

FCC 15.407 NII 5GHz Test Report

for

LG Electronics USA

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

Product Name : Wireless Audio Module
Model Name : WL1BKR22
Brand : LG
FCC ID : BEJ-WL1BKR22

**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

Applicant : LG Electronics USA
Manufacturer : LG Electronics Inc.
Factory : Shenzhen Shi Xinzhongxin Technology Co., Ltd.
EUT Description
(1) Product : Wireless Audio Module
(2) Model : WL1BKR22
(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: 2022. 07. 22

Reviewed by:



(Annie Yu/Administrator)

Approved by:



(Johnny Hsueh/Section Manager)



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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2022. 07. 22	Original Report	EM-F220294

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(b)	Conducted Band Edges	N/A
	Conducted Spurious Emission	PASS
15.407(a)	Power Spectral Density	PASS
15.407	Frequency Stability	PASS
15.203	Antenna Requirement	Compliance
Note: 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	WL1BKR22
Brand	LG

3.2. Description of EUT

Test Model	WL1BKR22		
Serial Number	N/A		
Power Rating	DC 3.3V		
Hardware Version	RX_V1.6		
Software Version	V3.0		
RF Features	GFSK		
Transmit Type	1T1R		
Device Category	☐ Outdoor Access Point ☐ Fixed point-to-point Access Point ☐ Indoor Access Point ☒ Mobile and Portable client device		
Test Sample	Sample No.	Test Item	Firmware
	03	AC Conduction	N/A
	07	Radiated	N/A
	06	RF Conducted	N/A
Sample Status	Trial sample		
Date of Receipt	2022. 04. 12		
Date of Test	2022. 07.11 ~ 21		
Interface Ports of EUT	None		
Accessories Supplied	None		

3.3. Reference Test Guidance

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

3.4. Antenna Information

No.	Antenna Part Number	Manufacturer	Antenna Type	Frequency (MHz)	Max Gain(dBi)
1.	RX Antenna	N/A	PCB Printing Antenna	5150	3.20
				5170	3.05
				5190	3.16
				5210	3.45
				5230	3.68
				5250	3.74
				5450	2.64
				5470	2.44
				5490	2.34
				5500	2.14
				5750	3.09
				5770	3.00
				5790	2.94
				5810	3.00
				5830	3.14
				5850	3.05

3.5. 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	24	5754	48	5778	72	5802	96	5826
1	5731	25	5755	49	5779	73	5803	97	5827
2	5732	26	5756	50	5780	74	5804	98	5828
3	5733	27	5757	51	5781	75	5805	99	5829
4	5734	28	5758	52	5782	76	5806	100	5830
5	5735	29	5759	53	5783	77	5807	101	5831
6	5736	30	5760	54	5784	78	5808	102	5832
7	5737	31	5761	55	5785	79	5809	103	5833
8	5738	32	5762	56	5786	80	5810	104	5834
9	5739	33	5763	57	5787	81	5811	105	5835
10	5740	34	5764	58	5788	82	5812	106	5836
11	5741	35	5765	59	5789	83	5813	107	5837
12	5742	36	5766	60	5790	84	5814	108	5838
13	5743	37	5767	61	5791	85	5815	109	5839
14	5744	38	5768	62	5792	86	5816	110	5840
15	5745	39	5769	63	5793	87	5817	111	5841
16	5746	40	5770	64	5794	88	5818	112	5842
17	5747	41	5771	65	5795	89	5819	113	5843
18	5748	42	5772	66	5796	90	5820	114	5844
19	5749	43	5773	67	5797	91	5821	115	5845
20	5750	44	5774	68	5798	92	5822	116	5846
21	5751	45	5775	69	5799	93	5823	117	5847
22	5752	46	5776	70	5800	94	5824	118	5848
23	5753	47	5777	71	5801	95	5825		

Note: Test modes are presented at section 3.7.

3.6. Description of Key Components

None

3.7. Test Configuration

Mode	TX _{on} (ms)	TX _{on+off} (ms)	Duty Cycle (x)	Duty Cycle Factor [10log(1/x)] (dB)
GFSK (U-NII Band 1)	9.300	39.75	0.234	6.308
GFSK (U-NII Band 3)	9.200	39.70	0.232	6.345

Note: 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.



AC Conduction

RF Test mode

Item	Test Frequency (MHz)
Radiated Test Case	
Radiated Spurious Emission (30MHz~1GHz)	5195
Radiated Band Edge ^{Note}	5155, 5730, 5848
Radiated Spurious Emission ^{Note}	5155, 5195, 5245, 5730, 5790, 5848

Item	Test Frequency (MHz)
Conducted Test Case	
Emission/Occupied Bandwidth	5155, 5195, 5245, 5730, 5790, 5848
Maximum output power	5155, 5195, 5245, 5730, 5790, 5848
Conducted Spurious Emission	5155, 5195, 5245, 5730, 5790, 5848
Power spectral density	5155, 5195, 5245, 5730, 5790, 5848

Note: ☒ Mobile Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

☒ Lie ☐ Side ☐ Stand

☐ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

☐ Lie ☐ Side ☐ Stand

3.8. Output Power Setting

Mode	U-NII Band	Centre Frequency (MHz)	Power Setting
GFSK	1	5155	Default
		5195	Default
		5245	Default
	3	5730	Default
		5790	Default
		5848	Default

3.9. Tested Supporting System List

3.9.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	Approval
1.	DC Power Supply#1	TOP WARD	3303A	N/A	N/A
2.	DC Power Supply#2	TOP WARD	6303A	N/A	N/A
3.	USB Jig	N/A	N/A	N/A	N/A
4.	Notebook PC	hp	TPN-Q189	5CD8175992	Contains FCC ID: PD93168NG Contains IC: 1000M-3168NG

3.9.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	AC Power Cord: Unshielded, Detachable, 1.8m DC Cable x2 : Unshielded, Detachable, 1.0m DC Cable x2: Unshielded, Undetectable, 0.1m
2.	AC Power Cord: Unshielded, Detachable, 1.8m DC Cable x2 : Unshielded, Detachable, 1.0m DC Cable x2: Unshielded, Undetectable, 0.1m
3.	USB Cable: Unshielded, Undetectable, 1.5m Data Cable x3: Unshielded, Undetectable, 0.1m
4.	Adapter: ASUS, M/N AD890526 DC Power Cord : Unshielded, Undetectable, 2.0m

3.10. Setup Configuration

3.10.1. EUT Configuration for Power Line & Radiated Emission



3.10.2. EUT Configuration for RF Conducted Test Items



3.11. Operating Condition of EUT

Test program “SSCOM V5.13.1” is used for enabling EUT RF function under continues transmitting and choosing channel.

3.12. 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

3.13.Measurement Uncertainty

Test Items/Facilities			Frequency Range	Uncertainty
Conduction Test			9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.4dB
Radiation Test	☒	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.8dB
			200MHz-1000MHz, 3m, Horizontal	±4.1dB
			30MHz-200MHz, 3m, Vertical	±4.5dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
			1GHz-6GHz, 3m	±4.7dB
			6GHz-18GHz, 3m	±4.1dB
			18GHz-40GHz, 3m	±3.52dB
	☐	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.9dB
			200MHz-1000MHz, 3m, Horizontal	±4.2dB
			30MHz-200MHz, 3m, Vertical	±4.3dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
	☐	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.1dB
			200MHz-1000MHz, 3m, Horizontal	±4.5dB
			30MHz-200MHz, 3m, Vertical	±4.4dB
			200MHz-1000MHz, 3m, Vertical	±4.8dB
			1GHz-6GHz, 3m	±5.0dB
			6GHz-18GHz, 3m	±4.7dB
	☐	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.2dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.3dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	☒	Fully Anechoic Chamber	30MHz~1000MHz	±4.6dB
			1GHz~18GHz	±5.4dB
			18GHz~40GHz	±3.52dB
			40GHz~260GHz	±3.56dB

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	2022.01.11	1 Year
2.	FOUR-LINE V-NETWORK	R&S	ENV432	101567	2022.02.26	1 Year
3.	L.I.S.N.	Kyoritsu	KNW-407	8-855-9	2021.12.19	1 Year
4.	Pulse Limiter	R&S	ESH3-Z2	100354	2021.12.23	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2022.04.14	1 Year
6.	Coaxial Cable	Yeida	RG/58AU	CE-08	2021.09.13	1 Year
7.	Test Software	Audix	e3	V6.120619c	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	2021.09.19	1 Year
2.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2022.04.08	1 Year
3.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2022.02.21	1 Year
4.	Test Receiver	R&S	ESCS30	100039	2022.06.01	1 Year
5.	Amplifier	HP	8447D	2944A06305	2022.01.05	1 Year
6.	Microwave Preamplifier	Agilent	8449B	3008A02678	2022.02.22	1 Year
7.	Microwave Amplifier	Keysight	83051A	MY53010042	2021.07.30	1 Year
8.	Bilog Antenna	TESEQ	CBL6112D	33821	2021.07.16	1 Year
9.	Horn Antenna	ETS-Lindgren	3117	00135902	2022.03.21	1 Year
10.	Horn Antenna	COM-POWER	AH-840	101092	2022.01.06	1 Year
11.	5G Notch Filter	Microwave Circuits	N0452502	459775	2022.05.04	1 Year
12.	5G Notch Filter	Microwave Circuits	N0257881	459776	2021.08.16	1 Year
13.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2022.01.20	1 Year
14.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 106	RE-29	2021.09.13	1 Year
15.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	RE-30	2021.08.25	1 Year
16.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2022.04.14	1 Year
17.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF	2022.04.14	1 Year
18.	Test Software	Audix	e3	V6.120619c	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	N9030B	MY61330403	2021.12.21	1 Year
2.	Power Meter	Anritsu	ML2487A	6K00005406	2022.04.26	1 Year
3.	Power Sensor	Anritsu	MA2491A	030873	2022.04.27	1 Year
4.	Digital Thermo-Hygro Meter	iMax	HTC-1	RF-03	2022.04.14	1 Year

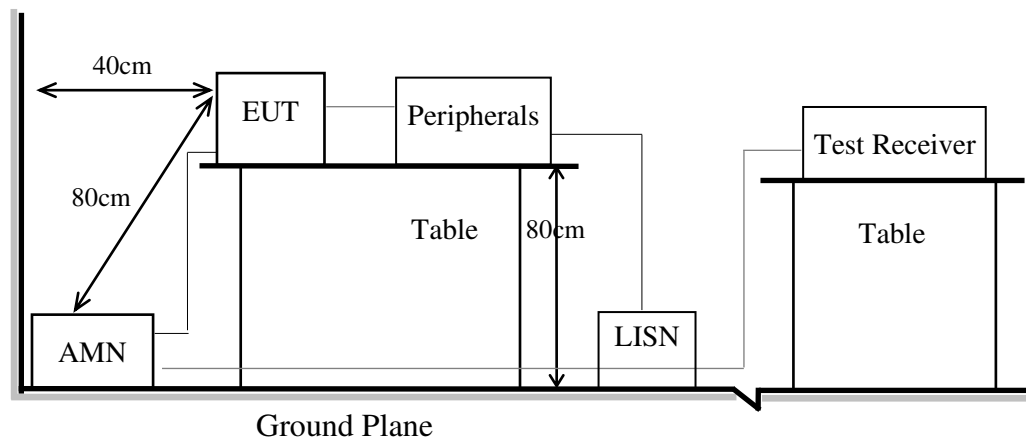
5. CONDUCTED EMISSION

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.
- 5.3.5. Spectrum Analyzer setting: RBW=9kHz, VBW=300kHz.

5.4. Test Results

Please refer to Appendix A.

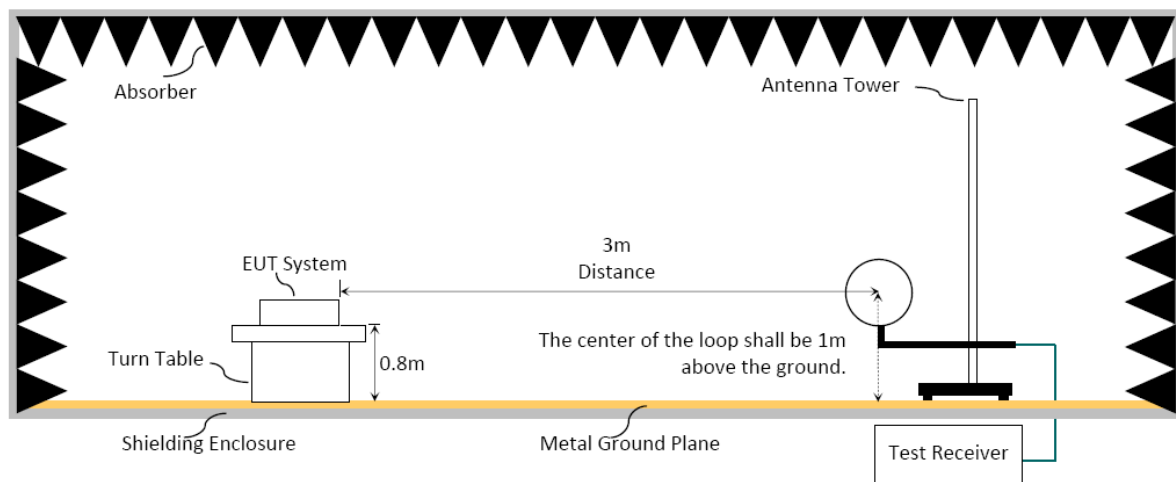
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

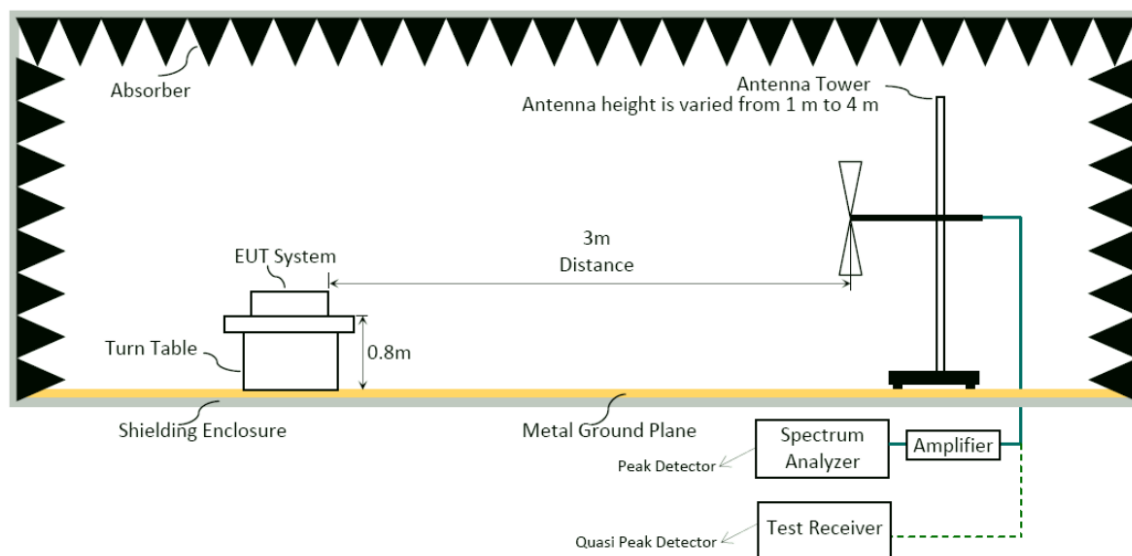
6.1.1. Block Diagram of EUT

Indicated as section 3.10

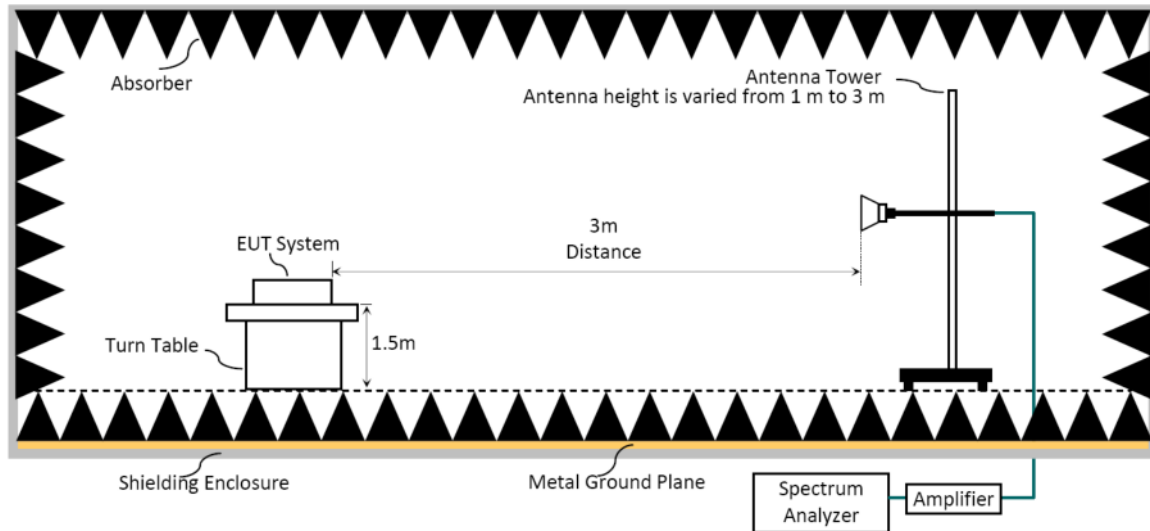
6.1.2. Setup Diagram for 9kHz-30MHz



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)

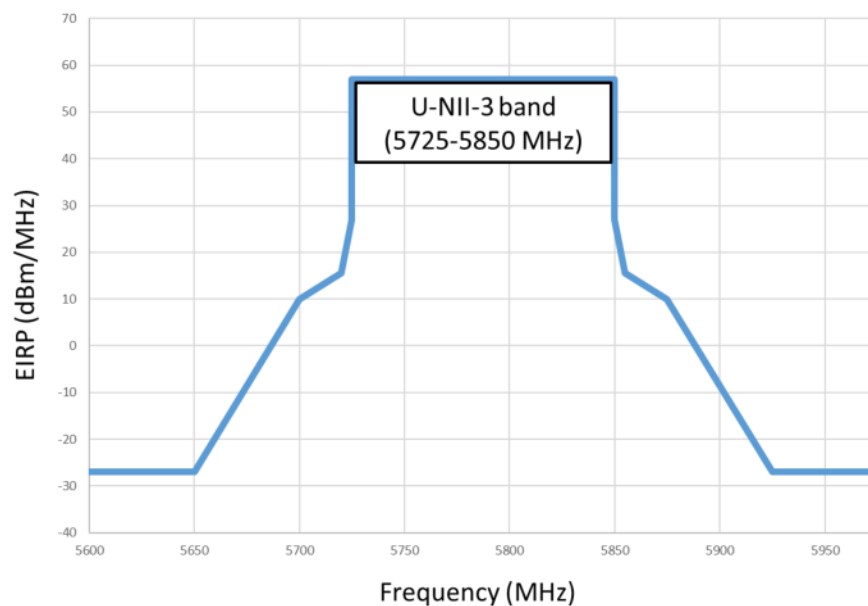
- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this 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	☒	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 increasing linearly to a level of 68.2 dB μ V/m at the band edge.
	☐	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))



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)

Modulation Type	VBW Setting
GFSK	1kHz

- (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.

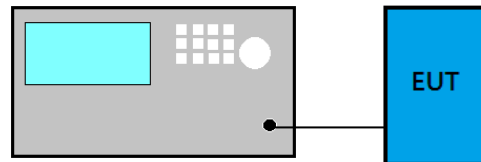
□ ERP(dBm) = Peak Emission Level(dB μ V/m) - 95.2dB - 2.14dB

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	$\geq 500\text{kHz}$

7.3. Test Procedure

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

■ 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

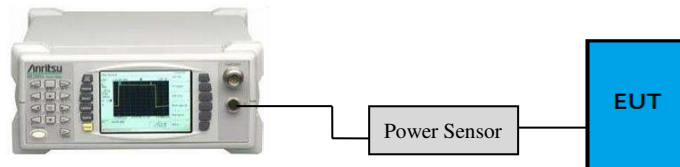
- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

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 $11 \text{ dBm} + 10 \log B^{\text{Note1}}$
5470 to 5725		250 mW or $11 \text{ dBm} + 10 \log B^{\text{Note1}}$
5725 to 5850		1 W(30 dBm)

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**

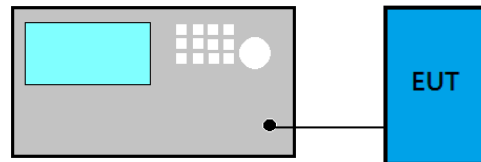
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the 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. EMISSION LIMITATIONS MEASUREMENT

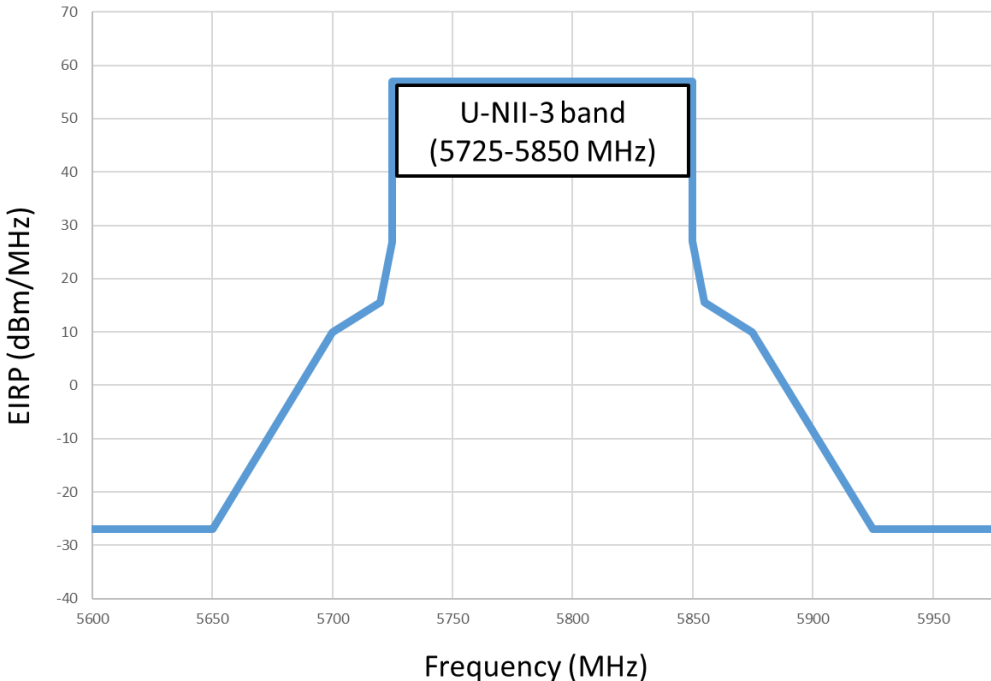
9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency Band (MHz)	E.I.R.P. Limit
5150 to 5250	-27 dBm
5250 to 5350	
5470 to 5725	

Frequency Band (MHz)	E.I.R.P. Limit	
5725 to 5850	☒	15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz 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 15.6 dBm/MHz 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 27 dBm/MHz at the band edge.
	☐	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))



The graph illustrates the EIRP limit for the U-NII-3 band (5725-5850 MHz). The y-axis represents EIRP in dBm/MHz, ranging from -40 to 70. The x-axis represents Frequency in MHz, ranging from 5600 to 5950. The limit is defined by a trapezoidal shape: it is -27 dBm/MHz from 5600 MHz to 5650 MHz, rises linearly to 57 dBm/MHz at 5725 MHz, remains constant at 57 dBm/MHz until 5850 MHz, and then falls linearly back to -27 dBm/MHz by 5950 MHz.

9.1. Test Procedure

Following measurement procedure is reference to KDB 789033 D02 General UNII Test Procedures New Rules v01r02:

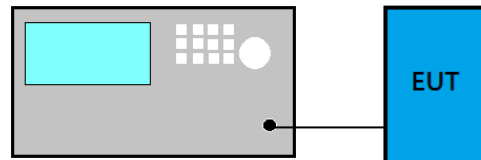
- (1) RBW = 1 MHz
- (2) VBW $\geq 3 \times$ RBW
- (3) Detector = Peak
- (4) Sweep time = auto
- (5) Trace mode = max hold
- (6) Allow sweeps to continue until the trace stabilizes.

9.2. Test Results

Please refer to Appendix A

10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. 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		30dBm/500 kHz

10.3. Test Procedure

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

■ Method AVGSA-2 (Spectrum channel power)

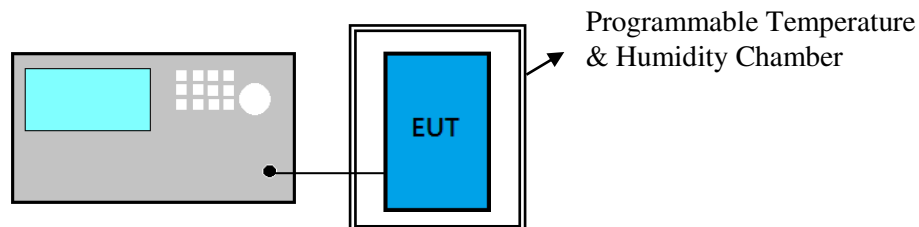
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 MHz
- (3) Set the video bandwidth (VBW) ≥ 3 MHz.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Use peak search function to find out the maximum power density.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is $< 98\%$.

10.4. Test Results

Please refer to Appendix A

11. FREQUENCY STABILITY

11.1. Block Diagram of Test Setup



11.2. Specification Limits

NONE

11.3. 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)

11.4. Test Results

Please refer to Appendix A



12.DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPDNDIX A

TEST DATA AND PLOTS

(Model: WL1BKR22)

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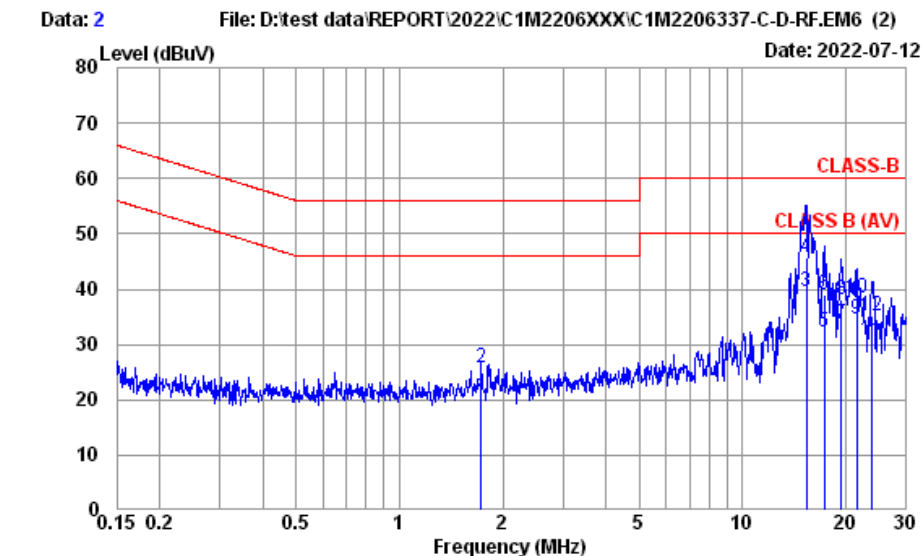
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A.1 CONDUCTED EMISSION

Test Date	2022/07/12	Temp./Hum.	26°C/58%
Test Voltage	DC 3.3V	Tested By	Ken Yang



Site No. : No.8 Shielded Room Data No. : 2
Instrument 1 : Receiver ESR3(774) RBW:9kHz VBW:300kHz
Instrument 2 : EMI432 (567)(A) | CE-08 | ESH3-Z2 (354)
Limit : CLASS-B Phase : NEUTRAL
Environment : 26°C / 58% Engineer : Ken Yang
EUT Model : WL1BKR22 Test Rating : DC 3.3V
Test Mode : Operating

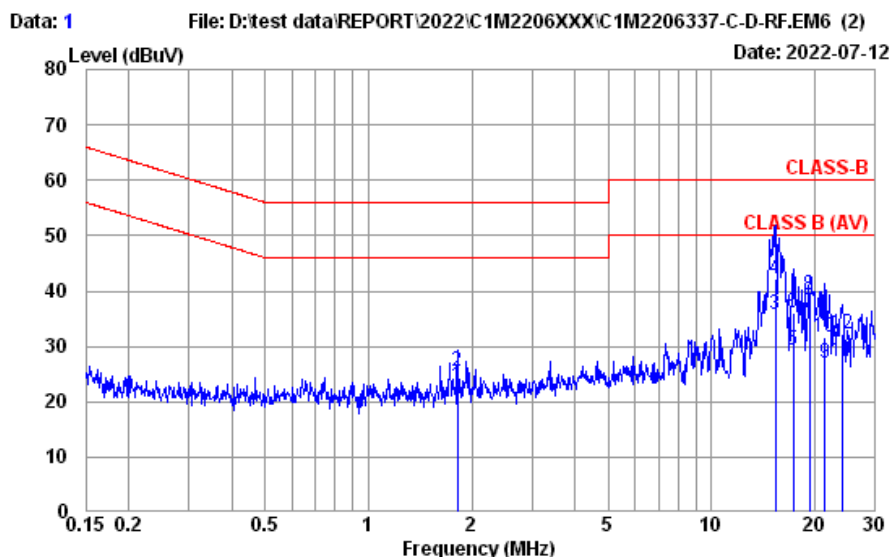
	Freq. (MHz)	AMF Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	1.725	10.36	0.05	9.86	0.19	20.46	46.00	25.54	Average
2	1.725	10.36	0.05	9.86	5.66	25.93	56.00	30.07	QP
3	15.388	10.89	0.17	9.91	18.55	39.52	50.00	10.48	Average
4	15.388	10.89	0.17	9.91	24.67	45.64	60.00	14.36	QP
5	17.291	10.96	0.18	9.92	11.29	32.35	50.00	17.65	Average
6	17.291	10.96	0.18	9.92	17.89	38.95	60.00	21.05	QP
7	19.428	11.03	0.19	9.94	12.45	33.61	50.00	16.39	Average
8	19.428	11.03	0.19	9.94	16.95	38.11	60.00	21.89	QP
9	21.486	11.11	0.20	9.95	13.27	34.53	50.00	15.47	Average
10	21.486	11.11	0.20	9.95	17.08	38.34	60.00	21.66	QP
11	23.888	11.19	0.21	9.96	9.33	30.69	50.00	19.31	Average
12	23.888	11.19	0.21	9.96	13.91	35.27	60.00	24.73	QP

Remarks: 1. Emission Level= AMF Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector,
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

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Test Date	2022/07/12	Temp./Hum.	26°C/58%
Test Voltage	DC 3.3V	Tested By	Ken Yang



Site No. : No.8 Shielded Room Data No. : 1
Instrument 1 : Receiver ESR3(774) RBW:9kHz VBW:300kHz
Instrument 2 : ENH432 (567)(A)|CE-08|ESH3-Z2 (354)
Limit : CLASS-B Phase : LINE
Environment : 26°C / 58% Engineer : Ken Yang
EUT Model : WL1BKR22 Test Rating : DC 3.3V
Test Mode : Operating

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	1.819	10.25	0.06	9.86	2.73	22.90	46.00	23.10	Average
2	1.819	10.25	0.06	9.86	5.35	25.52	56.00	30.48	QP
3	15.388	10.56	0.17	9.91	15.20	35.84	50.00	14.16	Average
4	15.388	10.56	0.17	9.91	21.43	42.07	60.00	17.93	QP
5	17.291	10.59	0.18	9.92	8.62	29.31	50.00	20.69	Average
6	17.291	10.59	0.18	9.92	15.24	35.93	60.00	24.07	QP
7	19.326	10.63	0.19	9.94	15.28	36.04	50.00	13.96	Average
8	19.326	10.63	0.19	9.94	18.51	39.27	60.00	20.73	QP
9	21.373	10.65	0.20	9.95	6.22	27.02	50.00	22.98	Average
10	21.373	10.65	0.20	9.95	10.78	31.58	60.00	28.42	QP
11	24.142	10.68	0.21	9.96	6.32	27.17	50.00	22.83	Average
12	24.142	10.68	0.21	9.96	11.36	32.21	60.00	27.79	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when using a quasi-peak detector,
the EUT shall be deemed to meet both limits and measurement
with average detector is unnecessary.

A.2 RADIATED EMISSION

Test Date	2022/07/12	Temp./Hum.	23°C/60%
Test Voltage	DC 3.3V	Tested By	Hua Wu

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

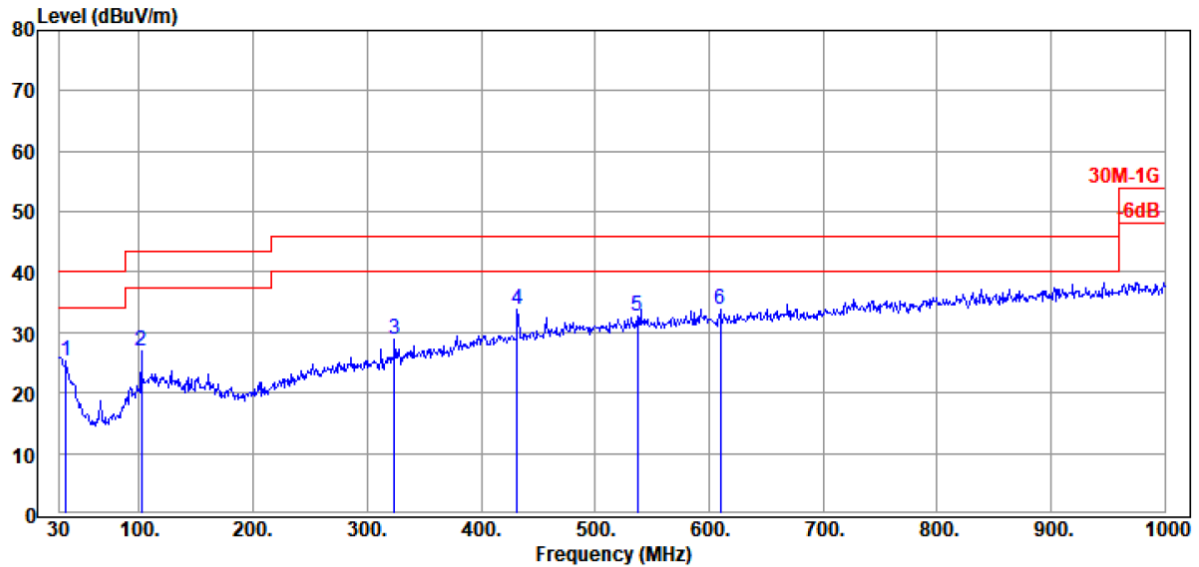
The emissions (9kHz~30MHz) not reported for there is no emission be found.

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A.2.1.2 Frequency Below 1GHz

Mode	GFSK	U-NII Band	1
		Frequency	TX 5195MHz



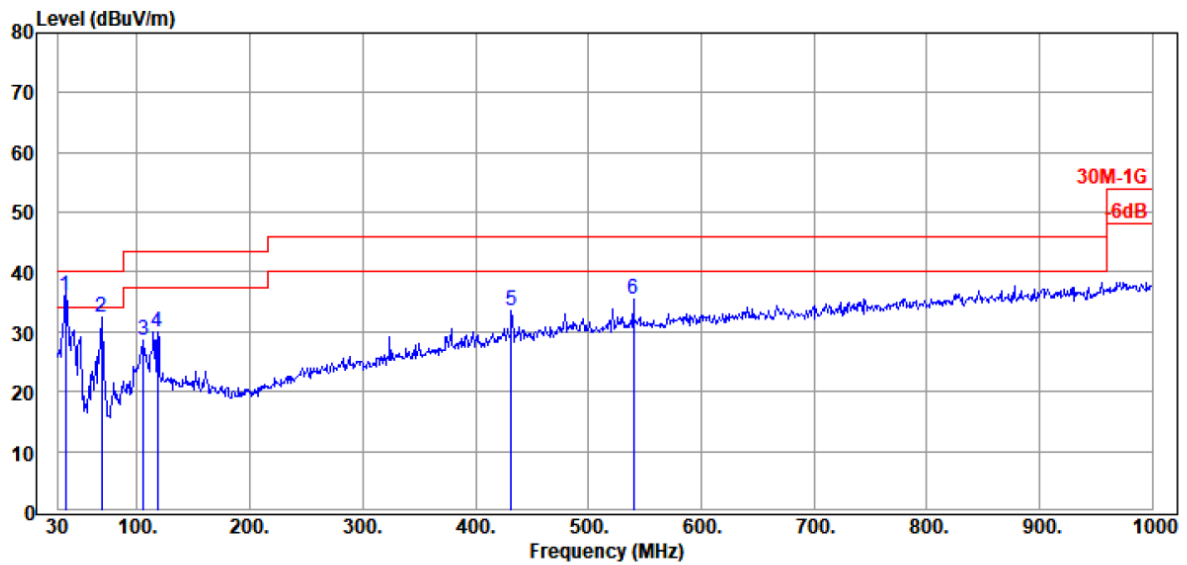
Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010A(071)|RBW 120KHz VBW 1MHz
Instrument 2 : CBL6112D (821)|RE-11|8447D (305)

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
35.82	21.22	1.55	26.48	29.12	25.41	40.00	14.59	Peak
101.78	16.65	2.63	26.28	33.83	26.83	43.50	16.67	Peak
323.91	19.70	5.02	25.82	30.04	28.94	46.00	17.06	Peak
431.58	21.97	6.21	26.68	32.28	33.78	46.00	12.22	Peak
537.31	23.59	6.90	27.24	29.35	32.60	46.00	13.40	Peak
610.06	24.35	7.16	27.40	29.71	33.82	46.00	12.18	Peak

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Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010A(071)|RBW 120KHz VBW 1MHz
Instrument 2 : CBL6112D (821)|RE-11|8447D (305)

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
36.79	20.71	1.57	26.48	40.35	36.15	40.00	3.85	Peak
68.80	12.16	2.15	26.38	44.45	32.38	40.00	7.62	Peak
105.66	16.96	2.68	26.25	35.20	28.59	43.50	14.91	Peak
118.27	17.87	2.83	26.17	35.52	30.05	43.50	13.45	Peak
431.58	21.97	6.21	26.68	32.11	33.61	46.00	12.39	Peak
540.22	23.61	6.90	27.24	32.17	35.44	46.00	10.56	Peak

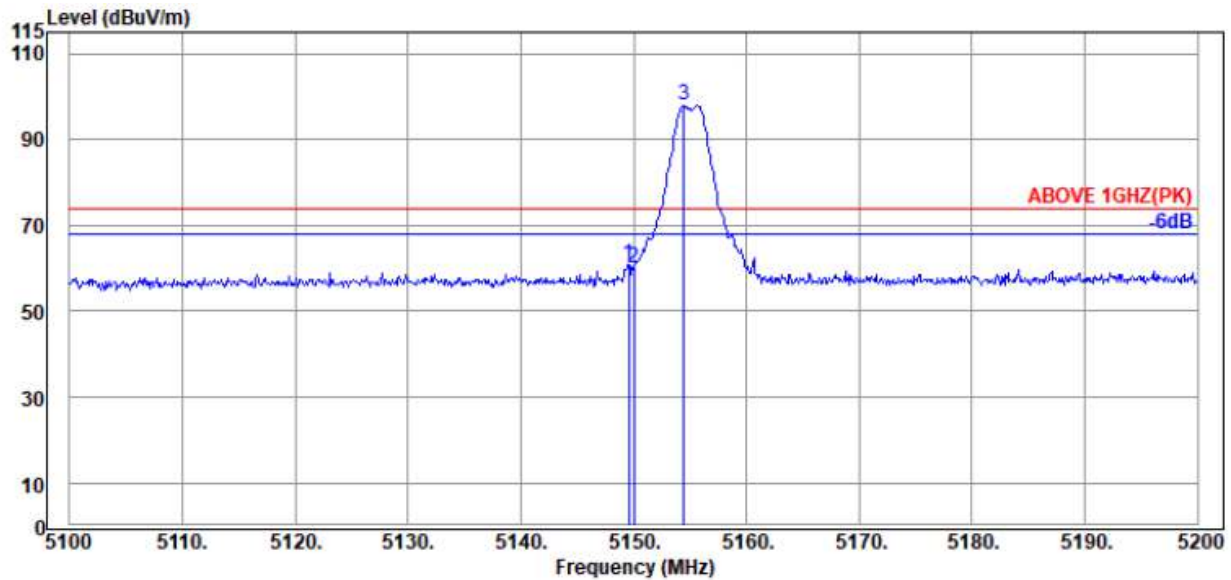
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A.2.1.3 Frequency Above 1 GHz to 10th harmonics

Band Edge:

Mode	GFSK	U-NII Band	1
		Frequency	TX 5155MHz



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9030A(269)|PK RBW 1MHz VBW 3MHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)

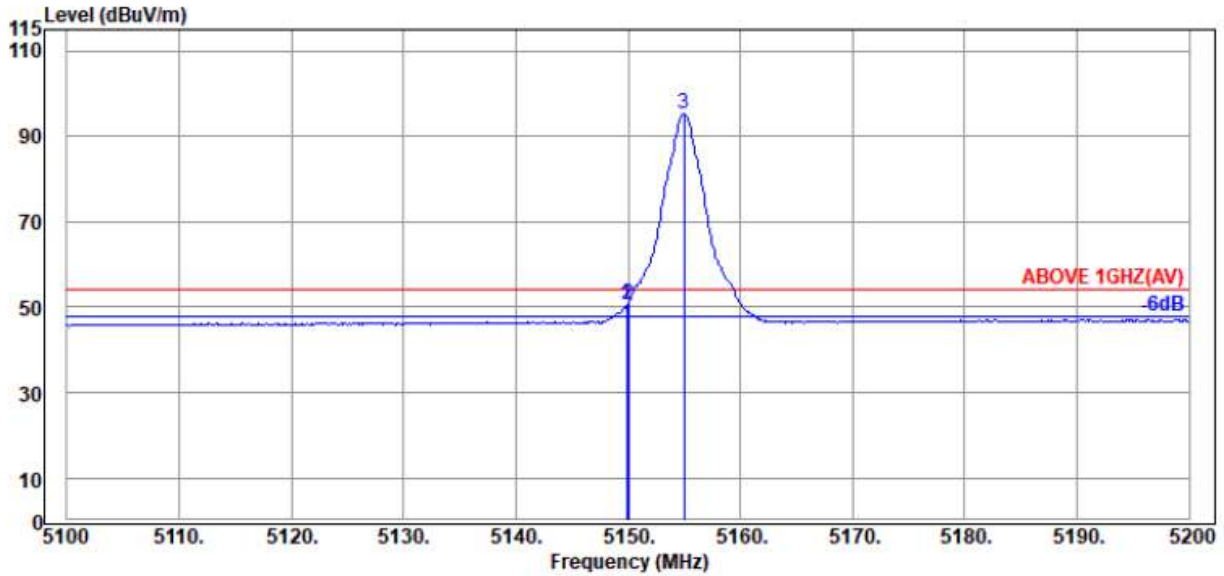
Antenna at Horizontal Polarization

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	34.50	11.20	34.34	49.68	61.04	74.00	12.96	Peak
5150.000	34.50	11.20	34.34	48.85	60.21	74.00	13.79	Peak
@ 5154.500	34.50	11.21	34.34	86.47	97.84	---	---	Peak

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

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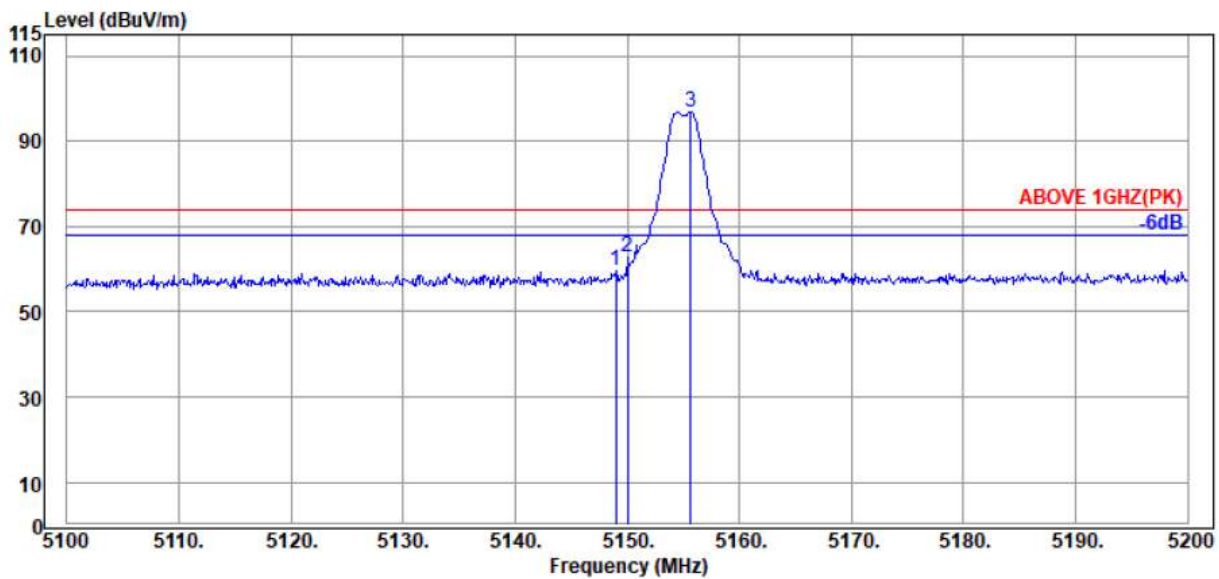
Condition : 3m **Ant.Pol.** : HORIZONTAL
Instrument 1 : Spectrum N9030A(269)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)

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
5149.900	34.50	11.20	34.34	39.18	50.54	54.00	3.46	Average
5150.000	34.50	11.20	34.34	39.41	50.77	54.00	3.23	Average
@ 5155.000	34.50	11.21	34.34	83.82	95.19	---	---	Average

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

Mode	GFSK	U-NII Band	1
		Frequency	TX 5155MHz



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9030A(269)|PK RBW 1MHz VBW 3MHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)

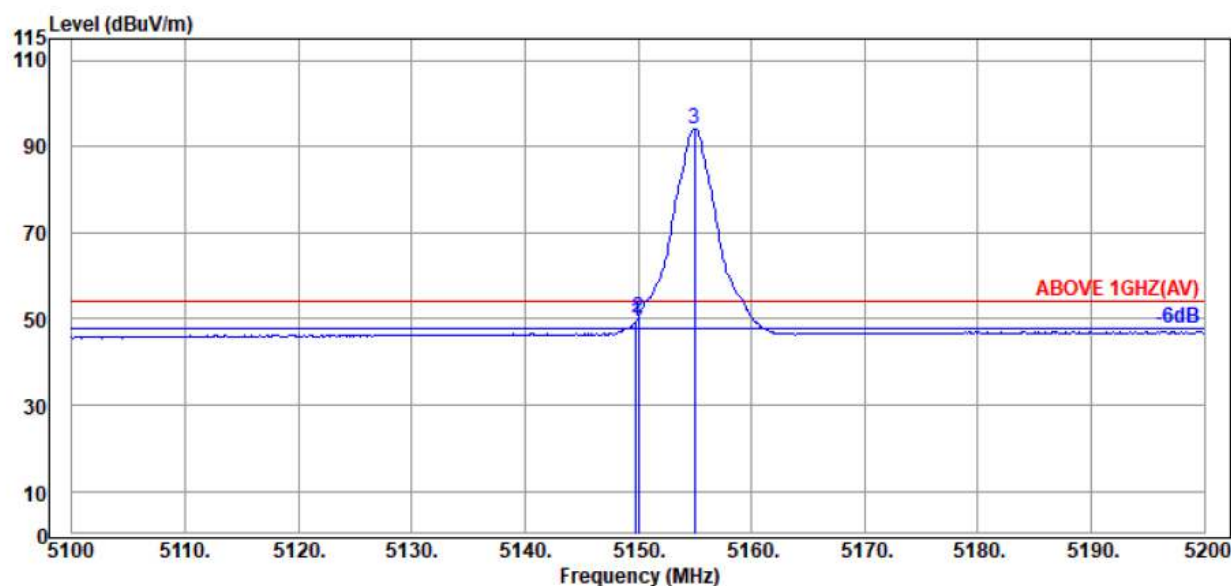
Antenna at Vertical Polarization

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
5149.000	34.50	11.20	34.34	48.25	59.61	74.00	14.39	Peak
5150.000	34.50	11.20	34.34	51.62	62.98	74.00	11.02	Peak
@ 5155.700	34.50	11.21	34.34	85.43	96.80	---	---	Peak

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

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Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9030A(269)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)

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
5149.800	34.50	11.20	34.34	38.18	49.54	54.00	4.46	Average
5150.000	34.50	11.20	34.34	38.86	50.22	54.00	3.78	Average
@ 5155.000	34.50	11.21	34.34	82.84	94.21	---	---	Average

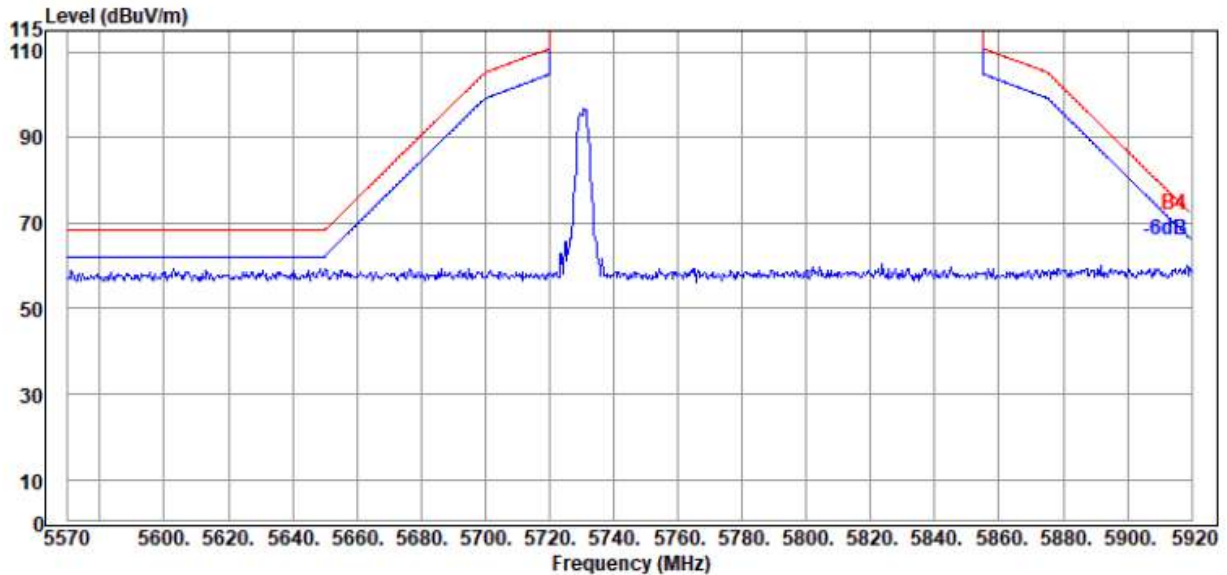
Remark: The “@” means fundamental frequency, it is ignored in this section.

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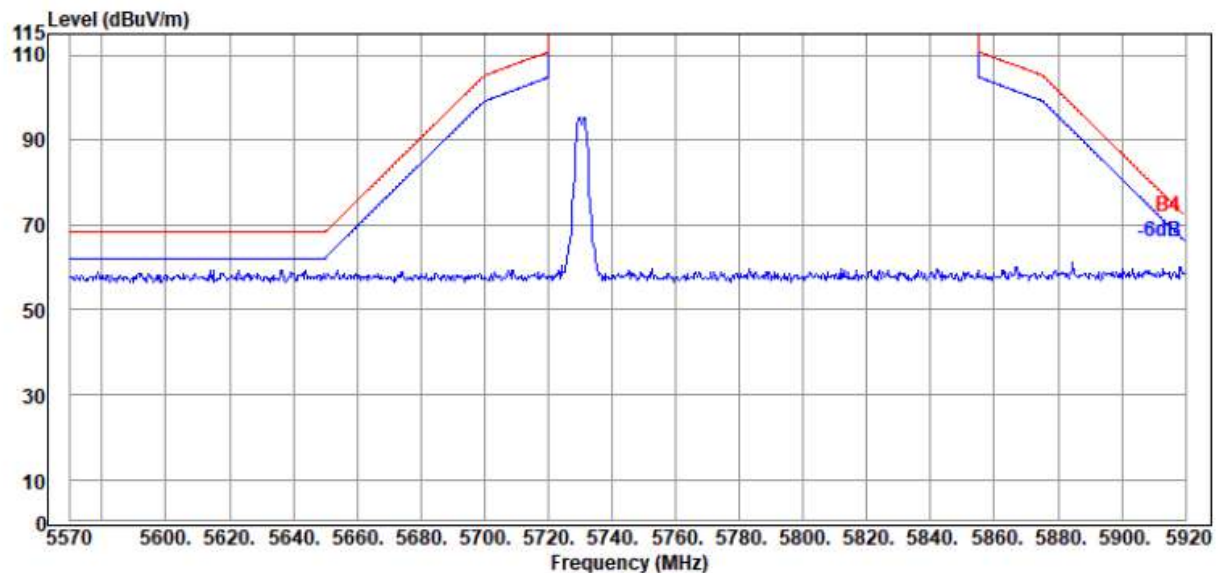
Mode	GFSK	U-NII Band	3
		Frequency	TX 5730MHz

Antenna at Horizontal Polarization



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9030A(269) | PK RBW 1MHz VBW 3MHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)

Antenna at Vertical Polarization



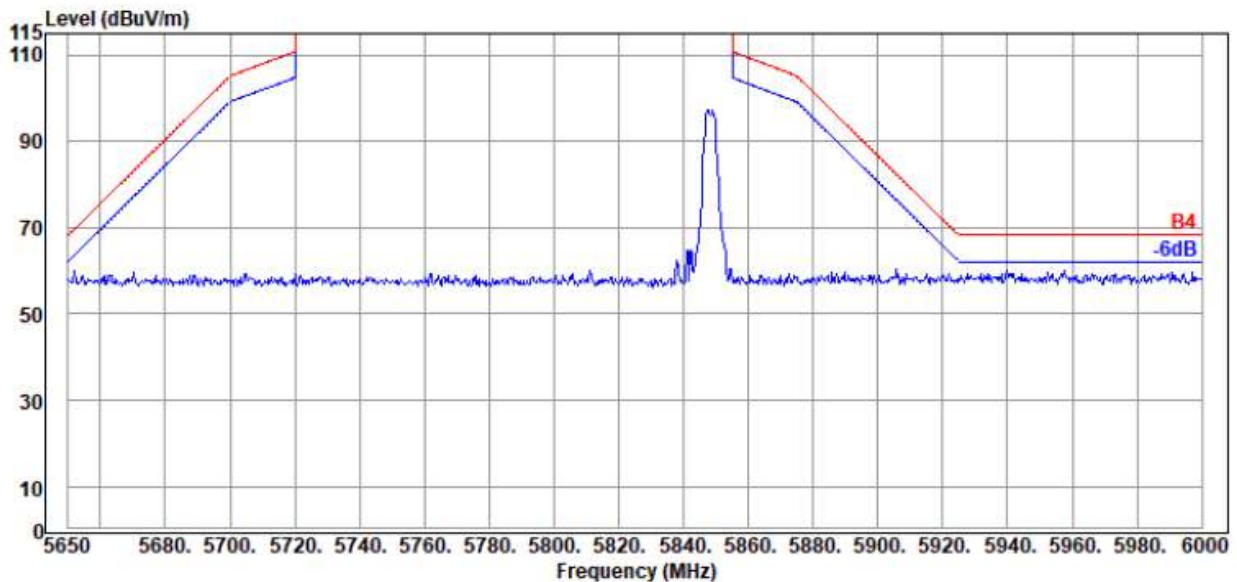
Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9030A(269) | PK RBW 1MHz VBW 3MHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)

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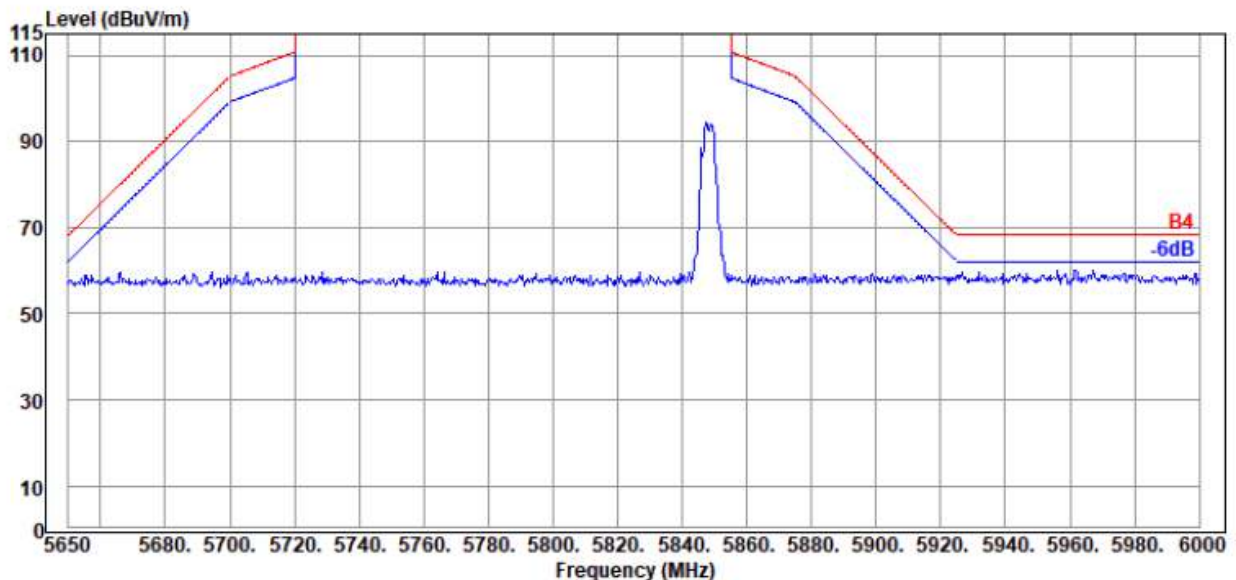
Mode	GFSK	U-NII Band	3
		Frequency	TX 5848MHz

Antenna at Horizontal Polarization



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9030A(269) | PK RBW 1MHz VBW 3MHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)

Antenna at Vertical Polarization



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9030A(269) | PK RBW 1MHz VBW 3MHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)

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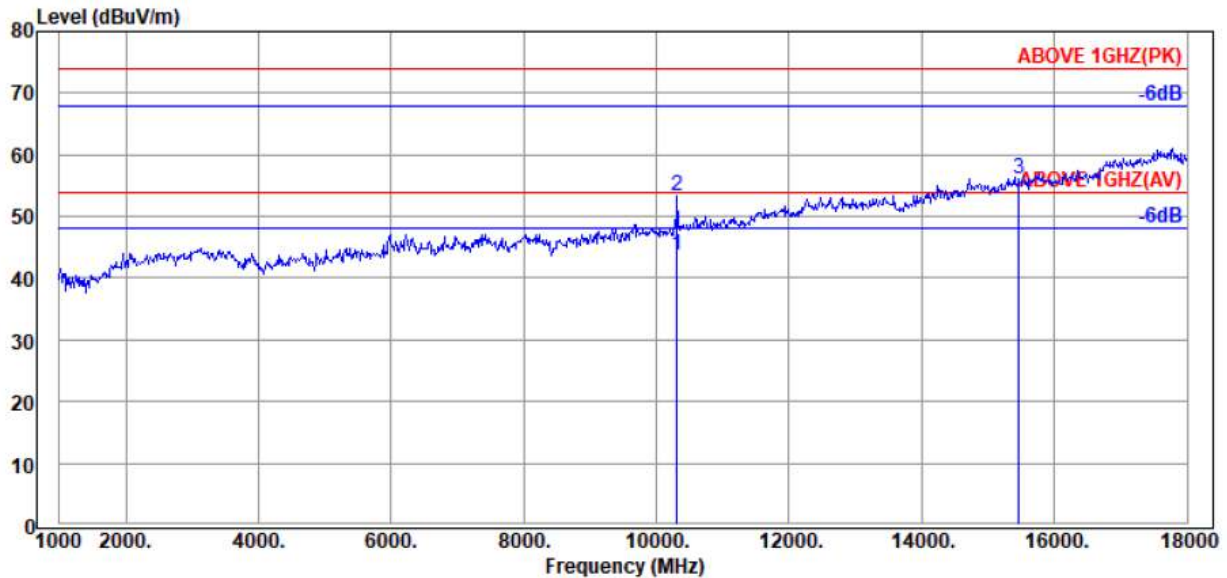
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A.2.2 Emissions outside the frequency band

The emissions (18GHz to 40GHz) not reported for there is no emission be found. And we preset worst investigated frequency spectrum segment in the report.

Mode	GFSK	U-NII Band	1
		Frequency	TX 5155MHz

Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

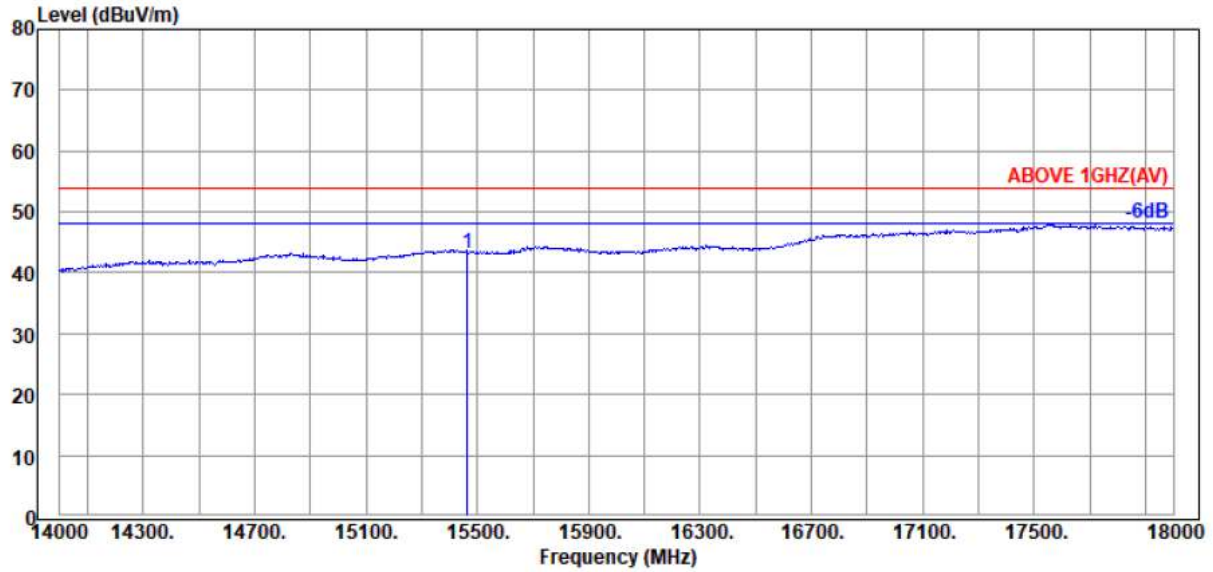
Antenna at Horizontal Polarization

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
10310.000	37.60	14.92	34.82	26.12	43.82	54.00	10.18	Average
10310.000	37.60	14.92	34.82	35.70	53.40	74.00	20.60	Peak
15465.000	40.15	17.69	34.57	32.74	56.01	74.00	17.99	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

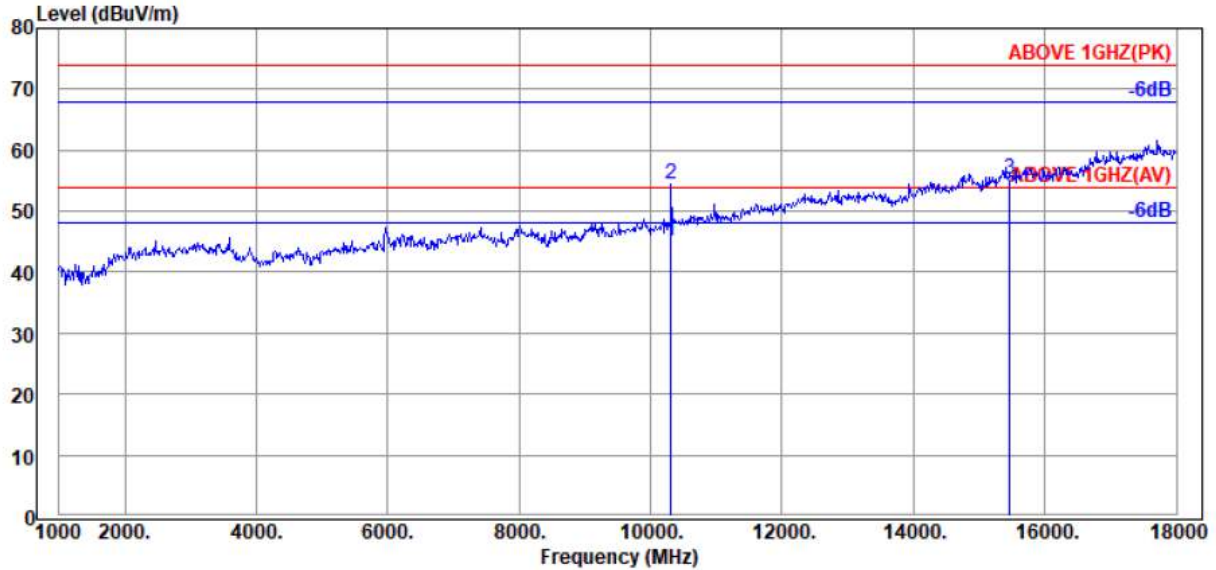
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
15465.000	40.15	17.69	34.57	19.95	43.22	54.00	10.78	Average

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Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

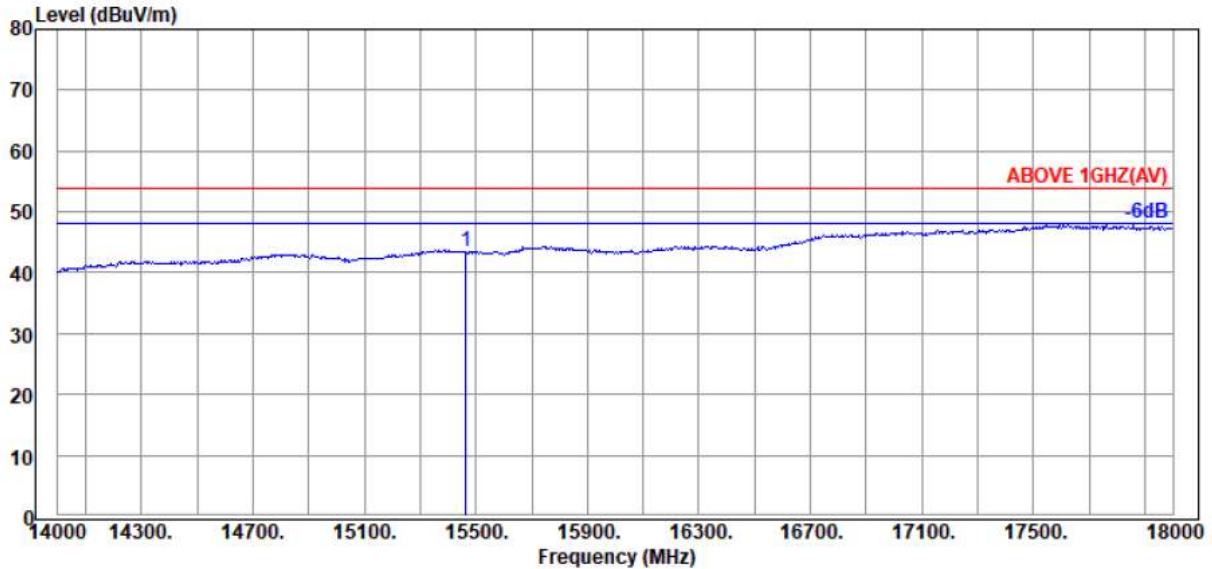
Antenna at Vertical Polarization

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
10310.000	37.60	14.92	34.82	27.39	45.09	54.00	8.91	Average
10310.000	37.60	14.92	34.82	36.87	54.57	74.00	19.43	Peak
15465.000	40.15	17.69	34.57	31.99	55.26	74.00	18.74	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

Antenna at Vertical Polarization

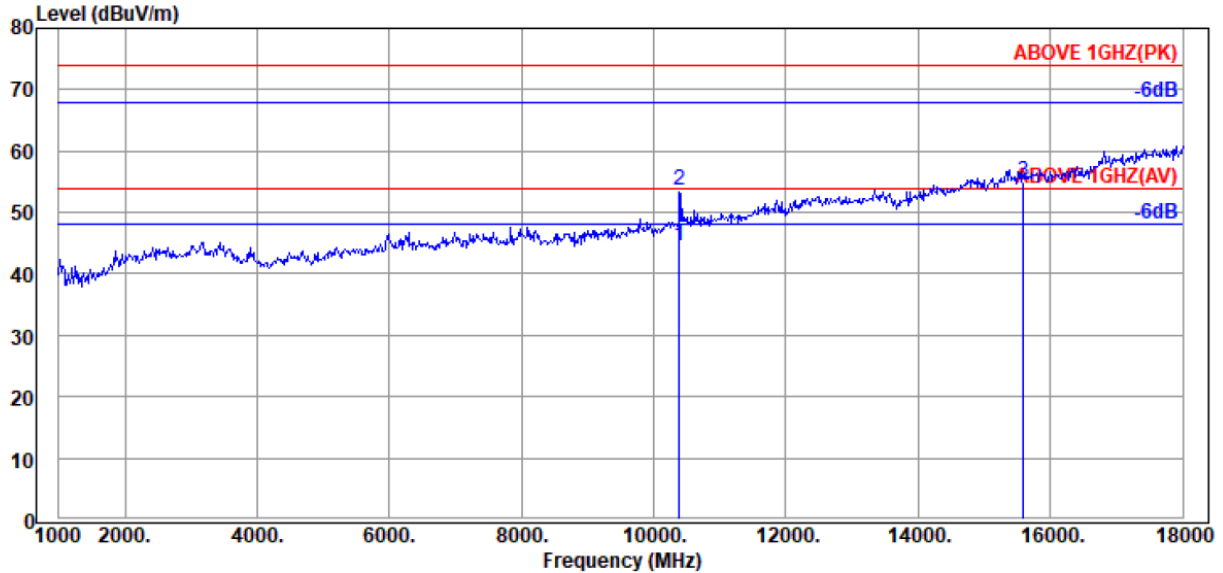
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
15465.000	40.15	17.69	34.57	20.05	43.32	54.00	10.68	Average

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Mode	GFSK	U-NII Band	1
		Frequency	TX 5195MHz

Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

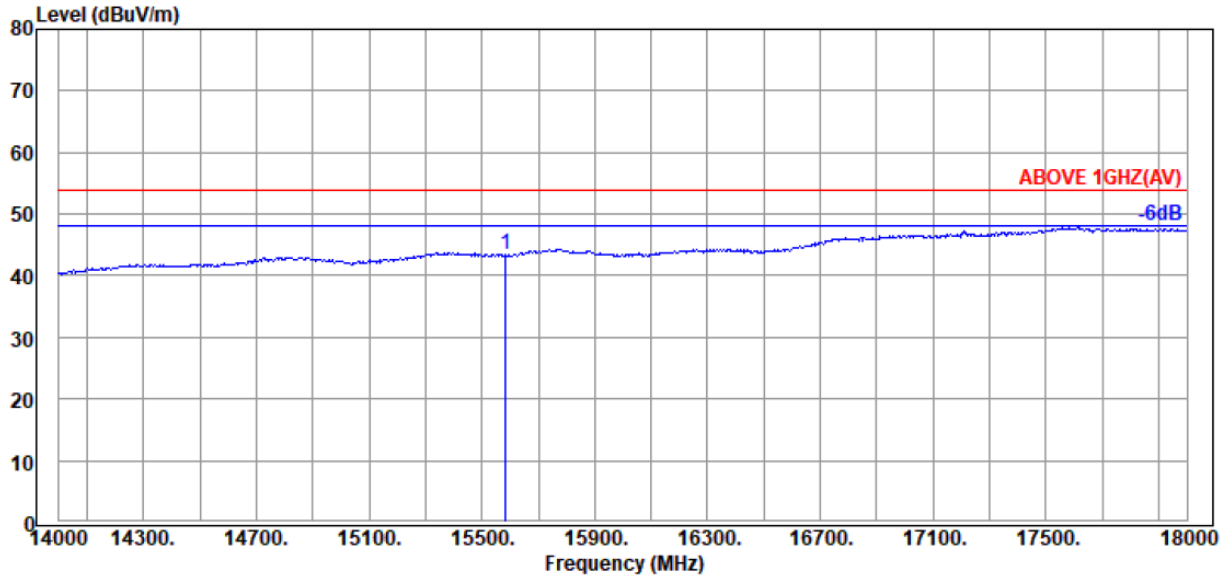
Antenna at Horizontal Polarization

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
10390.000	37.60	14.95	34.76	26.81	44.60	54.00	9.40	Average
10390.000	37.60	14.95	34.76	35.77	53.56	74.00	20.44	Peak
15585.000	40.30	17.77	34.60	31.58	55.05	74.00	18.95	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198) | AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)
Instrument 3 : AH-840 (092) | RE-30 | 83051A (042)

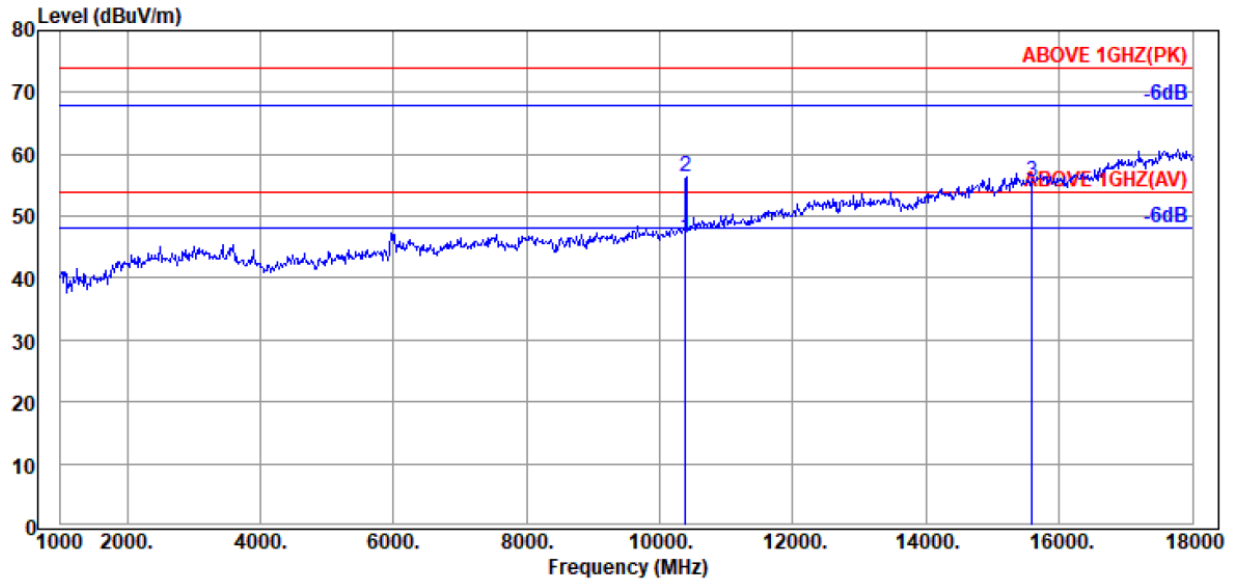
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
15585.000	40.30	17.77	34.60	19.92	43.39	54.00	10.61	Average

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Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

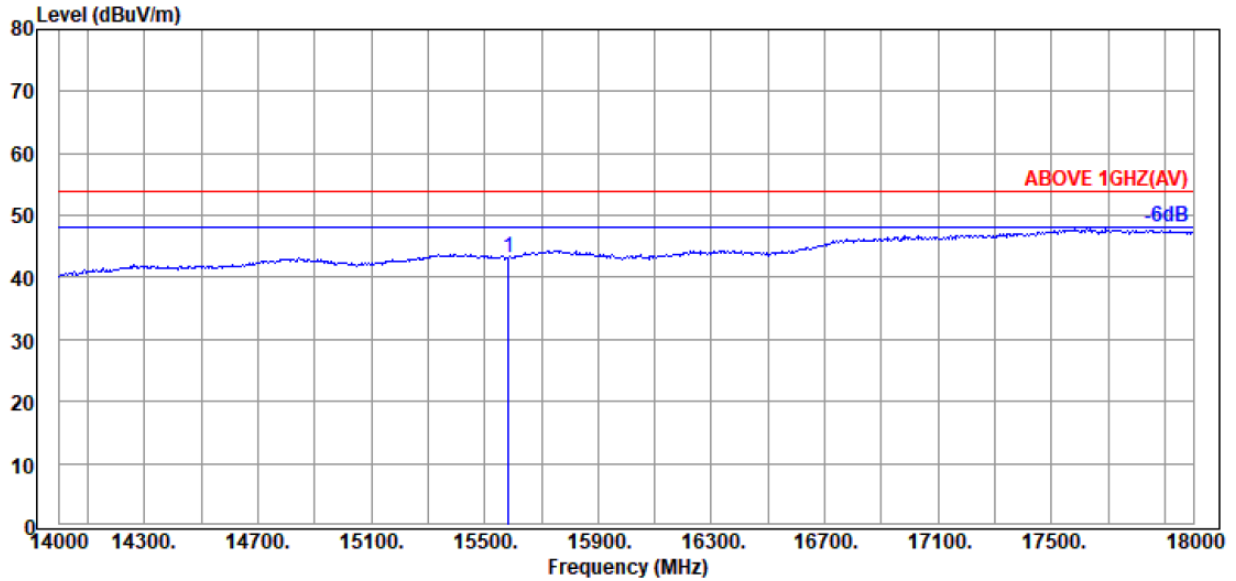
Antenna at Vertical Polarization

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
10390.000	37.60	14.95	34.76	28.64	46.43	54.00	7.57	Average
10390.000	37.60	14.95	34.76	38.52	56.31	74.00	17.69	Peak
15585.000	40.30	17.77	34.60	31.97	55.44	74.00	18.56	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198) | AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)
Instrument 3 : AH-840 (092) | RE-30 | 83051A (042)

Antenna at Vertical Polarization

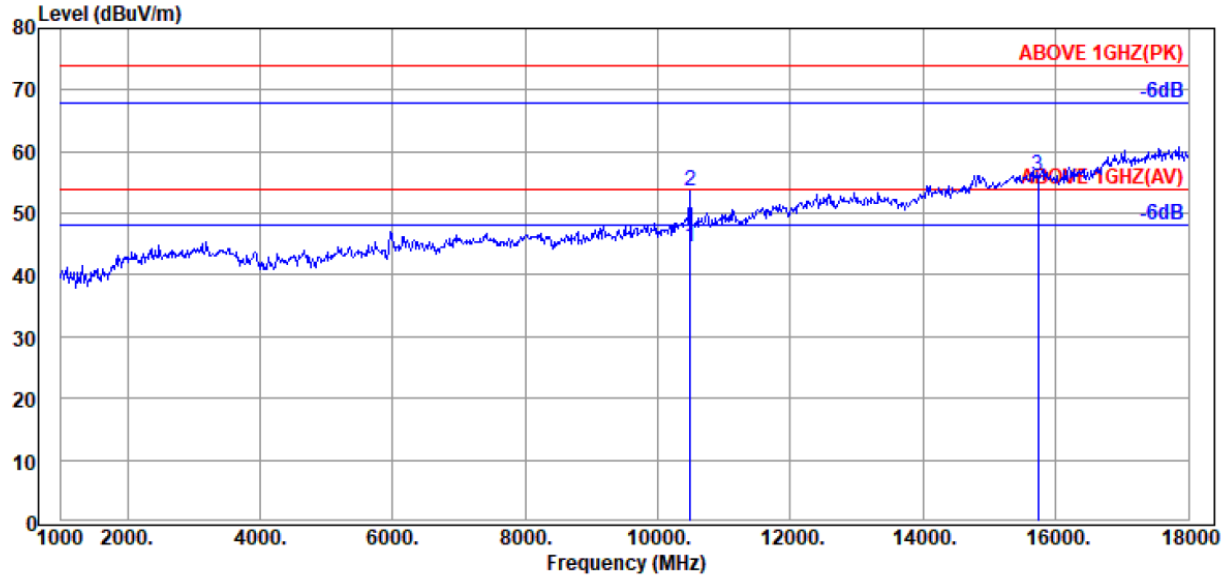
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
15585.000	40.30	17.77	34.60	19.80	43.27	54.00	10.73	Average

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Mode	GFSK	U-NII Band	1
		Frequency	TX 5245MHz

Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

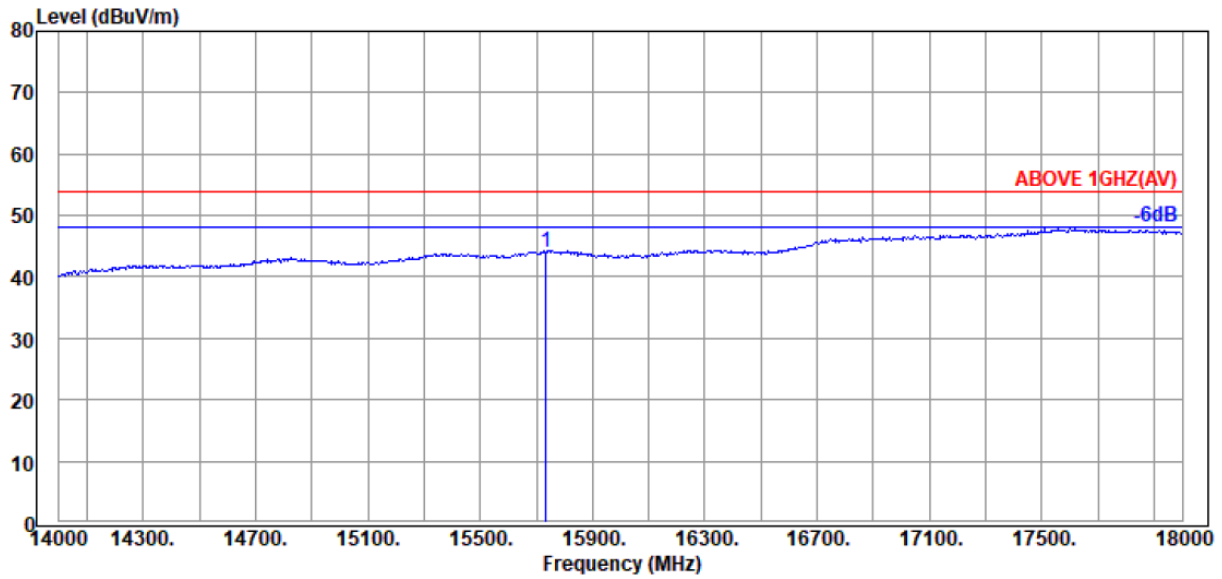
Antenna at Horizontal Polarization

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
10490.000	37.75	15.02	34.67	26.51	44.61	54.00	9.39	Average
10490.000	37.75	15.02	34.67	35.59	53.69	74.00	20.31	Peak
15735.000	40.60	17.91	34.63	32.09	55.97	74.00	18.03	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

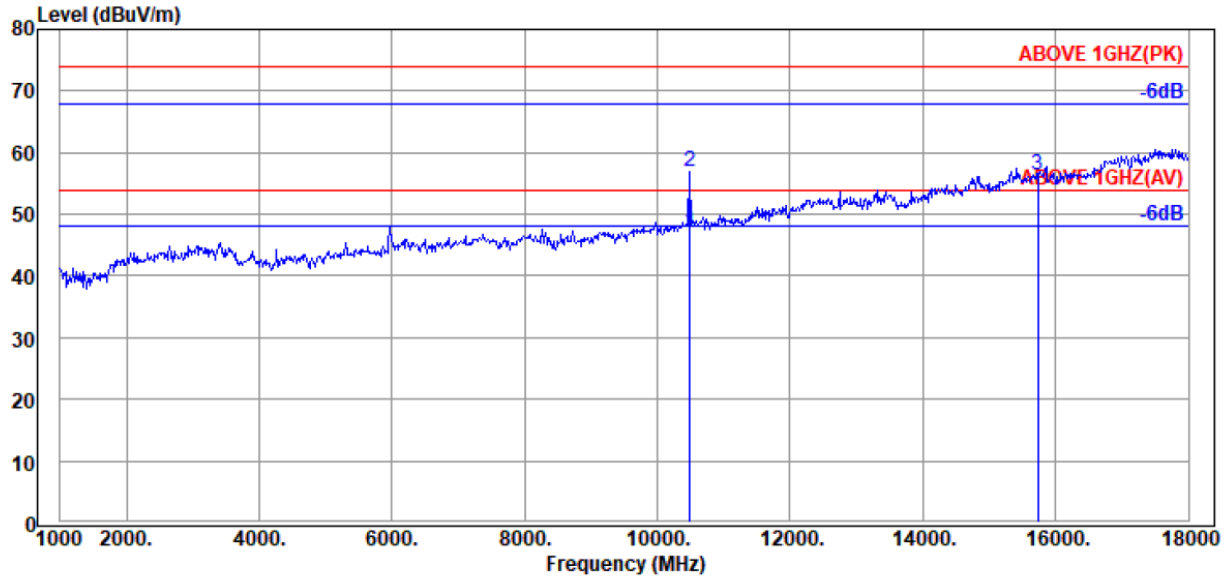
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
15735.000	40.70	17.91	34.63	20.05	44.03	54.00	9.97	Average

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Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

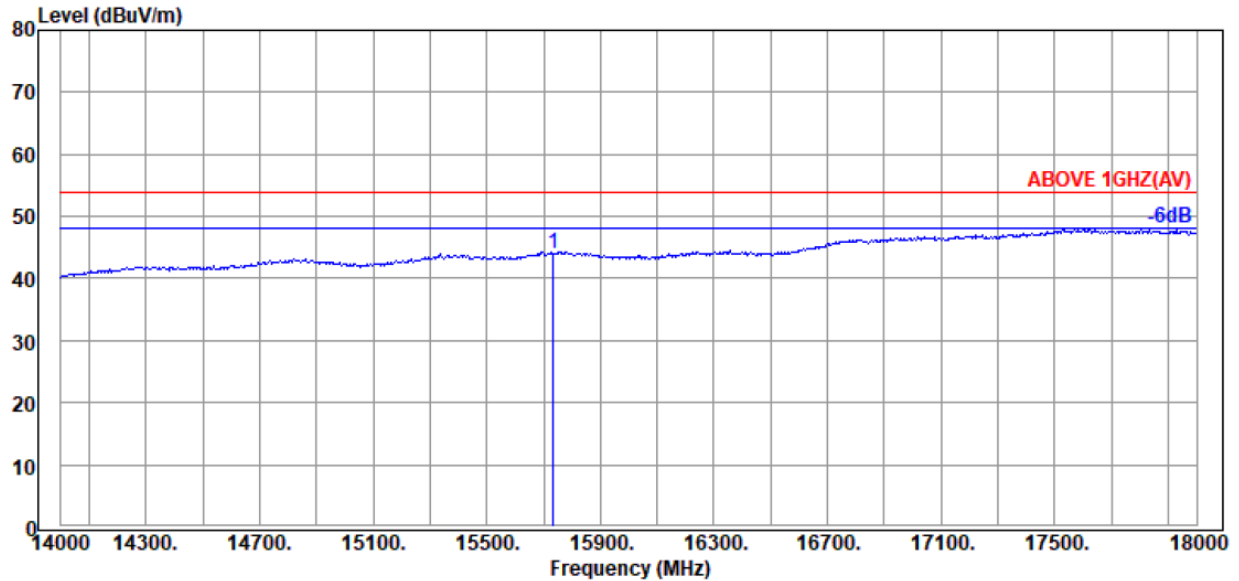
Antenna at Vertical Polarization

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
10490.000	37.75	15.02	34.67	28.91	47.01	54.00	6.99	Average
10490.000	37.75	15.02	34.67	38.83	56.93	74.00	17.07	Peak
15735.000	40.60	17.91	34.63	32.48	56.36	74.00	17.64	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198) | AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)
Instrument 3 : AH-840 (092) | RE-30 | 83051A (042)

Antenna at Vertical Polarization

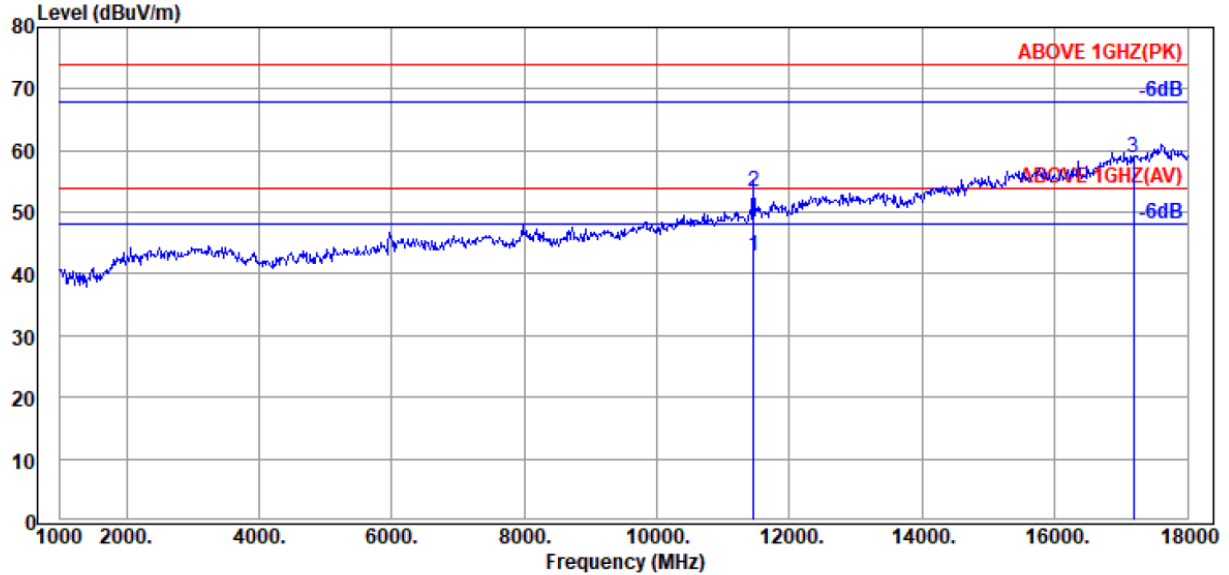
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
15735.000	40.70	17.91	34.63	20.06	44.04	54.00	9.96	Average

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Mode	GFSK	U-NII Band	3
		Frequency	TX 5730MHz

Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

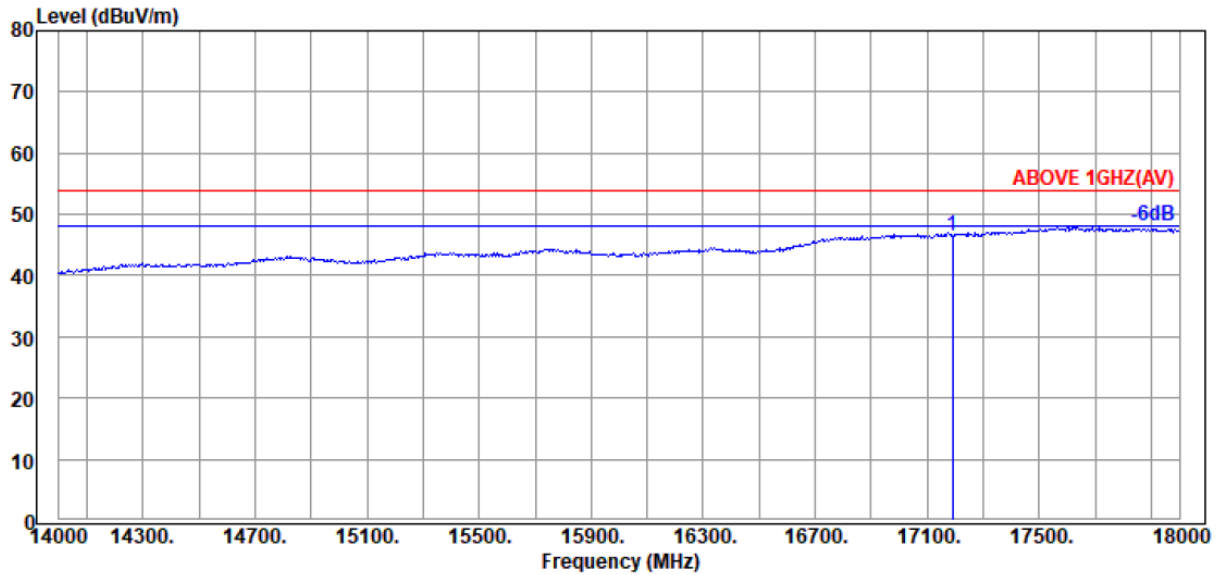
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11460.000	38.43	15.67	34.52	23.18	42.76	54.00	11.24	Average
11460.000	38.43	15.67	34.52	33.77	53.35	74.00	20.65	Peak
17190.000	41.30	18.77	33.69	32.46	58.84	74.00	15.16	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198) | AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)
Instrument 3 : AH-840 (092) | RE-30 | 83051A (042)

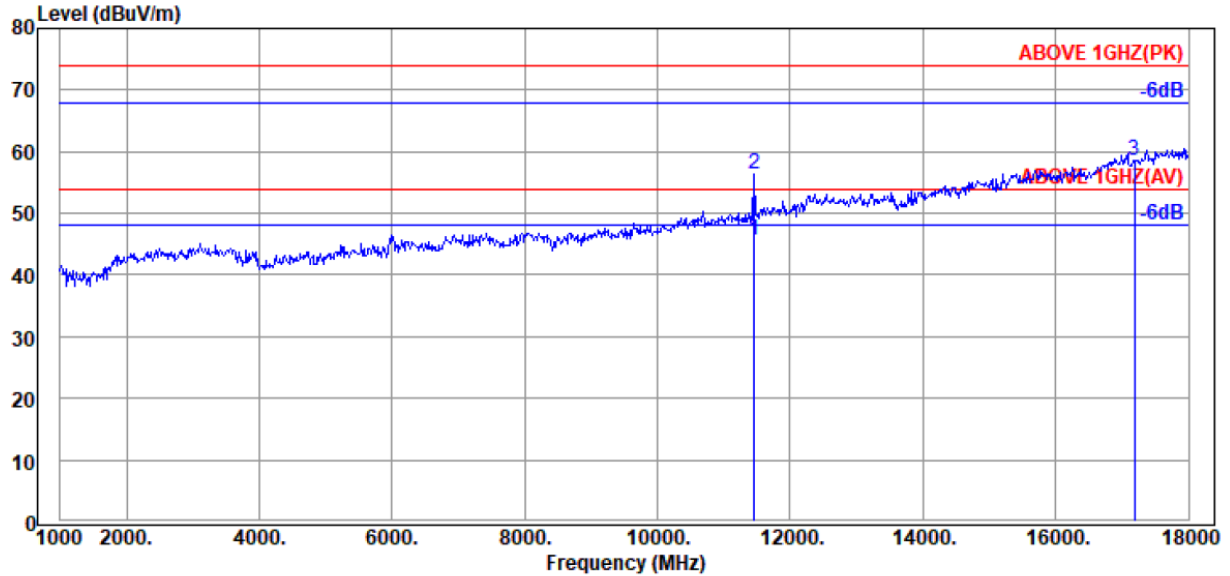
Antenna at Horizontal Polarization

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
17190.000	41.30	18.77	33.69	20.13	46.51	54.00	7.49	Average

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Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

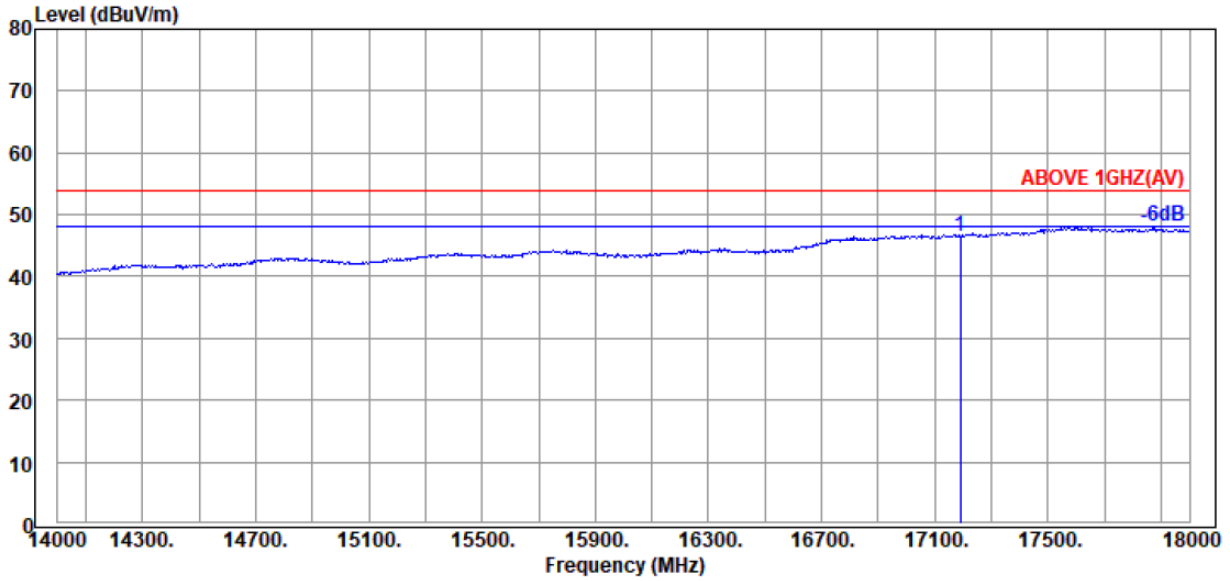
Antenna at Vertical Polarization

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
11460.000	38.43	15.67	34.52	26.14	45.72	54.00	8.28	Average
11460.000	38.43	15.67	34.52	36.88	56.46	74.00	17.54	Peak
17190.000	41.30	18.77	33.69	32.11	58.49	74.00	15.51	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

Antenna at Vertical Polarization

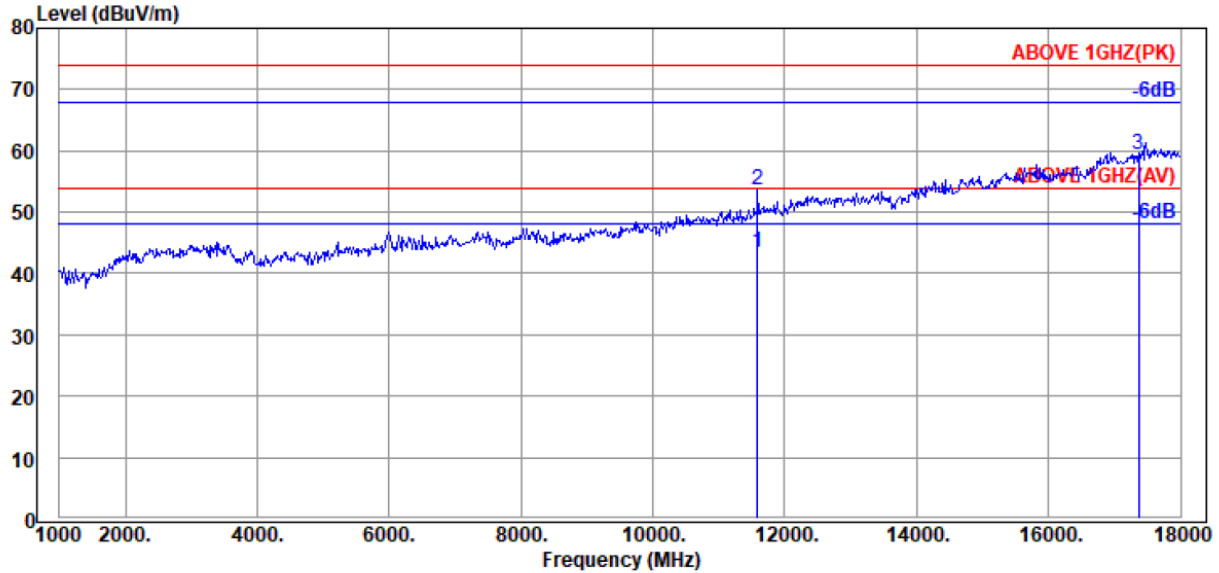
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
17190.000	41.30	18.77	33.69	20.06	46.44	54.00	7.56	Average

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Mode	GFSK	U-NII Band	3
		Frequency	TX 5790MHz

Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

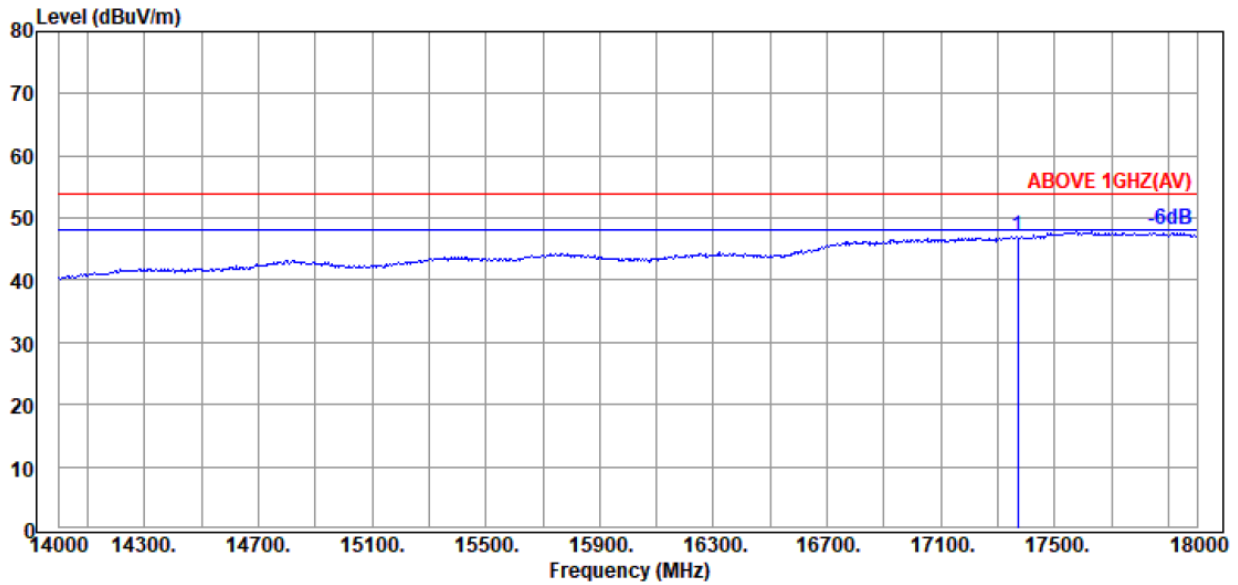
Antenna at Horizontal Polarization

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
11580.000	38.43	15.82	34.54	23.72	43.43	54.00	10.57	Average
11580.000	38.43	15.82	34.54	33.94	53.65	74.00	20.35	Peak
17370.000	41.10	18.86	33.64	33.02	59.34	74.00	14.66	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

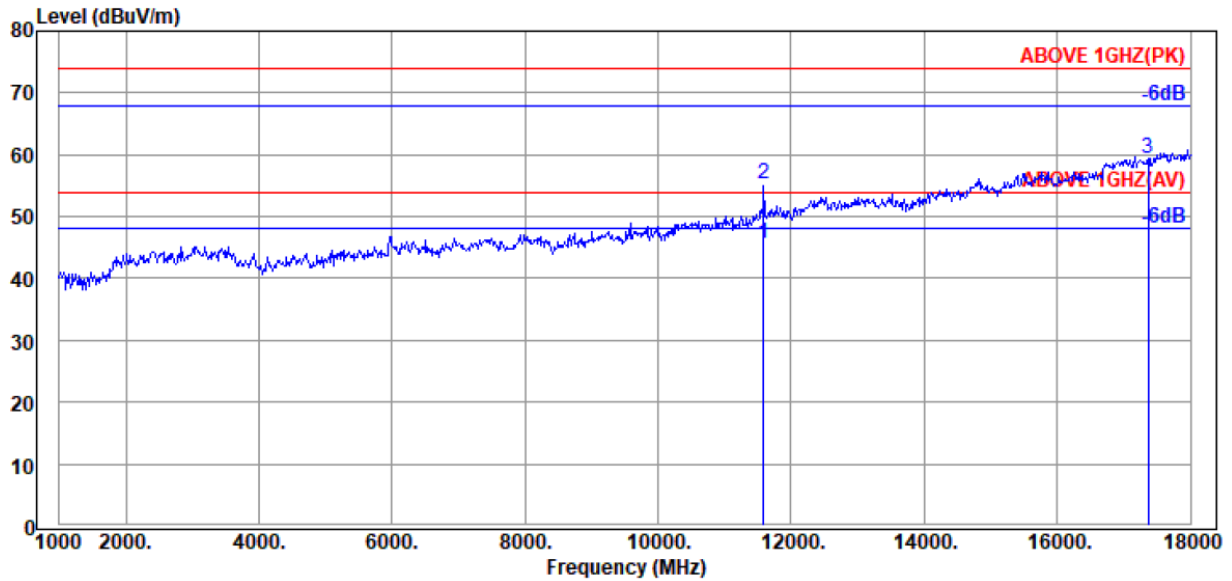
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
17370.000	41.10	18.86	33.64	20.75	47.07	54.00	6.93	Average

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Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

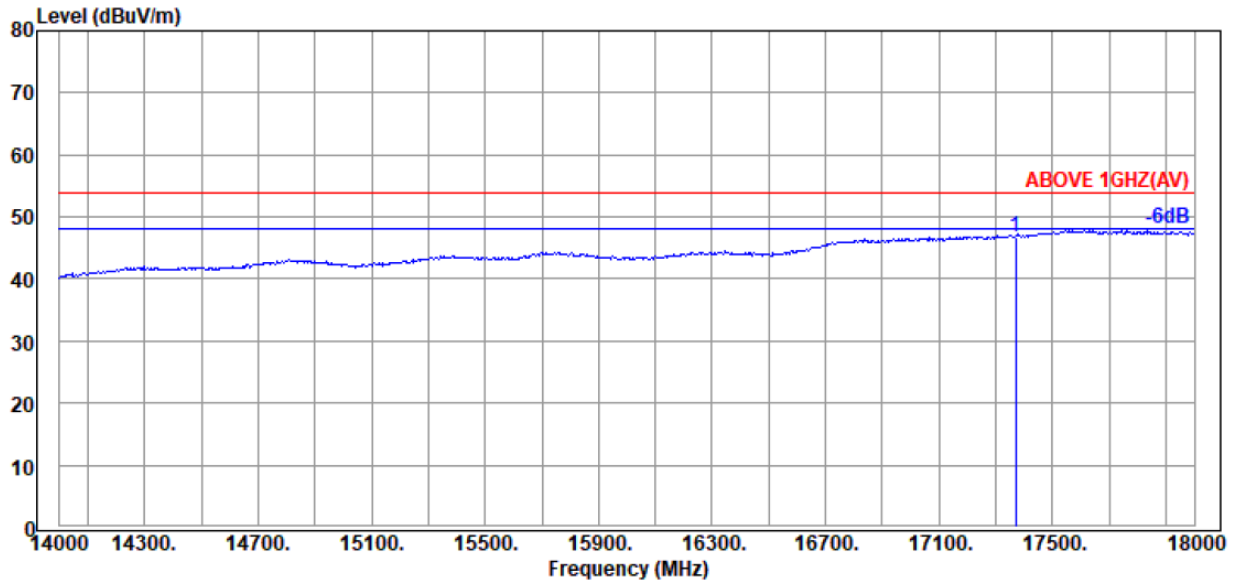
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11580.000	38.43	15.82	34.54	25.83	45.54	54.00	8.46	Average
11580.000	38.43	15.82	34.54	35.66	55.37	74.00	18.63	Peak
17370.000	41.10	18.86	33.64	32.94	59.26	74.00	14.74	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m **Ant.Pol.** : VERTICAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

Antenna at Vertical Polarization

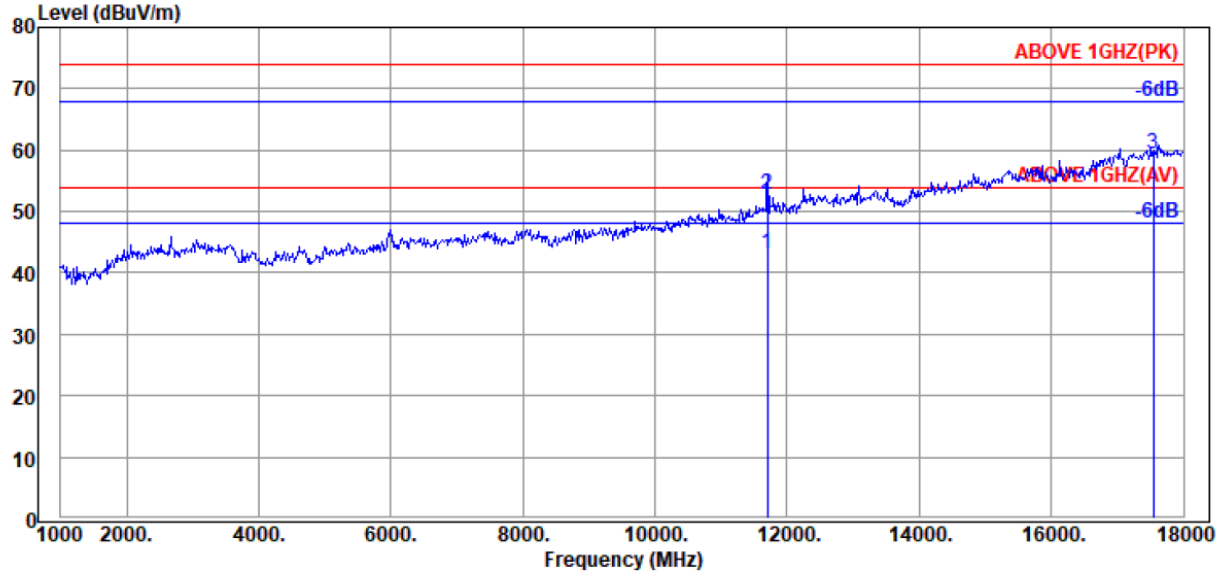
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
17370.000	41.10	18.86	33.64	20.51	46.83	54.00	7.17	Average

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Mode	GFSK	U-NII Band	3
		Frequency	TX 5848MHz

Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

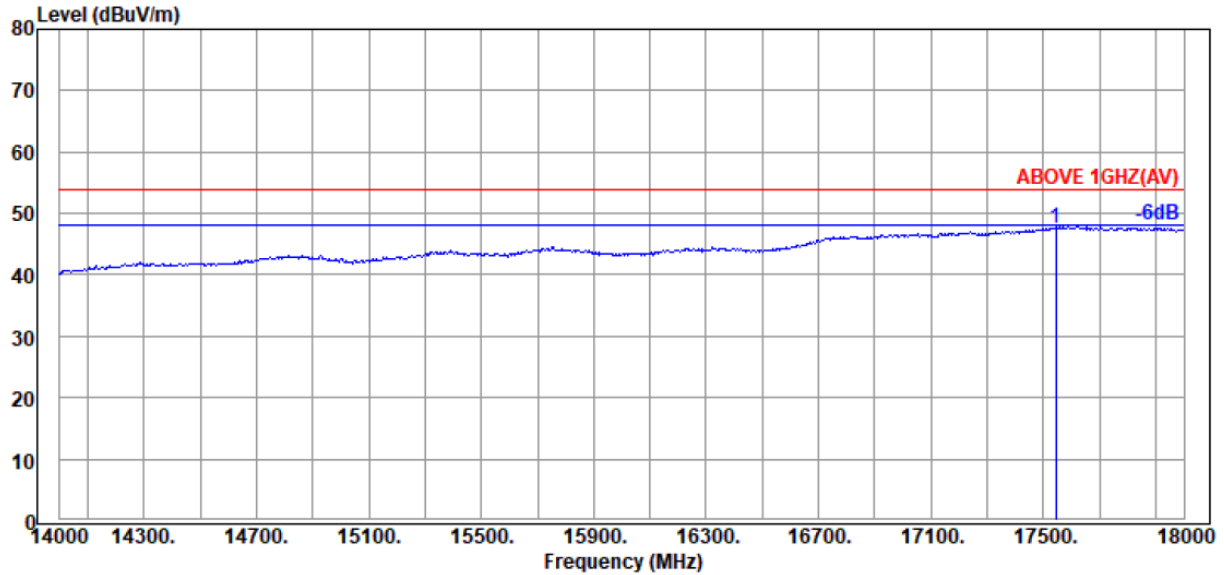
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
11696.000	38.50	15.97	34.57	23.23	43.13	54.00	10.87	Average
11696.000	38.50	15.97	34.57	33.00	52.90	74.00	21.10	Peak
17544.000	41.20	19.04	33.60	32.78	59.42	74.00	14.58	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : HORIZONTAL
Instrument 1 : Spectrum N9010B(198) | AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902) | RE-29 | 8449B (678)
Instrument 3 : AH-840 (092) | RE-30 | 83051A (042)

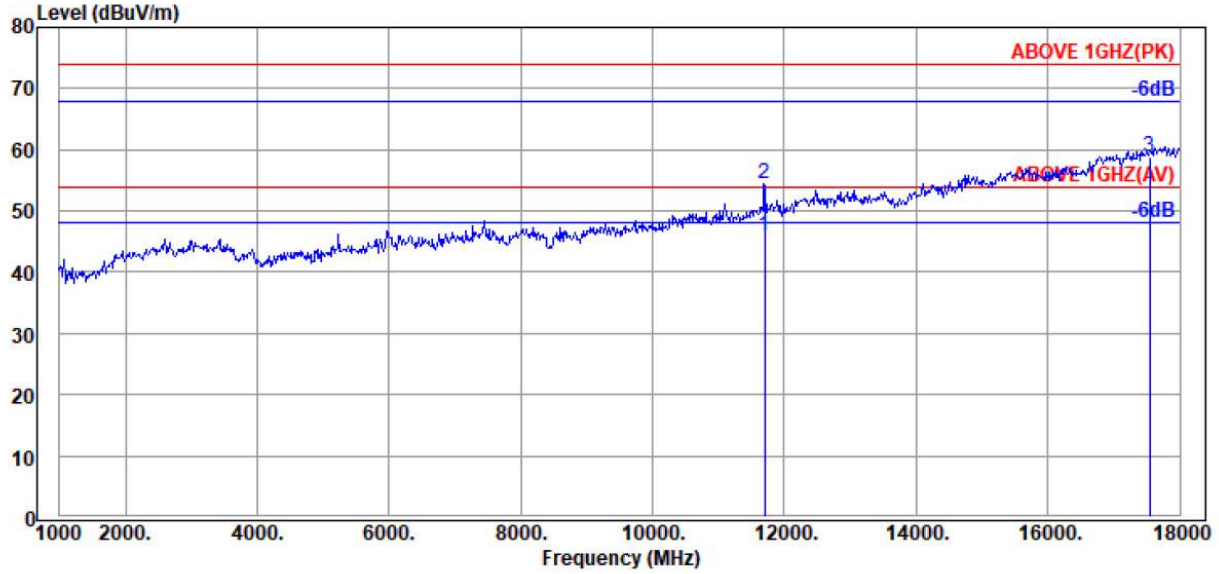
Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
17544.000	41.20	19.04	33.60	20.92	47.56	54.00	6.44	Average

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Identify 1 – 18 GHz spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|PK RBW 1MHz VBW 3MHz|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

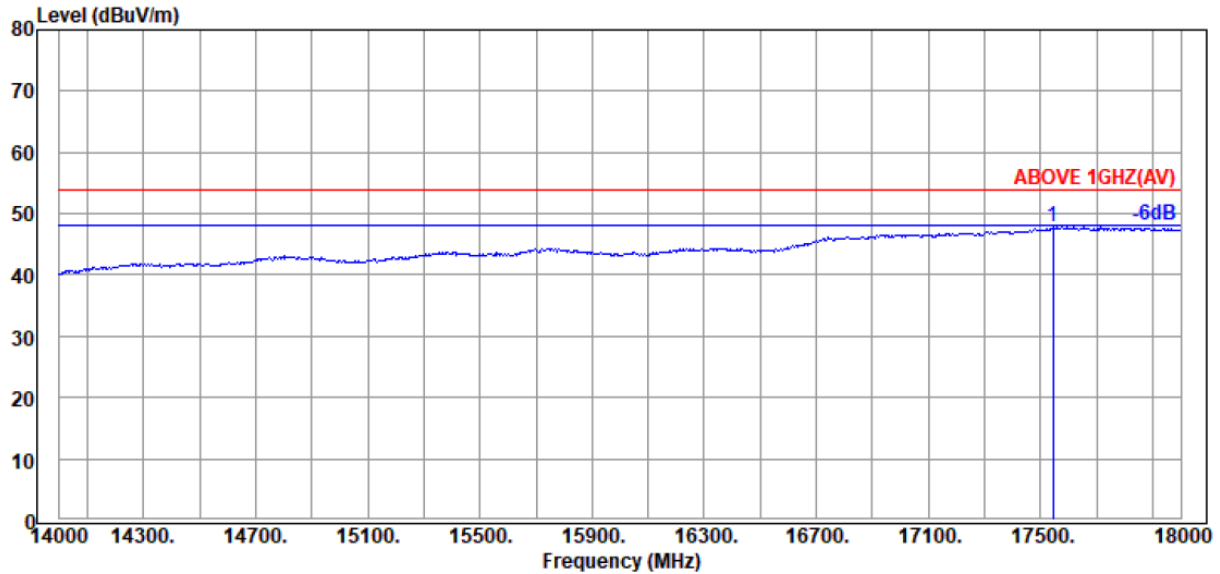
Antenna at Vertical Polarization

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
11696.000	38.50	15.97	34.57	25.98	45.88	54.00	8.12	Average
11696.000	38.50	15.97	34.57	34.47	54.37	74.00	19.63	Peak
17544.000	41.20	19.04	33.60	32.30	58.94	74.00	15.06	Peak

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Identify 14 – 18 GHz average spurious emissions:



Condition : 3m Ant.Pol. : VERTICAL
Instrument 1 : Spectrum N9010B(198)|AV RBW 1MHz VBW 1KHz
Instrument 2 : 3117 (902)|RE-29|8449B (678)
Instrument 3 : AH-840 (092)|RE-30|83051A (042)

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
17544.000	41.20	19.04	33.60	21.07	47.71	54.00	6.29	Average

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 general radiated emissions limits is not required.

A.3 EMISSION/OCCUPIED BANDWIDTH

Test Date	2022/07/11	Temp./Hum.	26°C/41%
Cable Loss	0.20dB	Test Voltage	DC 3.3V
		Tested By	Hua Wu

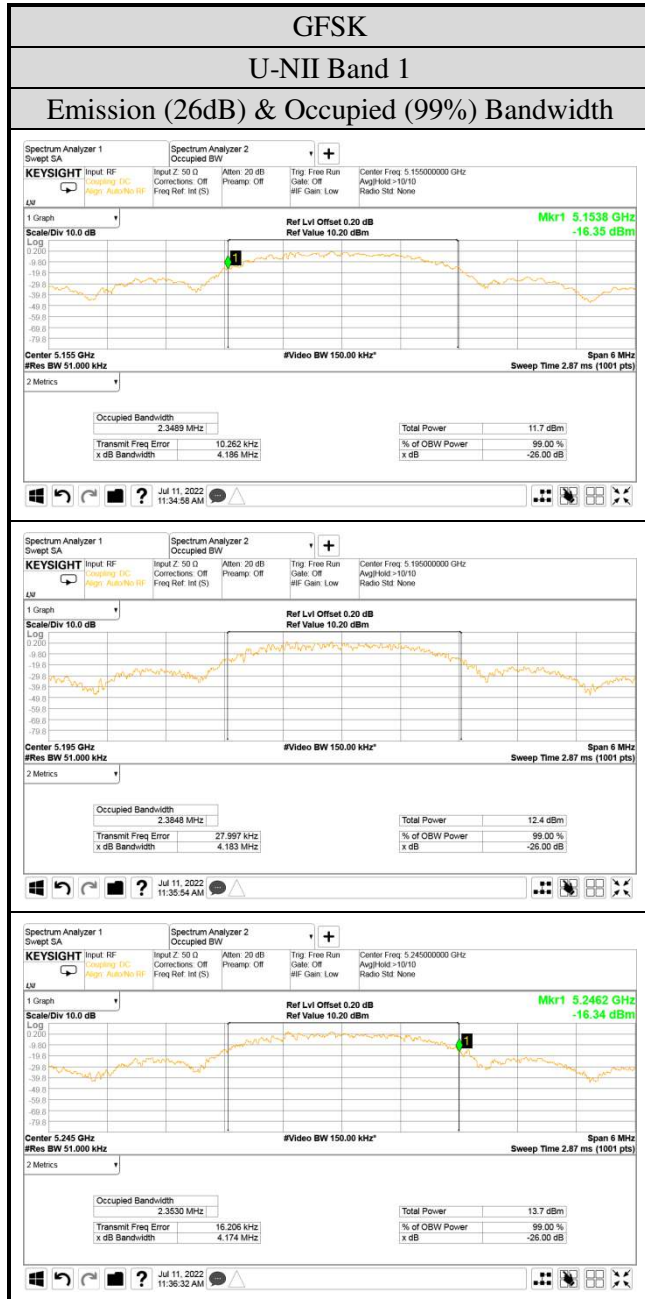
A.3.1 Emission/Occupied Bandwidth Result

Mode	U-NII Band	Centre Frequency (MHz)	Bandwidth (MHz)		Limit
			Emission (26dB)	Occupied (99%)	
GFSK	1	5155	4.186	2.3489	Reference only
		5195	4.183	2.3848	
		5245	4.174	2.3530	
	U-NII Band	Centre Frequency (MHz)	Bandwidth (MHz)		Limit
			Emission (6dB)	Occupied (99%)	
	3	5730	2.003	3.5481	≥ 500kHz
		5790	1.879	3.3988	
		5848	2.022	3.4611	

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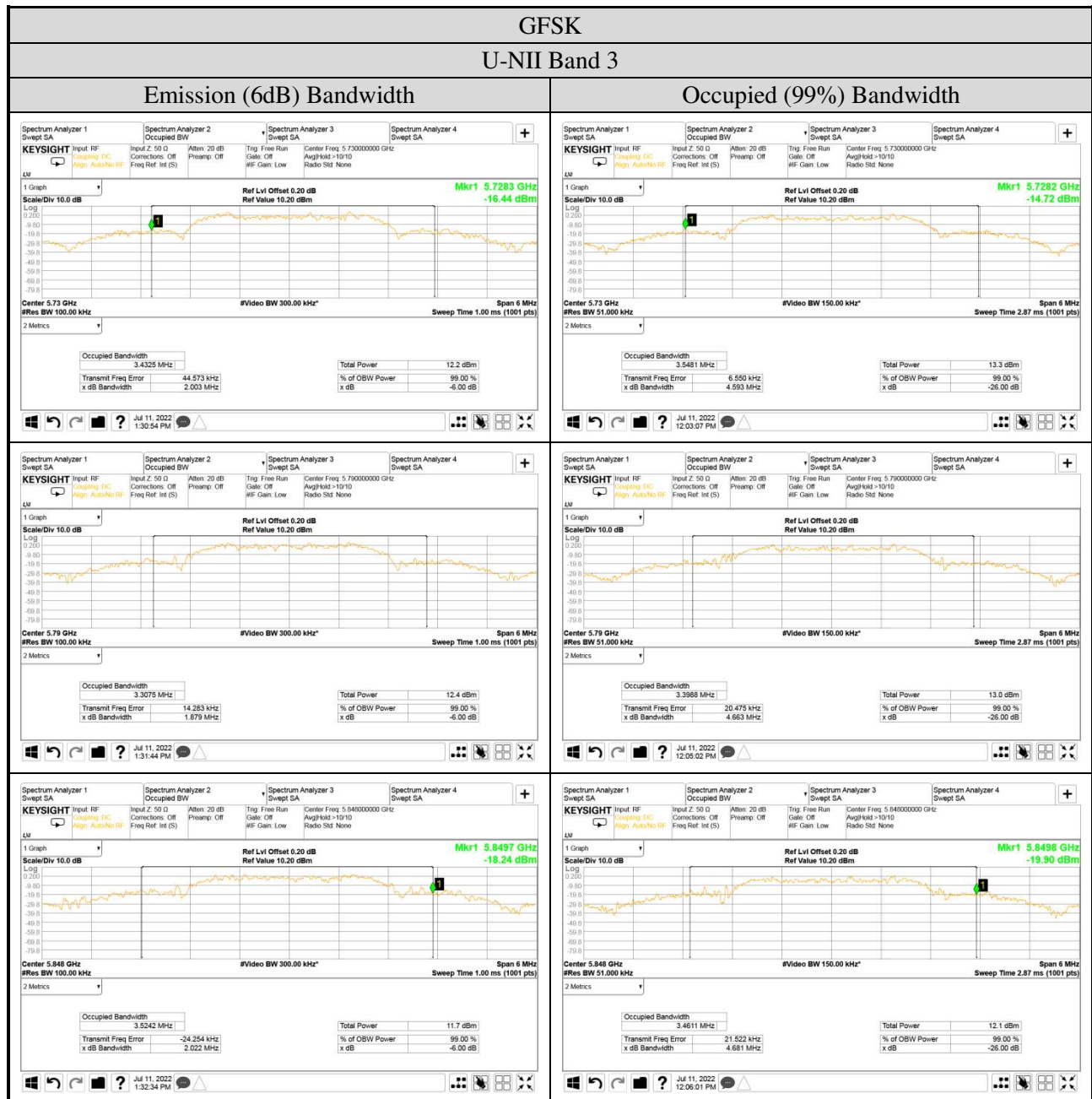
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A.3.2 Measurement Plots



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A.4 MAXIMUM OUTPUT POWER

Test Date	2022/07/11	Temp./Hum.	26°C/41%
Cable Loss	0.20dB	Test Voltage	DC 3.3V
		Tested By	Hua Wu

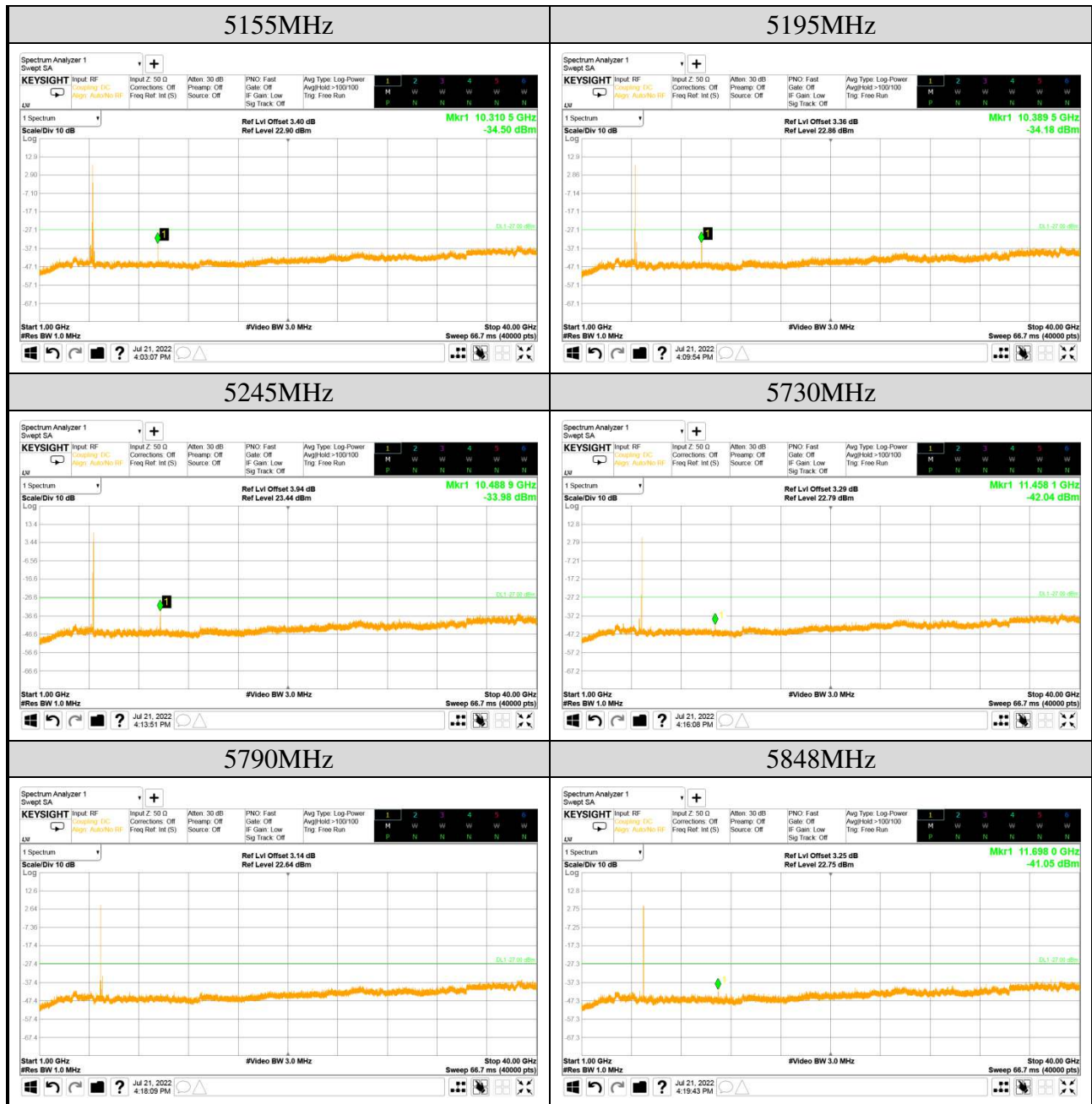
A.4.1 Average Output Power

Mode	U-NII Band	Centre Frequency (MHz)	Average Output Power (dBm)	Duty Cycle Factor 10log(1/X)	Average Max Output Power		Limit
					(dBm)	(W)	
GFSK	1	5155	-0.79	6.308	5.52	0.0036	< 250 mW (24 dBm)
		5195	1.48		7.79	0.0060	
		5245	1.44		7.75	0.0060	
	3	5730	-1.71	6.345	4.64	0.0029	< 1 W (30 dBm)
		5790	-2.28		4.07	0.0026	
		5848	-2.78		3.57	0.0023	

Note: The results have been included cable loss.

A.5 EMISSION LIMITATIONS MEASUREMENT

Test Date	2022/07/21	Temp./Hum.	24°C/49%
Cable Loss	0.20dB	Test Voltage	DC 3.3V
		Tested By	Hua Wu
Simultaneous Factor $10 \log(N_{ANT})$ (Note: where N_{ANT} is the number of outputs)			0dB



A.6 POWER SPECTRAL DENSITY

Test Date	2022/07/11	Temp./Hum.	26℃/41%
Cable Loss	0.20dB	Test Voltage	DC 3.3V
		Tested By	Hua Wu
Simultaneous Factor 10 log(N _{ANT})(Note: where N _{ANT} is the number of outputs)			0dB

A.6.1 Power Spectral Density Result

Mode	U-NII Band	Centre Frequency (MHz)	Power Spectral Density (dBm/1MHz)	Duty Cycle Factor $10\log(1/X)$	Max Power Spectral Density (dBm/1MHz)	Limit
GFSK	1	5155	-3.070	6.308	3.238	11 dBm/MHz
		5195	-2.423		3.885	
		5245	-2.506		3.802	
	U-NII Band	Centre Frequency (MHz)	Power Spectral Density (dBm/500kHz)	Duty Cycle Factor $10\log(1/X)$	Max Power Spectral Density (dBm/500kHz)	Limit
	3 ^{Note2}	5730	-5.450	6.345	0.895	30dBm/500 kHz
		5790	-5.962		0.383	
		5848	-6.165		0.180	

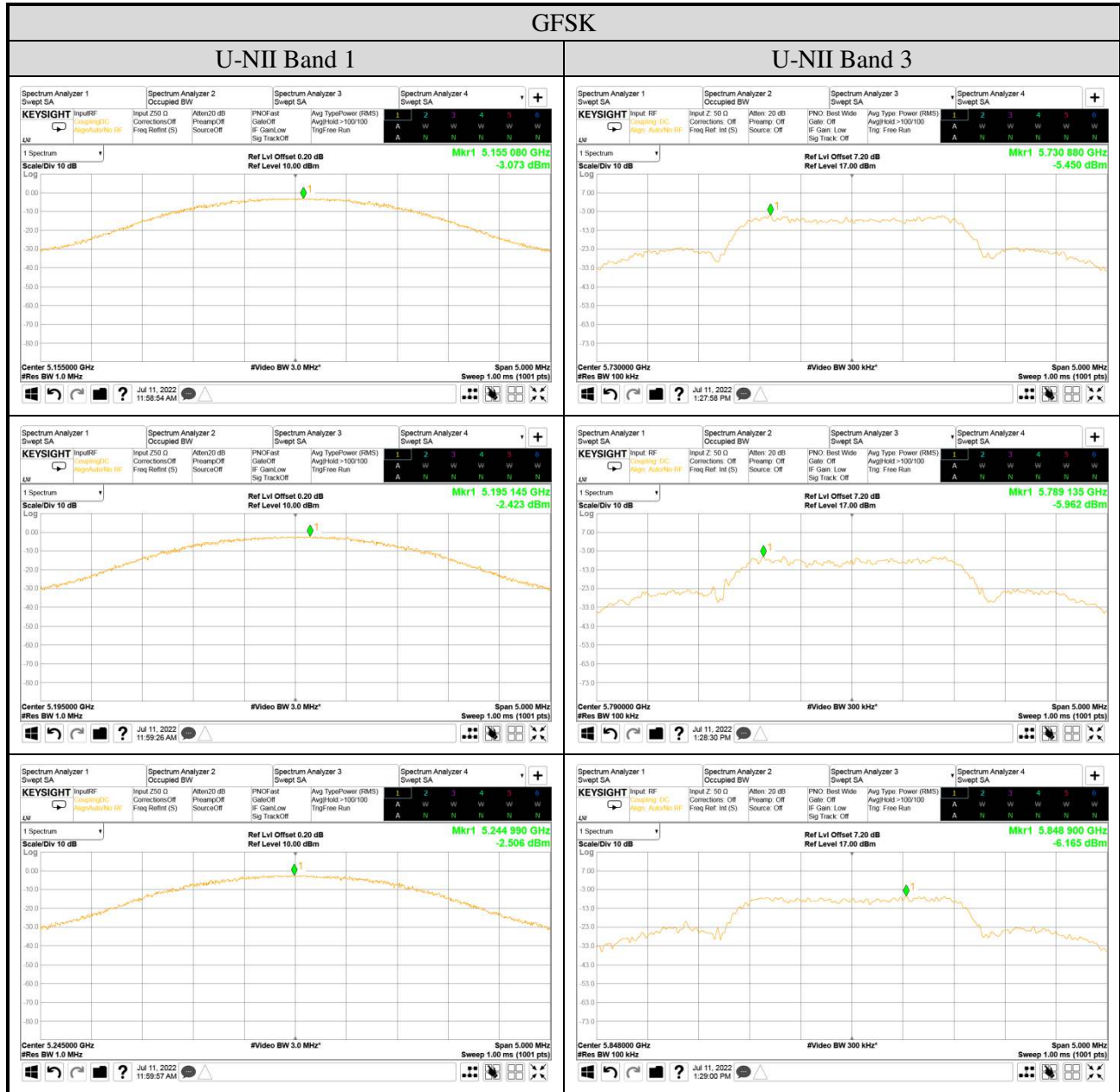
Note 1: All results have been included cable loss and duty cycle factor.

Note 2: BWCF 7dB (100kHz converted to 500kHz) has been included in the test result (measurement plot).

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A.6.2 Measurement Plots



A.7 FREQUENCY STABILITY

Test Date	2022/07/11	Temp./Hum.	26°C/41%
Test Voltage	DC 3.3V	Tested By	Hua Wu

A.7.1 Frequency stability Result

Temperature (°C)	Voltage (Vdc)	Centre Frequency (MHz)	Measurement Value (MHz)	Frequency Stability (ppm)
25	3.30	5155	5155.024	4.656
-30	2.97		5155.018	3.492
	3.63		5155.013	2.522
-20	2.97		5155.051	9.893
	3.63		5154.993	-1.358
-10	2.97		5155.014	2.716
	3.63		5155.035	6.790
0	2.97		5155.029	5.626
	3.63		5155.006	1.164
10	2.97		5154.981	-3.686
	3.63		5154.973	-5.238
20	2.97		5155.015	2.910
	3.63		5155.034	6.596
30	2.97		5155.048	9.311
	3.63		5155.024	4.656
40	2.97		5154.961	-7.565
	3.63		5155.045	8.729
50	2.97		5155.018	3.492
	3.63		5155.051	9.893