

TEST REPORT

The Radio Law, Article 2

Equipment under test SAMJIN Gateway
Model name GWTP-ST
Applicant Samjin LND
Manufacturer Samjin LND
Date of test(s) 2018.03.12 ~ 2018.03.16
Date of issue 2018.03.16

Issued to
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Test and report completed by :	Report approval by :
	
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Revision history

Revision	Date of issue	Test report No.	Description
-	2018.03.16	KES-RF-18T0046	Initial



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1. General information

Applicant: Samjin LND
Applicant address: 64-17, Dongtangiheung-ro, Dongtan-myeon, Hwaseong-si,
Gyeonggi-do, 18487, 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, Yeosu-si, Gyeonggi-do, Korea
J-MIC Radio law Article 2

1.1. EUT description

Equipment under test SAMJIN Gateway
Frequency range 2 402 MHz ~ 2 480 MHz (LE)
2 412 MHz ~ 2 472 MHz (11b/g/n_HT20)
Model: GWTP-ST
Modulation technique WIFI : DSSS, OFDM
BT : GFSK
Antenna specification 2.4 GHz Antenna type : Dipole Antenna, Peak gain : 5.25 dBi
Power source DC 5.0 V
Number of channels 2 402 MHz ~ 2 480 MHz (LE) : 40 ch
2 412 MHz ~ 2 462 MHz (11b/g/n_HT20) : 13 ch

1.2. Information about derivative model

N/A

1.3. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

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: **1 Mbps**
802.11g: **6 Mbps**
802.11n_HT20: **MCS0**
LE: **1 Mbps**



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)	Rate(Mbps)
01	2 402	1
.	.	.
20	2 442	1
.	.	.
39	2 480	1

Note.

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



2. Summary of tests

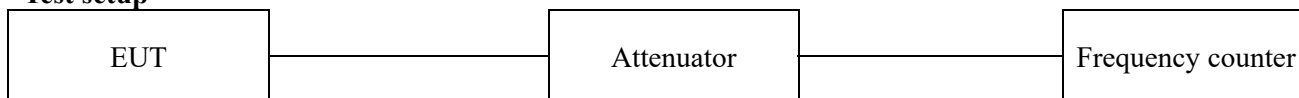
Parameter	Test results
Frequency tolerance	Pass
Occupied bandwidth	Pass
Spread bandwidth	Pass
RF output power	Pass
Transmitter spurious emission	Pass
Receiver spurious emission	Pass
Anti-Interference	Pass



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)
90	DC 4.5	2 412	2 411.998157	1 843	-0.76
		2 442	2 441.998209	1 791	-0.73
		2 472	2 471.998232	1 768	-0.72
100	DC 5.0	2 412	2 411.998179	1 821	-0.75
		2 442	2 441.998115	1 885	-0.77
		2 472	2 471.998221	1 779	-0.72
110	DC 5.5	2 412	2 411.998103	1 897	-0.79
		2 442	2 441.998260	1 740	-0.71
		2 472	2 471.998015	1 985	-0.80

Mode: 802.11g

Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
90	DC 4.5	2 412	2 411.998026	1 974	-0.82
		2 442	2 441.998119	1 881	-0.77
		2 472	2 471.998049	1 951	-0.79
100	DC 5.0	2 412	2 411.998261	1 739	-0.72
		2 442	2 441.998036	1 964	-0.80
		2 472	2 471.998197	1 803	-0.73
110	DC 5.5	2 412	2 411.998123	1 877	-0.78
		2 442	2 441.998185	1 815	-0.74
		2 472	2 471.998264	1 736	-0.70

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Mode: 802.11n(HT20)

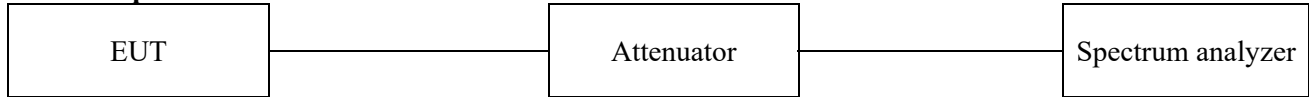
Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
90	DC 4.5	2 412	2 411.998114	1 886	-0.78
		2 442	2 441.998120	1 880	-0.77
		2 472	2 471.998265	1 735	-0.70
100	DC 5.0	2 412	2 411.998143	1 857	-0.77
		2 442	2 441.998068	1 932	-0.79
		2 472	2 471.999421	579	-0.23
110	DC 5.5	2 412	2 411.999826	174	-0.07
		2 442	2 441.999682	318	-0.13
		2 472	2 471.999971	29	-0.01

Mode: LE

Test voltage (%)	Test voltage (V)	Frequency (MHz)	Measure frequency (MHz)	Frequency deviation (Hz)	Deviation (ppm)
90	DC 4.5	2402	2401.992650	7 350	-3.06
		2442	2441.993493	6 507	-2.66
		2480	2479.992586	7 414	-2.99
100	DC 5.0	2402	2401.994181	5 819	-2.41
		2442	2441.993209	6 791	-2.78
		2480	2479.992481	7 519	-3.03
110	DC 5.5	2402	2401.994574	5 426	-2.26
		2442	2441.993431	6 569	-2.69
		2480	2479.992444	7 556	-3.05

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)
90	DC 4.5	802.11b	13.31	13.31	13.31
		802.11g	16.21	16.21	16.21
		802.11n	17.37	17.22	17.22
100	DC 5.0	802.11b	13.31	13.31	13.31
		802.11g	16.21	16.21	16.21
		802.11n	17.37	17.37	17.22
110	DC 5.5	802.11b	13.31	13.31	13.31
		802.11g	16.21	16.21	16.21
		802.11n	17.37	17.37	17.22

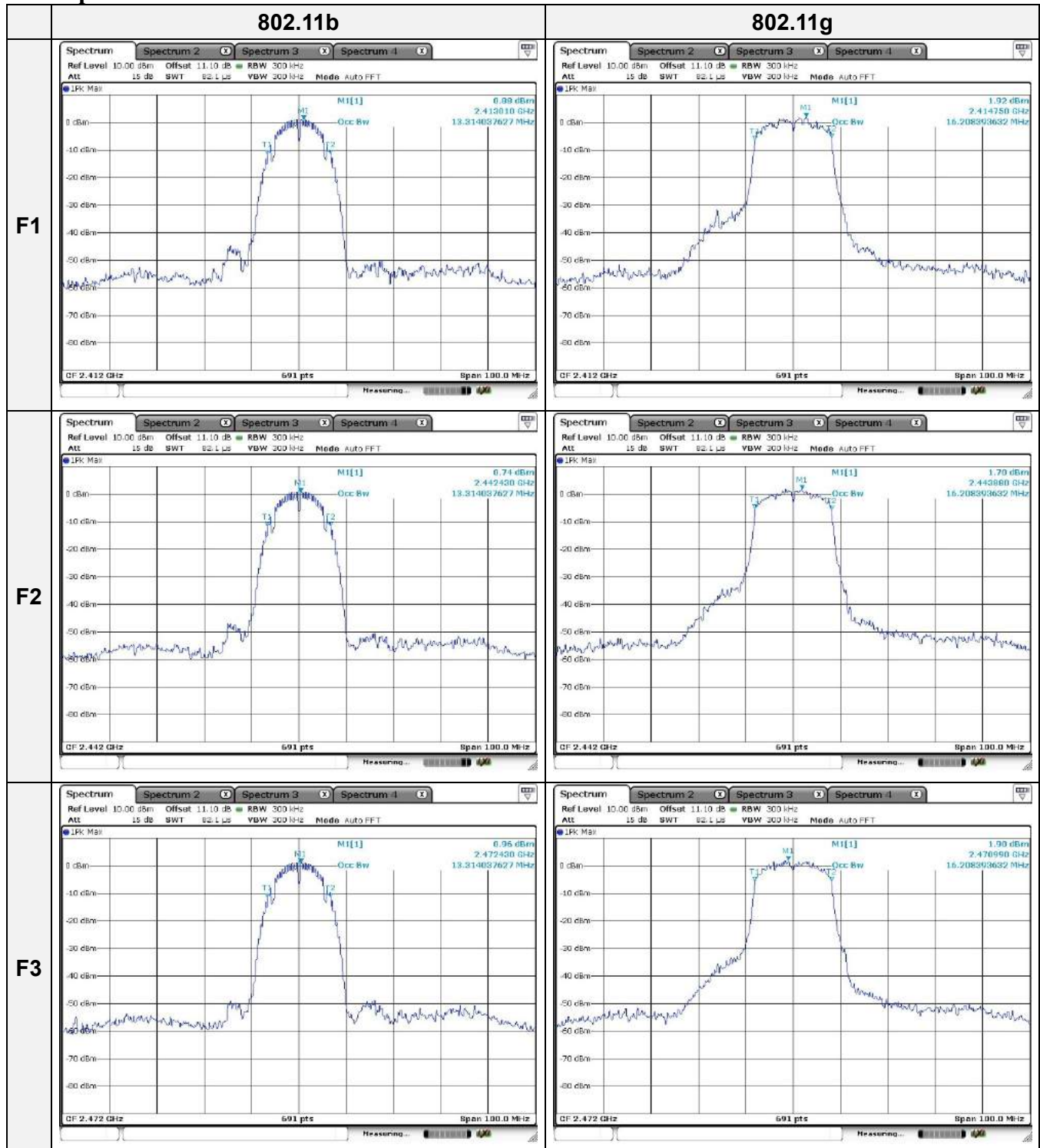
LE bandwidth

Test voltage (%)	Nominal Voltage(V)	Test mode	Occupied Bandwidth (MHz)		
			Frequency (2 402 MHz)	Frequency (2 442 MHz)	Frequency (2 480 MHz)
90	DC 4.5	LE	0.91	0.91	0.91
100	DC 5.0	LE	0.93	0.93	0.93
110	DC 5.5	LE	0.93	0.93	0.93

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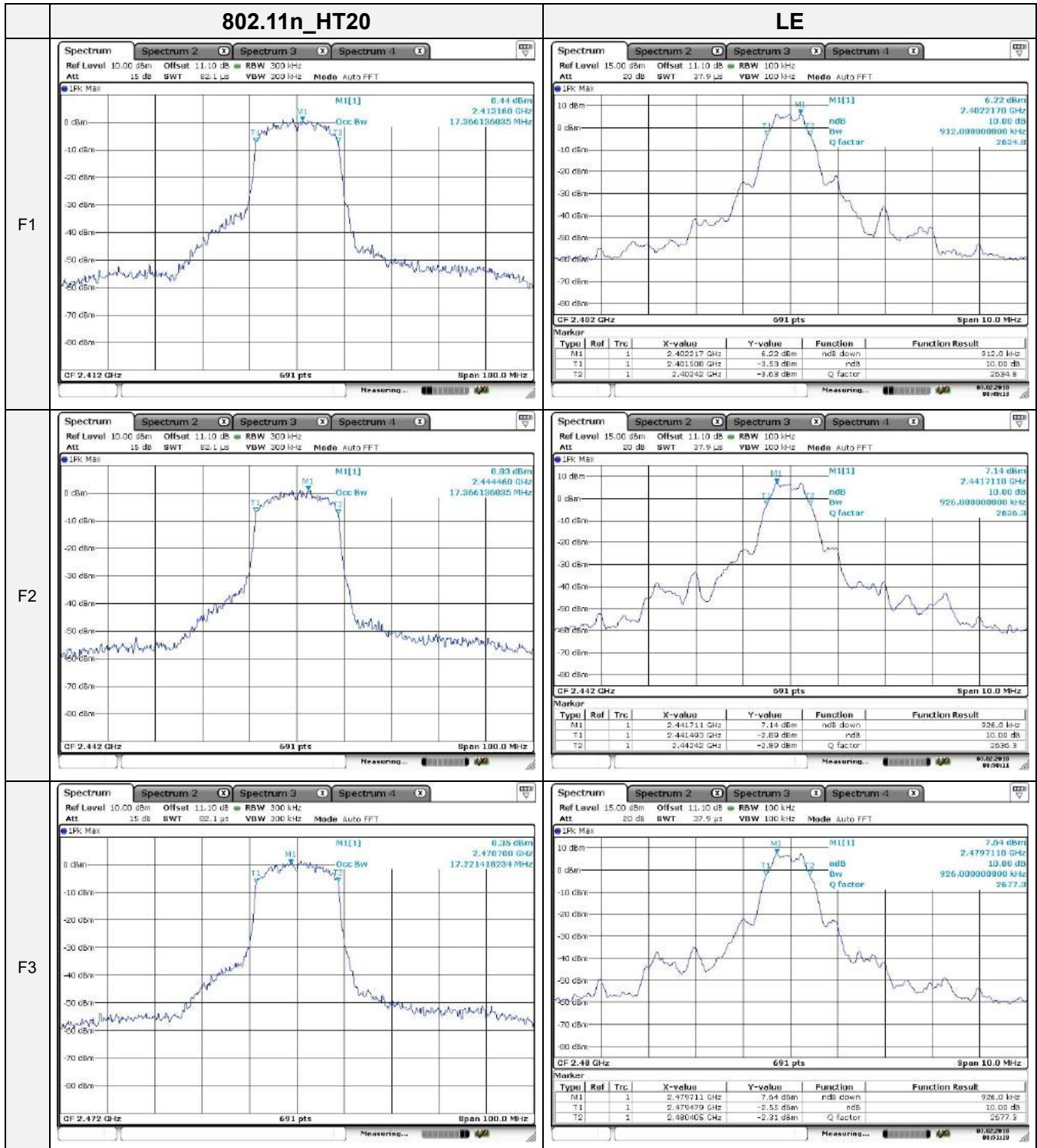
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Test plots



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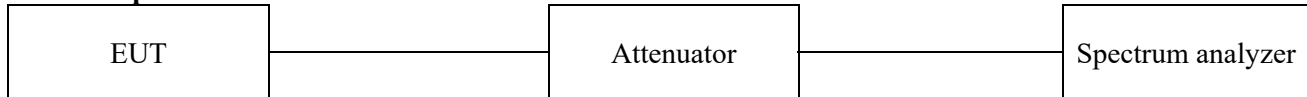


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3.3. Spread Bandwidth

Test setup



Limit

500 kHz or over

Test results

20 MHz bandwidth

Test voltage (%)	Nominal Voltage(V)	Test mode	Occupied Bandwidth (MHz)		
			Frequency (2 412 MHz)	Frequency (2 442 MHz)	Frequency (2 472 MHz)
90	DC 4.5	802.11b	9.12	9.12	9.12
100	DC 5.0	802.11b	9.12	9.12	9.12
110	DC 5.5	802.11b	9.12	9.12	9.12

LE bandwidth

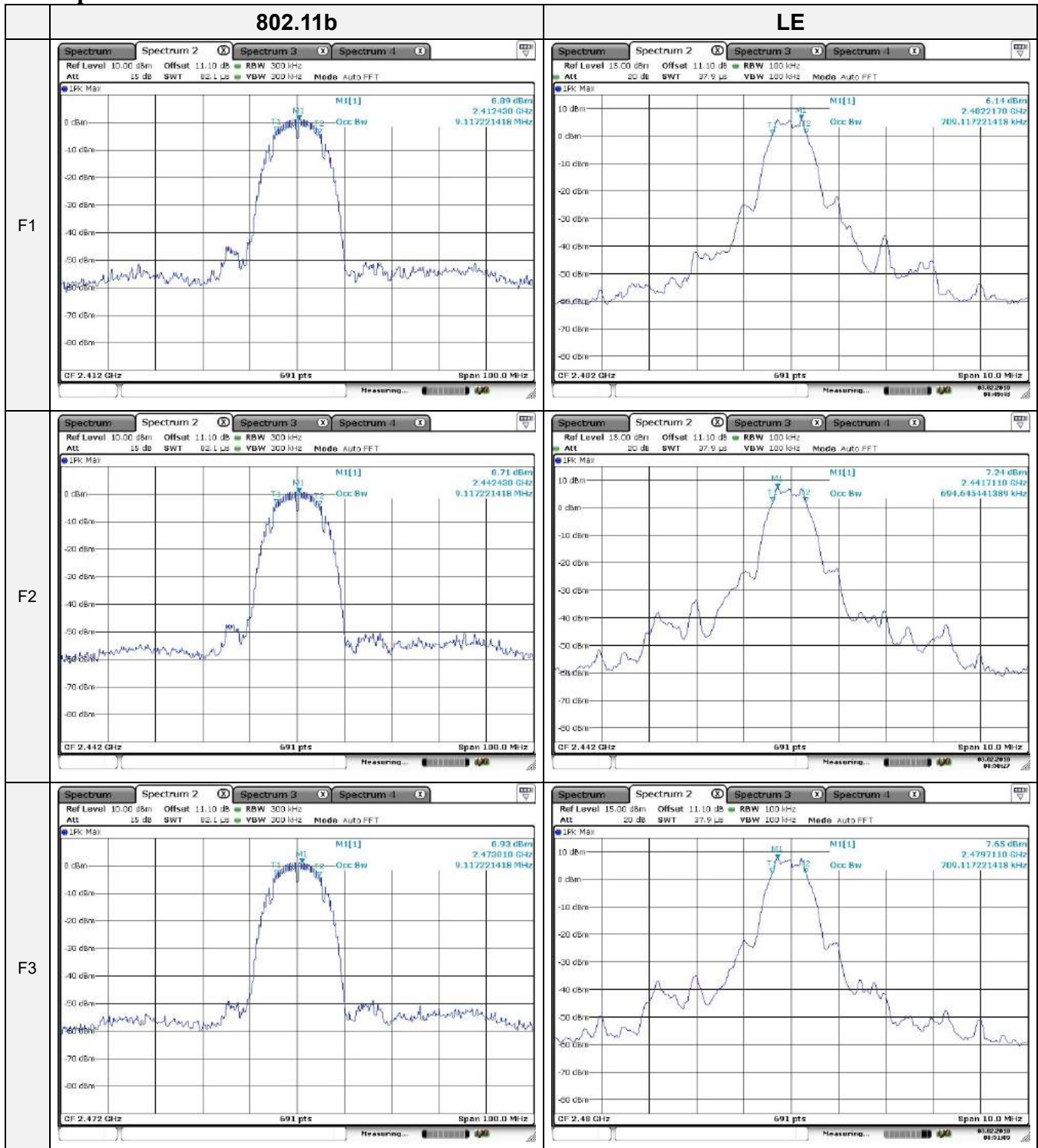
Test voltage (%)	Nominal Voltage(V)	Test mode	Occupied Bandwidth (MHz)		
			Frequency (2 402 MHz)	Frequency (2 442 MHz)	Frequency (2 480 MHz)
90	DC 4.5	LE	0.71	0.69	0.71
100	DC 5.0	LE	0.71	0.69	0.71
110	DC 5.5	LE	0.71	0.69	0.71

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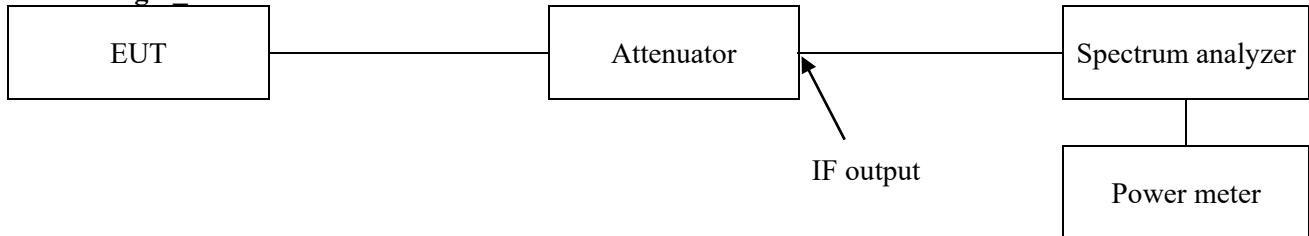
Test plots



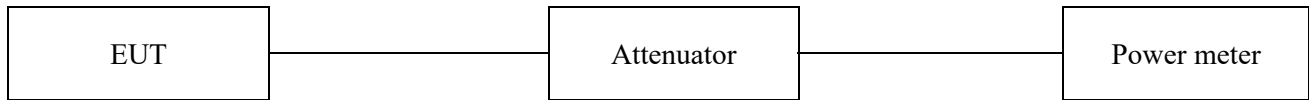
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3.4. RF output power

Test setup 802.11 b/g/n HT20



LE



Lmit

802.11 b/g/n(HT20)	LE
Rate power : 4 mW (+20%, -80%)	Rate power : 2 mW (+20%, -80%)
Upper : 4.8 mW	Upper : 2.4 mW
Lower : 0.8 mW	Lower : 0.4 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 (%)
90	DC 4.5	2 412	5.33	3.41	10.58	-14.70
		2 442	5.55	3.59	10.80	-10.27
		2 472	5.46	3.52	10.71	-12.11
100	DC 5.0	2 412	5.39	3.56	10.64	-13.52
		2 442	5.68	3.70	10.93	-7.54
		2 472	5.62	3.65	10.87	-8.81
110	DC 5.5	2 412	5.54	3.58	10.79	-10.48
		2 442	5.88	3.87	11.13	-3.19
		2 472	5.91	3.90	11.16	-2.51



Mode: 802.11g

Test voltage (%)	Nominal Voltage (V)	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
90	DC 4.5	2 412	5.54	3.58	10.79	-10.48
		2 442	5.85	3.85	11.10	-3.85
		2 472	5.89	3.88	11.14	-2.96
100	DC 5.0	2 412	5.59	3.62	10.84	-9.44
		2 442	5.92	3.91	11.17	-2.29
		2 472	5.86	3.85	11.11	-3.63
110	DC 5.5	2 412	5.54	3.58	10.79	-10.48
		2 442	5.88	3.87	11.13	-3.19
		2 472	5.91	3.90	11.16	-2.51

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 (%)
90	DC 4.5	2 412	5.31	3.40	10.56	-15.09
		2 442	5.55	3.59	10.80	-10.27
		2 472	5.44	3.50	10.69	-12.51
100	DC 5.0	2 412	5.33	3.41	10.58	-14.70
		2 442	5.55	3.59	10.80	-10.27
		2 472	5.46	3.52	10.71	-12.11
110	DC 5.5	2 412	5.36	3.44	10.61	-14.11
		2 442	5.49	3.54	10.74	-11.50
		2 472	5.42	3.48	10.67	-12.92

Mode: LE

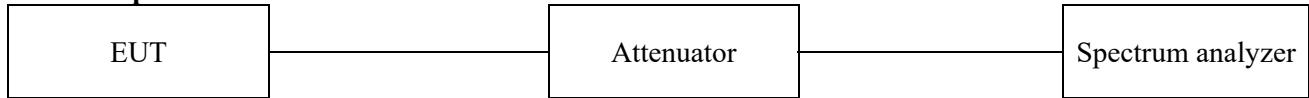
Test voltage (%)	Nominal Voltage (V)	Frequency (MHz)	Output power (dBm/MHz)	Output power (mW)	E.I.R.P (dBm/MHz)	Deviation (%)
90	DC 4.5	2 402	0.14	1.03	5.39	-48.36
		2 442	0.51	1.12	5.76	-43.77
		2 480	0.26	1.06	5.51	-46.92
100	DC 5.0	2 402	0.14	1.03	5.39	-48.36
		2 442	0.52	1.13	5.77	-43.64
		2 480	0.25	1.06	5.50	-47.04
110	DC 5.5	2 402	0.16	1.04	5.41	-48.12
		2 442	0.54	1.13	5.79	-43.38
		2 480	0.26	1.06	5.51	-46.92

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 : 5.25 dBi

3.5. Transmitter spurious emissions

Test setup



Limit

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



Test results

Test item: Less than 2387 MHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
90	4.5	802.11b	2 412	2 375.00	-57.23
			2 442	596.50	-61.29
			2 472	596.50	-61.03
		802.11g	2 412	2 375.00	-58.26
			2 442	596.50	-61.51
			2 472	596.50	-60.48
		802.11n(HT20)	2 412	2 375.30	-57.76
			2 442	596.50	-61.94
			2 472	596.50	-61.56
		LE	2 402	2 337.10	-49.54
			2 442	2 337.10	-48.23
			2 480	2 375.00	-49.09
100	5.0	802.11b	2 412	2 375.00	-57.96
			2 442	596.50	-61.68
			2 472	596.50	-61.40
		802.11g	2 412	2 375.00	-58.08
			2 442	596.50	-61.24
			2 472	596.50	-61.36
		802.11n(HT20)	2 412	2 375.00	-57.87
			2 442	596.50	-61.80
			2 472	596.50	-61.86
		LE	2 402	2 299.30	-53.68
			2 442	2 337.10	-48.57
			2 480	2 375.00	-45.61
110	5.5	802.11b	2 412	2 375.00	-57.89
			2 442	596.50	-61.86
			2 472	596.50	-61.02
		802.11g	2 412	2 375.00	-58.11
			2 442	596.50	-60.24
			2 472	596.50	-60.11
		802.11n(HT20)	2 412	2 375.30	-57.86
			2 442	596.50	-61.23
			2 472	596.50	-61.27
		LE	2 402	2 337.10	-48.11
			2 442	2 337.10	-49.06
			2 480	2 375.00	-49.43

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Test item: 2387 MHz ~ 2400 MHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
90	4.5	802.11b	2 412	2 397.68	-46.27
			2 442	2 399.95	-61.13
			2 472	2 398.43	-61.58
		802.11g	2 412	2 399.92	-36.05
			2 442	2 399.80	-58.33
			2 472	2 399.80	-66.52
		802.11n(HT20)	2 412	2 399.75	-36.35
			2 442	2 399.63	-60.02
			2 472	2 392.48	-67.66
		LE	2 402	2 399.99	-30.26
			2 442	2 393.58	-54.25
			2 480	2 393.48	-52.48
100	5.0	802.11b	2 412	2 397.68	-46.13
			2 442	2 399.95	-61.71
			2 472	2 398.43	-67.52
		802.11g	2 412	2 399.92	-35.71
			2 442	2 399.84	-59.51
			2 472	2 399.99	-67.38
		802.11n(HT20)	2 412	2 399.78	-36.80
			2 442	2 399.58	-60.38
			2 472	2 399.43	-67.07
		LE	2 402	2 399.99	-30.77
			2 442	2 390.00	-54.52
			2 480	2 393.76	-52.58
110	5.5	802.11b	2 412	2 397.68	-46.09
			2 442	2 399.95	-61.17
			2 472	2 398.43	-67.25
		802.11g	2 412	2 399.92	-35.63
			2 442	2 399.82	-60.36
			2 472	2 399.92	-67.52
		802.11n(HT20)	2 412	2 399.75	-36.41
			2 442	2 399.57	-60.73
			2 472	2 399.43	-67.06
		LE	2 402	2 399.99	-30.63
			2 442	2 392.52	-54.21
			2 480	2 393.76	-52.96

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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)
90	4.5	802.11b	2 412	2 484.09	-64.10
			2 442	2 483.53	-58.62
			2 472	2 487.99	-50.15
		802.11g	2 412	2 491.29	-63.24
			2 442	2 484.26	-55.06
			2 472	2 483.53	-43.01
		802.11n(HT20)	2 412	2 493.46	-63.93
			2 442	2 483.53	-57.61
			2 472	2 483.55	-40.54
		LE	2 402	2 483.59	-62.53
			2 442	2 492.77	-54.04
			2 480	2 483.51	-52.58
100	5.0	802.11b	2 412	2 484.09	-64.97
			2 442	2 483.53	-58.67
			2 472	2 487.99	-50.40
		802.11g	2 412	2 496.36	-64.15
			2 442	2 484.13	-56.55
			2 472	2 483.53	-42.25
		802.11n(HT20)	2 412	2 495.44	-63.78
			2 442	2 483.55	-57.54
			2 472	2 483.55	-40.59
		LE	2 402	2 485.56	-62.53
			2 442	2 493.89	-54.04
			2 480	2 483.51	-52.58
110	5.5	802.11b	2 412	2 484.09	-64.74
			2 442	2 483.53	-58.36
			2 472	2 487.99	-50.11
		802.11g	2 412	2 493.13	-64.22
			2 442	2 484.26	-56.47
			2 472	2 483.53	-42.39
		802.11n(HT20)	2 412	2 495.45	-63.94
			2 442	2 483.58	-57.95
			2 472	2 483.55	-40.40
		LE	2 402	2 483.59	-62.53
			2 442	2 492.05	-54.04
			2 480	2 483.51	-52.58



Test item: More than 2496.5 MHz

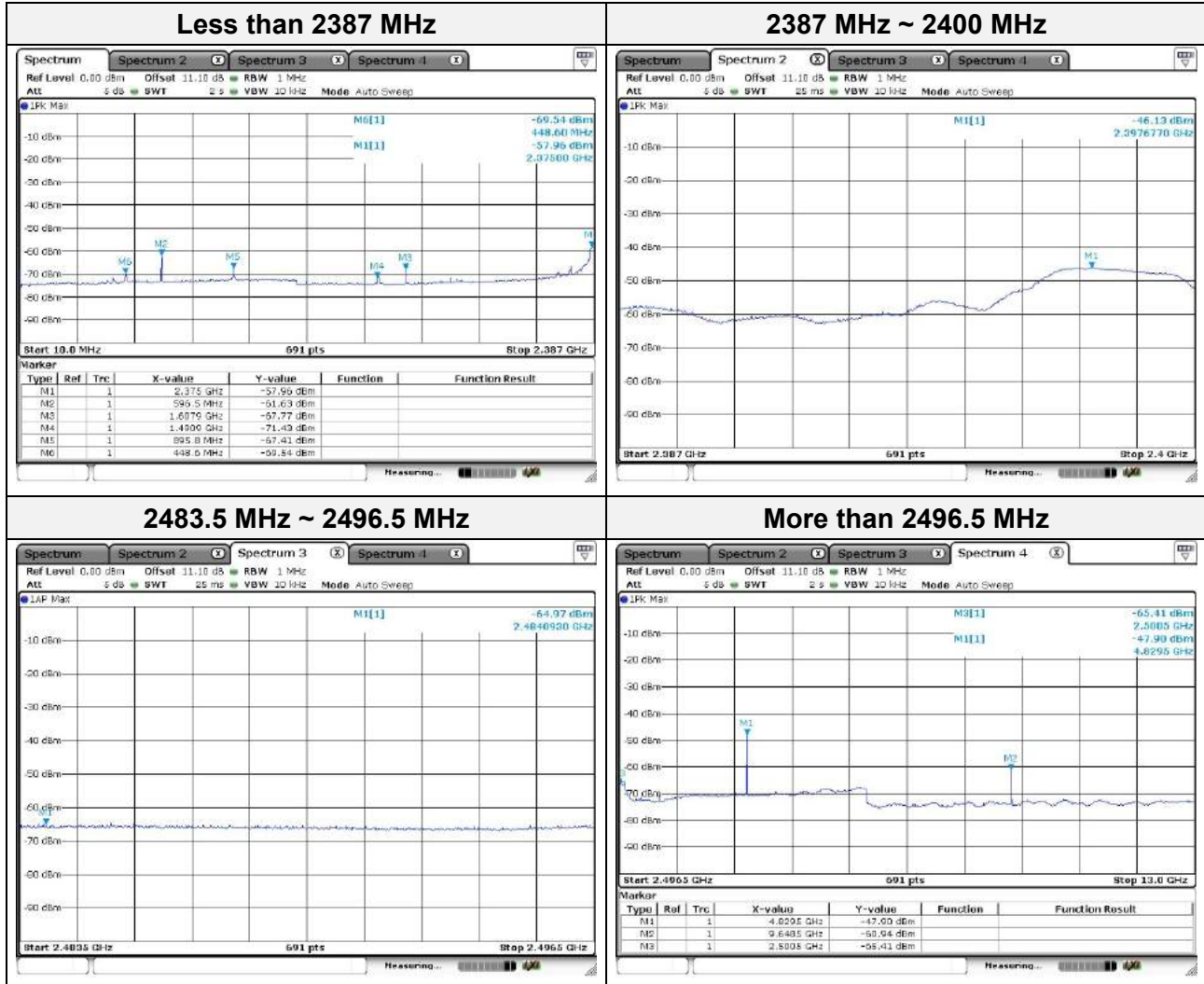
Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
90	4.5	802.11b	2 412	4829.50	-47.59
			2 442	4890.50	-48.23
			2 472	4951.50	-48.09
		802.11g	2 412	4829.50	-57.03
			2 442	4890.50	-58.11
			2 472	4951.50	-57.23
		802.11n(HT20)	2 412	4829.50	-57.61
			2 442	4875.50	-58.96
			2 472	2504.50	-55.59
		LE	2 402	2547.50	-43.45
			2 442	2581.30	-43.21
			2 480	2580.60	-43.76
100	5.0	802.11b	2 412	4829.50	-47.90
			2 442	4890.50	-49.00
			2 472	4951.50	-48.87
		802.11g	2 412	4829.50	-57.17
			2 442	4890.50	-58.51
			2 472	4951.50	-57.66
		802.11n(HT20)	2 412	4829.50	-57.47
			2 442	4875.50	-58.31
			2 472	2504.50	-55.65
		LE	2 402	2504.50	-43.45
			2 442	2549.50	-43.21
			2 480	2580.50	-43.76
110	5.5	802.11b	2 412	4829.50	-47.52
			2 442	4890.50	-48.59
			2 472	4951.50	-48.32
		802.11g	2 412	4829.50	-57.08
			2 442	4890.50	-58.26
			2 472	4951.50	-57.15
		802.11n(HT20)	2 412	4829.50	-57.57
			2 442	4875.50	-58.69
			2 472	2504.50	-55.84
		LE	2 402	2509.30	-43.45
			2 442	2549.40	-43.21
			2 480	2580.70	-43.76

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Test plots

802.11b – F1

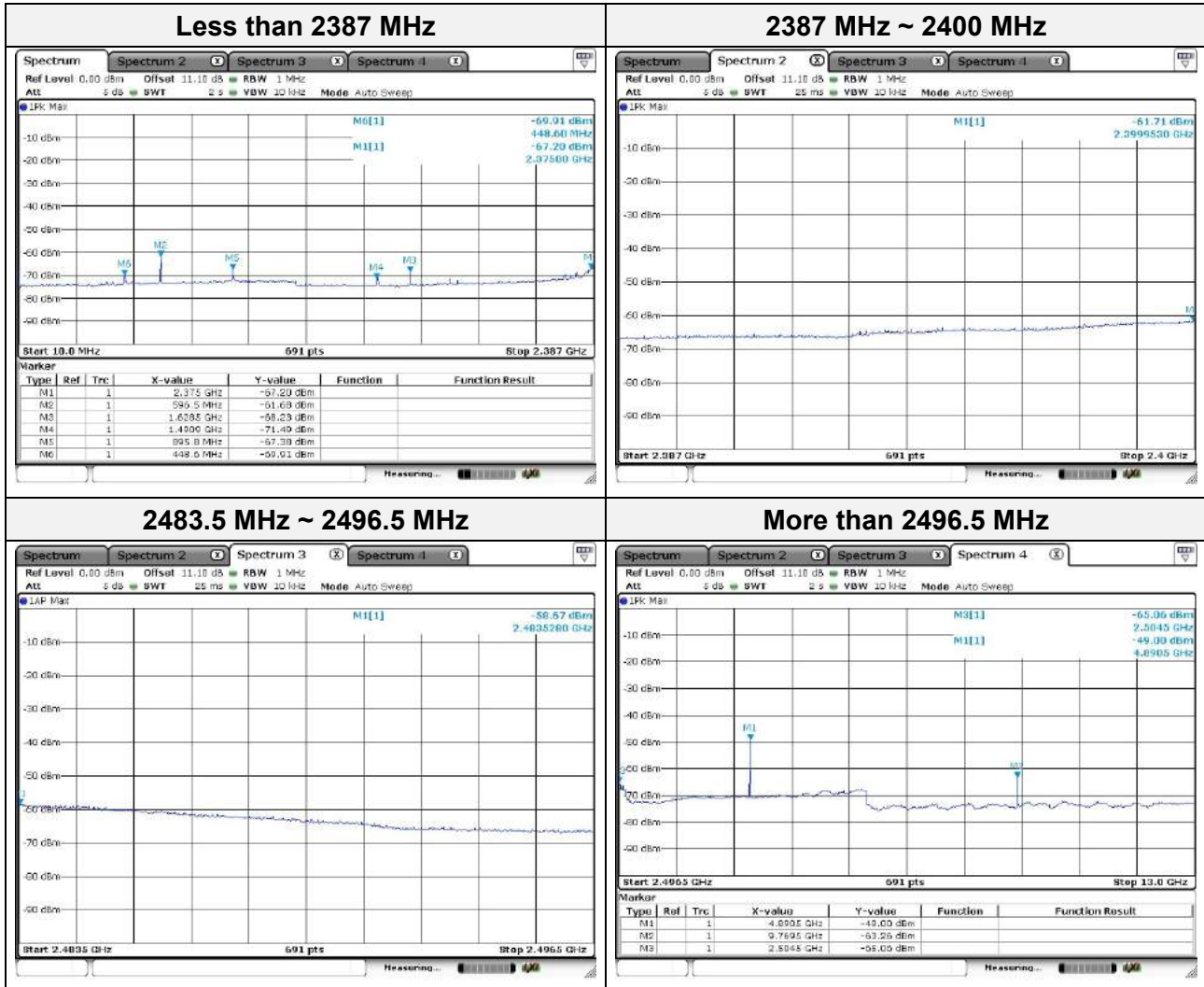


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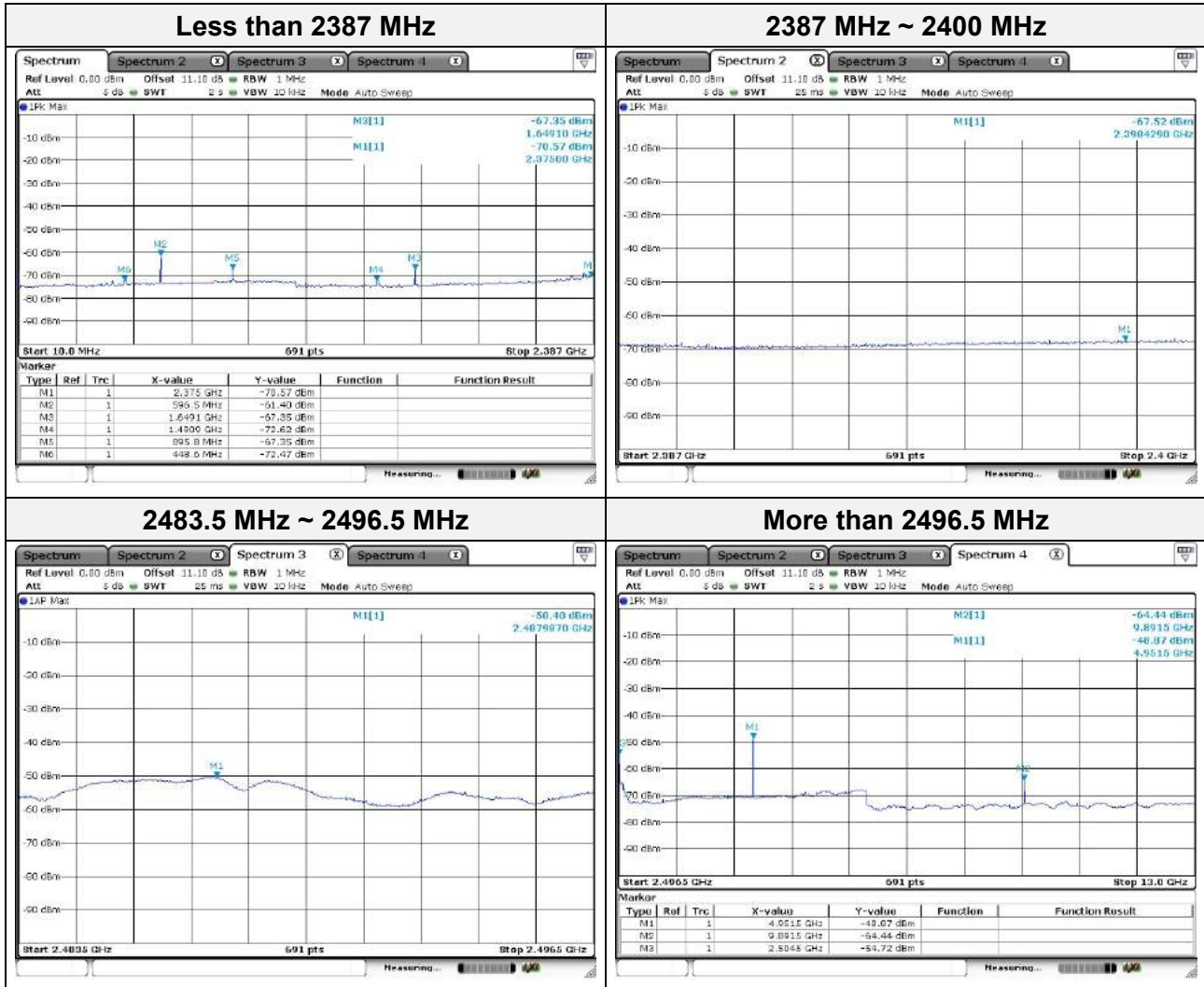
802.11b – F2



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802.11b – F3

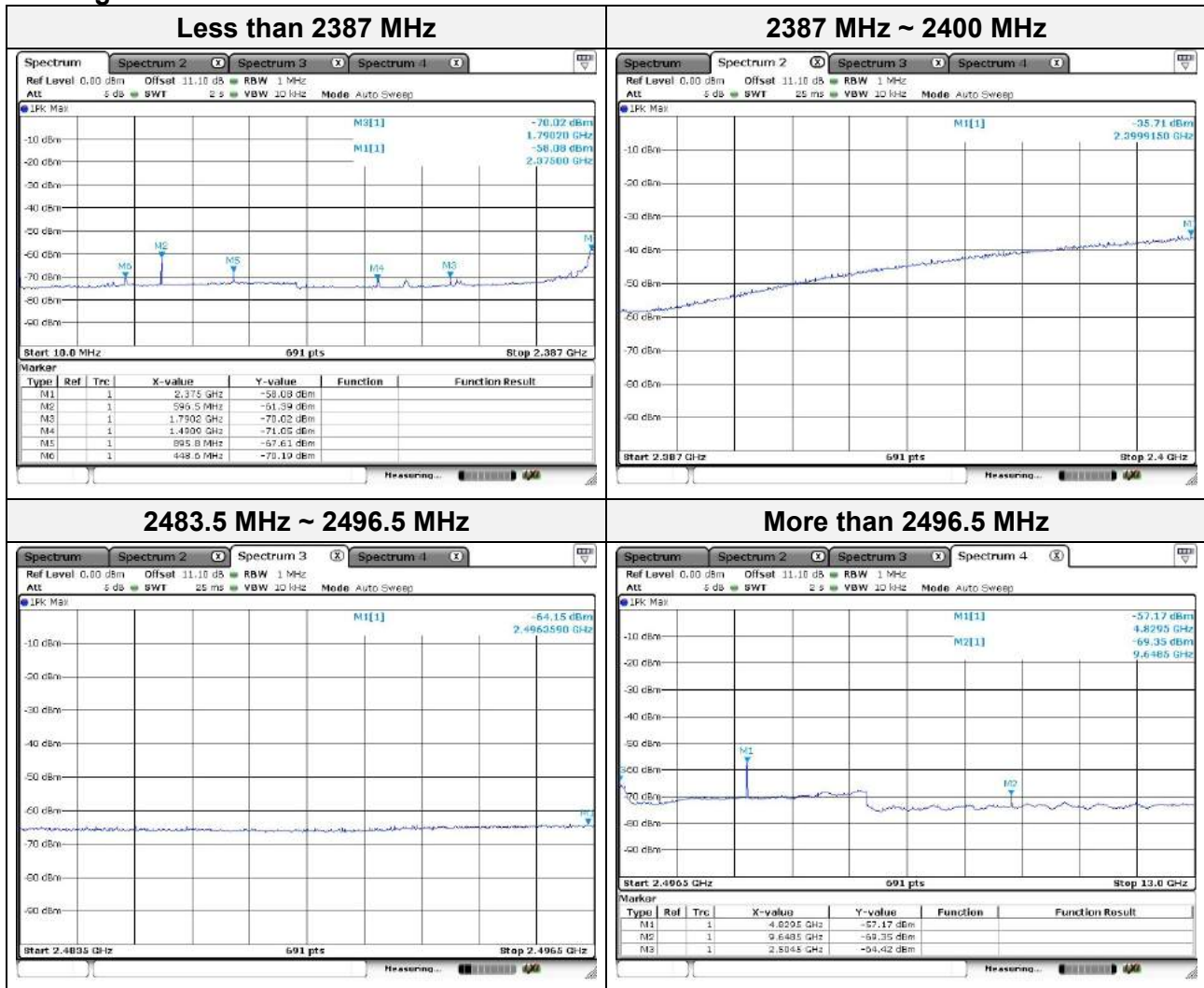


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802.11g – F1

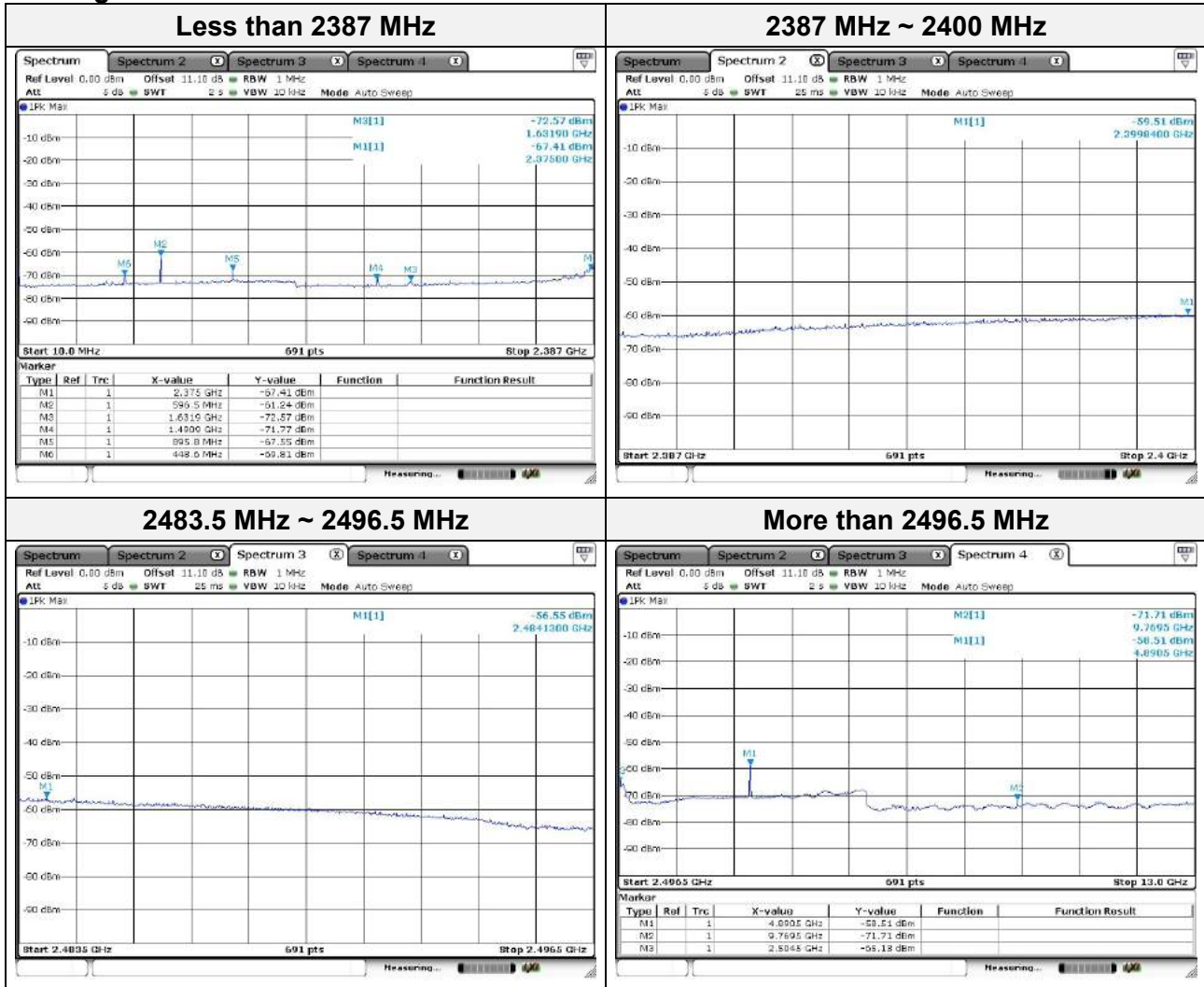


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802.11g – F2

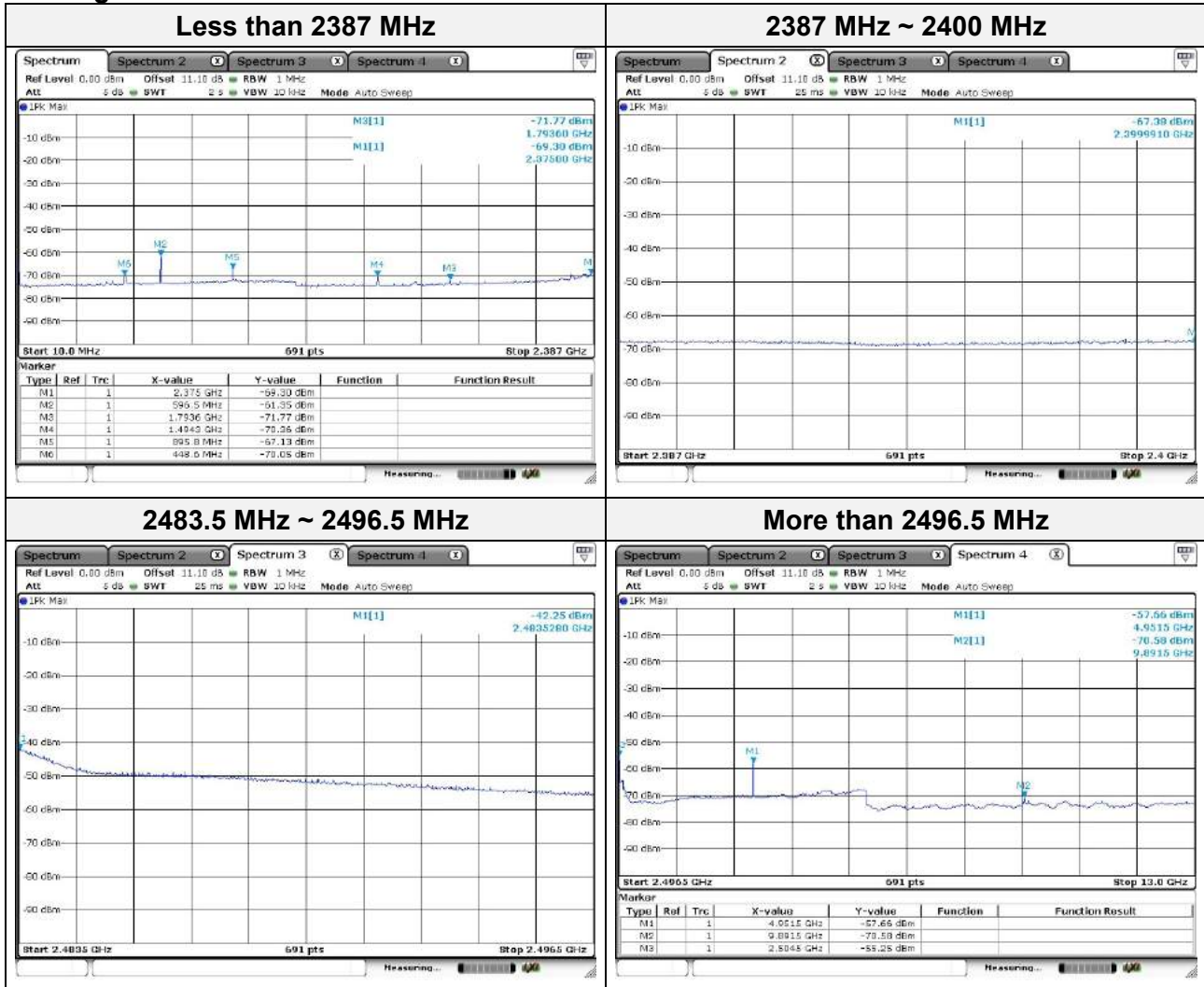


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802.11g – F3

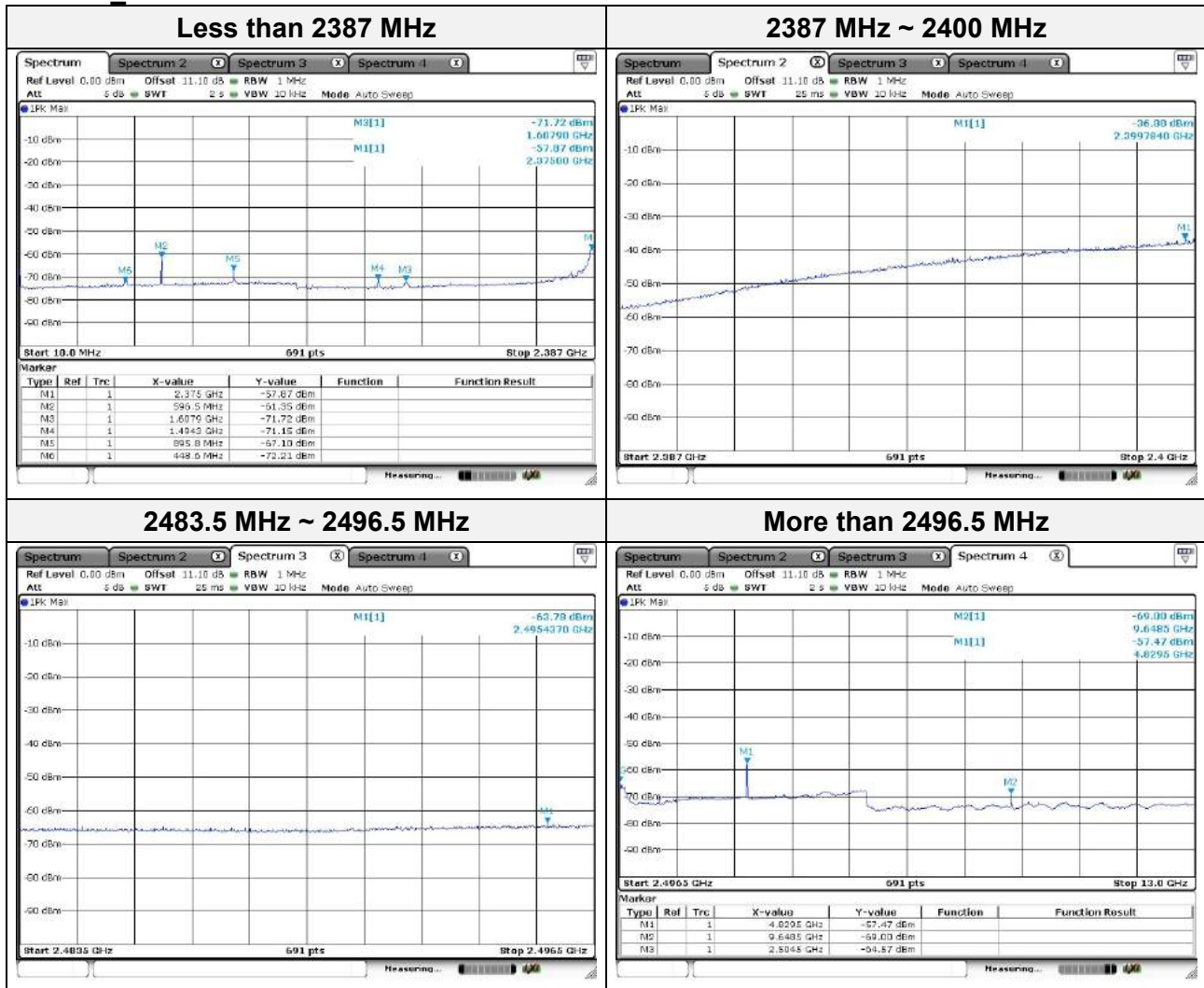


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802.11n_HT20 – F1

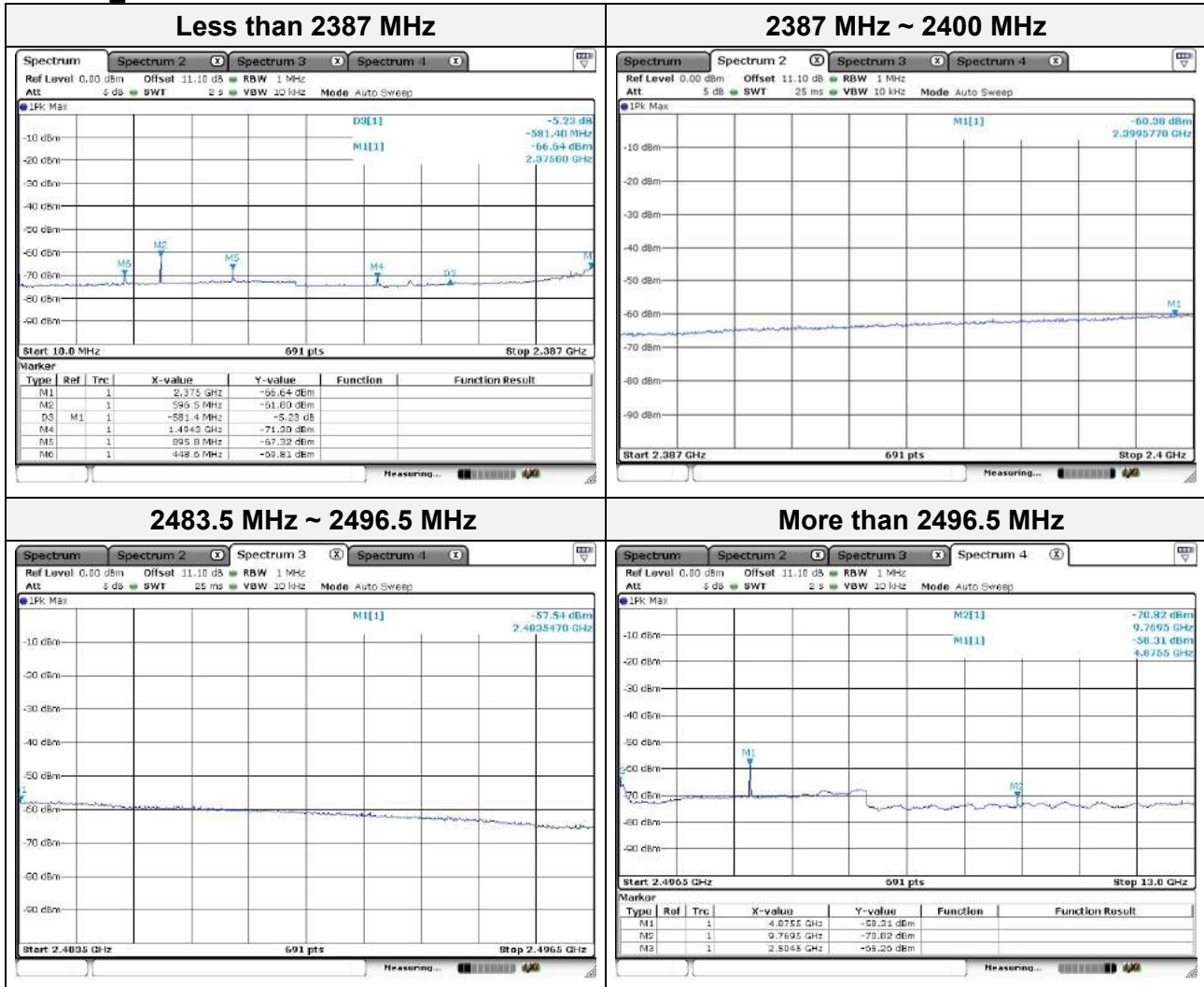


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802.11n_HT20 – F2

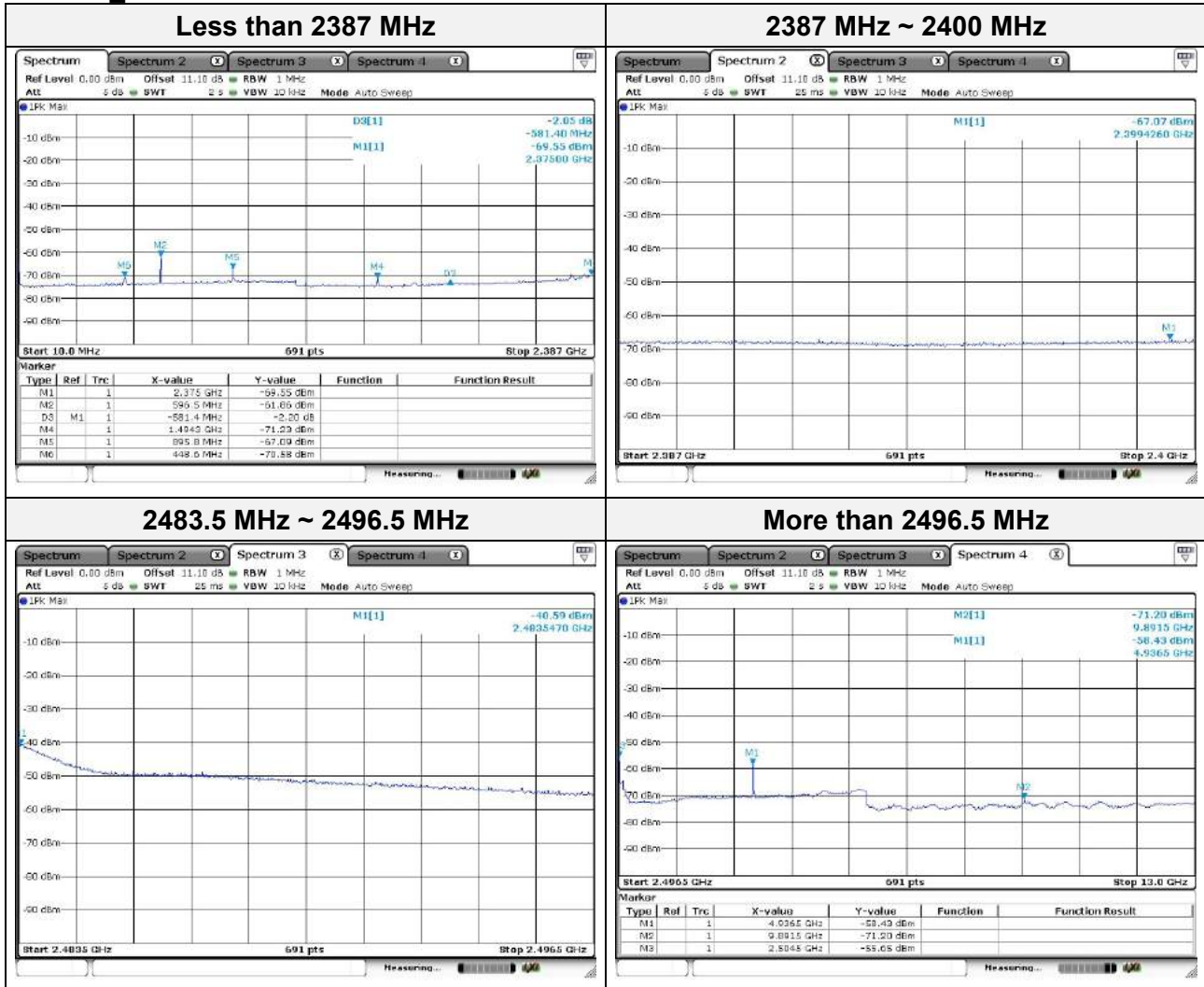


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802.11n_HT20 – F3

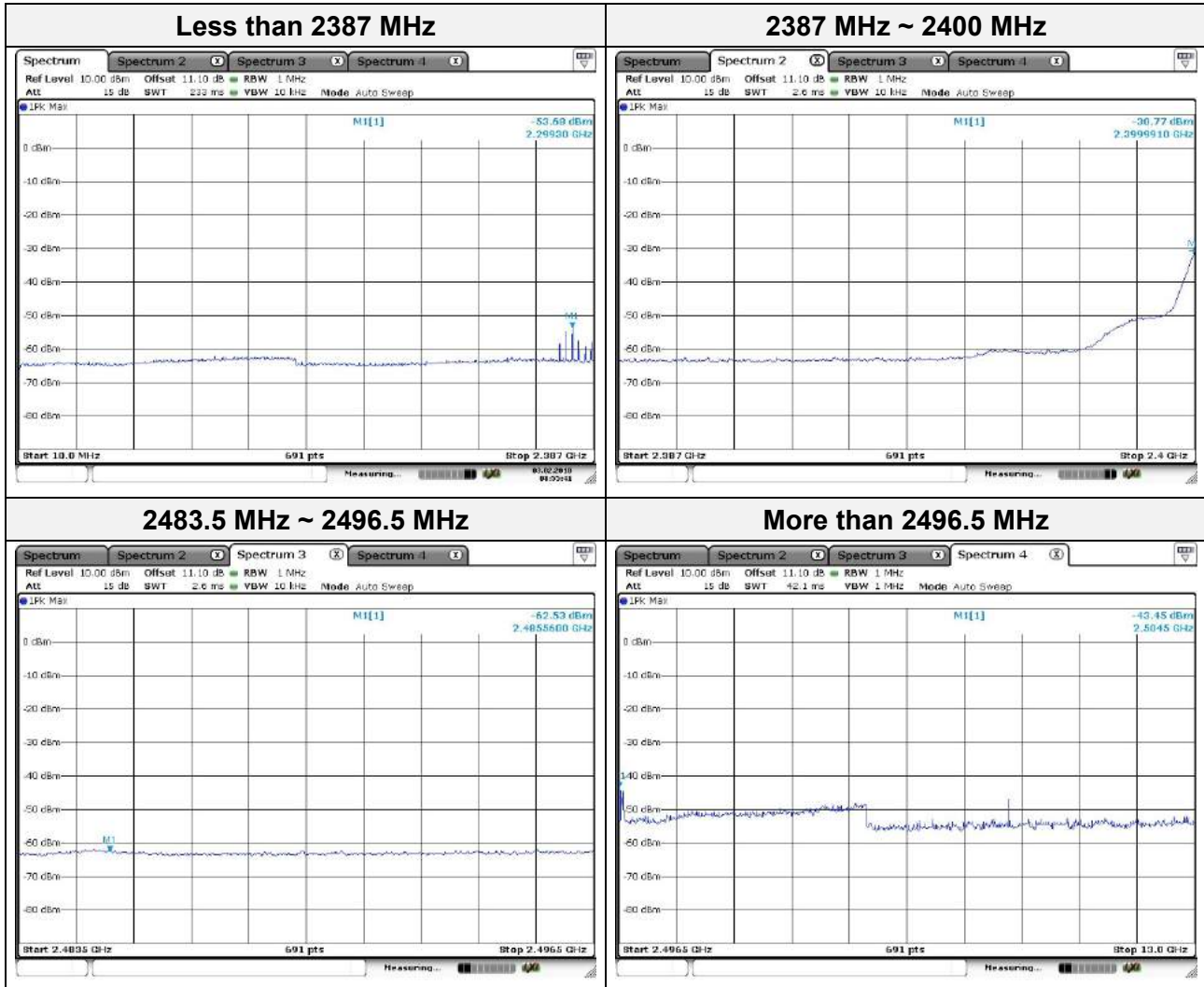


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LE - F1

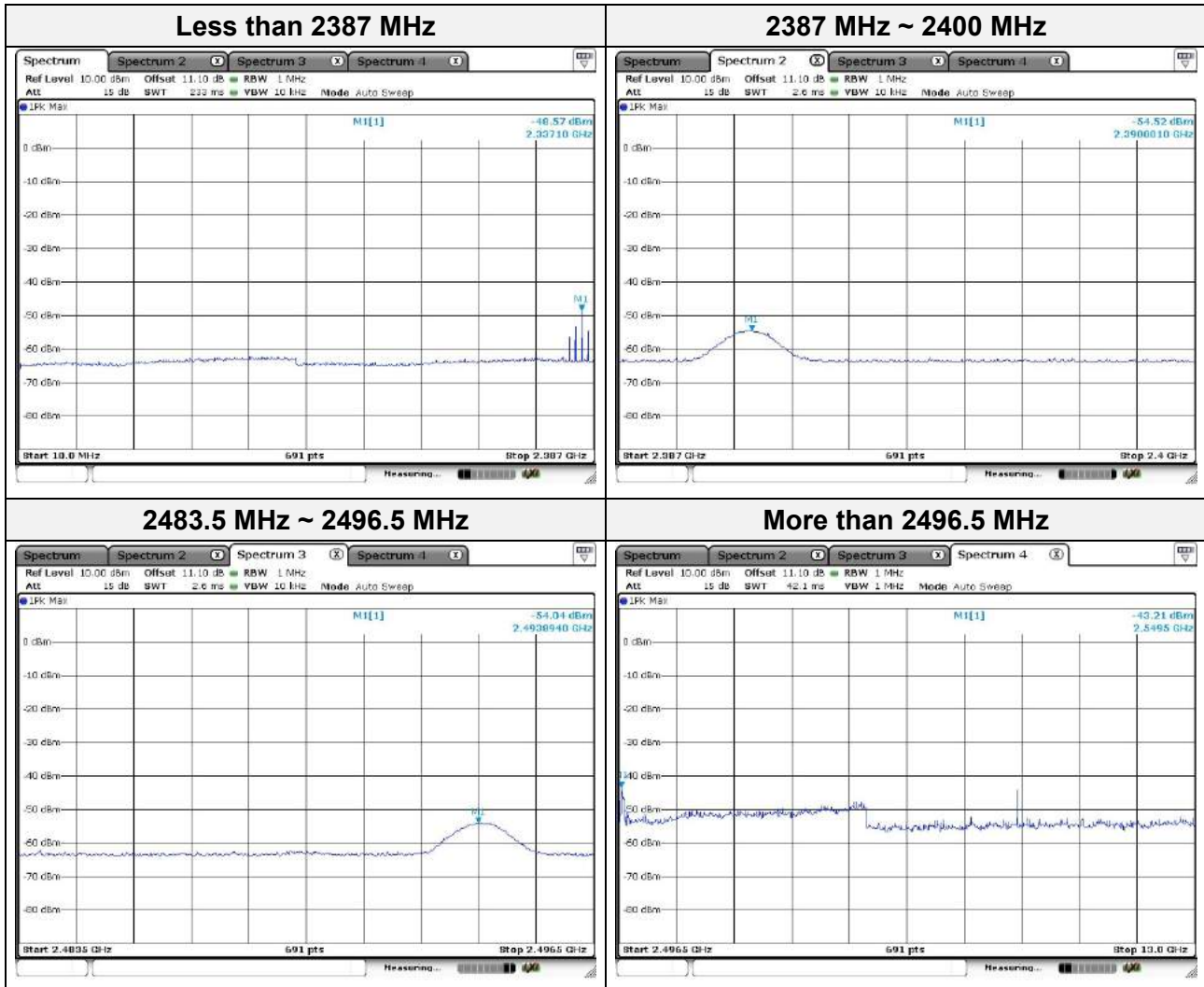


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LE - F2

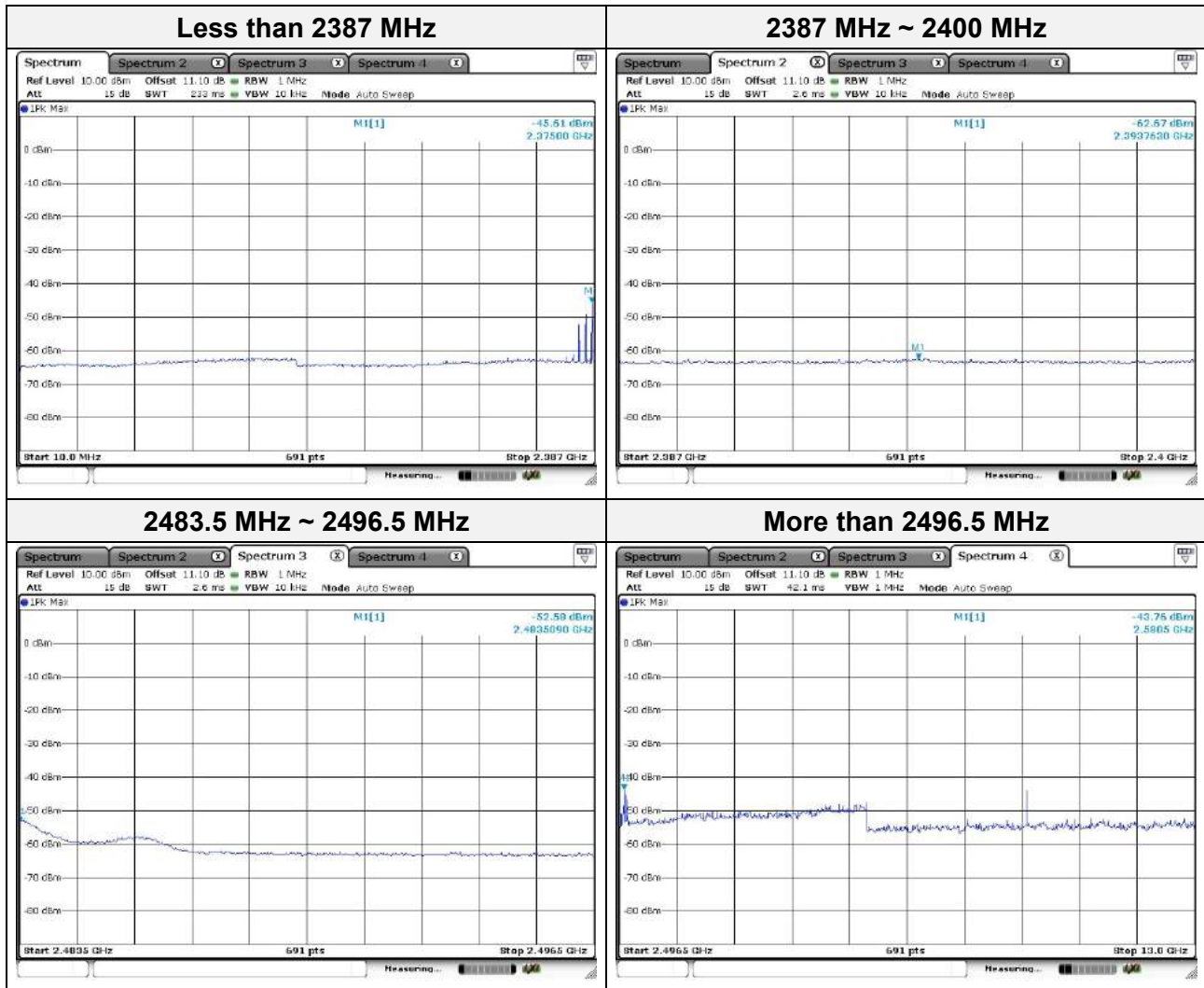


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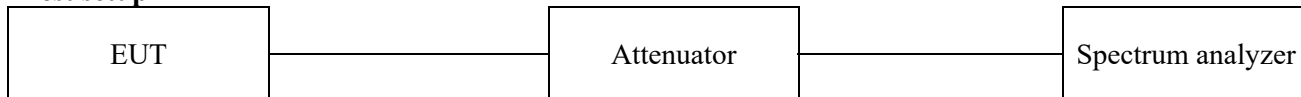
LE - F3



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3.6. Receiver spurious emissions

Test setup



Limit

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



Test results

Test item: Less than ~ 1 GHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
90	4.5	802.11b	2 412	939.10	-73.71
			2 442	939.10	-76.58
			2 472	896.10	-75.16
		802.11g	2 412	884.70	-75.95
			2 442	889.00	-75.69
			2 472	886.10	-75.06
		802.11n(HT20)	2 412	896.10	-75.02
			2 442	939.10	-74.24
			2 472	939.10	-74.36
		LE	2 402	894.20	-75.84
			2 442	892.10	-75.59
			2 480	899.40	-75.64
100	5.0	802.11b	2 412	939.10	-73.47
			2 442	939.10	-76.32
			2 472	896.10	-75.77
		802.11g	2 412	884.70	-75.24
			2 442	889.00	-76.33
			2 472	886.10	-75.96
		802.11n(HT20)	2 412	896.10	-75.99
			2 442	939.10	-74.54
			2 472	939.10	-74.51
		LE	2 402	896.10	-75.05
			2 442	890.40	-75.85
			2 480	897.60	-75.66
110	5.5	802.11b	2 412	939.10	-72.61
			2 442	939.10	-75.71
			2 472	896.10	-74.09
		802.11g	2 412	884.70	-75.93
			2 442	889.00	-76.40
			2 472	886.10	-76.65
		802.11n(HT20)	2 412	896.10	-75.34
			2 442	939.10	-74.83
			2 472	939.10	-74.25
		LE	2 402	896.20	-75.94
			2 442	894.50	-75.52
			2 480	896.20	-75.18

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Test item: 1 GHz ~ less than 12.75 GHz

Test voltage (%)	Nominal Voltage (V)	Mode	Frequency (MHz)	Measure frequency (MHz)	Level (dBm)
90	4.5	802.11b	2 412	3214.00	-63.63
			2 442	1738.00	-62.63
			2 472	3214.00	-62.87
		802.11g	2 412	3214.00	-63.12
			2 442	3214.00	-63.46
			2 472	3214.00	-64.22
		802.11n(HT20)	2 412	3214.00	-63.25
			2 442	3214.00	-63.33
			2 472	3214.00	-64.75
		LE	2 402	3214.00	-63.97
			2 442	3214.00	-63.65
			2 480	3214.00	-64.18
100	5.0	802.11b	2 412	3214.00	-63.20
			2 442	1738.00	-60.91
			2 472	3214.00	-63.31
		802.11g	2 412	3214.00	-63.27
			2 442	3214.00	-63.62
			2 472	3214.00	-64.80
		802.11n(HT20)	2 412	3214.00	-63.13
			2 442	3214.00	-64.41
			2 472	3214.00	-64.70
		LE	2 402	3214.00	-63.97
			2 442	3214.00	-63.65
			2 480	3214.00	-64.18
110	5.5	802.11b	2 412	3214.00	-62.81
			2 442	1738.00	-62.23
			2 472	3214.00	-63.38
		802.11g	2 412	3214.00	-63.48
			2 442	3214.00	-63.36
			2 472	3214.00	-64.47
		802.11n(HT20)	2 412	3214.00	-63.65
			2 442	3214.00	-64.51
			2 472	3214.00	-64.72
		LE	2 402	3214.00	-63.97
			2 442	3214.00	-63.65
			2 480	3214.00	-64.18

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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
Wide Band Power Sensor	R&S	NRP-Z81	101598	1 year	2019.01.19
Attenuator	Keysight	8493C	82506	1 year	2019.01.22
Frequency Counter	HP	5352B	3049A01336	1 year	2019.01.22
DC Power Supply	HP	6674A	US36370369	1 year	2018.07.03
EMI TEST RECEIVER	R&S	ESU26	100552	1 year	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.

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