

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

**Applicant:** Microsoft Corporation  
One Microsoft Way Redmond, WA 98052-6399, U.S.A

**Product Name:** Portable Computing Device

**Brand Name:** Microsoft

**Model No.:** 1979

**Model Difference:** N/A

**Report Number:** E2/2020/90090

**FCC ID:** C3K1979

**FCC Rule Part:** §15.247, Cat: DSS

**Issue Date:** Feb. 24, 2021

**Date of Test:** Sep. 22, 2020 ~ Feb. 19, 2021

**Date of EUT Received:** Sep. 22, 2020

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab. 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 conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

**Approved By:**

*Jay Lin*  
**Jay Lin / Asst. Supervisor**



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## Revision History

Report Number	Revision	Description	Issue Date	Remark
E2/2020/90090	Rev.00	Original.	Feb. 24, 2021	Revised By: Elle Chang

**Note:**

## 1、Disclaimer

Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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## 1 GENERAL INFORMATION

### 1.1 Product description

Product Name:	Portable Computing Device
Brand Name:	Microsoft
Model No.:	1979
Model Difference:	N/A
HW Version (Product):	EV2
SW Version (Product):	4.89.137
HW Version (Radio):	N/A
SW Version (Radio):	21.80.2.1
Radio Test Tool & Version:	DRTU: 21.21080.0.0-10722
Power Supply:	From Rechargeable Lithium-Ion Polymer Battery or from AC/DC Adapter

Radio Technology:	Bluetooth BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + $\pi/4$ DQPSK + 8DPSK
Transmit Power:	10.21dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$

### 1.2 Antenna Designation

Antenna Type	Chain A / Chain B	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
PIFA	Chain A	2402-2480	-1.4	-

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### 1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 15.247 Meas. Guidance v05r02

ANSI C63.10:2013

### 1.4 Test Facility

SGS Taiwan Ltd. Central RF Lab (TAF code 3702)

No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333

FCC Designation number: TW0028

### 1.5 Special Accessories

There is no special accessory used while test was conducted.

### 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

#### 2.3.3 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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## 2.4 Measurement Results Explanation Example

### 2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m\*9m\*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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## 2.5 Configuration of Tested System

**Fig. 2-1 Conducted (Antenna Port) Emission Configuration**



**Fig. 2-3 Conducted (AC Power Line) Configuration**



**Fig 2-2 Radiated Emission**



**Table 2-1 Equipment Used in Tested System**

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	DRTU	INTEL	21.21080.0.0-10722	N/A	N/A	N/A

Note: The EUT is tested with all external accessory ports populated.

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	Conducted & Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency Time of Occupancy	Compliant
§15.203	Antenna Requirement	Compliant

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY	CH	FREQUENCY
0	2402 MHz	20	2422 MHz	40	2442 MHz	70	2462 MHz
1	2403 MHz	21	2423 MHz	41	2443 MHz	71	2463 MHz
2	2404 MHz	22	2424 MHz	42	2444 MHz	72	2464 MHz
3	2405 MHz	23	2425 MHz	43	2445 MHz	73	2465 MHz
4	2406 MHz	24	2426 MHz	44	2446 MHz	74	2466 MHz
5	2407 MHz	25	2427 MHz	45	2447 MHz	75	2467 MHz
6	2408 MHz	26	2428 MHz	46	2448 MHz	76	2468 MHz
7	2409 MHz	27	2429 MHz	47	2449 MHz	77	2469 MHz
8	2410 MHz	28	2430 MHz	48	2450 MHz	78	2470 MHz
9	2411 MHz	29	2431 MHz	49	2451 MHz	79	2471 MHz
10	2412 MHz	30	2432 MHz	50	2452 MHz	70	2472 MHz
11	2413 MHz	31	2433 MHz	51	2453 MHz	71	2473 MHz
12	2414 MHz	32	2434 MHz	52	2454 MHz	72	2474 MHz
13	2415 MHz	33	2435 MHz	53	2455 MHz	73	2475 MHz
14	2416 MHz	34	2436 MHz	54	2456 MHz	74	2476 MHz
15	2417 MHz	35	2437 MHz	55	2457 MHz	75	2477 MHz
16	2418 MHz	36	2438 MHz	56	2458 MHz	76	2478 MHz
17	2419 MHz	37	2439 MHz	57	2459 MHz	77	2479 MHz
18	2420 MHz	38	2440 MHz	58	2460 MHz	78	2480 MHz
19	2421 MHz	39	2441 MHz	59	2461 MHz		

EUT	Serial Number	Note
Portable Computing Device	3978103657 (Conducted)	
Portable Computing Device	003973603657 (Radiated)	

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## 4.2 The Worst Test Modes and Channel Details

- 1 The EUT has been tested under operating condition.
- 2 Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
- 3 Investigation has been done on all the possible configurations for searching the worst case.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
<b>RADIATED EMISSION TEST (BELOW 1 GHz)</b>				
Bluetooth	0 to 78	39	GFSK	DH5
<b>RADIATED EMISSION TEST (ABOVE 1 GHz)</b>				
Bluetooth	0 to 78	0,39,78	GFSK	DH5
<b>Note:</b> The field strength of radiation emission was measured as NB plane for Bluetooth BR+EDR Transmitter for channel Low, Mid and High.				

<b>ANTENNA PORT CONDUCTED TEST</b>				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
<b>Peak Output Power, 20dB Band Width</b>				
Bluetooth	0 to 78	0,39,78	GFSK, $\pi/4$ -DQPSK, 8-DPSK	DH5/2DH5/3DH5
<b>Band Edge</b>				
Bluetooth	0 to 78	0,78	GFSK, 8-DPSK	DH5/3DH5
<b>Frequency Separation</b>				
Bluetooth	0 to 78	0,1,2	GFSK, 8-DPSK	DH5/3DH5
<b>Number of hopping frequency</b>				
Bluetooth	0 to 78	0 to 78	GFSK	DH5
<b>Time of Occupancy (Dwell time)</b>				
Bluetooth	0 to 78	0,39,78	GFSK, $\pi/4$ -DQPSK, 8-DPSK	DH5/2DH5/3DH5

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## 5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 0.84 dB
20dB Bandwidth	+/- 51.33 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 0.84 dB
Frequency Separation	+/- 51.33 Hz
Number of hopping frequency	+/- 51.33 Hz
Time of Occupancy	+/- 51.33 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC= +/- 0.2%

Radiated Spurious Emission Measurement Uncertainty	
Polarization: Vertical	9kHz~30MHz: +2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

### Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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## 6 CONDUCTED EMISSION TEST

### 6.1 Limits applicable/Test Requirement

Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

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

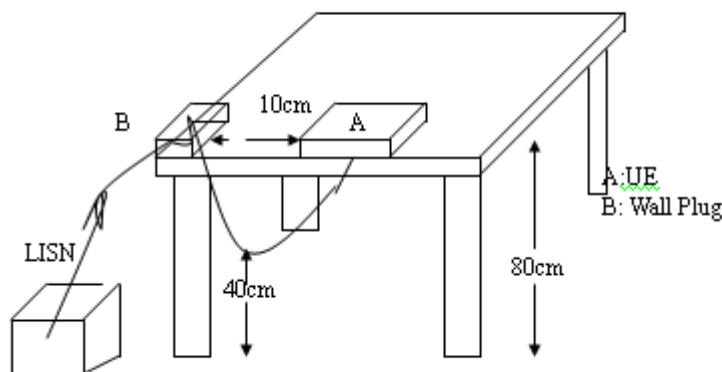
### 6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	974	03/25/2020	03/24/2021
EMI Test Receiver	R&S	ESCI	101342	04/28/2020	04/27/2021

### 6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

### 6.4 Test SET-UP (Block Diagram of Configuration)



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## 6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## 6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

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## AC POWER LINE CONDUCTED EMISSION TEST DATA

## Adapter 1

Report Number :E2-2020-90090

Test Site :Conduction Room C

Test Mode :BT

Test Date :2020-11-14

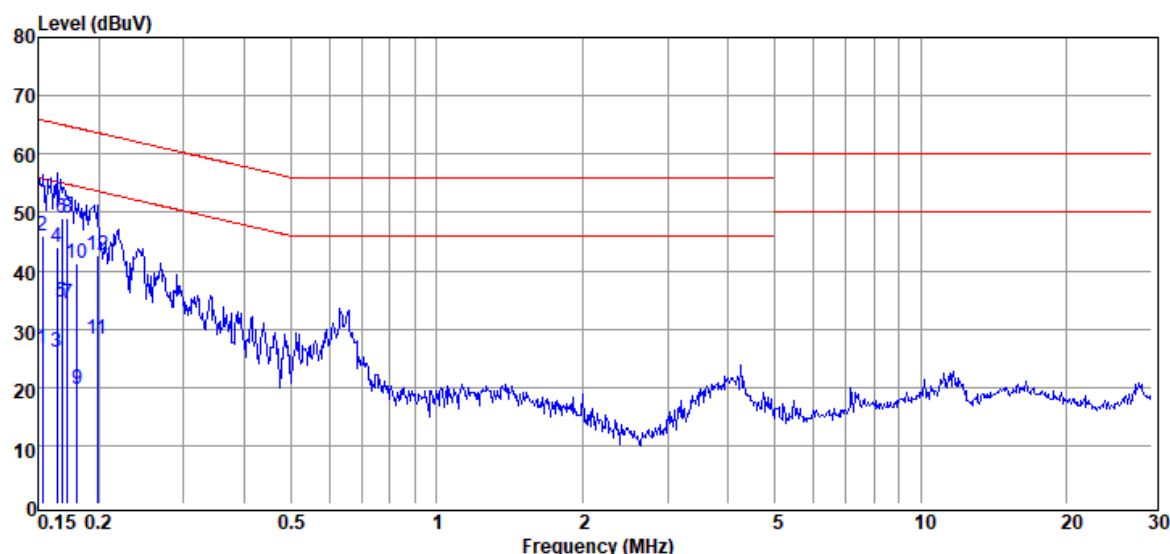
Power :120V/60Hz

Temp./Humi. :23.3/71

Probe :L1

Engineer :Ashton Chiu

Note: : Adapter 1



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	16.48	10.22	26.70	55.81	-29.11
0.15	QP	35.63	10.22	45.85	65.81	-19.96
0.16	Average	15.93	10.22	26.15	55.25	-29.10
0.16	QP	33.84	10.22	44.06	65.25	-21.19
0.17	Average	24.28	10.22	34.50	55.05	-20.55
0.17	QP	38.84	10.22	49.06	65.05	-15.99
0.17	Average	24.14	10.22	34.36	54.84	-20.48
0.17	QP	38.86	10.22	49.08	64.84	-15.76
0.18	Average	9.33	10.22	19.55	54.46	-34.91
0.18	QP	30.94	10.22	41.16	64.46	-23.30
0.20	Average	17.90	10.22	28.12	53.65	-25.53
0.20	QP	32.31	10.22	42.53	63.65	-21.12

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Report Number :E2-2020-90090

Test Site :Conduction Room C

Test Mode :BT

Test Date :2020-11-14

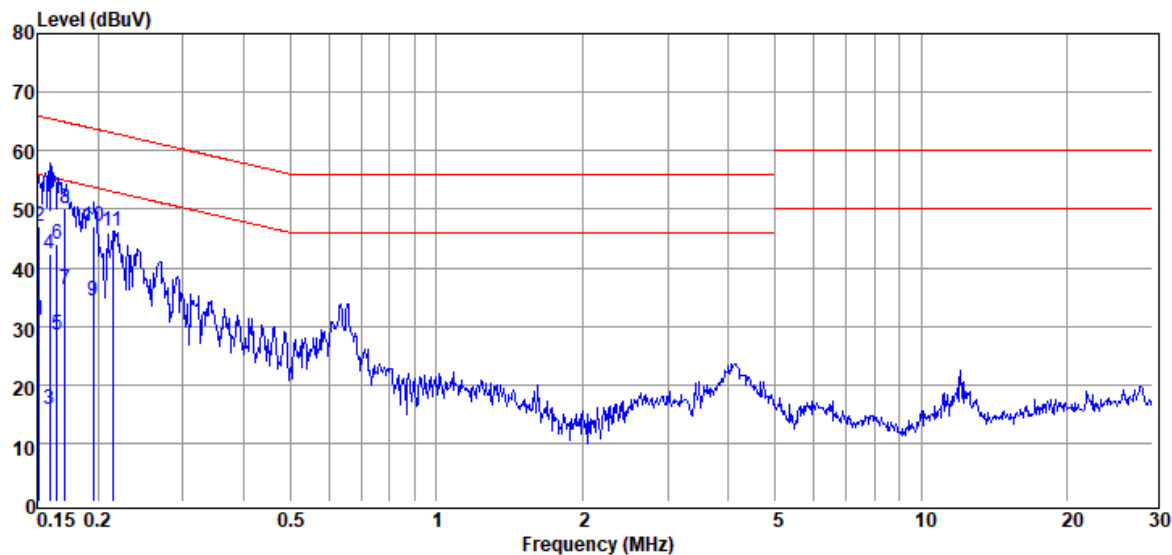
Power :120V/60Hz

Temp./Humi. :23.3/71

Probe :N

Engineer :Ashton Chiu

Note: : Adapter 1



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode	Reading Level		FS		
	PK/QP/AV	dBμV	dB	dBμV	dBμV	dB
0.15	Average	20.67	10.21	30.88	55.92	-25.04
0.15	QP	36.83	10.21	47.04	65.92	-18.88
0.16	Average	5.64	10.21	15.85	55.52	-39.67
0.16	QP	32.28	10.21	42.49	65.52	-23.03
0.16	Average	18.28	10.21	28.49	55.22	-26.73
0.16	QP	33.70	10.21	43.91	65.22	-21.31
0.17	Average	26.15	10.21	36.36	54.89	-18.53
0.17	QP	39.83	10.21	50.04	64.89	-14.85
0.20	Average	24.08	10.21	34.29	53.79	-19.50
0.20	QP	36.97	10.21	47.18	63.79	-16.61
0.22	Peak	36.03	10.21	46.24	63.01	-16.77

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## Adapter 2

Report Number :E2-2020-90090

Test Site :Conduction Room C

Test Mode :BT

Test Date :2020-11-13

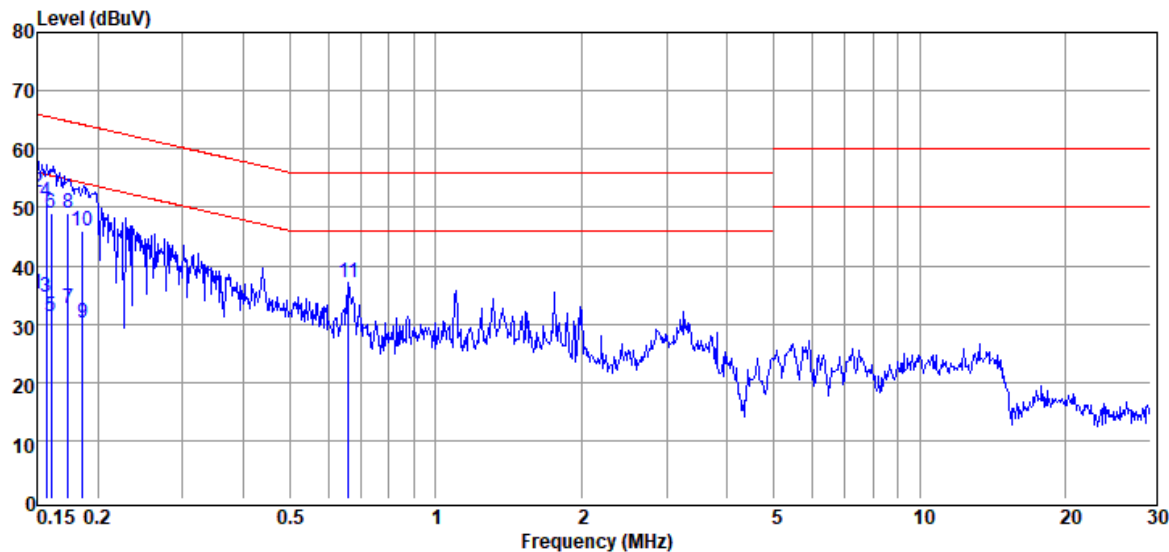
Power :120V/60Hz

Temp./Humi. :22.8/69

Probe :L1

Engineer :Ashton Chiu

Note: : Adapter 2



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	24.99	10.22	35.21	56.00	-20.79
0.15	QP	42.43	10.22	52.65	66.00	-13.35
0.16	Average	24.51	10.22	34.73	55.64	-20.91
0.16	QP	40.71	10.22	50.93	65.64	-14.71
0.16	Average	21.12	10.22	31.34	55.43	-24.09
0.16	QP	38.77	10.22	48.99	65.43	-16.44
0.17	Average	22.42	10.22	32.64	54.79	-22.15
0.17	QP	38.89	10.22	49.11	64.79	-15.68
0.19	Average	19.91	10.22	30.13	54.19	-24.06
0.19	QP	35.85	10.22	46.07	64.19	-18.12
0.66	Peak	26.82	10.31	37.13	56.00	-18.87

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Report Number :E2-2020-90090

Test Site :Conduction Room C

Test Mode :BT

Test Date :2020-11-13

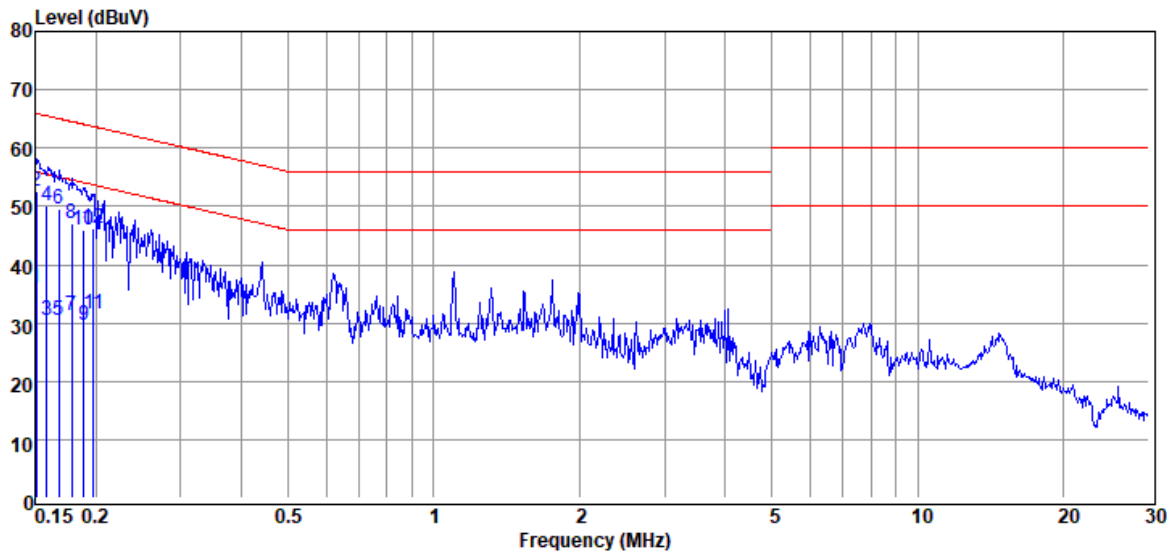
Power :120V/60Hz

Temp./Humi. :22.8/69

Probe :N

Engineer :Ashton Chiu

Note: : Adapter 2



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.15	Average	25.75	10.21	35.96	55.96	-20.00
0.15	QP	42.25	10.21	52.46	65.96	-13.50
0.16	Average	20.11	10.21	30.32	55.53	-25.21
0.16	QP	39.81	10.21	50.02	65.53	-15.51
0.17	Average	20.31	10.21	30.52	55.07	-24.55
0.17	QP	39.21	10.21	49.42	65.07	-15.65
0.18	Average	21.07	10.21	31.28	54.55	-23.27
0.18	QP	36.91	10.21	47.12	64.55	-17.43
0.19	Average	19.45	10.21	29.66	54.07	-24.41
0.19	QP	35.68	10.21	45.89	64.07	-18.18
0.20	Average	21.31	10.21	31.52	53.68	-22.16
0.20	QP	35.96	10.21	46.17	63.68	-17.51

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## 7 PEAK OUTPUT POWER MEASUREMENT

### 7.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

### 7.2 Measurement Equipment Used

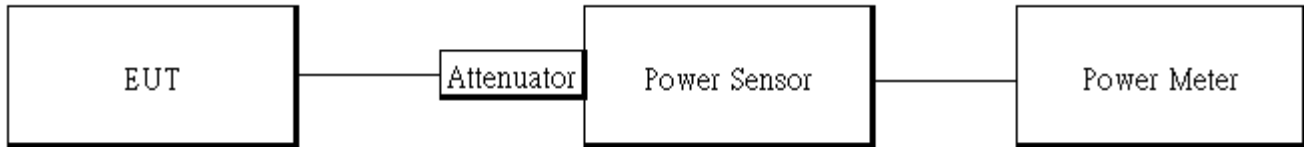
Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1326001	08/05/2020	08/04/2021
Power Sensor	Anritsu	MA2411B	1315048	08/05/2020	08/04/2021
Power Sensor	Anritsu	MA2411B	1315049	08/05/2020	08/04/2021
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/25/2020	06/24/2021
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	02/20/2020	02/19/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
Attenuator	Marvelous	MVE2213-10	RF10	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF10	11/19/2020	11/18/2021
Attenuator	Marvelous	MVE2213-10	RF11	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF11	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/20/2019	11/19/2020
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021
IPEX-4 Cable	Woken	00100A1H646027	N/A	N/A	N/A

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### 7.3 Test Set-up:



### 7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10 Measurement Guidelines.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter. (Max Hold, Detector = Peak, RBW  $\geq$  20dB bandwidth)
4. Record the max. reading.
5. Repeat above procedures until all default test channel is completed.

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## 7.5 Peak & Average Power Measurement Result

### 1M BR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	9.04	8.017	125
Mid	2441	9.70	9.333	125
High	2480	<b>10.21</b>	10.495	125

### 1M BR mode (Average):

CH	Freq. (MHz)	Max. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	9.00	7.937	125
Mid	2441	9.58	9.071	125
High	2480	10.13	10.295	125

### 2M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8.34	6.823	125
Mid	2441	8.65	7.328	125
High	2480	<b>8.80</b>	7.586	125

### 2M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	6.96	4.970	125
Mid	2441	6.85	4.846	125
High	2480	6.84	4.835	125

### 3M EDR mode (Peak):

CH	Freq. (MHz)	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	8.44	6.982	125
Mid	2441	8.74	7.482	125
High	2480	<b>8.92</b>	7.798	125

### 3M EDR mode (Average):

CH	Freq. (MHz)	Max. Avg. Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	6.93	4.936	125
Mid	2441	6.90	4.902	125
High	2480	6.84	4.835	125

**NOTE:** cable loss as 11.1dB that offsets in the spectrum

**\*Note:** Max. Output include tune up tolerance Power measured by using average detector.

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## 8 20dB BANDWIDTH MEASUREMENT

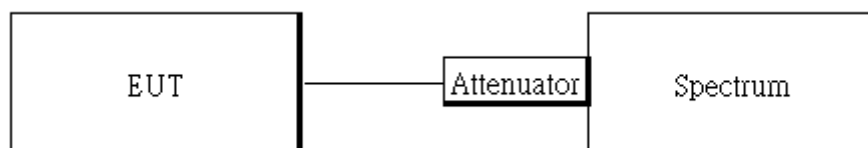
### 8.1 Standard Applicable

For frequency hopping systems operating in the 2400 MHz-2483.5 MHz no limit for 20dB bandwidth.

### 8.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/25/2020	06/24/2021
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	02/20/2020	02/19/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/20/2019	11/19/2020
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021
IPEX-4 Cable	Woken	00100A1H646027	N/A	N/A	N/A

### 8.3 Test Set-up



### 8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set the spectrum analyzer as  
 RBW= 1 % to 5% of OBW ,  
 VBW = 3 X RBW,  
 Span= 2 to 5 times of the OBW,  
 Sweep=auto,  
 Detector = Peak, and Max hold for 20dB Bandwidth test.
5. Mark the peak frequency and -20dB (upper and lower) frequency
6. Repeat above procedures until all test default channel is completed

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## 8.5 20dB Bandwidth

### GFSK

CH	Occupied Bandwidth (MHz)	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.88605	0.9781	0.65
Mid	0.88862	0.9753	0.65
High	0.88369	0.9799	0.65

### $\pi/4$ -DQPSK

CH	Occupied Bandwidth (MHz)	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.38	1.410	0.94
Mid	1.3603	1.418	0.95
High	1.3546	1.426	0.95

### 8-DPSK

CH	Occupied Bandwidth (MHz)	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.3981	1.482	0.99
Mid	1.3687	1.482	0.99
High	1.3596	1.484	0.99

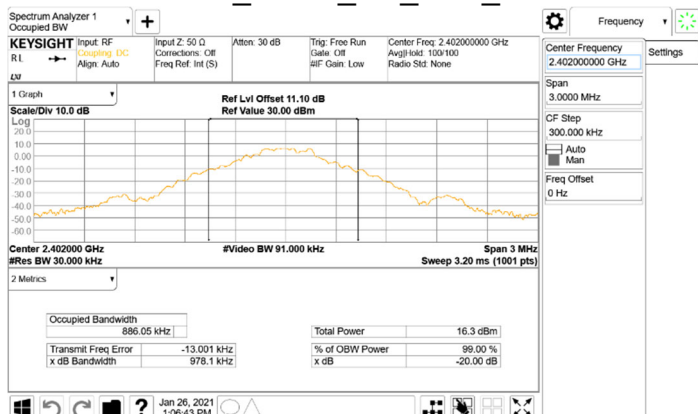
Note: For the test plots, Detector: PEAK, Trace: MAX Hold

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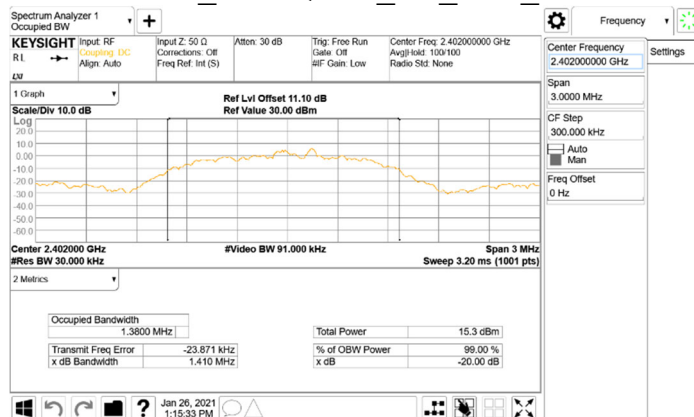
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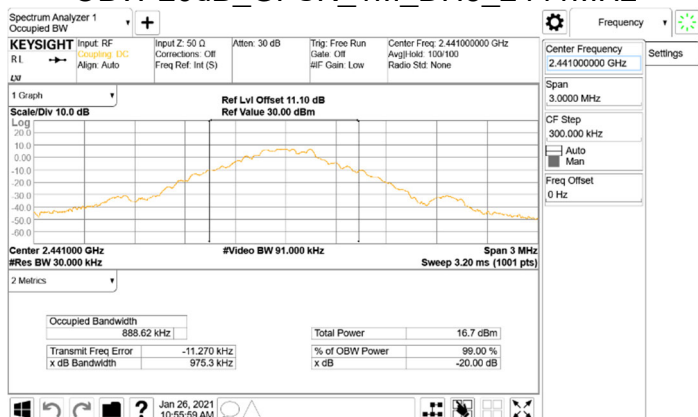
## OBW 20dB\_GFSK\_1M\_DH5\_2402MHz



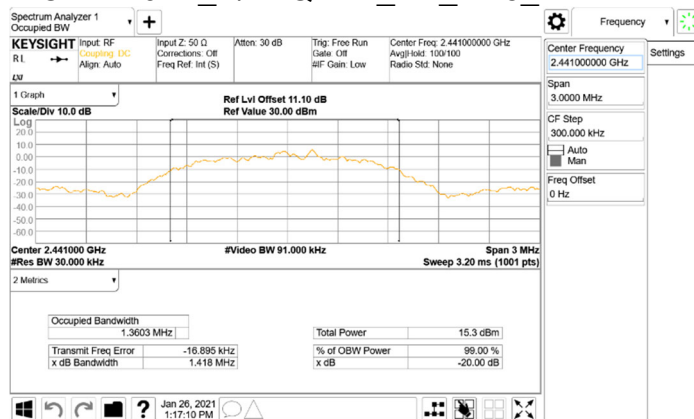
## OBW 20dB\_π/4DQPSK\_2M\_DH5\_2402MHz



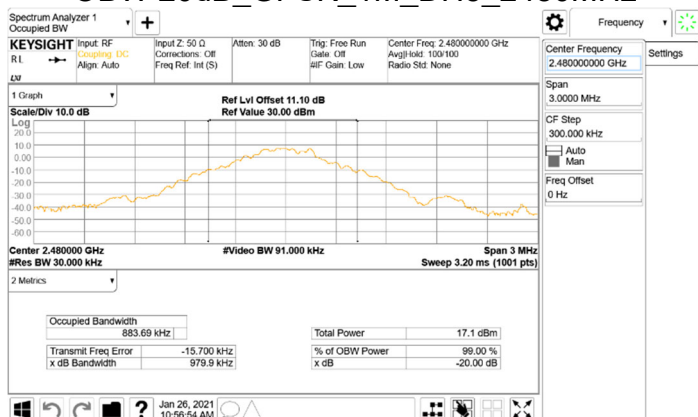
## OBW 20dB\_GFSK\_1M\_DH5\_2441MHz



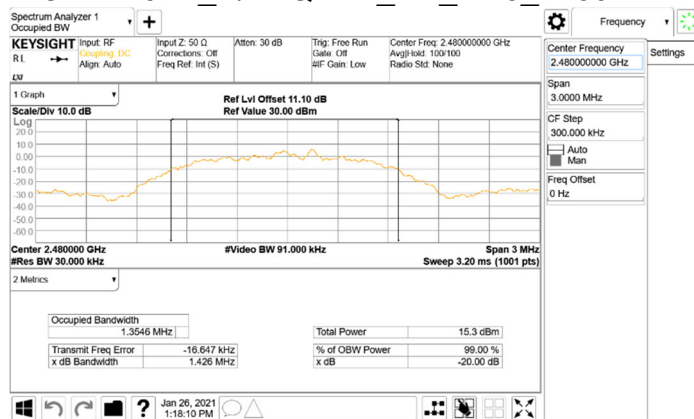
## OBW 20dB\_π/4DQPSK\_2M\_DH5\_2441MHz



## OBW 20dB\_GFSK\_1M\_DH5\_2480MHz



## OBW 20dB\_π/4DQPSK\_2M\_DH5\_2480MHz

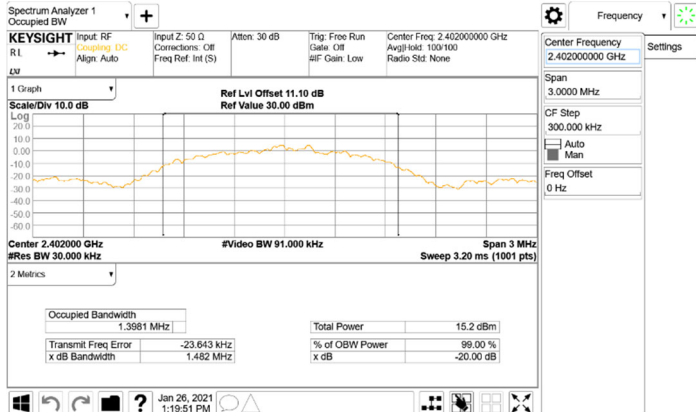


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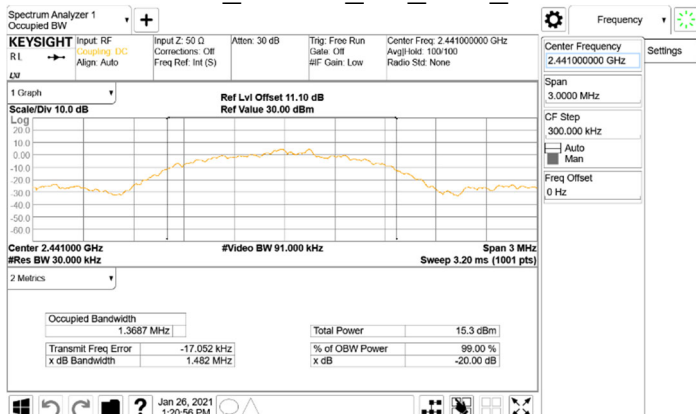
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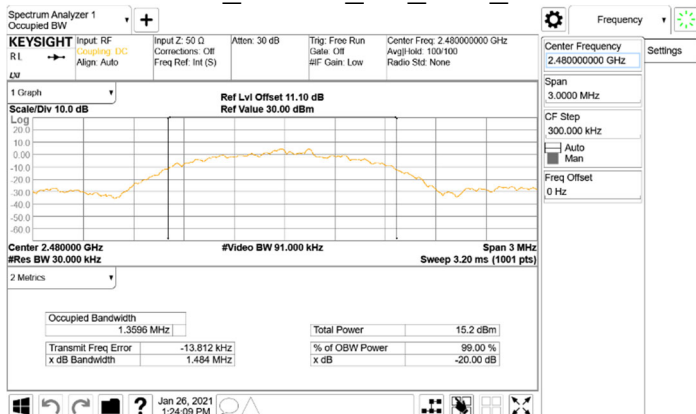
## OBW 20dB\_8DPSK\_3M\_DH5\_2402MHz



## OBW 20dB\_8DPSK\_3M\_DH5\_2441MHz



## OBW 20dB\_8DPSK\_3M\_DH5\_2480MHz



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## 9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

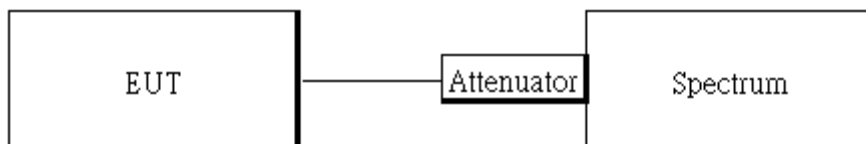
### 9.1 Standard Applicable

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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### 9.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/25/2020	06/24/2021
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	02/20/2020	02/19/2021
Attenuator	Marvelous	MVE2213-10	RF09	11/20/2019	11/19/2020
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF151	11/20/2019	11/19/2020
DC Block	PASTERNAK	PE8210	RF151	11/19/2020	11/18/2021
IPEX-4 Cable	Woken	00100A1H64 6027	N/A	N/A	N/A

### 9.3 Test SET-UP



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## 9.4 Measurement Procedure

### 9.4.1 Conducted Band Edge:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
7. Repeat above procedures until all frequency measured were complete.

### 9.4.2 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows ANSI C63.10:2013.
3. Set RBW = 100 kHz & VBW = 300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

## 9.5 Measurement Result

See next page for test plots.

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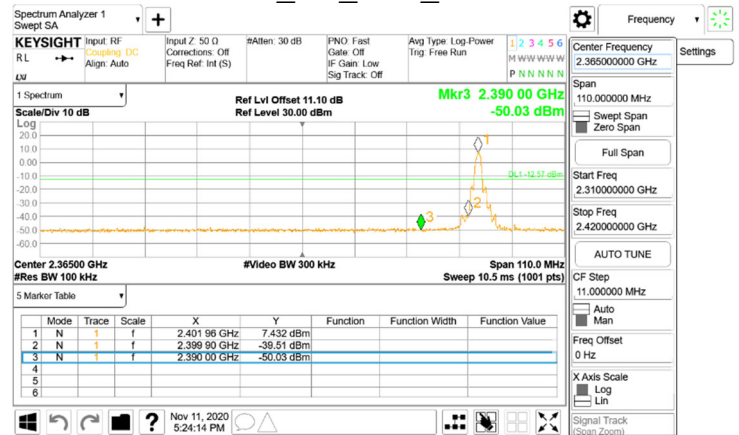
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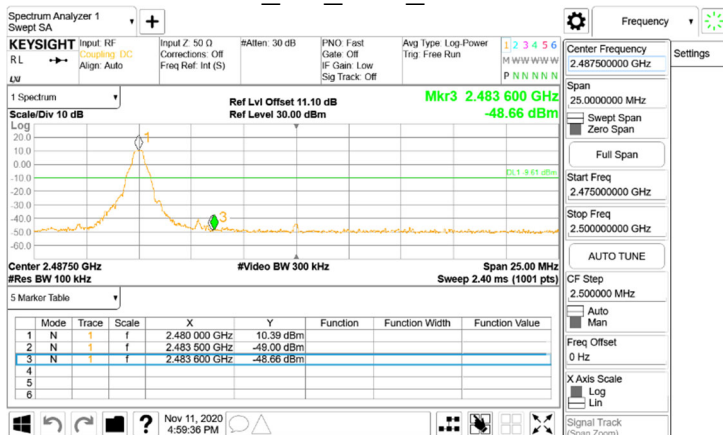
## GFSK\_1M\_DH5\_2402MHz



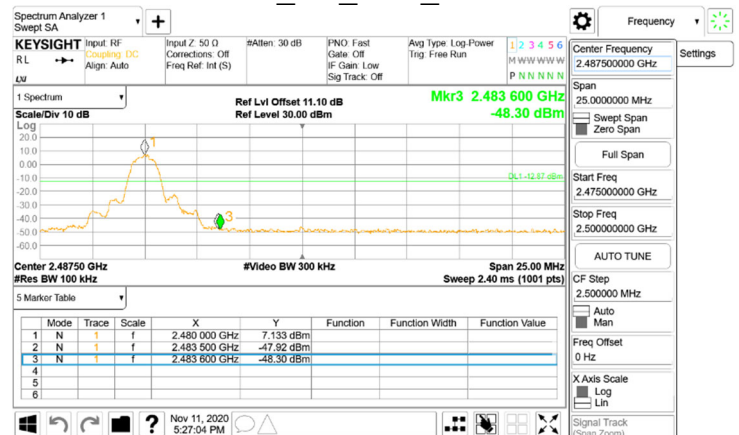
## 8DPSK\_3M\_DH5\_2402MHz



## GFSK\_1M\_DH5\_2480MHz



## 8DPSK\_3M\_DH5\_2480MHz

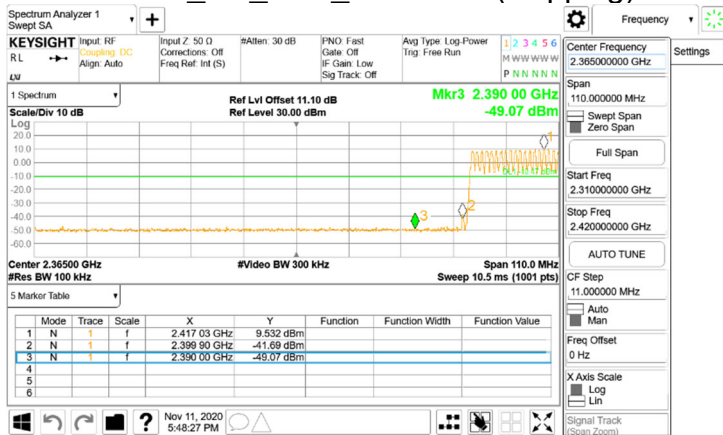


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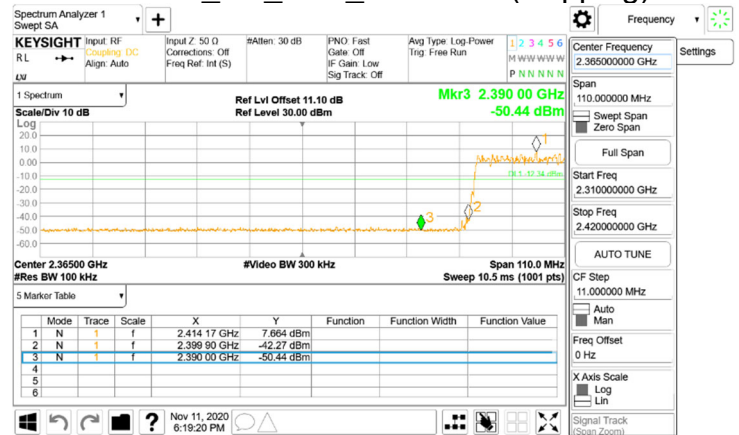
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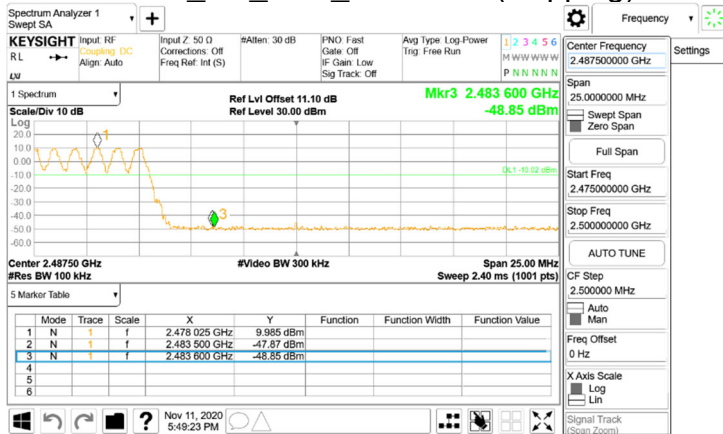
### GFSK\_1M\_DH5\_2402MHz (Hopping)



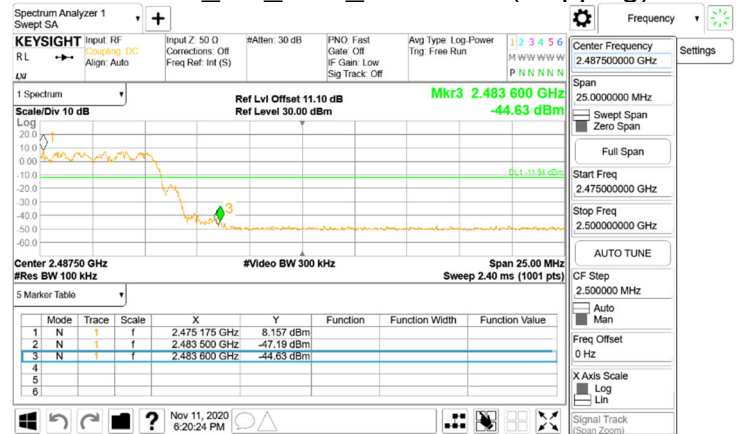
### 8DPSK\_3M\_DH5\_2402MHz (Hopping)



### GFSK\_1M\_DH5\_2480MHz (Hopping)



### 8DPSK\_3M\_DH5\_2480MHz (Hopping)

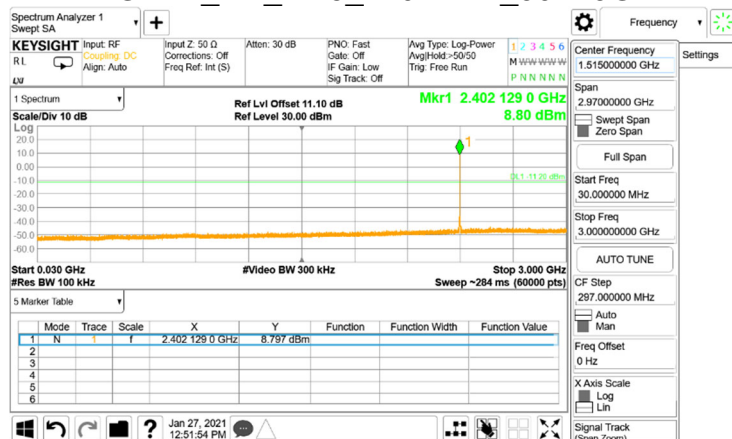


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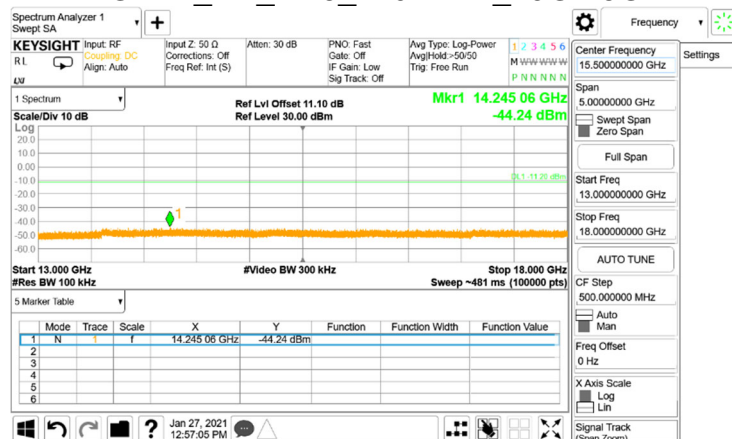
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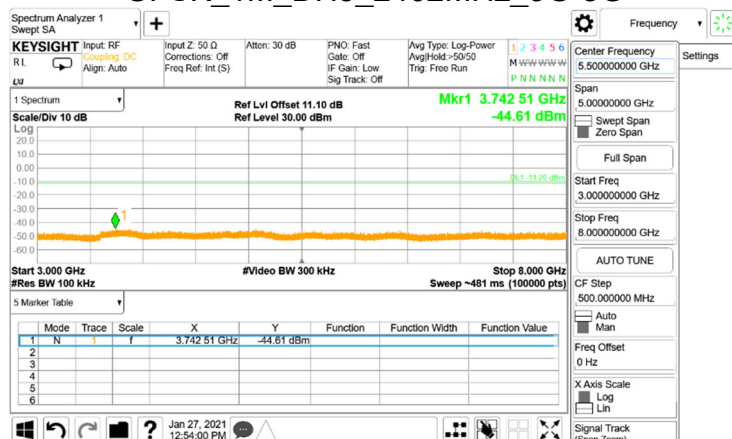
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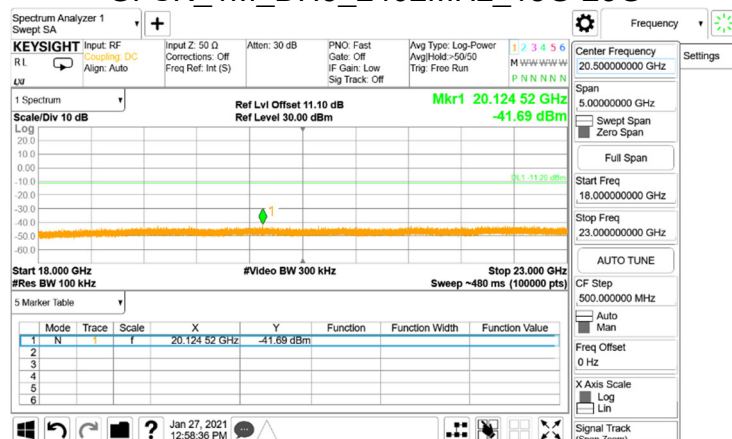
## GFSK\_1M\_DH5\_2402MHz\_13G-18G



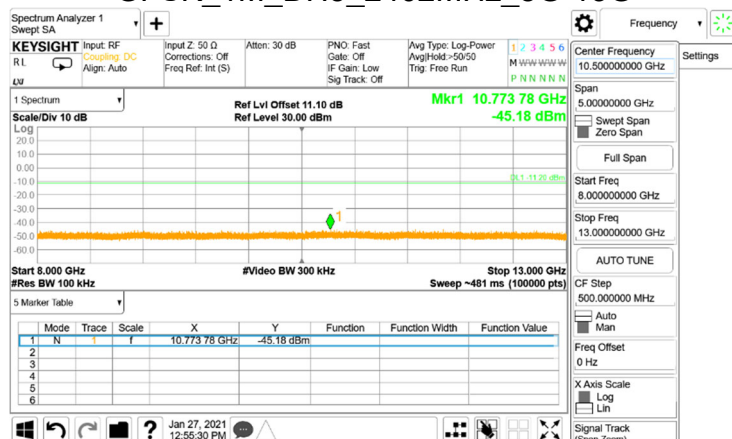
## GFSK\_1M\_DH5\_2402MHz\_3G-8G



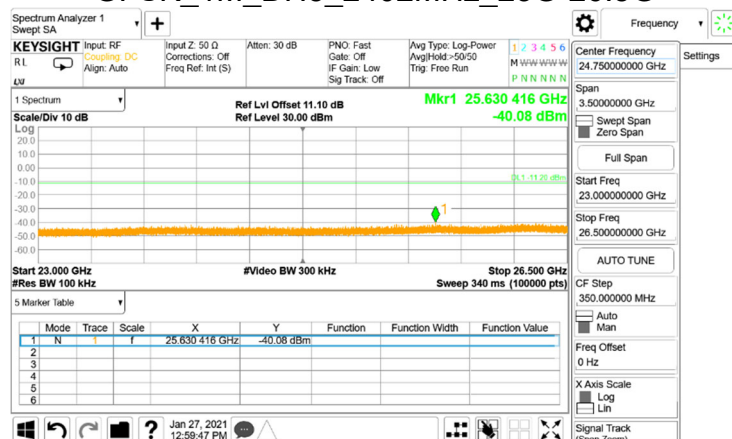
## GFSK\_1M\_DH5\_2402MHz\_18G-23G



## GFSK\_1M\_DH5\_2402MHz\_8G-13G



## GFSK\_1M\_DH5\_2402MHz\_23G-26.5G

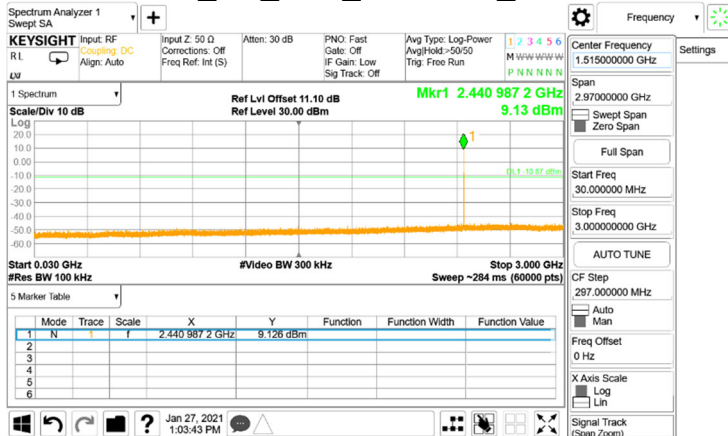


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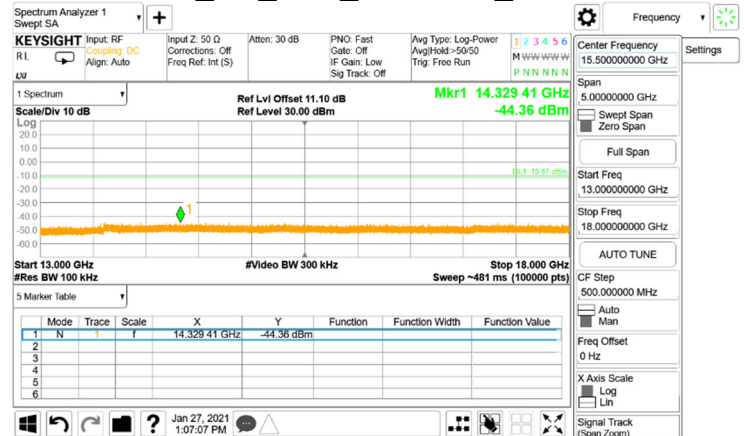
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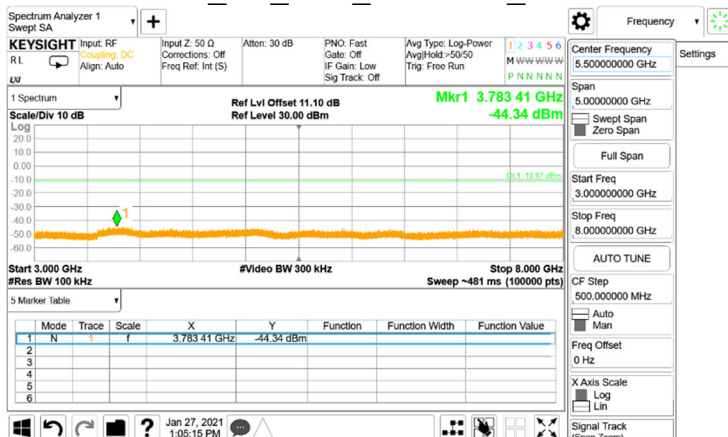
### GFSK\_1M\_DH5\_2441MHz\_30M-3G



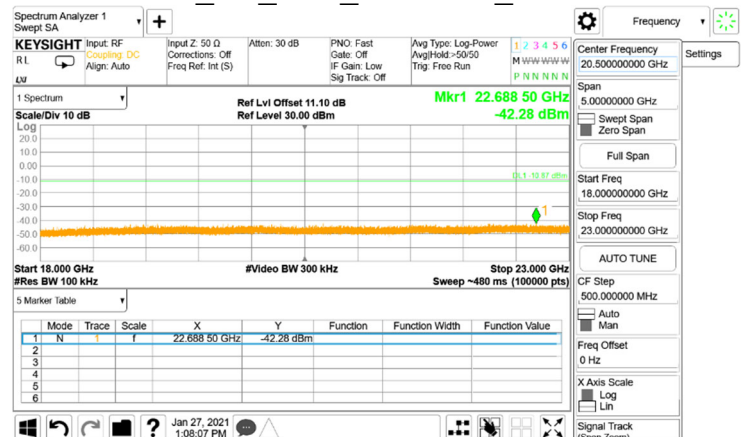
### GFSK\_1M\_DH5\_2441MHz\_13G-18G



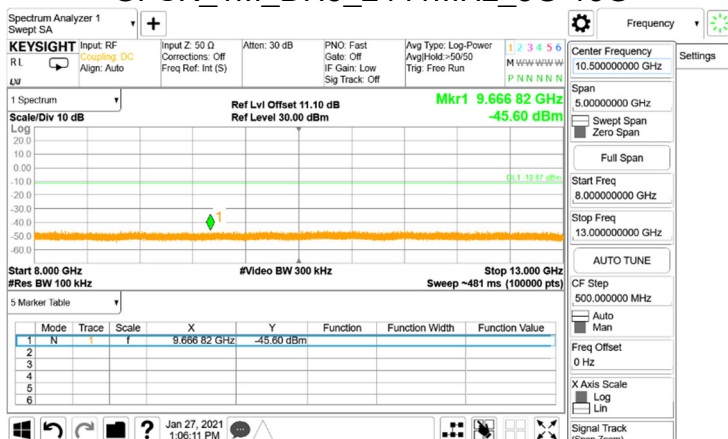
### GFSK\_1M\_DH5\_2441MHz\_3G-8G



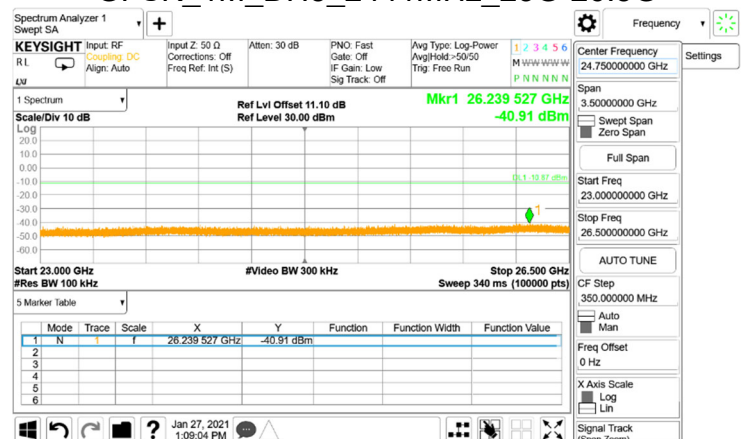
### GFSK\_1M\_DH5\_2441MHz\_18G-23G



### GFSK\_1M\_DH5\_2441MHz\_8G-13G



### GFSK\_1M\_DH5\_2441MHz\_23G-26.5G

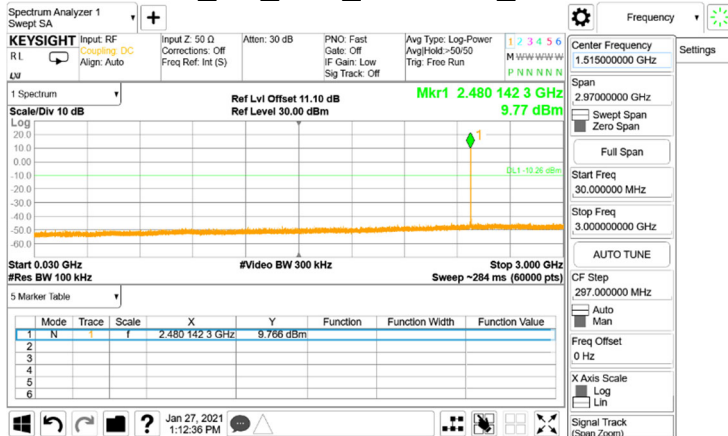


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## GFSK\_1M\_DH5\_2480MHz\_30M-3G



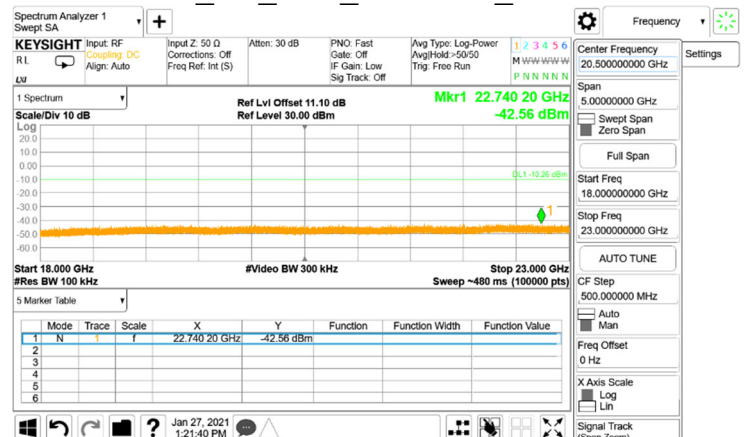
## GFSK\_1M\_DH5\_2480MHz\_13G-18G



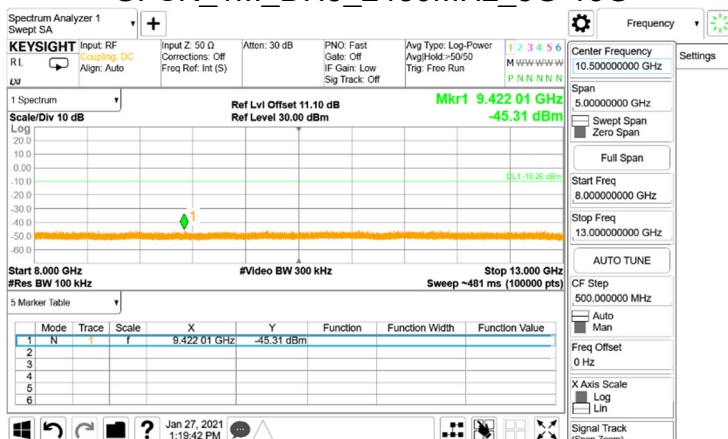
## GFSK\_1M\_DH5\_2480MHz\_3G-8G



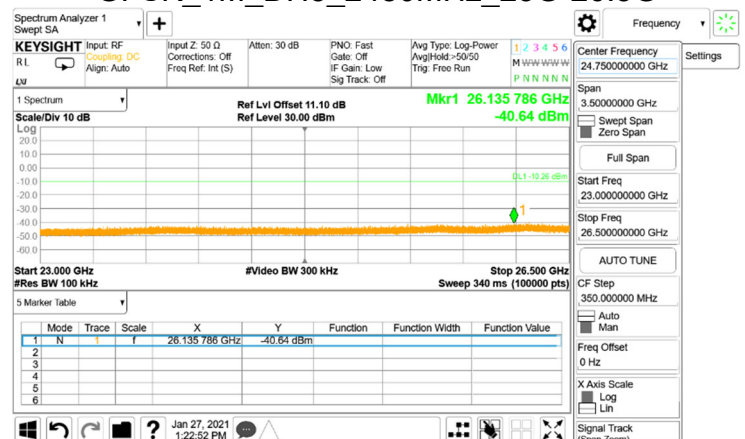
## GFSK\_1M\_DH5\_2480MHz\_18G-23G



## GFSK\_1M\_DH5\_2480MHz\_8G-13G



## GFSK\_1M\_DH5\_2480MHz\_23G-26.5G



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