

RF TEST REPORT

Test Equipment : Grand Multicom
Model Name : GM-900M
FCC variant model name : Cobalt Plus, MicroCom XR, MicroCom XR 900, CP-900, XR-900, GM11-900M, RefAudio Elite
IC variant model name : Cobalt Plus, MicroCom XR, MicroCom XR 900
FCC ID : YJH-GM-900M
IC : 9066A-GM900M
Date of receipt : 2019.11.14
Test duration : 2019.11.18 ~ 2019.12.03
Date of issue : 2019.12.06

Applicant : Maytel Co., Ltd
#417 Doosan Venture Digm 126-1, Pyeongchon-dong, Dongan-gu,
Anyang-si, Gyeonggi-do, Republic of Korea

Test Laboratory : Lab-T, Inc.
2182-42 Baegok-daero, Mohyeon-myeon, Cheoin-gu, Yongin-si
Gyeonggi-do 17036, South Korea

Test specification : FCC Part 15 Subpart C 15.247
RSS-247 Issue 2 (2017-02), RSS-GEN Issue 5 (2018-04)

RF Output Power : 17.78 dBm

Test result : Pass

The above equipment was tested by Lab-T Testing Laboratory for compliance
with the requirements of FCC, IC Rules and Regulations.

The test results presented in this test report are limited only to the sample supplied by applicant
and the use of this test report is inhibited other than its purpose.

This test report shall not be reproduced except in full, without the written approval of Lab-T, Inc

Tested by:

Engineer
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1. Applicant Information

Applicant : Maytel Co., Ltd
Address : #417 Doosan Venture Digm 126-1, Pyeongchon-dong, Dongan-gu,
Anyang-si, Gyeonggi-do, Republic of Korea
Telephone No. : +82-32-487-5508
Person in charge : Su Won, Bae / swmaytel@naver.com

Manufacturer : Maytel Co., Ltd
Address : #417 Doosan Venture Digm 126-1, Pyeongchon-dong, Dongan-gu,
Anyang-si, Gyeonggi-do, Republic of Korea

2. Laboratory Information

Test Laboratory : Lab-T, Inc.
Address : 2182-42 Baegok-daero, Mohyeon-myeon, Cheoin-gu, Yongin-si Gyeonggi-do
17036, South Korea
Telephone No. : +82 31-322-6767
Facsimile No. : +82 31-322-6768

Certificate

FCC Designation No. : KR0159
FCC Registration No. : 133186
IC Site Registration No. : 22000

3. Information About Test Equipment

3.1 Equipment Information

| | |
|---|---|
| Equipment type | Grand Multicom |
| Equipment model name | GM-900M |
| FCC variant model name | Cobalt Plus, MicroCom XR, MicroCom XR 900, CP-900, XR-900, GM11-900M, RefAudio Elite ^{Note2} |
| IC variant model name | Cobalt Plus, MicroCom XR, MicroCom XR 900 ^{Note2} |
| Frequency range | 903 MHz ~ 926.5 MHz (Number of Channels : 48, Hopping Channels : 25) ^{Note3} |
| Modulation type (Symbol rate / Bit rate) | GFSK (625 ksps / 1250 kbps) |
| Modulation technology | FHSS |
| Power supply | DC 3.7 V |
| H/W version | V0.3 |
| S/W version | V0.3 |

Note1: The above EUT information was declared by the manufacturer.

Note2: Variant Model Names are used for each other different Buyers.

Note3: This device uses 25 random hopping channels among total 48 channels.

3.2 Antenna Information

| | | |
|-----------|------|----------------|
| Antenna 1 | Type | Dipole Antenna |
| | Gain | 1.00 dBi |
| Antenna 2 | Type | Dipole Antenna |
| | Gain | 3.86 dBi |
| Antenna 3 | Type | Yagi Antenna |
| | Gain | 6.00 dBi |

3.3 Test Frequency

| Test mode | Test frequency (MHz) | | |
|-----------|----------------------|------------------|-------------------|
| | Lowest frequency | Middle frequency | Highest frequency |
| GFSK | 903 | 915 | 926.5 |

3.4 Tested Companion Device and accessory Information

| Type | Manufacturer | Model | Note |
|---------|-------------------------|------------|---|
| Adaptor | DELTA ELECTRONICS, INC. | ADP-10HW A | Input : AC 100 ~ 240 V Output : DC 5.35V, 2.0A |

3.5 Operating conditions for the EUT

| | | |
|-------------------------------|--------------------------|---|
| Firmware state | V0.2 | |
| Test software name(version) | Used native test mode(-) | |
| Test power setting | 17 dBm | |
| Serial number (Setup mode) | EUT #1 | N/A (Radiated Emission, Conducted Emission) |
| | EUT #2 | - |

3.6 Equipment Channel List

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
| 0 | 903 | 20 | 913 | 40 | 923 |
| 1 | 903.5 | 21 | 913.5 | 41 | 923.5 |
| 2 | 904 | 22 | 914 | 42 | 924 |
| 3 | 904.5 | 23 | 914.5 | 43 | 924.5 |
| 4 | 905 | 24 | 915 | 44 | 925 |
| 5 | 905.5 | 25 | 915.5 | 45 | 925.5 |
| 6 | 906 | 26 | 916 | 46 | 926 |
| 7 | 906.5 | 27 | 916.5 | 47 | 926.5 |
| 8 | 907 | 28 | 917 | | |
| 9 | 907.5 | 29 | 917.5 | | |
| 10 | 908 | 30 | 918 | | |
| 11 | 908.5 | 31 | 918.5 | | |
| 12 | 909 | 32 | 919 | | |
| 13 | 909.5 | 33 | 919.5 | | |
| 14 | 910 | 34 | 920 | | |
| 15 | 910.5 | 35 | 920.5 | | |
| 16 | 911 | 36 | 921 | | |
| 17 | 911.5 | 37 | 921.5 | | |
| 18 | 912 | 38 | 922 | | |
| 19 | 912.5 | 39 | 922.5 | | |

Note1: Test frequencies are the lowest channel: 0 channel(903 MHz), middle channel(915 MHz) and highest channel: 47 channel(926.5 MHz).

Note2: The device uses 25 random hopping channels among total 48 channels.

4. Test Report

4.1 Summary

| FCC Part 15 & RSS-GEN Issue 5 & RSS-247 Issue 2 | | | | |
|---|--|--|--------|--------|
| FCC Rule | IC Rule | Parameter | Clause | Status |
| Transmitter Requirements | | | | |
| 15.203 15.247(c) | - | Antenna Requirement | 4.4.1 | C |
| 15.247(a)(1)(i) | RSS-247 5.1(c) | 20 dB Channel Bandwidth | 4.4.2 | C |
| - | RSS-GEN 6.7 | Occupied Bandwidth | 4.4.2 | C |
| 15.247(a)(1)(i) | RSS-247 5.1(c) | Number of Hopping Frequencies | 4.4.3 | C |
| 15.247(a)(1)(i) | RSS-247 5.1(c) | Average Time of occupancy | 4.4.4 | C |
| 15.247(a)(1) | RSS-247 5.1(b) | Carrier Frequencies Separation | 4.4.5 | C |
| 15.247(b)(2) | RSS-247 5.4(a) | Peak Output Power | 4.4.6 | C |
| 15.247(d) 15.205(a) 15.209(a) | RSS-247 5.5 RSS-GEN 8.9 RSS-GEN 8.10 | Spurious Emission, Band Edge and Restricted bands | 4.4.7 | C |
| 15.207(a) | RSS-GEN 8.8 | Conducted Emissions | 4.4.8 | C |

Note 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable

* The general test methods used to test this device is ANSI C63.10:2013

* The method of measurement used to test this DSS device is FCC public Notice DA 00-705

4.2 Measurement Uncertainty

| Mesurement items | Expanded Uncertainty | |
|--|----------------------|---|
| RF Output Power | ±0.72 dB | (The confidence level is about 95 %, k=2) |
| Occupied Channel Bandwidth | ±11.27 kHz | (The confidence level is about 95 %, k=2) |
| Conducted Spurious Emissions | ±0.39 dB | (The confidence level is about 95 %, k=2) |
| Radiated Spurious Emissions (1 GHz under) | ±4.67 dB | (The confidence level is about 95 %, k=2) |
| Radiated Spurious Emissions (Above 1 GHz) | ±5.85 dB | (The confidence level is about 95 %, k=2) |
| Conducted emission | ±2.36 dB | (The confidence level is about 95 %, k=2) |

4.3 Test Report Version

| Test Report No. | Date | Description |
|-----------------|----------|---------------|
| TRRFCC19-0033 | 19.12.06 | Initial issue |
| | | |
| | | |
| | | |

4.4 Transmitter Requirements

4.4.1 Antenna Requirement

4.4.1.1 Regulation

According to §15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to §15.247(b)(4) e conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.4.1.2 Result

Comply

| | | |
|-----------|------|---|
| Antenna 1 | Type | External Dipole Antenna ^{Note 1} |
| | Gain | 1.00 dBi |
| Antenna 2 | Type | External Dipole Antenna ^{Note 1} |
| | Gain | 3.86 dBi |
| Antenna 3 | Type | External Yagi Antenna ^{Note 2, Note 3} |
| | Gain | 6.00 dBi |

Note 1 : The connector type of Diopole Antenna is reverse polarity SMA connector.

Note 2 : External Yagi Antenna is required installation by professional installers.

Note 3 : In case of using an External Yagi Antenna, This device is fixed and used at least 20cm away from human body.

4.4.2 20 dB Bandwidth and Occupied Bandwidth

4.4.2.1 Regulation

According to §15.247(a)(1)(i) and RSS-247 §5.1(c) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

20 dB and 99% emission bandwidth reporting only, measurement is also used to determine limits for other requirements of FHSS transmitters.

4.4.2.2 Measurement Procedure

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.

ANSI C63.10 § 6.9.2 Occupied bandwidth 20dB Relative procedure

ANSI C63.10 § 6.9.3 Occupied bandwidth 99% procedure

4.4.2.3 Result

Comply (measurement data : refer to the next page)

4.4.2.4 Measurement data

Test mode : GFSK

| Frequency (MHz) | 20 dB Bandwidth (MHz) | Max. Limit (MHz) | Occupied Bandwidth (99 % Bandwith)(MHz) |
|--------------------|--------------------------|---------------------|--|
| 903 | 0.292 | 0.500 | 0.265 |
| 915 | 0.291 | 0.500 | 0.265 |
| 926.5 | 0.290 | 0.500 | 0.266 |

4.4.2.5 Test Plot

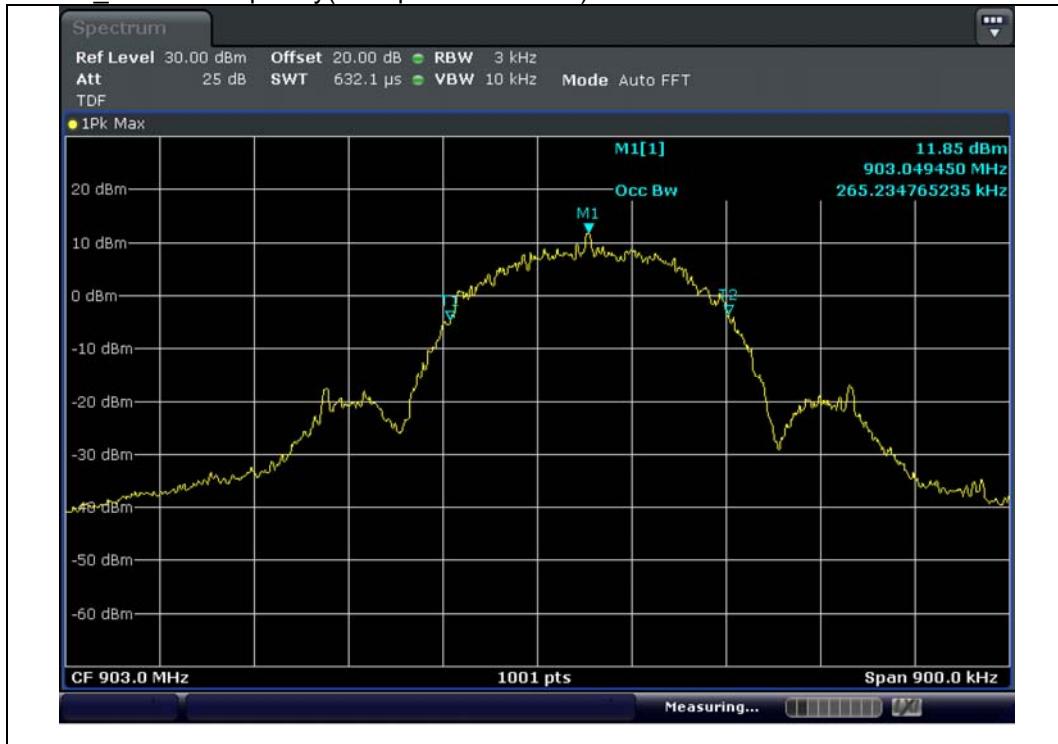
GFSK_Lowest Frequency(20 dB Bandwidth)

GFSK_Middle Frequency(20 dB Bandwidth)

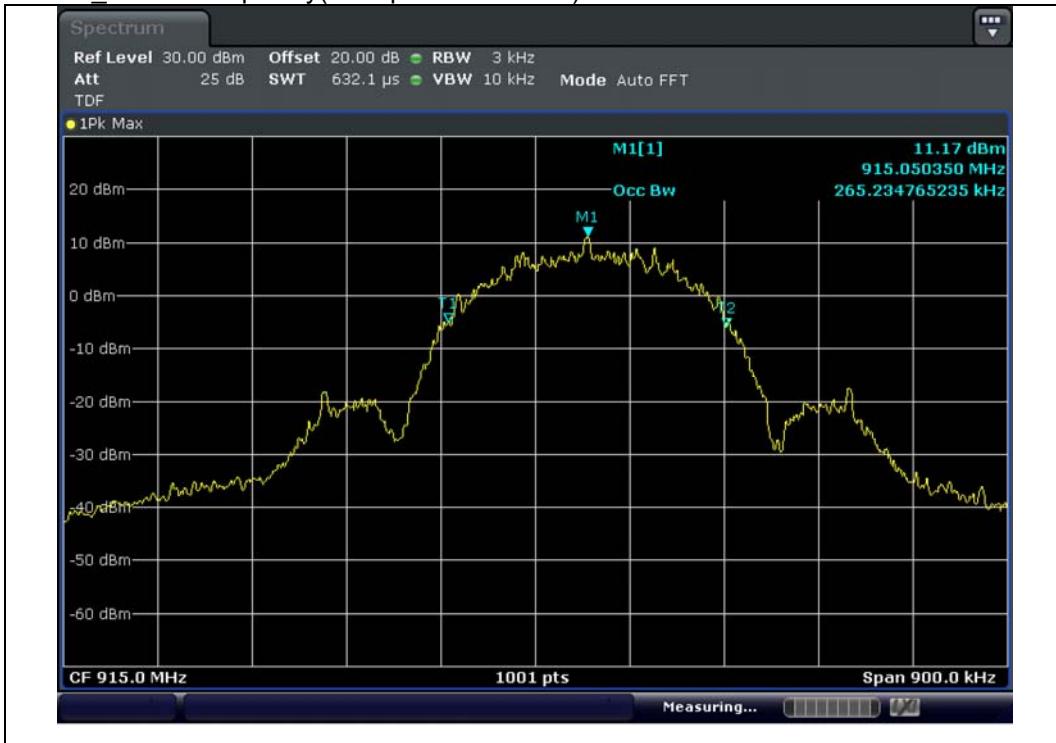

GFSK_Highest Frequency(20 dB Bandwidth)



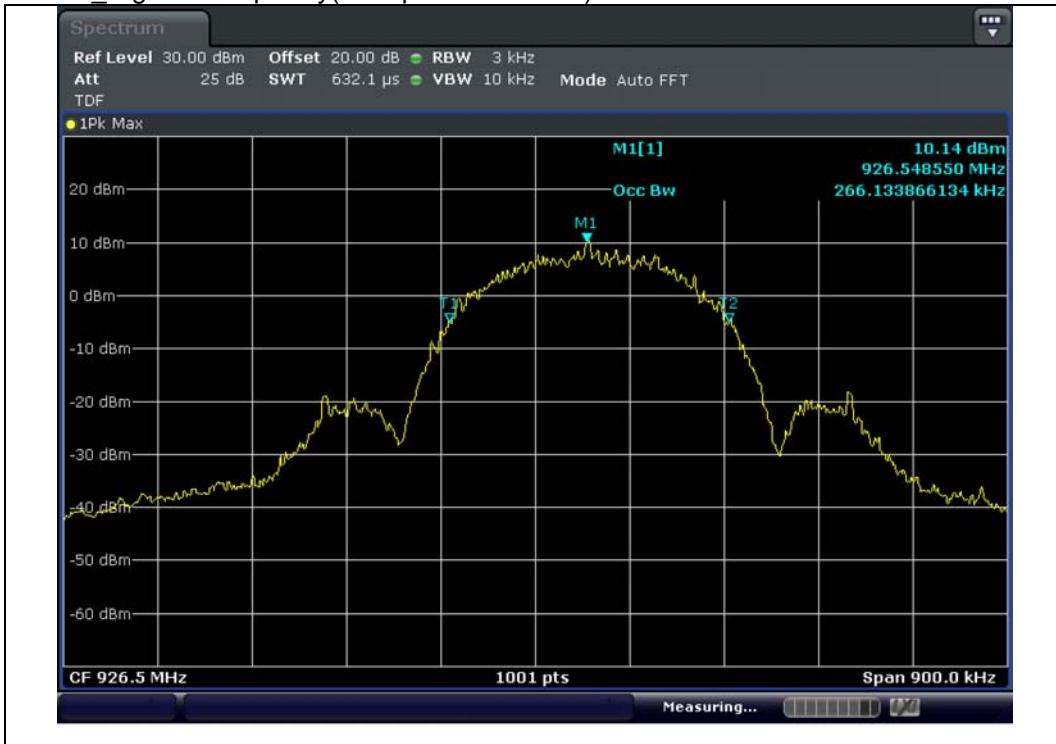
GFSK_Lowest Frequency(Occupied Bandwidth)



GFSK_Middle Frequency(Occupied Bandwidth)



GFSK_Highest Frequency(Occupied Bandwidth)



4.4.3 Number of Hopping Frequencies

4.4.3.1 Regulation

According to §15.247(a)(1)(i) and RSS-247 §5.1(c) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.4.3.2 Measurement Procedure

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines
ANSI C63.10 § 7.8.3 Number of hopping frequencies

4.4.3.3 Result

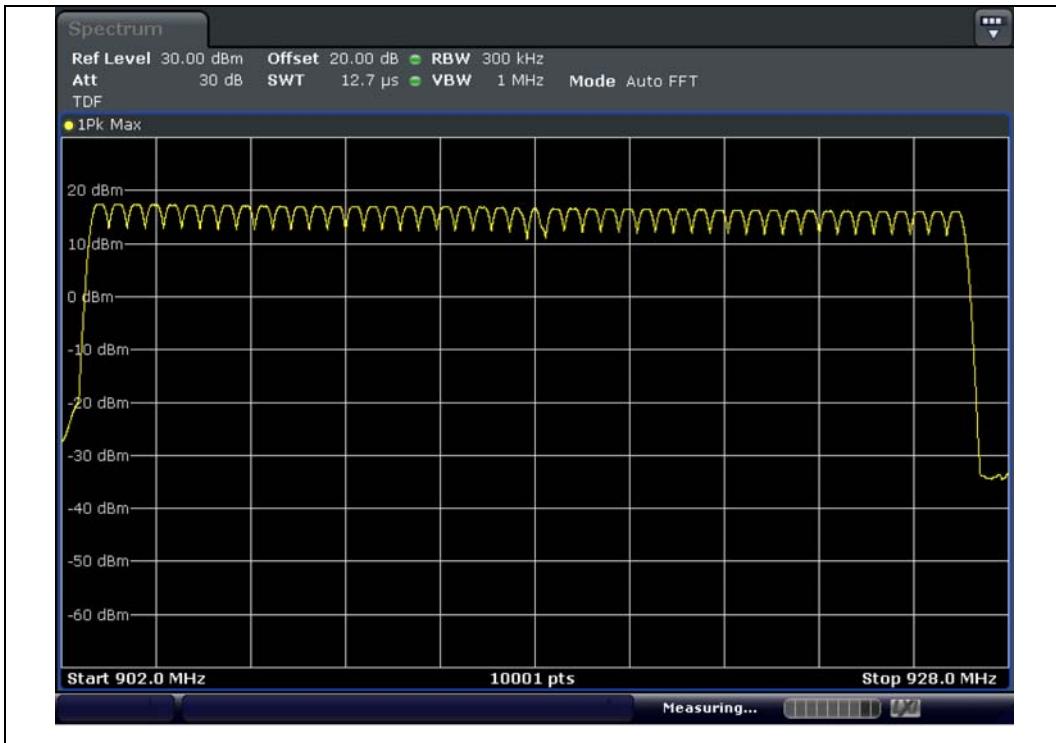
Comply (measurement data : refer to the next page)

4.4.3.4 Measurement data

Total number of Hopping Channels is 48.

4.4.3.5 Test Plot

GFSK



4.4.4 Average Time of occupancy

4.4.4.1 Regulation

According to §15.247(a)(1)(i) and RSS-247 §5.1(c) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

4.4.4.2 Measurement Procedure

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines
ANSI C63.10 § 7.8.3 Time of Occupancy

4.4.4.3 Result

Comply (measurement data : refer to the next page)

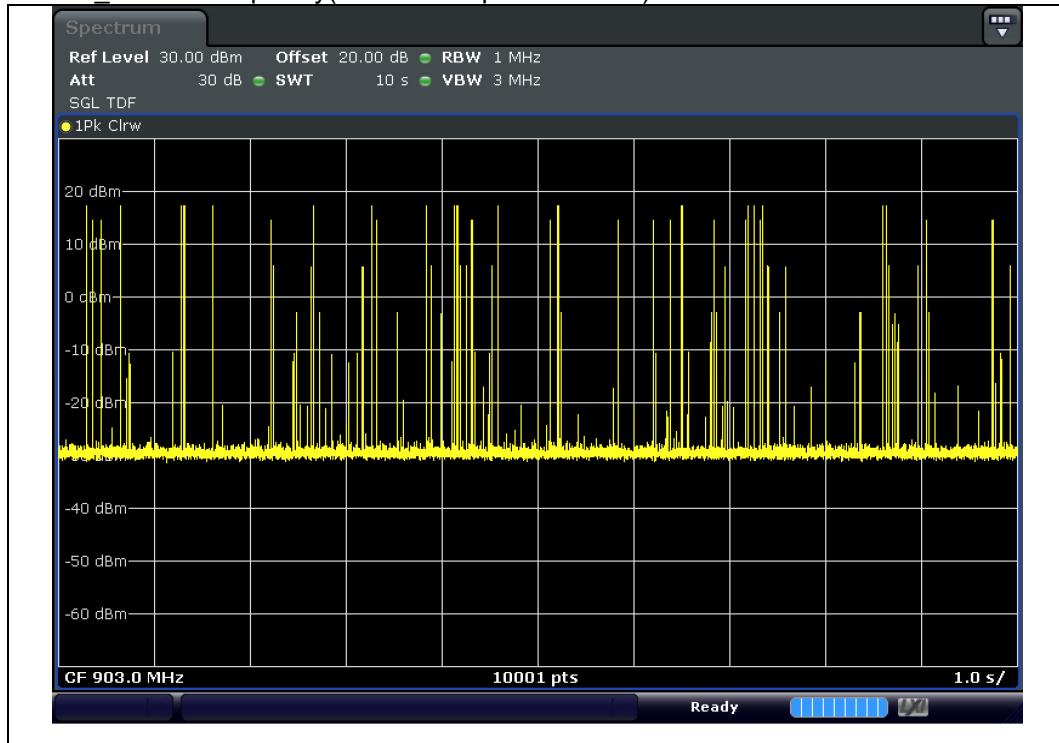
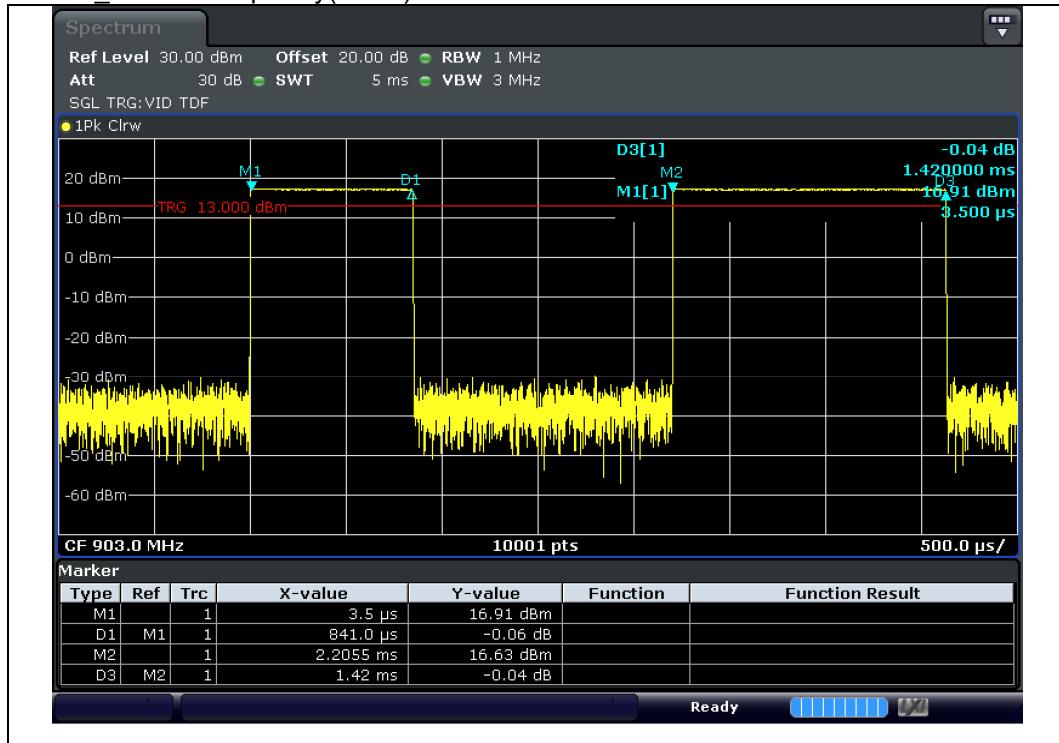
4.4.4.4 Measurement data

Test mode : GFSK

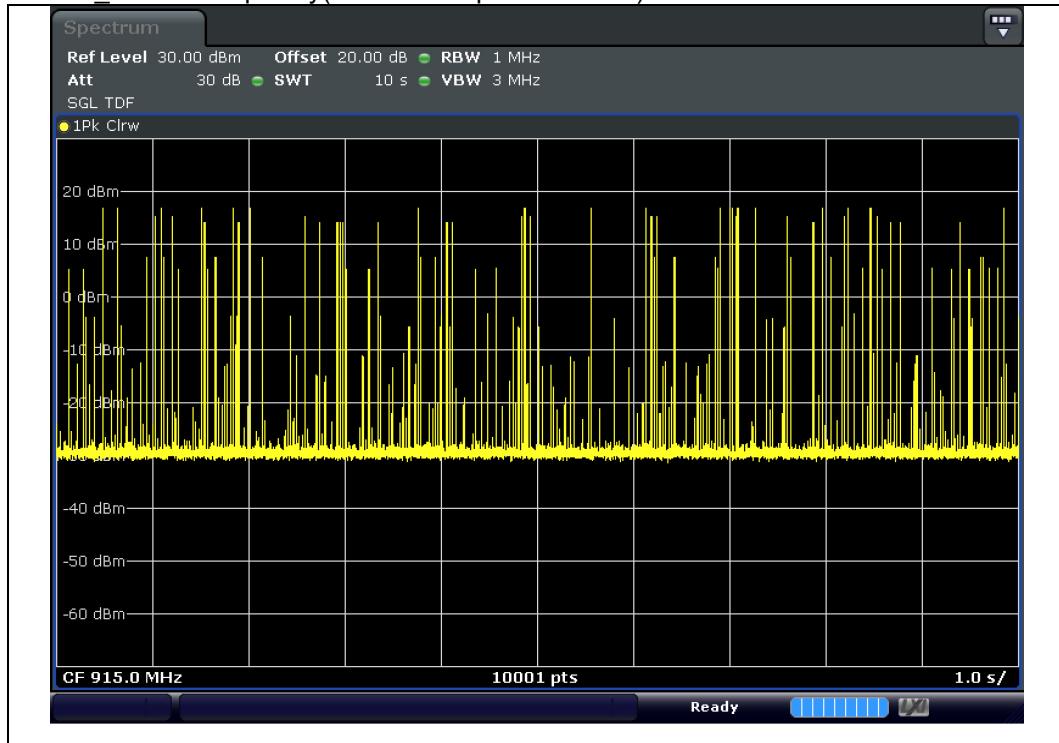
| Average Time of occupancy | | | | | |
|---------------------------|----------------------------------|----------------------------------|-------------------------------|------------|------------|
| Frequency (MHz) | Average Time of occupancy 1 (ms) | Average Time of occupancy 2 (ms) | Number of Pulse in 10 seconds | Total (ms) | Limit (ms) |
| 903 | 0.841 | 1.420 | 18 | 40.698 | 400.000 |
| 915 | 0.840 | 1.419 | 18 | 40.662 | 400.000 |
| 926.5 | 0.840 | 1.413 | 19 | 42.807 | 400.000 |

NOTE1 : Total : (Average Time of occupancy 1+ Average Time of occupancy 2) * Number of Pulse in 10 seconds

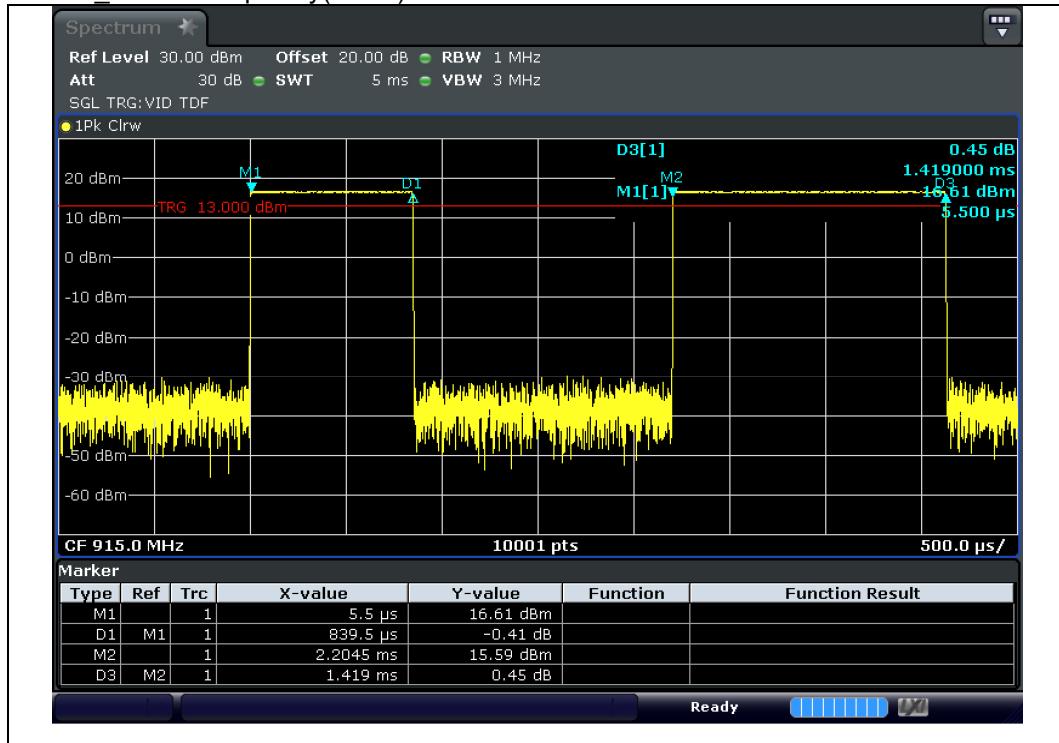
4.4.4.5 Test Plot

GFSK_Lowest Frequency(observation period in 10 s)

GFSK_Lowest Frequency(Pulse)


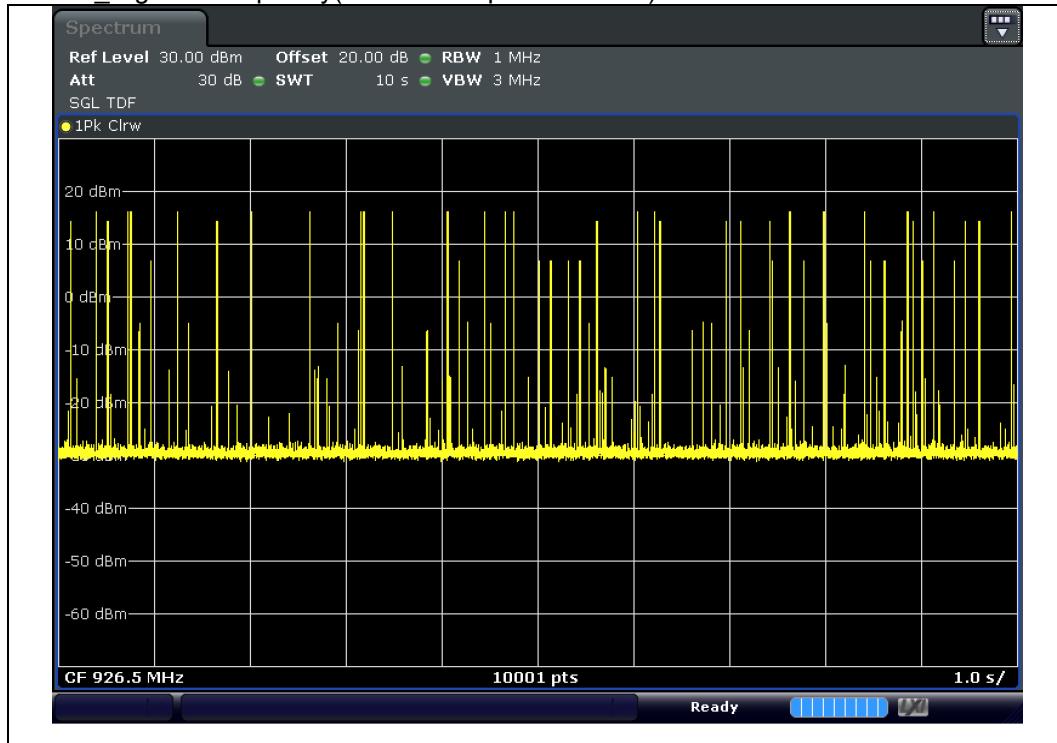
GFSK_Middle Frequency(observation period in 10 s)



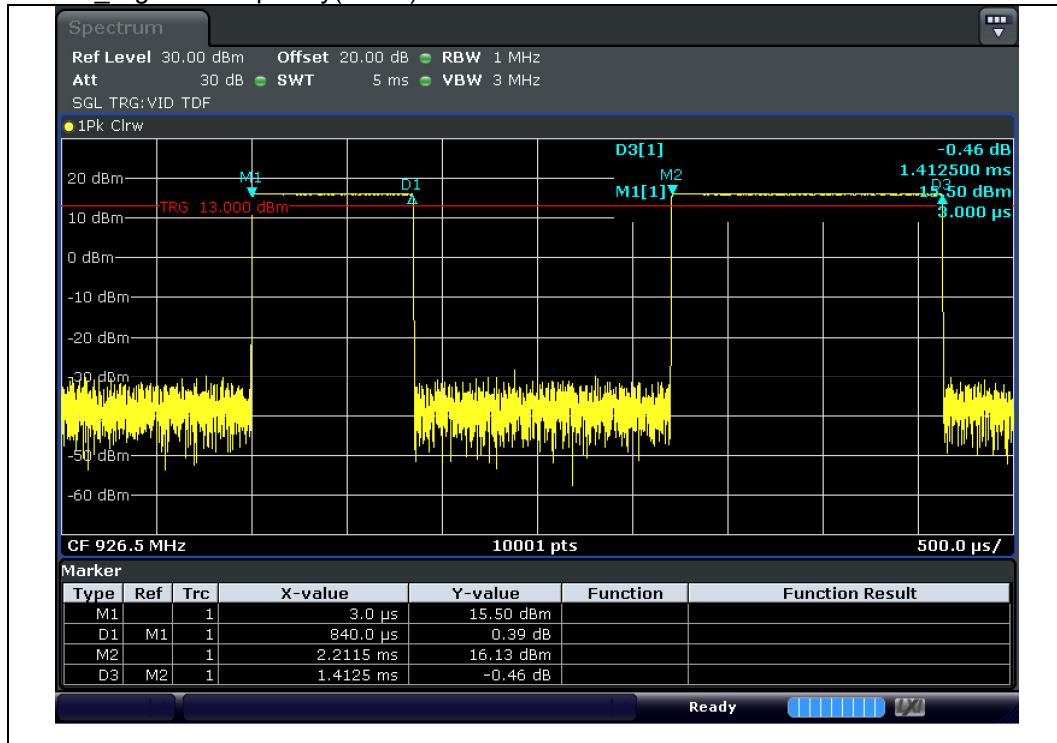
GFSK_Middle Frequency(Pulse)



GFSK_Highest Frequency(observation period in 10 s)



GFSK_Highest Frequency(Pulse)



4.4.5 Carrier Frequencies Separation

4.4.5.1 Regulation

According to §15.247(a)(1) and RSS-247 §5.1(b) 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

4.4.5.2 Measurement Procedure

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines
ANSI C63.10 § 7.8.2 Carrier frequency separation

4.4.5.3 Result

Comply (measurement data : refer to the next page)

4.4.5.4 Measurement data

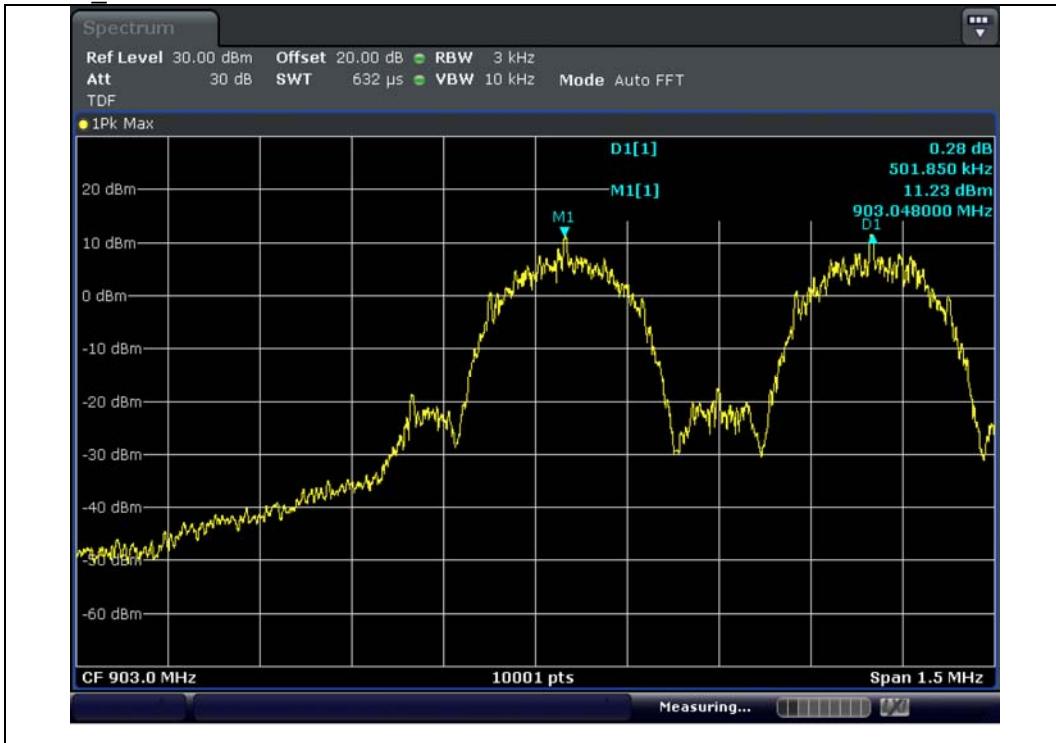
Test mode : GFSK

| Carrier Frequency Separation | | |
|------------------------------|-----------------|---------------------|
| Test Channel | Result (MHz) | Min. Limit (MHz) |
| Channel 0 to Channel 2 | 0.500 | 0.292 |
| Channel 24 to Channel 26 | 0.500 | 0.291 |
| Channel 46 to Channel 47 | 0.500 | 0.290 |

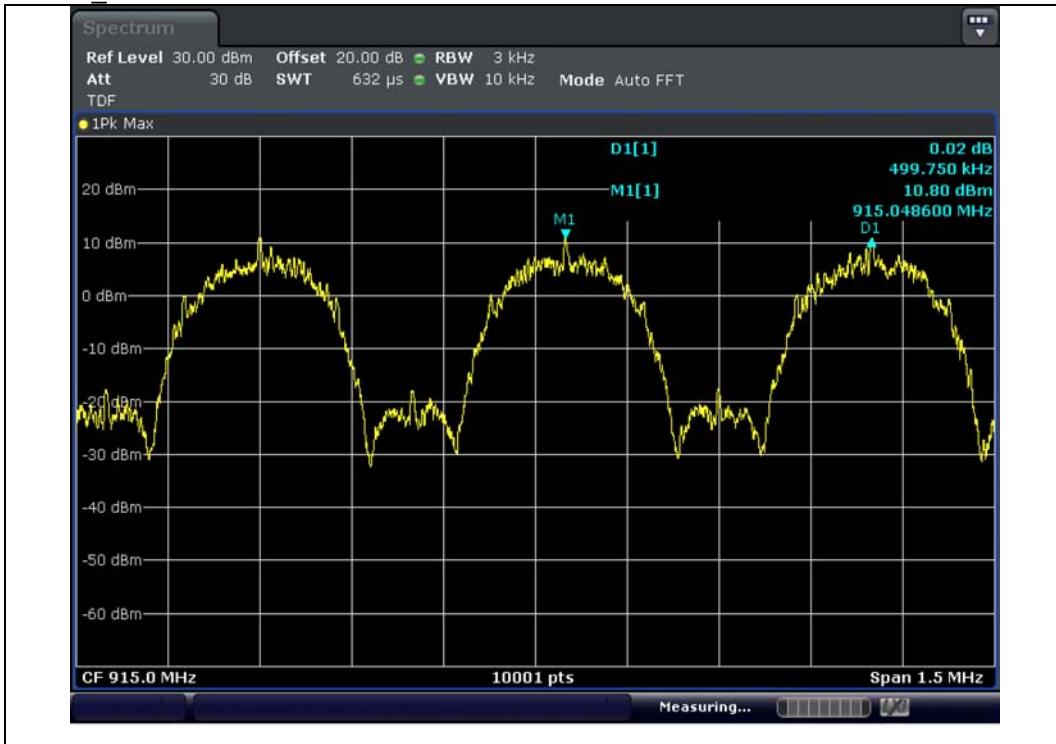
NOTE1 : Limit(kHz) : Result of 20 dB Bandwidth

4.4.5.5 Test Plot

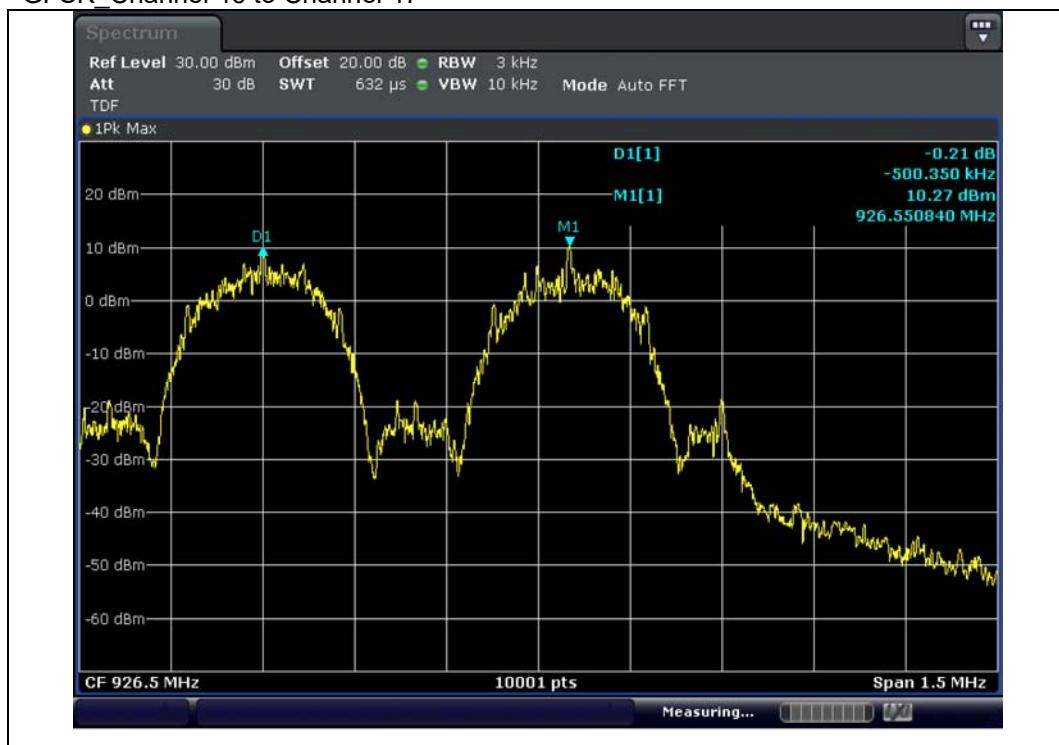
GFSK_Channel 0 to Channel 1



GFSK_Channel 24 to Channel 25



GFSK_Channel 46 to Channel 47



4.4.6 Peak Output Power

4.4.6.1 Regulation

According to §15.247(b)(1) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

According to RSS-247 §5.4(b) For FHSS operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and e.i.r.p shall not exceed 1 W if the hopset uses less than 50 hopping channels.

4.4.6.2 Measurement Procedure

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines
ANSI C63.10 § 7.8.5 Output Power test procedure for FHSS

4.4.6.3 Result

Comply (measurement data : refer to the next page)

4.4.6.4 Measurement data

Test mode : GFSK

| Frequency (MHz) | Peak Output Power Result (dBm) | Peak Output Power Result (mW) | Peak Output Power Limit (mW) | Avg Output Power Result (dBm) |
|-----------------|--------------------------------|-------------------------------|------------------------------|-------------------------------|
| 903 | 17.78 | 59.98 | 250.00 | 9.11 |
| 915 | 16.93 | 49.32 | 250.00 | 8.28 |
| 926.5 | 16.24 | 42.07 | 250.00 | 7.12 |

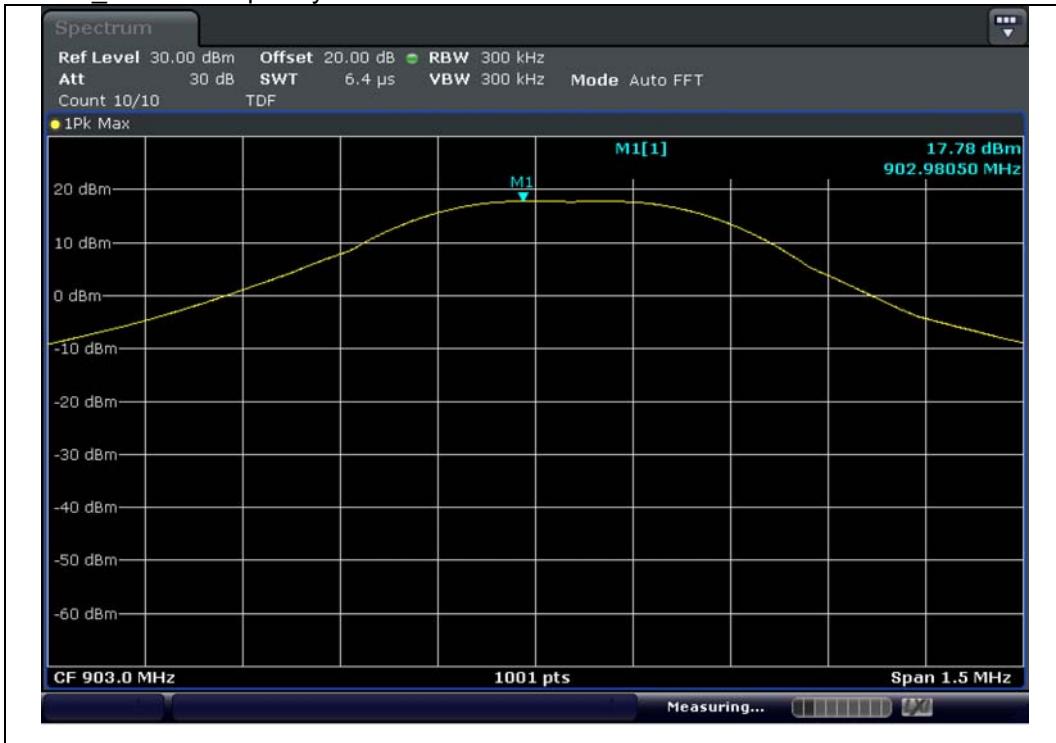
NOTE1 : Since the directional gain of Antenna declared by the manufacturer, does not exceed 6.0 dBi ,there was no need to reduce the output power.

NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.

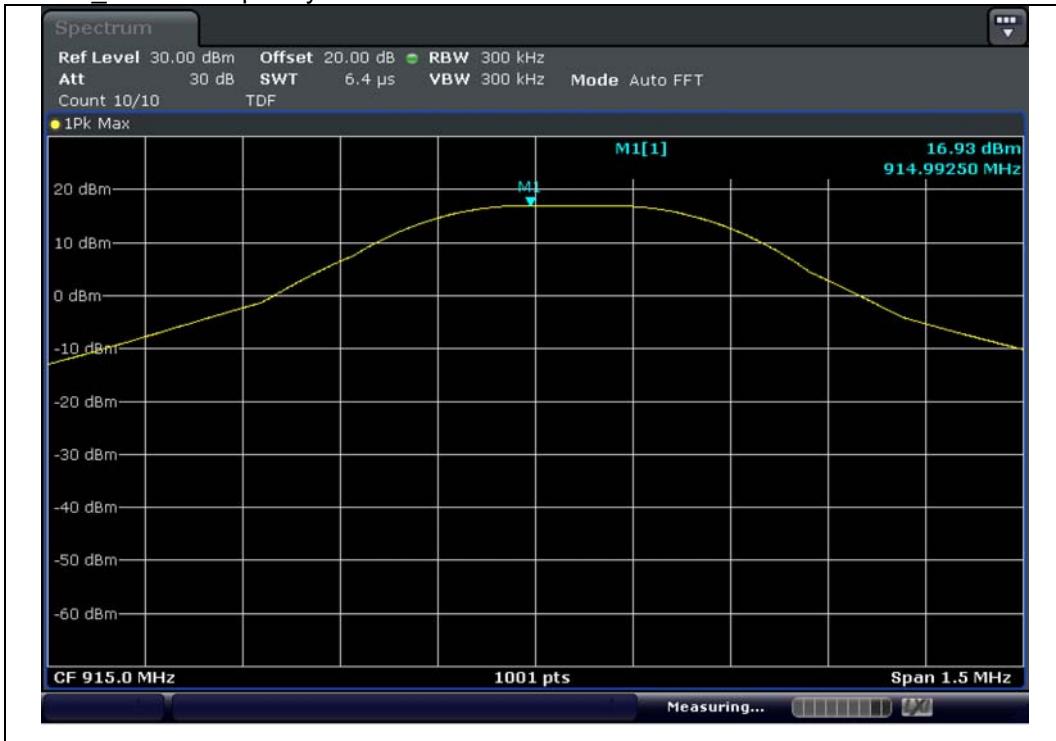
NOTE3 : Peak Output Power Result(mW) = (10^(Peak Output Power Result(dBm)/10))

4.4.6.5 Test Plot

GFSK_Lowest Frequency



GFSK_Middle Frequency



GFSK_Highest Frequency



4.4.7 Spurious Emission, Band Edge, and Restricted bands

4.4.7.1 Regulation

According to §15.247(d) and RSS-247 §5.5 in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a) and RSS-GEN §8.9 Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|----------------|----------------------------------|------------------------------|
| 0.009 - 0.490 | $2\ 400/F(\text{kHz})$ | 300 |
| 0.490 - 1.705 | $24\ 000/F(\text{kHz})$ | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100** | 3 |
| 88 - 216 | 150** | 3 |
| 216 - 960 | 200** | 3 |
| Above 960 | 500 | 3 |

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

According to §15.205(a),(b) and RSS-GEN §8.10 only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|-----------------------|-------------------------|-------------------|---------------|
| 0.009 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| 0.495 - 0.505 | 16.694 75 - 16.695 25 | 608 - 614 | 5.35 - 5.46 |
| 2.173 5 - 2.190 5 | 16.804 25 - 16.804 75 | 960 - 1 240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1 300 - 1 427 | 8.025 - 8.5 |
| 4.177 25 - 4.177 75 | 37.5 - 38.25 | 1 435 - 1 626.5 | 9.0 - 9.2 |
| 4.207 25 - 4.207 75 | 73 - 74.6 | 1 645.5 - 1 646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1 660 - 1 710 | 10.6 - 12.7 |
| 6.267 75 - 6.268 25 | 108 - 121.94 | 1 718.8 - 1 722.2 | 13.25 - 13.4 |
| 6.311 75 - 6.312 25 | 123 - 138 | 2 200 - 2 300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2 310 - 2 390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.524 75 - 156.525 25 | 2 483.5 - 2 500 | 17.7 - 21.4 |
| 8.376 25 - 8.386 75 | 156.7 - 156.9 | 2 690 - 2 900 | 22.01 - 23.12 |
| 8.414 25 - 8.414 75 | 162.012 5 - 167.17 | 3 260 - 3 267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3 332 - 3 339 | 31.2 - 31.8 |
| 12.519 75 - 12.520 25 | 240 - 285 | 3 345.8 - 3 358 | 36.43 - 36.5 |
| 12.576 75 - 12.577 25 | 322 - 335.4 | 3 600 - 4 400 | Above 38.6 |
| 13.36 - 13.41 | | | |

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurement

4.4.7.2 Measurement Procedure

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines
ANSI C63.10 § 6.10.4 Authorized band-edge relative method (lower bandedge)
ANSI C63.10 § 6.10.6 Marker Delta Method (upper restricted bandedge)
ANSI C63.10 § 11.11.1 General Information
ANSI C63.10 § 11.11.3 Emission level measurement

4.4.7.2.1 Band-edge Compliance of RF Conducted Emissions

- Span : wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation
- RBW : $\geq 1\%$ of the span
- VBW : \geq RBW
- Sweep : Auto
- Detector : Peak
- Trace : Max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section. Submit this plot.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit. Submit this plot.

4.4.7.2.2 Conducted Spurious Emissions

Span : wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation
RBW : $\geq 1\%$ of the span
VBW : \geq RBW
Sweep : Auto
Detector : Peak
Trace : Max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section. Submit these plots.

4.4.7.2.3 Radiated Spurious Emissions

- 1) The preliminary and final radiated measurements were performed to determine the frequency producing the maximum emissions in a 10m anechoic chamber. The EUT was tested at a distance 3 m(Below 1 GHz) and 1 m(Above 1 GHz).
- 2) The EUT was placed on the top of the 0.8-meter height, 1×1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360° .
- 3) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1 000 MHz using the BILOG broadband antenna, and from 1 000 MHz to 10 000 MHz using the horn antenna.
- 4) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

Span : wide enough to fully capture the emission being measured
RBW : ≥ 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz
VBW : \geq RBW
Sweep : Auto
Detector : Peak
Trace : Max hold

Follow the guidelines in ANSI C63.4 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

- NOTE1 : The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
NOTE2 : The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
NOTE3 : The 0.8 m height is for below 1 GHz testing, and 1.5 m is for above 1 GHz testing

4.4.7.3 Result

Comply (measurement data : refer to the next page)

4.4.7.4 Measurement data_Radiated Spurious Emissions

Test mode : Below 1 GHz_GFSK_Lowest Frequency(Antenna 2)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Ant Factor (dB) | Loss (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|--------------|------------|----------------------|-----------------|-----------|-----------------------|----------------------|-------------|
| Below 1 GHz | Not Detected | - | - | - | - | - | - | - |

Note 1 : Loss : Cable loss – Amp gain

Note 2 : Result : Reading + Ant Factor + Loss

Note 3 : Limit of excluding Restrictband($30 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$) : Reference(116.3 dB μ V/m) -20 Db

Note 4 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : Below 1 GHz_GFSK_Middle Frequency(Antenna 2)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Ant Factor (dB) | Loss (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|--------------|------------|----------------------|-----------------|-----------|-----------------------|----------------------|-------------|
| Below 1 GHz | Not Detected | - | - | - | - | - | - | - |

Note 1 : Loss : Cable loss – Amp gain

Note 2 : Result : Reading + Ant Factor + Loss

Note 3 : Limit of excluding Restrictband($30 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$) : Reference(116 dB μ V/m) -20 dB

Note 4 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : Below 1 GHz_GFSK_Highest Frequency(Antenna 2)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Ant Factor (dB) | Loss (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|--------------|------------|----------------------|-----------------|-----------|-----------------------|----------------------|-------------|
| Below 1 GHz | Not Detected | - | - | - | - | - | - | - |

Note 1 : Loss : Cable loss – Amp gain

Note 2 : Result : Reading + Ant Factor + Loss

Note 3 : Limit of excluding Restrictband($30 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$) : Reference(118.4 dB μ V/m) -20 dB

Note 4 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : Below 1 GHz_GFSK_Lowest Frequency(Antenna 3)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Ant Factor (dB) | Loss (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-----------------|-----------|-----------------------|----------------------|-------------|
| 997.063 | PK | H | 41.10 | 24.80 | -18.40 | 47.50 | 54.00 | 6.50 |

Note 1 : Loss : Cable loss – Amp gain

Note 2 : Result : Reading + Ant Factor + Loss

Note 3 : Limit of excluding Restricband($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$) : Reference(120 dB μ V/m) -20 dB

Note 4 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : Below 1 GHz_GFSK_Middle Frequency(Antenna 3)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Ant Factor (dB) | Loss (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|--------------|------------|----------------------|-----------------|-----------|-----------------------|----------------------|-------------|
| Below 1 GHz | Not Detected | - | - | - | - | - | - | - |

Note 1 : Loss : Cable loss – Amp gain

Note 2 : Result : Reading + Ant Factor + Loss

Note 3 : Limit of excluding Restricband($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$) : Reference(120.2 dB μ V/m) -20 dB

Note 4 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : Below 1 GHz_GFSK_Highest Frequency(Antenna 3)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Ant Factor (dB) | Loss (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|--------------|------------|----------------------|-----------------|-----------|-----------------------|----------------------|-------------|
| Below 1 GHz | Not Detected | - | - | - | - | - | - | - |

Note 1 : Loss : Cable loss – Amp gain

Note 2 : Result : Reading + Ant Factor + Loss

Note 3 : Limit of excluding Restricband($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$) : Reference(120.4 dB μ V/m) -20 dB

Note 4 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : Above 1 GHz_GFSK_Lowest Frequency(Antenna 2)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Factor (dB) | Duty Cycle Factor (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-------------|------------------------|-----------------------|----------------------|-------------|
| 2 709.17 | PK | H | 67.30 | -3.90 | - | 63.36 | 74.00 | 10.64 |
| | AV | H | 45.30 | -3.90 | -28.69 | 12.67 | 54.00 | 41.33 |
| 3 612.24 | PK | H | 57.90 | -2.30 | - | 55.56 | 74.00 | 18.44 |
| | AV | H | 39.40 | -2.30 | -28.69 | 8.37 | 54.00 | 45.63 |
| 7 224.86 | PK | V | 53.40 | 4.10 | - | 57.46 | 74.00 | 16.54 |
| | AV | V | 38.50 | 4.10 | -28.69 | 13.87 | 54.00 | 40.13 |

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor

Note 2 : Peak Result : Reading + Factor

Note 3 : Duty Cycle Factor : $20 \times \log(\text{Worst Case Dwell Time} / 100\text{ms})$ dB, refer to 4.4.7.7

Average Result : Reading + Factor + Duty Cycle Factor

Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m

Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Note 5 : Average measurement did not take place because the peak data did not exceed Average Limit.

Note 6 : Not Detected means that peak data does not exceed the average limit.

Test mode : Above 1 GHz_GFSK_Middle Frequency(Antenna 2)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Factor (dB) | Duty Cycle Factor (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-------------|------------------------|-----------------------|----------------------|-------------|
| 2 745.23 | PK | H | 70.00 | -3.90 | - | 66.06 | 74.00 | 7.94 |
| | AV | H | 48.30 | -3.90 | -28.69 | 15.67 | 54.00 | 38.33 |
| 3 660.04 | PK | H | 59.30 | -2.10 | - | 57.16 | 74.00 | 16.84 |
| | AV | H | 38.90 | -2.10 | -28.69 | 8.07 | 54.00 | 45.93 |
| 6 405.60 | PK | H | 53.00 | 2.80 | - | 55.76 | 74.00 | 18.24 |
| | AV | H | 38.60 | 2.80 | -28.69 | 12.67 | 54.00 | 41.33 |

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor

Note 2 : Peak Result : Reading + Factor

Note 3 : Duty Cycle Factor : $20 \times \log(\text{Worst Case Dwell Time} / 100\text{ms})$ dB, refer to 4.4.7.7

Average Result : Reading + Factor + Duty Cycle Factor

Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m

Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Note 5 : Average measurement did not take place because the peak data did not exceed Average Limit.

Note 6 : Not Detected means that peak data does not exceed the average limit.

Test mode : Above 1 GHz_GFSK_Highest Frequency(Antenna 2)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Factor (dB) | Duty Cycle Factor (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-------------|------------------------|-----------------------|----------------------|-------------|
| 2 779.24 | PK | H | 60.90 | -3.90 | - | 56.96 | 74.00 | 17.04 |
| | AV | H | 43.20 | -3.90 | -28.69 | 10.57 | 54.00 | 43.43 |
| 3 705.78 | PK | H | 63.60 | -1.90 | - | 61.66 | 74.00 | 12.34 |
| | AV | H | 43.80 | -1.90 | -28.69 | 13.17 | 54.00 | 40.83 |
| 6 486.30 | PK | H | 54.50 | 2.80 | - | 57.26 | 74.00 | 16.74 |
| | AV | H | 38.90 | 2.80 | -28.69 | 12.97 | 54.00 | 41.03 |

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor

Note 2 : Peak Result : Reading + Factor

Note 3 : Duty Cycle Factor : $20 \times \log(\text{Worst Case Dwell Time} / 100\text{ms})$ dB, refer to 4.4.7.7

Average Result : Reading + Factor + Duty Cycle Factor

Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m

Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Note 5 : Average measurement did not take place because the peak data did not exceed Average Limit.

Note 6 : Not Detected means that peak data does not exceed the average limit.

Test mode : Above 1 GHz_GFSK_Lowest Frequency(Antenna 3)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Factor (dB) | Duty Cycle Factor (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-------------|------------------------|-----------------------|----------------------|-------------|
| 1 806.02 | PK | V | 70.50 | -8.00 | - | 62.46 | 74.00 | 11.54 |
| | AV | V | 48.30 | -8.00 | -28.69 | 11.57 | 54.00 | 42.43 |
| 2 709.05 | PK | H | 74.40 | -3.90 | - | 70.46 | 74.00 | 3.54 |
| | AV | H | 49.30 | -3.90 | -28.69 | 16.67 | 54.00 | 37.33 |
| 5 418.55 | PK | V | 63.20 | 1.30 | - | 64.46 | 74.00 | 9.54 |
| | AV | V | 42.50 | 1.30 | -28.69 | 15.07 | 54.00 | 38.93 |

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor

Note 2 : Peak Result : Reading + Factor

Note 3 : Duty Cycle Factor : $20 \times \log(\text{Worst Case Dwell Time} / 100\text{ms})$ dB, refer to 4.4.7.7

Average Result : Reading + Factor + Duty Cycle Factor

Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m

Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Note 5 : Average measurement did not take place because the peak data did not exceed Average Limit.

Note 6 : Not Detected means that peak data does not exceed the average limit.

Test mode : Above 1 GHz_GFSK_Middle Frequency(Antenna 3)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Factor (dB) | Duty Cycle Factor (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-------------|------------------------|-----------------------|----------------------|-------------|
| 2 745.26 | PK | V | 70.30 | -3.90 | - | 66.36 | 74.00 | 7.64 |
| | AV | V | 50.10 | -3.90 | -28.69 | 17.47 | 54.00 | 36.53 |
| 2 745.26 | PK | H | 69.50 | -3.90 | - | 65.56 | 74.00 | 8.44 |
| | AV | H | 48.60 | -3.90 | -28.69 | 15.97 | 54.00 | 38.03 |
| 3 660.08 | PK | H | 65.20 | -2.00 | - | 63.16 | 74.00 | 10.84 |
| | AV | H | 42.40 | -2.00 | -28.69 | 11.67 | 54.00 | 42.33 |

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor

Note 2 : Peak Result : Reading + Factor

Note 3 : Duty Cycle Factor : $20 \times \log(\text{Worst Case Dwell Time} / 100\text{ms})$ dB, refer to 4.4.7.7

Average Result : Reading + Factor + Duty Cycle Factor

Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m

Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Note 5 : Average measurement did not take place because the peak data did not exceed Average Limit.

Note 6 : Not Detected means that peak data does not exceed the average limit.

Test mode : Above 1 GHz_GFSK_Highest Frequency(Antenna 3)

| Frequency (MHz) | Detector | Pol. (V/H) | Reading (dB μ V) | Factor (dB) | Duty Cycle Factor (dB) | Result (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) |
|-----------------|----------|------------|----------------------|-------------|------------------------|-----------------------|----------------------|-------------|
| 1852.74 | PK | H | 69.50 | -7.50 | - | 61.96 | 74.00 | 12.04 |
| | AV | H | 45.70 | -7.50 | -28.69 | 9.47 | 54.00 | 44.53 |
| 2780.21 | PK | H | 63.30 | -3.90 | - | 59.36 | 74.00 | 14.64 |
| | AV | H | 40.50 | -3.90 | -28.69 | 7.87 | 54.00 | 46.13 |
| 3706.18 | PK | H | 62.50 | -1.90 | - | 60.56 | 74.00 | 13.44 |
| | AV | H | 41.70 | -1.90 | -28.69 | 11.07 | 54.00 | 42.93 |

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor

Note 2 : Peak Result : Reading + Factor

Note 3 : Duty Cycle Factor : $20 \times \log(\text{Worst Case Dwell Time} / 100\text{ms})$ dB, refer to 4.4.7.7

Average Result : Reading + Factor + Duty Cycle Factor

Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m

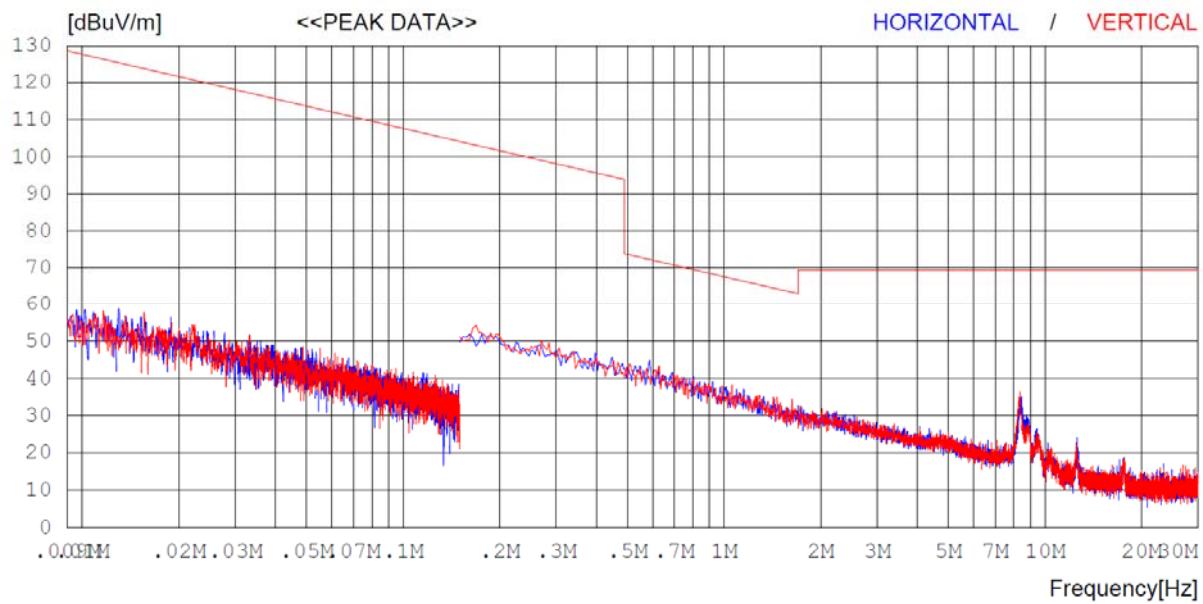
Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Note 5 : Average measurement did not take place because the peak data did not exceed Average Limit.

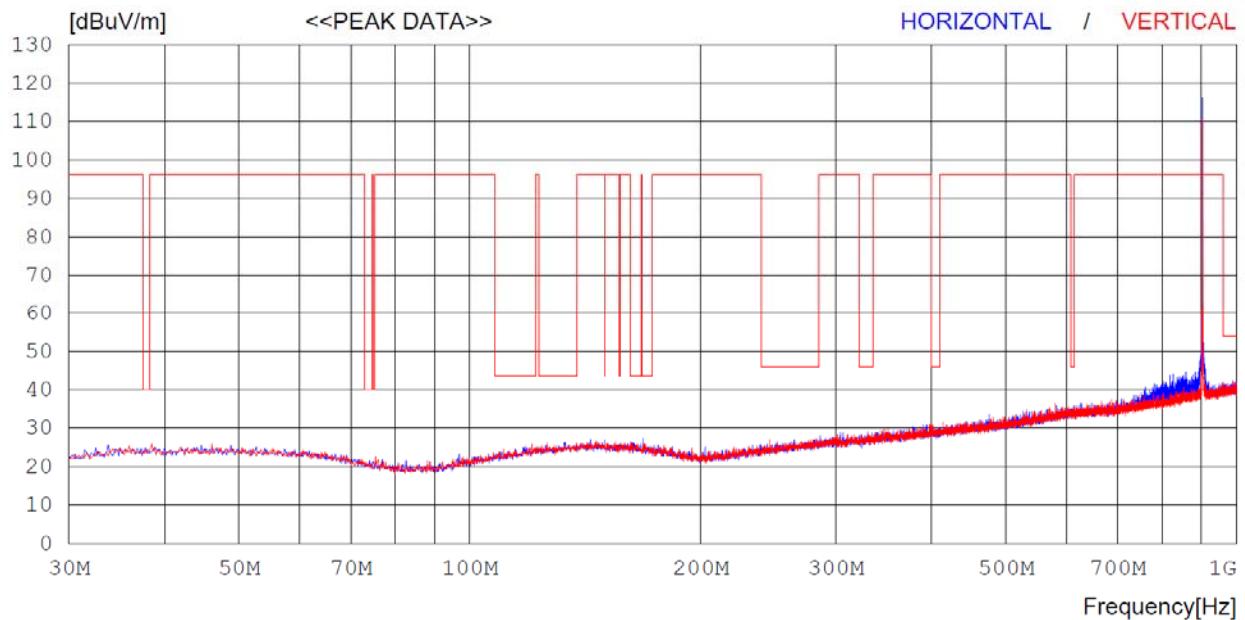
Note 6 : Not Detected means that peak data does not exceed the average limit.

4.4.7.5 Measurement Plot_Radiated Spurious Emissions

Test mode : 9 kHz ~ 30 MHz Worst Case(GFSK_Lowest Frequency_Antenna 3)

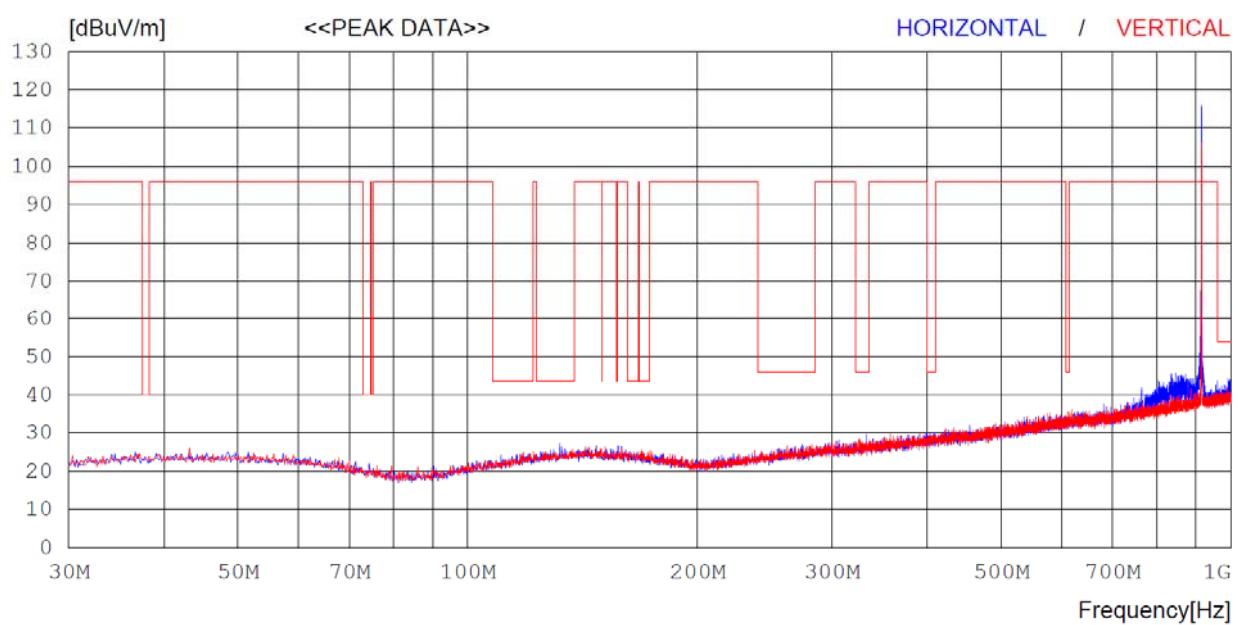


Test mode : 30 MHz ~ 1 GHz(GFSK_Lowest Frequency_Antenna 2)



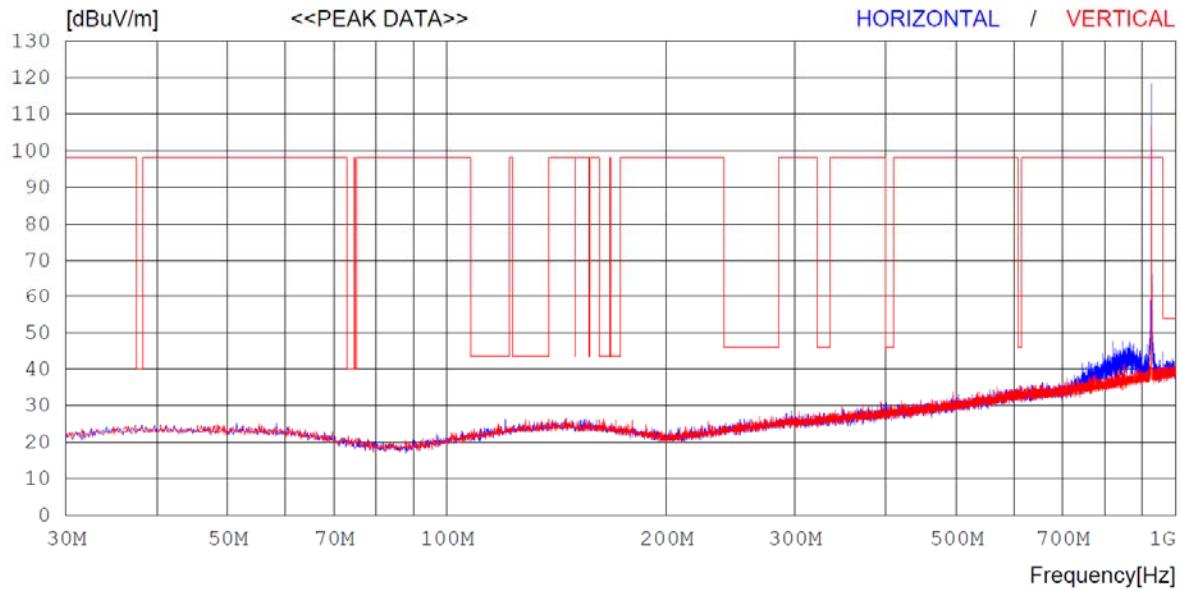
Note 1 : 903.073 MHz = Reference(116.3 dB μ V/m)

Test mode : 30 MHz ~ 1 GHz(GFSK_Middle Frequency_Antenna 2)



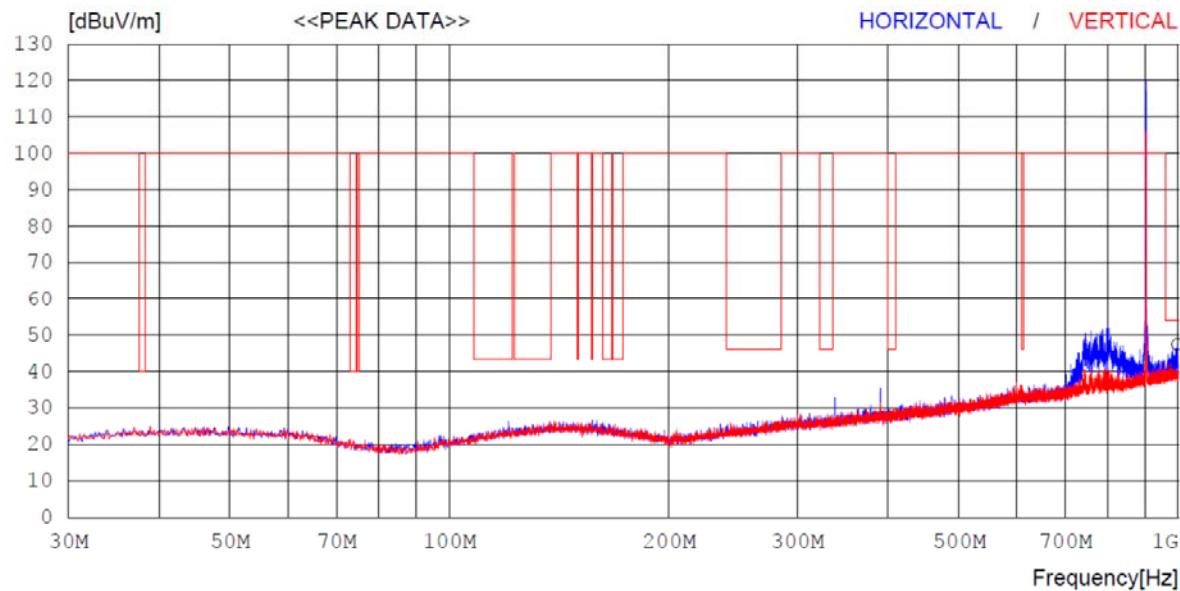
Note 1 : 915.201 MHz = Reference(116.0 dB μ V/m)

Test mode : 30 MHz ~ 1 GHz(GFSK_Highest Frequency_Antenna 2)



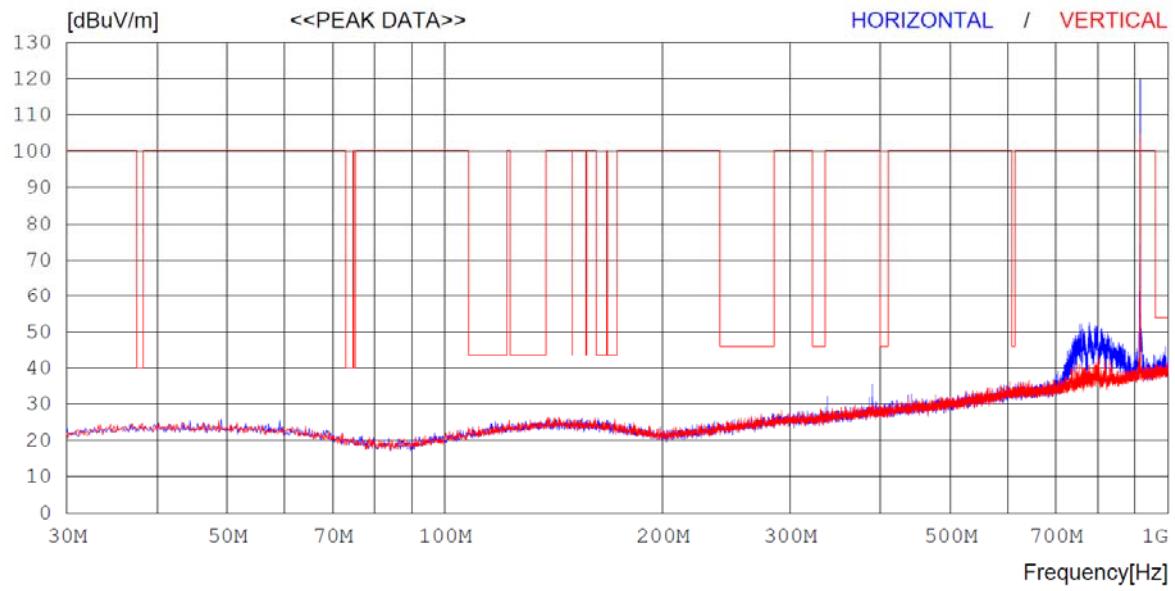
Note 1 : 926.601 MHz = Reference(118.4 dB μ V/m)

Test mode : 30 MHz ~ 1 GHz(GFSK_Lowest Frequency_Antenna 3)



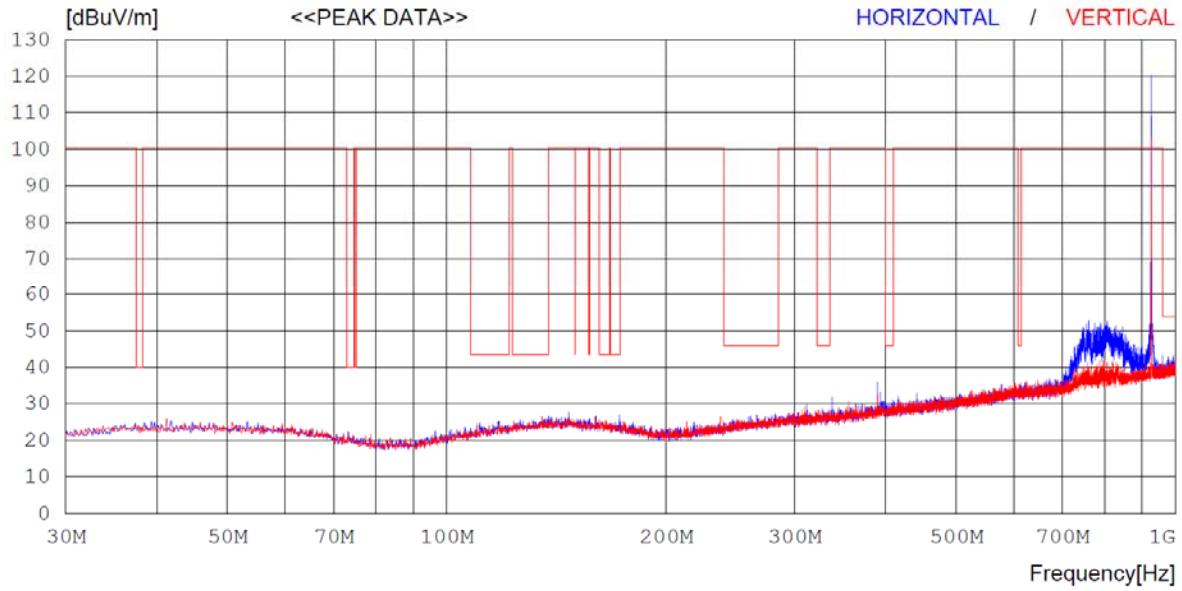
Note 1 : 903.194 MHz = Reference(120.0 dB μ V/m)

Test mode : 30 MHz ~ 1 GHz(GFSK_Middle Frequency_Antenna 3)



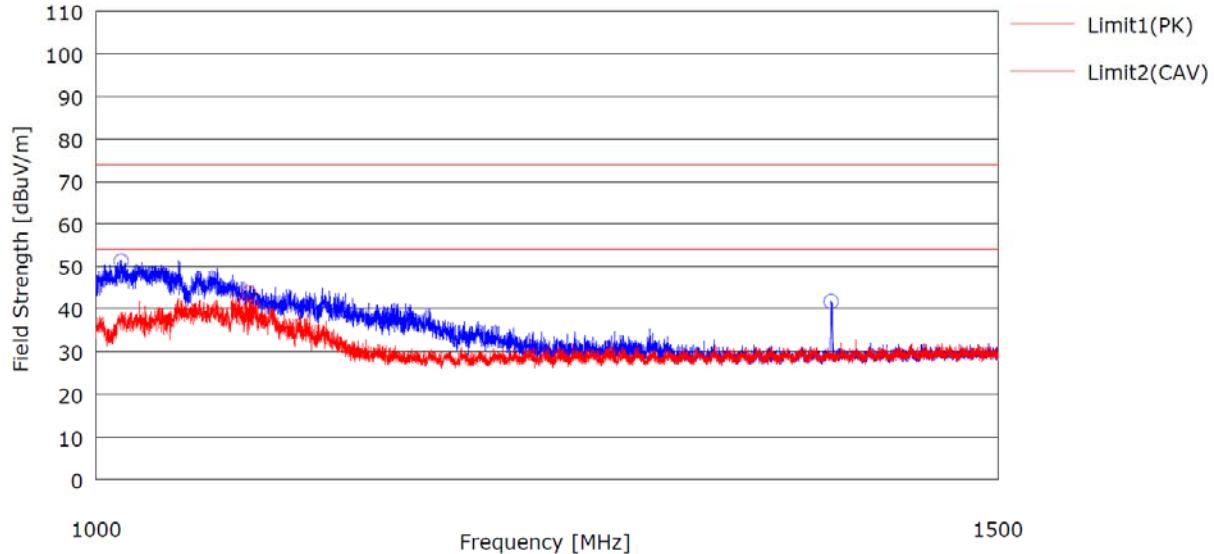
Note 1 : 915.201 MHz = Reference(120.2 dB μ V/m)

Test mode : 30 MHz ~ 1 GHz(GFSK_Highest Frequency_Antenna 3)



Note 1 : 926.722 MHz = Reference(120.4 dB μ V/m)

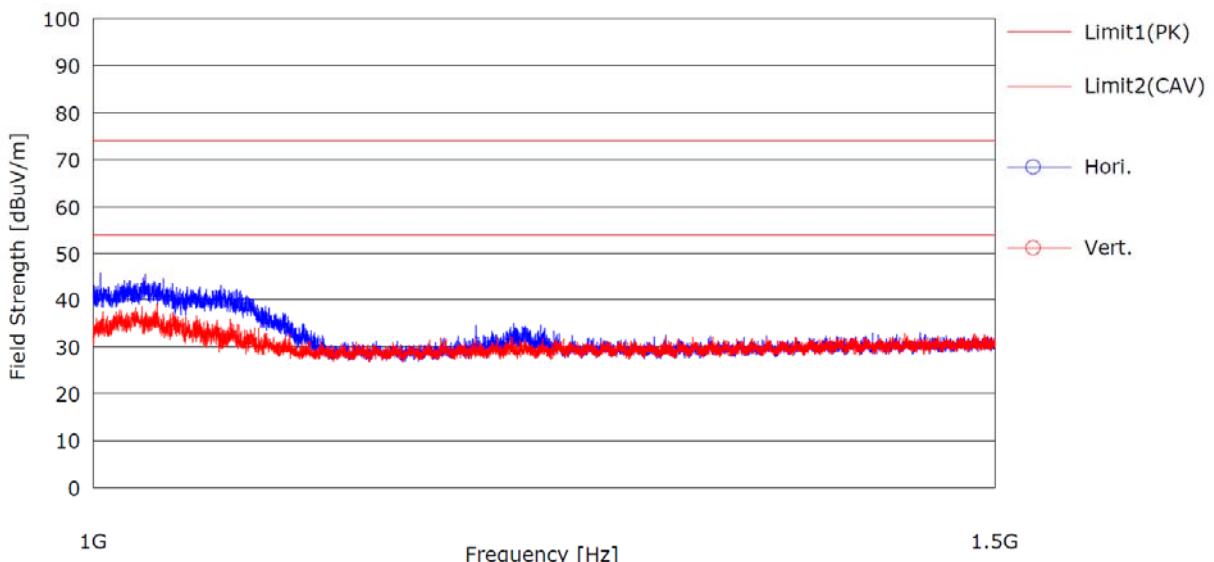
Test mode : 1 GHz ~ 1.5GHz Worst Case(GFSK_Highest Frequency_Antenna 2)



Note 1 : Measured distance : 1 m

Note 2 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m
 Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

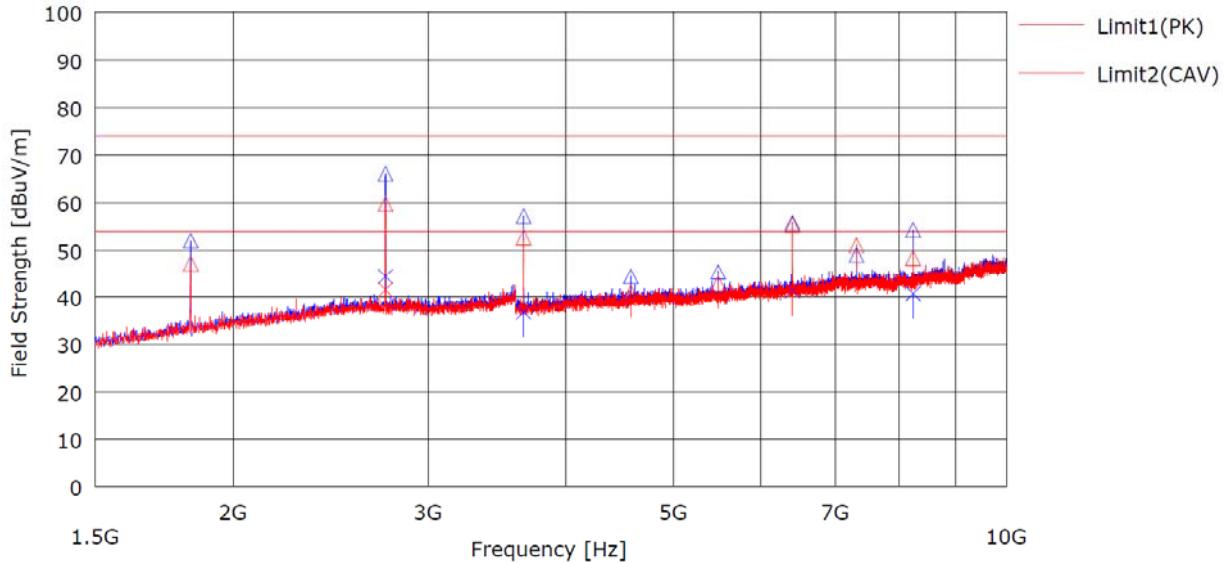
Test mode : 1 GHz ~ 1.5GHz Worst Case(GFSK_Lowest Frequency_Antenna 3)



Note 1 : Measured distance : 1 m

Note 2 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m
 Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

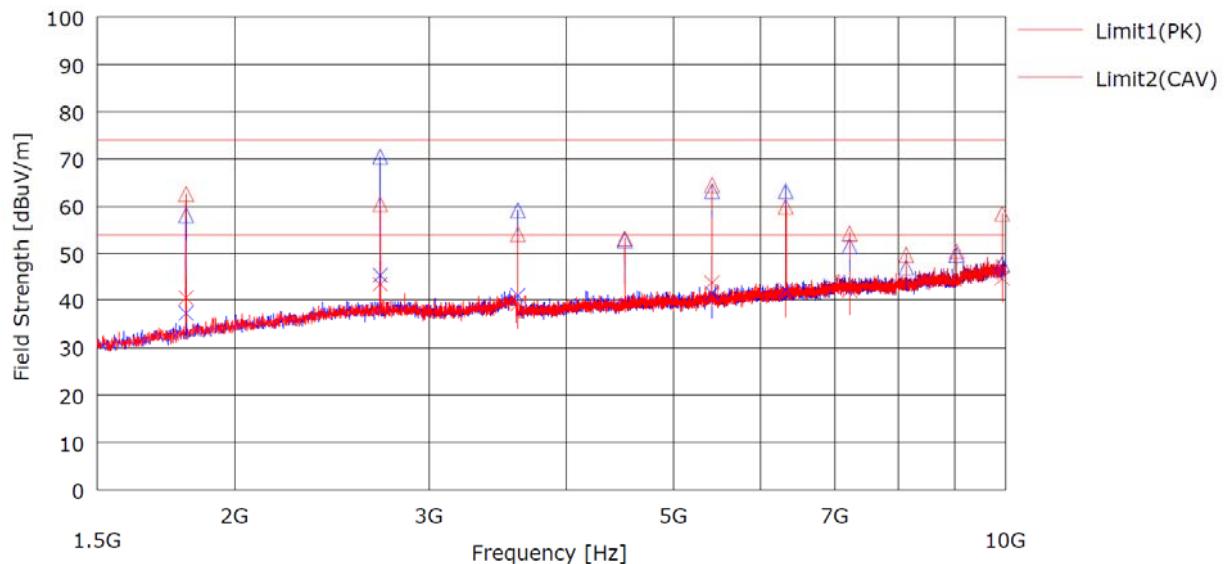
Test mode : 1.5 GHz ~ 10 GHz Worst Case(GFSK_Middle Frequency_Antenna 2)



Note 1 : Measured distance : 1 m

Note 2 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m
 Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

Test mode : 1.5 GHz ~ 10 GHz Worst Case(GFSK_Lowest Frequency_Antenna 3)

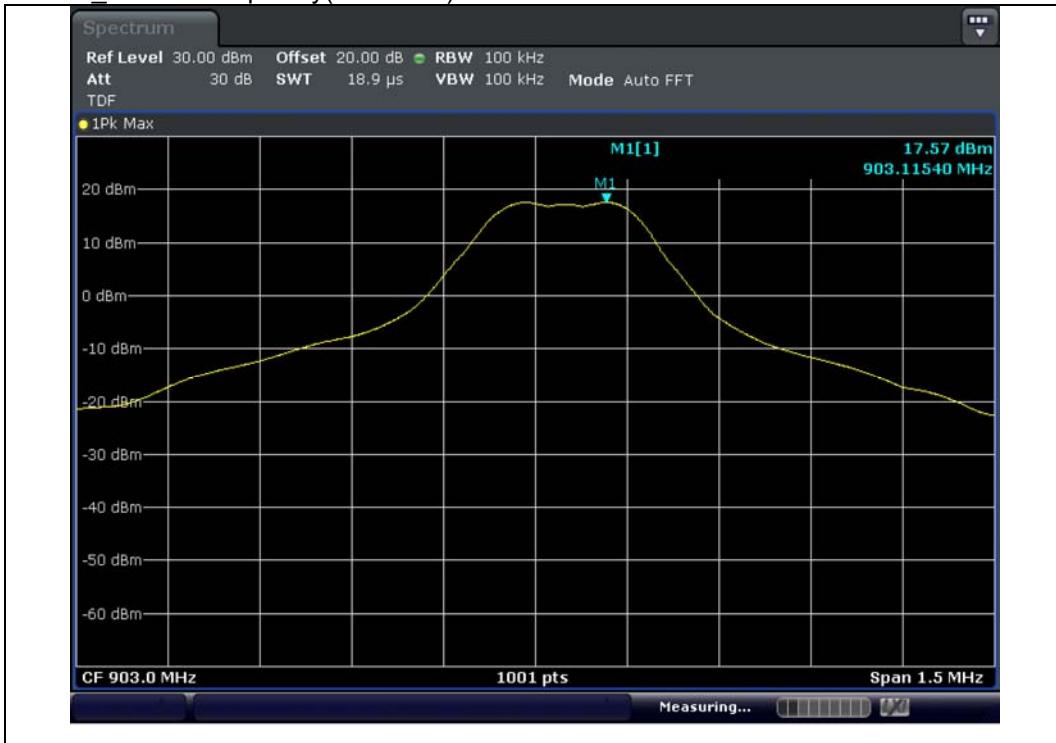


Note 1 : Measured distance : 1 m

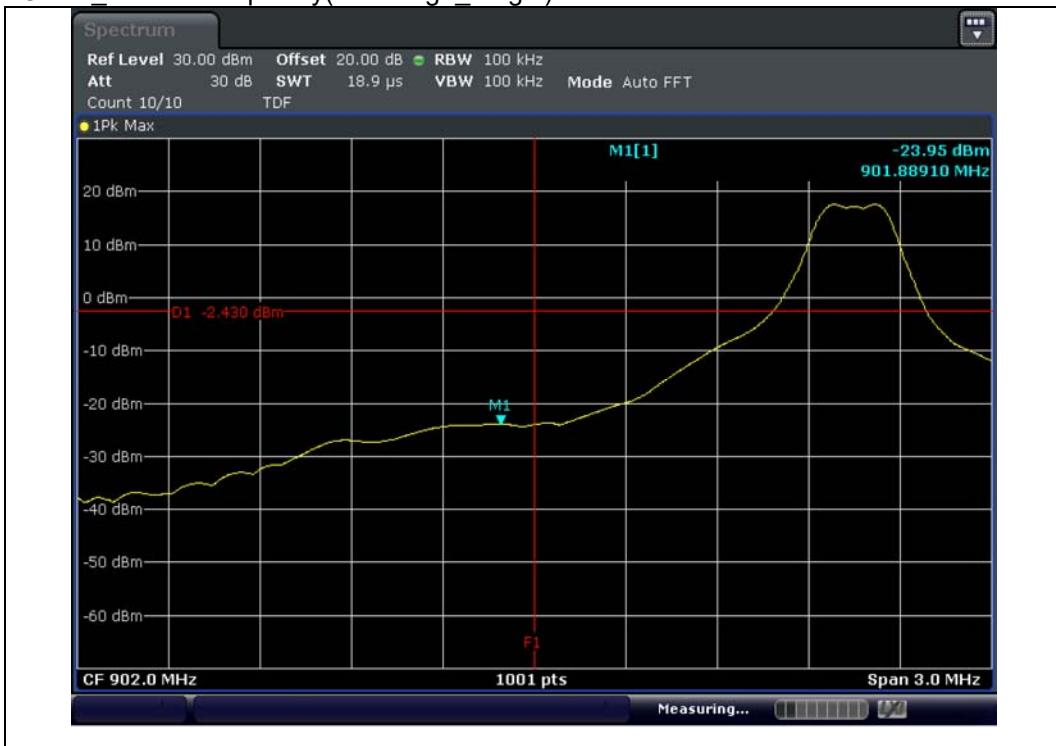
Note 2 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m
 Above 1 GHz Distance Factor = $20\log(1 / 3) = -9.54$

4.4.7.6 Measurement data_Conducted Spurious Emissions

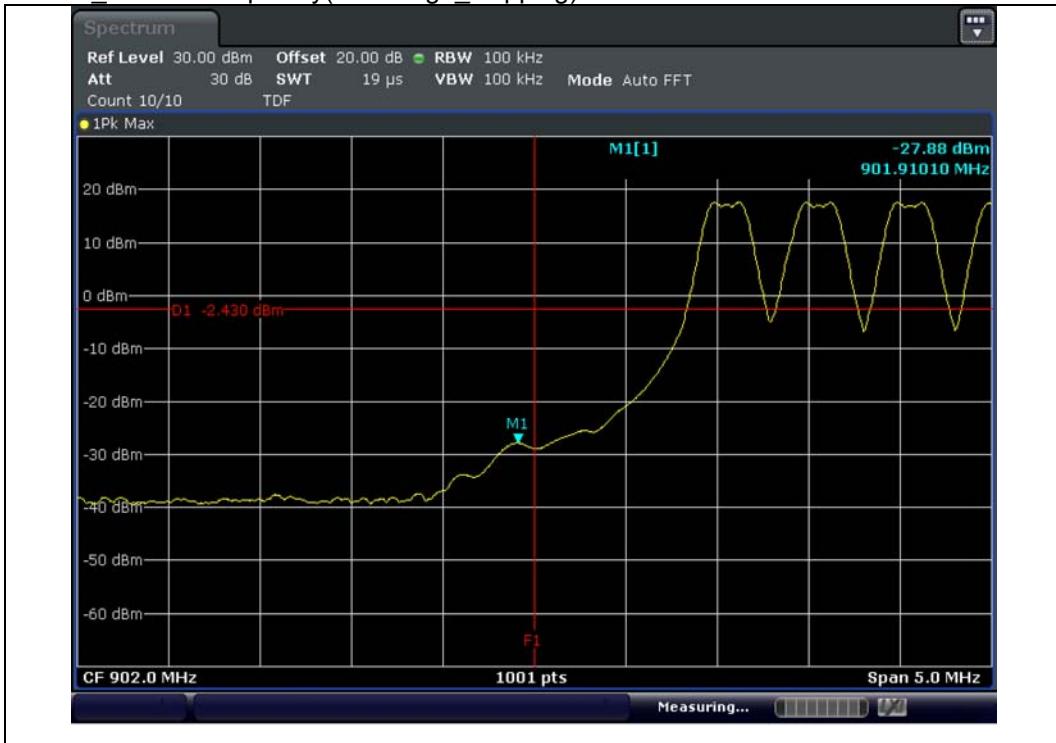
GFSK_Lowest Frequency(reference)



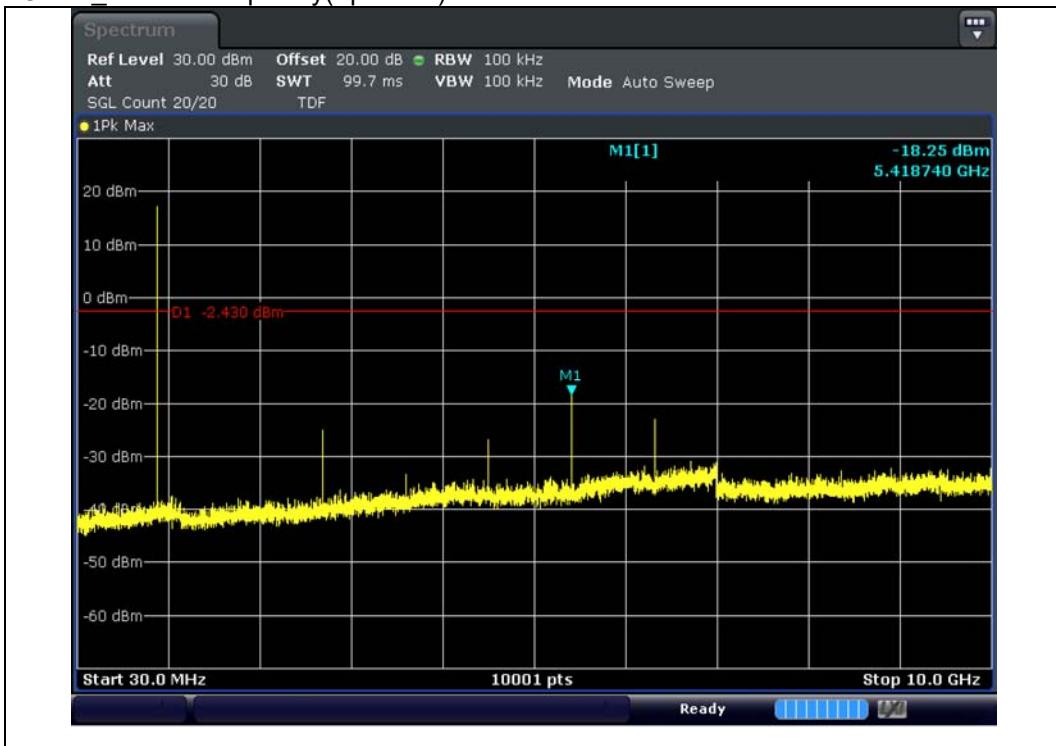
GFSK_Lowest Frequency(Bandedge_Single)



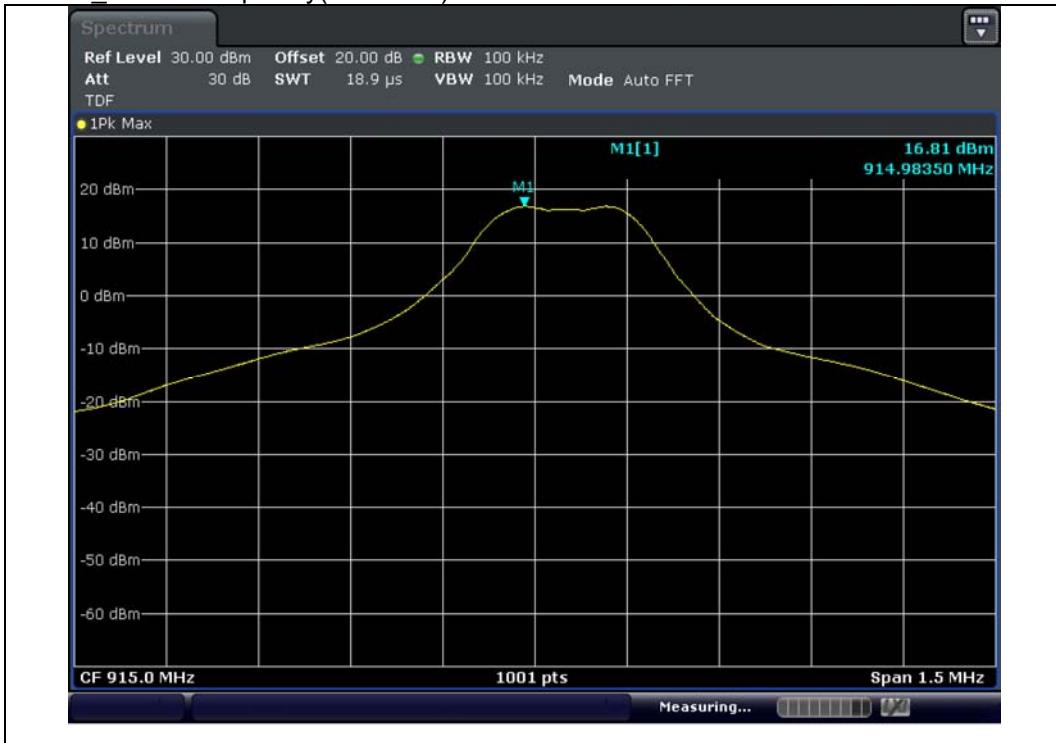
GFSK_Lowest Frequency(Bandedge_Hopping)



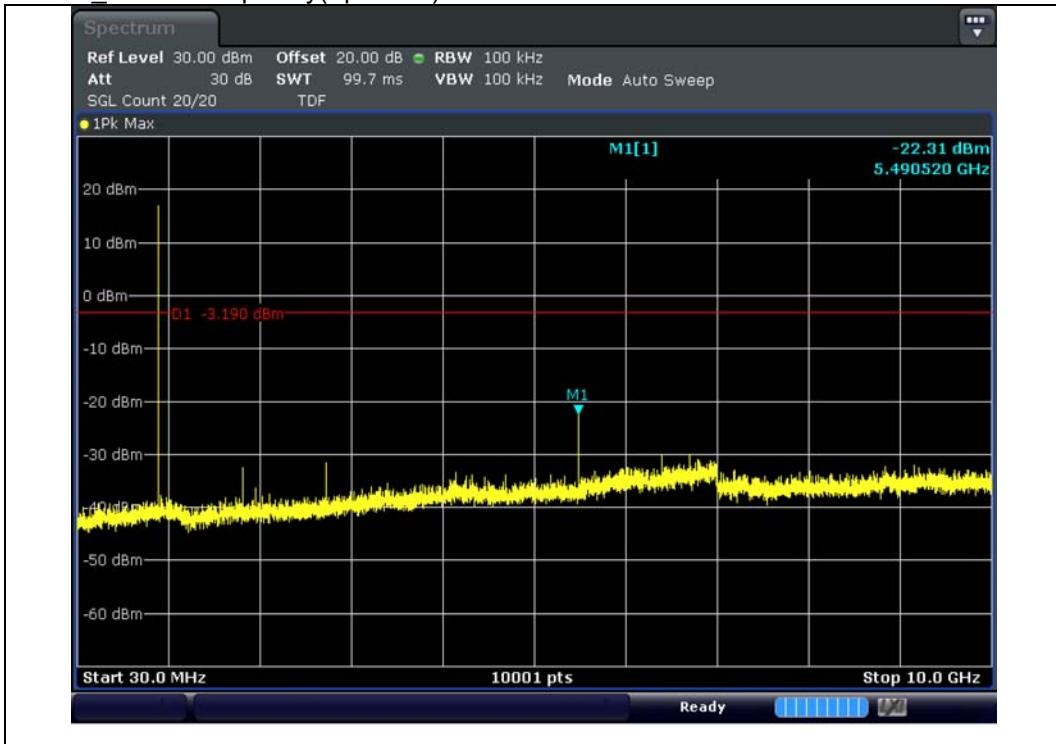
GFSK_Lowest Frequency(Spurious)



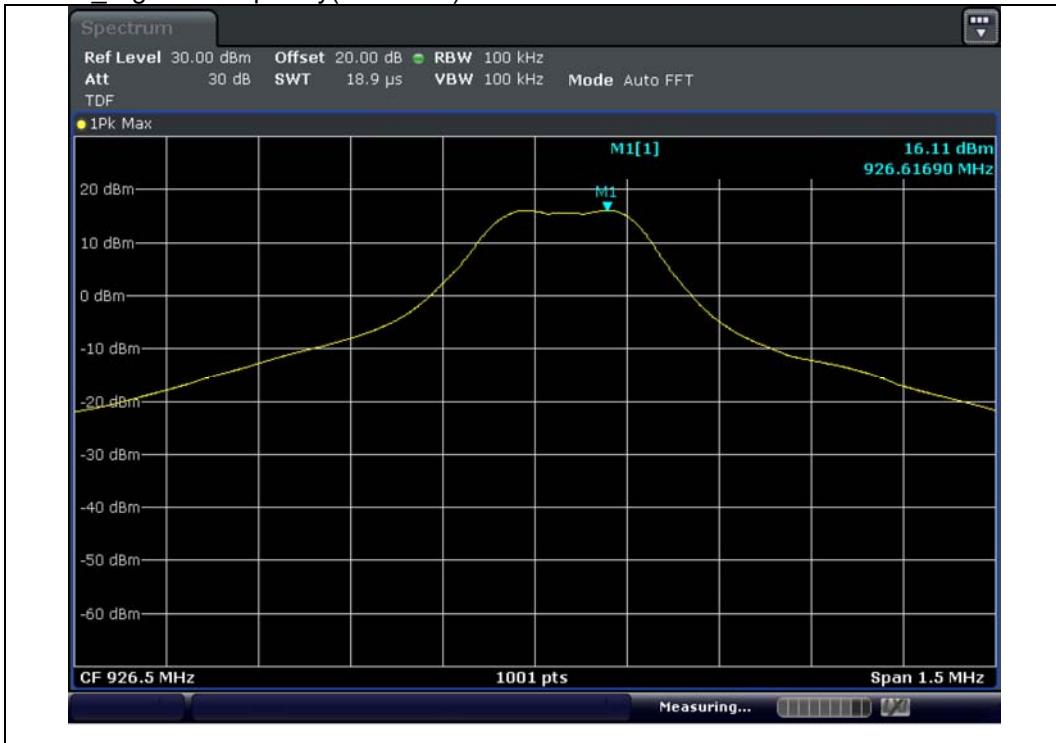
GFSK_Middle Frequency(reference)



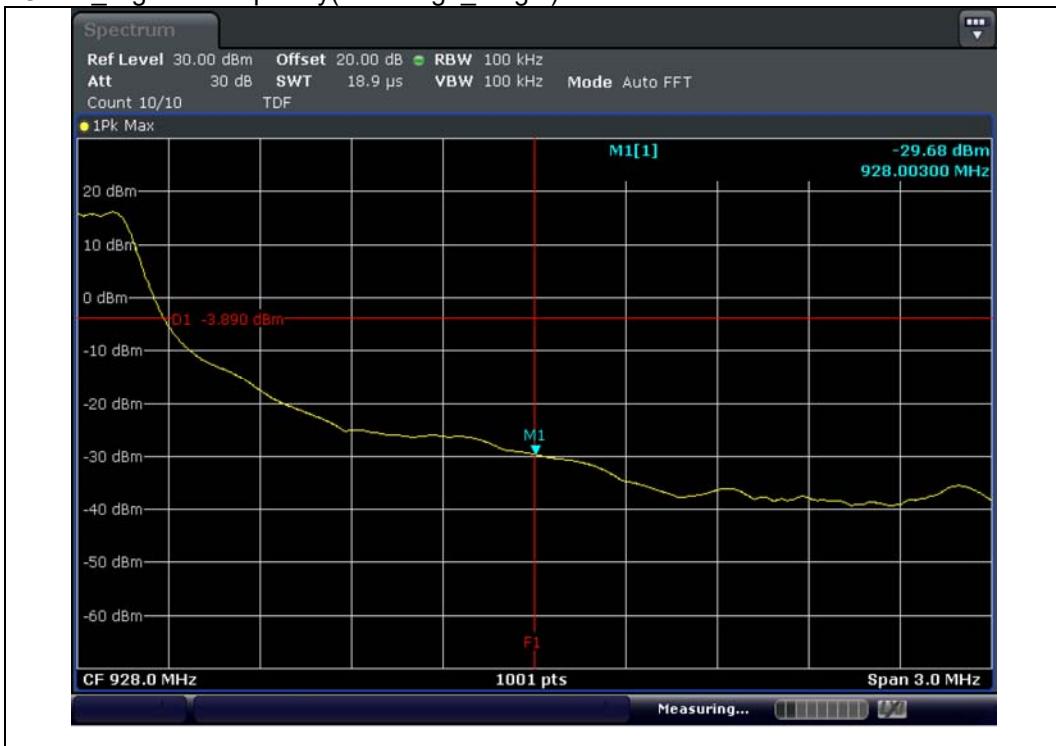
GFSK_Middle Frequency(Spurious)



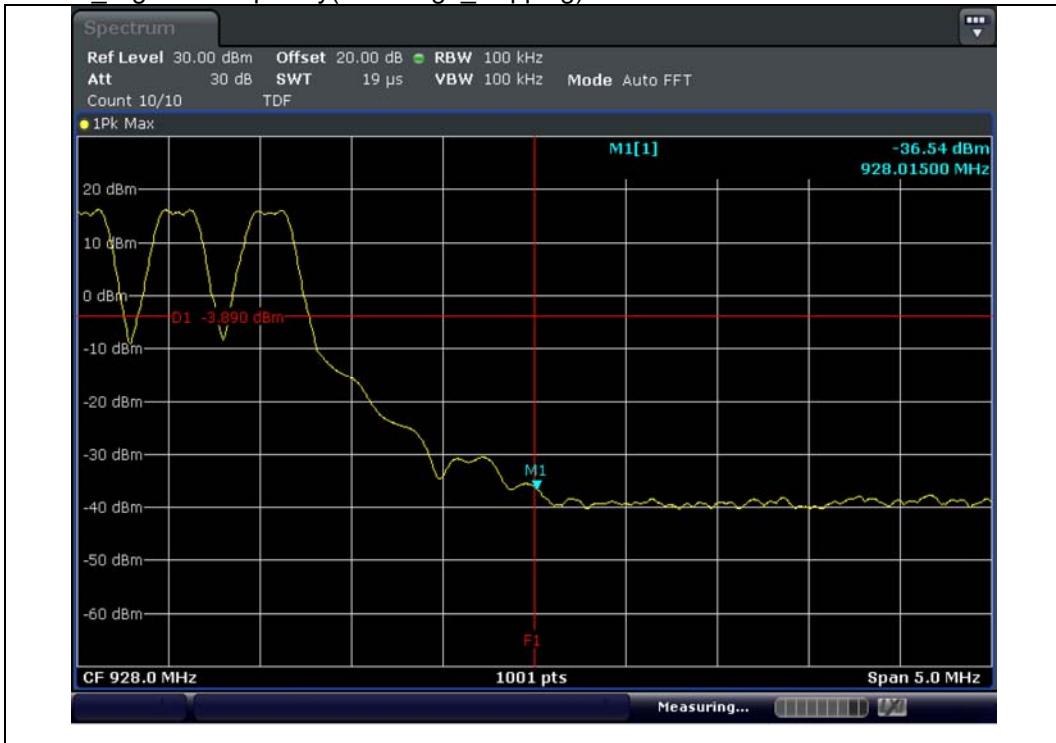
GFSK_Highest Frequency(reference)



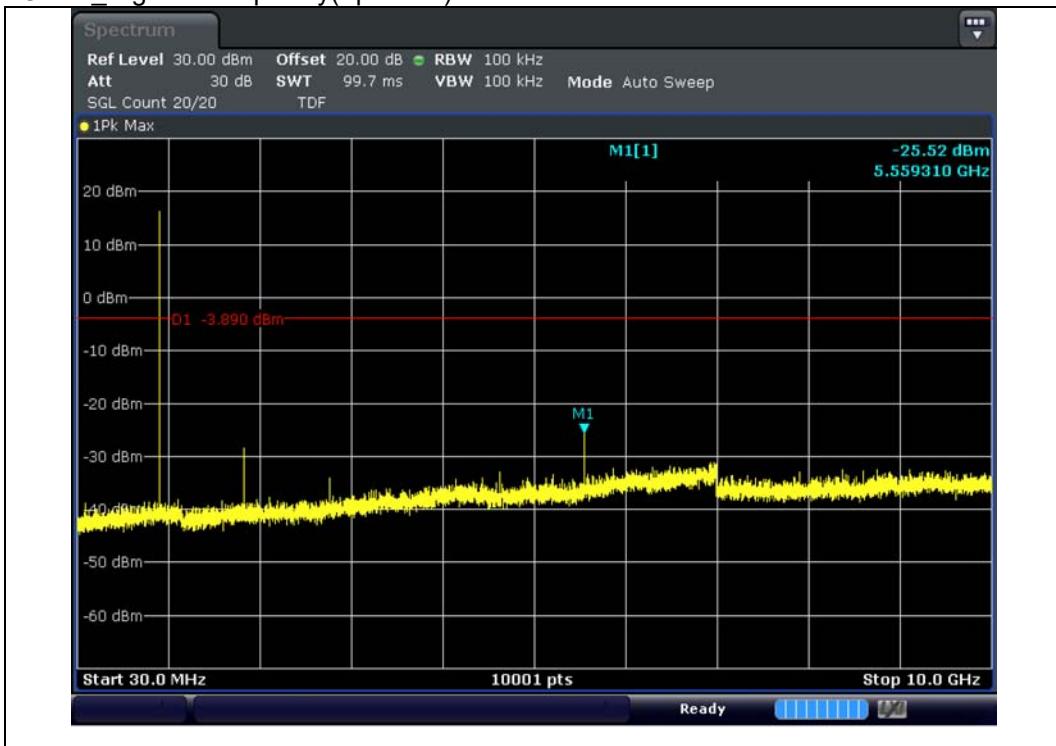
GFSK_Highest Frequency(Bandedge_Single)



GFSK_Highest Frequency(Bandedge_Hopping)

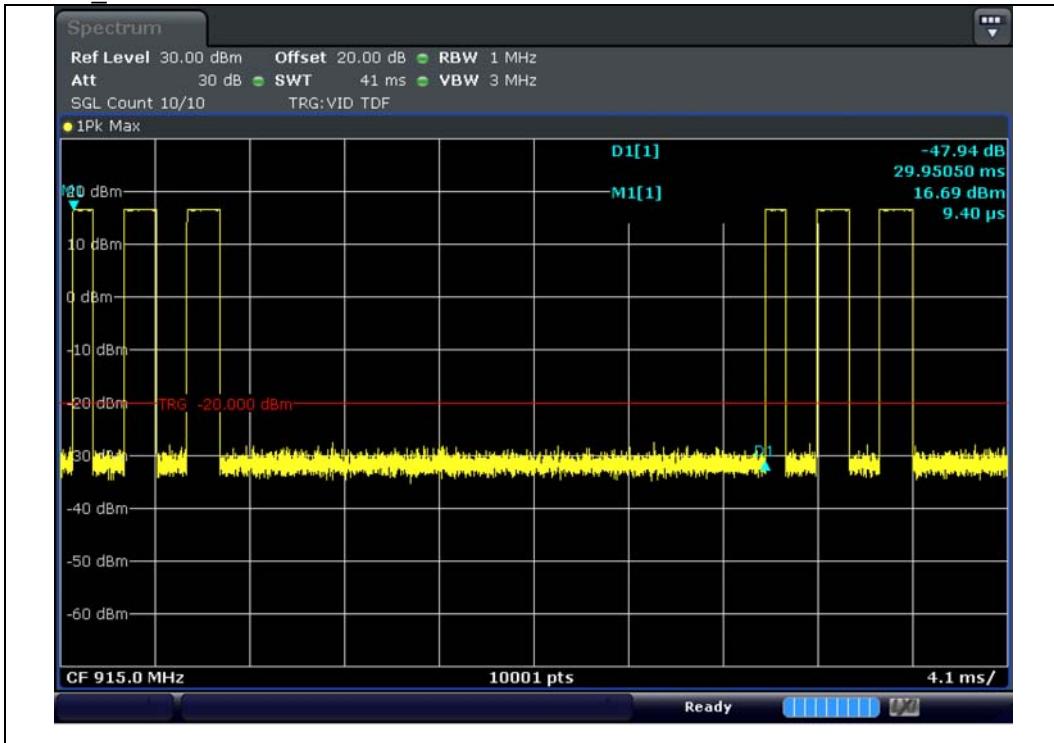


GFSK_Highest Frequency(Spurious)

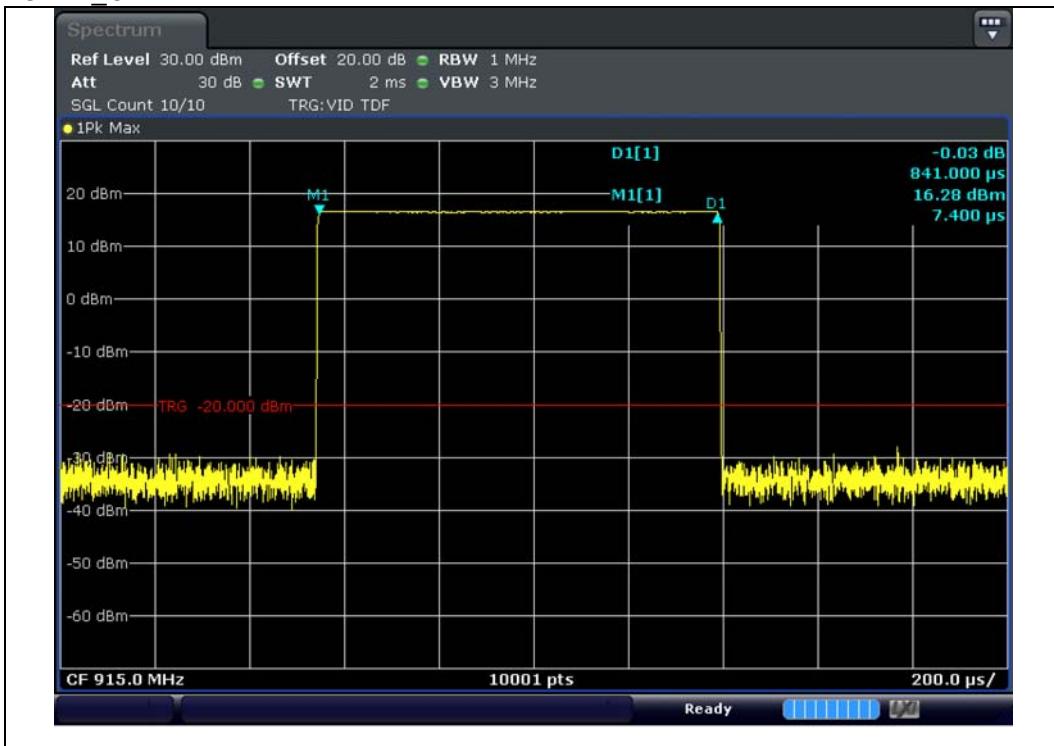


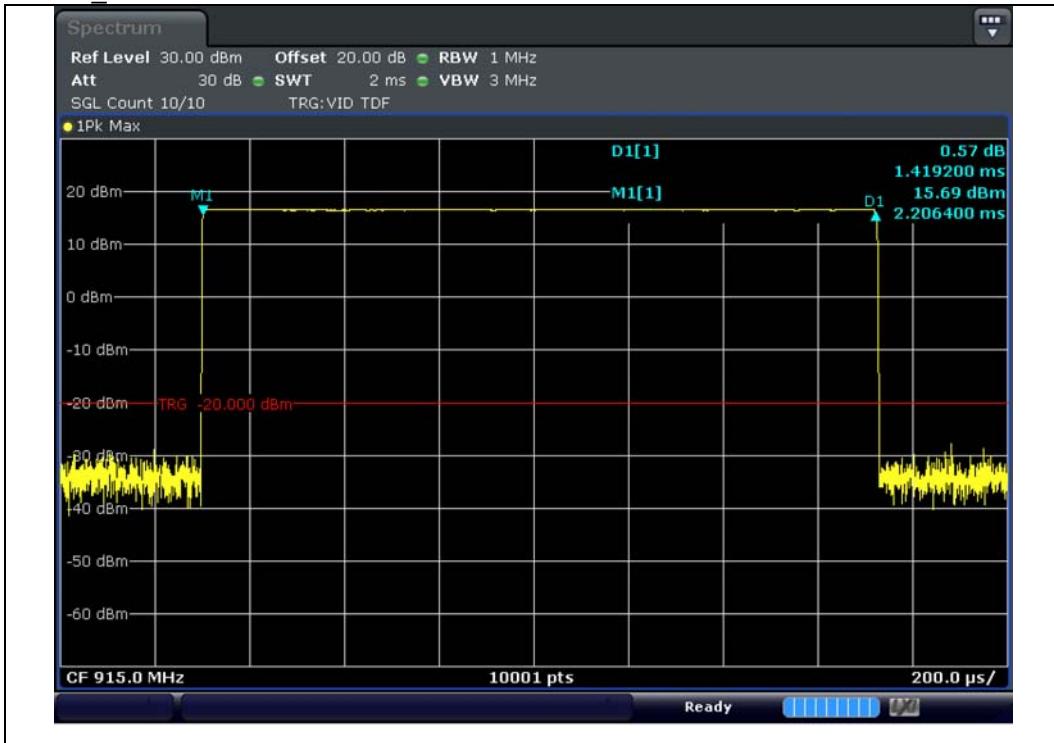
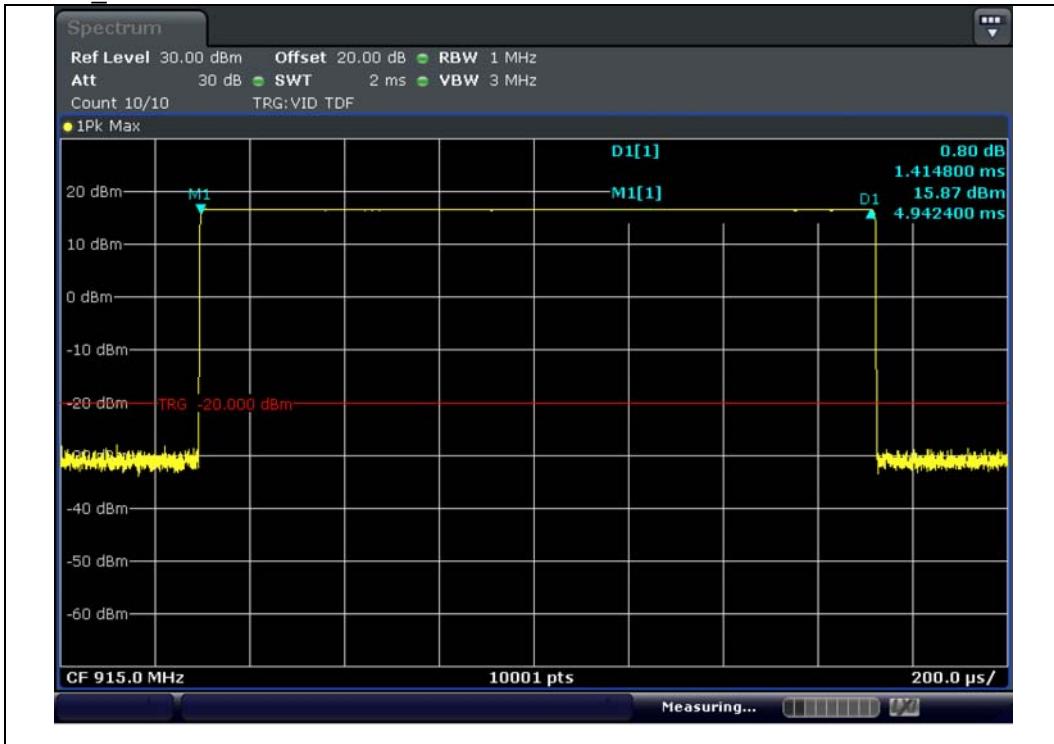
4.4.7.7 Measurement Plot_Dutycycle

GFSK_Period



GFSK_On time 1



GFSK_On time 2

GFSK_On time 3


NOTE: Dwell time: on time*No. of hop
 Dutycycle Factor : $20\log((0.841+1.4192+1.4148)*1)/100 = -28.69$

4.4.8 Conducted Emission

4.4.8.1 Regulation

According to §15.207(a) and RSS-GEN §8.8 for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

4.4.8.2 Measurement Procedure

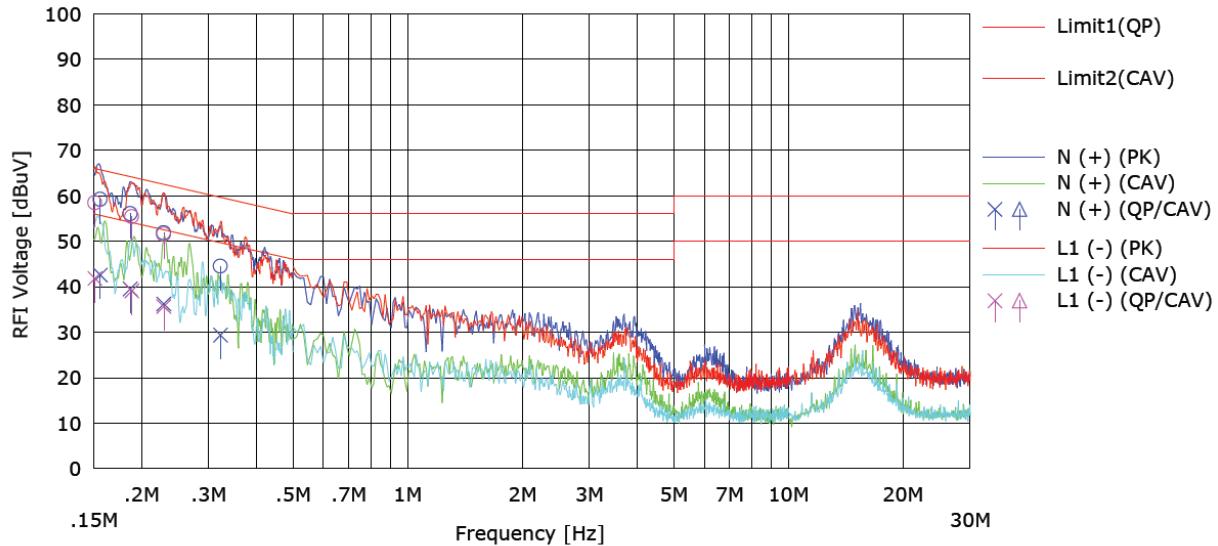
- 1) The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.
- 2) Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
- 3) Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
- 4) The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
- 5) The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASIEPICK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

4.4.8.3 Result

Comply (measurement data : refer to the next page)

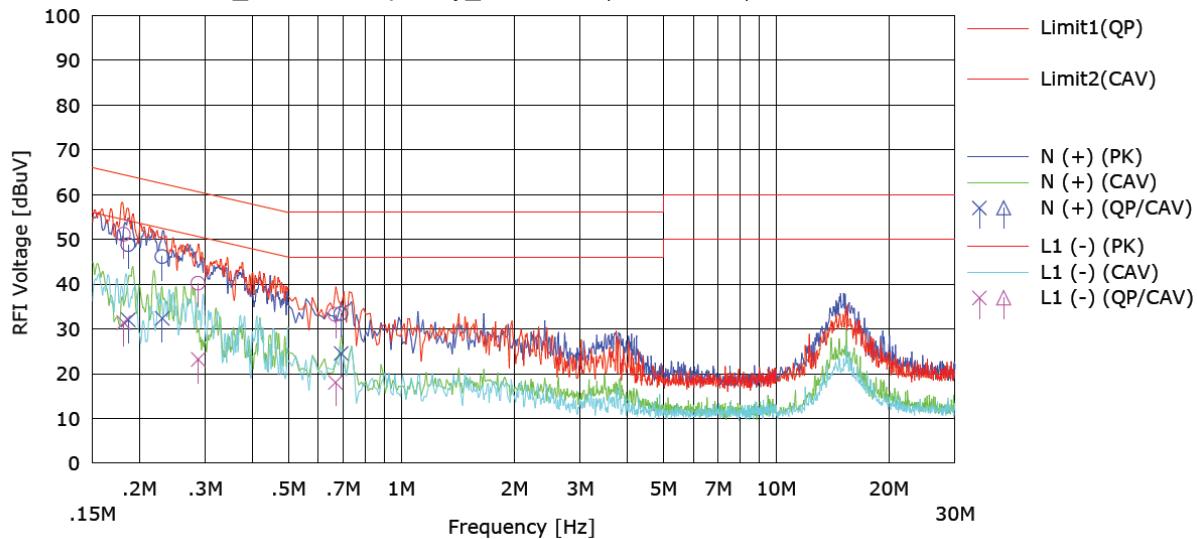
4.4.8.4 Measurement data

Test mode: GFSK_Middle Frequency_Antenna 2(Worst case)



| NO | FREQ [MHz] | READING | | C.FACTOR [dB] | RESULT | | LIMIT | | MARGIN | | PHASE |
|----|---------------|--------------|---------------|------------------|--------------|---------------|--------------|---------------|--------------|---------------|--------|
| | | QP [dBuV] | CAV [dBuV] | | QP [dBuV] | CAV [dBuV] | QP [dBuV] | CAV [dBuV] | QP [dBuV] | CAV [dBuV] | |
| 1 | 0.15570 | 38.9 | 22.3 | 20.3 | 59.1 | 42.6 | 65.7 | 55.7 | 6.6 | 13.1 | N (+) |
| 2 | 0.18675 | 35.6 | 19.1 | 20.4 | 56.0 | 39.5 | 64.2 | 54.2 | 8.2 | 14.7 | N (+) |
| 3 | 0.22875 | 31.6 | 16.0 | 20.2 | 51.8 | 36.2 | 62.5 | 52.5 | 10.7 | 16.3 | N (+) |
| 4 | 0.32238 | 24.2 | 9.1 | 20.2 | 44.5 | 29.4 | 59.6 | 49.6 | 15.1 | 20.2 | N (+) |
| 5 | 0.15088 | 38.2 | 21.6 | 20.2 | 58.4 | 41.8 | 66.0 | 56.0 | 7.6 | 14.2 | L1 (-) |
| 6 | 0.18850 | 35.0 | 18.7 | 20.3 | 55.4 | 39.1 | 64.1 | 54.1 | 8.7 | 15.0 | L1 (-) |
| 7 | 0.22875 | 31.3 | 15.5 | 20.2 | 51.5 | 35.6 | 62.5 | 52.5 | 11.0 | 16.9 | L1 (-) |

Test mode: GFSK_Lowest Frequency_Antenna 3(Worst case)



| NO | FREQ [MHz] | READING | | C.FACTOR [dB] | RESULT | | LIMIT | | MARGIN | | PHASE |
|----|---------------|--------------|---------------|------------------|--------------|---------------|--------------|---------------|--------------|---------------|--------|
| | | QP [dBuV] | CAV [dBuV] | | QP [dBuV] | CAV [dBuV] | QP [dBuV] | CAV [dBuV] | QP [dBuV] | CAV [dBuV] | |
| 1 | 0.18684 | 28.4 | 11.6 | 20.4 | 48.8 | 32.0 | 64.2 | 54.2 | 15.4 | 22.2 | N (+) |
| 2 | 0.23023 | 25.9 | 12.1 | 20.2 | 46.1 | 32.3 | 62.4 | 52.4 | 16.3 | 20.1 | N (+) |
| 3 | 0.69022 | 13.0 | 4.2 | 20.3 | 33.3 | 24.5 | 56.0 | 46.0 | 22.7 | 21.5 | N (+) |
| 4 | 0.18153 | 30.7 | 11.0 | 20.4 | 51.1 | 31.4 | 64.4 | 54.4 | 13.3 | 23.0 | L1 (-) |
| 5 | 0.28690 | 20.0 | 3.0 | 20.1 | 40.1 | 23.2 | 60.6 | 50.6 | 20.5 | 27.4 | L1 (-) |
| 6 | 0.66685 | 12.9 | -2.2 | 20.3 | 33.2 | 18.0 | 56.0 | 46.0 | 22.8 | 28.0 | L1 (-) |

APPENDIX I

TEST EQUIPMENT USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

| Equipment | Manufacturer | Model | Serial No. | Cal. Date (yy.mm.dd) | Next Cal.Date (yy.mm.dd) |
|----------------------------|-----------------------------|----------------------------|------------|----------------------|--------------------------|
| FSV Signal Analyzer | ROHDE&SCHWARZ | FSV30 | 103370 | 2019-10-15 | 2020-10-15 |
| Power Sensor | KEYSIGHT | U2022XA | MY55320008 | 2019-08-19 | 2020-08-19 |
| ATTENUATOR | INMET | 26A-20 | TR011 | 2019-10-14 | 2020-10-14 |
| DC Power Supply | HP | 66332A | US37471465 | 2019-01-10 | 2020-01-10 |
| Digital MultiMeter | HP | 34401A | US36025428 | 2019-01-10 | 2020-01-10 |
| Signal Generator | ROHDE&SCHWARZ | SMB100A | 178384 | 2019-10-14 | 2020-10-14 |
| EMI Test Receiver | ROHDE&SCHWARZ | ESU40 | 100445 | 2018-12-14 | 2019-12-14 |
| BiLog Antenna | Schwarzbeck | VULB9160 | 9160-3381 | 2019-04-09 | 2021-04-09 |
| ATTENUATOR | JFW | 50FPE-006N | - | 2019-04-23 | 2020-04-23 |
| Preamplifier | TSJ | MLA-10k01-b01-27 | 1870369 | 2019-04-23 | 2020-04-23 |
| Antenna Mast(10 m) | TOKIN | 5977 | - | - | - |
| Antenna Mast(10 m) | Innco | MA4640-XPET-0800 | 578 | - | - |
| Controller(10 m) | TOKIN | 5909L | 141909L-1 | - | - |
| Controller(10 m) | Innco | CO3000 | 40040217 | - | - |
| Turn Table(10 m) | TOKIN | 5983-1.5 | - | - | - |
| 10 m Semi-Anechoic Chamber | SY CORPORATION | - | - | - | - |
| Active Loop H-Field | ETS | 6502 | 00150598 | 2019-05-15 | 2021-05-15 |
| Double Ridge Horn Antenna | ETS | 3117 | 00168719 | 2019-04-09 | 2021-04-09 |
| PREAMPLIFIER | Agilent | 8449B | 3008A02110 | 2019-01-14 | 2020-01-14 |
| EMI Test Receiver | ROHDE&SCHWARZ | ESR7 | 101440 | 2018-12-14 | 2019-12-14 |
| LISN | ROHDE&SCHWARZ | ENV216 | 101883 | 2019-04-24 | 2020-04-24 |
| Pulse Limiter | Schwarzbeck | VTSD 9561-F | 9561-F189 | 2019-04-23 | 2020-04-23 |
| High pass filter | Wainwright Instruments GmbH | WHK10-1290-1500-10000-60SS | 1 | 2019-08-19 | 2020-08-19 |