FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10: 2013

TEST REPORT

For

Audio Device

Model: HV01

Brand: Headrush

Issued for

inMusic Brands, Inc.

200 Scenic View Drive, Cumberland, RI 02864, U.S.A.

Issued by

Compliance Certification Services Inc.
Tainan Lab.
No.8, Jiucengling, Xinhua Dist.,
Tainan City, Taiwan
Issued Date: March 06, 2023

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REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	March 06, 2023	Initial Issue	ALL	Polly Wang

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TABLE OF CONTENTS

1. TEST REPORT CERTIFICATION 4

2. EUT DESCRIPTION 5

3. DESCRIPTION OF TEST MODES 7

4. TEST METHODOLOGY 8

5. FACILITIES AND ACCREDITATIONS 8

5.1 FACILITIES 8
5.2 EQUIPMENT 8
5.3 LABORATORY ACCREDITATIONS LISTINGS 8
5.4 TABLE OF ACCREDITATIONS AND LISTINGS 9

6. CALIBRATION AND UNCERTAINTY 10

6.1 MEASURING INSTRUMENT CALIBRATION 10
6.2 MEASUREMENT UNCERTAINTY 10

7. SETUP OF EQUIPMENT UNDER TEST 11

7.1 SETUP CONFIGURATION OF EUT 11
7.2 SUPPORT EQUIPMENT 12
7.3 EUT OPERATING CONDITION 14

8. APPLICABLE LIMITS AND TEST RESULTS 17

8.1 6dB BANDWIDTH 17
8.2 MAXIMUM PEAK OUTPUT POWER 31
8.3 DUTY CYCLE 46
8.4 POWER SPECTRAL DENSITY 59
8.5 CONDUCTED SPURIOUS EMISSION 73
8.6 RADIATED EMISSIONS 95
8.6.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS 95
8.6.2 WORST-CASE RADIATED EMISSION BELOW 1 GHZ 100
8.6.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHZ 102
8.6.4 RESTRICTED BAND EDGES 117
8.7 POWERLINE CONDUCTED EMISSIONS 142

9. ANTENNA REQUIREMENT 146

9.1 STANDARD APPLICABLE 146
9.2 ANTENNA CONNECTED CONSTRUCTION 146

APPENDIX I SETUP PHOTOS 147

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1. TEST REPORT CERTIFICATION

Applicant	:	**inMusic Brands, Inc.** 200 Scenic View Drive, Cumberland, RI 02864, U.S.A.
Manufacturer	:	**inMusic Brands, Inc.** 200 Scenic View Drive, Cumberland, RI 02864, U.S.A.
Equipment Under Test	:	Audio Device
Model	:	HV01
Brand	:	Headrush
Date of Test	:	December 08, 2021 ~ February 18, 2022

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C AND ANSI C63.10: 2013	No non-compliance noted

Statements of Conformity
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Approved by:

John Chen
Supervisor

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2. EUT DESCRIPTION

Product Name	Audio Device
Model	HV01
Brand	Headrush
Received Date	December 07, 2021
Frequency Range	IEEE 802.11b/g, 802.11n HT20: 2412MHz~2462MHz Bluetooth 5.0: 2402MHz~2480MHz
Transmit Power	IEEE 802.11b Mode: 18.60dBm (72.444mW) IEEE 802.11g Mode: 19.99dBm (99.770mW) IEEE 802.11n HT20 Mode: 19.29dBm (84.918mW) Bluetooth 4.0 Mode: 4.20dBm (2.628mW) Bluetooth 5.0 Mode: 4.43dBm (2.772mW)
Channel Spacing	IEEE 802.11b/g, 802.11n HT20: 5MHz Bluetooth 5.0: 2MHz
Channel Number	IEEE 802.11b/g, 802.11n HT20: 11 Channels Bluetooth 5.0 : 40 Channels
Transmit Data Rate	IEEE 802.11b : 11, 5.5, 2, 1 Mbps IEEE 802.11g : 54, 48 ,36, 24, 18, 12, 9, 6 Mbps IEEE 802.11n HT20 : 130, 117 ,104, 78, 65, 58.5, 52, 39, 26, 19.5,13, 6.5 Mbps Bluetooth 5.0: 2 Mbps
Type of Modulation	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK, BPSK) Bluetooth 5.0: GFSK
Antenna Type	Type: WLAN EMBEDDEN ANTENNA Model: WLA1EM128-I0300 Manufacturer: BRITO Gain: 2.0 dBi
Power Rating	AC 100-240V
Hardware Version	INM-AZ05-Carrier Board
Software Version	N/A
Firmware Version	hv01-2021-11-12-16-08-wifi-720791c-AZ01-master-3862304-INTERNAL-incremental-FullImage.tar.bz2
Temperature Range	0°C ~ +40°C
Reported Date	April 16, 2022

Power Adapter :

No.	Manufacturer	Model No.	Power Input	Power Output
1	FSP	FSP036-RHBN3	AC 100-240V~,1.8A, 50-60Hz	DC 12.0V, 3.0A, 36.0W

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REMARK:

1. The sample **(HV01)** selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **Y4O-HV01** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.

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3. DESCRIPTION OF TEST MODES

The EUT is a Audio Device. It has one transmitter chains and one receive chains (1x1 configurations) and BT5.0. The 1x1 configuration is implemented with one outside chains (Chain 0).

The RF chipset is manufactured by Broadcom.

The antenna peak gain 4.6dBi (highest gain) were chosen for full testing.

IEEE 802.11 b ,802.11g ,802.11n HT20 mode (DTS Band)

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2412
Middle	2437
High	2462

IEEE 802.11b mode: 1Mbps long data rate (worst case) were chosen for full testing.

IEEE 802.11g mode: 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode: 6.5Mbps data rate (worst case) were chosen for full testing.

GFSK mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2442
High	2480

Bluetooth 5.0 (GFSK) mode: 1Mbps data rate (worst case) were chosen for full testing.

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4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 15.207, 15.209 and 15.247.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW1109).

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5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada (TW1109)
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

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6. CALIBRATION AND UNCERTAINTY

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	±3.3456dB
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	±2.6828dB
Radiated Emission, 1 to 8 GHz	± 2.6485dB
Radiated Emission, 8 to 18 GHz	± 2.6852dB
Radiated Emission, 18 to 26.5 GHz	± 2.6485dB
Radiated Emission, 26 to 40 GHz	± 3.0295dB
Power Line Conducted Emission	±1.91dB
Band Width	136.49kHz
Peak Output Power MU	±1.904dB
Band Edge MU	±0.302dBuV
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

Uncertainty figures are valid to a confidence level of 95%, K=2

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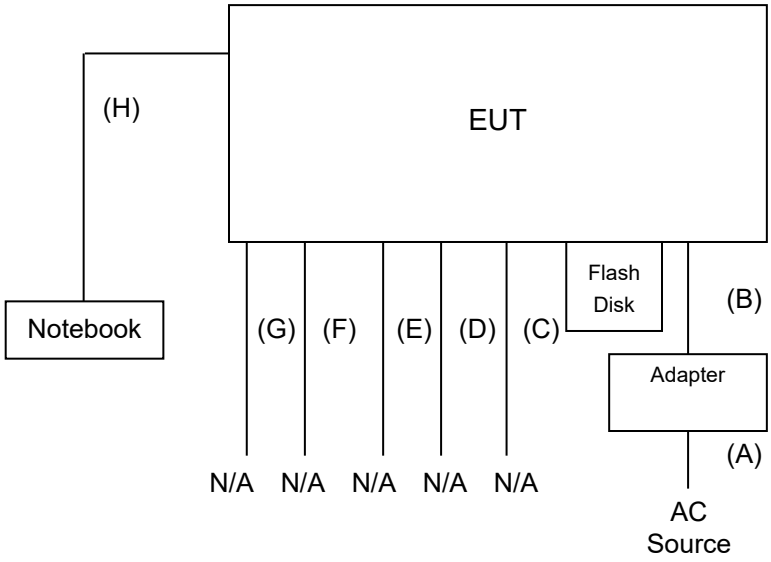
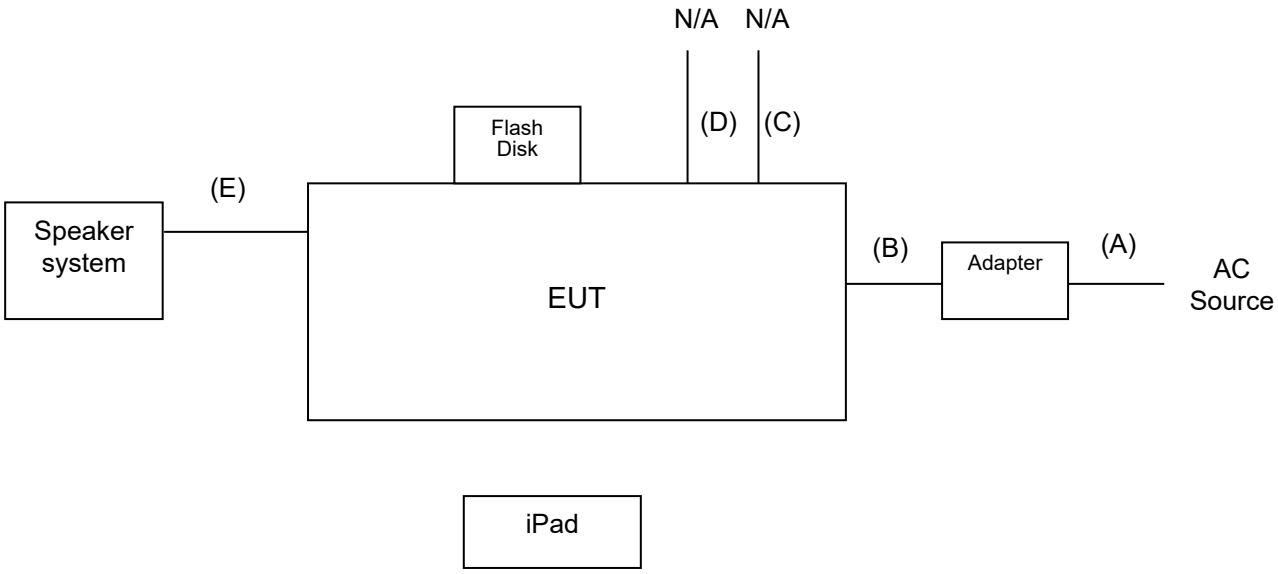
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

FOR RF TEST



FOR EMI TEST



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7.2 SUPPORT EQUIPMENT

RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Flash Disk	Transcend	Jet Flash700	DOC	N/A
2	Notebook	Acer	MS2229	DOC	Unshielded, 1.4m Unshielded, 1.6m with one core

No.	Signal cable description	
A	AC Power cable	Unshielded, 1.0m, 1pcs.
B	DC Power cable	Unshielded, 1.5m, 1pcs.
C	USB	Shielded, 1.4m, 1pcs. with one core
D	MIC	Shielded, 1.0m, 2pcs.
E	MIC	Shielded, 0.5m, 2pcs.
F	Audio 6.4m	Shielded, 0.5m, 9pcs.
G	Audio 3.5m	Shielded, 1.0m, 2pcs.
H	USB	Shielded, 2.0m, 1pcs.

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EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	iPad	Apple	A1219	DOC	N/A
2	Speaker System	T.C.SATR	TCS2285	DOC	N/A
3	Flash Disk	Transcend	Jet Flash700	DOC	N/A

No.	Signal cable description	
A	AC Power cable	Unshielded, 1.0m, 1pcs.
B	DC Power cable	Unshielded, 1.6m, 1pcs.
C	USB	Shielded, 2.0m, 1pcs. with one core
D	Audio	Shielded, 1.0m, 13pcs.
E	Audio	Shielded, 1.0m, 2pcs.

REMARK:

1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer’s requirements and conditions for the intended use.

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7.3 EUT OPERATING CONDITION

RF Setup

1. Set up a whole system as the setup diagram.
2. The “Tera Term” software was used for testing
3. Key in “root”，”connmanctl enable wifi”.

TX Mode Key in:

B Mode :

wl down
wl mpc 0
wl country ALL
wl band b
wl up
wl 2g_rate -r 01 -b 20
wl channel 01 (01,06,11)
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1
wl phy_txpwrctrl 1
wl txpwr1 -o -d 15
wl pkteng_start 00:90:4c:14:43:19 tx 100 1000 0

G Mode :

wl down
wl mpc 0
wl country ALL
wl band b
wl up
wl 2g_rate -r 06 -b 20
wl channel 01 (01,06,11)
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1
wl phy_txpwrctrl 1
wl txpwr1 -o -d 13 (13,12,11)
wl pkteng_start 00:90:4c:14:43:19 tx 100 1000 0

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HT20 Mode :

wl down
wl mpc 0
wl country ALL
wl band b
wl up
wl 2g_rate -h 0 -b 20
wl channel 01 (01,06,11)
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1
wl phy_txpwrctrl 1
wl txpwr1 -o -d 12 (12,11)
wl pkteng_start 00:90:4c:14:43:19 tx 100 1000 0

RX Mode Key in:

wl down
wl band auto
wl mpc 0
wl country ALL
wl channel 01 (01,06,11)
wl bi 65535
wl up
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1

4. All of the function are under run.
5. Start test.

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Bluetooth:

1. Set up a whole system as the setup diagram.
2. The “Tera Term” software was used for testing.
3. Key in :
   root
   cd /sys/class/bluetooth/hci0
   ls -al
   cd rfkill2/
   echo 1 >state
   echo 0 > /sys/class/rfkill/rfkill1/soft
   bluetoothctl
   power on
4. Press ”Ctrl + z”

   TX Mode
   BLE 1M Key in:
   hciconfig hci0 up
   hcitool cmd 0x03 0x0003
   hcitool cmd 0x08 0X0001e 00(00,14,27) 25 00
   BLE 2M
   BLE 2M Key in:
   hciconfig hci0 up
   hcitool cmd 0x03 0x0003
   hcitool cmd 0x08 0x0034 00(00,14,27) 25 00 02

   RX Mode
   BLE1M Key in:
   hciconfig hci0 up
   hcitool cmd 0x03 0x0003
   hcitool cmd 0x3f 0x0052 EE FF C0 88 00 00 E8 03 00(00,27,4E) 04 00 01 FF FF
   BLE2M Key in:
   hciconfig hci0 up
   hcitool cmd 0x03 0x0003
   hcitool cmd 0x08 0x0033 00(00,14,27) 02 00

5. All of the function are under run.
6. Start test.

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8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6dB BANDWIDTH

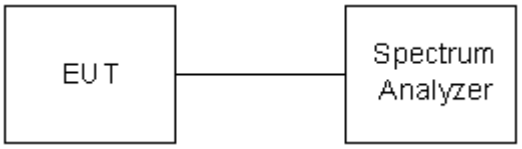
LIMIT

§ 15.247(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Chamber Room #966					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2022
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2022
SMA Cable+10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/28/2022	01/27/2023
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

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TEST RESULTS

No non-compliance noted.

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	23.2℃, 65%	Test Date	2022/02/17

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	7.60	500	PASS
Middle	2437	8.07	500	PASS
High	2462	7.60	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	15.51	500	PASS
Middle	2437	15.52	500	PASS
High	2462	15.21	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

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IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	15.22	500	PASS
Middle	2437	15.22	500	PASS
High	2462	15.21	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

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Model Name	HV01	Test By	Ted Huang
Temp & Humidity	22.5℃, 68%	Test Date	2022/02/18

Bluetooth 4.0 (GFSK) mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	2402	714	500	PASS
Middle	2442	710	500	PASS
High	2480	713	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	22.5℃, 68%	Test Date	2022/02/18

Bluetooth 5.0 (GFSK) mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	2402	1160	500	PASS
Middle	2442	1150	500	PASS
High	2480	1140	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 2Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

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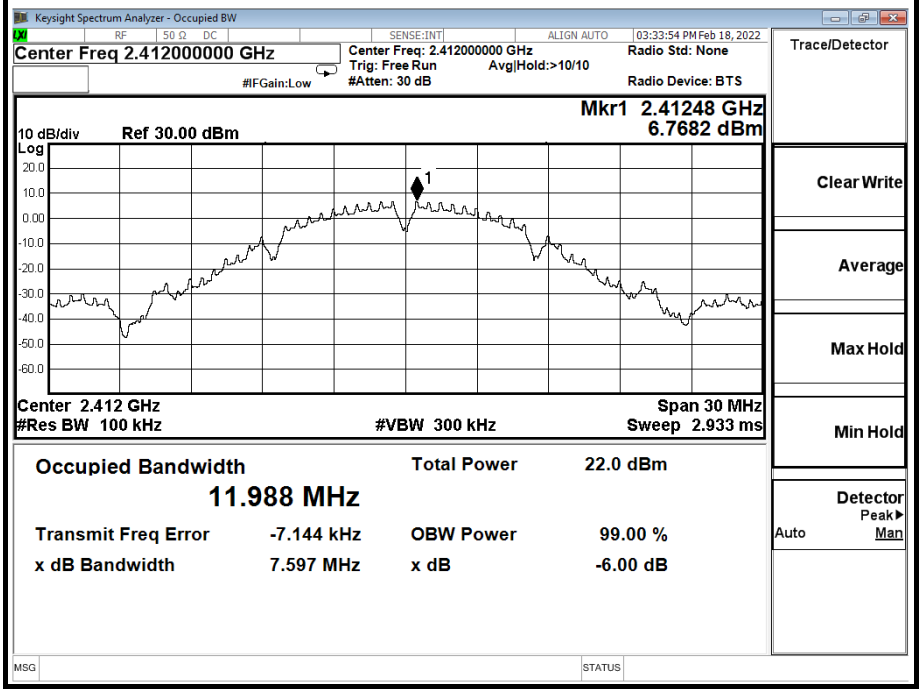
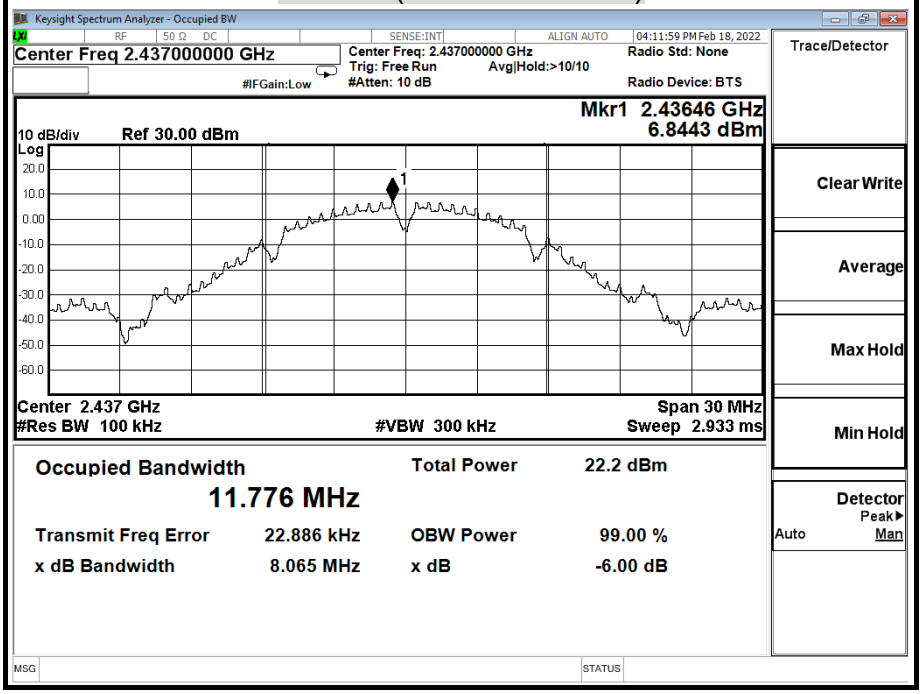
6dB BANDWIDTH (802.11b MODE)

CH Low (802.11b MODE)



CH Mid (802.11b MODE)



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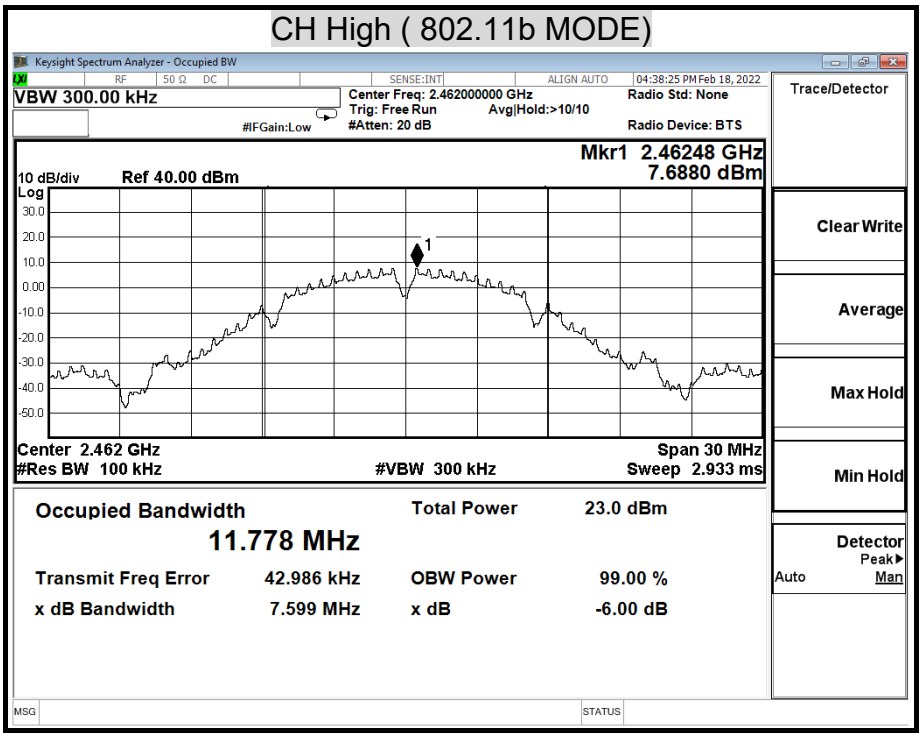
CH High (802.11b MODE)



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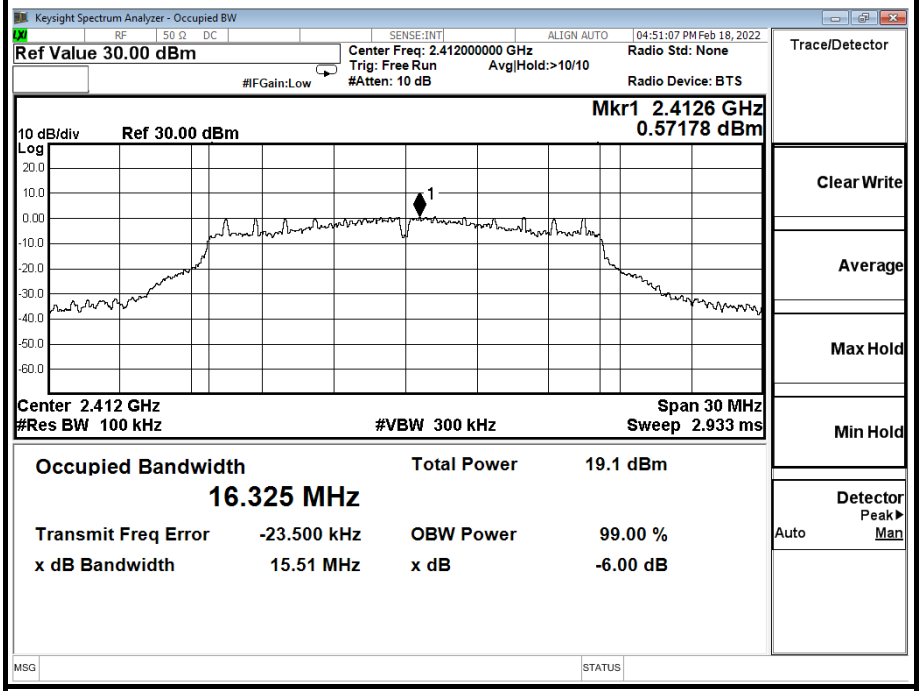
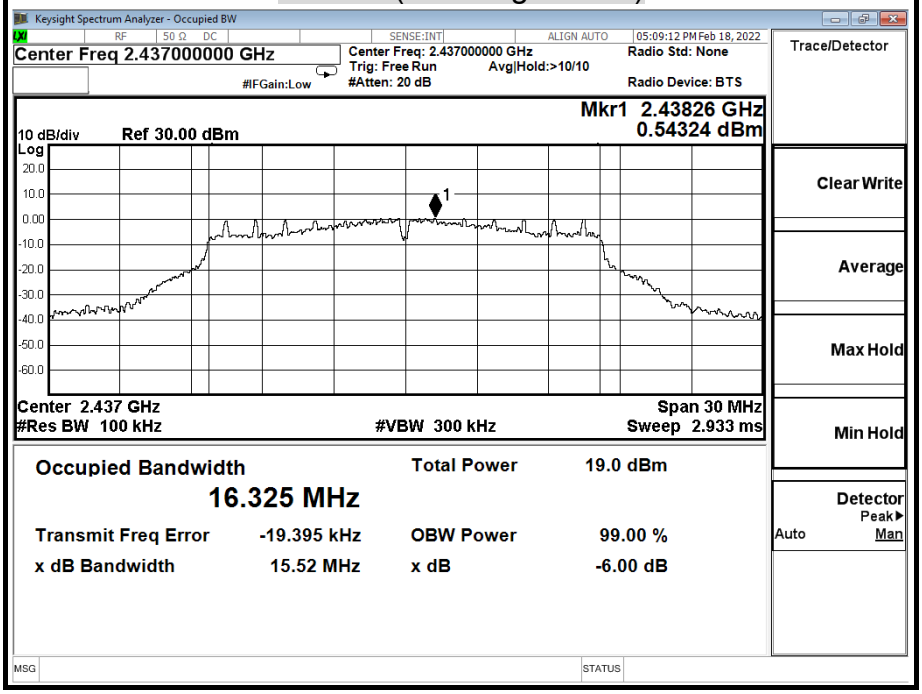
6dB BANDWIDTH (802.11g MODE)

CH Low (802.11g MODE)



CH Mid (802.11g MODE)



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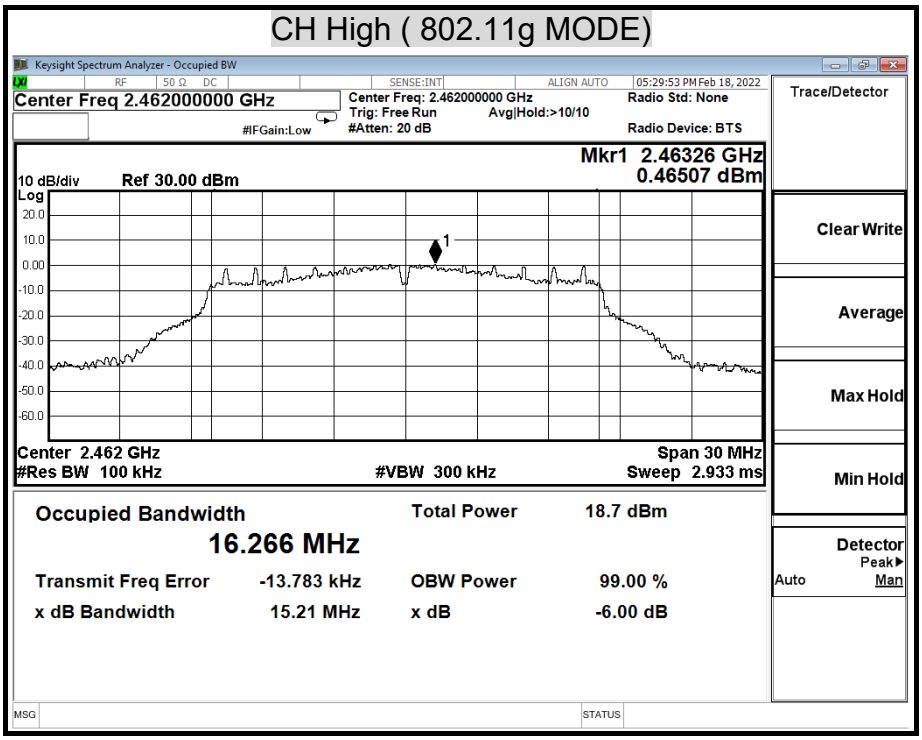
CH High (802.11g MODE)



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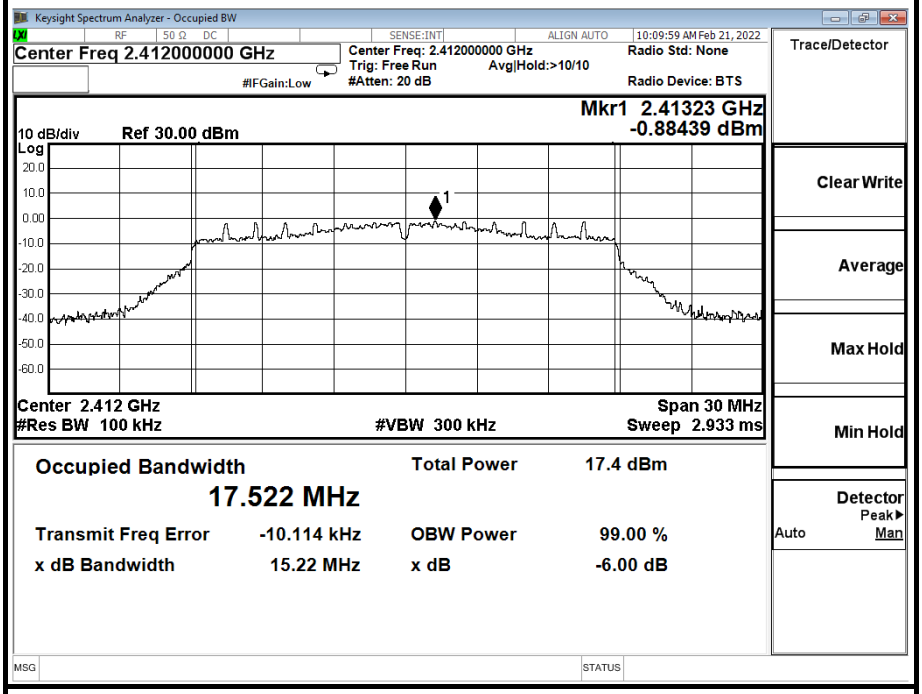
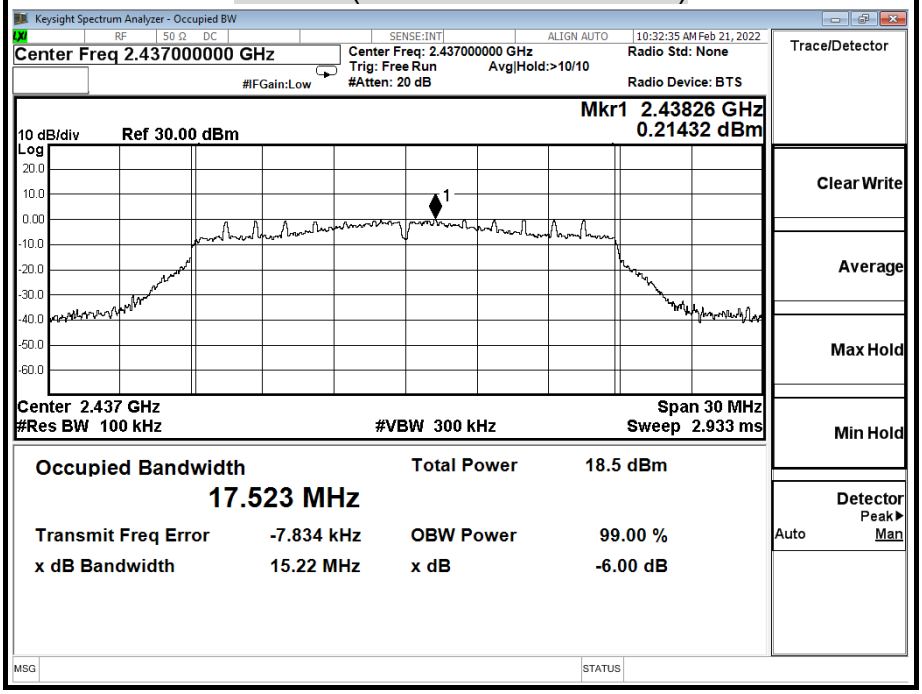
6dB BANDWIDTH (802.11n HT20 MODE)

CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)



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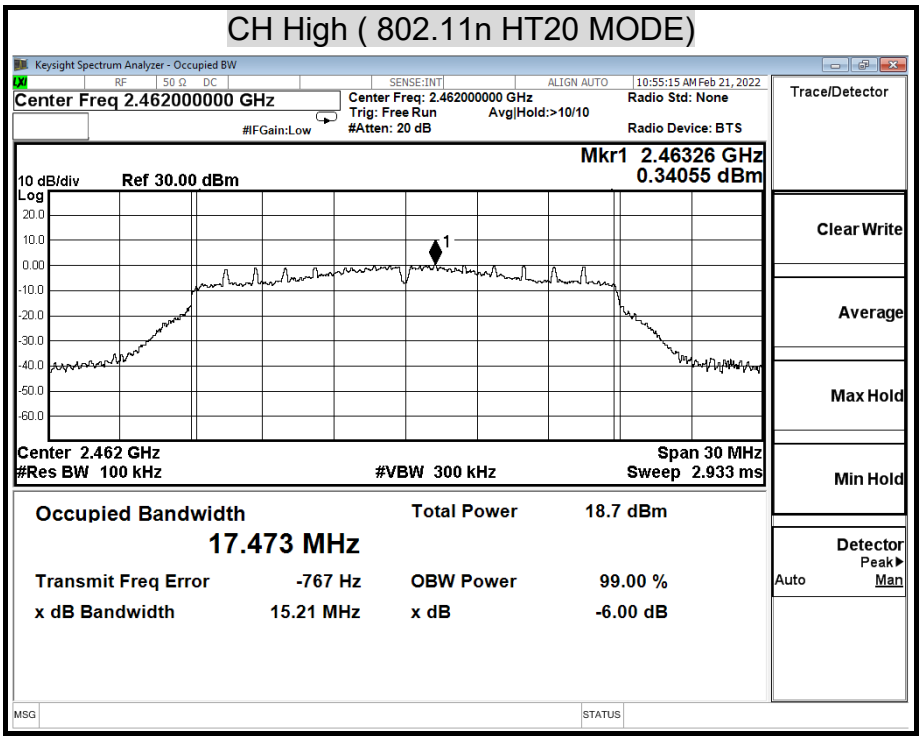
CH High (802.11n HT20 MODE)



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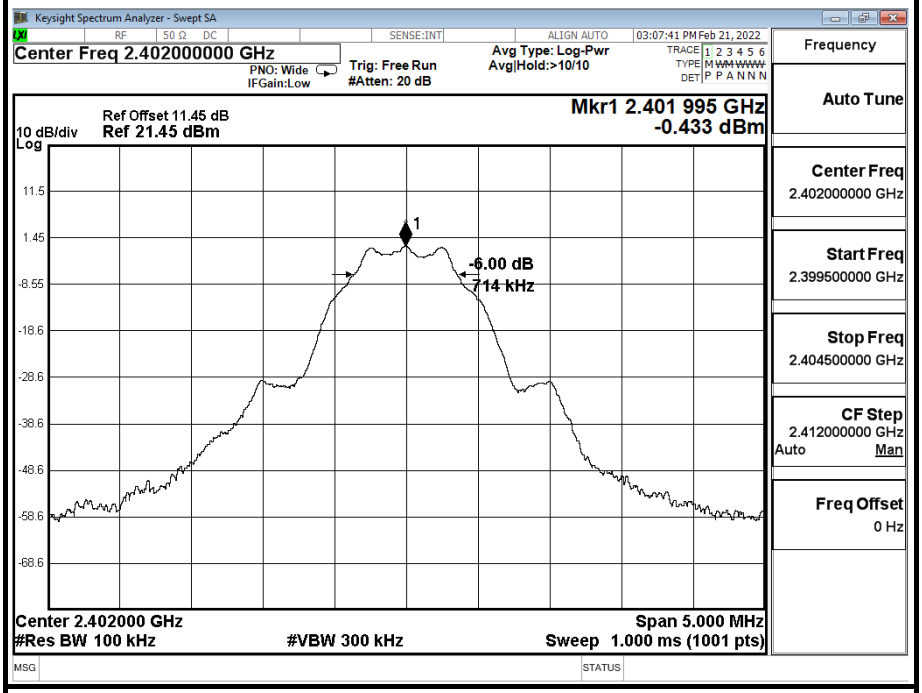
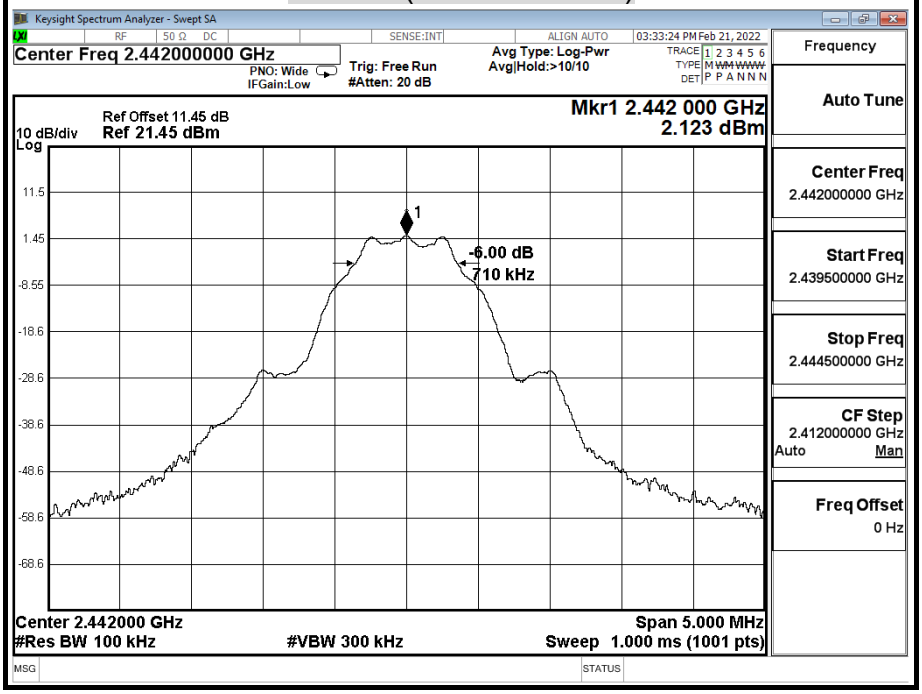
6dB BANDWIDTH (GFSK(4.0) MODE)

CH Low (GFSK MODE)



CH Mid (GFSK MODE)



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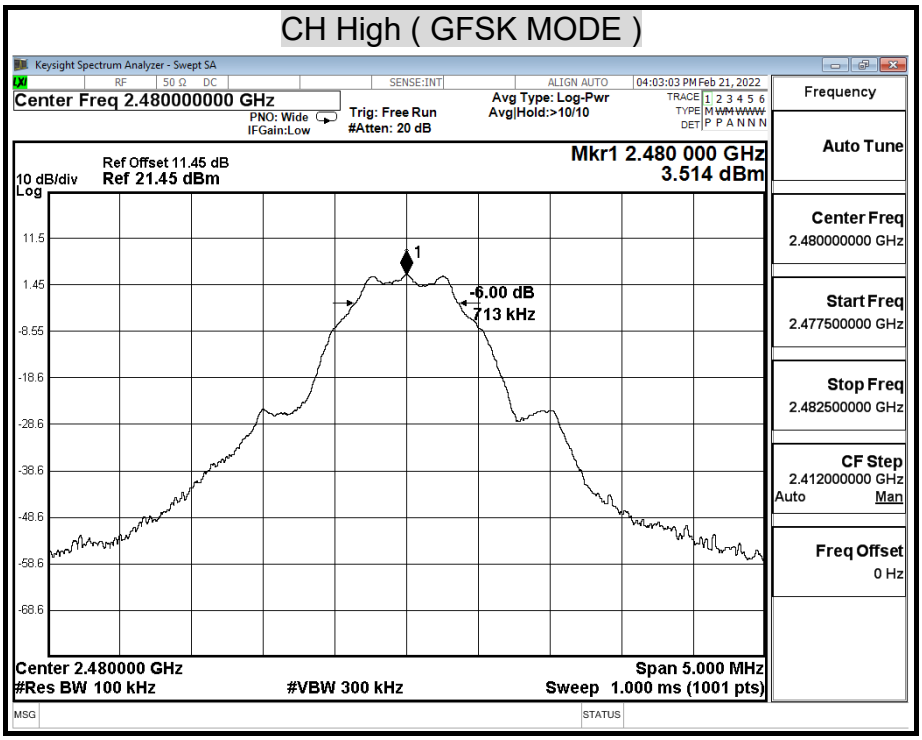
CH High (GFSK MODE)



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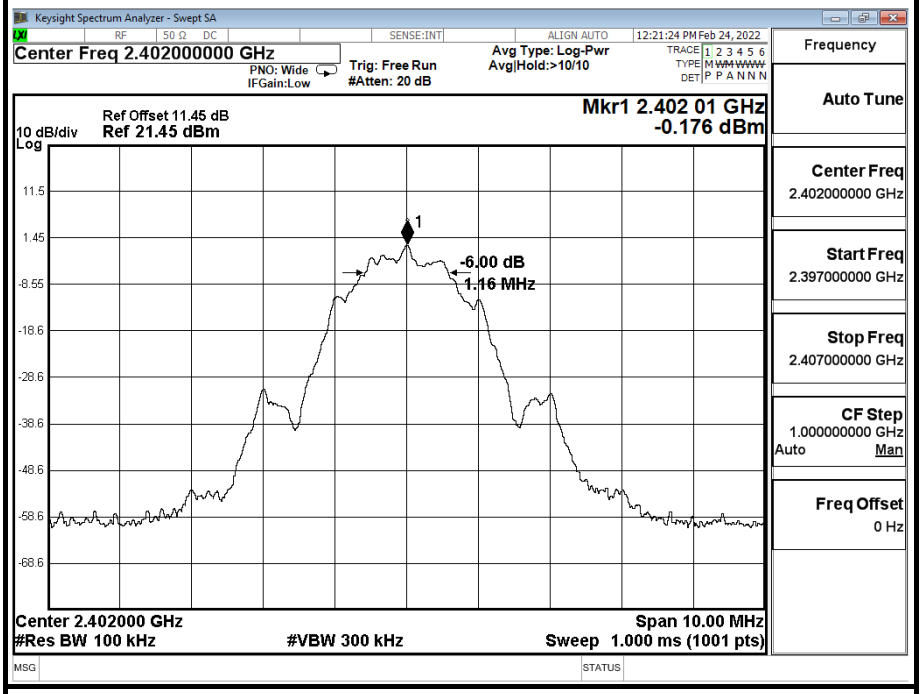
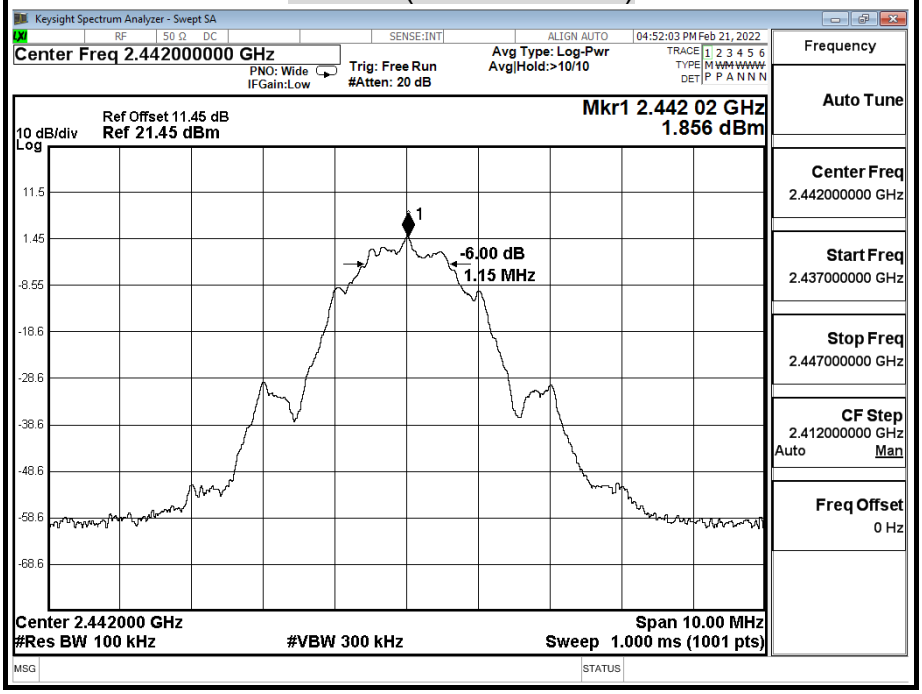
6dB BANDWIDTH (GFSK(5.0) MODE)

CH Low (GFSK MODE)



CH Mid (GFSK MODE)



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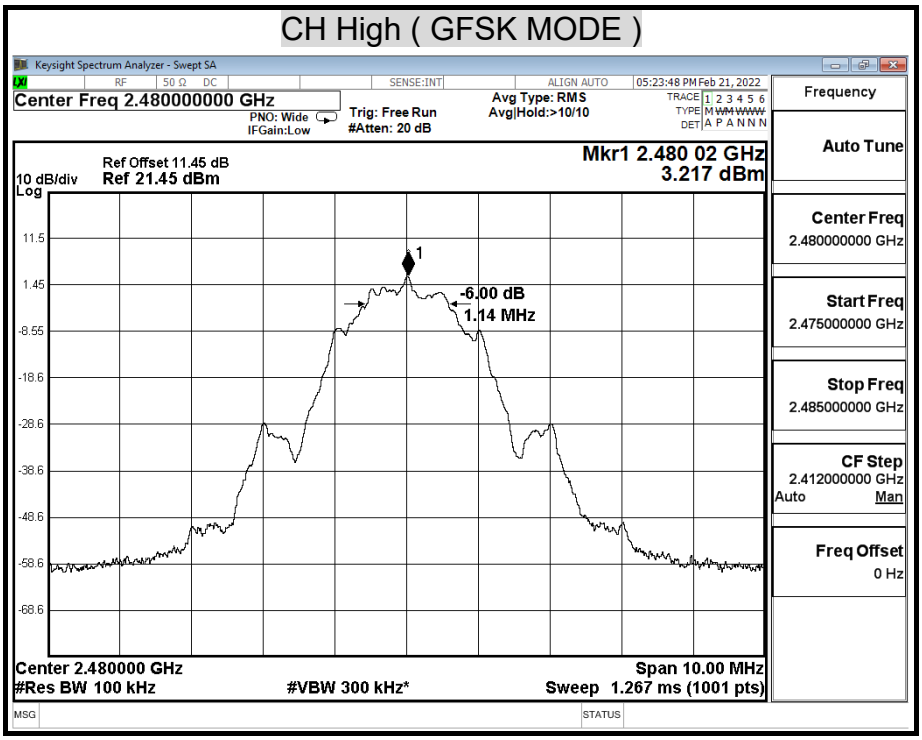
CH High (GFSK MODE)



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8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (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.

TEST EQUIPMENTS

Chamber Room #966					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2022
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2022
SMA Cable+10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/28/2022	01/27/2023
Software	Excel(ccs-o6-2020 v1.1)				

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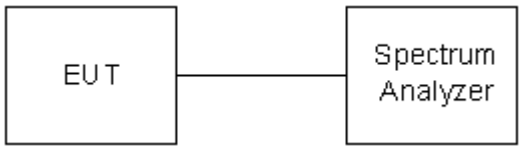
TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 8.3.1.1.

11.9.1.1 RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than
the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

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TEST RESULTS

No non-compliance noted

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	23.2℃, 65%	Test Date	2022/02/17

IEEE 802.11b mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)	Output Power Total		Limit (dBm)	Result
				ChainA	(dBm)	(W)		
Low	2412	1	15	17.42	17.42	0.0552	30.00	PASS
Middle	2437	1	15	17.64	17.64	0.0581		PASS
High	2462	1	15	18.60	18.60	0.0724		PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)	Output Power Total		Limit (dBm)	Result
				ChainA	(dBm)	(W)		
Low	2412	6	13	19.99	19.99	0.0998	30.00	PASS
Middle	2437	6	12	19.83	19.83	0.0962		PASS
High	2462	6	11	19.63	19.63	0.0918		PASS

NOTE : 1.At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)	Output Power Total		Limit (dBm)	Result
				ChainA	(dBm)	(W)		
Low	2412	MCS1	12	18.35	18.35	0.0684	30.00	PASS
Middle	2437	MCS1	12	19.29	19.29	0.0849		PASS
High	2462	MCS1	11	18.97	18.97	0.0789		PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

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Model Name	HV01	Test By	Ted Huang
Temp & Humidity	22.5℃, 68%	Test Date	2022/02/18

Bluetooth 4.0 (GFSK) mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	0.40	30.00	PASS
Middle	2442	2.61	30.00	PASS
High	2480	4.20	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Bluetooth 5.0 (GFSK) mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	0.57	30.00	PASS
Middle	2442	2.76	30.00	PASS
High	2480	4.43	30.00	PASS

NOTE : 1. At finial test to get the worst-case emission at 2Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

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Average Power Data

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2412	14.50
Middle	2437	14.64
High	2462	15.67

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2412	11.73
Middle	2437	11.57
High	2462	11.36

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
		Chain 0
Low	2412	9.83
Middle	2437	10.83
High	2462	10.66

Bluetooth 4.0 (GFSK) mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2402	-0.06
Middle	2442	2.29
High	2480	3.78

Bluetooth 5.0 (GFSK) mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2402	0.19
Middle	2442	2.38
High	2480	4.07

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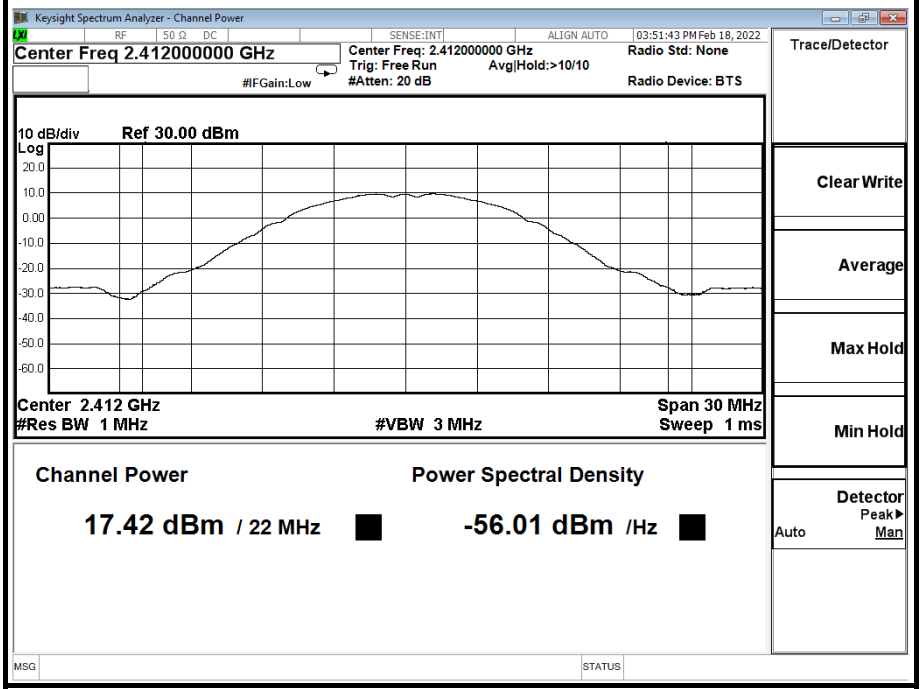
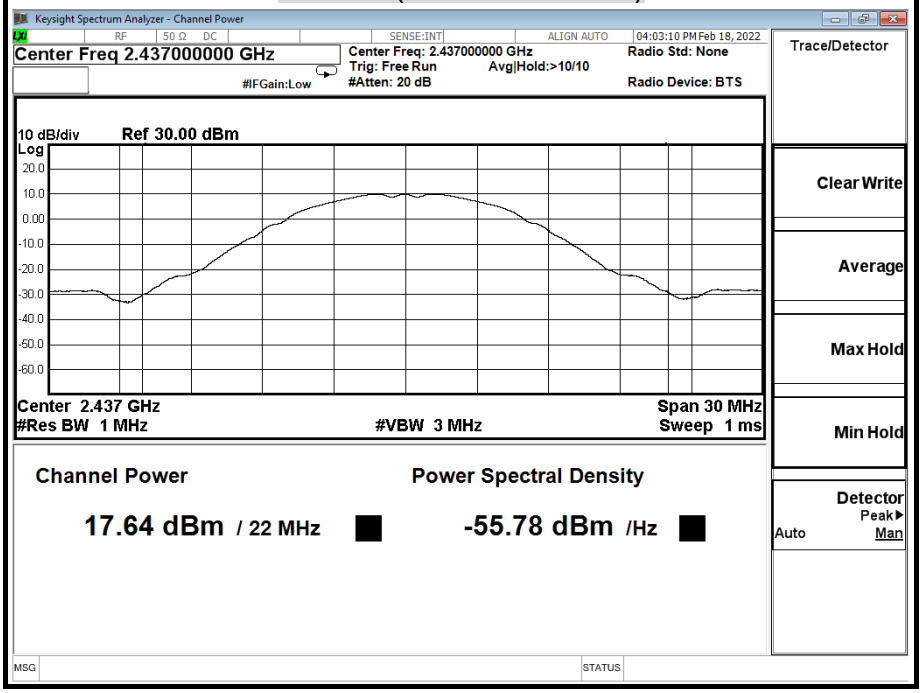
MAXIMUM PEAK OUTPUT POWER (802.11b MODE)

CH Low (802.11b MODE)



CH Mid (802.11b MODE)



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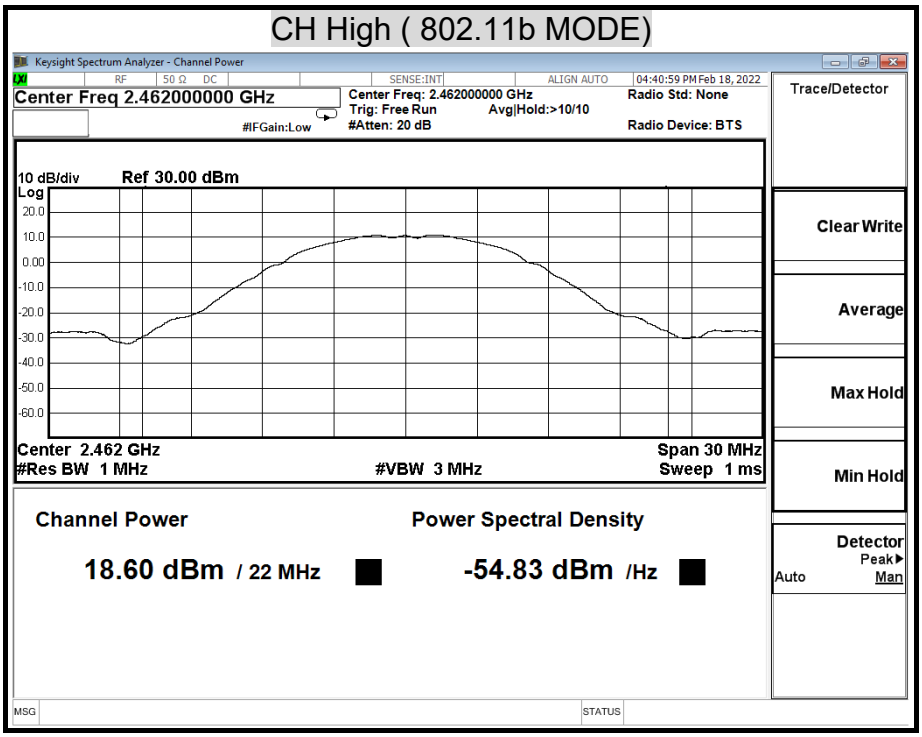
CH High (802.11b MODE)



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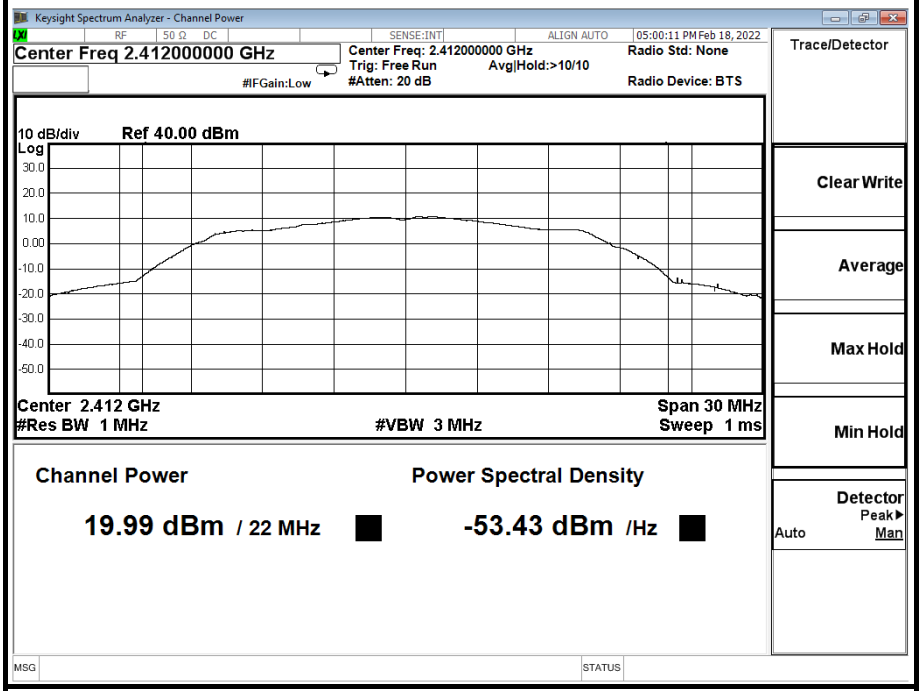
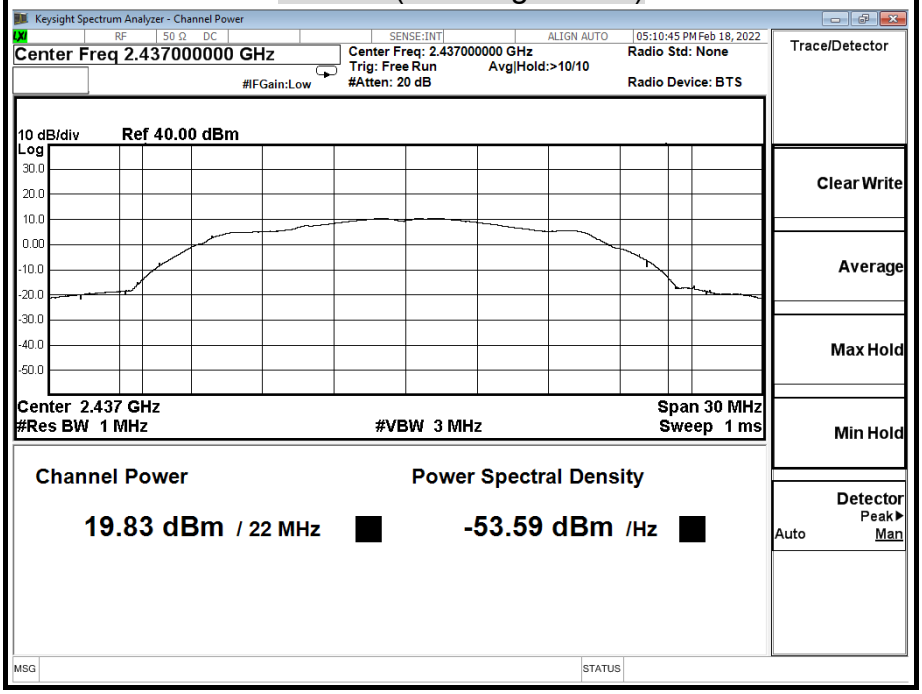
MAXIMUM PEAK OUTPUT POWER (802.11g MODE)

CH Low (802.11g MODE)



CH Mid (802.11g MODE)



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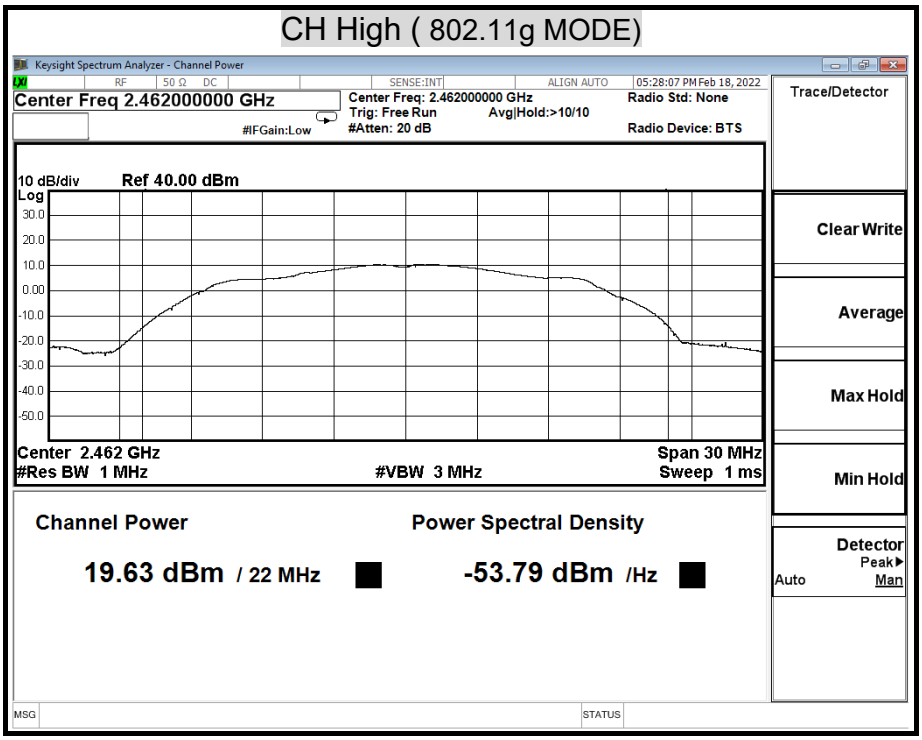
CH High (802.11g MODE)



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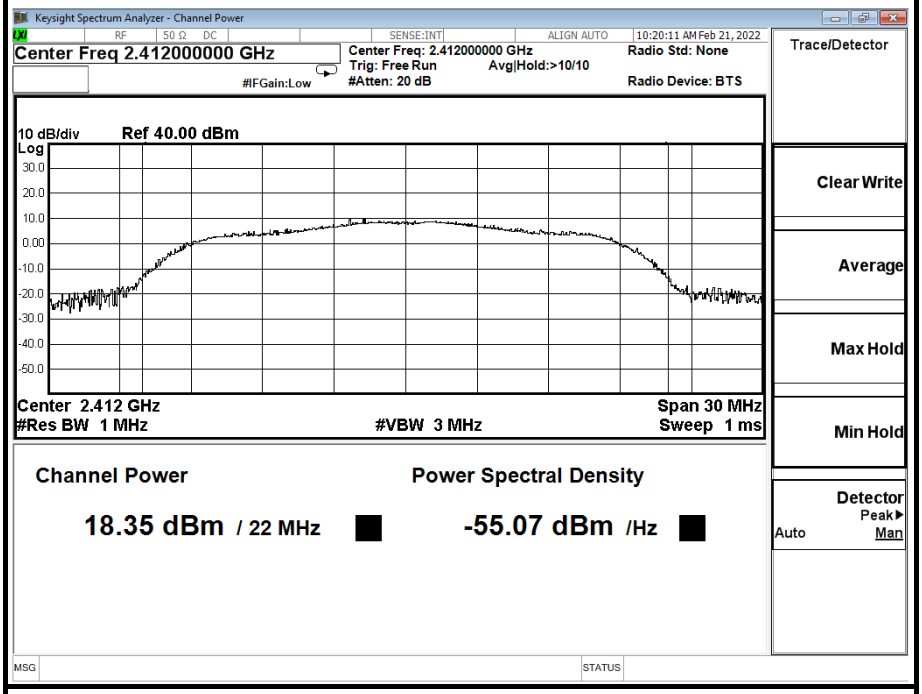
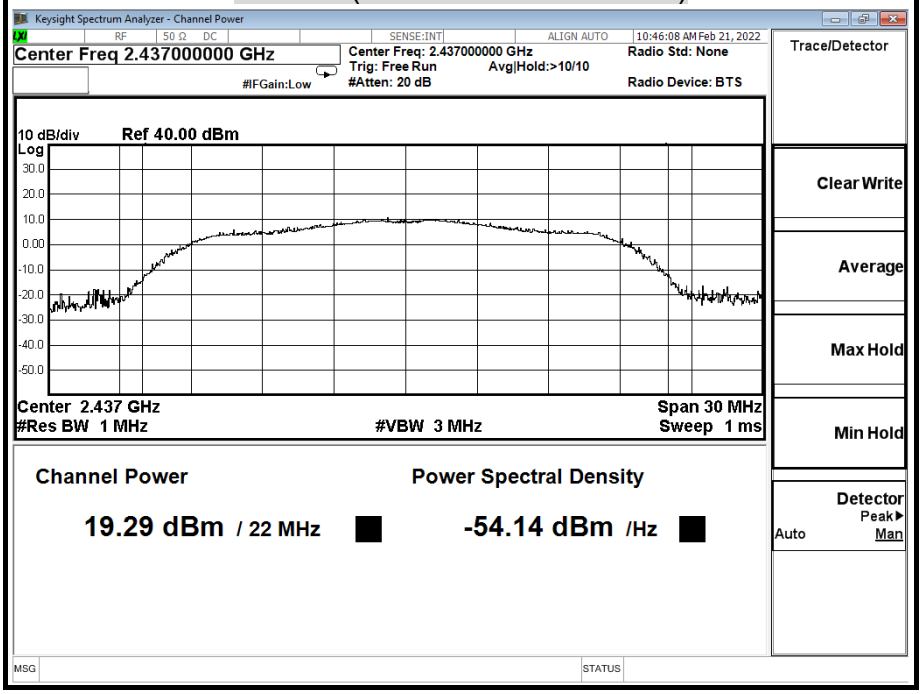
MAXIMUM PEAK OUTPUT POWER (802.11n HT20 MODE)

CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)



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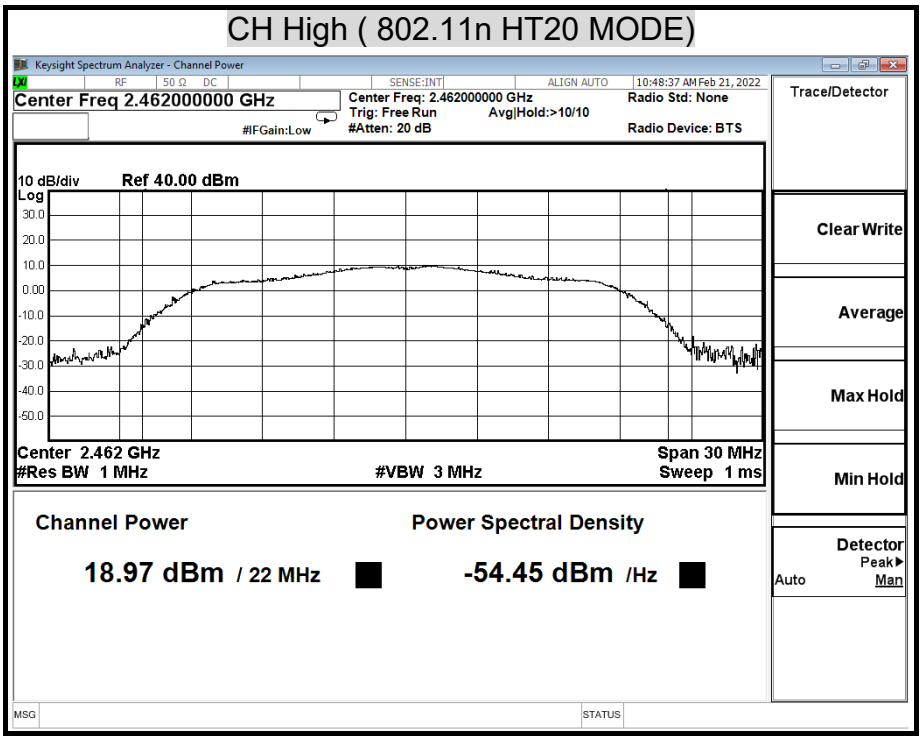
CH High (802.11n HT20 MODE)



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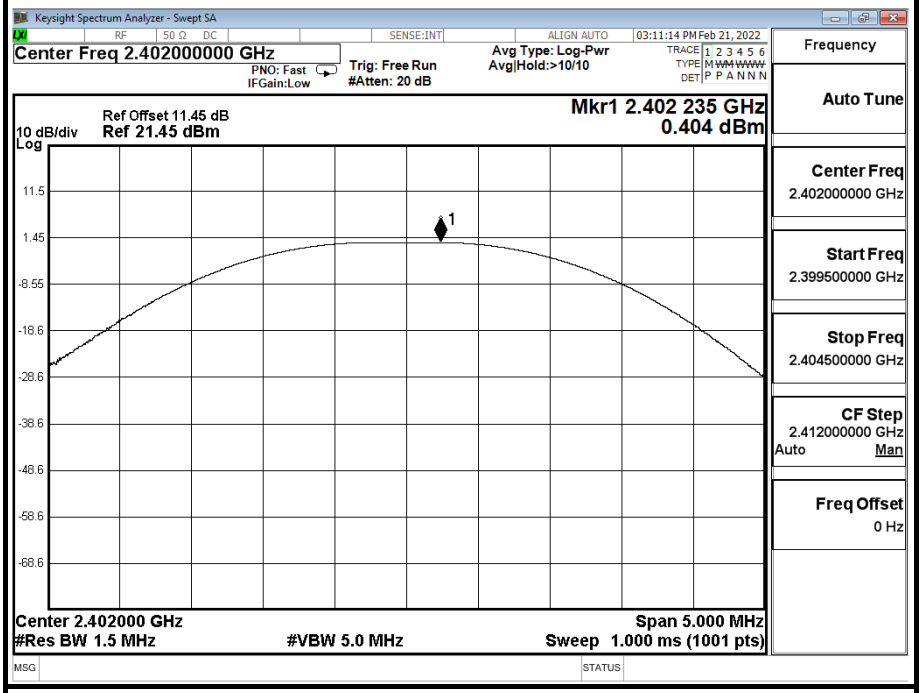
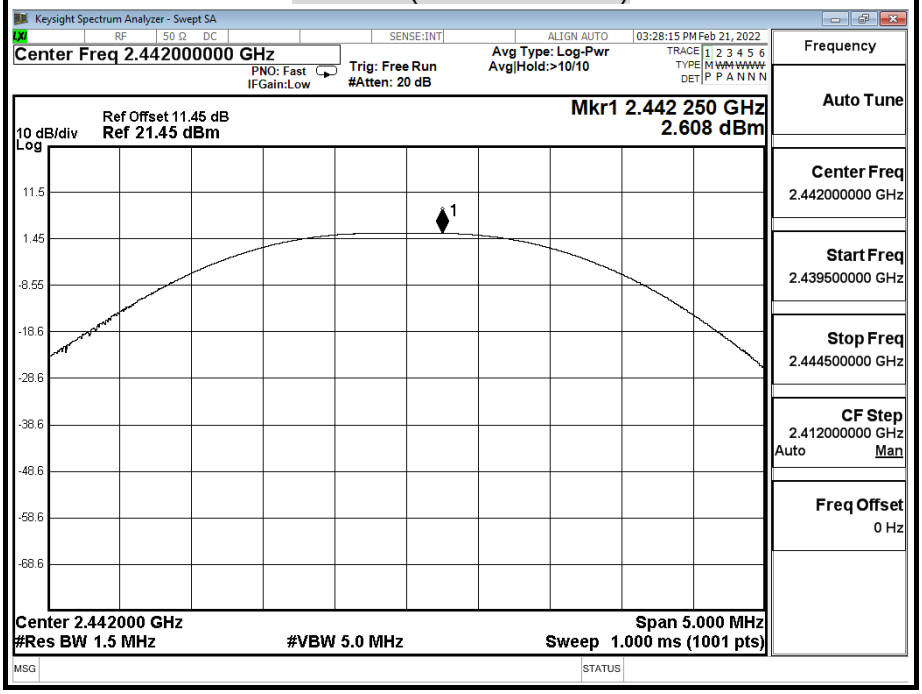
MAXIMUM PEAK OUTPUT POWER (GFSK(4.0) MODE)

CH Low (GFSK MODE)



CH Mid (GFSK MODE)



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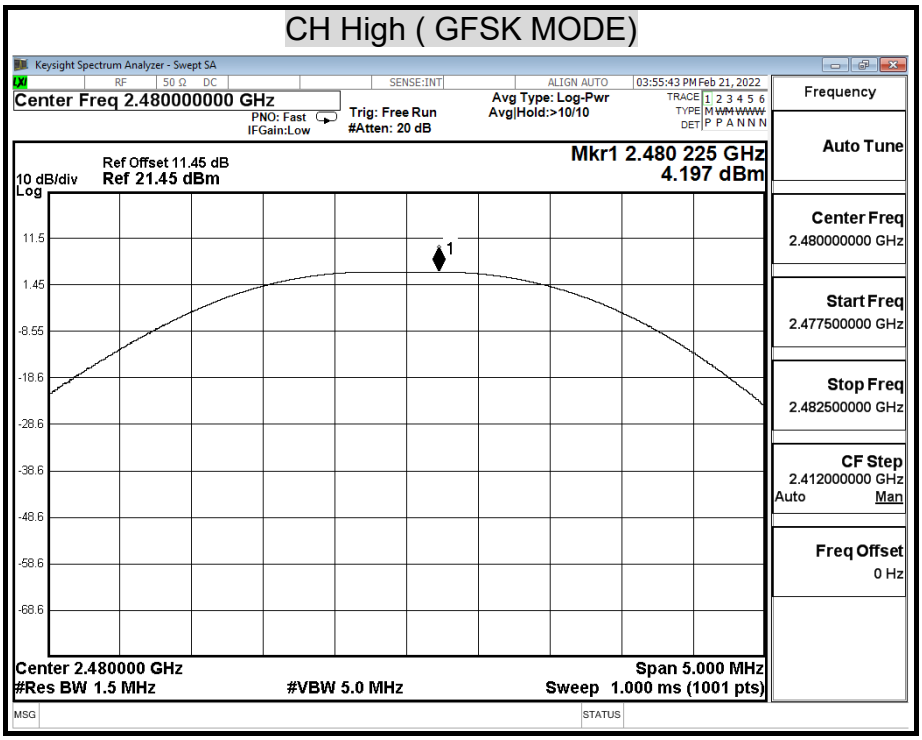
CH High (GFSK MODE)



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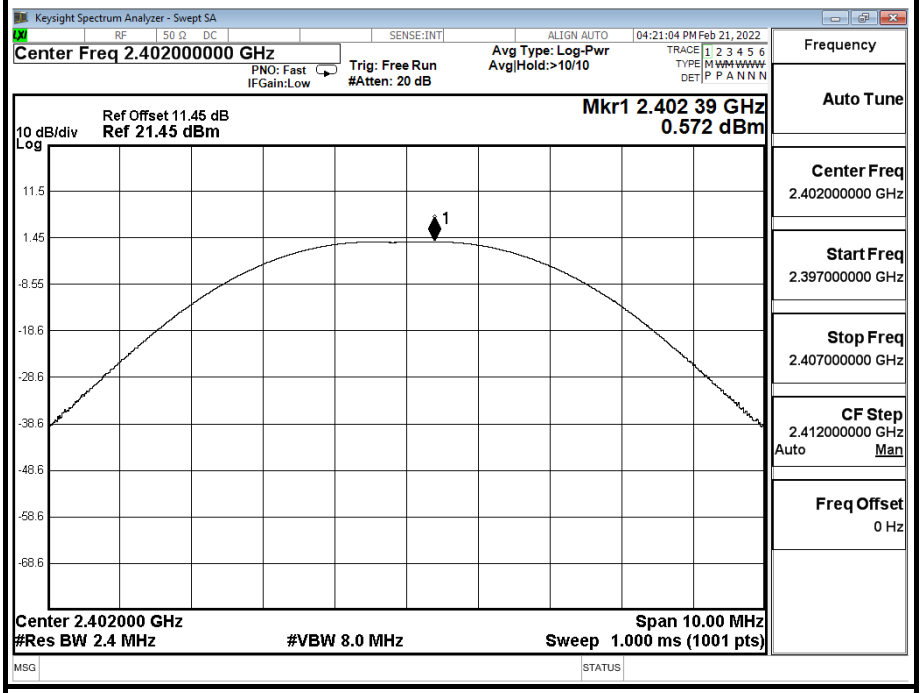
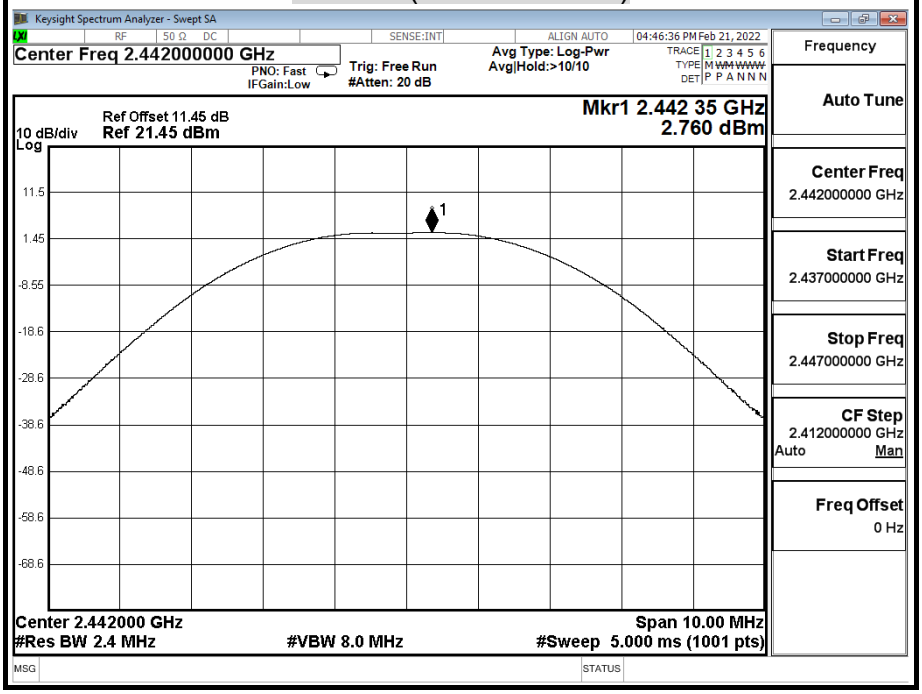
MAXIMUM PEAK OUTPUT POWER (GFSK(5.0) MODE)

CH Low (GFSK MODE)



CH Mid (GFSK MODE)



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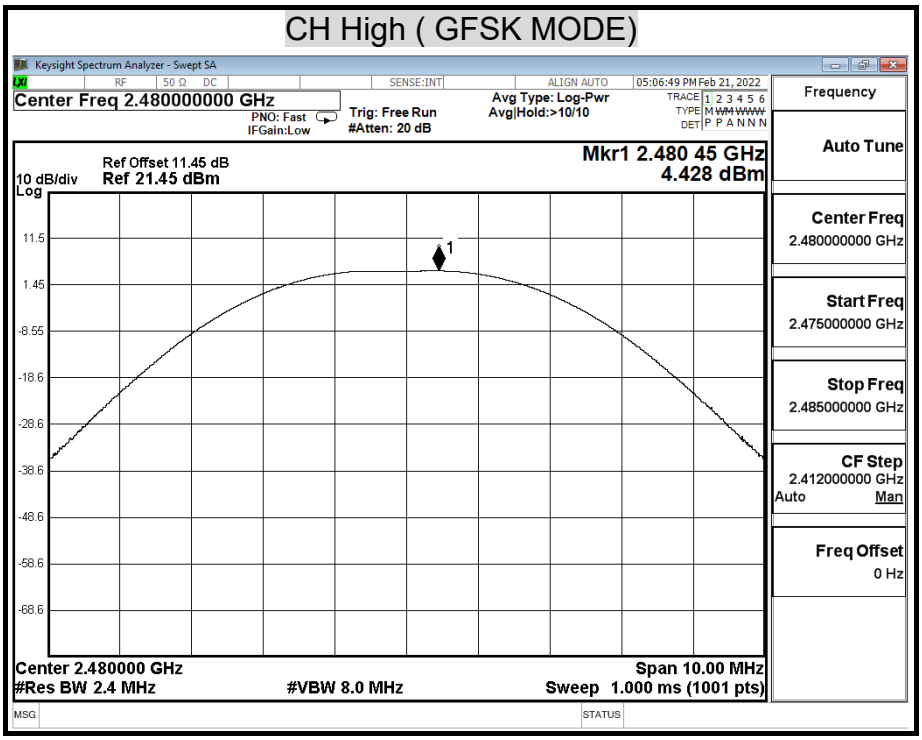
CH High (GFSK MODE)



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8.3 DUTY CYCLE

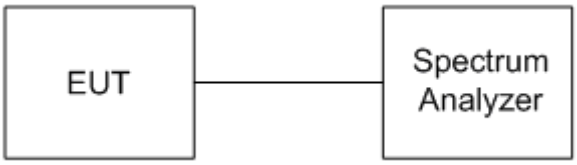
LIMIT

Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENTS

Chamber Room #966					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2022
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2022
SMA Cable+10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/28/2022	01/27/2023
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

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TEST RESULTS

No non-compliance noted.

TEST DATA

WIFI

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	23.2℃, 65%	Test Date	2022/02/17

	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000	
Ton2		0	0	
Ton3			0	100
Tp				100

Ton	100
Tp(Ton+Toff)	100
Duty Cycle	1
10 * log (1/x) =	0

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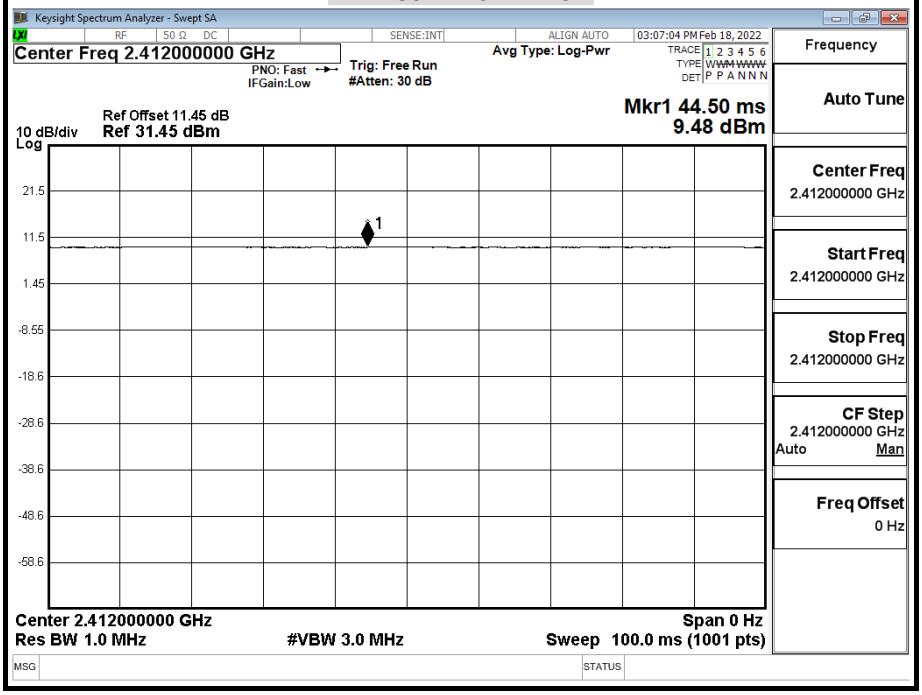
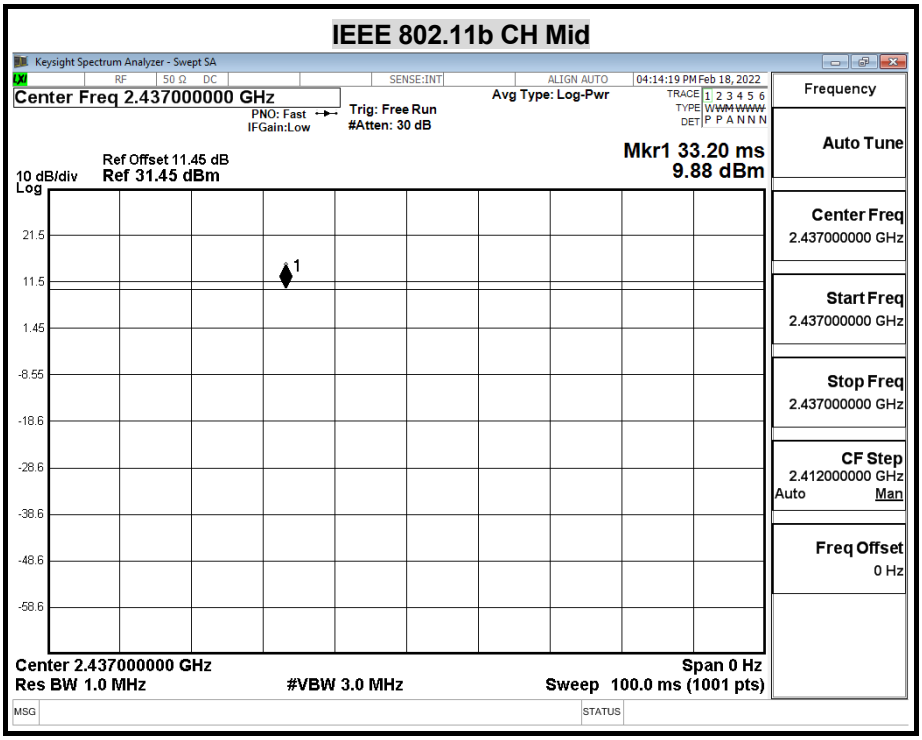
TEST PLOT

Plot

IEEE 802.11b CH Low



IEEE 802.11b CH Mid



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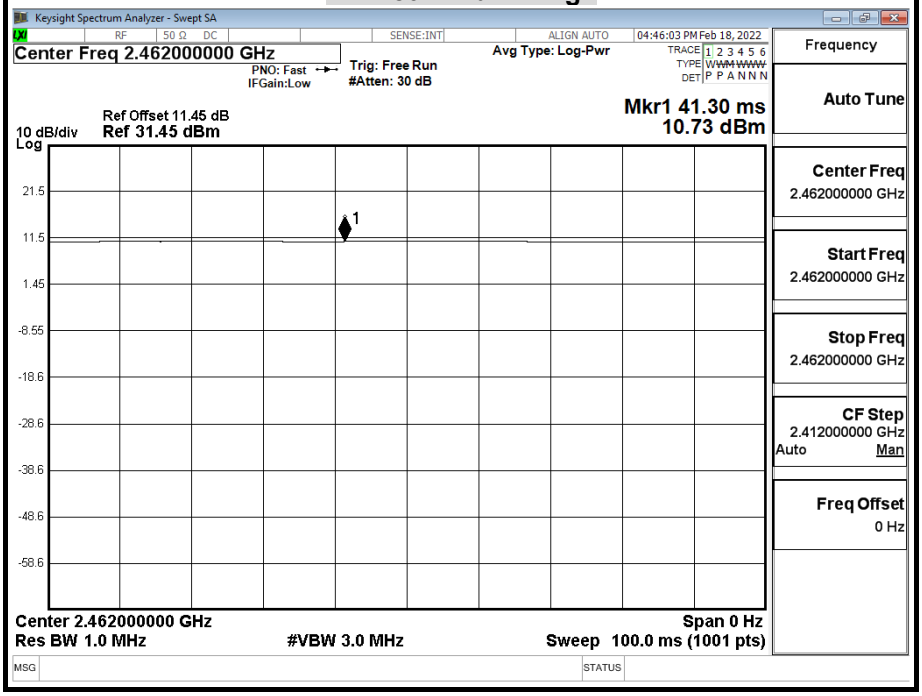
IEEE 802.11b CH High



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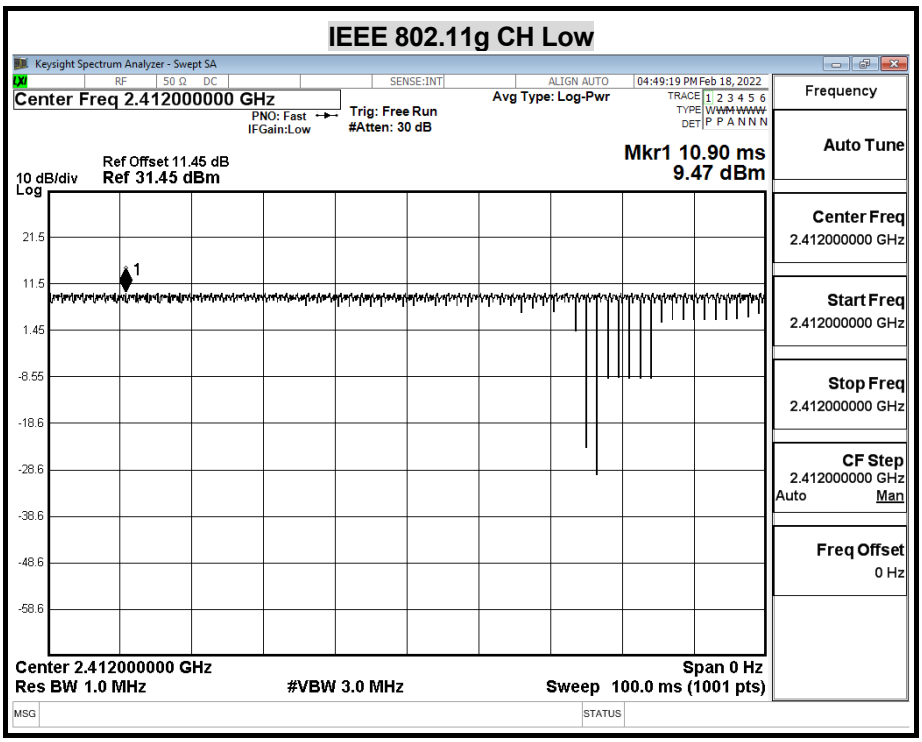
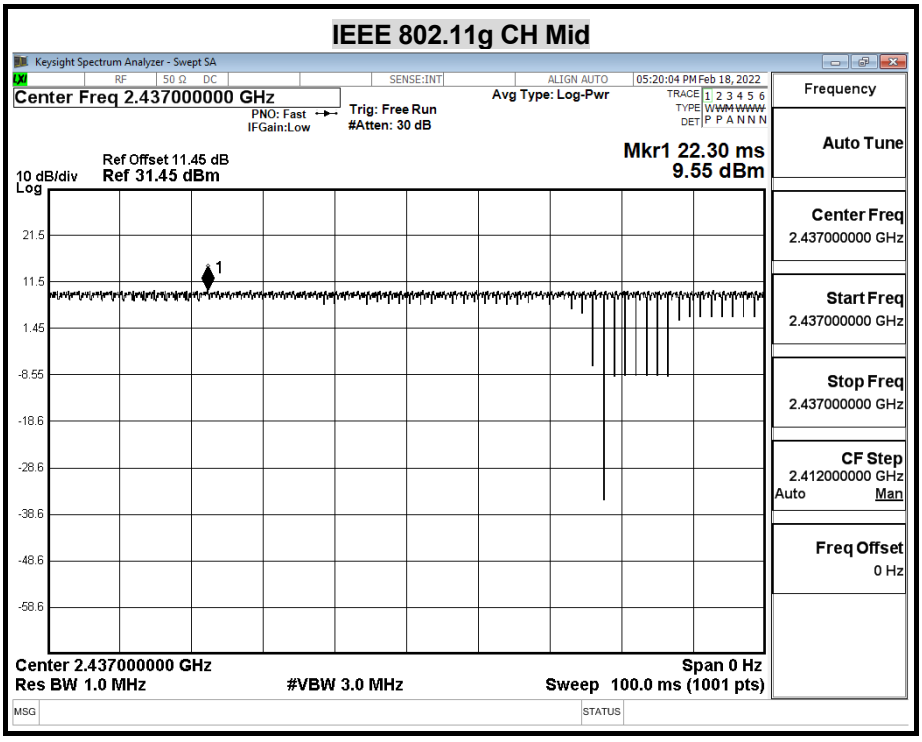
IEEE 802.11g CH Low



IEEE 802.11g CH Mid



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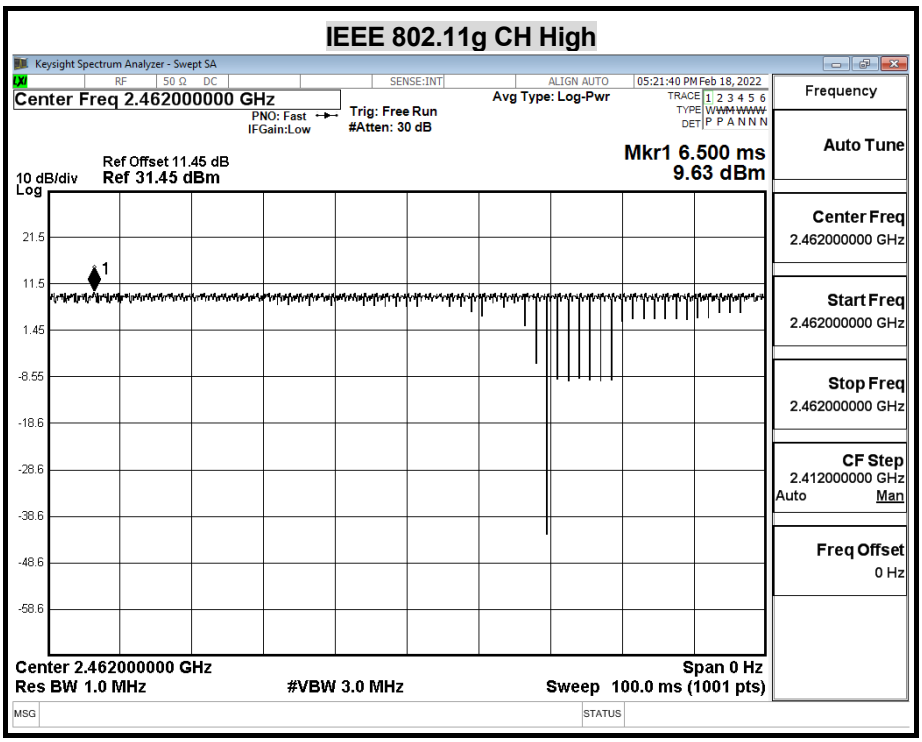
IEEE 802.11g CH High



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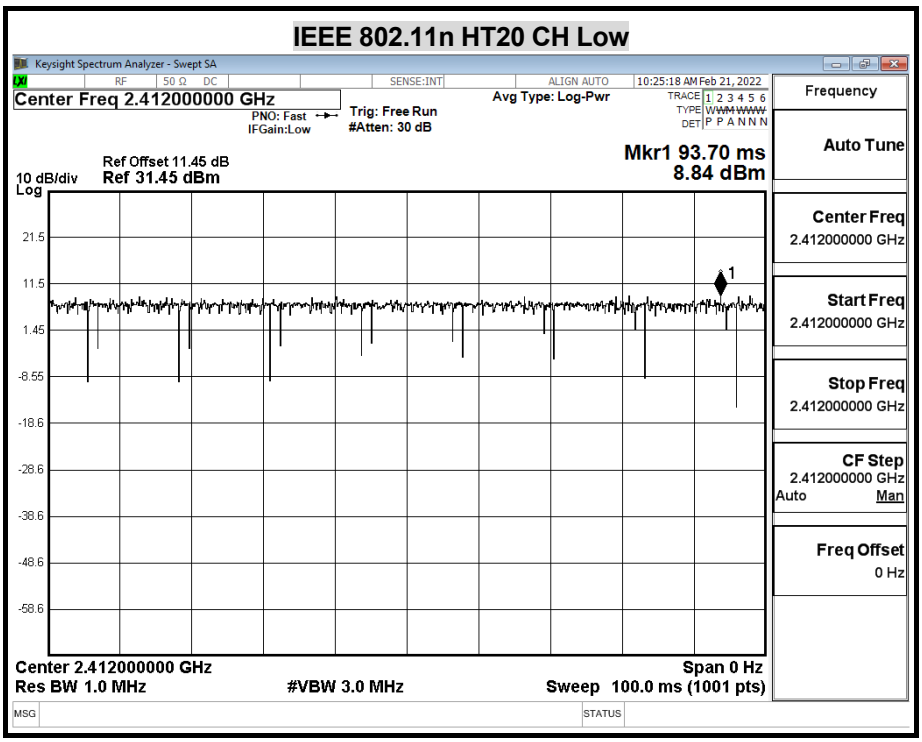
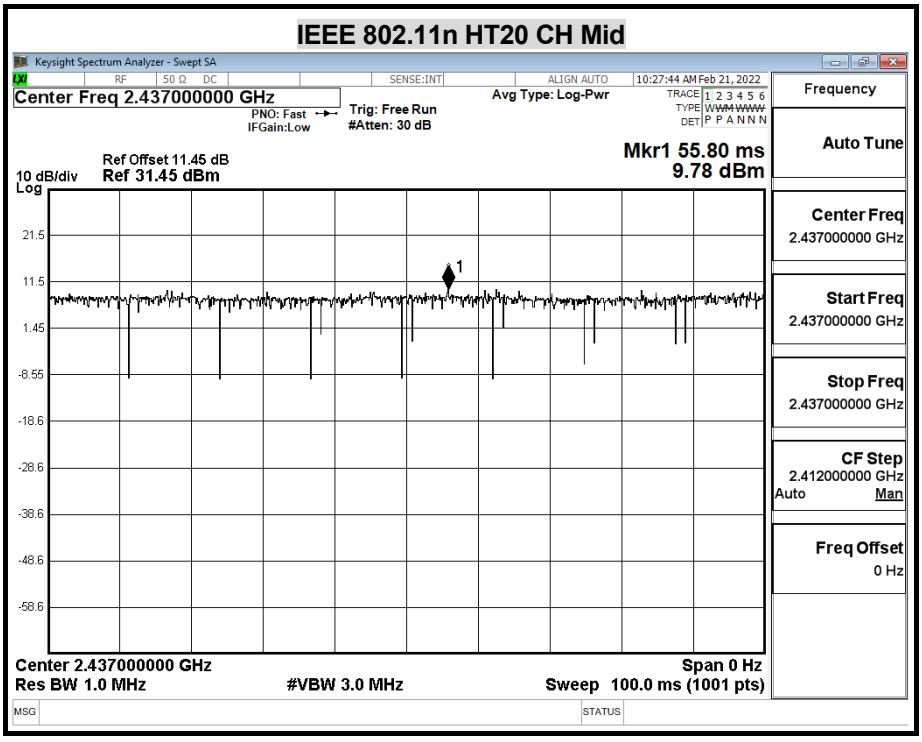
IEEE 802.11n HT20 CH Low



IEEE 802.11n HT20 CH Mid



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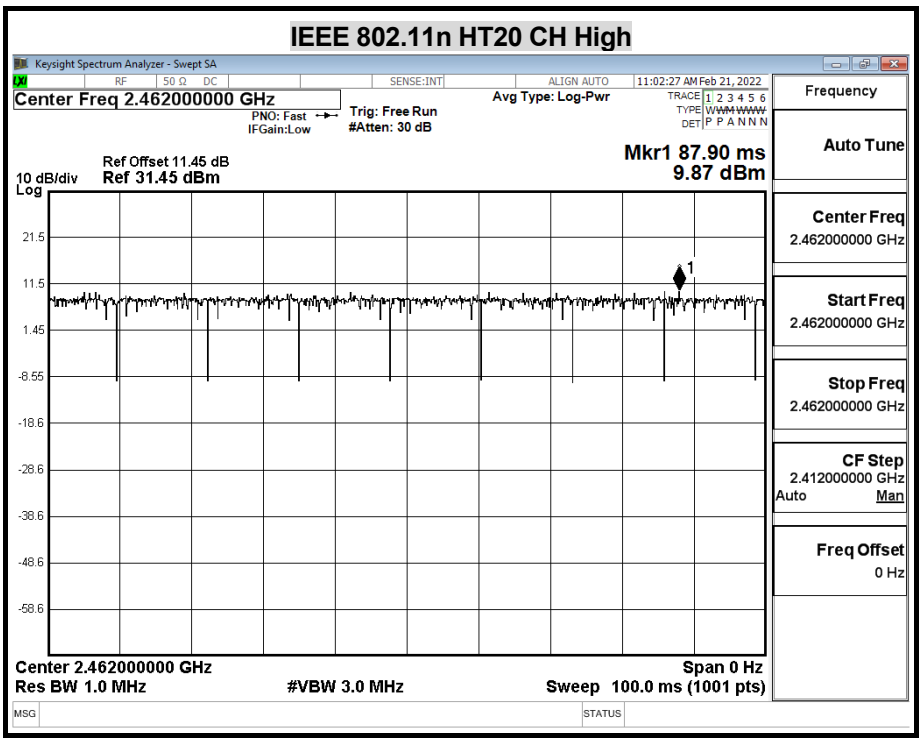

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Bluetooth 4.0:

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	22.5℃, 68%	Test Date	2022/02/18

	us	Times	Ton	Total Ton time(ms)
Ton1	400	1	400	
Ton2		0	0	
Ton3			0	0.4
Tp				0.625

Ton	0.4
Tp(Ton+Toff)	0.625
Duty Cycle	0.64
10 * log (1/x) =	1.94

Bluetooth 5.0:

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	22.5℃, 68%	Test Date	2022/02/18

	us	Times	Ton	Total Ton time(ms)
Ton1	200	1	200	
Ton2		0	0	
Ton3			0	0.2
Tp				0.625

Ton	0.2
Tp(Ton+Toff)	0.625
Duty Cycle	0.32
10 * log (1/x) =	4.95

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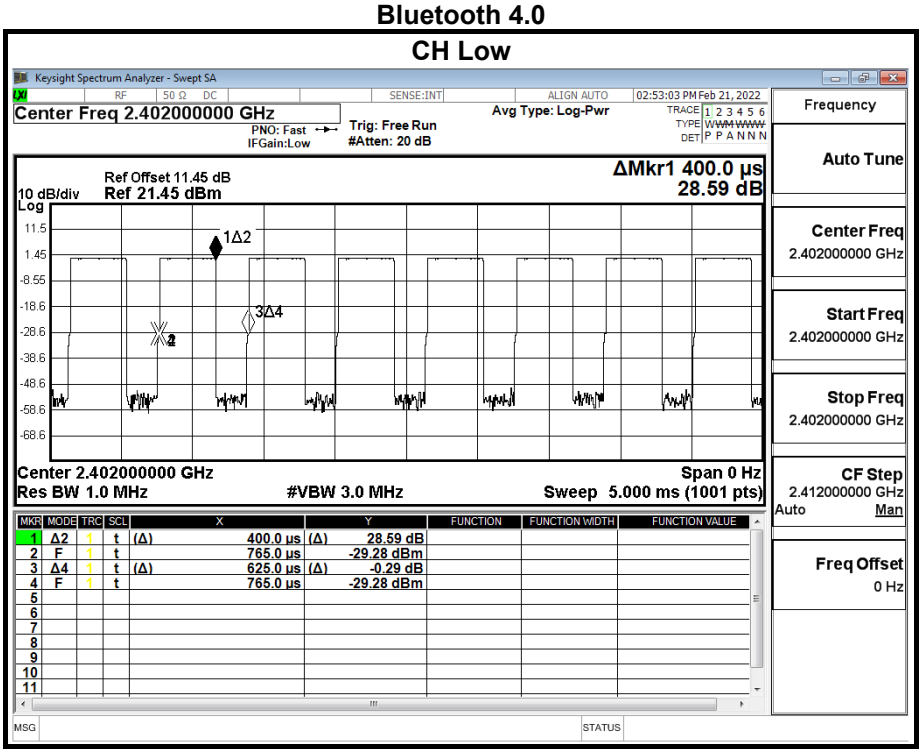
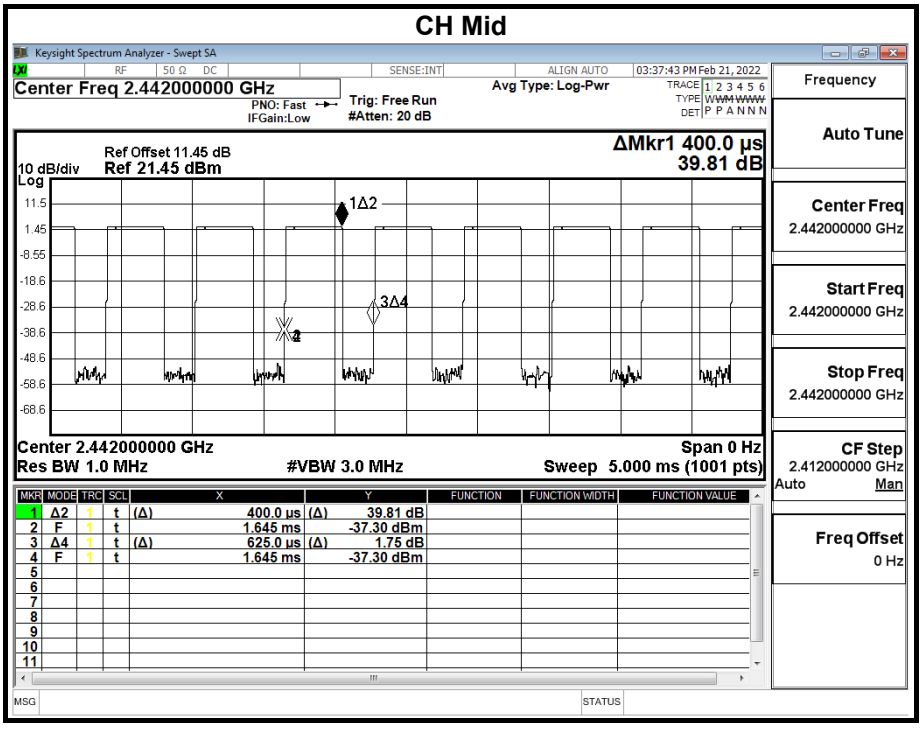
Plot

Bluetooth 4.0

CH Low



CH Mid



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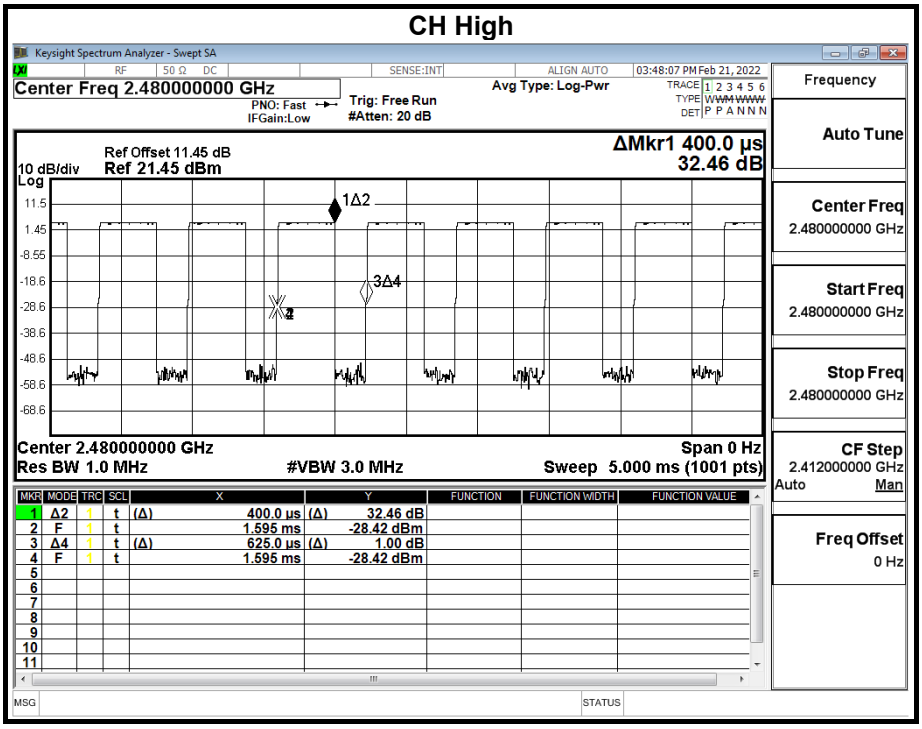

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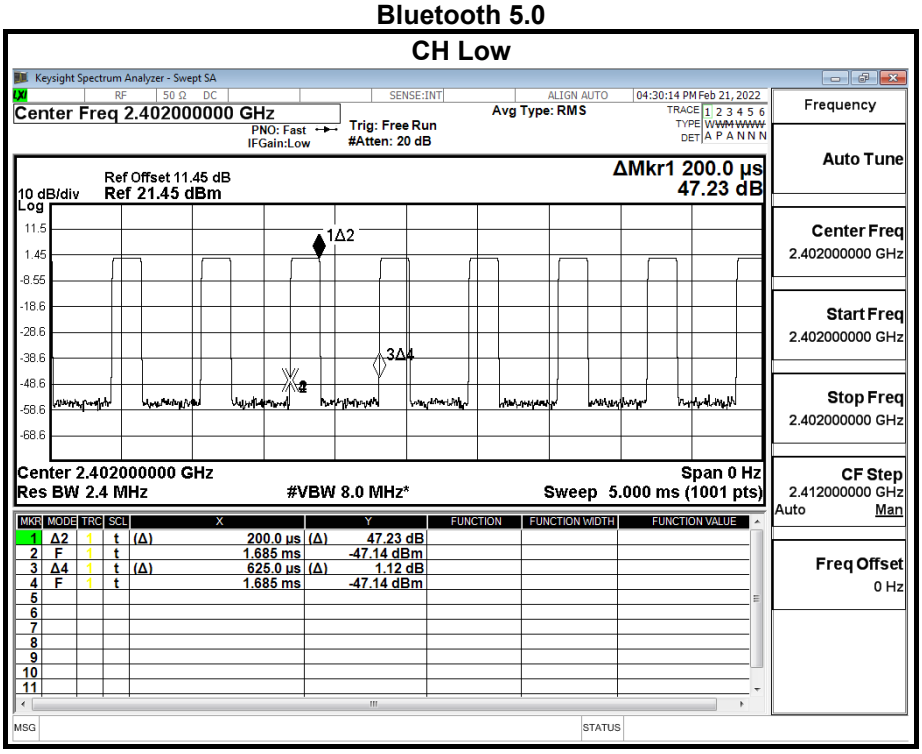
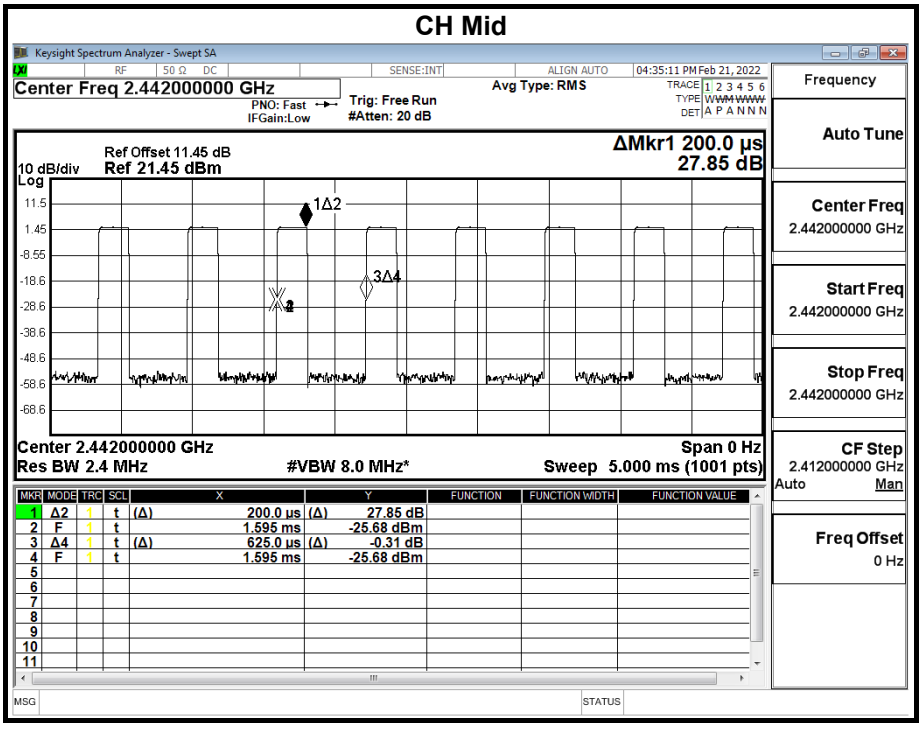
Bluetooth 5.0

CH Low



CH Mid



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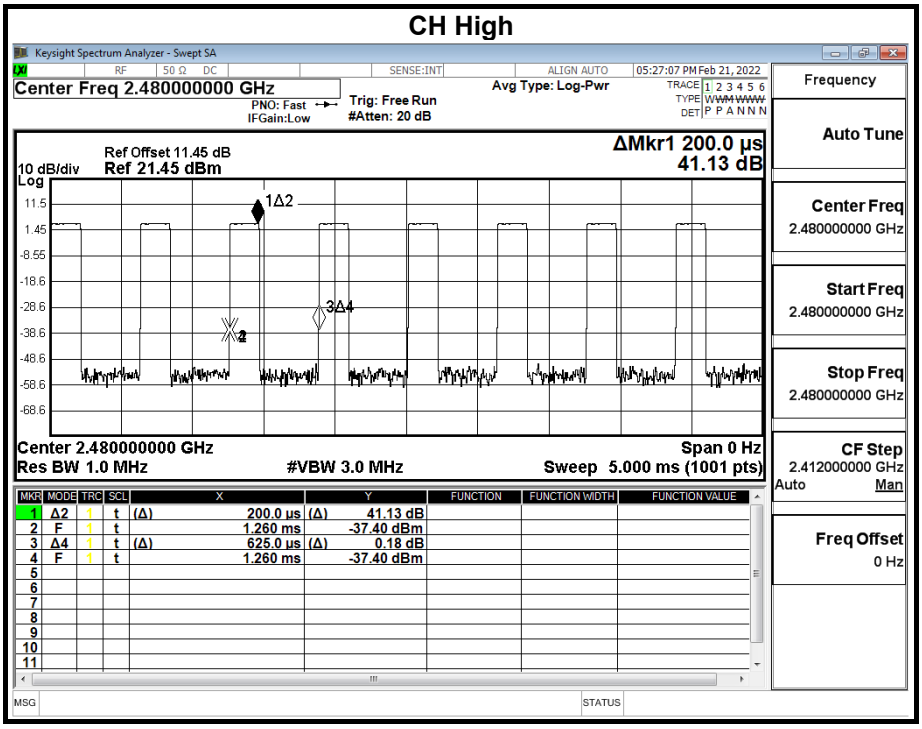

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8.4 POWER SPECTRAL DENSITY

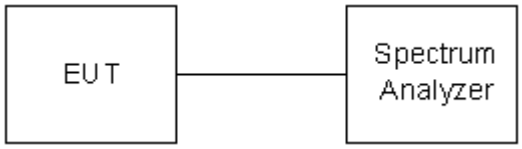
LIMIT

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST EQUIPMENTS

Chamber Room #966					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2022
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2022
SMA Cable+10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/28/2022	01/27/2023
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



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TEST PROCEDURE

The tests were performed in accordance with KDB 558074 5.3.1.

5.3.1 Measurement Procedure PKPSD:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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TEST RESULTS

Model Name	HV01	Test By	Ted Huang
Temp & Humidity	23.2℃, 65%	Test Date	2022/02/17

IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-6.83	8.00	-14.83	PASS
Middle	2437	-7.00	8.00	-15.00	PASS
High	2462	-5.97	8.00	-13.97	PASS

NOTE : 1. At finial test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-10.64	8.00	-18.64	PASS
Middle	2437	-10.79	8.00	-18.79	PASS
High	2462	-11.86	8.00	-19.86	PASS

NOTE : 1. At finial test to get the worst-case emission at 6long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-12.80	8.00	-20.80	PASS
Middle	2437	-11.19	8.00	-19.19	PASS
High	2462	-11.26	8.00	-19.26	PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

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Model Name	HV01	Test By	Ted Huang
Temp & Humidity	22.5℃, 68%	Test Date	2022/02/18

Bluetooth 4.0 (GFSK) mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2402	-13.79	8.00	-21.79	PASS
Middle	2442	-11.71	8.00	-19.71	PASS
High	2480	-9.89	8.00	-17.89	PASS

NOTE : 1. At finial test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

Bluetooth 5.0 (GFSK) mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2402	-16.56	8.00	-24.56	PASS
Middle	2442	-14.37	8.00	-22.37	PASS
High	2480	-12.85	8.00	-20.85	PASS

NOTE : 1. At finial test to get the worst-case emission at 2long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

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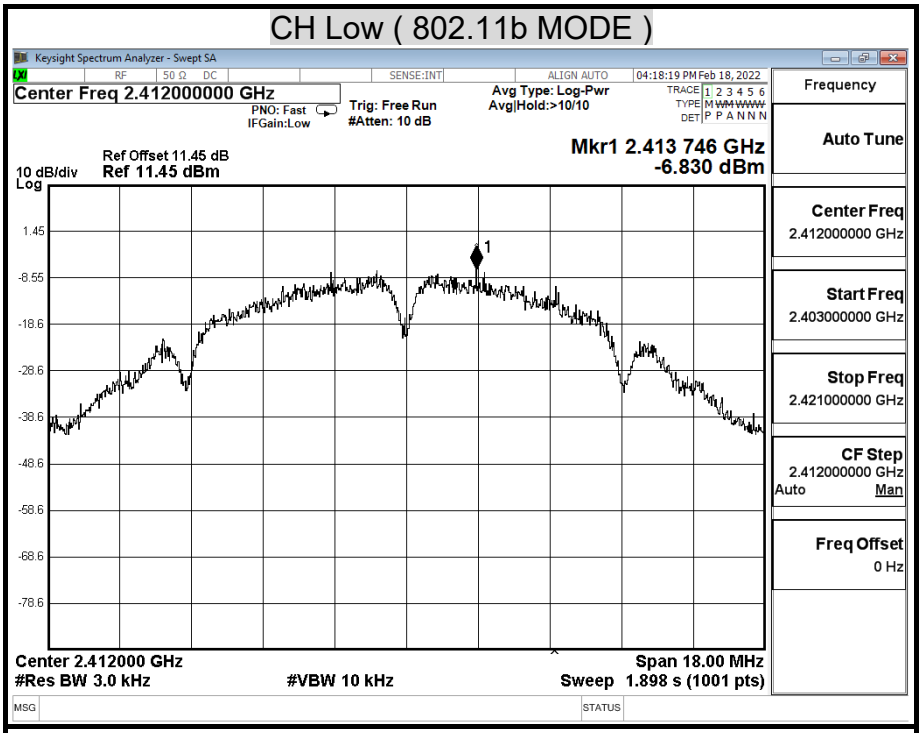
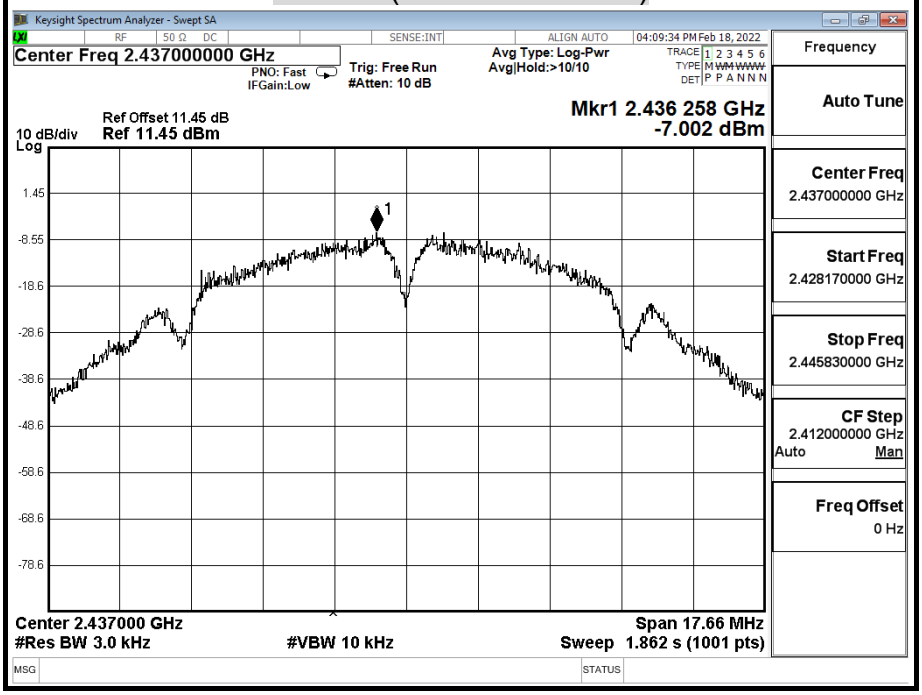
POWER SPECTRAL DENSITY (IEEE 802.11b MODE)

CH Low (802.11b MODE)



CH Mid (802.11b MODE)



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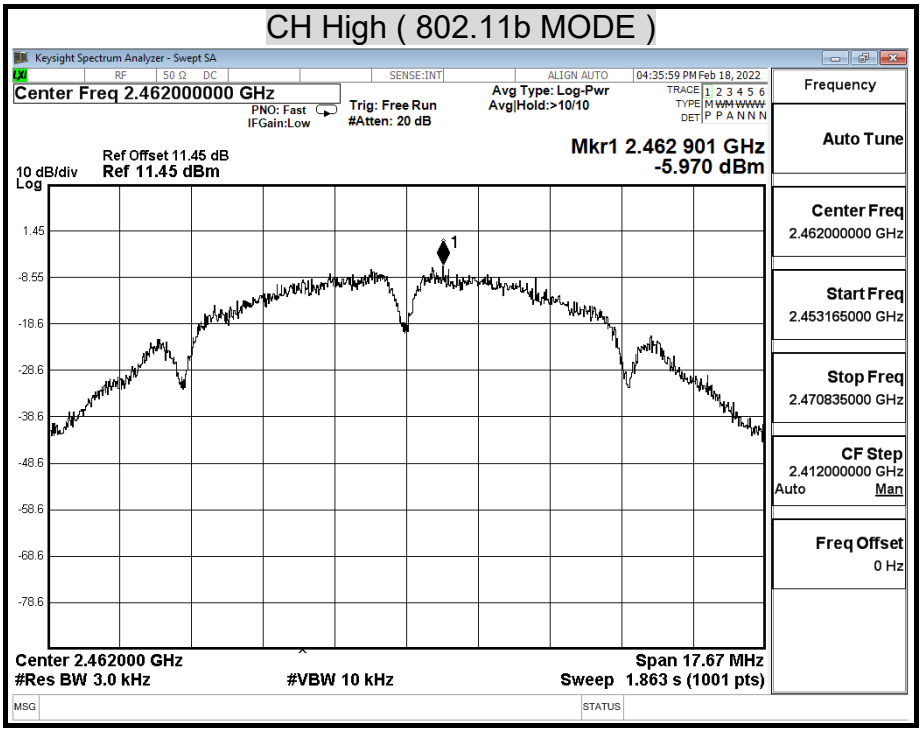
CH High (802.11b MODE)



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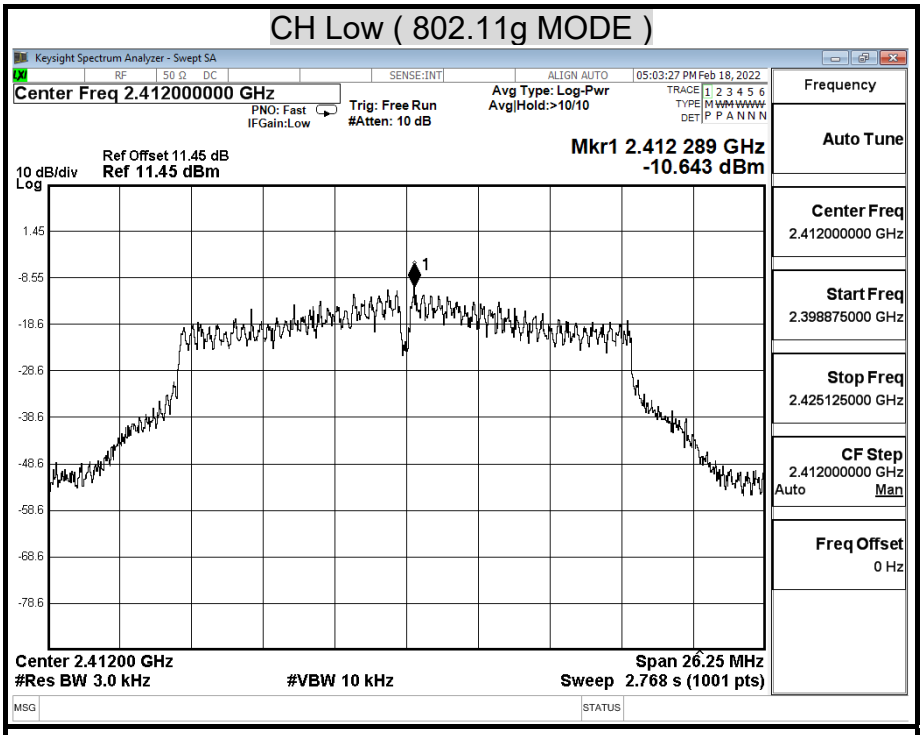
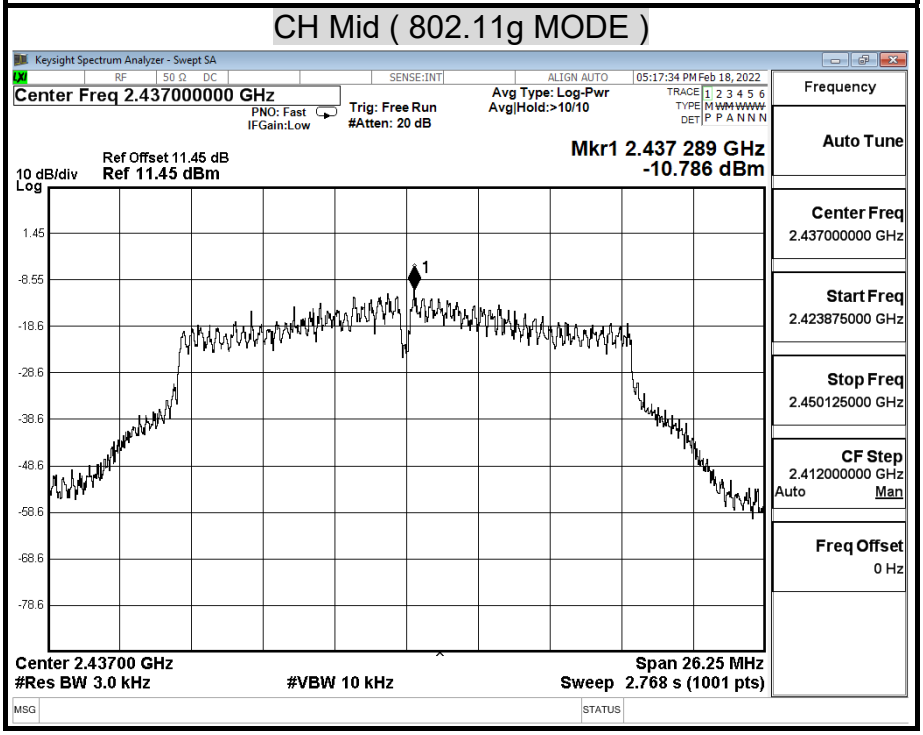
POWER SPECTRAL DENSITY (IEEE 802.11g MODE)

CH Low (802.11g MODE)



CH Mid (802.11g MODE)



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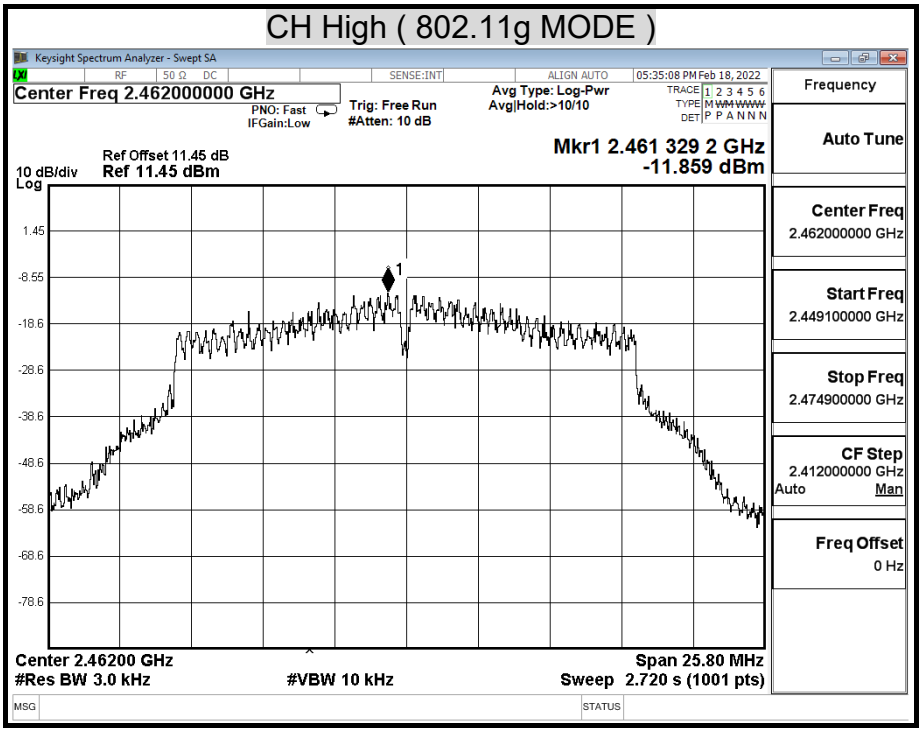
CH High (802.11g MODE)



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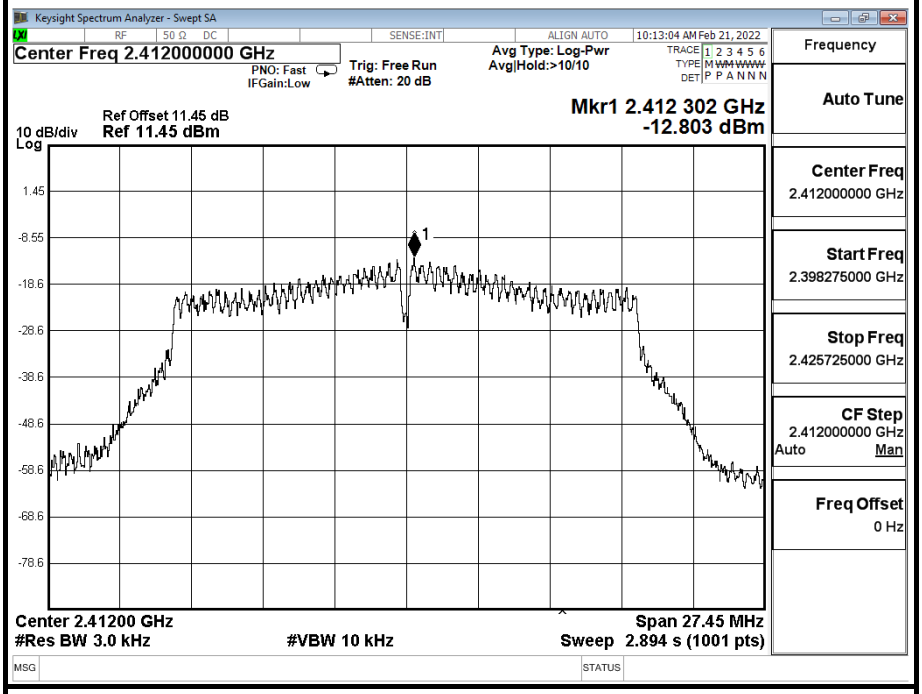
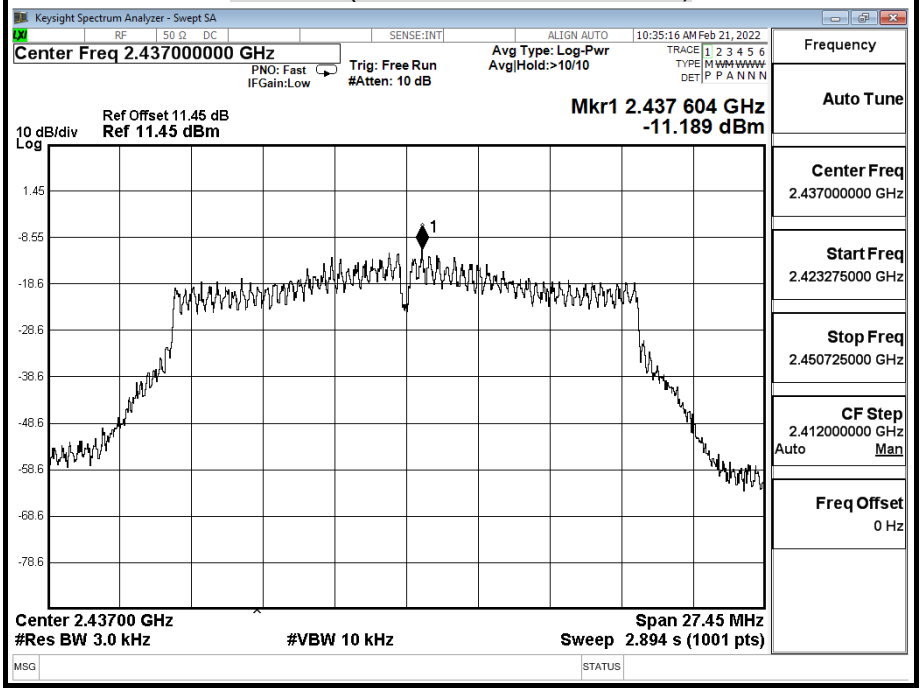
POWER SPECTRAL DENSITY (802.11n HT20 MODE)

CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)



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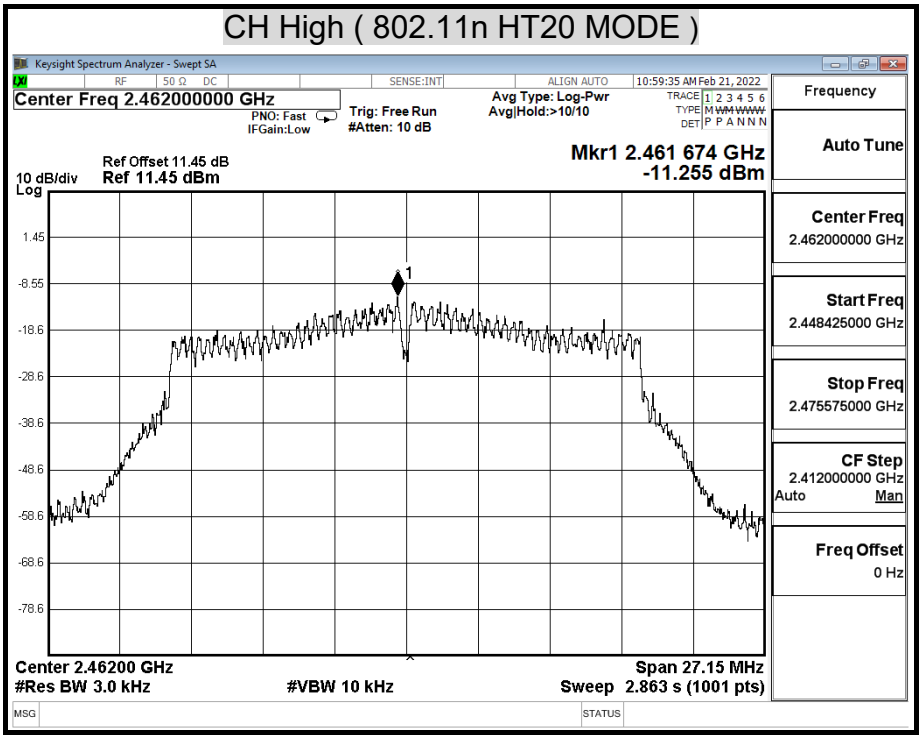
CH High (802.11n HT20 MODE)



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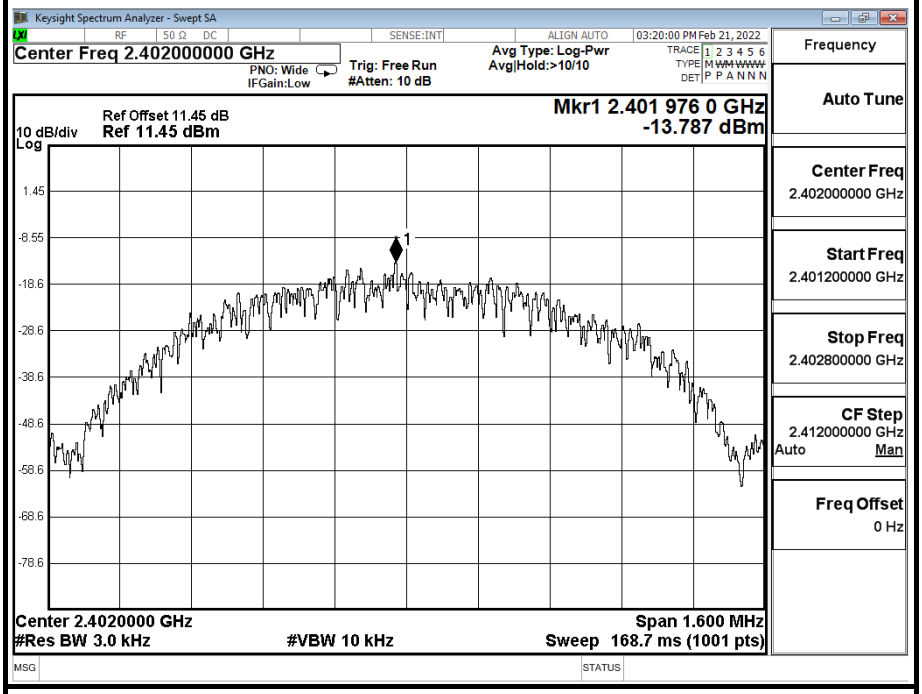
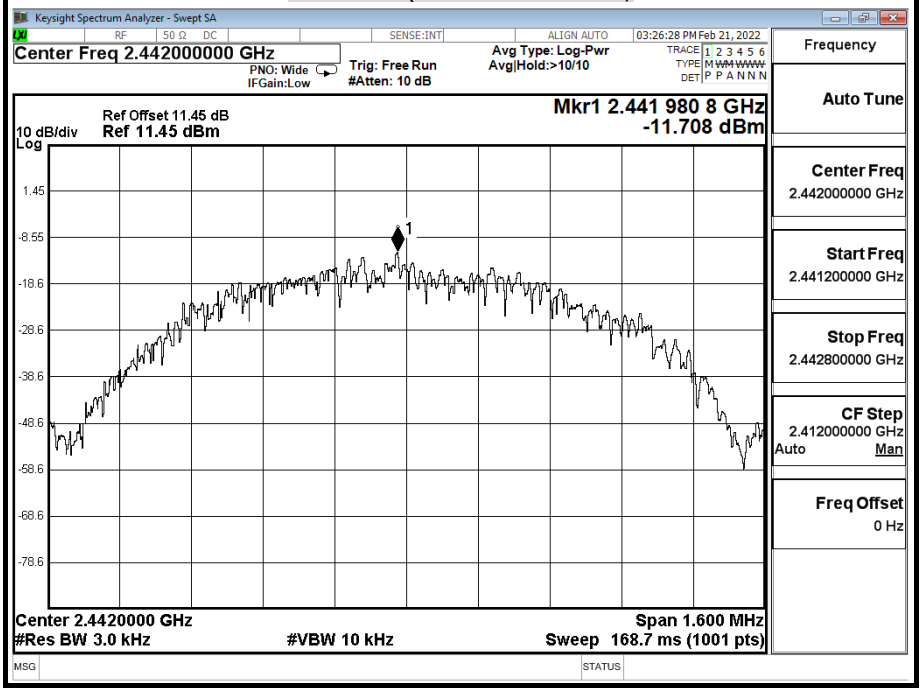
POWER SPECTRAL DENSITY (Bluetooth 4.0 (GFSK) MODE)

CH Low (GFSK MODE)



CH Mid (GFSK MODE)



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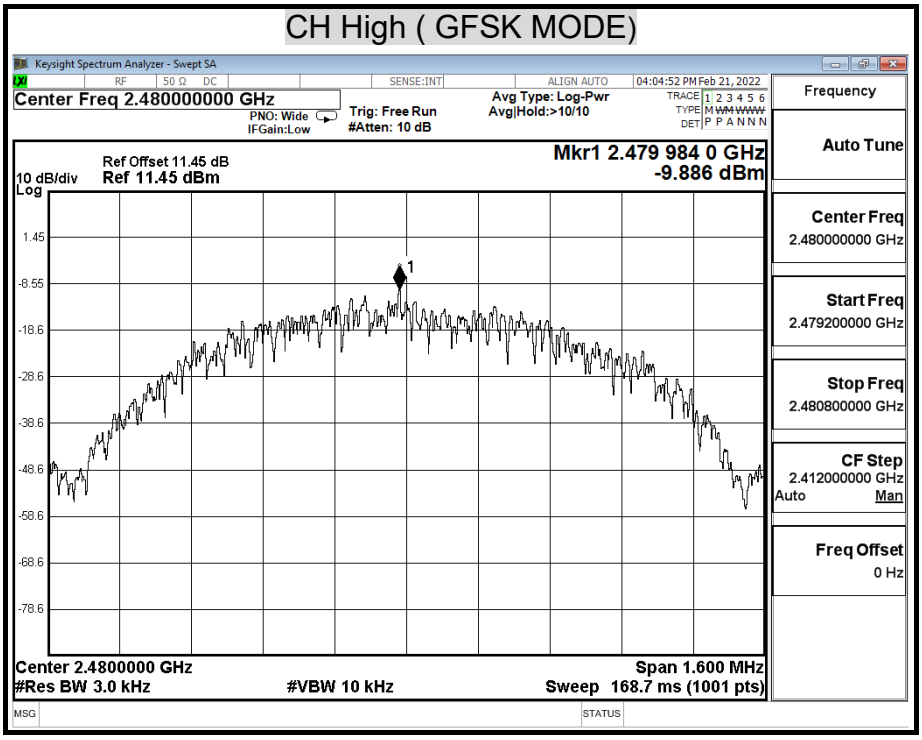
CH High (GFSK MODE)



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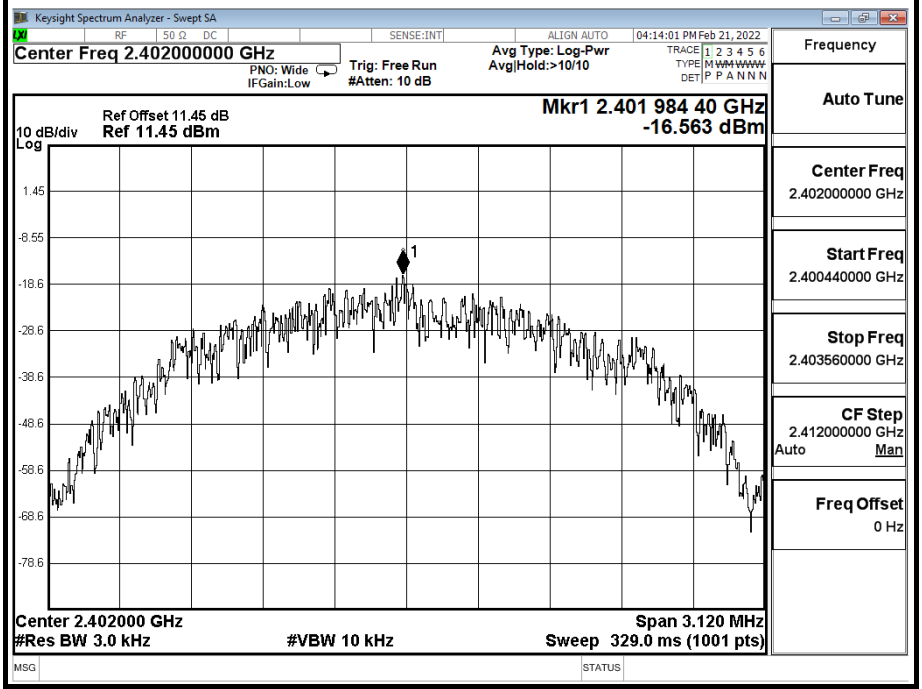
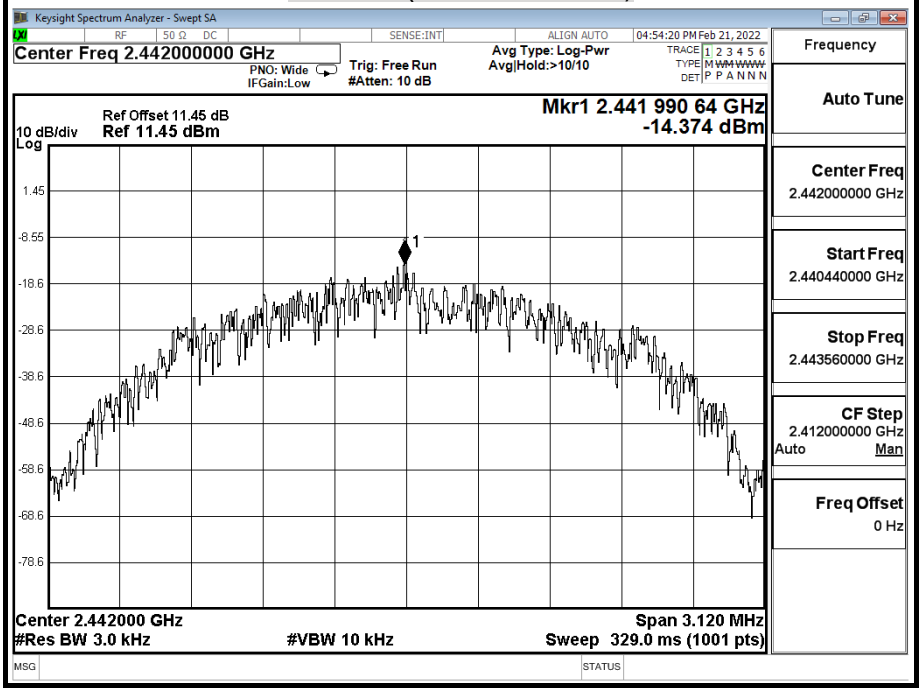
POWER SPECTRAL DENSITY (Bluetooth 5.0 (GFSK) MODE)

CH Low (GFSK MODE)



CH Mid (GFSK MODE)



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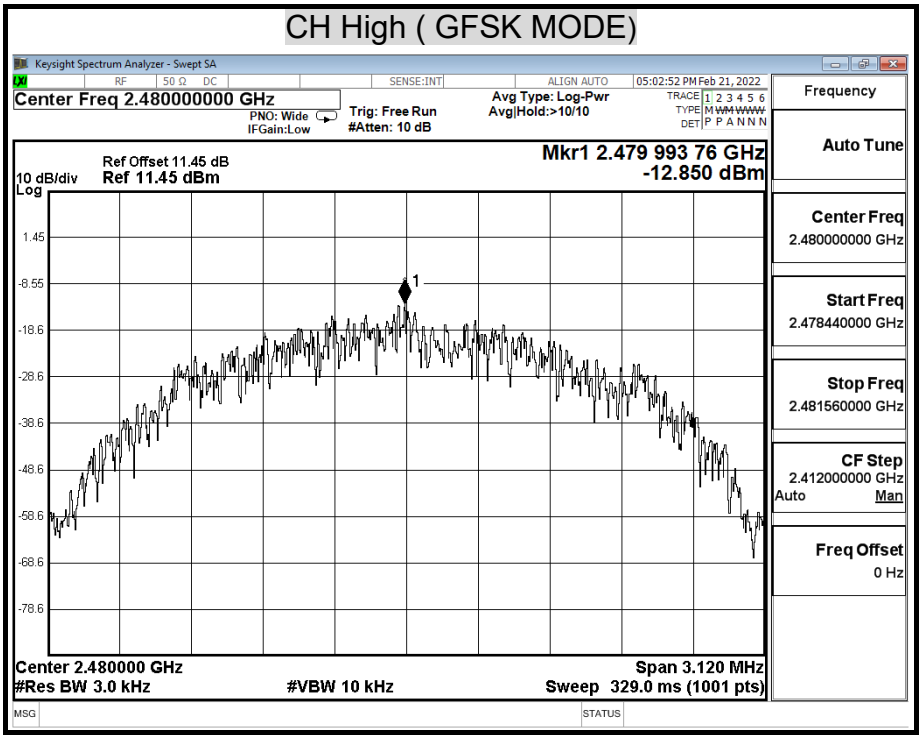
CH High (GFSK MODE)



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