

FCC 15.247 & RSS-247 2.4GHz Report

for

FUTABA Corporation

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

**Product : Radio Control
Model : T6L
Brand : Futaba
FCC ID : AZP-T6L-24G
IC : 2914D-T6L**

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



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TEST REPORT CERTIFICATION

Applicant : FUTABA Corporation
Manufacture : FUTABA Corporation
Product Name : Radio Control
Model No. : T6L
Serial No. : N/A
Brand : Futaba

Rules of Compliance and Measurement Standards:

47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 4), November 2014
RSS-247 (Issue 2), October 2016
ANSI C63.10:2013
FCC Public Notice DA 00-705

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 Test: 2017. 03. 17 ~ 04. 07

Date of Report: 2017. 04. 11

Producer: Sabrina Wang
(Sabrina Wang/Administrator)

Signatory: Ben Cheng
(Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2017. 04. 11	Original Report.	EM-F170202

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	PASS

3. GENERAL INFORMATION

3.1. Description of EUT

Product	Radio Control
Model	T6L
Brand	Futaba
Serial	N/A
Applicant	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Manufacture	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.

3.2. Description of EUT

Test Model	T6L
Serial Number	N/A
Power Rating	6.0 ± 0.2Vdc
Equipment Type	Frequency-Hopping Spread-Spectrum
Sample Status	Production
Date of Receipt	2017. 02. 10

3.3. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (kbps)
T-FHSS	2407.5-2467.5	31	Hopping	128

T-FHSS Channel List							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	2407.5	11	2427.5	21	2447.5	31	2467.5
2	2409.5	12	2429.5	22	2449.5		
3	2411.5	13	2431.5	23	2451.5		
4	2413.5	14	2433.5	24	2453.5		
5	2415.5	15	2435.5	25	2455.5		
6	2417.5	16	2437.5	26	2457.5		
7	2419.5	17	2439.5	27	2459.5		
8	2421.5	18	2441.5	28	2461.5		
9	2423.5	19	2443.5	29	2463.5		
10	2425.5	20	2445.5	30	2465.5		

3.4. Antenna Information

Antenna Part Number	Manufacture	Antenna Type	Frequency	Max Gain (dBi)
---	---	1/2λ Print Pattern Type Antenna	2.4GHz	2.14

3.5. Test Configuration

Modulation	T _{on} (ms)	Duty Cycle Factor (dB)
T-FHSS	0.630	-44.01

Item		Modulation	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	T-FHSS	1/31
	Radiated Spurious Emission ^{Note1}	T-FHSS	1/15/31
Conducted Test Case	20dB Bandwidth	T-FHSS	1/15/31
	Carrier Frequency Separation	T-FHSS	1/15/31
	Time of Occupancy	T-FHSS	1/15/31
	Number of Hopping Channels	T-FHSS	15
	Maximum Peak Output Power	T-FHSS	1/15/31
	Band Edges	T-FHSS	1/31
	Spurious Emission	T-FHSS	1/15/31

Note 1:

Mobile Device

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

Lie

Side

Stand

3.6. Tested Supporting System List

3.6.1. Support Peripheral Unit

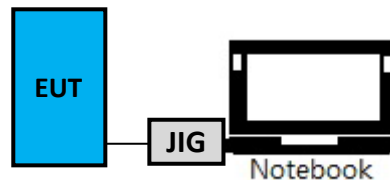
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	acer	Acer Aspire 4755G	N/A	HLZ-AR5B97
2.	Jig	N/A	N/A	N/A	N/A
3.	DC Power Supply	TOP WARD	6303A	N/A	N/A
	DC Power Supply	TOP WARD	3303A	N/A	N/A

3.6.2. Cable Lists

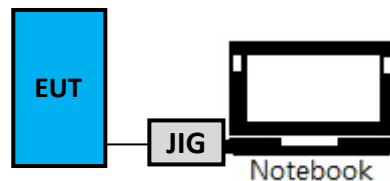
No.	Cable Description Of The Above Support Units
1.	Adapter: DELTA, M/N ADP-90CDD Power Cord: I/P: Non-Shielded, Detachable, 1.8m Power Cable: O/P: Shielded, Undetachable, 1.8m, Bonded a ferrite core
2.	Cable: Non-Shielded, Detachable, 0.3m
3.	DC Power Cord*2: Unshielded, Detachable, 1.0m

3.7. Setup Configuration

3.7.1. EUT Configuration for Radiated Emission



3.7.2. EUT Configuration for RF Conducted Test Items



3.8. Operating Condition of EUT

Test program “Futaba Term” is used for enabling EUT RF function under continues transmitting and choosing data rate/ channel.

3.9. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: sales@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2005 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724 (3) FCC OET Designation No. TW1004 & TW1090
Test Facilities	(1) Semi-Anechoic Chamber (IC Test Site Registration No.: 5183B-1) (2) Fully Anechoic Chamber (IC Test Site Registration No.: 5183B-4)

3.10. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty = $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	±0.2kHz
Carrier Frequency Separation	±0.2kHz
Time of Occupancy	±0.03sec
Maximum peak Output power	± 0.52dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2016. 04. 20	1 Year
2.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2016. 09. 19	1 Year
3.	Test Receiver	R&S	ESCI7	100923	2016. 04. 12	1 Year
4.	Amplifier	HP	8447D	2944A06305	2017. 02. 16	1 Year
5.	Pre-Amplifier	Sonoma	310N	187161	2016. 06. 14	1 Year
6.	Bilog Antenna	TESEQ	CBL6112D	33821	2017. 01. 21	1 Year
7.	Horn Antenna	ETS-Lindgren	3117	00135902	2017. 03. 08	1 Year
8.	Horn Antenna	EMCO	3116	2653	2016. 10. 24	1 Year
9.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-0 0	1	2016. 07. 27	1 Year
10.	Test Software	Audix	e3	V.120619C	N.C.R.	N.C.R.
11.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

4.2. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2017. 01. 03	1 Year

5. CONDUCTED EMISSION MEASUREMENT

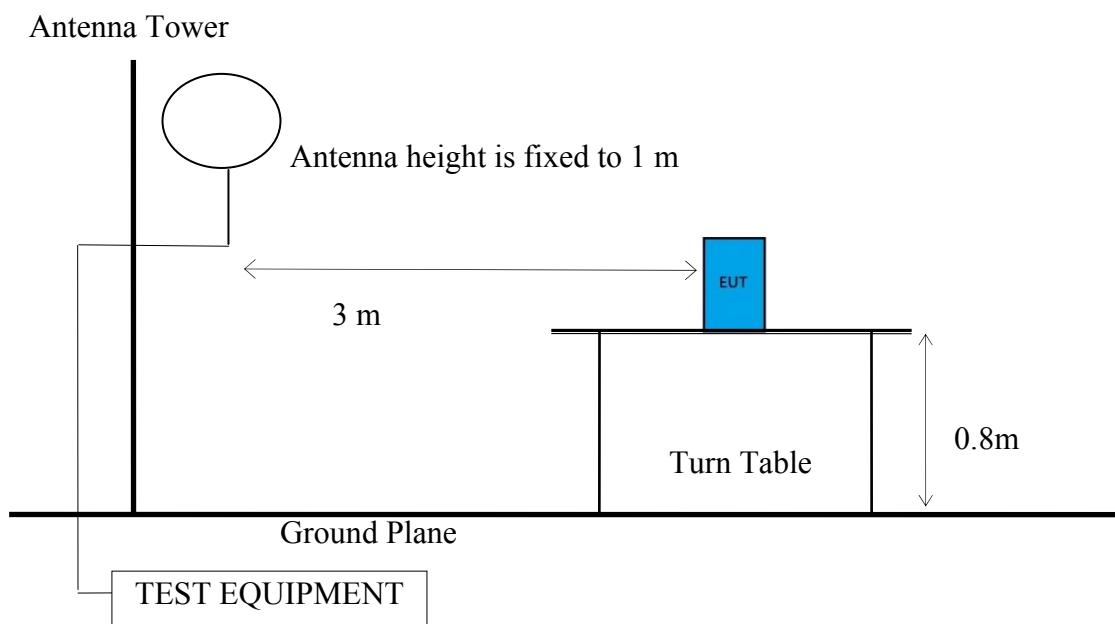
【The EUT only employs battery power for operation, no conductive emission limits are required according to RSS-Gen §8.8】

6. RADIATED EMISSION MEASUREMENT

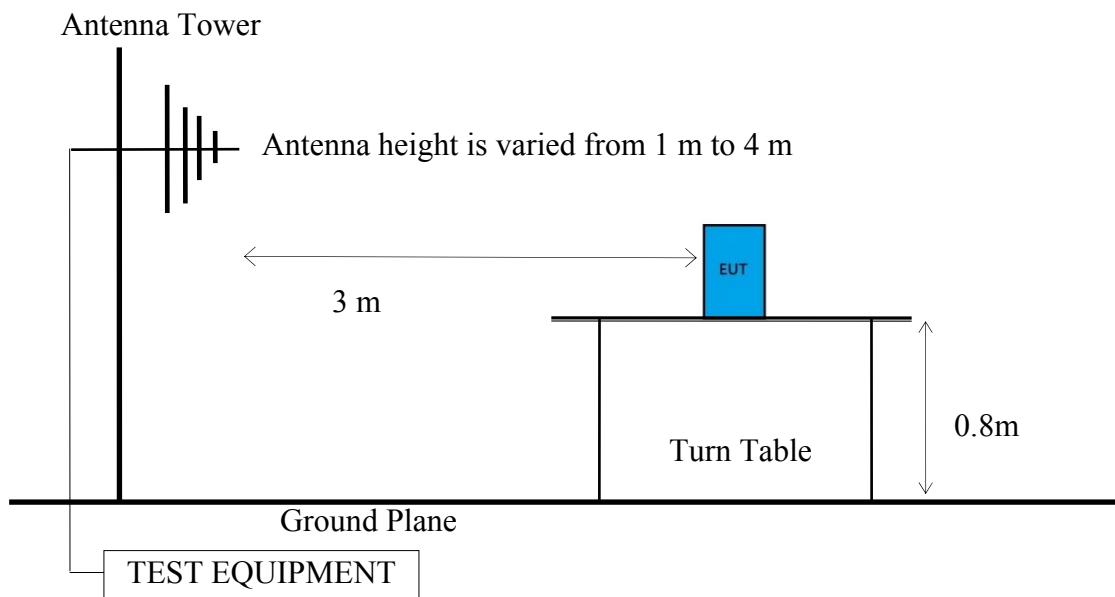
6.1. Block Diagram of Test Setup

6.1.1. Block Diagram of connection between EUT and simulators
Indicated as section 3.7

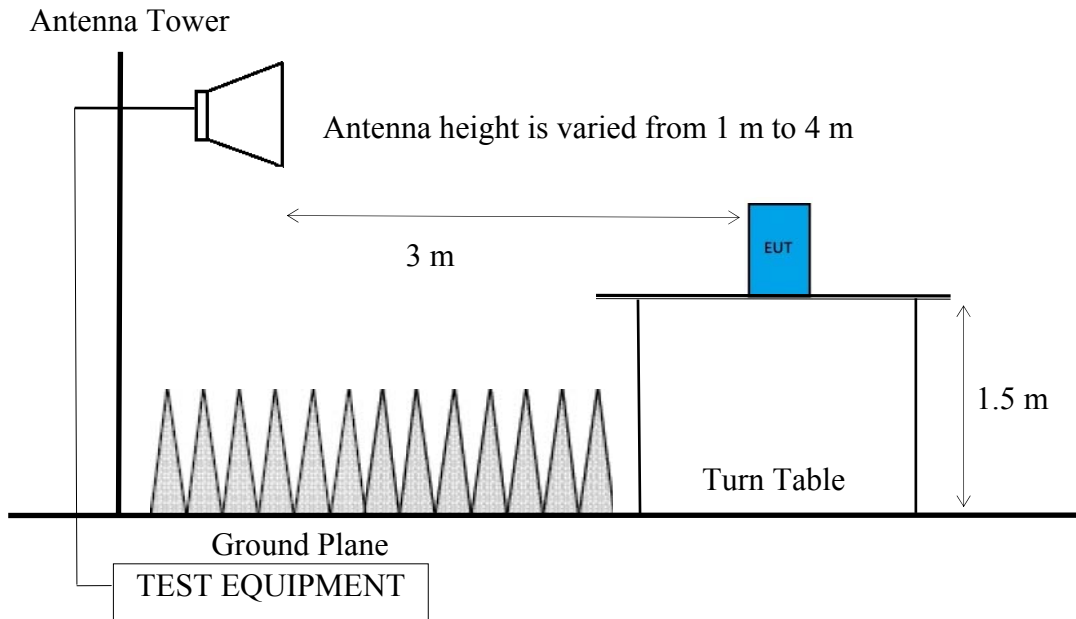
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000 MHz



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 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	2400/kHz
0.490 - 1.705	30	87.6	24000/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) $dB\mu V/m = 20 \log (\mu V/m)$
 - (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 turn table 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 find table which has 80 cm (for 30-1000 MHz) 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 x RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

Frequency above 1GHz to 10th harmonic:

Peak Measurement:

- (1) RBW = 1 MHz
- (2) VBW \geq 3 x RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average for finally measurement.

Average Measurement: **Option 1:**

- (1) RBW = 1 MHz
- (2) VBW = 1/T, where T is Tx-on presented in Appendix A.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 = Antenna Factor + Cable Loss + Meter Reading

Average Emission Level = Antenna Factor + Cable Loss + Meter Reading

Average Emission Level = Peak Emission Level + DCCF

Duty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/100ms)$ presented in section 3.5

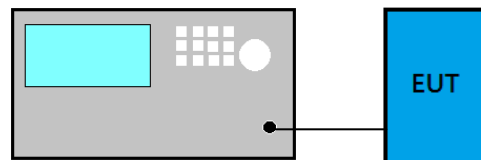
ERP = Peak Emission Level - 95.2 dB - 2.14 dB

6.5. Test Results

Please refer to Appendix A.

7. 20dB BANDWIDTH MEASUREMENT

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 DA00-705:

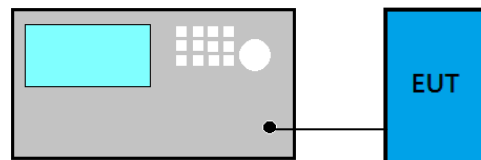
- (1) Set RBW close to 1% of OBW.
- (2) Set VBW \geq RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

8. CARRIER FREQUENCY SEPARATION MEASUREMENT

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 DA00-705:

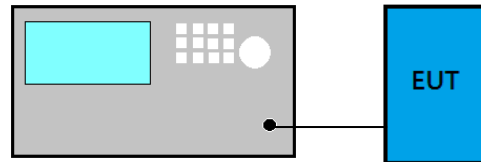
- (1) Span = wide enough to capture the peaks of two adjacent channels
- (2) RBW \geq 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

8.4. Test Results

Please refer to Appendix A

9. TIME OF OCCUPANCY MEASUREMENT

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 DA00-705:

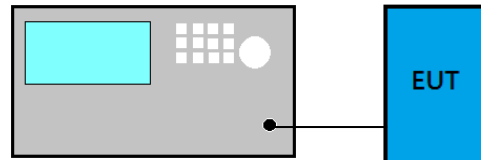
- (1) Span = zero span, centered on a hopping channel
- (2) RBW = 1 MHz
- (3) VBW \geq RBW
- (4) Sweep = as necessary to capture the entire dwell time per hopping channel
- (5) Detector function = peak
- (6) Trace = max hold

9.4. Test Results

Please refer to Appendix A

10. NUMBER OF HOPPING CHANNELS MEASUREMENT

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 DA00-705:

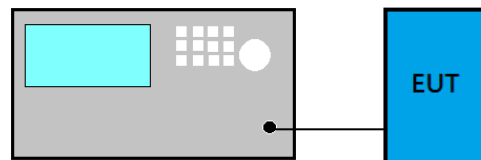
- (1) Span = the frequency band of operation
- (2) RBW \geq 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

10.4. Test Results

Please refer to Appendix A

11. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

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 DA00-705:

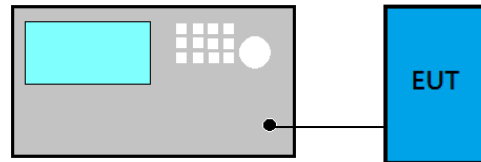
- (1) Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- (2) RBW \geq 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

11.4. Test Results

Please refer to Appendix A

12. EMISSION LIMITATIONS MEASUREMENT

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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).(※This test result attaching to §3.6.3)

12.3. Test Procedure

Following measurement procedure is reference to DA00-705:

- (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 ≥ RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

12.4. Test Results

Please refer to Appendix A

13. DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPENDIX A

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APPENDIX A

TEST DATA AND PLOTS

(Model: T6L)

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A.1 RADIATED EMISSION

Test Date	2017/04/17	Temp./Hum.	24°C/56%
Test Voltage	DC 6V (Via DC Power Supply)		

A.1.1 Emissions within Restricted Frequency Bands

A.1.1.1 Frequency 9kHz~30MHz

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

A.1.1.2 Frequency Below 1 GHz

Mode	T-FHSS	Frequency	TX 2407.5MHz
------	--------	-----------	--------------

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector (dB)
194.90	9.42	3.29	28.81	41.52	43.50	1.98	Peak
208.48	10.09	3.43	28.28	41.80	43.50	1.70	Peak
221.09	10.96	3.55	25.69	40.20	46.00	5.80	Peak
385.02	15.66	5.39	17.31	38.36	46.00	7.64	Peak
637.22	18.45	6.88	15.43	40.76	46.00	5.24	Peak

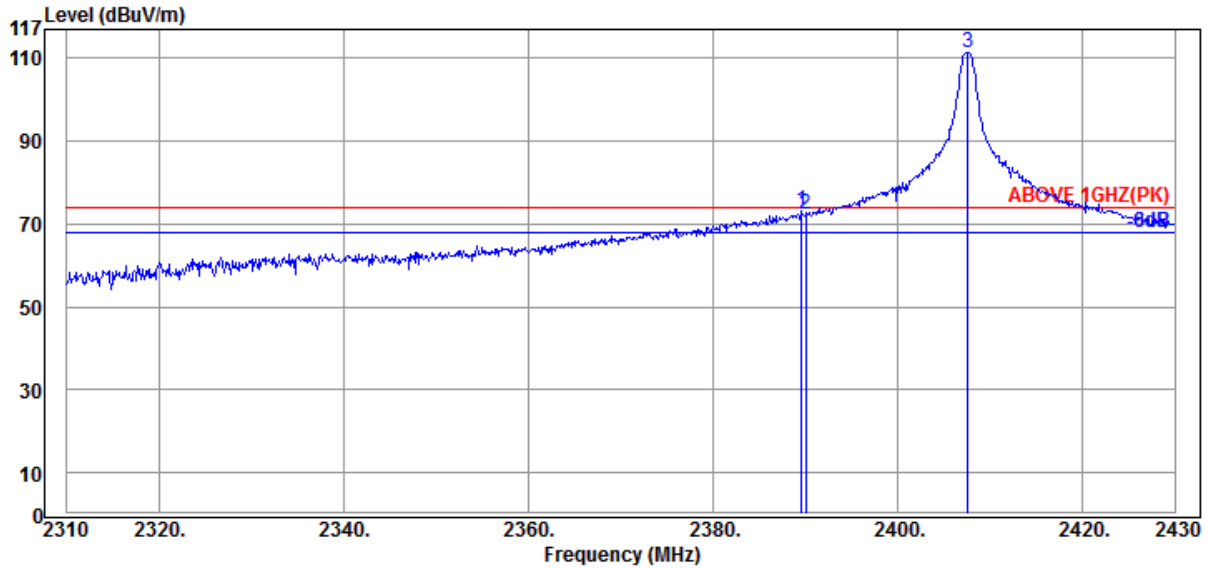
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector (dB)
104.69	12.20	2.33	17.56	32.09	43.50	11.41	Peak
147.37	11.79	2.80	14.55	29.14	43.50	14.36	Peak
194.90	9.42	3.29	19.42	32.13	43.50	11.37	Peak
637.22	18.45	6.88	19.76	45.09	46.00	0.91	Peak
649.83	18.46	6.92	11.82	37.20	46.00	8.80	Peak

A.1.2 Frequency Above 1 GHz to 10th harmonics

Band Edge:

Mode	T-FHSS	Frequency	TX 2407.5MHz
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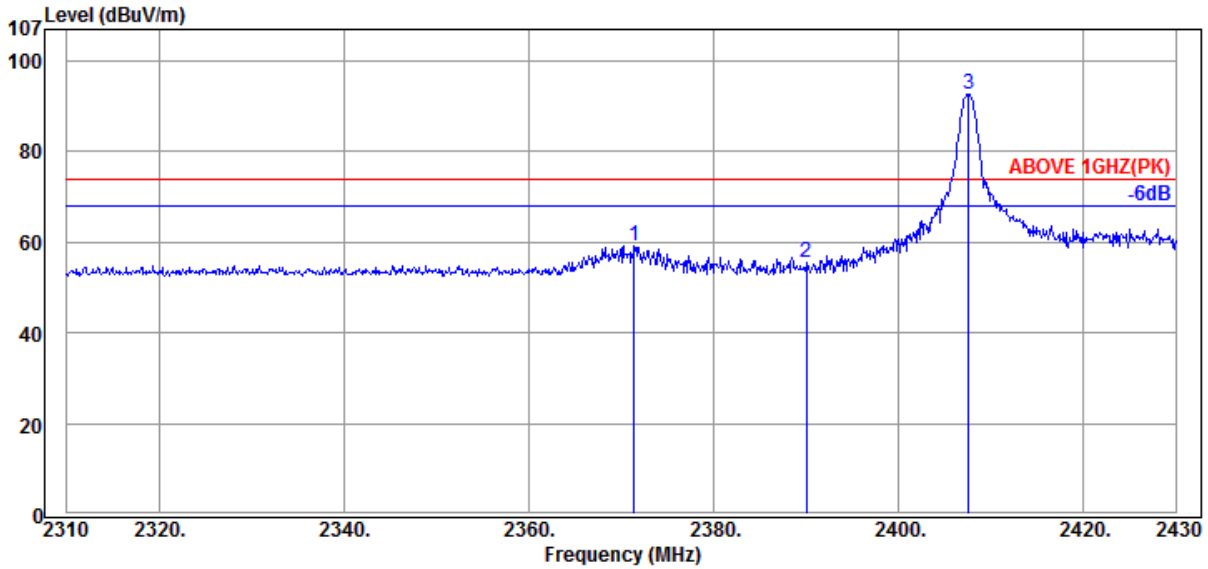


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.56	32.16	6.08	34.93	73.17	74.00	0.83	Peak
2390.04	32.16	6.08	33.99	72.23	74.00	1.77	Peak
2407.56	32.18	6.10	73.18	111.46	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2389.56	73.17	-44.01	29.16	54.00	24.84	Average
2390.04	72.23	-44.01	28.22	54.00	25.78	Average

Mode	T-FHSS	Frequency	TX 2407.5MHz
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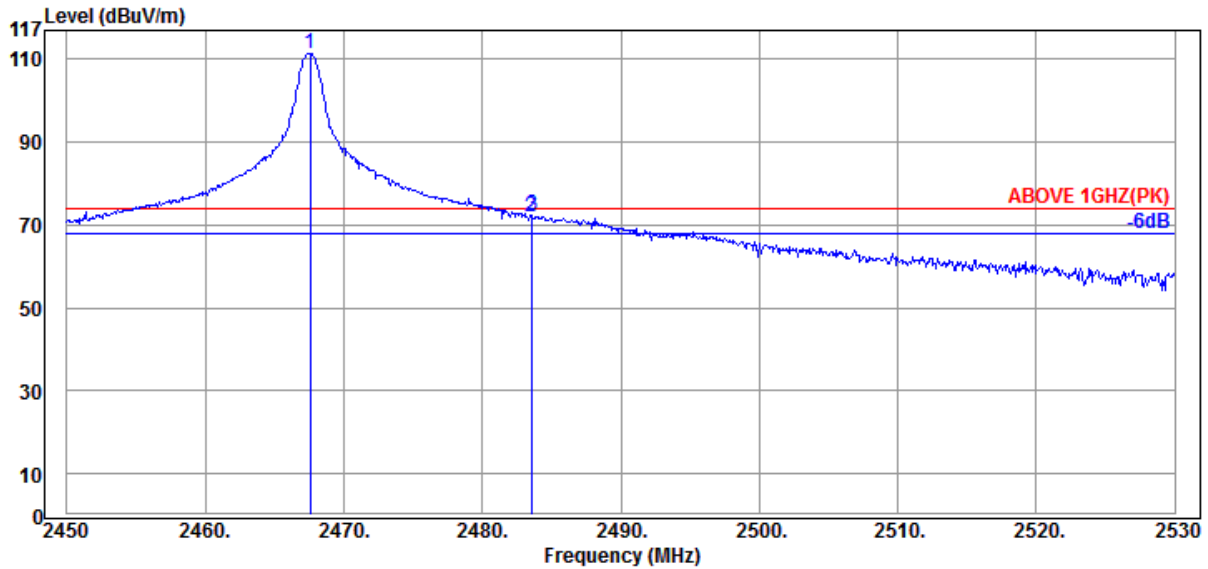


Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2371.44	32.13	6.05	21.15	59.33	74.00	14.67	Peak
2390.04	32.16	6.08	17.19	55.43	74.00	18.57	Peak
2407.56	32.18	6.10	54.26	92.54	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2371.44	59.33	-44.01	15.32	54.00	38.68	Average
2390.04	55.43	-44.01	11.42	54.00	42.58	Average

Mode	T-FHSS	Frequency	TX 2467.5MHz
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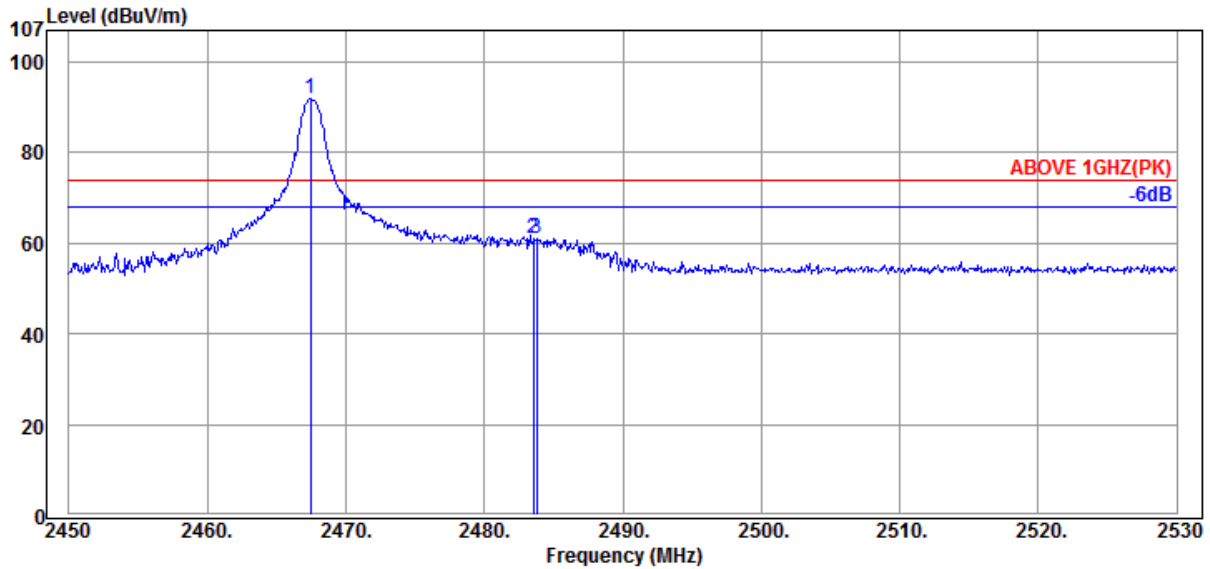


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2467.60	32.25	6.17	72.87	111.29	---	---	Peak
2483.52	32.28	6.19	33.57	72.04	74.00	1.96	Peak
2483.60	32.28	6.19	33.80	72.27	74.00	1.73	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.52	72.04	-44.01	28.03	54.00	25.97	Average
2483.60	72.27	-44.01	28.26	54.00	25.74	Average

Mode	T-FHSS	Frequency	TX 2467.5MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2467.44	32.25	6.17	53.41	91.83	---	---	Peak
2483.52	32.28	6.19	22.51	60.98	74.00	13.02	Peak
2483.76	32.28	6.19	22.58	61.05	74.00	12.95	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2483.52	60.98	-44.01	16.97	54.00	37.03	Average
2483.76	61.05	-44.01	17.04	54.00	36.96	Average

A.1.3 Emissions outside the frequency band:

Mode	T-FHSS	Frequency	TX 2407.5MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
2252.00	31.96	5.91	12.11	49.98	74.00	24.02	Peak
4815.00	34.22	8.93	4.07	47.22	74.00	26.78	Peak
7225.00	35.80	11.27	2.50	49.57	74.00	24.43	Peak

Emission Frequency (MHz)	Peak Emission Level (dB μ V/m)	DCCF (dB)	Average Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Remark
2252.00	49.98	-44.01	5.97	54.00	48.03	Average
4815.00	47.22	-44.01	3.21	54.00	50.79	Average
7225.00	49.57	-44.01	5.56	54.00	48.44	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
2252.00	31.96	5.91	8.89	46.76	74.00	27.24	Peak
4815.00	34.22	8.93	3.79	46.94	74.00	27.06	Peak
7220.00	35.80	11.27	2.75	49.82	74.00	24.18	Peak

Emission Frequency (MHz)	Peak Emission Level (dB μ V/m)	DCCF (dB)	Average Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Remark
2252.00	46.76	-44.01	2.75	54.00	51.25	Average
4815.00	46.94	-44.01	2.93	54.00	51.07	Average
7220.00	49.82	-44.01	5.81	54.00	48.19	Average

Mode	T-FHSS	Frequency	TX 2435.5MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2280.00	31.99	5.94	12.27	50.20	74.00	23.80	Peak
4870.00	34.25	9.09	4.48	47.82	74.00	26.18	Peak
7305.00	35.80	11.80	4.38	51.98	74.00	22.02	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark	
2280.00	50.20	-44.01	6.19	54.00	47.81	Average	
4870.00	47.82	-44.01	3.81	54.00	50.19	Average	
7305.00	51.98	-44.01	7.97	54.00	46.03	Average	

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2280.00	31.99	5.94	7.75	45.68	74.00	28.32	Peak
4870.00	34.25	9.09	5.73	49.07	74.00	24.93	Peak
7305.00	35.80	11.80	11.80	59.40	74.00	14.60	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark	
2280.00	45.68	-44.01	1.67	54.00	52.33	Average	
4870.00	49.07	-44.01	5.06	54.00	48.94	Average	
7305.00	59.40	-44.01	15.39	54.00	38.61	Average	

Mode	T-FHSS	Frequency	TX 2467.5MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
2312.00	32.03	5.98	14.80	52.81	74.00	21.19	Peak
4935.00	34.27	9.30	7.74	51.31	74.00	22.69	Peak
7405.00	35.80	12.41	12.44	60.65	74.00	13.35	Peak

Emission Frequency (MHz)	Peak Emission Level (dB μ V/m)	DCCF (dB)	Average Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Remark
2312.00	52.81	-44.01	8.80	54.00	45.20	Average
4935.00	51.31	-44.01	7.30	54.00	46.70	Average
7405.00	60.65	-44.01	16.64	54.00	37.36	Average

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
2312.00	32.03	5.98	9.25	47.26	74.00	26.74	Peak
4935.00	34.27	9.30	7.49	51.06	74.00	22.94	Peak
7405.00	35.80	12.41	6.61	54.82	74.00	19.18	Peak

Emission Frequency (MHz)	Peak Emission Level (dB μ V/m)	DCCF (dB)	Average Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Remark
2312.00	47.26	-44.01	3.25	54.00	50.75	Average
4935.00	51.06	-44.01	7.05	54.00	46.95	Average
7405.00	54.82	-44.01	10.81	54.00	43.19	Average

A.1.4 Emissions in Non-restricted Frequency Bands:

All emission levels below the 15.209 general radiated emissions limits is not required.

A.2 20dB BANDWIDTH MEASUREMENT

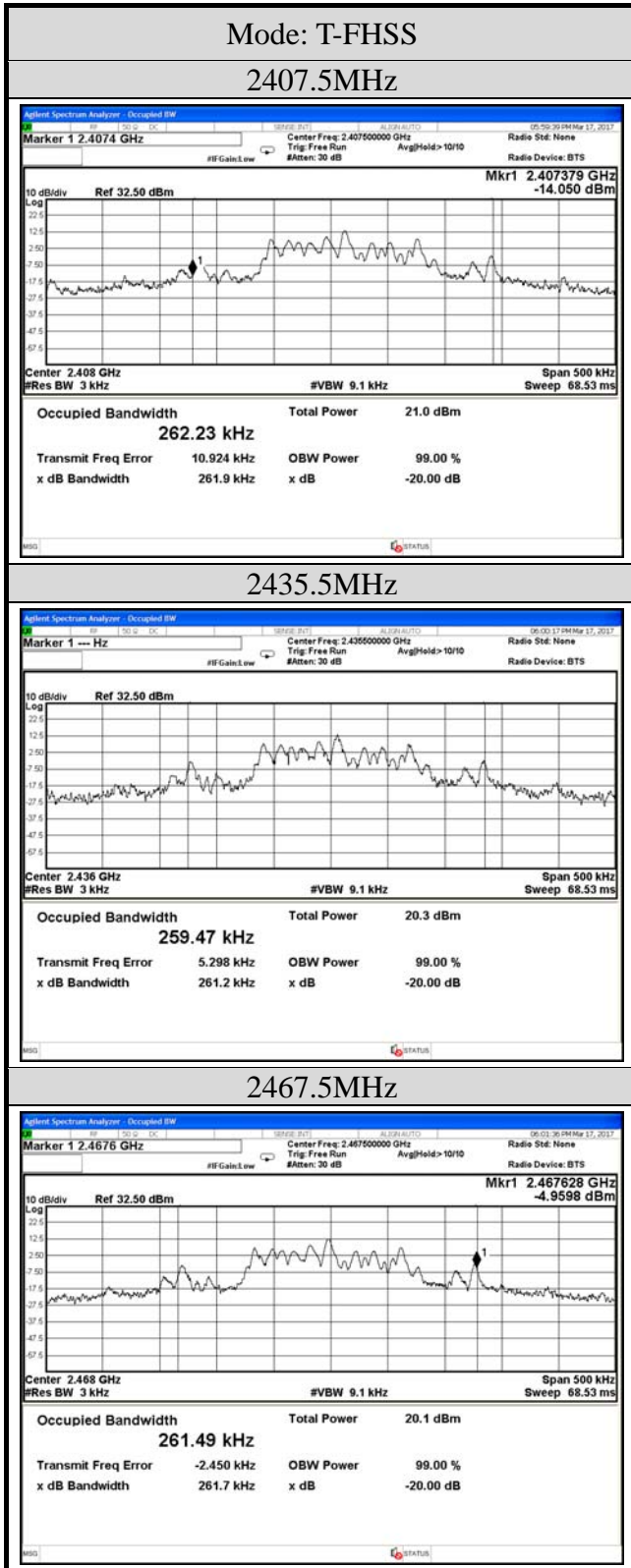
Test Date	2017/03/17	Temp./Hum.	23°C/53%
Cable Loss	---	Test Voltage	DC 6.0V

A.2.1 20dB Bandwidth Result

Mode	Centre Frequency (MHz)	20dB Bandwidth (MHz)	2/3 (20dB Bandwidth)
T-FHSS	2407.5	0.2619	0.175
	2435.5	0.2612	0.174
	2467.5	0.2617	0.174

Remark: The maximum two-thirds of the 20dB bandwidth shall be at maximum 0.175MHz.

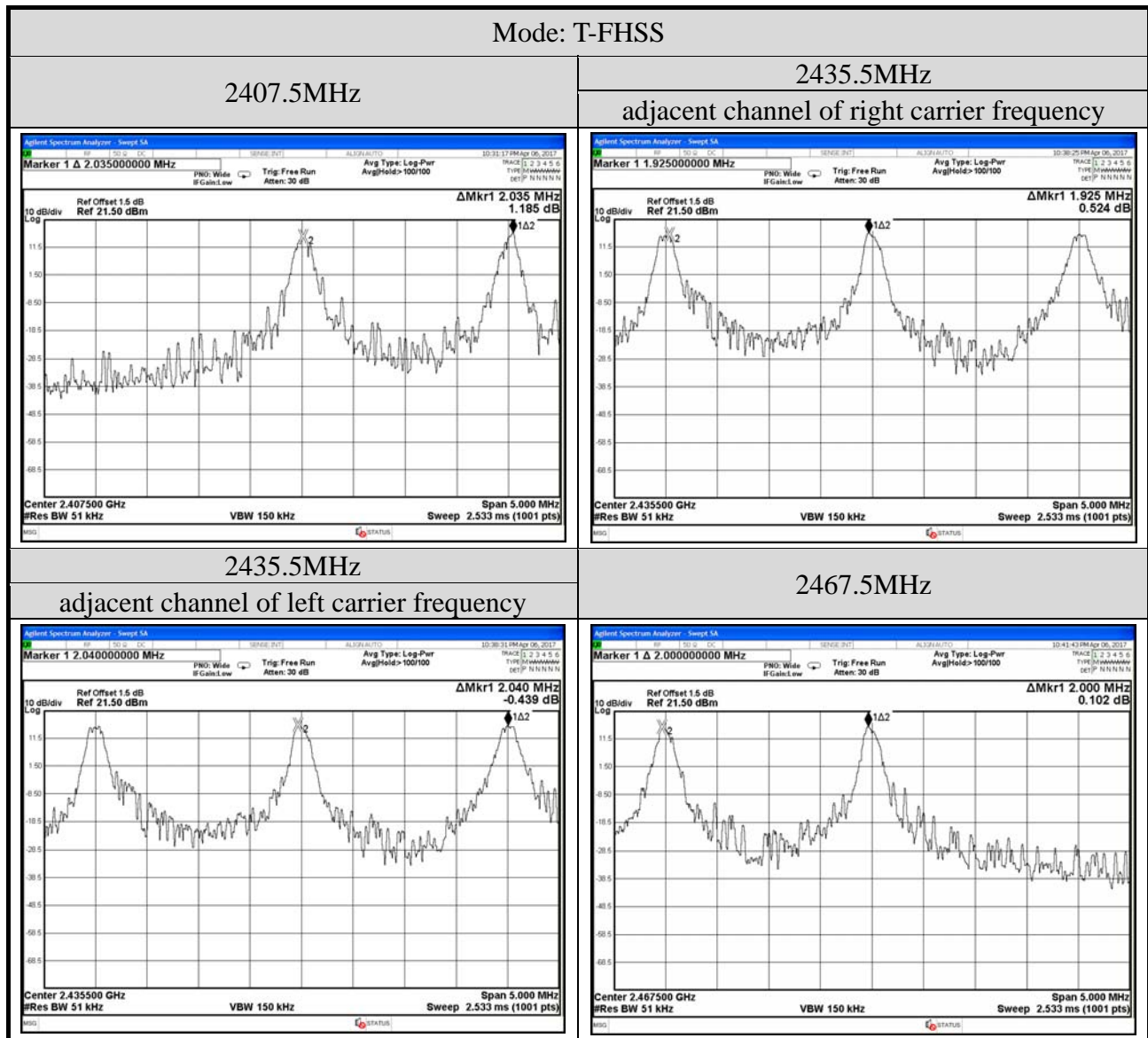
A.2.2 Measurement Plots



A.3 CARRIER FREQUENCY SEPARATION MEASUREMENT

Test Date	2017/04/06	Temp./Hum.	25°C/50%
Cable Loss	1.5dB	Test Voltage	DC 6.0V

A.3.1 Measurement Plots



A.4 TIME OF OCCUPANCY MEASUREMENT

Test Date	2017/04/06	Temp./Hum.	25°C/50%
Cable Loss	1.5dB	Test Voltage	DC 6.0V

A.4.1 Time of Occupancy

Mode	Centre Frequency (MHz)	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
T-FHSS	2407.5	0.600	22.320	<400
	2435.5	0.630	23.436	<400
	2467.5	0.630	23.436	<400

Observation Period: 31 channels*0.4 seconds = 12.4 seconds

Test Frequency: 2407.500MHz

DH1 : For each second of 3channel appearance, the longest time of occupancy for each of 12.4 seconds is:

$$3 \text{ Channels} * 12.4 * \text{seconds} * 0.600 \text{ ms} = 22.320 \text{ ms} (<400\text{ms})$$

Test Frequency: 2435.500MHz

DH3 : For each second of 3channel appearance, the longest time of occupancy for each of 12.4 seconds is:

$$3 \text{ Channels} * 12.4 * \text{seconds} * 0.630 \text{ ms} = 23.436 \text{ ms} (<400\text{ms})$$

Test Frequency: 2467.500MHz

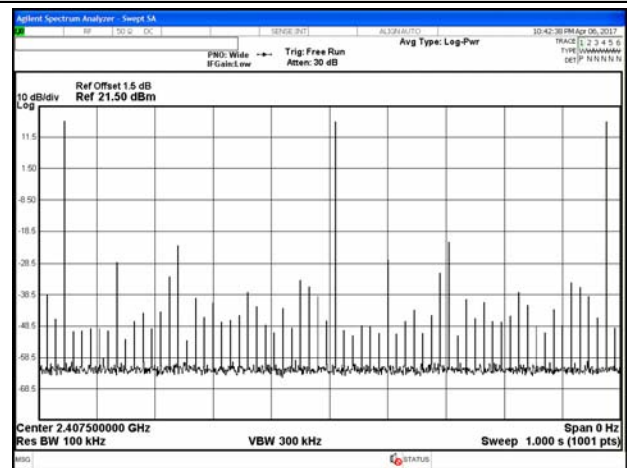
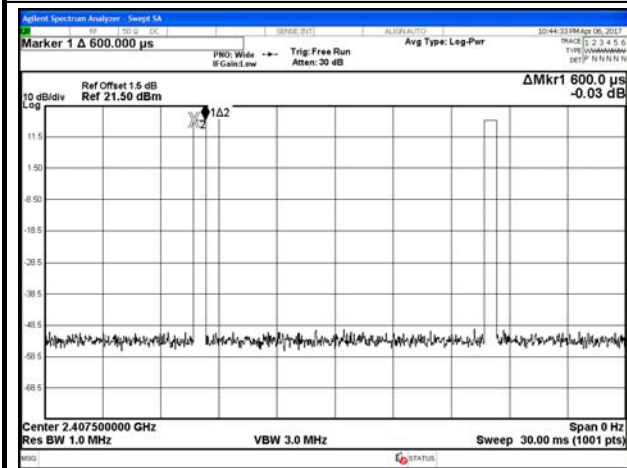
DH5 : For each second of 3channel appearance, the longest time of occupancy for each of 12.4 seconds is:

$$3 \text{ Channels} * 12.4 * \text{seconds} * 0.630 \text{ ms} = 23.436 \text{ ms} (<400\text{ms})$$

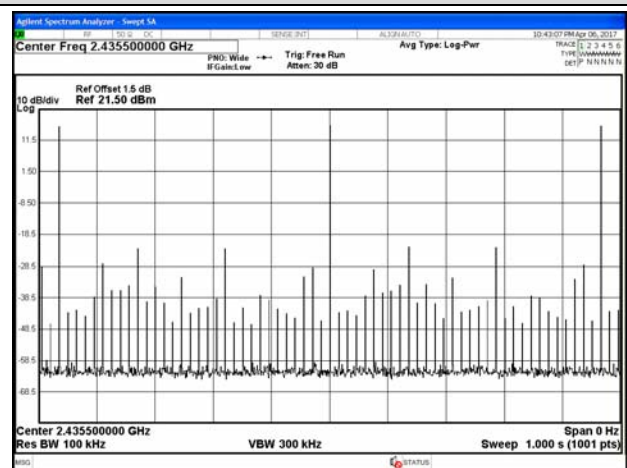
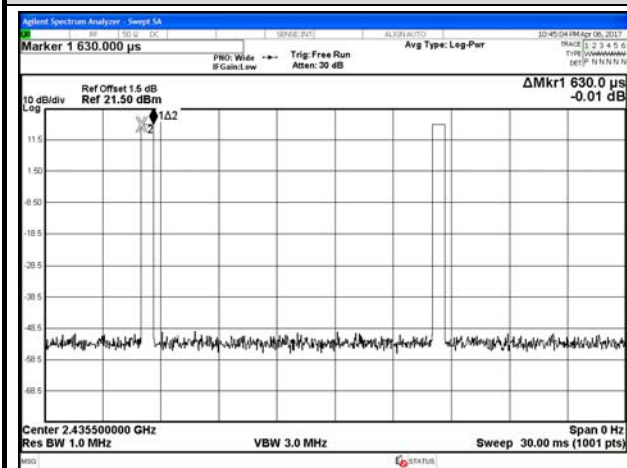
A.4.2 Measurement Plots

Mode: T-FHSS

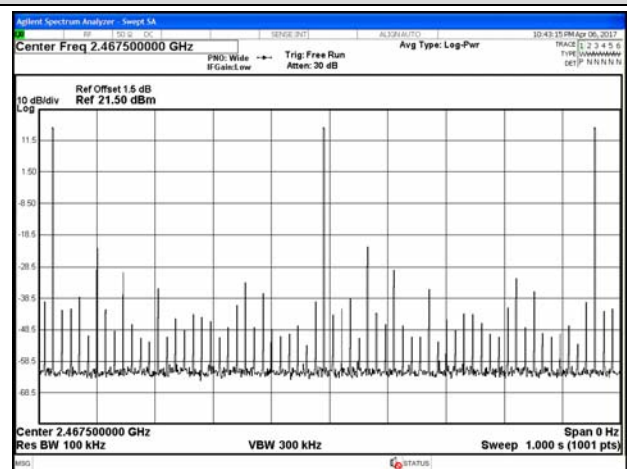
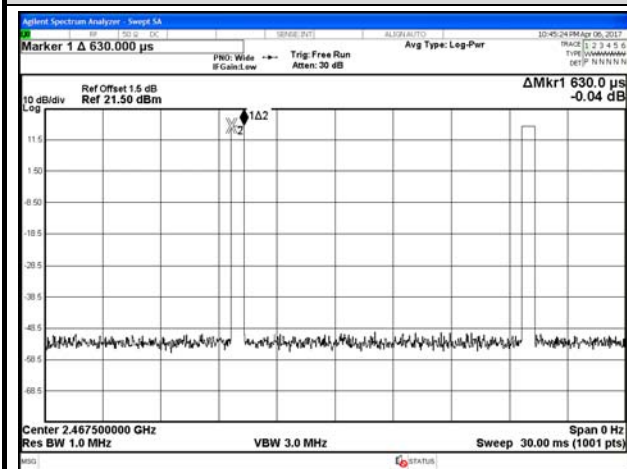
2407.5MHz



2435.5MHz



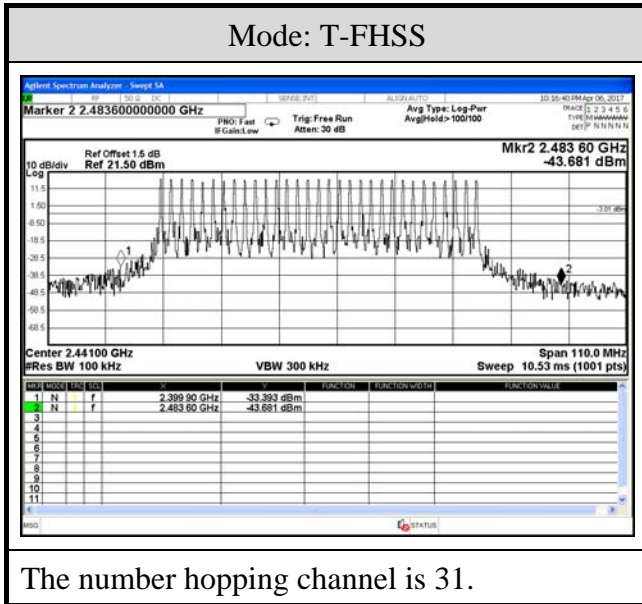
2467.5MHz



A.5 NUMBER OF HOPPING CHANNELS MEASUREMENT

Test Date	2017/04/06	Temp./Hum.	25°C/50%
Cable Loss	1.5dB	Test Voltage	DC 6.0V

A.5.1 Measurement Plots

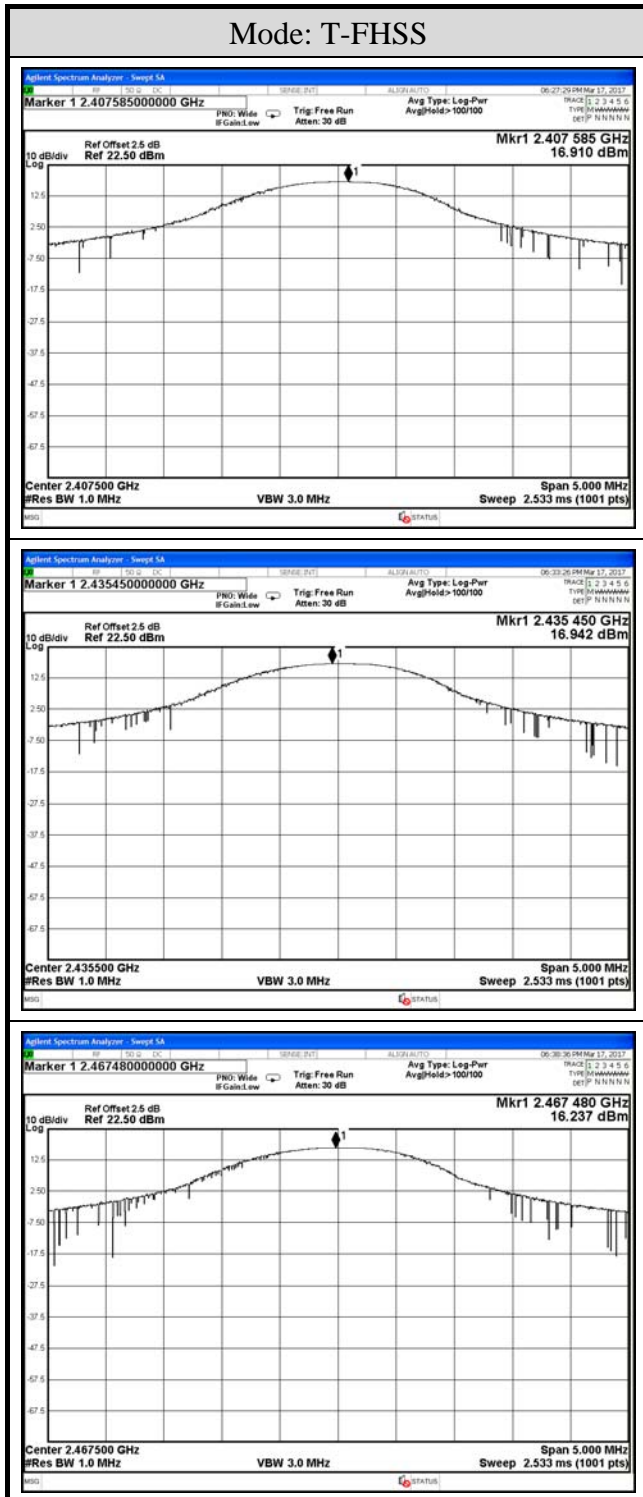


A.6 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

Test Date	2017/03/17	Temp./Hum.	23°C/53%
Cable Loss	2.5dB	Test Voltage	DC 6.0V

Modulation	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
T-FHSS	2407.50	16.910	0.049091	21dBm (0.125W)
	2435.50	16.942	0.049454	
	2467.50	16.237	0.042044	

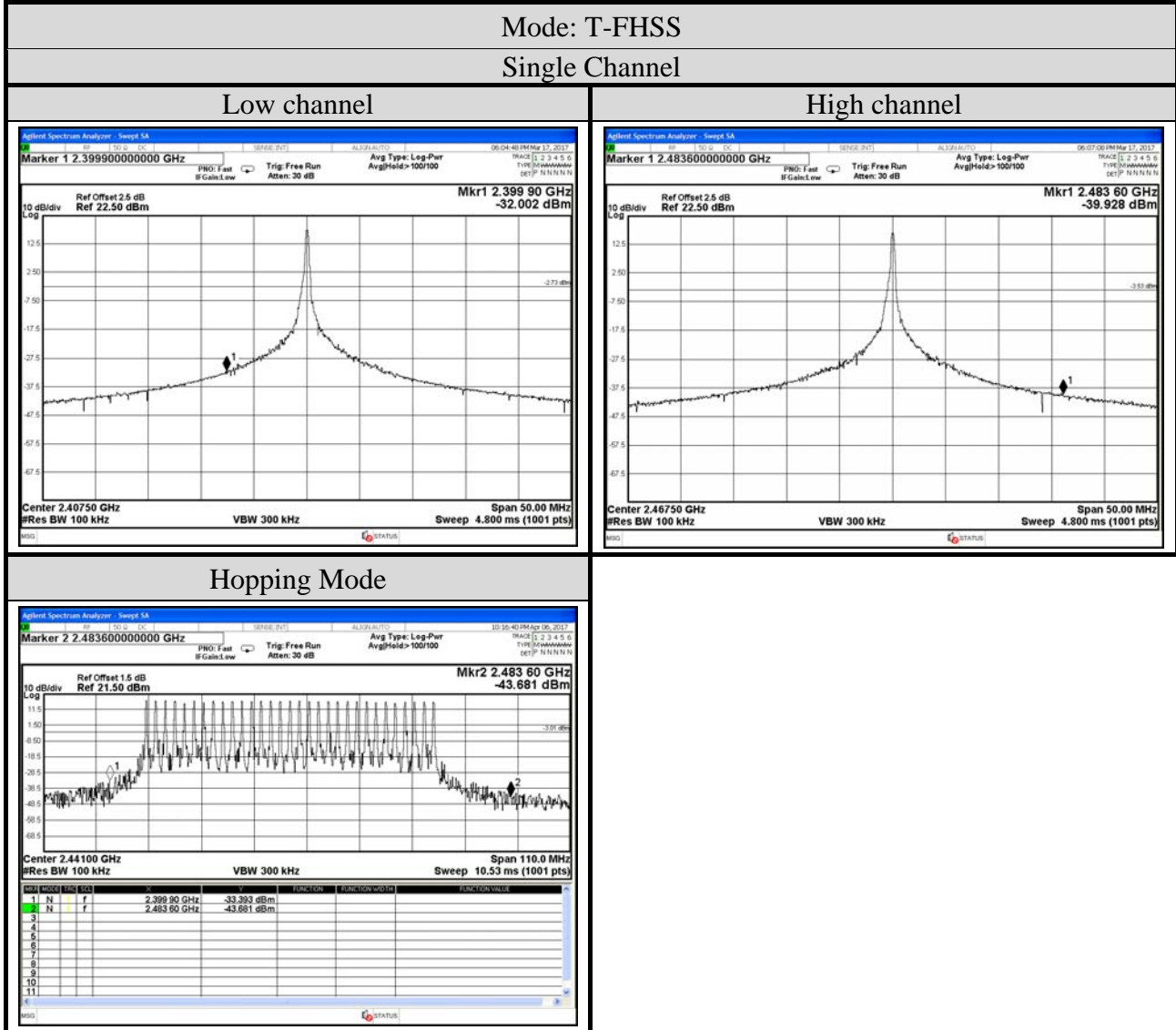
A.6.1 Measurement Plots



A.7 EMISSION LIMITATIONS MEASUREMENT

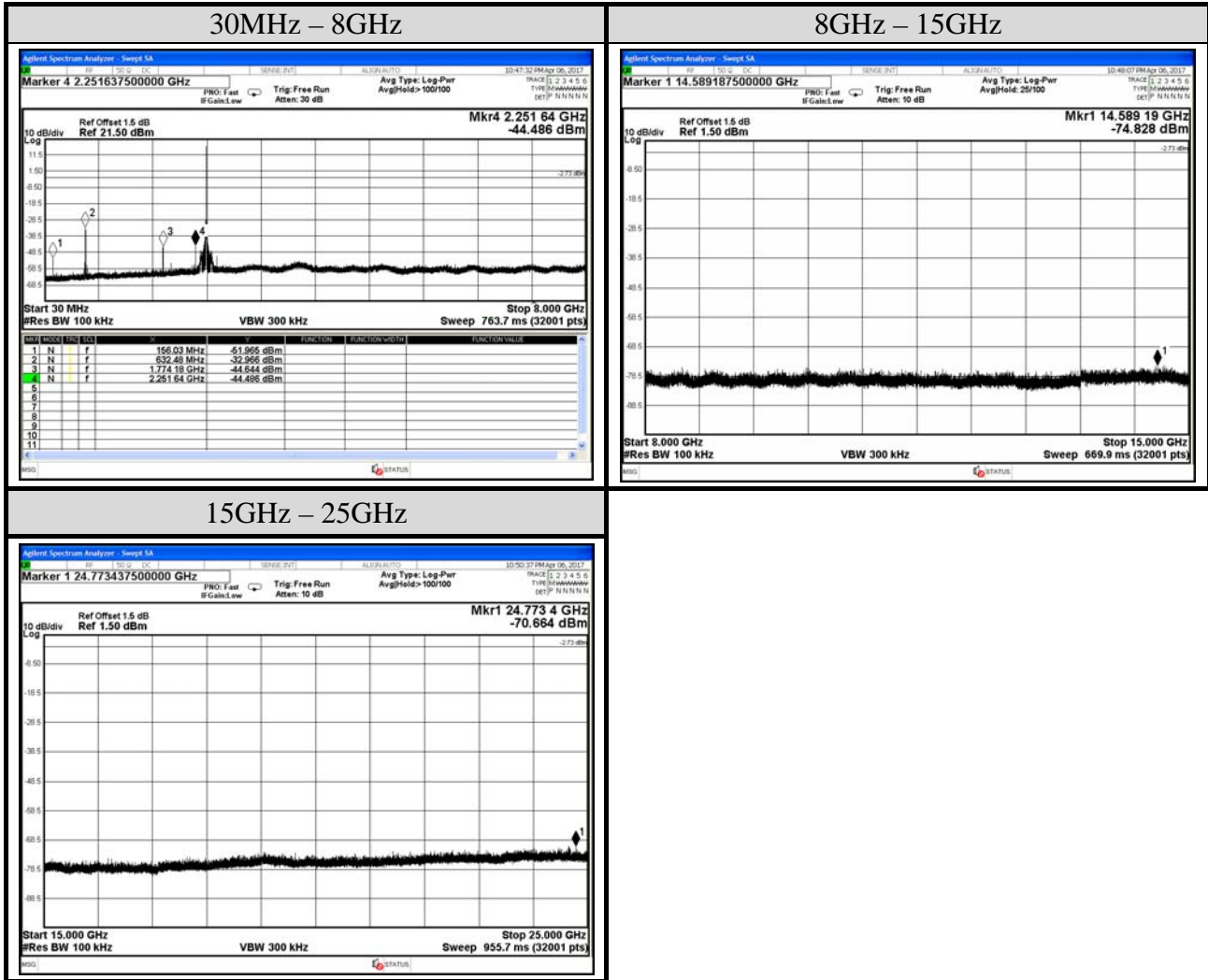
A.7.1 Band Edge

Test Date	2017/03/17	Temp./Hum.	23°C/53%
Cable Loss	2.5dB	Test Voltage	DC 6.0V



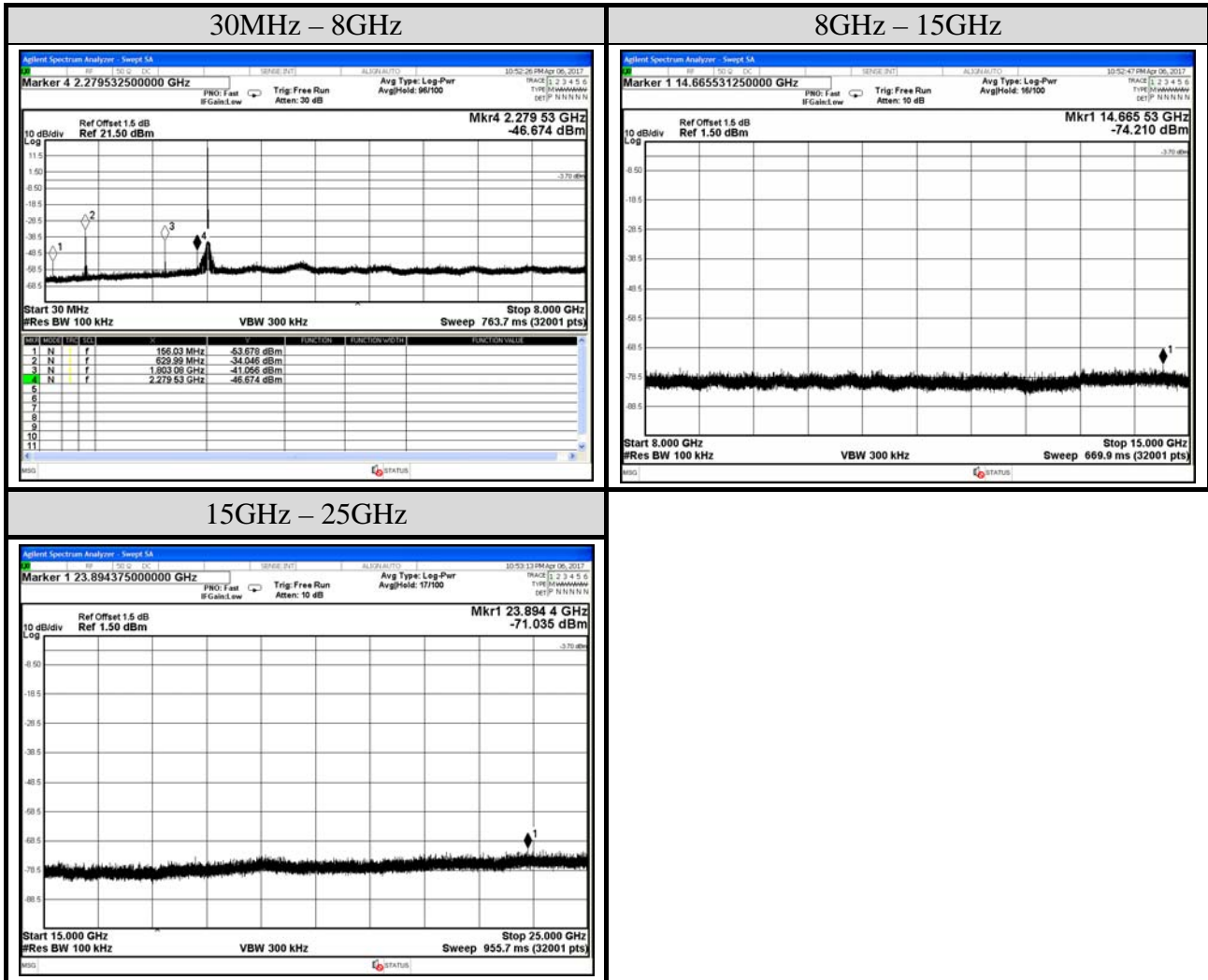
A.7.2 Spurious Emission

Test Date	2017/04/06	Temp./Hum.	25°C/50%
Mode	T-FHSS	Frequency	TX 2407.5MHz
Cable Loss	1.5dB	Test Voltage	DC 6.0V



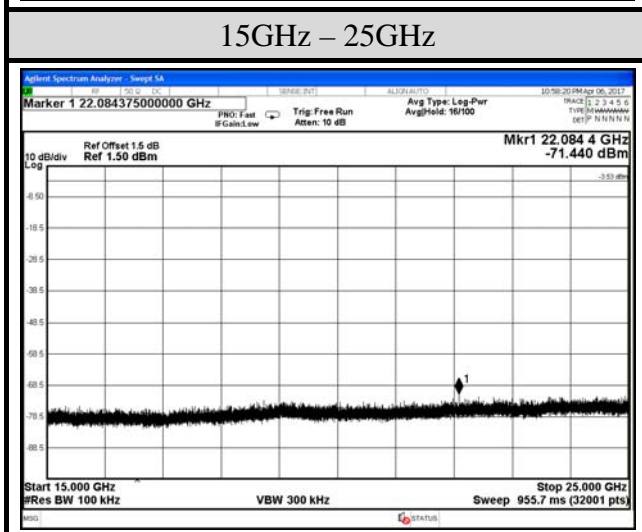
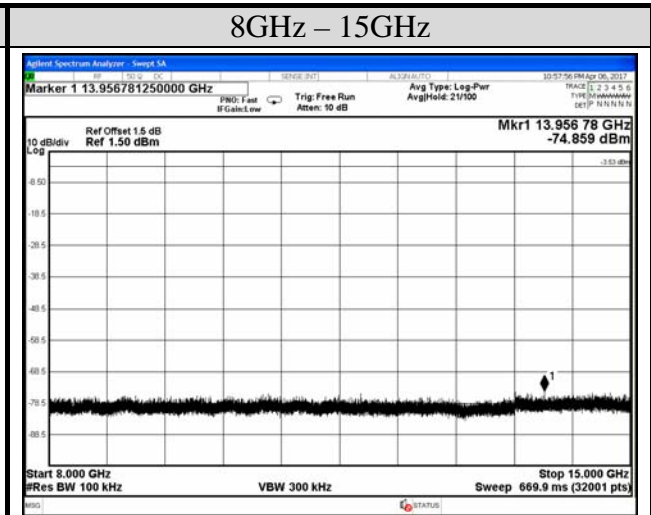
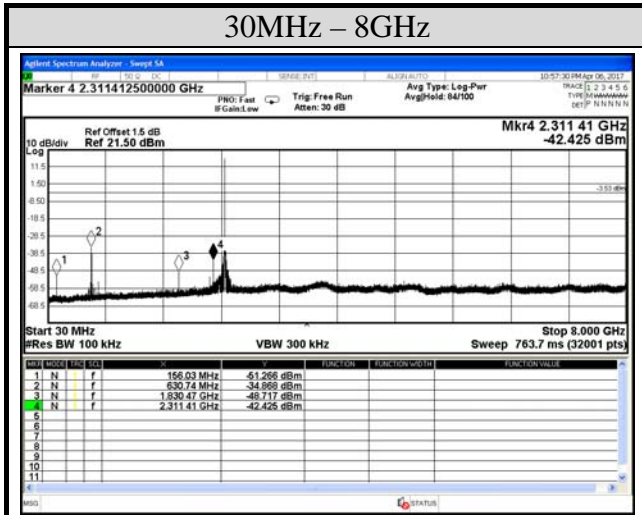
Note: All results have been included cable loss and simultaneous factor.

Test Date	2017/04/06	Temp./Hum.	25°C/50%
Mode	T-FHSS	Frequency	TX 2435.5MHz
Cable Loss	1.5dB	Test Voltage	DC 6.0V



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

Test Date	2017/04/06	Temp./Hum.	25°C/50%
Mode	T-FHSS	Frequency	TX 2467.5MHz
Cable Loss	1.5dB	Test Voltage	DC 6.0V



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