

FCC 15.247 & RSS-247 DSS 2.4GHz Report

for

FUTABA Corporation

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

Brand : Futaba
Product Name : Radio Control
Model Name : R7014SB
FCC ID : AZP-R7014SB-24G
IC : 2914D-R7014SB

**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. : R7014SB
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 Report: 2017. 06. 05

Reviewed by: Annie Yu (Annie Yu/Administrator)

Approved by: Ben Cheng (Ben Cheng/Manager)

1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2017. 06. 05	Original Report.	EM-F170338

2. SUMMARY OF TEST RESULTS

Rule		Description	Results
15.207	RSS-Gen §8.8	Conducted Emission	N/A, NOTE
15.247(d)/15.209	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
Note: The EUT only employs battery power for operation, so it is unnecessary to test.			

3. GENERAL INFORMATION

3.1. Description of EUT

Product	Radio Control
Model Number	R7014SB
Serial Number	N/A
Brand Name	Futaba
Applicant	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Manufacture	FUTABA Corporation 1080 YabutsukaChosei-son Chosei-gun Chiba, 299-4395 Japan.
Transmit Type	1T1R
Date of Receipt of Sample	2016. 10. 12

3.2. Antenna Information

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain (dBi)
1	UFL-LP6-068N1 T-A11-T-153D	HRS	1/4λ Antenna	2.4GHz	ANT A: -5.35 ANT B: -5.35

We performed conducted tests for both antennas and submit test data measured on antenna A as worse performance.

3.3. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (kbps)
FASSTest	2405.376 to 2472.960	23	DSSS (FSK)	136

Mode: FASSTest			
Channel List			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
00	2405.376	12	2442.240
01	2408.448	13	2445.312
02	2411.520	14	2448.384
03	2414.592	15	2451.456
04	2417.664	16	2454.528
05	2420.736	17	2457.600
06	2423.808	18	2460.672
07	2462.880	19	2463.744
08	2429.952	20	2466.816
09	2433.024	21	2469.888
10	2436.096	22	2472.960
11	2439.168		

3.4. Test Configuration

Modulation	T _{on} (ms)	Duty Cycle Factor (dB)
FASSTest	1.415	-36.98

Item		Modulation	Test Channel
Radiated Test Case	Radiated Band Edge ^{Note1}	FASSTest	00/22
	Radiated Spurious Emission ^{Note1}	FASSTest	00/11/22
Conducted Test Case	20dB Bandwidth	FASSTest	00/11/22
	Carrier Frequency Separation	FASSTest	00/11/22
	Time of Occupancy	FASSTest	00/11/22
	Number of Hopping Channels	FASSTest	11
	Maximum Peak Output Power	FASSTest	00/11/22
	Band Edges	FASSTest	00/22
	Spurious Emission	FASSTest	00/11/22

Note 1:

☐ Mobile Device

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

☒ Lie

☐ Side

☐ Stand

3.5. Tested Supporting System List

3.5.1. Support Peripheral Unit

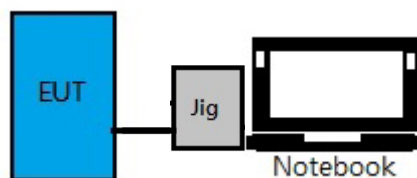
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	DELL	P20G	N/A	PPD-AR5B-95
2.	Test Jig	N/A	N/A	N/A	N/A
3.	DC Power Supply	TOP WARD	6303A	N/A	N/A
4.	DC Power Supply	TOP WARD	3303A	N/A	N/A

3.5.2. Cable Lists

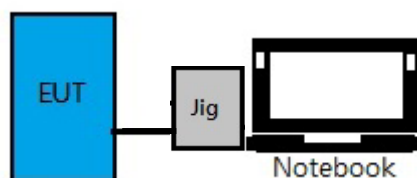
No.	Cable Description Of The Above Support Units
1.	AC Adapter: ACBEL, M/N AA90PM111 AC Power Cord: Unshielded, Detachable, 1.8m DC Power Cord: Unshielded, Undetachable, 1.8m
2.	USB Cable: Unshielded, Detachable, 1.1m Data Cable: Unshielded, Detachable, 0.6m
3.	DC Power Cord*2: Unshielded, Detachable, 0.5m AC Power Cord: Unshielded, Undetachable, 1.8m
4.	DC Power Cord*2: Unshielded, Detachable, 0.5m AC Power Cord: Unshielded, Undetachable, 1.8m

3.6. Setup Configuration

3.6.1. EUT Configuration for Power Line Emission



3.6.2. EUT Configuration for Conducted Test Items



3.7. Operating Condition of EUT

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

3.8. Description of Test Facility

Test Firm Name	:	AUDIX Technology Corporation EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
Test Location & Facility	:	Semi-Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan IC Test Site Registration No.: 5183B-1 Renewal on September 17, 2014 Fully Anechoic Chamber No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan IC Test Site Registration No.: 5183B-4 Renewal on August 31, 2015
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724
FCC OET Designation	:	TW1004 & TW1090

3.9. Measurement Uncertainty

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

Remark : Uncertainty = $k_{uc}(y)$

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	Amplifier	HP	8447D	2944A06305	2017. 02. 16	1 Year
3	Pre-Amplifier	HP	8449B	3008A00529	2017. 02. 08	1 Year
4	Bilog Antenna	TESEQ	CBL6112D	33821	2017. 01. 21	1 Year
5	Horn Antenna	EMCO	3115	9609-4927	2016. 06. 27	1 Year
6	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-0 0	1	2016. 07. 27	1 Year
7.	Test Software	Audix	e3	V.120619C	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-544	US51350140	2016. 06. 07	1 Year

5. CONDUCTED EMISSION MEASUREMENT

【The EUT only employs battery power for operation, no conductive emission limits are required according to 15.207 and RSS-Gen §8.8】

6. RADIATED EMISSION MEASUREMENT

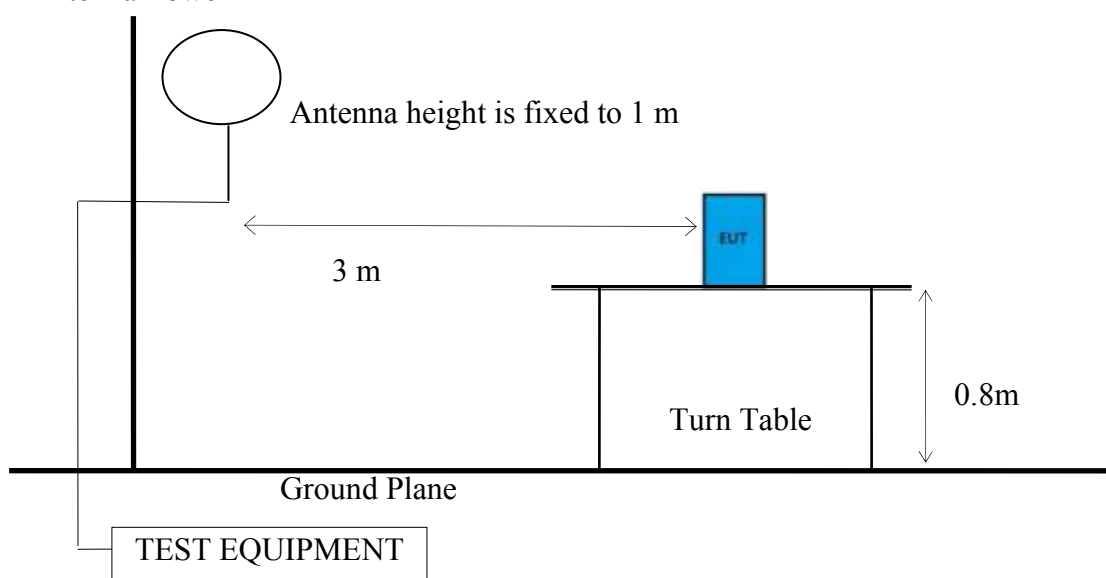
6.1. Block Diagram of Test Setup

6.1.1. Block Diagram of connection between EUT and simulators

Indicated as section 3.7

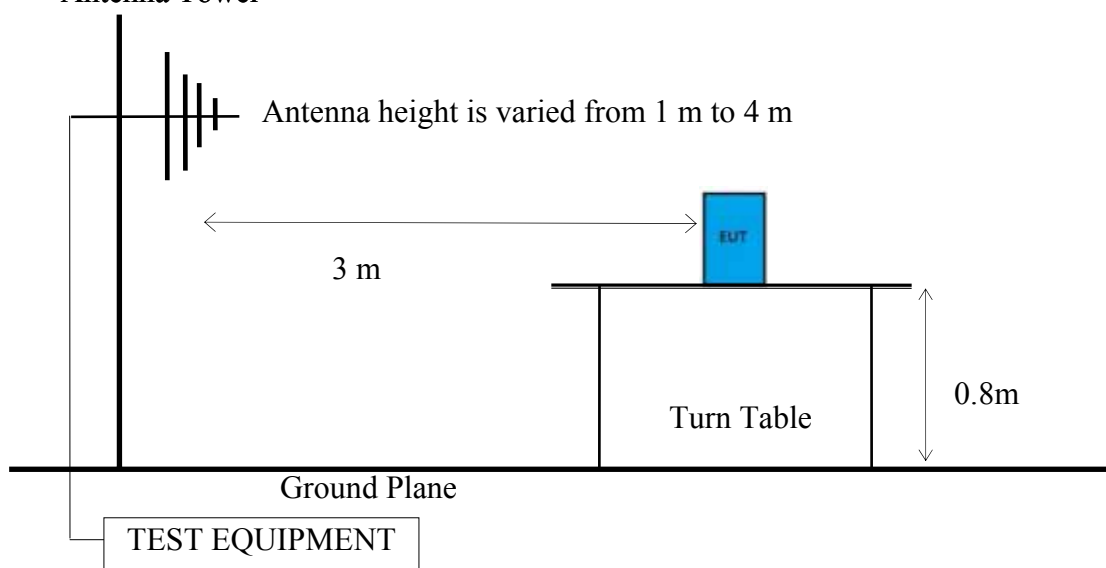
6.1.2. Semi Anechoic Chamber (3m) Setup Diagram for 9kHz-30MHz

Antenna Tower

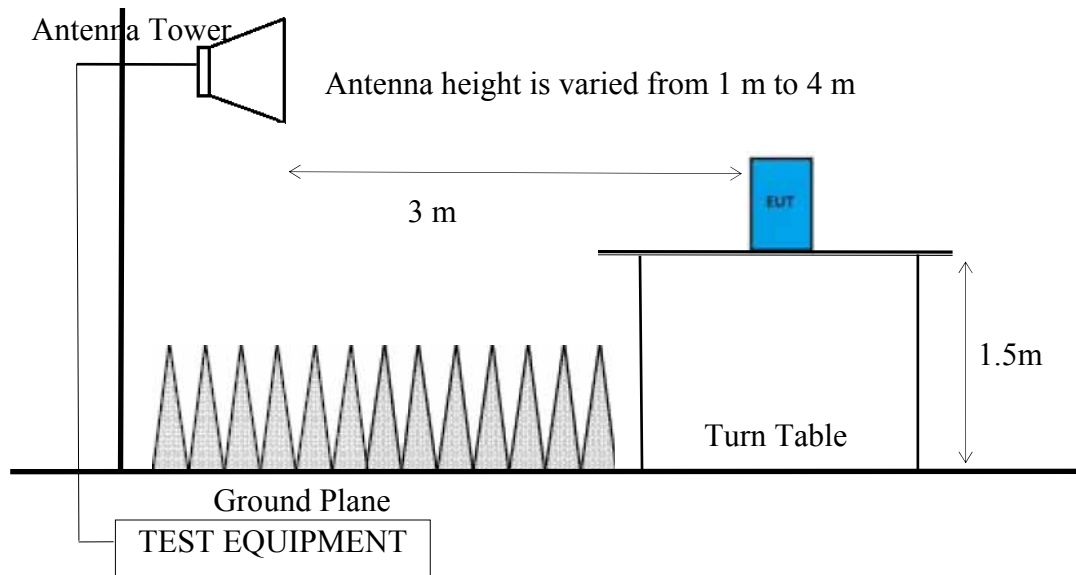


6.1.3. Semi-Anechoic Chamber (3m) Setup Diagram for 30-1000 MHz

Antenna Tower



6.1.4. Semi Anechoic Chamber (3m) 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 RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Field Strengths Limits	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
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	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (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 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 table which has 1.5 m 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.
- (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 $\geq 3 \times$ 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 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

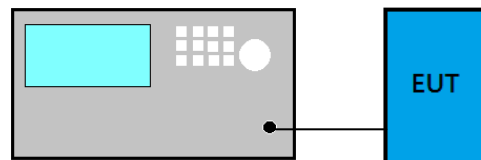
- ☒ Peak Emission Level = Antenna Factor + Cable Loss + Meter Reading
- ☐ Average Emission Level = Antenna Factor + Cable Loss + Meter Reading
- ☒ Average Emission Level = Peak Emission Level + DCCF
Duty Cycle Correction Factor (DCCF) = $20\log(TX_{on}/100ms)$ presented in section 3.4
- ☐ ERP = Peak Emission Level - 95.2dB - 2.14dB

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:

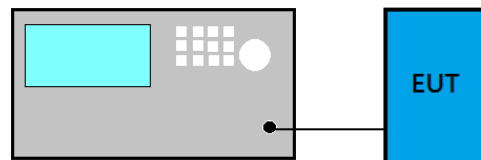
- (1) Set RBW close to 1% of OBW.
- (2) Set VBW = RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

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:

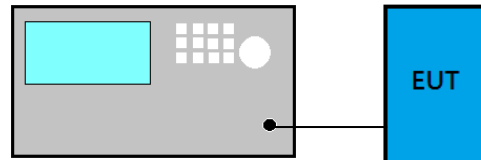
- (1) Span = wide enough to capture the peaks of two adjacent channels
- (2) RBW $\geq$ 1% of the span
- (3) VBW $\geq$ RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

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:

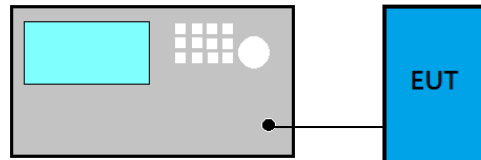
- (1) Span = zero span, centered on a hopping channel
- (2) RBW = 1 MHz
- (3) VBW $\geq$ RBW
- (4) Sweep = as necessary to capture the entire dwell time per hopping channel
- (5) Detector function = peak
- (6) Trace = max hold

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:

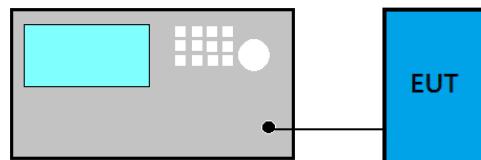
- (1) Span = the frequency band of operation
- (2) RBW $\geq$ 1% of the span
- (3) VBW $\geq$ RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

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:

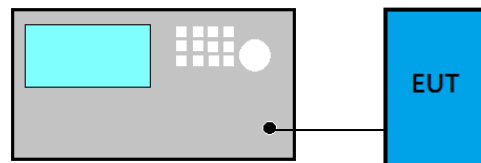
- (1) Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- (2) RBW $\geq$ 1% of the span
- (3) VBW $\geq$ RBW
- (4) Sweep = auto
- (5) Detector function = peak
- (6) Trace = max hold

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

TEST PLOTS

(Model: R7014SB)

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A.1 RADIATED EMISSION

Test Date	2017/05/31	Temp./Hum.	24°C/45%
Test Voltage	DC 6.0V		

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	FASSTest	Frequency	TX 2472.960MHz
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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 (dB)
156.10	10.16	3.65	5.12	18.93	43.50	24.57	Peak
358.83	14.64	5.28	3.41	23.33	46.00	22.67	Peak
637.22	18.48	6.59	2.94	28.01	46.00	17.99	Peak
922.40	20.70	7.67	2.75	31.12	46.00	14.88	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)
31.94	17.52	2.37	19.33	39.22	40.00	0.78	Peak
92.08	9.49	3.17	21.51	34.17	43.50	9.33	Peak
141.55	11.14	3.53	14.16	28.83	43.50	14.67	Peak
498.51	16.93	6.43	7.45	30.81	46.00	15.19	Peak

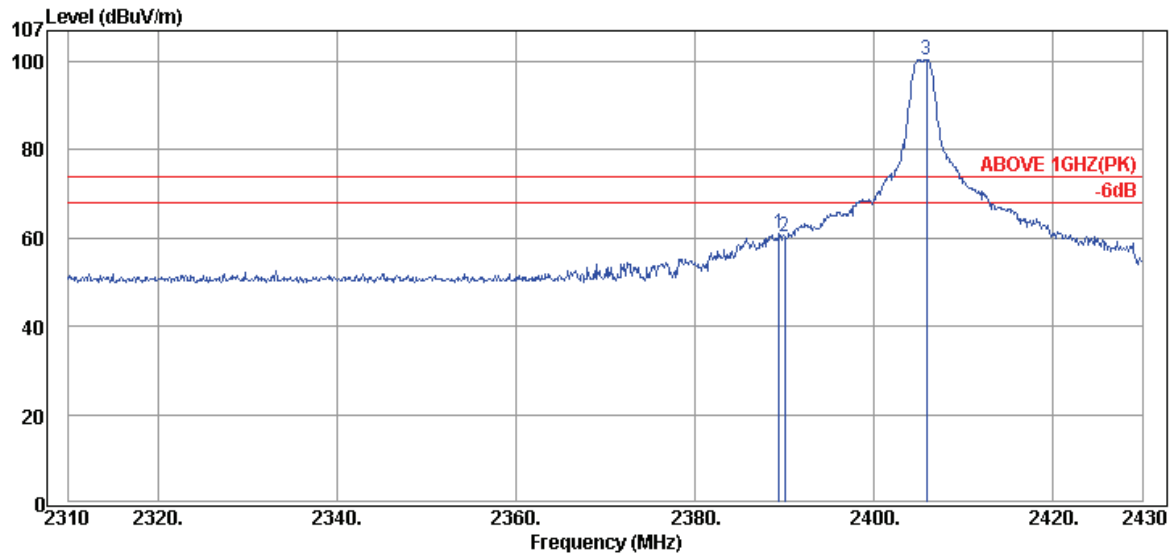
Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City 244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

A.1.2 Frequency Above 1 GHz to 10th harmonics

Band Edge:

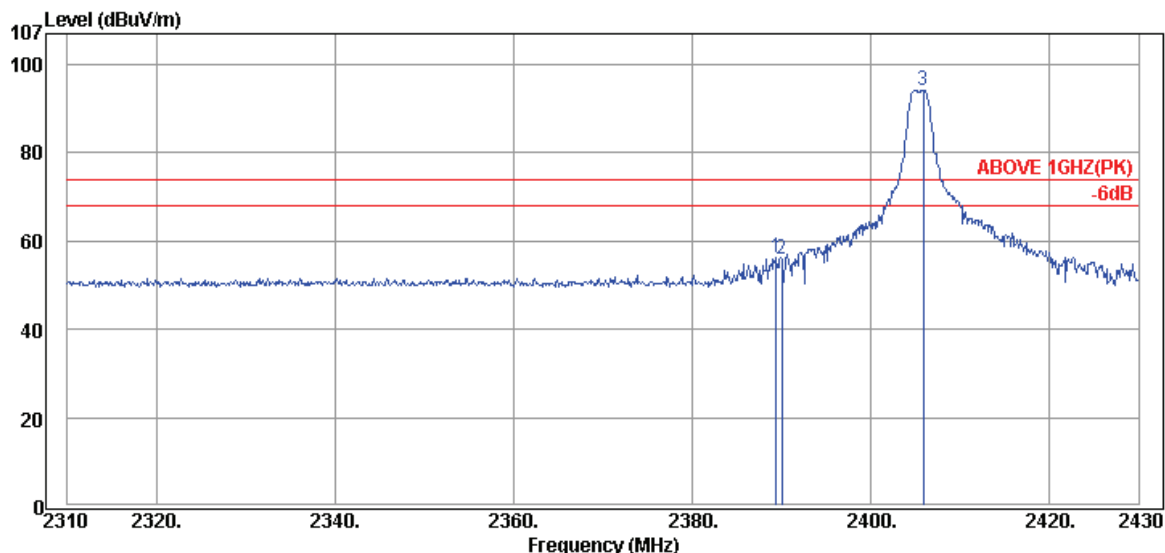
Mode	FASSTest	Frequency	TX 2405.376MHz
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Antenna at Horizontal Polarization

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	28.35	5.24	27.39	60.98	74.00	13.02	Peak
2390.04	28.35	5.24	26.64	60.23	74.00	13.77	Peak
2405.88	28.38	5.25	66.78	100.41	---	---	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
2389.44	60.98	-36.98	24.00		54.00	30.00	Average
2390.04	60.23	-36.98	23.25		54.00	30.75	Average

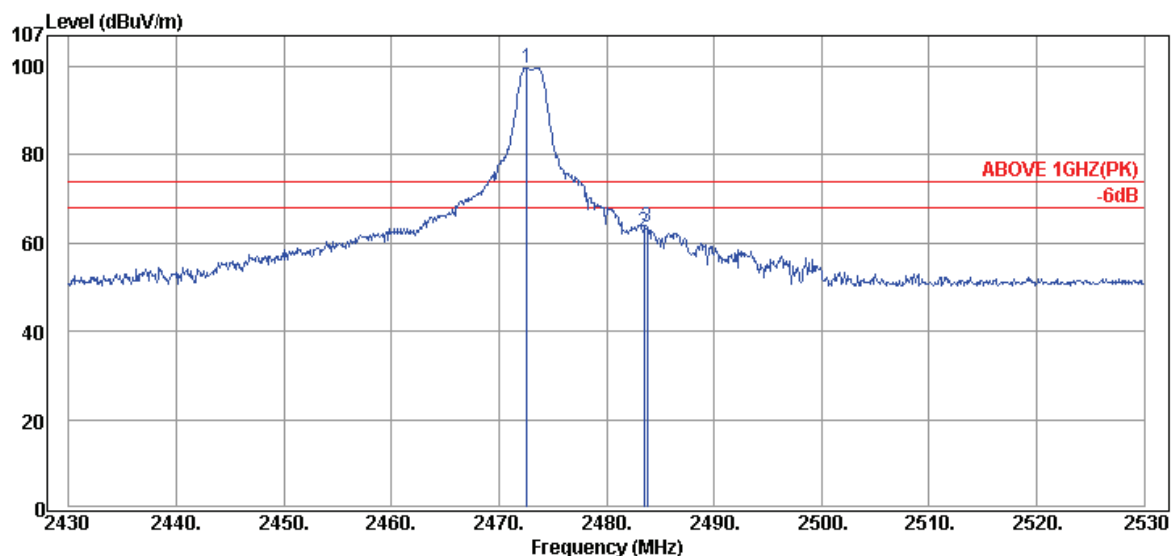
Mode	FASSTest	Frequency	TX 2405.376MHz
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Antenna at Vertical Polarization

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	28.35	5.24	22.69	56.28	74.00	17.72	Peak
2390.04	28.35	5.24	22.34	55.93	74.00	18.07	Peak
2405.88	28.38	5.25	60.66	94.29	---	---	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
2389.44	56.28	-36.98	19.30		54.00	34.70	Average
2390.04	55.93	-36.98	18.95		54.00	35.05	Average

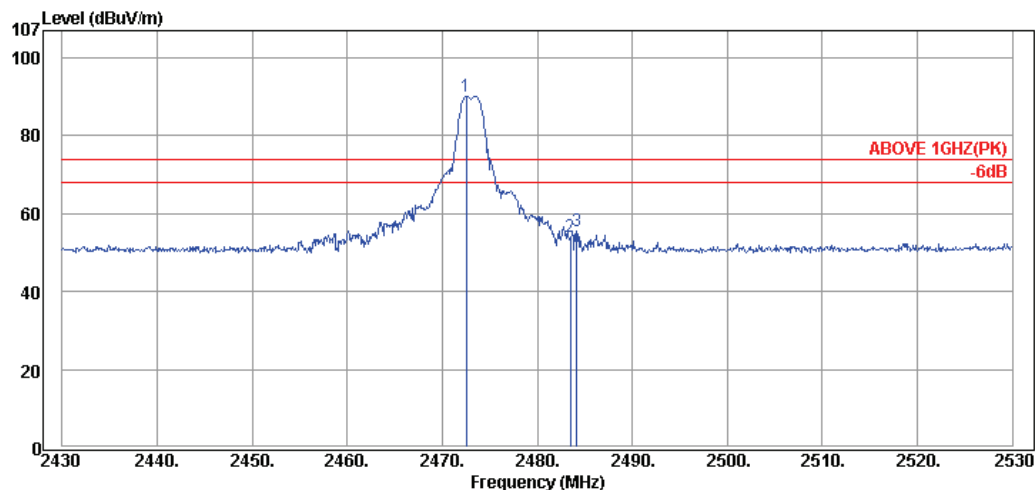
Mode	FASSTest	Frequency	TX 2472.960MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2472.60	28.46	5.30	66.03	99.79	---	---	Peak
2483.50	28.48	5.31	28.77	62.56	74.00	11.44	Peak
2483.80	28.48	5.31	29.88	63.67	74.00	10.33	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
2483.50	62.56	-36.98	25.58		54.00	28.42	Average
2483.80	63.67	-36.98	26.69		54.00	27.31	Average

Mode	FASSTest	Frequency	TX 2472.960MHz
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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
2472.50	28.46	5.30	56.39	90.15	---	---	Peak
2483.50	28.48	5.31	20.16	53.95	74.00	20.05	Peak
2484.20	28.48	5.31	21.80	55.59	74.00	18.41	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
2483.50	53.95	-36.98	16.97		54.00	37.03	Average
2484.20	55.59	-36.98	18.61		54.00	35.39	Average

A.1.3 Emissions outside the frequency band:

Mode	FASSTest	Frequency	TX 2405.376MHz
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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
1604.00	26.03	4.17	20.12	50.32	74.00	23.68	Peak
4810.00	32.82	8.98	12.04	53.84	74.00	20.16	Peak
7215.00	35.74	10.46	5.01	51.21	74.00	22.79	Peak
9620.00	37.87	11.70	23.49	73.06	74.00	0.94	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark	
1604.00	50.32	-36.98	13.34	54.00	40.66	Average	
4810.00	53.84	-36.98	16.86	54.00	37.14	Average	
7215.00	51.21	-36.98	14.23	54.00	39.77	Average	
9620.00	73.06	-36.98	36.08	54.00	17.92	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
1604.00	26.03	4.17	17.50	47.70	74.00	26.30	Peak
4810.00	32.82	8.98	15.93	57.73	74.00	16.27	Peak
7215.00	35.74	10.46	9.72	55.92	74.00	18.08	Peak
9620.00	37.87	11.70	22.34	71.91	74.00	2.09	Peak
12030.00	39.36	12.56	13.02	64.94	74.00	9.06	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
1604.00	47.70	-36.98	10.72		54.00	43.28	Average
4810.00	57.73	-36.98	20.75		54.00	33.25	Average
7215.00	55.92	-36.98	18.94		54.00	35.06	Average
9620.00	71.91	-36.98	34.93		54.00	19.07	Average
12030.00	64.94	-36.98	27.96		54.00	26.04	Average

Mode	FASSTest	Frequency	TX 2439.168MHz
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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
1626.00	26.14	4.22	21.58	51.94	74.00	22.06	Peak
3250.00	29.88	6.82	13.32	50.02	74.00	23.98	Peak
4880.00	32.73	8.17	12.27	53.17	74.00	20.83	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark	
1626.00	51.94	-36.98	14.96	54.00	39.04	Average	
3250.00	50.02	-36.98	13.04	54.00	40.96	Average	
4880.00	53.17	-36.98	16.19	54.00	37.81	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
1626.00	26.14	4.22	19.04	49.40	74.00	24.60	Peak
3250.00	29.88	6.82	14.55	51.25	74.00	22.75	Peak
4880.00	32.73	8.17	19.22	60.12	74.00	13.88	Peak
7320.00	37.03	10.03	7.94	55.00	74.00	19.00	Peak
9760.00	37.60	11.82	11.74	61.16	74.00	12.84	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
1626.00	49.40	-36.98	12.42		54.00	41.58	Average
3250.00	51.25	-36.98	14.27		54.00	39.73	Average
4880.00	60.12	-36.98	23.14		54.00	30.86	Average
7320.00	55.00	-36.98	18.02		54.00	35.98	Average
9760.00	61.16	-36.98	24.18		54.00	29.82	Average

Mode	FASSTest	Frequency	TX 2472.960MHz
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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
1648.00	26.26	4.27	21.77	52.30	74.00	21.70	Peak
4945.00	33.09	9.18	13.28	55.55	74.00	18.45	Peak
7420.00	36.27	10.69	11.63	58.59	74.00	15.41	Peak
9890.00	38.03	11.80	19.94	69.77	74.00	4.23	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
1648.00	52.30	-36.98	15.32		54.00	38.68	Average
4945.00	55.55	-36.98	18.57		54.00	35.43	Average
7420.00	58.59	-36.98	21.61		54.00	32.39	Average
9890.00	69.77	-36.98	32.79		54.00	21.21	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
1648.00	26.26	4.27	19.57	50.10	74.00	23.90	Peak
4945.00	33.09	9.18	16.55	58.82	74.00	15.18	Peak
7420.00	36.27	10.69	13.50	60.46	74.00	13.54	Peak
9890.00	38.03	11.80	17.35	67.18	74.00	6.82	Peak
12370.00	39.04	12.97	9.31	61.32	74.00	12.68	Peak
Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)		Limits (dBμV/m)	Margin (dB)	Remark
1648.00	50.10	-36.98	13.12		54.00	40.88	Average
4945.00	58.82	-36.98	21.84		54.00	32.16	Average
7420.00	60.46	-36.98	23.48		54.00	30.52	Average
9890.00	67.18	-36.98	30.20		54.00	23.80	Average
12370.00	61.32	-36.98	24.34		54.00	29.66	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

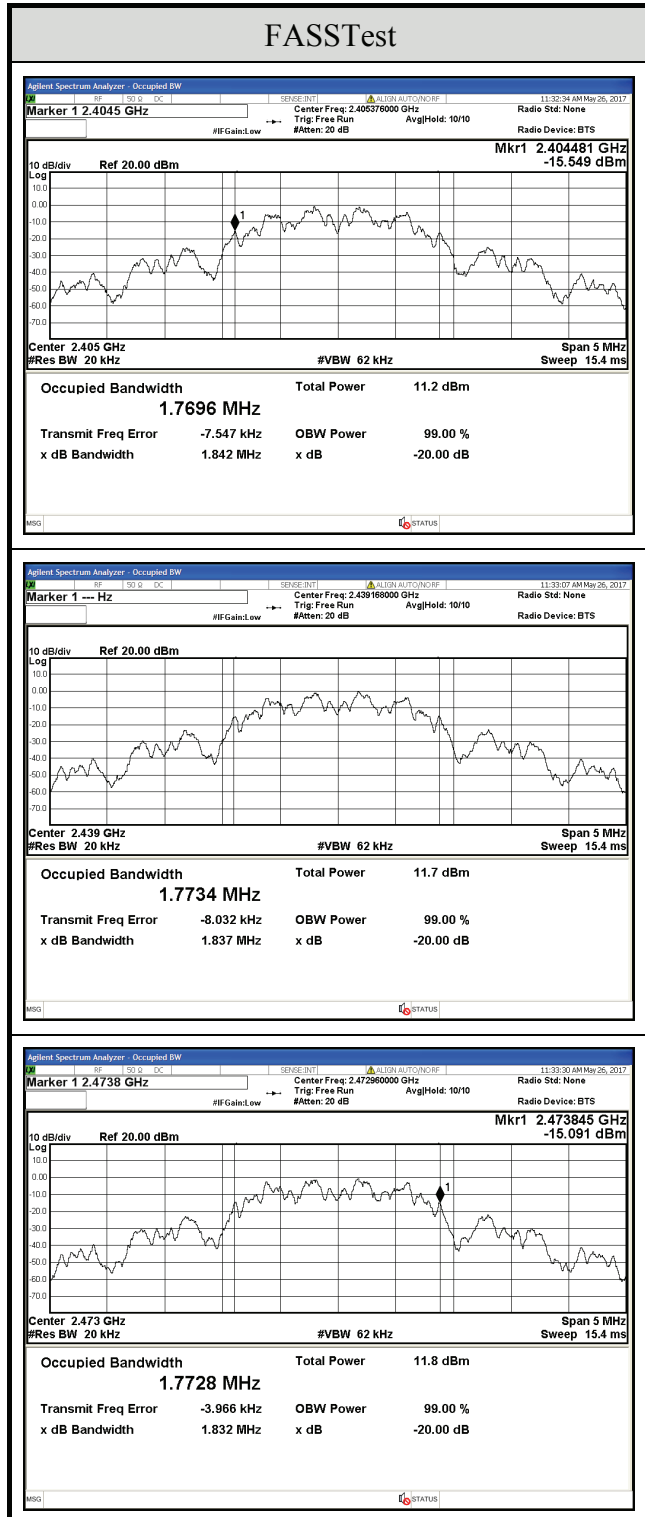
Test Date	2017/05/26	Temp./Hum.	24°C/49%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

A.2.1 20dB Bandwidth Result

Modulation	Centre Frequency (MHz)	20 dB Bandwidth (MHz)	Limit 2/3 (20dB Bandwidth)
FASSTest	2405.376	1.842	1.228
	2439.168	1.837	1.225
	2472.960	1.832	1.221

Remark: The maximum two-thirds of the 20dB bandwidth shall be at maximum 1.228MHz.

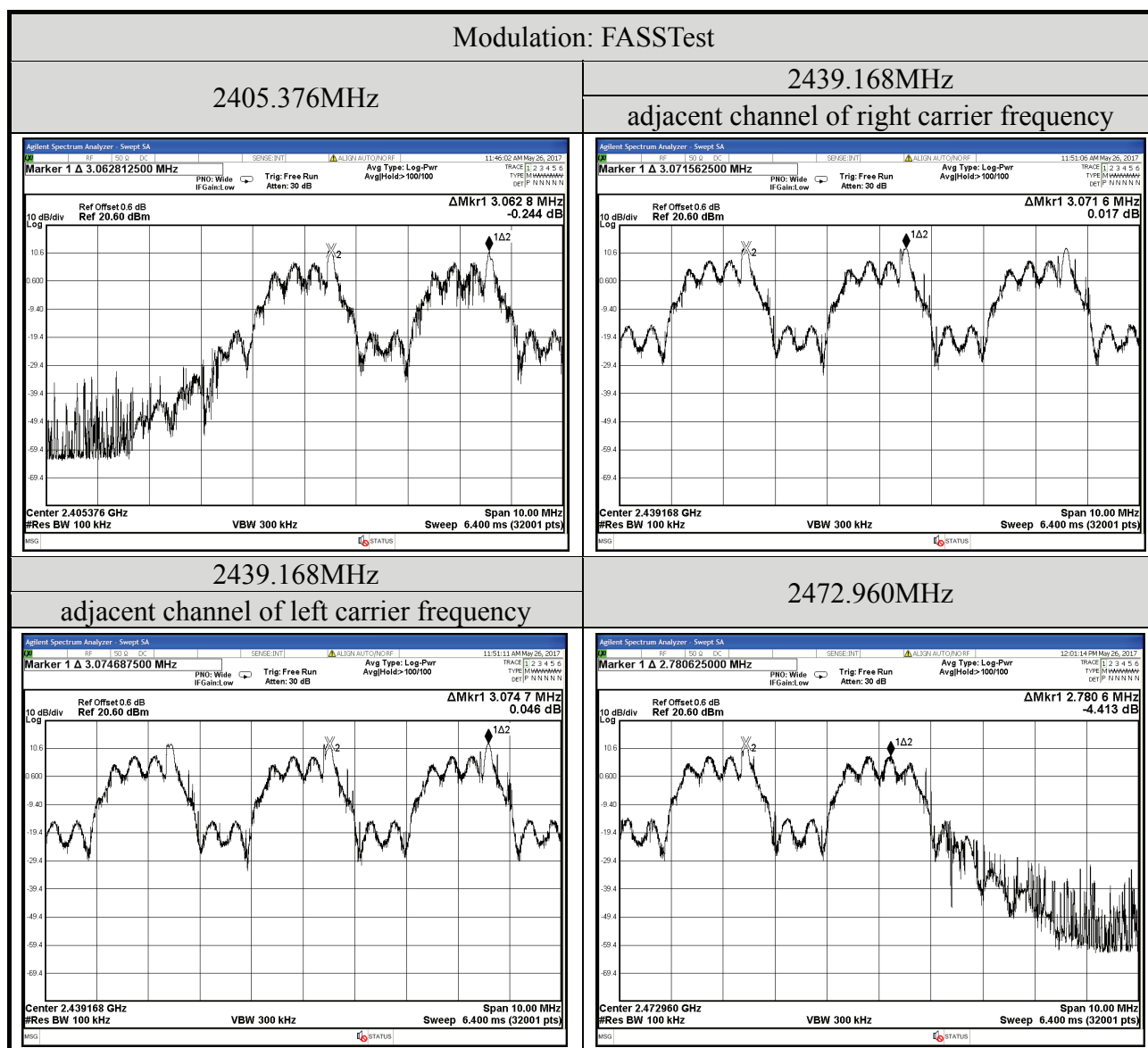
A.2.2 Measurement Plots



A.3 CARRIER FREQUENCY SEPARATION MEASUREMENT

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

A.3.1 Measurement Plots



A.4 TIME OF OCCUPANCY MEASUREMENT

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

A.4.1 Time of Occupancy

Modulation	Centre Frequency (MHz)	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
FASSTest	2405.376	1.415	26.036	<400
	2439.168	1.403	25.815	<400
	2472.960	1.404	25.834	<400

Duty cycle: 23 channels*0.4 seconds = 9.2 seconds

Test Frequency: 2405.376MHz

For each 1 second of 2 channel appearance, the longest time of occupancy for each of 9.2 seconds is:

$$2 \text{ channels} * 9.2 \text{ seconds} / 1 * 1.415 \text{ ms} = 26.036 \text{ ms}$$

Test Frequency: 2439.168MHz

For each 1 second of 2 channel appearance, the longest time of occupancy for each of 9.2 seconds is:

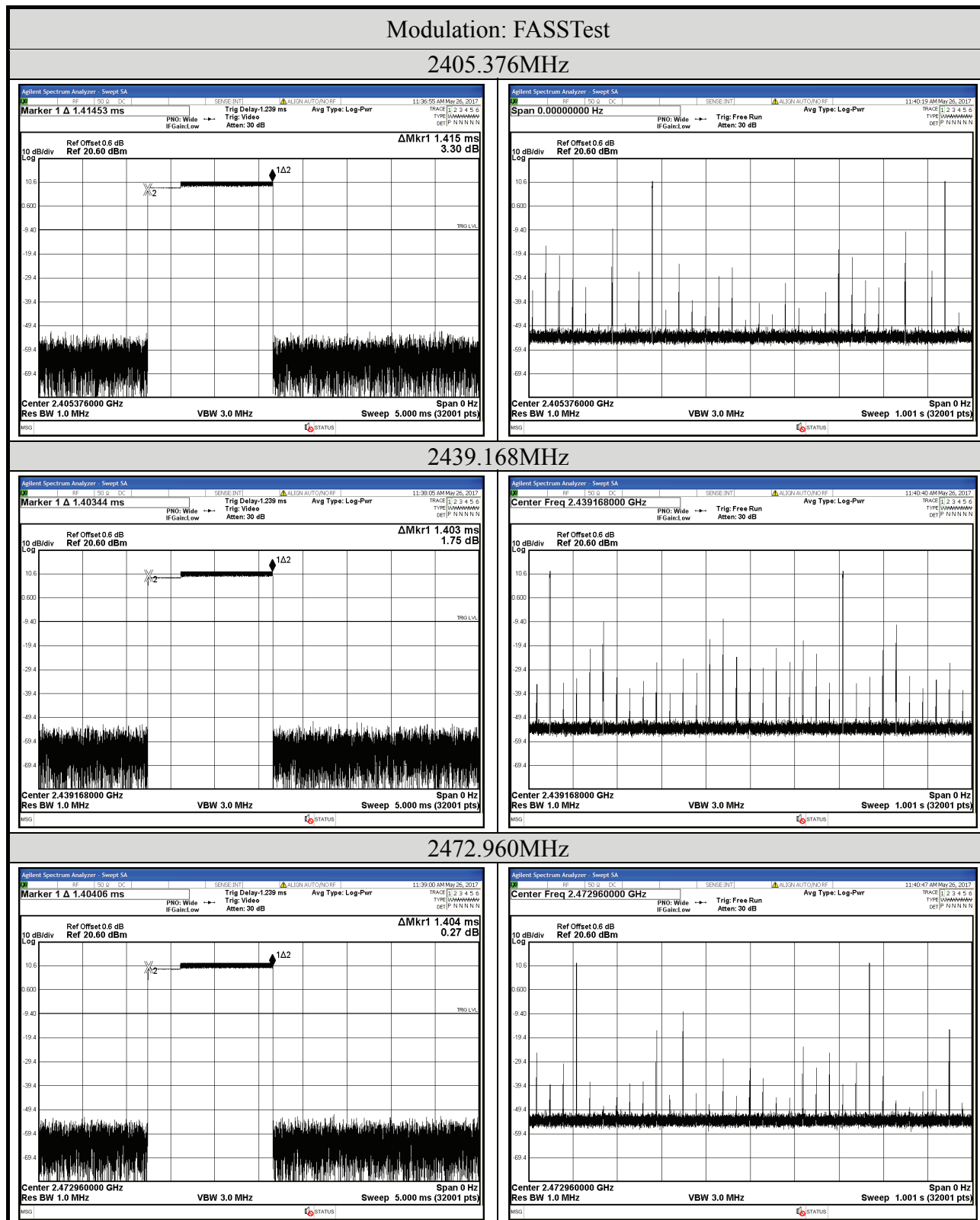
$$2 \text{ channel} * 9.2 \text{ seconds} / 1 * 1.403 \text{ ms} = 25.815 \text{ ms}$$

Test Frequency: 2472.960MHz

For each 1 second of 2 channel appearance, the longest time of occupancy for each of 9.2 seconds is:

$$2 \text{ channel} * 9.2 \text{ seconds} / 1 * 1.404 \text{ ms} = 25.834 \text{ ms}$$

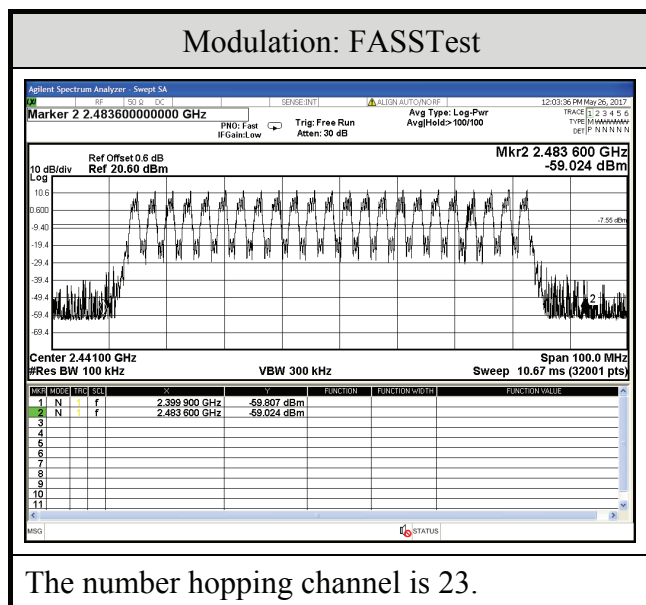
A.4.2 Measurement Plots



A.5 NUMBER OF HOPPING CHANNELS MEASUREMENT

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

A.5.1 Measurement Plots



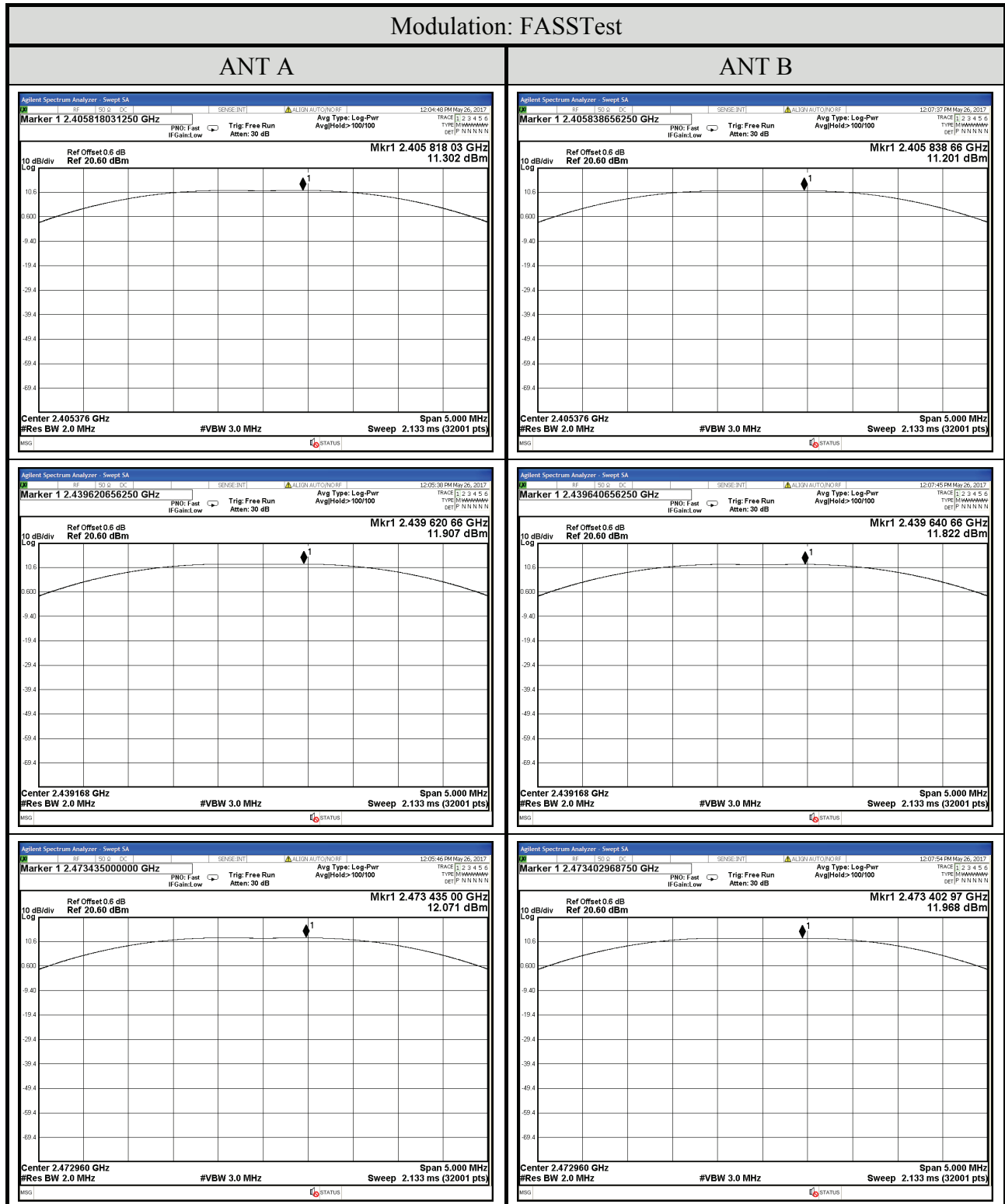
A.6 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

ANT A				
Modulation	Centre Frequency (MHz)	Peak Output Power		Limit
		dBm	W	
FASSTest	2405.376	11.302	0.013496	21dBm (0.125W)
	2439.168	11.907	0.015513	
	2472.960	12.071	0.016110	

ANT B				
Modulation	Centre Frequency (MHz)	Peak Output Power		Limit
		dBm	W	
FASSTest	2405.376	11.201	0.013186	21dBm (0.125W)
	2439.168	11.822	0.015212	
	2472.960	11.968	0.015733	

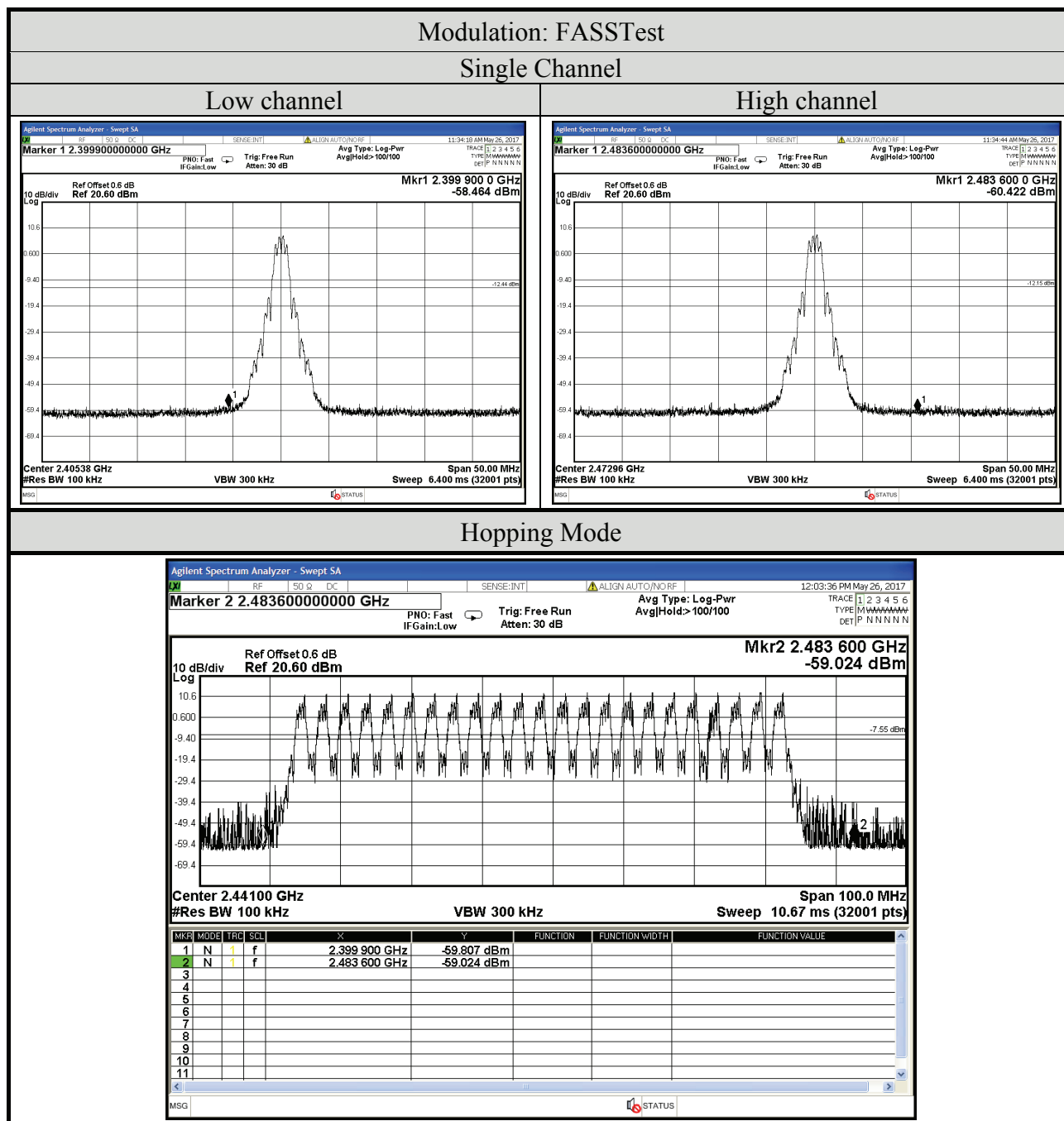
A.6.1 Measurement Plots



A.7 EMISSION LIMITATIONS MEASUREMENT

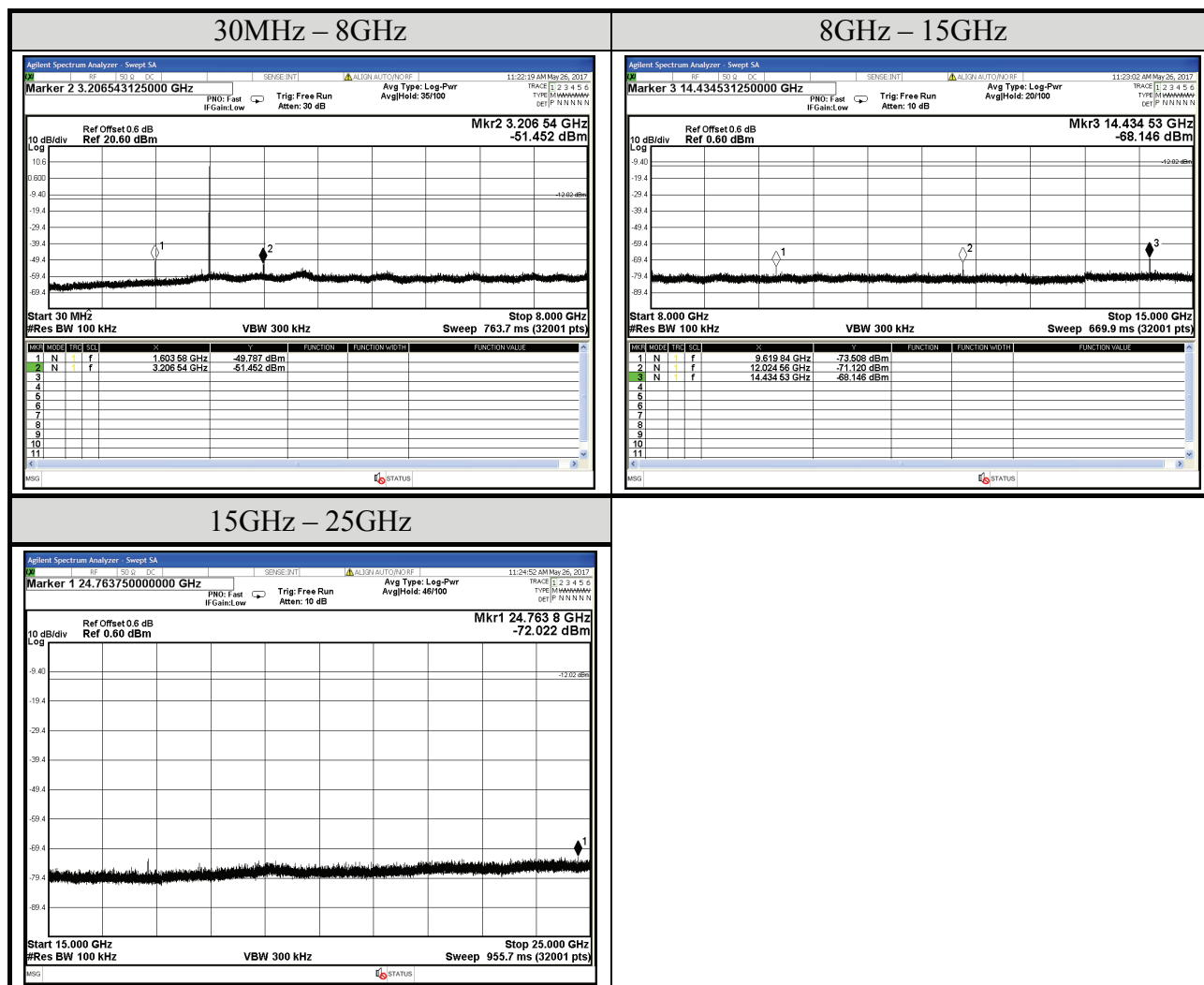
A.7.1 Band Edge

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Cable Loss	0.6dB	Test Voltage	DC 6.0V



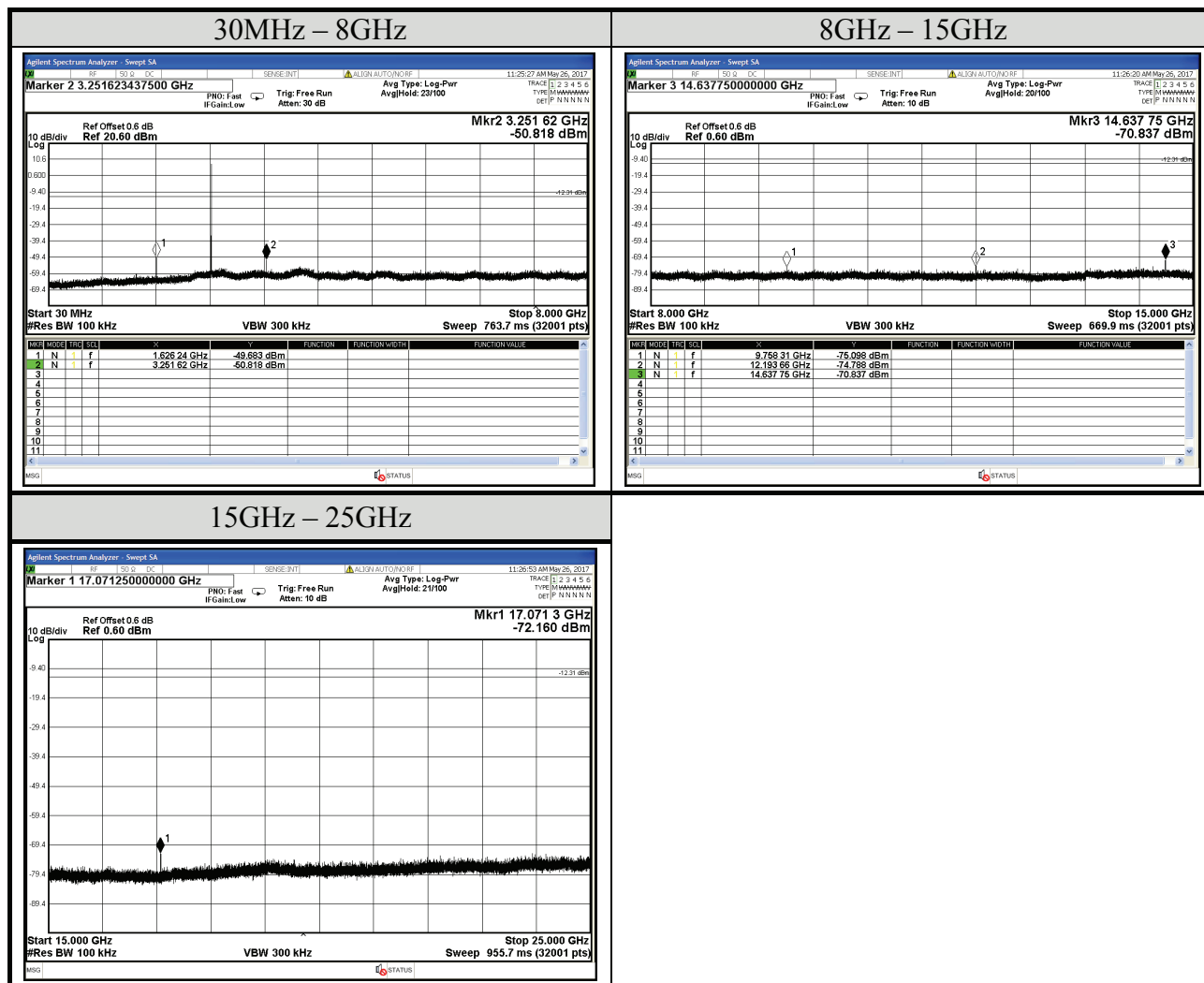
A.7.2 Spurious Emission

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Mode	TX	Modulation	FASSTest
		Frequency	2405.376MHz
Cable Loss	0.6dB	Test Voltage	DC 6.0V



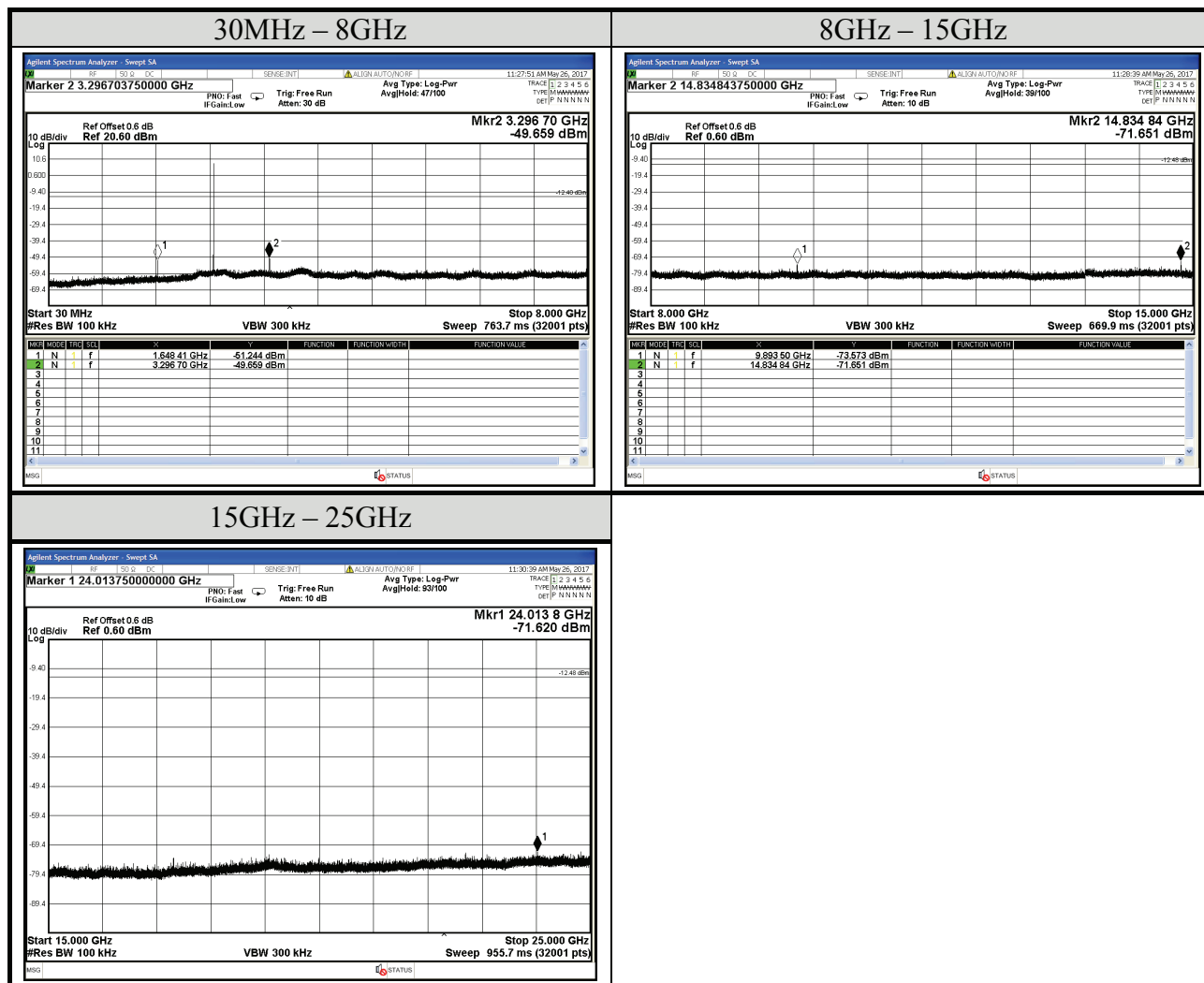
Note: All results have been included cable loss and simultaneous factor.

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Mode	TX	Modulation	FASSTest
		Frequency	2439.168MHz
Cable Loss	0.6dB	Test Voltage	DC 6.0V



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

Test Date	2017/05/26	Temp./Hum.	24°C/49%
Mode	TX	Modulation	FASSTest
		Frequency	2472.960MHz
Cable Loss	0.6dB	Test Voltage	DC 6.0V



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