



MEASUREMENT REPORT

FCC PART 15.247 / ISED RSS-247 SRD

FCC ID: YIY-ASMB0878

IC: 8903A-ASMB0878

Applicant: Industrea Mining Technology Pty Ltd

Application Type: Certification

Product: MINI RF TOF MODULE NANOPAN

Model No.: ASMB0878

Trading Name: T/A Digital Mining Technology

FCC Rule(s): Part 15 Subpart C (Section 15.247)

ISED Rule(s): RSS-247 Issue 2, RSS-GEN Issue 5

AUS Standard: AS/NZS 4268: 2017

Test Procedure(s): ANSI C63.10-2013

Test Date: November 14 ~ December 27, 2021

Reviewed By:

 Sunny Sun

Approved By:

 Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2110RSU055-U1	Rev. 01	Initial Report	02-28-2022	Valid

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1.4. Product Information

Product	MINI RF TOF MODULE NANOPAN
Model No.	ASMB0878
Frequency Range	2400 ~ 2483.5MHz
Operating Temp.	-40 ~ 75°C
Power Supply	3.3 Vdc
Remark: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	2400 ~ 2483.5MHz
Channel Number	2
Modulation	CSS
Antenna Type	External antenna
Antenna Gain	8 dBi

1.6. Antenna Information

Antenna Part No.	Antenna Type	Peak Gain
WA2-0243-N01SJ4-080	Omni-directional	8 dBi
PROD0832	Omni-directional	3 dBi
MISC0483	Omni-directional	3 dBi
Remark: All the three antenna types are the same, so we chose the antenna with maximum gain for all testing.		

2. TEST CONFIGURATION

2.1. Test Mode

Test Mode	Mode 1: Transmit at Frequency 2437MHz
	Mode 2: Transmit at Frequency 2442MHz

2.2. Test Environment Condition

Ambient Temperature	15°C ~ 35°C
Relative Humidity	20%RH ~ 75%RH

2.3. Working Frequencies

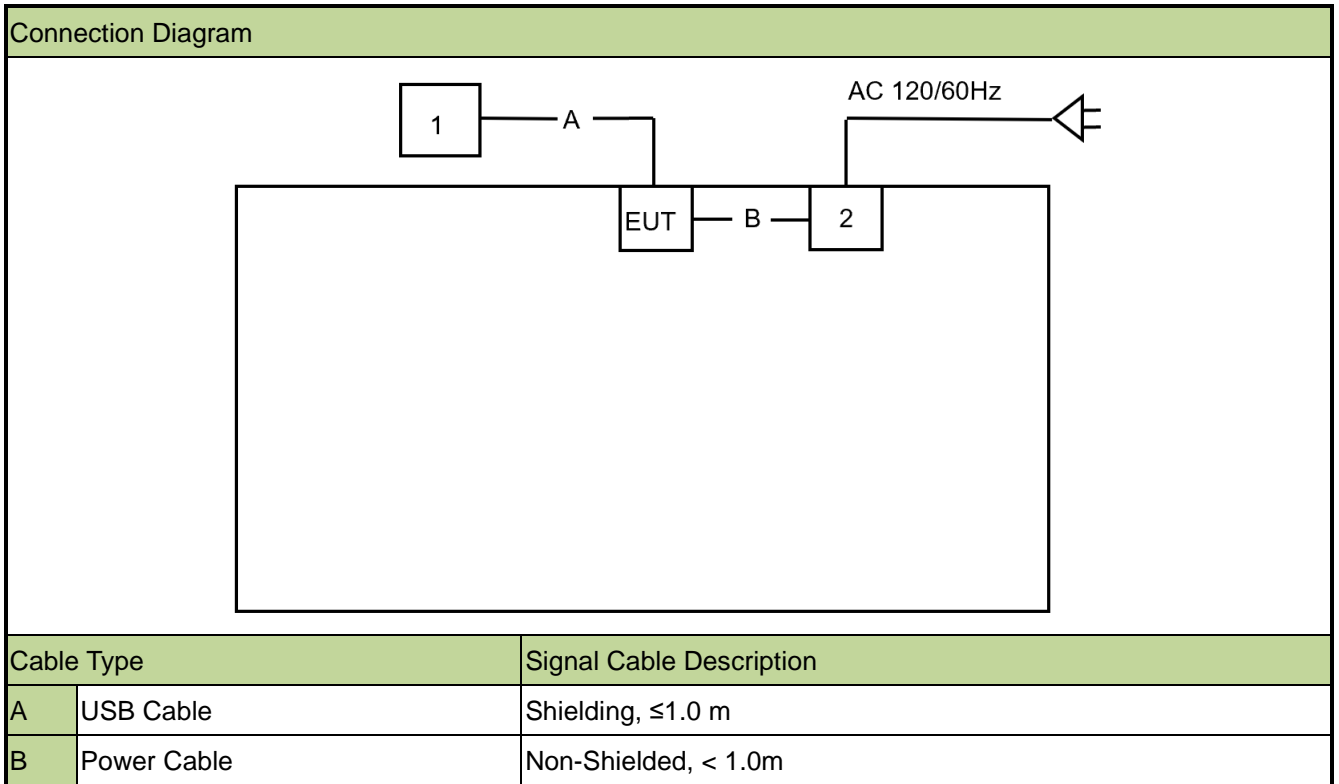
Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2437 MHz	01	2442 MHz	--	--

2.4. Test Software

The test utility software used during testing was “PT Manager”, and the version was 0.04.015.

2.5. Test System Connection Diagram

The ANSI C63.10: 2013 was used to reference the appropriate EUT setup for testing.



2.6. Test System Details

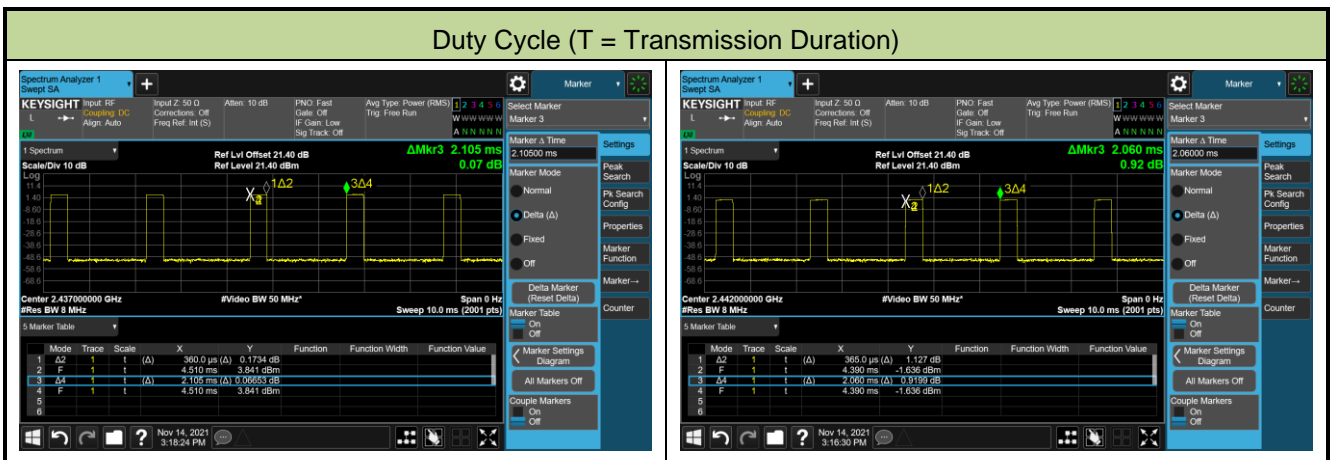
The types for all equipment and descriptions of all cables used in the tested system:

Product	Manufacturer	Model No.	
1	Notebook	Lenovo	E495
2	DC Source	GWINSTEK	GPS-2303C

2.7. Duty Cycle

The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
Mode 1	17.10%
Mode 2	17.72%



3. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

- The antenna of the device is **used a unique coupling.**

Conclusion:

The device unit complies with the requirement of §15.203.

4. MEASURING INSTRUMENTS

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
Anechoic Chamber	RIKEN	SIP-AC1	MRTSUE06554	1 year	2021/12/24	SIP-AC1
Preamplifier	EMCI	EMC051845SE	MRTSUE06600	1 year	2022/11/8	SIP-AC1
Horn Antenna	R&S	HF907	MRTSUE06610	1 year	2022/8/5	SIP-AC1
Thermohygrometer	testo	608-H1	MRTSUE06616	1 year	2022/11/2	SIP-AC1
Thermohygrometer	testo	608-H1	MRTSUE06620	1 year	2021/12/3	SIP-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06645	1 year	2022/8/26	SIP-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2022/1/12	SIP-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE06613	1 year	2022/6/24	SIP-AC1
Preamplifier	EMCI	EMC001330	MRTSUE06643	1 year	2022/1/14	SIP-AC1
Loop Antenna	Schwarzbeck	FMZB 1519 B	MRTSUE06937	1 year	2022/3/9	SIP-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2022/6/24	SIP-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06603	1 year	2022/10/31	SIP-AC1
Signal Analyzer	Keysight	N9020B	MRTSUE06604	1 year	2022/9/7	SIP-AC1
Temperature Chamber	BAOYT	BYG-408CS	MRTSUE06847	1 year	2022/2/23	SIP-TR1
Communication Tester	R&S	CMW500	MRTSUE06881	1 year	2022/6/2	SIP-TR1
Broadband Field Meter	narda	NBM 550	MRTSUE06897	3 years	2023/2/26	SIP-TR1
E-Field Probe	narda	EF 0691	MRTSUE06898	3 years	2023/8/13	SIP-TR1
DECT Tester	RTX	RTX2012	MRTSUE06914	1 year	2022/2/23	SIP-TR1
B-Field Probe	narda	100 cm ²	MRTSUE06919	3 years	2024/2/14	SIP-TR1
Exposure Level Tester	narda	ELT-400	MRTSUE06920	3 years	2023/11/29	SIP-TR1
H-Field Probe	narda	HF 3061	MRTSUE06921	3 years	2023/12/1	SIP-TR1
H-Field Probe	narda	HF 0191	MRTSUE06922	3 years	2023/5/5	SIP-TR1
E-Field Probe	narda	EF 9091	MRTSUE06923	3 years	2024/2/15	SIP-TR1
Thermohygrometer	testo	Testo 608-H1	MRTSUE11022	1 year	2022/11/2	SIP-TR1
Signal Analyzer	Keysight	N9030B	MRTSUE06395	1 year	2022/8/8	SIP-TR1
Signal Generator	R&S	SMU200A	MRTSUE06489	1 year	2022/2/23	SIP-TR1
USB Power Sensor	Keysight	U2021XA	MRTSUE06595	1 year	2022/9/7	SIP-TR1
USB Power Sensor	Keysight	U2021XA	MRTSUE06596	1 year	2022/9/7	SIP-TR1
Signal Generator	Keysight	N5182B	MRTSUE06605	1 year	2022/10/31	SIP-TR1
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2022/6/8	SIP-SR2
Power Analyzer	California Instruments	PACS-1	MRTSUE06010	1 year	2022/1/3	SIP-SR2
AC Power Source	California Instruments	3001IX-208-CTS	MRTSUE06011	1 year	2022/1/3	SIP-SR2
ISN	R&S	ENY81	MRTSUE06608	1 year	2022/6/7	SIP-SR2
ISN	R&S	ENY81-CA6	MRTSUE06609	1 year	2022/6/7	SIP-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06612	1 year	2022/6/24	SIP-SR2

Thermohygrometer	testo	608-H1	MRTSUE06621	1 year	2022/11/28	SIP-SR2
CDNE	Schwarzbeck	CDNE M2	MRTSUE06934	1 year	2022/3/9	SIP-SR2
CDNE	Schwarzbeck	CDNE M3	MRTSUE06935	1 year	2022/3/9	SIP-SR2
50 Ω to 150 Ω Adapter	Schwarzbeck	SR100-6W	MRTSUE06936	1 year	2022/3/9	SIP-SR2
Shielding Room	MIX-BEP	SIP-SR2	MRTSUE06949	/	/	SIP-SR2

Software	Version	Function
EMI Software	V3	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT 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 $k = 2$.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.78dB
Output Power
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.13dB
Power Spectrum Density
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.15dB
Occupied Bandwidth
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.28%

6. TEST RESULT

6.1. Summary

FCC Section(s)	ISED Section(s)	Test Description	Test Condition	Test Result
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	Conducted	Pass
N/A	RSS-Gen [6.7]	99% Bandwidth		Pass
15.247(b)(3)	RSS-247 [5.4(d)]	Output Power		Pass
15.247(e)	RSS-247 [5.2]	Power Spectral Density		Pass
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions		Pass
15.205 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Radiated	Pass
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

Notes:

- 1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 3) N/A means the test item is not applicable, the detailed information refers to relevant section.

6.2. Occupied Bandwidth Measurement

6.2.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

6.2.2. Test Procedure used

ANSI C63.10-2013 - Section 11.8 (6dB bandwidth)

ANSI C63.10-2013 - Section 6.9.3 (99% bandwidth)

6.2.3. Test Setting

For 6dB bandwidth

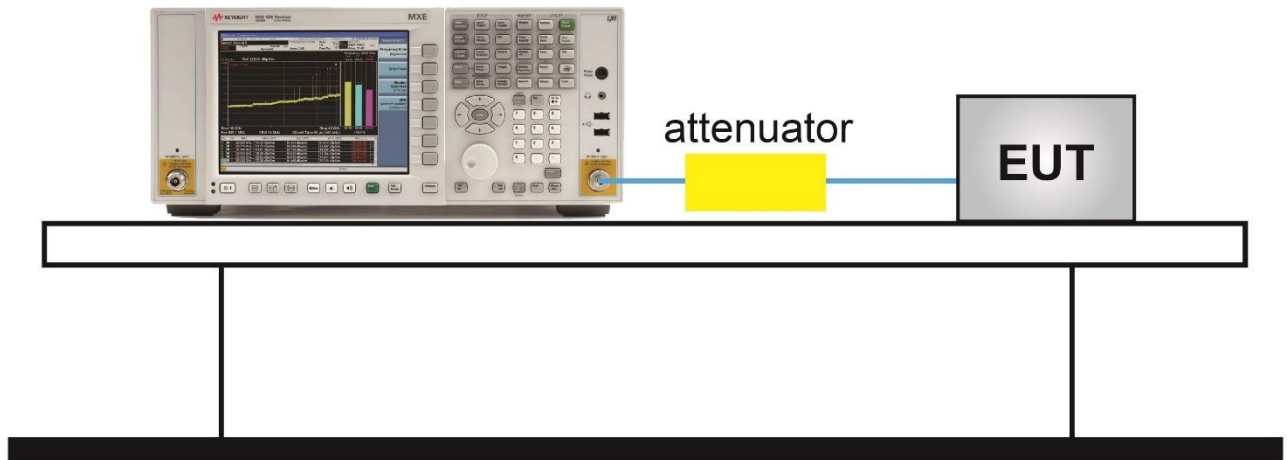
1. Set RBW = 100 kHz
2. VBW $\geq 3 \times$ RBW
3. Detector = Peak
4. Trace mode = Max hold
5. Sweep = Auto couple
6. Allow the trace to stabilize
7. Use the X dB bandwidth mode with X set to 6 dB

For 99% bandwidth

1. Span = 1.5 times to 5 times the OBW
2. Set RBW = 1% to 5% the OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace was allowed to stabilize

6.2.4. Test Setup

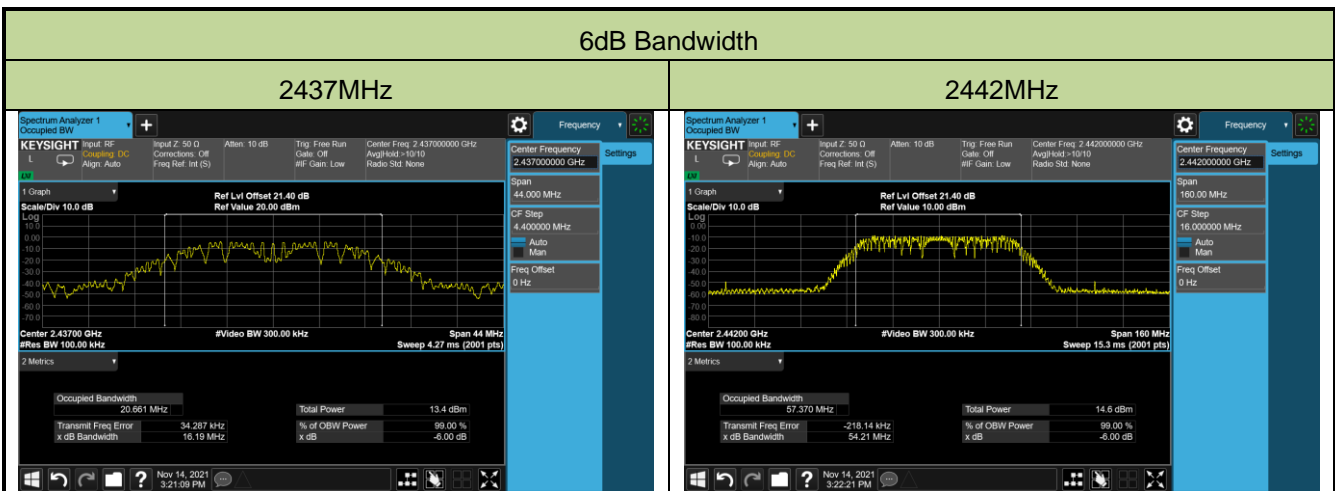
Spectrum Analyzer



6.2.5. Test Result

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2021/11/14		

Test Mode	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	99% Bandwidth (MHz)	Result
Mode 1	2437	16.19	≥ 0.5	20.89	Pass
Mode 2	2442	54.21	≥ 0.5	58.34	Pass



6.3. Output Power Measurement

6.3.1. Test Limit

The maximum out power shall be less 1 Watt (30dBm) and the EIRP shall not exceed 4 Watt (36dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. 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 FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 11.9.1.3 Method PKPM1

ANSI C63.10-2013 - Section 11.9.2.3.2 Method AVGPM-G

6.3.3. Test Setting

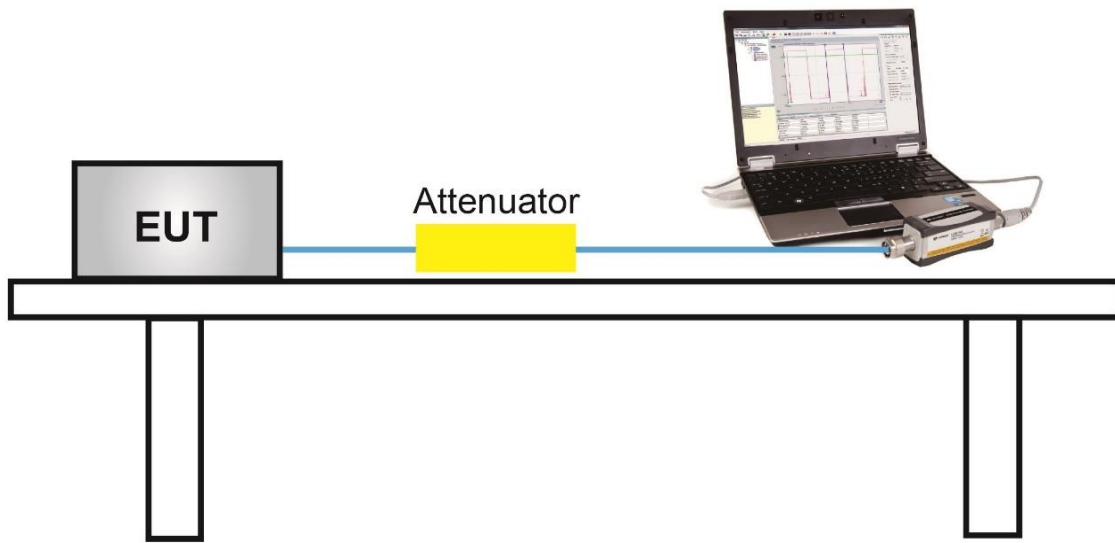
PKPM1 Peak-reading power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

6.3.4. Test Setup



6.3.5. Test Result

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2021/11/14		

Test Mode	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Max EIRP (dBm)	EIRP Limit (dBm)	Result
Peak Output Power						
Mode 1	2437	9.07	≤ 28.00	17.07	≤ 36.00	Pass
Mode 2	2442	9.08	≤ 28.00	17.08	≤ 36.00	Pass
Average Output Power (Reported Only)						
Mode 1	2437	7.24	≤ 28.00	15.24	≤ 36.00	Pass
Mode 2	2442	7.84	≤ 28.00	15.84	≤ 36.00	Pass

Note: Max EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi), Antenna Gain = 8.00 dBi.

6.4. Power Spectral Density Measurement

6.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

The same method of determining the conducted output power shall be used to determine the power spectral density.

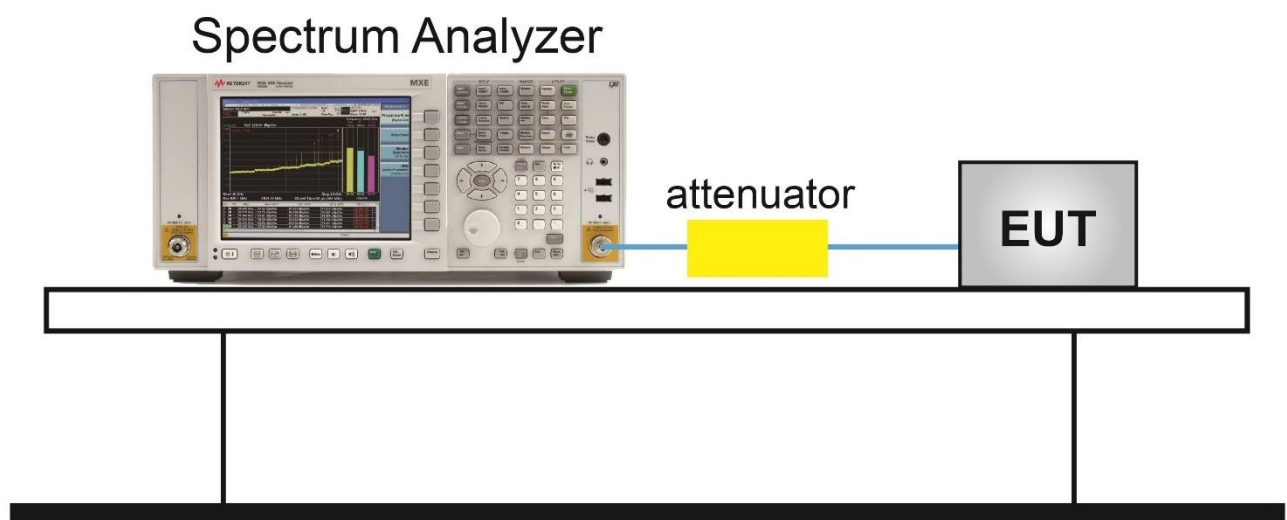
6.4.2. Test Procedure Used

ANSI C63.10-2013 Section 11.10.2

6.4.3. Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

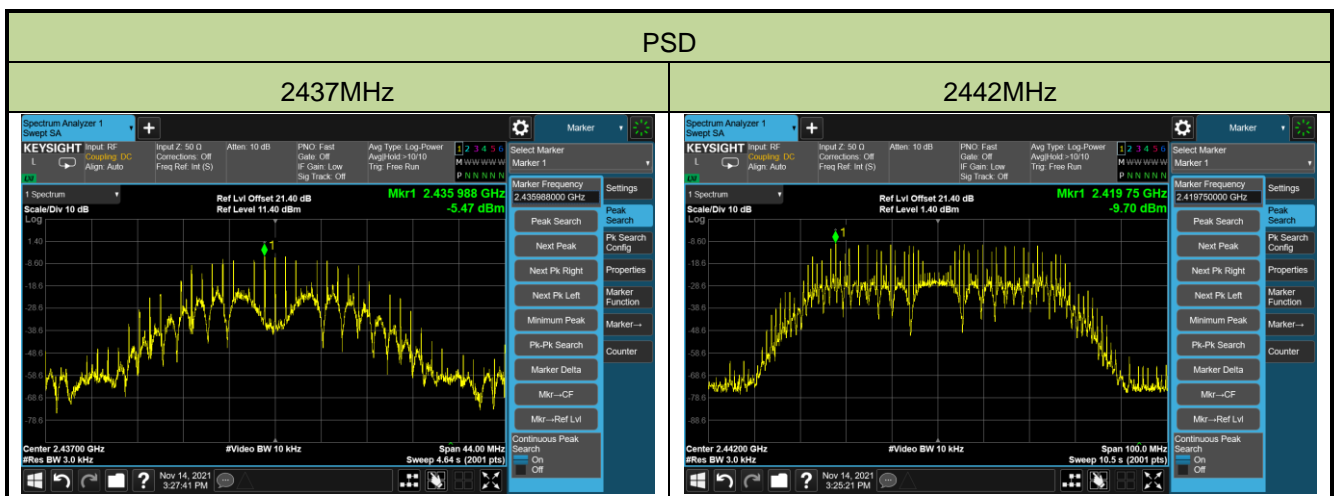
6.4.4. Test Setup



6.4.5. Test Result

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2021/11/14		

Test Mode	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
Mode 1	2437	-5.47	≤ 8.00	Pass
Mode 2	2442	-9.70	≤ 8.00	Pass



6.5. Conducted Band Edge and Out-of-Band Emissions

6.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure.

6.5.2. Test Procedure Used

ANSI C63.10-2013 Section 11.11

6.5.3. Test Setting

Reference level measurement

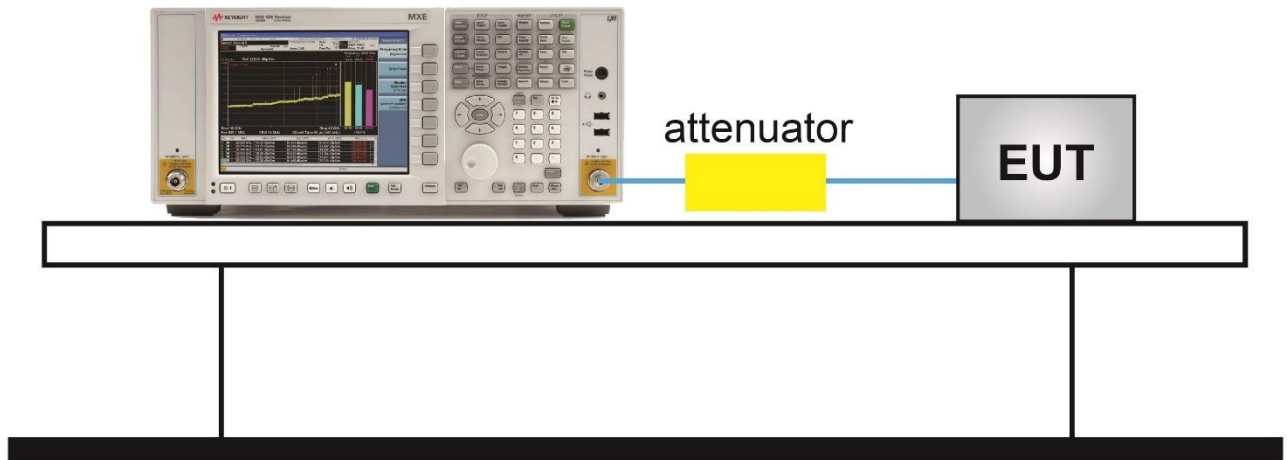
1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW $\geq 3 \times$ RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

6.5.4. Test Setup

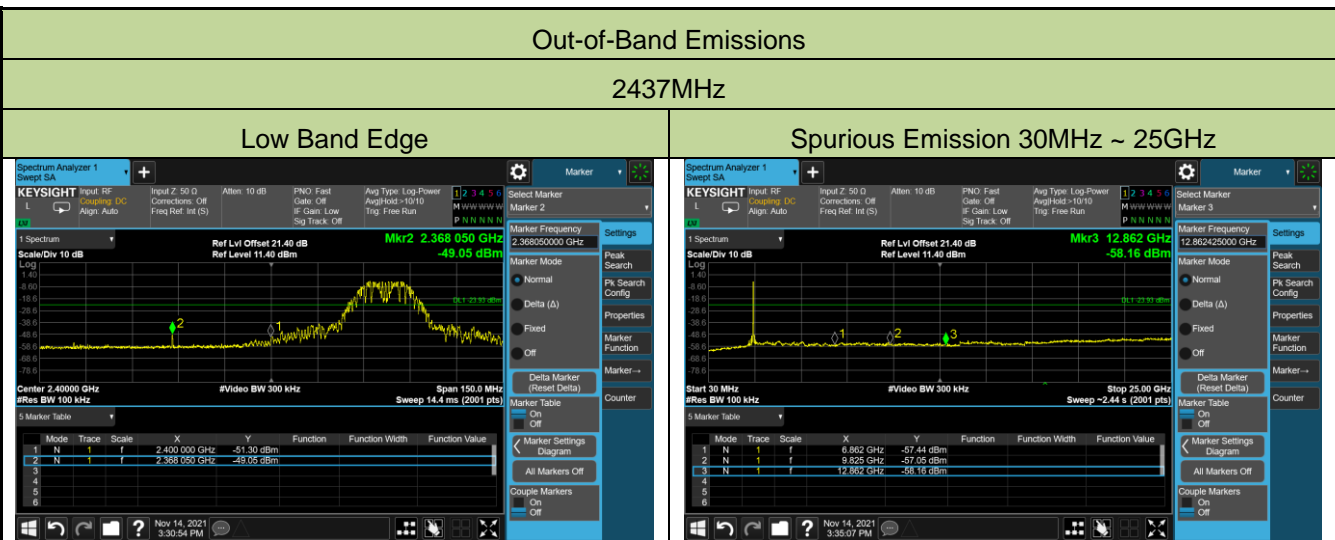
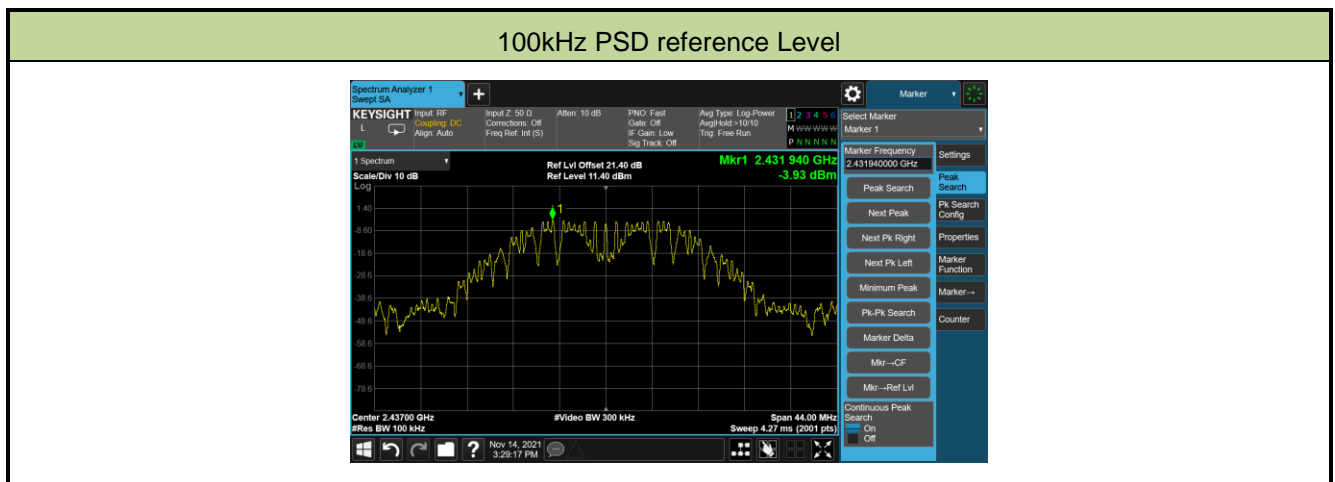
Spectrum Analyzer

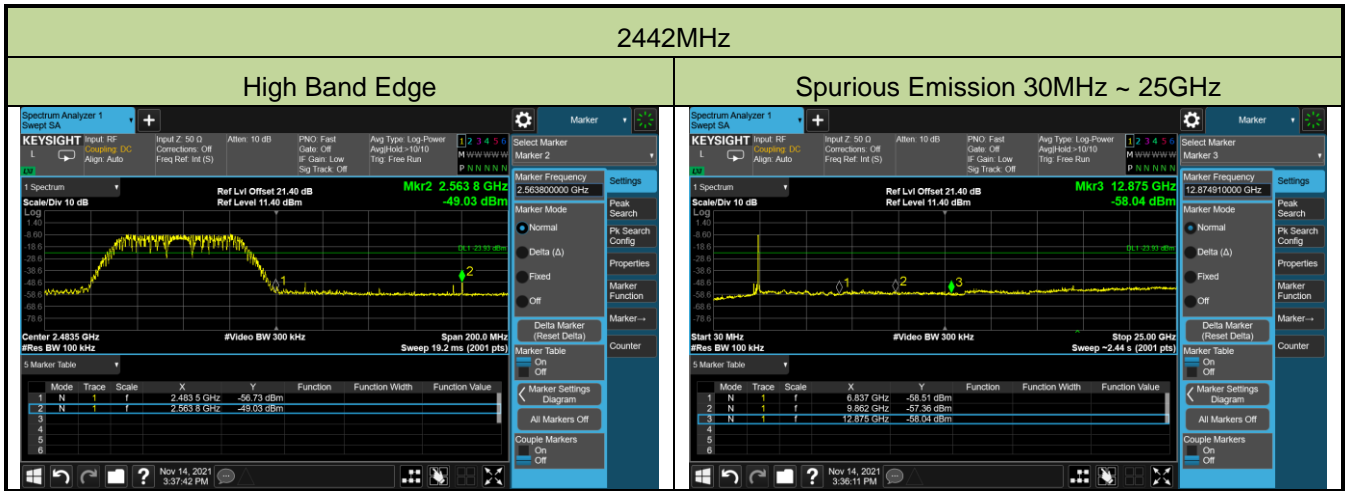


6.5.5. Test Result

Test Site	SIP-TR1	Test Engineer	Alisa Deng
Test Date	2021/11/14		

Test Mode	Frequency (MHz)	Limit	Result
Mode 1	2437	20dBc	Pass
Mode 2	2442	20dBc	Pass





6.6. Radiated Spurious Emission Measurement

6.6.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [$\mu\text{V/m}$]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

All out of band emissions appearing in a restricted band as specified in Section 8.10 of the RSS-GEN Issue 5 must not exceed the limits shown in Table per Section 8.9.

RSS-Gen Section 8.9			
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Magnetic Field Strength (H-Field) ($\mu\text{A/m}$)	Measured Distance (m)
0.009 - 0.490 1	--	6.37/F (F in kHz)	300
0.490 - 1.705	--	6.37/F (F in kHz)	30
1.705 - 30	--	0.08	30
30 - 88	100	--	3
88 - 216	150	--	3
216 - 960	200	--	3
Above 960	500	--	3

6.6.2. Test Procedure Used

ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6

6.6.3. Test Setting**Table 1 - RBW as a function of frequency**

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000MHz	1MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Peak Measurements above 1GHz

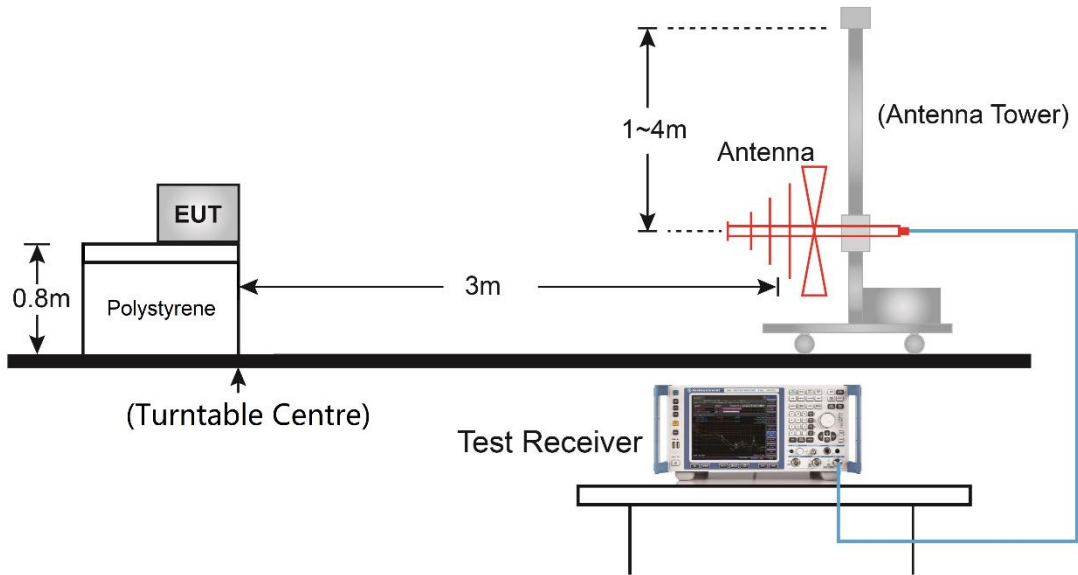
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

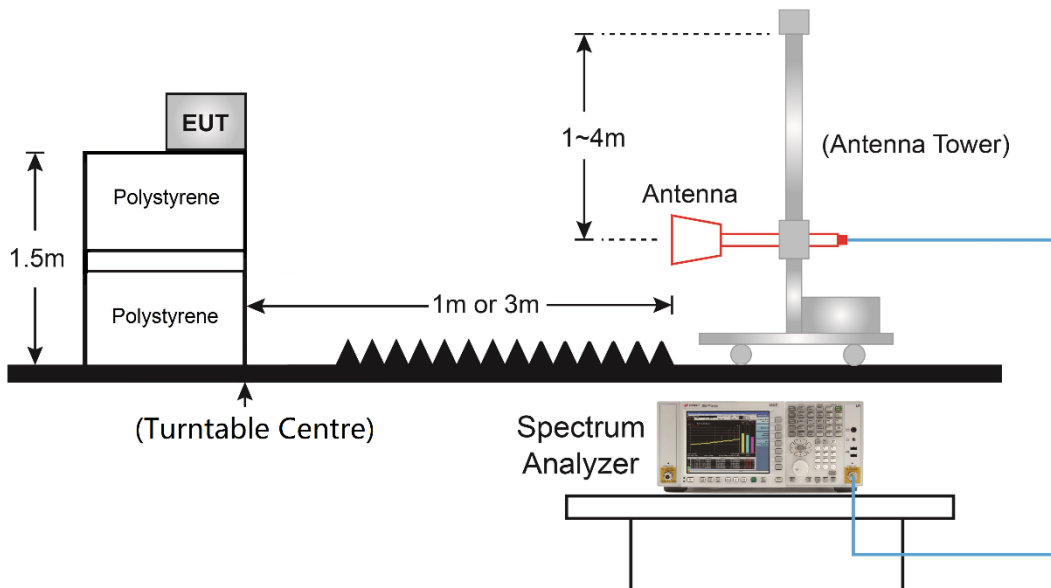
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10 Hz.
If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

6.6.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



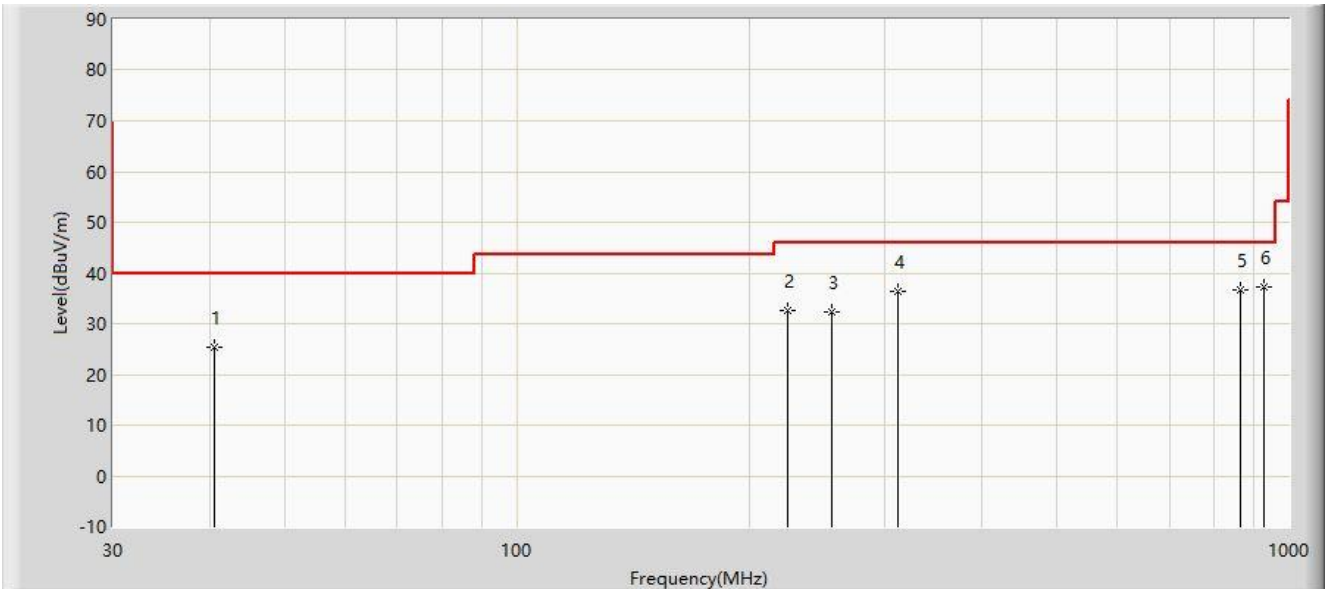
6.6.5. Test Result

Test Site	SIP-AC1	Test Engineer	Edward Zhang
Test Date	2021/11/21		
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not shown in the report.		

Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Detector	Polarization
Mode 1							
7485.5	41.0	48.4	-33.0	74.0	-7.4	Peak	Horizontal
8497.0	42.6	48.8	-31.4	74.0	-6.2	Peak	Horizontal
15688.0	47.2	45.2	-26.8	74.0	2.0	Peak	Horizontal
7426.0	41.0	48.5	-33.0	74.0	-7.5	Peak	Vertical
8259.0	41.2	47.3	-32.8	74.0	-6.1	Peak	Vertical
15722.0	47.5	45.6	-26.5	74.0	1.9	Peak	Vertical
Mode 2							
7681.0	41.7	48.7	-32.3	74.0	-7.0	Peak	Horizontal
8327.0	42.4	48.4	-31.6	74.0	-6.0	Peak	Horizontal
11140.5	43.2	48.2	-30.8	74.0	-5.0	Peak	Horizontal
7502.5	42.0	49.4	-32.0	74.0	-7.4	Peak	Vertical
9398.0	42.6	48.6	-31.4	74.0	-6.0	Peak	Vertical
15773.0	47.9	44.9	-26.1	74.0	3.0	Peak	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m) Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)							

The Result of Radiated Emission below 1GHz:

Site: SIP-AC1	Test Date: 2021/11/30
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_VULB 9168 _30-1000MHz	Polarity: Horizontal
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2442MHz	



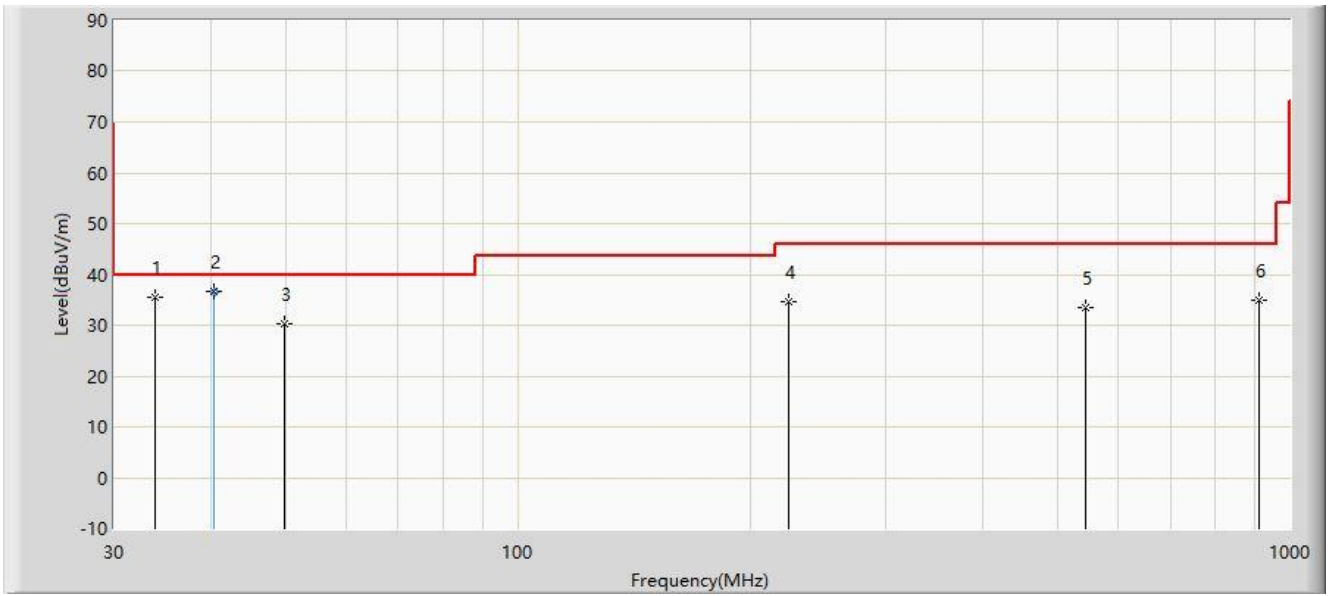
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1			40.670	25.443	7.895	-14.557	40.000	17.548	PK
2			224.000	32.602	17.873	-13.398	46.000	14.729	PK
3			256.010	32.375	15.758	-13.625	46.000	16.617	PK
4			311.785	36.484	17.838	-9.516	46.000	18.646	PK
5			864.200	36.776	8.660	-9.224	46.000	28.116	PK
6		*	928.220	37.105	7.689	-8.895	46.000	29.416	PK

Note 1: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz, 18GHz to 40GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: SIP-AC1	Test Date: 2021/11/30
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_VULB 9168 _30-1000MHz	Polarity: Vertical
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2442MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1			33.880	35.365	18.390	-4.635	40.000	16.975	PK
2		*	40.361	36.525	19.000	-3.475	40.000	17.524	QP
3			49.885	30.403	12.625	-9.597	40.000	17.778	PK
4			224.000	34.763	20.034	-11.237	46.000	14.729	PK
5			544.100	33.439	9.976	-12.561	46.000	23.463	PK
6			912.215	34.922	5.800	-11.078	46.000	29.121	PK

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz, 18GHz to 40GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

6.7. Radiated Restricted Band Edge Measurement

6.7.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	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	(²)
13.36 - 13.41	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [μ V/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

For RSS-Gen Section 8.10 Requirement

Radiated emissions which fall in the restricted bands, as defined in Section 8.10 of RSS-Gen, must also comply with the radiated emission limits specified in Section 8.9.

Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.525225	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	--
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138	--	

All out of band emissions appearing in a restricted band as specified in Section 8.10 of the RSS-Gen must not exceed the limits shown in Table per Section 8.9.

RSS-Gen Section 8.9			
Frequency [MHz]	Magnetic field strength (H-Field) [$\mu\text{A}/\text{m}$]	Field Strength [$\mu\text{V}/\text{m}$]	Measured Distance [Meters]
0.009 - 0.490	6.37/F(F in kHz)	--	300
0.490 - 1.705	63.7/F(F in kHz)	--	30
1.705 - 30	0.08	--	30
30 - 88	--	100	3
88 - 216	--	150	3
216 - 960	--	200	3
Above 960	--	500	3

6.7.2. Test Procedure Used

ANSI C63.10-2013 Section 6.3, 6.6, 6.10

6.7.3. Test Setting

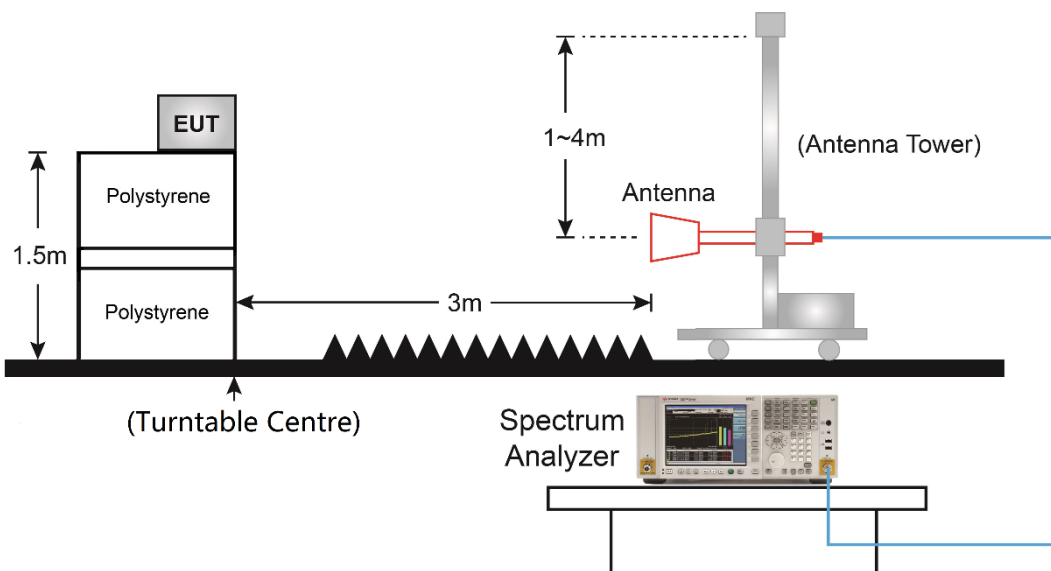
Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

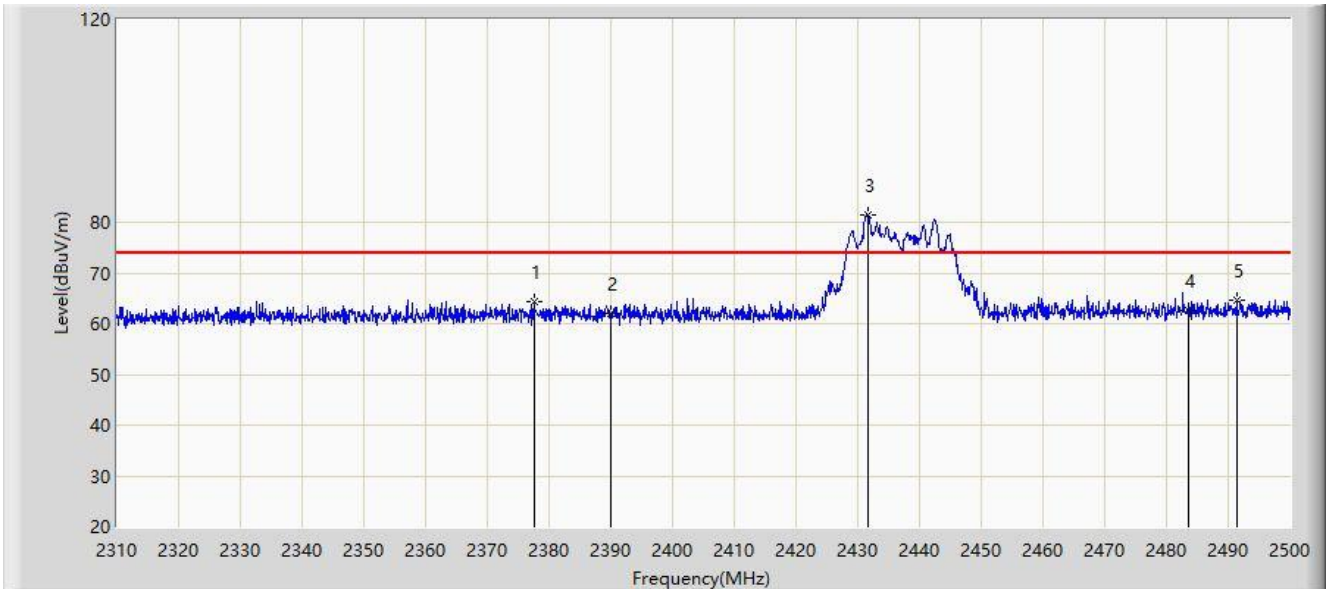
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW $\geq 1/T$
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

6.7.4. Test Setup



6.7.5. Test Result

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Horizontal
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2437MHz	

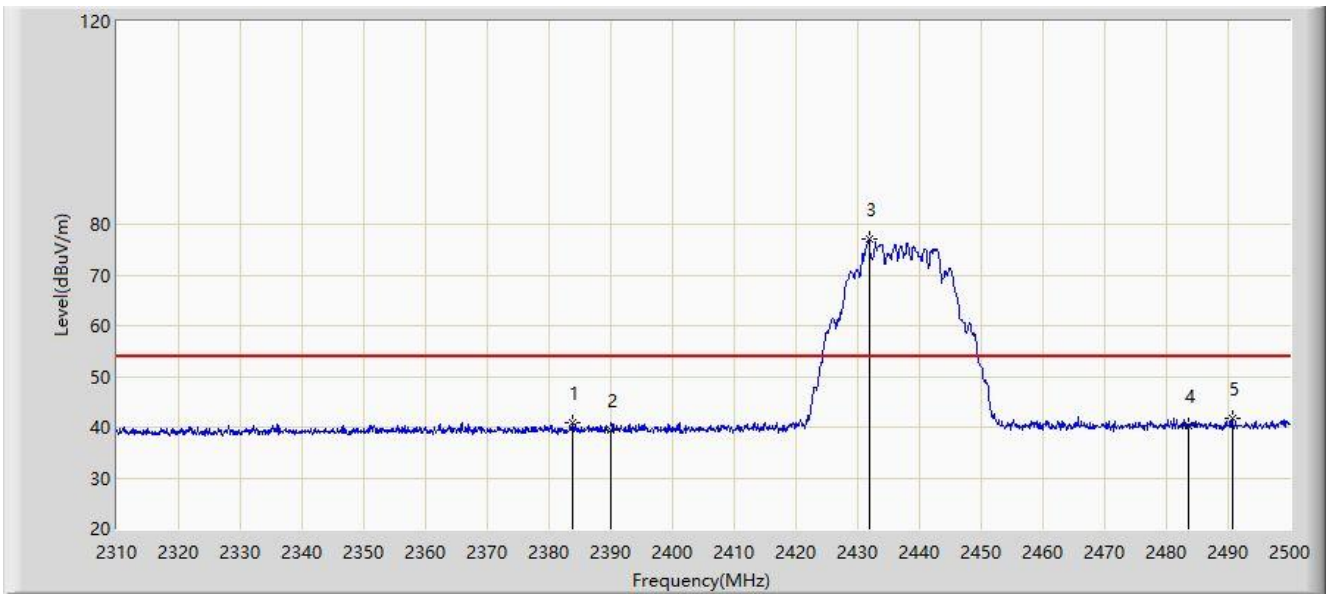


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1			2377.545	64.225	32.889	-9.775	74.000	31.336	PK
2			2390.000	61.886	30.515	-12.114	74.000	31.371	PK
3		*	2431.600	81.369	49.870	N/A	N/A	31.499	PK
4			2483.500	62.716	31.061	-11.284	74.000	31.654	PK
5			2491.355	64.649	32.967	-9.351	74.000	31.681	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Horizontal
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2437MHz	

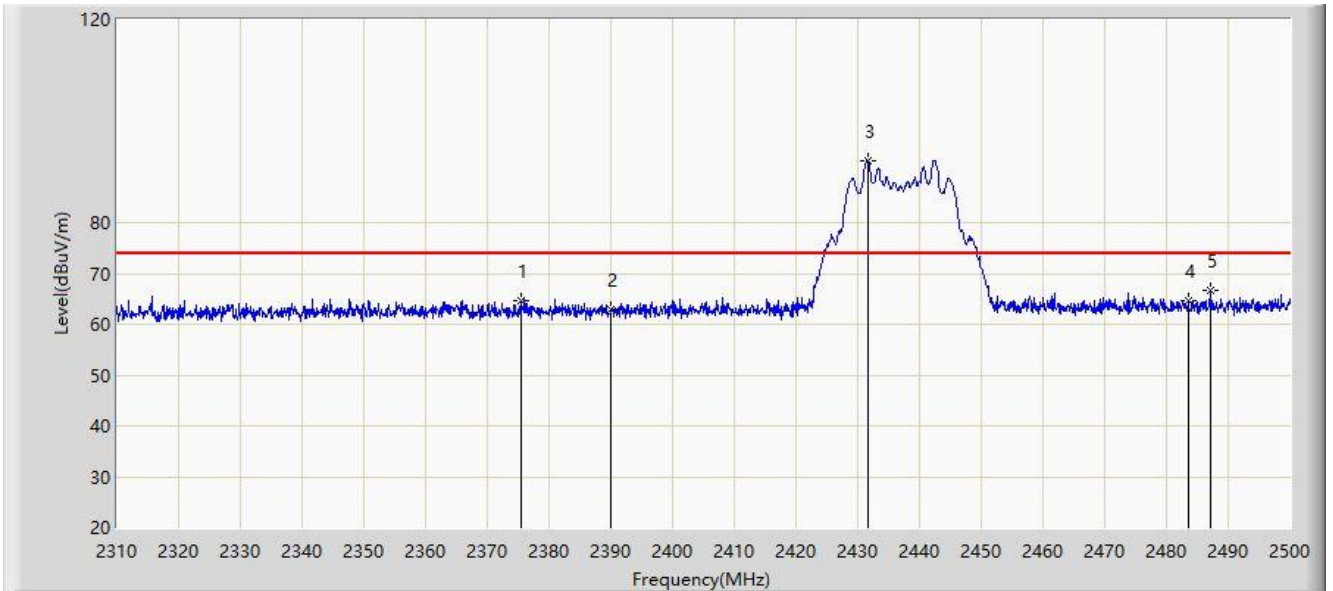


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1			2383.720	40.978	9.625	-13.022	54.000	31.354	AV
2			2390.000	39.494	8.123	-14.506	54.000	31.371	AV
3		*	2431.790	77.020	45.521	N/A	N/A	31.500	AV
4			2483.500	40.341	8.686	-13.659	54.000	31.654	AV
5			2490.690	41.880	10.200	-12.120	54.000	31.680	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Vertical
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2437MHz	

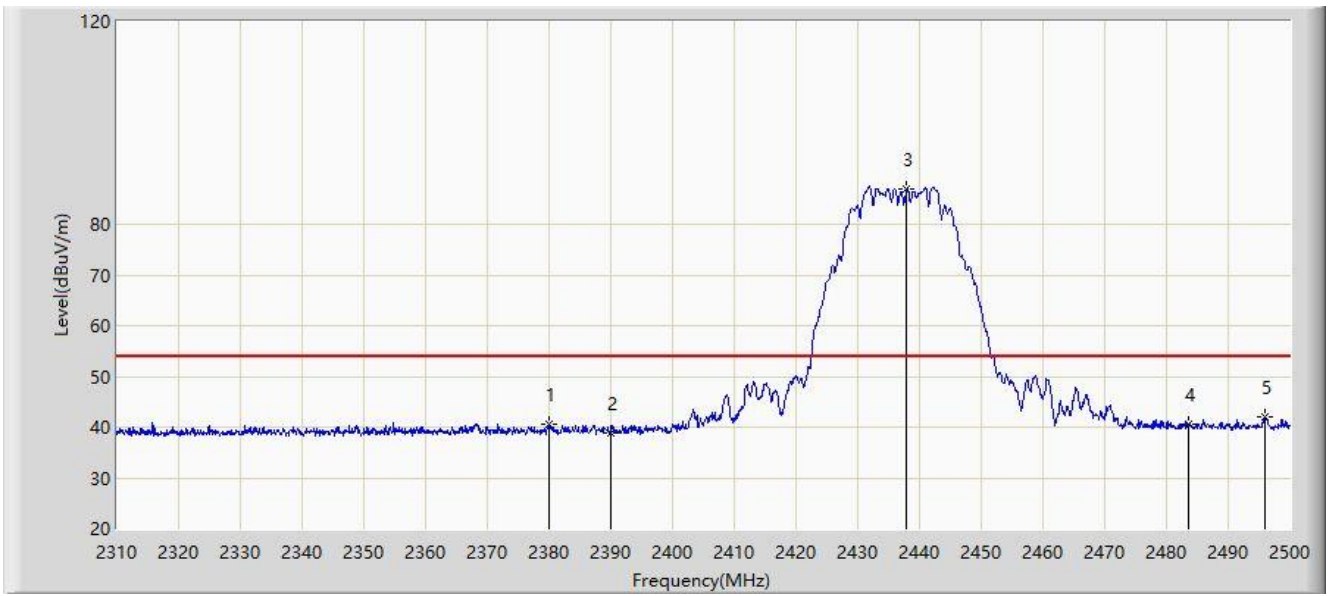


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1			2375.360	64.693	33.364	-9.307	74.000	31.329	PK
2			2390.000	62.815	31.444	-11.185	74.000	31.371	PK
3		*	2431.600	92.227	60.728	N/A	N/A	31.499	PK
4			2483.500	64.645	32.990	-9.355	74.000	31.654	PK
5			2487.080	66.748	35.081	-7.252	74.000	31.667	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Vertical
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2437MHz	

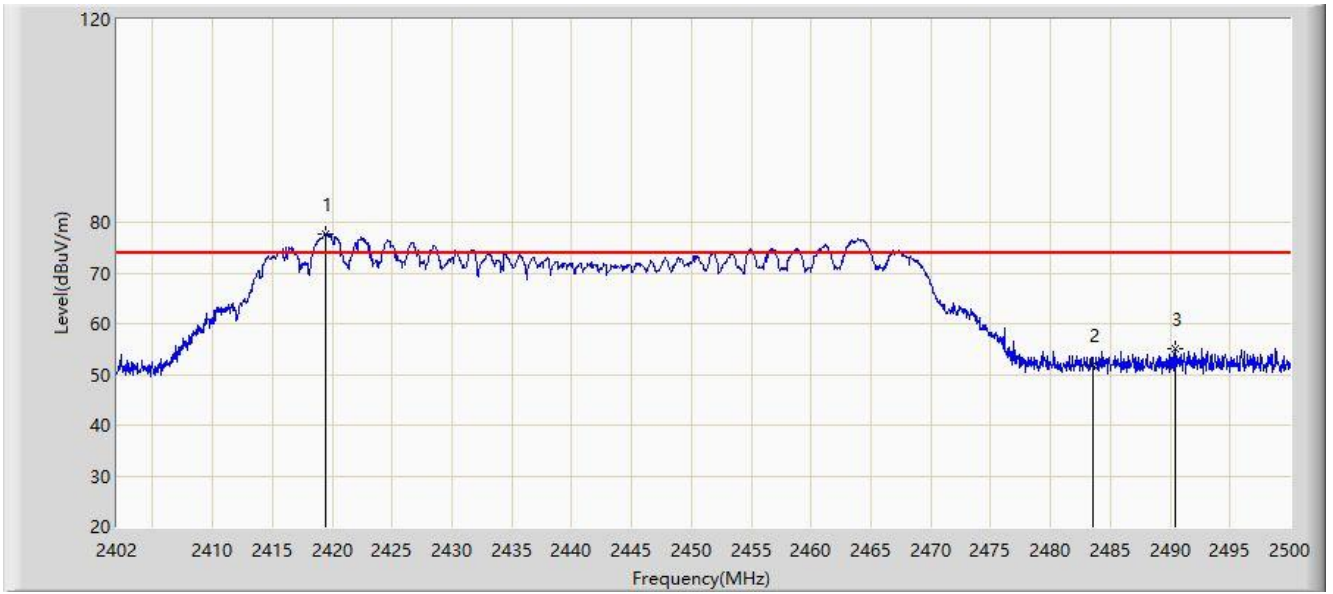


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1			2379.920	40.439	9.097	-13.561	54.000	31.342	AV
2			2390.000	38.974	7.603	-15.026	54.000	31.371	AV
3		*	2437.965	86.957	55.440	N/A	N/A	31.517	AV
4			2483.500	40.560	8.905	-13.440	54.000	31.654	AV
5			2496.010	42.036	10.338	-11.964	54.000	31.698	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Horizontal
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2442MHz	

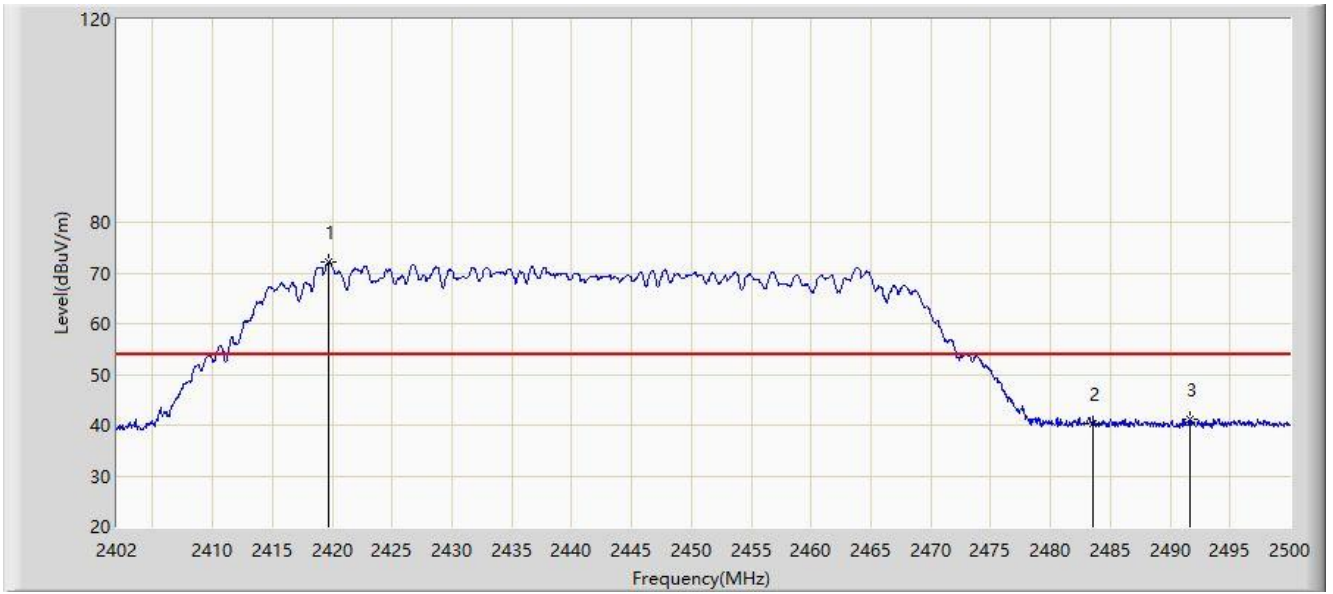


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		*	2419.395	77.701	46.232	N/A	N/A	31.469	PK
2			2483.500	51.851	20.196	-22.149	74.000	31.654	PK
3			2490.445	55.141	23.462	-18.859	74.000	31.679	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Horizontal
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2442MHz	

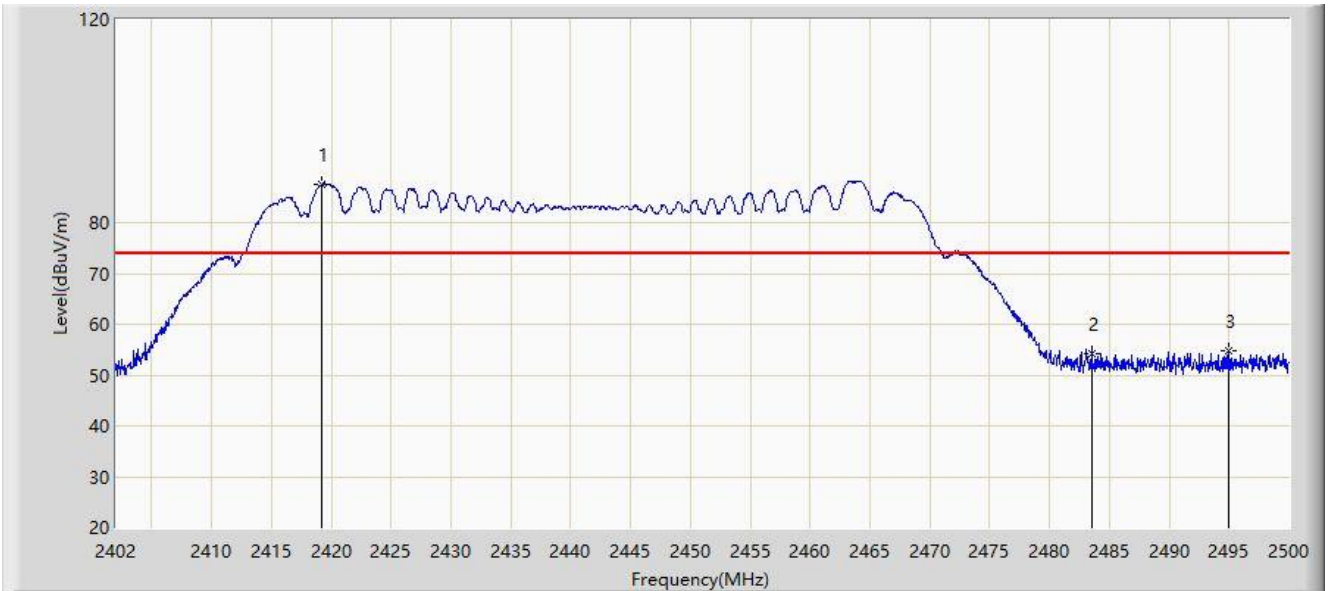


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		*	2419.640	72.072	40.602	N/A	N/A	31.470	AV
2			2483.500	40.392	8.737	-13.608	54.000	31.654	AV
3			2491.670	41.182	9.499	-12.818	54.000	31.683	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Vertical
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2442MHz	

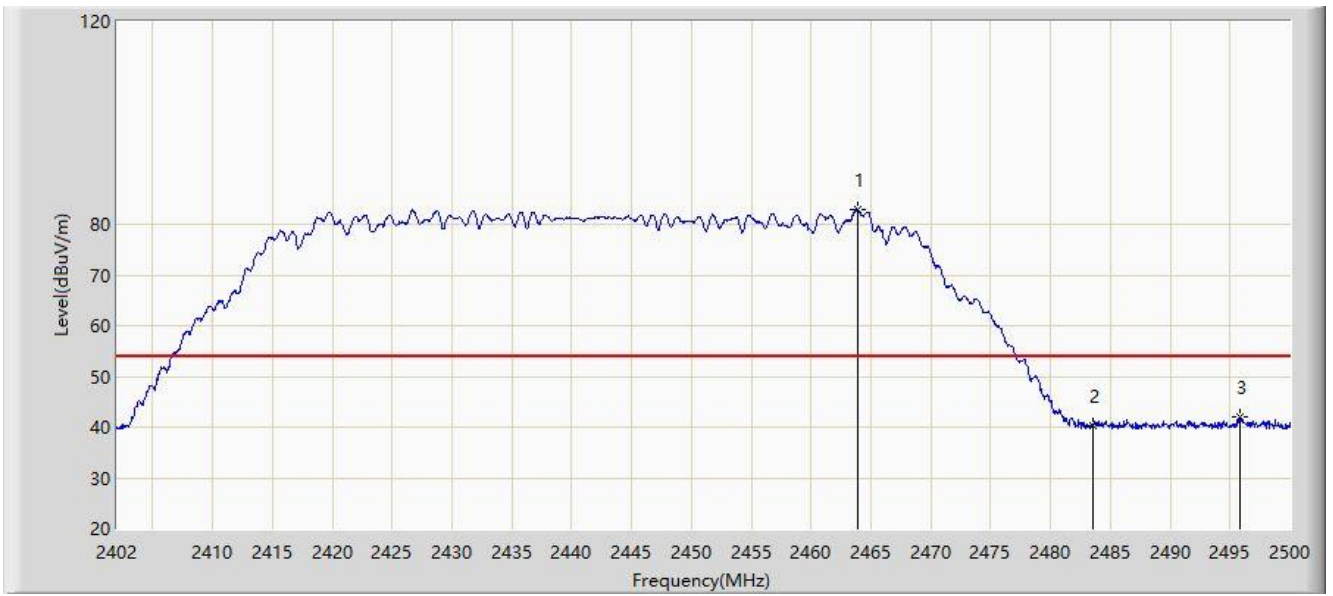


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		*	2419.199	87.549	56.080	N/A	N/A	31.469	PK
2			2483.500	54.117	22.462	-19.883	74.000	31.654	PK
3			2494.904	54.678	22.984	-19.322	74.000	31.694	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: SIP-AC1	Test Date: 2021/11/21
Limit: FCC_Part15.209_RE(3m)	Engineer: Edward Zhang
Probe: SIP-AC1_HF907_102862_1-18GHz	Polarity: Vertical
EUT: MINI RF TOF MODULE NANOPAN	Power: 3.3 Vdc
Note: Transmit at 2442MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		*	2463.838	82.904	51.319	N/A	N/A	31.585	AV
2			2483.500	40.198	8.543	-13.802	54.000	31.654	AV
3			2495.835	41.942	10.245	-12.058	54.000	31.698	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

6.8. AC Conducted Emissions Measurement

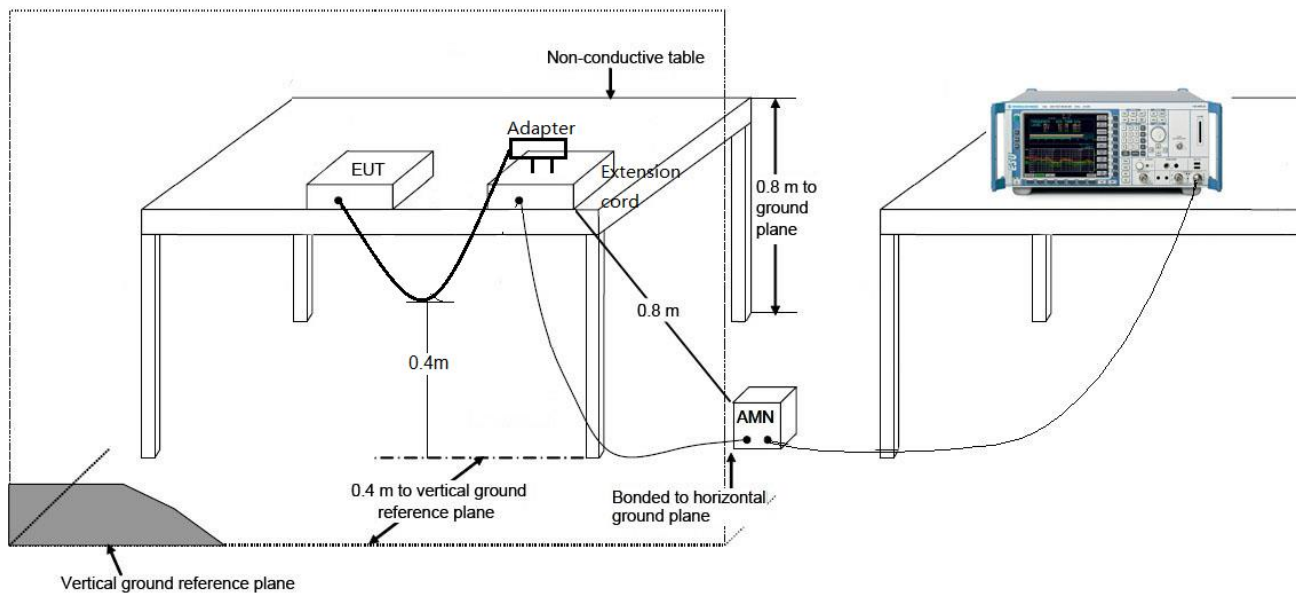
6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits / RSS-Gen Section 8.8		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

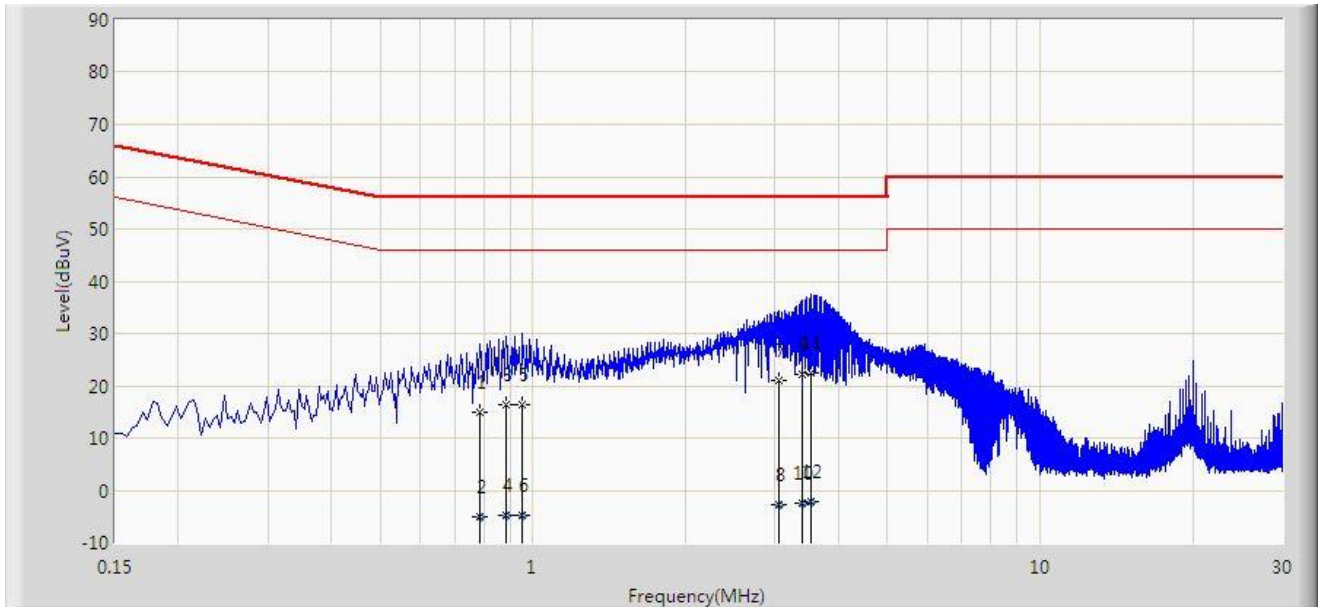
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.8.2. Test Setup



6.8.3. Test Result

Site: SIP-SR2	Test Date: 2021/12/27
Limit: FCC_Part15.207_CE_AC Power	Engineer: Barry Wu
Probe: SIP-SR2-ENV216_101684_C	Polarity: Line
EUT: MINI RF TOF MODULE NANOPAN	Power: AC 120V/60Hz
Note: Transmit at channel 2437MHz	

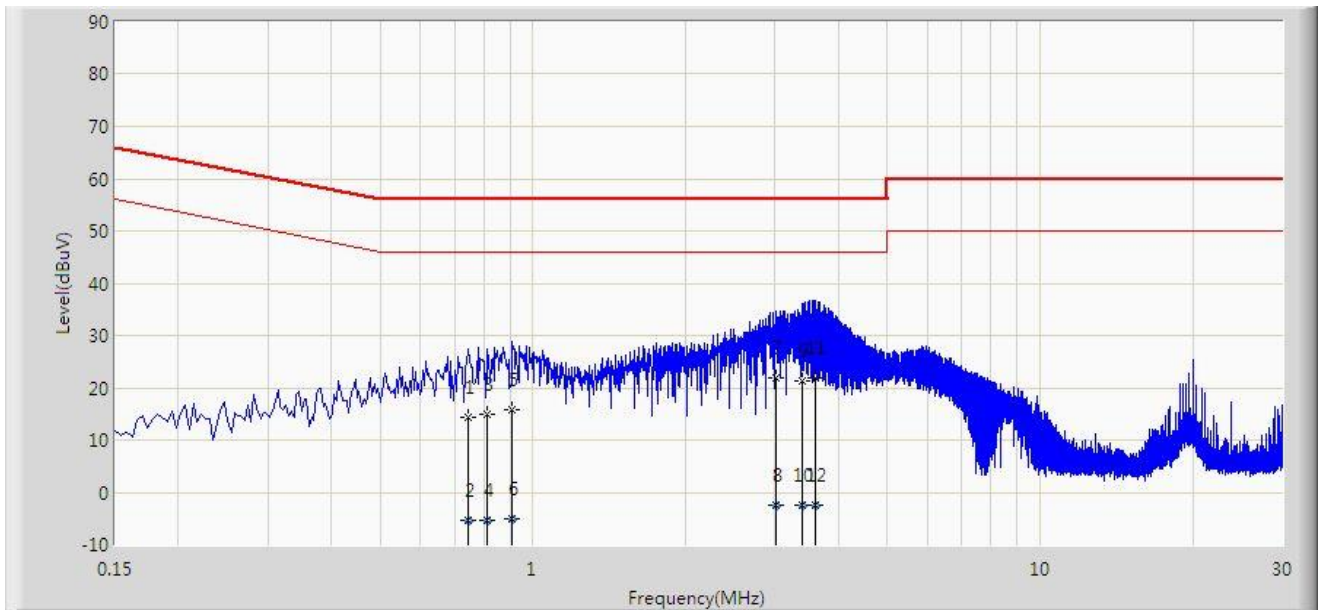


No	Flag	Mark	Frequency (MHz)	Measure Level (dBμV)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV)	Factor (dB)	Type
1			0.786	14.799	5.079	-41.201	56.000	9.720	QP
2			0.786	-4.937	-14.657	-50.937	46.000	9.720	AV
3			0.886	16.313	6.600	-39.687	56.000	9.713	QP
4			0.886	-4.843	-14.556	-50.843	46.000	9.713	AV
5			0.954	16.455	6.745	-39.545	56.000	9.710	QP
6			0.954	-4.718	-14.428	-50.718	46.000	9.710	AV
7			3.058	21.144	11.363	-34.856	56.000	9.781	QP
8			3.058	-2.634	-12.414	-48.634	46.000	9.781	AV
9			3.406	22.187	12.363	-33.813	56.000	9.824	QP
10			3.406	-2.341	-12.165	-48.341	46.000	9.824	AV
11		*	3.538	22.442	12.617	-33.558	56.000	9.825	QP
12			3.538	-2.232	-12.057	-48.232	46.000	9.825	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Site: SIP-SR2	Test Date: 2021/12/27
Limit: FCC_Part15.207_CE_AC Power	Engineer: Barry Wu
Probe: SIP-SR2-ENV216_101684_C	Polarity: Neutral
EUT: MINI RF TOF MODULE NANOPAN	Power: AC 120V/60Hz
Note: Transmit at channel 2437MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V)	Factor (dB)	Type
1			0.746	14.319	4.607	-41.681	56.000	9.712	QP
2			0.746	-5.427	-15.138	-51.427	46.000	9.712	AV
3			0.810	14.854	5.142	-41.146	56.000	9.713	QP
4			0.810	-5.399	-15.111	-51.399	46.000	9.713	AV
5			0.910	15.816	6.109	-40.184	56.000	9.707	QP
6			0.910	-4.945	-14.652	-50.945	46.000	9.707	AV
7		*	3.006	21.779	12.016	-34.221	56.000	9.763	QP
8			3.006	-2.549	-12.312	-48.549	46.000	9.763	AV
9			3.386	21.390	11.582	-34.610	56.000	9.809	QP
10			3.386	-2.596	-12.404	-48.596	46.000	9.809	AV
11			3.614	21.767	11.946	-34.233	56.000	9.821	QP
12			3.614	-2.383	-12.205	-48.383	46.000	9.821	AV

Note: Measure Level (dB μ V) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

7. CONCLUSION

The data collected relate only the item(s) tested and show that the device is compliance with FCC & ISED

Rules and AS/NZS 4268: 2017 standard.

The End

Appendix A - Test Setup Photograph

Refer to "2110RSU055-UT" file.

Appendix B - EUT Photograph

Refer to "2110RSU055-UE" file.