

**FCC 15.407 U-NII
(Permissive Change)
5GHz Test Report**

for

LG Electronics USA

111 Sylvan Avenue, North Building, Englewood Cliffs, NJ 07632

**Product Name : Wireless Audio Module
Model Name : WL1BKR23
Brand : LG
FCC ID : BEJ-WL1BKR23**

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.

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TEST REPORT (Permissive Change)

Applicant : LG Electronics USA
Manufacturer : LG Electronics Inc.
Factory : Shenzhen Shi Xinzhongxin Technology Co., Ltd.
EUT Description
(1) Product : Wireless Audio Module
(2) Model : WL1BKR23
(3) Brand : LG
(4) Power Supply: DC 3.3V

Applicable Standards:

Title 47 FCC CFR Part 15 Subpart E

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **Audix Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

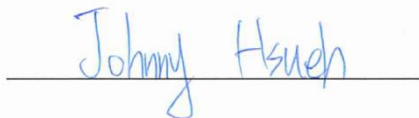
Date of Report: 2023. 06. 09

Reviewed by:



(Sunnie Huang/Administrator)

Approved by:



(Johnny Hsueh/Section Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2023. 06. 09	Original Report	EM-F230275

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	PASS
15.205/15.209/15.407	Undesirable Emissions Limits: Radiated Band Edge and Radiated Spurious Emission	PASS
15.407(a)(5)/15.407(e)	Emission/Occupied Bandwidth	PASS
15.407(a)	Maximum Output Power	PASS
15.407(a)	Power Spectral Density	PASS
15.407	Frequency Stability	PASS
15.203	Antenna Requirement	Compliance
Note: 1. Decision rule according to the limit of the test standard chapter, the test value is lower than the limit specified in the test chapter, and it is judged as Pass. 2. The uncertainties value is not used in determining the result.		

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics USA 111 Sylvan Avenue, North Building, Englewood Cliffs, NJ 07632
Manufacturer	LG Electronics Inc. 222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea
Factory	Shenzhen Shi Xinzhongxin Technology Co., Ltd. Block A1, Donghuan Industrial Zone, Nanpu Road Shajing Street, Baoan District, Shenzhen, China
Product	Wireless Audio Module
Model	WL1BKR23
Brand	LG

3.2. Description of EUT

Test Model	WL1BKR23														
Serial Number	N/A														
Power Rating	DC 3.3V														
Software Version	V1.6														
Hardware version	V1.6														
RF Features	GFSK														
Transmit Type	1T1R														
Device Category	<input type="checkbox"/> Outdoor Access Point <input type="checkbox"/> Fixed point-to-point Access Point <input type="checkbox"/> Indoor Access Point <input checked="" type="checkbox"/> Mobile and Portable client device (For FCC 15.407 U-NII)														
Test Sample	<table border="1"> <thead> <tr> <th>Sample No.</th> <th>Test Item</th> <th>Firmware</th> </tr> </thead> <tbody> <tr> <td>01</td> <td>AC Conduction</td> <td>N/A</td> </tr> <tr> <td>02</td> <td>RF Conducted</td> <td>N/A</td> </tr> <tr> <td>03</td> <td>Radiated</td> <td>N/A</td> </tr> </tbody> </table>			Sample No.	Test Item	Firmware	01	AC Conduction	N/A	02	RF Conducted	N/A	03	Radiated	N/A
Sample No.	Test Item	Firmware													
01	AC Conduction	N/A													
02	RF Conducted	N/A													
03	Radiated	N/A													
Sample Status	Trial sample														
Date of Receipt	2023. 05. 22														
Date of Test	2023. 05. 23~ 06. 09														
Interface Ports of EUT	None														
Accessories Supplied	None														

Note: Pursuant ISO 17025:2017 section 7.8.2, **Audix Technology Corp.** does not assume responsibility for all EUT's information including RF features, transmit type, antenna information...etc. are provided by customer.

3.3. Reference Test Guidance

KDB 789033 D02 General UNII Test Procedures New Rules v02r01
 ANSI C63.10:2013

3.4. Information for Permissive Change

- The EUT is an addition version with original FCC ID: BEJ-WL1BKR23 is to add Frequency by Software and decrease power from the power setting configuration via software change.
- The differences between this application and original's ID as clarify in following list.

Item	Original	Permissive Change
Model	WL1BKR23	WL1BKR23
Frequency	U-NII Band 3: 5730-5848MHz.	To add Frequency by Software. U-NII Band 1: 5155-5245MHz U-NII Band 3: 5730-5848MHz
Software Version	V1.1	V1.6
Hardware version	V1.3	V1.6
Antenna Shape		To change Antenna Shape.
Components	Original	To change Internal Components are mainly for the new Antenna Shape (C71, C72, C10, C23, C13, C11, C14, C62 and C64) Please see as below red mark.

- Due to above different item, there have some test item should be re-tested (see section 2), the test data are recorded in this report.

3.5. Antenna Information

No.	Antenna Part Number	Manufacturer	Antenna Type	Frequency (MHz)	Gain (dBi)
1.	Antenna_L (ANT 1)	SHENZHENSHI XINZHONGXIN TECHNOLOGY CO., LTD.	PCB Printing Antenna	5155-5245	1.23
				5730-5850	1.93
2.	Antenna_R (ANT 2)	SHENZHENSHI XINZHONGXIN TECHNOLOGY CO., LTD.	PCB Printing Antenna	5155-5245	1.96
				5730-5850	1.92

3.6. EUT Specifications Assessed in Current Report

Modulation	U-NII Band	Fundamental Range (MHz)	Channel Number	Data Rate
GFSK	1	5155-5245	91	2 Mbps
	3	5730-5848	119	

Channel List									
U-NII Band 1									
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
0	5155	19	5174	38	5193	57	5212	76	5231
1	5156	20	5175	39	5194	58	5213	77	5232
2	5157	21	5176	40	5195	59	5214	78	5233
3	5158	22	5177	41	5196	60	5215	79	5234
4	5159	23	5178	42	5197	61	5216	80	5235
5	5160	24	5179	43	5198	62	5217	81	5236
6	5161	25	5180	44	5199	63	5218	82	5237
7	5162	26	5181	45	5200	64	5219	83	5238
8	5163	27	5182	46	5201	65	5220	84	5239
9	5164	28	5183	47	5202	66	5221	85	5240
10	5165	29	5184	48	5203	67	5222	86	5241
11	5166	30	5185	49	5204	68	5223	87	5242
12	5167	31	5186	50	5205	69	5224	88	5243
13	5168	32	5187	51	5206	70	5225	89	5244
14	5169	33	5188	52	5207	71	5226	90	5245
15	5170	34	5189	53	5208	72	5227		
16	5171	35	5190	54	5209	73	5228		
17	5172	36	5191	55	5210	74	5229		
18	5173	37	5192	56	5211	75	5230		

Channel List									
U-NII Band 3									
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
0	5730	25	5755	50	5780	75	5805	101	5831
1	5731	26	5756	51	5781	76	5806	102	5832
2	5732	27	5757	52	5782	78	5808	103	5833
3	5733	28	5758	53	5783	79	5809	104	5834
4	5734	29	5759	54	5784	80	5810	105	5835
5	5735	30	5760	55	5785	81	5811	106	5836
6	5736	31	5761	56	5786	82	5812	107	5837
7	5737	32	5762	57	5787	83	5813	108	5838
8	5738	33	5763	58	5788	84	5814	109	5839
9	5739	34	5764	59	5789	85	5815	110	5840
10	5740	35	5765	60	5790	86	5816	111	5841
11	5741	36	5766	61	5791	87	5817	112	5842
12	5742	37	5767	62	5792	88	5818	113	5843
13	5743	38	5768	63	5793	89	5819	114	5844
14	5744	39	5769	64	5794	90	5820	115	5845
15	5745	40	5770	65	5795	91	5821	116	5846
16	5746	41	5771	66	5796	92	5822	117	5847
17	5747	42	5772	67	5797	93	5823	118	5848
18	5748	43	5773	68	5798	94	5824		
19	5749	44	5774	69	5799	95	5825		
20	5750	45	5775	70	5800	96	5826		
21	5751	46	5776	71	5801	97	5827		
22	5752	47	5777	72	5802	98	5828		
23	5753	48	5778	73	5803	99	5829		
24	5754	49	5779	74	5804	100	5830		

Note: Test modes are presented at section 3.7.

3.7. Description of Key Components

None

3.8. Test Configuration

GFSK Mode	TX _{on} (ms)	TX _{on+off} (ms)	Duty Cycle (x)	Duty Cycle Factor [10log(1/x)] (dB)
5155MHz	8.9	39.8	0.224	6.498
5730MHz	39.88	40.01	0.997	N/A

Note: 1. When duty cycle is less than 98% (0.98) that duty cycle factor 10log(1/x) is needed to add in conducted test items measured in average detector.

2. N/A represent the duty cycle is 100%, TX_{on} and TX_{on+off} cannot be measured.



AC Conduction
Normal operation

Modulation: GFSK (2 Mbps)			
Item	Antenna	Test Frequency (MHz)	
Radiated Test Case	Radiated Spurious Emission (30MHz~1GHz)	#1	5245, 5845
		#2	5245, 5790
	Radiated Band Edge	#1	5155, 5730, 5845, 5848
		#2	5155, 5730, 5845, 5848
	Radiated Spurious Emission	#1	5155, 5195, 5245, 5730, 5790, 5845, 5848
		#2	5155, 5195, 5245, 5730, 5790, 5845, 5848

Modulation: GFSK (2 Mbps)			
Item	Antenna	Test Frequency (MHz)	
Conducted Test Case	Emission/Occupied Bandwidth	#1	5155, 5195, 5245
		#2	5155, 5195, 5245
	Maximum output power	#1	5155, 5195, 5245, 5730, 5790, 5845, 5846, 5847, 5848
		#2	5155, 5195, 5245, 5730, 5790, 5845, 5846, 5847, 5848
	Power spectral density	#1	5155, 5195, 5245
		#2	5155, 5195, 5245

Note 1: Mobile Device Portable Device,
 and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: Lie Side Stand
 Note 2: Low, mid, and high channels were measured, only the worst channel was presented in this report.

3.9. Output Power Setting

Mode	U-NII Band	Antenna	Centre Frequency (MHz)	POWER SETTING
GFSK	1	ANT 1	5155	Default
			5195	Default
			5245	Default
	3	ANT 1	5730	Default
			5790	Default
			5845	Default
			5846	Default
			5847	Default
			5848	Default
	1	ANT 2	5155	Default
			5195	Default
			5245	Default
	3	ANT 2	5730	Default
			5790	Default
			5845	Default
5846			Default	
5847			Default	
			5848	Default

3.10. Tested Supporting System List

3.10.1. Support Peripheral Unit

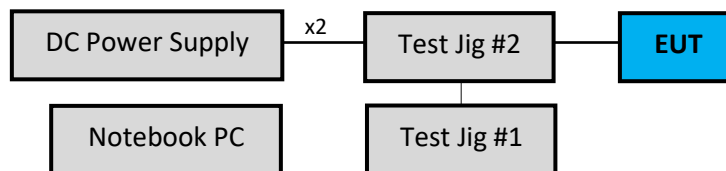
No.	Product	Brand	Model No.	Serial No.	Approval
1.	Test Jig #1	N/A	N/A	N/A	N/A
2.	Test Jig #2	N/A	N/A	N/A	N/A
3.	DC Power Supply	TOP WARD	6303A	N/A	N/A
	DC Power Supply	TOP WARD	3303A	N/A	N/A
4.	Notebook PC	ASUS	E403SA	N/A	N/A

3.10.2. Cable Lists

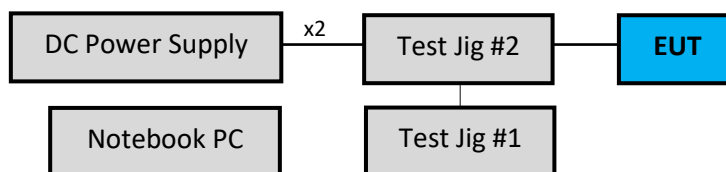
No.	Cable Description Of The Above Support Units
1.	USB Cable: Unshielded, Undetectable, 0.5m, Bonded a ferrite core USB Cable: Unshielded, Undetectable, 0.3m
2.	Data Cable: Unshielded, Undetectable, 0.05m
3.	DC Power Cordx2: Unshielded, Undetectable, 1.0m
4.	Adapter: ASUS, M/N AD890526 DC Power Cord : Unshielded, Undetachable, 2.0m

3.11. Setup Configuration

3.11.1. EUT Configuration for Power Line & Radiated Emission



3.11.2. EUT Configuration for RF Conducted Test Items



3.12. Operating Condition of EUT

Test program “Uart Assist.exe” is used for enabling EUT RF function under continues transmitting and choosing channel.

3.13. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 491, Zhongfu Rd., Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724 (1) No.8 Shielded Room (2) No.1 3m Semi Anechoic Chamber

3.14. Measurement Uncertainty

The measurement uncertainty levels have been estimated as specified in ETSI TR 100 028-2001

Test Items/Facilities		Frequency Range	Uncertainty	
Conduction Test	<input type="checkbox"/>	No. 7 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.4dB
	<input checked="" type="checkbox"/>	No. 8 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.5dB
Radiation Test	<input checked="" type="checkbox"/>	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.6dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.4dB
			200MHz-1000MHz, 3m, Vertical	±4.8dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	<input type="checkbox"/>	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
			200MHz-1000MHz, 3m, Horizontal	±4.4dB
			30MHz-200MHz, 3m, Vertical	±4.7dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	<input type="checkbox"/>	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.3dB
			200MHz-1000MHz, 3m, Horizontal	±4.2dB
			30MHz-200MHz, 3m, Vertical	±4.8dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.6dB
			6GHz-18GHz, 3m	±4.4dB
	<input type="checkbox"/>	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.6dB
			200MHz-1000MHz, 3m, Horizontal	±4.4dB
			30MHz-200MHz, 3m, Vertical	±4.5dB
			200MHz-1000MHz, 3m, Vertical	±4.9dB
			1GHz-6GHz, 3m	±4.9dB
			6GHz-18GHz, 3m	±4.6dB
Radiated emissions (18GHz-40GHz)		18GHz-40GHz, 3m	±3.4dB	

Remark : Uncertainty = $ku_c(y)$

Test Items	Uncertainty
Bandwidth	± 0.2kHz
Maximum output power	± 0.33dB
Power spectral density	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2023.01.11	1 Year
2.	A.M.N.	R&S	ENV432	101567	2022.05.26	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2022.12.19	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2022.12.14	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2023.04.13	1 Year
6.	Coaxial Cable	Yeida	RG/58AU	CE-08	2022.09.07	1 Year
7.	Test Software	Audix	e3	V9 18621a	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2022.08.24	1 Year
2.	Test Receiver	R&S	ESCS30	100338	2022.06.15	1 Year
3.	Microwave Amplifier	HP	8447D	2944A06305	2022.12.29	1 Year
4.	Microwave Amplifier	Agilent	8449B	3008A02678	2023.02.17	1 Year
5.	Microwave Amplifier	Keysight	83051A	MY56480113	2022.09.07	1 Year
6.	Loop Antenna	TESEQ	HLA 6121	60478	2023.02.21	1 Year
7.	Bilog Antenna	TESEQ	CBL6112D	33821	2022.07.01	1 Year
8.	Double-Ridged Waveguide Horn	EMCO	3115	9609-4927	2022.07.13	1 Year
9.	Horn Antenna	COM-POWER	AH-840	101092	2022.12.30	1 Year
10.	5G Notch Filter	Microwave	H3G018G1	484796	2022.07.23	1 Year
11.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2023.01.07	1 Year
12.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 106	RE-14	2023.01.07	1 Year
13.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	RE-30	2022.08.22	1 Year
14.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2023.04.13	1 Year
15.	Test Software	Audix	e3	V9 18621a	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2023.03.29	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2022.06.22	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2022.06.22	1 Year
4.	Digital Thermo-Hygro Meter	iMax	HTC-1	RF-03	2022.04.13	1 Year

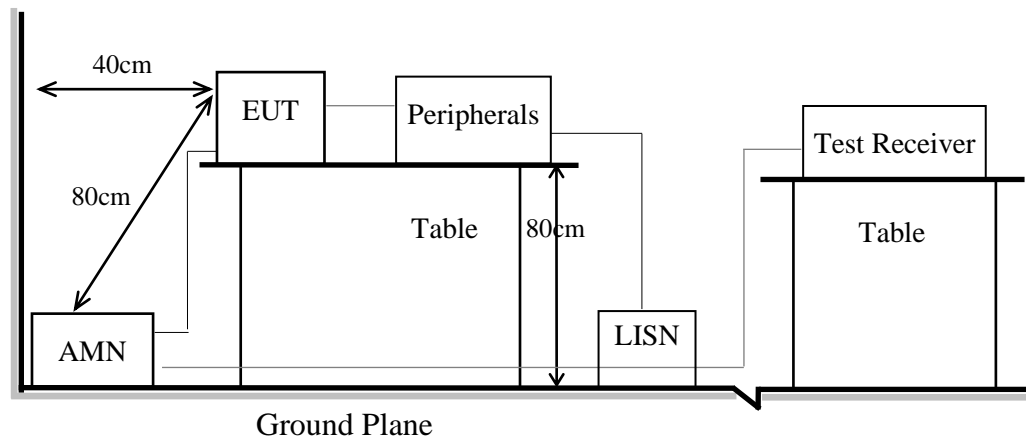
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.10

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dB μ V	56 ~ 46 dB μ V
500kHz ~ 5MHz	56 dB μ V	46 dB μ V
5MHz ~ 30MHz	60 dB μ V	50 dB μ V

Remark1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.

2.: The lower limit applies to the band edges.

5.3. Test Procedure

- 5.3.1. To set up the EUT as indicated in ANSI C63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.
- 5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).
- 5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)
- 5.3.4. Checking frequency range from 150kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

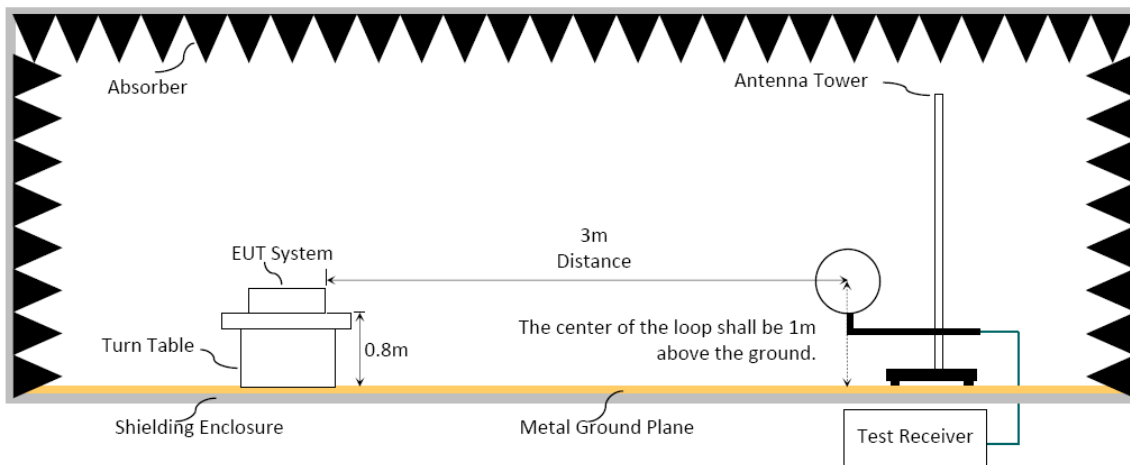
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

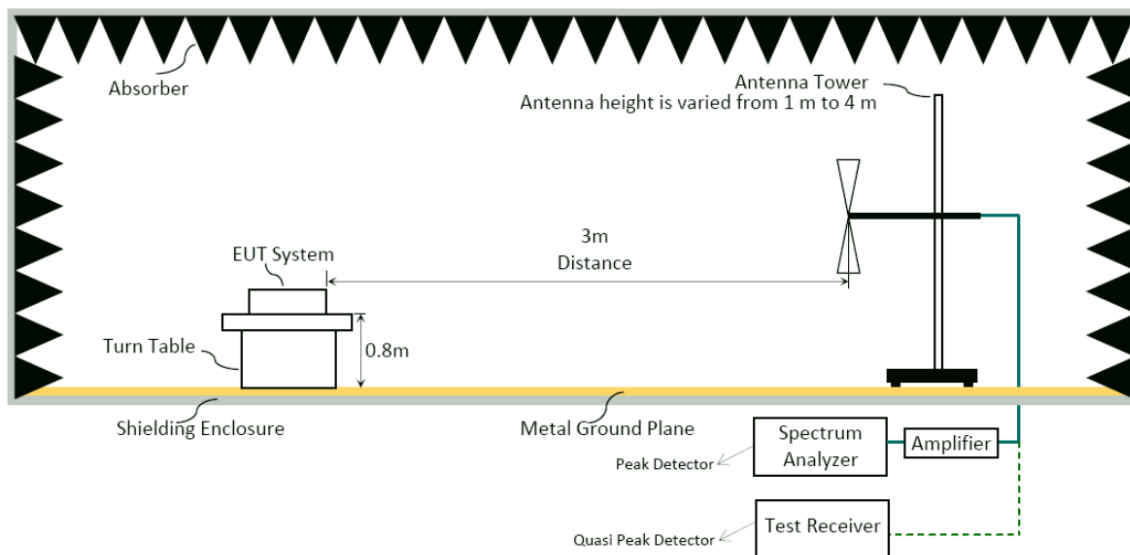
6.1.1. Block Diagram of EUT

Indicated as section 3.10

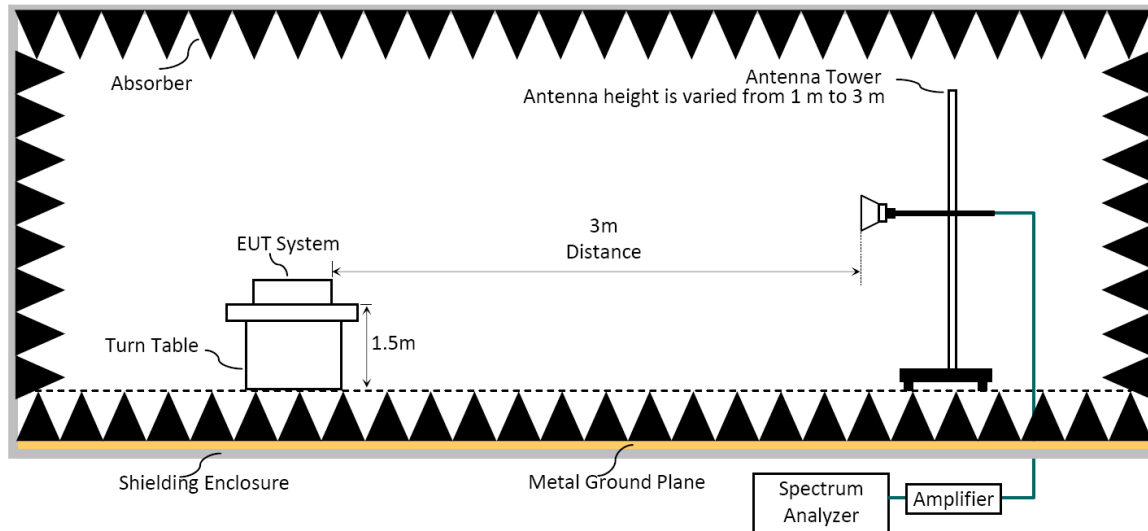
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

Radiated emissions fall in restricted bands, as defined in Section 15.205 must be in compliance with the radiated emission limits specified in 15.209 as below.

6.2.1. General Limit

Frequency (MHz)	Distance(m)	Limits	
		dB μ V/m	μ V/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dB μ V/m (Peak) 54.0 dB μ V/m (Average)	

Remark : (1) dB μ V/m = 20 log (μ V/m)

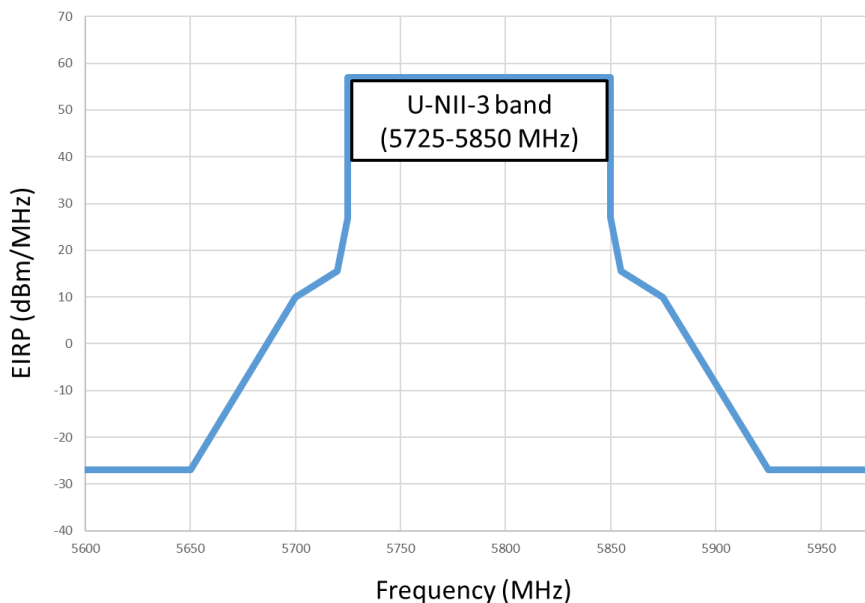
- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.2.2. Limit for non-restricted frequency above 1 GHz

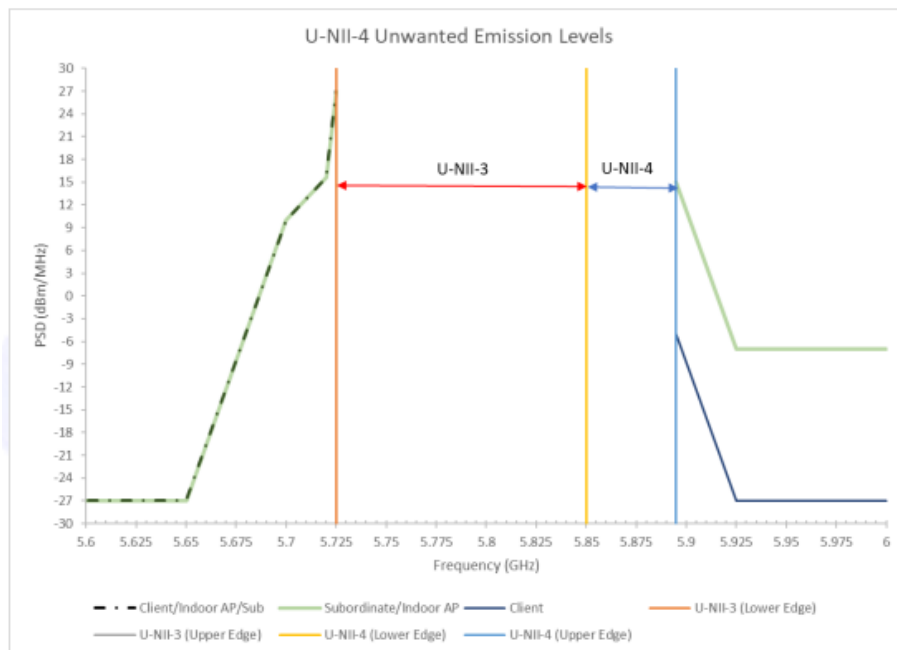
Frequency Band (MHz)	E.I.R.P. Limit	Field Strength Limit at 3 m
5150 to 5250	-27 dBm	68.2 dB μ V/m
5250 to 5350		68.2 dB μ V/m
5470 to 5725		68.2 dB μ V/m

Note: Field Strength at 3 m = E.I.R.P. + 95.2 Db

Frequency Band (MHz)	Field Strength Limit at 3 m
5725 to 5850	<input checked="" type="checkbox"/> 15.407(b)(4)(i) All emissions shall be limited to a level of 68.2 dB μ V/m at 75 MHz or more above or below the band edge increasing linearly to 105.2 dB μ V/m at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 110.8 dB μ V/m at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 122.2 dB μ V/m at the band edge.
	<input type="checkbox"/> 15.407(b)(4)(ii), compliance with the emission limits in § 15.247(d) shall be at least 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. 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))



Frequency Band (MHz)	Field Strength Limit at 3 m	
5850 to 5895	<input type="checkbox"/>	15.407(b)(5)(i) For an indoor access point or subordinate device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of 15 dBm/MHz and shall decrease linearly to an e.i.r.p. of -7 dBm/MHz at or above 5.925 GHz.
	<input checked="" type="checkbox"/>	15.407(b)(5)(ii) , For a client device, all emissions at or above 5.895 GHz shall not exceed an e.i.r.p. of -5 dBm/MHz and shall decrease linearly to an e.i.r.p. of -27 dBm/MHz at or above 5.925 GHz.
	<input checked="" type="checkbox"/>	15.407(b)(5)(iii) , For a client device or indoor access point or subordinate device, all emissions below 5.725 GHz shall not exceed an e.i.r.p. of -27 dBm/MHz at 5.65 GHz increasing linearly to 10 dBm/MHz at 5.7 GHz, and from 5.7 GHz increasing linearly to a level of 15.6 dBm/MHz at 5.72 GHz, and from 5.72 GHz increasing linearly to a level of 27 dBm/MHz at 5.725 GHz.



6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 40GHz:

The EUT setup on the turn table which has 80cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1)RBW = 120kHz
- (2)VBW $\geq 3 \times$ RBW.
- (3)Detector = Peak.
- (4)Sweep time = auto.
- (5)Trace mode = max hold.
- (6)Allow sweeps to continue until the trace stabilizes.

Note 1: When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic(up to 40 GHz):

Peak Detector:

- (1)RBW = 1MHz
- (2)VBW $\geq 3 \times$ RBW.
- (3)Detector = Peak.
- (4)Sweep time = auto.
- (5)Trace mode = max hold.
- (6)Allow sweeps to continue until the trace stabilizes.

Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

Average Detector:**■ Option 1:**

- (1) RBW = 1MHz
 (2) VBW $\geq 1/T$. (Duty Cycle < 98%, when duty cycle presented in section 3.7)
 (3) VBW = set VBW \leq RBW / 100, but not less than 10Hz (Duty Cycle \geq 98%, when duty cycle presented in section 3.7)

Mode	Antenna	VBW Setting
GFSK	ANT 1	120Hz
	ANT 2	120Hz

- (4) Detector = Peak.
 (5) Sweep time = auto.
 (6) Trace mode = max hold.
 (7) Allow sweeps to continue until the trace stabilizes.

□ Option 2:

Average Emission Level(dB μ V/m) = Peak Emission Level(dB μ V/m) + DCCF(dB).

6.4. Measurement Result Explanation

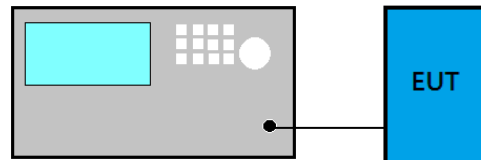
- Peak Emission Level(dB μ V/m) = Antenna Factor(dB/m) + Cable Loss (dB) – Preamp Gain (dB) + Reading(dB μ V).
 ■ Average Emission Level(dB μ V/m) = Antenna Factor(dB/m) + Cable Loss (dB) – Preamp Gain (dB) + Reading(dB μ V).
 □ Average Emission Level(dB μ V/m) = Peak Emission Level(dB μ V/m) + DCCF(dB)
 Duty Cycle Correction Factor (DCCF)(dB) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.7.
 □ ERP(dBm) = Peak Emission Level(dB μ V/m) - 95.2dB - 2.14dB

6.5. Test Results

Please refer to Appendix A.

7. EMISSION/OCCUPIED BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

Frequency Band (MHz)	Limit
5150 to 5250	Reference only
5250 to 5350	
5470 to 5725	
5725 to 5850	≥ 500kHz

7.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

For Emission Bandwidth

■ Applicable to all bands except to 5725 MHz- 5850 MHz

- (1) Set RBW= 1% of the emission bandwidth
- (2) Set VBW > RBW
- (3) Detector = Peak
- (4) Trace mode = max hold
- (5) Setting channel bandwidth function x dB to -26 dB to record the final bandwidth.

■ 5725 MHz- 5850 MHz

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) ≥ 3 × RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

For 99% Occupied Bandwidth

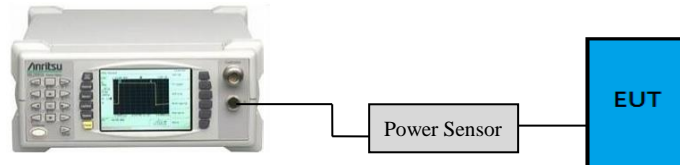
- (1) Set Span range 1.5~5 times the OBW
- (2) Set RBW close to 1% to 5% of OBW.
- (3) Set VBW ≥ 3 × RBW.
- (4) Detector = Peak.
- (5) Trace mode = Max hold
- (6) Sweep = Auto couple.
- (7) Allow the trace to stabilize.

7.4. Test Results

Please refer to Appendix A

8. MAXIMUM OUTPUT POWER

8.1. Block Diagram of Test Setup



8.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	1 W(30 dBm)/ Max e.i.r.p. ≤125 mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon
	Fixed point-to-point Access Point	1 W(30 dBm)
	Indoor Access Point	1 W(30 dBm)
	Mobile and Portable client device	250 mW(24 dBm)
5250 to 5350	N/A	250 mW or 11 dBm + 10 log B ^{Note1}
5470 to 5725		250 mW or 11 dBm + 10 log B ^{Note1}
5725 to 5850	N/A	1 W(30 dBm)
5850 to 5895	indoor access point	4 W (36 dBm) (e.i.r.p.)
	client devices	1 W (30 dBm) (e.i.r.p.)
	subordinate device	4 W (36 dBm) (e.i.r.p.)

Note 1: B is the 26 dB emission bandwidth, which presented in section 7 and appendix A.1.

8.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ **Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

□ **Method AVGSA-2 (Spectrum channel power) for 802.11ac-VHT80/160, 802.11ax-HE80/160 modes only**

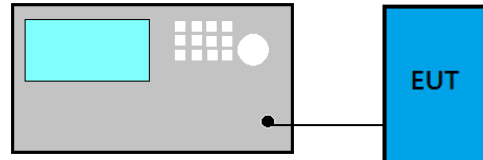
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) \geq 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

8.4. Test Results

Please refer to Appendix A

9. POWER SPECTRAL DENSITY

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency Band (MHz)	Category	Limit
5150 to 5250	Outdoor Access Point	17dBm/MHz
	Fixed point-to-point Access Point	
	Indoor Access Point	
	Mobile and Portable client device	11 dBm/MHz
5250 to 5350	N/A	11 dBm/MHz
5470 to 5725		11 dBm/MHz
5725 to 5850		30 dBm/500kHz
5850 to 5895	indoor access point	20dBm/MHz(e.i.r.p.)
	client devices	14dBm/MHz(e.i.r.p.)
	subordinate device	20dBm/MHz(e.i.r.p.)

9.3. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v02r01:

■ Method AVGSA-2

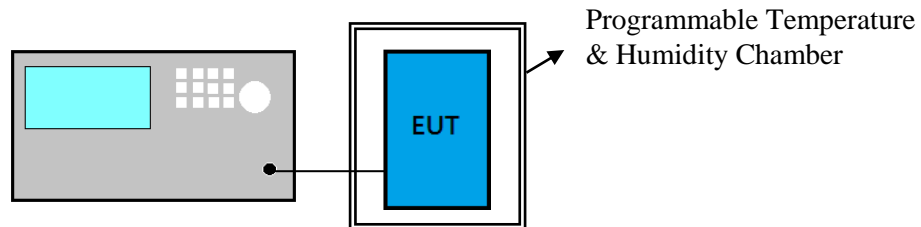
- (1) Set span to encompass the EBW (or 99% OBW) of the signal.
- (2) Set RBW = 1 MHz (Applicable to all bands except to 5725 MHz- 5850 MHz)/
Set RBW=100 KHz(when EUT operate at 5725 MHz- 5850 MHz)
- (3) Set the video bandwidth (VBW) ≥ 3 RBW.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Use peak search function to find out the maximum power density.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is $< 98\%$.
- (9) Offset BWCF (7dB) when EUT operate at 5725 MHz –5850 MHz.

9.4. Test Results

Please refer to Appendix A

10. FREQUENCY STABILITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

NONE

10.3. Test Procedure

- (1) Frequency: Test frequency.
- (2) Span: enough to cover the complete power envelope
- (3) RBW: 1MHz(modulation ON) ; 10KHz(CW)
- (4) VBW: 1MHz(modulation ON) ; 10KHz(CW)
- (5) Detector Mode: Positive Peak
- (6) Indication mode: Max hold
- (7) Find the peak frequency and take calculate by the formula:
(Measurement Value-declaration frequency)/ declaration frequency)

10.4. Test Results

Please refer to Appendix A

11. DEVIATION TO TEST SPECIFICATIONS

【NONE】



APPENDIX A

TEST DATA AND PLOTS

(Model: WL1BKR23)

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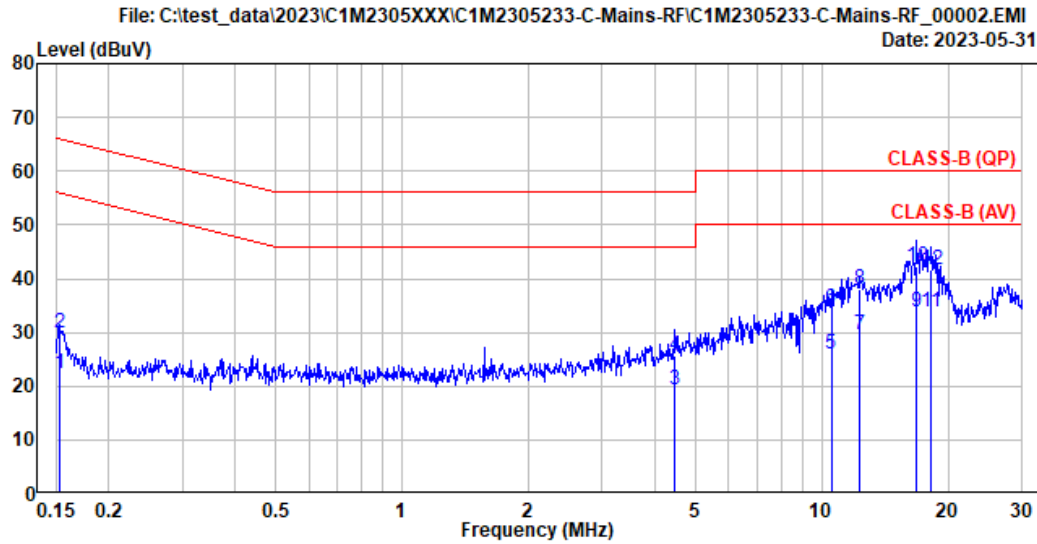
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A.1 CONDUCTED EMISSION

Test Date	2023/05/31	Temp./Hum.	26°C/64%
Test Voltage	DC 3.3V	Tested By	Joe Kuo



Site No.	: No.8 Shielded Room	Data No.	: 2
Instrument 1	: Receiver ESR(774)		
Instrument 2	: ENV4200 (169)(A) CE-08 ESH3-Z2 (354)		
Limit	: CLASS-B (QP)		
Environment	: 26°C/64%	Test Rating	: DC 3.3V
EUT Model	: WL1BKR23	Engineer	: Joe_Kuo
Test Mode	: Operating		

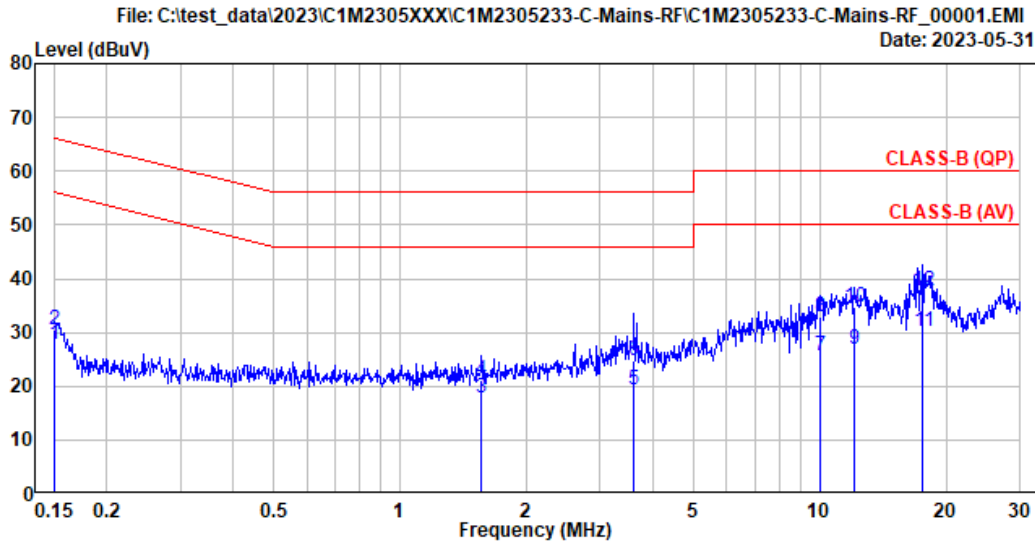
	Freq. (MHz)	ISN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.152	10.67	0.03	9.85	1.91	22.46	55.88	33.42	Average
2	0.152	10.67	0.03	9.85	9.29	29.84	65.88	36.04	QP
3	4.469	10.74	0.09	9.86	-1.34	19.35	46.00	26.65	Average
4	4.469	10.74	0.09	9.86	4.84	25.53	56.00	30.47	QP
5	10.533	11.60	0.14	9.89	4.27	25.90	50.00	24.10	Average
6	10.533	11.60	0.14	9.89	12.66	34.29	60.00	25.71	QP
7	12.354	12.14	0.15	9.90	7.44	29.63	50.00	20.37	Average
8	12.354	12.14	0.15	9.90	15.76	37.95	60.00	22.05	QP
9	16.828	13.17	0.18	9.92	10.52	33.79	50.00	16.21	Average
10	16.828	13.17	0.18	9.92	18.85	42.12	60.00	17.88	QP
11	18.225	13.44	0.19	9.93	10.10	33.66	50.00	16.34	Average
12	18.225	13.44	0.19	9.93	18.11	41.67	60.00	18.33	QP

Remarks: 1. Emission Level(dBμV)= ISN Factor(dB) + Cable Loss(dB) + Pulse Att.(dB) + Reading(dBμV).

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 New Taipei City 244, Taiwan

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Test Date	2023/05/31	Temp./Hum.	26°C/64%
Test Voltage	DC 3.3V	Tested By	Joe Kuo



Site No. : No.8 Shielded Room
 Instrument 1 : Receiver ESR(774)
 Instrument 2 : ENV4200 (169)(A)|CE-08|ESH3-Z2 (354)
 Limit : CLASS-B (QP)
 Environment : 26°C/64%
 EUT Model : WL1BKR23
 Test Mode : Operating

Data No. : 1
 Test Rating : DC 3.3V
 Engineer : Joe_Kuo

	Freq. (MHz)	ISN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.151	10.60	0.03	9.85	7.22	27.70	55.96	28.26	Average
2	0.151	10.60	0.03	9.85	9.98	30.46	65.96	35.50	QP
3	1.561	10.43	0.05	9.86	-2.56	17.78	46.00	28.22	Average
4	1.561	10.43	0.05	9.86	0.92	21.26	56.00	34.74	QP
5	3.607	10.54	0.08	9.86	-1.18	19.30	46.00	26.70	Average
6	3.607	10.54	0.08	9.86	4.17	24.65	56.00	31.35	QP
7	10.071	11.23	0.14	9.89	4.46	25.72	50.00	24.28	Average
8	10.071	11.23	0.14	9.89	11.73	32.99	60.00	27.01	QP
9	12.050	11.77	0.15	9.90	4.97	26.79	50.00	23.21	Average
10	12.050	11.77	0.15	9.90	12.84	34.66	60.00	25.34	QP
11	17.600	12.90	0.19	9.93	7.09	30.11	50.00	19.89	Average
12	17.600	12.90	0.19	9.93	14.66	37.68	60.00	22.32	QP

Remarks: 1. Emission Level(dBμV)= ISN Factor(dB) + Cable Loss(dB) + Pulse Att.(dB) + Reading(dBμV).

A.2 RADIATED EMISSION

Test Date	2023/05/26 ~ 30	Temp./Hum.	21°C/68%
Test Voltage	DC 3.3V	Tested By	Hua Wu

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

A.2.1.2 Frequency Below 1GHz

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5245MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
59.941	12.41	2.00	26.42	48.62	36.62	40.00	3.38	Peak
59.941	12.41	2.00	26.42	48.62	36.62	40.00	3.38	Peak
83.932	13.97	2.41	26.33	46.68	36.73	40.00	3.27	Peak
143.878	17.28	3.13	26.03	44.79	39.18	43.50	4.32	Peak
167.934	16.00	3.39	25.92	46.02	39.49	43.50	4.01	Peak
191.990	15.42	3.63	25.82	45.04	38.27	43.50	5.23	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
35.820	21.78	1.55	26.48	39.39	36.25	40.00	3.75	Peak
59.876	12.42	2.00	26.42	47.54	35.54	40.00	4.46	Peak
71.904	12.33	2.21	26.37	46.38	34.54	40.00	5.46	Peak
83.997	13.99	2.41	26.33	46.31	36.37	40.00	3.63	Peak
143.943	17.27	3.13	26.03	46.00	40.38	43.50	3.12	Peak
167.934	16.00	3.39	25.92	45.37	38.84	43.50	4.66	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5845MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
36.079	21.62	1.56	26.48	38.05	34.74	40.00	5.26	Peak
60.135	12.40	2.00	26.41	47.50	35.48	40.00	4.52	Peak
83.932	13.97	2.41	26.33	45.70	35.75	40.00	4.25	Peak
143.943	17.27	3.13	26.03	44.93	39.31	43.50	4.19	Peak
168.063	16.00	3.39	25.92	46.38	39.85	43.50	3.65	Peak
191.990	15.42	3.63	25.82	45.07	38.29	43.50	5.21	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
36.079	21.62	1.56	26.48	39.32	36.02	40.00	3.98	Peak
59.941	12.41	2.00	26.42	48.11	36.11	40.00	3.89	Peak
71.904	12.33	2.21	26.37	45.39	33.56	40.00	6.44	Peak
84.061	14.00	2.41	26.33	44.38	34.46	40.00	5.54	Peak
143.943	17.27	3.13	26.03	44.24	38.62	43.50	4.88	Peak
167.934	16.00	3.39	25.92	44.49	37.96	43.50	5.54	Peak

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5245MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
35.885	21.74	1.55	26.48	38.21	35.02	40.00	4.98	Peak
60.005	12.40	2.00	26.42	48.17	36.16	40.00	3.84	Peak
83.997	13.99	2.41	26.33	46.62	36.69	40.00	3.31	Peak
143.943	17.27	3.13	26.03	43.61	37.98	43.50	5.52	Peak
167.999	16.00	3.39	25.92	46.42	39.89	43.50	3.61	Peak
191.861	15.42	3.63	25.82	45.62	38.84	43.50	4.66	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
36.014	21.66	1.55	26.48	39.54	36.28	40.00	3.72	Peak
60.135	12.40	2.00	26.41	47.82	35.80	40.00	4.20	Peak
72.033	12.34	2.21	26.37	47.53	35.71	40.00	4.29	Peak
83.803	13.94	2.41	26.33	44.30	34.32	40.00	5.68	Peak
143.943	17.27	3.13	26.03	44.88	39.26	43.50	4.24	Peak
167.805	16.00	3.38	25.92	44.05	37.52	43.50	5.98	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5790MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
35.885	21.74	1.55	26.48	39.95	36.76	40.00	3.24	Peak
59.941	12.41	2.00	26.42	48.69	36.68	40.00	3.32	Peak
83.738	13.93	2.41	26.33	46.10	36.11	40.00	3.89	Peak
143.813	17.28	3.13	26.03	45.52	39.91	43.50	3.59	Peak
167.934	16.00	3.39	25.92	44.33	37.80	43.50	5.70	Peak
191.796	15.42	3.62	25.82	44.50	37.73	43.50	5.77	Peak

Antenna at Vertical Polarization

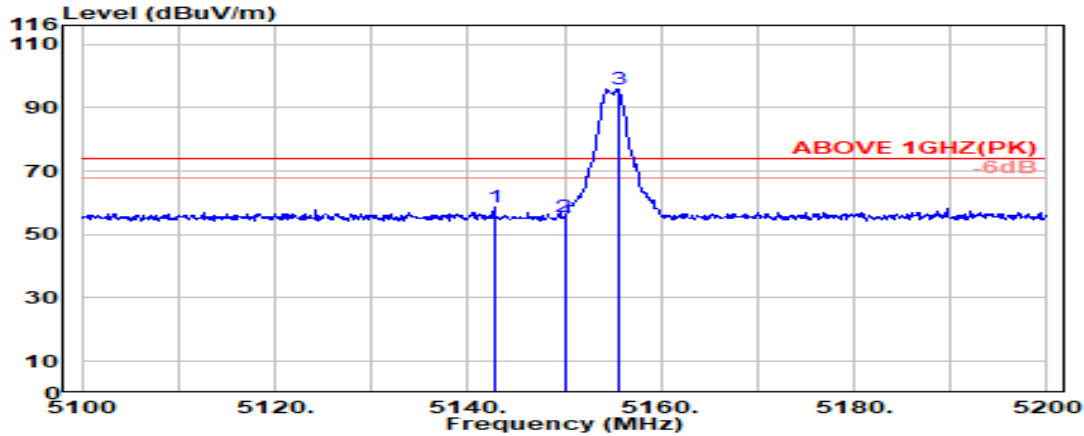
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
36.014	21.66	1.55	26.48	39.22	35.95	40.00	4.05	Peak
59.941	12.41	2.00	26.42	48.00	35.99	40.00	4.01	Peak
72.033	12.34	2.21	26.37	46.81	34.99	40.00	5.01	Peak
83.803	13.94	2.41	26.33	46.07	36.09	40.00	3.91	Peak
143.943	17.27	3.13	26.03	45.98	40.36	43.50	3.14	Peak
167.869	16.00	3.39	25.92	45.23	38.71	43.50	4.79	Peak

A.2.1.3 Frequency Above 1 GHz to 10th harmonics

Band Edge:

- ANT 1

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5155MHz

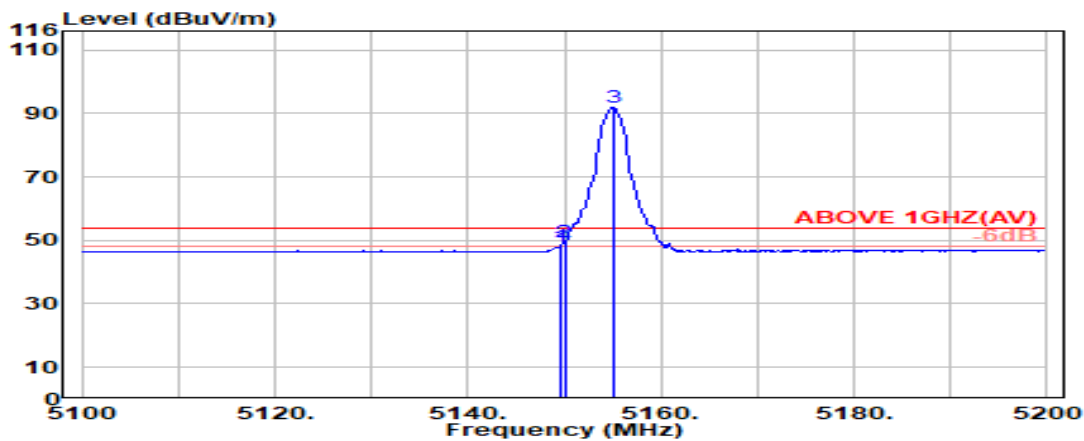


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5142.700	33.69	8.54	34.24	50.46	58.44	74.00	15.56	Peak
5150.000	33.70	8.54	34.24	47.41	55.41	74.00	18.59	Peak
@ 5155.600	33.73	8.55	34.24	87.67	95.71	---	---	Peak

Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5155MHz

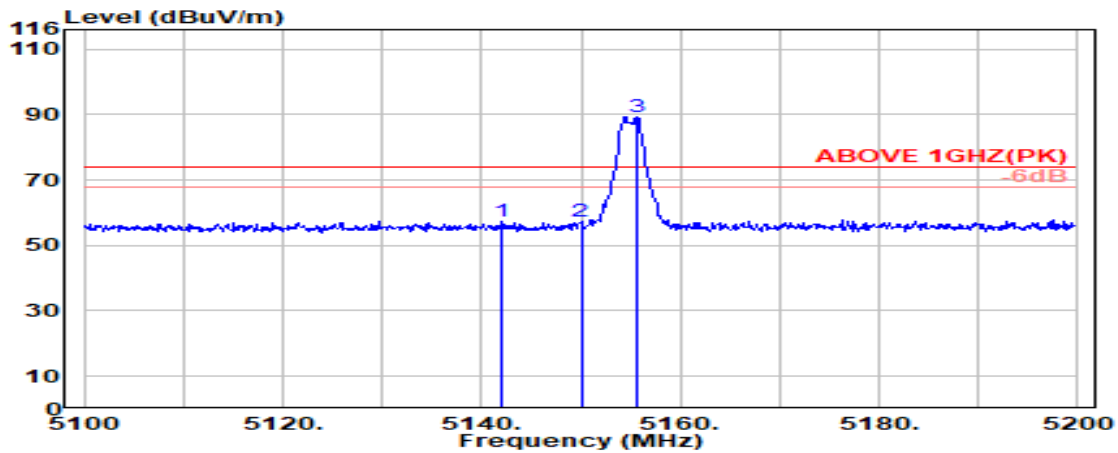


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.600	33.70	8.54	34.24	40.21	48.21	54.00	5.79	Average
5150.000	33.70	8.54	34.24	41.31	49.32	54.00	4.68	Average
@ 5155.000	33.73	8.55	34.24	83.72	91.76	---	---	Average

Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5155MHz

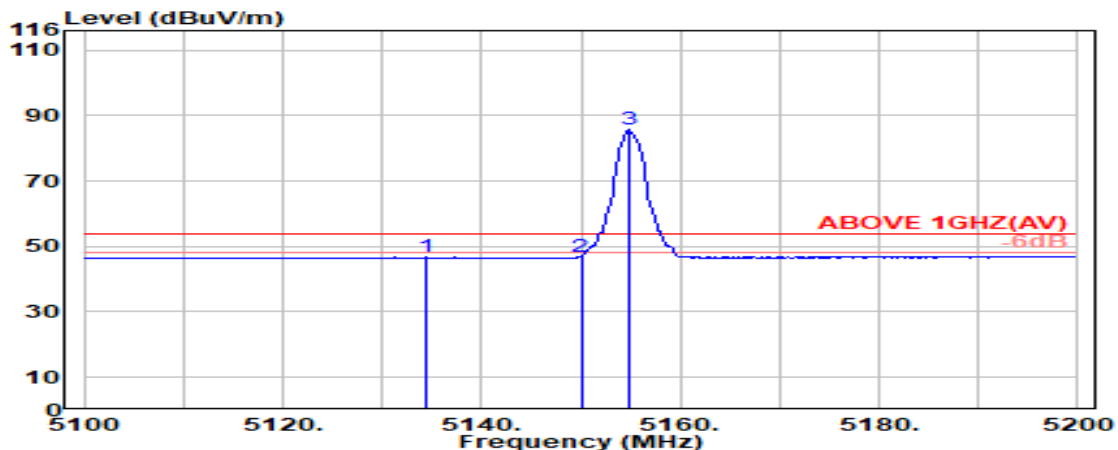


Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5142.000	33.68	8.54	34.24	49.51	57.48	74.00	16.52	Peak
5150.000	33.70	8.54	34.24	49.15	57.15	74.00	16.85	Peak
@ 5155.600	33.73	8.55	34.24	81.23	89.27	---	---	Peak

Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5155MHz



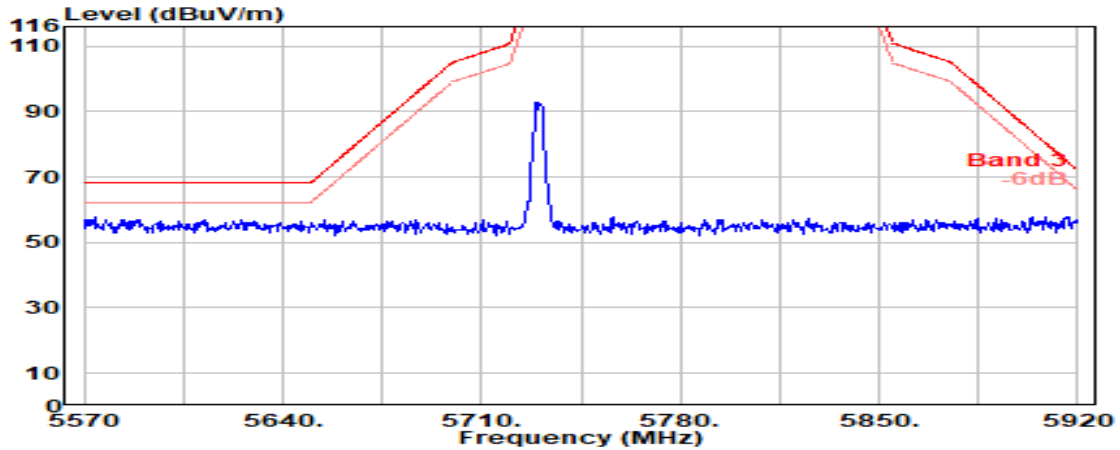
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5134.400	33.67	8.53	34.25	38.74	46.70	54.00	7.30	Average
5150.000	33.70	8.54	34.24	38.75	46.76	54.00	7.24	Average
@ 5154.800	33.73	8.55	34.24	77.64	85.68	---	---	Average

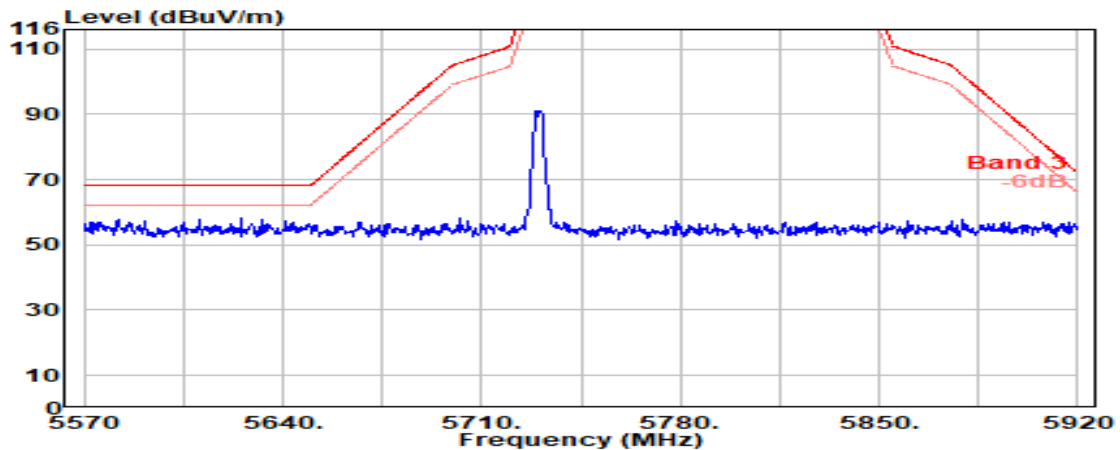
Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5730MHz

Antenna at Horizontal Polarization

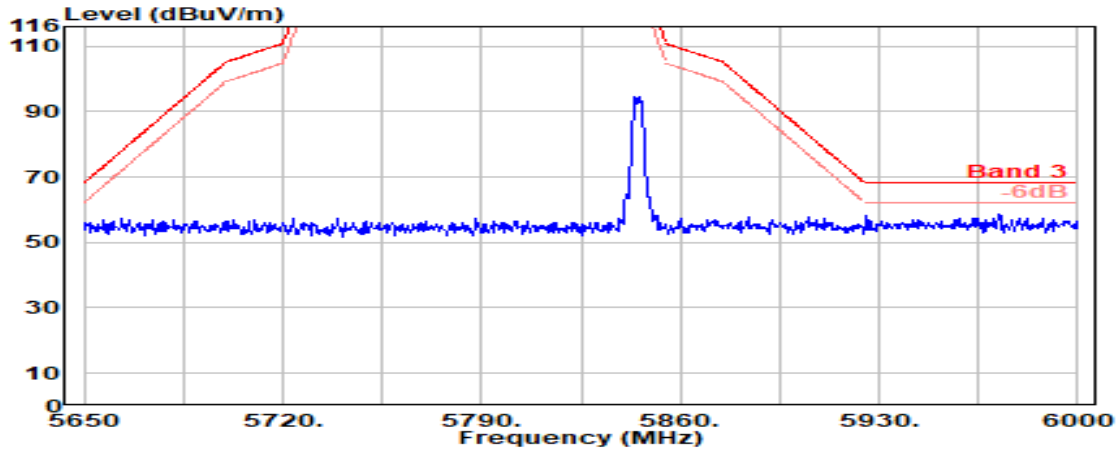


Antenna at Vertical Polarization

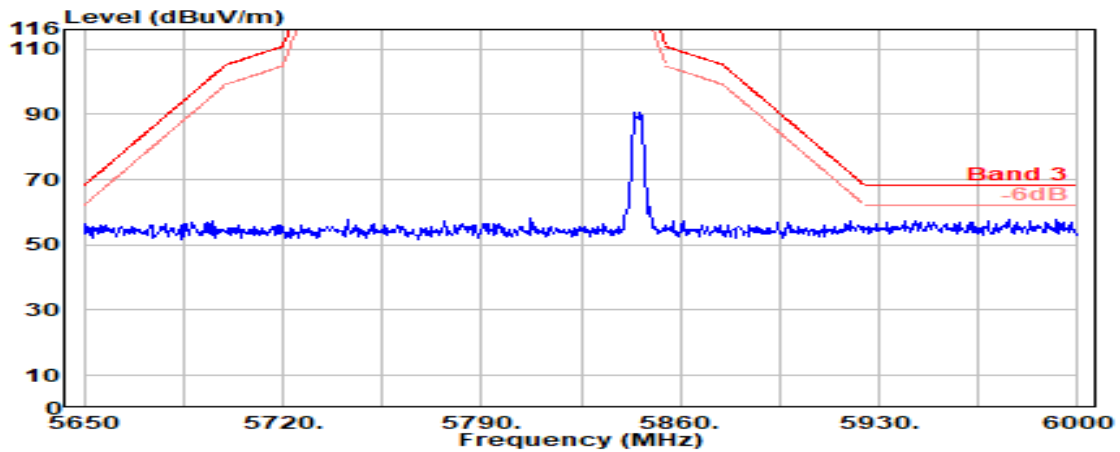


Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5845MHz

Antenna at Horizontal Polarization

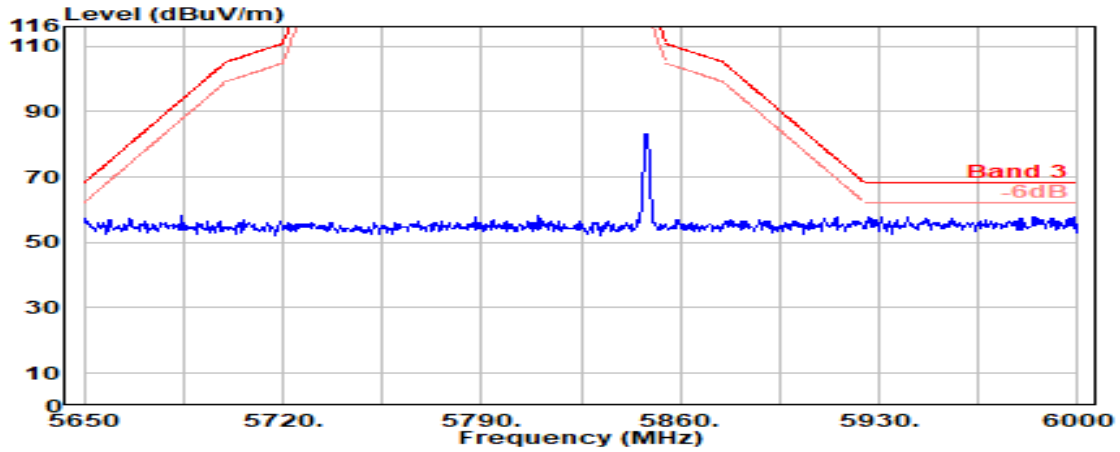


Antenna at Vertical Polarization

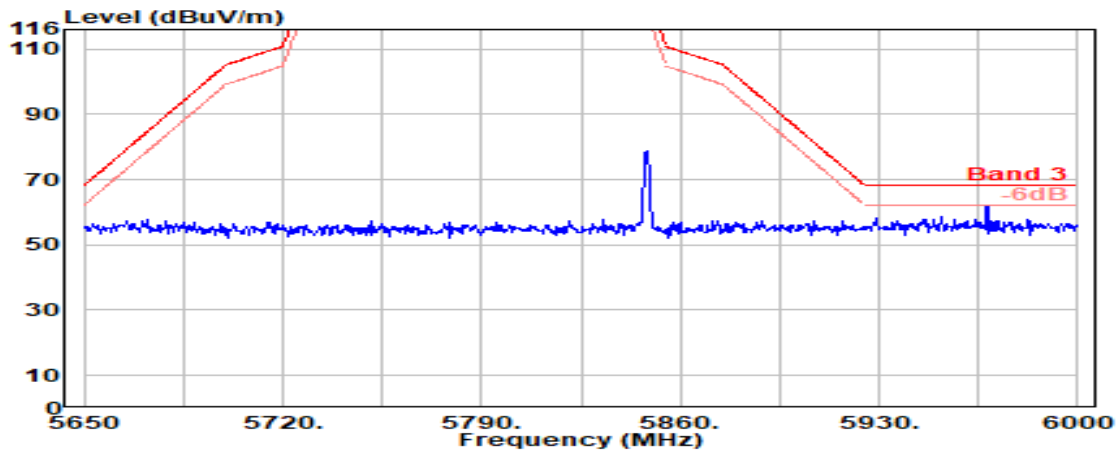


Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5848MHz

Antenna at Horizontal Polarization

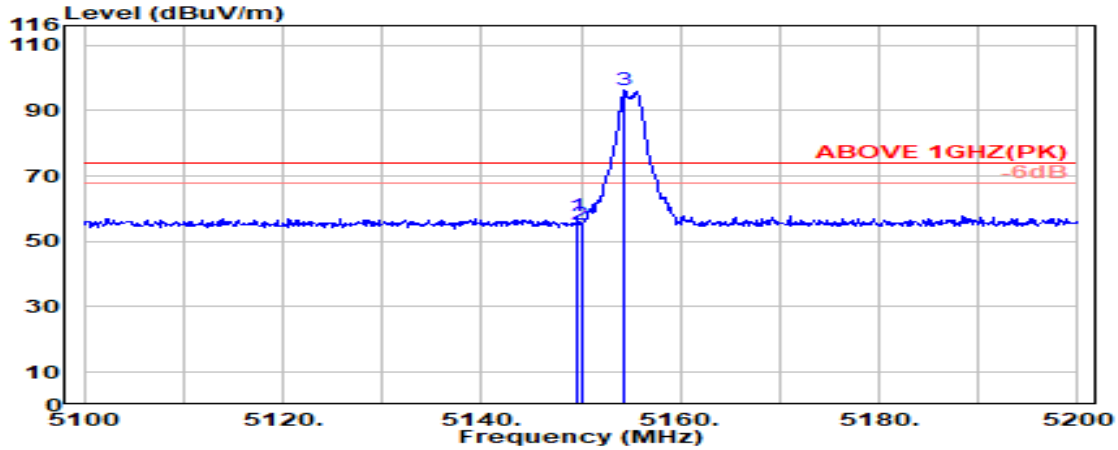


Antenna at Vertical Polarization



● ANT 2

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5155MHz

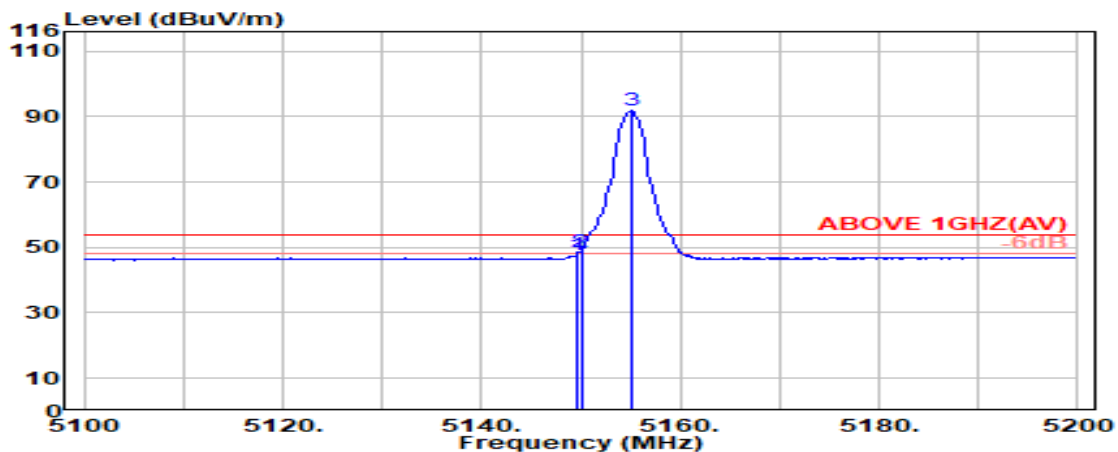


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.600	33.70	8.54	34.24	49.72	57.73	74.00	16.27	Peak
5150.000	33.70	8.54	34.24	47.31	55.31	74.00	18.69	Peak
@ 5154.400	33.73	8.55	34.24	88.09	96.12	---	---	Peak

Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5155MHz

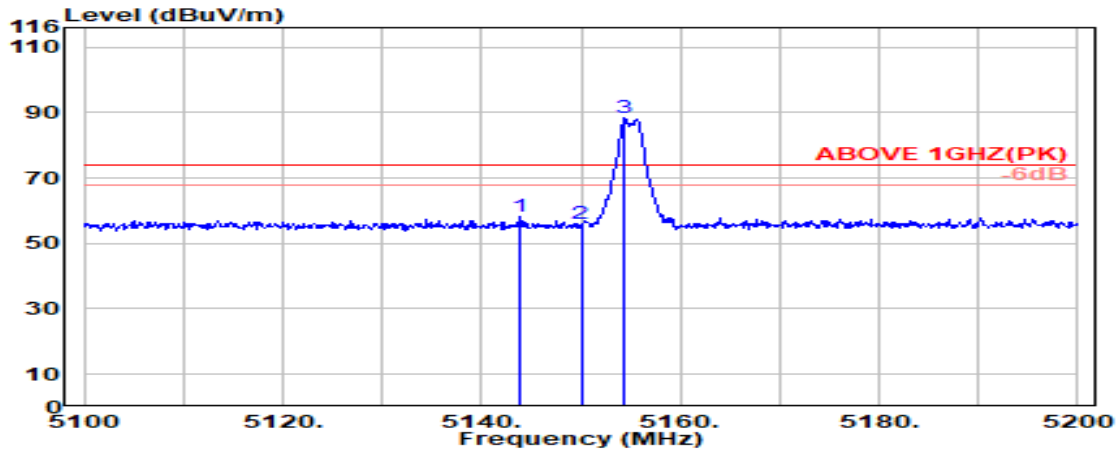


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5149.600	33.70	8.54	34.24	39.65	47.65	54.00	6.35	Average
5150.000	33.70	8.54	34.24	40.75	48.76	54.00	5.24	Average
@ 5155.000	33.73	8.55	34.24	83.74	91.78	---	---	Average

Remark: The “@” means fundamental frequency, it is ignored in this section.

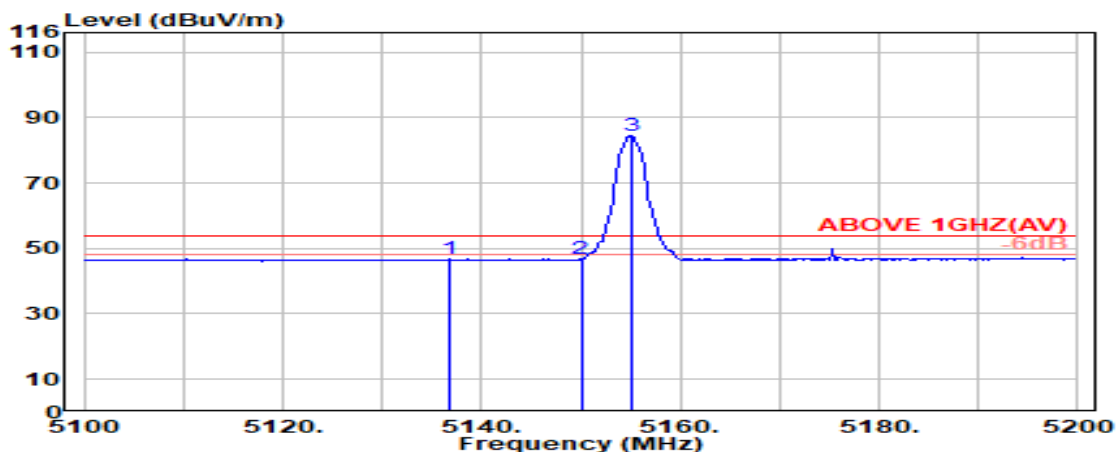
Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5155MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5143.800	33.69	8.54	34.24	50.28	58.26	74.00	15.74	Peak
5150.000	33.70	8.54	34.24	47.92	55.93	74.00	18.07	Peak
@ 5154.400	33.73	8.55	34.24	80.22	88.25	---	---	Peak

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5155MHz



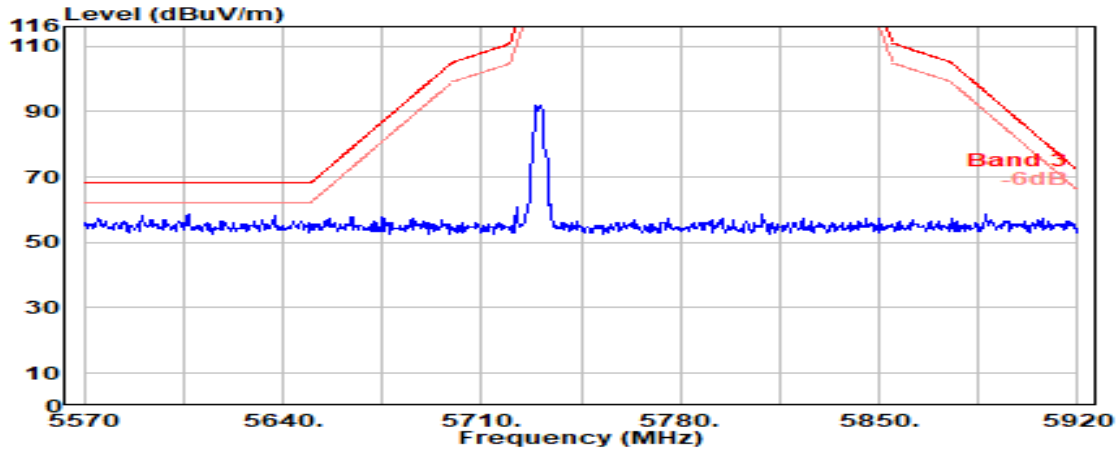
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
5136.800	33.67	8.54	34.25	38.80	46.76	54.00	7.24	Average
5150.000	33.70	8.54	34.24	38.66	46.66	54.00	7.34	Average
@ 5155.000	33.73	8.55	34.24	76.49	84.52	---	---	Average

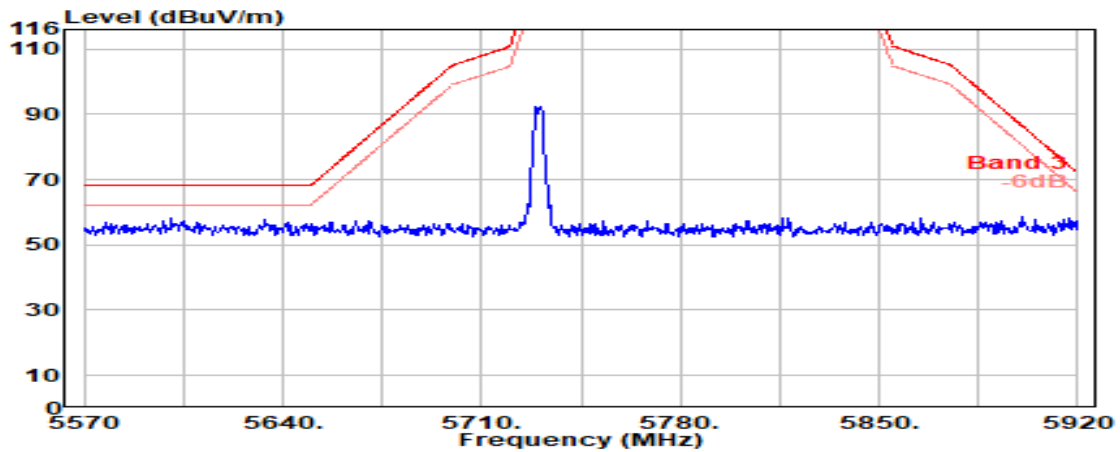
Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5730MHz

Antenna at Horizontal Polarization

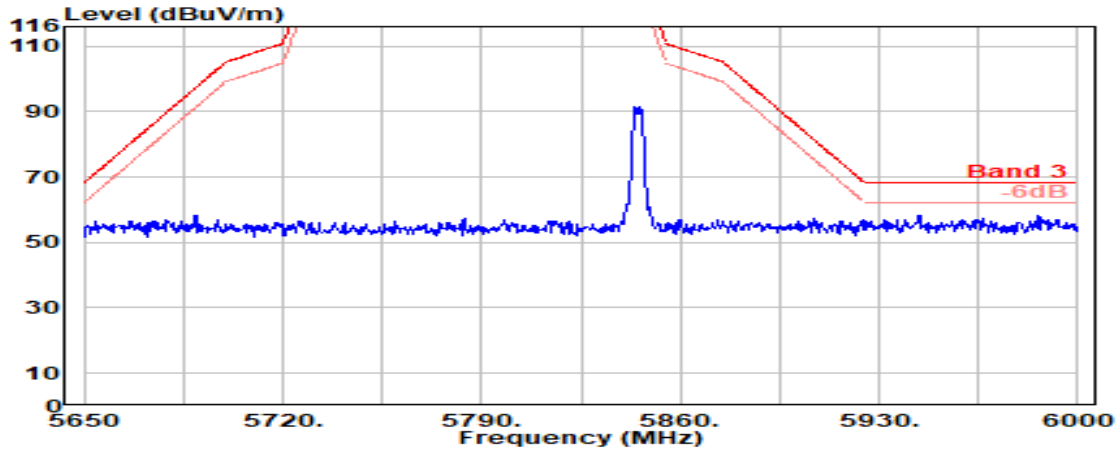


Antenna at Vertical Polarization

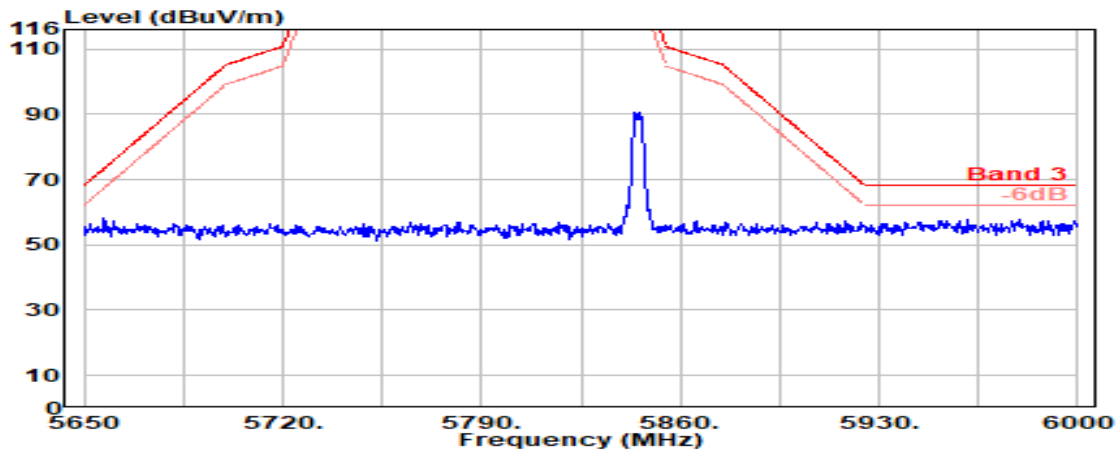


Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5845MHz

Antenna at Horizontal Polarization

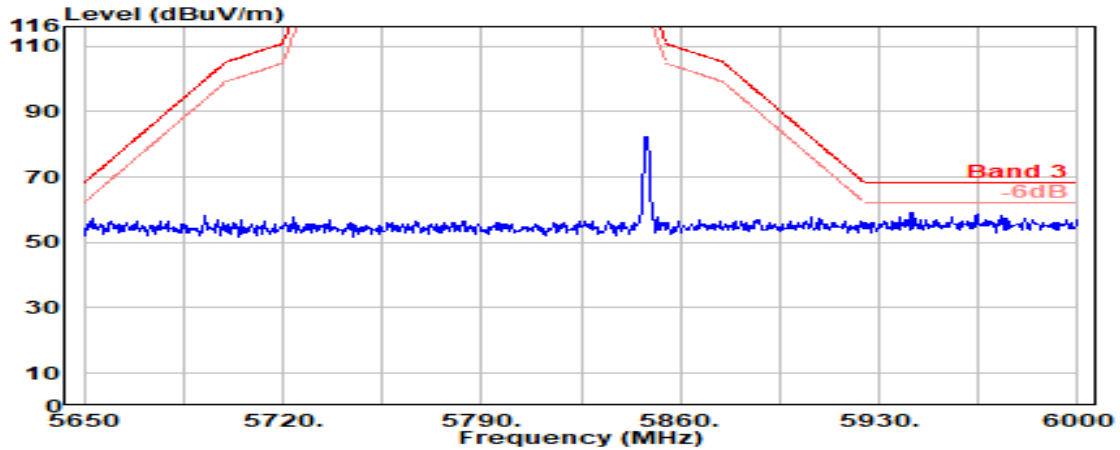


Antenna at Vertical Polarization

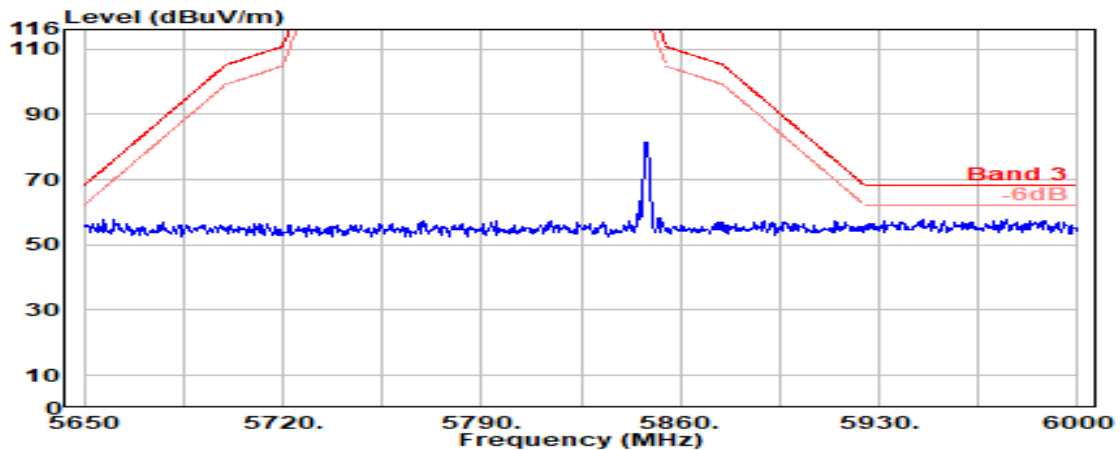


Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5848MHz

Antenna at Horizontal Polarization



Antenna at Vertical Polarization



A.2.2 Emissions outside the frequency band

The emissions (up to 40GHz) not reported for there is no emission be found.

● **ANT 1**

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5155MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10310.000	38.29	11.84	34.71	32.56	47.99	54.00	6.01	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10310.000	38.29	11.84	34.71	32.08	47.50	54.00	6.50	Peak

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5195MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10390.000	38.21	11.95	34.64	34.25	49.77	54.00	4.23	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10390.000	38.21	11.95	34.64	34.08	49.60	54.00	4.40	Peak

Mode	GFSK	U-NII Band	1
Antenna	ANT 1	Frequency	TX 5245MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10490.000	38.38	12.08	34.55	33.67	49.58	54.00	4.42	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10490.000	38.38	12.08	34.55	33.67	49.58	54.00	4.42	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5730MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11460.000	39.26	13.28	34.42	32.62	50.74	54.00	3.26	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11460.000	39.26	13.28	34.42	31.28	49.40	54.00	4.60	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5790MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11580.000	39.54	13.41	34.44	31.23	49.75	54.00	4.25	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11580.000	39.54	13.41	34.44	31.37	49.88	54.00	4.12	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5845MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11690.000	39.78	13.53	34.46	31.33	50.18	54.00	3.82	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11690.000	39.78	13.53	34.46	30.91	49.77	54.00	4.23	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 1	Frequency	TX 5848MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11696.000	39.79	13.54	34.46	30.55	49.42	54.00	4.58	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11696.000	39.79	13.54	34.46	31.32	50.19	54.00	3.81	Peak

● ANT 2

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5155MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10310.000	38.29	11.84	34.71	32.82	48.24	54.00	5.76	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10310.000	38.29	11.84	34.71	34.51	49.93	54.00	4.07	Peak

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5195MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10390.000	38.21	11.95	34.64	33.76	49.28	54.00	4.72	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10390.000	38.21	11.95	34.64	33.71	49.23	54.00	4.77	Peak

Mode	GFSK	U-NII Band	1
Antenna	ANT 2	Frequency	TX 5245MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10490.000	38.38	12.08	34.55	33.91	49.83	54.00	4.17	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
10490.000	38.38	12.08	34.55	33.09	49.00	54.00	5.00	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5730MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11460.000	39.26	13.28	34.42	31.60	49.72	54.00	4.28	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11460.000	39.26	13.28	34.42	31.37	49.49	54.00	4.51	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5790MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11580.000	39.54	13.41	34.44	31.35	49.87	54.00	4.13	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11580.000	39.54	13.41	34.44	31.83	50.34	54.00	3.66	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5845MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11690.000	39.78	13.53	34.46	31.33	50.18	54.00	3.82	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11690.000	39.78	13.53	34.46	31.98	50.84	54.00	3.16	Peak

Mode	GFSK	U-NII Band	3
Antenna	ANT 2	Frequency	TX 5848MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11696.000	39.79	13.54	34.46	31.45	50.32	54.00	3.68	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
11696.000	39.79	13.54	34.46	31.90	50.77	54.00	3.23	Peak

A.2.3 Emissions in Non-restricted Frequency Bands

Pursuant to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 that emission levels below the 15.209 Section 8.9 table 4 general radiated emissions limits is not required.

A.3 EMISSION/OCCUPIED BANDWIDTH

Test Date	2023/05/24 ~ 6/9	Temp./Hum.	23-24°C/50-64%
Cable Loss	0.40dB	Tested By	Hua Wu
Test Voltage	DC 3.3V		

A.3.1 Emission/Occupied Bandwidth Result

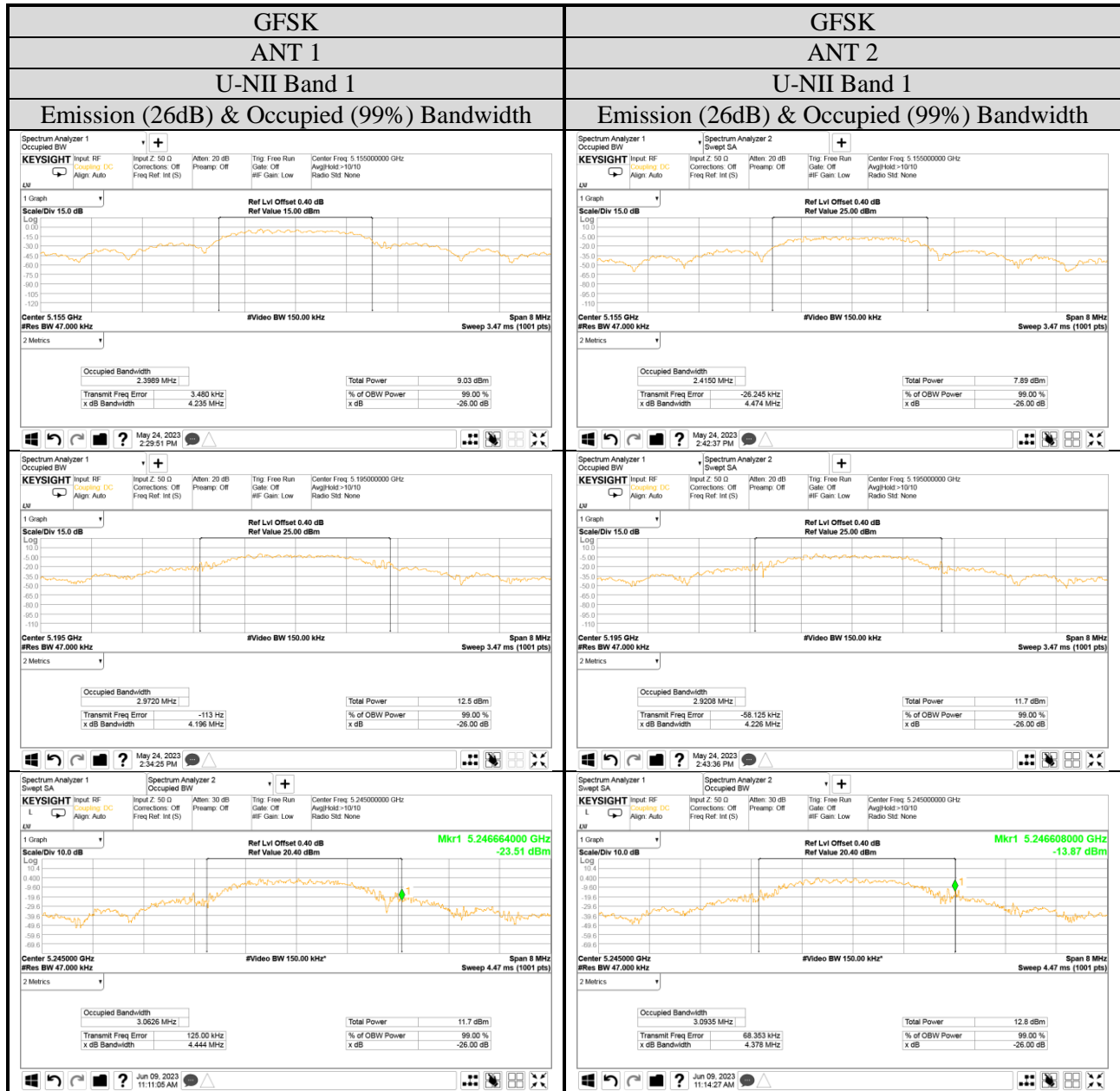
● ANT 1

Mode	U-NII Band	Centre Frequency (MHz)	Bandwidth (MHz)		Limit
			Emission (26dB)	Occupied (99%)	
GFSK	1	5155	4.235	2.3989	Reference only
		5195	4.196	2.9720	
		5245	4.444	3.0626	

● ANT 2

Mode	U-NII Band	Centre Frequency (MHz)	Bandwidth (MHz)		Limit
			Emission (26dB)	Occupied (99%)	
GFSK	1	5155	4.474	2.4150	Reference only
		5195	4.226	2.9208	
		5245	4.378	3.0935	

A.3.2 Measurement Plots



A.4 MAXIMUM OUTPUT POWER

Test Date	2023/05/25	Temp./Hum.	25°C/55%
Cable Loss	0.40dB	Tested By	Hua Wu
Test Voltage	DC 3.3V		

A.4.1 Average Output Power

● ANT 1

Mode	U-NII Band	Centre Frequency (MHz)	Average Output Power (dBm)	Duty Cycle Factor $10\log(1/X)$	Average Output Power		Limit
					(dBm)	(W)	
GFSK	1	5155	-3.92	6.498	2.58	0.00181	< 250 mW (24 dBm)
		5195	-1.17	6.498	5.33	0.00341	
		5245	-0.95	6.498	5.55	0.00359	
	3	5730	4.05	N/A	4.05	0.00254	< 1 W (30 dBm)
		5790	4.43	N/A	4.43	0.00277	
		5845	5.26	N/A	5.26	0.00336	
		5846	-8.35	N/A	-8.35	0.00015	
		5847	-8.39	N/A	-8.39	0.00014	
		5848	-8.46	N/A	-8.46	0.00014	

Note: The results have been included cable loss.

● ANT 2

Mode	U-NII Band	Centre Frequency (MHz)	Average Output Power (dBm)	Duty Cycle Factor $10\log(1/X)$	Average Output Power		Limit
					(dBm)	(W)	
GFSK	1	5155	-4.03	6.498	2.47	0.00177	< 250 mW (24 dBm)
		5195	-1.42	6.498	5.08	0.00322	
		5245	-1.29	6.498	5.21	0.00332	
	3	5730	4.92	N/A	4.92	0.00310	< 1 W (30 dBm)
		5790	5.73	N/A	5.73	0.00374	
		5845	4.32	N/A	4.32	0.00270	
		5846	-9.16	N/A	-9.16	0.00012	
		5847	-9.17	N/A	-9.17	0.00012	
		5848	-7.12	N/A	-7.12	0.00019	

Note: The results have been included cable loss.

A.5 POWER SPECTRAL DENSITY

Test Date	2023/05/24	Temp./Hum.	24°C/64%
Cable Loss	0.40dB	Tested By	Hua Wu
Test Voltage	DC 3.3V		

A.5.1 Power Spectral Density Result

● ANT 1

Mode	U-NII Band	Centre Frequency (MHz)	Power Spectral Density (dBm)	Duty Cycle Factor $10\log(1/X)$	Power Spectral Density (dBm)	Limit
GFSK	1	5155	-7.055	6.498	-0.557	11 dBm/MHz
		5195	-3.906	6.498	2.592	
		5245	-3.690	6.498	2.808	

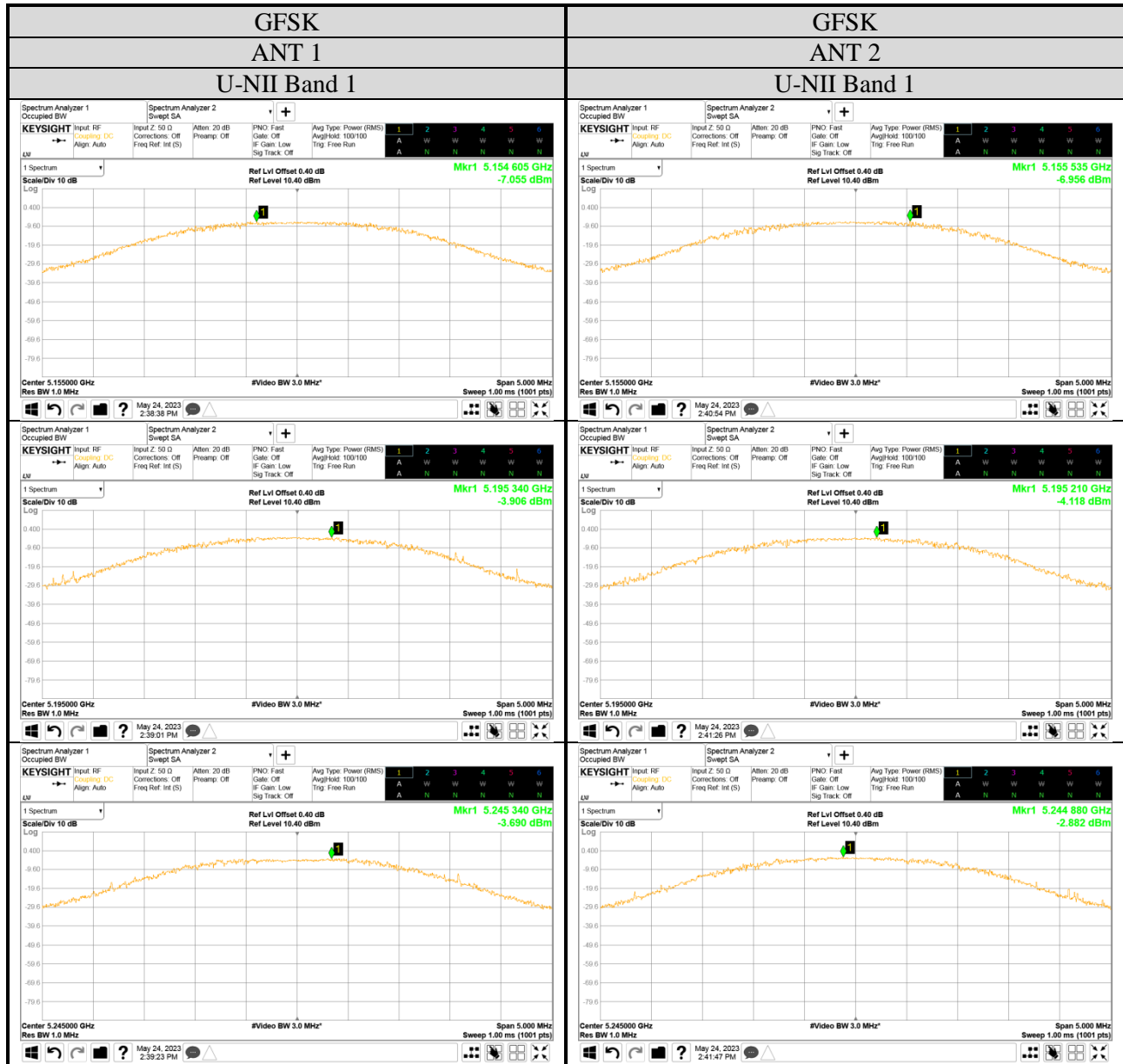
Note: All results have been included cable loss and duty cycle factor.

● ANT 2

Mode	U-NII Band	Centre Frequency (MHz)	Power Spectral Density (dBm)	Duty Cycle Factor $10\log(1/X)$	Power Spectral Density (dBm)	Limit
GFSK	1	5155	-6.956	6.498	-0.458	11 dBm/MHz
		5195	-4.118	6.498	2.380	
		5245	-2.822	6.498	3.676	

Note: All results have been included cable loss and duty cycle factor.

A.5.2 Measurement Plots



A.6 FREQUENCY STABILITY

Test Date	2023/05/23	Temp./Hum.	23°C/63%
Test Voltage	DC 3.3V	Tested By	Hua Wu

A.6.1 Frequency stability Result

● ANT 1

Temperature (°C)	Voltage (Vdc)	Centre Frequency (MHz)	Measurement Value (MHz)	Frequency Stability (ppm)
25	3.30	5155	5155.025	4.850
	-30		3.15	5155.006
3.45			5155.02	3.880
-20	3.15		5154.991	-1.746
	3.45		5154.984	-3.104
-10	3.15		5155.023	4.462
	3.45		5154.994	-1.164
0	3.15		5155.018	3.492
	3.45		5154.991	-1.746
10	3.15		5155.029	5.626
	3.45		5154.989	-2.134
20	3.15		5155.022	4.268
	3.45		5154.984	-3.104
30	3.15		5154.987	-2.522
	3.45		5155.025	4.850
40	3.15		5154.990	-1.940
	3.45		5154.988	-2.328
50	3.15		5155.018	3.492
	3.45		5154.989	-2.134

● ANT 2

Temperature (°C)	Voltage (Vdc)	Centre Frequency (MHz)	Measurement Value (MHz)	Frequency Stability (ppm)
25	3.30	5155	5154.975	-4.850
-30	3.15		5154.981	-3.686
	3.45		5155.002	0.388
-20	3.15		5154.973	-5.238
	3.45		5154.984	-3.104
-10	3.15		5155	0.000
	3.45		5155.023	4.462
0	3.15		5155.01	1.940
	3.45		5155.018	3.492
10	3.15		5154.971	-5.626
	3.45		5154.975	-4.850
20	3.15		5154.975	-4.850
	3.45		5155.011	2.134
30	3.15		5154.986	-2.716
	3.45		5155.011	2.134
40	3.15		5154.974	-5.044
	3.45		5155.013	2.522
50	3.15		5155.002	0.388
	3.45		5154.988	-2.328



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APPENDIX B

TEST PHOTOGRAPHS

(Model: WL1BKR23)