AUDIX Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244,Taiwan
Tel: +886 2 26099301
Fax: +886 2 26099303

FCC 15.247 DSS
2.4GHz Report

for

FUTABA Corporation

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

Brand	**:**	**Futaba**
Product Name	**:**	**Receiver**
Model Name	**:**	**R3001SB**
FCC ID	**:**	**AZPR3001SB-24G**

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TEST REPORT CERTIFICATION

Applicant	:	FUTABA Corporation
Manufacture	:	FUTABA Corporation
Product Name	:	Receiver
Model No.	:	R3001SB
Serial No.	:	N/A
Brand	:	Futaba

Rules of Compliance and Measurement Standards:

47 CFR FCC Part 15 Subpart C:2015
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: 2016. 12. 29 ~ 2017. 01. 17 Date of Report: 2017. 01. 17

Producer: _____
(Annie Yu/Administrator)

Signatory: _____
(Ben Cheng/Manager)

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1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2017. 01. 17	Original Report.	EM-F170002

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2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	**N/A, NOTE**
15.247(d)/15.209	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.		

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3. GENERAL INFORMATION

3.1. Description of EUT

Product	Receiver
Model Number	R3001SB
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
Device Category	☐Outdoor Access Point ☐Fixed point-to-point Access Point ☐Indoor Access Point ▒Mobile and Portable client device
Date of Receipt of Sample	2016. 12. 26

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3.2. EUT Specifications Assessed in Current Report

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

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		

3.3. Antenna Information

Manufacture	Antenna Type	Frequency	Max Gain (dBi)
WAN SHIH ELECTRONIC (H.K) CO.,LTD	mono-pole type	2.4GHz	ANT A: -5.16 ANT B: -5.16

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

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3.4. Test Configuration

Modulation	T_{on} (ms)	Duty Cycle Factor (dB)
T-FHSS	1.760	-35.09

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

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3.5. Tested Supporting System List

3.5.1. Support Peripheral Unit

No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook PC	acer	Acer Aspire 4755G	N/A	HLZ-AR5B97
2.	Battery	Futaba	HT5F1800B	N/A	N/A
3.	Servo	Futaba	S3004	N/A	N/A
4.	JIG	Futaba	CIU-2	N/A	N/A

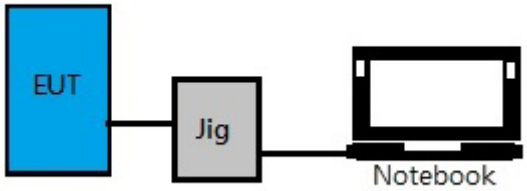
3.5.2. .Cable Lists

No.	Cable Description Of The Above Support Units
1.	Adapter: DELTA, M/N ADP-90CDD Power Cord: I/P: Non-Shielded, Detachable, 1.8m O/P: Shielded, Undetachable, 1.8m, Bonded a ferrite core
2.	DC Power Cord: Unshielded, Detachable, 0.1m
3.	Cable: Unshielded, Detachable, 0.3m
4.	Bun Cable: Unshielded, Detachable, 0.3m

3.6. Setup Configuration

3.6.1. EUT Configuration for Power Line Emission

3.6.2. EUT Configuration for Conducted Test Items



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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 TaipeiCity 244, Taiwan
Test Location& Facility	:	No. 53-11, Dingfu, Linkou Dist., New TaipeiCity 244, Taiwan
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724

3.9. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~300MHz	± 3.64dB
	300MHz~1000MHz	± 4.70dB
	Above 1GHz	± 1.60dB

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

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4. MEASUREMENT EQUIPMENTLIST

4.1. Radiated Emission Measurement

4.1.1. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9010B-544	MY55460198	2016. 04. 20	1 Year
2.	Test Receiver	R&S	ESCI7	100923	2016. 04. 12	1 Year
3.	Amplifier	HP	8447D	2944A06669	2016. 05. 10	1 Year
4.	Bilog Antenna	Schaffner	CBL6112B	2829	2016. 01. 30	1 Year
5.	Test Software	Audix	e3	V.120619C	N.C.R.	N.C.R.

4.1.2. Frequency Range 30MHz~1000MHz

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2016. 08. 19	1 Year
2.	Pre-Amplifier	Sonoma	310N	187161	2016. 06. 14	1 Year
3.	2.4GHz Notch Filter	K&L	7NSL10-2441.5E130.5-00	1	2016. 07. 27	1 Year
4.	Horn Antenna	ETS-Lindgren	3117	00135902	2016. 03. 09	1 Year
5.	Horn Antenna	EMCO	3116	2653	2016. 10. 24	1 Year
6.	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	N9010A-526	MY52220368	2016. 12. 01	1 Year

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5. CONDUCTED EMISSION MEASUREMET

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

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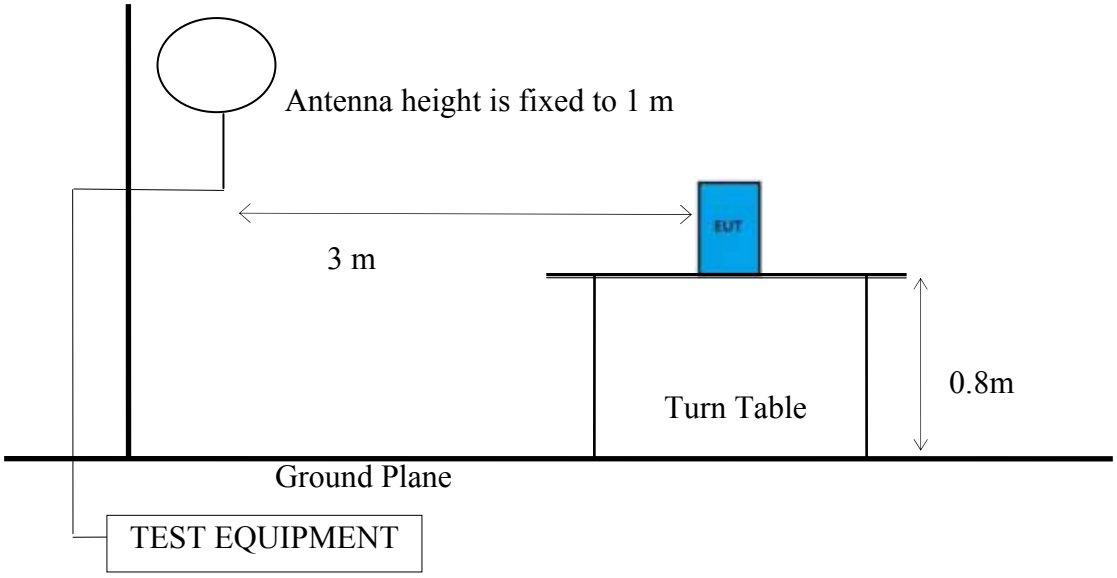
6. RADIATED EMISSION MEASUREMENT

6.1. Block Diagram of Test Setup

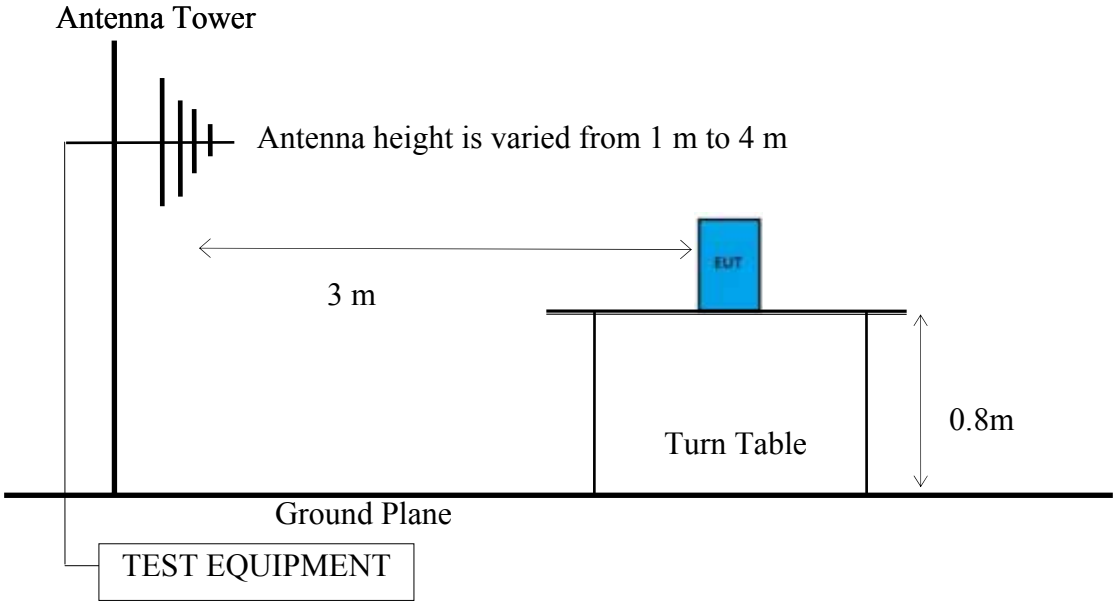
6.1.1. Block Diagram of connection between EUT and simulators

Indicated as section 3.7

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



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



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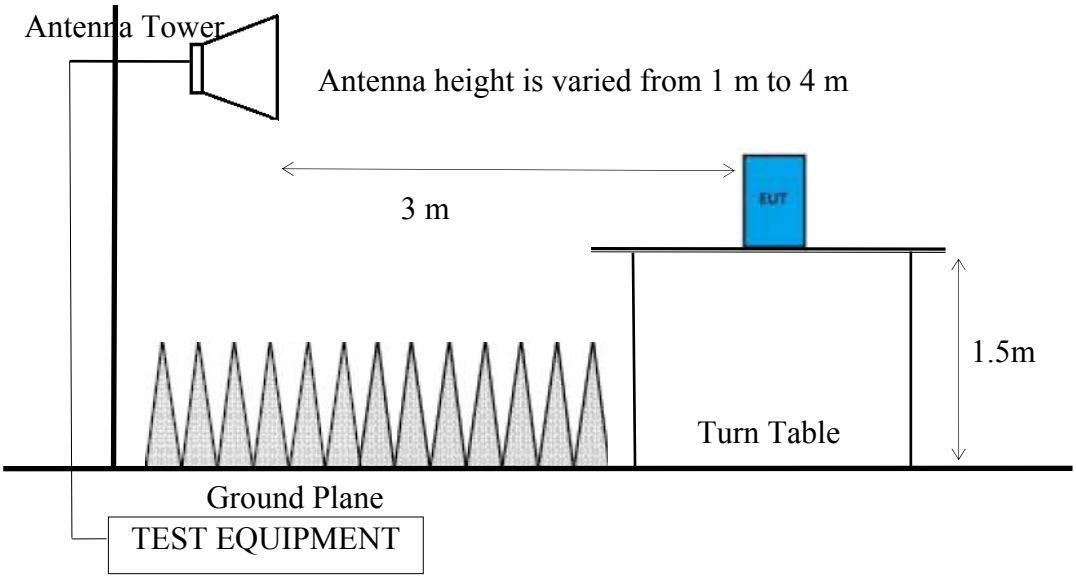
6.1.4. Fully Anechoic Chamber (3m) Setup Diagram for above 1GHz



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 Section 15.205, must also comply with the radiated emission limits specified as below.

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

Remark：(1) dBμV/m = 20 log (μV/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.

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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 table which has1.5 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 ≥ 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 ≥ 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.

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

6.5. Test Results

PASSED.

Test Date	2016/12/30	Temp./Hum.	25℃/55%
Test Voltage	DC 6.0V		

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6.5.1. Emissions within Restricted Frequency Bands

6.5.1.1. Frequency Below 1GHz

Modulation	T-FHSS	Frequency	TX 2435.5MHz

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
101.78	17.38	2.29	5.15	24.82	43.50	18.68	Peak
286.08	19.55	4.18	5.42	29.15	46.00	16.85	Peak
438.37	23.16	5.91	1.93	31.00	46.00	15.00	Peak
623.64	24.97	6.83	1.09	32.89	46.00	13.11	Peak
776.90	26.35	7.49	0.81	34.65	46.00	11.35	Peak
918.52	27.29	8.30	1.91	37.50	46.00	8.50	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
101.78	17.38	2.29	4.12	23.79	43.50	19.71	Peak
237.58	18.17	3.70	2.64	24.51	46.00	21.49	Peak
374.35	22.06	5.27	2.15	29.48	46.00	16.52	Peak
534.40	24.11	6.54	1.47	32.12	46.00	13.88	Peak
637.22	25.09	6.88	2.44	34.41	46.00	11.59	Peak
934.04	27.40	8.41	1.54	37.35	46.00	8.65	Peak

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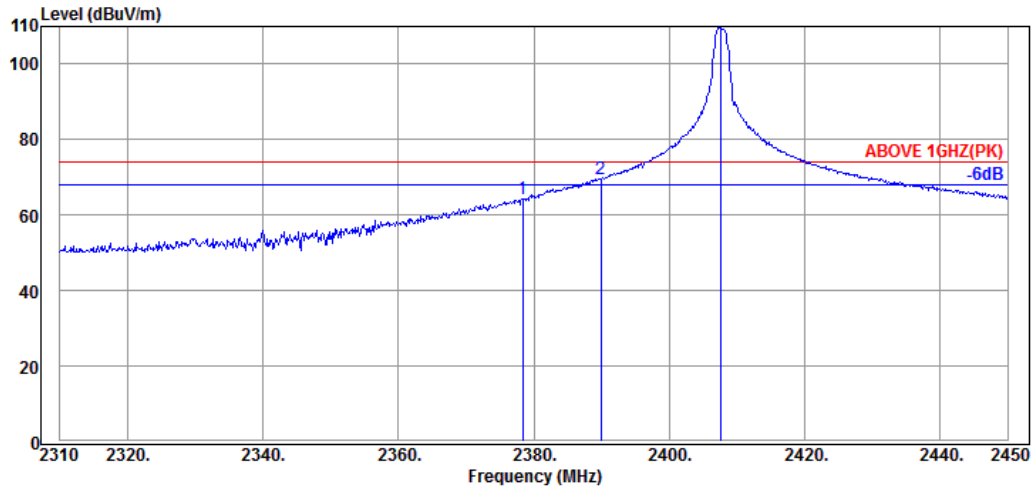
6.5.1.2.Frequency Above 1 GHz to 10th harmonics

Band Edge:

Modulation	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
2378.32	32.13	5.71	26.48	64.32	74.00	9.68	Peak
2389.94	32.16	5.72	31.60	69.48	74.00	4.52	Peak
2407.58	32.18	5.74	71.65	109.57	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2378.32	64.32	-35.09	29.23	54.00	24.77	Average
2389.94	69.48	-35.09	34.39	54.00	19.61	Average

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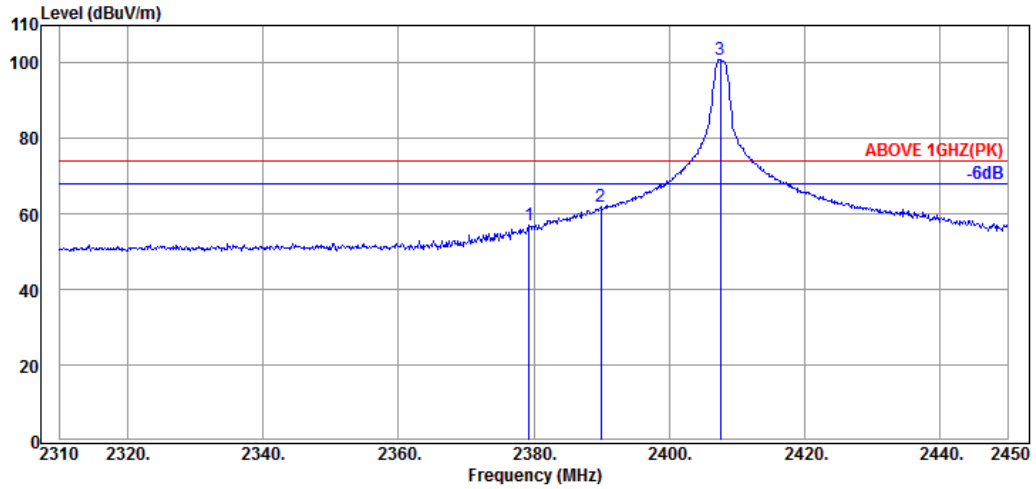
Modulation	T-FHSS	Frequency	TX 2407.5MHz



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
2379.30	32.13	5.71	19.20	57.04	74.00	16.96	Peak
2389.94	32.16	5.72	24.21	62.09	74.00	11.91	Peak
2407.58	32.18	5.74	62.93	100.85	---	---	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2379.30	57.04	-35.09	21.95	54.00	32.05	Average
2389.94	62.09	-35.09	27.00	54.00	27.00	Average

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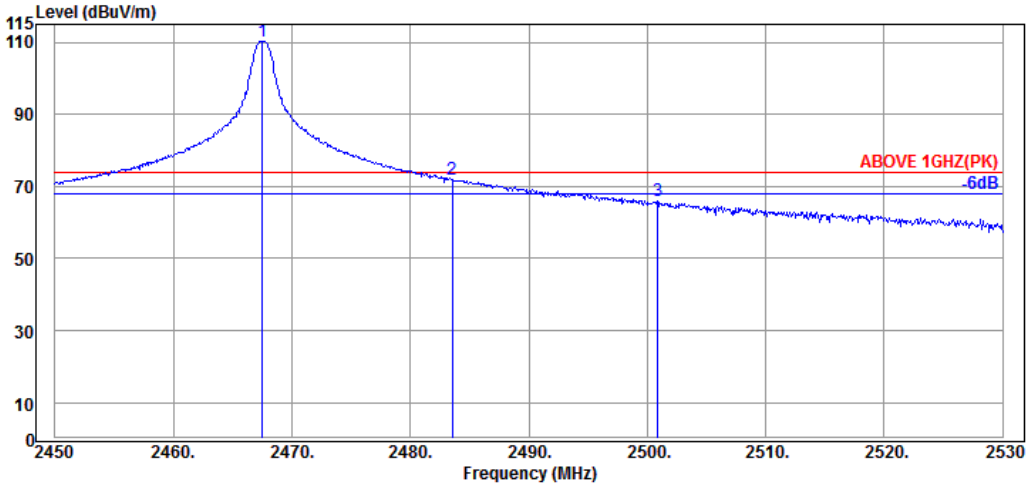
Modulation	T-FHSS	Frequency	TX 2467.5MHz



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
2467.52	32.25	5.80	72.29	110.34	---	---	Peak
2483.52	32.28	5.82	33.72	71.82	74.00	2.18	Peak
2500.88	32.30	5.84	27.68	65.82	74.00	8.18	Peak

Emission Frequency (MHz)	Peak Emission Level (dBµV/m)	DCCF (dB)	Average Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
2467.52	65.82	-35.09	30.73	54.00	23.27	Average
2483.52	71.82	-35.09	36.73	54.00	17.27	Average

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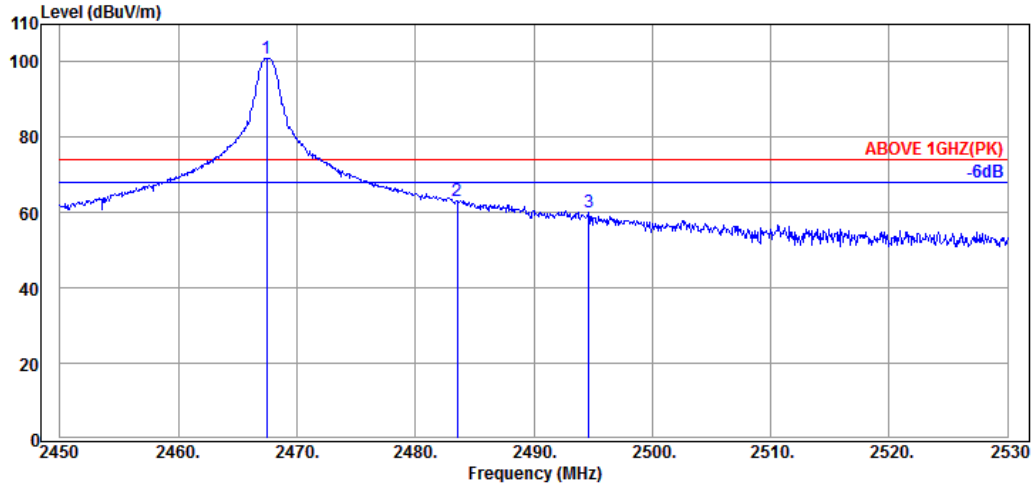
Modulation	T-FHSS	Frequency	TX 2467.5MHz



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	5.80	63.02	101.07	---	---	Peak
2483.52	32.28	5.82	24.94	63.04	74.00	10.96	Peak
2494.64	32.30	5.84	21.87	60.01	74.00	13.99	Peak

Emission Frequency (MHz)	Peak Emission Level (dBµV/m)	DCCF (dB)	Average Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
2483.52	63.04	-35.09	27.95	54.00	26.05	Average
2494.64	60.01	-35.09	24.92	54.00	29.08	Average

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6.5.2. Emissions outside the frequency band:

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

Modulation	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
4815.00	34.22	7.86	19.64	61.72	74.00	12.28	Peak
7225.00	35.80	9.32	8.87	53.99	74.00	20.01	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4815.00	61.72	-35.09	26.63	54.00	27.37	Average
7225.00	53.99	-35.09	18.90	54.00	35.10	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
4815.00	34.22	7.86	12.55	54.63	74.00	19.37	Peak
7225.00	35.80	9.32	11.24	56.36	74.00	17.64	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4815.00	54.63	-35.09	19.54	54.00	34.46	Average
7225.00	56.36	-35.09	21.27	54.00	32.73	Average

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Modulation	T-FHSS	Frequency	TX 2435.5MHz

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
4870.00	34.25	8.35	20.35	62.95	74.00	11.05	Peak
7305.00	35.80	9.82	6.17	51.79	74.00	22.21	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4870.00	62.95	-35.09	27.86	54.00	26.14	Average
7305.00	51.79	-35.09	16.70	54.00	37.30	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
4870.00	34.25	8.35	13.54	56.14	74.00	17.86	Peak
7305.00	35.80	9.82	8.24	53.86	74.00	20.14	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4870.00	56.14	-35.09	21.05	54.00	32.95	Average
7305.00	53.86	-35.09	18.77	54.00	35.23	Average

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Modulation	T-FHSS	Frequency	TX 2467.5MHz

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
4935.00	34.27	8.57	16.72	59.56	74.00	14.44	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4935.00	59.56	-35.09	24.47	54.00	29.53	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
4935.00	34.27	8.57	13.57	56.41	74.00	17.59	Peak

Emission Frequency (MHz)	Peak Emission Level (dBμV/m)	DCCF (dB)	Average Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
4935.00	56.41	-35.09	21.32	54.00	32.68	Average

6.5.3. Emissions in Non-restricted Frequency Bands

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

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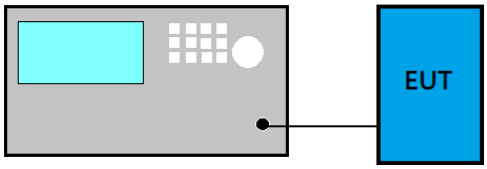
7. 20dB BANDWIDTH MEASUREMENT

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 toDA00-705:

(1) Set RBW close to1% 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

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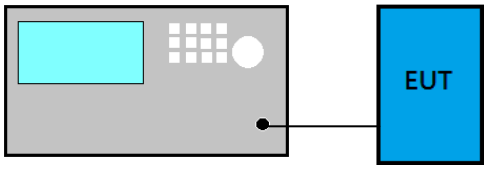
8. CARRIER FREQUENCY SEPARATION MEASUREMENT

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 ≥ 1% of the span
(3) VBW≥ RBW
(4) Sweep = auto
(5) Detector function = peak
(6) Trace = max hold

8.4. Test Results

Please refer to Appendix A

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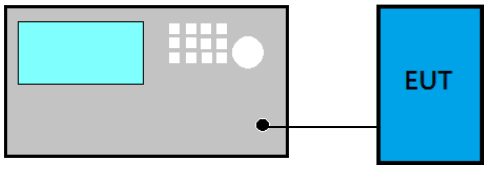
9. TIME OF OCCUPANCY MEASUREMENT

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 ≥ 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

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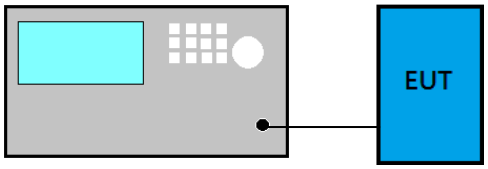
10. NUMBER OF HOPPING CHANNELS MEASUREMENT

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 ≥ 1% of the span
(3) VBW ≥ RBW
(4) Sweep = auto
(5) Detector function = peak
(6) Trace = max hold

10.4. Test Results

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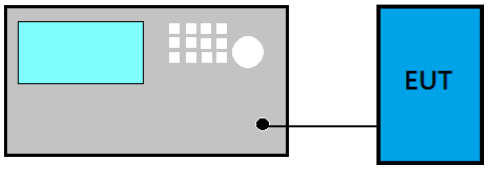
11. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

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

11.4. Test Results

Please refer to Appendix A

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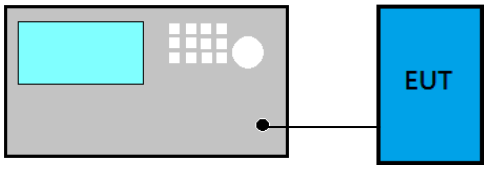
12. EMISSION LIMITATIONS MEASUREMENT

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

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13. DEVIATION TO TEST SPECIFICATIONS

【NONE】

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APPENDIX A

TEST PLOTS

(Model: R3001SB)

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A.1 20DB BANDWIDTH MEASUREMENT

Test Date	2016/12/29	Temp./Hum.	22℃/60%
Cable Loss	---	Test Voltage	DC 6.0V

A.1.1 20dB Bandwidth Result

Modulation	Centre Frequency (MHz)	20 dB Bandwidth (MHz)	Limit 2/3 (20dB Bandwidth)
T-FHSS	2407.5	0.3354	0.224
	2435.5	0.3280	0.219
	2467.5	0.3279	0.219

Remark: The maximum two-thirds of the 20dB bandwidth shall be at maximum 0.224Hz.

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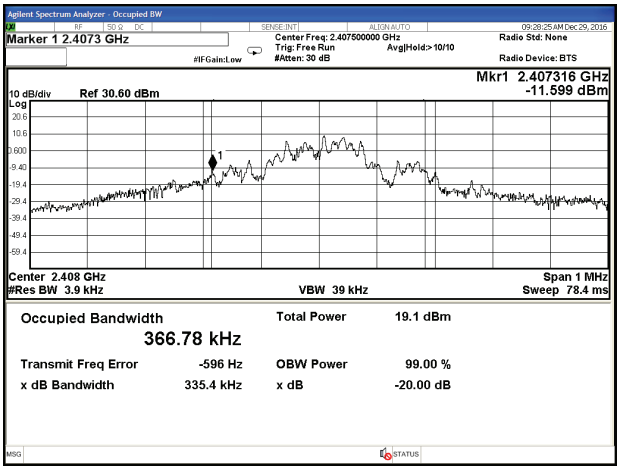
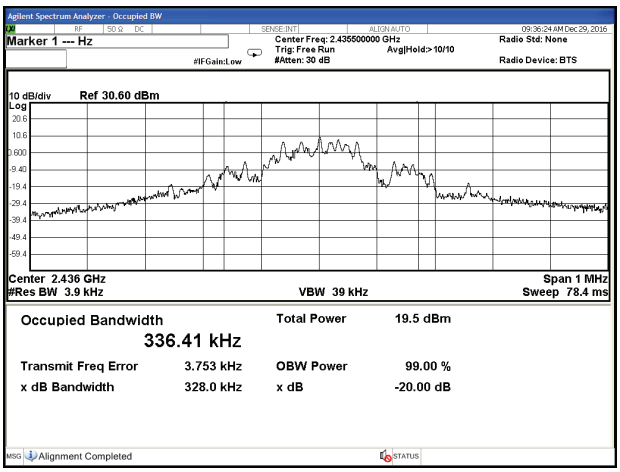
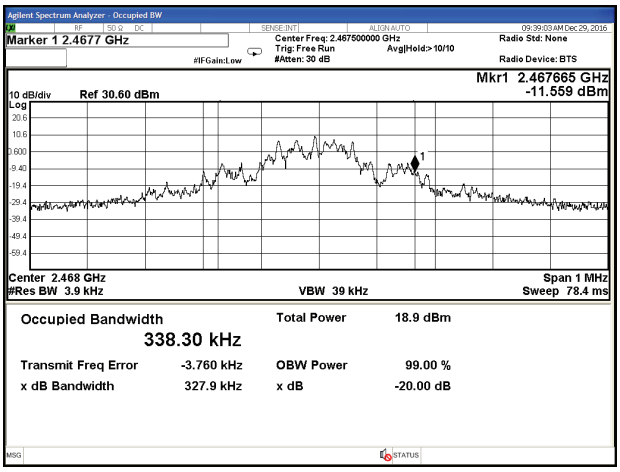
A.1.2 Measurement Plots

T-FHSS







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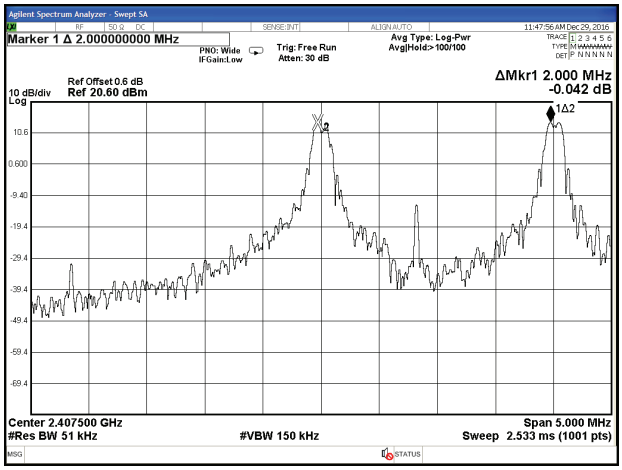
A.2 CARRIER FREQUENCY SEPARATION MEASUREMENT

Test Date	2016/12/29	Temp./Hum.	22℃/60%
Cable Loss	1.54dB	Test Voltage	DC 6.0V

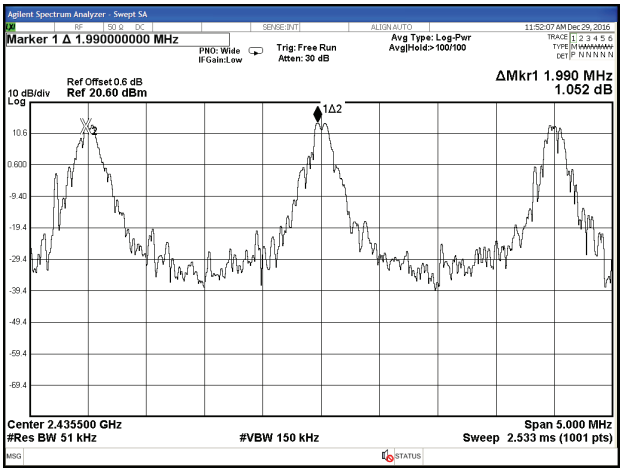
A.2.1 Measurement Plots

Modulation: T-FHSS

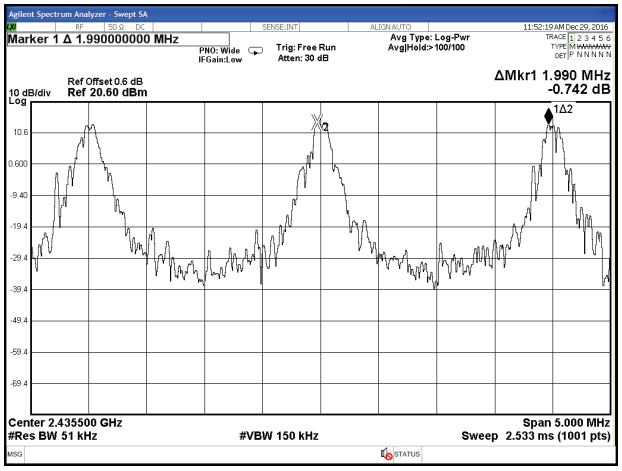
2407.5MHz



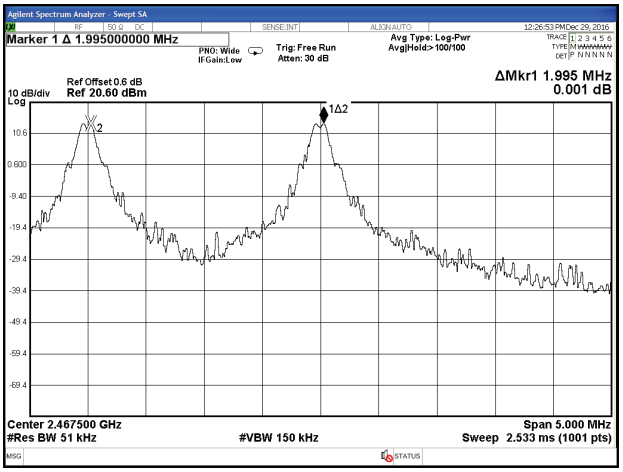
2435.5MHz
adjacent channel of right carrier frequency



2435.5MHz
adjacent channel of left carrier frequency



2467.5MHz



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A.3 TIME OF OCCUPANCY MEASUREMENT

Test Date	2016/12/29 ~ 2017/01/17	Temp./Hum.	22℃/60%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

A.3.1 Time of Occupancy

Modulation	Centre Frequency (MHz)	Time of Occupancy (ms)	Maximum accumulated Time of Occupancy (ms)	Limit (ms)
T-FHSS	2407.5	1.740	8.6304	<400
	2435.5	1.750	8.6800	<400
	2467.5	1.760	8.7296	<400

Duty cycle: 31 channels*0.4 seconds = 12.4 seconds

Test Frequency: 2407.500MHz

For each 5 seconds of 2 channel appearance, the longest time of occupancy for each of 12.4 seconds is:

2 channels*12.4 seconds/5* 1.740ms = 8.6304ms

Test Frequency: 2435.500MHz

For each 5 seconds of 2 channel appearance, the longest time of occupancy for each of 12.4 seconds is:

2 channel*12.4 seconds/5* 1.750ms = 8.6800ms

Test Frequency: 2467.500MHz

For each 5 seconds of 2 channel appearance, the longest time of occupancy for each of 12.4 seconds is:

2 channel*12.4 seconds/5* 1.760ms = 8.7296ms

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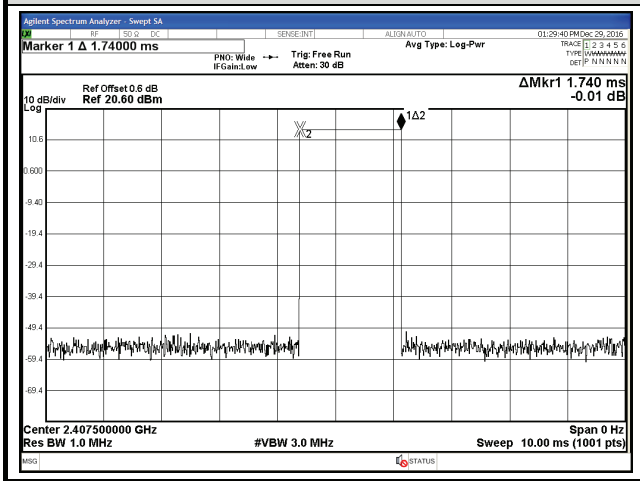
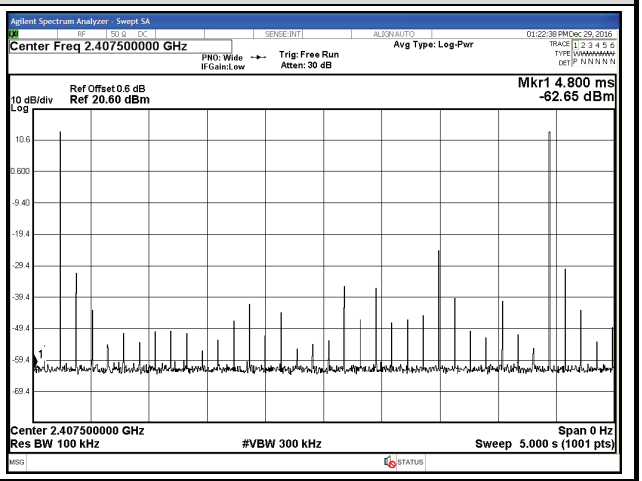
A.3.2 Measurement Plots

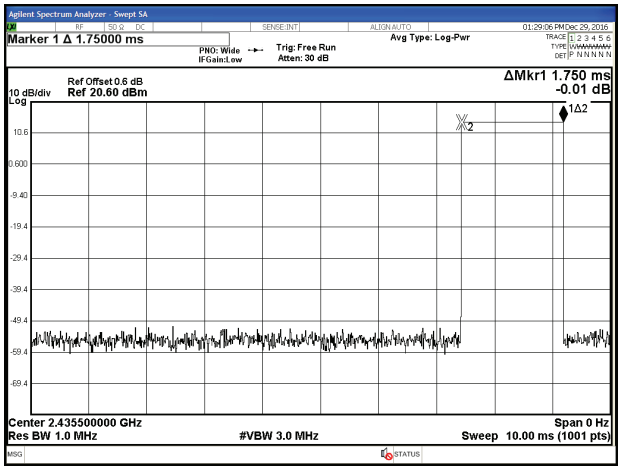
Modulation: T-FHSS

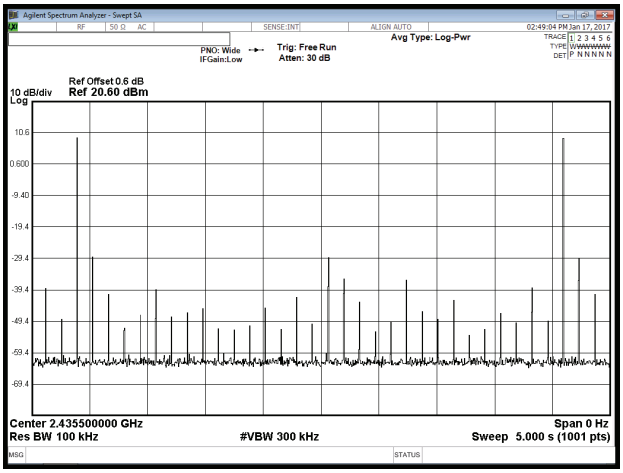
2407.5MHz



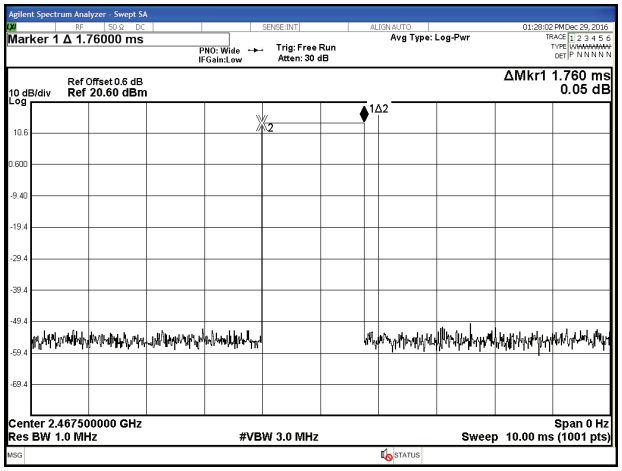


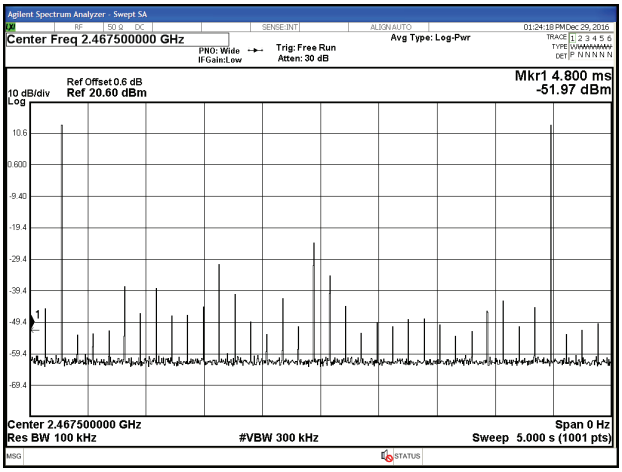
2435.5MHz





2467.5MHz





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New Taipei City244, Taiwan
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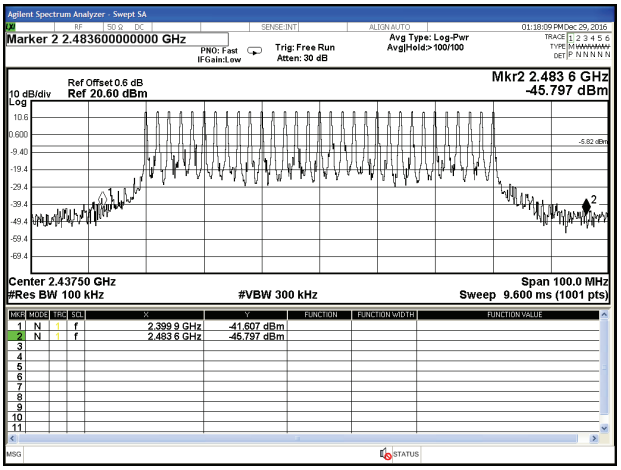
Fax: +886 2 26099303

A.4 NUMBER OF HOPPING CHANNELS MEASUREMENT

Test Date	2016/12/29	Temp./Hum.	22℃/60%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

A.4.1 Measurement Plots

Modulation: T-FHSS



The number hopping channel is 31.

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A.5 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

Test Date	2016/12/29	Temp./Hum.	22℃/60%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

Modulation	Centre Frequency (MHz)	Peak Output Power		Limit
		dBm	W	
T-FHSS	2407.50	13.757	0.023752	21dBm (0.125W)
	2435.50	13.813	0.024060	
	2467.50	13.786	0.023911	

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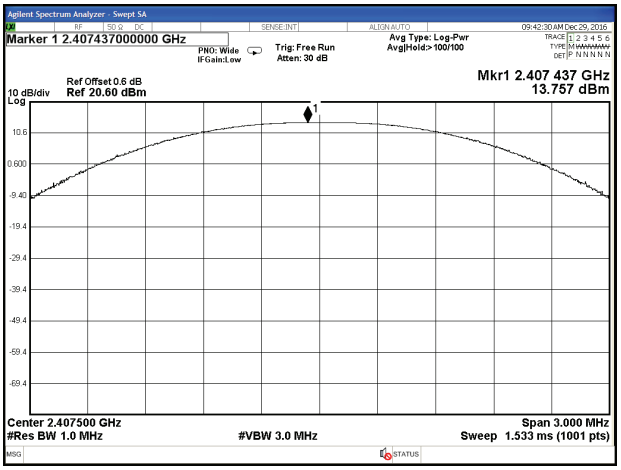
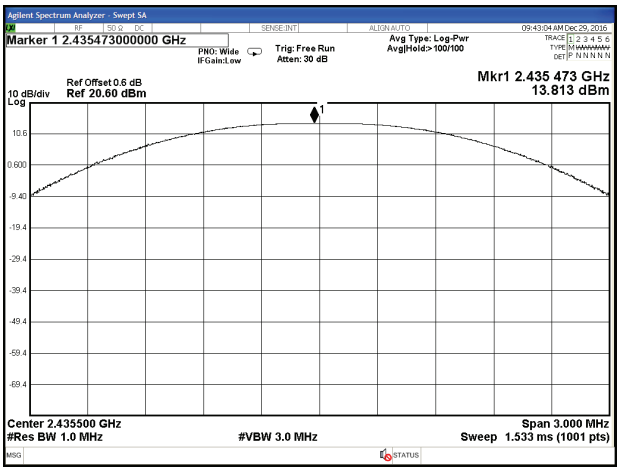
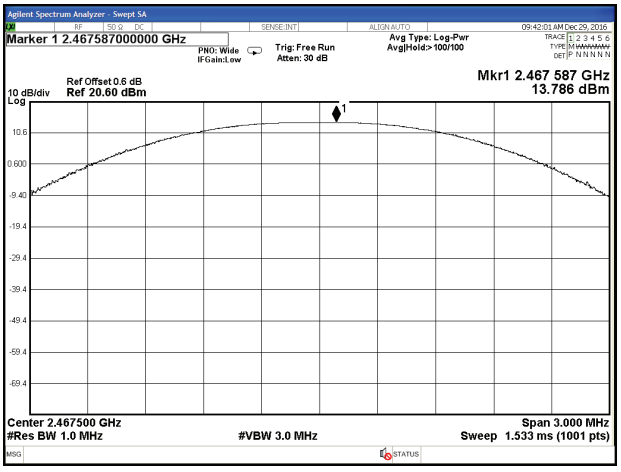
Fax: +886 2 26099303

A.5.1 Measurement Plots

Modulation: T-FHSS







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A.6 EMISSION LIMITATIONS MEASUREMENT

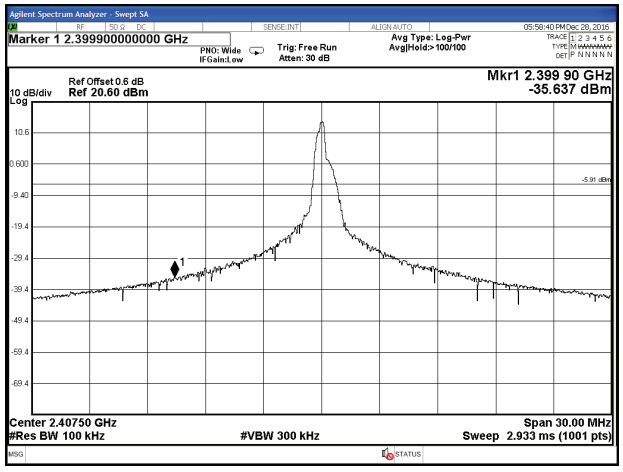
A.6.1 Band Edge

Test Date	2016/12/29	Temp./Hum.	22℃/60%
Cable Loss	0.6dB	Test Voltage	DC 6.0V

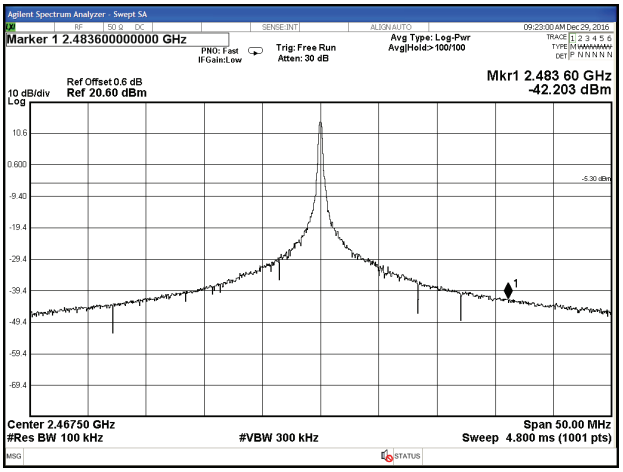
Modulation: T-FHSS

Single Channel

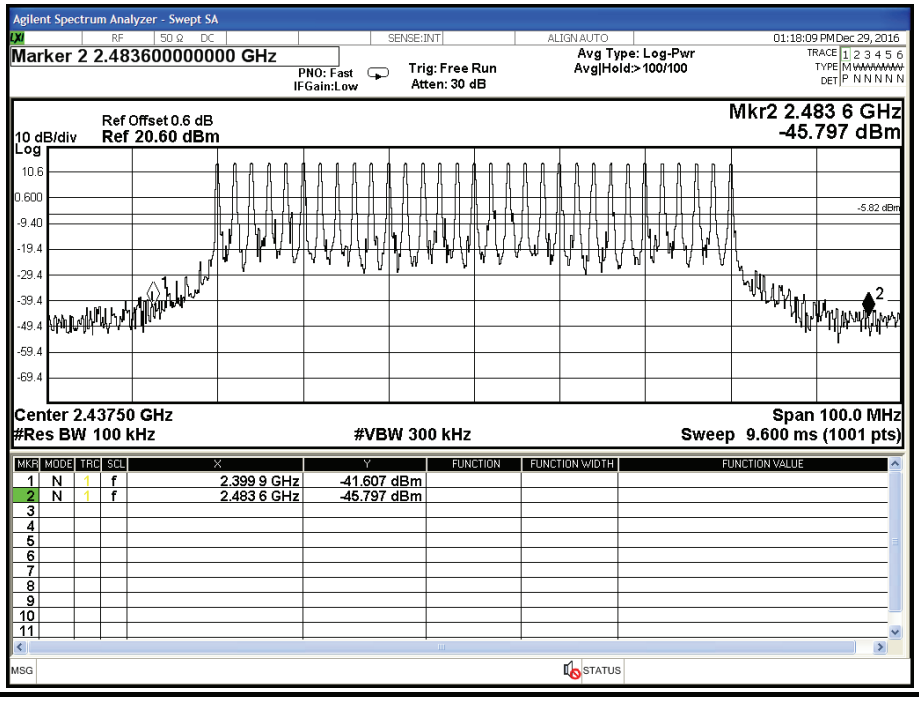
Low channel



High channel



Hopping Mode



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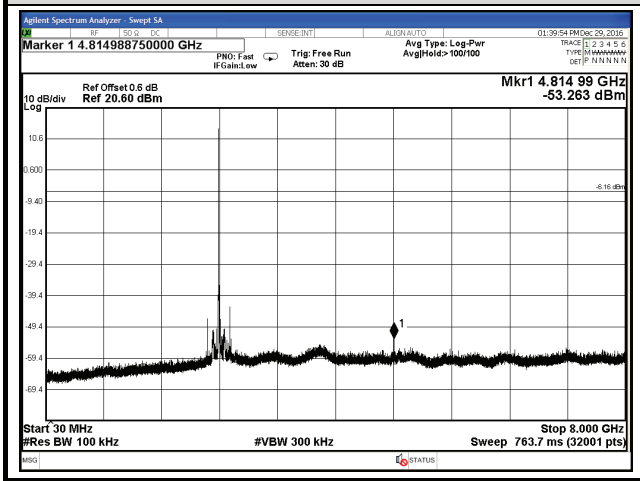
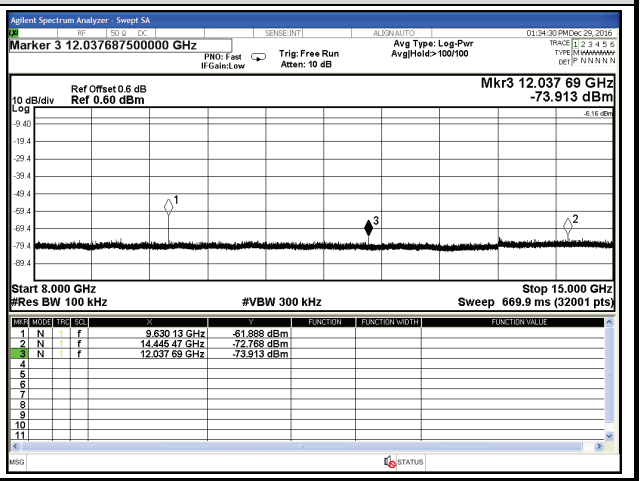
A.6.2 Spurious Emission

Test Date	2016/12/29	Temp./Hum.	22℃/60%
Mode	TX	Modulation	T-FHSS
		Frequency	2407.5MHz
Cable Loss	0.6dB	Test Voltage	DC 6.0V

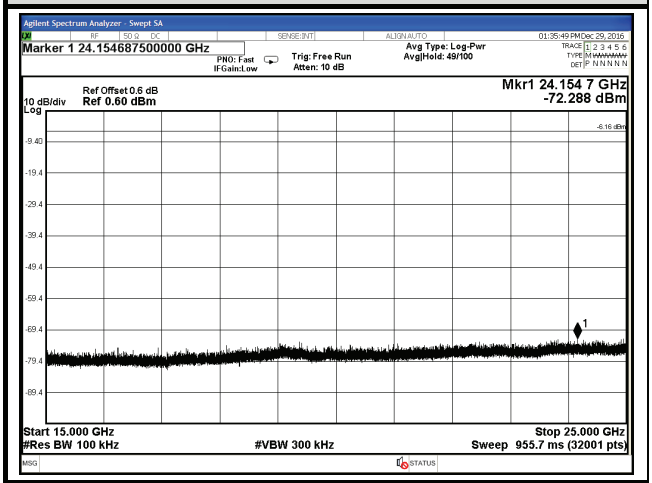
30MHz – 8GHz



8GHz – 15GHz



15GHz – 25GHz



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

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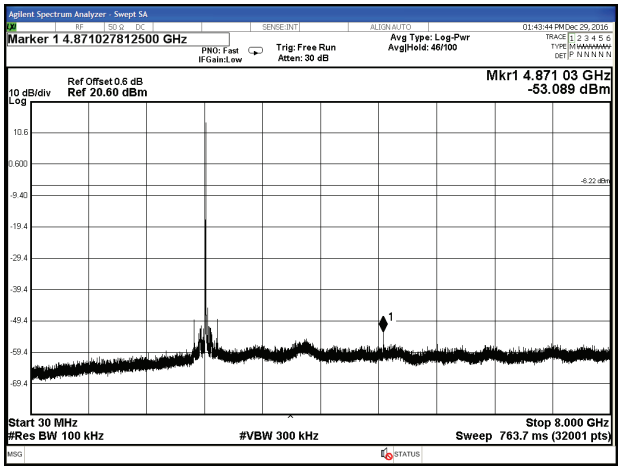
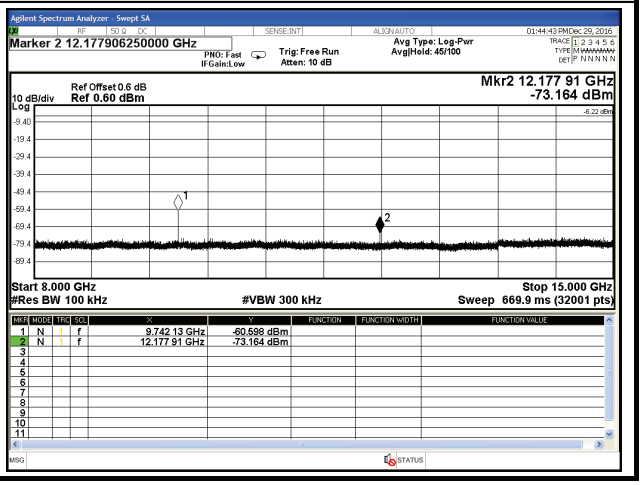
Test Date	2016/12/29	Temp./Hum.	22℃/60%
Mode	TX	Modulation	T-FHSS
		Frequency	2435.5MHz
Cable Loss	0.6dB	Test Voltage	DC 6.0V

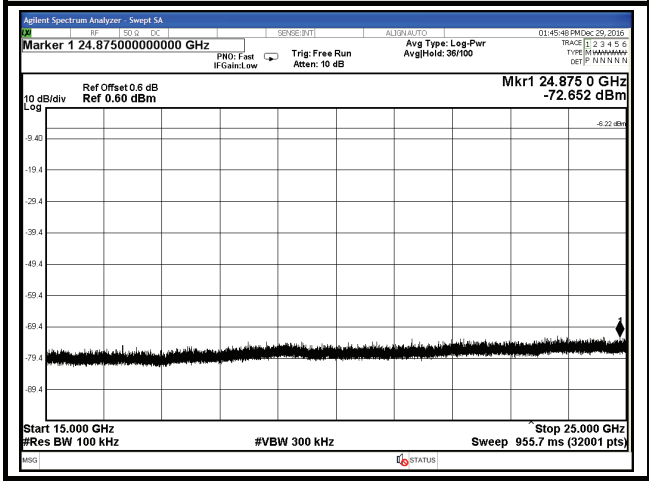
30MHz – 8GHz



8GHz – 15GHz



15GHz – 15GHz



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

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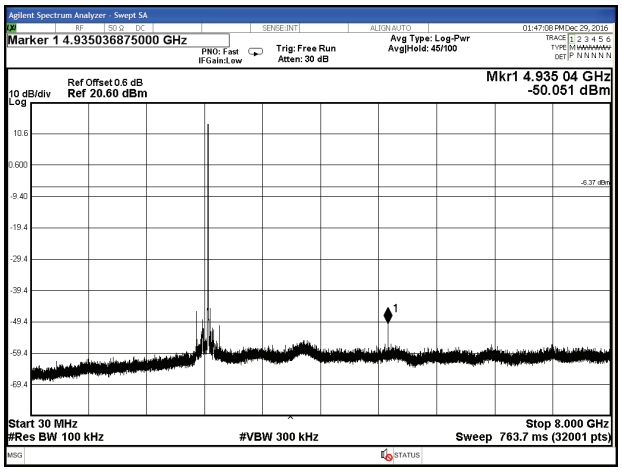
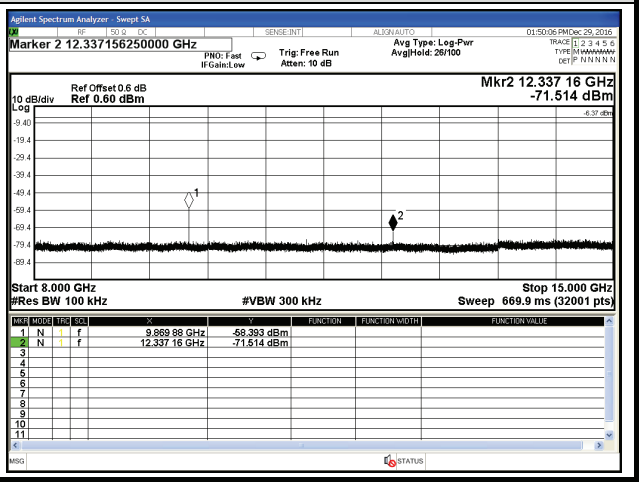
Test Date	2016/12/29	Temp./Hum.	22℃/60%
Mode	TX	Modulation	T-FHSS
		Frequency	2467.5MHz
Cable Loss	0.6dB	Test Voltage	DC 6.0V

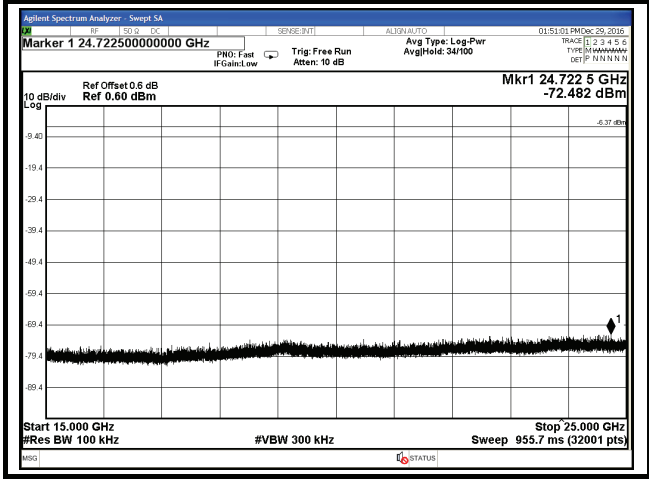
30MHz – 8GHz



8GHz – 15GHz



15GHz – 25GHz



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

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