Report on the Radio Testing of:

RADIATION DOSIMETER SYSTEM

Model(s): Hub 1/861906

Add value.
Inspire trust.

In accordance with
47 CFR FCC Part 15C
47 CFR FCC Part 1.1310
47 CFR FCC Part 2.1091
(Bluetooth Low Energy)

Prepared for:
Electrogenics Laboratories Ltd.
Suite 1, Level 10, 76 Berry St,
North Sydney, NSW 2060
Australia

COMMERCIAL-IN-CONFIDENCE

Document Number: 7191336525-EEC24/03 | Issue: CR_1
FCC ID: 2BN481861906

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Approved By	Foo Kai Maun	Original Report's Date15 Feb 2024 Corrigendum Report's Date 03 Jun 2025	
Prepared By	Quek Keng Huat	14 Feb 2025 03 Jun 2025	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD PSB document controls.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with the mentioned standard(s).

TÜV SÜD PSB

ilac-MRA

Accredited Laboratory SAC-SINGLAS

LA-2007-0380-A LA-2007-0386-C
LA-2007-0381-F LA-2010-0464-D
LA-2007-0382-B LA-2018-0702-B
LA-2007-0383-G LA-2018-0703-G
LA-2007-0384-G LA-2020-0747-L
LA-2007-0385-E

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
15 International Business Park
TÜV SÜD @ IBP
Singapore 609937

Phone : +65-6778 7777
E-mail: info.sg@tuvsud.com
https://www.tuvsud.com/sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
15 International Business Park
TÜV SÜD @ IBP
Singapore 609937

Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	15 Feb 2025
2	Update FCC ID and FCC Label	03 Jun 2025

1.2 Introduction

Applicant	:	Electrogenics Laboratories Ltd. Suite 1, Level 10, 76 Berry St, North Sydney, NSW 2060, Australia
Manufacturer	:	Electrogenics Laboratories Ltd, Suite 1, Level 10, 76 Berry St, North Sydney, NSW 2060, Australia
Factory	:	Factory 1 Circuitwise 4/18 Lexington Drive, Bella Vista, New South Wales, 2153, Australia Factory 2 Kaifa Technology 7006# Caitian Rd., Futian Dist., Shenzhen, China.P.C 518035
Brand	:	MOSKIN
Software Version	:	01.0.0
Model Number(s)	:	Hub 1/861906
Serial Number(s)	:	RD ELL-020-0003-03
Number of Samples Tested	:	1
Test Sample(s) Condition	:	Good
Quotation Reference	:	5832862

Continued

Test Specification/Issue/Date	:	FCC 47 CFR Part 15C 47 CFR FCC Part 1.1310 47 CFR FCC Part 2.1091
Test Sample(s) Received Date	:	23 Sep 2024
Start of Test	:	23 Sep 2024
Finish of Test	:	14 Feb 2025

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with specifications as shown below.

Specification Clause	Test Description	Result	Comments/Base Standard
47 CFR FCC Part 15			
15.107(a), 15.207	Conducted Emissions	Pass	ANSI C63.4: 2014 ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2018
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions Inclusive Restricted Bands Requirement)	Pass	ANSI C63.4: 2014 ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(a)(2)	Spectrum Bandwidth (6dB Bandwidth Measurement)	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(b)(3)	Maximum Peak Power	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(d)	RF Conducted Spurious Emissions (Non-Restricted Bands)	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(d)	RF Conducted Spurious Emissions (Restricted Bands)	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(d)	Band Edge Compliance (Conducted)	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(d)	Band Edge Compliance (Radiated)	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.247(e)	Peak Power Spectral Density	Pass	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
15.35(c)	Duty Cycle Factor Computation	Not Applicable *See Note 5	ANSI C63.10: 2013 KDB 558074 D01 DTS Measurement Guidance V05R02: 2019
2.1091	Maximum Permissible Exposure	Pass	KDB 447498 D01 General RF Exposure Guidance v06: 2015

Notes

1. All the measurements in section 15.247 were done based on conducted measurements except Band Edge Compliance (Radiated) test.

2. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.

3. The maximum measured RF power of the Equipment Under Test is -2.01dBm.

4. The EUT was tested using DC Power Supply with DC voltage of 3.5V.

5. The EUT was operated in continuous transmission, ie 100% duty cycle.

1.4 Product Information

1.4.1 Technical Description

Description	:	The Equipment Under Test(s) (EUT(s)) is a **RADIATION DOSIMETER SYSTEM.**
Microprocessor	:	Nordic Semiconductor nRF52840
Operating Frequency	:	64MHz
Clock / Oscillator Frequency	:	32MHz
Modulation	:	2Mbit Gaussian Frequency-Shift Keying (GFSK)
Antenna Gain	:	2.5dBi
Port / Connectors	:	Refer to manufacturer
Rated Power	:	5 VDC, 1.0 A (5 Wmax.) or Lithium battery 3.7 VDC
Accessories	:	Refer to manufacturer

1.4.2 Test Configuration and Modes of Operation

<table>
<tr><th>Mode(s)</th><th>Description</th></tr>
<tr><td>Maximum RF power transmission</td><td>The EUT was exercised in the mode, transmitting at lower, middle and upper channels as shown below one at a time with all supported modulation schemes were evaluated. For Band Edge Compliance, only lower and upper channels were evaluated.
<table>
<tr><th>Transmit Channel</th><th>Frequency (GHz)</th></tr>
<tr><td>Channel 0 (Lower Channel)</td><td>2.402</td></tr>
<tr><td>Channel 19 (Middle Channel)</td><td>2.440</td></tr>
<tr><td>Channel 39 (Upper Channel)</td><td>2.480</td></tr>
</table>
</td></tr>
</table>

1.4.3 Performance Criteria and Monitoring Methods

Not Applicable.

1.5 Deviations from the Standard

Nil.

1.6 EUT Modification Record

No modifications were made.

1.7 Test Location(s)

TÜV SÜD PSB Pte Ltd
Electrical & Electronics Centre (EEC), Product Services,
15 International Business Park
TÜV SÜD @ IBP
Singapore 609937

1.8 Test Facilities Registrations

Requirements	Registration Numbers
FCC	994109 (Test Firm Registration Number) SG0002 (Designation Number)
ISED	SGAP01 (CAB Identifier) 2932N-1 (10m Semi-Anechoic Chamber)
VCCI	R-13324 (10m ANC), G-10203 (10mANC) R-20151 (3m RF Chamber - Lab 7), G-20149 (3m RF Chamber - Lab 7) C-14933 (C.E @ CEIBP) T-12403 (Telecom Ports @ CEIBP)
BSMI	SL2-IS-E-6001R *[CNS-13803 (ISM Equipment)]* SL2-IN-E-6001R *[CNS-13438, CNS-15936 (IT Equipment)]* SL2-R1/R2-E-6001R *[CNS-13439, CNS-15936 (Broadcast Receivers)]* SL2-A1-E-6001R *[CNS-13783-1 (Household Appliances)]* SL2-L1-E-6001R *[CNS-14115 (Lighting Equipment)]*
SABS	SABS/A-LAB/0030/2018
ASCA	TL-86

1.9 Supporting Equipment

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Asus Notebook PC	M/N: X206H S/N: G9NLCX08090139A FCC ID: PPD-QCNFA435	Nil
Asus AC Adaptor	M/N: AD890M26 S/N: 16335 FCC ID: Nil	2.00m unshielded power cable
GlobeTek, Inc. ITE / Medical Power Supply	M/N: WR9HA000USBFMR68 S/N: Nil FCC ID: Nil	0.90m unshielded power cable
Unbranded USB to TTL serial UART converter cable	M/N: TTL-232R-3V3-2MM S/N: Nil FCC ID: Nil	1.60m unshielded signal cable

2 Test Details

2.1 Conducted Emissions

2.1.1 Test Limits

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		

2.1.2 Test Setup

2.1.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.

2.1.2.2 The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.

2.1.2.3 The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.

2.1.2.4 All other supporting equipment were powered separately from another LISN.

2.1.3 Test Method

2.1.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.1.3.2 A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.

2.1.3.3 High peaks, relative to the limit line, were then selected.

2.1.3.4 The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.

2.1.3.5 The measurements were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz	Q-P limit = 60.0 dBμV
Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB Q-P reading obtained directly from EMI Receiver = 40.0 dBμV (Calibrated for system losses)	
Therefore, Q-P margin = 60.0 - 40.0 = 20.0	i.e. 20.0 dB below Q-P limit

2.1.4 Test Results

Test Input Power	120V 60Hz	Temperature	24°C
Line Under Test	AC Mains	Relative Humidity	49%
		Atmospheric Pressure	1040mbar
		Tested By	Mohd Nazrulhizat
		Test Date	23 Sep 2024

Frequency (MHz)	Q-P Value (dBµV)	Q-P Limit (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Line	Channel (Worst)
0.5801	24.9	56.0	31.1	20.8	46.0	25.2	Live	Lowest
0.6593	36.2	56.0	19.8	32.6	46.0	13.4	Live	Lowest
0.6624	34.8	56.0	21.2	26.2	46.0	19.8	Neutral	Lowest
1.5413	28.3	56.0	27.7	18.3	46.0	27.7	Neutral	Lowest
2.1506	29.5	56.0	26.5	25.0	46.0	21.0	Live	Lowest
4.5809	27.6	56.0	28.4	17.4	46.0	28.6	Neutral	Lowest

Notes

1.	All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 150kHz - 30MHz RBW: 9kHz VBW: 30kHz

2.2 Radiated Emissions (Spurious Emissions Inclusive Restricted Bands Requirement)

2.2.1 Test Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m)
0.009 - 0.490 *	20 log [2400 / F (kHz)] @ 300m
0.490 - 1.705	20 log [24000 / F (kHz)] @ 30m
1.705 - 30.0	30.0 @ 30m
30 – 88	40.0 @ 3m
88 – 216	43.5 @ 3m
216 – 960	46.0 @ 3m
Above 960 *	54.0 @ 3m
* For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.	

Restricted Bands

MHz			MHz			MHz			GHz		
0.090	-	0.110	16.42	-	16.423	399.9	-	410	4.5	-	5.15
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	2690	-	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	-	3358	36.43	-	36.5
12.57675	-	12.57725	322	-	335.4	3600	-	4400	Above 38.6		
13.36	-	13.41									

2.2.2 Test Setup

2.2.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.

2.2.2.2 The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

2.2.2.3 The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

2.2.3 Test Method

2.2.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.2.3.2 A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.

2.2.3.3 The test was carried out at the selected frequency points obtained from the pre-scan. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:

a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission

2.2.3.4 A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz.For frequency point in range of 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, both Peak and Average measurements were carried out.

2.2.3.5 The measurements were repeated for the next frequency point, until all selected frequency points were measured.

2.2.3.6 The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10th harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz	Q-P limit = 46.0 dBμV/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 46.0 - 40.0 = 6.0	i.e. 6.0 dB below Q-P limit

2.2.4 Test Results

Test Input Power	Battery Operated	Temperature	24°C
Test Distance	3m (<30MHz) 3m (≥30MHz – 25GHz)	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin
		Test Date	01 Oct 2024

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) *See Note 4

Frequency (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--

Spurious Emissions ranging from 9kHz – 30MHz *See Note 4

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel (Worst)
33.6270	34.4	40.0	5.6	100	134	V	39
96.0090	33.3	43.5	10.2	202.3	134	H	39
168.0130	30.5	43.5	13.0	100	131	H	39
312.0480	30.5	46.0	15.5	110.4	99	H	39
491.9400	31.0	46.0	15.0	213.1	185	H	39
937.5660	29.7	46.0	16.3	186.2	54	V	39

Spurious Emissions above 1GHz – 25GHz

Frequency (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
2.1277	46.4	74.0	27.6	24.9	54.0	29.1	187	65	V	0
9.3646	56.1	74.0	17.9	41.9	54.0	12.1	300	212	H	0
9.3928	55.6	74.0	18.4	41.6	54.0	12.4	148	258	V	0
14.5123	57.2	74.0	16.8	43.7	54.0	10.3	291	282	V	0
17.5324	59.5	74.0	14.5	45.7	54.0	8.3	105	355	V	0
17.6324	61.1	74.0	12.9	47.6	54.0	6.4	154	12	H	0

Spurious Emissions above 1GHz – 25GHz

Frequency (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
2.1301	47.1	74.0	26.9	24.8	54.0	29.2	238	146	V	19
9.3637	56.0	74.0	18.0	42.2	54.0	11.8	150	220	H	19
9.3822	55.6	74.0	18.4	41.7	54.0	12.3	144	222	V	19
14.5226	57.7	74.0	16.3	44.0	54.0	10.0	277	240	V	19
17.5538	61.5	74.0	12.5	47.5	54.0	6.5	272	12	H	19
17.7243	60.9	74.0	13.1	47.1	54.0	6.9	300	262	V	19

Spurious Emissions above 1GHz – 25GHz

Frequency (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Channel
2.1267	47.1	74.0	26.9	23.5	54.0	30.5	188	93	V	39
9.3642	56.1	74.0	17.9	43.0	54.0	11.0	300	254	H	39
9.3643	56.1	74.0	17.9	42.2	54.0	11.8	133	128	V	39
9.9199	56.9	74.0	17.1	50.8	54.0	3.2	300	342	V	39
14.6229	58.2	74.0	15.8	44.2	54.0	9.8	286	156	V	39
17.6777	60.6	74.0	13.4	47.9	54.0	6.1	266	339	V	39

Notes

1.	All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 9kHz – 150kHz RBW: 200Hz VBW: 1kHz 150kHz – 30MHz RBW: 9kHz VBW: 30kHz 30MHz - 1GHz RBW: 120kHz VBW: 1MHz >1GHz RBW: 1MHz VBW: 3MHz
4.	"--" indicates no emissions were found and shows compliance to the limits
5.	The measurement was done at 3m. The measured results were extrapolated to the specified test limits as specified in § 15.209 (a) based on 40dB/decade.
6.	Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
7.	The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33 (a) for intentional radiators & Section 15.33 (b) for unintentional radiators.
8.	The channel in the table refers to the transmit channel of the EUT.

2.3 Spectrum Bandwidth (6db Bandwidth Measurement)

2.3.1 Test Limits

The EUT shows compliance to the requirements of this section, which states that the minimum bandwidth of the EUT employing digital modulation techniques shall be at least 500kHz.

2.3.2 Test Setup

2.3.2.1 The EUT and supporting equipment were set up as shown in the set up photo.

2.3.2.2 The power supply for the EUT was connected to a filtered mains.

2.3.2.3 The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.

2.3.2.4 The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 3 times of RBW.

2.3.2.5 All other supporting equipment were powered separately from another filtered mains.

2.3.3 Test Method

2.3.3.1 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at lower channel.

2.3.3.2 The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 6dB bandwidth of the transmitting frequency.

2.3.3.3 The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.

2.3.3.4 The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. The frequencies below the 6dB peak frequency at lower (f_L) and upper (f_H) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser.

2.3.3.5 The 6dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies, $| f_H - f_L |$.

2.3.3.6 The measurements were repeated if the EUT supports more than one modulation and data rate.

2.3.3.7 The measurements were repeated with the transmitting frequency was set to middle and upper channels respectively.

2.3.4 Test Results

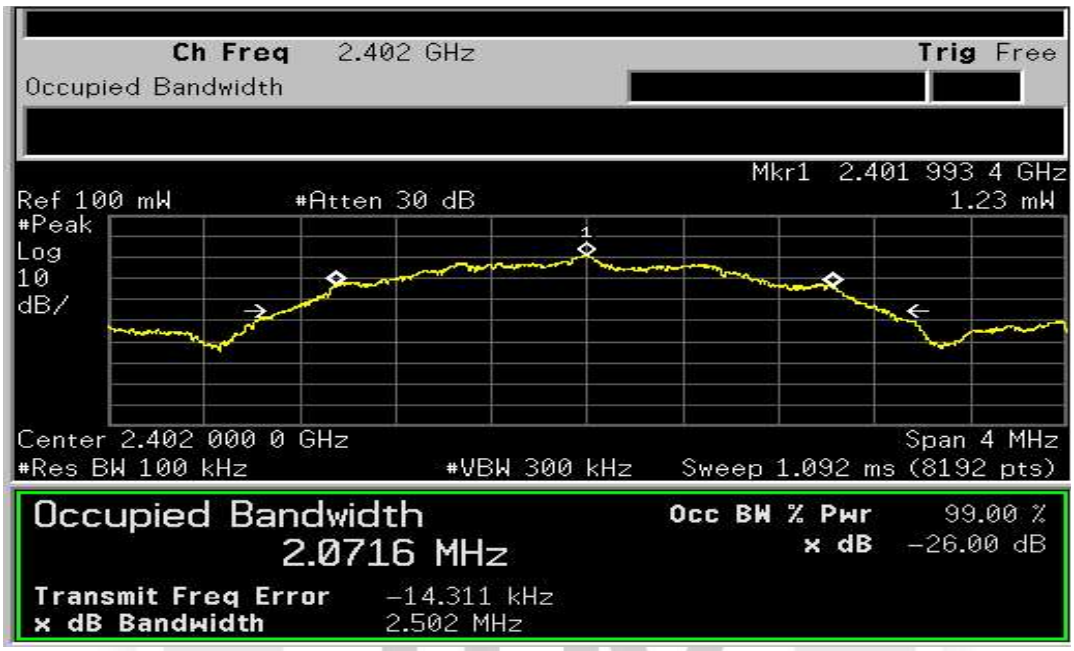
Test Input Power	3.5VDC	Temperature	24°C
Attached Plots	A1 - A3	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Lim Poh Huat
		Test Date	23 Jan 2025

Channel	Channel Frequency (GHz)	6dB Bandwidth (MHz) *See Note 1	Limit (kHz)
Lower	2.402	2.0707	≥ 500
Middle	2.440	2.0809	≥ 500
Upper	2.480	2.0833	≥ 500

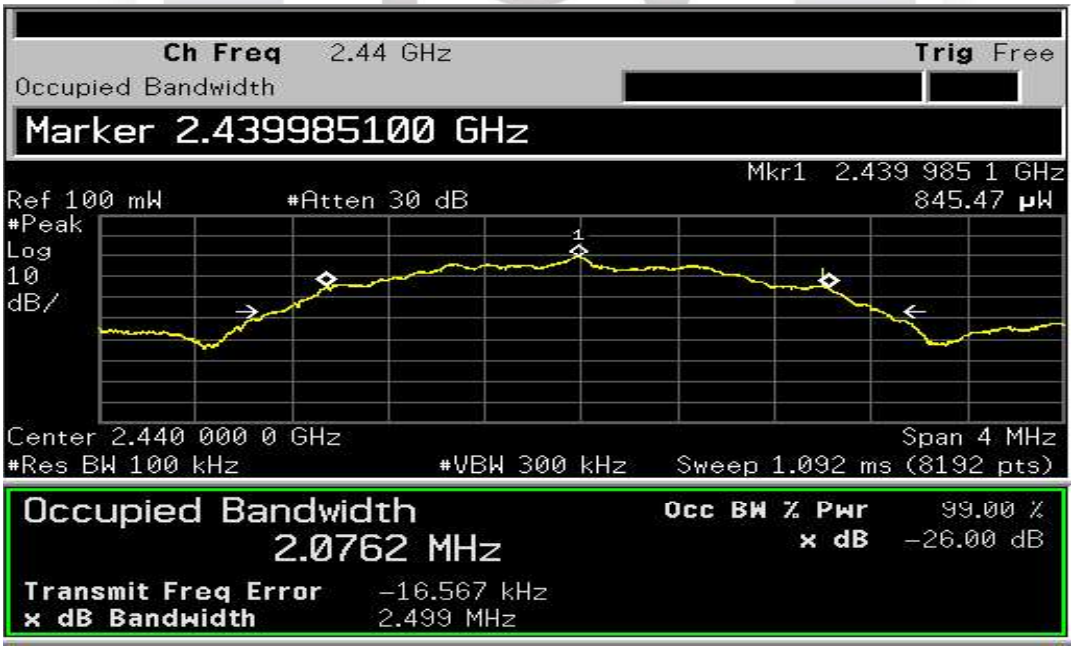
Notes

1.	Only the largest measured bandwidths were reported. Refer to plots for all measured bandwidth.

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots

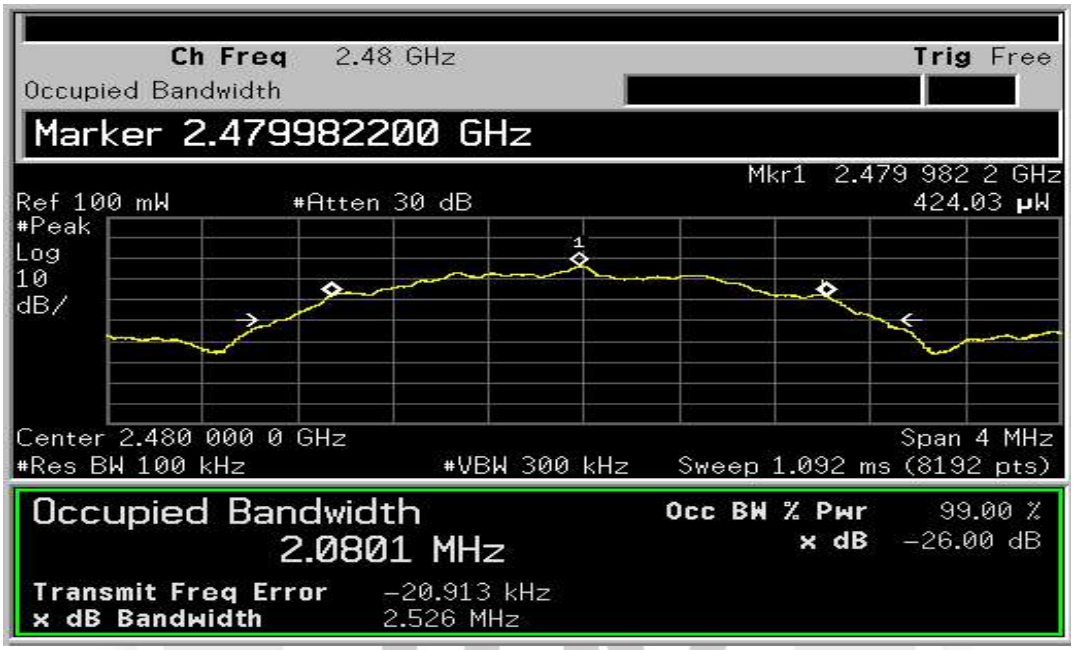


Plot A1 – Lower Channel



Plot A2 – Middle Channel

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots



Plot A3 – Upper Channel

2.4 Maximum Peak Power

2.4.1 Test Limits

The EUT shows compliance to the requirements of this section, which states the maximum peak power of the EUT employing digital modulation shall not exceed 1W (30dBm).

2.4.2 Test Setup

2.4.2.1 The EUT and supporting equipment were set up as shown in the setup photo.

2.4.2.2 The power supply for the EUT was connected to a filtered mains.

2.4.2.3 The RF antenna connector was connected to a power meter.

2.4.2.4 All other supporting equipment were powered separately from another filtered mains.

2.4.3 Test Method

2.4.3.1 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at lower channel.

2.4.3.2 The maximum peak power of the transmitting frequency was detected and recorded.

2.4.3.3 The measurements were repeated if the EUT supports more than one modulation and data rate.

2.4.3.4 The measurement was repeated with the transmitting frequency was set to middle channel and upper channels respectively.

2.4.4 Test Results

Test Input Power	3.5VDC	Temperature	24°C
Antenna Gain	2.5 dBi	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Lim Poh Huat
		Test Date	23 Jan 2025

Channel	Channel Frequency (GHz)	Maximum Peak Power (W) *See Note 1	Limit (W)
Lower	2.402	0.00063	1.0
Middle	2.440	0.00041	1.0
Upper	2.480	0.00043	1.0

Notes

1.	Only the highest measured peak power were reported.

2.5 RF Conducted Spurious Emissions (Non-Restricted Bands)

2.5.1 Test Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

2.5.2 Test Setup

2.5.2.1 The EUT and supporting equipment were set up as shown in the setup photo.

2.5.2.2 The power supply for the EUT was connected to a filtered mains.

2.5.2.3 The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.

2.5.2.4 The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 3 times of RBW.

2.5.2.5 All other supporting equipment were powered separately from another filtered mains.

2.5.3 Test Method

2.5.3.1 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, with transmitting frequency at lower channel.

2.5.3.2 The start and stop frequencies of the spectrum analyser were set to 30MHz and 10GHz.

2.5.3.3 The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.

2.5.3.4 The measurements were repeated with frequency span was set from 10GHz to 25GHz.

2.5.3.5 The measurements were repeated if the EUT supports more than one modulation and data rate.

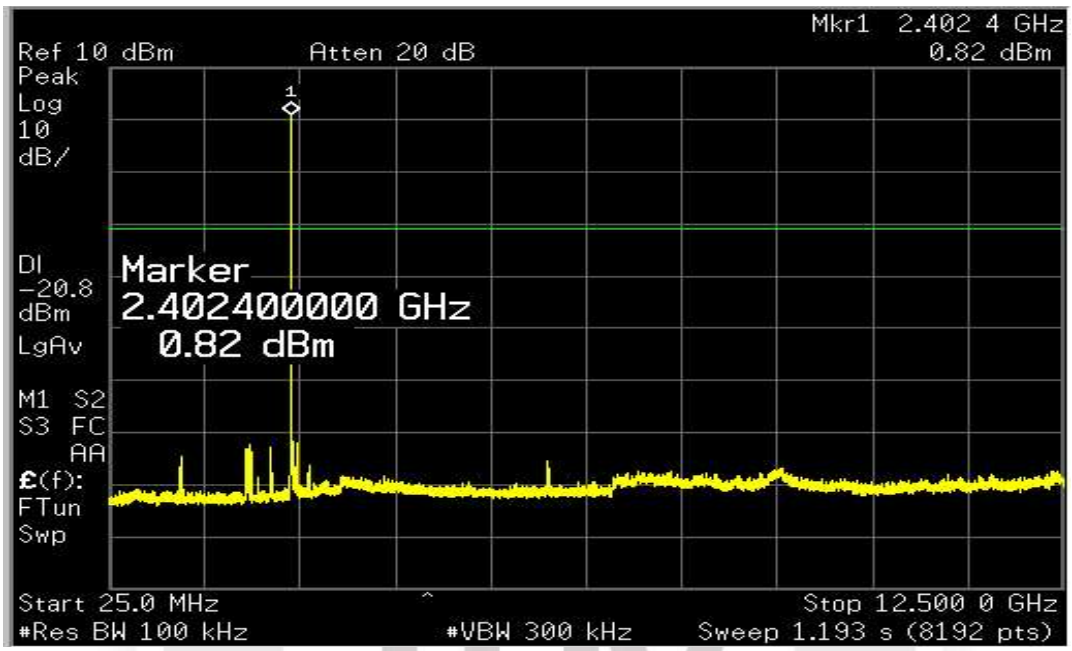
2.5.3.6 The measurements were repeated with the transmitting frequency was set to middle and upper channels respectively.

2.5.4 Test Results

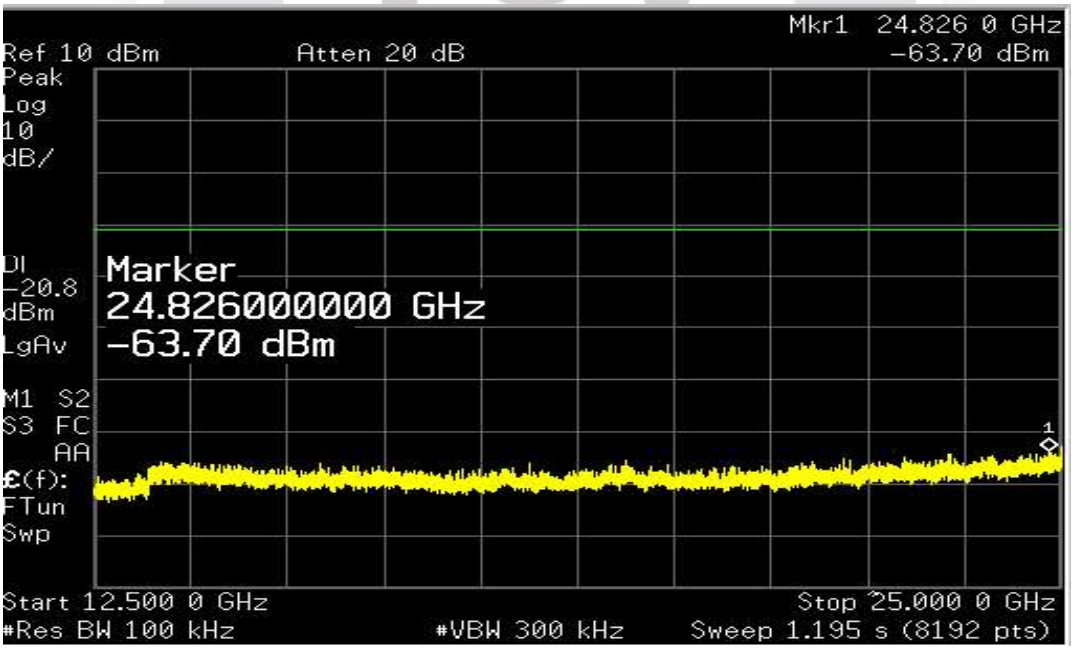
Test Input Power	3.5VDC	Temperature	24°C
Attached Plots	B1 – B6	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Lim Poh Huat
		Test Date	23 Jan 2025

All spurious signals found were below the specified limit. Please refer to the attached plots.

RF Conducted Spurious Emissions (Non-Restricted Bands) Plots

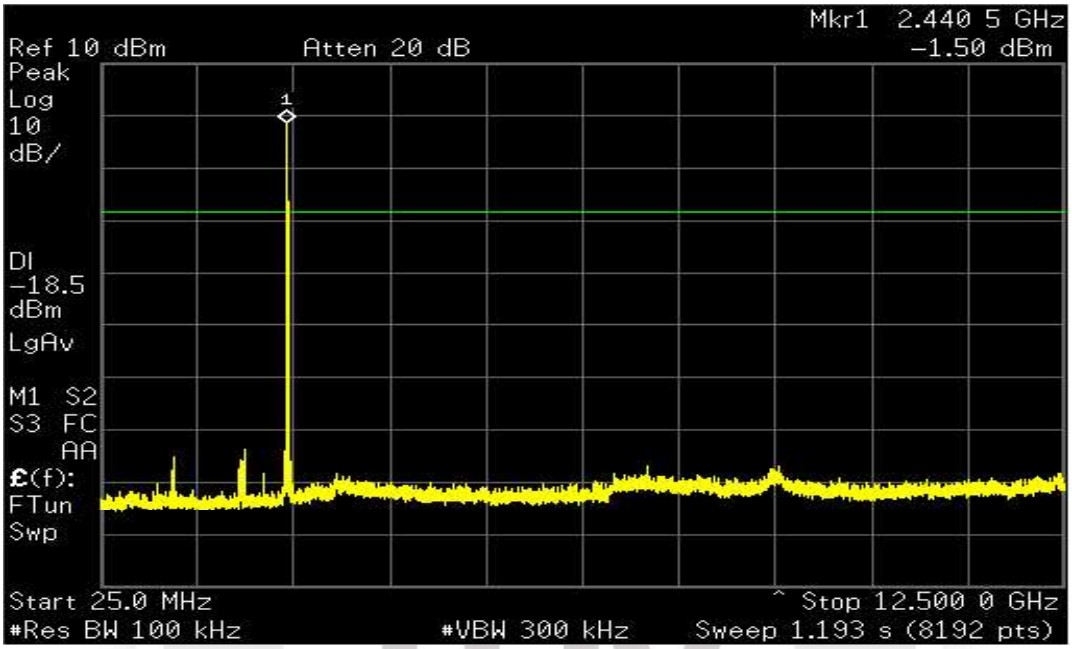


Plot B1 – Lower Channel

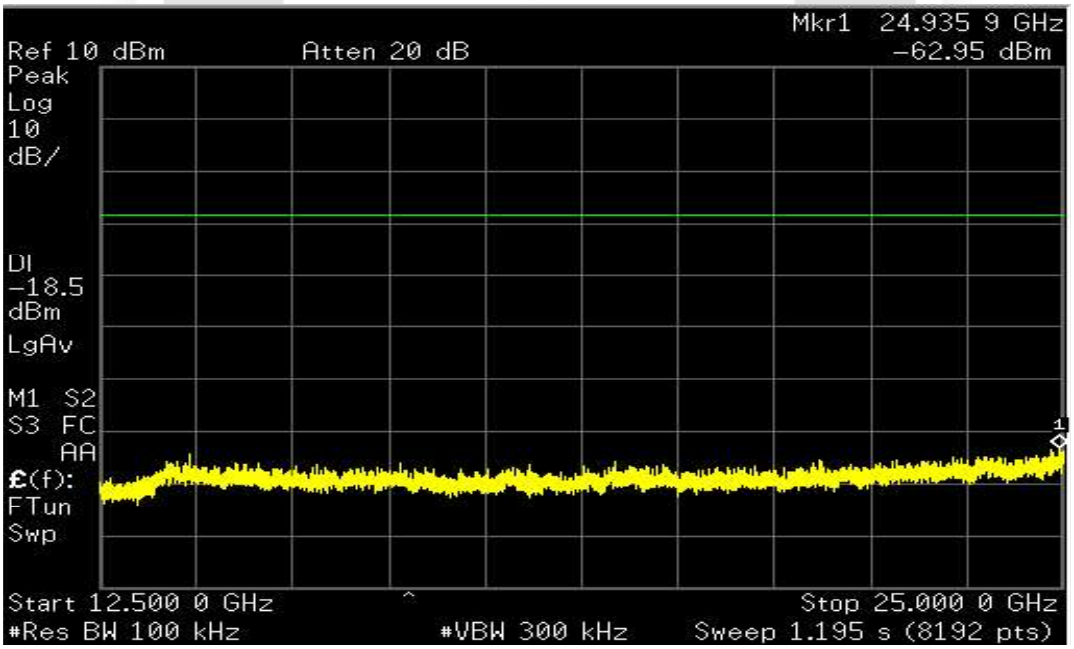


Plot B2 – Lower Channel

RF Conducted Spurious Emissions (Non-Restricted Bands) Plots

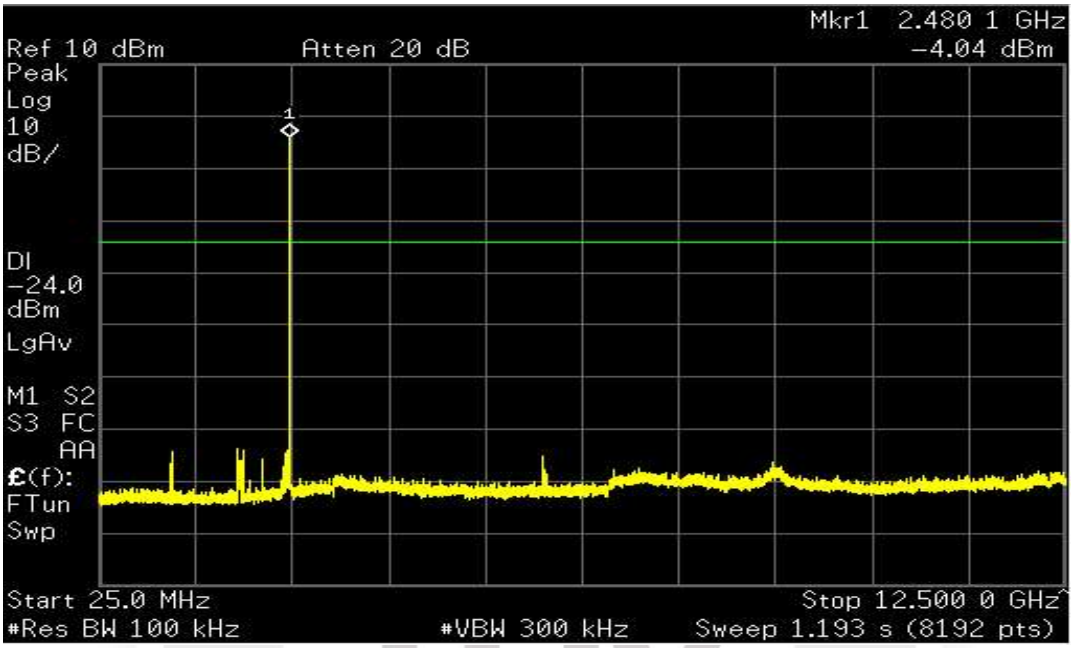


Plot B3 – Middle Channel

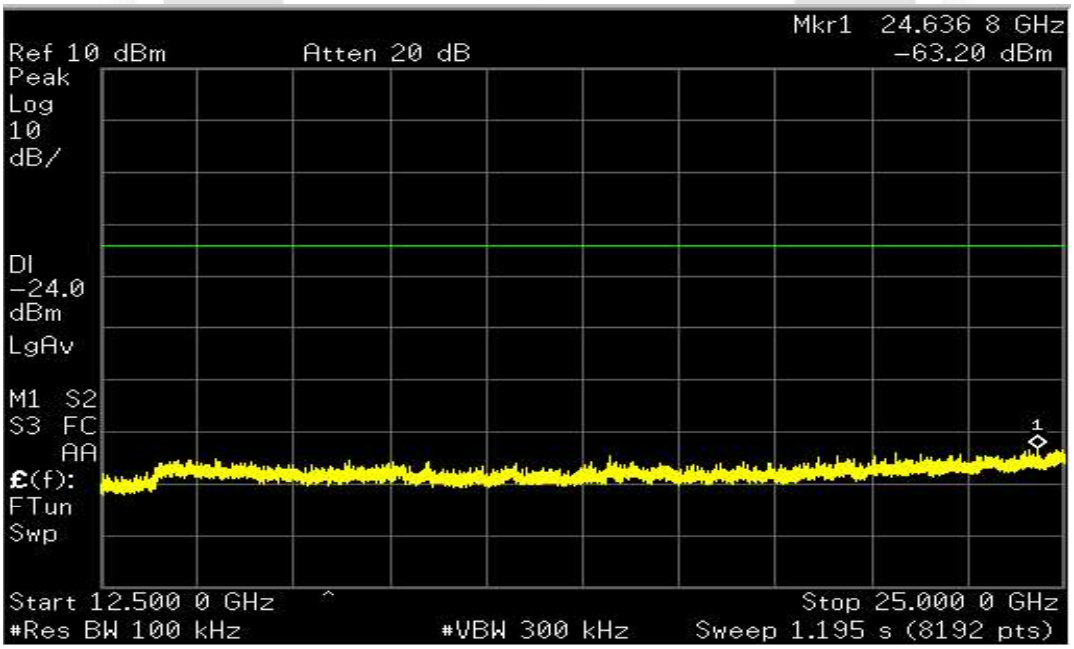


Plot B4 – Middle Channel

RF Conducted Spurious Emissions (Non-Restricted Bands) Plots



Plot B5 – Upper Channel



Plot B6 – Upper Channel

2.6 RF Conducted Spurious Emissions (Restricted Bands)

2.6.1 Test Limits

The EUT shows compliance to the requirements of this section, which states that emissions which fall in the restricted bands must comply with the radiated emission limits specified in the table below:

Frequency Range (MHz)	EIRP (dBm)	Radiated Emissions (dBµV/m)
0.009 – 0.490	-6.7 – (-41.4) **	67.6 – 20logF* @ 300m **
0.490 – 1.705	-41.4 – (-52.3) **	87.6 – 20logF* @ 30m **
1.705 – 30	-45.7	29.5 @ 30m
30 - 88	-55.2	40.0 @ 3m
88 - 216	-51.7	43.5 @ 3m
216 - 960	-49.2	46.0 @ 3m
>960	-41.2 ***	54.0 @ 3m ***
* F is frequency in kHz.		
** Decreasing linearly with the logarithm of the frequency.		
*** Above 1GHz, a peak limit of 20dB above the average limit does apply.		

47 CFR FCC Part 15.205 Restricted Bands

MHz			MHz			MHz			GHz		
0.090	-	0.110	16.42	-	16.423	399.9	-	410	4.5	-	5.15
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	2690	-	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	-	3358	36.43	-	36.5
12.57675	-	12.57725	322	-	335.4	3600	-	4400	Above 38.6		
13.36	-	13.41									

2.6.2 Test Setup

2.6.2.1 The EUT and supporting equipment were set up as shown in the setup photo.

2.6.2.2 The power supply for the EUT was connected to a filtered-mains.

2.6.2.3 The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.

2.6.2.4 The resolution bandwidth (RBW) of the spectrum analyser was set to the following settings. The video bandwidth (VBW) was set to at least three times of the RBW.

Frequency (MHz)	RBW (kHz)
0.009 – 0.150	0.2
0.150 – 30.0	9.0
30.0 - 1000	100.0
> 1000	1000.0

2.6.2.5 The detector of the spectrum analyser was set to peak detection mode.

2.6.2.6 All other supporting equipment were powered separately from another filtered mains.

2.6.3 Test Method

Measurement in the range 9kHz – 1000MHz

2.6.3.1 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, with the transmitting frequency was set to lower channel.

2.6.3.2 The start and stop frequencies of the spectrum analyser were set according to the supported RBW.

2.6.3.3 The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected. The antenna gain of the EUT was added to the captured spurious emissions.

2.6.3.4 No further measurement was required if all the captured emissions complied to the limits. Else, the spectrum analyser was set to zoom to the captured emission with the detector of the spectrum analyser was set to quasi-peak. The emission level of the captured frequency was measured.

2.6.3.5 The measurements were repeated until all the captured emissions which exceeding the limits were measured.

2.6.3.6 The measurements were repeated if the EUT supports more than one modulation and data rate.

2.6.3.7 The measurements were repeated with the transmitting frequency was set to middle and upper channels respectively

Measurement above 1000MHz

2.6.3.8 The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, with the transmitting frequency was set to lower channel.

2.6.3.9 The start and stop frequencies of the spectrum analyser were set according to the supported frequency band of the set RBW with the number of points in a sweep was set to equal or greater than 2 times of the ratio of span over RBW.

2.6.3.10 The detector of the spectrum analyser was set to power average (RMS) mode with the sweep time was set to equal or greater than 10 times of the product of number of measurement points in a sweep and transmission symbol time.

2.6.3.11 The spectrum analyser was then allowed to capture any spurious emissions within a single sweep. The peak marker function of the spectrum analyser was used to locate the highest power level. The antenna gain of the EUT was added to the captured spurious emissions.

2.6.3.12 The measurements were repeated until all the required frequency bands were measured.

2.6.3.13 The measurements were repeated if the EUT supports more than one modulation and data rate.

2.6.3.14 The measurements were repeated with the transmitting frequency was set to middle and upper channels respectively.

2.6.3.15 The measurements were repeated with the detector of the spectrum analyser was set to peak detecting mode. The sweep time was set to auto coupler.

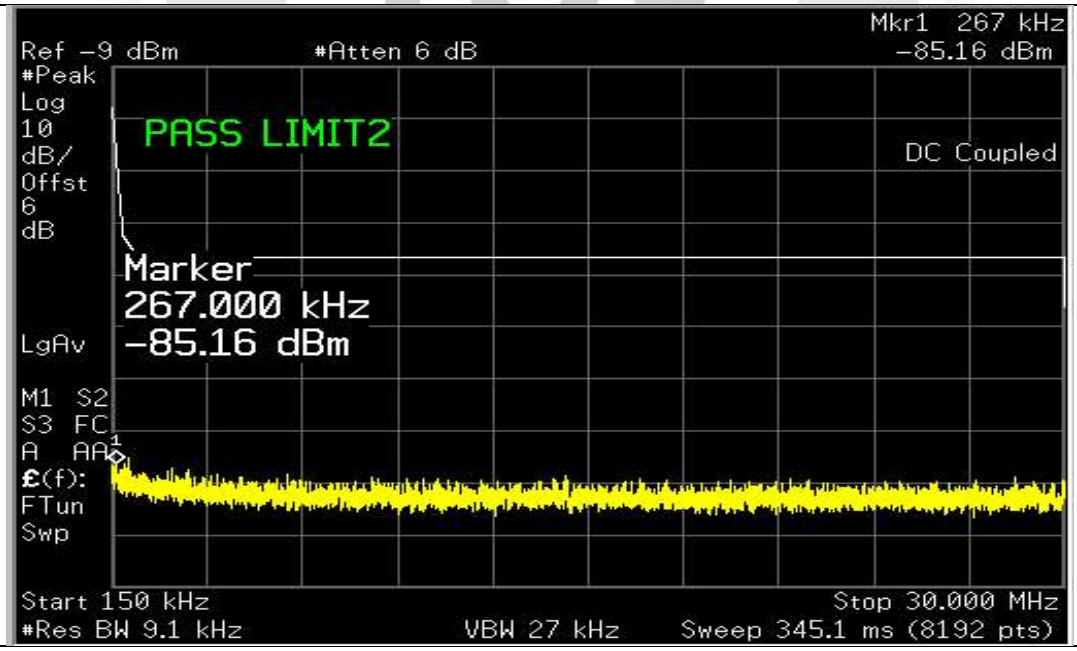
2.6.4 Test Results

Test Input Power	3.5VDC	Temperature	24°C
Attached Plots	C1 – C33	Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Lim Poh Huat
		Test Date	23 Jan 2025

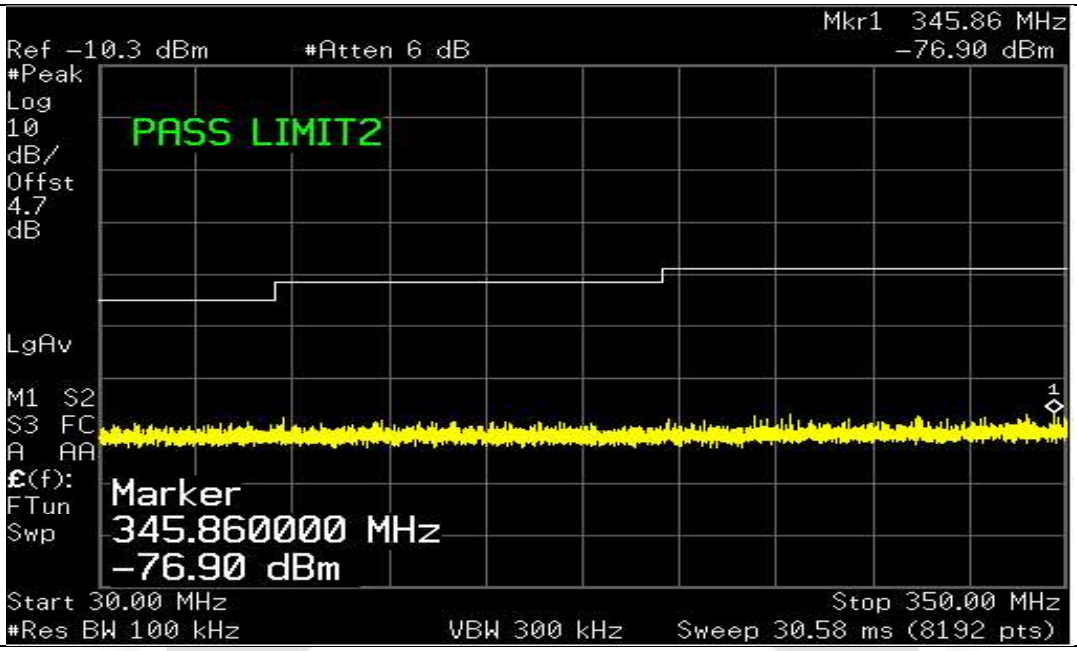
All spurious signals found were below the specified limit. Please refer to the attached plots.

RF Conducted Spurious Emissions (Restricted Bands) Plots – Peak

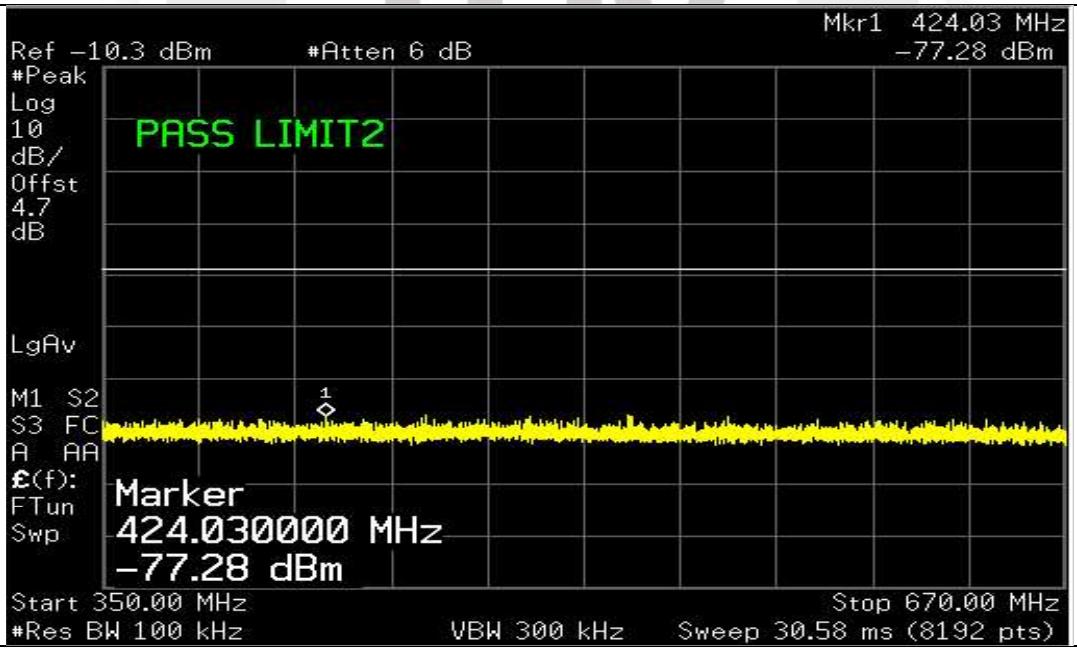
Plot C1 – Lower Channel 9kHz to 150kHz



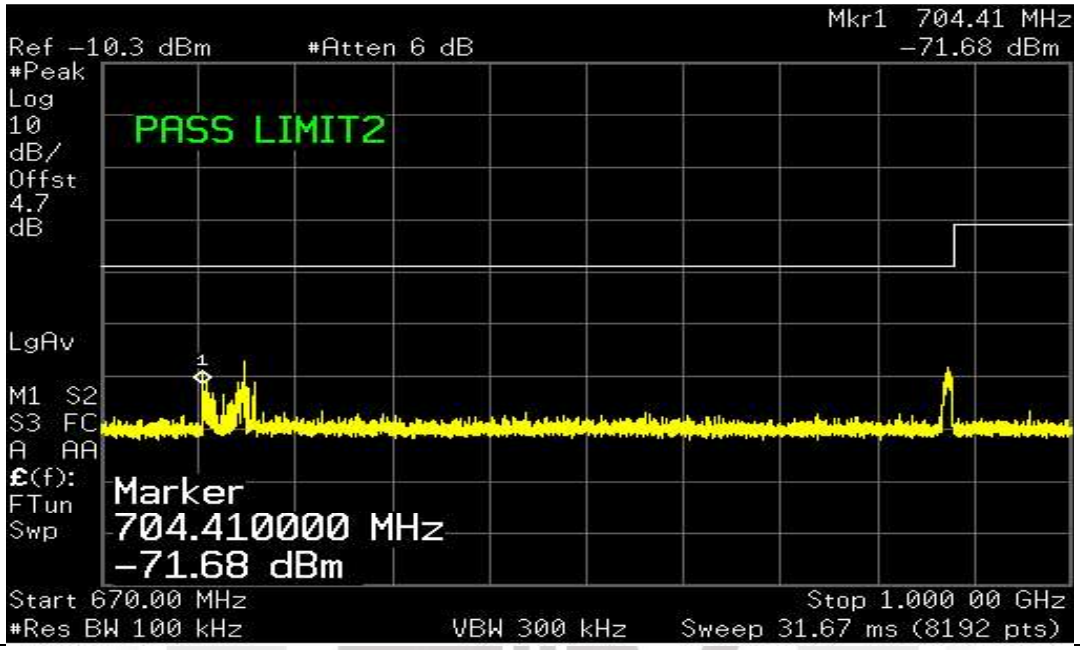
Plot C2 – Lower Channel 150kHz to 30MHz



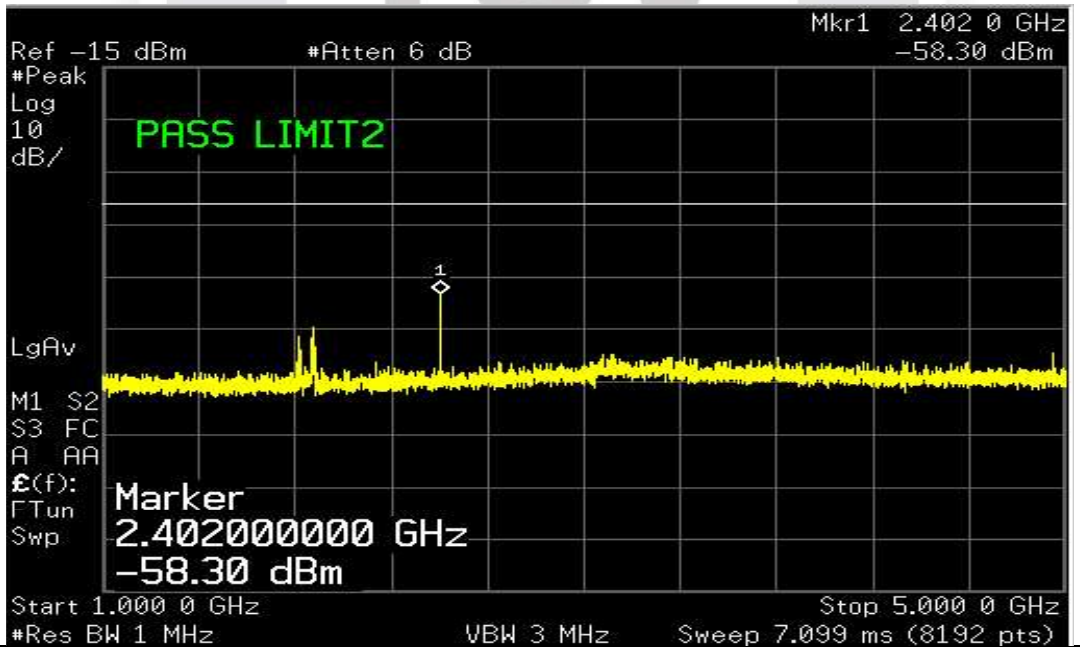
Plot C3 – Lower Channel 30MHz to 350MHz



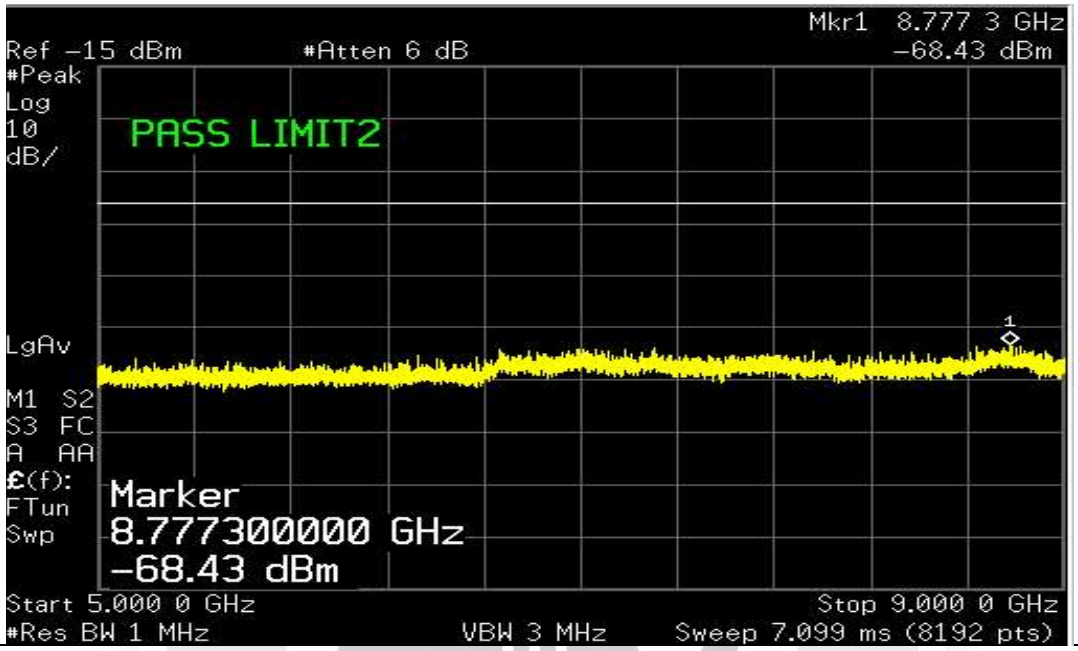
Plot C4 – Lower Channel 350MHz to 670MHz



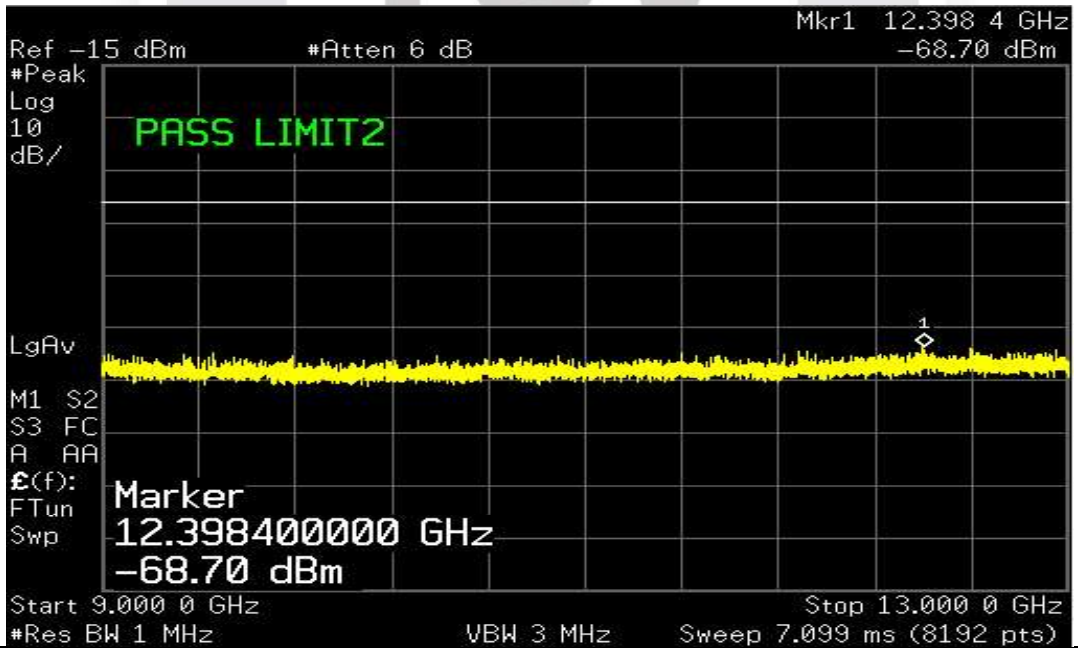
Plot C5 – Lower Channel 670MHz to 1GHz



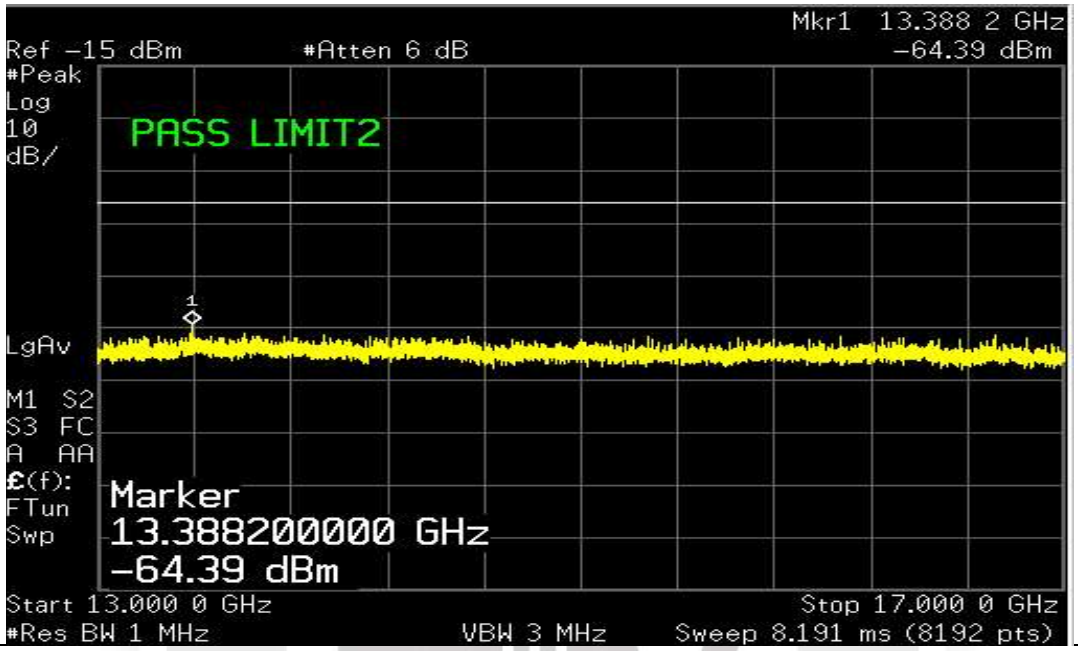
Plot C6 – Lower Channel 1GHz to 5GHz



Plot C7 – Lower Channel 5GHz to 9GHz



Plot C8 – Lower Channel 9GHz to 13GHz



Plot C9 – Lower Channel 13GHz to 17GHz

Plot C10 – Lower Channel 17GHz to 21GHz