FCC RF Test Report

APPLICANT	:	Nokia Shanghai Bell Co., Ltd.
EQUIPMENT	:	Nokia FastMile 5G Gateway 12
BRAND NAME	:	Nokia
MODEL NAME	:	5G31-03W-B
FCC ID	:	2ADZR5G3103WB
STANDARD	:	FCC Part 15 Subpart E §15.407
TEST DATE(S)	:	Apr. 22, 2024 ~ Jun. 20, 2024

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia

ACCREDITED Cert #5145.02

Sporton International Inc. (Kunshan)
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People's Republic of China

Table of Contents

History of this test report

Report No.	Version	Description	Issued Date
FR432101-01	01	Initial issue of report	Jun. 27, 2024
FR432101-01	02	1. Update sections 3.5.4 and 3.5.5 2. Update section 4. Measuring Equipment for CBP 3. Appendix E adds CBP setup photos	Jul. 09, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(a)(11)	26dB Emission Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Pass	-
3.2	15.407(a)(5)(6)	Fundamental Maximum EIRP	Pass	-
3.3	15.407(a)(5)(6)	Fundamental Power Spectral Density	Pass	-
3.4	15.407(b)(7)	In-Band Emissions (Channel Mask)	Pass	-
3.5	15.407(d)(6)	Contention Based Protocol	Pass	
3.6	15.407(b)	Unwanted Emissions	Pass	Under limit 0.26 dB at 7267.400 MHz
3.7	15.207	AC Conducted Emission	Pass	Under limit 22.21 dB at 0.152 MHz
3.8	15.203 15.407(a)	Antenna Requirement	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1. Applicant

Nokia Shanghai Bell Co., Ltd.
388#, Ningqiao Road, China (Shanghai) Pilot Free Trade Zone, Shanghai 201206, China

1.2. Manufacturer

Nokia Solutions and Networks Oy
Karakaari 7, 02610 Espoo, Finland

1.3. Product Feature of Equipment Under Test

Product Feature	
Equipment	Nokia FastMile 5G Gateway 12
Brand Name	Nokia
Model Name	5G31-03W-B
FCC ID	2ADZR5G3103WB
SN / IMEI Code	Conducted: KLT241200BDC (SN) Conduction: KLT241102358 (SN) Radiation: KLT241200BDB for Sample1 (SN) 355630740001388 for Sample2 (IMEI) 355630740001404 for Sample3 (IMEI) CBP: KLT241200BDC(SN)
HW Version	3TG03021Exxx (x may be from A to Z)
SW Version	5GGW-QCOM7X_D240200B31T0601E0496
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are three samples under test, only different for the antenna manufacturers. According to the difference, we choose sample 1 to full test and the sample 2/3 are verified the worst case for RSE.

Ant Description	P/N	Vendor_1	Vendor_2	Vendor_3
Ant0&WiFi3_2.4G	3TG03393AAAA	GW12-A0W3	N42NKASA-PK1-D1X95BUD150U4LI	NKH049-15-000-R
Ant1&WiFi2_6G	3TG03394AAAA	GW12-A1W2	N40NKASB-PK1-E1X190BUE110U4LI	NKH050-15-000-R
Ant 2,Ant3,Ant5,Ant7	3TG03395AAAA	GW12-A2357	N40NKASC-PK1-R150U4LID115U4LI E165U4LIA105U4LI	NKH051-15-000-R
Ant4,Ant6&Ant9	3TG03396AAAA	GW12-A469	N40NKASD-PK1-A135U4LID170U4LI E200U4LI	NKH052-15-000-R
WiFi1_6G	3TG03397AAAA	GW12-W1	N06NKASF-PK1-A1X95BU	NKH053-15-000-R
WiFi4_2.4G	3TG03398AAAA	GW12-W4	N01NKASG-PK1-R1X160BU	NKH054-15-000-R
WiFi5_5G	3TG03399AAAA	GW12-W5	N02NKASH-PK1-D1X90BU	NKH055-15-000-R
Ant8&WiFi6_5G	3TG03400AAAA	GW12-A8W6	N43NKASE-PK1-E1X95BUA165U4LI	NKH056-15-000-R
WiFi7_5G	3TG03401AAAA	GW12-W7	N02NKASJ-PK1-A1X95BU	NKH057-15-000-R
WiFi8_5G	3TG03402AAAA	GW12-W8	N02NKASK-PK1-R1X115BU	NKH058-15-000-R

1.4. Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	U-NII-5: 5925 MHz ~ 6425 MHz U-NII-6: 6425 MHz ~ 6525 MHz U-NII-7: 6525 MHz ~ 6875 MHz U-NII-8: 6875 MHz ~ 7125 MHz
Maximum EIRP	**MIMO<Ant.1+2>** **<5925 MHz ~ 7125 MHz >** 802.11ax HE20 : 15.54 dBm / 0.0358 W 802.11ax HE40 : 18.48 dBm / 0.0705 W 802.11ax HE80 : 21.09 dBm / 0.1285 W 802.11ax HE160 : 24.41 dBm / 0.2761 W 802.11be EHT20 : 15.71 dBm / 0.0372 W 802.11be EHT40 : 18.56 dBm / 0.0718 W 802.11be EHT80 : 21.27 dBm / 0.1340 W 802.11be EHT160 : 24.42 dBm / 0.2767 W 802.11be EHT320 : 26.62 dBm / 0.4592 W **TX Beamforming** 802.11ax HE20 : 16.38 dBm / 0.0435 W 802.11ax HE40 : 19.73 dBm / 0.0940 W 802.11ax HE80 : 22.14 dBm / 0.1637 W 802.11ax HE160 : 24.16 dBm / 0.2606 W 802.11be EHT20 : 16.59 dBm / 0.0456 W 802.11be EHT40 : 19.77 dBm / 0.0948 W 802.11be EHT80 : 22.16 dBm / 0.1644 W 802.11be EHT160 : 24.18 dBm / 0.2618 W 802.11be EHT320 : 26.73 dBm / 0.4710 W
99% Occupied Bandwidth	**MIMO<Ant.1+2>** 802.11 be EHT20 : 19.820 MHz 802.11 be EHT40 : 39.241 MHz 802.11 be EHT80 : 79.600 MHz 802.11be EHT160 : 160.160 MHz 802.11be EHT320: 319.041 MHz **TX Beamforming** 802.11 be EHT20 : 19.620 MHz 802.11 be EHT40 : 38.761 MHz 802.11 be EHT80 : 79.600 MHz 802.11be EHT160 : 160.160 MHz 802.11be EHT320: 319.680 MHz
Antenna Type	Monopole Antenna
Type of Modulation	802.11ax: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM) 802.11be: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM / 4096QAM)

Remark:

1. For SISO&MIMO mode, the whole testing has assessed only MIMO mode by referring to their higher conducted power.
2. WLAN MIMO support CDD mode and Tx Beamforming mode for 802.11ax/be.
3. For 802.11ax & 11be mode, the whole testing has assessed only 802.11be EHT20 / EHT40 / EHT80 / EHT160MHz / EHT320MHz by referring to the higher output power.

4. 802.11ax/be does not support partial RU tone.
5. The device support UNII-8 CH233 (BW=20M, Center Frequency = 7115MHz).
6. The device supports multiple spatial streams, the worst cases directional gain will occur when NSS = 1, therefore, the 1S2T(CDD&TXBF) mode is the worst; 1S2T: NSS=1, MIMO 2Tx.
7. The channel puncturing mode is for improving network performance and not available for CBP, the CBP will apply channel bandwidth reduction mechanism to protect incumbent operations
8. This device supports full RU and OFDMA modes for 802.11ax/be, the PSD of OFDMA modes is reduced to be smaller than full RU, therefore the full RU perform full test to cover OFDMA except for Power/PSD. In OFDMA mode, Resource Unit (RU) fill the entire frequency bandwidth. Supports up to 8 Resource Unit (RU) being used at the same time.
9. Please refer to the antenna report for the maximum/ minimum Single antenna gain.

Frequency Band	Maximum Single Antenna gain (dBi)		Minimum Antenna Gain (dBi)	
	ANT1	ANT2	ANT1	ANT2
6GHz UNII-5	4.56	4.06	3.66	2.41
6GHz UNII-6	4.12	4.05	3.86	3.32
6GHz UNII-7	4.12	4.36	3.87	3.70
6GHz UNII-8	4.10	4.36	4.05	2.99

CBP test with antenna path of minimum gain (Antenna 2, Minimum gain= 2.41 dBi).

10. The Ant.1 in this report is the corresponding antenna report is W1, ant. 2 corresponding antenna report is W2.
11. This device supports channel puncturing for 802.11be EHT80/EHT160//EHT320 as below, which is less than full RU PSD, therefore have assessed only EIRP/PSD/MASK/RSE.

<80M BW Puncturing 20MHz>:

Bandwidth	Tones		Index		For test modes configure
80MHz	242	484	62	66	1
80MHz	242	484	61	66	2
80MHz	484	242	65	64	3
80MHz	484	242	65	63	4

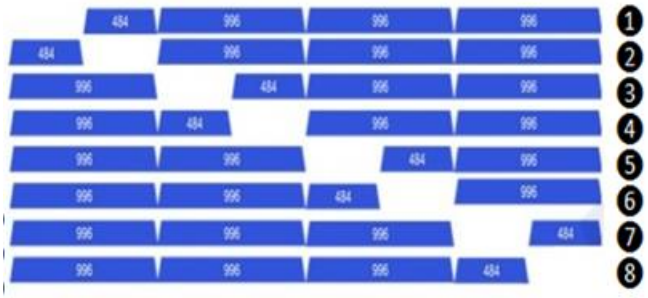
<160M BW Puncturing 20MHz>:

Bandwidth	Tones			Index			For test modes configure
160MHz	242-Left	484-Left	996-Right	62-Left	66-Left	67-Right	1
160MHz	242-Left	484-Left	996-Right	61-Left	66-Left	67-Right	2
160MHz	484-Left	242-Left	996-Right	65-Left	64-Left	67-Right	3
160MHz	484-Left	242-Left	996-Right	65-Left	63-Left	67-Right	4
160MHz	996-Left	242-Right	484-Right	67-Left	62-Right	66-Right	5
160MHz	996-Left	242-Right	484-Right	67-Left	61-Right	66-Right	6
160MHz	996-Left	484-Right	242-Right	67-Left	65-Right	64-Right	7
160MHz	996-Left	484-Right	242-Right	67-Left	65-Right	63-Right	8

<160M BW Puncturing 40MHz>:

Bandwidth	Tones		Index		For test modes configure
160MHz	484-Left	996-Right	66-Left	67-Right	1
160MHz	484-Left	996-Right	65-Left	67-Right	2
160MHz	996-Left	484-Right	67-Left	66-Right	3
160MHz	996-Left	484-Right	67-Left	65-Right	4

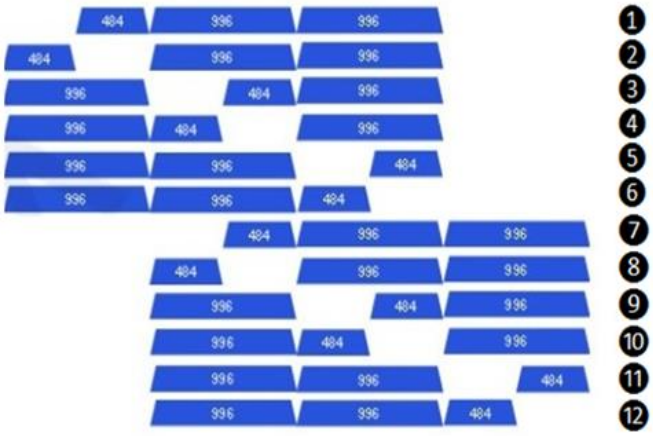
<320M BW Puncturing 40MHz>:

Bandwidth	Tones	Index	For test modes configure
320MHz			1
			2
			3
			4
			5
			6
			7
			8

<320M BW Puncturing 80MHz>:

Bandwidth	Tones	Index	For test modes configure
320MHz			1
			2
			3
			4

<320M BW Puncturing 80+40MHz>:

Bandwidth	Tones	Index	For test modes configure
320MHz			1
			2
			3
			4
			5
			6
			7
			8
			9
			10
			11
			12

Only the worse cases are shown in this report.

1.5. Modification of EUT

No modifications are made to the EUT during all test items.

1.6. Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH05-KS 03CH08-KS DFS01-KS TH01-KS	CN1257	314309

1.7. Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH05-KS	AUDIX	E3	6.2009-8-24
2.	03CH08-KS	AUDIX	E3	6.2009-8-24al
3.	CO01-KS	AUDIX	E3	6.2009-8-24
4.	DFS01-KS	Sporton	Test Tools	1.0

1.8. Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart E
- FCC KDB 987594 D02 U-NII 6 GHz EMC Measurement v02r01
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1. Carrier Frequency and Channel

<U-NII-5, 6, 7, 8>

BW 20M	**Channel**	1	5	9	13	17	21	25	29
	Freq. (MHz)	5955	5975	5995	6015	6035	6055	6075	6095
BW 40M	**Channel**	3		11		19		27	
	Freq. (MHz)	5965		6005		6045		6085	
BW 80M	**Channel**	7				23			
	Freq. (MHz)	5985				6065			
BW 160M	**Channel**	15							
	Freq. (MHz)	6025							

BW 20M	**Channel**	33	37	41	45	49	53	57	61
	Freq. (MHz)	6115	6135	6155	6175	6195	6215	6235	6255
BW 40M	**Channel**	35		43		51		59	
	Freq. (MHz)	6125		6165		6205		6245	
BW 80M	**Channel**	39				55			
	Freq. (MHz)	6145				6225			
BW 160M	**Channel**	47							
	Freq. (MHz)	6185							
BW 320M	**Channel**	31				63			
	Freq. (MHz)	6105				6265			

BW 20M	Channel	65	69	73	77	81	85	89	93
	Freq. (MHz)	6275	6295	6315	6335	6355	6375	6395	6415
BW 40M	Channel	67		75		83		91	
	Freq. (MHz)	6285		6325		6365		6405	
BW 80M	Channel	71				87			
	Freq. (MHz)	6305				6385			
BW 160M	Channel	79							
	Freq. (MHz)	6345							
BW 320M	Channel	95							
	Freq. (MHz)	6425							

BW 20M	Channel	97	101	105	109	113	117	121	125
	Freq. (MHz)	6435	6455	6475	6495	6515	6535	6555	6575
BW 40M	Channel	99		107		115		123	
	Freq. (MHz)	6445		6485		6525		6565	
BW 80M	Channel	103				119			
	Freq. (MHz)	6465				6545			
BW 160M	Channel	111							
	Freq. (MHz)	6505							

BW 20M	Channel	129	133	137	141	145	149	153	157
	Freq. (MHz)	6595	6615	6635	6655	6675	6695	6715	6735
BW 40M	Channel	131		139		147		155	
	Freq. (MHz)	6605		6645		6685		6725	
BW 80M	Channel	135				151			
	Freq. (MHz)	6625				6705			
BW 160M	Channel	143							
	Freq. (MHz)	6665							
BW 320M	Channel	127							
	Freq. (MHz)	6585							

BW 20M	Channel	161	165	169	173	177	181	185	189
	Freq. (MHz)	6755	6775	6795	6815	6835	6855	6875	6895
BW 40M	Channel	163		171		179		187	
	Freq. (MHz)	6765		6805		6845		6885	
BW 80M	Channel	167				183			
	Freq. (MHz)	6785				6865			
BW 160M	Channel	175							
	Freq. (MHz)	6825							
BW 320M	Channel	159							
	Freq. (MHz)	6745							

BW 20M	Channel	193	197	201	205	209	213	217	221
	Freq. (MHz)	6915	6935	6955	6975	6995	7015	7035	7055
BW 40M	Channel	195		203		211		219	
	Freq. (MHz)	6925		6965		7005		7045	
BW 80M	Channel	199				215			
	Freq. (MHz)	6945				7025			
BW 160M	Channel	207							
	Freq. (MHz)	6985							
BW 320M	Channel	191							
	Freq. (MHz)	6905							

BW 20M	Channel	225	229	233
	Freq. (MHz)	7075	7095	7115
BW 40M	Channel	227		
	Freq. (MHz)	7085		

2.2. Test Mode

CDD and TXBF Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11be EHT20	MCS0
802.11be EHT40	MCS0
802.11be EHT80	MCS0
802.11be EHT160	MCS0
802.11be EHT320	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : LTE Band 5 Idle + WLAN Link(6G) + Power From Adaptor
Remark: For Radiated Test Cases, the tests were performance with Adapter.	

Band	Channel	Freq	Data Rate	Ru/PC	MIMO	CDD Power Setting	TXBF Power Setting
EHT20	CH1	5955	MCS0	Full	CDD	11.5	11
	CH1	5955	MCS0	52*4	CDD	10	-
	CH45	6175	MCS0	Full	CDD	12	12
	CH93	6415	MCS0	Full	CDD	9	10
	CH97	6435	MCS0	Full	CDD	10	12
	CH97	6435	MCS0	52*4	CDD	9	-
	CH105	6475	MCS0	Full	CDD	10	11
	CH113	6515	MCS0	Full	CDD	10.5	11
	CH117	6535	MCS0	Full	CDD	9	11
	CH117	6535	MCS0	52*4	CDD	8	-
	CH149	6695	MCS0	Full	CDD	10	14
	CH181	6855	MCS0	Full	CDD	10	13
	CH189	6895	MCS0	Full	CDD	10	11
	CH209	6995	MCS0	Full	CDD	10	11
	CH229	7095	MCS0	Full	CDD	10	12
	CH229	7095	MCS0	52*4	CDD	9	-
	CH233	7115	MCS0	Full	CDD	2	1
	CH233	7115	MCS0	52*4	CDD	-2	-
	CH185	6875	MCS0	Full	CDD	10	10
EHT40	CH3	5965	MCS0	Full	CDD	15	13
	CH3	5965	MCS0	52*8	CDD	14	-
	CH43	6165	MCS0	Full	CDD	13.5	15
	CH91	6405	MCS0	Full	CDD	13.5	16
	CH99	6445	MCS0	Full	CDD	13	13
	CH99	6445	MCS0	52*8	CDD	12	-
	CH107	6485	MCS0	Full	CDD	13	14
	CH123	6565	MCS0	Full	CDD	13	15

	CH123	6565	MCS0	52*8	CDD	11	-
	CH147	6685	MCS0	Full	CDD	13	15
	CH179	6845	MCS0	Full	CDD	13.5	14
	CH195	6925	MCS0	Full	CDD	13	14
	CH211	7005	MCS0	Full	CDD	13	15
	CH227	7085	MCS0	Full	CDD	13	16
	CH227	7085	MCS0	52*8	CDD	12.5	-
	CH187	6885	MCS0	Full	CDD	13.5	15
	CH115	6525	MCS0	Full	CDD	11.5	14
EHT80	CH7	5985	MCS0	Full	CDD	17	16
	CH7	5985	MCS0	106*8	CDD	15.5	-
	CH7	5985	MCS0	PC 20,Loc 4	CDD	15.5	-
	CH39	6145	MCS0	Full	CDD	17	20
	CH87	6385	MCS0	Full	CDD	16	18
	CH103	6465	MCS0	Full	CDD	16.5	17
	CH103	6465	MCS0	106*8	CDD	15	-
	CH103	6465	MCS0	PC 20,Loc 4	CDD	14.5	-
	CH135	6625	MCS0	Full	CDD	17.5	17
	CH135	6625	MCS0	106*8	CDD	16.5	-
	CH135	6625	MCS0	PC 20,Loc 4	CDD	15.5	-
	CH151	6705	MCS0	Full	CDD	17.5	17
	CH167	6785	MCS0	Full	CDD	17.5	17
	CH199	6945	MCS0	Full	CDD	17.5	18
	CH215	7025	MCS0	Full	CDD	18	18
	CH215	7025	MCS0	106*8	CDD	17	-
	CH215	7025	MCS0	PC 20,Loc 1	CDD	16	-
	CH183	6865	MCS0	Full	CDD	17	18
	CH119	6545	MCS0	Full	CDD	16	17
EHT160	CH15	6025	MCS0	Full	CDD	18.5	20
	CH15	6025	MCS0	242*8	CDD	18	-
	CH15	6025	MCS0	PC 20,Loc 8	CDD	17.5	-
	CH15	6025	MCS0	PC 40,Loc 4	CDD	17	-
	CH47	6185	MCS0	Full	CDD	20	21
	CH79	6345	MCS0	Full	CDD	18	21
	CH143	6665	MCS0	Full	CDD	19	20
	CH207	6985	MCS0	Full	CDD	19.5	20
	CH207	6985	MCS0	242*8	CDD	19	-
	CH207	6985	MCS0	PC 20,Loc 1	CDD	18	-
	CH207	6985	MCS0	PC 40,Loc 1	CDD	18	-
	CH175	6825	MCS0	Full	CDD	19	21
	CH111	6505	MCS0	Full	CDD	19	21
	CH111	6505	MCS0	242*8	CDD	18.5	-
	CH111	6505	MCS0	PC 20,Loc 8	CDD	18	-
	CH111	6505	MCS0	PC 40,Loc 4	CDD	17	-
EHT320	CH31	6105	MCS0	Full	CDD	21.5	23
	CH31	6105	MCS0	484*8	CDD	21.5	-
	CH31	6105	MCS0	PC 40,Loc 8	CDD	21	-
	CH31	6105	MCS0	PC 80,Loc 4	CDD	20.5	-
	CH31	6105	MCS0	PC 80+40,Loc 6	CDD	20	-
	CH95	6425	MCS0	Full	CDD	20.5	22

	CH159	6745	MCS0	Full	CDD	21.5	24
	CH63	6265	MCS0	Full	CDD	20.5	22
	CH127	6585	MCS0	Full	CDD	21	23
	CH127	6585	MCS0	484*8	CDD	20	-
	CH127	6585	MCS0	PC 40,Loc 8	CDD	20.5	-
	CH127	6585	MCS0	PC 80,Loc 4	CDD	20	-
	CH127	6585	MCS0	PC 80+40,Loc 6	CDD	19.5	-
	CH191	6905	MCS0	Full	CDD	14.5	23
	CH191	6905	MCS0	484*8	CDD	20.5	-
	CH191	6905	MCS0	PC 40,Loc 1	CDD	20.5	-
	CH191	6905	MCS0	PC 80,Loc 1	CDD	20	-
	CH191	6905	MCS0	PC 80+40,Loc 7	CDD	18	-

Ch. #		UNII-5	UNII-6	UNII-7	UNII-8
		20M BW	20M BW	20M BW	20M BW
L	Low	001	097	117	189
M	Middle	045	105	149	209
H	High	093	113	181	229/233
Straddle		-	-	-	185

Ch. #		UNII-5	UNII-6	UNII-7	UNII-8
		40M BW	40M BW	40M BW	40M BW
L	Low	003	099	123	195
M	Middle	043	-	147	203
H	High	091	107	179	227
Straddle		-	115	-	187

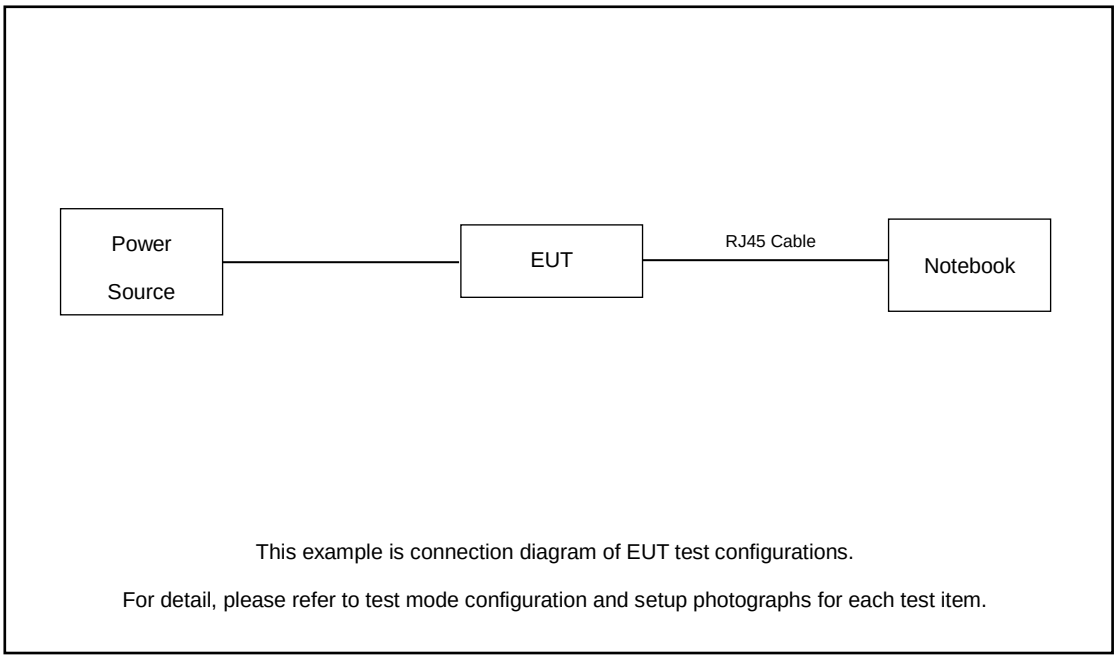
Ch. #		UNII-5	UNII-6	UNII-7	UNII-8
		80M BW	80M BW	80M BW	80M BW
L	Low	007	103	135	199
M	Middle	039		151	-
H	High	087		167	215
Straddle		-	119	183	-

Ch. #		UNII-5	UNII-6	UNII-7	UNII-8
		160M BW	160M BW	160M BW	160M BW
L	Low	015	-	143	207
M	Middle	047			
H	High	079			
Straddle		-	111	175	-

Ch. #		UNII-5	UNII-6	UNII-7	UNII-8
		320M BW	320M BW	320M BW	320M BW
L	Low	-	-	-	-
M	Middle	031			
H	High	063			
Straddle		095	127	159	191

Remark: For radiation spurious emission, the final modulation and the worst data rate was reference the max EIRP power.

2.3. Connection Diagram of Test System



This example is connection diagram of EUT test configurations.

For detail, please refer to test mode configuration and setup photographs for each test item.

2.4. Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritus	MT8821C	N/A	N/A	Unshielded,1.8m
2.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
3.	RJ45 Cable	N/A	N/A	N/A	N/A	N/A

2.5. EUT Operation Test Setup

For WLAN CDD and TXBF mode, an engineering test program “QSPR.5.0-00202” TX Tool was provided and enabled to make EUT continuously transmit.

For AC power line conducted emissions, the EUT WIFI was set to connect with the notebook under large package sizes transmission.

2.6. Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 8.33 dB and 30dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 8.33 + 30 = 38.33 (dB)

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 CFR 15.407 (a)(11)

The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.

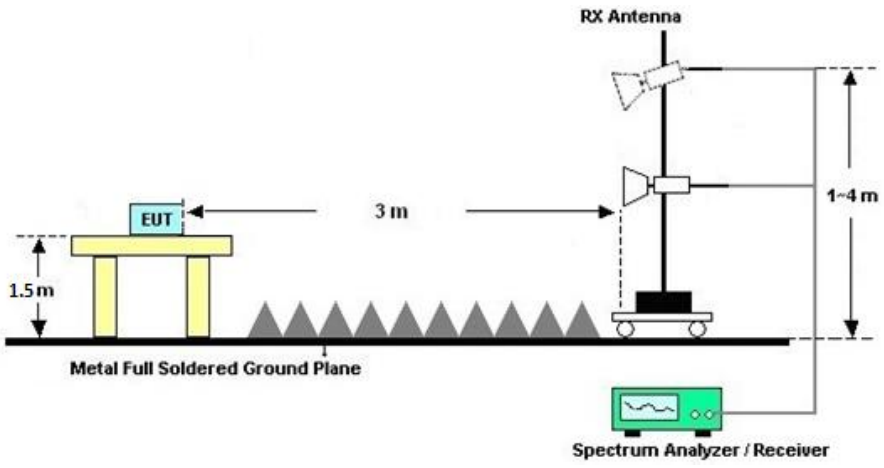
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Maximum EIRP Measurement

3.2.1 Limit of Fundamental Maximum EIRP

<FCC 14-30 CFR 15.407>

(a)(5) For an indoor access point operating in the 5.925-7.125 GHz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 30dBm.
(a)(6) For a subordinate device operating under the control of an indoor access point operating in the 5.925-7.125 GHz band, the maximum e.i.r.p. over the frequency band of operation must not exceed 30dBm.

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

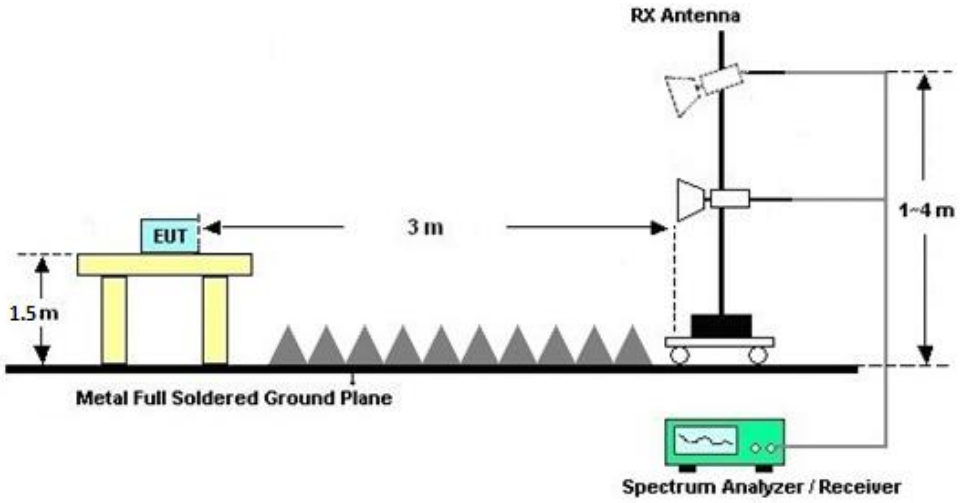
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction):

1. Measure the duty cycle, x, of the transmitter output signal as described in II.B.
2. Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal
3. Set RBW = 1 MHz
4. Set VBW ≥ 3 MHz
5. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto
7. Detector = power averaging (rms), if available. Otherwise, use sample detector mode
8. Allow the sweep to “free run.”
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter
10. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times
11. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.

3.2.4 Test Setup



3.2.5 Test Result of Fundamental Maximum EIRP

Please refer to Appendix A.

Note：

EIRP(dBm) = Final Level(dBμV/m) - 95.2

Final Level(dBμV/m) = Read Level(dBμV/m) + Path Loss(dB) + DT Factor

Path Loss(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) - Preamp Factor(dB)

3.3 Fundamental Power Spectral Density Measurement

3.3.1 Limit of Fundamental Power Spectral Density

<FCC 14-30 CFR 15.407>

(a)(5) For an indoor access point operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5dBm e.i.r.p. in any 1-megahertz band.
(a)(6) For a subordinate device operating under the control of an indoor access point operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5dBm e.i.r.p. in any 1-megahertz band.

3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

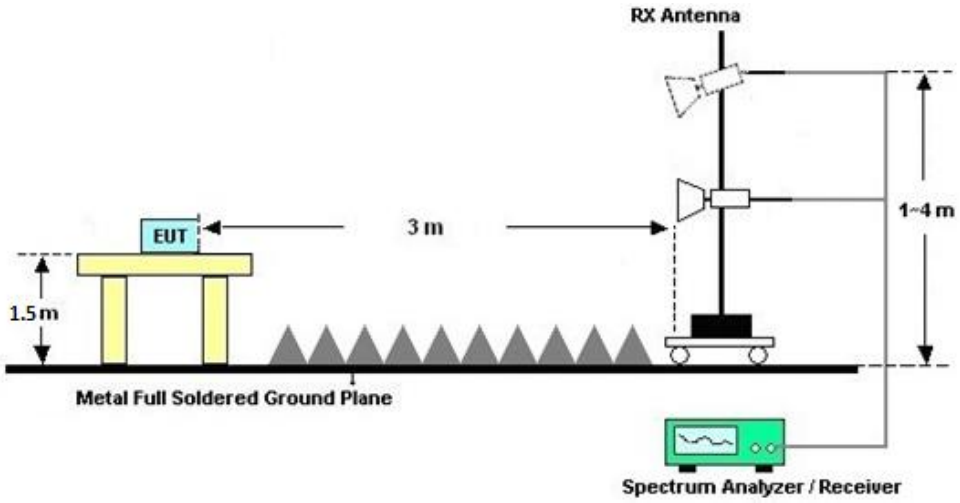
Section F) Maximum power spectral density.

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction):

1. Measure the duty cycle, x, of the transmitter output signal as described in II.B.
2. Set span to encompass the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal
3. Set RBW = 1 MHz
4. Set VBW ≥ 3 MHz
5. Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto
7. Detector = power averaging (rms), if available. Otherwise, use sample detector mode
8. Allow the sweep to “free run.”
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter
10. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times

The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Note：

EIRP PSD(dBm/MHz) = Final Level(dBμV/m) - 95.2

Final Level(dBμV/m) = Read Level(dBμV/m) + Path Loss(dB) + DT Factor

Path Loss(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) - Preamp Factor(dB)

3.4 In-Band Emissions (Channel Mask)Limit of Unwanted Emissions

<FCC 14-30 CFR 15.407>

(b)(7) For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB.

3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

The testing follows FCC KDB 987594 D02 U-NII 6GHz EMC Measurement.

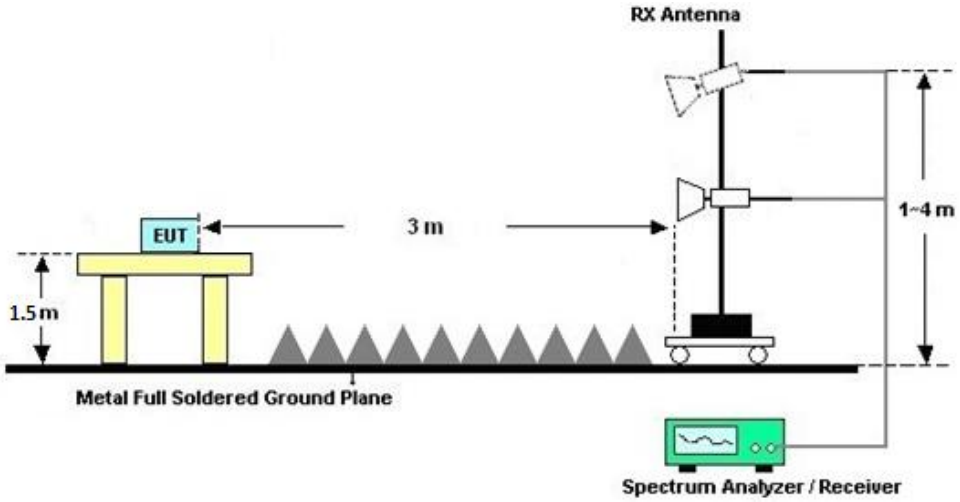
Section J) In-Band Emissions.

1. Take nominal bandwidth as reference channel bandwidth provided that 26 dB emission bandwidth is always larger than nominal bandwidth
2. Measure the power spectral density (which will be used for emissions mask reference) using the following procedure:
   a) Set the span to encompass the entire 26 dB EBW of the signal.
   b) Set RBW = same RBW used for 26 dB EBW measurement.
   c) Set VBW ≥ 3 X RBW
   d) Number of points in sweep ≥ [2 X span / RBW].
   e) Sweep time = auto.
   f) Detector = RMS (i.e., power averaging)
   g) Trace average at least 100 traces in power averaging (rms) mode.
   h) Use the peak search function on the instrument to find the peak of the spectrum.
3. Using the measuring equipment limit line function, develop the emissions mask based on the following requirements. The emissions power spectral density must be reduced below the peak power spectral density (in dB) as follows:
   a. Suppressed by 20 dB at 1 MHz outside of the channel edge.
   b. Suppressed by 28 dB at one channel bandwidth from the channel center.
   c. Suppressed by 40 dB at one- and one-half times the channel bandwidth from the channel

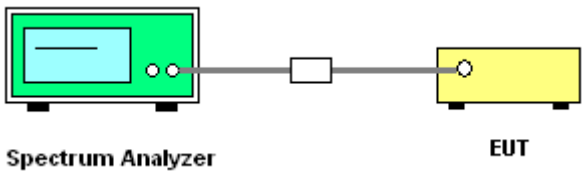
center.

4. Adjust the span to encompass the entire mask as necessary.
5. Clear trace.
6. Trace average at least 100 traces in power averaging (rms) mode.
7. Adjust the reference level as necessary so that the crest of the channel touches the top of the emission mask.

3.4.4 Test Setup



Radiated test for CDD and TXBF mode



Conducted test for OFDMA and Puncturing mode

3.4.5 Test Result

Please refer to Appendix A

3.5 Contention Based Protocol

3.5.1 Limit of Contention Based Protocol

<FCC 14-30 CFR 15.407>

(d)(6) Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band must employ a contention-based protocol.

Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel and stay off the channel as long as detected radio frequency power is equal to or greater than the threshold (-62 dBm). The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain. To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel. For example, an 802.11 device that plans to transmit a 40 MHz- wide signal (on a primary 20 MHz channel and a secondary 20 MHz channel) must detect energy throughout the entire 40 MHz channel. Additionally, low-power indoor devices must detect co-channel energy with 90% or greater certainty.

Table 1. Criteria to determine number of times detection threshold test may be performed

If	Number of Tests	Placement of Incumbent Transmission
$BW_{EUT} \leq BW_{Inc}$	Once	Tune incumbent and EUT transmissions ($f_{c1} = f_{c2}$)
$BW_{Inc} < BW_{EUT} \leq 2BW_{Inc}$	Once	Incumbent transmission is contained within BW_{EUT}
$2BW_{Inc} < BW_{EUT} \leq 4BW_{Inc}$	Twice. Incumbent transmission is contained within BW_{EUT}	Incumbent transmission is located as closely as possible to the lower edge and upper edge, respectively, of the EUT channel
$BW_{EUT} > 4BW_{Inc}$	Three times	Incumbent transmission is located as closely as possible to the lower edge of the EUT channel, in the middle of EUT channel, and as closely as possible to the upper edge of the EUT channel

where:
$BWEUT$: Transmission bandwidth of EUT signal
$BWInc$: Transmission bandwidth of the simulated incumbent signal (10 MHz wide AWGN signal)
$fc1$: Center frequency of EUT transmission
$fc2$: Center frequency of simulated incumbent signal

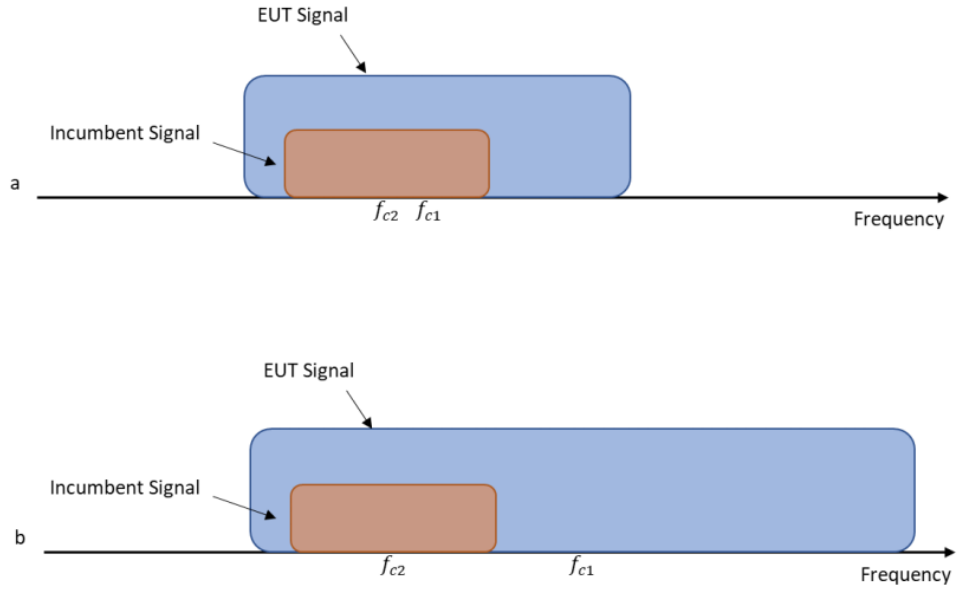


Figure 1. Two possible scenarios where a) center frequency of EUT transmission falls within incumbent's bandwidth, or b) outside of it

3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

3.5.3 Test Procedures

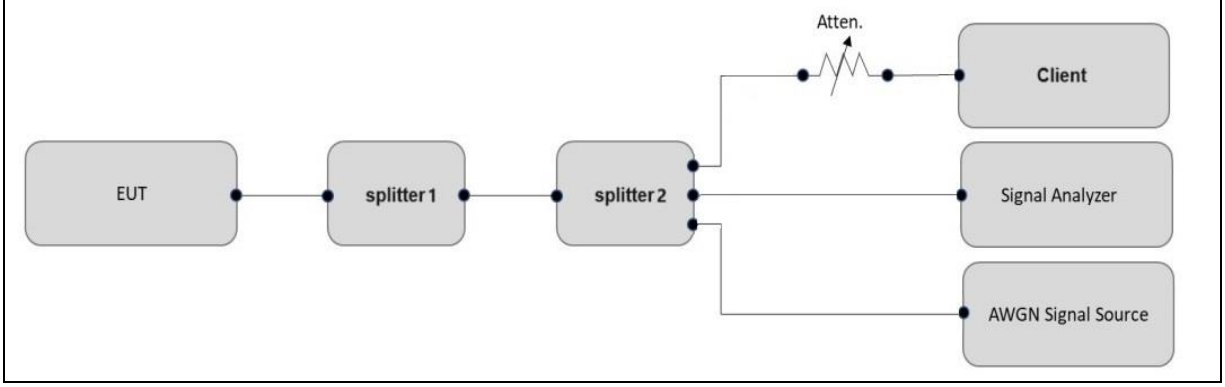
1. To ensure EUT reliably detects an incumbent signal in both scenarios shown in Figure 1, the detection threshold test may be repeated more than once with the incumbent signal (having center frequency $fc2$) tuned to different center frequencies within the EUT transmission bandwidth. The criteria specified in Table 1 determines how many times the detection threshold test must be performed
2. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
3. Monitor the signal analyzer to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
4. (Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
5. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 2, choose a different center

frequency for the AWGN signal and repeat the process.

6. EUT was driven in MIMO mode, the interferer signal was injected to both chains to monitor the performance, while the interferer level is determined according to the lowest antenna gain among both antennas.

3.5.4 Test Setup

Conducted Setup



Note: The purpose of using the client is to enable the EUT to communicate with the client.

3.5.5 Support Unit used in test configuration and system

Instrument	Brand Name	Model No.	Characteristics
Signal Generator	Keysight	5182B/5182BX07	9KHz~7.2GHz
Spectrum Analyzer	R&S	FSV40	10kHz~40GHz
Terminal (NB Server)	DELL	P78G	LAN
Combiner (splitter1)	Tojoin	N/A	2G~8GHz
Combiner (splitter2)	MTJ Cooperation	MTJ7144-M	0.5GHz~18GHz
Attenuator	Keysight	8494B	0-110dBm
Client (phone)	N/A	N/A	N/A

3.5.6 Test Summary of Contention Based Protocol Test

Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 5	6135	20	6135	-63.06	100	-62	-65.47	3.47
					Result: Stop Transmission			
				-64.06	< 90	-62	-66.47	4.47
					Result: Minimal Operation			
				-67.66	0	-62	-70.07	8.07
					Result: Normal Operation			
UNII Band 5	6105	320	5950	-63.48	100	-62	-65.89	3.89
					Result: Stop Transmission			
				-64.48	< 90	-62	-66.89	4.89
					Result: Minimal Operation			
				-66.69	0	-62	-69.1	7.1
					Result: Normal Operation			
			6105	-60.02	100	-62	-62.43	0.43
					Result: Stop Transmission			
				-61.02	< 90	-62	-63.43	1.43
					Result: Minimal Operation			
				-66.48	0	-62	-68.89	6.89
					Result: Normal Operation			
			6260	-66.20	100	-62	-68.61	6.61
					Result: Stop Transmission			
				-67.20	< 90	-62	-69.61	7.61
					Result: Minimal Operation			
				-69.57	0	-62	-71.98	9.98
					Result: Normal Operation			

Note 1: Adjusted Power = Injected AWGN Level - minimum antenna gain (Antenna 2, gain = 2.41dBi)

Note 2: Path Loss between antenna and RF connector is negligible. (0 dB)

Note 3: Margin = Regulated Threshold level - Adjusted Power

Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 6	6455	20	6455	-68.00	100	-62	-70.41	8.41
					Result: Stop Transmission			
				-69.00	< 90	-62	-71.41	9.41
					Result: Minimal Operation			
				-71.73	0	-62	-74.14	12.14
					Result: Normal Operation			
UNII Band 5/6/7	6425	320	6270	-69.61	100	-62	-72.02	10.02
					Result: Stop Transmission			
				-70.61	< 90	-62	-73.02	11.02
					Result: Minimal Operation			
				-72.29	0	-62	-74.7	12.7
					Result: Normal Operation			
			6425	**-59.89**	100	-62	-62.3	**0.3**
					Result: Stop Transmission			
				-60.89	< 90	-62	-63.3	1.3
					Result: Minimal Operation			
				-66.31	0	-62	-68.72	6.72
					Result: Normal Operation			
			6580	-67.82	100	-62	-70.23	8.23
					Result: Stop Transmission			
				-68.82	< 90	-62	-71.23	9.23
					Result: Minimal Operation			
				-70.82	0	-62	-73.23	11.23
					Result: Normal Operation			

Note 1: Adjusted Power = Injected AWGN Level - minimum antenna gain (Antenna 2, gain = 2.41dBi)

Note 2: Path Loss between antenna and RF connector is negligible. (0 dB)

Note 3: Margin = Regulated Threshold level - Adjusted Power

Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 7	6695	20	6695	-68.74	100	-62	-71.15	9.15
					Result: Stop Transmission			
				-69.74	< 90	-62	-72.15	10.15
					Result: Minimal Operation			
				-72.24	0	-62	-74.65	12.65
					Result: Normal Operation			
UNII Band 7/8	6745	320	6590	-72.26	100	-62	-74.67	12.67
					Result: Stop Transmission			
				-73.26	< 90	-62	-75.67	13.67
					Result: Minimal Operation			
				-73.43	0	-62	-75.84	13.84
					Result: Normal Operation			
			6745	-62.78	100	-62	-65.19	3.19
					Result: Stop Transmission			
				-63.78	< 90	-62	-66.19	4.19
					Result: Minimal Operation			
				-70.06	0	-62	-72.47	10.47
					Result: Normal Operation			
			6900	-68.28	100	-62	-70.69	8.69
					Result: Stop Transmission			
				-69.28	< 90	-62	-71.69	9.69
					Result: Minimal Operation			
				-71.69	0	-62	-74.1	12.1
					Result: Normal Operation			

Note 1: Adjusted Power = Injected AWGN Level - minimum antenna gain (Antenna 2, gain = 2.41dBi)

Note 2: Path Loss between antenna and RF connector is negligible. (0 dB)

Note 3: Margin = Regulated Threshold level - Adjusted Power

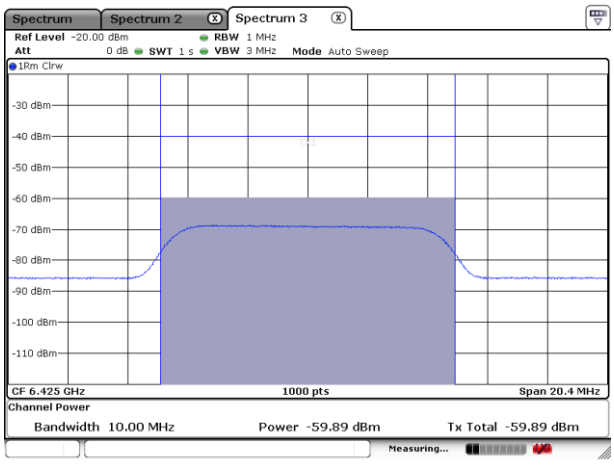
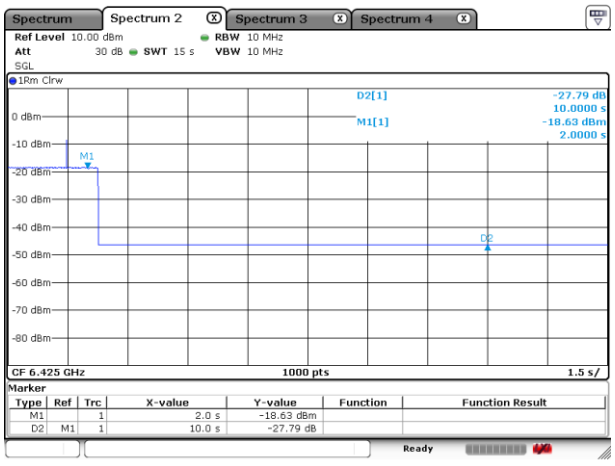
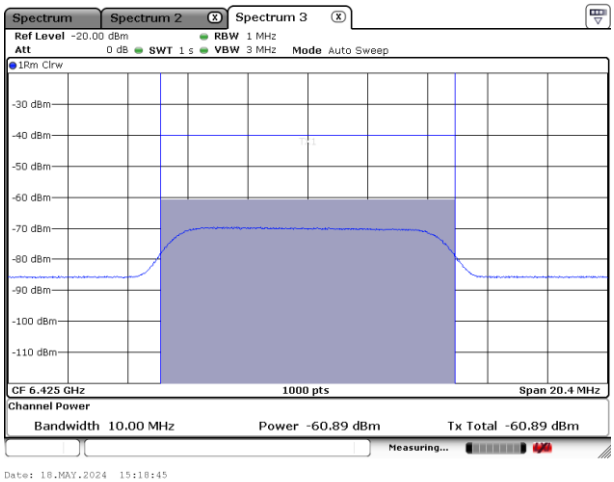
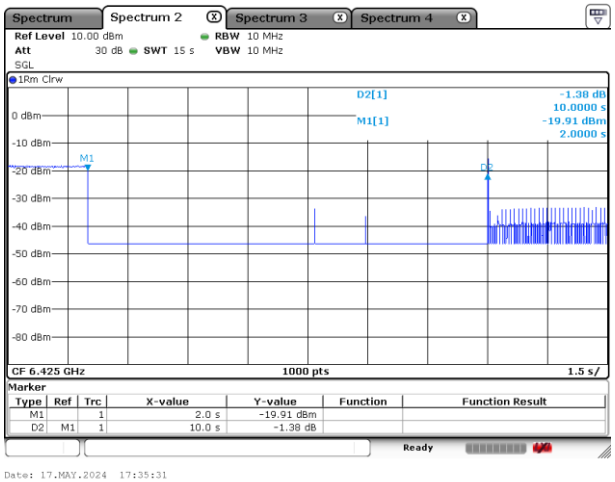
Band	Channel Freq. (MHz)	Channel BW (MHz)	Incumbent freq. (MHz)	Injected AWGN Level (dBm)	Detection Rate (%)	Regulated Threshold level (dBm)	Adjusted Power (dBm)	Margin (dB)
UNII Band 8	7015	20	7015	-68.92	100	-62	-71.33	9.33
					Result: Stop Transmission			
				-69.92	< 90	-62	-72.33	10.33
					Result: Minimal Operation			
				-72.33	0	-62	-74.74	12.74
					Result: Normal Operation			

Note 1: Adjusted Power = Injected AWGN Level - minimum antenna gain (Antenna 2, gain = 2.41dBi)

Note 2: Path Loss between antenna and RF connector is negligible. (0 dB)

Note 3: Margin = Regulated Threshold level - Adjusted Power

3.5.7 Worst Case Plots of Contention Based Protocol

Contention Based Protocol Result Plots on U-NII 5/6/7 (AWGN Interference)	
802.11be (EHT320) / 6425MHz (Middle) Threshold Level (TL) = -59.89 dBm	802.11be (EHT320)/ CH95 (Middle) Test result is pass due to no transmission
	
802.11be (EHT320) / 6425MHz (Middle) Threshold Level (TL) =-60.89 dBm	802.11be (EHT320)/ CH95 (Middle) Transmit when the interferer is 1dB lower.
	

Remark: M1: Injection of AWGN signal, D1: Removal of AWGN signal

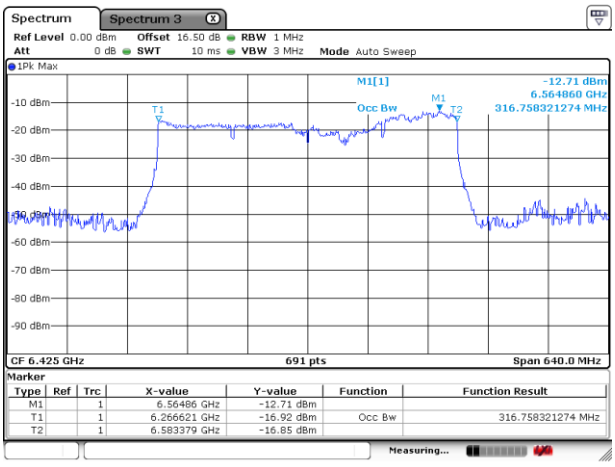
3.5.8 Worst Case of Contention Based Protocol Transmission Bandwidth

Verify transmission absence when Incumbent signal at different frequency (frequency domain plots).

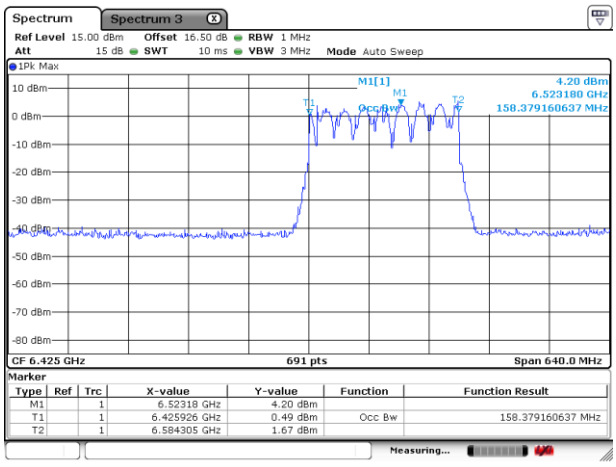
1. When Incumbent Signal inject at lowest frequency, the transmission bandwidth reduced to 160MHz;
2. When Incumbent Signal inject at middle frequency, the whole 160MHz bandwidth stop transmission;
3. When Incumbent Signal inject at highest frequency, the transmission bandwidth reduced to 80MHz;
4. The channel puncturing mode is for improving network performance and not available for CBP, the CBP will apply channel bandwidth reduction mechanism to protect incumbent operations.

UNII 6_CH95 (6425MHz / BW=320MHz)

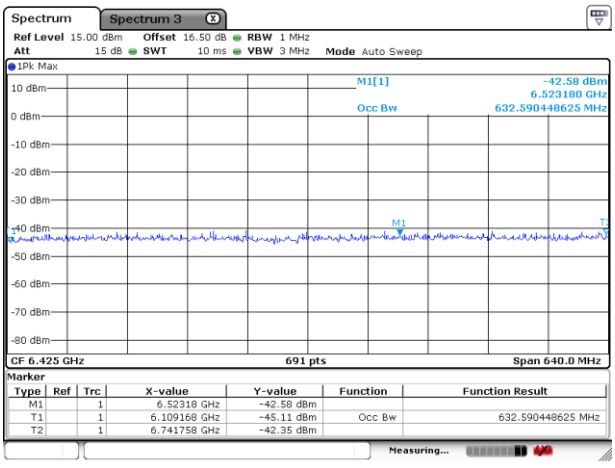
Non-Incumbent Signal



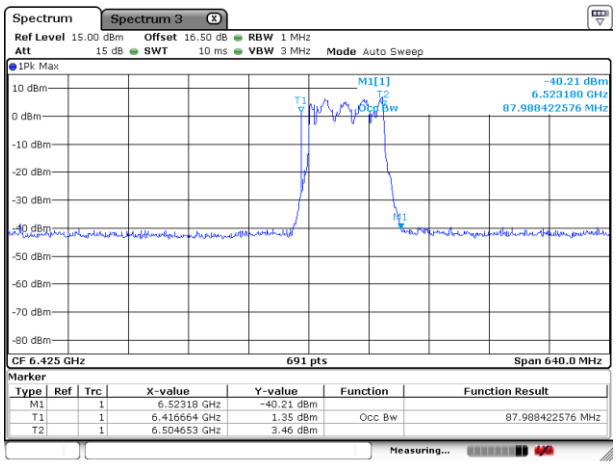
Incumbent freq @ 6270MHz



Incumbent freq @ 6425MHz



Incumbent freq @ 6580 MHz



3.6 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.6.1 Limit of Unwanted Emissions

(1) For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of −27 dBm/MHz.

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27 (RMS)	68.2
- 7 (Peak)	88.2

Unwanted emissions outside of restricted bands are measured with a RMS detector.
In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

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

Note: The following formula is used to convert the EIRP to field strength.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

   Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

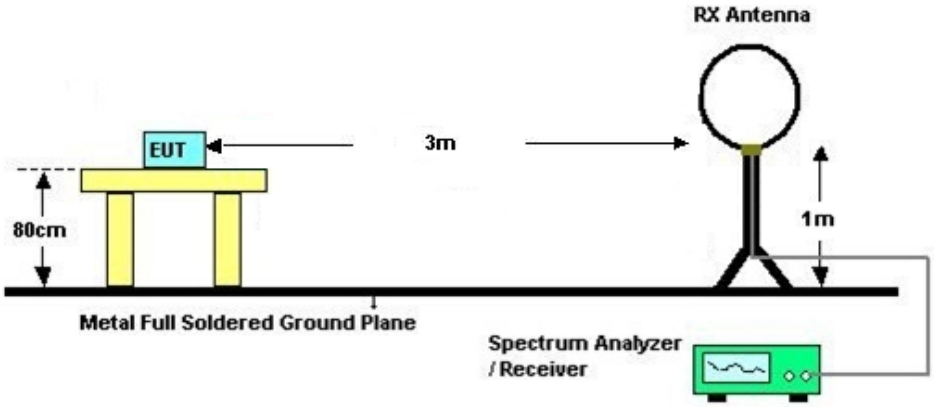
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

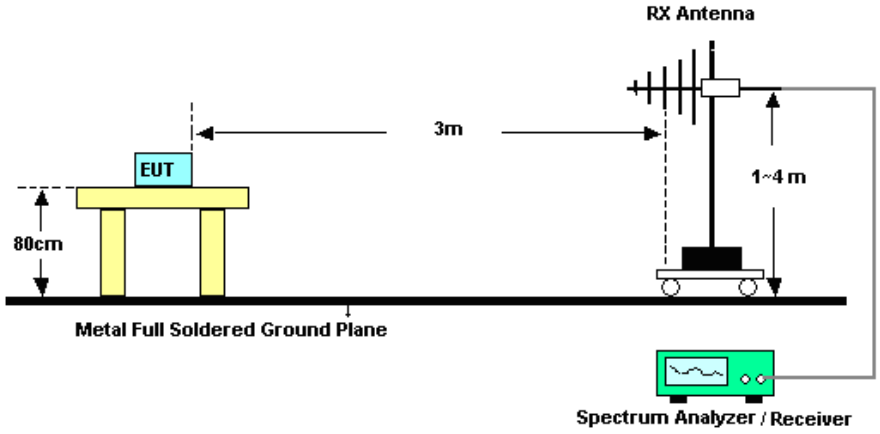
3.6.4 Test Setup

For radiated emissions below 30MHz

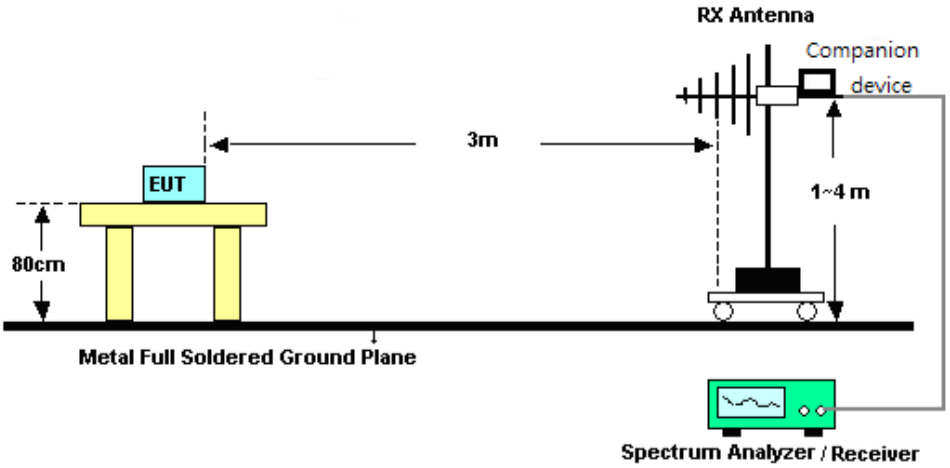


For radiated emissions from 30MHz to 1GHz

<CDD Mode>

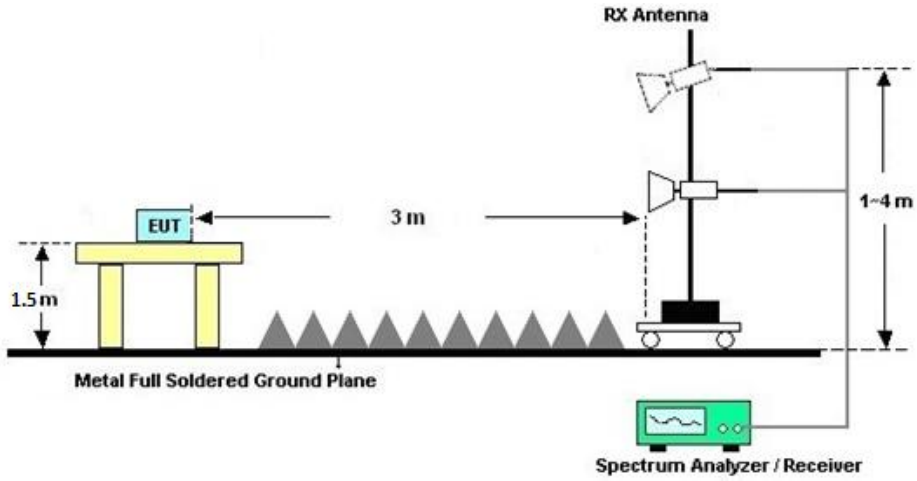


<TXBF Modes>



For radiated emissions above 1GHz

<CDD Mode>



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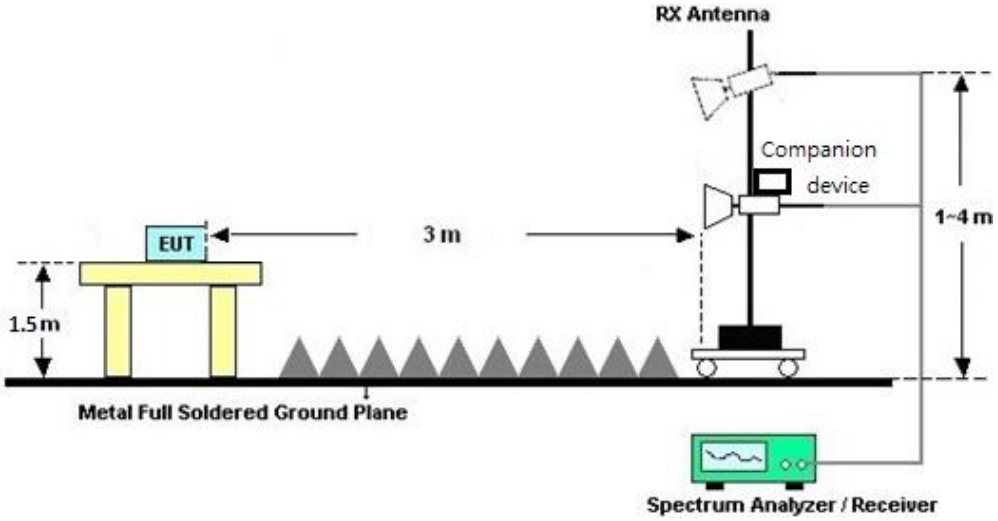


3.6.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.6.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C

3.6.7 Duty Cycle

Please refer to Appendix D.

3.6.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C.

The emission level above 18GHz is checked that the emission level is noise floor only, so only the worst mode reflected in the report.

3.7 AC Conducted Emission Measurement

3.7.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	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.

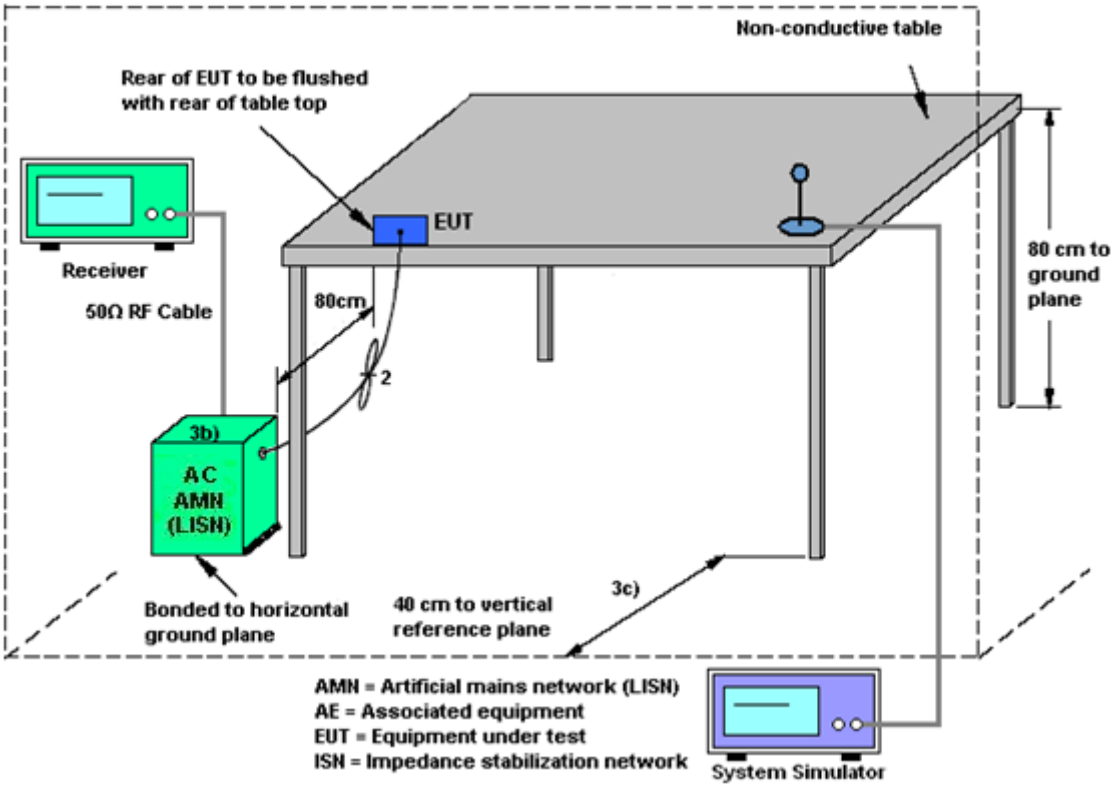
3.7.2 Measuring Instruments

See list of measuring equipment of this test report.

3.7.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.7.4 Test Setup



3.7.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.8 Antenna Requirements

3.8.1 Standard Applicable

§15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used. The EUT complies with the requirement of 15.203.

3.8.3 Antenna Gain

The following information was declared by manufacturer. Please refer to the antenna report for the Max/Min Antenna Gain.

Frequency Band	Maximum Single Antenna gain (dBi)		Minimum Antenna Gain (dBi)	
	ANT1	ANT2	ANT1	ANT2
6GHz UNII-5	4.56	4.06	3.66	2.41
6GHz UNII-6	4.12	4.05	3.86	3.32
6GHz UNII-7	4.12	4.36	3.87	3.70
6GHz UNII-8	4.10	4.36	4.05	2.99

For Power/PSD testing, the radiated method is selected, including the antenna gain, and no need to calculate direction gain using formula according to KDB 662911. Refer to the appendix for the test results.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 11, 2023	Apr. 23, 2024~ Jun. 20, 2024	Oct. 10, 2024	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400023	3Hz~8.5GHz;Max 30dBm	Jan. 04, 2024	Apr. 23, 2024~ Jun. 20, 2024	Jan. 03, 2025	Conducted (03CH08-KS)
Spectrum Analyzer	R&S	FSV40	101932	10kHz~40GHz; Max 30dBm	Oct. 10, 2023	Apr. 23, 2024~ Jun. 20, 2024	Oct. 09, 2024	Conducted (03CH08-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY60242126	10Hz-44GHz	Oct. 10, 2023	Apr. 23, 2024~ Jun. 20, 2024	Oct. 09, 2024	Conducted (03CH08-KS)
Loop Antenna	R&S	HFH2-Z2E	101125	9kHz~30MHz	Oct. 10, 2023	Apr. 23, 2024~ Jun. 20, 2024	Oct. 09, 2024	Conducted (03CH08-KS)
Bilog Antenna	TESEQ& VGT	CBL 61110	59915	30MHz-1GHz	Aug. 12, 2023	Apr. 23, 2024~ Jun. 20, 2024	Aug. 11, 2024	Conducted (03CH08-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75959	1GHz~18GHz	Mar. 01, 2024	Apr. 23, 2024~ Jun. 20, 2024	Feb. 28, 2025	Conducted (03CH08-KS)
high gain Amplifier	EM	EM01G18GA	060845	1Ghz-18Ghz	Jan. 05, 2024	Apr. 23, 2024~ Jun. 20, 2024	Jan. 04, 2025	Conducted (03CH08-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2024	Apr. 23, 2024~ Jun. 20, 2024	Jan. 04, 2025	Conducted (03CH08-KS)
Amplifier	SONOMA	310N	413741	9KHz-1GHz	Jan. 05, 2024	Apr. 23, 2024~ Jun. 20, 2024	Jan. 04, 2025	Conducted (03CH08-KS)
Amplifier	EM	EM01G18GA	060834	1Ghz-18Ghz	Oct. 10, 2023	Apr. 23, 2024~ Jun. 20, 2024	Oct. 09, 2024	Conducted (03CH08-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 04, 2024	Apr. 23, 2024~ Jun. 20, 2024	Jan. 03, 2025	Conducted (03CH08-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Apr. 23, 2024~ Jun. 20, 2024	NCR	Conducted (03CH08-KS)
Turn Table	EM	EM 1000-T	N/A	0~360 degree	NCR	Apr. 23, 2024~ Jun. 20, 2024	NCR	Conducted (03CH08-KS)
Antenna Mast	EM	EM 1000-A	N/A	1 m~4 m	NCR	Apr. 23, 2024~ Jun. 20, 2024	NCR	Conducted (03CH08-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Max 30dBm	Oct. 10, 2023	May 11, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44G,MAX 30dB	Apr. 18, 2024	May 11, 2024	Apr. 17, 2025	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 10, 2023	May 11, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	59913	30MHz-1GHz	Aug. 19, 2023	May 11, 2024	Aug. 18, 2024	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Oct. 23, 2023	May 11, 2024	Oct. 22, 2024	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 05, 2024	May 11, 2024	Jan. 04, 2025	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 06, 2023	May 11, 2024	Jul. 05, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM18G40GA	060852	18~40GHz	Jan. 05, 2024	May 11, 2024	Jan. 04, 2025	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060839	1Ghz-18Ghz	Oct. 10, 2023	May 11, 2024	Oct. 09, 2024	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 03, 2024	May 11, 2024	Jan. 02, 2025	Radiation (03CH05-KS)
6db attenuator	TOJOIN	SMA(JK)	EMC01	2W/DC-18G	Jan. 09, 2024	May 11, 2024	Jan. 08, 2025	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	May 11, 2024	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	May 11, 2024	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	May 11, 2024	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Apr. 22, 2024	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Apr. 22, 2024	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Apr. 22, 2024	May 15, 2024	Conduction

								(CO01-KS)
AC Power Source	Chroma	61602	ABP0000008 11	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Apr. 22, 2024	Oct. 10, 2024	Conduction (CO01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 11, 2023	May 17, 2024~ May 18, 2024	Oct. 10, 2024	CBP (DFS01-KS)
MXG-B RF Vector Signal Genertor	Keysight	5182B /5182BX07	MY56200417 /MY5936021 0	9kHz~7.2GHz	May 16, 2023	May 17, 2024~ May 18, 2024	May 15, 2024	CBP (DFS01-KS)
Combiner	MTJ Cooperation	MTJ7114-M	N/A	0.5GHz~18GHz	NCR	May 17, 2024~ May 18, 2024	NCR	CBP (DFS01-KS)
Combiner	Tojoin	N/A	SZE24A6800 5	2G~8GHz	NCR	May 17, 2024~ May 18, 2024	NCR	CBP (DFS01-KS)
Attenuator	Keysight	8494B	MY42155761	0-110dBm	NCR	May 17, 2024~ May 18, 2024	NCR	CBP (DFS01-KS)

NCR: No Calibration Required

5 Measurement Uncertainty

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.84 dB

Uncertainty of Conducted Measurement

Conducted Emission	±2.26 dB

For 03CH05-KS

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.30 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.02 dB

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.22 dB

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.34 dB

For 03CH08-KS

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.30 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.04 dB

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.26 dB

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

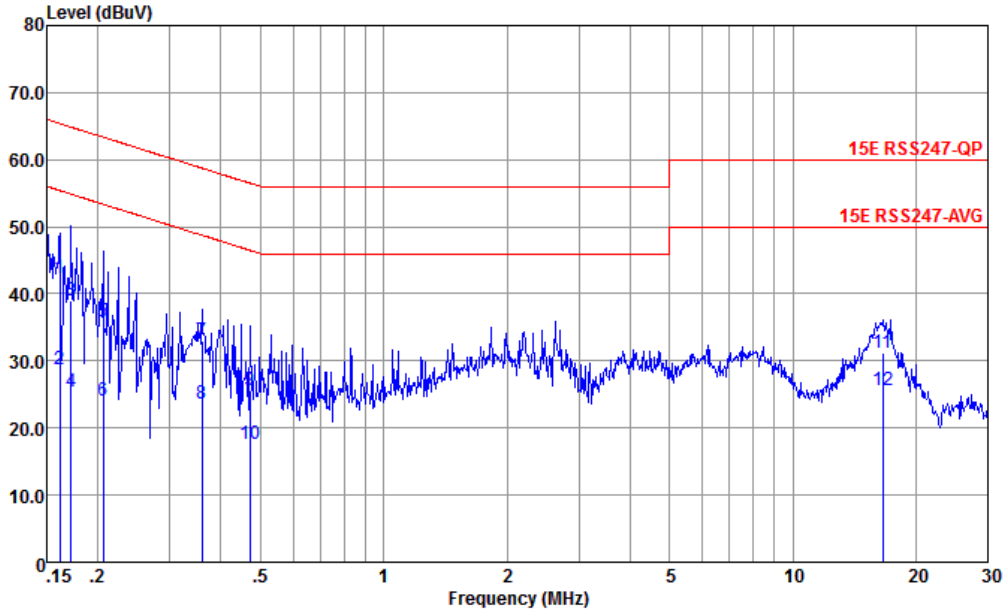
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.40 dB

---------- THE END ----------

Appendix A. Test Results of EIRP & PSD & 26dB/99% & Bandwidth & Mask

Appendix B. AC Conducted Emission Test Results

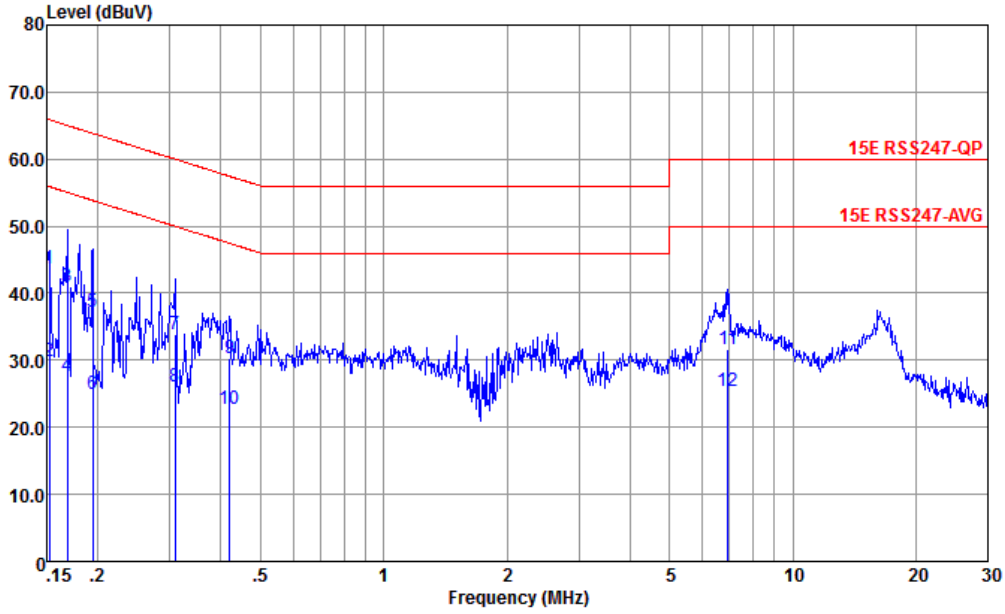
Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : 15E RSS247-QP LISN-060105-L 2023 LINE

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.162	42.26	-23.12	65.38	31.80	0.04	10.42	QP
2		0.162	28.66	-26.72	55.38	18.20	0.04	10.42	Average
3		0.172	38.96	-25.90	64.86	28.50	0.04	10.42	QP
4		0.172	25.36	-29.50	54.86	14.90	0.04	10.42	Average
5		0.206	35.93	-27.43	63.36	25.50	0.03	10.40	QP
6		0.206	24.03	-29.33	53.36	13.60	0.03	10.40	Average
7		0.360	32.91	-25.83	58.74	22.60	0.01	10.30	QP
8		0.360	23.61	-25.13	48.74	13.30	0.01	10.30	Average
9		0.471	25.71	-30.78	56.49	15.49	-0.02	10.24	QP
10		0.471	17.51	-28.98	46.49	7.29	-0.02	10.24	Average
11		16.573	31.25	-28.75	60.00	20.20	-0.21	11.26	QP
12		16.573	25.55	-24.45	50.00	14.50	-0.21	11.26	Average

Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : 15E RSS247-QP LISN-060105-N 2023 NEUTRAL

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.152	43.66	-22.21	65.87	33.20	0.04	10.42	QP
2		0.152	29.76	-26.11	55.87	19.30	0.04	10.42	Average
3		0.169	41.06	-23.97	65.03	30.60	0.04	10.42	QP
4		0.169	27.66	-27.37	55.03	17.20	0.04	10.42	Average
5		0.194	37.26	-26.58	63.84	26.80	0.05	10.41	QP
6		0.194	25.06	-28.78	53.84	14.60	0.05	10.41	Average
7		0.308	33.89	-26.13	60.02	23.60	-0.04	10.33	QP
8		0.308	26.09	-23.93	50.02	15.80	-0.04	10.33	Average
9		0.419	30.41	-27.05	57.46	20.20	-0.06	10.27	QP
10		0.419	22.71	-24.75	47.46	12.50	-0.06	10.27	Average
11		6.951	31.65	-28.35	60.00	21.50	-0.10	10.25	QP
12		6.951	25.45	-24.55	50.00	15.30	-0.10	10.25	Average

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)