

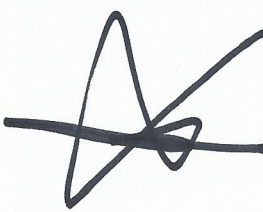
TEST REPORT

The Radio Law, Article 2

Equipment under test ACM
Model name ACM
Applicant Aram Huvis Co., LTD.
Manufacturer Aram Huvis Co., LTD.
Date of test(s) 2018.03.12 ~ 2018.03.26
Date of issue 2018.03.29

Issued to
Aram Huvis Co., LTD.
 Jung-Ja Dong-Rm401-402, Seoul National University Hospital's
 Health Care Innovation Park, 172, Dolma-ro, Bundang-gu,
 Seongnam-si, Gyeonggi-do, South Korea
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Issued by
KES Co., Ltd.
 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
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Test and report completed by :	Report approval by :
	
Kwon-se Kim Test engineer	Hyeon-Su, Jang Technical manager



Revision history

Revision	Date of issue	Test report No.	Description
-	2018.03.29	KES-RF-18T0047	Initial



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1. General information

Applicant: Aram Huvis Co., LTD.
Applicant address: Jung-Ja Dong-Rm401-402, Seoul National University Hospital's
Health Care Innovation Park, 172, Dolma-ro, Bundang-gu,
Seongnam-si, Gyeonggi-do, South Korea
Test site: KES Co., Ltd.
Test site address: 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea
473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
J-MIC Radio law Article 2

1.1. EUT description

Equipment under test ACM
Frequency range 2 412 MHz ~ 2 472 MHz (11b/g/n_HT20)
2 422 MHz ~ 2 462 MHz (11n_HT40)
Model: ACM
Modulation technique DSSS, OFDM
Antenna specification Antenna type : PCB antenna, Peak gain : 5.33 dBi
Power source DC 3.7 V (Internal Rechargeable Battery)
Number of channels 2 412 MHz ~ 2 472 MHz (11n_HT20) : 13ch
2 422 MHz ~ 2 462 MHz (11n_HT40) : 11ch

1.2. Information about derivative model

N/A

1.3. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Smart Cradle	Aram Huvis Co., LTD.	ACM	-	DC 5 V

1.4. Worst case data rate

- Conducted test was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
- Worst-case data rates were:
802.11b: **11 Mbps**
802.11g: **54 Mbps**
802.11n_HT20: **MCS7**
802.11n_HT40: **MCS7**

1.5. Frequency/channel operations

Ch.	Frequency (MHz)	Mode
01	2412	802.11b/g/n_HT20
.	.	.
07	2442	802.11b/g/n_HT20
.	.	.
13	2472	802.11b/g/n_HT20

Ch.	Frequency (MHz)	Mode
03	2 422	802.11n_HT40
.	.	.
07	2 442	802.11n_HT40
.	.	.
11	2 462	802.11n_HT40

Note.

This test report is prepared according to the requirements of ISO/IEC 17025.

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2. Summary of tests

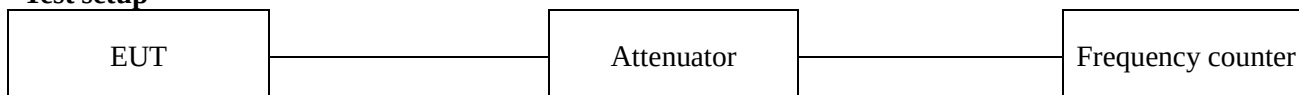
Parameter	Test results
Frequency Tolerance	Pass
Occupied Bandwidth	Pass
Spread Bandwidth	Pass
RF Output Power	Pass
Transmitter Spurious Emission	Pass
Receiver Spurious Emission	Pass
Carrier Sensing	Pass
Anti-Interference	Pass

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3. Test results

3.1. Frequency tolerance

Test setup



Limit

Permission deviation $\pm 50 \times 10^{-6}$

Test results

Mode: 802.11b

Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
100	DC 3.7	2 412	2 411.994 762	-5 238	-2.17
		2 442	2 441.994 443	-5 557	-2.28
		2 472	2 471.994 993	-5 007	-2.03

Mode: 802.11g

Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
100	DC 3.7	2 412	2 411.994 645	-5 355	-2.22
		2 442	2 441.998 119	-1 881	-0.77
		2 472	2 471.998 466	-1 534	-0.62

Mode: 802.11n(HT20)

Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
100	DC 3.7	2 412	2 411.996 440	-3 560	-1.48
		2 442	2 441.997 656	-2 344	-0.96
		2 472	2 471.998 263	-1 737	-0.70

Mode: 802.11n(HT40)

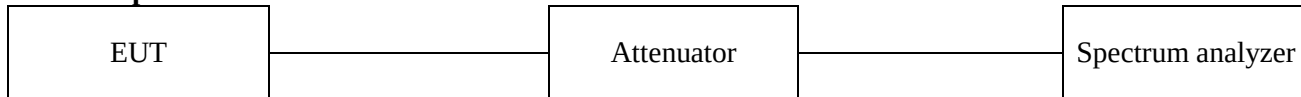
Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
100	DC 3.7	2 422	2 421.998 625	-1 375	-0.57
		2 442	2 441.998 061	-1 939	-0.79
		2 462	2 461.997 858	-2 142	-0.87

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3.2. Occupied Bandwidth

Test setup



Limit

Equal or less than 26 MHz(DSSS).

Test results

20 MHz bandwidth

Test voltage (%)	Nominal Voltage(V)	Test mode	Occupied Bandwidth (MHz)		
			Frequency (2 412 MHz)	Frequency (2 442 MHz)	Frequency (2 472 MHz)
100	DC 3.7	802.11b	11.72	11.72	11.72
		802.11g	16.93	16.93	16.93
		802.11n	17.95	17.95	17.95

40 MHz bandwidth

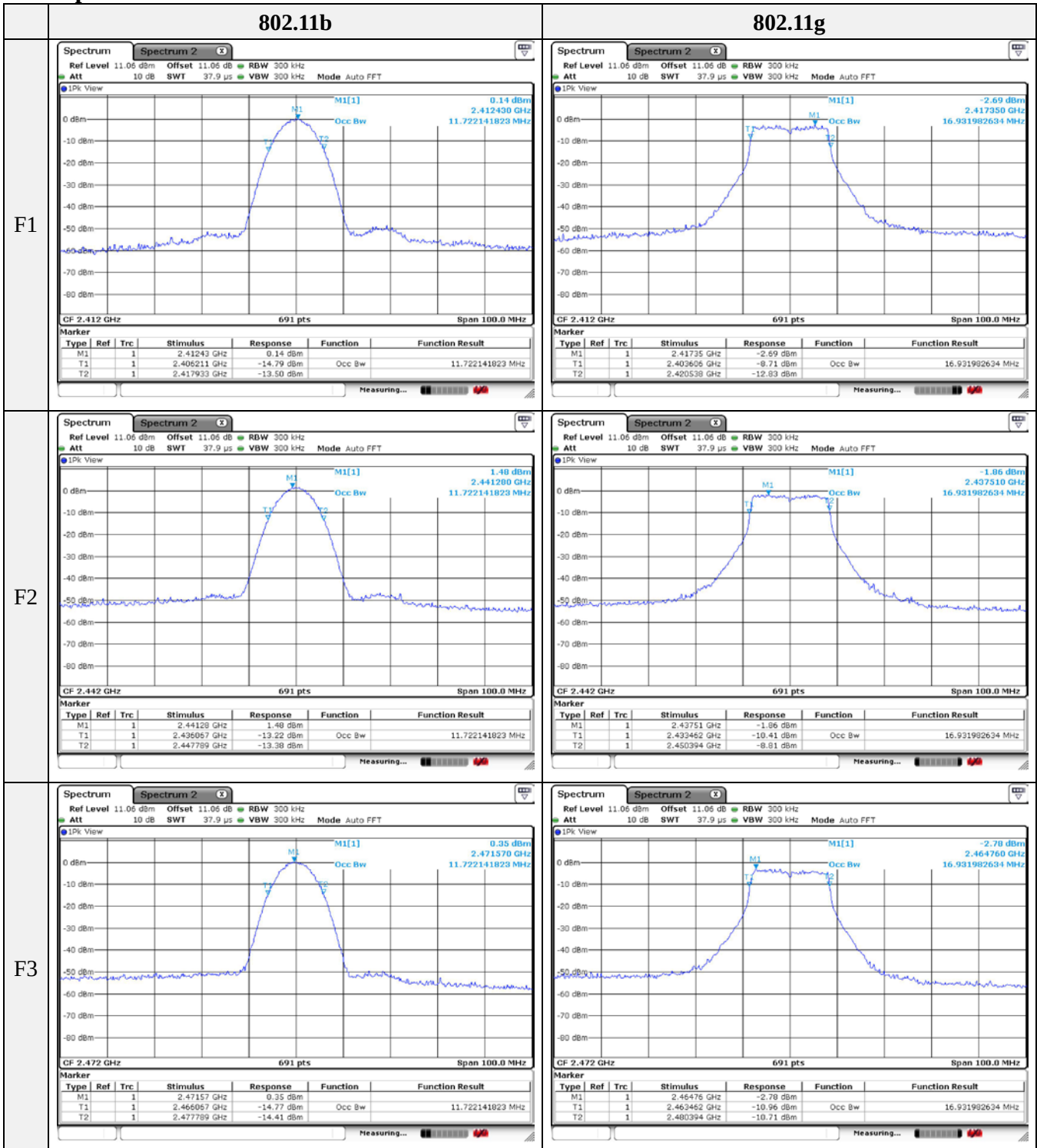
Test voltage (%)	Nominal Voltage(V)	Test mode	Occupied Bandwidth (MHz)		
			Frequency (2 422 MHz)	Frequency (2 442 MHz)	Frequency (2 462 MHz)
100	DC 3.7	802.11n	36.47	36.61	36.47

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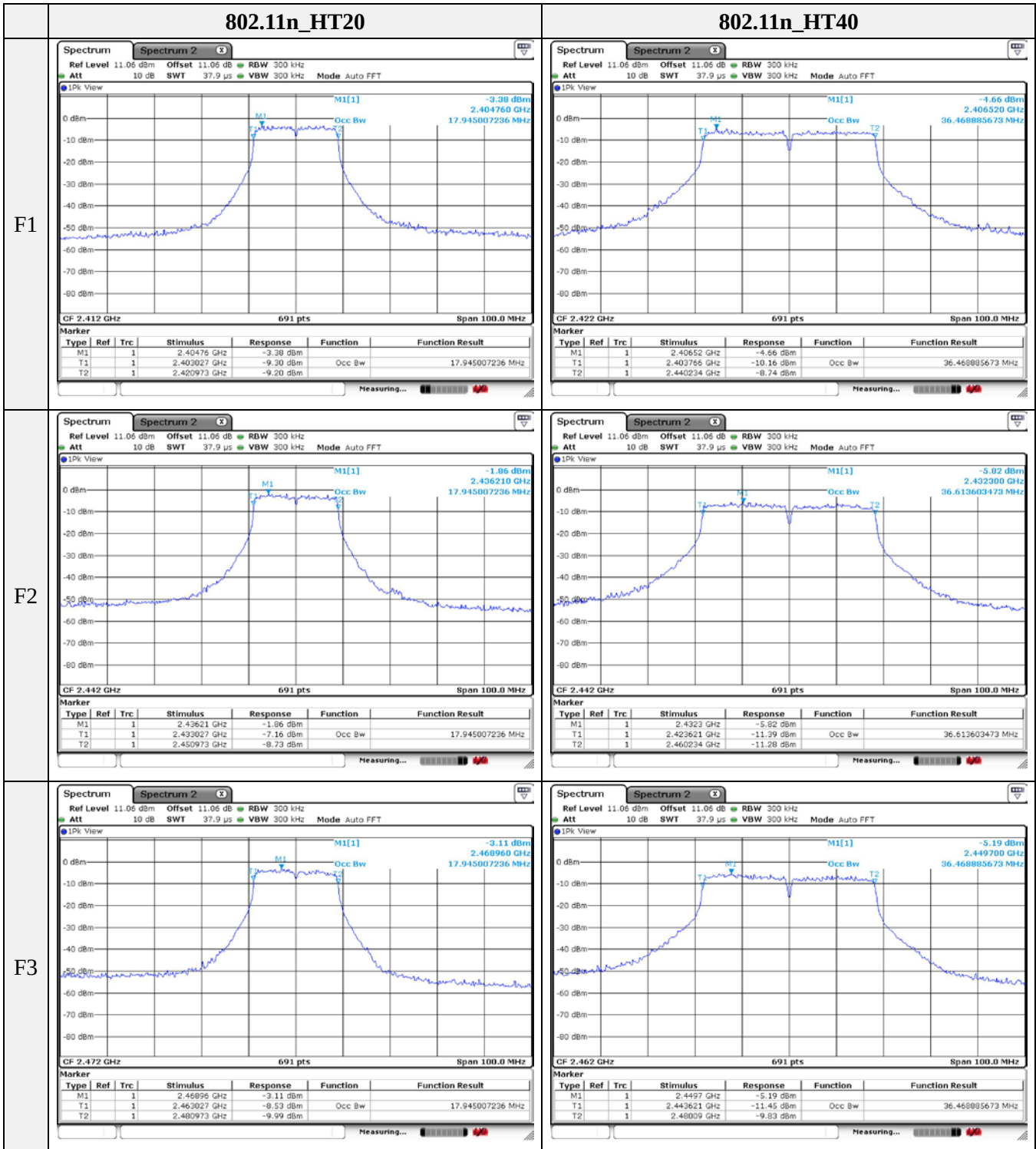


Test plots



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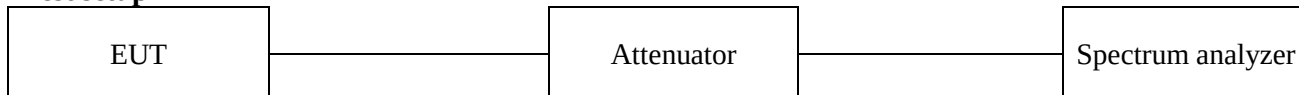
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3.3. Spread Bandwidth

Test setup



Limit

500 kHz or over

Test results

20 MHz bandwidth

Test voltage (%)	Nominal Voltage(V)	Test mode	Spread Bandwidth (MHz)		
			Frequency (2 412 MHz)	Frequency (2 442 MHz)	Frequency (2 472 MHz)
100	DC 3.7	802.11b	7.53	7.53	7.53

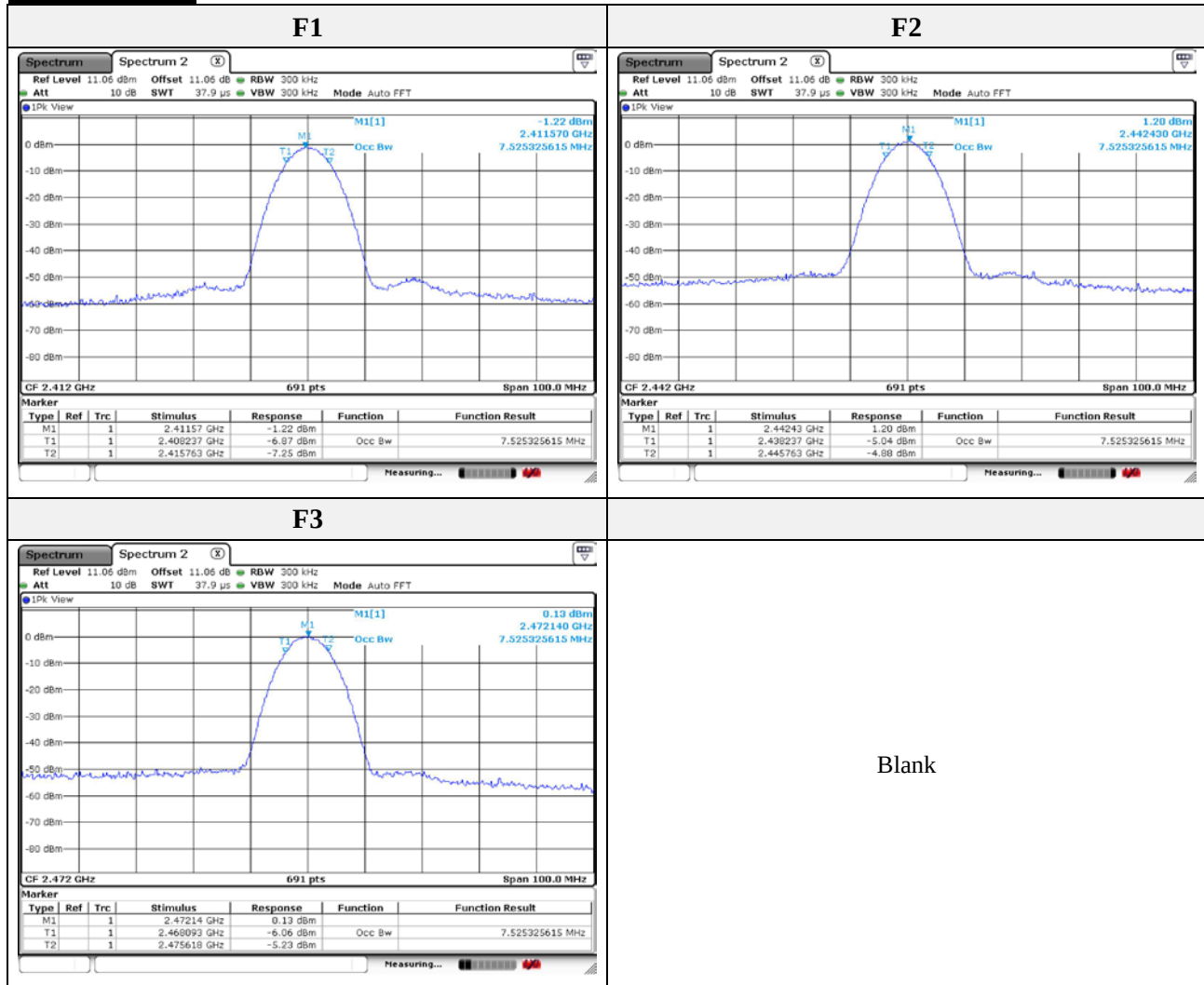
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Test plots

Mode: 802.11b

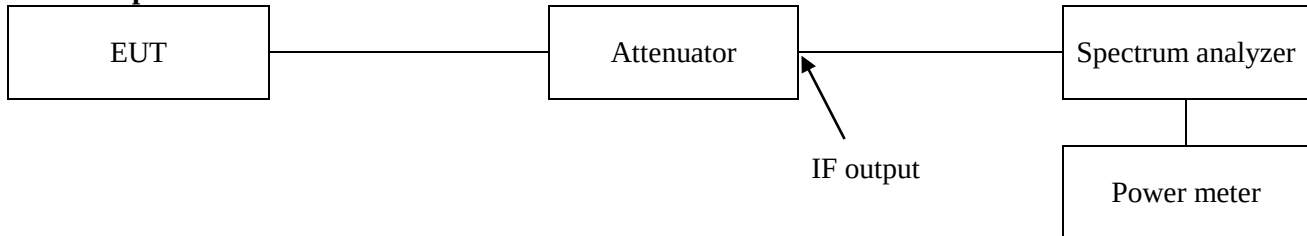


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3.4. RF output power

Test setup



Limit

Rate power : 3 mW (+20%, -80%)

Upper : 3.6 mW

Lower : 0.6 mW

Test results

Mode: 802.11b

Test voltage (%)	Nominal Voltage (V)	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
100	DC 3.7	2 412	2.47	1.77	7.80	-41.00
		2 442	3.06	2.02	8.39	-32.67
		2 472	3.12	2.05	8.45	-31.67

Mode: 802.11g

Test voltage (%)	Nominal Voltage (V)	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
100	DC 3.7	2 412	1.78	1.51	7.11	-49.67
		2 442	3.24	2.11	8.57	-29.67
		2 472	1.62	1.45	6.95	-51.67

Mode: 802.11n(HT20)

Test voltage (%)	Nominal Voltage (V)	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
100	DC 3.7	2 412	1.56	1.43	6.89	-43.33
		2 442	2.77	1.89	8.10	-42.00
		2 472	1.64	1.46	6.97	-35.00

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Test report No.:
KES-RF-18T0047
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Mode: 802.11n(HT40)

Test voltage (%)	Nominal Voltage (V)	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
100	DC 3.7	2 422	2.31	1.70	7.64	-43.33
		2 442	2.40	1.74	7.73	-42.00
		2 462	2.90	1.95	8.23	-35.00

Note.

1. Output power is the result which the Burst Ratio is calculated.
2. E.I.R.P : Output power data + Ant. Max peak gain
3. Antenna gain : 5.33 dBi

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3.5. Transmitter spurious emissions

Test setup



Limit

1. Less than 2387 MHz : Equal or less than 2.5 μ W/MHz ($\approx$ -26 dBm)
2. 2387 MHz ~ 2400 MHz : Equal or less than 25 μ W/MHz ($\approx$ -16 dBm)
3. 2483.5 MHz ~ 2496.5 MHz : Equal or less than 25 μ W/MHz ($\approx$ -16 dBm)
4. More than 2496.5 MHz : Equal or less than 2.5 μ W/MHz ($\approx$ -26 dBm)

Test results

Test item: Less than 2387 MHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
100	DC 3.7	802.11b	2 412	2 289.80	-49.38
			2 442	2 289.80	-46.18
			2 472	2 381.90	-47.43
		802.11g	2 412	2 385.30	-44.51
			2 442	2 381.90	-46.23
			2 472	2 385.30	-46.19
		802.11n(HT20)	2 412	2 385.30	-44.99
			2 442	2 358.00	-45.05
			2 472	2 385.30	-46.00
		802.11n(HT40)	2 422	2 385.30	-41.98
			2 442	2 289.80	-46.58
			2 462	2 385.30	-45.88

Test item: 2387 MHz ~ 2400 MHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
100	DC 3.7	802.11b	2 412	2 399.82	-44.98
			2 442	2 392.52	-45.07
			2 472	2 387.20	-49.96
		802.11g	2 412	2 399.99	-20.81
			2 442	2 399.78	-45.10
			2 472	2 391.39	-44.22
		802.11n(HT20)	2 412	2 399.88	-18.49
			2 442	2 397.36	-44.15
			2 472	2 391.05	-44.43
		802.11n(HT40)	2 422	2 399.46	-20.82
			2 442	2 399.71	-39.95
			2 462	2 397.92	-44.37

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Test item: 2483.5 MHz ~ 2496.5 MHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
100	DC 3.7	802.11b	2 412	2 496.15	-51.32
			2 442	2 485.69	-47.31
			2 472	2 488.82	-43.51
		802.11g	2 412	2 496.27	-47.11
			2 442	2 484.24	-47.36
			2 472	2 483.59	-19.58
		802.11n(HT20)	2 412	2 492.41	-46.48
			2 442	2 487.07	-46.50
			2 472	2 483.53	-17.89
		802.11n(HT40)	2 422	2 494.65	-46.90
			2 442	2 484.11	-43.87
			2 462	2 483.79	-20.01

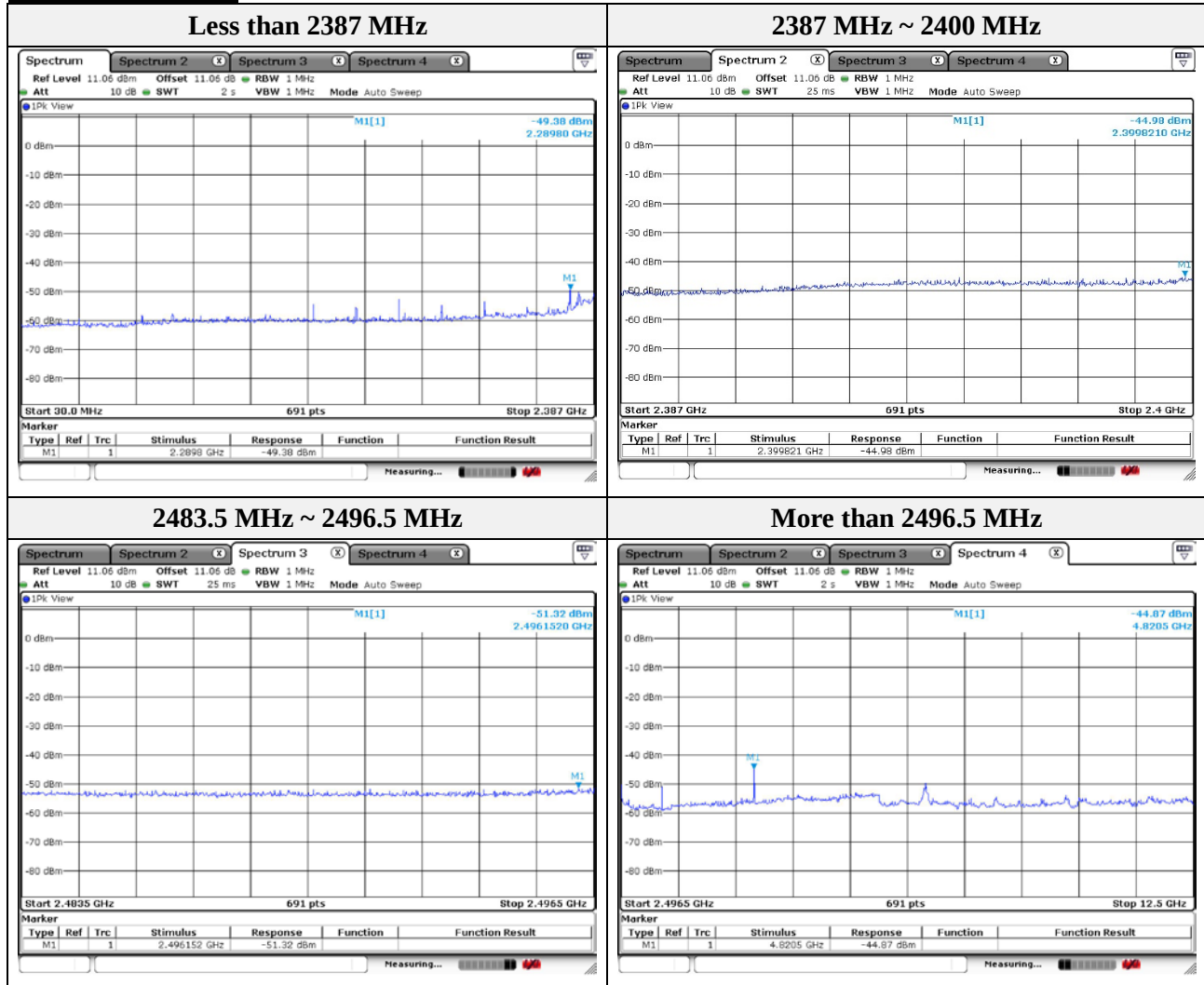
Test item: More than 2496.5 MHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
100	DC 3.7	802.11b	2 412	4 820.50	-44.87
			2 442	4 877.50	-47.28
			2 472	3 299.50	-51.04
		802.11g	2 412	4 820.50	-43.36
			2 442	4 892.50	-46.25
			2 472	3 299.50	-47.94
		802.11n(HT20)	2 412	4 820.50	-42.65
			2 442	3 256.50	-47.67
			2 472	2 503.50	-48.02
		802.11n(HT40)	2 422	4 848.50	-47.05
			2 442	3 256.50	-48.12
			2 462	2 503.50	-41.20



Test plots

Mode: 802.11b – F1

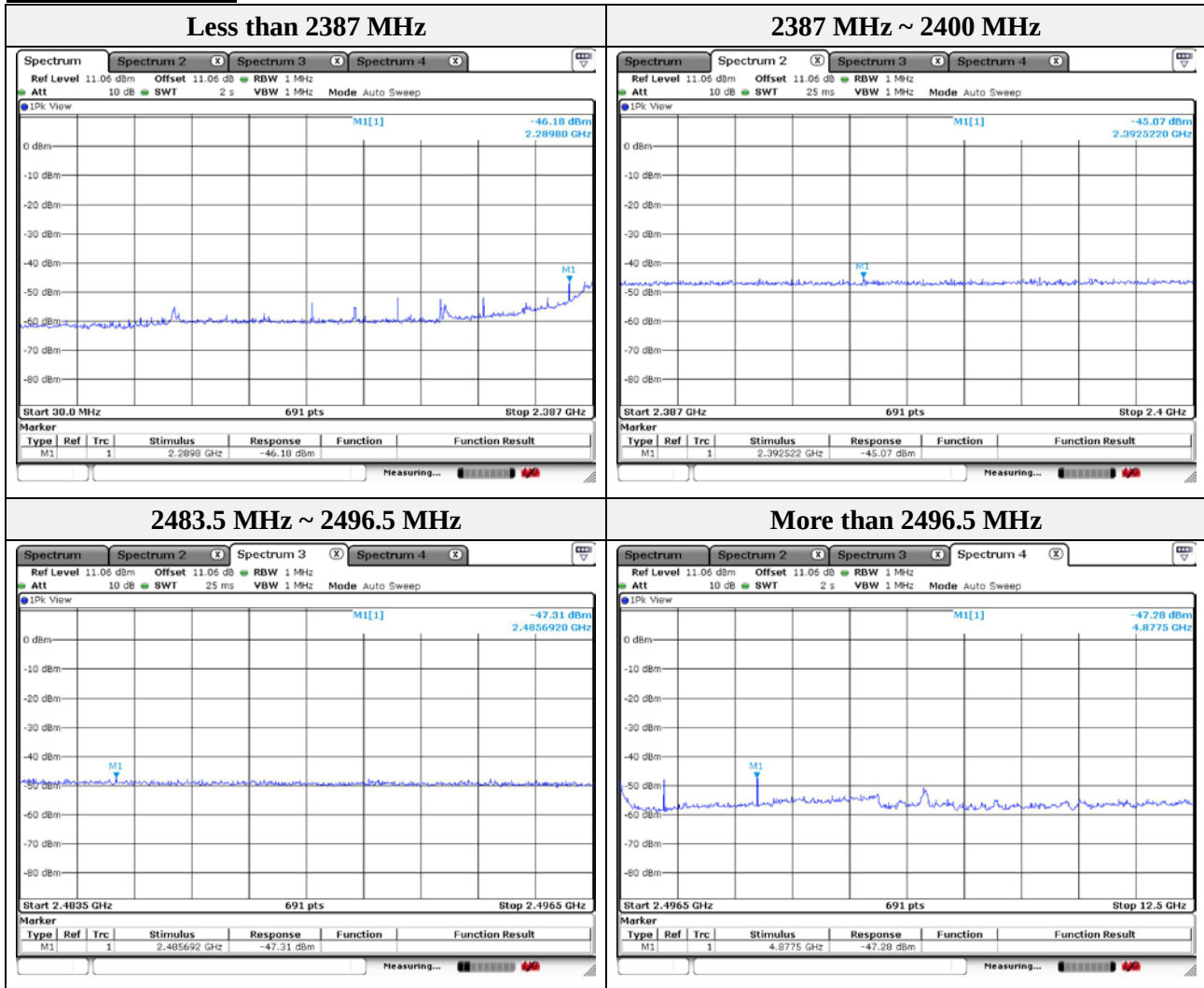


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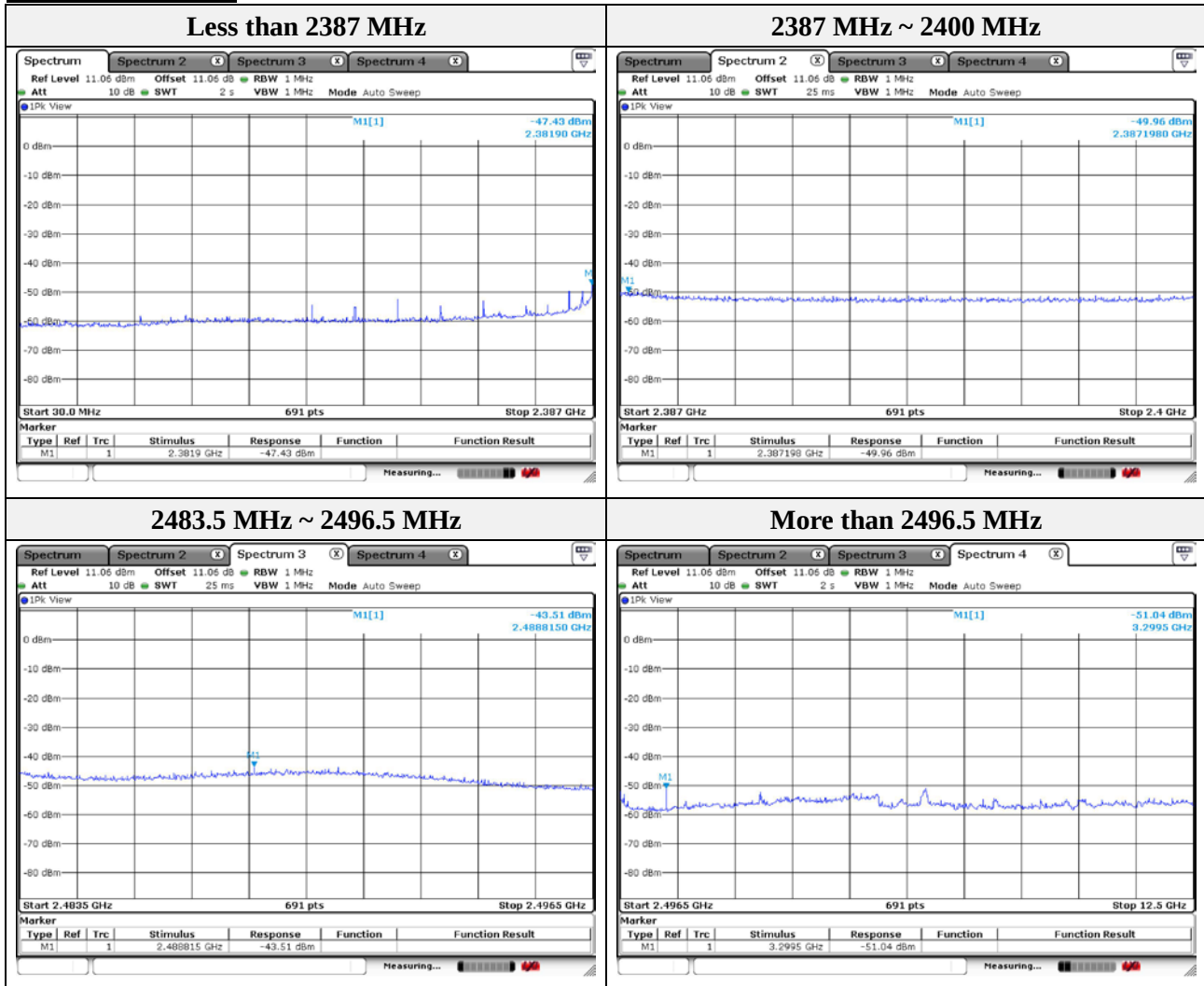
Mode: 802.11b – F2



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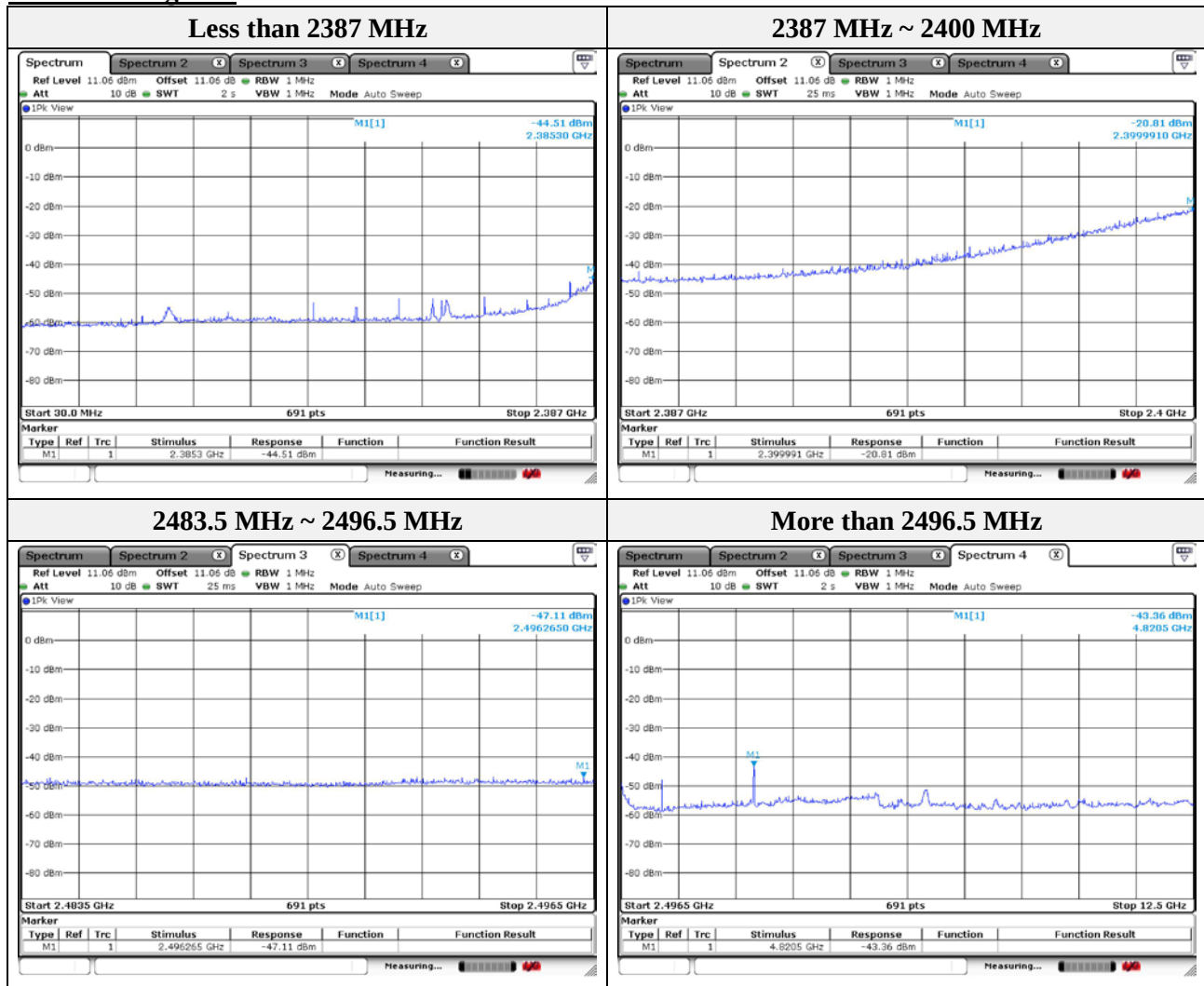
Mode: 802.11b – F3



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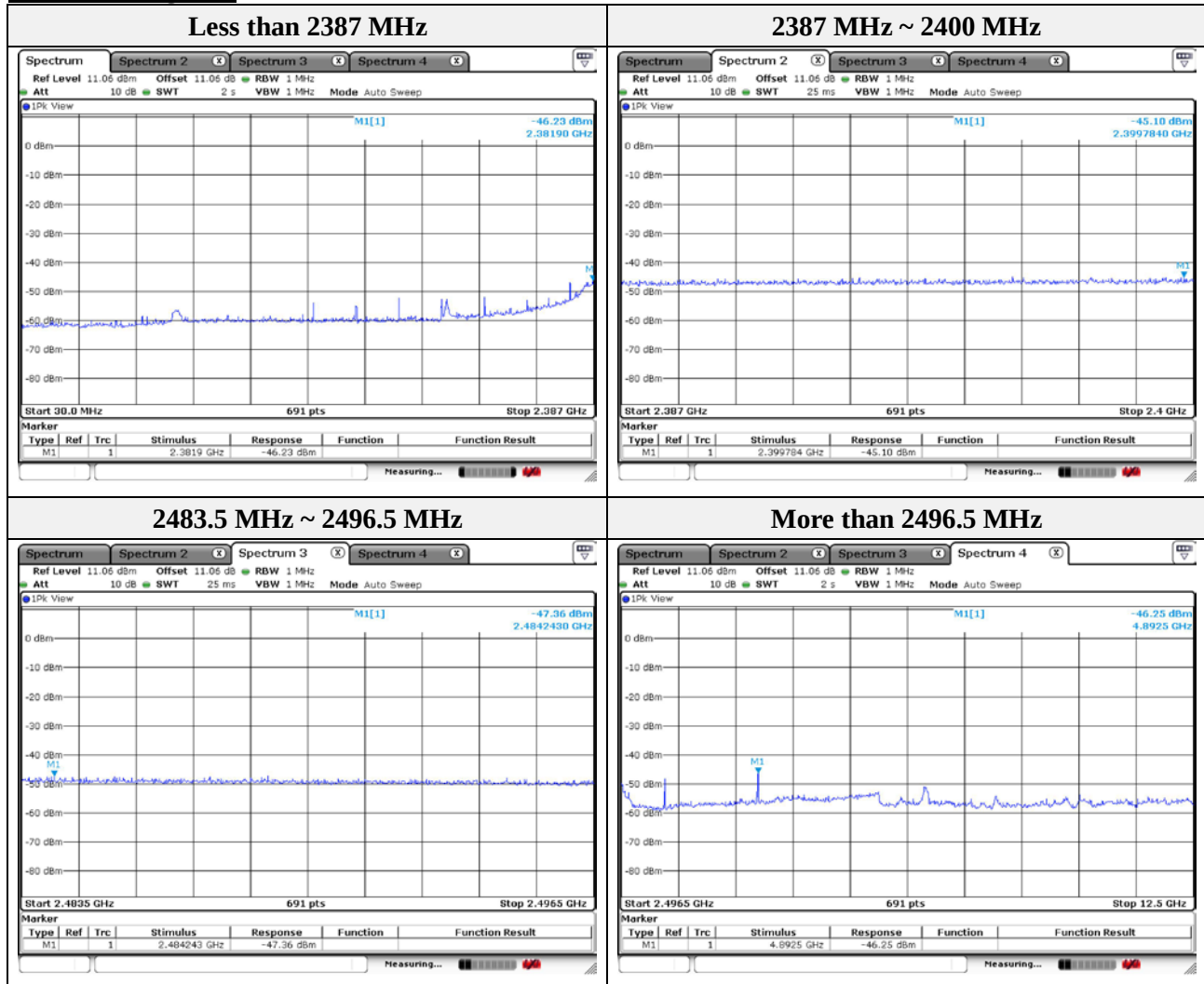
Mode: 802.11g – F1



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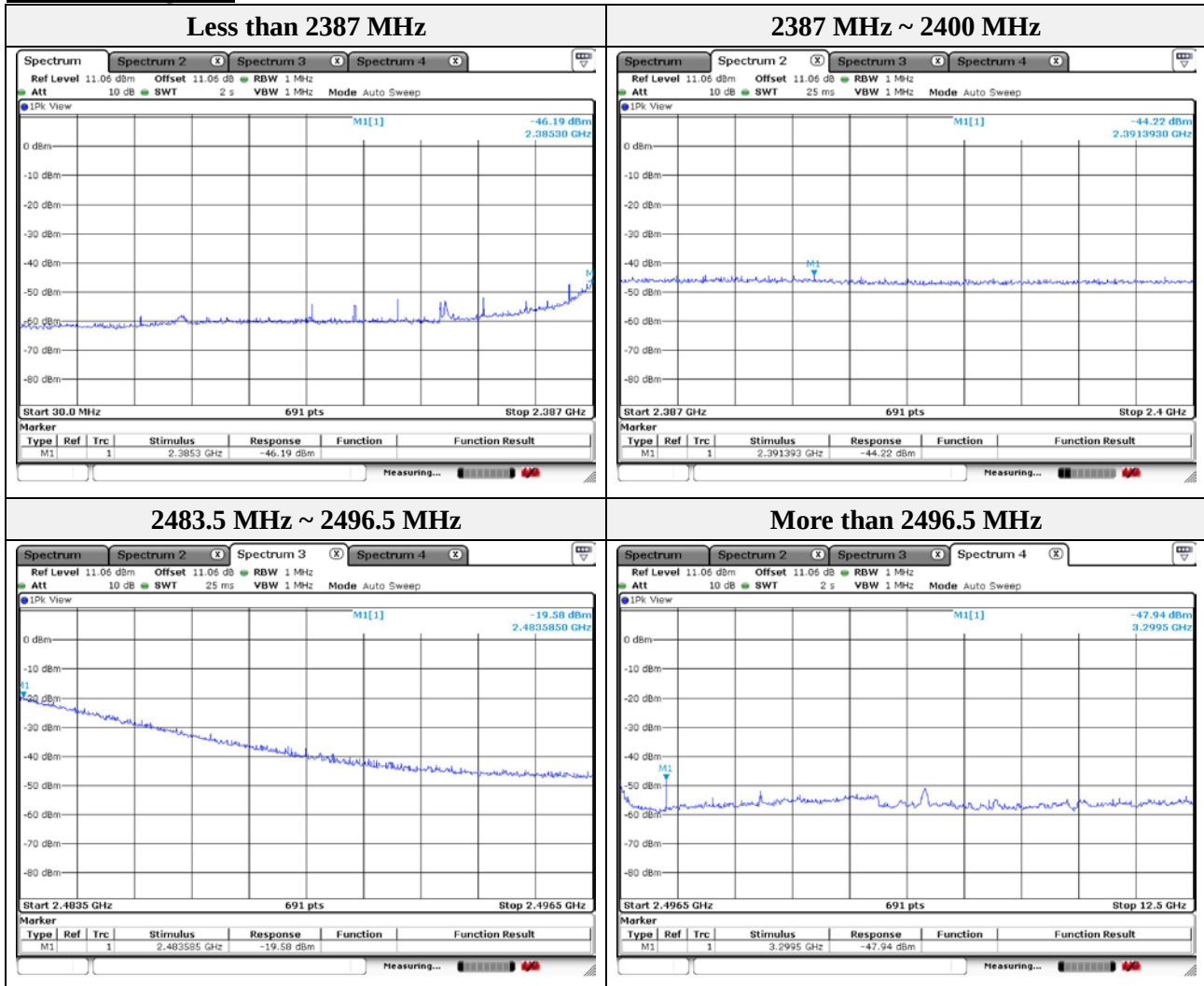
Mode: 802.11g – F2



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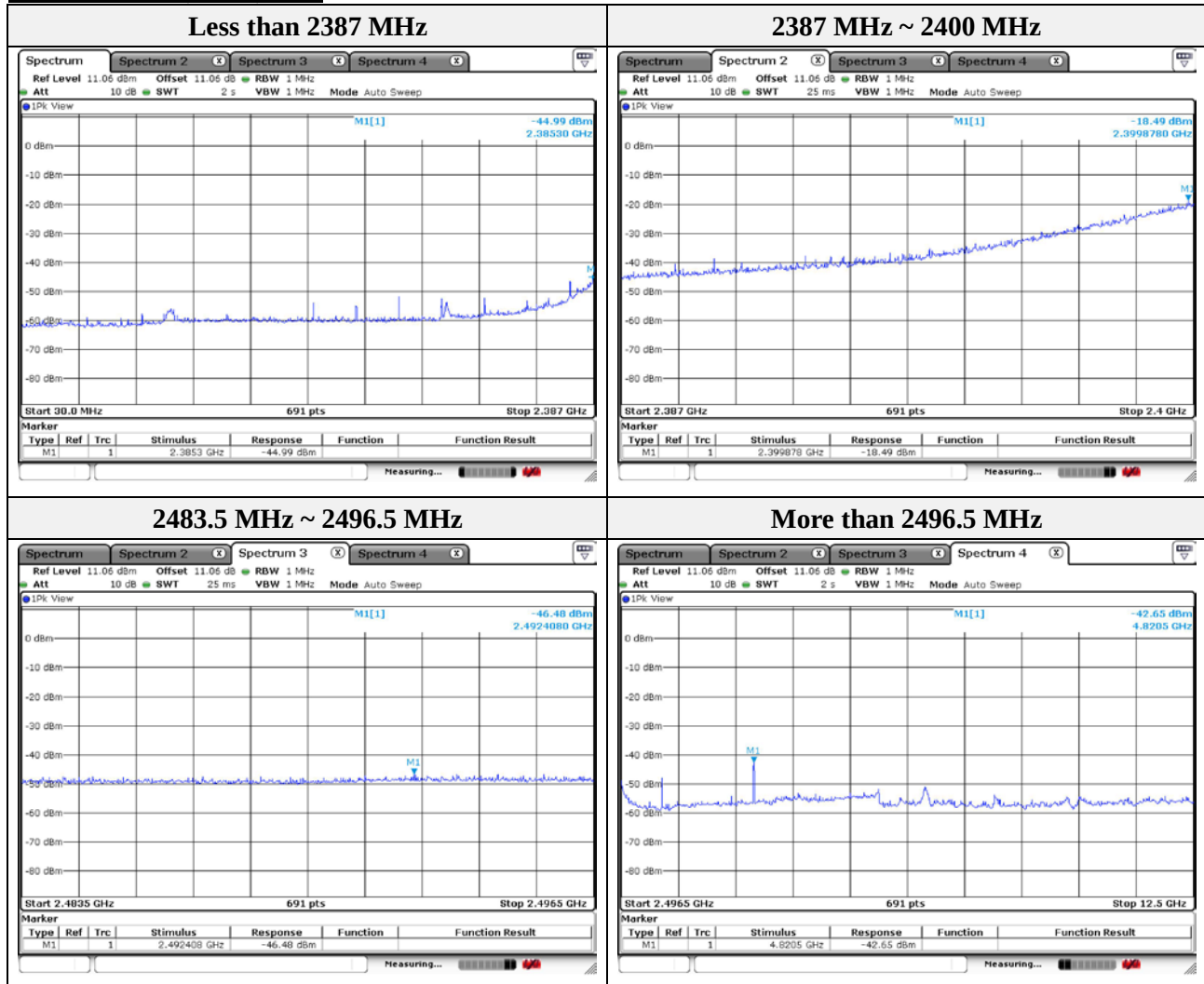
Mode: 802.11g – F3



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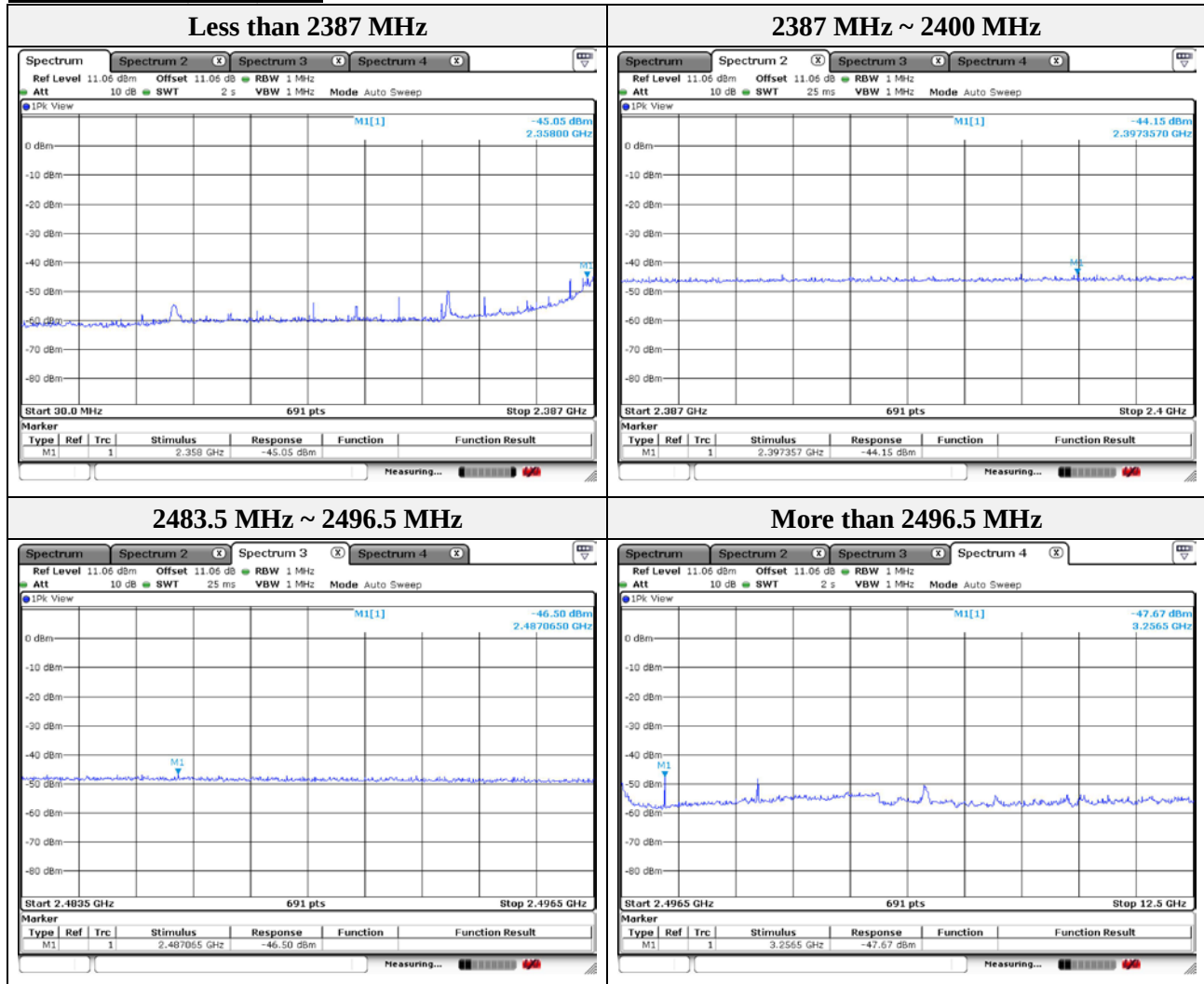
Mode: 802.11n(HT20) – F1



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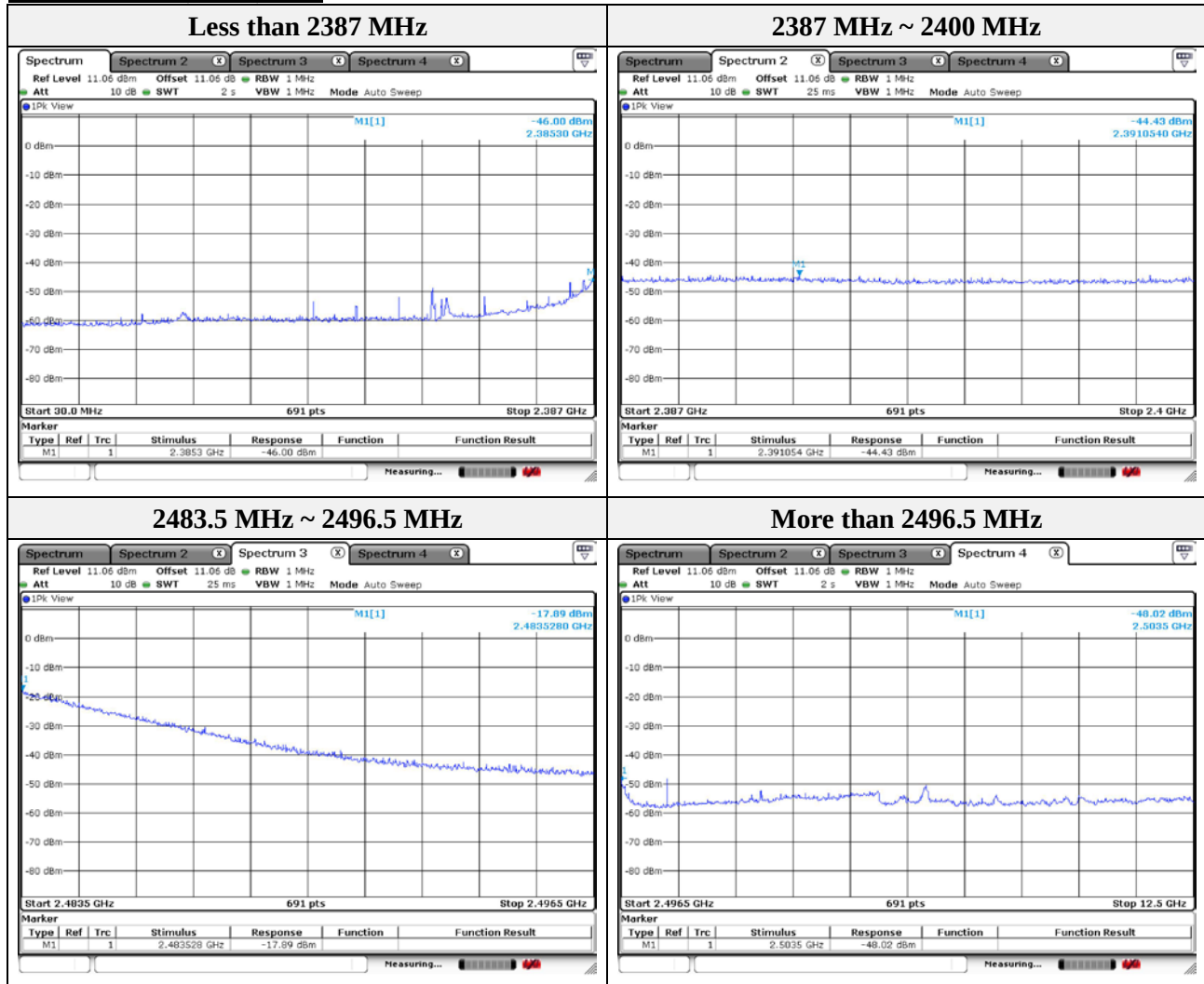
Mode: 802.11n(HT20) – F2



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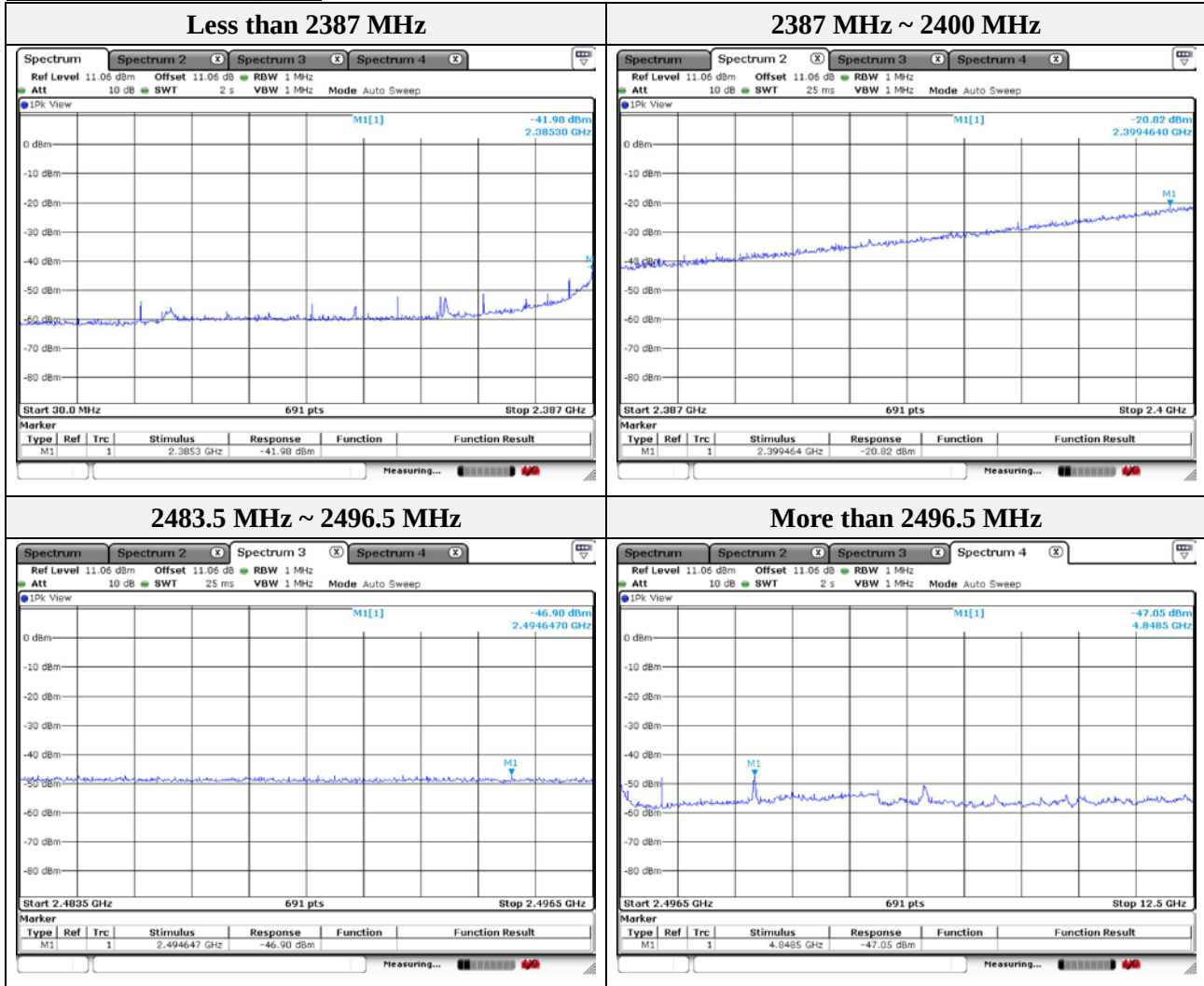
Mode: 802.11n(HT20) – F3



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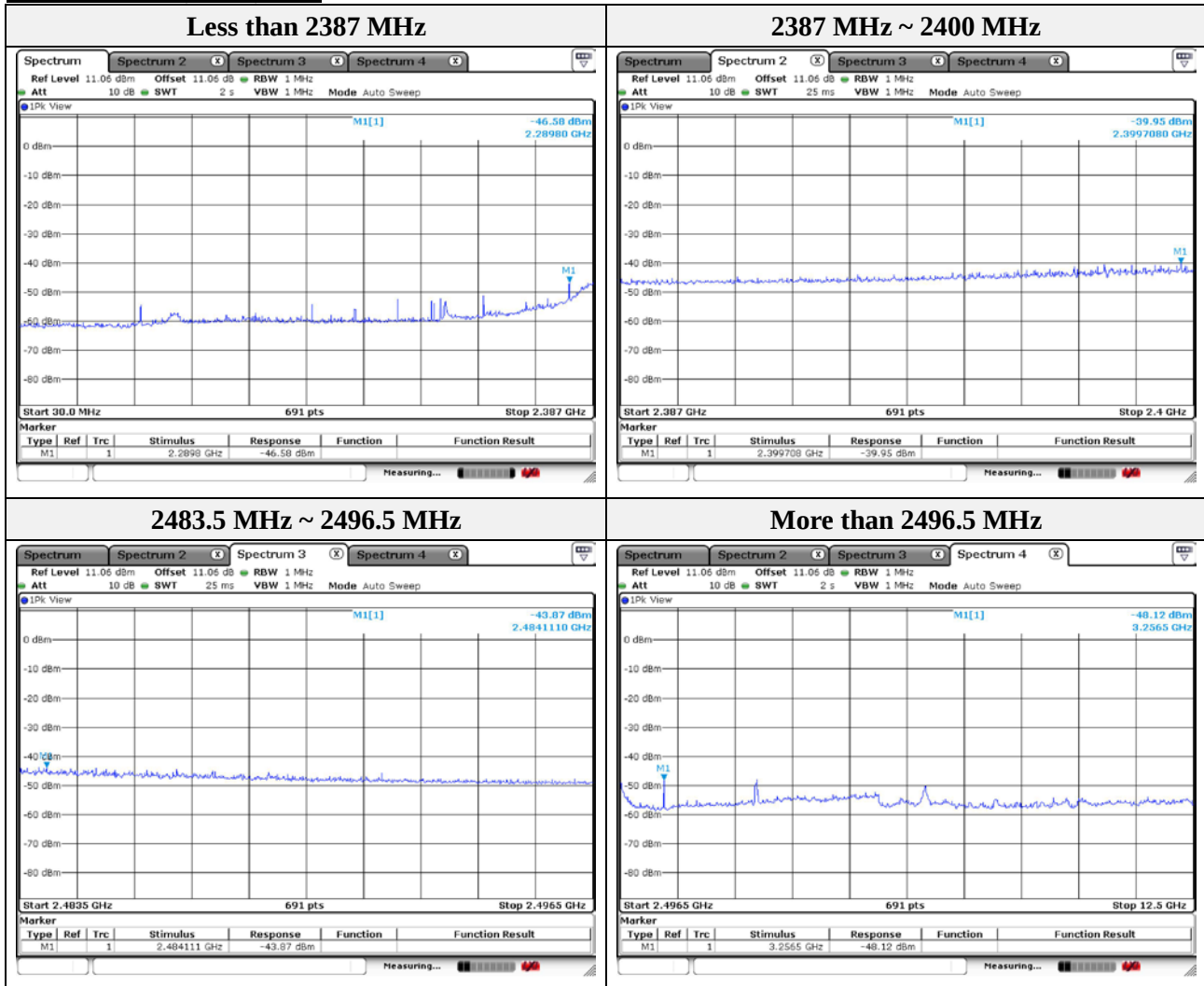
Mode: 802.11n(HT40) – F1



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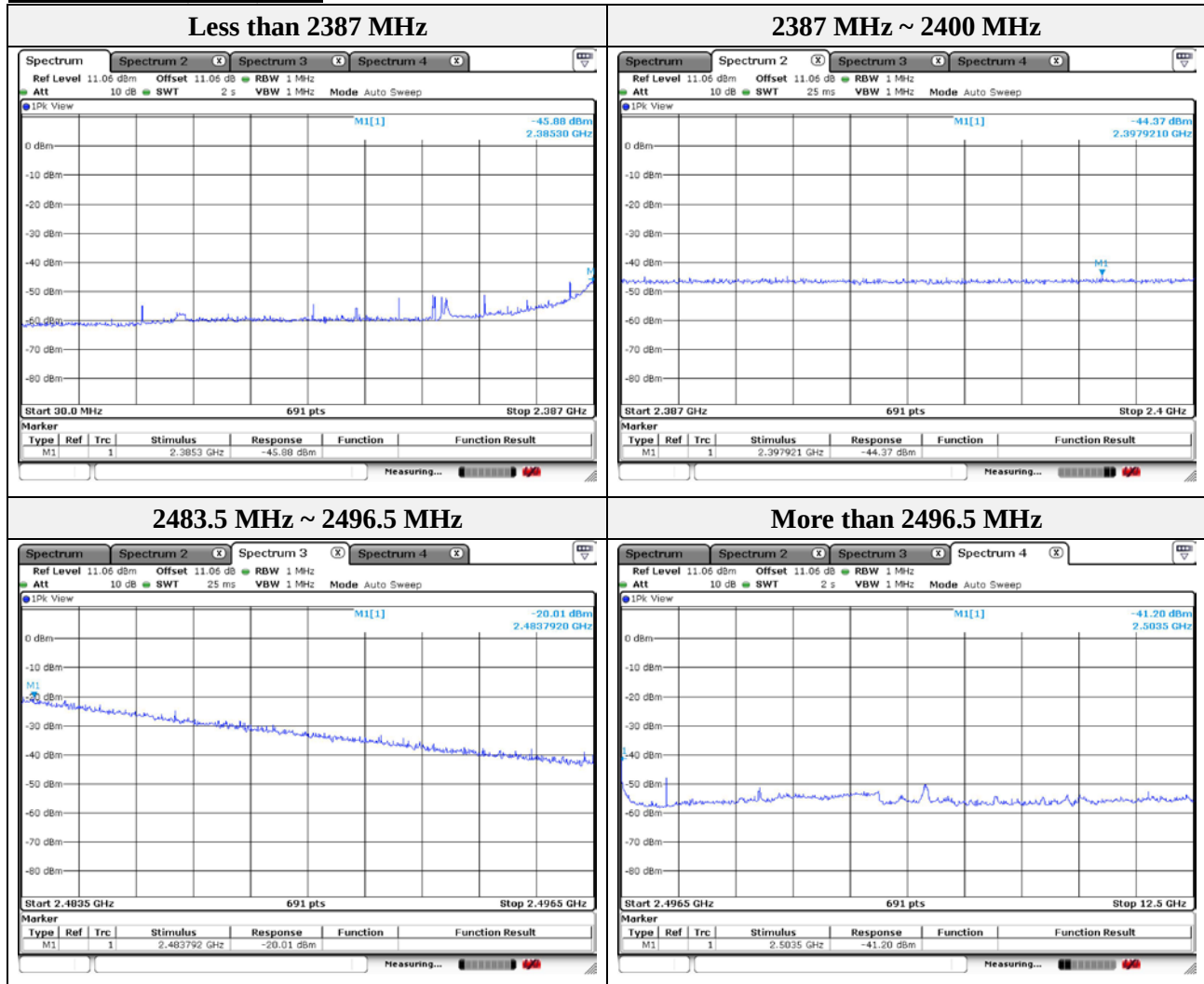
Mode: 802.11n(HT40) – F2



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Mode: 802.11n(HT40) – F3



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3.6. Receiver spurious emissions

Test setup



Limit

1. Less than 1GHz : Equal or less than 4 nW(≒ -53.98 dBm)
2. 1GHz ~ less than 12.75 GHz : Equal or less than 20 nW(≒ -46.99 dBm)

Test results

Test item: Less than ~ 1 GHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
100	DC 3.7	802.11b	2 412	858.90	-66.94
			2 442	999.30	-66.23
			2 472	999.46	-65.90
		802.11g	2 412	999.46	-66.92
			2 442	999.46	-66.44
			2 472	999.46	-64.98
		802.11n(HT20)	2 412	999.46	-64.75
			2 442	999.46	-65.41
			2 472	999.46	-64.70
		802.11n(HT40)	2 422	999.46	-65.40
			2 442	999.46	-64.76
			2 462	999.46	-65.46

Test item: 1 GHz ~ less than 12.75 GHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
100	DC 3.7	802.11b	2 412	7 793.00	-51.54
			2 442	7 827.00	-51.26
			2 472	7 827.00	-51.99
		802.11g	2 412	7 810.00	-51.40
			2 442	7 827.00	-51.54
			2 472	7 793.00	-51.18
		802.11n(HT20)	2 412	7 810.00	-50.50
			2 442	7 793.00	-51.03
			2 472	7 810.00	-51.18
		802.11n(HT40)	2 422	7 793.00	-51.85
			2 442	7 810.00	-51.90
			2 462	7 827.00	-51.11

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Appendix A. Measurement equipment

Equipment 24-2 paragraph4「ハ」	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV30	101389	1 year	2019.01.19
8360B Series Swept Signal Generator	HP	83630B	3844A00786	1 year	2019.01.22
Power Meter	Anritsu	ML2495A	1438001	1 year	2019.01.25
Pulse Power Sensor	Anritsu	MA2411B	1339205	1 year	2019.01.25
Attenuator	KEYSIGHT	8493C	82507	1 year	2019.01.22
DC Power Supply	Agilent	6632B	MY43004130	1 years	2018.07.03
Frequency Counter	HP	5352B	3049A01336	1 years	2019.01.23
EMI Test receiver	R&S	ESU26	100552	1 years	2018.04.19

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook Computer	LG Electronics Inc.,	LGS53	306QCZP560949
Test Board	N/A	N/A	N/A

The end of test report.