

Ecovacs Home Service Robotics Co., Ltd.

RF TEST REPORT

Report Type:

FCC Part 15.247 & ISSED RSS-247 RF report

MODEL:

WG841-01

REPORT NUMBER:

2410B0917SHA-002

ISSUE DATE:

November 18, 2024

DOCUMENT CONTROL NUMBER:

TTRF15.247-02_V1 © 2018 Intertek



Applicant: Ecovacs Home Service Robotics Co., Ltd.
No.518 Songwei Road, Wusongjiang industry Park, Guoxiang Street,
Wuzhong District, Suzhou, Jiangsu, China.

Manufacturer: Ecovacs Home Service Robotics Co., Ltd.
No.518 Songwei Road, Wusongjiang industry Park, Guoxiang Street,
Wuzhong District, Suzhou, Jiangsu, China.

Factory 1: Ecovacs Robotics Co., Ltd.
No.518 Songwei Road, Wusongjiang industry Park, Guoxiang Street,
Wuzhong District, Suzhou, Jiangsu, China

Factory 2: Ecovacs Home Service Robotics Co., Ltd.
No.518 Songwei Road, Wusongjiang industry Park, Guoxiang Street,
Wuzhong District, Suzhou, Jiangsu, China.

FCC ID: 2A64B-WG841

IC: 28593-WG841

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2023): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2020): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-247 Issue 3 (August 2023): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 5 (March 2019) Amendment1: General Requirements for Compliance of Radio Apparatus

PREPARED BY:**REVIEWED BY:**

Project Engineer
Sky Yang



Reviewer
Wakeyou Wang

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

TEST REPORT

Content

REVISION HISTORY.....	5
MEASUREMENT RESULT SUMMARY	6
1 GENERAL INFORMATION	7
1.1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	7
1.2 TECHNICAL SPECIFICATION	7
1.3 DESCRIPTION OF TEST FACILITY	8
2 TEST SPECIFICATIONS.....	9
2.1 STANDARDS OR SPECIFICATION	9
2.2 MODE OF OPERATION DURING THE TEST	9
2.3 TEST SOFTWARE LIST	10
2.4 TEST PERIPHERALS LIST	10
2.5 TEST ENVIRONMENT CONDITION:	10
2.6 INSTRUMENT LIST	11
2.7 MEASUREMENT UNCERTAINTY	12
3 MINIMUM 6DB BANDWIDTH.....	13
3.1 LIMIT.....	13
3.2 MEASUREMENT PROCEDURE.....	13
3.3 TEST CONFIGURATION	13
3.4 TEST RESULTS OF MINIMUM 6dB BANDWIDTH	13
4 MAXIMUM CONDUCTED OUTPUT POWER AND E.I.R.P.....	14
4.1 LIMIT.....	14
4.2 MEASUREMENT PROCEDURE.....	14
4.3 TEST CONFIGURATION	14
4.4 TEST RESULTS OF MAXIMUM CONDUCTED OUTPUT POWER	14
5 POWER SPECTRUM DENSITY	15
5.1 LIMIT.....	15
5.2 MEASUREMENT PROCEDURE.....	15
5.3 TEST CONFIGURATION	15
5.4 TEST RESULTS OF POWER SPECTRUM DENSITY	15
6 EMISSION OUTSIDE THE FREQUENCY BAND	16
6.1 LIMIT.....	16
6.2 MEASUREMENT PROCEDURE.....	16
6.3 TEST CONFIGURATION	17
6.4 THE RESULTS OF EMISSION OUTSIDE THE FREQUENCY BAND	17
7 RADIATED EMISSIONS IN RESTRICTED FREQUENCY BANDS.....	18
7.1 LIMIT.....	18
7.2 MEASUREMENT PROCEDURE.....	18
7.3 TEST CONFIGURATION	20
7.4 TEST RESULTS OF RADIATED EMISSIONS	22
8 POWER LINE CONDUCTED EMISSION.....	25
8.1 LIMIT.....	25
8.2 TEST CONFIGURATION	25
8.3 MEASUREMENT PROCEDURE.....	26

TEST REPORT

8.4 TEST RESULTS OF POWER LINE CONDUCTED EMISSION	27
9 OCCUPIED BANDWIDTH	29
9.1 LIMIT	29
9.2 MEASUREMENT PROCEDURE	29
9.3 TEST CONFIGURATION	29
9.4 THE RESULTS OF OCCUPIED BANDWIDTH	29
10 ANTENNA REQUIREMENT	30
APPENDIX A: TEST RESULTS	31
DTS BANDWIDTH	31
<i>Test Result</i>	31
<i>Test Graphs</i>	32
OCCUPIED CHANNEL BANDWIDTH	33
<i>Test Result</i>	33
<i>Test Graphs</i>	34
MAXIMUM CONDUCTED OUTPUT POWER	35
<i>Test Result Peak</i>	35
<i>Test Graphs Peak</i>	36
MAXIMUM POWER SPECTRAL DENSITY	37
<i>Test Result</i>	37
<i>Test Graphs</i>	38
BAND EDGE MEASUREMENTS	39
<i>Test Result</i>	39
<i>Test Graphs</i>	40
CONDUCTED SPURIOUS EMISSION	41
<i>Test Result</i>	41
<i>Test Graphs</i>	42
DUTY CYCLE	45
<i>Test Result</i>	45
<i>Test Graphs</i>	46

Revision History

Report No.	Version	Description	Issued Date
2410B0917SHA-002	Rev. 01	Initial issue of report	November 18, 2024

Measurement result summary

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-247 Issue 3 Clause 5.2	Pass
Maximum conducted output power and e.i.r.p.	15.247(b)(3)	RSS-247 Issue 3 Clause 5.4	Pass
Power spectrum density	15.247(e)	RSS-247 Issue 3 Clause 5.2	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 3 Clause 5.5	Pass
Radiated Emissions in restricted frequency bands	15.247(d), 15.205&15.209	RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207(a)	RSS-Gen Issue 5 Clause 8.8	Pass
Occupied bandwidth	-	RSS-Gen Issue 5 Clause 6.7	Tested
Antenna requirement	15.203	-	Pass

Notes: 1: NA =Not Applicable

2: Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

3: Additions, Deviations and Exclusions from Standards: None.

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Window Cleaning Robot
Type/Model:	WG841-01
Description of EUT:	The EUT is a window cleaning robot with Bluetooth function.
Rating:	24VDC, 3.75A Adapter: GM95-240375-D Input: 100-240VAC, 50-60Hz, 2.5A Output: 24VDC, 3.75A, 90W
Category of EUT:	Class B
EUT type:	☒ Table top ☐ Floor standing
Software Version:	/
Hardware Version:	/
Sample Identification No.:	A241023-33
Sample received date:	October 24, 2024
Date of test:	October 25, 2024~ November 6, 2024

1.2 Technical Specification

Frequency Band:	2400MHz ~ 2483.5MHz
Support Standards:	Bluetooth LE 4.2
Type of Modulation:	GFSK
Channel Number:	40
Data Rate:	1Mbps
Channel Separation:	2MHz
Antenna Information:	-3.13dBi, PCB Antenna

1.3 Description of Test Facility

Name:	Intertek Testing Services (Shanghai FTZ) Co., Ltd.
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L21189
	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab CAB identifier.: CN0014
	VCCI Registration Lab Member No.: 3598 (Registration No.: R-14243, G-10845, C-14723, T-12252)
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2023)

ANSI C63.10 (2020)

RSS-247 Issue 3 (August 2023)

RSS-Gen Issue 5 (April 2019) Amendment1

KDB 558074 (v05r02)

2.2 Mode of operation during the test

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)				2400 ~ 2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Data rate VS Power:

The test setting software is offered by the applicant. The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

Test software and Power Setting parameter			
Test Software	UartAssist		
Working Mode	BLE		
Test Channel	2402MHz	2440MHz	2480MHz
Power Setting	Default	Default	Default

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

Radiated test mode: EUT transmitted signal with antenna;

Conducted test mode: EUT transmitted signal from RF port connected to SPA directly;

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	SKET Auto EMC Test Software	Keleto	V3.0
Radiated emission	SKET Auto EMC Test Software	Keleto	V3.0

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	HP ProBook 6470b	100-240V AC, 50/60Hz

2.5 Test environment condition:

Test items	Temperature	Humidity
Minimum 6dB Bandwidth	23°C	52% RH
Maximum conducted output power and e.i.r.p.		
Power spectrum density		
Emission outside the frequency band		
Occupied bandwidth		
Radiated Emissions in restricted frequency bands	22°C	53% RH
Power line conducted emission	22°C	55% RH

2.6 Instrument list

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESR7	EC 6194	2025-02-27
☒	A.M.N.	R&S	ESH2-Z5	EC 3119	2025-07-23
☒	Shielded room	Zhongyu	-	EC 2838	2025-01-11
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESIB 26	EC 3045	2025-08-18
☒	Bilog Antenna	TESEQ	CBL 6112B	EC 6411	2025-09-11
☒	Pre-amplifier	Tonscend	tap01018050	EC 6432-1	2024-12-07
☒	Horn antenna	Tonscend	bha9120d	EC 6432-2	2025-03-20
☒	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2026-09-12
☒	Semi-anechoic chamber	Albatross project	-	EC 3048	2026-07-11
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2025-03-05
☒	Spectrum Analyzer	Keysight	N9030B	EC 6078	2025-03-18
☒	Test Receiver	R&S	ESCI 7	EC 4501	2025-03-09
☒	Signal generator	Agilent	N5182A	EC 6172	2025-08-06
☒	Signal generator	Agilent	N5181A	EC 6171	2025-08-06
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Therom-Hygrograph	Testo	175h1	EC 6640	2025-08-29
☒	Therom-Hygrograph	Testo	175h1	EC6642	2025-08-29
☒	Pressure meter	YM3	Shanghai Mengde	EC 3320	2025-08-16

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Maximum peak output power	$\pm 0.74\text{dB}$
Power spectrum density	$\pm 0.74\text{dB}$
Radiated Emissions in restricted frequency bands below 1GHz	$\pm 4.90\text{dB}$
Radiated Emissions in restricted frequency bands above 1GHz	$\pm 5.02\text{dB}$
Emission outside the frequency band	$\pm 2.89\text{dB}$
Power line conducted emission	$\pm 3.19\text{dB}$
Minimum 6dB Bandwidth	$\pm 0.84 \times 10^{-7}$
Occupied bandwidth	$\pm 0.84 \times 10^{-7}$

3 Minimum 6dB bandwidth

Test result: Pass

3.1 Limit

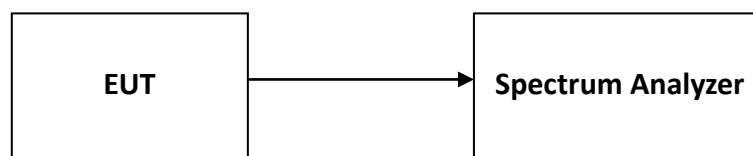
For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Measurement Procedure

The minimum 6dB bandwidth is measured using the Spectrum Analyzer according to DTS test procedure of "558074 D01 15.247 Meas Guidance v05r02" (clause 8.2) for compliance requirements.

- 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.

3.3 Test Configuration



3.4 Test Results of Minimum 6dB bandwidth

Please refer to Appendix A

4 Maximum conducted output power and e.i.r.p.

Test result: Pass

4.1 Limit

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands:
1 W. (The e.i.r.p. shall not exceed 4 W)

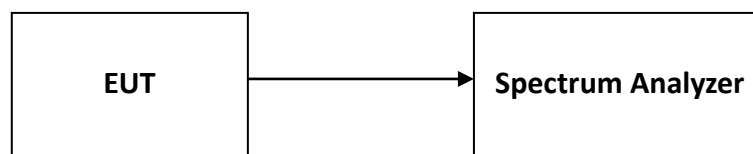
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

4.2 Measurement Procedure

The EUT was tested according to DTS test procedure of “558074 D01 15.247 Meas Guidance v05r02” (clause 8.3.1) for compliance requirements.

- a) Set the RBW $\geq$ DTS bandwidth.
- b) Set VBW $\geq 3 \times$ RBW.
- c) Set span $\geq 3 \times$ 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.

4.3 Test Configuration



4.4 Test Results of Maximum conducted output power

Please refer to Appendix A

5 Power spectrum density

Test result: Pass

5.1 Limit

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

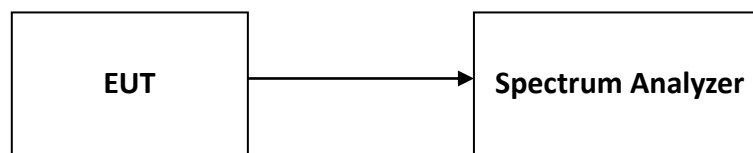
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and $8 + (6 - \text{antenna gain} - \text{beam forming gain})$.

5.2 Measurement Procedure

The power output was tested according to DTS test procedure of "558074 D01 15.247 Meas Guidance v05r02" (clause 8.4) for compliance requirements.

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq 3 \times \text{RBW}$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 Test Configuration



5.4 Test Results of Power spectrum density

Please refer to Appendix A

6 Emission outside the frequency band

Test result: Pass

6.1 Limit

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 band that contains the highest level of the desired power.

6.2 Measurement Procedure

The EUT was tested according to DTS test procedure of "558074 D01 15.247 Meas Guidance v05r02" (clause 8.5) for compliance requirements.

Reference level measurement

Establish a reference level by using the following procedure:

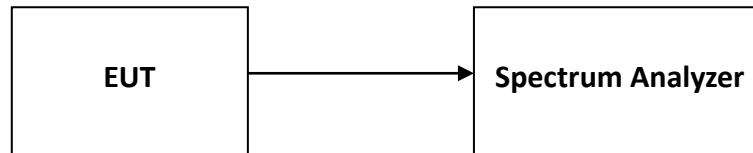
- Set instrument center frequency to DTS channel center frequency.
- Set the span to ≥ 1.5 times the DTS bandwidth.
- Set the RBW = 100 kHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

Emission level measurement

- Set the center frequency and span to encompass frequency range to be measured.
- Set the RBW = 100 kHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

6.3 Test Configuration



6.4 The results of Emission outside the frequency band

Please refer to Appendix A

7 Radiated Emissions in restricted frequency bands

Test result: Pass

7.1 Limit

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

7.2 Measurement Procedure

For Radiated emission below 30MHz:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Both X and Y axes of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz:

- The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for

TEST REPORT

above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

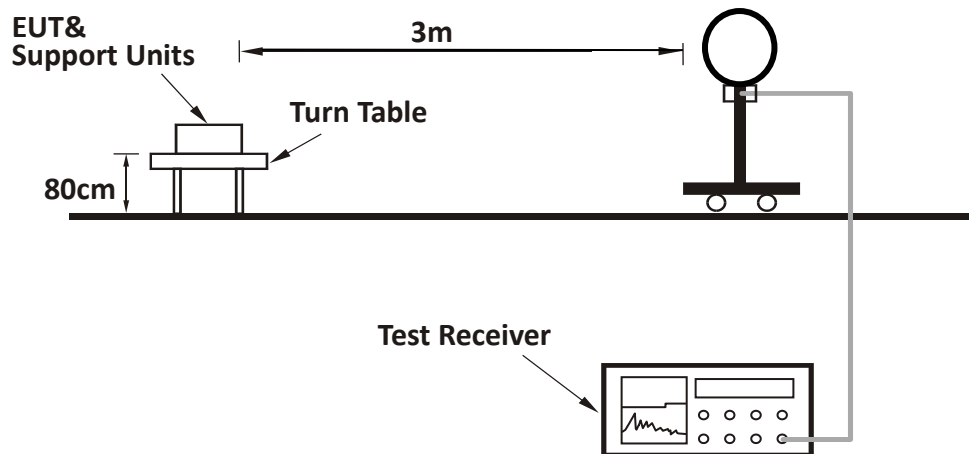
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

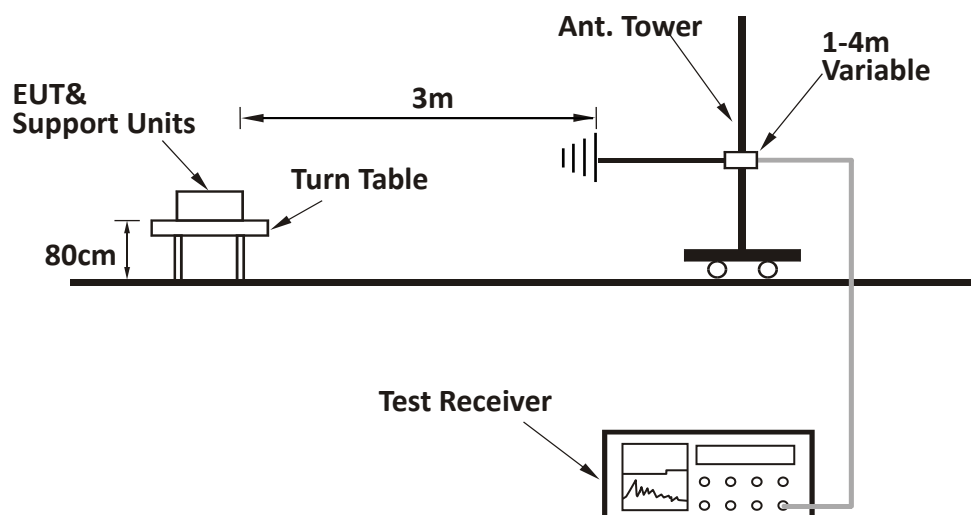
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 3 x RBW (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported

7.3 Test Configuration

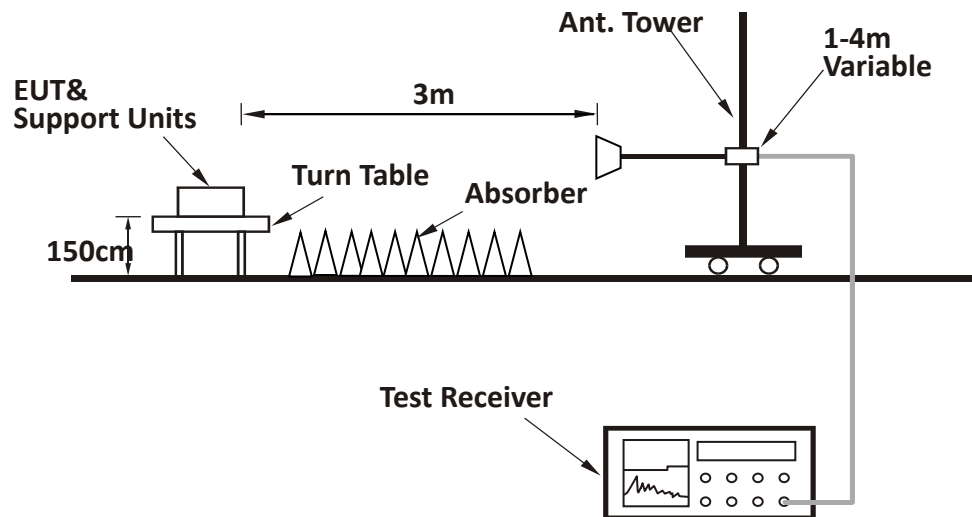
For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



For Radiated emission above 1GHz:



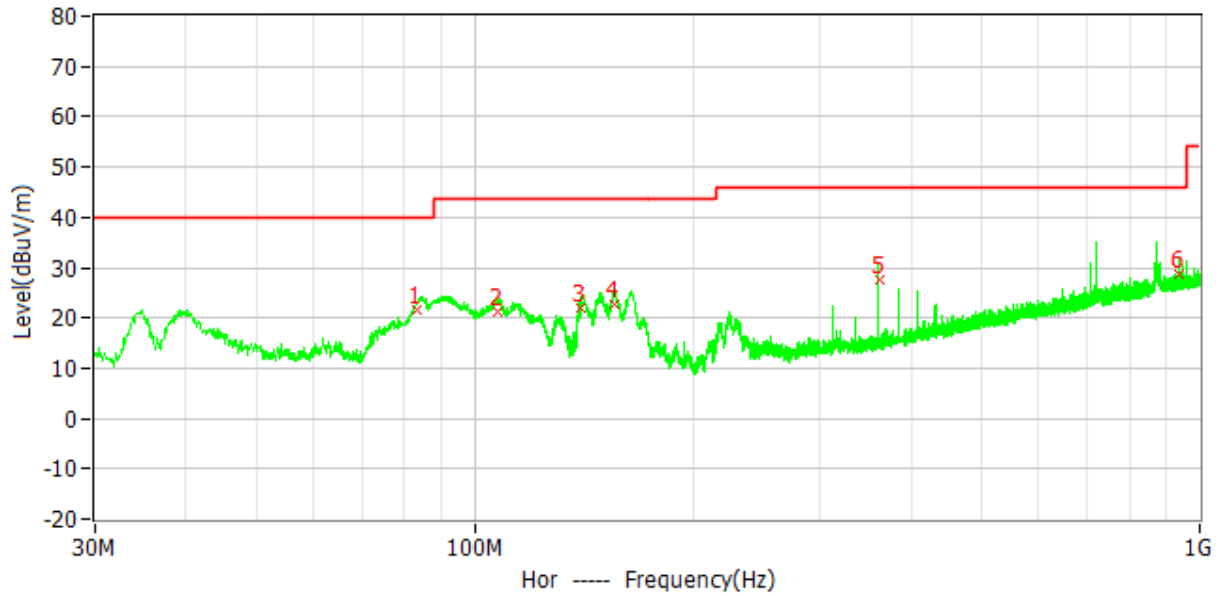
TEST REPORT

7.4 Test Results of Radiated Emissions

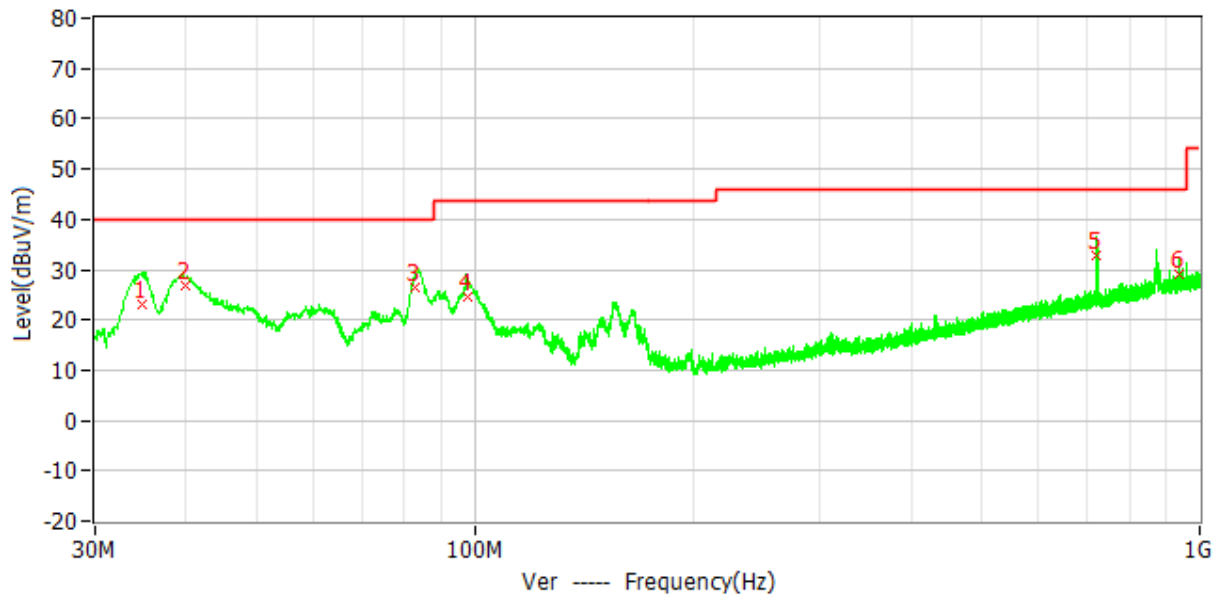
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



TEST REPORT

Test Data:

Antenna	Frequency (MHz)	Limit (dBuV/m)	Level (dBuV/m)	Delta (dB)	Detector
H	83.52	40.00	21.62	18.38	QP
	107.65	43.50	21.09	22.41	QP
	140.45	43.50	21.84	21.66	QP
	156.12	43.50	22.68	20.82	QP
	361.96	46.00	27.64	18.36	QP
	935.57	46.00	28.61	17.39	QP
V	34.87	40.00	23.12	16.88	QP
	39.89	40.00	26.93	13.07	QP
	82.88	40.00	26.59	13.41	QP
	98.11	43.50	24.53	18.97	QP
	721.01	46.00	32.86	13.14	QP
	935.01	46.00	28.96	17.04	QP

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
 2. Level = Original Receiver Reading + Correct Factor
 3. Delta = Limit - Level
 4. If the PK Level is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
 Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
 Limit = 40.00dBuV/m.
 Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
 Level = 10dBuV + 0.20dB/m = 10.20dBuV/m;
 Delta = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

TEST REPORT

Test result above 1GHz:

The emission was conducted from 1GHz to 25GHz

CH	Antenna	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Detector
L	H	2390.00	49.05	74.00	24.95	PK
	H	2390.00	37.39	54.00	16.61	AV
	V	2390.00	48.06	74.00	25.94	PK
	V	2390.00	37.09	54.00	16.91	AV
	H	4804.00	46.03	74.00	27.97	PK
	V	4804.00	45.87	74.00	28.13	PK
M	H	4880.00	48.27	74.00	25.73	PK
	V	4880.00	47.69	74.00	26.31	PK
H	H	2483.50	56.61	74.00	17.39	PK
	H	2483.50	46.90	54.00	7.10	AV
	V	2483.50	55.36	74.00	18.64	PK
	V	2483.50	44.83	54.00	9.17	AV
	H	4960.00	49.98	74.00	24.02	PK
	V	4960.00	49.00	74.00	25.00	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.

2. Level = Original Receiver Reading + Correct Factor

3. Delta = Limit - Level

4. If the PK Level is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.

Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;

Level = 10dBuV + 0.20dB/m = 10.20dBuV/m;

Delta = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

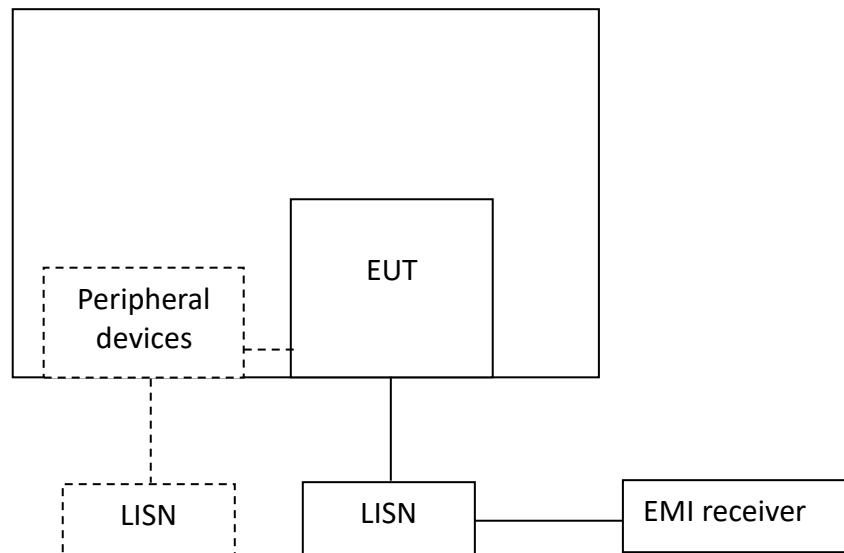
8 Power line conducted emission

Test result: Pass

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

8.2 Test Configuration



8.3 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

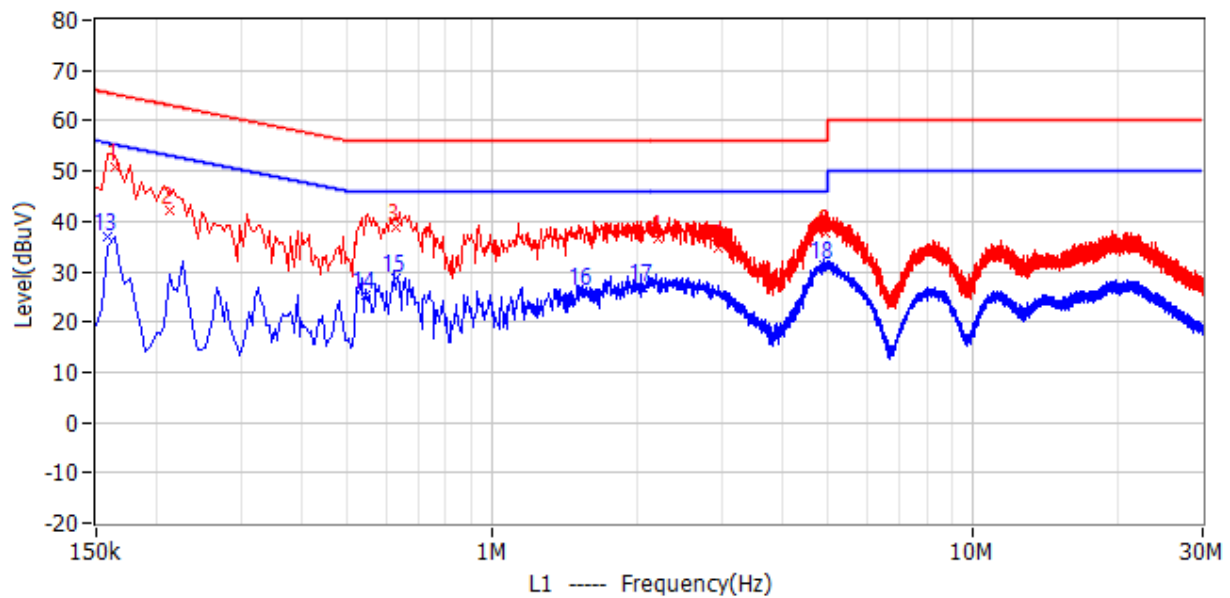
The bandwidth of the test receiver is set at 9 kHz.

8.4 Test Results of Power line conducted emission

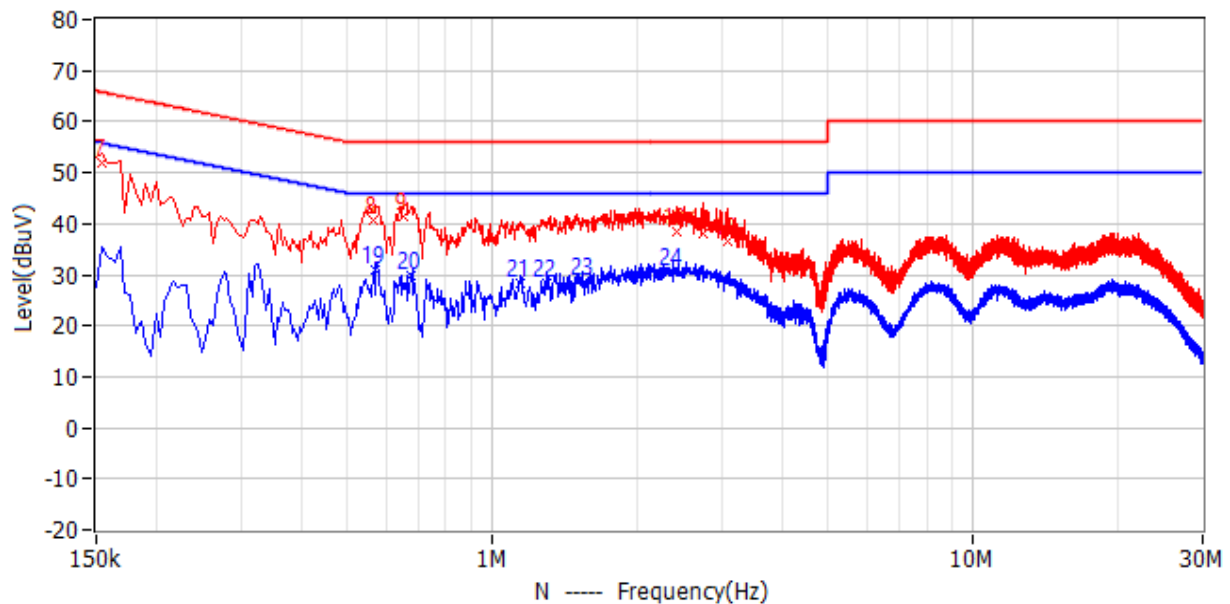
Test Voltage: 120VAC/60Hz

Test Curve:

L Line



N Line



Test Data:

No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Detector	Phase
1	163.500kHz	65.28	50.66	14.62	QP	L
2	213.000kHz	63.09	42.22	20.87	QP	L
3	631.500kHz	56.00	38.64	17.36	QP	L
4	2.202MHz	56.00	36.39	19.61	QP	L
5	2.958MHz	56.00	34.52	21.48	QP	L
6	4.952MHz	56.00	37.60	18.40	QP	L
7	154.500kHz	65.75	52.06	13.69	QP	N
8	564.000kHz	56.00	40.79	15.21	QP	N
9	654.000kHz	56.00	41.51	14.49	QP	N
10	2.427MHz	56.00	38.42	17.58	QP	N
11	2.733MHz	56.00	37.87	18.13	QP	N
12	3.084MHz	56.00	36.45	19.55	QP	N
13	159.000kHz	55.52	36.85	18.67	CAV	L
14	546.000kHz	46.00	25.43	20.57	CAV	L
15	631.500kHz	46.00	28.81	17.19	CAV	L
16	1.541MHz	46.00	26.02	19.98	CAV	L
17	2.058MHz	46.00	26.89	19.11	CAV	L
18	4.907MHz	46.00	31.17	14.83	CAV	L
19	573.000kHz	46.00	30.81	15.19	CAV	N
20	676.500kHz	46.00	29.93	16.07	CAV	N
21	1.140MHz	46.00	28.26	17.74	CAV	N
22	1.298MHz	46.00	28.42	17.58	CAV	N
23	1.554MHz	46.00	28.73	17.27	CAV	N
24	2.382MHz	46.00	30.51	15.49	CAV	N

Remark: 1. Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Level = Original Receiver Reading + Factor

3. Delta = Limit - Level

Example: Assuming LISN Factor = 10.00dB, Cable Loss = 2.00dB,

Original Receiver Reading = 10.00dBuV, Limit = 66.00dBuV.

Then Factor = 10.00 + 2.00 = 12.00dB;

Level = 10dBuV + 12.00dB = 22.00dBuV;

Delta = 66.00dBuV - 22.00dBuV = 44.00dB.

9 Occupied Bandwidth

Test result: Tested

9.1 Limit

None

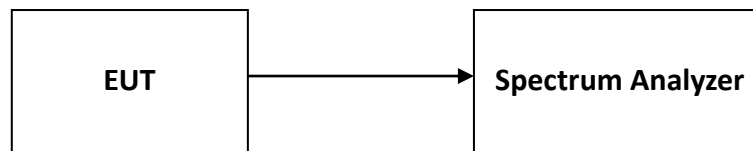
9.2 Measurement Procedure

The occupied bandwidth per RSS-Gen was measured using the Spectrum Analyzer.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

9.3 Test Configuration



9.4 The results of Occupied Bandwidth

Please refer to Appendix A

10 Antenna requirement

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 shall be considered sufficient to comply with the provisions of this section.

Result:

EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

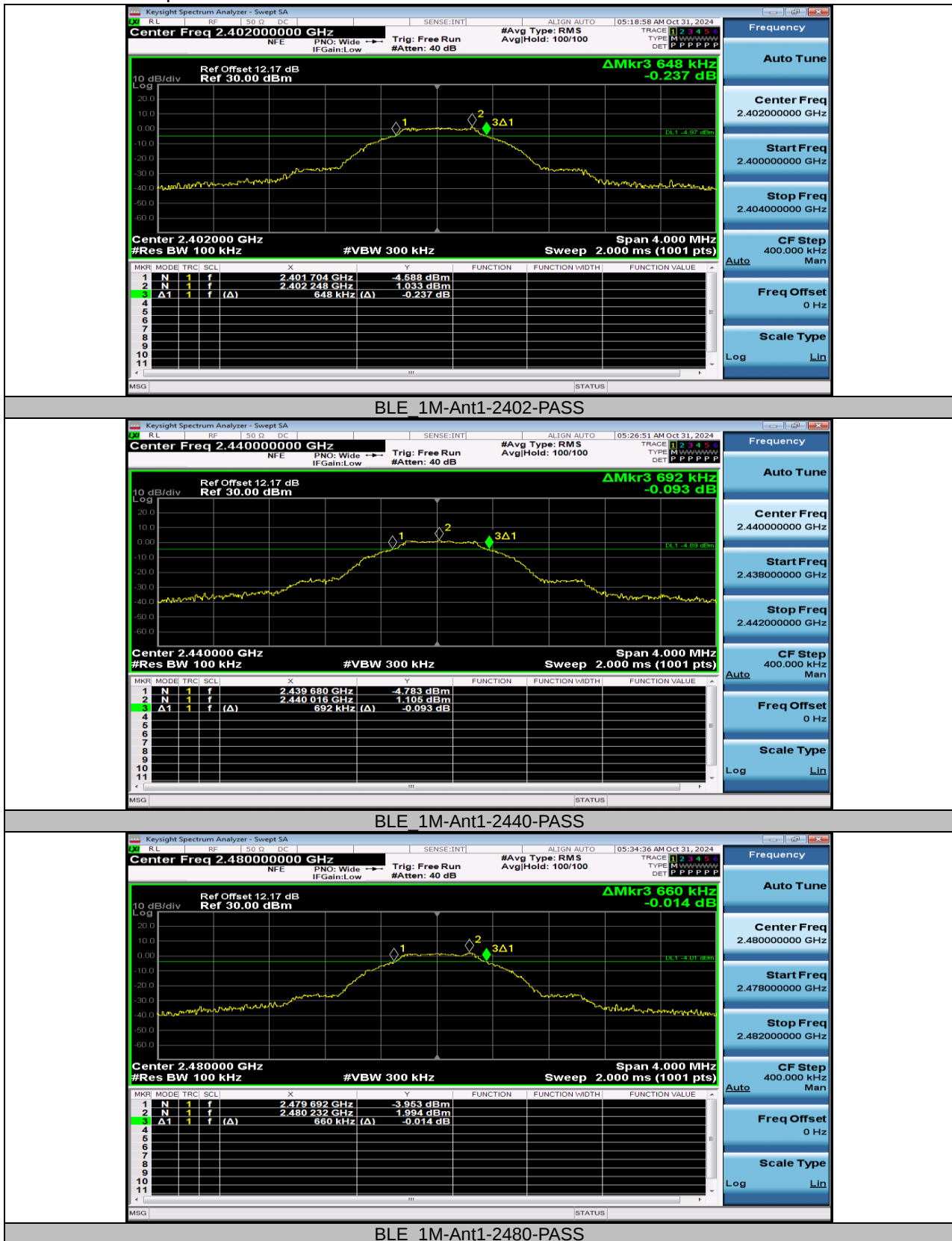
Appendix A: Test results

DTS Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	FL [MHz]	FH [MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	0.648	2401.704	2402.352	0.5	PASS
		2440	0.692	2439.680	2440.372	0.5	PASS
		2480	0.660	2479.692	2480.352	0.5	PASS

Test Graphs

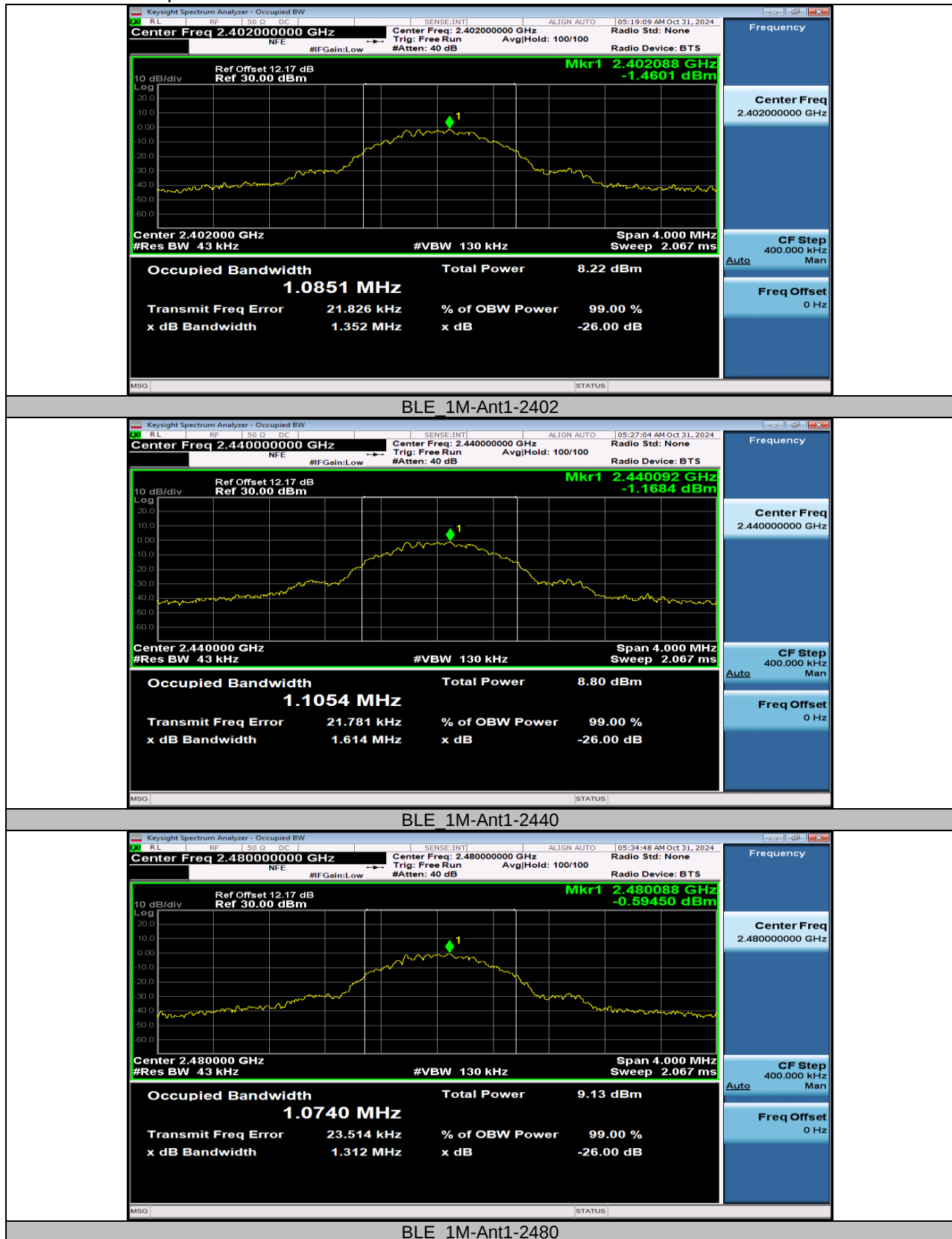


Occupied Channel Bandwidth

Test Result

Test Mode	Antenna	Frequency [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	Verdict
BLE_1M	Ant1	2402	1.0851	2401.4793	2402.5644	---	---
		2440	1.1054	2439.4691	2440.5745	---	---
		2480	1.0740	2479.4865	2480.5605	---	---

Test Graphs

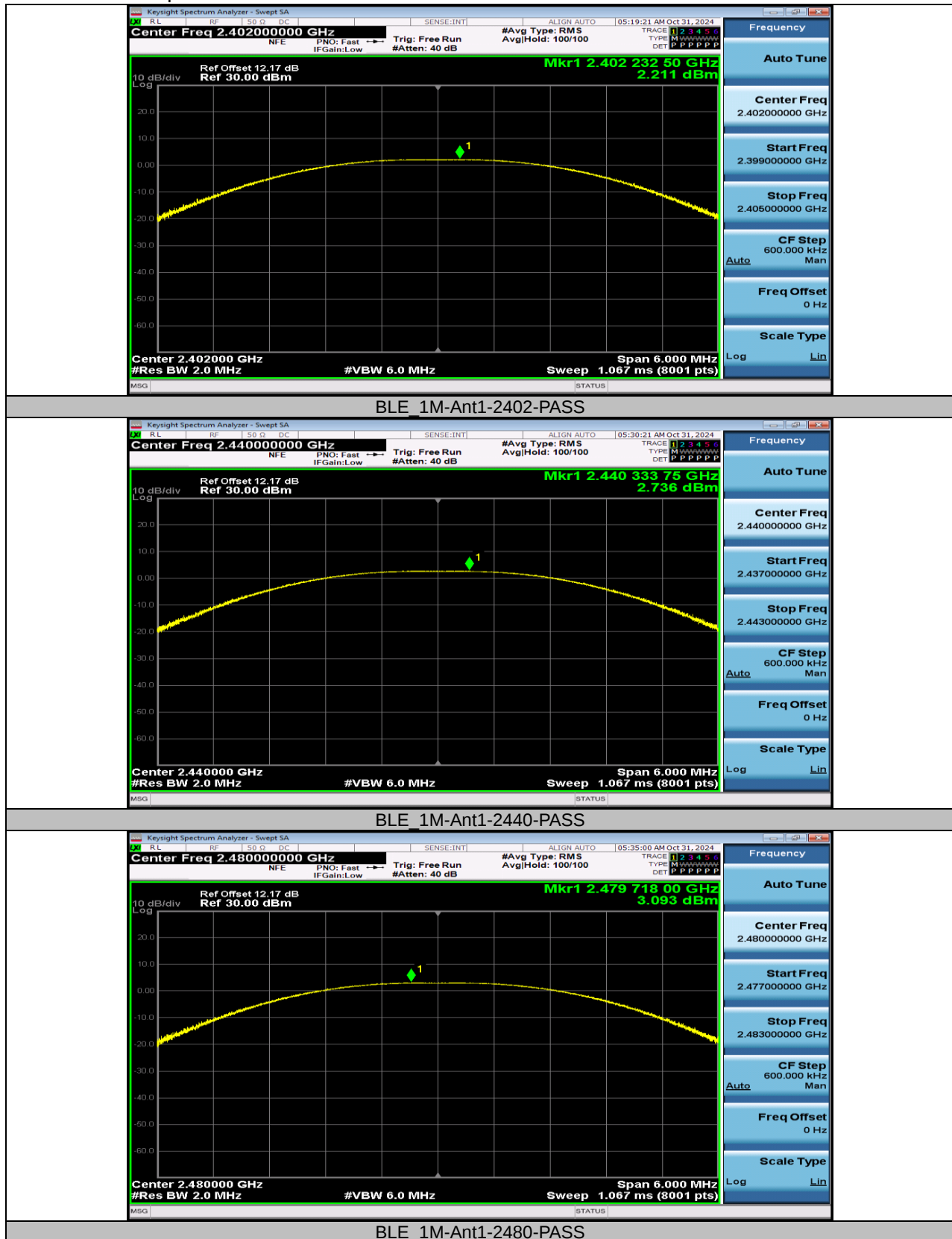


Maximum conducted output power

Test Result Peak

Test Mode	Antenna	Frequency [MHz]	Conducted Power [dBm]	Conducted Limit[dBm]	EIRP [dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	2.21	≤30	-0.92	≤36	PASS
		2440	2.74	≤30	-0.39	≤36	PASS
		2480	3.09	≤30	-0.04	≤36	PASS

Test Graphs Peak

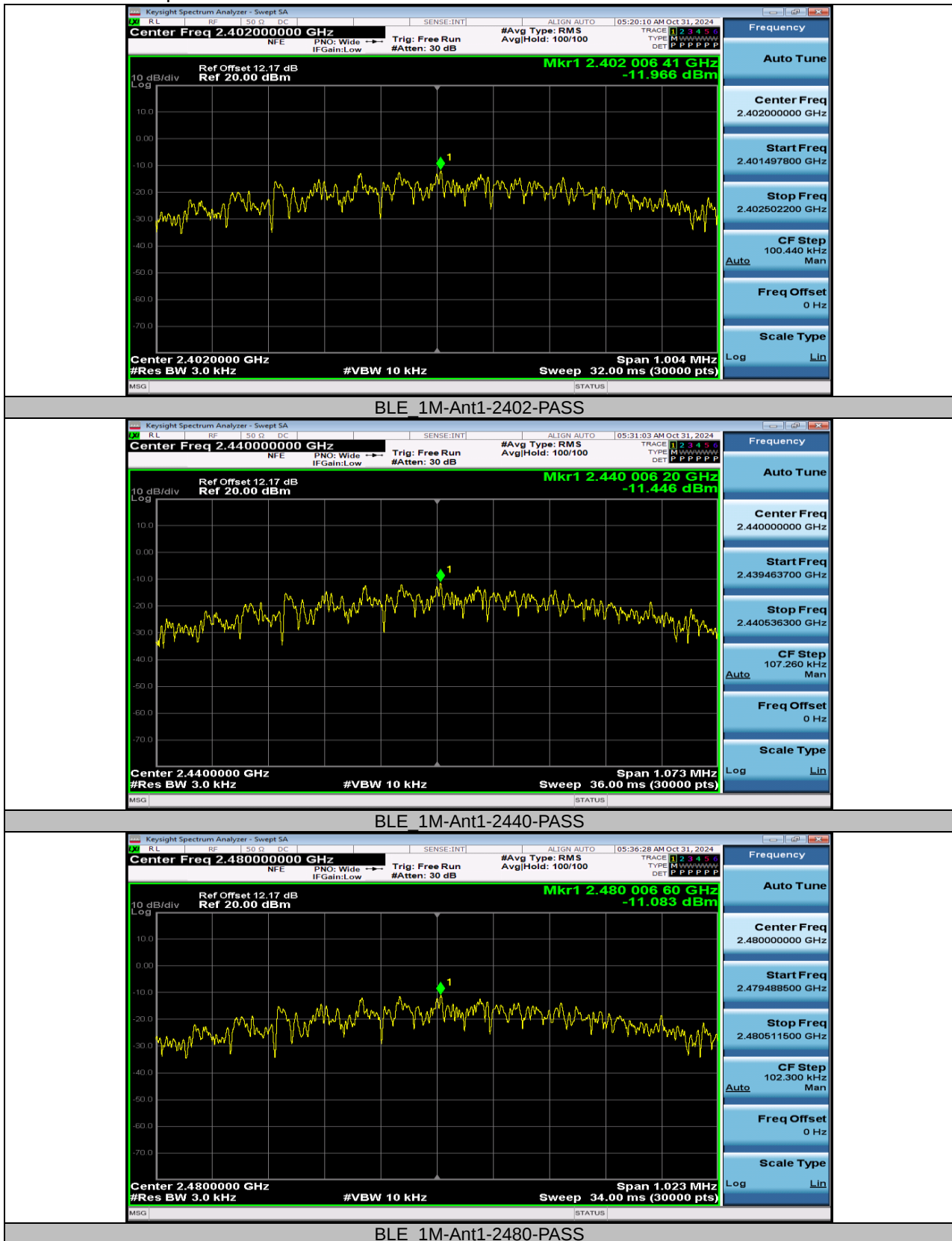


Maximum power spectral density

Test Result

Test Mode	Antenna	Frequency [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-11.97	≤8.00	PASS
		2440	-11.45	≤8.00	PASS
		2480	-11.08	≤8.00	PASS

Test Graphs

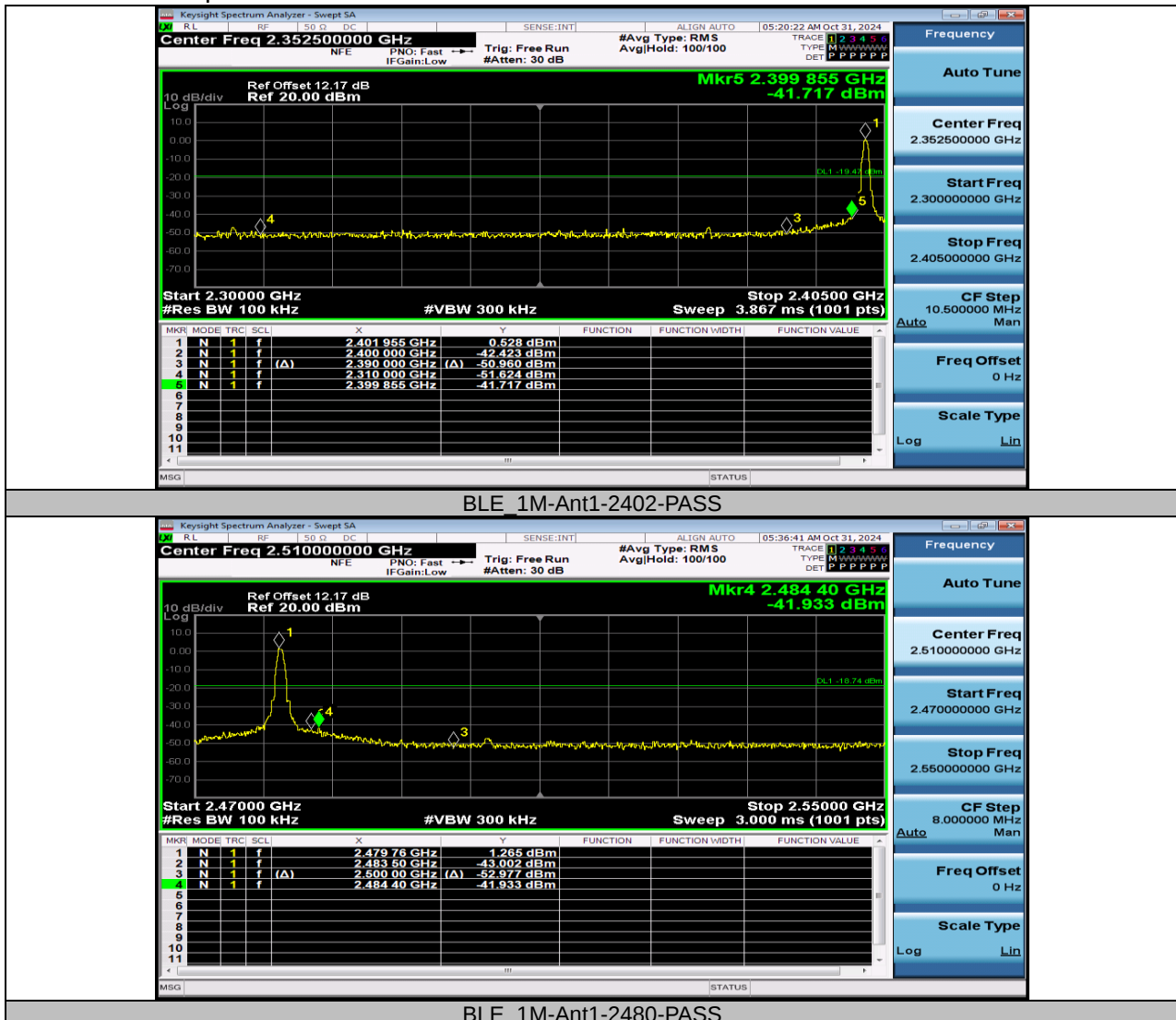


Band edge measurements

Test Result

Test Mode	Antenna	Ch Name	Frequency [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
BLE_1M	Ant1	Low	2402	0.53	-41.72	≤ -19.47	PASS
		High	2480	1.27	-41.93	≤ -18.74	PASS

Test Graphs

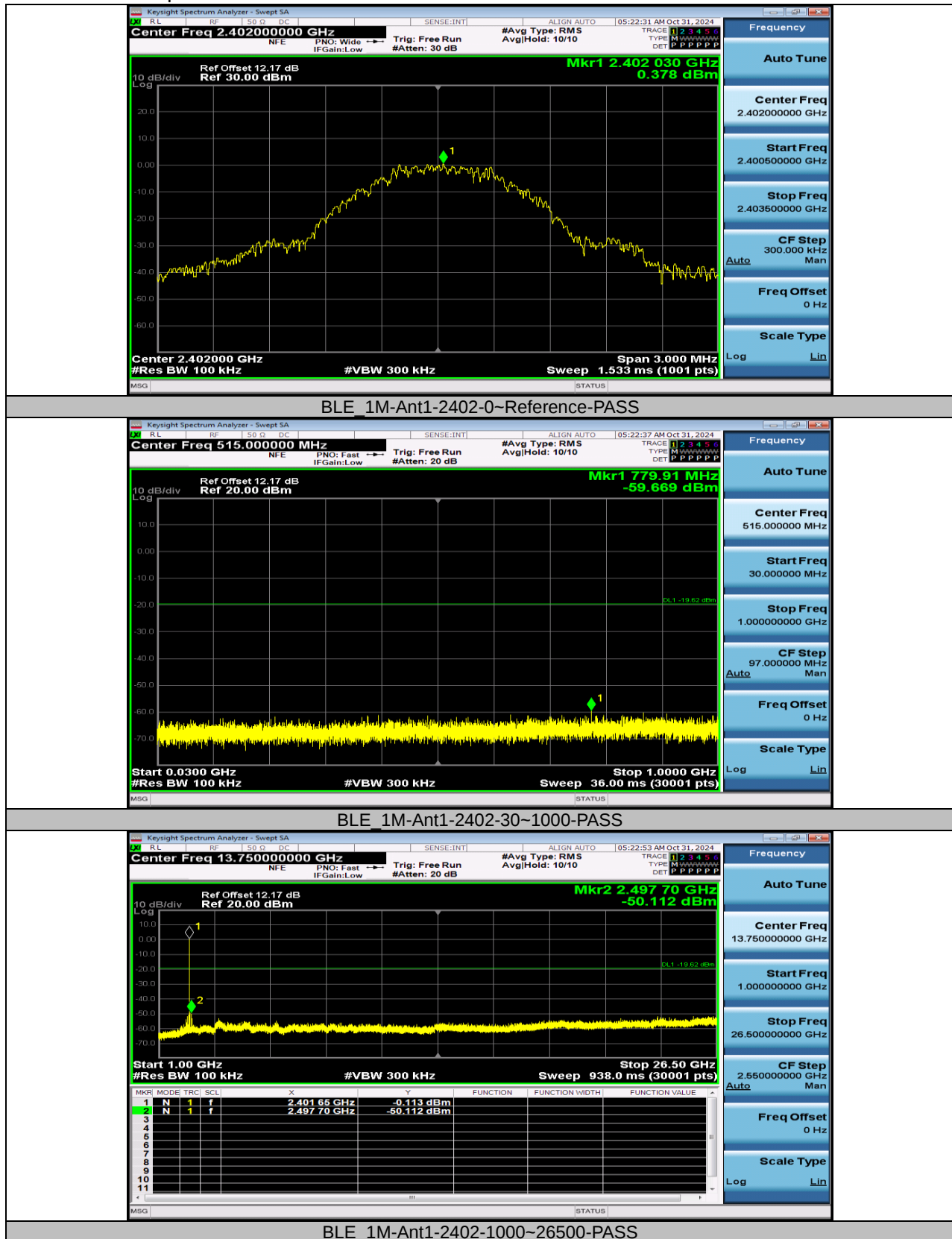


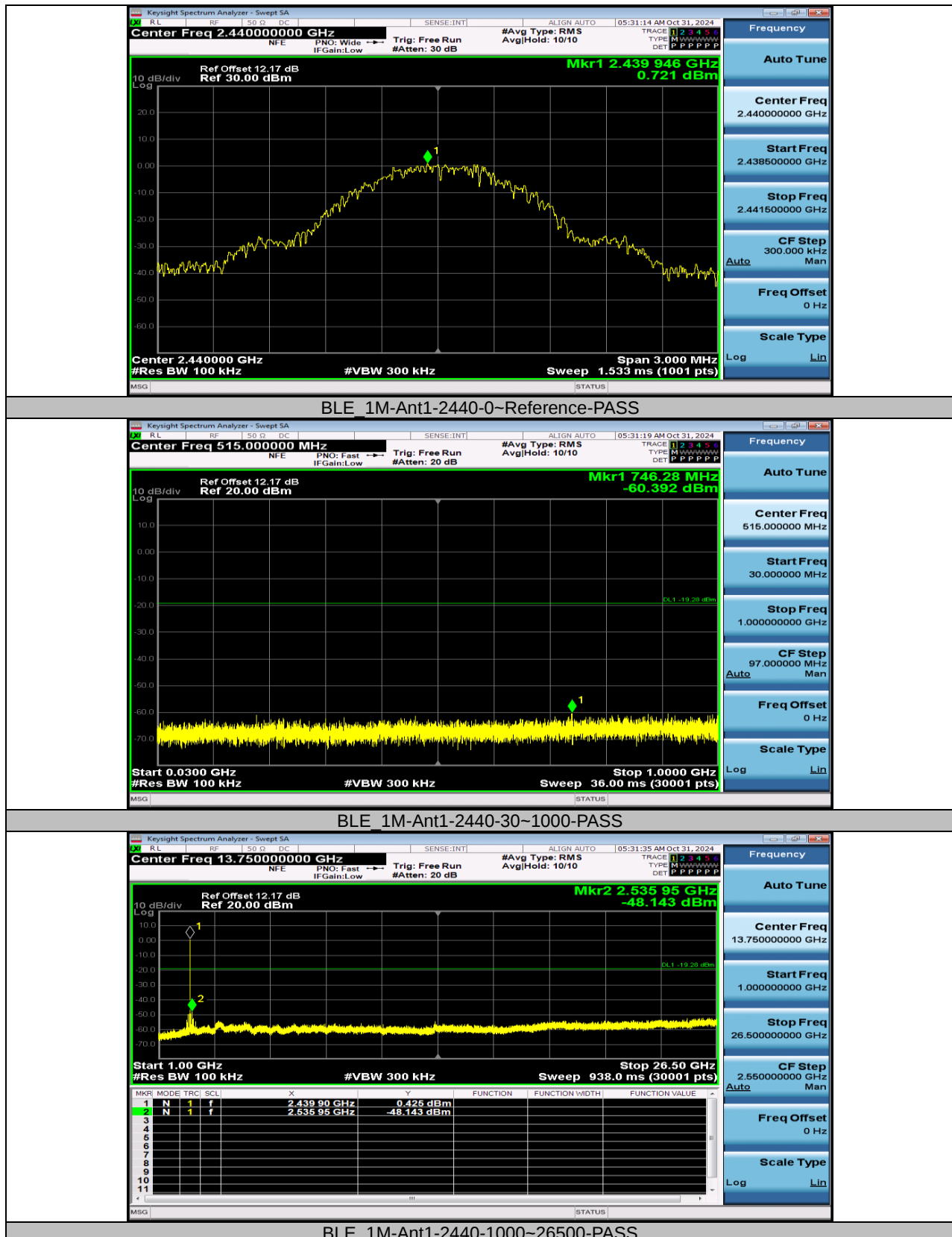
Conducted Spurious Emission

Test Result

Test Mode	Antenna	Frequency [MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
BLE_1M	Ant1	2402	Reference	0.38	0.38	---	PASS
			30~1000	0.38	-59.67	≤-19.62	PASS
			1000~26500	0.38	-50.11	≤-19.62	PASS
		2440	Reference	0.72	0.72	---	PASS
			30~1000	0.72	-60.39	≤-19.28	PASS
			1000~26500	0.72	-48.14	≤-19.28	PASS
		2480	Reference	1.93	1.93	---	PASS
			30~1000	1.93	-60.73	≤-18.07	PASS
			1000~26500	1.93	-50.44	≤-18.07	PASS

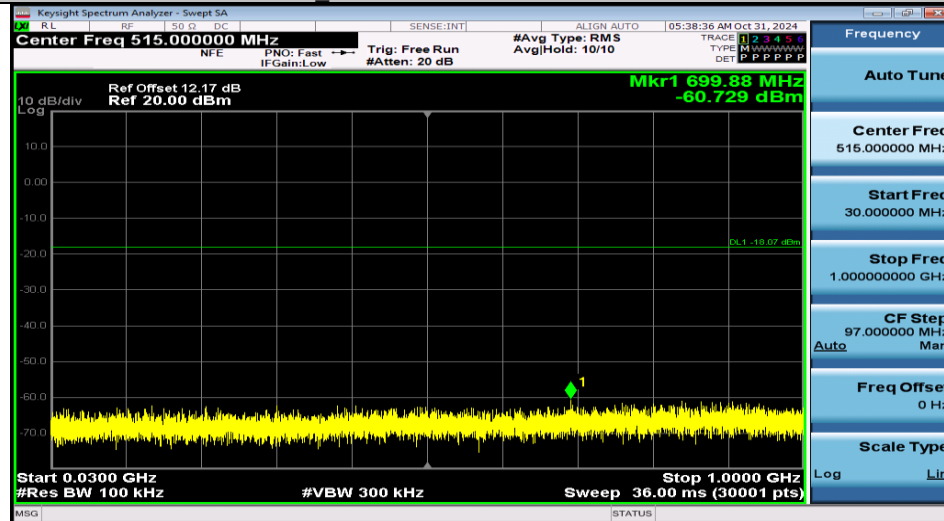
Test Graphs



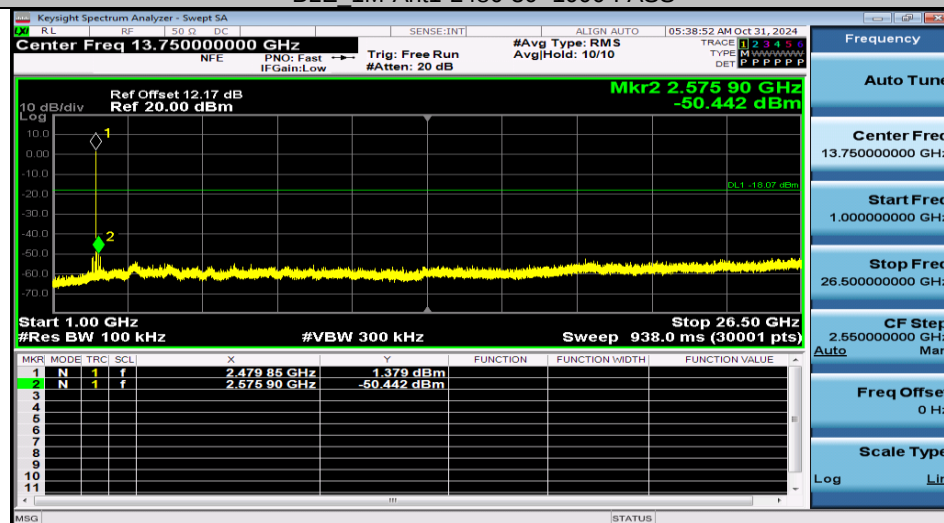




BLE_1M-Ant1-2480-0-Reference-PASS



BLE_1M-Ant1-2480-30-1000-PASS



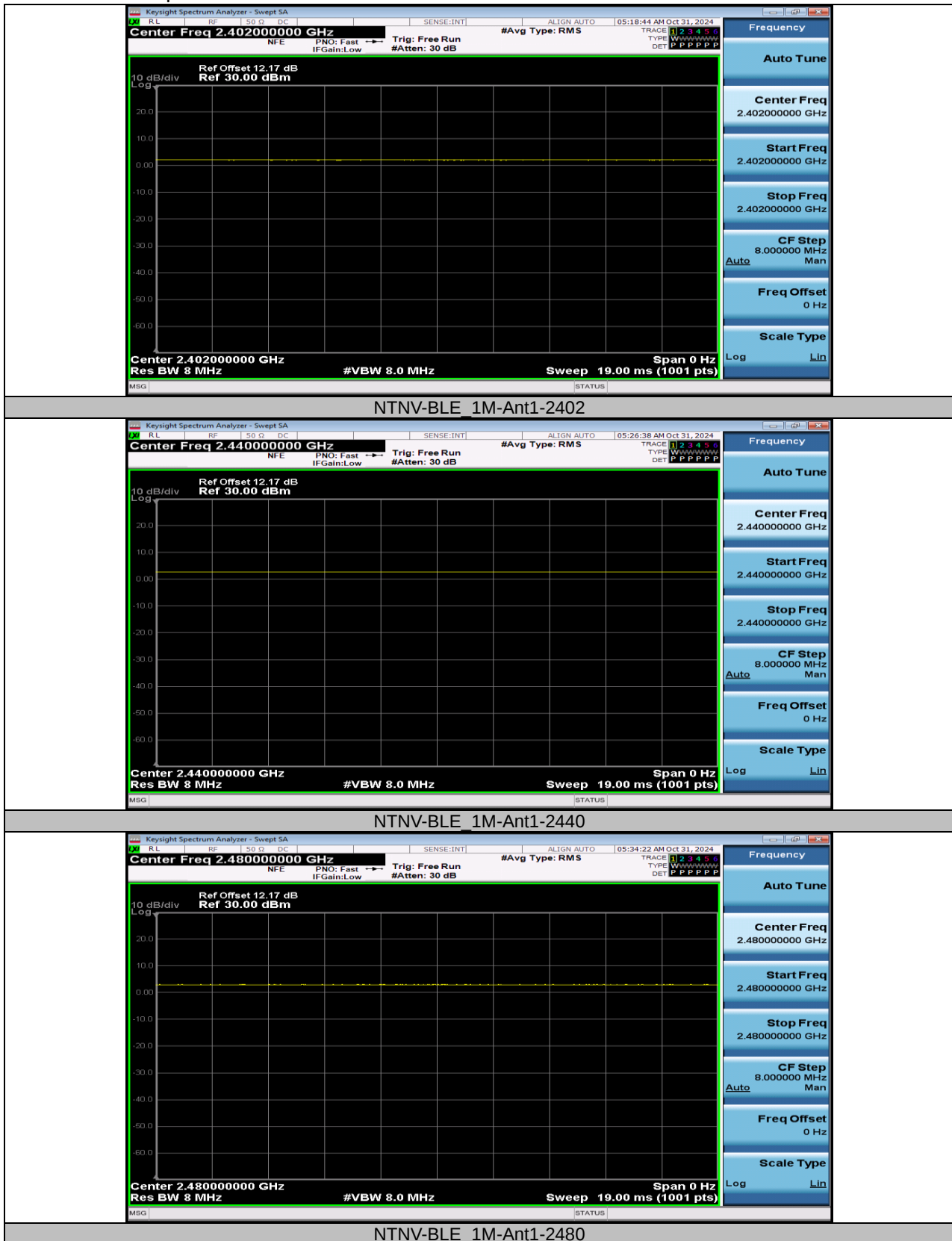
BLE_1M-Ant1-2480-1000-26500-PASS

Duty Cycle

Test Result

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
BLE_1M	Ant1	2402	19.00	19.00	100.00	0.00
		2440	19.00	19.00	100.00	0.00
		2480	19.00	19.00	100.00	0.00

Test Graphs



***** END *****