

RF TEST REPORT

Test Equipment : Connectivity Display Audio with Navigation System
Model Name : JCHAI300AVNC
FCC ID : 2A2QTJCHAI300AVNC
Date of receipt : 2021-07-28
Test duration : 2021-08-02 ~ 2021-08-04
Date of issue : 2021-08-13

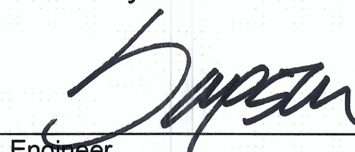
Applicant : JCH Automotive Technology Co., Ltd.
A-711-1, 7F, SAMWHAN-HIPEX,,240, Pangyoyeok-ro,
Bundang-gu, Seongnam-si, Gyeonggi-do, 13493
Republic of Korea

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

Test specification : FCC Part 15 Subpart C 15.247
RF Output Power : 3.08 dBm
Test result : Pass

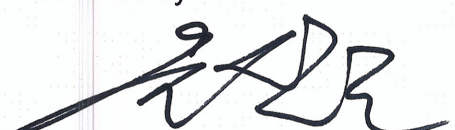
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This test report is not related to KOLAS.

Tested by:



Engineer
SungSin Kim

Reviewed by:



Technical Manager
SangHoon Yu

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1. Revision history

Test Report No.	Date	Description
TRRFCC21-0007	2021-08-13	Initial issue

2. Information

2.1 Applicant Information

Applicant name	JCH Automotive Technology Co., Ltd.
Address	A-711-1, 7F, SAMWHAN-HIPEX,,240, Pangyoyeok-ro, Bundang-gu, Seongnam-si Gyeonggi-do, 13493, Republic of Korea
Telephone No.	+82-31-609-4880
Person in charge	Aron Choi / aron@jchtech.co.kr
Manufacturer	DAESUNG ELTEC CO., LTD.
Address	82, Segyosandan-ro, Pyeongtaek-si, Gyeonggi-do, 17843, Korea

2.2 Test Laboratory information

Corporate name	Lab-T, Inc.
Representative	Duke(Jongyoung) Kim
Address	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Telephone	+82-31-322-6767
Fax	+82-31-322-6768
E-mail	info@lab-t.net
FCC Designation No.	KR0159
FCC Registration No.	133186

2.3 Test Site

Test Site	used	Address
Building L	☒	2182-40 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building A	☐	2182-44 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)
Building T	☒	2182-42 Baegok-daero, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17036, Korea(Republic of)

3. Information About Test Equipment

3.1 Equipment Information

Equipment type	Connectivity Display Audio with Navigation System
Model name	JCHAI300AVNC
Variant model name	-
Frequency range	2 402 ~ 2 480 MHz
Modulation type (Symbol rate / Bit rate)	GFSK(1 MSps / 1 Mbps), pi/4DQPSK(2 MSps / 2 Mbps), 8DPSK(3 MSps / 3 Mbps)
Power supply	DC 14.4 V
H/W version	1.0
S/W version	AI3AVN_0.9.2

NOTE1: The above EUT information was declared by the manufacturer.

3.2 Antenna Information

Antenna	Type	PCB Pattern Antenna
	Gain	0.5 dBi

3.3 Test Frequency

Test mode	Test frequency (MHz)		
	Lowest frequency	Middle frequency	Highest frequency
GFSK	2 402	2 441	2 480
pi/4DQPSK	2 402	2 441	2 480
8DPSK	2 402	2 441	2 480

3.4 Worst-Case

BDR	GFSK(DH5)
EDR	8DPSK(3-DH5)

Note:The power measurement has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

3.5 Tested Companion Device Information

Type	Manufacturer	Model	Note
-	-	-	-

3.6 Operating conditions for the EUT

Firmware state		S0025(0.9.0)D
Test software name(version)		Broadcom BlueTool(v1.9.0.5)
Test power setting		Specify Power Table index(index 0)
Serial number (Setup mode)	EUT #1	#1 (Conducted Emission)
	EUT #2	#2 (Radiated Emission)

4. Test Report

4.1 Summary

FCC Rule	Parameter	Clause	Status
Transmitter Requirements			
15.203 15.247(b)(4)	Antenna Requirement	4.3.1	C
15.247(a)(1)	20 dB Channel Bandwidth	4.3.2	C
-	Occupied Bandwidth	4.3.2	-
15.247(a)(1)(iii)	Number of Hopping Frequencies	4.3.3	C
15.247(a)(1)(iii)	Time of occupancy (Dwell Time)	4.3.4	C
15.247(a)(1)	Carrier Frequencies Separation	4.3.5	C
15.247(b)(1)	Peak Output Power	4.3.6	C
15.247(d) 15.205(a) 15.209(a)	Spurious Emission, Band Edge and Restricted bands	4.3.7	C
15.207(a)	Conducted Emissions	4.3.8	N/A ^{NOTE2}
NOTE 1 : C = Comply N/C = Not Comply N/T = Not Tested N/A = Not Applicable			
NOTE 2 : Not Applicable (This device gets power supply from vehicle battery. (DC 12 V) Therefore this test item was not performed)			

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

4.2 Measurement Uncertainty

Mesurement items	Expanded Uncertainty	
RF Output Power	0.76 dB	(The confidence level is about 95 %, $k=2$)
Power Spectral Density	0.93 dB	(The confidence level is about 95 %, $k=2$)
Occupied Channel Bandwidth	17.25 kHz	(The confidence level is about 95 %, $k=2$)
Conducted Spurious Emissions	0.40 dB	(The confidence level is about 95 %, $k=2$)
Radiated Spurious Emissions (1 GHz under)	4.84 dB	(The confidence level is about 95 %, $k=2$)
Radiated Spurious Emissions (Above 1 GHz)	5.96 dB	(The confidence level is about 95 %, $k=2$)

4.3 Transmitter Requirements

4.3.1 Antenna Requirement

4.3.1.1 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) the 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.

4.3.1.2 Result

Comply

(The transmitter has a internal PCB Pattern Antenna. The directional peak gain of the antenna is 0.5 dBi.)

4.3.2 20 dB Bandwidth and Occupied Bandwidth

4.3.2.1 Regulation

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

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)

4.3.2.4 Measurement data

Test mode : GFSK

Frequency (MHz)	20 dB Bandwidth (MHz)	Min. Limit (MHz)	Occupied Bandwidth (99 % Bandwidth)(MHz)
2 402	0.80	0.25	0.88
2 441	0.80	0.25	0.88
2 480	0.80	0.25	0.87

Test mode : 8DPSK

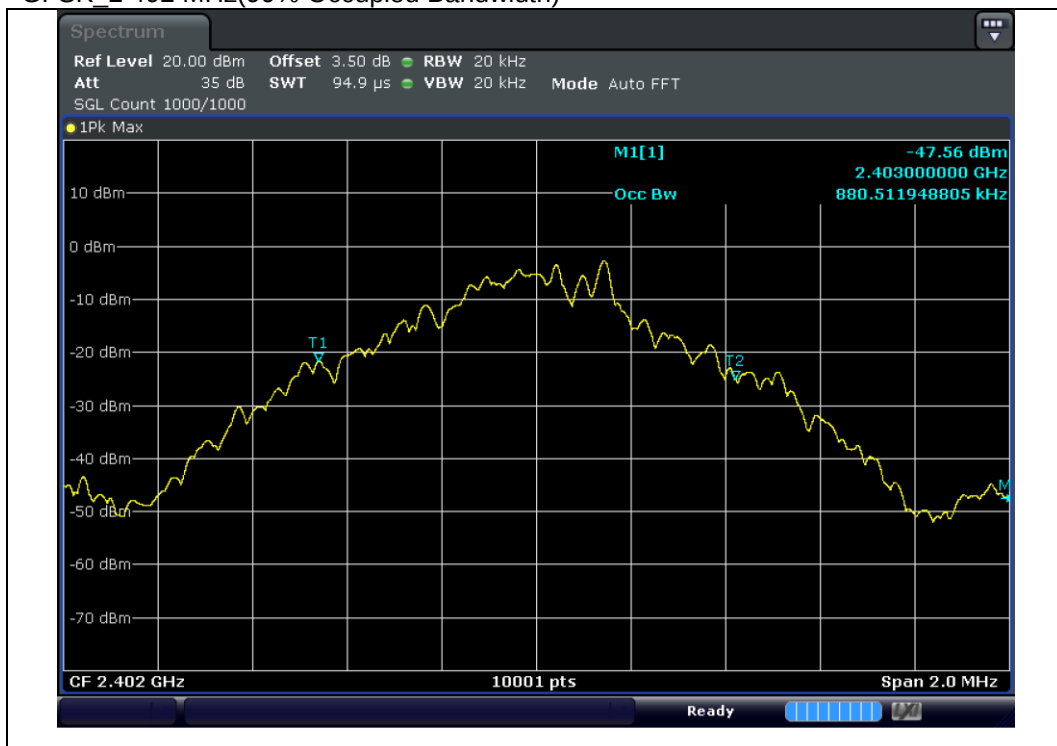
Frequency (MHz)	20 dB Bandwidth (MHz)	Min. Limit (MHz)	Occupied Bandwidth (99 % Bandwidth)(MHz)
2 402	1.26	0.25	1.17
2 441	1.25	0.25	1.17
2 480	1.26	0.25	1.17

4.3.2.5 Test Plot

GFSK 2 402 MHz(20 dB Bandwidth)



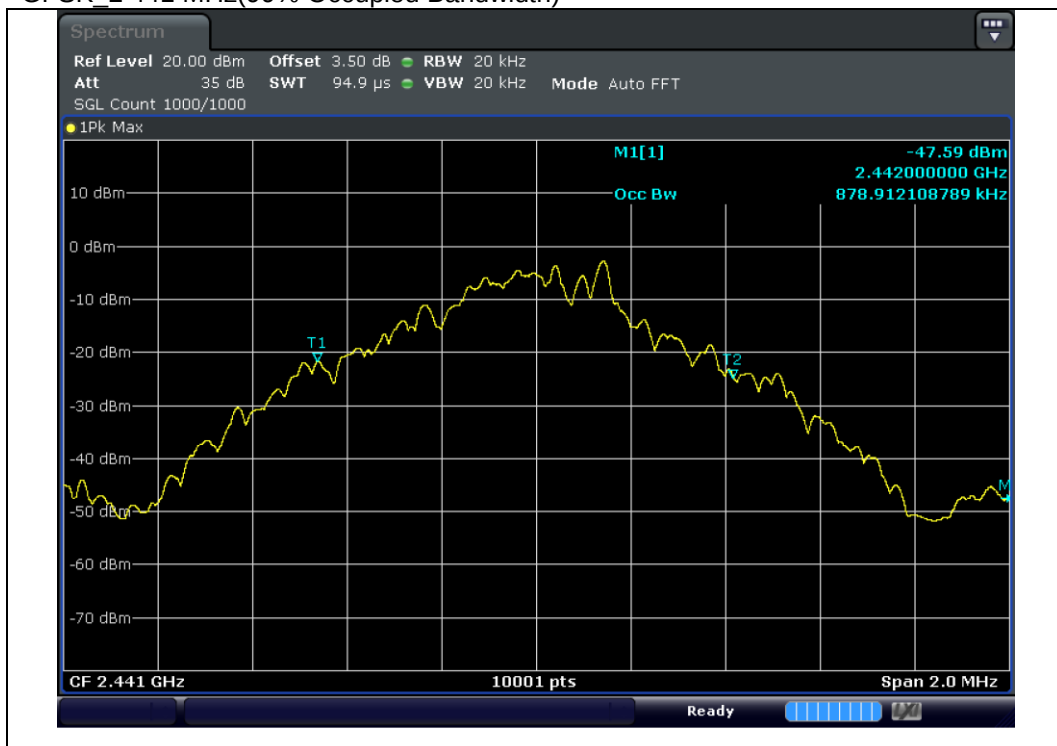
GFSK 2 402 MHz(99% Occupied Bandwidth)



GFSK 2 441 MHz(20 dB Bandwidth)



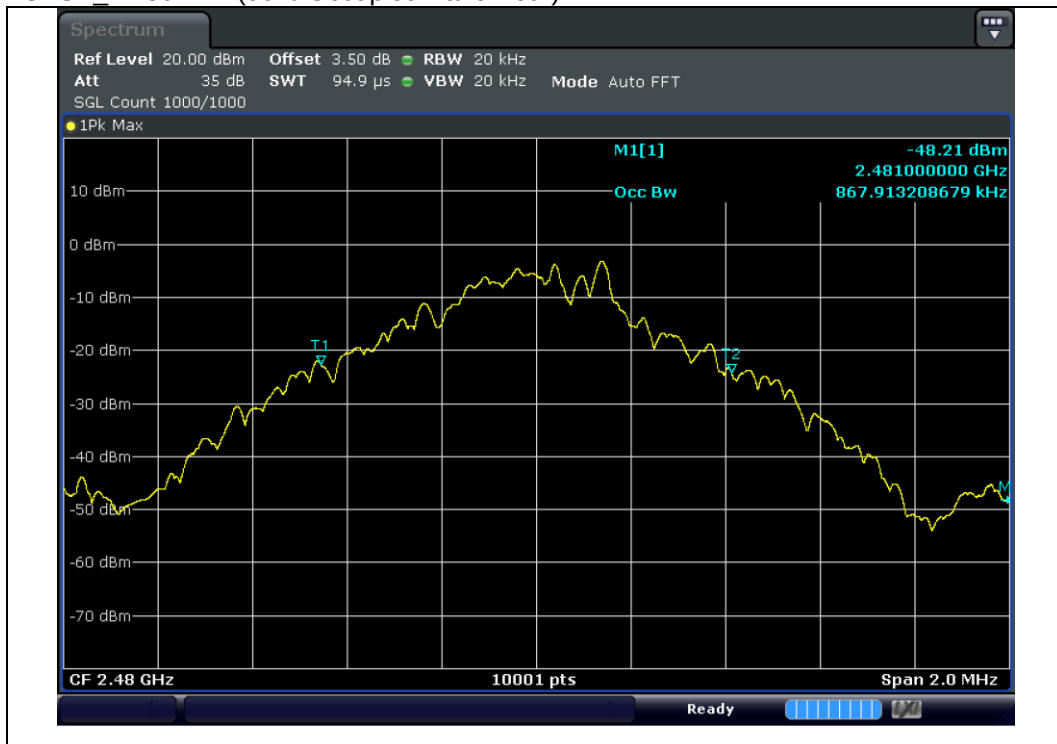
GFSK_2 441 MHz(99% Occupied Bandwidth)



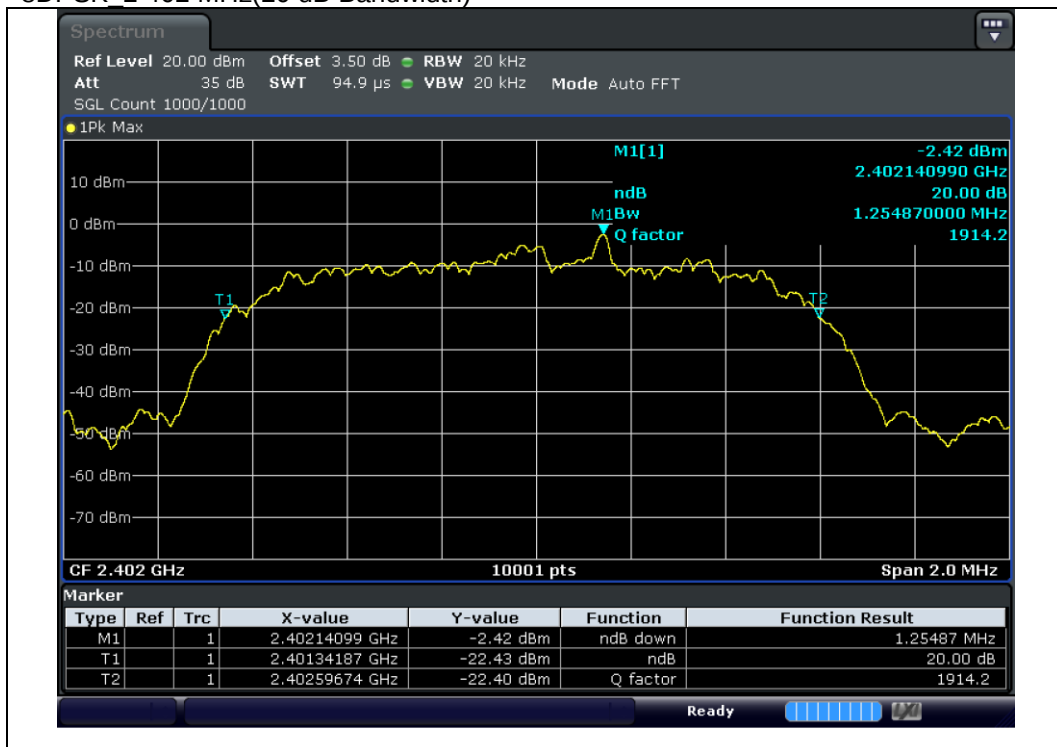
GFSK 2 480 MHz(20 dB Bandwidth)



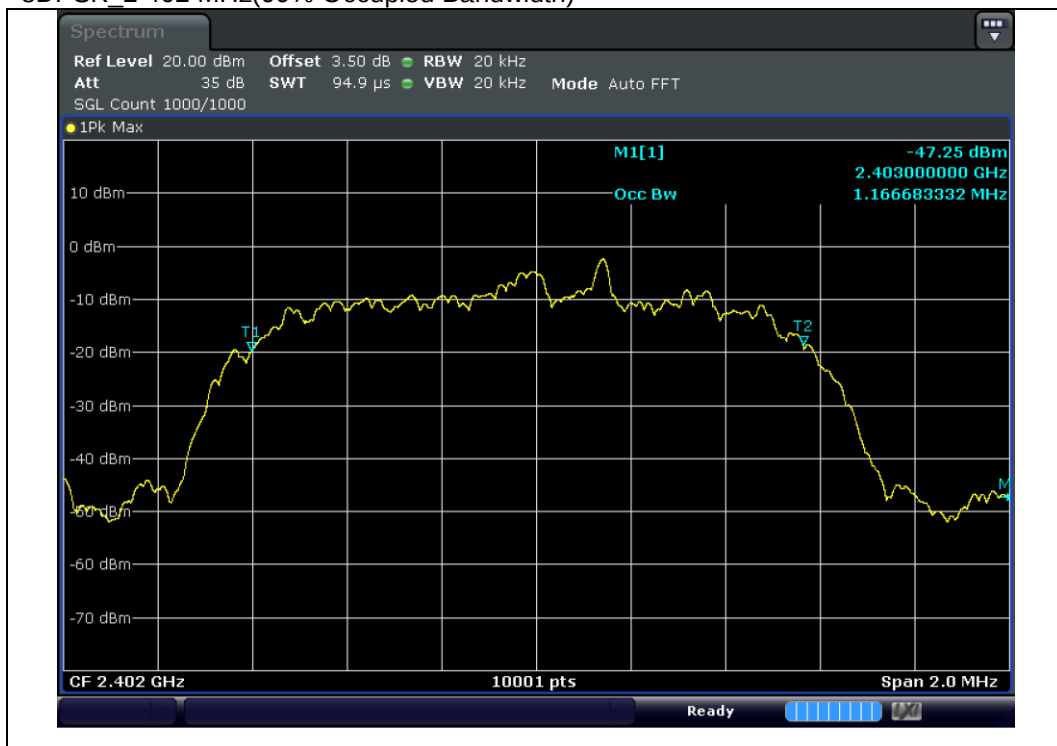
GFSK_2 480 MHz(99% Occupied Bandwidth)



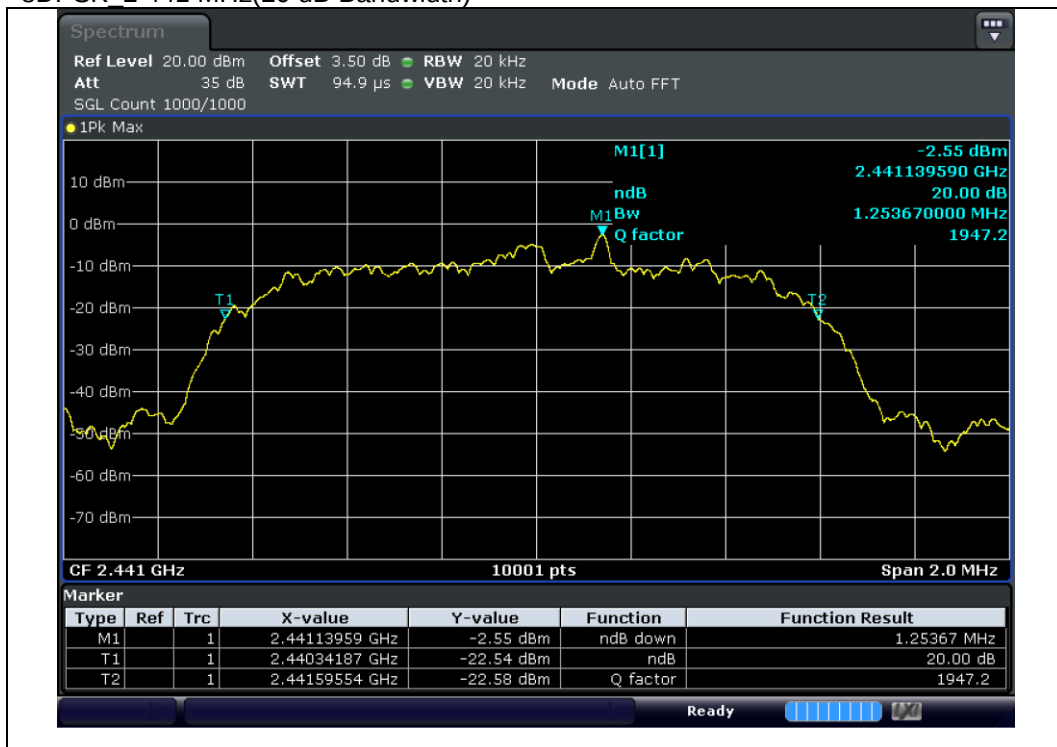
8DPSK 2 402 MHz(20 dB Bandwidth)



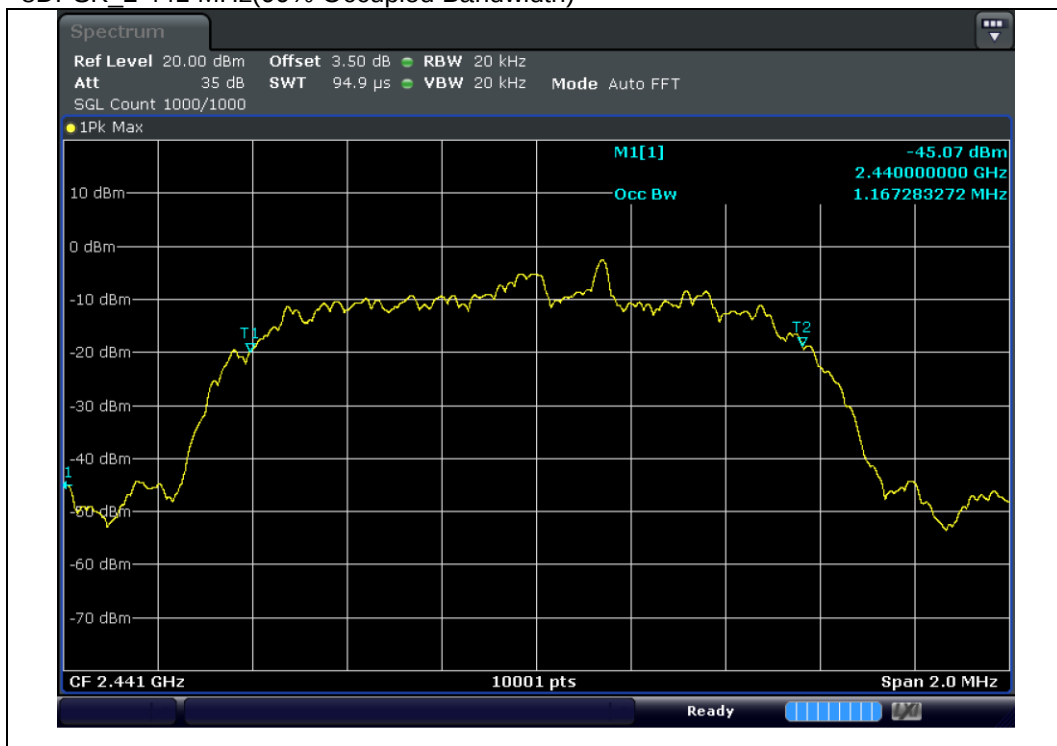
8DPSK 2 402 MHz(99% Occupied Bandwidth)



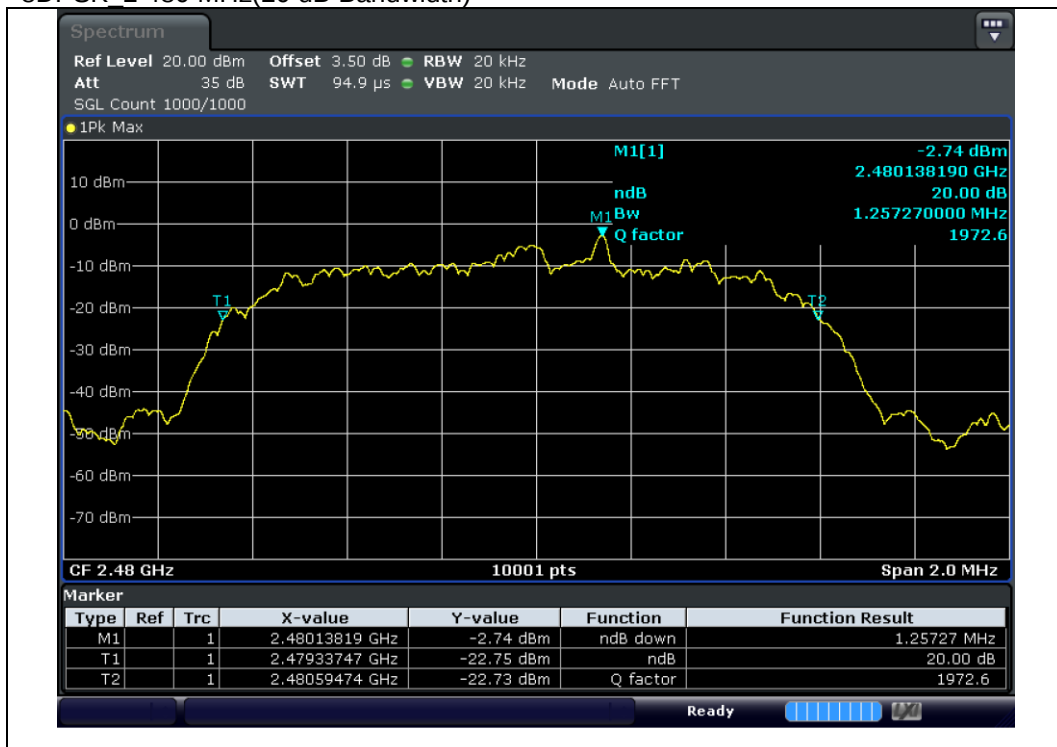
8DPSK 2 441 MHz(20 dB Bandwidth)



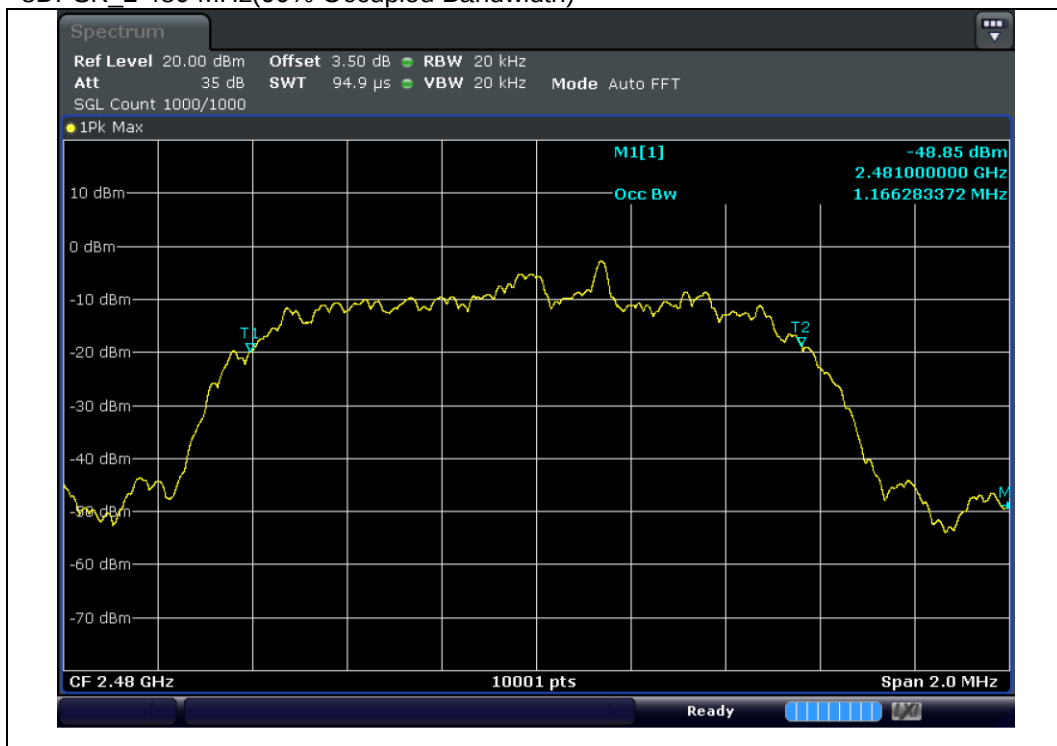
8DPSK 2 441 MHz(99% Occupied Bandwidth)



8DPSK 2 480 MHz(20 dB Bandwidth)



8DPSK 2 480 MHz(99% Occupied Bandwidth)



4.3.3 Number of Hopping Frequencies

4.3.3.1 Regulation

According to §15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.3.3.2 Measurement Procedure

ANSI C63.10 § 7.8.3 Number of hopping frequencies

4.3.3.3 Result

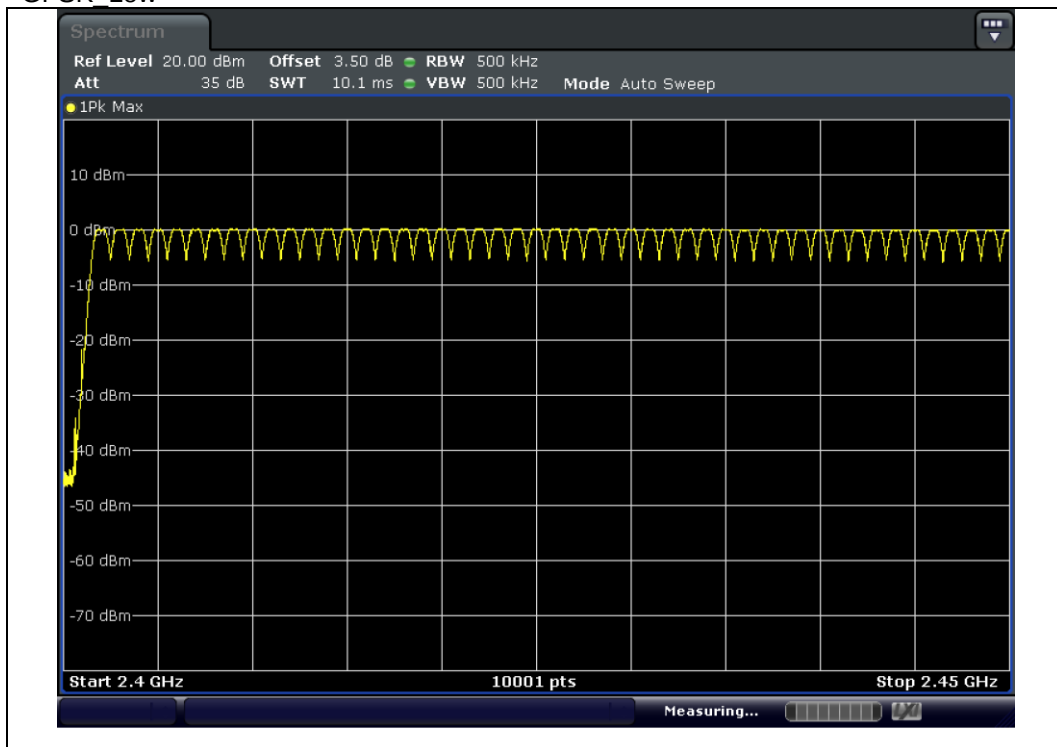
Comply (measurement data : refer to the next page)

4.3.3.4 Measurement data

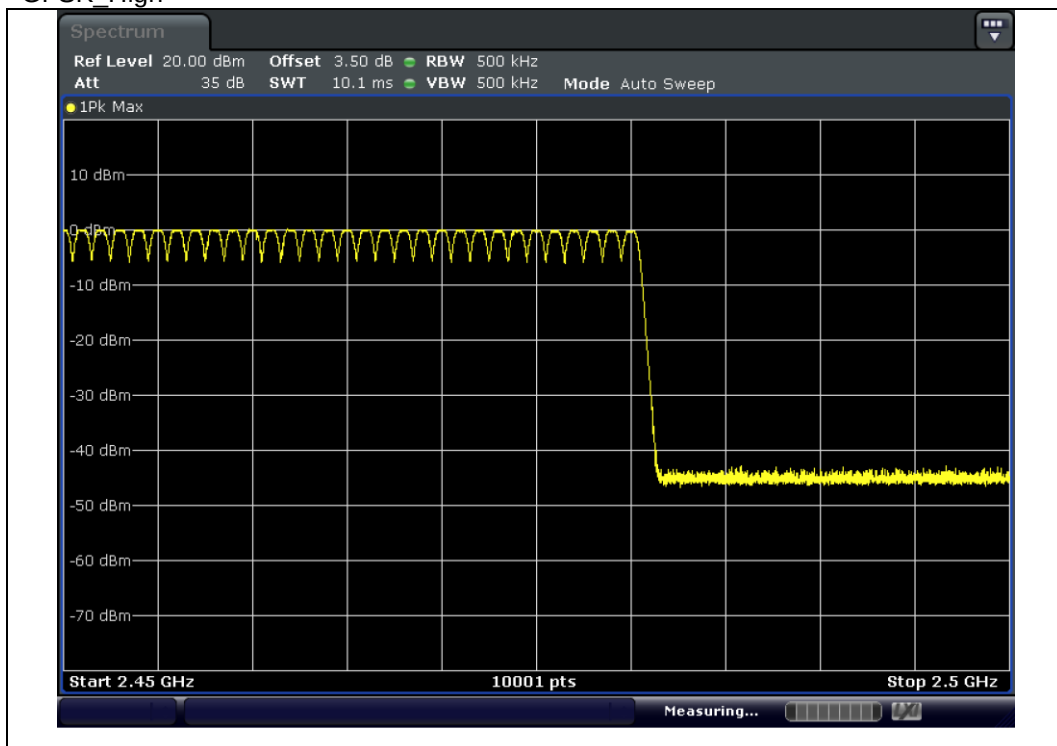
TEST MODE	Number of Hopping channels
GFSK	79
GFSK(AFH)	20
8DPSK	79
8DPSK(AFH)	20

4.3.3.5 Test Plot

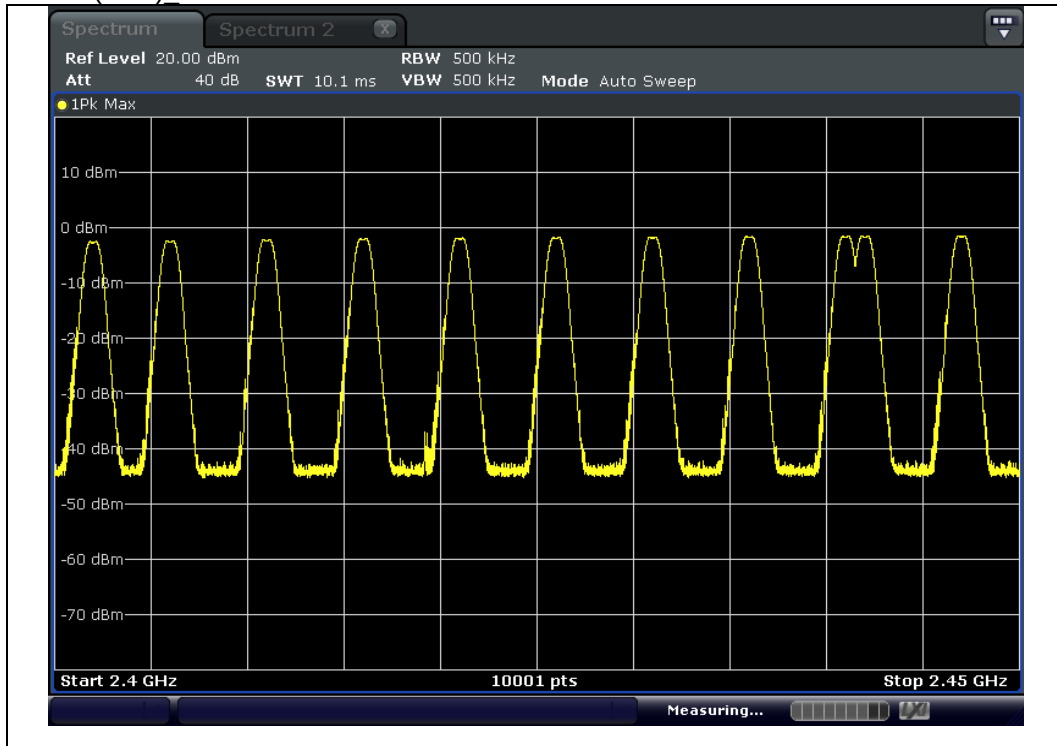
GFSK_Low



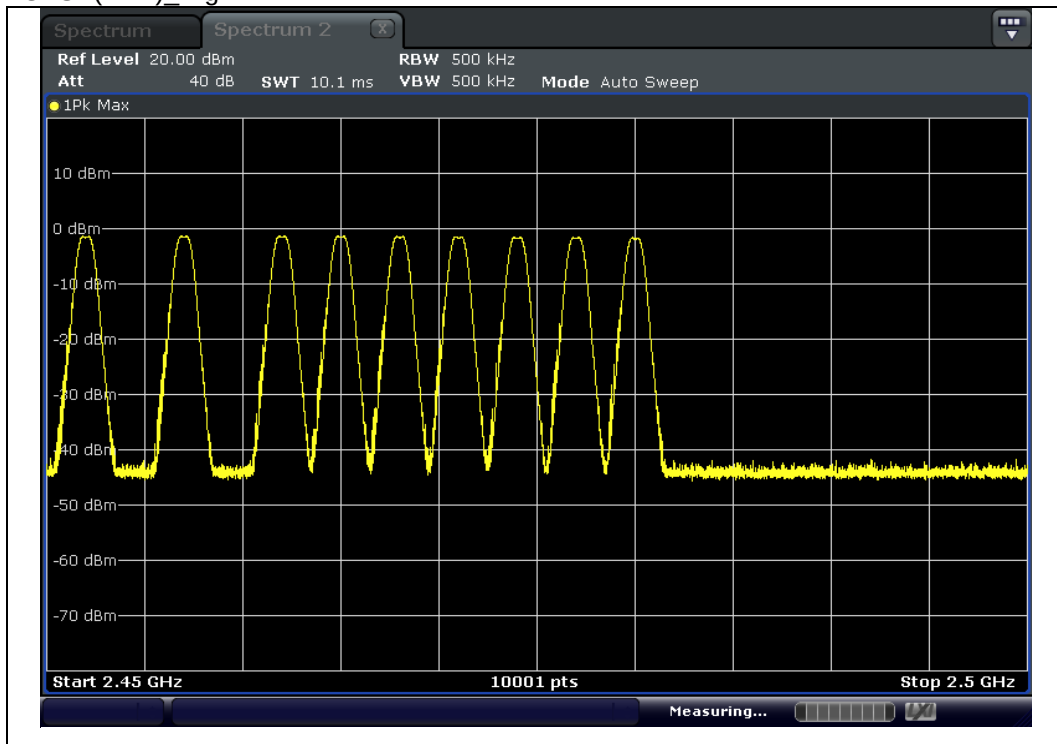
GFSK_High



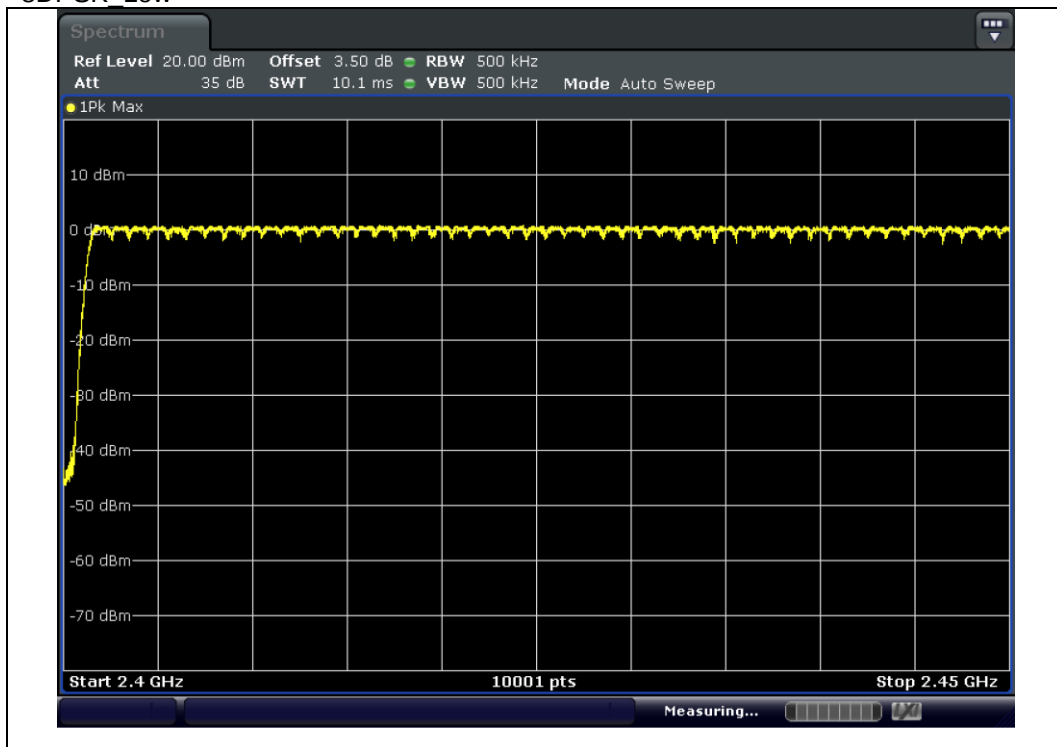
GFSK(AFH) Low



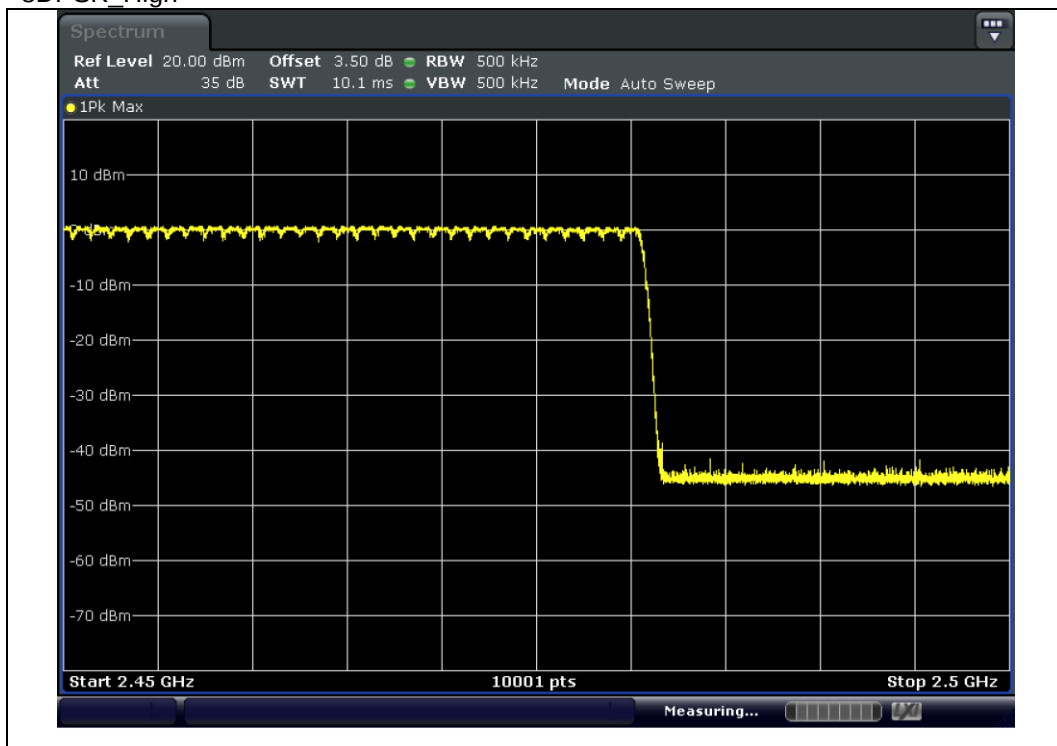
GFSK(AFH) High



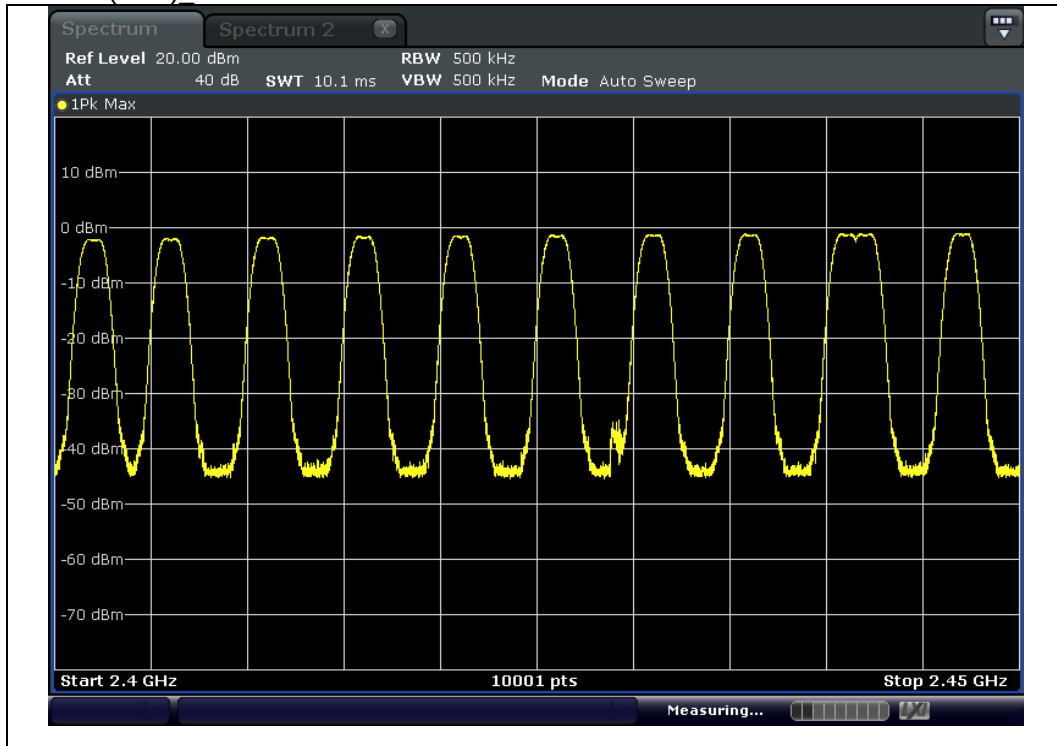
8DPSK_Low



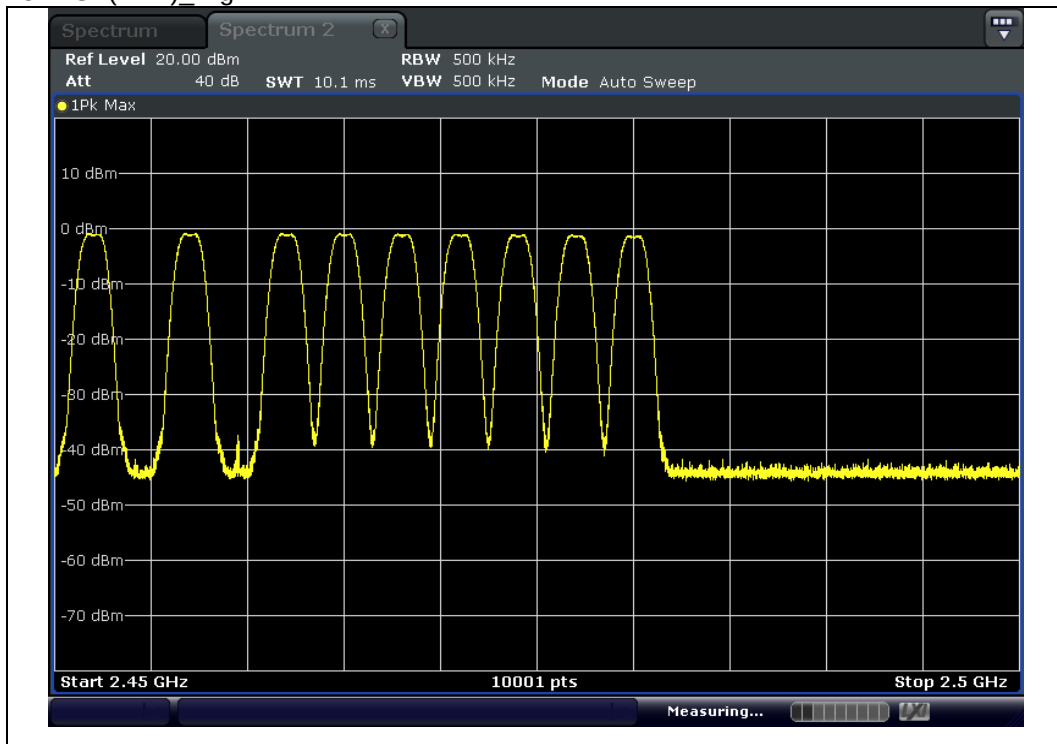
8DPSK_High



8DPSK(AFH) Low



8DPSK(AFH) High



4.3.4 Time of occupancy (Dwell Time)

4.4.4.1 Regulation

According to §15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.3.4.2 Measurement Procedure

ANSI C63.10 § 7.8.3 Time of Occupancy

4.3.4.3 Result

Comply (measurement data : refer to the next page)

4.3.4.4 Measurement data

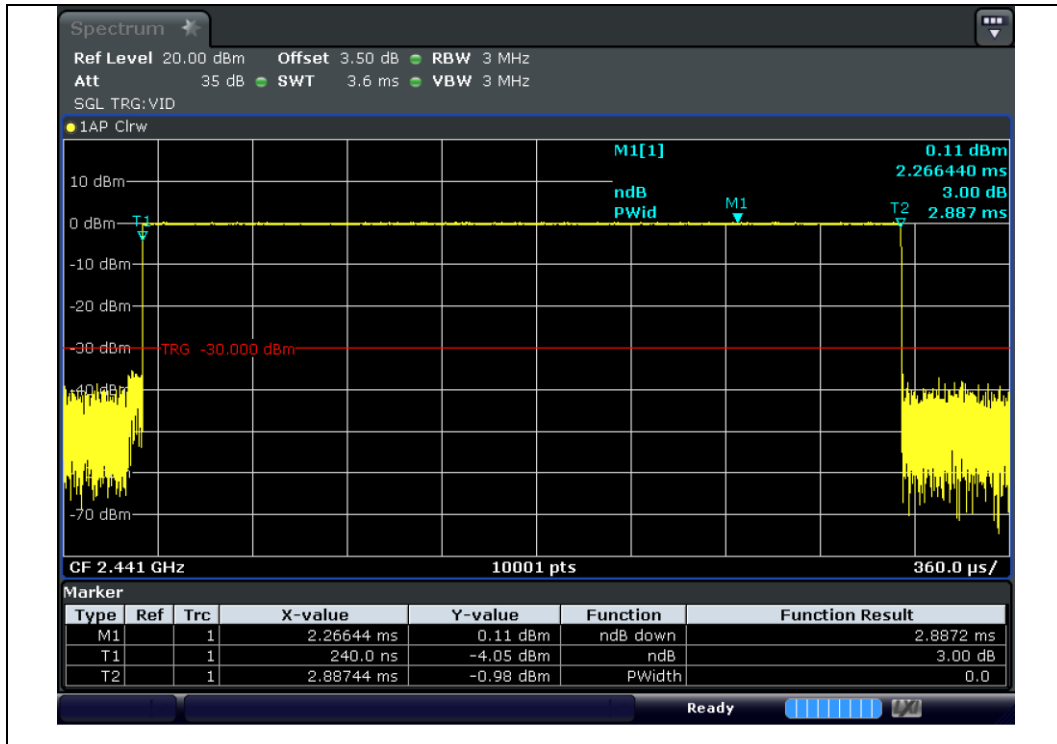
Test mode : Hopping

Time of occupancy				
Packet Type	Number of hopping Channels	Burst On Time (ms)	Result (sec)	Limit (sec)
GFSK(non-AFH)	79	2.89	0.31	0.40
GFSK(AFH)	20	2.89	0.15	0.40
8DPSK(non-AFH)	79	2.89	0.31	0.40
8DPSK(AFH)	20	2.89	0.15	0.40

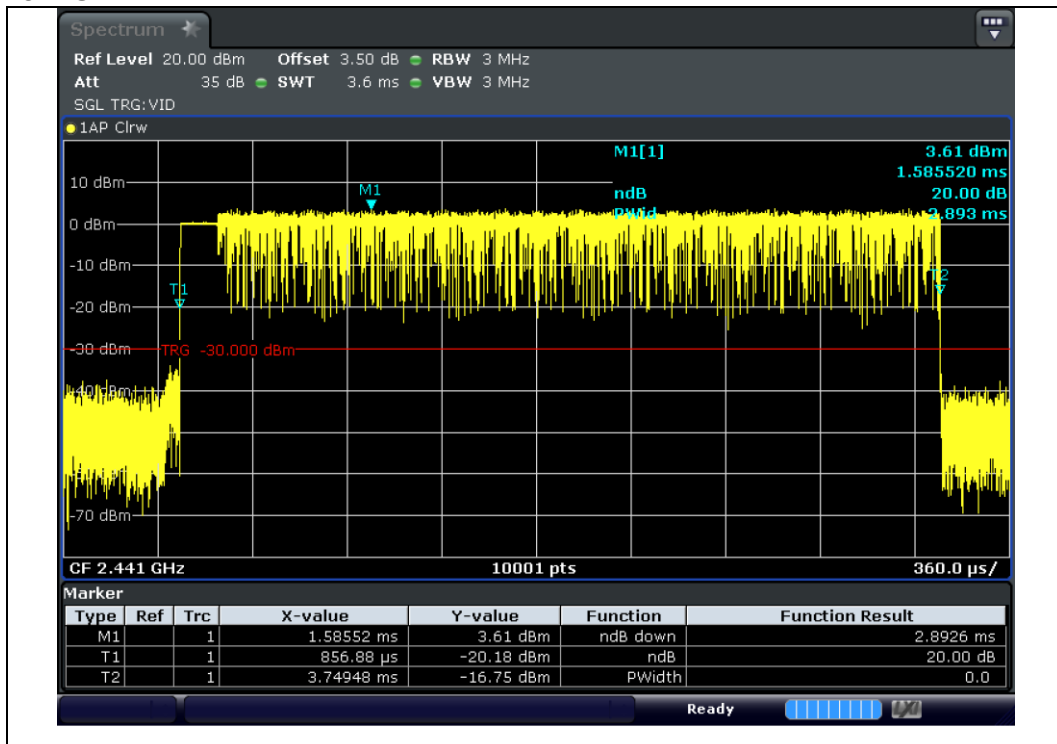
NOTE1 : Result = $0.4 * \text{Hopping Channel} * \text{Burst On Time} * ((\text{Hopping rate}/\text{Time slots})/\text{Hopping channel})$
 - Time slots for DH5 = 6 slots(TX = 5 slot, RX = 1 slot)
 - Hopping Rate = 1600 for FH mode
 - Hopping Rate = 800 for AFH mode

4.3.4.5 Test Plot

GFSK



8DPSK



4.3.5 Carrier Frequencies Separation

4.3.5.1 Regulation

According to §15.247(a)(1) 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.

4.3.5.2 Measurement Procedure

ANSI C63.10 § 7.8.2 Carrier frequency separation

4.3.5.3 Result

Comply (measurement data : refer to the next page)

4.3.5.4 Measurement data

Test mode : GFSK

Carrier Frequency Separation		
Test hopping channel No.	Result (MHz)	Min. Limit (MHz)
Channel 1 to Channel 2	1.00	0.80
Channel 39 to Channel 40	1.00	0.80
Channel 78 to Channel 79	1.00	0.80

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

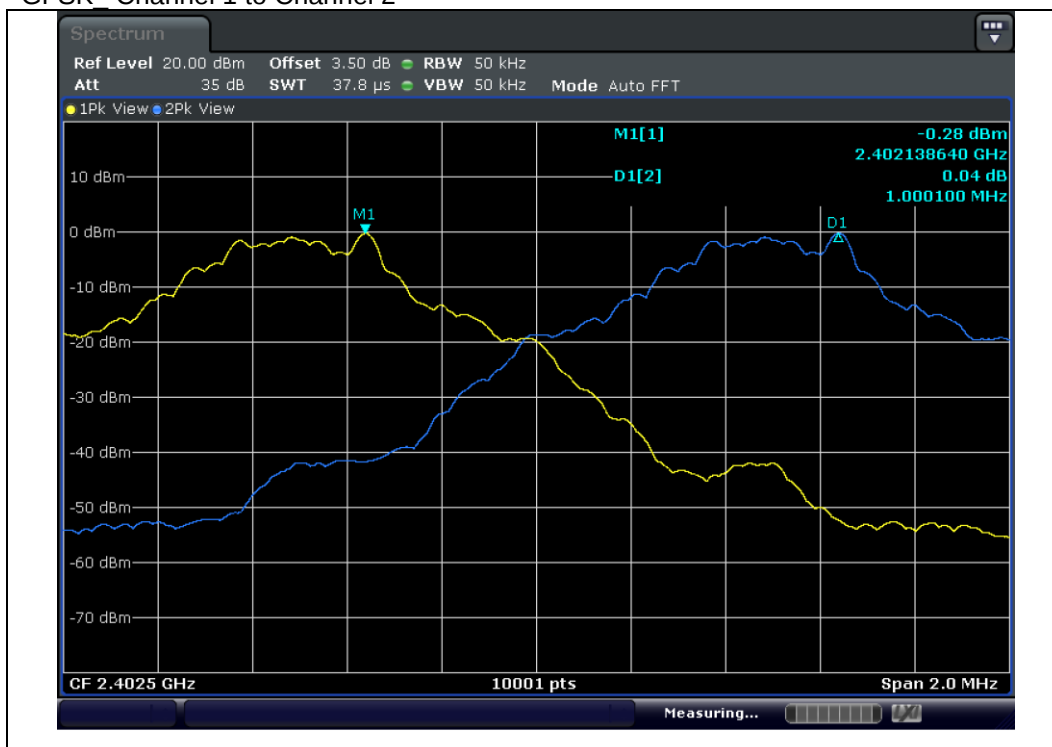
Test mode : 8DPSK

Carrier Frequency Separation		
Test hopping channel No.	Result (MHz)	Min. Limit (MHz)
Channel 1 to Channel 2	1.00	0.84
Channel 39 to Channel 40	1.00	0.84
Channel 78 to Channel 79	1.00	0.84

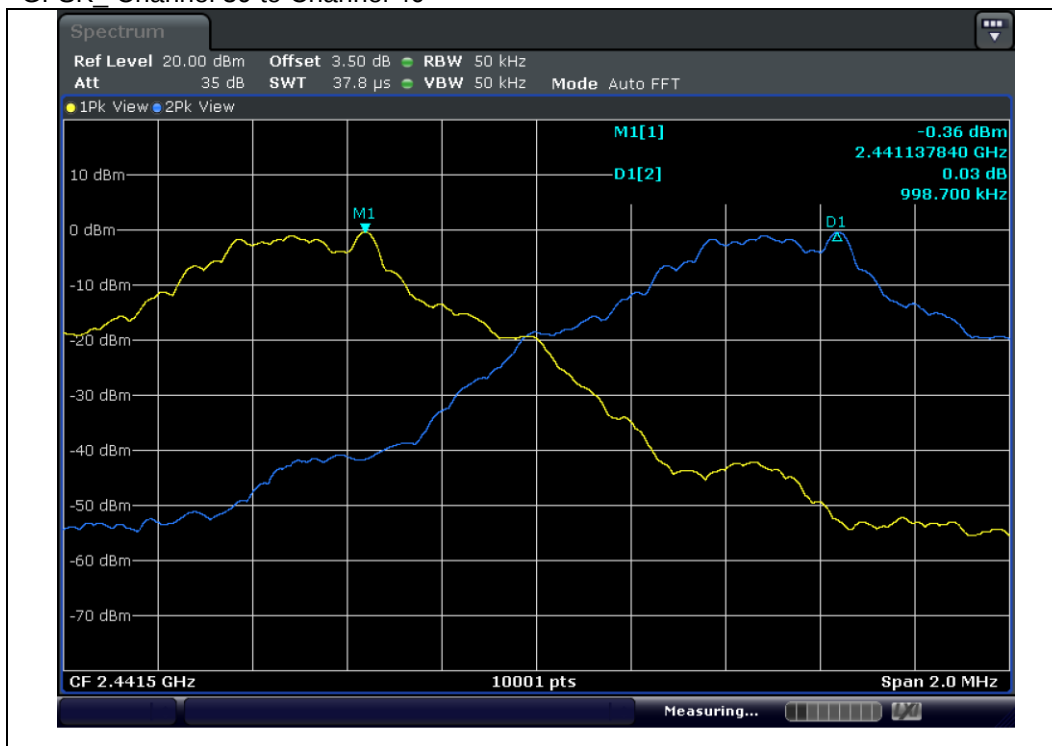
NOTE1 : Limit(kHz) : Result of 20 dB Bandwidth*2/3

4.3.5.5 Test Plot

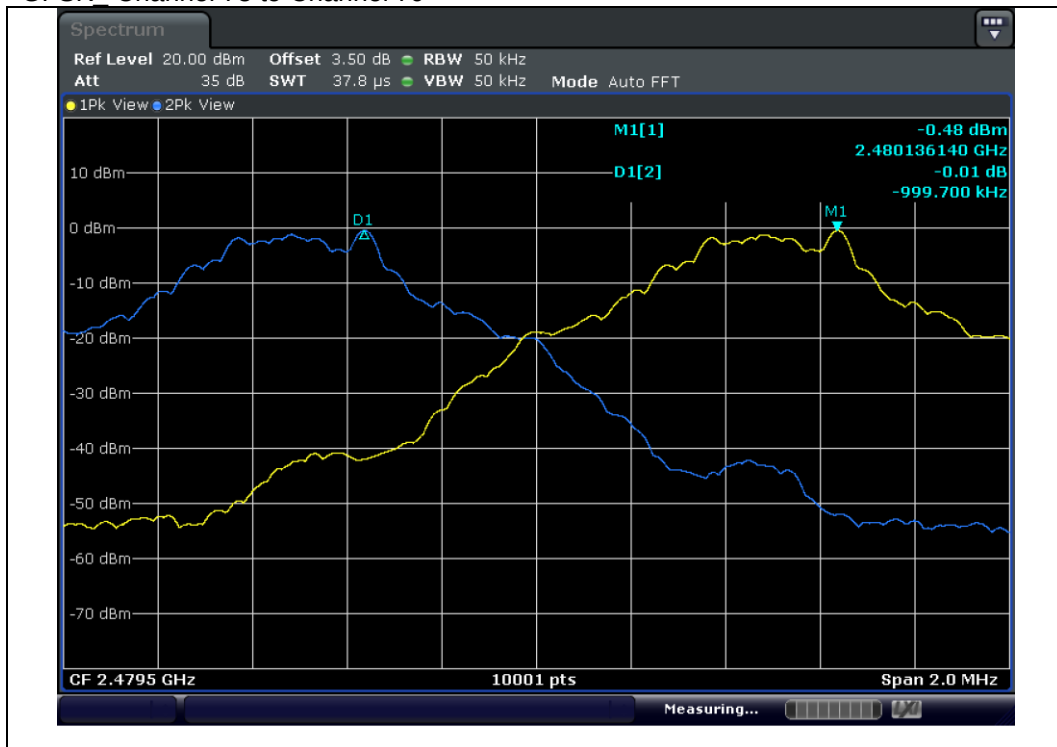
GFSK Channel 1 to Channel 2



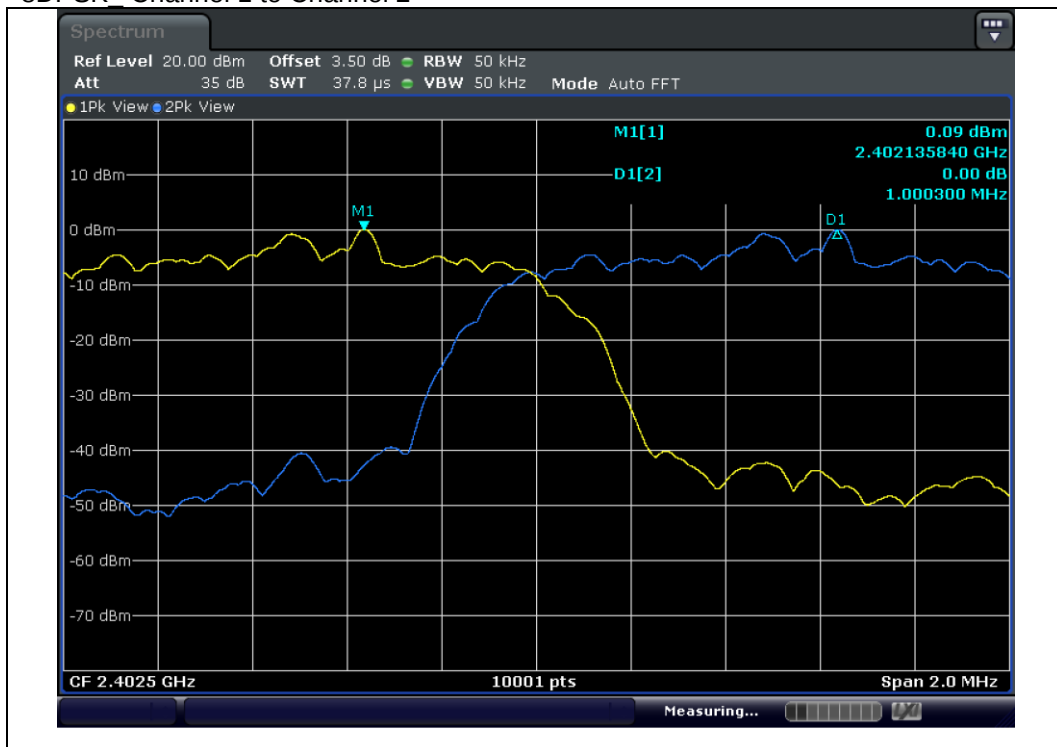
GFSK Channel 39 to Channel 40



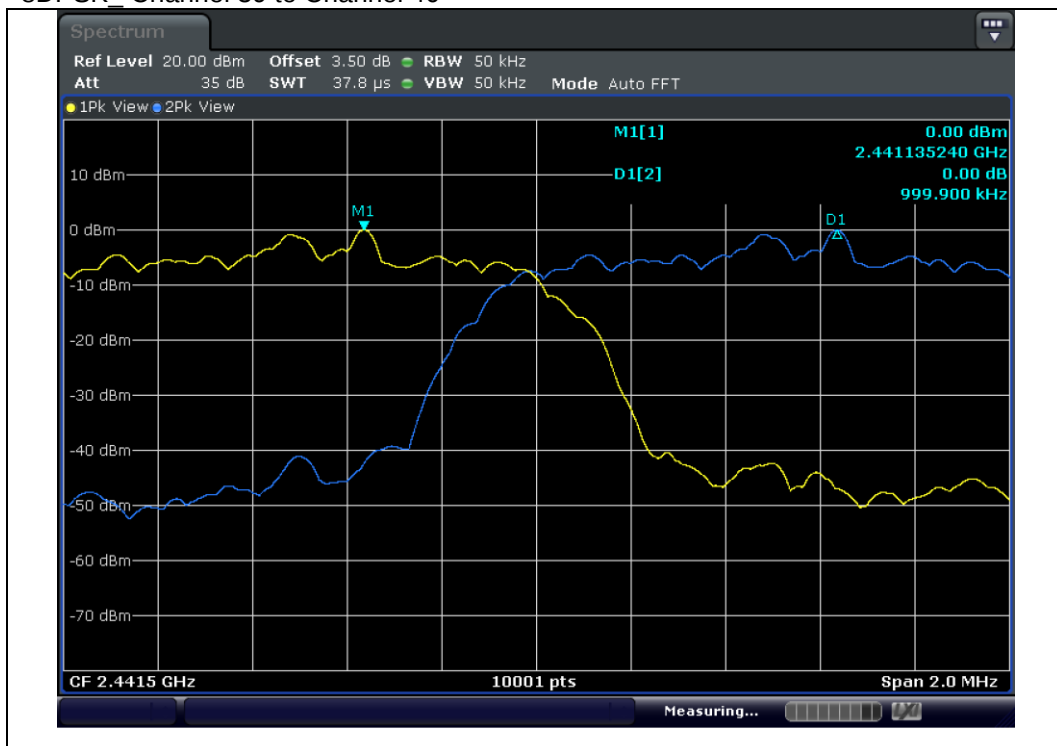
GFSK Channel 78 to Channel 79



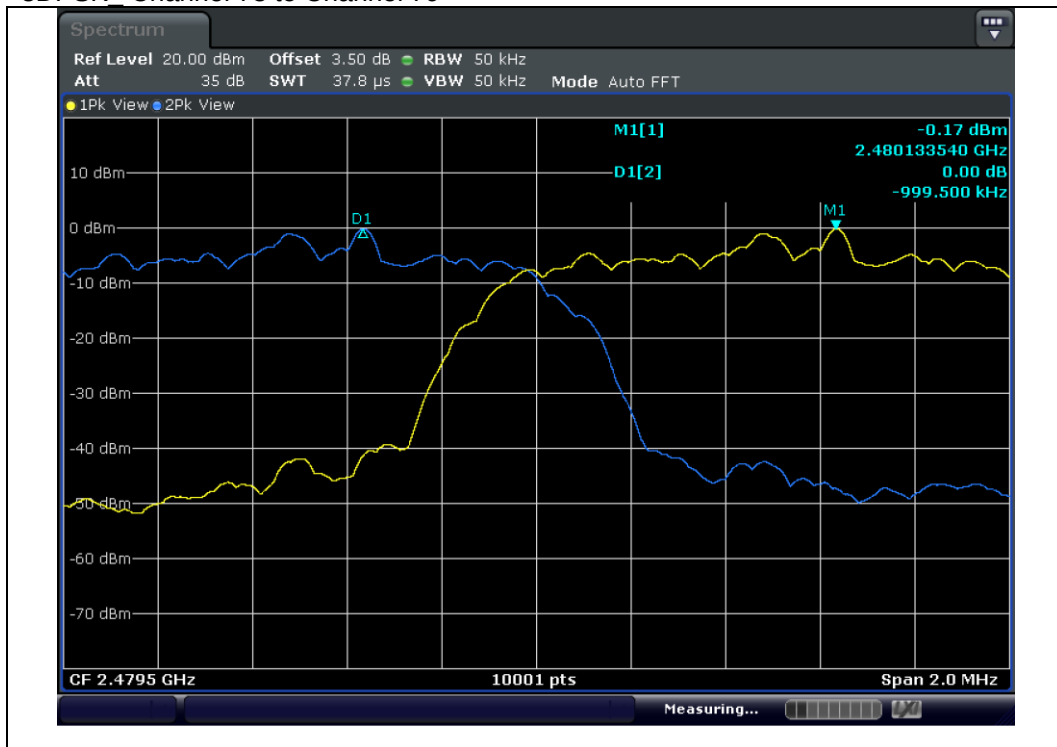
8DPSK_Channel 1 to Channel 2



8DPSK_Channel 39 to Channel 40



8DPSK Channel 78 to Channel 79



4.3.6 Peak Output Power

4.3.6.1 Regulation

According to §15.247(a)(1) 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.

According to §15.247(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 nonoverlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

4.3.6.2 Measurement Procedure

ANSI C63.10 § 7.8.5 Output Power test procedure for FHSS

4.3.6.3 Result

Comply (measurement data : refer to the next page)

4.3.6.4 Measurement data

Test mode : GFSK

Frequency (MHz)	Peak Output Power Result (dBm)	Peak Output Power Result (mW)	Peak Output Power Limit (mW)
2 402	0.07	1.02	1000.00
2 441	-0.03	0.99	1000.00
2 480	-0.17	0.96	1000.00

- NOTE1 : Since the directional gain of the PCB 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)})
NOTE4 : In the case of AFH, the limit for peak power is 0.125W

Test mode : pi/4DQPSK

Frequency (MHz)	Peak Output Power Result (dBm)	Peak Output Power Result (mW)	Peak Output Power Limit (mW)
2 402	3.00	2.00	125.00
2 441	2.96	1.98	125.00
2 480	2.83	1.92	125.00

- NOTE1 : Since the directional gain of the PCB 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)})
NOTE4 : In the case of AFH, the limit for peak power is 0.125W

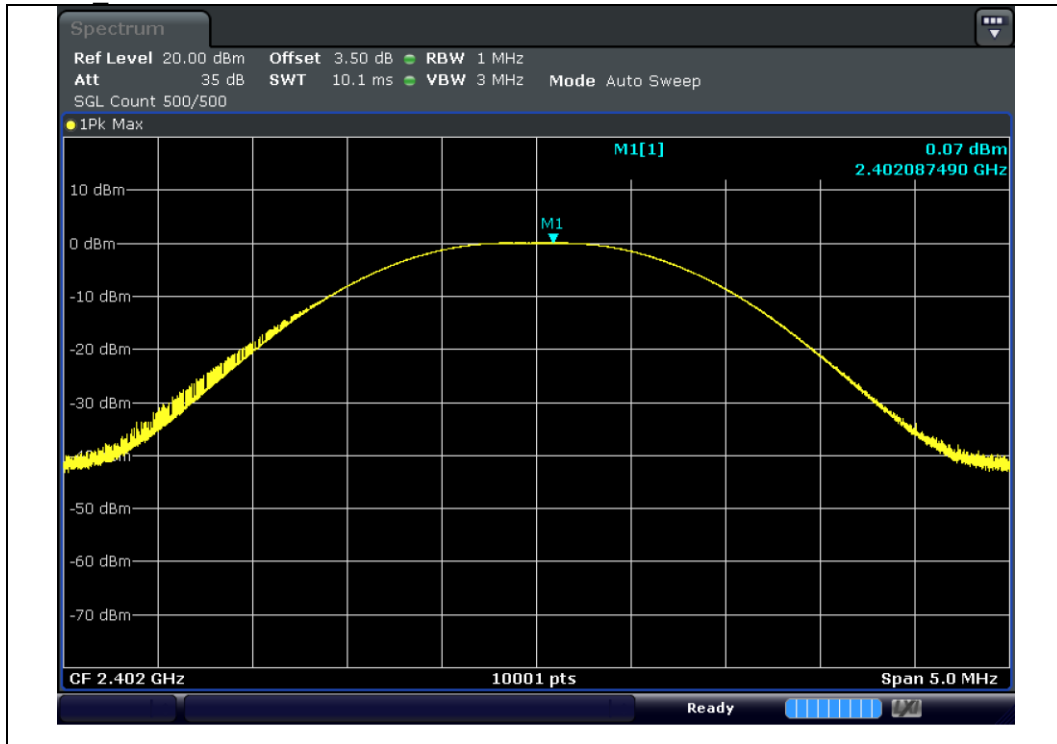
Test mode : 8DPSK

Frequency (MHz)	Peak Output Power Result (dBm)	Peak Output Power Result (mW)	Peak Output Power Limit (mW)
2 402	3.08	2.03	125.00
2 441	3.03	2.01	125.00
2 480	2.89	1.94	125.00

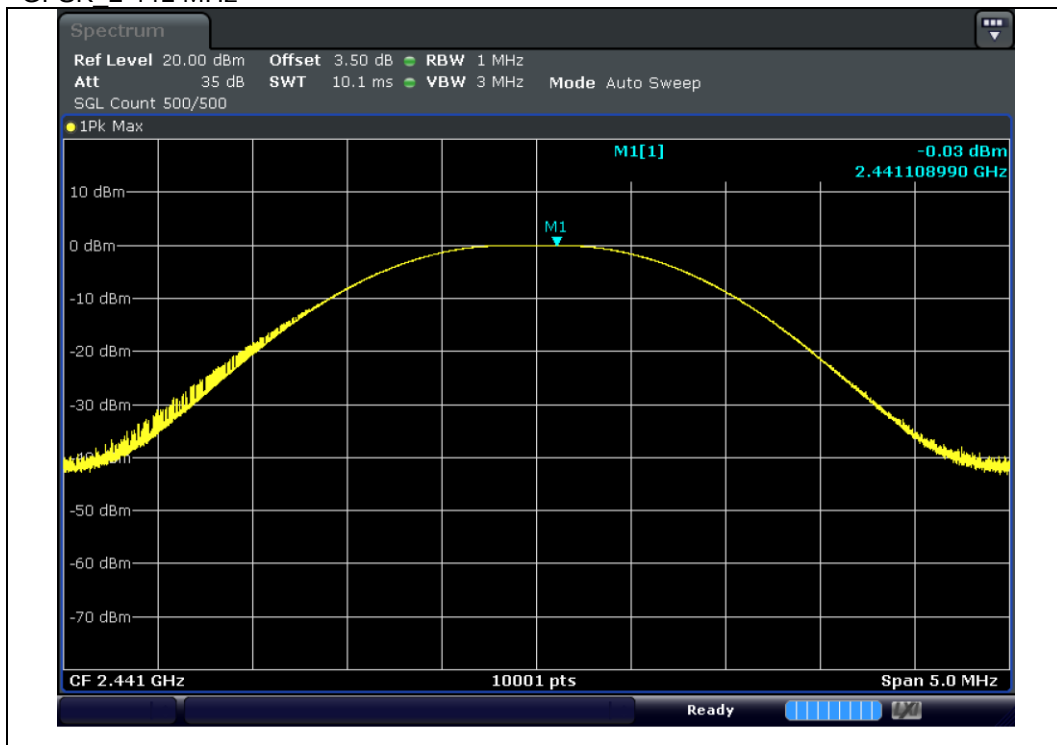
- NOTE1 : Since the directional gain of the PCB Antenna declared by the manufacturer, does not exceed 6.0 dBi ,there was no need to reduce the output power.
NOTE2 : We took the insertion loss of the cable loss into consideration within the measuring instrument.
NOTE3 : Peak Output Power Result(mW) = (10^{^(Peak Output Power Result(dBm)/10)})
NOTE4 : In the case of AFH, the limit for peak power is 0.125W

4.3.6.5 Test Plot

GFSK 2 402 MHz



GFSK 2 441 MHz



GFSK 2 480 MHz

