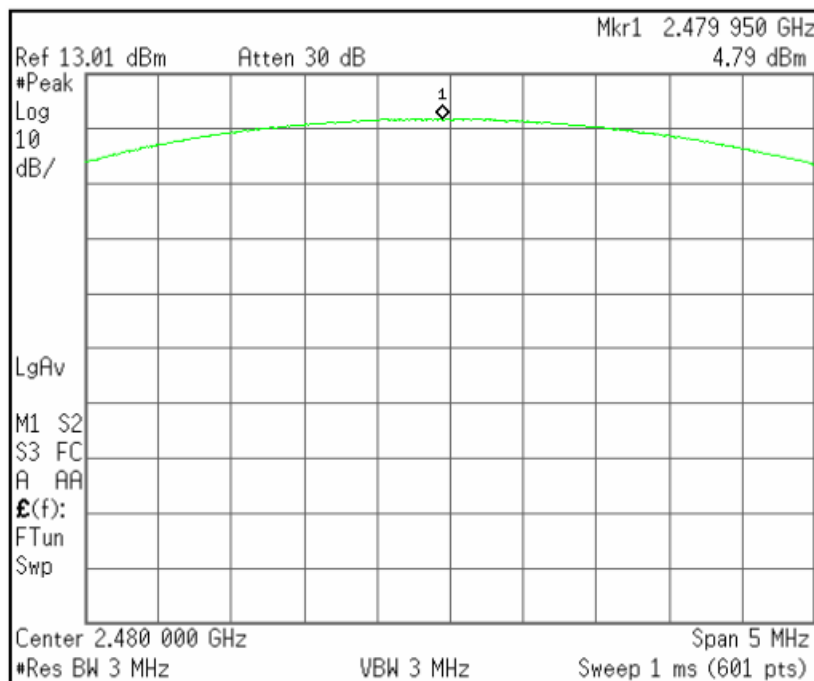
[2 402 MHz]



[2 441 MHz]



[2 480 MHz]



5.4 Bandwidth of Frequency Band Edges

| | |
|-----------------------|---|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.247(d) |
| Test Date | August 27, 2014 |
| Environmental of Test | (21.5 ± 0.3) °C, (42 ± 1) % R.H., (100.9 ± 0.1) kPa |
| Operating Condition | RF transmitting continuously during the tested. |
| Result | Passed |

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Results

- Refer to see the measured plot in next page.

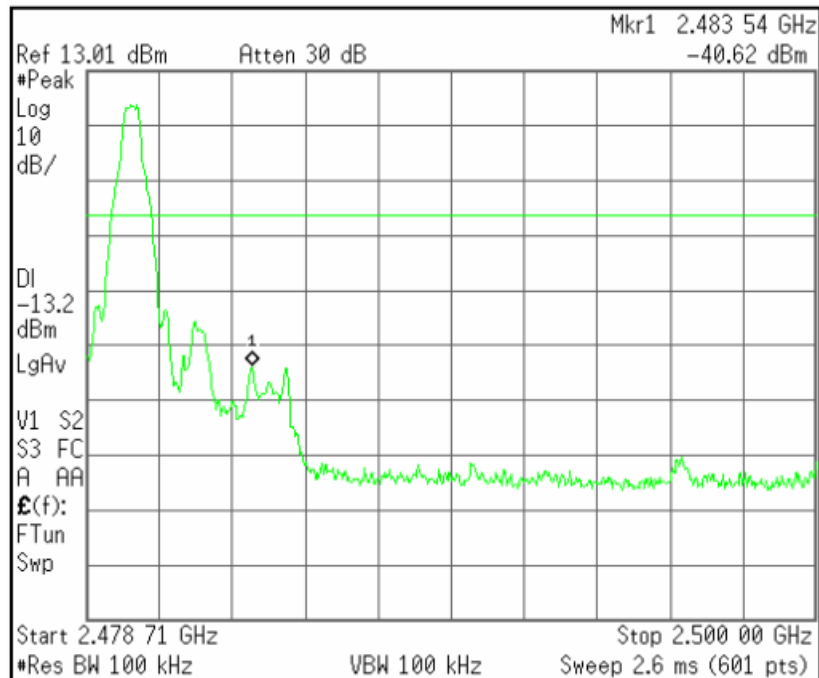
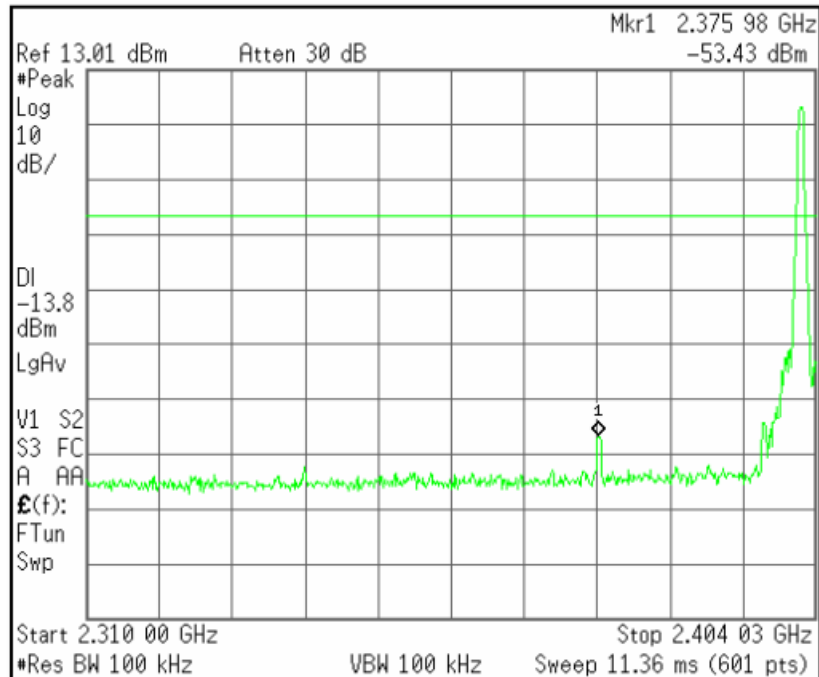
NOTES:

1. The test was performed to make a direct field strength measurement at the band edge frequencies.

Plots of Bandwidth of Frequency Band Edges (BDR)

[Non-hopping mode]

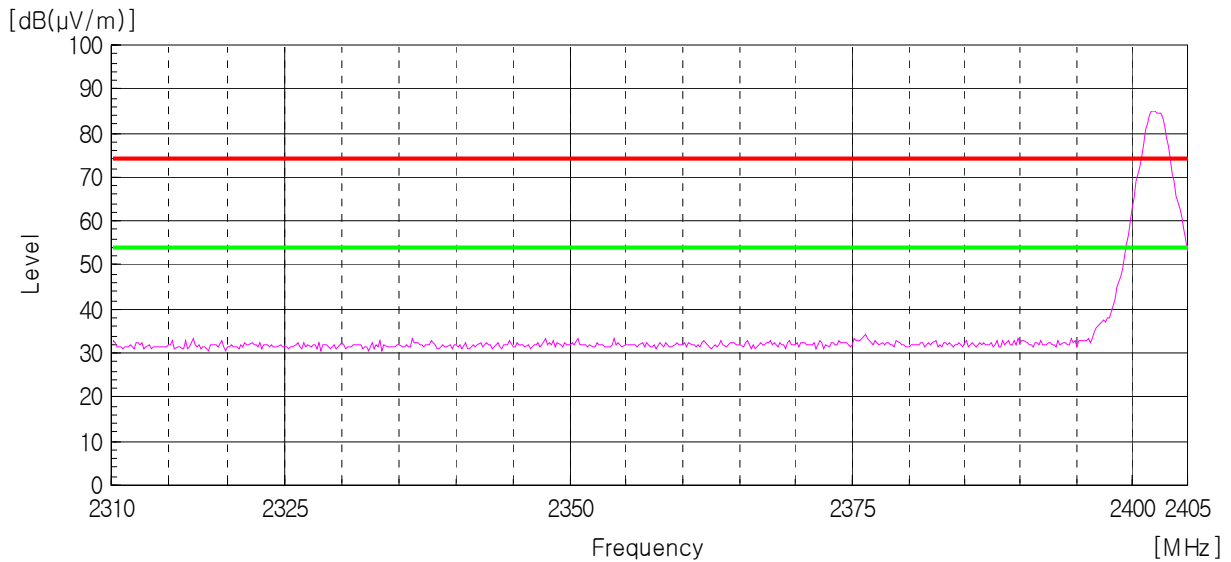
Conducted



Radiated

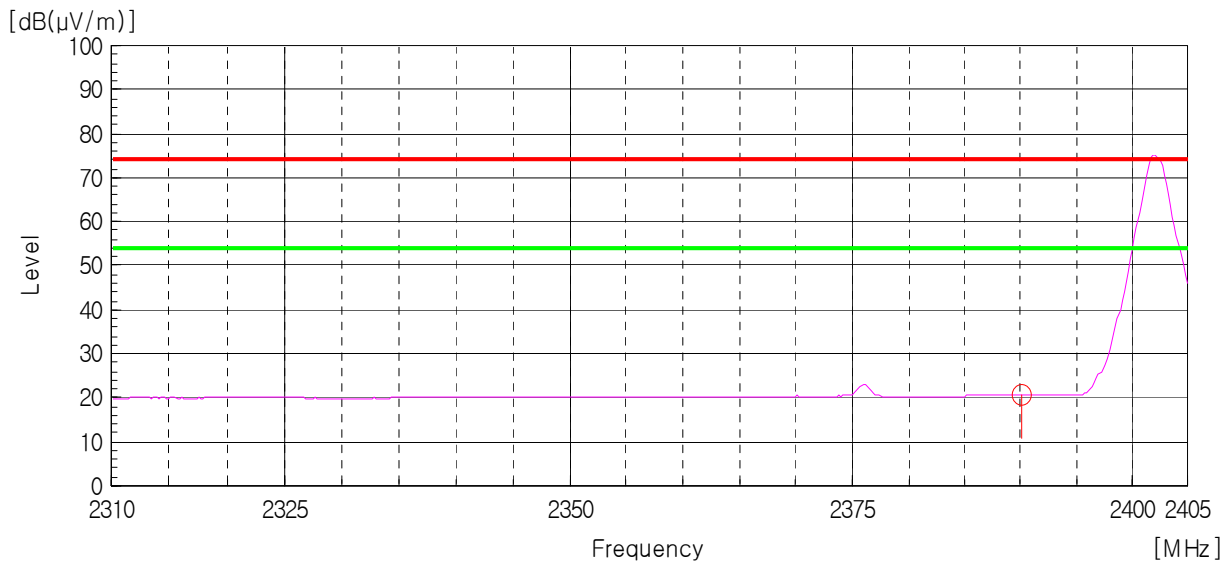
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



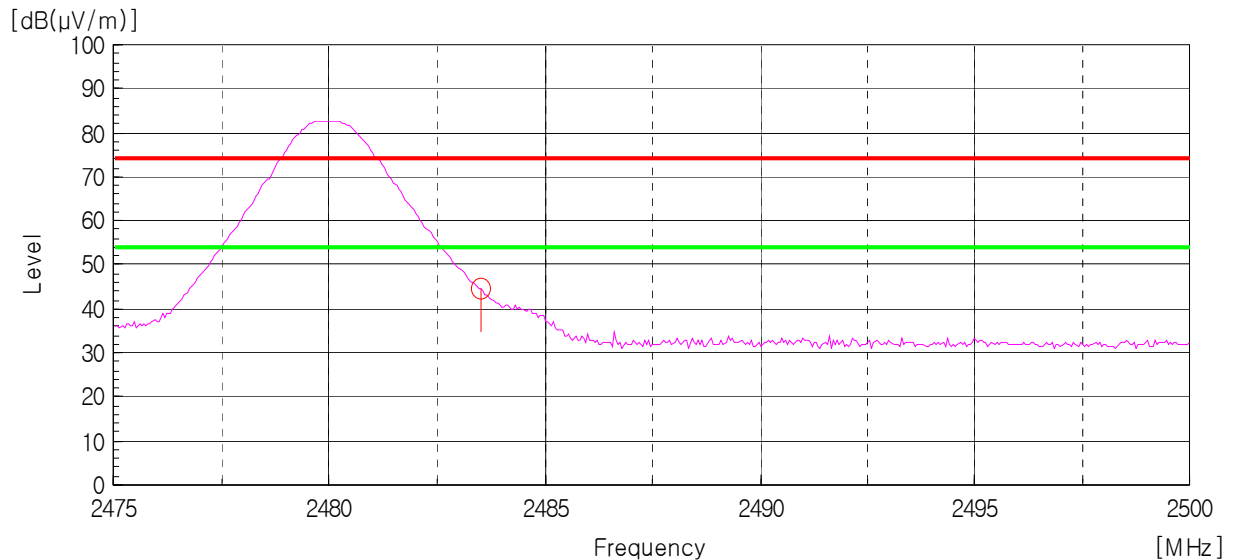
AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



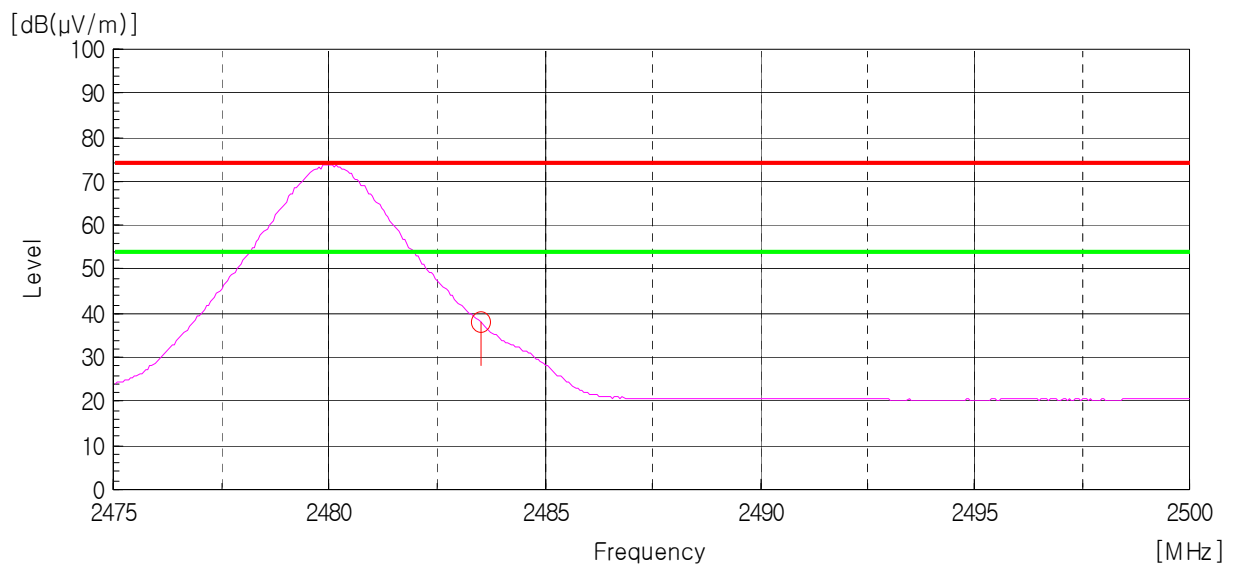
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

— Peak Limit Line
— AV Limit Line



AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

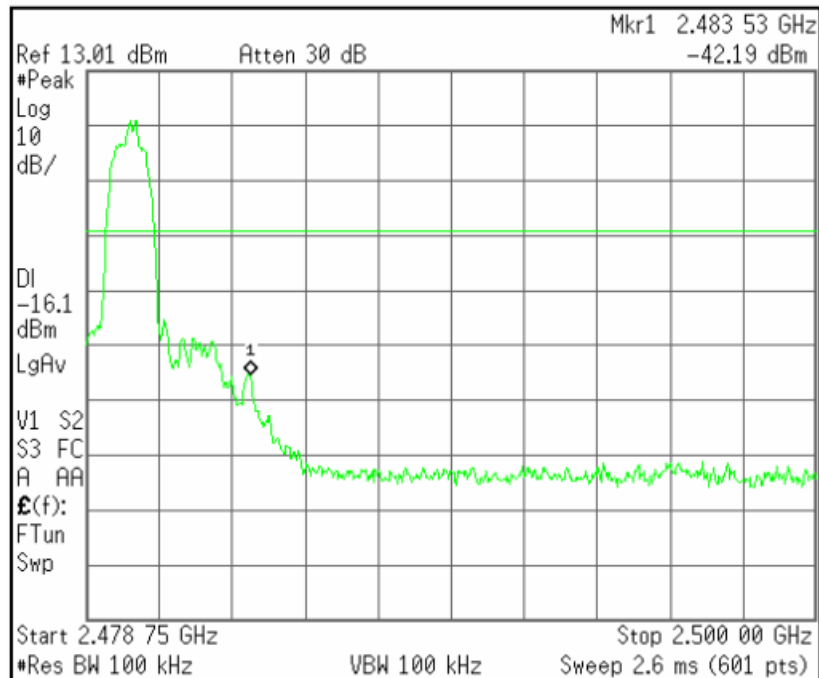
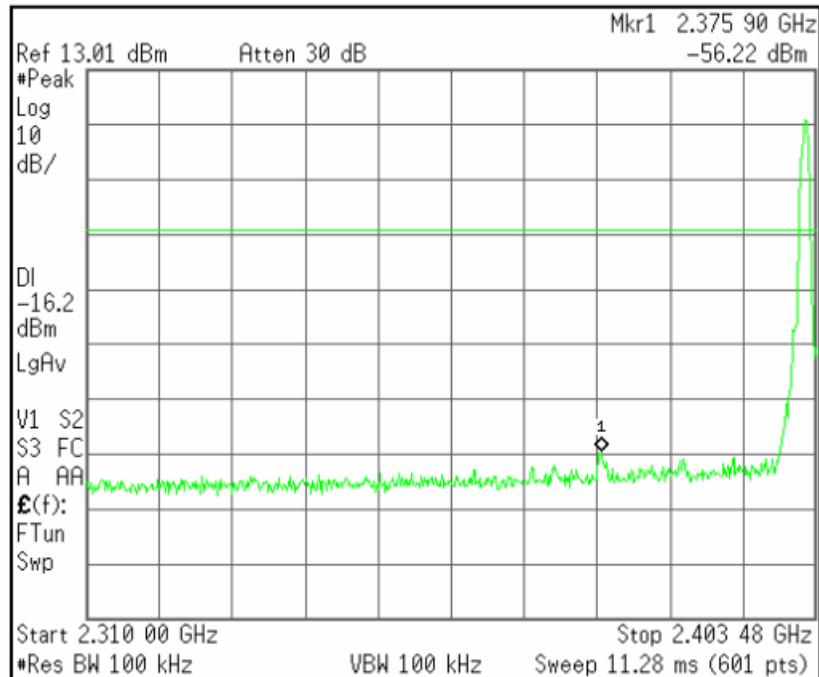
— Peak Limit Line
— AV Limit Line



Plots of Bandwidth of Frequency Band Edges (EDR)

[Non-hopping mode]

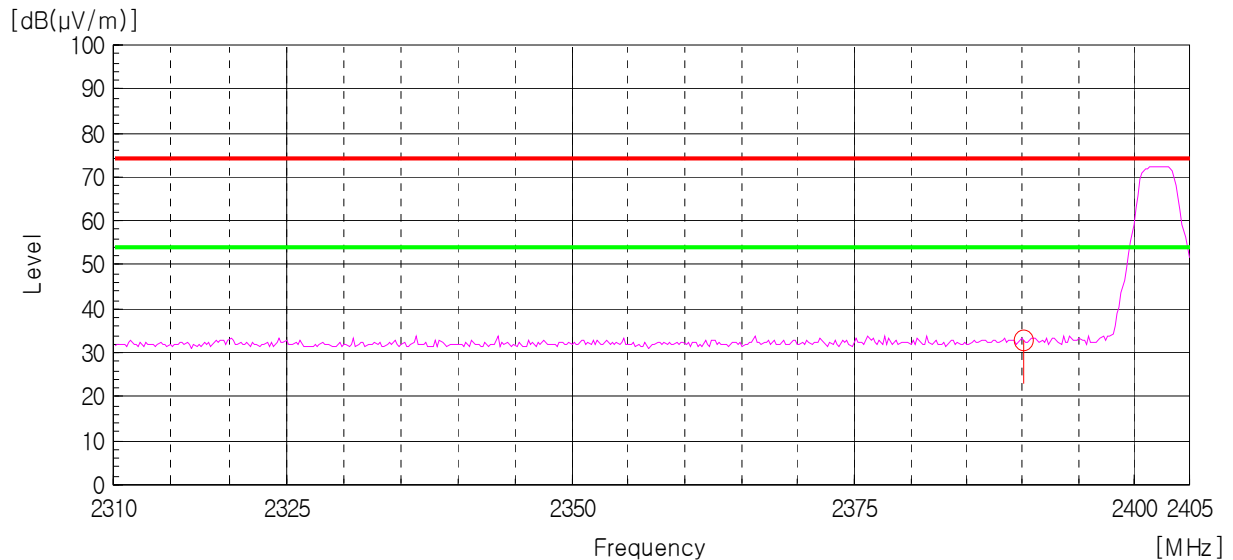
Conducted



Radiated

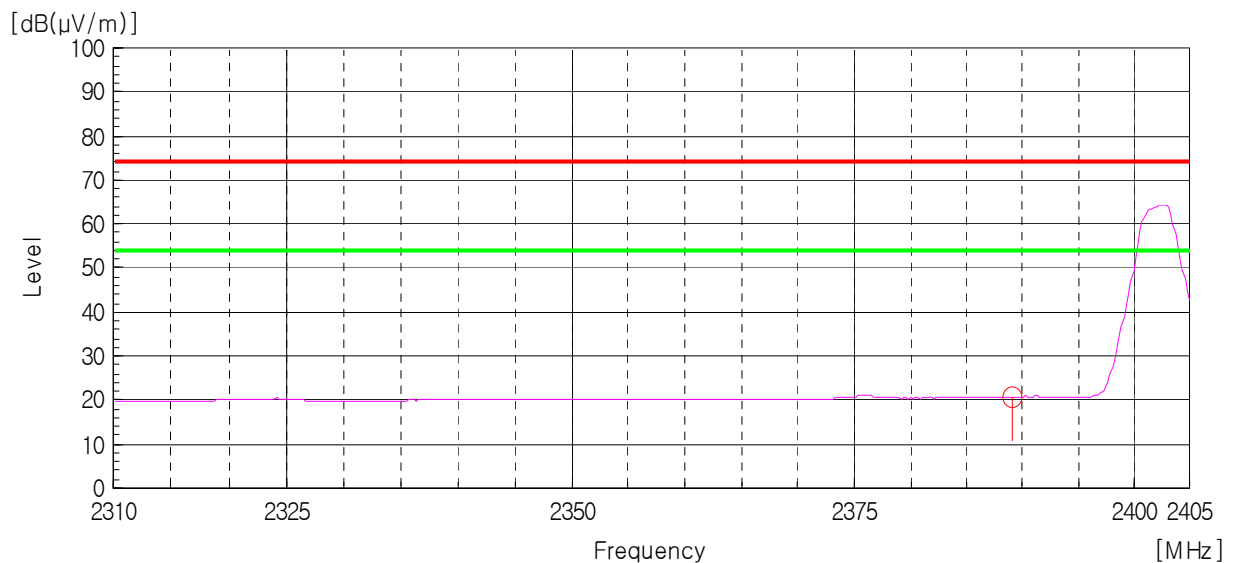
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



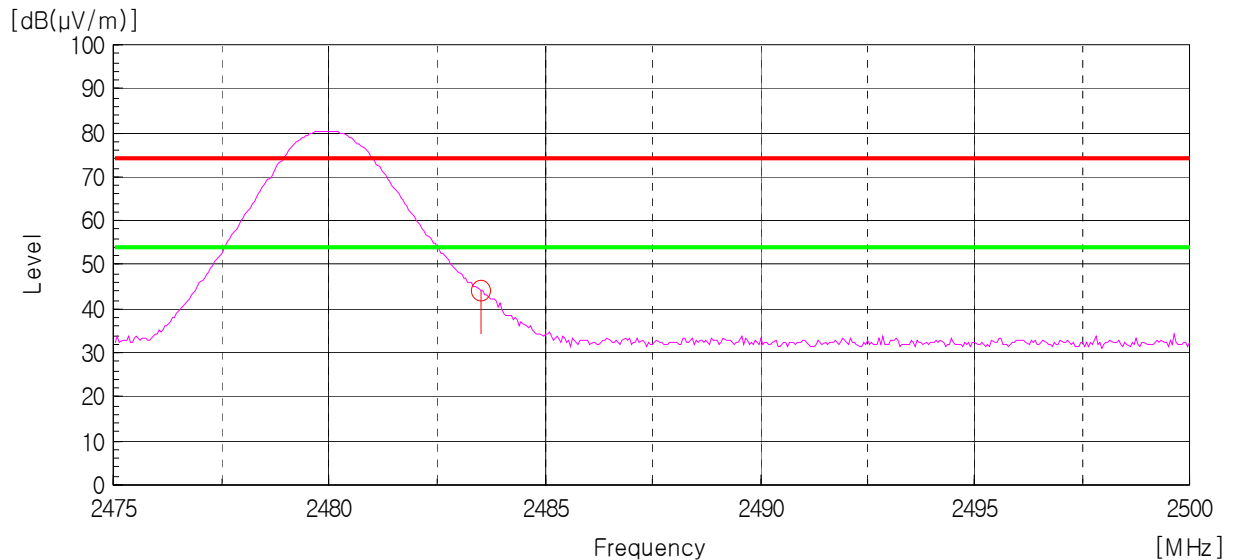
AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



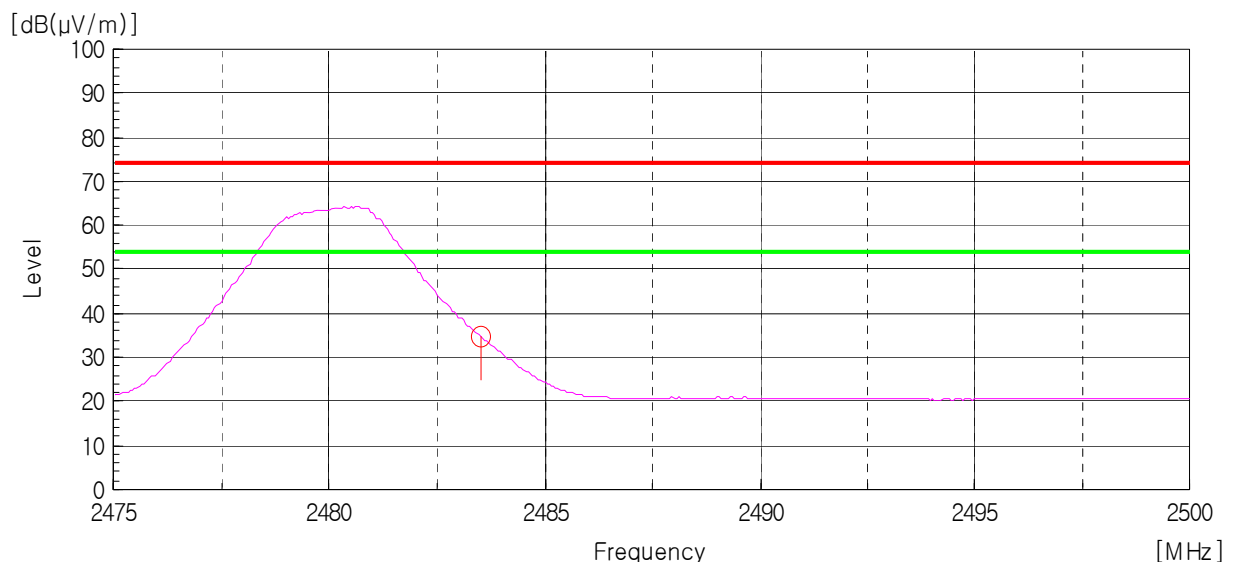
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

— Peak Limit Line
— AV Limit Line



AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

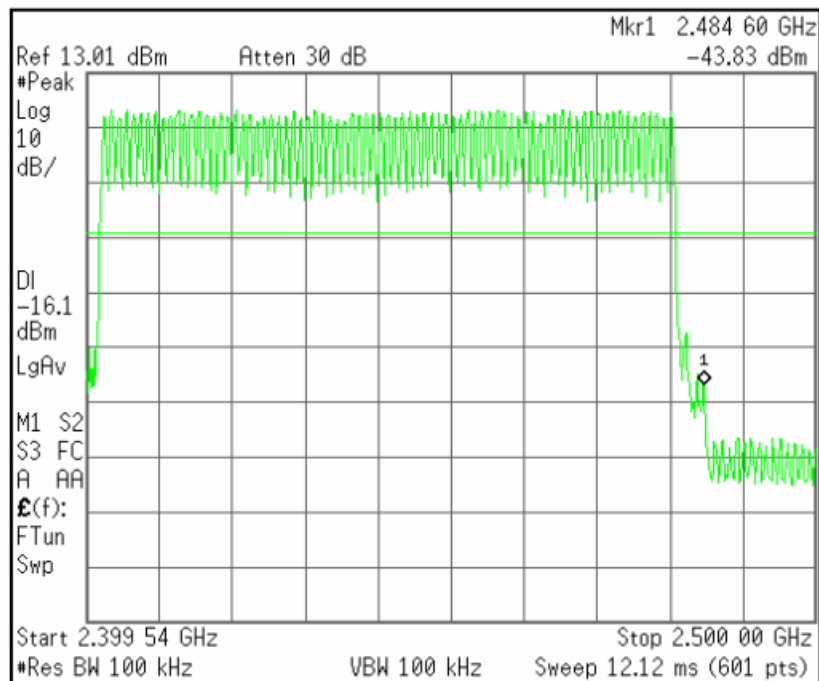
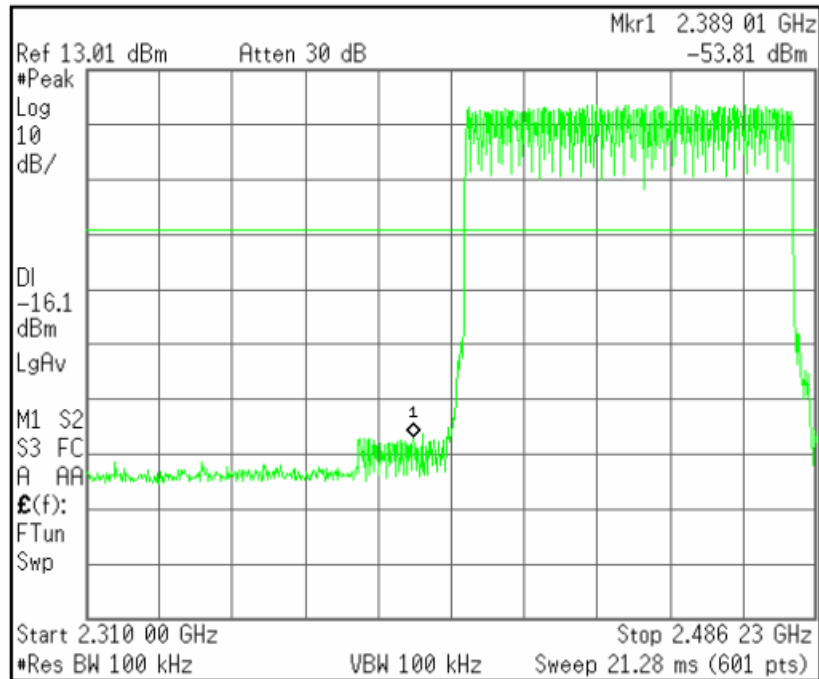
— Peak Limit Line
— AV Limit Line



Plots of Bandwidth of Frequency Band Edges (BDR)

[Hopping mode]

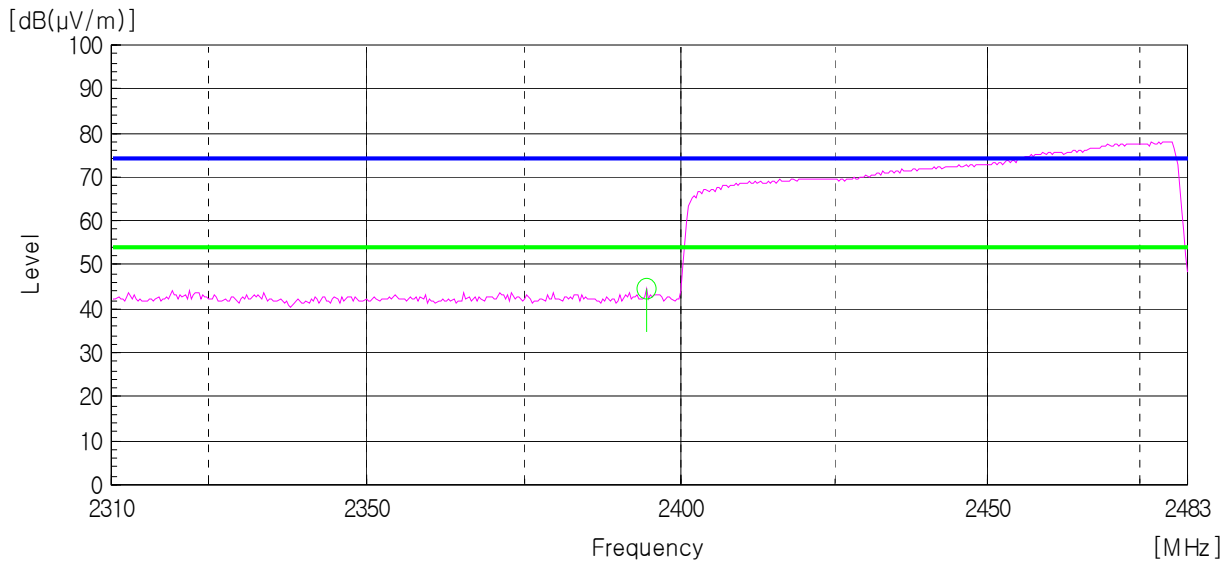
Conducted



Radiated

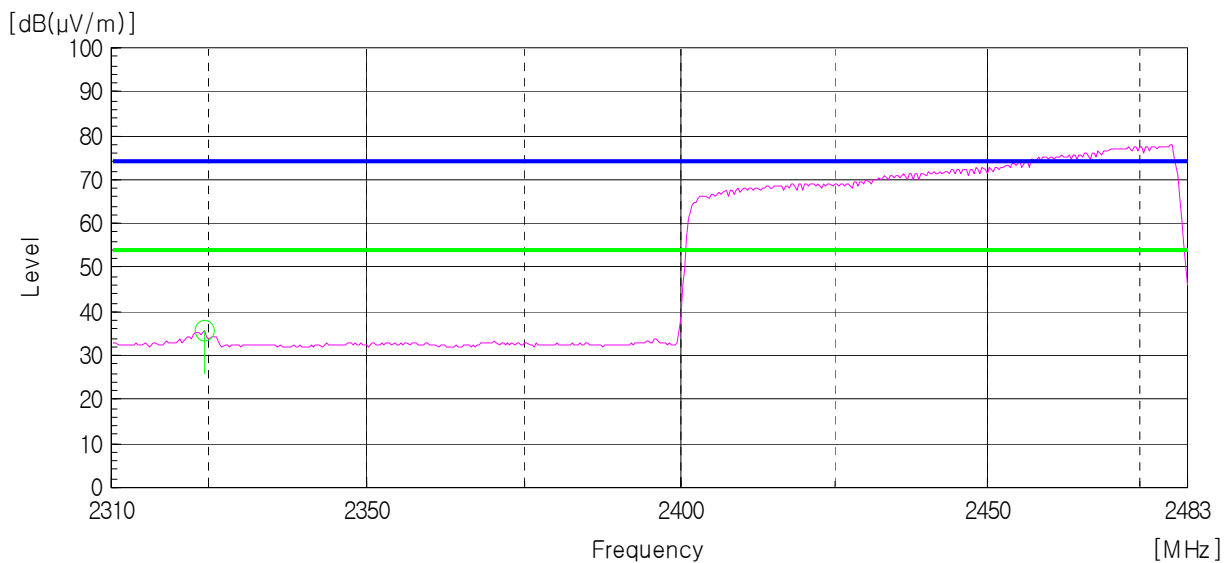
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



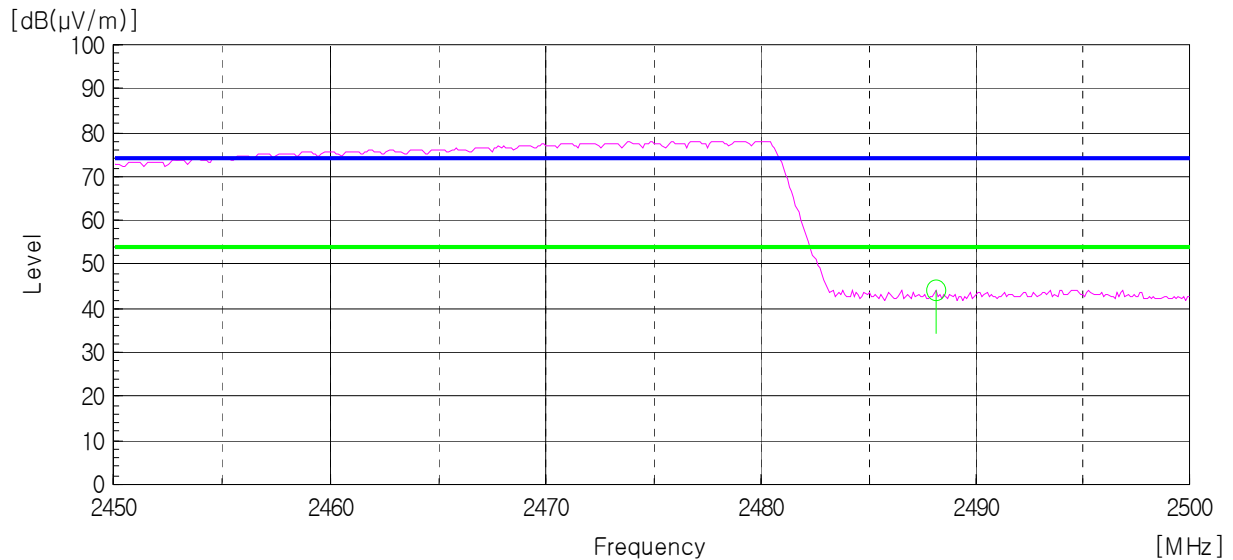
AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



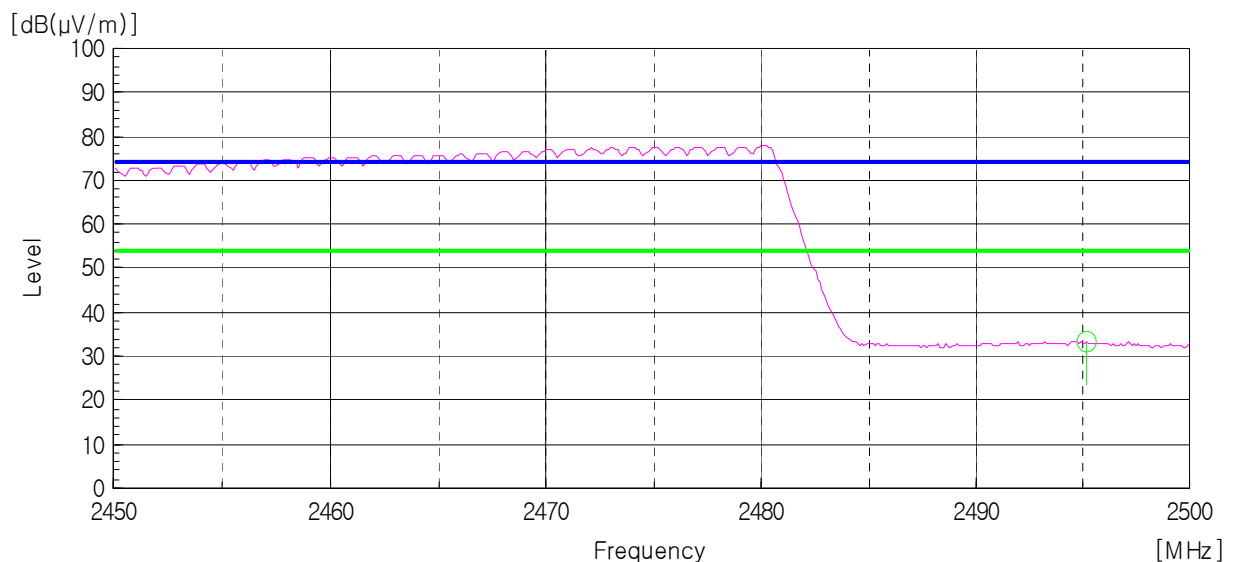
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

— Peak Limit Line
— AV Limit Line



AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

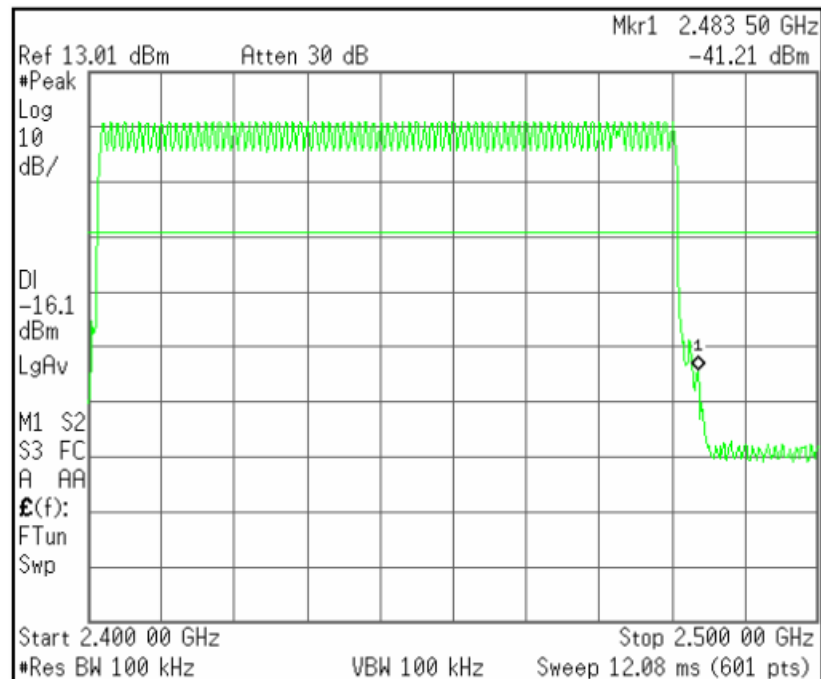
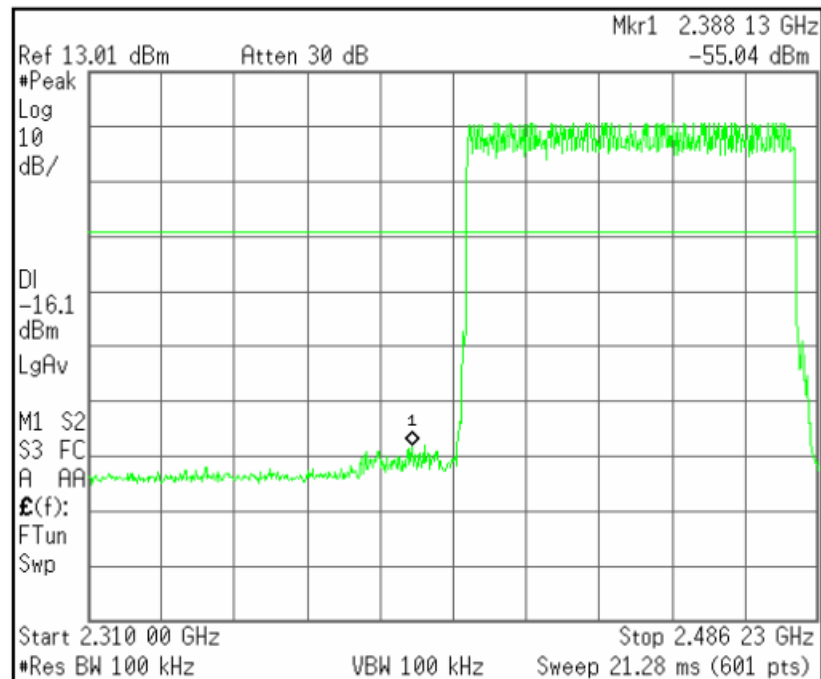
— Peak Limit Line
— AV Limit Line



Plots of Bandwidth of Frequency Band Edges (EDR)

[Hopping mode]

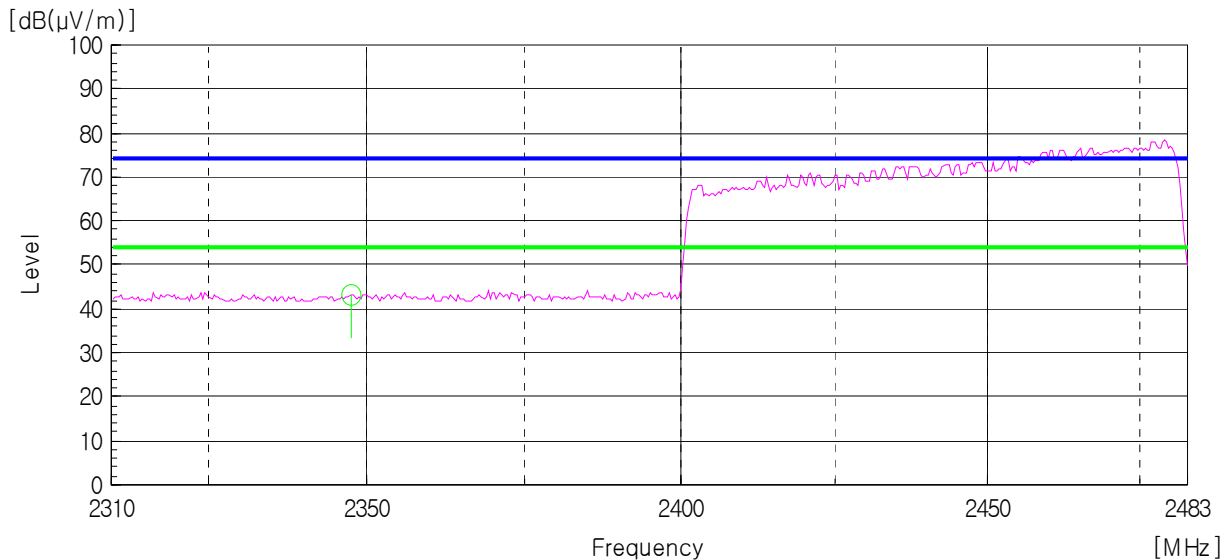
Conducted



Radiated

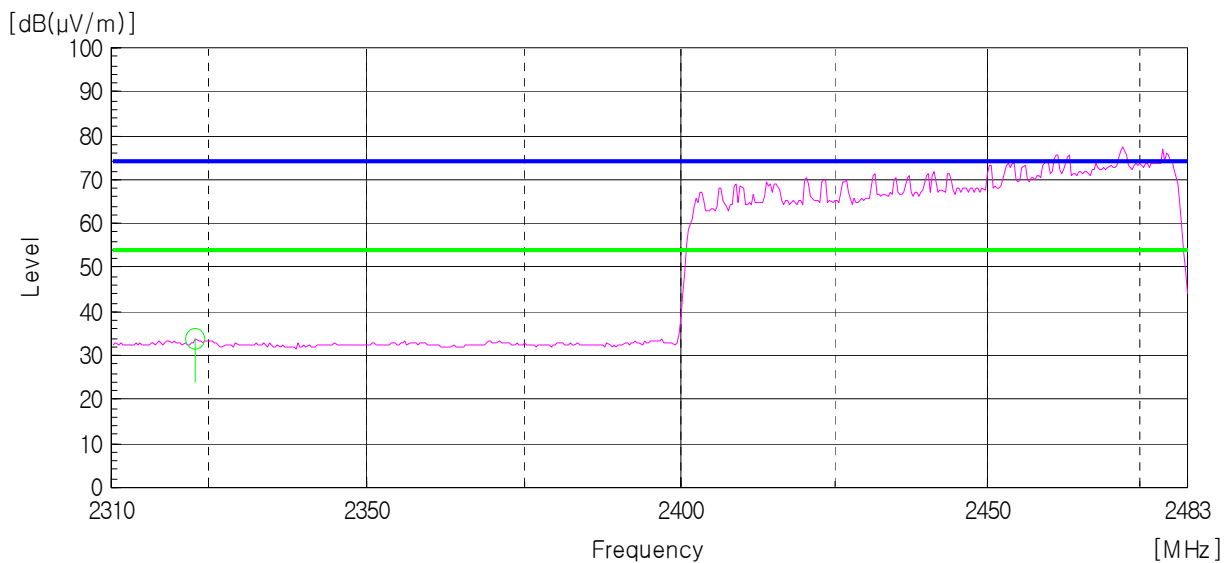
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



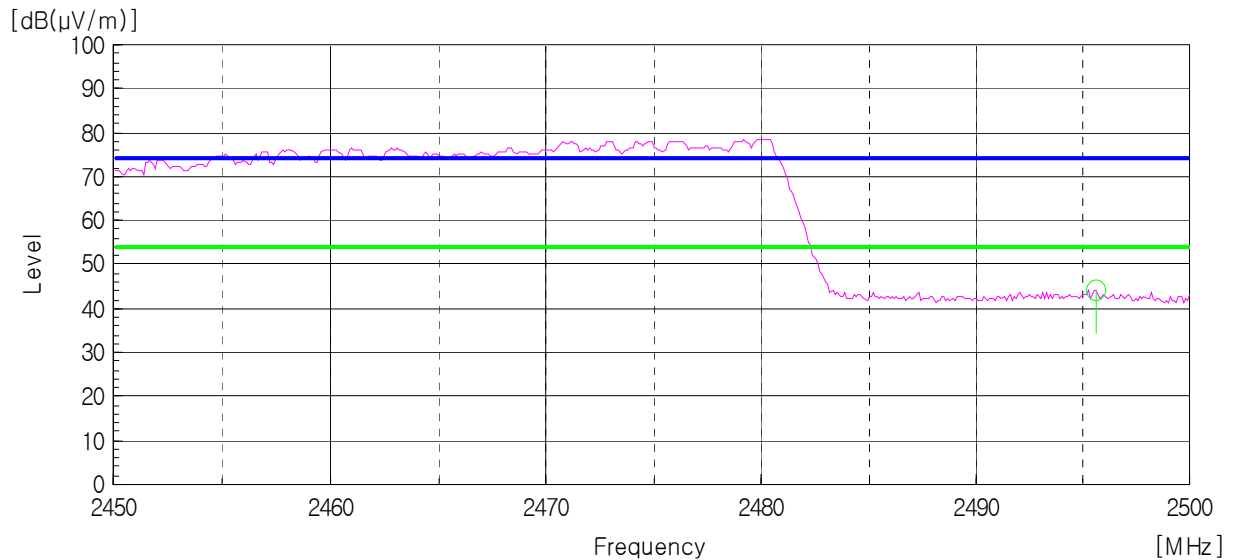
AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)

— Peak Limit Line
— AV Limit Line



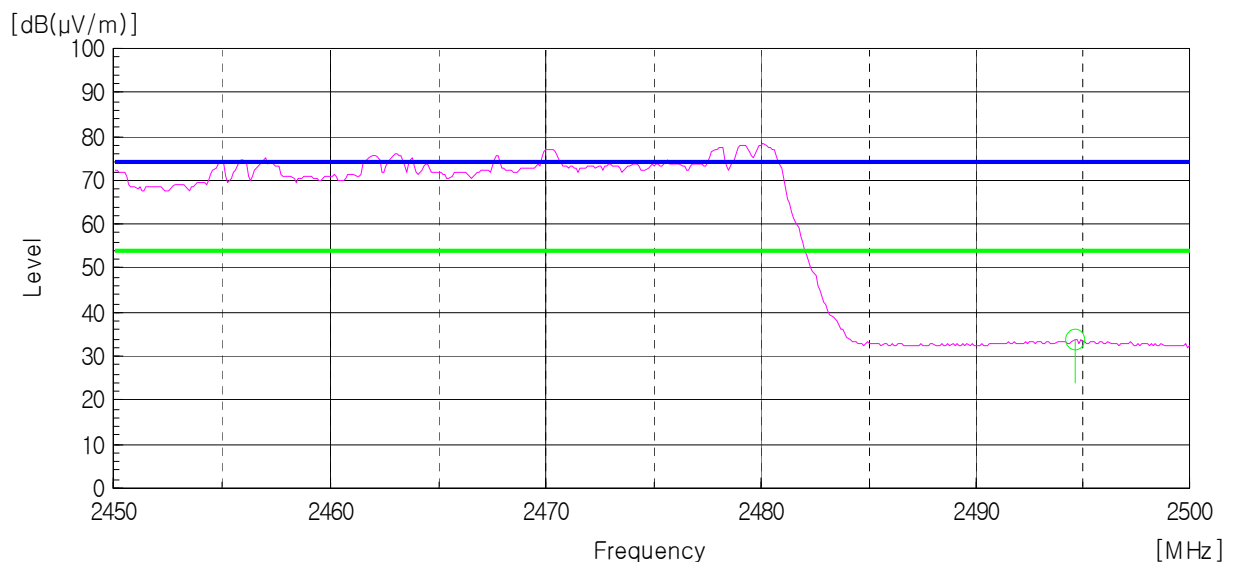
Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

— Peak Limit Line
— AV Limit Line



AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)

— Peak Limit Line
— AV Limit Line



5.5 Number of Hopping Channels

| | |
|-----------------------|---|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.247(a)(1)(iii) |
| Test Date | August 28, 2014 |
| Environmental of Test | (21.9 ± 0.0) °C, (47 ± 0) % R.H., (100.7 ± 0.0) kPa |
| Operating Condition | RF transmitting continuously during the tested. |
| Result | Passed |

Limit

Frequency hopping systems in the 2 400.0 MHz - 2 483.5 MHz band shall use at least 15 channels.

Test Data

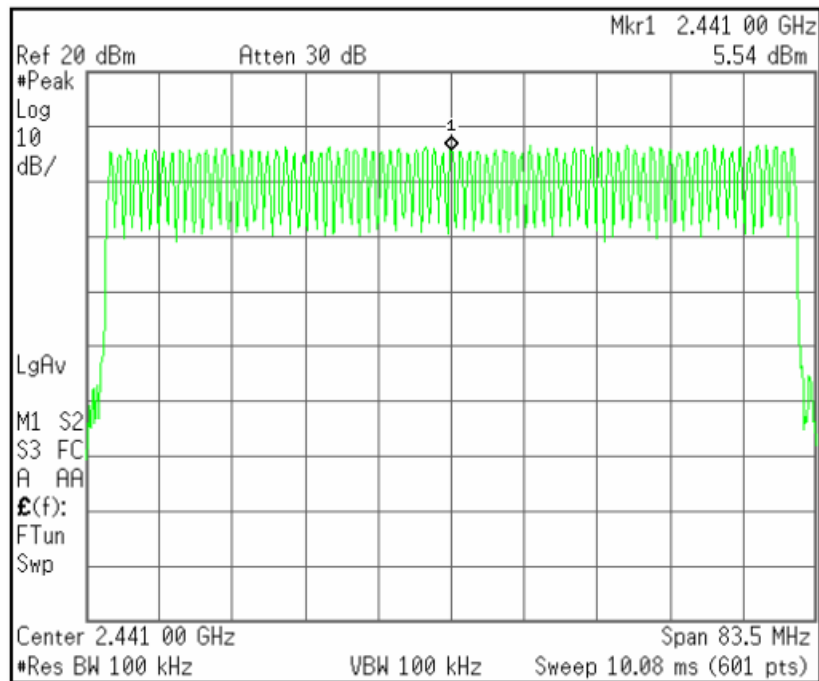
| Type of Modulation | Result | Limit |
|--------------------|--------|--------------|
| BDR | 79 | > 15 Channel |
| EDR | 79 | |

NOTES:

1. Measure number of hopping channel of relevant channel using spectrum analyzer.
2. Please see the measured plot in next page.

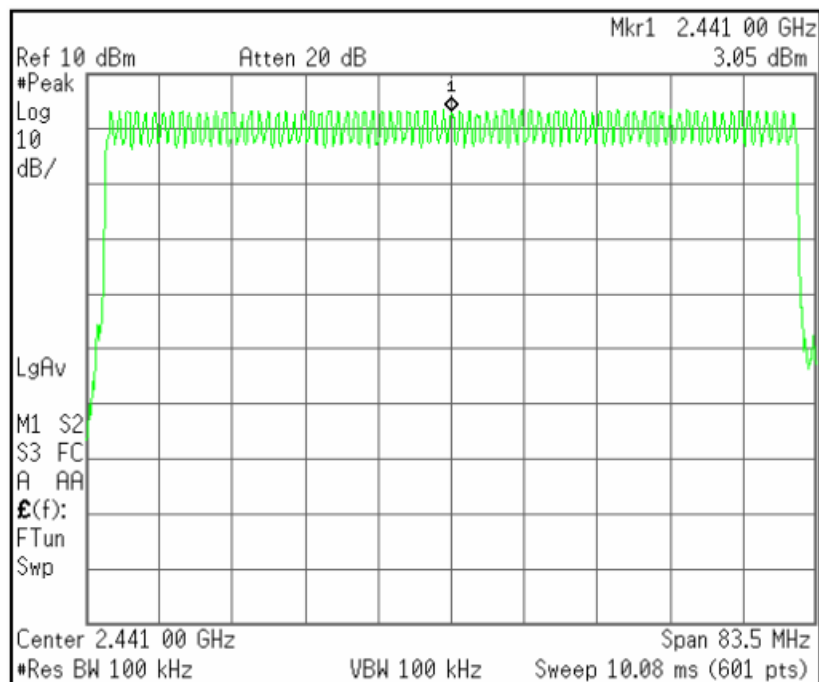
Plots of Number of Hopping Channels (BDR)

[Hopping Channels]



Plots of Number of Hopping Channels (EDR)

[Hopping Channels]



5.6 Time of Occupancy

| | |
|-----------------------|---|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.247(a)(1)(iii) |
| Test Date | August 28, 2014 |
| Environmental of Test | (21.2 ± 0.0) °C, (45 ± 0) % R.H., (100.7 ± 0.0) kPa |
| Operating Condition | RF transmitting continuously during the tested. |
| Result | Passed |

Limit

Frequency hopping systems in the 2 400.0 MHz - 2 483.5 MHz band. 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.

Test Data

Time of Occupancy

Test period = 0.4 [seconds/channel] x 79 [channel]

Actual = Reading x (Hopping rate/Number of channels) x Test period

Hopping rate (DH5 Packet) = 1 600 [hopping/second] / 6 [time slot] = 266.667

- Type of Modulation: BDR

0.4 s x 79 (CH) = 31.6 s

2.899 ms x (266.667/79) x 31.6 s = 309.227 ms

| Pulse Time [ms] | Total of Dwell [ms] | Limit [ms] |
|--------------------|------------------------|---------------|
| 2.899 | 309.227 | 400.000 |

- Type of Modulation: EDR

0.4 s x 79 (CH) = 31.6 s

2.909 ms x (266.667/79) x 31.6 s = 310.293 ms

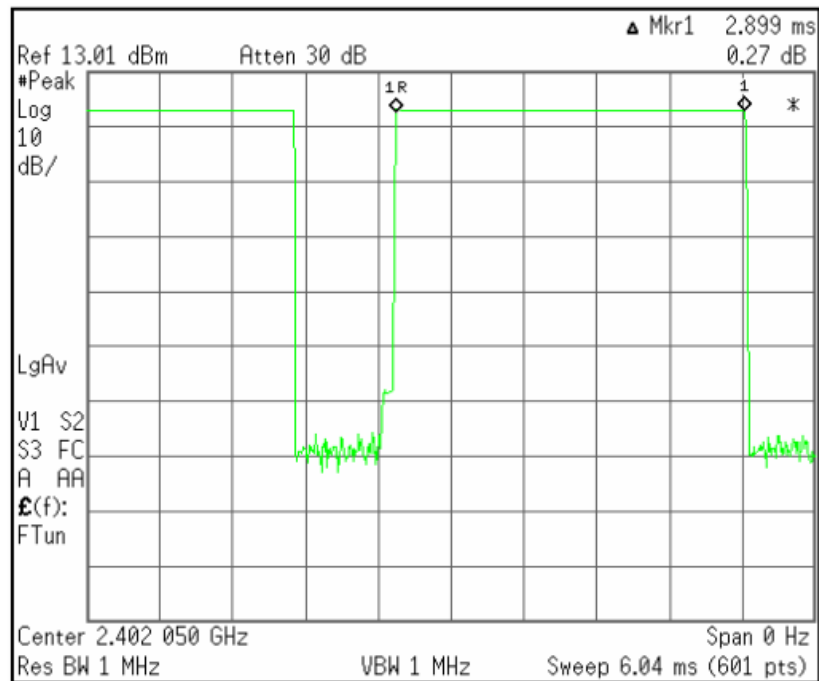
| Pulse Time [ms] | Total of Dwell [ms] | Limit [ms] |
|--------------------|------------------------|---------------|
| 2.909 | 310.293 | 400.000 |

NOTES:

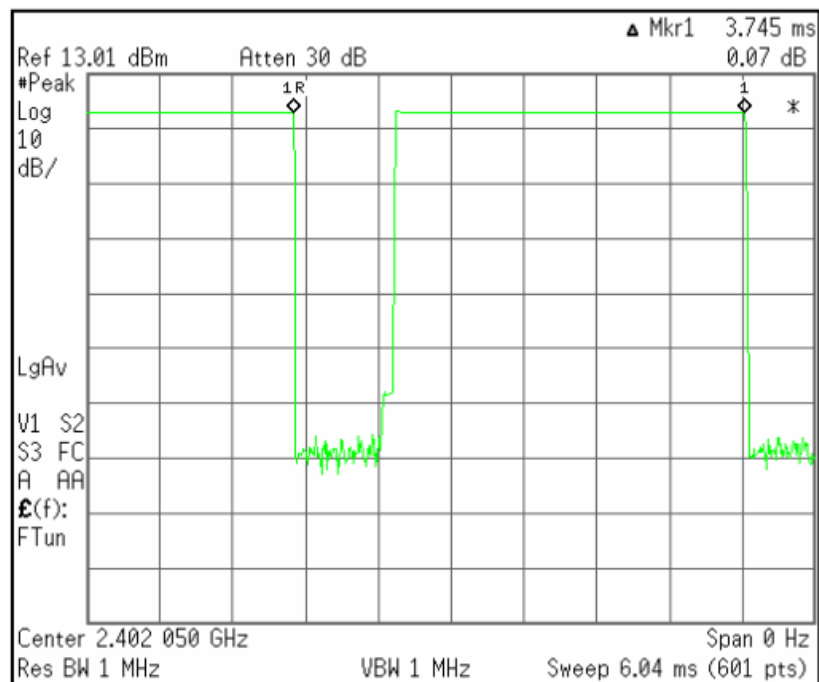
1. Measure time of occupancy of relevant channel using spectrum analyzer.
2. Please see the measured plot in next page.

Plots of Time of Occupancy (BDR)

[Continuous Time]

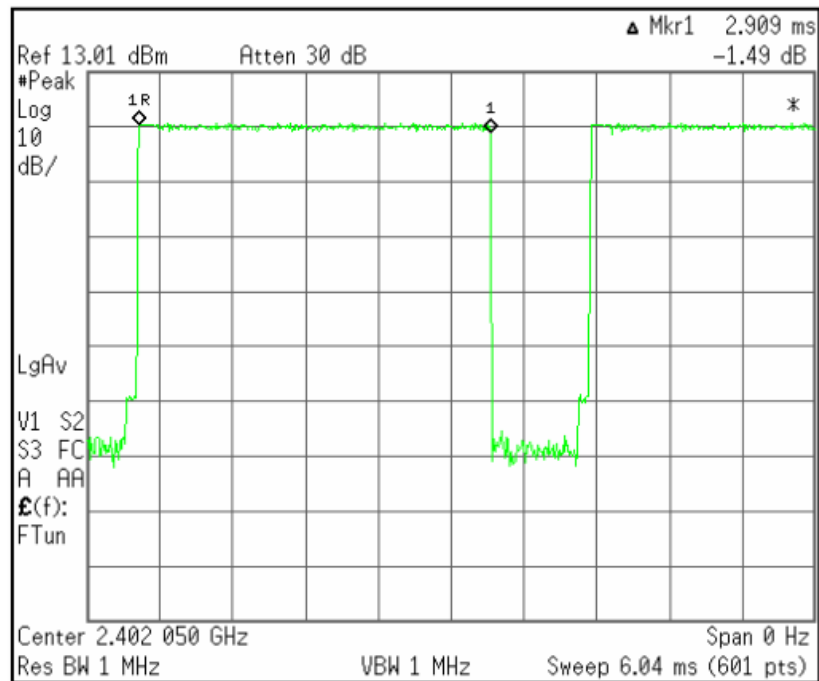


[Hopping Period]

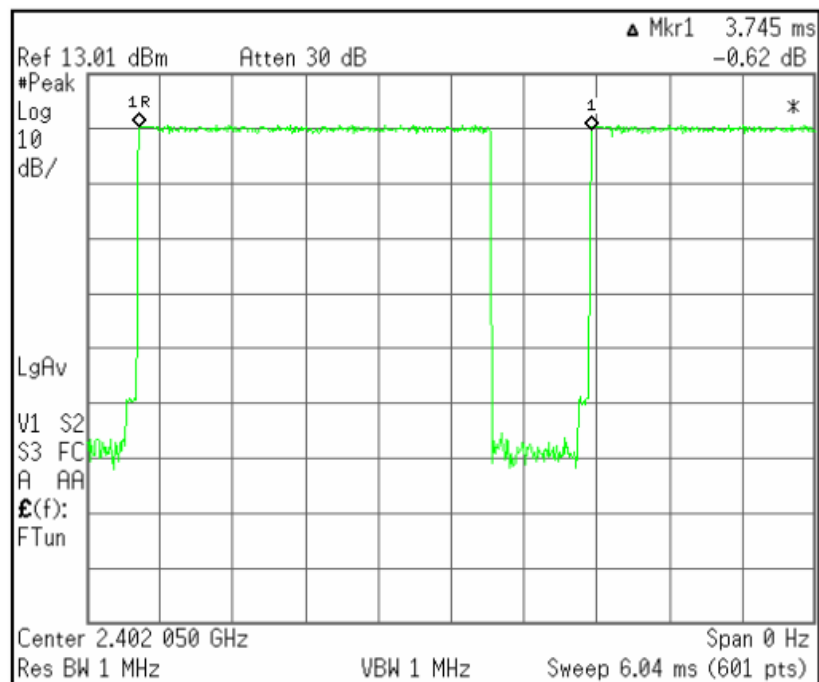


Plots of Time of Occupancy (EDR)

[Continuous Time]



[Hopping Period]



5.7 Spurious Emissions

| | |
|-----------------------|--|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.209 |
| Test Date | September 03, 2014 to September 04, 2014 |
| Environmental of Test | (24.4 ± 3.1) °C, (60 ± 16) % R.H., (101.2 ± 0.2) kPa |
| Operating Condition | Low CH, Middle CH, High CH Transmission |
| Result | Passed |

Limit

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequencies [MHz] | Field Strength [μV/m] | Measurement Distance [m] |
|-------------------|-----------------------|--------------------------|
| 0.009 - 0.490 | 2 400/F(kHz) | 300 |
| 0.490 - 1.705 | 24 000/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

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

Test Results

- Refer to see the measured plot in next page.

Radiated Emissions Test data

- 9 kHz to 30 MHz

| | |
|-----------------------|---|
| Test Date | September 01, 2014 |
| Environmental of Test | (27.4 ± 0.1) °C, (74 ± 2) % R.H., (101.0 ± 0.0) kPa |

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi-Peak mode (100 Hz, 9 kHz)

- Type of Modulation: BDR, EDR

| Frequency [MHz] | Reading [dB(μV)] | Polarization (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|-----------------|--|-----------------------|--------------------|-----------------|-------------------|------------------|-------------|
| | | | | | | | |
| | Emission attenuated more than 20 dB below the limit are not reported. | | | | | | |
| | | | | | | | |
| | | | | | | | |

Result: All emissions below noise floor of 20 dB(μV/m).

NOTES:

- * H : Horizontal polarization , ** V : Vertical polarization
- Result = Reading + Antenna factor + Cable loss
- Margin = Limit - Result
- The measurement was performed for the frequency range 9 kHz to 30 MHz according to FCC Part 15.209.

- Below 1 GHz (30 MHz to 1 GHz)

| | |
|-----------------------|---|
| Test Date | September 02, 2014 |
| Environmental of Test | (26.5 ± 0.2) °C, (70 ± 1) % R.H., (101.0 ± 0.0) kPa |

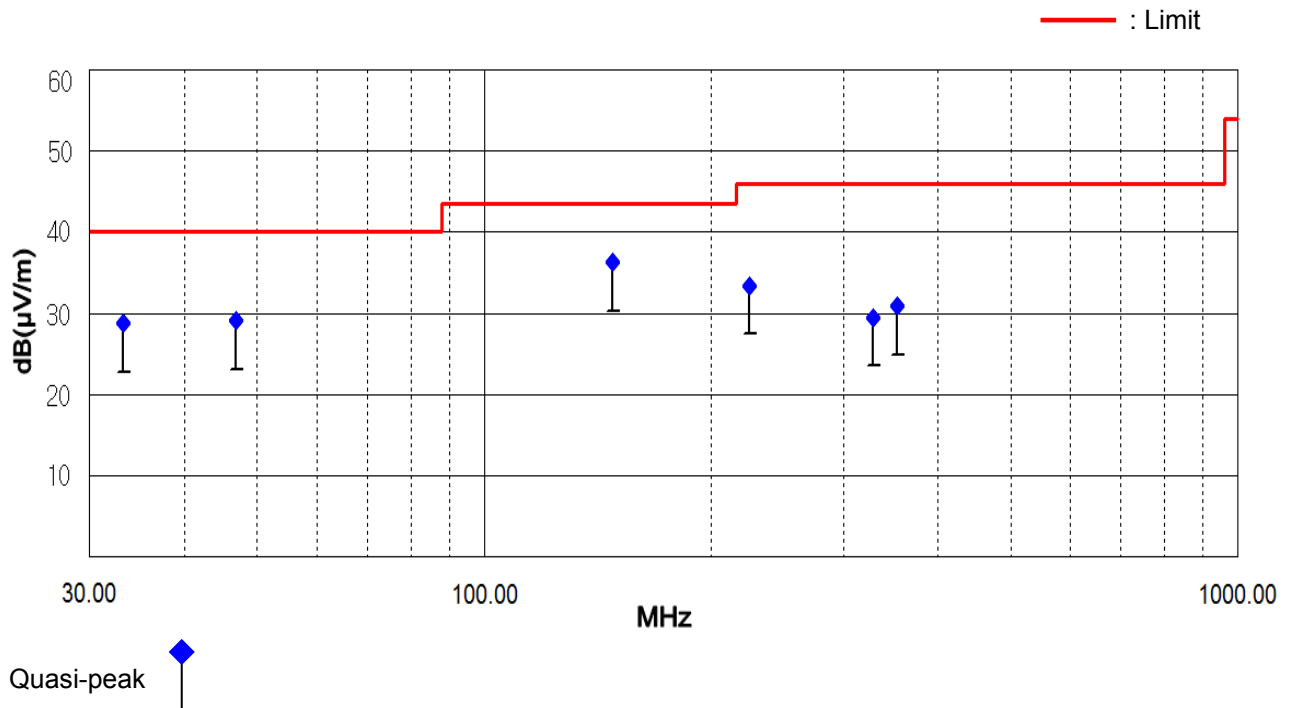
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi-Peak mode (6 dB Bandwidth: 120 kHz)

- Type of Modulation: BDR (Worst case)

| Frequency [MHz] | Reading [dB(μV)] | Polarization (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB(μV)] | Height [cm] | Result [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|-----------------|------------------|-----------------------|--------------------|---------------------|-------------|-------------------|------------------|-------------|
| 33.27 | 17.17 | V | 10.67 | 0.96 | 100 | 28.80 | 40.00 | 11.20 |
| 46.90 | 16.24 | V | 11.78 | 1.08 | 105 | 29.10 | 40.00 | 10.90 |
| 148.08 | 22.16 | V | 12.55 | 1.59 | 124 | 36.30 | 43.50 | 7.20 |
| 225.25 | 21.30 | H | 10.29 | 1.81 | 350 | 33.40 | 46.00 | 12.60 |
| 328.28 | 13.40 | H | 13.82 | 2.28 | 310 | 29.50 | 46.00 | 16.50 |
| 353.02 | 14.09 | H | 14.44 | 2.37 | 305 | 30.90 | 46.00 | 15.10 |

NOTES:

- * H : Horizontal polarization , ** V : Vertical polarization
- Result = Reading + Antenna factor + Cable loss
- Margin value = Limit - Result
- The measurement was performed for the frequency range above 30 MHz according to FCC Part 15.209.



- Above 1 GHz (1 GHz to 25 GHz)

| | |
|-----------------------|---|
| Test Date | September 02, 2014 |
| Environmental of Test | (21.5 ± 0.2) °C, (47 ± 1) % R.H., (101.2 ± 0.1) kPa |

- Type of Modulation: BDR

1. Low CH

| Frequency [MHz] | Reading [dB(μV)] | | Polarity (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | | Limit [dB(μV/m)] | | Margin [dB] | |
|-----------------|------------------|---------|-------------------|--------------------|-----------------|-------------------|---------|------------------|---------|-------------|---------|
| | Peak | Average | | | | Peak | Average | Peak | Average | Peak | Average |
| 2 018.08 | 57.62 | 48.02 | V | 26.22 | -37.14 | 46.70 | 37.10 | 73.97 | 53.97 | 27.27 | 16.87 |
| 4 804.40 | 58.44 | 46.94 | V | 31.80 | -34.64 | 55.60 | 44.10 | 73.97 | 53.97 | 18.37 | 9.87 |

2. Middle CH

| Frequency [MHz] | Reading [dB(μV)] | | Polarity (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | | Limit [dB(μV/m)] | | Margin [dB] | |
|-----------------|------------------|---------|-------------------|--------------------|-----------------|-------------------|---------|------------------|---------|-------------|---------|
| | Peak | Average | | | | Peak | Average | Peak | Average | Peak | Average |
| 1 997.88 | 56.82 | 47.62 | V | 26.18 | -37.19 | 45.80 | 36.60 | 73.97 | 53.97 | 28.17 | 17.37 |
| 4 881.70 | 56.88 | 44.68 | V | 32.08 | -34.66 | 54.30 | 42.10 | 73.97 | 53.97 | 19.67 | 11.87 |

3. High CH

| Frequency [MHz] | Reading [dB(μV)] | | Polarity (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | | Limit [dB(μV/m)] | | Margin [dB] | |
|-----------------|------------------|---------|-------------------|--------------------|-----------------|-------------------|---------|------------------|---------|-------------|---------|
| | Peak | Average | | | | Peak | Average | Peak | Average | Peak | Average |
| 1 969.60 | 55.80 | 46.60 | V | 26.15 | -37.25 | 44.70 | 35.50 | 73.97 | 53.97 | 29.27 | 18.47 |
| 4 960.00 | 52.42 | 45.52 | V | 32.36 | -34.67 | 50.10 | 43.20 | 73.97 | 53.97 | 23.87 | 10.77 |

Result: No signal detect above second harmonic.

- Type of Modulation: EDR

1. Low CH

| Frequency [MHz] | Reading [dB(μV)] | | Polarity (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | | Limit [dB(μV/m)] | | Margin [dB] | |
|-----------------|------------------|---------|-------------------|--------------------|-----------------|-------------------|---------|------------------|---------|-------------|---------|
| | Peak | Average | | | | Peak | Average | Peak | Average | Peak | Average |
| 2 018.10 | 56.02 | 47.42 | V | 26.22 | -37.14 | 45.10 | 36.50 | 73.97 | 53.97 | 28.87 | 17.47 |
| 4 803.78 | 56.04 | 44.54 | V | 31.80 | -34.64 | 53.20 | 41.70 | 73.97 | 53.97 | 20.77 | 12.27 |

2. Middle CH

| Frequency [MHz] | Reading [dB(μV)] | | Polarity (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | | Limit [dB(μV/m)] | | Margin [dB] | |
|-----------------|------------------|---------|-------------------|--------------------|-----------------|-------------------|---------|------------------|---------|-------------|---------|
| | Peak | Average | | | | Peak | Average | Peak | Average | Peak | Average |
| 1 998.20 | 54.82 | 43.12 | V | 26.18 | -37.19 | 43.80 | 32.10 | 73.97 | 53.97 | 30.17 | 21.87 |
| 4 882.05 | 52.78 | 42.78 | V | 32.08 | -34.66 | 50.20 | 40.20 | 73.97 | 53.97 | 23.77 | 13.77 |

3. High CH

| Frequency [MHz] | Reading [dB(μV)] | | Polarity (*H/**V) | Ant. Factor [dB/m] | Cable Loss [dB] | Result [dB(μV/m)] | | Limit [dB(μV/m)] | | Margin [dB] | |
|-----------------|------------------|---------|-------------------|--------------------|-----------------|-------------------|---------|------------------|---------|-------------|---------|
| | Peak | Average | | | | Peak | Average | Peak | Average | Peak | Average |
| 1 969.80 | 53.20 | 45.80 | V | 26.15 | -37.25 | 42.10 | 34.70 | 73.97 | 53.97 | 31.87 | 19.27 |
| 4 960.10 | 50.91 | 41.41 | V | 32.36 | -34.67 | 48.60 | 39.10 | 73.97 | 53.97 | 25.37 | 14.87 |

Result: No signal detect above second harmonic.

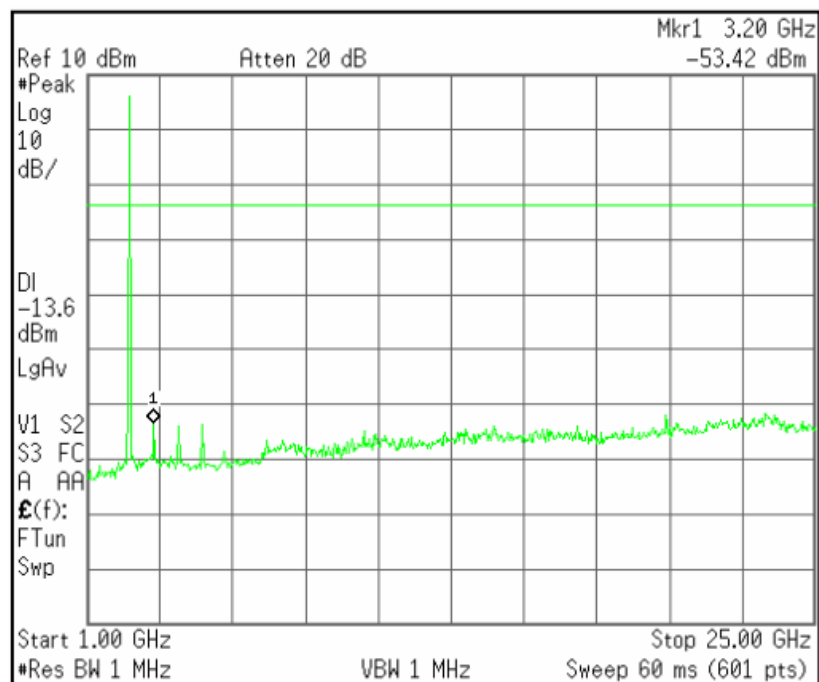
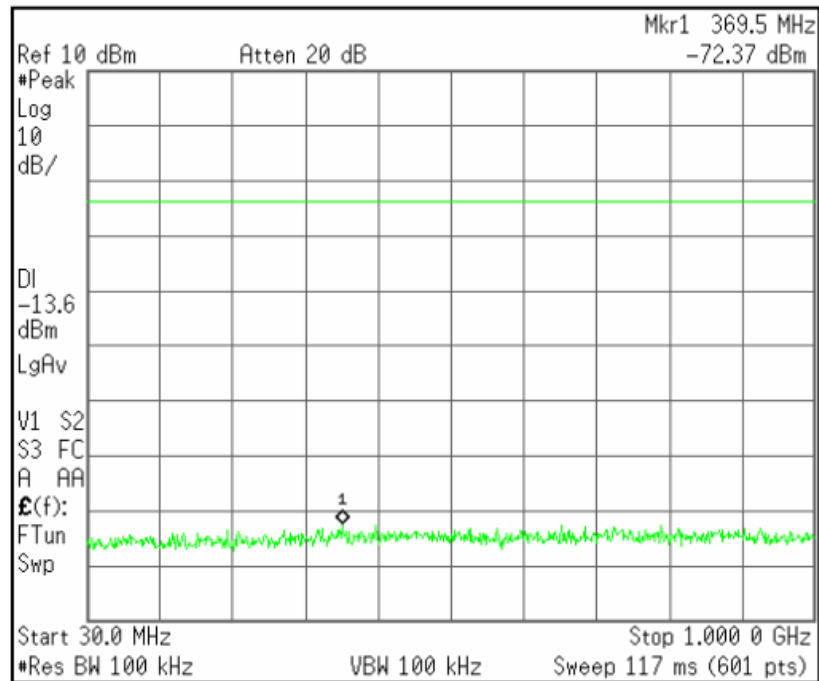
NOTES:

- * H : Horizontal polarization , ** V : Vertical polarization
- Cable loss = Cable loss + Amp. Gain
- Result = Reading + Antenna factor + Cable loss
- Margin value = Limit - Result
- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
- Spectrum setting:
 - Peak Setting 1 GHz to 10th harmonics of fundamental, RBW = 1 MHz, VBW = 1 MHz, Sweep = Auto
 - AV Setting 1 GHz to 10th harmonics of fundamental, RBW = 1 MHz, VBW = 10 Hz, Sweep = Auto

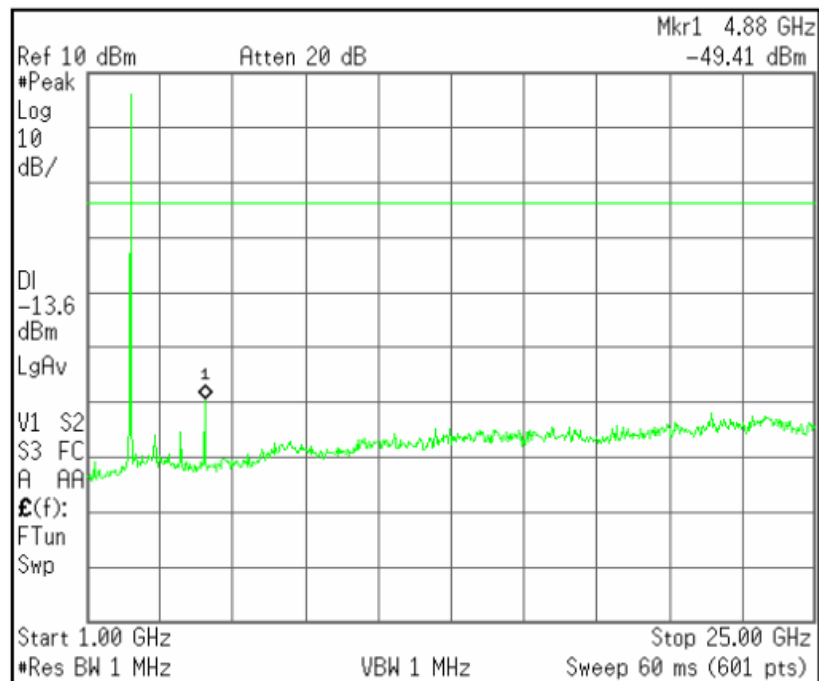
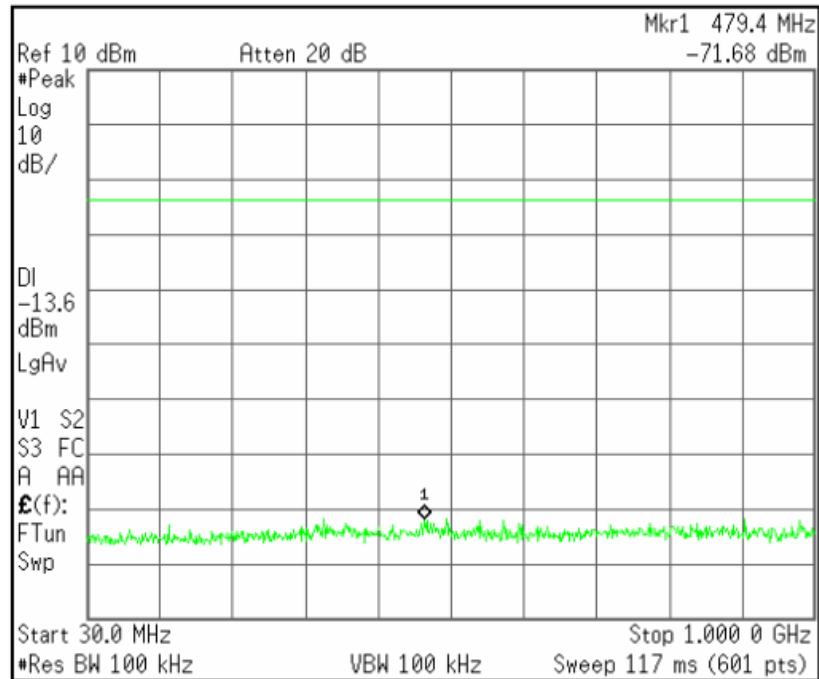
Plots of Spurious Emissions (Conducted Measurement) (BDR)

| | |
|-----------------------|---|
| Test Date | September 02, 2014 |
| Environmental of Test | (25.1 ± 0.1) °C, (45 ± 1) % R.H., (101.2 ± 0.1) kPa |

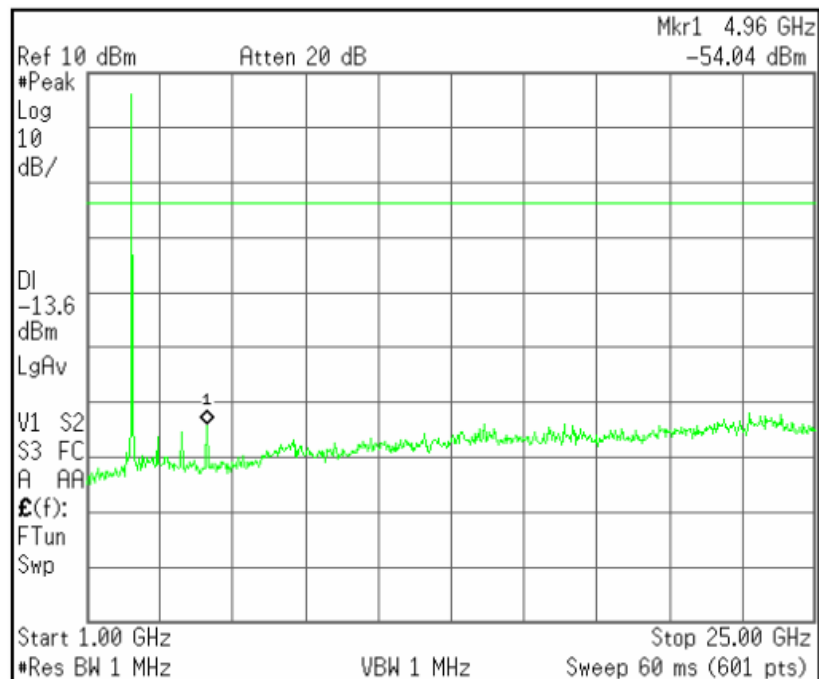
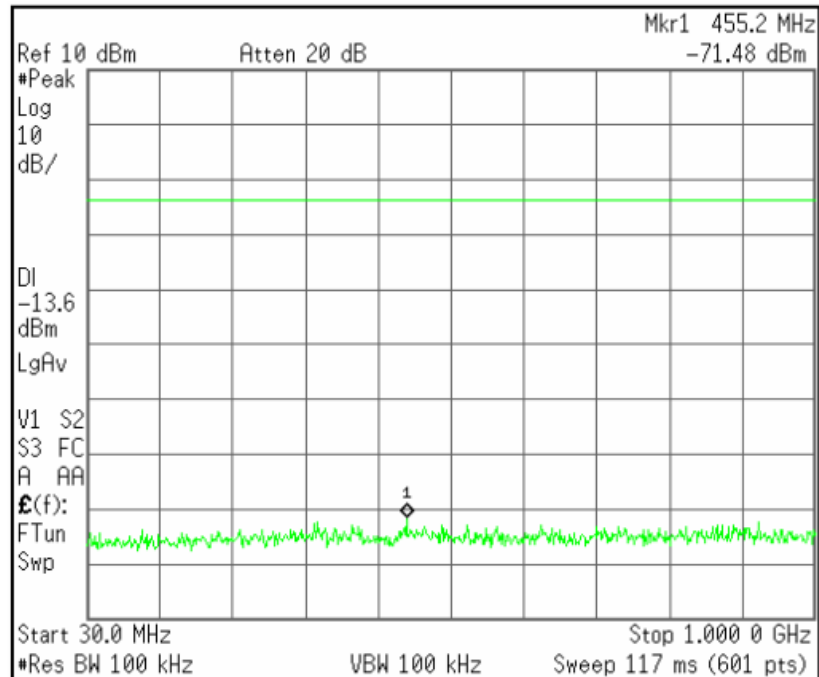
[CH Low]



[CH Mid]

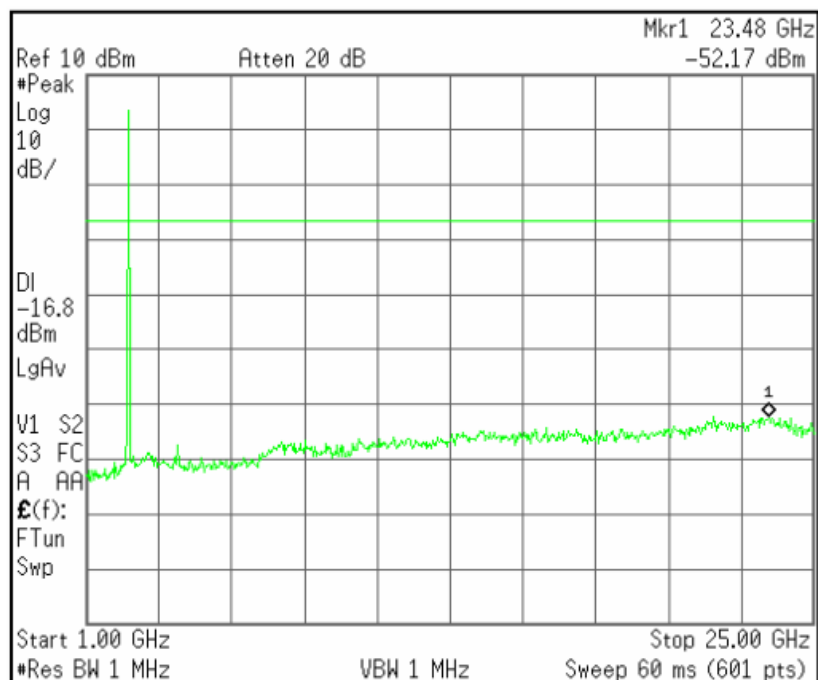
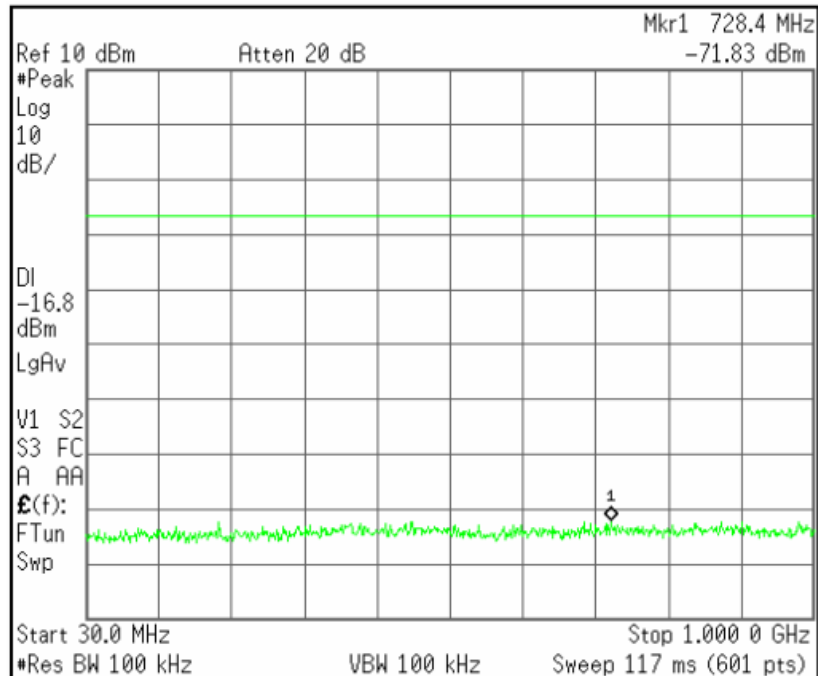


[CH High]

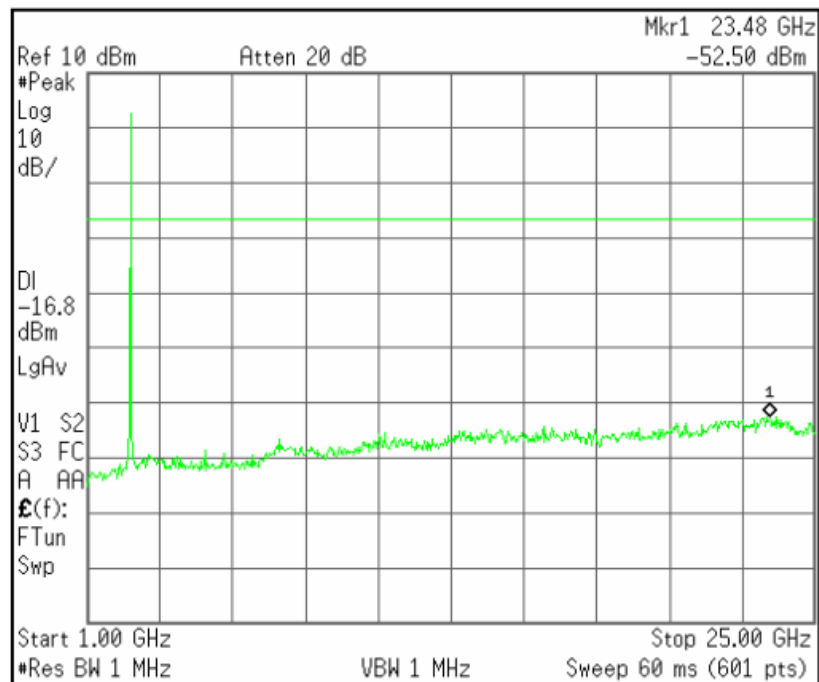
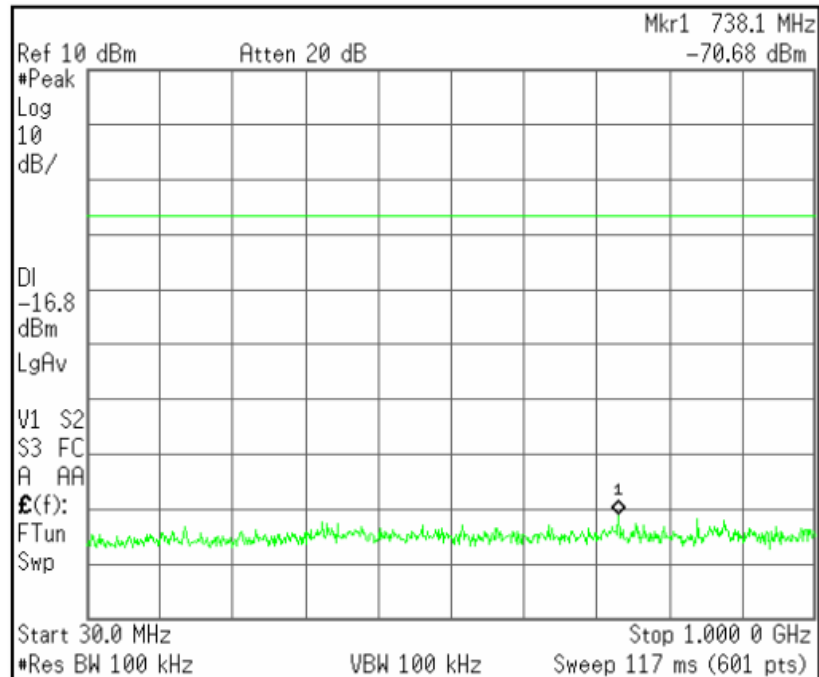


Plots of Spurious Emissions (Conducted Measurement) (EDR)

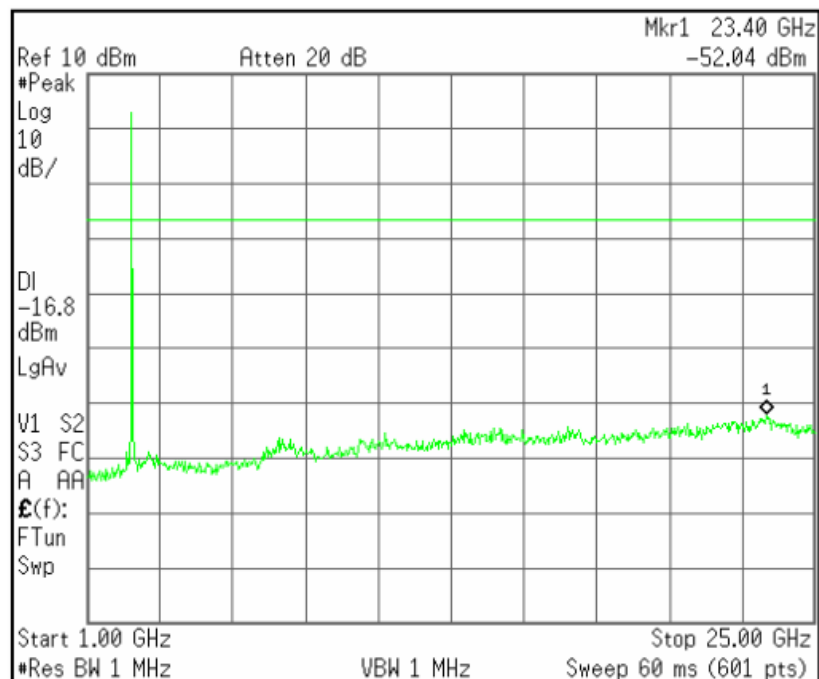
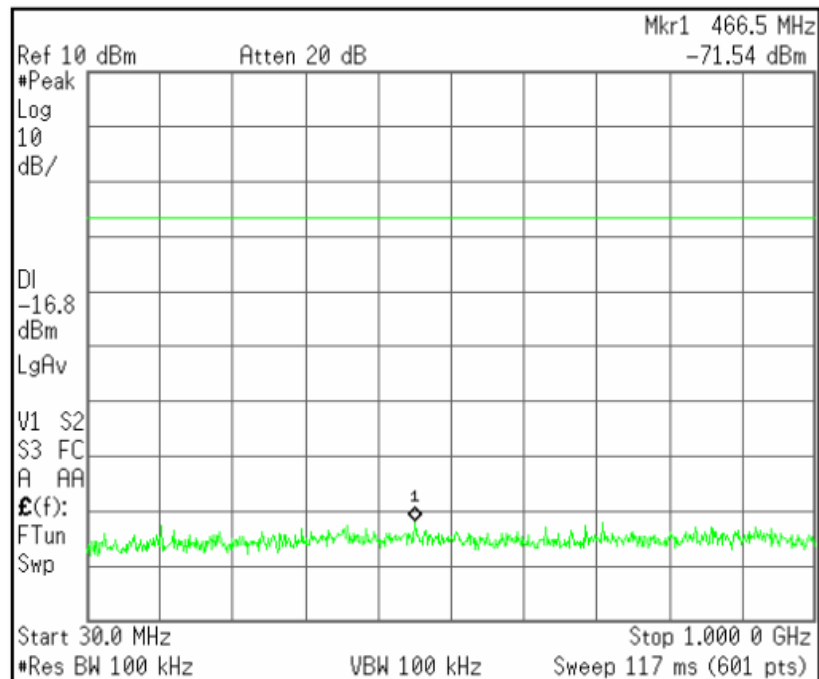
[CH Low]



[CH Mid]



[CH High]



5.8 Conducted Emissions Measurement

| | |
|-----------------------|---|
| EUT | Mobile Printer / WSP-R350 |
| Limit apply to | FCC Part 15.207 |
| Test Date | September 02, 2014 |
| Environmental of Test | (24.1 ± 0.0) °C, (45 ± 0) % R.H., (101.2 ± 0.0) kPa |
| Operating Condition | RF transmitting continuously during the tested. |
| Result | Passed by 14.96 dB |

Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

| Frequency of Emission [MHz] | Conducted limit [dB(μ V)] | |
|--------------------------------|-----------------------------------|------------|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 - 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

Test Results

- Refer to see the measured plot in next page.

Conducted Emission Test Data

The following data and graph shows the highest levels of conducted emissions on both polarizations of hot and neutral line.

Detector mode: CISPR Quasi-Peak mode (6 dB Bandwidth: 9 kHz)

NOTES:

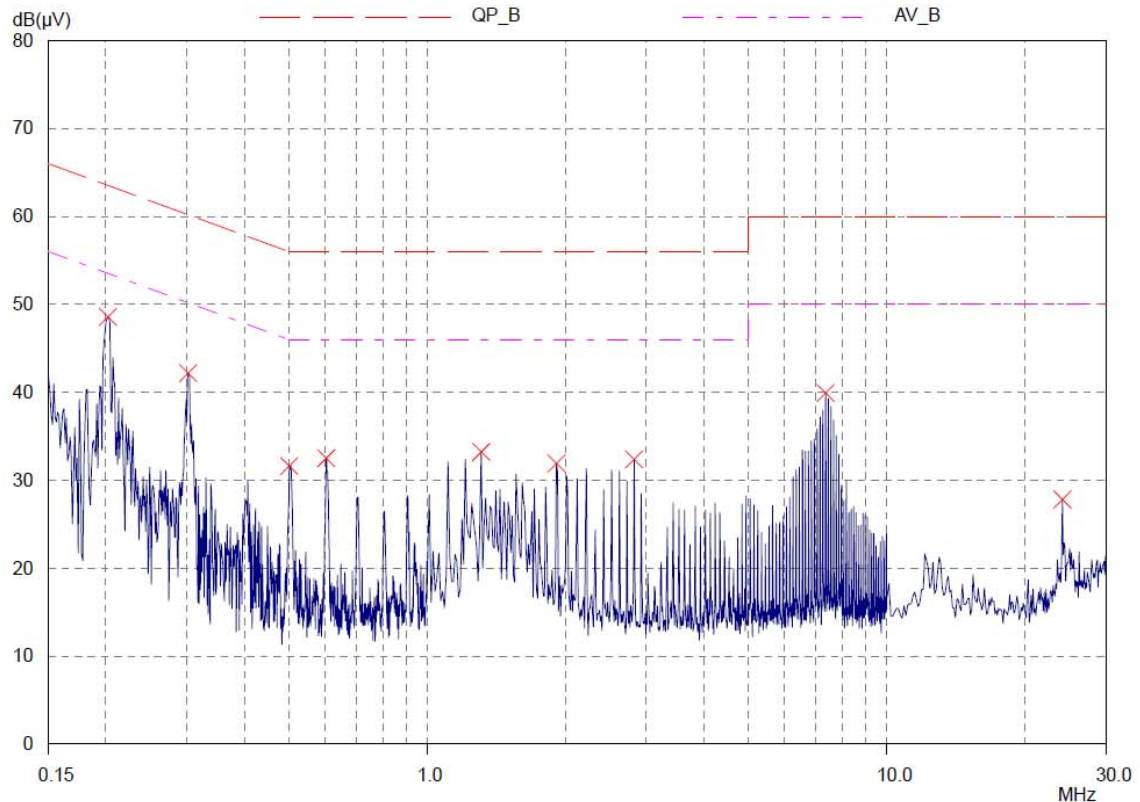
1. Please see the measured data and graph in next page.
2. The Level (Result) value was included the reading, antenna factor and cable loss.
3. Delta (Margin) value = Limit - Level (Result)
4. Measurements were performed at the AC Power Inlet in the frequency band of 150 kHz ~ 30 MHz according to the FCC Part 15 Class B.

Line: HOT

ETL EMC Laboratory
Conducted Emission Test Result

EUT: ETLE140819.1210
Manuf:
Op Cond:
Operator:
Test Spec:
Comment: H

Prescan Measurement: Detector: X PK
Meas Time: see scan settings
Peaks: 16
Acc Margin: 10 dB



ETL EMC Laboratory

Conducted Emission Test Result

EUT: ETLE140819.1210

Manuf:

Op Cond:

Operator:

Test Spec:

Comment: H

| | | |
|----------------------|-------------|-------------------|
| Prescan Measurement: | Detector: | X PK |
| | Meas Time: | see scan settings |
| | Peaks: | 16 |
| | Acc Margin: | 10 dB |

Peak Search Results

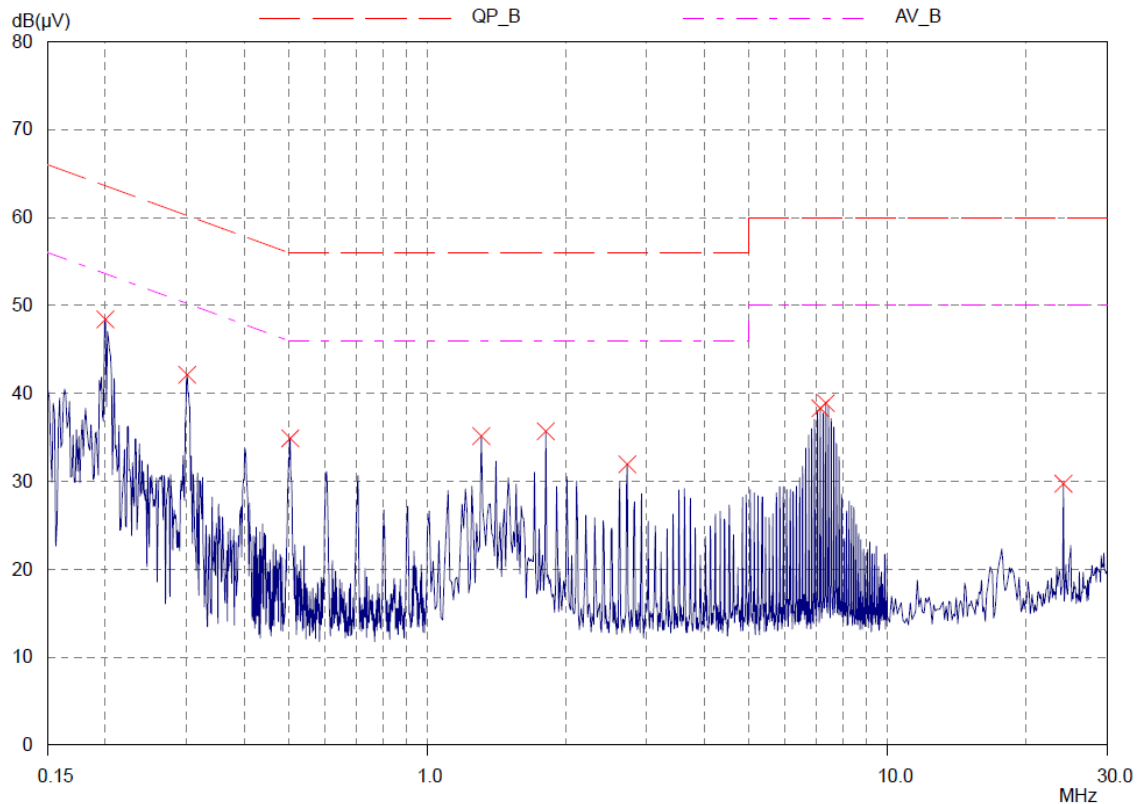
| Frequency MHz | PK Level dB(μV) | PK Limit dB(μV) | PK Delta dB |
|------------------|--------------------|--------------------|----------------|
| 0.202 | 48.57 | 63.53 | 14.96 |
| 0.302 | 42.17 | 60.19 | 18.02 |
| 0.501 | 31.62 | 56.00 | 24.38 |
| 0.603 | 32.51 | 56.00 | 23.49 |
| 1.31 | 33.22 | 56.00 | 22.78 |
| 1.91 | 31.91 | 56.00 | 24.09 |
| 2.82 | 32.36 | 56.00 | 23.64 |
| 7.36 | 39.94 | 60.00 | 20.06 |
| 24.1 | 27.81 | 60.00 | 32.19 |

* limit exceeded

Line: Neutral

ETL EMC Laboratory
Conducted Emission Test Result
EUT: ETLE140819.1210
Manuf:
Op Cond:
Operator:
Test Spec:
Comment: N

Prescan Measurement: Detector: X PK
Meas Time: see scan settings
Peaks: 16
Acc Margin: 10 dB



ETL EMC Laboratory

Conducted Emission Test Result

EUT: ETLE140819.1210

Manuf:

Op Cond:

Operator:

Test Spec:

Comment: N

| | | |
|----------------------|-------------|-------------------|
| Prescan Measurement: | Detector: | X PK |
| | Meas Time: | see scan settings |
| | Peaks: | 16 |
| | Acc Margin: | 10 dB |

Peak Search Results

| Frequency MHz | PK Level dB(μV) | PK Limit dB(μV) | PK Delta dB |
|------------------|--------------------|--------------------|----------------|
| 0.2 | 48.42 | 63.61 | 15.19 |
| 0.301 | 42.12 | 60.22 | 18.10 |
| 0.504 | 34.88 | 56.00 | 21.12 |
| 1.31 | 35.12 | 56.00 | 20.88 |
| 1.81 | 35.69 | 56.00 | 20.31 |
| 2.72 | 31.93 | 56.00 | 24.07 |
| 7.14 | 38.30 | 60.00 | 21.70 |
| 7.34 | 38.87 | 60.00 | 21.13 |
| 24.1 | 29.73 | 60.00 | 30.27 |

* limit exceeded

5.9 Radio Frequency Exposure

Standard Applicable:

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Portable device with its physical nature to be used nearby, the distance between radiating structure and human is less than 20 cm.

As per KDB 447498 D01, The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{[\sqrt{f(\text{GHz})}]^2} \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where} \right]^*$$

f (GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

Measurement Result:

This is a portable device and the Max peak output power is **(4.731 mW)** lower than the threshold given and derived as above, where

$$= 4.731 \text{ (mW)} / 5 \text{ (mm)} * \sqrt{2.480 \text{ (GHz)}} = 1.490 < 3.000$$

As the result of calculation result indicates, the RF exposure generating from given transmitter (transmitter employed digital modulation) can be excluded from SAR measurement, and is deemed compliant with RF exposure as per FCC.

6. SAMPLE CALCULATION

Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.
The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - PA$$

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

PA* = Preamplifier Factor

* PA is only be used for the measuring frequency above 1 GHz.

$$dB(\mu V) = 20 \log_{10} (\mu V) : \text{Equation}$$

$$dB(\mu V) = dBm + 107$$

Example : @ 148.08 MHz

$$\text{Class B Limit} = 43.50 \text{ dB}(\mu V/m)$$

$$\text{Reading} = 22.16 \text{ dB}(\mu V)$$

$$\text{Antenna Factor} + \text{Cable Loss} = 12.55 + 1.59 = 14.14 \text{ dB}(\mu V/m)$$

$$\text{Total} = 36.30 \text{ dB}(\mu V/m)$$

$$\text{Margin} = 43.50 - 36.30 = 7.20 \text{ dB}$$

$$= 7.20 \text{ dB below Limit}$$

7. List of test equipments used for measurements

| | Test Equipment | Model | Mfg. | Serial No. | Cal. Date | Cal. Due Date |
|-------------------------------------|------------------------------|-----------------------------------|-----------------------|------------|-----------|---------------|
| <input checked="" type="checkbox"/> | EMI Test Receiver | ESVS 10 | R&S | 835165/001 | 14.03.18 | 15.03.18 |
| <input checked="" type="checkbox"/> | EMI Test Receiver | ESCS30 | R&S | 847793/005 | 14.03.18 | 15.03.18 |
| <input checked="" type="checkbox"/> | EMI Test Receiver | ESCI7 | R&S | 100851 | 13.09.05 | 14.09.05 |
| <input checked="" type="checkbox"/> | Two-Line V-Network | ENV216 | R&S | 101715 | 14.03.17 | 15.03.17 |
| <input checked="" type="checkbox"/> | Loop Antenna | 6502 | EMCO | 00033743 | 12.09.24 | 14.09.24 |
| <input checked="" type="checkbox"/> | LogBicon Antenna | VULB9160 | Schwarzbeck | 3082 | 13.07.25 | 15.07.25 |
| <input checked="" type="checkbox"/> | Horn Antenna | BBHA 9120D | Schwarzbeck | 826 | 14.04.02 | 16.04.02 |
| <input checked="" type="checkbox"/> | PSA Series Spectrum Analyzer | E4440A | Agilent | US40420382 | 13.09.11 | 14.09.11 |
| <input checked="" type="checkbox"/> | Amplifier | TK-PA18 | TESTEK. | 120020 | 13.09.05 | 14.09.05 |
| <input checked="" type="checkbox"/> | Band Reject Filter | WRCGV 2402/2480-2382/2500-52/10SS | Wainwright Instrument | 2 | 13.09.05 | 14.09.05 |
| <input checked="" type="checkbox"/> | Power Meter | NRVS | R&S | 834053/060 | 13.09.05 | 14.09.05 |
| <input checked="" type="checkbox"/> | System Power Supply | 6030A | Agilent | 1036546 | 14.03.17 | 15.03.17 |
| <input checked="" type="checkbox"/> | Highpass Filter | WHKX3.0 /18G-6SS | Wainwright Instrument | 15 | 14.03.18 | 15.03.18 |
| <input checked="" type="checkbox"/> | Turn-Table | DS1200-S | Innco Systems GmbH | 2740311 | N/A | N/A |
| <input checked="" type="checkbox"/> | Turn-Table | TT 1.35 SI | SES | - | N/A | N/A |
| <input checked="" type="checkbox"/> | Antenna Master | AM 4.5 | SES | - | N/A | N/A |