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# FCC Test Report

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Report No.: AGC08509200801FE02

**FCC ID** : 2ASEO-HM-BT2204

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION** : Bluetooth Low Energy Data Transmission Module

**BRAND NAME** : HOPERF

**MODEL NAME** : HM-BT2204

**APPLICANT** : SHEN ZHEN HOPE MICROELECTRONICS CO., LTD

**DATE OF ISSUE** : Aug. 27, 2020

**STANDARD(S)** : FCC Part 15.247

**REPORT VERSION** : V1.0

**Attestation of Global Compliance (Shenzhen) Co., Ltd**



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**REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Aug. 27, 2020	Valid	Initial Release

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## 1. VERIFICATION OF COMPLIANCE

<b>Applicant</b>	SHEN ZHEN HOPE MICROELECTRONICS CO., LTD
<b>Address</b>	2/F, 3 Building, Minqi Technology Park Pingshan Village, Xili Town, Nanshan District, Shenzhen, Guangdong, China
<b>Manufacturer</b>	SHEN ZHEN HOPE MICROELECTRONICS CO., LTD
<b>Address</b>	2/F, 3 Building, Minqi Technology Park Pingshan Village, Xili Town, Nanshan District, Shenzhen, Guangdong, China
<b>Factory</b>	SHEN ZHEN HOPE MICROELECTRONICS CO., LTD
<b>Address</b>	2/F, 3 Building, Minqi Technology Park Pingshan Village, Xili Town, Nanshan District, Shenzhen, Guangdong, China
<b>Product Designation</b>	Bluetooth Low Energy Data Transmission Module
<b>Brand Name</b>	HOPERF
<b>Test Model</b>	HM-BT2204
<b>Series Model</b>	HM-BT2201, HM-BT2202, HM-BT2206, HM-BT2208, HM-BT2210
<b>Difference Description</b>	All the same except for the model name.
<b>Date of test</b>	Aug. 14, 2020 to Aug. 24, 2020
<b>Deviation</b>	No any deviation from the test method
<b>Condition of Test Sample</b>	Normal
<b>Test Result</b>	Pass
<b>Report Template</b>	AGCRT-US-BLE/RF

We hereby certify that:

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

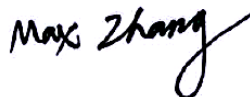
Prepared By



John Zeng  
(Project Engineer)

Aug. 24, 2020

Reviewed By



Max Zhang  
(Reviewer)

Aug. 27, 2020

Approved By



Forrest Lei  
(Authorized Officer)

Aug. 27, 2020

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## 2. GENERAL INFORMATION

### 2.1. PRODUCT DESCRIPTION

The EUT is designed as a “Bluetooth Low Energy Data Transmission Module”. It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

<b>Operation Frequency</b>	2.402 GHz to 2.480GHz
<b>RF Output Power</b>	-1.022dBm (Max)
<b>Bluetooth Version</b>	V5.0
<b>Modulation</b>	BR <input type="checkbox"/> GFSK, EDR <input type="checkbox"/> π/4-DQPSK, <input type="checkbox"/> 8DPSK BLE <input checked="" type="checkbox"/> GFSK 1Mbps <input checked="" type="checkbox"/> GFSK 2Mbps
<b>Number of channels</b>	40 Channel
<b>Antenna Designation</b>	PCB Antenna (Comply with requirements of the FCC part 15.203)
<b>Antenna Gain</b>	1dBi
<b>Hardware Version</b>	V1.0
<b>Software Version</b>	V1.1
<b>Power Supply</b>	DC 3.3V
Note: The EUT doesn't support BR/EDR.	

### 2.2. TABLE OF CARRIER FREQUENCIES

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402 MHz
	1	2404 MHz
	:	:
	38	2478 MHz
	39	2480 MHz

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### 2.3. RELATED SUBMITTAL(S)/GRANT(S)

This submittal(s) (test report) is intended for **FCC ID:2ASEO-HM-BT2204** filing to comply with the FCC Part 15.247 requirements.

### 2.4. TEST METHODOLOGY

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

### 2.5. SPECIAL ACCESSORIES

Refer to section 5.2.

### 2.6. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

### 2.7. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device. For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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### 3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission,  $U_c = \pm 3.1$  dB
- Uncertainty of Radiated Emission below 1GHz,  $U_c = \pm 4.0$  dB
- Uncertainty of Radiated Emission above 1GHz,  $U_c = \pm 4.8$  dB
- Uncertainty of total RF power, conducted,  $U_c = \pm 0.8$  dB
- Uncertainty of RF power density, conducted,  $U_c = \pm 2.6$  dB
- Uncertainty of spurious emissions, conducted,  $U_c = \pm 2.7$  dB
- Uncertainty of Occupied Channel Bandwidth:  $U_c = \pm 2$  %

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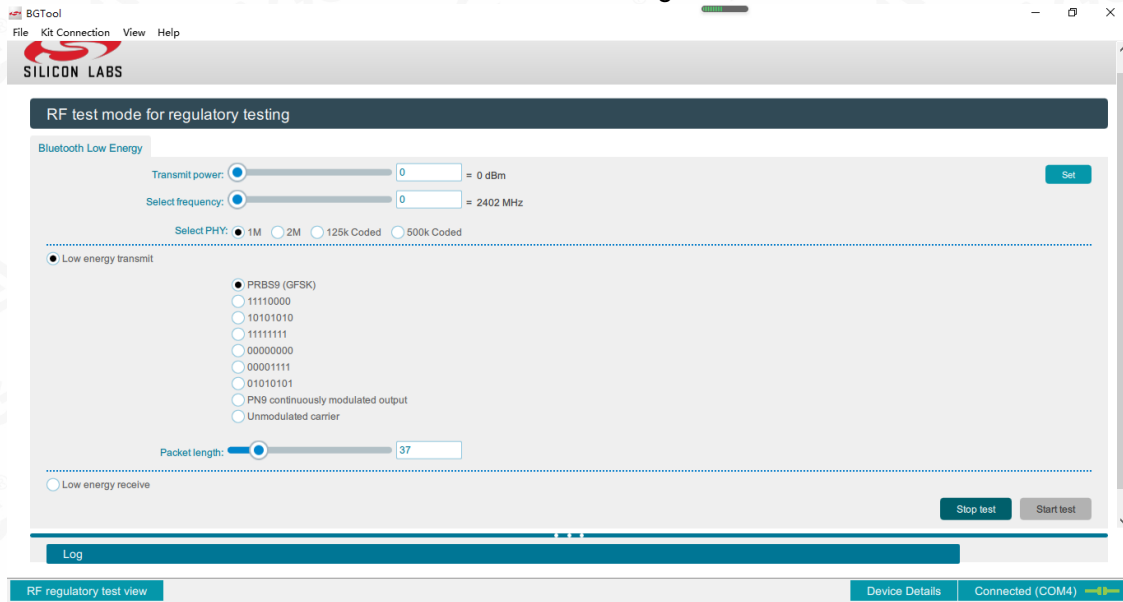
#### 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX(1M)
2	Middle channel TX(1M)
3	High channel TX(1M)
4	Low channel TX(2M)
5	Middle channel TX(2M)
6	High channel TX(2M)

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

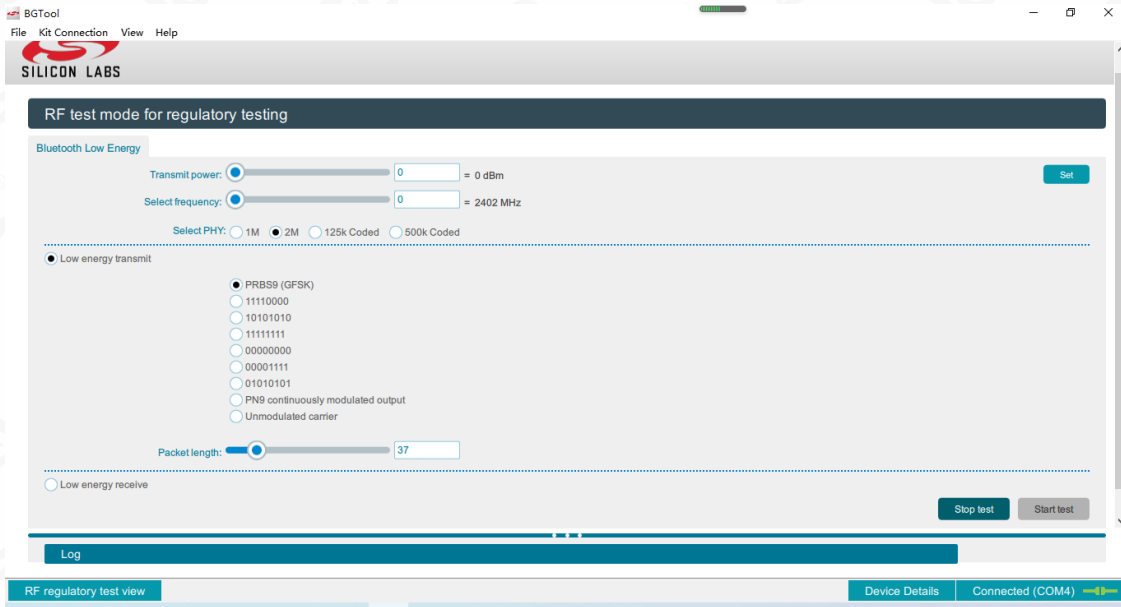
#### Software Setting



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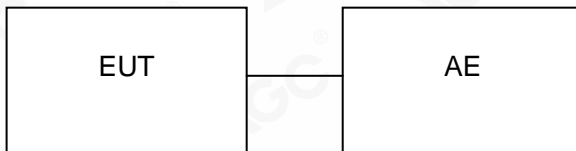
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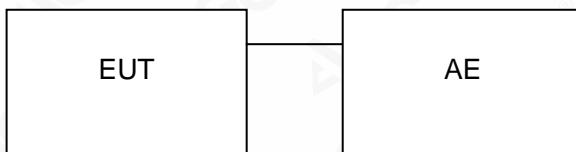
## 5. SYSTEM TEST CONFIGURATION

### 5.1. CONFIGURATION OF TESTED SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



### 5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Bluetooth Low Energy Data Transmission Module	HM-BT2204	2ASEO-HM-BT2204	EUT
2	PC1	Xiao Mi	161301-01	AE
3	Adapter1	Xiao Mi	ADC6501TM	AE
4	control board	--	USB-TTL	AE
5	PC2	Huawei	Boh-WAQ9RP	AE
6	USB Cable	--	0.8m unshield	AE

### 5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(3)	Peak Output Power	Compliant
15.247 (a)(2)	6 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.247 (e)	Maximum Conducted Output Power Density	Compliant
15.209	Radiated Emission	Compliant
15.207	Conducted Emission	Compliant

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## 6. TEST FACILITY

<b>Test Site</b>	Attestation of Global Compliance (Shenzhen) Co., Ltd
<b>Location</b>	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
<b>Designation Number</b>	CN1259
<b>FCC Test Firm Registration Number</b>	975832
<b>A2LA Cert. No.</b>	5054.02
<b>Description</b>	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA

### TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	May 15, 2020	May 14, 2021
LISN	R&S	ESH2-Z5	100086	Aug. 26, 2019	Aug. 25, 2020
Test software	R&S	ES-K1(Ver.V1.71)	N/A	N/A	N/A

### TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Agilent	N9010A	MY53470504	Dec. 12, 2019	Dec. 11, 2020
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	Aug. 26, 2019	Aug. 25, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 09, 2019	Sep. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 17, 2019	May 16, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 16, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 09, 2019	Jan. 08, 2021
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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## 7. PEAK OUTPUT POWER

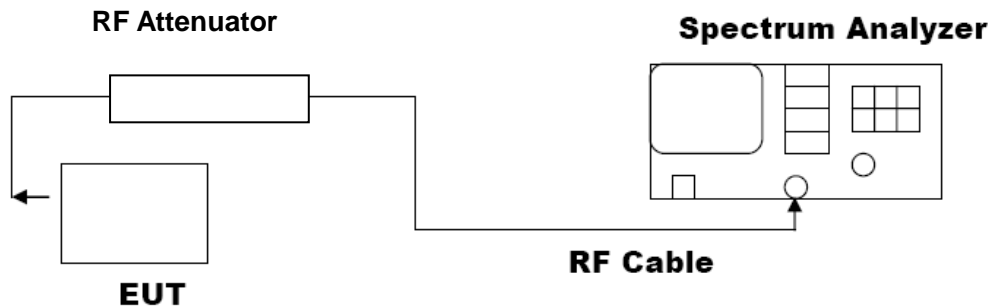
### 7.1. MEASUREMENT PROCEDURE

For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2.  $RBW \geq DTS$  bandwidth
3.  $VBW \geq 3 * RBW$ .
4.  $SPAN \geq VBW$ .
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

### 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) PEAK POWER TEST SETUP



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**7.3. LIMITS AND MEASUREMENT RESULT**  
**1M**

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MODULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	-1.795	30	Pass
2.440	-1.664	30	Pass
2.480	-1.694	30	Pass

CH0

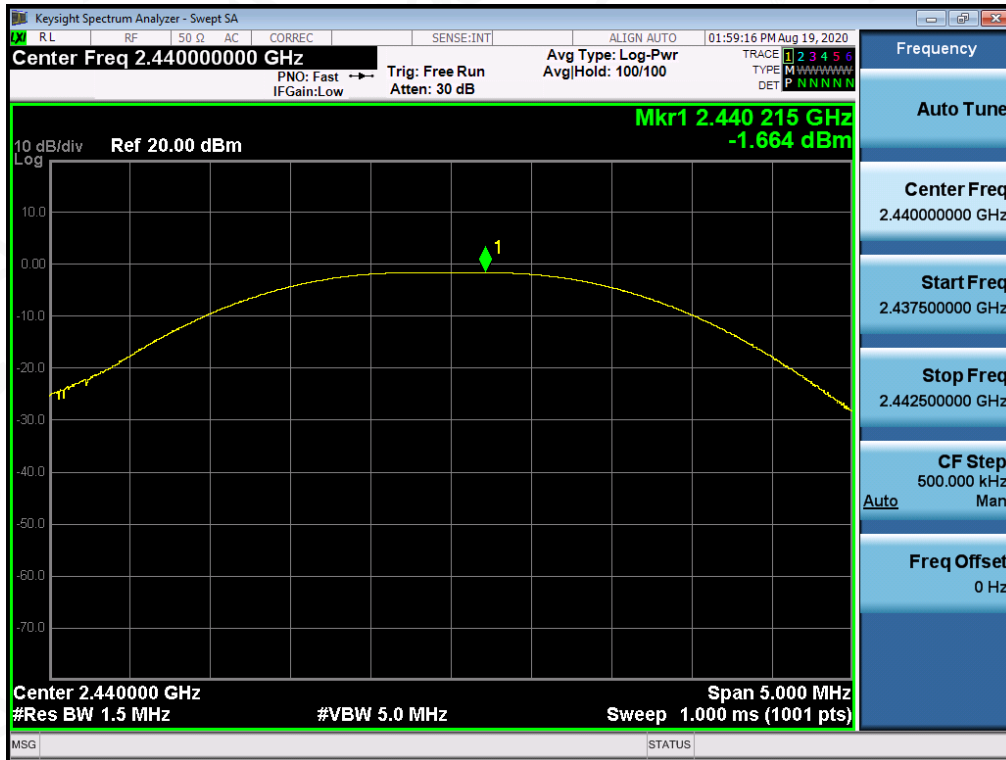


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2M

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	-1.326	30	Pass
2.440	-1.022	30	Pass
2.480	-1.025	30	Pass

CH0



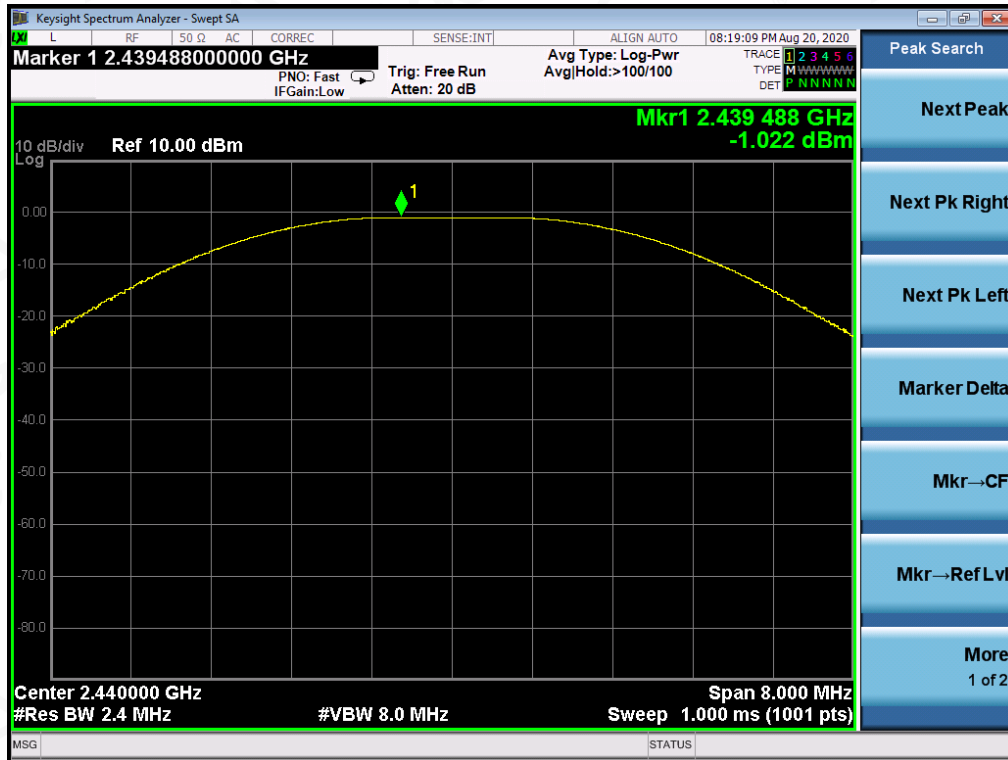
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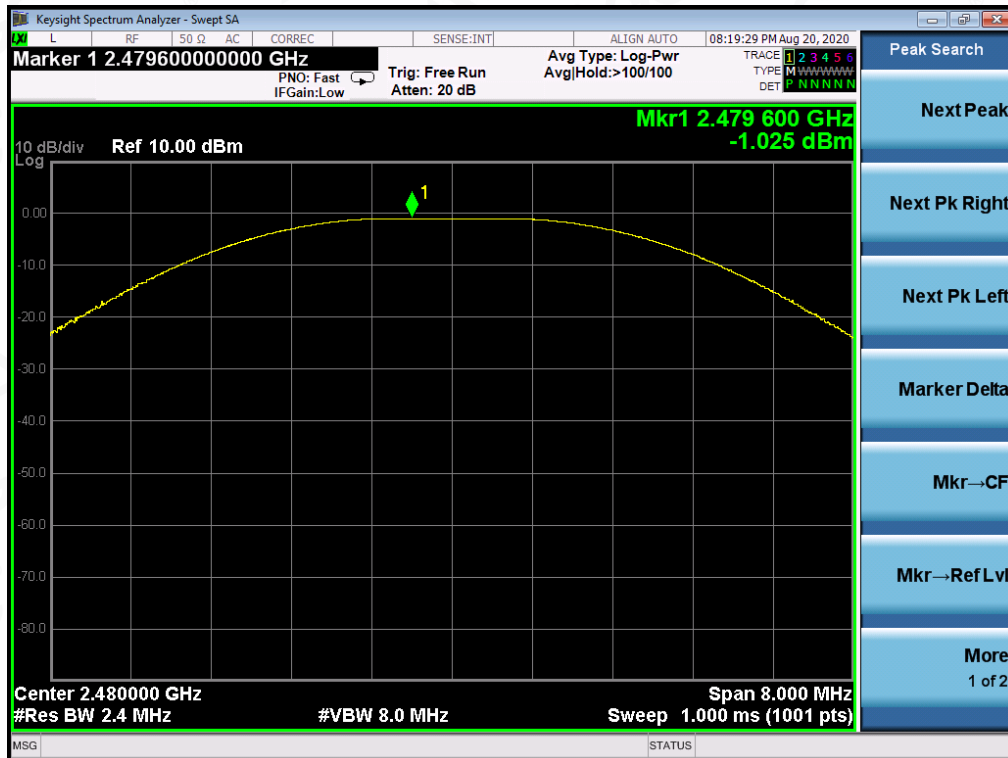




CH19



CH39



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## 8. 6 DB BANDWIDTH

### 8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 kHz, VBW $\geq$ 3 $\times$ RBW.
4. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

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

The same as described in section 7.2.

### 8.3. LIMITS AND MEASUREMENT RESULTS

1M

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (kHz)		Criteria
>500KHZ	Low Channel	657.8	PASS
	Middle Channel	656.9	PASS
	High Channel	655.6	PASS

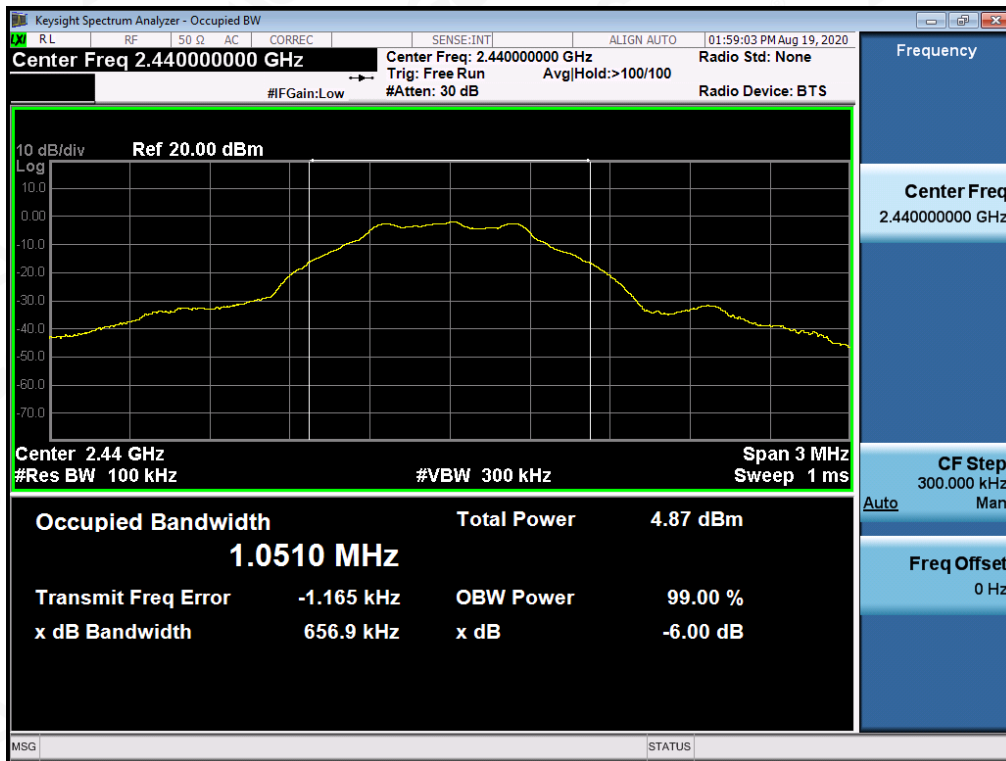
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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2M

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (kHz)		Criteria
>500KHZ	Low Channel	1176	PASS
	Middle Channel	1174	PASS
	High Channel	1174	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



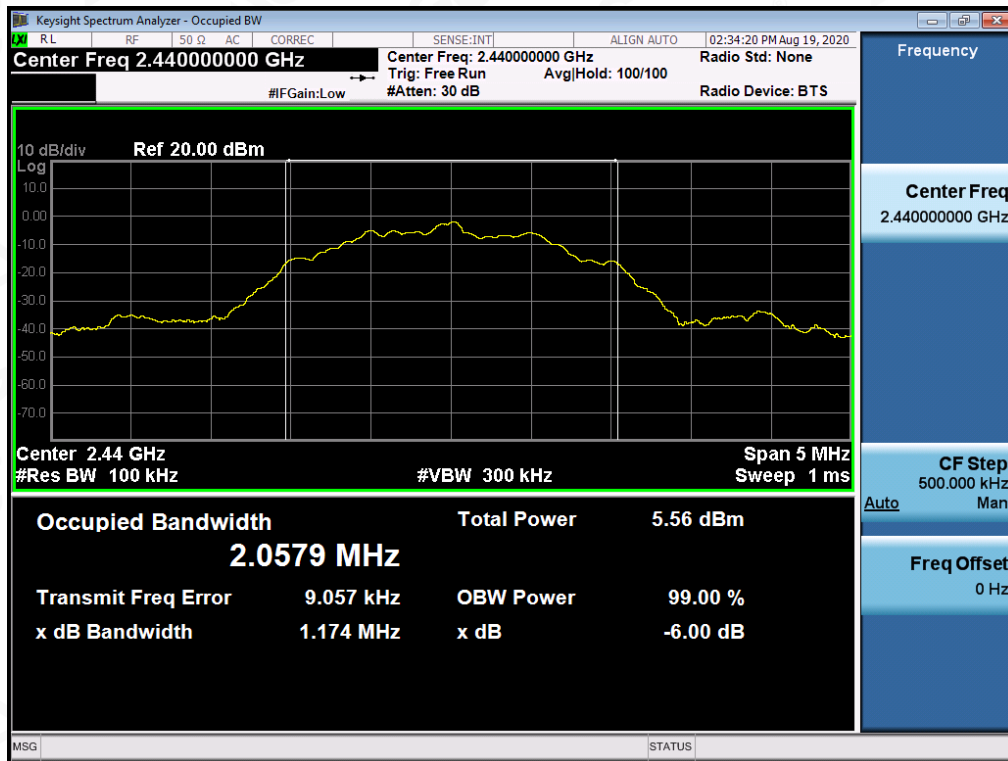
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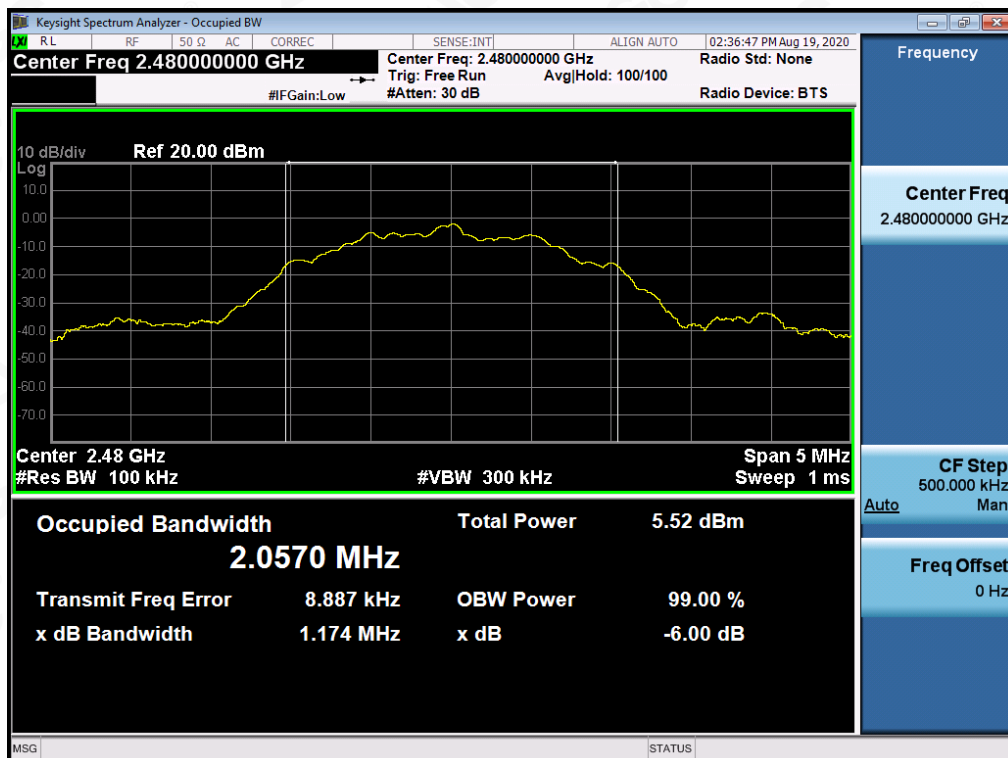




### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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## 9. CONDUCTED SPURIOUS EMISSION

### 9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

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

The same as described in section 7.2.

### 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

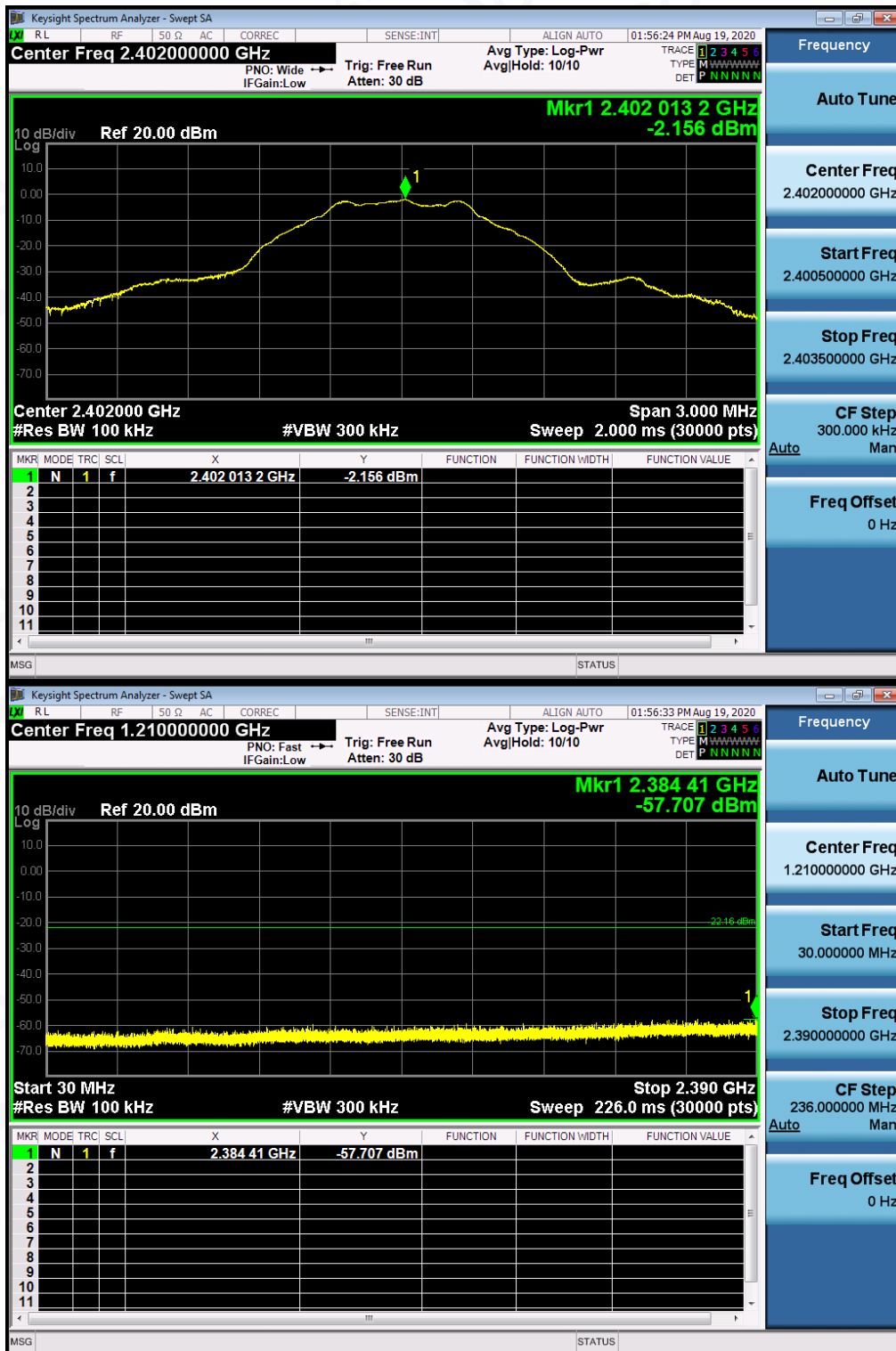
### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.	At least -20dBc than the reference level	PASS

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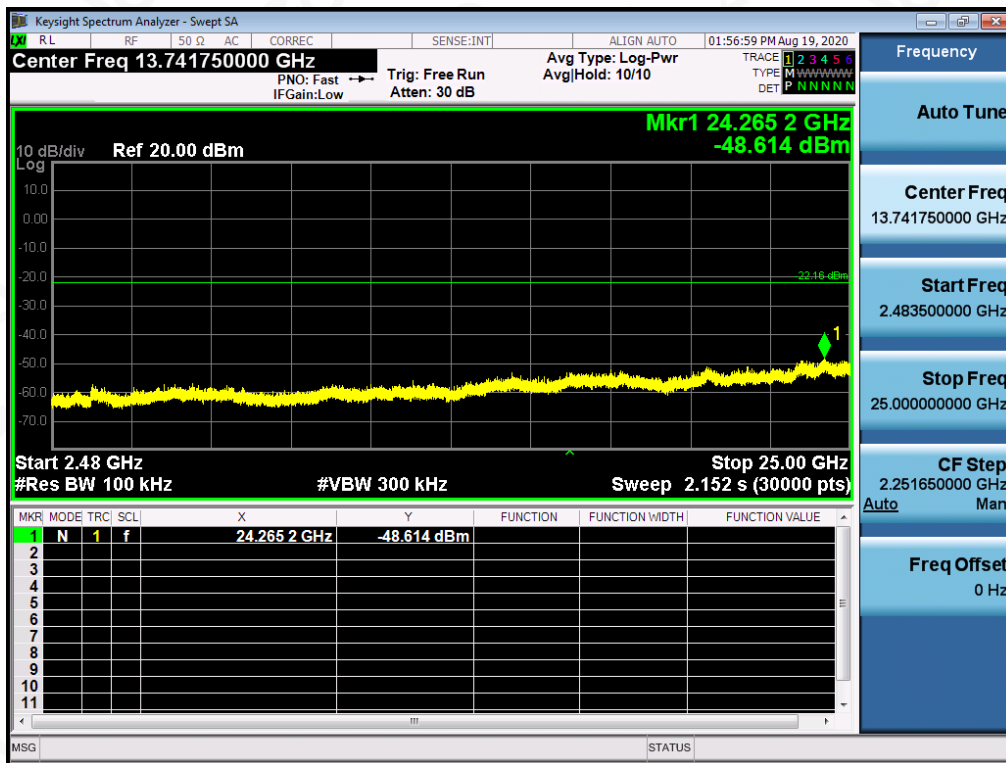
**TEST RESULT FOR ENTIRE FREQUENCY RANGE--1M  
GFSK MODULATION IN LOW CHANNEL**



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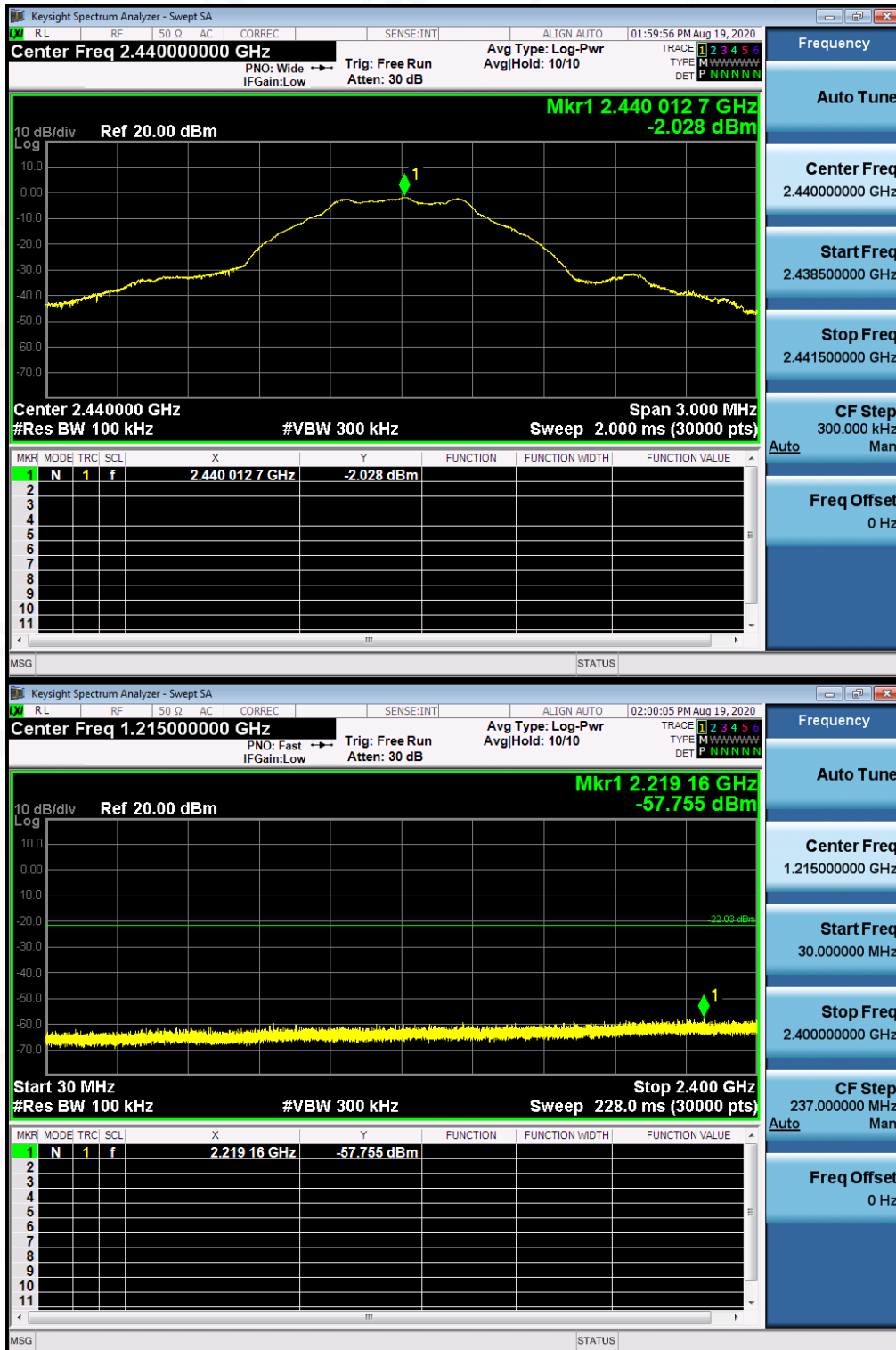
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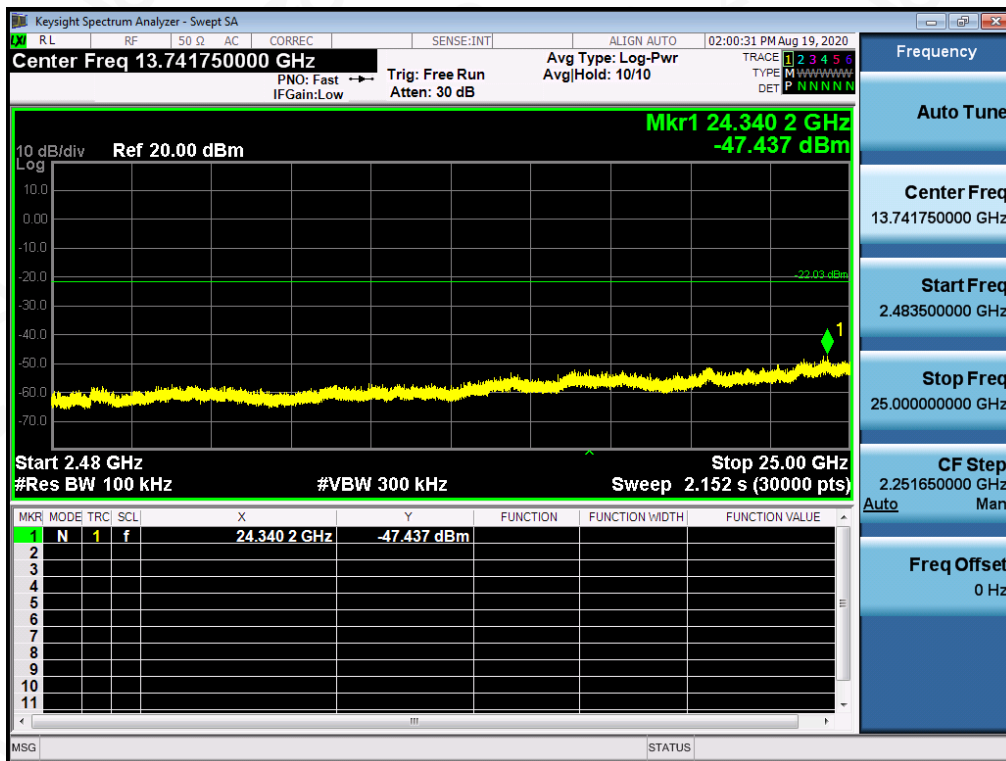
### GFSK MODULATION IN MIDDLE CHANNEL



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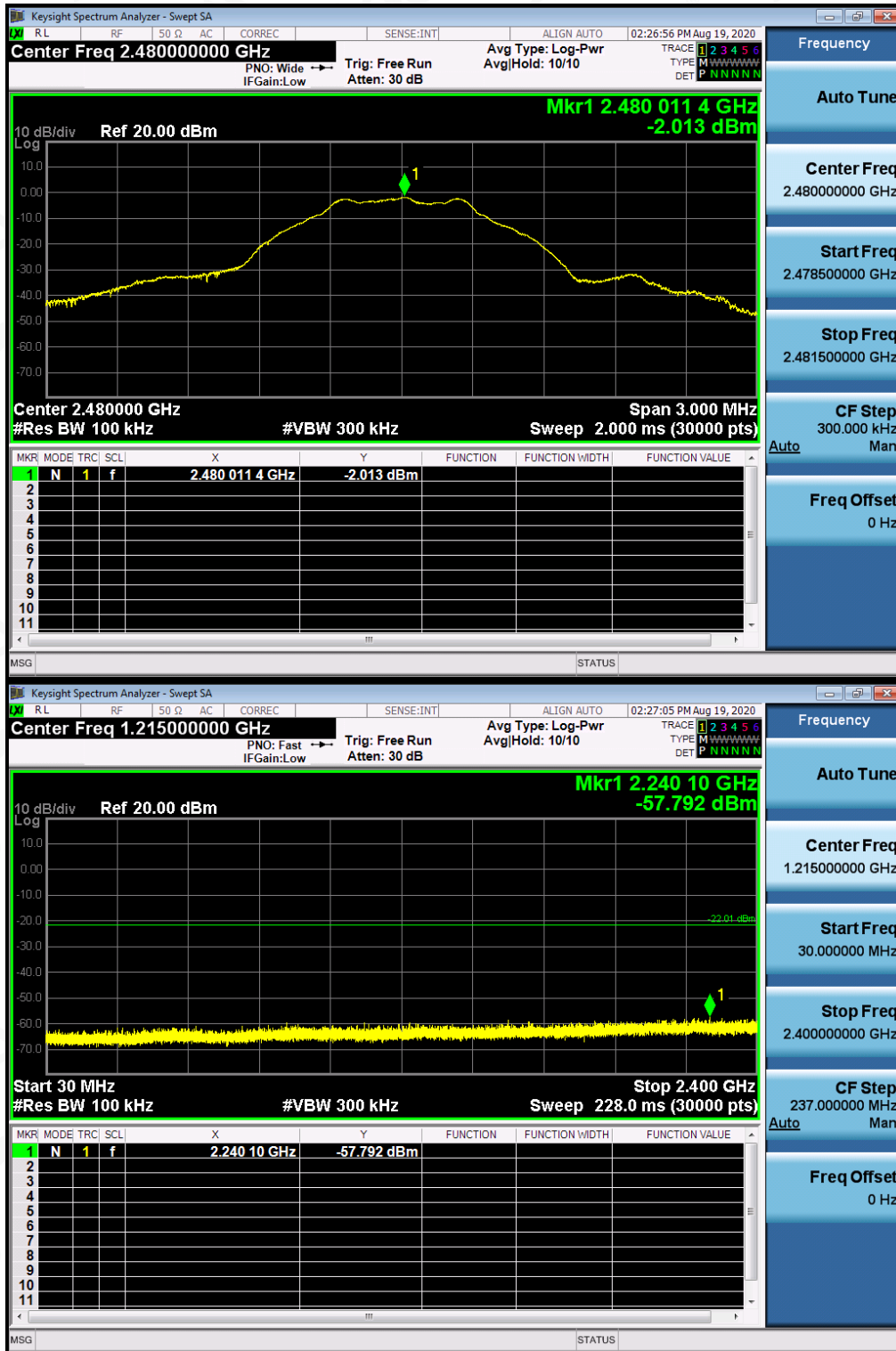


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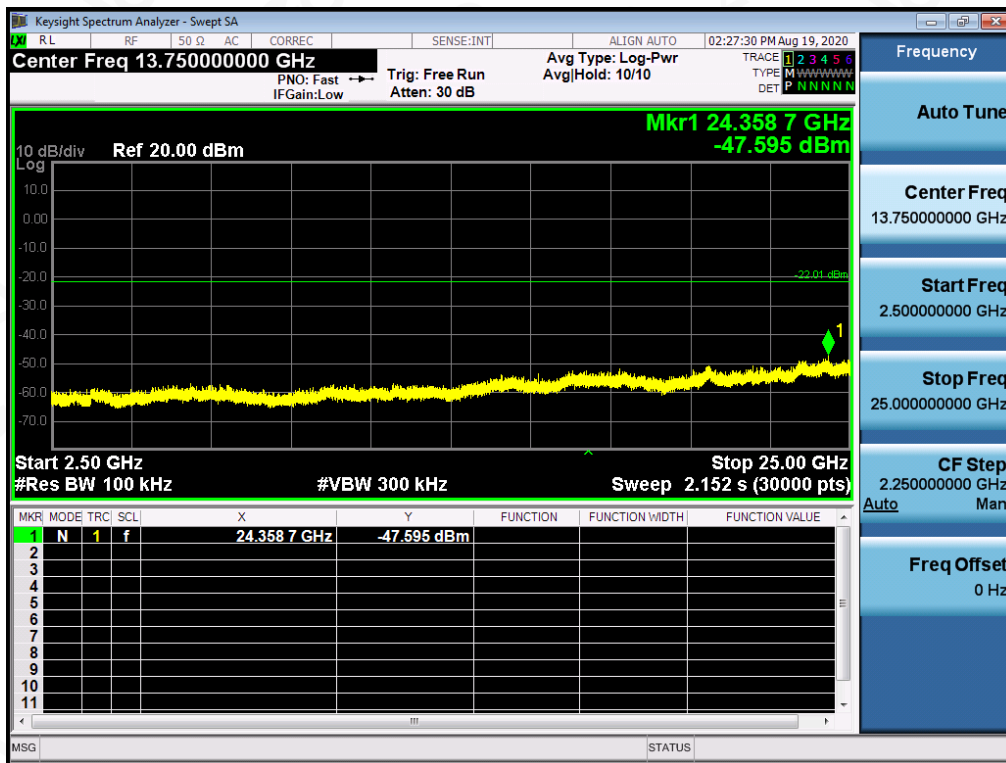
### GFSK MODULATION IN HIGH CHANNEL



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Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit.

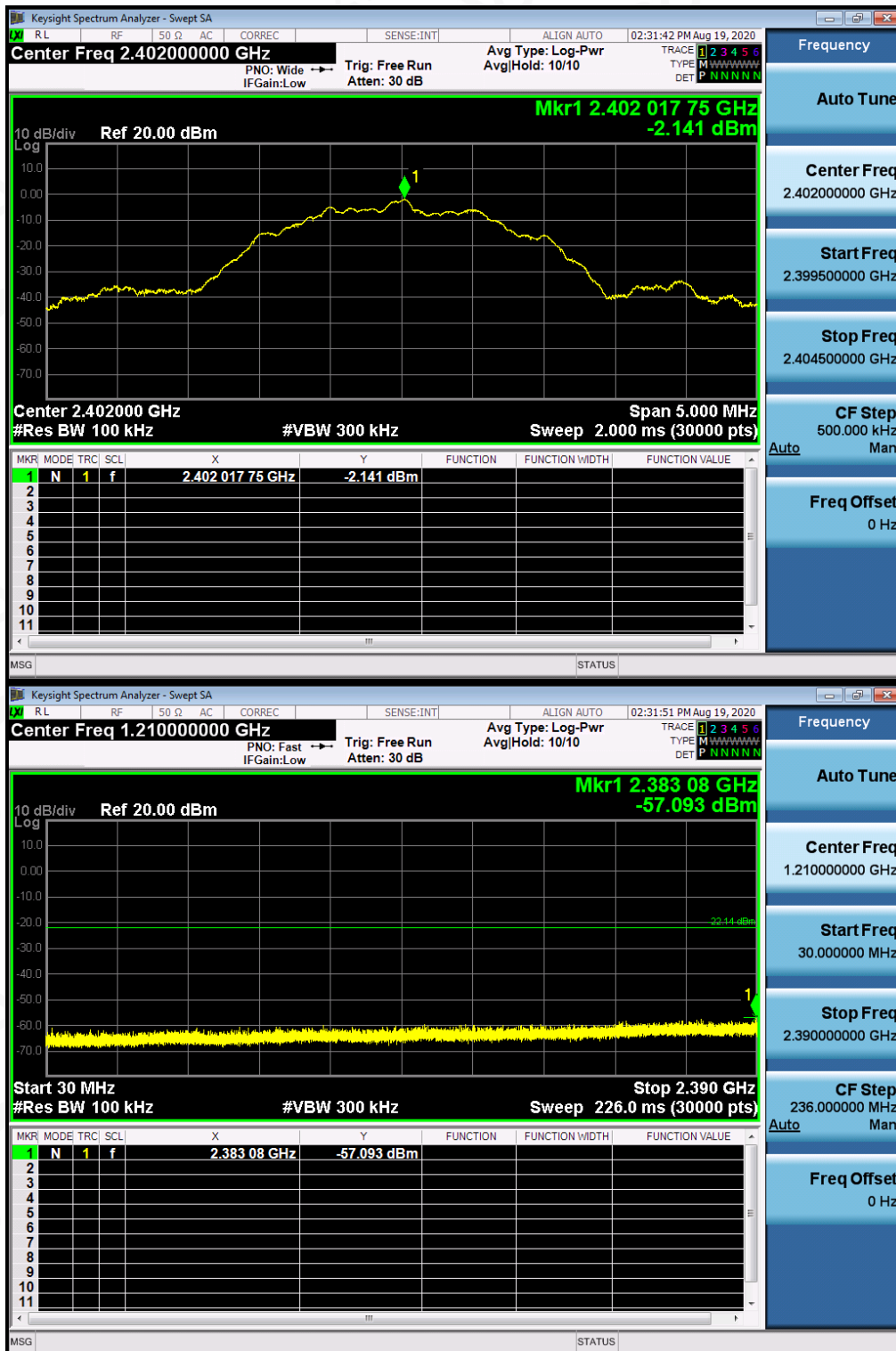
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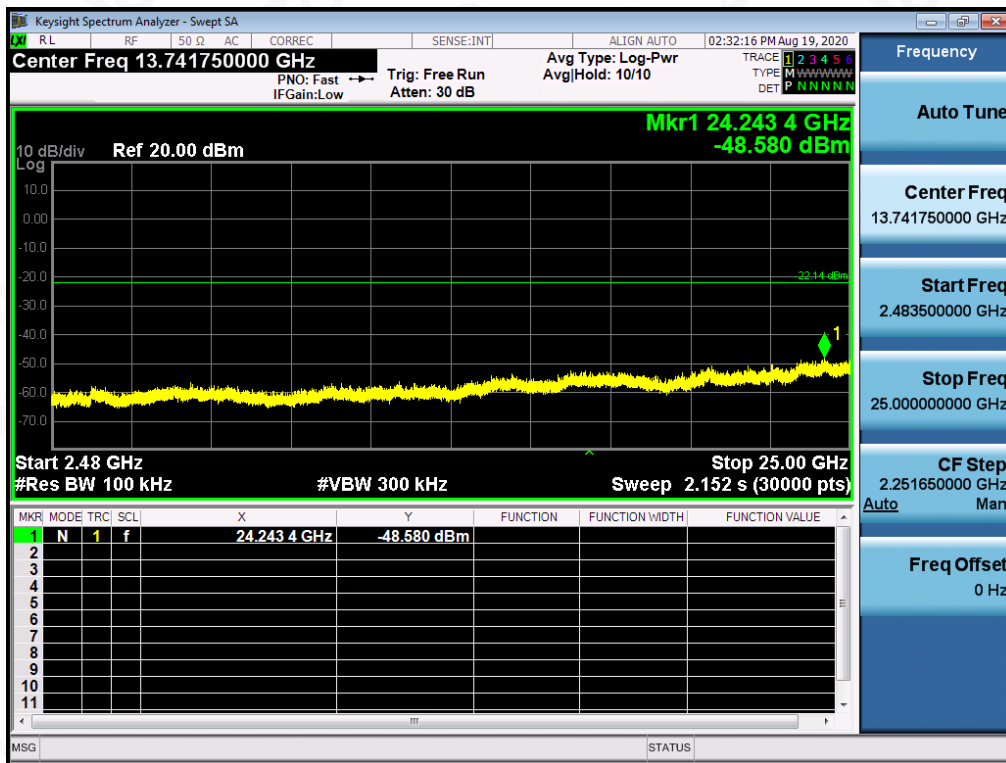
**TEST RESULT FOR ENTIRE FREQUENCY RANGE--2M  
GFSK MODULATION IN LOW CHANNEL**



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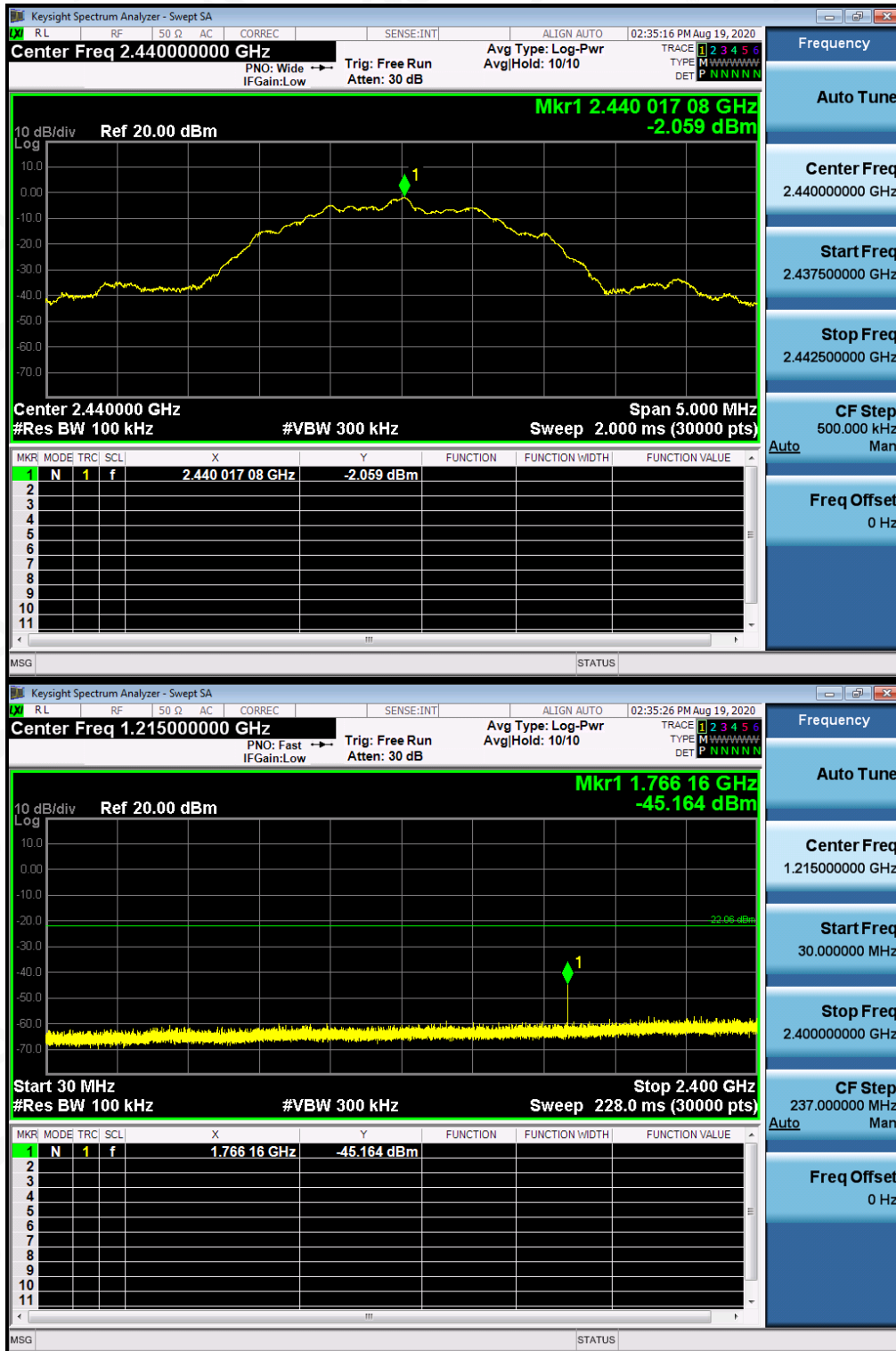


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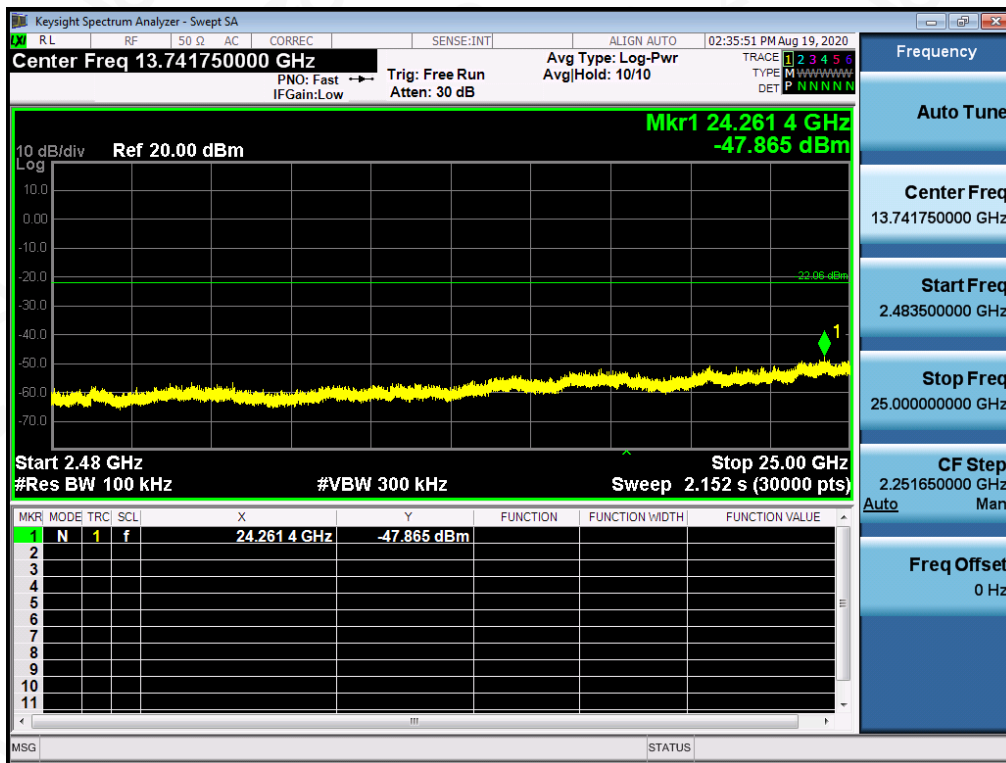
### GFSK MODULATION IN MIDDLE CHANNEL



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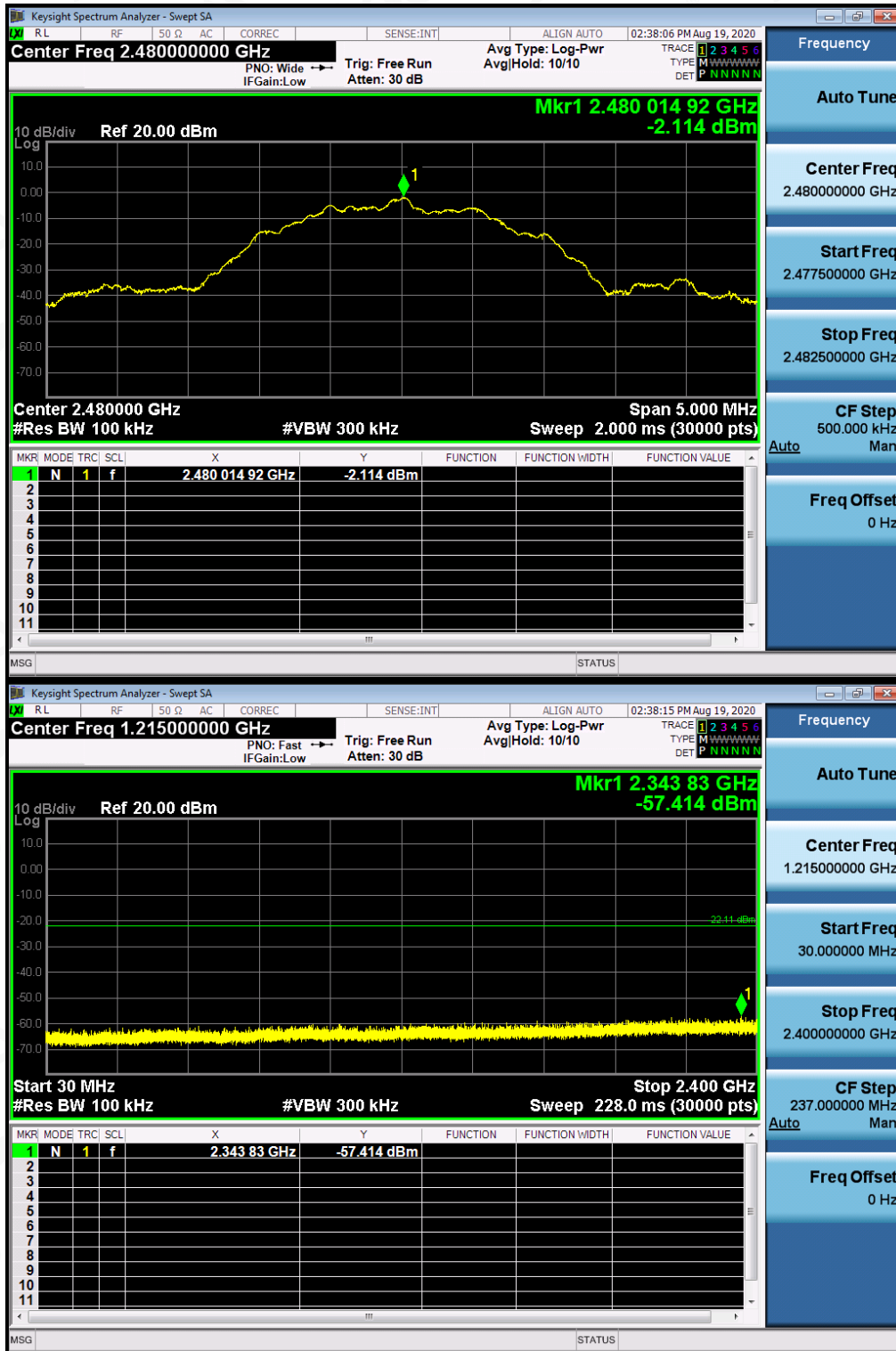
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