

FCC 15.247 DTS

2.4 GHz Report

for

FUTABA Corporation

**1080 Yabutsuka Chosei-son Chosei-gun
Chiba, 299-4395 Japan.**

Brand : Futaba
Product Name : Radio Control
Model Name : R7018SB
FCC ID : AZPR7018SB-24G

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APPENDIX A TEST PHOTOGRAPHS

TEST REPORT CERTIFICATION

Applicant : FUTABA Corporation
Manufacture : FUTABA Corporation
Product Name : Radio Control
Model No. : R7018SB
Serial No. : N/A
Brand : Futaba
Power Supply : DC 4.8~8.4V

Applicable Standards:

FCC Rules and Regulations Part 15 Subpart C, Oct. 2014
ANSI C63.10:2013
KDB 558074 D01 DTS Meas Guidance v03r02

AUDIX Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **AUDIX Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Test: 2015. 06. 16 ~ 24

Date of Report: 2015. 06. 30

Producer: 
(Tina Huang/Administrator)

Signatory: 
(Ben Cheng/Manager)

1. REPORT HISTORY

| Revision | Date | Revision Summary | Report Number |
|----------|--------------|------------------|---------------|
| 0 | 2015. 06. 30 | Original Report. | EM-F150354 |

2. SUMMARY OF TEST RESULTS

| Rule | Description | Results |
|---|--|-----------|
| 15.207 | Conducted Emission | N/A, Note |
| 15.247(d)/15.209 | Radiated Band Edge and Radiated Spurious Emission | PASS |
| 15.247(a)(2) | 6dB Bandwidth | PASS |
| 15.247(b)(3) | Maximum Peak Output Power | PASS |
| 15.247(d)/15.205 | Conducted Band Edges and Conducted Spurious Emission | PASS |
| 15.247 (e) | Peak Power Spectral Density | PASS |
| 15.203 | Antenna Requirement | PASS |
| Note: The EUT only employs battery power for operation, so it is unnecessary to test. | | |

3. GENERAL INFORMATION

3.1. Description of EUT

| | |
|---------------------------|---|
| Product | Radio Control |
| Model Number | R7018SB |
| Serial Number | N/A |
| Brand Name | Futaba |
| Applicant | FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan. |
| Manufacture | FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan. |
| RF Features | 2.4GHz |
| Transmit Type | 2 Antennas (diversity) |
| Device Category | Outdoor Access Point Fixed point-to-point Access Point Indoor Access Point Mobile and Portable client device |
| Date of Receipt of Sample | 2015. 05. 28 |

3.2. EUT Specifications Assessed in Current Report

| Fundamental Range (MHz) | Channel Number | Modulation | Data Rate (kbps) |
|-------------------------|----------------|----------------|------------------|
| 2405.376-2472.960 | 23 | FASSTest (FSK) | 136 |

| Channel List | | | |
|----------------|-----------------|----------------|-----------------|
| Channel Number | Frequency (MHz) | Channel Number | Frequency (MHz) |
| 0 | 2405.376 | 12 | 2442.240 |
| 1 | 2408.448 | 13 | 2445.312 |
| 2 | 2411.520 | 14 | 2448.384 |
| 3 | 2414.592 | 15 | 2451.456 |
| 4 | 2417.664 | 16 | 2454.528 |
| 5 | 2420.736 | 17 | 2457.600 |
| 6 | 2423.808 | 18 | 2460.672 |
| 7 | 2462.880 | 19 | 2463.744 |
| 8 | 2429.952 | 20 | 2466.816 |
| 9 | 2433.024 | 21 | 2469.888 |
| 10 | 2436.096 | 22 | 2472.960 |
| 11 | 2439.168 | | |

3.3. Antenna Information

| Manufacture | Antenna Type | Frequency | Max Gain (dBi) |
|--------------------------|-----------------------|-----------|------------------------------|
| SANSEI ELECTRIC CO., LTD | 1/4 λ Antenna | 2.4GHz | ANT A: -5.35 ANT B: -5.35 |

We performed conducted tests for both antennas and submit test data measured on antenna B as worse performance.

3.4. Test Configuration

| Modulation | Duty Cycle (x) | T (ms) | Duty Cycle Factor (dB) |
|------------|----------------|--------|------------------------|
| FASSTest | 0.0493 | N/A | N/A |

Note: When duty cycle is less than 98% (0.98) that duty cycle factor $10\log(1/x)$ is needed to add in conducted test items measured in average detector.

| Antenna A | | Antenna B | |
|----------------|--------------|----------------|--------------|
| Test Frequency | Output Power | Test Frequency | Output Power |
| 2405.376 | 11.255 | 2405.376 | 11.151 |
| 2439.168 | 11.673 | 2439.168 | 11.468 |
| 2472.960 | 11.239 | 2472.960 | 11.018 |

Note: This device has 2 antennas for diversity, they cannot transmit simultaneously. The power of both antennas are listed as follow table. We assessed ANT A has worse power, thus all test items presented in this report were test in ANT A.

| Item | | Modulation | Test Channel |
|---------------------|---|------------|--------------|
| Radiated Test Case | Radiated Band Edge ^{Note1} | FASSTest | 0/22 |
| | Radiated Spurious Emission ^{Note1} | FASSTest | 0/11/22 |
| Conducted Test Case | 6dB Bandwidth | FASSTest | 0/11/22 |
| | Peak Power Spectral Density | FASSTest | 0/11/22 |
| | Peak Output Power | FASSTest | 0/11/22 |
| | Band Edge | FASSTest | 0/22 |
| | Spurious Emission | FASSTest | 0/11/22 |

Note 1:

Mobile Device

Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

- Lie
- Side
- Stand

3.5. Tested Supporting System List

3.5.1. Support Peripheral Units

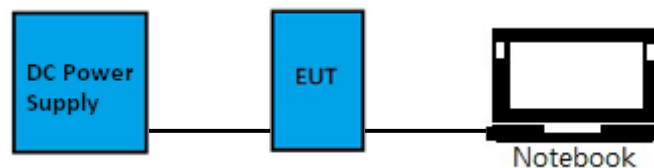
| No. | Product | Brand | Model No. | Serial No. | Approval |
|-----|-----------------|-------------|-------------|------------|--------------------------------|
| 1. | Notebook PC | IBM | 2652 | 99NXMML | FCC ID: ANOVNCBDC80 211B |
| 2. | USB Mouse | Targus | AMU94APZ-CN | 1109001101 | By DoC |
| 3. | DC Power Supply | TOP WARD | 3303A | N/A | N/A |
| 4. | DC Power Supply | TOP WARD | 6303A | N/A | N/A |

3.5.2. Cable Lists

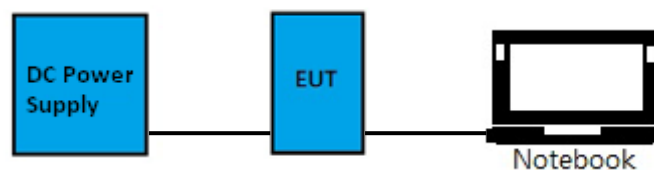
| No. | Cable Description Of The Above Support Units |
|-----|--|
| 1. | Adapter: IBM, M/N 02K6747 DC Power Cord: Unshielded, Undetachable, 1.8m, Bonded a ferrite core AC Power Cord: Unshielded, Detachable, 1.0m |
| 2. | USB Cable: Unshielded, Undetachable, 1.8m |
| 3. | DC Power Cord*2: Unshielded, Detachable, 0.6m AC Power Cord: Unshielded, Undetachable, 1.8m |
| 4. | DC Power Cord*2: Unshielded, Detachable, 0.6m AC Power Cord: Unshielded, Undetachable, 1.8m |

3.6. Setup Configuration

3.6.1. EUT Configuration for Power Line Emission



3.6.2. EUT Configuration for Conducted Test Items



3.7. Operating Condition of EUT

Test program “Futaba Term” is used for enabling EUT RF function under continues transmitting and choosing data rate/ channel.

3.8. Description of Test Facility

| | | |
|--------------------------|---|---|
| Test Firm Name | : | AUDIX Technology Corporation EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan |
| Test Location & Facility | : | Semi-Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan May 11, 2012 File on Federal Communication Commission Registration Number: 90993 |
| NVLAP Lab. Code | : | 200077-0 |
| TAF Accreditation No | : | 1724 |

3.9. Measurement Uncertainty

| Test Item | Frequency Range | Uncertainty |
|----------------------------------|-----------------|-------------|
| Radiation Test (Distance: 3m) | 30MHz~300MHz | ± 2.91dB |
| | 300MHz~1000MHz | ± 2.74dB |
| | Above 1GHz | ± 5.02dB |

Remark : Uncertainty = $k_{uc}(y)$

| Test Item | Uncertainty |
|--------------------------------|-------------|
| 6dB Bandwidth | ± 0.05kHz |
| Maximum peak output power | ± 0.33dB |
| Power spectral density | ± 0.13dB |
| Conducted Emission Limitations | ± 0.13dB |

4. MEASUREMENT EQUIPMENT LIST

4.1. Radiated Emission Measurement

4.1.1. Frequency Range 30MHz~1000MHz

| Item | Type | Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Interval |
|------|-------------------|--------------|------------|------------|--------------|---------------|
| 1. | Spectrum Analyzer | Agilent | N9010A-526 | MY53400071 | 2014. 09. 15 | 1 Year |
| 2. | Test Receiver | R & S | ESCS30 | 100265 | 2014. 08. 21 | 1 Year |
| 3. | Amplifier | HP | 8447D | 2944A06305 | 2015. 02. 12 | 1 Year |
| 4. | Bilog Antenna | TESEQ | CBL6112D | 33821 | 2014. 08. 02 | 1 Year |

4.1.2. Frequency Range 30MHz~1000MHz

| Item | Type | Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Interval |
|------|---------------------|--------------------|--------------------------------|------------|--------------|---------------|
| 1. | Spectrum Analyzer | Agilent | N9010A-526 | MY53400071 | 2014. 09. 15 | 1 Year |
| 2. | Test Receiver | R & S | ESCS30 | 100265 | 2014. 08. 21 | 1 Year |
| 3. | Amplifier | Agilent | 8449B | 3008A00529 | 2015. 01. 22 | 1 Year |
| 4. | 2.4GHz Notch Filter | K&L | 7NSL10-244 1.5E130.5-0 0 | 1 | 2014. 07. 23 | 1 Year |
| 5. | 3G High Pass Filter | Microwave Circuits | H3G018G1 | 484796 | 2014. 08. 25 | 1 Year |
| 6. | Horn Antenna | EMCO | 3115 | 9609-4927 | 2015. 06. 22 | 1 Year |
| 7. | Horn Antenna | EMCO | 3116 | 2653 | 2014. 10. 14 | 1 Year |

4.2. RF Conducted Measurement

| Item | Type | Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Interval |
|------|-------------------|--------------|------------|------------|--------------|---------------|
| 1. | Spectrum Analyzer | Agilent | N9030A-544 | US51350140 | 2015. 06. 10 | 1 Year |

5. CONDUCTED EMISSION MEASUREMENT

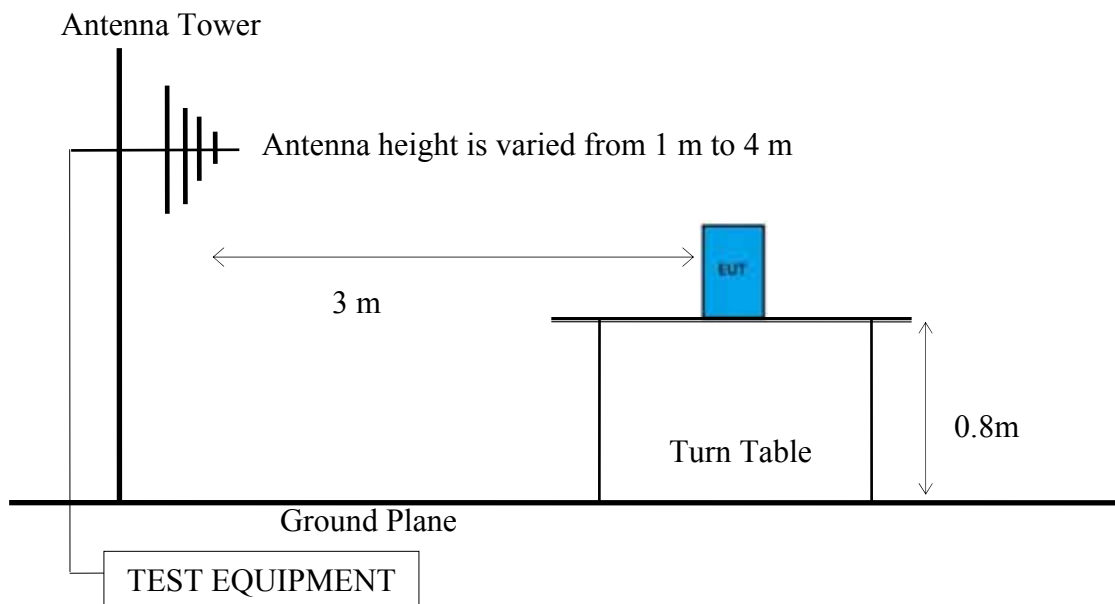
【The EUT only employs battery power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207】

6. RADIATED EMISSION MEASUREMENT

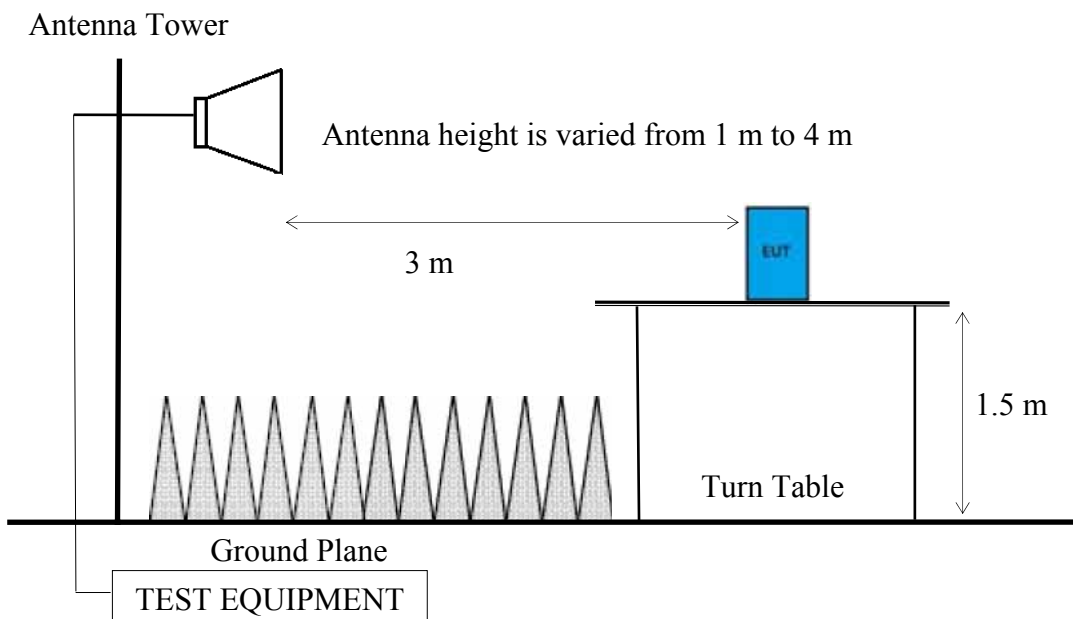
6.1. Block Diagram of Test Setup

6.1.1. Block Diagram of connection between EUT and simulators
Indicated as section 3.7

6.1.2. Setup Diagram for 30-1000 MHz



6.1.3. Semi-Anechoic Chamber (3m) Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified as below.

| Frequency (MHz) | Distance (m) | Field Strengths Limits | |
|-----------------|--------------|---|--------------------------|
| | | $\mu\text{V/m}$ | $\text{dB}\mu\text{V/m}$ |
| 30 ~ 88 | 3 | 100 | 40.0 |
| 88 ~ 216 | 3 | 150 | 43.5 |
| 216 ~ 960 | 3 | 200 | 46.0 |
| Above 960 | 3 | 500 | 54.0 |
| Above 1000 | 3 | 74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average) | |

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

The EUT setup on the turn table which has 1.5m height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120 kHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

Frequency above 1GHz to 10th harmonic:

Peak Detector:

- (1) RBW = 1 MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average for finally measurement.

Average Detector:

Option 1:

- (1) RBW = 1 MHz
- (2) VBW = 1/T
- (1) Detector = Peak.
- (2) Sweep time = auto.
- (3) Trace mode = max hold.
- (4) Allow sweeps to continue until the trace stabilizes.

Option 2:

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation

Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading

Average Emission Level = Antenna Factor + Cable Loss + Meter Reading

Average Emission Level = Peak Emission Level + DCCF

Duty Cycle Correction Factor (DCCF) = $20 \log (TX_{on}/TX_{on+off})$ presented in section 3.5

EPR = Peak Emission Level - 95.2dB - 2.14dBi

6.5. Test Results

PASSED.

| | | | |
|--------------|----------------------------|------------|---------|
| Test Date | 2015/06/24 | Temp./Hum. | 22 /48% |
| Test Voltage | DC 6V(via DC Power Supply) | | |

6.5.1. Emissions within Restricted Frequency Bands

6.5.1.1. Frequency Below 1 GHz

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
|------------|----------|-----------|----------------|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dB μ V) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------------|-------------------------------|-----------------------|-------------|----------|
| 191.99 | 9.21 | 3.92 | 9.72 | 22.85 | 43.50 | 20.65 | Peak |
| 485.90 | 16.77 | 6.34 | 9.98 | 33.09 | 46.00 | 12.91 | Peak |
| 580.96 | 18.08 | 6.49 | 11.87 | 36.44 | 46.00 | 9.56 | Peak |
| 746.83 | 19.38 | 6.94 | 9.40 | 35.72 | 46.00 | 10.28 | Peak |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dB μ V) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------------|-------------------------------|-----------------------|-------------|----------|
| 165.80 | 9.65 | 3.73 | 14.33 | 27.71 | 43.50 | 15.79 | Peak |
| 580.96 | 18.08 | 6.49 | 13.01 | 37.58 | 46.00 | 8.42 | Peak |
| 746.83 | 19.38 | 6.94 | 7.78 | 34.10 | 46.00 | 11.90 | Peak |
| 912.70 | 20.65 | 7.62 | 4.86 | 33.13 | 46.00 | 12.87 | Peak |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2439.168MHz |
|------------|----------|-----------|----------------|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dB μ V) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------------|-------------------------------|-----------------------|-------------|----------|
| 191.99 | 9.21 | 3.92 | 10.66 | 23.79 | 43.50 | 19.71 | Peak |
| 485.90 | 16.77 | 6.34 | 5.60 | 28.71 | 46.00 | 17.29 | Peak |
| 580.96 | 18.08 | 6.49 | 11.29 | 35.86 | 46.00 | 10.14 | Peak |
| 746.83 | 19.38 | 6.94 | 8.16 | 34.48 | 46.00 | 11.52 | Peak |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dB μ V) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------------|-------------------------------|-----------------------|-------------|----------|
| 165.80 | 9.65 | 3.73 | 9.60 | 22.98 | 43.50 | 20.52 | Peak |
| 365.62 | 14.79 | 5.34 | 6.79 | 26.92 | 46.00 | 19.08 | Peak |
| 580.96 | 18.08 | 6.49 | 10.92 | 35.49 | 46.00 | 10.51 | Peak |
| 746.83 | 19.38 | 6.94 | 8.90 | 35.22 | 46.00 | 10.78 | Peak |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2472.960MHz |
|------------|----------|-----------|----------------|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 191.99 | 9.21 | 3.92 | 11.06 | 24.19 | 43.50 | 19.31 | Peak |
| 486.87 | 16.80 | 6.35 | 6.83 | 29.98 | 46.00 | 16.02 | Peak |
| 580.96 | 18.08 | 6.49 | 11.33 | 35.90 | 46.00 | 10.10 | Peak |
| 746.83 | 19.38 | 6.94 | 7.86 | 34.18 | 46.00 | 11.82 | Peak |
| 912.70 | 20.65 | 7.62 | 4.71 | 32.98 | 46.00 | 13.02 | Peak |

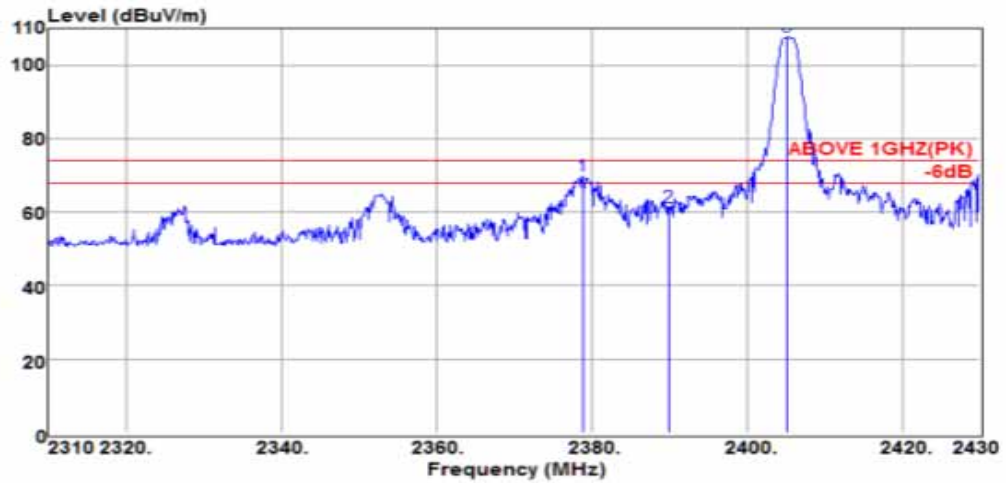
Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 165.80 | 9.65 | 3.73 | 7.51 | 20.89 | 43.50 | 22.61 | Peak |
| 485.90 | 16.77 | 6.34 | 7.01 | 30.12 | 46.00 | 15.88 | Peak |
| 580.96 | 18.08 | 6.49 | 11.16 | 35.73 | 46.00 | 10.27 | Peak |
| 746.83 | 19.38 | 6.94 | 8.40 | 34.72 | 46.00 | 11.28 | Peak |

6.5.1.2. Frequency Above 1 GHz to 10th harmonics

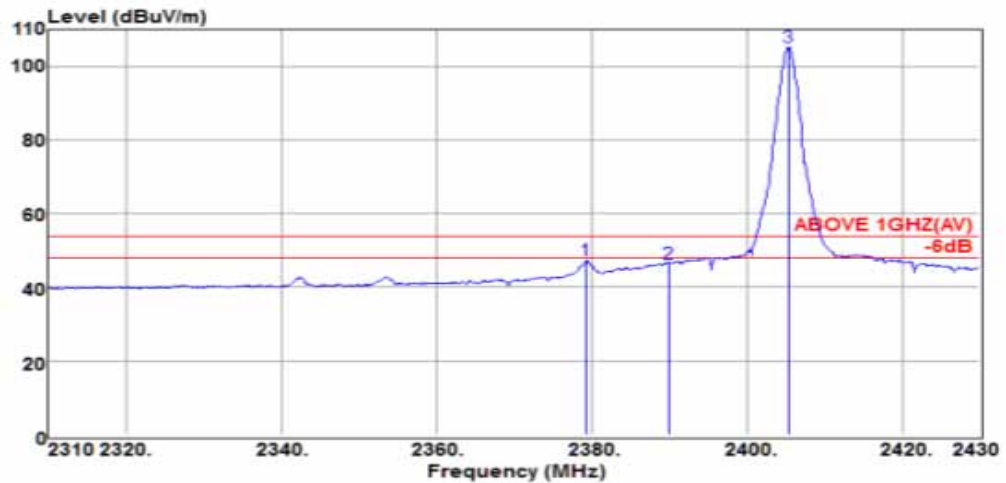
Band Edge:

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
|------------|----------|-----------|----------------|



Antenna at Horizontal Polarization

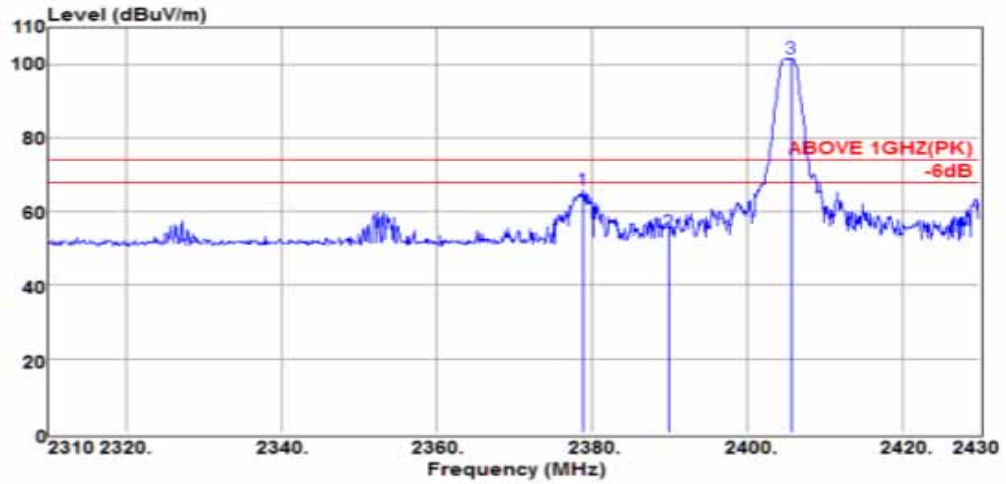
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2378.88 | 28.39 | 5.22 | 36.32 | 69.93 | 74.00 | 4.07 | Peak |
| 2390.04 | 28.40 | 5.24 | 27.66 | 61.30 | 74.00 | 12.70 | Peak |
| 2405.28 | 28.42 | 5.26 | 74.00 | 107.68 | --- | --- | Peak |



Antenna at Horizontal Polarization

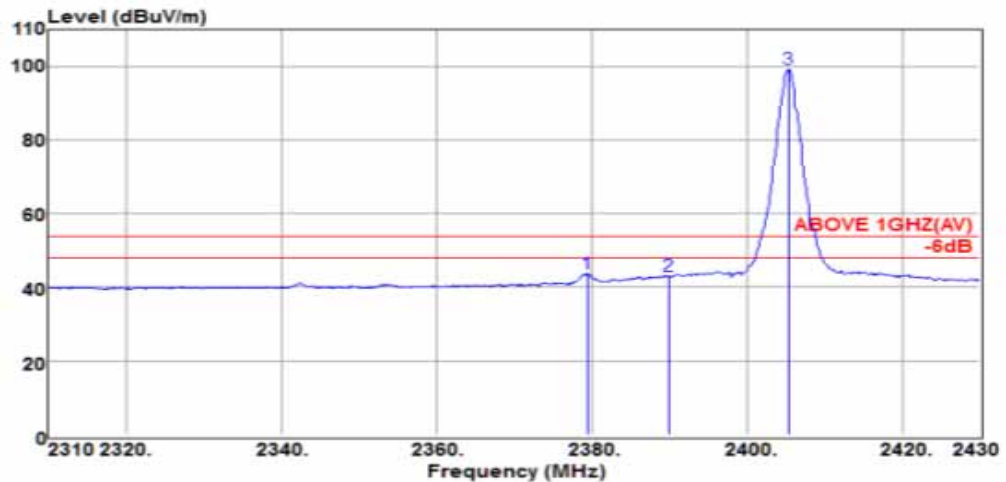
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2379.36 | 28.39 | 5.22 | 13.69 | 47.30 | 54.00 | 6.70 | Average |
| 2390.04 | 28.40 | 5.24 | 12.87 | 46.51 | 54.00 | 7.49 | Average |
| 2405.40 | 28.42 | 5.26 | 71.45 | 105.13 | --- | --- | Average |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
|------------|----------|-----------|----------------|



Antenna at Vertical Polarization

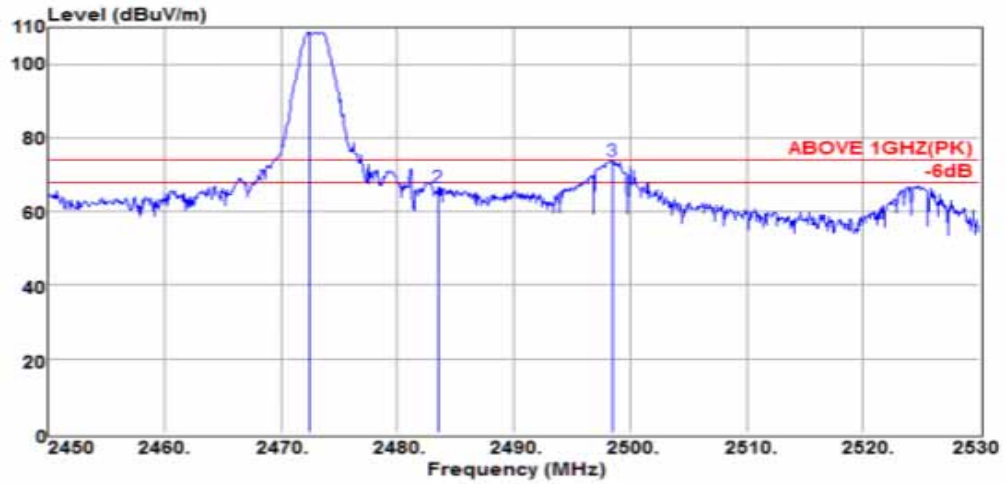
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2378.88 | 28.39 | 5.22 | 32.23 | 65.84 | 74.00 | 8.16 | Peak |
| 2390.04 | 28.40 | 5.24 | 20.87 | 54.51 | 74.00 | 19.49 | Peak |
| 2405.88 | 28.42 | 5.26 | 68.00 | 101.68 | --- | --- | Peak |



Antenna at Vertical Polarization

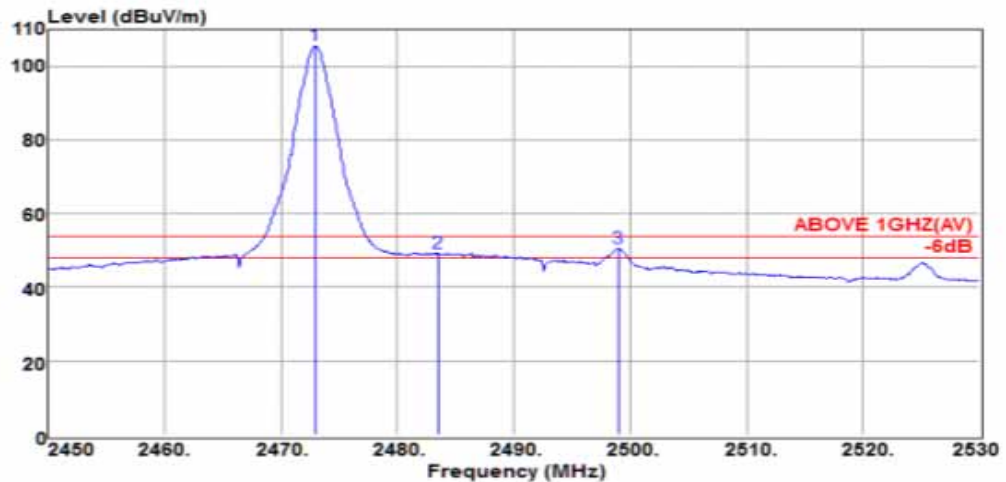
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2379.48 | 28.39 | 5.22 | 10.24 | 43.85 | 54.00 | 10.15 | Average |
| 2390.04 | 28.40 | 5.24 | 9.30 | 42.94 | 54.00 | 11.06 | Average |
| 2405.40 | 28.42 | 5.26 | 65.44 | 99.12 | --- | --- | Average |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2472.960MHz |
|------------|----------|-----------|----------------|



Antenna at Horizontal Polarization

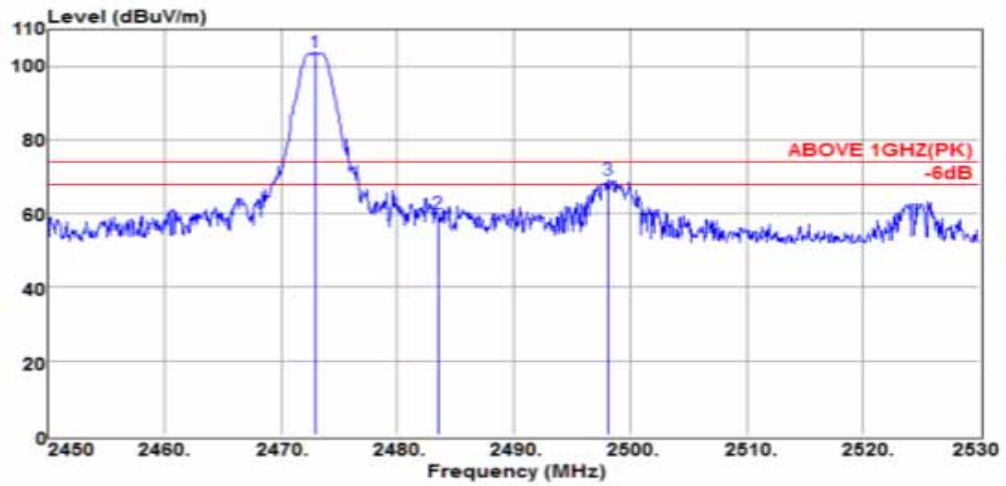
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2472.48 | 28.47 | 5.35 | 74.88 | 108.70 | --- | --- | Peak |
| 2483.52 | 28.49 | 5.37 | 32.74 | 66.60 | 74.00 | 7.40 | Peak |
| 2498.48 | 28.50 | 5.39 | 39.82 | 73.71 | 74.00 | 0.29 | Peak |



Antenna at Horizontal Polarization

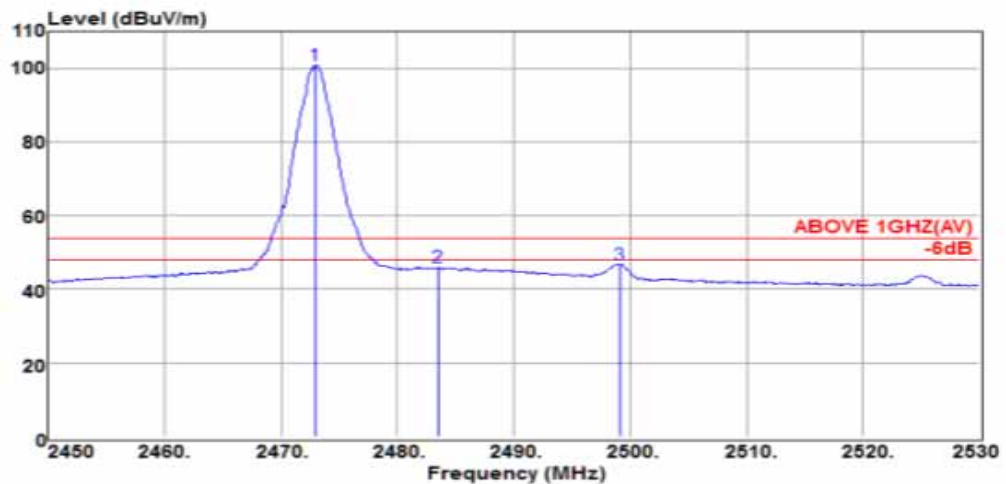
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2472.96 | 28.47 | 5.35 | 71.77 | 105.59 | --- | --- | Average |
| 2483.52 | 28.49 | 5.37 | 15.33 | 49.19 | 54.00 | 4.81 | Average |
| 2498.96 | 28.50 | 5.39 | 16.62 | 50.51 | 54.00 | 3.49 | Average |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2472.960MHz |
|------------|----------|-----------|----------------|



Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2472.96 | 28.47 | 5.35 | 70.04 | 103.86 | --- | --- | Peak |
| 2483.52 | 28.49 | 5.37 | 26.23 | 60.09 | 74.00 | 13.91 | Peak |
| 2498.16 | 28.50 | 5.39 | 35.41 | 69.30 | 74.00 | 4.70 | Peak |



Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 2473.04 | 28.47 | 5.35 | 66.96 | 100.78 | --- | --- | Average |
| 2483.52 | 28.49 | 5.37 | 12.02 | 45.88 | 54.00 | 8.12 | Average |
| 2499.12 | 28.50 | 5.39 | 12.88 | 46.77 | 54.00 | 7.23 | Average |

6.5.2. Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
|------------|----------|-----------|----------------|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 4810.00 | 32.98 | 8.09 | 16.56 | 57.63 | 74.00 | 16.37 | Peak |
| 4810.00 | 32.98 | 8.09 | 5.95 | 47.02 | 54.00 | 6.98 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 4810.00 | 32.98 | 8.09 | 19.46 | 60.53 | 74.00 | 13.47 | Peak |
| 4810.00 | 32.98 | 8.09 | 9.42 | 50.49 | 54.00 | 3.51 | Average |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2439.168MHz |
|------------|----------|-----------|----------------|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 4900.00 | 33.19 | 8.18 | 17.57 | 58.94 | 74.00 | 15.06 | Peak |
| 4900.00 | 33.19 | 8.18 | 7.51 | 48.88 | 54.00 | 5.12 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 4900.00 | 33.19 | 8.18 | 20.56 | 61.93 | 74.00 | 12.07 | Peak |
| 4900.00 | 33.19 | 8.18 | 10.53 | 51.90 | 54.00 | 2.10 | Average |

| | | | |
|------------|----------|-----------|----------------|
| Modulation | FASSTest | Frequency | TX 2472.960MHz |
|------------|----------|-----------|----------------|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 4945.00 | 33.28 | 8.24 | 14.94 | 56.46 | 74.00 | 17.54 | Peak |
| 4945.00 | 33.28 | 8.24 | 4.85 | 46.37 | 54.00 | 7.63 | Average |

Antenna at Vertical Polarization

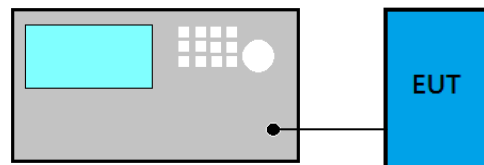
| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Meter Reading (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|--------------------------|-----------------------|-----------------|----------------------|-------------------------|-----------------|-------------|----------|
| 4945.00 | 33.28 | 8.24 | 21.11 | 62.63 | 74.00 | 11.37 | Peak |
| 4945.00 | 33.28 | 8.24 | 10.52 | 52.04 | 54.00 | 1.96 | Average |

6.5.3. Emissions in Non-restricted Frequency Bands

Pursuant to KDB 558074 D01 v03r02 that emission levels below the 15.209 general radiated emissions limits is not required.

7. 6dB BANDWIDTH MEASUREMENT

7.1. Block Diagram of Test Setup



7.2. Specification Limits

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

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r02:

Option 2

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

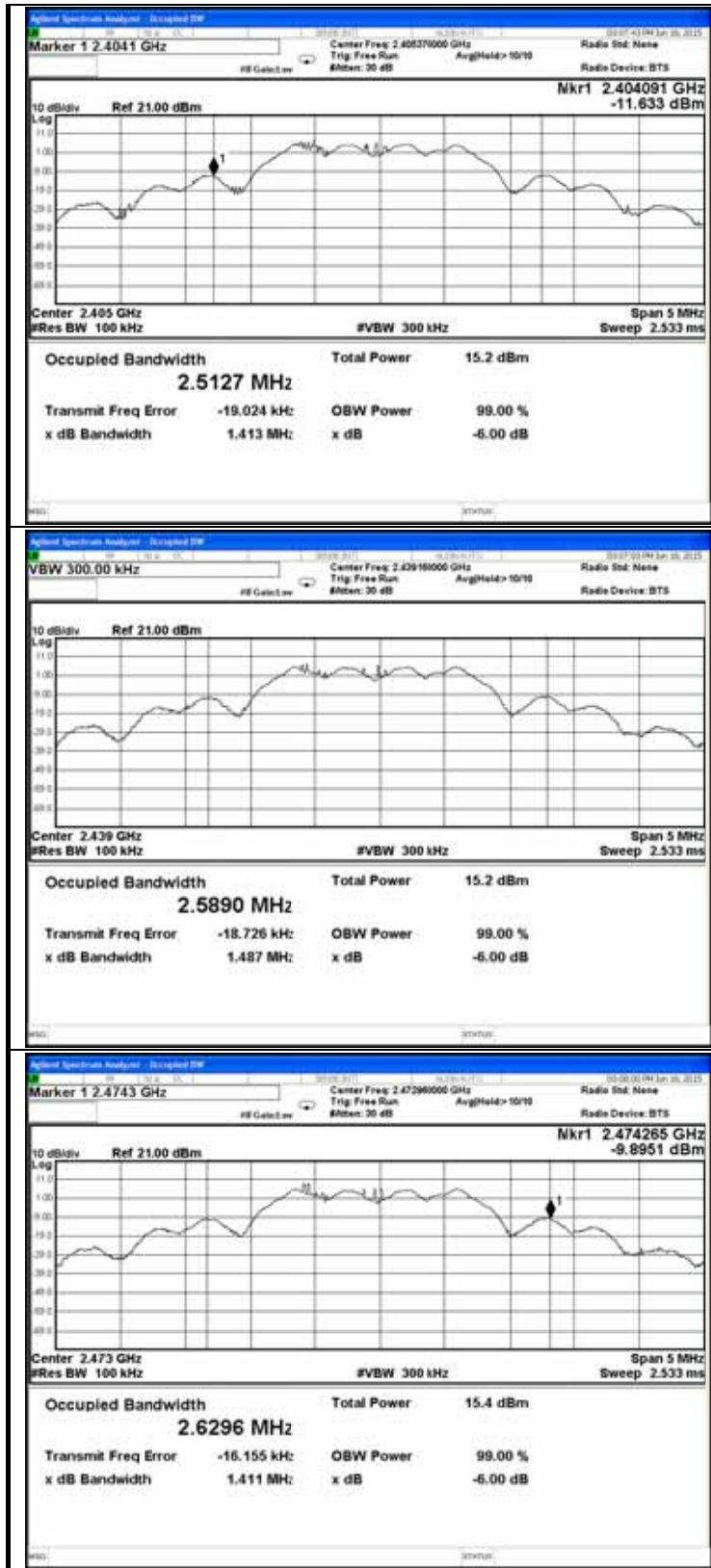
7.4. Test Results

| | | | |
|------------|------------|--------------|----------------------------|
| Test Date | 2015/06/16 | Temp./Hum. | 22 /48% |
| Cable Loss | 1dB | Test Voltage | DC 6V(via DC Power Supply) |

7.4.1. 6dB Bandwidth Result

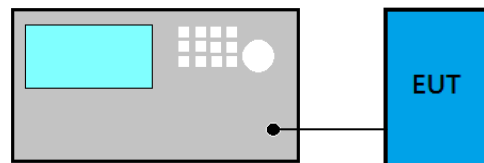
| Modulation Type | Centre Frequency (MHz) | 6 dB Bandwidth (MHz) |
|-----------------|------------------------|----------------------|
| FASSTest | 2405.376 | 1.413 |
| | 2439.168 | 1.487 |
| | 2472.960 | 1.411 |

7.4.2. Measurement Plots



8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm)

8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r02:

PKPM1 Peak power meter method:

EUT is connected to power sensor and record the maximum output power.

Method AVGPM (Measurement using an RF average power meter):

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.5 is < 98%.

Method AVGSA-2 (Spectrum channel power)

- (1) Set span to at least 3 times the OBW
- (2) Set $RBW \geq OBW$
- (3) Set the video bandwidth (VBW) $\geq 3 \times RBW$.
- (4) Detector = Peak
- (5) Trace mode = max hold
- (6) Sweep = auto couple.
- (7) To find the peak amplitude level.

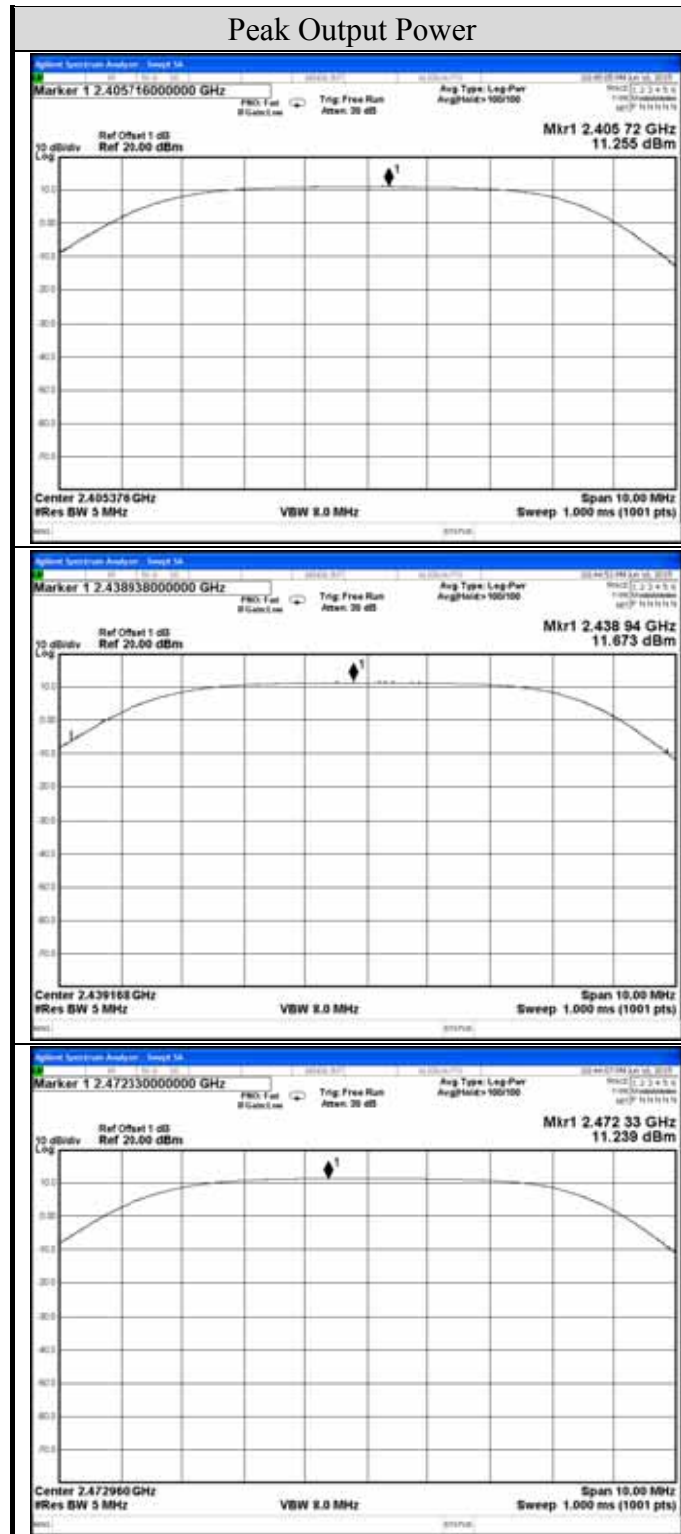
8.4. Test Results

| | | | |
|------------|------------|--------------|----------------------------|
| Test Date | 2015/06/16 | Temp./Hum. | 22 /48% |
| Cable Loss | 1dB | Test Voltage | DC 6V(via DC Power Supply) |

| Modulation Type | Centre Frequency (MHz) | Peak Output Power | | Limit |
|-----------------|------------------------|-------------------|----------|----------------|
| | | (dBm) | (W) | |
| FASSTest | 2405.376 | 11.255 | 0.013351 | < 30 dBm (1 W) |
| | 2439.168 | 11.673 | 0.014699 | |
| | 2472.960 | 11.239 | 0.013301 | |

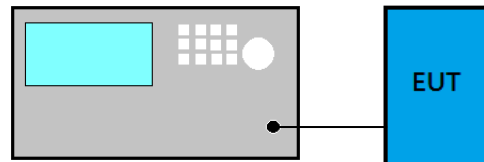
Note: The results have been included cable loss.

8.4.1. Peak Measurement Plots



9. EMISSION LIMITATIONS MEASUREMENT

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in 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)).

9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r02:

Reference Level

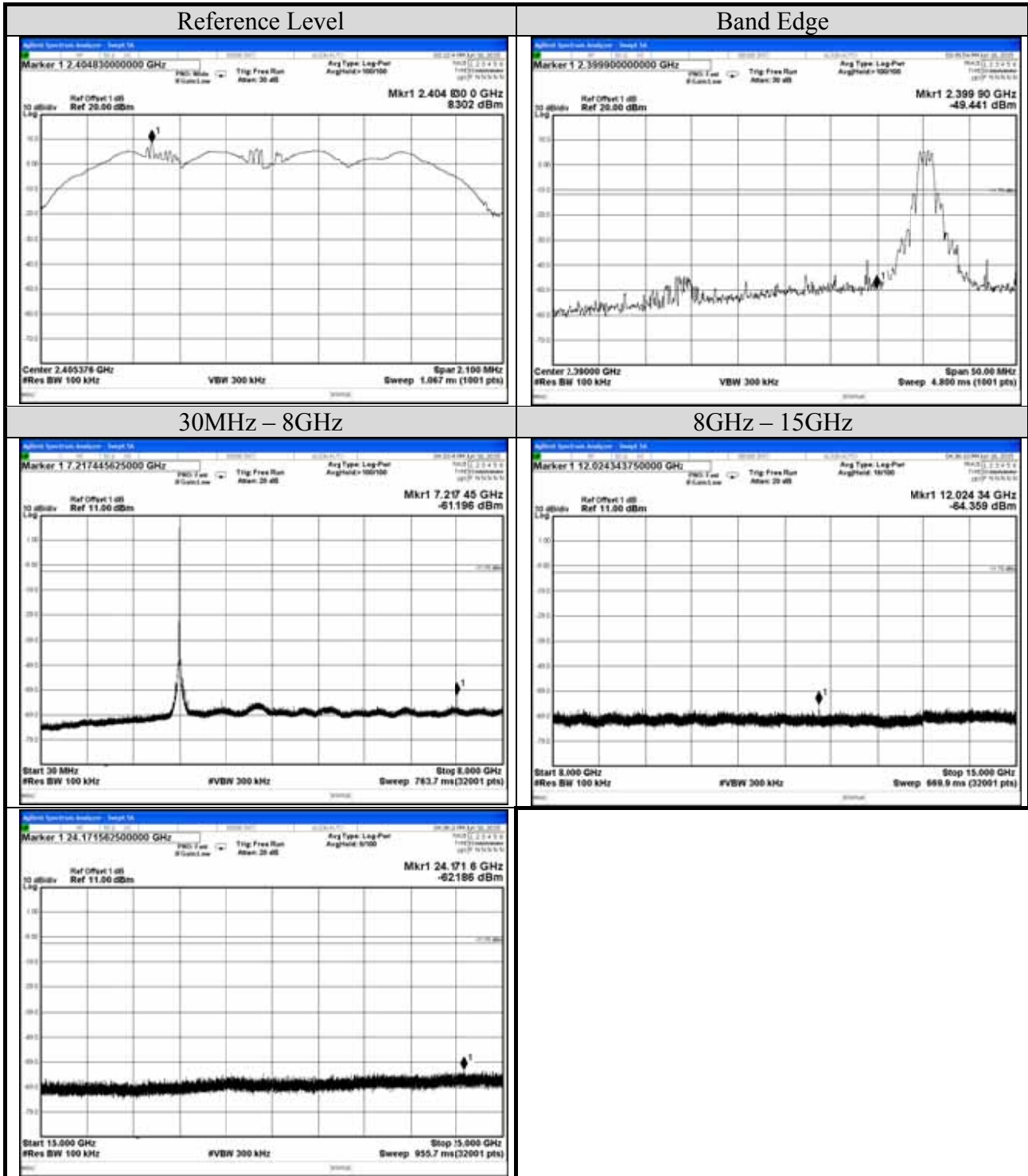
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

Emission Level Measurement

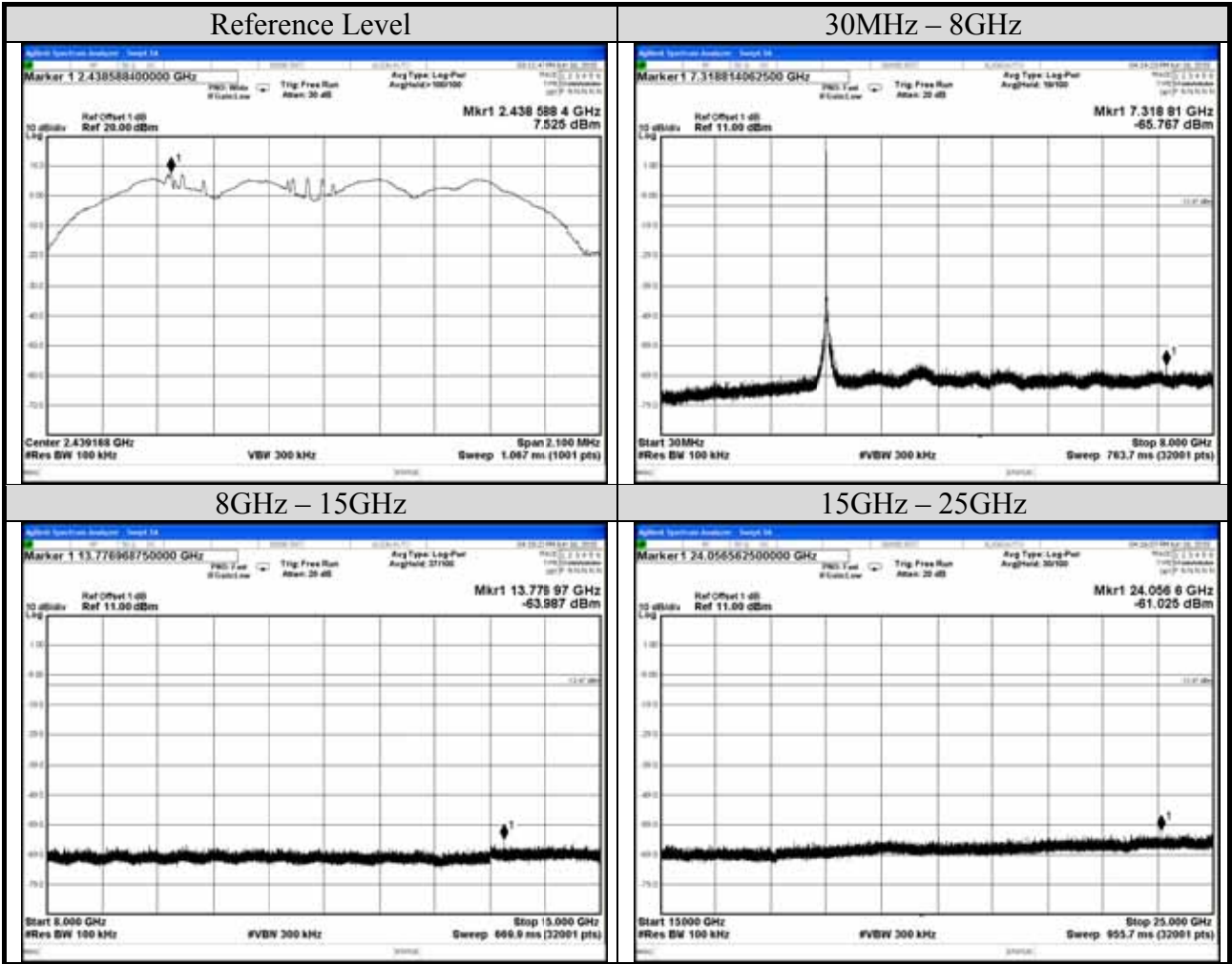
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

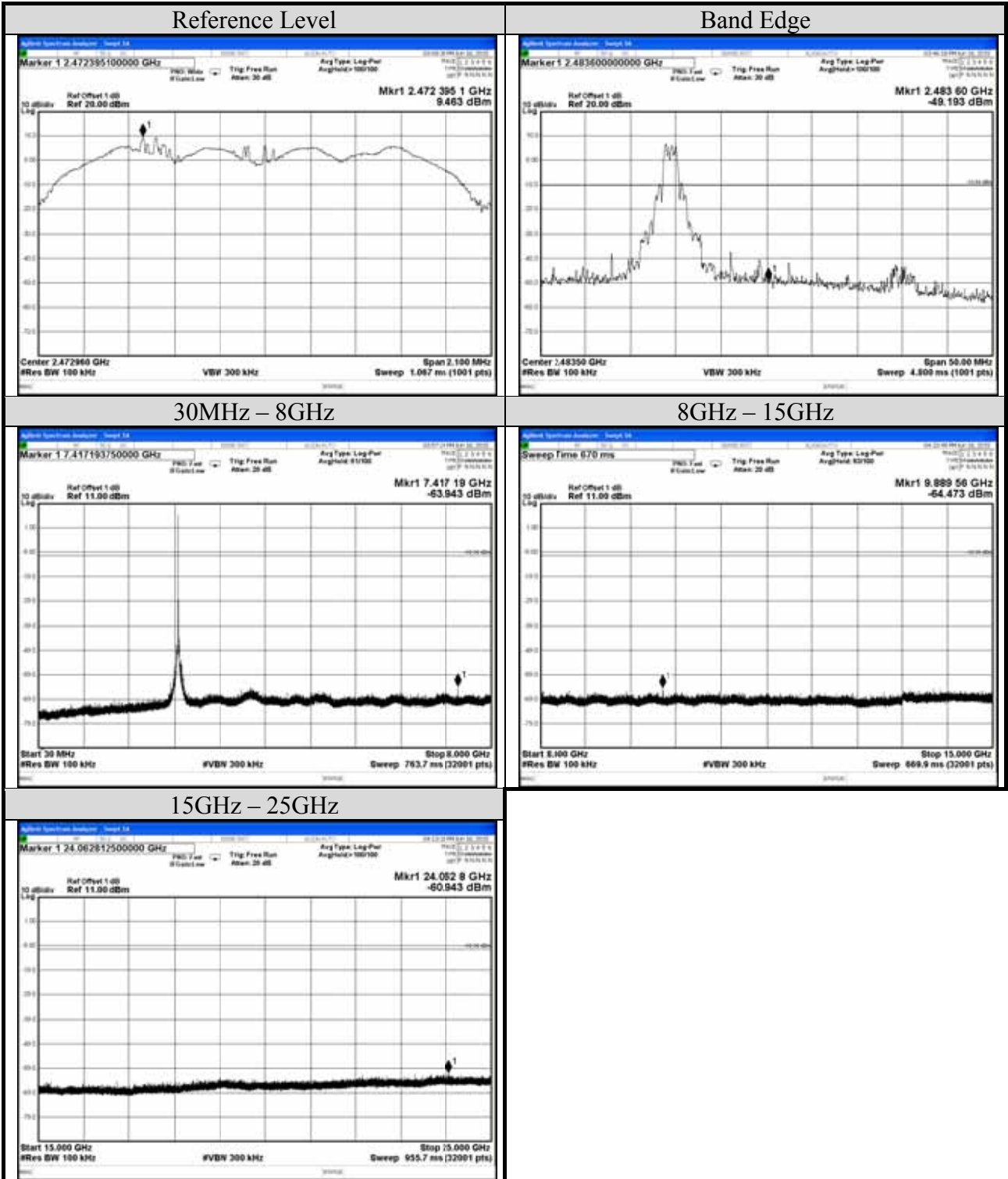
| | | | |
|------------|------------|--------------|----------------------------|
| Test Date | 2015/06/16 | Temp./Hum. | 22 /48% |
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
| Cable Loss | 1dB | Test Voltage | DC 6V(via DC Power Supply) |



| | | | |
|------------|------------|--------------|----------------------------|
| Test Date | 2015/06/16 | Temp./Hum. | 22 /48% |
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
| Cable Loss | 1dB | Test Voltage | DC 6V(via DC Power Supply) |

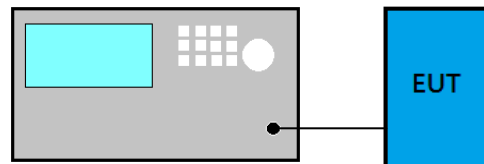


| | | | |
|------------|------------|--------------|----------------------------|
| Test Date | 2015/06/16 | Temp./Hum. | 22 /48% |
| Modulation | FASSTest | Frequency | TX 2405.376MHz |
| Cable Loss | 1dB | Test Voltage | DC 6V(via DC Power Supply) |



10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r02:

Method PKPSD (peak PSD)

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- (4) Set the VBW $\geq 3 \times \text{RBW}$.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.5.1. < 98%.
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

| | | | |
|------------|------------|--------------|----------------------------|
| Test Date | 2015/06/16 | Temp./Hum. | 22 /48% |
| Cable Loss | 1dB | Test Voltage | DC 6V(via DC Power Supply) |



11. DEVIATION TO TEST SPECIFICATIONS

【NONE】