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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 : 2019-06-17

2. Use of Report : -

3. Name of Product and Model : Smart Wearable / SM-R835U

4. Manufacturer and Country of Origin : Samsung Electronics Co., Ltd. / Korea

5. FCC ID : A3LSMR835

6. Date of Test : 2019-06-27 to 2019-07-27

7. Test Standards : FCC Part 2
FCC Part 90 subpart S

8. Test Results : Refer to the test result in the test report

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

2019-08-08

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As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

Report revision history

Date	Revision	Page No
2019-07-29	Initial report	-
2019-08-08	Updated	5

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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
Laboratory	:	KCTL Inc.
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-3327, G-198, C-3706, T-1849
		Industry Canada Registration No. : 8035A
		KOLAS No.: KT231

2. Device information

Equipment under test	:	Smart Wearable
Model	:	SM-R835U
Derivative model	:	SM-R835F
Frequency range	:	Bluetooth(BDR/EDR/BLE)_2 402 ㎒ ~ 2 480 ㎒
		WIFI(802.11b/g/n20)_2 412 ㎒ ~ 2 472 ㎒
		LTE Band 12_699.7 ㎒ ~ 715.3 ㎒
		LTE Band 13_779.5 ㎒ ~ 784.5 ㎒
		LTE Band 5_824.7 ㎒ ~ 848.3 ㎒
		LTE Band 26_824.7 ㎒ ~ 848.3 ㎒, 814.7 ㎒ ~ 823.3 ㎒
		LTE Band 4_1 710.7 ㎒ ~ 1 754.3 ㎒
		LTE Band 66_1 710.7 ㎒ ~ 1 779.3 ㎒
		LTE Band 2_1 850.7 ㎒ ~ 1 909.3 ㎒
		LTE Band 25_1 850.7 ㎒ ~ 1 914.3 ㎒
		WCDMA 850_826.4 ㎒ ~ 846.6 ㎒
		WCDMA 1700_1 712.4 ㎒ ~ 1 752.6 ㎒
		WCDMA 1900_1 852.4 ㎒ ~ 1 907.6 ㎒
Modulation technique	:	Bluetooth(BDR/EDR)_ GFSK, π/4DQPSK, 8DPSK
		Bluetooth(BLE)_GFSK
		WIFI(802.11b/g/n20)_DSSS, OFDM
		LTE_QPSK, 16QAM
		WCDMA_QPSK
Number of channels	:	Bluetooth(BDR/EDR)_79 ch
		Bluetooth(BLE)_40 ch
		WIFI(802.11b/g/n20)_13 ch
Power source	:	DC 3.85 V

Antenna specification	:	LTE/WCDMA_PIFA (Housing metal) Antenna WIFI/Bluetooth(BDR/EDR/BLE)_LDS Antenna
Antenna gain	:	WIFI/Bluetooth(BDR/EDR/BLE) : -6.4 dBi
Software version	:	R835U.001
Hardware version	:	REV1.0
Test device serial No.	:	Conducted(R3AM6002T0W, R3AM600ZPAT), Radiated(R3AM600ZJNZ, R3AM600ZJPB, R3AM600ZJJF, R3AM600NE0B, R3AM600NEDH, R3AM600NEJZ, R3AM600NFWP) R3AM6002T0W)
Operation temperature	:	-30 ℃ ~ 50 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source	FCC ID & IC
Wireless charger	Samsung Electronics Co., Ltd.	EP-OR825	-	DC 5.0 V, 1.0 A	A3LEPOR825 / 649E-EPOR825

2.2. Information about derivative model

The difference between basic model and derivative models is:

Hardware is identical with the basic model and software is as follows.

a. For the model SM-R835U:
- 3G(B2,B4,B5), 4G(B2,B4,B5,B12,B13,B25,B26,B66) are enabled by software.

b. For the model SM-R835F:
- 3G(B2,B4), 4G(B2,B4,B12,B13,B25,B26,B66) are disabled by software.
- 3G(B1,B8), 4G(B1,B3,B7,B8,B20) are enabled by software.

c. In USA, 4G(B7) disabled by MCC code. Because device doesn't support B7 roaming in USA.

d. All other protocol part is same and all other features of Volte, SUPL is same.

2.3. Frequency/channel operations

This device contains the following capabilities:
Bluetooth(BDR/EDR/BLE), WIFI(802.11b/g/n20), NFC
LTE Band 12, LTE Band 13, LTE Band 5, LTE Band 26, LTE Band 4, LTE Band 66, LTE Band 2
LTE Band 25, WCDMA 850, WCDMA 1700, WCDMA 1900

LTE Band 26

Ch.	Frequency (MHz)
26697	814.7
-	-
26783	823.3

Table 2.3.1. 1.4M BW

Ch.	Frequency (MHz)
26705	815.5
-	-
26775	822.5

Table 2.3.2. 3M BW

Ch.	Frequency (MHz)
26715	816.5
-	-
26765	821.5

Table 2.3.3. 5M BW

Ch.	Frequency (MHz)
-	-
26740	819.0
-	-

Table 2.3.4. 10M BW

Ch.	Frequency (MHz)
-	-
26765	821.5
-	-

Table 2.3.5. 15M BW

3. Maximum ERP/EIRP power

LTE Band 26

Mode	Tx frequency (MHz)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 26	814.7 ~ 823.3	1M10G7D	9.48	0.009
		1M10W7D	7.40	0.005
	815.5 ~ 822.5	2M70G7D	8.08	0.006
		2M71W7D	6.70	0.005
	816.5 ~ 821.5	4M56G7D	8.18	0.007
		4M55W7D	7.05	0.005
	819.0	8M99G7D	8.00	0.006
		9M02W7D	6.81	0.005
	821.5	13M5G7D	8.19	0.007
		13M5W7D	6.83	0.005

4. Summary of tests

FCC Part section(s)	Parameter	Test results
2.1046 90.635	Conducted Output Power	Pass
2.1049	Occupied Bandwidth & 26 dB Bandwidth	Pass
2.1051 90.691(a)	Band Edge Emissions at Antenna Terminal	Pass
	Spurious Emissions at Antenna Terminal	Pass
24.232(d) 27.50(d)(5)	Peak to Average Power Ratio	Pass
2.1055 90.213	Frequency stability	Pass
90.635	Effective Radiated Power	Pass
2.1053 90.691(a)	Radiated Spurious Emissions	Pass

Notes:

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. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.
3. All the radiated tests have been performed two modes (with charger and without charger)
4. For ERP/EIRP tests, the LTE Band 26 was performed with charger for evaluation of worst case mode.
5. 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

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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	1.76 dB	
Conducted spurious emissions	4.03 dB	
Radiated spurious emissions	9 kHz ~ 30 MHz:	2.28 dB
	30 MHz ~ 1 GHz	3.68 dB
	Above 1 GHz	5.72 dB

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6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.
With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	6.20	11 000	8.82
50	6.29	12 000	8.83
100	6.36	13 000	8.58
200	6.47	14 000	8.91
300	6.67	15 000	9.08
400	6.85	16 000	9.10
500	7.02	17 000	9.13
600	7.11	18 000	9.15
700	7.15	19 000	9.35
800	7.26	20 000	9.46
900	7.38	21 000	9.50
1 000	7.79	22 000	9.49
2 000	8.36	23 000	9.68
3 000	8.46	24 000	9.93
4 000	8.45	25 000	10.12
5 000	8.47	26 000	11.03
6 000	8.54	26 500	11.58
7 000	8.60	27 000	11.95
8 000	8.61	28 000	12.12
9 000	8.70	29 000	12.39
10 000	8.76	30 000	13.05

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

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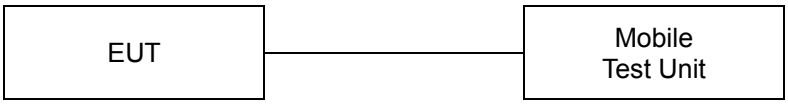
7. Test results

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.

Notes:

Offset(dB) = RF cable loss(dB)

Test results

Test Band	Bandwidth (㎒)	Test mode	RB size	RB offset	MPR	Maximum power Frequency (㎒) Low	Middle	High
LTE Band 26	1.4	QPSK	1	0	0	22.43	-	22.51
			1	3	0	22.38	-	22.37
			1	5	0	22.39	-	22.35
			3	0	0	22.33	-	22.39
			3	1	0	22.33	-	22.37
			3	3	0	22.35	-	22.40
			6	0	1	21.37	-	21.38
		16QAM	1	0	1	21.45	-	21.40
			1	3	1	21.42	-	21.35
			1	5	1	21.44	-	21.34
			3	0	1	21.45	-	21.41
			3	1	1	21.41	-	21.38
			3	3	1	21.38	-	21.36
			6	0	2	20.33	-	20.53
	3	QPSK	1	0	0	22.52	-	22.52
			1	8	0	22.43	-	22.50
			1	14	0	22.42	-	22.44
			8	0	1	21.40	-	21.34
			8	4	1	21.39	-	21.33
			8	7	1	21.39	-	21.34
			15	0	1	21.44	-	21.35
		16QAM	1	0	1	21.53	-	21.34
			1	8	1	21.34	-	21.30
			1	14	1	21.20	-	21.28
			8	0	2	20.31	-	20.38
			8	4	2	20.30	-	20.36
			8	7	2	20.26	-	20.33
			15	0	2	20.35	-	20.36
	5	QPSK	1	0	0	22.38	-	22.37
			1	12	0	22.37	-	22.30
			1	24	0	22.30	-	22.31
			12	0	1	21.44	-	21.32
			12	7	1	21.40	-	21.30
			12	13	1	21.37	-	21.29
			25	0	1	21.33	-	21.33
		16QAM	1	0	1	21.32	-	21.32
			1	12	1	21.22	-	21.22
			1	24	1	21.20	-	21.23
			12	0	2	20.25	-	20.31
			12	7	2	20.23	-	20.26
			12	13	2	20.25	-	20.23
			25	0	2	20.20	-	20.30
	10	QPSK	1	0	0	-	22.34	-
			1	25	0	-	22.33	-
			1	49	0	-	22.30	-
			25	0	1	-	21.35	-
			25	12	1	-	21.34	-
			25	25	1	-	21.35	-
			50	0	1	-	21.34	-
		16QAM	1	0	1	-	21.38	-
			1	25	1	-	21.21	-
			1	49	1	-	21.14	-
			25	0	2	-	20.52	-
			25	12	2	-	20.50	-
			25	25	2	-	20.44	-
			50	0	2	-	20.40	-
	15	QPSK	1	0	0	-	22.58	-
			1	36	0	-	22.50	-
			1	74	0	-	22.44	-
			36	0	1	-	21.49	-
			36	18	1	-	21.44	-
			36	37	1	-	21.42	-
			75	0	1	-	21.47	-
		16QAM	1	0	1	-	21.37	-
			1	36	1	-	21.35	-
			1	74	1	-	21.35	-
			36	0	2	-	20.57	-
			36	18	2	-	20.54	-
			36	37	2	-	20.51	-
			75	0	2	-	20.50	-

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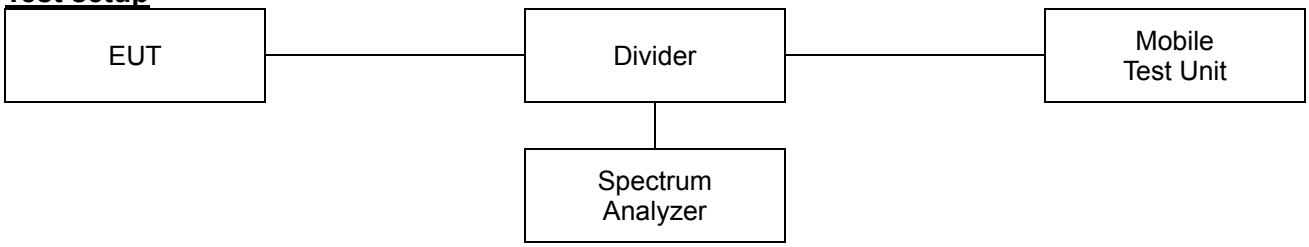
7.2. 99% Occupied Bandwidth & 26 dB Bandwidth

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

◆ 26dB Bandwidth

c) 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.

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

e) 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 dB below the target "−X dB" requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB 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 dB 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."

j) 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 as its lowest and highest channel with all bandwidth, Modulation.

Test results

Test Band	Bandwidth (㎒)	Frequency (㎒)	Test mode	26㏈ bandwidth (㎒)	99 % bandwidth (㎒)
LTE Band 26	1.4	814.7	QPSK	1.36	1.09
			16QAM	1.34	1.10
		823.3	QPSK	1.33	1.10
			16QAM	1.36	1.10
	3	815.5	QPSK	3.12	2.70
			16QAM	3.09	2.71
		822.5	QPSK	3.14	2.70
			16QAM	3.12	2.71
	5	816.5	QPSK	5.32	4.56
			16QAM	5.43	4.53
		821.5	QPSK	5.38	4.53
			16QAM	5.43	4.55
	10	819.0	QPSK	10.29	8.99
			16QAM	10.14	9.02
	15	821.5	QPSK	15.32	13.49
			16QAM	15.25	13.49

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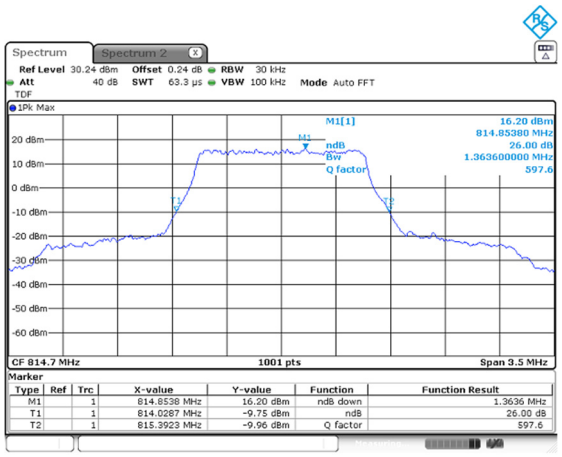
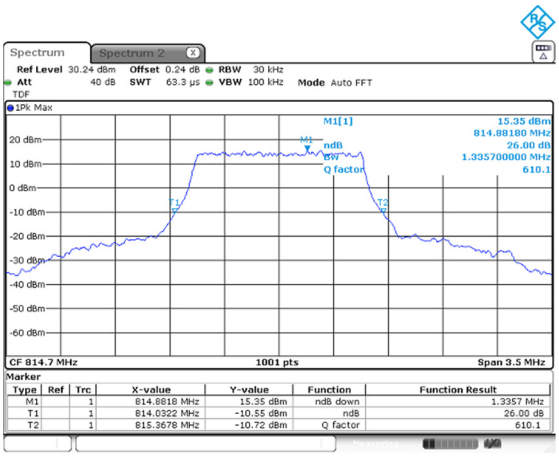
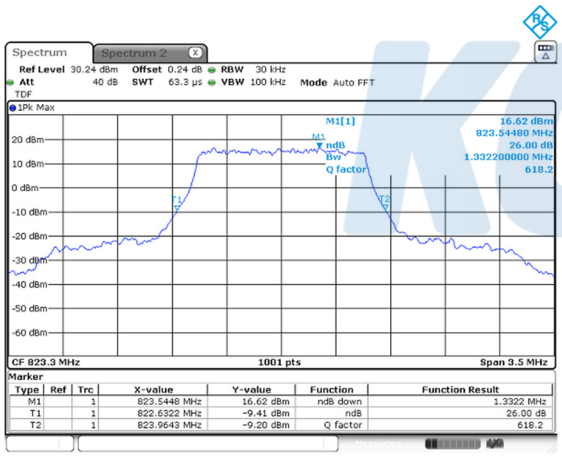
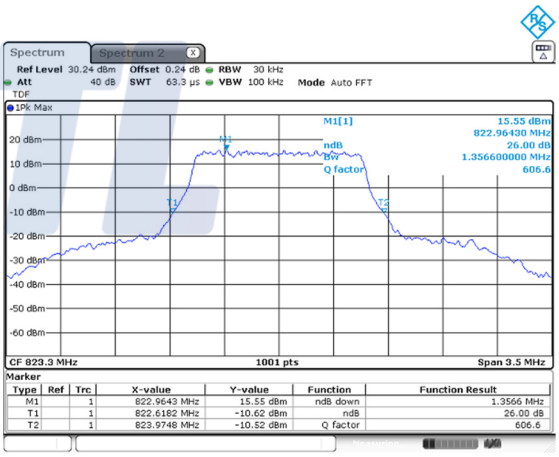
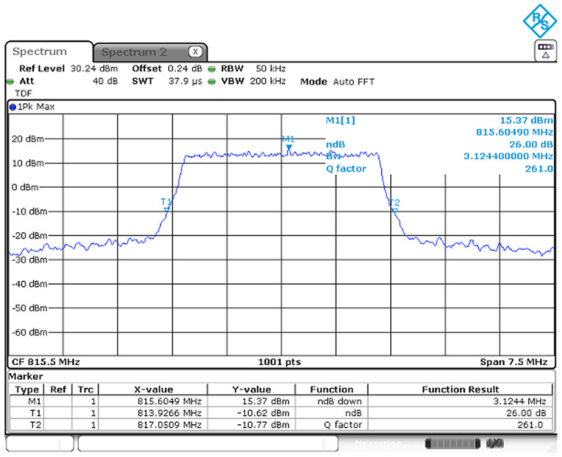
26dB Bandwidth

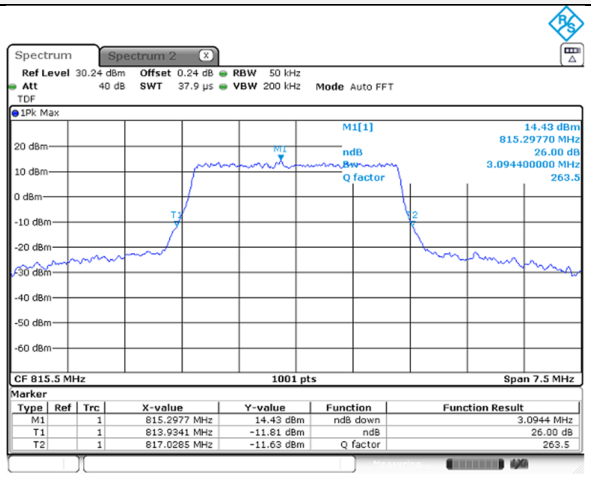
Test mode: LTE Band 26

1.4M BW / QPSK / Low ch.	1.4M BW / 16QAM / Low ch.
	
1.4M BW / QPSK / High ch.	**1.4M BW / 16QAM / High ch.**
	

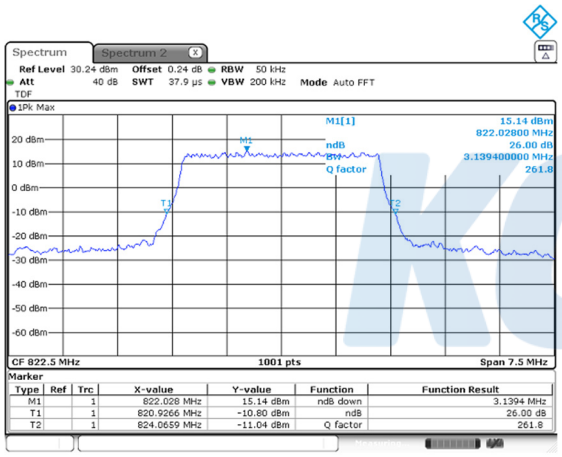
3M BW / QPSK / Low ch.



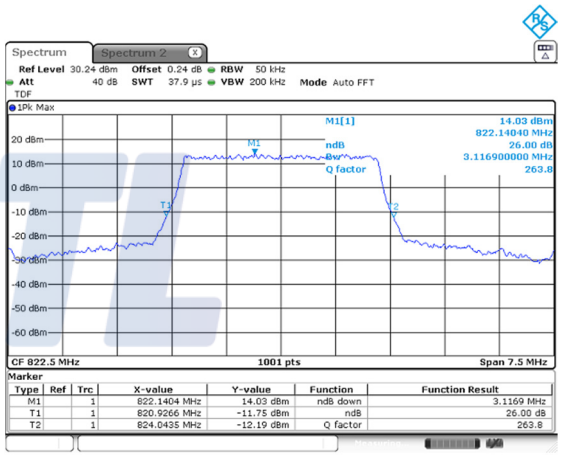
3M BW / 16QAM / Low ch.



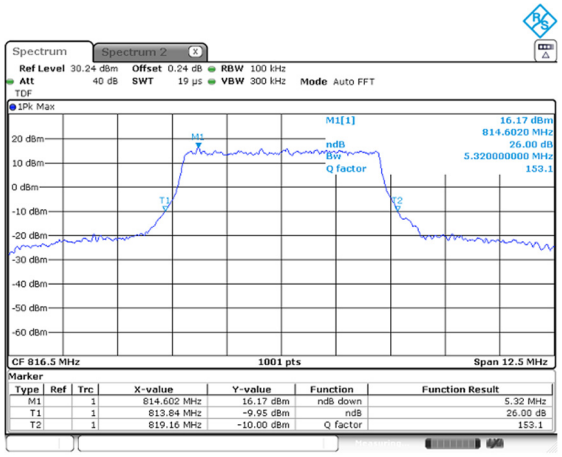
3M BW / QPSK / High ch.



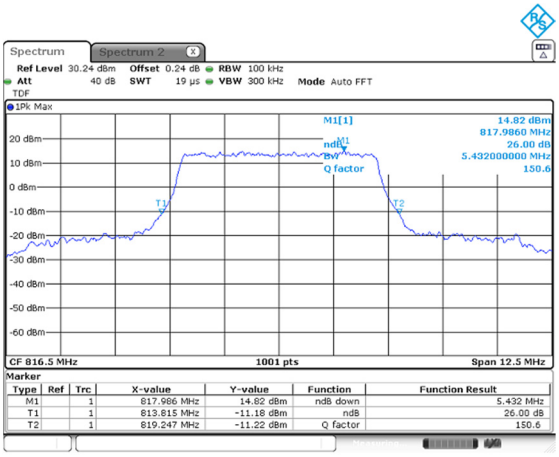
3M BW / 16QAM / High ch.



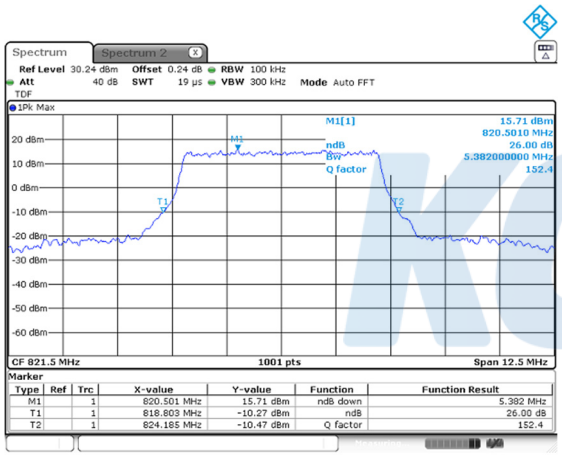
5M BW / QPSK / Low ch.



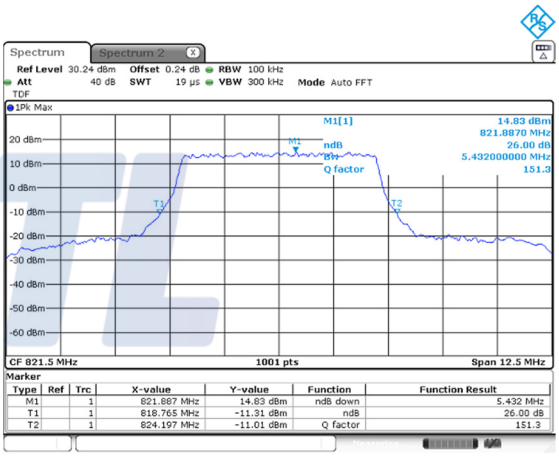
5M BW / 16QAM / Low ch.



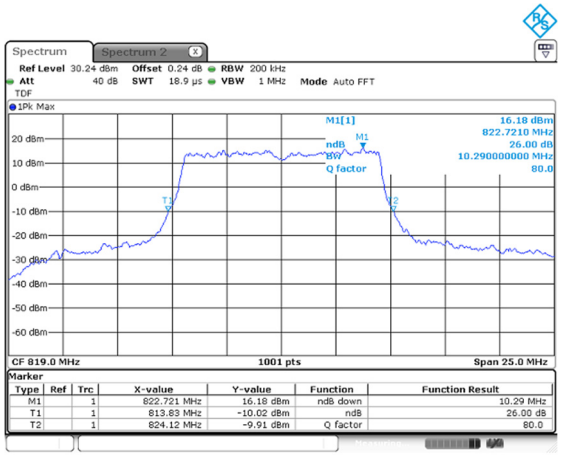
5M BW / QPSK / High ch.



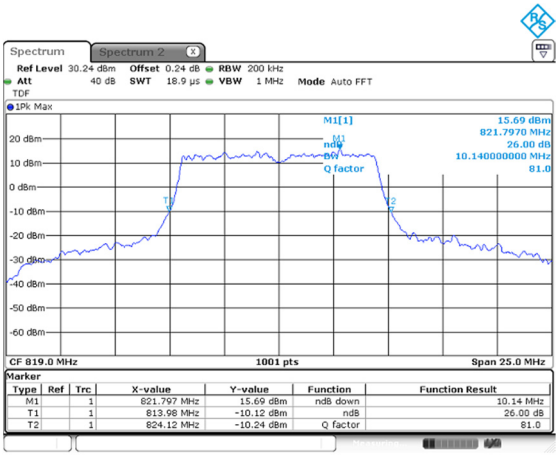
5M BW / 16QAM / High ch.



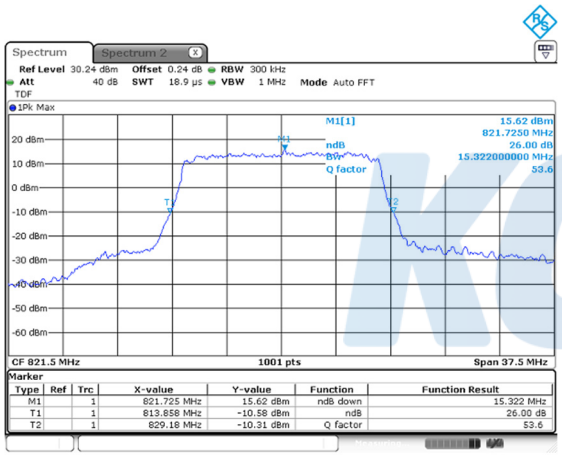
10M BW / QPSK / Mid ch.



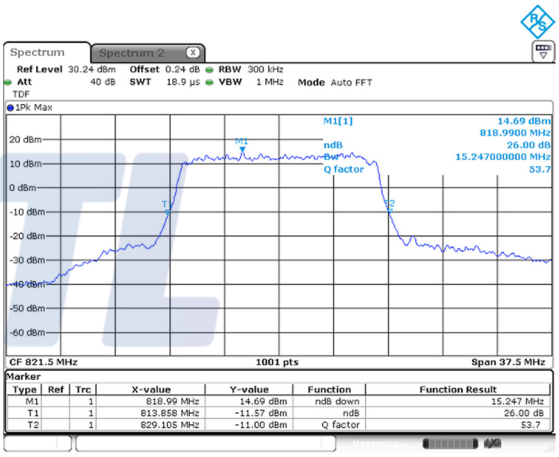
10M BW / 16QAM / Mid ch.



15M BW / QPSK / Mid ch.

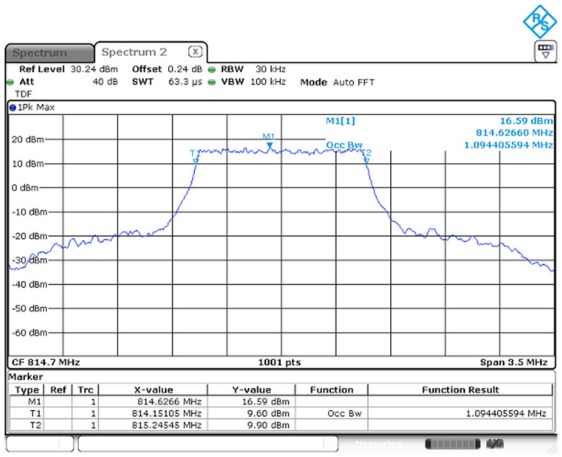
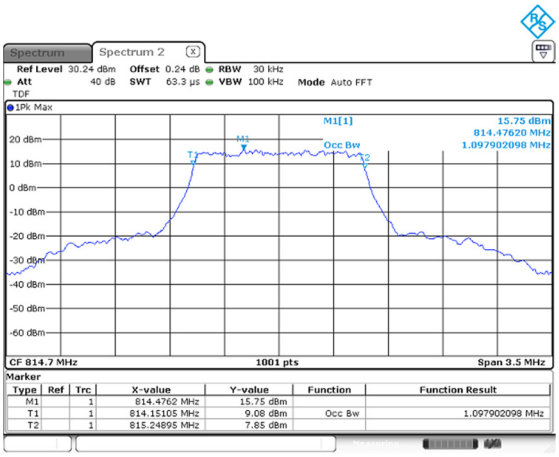
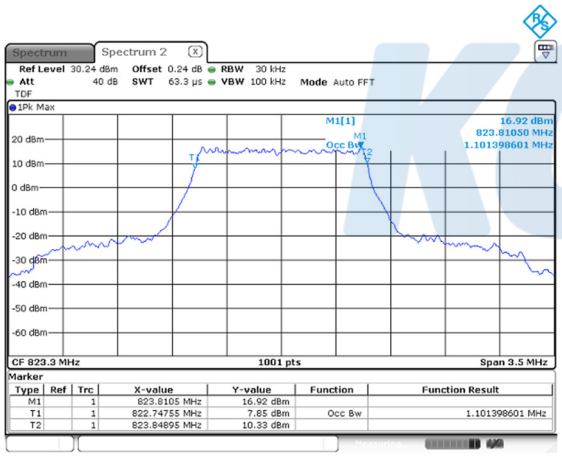
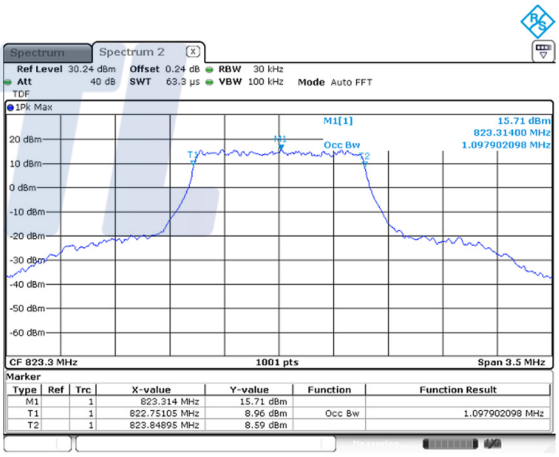


15M BW / 16QAM / Mid ch.

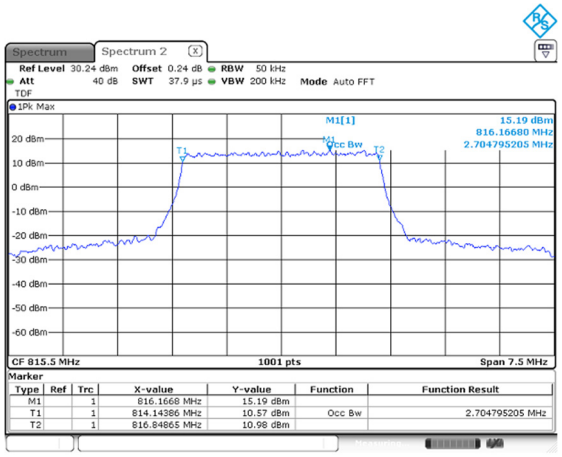


99% Occupied Bandwidth

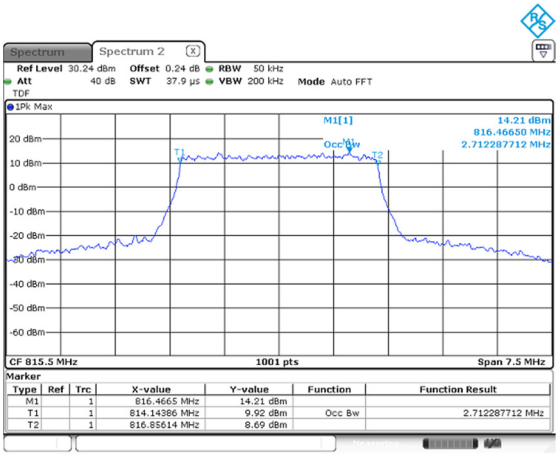
Test mode: LTE Band 26

1.4M BW / QPSK / Low ch.	1.4M BW / 16QAM / Low ch.
	
1.4M BW / QPSK / High ch.	**1.4M BW / 16QAM / High ch.**
	

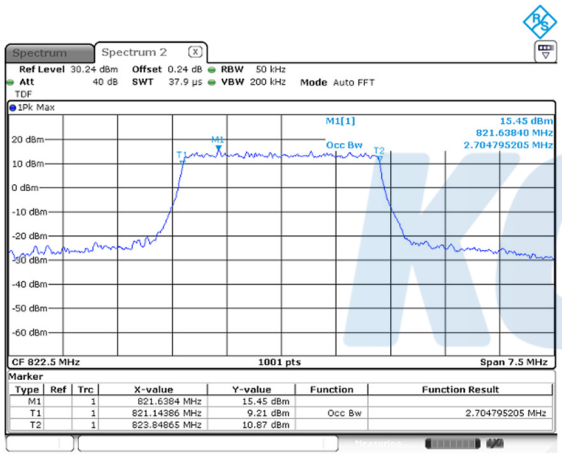
3M BW / QPSK / Low ch.



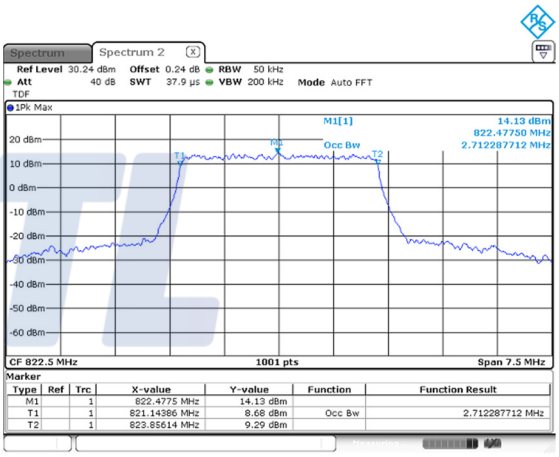
3M BW / 16QAM / Low ch.



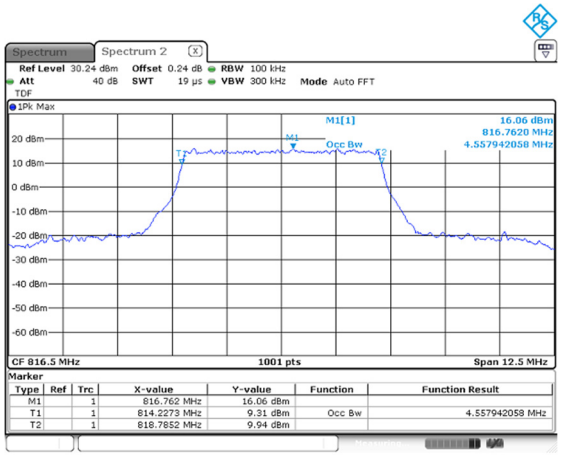
3M BW / QPSK / High ch.



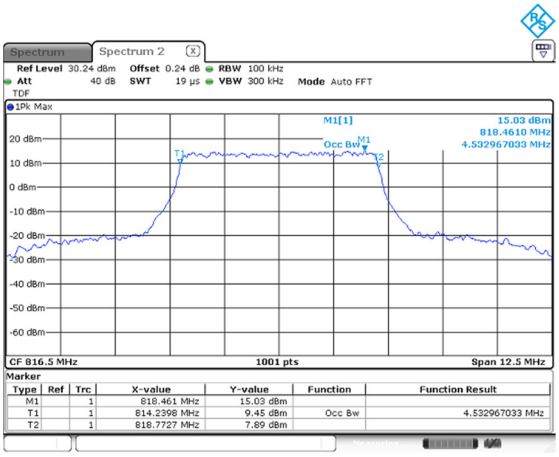
3M BW / 16QAM / High ch.



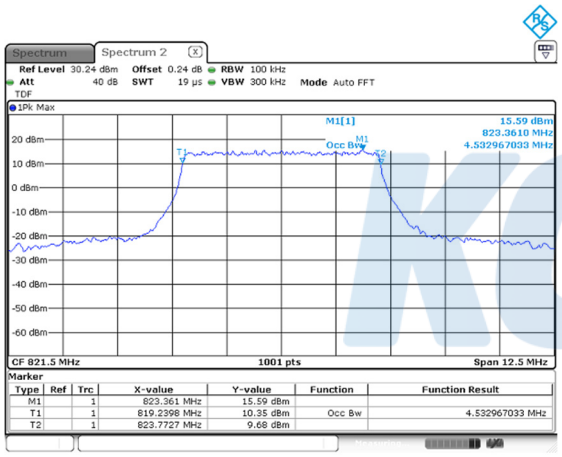
5M BW / QPSK / Low ch.



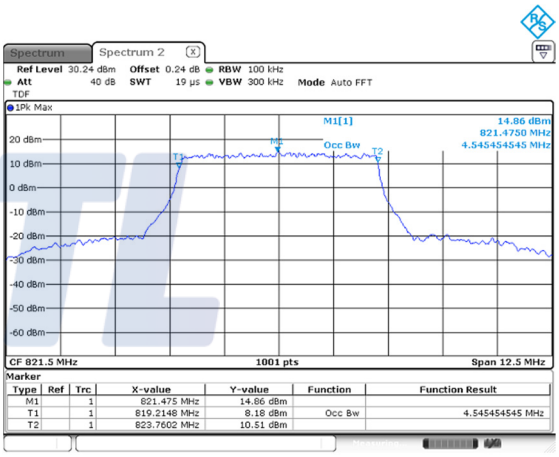
5M BW / 16QAM / Low ch.



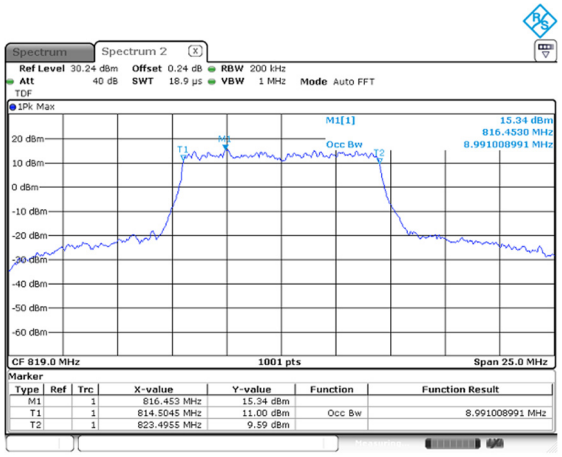
5M BW / QPSK / High ch.



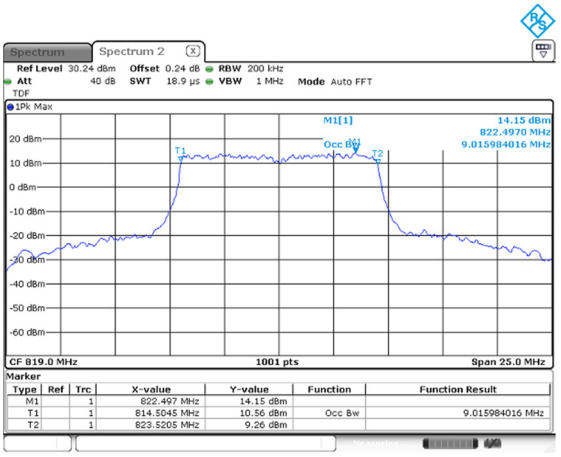
5M BW / 16QAM / High ch.



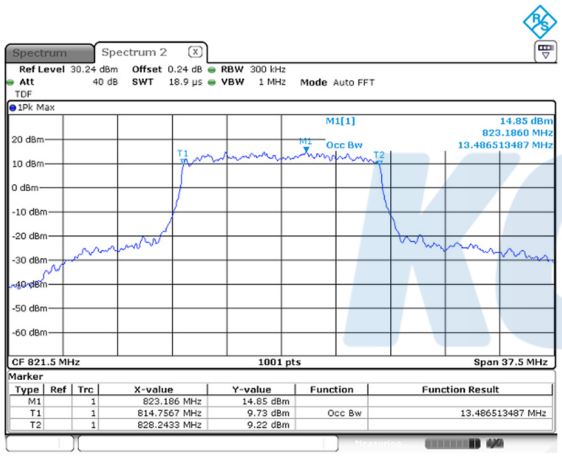
10M BW / QPSK / Mid ch.



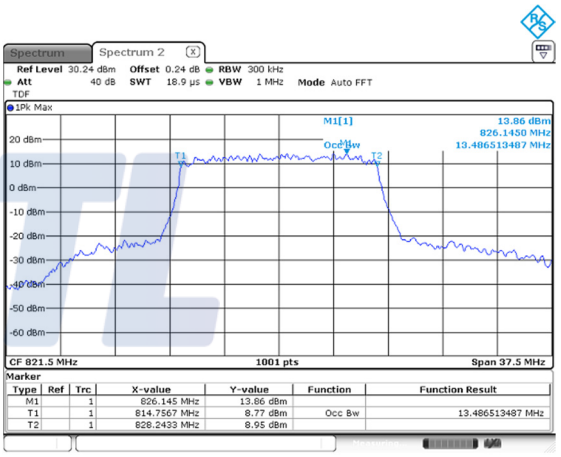
10M BW / 16QAM / Mid ch.



15M BW / QPSK / Mid ch.

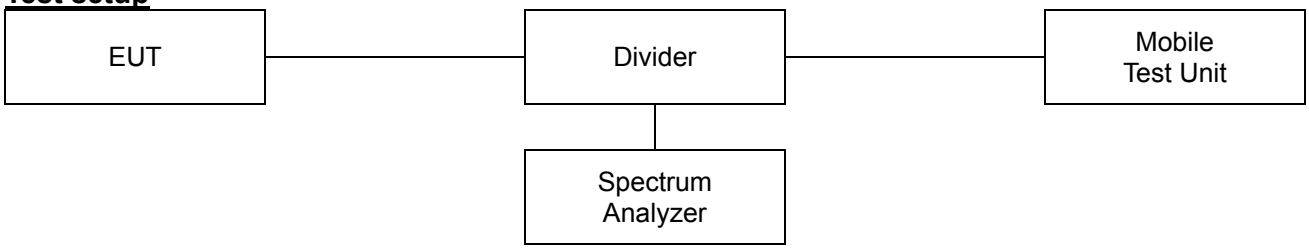


15M BW / 16QAM / Mid ch.



7.3. Spurious Emissions at Antenna Terminal

Test setup



Limit

According to §90.691(a), Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

Test procedure

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

Test settings

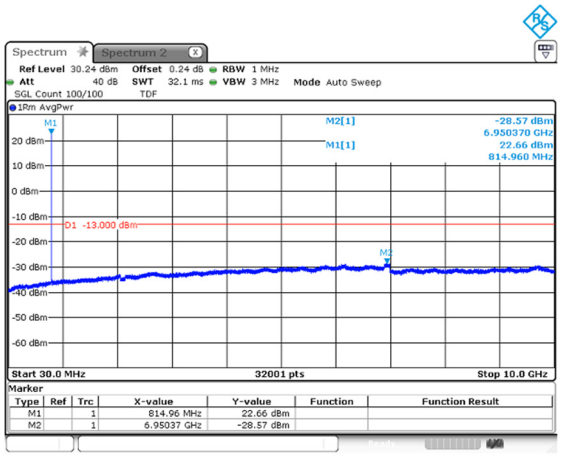
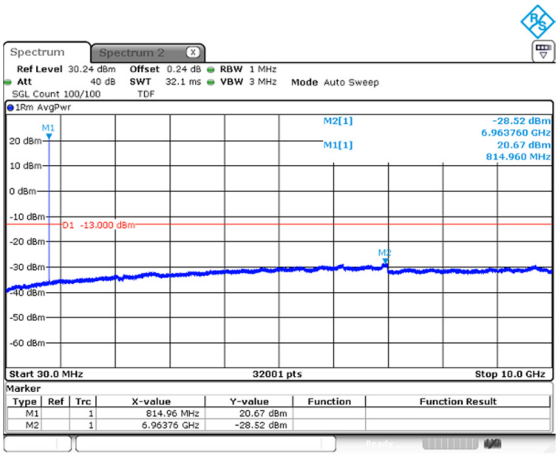
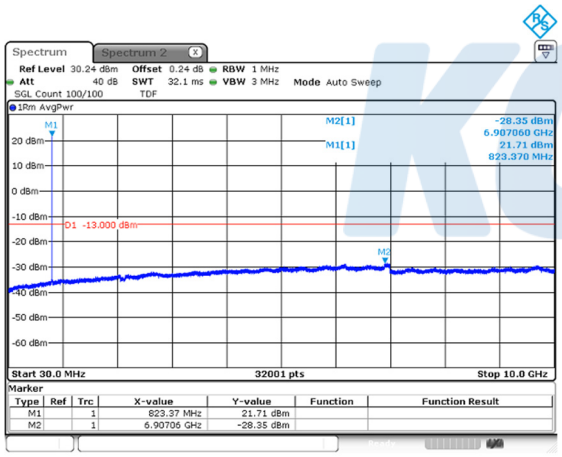
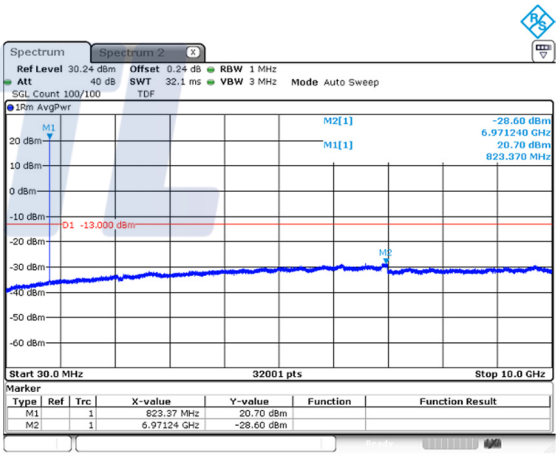
1) Start frequency was set to 30 ㎒ and stop frequency was set to at least 10th the fundamental frequency.
2) Detector = RMS
3) Sweep time = auto couple.
4) Trace mode = trace average
5) Allow trace to fully stabilize.
6) Please see test notes below RBW and VBW settings.

Notes:

1. 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.

Test results

Test mode: LTE Band 26

1.4M BW / QPSK / Low ch.	1.4M BW / 16QAM / Low ch.
	
1.4M BW / QPSK / High ch.	**1.4M BW / 16QAM / High ch.**