RF TEST REPORT

Test equipment	:	Grand Multicom
FCC Basic model name	:	GM-900M
IC Basic model name	:	GM-900MS
FCC Variant model name	:	Cobalt Plus, MicroCom XR, MicroCom XR 900, CP-900, XR-900, GM11-900M, RefAudio Elite
IC Variant model name	:	GM11-900M, GM-900, XR-900
FCC ID	:	YJH-GM-900MS
IC	:	9066A-GM900MS
Date of receipt	:	2020.01.07
Test duration	:	2020.01.09 ~ 2020.02.11
Date of issue	:	2020.02.11

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 (2019-03)
RF Output Power	:	22.74 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
Namhyoung Kwon

Reviewed by:
Technical Manager
SangHoon Yu

CONTENTS

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
FCC Basic model name	GM-900M
IC Basic model name	GM-900MS
FCC variant model name	Cobalt Plus, MicroCom XR, MicroCom XR 900, CP-900, XR-900, GM11-900M, RefAudio Elite[Note2]
IC variant model name	GM11-900M, GM-900, 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	-
	Gain	-

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		22 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
15.111(a) 15.209(a)	-	Receiver Radiated Emission	4.4.8	C
15.207(a)	RSS-GEN 8.8	Conducted Emissions[Note 2]	4.4.9	N/A

Note 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable
Note 2 : This device gets power supply from only battery(DC 3.7 V), The battery only charges with a excusive cradle

* 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
TRRFCC20-0002	20.01.28	Initial issue
TRRFCC20-0002(1)	20.02.11	Added Receiver Radiated Emission

4.4 Transmitter Requirements

4.4.1 Antenna Requirement

4.4.1.1 Regulation

Accoding 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.

Accoding 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

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

4.4.2 20 dB Bandwidth and Occupied Bandwidth

4.4.2.1 Regulation

Accoding 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	0.293	0.500	0.265
926.5	0.294	0.500	0.265

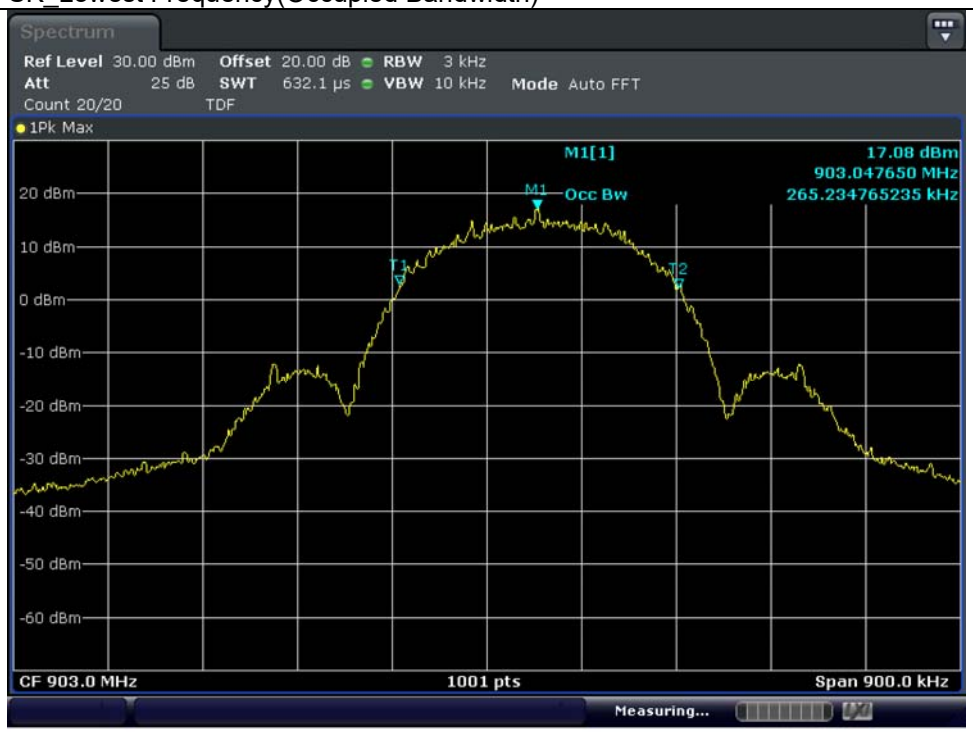
4.4.2.5 Test Plot

GFSK_Lowest Frequency(20 dB Bandwidth)

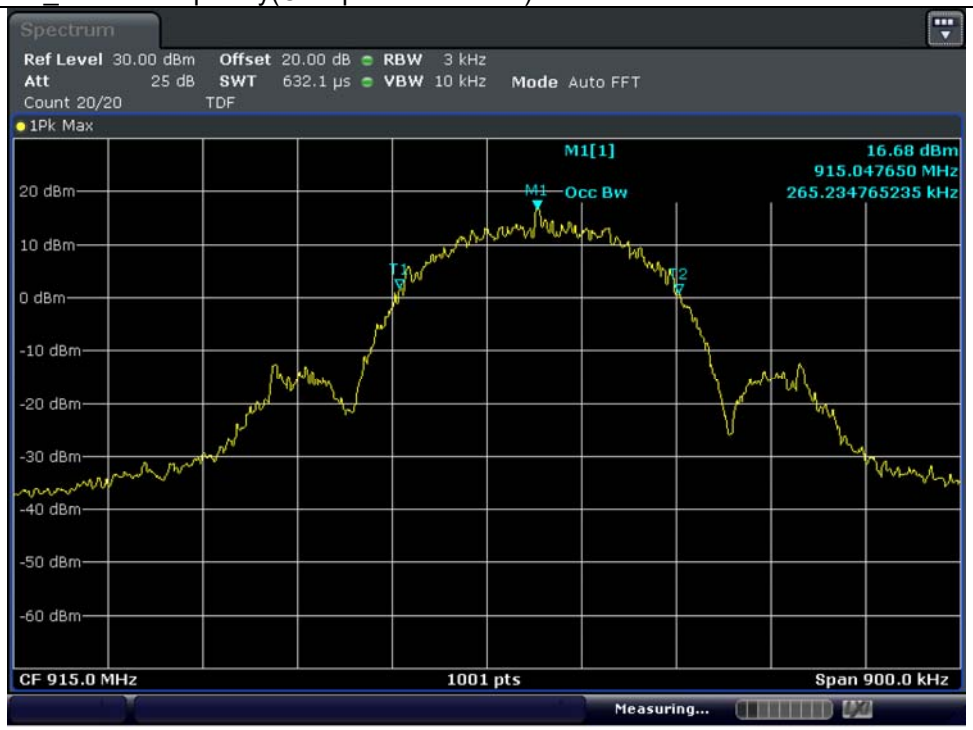
GFSK_Middle Frequency(20 dB Bandwidth)

GFSK_Highest Frequency(20 dB Bandwidth)

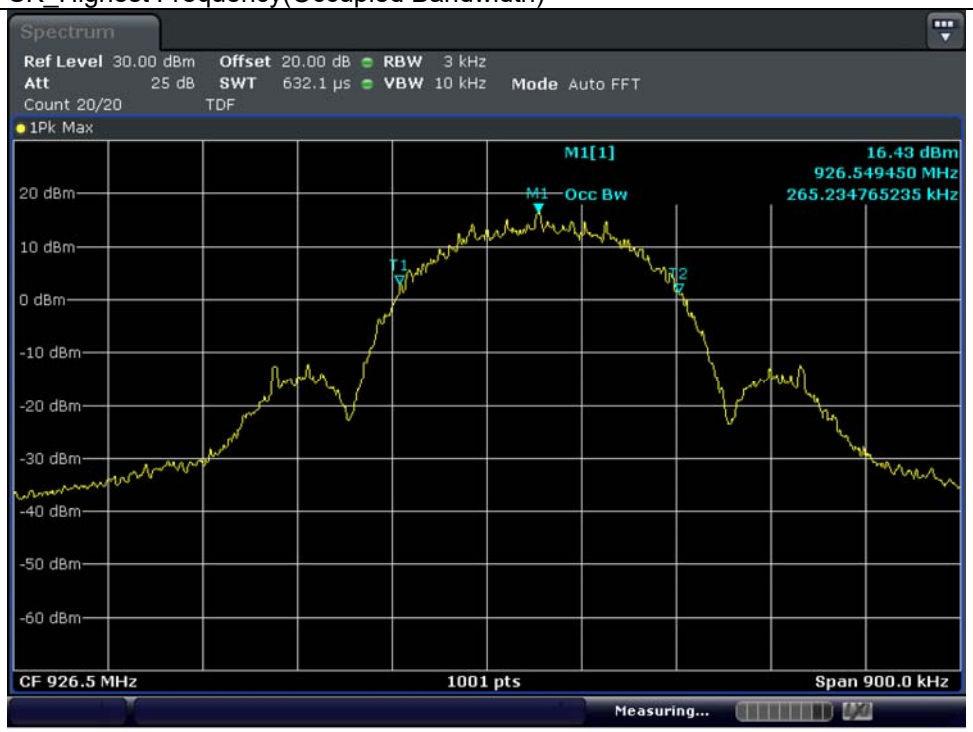
GFSK_Lowest Frequency(Occupied Bandwidth)



GFSK_Middle Frequency(Occupied Bandwidth)



GFSK_Highest Frequency(Occupied Bandwidth)



4.4.3 Number of Hopping Frequencies

4.4.3.1 Regulation

Accoding 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

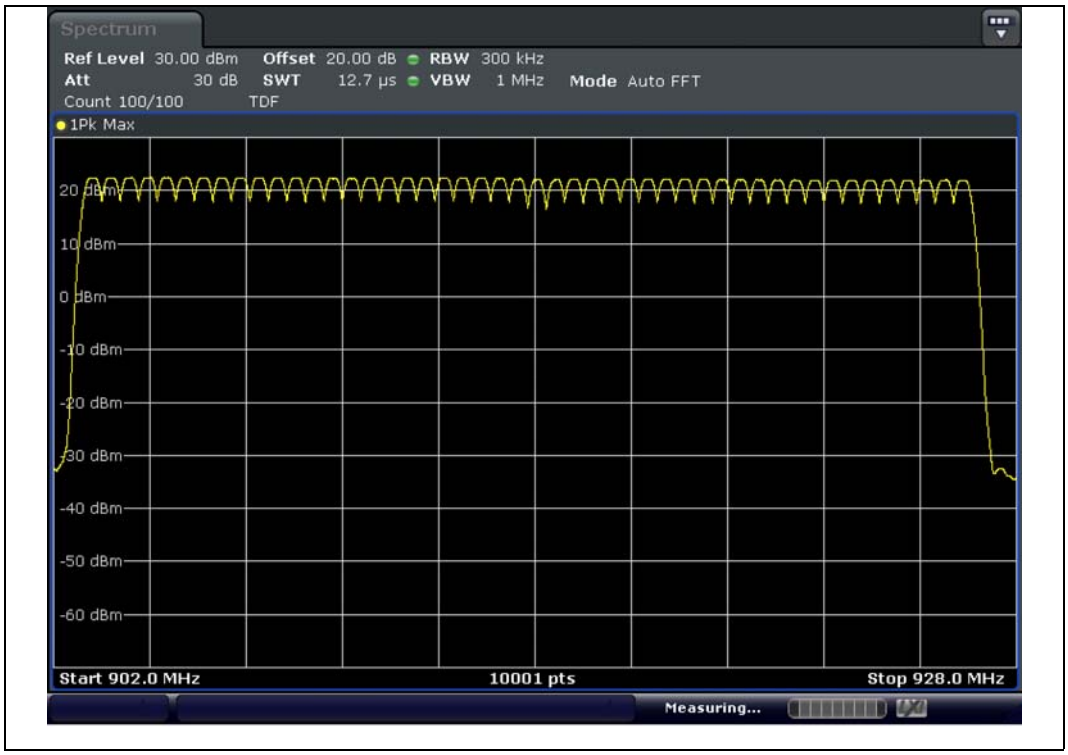
Comply (measurement data : refer to the next page)

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

Accoding 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

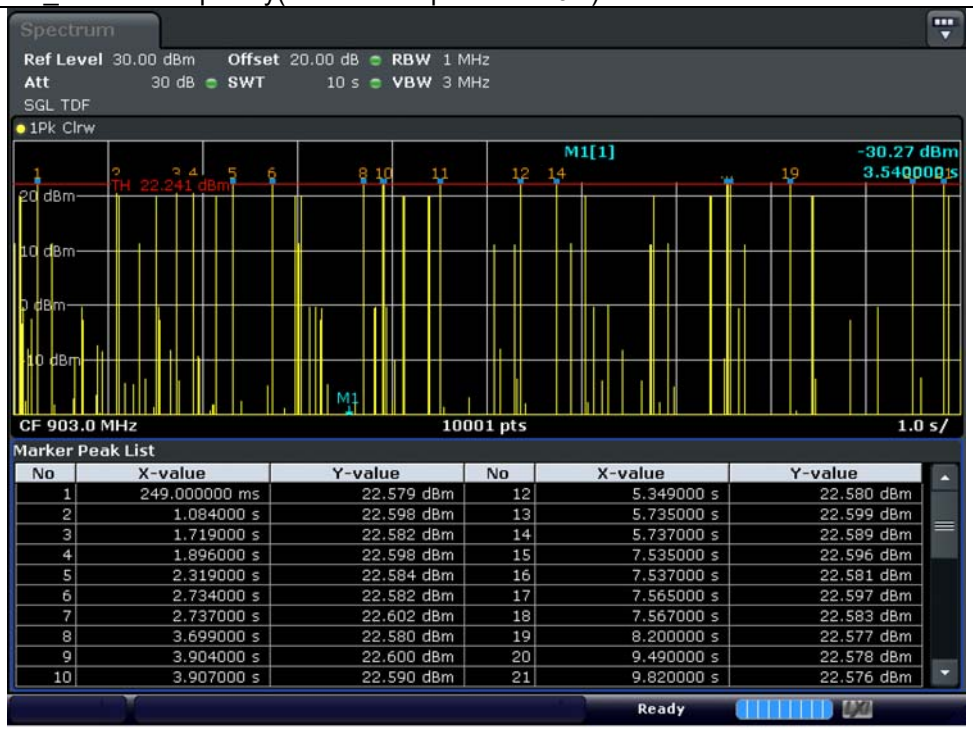
Test mode : GFSK

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	0.837	1.416	21	47.318	400.000
915	0.837	1.417	20	45.091	400.000
926.5	0.840	1.419	20	45.188	400.000

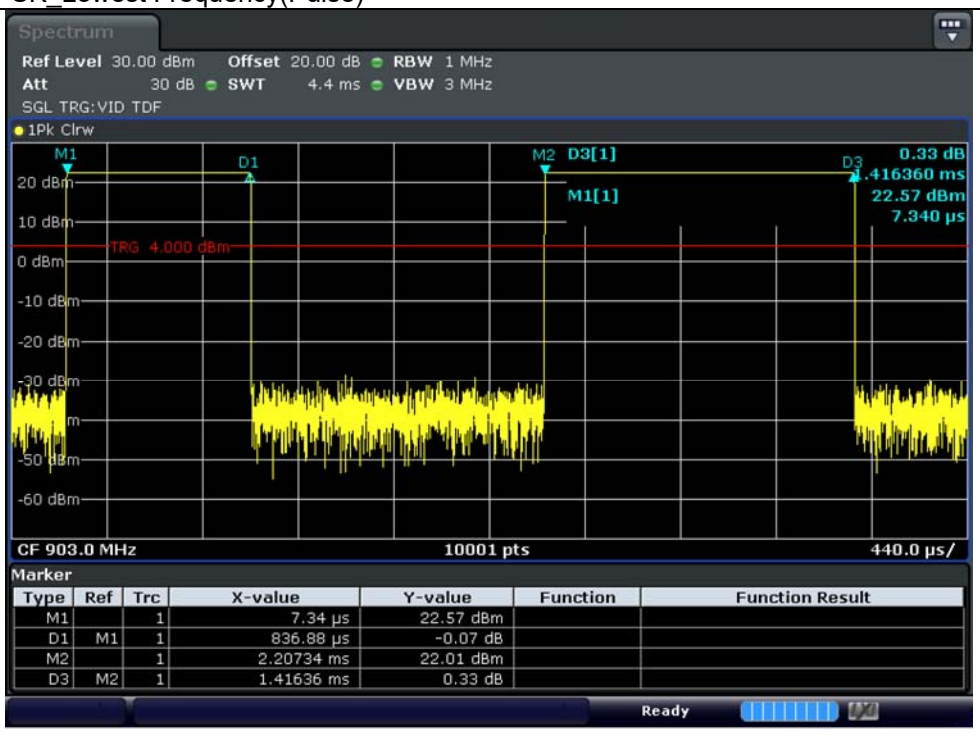
NOTE1 : Total : (Average Time of occupancy 1+ Average Time of occupancy 2) * Number of Pulse in 10 seconds

4.4.4.5 Test Plot

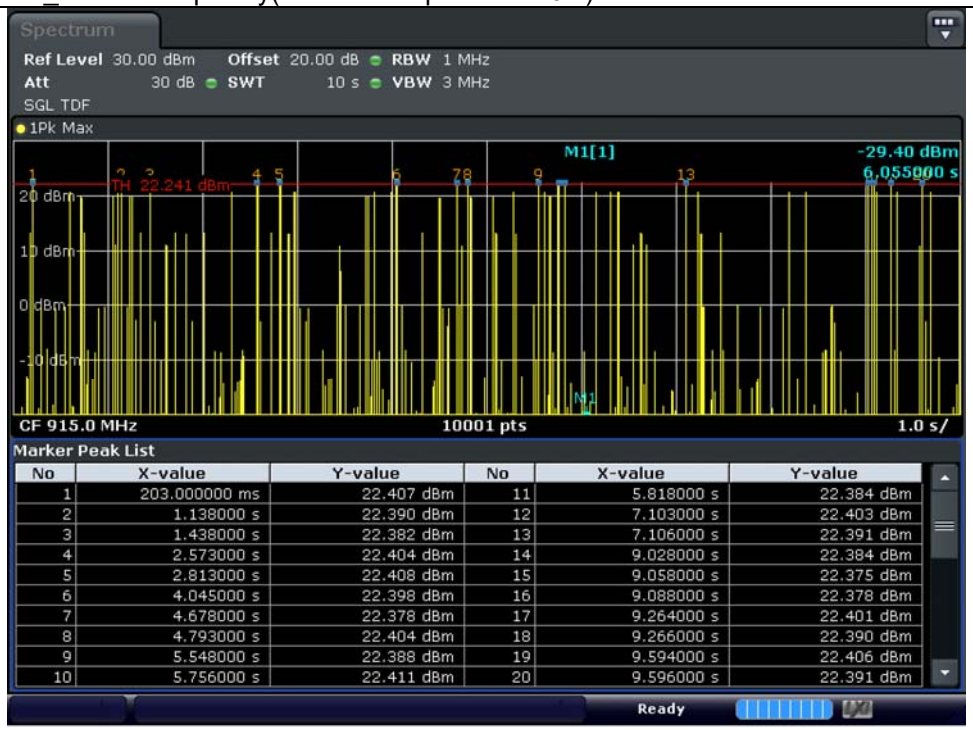
GFSK_Lowest Frequency(observation period in 10 s)



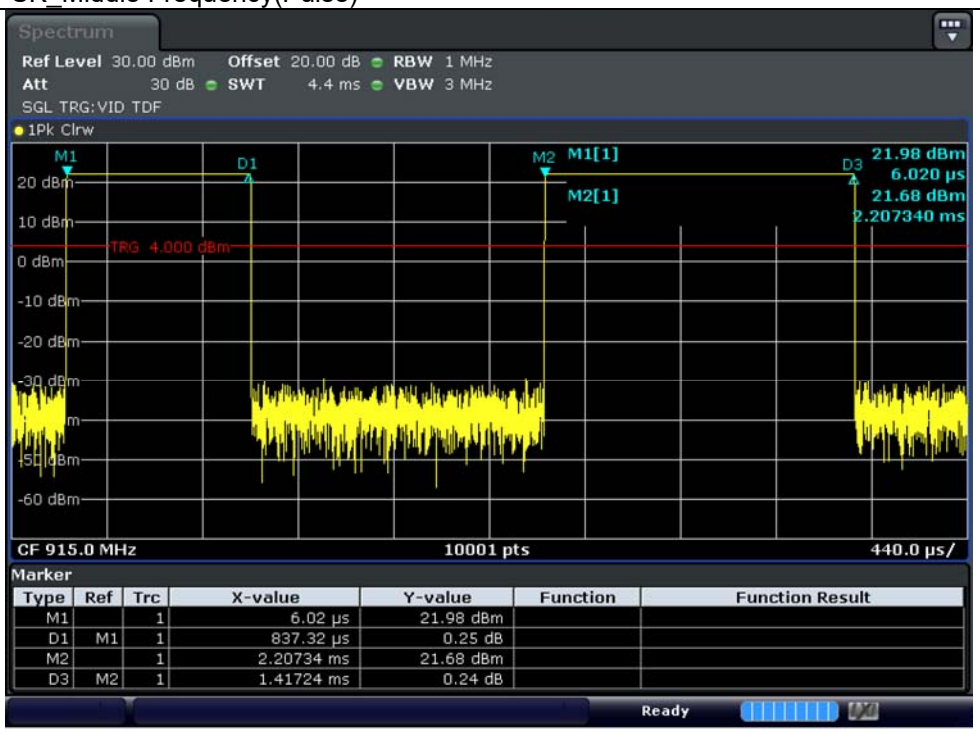
GFSK_Lowest Frequency(Pulse)



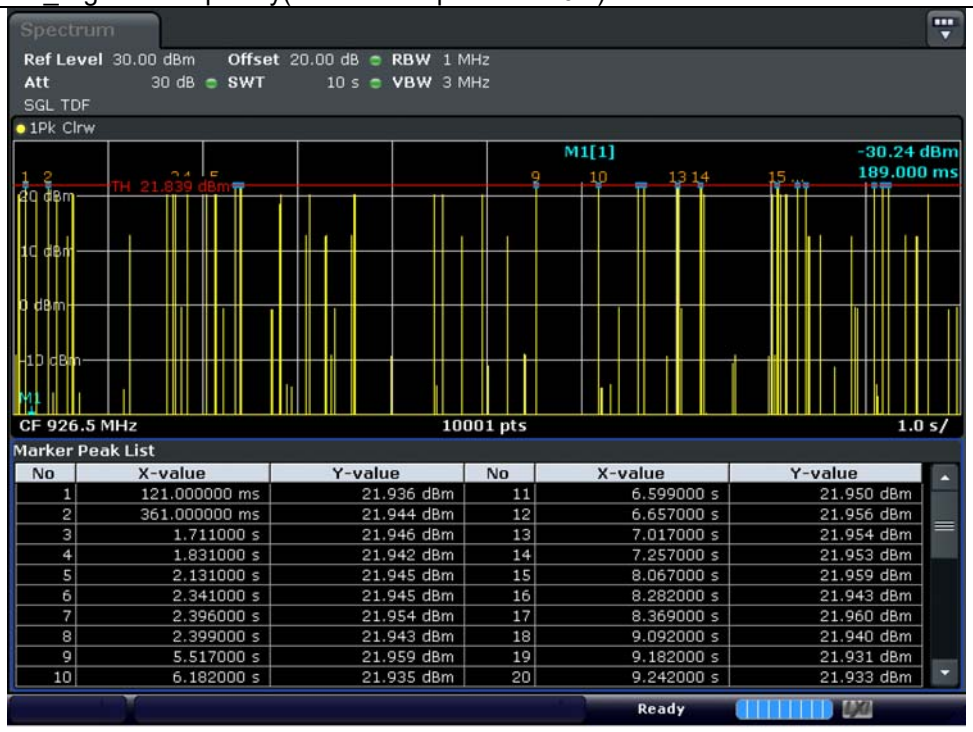
GFSK_Middle Frequency(observation period in 10 s)



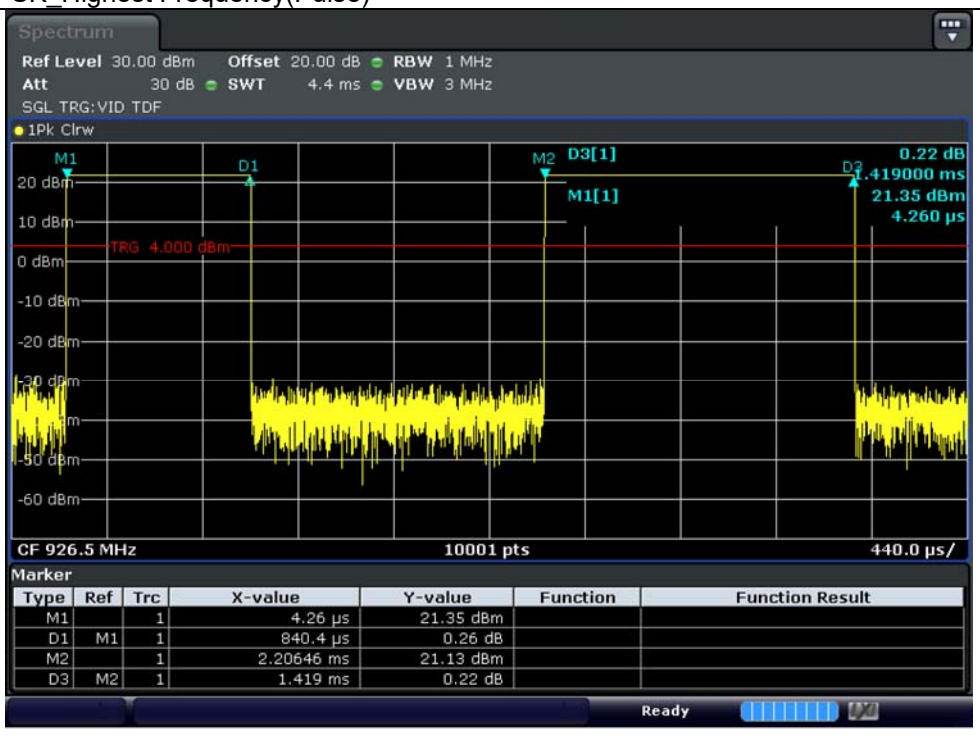
GFSK_Middle Frequency(Pulse)



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

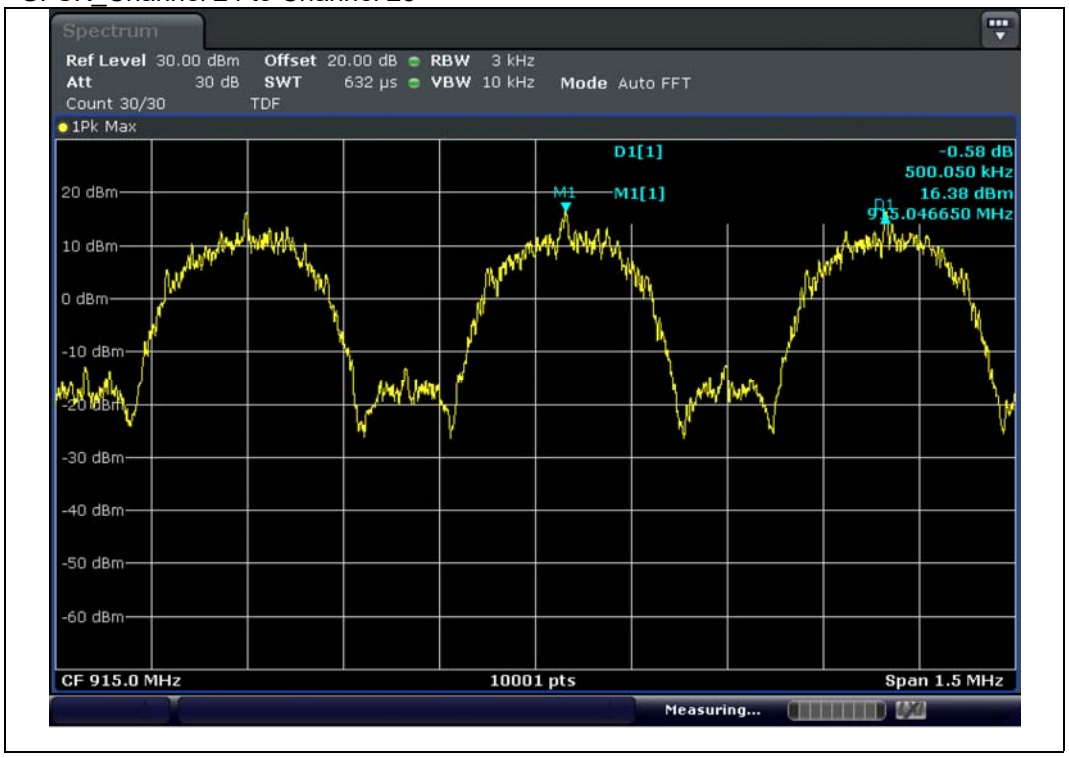
Carrier Frequency Separation		
Test Channel	Result (MHz)	Min. Limit (MHz)
Channel 0 to Channel 2	0.501	0.292
Channel 24 to Channel 26	0.500	0.293
Channel 46 to Channel 47	0.502	0.294

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

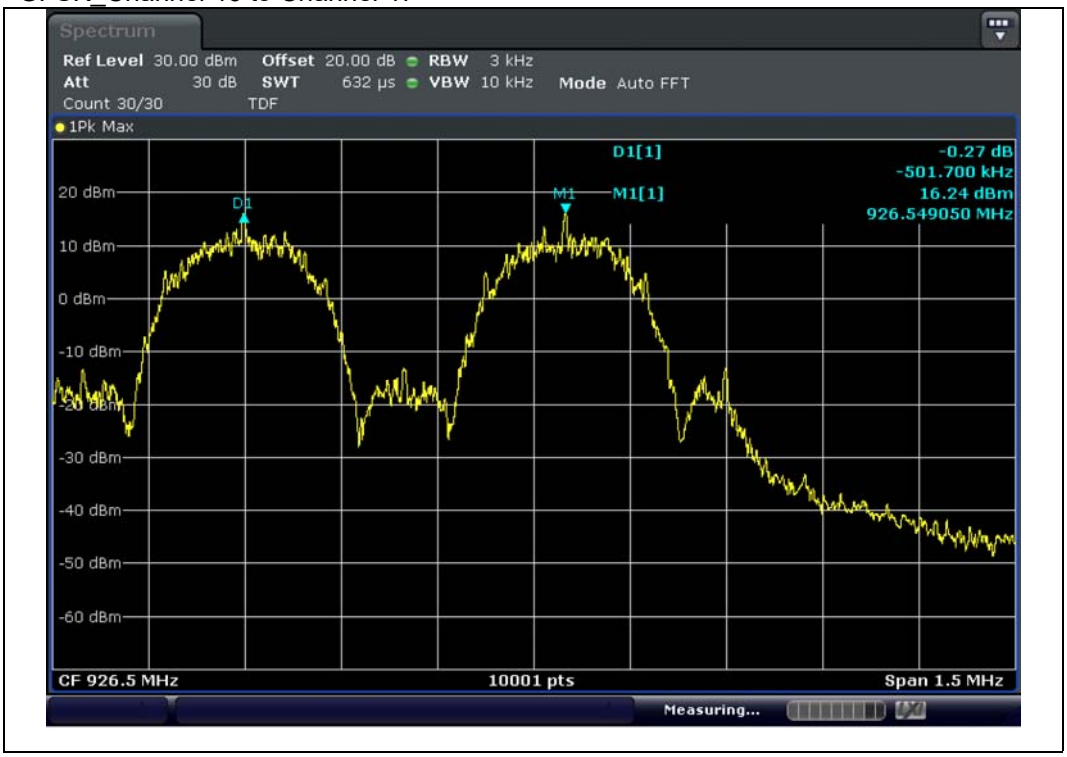
4.4.5.5 Test Plot

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

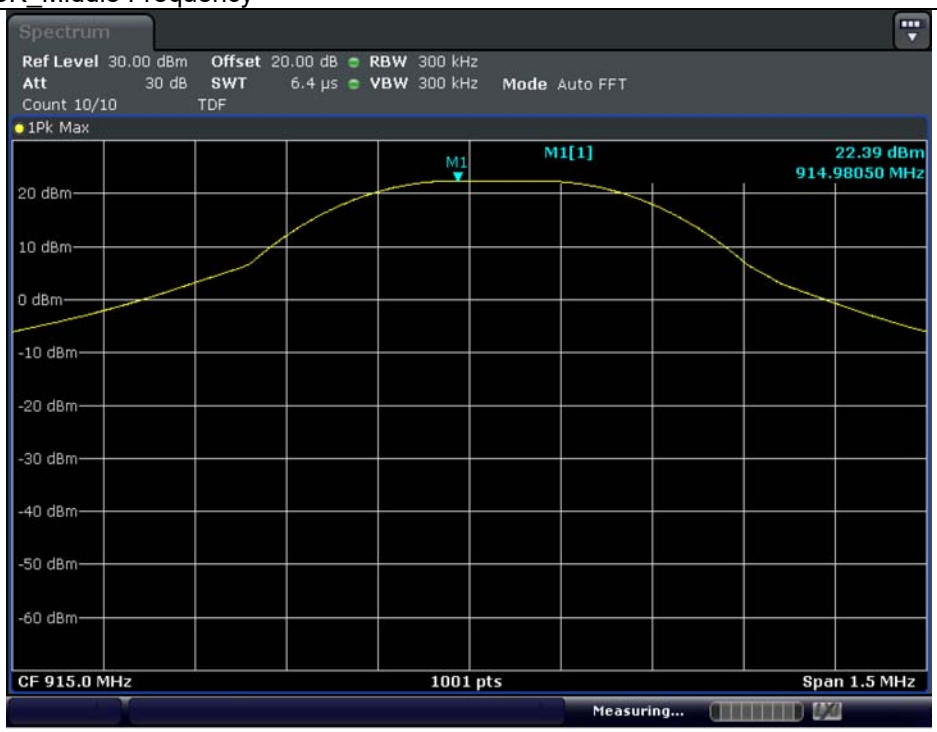
Frequency (MHz)	Peak Output Power Result (dBm)	Peak Output Power Result (mW)	Peak Output Power Limit (mW)	Avg Output Power Result (dBm)
903	22.74	187.93	250.00	13.78
915	22.39	173.38	250.00	13.33
926.5	22.09	161.81	250.00	13.05

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))

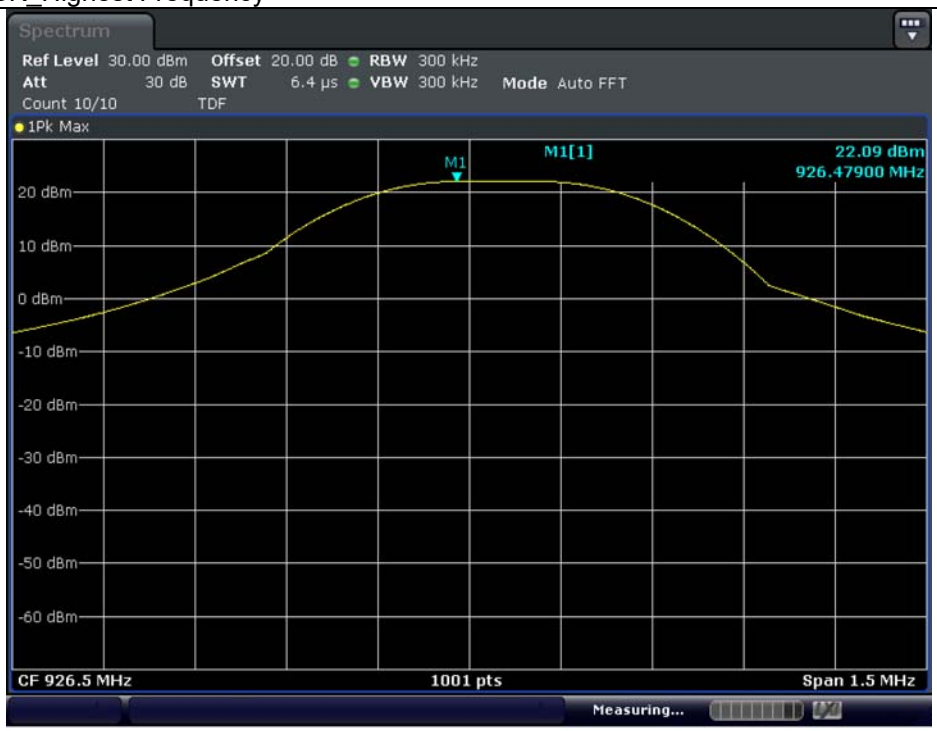
4.4.6.5 Test Plot

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 notexceed 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(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shallnot 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 : ≥ 1% of the span
VBW : ≥ 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	:	≥ 1% of the span
VBW	:	≥ 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 rdiated measurements were performed to determine the frequency producing the maximum emissions in at 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 ≥1 GHz, 100 kHz for f < 1 GHz
VBW	:	≥ 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 20log(dwell time/100 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 (dBμV)	Ant Factor (dB)	Loss (dB)	Result (dBμV/m)	Limit (dBμV/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 MHz ≤ f ≤ 1 000 MHz) : Reference(119.5 dBμV/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 (dBμV)	Ant Factor (dB)	Loss (dB)	Result (dBμV/m)	Limit (dBμV/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 MHz ≤ f ≤ 1 000 MHz) : Reference(119 dBμV/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 (dBμV)	Ant Factor (dB)	Loss (dB)	Result (dBμV/m)	Limit (dBμV/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 MHz ≤ f ≤ 1 000 MHz) : Reference(119.1 dBμV/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 (dBμV)	Factor (dB)	Duty Cycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 709.19	PK	H	75.60	-3.90	-	71.66	74.00	2.34
	AV	H	57.70	-3.90	-28.69	25.07	54.00	28.93
2 709.19	PK	V	73.90	-3.90	-	69.96	74.00	4.04
	AV	V	56.00	-3.90	-28.69	23.37	54.00	30.63
3 612.15	PK	H	68.10	-2.30	-	65.76	74.00	8.24
	AV	H	49.60	-2.30	-28.69	18.57	54.00	35.43

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor
Note 2 : Peak Result : Reading + Factor
Note 3 : Duty Cycle Factor : 20 x Log(Worst Case Dwell Time / 100ms)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 = 20log(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 (dBμV)	Factor (dB)	Duty Cycle Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 745.24	PK	H	74.40	-3.90	-	70.46	74.00	3.54
	AV	H	57.50	-3.90	-28.69	24.87	54.00	29.13
2 745.24	PK	V	74.30	-3.90	-	70.36	74.00	3.64
	AV	V	56.10	-3.90	-28.69	23.47	54.00	30.53
3 660.07	PK	H	62.00	-2.10	-	59.86	74.00	14.14
	AV	H	48.80	-2.10	-28.69	17.97	54.00	36.03

Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor
Note 2 : Peak Result : Reading + Factor
Note 3 : Duty Cycle Factor : 20 x Log(Worst Case Dwell Time / 100ms)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 = 20log(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.

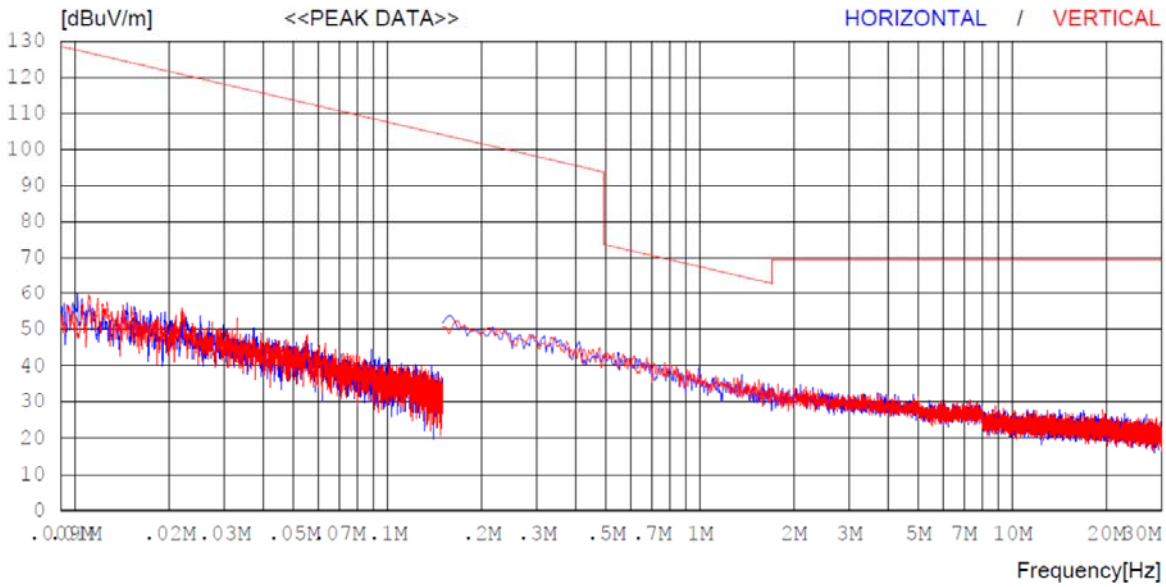
Test mode : Above 1 GHz_GFSK_Highest Frequency_Antenna 2

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBµV)	Factor (dB)	Duty Cycle Factor (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2 779.26	PK	H	69.80	-3.90	-	65.86	74.00	8.14
	AV	H	51.80	-3.90	-28.69	19.17	54.00	34.83
2 779.26	PK	V	68.70	-3.90	-	64.76	74.00	9.24
	AV	V	50.70	-3.90	-28.69	18.07	54.00	35.93
3 705.72	PK	H	57.50	-2.00	-	55.46	74.00	18.54
	AV	H	41.60	-2.00	-28.69	10.87	54.00	43.13

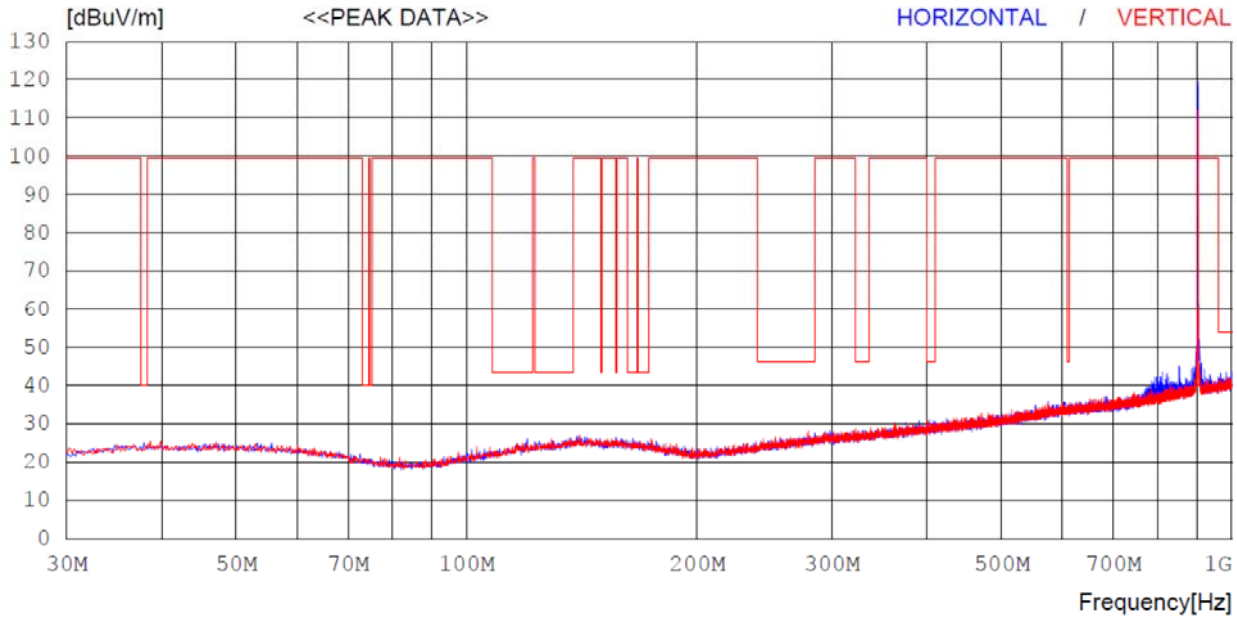
Note 1 : Factor : Ant Factor + Cable loss - Amp gain + Distance Factor
Note 2 : Peak Result : Reading + Factor
Note 3 : Duty Cycle Factor : 20 x Log(Worst Case Dwell Time / 100ms)dB, refer to 4.4.7.7
Average Result : Reading + Factor + Duty Cycle Factor
Note 4 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m
Above 1 GHz Distance Factor = 20log(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 2

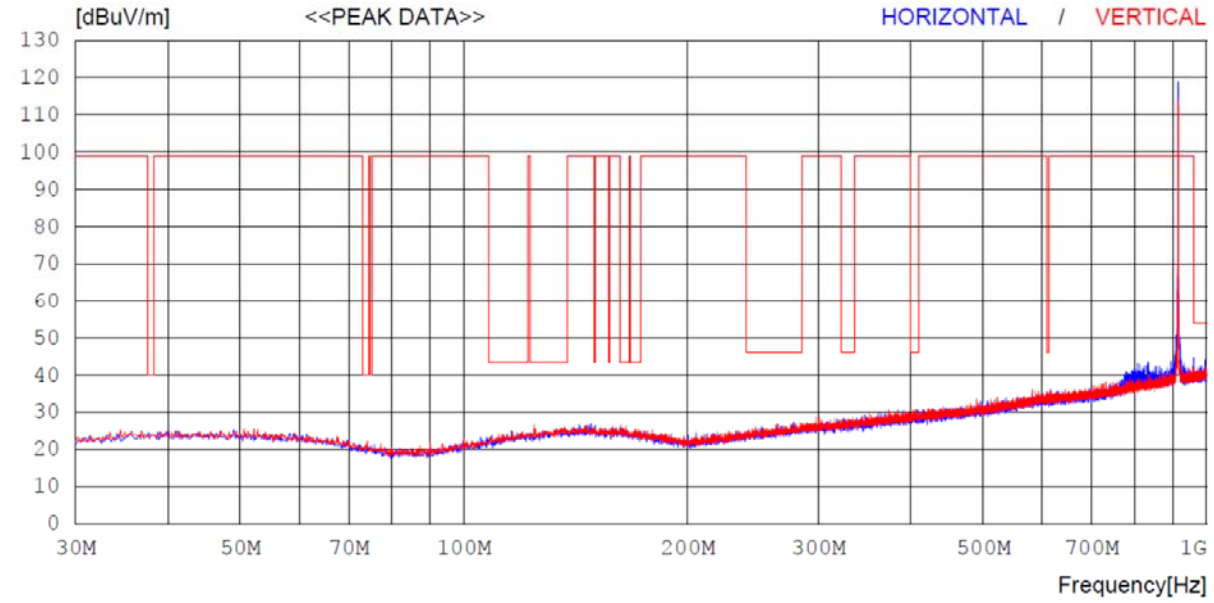


Test mode : 30 MHz ~ 1 GHz(GFSK_Lowest Frequency)_Antenna 2



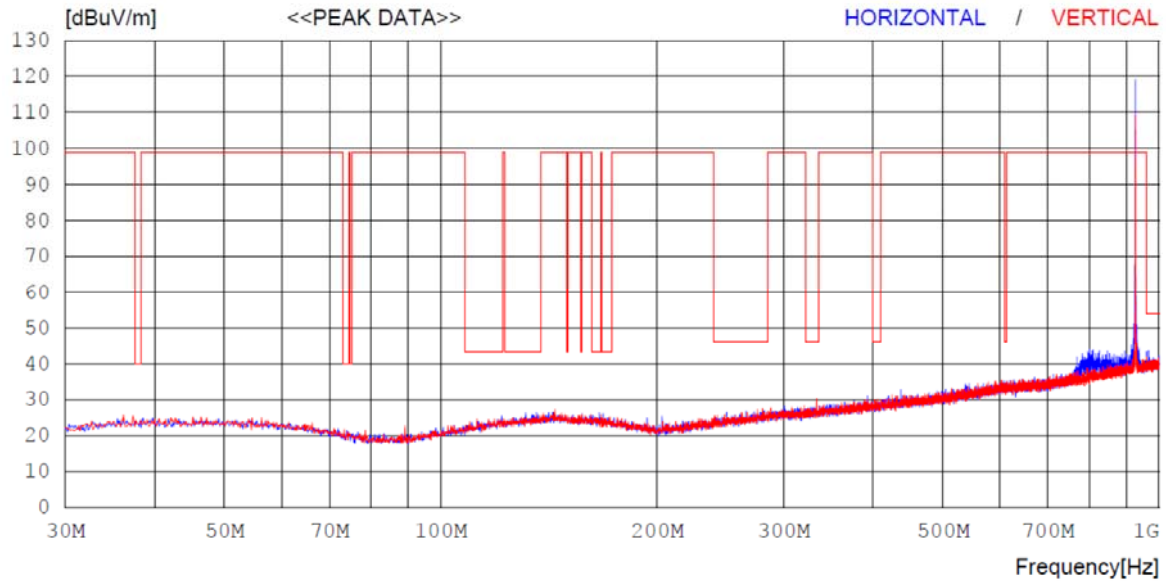
Note 1 : 903.194 MHz = Reference(119.5 dBμV/m)

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



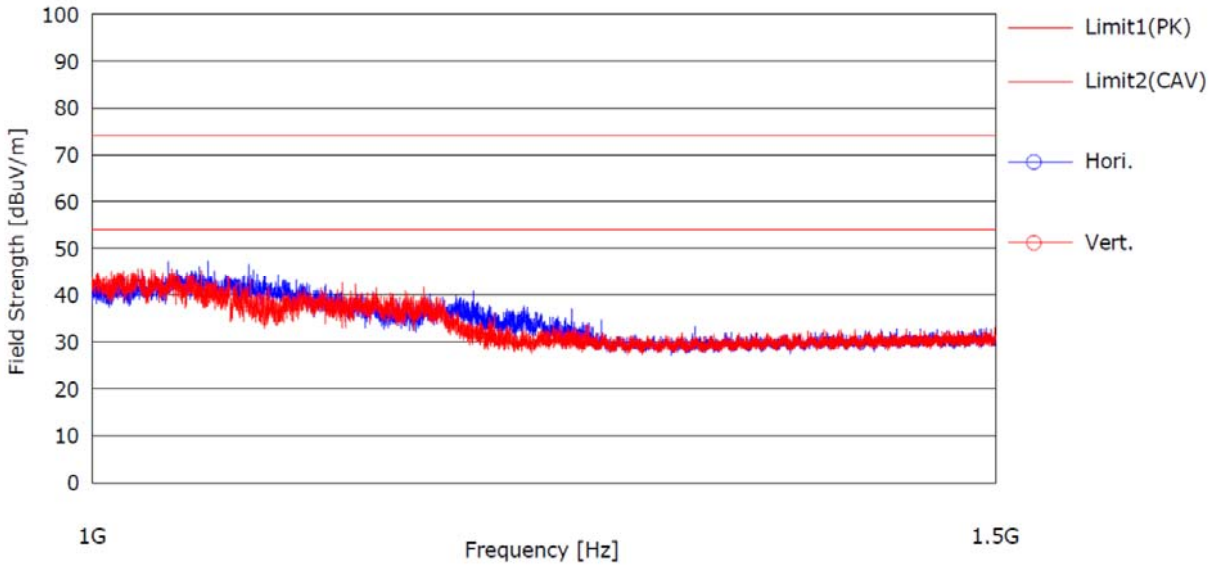
Note 1 : 915.201 MHz = Reference(119.0 dBμV/m)

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



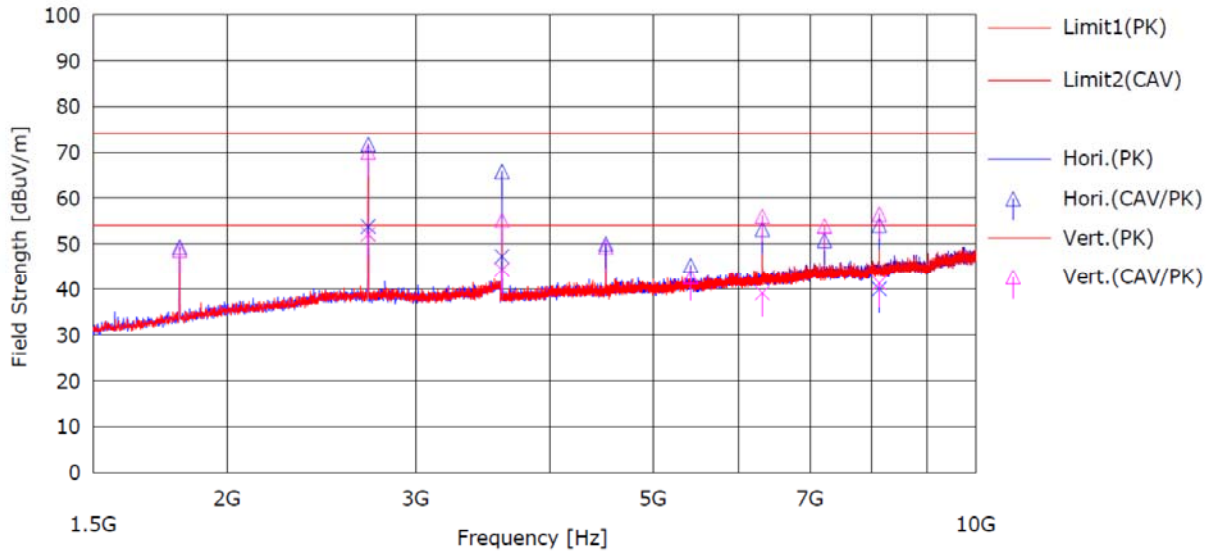
Note 1 : 926.722 MHz = Reference(119.1 dBμV/m)

Test mode : 1 GHz ~ 1.5GHz Worst Case(GFSK_Lowest 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 = 20log(1 / 3) = -9.54

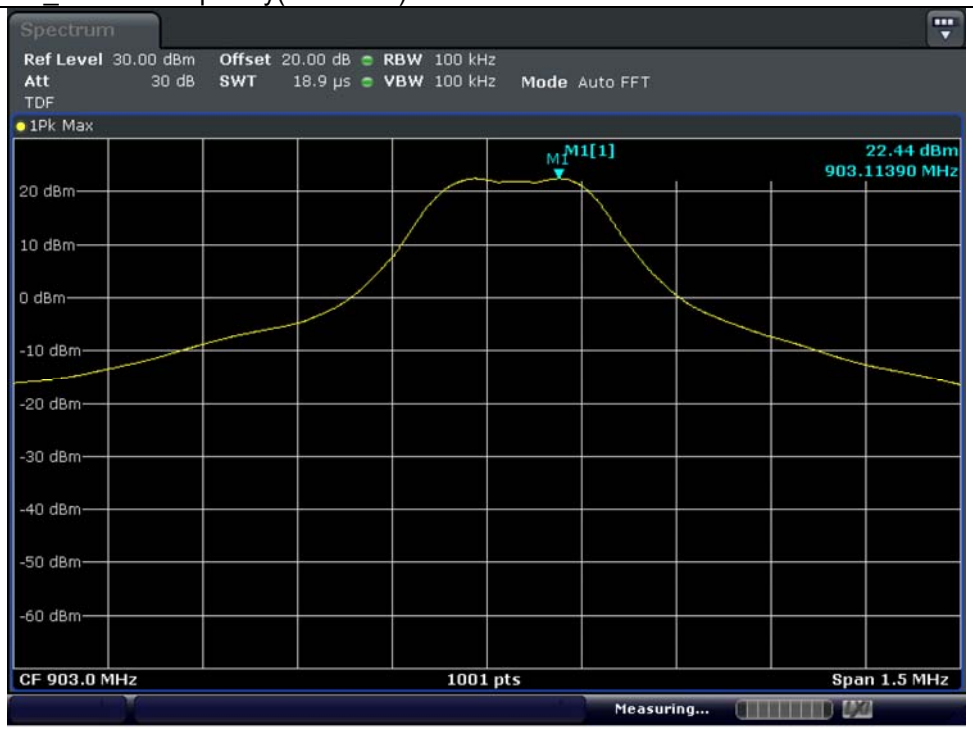
Test mode : 1.5 GHz ~ 10 GHz Worst Case(GFSK_ Lowest Frequency)_Antenna 2



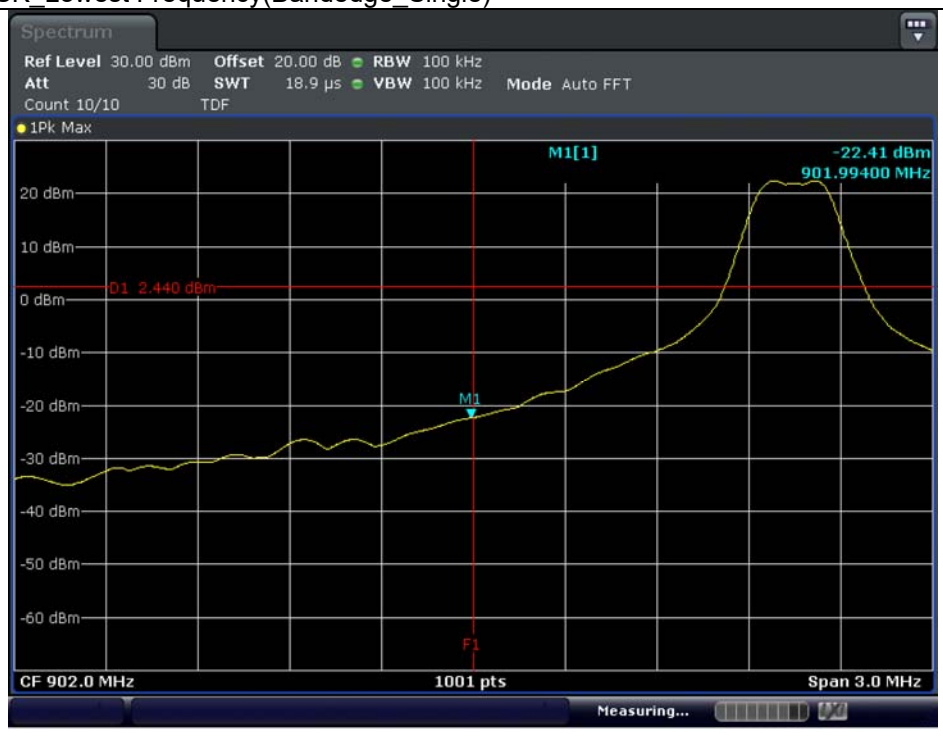
Note 1 : Measured distance : 1 m
Note 2 : Below 1 GHz Measured distance : 3 m, Above 1 GHz Measured distance : 1 m
Above 1 GHz Distance Factor = 20log(1 / 3) = -9.54

4.4.7.6 Measurement data_Conducted Spurious Emissions

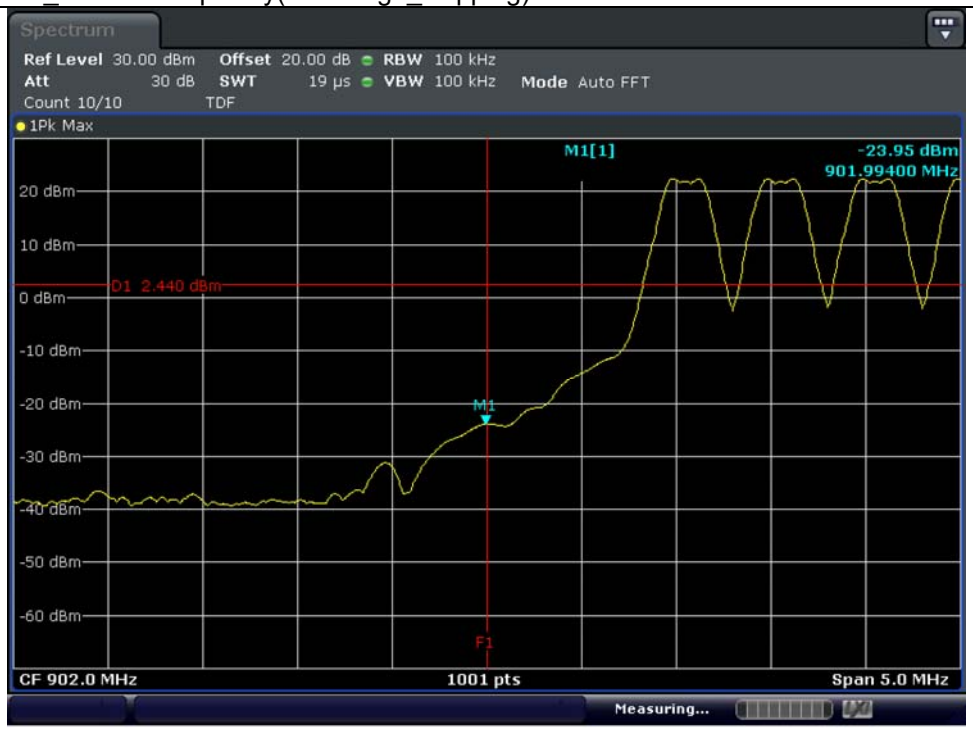
GFSK_Lowest Frequency(reference)



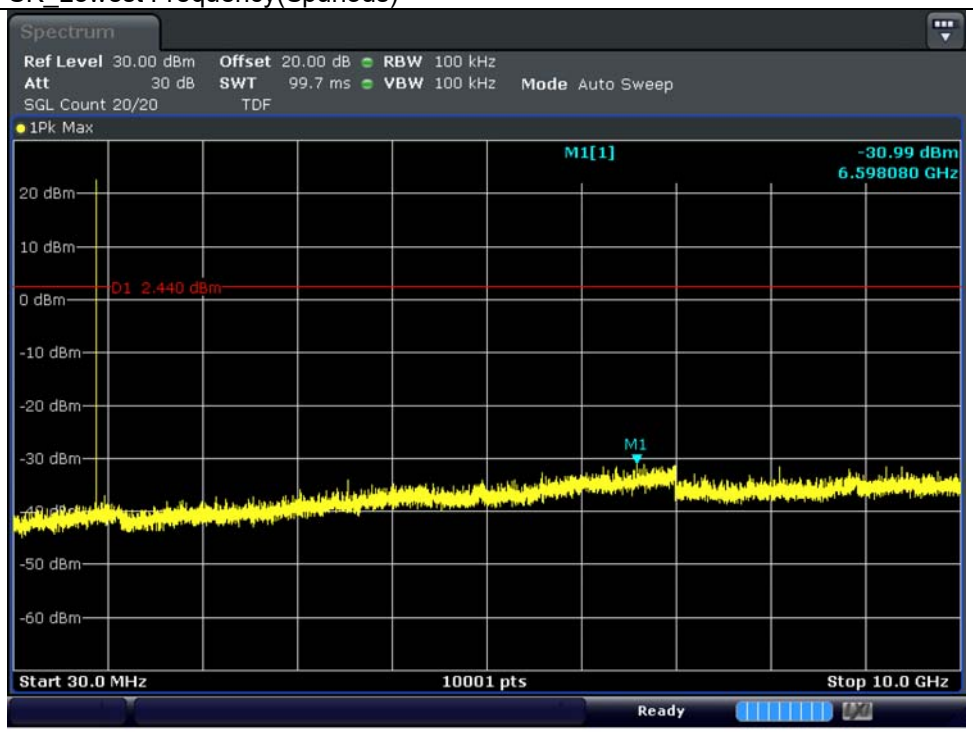
GFSK_Lowest Frequency(Bandedge_Single)



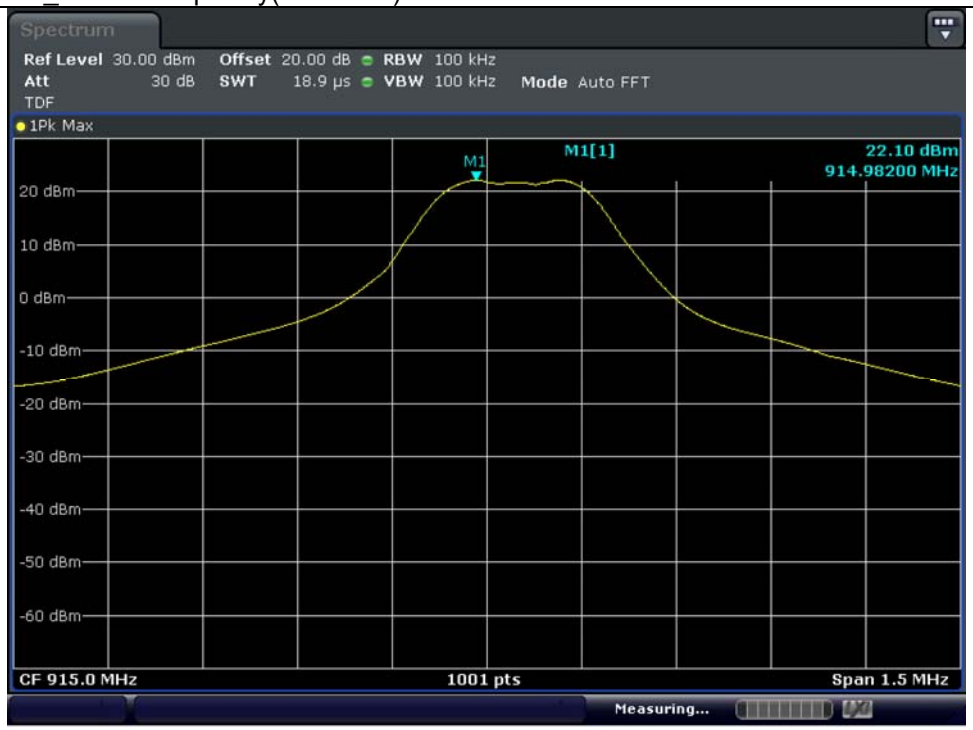
GFSK_Lowest Frequency(Bandedge_Hopping)



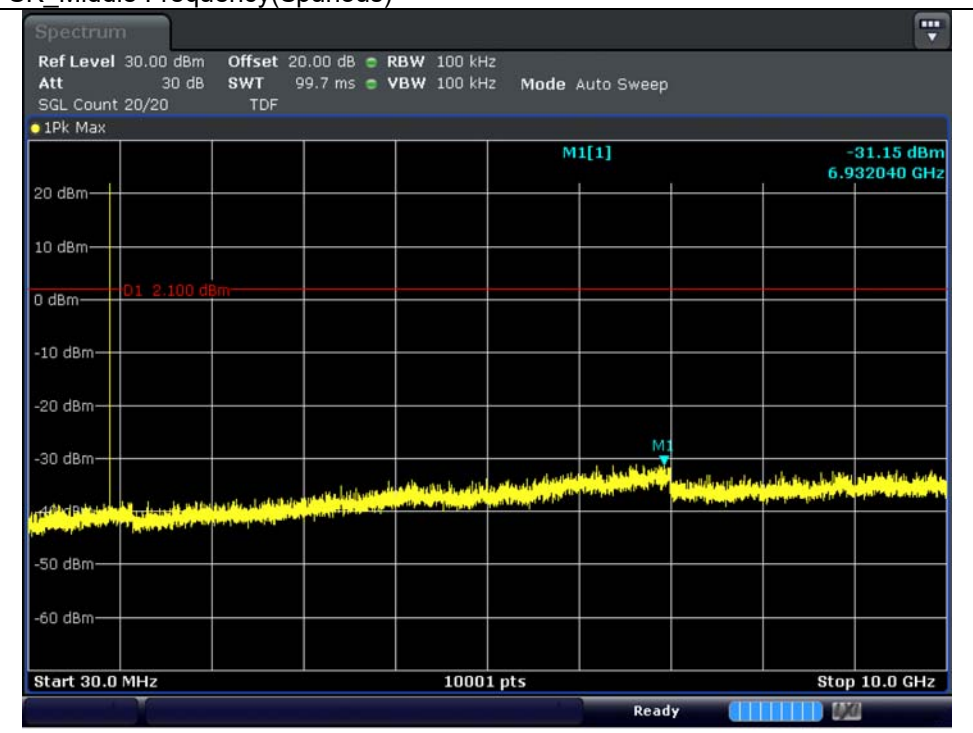
GFSK_Lowest Frequency(Spurious)



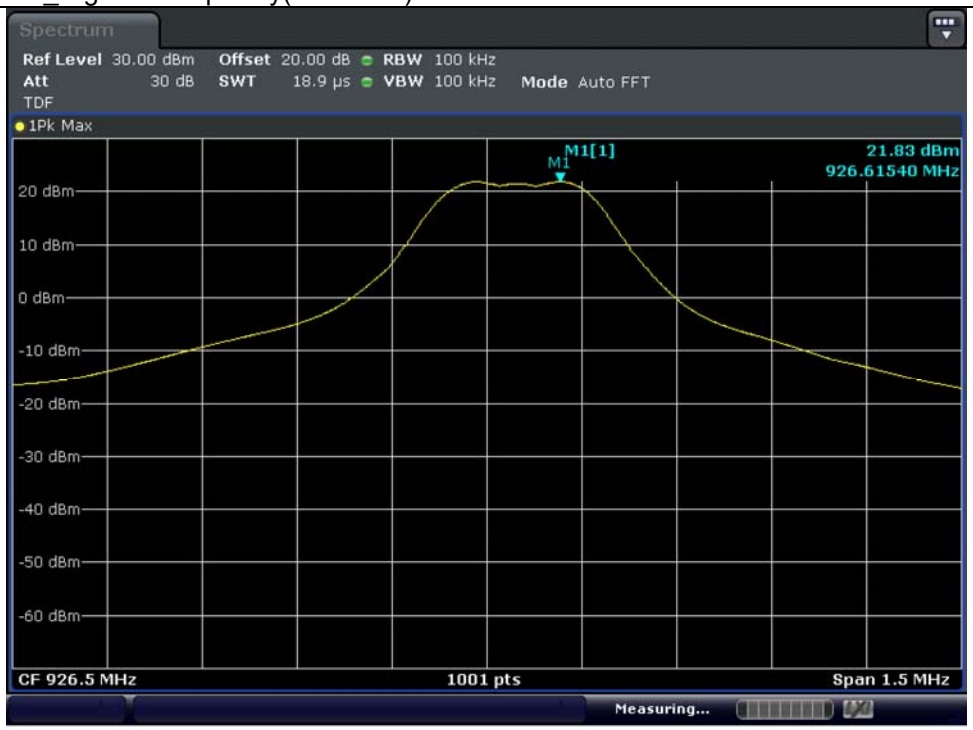
GFSK_Middle Frequency(reference)



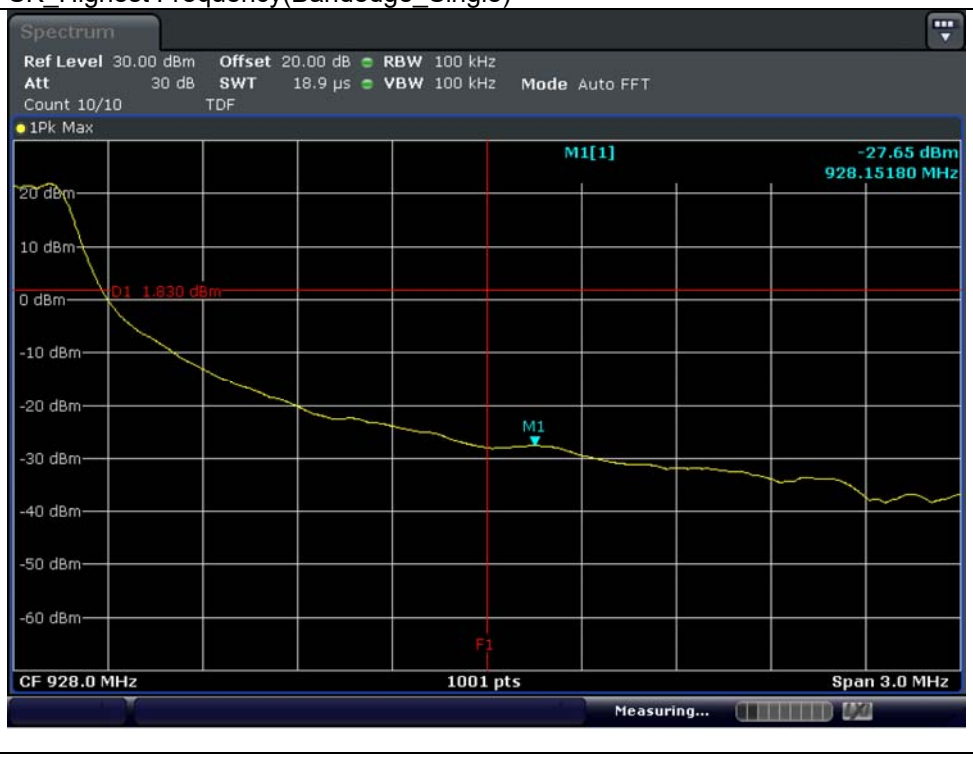
GFSK_Middle Frequency(Spurious)



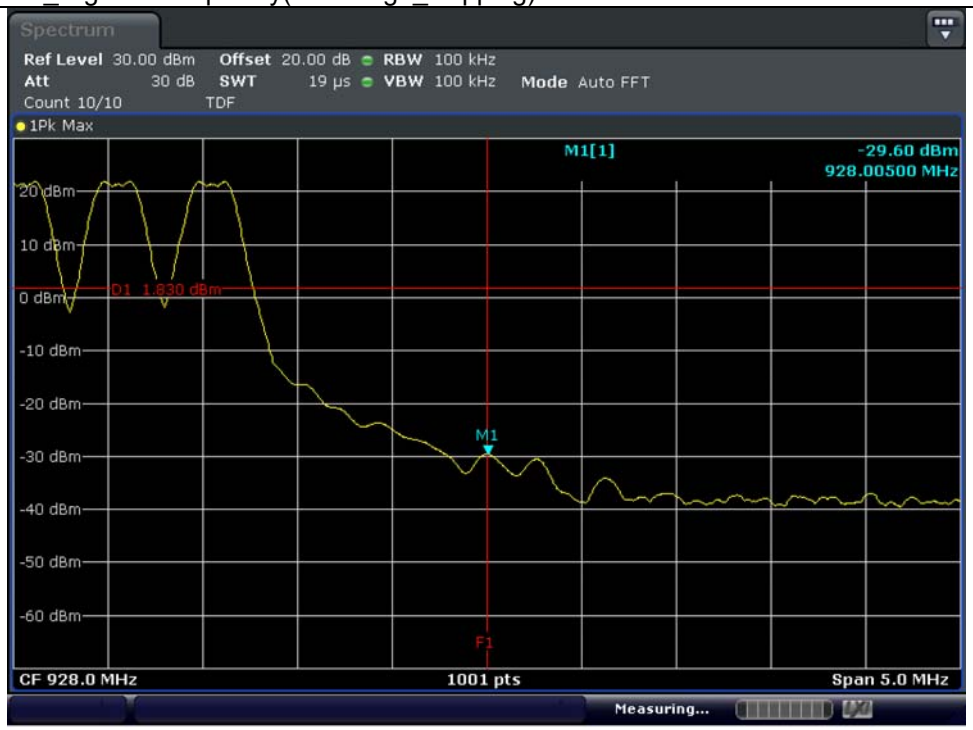
GFSK_Highest Frequency(reference)



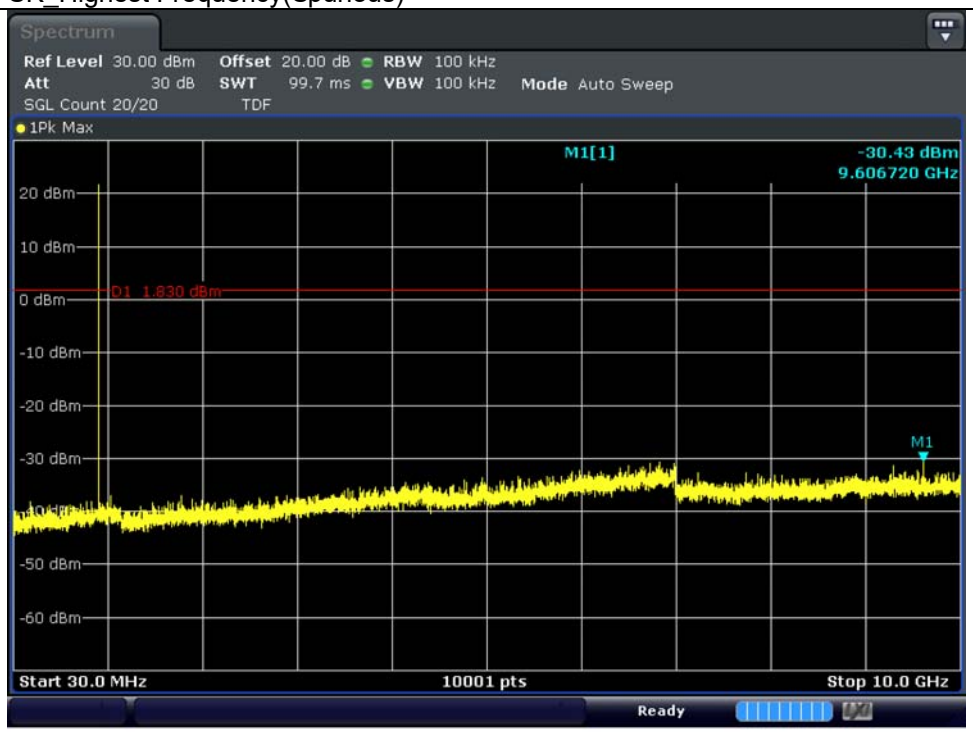
GFSK_Highest Frequency(Bandedge_Single)



GFSK_Highest Frequency(Bandedge_Hopping)

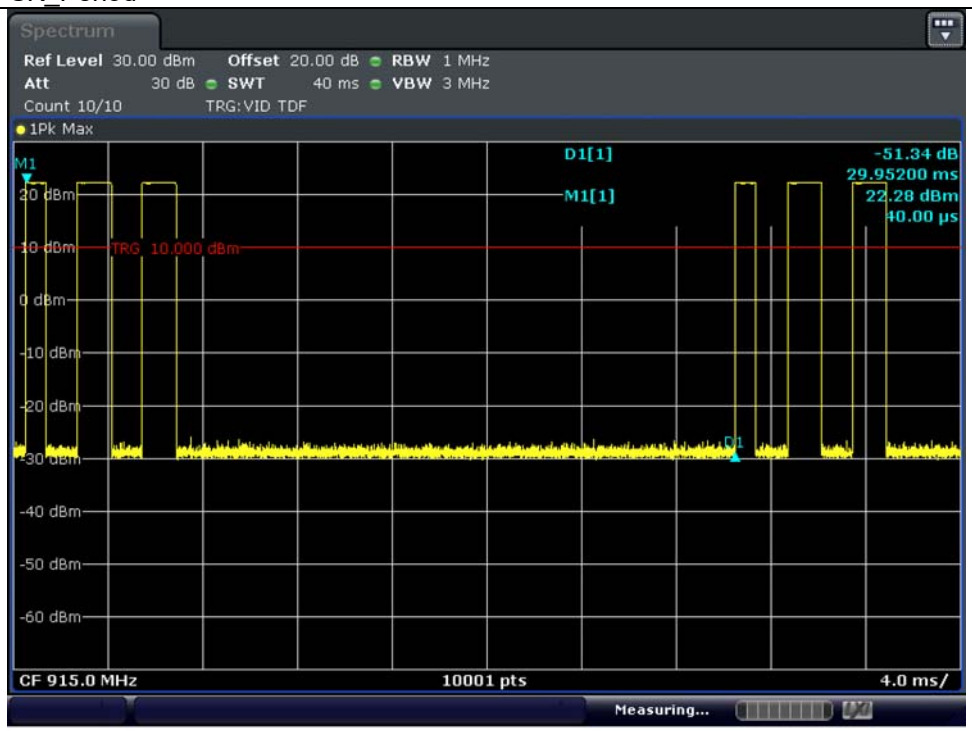


GFSK_Highest Frequency(Spurious)

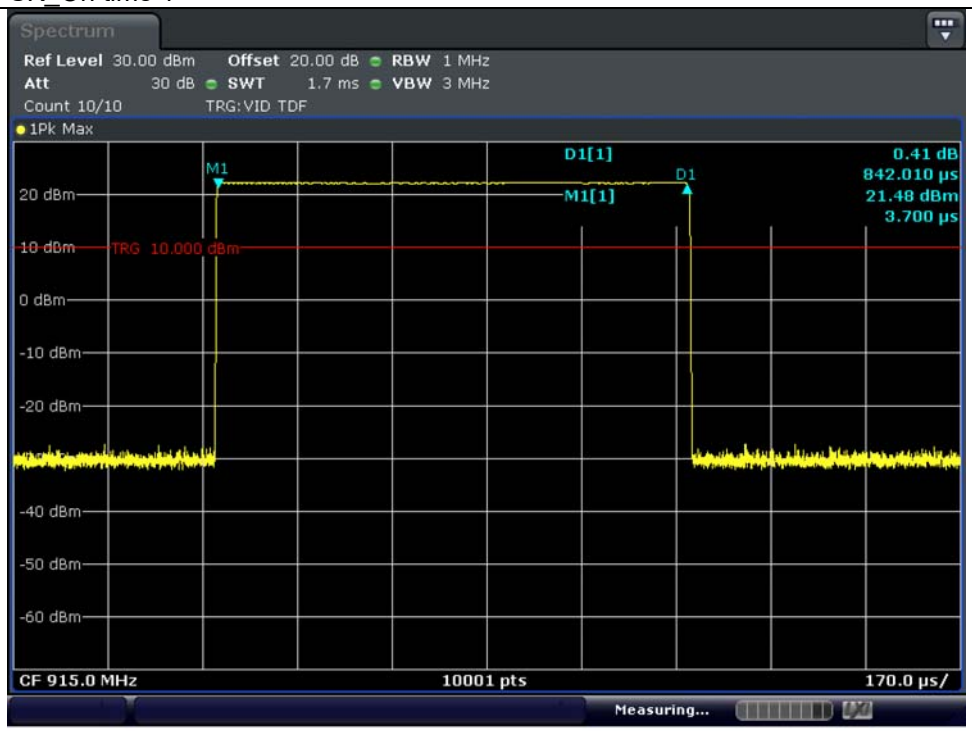


4.4.7.7 Measurement Plot_Dutycycle

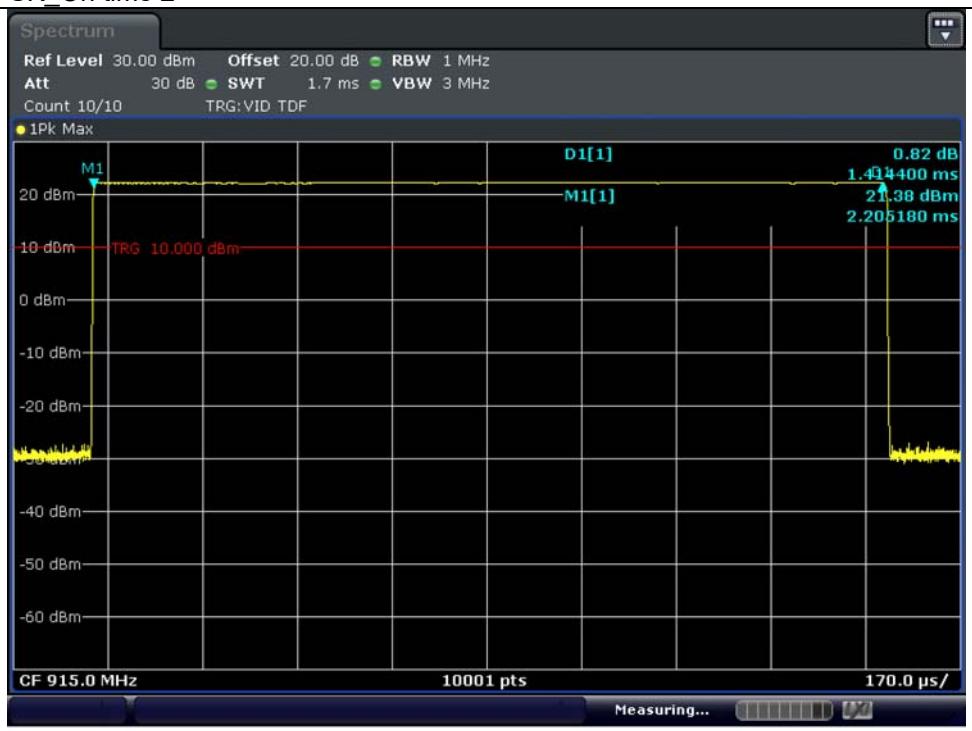
GFSK_Period



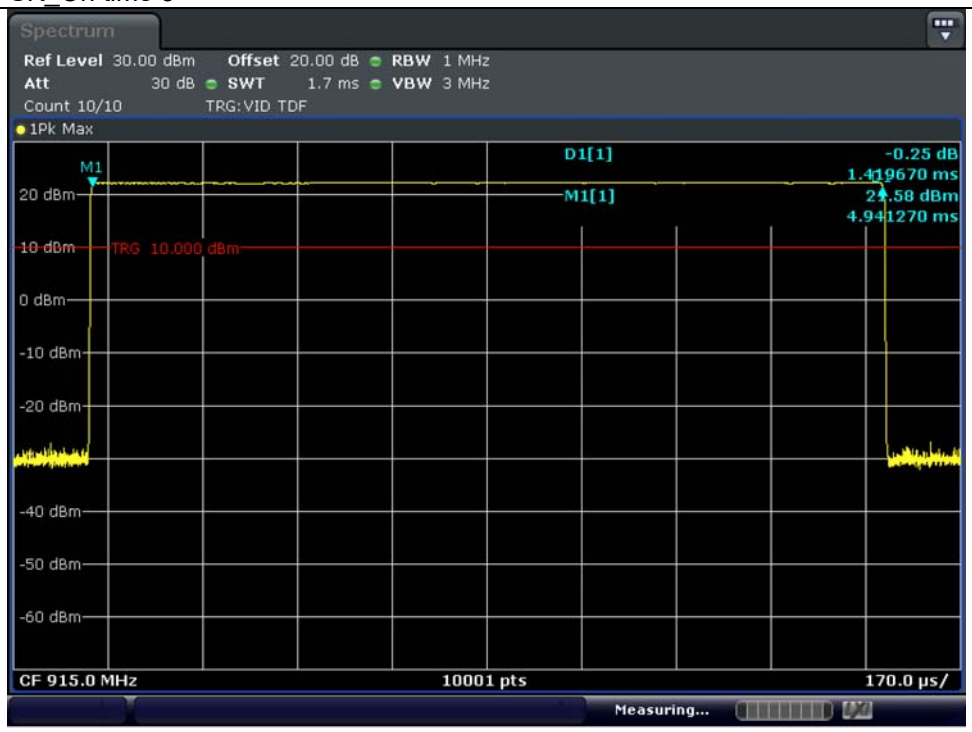
GFSK_On time 1



GFSK_On time 2



GFSK_On time 3



NOTE: Dwell time: on time*No. of hop
Dutycycle Factor : 20log(dwell time/100) = 20log(((0.842+1.4144+1.41967)*1)/100) = -28.69

4.4.8 Receiver Radiated Emission

4.4.8.1 Regulation

According to §15.111(a) In addition to the radiated emission limits, receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provide terminals for the connection of an external receiving antenna may be tested to demonstrate compliance with the provisions of §15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna, provided these receivers also comply with the following: With the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at any frequency within the range of measurements specified in §15.33 shall not exceed 2.0 nanowatts.

According to §15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed 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(kHz)	300
0.490 - 1.705	24 000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shallnot 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.

4.4.8.2 Measurement Procedure

ANSI C63.10 § 11.11.1 General Information
ANSI C63.10 § 11.11.3 Emission level measurement

4.4.8.2.1 Receiver Radiated Emission

1) The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 m(Below 1 GHz).
2) The EUT was placed on the top of the 0.8-meter height. 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 30 to 1 000 MHz using the BILOG broadband 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	:	100 kHz for f < 1 GHz
VBW	:	≥ 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.

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.

4.4.8.3 Result

Comply (measurement data : refer to the next page)

4.4.8.4 Measurement data_Receiver Radiated Emissions

Test mode : 30 MHz ~ 1 GHz_GFSK_Lowest Frequency_Antenna 2

Frequency (MHz)	Detector	Pol. (V/H)	Reading (dBμV)	Ant Factor (dB)	Loss (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
877.00	QP	H	19.20	23.60	-19.10	23.70	46.00	22.30

Note 1 : Loss : Cable loss – Amp gain
Note 2 : Result : Reading + Ant Factor + Loss
Note 3 : Peak measurement did not take place because it is more than 20dB difference in the limit

Test mode : 30 MHz ~ 1 GHz_GFSK_Middle Frequency_Antenna 2

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

Note 1 : Loss : Cable loss – Amp gain
Note 2 : Result : Reading + Ant Factor + Loss
Note 3 : Peak measurement did not take place because it is more than 20dB difference in the limit

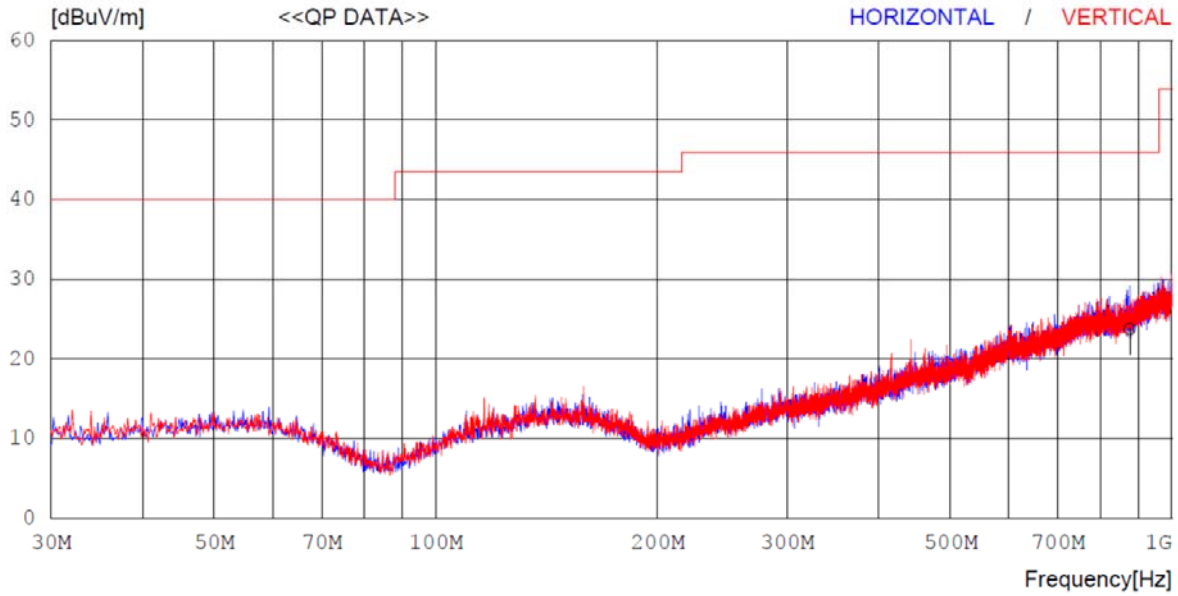
Test mode : 30 MHz ~ 1 GHz_GFSK_Highest Frequency_Antenna 2

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

Note 1 : Loss : Cable loss – Amp gain
Note 2 : Result : Reading + Ant Factor + Loss
Note 3 : Peak measurement did not take place because it is more than 20dB difference in the limit

4.4.8.5 Measurement Plot_Receiver Radiated Emissions

Test mode : 30 MHz ~ 1 GHz Worst Case(GFSK_Lowest Frequency)_Antenna 2



4.4.9 Conducted Emission

4.4.9.1 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 μH/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 (dBμV)	
	Qausi-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.

4.4.9.2 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 μH 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 QUASIPEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

4.4.9.3 Result

Not Applicable(This device gets power supply from only battery(DC 3.7 V)
The battery only charges with a excusive cradle.)

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	2020-01-15	2021-01-15
Digital MultiMeter	HP	34401A	US36025428	2020-01-14	2021-01-14
Signal Generator	ROHDE&SCHWARZ	SMB100A	178384	2019-10-14	2020-10-14
EMI Test Receiver	ROHDE&SCHWARZ	ESU40	100445	2019-12-13	2020-12-13
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 Ridege Horn Antenna	ETS	3117	00168719	2019-04-09	2021-04-09
PREAMPLIFIER	Agilent	8449B	3008A02110	2020-01-10	2021-01-10
EMI Test Receiver	ROHDE&SCHWARZ	ESR7	101440	2019-12-13	2020-12-13
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