

FCC 15.247 & RSS-247 2.4 GHz Test Report

for

FUTABA Corporation

**1080 Yabutsuka Chosei-son Chosei-gun,
Chiba-ken, 299-4395 Japan.**

Product Name : Radio Control
Model Name : T16IZS
Brand Futaba
FCC ID : AZPT16IZS-24G
IC : 2914D-T16IZS

**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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APPENDIX A TEST DATA AND PLOTS

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TEST REPORT

Applicant : FUTABA Corporation
Manufacturer : FUTABA Corporation

EUT Description

(1) Product : Radio Control
(2) Model : T16IZS
(3) Brand : Futaba
(4) Power Supply: (1)DC 5V (USB)
(2)DC 7.4V (Battery)

Applicable Standards:

Title 47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 5), Amendment 2, February 2021
RSS-247 (Issue 2), February 2017
ANSI C63.10:2013

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.

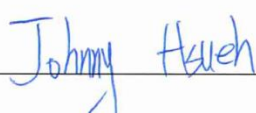
Date of Report: 2023. 03. 09

Reviewed by:



(Sunnie Huang/Administrator)

Approved by:



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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2023. 02. 14	Original Report	EM-F230134

2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	IC		
15.207	RSS-Gen §8.8	Conducted Emission	PASS
15.247(d)/15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(1)	RSS-247 §5.1(2)	20dB Bandwidth	PASS
15.247(a)(1)	RSS-247 §5.1(2)	Carrier Frequency Separation	PASS
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Time of Occupancy	PASS
15.247(a)(1)(iii)	RSS-247 §5.1(4)	Number of Hopping Channels	PASS
15.247(b)(1)	RSS-247 §5.1(2)	Maximum Peak Output Power	PASS
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	PASS
15.203	---	Antenna Requirement	Compliance
Note: The uncertainties value is not used in determining the result.			



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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	FUTABA Corporation 1080 Yabutsuka Chosei-mura Chosei-gun Chiba-ken, 299-4395 Japan.
Manufacturer	FUTABA Corporation 1080 Yabutsuka Chosei-mura Chosei-gun Chiba-ken, 299-4395 Japan.
Product	Radio Control
Model	T16IZS
Brand	Futaba



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3.2. Description of EUT

Test Model	T16IZS		
Serial Number	N/A		
Power Rating	(1)DC 5V (USB) (2)DC7.4V (Battery)		
Software Version	N/A		
RF Features	DSSS: FASSTest, FASST FHSS: S-FHSS, T-FHSS		
Transmit Type	1T1R		
Test Sample	Sample No.	Test Item	Firmware
	01	AC Conduction, RSE, RF Conducted	N/A
Sample Status	Trial sample		
Date of Receipt	2022. 12. 07		
Date of Test	2022. 12. 21 ~ 2023. 03. 09		
Interface Ports of EUT	• Micro SD Slot x 1 • PC Port (Type C) x 1 • S.I/F (S.BUS setting)Port x 1 • Trainer Port x 1 • Charging Port (Type C) x 1 • Earphone Jack x 1 • Battery Connector x 1		
Accessories Supplied	• Type C Cable		

3.3. Antenna Information

No.	Antenna Type	Manufacture	Antenna Part Number	Frequency (MHz)	Max Gain (dBi)
1.	1/2λ Sleeve antenna	SANSEI	ANTB24	2400 - 2500	1.48

3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (kbps)
S-FHSS	2403.25 - 2447.50	60	FHSS	128
T-FHSS	2407.50 - 2467.50	31	FHSS	128

S-FHSS							
Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	2403.25	16	2414.50	31	2425.75	46	2437.00
2	2404.00	17	2415.25	32	2426.50	47	2437.75
3	2404.75	18	2416.00	33	2427.25	48	2438.50
4	2405.50	19	2416.75	34	2428.00	49	2439.25
5	2406.25	20	2417.50	35	2428.75	50	2440.00
6	2407.00	21	2418.25	36	2429.50	51	2440.75
7	2407.75	22	2419.00	37	2430.25	52	2441.50
8	2408.50	23	2419.75	38	2431.00	53	2442.25
9	2409.25	24	2420.50	39	2431.75	54	2443.00
10	2410.00	25	2421.25	40	2432.50	55	2443.75
11	2410.75	26	2422.00	41	2433.25	56	2444.50
12	2411.50	27	2422.75	42	2434.00	57	2445.25
13	2412.25	28	2423.50	43	2434.75	58	2446.00
14	2413.00	29	2424.25	44	2435.50	59	2446.75
15	2413.75	30	2425.00	45	2436.25	60	2447.50

T-FHSS							
Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	2407.50	9	2423.50	17	2439.50	25	2455.50
2	2409.50	10	2425.50	18	2441.50	26	2457.50
3	2411.50	11	2427.50	19	2443.50	27	2459.50
4	2413.50	12	2429.50	20	2445.50	28	2461.50
5	2415.50	13	2431.50	21	2447.50	29	2463.50
6	2417.50	14	2433.50	22	2449.50	30	2465.50
7	2419.50	15	2435.50	23	2451.50	31	2467.50
8	2421.50	16	2437.50	24	2453.50		



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3.5. Description of Key Components

Item	Supplier/Brand	Model	Specification
Wireless Module	Futaba	TC57A	DSSS: FASSTest, FASST FHSS: S-FHSS, T-FHSS
Lithium-ion polymer battery	Futaba	LT2F2000B	DC 7.4A, 2000mA, 14.8Wh
Type C Cable	Futaba	KH7674-011	Shielded, Detachable, 1.0m

3.6. Test Configuration

Mode	Frequency (MHz)	TX _{on} (ms)	TX _{on+off} (ms)	Duty Cycle Correction Factor (dB)
S-FHSS	2403.25	2.775	100	-31.13
	2447.50	2.760	100	-31.18
T-FHSS	2467.5	1.450	100	-36.77

Note: Duty Cycle Correction Factor (DCCF)= 20log (TXon/TX on+off) °

“TX on + off” means the period of the pulse train or 100ms if the pulse train length is greater than 100ms.



AC Conduction	
Charge Mode	

Item	Mode	Test Channel
Radiated Test Case	Radiated Spurious Emission (30MHz~1GHz)	Charge

		S-FHSS
		60
		T-FHSS
		31

Item	Modulation	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note}	S-FHSS
		1/2/60
		T-FHSS
		1/31
Conducted Test Case	Radiated Spurious Emission ^{Note}	S-FHSS
		1/30/60
		T-FHSS
		1/16/31
	20dB Bandwidth	S-FHSS
		1/30/60
		T-FHSS
		1/16/31
	Carrier Frequency Separation	S-FHSS
		1/30/60
		T-FHSS
		1/16/31
	Time of Occupancy	S-FHSS
		1/30/60
		T-FHSS
		1/16/31
	Number of Hopping Channels	S-FHSS
		50
		T-FHSS
		17
	Maximum Peak Output Power	S-FHSS
		1/30/60
		T-FHSS
		1/2/16/31
	Band Edges	S-FHSS
		1/60
		T-FHSS
		1/31
	Spurious Emission	S-FHSS
		1/30/60
		T-FHSS
		1/16/31

Note : ☐ Mobile Device ☒ Portable Device
and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☐ Lie ☐ Side ☒ Stand

3.7. Output Power Setting

Mode	Centre Frequency (MHz)	Power Setting
S-FHSS	2403.25	Default
	2425.00	Default
	2447.50	Default
T-FHSS	2407.50	Default
	2437.50	Default
	2467.50	Default

3.8. Tested Supporting System List

3.8.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	Approval
1.	AC Adapter Wall-mount, 2C (DC 5V)	ASUS	AD2022M20	N/A	N/A
2.	Power Socket	N/A	N/A	N/A	N/A
3.	Earphone	I-phone	N/A	N/A	N/A
4.	Micro SD Card (16GB)	SanDisk	N/A	N/A	N/A

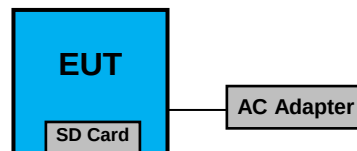
3.8.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	USB Cable: Shielded, Detachable, 1.0m
2.	AC Power Cable: Unshielded, Undetachable, 1.8m
3.	Audio Cable: Unshielded, Undetachable, 1.0m

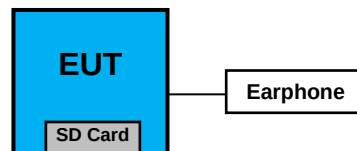
3.9. Setup Configuration

3.9.1. EUT Configuration for Power Line & Radiated Emission

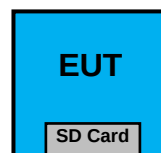
- Charge mode



- Transmit Mode



3.9.2. EUT Configuration for RF Conducted Test Items



3.10. Operating Condition of EUT

- Charge Mode: The EUT connects the AC adapter on charge mode.
- Transmit Mode: Press the button of the EUT is used for enabling EUT RF function under continues transmitting and choosing mode/channel.

3.11. 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

3.12.Measurement Uncertainty

Test Items/Facilities			Frequency Range	Uncertainty
Conduction Test	☐	No. 7 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.4dB
	☒	No. 8 Shielded Room	9kHz-150kHz	±3.7dB
			150kHz-30MHz	±3.5dB
Radiation Test	☒	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.8dB
			200MHz-1000MHz, 3m, Horizontal	±4.4dB
			30MHz-200MHz, 3m, Vertical	±4.5dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.9dB
			6GHz-18GHz, 3m	±4.5dB
	☐	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.6dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	☐	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.3dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.6dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.4dB
	☐	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.3dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.5dB
			200MHz-1000MHz, 3m, Vertical	±4.6dB
			1GHz-6GHz, 3m	±4.9dB
			6GHz-18GHz, 3m	±4.1dB
		Radiated emissions (18GHz-40GHz)		18GHz-40GHz, 3m

Remark : Uncertainty = $ku_c(y)$

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Test Item	Uncertainty
20dB Bandwidth	$\pm 0.2\text{kHz}$
99% Occupied Bandwidth	$\pm 0.38\%$
Carrier Frequency Separation	$\pm 0.2\text{kHz}$
Time of Occupancy	$\pm 0.03\text{sec}$
Maximum peak Output power	$\pm 0.52\text{dB}$
Conducted Emission Limitations	$\pm 0.13\text{dB}$



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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.	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	2022. 04. 14	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	Keysight	N9010B-526	MY57410128	2022.12.21	1 Year
2.	Test Receiver	R&S	ESCS30	100338	2022.06.15	1 Year
3.	Amplifier	HP	8447D	2944A06305	2022.01.05	1 Year
4.	Microwave Preamplifier	HP	8449B	3008A01284	2022.06.01	1 Year
5.	Microwave Amplifier	Keysight	83051A	MY56480113	2022.09.07	1 Year
6.	Bilog Antenna	TESEQ	CBL6112D	33821	2022.07.01	1 Year
7.	Double-Ridged Waveguide Horn	EMCO	3115	9112-3775	2022.05.18	1 Year
8.	Horn Antenna	COM-POWER	AH-840	101092	2022.01.06	1 Year
9.	2.4GHz Notch Filter	K&L Microwave	7NSL10-2441.5/E130.5-O/O	2	2022.07.23	1 Year
10.	High-Pass Filter	Microwave	H3G018G1	484796	2022.07.23	1 Year
11.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2022.01.20	1 Year
12.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 106	RE-14	2022.01.20	1 Year
					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	2022.04.14	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	2022.04.08	1 Year
2.	Digital Thermo-Hygro Meter	iMax	HTC-1	RF-03	2022.04.14	1 Year

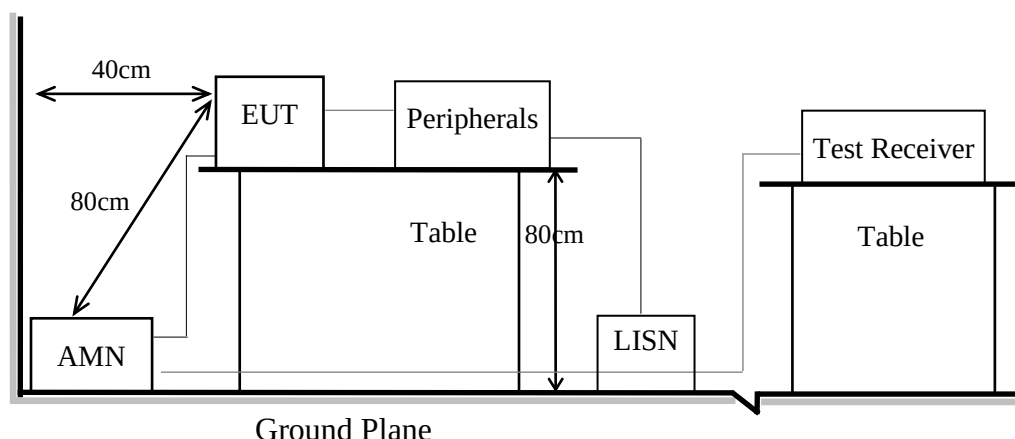
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.9

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.



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5.4. Test Results

Please refer to Appendix A.

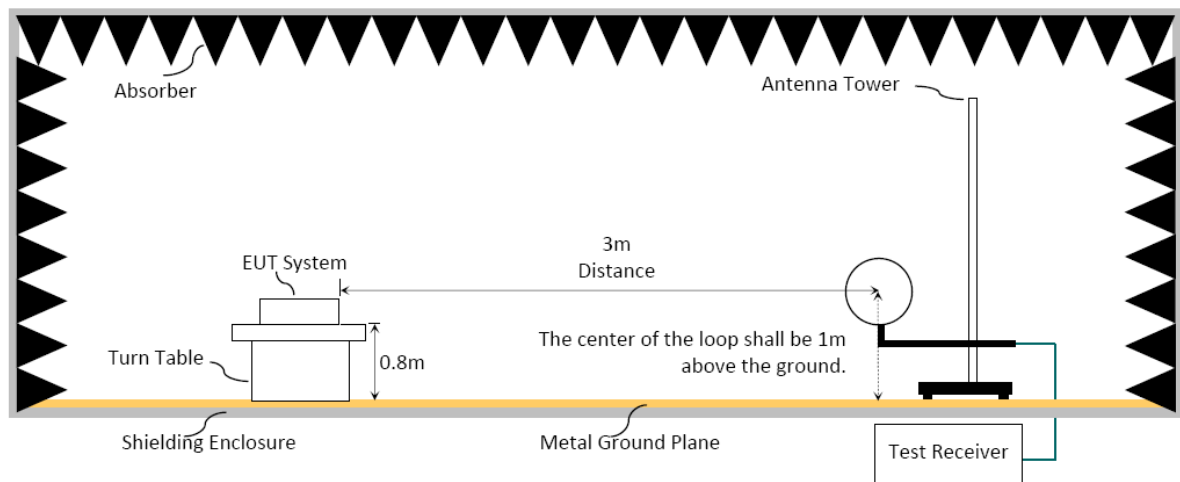
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

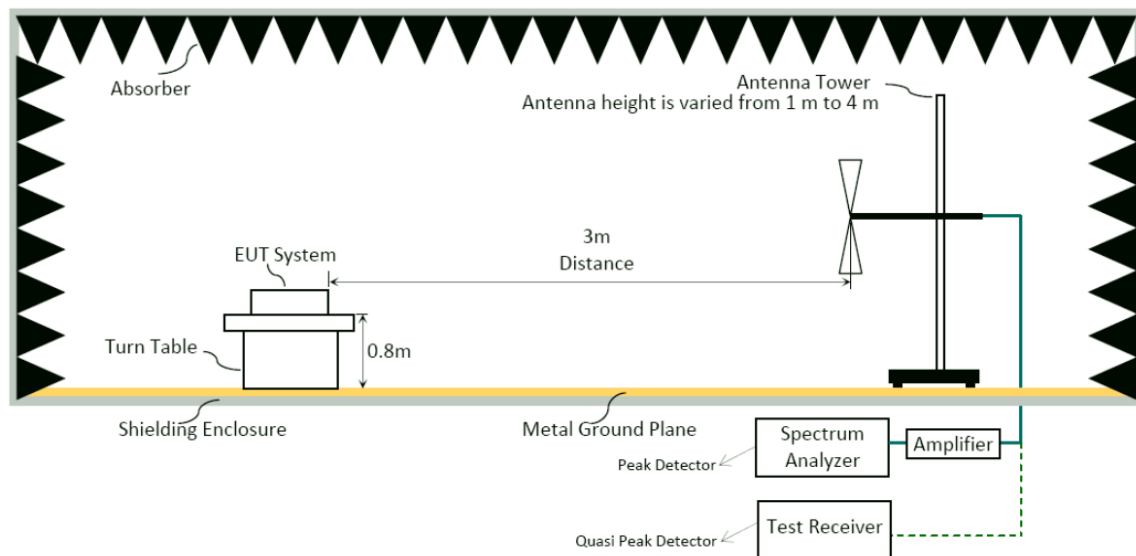
6.1.1. Block Diagram of EUT

Indicated as section 3.9

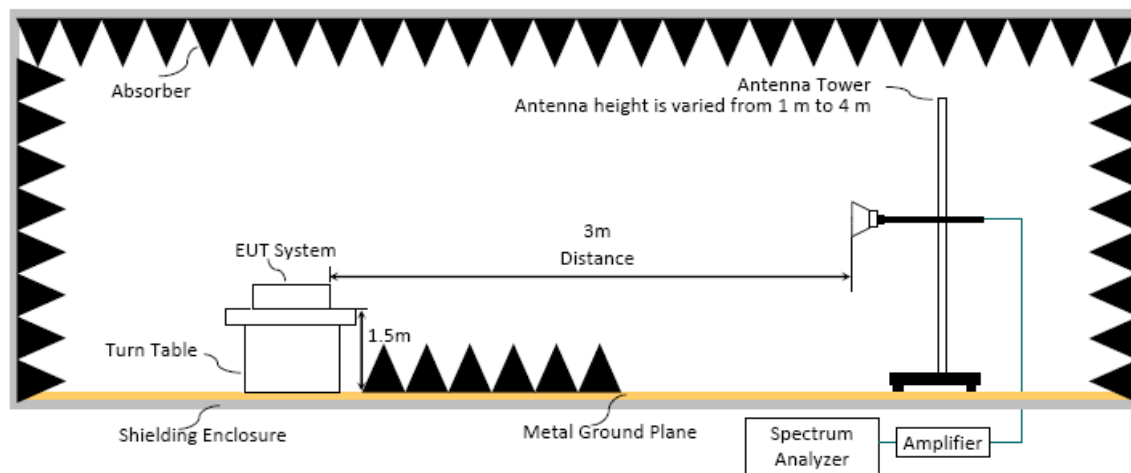
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/ RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance(m)	Limits	
		dBμV/m	μV/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 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

(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.

6.3. 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 ~ 25GHz:

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 25 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 $\geq 1/T$

Mode	TX _{on} (ms)	1/ TX _{on} (kHz)	VBW(>1/ TX _{on}) (kHz)
S-FHSS	2.775	0.360	3
T-FHSS	1.450	0.690	3

(3) Detector = Peak.

(4) Sweep time = auto.

(5) Trace mode = max hold.

(6) Allow sweeps to continue until the trace stabilizes.

☒ **Option 2:**

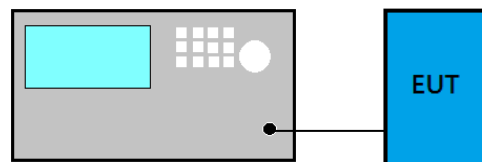
Average Emission Level = Peak Emission Level + D.C.C.F.

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. 20dB/OCCUPIED BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

For 20dB Bandwidth

- (1) Set Span range 2~5 times the OBW
- (2) Set VBW $\geq 3 \times$ 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 -20 dB to record the final bandwidth.

For 99% Occupied Bandwidth

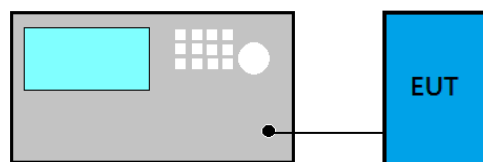
- (8) Set Span range 1.5~5 times the OBW
- (9) Set RBW close to 1% to 5% of OBW.
- (10) Set VBW $\geq 3 \times$ RBW.
- (11) Detector = Peak.
- (12) Trace mode = Max hold
- (13) Sweep = Auto couple.
- (14) Allow the trace to stabilize.

7.4. Test Results

Please refer to Appendix A

8. CARRIER FREQUENCY SEPARATION

8.1. Block Diagram of Test Setup



8.2. Specification Limits

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output no greater than 125mW.

8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

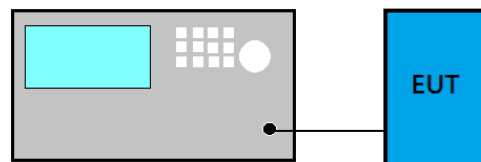
- (1) Span = Wide enough to capture the peaks of two adjacent channels
- (2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- (3) $VBW \geq RBW$
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = Max hold
- (7) Allow the trace to stabilize.

8.4. Test Results

Please refer to Appendix A

9. TIME OF OCCUPANCY

9.1. Block Diagram of Test Setup



9.2. Specification Limits

Frequency hopping systems in the 2400-2483.5MHz shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by number of hopping channels employed.

9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

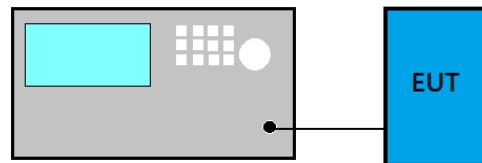
- (1) Span: Zero span, centered on a hopping channel.
- (2) RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
- (3) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- (4) Detector function = Peak
- (5) Trace = Max hold

9.4. Test Results

Please refer to Appendix A

10. NUMBER OF HOPPING CHANNELS

10.1. Block Diagram of Test Setup



10.2. Specification Limits

Frequency hopping systems which use fewer than 20 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels.

10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

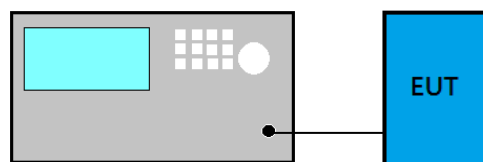
- (1) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- (2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- (3) VBW $\geq$ RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = m=Max hold
- (7) Allow the trace to stabilize.

10.4. Test Results

Please refer to Appendix A

11. MAXIMUM PEAK OUTPUT POWER

11.1. Block Diagram of Test Setup



11.2. Specification Limits

The Limits of maximum Peak Output Power for frequency hopping systems in 2400-2483.5MHz is: 0.125Watt. (21dBm)

11.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

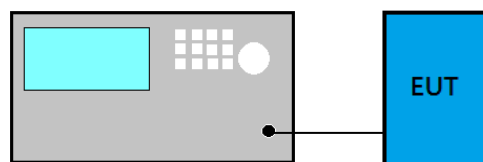
- (a) Use the following spectrum analyzer settings
 - (1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
 - (2) RBW > 20 dB bandwidth of the emission being measured.
 - (3) VBW $\geq$ RBW
 - (4) Sweep: Auto
 - (5) Detector function: Peak
 - (6) Trace: Max hold
- (b) Allow trace to stabilize.
- (c) Use the marker-to-peak function to set the marker to the peak of the emission.

11.4. Test Results

Please refer to Appendix A

12. EMISSION LIMITATIONS

12.1. Block Diagram of Test Setup



12.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a)/ RSS-Gen Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4. (See Section 15.205(c)).

12.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

- (1) Set span wide enough to capture the peak level of the in-band emission and all spurious emissions; up to 10th harmonic.
- (2) RBW = 100 kHz
- (3) VBW $\geq$ RBW
- (4) Sweep = Auto
- (5) Detector function = Peak
- (6) Trace = Max hold

12.4. Test Results

Please refer to Appendix A



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13.DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPENDIX A

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APPENDIX A

TEST DATA AND PLOTS

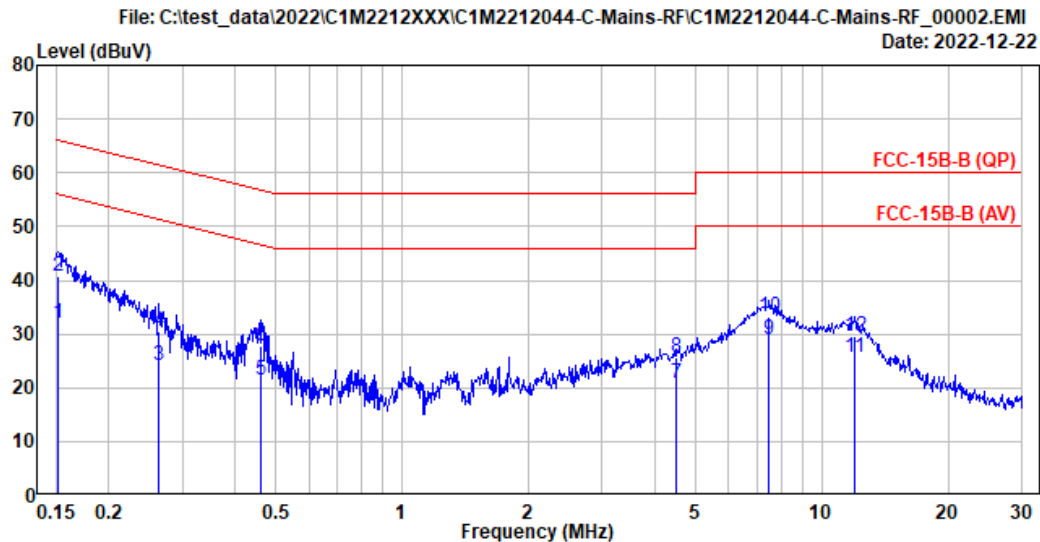
(Model: T16IZS)

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A.1 CONDUCTED EMISSION

Test Date	2022/12/22	Temp./Hum.	20°C/51%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Ken Yang

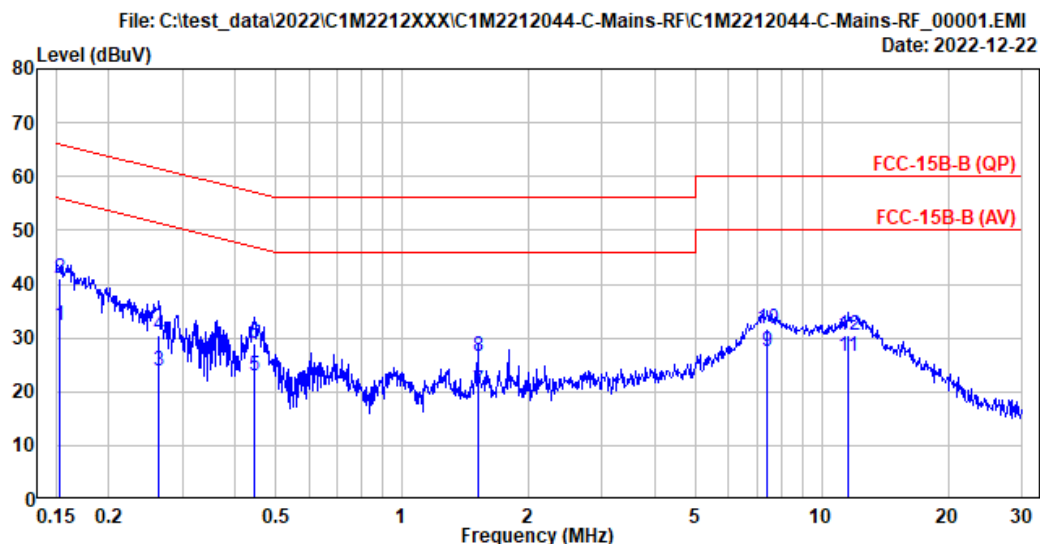


Site No.	: No.8 Shielded Room	Data No.	: 2
Instrument 1	: Receiver ESR(774)		
Instrument 2	: ENV432 (567)(A) CE-08 ESH3-Z2 (354)		
Limit	: FCC-15B-B (QP)	Phase	: Neutral
Environment	: 20°C/51%	Test Rating	: 120Vac/60Hz
EUT Model	: T16IZS	Engineer	: Ken Yang
Test Mode	: Charge		

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.152	10.34	0.03	9.85	11.65	31.87	55.92	24.05	Average
2	0.152	10.34	0.03	9.85	20.46	40.68	65.92	25.24	QP
3	0.262	10.32	0.03	9.85	4.10	24.30	51.36	27.06	Average
4	0.262	10.32	0.03	9.85	10.33	30.53	61.36	30.83	QP
5	0.460	10.32	0.03	9.85	1.36	21.56	46.69	25.13	Average
6	0.460	10.32	0.03	9.85	7.44	27.64	56.69	29.05	QP
7	4.491	10.43	0.09	9.87	0.35	20.74	46.00	25.26	Average
8	4.491	10.43	0.09	9.87	5.20	25.59	56.00	30.41	QP
9	7.505	10.56	0.12	9.88	8.51	29.07	50.00	20.93	Average
10	7.505	10.56	0.12	9.88	12.55	33.11	60.00	26.89	QP
11	11.990	10.74	0.15	9.90	4.85	25.64	50.00	24.36	Average
12	11.990	10.74	0.15	9.90	8.88	29.67	60.00	30.33	QP

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

Test Date	2022/12/22	Temp./Hum.	20°C/51%
Test Voltage	AC 120V 60Hz (Via AC Adapter)	Tested By	Ken Yang



Site No.	: No.8 Shielded Room	Data No.	: 1
Instrument 1	: Receiver ESR(774)		
Instrument 2	: ENV432 (567)(A) CE-08 ESH3-Z2 (354)		
Limit	: FCC-15B-B (QP)	Phase	: Line
Environment	: 20°C/51%	Test Rating	: 120Vac/60Hz
EUT Model	: T16IZS	Engineer	: Ken Yang
Test Mode	: Charge		

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.152	10.22	0.03	9.85	12.29	32.39	55.88	23.49	Average
2	0.152	10.22	0.03	9.85	20.86	40.96	65.88	24.92	QP
3	0.263	10.22	0.03	9.85	3.79	23.89	51.32	27.43	Average
4	0.263	10.22	0.03	9.85	10.51	30.61	61.32	30.71	QP
5	0.445	10.22	0.03	9.85	2.85	22.95	46.98	24.03	Average
6	0.445	10.22	0.03	9.85	8.82	28.92	56.98	28.06	QP
7	1.515	10.24	0.05	9.86	0.01	20.16	46.00	25.84	Average
8	1.515	10.24	0.05	9.86	6.35	26.50	56.00	29.50	QP
9	7.430	10.37	0.11	9.87	7.14	27.49	50.00	22.51	Average
10	7.430	10.37	0.11	9.87	11.20	31.55	60.00	28.45	QP
11	11.521	10.46	0.15	9.90	5.97	26.48	50.00	23.52	Average
12	11.521	10.46	0.15	9.90	10.13	30.64	60.00	29.36	QP

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

A.2 RADIATED EMISSION

Test Date	2022/12/26~ 2023/03/09	Temp./Hum.	16-19°C /51-62%
Test Voltage	(1) AC 120V 60Hz (Via AC Adapter) (2) DC 7.4V (Via Battery)	Tested By	Sam Chang

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 1 GHz

Mode	Charge	Frequency	---
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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
323.910	19.93	5.02	25.82	30.34	29.47	46.00	16.53	Peak
378.230	21.18	5.69	26.28	36.50	37.09	46.00	8.91	Peak
431.580	22.24	6.21	26.68	33.28	35.05	46.00	10.95	Peak
485.900	23.24	6.65	27.04	32.26	35.11	46.00	10.89	Peak
540.220	23.86	6.90	27.24	30.87	34.39	46.00	11.61	Peak
827.340	25.50	8.36	27.20	29.15	35.81	46.00	10.19	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
38.730	20.02	1.61	26.47	37.23	32.39	40.00	7.61	Peak
50.370	14.09	1.84	26.46	40.74	30.21	40.00	9.79	Peak
323.910	19.93	5.02	25.82	31.20	30.33	46.00	15.67	Peak
378.230	21.18	5.69	26.28	36.66	37.25	46.00	8.75	Peak
431.580	22.24	6.21	26.68	34.08	35.85	46.00	10.15	Peak
485.900	23.24	6.65	27.04	34.15	37.00	46.00	9.00	Peak

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Mode	S-FHSS	Frequency	TX 2447.50MHz
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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
169.680	15.93	3.40	25.91	33.01	26.43	43.50	17.07	Peak
250.190	18.49	4.26	25.69	32.56	29.62	46.00	16.38	Peak
378.230	21.18	5.69	26.28	38.00	38.59	46.00	7.41	Peak
431.580	22.24	6.21	26.68	33.85	35.62	46.00	10.38	Peak
485.900	23.24	6.65	27.04	32.74	35.59	46.00	10.41	Peak
540.220	23.86	6.90	27.24	31.34	34.86	46.00	11.14	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
41.640	18.34	1.67	26.47	39.04	32.58	40.00	7.42	Peak
323.910	19.93	5.02	25.82	30.28	29.41	46.00	16.59	Peak
378.230	21.18	5.69	26.28	36.68	37.27	46.00	8.73	Peak
431.580	22.24	6.21	26.68	33.82	35.59	46.00	10.41	Peak
485.900	23.24	6.65	27.04	31.58	34.43	46.00	11.57	Peak
540.220	23.86	6.90	27.24	32.50	36.02	46.00	9.98	Peak

Mode	T-FHSS	Frequency	TX 2467.50MHz
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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
250.190	18.49	4.26	25.69	31.91	28.97	46.00	17.03	Peak
378.230	21.18	5.69	26.28	37.00	37.59	46.00	8.41	Peak
431.580	22.24	6.21	26.68	34.78	36.55	46.00	9.45	Peak
485.900	23.24	6.65	27.04	32.73	35.58	46.00	10.42	Peak
540.220	23.86	6.90	27.24	31.29	34.81	46.00	11.19	Peak
971.870	26.82	9.15	26.75	28.68	37.90	54.00	16.10	Peak

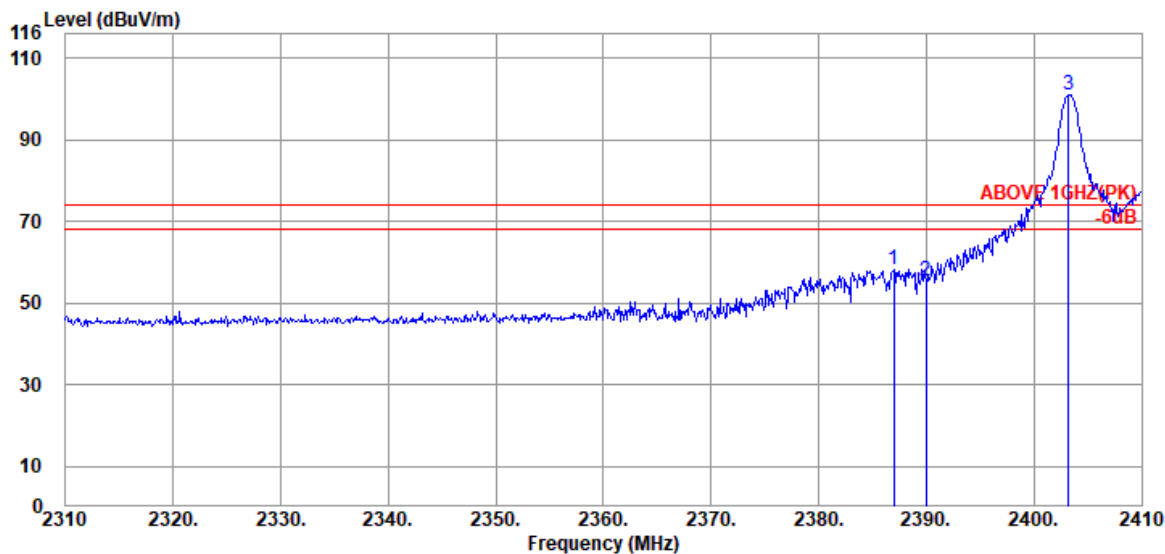
Antenna at Vertical Polarization

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
38.730	20.02	1.61	26.47	38.11	33.27	40.00	6.73	Peak
219.150	16.63	3.93	25.75	36.06	30.87	46.00	15.13	Peak
305.480	19.45	4.77	25.66	42.17	40.73	46.00	5.27	Peak
378.230	21.18	5.69	26.28	36.88	37.47	46.00	8.53	Peak
431.580	22.24	6.21	26.68	34.60	36.37	46.00	9.63	Peak
485.900	23.24	6.65	27.04	32.32	35.17	46.00	10.83	Peak

A.2.1.3 Frequency Above 1 GHz to 10th harmonics

Band Edge:

Mode	S-FHSS	Frequency	TX 2403.25MHz
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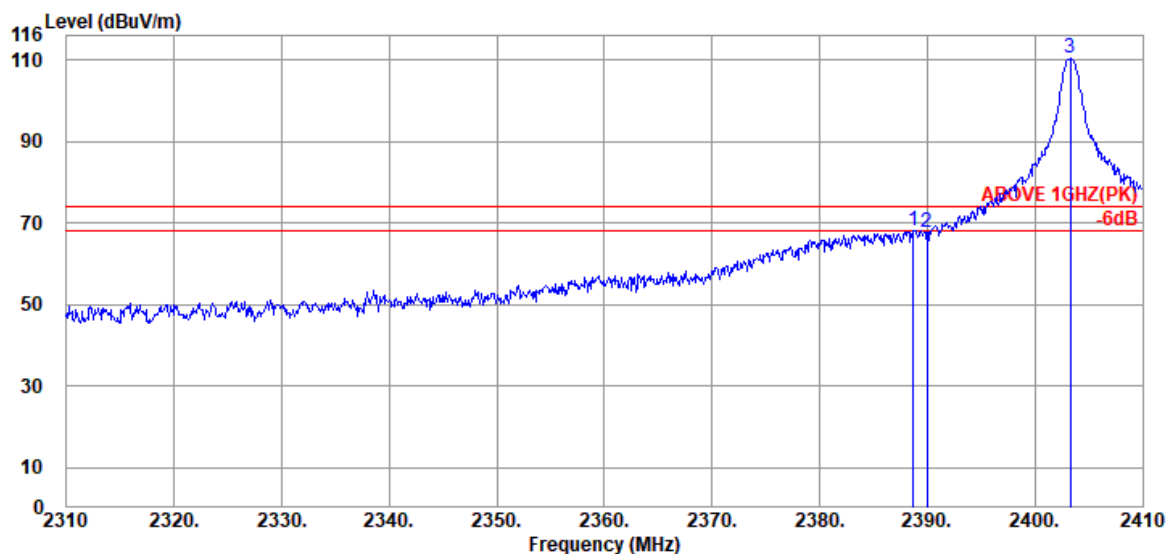
Antenna at Horizontal Polarization

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
2387.000	28.21	5.72	39.93	64.31	58.31	74.00	15.69	Peak
2390.000	28.21	5.72	39.93	61.42	55.42	74.00	18.58	Peak
@ 2403.200	28.10	5.74	39.93	106.96	100.87	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2387.000	58.31	-31.13	27.18	54.00	26.82	Average
2390.000	55.42	-31.13	24.29	54.00	29.71	Average

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

Mode	S-FHSS	Frequency	TX 2403.25MHz
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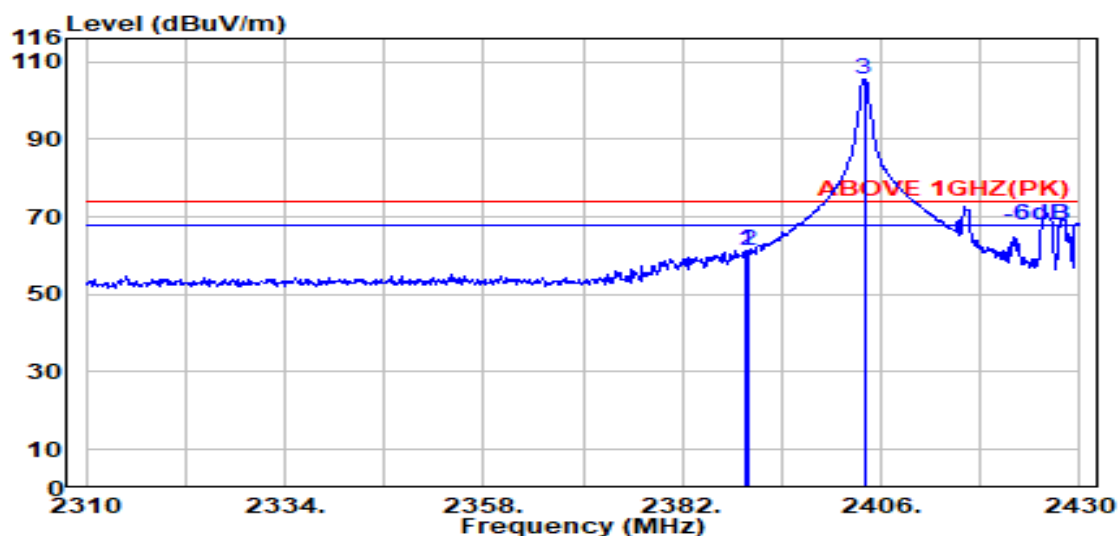
Antenna at Vertical Polarization

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
2388.700	28.21	5.72	39.93	74.17	68.17	74.00	5.83	Peak
2390.000	28.21	5.72	39.93	73.52	67.52	74.00	6.48	Peak
@ 2403.300	28.10	5.74	39.93	116.35	110.26	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2388.700	68.17	-31.13	37.04	54.00	16.96	Average
2390.000	67.52	-31.13	36.39	54.00	17.61	Average

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

Mode	S-FHSS	Frequency	TX 2404.00MHz
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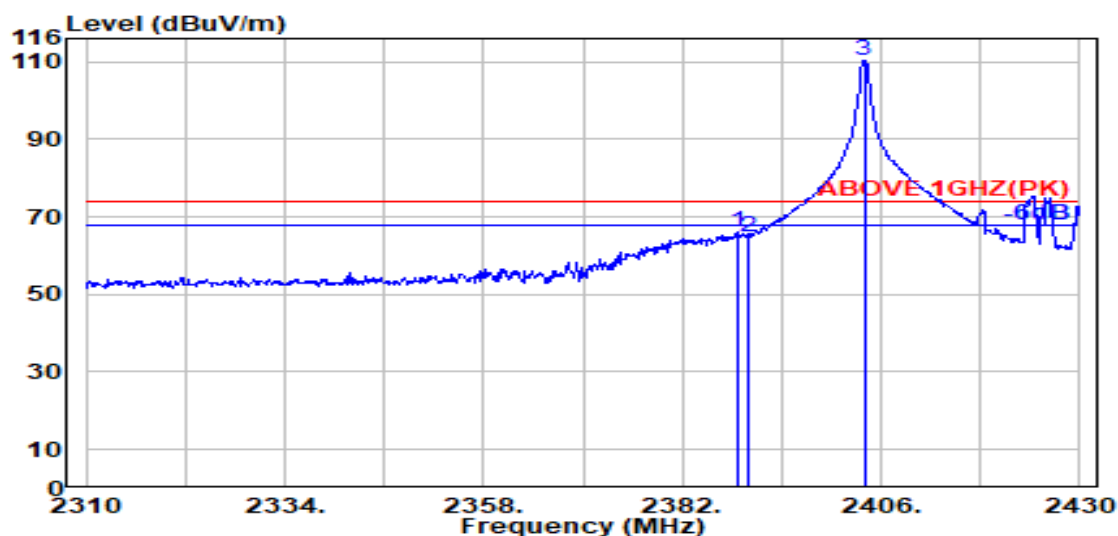
Antenna at Horizontal Polarization

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
2389.560	28.18	6.03	39.93	67.14	61.42	74.00	12.58	Peak
2390.000	28.18	6.03	39.93	67.22	61.50	74.00	12.50	Peak
@ 2403.960	28.12	6.05	39.93	111.23	105.48	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2389.560	61.42	-31.13	30.29	54.00	23.71	Average
2390.000	61.50	-31.13	30.37	54.00	23.63	Average

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

Mode	S-FHSS	Frequency	TX 2404.00MHz
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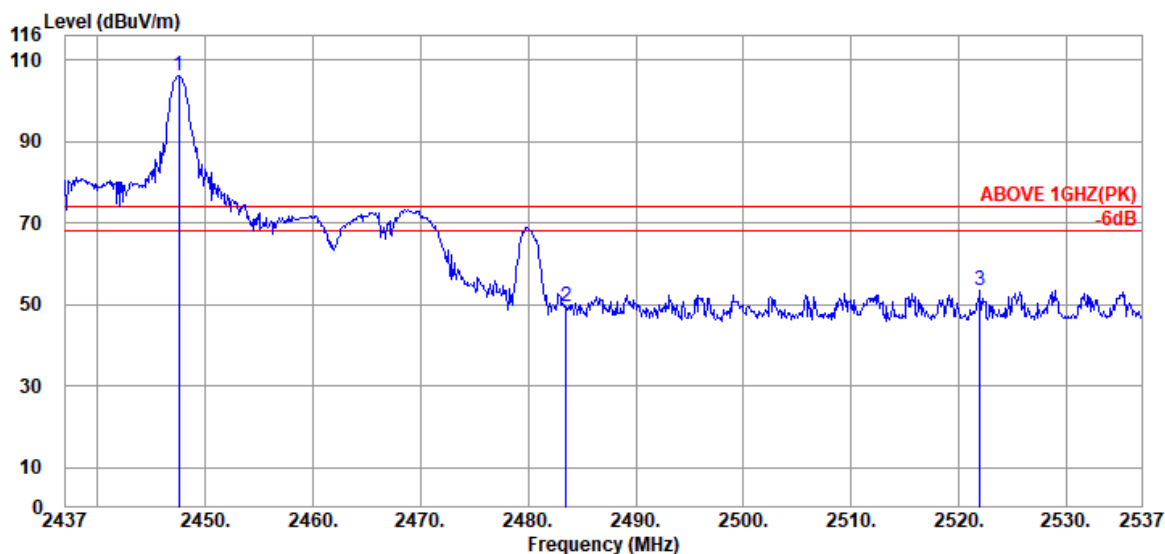
Antenna at Vertical Polarization

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
2388.600	28.19	6.03	39.93	71.69	65.99	74.00	8.01	Peak
2390.000	28.18	6.03	39.93	70.67	64.96	74.00	9.04	Peak
@ 2403.960	28.12	6.05	39.93	116.05	110.30	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2388.600	65.99	-31.13	34.86	54.00	19.14	Average
2390.000	64.96	-31.13	33.83	54.00	20.17	Average

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

Mode	S-FHSS	Frequency	TX 2447.50MHz
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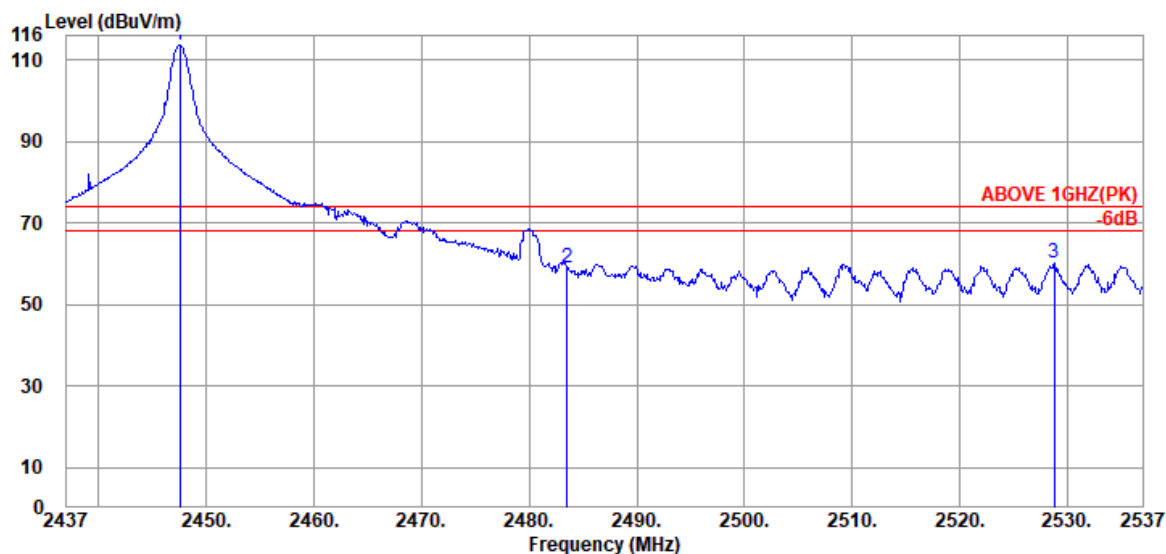
Antenna at Horizontal Polarization

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
@ 2447.500	28.40	5.81	39.93	111.68	105.96	---	---	Peak
2483.500	28.47	5.87	39.92	54.90	49.32	74.00	24.68	Peak
2522.000	28.63	5.94	39.93	58.99	53.63	74.00	20.37	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.500	49.32	-31.18	18.14	54.00	35.86	Average
2522.000	53.63	-31.18	22.45	54.00	31.55	Average

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

Mode	S-FHSS	Frequency	TX 2447.50MHz
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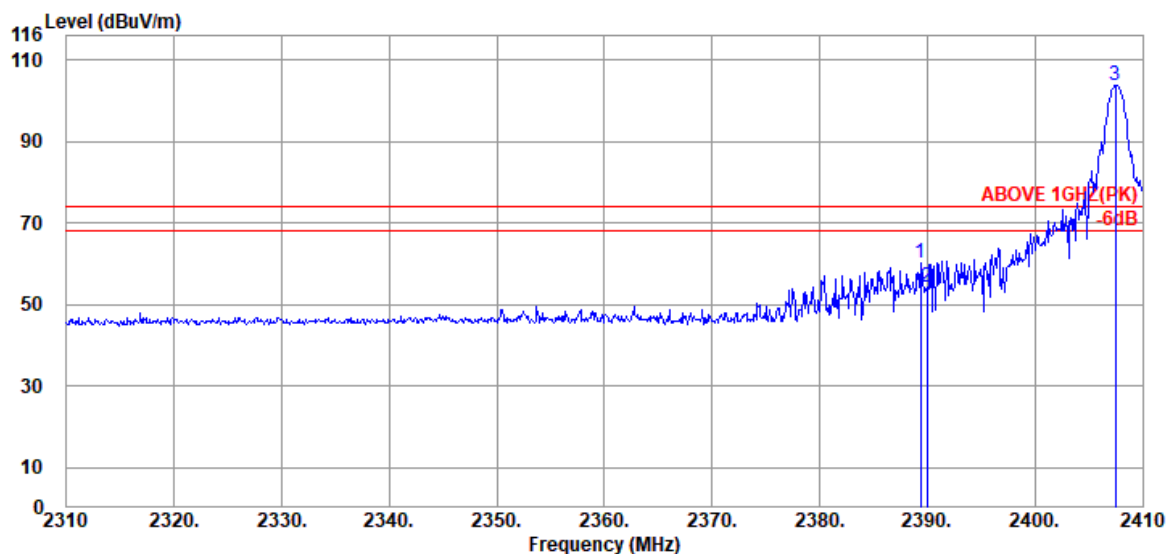
Antenna at Vertical Polarization

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
@ 2447.500	28.40	5.81	39.93	119.27	113.55	---	---	Peak
2483.500	28.47	5.87	39.92	64.73	59.15	74.00	14.85	Peak
2528.800	28.67	5.96	39.93	65.29	59.99	74.00	14.01	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.500	59.15	-31.18	27.97	54.00	26.03	Average
2528.800	59.99	-31.18	28.81	54.00	25.19	Average

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

Mode	T-FHSS	Frequency	TX 2407.50MHz
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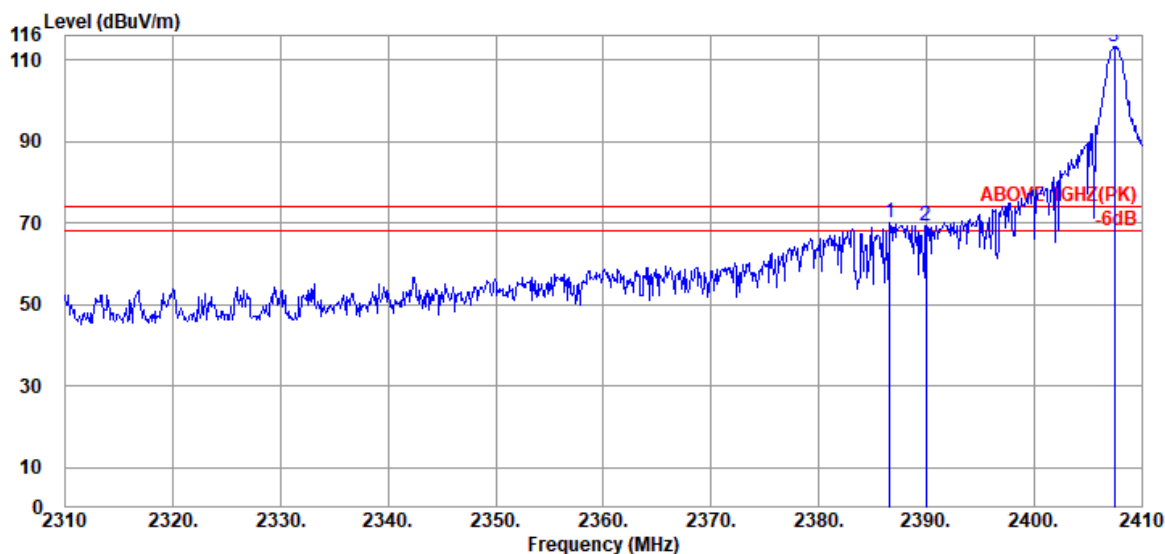
Antenna at Horizontal Polarization

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
2389.400	28.21	5.72	39.93	66.36	60.36	74.00	13.64	Peak
2390.000	28.21	5.72	39.93	60.15	54.15	74.00	19.85	Peak
@ 2407.500	28.14	5.75	39.93	109.65	103.61	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2389.400	60.36	-36.77	23.59	54.00	30.41	Average
2390.000	60.15	-36.77	23.38	54.00	30.62	Average

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

Mode	T-FHSS	Frequency	TX 2407.50MHz
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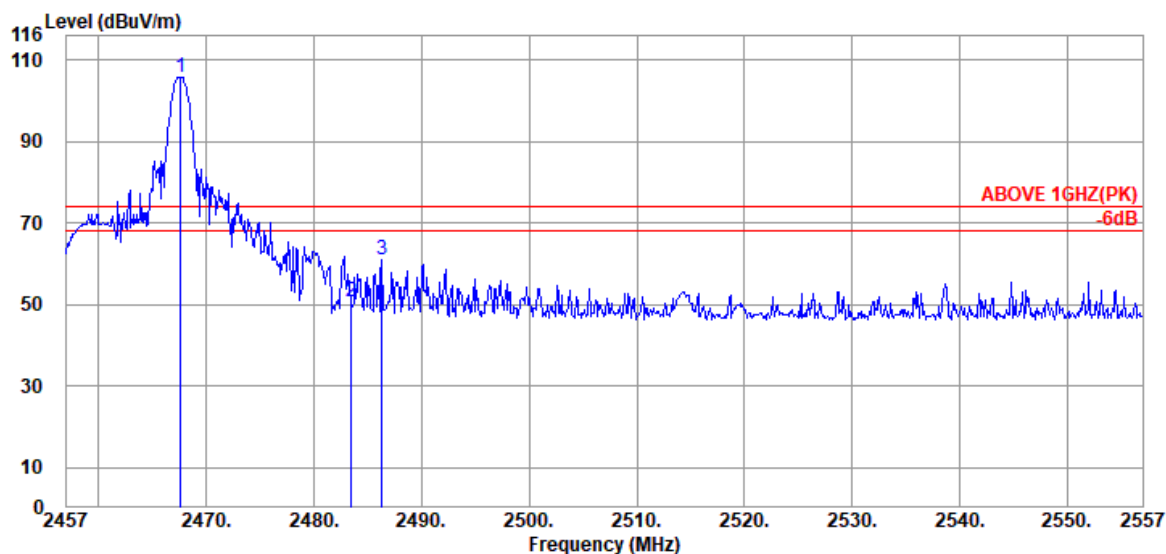
Antenna at Vertical Polarization

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
2386.600	28.21	5.72	39.93	75.88	69.88	74.00	4.12	Peak
2390.000	28.21	5.72	39.93	75.47	69.47	74.00	4.53	Peak
@ 2407.500	28.14	5.75	39.93	119.11	113.07	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2386.600	69.88	-36.77	33.11	54.00	20.89	Average
2390.000	69.47	-36.77	32.70	54.00	21.30	Average

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

Mode	T-FHSS	Frequency	TX 2467.50MHz
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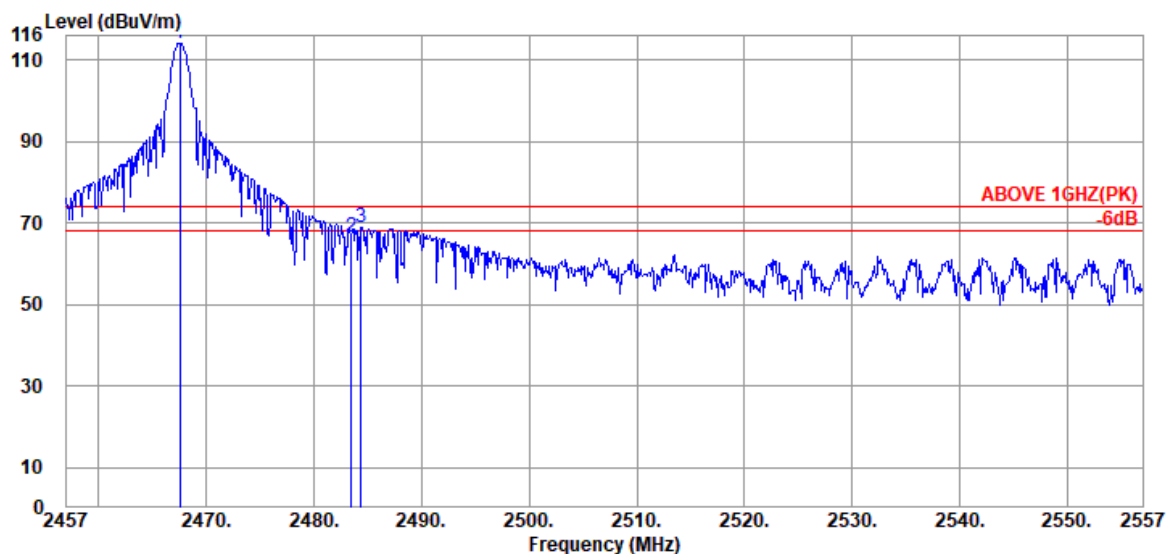
Antenna at Horizontal Polarization

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
@ 2467.600	28.44	5.85	39.92	111.50	105.87	---	---	Peak
2483.500	28.47	5.87	39.92	56.40	50.82	74.00	23.18	Peak
2486.300	28.47	5.87	39.92	66.74	61.16	74.00	12.84	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.500	50.82	-36.77	14.05	54.00	39.95	Average
2486.300	61.16	-36.77	24.39	54.00	29.61	Average

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

Mode	T-FHSS	Frequency	TX 2467.50MHz
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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
@ 2467.500	28.43	5.84	39.92	119.85	114.20	---	---	Peak
2483.500	28.47	5.87	39.92	72.03	66.45	74.00	7.55	Peak
2484.400	28.47	5.87	39.92	74.31	68.73	74.00	5.27	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.500	66.45	-36.77	29.68	54.00	24.32	Average
2484.400	68.73	-36.77	31.96	54.00	22.04	Average

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

A.2.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	S-FHSS	Frequency	TX 2403.25MHz
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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
4806.000	33.00	8.53	39.39	54.49	56.63	74.00	17.37	Peak
7211.000	36.30	9.92	39.52	45.30	52.00	74.00	22.00	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4806.000	56.63	-31.13	25.50	54.00	28.50	Average
7211.000	52	-31.13	20.87	54.00	33.13	Average

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
4806.000	33.00	8.53	39.39	61.04	63.18	74.00	10.82	Peak
7211.000	36.30	9.92	39.52	43.84	50.54	74.00	23.46	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4806.000	63.18	-31.13	32.05	54.00	21.95	Average
7211.000	50.54	-31.13	19.41	54.00	34.59	Average

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Mode	S-FHSS	Frequency	TX 2425.00MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4850.000	33.10	8.59	39.36	60.70	63.03	74.00	10.97	Peak
7274.000	36.43	9.97	39.53	48.34	55.21	74.00	18.79	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4850.000	63.03	-31.13	31.90	54.00	22.10	Average
7274.000	55.21	-31.13	24.08	54.00	29.92	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4850.000	33.10	8.59	39.36	64.68	67.01	74.00	6.99	Peak
7274.000	36.43	9.97	39.53	43.82	50.69	74.00	23.31	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4850.000	67.01	-31.13	35.88	54.00	18.12	Average
7274.000	50.69	-31.13	19.56	54.00	34.44	Average

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Mode	S-FHSS	Frequency	TX 2447.50MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4896.000	33.30	8.66	39.34	60.76	63.38	74.00	10.62	Peak
7343.000	36.60	10.03	39.55	48.10	55.18	74.00	18.82	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4896.000	63.38	-31.18	32.20	54.00	21.80	Average
7343.000	55.18	-31.18	24.00	54.00	30.00	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4896.000	33.30	8.66	39.34	65.00	67.62	74.00	6.38	Peak
7343.000	36.60	10.03	39.55	44.63	51.71	74.00	22.29	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4896.000	67.62	-31.18	36.44	54.00	17.56	Average
7343.000	51.71	-31.18	20.53	54.00	33.47	Average

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Mode	T-FHSS	Frequency	TX 2407.50MHz
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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
4816.000	33.03	8.55	39.38	58.32	60.52	74.00	13.48	Peak
7223.000	36.30	9.92	39.52	47.38	54.08	74.00	19.92	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4816.000	60.52	-36.77	23.75	54.00	30.25	Average
7223.000	54.08	-36.77	17.31	54.00	36.69	Average

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
4816.000	33.03	8.55	39.38	64.16	66.36	74.00	7.64	Peak
7223.000	36.30	9.92	39.52	45.48	52.18	74.00	21.82	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4816.000	66.36	-36.77	29.59	54.00	24.41	Average
7223.000	52.18	-36.77	15.41	54.00	38.59	Average

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Mode	T-FHSS	Frequency	TX 2437.50MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4876.000	33.20	8.62	39.36	61.09	63.55	74.00	10.45	Peak
7313.000	36.50	9.99	39.54	48.76	55.71	74.00	18.29	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4876.000	63.55	-36.77	26.78	54.00	27.22	Average
7313.000	55.71	-36.77	18.94	54.00	35.06	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4876.000	33.20	8.62	39.36	64.44	66.90	74.00	7.10	Peak
7313.000	36.50	9.99	39.54	44.32	51.27	74.00	22.73	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4876.000	66.9	-36.77	30.13	54.00	23.87	Average
7313.000	51.27	-36.77	14.50	54.00	39.50	Average

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Mode	T-FHSS	Frequency	TX 2467.50MHz
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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
4936.000	33.37	8.70	39.33	58.97	61.71	74.00	12.29	Peak
7403.000	36.60	10.08	39.57	47.42	54.53	74.00	19.47	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4936.000	61.71	-36.77	24.94	54.00	29.06	Average
7403.000	54.53	-36.77	17.76	54.00	36.24	Average

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
4936.000	33.37	8.70	39.33	64.55	67.29	74.00	6.71	Peak
7403.000	36.60	10.08	39.57	45.50	52.61	74.00	21.39	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	Duty Cycle Correction Factor (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4936.000	67.29	-36.77	30.52	54.00	23.48	Average
7403.000	52.61	-36.77	15.84	54.00	38.16	Average

A.2.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the FCC 15.209(a)/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.

A.3 20dB/OCCUPIED BANDWIDTH

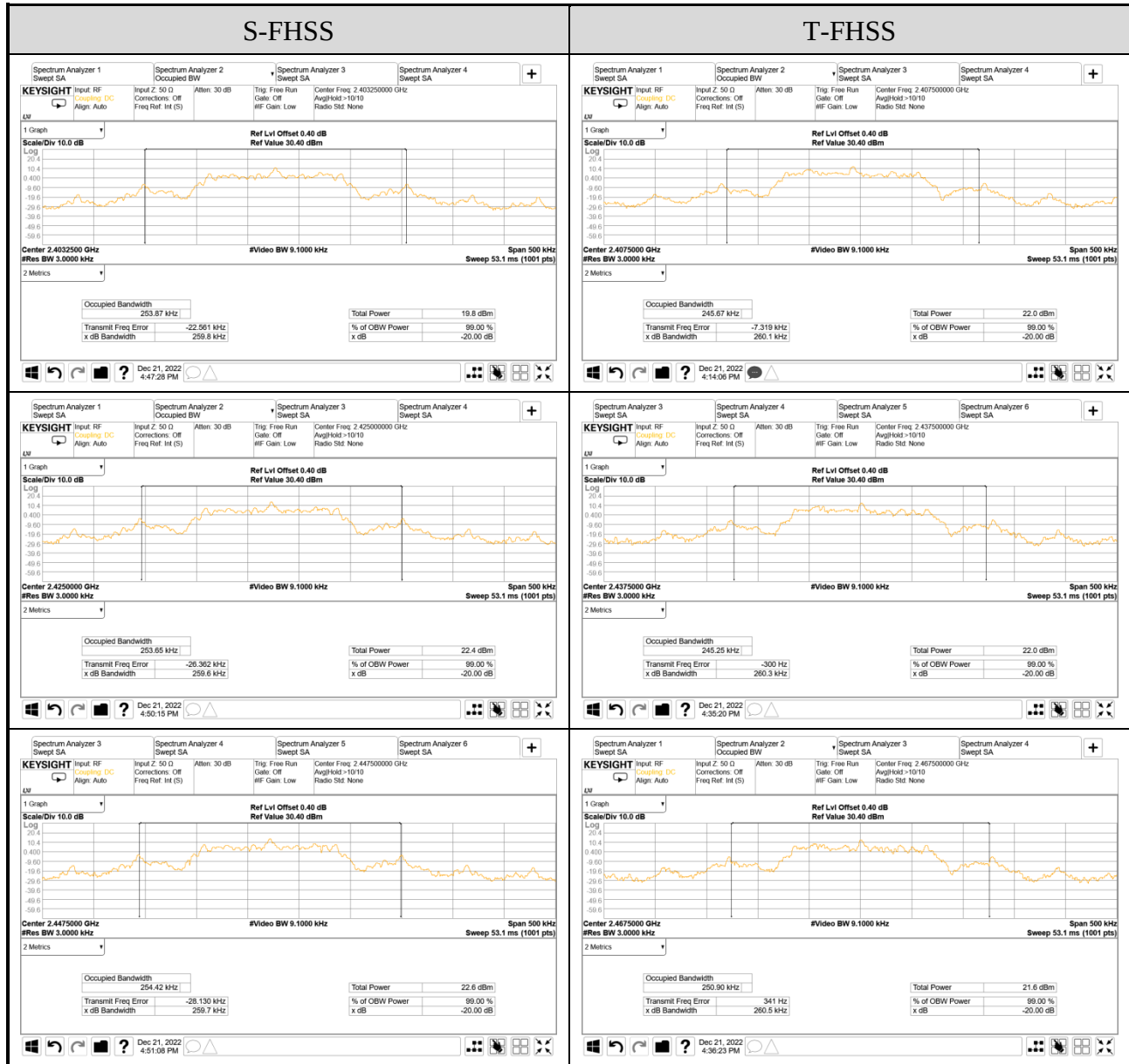
Test Date	2022/12/21	Temp./Hum.	18°C /68%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)		

A.3.1 Emission Bandwidth Result

Mode	Centre Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit 2/3 (20dB Bandwidth)
S-FHSS	2403.25	0.2598	0.25387	0.173
	2425.00	0.2596	0.25365	0.173
	2447.50	0.2597	0.25442	0.173
T-FHSS	2407.50	0.2601	0.24567	0.173
	2437.50	0.2603	0.24525	0.174
	2467.50	0.2605	0.25090	0.174

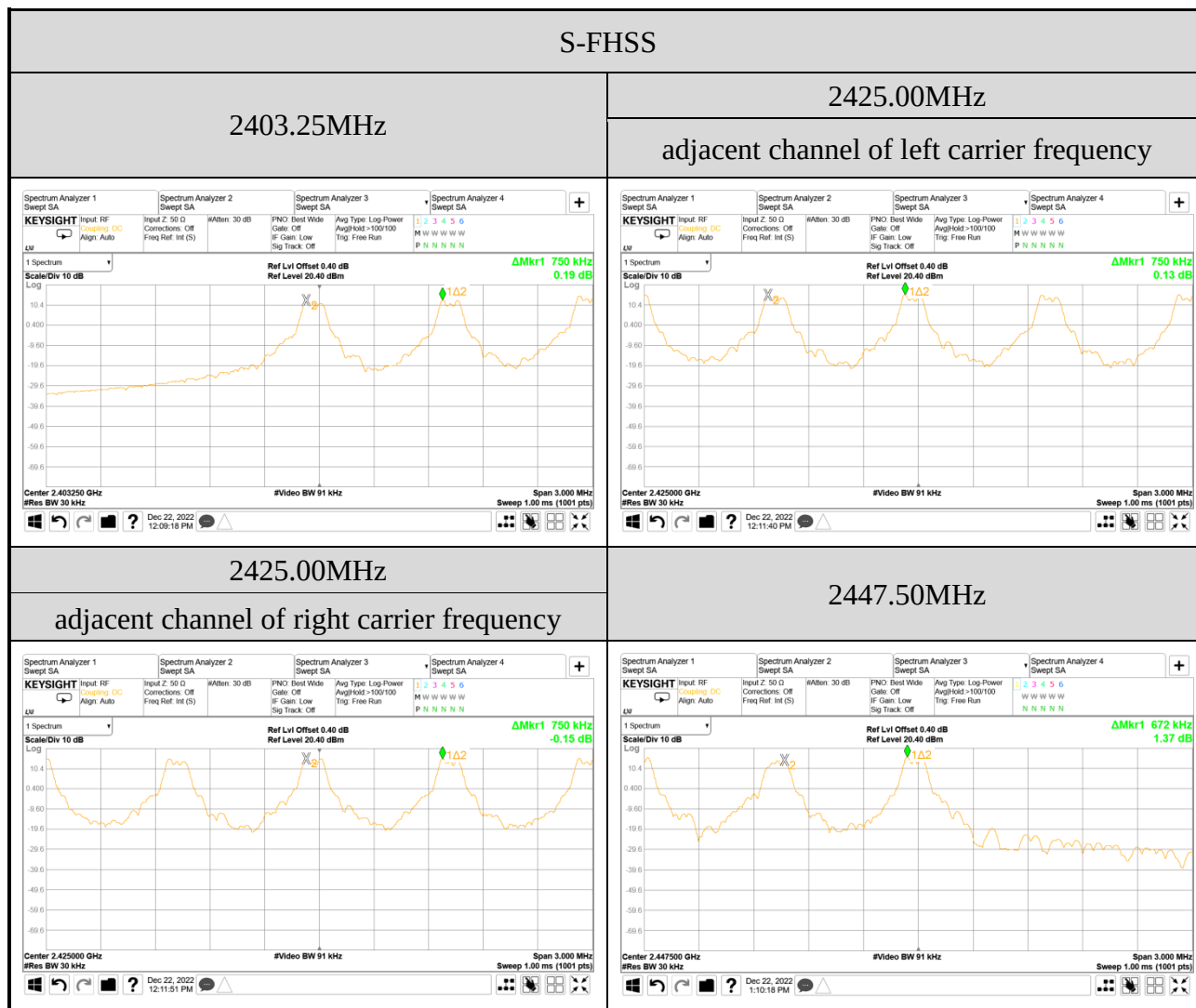
Remark: The maximum two-thirds of the 20dB bandwidth shall be at maximum 0.182MHz.

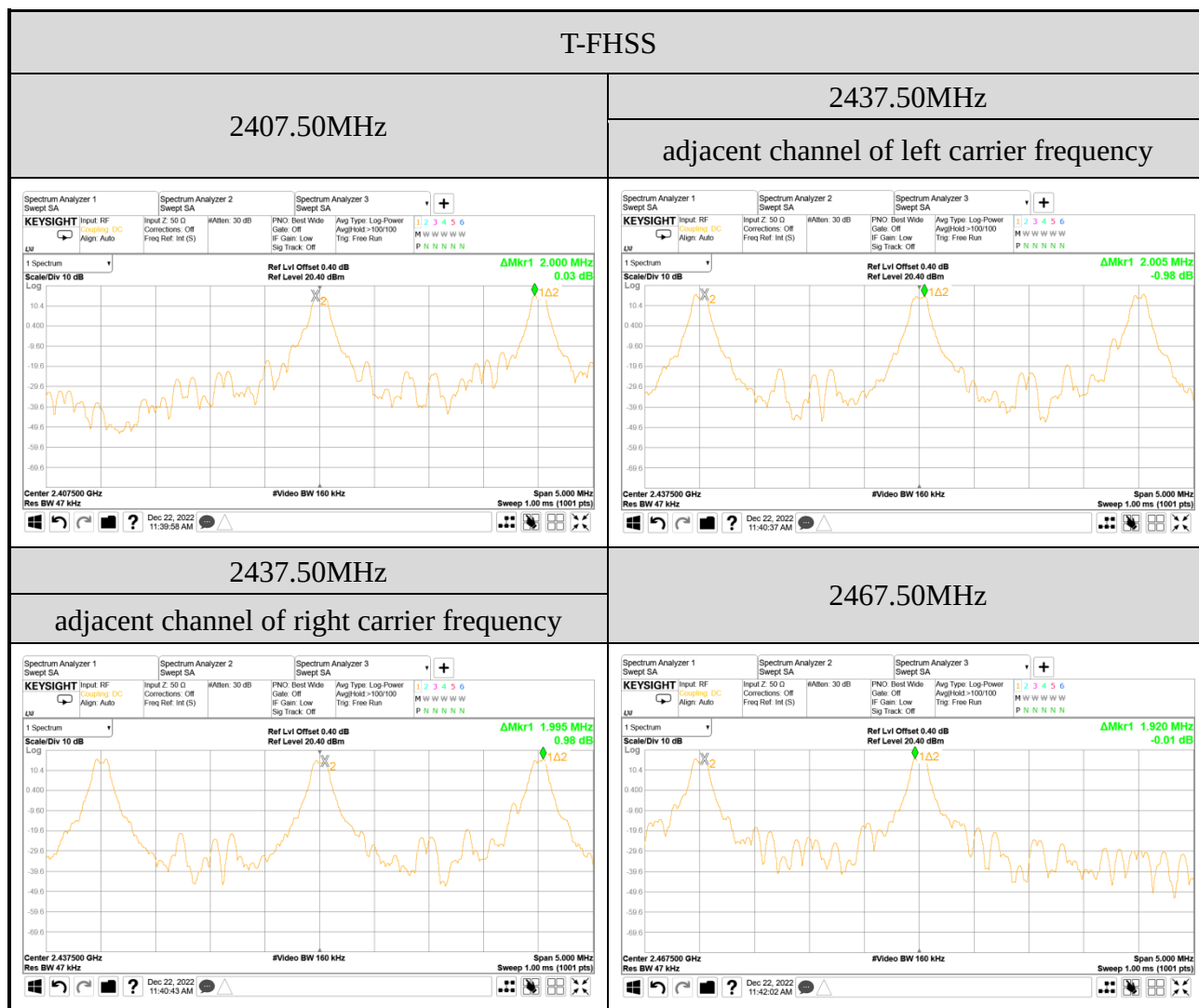
A.3.2 Measurement Plots



A.4 CARRIER FREQUENCY SEPARATION

Test Date	2022/12/22	Temp./Hum.	23°C/59%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)		





A.5 TIME OF OCCUPANCY

Test Date	2022/12/21 ~ 22	Temp./Hum.	18°C/64%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)		

A.5.1 Time of Occupancy

Mode	Centre Frequency (MHz)	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
S-FHSS	2403.25	5	2.775	333.000	<400
	2425.00	5	2.775	333.000	<400
	2447.50	5	2.760	331.200	<400

Observation Period:

60 channels* 0.4 seconds= 24.0 seconds

Centre Frequency: 2403.25MHz

For each second of 5 transmission appearance, the longest time of occupancy is

5 channels* 24.0 /1* 2.775 ms= 333.000 ms (<400ms)

Centre Frequency: 2425.00MHz

For each second of 5 transmission appearance, the longest time of occupancy is

5 channels* 24.0 /1* 2.775 ms= 333.000 ms (<400ms)

Centre Frequency: 2447.50MHz

For each second of 5 transmission appearance, the longest time of occupancy is

5 channels* 24.0 /1* 2.760 ms= 331.200 ms (<400ms)

Mode	Centre Frequency (MHz)	Each second appearance transmission	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
T-FHSS	2407.50	2	1.450	35.9600	<400
	2437.50	2	1.450	35.9600	<400
	2467.50	2	1.450	35.9600	<400

Observation Period:

31 channels* 0.4 seconds= 12.4 seconds

Centre Frequency: 2407.50MHz

For each second of 2 transmission appearance, the longest time of occupancy is

2 channels* 12.4 /1* 1.4500 ms= 35.9600 ms (<400ms)

Centre Frequency: 2437.50MHz

For each second of 2 transmission appearance, the longest time of occupancy is

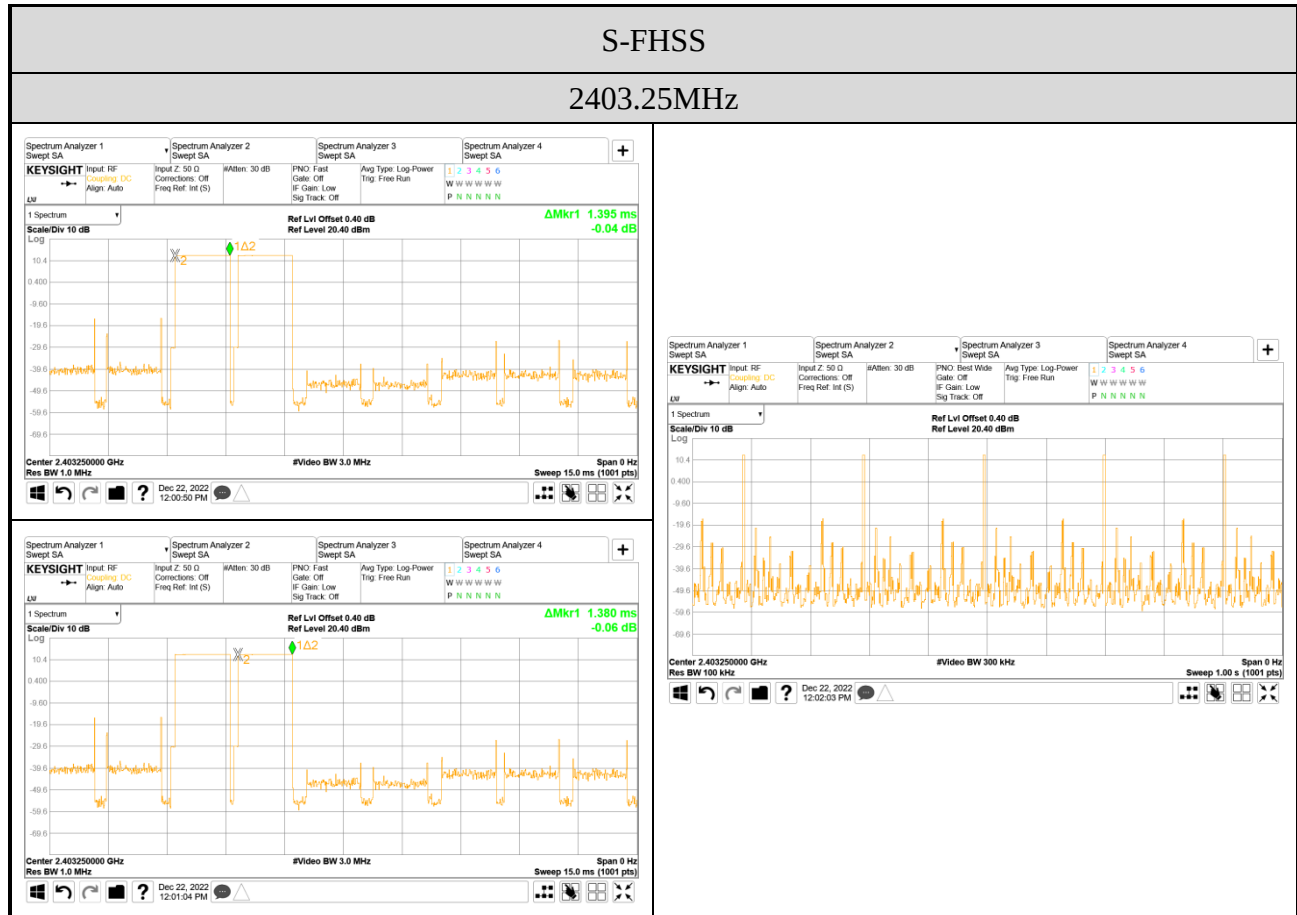
2 channels* 12.4 /1* 1.4500 ms= 35.9600 ms (<400ms)

Centre Frequency: 2467.50MHz

For each second of 2 transmission appearance, the longest time of occupancy is

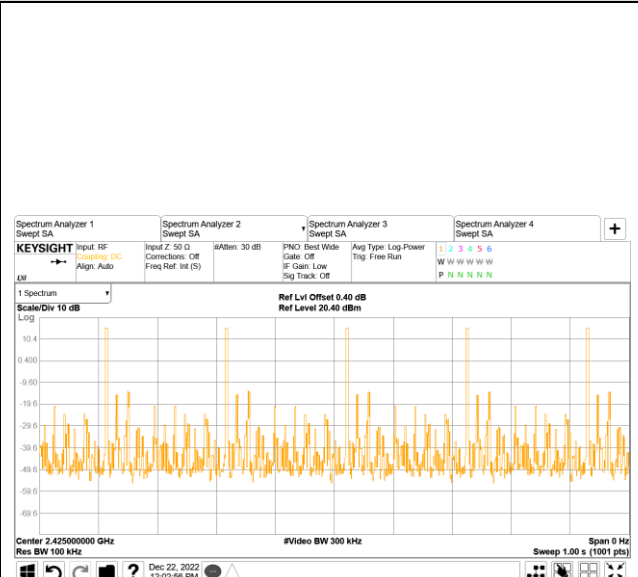
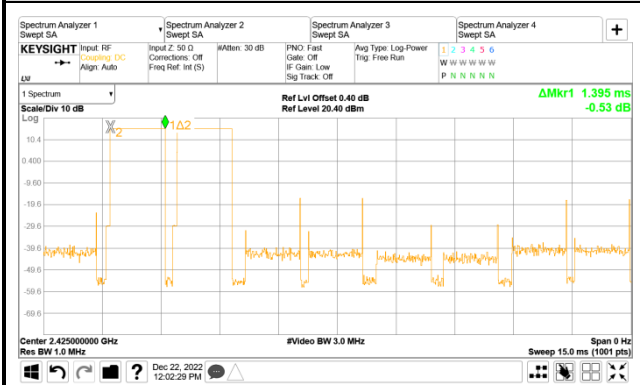
2 channels* 12.4 /1* 1.4500 ms= 35.9600 ms (<400ms)

A.5.2 Measurement Plots

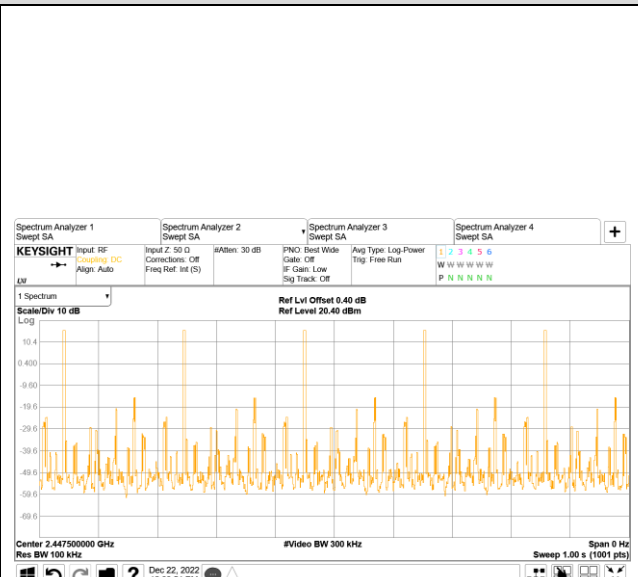
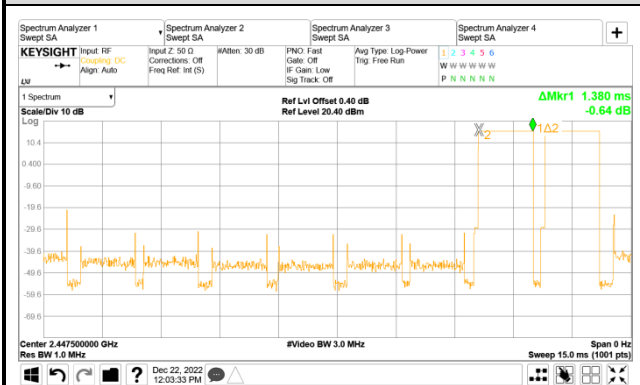


S-FHSS

2425.00MHz



2447.50MHz



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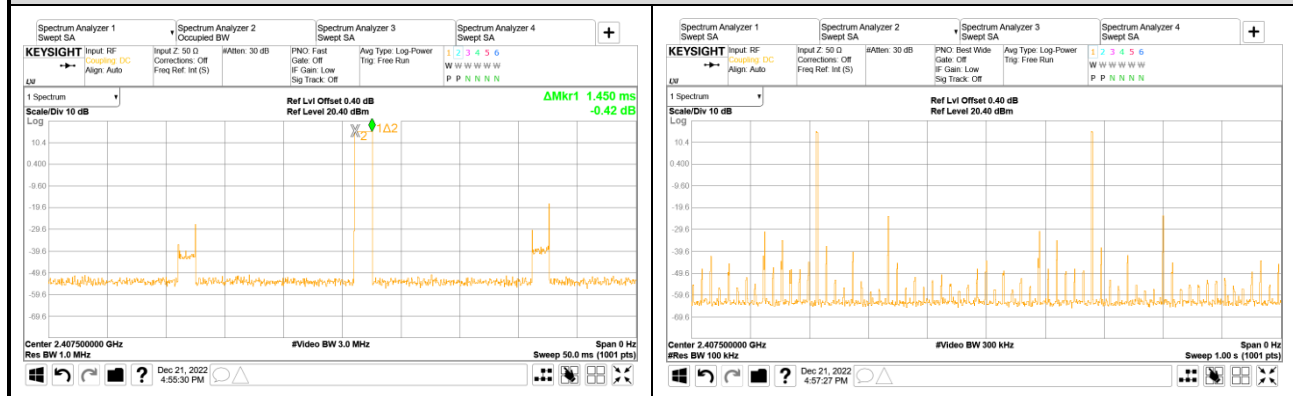
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301

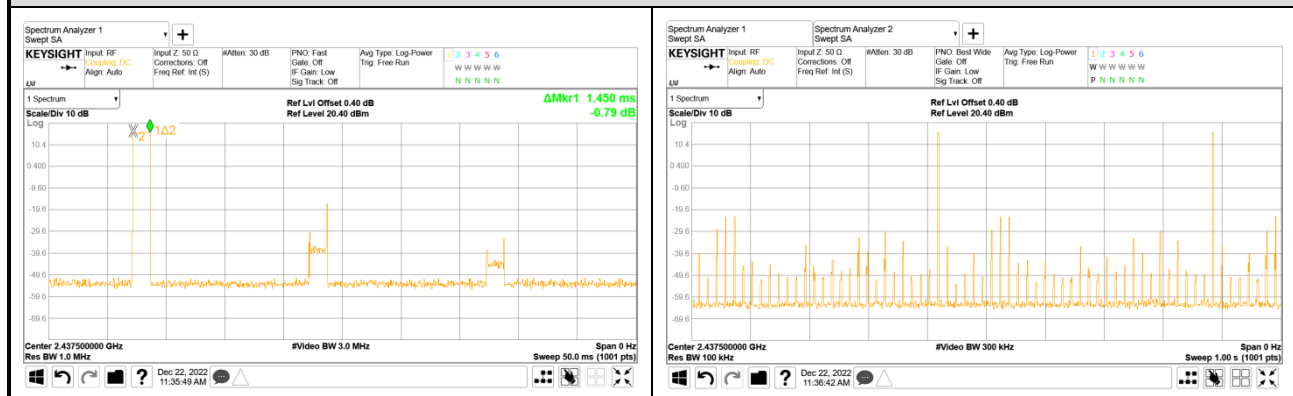
Fax: +886 2 26099303

T-FHSS

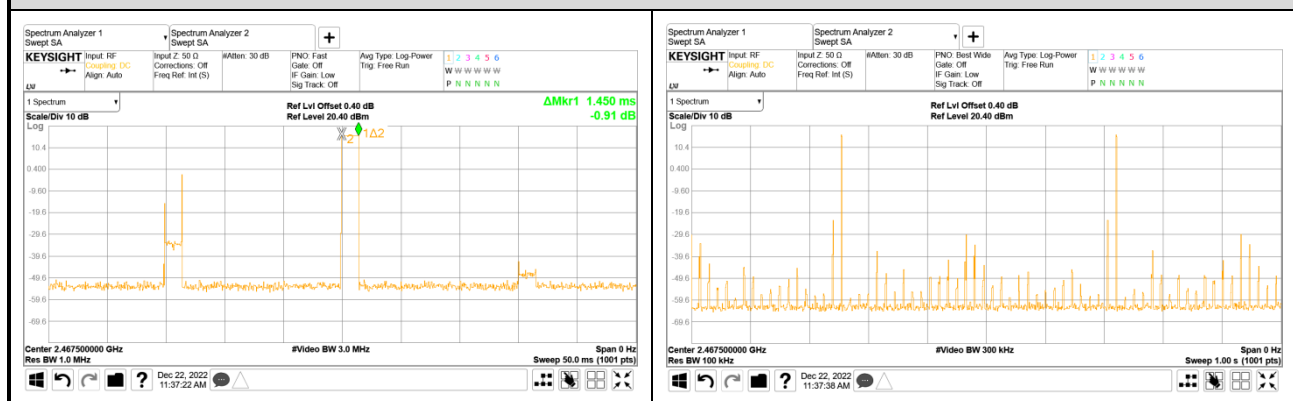
2407.50MHz



2437.50MHz

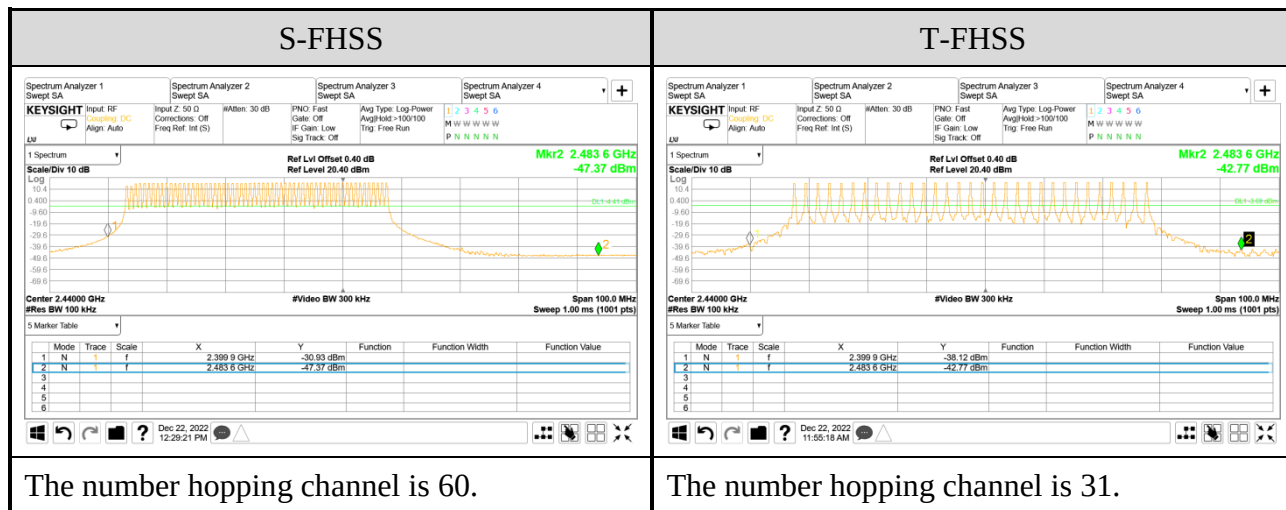


2467.50MHz



A.6 NUMBER OF HOPPING CHANNELS

Test Date	2022/12/22	Temp./Hum.	18°C/64%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)		



A.7 MAXIMUM PEAK OUTPUT POWER

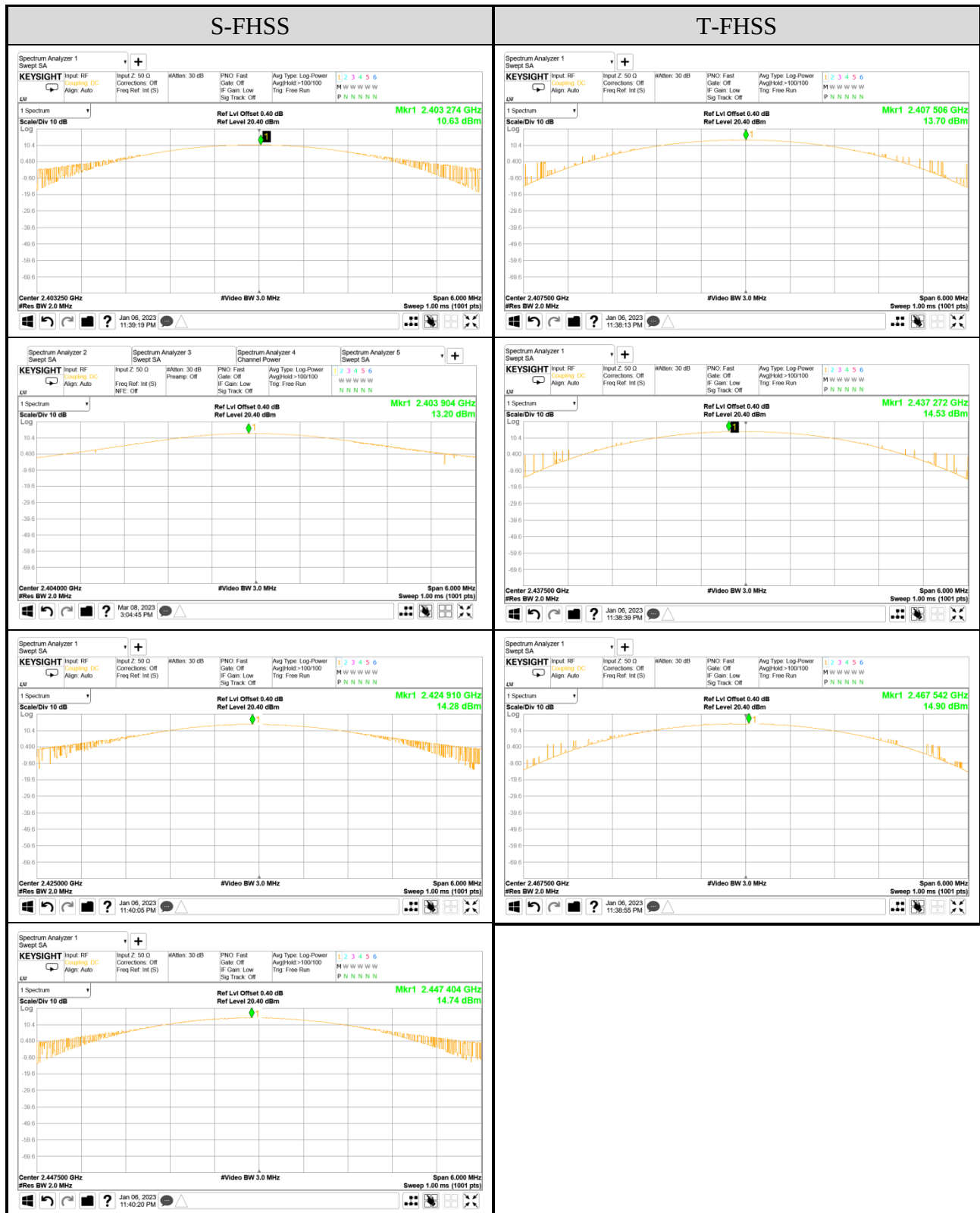
Test Date	2023/01/06 ~ 03/08	Temp./Hum.	18-23°C/47-69%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)		

A.7.1 Maximum Peak Output Power

Mode	Centre Frequency (MHz)	Peak Output Power		Limit
		dBm	W	
S-FHSS	2403.25	10.63	0.011561	21dBm (0.125W)
	2404.00	13.20	0.020893	
	2425.00	14.28	0.026792	
	2447.50	14.74	0.029785	

Mode	Centre Frequency (MHz)	Peak Output Power		Limit
		dBm	W	
T-FHSS	2407.50	13.70	0.023442	21dBm (0.125W)
	2437.50	14.53	0.028379	
	2467.50	14.90	0.030903	

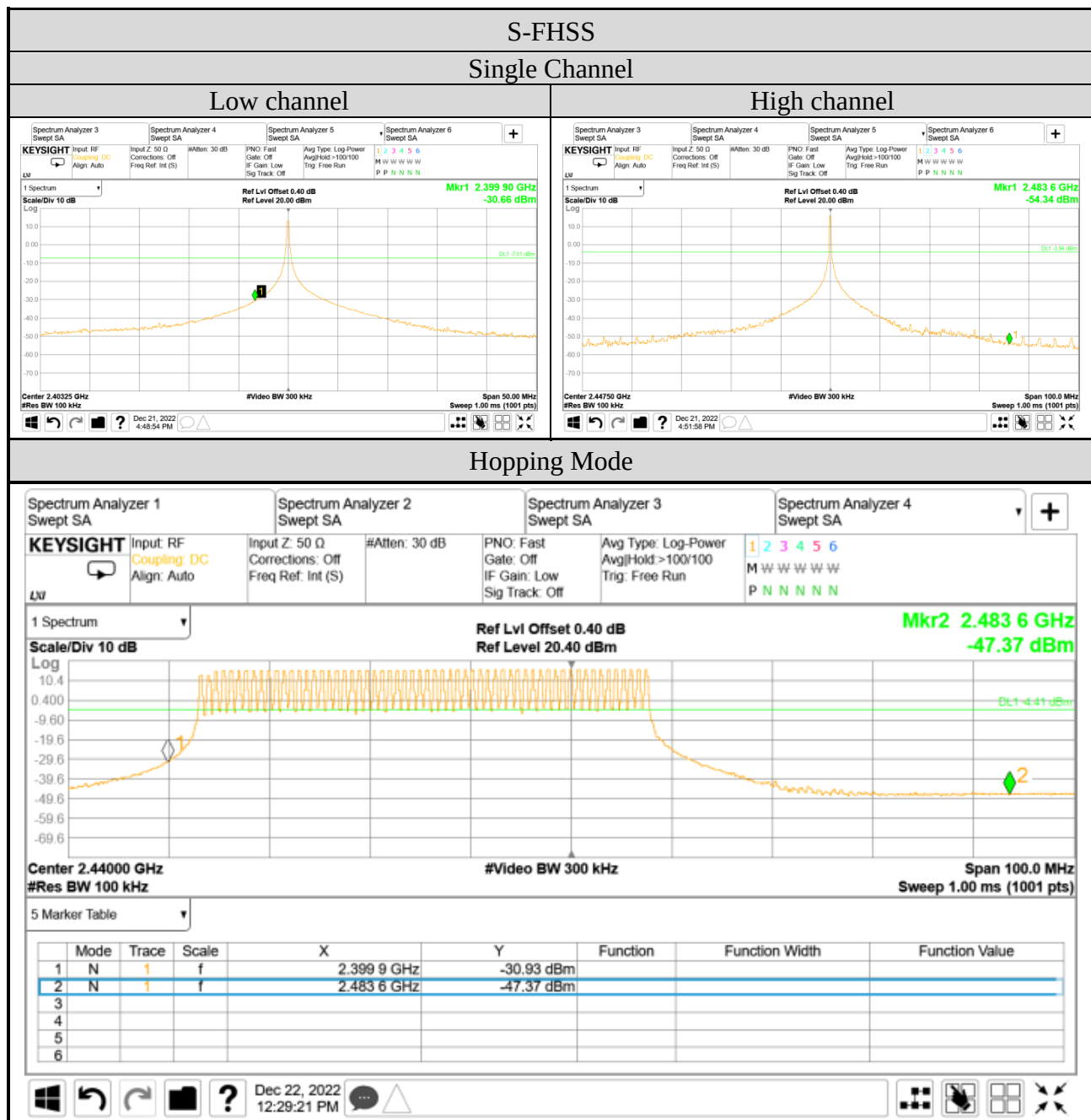
A.7.2 Measurement Plots

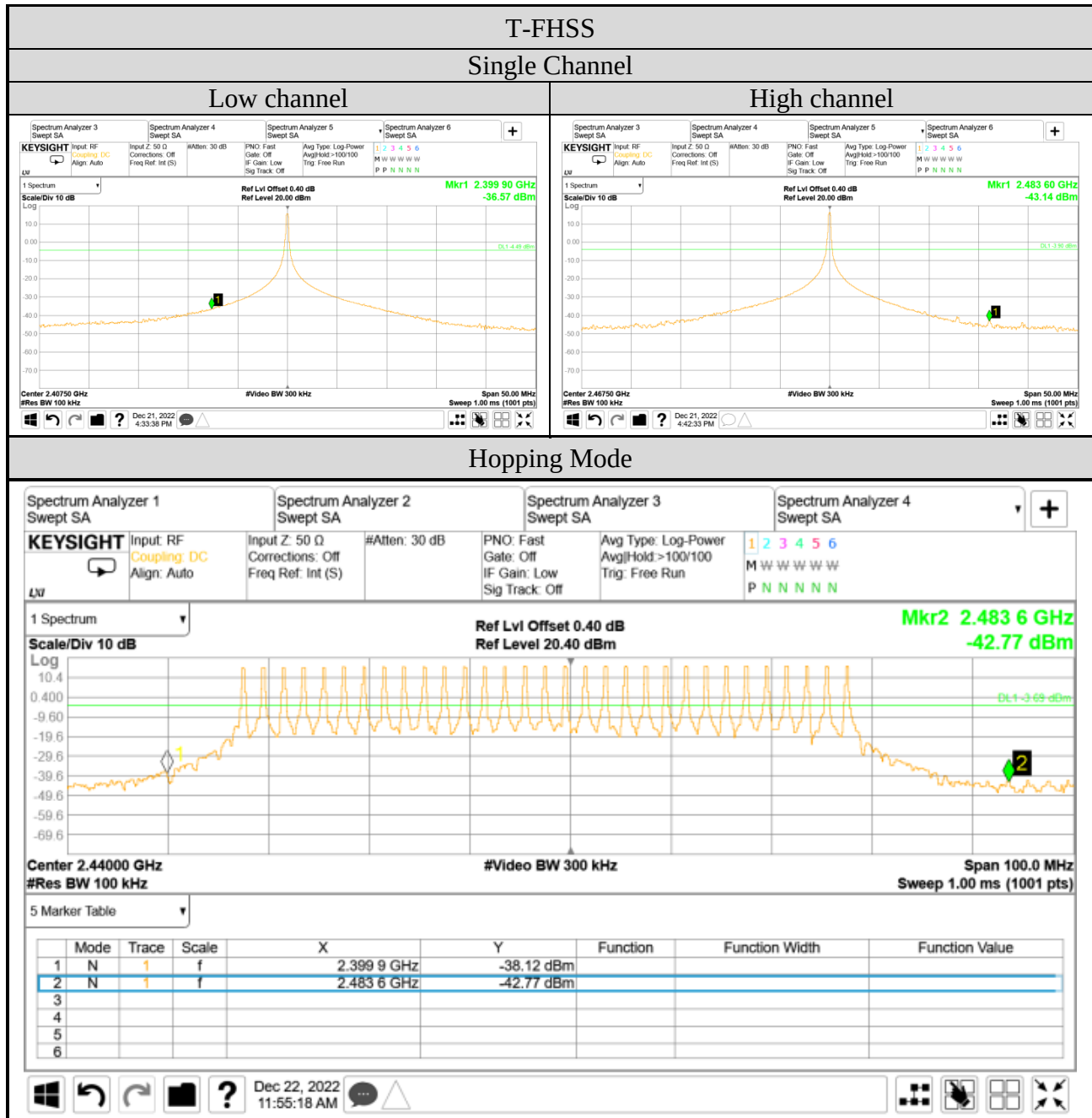


A.8 EMISSION LIMITATIONS MEASUREMENT

A.8.1 Band Edge

Test Date	2022/12/21	Temp./Hum.	18°C/68%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)	Test Model	FEX01TB-1





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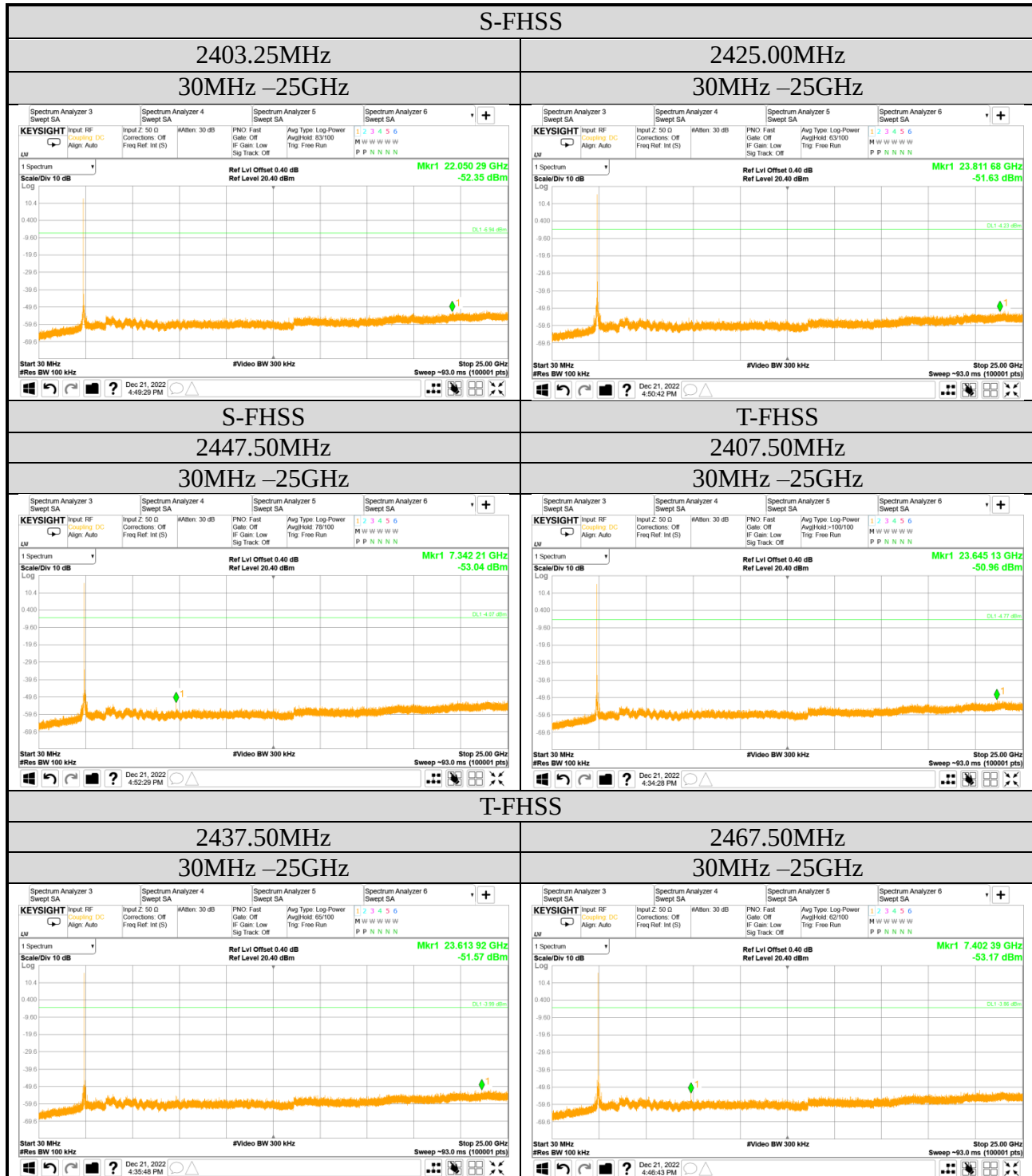
No. 491, Zhongfu Rd., Linkou Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301

Fax: +886 2 26099303

A.8.2 Spurious Emission

Test Date	2022/12/21	Temp./Hum.	18°C/68%
Cable Loss	0.40dB	Tested By	Sam Chang
Test Voltage	DC 7.4V (Via Battery)		



File Number: C1M2212045

Report Number: EM-F230134

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