# TEST REPORT

## FCC ID: 2ACHP-LCM

For

Inature Hong Kong Limited

M.CRAFTSMAN LCM

| | | |
|---|---|---|
| Model No. | : | LCM |
| Trade Name | : | N/A |
| Prepared for | : | Inature Hong Kong Limited |
| Address | : | Room 50, 2/F, Sino Industrial Plaza, 9 Kai Cheung Road, Kowloon Bay, Kowloon Hong Kong |
| Prepared by | : | Shenzhen Alpha Product Testing Co., Ltd. |
| Address | : | Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road, Bao'an, Shenzhen, China |
| Report No. | : | T1861291 06 |
| Date of Receipt | : | July 12, 2016 |
| Date of Test | : | July 12-August 09, 2016 |
| Date of Report | : | August 11, 2016 |
| Version Number | : | REV0 |

**Contents**

# DECLARATION

| | | |
|---|---|---|
| Applicant | : | Inature Hong Kong Limited |
| Manufacturer | : | Inature Hong Kong Limited |
| Product | : | M.CRAFTSMAN LCM |
| (A) Model No. | : | LCM |
| (B) Trade Name | : | N/A |
| (C) Power supply | : | DC 19V From DC Port |

Measurement Standard Used:

**FCC Rules and Regulations Part 15 Subpart C Section 15.247: 2016, ANSI C63.4:2014**

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

| | | |
|---|---|---|
| Tested by (name + signature).....…..: | Reak Yang<br>Test Engineer | Reak Yang …… |
| Approved by (name + signature)…....: | Simple Guan<br>Project Manager | …… |
| Date of issue…… ……...: | | August 11, 2016 |

# 1. General Information

## 1.1. Description of Device (EUT)

| | | |
|---|---|---|
| EUT | : | M.CRAFTSMAN LCM |
| Model No. | : | LCM |
| Trade mark | : | N/A |
| Power supply | : | DC 19V From DC Port |
| Radio Technology | : | Bluetooth 2.1 + EDR |
| Operation frequency | : | 2402-2480MHz |
| Modulation | : | GFSK, π /4 DQPSK, 8- DPSK |
| Antenna Type | : | Integrated Antenna, max gain 0Bi. |
| Hardware REV. | : | N/A |
| Software REV. | : | N/A |
| Applicant | : | Inature Hong Kong Limited |
| Address | : | Room 50, 2/F, Sino Industrial Plaza, 9 Kai Cheung Road, Kowloon Bay, Kowloon Hong Kong |
| Manufacturer | : | Inature Hong Kong Limited |
| Address | : | Room 50, 2/F, Sino Industrial Plaza, 9 Kai Cheung Road, Kowloon Bay, Kowloon Hong Kong |

## 1.2. Accessories of device (EUT)

Accessories : N/A

Type : N/A

## 1.3. Test Lab information

Shenzhen Alpha Product Testing Co., Ltd.

2F, Building B, East Area of Nanchang Second Industrial Zone,
Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China

FCC Registered No.: 203110

# 2. Summary of test

## 2.1. Summary of test result

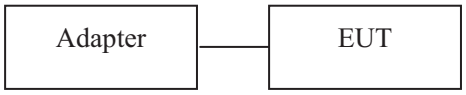
| Description of Test Item | Standard | Results |
|---|---|---|
| Maximum Peak Output Power | FCC Part 15: 15.247(b)(1)<br>ANSI C63.4 :2014 | PASS |
| Bandwidth | FCC Part 15: 15.215<br>ANSI C63.4 :2014 | PASS |
| Carrier Frequency Separation | FCC Part 15: 15.247(a)(1)<br>ANSI C63.4 :2014 | PASS |
| Number Of Hopping Channel | FCC Part 15: 15.247(a)(1)(iii)<br>ANSI C63.4 :2014 | PASS |
| Dwell Time | FCC Part 15: 15.247(a)(1)(iii)<br>ANSI C63.4 :2014 | PASS |
| Radiated Emission | FCC Part 15: 15.209<br>FCC Part 15: 15.247(d)<br>ANSI C63.4 :2014 | PASS |
| Band Edge Compliance | FCC Part 15: 15.247(d)<br>ANSI C63.4 :2014 | PASS |
| Power Line Conducted Emissions | FCC Part 15: 15.207<br>ANSI C63.4 :2014 | PASS |
| Antenna requirement | FCC Part 15: 15.203 | PASS |
| Note: Test with the test procedure Blue tool. | | |

## 2.2. Assistant equipment used for test

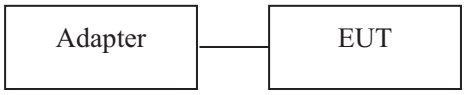
| | | |
|---|---|---|
| Description | : | N/A |
| Manufacturer | : | N/A |
| Model No. | : | N/A |
| Remark: FCC DOC approved | | |

## 2.3. Block Diagram

1, For radiated emissions test: EUT was placed on a turn table, which is 0.8 meter high above ground for blew 1GHz, 1.5 meter high above ground for above 1GHz. EUT was be set into BT test mode by software before test.




2, For Power Line Conducted Emissions Test




## 2.4. Test mode

The test software was used to control EUT work in Continuous TX mode, and select test channel, wireless mode.

| Tested mode, channel, and data rate information | | |
|---|---|---|
| Mode | Channel | Frequency (MHz) |
| GFSK | Low :CH1 | 2402 |
| | Middle: CH40 | 2441 |
| | High: CH79 | 2480 |

| Tested mode, channel, and data rate information | | |
|---|---|---|
| Mode | Channel | Frequency (MHz) |
| π /4 DQPSK | Low :CH1 | 2402 |
| | Middle: CH40 | 2441 |
| | High: CH79 | 2480 |

| Tested mode, channel, and data rate information | | |
|---|---|---|
| Mode | Channel | Frequency (MHz) |
| 8- DPSK | Low :CH1 | 2402 |
| | Middle: CH40 | 2441 |
| | High: CH79 | 2480 |

## 2.5. Test Conditions

| | |
|---|---|
| Temperature range | 21-25℃ |
| Humidity range | 40-75% |
| Pressure range | 86-106kPa |

## 2.6. Measurement Uncertainty (95% confidence levels, k=2)

| Item | MU | Remark |
|---|---|---|
| Uncertainty for Power point Conducted Emissions Test | 2.71dB | |
| Uncertainty for Radiation Emission test in 3m chamber (below 30MHz) | 2.13 dB | Polarize: V |
| | 2.57dB | Polarize: H |
| Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz) | 3.90dB | Polarize: V |
| | 3.92dB | Polarize: H |
| Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz) | 4.28dB | Polarize: H |
| | 4.26dB | Polarize: V |
| Uncertainty for radio frequency | 1×10-9 | |
| Uncertainty for conducted RF Power | 0.16dB | |
| Uncertainty for temperature | 0.2℃ | |
| Uncertainty for humidity | 1% | |
| Uncertainty for DC and low frequency voltages | 0.06% | |

## 2.7. Test Equipment

| Equipment | Manufacture | Model No. | Serial No. | Due cal. | Cal Interval |
|---|---|---|---|---|---|
| 3m Semi-Anechoic | CHENYU | N/A | N/A | 2018.01.18 | 2Year |
| Spectrum analyzer | Agilent | E4407B | MY46185649 | 2017.01.16 | 1Year |
| Receiver | R&S | ESPI | 101873 | 2017.01.16 | 1Year |
| Receiver | R&S | ESCI | 101165 | 2017.01.16 | 1Year |
| Bilog Antenna | SCHWARZBECK | VULB 9168 | VULB9168-438 | 2018.01.18 | 2Year |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | BBHA 9120 D(1201) | 2017.01.20 | 2Year |
| L.I.S.N.#1 | Schwarzbeck | NSLK8126 | 8126466 | 2017.01.16 | 1 Year |
| L.I.S.N.#2 | ROHDE&SCHWARZ | ENV216 | 101043 | 2017.01.16 | 1 Year |
| Cable | Resenberger | N/A | No.1 | 2017.01.16 | 1Year |
| Cable | SCHWARZBECK | N/A | No.2 | 2017.01.16 | 1Year |
| Cable | SCHWARZBECK | N/A | No.3 | 2017.01.16 | 1Year |
| Pre-amplifier | HP | HP8347A | 2834A00455 | 2017.01.18 | 1Year |
| Pre-amplifier | Agilent | 8449B | 3008A02664 | 2017.01.18 | 1Year |
| vector Signal Generator | Agilent | N5182A | MY49060042 | 2016.11.16 | 1 Year |
| vector Signal Generator | Agilent | E4438C | US44271917 | 2016.11.16 | 1 Year |
| X-series USB Peak and Average Power Sensor | Agilent | U2021XA | MY54080020 | 2016.11.16 | 1 Year |
| X-series USB Peak and Average Power Sensor | Agilent | U2021XA | MY54110001 | 2016.11.16 | 1 Year |
| Signal Analyzer | Agilent | N9020A | MY48030494 | 2016.11.16 | 1 Year |

# 3. Maximum Peak Output power

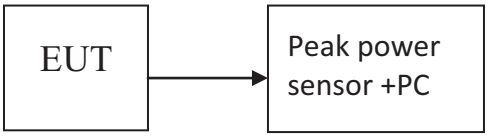
## 3.1. Limit

Please refer section15.247.
For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

## 3.2. Test Procedure

The transmitter output is connected to the PK power sensor .

## 3.3. Test Setup




## 3.4. Test Result

| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | |
|---|---|---|---|---|---|
| Test date: 2016-08-04 | | Test site: RF site Tested by: Reak | | | |
| Mode | Freq (MHz) | PK Output Power (dBm) | PK Output Power (mW) | Limit (dBm) | Margin (dB) |
| GFSK | 2402 | 2.27 | 1.687 | 21 | 18.730 |
| | 2441 | 2.57 | 1.807 | 21 | 18.430 |
| | 2480 | 2.77 | 1.892 | 21 | 18.230 |
| π /4 DQPSK, | 2402 | 1.53 | 1.422 | 21 | 19.470 |
| | 2441 | 1.91 | 1.552 | 21 | 19.090 |
| | 2480 | 2.05 | 1.603 | 21 | 18.950 |
| 8- DPSK | 2402 | 1.69 | 1.476 | 21 | 19.310 |
| | 2441 | 2.05 | 1.603 | 21 | 18.950 |
| | 2480 | 2.25 | 1.679 | 21 | 18.750 |
| Conclusion: PASS | | | | | |

# 4. Bandwidth

## 4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

## 4.2. Test Procedure

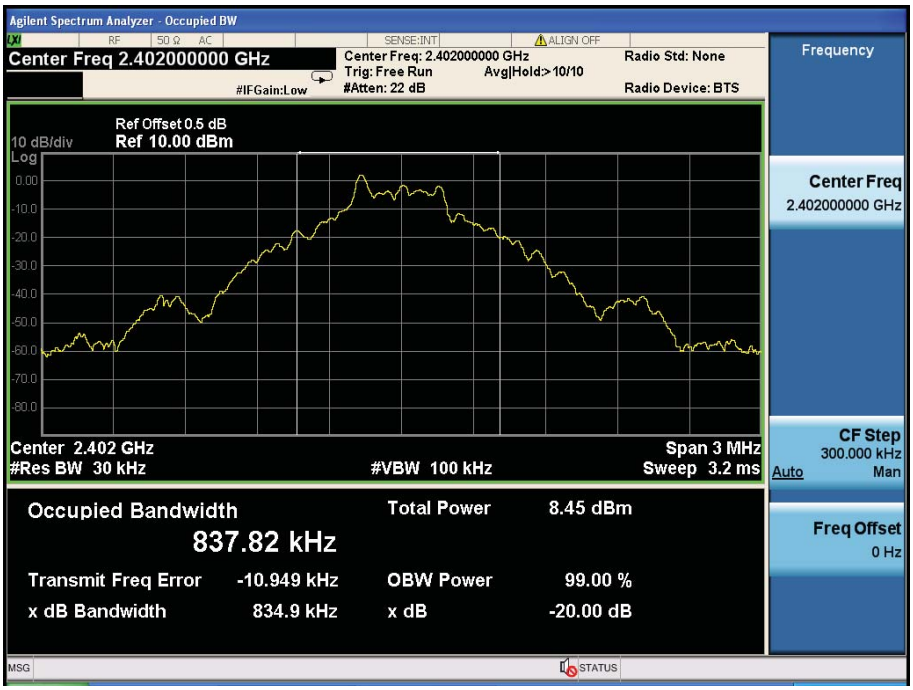
The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

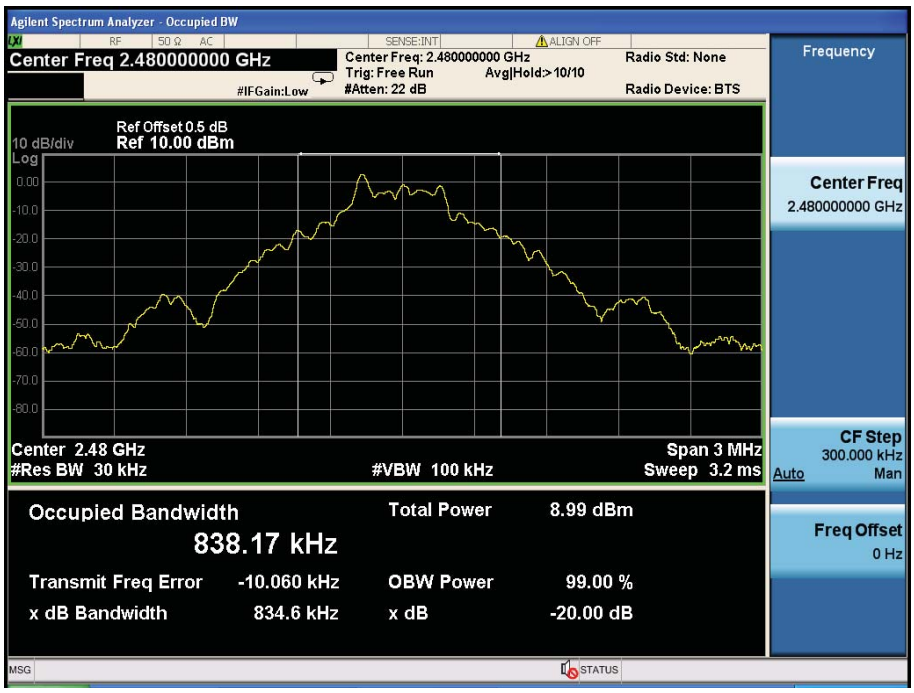
## 4.3. Test Result

| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | |
|---|---|---|---|---|
| Test date: 2016-08-04 | | Test site: RF site | Tested by: Reak | |
| Mode | Freq (MHz) | 20dB Bandwidth (KHz) | Limit (kHz) | Conclusion |
| GFSK | 2402 | 834.9 | / | PASS |
| | 2441 | 834.7 | / | PASS |
| | 2480 | 834.6 | / | PASS |
| π /4 DQPSK | 2402 | 1117 | / | PASS |
| | 2441 | 1117 | / | PASS |
| | 2480 | 1118 | / | PASS |
| 8- DPSK | 2402 | 1164 | / | PASS |
| | 2441 | 1165 | / | PASS |
| | 2480 | 1166 | / | PASS |

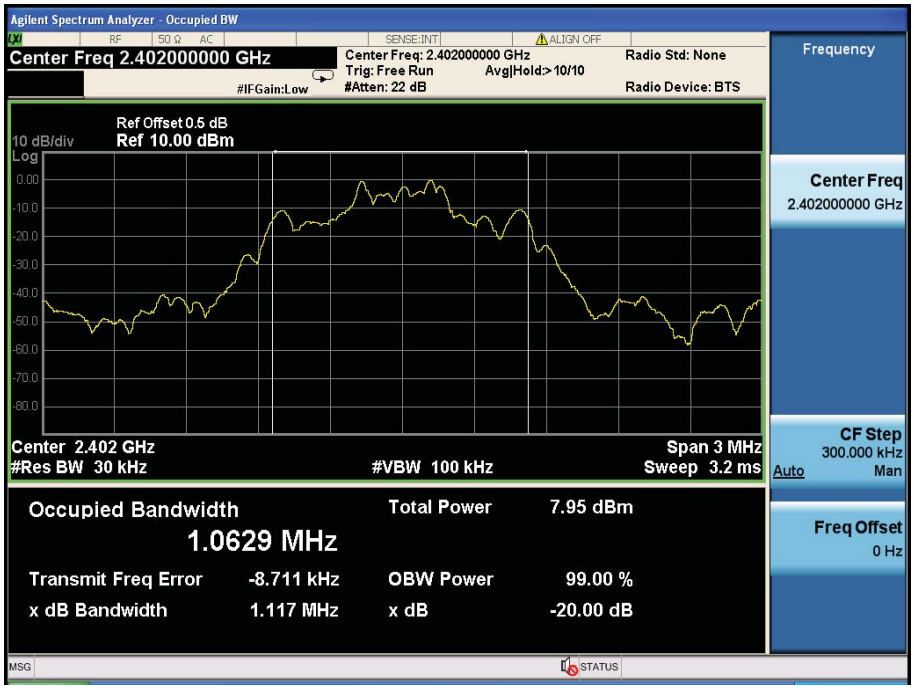
Orginal Test data For 20dB bandwidth

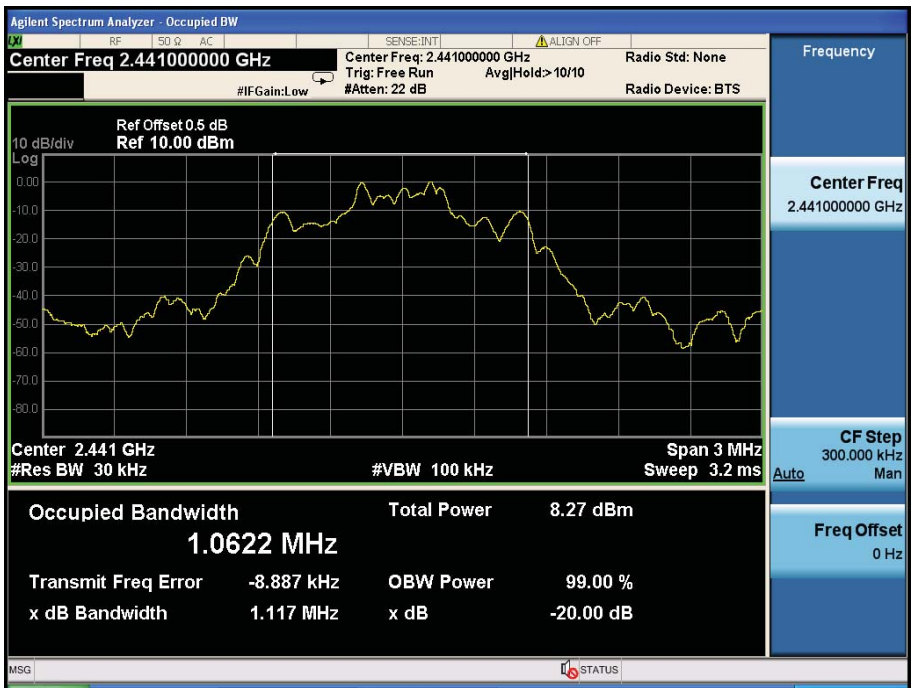
GFSK:

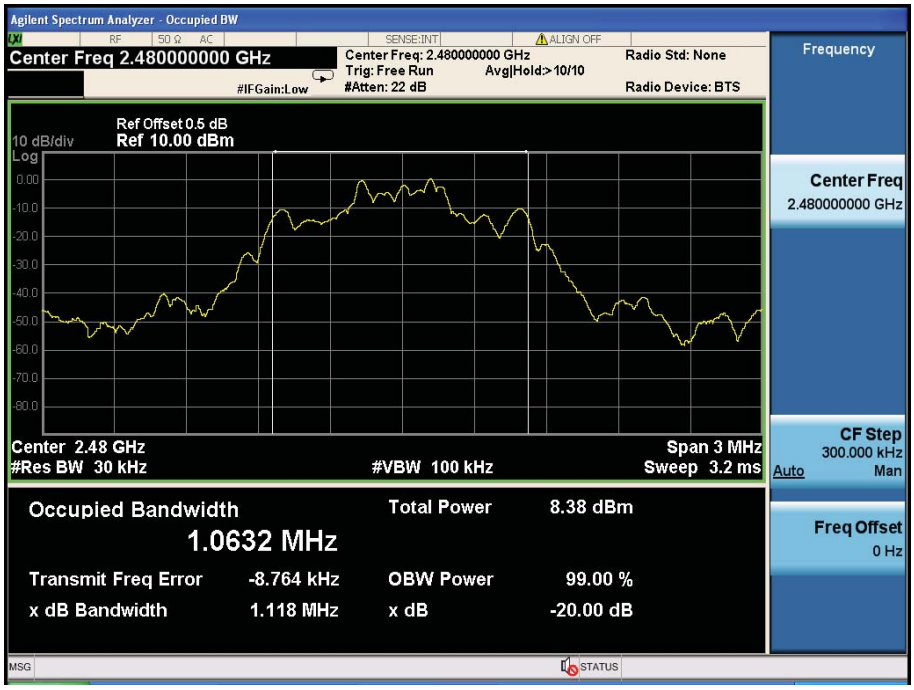




Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
#IFGain:Low
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
838.17 kHz
Total Power 8.99 dBm
Transmit Freq Error -10.060 kHz
OBW Power 99.00 %
x dB Bandwidth 834.6 kHz
x dB -20.00 dB
Center Freq
2.480000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

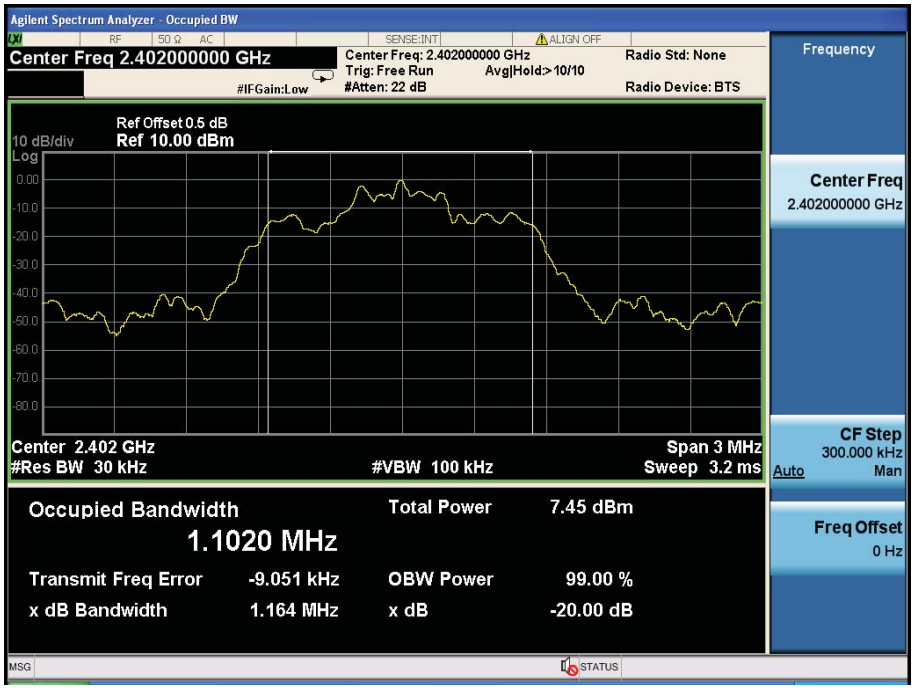
π /4 DQPSK:

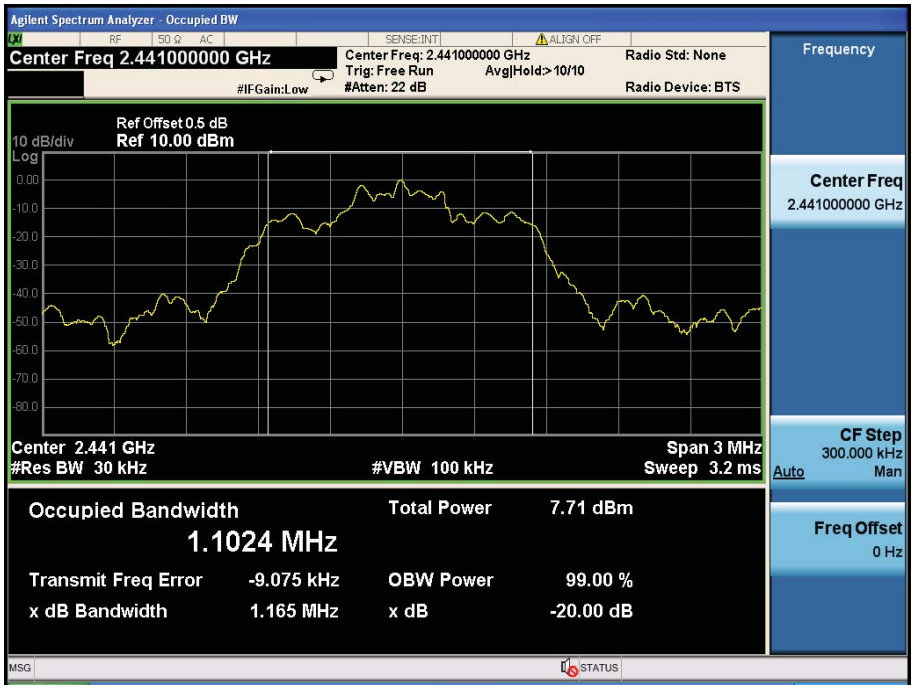

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.402000000 GHz
#IFGain:Low
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.402 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.0629 MHz
Total Power 7.95 dBm
Transmit Freq Error -8.711 kHz
OBW Power 99.00 %
x dB Bandwidth 1.117 MHz
x dB -20.00 dB
Center Freq
2.402000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

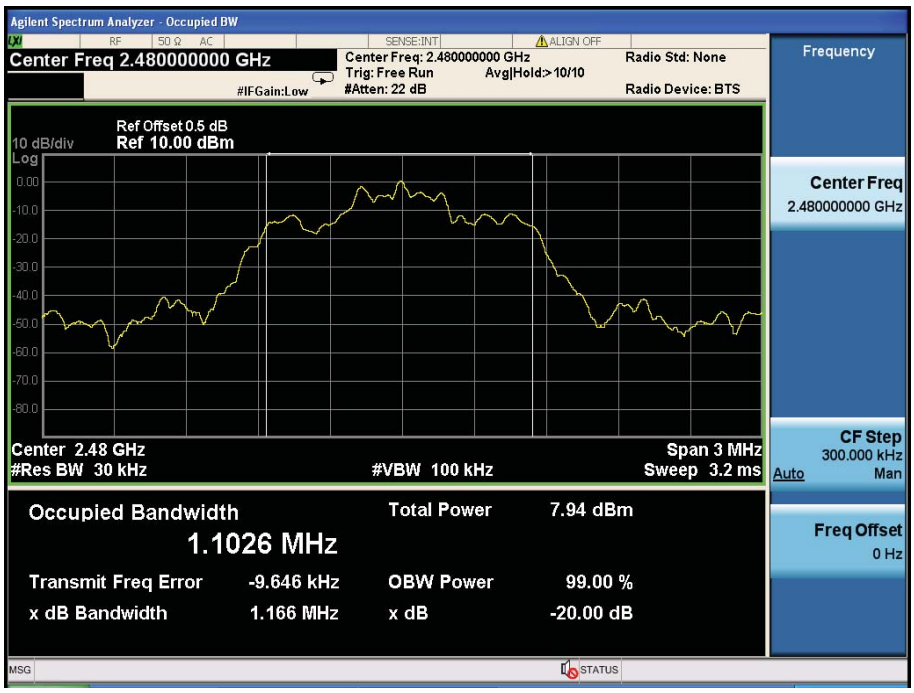

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.441000000 GHz
#IFGain:Low
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
Radio Std: None
Radio Device: BTS
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.0622 MHz
Total Power 8.27 dBm
Transmit Freq Error -8.887 kHz
OBW Power 99.00 %
x dB Bandwidth 1.117 MHz
x dB -20.00 dB
MSG
STATUS
Frequency
Center Freq
2.441000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
#IFGain:Low
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
Radio Std: None
Radio Device: BTS
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.0632 MHz
Total Power 8.38 dBm
Transmit Freq Error -8.764 kHz
OBW Power 99.00 %
x dB Bandwidth 1.118 MHz
x dB -20.00 dB
MSG
STATUS
Frequency
Center Freq
2.480000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz

8- DPSK:


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.402000000 GHz
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Center 2.402 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1020 MHz
Total Power
7.45 dBm
Transmit Freq Error
-9.051 kHz
OBW Power
99.00 %
x dB Bandwidth
1.164 MHz
x dB
-20.00 dB
Frequency
Center Freq
2.402000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1024 MHz
Total Power
7.71 dBm
Transmit Freq Error
-9.075 kHz
OBW Power
99.00 %
x dB Bandwidth
1.165 MHz
x dB
-20.00 dB
Frequency
Center Freq
2.441000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Occupied BW
RF
50 Ω AC
SENSE:INT
ALIGN OFF
Center Freq 2.480000000 GHz
#IFGain:Low
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 22 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
1.1026 MHz
Total Power
7.94 dBm
Transmit Freq Error
-9.646 kHz
OBW Power
99.00 %
x dB Bandwidth
1.166 MHz
x dB
-20.00 dB
Freq Offset
0 Hz
MSG
STATUS

# 5. Carrier Frequency Separation

## 5.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

## 5.2. Test Procedure

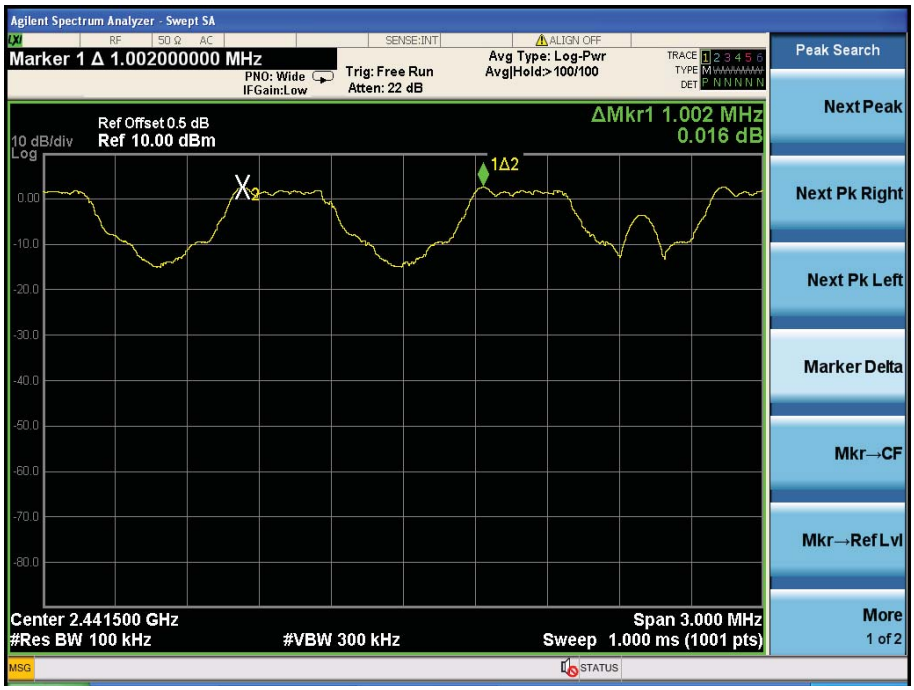
The transmitter output was coupled to a spectrum analyzer via a antenna. The carrier frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW.

## 5.3. Test Result

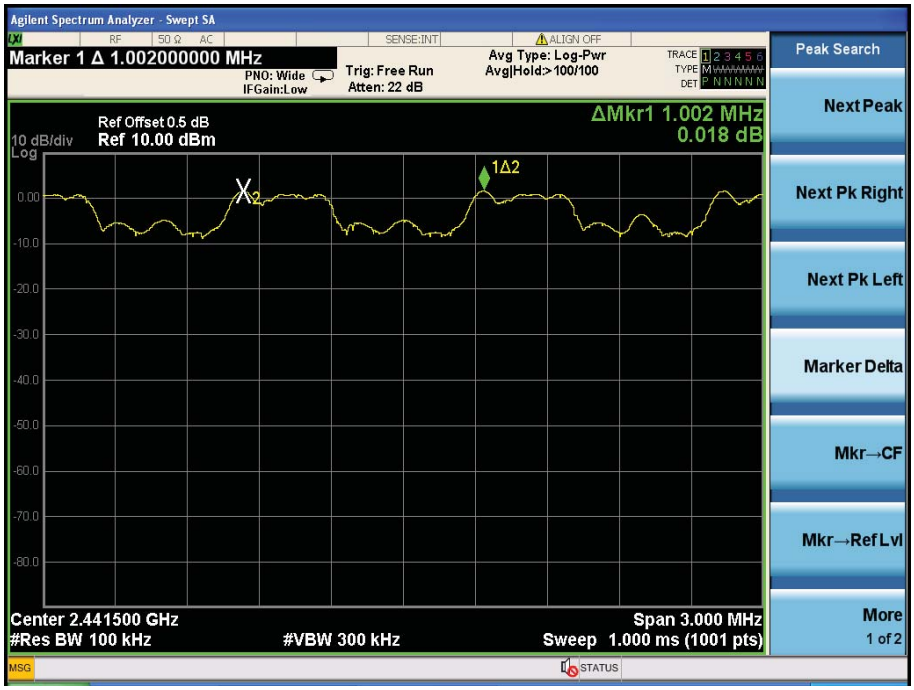
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | |
|---|---|---|---|---|
| Test date: 2016-08-04 | | Test site: RF site | Tested by: Reak | |
| Mode/Channel | Channel separation (MHz) | 20dB Bandwidth (KHz) | Limit (KHz) 2/3 20dB bandwidth | Conclusion |
| GFSK | 1.002 | 834.9 | 556.6 | PASS |
| π /4 DQPSK | 1.002 | 1118 | 745.333 | PASS |
| 8- DPSK | 1.002 | 1166 | 777.333 | PASS |

Orginal test data for channel separation

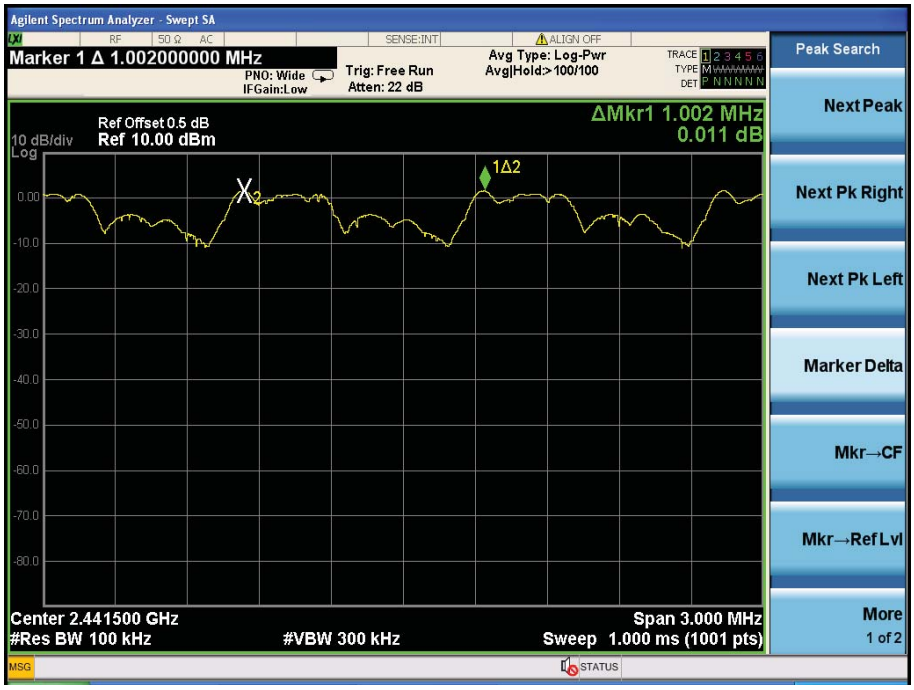
GFSK




π /4 DQPSK



8- DPSK:


Agilent Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN OFF
Marker 1 Δ 1.002000000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 22 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 0.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 1.002 MHz
0.011 dB
1Δ2
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.441500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

# 6. Number Of Hopping Channel

## 6.1. Limit

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

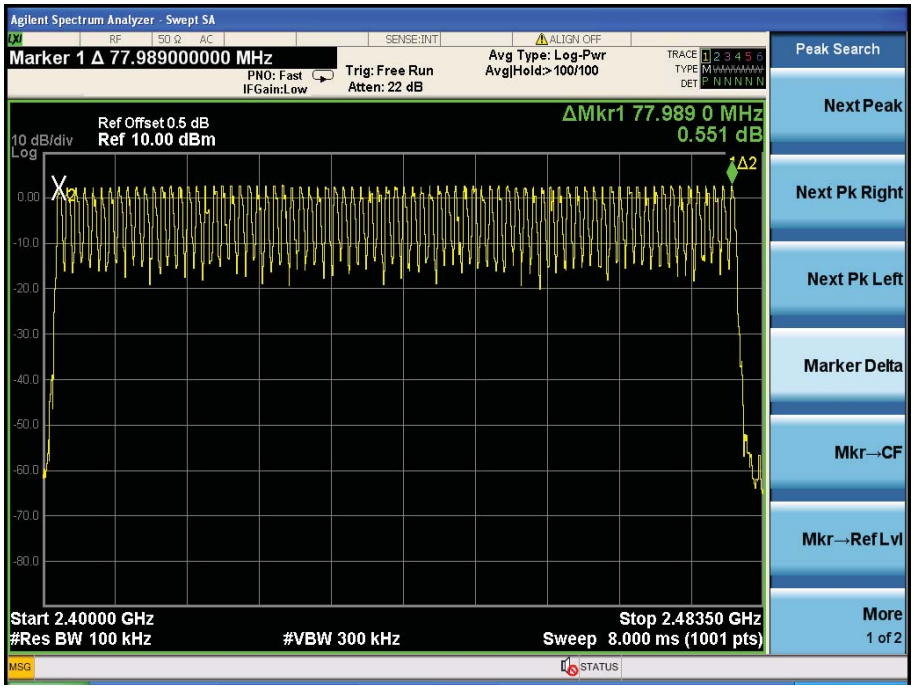
## 6.2. Test Procedure

The transmitter output was coupled to a spectrum analyzer via a antenna. The number of hopping channel was measured by spectrum analyzer with 300kHz RBW and 1MHz VBW.

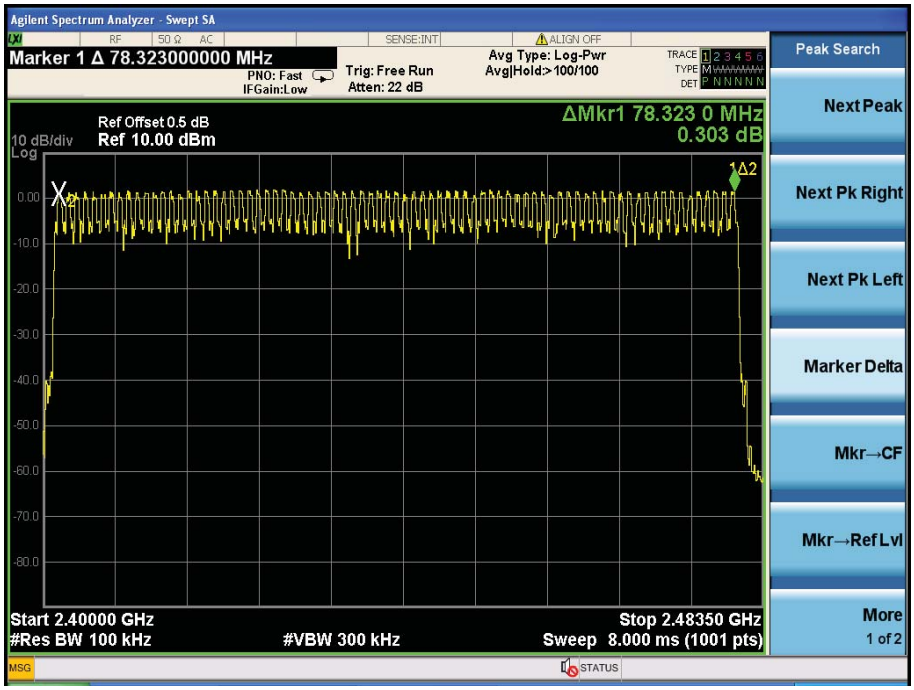
## 6.3. Test Result

| EUT: M.CRAFTSMAN LCM M/N: LCM | | | |
|---|---|---|---|
| Test date: 2016-08-04 | Test site: RF site | Tested by: Reak | |
| Mode | Number of hopping channel | Limit | Conclusion |
| GFSK | 79 | >15 | PASS |
| π /4 DQPSK | 79 | >15 | PASS |
| 8- DPSK | 79 | >15 | PASS |

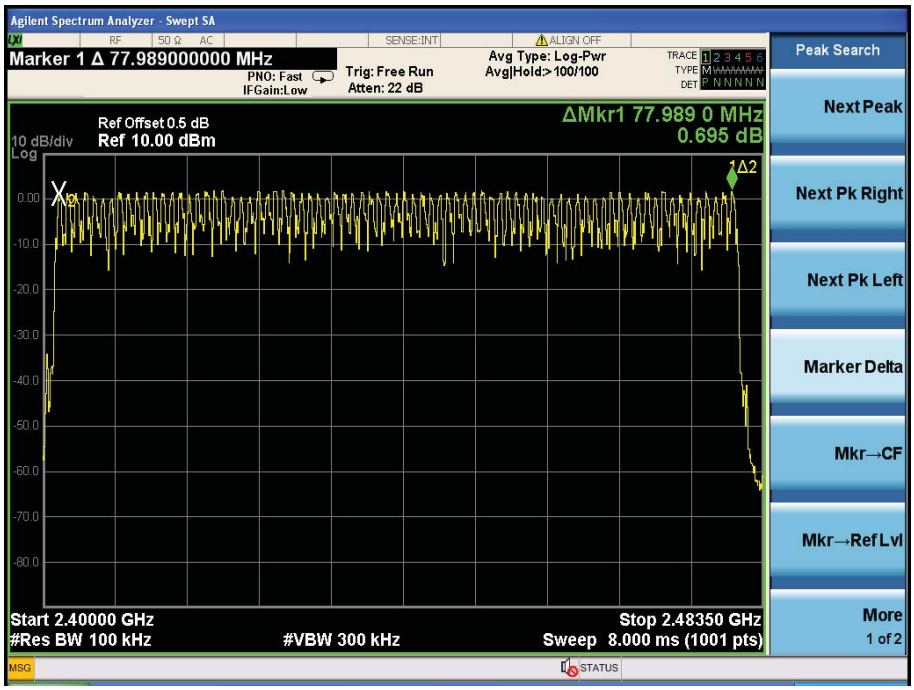
Original test data for hopping channel number
GFSK




π /4 DQPSK



8- DPSK:


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 77.989000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 22 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Ref Offset 0.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 77.989 0 MHz
0.695 dB
1Δ2
Start 2.40000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.48350 GHz
Sweep 8.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

# 7. Dwell Time

## 7.1. Test limit

Please refer section15.247

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 sec- onds multiplied by the number of hopping channel employed.

## 7.2. Test Procedure

7.2.1. Place the EUT on the table and set it in transmitting mode.

7.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.2.3. Set center frequency of spectrum analyzer = operating frequency.

7.2.4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.

7.2.5. Repeat above procedures until all frequency measured were complete.

## 7.3. Test Results

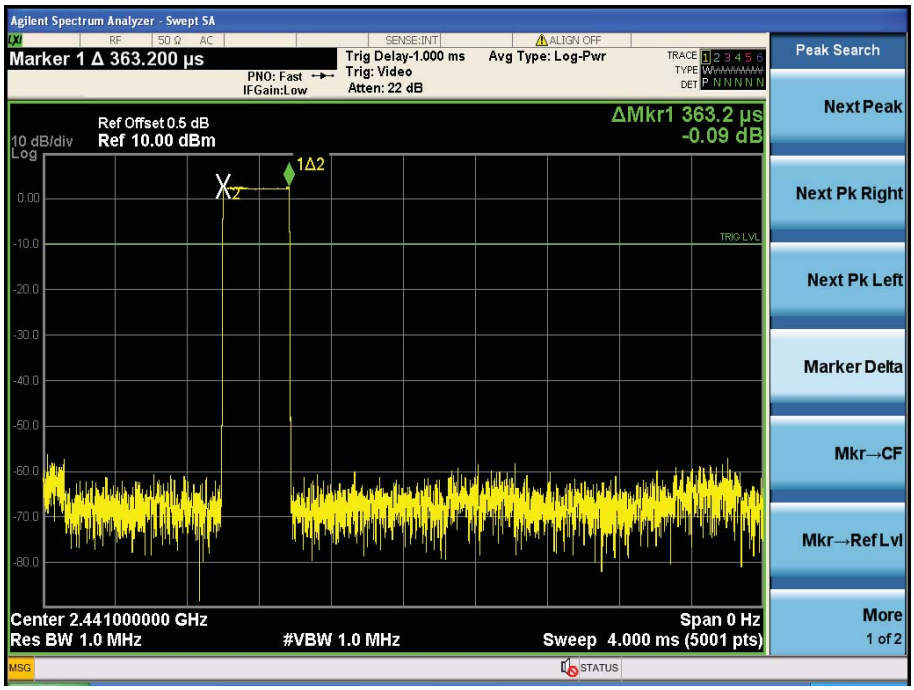
PASS.

Detailed information please see the following page.

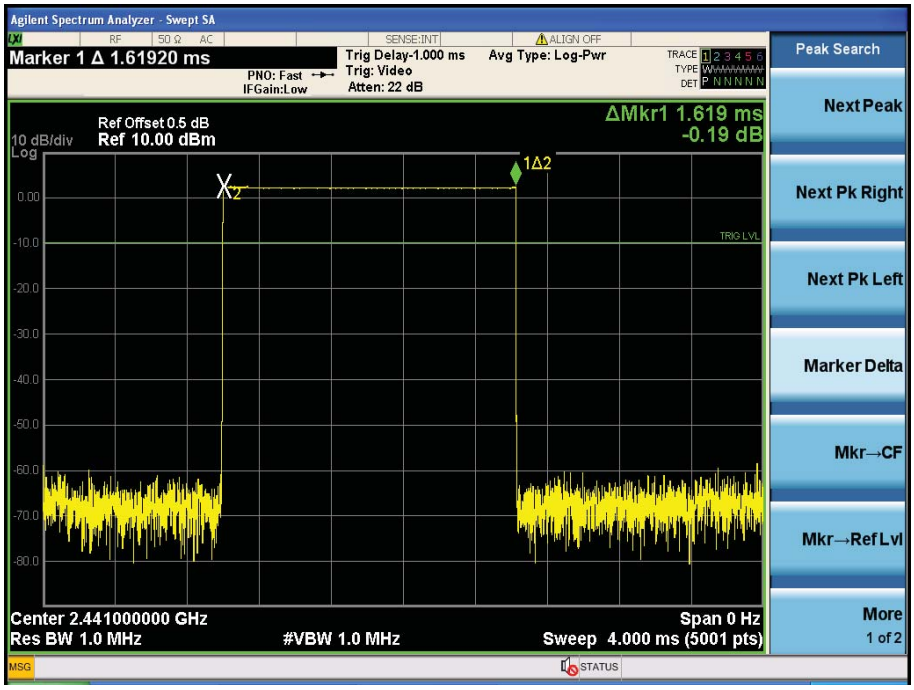
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | | |
|---|---|---|---|---|---|---|
| Test date: 2016-08-04 | | Test site: RF site Tested by: Reak | | | | |
| Mode | Data Packet | Frequency (MHz) | Pulse Duration (ms) | Dwell Time (s) | Limit (s) | Conclusion |
| GFSK | DH1 | 2441 | 0.363 | 0.232 | <0.4 | PASS |
| | DH3 | 2441 | 1.619 | 0.345 | <0.4 | PASS |
| | DH5 | 2441 | 2.865 | 0.367 | <0.4 | PASS |
| π /4 DQPSK | DH1 | 2441 | 0.369 | 0.236 | <0.4 | PASS |
| | DH3 | 2441 | 1.622 | 0.346 | <0.4 | PASS |
| | DH5 | 2441 | 2.87 | 0.367 | <0.4 | PASS |
| 8- DPSK | DH1 | 2441 | 0.373 | 0.239 | <0.4 | PASS |
| | DH3 | 2441 | 1.616 | 0.345 | <0.4 | PASS |
| | DH5 | 2441 | 2.868 | 0.367 | <0.4 | PASS |
| Note: 1 A period time = 0.4 (s) * 79 = 31.6(s)<br>2 DH1 time slot = Pulse Duration * (1600/(1*79)) * A period time/1000<br>DH3 time slot = Pulse Duration * (1600/(3*79)) * A period time/1000<br>DH5 time slot = Pulse Duration * (1600/(5*79)) * A period time/1000 | | | | | | |

GFSK

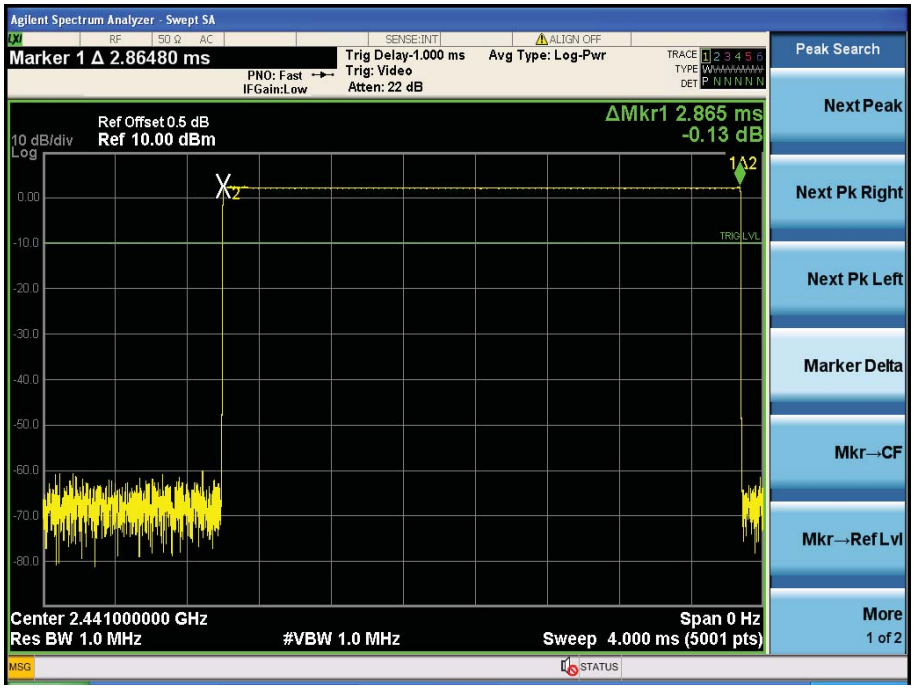
DH1:


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 363.200 µs
PNO: Fast
IFGain:Low
Trig Delay-1.000 ms
Trig: Video
Atten: 22 dB
Avg Type: Log-Pwr
Ref Offset 0.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 363.2 µs
-0.09 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 4.000 ms (5001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

DH3:

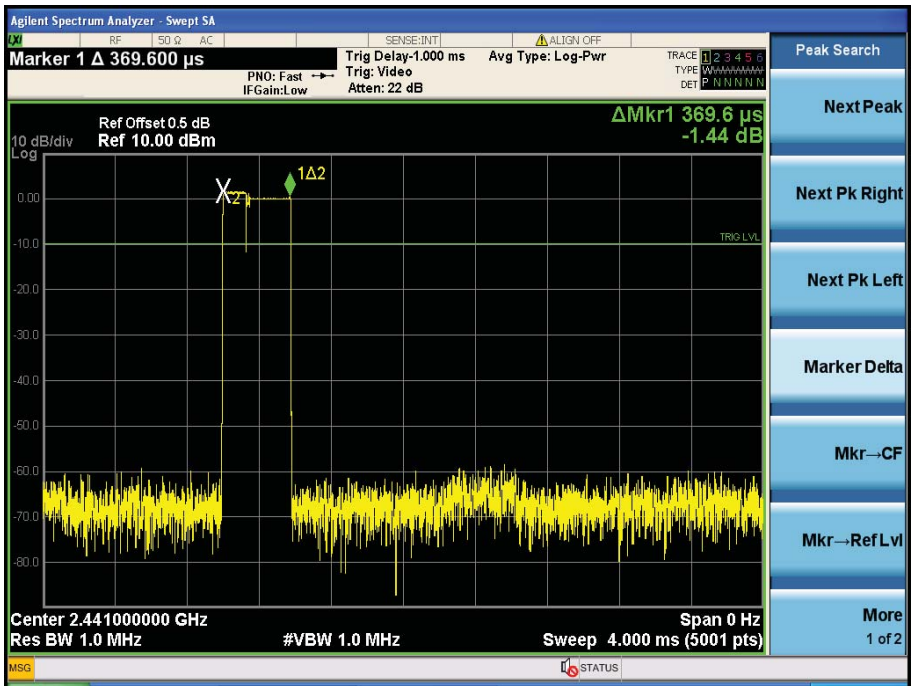

Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.61920 ms
PNO: Fast
IFGain:Low
Trig Delay-1.000 ms
Trig: Video
Atten: 22 dB
Avg Type: Log-Pwr
Ref Offset 0.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 1.619 ms
-0.19 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 4.000 ms (5001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

DH5

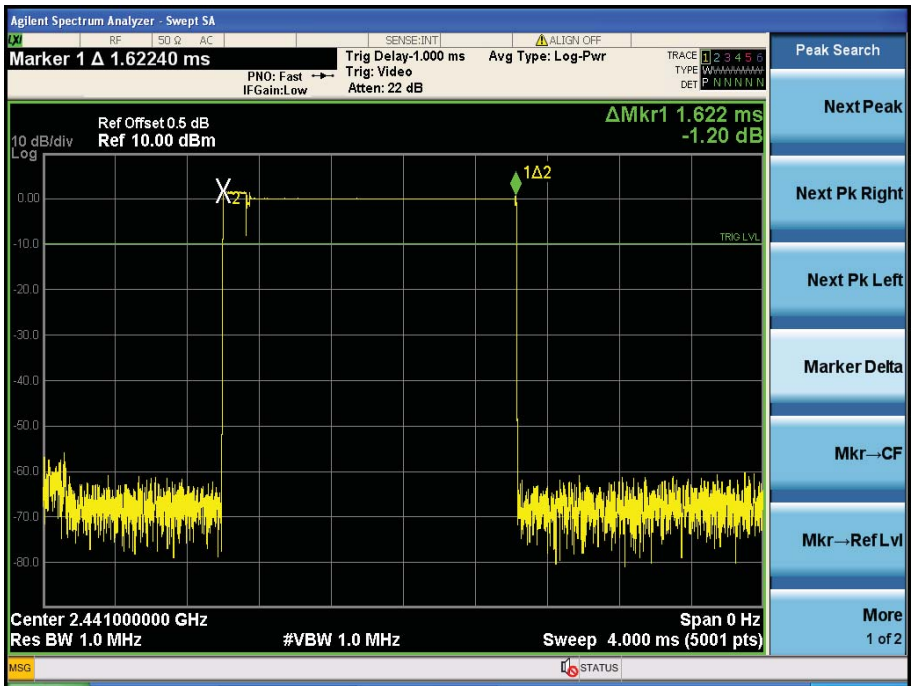



$\pi$ /4 DQPSK

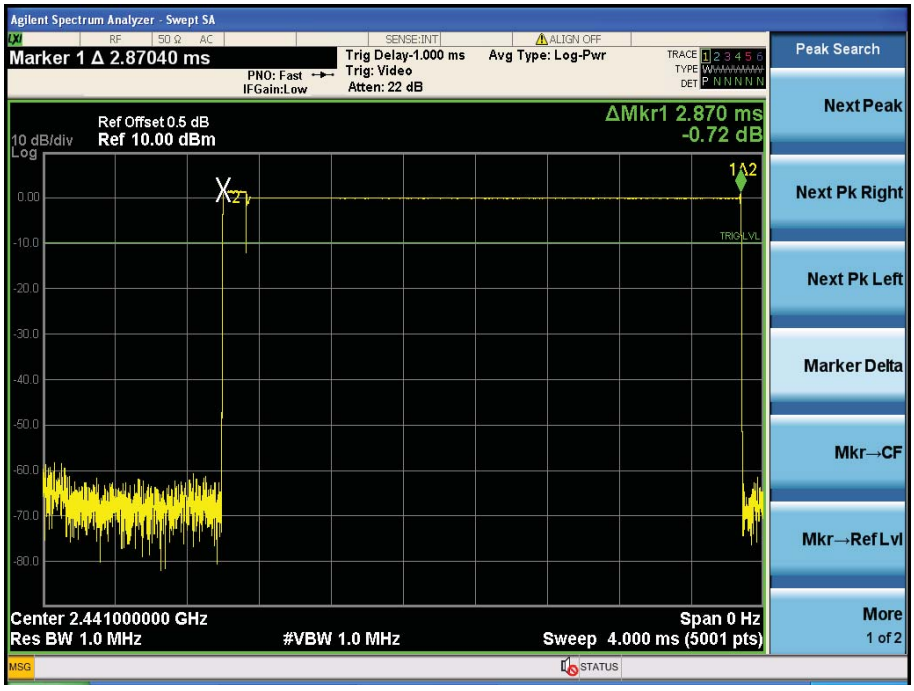
DH1



DH3

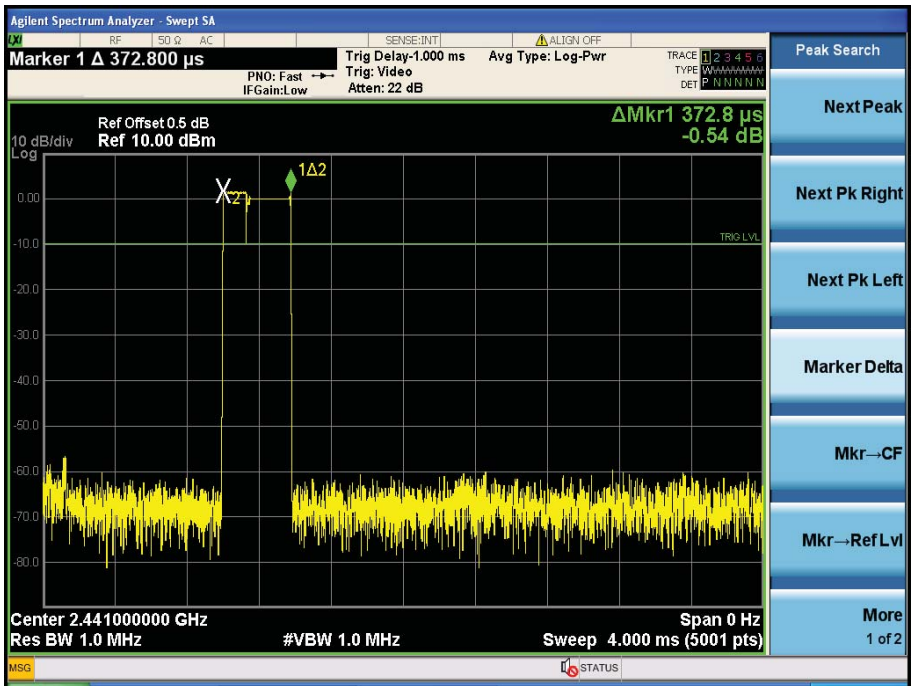

Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 1.62240 ms
PNO: Fast
IFGain:Low
Trig Delay-1.000 ms
Trig: Video
Atten: 22 dB
Avg Type: Log-Pwr
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.622 ms
-1.20 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 4.000 ms (5001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

DH5

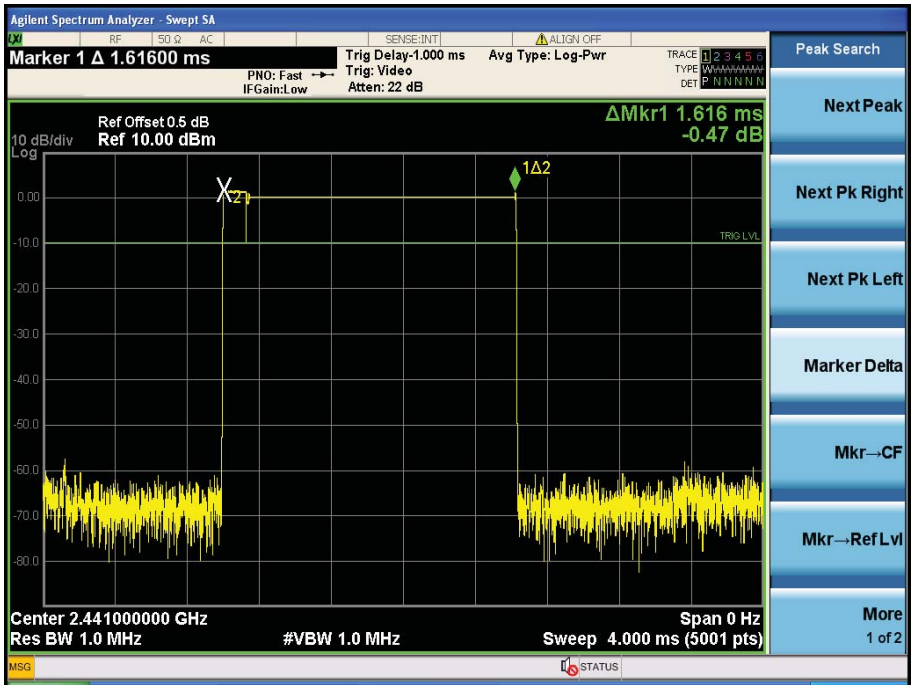

Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.87040 ms
PNO: Fast
IFGain:Low
Trig Delay-1.000 ms
Trig: Video
Atten: 22 dB
Avg Type: Log-Pwr
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 2.870 ms
-0.72 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 4.000 ms (5001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

8- DPSK:

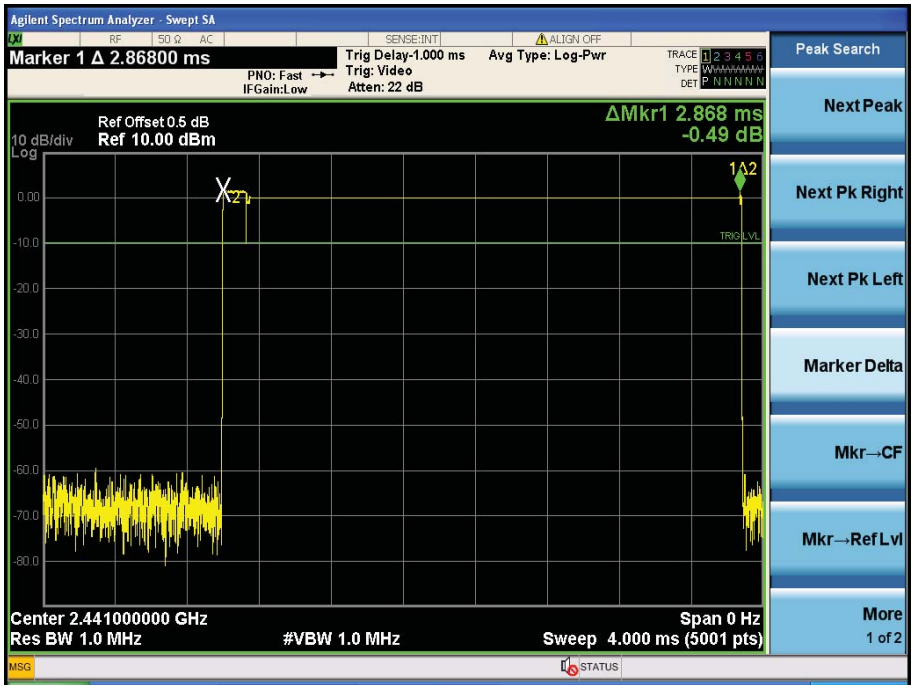
DH1:




DH3:



DH5:


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 2.86800 ms
PNO: Fast
IFGain:Low
Trig Delay-1.000 ms
Trig: Video
Atten: 22 dB
Avg Type: Log-Pwr
Ref Offset 0.5 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 2.868 ms
-0.49 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 4.000 ms (5001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

# 8. Radiated emissions

## 8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

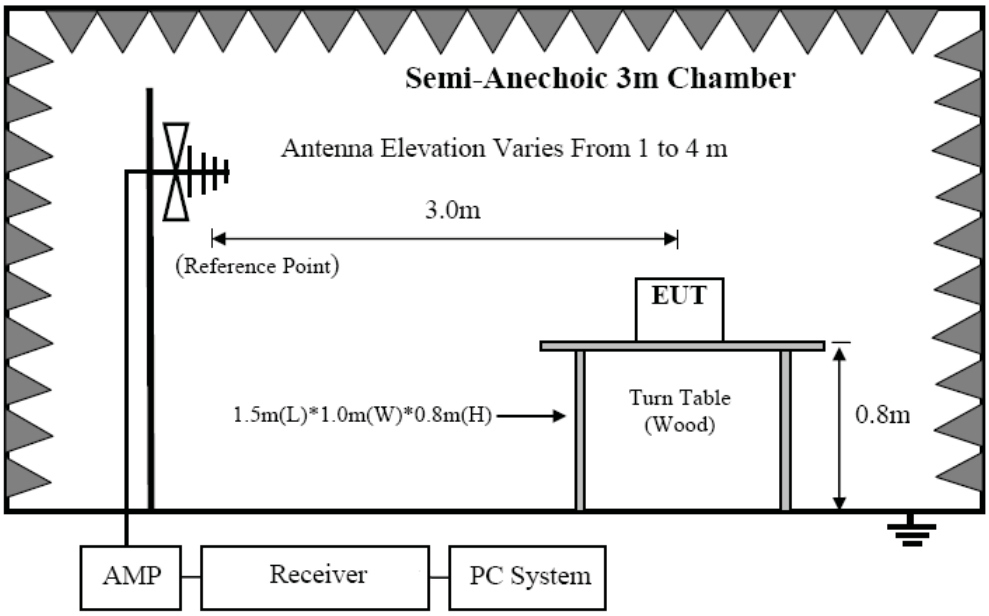
| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2690 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | ([2]) |

15.209 Limit

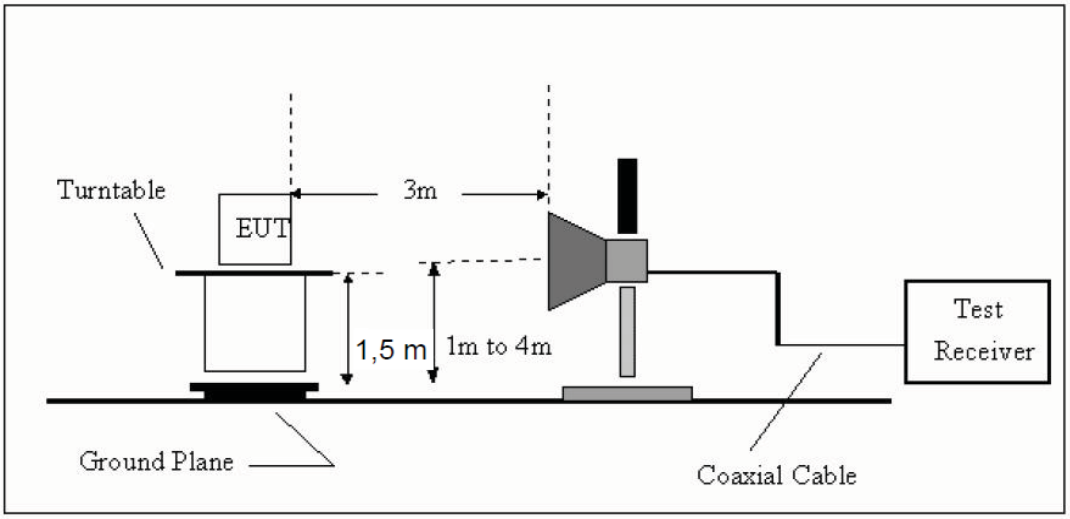
| FREQUENCY MHz | DISTANCE Meters | FIELD STRENGTHS LIMIT | |
|---|---|---|---|
| | | μV/m | dB(μV)/m |
| 0.009-0.490 | 300 | 2400/F(KHz) | / |
| 0.490-1.705 | 30 | 24000/F(KHz) | / |
| 1.705-30 | 30 | 30 | 29.5 |
| 30 ~ 88 | 3 | 100 | 40.0 |
| 88 ~ 216 | 3 | 150 | 43.5 |
| 216 ~ 960 | 3 | 200 | 46.0 |
| 960 ~ 1000 | 3 | 500 | 54.0 |
| Above 1000 | 3 | 74.0 dB(μV)/m (Peak)<br>54.0 dB(μV)/m (Average) | |

## 8.2. Block Diagram of Test setup

8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz




8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz




Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

## 8.3. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.
(2) Setup EUT and simulator as shown in section 1.4 and 6.1
(3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
(a) Change work frequency or channel of device if practicable.
(b) Change modulation type of device if practicable.
(c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
(4) Spectrum frequency from 9KHz to 25GHz (tenth harmonic of fundamental frequency) was investigated
(5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4 :2014on Radiated Emission test.
(6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure.

## 8.4. Test Result

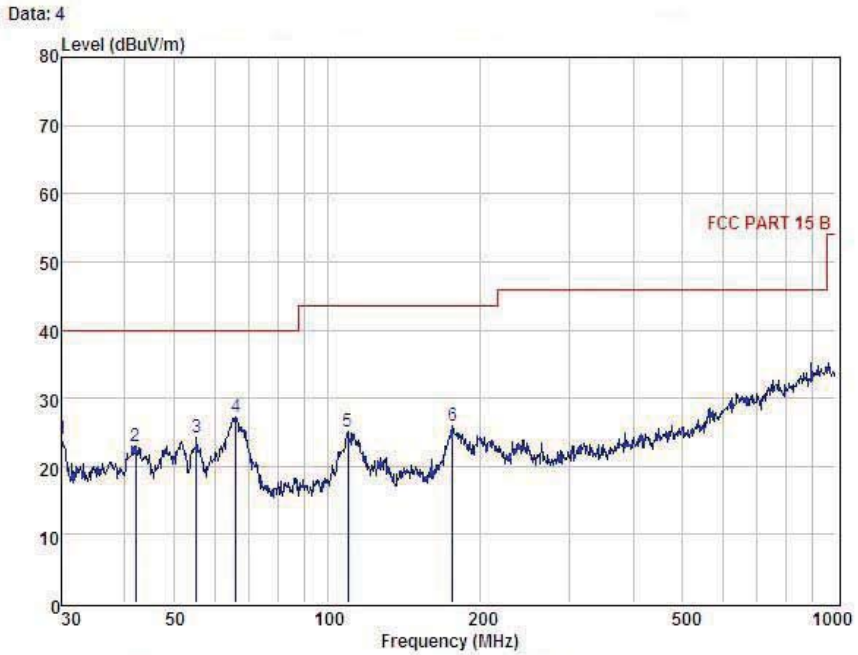
We have scanned the 10th harmonic from 9KHz to the EUT.
Detailed information please see the following page.

From 9KHz to 30MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

From 30MHz to 1000MHz: Conclusion: PASS

Shenzhen Alpha Product Testing Co., Ltd.
Building B, East Area of Nanchang Second Industrial Zone,
Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China
Tel: +86-755-29766001 FAX: +86-755-86375565
Website: http://www.a-lab.cn Email: service@a-lab.cn

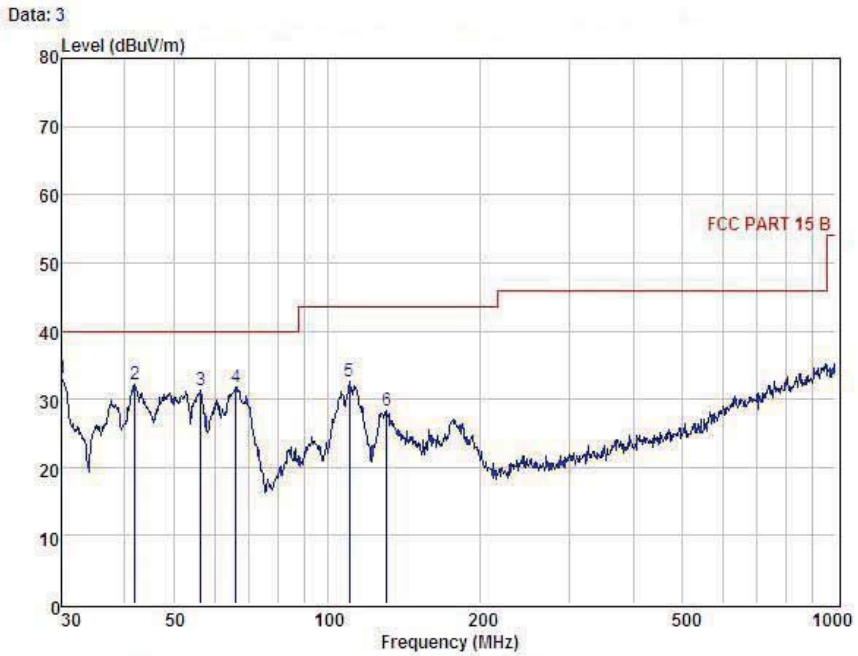



Condition : FCC PART 15 B 3m POL: HORIZONTAL
EUT :
Model No :
Test Mode :
Power :
Test Engineer :
Remark :
Temp : 24.2℃
Hum : 54%

| Item | Freq | Read Level | Antenna Factor | Preamp Factor | Cable Loss | Level | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dB | dBuV | dBuV | dBuV | |
| 1 | 30.00 | 41.81 | 13.22 | 30.98 | 0.03 | 24.08 | 40.00 | -15.92 | Peak |
| 2 | 42.01 | 39.33 | 13.93 | 30.40 | 0.19 | 23.05 | 40.00 | -16.95 | Peak |
| 3 | 55.22 | 41.86 | 13.07 | 30.87 | 0.18 | 24.24 | 40.00 | -15.76 | Peak |
| 4 | 66.03 | 45.79 | 11.59 | 30.39 | 0.26 | 27.25 | 40.00 | -12.75 | Peak |
| 5 | 109.80 | 43.46 | 11.13 | 29.93 | 0.38 | 25.04 | 43.50 | -18.46 | Peak |
| 6 | 176.27 | 42.12 | 12.28 | 29.04 | 0.59 | 25.95 | 43.50 | -17.55 | Peak |

Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss

Shenzhen Alpha Product Testing Co., Ltd.
Building B, East Area of Nanchang Second Industrial Zone,
Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China
Tel: +86-755-29766001 FAX: +86-755-86375565
Website: http://www.a-lab.cn Email: service@a-lab.cn




Condition : FCC PART 15 B 3m POL: VERTICAL
EUT :
Model No :
Test Mode :
Power :
Test Engineer :
Remark :
Temp : 24.2℃
Hum : 54%

| Item | Freq | Read Level | Antenna Factor | Preamp Factor | Cable Loss | Level | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dB | dB | dBuV | dBuV | dBuV | |
| 1 | 30.00 | 50.77 | 13.22 | 30.98 | 0.03 | 33.04 | 40.00 | -6.96 | Peak |
| 2 | 41.86 | 48.41 | 13.93 | 30.40 | 0.19 | 32.13 | 40.00 | -7.87 | Peak |
| 3 | 56.39 | 48.87 | 13.07 | 30.88 | 0.16 | 31.22 | 40.00 | -8.78 | Peak |
| 4 | 66.03 | 50.28 | 11.59 | 30.39 | 0.26 | 31.74 | 40.00 | -8.26 | Peak |
| 5 | 110.57 | 50.71 | 11.32 | 29.93 | 0.41 | 32.51 | 43.50 | -10.99 | Peak |
| 6 | 130.84 | 44.43 | 12.79 | 29.47 | 0.50 | 28.25 | 43.50 | -15.25 | Peak |

Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss



Remark: All modes have been tested, and only worst data of GFSK mode, Channel 2402MHz was listed in this report.

| 1GHz—25GHz Radiated emissison Test result | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | | | | | |
| Power: DC 19V From DC Port | | | | | | | | | |
| Test date: 2016-08-08 Test site: 3m Chamber Tested by: Reak | | | | | | | | | |
| Test mode: GFSK Tx CH1 2402MHz | | | | | | | | | |
| Antenna polarity: Vertical | | | | | | | | | |
| No | Freq (MHz) | Read Level (dBuV/m) | Antenna Factor (dB/m) | Cable loss(dB) | Amp Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 1 | 4804 | 42.87 | 33.95 | 10.18 | 34.26 | 52.74 | 74 | 21.26 | PK |
| 2 | 4804 | 33.24 | 33.95 | 10.18 | 34.26 | 43.11 | 54 | 10.89 | AV |
| 3 | 7206 | / | | | | | | | |
| 4 | 9608 | / | | | | | | | |
| 5 | 12010 | / | | | | | | | |
| Antenna Polarity: Horizontal | | | | | | | | | |
| 1 | 4804 | 41.23 | 33.95 | 10.18 | 34.26 | 51.1 | 74 | 22.9 | PK |
| 2 | 4804 | 31.54 | 33.95 | 10.18 | 34.26 | 41.41 | 54 | 12.59 | AV |
| 3 | 7206 | / | | | | | | | |
| 4 | 9608 | / | | | | | | | |
| 5 | 12010 | / | | | | | | | |
| Note:<br>1, Measuring frequency from 1GHz to 25GHz<br>2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK<br>2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK<br>3, Result = Read level + Antenna factor + cable loss-Amp factor<br>4, All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | | | | |

| 1GHz—25GHz Radiated emissison Test result | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | | | | | |
| Power: DC 19V From DC Port | | | | | | | | | |
| Test date: 2016-08-08 Test site: 3m Chamber Tested by: Reak | | | | | | | | | |
| Test mode: GFSK Tx CH40 2441MHz | | | | | | | | | |
| Antenna polarity: Vertical | | | | | | | | | |
| No | Freq (MHz) | Read Level (dBuV/m) | Antenna Factor (dB/m) | Cable loss(dB) | Amp Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 1 | 4882 | 43.42 | 33.93 | 10.2 | 34.29 | 53.26 | 74 | 20.74 | PK |
| 2 | 4882 | 33.69 | 33.93 | 10.2 | 34.29 | 43.53 | 54 | 10.47 | AV |
| 3 | 7323 | / | | | | | | | |
| 4 | 9764 | / | | | | | | | |
| 5 | 12205 | / | | | | | | | |
| Antenna Polarity: Horizontal | | | | | | | | | |
| 1 | 4882 | 42.44 | 33.93 | 10.2 | 34.29 | 52.28 | 74 | 21.72 | PK |
| 2 | 4882 | 32.52 | 33.93 | 10.2 | 34.29 | 42.36 | 54 | 11.64 | AV |
| 3 | 7323 | / | | | | | | | |
| 4 | 9764 | / | | | | | | | |
| 5 | 12205 | / | | | | | | | |
| Note:<br>1, Measuring frequency from 1GHz to 25GHz<br>2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK<br>2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK<br>3, Result = Read level + Antenna factor + cable loss-Amp factor<br>4, All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | | | | |

| 1GHz—25GHz Radiated emissison Test result | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | | | | | |
| Power: DC 19V From DC Port | | | | | | | | | |
| Test date: 2016-08-08 Test site: 3m Chamber Tested by: Reak | | | | | | | | | |
| Test mode: GFSK Tx CH79 2480MHz | | | | | | | | | |
| Antenna polarity: Vertical | | | | | | | | | |
| No | Freq (MHz) | Read Level (dBuV/m) | Antenna Factor (dB/m) | Cable loss(dB) | Amp Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 1 | 4960 | 42.99 | 33.98 | 10.22 | 34.25 | 52.94 | 74 | 21.06 | PK |
| 2 | 4960 | 32.14 | 33.98 | 10.22 | 34.25 | 42.09 | 54 | 11.91 | AV |
| 3 | 7440 | / | | | | | | | |
| 4 | 9920 | / | | | | | | | |
| 5 | 12400 | / | | | | | | | |
| Antenna Polarity: Horizontal | | | | | | | | | |
| 1 | 4960 | 41.76 | 33.98 | 10.22 | 34.25 | 51.71 | 74 | 22.29 | PK |
| 2 | 4960 | 31.02 | 33.98 | 10.22 | 34.25 | 40.97 | 54 | 13.03 | AV |
| 3 | 7440 | / | | | | | | | |
| 4 | 9920 | / | | | | | | | |
| 5 | 12400 | / | | | | | | | |
| Note:<br>1, Measuring frequency from 1GHz to 25GHz<br>2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK<br>2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK<br>3, Result = Read level + Antenna factor + cable loss-Amp factor<br>4, All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | | | | |

| 1GHz—25GHz Radiated emissison Test result | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | | | | | |
| Power: DC 19V From DC Port | | | | | | | | | |
| Test date: 2016-08-08 Test site: 3m Chamber Tested by: Reak | | | | | | | | | |
| Test mode: π /4 DQPSK Tx CH1 2402MHz | | | | | | | | | |
| Antenna polarity: Vertical | | | | | | | | | |
| No | Freq (MHz) | Read Level (dBuV/m) | Antenna Factor (dB/m) | Cable loss(dB) | Amp Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 1 | 4804 | 43.55 | 33.95 | 10.18 | 34.26 | 53.42 | 74 | 20.58 | PK |
| 2 | 4804 | 32.62 | 33.95 | 10.18 | 34.26 | 42.49 | 54 | 11.51 | AV |
| 3 | 7206 | / | | | | | | | |
| 4 | 9608 | / | | | | | | | |
| 5 | 12010 | / | | | | | | | |
| Antenna Polarity: Horizontal | | | | | | | | | |
| 1 | 4804 | 42.17 | 33.95 | 10.18 | 34.26 | 52.04 | 74 | 21.96 | PK |
| 2 | 4804 | 31.35 | 33.95 | 10.18 | 34.26 | 41.22 | 54 | 12.78 | AV |
| 3 | 7206 | / | | | | | | | |
| 4 | 9608 | / | | | | | | | |
| 5 | 12010 | / | | | | | | | |
| Note:<br>1, Measuring frequency from 1GHz to 25GHz<br>2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK<br>2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK<br>3, Result = Read level + Antenna factor + cable loss-Amp factor<br>4, All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | | | | |

| 1GHz—25GHz Radiated emissison Test result | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| EUT: M.CRAFTSMAN LCM M/N: LCM | | | | | | | | | |
| Power: DC 19V From DC Port | | | | | | | | | |
| Test date: 2016-08-08 Test site: 3m Chamber Tested by: Reak | | | | | | | | | |
| Test mode: π /4 DQPSK Tx CH40 2441MHz | | | | | | | | | |
| Antenna polarity: Vertical | | | | | | | | | |
| No | Freq (MHz) | Read Level (dBuV/m) | Antenna Factor (dB/m) | Cable loss(dB) | Amp Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
| 1 | 4882 | 43.87 | 33.93 | 10.2 | 34.29 | 53.71 | 74 | 20.29 | PK |
| 2 | 4882 | 32.71 | 33.93 | 10.2 | 34.29 | 42.55 | 54 | 11.45 | AV |
| 3 | 7323 | / | | | | | | | |
| 4 | 9764 | / | | | | | | | |
| 5 | 12205 | / | | | | | | | |
| Antenna Polarity: Horizontal | | | | | | | | | |
| 1 | 4882 | 42.97 | 33.93 | 10.2 | 34.29 | 52.81 | 74 | 21.19 | PK |
| 2 | 4882 | 31.89 | 33.93 | 10.2 | 34.29 | 41.73 | 54 | 12.27 | AV |
| 3 | 7323 | / | | | | | | | |
| 4 | 9764 | / | | | | | | | |
| 5 | 12205 | / | | | | | | | |
| Note:<br>1, Measuring frequency from 1GHz to 25GHz<br>2, Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK<br>2, Spectrum Set for AV measure: RBW=1MHz, VBW=10Hz, Sweep time=Auto, Detector: PK<br>3, Result = Read level + Antenna factor + cable loss-Amp factor<br>4, All the other emissions not reported were too low to read and deemed to comply with FCC limit. | | | | | | | | | |