
FCC Test Report

Report No.: AGC00639170602FE03

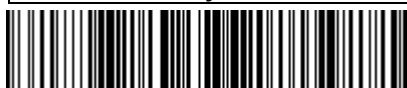
FCC ID : 2AMSXR20
APPLICATION PURPOSE : Original Equipment
PRODUCT DESIGNATION : Mobile Phone
BRAND NAME : ALIGATOR
MODEL NAME : R20
CLIENT : ADART COMPUTERS s.r.o.
DATE OF ISSUE : July 06, 2017
STANDARD(S) : FCC Part 15 Rules
TEST PROCEDURE(S) : ANSI C63.10 (2013)
REPORT VERSION : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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Report Revise Record

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|----------------|-------------|---------------|---------------|-----------------|
| V1.0 | / | July 06, 2017 | Valid | Original Report |

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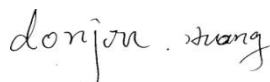
1. VERIFICATION OF CONFORMITY

| | |
|---------------------------------|---|
| Applicant | ADART COMPUTERS s.r.o. |
| Address | Sokolovska 2170/161, Prague, Czech Republic,18000 |
| Manufacturer | ADART COMPUTERS s.r.o. |
| Address | Sokolovska 2170/161, Prague, Czech Republic,18000 |
| Product Designation | Mobile Phone |
| Brand Name | ALIGATOR |
| Test Model | R20 |
| Date of test | June 15, 2017~July 06, 2017 |
| Deviation | None |
| Condition of Test Sample | Normal |
| Report Template | AGCRT-US-BR/RF |

We hereby certify that:

The above equipment was tested by Dongguan Precise Testing Service Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Tested By



Donjon Huang(Huang
Dongyang)

July 06, 2017

Reviewed By



Bart Xie(Xie Xiaobin)

July 06, 2017

Approved By



Solger Zhang(Zhang Hongyi)
Authorized Officer

July 06, 2017

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is “Mobile Phone” designed as a “Communication Device”. It is designed by way of utilizing the FHSS technology to achieve the system operation.

A major technical description of EUT is described as following

| | |
|----------------------------|-----------------------------|
| Operation Frequency | 2.402 GHz to 2.480GHz |
| Bluetooth Version | V2.1 |
| Modulation | GFSK |
| Number of channels | 79(For BR) |
| Hardware Version | L6135_MB_V1.2 |
| Software Version | ALIGATOR_R20_V1_00_20160523 |
| Antenna Designation | PIFA Antenna |
| Antenna Gain | 0.8dBi |
| Power Supply | DC3.7V by Battery |

2.2. TABLE OF CARRIER FREQUENCIES

| Frequency Band | Channel Number | Frequency |
|----------------|----------------|-----------|
| 2400~2483.5MHZ | 0 | 2402MHZ |
| | 1 | 2403MHZ |
| | : | : |
| | 38 | 2440 MHZ |
| | 39 | 2441 MHZ |
| | 40 | 2442 MHZ |
| | : | : |
| | 77 | 2479 MHZ |
| | 78 | 2480 MHZ |

2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 1.3MHz. In every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multislotted packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.

Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be sent on the same frequency, it is sent on the next frequency of the hopping sequence.

2.4. EXAMPLE OF A HOPPING SEQUENCE IN DATA MODE

Example of a 79 hopping sequence in data mode:

40,21,44,23,42,53,46,55,48,33,52,35,50,65,54,67
56,37,60,39,58,69,62,71,64,25,68,27,66,57,70,59
72,29,76,31,74,61,78,63,01,41,05,43,03,73,07,75
09,45,13,47,11,77,15,00,64,49,66,53,68,02,70,06
01, 51, 03, 55, 05, 04

2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection.
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS.

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units only offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 µs. The clock has a cycle of about one day (23h30). In most cases it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With these input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended.

The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmissions is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 µs). The hopping sequence will always differ from the first one.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AMSXR20** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10:2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. MEASUREMENT UNCERTAINTY

Conducted measurement: +/- 2.75dB

Radiated measurement: +/- 3.2dB

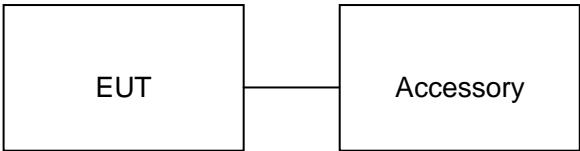
4. DESCRIPTION OF TEST MODES

| NO. | TEST MODE DESCRIPTION |
|---|-------------------------------|
| 1 | Low channel GFSK |
| 2 | Middle channel GFSK |
| 3 | High channel GFSK |
| 4 | Low channel $\pi/4$ -DQPSK |
| 5 | Middle channel $\pi/4$ -DQPSK |
| 6 | High channel $\pi/4$ -DQPSK |
| 7 | Low channel 8DPSK |
| 8 | Middle channel 8DPSK |
| 9 | High channel 8DPSK |
| 10 | Normal Hopping |
| <p>Note:</p> <p>1. All the test modes can be supply by Built-in Li-ion battery, only the result of the worst case was recorded in the report, if no other cases.</p> <p>2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.</p> | |

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configuration:



5.2. EQUIPMENT USED IN EUT SYSTEM

| Item | Equipment | Model No. | ID or Specification | Note |
|------|--------------|-----------|---------------------|-----------|
| 1 | Mobile Phone | R20 | 2AMSXR20 | EUT |
| 2 | Adapter | R20 | DC4.5V /800mAh | Accessory |
| 3 | Battery | R20 | DC3.7V/4000mAh | Accessory |
| 5 | USB Cable | N/A | N/A | Accessory |

5.3. SUMMARY OF TEST RESULTS

| FCC RULES | DESCRIPTION OF TEST | RESULT |
|-----------|-----------------------------|-----------|
| §15.247 | Peak Output Power | Compliant |
| §15.247 | 20 dB Bandwidth | Compliant |
| §15.247 | Spurious Emission | Compliant |
| §15.209 | Radiated Emission | Compliant |
| §15.247 | Band Edges | Compliant |
| §15.207 | Conduction Emission | Compliant |
| §15.247 | Number of Hopping Frequency | Compliant |
| §15.247 | Time of Occupancy | Compliant |
| §15.247 | Frequency Separation | Compliant |

6. TEST FACILITY

| | |
|-----------------------------|---|
| Site | Dongguan Precise Testing Service Co., Ltd. |
| Location | Building D,Baoding Technology Park,Guangming Road2,Dongcheng District, Dongguan, Guangdong, China, |
| FCC Registration No. | 371540 |
| Description | The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.10:2013. |

ALL TEST EQUIPMENT LIST

FOR RADIATED EMISSION TEST (BELOW 1GHZ)

| Radiated Emission Test Site | | | | | |
|-------------------------------------|-----------------|--------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| EMI Test Receiver | Rohde & Schwarz | ESCI | 101417 | July 3, 2016 | July 2, 2017 |
| EMI Test Receiver | Rohde & Schwarz | ESCI | 101417 | July 2, 2017 | July 1, 2018 |
| Trilog Broadband Antenna (25M-1GHz) | SCHWARZBECK | VULB9160 | 9160-3355 | July 3, 2016 | July 2, 2017 |
| Trilog Broadband Antenna (25M-1GHz) | SCHWARZBECK | VULB9160 | 9160-3355 | July 2, 2017 | July 1, 2018 |
| Signal Amplifier | SCHWARZBECK | BBV 9475 | 9745-0013 | July 3, 2016 | July 2, 2017 |
| Signal Amplifier | SCHWARZBECK | BBV 9475 | 9745-0013 | July 2, 2017 | July 1, 2018 |
| RF Cable | SCHWARZBECK | AK9515E | 96221 | July 3, 2016 | July 2, 2017 |
| RF Cable | SCHWARZBECK | AK9515E | 96221 | July 2, 2017 | July 1, 2018 |
| 3m Anechoic Chamber | CHENGYU | 966 | PTS-001 | June 2, 2017 | June 1, 2018 |
| MULTI-DEVICE Positioning Controller | Max-Full | MF-7802 | MF780208339 | N/A | N/A |
| Active loop antenna (9K-30MHz) | Schwarzbeck | FMZB1519 | 1519-038 | June 2, 2017 | June 1, 2018 |
| Spectrum analyzer | Agilent | E4407B | MY46185649 | June 2, 2017 | June 1, 2018 |
| Power Probe | R&S | NRP-Z23 | 100323 | July 24,2016 | July 23,2017 |
| RF attenuator | N/A | RFA20db | 68 | N/A | N/A |

FOR RADIATED EMISSION TEST (1GHZ ABOVE)

| Radiated Emission Test Site | | | | | |
|--|-----------------|--------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| EMI Test Receiver | Rohde & Schwarz | ESCI | 101417 | July 3, 2016 | July 2, 2017 |
| EMI Test Receiver | Rohde & Schwarz | ESCI | 101417 | July 2, 2017 | July 1, 2018 |
| Horn Antenna (1G-18GHz) | SCHWARZBECK | BBHA9120D | 9120D-1246 | July 10, 2016 | July 9, 2017 |
| Spectrum Analyzer | Agilent | E4411B | MY4511453 | July 3, 2016 | July 2, 2017 |
| Spectrum Analyzer | Agilent | E4411B | MY4511453 | July 2, 2017 | July 1, 2018 |
| Signal Amplifier | SCHWARZBECK | BBV 9718 | 9718-269 | July 6, 2016 | July 5, 2017 |
| RF Cable | SCHWARZBECK | AK9515H | 96220 | July 7, 2016 | July 6, 2017 |
| 3m Anechoic Chamber | CHENGYU | 966 | PTS-001 | June 2, 2017 | June 1, 2018 |
| MULTI-DEVICE Positioning Controller | Max-Full | MF-7802 | MF780208339 | N/A | N/A |
| Horn Ant (18G-40GHz) | Schwarzbeck | BBHA 9170 | 9170-181 | June 2, 2017 | June 1, 2018 |
| Power Probe | R&S | NRP-Z23 | 100323 | July 24,2016 | July 23,2017 |
| RF attenuator | N/A | RFA20db | 68 | N/A | N/A |

7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, middle and the bottom operation frequency individually.
3. $RBW > \text{the 20 dB bandwidth of the emission being measured}$, $VBW \geq RBW$.
4. Record the maximum power from the Spectrum Analyzer.

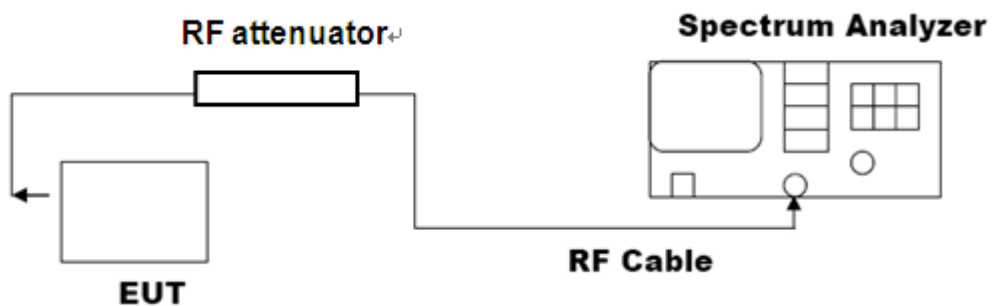
For average power test:

1. Connect EUT RF output port to power probe through an RF attenuator.
2. Connect the power probe to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

Note : The EUT was tested according for compliance ANSI C63.10(2013) requirements.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

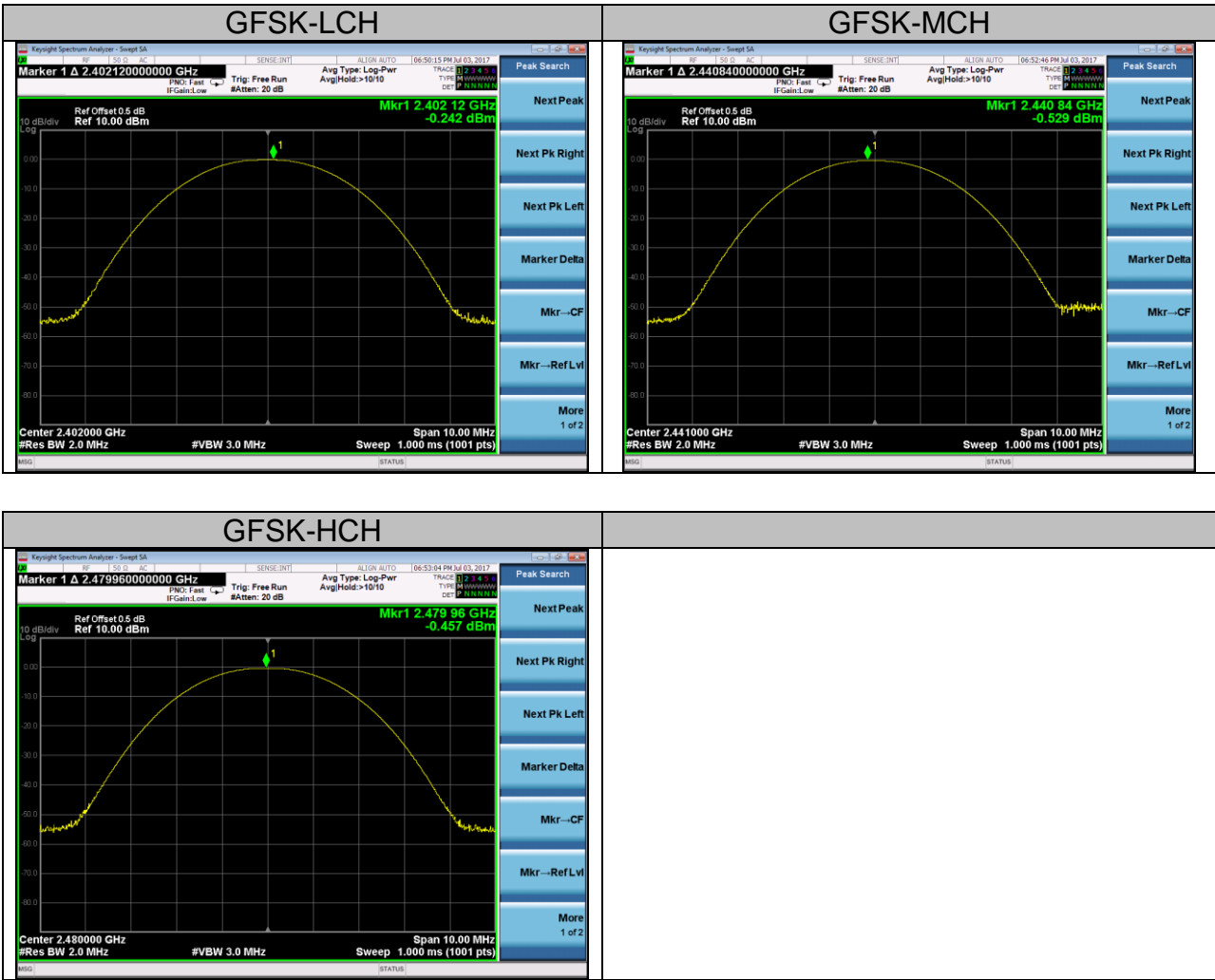
PEAK POWER TEST SETUP



7.3. LIMITS AND MEASUREMENT RESULT

| Mode | Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
|------|-----------------|------------------|-------------------------|--------------|
| GFSK | 2.402 | -0.242 | 30 | Pass |
| | 2.441 | -0.529 | 30 | Pass |
| | 2.480 | -0.457 | 30 | Pass |

Test Graph

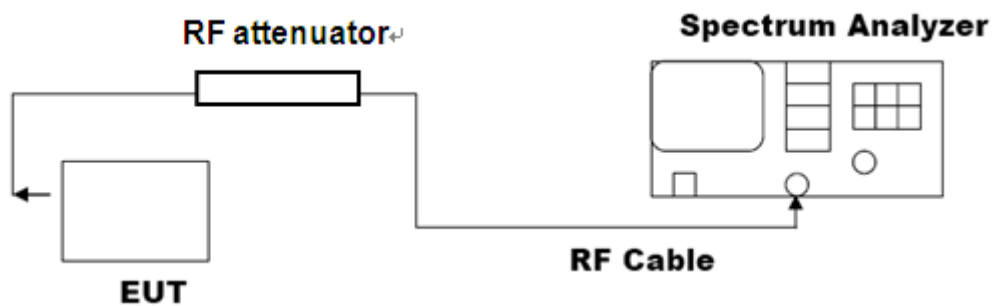


8. 20DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hoping channel
RBW \geq 1% of the 20 dB bandwidth, VBW \geq RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

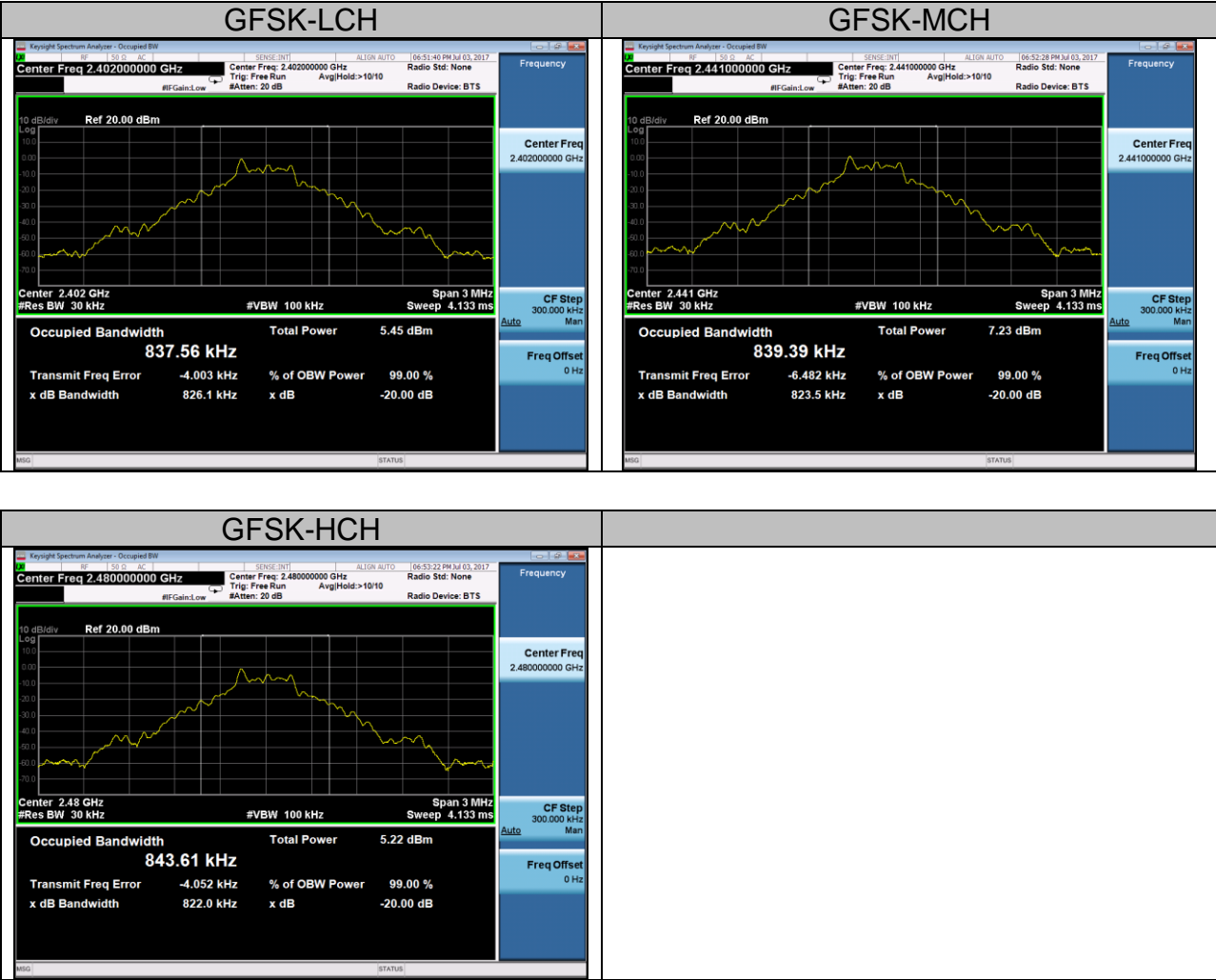
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



8.3. LIMITS AND MEASUREMENT RESULTS

| Mode | Channel. | EBW [KHz] | Verdict |
|------|----------|-----------|---------|
| GFSK | LCH | 826.1 | PASS |
| GFSK | MCH | 823.5 | PASS |
| GFSK | HCH | 822.0 | PASS |

Test Graph



9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
RBW = 100 kHz; VBW \geq RBW; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according for compliance ANSI C63.10(2013) requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW > RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW > RBW) are conform to the requirement.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

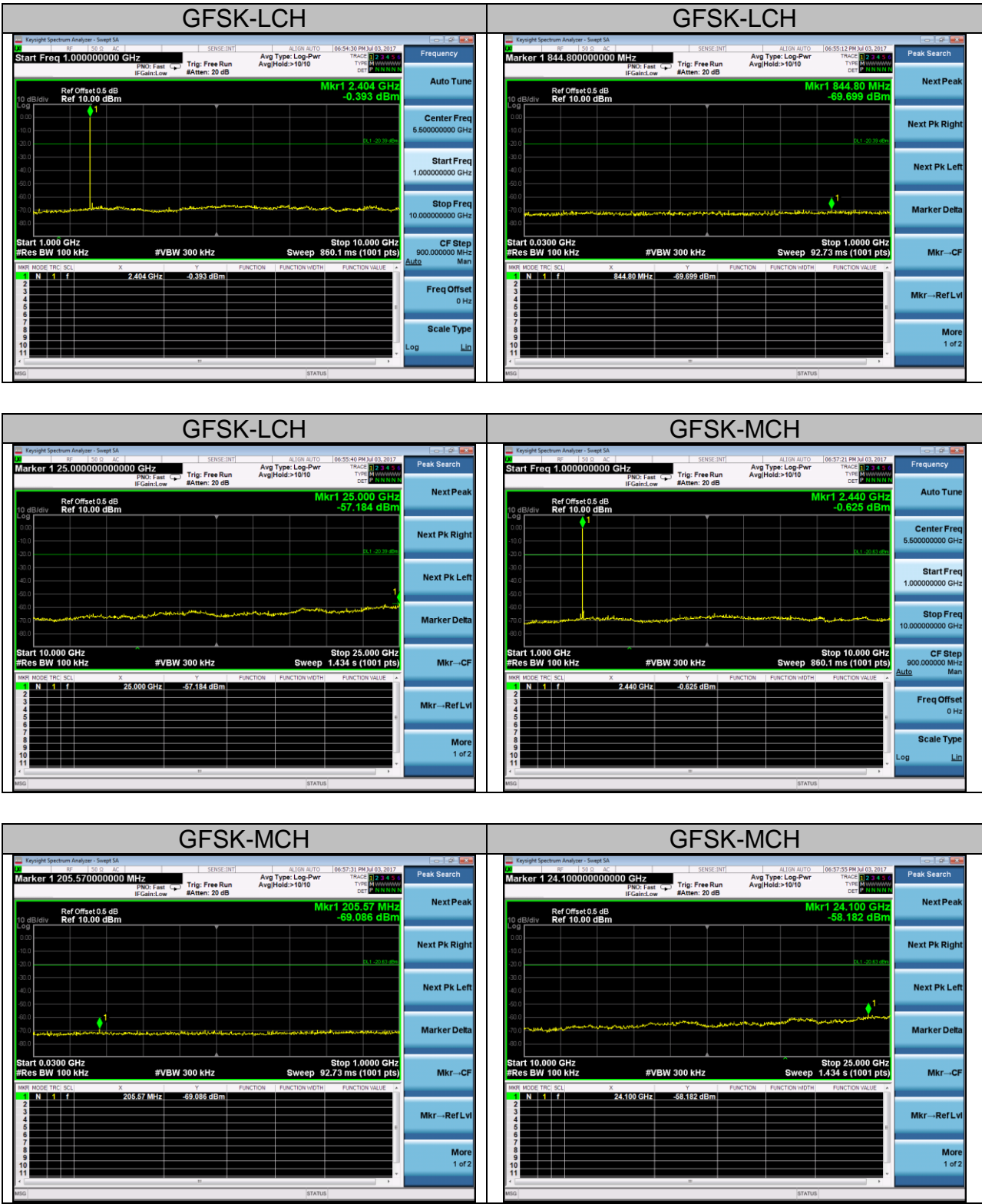
9.3. MEASUREMENT EQUIPMENT USED

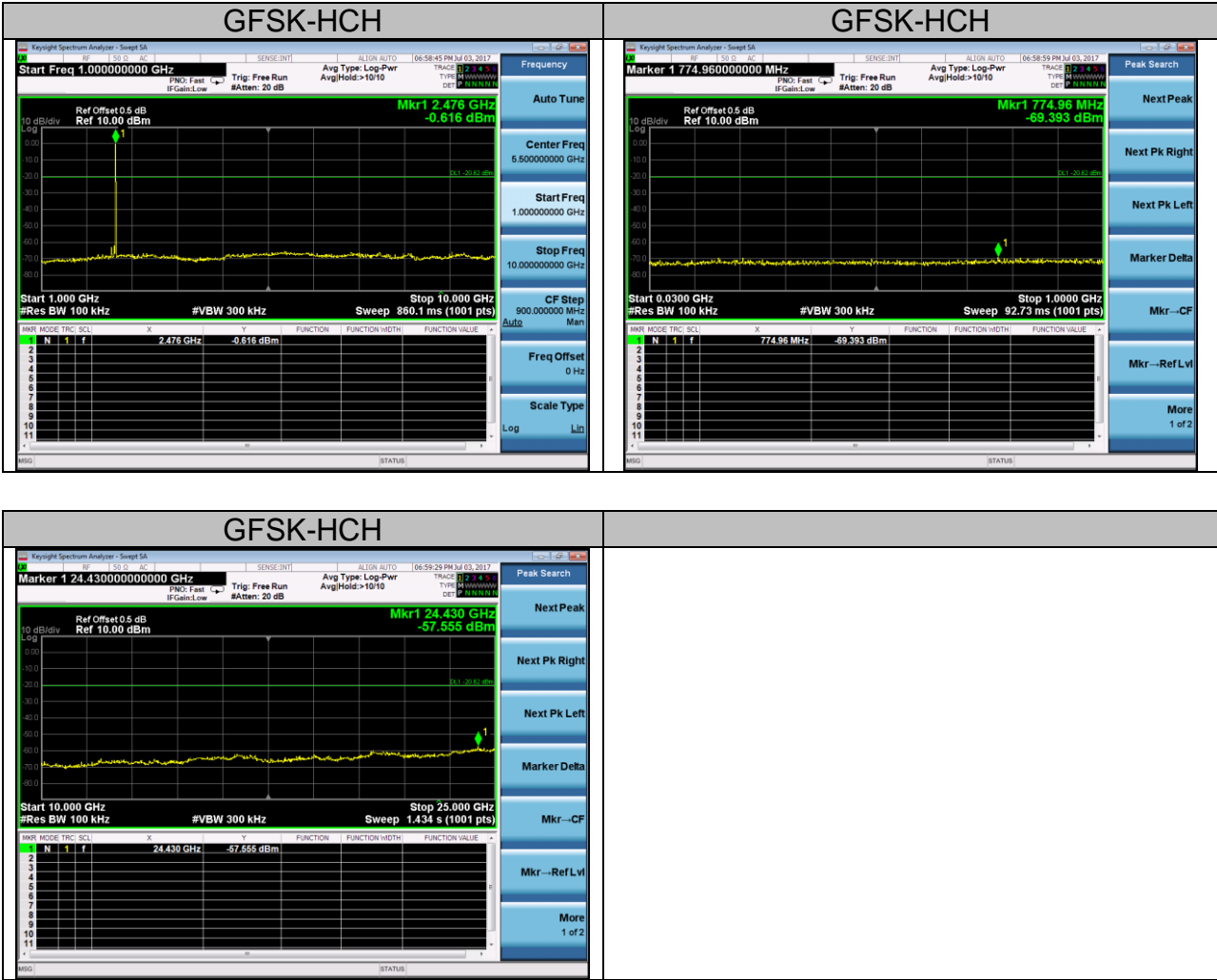
The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

| LIMITS AND MEASUREMENT RESULT | | |
|---|--|----------|
| Applicable Limits | Measurement Result | |
| | Test Data | Criteria |
| In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a)) | At least -20dBc than the limit Specified on the BOTTOM Channel | PASS |
| | At least -20dBc than the limit Specified on the TOP Channel | PASS |

Test Graph





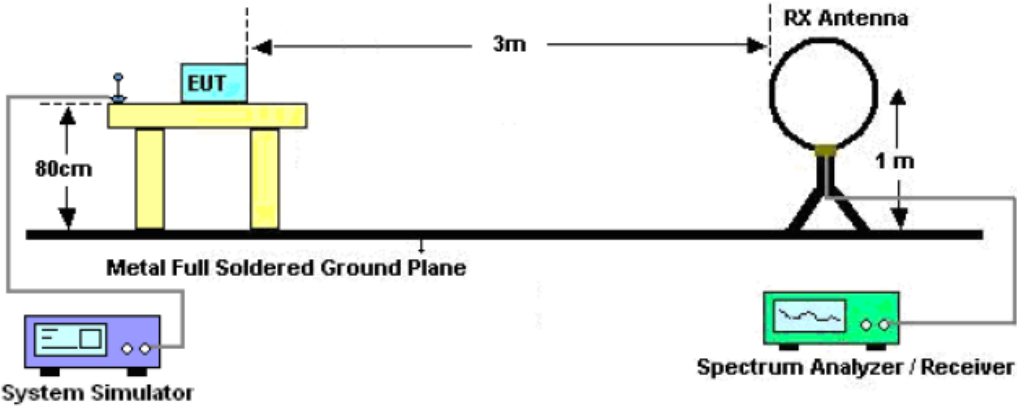
10. RADIATED EMISSION

10.1. MEASUREMENT PROCEDURE

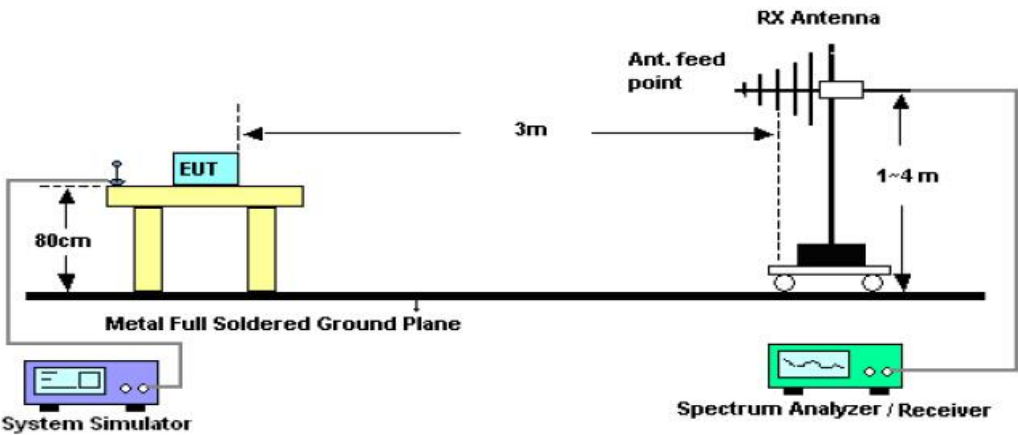
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case

10.2. TEST SETUP

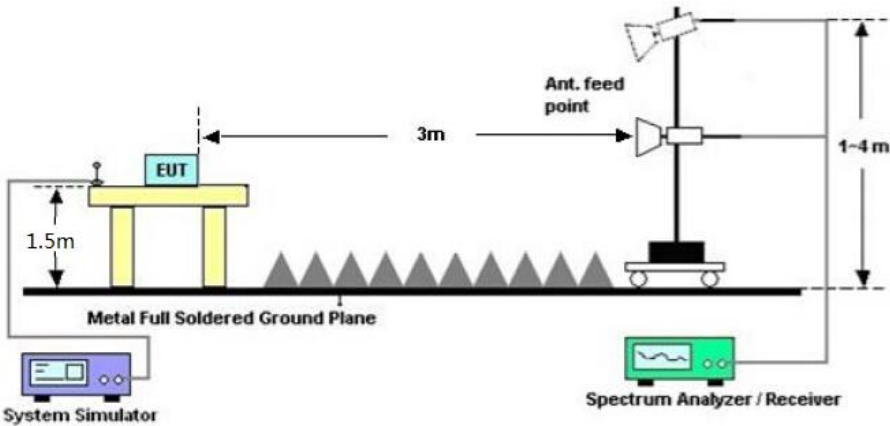
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



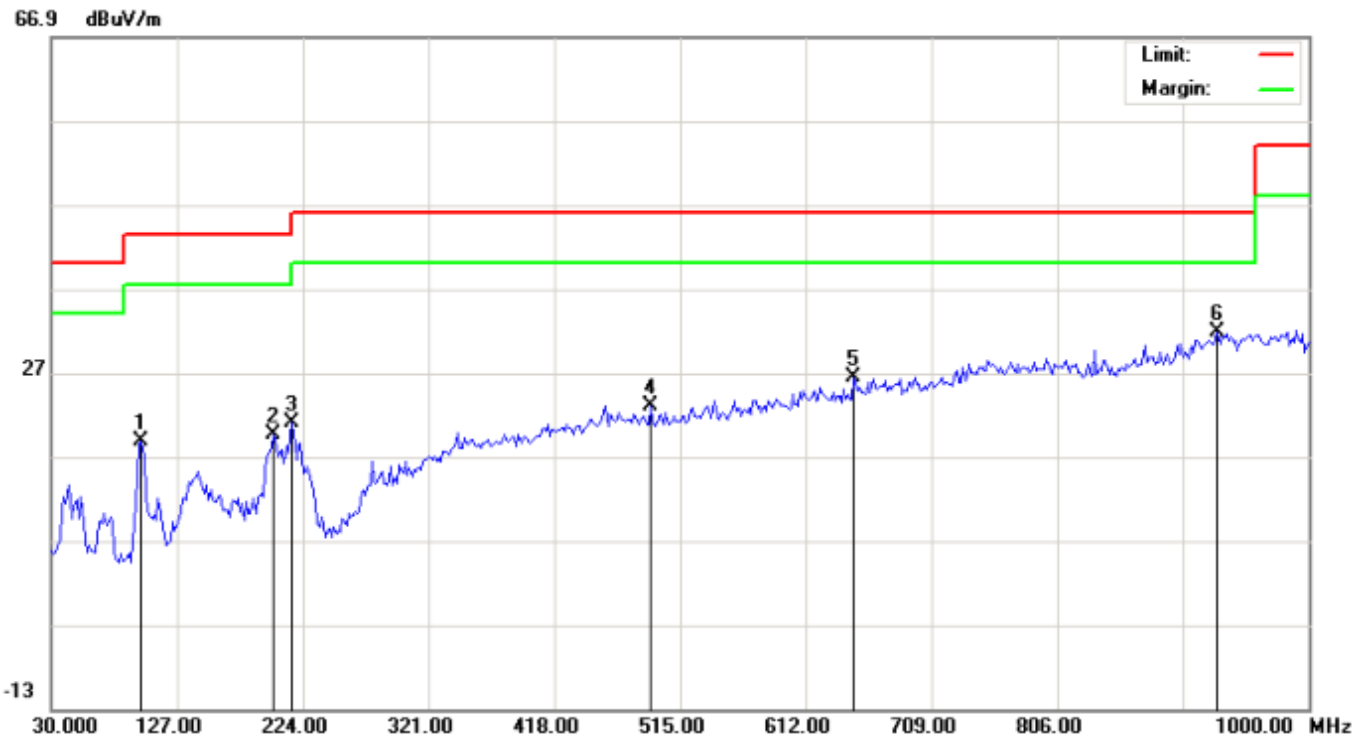
10.3. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ

RADIATED EMISSION TEST- (30MHZ-1GHZ) -HORIZONTAL

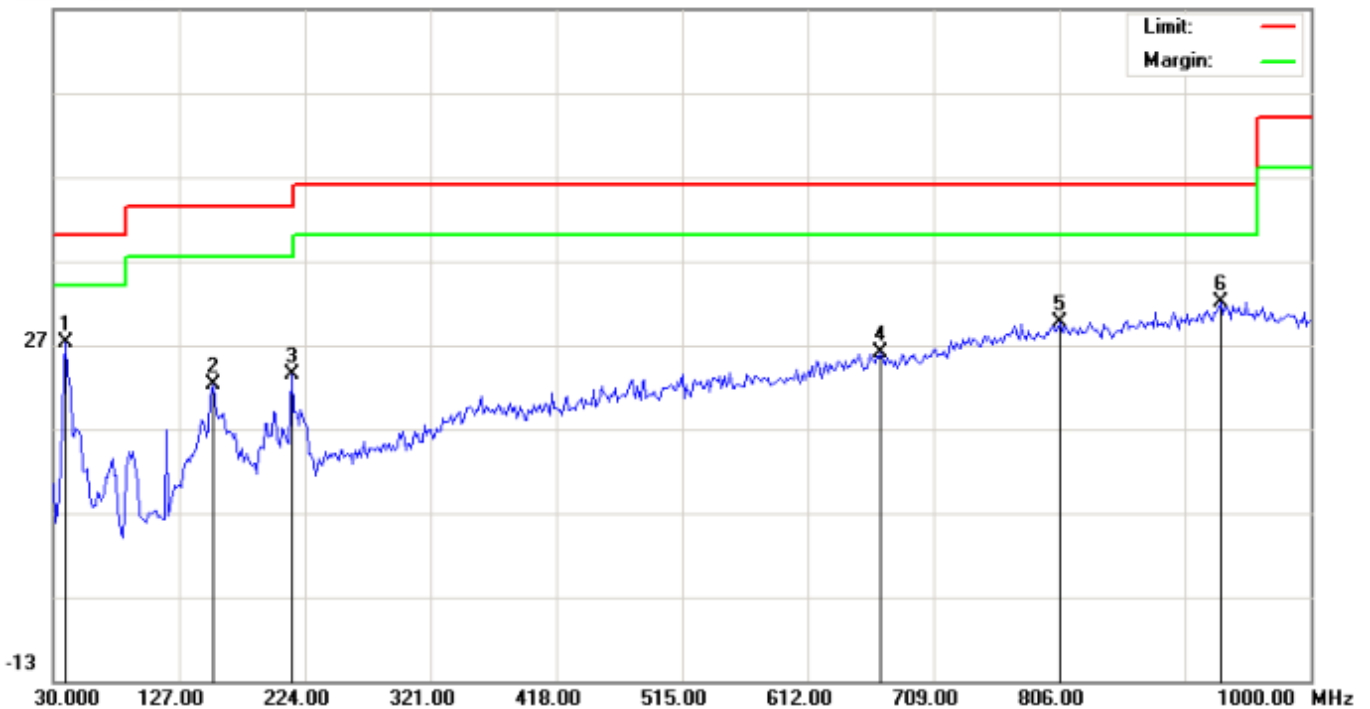


| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 99.5167 | 8.85 | 10.00 | 18.85 | 43.50 | -24.65 | peak | | | |
| 2 | | 201.3667 | 7.83 | 11.86 | 19.69 | 43.50 | -23.81 | peak | | | |
| 3 | | 215.9167 | 10.61 | 10.38 | 20.99 | 43.50 | -22.51 | peak | | | |
| 4 | | 492.3667 | 1.88 | 21.05 | 22.93 | 46.00 | -23.07 | peak | | | |
| 5 | | 649.1833 | 2.59 | 23.85 | 26.44 | 46.00 | -19.56 | peak | | | |
| 6 | * | 928.8667 | 2.49 | 29.41 | 31.90 | 46.00 | -14.10 | peak | | | |

RESULT: PASS

RADIATED EMISSION TEST- (30MHZ-1GHZ) -VERTICAL

66.9 dBuV/m

**RESULT: PASS**

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

3. All test modes had been pre-tested. The GFSK mode at low channel is the worst case and recorded in the report.

RADIATED EMISSION TEST- (ABOVE 1GHZ)

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector | Comment |
|-------------------------|---------------|--------|----------------|----------|--------|----------|------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | Type | |
| Low Channel (2402 MHz) | | | | | | | |
| 4804 | 64.04 | -3.62 | 60.42 | 74 | -13.58 | Pk | Vertical |
| 4804 | 43.92 | -3.62 | 40.30 | 54 | -13.70 | AV | Vertical |
| 4804 | 64.20 | -3.64 | 60.56 | 74 | -13.44 | Pk | Horizontal |
| 4804 | 44.71 | -3.64 | 41.07 | 54 | -12.93 | AV | Horizontal |
| Mid Channel (2441 MHz) | | | | | | | |
| 4882 | 62.91 | -3.65 | 59.26 | 74 | -14.74 | Pk | Vertical |
| 4882 | 42.38 | -3.65 | 38.73 | 54 | -15.27 | AV | Vertical |
| 4882 | 63.83 | -3.68 | 60.15 | 74 | -13.85 | Pk | Horizontal |
| 4882 | 43.30 | -3.68 | 39.62 | 54 | -14.38 | AV | Horizontal |
| High Channel (2480 MHz) | | | | | | | |
| 4960 | 64.81 | -3.59 | 61.22 | 74 | -12.78 | pk | Vertical |
| 4960 | 43.02 | -3.59 | 39.43 | 54 | -14.57 | AV | Vertical |
| 4960 | 64.63 | -3.59 | 61.04 | 74 | -12.96 | pk | Horizontal |
| 4960 | 42.31 | -3.59 | 38.72 | 54 | -15.28 | AV | Horizontal |

Note:

- 1) 30MHz~25GHz:(All modes were tested, only the worst case record in the report.)
- 2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Emission Level = Meter Reading + Factor
Margin = Emission Level - Limit

RESULT: PASS

11. BAND EDGE EMISSION

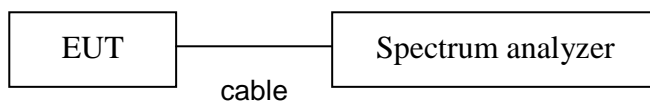
11.1. MEASUREMENT PROCEDURE

1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100kHz. The video bandwidth is set to 300kHz.
2. Transmitter set to the normal hopping mode at 2.4 and 2.4835 GHz.

11.2. TEST SET-UP

Radiated same as 10.2

Conducted set up



11.3. Radiated TEST RESULT

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector | Comment |
|-----------|---------------|--------|----------------|----------|--------|----------|------------|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | Type | |
| GFSK | | | | | | | |
| 2399.9 | 61.17 | -12.99 | 48.18 | 74 | -25.82 | peak | Vertical |
| 2399.9 | 53.37 | -12.99 | 40.38 | 54 | -13.62 | AVG | Vertical |
| 2399.9 | 62.10 | -12.99 | 49.11 | 74 | -24.89 | peak | Horizontal |
| 2399.9 | 51.34 | -12.99 | 38.35 | 54 | -15.65 | AVG | Horizontal |
| 2483.6 | 62.52 | -12.78 | 49.74 | 74 | -24.26 | peak | Vertical |
| 2483.6 | 51.70 | -12.78 | 38.92 | 54 | -15.08 | AVG | Vertical |
| 2483.6 | 62.36 | -12.78 | 49.58 | 74 | -24.42 | peak | Horizontal |
| 2483.6 | 52.11 | -12.78 | 39.33 | 54 | -14.67 | AVG | Horizontal |

RESULT: PASS

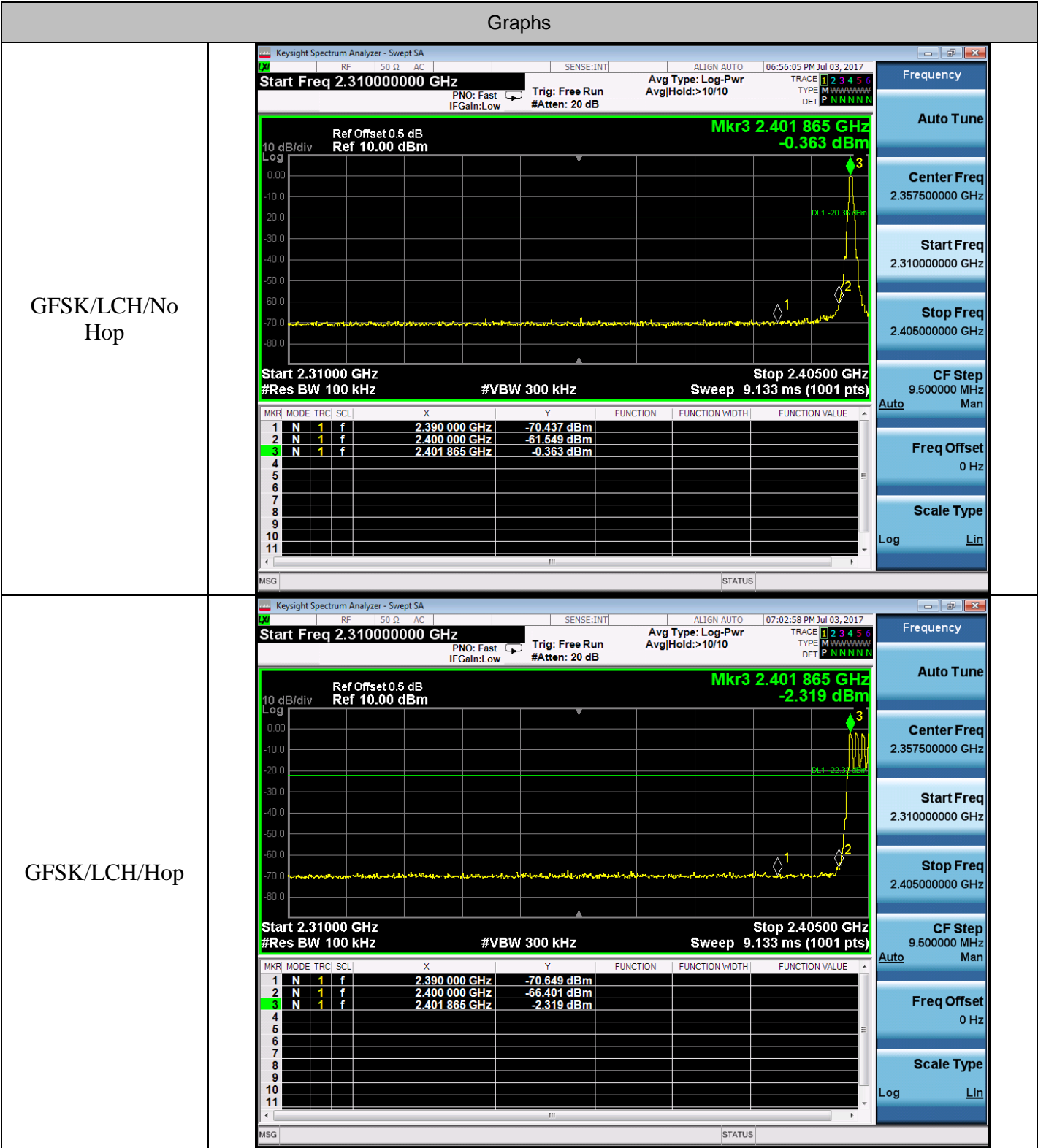
Note: The other modes radiation emission have enough 20dB margin.

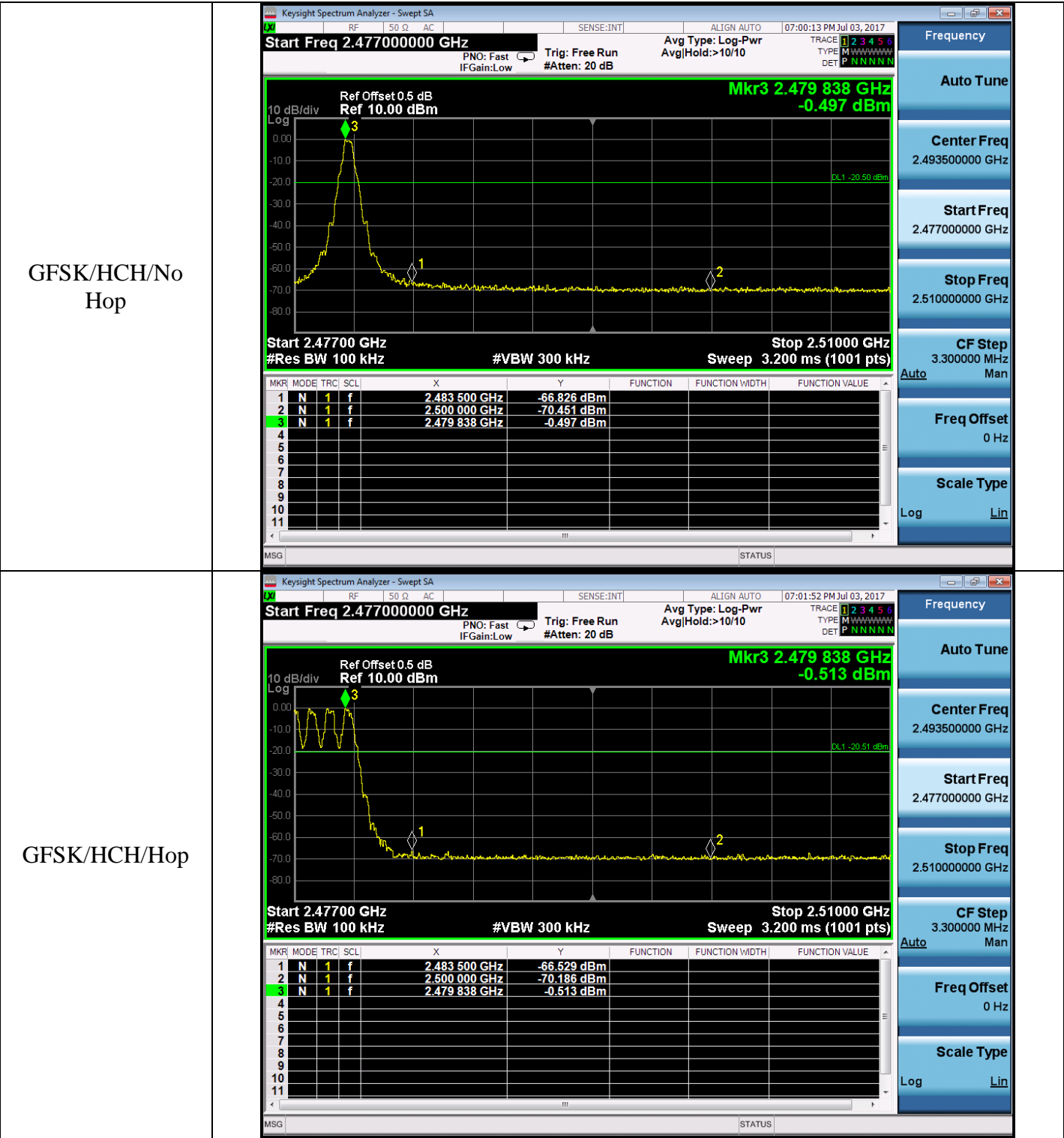
Factor=Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

11.4 Conducted TEST RESULT

Test Graph





Note: All modes were tested, only the worst case record in the report.

12. NUMBER OF HOPPING FREQUENCY

12.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer Start = 2.4GHz Stop = 2.4835GHz
4. Set the Spectrum Analyzer as RBW>=1%span, VBW>=RBW.

12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

12.3. MEASUREMENT EQUIPMENT USED

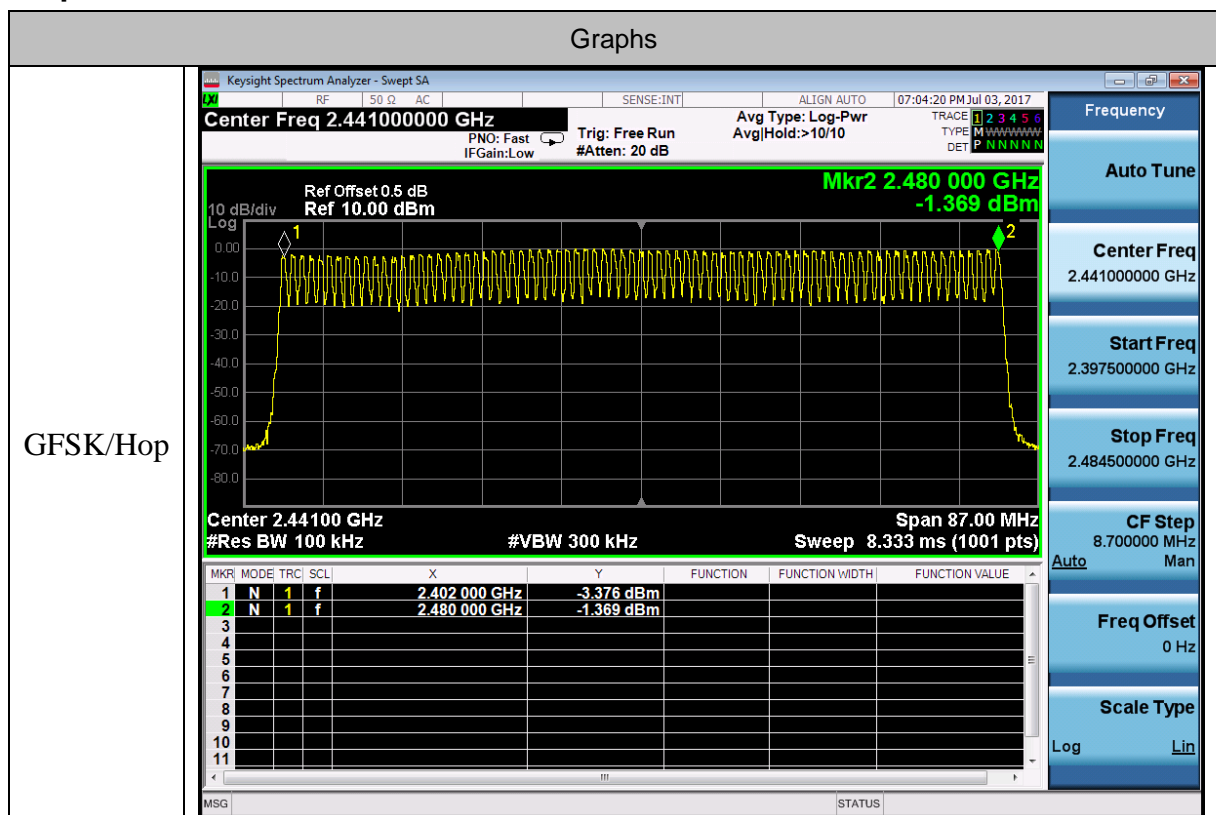
The same as described in section 6

12.4. LIMITS AND MEASUREMENT RESULT

| Mode | Channel. | Number of Hopping Channel | Verdict |
|------|----------|---------------------------|---------|
| GFSK | Hop | 79 | PASS |

Note: All modes were tested, only the worst case record in the report.

Test Graph



13. TIME OF OCCUPANCY (DWELL TIME)

13.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be \leq channel spacing and where possible RBW should be set $\gg 1 / T$, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) \times (period specified in the requirements / analyzer sweep time)
7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

13.4. LIMITS AND MEASUREMENT RESULT

| Channel. | Burst Width [ms/hop/ch] | Dwell Time[ms] | Verdict | Limit (ms) |
|----------|-------------------------|----------------|---------|------------|
| LCH | 3.085 | 329.067078 | PASS | 400 |
| MCH | 3.085 | 329.067078 | PASS | 400 |
| HCH | 3.080 | 328.533744 | PASS | 400 |

Note: The DH5 for GFSK modulation is the worst case and recorded in the report.

The dwell time is calculated with the following formula:

Dwell time = $t_{\text{pulse}} \times n_{\text{hops}} / \text{number of channels} \times 31.6 \text{ s}$

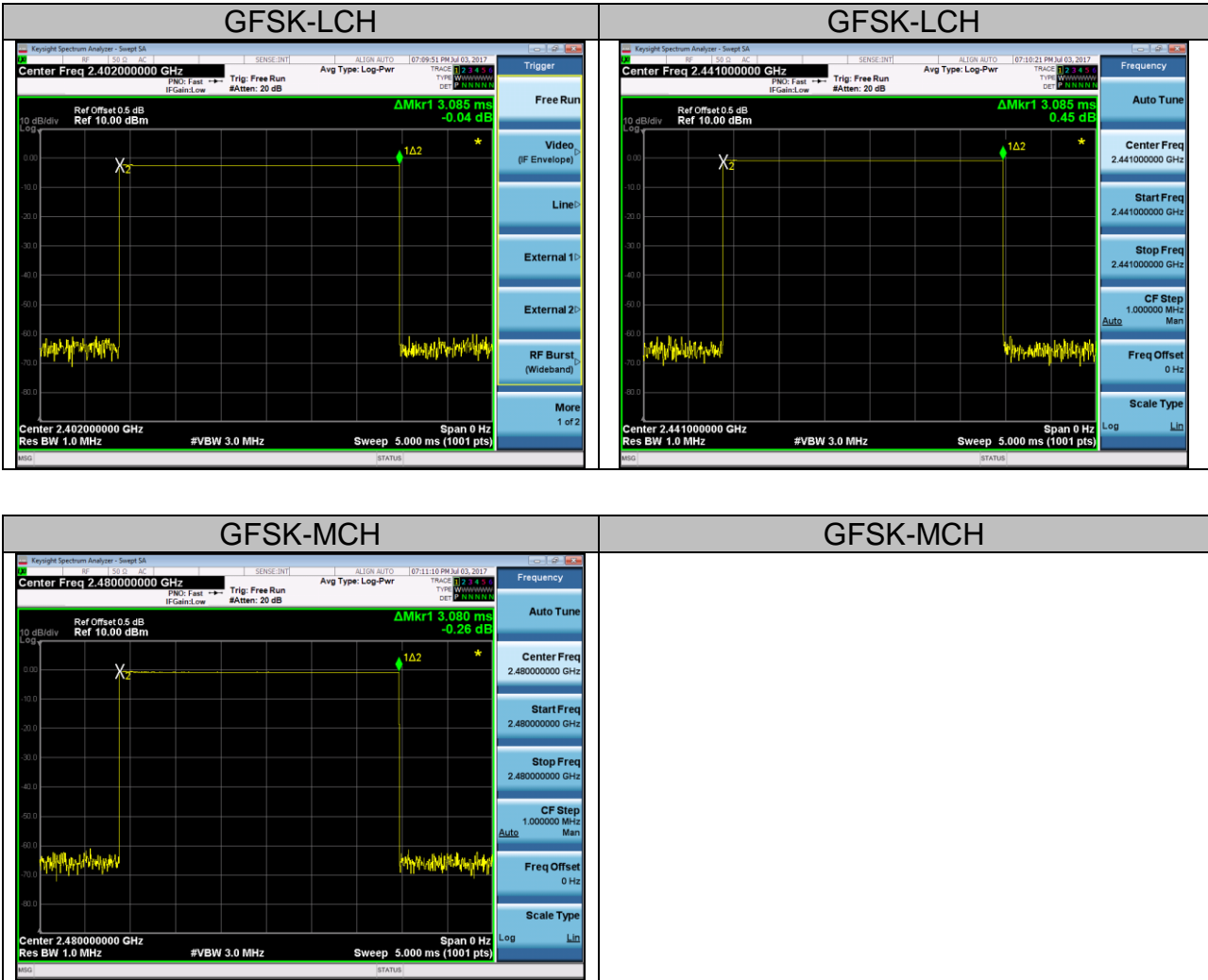
Where:

- t_{pulse} is the measured pulse time (pls. refer the plots of the spectrum analyser above) [s],
- n_{hops} is the number of hops per second in the actual operating mode of the transmitter [1/s].

The hopping rate of the system is 1600 hops per second and the system uses 79 channels. For this reason one time slot has a length of 625 μs .

With the used hopping mode (DH5) a packet need 5 timeslots for transmitting and the next timeslot for receiving. So the system makes in worst case 266,67 hops per second in transmit mode ($n_{\text{hops}} = 266.667 \text{ 1/s}$)

Test Graph



14. FREQUENCY SEPARATION

14.1. MEASUREMENT PROCEDURE

1. Place the EUT on the table and set it in transmitting mode
2. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum analyzer
3. Set Span = wide enough to capture the peaks of two adjacent channels Resolution (or IF) Bandwidth (RBW) $\geq 1\%$ of the span Video (or Average) Bandwidth (VBW) \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold

14.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

14.3. MEASUREMENT EQUIPMENT USED

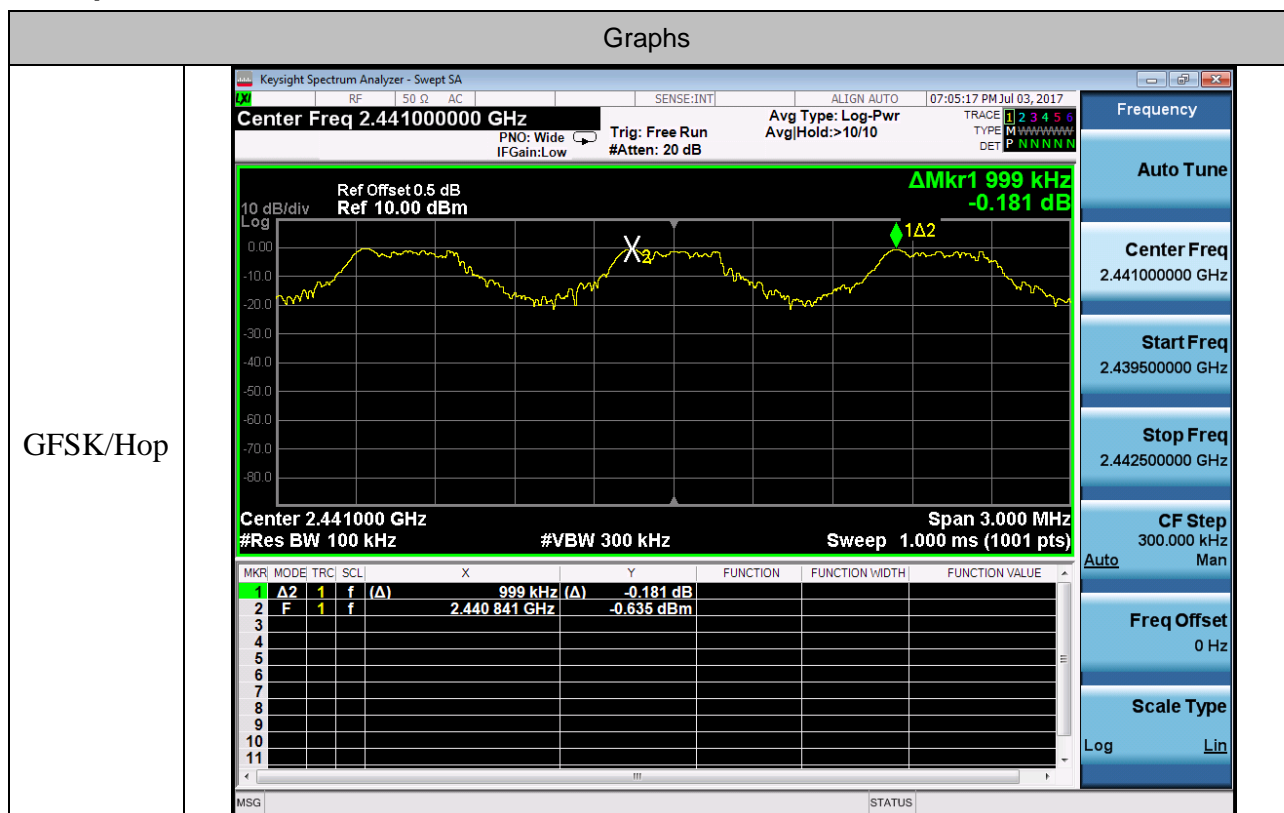
The same as described in section 6.3

14.4. LIMITS AND MEASUREMENT RESULT

| Mode | Channel. | Carrier Frequency Separation [MHz] | Verdict |
|------|----------|------------------------------------|---------|
| GFSK | Hop | 0.999 | PASS |

Note: All modes were tested, only the worst case record in the report.

Test Graph



15. FCC LINE CONDUCTED EMISSION TEST

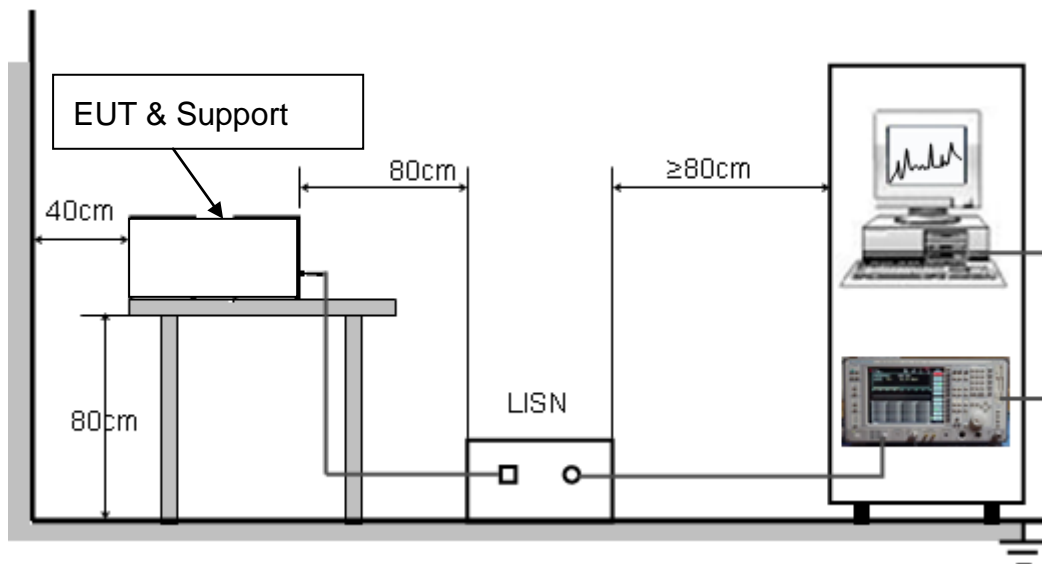
15.1. LIMITS OF LINE CONDUCTED EMISSION TEST

| Frequency | Maximum RF Line Voltage | |
|---------------|-------------------------|----------------|
| | Q.P.(dBuV) | Average(dBuV) |
| 150kHz~500kHz | 66-56 | 56-46 |
| 500kHz~5MHz | 56 | 46 |
| 5MHz~30MHz | 60 | 50 |

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

15.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



15.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC charging voltage by adapter which received 120V/60Hz power by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

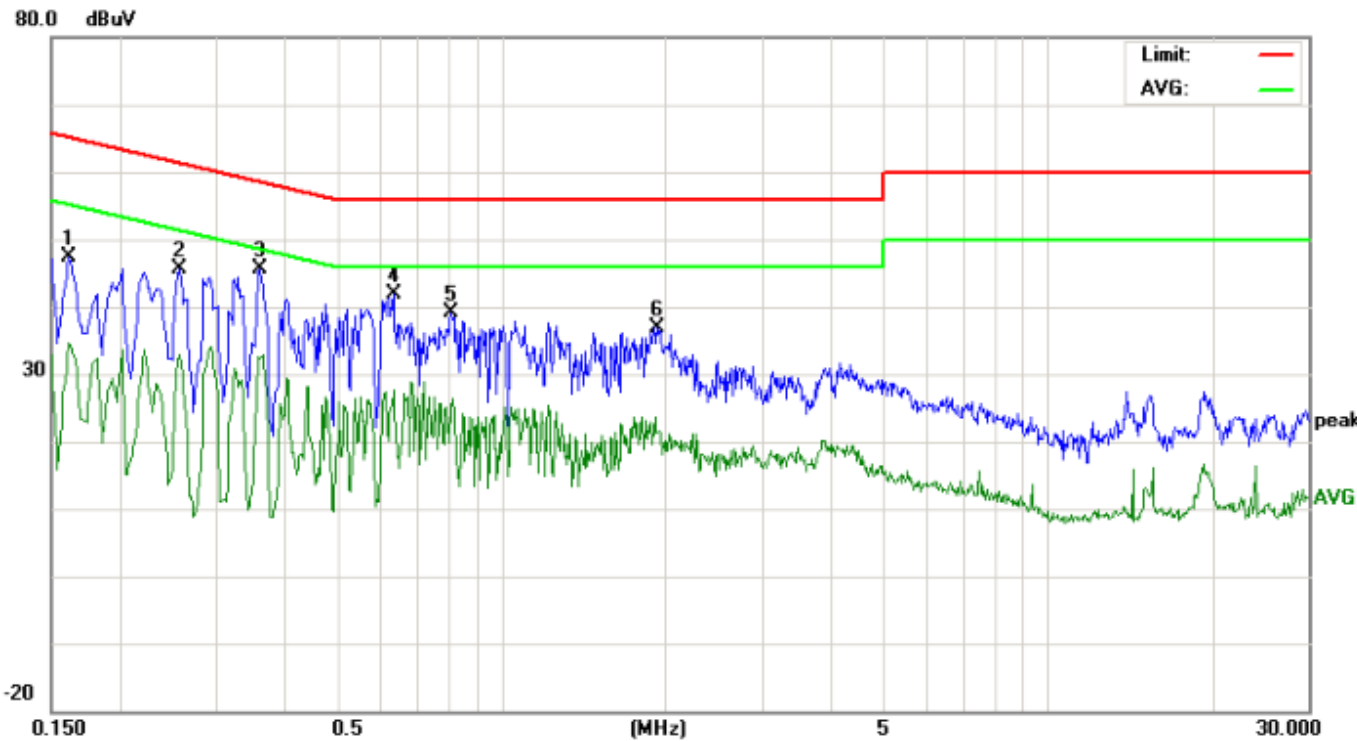
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

15.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

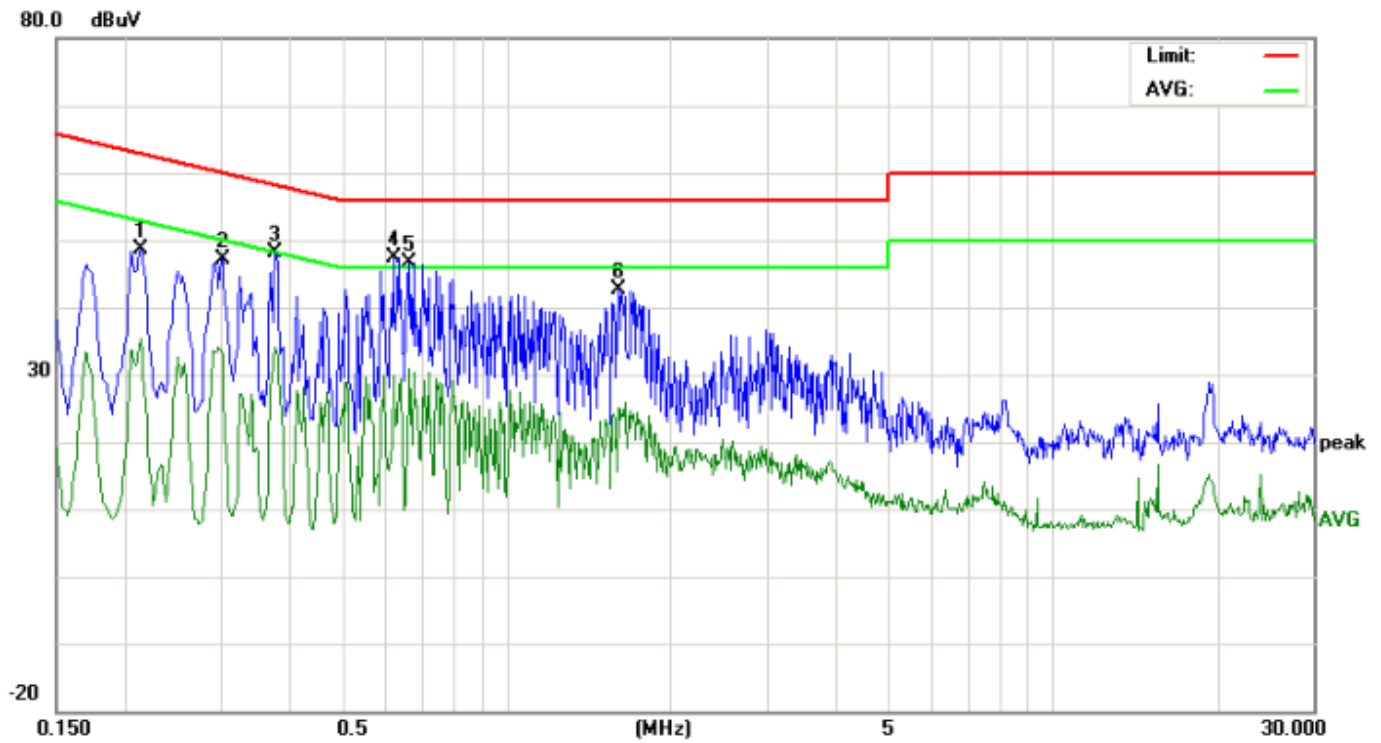
15.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L



| No. | Freq. (MHz) | Reading_Level (dBuV) | | | Correct Factor | Measurement (dBuV) | | | Limit (dBuV) | | Margin (dB) | | P/F | Comment |
|-----|-------------|----------------------|----|-------|----------------|--------------------|----|-------|--------------|-------|-------------|--------|-----|---------|
| | | Peak | QP | AVG | | Peak | QP | AVG | QP | AVG | QP | AVG | | |
| 1 | 0.1620 | 37.22 | | 24.45 | 10.17 | 47.39 | | 34.62 | 65.36 | 55.36 | -17.97 | -20.74 | P | |
| 2 | 0.2580 | 35.47 | | 22.56 | 10.27 | 45.74 | | 32.83 | 61.49 | 51.49 | -15.75 | -18.66 | P | |
| 3 | 0.3619 | 35.29 | | 22.14 | 10.31 | 45.60 | | 32.45 | 58.68 | 48.68 | -13.08 | -16.23 | P | |
| 4 | 0.6340 | 31.66 | | 17.37 | 10.32 | 41.98 | | 27.69 | 56.00 | 46.00 | -14.02 | -18.31 | P | |
| 5 | 0.8100 | 28.76 | | 14.79 | 10.29 | 39.05 | | 25.08 | 56.00 | 46.00 | -16.95 | -20.92 | P | |
| 6 | 1.9299 | 26.63 | | 11.04 | 10.24 | 36.87 | | 21.28 | 56.00 | 46.00 | -19.13 | -24.72 | P | |

Line Conducted Emission Test Line 2-N



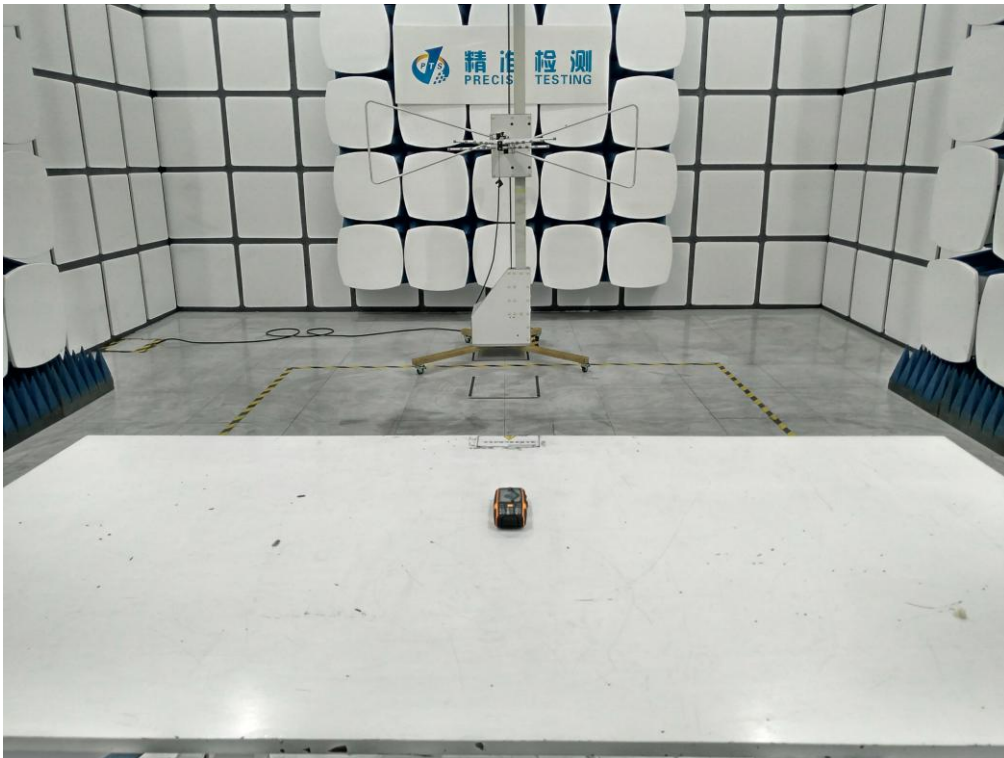
| No. | Freq. (MHz) | Reading_Level (dBuV) | | | Correct Factor | Measurement (dBuV) | | | Limit (dBuV) | | Margin (dB) | | P/F | Comment |
|-----|-------------|----------------------|----|-------|----------------|--------------------|----|-------|--------------|-------|-------------|--------|-----|---------|
| | | Peak | QF | AVG | | Peak | QF | AVG | QF | AVG | QF | AVG | | |
| 1 | 0.2140 | 38.46 | | 25.03 | 10.23 | 48.69 | | 35.26 | 63.04 | 53.04 | -14.35 | -17.78 | P | |
| 2 | 0.3020 | 36.81 | | 22.88 | 10.29 | 47.10 | | 33.17 | 60.19 | 50.19 | -13.09 | -17.02 | P | |
| 3 | 0.3780 | 37.91 | | 23.85 | 10.32 | 48.23 | | 34.17 | 58.32 | 48.32 | -10.09 | -14.15 | P | |
| 4 | 0.6220 | 37.04 | | 19.48 | 10.32 | 47.36 | | 29.80 | 56.00 | 46.00 | -8.64 | -16.20 | P | |
| 5 | 0.6660 | 36.36 | | 20.43 | 10.34 | 46.70 | | 30.77 | 56.00 | 46.00 | -9.30 | -15.23 | P | |
| 6 | 1.6060 | 32.36 | | 14.87 | 10.35 | 42.71 | | 25.22 | 56.00 | 46.00 | -13.29 | -20.78 | P | |

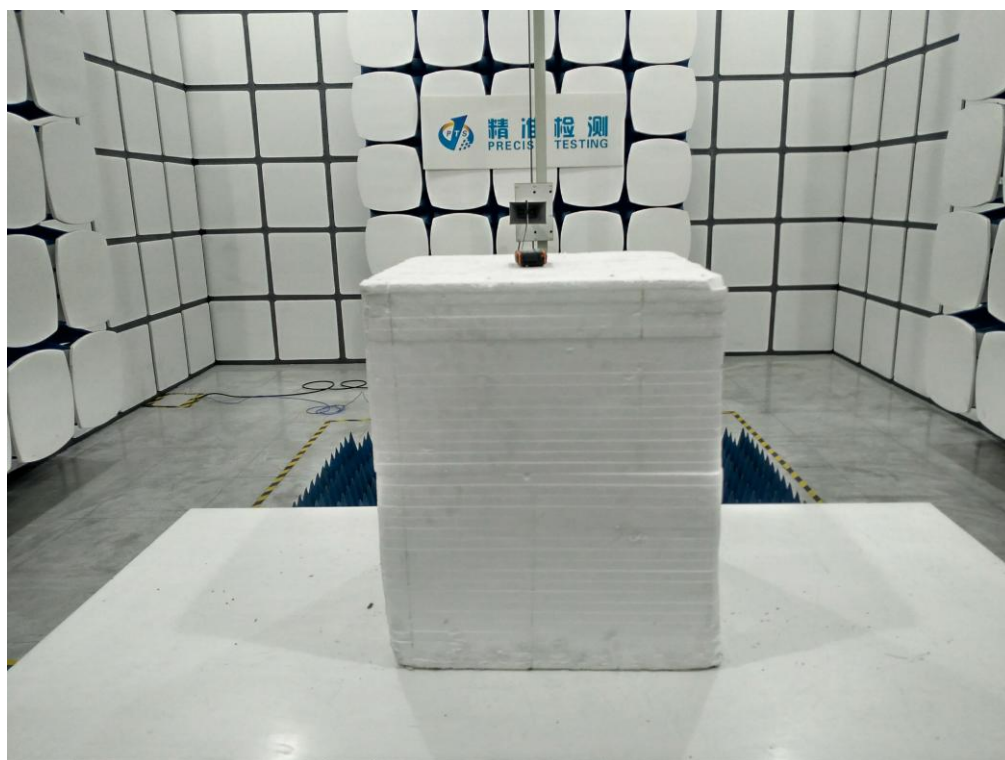
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

FCC LINE CONDUCTED EMISSION TEST SETUP



FCC RADIATED EMISSION TEST SETUP





----END OF REPORT----