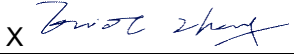


Prüfbericht-Nr.: Test report no.:	CN2130SX 001	Auftrags-Nr.: Order no.:	244329941	Seite 1 von 119 Page 1 of 119
Kunden-Referenz-Nr.: Client reference no.:	2113503	Auftragsdatum: Order date:	2021-05-08	
Auftraggeber: Client:	SHINING 3D Tech. Co., Ltd. No.1398 Xiangbin Rd., Wenyan St., Xiaoshan District, Hangzhou, China			
Prüfgegenstand: Test item:	3D Printer			
Bezeichnung / Typ-Nr.: Identification / Type no.:	AccuFab-L4D, AccuFab-L4K FCC ID: 2AMG4-L4DL4K			
Auftrags-Inhalt: Order content:	Complete test			
Prüfgrundlage: Test specification:	FCC CFR47 Part 15, Subpart C Section 15.247 ANSI C63.10: 2013			
Wareneingangsdatum: Date of sample receipt:	2021-07-09			
Prüfmuster-Nr.: Test sample no.:	A003088615-001			
Prüfzeitraum: Testing period:	Refer to test report			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:			genehmigt von: authorized by:	
Datum: Date:	2021-09-24	Ausstellungsdatum: Issue date:		2021-09-24
Stellung / Position:	PE / Hongfei Wu	Stellung / Position:		Reviewer / Elliot Zhang
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT*RESULT: Pass***5.1.2 6dB & 99% BANDWIDTH***RESULT: Pass***5.1.3 PEAK OUTPUT POWER***RESULT: Pass***5.1.4 POWER SPECTRAL DENSITY***RESULT: Pass***5.1.5 CONDUCTED BAND EDGE AND OUT-OF BAND EMISSIONS***RESULT: Pass***5.2.1 CONDUCTED EMISSION***RESULT: Pass***5.3.1 RADIATED BAND-EDGE***RESULT: Pass***5.3.2 RADIATED SPURIOUS EMISSION***RESULT: Pass*

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1. General Remarks

1.1 Complementary Materials

Null.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland (Shanghai) Co., Ltd.

Shanghai TUV Rheinland Building No. 177, 178 Lane 777, West Guangzhong Rd, Jing'an District, Shanghai, China

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 958801.

The Innovation, Science and Economic Development Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 2932F.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Due Date
3m modified semi-anechoic chamber	Frankonia	SAC3	G1811378	2022-06-27
Bilog antenna	Teseq	CBL 6112D	G1811425	2023-03-10
EMI test receiver	Rohde & Schwarz	ESCI	G1811402	2021-09-18
Spectrum analyser	Rohde & Schwarz	FSV40	G1822702	2021-11-01
Preamplifier	Taiwan EMCI	EMC184045SE	G1825372	2023-03-06
Log periodic antenna	Rohde & Schwarz	HL050	G1811417	2023-03-10
Broadband Horn Antenna	Schwarzbeck	BBHA 9170	9170-305	2023-07-09
Preamplifier	Taiwan EMCI	EMC051845SE	G1825371	2023-03-06
Spectrum Analyzer	Keysight	N9020A	MY54500180	2021-09-08
Thermohygrometer	Testo	608-H1	1241320614	2021-10-13
EMI test receiver	R&S	ESIB26	G1811380	2023-03-06
Artificial main network	R&S	ENV432	G1830003	2022-11-01
EMC measurement software	R&S	EMC32 (Ver 10.20.01)	G1824845	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	9kHz – 30MHz	±2.93dB
	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a 3D printer which supports Wi-Fi function.

For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Description of EUT	
Product Name:	3D Printer
Model No.:	AccuFab-L4D, AccuFab-L4K
Operating Voltage:	AC 100~240V, 50/60Hz
Test Voltage:	DC 24V for Radio Conducted test AC 120V/60Hz for Conducted Emission and Spurious Emission test
Technical Specification of Wi-Fi	
Frequency Range:	2412~2462 MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g/n-HT20: OFDM (QPSK/BPSK/16QAM/64QAM)
Date Rate:	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 72.2Mbps
Antenna Type:	PCB Antenna
Antenna Gain:	1 dBi (Provided by the Client)

Note:

The difference between the two model is color of lens hood which will not impact on RF performance.

So, AccuFab-L4D was choosen for the test.

3.3 Independent Operation Modes

Table 4: Independent Operation Modes

Test Mode	Operating Mode	Channel Number	Channel Frequency [MHz]
TM1	802.11b	1	2412
TM2	802.11b	6	2437
TM3	802.11b	11	2462
TM4	802.11g	1	2412
TM5	802.11g	6	2437
TM6	802.11g	11	2462
TM7	802.11n-HT20	1	2412
TM8	802.11n-HT20	6	2437
TM9	802.11n-HT20	11	2462
TM10	Normal Operating Mode		

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software used: SecureCRT

Table 5: Power parameter value

Operating Mode	Channel Frequency [MHz]	Power Parameter Value	Operating Mode	Channel Frequency [MHz]	Power Parameter Value
802.11b	2412	38	802.11n-HT20	2412	35
	2437	38		2437	35
	2462	38		2462	35
802.11g	2412	35	-	-	-
	2437	35		-	-
	2462	35		-	-

4.3 Special Accessories and Auxiliary Equipment

Null.

4.4 Countermeasures to achieve EMC Compliance

Null.

5. Test Results

5.1 Conducted Testing at Antenna Port

5.1.1 Antenna Requirement

RESULT:**Pass**

According to the manufacturer declared, the EUT has one PCB antenna, the directional gain of antenna is 1 dBi and the antenna is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Table 6: Antenna Requirement**FCC 15.203 – Antenna Requirement 1**

Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	Antenna type:	PCB antenna
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2

Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.	
Results:	Only one PCB antenna can be used	
Verdict:	Pass	

RSS-Gen 6.4 – External Control

Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the regulatory requirements, including RSS-Gen and the applicable RSSs	
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	PASS	

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RSS-Gen 6.8 – Antenna Requirement

Requirement: When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

Results:

a) Antenna Type:	PCB Antenna
b) Manufacture:	N/A
c) Model No.:	N/A
d) Gain with reference to an isotropic radiator:	1 dBi

Verdict: PASS

5.1.2 6dB & 99% Bandwidth**RESULT:****Pass**

Date of testing : 2021-08-03
Ambient temperature : 22.9°C
Relative humidity : 56.1%
Atmospheric pressure : 101kPa
Test requirement : FCC Part 15.247(a)(2)
RSS-247 Issue 2, February 2017, Clause 5.2(a)
Test procedure : ANSI C63.10: 2013
Test voltage : DC 24V
Test modes applied : TM1 to TM9

Table 7: 6dB & 99% Bandwidth

Test Mode	Data rate/ MCS	CH.	Freq. [MHz]	6dB Bandwidth [MHz]	6dB Bandwidth limit [kHz]	99% Bandwidth [MHz]
TM1	1Mbps	1	2412	10.06	≥500	14.954
TM2	1Mbps	6	2437	10.07	≥500	14.961
TM3	1Mbps	11	2462	10.06	≥500	14.975
TM4	6Mbps	1	2412	16.37	≥500	16.889
TM5	6Mbps	6	2437	16.38	≥500	16.866
TM6	6Mbps	11	2462	16.38	≥500	16.904
TM7	MCS0	1	2412	17.53	≥500	17.853
TM8	MCS0	6	2437	17.58	≥500	18.010
TM9	MCS0	11	2462	17.56	≥500	18.015

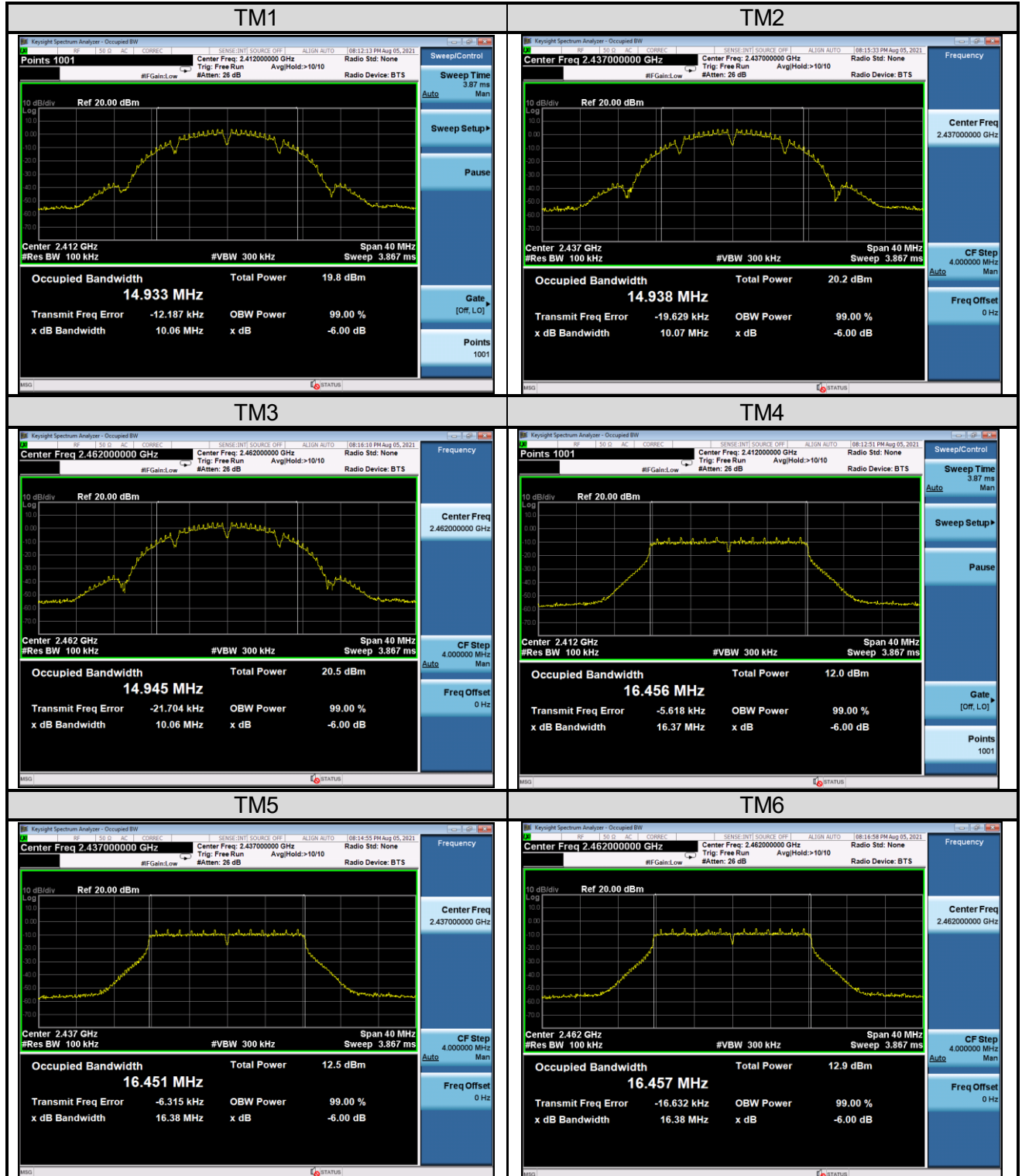
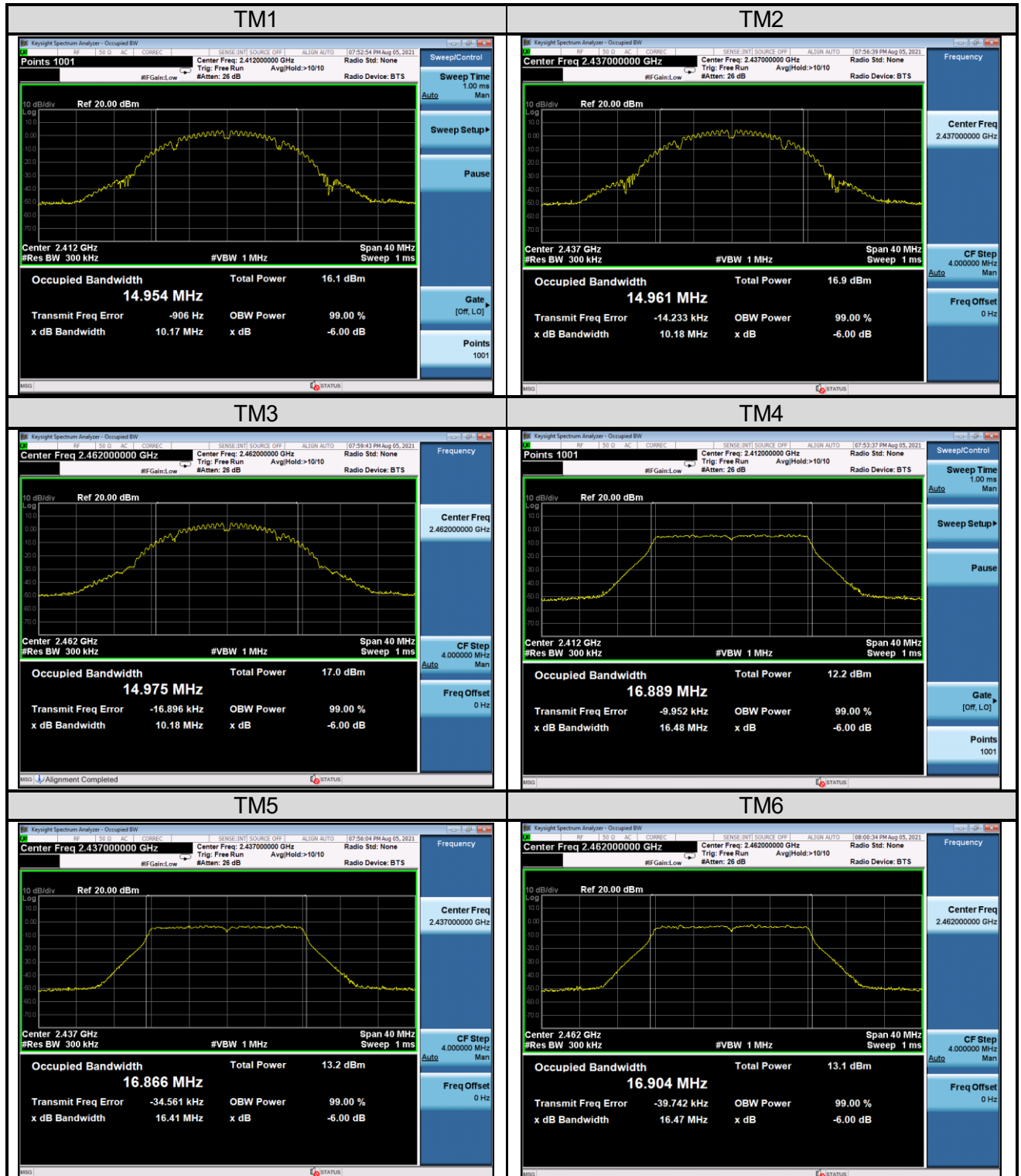
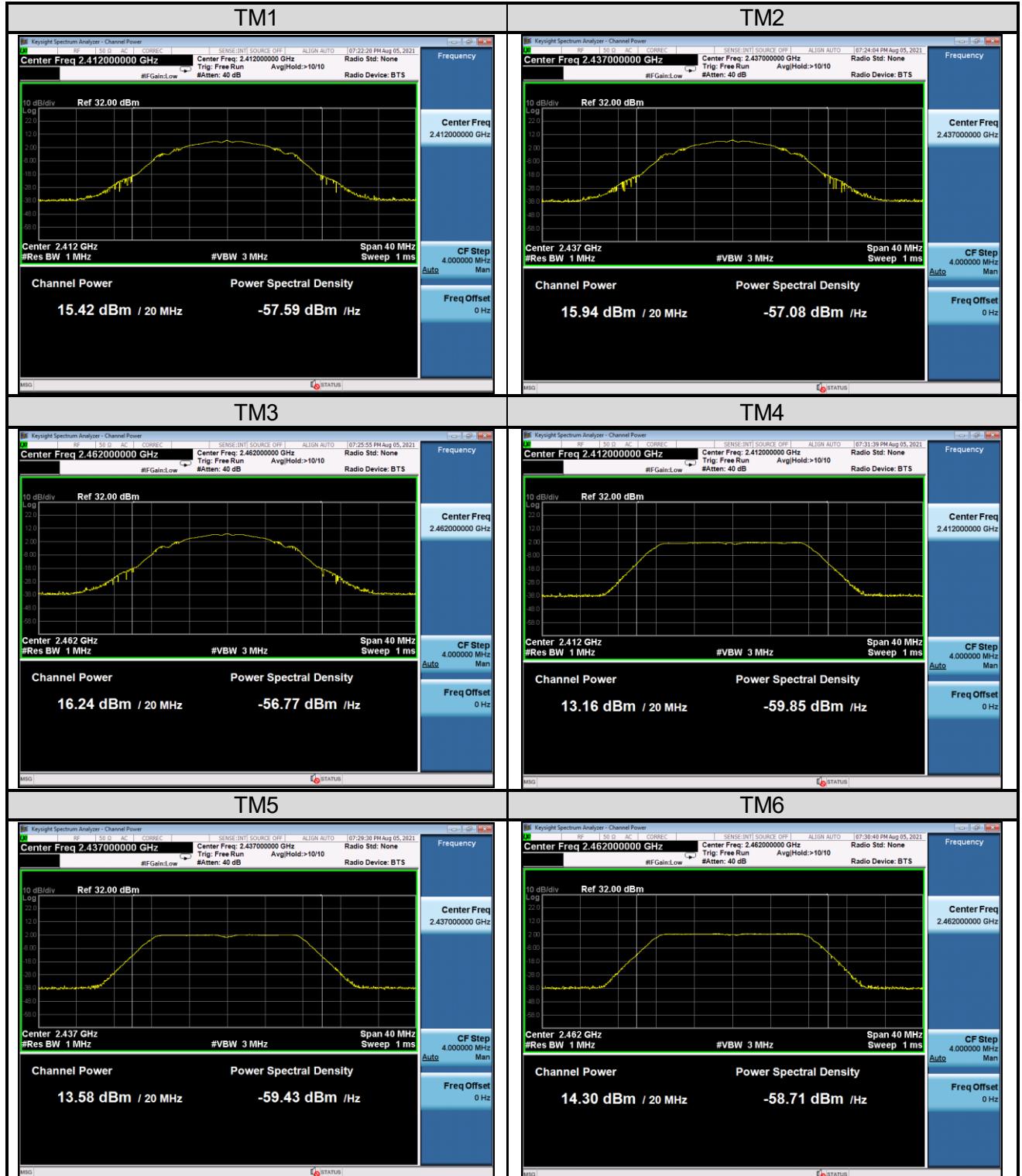
Figure 1: 6dB Bandwidth




Figure 2: 99% Bandwidth




The cable loss=1dB was provided by the client, and was factored in the result Peak Conducted Output Power

Figure 3: Peak Output Power, TM1 to TM9




5.1.4 Power Spectral Density

RESULT:

Pass

Date of testing	: 2021-08-03
Ambient temperature	: 22.9°C
Relative humidity	: 56.1%
Atmospheric pressure	: 101kPa
Test requirement	: FCC Part 15.247(e) RSS-247 Issue 2, February 2017, Clause 5.2(b)
Test procedure	: ANSI C63.10: 2013
Test voltage	: DC 24V
Test modes applied	: TM1 to TM9

Table 9: Power Spectral Density

Mode	Data rate/ MCS	CH.	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]
TM1	1Mbps	1	2412	-9.803	8
TM2	1Mbps	6	2437	-8.937	8
TM3	1Mbps	11	2462	-8.808	8
TM4	6Mbps	1	2412	-19.536	8
TM5	6Mbps	6	2437	-19.682	8
TM6	6Mbps	11	2462	-17.392	8
TM7	MCS0	1	2412	-19.104	8
TM8	MCS0	6	2437	-17.457	8
TM9	MCS0	11	2462	-17.921	8