TEST REPORT

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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2024-03-28

2. Use of Report : Certification

3. Name of Product / Model : Smart Wearable / SM-L705U

4. Derivative Model : SM-L705F

5. Manufacturer / Country of Origin : Samsung Electronics Co., Ltd. / Vietnam

6. FCC ID : A3LSML705

7. Date of Test : 2024-04-01 to 2024-05-20

8. Location of Test : ■ Permanent Testing Lab ☐ On Site Testing
(Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

9. Test method used : FCC Part 2
FCC Part 24 Subpart E

10. Test Result : Refer to the test result in the test report

	Tested by	Technical Manager
Affirmation	Name : Kwonse Kim (Signature)	Name : Seungyong Kim (Signature)

2024-05-22

Eurofins KCTL Co.,Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2024-05-22	Originally issued	-

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:
Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

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1. General information

Client	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Manufacturer	:	Samsung Electronics Co., Ltd.
Address	:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Factory 1	:	AG TECH CO.,LTD
Address 1	:	Lot G3, Que Vo Industrial Park(Expanded Area), Nam son Ward, Bac Ninh Province, Vietnam
Factory 2	:	ALMUS VINA
Address 2	:	Lot CN07A, Phu Ha Industrial Park, Ha Thach Commune, Phu Tho Town, Phu Tho Province, Vietnam
Laboratory	:	Eurofins KCTL Co.,Ltd.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 CAB Identifier: KR0040 ISED Number: 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	Smart Wearable		
Model	:	SM-L705U		
Derivative model	:	SM-L705F		
Modulation technique	:	WCDMA	:	QPSK
		LTE	:	QPSK, 16QAM
Power source	:	DC 3.88 V		
Antenna specification	:	PIFA + Metal Antenna		
Antenna gain	:	-10.8 dBi		
Frequency range	:	WCDMA 1900	:	1 852.4 ㎒ ~ 1 907.6 ㎒
		LTE B2	:	1 850.7 ㎒ ~ 1 909.3 ㎒
		LTE B25	:	1 850.7 ㎒ ~ 1 914.3 ㎒
Bandwidth	:	LTE B2	:	1.4/3/5/10/15/20 ㎒
		LTE B25	:	1.4/3/5/10/15/20 ㎒
Software version	:	L705U.001		
Hardware version	:	REV1.0		
Test device serial No.	:	Conducted	:	R3AX200WYAD
		Radiated	:	R3AX200WYLH, R3AX200WYCR, R3AX200WYKB, R3AX402DJKP
Operation Temperature	:	0 ℃ ~ 35 ℃		

Note.

1. The product equality letter includes detailed information about the differences between SM-L705U and SM-L705F model.

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source	FCC ID & IC
Wireless charger	RF TECH	EP-OL300	-	5.0 V, 2.0 A	FCC ID : A3LEPOL300 IC : 649E-EPOL300

2.2. Frequency/channel operations

This device contains the following capabilities:
WCDMA 1900, LTE B2/25

WCDMA 1900

Ch.	Frequency (㎒)
9262	1 852.4
9400	1 880.0
9538	1 907.6

Table 2.2-1. RMC/HSDPA/HSUPA/DC-HSDPA

LTE B2

Ch.	Frequency (㎒)
18607	1 850.7
18900	1 880.0
19193	1 909.3

Table 2.2-2. 1.4M BW

Ch.	Frequency (㎒)
18615	1 851.5
18900	1 880.0
19185	1 908.5

Table 2.2-3. 3M BW

Ch.	Frequency (㎒)
18625	1 852.5
18900	1 880.0
19175	1 907.5

Table 2.2-4. 5M BW

Ch.	Frequency (㎒)
18650	1 855.0
18900	1 880.0
19150	1 905.0

Table 2.2-5. 10M BW

Ch.	Frequency (㎒)
18675	1 857.5
18900	1 880.0
19125	1 902.5

Table 2.2-6. 15M BW

Ch.	Frequency (㎒)
18700	1 860.0
18900	1 880.0
19100	1 900.0

Table 2.2-7. 20M BW

LTE B25

Ch.	Frequency (㎒)
26047	1 850.7
26365	1 882.5
26683	1 914.3

Table 2.2-8. 1.4M BW

Ch.	Frequency (㎒)
26055	1 851.5
26365	1 882.5
26675	1 913.5

Table 2.2-9. 3M BW

Ch.	Frequency (㎒)
26065	1 852.5
26365	1 882.5
26665	1 912.5

Table 2.2-10. 5M BW

Ch.	Frequency (㎒)
26090	1 855.0
26365	1 882.5
26640	1 910.0

Table 2.2-11. 10M BW

Ch.	Frequency (㎒)
26115	1 857.5
26365	1 882.5
26615	1 907.5

Table 2.2-12. 15M BW

Ch.	Frequency (㎒)
26140	1 860.0
26365	1 882.5
26590	1 905.0

Table 2.2-13. 20M BW

Notes:

1. LTE B2(1 850 – 1 910 ㎒) overlaps the entire frequency range of LTE B25(1 850 – 1 915 ㎒) and they have same maximum tune-up power. Therefore, B25 was tested as a representative and the test data provided in this report covers B25 as well as B2 subpart to Part24.

3. Maximum ERP/EIRP power

WCDMA 1900

Mode	Tx frequency (㎒)	Emission designator	EIRP	
			Max. power (㏈m)	Max. power (W)
WCDMA 1900	1 852.4 ~ 1 907.6	4M18F9W	8.90	0.008

LTE B25/2

Mode	Tx frequency (㎒)	Emission designator	EIRP	
			Max. power (㏈m)	Max. power (W)
LTE B25/2	1 850.7 ~ 1 914.3	1M10G7D	10.67	0.012
		1M11W7D	9.80	0.010
	1 851.5 ~ 1 913.5	2M71G7D	10.58	0.011
		2M71W7D	9.67	0.009
	1 852.5 ~ 1 912.5	4M53G7D	10.15	0.010
		4M53W7D	9.08	0.008
	1 855.0 ~ 1 910.0	8M99G7D	9.58	0.009
		9M04W7D	8.74	0.007
	1 857.5 ~ 1 907.5	13M5G7D	9.71	0.009
		13M5W7D	8.64	0.007
	1 860.0 ~ 1 905.0	18M0G7D	9.79	0.010
		18M0W7D	8.62	0.007

4. Summary of tests

FCC Part section(s)	Parameter	Test Limit	Test Condition	Test results
2.1046	Conducted Output Power	N/A	Conducted	Pass
2.1049	Occupied Bandwidth & 26 dB Bandwidth	N/A		Pass
2.1051 24.238(a)	Band Edge Emissions at Antenna Terminal	<43 + 10Log$_{10}$(P) dB at Band edge and for all out of band emissions		Pass
	Spurious Emissions at Antenna Terminal			Pass
24.232(d)	Peak to Average Power Ratio	<13 dB		Pass
2.1055 24.355	Frequency stability	< 2.5 ppm		Pass
24.232(c)	Equivalent Isotropic Radiated Power	< 2 Watts max. ERP	Radiated	Pass
2.1053 24.238(a)	Radiated Spurious Emissions	<43 + 10Log$_{10}$(P) dB for all out of band emissions		Pass

Notes:

1. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.26-2015
   - ANSI/TIA-603-E-2016
   - KDB 971168 D01 v03r01

4.1. Worst case orientation

1. All modes of operation were investigated and the worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations in the test data.
2. In the case of radiated spurious emissions, only the worst case bandwidth results were reported.
3. Output power measurements were measured on all of modulation. All tests except output power was performed with below modulation with highest power.
   1) WCDMA: RMC
   2) LTE: QPSK, 16QAM
4. However, the PAPR was evaluated for all wave forms and modulations during pre-test, then all bandwidth was performed for the modulations with the highest result.
   1) LTE: QPSK, 16QAM
5. All configurations have been performed (Stand-alone, Stand-alone with TA, and Strap).
6. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z and all Of the radiated tests have been performed with the accessories as below. It was determined that below orientation was worst case orientation for each band.

Band	Strap	With charger	Without charger		
		X-axis	X-axis	Y-axis	Z-axis
WCDMA1900	With strap	-	-	-	-
	Without strap	O	-	-	-
LTE B25/2	With strap	-	-	-	-
	Without strap	O	-	-	-

7. Test Condition
   - The measurement was performed with various configurations then worst results are reported.

1) Radiated measurement

Test Description	Mode	Condition		Test Channel
Effective Radiated Power	WCDMA	RMC (12.2 kbps)		Low, Middle, High
	LTE	QPSK, 16QAM	RB Size: 1	
Radiated Spurious Emissions	WCDMA	RMC (12.2 kbps)		Low, Middle, High
	LTE	QPSK	RB Size: 1	

Band	Bandwidth (㎒)	RB size	RB offset
LTE B25/2	1.4, 3, 5, 10, 15, 20	1	Low, Middle, High

2) Conducted measurement

Test Description	Mode	Condition		Test Channel
OBW & 26 dB BW	WCDMA	RMC (12.2 kbps)		Low, Middle, High
	LTE	QPSK, 16QAM	RB Size: Full	
PAPR	WCDMA	RMC (12.2 kbps)		Middle
	LTE	QPSK, 16QAM	RB Size: Full	
Band Edge	WCDMA	RMC (12.2 kbps)		Low, High
	LTE	QPSK	RB Size: 1, Full	
Spurious Emissions	WCDMA	RMC (12.2 kbps)		Low, Middle, High
	LTE	QPSK	RB Size: 1	

Band	Bandwidth (㎒)	RB size	RB offset
LTE B25/2	1.4, 3, 5, 10, 15, 20	1	0, 5, 14, 24, 49, 74, 99
		Full	0

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014.

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty (±)	
Conducted RF power	0.9 dB	
Conducted spurious emissions	1.9 dB	
Radiated spurious emissions	Below 1 000 ㎒	2.5 dB
	1 000 ㎒ ~ 18 000 ㎒	2.5 dB
	Above 1 8000 ㎒	2.6 dB

6. Measurement results explanation example

Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	5.82	16 000	9.29
50	6.09	17 000	9.50
100	6.15	18 000	9.55
200	6.09	19 000	9.31
300	6.28	20 000	8.51
400	6.51	21 000	9.00
500	6.57	22 000	9.52
600	6.62	23 000	9.53
700	6.67	24 000	9.95
800	6.70	25 000	10.82
900	6.74	26 000	10.60
1 000	6.76	26 500	10.73
2 000	7.06	27 000	10.59
3 000	7.25	28 000	11.48
4 000	7.39	29 000	10.38
5 000	7.54	30 000	10.69
6 000	7.94	31 000	11.57
7 000	8.10	32 000	11.70
8 000	8.21	33 000	12.00
9 000	8.26	34 000	11.88
10 000	7.36	35 000	11.65
11 000	8.35	36 000	11.80
12 000	8.40	37 000	11.51
13 000	8.62	38 000	10.82
14 000	8.71	39 000	11.00
15 000	9.02	40 000	11.30

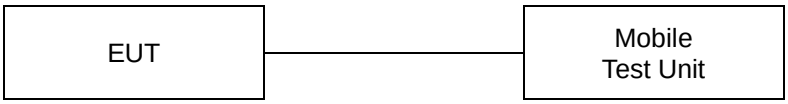
Note.

1. Offset(㏈) = RF cable loss(㏈) + Divider (㏈)

7. Test results

7.1. Conducted output power

Test setup



Test procedure

971168 D01 v03r01 – Section 5.2
ANSI C63.26-2015 – Section 5.2.4.2
CFR 47 - Section §2.1046

Test settings

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurement be performed only over durations of active transmissions at maximum output power level applies. Thus, an average power meter can always be used to perform the measurement when the EUT can be configured to transmit continuously.

If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98%), then the following options can be implemented to facilitate measurement of the average power with an average power meter:

a) A gated average power meter can be used to perform the measurement if the gating parameters can be adjusted such that the power is measured only during active transmission bursts at maximum output power levels.
b) A conventional average power meter with no signal gating capability can also be used if the measured burst duty cycle is constant (i.e., duty cycle variations are less than or equal to ± 2%) by performing the measurement over the on/off burst cycles and then correcting (increasing) the measured level by a factor equal to [10log (1/duty cycle)]. See 5.2.4.3.4 for guidance with respect to measuring the transmitter duty cycle.

See item r) of 4.1 for more information regarding power meter functional requirements and limitations, and consult the instrumentation-specific application literature for proper set-up and use.

Note:

1. Offset(㏈) = RF cable loss(㏈)

Test results

Test Band	Test mode	Maximum Average Power (dBm)		
		Channel		
		Low	Middle	High
WCDMA 1900	RMC	22.04	22.07	22.04
	HSDPA-Subtest 1	21.26	21.29	21.31
	HSDPA-Subtest 2	19.52	19.51	19.59
	HSDPA-Subtest 3	19.11	19.11	19.05
	HSDPA-Subtest 4	19.05	19.05	19.03
	HSUPA-Subtest 1	19.65	19.54	19.39
	HSUPA-Subtest 2	17.74	17.60	17.42
	HSUPA-Subtest 3	18.74	18.51	18.58
	HSUPA-Subtest 4	17.76	17.53	17.36
	HSUPA-Subtest 5	21.68	21.57	21.41
	DC-HSDPA-Subtest 1	20.98	20.91	20.84
	DC-HSDPA-Subtest 2	19.58	19.58	19.59
	DC-HSDPA-Subtest 3	19.09	19.05	19.09
	DC-HSDPA-Subtest 4	19.06	19.05	19.05

Test Band	Bandwidth (㎒)	Test mode	RB size	RB offset	Maximum Average Power (㏈m)		
					Channel		
					Low	Middle	High
LTE B2	1.4	QPSK	1	0	22.81	22.65	22.73
			1	3	23.08	22.58	22.68
			1	5	22.81	22.62	22.96
			3	0	23.56	23.17	23.44
			3	1	23.53	23.14	23.40
			3	3	23.55	23.12	23.39
			6	0	22.57	22.18	22.42
		16QAM	1	0	22.74	22.18	22.26
			1	3	22.52	22.09	22.24
			1	5	22.49	22.30	22.29
			3	0	22.53	22.13	22.52
			3	1	22.51	22.10	22.50
			3	3	22.49	22.09	22.45
			6	0	21.59	21.15	21.40
	3	QPSK	1	0	23.06	22.64	22.96
			1	8	23.01	22.53	22.80
			1	14	22.96	22.54	22.79
			8	0	22.63	22.21	22.45
			8	4	22.56	22.18	22.42
			8	7	22.56	22.13	22.42
			15	0	22.61	22.19	22.46
		16QAM	1	0	22.76	21.96	22.38
			1	8	22.69	22.19	22.25
			1	14	22.45	22.18	22.23
			8	0	21.69	21.20	21.54
			8	4	21.67	21.18	21.44
			8	7	21.63	21.15	21.44
			15	0	21.57	21.18	21.43
	5	QPSK	1	0	23.26	22.50	22.81
			1	12	22.87	22.69	22.70
			1	24	22.95	22.57	22.68
			12	0	22.66	22.22	22.51
			12	7	22.57	22.18	22.44
			12	13	22.55	22.15	22.41
			25	0	22.59	22.18	22.43
		16QAM	1	0	22.60	22.30	22.24
			1	12	22.48	22.19	22.16
			1	24	22.50	22.12	22.65
			12	0	21.58	21.18	21.45
			12	7	21.55	21.14	21.41
			12	13	21.52	21.11	21.35
			25	0	21.57	21.14	21.44
	10	QPSK	1	0	22.97	22.84	23.05
			1	25	22.79	22.59	22.67
			1	49	23.05	22.51	22.65
			25	0	22.64	22.27	22.46
			25	12	22.54	22.18	22.41
			25	25	22.51	22.15	22.33
			50	0	22.54	22.20	22.42
		16QAM	1	0	22.89	22.39	22.56
			1	25	22.68	22.16	22.33
			1	49	22.48	22.09	22.26
			25	0	21.65	21.29	21.52
			25	12	21.55	21.23	21.48
			25	25	21.50	21.15	21.40
			50	0	21.54	21.21	21.46

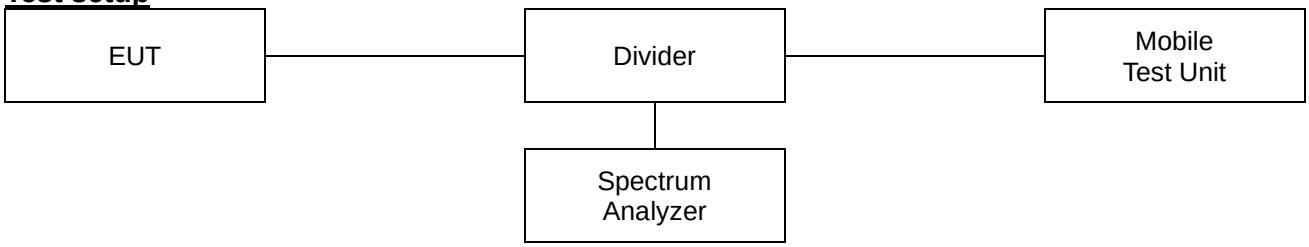
Test Band	Bandwidth (㎒)	Test mode	RB size	RB offset	Maximum Average Power (dBm)		
					Channel		
					Low	Middle	High
LTE B2	15	QPSK	1	0	23.33	22.93	23.10
			1	36	22.97	22.73	22.86
			1	74	23.02	22.62	22.76
			36	0	22.64	22.33	22.56
			36	18	22.50	22.21	22.44
			36	37	22.45	22.16	22.36
			75	0	22.53	22.24	22.45
		16QAM	1	0	22.62	22.36	22.57
			1	36	22.30	22.05	22.50
			1	74	22.31	22.01	22.49
			36	0	21.62	21.38	21.57
			36	18	21.50	21.25	21.42
			36	37	21.46	21.17	21.37
			75	0	21.53	21.24	21.46
	20	QPSK	1	0	23.27	23.08	23.21
			1	49	22.92	22.62	22.76
			1	99	22.97	22.57	22.58
			50	0	22.66	22.39	22.56
			50	24	22.49	22.22	22.40
			50	50	22.43	22.14	22.32
			100	0	22.53	22.25	22.43
		16QAM	1	0	22.72	22.55	23.01
			1	49	22.46	22.02	22.53
			1	99	22.41	21.92	22.48
			50	0	21.68	21.38	21.57
			50	24	21.50	21.19	21.37
			50	50	21.44	21.10	21.31
			100	0	21.54	21.24	21.43

Test Band	Bandwidth (㎒)	Test mode	RB size	RB offset	Maximum Average Power (㏈m)		
					Channel		
					Low	Middle	High
LTE B25	1.4	QPSK	1	0	23.06	22.89	22.74
			1	3	23.33	22.67	22.71
			1	5	23.04	23.02	22.83
			3	0	23.64	23.21	23.54
			3	1	23.61	23.20	23.53
			3	3	23.61	23.19	23.53
			6	0	22.62	22.16	22.53
		16QAM	1	0	22.79	22.00	22.60
			1	3	22.75	21.99	22.57
			1	5	22.76	22.40	22.59
			3	0	22.64	22.21	22.42
			3	1	22.62	22.04	22.40
			3	3	22.53	22.03	22.40
			6	0	21.71	21.14	21.57
	3	QPSK	1	0	23.12	22.91	23.27
			1	8	23.00	22.86	22.91
			1	14	23.03	22.58	22.89
			8	0	22.66	22.20	22.51
			8	4	22.64	22.19	22.50
			8	7	22.60	22.15	22.47
			15	0	22.67	22.17	22.54
		16QAM	1	0	22.69	22.18	22.46
			1	8	22.65	22.10	22.42
			1	14	22.57	22.37	22.51
			8	0	21.72	21.15	21.45
			8	4	21.70	21.10	21.45
			8	7	21.68	21.11	21.43
			15	0	21.63	21.21	21.51
	5	QPSK	1	0	23.18	22.88	23.11
			1	12	23.11	22.54	23.05
			1	24	22.78	22.75	22.84
			12	0	22.66	22.21	22.50
			12	7	22.63	22.17	22.46
			12	13	22.57	22.17	22.47
			25	0	22.65	22.19	22.49
		16QAM	1	0	22.59	22.33	22.48
			1	12	22.48	22.13	22.49
			1	24	22.67	22.18	22.37
			12	0	21.67	21.21	21.52
			12	7	21.60	21.14	21.51
			12	13	21.56	21.13	21.46
			25	0	21.61	21.12	21.53
	10	QPSK	1	0	23.10	22.66	22.93
			1	25	23.00	22.65	22.87
			1	49	22.94	22.54	22.75
			25	0	22.66	22.27	22.51
			25	12	22.57	22.19	22.43
			25	25	22.52	22.10	22.40
			50	0	22.59	22.23	22.44
		16QAM	1	0	22.81	22.27	22.63
			1	25	22.56	22.04	22.51
			1	49	22.42	22.10	22.54
			25	0	21.63	21.28	21.56
			25	12	21.59	21.15	21.49
			25	25	21.54	21.14	21.45
			50	0	21.61	21.21	21.47

Test Band	Bandwidth (㎒)	Test mode	RB size	RB offset	Maximum Average Power (㏈m)		
					Channel		
					Low	Middle	High
LTE B25	15	QPSK	1	0	23.34	22.80	23.17
			1	36	23.04	22.63	22.85
			1	74	22.92	22.61	22.88
			36	0	22.65	22.35	22.64
			36	18	22.55	22.21	22.50
			36	37	22.49	22.15	22.43
			75	0	22.57	22.24	22.52
		16QAM	1	0	22.78	22.58	22.76
			1	36	22.38	22.11	22.34
			1	74	22.42	22.28	22.35
			36	0	21.66	21.36	21.64
			36	18	21.54	21.25	21.50
			36	37	21.49	21.15	21.45
			75	0	21.57	21.25	21.55
	20	QPSK	1	0	23.41	22.94	23.21
			1	49	22.83	22.63	22.79
			1	99	22.94	22.62	22.89
			50	0	22.72	22.41	22.66
			50	24	22.53	22.21	22.48
			50	50	22.50	22.13	22.40
			100	0	22.58	22.25	22.54
		16QAM	1	0	22.76	22.58	22.78
			1	49	22.49	22.12	22.28
			1	99	22.50	21.99	22.55
			50	0	21.71	21.36	21.63
			50	24	21.54	21.19	21.44
			50	50	21.50	21.11	21.42
			100	0	21.60	21.26	21.56

7.2. 99% Occupied Bandwidth & 26㏈ Bandwidth

Test setup



Limit

According to §2.1049,

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

Test procedure

971168 D01 v03r01 – Section 4.2 and 4.3
ANSI C63.26-2015 – Section 5.4.3 and 5.4.4

Test settings

◆ **26㏈ Bandwidth**

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.

b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
See guidance provided in 4.2.3.

d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 ㏈ below the target "−X ㏈" requirement, i.e., if the requirement calls for measuring the −26 ㏈ OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 ㏈ below the reference level.

e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

f) Determine the reference value by either of the following:
   1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize.
   Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
   2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.

g) Determine the "−X ㏈ amplitude" as equal to (Reference Value − X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.

h) If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).

i) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the "−X dB amplitude" determined in step f). If a marker is below this "−X dB amplitude" value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.

j) The spectral envelope can cross the "−X dB amplitude" at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the "−X dB amplitude."

k) The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

◆ 99% Occupied Bandwidth

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

d) Set the detection mode to peak, and the trace mode to max-hold.

e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.

f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

Notes:

1. The EUT was setup to maximum output power with all bandwidth and modulation.

Test results

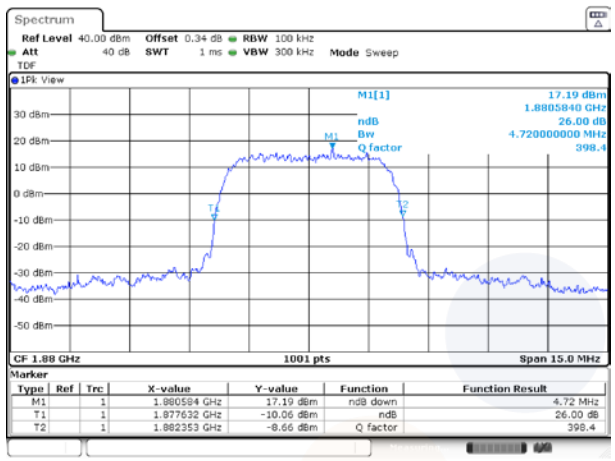
Test mode		Channel	26 dB Bandwidth (㎒)	99 % Bandwidth (㎒)
WCDMA1900	RMC	Low	4.75	4.18
		Middle	4.72	4.17
		High	4.77	4.15

Test Band	Bandwidth (㎒)	Channel	Test mode	26㏈ Bandwidth (㎒)	99 % Bandwidth (㎒)
LTE B25/2	1.4	Low	QPSK	1.36	1.10
			16QAM	1.34	1.10
		Middle	QPSK	1.34	1.10
			16QAM	1.34	1.10
		High	QPSK	1.37	1.10
			16QAM	1.39	1.11
	3	Low	QPSK	3.07	2.70
			16QAM	3.09	2.70
		Middle	QPSK	3.12	2.71
			16QAM	3.06	2.71
		High	QPSK	3.13	2.71
			16QAM	3.15	2.70
	5	Low	QPSK	5.38	4.52
			16QAM	5.42	4.52
		Middle	QPSK	5.33	4.52
			16QAM	5.38	4.53
		High	QPSK	5.35	4.53
			16QAM	5.37	4.53
	10	Low	QPSK	10.34	8.99
			16QAM	10.34	9.02
		Middle	QPSK	10.17	8.99
			16QAM	10.27	9.04
		High	QPSK	10.27	8.99
			16QAM	10.09	8.99
	15	Low	QPSK	15.14	13.52
			16QAM	14.99	13.49
		Middle	QPSK	15.25	13.49
			16QAM	15.10	13.45
		High	QPSK	15.02	13.49
			16QAM	15.14	13.45
	20	Low	QPSK	19.83	17.93
			16QAM	19.73	17.98
		Middle	QPSK	19.78	18.03
			16QAM	19.63	17.98
		High	QPSK	19.73	17.98
			16QAM	19.98	17.93

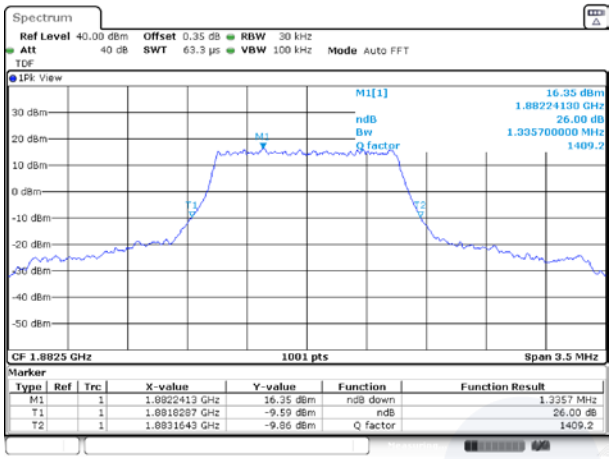
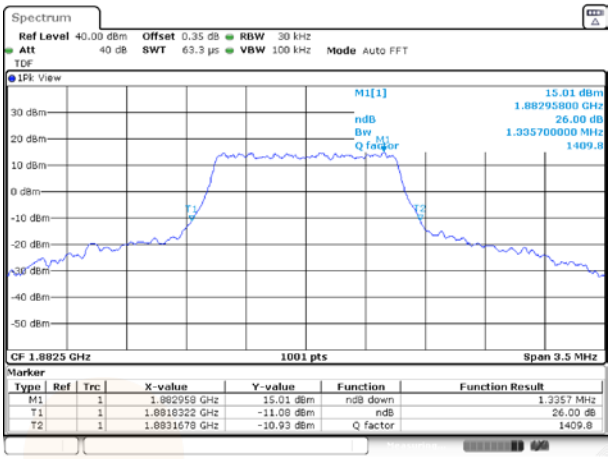
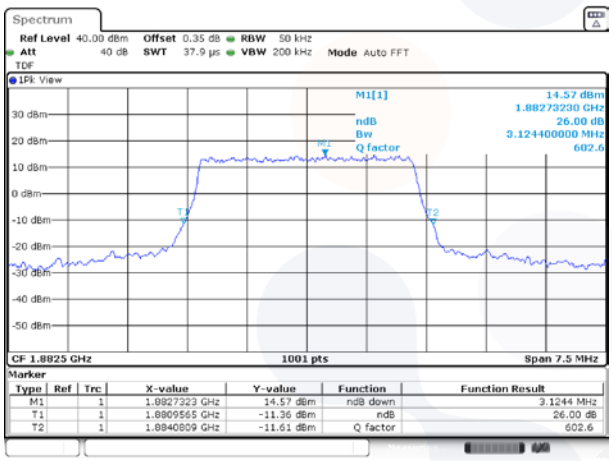
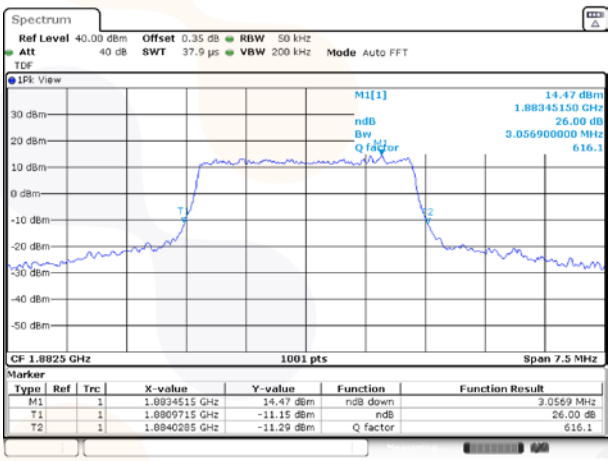
In order to simplify the report, only Middle channel test plots are attached

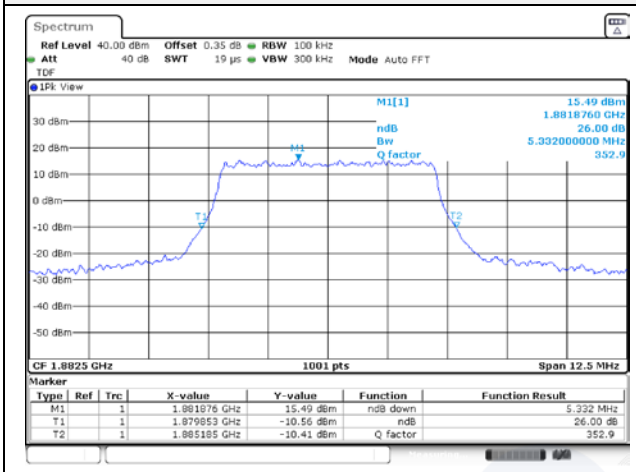
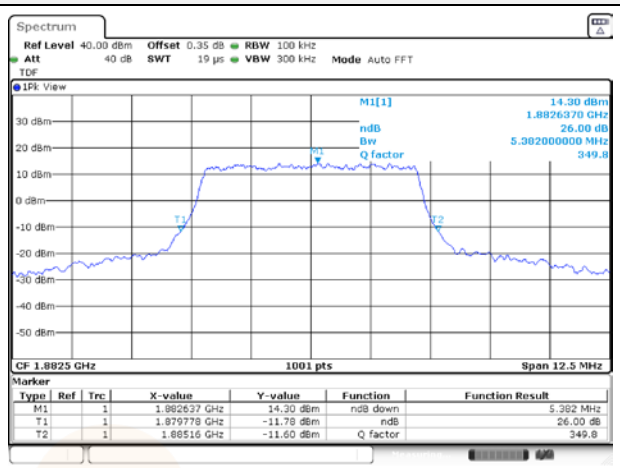
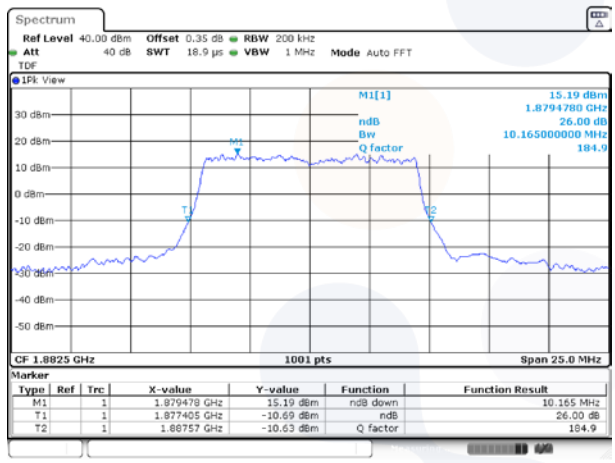
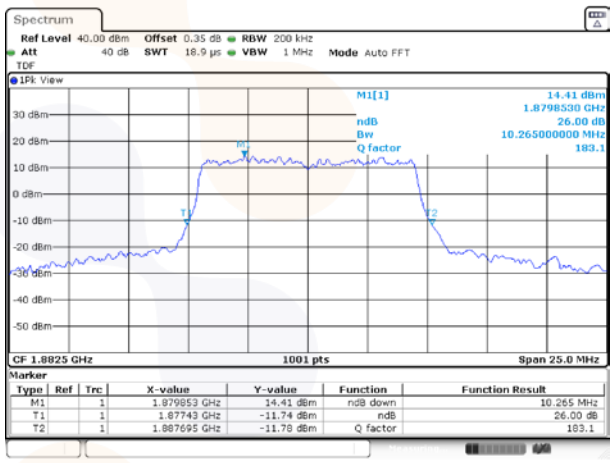
26dB Bandwidth

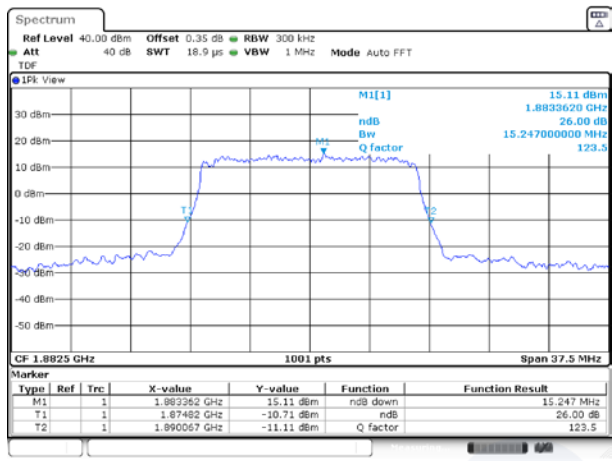
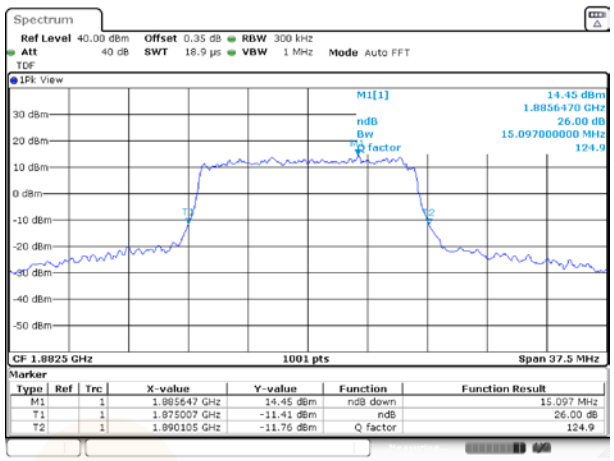
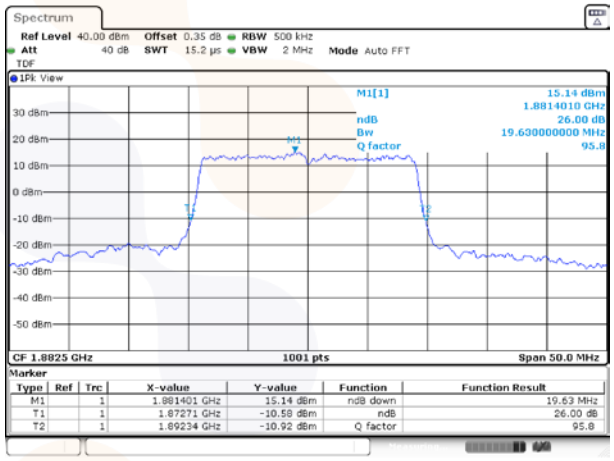
Test mode: WCDMA 1900

RMC Middle channel	-
	Blank

Test mode: LTE B25/2

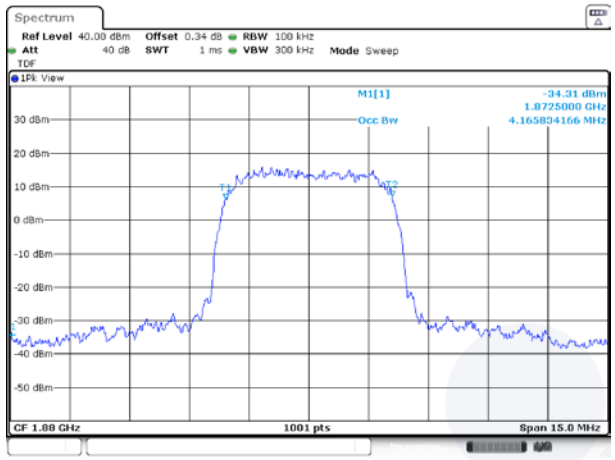
1.4M BW QPSK Middle channel	1.4M BW 16QAM Middle channel
	
3M BW QPSK Middle channel	**3M BW 16QAM Middle channel**
	

5M BW QPSK Middle channel	5M BW 16QAM Middle channel
	
10M BW QPSK Middle channel	**10M BW 16QAM Middle channel**
	

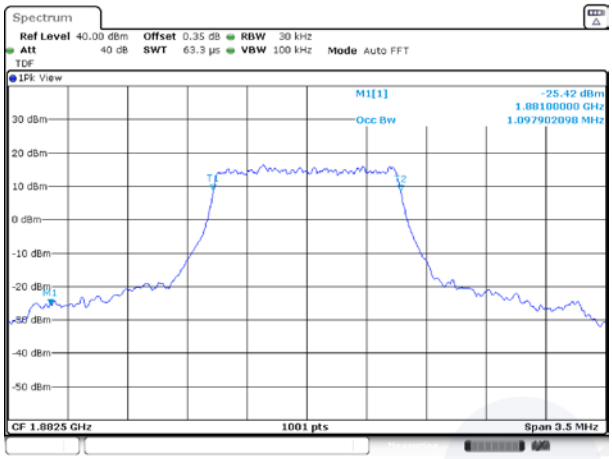
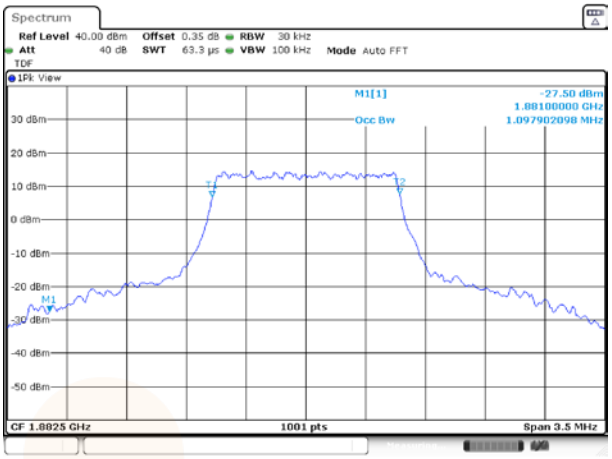
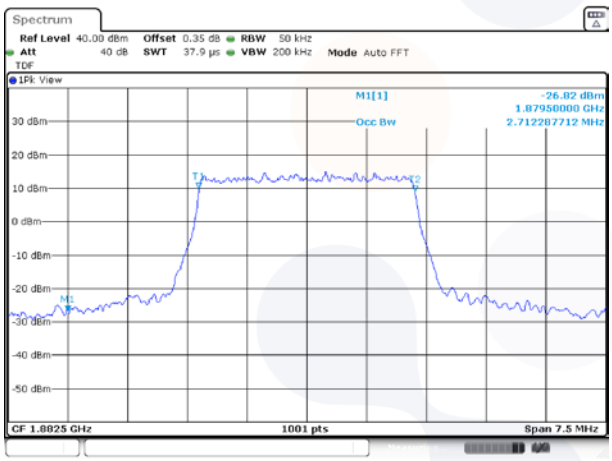
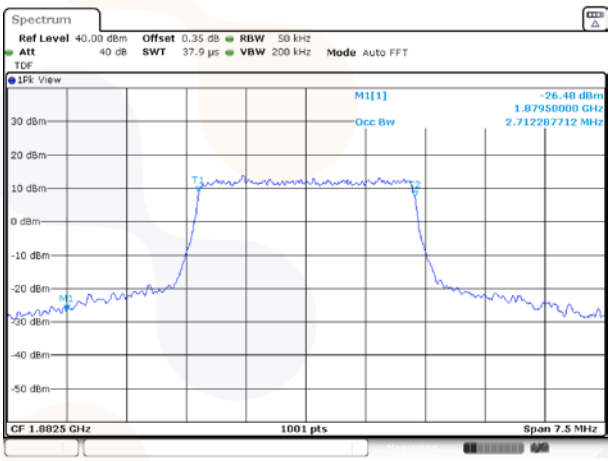
15M BW QPSK Middle channel	15M BW 16QAM Middle channel
	
20M BW QPSK Middle channel	**20M BW 16QAM Middle channel**
	

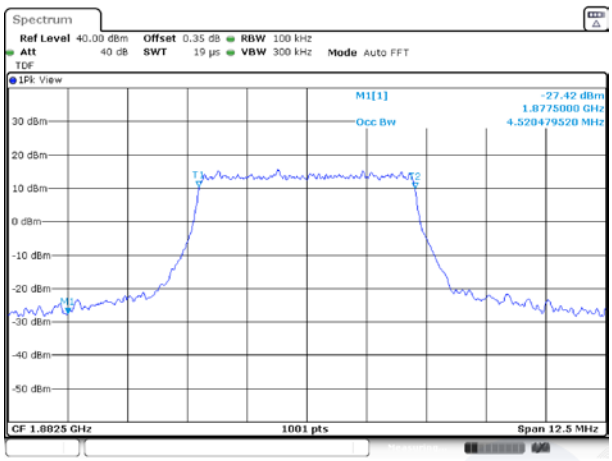
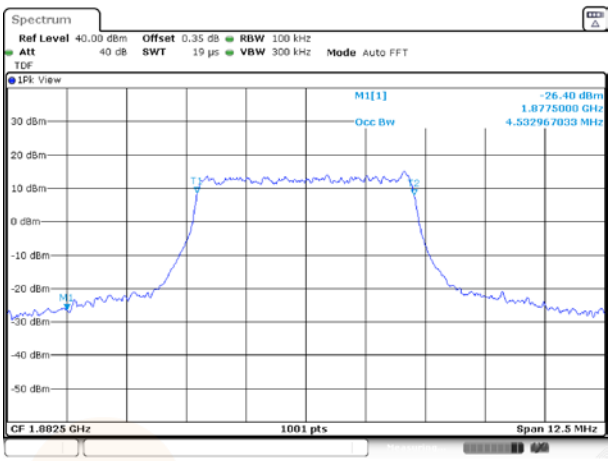
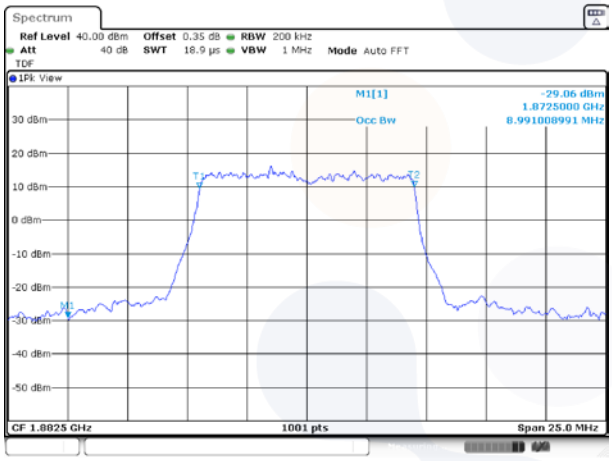
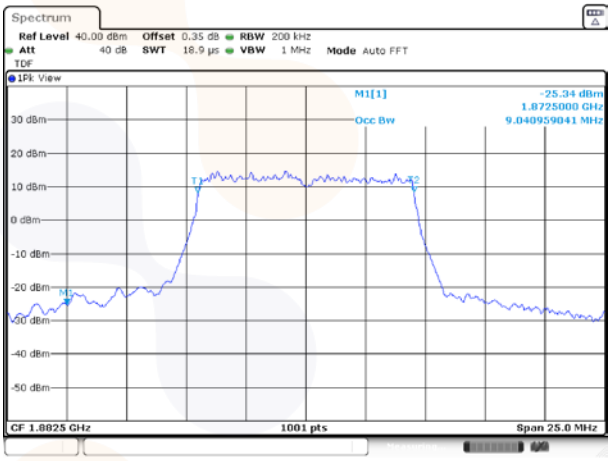
99% Occupied Bandwidth

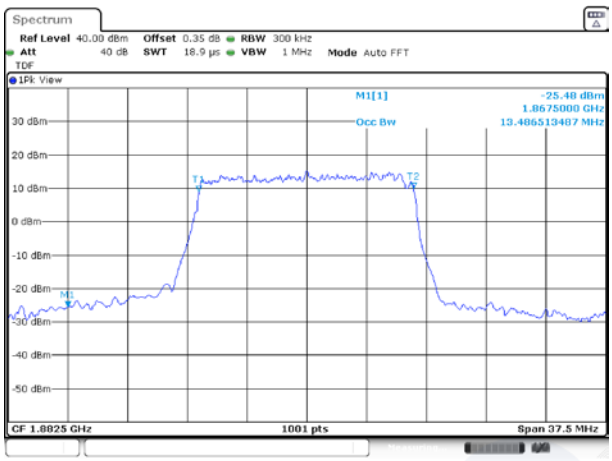
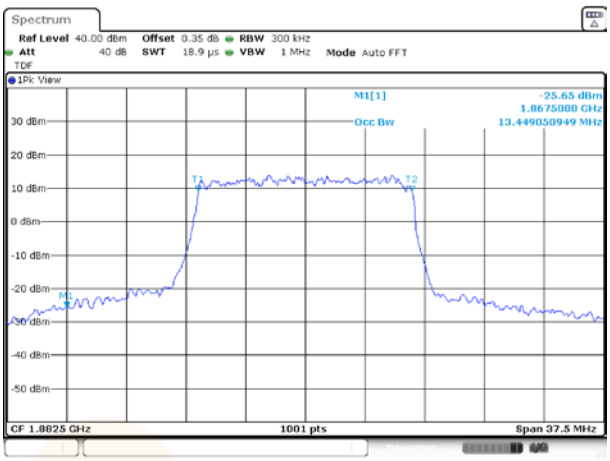
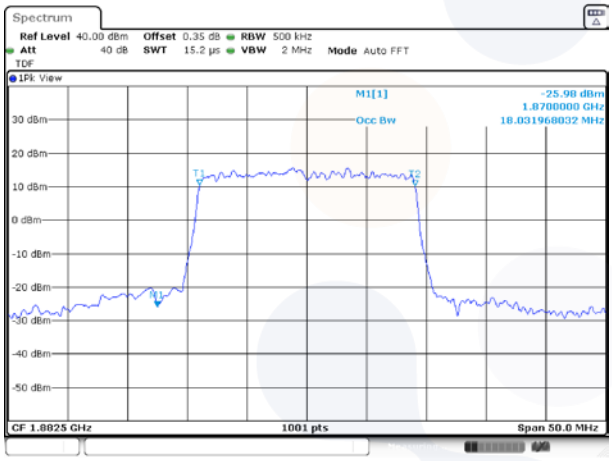
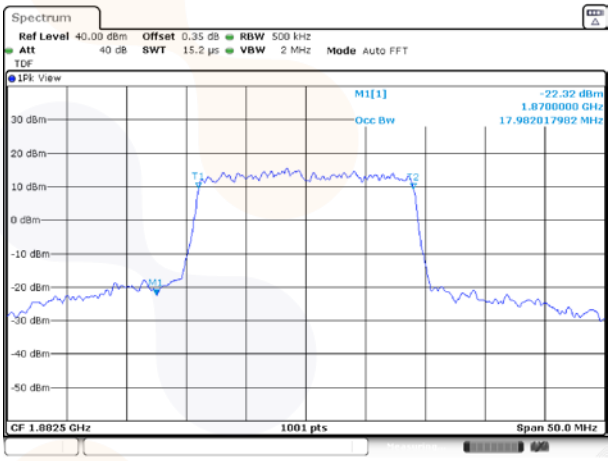
Test mode: WCDMA 1900

RMC Middle channel	-
	Blank

Test mode: LTE B25/2

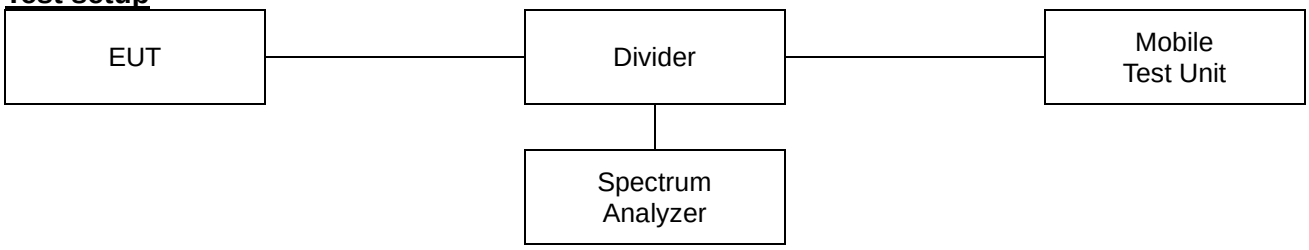
1.4M BW QPSK Middle channel	1.4M BW 16QAM Middle channel
	
3M BW QPSK Middle channel	**3M BW 16QAM Middle channel**
	

5M BW QPSK Middle channel	5M BW 16QAM Middle channel
	
10M BW QPSK Middle channel	**10M BW 16QAM Middle channel**
	

15M BW QPSK Middle channel	15M BW 16QAM Middle channel
	
20M BW QPSK Middle channel	**20M BW 16QAM Middle channel**
	

7.3. Band Edge Emissions at Antenna Terminal

Test setup



Limit

According to §24.238(a),

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) ㏈.

Test procedure

971168 D01 v03r01 - Section 6

ANSI C63.26-2015 – Section 5.7

Test settings

1) Start and stop frequency were set such that the band edge would be placed in the center of the plot
2) Span was set large enough so as to capture all out of band emissions near the band edge.
3) Set the RBW > 1% of the emission bandwidth.
4) Set the VBW ≥ 3 x RBW.
5) Set the number of sweep points ≥ 2 x Span/RBW
6) Detector = RMS
7) Trace mode = trace average
8) Sweep time should be auto for peak detection. For RMS detection the sweep time should be set as follows:
    a) If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) x (symbol period) (e.g., by a factor of 10 x symbol period x number of points) Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.
    b) If the device cannot transmit continuously (duty cycle < 98%), a gated sweep shall be used when possible (i.e., gate triggered such that the analyzer only sweeps when the device is transmitting at full power), set the sweep time > (number of points in sweep) x (symbol period) but the sweep time shall always be maintained at a value that is less than or equal to the minimum transmission time
    c) If the device cannot be configured to transmit continuously (duty cycle > 98%), and a free-running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).
    d) If the device cannot be configured to transmit continuously and a free-running

sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold art necessary to ensure that the maximum power is measured.

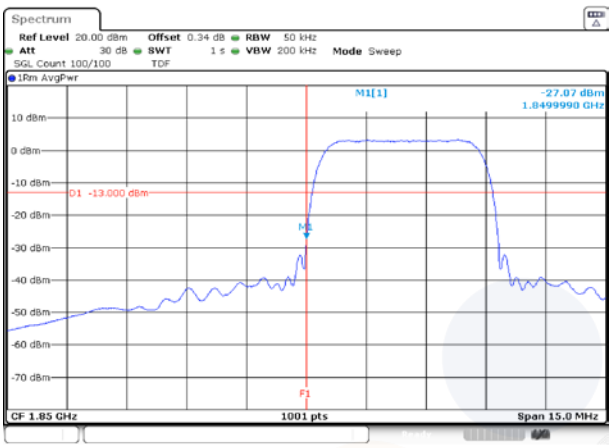
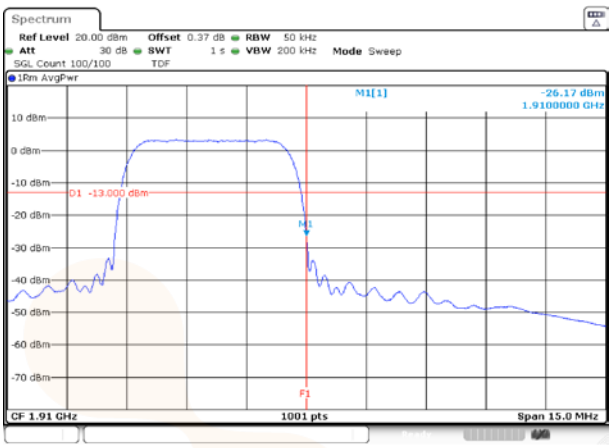
9) Allow trace to fully stabilize.

Notes:

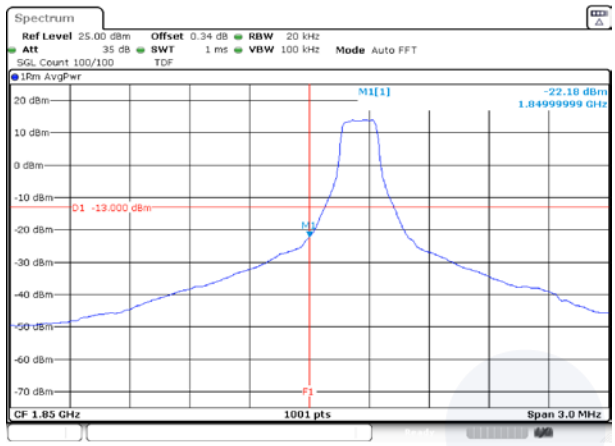
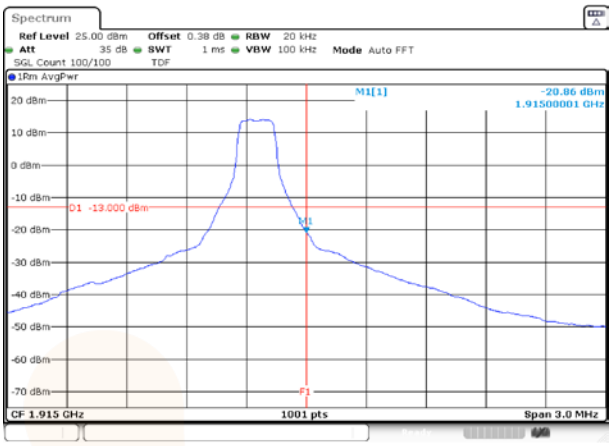
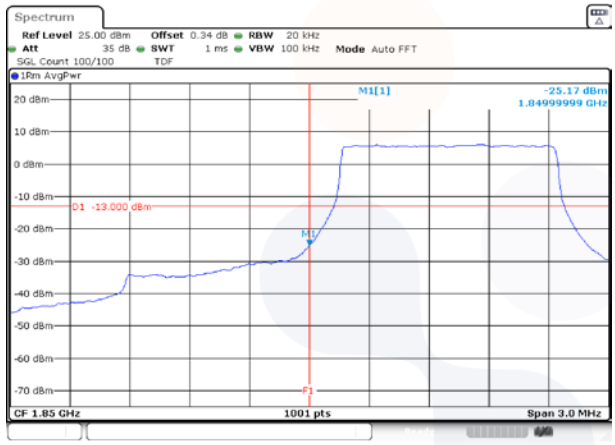
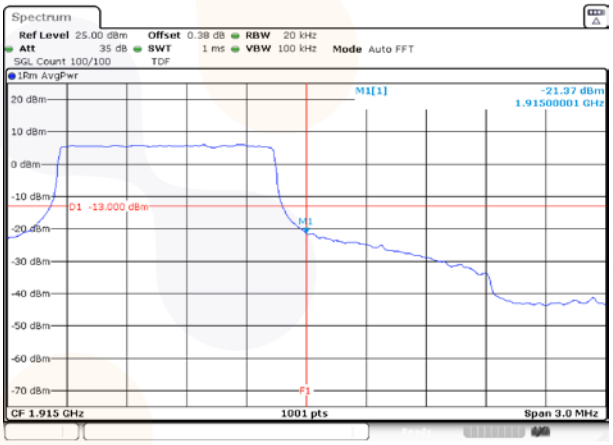
1. Per 24.238(b), compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 ㎒ or greater. however in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
2. The EUT was setup to maximum output power as its lowest and highest channel with all bandwidth, modulation and RB configurations.

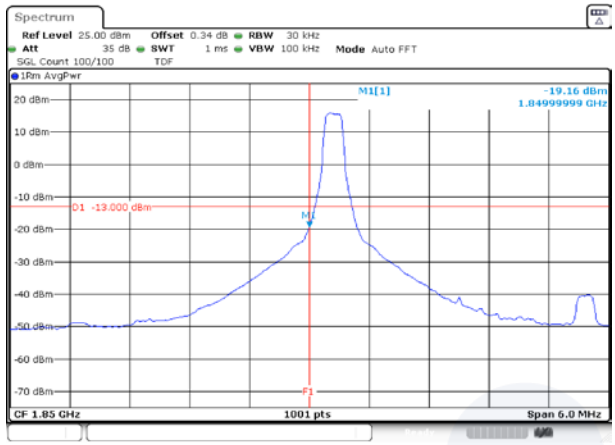
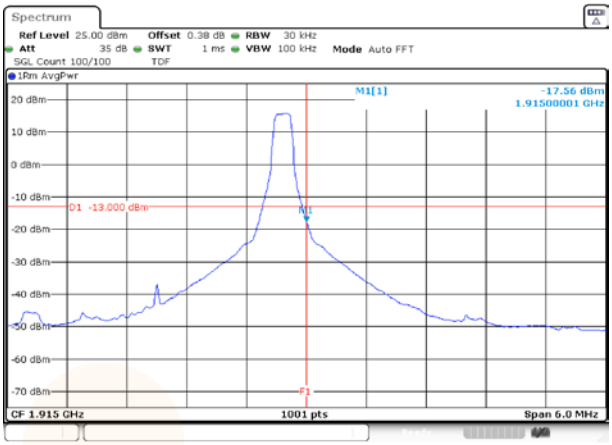
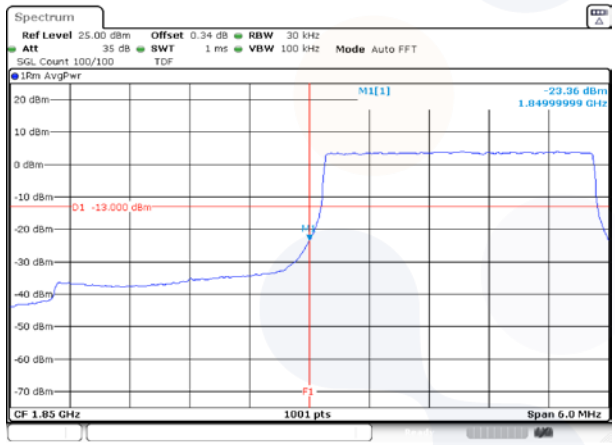
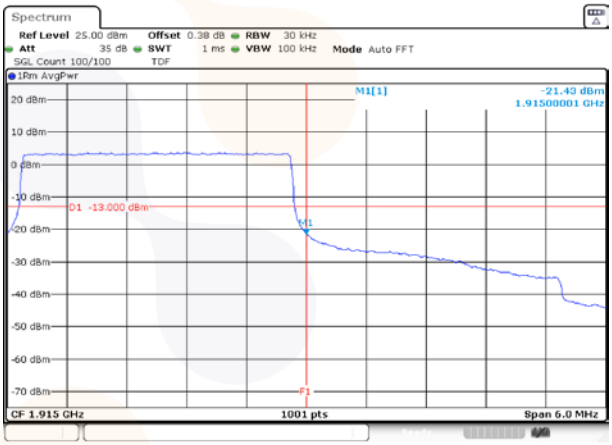
Test results

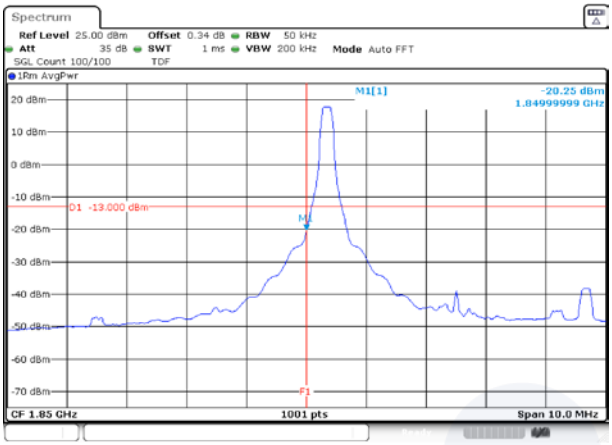
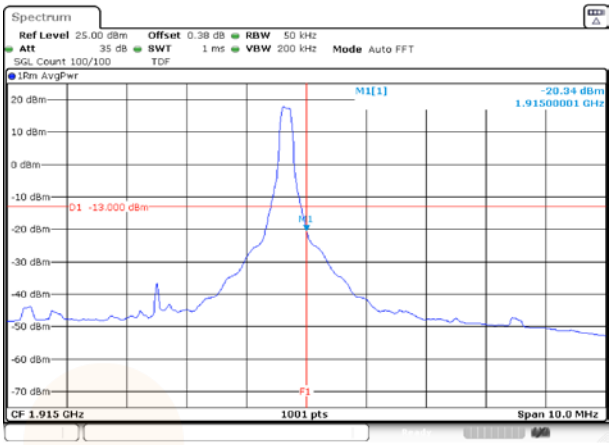
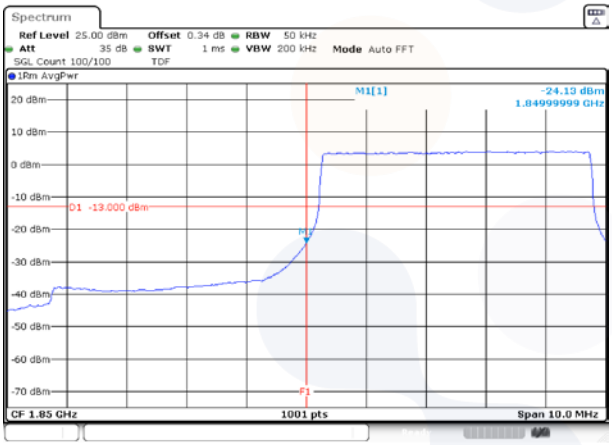
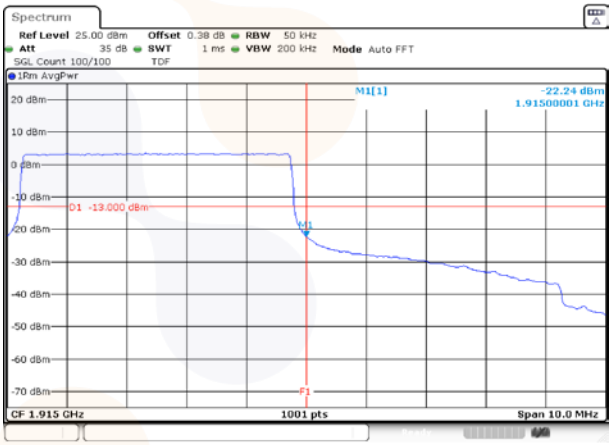
Test mode: WCDMA 1900

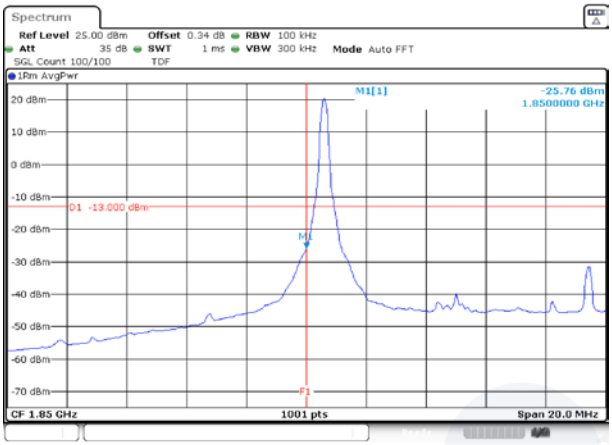
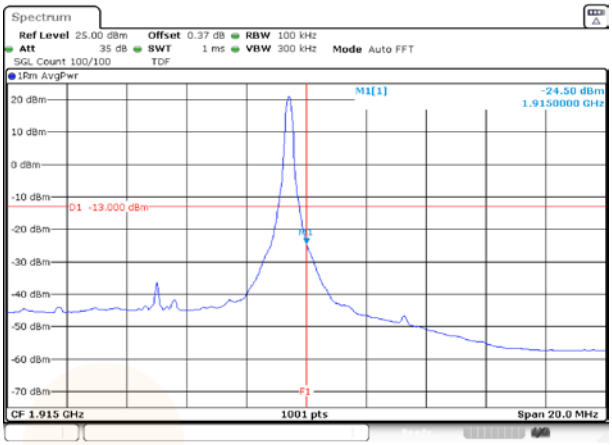
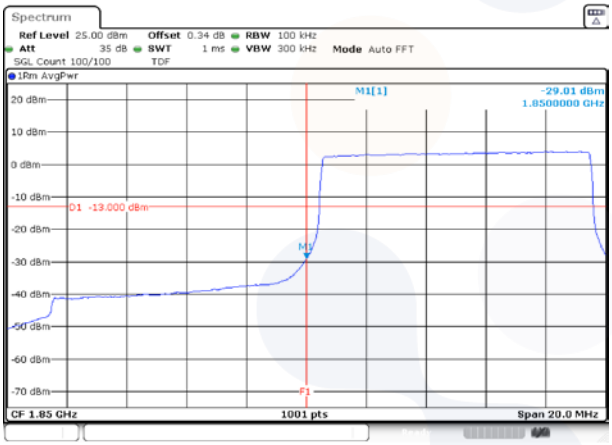
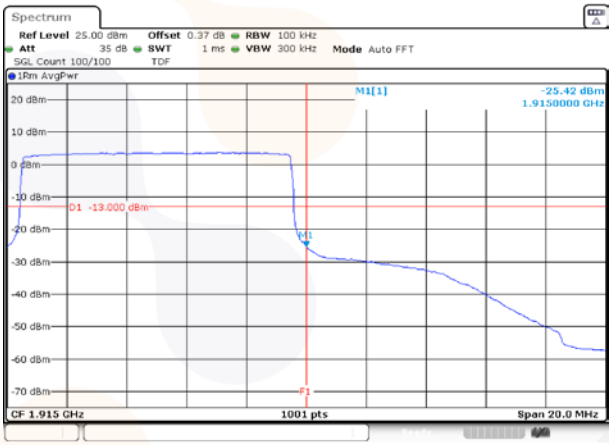
RMC	
Low channel	**High channel**
	

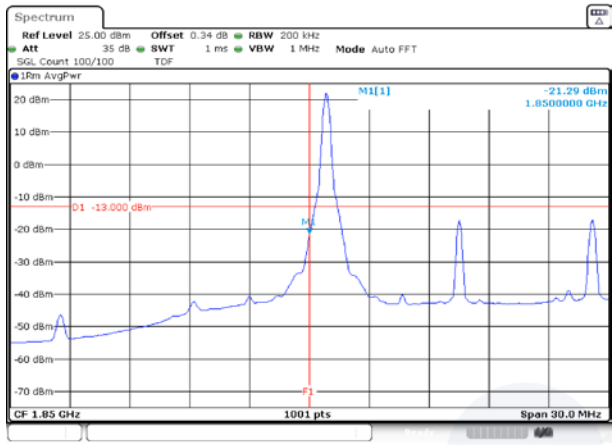
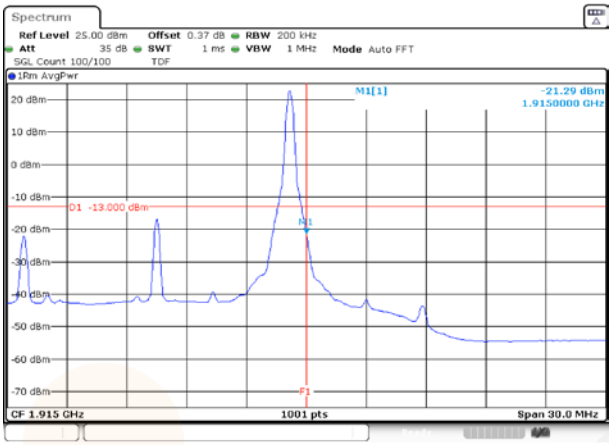
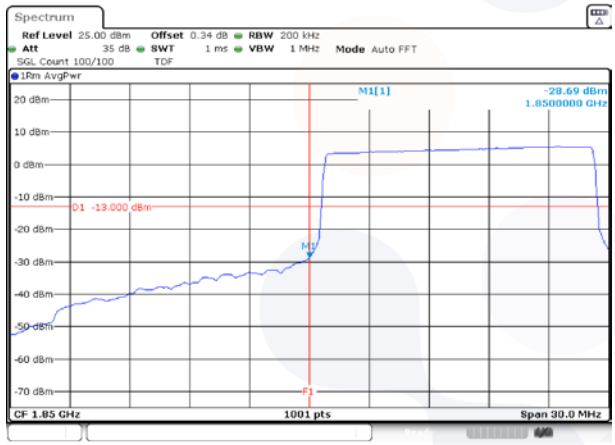
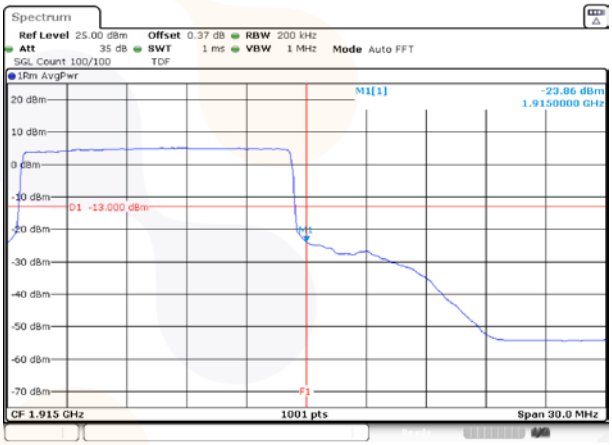
Test mode: LTE B25/2

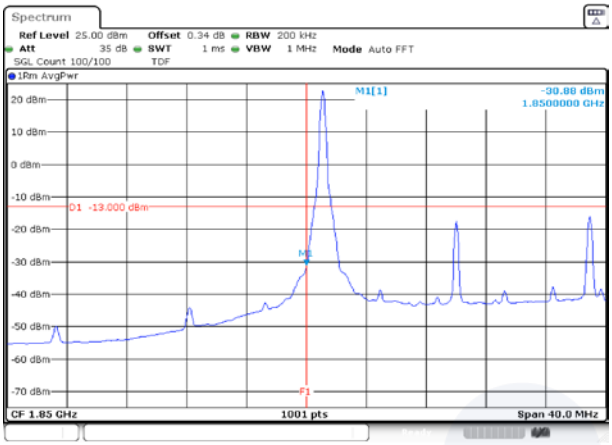
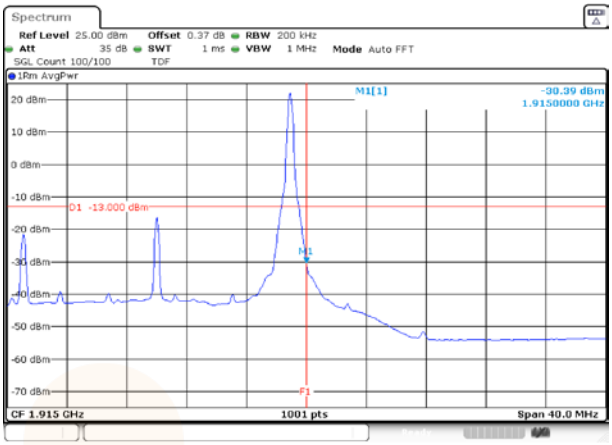
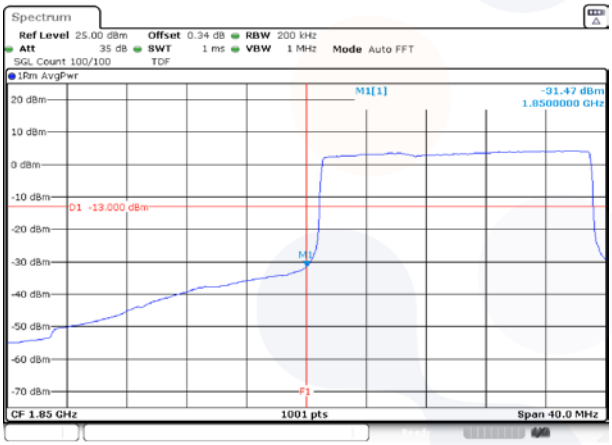
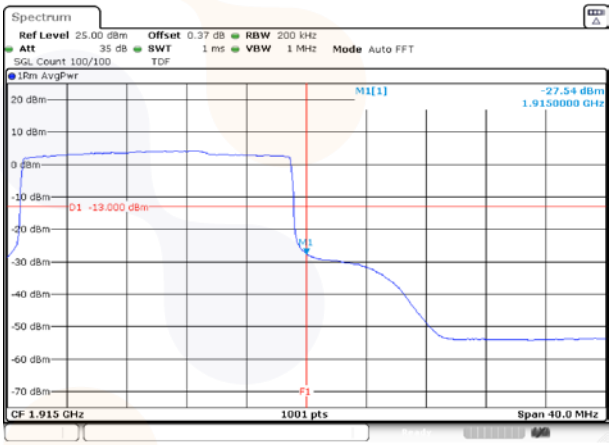
1.4M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

3M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

5M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

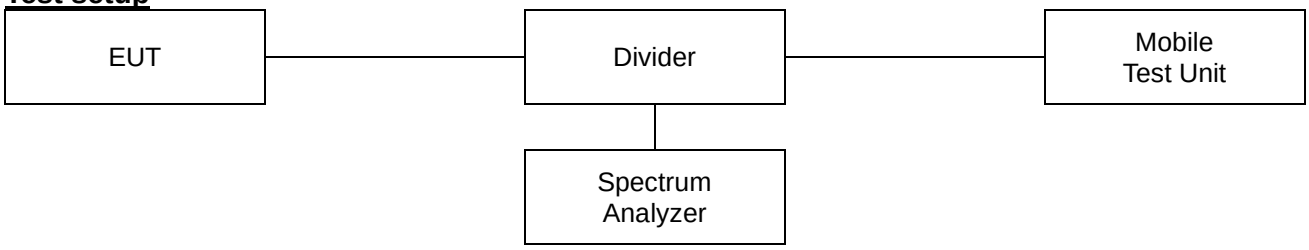
10M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

15M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

20M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

7.4. Spurious Emissions at Antenna Terminal

Test setup



Limit

According to §24.238(a),

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) ㏈.

Test procedure

971168 D01 v03r01 - Section 6
ANSI 63.26-2015 – Section 5.7

Test settings

1) Start frequency was set to 30 ㎒ and stop frequency was set to at least 10th the fundamental frequency.
2) Detector = RMS
3) Sweep time = auto couple.
4) Trace mode = trace average
5) Allow trace to fully stabilize.
6) Please see test notes below RBW and VBW settings.

Notes:

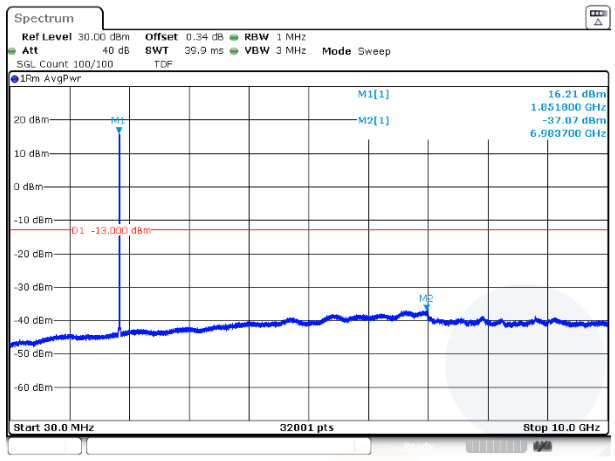
1. Per 24.238(b), compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and 1 ㎒ or greater for frequencies greater than 1 ㎓. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
2. All modes of operation were investigated and the worst-case configuration results are reported.

Test results

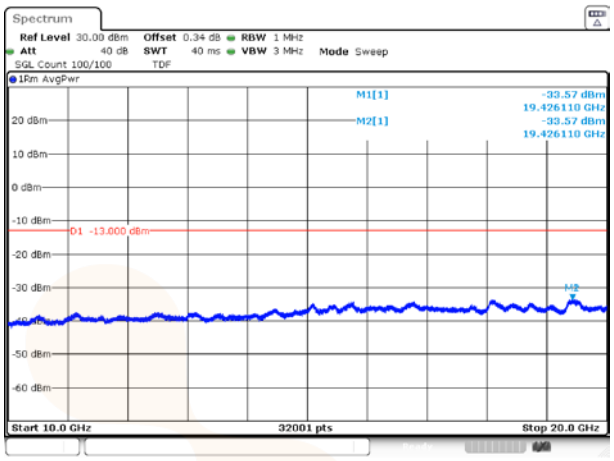
Test mode: WCDMA 1900

RMC

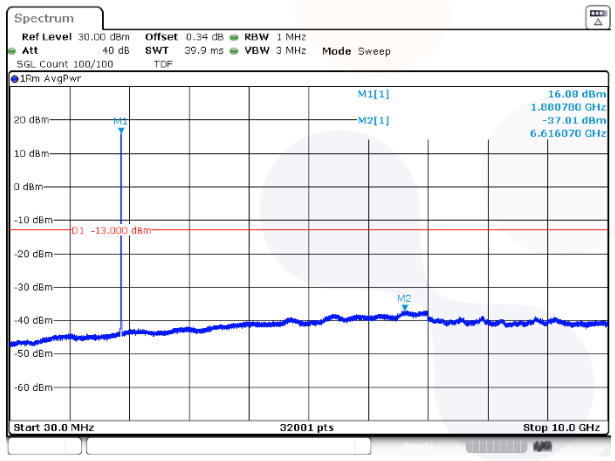
Low channel (30 ㎒ ~ 10 ㎓)



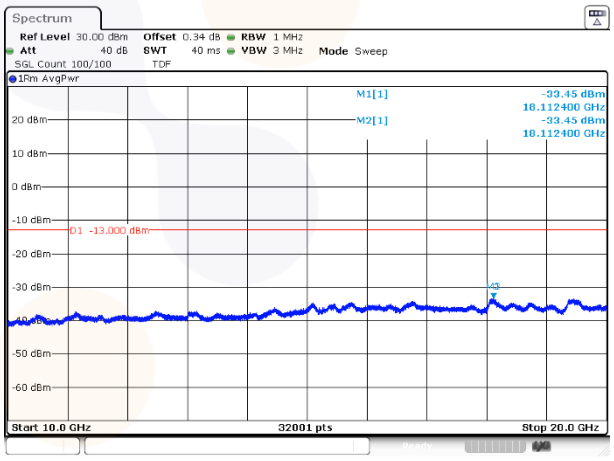
Low channel (10 ㎓ ~ 20 ㎓)



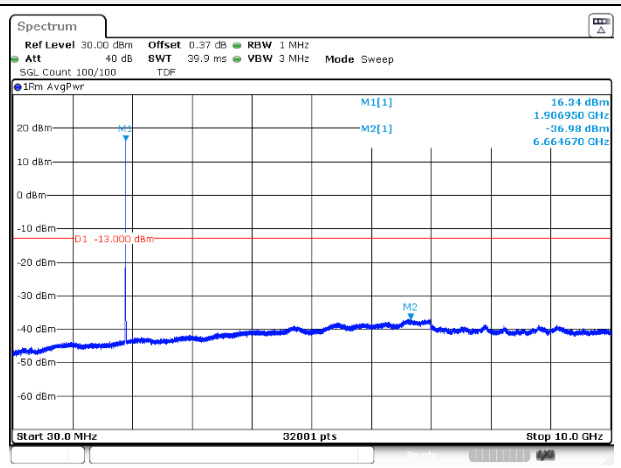
Middle channel (30 ㎒ ~ 10 ㎓)



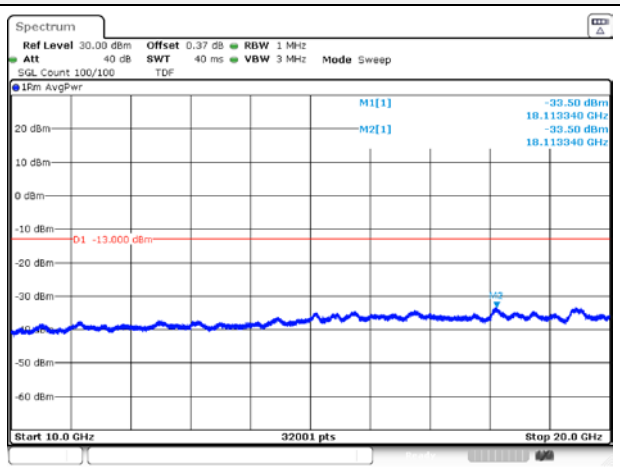
Middle channel (10 ㎓ ~ 20 ㎓)



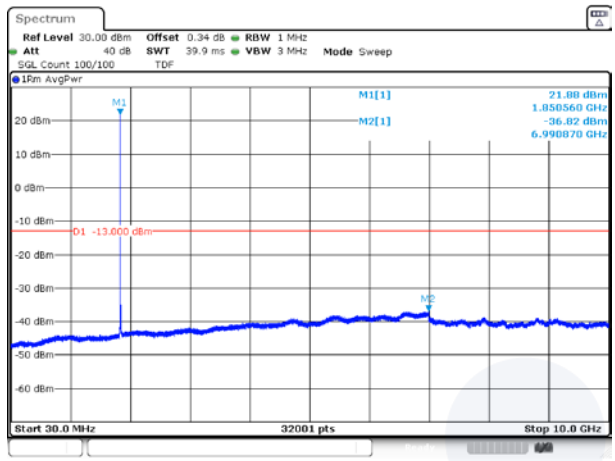
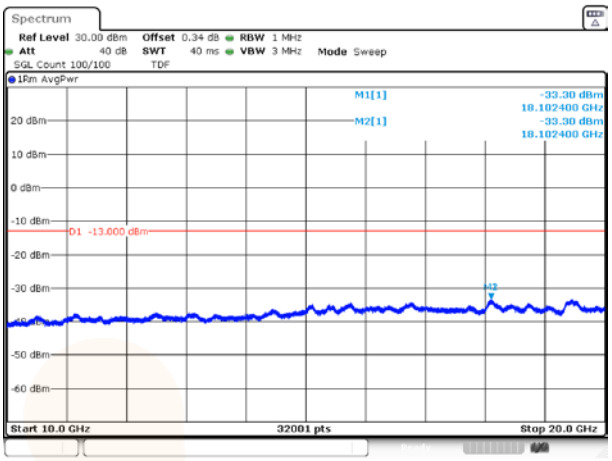
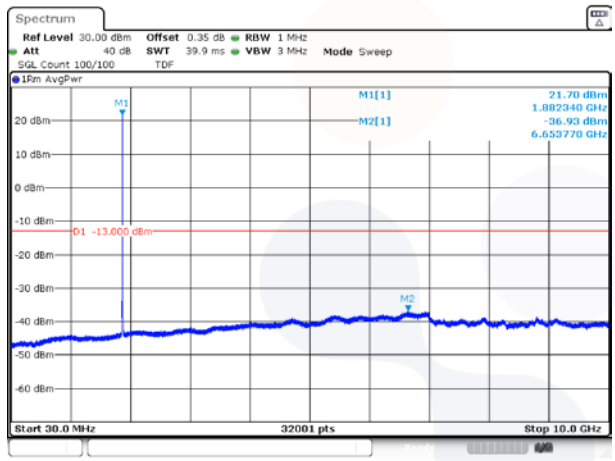
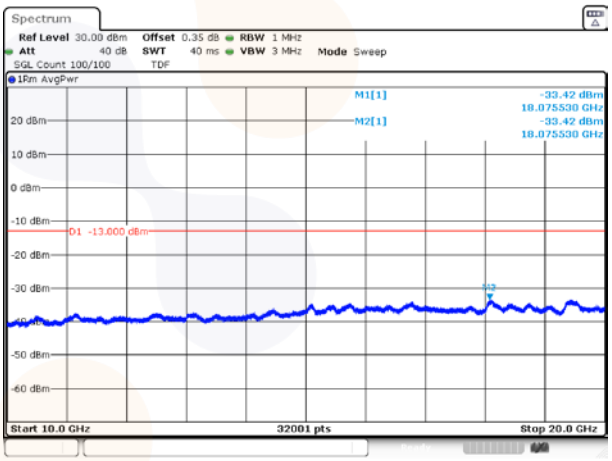
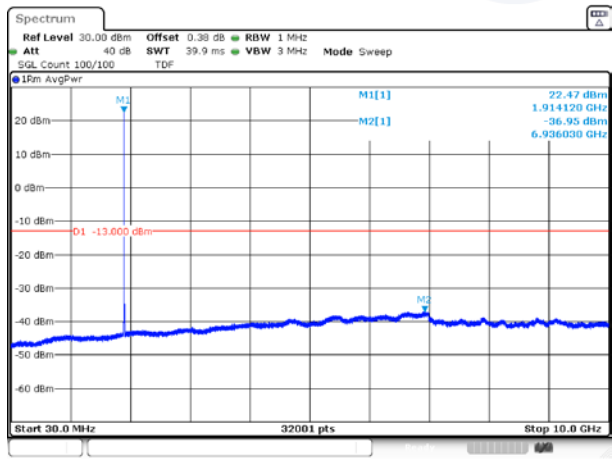
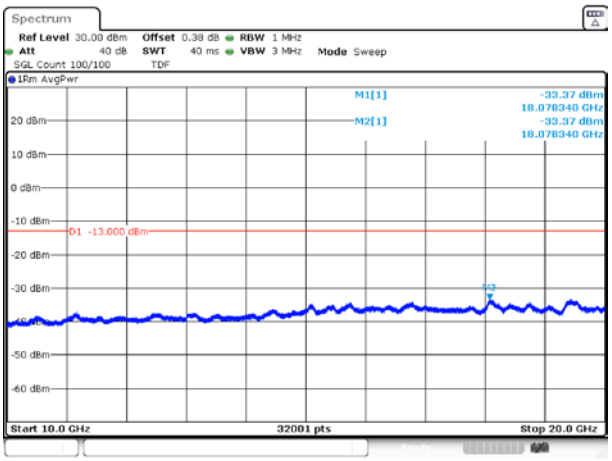
High channel (30 ㎒ ~ 10 ㎓)



High channel (10 ㎓ ~ 20 ㎓)

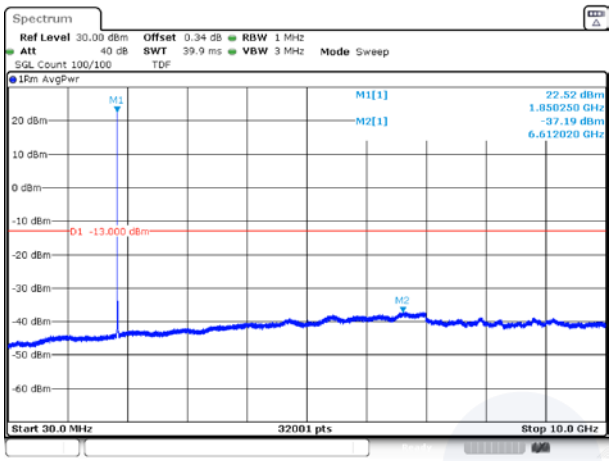


Test mode: LTE B25/2

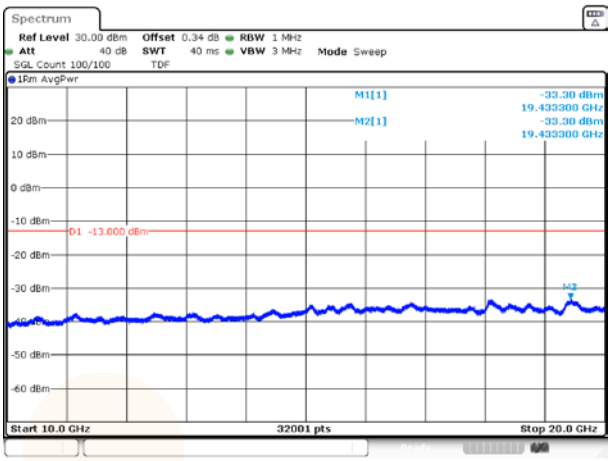
1.4M BW QPSK	
Low channel (30 ㎒ ~ 10 ㎓)	**Low channel (10 ㎓ ~ 20 ㎓)**
	
Middle channel (30 ㎒ ~ 10 ㎓)	**Middle channel (10 ㎓ ~ 20 ㎓)**
	
High channel (30 ㎒ ~ 10 ㎓)	**High channel (10 ㎓ ~ 20 ㎓)**
	

3M BW QPSK

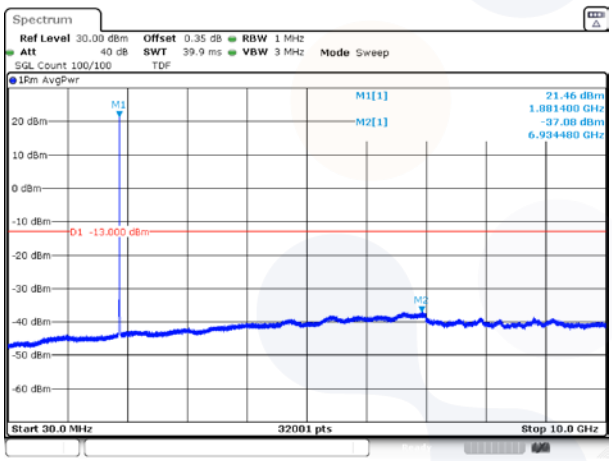
Low channel (30 ㎒ ~ 10 ㎓)



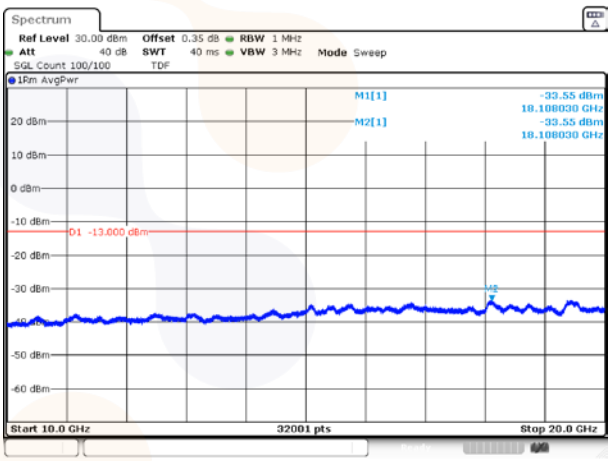
Low channel (10 ㎓ ~ 20 ㎓)



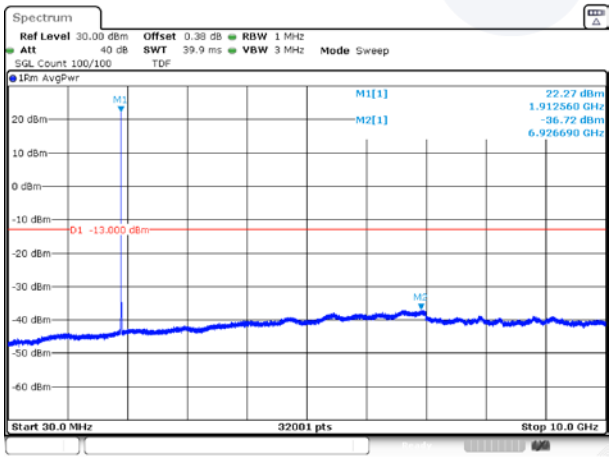
Middle channel (30 ㎒ ~ 10 ㎓)



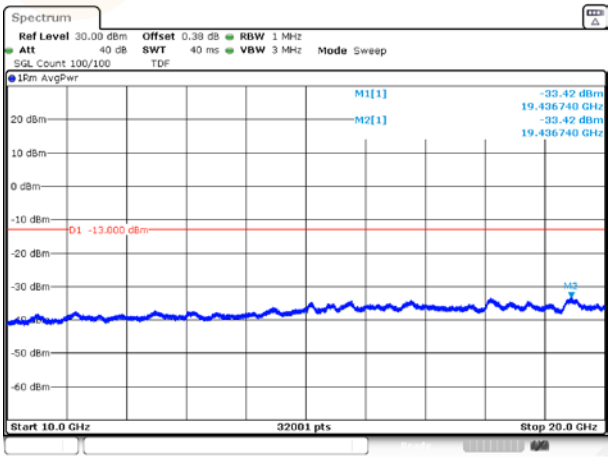
Middle channel (10 ㎓ ~ 20 ㎓)



High channel (30 ㎒ ~ 10 ㎓)

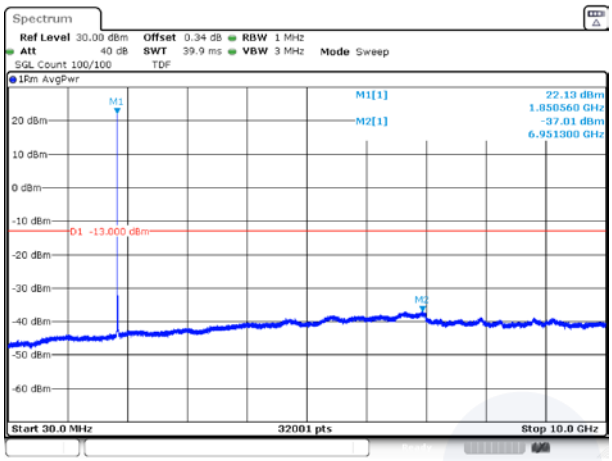


High channel (10 ㎓ ~ 20 ㎓)

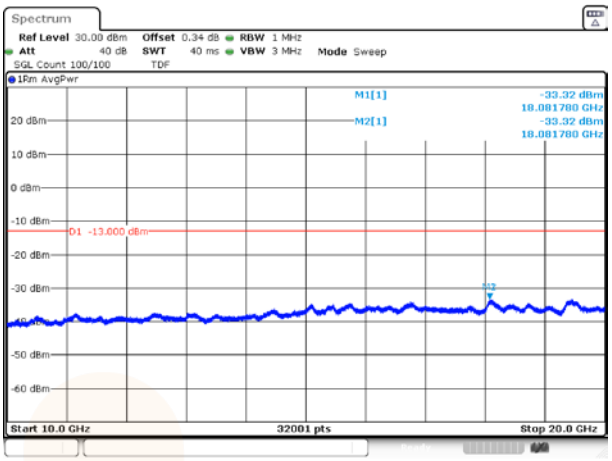


5M BW QPSK

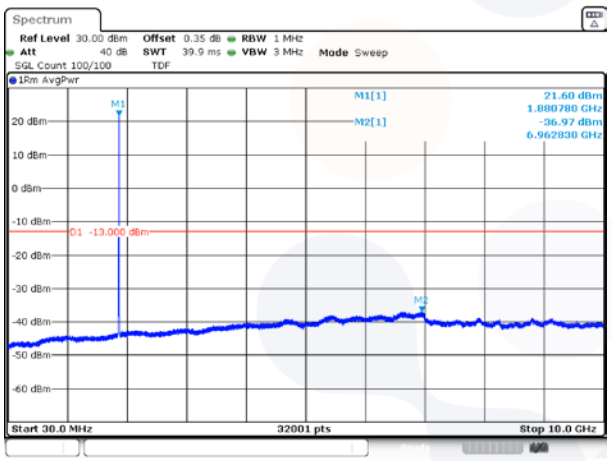
Low channel (30 ㎒ ~ 10 ㎓)



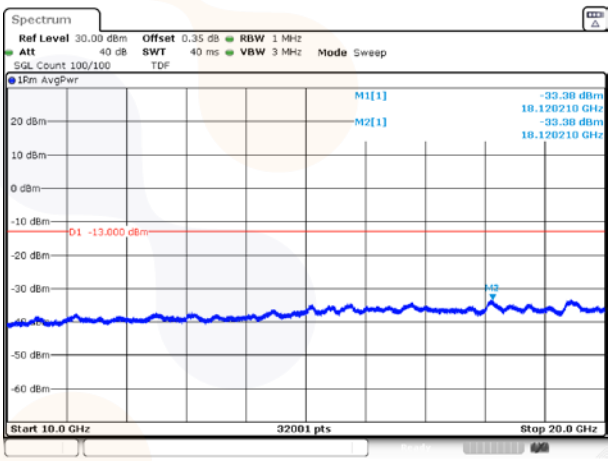
Low channel (10 ㎓ ~ 20 ㎓)



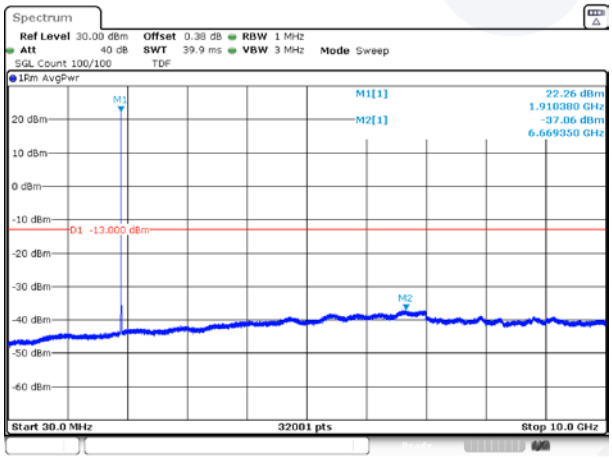
Middle channel (30 ㎒ ~ 10 ㎓)



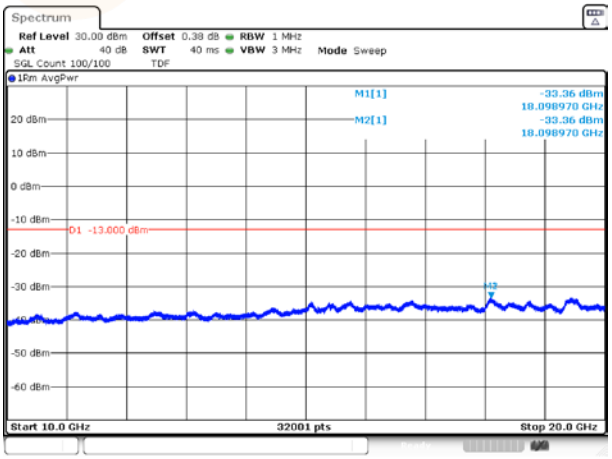
Middle channel (10 ㎓ ~ 20 ㎓)

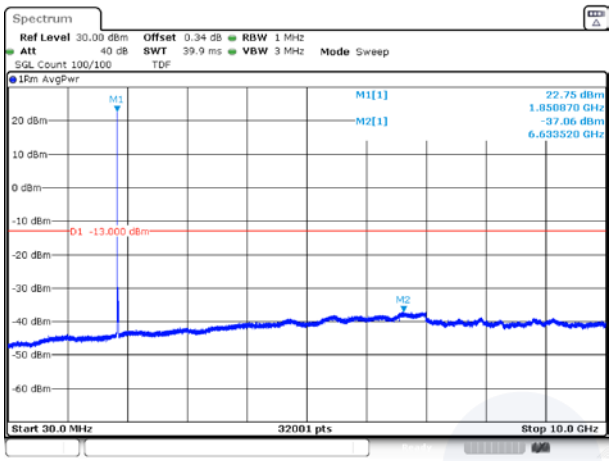
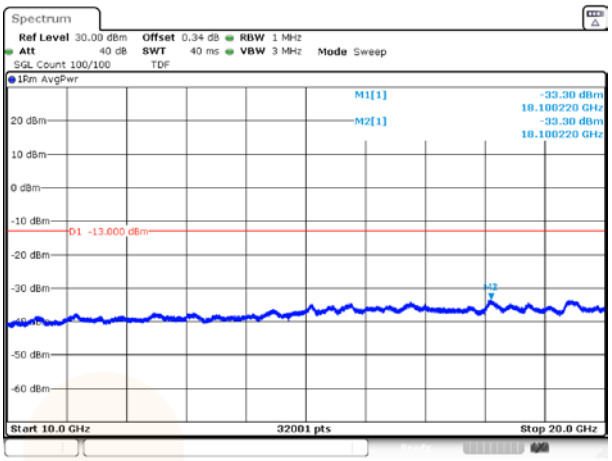
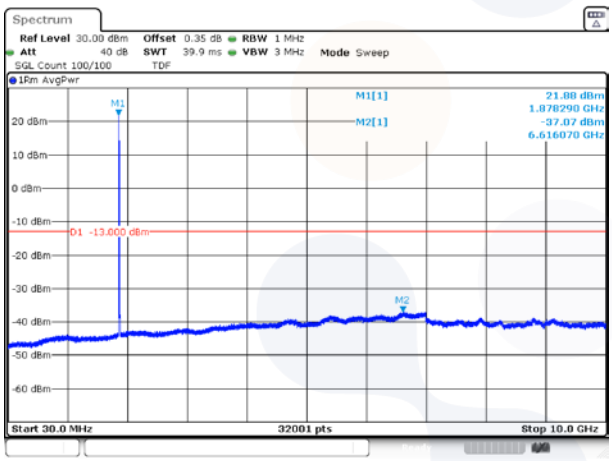
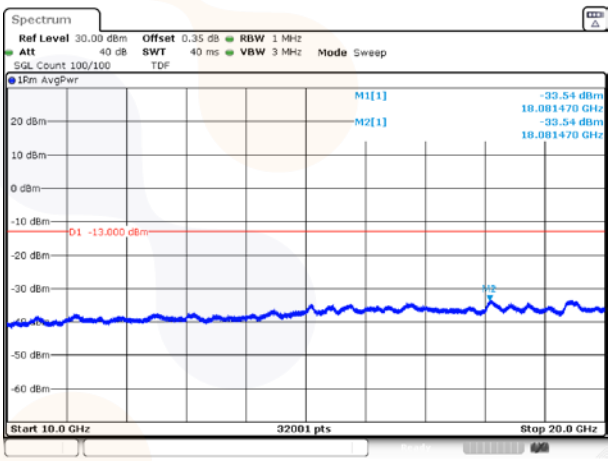


High channel (30 ㎒ ~ 10 ㎓)



High channel (10 ㎓ ~ 20 ㎓)



10M BW QPSK	
Low channel (30 ㎒ ~ 10 ㎓)	**Low channel (10 ㎓ ~ 20 ㎓)**
	
Middle channel (30 ㎒ ~ 10 ㎓)	**Middle channel (10 ㎓ ~ 20 ㎓)**
	
High channel (30 ㎒ ~ 10 ㎓)	**High channel (10 ㎓ ~ 20 ㎓)**