

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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 * \text{RBW}$.
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.

TEST RESULTS

Model Name	HG12	Test By	Peter Chu
Temp & Humidity	25.5°C, 52%	Test Date	2024/04/23

IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-5.54	8.00	-13.54	PASS
Middle	2437	-5.88	8.00	-13.88	PASS
High	2462	-5.12	8.00	-13.12	PASS

NOTE : 1. At final test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.24dB was entered as an offset in the spectrum analyzer to allow for direct reading of power, it was not displayed on the plot due to the instrument.

IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-9.89	8.00	-17.89	PASS
Middle	2437	-9.03	8.00	-17.03	PASS
High	2462	-8.34	8.00	-16.34	PASS

NOTE : 1. At final test to get the worst-case emission at 6long Mbps long.
2. The cable assembly insertion loss of 11.24dB was entered as an offset in the spectrum analyzer to allow for direct reading of power, it was not displayed on the plot due to the instrument.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-10.08	8.00	-18.08	PASS
Middle	2437	-9.99	8.00	-17.99	PASS
High	2462	-10.70	8.00	-18.70	PASS

NOTE : 1. At final test to get the worst-case emission at 6.5long Mbps long.
2. The cable assembly insertion loss of 11.24dB was entered as an offset in the spectrum analyzer to allow for direct reading of power, it was not displayed on the plot due to the instrument.

Model Name	HG12	Test By	Peter Chu
Temp & Humidity	24.4°C, 45%	Test Date	2024/04/29

Bluetooth 4.0 (GFSK) mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2402	-8.68	8.00	-16.68	PASS
Middle	2442	-8.80	8.00	-16.80	PASS
High	2480	-9.11	8.00	-17.11	PASS

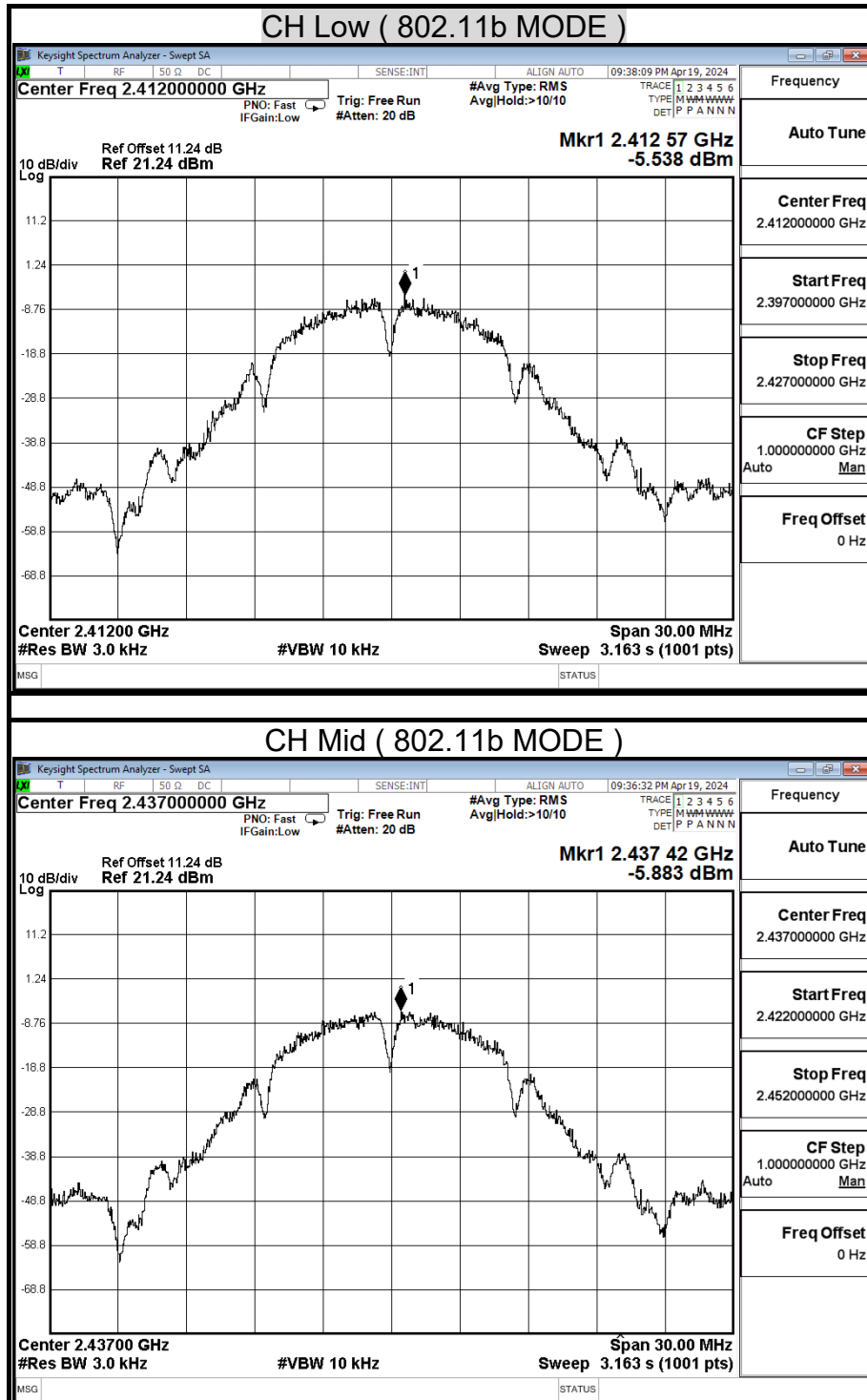
NOTE : 1. At final test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.24dB was entered as an offset in the spectrum analyzer to allow for direct reading of power, it was not displayed on the plot due to the instrument.

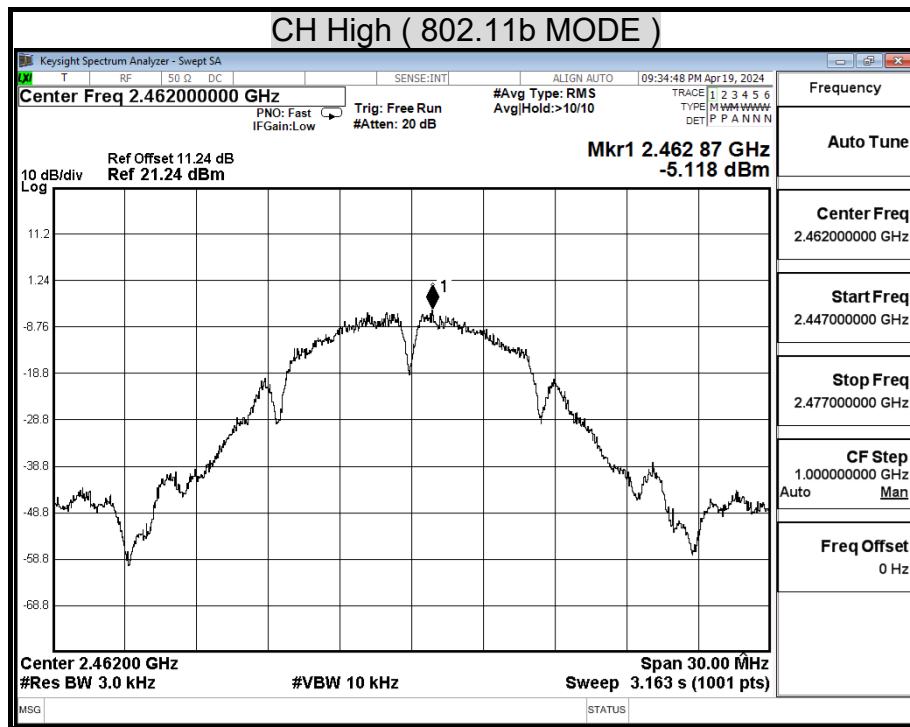
Bluetooth 5.0 (GFSK) mode

Channel	Frequency (MHz)	PPSD/3kHz (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2402	-11.51	8.00	-19.51	PASS
Middle	2442	-11.59	8.00	-19.59	PASS
High	2480	-11.93	8.00	-19.93	PASS

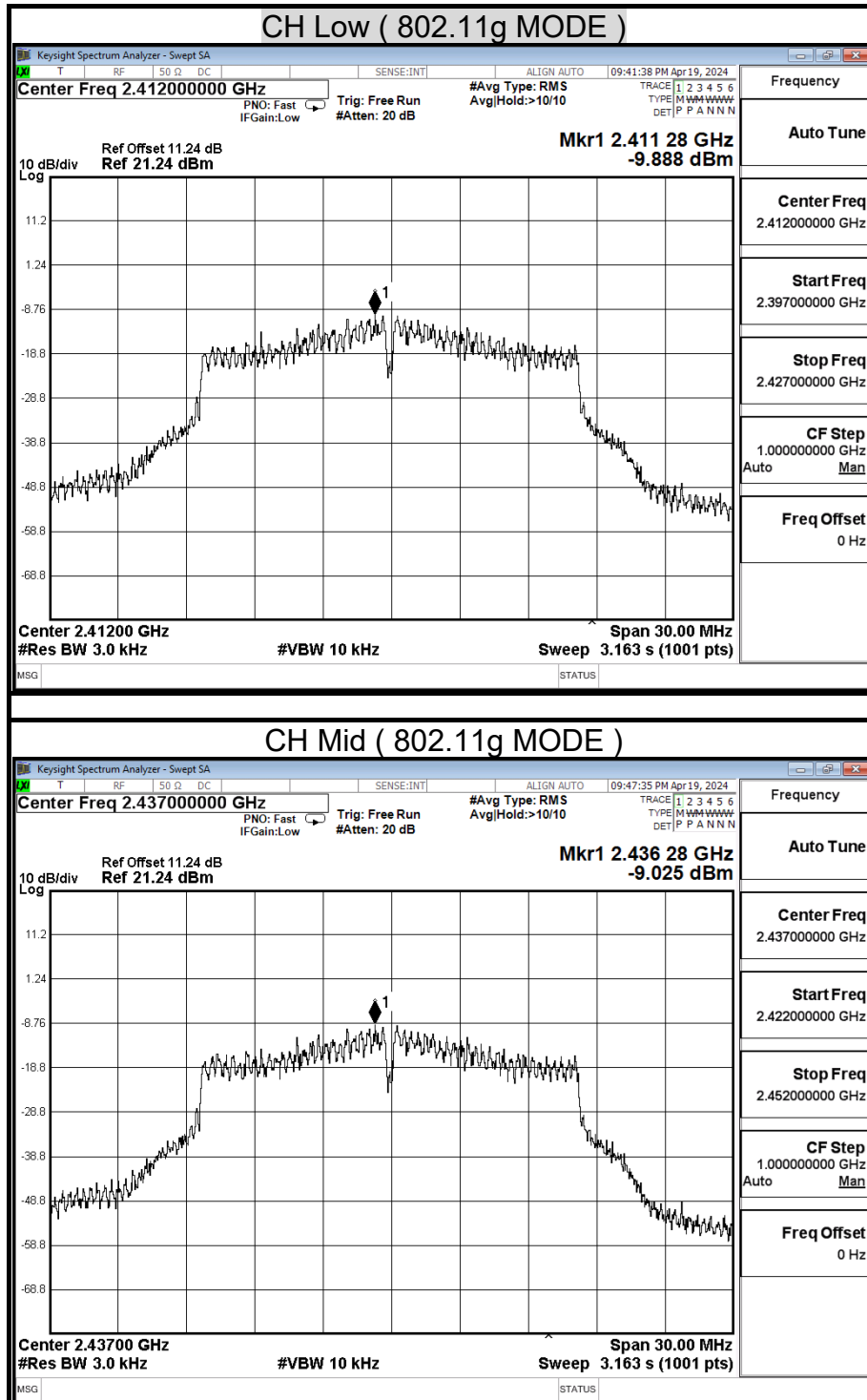
NOTE : 1. At final test to get the worst-case emission at 2long Mbps long.
2. The cable assembly insertion loss of 11.24dB was entered as an offset in the spectrum analyzer to allow for direct reading of power, it was not displayed on the plot due to the instrument.

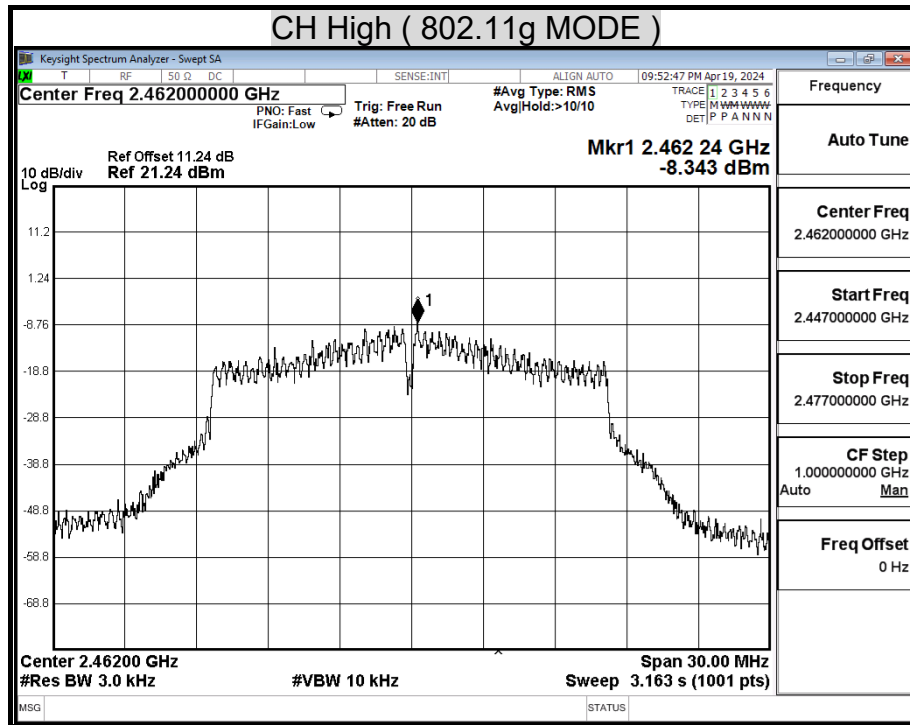
POWER SPECTRAL DENSITY (IEEE 802.11b MODE)



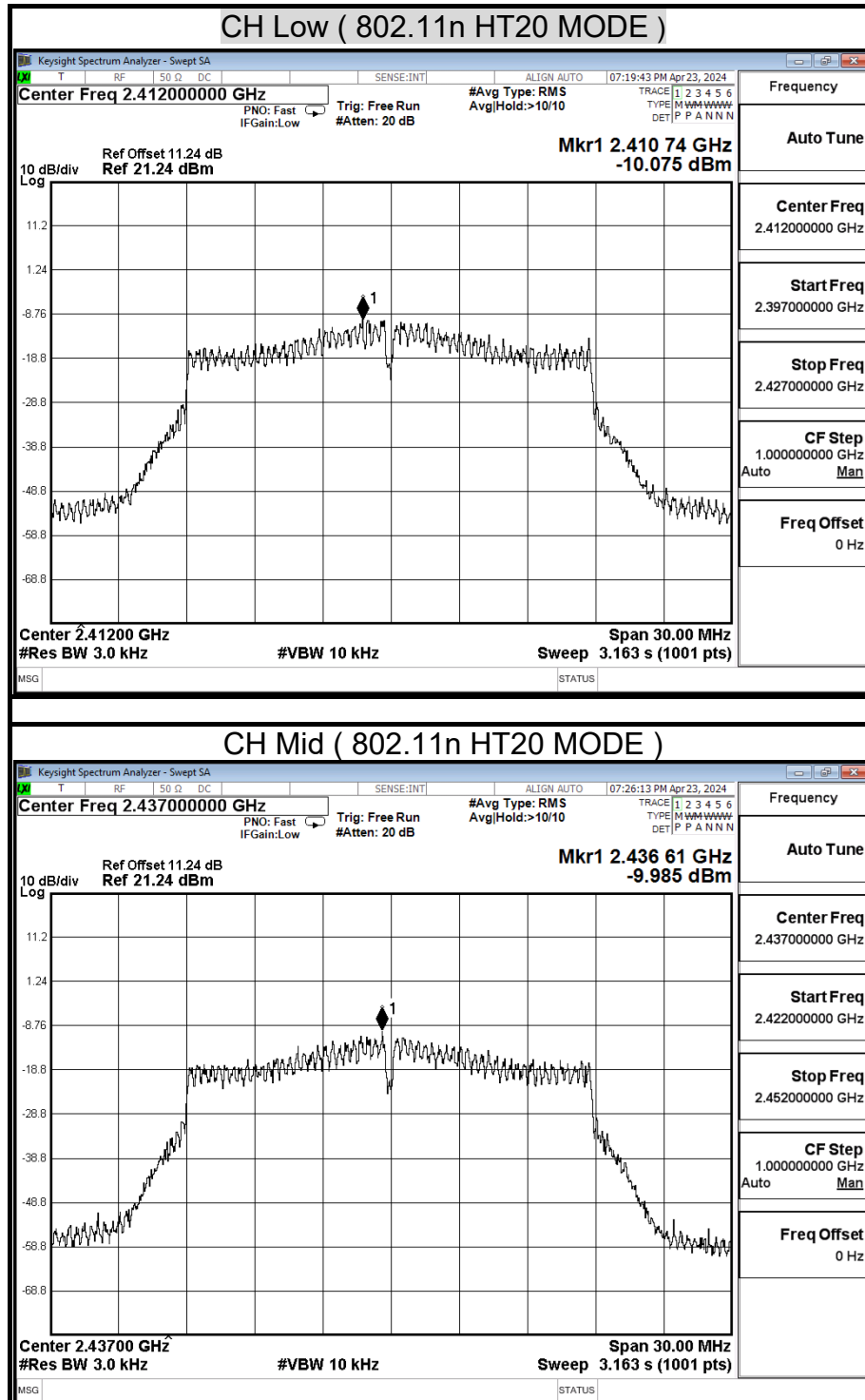


POWER SPECTRAL DENSITY (IEEE 802.11g MODE)

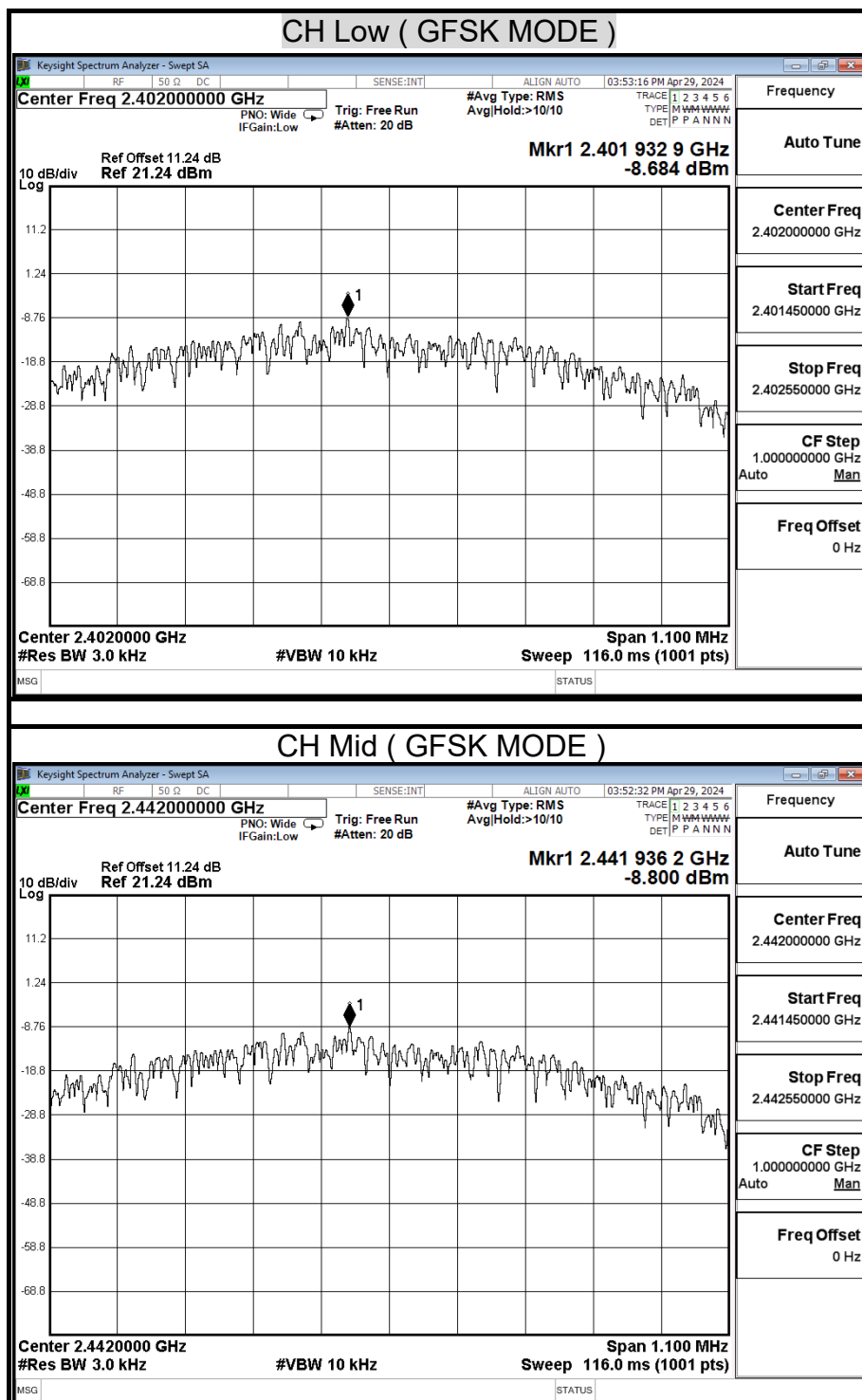


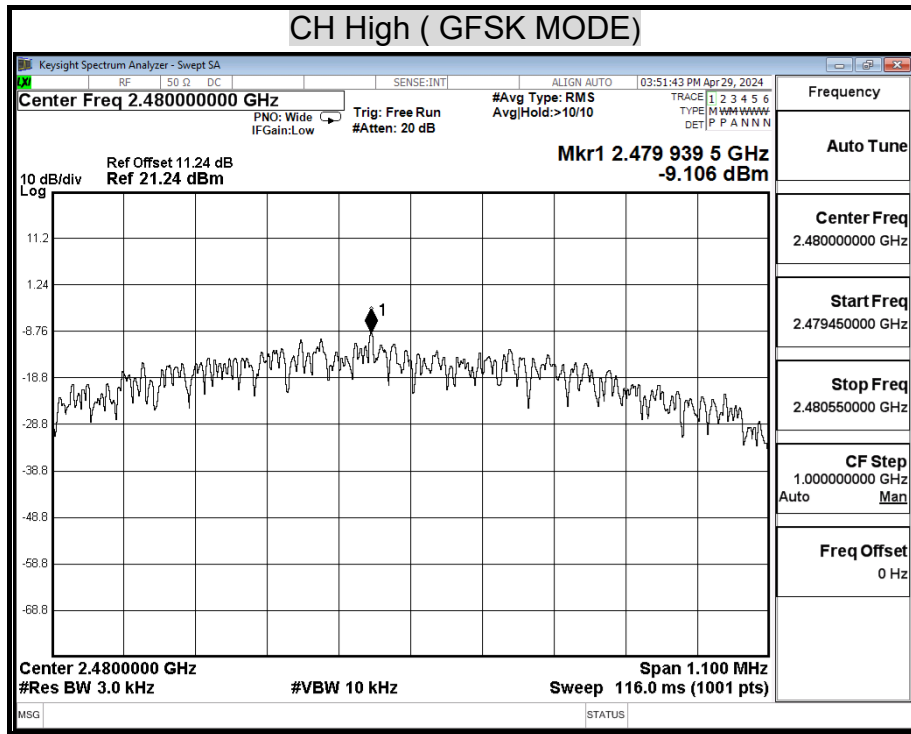


POWER SPECTRAL DENSITY (802.11n HT20 MODE)

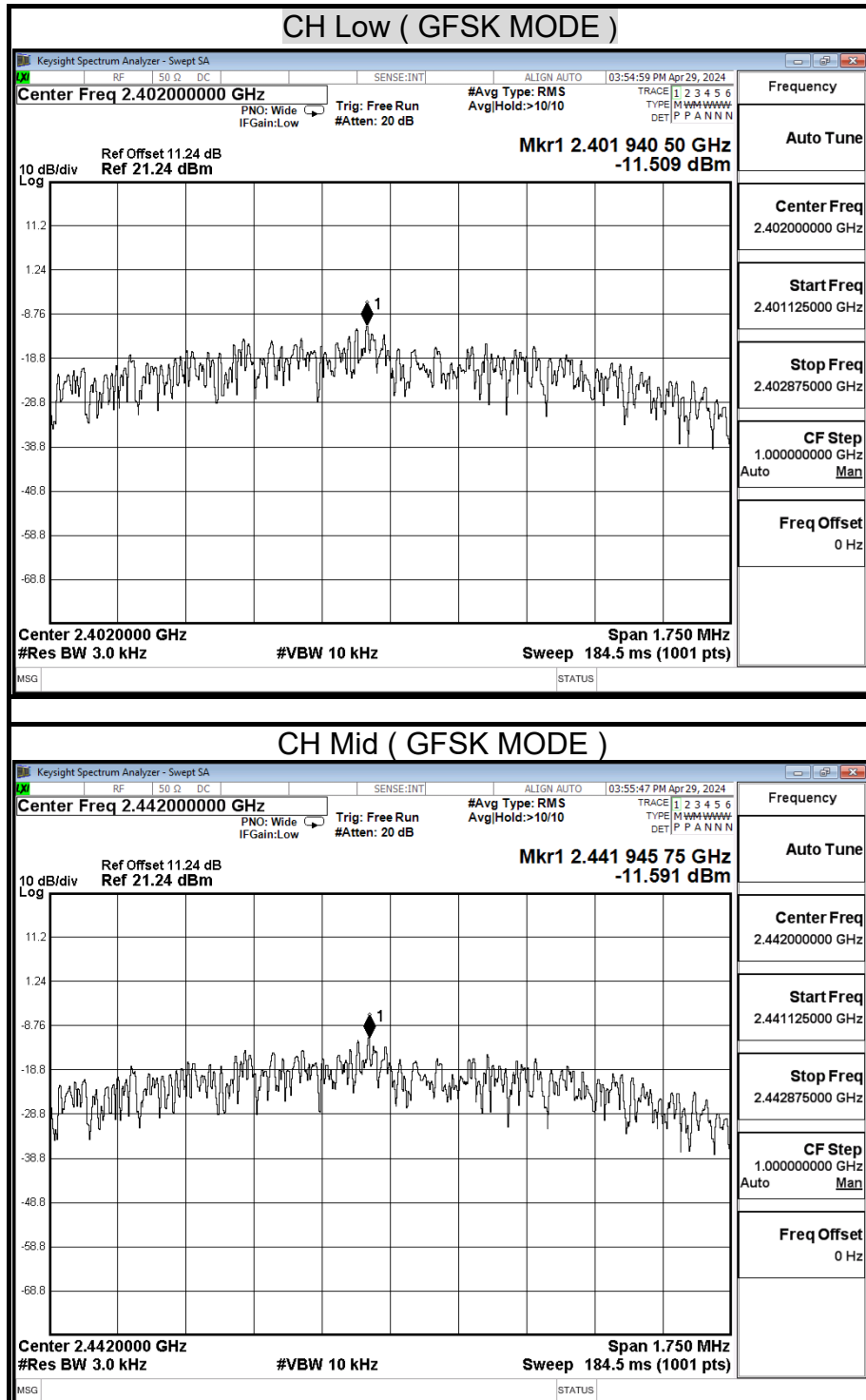


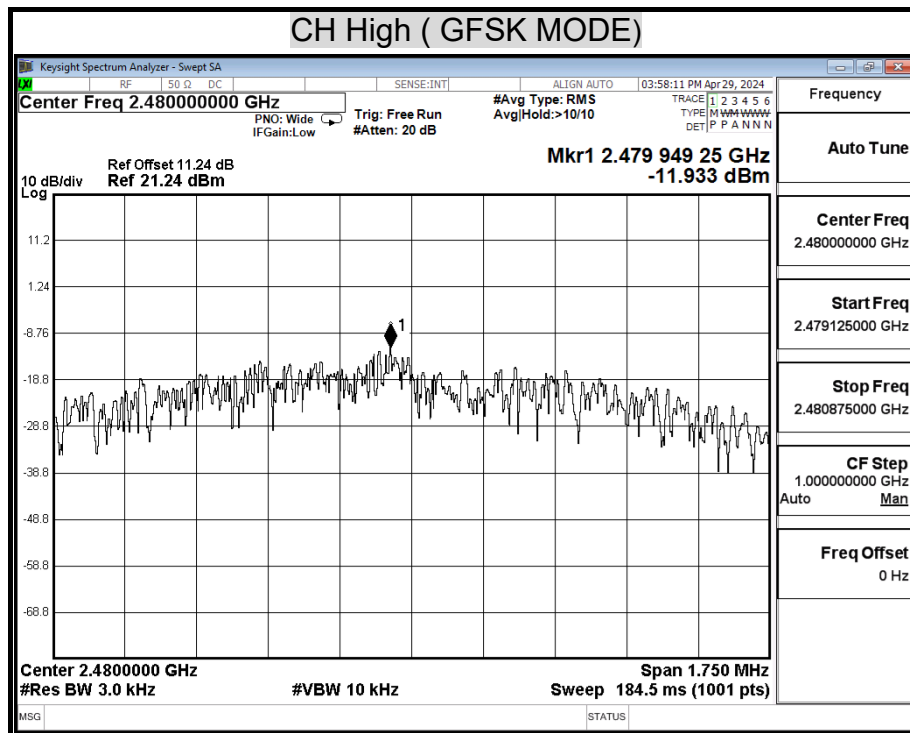
POWER SPECTRAL DENSITY (Bluetooth 4.0 (GFSK) MODE)





POWER SPECTRAL DENSITY (Bluetooth 5.0 (GFSK) MODE)





8.5 CONDUCTED SPURIOUS EMISSION

LIMITS

§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. 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) (see § 15.205(c)).

TEST EQUIPMENTS

Chamber Room #1166					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/25/2023	07/24/2024
SMA Cable+10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/17/2024	01/16/2025
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP**TEST PROCEDURE**

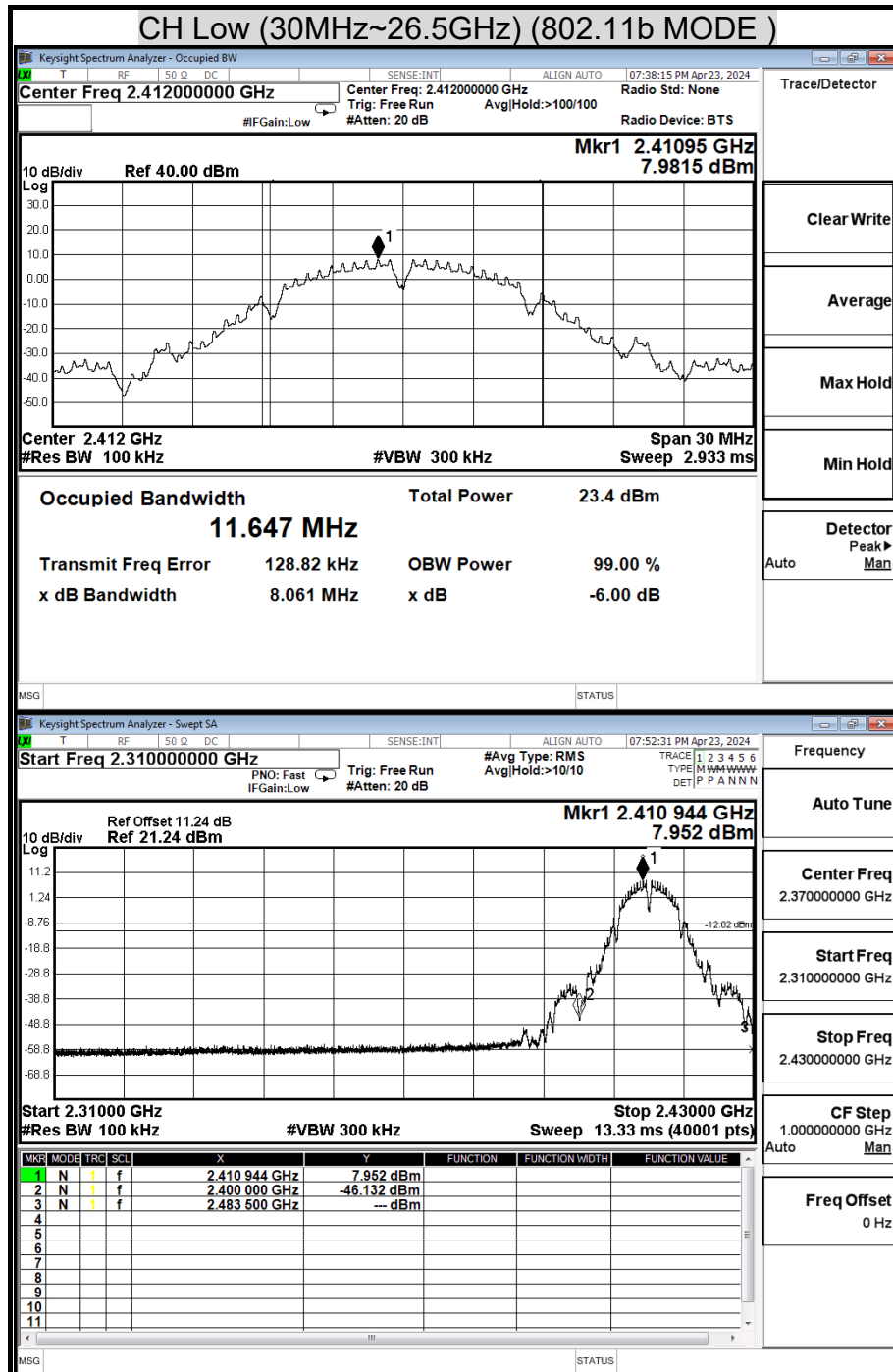
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

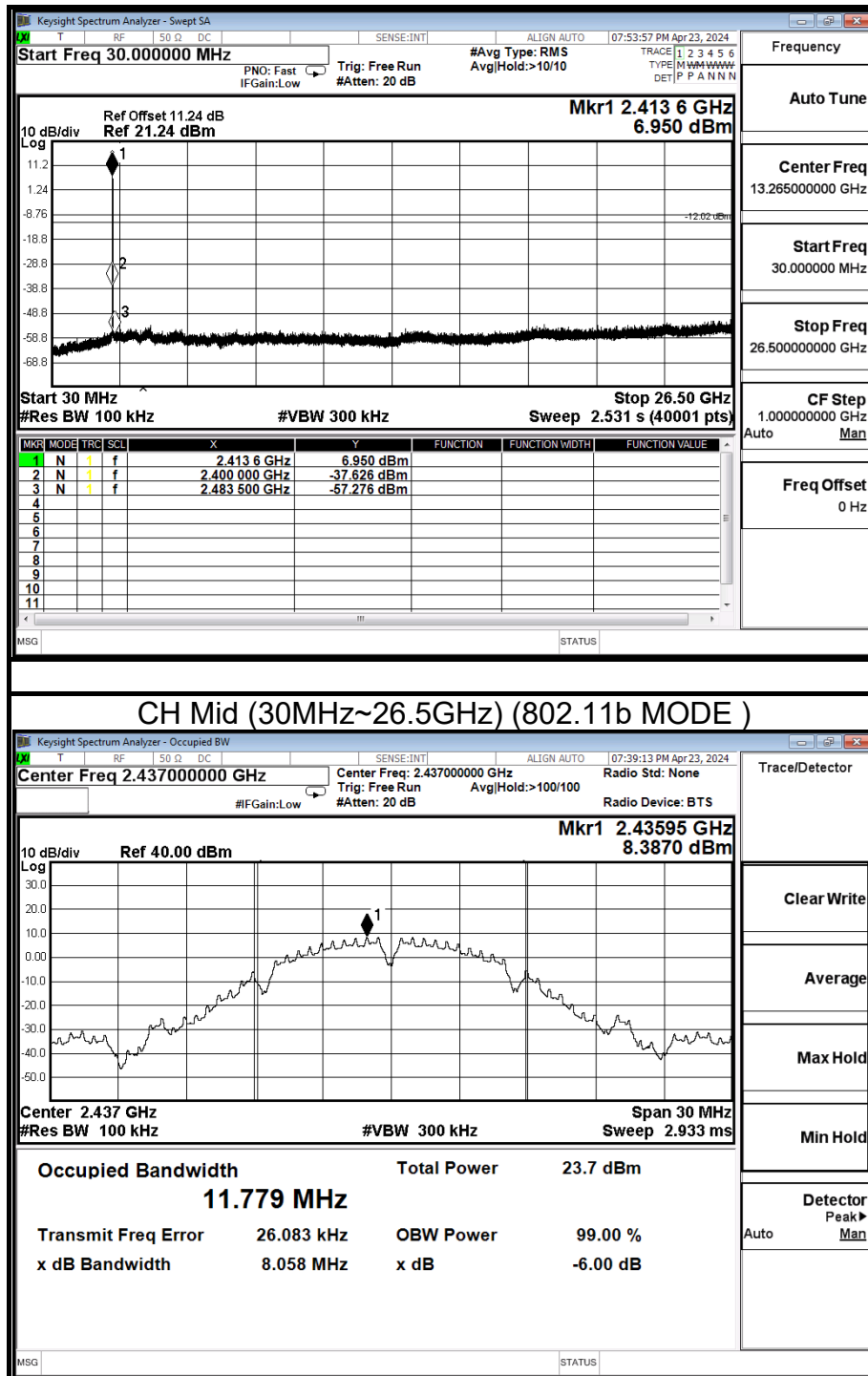
The spectrum from 30 MHz to 26.5 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

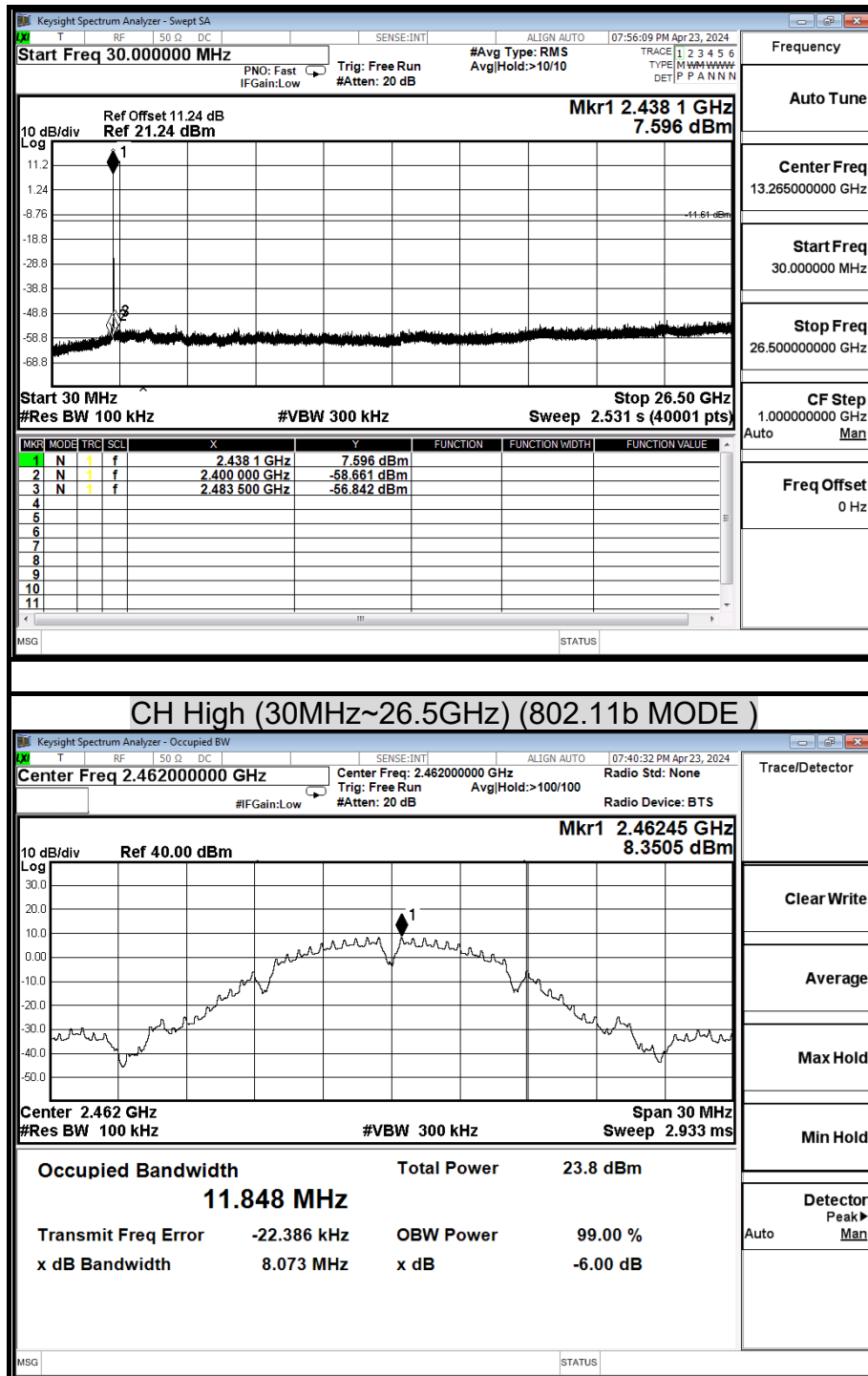
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

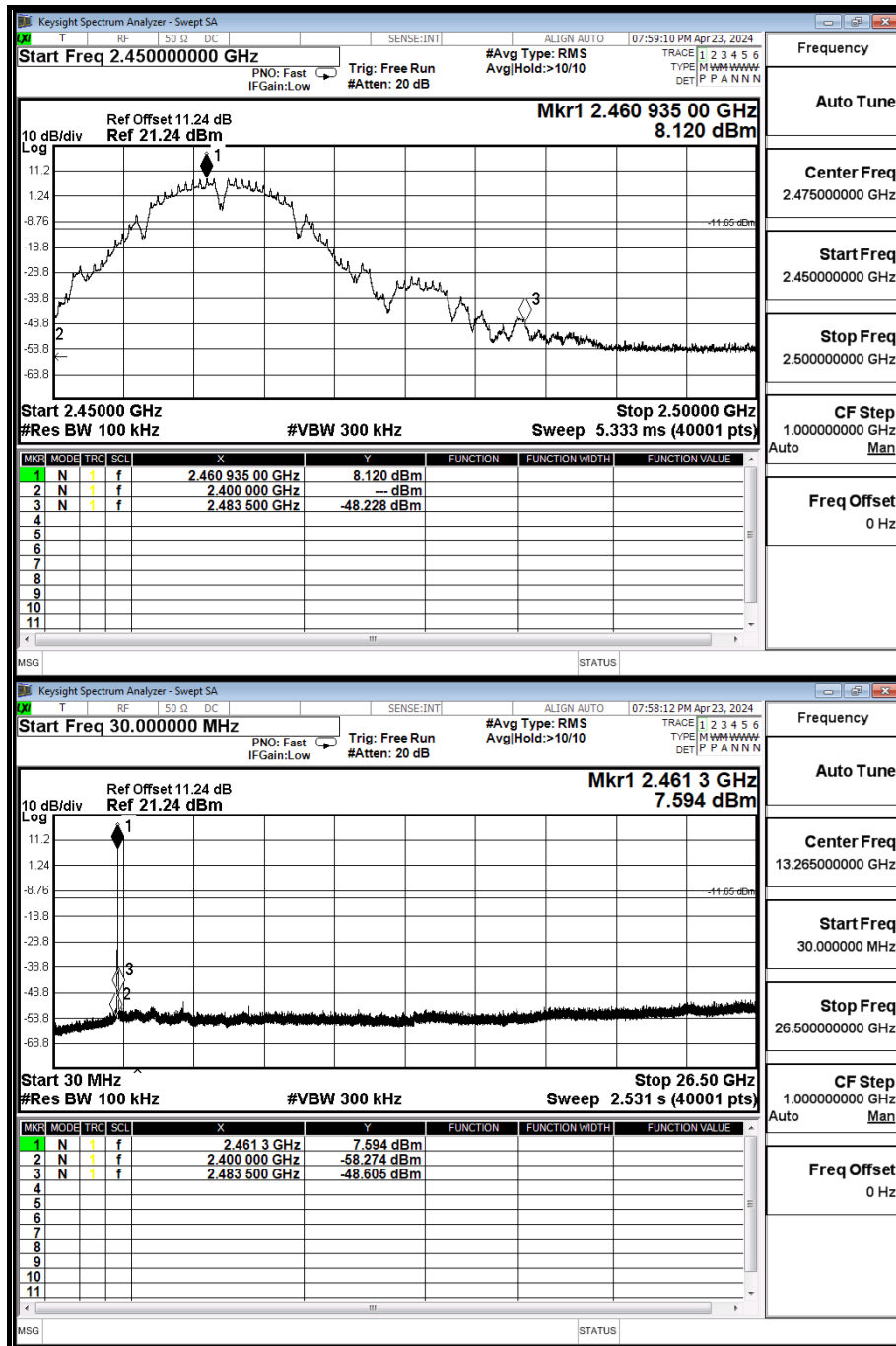
Model Name	HG12	Test By	Peter Chu
Temp & Humidity	25.5°C, 52%	Test Date	2024/04/23

(IEEE 802.11b MODE)



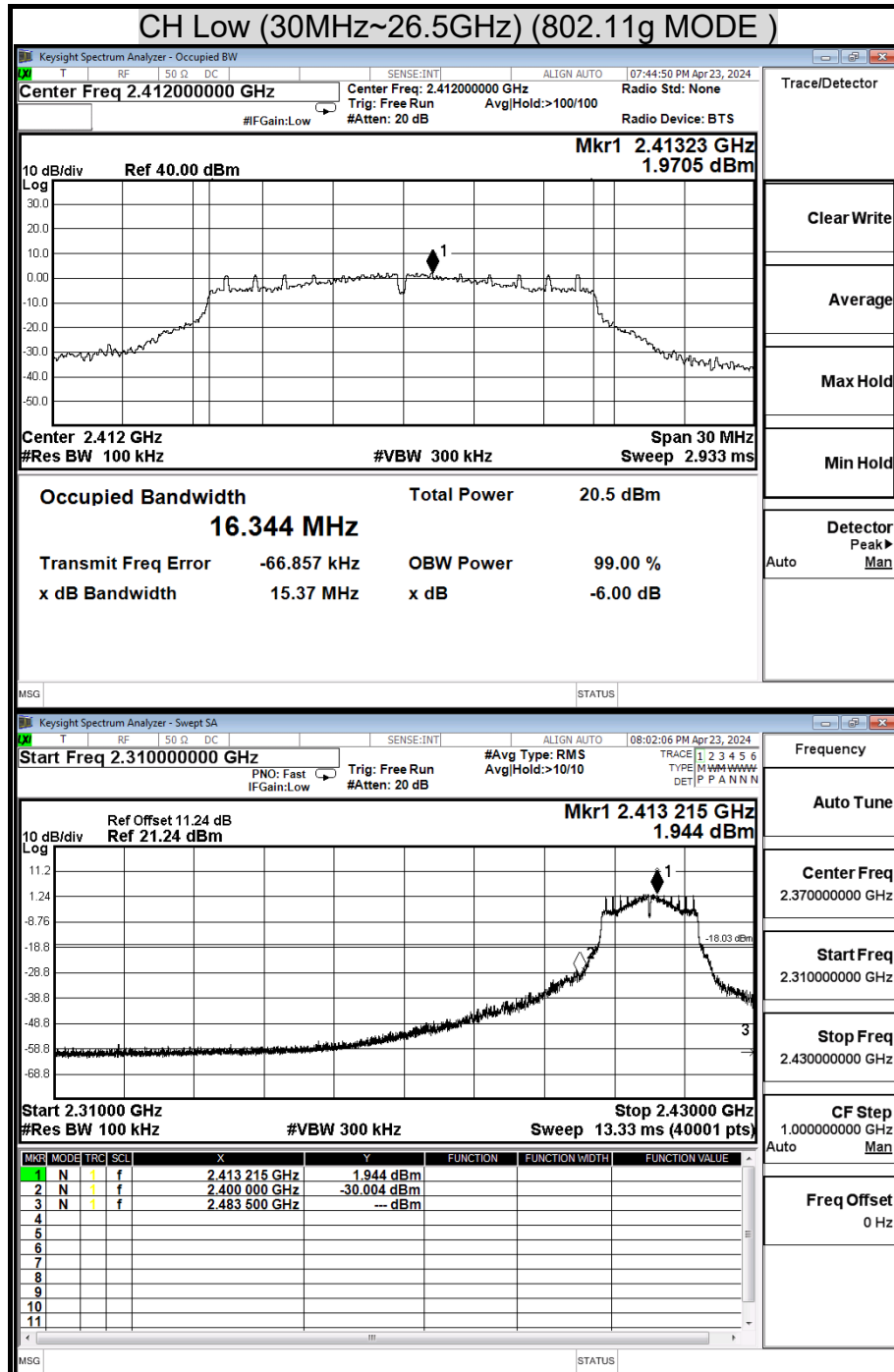


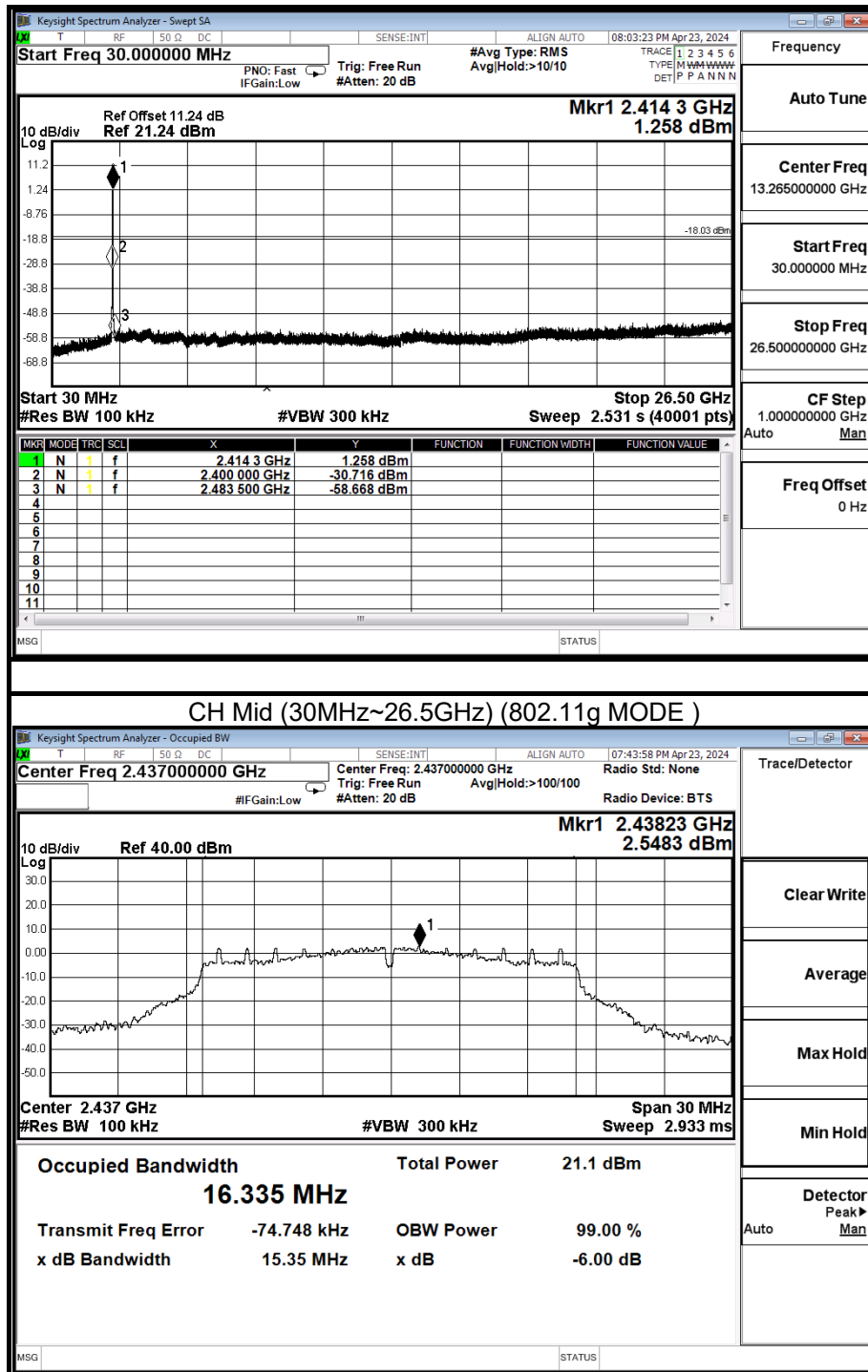


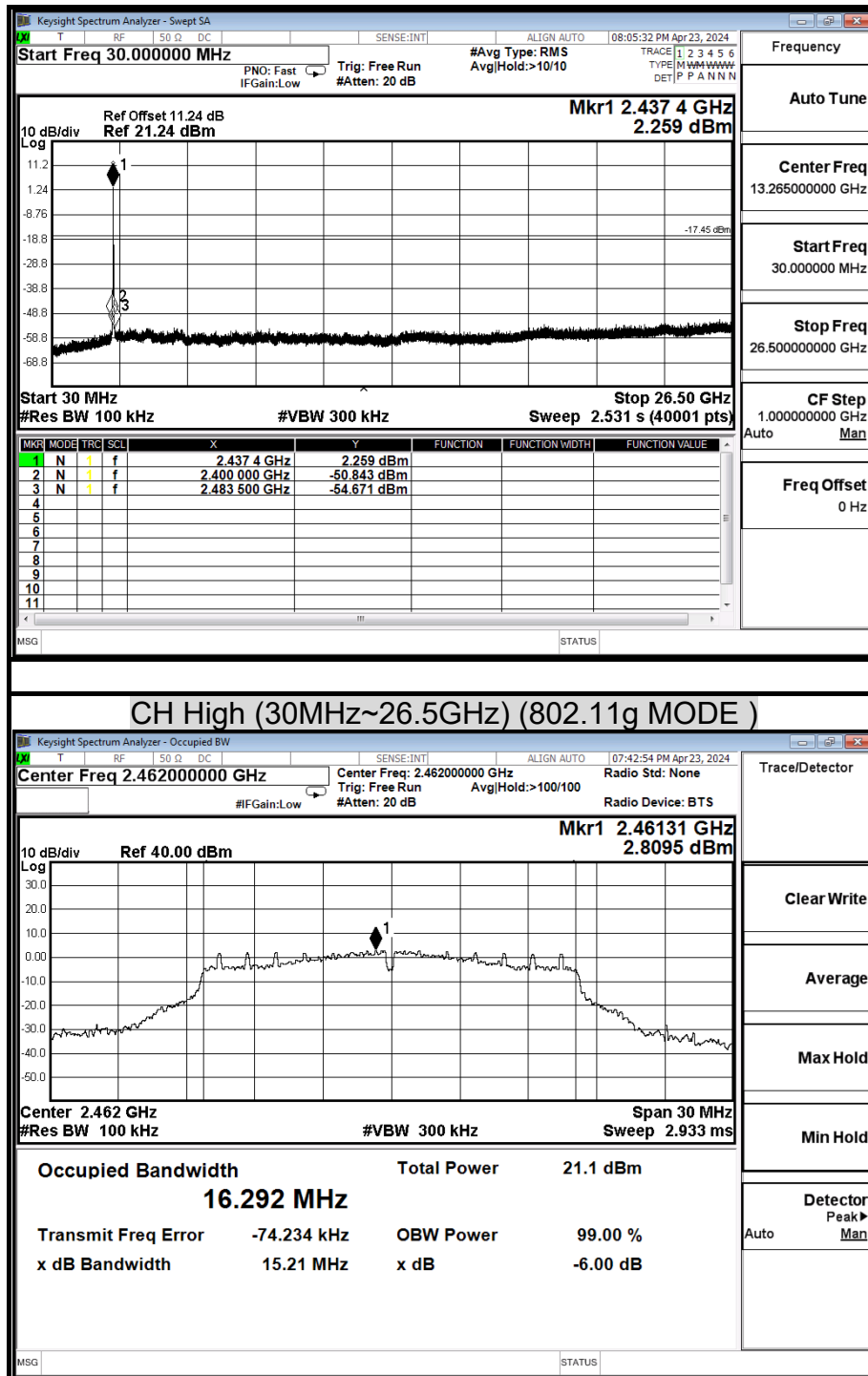


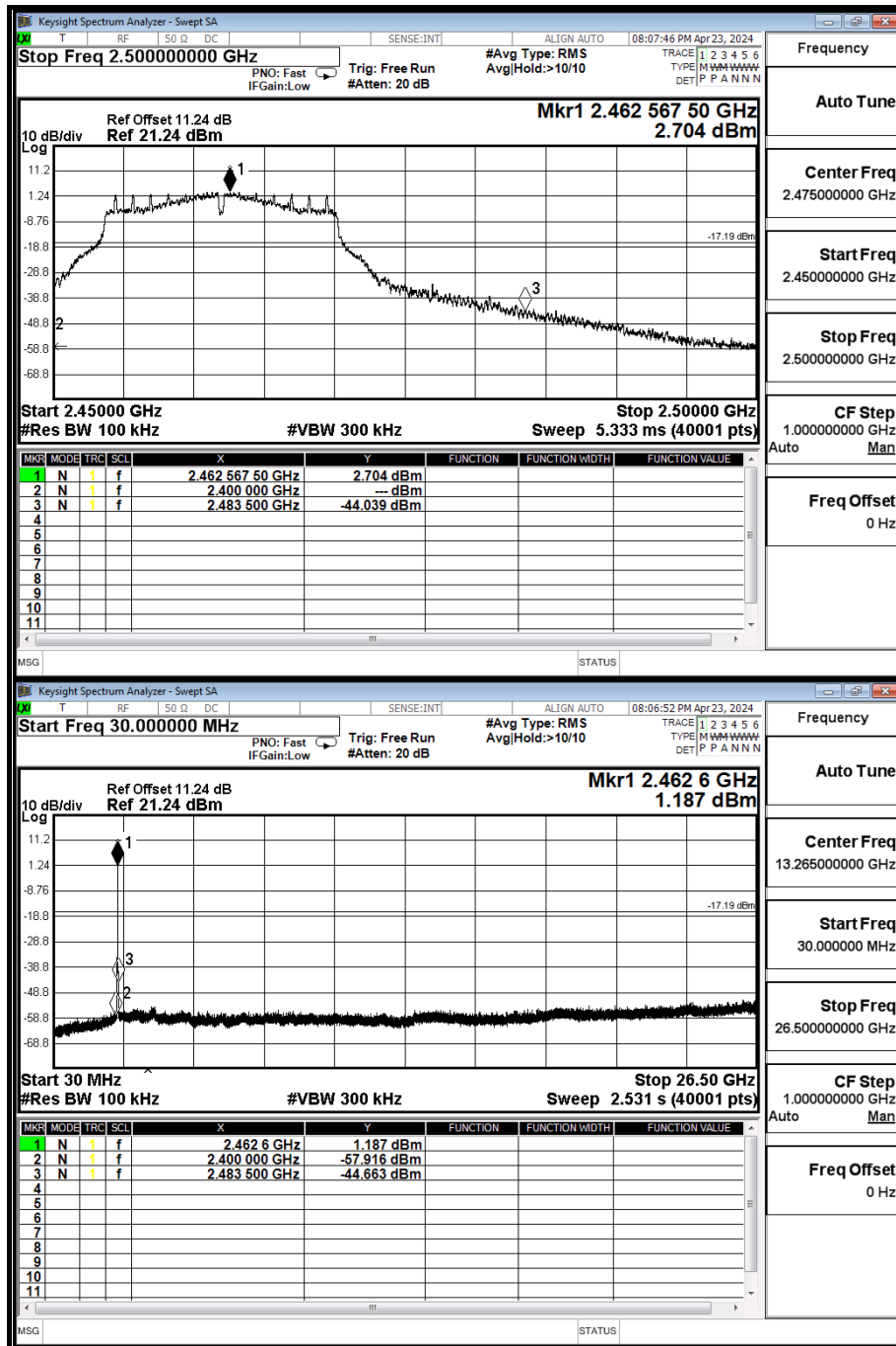
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(802.11g MODE)



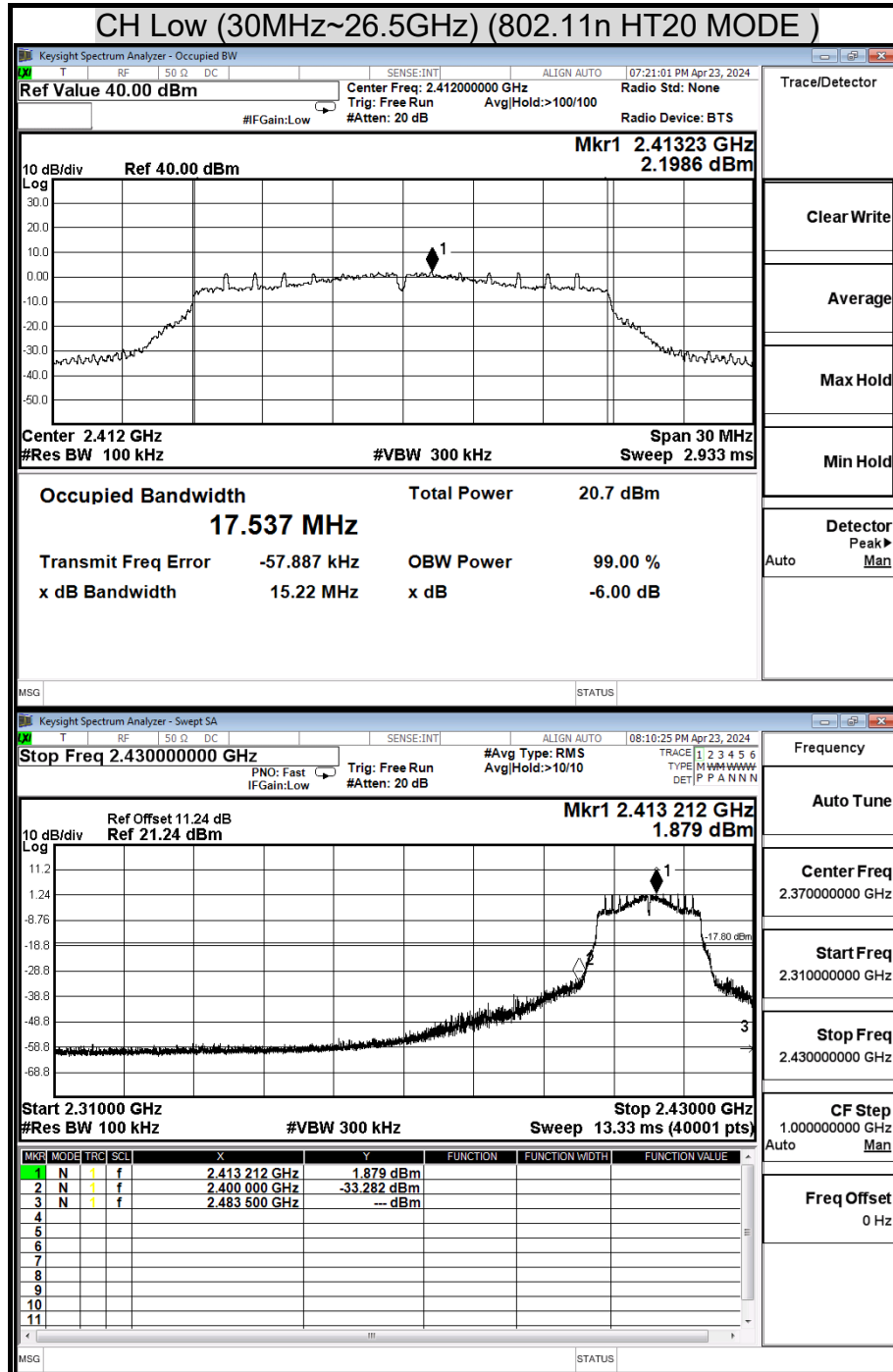


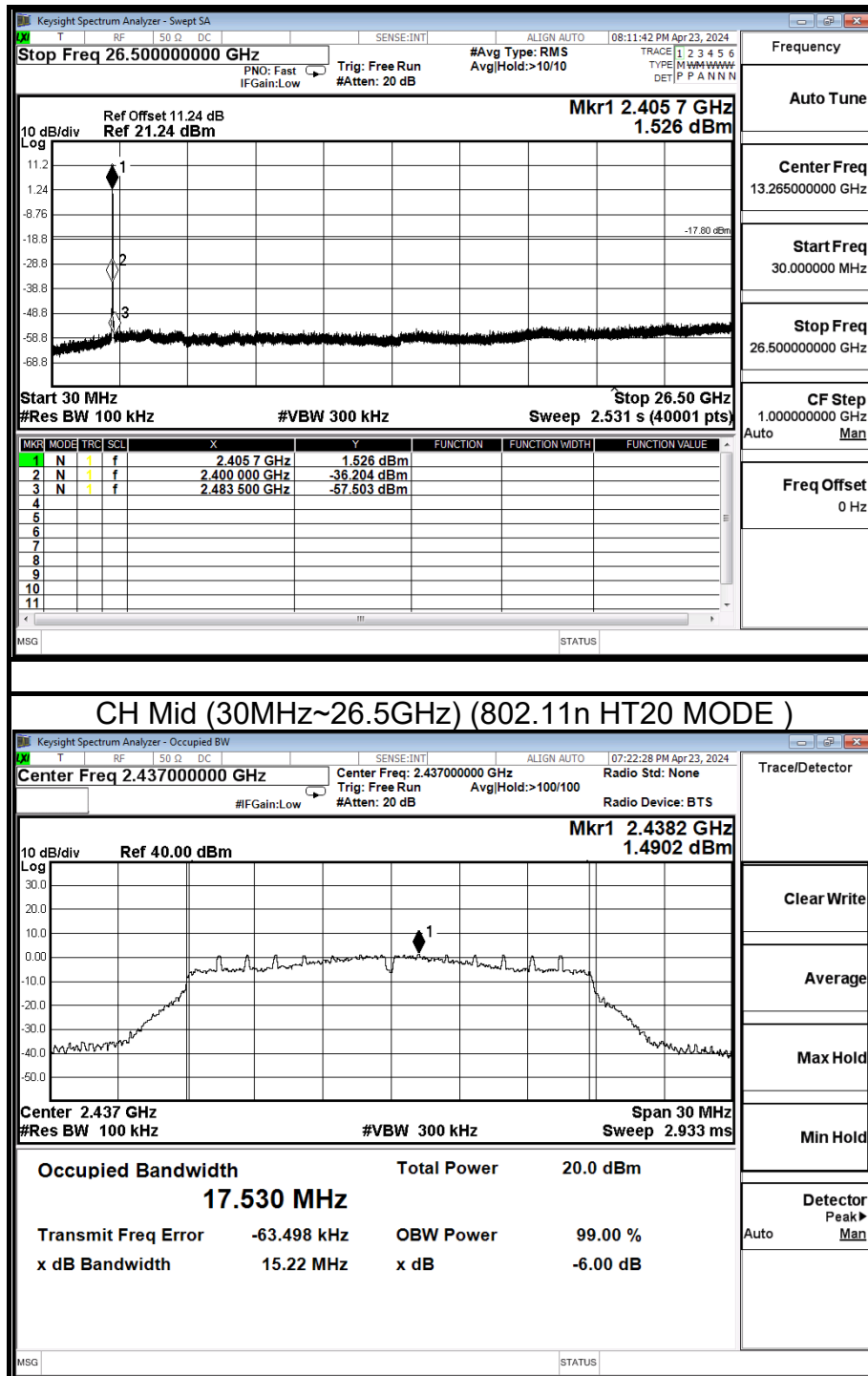


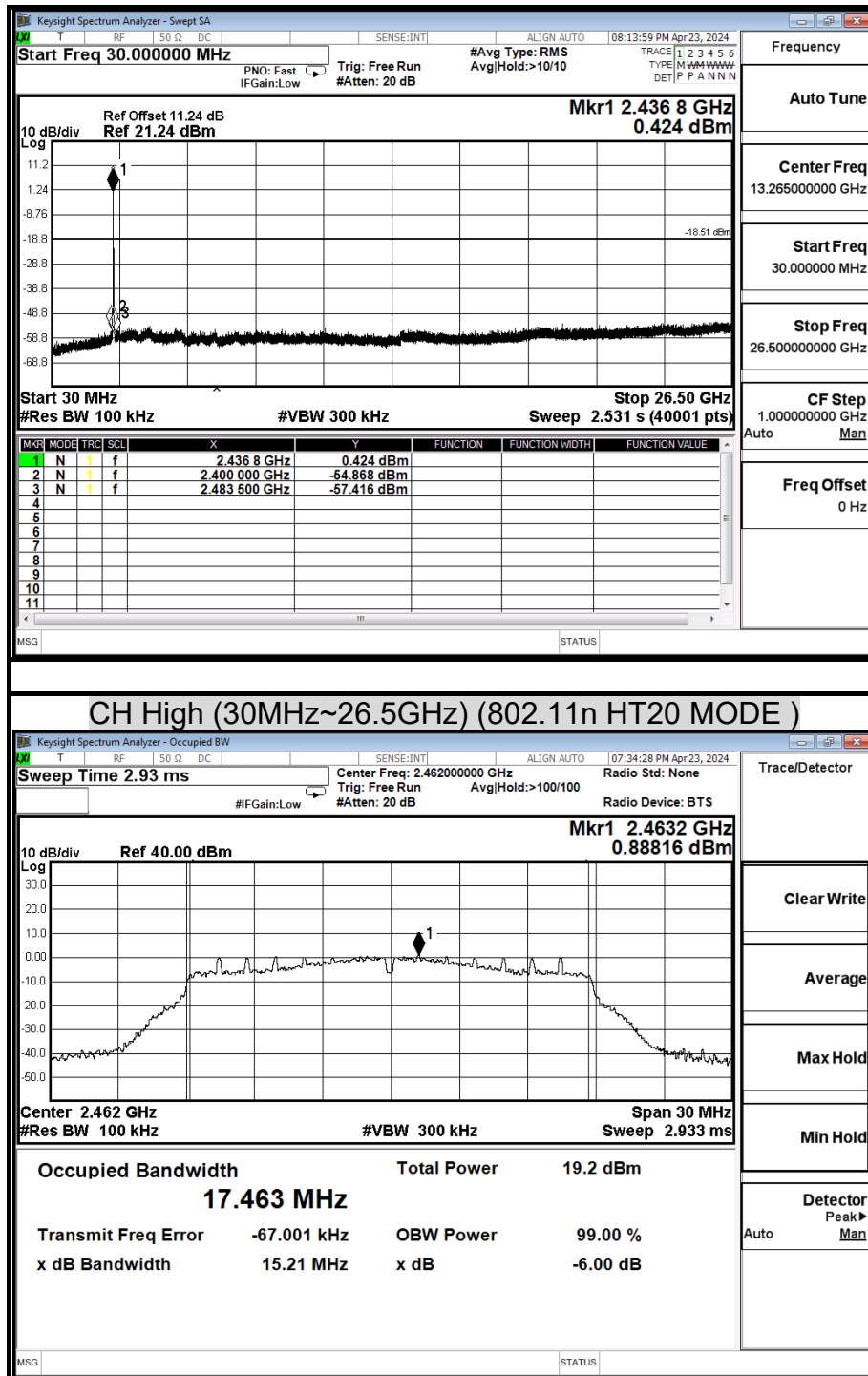


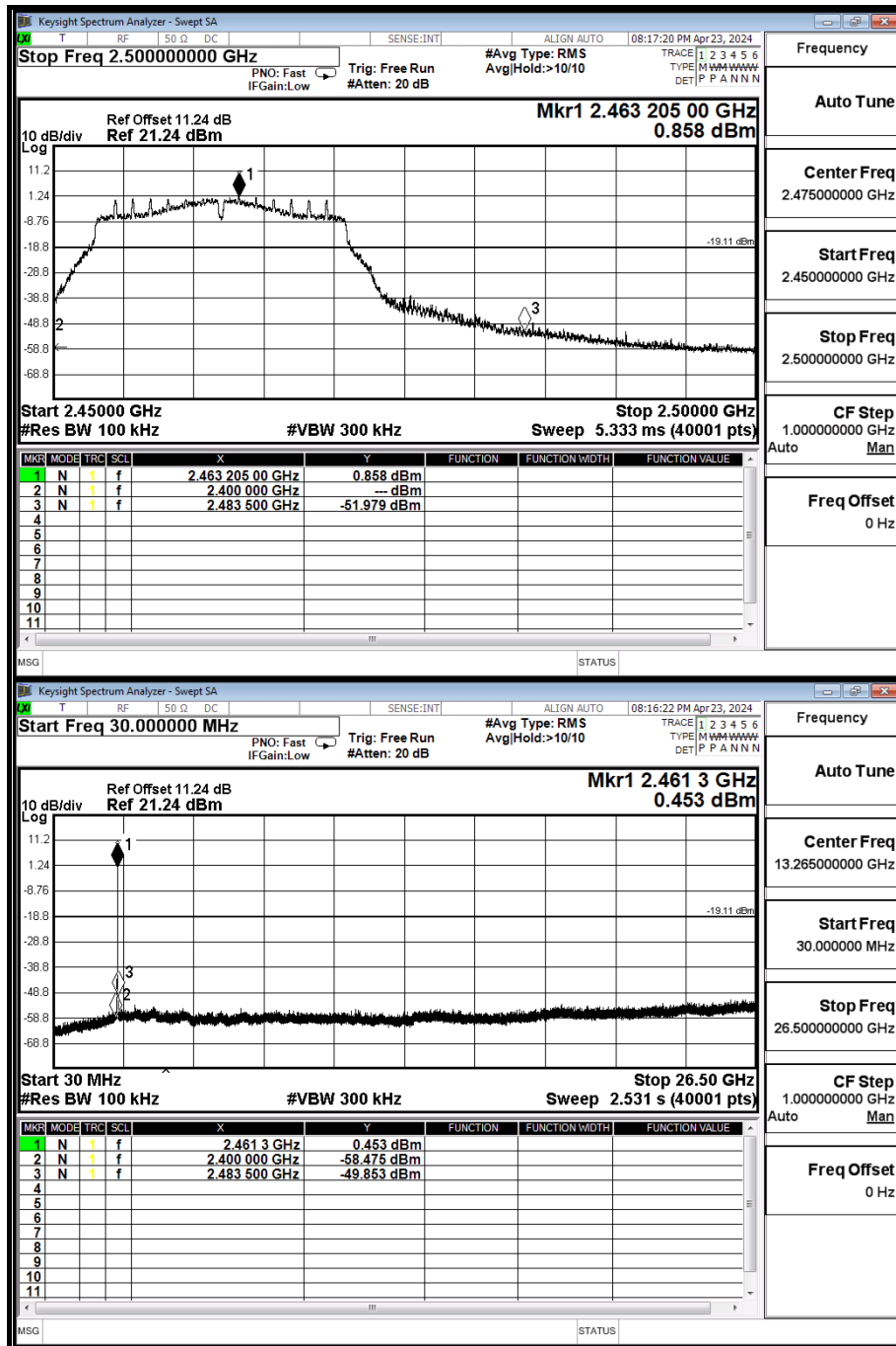
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(802.11n HT20 MODE)





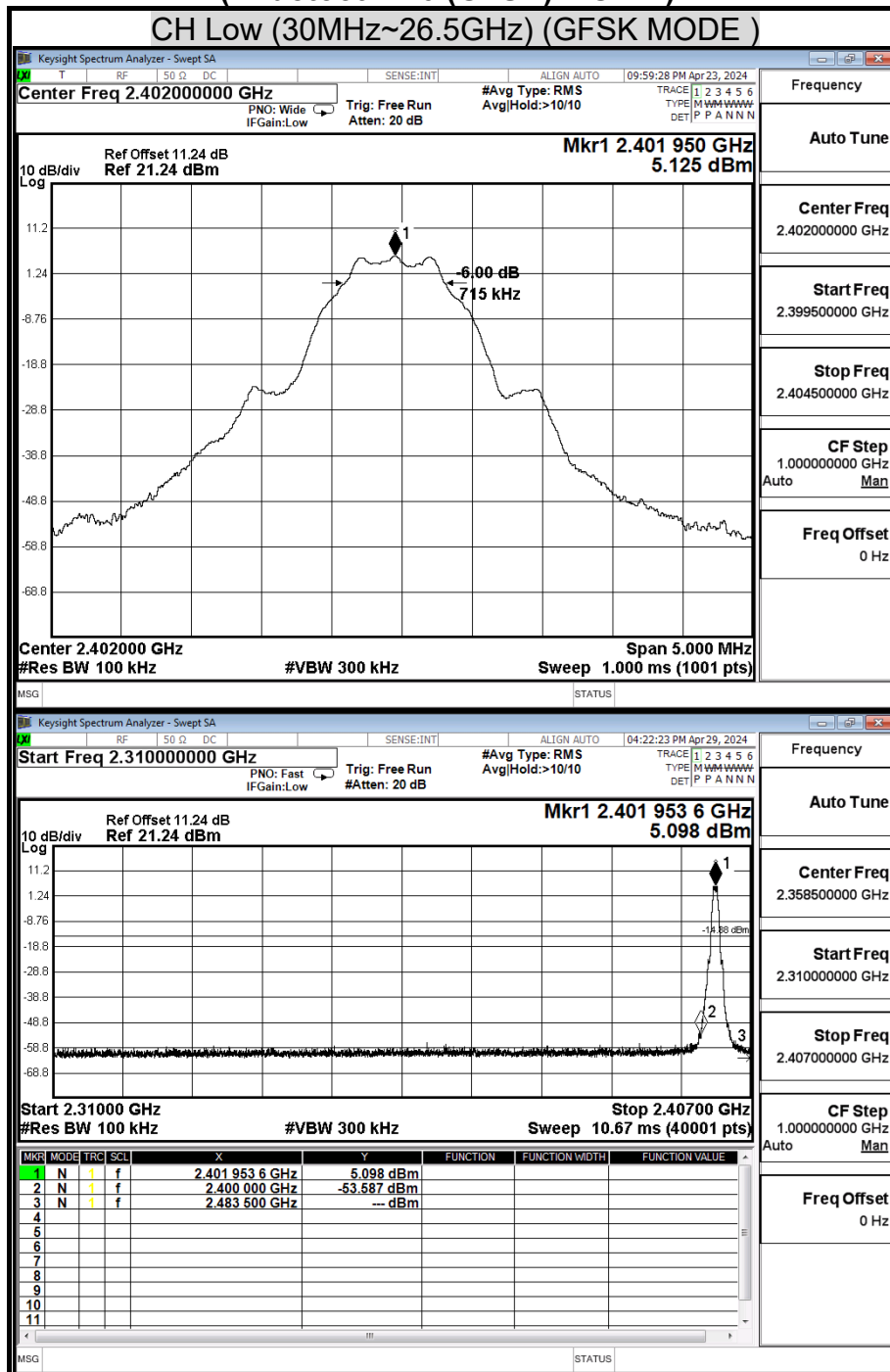


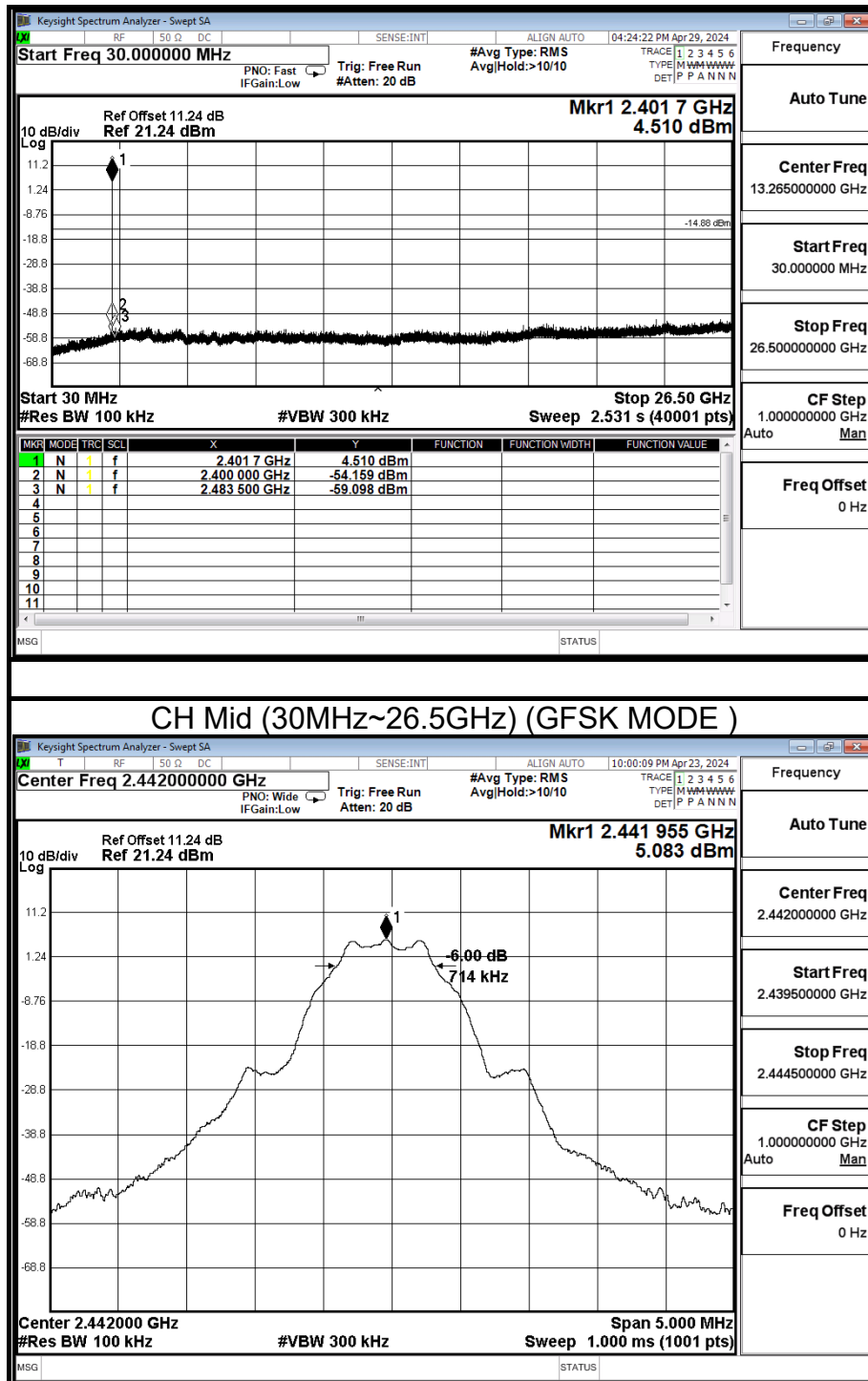


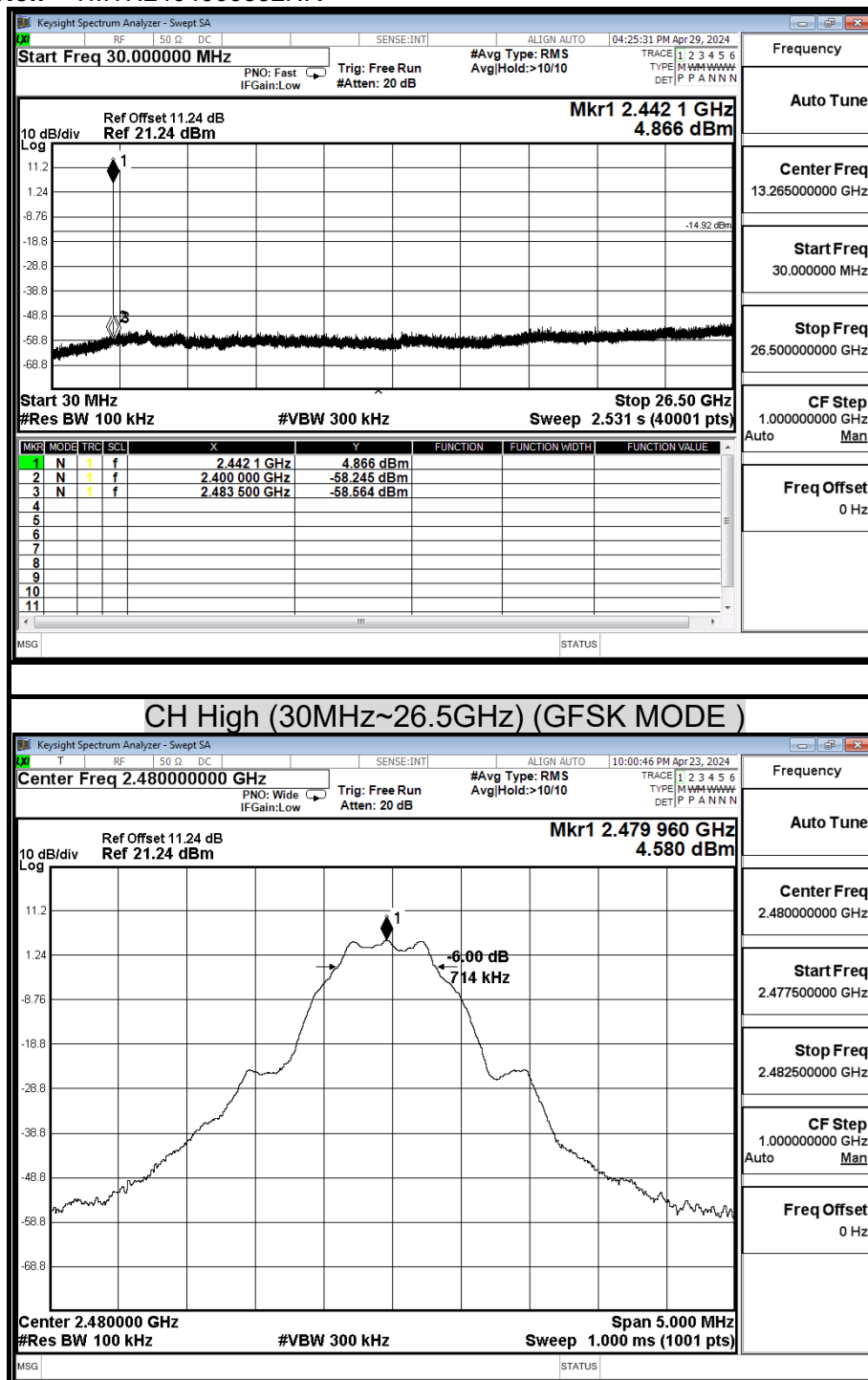
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

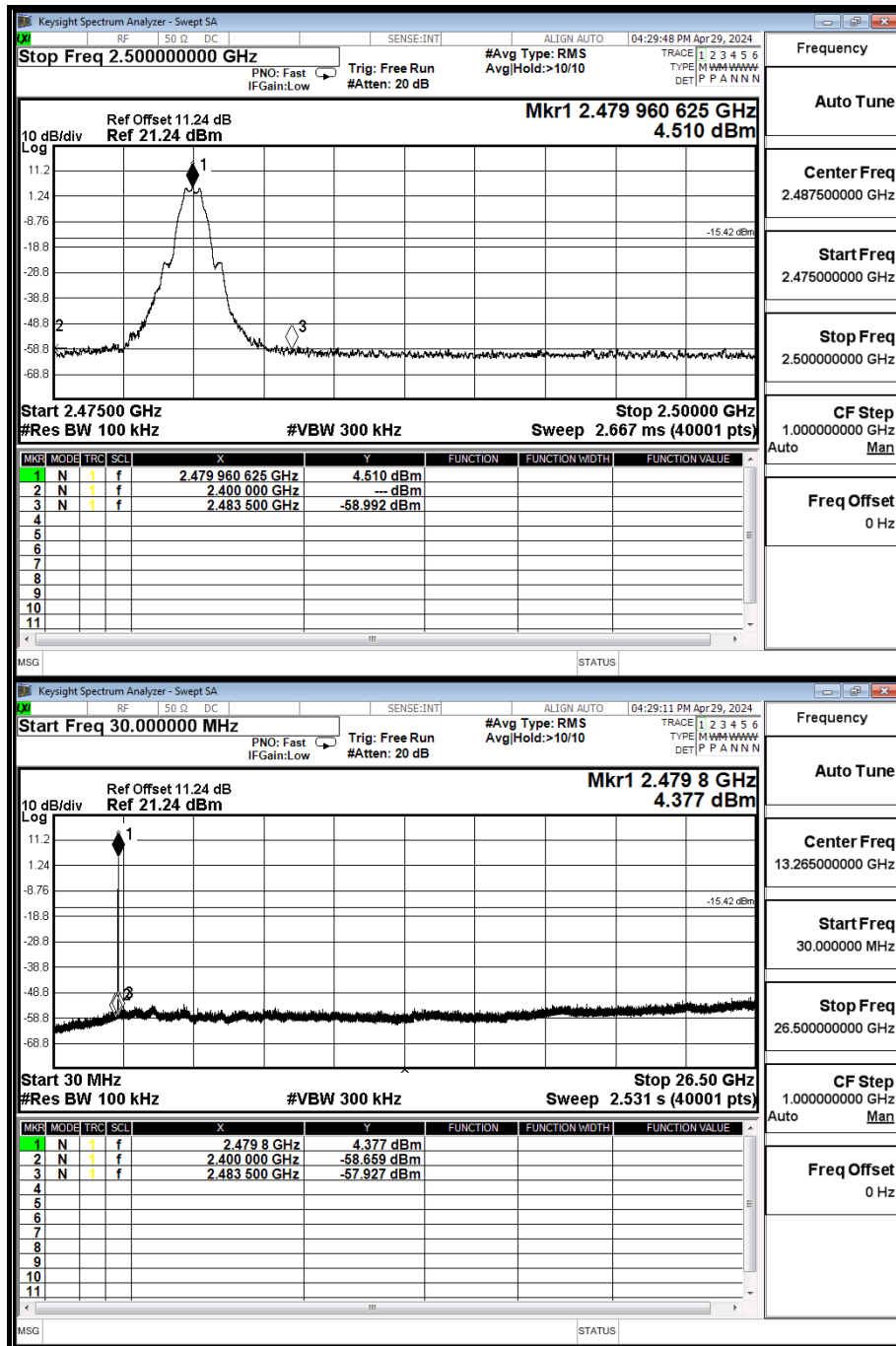
Model Name	HG12	Test By	Peter Chu
Temp & Humidity	24.4°C, 45%	Test Date	2024/04/29

(Bluetooth 4.0 (GFSK) MODE)





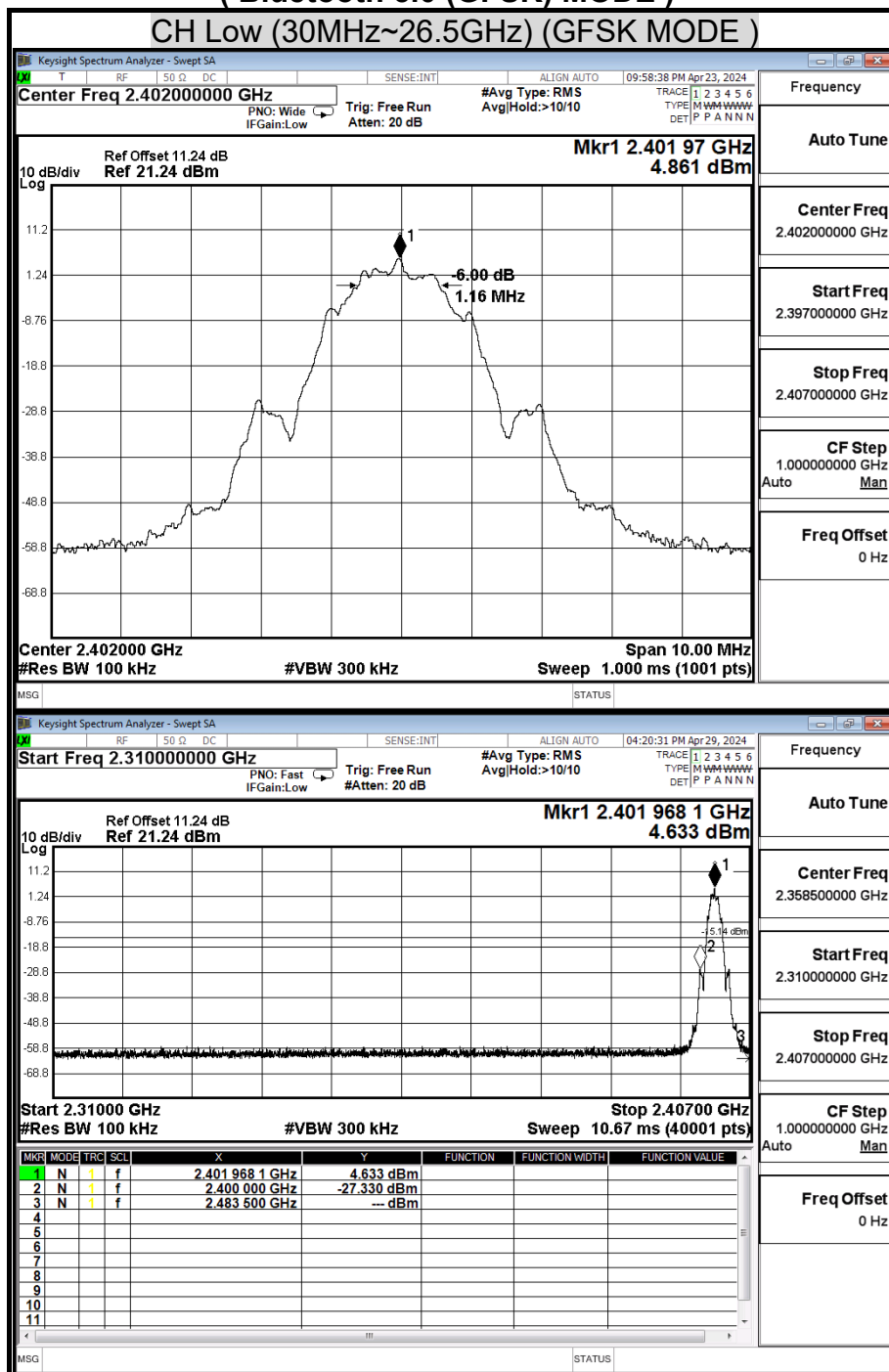


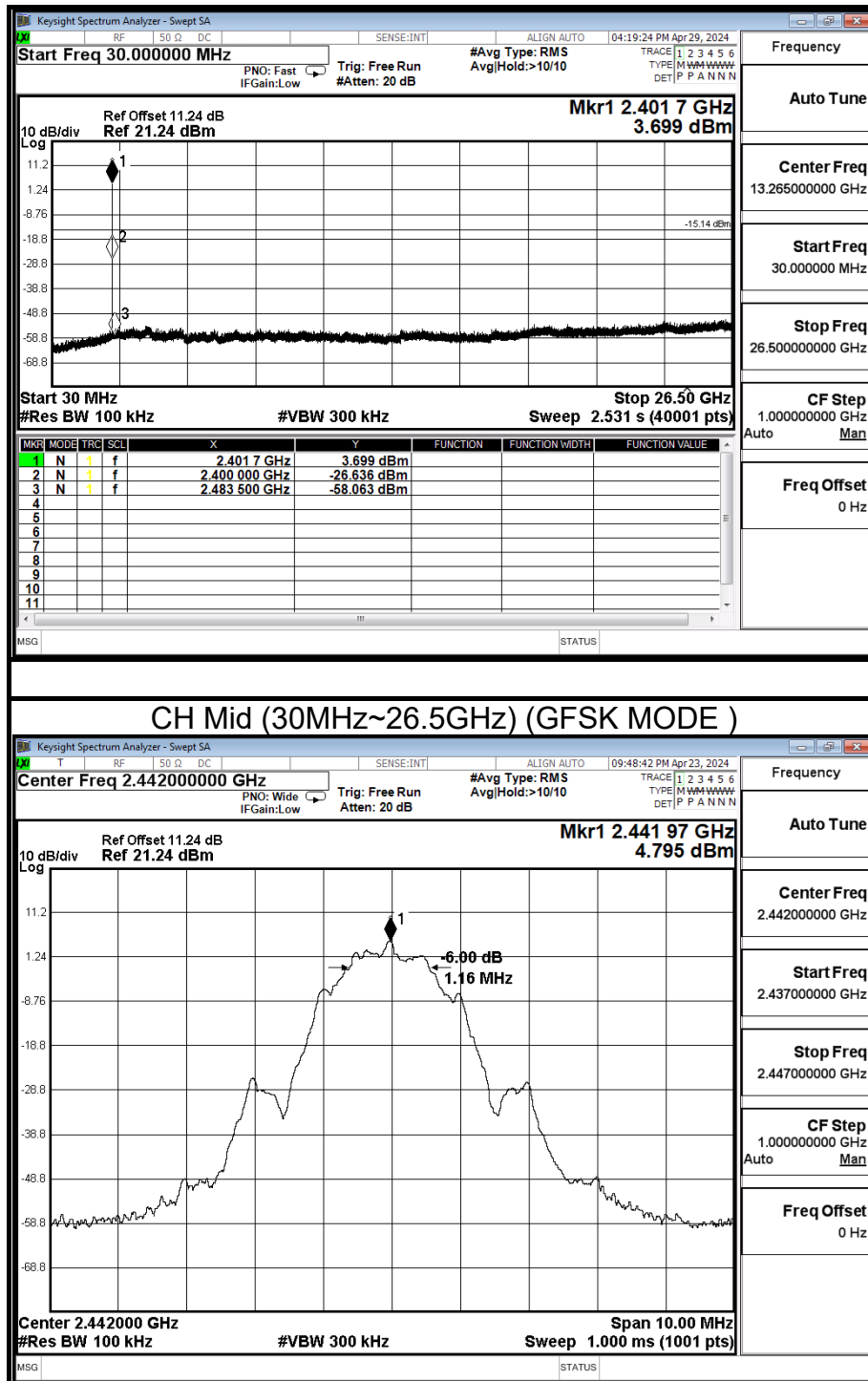


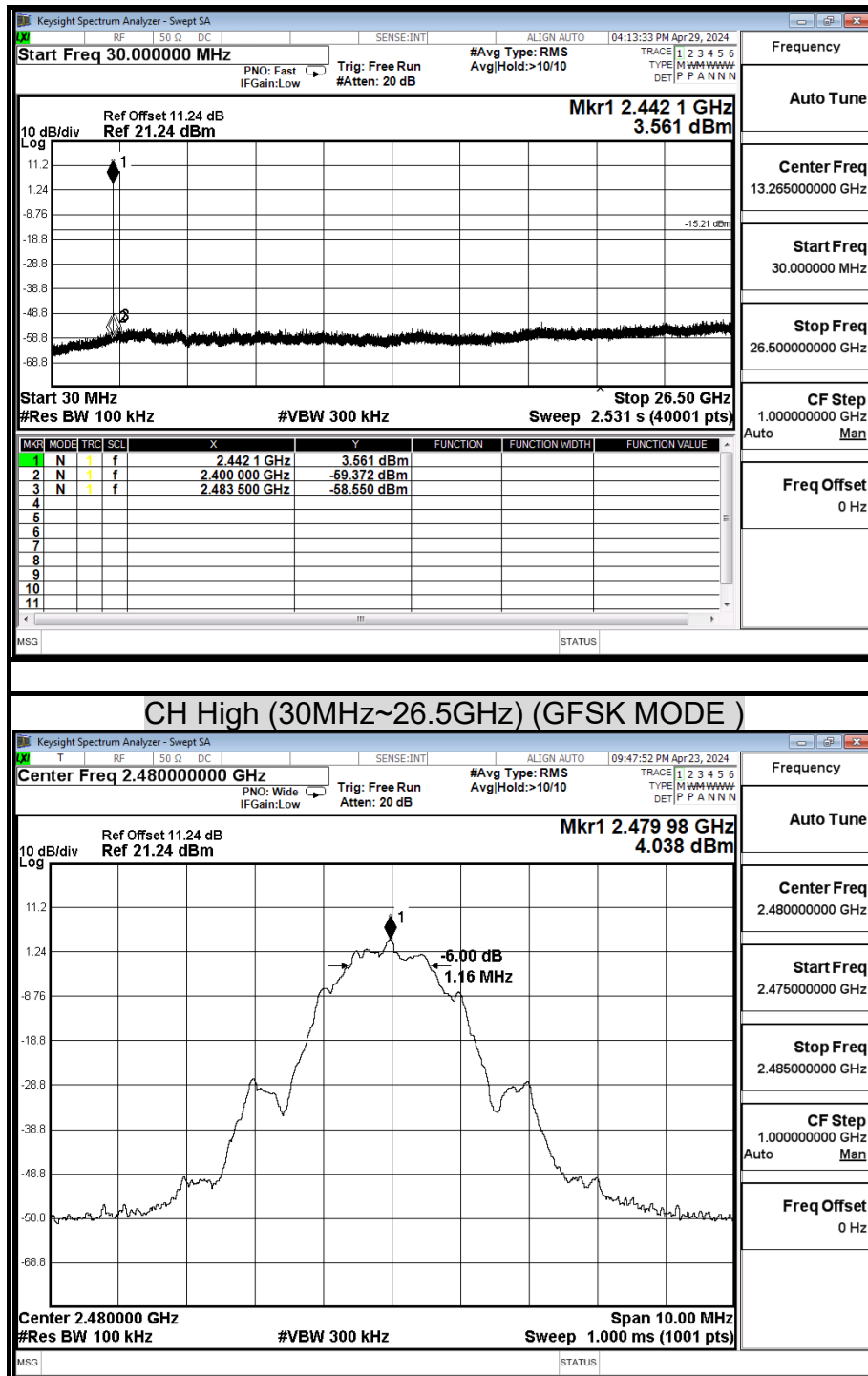
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

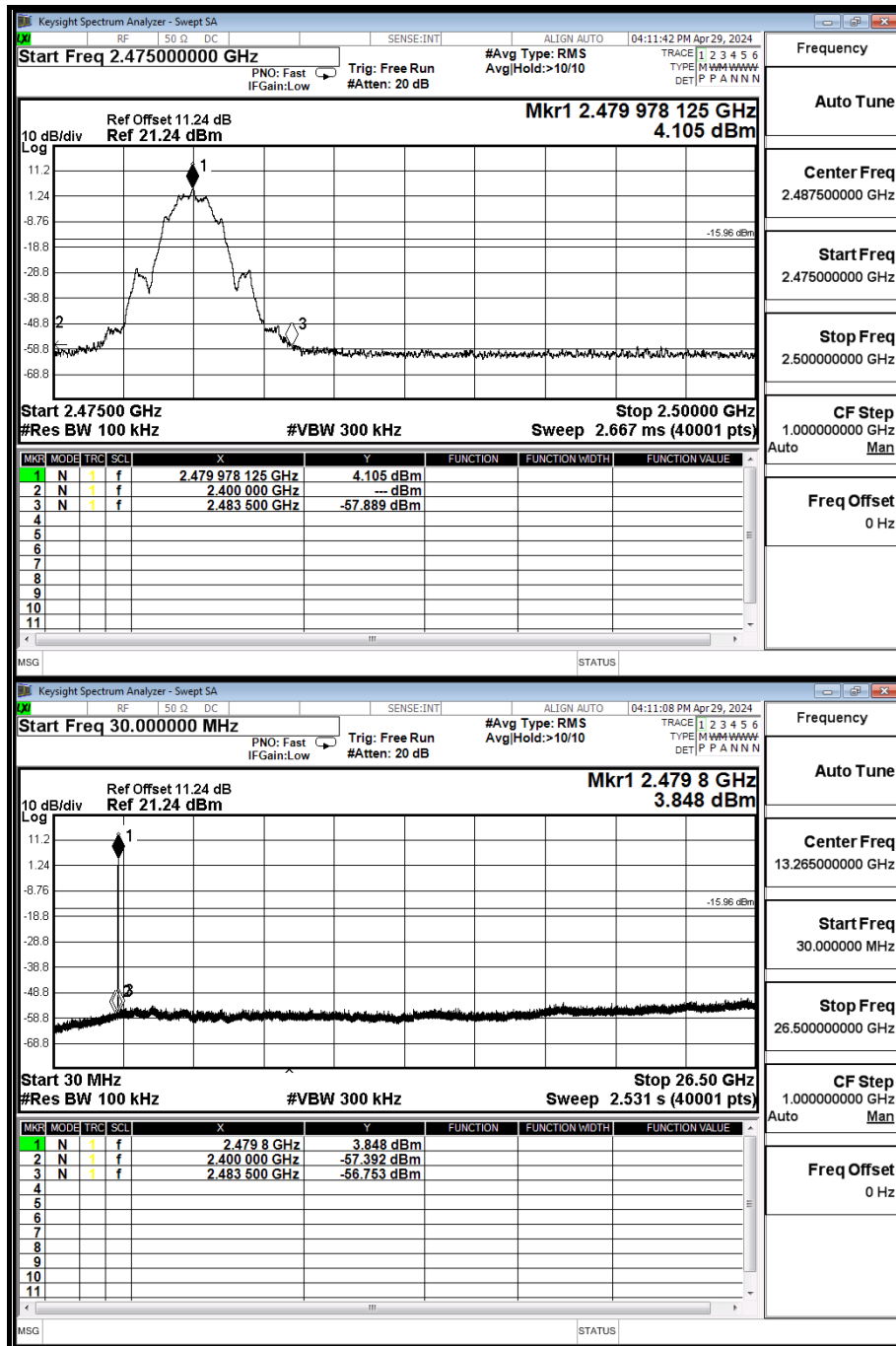
Model Name	HG12	Test By	Peter Chu
Temp & Humidity	24.4°C, 45%	Test Date	2024/04/29

(Bluetooth 5.0 (GFSK) MODE)









8.6 RADIATED EMISSIONS

8.6.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Report No.: TMTN2404000332NR

§ 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST EQUIPMENTS

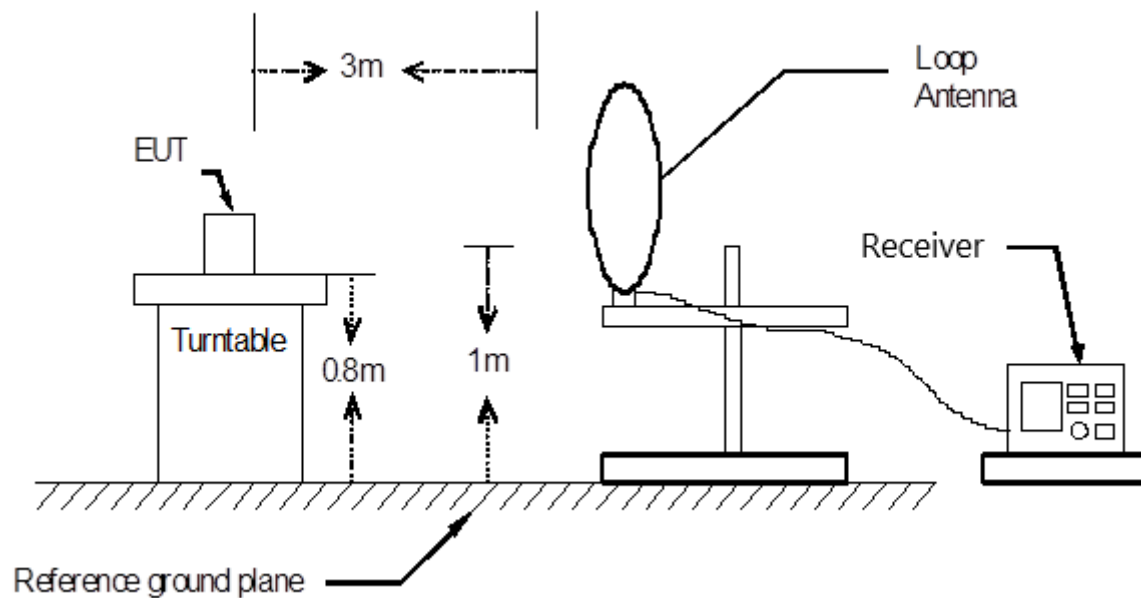
The following test equipments are utilized in making the measurements contained in this report.

Chamber Room #1166					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	09/04/2023	09/03/2024
Attenuator	MCL	BW-S15W5	0535	01/17/2024	01/16/2025
Bilog Antenna with 6dB Attenuator	SUNOL SCIENCES & EMCI	JB1 & N-6-06	A021306 & AT-N0682	10/03/2023	10/02/2024
Cable	EMCI	EM102-KMKM	CB1166-01	06/17/2023	06/16/2024
Double Ridged Guide Horn Antenna	ETS-LINDGREN	3116	00078900	03/19/2024	03/18/2025
EMI Test Receiver	R&S	ESCI	101203	10/16/2023	10/15/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/25/2023	07/24/2024
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-778(98006)	04/25/2024	04/24/2025
Notch Filter	MICRO-TRONICS	BRM50702-01	018	01/17/2024	01/16/2025
Pre-Amplifier	EMCI	EMC012645	980098	01/17/2024	01/16/2025
Pre-Amplifier	Com-Power	PAM-840A	461378	06/07/2023	06/06/2024
Software	Excel(ccs-o6-2020 v1.1) , e3(v6.101222)				

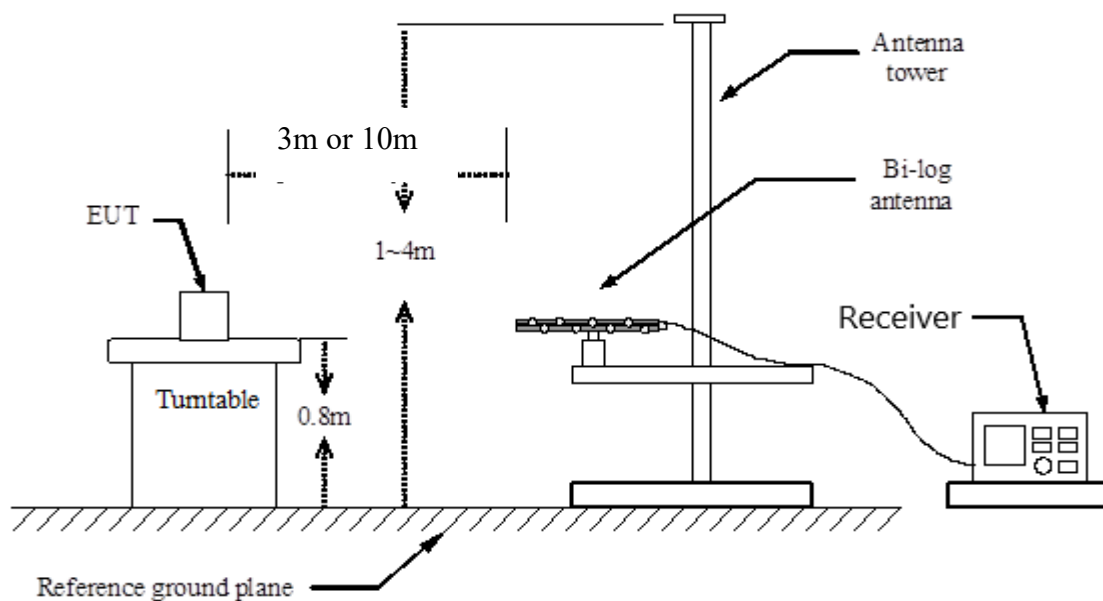
TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission below 1GHz.

9kHz ~ 30MHz

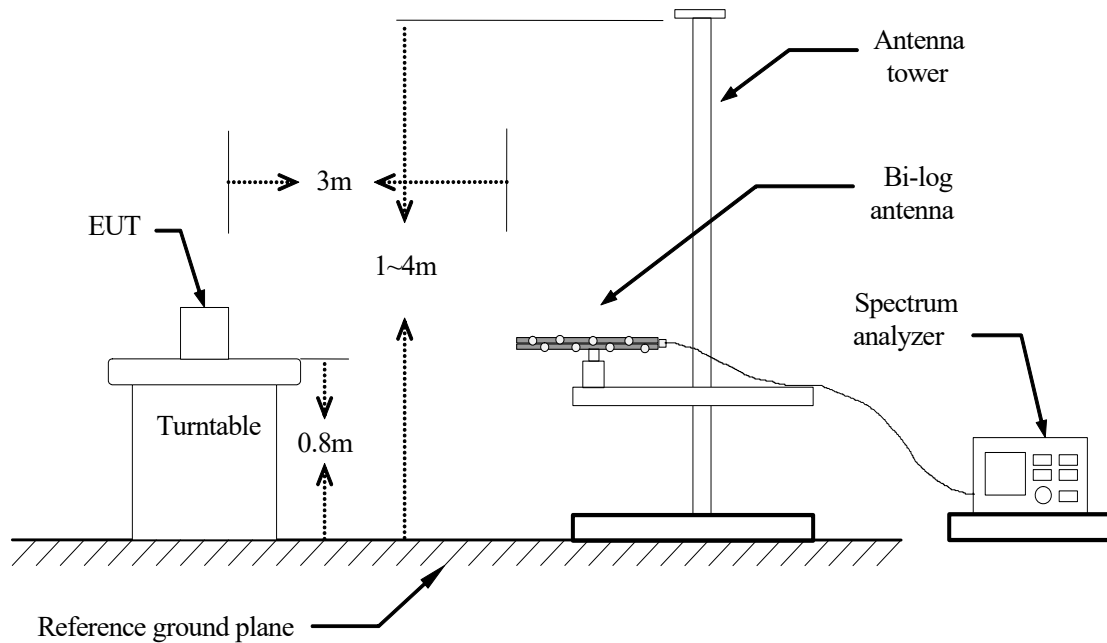


30MHz ~ 1GHz



Antenna Elevation Variable

The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



Antenna Elevation Variable