



Report No.: HKEM221200109504

Page: 1 of 54

TEST REPORT

Application No.: HKEM2212001095AT
Applicant: Wittra Networks AB
Address of Applicant: Vastra Jarnvagsgatan 3, 11164 Stockholm, Sweden
Equipment Under Test (EUT):
EUT Name: Wittra Unified Gateway
Model No.: UNIFIED-GATEWAY-1.0-US
FCC ID: 2AYHX00515
IC: 26847-00515
HVIN: UNIFIED GATEWAY-1.0-US
Standard(s) : 47 CFR Part 15 Subpart C, 2022
RSS-247 Issue 2, February 2017
RSS-Gen: Issue 5, Amdt 2021
Date of Receipt: 2022-12-15
Date of Test: 2022-12-20 to 2023-02-16
Date of Issue: 2023-02-17

Test Result:	The submitted sample was found to comply with the test requirement
---------------------	--

Law Man Kit
EMC Manager

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request and accessible at <http://www.sgs.com/en/Terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. The document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Revision Record			
Revision No.	Date	Report superseded	Remark

Authorized for issue by:				
				
		Panny Leung /Project Engineer		Date: 2023-02-17
				
		Law Man Kit /Reviewer		Date: 2023-02-17

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Disturbance at AC Power Line(150kHz-30MHz)	47 CFR Part 15, Subpart C 15.207	ANSI C63.10: 2013 Section 6.2	47 CFR FCC Part 15, Subpart C 15.207	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	RSS-247 Issue 2, February 2017	N/A	RSS-Gen Section 6.8	Pass
Pseudorandom Frequency Hopping Sequence	RSS-247 Issue 2, February 2017	N/A	RSS-247 Section 5.1(a)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	RSS-Gen Issue 5: Amdt 2019	ANSI C63.10 (2013) Section 6.2	RSS-Gen Section 8.8	Pass
99% Bandwidth	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.9.3	RSS-Gen Section 6.7	Pass
Conducted Peak Output Power	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 7.8.5	RSS-247 Section 5.4(b)	Pass
20dB Bandwidth	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.9.2	RSS-247 Section 5.1(a)	Pass
Carrier Frequencies Separation	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 7.8.2	RSS-247 Section 5.1(b)	Pass
Hopping Channel Number	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 7.8.3	RSS-247 Section 5.1(d)	Pass
Dwell Time	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 7.8.4	RSS-247 Section 5.1(d)	Pass
Conducted Band Edges Measurement	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 7.8.6	RSS-247 Section 5.5	Pass
Conducted Spurious Emissions	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 7.8.8	RSS-247 Section 5.5	Pass
Radiated Emissions which fall in the restricted bands	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.10.5	Section 3.3 & RSS-Gen Section 8.10	Pass
Radiated Spurious Emissions	RSS-247 Issue 2, February 2017	ANSI C63.10 (2013) Section 6.4&6.5&6.6	Section 3.3 & RSS-Gen Section 8.9	Pass
Frequency stability	RSS-247 Issue 2, February 2017	RSS-Gen Section 6.11	RSS-Gen Section 8.11	Pass

Note: Frequency stability requested in RSS GEN Section 8.1.1 has been complied since the result of band edge can demonstrate.

Declaration of EUT Family Grouping:

N/A

3 Contents

	Page
1 COVER PAGE	1
2 TEST SUMMARY	3
3 CONTENTS	5
4 GENERAL INFORMATION	7
4.1 DETAILS OF E.U.T.	7
4.2 DESCRIPTION OF SUPPORT UNITS	13
4.3 MEASUREMENT UNCERTAINTY	14
4.4 TEST LOCATION	15
4.5 TEST FACILITY	15
4.6 DEVIATION FROM STANDARDS	15
4.7 ABNORMALITIES FROM STANDARD CONDITIONS	15
5 EQUIPMENT LIST	16
6 RADIO SPECTRUM TECHNICAL REQUIREMENT	19
6.1 ANTENNA REQUIREMENT	19
6.1.1 Test Requirement:	19
6.1.2 Conclusion	19
6.2 PSEUDORANDOM FREQUENCY HOPPING SEQUENCE	20
6.2.1 Test Requirement:	20
6.2.2 Test Setup Diagram	20
6.2.3 Conclusion	20
7 RADIO SPECTRUM MATTER TEST RESULTS	21
7.1 CONDUCTED EMISSIONS AT AC POWER LINE (150kHz-30MHz)	21
7.1.1 E.U.T. Operation	21
7.1.2 Test Setup Diagram	22
7.1.3 Measurement Procedure and Data	22
7.2 99% BANDWIDTH	25
7.2.1 E.U.T. Operation	25
7.2.2 Test Setup Diagram	25
7.2.3 Measurement Procedure and Data	26
7.3 CONDUCTED PEAK OUTPUT POWER	27
7.3.1 E.U.T. Operation	27
7.3.2 Test Setup Diagram	27
7.3.3 Measurement Procedure and Data	28
7.4 20dB BANDWIDTH	29
7.4.1 E.U.T. Operation	29
7.4.2 Test Setup Diagram	29
7.4.3 Measurement Procedure and Data	30
7.5 CARRIER FREQUENCIES SEPARATION	31
7.5.1 E.U.T. Operation	31
7.5.2 Test Setup Diagram	31
7.5.3 Measurement Procedure and Data	32
7.6 HOPPING CHANNEL NUMBER	33
7.6.1 E.U.T. Operation	33
7.6.2 Test Setup Diagram	33
7.6.3 Measurement Procedure and Data	34



7.7	DWELL TIME	35
7.7.1	<i>E.U.T. Operation</i>	35
7.7.2	<i>Test Setup Diagram</i>	35
7.7.3	<i>Measurement Procedure and Data</i>	36
7.8	CONDUCTED BAND EDGES MEASUREMENT	37
7.8.1	<i>E.U.T. Operation</i>	39
7.8.2	<i>Test Setup Diagram</i>	39
7.8.3	<i>Measurement Procedure and Data</i>	40
7.9	CONDUCTED SPURIOUS EMISSIONS.....	42
7.9.1	<i>E.U.T. Operation</i>	42
7.9.2	<i>Test Setup Diagram</i>	42
7.9.3	<i>Measurement Procedure and Data</i>	43
7.10	RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS.....	45
7.10.1	<i>E.U.T. Operation</i>	45
7.10.2	<i>Test Setup Diagram</i>	45
7.10.3	<i>Measurement Procedure and Data</i>	46
7.11	RADIATED SPURIOUS EMISSIONS	47
7.11.1	<i>E.U.T. Operation</i>	48
7.11.2	<i>Test Setup Diagram</i>	48
7.11.3	<i>Measurement Procedure and Data</i>	49
8	PHOTOGRAPHS	54

4 General Information

4.1 Details of E.U.T.

Power supply:	Adaptor Model: KSA-36W-120300D5 Input: AC 100-240V, 50/60Hz, 1.0A Output: DC 12.0V, 3.0A, 36.0W and DC 3V ('CR2032' size battery x 1)
Test voltage:	AC 120V DC 3 V
Cable:	Power Cable: 143cm unshielded 2 wires DC cable
Antenna Gain:	2dBi
Antenna Type:	Dipole Antenna
Modulation Type:	MSK/GMSK
Number of Channels:	50
Operation Frequency:	915.25MHz to 916.75MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum (FHSS)
Series number:	A1
Hardware Version:	UNIFIED GATEWAY-1.0-US
Software Version:	Radio FW v1.
	Remark: Power level setting was not adjustable and fixed default through SW Version.

EUT channels and frequencies list:

Channel A carrier frequency:

c	C_{RF}	f_{TX} in Hz	c	C_{RF}	f_{TX} in Hz	c	C_{RF}	f_{TX} in Hz
24	5	916754675.3	15	5	916497595.2	6	5	916240515.1
24	4	916752294.9	15	4	916495214.8	6	4	916238134.8
24	3	916749914.6	15	3	916492834.5	6	3	916235754.4
24	2	916747534.2	15	2	916490454.1	6	2	916233374.0
24	1	916745153.8	15	1	916488073.7	6	1	916230993.7
24	0	916742773.4	15	0	916485693.4	6	0	916228613.3
24	-1	916740393.1	15	-1	916483313.0	6	-1	916226232.9
24	-2	916738012.7	15	-2	916480932.6	6	-2	916223852.5
24	-3	916735632.3	15	-3	916478552.2	6	-3	916221472.2
24	-4	916733252.0	15	-4	916476171.9	6	-4	916219091.8
24	-5	916730871.6	15	-5	916473791.5	6	-5	916216711.4
		916728491.2			916471411.1			916214331.1
23	5	916726110.8	14	5	916469030.8	5	5	916211950.7
23	4	916723730.5	14	4	916466650.4	5	4	916209570.3
23	3	916721350.1	14	3	916464270.0	5	3	916207189.9
23	2	916718969.7	14	2	916461889.6	5	2	916204809.6
23	1	916716589.4	14	1	916459509.3	5	1	916202429.2
23	0	916714209.0	14	0	916457128.9	5	0	916200048.8
23	-1	916711828.6	14	-1	916454748.5	5	-1	916197668.5
23	-2	916709448.2	14	-2	916452368.2	5	-2	916195288.1
23	-3	916707067.9	14	-3	916449987.8	5	-3	916192907.7
23	-4	916704687.5	14	-4	916447607.4	5	-4	916190527.3
23	-5	916702307.1	14	-5	916445227.1	5	-5	916188147.0
		916699926.8			916442846.7			916185766.6
22	5	916697546.4	13	5	916440466.3	4	5	916183386.2
22	4	916695166.0	13	4	916438085.9	4	4	916181005.9
22	3	916692785.6	13	3	916435705.6	4	3	916178625.5
22	2	916690405.3	13	2	916433325.2	4	2	916176245.1
22	1	916688024.9	13	1	916430944.8	4	1	916173864.7
22	0	916685644.5	13	0	916428564.5	4	0	916171484.4
22	-1	916683264.2	13	-1	916426184.1	4	-1	916169104.0

22	-2	916680883.8	13	-2	916423803.7	4	-2	916166723.6
22	-3	916678503.4	13	-3	916421423.3	4	-3	916164343.3
22	-4	916676123.0	13	-4	916419043.0	4	-4	916161962.9
22	-5	916673742.7	13	-5	916416662.6	4	-5	916159582.5
		916671362.3			916414282.2			916157202.1
21	5	916668981.9	12	5	916411901.9	3	5	916154821.8
21	4	916666601.6	12	4	916409521.5	3	4	916152441.4
21	3	916664221.2	12	3	916407141.1	3	3	916150061.0
21	2	916661840.8	12	2	916404760.7	3	2	916147680.7
21	1	916659460.4	12	1	916402380.4	3	1	916145300.3
21	0	916657080.1	12	0	916400000.0	3	0	916142919.9
21	-1	916654699.7	12	-1	916397619.6	3	-1	916140539.6
21	-2	916652319.3	12	-2	916395239.3	3	-2	916138159.2
21	-3	916649939.0	12	-3	916392858.9	3	-3	916135778.8
21	-4	916647558.6	12	-4	916390478.5	3	-4	916133398.4
21	-5	916645178.2	12	-5	916388098.1	3	-5	916131018.1
		916642797.9			916385717.8			916128637.7
20	5	916640417.5	11	5	916383337.4	2	5	916126257.3
20	4	916638037.1	11	4	916380957.0	2	4	916123877.0
20	3	916635656.7	11	3	916378576.7	2	3	916121496.6
20	2	916633276.4	11	2	916376196.3	2	2	916119116.2
20	1	916630896.0	11	1	916373815.9	2	1	916116735.8
20	0	916628515.6	11	0	916371435.5	2	0	916114355.5
20	-1	916626135.3	11	-1	916369055.2	2	-1	916111975.1
20	-2	916623754.9	11	-2	916366674.8	2	-2	916109594.7
20	-3	916621374.5	11	-3	916364294.4	2	-3	916107214.4
20	-4	916618994.1	11	-4	916361914.1	2	-4	916104834.0
20	-5	916616613.8	11	-5	916359533.7	2	-5	916102453.6
		916614233.4			916357153.3			916100073.2
19	5	916611853.0	10	5	916354772.9	1	5	916097692.9
19	4	916609472.7	10	4	916352392.6	1	4	916095312.5
19	3	916607092.3	10	3	916350012.2	1	3	916092932.1
19	2	916604711.9	10	2	916347631.8	1	2	916090551.8
19	1	916602331.5	10	1	916345251.5	1	1	916088171.4
19	0	916599951.2	10	0	916342871.1	1	0	916085791.0
19	-1	916597570.8	10	-1	916340490.7	1	-1	916083410.6
19	-2	916595190.4	10	-2	916338110.4	1	-2	916081030.3
19	-3	916592810.1	10	-3	916335730.0	1	-3	916078649.9
19	-4	916590429.7	10	-4	916333349.6	1	-4	916076269.5
19	-5	916588049.3	10	-5	916330969.2	1	-5	916073889.2
		916585668.9			916328588.9			916071508.8
18	5	916583288.6	9	5	916326208.5	0	5	916069128.4
18	4	916580908.2	9	4	916323828.1	0	4	916066748.0
18	3	916578527.8	9	3	916321447.8	0	3	916064367.7



18	2	916576147.5	9	2	916319067.4	0	2	916061987.3
18	1	916573767.1	9	1	916316687.0	0	1	916059606.9
18	0	916571386.7	9	0	916314306.6	0	0	916057226.6
18	-1	916569006.3	9	-1	916311926.3	0	-1	916054846.2
18	-2	916566626.0	9	-2	916309545.9	0	-2	916052465.8
18	-3	916564245.6	9	-3	916307165.5	0	-3	916050085.4
18	-4	916561865.2	9	-4	916304785.2	0	-4	916047705.1
18	-5	916559484.9	9	-5	916302404.8	0	-5	916045324.7
		916557104.5			916300024.4			
17	5	916554724.1	8	5	916297644.0			
17	4	916552343.8	8	4	916295263.7			
17	3	916549963.4	8	3	916292883.3			
17	2	916547583.0	8	2	916290502.9			
17	1	916545202.6	8	1	916288122.6			
17	0	916542822.3	8	0	916285742.2			
17	-1	916540441.9	8	-1	916283361.8			
17	-2	916538061.5	8	-2	916280981.4			
17	-3	916535681.2	8	-3	916278601.1			
17	-4	916533300.8	8	-4	916276220.7			
17	-5	916530920.4	8	-5	916273840.3			
		916528540.0			916271460.0			
16	5	916526159.7	7	5	916269079.6			
16	4	916523779.3	7	4	916266699.2			
16	3	916521398.9	7	3	916264318.8			
16	2	916519018.6	7	2	916261938.5			
16	1	916516638.2	7	1	916259558.1			
16	0	916514257.8	7	0	916257177.7			
16	-1	916511877.4	7	-1	916254797.4			
16	-2	916509497.1	7	-2	916252417.0			
16	-3	916507116.7	7	-3	916250036.6			
16	-4	916504736.3	7	-4	916247656.3			
16	-5	916502356.0	7	-5	916245275.9			
		916499975.6			916242895.5			

Channel B carrier frequency:

c	C_{RF}	f_{TX} in Hz	c	C_{RF}	f_{TX} in Hz	c	C_{RF}	f_{TX} in Hz
24	5	915954870.6	15	5	915697790.5	6	5	915440710.4
24	4	915952490.2	15	4	915695410.2	6	4	915438330.1
24	3	915950109.9	15	3	915693029.8	6	3	915435949.7
24	2	915947729.5	15	2	915690649.4	6	2	915433569.3
24	1	915945349.1	15	1	915688269.0	6	1	915431189.0

24	0	915942968.8	15	0	915685888.7	6	0	915428808.6
24	-1	915940588.4	15	-1	915683508.3	6	-1	915426428.2
24	-2	915938208.0	15	-2	915681127.9	6	-2	915424047.9
24	-3	915935827.6	15	-3	915678747.6	6	-3	915421667.5
24	-4	915933447.3	15	-4	915676367.2	6	-4	915419287.1
24	-5	915931066.9	15	-5	915673986.8	6	-5	915416906.7
		915928686.5			915671606.4			915414526.4
23	5	915926306.2	14	5	915669226.1	5	5	915412146.0
23	4	915923925.8	14	4	915666845.7	5	4	915409765.6
23	3	915921545.4	14	3	915664465.3	5	3	915407385.3
23	2	915919165.0	14	2	915662085.0	5	2	915405004.9
23	1	915916784.7	14	1	915659704.6	5	1	915402624.5
23	0	915914404.3	14	0	915657324.2	5	0	915400244.1
23	-1	915912023.9	14	-1	915654943.8	5	-1	915397863.8
23	-2	915909643.6	14	-2	915652563.5	5	-2	915395483.4
23	-3	915907263.2	14	-3	915650183.1	5	-3	915393103.0
23	-4	915904882.8	14	-4	915647802.7	5	-4	915390722.7
23	-5	915902502.4	14	-5	915645422.4	5	-5	915388342.3
		915900122.1			915643042.0			915385961.9
22	5	915897741.7	13	5	915640661.6	4	5	915383581.5
22	4	915895361.3	13	4	915638281.3	4	4	915381201.2
22	3	915892981.0	13	3	915635900.9	4	3	915378820.8
22	2	915890600.6	13	2	915633520.5	4	2	915376440.4
22	1	915888220.2	13	1	915631140.1	4	1	915374060.1
22	0	915885839.8	13	0	915628759.8	4	0	915371679.7
22	-1	915883459.5	13	-1	915626379.4	4	-1	915369299.3
22	-2	915881079.1	13	-2	915623999.0	4	-2	915366918.9
22	-3	915878698.7	13	-3	915621618.7	4	-3	915364538.6
22	-4	915876318.4	13	-4	915619238.3	4	-4	915362158.2
22	-5	915873938.0	13	-5	915616857.9	4	-5	915359777.8
		915871557.6			915614477.5			915357397.5
21	5	915869177.2	12	5	915612097.2	3	5	915355017.1
21	4	915866796.9	12	4	915609716.8	3	4	915352636.7
21	3	915864416.5	12	3	915607336.4	3	3	915350256.3
21	2	915862036.1	12	2	915604956.1	3	2	915347876.0
21	1	915859655.8	12	1	915602575.7	3	1	915345495.6
21	0	915857275.4	12	0	915600195.3	3	0	915343115.2
21	-1	915854895.0	12	-1	915597814.9	3	-1	915340734.9
21	-2	915852514.6	12	-2	915595434.6	3	-2	915338354.5
21	-3	915850134.3	12	-3	915593054.2	3	-3	915335974.1
21	-4	915847753.9	12	-4	915590673.8	3	-4	915333593.8
21	-5	915845373.5	12	-5	915588293.5	3	-5	915331213.4
		915842993.2			915585913.1			915328833.0
20	5	915840612.8	11	5	915583532.7	2	5	915326452.6

20	4	915838232.4	11	4	915581152.3	2	4	915324072.3
20	3	915835852.1	11	3	915578772.0	2	3	915321691.9
20	2	915833471.7	11	2	915576391.6	2	2	915319311.5
20	1	915831091.3	11	1	915574011.2	2	1	915316931.2
20	0	915828710.9	11	0	915571630.9	2	0	915314550.8
20	-1	915826330.6	11	-1	915569250.5	2	-1	915312170.4
20	-2	915823950.2	11	-2	915566870.1	2	-2	915309790.0
20	-3	915821569.8	11	-3	915564489.7	2	-3	915307409.7
20	-4	915819189.5	11	-4	915562109.4	2	-4	915305029.3
20	-5	915816809.1	11	-5	915559729.0	2	-5	915302648.9
		915814428.7			915557348.6			915300268.6
19	5	915812048.3	10	5	915554968.3	1	5	915297888.2
19	4	915809668.0	10	4	915552587.9	1	4	915295507.8
19	3	915807287.6	10	3	915550207.5	1	3	915293127.4
19	2	915804907.2	10	2	915547827.1	1	2	915290747.1
19	1	915802526.9	10	1	915545446.8	1	1	915288366.7
19	0	915800146.5	10	0	915543066.4	1	0	915285986.3
19	-1	915797766.1	10	-1	915540686.0	1	-1	915283606.0
19	-2	915795385.7	10	-2	915538305.7	1	-2	915281225.6
19	-3	915793005.4	10	-3	915535925.3	1	-3	915278845.2
19	-4	915790625.0	10	-4	915533544.9	1	-4	915276464.8
19	-5	915788244.6	10	-5	915531164.6	1	-5	915274084.5
		915785864.3			915528784.2			915271704.1
18	5	915783483.9	9	5	915526403.8	0	5	915269323.7
18	4	915781103.5	9	4	915524023.4	0	4	915266943.4
18	3	915778723.1	9	3	915521643.1	0	3	915264563.0
18	2	915776342.8	9	2	915519262.7	0	2	915262182.6
18	1	915773962.4	9	1	915516882.3	0	1	915259802.2
18	0	915771582.0	9	0	915514502.0	0	0	915257421.9
18	-1	915769201.7	9	-1	915512121.6	0	-1	915255041.5
18	-2	915766821.3	9	-2	915509741.2	0	-2	915252661.1
18	-3	915764440.9	9	-3	915507360.8	0	-3	915250280.8
18	-4	915762060.5	9	-4	915504980.5	0	-4	915247900.4
18	-5	915759680.2	9	-5	915502600.1	0	-5	915245520.0
		915757299.8			915500219.7			
17	5	915754919.4	8	5	915497839.4			
17	4	915752539.1	8	4	915495459.0			
17	3	915750158.7	8	3	915493078.6			
17	2	915747778.3	8	2	915490698.2			
17	1	915745397.9	8	1	915488317.9			
17	0	915743017.6	8	0	915485937.5			
17	-1	915740637.2	8	-1	915483557.1			
17	-2	915738256.8	8	-2	915481176.8			
17	-3	915735876.5	8	-3	915478796.4			
17	-4	915733496.1	8	-4	915476416.0			
17	-5	915731115.7	8	-5	915474035.6			
		915728735.4			915471655.3			
16	5	915726355.0	7	5	915469274.9			
16	4	915723974.6	7	4	915466894.5			
16	3	915721594.2	7	3	915464514.2			
16	2	915719213.9	7	2	915462133.8			
16	1	915716833.5	7	1	915459753.4			
16	0	915714453.1	7	0	915457373.0			
16	-1	915712072.8	7	-1	915454992.7			
16	-2	915709692.4	7	-2	915452612.3			
16	-3	915707312.0	7	-3	915450231.9			
16	-4	915704931.6	7	-4	915447851.6			
16	-5	915702551.3	7	-5	915445471.2			
		915700170.9			915443090.8			

Remark: 1. Test frequencies are the lowest channel: 915.25 MHz and highest channel: 916.75 MHz



4.2 Description of Support Units

The EUT has been with corresponding accessories as below:

Supplied by SGS:

Description	Manufacturer	Model No.	Serial No.
Notebook	Dell	Inspiron 15	4RZCWN2

4.3 Measurement Uncertainty

RF

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	RF conducted power (30MHz-40GHz)	1.7dB
5	RF power density	1.7dB
6	Conducted Spurious emissions	1.7dB
7	RF Radiated power & Radiated Spurious emission test	4.7dB (30MHz-1GHz)
		4.7dB (1GHz-6GHz)
		4.7dB (6GHz-18GHz)
		5.7dB (18GHz-40GHz)
8	Temperature test	$\pm 1^\circ\text{C}$
9	Humidity test	$\pm 3\%$
10	Supply voltages	$\pm 1.5\%$
11	Time	$\pm 3\%$

Remark:

The U_{lab} (lab Uncertainty) is less than U_{CISPR} (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

According to decision rule based on Clause 4.2 of CISPR 16-4-2, the EUT complied with the standards specified above.

4.4 Test Location

All tests were performed at:

SGS Hong Kong Limited

Unit 2 and 3, G/F, Block A, Po Lung Centre,

11 Wang Chiu Road, Kowloon Bay, Kowloon, Hong Kong

Tel: +852 2305 2570 Fax: +852 2756 4480

No tests were sub-contracted.

4.5 Test Facility

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

• **IAS Accreditation (Lab Code: TL-817)**

SGS Hong Kong Limited has met the requirements of AC89, IAS Accreditation Criteria for Testing Laboratories, and has demonstrated compliance with ISO/IEC Standard 17025:2017, General requirements for the competence of testing and calibration laboratories. This organization is accredited to provide the services specified in the scope of accreditation maintained on the IAS website (www.iasonline.org).

The report must not be used by the client to claim product certification, approval, or endorsement by IAS, NIST, or any agency of the Federal Government.

• **FCC Recognized Accredited Test Firm (CAB Registration No.: 514599)**

SGS Hong Kong Limited has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: HK0015, Test Firm Registration Number: 514599.

• **Industry Canada (Site Registration No.: 26103; CAB Identifier No.: HK0015)**

SGS Hong Kong Limited has been recognized by Department of Innovation, Science and Economic Development (ISED) Canada as a wireless testing laboratory. The acceptance letter from the ISED is maintained in our files. CAB Identifier No: HK0015, Site Registration Number: 26103.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



5 Equipment List

20dB Bandwidth, Conducted Peak Output Power, Hopping Channel Number, Carrier Frequencies Separation, Dwell Time, Conducted Band Edges Measurement, Conducted Spurious Emissions

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
SMBV100A VECTOR SIGNAL GENERATOR	Rohde & Schwarz	SMBV100A	E234	2022/10/17	2023/10/16
FSV40 SIGNAL ANALYZER 40GHz	Rohde & Schwarz	FSV40	E235	2022/10/17	2023/10/16
SMB100A SIGNAL GENERATOR	Rohde & Schwarz	SMB100A	E236	2022/10/17	2023/10/16
Wireless Conn. Tester (CMW)	Rohde & Schwarz	CMW270	E240	2022/10/11	2023/10/10
OSP	Rohde & Schwarz	OSP-B157W8	E332	2022/10/18	2023/10/17
Cable	Rohde & Schwarz	J12J103539-00-2	E239	2022/10/12	2023/10/11
WMS32 Test software	Rohde & Schwarz	N/A	Version 11	N/A	N/A

Radiated Spurious Emissions (30MHz-1GHz)

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	ChamPro	N/A	E229	2022/08/08	2023/08/07
Coaxial Cable	SGS	N/A	E167	2022/07/15	2023/07/14
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESR7 / 102298	E314	2022/06/29	2023/06/28
TRILOG Super Broadb. Test Antenna, (25) 30-1000 MHz	Schwarzbeck	9168-1110	E311	2021/10/18	2023/10/17
EMC32 Test software	Rohde & Schwarz	Version 10	N/A	N/A	N/A
Boresight Mast Controller	ChamPro	AM-BS-4500-E	E237	N/A	N/A
Turntable with Controller	ChamPro	EM1000	E238	N/A	N/A

Radiated Spurious Emissions (above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	ChamPro	N/A	E229	2022/08/08	2023/08/07
Coaxial Cable	SGS	N/A	E167	2022/07/15	2023/07/14
EMI Test Receiver 9kHz to 7GHz	Rohde & Schwarz	ESR7 / 102298	E314	2022/06/29	2023/06/28
Signal and Spectrum Analyzer 2Hz - 26.5GHz	Rohde & Schwarz	FSW26	E296	2022/10/18	2023/10/17
Horn Antenna 1 - 18GHz	Schwarzbeck	BBHA9120D	E211	2022/03/03	2024/03/02
Horn Antenna 15 - 40GHz	Schwarzbeck	BBHA9170	E212	2022/03/16	2024/03/15
Preamplifier 33dB, 1 - 18GHz	Schwarzbeck	BBV9718	E214	2022/04/24	2023/04/23
Preamplifier 33dB, 18 - 26.5GHz	Schwarzbeck	BBV9719	E215	2022/09/21	2023/09/20
Broadband Coaxial Preamplifier typ. 30 dB, 18-40GHz	Schwarzbeck	BBV 9721	E266	2022/09/17	2023/09/16
Band Reject Filter 2.4 -2.5GHz	MICRO-TRONICS	BRM50702	E324	2022/09/17	2023/09/16
RF cable SMA to SMA 10000mm	HUBER+SUHNER	SF104- 26.5/2*11SMA 45	E207-1	2022/09/17	2023/09/16
Boresight Mast Controller	ChamPro	AM-BS-4500-E	E237	N/A	N/A
Turntable with Controller	ChamPro	EM1000	E238	N/A	N/A

Conducted Emissions at Mains Terminals (150kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver 9kHz to 3.6GHz	Rohde & Schwarz	ESR3 / 102326	E231	2022/08/17	2023/08/16
Artificial Mains Network (LISN)	Schwarzbeck	NSLK 8127 / 8127312	E005	2022/04/13	2023/04/12
Impulse Limiter	Rohde & Schwarz	ESH-3-Z2 / 357881052	E028	2022/07/15	2023/07/14
EMC32 Test software	Rohde & Schwarz	Version 10	N/A	N/A	N/A



Report No.: HKEM221200109504

Page: 18 of 54

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Digital temperature & humidity data logger	SATO	SK-L200TH II	E232	2022/08/15	2023/08/14
Electronic Digital Thermometer with Hygrometer	nil	2074/2075	E159	2022/08/15	2023/08/14
Barometer with digital thermometer	SATO	7612-00	E218	2022/03/29	2023/03/28
Conditional Chamber	Zhong Zhi Testing Instruments	CZ-E-608D	E216	2022/08/16	2023/08/15

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

RSS-Gen Section 6.8

6.1.2 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antennas are external with two rp-sma external connectors. The maximum gain of the antennas are 2dBi.

Photo of antenna refer to Appendix – Internal photo.

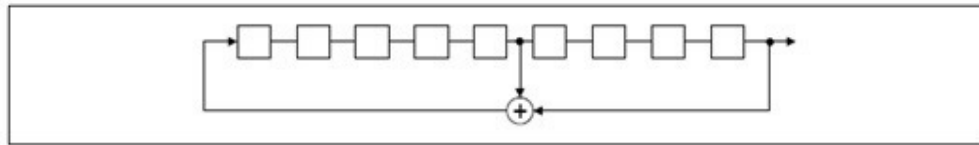
6.2 Pseudorandom Frequency Hopping Sequence

6.2.1 Test Requirement:

FCC Part 15 Subpart C Section 15.247(a)(1)

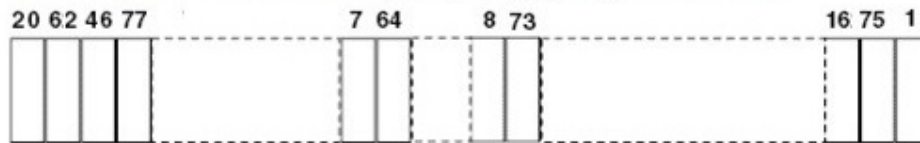
RSS-247 Section 5.1(a)

6.2.2 Test Setup Diagram



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



6.2.3 Conclusion

Standard Requirement:

The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15 Subpart C 15.207, RSS-Gen Section 8.8

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
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.

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 C Humidity: 52.0 % RH

Test mode c: TX_Keep the EUT transmitted the continuous modulation test signal at the specific channel(s).

The diagram illustrates the setup of a Shielding Room for EMC testing. Key components and dimensions include:

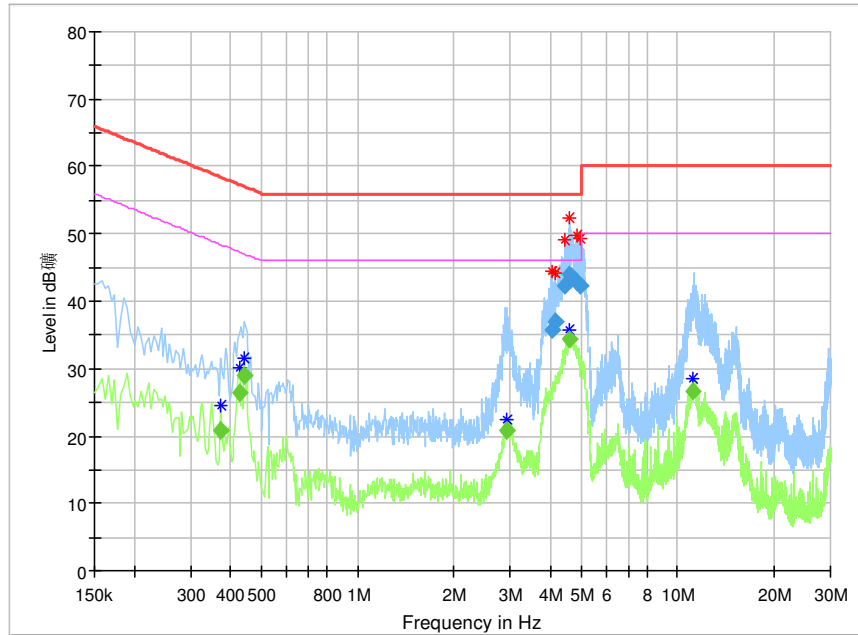
- Shielding Room:** The entire setup is enclosed within a room designed to prevent electromagnetic interference.
- EUT (Equipment Under Test):** Positioned on a table, with a height of 80cm from the Ground Reference Plane.
- AE (Antenna):** Positioned next to the EUT, with a distance of 1.0m between them.
- Test Receiver:** Positioned on a separate table, connected to the EUT via a cable.
- LISN (Line Impedance Stabilization Network):** Connected to the power line to stabilize impedance.
- Ground Reference Plane:** A horizontal plane at the bottom of the room, serving as a reference for measurements.

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 50\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Channel: Low;
Mode: c;
Line: Live Line

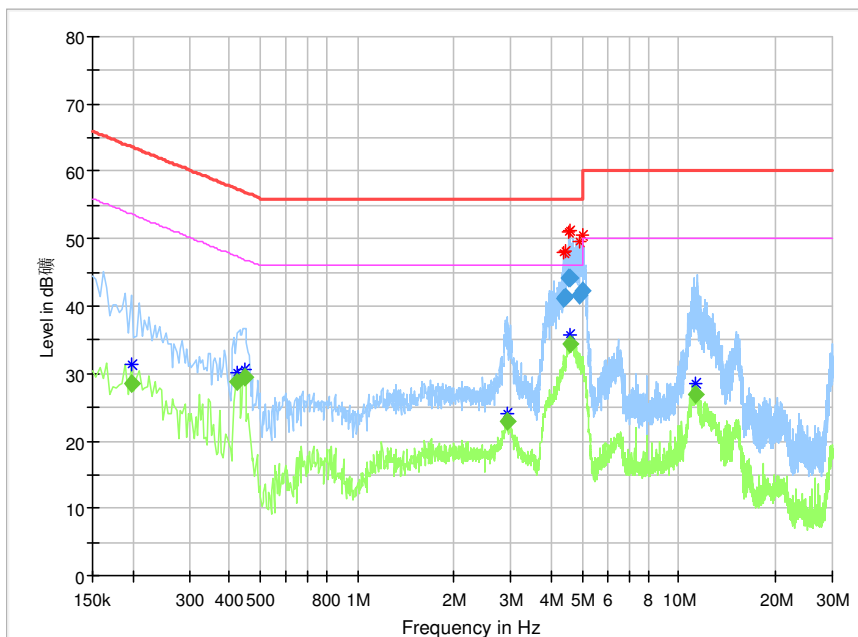
Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Corr. (dB)	Result
0.374000	---	20.78	48.41	27.63	11.0	Pass
0.426000	---	26.45	47.33	20.89	10.9	Pass
0.442000	---	29.04	47.02	17.98	10.9	Pass
2.922000	---	20.77	46.00	25.23	10.3	Pass
4.038000	35.80	---	56.00	20.20	10.3	Pass
4.134000	37.03	---	56.00	18.97	10.3	Pass
4.450000	42.26	---	56.00	13.74	10.3	Pass
4.598000	---	34.31	46.00	11.69	10.3	Pass
4.606000	43.91	---	56.00	12.09	10.3	Pass
4.850000	42.78	---	56.00	13.22	10.3	Pass
4.966000	42.43	---	56.00	13.57	10.3	Pass
11.194000	---	26.77	50.00	23.23	10.5	Pass

Mode: c;
Line: Neutral Line

Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Corr. (dB)	Result
0.198000	---	28.60	53.69	25.09	11.2	Pass
0.422000	---	28.74	47.41	18.66	10.9	Pass
0.446000	---	29.55	46.95	17.40	10.9	Pass
2.934000	---	22.83	46.00	23.17	10.3	Pass
4.378000	41.16	---	56.00	14.84	10.3	Pass
4.426000	41.48	---	56.00	14.52	10.3	Pass
4.534000	44.28	---	56.00	11.72	10.3	Pass
4.590000	44.31	---	56.00	11.69	10.3	Pass
4.606000	---	34.38	46.00	11.62	10.3	Pass
4.906000	41.65	---	56.00	14.35	10.3	Pass
5.018000	42.37	---	60.00	17.63	10.3	Pass
11.330000	---	26.80	50.00	23.20	10.5	Pass

7.2 99% Bandwidth

Test Requirement RSS-Gen Section 6.7
Test Method: ANSI C63.10 (2013) Section 6.9.3

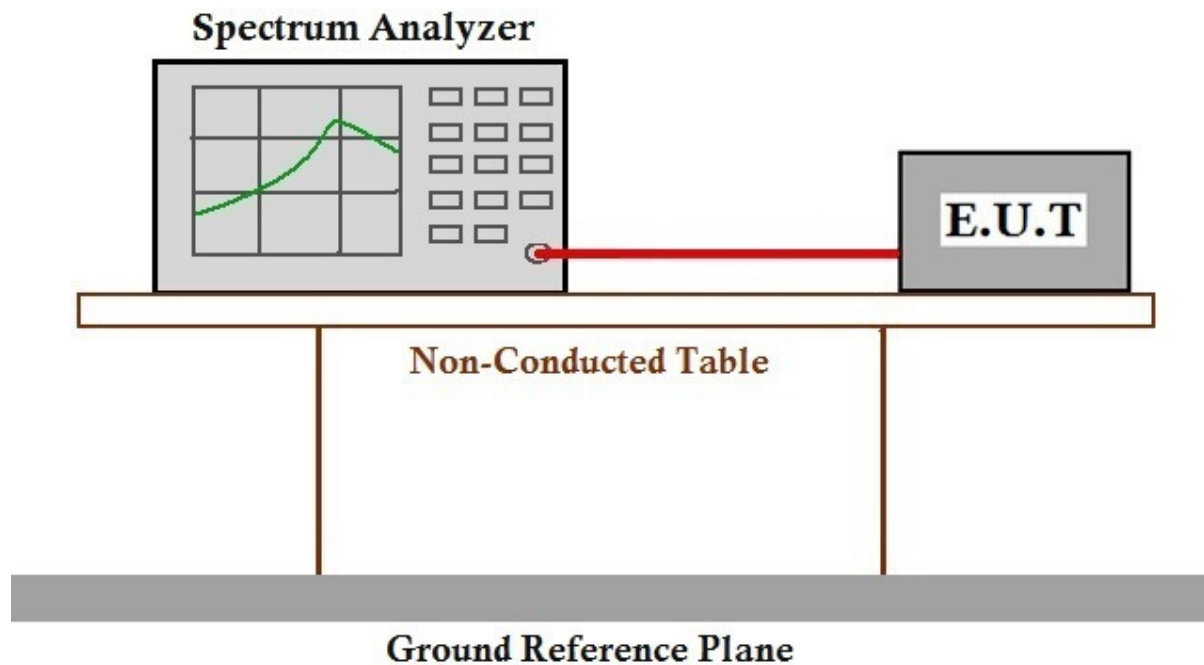
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

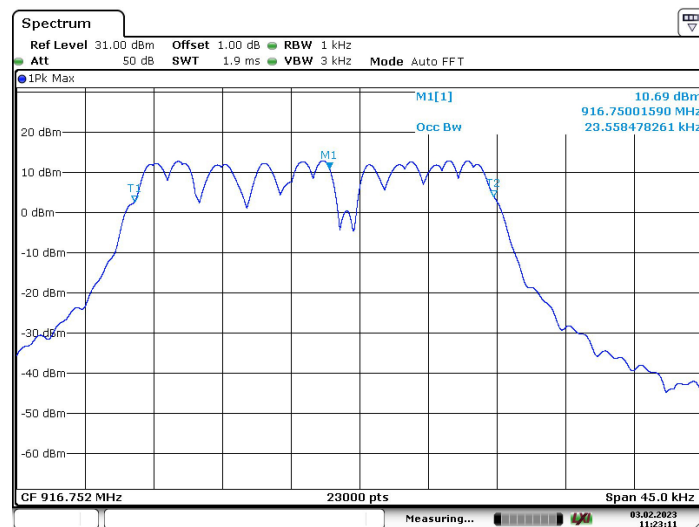
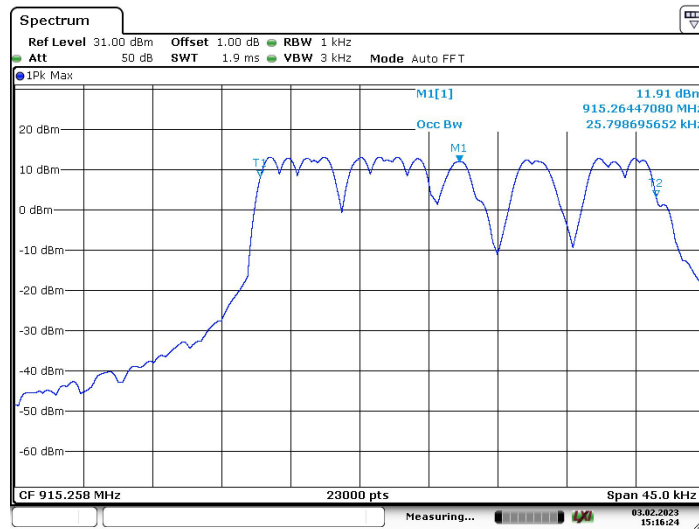
7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

DUT Frequency (MHz)	Bandwidth (kHz)	Limit (MHz)	Result
915.25	25.80	---	PASS
916.75	23.56	---	PASS

Test plots:



7.3 Conducted Peak Output Power

Test Requirement 47 CFR Part 15 Subpart C 15.247(b)(1) & 15.247(b)(3),
RSS-247 Section 5.4(b)

Test Method: ANSI C63.10 (2013) Section 7.8.5

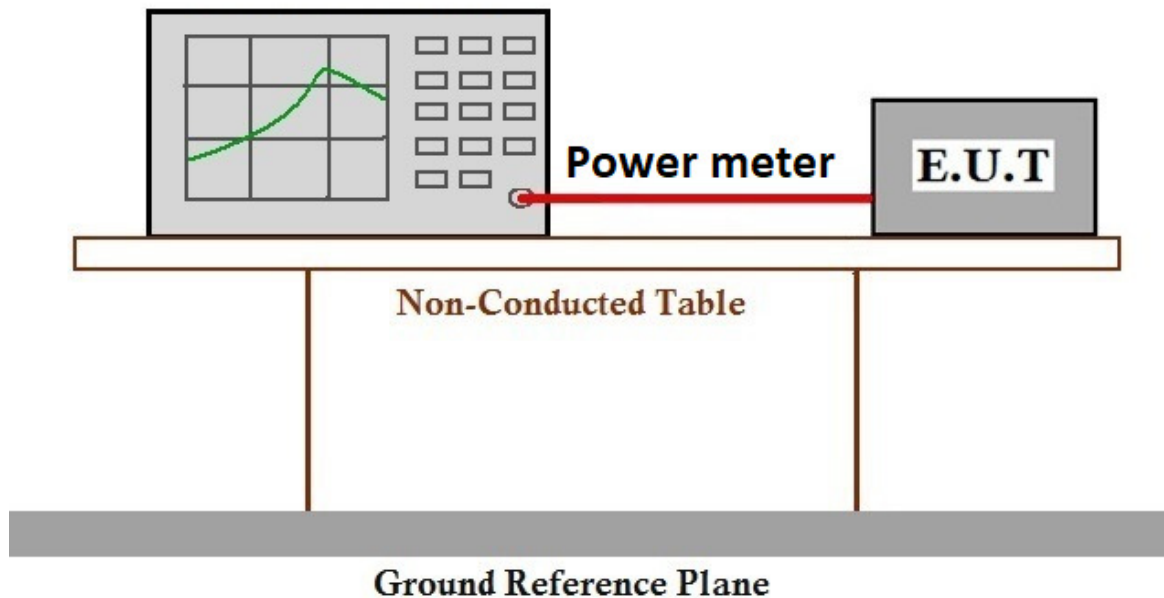
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

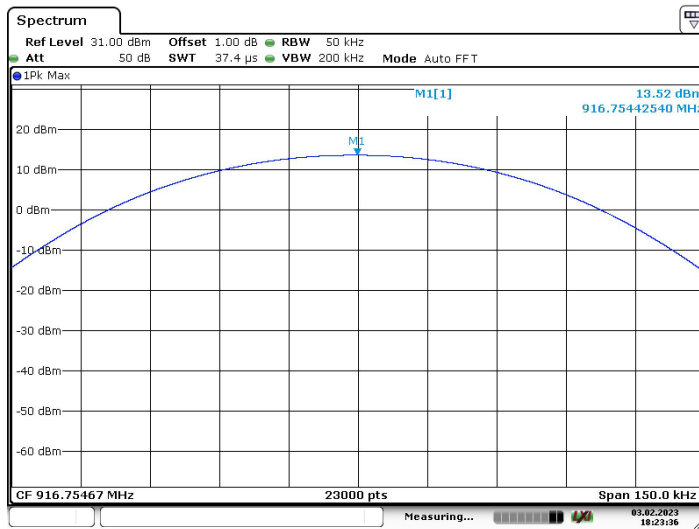
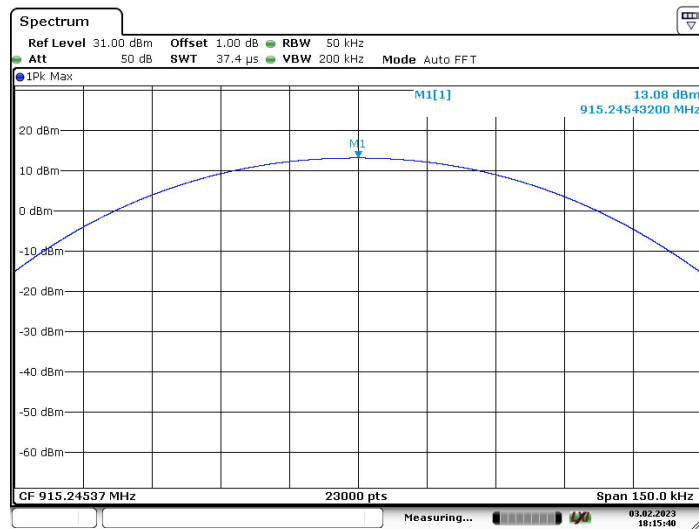
7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
915.25	13.08	30.0	PASS
916.75	13.52	30.0	PASS

Test plots:



7.4 20dB Bandwidth

Test Requirement 47 CFR Part 15 Subpart C 15.215, RSS-247 Section 5.1(a)

Test Method: ANSI C63.10 (2013) Section 6.9.2

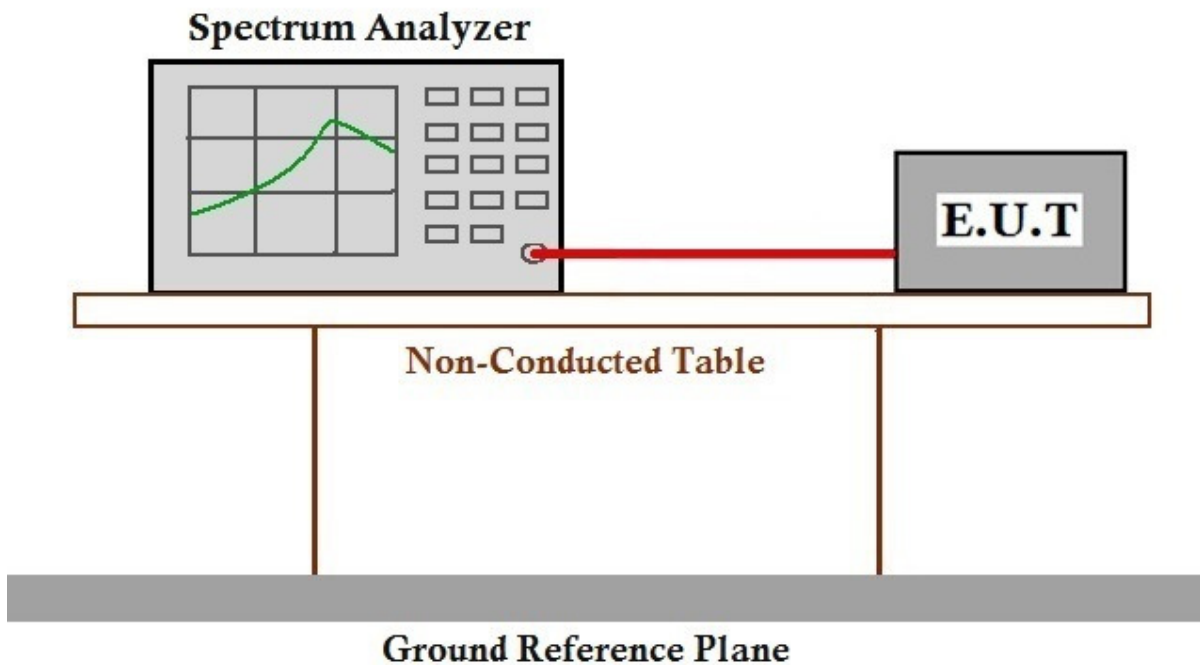
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

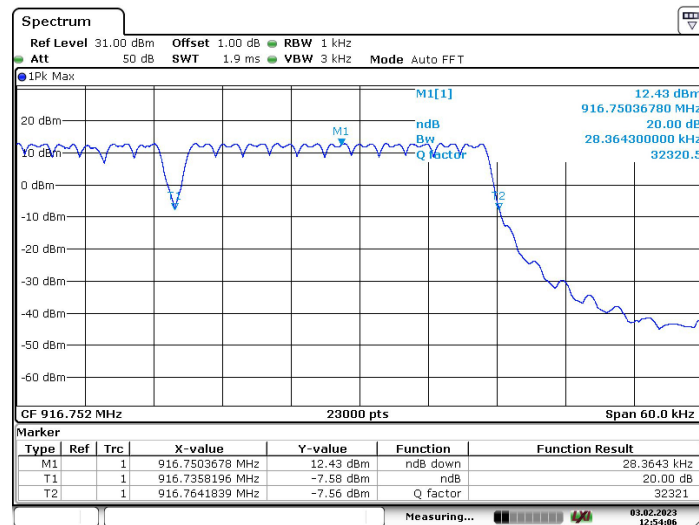
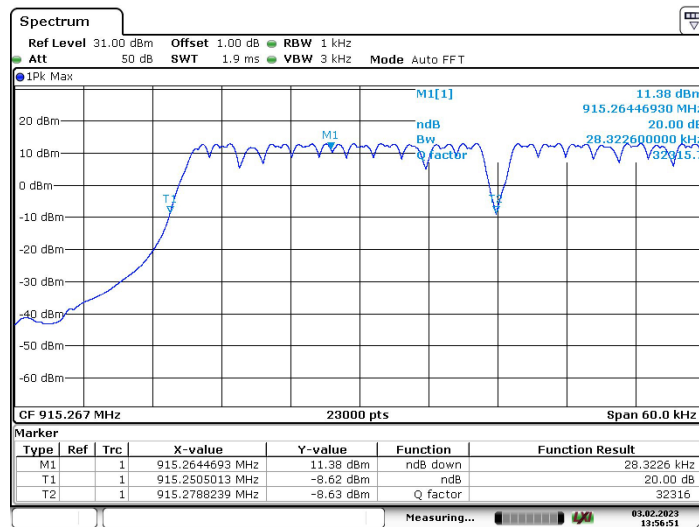
7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

DUT Frequency (MHz)	Bandwidth (kHz)	Limit (MHz)	Result
915.25	28.32	---	PASS
916.75	28.36	---	PASS

Test plots:



7.5 Carrier Frequencies Separation

Test Requirement	47 CFR Part 15 Subpart C 15.247a(1), RSS-247 Section 5.1(b)
Test Method:	ANSI C63.10 (2013) Section 7.8.2
Limit:	A minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

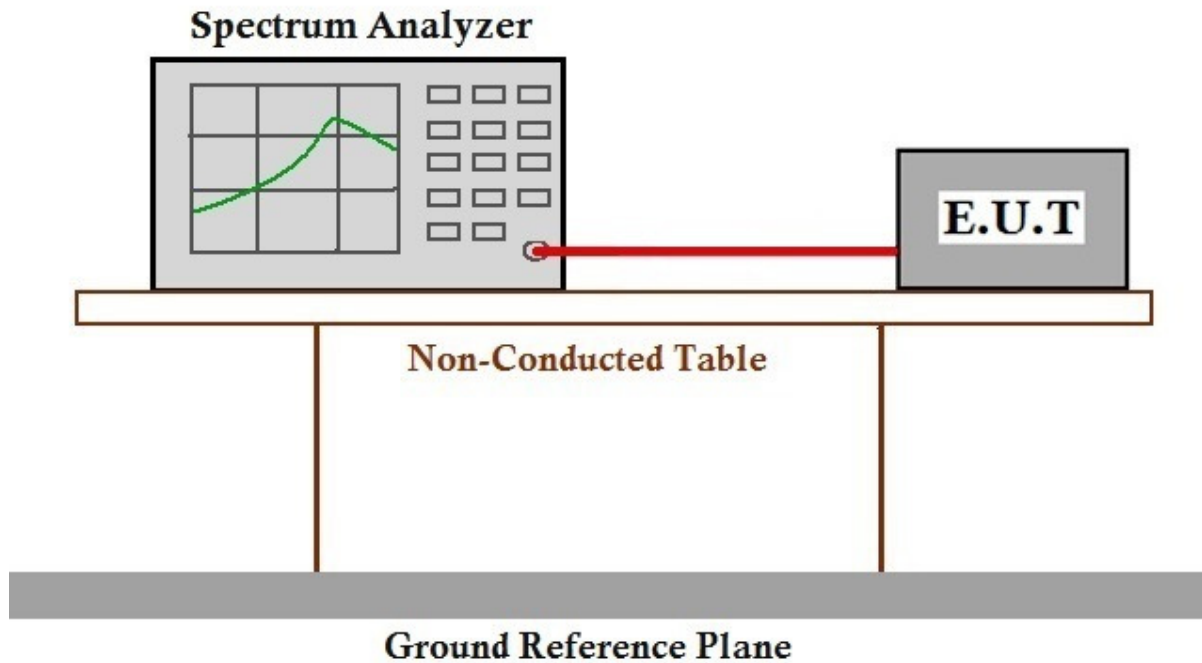
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

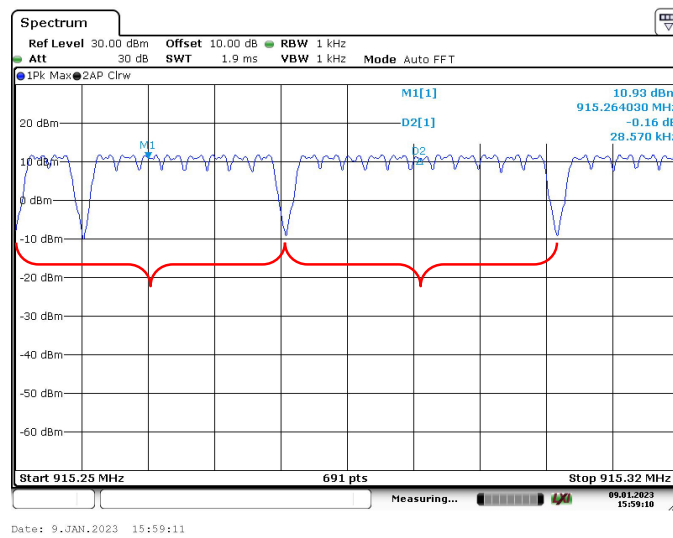
Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

DUT Frequency (MHz)	Frequency Separation (kHz)	Limit (kHz)	Result
915.26	28.57	28.32	PASS



7.6 Hopping Channel Number

Test Requirement 47 CFR Part 15 Subpart C 15.247a(1)(iii), RSS-247 Section 5.1(d)

Test Method: ANSI C63.10 (2013) Section 7.8.3

Limit:

Frequency range (MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

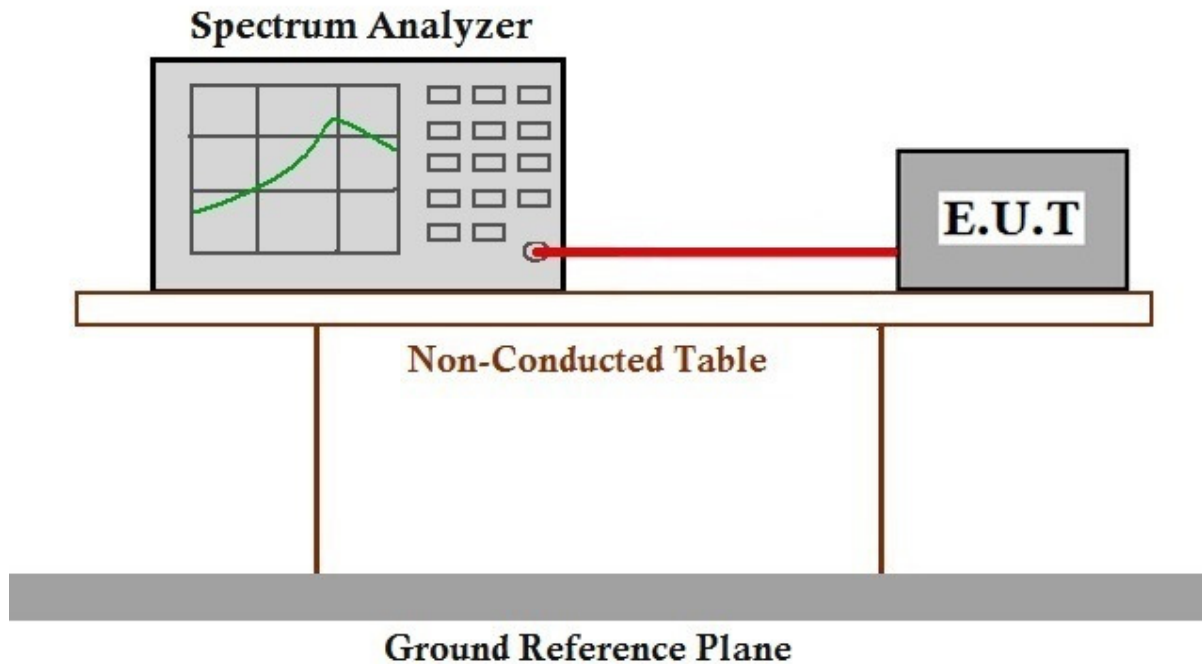
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

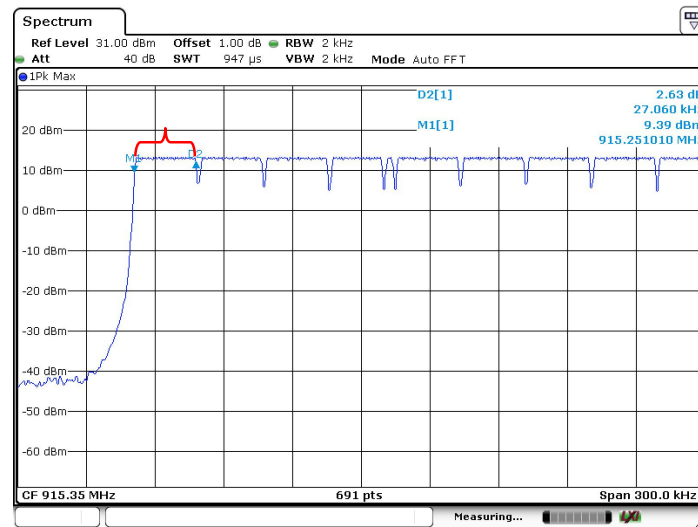
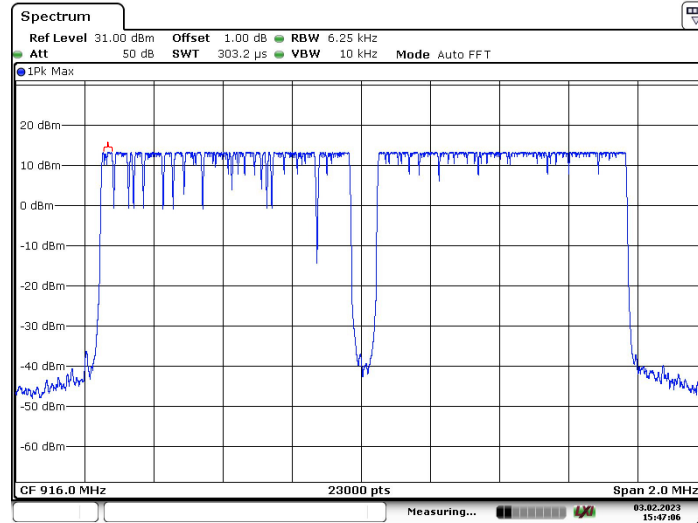
Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

Channels	Limit Min	Result
50	50	PASS



7.7 Dwell Time

Test Requirement 47 CFR Part 15 Subpart C 15.247a(1)(iii), RSS-247 Section 5.1(d)
Test Method: ANSI C63.10 (2013) Section 7.8.4
Limit:

Frequency (MHz)	Limit
902-928	0.4S within a 20S period (20dB bandwidth<250kHz)
	0.4S within a 10S period (20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

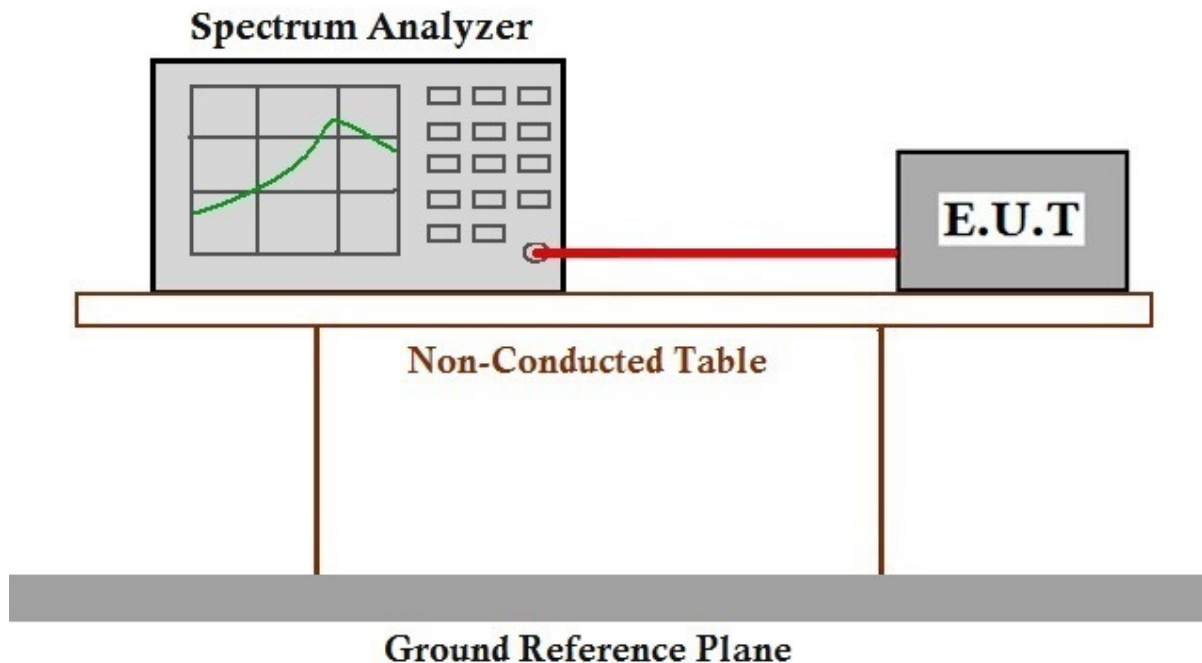
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

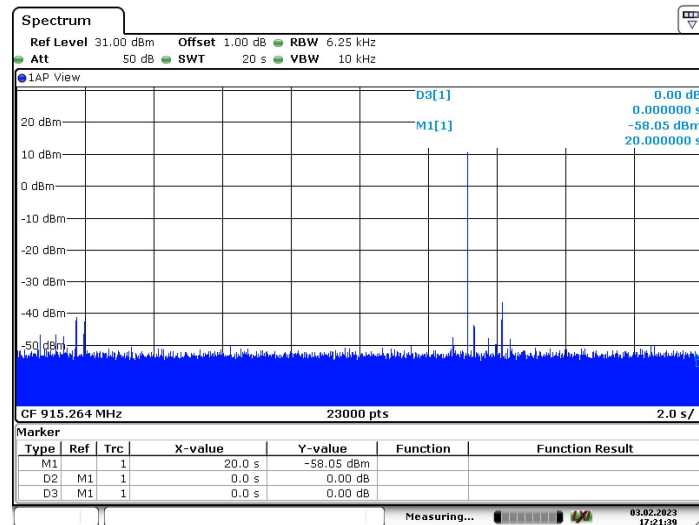
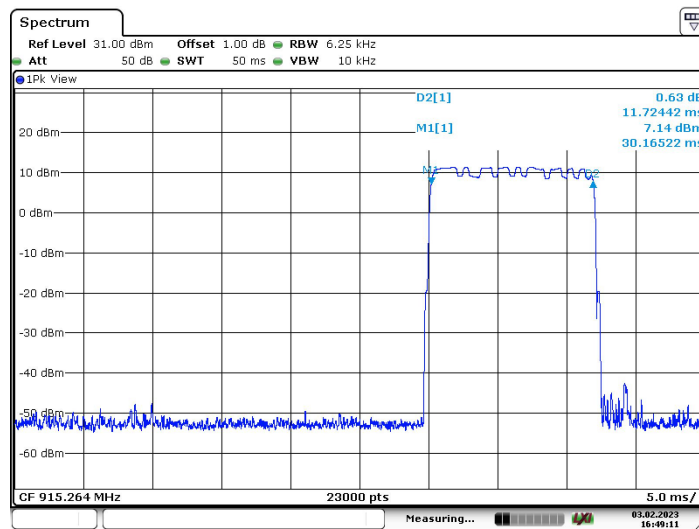
7.7.2 Test Setup Diagram



7.7.3 Measurement Procedure and Data

Channel (MHz)	Width of Burst (ms)	Number of Burst (s)	Measurement Time (s)	Dwell Time (ms)	Limit (ms)	Result
915.26	11.72	1	20	11.72	≤400	Pass

*Remark: the channel shown is the worst case.





7.8 Conducted Band Edges Measurement

Test Requirement	47 CFR Part 15 Subpart C 15.247(d), RSS-247 Section 5.5
Test Method:	ANSI C63.10 (2013) Section 7.8.6
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

FCC Part 15 C Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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	2655 - 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	
13.36 - 13.41			

RSS-Gen Section 8.10 Restricted bands of operation.

Restricted frequency bands, identified in table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

(a) The transmit frequency, including fundamental components of modulation, of licence-exempt radio

apparatus shall not fall within the restricted frequency bands listed in table 7 except for apparatus compliant with RSS-287, *Emergency Position Indicating Radio Beacons (EPIRB)*, *Emergency Locator Transmitters (ELT)*, *Personal Locator Beacons (PLB)*, and *Maritime Survivor Locator Devices (MSLD)*.

(b) Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table 5 and table 6.

(c) Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7 – Restricted frequency bands* MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	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	* Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.
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	--	

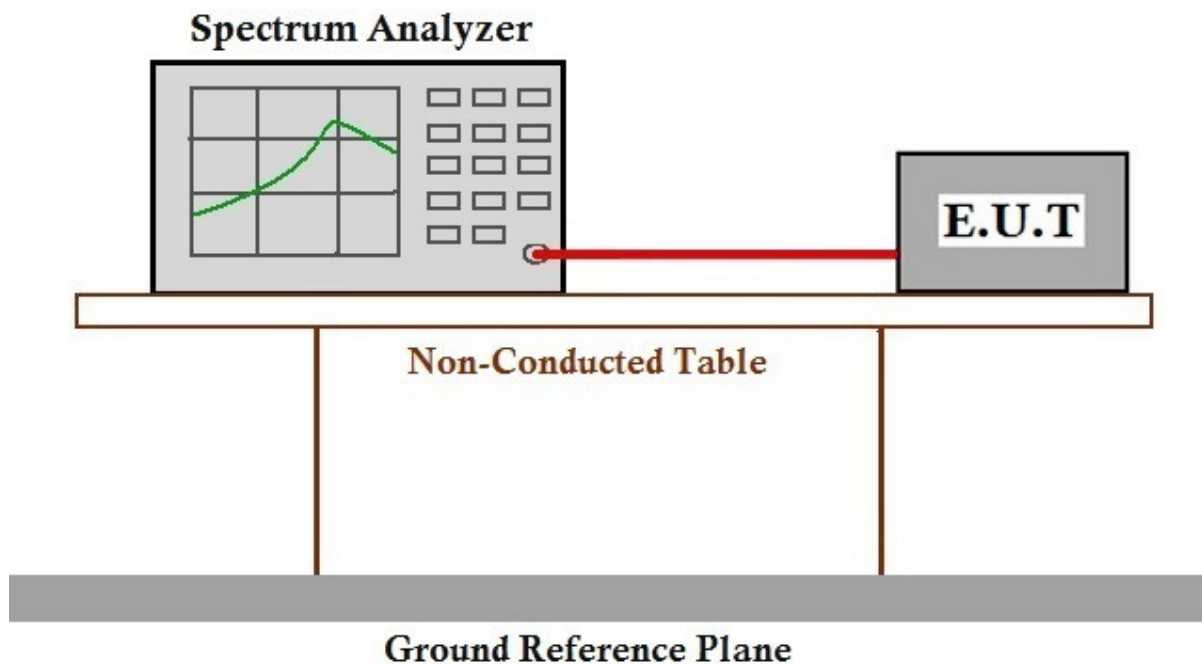
7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 20.0 °C Humidity: 48.0 % RH :

Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.
b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.8.2 Test Setup Diagram



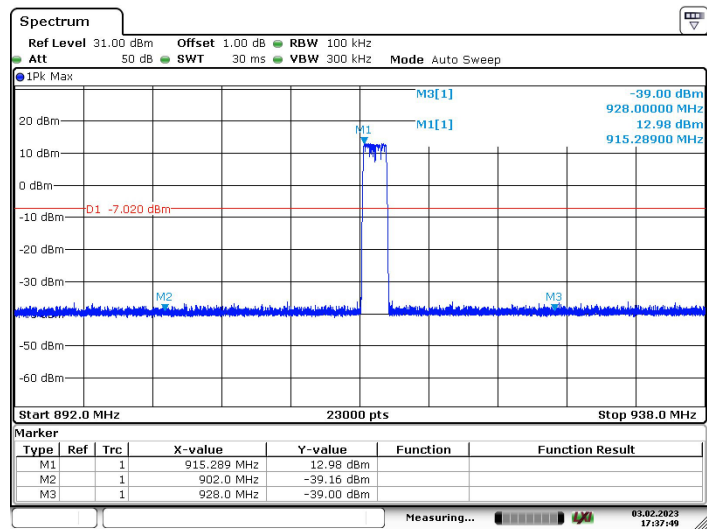
7.8.3 Measurement Procedure and Data

Mode: a;

Inband Peak

Frequency (MHz)	Level (dBm)
915.289	12.98

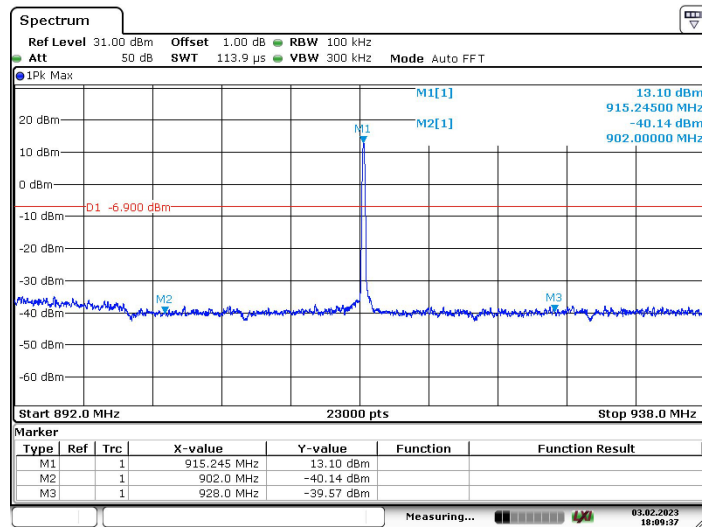
Remark: Limit = Inband peak – 20dB



Mode: b;
Inband Peak

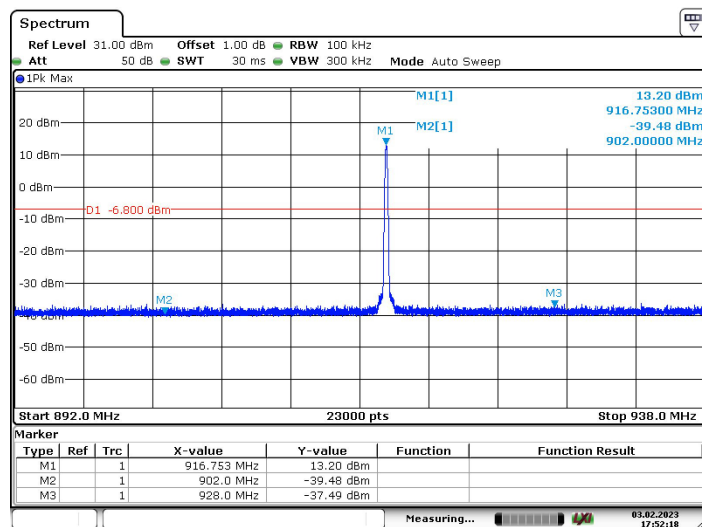
Frequency (MHz)	Level (dBm)
915.245	13.10

Remark: Limit = Inband peak – 20dB



Frequency (MHz)	Level (dBm)
916.753	13.20

Remark: Limit = Inband peak – 20dB



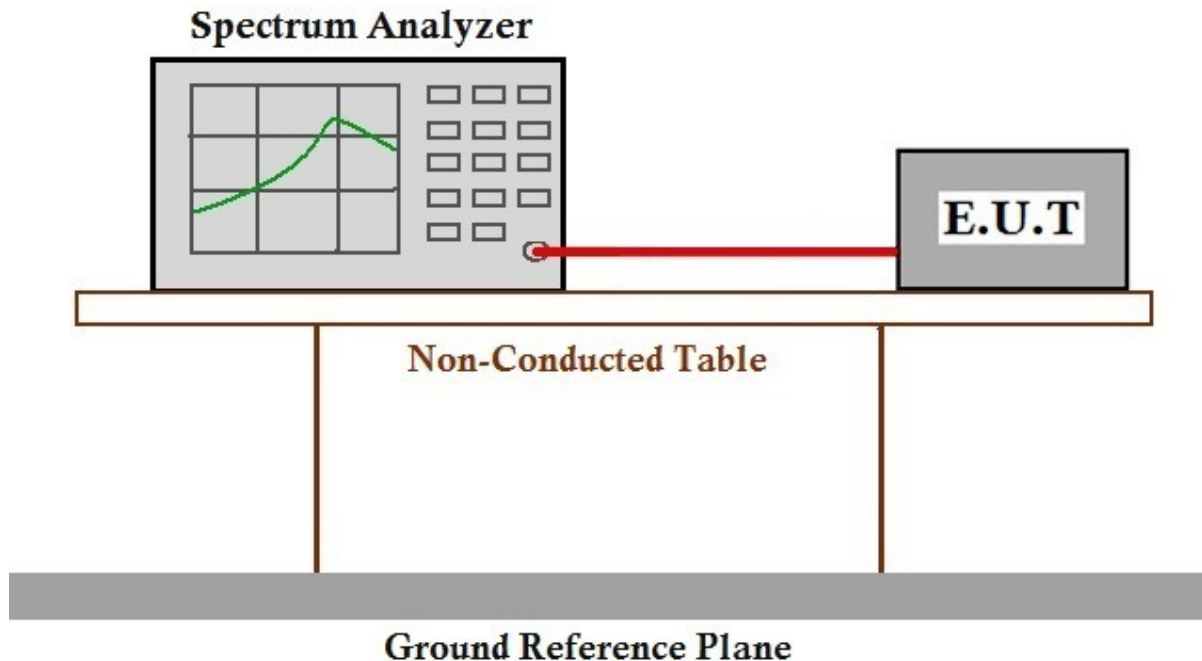
7.9 Conducted Spurious Emissions

Test Requirement	47 CFR Part 15 Subpart C 15.247(d), RSS-247 Section 5.5
Test Method:	ANSI C63.10 (2013) Section 7.8.8
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

7.9.1 E.U.T. Operation

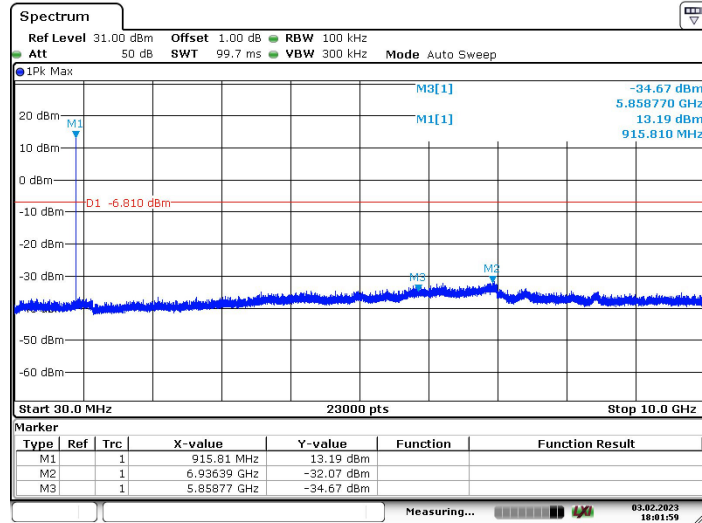
Operating Environment:				
Temperature:	20.0 °C	Humidity:	48.0 % RH	:
Test mode	a: TX_Hop mode_Keep the EUT in frequency hopping mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.			

7.9.2 Test Setup Diagram

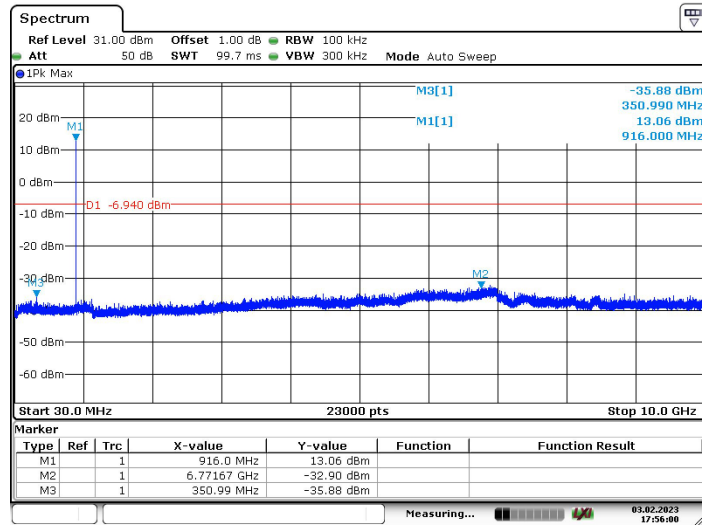


7.9.3 Measurement Procedure and Data

Lowest channel

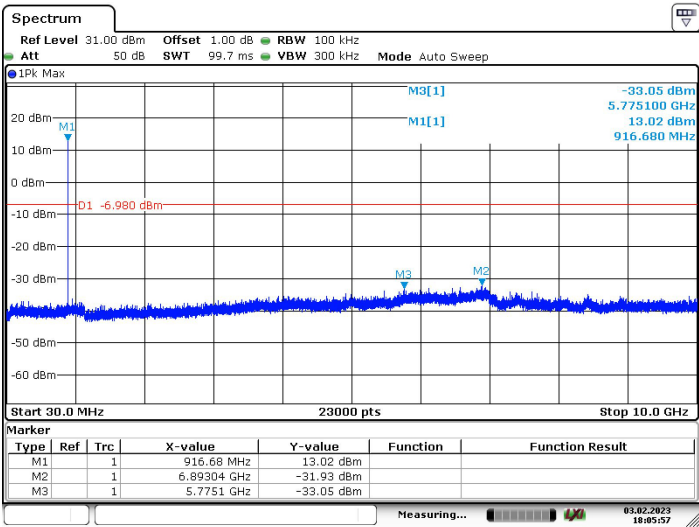


Middle channel





Highest channel



7.10 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15 Subpart C 15.209 & 15.247(d), Section 3.3
& RSS-Gen Section 8.10
Test Method: ANSI C63.10 (2013) Section 6.10.5
Limit:

Table 5 - General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field strength (μ V/m at 3 m)
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

Table 6 - General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) (μ A/m)	Measurement distance (m)
9 - 490 kHz 1	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

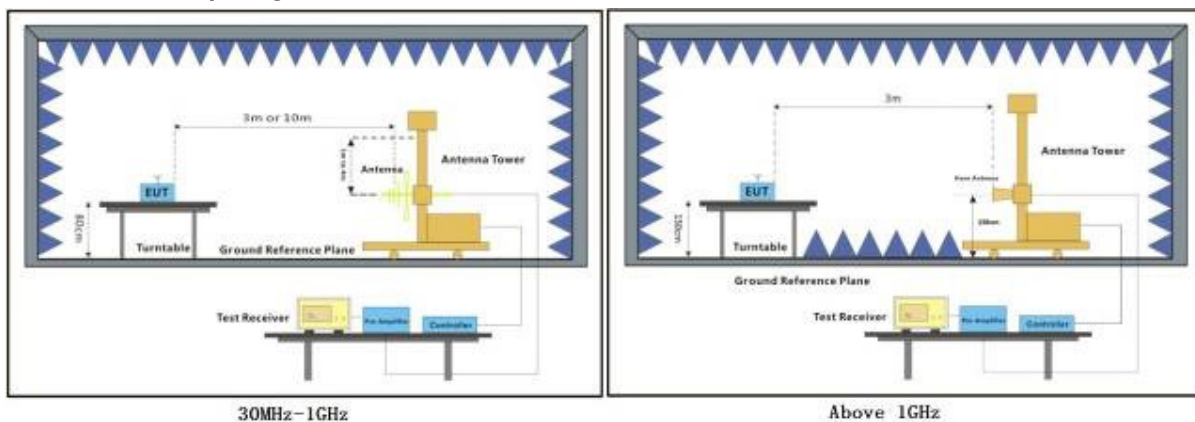
7.10.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C Humidity: 53.0 % RH :

Test mode b: TX_non-Hop mode. Keep the EUT in continuously transmitting mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.10.2 Test Setup Diagram



7.10.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height 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.
- e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)	Limit (dBμV/m)	Result
		QP	QP	
902.000	H	25.7	46.0	Pass
928.000	H	25.9	46.0	Pass
902.000	V	26.1	46.0	Pass
928.000	V	26.9	46.0	Pass

7.11 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15 Subpart C 15.205 & 15.209, Section 3.3
& RSS-Gen Section 8.9

Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6

Limit:

Table 5 - General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field strength (μ V/m at 3 m)
30 - 88	100
88 - 216	150
216 - 960	200
Above 960	500

Table 6 - General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) (μ A/m)	Measurement distance (m)
9 - 490 kHz 1	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

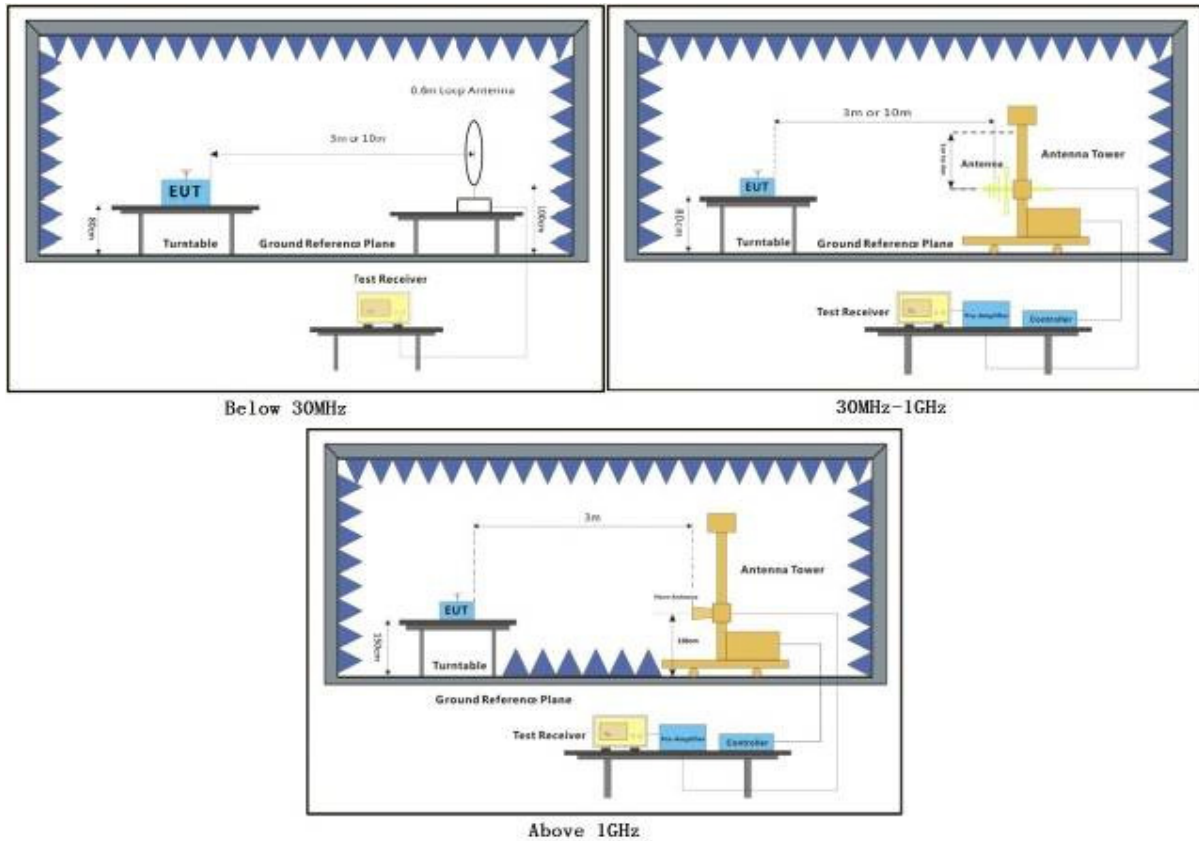
7.11.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C Humidity: 53.0 % RH :

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.11.2 Test Setup Diagram



7.11.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height 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.
- e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

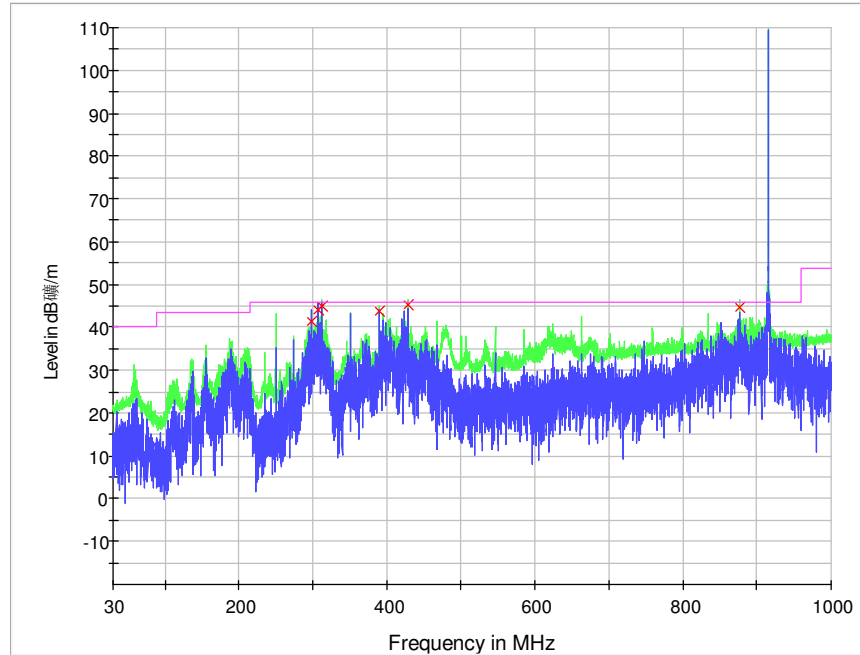
Radiated emission below 1GHz

Channel: Low

Mode: b;

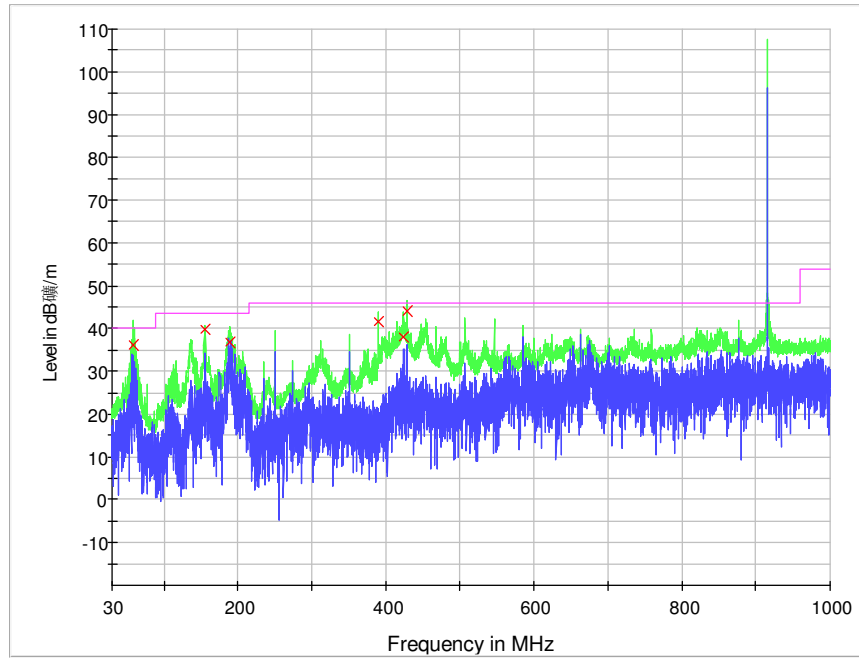
Polarization: Horizontal

Quasi-peak measurement:



Frequency (MHz)	QuasiPeak (dBμV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBμV/m)	Result
297.332000	41.4	H	14.6	4.6	46.0	Pass
307.129000	44.0	H	14.9	2.0	46.0	Pass
311.979000	44.9	H	15.0	1.1	46.0	Pass
389.967000	43.7	H	17.1	2.3	46.0	Pass
428.961000	45.4	H	18.0	0.6	46.0	Pass
876.228000	44.7	H	25.3	1.3	46.0	Pass

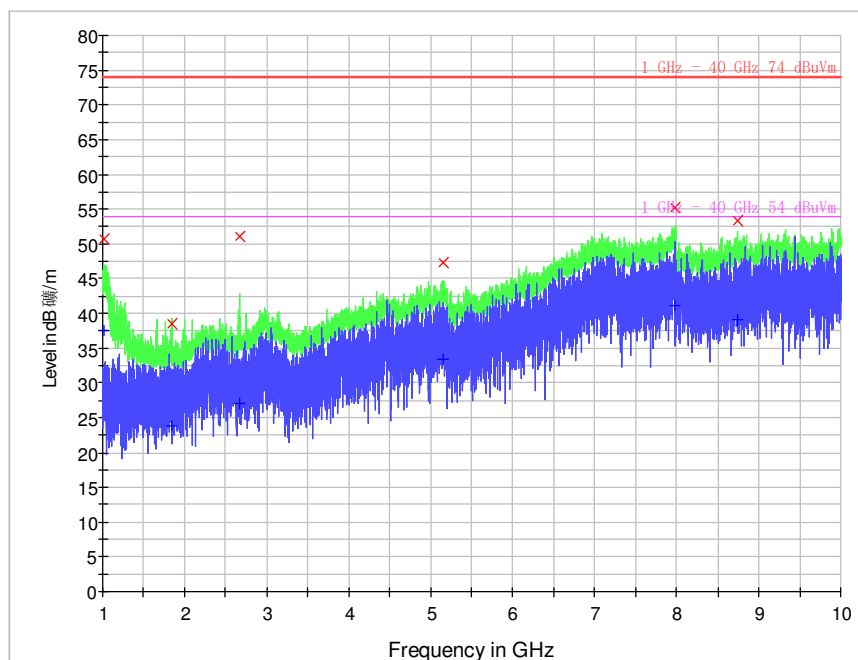
Mode: b;
Polarization: Vertical
Quasi-peak measurement:



Frequency (MHz)	QuasiPeak (dBμV/m)	Pol.	Corr. (dB/m)	Margin (dB)	Limit (dBμV/m)	Result
58.615000	36.2	V	13.8	3.8	40.0	Pass
156.003000	39.9	V	14.5	3.6	43.5	Pass
189.274000	36.8	V	11.5	6.7	43.5	Pass
389.967000	41.6	V	17.1	4.4	46.0	Pass
422.753000	38.1	V	17.8	7.9	46.0	Pass
428.961000	44.1	V	18.0	1.9	46.0	Pass

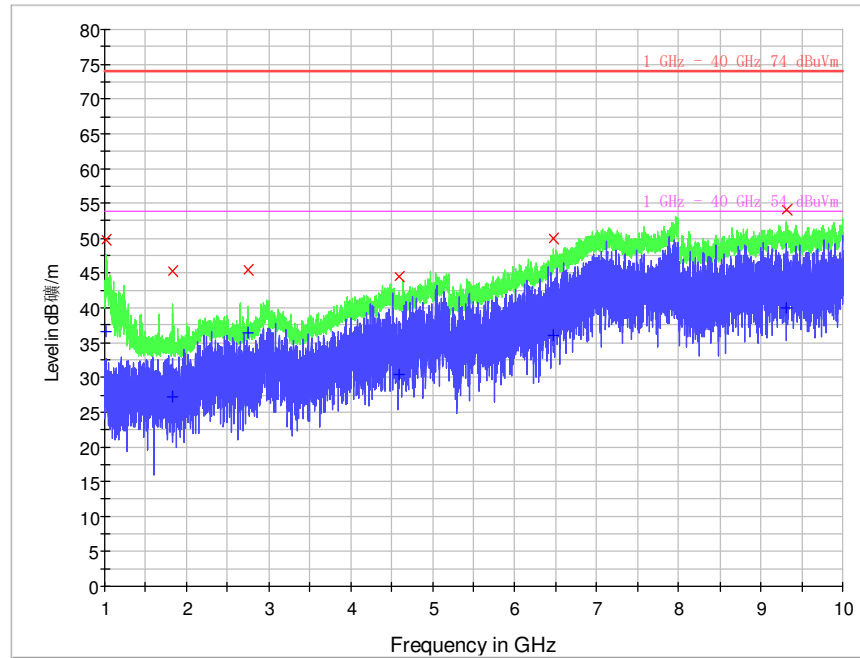
Above 1GHz

Channel: Low



Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Result
		Peak	Average	Peak	Average	
1021.857	H	50.7	/	74	54	Pass
2665.392	H	51.1	/	74	54	Pass
7968.785	V	55.2	41.3	74	54	Pass
7979.107	H	55.3	41.2	74	54	Pass
8738.035	H	53.4	/	74	54	Pass
9710.678	V	53.5	/	74	54	Pass

Channel: High



Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Result
		Peak	Average	Peak	Average	
1020.642	H	49.8	/	74	54	Pass
5150.428	V	46.8	/	74	54	Pass
6472.178	H	50.0	/	74	54	Pass
7118.785	V	53.5	/	74	54	Pass
9319.071	H	54.1	40.1	74	54	Pass
9763.500	V	53.6	/	74	54	Pass



Report No.: HKEM221200109504
Page: 54 of 54

8 Photographs

Remark: Photos refer to Appendix: External Photo, Internal Photo and setup Photo.

- End of the Report -
