

TEST REPORT

Product Name: Wifi Module
Trade Mark: N/A
Model No.: MWH516B.01
HVIN: MWH516B.01
Report Number: 211230011RFC-3
Test Standards: FCC 47 CFR Part 15 Subpart C
RSS-247 Issue 2
RSS-Gen Issue 5
FCC ID: BBP-WLPIN01
IC: 144D-WLPIN01
Test Result: PASS
Date of Issue: March 31, 2022

Prepared for:

Ricoh Company Ltd
2-7-1 Izumi, Ebina, Kanagawa 243-0460, Japan

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March 31, 2022

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UTTR-RF-RSS247-V1.1

Version

Version No.	Date	Description
V1.0	March 31, 2022	Original



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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Ricoh Company Ltd
Address of Applicant:	2-7-1 Izumi, Ebina, Kanagawa 243-0460, Japan
Manufacturer:	Ricoh Company Ltd
Address of Manufacturer:	2-7-1 Izumi, Ebina, Kanagawa 243-0460, Japan

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Wifi Module		
Model No.:	MWH516B.01		
HVIN:	MWH516B.01		
Trade Mark:	N/A		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth 5.1	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
Sample Received Date:	December 31, 2021		
Sample Tested Date:	February 17, 2022 to March 12, 2022		

Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.

1.2.2 Description of Accessories

None

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	2400 MHz to 2483.5 MHz	
Frequency Range:	2412 MHz to 2462 MHz	
Support Standards:	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20, IEEE 802.11n-HT40	
Type of Modulation:	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT20: OFDM (64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11n-HT40: OFDM (64-QAM, 16-QAM, QPSK, BPSK)	
Data Rate:	IEEE 802.11b: Up to 11 Mbps IEEE 802.11g: Up to 54 Mbps IEEE 802.11n-HT20: Up to MCS15 IEEE 802.11n-HT40: Up to MCS15	
Number of Channels:	IEEE 802.11b: 11 IEEE 802.11g: 11 IEEE 802.11n-HT20: 11 IEEE 802.11n-HT40: 7	
Channel Separation:	5 MHz	
Antenna Type:	Chain 0	PCB Antenna
	Chain 1	PCB Antenna
Antenna Gain: (Provided by the customer)	Chain 0	0.3 dBi
	Chain 1	0.2 dBi
Directional gain:	3.26 dBi	
Maximum e.i.r.p	SISO_ Chain 0	IEEE 802.11b: 16.63 dBm IEEE 802.11g: 12.75 dBm
	SISO_ Chain 1	IEEE 802.11b: 16.72 dBm IEEE 802.11g: 13.02 dBm
	MIMO_ Chain 0+1	IEEE 802.11n-HT20: 18.86 dBm IEEE 802.11n-HT40: 18.92 dBm
Maximum conducted output power:	SISO_ Chain 0	IEEE 802.11b: 16.33 dBm IEEE 802.11g: 12.45 dBm
	SISO_ Chain 1	IEEE 802.11b: 16.52 dBm IEEE 802.11g: 12.82 dBm
	MIMO_ Chain 0+1	IEEE 802.11n-HT20: 15.60 dBm IEEE 802.11n-HT40: 15.66 dBm
Normal Test Voltage:	5Vdc	

1.4 OTHER INFORMATION

Operation Frequency Each of Channel	
IEEE 802.11b, IEEE 802.11g, IEEE 802.11n-HT20	$f = 2407 + 5k \text{ MHz}, k = 1, \dots, 11$
Note: f is the operating frequency (MHz); k is the operating channel.	

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	LENOVO	E450	PF-0EQBE3 15/11	UnionTrust
Notebook Adapter	LENOVO	ADLX65NLC3A	5A10J75114	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.15 Meter	UnionTrust
2	USB extension cable	USB	1 Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Telephone: +86 (0) 755 2823 0888

Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

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ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.9 dB
5	Radiated emission 1GHz-18GHz	± 4.8 dB
6	Radiated emission 18GHz-26GHz	± 5.1 dB
7	Radiated emission 26GHz-40GHz	± 5.1 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.68 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	2.4 GHz: ± 6.5 x 10 ⁻⁸
12	Transmission Time	± 0.19 %

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2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	PASS
Conducted Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 2, Section 5.4(d)	ANSI C63.10-2013 Clause 1.9.2.2.2	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a)	ANSI C63.10-2013 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 2, Section 5.2(b)	ANSI C63.10-2013 Clause 11.10.3	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2013 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 2, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS
Disclaimer and Explanations: The declared of product specification and data (e.g. antenna gain, RF specification, etc) for EUT presented in the report are provided by the customer, and the customer takes all the responsibilities for the accuracy of product specification.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3M SAC	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 05, 2021	Nov. 04, 2022
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Apr. 22, 2021	Apr. 21, 2022
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 11, 2021	Nov. 10, 2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 11, 2021	Nov. 10, 2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103002	Nov. 11, 2021	Nov. 10, 2023
☒	Preamplifier	HP	8447F	2805A02960	Nov. 05, 2021	Nov. 04, 2022
☒	Band Rejection Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	Nov. 06, 2021	Nov. 05, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Apr. 30, 2021	Apr. 29, 2023
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 06, 2021	Nov. 05, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 14, 2020	Nov. 13, 2023
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	Nov. 17, 2020	Nov. 16, 2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 05, 2021	Nov. 04, 2022
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 05, 2021	Nov. 04, 2022
☒	Test Software	Audix	e3	Software Version: 9.20151119i		

Conducted RF test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Apr. 22, 2021	Apr. 21, 2022
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 05, 2021	Nov. 04, 2022
☐	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Nov. 05, 2021	Nov. 04, 2022
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Nov. 05, 2021	Nov. 04, 2022

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4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage	Relative Humidity (%)
NV/NT	+15 to +35	5Vdc	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	25.3	45	101.10	211230013-A01/11	David Zhang
Conducted Peak Output Power	25.1	50	100.01	211230013-A02/11	Hank Wu
6dB Bandwidth & Occupied Bandwidth					
Power Spectral Density					
Conducted Out of Band Emission	24.2	49	100.02	211230013-A01/11	Asia Yan
Radiated Spurious Emissions					
Band Edge Measurements (Radiated)					

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11b	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11g	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT20	2412 MHz to 2462 MHz	Channel 1	Channel 7	Channel 11
		2412 MHz	2437 MHz	2462 MHz
IEEE 802.11n-HT40	2422 MHz to 2452 MHz	Channel 3	Channel 7	Channel 9
		2422 MHz	2437 MHz	2452 MHz

4.3 EUT TEST STATUS

Mode	Tx/Rx Function	Description
IEEE 802.11b IEEE 802.11g IEEE 802.11n-HT20 IEEE 802.11n-HT40	1Tx	1. Keep the EUT in continuously transmitting or receiving with modulation test single.
IEEE 802.11n-HT20 IEEE 802.11n-HT40	2Tx	2. Keep the EUT in continuously transmitting or receiving with modulation test single.

Wi-Fi Power Setting (Provided by the customer)						
Mode	Channel 1		Channel 6		Channel 11	
	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1
IEEE 802.11b	1E	1E	1E	1E	1E	1E
IEEE 802.11g	16	16	16	16	16	16
IEEE 802.11n-HT20	18	18	18	18	18	18
IEEE 802.11n-HT40	18	18	18	18	18	18

Test Software (Provided by the customer)
Test software name: QATool_Dbg;

4.4 PRE-SCAN

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below

Mode	Worst-case data rates
IEEE 802.11b	1 Mbps
IEEE 802.11g	6 Mbps
IEEE 802.11n-HT20	MCS8
IEEE 802.11n-HT40	MCS8

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

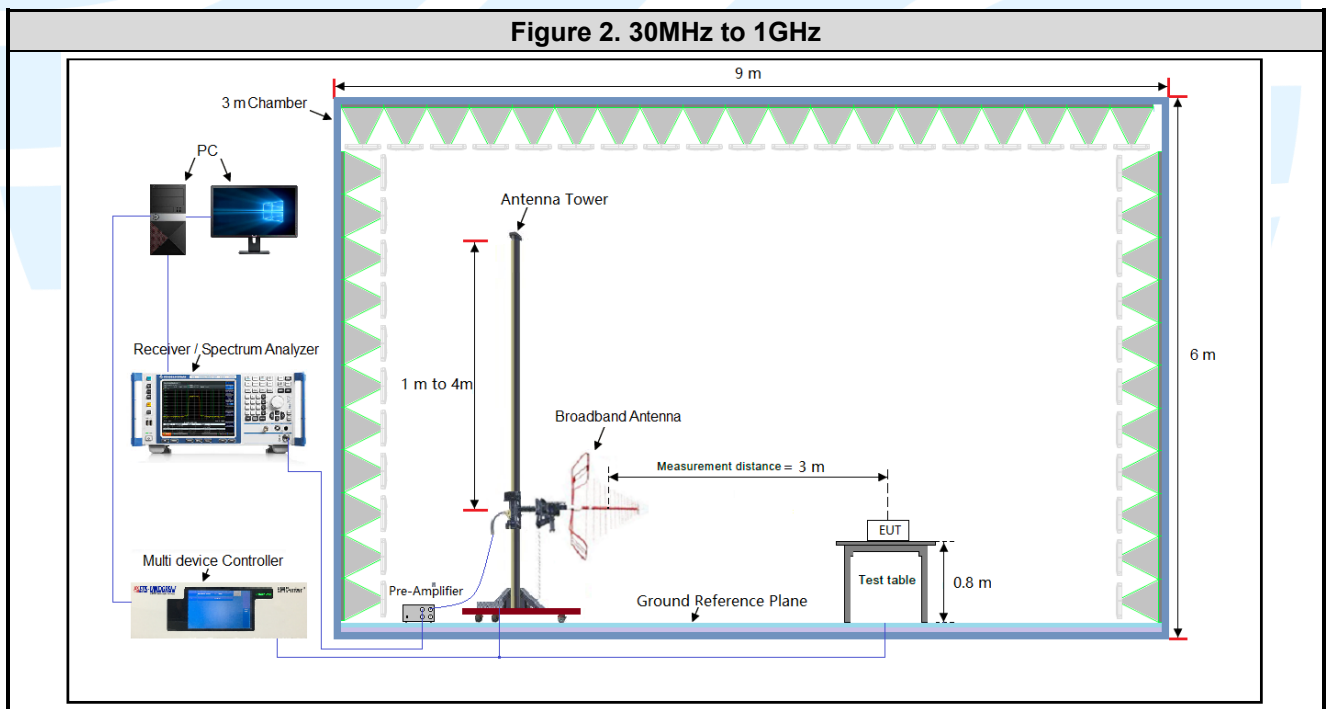
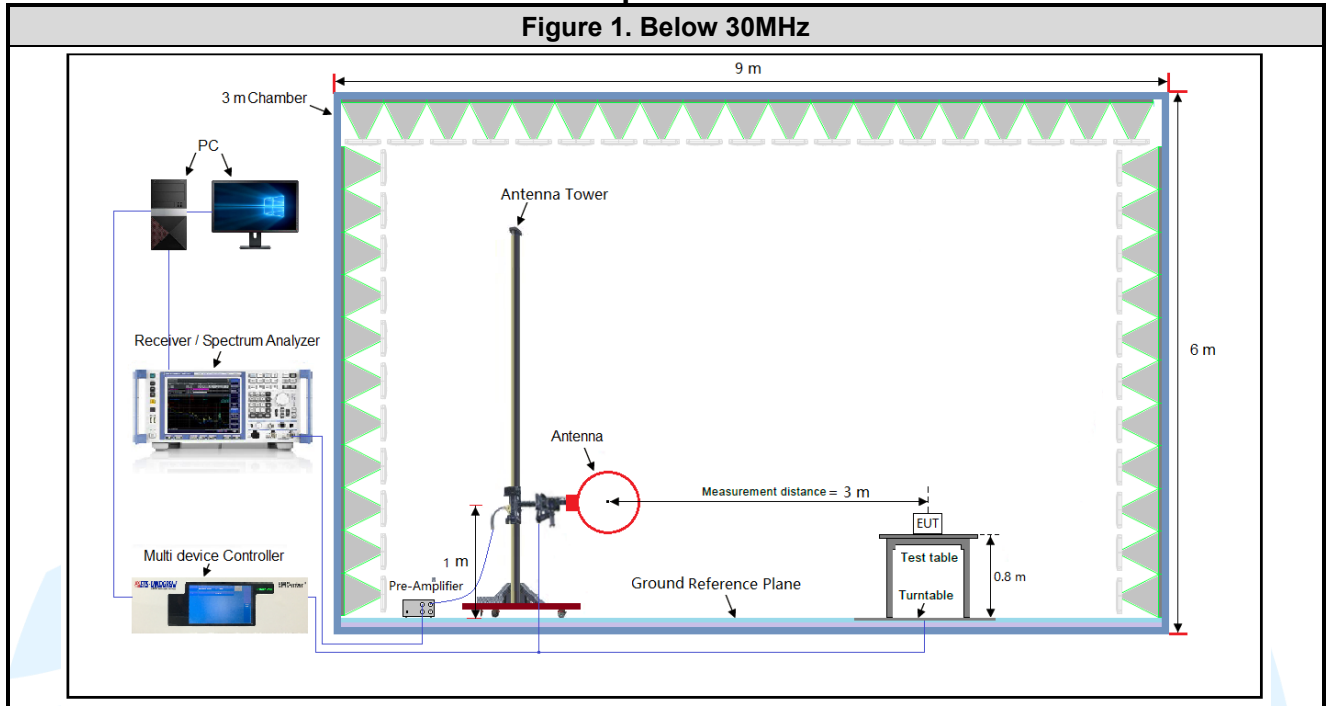
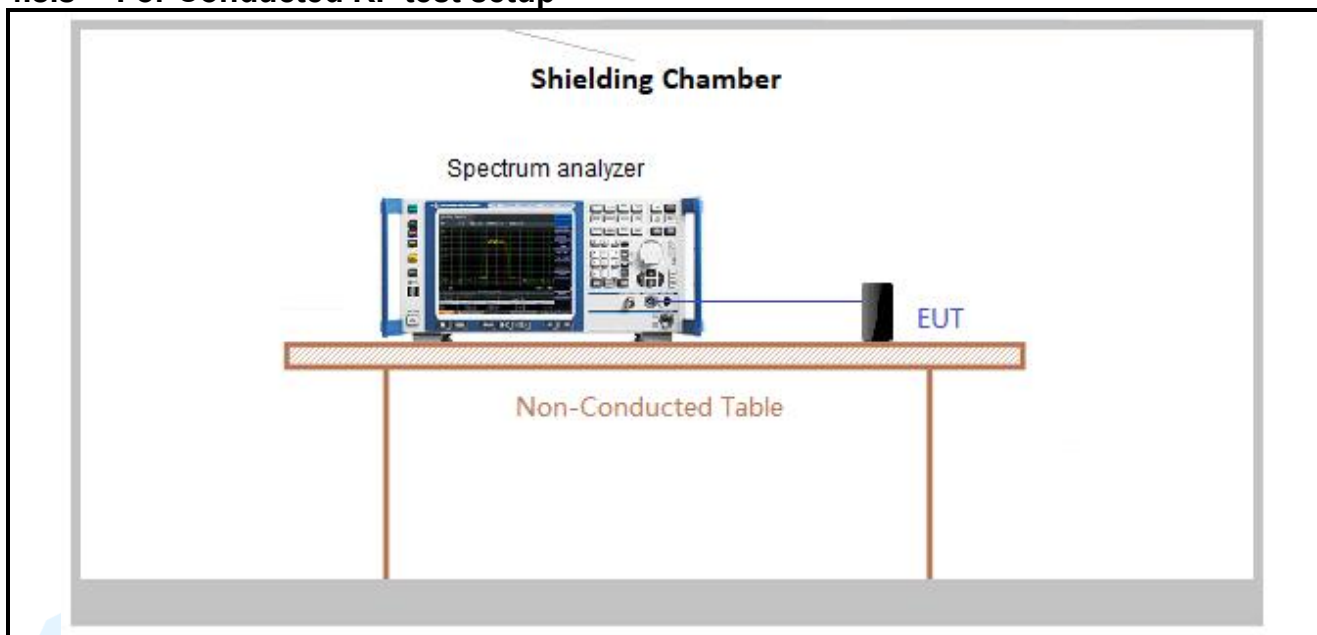


Figure 3. Above 1GHz

The diagram illustrates the experimental setup for measurements above 1 GHz within a 3 m Chamber. The chamber has a width of 9 m and a height of 6 m. The walls are lined with gray pyramidal absorbers. A central Antenna Tower, adjustable from 1 m to 4 m, holds a Horn Antenna. A Pre-Amplifier is connected to the antenna. The measurement distance is 3 m. The Under-Electronics Test (EUT) is placed on a Test table (1.5 m high) which sits on a Turntable. A Ground Reference Plane is also shown. The setup is connected to a PC, a Receiver / Spectrum Analyzer, and a Multi device Controller.

The diagram illustrates the experimental setup within a Shielding Room. On the left, a control station on a table includes a PC, a Receiver, and a Pulse Limiter. A Ground Reference Plane is indicated below this station. The test area features a Test table with two EUT/AE units and a PSU. The units are spaced 10 cm apart, and the PSU is 10 cm from the second EUT/AE. The Test table is 40 cm high and is insulated from the floor (Insulation ≤ 0.15 m). Two LISN units (LISN 1 and LISN 2) are connected to the AC Mains and the Test table. The distance from the AC Mains to LISN 1 is 80 cm, and from LISN 2 to the AC Mains is 80 cm. The distance from the AC Mains to the Test table is 40 cm. The distance from the Test table to the control station is 80 cm.

4.5.3 For Conducted RF test setup



4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 11.6.

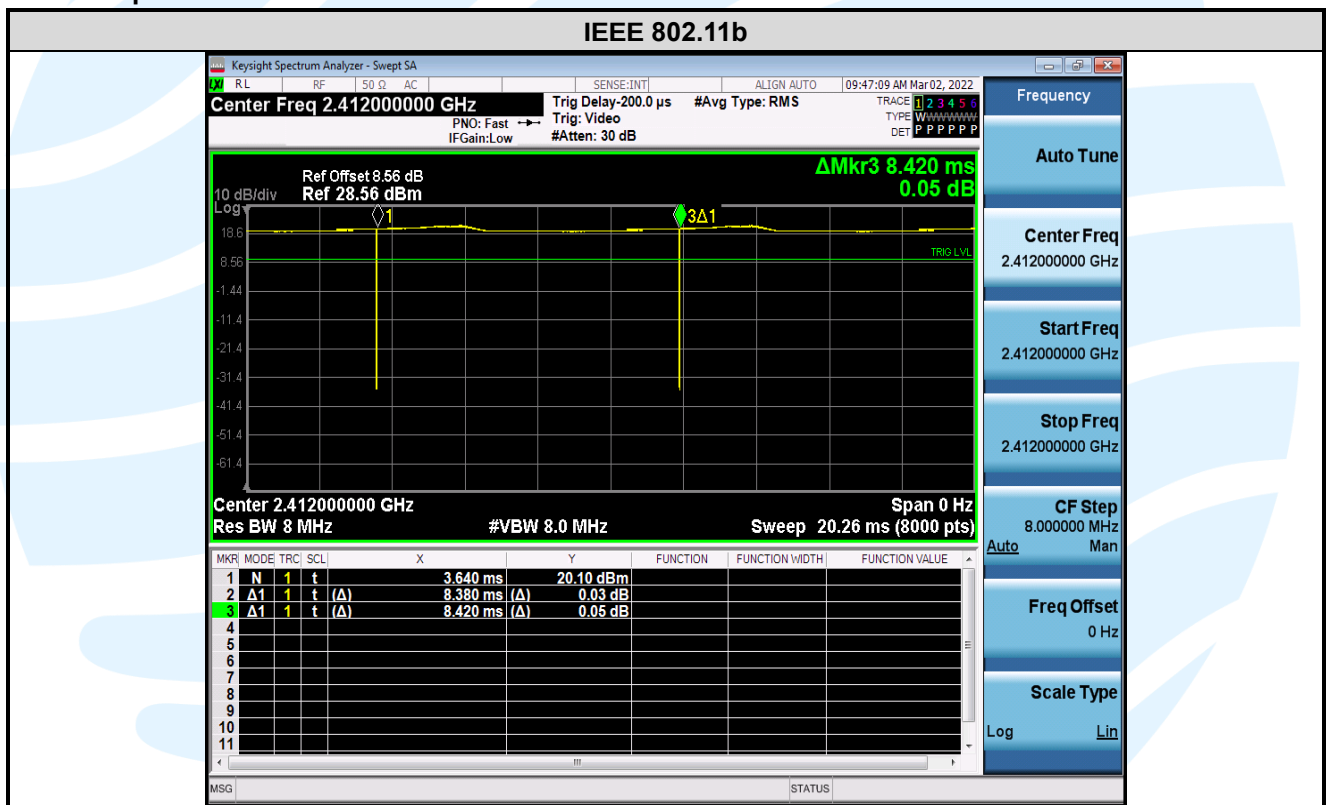
Test Results

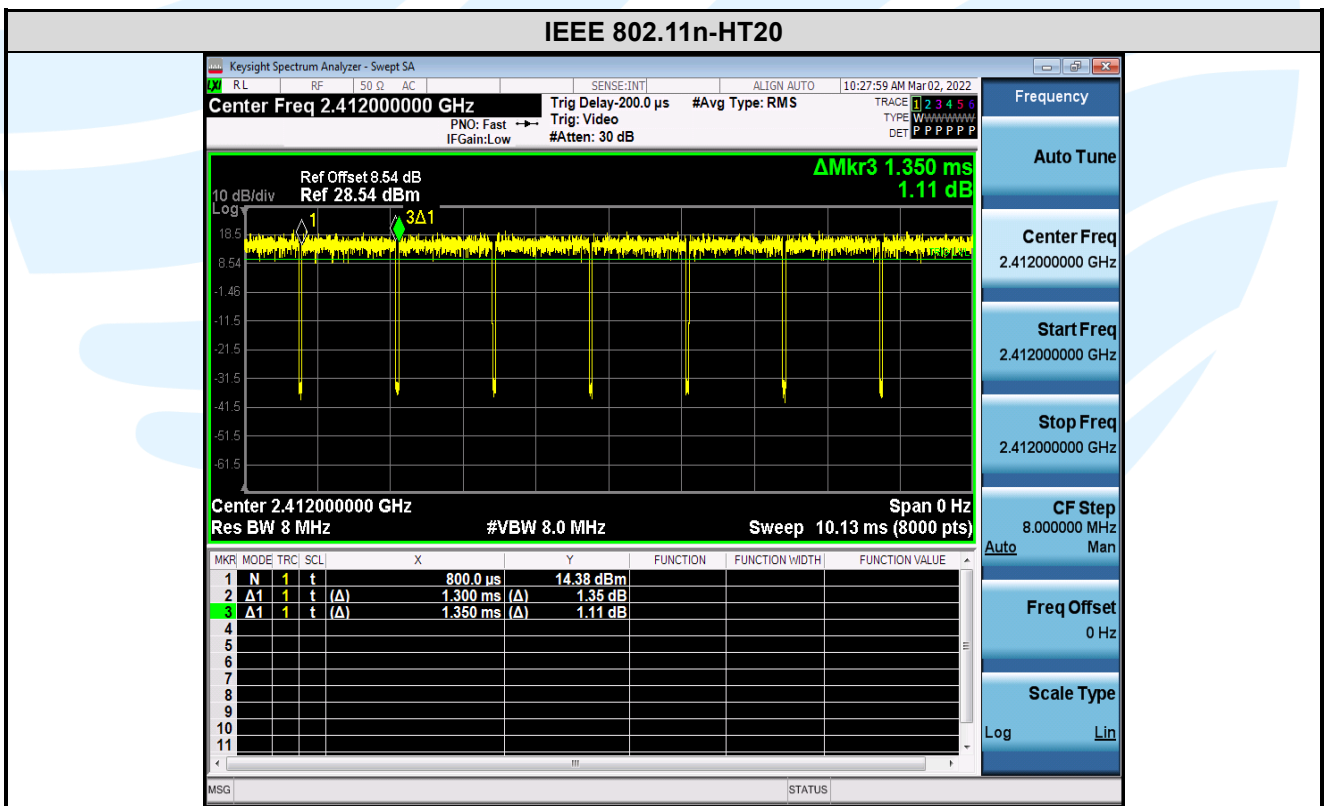
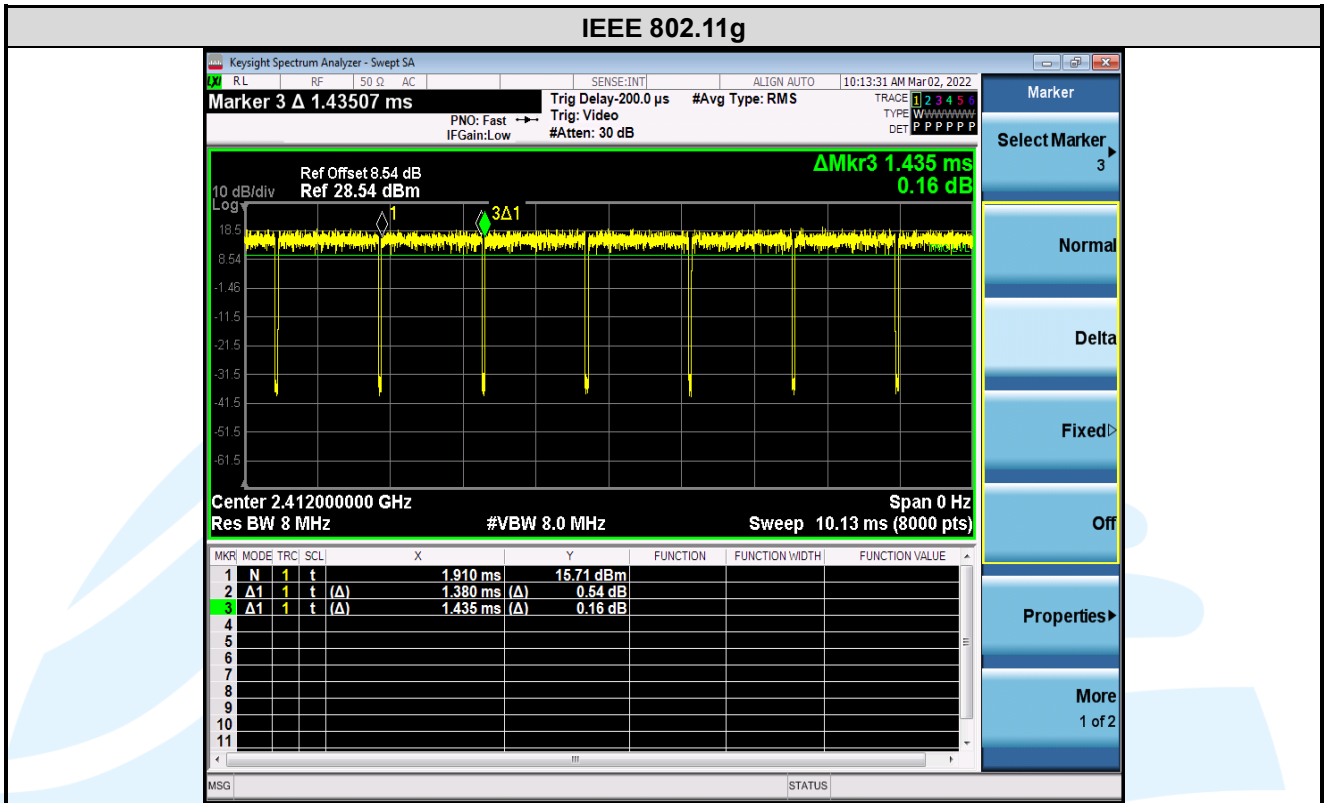
Mode	Data rates (Mbps)	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
IEEE 802.11b	1	8.38	8.42	1.00	99.52	0.00	0.01	-0.04
IEEE 802.11g	6	1.390	1.440	0.97	96.53	0.15	0.72	-0.31
IEEE 802.11n-HT20	MCS8	1.300	1.350	0.96	96.30	0.16	0.77	-0.33
IEEE 802.11n-HT40	MCS8	0.640	0.690	0.93	92.75	0.33	1.56	-0.65

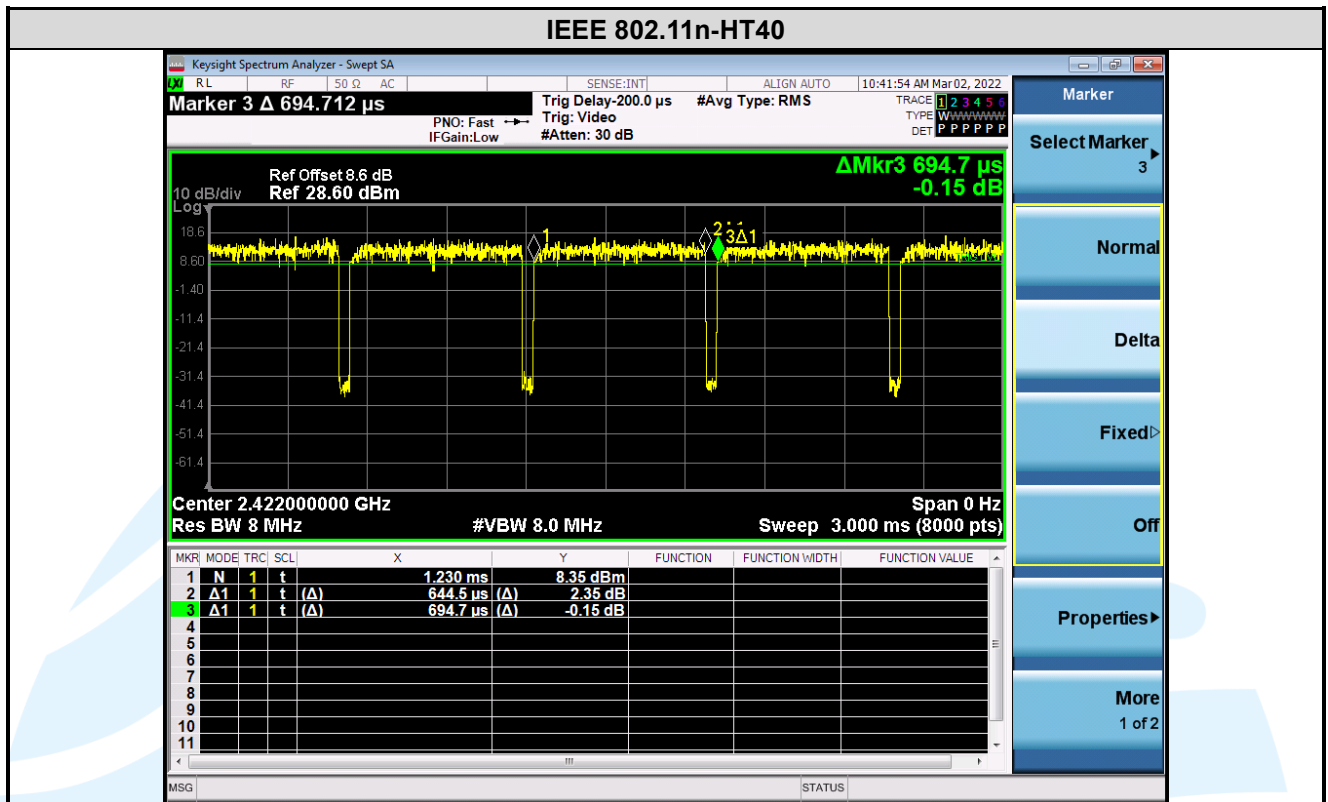
Remark:

- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor = $10 * \log(1/ \text{Duty cycle})$;
- 3) Average factor = $20 \log_{10} \text{Duty Cycle}$.

The test plots as follows







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5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 2	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
6	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. RSS-Gen Issue 5, Section 6.8 requirement: According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. EUT Antenna: Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 3.26 dBi.

5.3 CONDUCTED OUTPUT POWER

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 2, Section 5.4(d)
Test Method:	ANSI C63.10-2013 Clause 11.9.2.2.2
Limit:	For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.
Test Procedure:	Method AVGSA-1 uses trace averaging with the EUT transmitting at full power throughout each sweep. The procedure for this method is as follows: a) Set span to at least 1.5 times the OBW. b) Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz c) Set VBW $\geq [3 \times \text{RBW}]$. d) Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.) e) Sweep time = auto. f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode. g) If transmit duty cycle < 98%, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at the maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no OFF intervals) or at duty cycle $\geq 98\%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run." h) Trace average at least 100 traces in power averaging (rms) mode. i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
Test Setup:	Refer to section 4.5.3 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	Pass

Test Mode	Antenna	Channel	Average power Result [dBm]	EIRP [dBm]	Limit[dBm]	Verdict
IEEE 802.11b	Chain 0	2412	16.09	16.39	≤30	PASS
	Chain 1	2412	16.27	16.47	≤30	PASS
	Chain 0	2437	16.30	16.60	≤30	PASS
	Chain 1	2437	16.52	16.72	≤30	PASS
	Chain 0	2462	16.33	16.63	≤30	PASS
	Chain 1	2462	16.32	16.52	≤30	PASS
IEEE 802.11g	Chain 0	2412	12.45	12.75	≤30	PASS
	Chain 1	2412	12.82	13.02	≤30	PASS
	Chain 0	2437	12.29	12.59	≤30	PASS
	Chain 1	2437	12.58	12.78	≤30	PASS
	Chain 0	2462	12.40	12.70	≤30	PASS
	Chain 1	2462	12.80	13.00	≤30	PASS
IEEE 802.11n-HT20	Chain 0	2412	12.46	12.76	≤30	PASS
	Chain 1	2412	12.64	12.84	≤30	PASS
	Total	2412	15.56	18.82	≤30	PASS
	Chain 0	2437	12.31	12.61	≤30	PASS
	Chain 1	2437	12.39	12.59	≤30	PASS
	Total	2437	15.36	18.62	≤30	PASS
	Chain 0	2462	12.55	12.85	≤30	PASS
	Chain 1	2462	12.62	12.82	≤30	PASS
	Total	2462	15.60	18.86	≤30	PASS
IEEE 802.11n-HT40	Chain 0	2422	12.46	12.76	≤30	PASS
	Chain 1	2422	12.83	13.03	≤30	PASS
	Total	2422	15.66	18.92	≤30	PASS
	Chain 0	2437	12.60	12.90	≤30	PASS
	Chain 1	2437	12.63	12.83	≤30	PASS
	Total	2437	15.63	18.89	≤30	PASS
	Chain 0	2452	12.47	12.77	≤30	PASS
	Chain 1	2452	12.56	12.76	≤30	PASS
	Total	2452	15.53	18.79	≤30	PASS

Note: The maximum ERP/EIRP is calculated from max output power and antenna gain, the antenna gain provided by the customer, and the customer takes all the responsibilities for the accuracy of antenna gain.

Remark:

1. Directional gain and the maximum conducted output power limit see table below:

Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Correlated chains directional gain (dBi)	Output Power Limit (dBm)
2400 MHz to 2483.5 MHz	0.30	0.20	3.26	30.00

Unequal antenna gains, with equal transmit powers. Directional gain is to be computed as follows:

If transmit signals are correlated, then

Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / NANT]$ dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

The test plots as follows:



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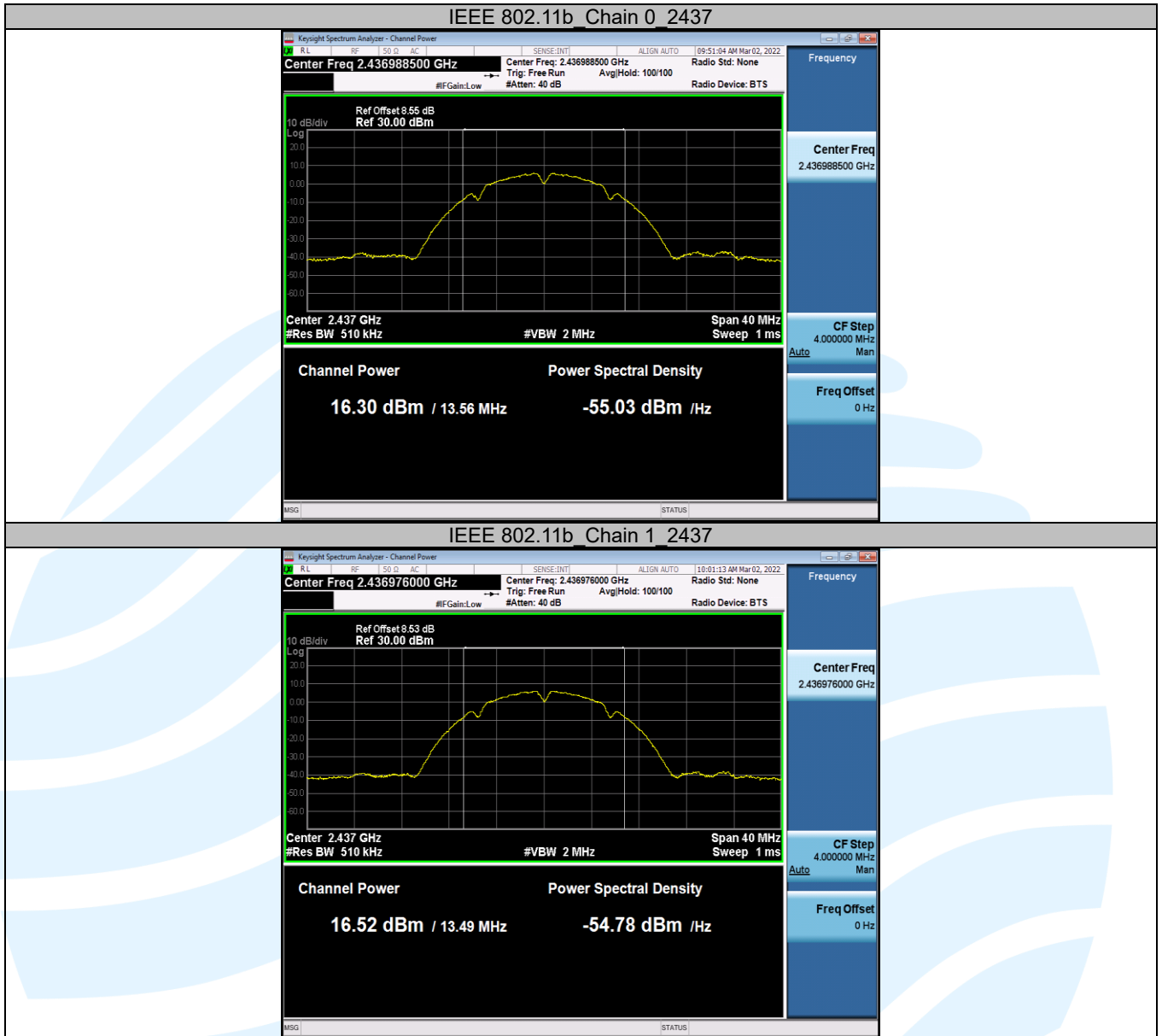
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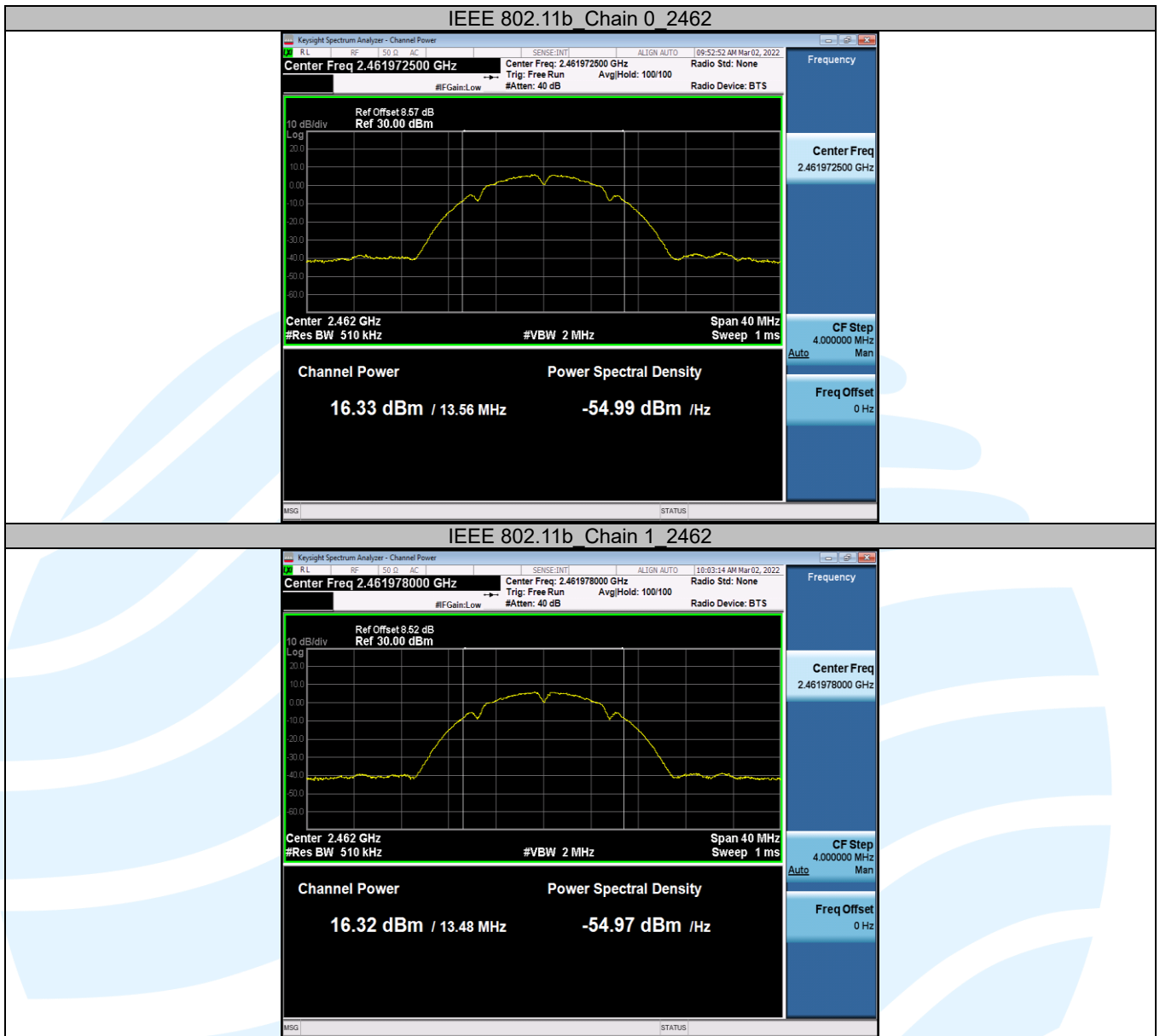
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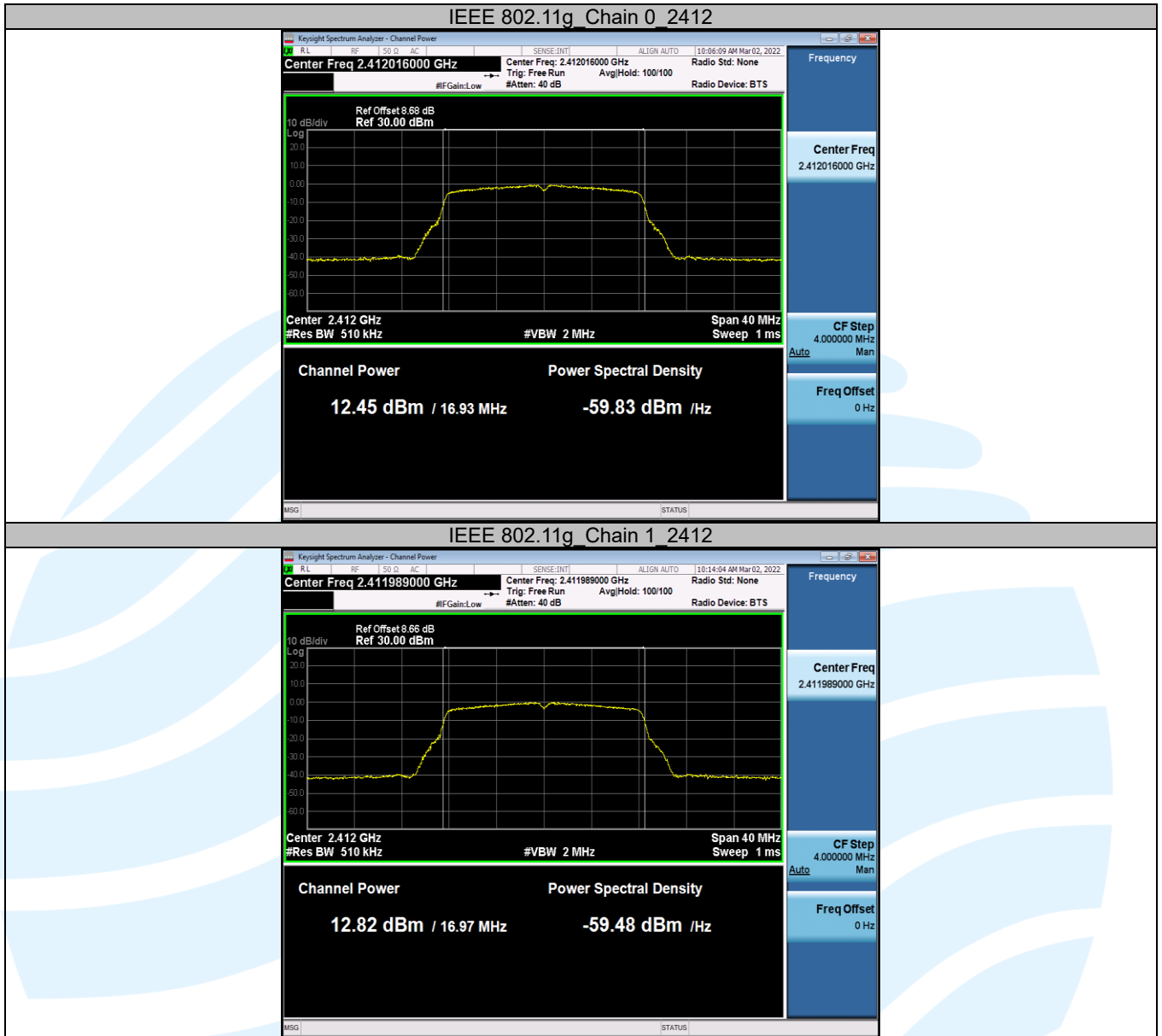
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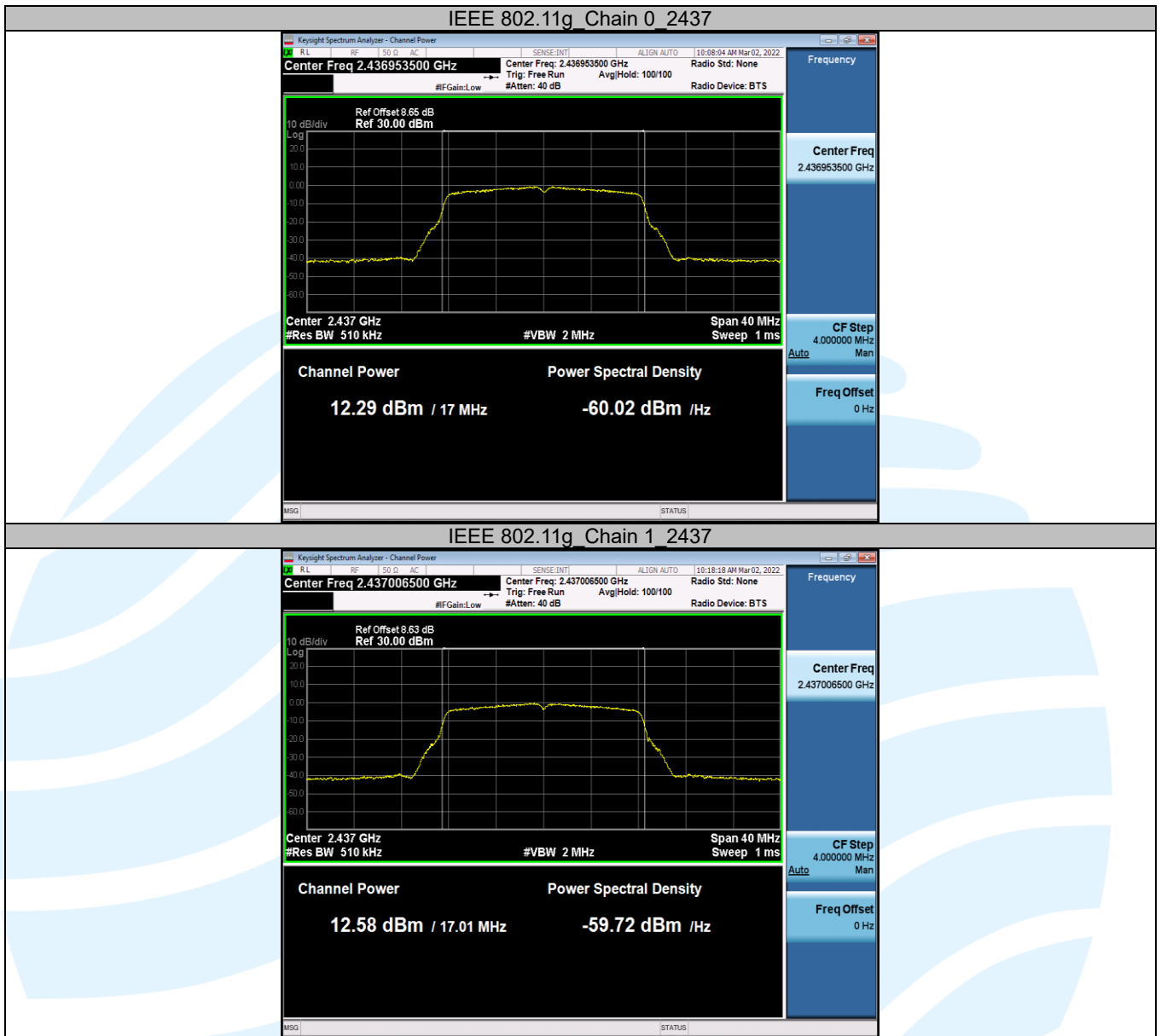
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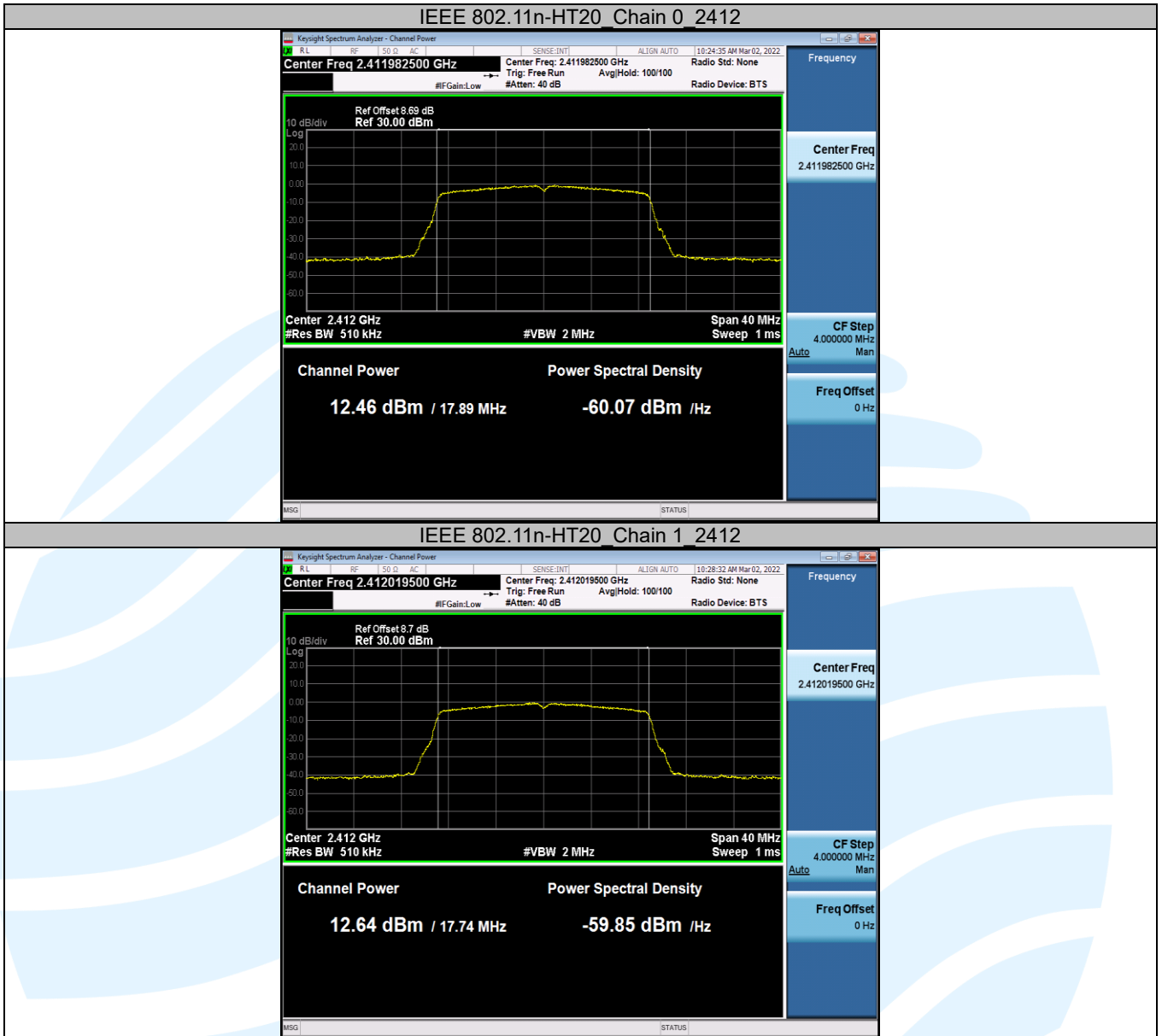


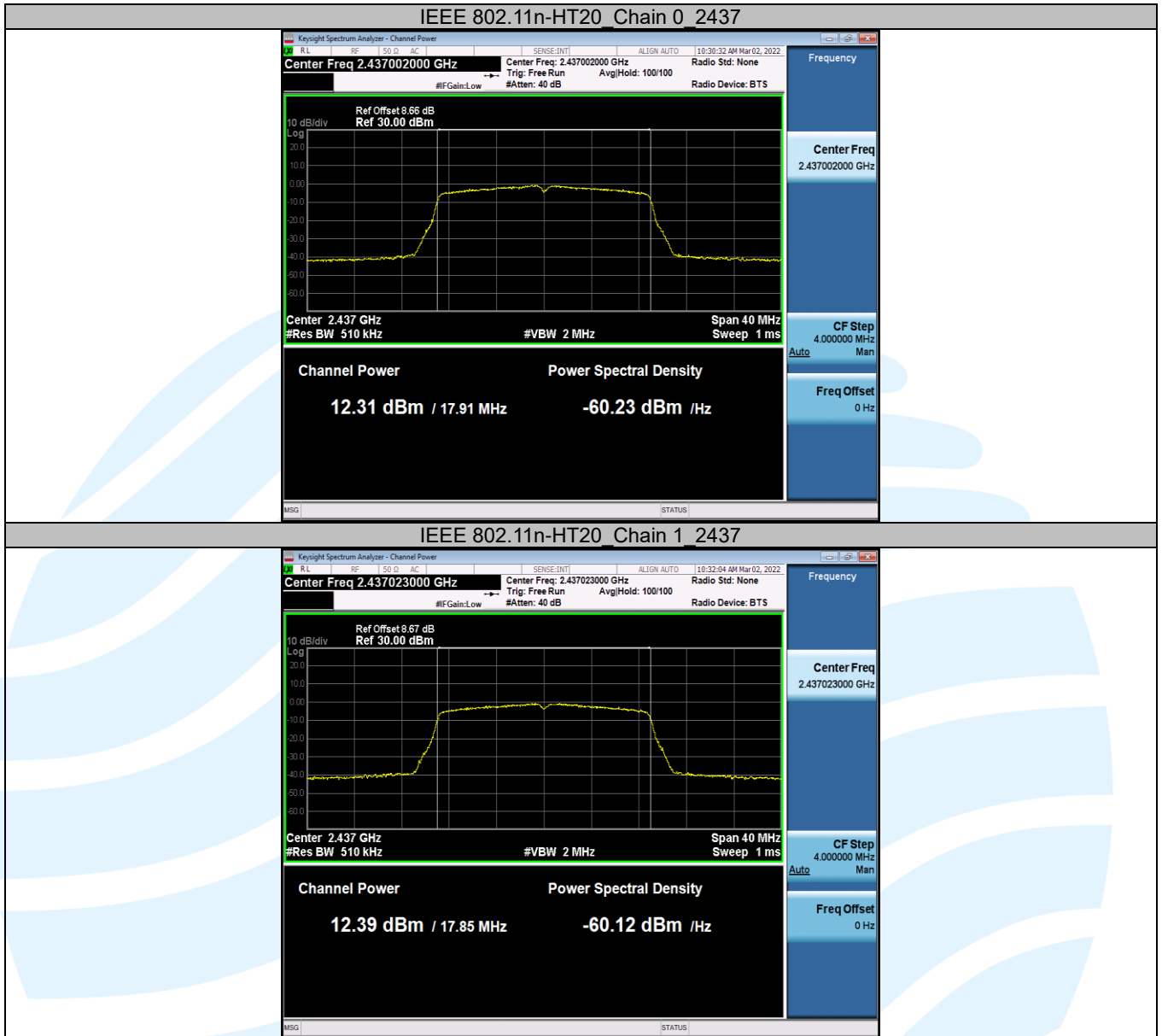


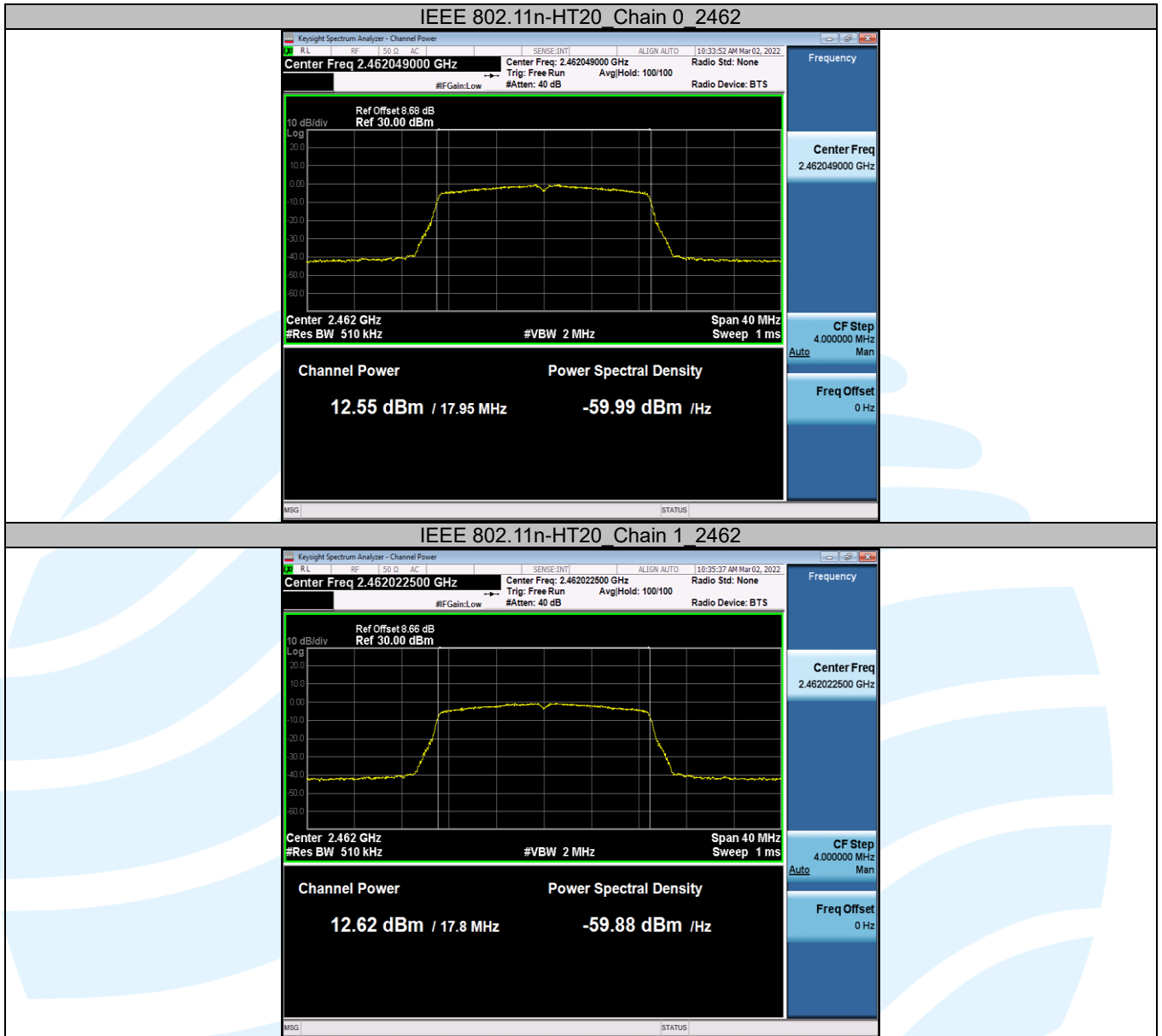


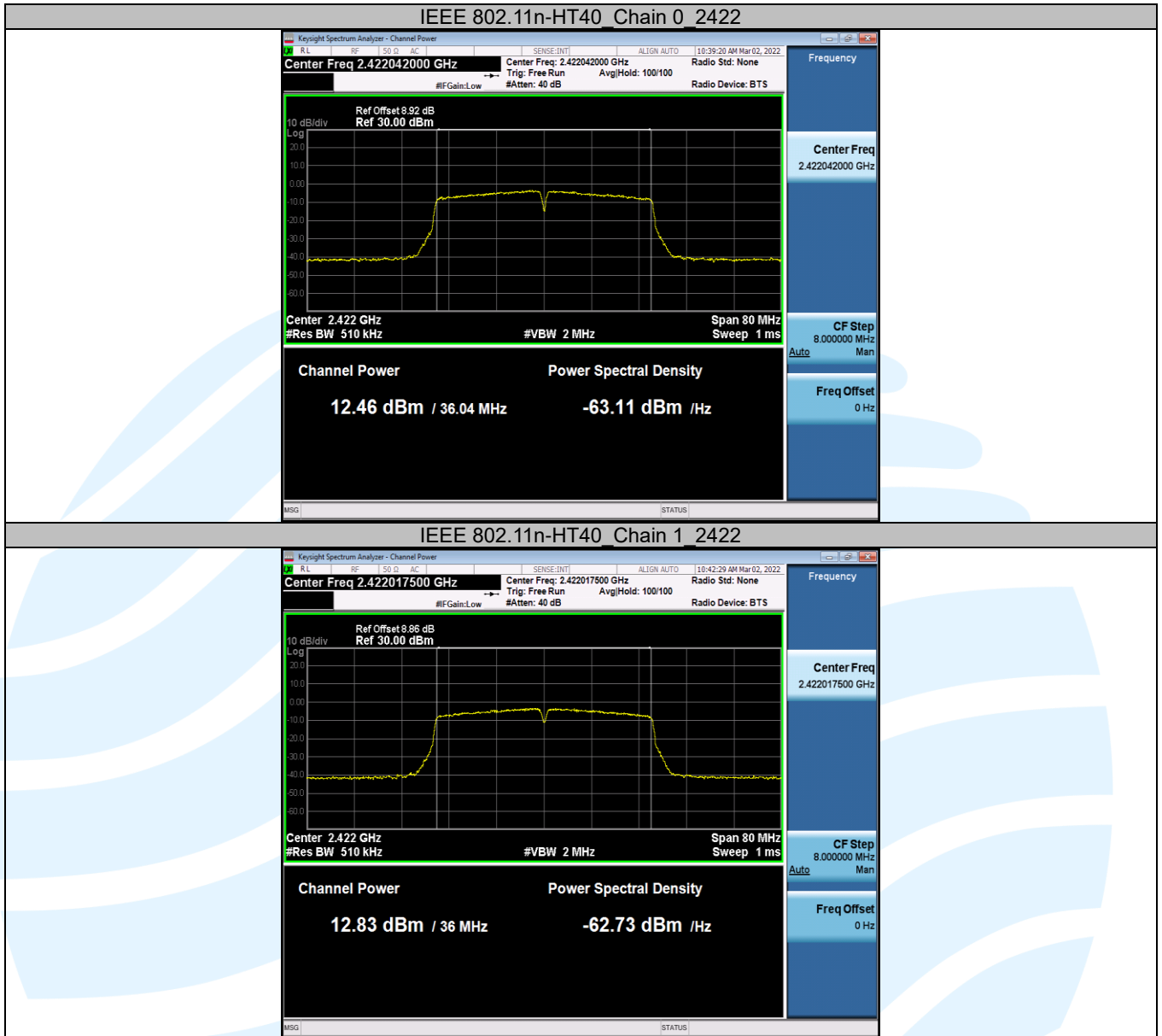


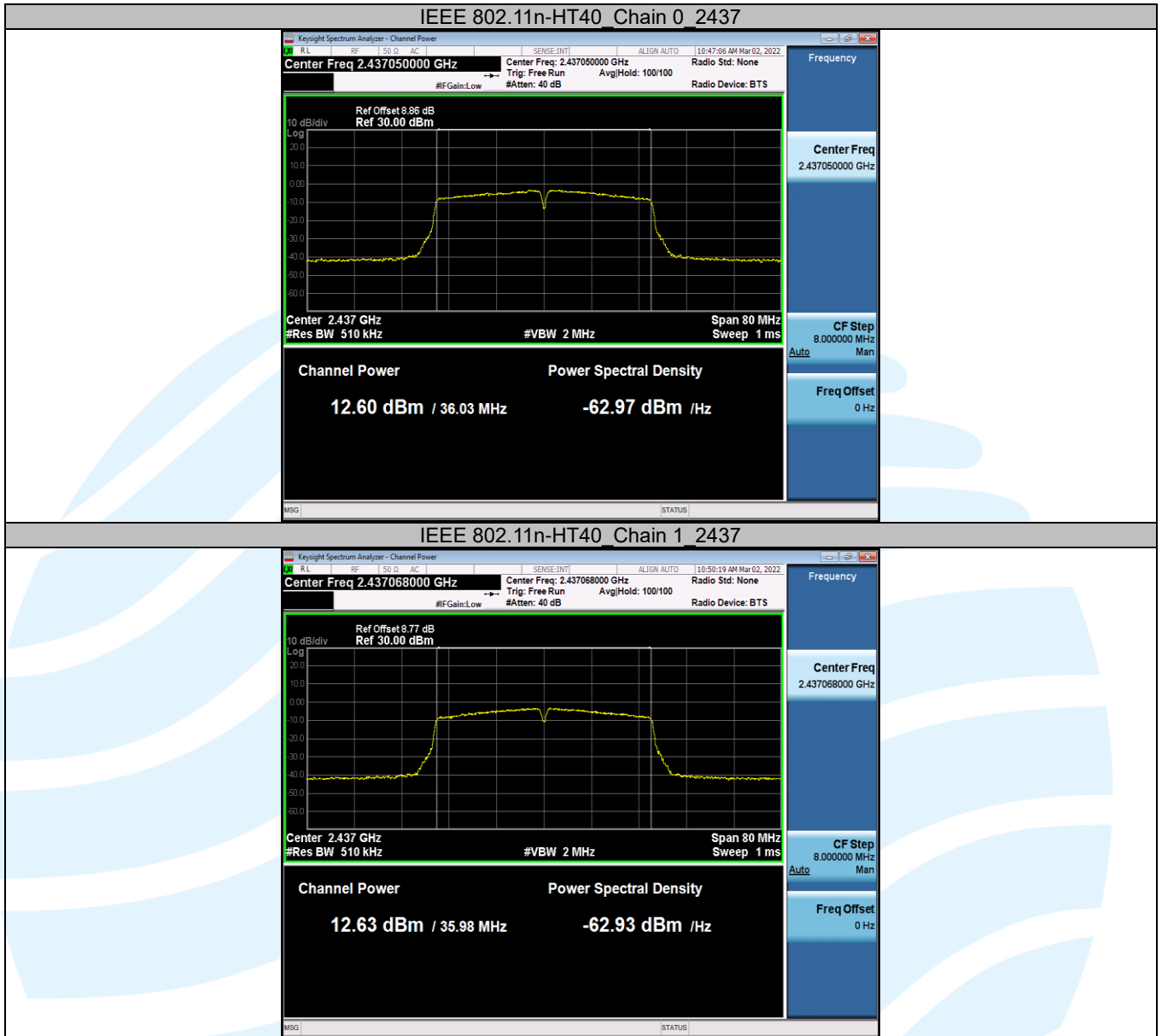


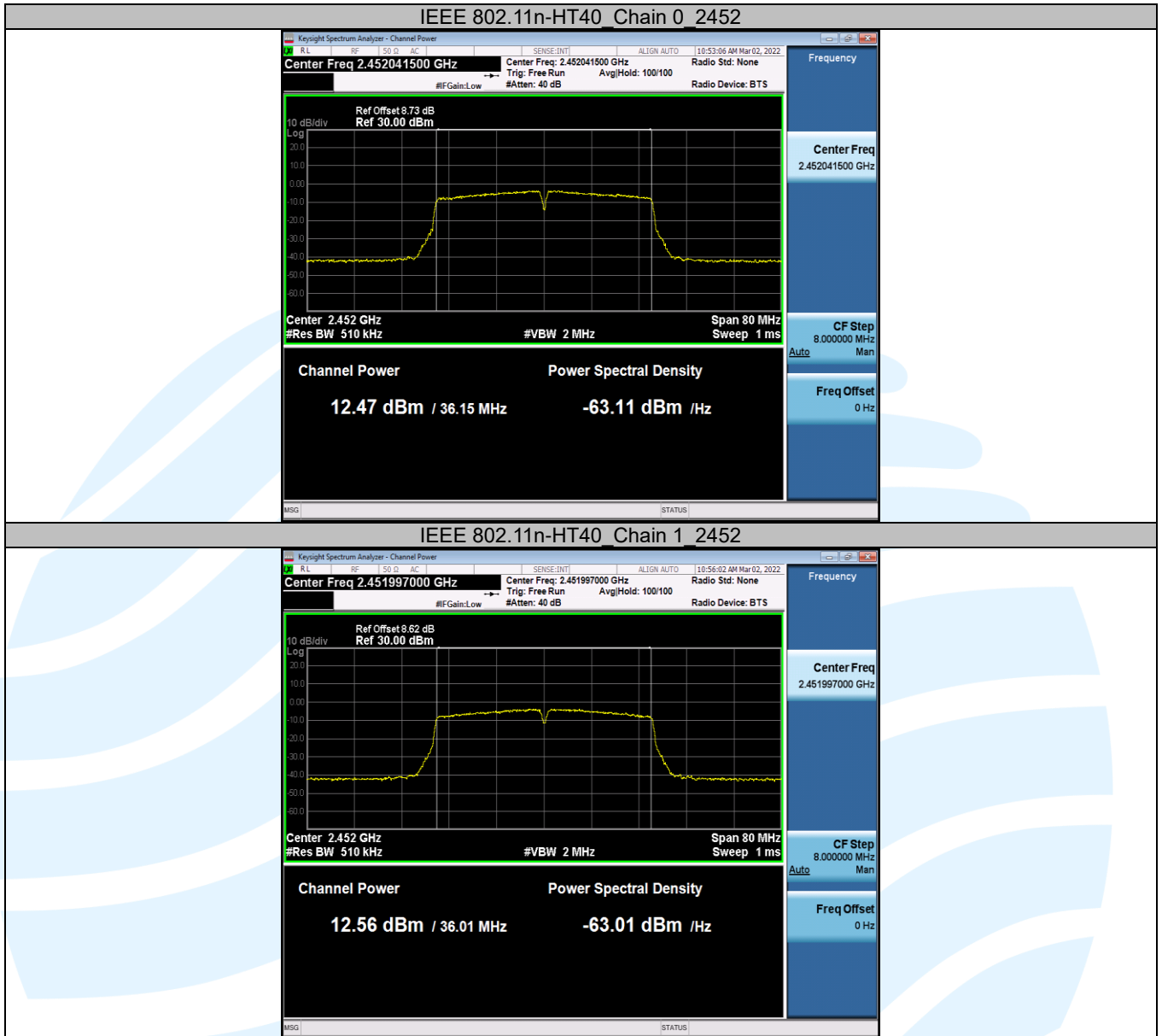












5.46DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 2, Section 5.2(a) RSS-Gen Issue 5, Section 6.7
Test Method:	ANSI C63.10-2013 Clause 11.8.1 RSS-Gen Issue 5, Section 6.7
Limit:	For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings:

6dB Bandwidth

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

- a) Set RBW = 1% to 5% of the occupied bandwidth
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup:	Refer to section 4.5.3 for details.
Instruments Used:	Refer to section 3 for details
Test Results:	Pass

Test Mode	Antenna	Channel	DTS BW [MHz]	DTS BW Limit [MHz]	OCB [MHz]	Verdict
IEEE 802.11b	Chain 0	2412	8.040	≥0.5	13.567	PASS
	Chain 1	2412	8.560	≥0.5	13.478	PASS
	Chain 0	2437	8.520	≥0.5	13.563	PASS
	Chain 1	2437	8.520	≥0.5	13.490	PASS
	Chain 0	2462	8.040	≥0.5	13.559	PASS
	Chain 1	2462	8.600	≥0.5	13.480	PASS
IEEE 802.11g	Chain 0	2412	15.080	≥0.5	16.926	PASS
	Chain 1	2412	15.040	≥0.5	16.968	PASS
	Chain 0	2437	16.280	≥0.5	17.001	PASS
	Chain 1	2437	15.040	≥0.5	17.007	PASS
	Chain 0	2462	15.320	≥0.5	16.990	PASS
	Chain 1	2462	15.240	≥0.5	16.934	PASS
IEEE 802.11n-HT20	Chain 0	2412	15.120	≥0.5	17.891	PASS
	Chain 1	2412	14.400	≥0.5	17.741	PASS
	Chain 0	2437	15.640	≥0.5	17.914	PASS
	Chain 1	2437	15.040	≥0.5	17.850	PASS
	Chain 0	2462	15.040	≥0.5	17.954	PASS
	Chain 1	2462	14.440	≥0.5	17.799	PASS
IEEE 802.11n-HT40	Chain 0	2422	33.760	≥0.5	36.038	PASS
	Chain 1	2422	35.120	≥0.5	35.997	PASS
	Chain 0	2437	32.640	≥0.5	36.030	PASS
	Chain 1	2437	35.040	≥0.5	35.984	PASS
	Chain 0	2452	35.040	≥0.5	36.145	PASS
	Chain 1	2452	35.120	≥0.5	36.012	PASS

The test plots as follows:
DTS Bandwidth



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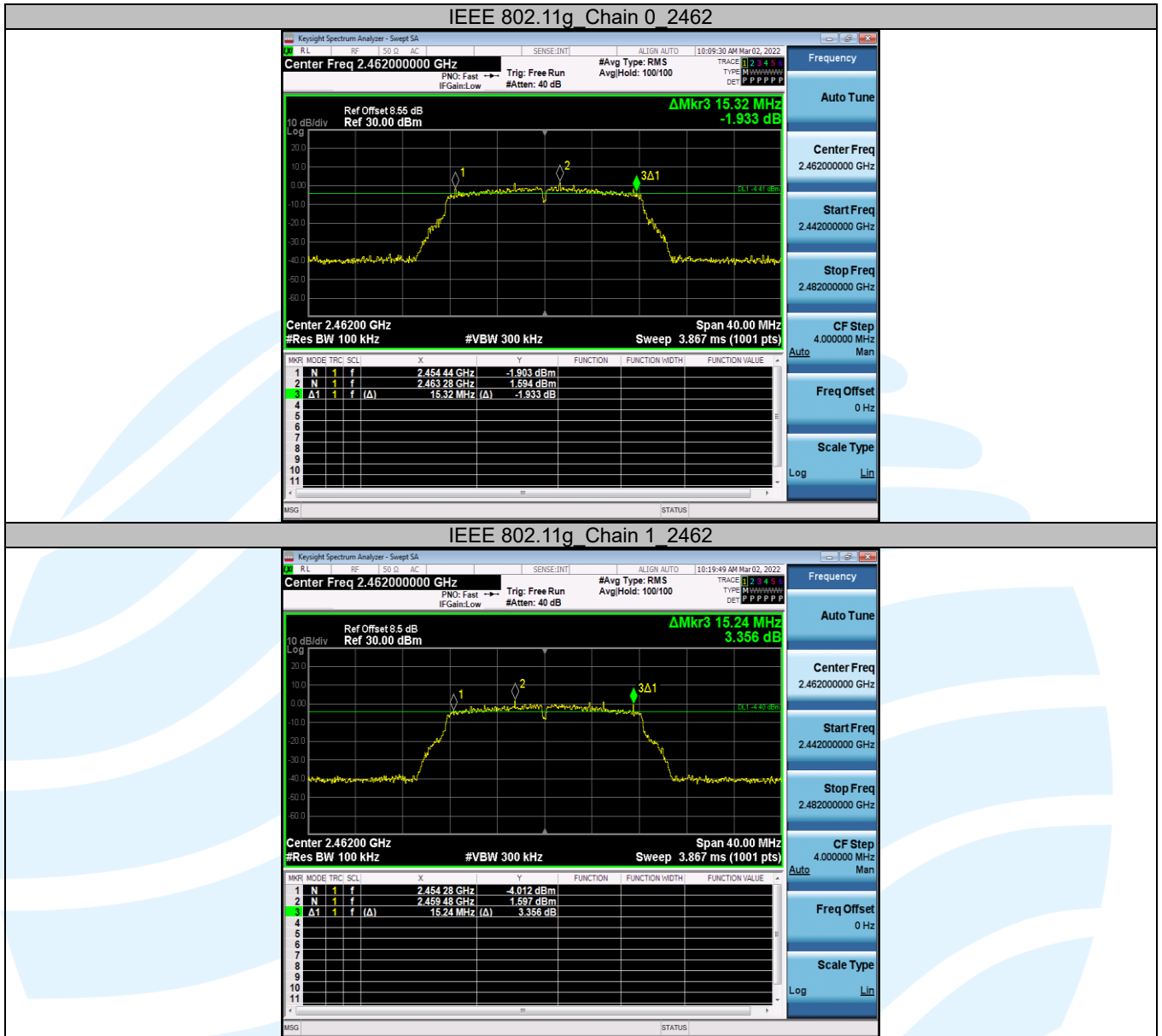
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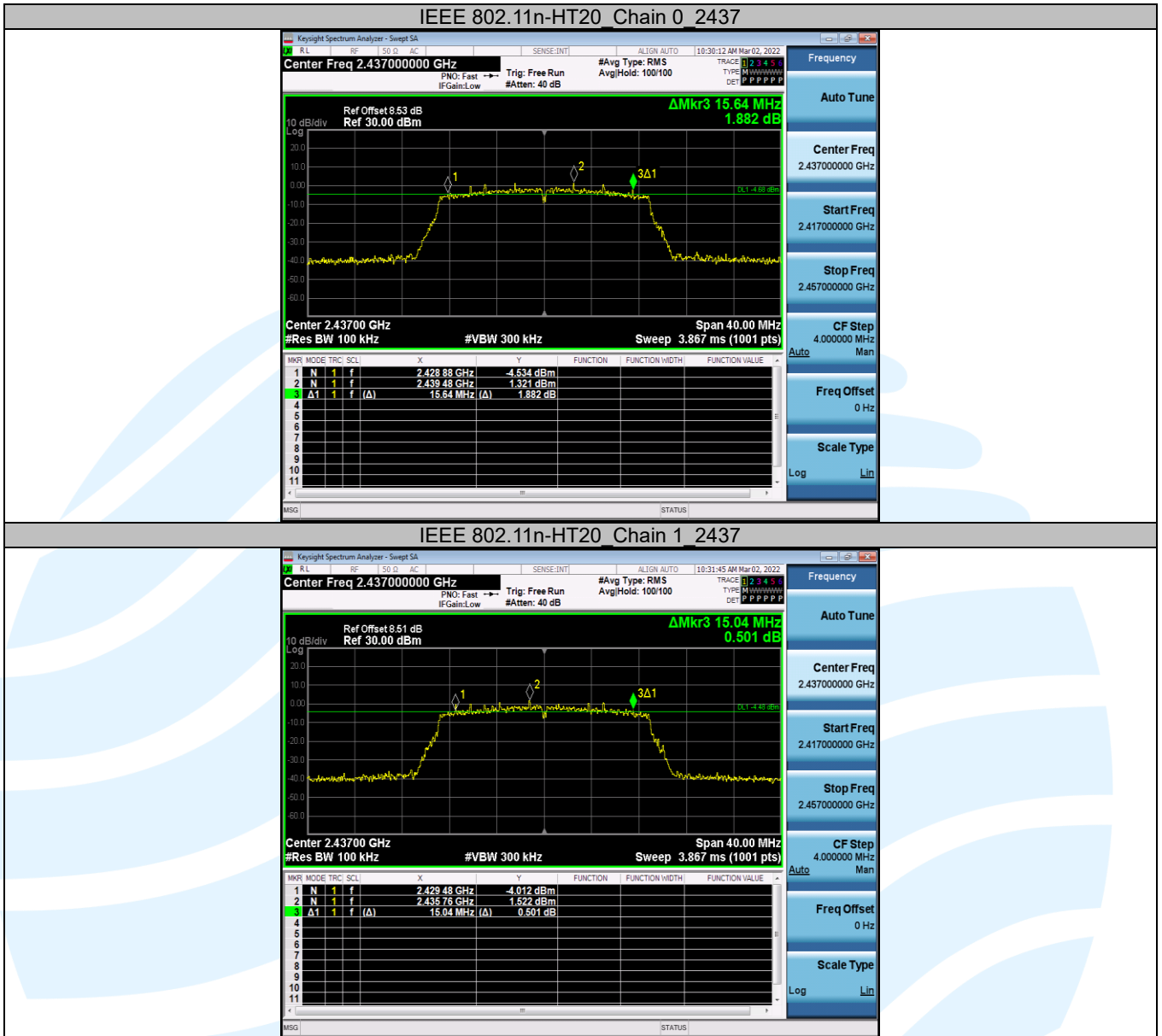
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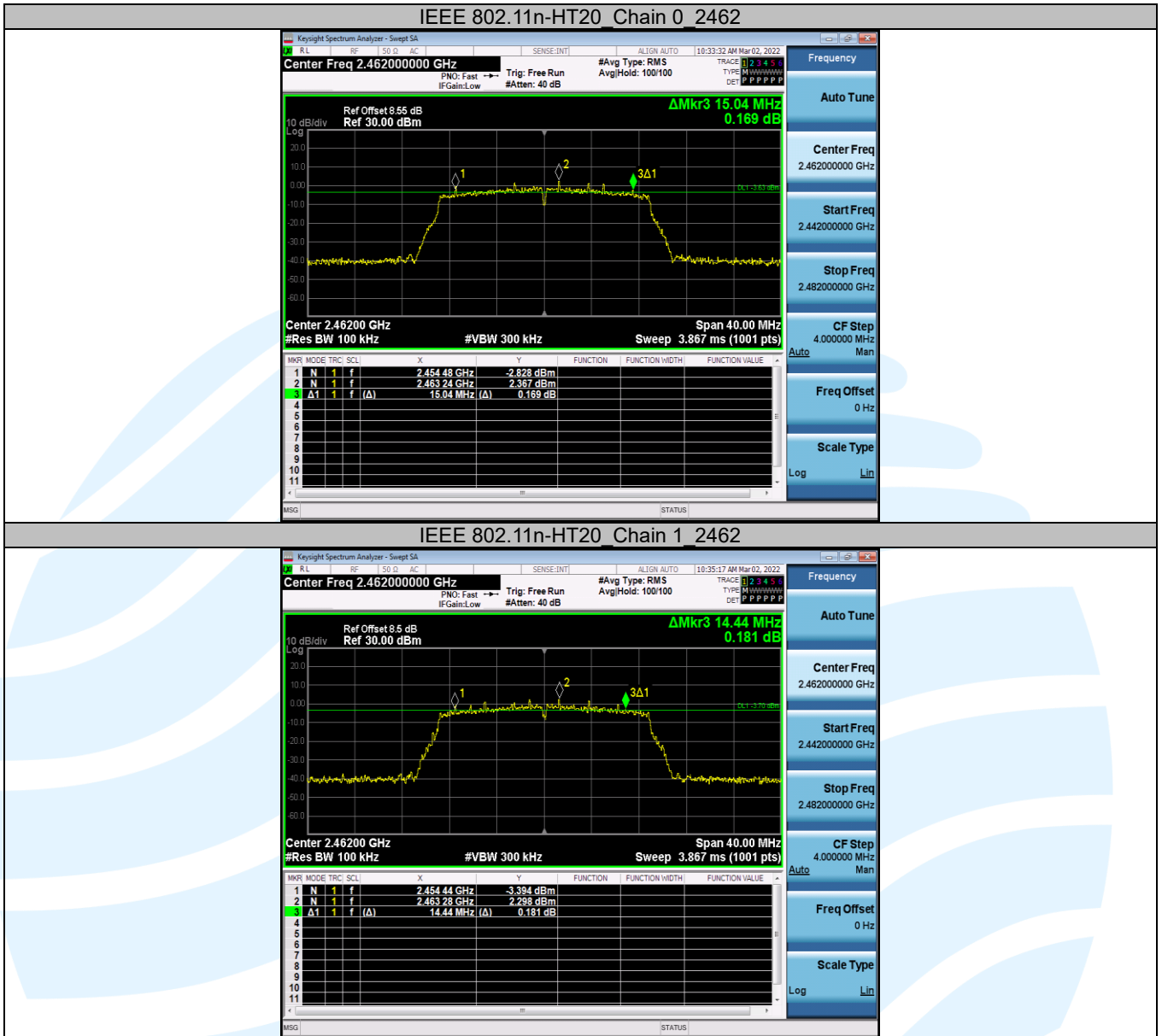
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