

FCC 15.247 2.4 GHz Report

for

FUTABA Corporation

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

Brand : Futaba
Product Name : Radio Control
Model Name : R334SBS
FCC ID : AZPR334SBS-24G

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



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TEST REPORT CERTIFICATION

Applicant : FUTABA Corporation
EUT Description
(1) Product : Radio Control
(2) Model : R334SBS
(3) Brand : Futaba

Applicable Standards:

47 CFR FCC Part 15 Subpart C
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 Report: 2017. 07. 25

Reviewed by:

Sabrina Wang

(Sabrina Wang/Administrator)

Approved by:

Ben Cheng

(Ben Cheng/Manager)

1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2017. 07. 25	Original Report	EM-F170446

2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	N/A, Note
15.247(d)/15.205	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(1)	20dB Bandwidth	PASS
15.247(a)(1)	Carrier Frequency Separation	PASS
15.247(a)(1)(iii)	Time of Occupancy	PASS
15.247(a)(1)(iii)	Number of Hopping Channels	PASS
15.247(b)(1)	Maximum Peak Output Power	PASS
15.247(d)	Conducted Band Edges and Conducted Spurious Emission	PASS
15.203	Antenna Requirement	PASS
Note: The EUT only employs battery power for operation, so it is unnecessary to test.		

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Manufacture	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Product	Radio Control
Model	R334SBS
Brand	Futaba

3.2. Description of EUT

Test Model	R334SBS
Serial Number	N/A
Power Rating	DC 6V
Firmware Version	N/A
Sample Status	Production
RF Features	FHSS (T-FHSS)
Date of Receipt	2017. 06. 22
Data of Test	2017. 07. 04 ~ 13
I/O Ports List	N/A
Accessories	N/A

3.3. Antenna Information

Antenna Part Number	Manufacture	Antenna Type	Frequency	Max Gain
ANT1409 (ANT A)	NISSEI	mono-pole type (coaxial)	2.4GHz	-5.16 dBi
ANT-S-1327 (ANT B)	SANSEI ELECTRIC CO., LTD	PCB type	2.4GHz	-4.8 dBi

3.4. EUT Specifications Assessed in Current Report

Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (kbps)
2407.5-2467.5	31	T-FHSS	384

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

3.5. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
T-FHSS	N/A	0.420	N/A

	Item	Modulation	Data Rate	Test Channel
Radiated Test Case ^{Note1}	Radiated Band Edge	T-FHSS	384 kbps	1/31
	Radiated Spurious Emission	T-FHSS	384 kbps	1/15/31
Conducted Test Case	20dB Bandwidth	T-FHSS	384 kbps	1/15/31
	Carrier Frequency Separation	T-FHSS	384 kbps	1/15/31
	Time of Occupancy	T-FHSS	384 kbps	1/15/31
	Number of Hopping Channels	T-FHSS	384 kbps	---
	Maximum Peak Output Power	T-FHSS	384 kbps	1/15/31
	Band Edges	T-FHSS	384 kbps	1/31
	Spurious Emission	T-FHSS	384 kbps	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

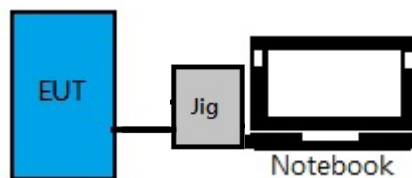
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	ASUS	X5502E	N/A	PPD-AR5B225
2.	Test JIG	Futaba	CIU-2JIG	N/A	N/A
3.	Servo*3	Futaba	S3004	N/A	N/A
4.	DC Power Supply	TOP WARD	3303A	N/A	N/A
5.	Battery	TOP WARD	3303A	N/A	N/A

3.6.2. Cable Lists

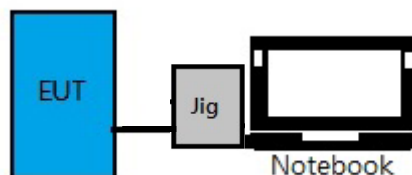
No.	Cable Description Of The Above Support Units
1.	Adapter: ACBEL, M/N AA90PM111 Power Cord: I/P: Unshielded, Detachable, 1.8m O/P: Shielded, Undetachable, 1.8m, Bonded a ferrite core
2.	Data Cable: Unshielded, Detachable, 0.3m
3.	Data Cable *3: Unshielded, Detachable, 0.15m
4.	DC Power Cord*2: Unshielded, Detachable, 0.7m AC Power Cord: Unshielded, Undetachable, 1.8m
5.	DC Power Cord*2: Unshielded, Detachable, 0.1m

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

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	Agilent	N9010A-526	MY53400071	2016. 09. 19	1 Year
2.	Test Receiver	R&S	ESCS30	100338	2017. 06. 19	1 Year
3.	Amplifier	HP	8449B	3008A00529	2017. 02. 08	1 Year
4.	Bilog Antenna	CHASE	CBL6112D	33821	2017. 01. 21	1 Year
5.	Loop Antenna	R&S	HFH2-Z2	891847/27	2016. 12. 23	1 Year
6.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2017. 03. 08	1 Year
7.	Horn Antenna	EMCO	3116	2653	2016. 10. 24	1 Year
8.	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-00	1	2016. 07. 28	1 Year
9.	3GHz Notch Filter	Microwave	H3G018G1	484798	2016. 08. 25	1 Year
10.	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. Due
1.	Spectrum Analyzer	Agilent	N9030A-526	MY53310269	2017. 01. 03	1 Year

5. CONDUCTED EMISSION

【The EUT only employs battery power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207】

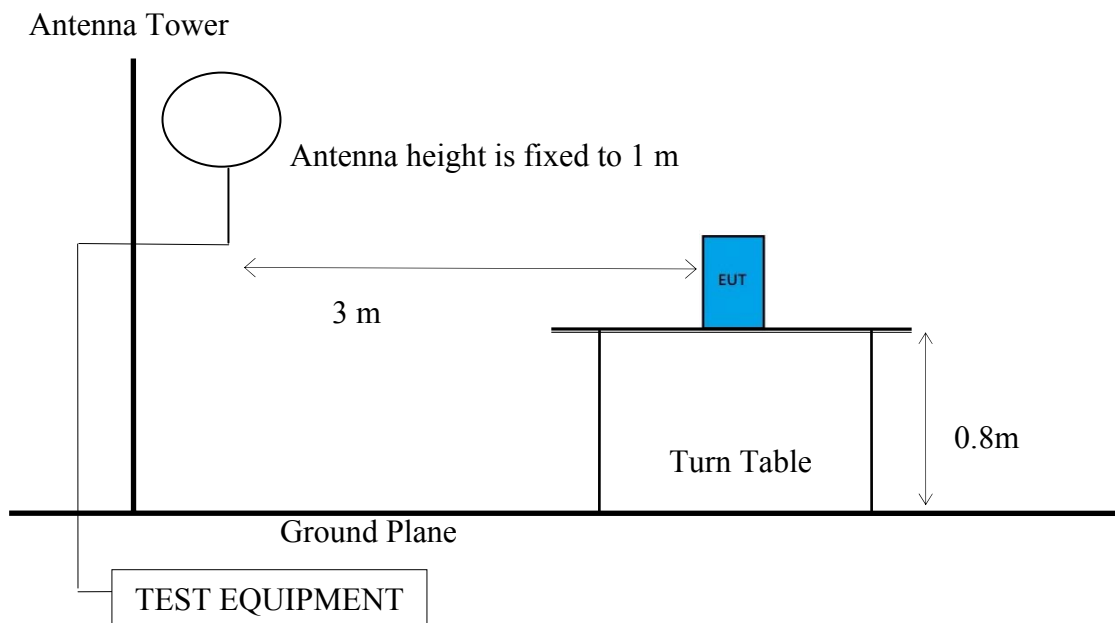
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

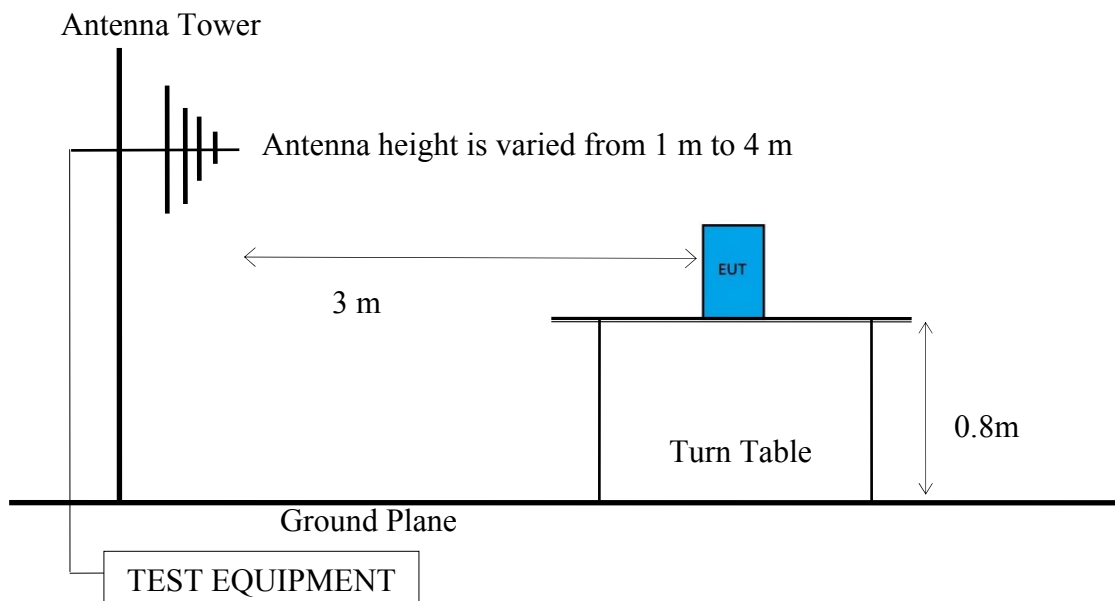
6.1.1. Block Diagram of EUT

Indicated as section 3.7

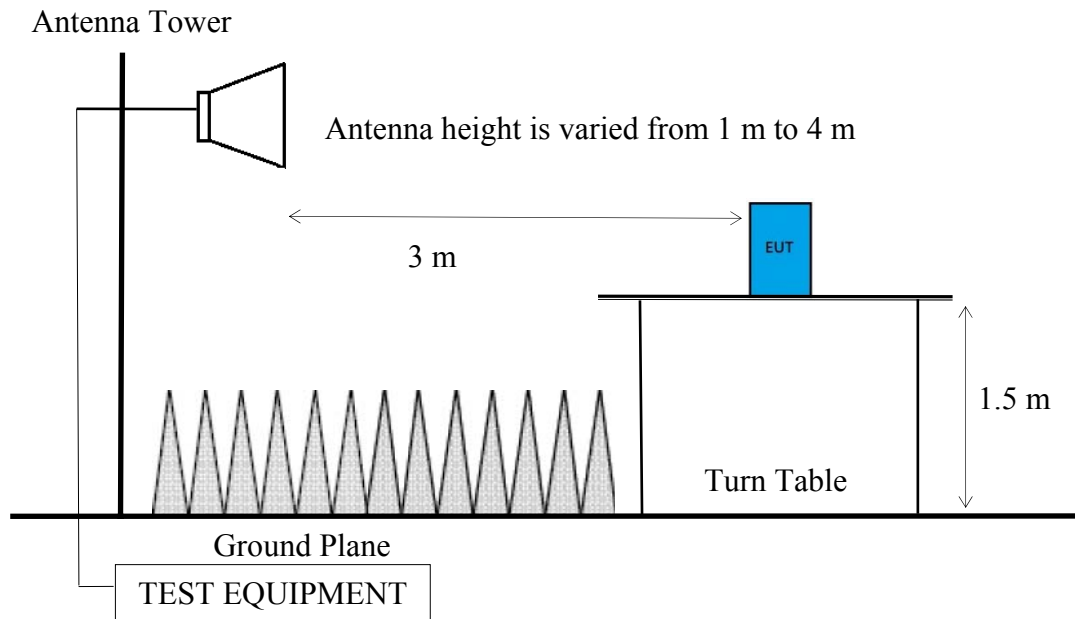
6.1.2. Setup Diagram for 9kHz-30MHz



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	
		dB μ V/m	μ V/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 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.

6.3. 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 ~ 25GHz:

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 1 GHz:

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.
- (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 (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.
- (7)When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average detector for finally measurement.

Average Detector: **Option 1:**

- (1) RBW = 1MHz
- (2) VBW $\geq 1/T$.
- (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) = $20 \log (TX_{on}/TX_{on+off})$ presented in section 3.6

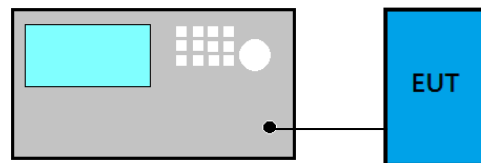
ERP = Peak Emission Level - 95.2dB - 2.14dB

6.5. Test Results

Please refer to Appendix A.

7. 20dB 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 DA00-705:

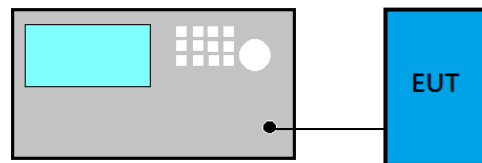
- (1) Set RBW close to 1% of OBW.
- (2) Set $VBW \geq RBW$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

8. CARRIER FREQUENCY SEPARATION

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:

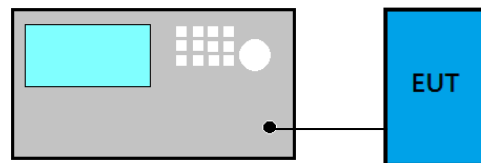
- (1) Span = wide enough to capture the peaks of two adjacent channels
- (2) RBW \geq 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

8.4. Test Results

Please refer to Appendix A

9. TIME OF OCCUPANCY

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:

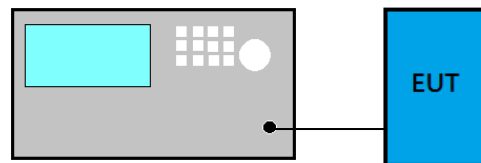
- (1) Span = zero span, centered on a hopping channel
- (2) RBW = 1 MHz
- (3) VBW \geq RBW
- (4) Sweep = as necessary to capture the entire dwell time per hopping channel
- (5) Detector function = peak
- (6) Trace = max hold

9.4. Test Results

Please refer to Appendix A

10. NUMBER OF HOPPING CHANNELS

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:

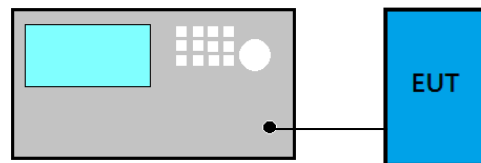
- (1) Span = the frequency band of operation
- (2) RBW \geq 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

10.4. Test Results

Please refer to Appendix A

11. MAXIMUM PEAK OUTPUT POWER

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:

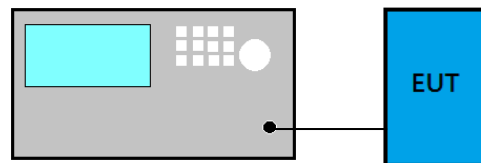
- (1) Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- (2) RBW \geq 1% of the span
- (3) VBW \geq RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

11.4. Test Results

Please refer to Appendix A

12. EMISSION LIMITATIONS

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) 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)).

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 \geq 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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APPDNDIX A

TEST DATA AND PLOTS

(Model: R334SBS)

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A.1 RADIATED EMISSION

Test Date	2017/07/13	Temp./Hum.	24°C/53%
Test Voltage	DC 6V		

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
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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
35.82	21.81	1.33	15.67	38.81	40.00	1.19	Peak
120.21	18.72	2.51	11.24	32.47	43.50	11.03	Peak
232.73	17.88	3.66	15.72	37.26	46.00	8.74	Peak
576.11	24.52	6.68	6.67	37.87	46.00	8.13	Peak
815.70	26.64	7.70	4.64	38.98	46.00	7.02	Peak
973.81	27.65	8.65	2.58	38.88	54.00	15.12	Peak

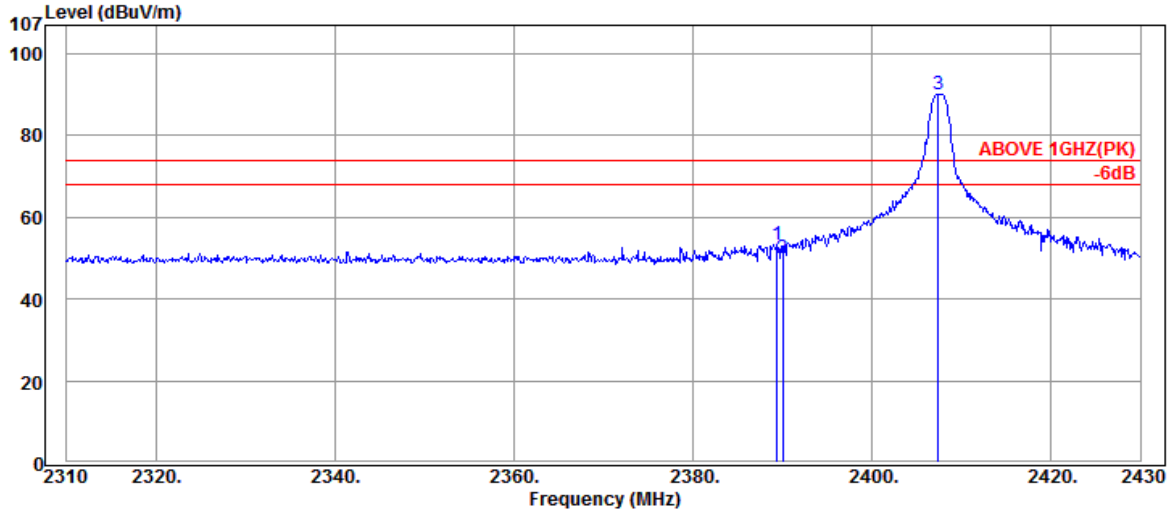
Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
35.82	21.81	1.33	15.26	38.40	40.00	1.60	Peak
120.21	18.72	2.51	9.35	30.58	43.50	12.92	Peak
288.02	19.59	4.19	14.43	38.21	46.00	7.79	Peak
576.11	24.52	6.68	6.63	37.83	46.00	8.17	Peak
828.31	26.71	7.77	1.56	36.04	46.00	9.96	Peak
963.14	27.58	8.59	1.29	37.46	54.00	16.54	Peak

A.1.1.3 Frequency Above 1 GHz to 10th harmonics

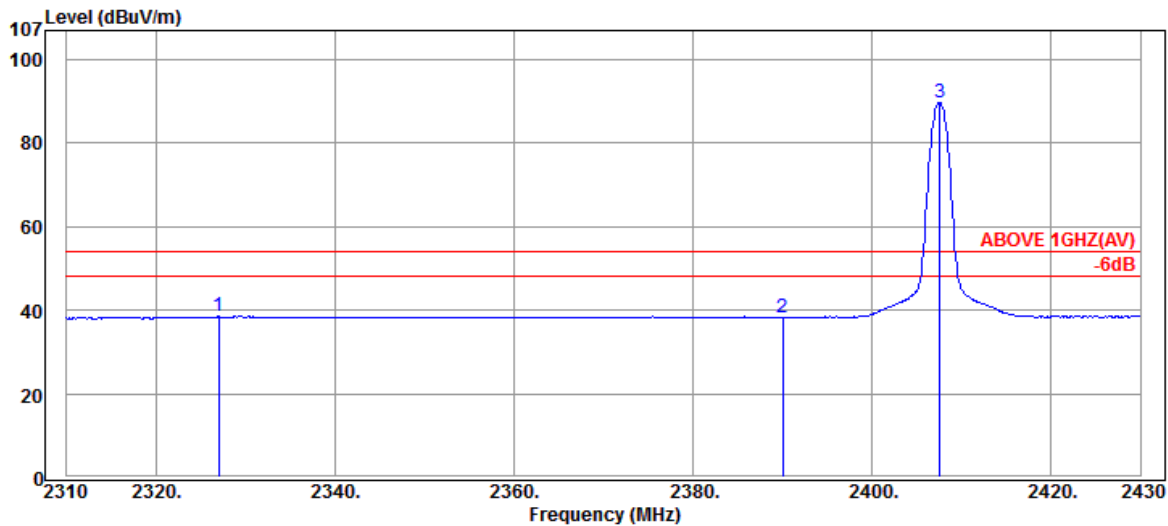
Band Edge:

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

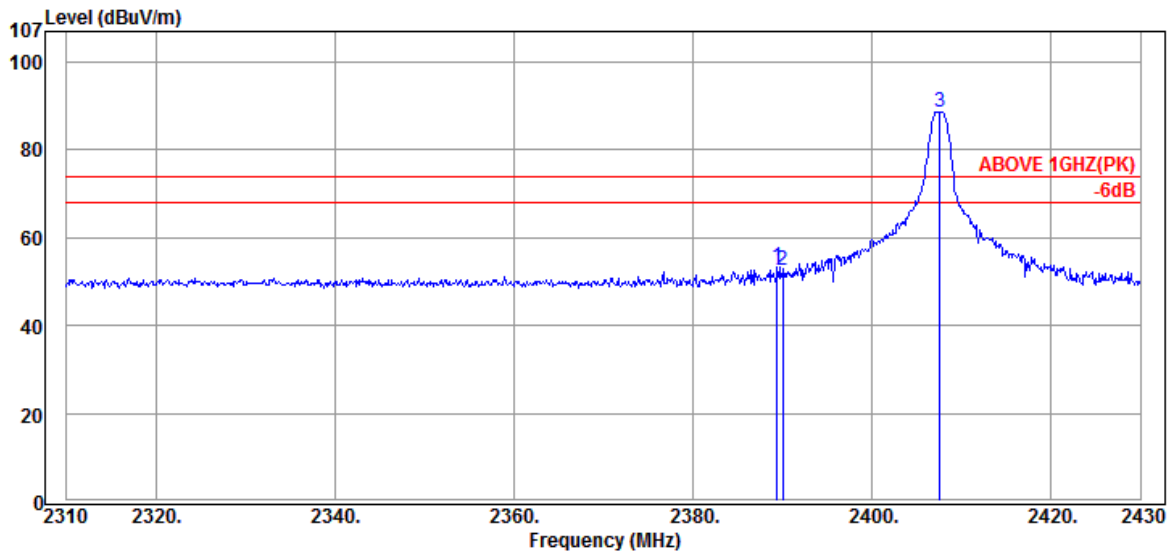
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.44	28.17	5.24	19.98	53.39	74.00	20.61	Peak
2390.04	28.17	5.24	16.57	49.98	74.00	24.02	Peak
2407.44	28.14	5.25	56.66	90.05	---	---	Peak



Antenna at Horizontal Polarization

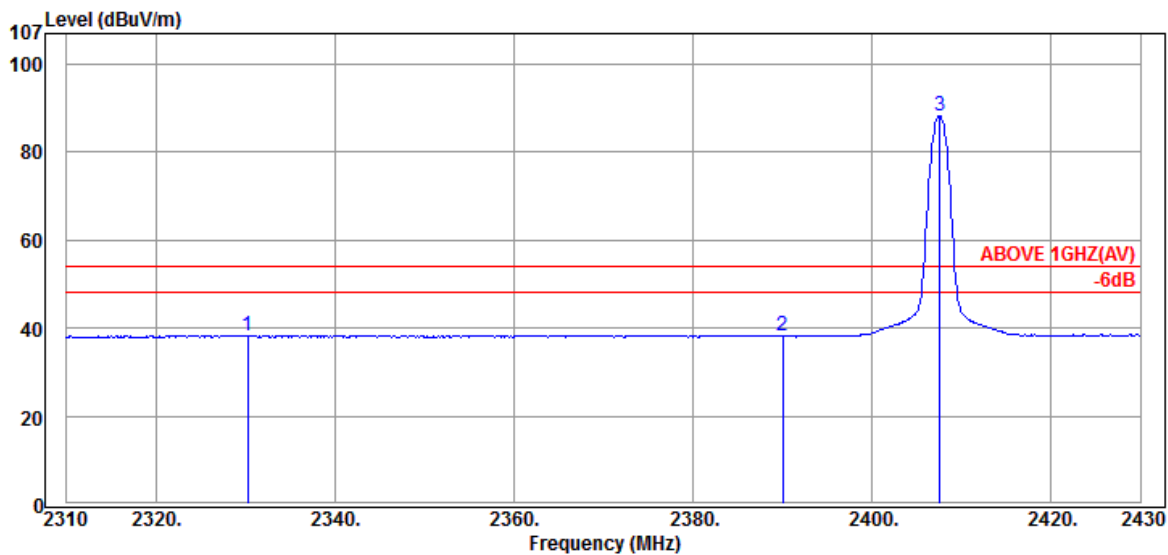
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2327.04	28.28	5.19	5.04	38.51	54.00	15.49	Average
2390.04	28.17	5.24	4.83	38.24	54.00	15.76	Average
2407.56	28.14	5.25	56.38	89.77	---	---	Average

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

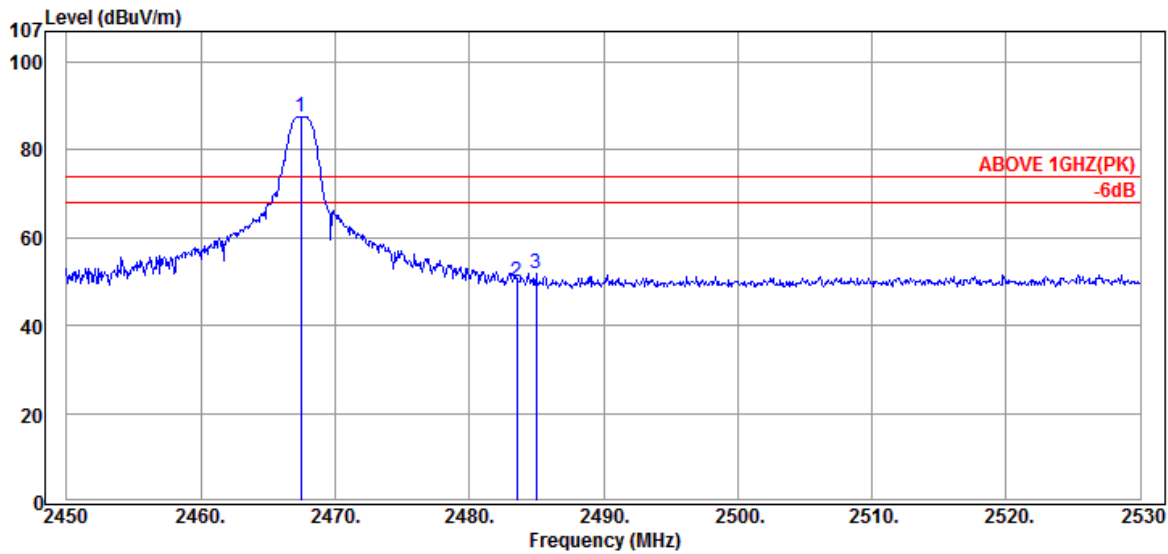
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.44	28.17	5.24	19.76	53.17	74.00	20.83	Peak
2390.04	28.17	5.24	19.07	52.48	74.00	21.52	Peak
2407.56	28.14	5.25	55.20	88.59	---	---	Peak



Antenna at Vertical Polarization

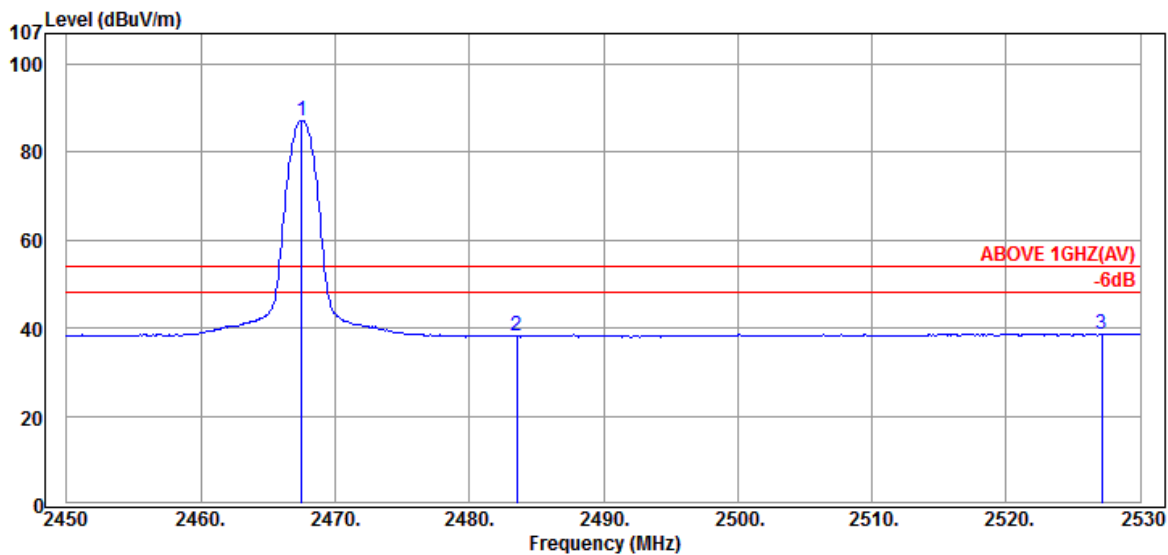
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2330.28	28.28	5.19	4.87	38.34	54.00	15.66	Average
2390.04	28.17	5.24	4.85	38.26	54.00	15.74	Average
2407.56	28.14	5.25	54.91	88.30	---	---	Average

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

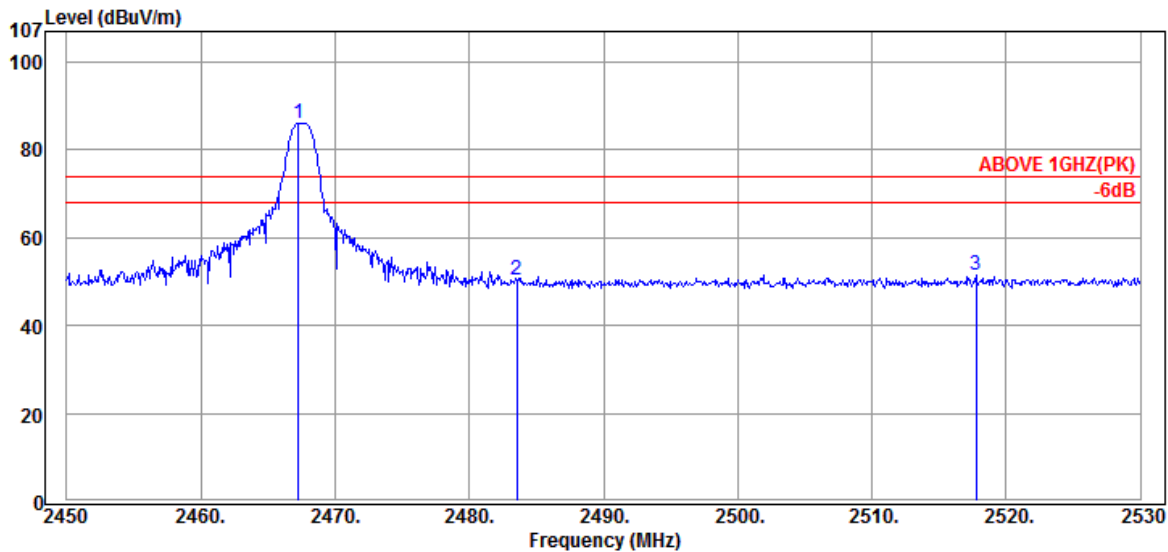
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2467.44	28.06	5.29	54.28	87.63	---	---	Peak
2483.52	28.03	5.31	16.60	49.94	74.00	24.06	Peak
2484.96	28.03	5.31	18.47	51.81	74.00	22.19	Peak



Antenna at Horizontal Polarization

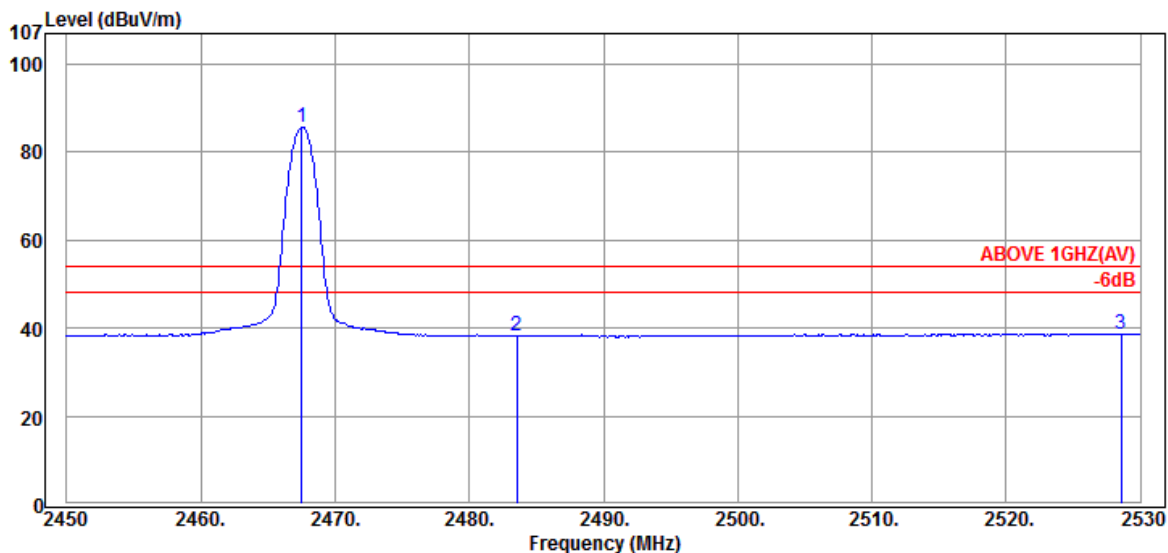
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2467.52	28.06	5.30	53.93	87.29	---	---	Average
2483.52	28.03	5.31	4.89	38.23	54.00	15.77	Average
2527.12	28.09	5.34	5.33	38.76	54.00	15.24	Average

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
2467.28	28.06	5.29	52.64	85.99	---	---	Peak
2483.52	28.03	5.31	17.11	50.45	74.00	23.55	Peak
2517.76	28.05	5.33	18.17	51.55	74.00	22.45	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
2467.52	28.06	5.30	52.30	85.66	---	---	Average
2483.52	28.03	5.31	4.94	38.28	54.00	15.72	Average
2528.56	28.09	5.35	5.34	38.78	54.00	15.22	Average

A.1.2 Emissions outside the frequency band:

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

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
4815.00	32.54	9.00	4.75	46.29	54.00	7.71	Peak
7220.00	36.71	10.46	4.80	51.97	54.00	2.03	Peak

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
4815.00	32.54	9.00	6.89	48.43	54.00	5.57	Peak
7220.00	36.71	10.46	4.55	51.72	54.00	2.28	Peak

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 (dB μ V)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector
4870.00	32.71	9.06	3.56	45.33	54.00	8.67	Peak
7305.00	36.83	10.56	5.29	52.68	54.00	1.32	Peak

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
4870.00	32.71	9.06	6.60	48.37	54.00	5.63	Peak
7305.00	36.83	10.56	5.31	52.70	54.00	1.30	Peak

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
4935.00	32.83	9.16	4.61	46.60	54.00	7.40	Peak
7400.00	36.96	10.66	5.10	52.72	54.00	1.28	Peak

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
4935.00	32.83	9.16	6.54	48.53	54.00	5.47	Peak
7400.00	36.96	10.66	5.76	53.38	54.00	0.62	Peak

A.1.3 Emissions in Non-restricted Frequency Bands:

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

A.2 20dB BANDWIDTH

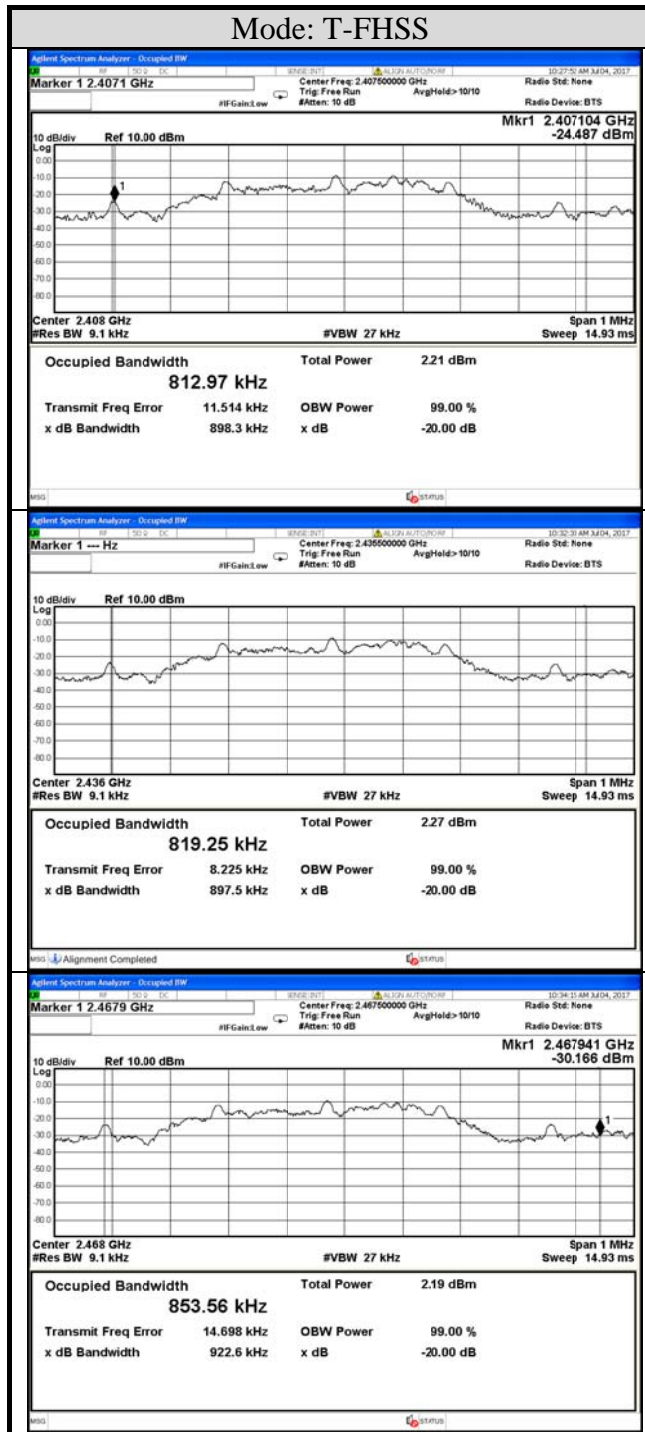
Test Date	2017/07/04	Temp./Hum.	26°C/43%
Cable Loss	0.8dB	Test Voltage	DC 6V

A.2.1 20dB Bandwidth Result

Mode	Centre Frequency (MHz)	20dB Bandwidth (MHz)	2/3 (20dB Bandwidth)
T-FHSS	2407.5	0.8983	0.599
	2435.5	0.8975	0.598
	2467.5	0.9226	0.615

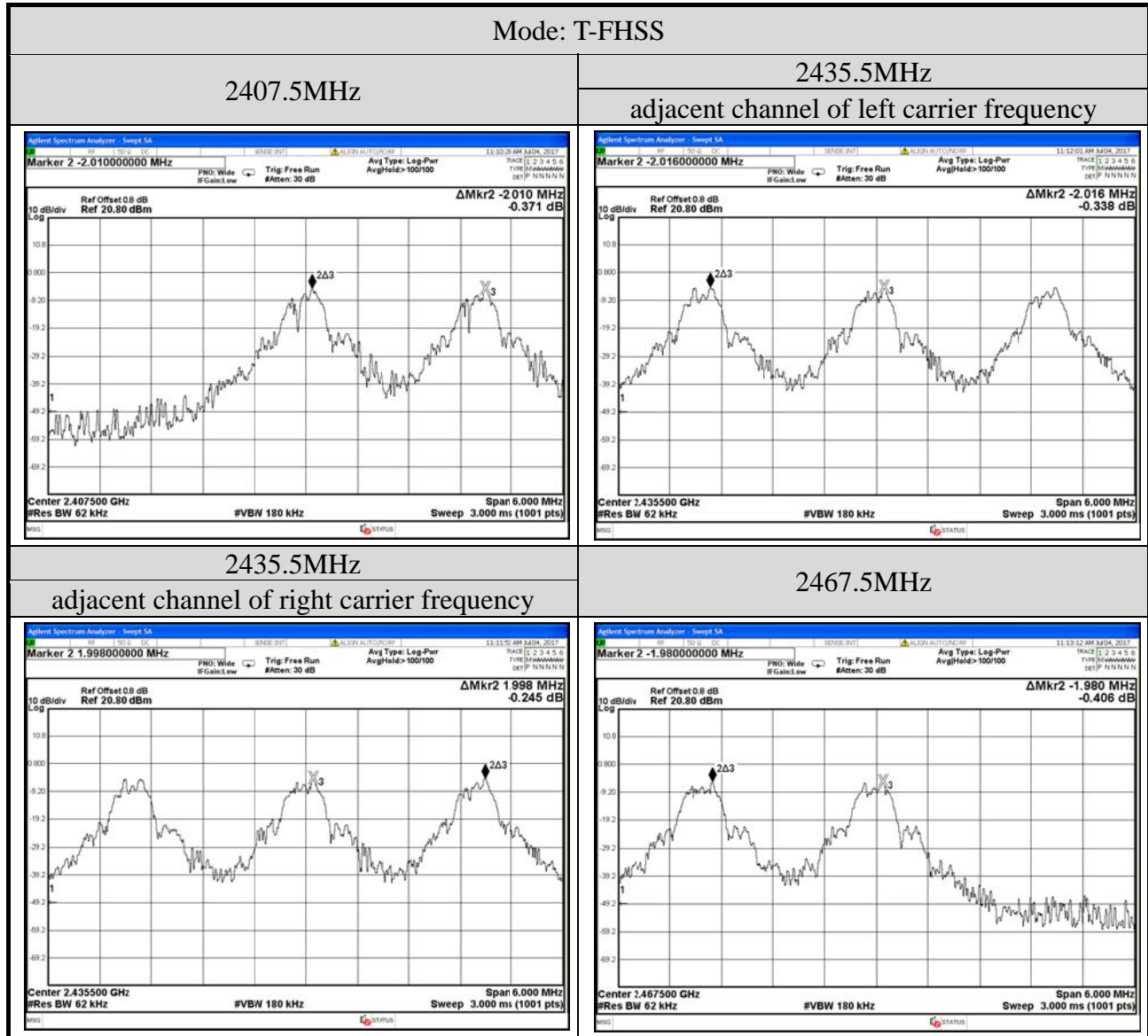
Remark: The maximum two-thirds of the 20dB bandwidth is the limit for carrier frequency separation presented.

A.2.2 Measurement Plots



A.3 CARRIER FREQUENCY SEPARATION

Test Date	2017/07/04	Temp./Hum.	26°C/43%
Cable Loss	0.8dB	Test Voltage	DC 6V



A.4 TIME OF OCCUPANCY

Test Date	2017/07/04	Temp./Hum.	26°C/43%
Cable Loss	0.8dB	Test Voltage	DC 6V

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	0.165	52.14	<400
	2435.5	0.165	52.14	<400
	2467.5	0.165	52.14	<400

Observation Period: **31** Channels * **0.4** seconds = **12.4** seconds

Centre Frequency: 2407.5MHz

For each observation period of **10** channels appearance, the longest time of occupancy for each of **12.4** seconds is:

10 Channels * **12.4** seconds * **0.420** ms = **52.080** ms (<400ms)

Centre Frequency: 2435.5MHz

For each observation period of **10** channels appearance, the longest time of occupancy for each of **12.4** seconds is:

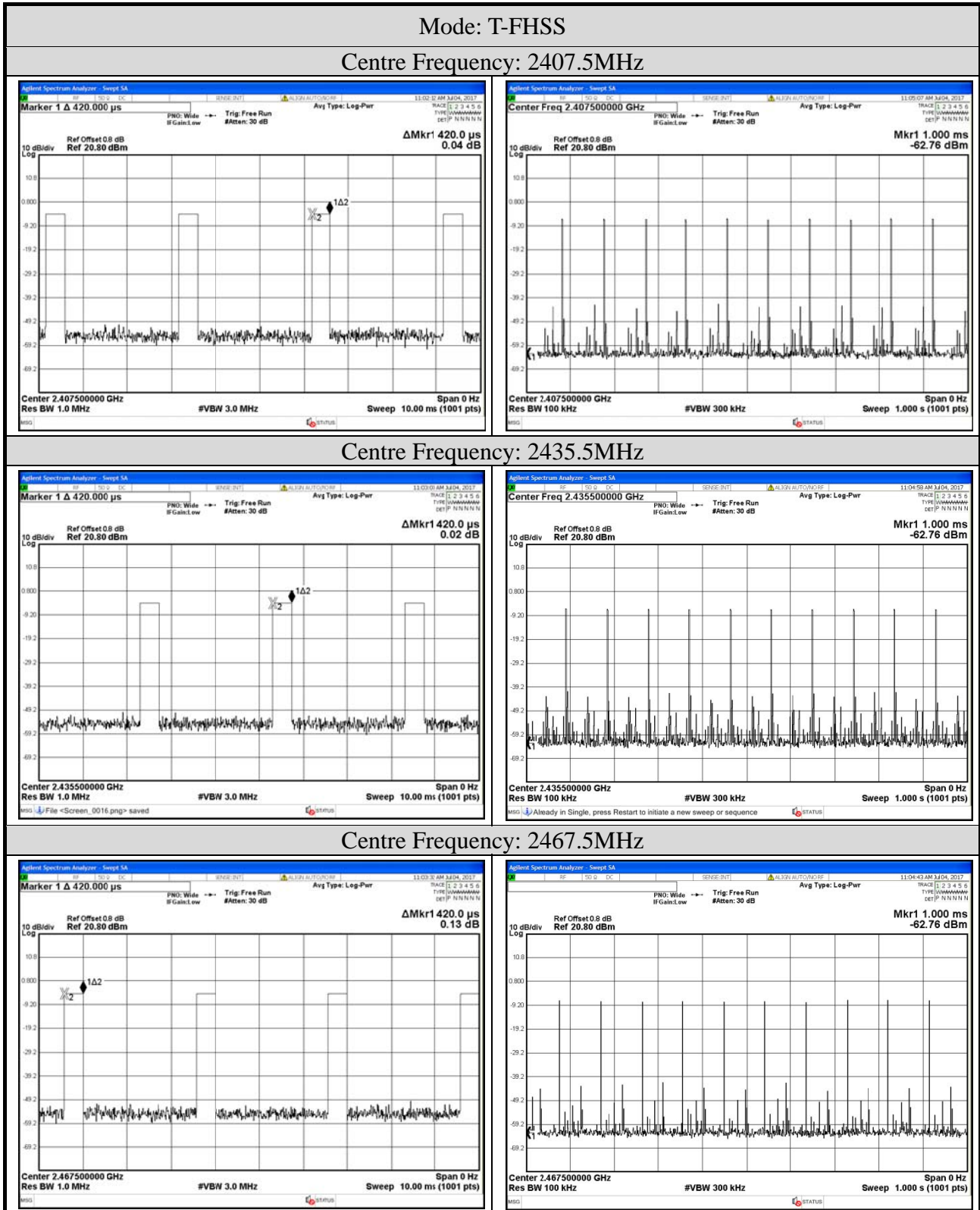
10 Channels * **12.4** seconds * **0.420** ms = **52.080** ms (<400ms)

Centre Frequency: 2467.5MHz

For each observation period of **10** channels appearance, the longest time of occupancy for each of **12.4** seconds is:

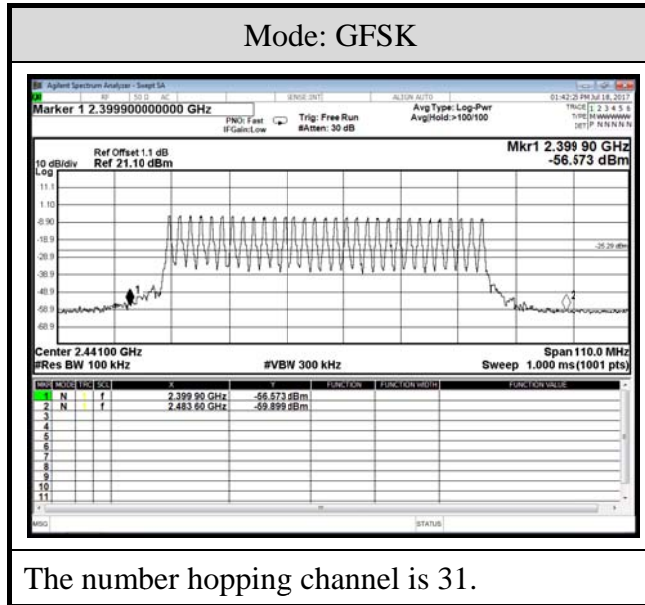
10 Channels * **12.4** seconds * **0.420** ms = **52.080** ms (<400ms)

A.4.2 Measurement Plots



A.5 NUMBER OF HOPPING CHANNELS

Test Date	2017/07/18	Temp./Hum.	26°C/43%
Cable Loss	1.1dB	Test Voltage	DC 6V



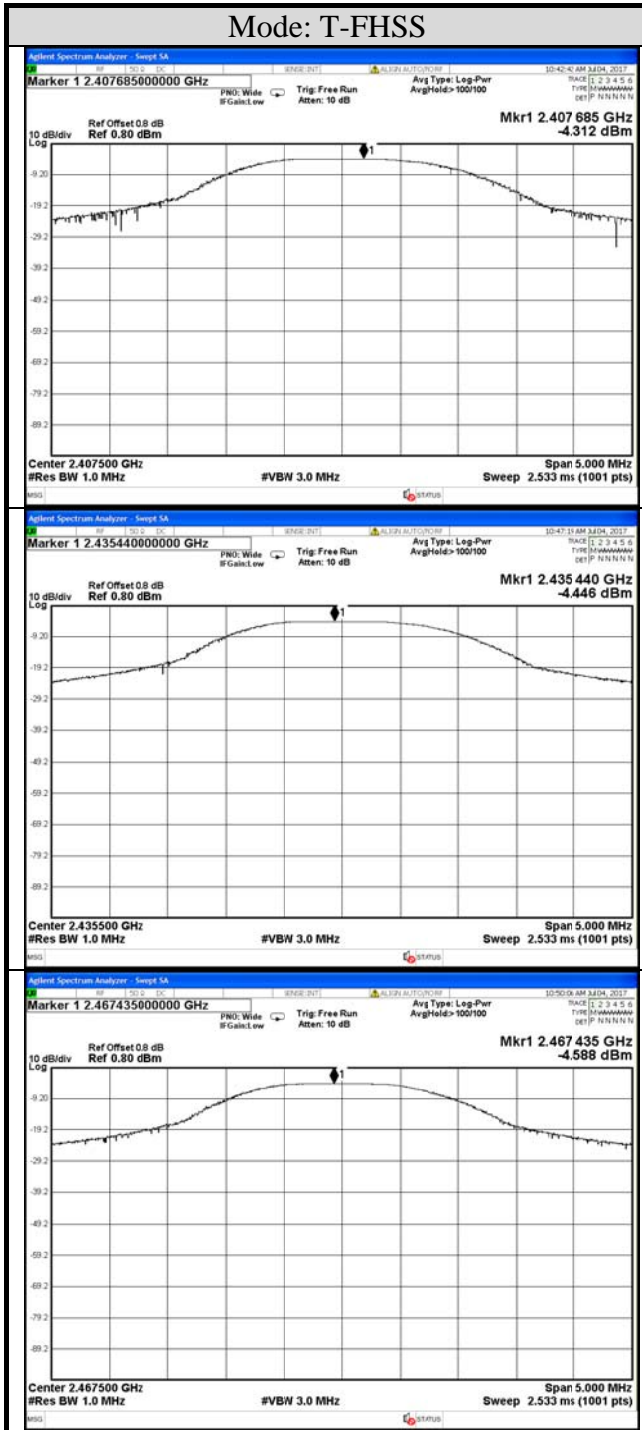
A.6 MAXIMUM PEAK OUTPUT POWER

Test Date	2017/07/04	Temp./Hum.	26°C/43%
Cable Loss	0.8dB	Test Voltage	DC 6V

A.6.1 Maximum Peak Output Power

Modulation	Centre Frequency (MHz)	Maximum Peak Output Power		Limit
		dBm	W	
T-FHSS	2407.5	-4.312	0.000371	21dBm (0.125W)
	2435.5	-4.446	0.000359	
	2467.5	-4.588	0.000348	

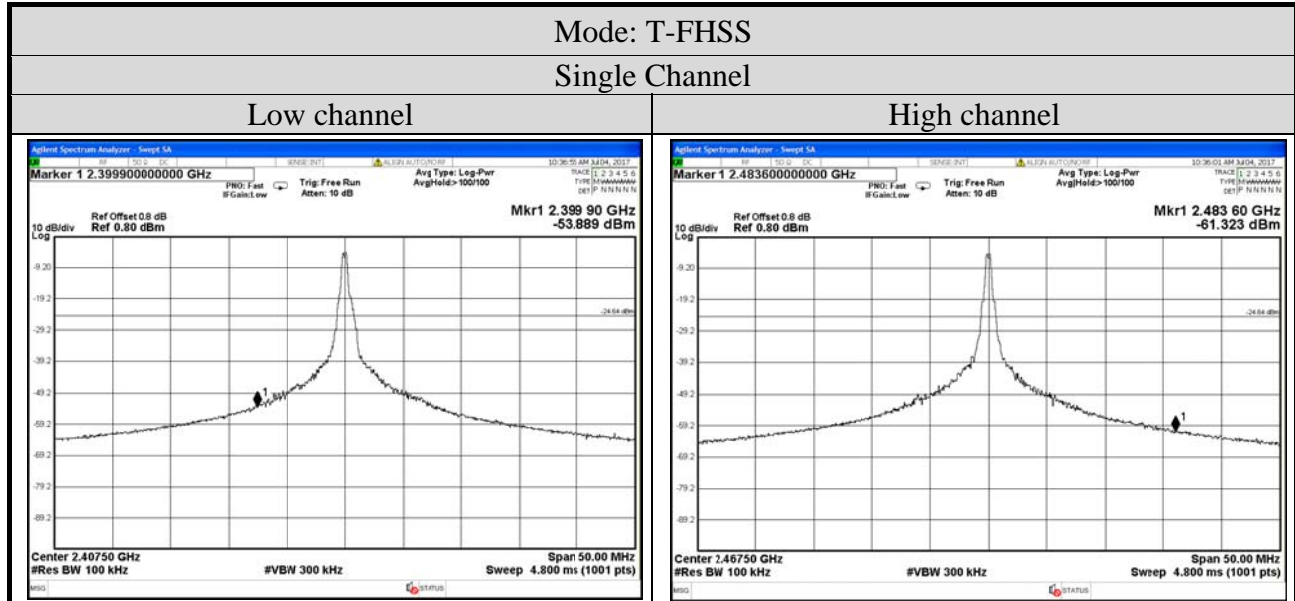
A.6.2 Measurement Plots



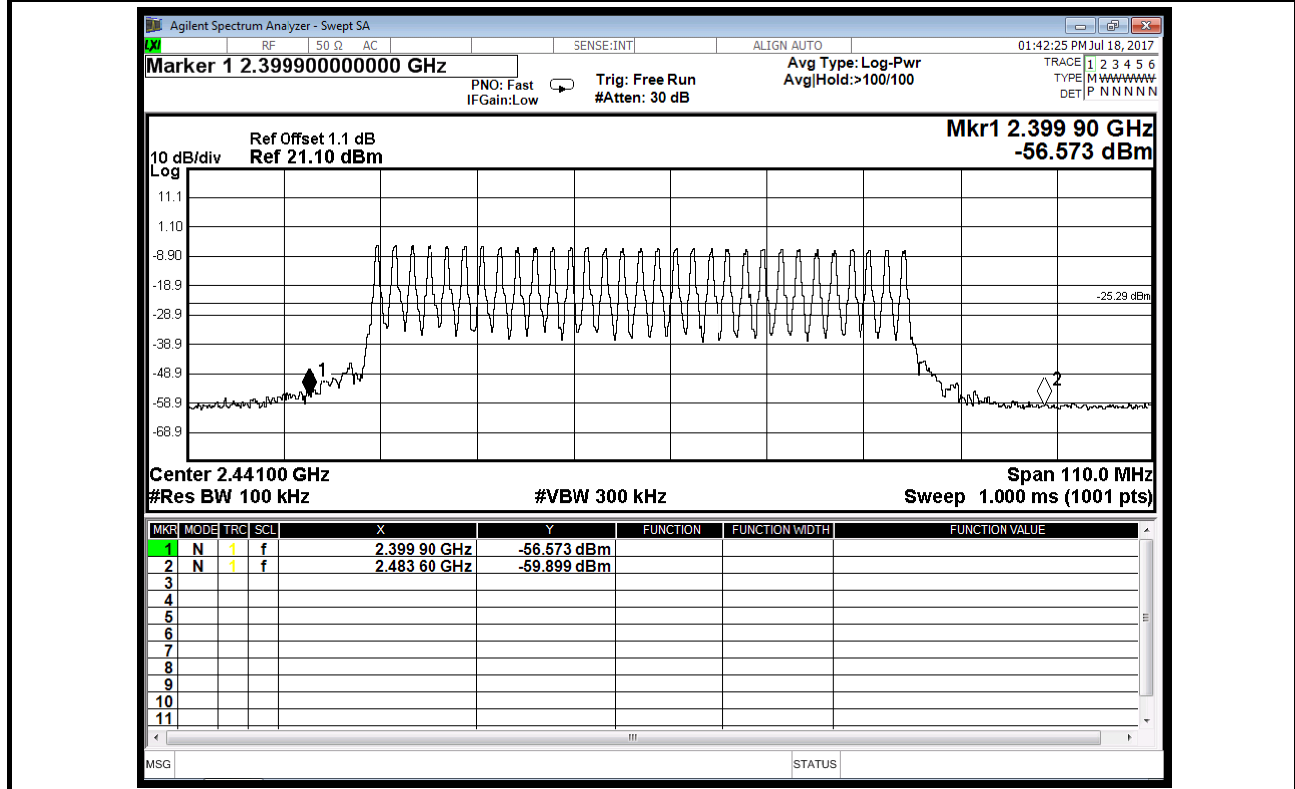
A.7 EMISSION LIMITATIONS MEASUREMENT

Test Date	2017/07/04	Temp./Hum.	26°C/43%
Cable Loss	0.8dB	Test Voltage	DC 6V

A.7.1 Band Edge

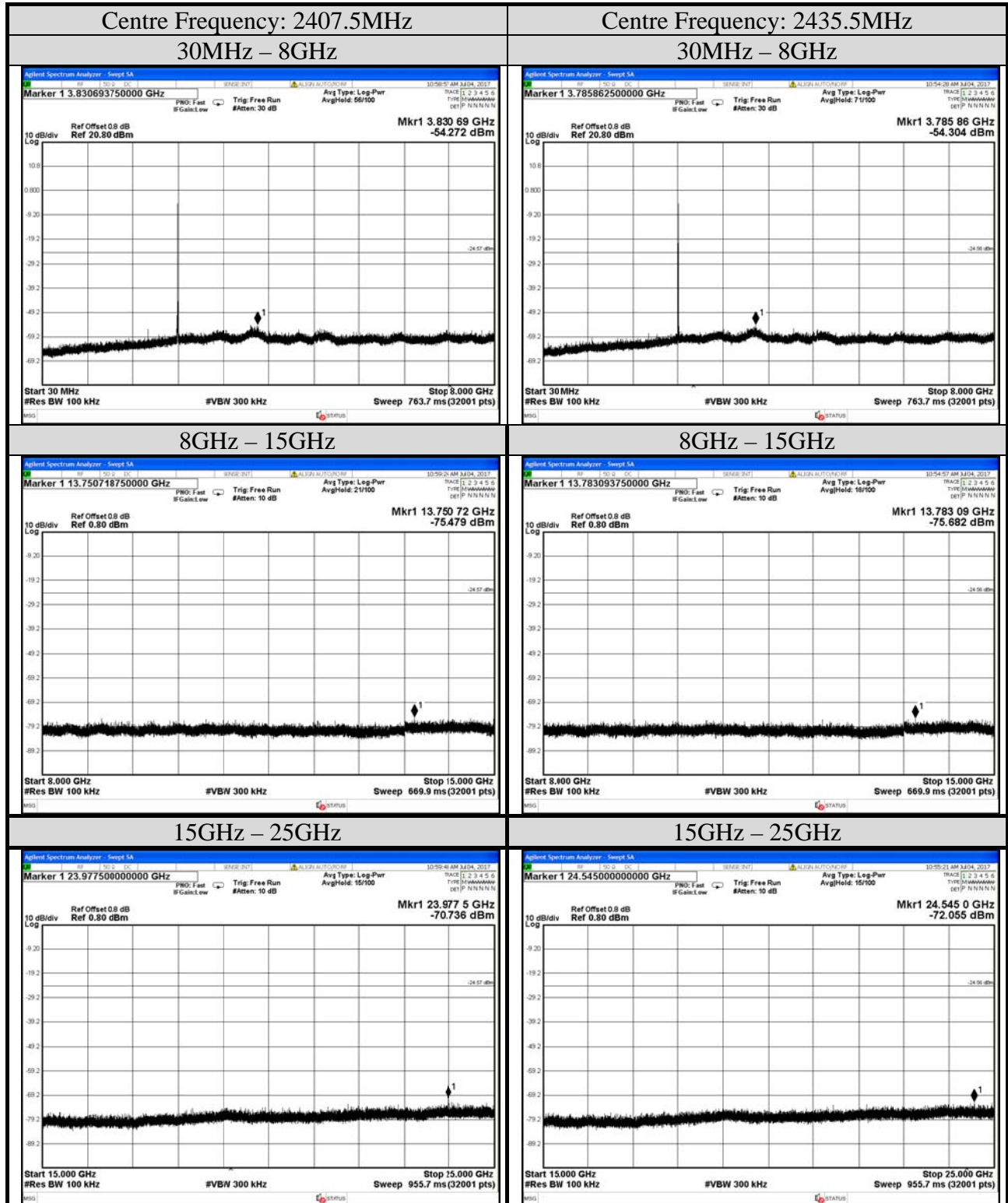


Hopping Mode



A.8 SPURIOUS EMISSION

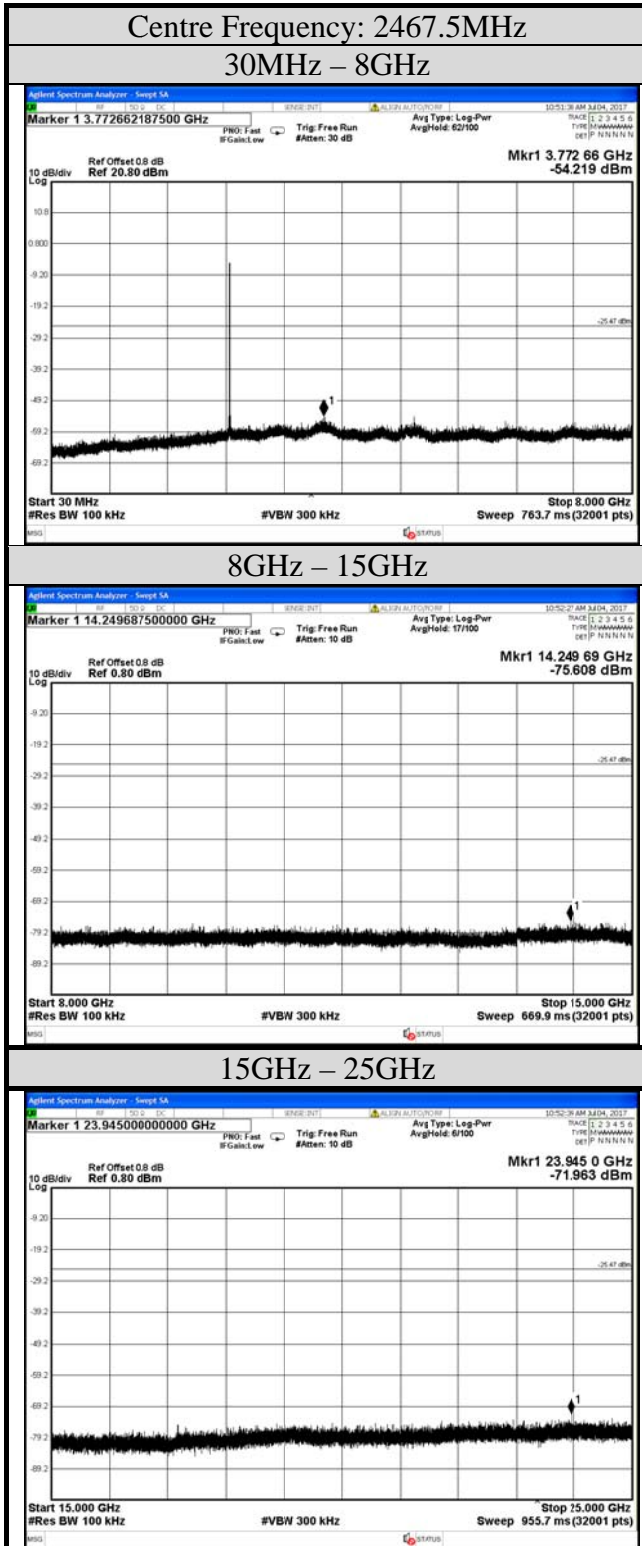
Test Date	2017/07/04	Temp./Hum.	26°C/43%
Cable Loss	0.8dB	Test Voltage	DC 6V



Note: All results have been included cable loss.

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Note: All results have been included cable loss.



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APPENDIX B

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: R334SBS)