



TEST REPORT

<p>KCTL Inc. 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea TEL: 82-31-285-0894 FAX: 82-505-299-8311 www.kctl.co.kr</p>	<p>Report No.: KR20-SRF0115-A Page (1) of (103)</p>	
--	---	---

1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2020-03-26

2. Use of Report : Certification

3. Name of Product and Model : Mobile phone / SC-41A, SCV48

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

5. FCC ID : A3LSMA415JPN

6. Date of Test : 2020-03-27 to 2020-04-22

7. Test Standards : FCC Part 2
 FCC Part 22 Subpart H
 FCC Part 27 Subpart L

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

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

2020-05-04

KCTL Inc.

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
2020-04-29	Initial report	-
2020-05-04	Plot update	32

This report shall not be reproduced except in full, without the written approval of KCTL Inc. This document may be altered or revised by KCTL Inc. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KCTL Inc. will constitute fraud and shall nullify the document. This test report is a general report that does not use the KOLAS accreditation mark and is not related to KOLAS accreditation.

Note. The report No. KR20-SRF0115 is superseded by the report No. KR20-SRF0115-A.



CONTENTS

1.	General information	4
2.	Device information	4
2.1.	Accessory information	5
2.2.	Model Information	6
2.3.	Frequency/channel operations.....	6
3.	Maximum ERP/EIRP power.....	7
4.	Summary of tests.....	8
4.1.	Worst case orientation	9
5.	Measurement uncertainty	9
6.	Measurement results explanation example	10
7.	Test results	11
7.1.	Conducted output power.....	11
7.2.	99% Occupied Bandwidth & 26 dB Bandwidth.....	18
7.3.	Spurious Emissions at Antenna Terminal.....	47
7.4.	Band Edge Emissions at Antenna Terminal	60
7.5.	Peak to Average Power Ratio (PAPR)	82
7.6.	Frequency stability	87
7.7.	Radiated Power (ERP/EIRP)	92
7.8.	Radiated Spurious Emissions.....	98
8.	Measurement equipment.....	103

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

Page (4) of (103)

KCTL

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 : Samsung Electronics Vietnam Thai Nguyen Co., Ltd
Address : YEN BINH 1 INDUSTRIAL PARK, PHO YEN DISTRICT, THAI NGUYEN
PROVINCE THAI NGUYEN 23000
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-20080, G-20078, C-20059, T-20056
Industry Canada Registration No. : 8035A
KOLAS No.: KT231

2. Device information

Equipment under test : Mobile Phone
Model : SC-41A, SCV48
Difference in model name : Model SCV48 is electrically identical to model SC-41A. Two model numbers are allocated for marketing and logistic purposes only.
Modulation technique : Bluetooth(BDR/EDR)_GFSK, $\pi/4$ DQPSK, 8DPSK
Bluetooth(BLE)_GFSK
WIFI(802.11b/g/n20/n40/ac20/ac40/ac80)_DSSS, OFDM
NFC_ASK
LTE_QPSK, 16QAM, 64QAM
WCDMA_QPSK
GSM_GMSK, 8-PSK
Number of channels : Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch
802.11b/g/n_HT20 : 13 ch
UNII-1: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2A: 4 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
UNII-2C: 12 ch (20 MHz), 6 ch (40 MHz), 3 ch (80 MHz)
UNII-3: 5 ch (20 MHz), 2 ch (40 MHz), 1 ch (80 MHz)
Power source : DC 3.85 V
Antenna specification : LTE/GSM/WCDMA_LDS+METAL Antenna
WIFI/Bluetooth(BDR/EDR/BLE)_LDS+METAL Antenna
NFC_FPCB Antenna

Antenna gain : WIFI/Bluetooth(BDR/EDR/BLE) : -5.74 dBi
 UNII-1 -5.41 dBi
 UNII-2A -5.78 dBi
 UNII-2C -6.86 dBi
 UNII-3 -5.61 dBi

Frequency range : Bluetooth(BDR/EDR/BLE)_2 402 MHz ~ 2 480 MHz
 2 412 MHz ~ 2 472 MHz (802.11b/g/n_HT20)
 UNII-1: 5 180 MHz ~ 5 240 MHz (802.11a/n_HT20/ac_VHT20)
 UNII-1: 5 190 MHz ~ 5 230 MHz (802.11n_HT40/ac_VHT40)
 UNII-1: 5 210 MHz (802.11ac_VHT80)
 UNII-2A: 5 260 MHz ~ 5 320 MHz (802.11a/n_HT20/ac_VHT20)
 UNII-2A: 5 270 MHz ~ 5 310 MHz (802.11n_HT40/ac_VHT40)
 UNII-2A: 5 290 MHz (802.11ac_VHT80)
 UNII-2C: 5 500 MHz ~ 5 720 MHz (802.11a/n_HT20/ac_VHT20)
 UNII-2C: 5 510 MHz ~ 5 710 MHz (802.11n_HT40/ac_VHT40)
 UNII-2C: 5 530 MHz ~ 5 690 MHz (802.11ac_VHT80)
 UNII-3: 5 745 MHz ~ 5 825 MHz (802.11a/n_HT20/ac_VHT20)
 UNII-3: 5 755 MHz ~ 5 795 MHz (802.11n_HT40/ac_VHT40)
 UNII-3: 5 775 MHz (802.11ac_VHT80)
 LTE Band 5_824.7 MHz ~ 848.3 MHz
 LTE Band 12_699.7 MHz ~ 715.3 MHz
 LTE Band 41_2 498.5 MHz ~ 2 687.5 MHz
 GSM 850_824.2 MHz ~ 848.8 MHz
 GSM 1900_1 850.2 MHz ~ 1 909.8 MHz
 WCDMA 850_826.4 MHz ~ 846.6 MHz

Software version : SC-41A_A415D.001, SCV48_A415J.001

Hardware version : REV0.1

Test device serial No. : Conducted(R38N301XM3J, R38N301XM2M)
 Radiated(R38N301XMFK, R38N301XMBP, R38N301XMCA)

Operation temperature : -30 °C ~ 50 °C

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Earphone	Samsung Electronics Co., Ltd.	EHS61ASFBE	-	-

2.2. Model Information

The only difference between the SCV48 and SC-41A is:

1. H/W
-All part is same.
2. S/W
- Supported WCDMA, LTE FDD/TDD bands are different by Software.
 - * SC-41A
: 3G(B1,B5,B6,B19), 4G FDD(B1,B3,B5,B12,B19,B21), 4G TDD(B38,B39,B41)
 - * SCV48
: 3G(B1,B5), 4G FDD(B1,B3,B12,B18), 4G TDD(B41)
- Other part is same.

2.3. Frequency/channel operations

This device contains the following capabilities:

2.4GHz WIFI(802.11b/g/n(HT20)), 5GHz WIFI(802.11a/n(HT20/HT40)/ac(VHT20/VHT40/VHT80))

Bluetooth(BDR/EDR/BLE), NFC,

LTE Band 5, LTE Band 12, LTE Band 41, GSM 850, GSM 1900, WCDMA 850

LTE Band 5

Ch.	Frequency (MHz)
20407	824.7
20525	836.5
20643	848.3

Table 2.3.1. 1.4M BW

Ch.	Frequency (MHz)
20415	825.5
20525	836.5
20635	847.5

Table 2.3.2. 3M BW

Ch.	Frequency (MHz)
20425	826.5
20525	836.5
20625	846.5

Table 2.3.3. 5M BW

Ch.	Frequency (MHz)
20450	829.0
20525	836.5
20600	844.0

Table 2.3.4. 10M BW

LTE Band 12

Ch.	Frequency (MHz)
23017	699.7
23095	707.5
23173	715.3

Table 2.3.5. 1.4M BW

Ch.	Frequency (MHz)
23025	700.5
23095	707.5
23165	714.5

Table 2.3.6. 3M BW

Ch.	Frequency (MHz)
23035	701.5
23095	707.5
23155	713.5

Table 2.3.7. 5M BW

Ch.	Frequency (MHz)
23060	704.0
23095	707.5
23130	711.0

Table 2.3.8. 10M BW

LTE Band 41

Ch.	Frequency (MHz)
39675	2 498.5
40620	2 593.0
41565	2 687.5

Table 2.3.9. 5M BW

Ch.	Frequency (MHz)
39700	2 501.0
40620	2 593.0
41540	2 685.0

Table 2.3.10. 10M BW

Ch.	Frequency (MHz)
39725	2 503.5
40620	2 593.0
41515	2 682.5

Table 2.3.11. 15M BW

Ch.	Frequency (MHz)
39750	2 506.0
40620	2 593.0
41490	2 680.0

Table 2.3.12. 20M BW

3. Maximum ERP/EIRP power**LTE Band 5**

Mode	Tx frequency (MHz)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 5	824.7 ~ 848.3	1M10G7D	20.84	0.121
		1M09W7D	19.76	0.095
	825.5 ~ 847.5	2M69G7D	20.85	0.122
		2M69W7D	20.16	0.104
	826.5 ~ 846.5	4M52G7D	20.85	0.122
		4M52W7D	19.79	0.095
	829.0 ~ 844.0	8M97G7D	21.00	0.126
		8M99W7D	20.19	0.104

LTE Band 12

Mode	Tx frequency (MHz)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 12	699.7 ~ 715.3	1M10G7D	21.37	0.137
		1M10W7D	20.44	0.111
	700.5 ~ 714.5	2M69G7D	21.43	0.139
		2M69W7D	20.61	0.115
	701.5 ~ 713.5	4M53G7D	21.34	0.136
		4M53W7D	20.67	0.117
	704.0 ~ 711.0	9M04G7D	21.49	0.141
		9M02W7D	20.50	0.112

LTE Band 41

Mode	Tx frequency (MHz)	Emission designator	EIRP	
			Max. power (dBm)	Max. power (W)
LTE Band 41	2 498.5 ~ 2 687.5	4M51G7D	18.67	0.074
		4M52W7D	16.99	0.050
	2 501.0 ~ 2 685.0	8M99G7D	19.10	0.081
		9M02W7D	18.53	0.071
	2 503.5 ~ 2 682.5	13M5G7D	19.00	0.079
		13M5W7D	17.84	0.061
	2 506.0 ~ 2 680.0	18M0G7D	18.71	0.074
		18M0W7D	17.24	0.053

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	Band Edge Emissions at Antenna Terminal	<43 + 10Log ₁₀ (P) dB for all out of band emissions, Undesirable emissions must meet the limits detailed in 27.53(m).		Pass
22.917(a) 27.53(g) 27.53(m)(4)	Spurious Emissions at Antenna Terminal			Pass
27.50(d)(5)	Peak to Average Power Ratio	< 13 dB		Pass
2.1055 22.355	Frequency stability	< 2.5 ppm		Pass
27.54		Fundamental emissions stay within authorized frequency block.		
22.913(a)(5)	Effective Radiated Power	< 7 Watts max. ERP	Radiated	Pass
27.50(c)(10)		< 3 Watts max. ERP		Pass
27.50(h)(2)	Equivalent Isotropic Radiated Power	< 2 Watts max. EIRP		Pass
2.1053 22.917(a) 27.53(g)	Radiated Spurious Emissions	<43 + 10Log ₁₀ (P) dB for all out of band emissions.		Pass
27.53(m)(4)		Undesirable emissions must meet the limits detailed in 27.53(m).		

Notes:

- 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

- 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.
- Output power measurements were measured on QPSK, 16QAM and 64QAM modulation. All tests except output power was performed with QPSK and 16QAM modulation.
- All final radiated testing was performed with the EUT in worst case orientation and highest power.
- For LTE Band 5 and 12, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **Y** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Y** orientation.
- For LTE Band 41, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **Z** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Z** orientation.

Test condition	LTE Band	Modulation	Bandwidth (MHz)	RB size	RB offset
Radiated	B5	QPSK	10	1	0
	B12		10	1	0
	B41		15	1	0
Conducted	B5	QPSK 16QAM	1.4, 3, 5, 10	1	0, 5, 14, 24, 49
				Full	0
	B12		1.4, 3, 5, 10	1	0, 5, 14, 24, 49
				Full	0
	B41		5, 10, 15, 20	1	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 or 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 (\pm)	
Conducted RF power	1.23 dB	
Conducted spurious emissions	1.24 dB	
Radiated spurious emissions	30 MHz ~ 1 GHz	3.66 dB
	Above 1 GHz	3.32 dB

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 (MHz)	Factor(dB)	Frequency (MHz)	Factor(dB)
30	4.90	11 000	7.37
50	5.57	12 000	7.29
100	6.04	13 000	7.41
200	6.16	14 000	7.64
300	6.21	15 000	7.66
400	6.23	16 000	7.95
500	6.45	17 000	7.25
600	6.45	18 000	7.77
700	6.54	19 000	7.90
800	6.52	20 000	8.06
900	6.56	21 000	8.05
1 000	6.52	22 000	8.11
2 000	6.65	23 000	8.25
3 000	6.75	24 000	8.30
4 000	6.96	25 000	8.31
5 000	7.04	26 000	8.48
6 000	7.18	26 500	8.51
7 000	7.20	27 000	9.06
8 000	7.25	28 000	9.43
9 000	7.29	29 000	9.50
10 000	7.32	30 000	9.38

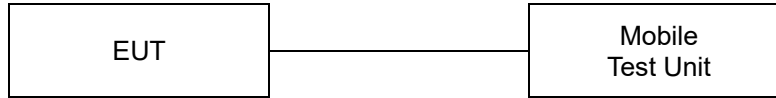
Note.

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

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 $\pm 2\%$) by performing the measurement over the on/off burst cycles and then correcting (increasing) the measured level by a factor equal to $[10\log (1/\text{duty cycle})]$. 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.

Test results

Test Band	Bandwidth (MHz)	Test mode	RB size	RB offset	MPR	Maximum power			
						Frequency (MHz)			
						Low	Middle	High	
LTE Band 5	1.4	QPSK	1	0	0	24.68	24.51	24.44	
			1	3	0	24.63	24.63	24.57	
			1	5	0	24.68	24.48	24.45	
			3	0	0	24.65	24.60	24.58	
			3	1	0	24.70	24.66	24.61	
			3	3	0	24.64	24.60	24.59	
		6	0	1	23.85	23.68	23.67		
		16QAM	1	0	1	23.97	23.85	23.72	
			1	3	1	24.00	23.88	23.92	
			1	5	1	23.88	23.87	23.72	
			3	0	1	23.75	23.60	23.56	
			3	1	1	23.88	23.69	23.69	
			3	3	1	23.79	23.67	23.50	
		6	0	2	22.92	22.81	22.74		
		64QAM	1	0	2	22.96	22.72	22.65	
			1	3	2	23.00	22.85	22.84	
			1	5	2	22.95	22.81	22.65	
			3	0	2	22.96	22.76	22.69	
	3		1	2	23.00	22.82	22.84		
	3		3	2	22.97	22.82	22.70		
	6	0	3	21.85	21.70	21.65			
	3	QPSK	1	0	0	24.70	24.53	24.49	
			1	8	0	24.63	24.54	24.52	
			1	14	0	24.67	24.53	24.47	
			8	0	1	23.81	23.63	23.59	
			8	4	1	23.83	23.66	23.66	
			8	7	1	23.82	23.64	23.58	
			15	0	1	23.83	23.66	23.67	
			16QAM	1	0	1	24.00	23.84	23.63
				1	8	1	24.00	23.86	23.79
		1		14	1	23.92	23.86	23.71	
		8		0	2	22.93	22.73	22.64	
		8		4	2	22.95	22.75	22.71	
		8		7	2	22.92	22.73	22.68	
		15	0	2	22.85	22.67	22.66		
		64QAM	1	0	2	22.98	22.75	22.67	
1			8	2	23.00	22.84	22.73		
1			14	2	22.93	22.75	22.79		
8			0	3	21.89	21.72	21.65		
8	4		3	21.95	21.76	21.71			
8	7		3	21.88	21.71	21.68			
15	0	3	21.82	21.65	21.67				

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

Page (13) of (103)



Test Band	Bandwidth (MHz)	Test mode	RB size	RB offset	MPR	Maximum power		
						Frequency (MHz)		
						Low	Middle	High
LTE Band 5	5	QPSK	1	0	0	24.59	24.39	24.33
			1	12	0	24.64	24.70	24.62
			1	24	0	24.53	24.40	24.37
			12	0	1	23.79	23.65	23.64
			12	7	1	23.90	23.70	23.67
			12	13	1	23.79	23.62	23.60
		25	0	1	23.83	23.67	23.66	
		16QAM	1	0	1	23.95	23.78	23.60
			1	12	1	23.95	23.97	23.86
			1	24	1	23.86	23.71	23.63
			12	0	2	22.80	22.68	22.62
			12	7	2	22.90	22.71	22.63
			12	13	2	22.82	22.63	22.58
		25	0	2	22.86	22.67	22.64	
		64QAM	1	0	2	22.90	22.70	22.59
			1	12	2	22.99	22.97	22.79
			1	24	2	22.82	22.67	22.65
			12	0	3	21.84	21.72	21.68
	12		7	3	21.91	21.74	21.69	
	12		13	3	21.82	21.68	21.65	
	25	0	3	21.84	21.66	21.65		
	10	QPSK	1	0	0	24.56	24.70	24.48
			1	25	0	24.65	24.68	24.59
			1	49	0	24.43	24.47	24.43
			25	0	1	23.69	23.81	23.62
			25	12	1	23.68	23.80	23.62
			25	25	1	23.67	23.75	23.57
		50	0	1	23.68	23.76	23.58	
		16QAM	1	0	1	23.78	23.96	23.66
			1	25	1	23.86	24.00	23.68
			1	49	1	23.77	23.80	23.64
			25	0	2	22.70	22.82	22.60
			25	12	2	22.69	22.81	22.58
			25	25	2	22.69	22.76	22.58
		50	0	2	22.72	22.78	22.61	
		64QAM	1	0	2	22.76	22.96	22.62
1			25	2	22.86	22.96	22.71	
1			49	2	22.60	22.69	22.55	
25			0	3	21.72	21.81	21.60	
25	12		3	21.70	21.83	21.60		
25	25		3	21.68	21.75	21.55		
50	0	3	21.70	21.77	21.56			

Test Band	Bandwidth (MHz)	Test mode	RB size	RB offset	MPR	Maximum power		
						Frequency (MHz)		
						Low	Middle	High
LTE Band 12	1.4	QPSK	1	0	0	24.75	24.46	24.20
			1	3	0	24.80	24.54	24.29
			1	5	0	24.74	24.40	24.17
			3	0	0	24.80	24.53	24.26
			3	1	0	24.74	24.61	24.33
			3	3	0	24.77	24.47	24.29
		16QAM	6	0	1	23.91	23.54	23.30
			1	0	1	23.92	23.59	23.37
			1	3	1	24.00	23.76	23.43
			1	5	1	23.96	23.62	23.42
			3	0	1	23.81	23.47	23.27
			3	1	1	23.90	23.59	23.22
		64QAM	3	3	1	23.79	23.49	23.32
			6	0	2	22.97	22.59	22.37
			1	0	2	22.95	22.59	22.31
			1	3	2	23.00	22.62	22.50
			1	5	2	22.93	22.58	22.38
			3	0	2	22.94	22.59	22.34
	3	QPSK	3	1	2	23.00	22.64	22.37
			3	3	2	22.92	22.58	22.39
			6	0	3	21.86	21.55	21.30
			1	0	0	24.80	24.56	24.52
			1	8	0	24.76	24.43	24.41
			1	14	0	24.70	24.38	24.37
		16QAM	8	0	1	23.84	23.52	23.52
			8	4	1	23.84	23.55	23.53
			8	7	1	23.79	23.49	23.45
			15	0	1	23.81	23.53	23.51
			1	0	1	24.00	23.72	23.74
			1	8	1	23.99	23.67	23.62
		64QAM	1	14	1	24.00	23.66	23.54
			8	0	2	22.90	22.57	22.56
			8	4	2	22.89	22.57	22.57
			8	7	2	22.85	22.50	22.51
			15	0	2	22.82	22.51	22.50
			1	0	2	22.91	22.67	22.72
64QAM	1	8	2	22.90	22.62	22.52		
	1	14	2	22.86	22.54	22.55		
	8	0	3	21.90	21.60	21.62		
	8	4	3	21.93	21.60	21.57		
	8	7	3	21.86	21.52	21.54		
	15	0	3	21.83	21.51	21.53		

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

Page (15) of (103)



Test Band	Bandwidth (MHz)	Test mode	RB size	RB offset	MPR	Maximum power		
						Frequency (MHz)		
						Low	Middle	High
LTE Band 12	5	QPSK	1	0	0	24.69	24.46	24.25
			1	12	0	24.79	24.61	24.38
			1	24	0	24.49	24.30	24.12
			12	0	1	23.80	23.56	23.38
			12	7	1	23.82	23.55	23.36
			12	13	1	23.67	23.42	23.24
		25	0	1	23.77	23.49	23.30	
		16QAM	1	0	1	23.97	23.64	23.44
			1	12	1	24.00	23.81	23.63
			1	24	1	23.73	23.54	23.35
			12	0	2	22.75	22.56	22.36
			12	7	2	22.78	22.53	22.31
			12	13	2	22.66	22.40	22.20
		25	0	2	22.72	22.50	22.28	
		64QAM	1	0	2	22.88	22.68	22.42
			1	12	2	23.00	22.85	22.63
			1	24	2	22.66	22.47	22.28
			12	0	3	21.84	21.59	21.40
	12		7	3	21.87	21.60	21.37	
	12		13	3	21.72	21.47	21.26	
	25	0	3	21.78	21.51	21.33		
	10	QPSK	1	0	0	24.64	24.80	24.54
			1	25	0	24.55	24.72	24.43
			1	49	0	24.32	24.38	24.20
			25	0	1	23.62	23.80	23.57
			25	12	1	23.59	23.73	23.47
			25	25	1	23.47	23.64	23.33
		50	0	1	23.54	23.75	23.48	
		16QAM	1	0	1	23.94	24.00	23.77
			1	25	1	23.79	23.98	23.58
			1	49	1	23.46	23.62	23.35
			25	0	2	22.62	22.81	22.54
			25	12	2	22.54	22.71	22.45
			25	25	2	22.44	22.63	22.33
		50	0	2	22.51	22.72	22.45	
		64QAM	1	0	2	22.84	23.00	22.70
1			25	2	22.69	22.89	22.62	
1			49	2	22.47	22.59	22.38	
25			0	3	21.63	21.87	21.56	
25	12		3	21.59	21.76	21.50		
25	25		3	21.47	21.66	21.36		
50	0	3	21.53	21.76	21.49			

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

Page (16) of (103)



Test Band	Bandwidth (MHz)	Test mode	RB size	RB offset	MPR	Maximum power		
						Frequency (MHz)		
						Low	Middle	High
LTE Band 41	5	QPSK	1	0	0	23.41	23.62	23.65
			1	12	0	23.50	23.75	23.75
			1	24	0	23.26	23.63	23.63
			12	0	1	22.49	22.77	22.72
			12	7	1	22.52	22.86	22.86
			12	13	1	22.65	22.84	22.85
		25	0	1	22.49	22.72	22.73	
		16QAM	1	0	1	22.50	22.68	22.70
			1	12	1	22.71	22.86	22.88
			1	24	1	22.43	22.72	22.69
			12	0	2	21.36	21.67	21.77
			12	7	2	21.42	21.80	21.82
			12	13	2	21.46	21.79	21.75
		25	0	2	21.55	21.82	21.72	
		64QAM	1	0	2	21.11	21.36	21.39
			1	12	2	21.30	21.53	21.76
			1	24	2	21.13	21.39	21.33
			12	0	3	20.45	20.77	20.85
	12		7	3	20.56	20.78	20.73	
	12		13	3	20.49	20.87	20.71	
	25	0	3	20.54	20.81	20.92		
	10	QPSK	1	0	0	23.51	23.78	23.68
			1	25	0	23.35	23.66	23.62
			1	49	0	23.37	23.70	23.86
			25	0	1	22.56	22.74	22.93
			25	12	1	22.51	22.73	22.72
			25	25	1	22.54	22.78	22.77
		50	0	1	22.54	22.71	22.86	
		16QAM	1	0	1	22.55	22.81	22.99
			1	25	1	22.63	22.76	22.72
			1	49	1	22.64	22.81	23.03
			25	0	2	21.52	21.80	21.97
			25	12	2	21.59	21.85	21.93
			25	25	2	21.62	21.84	21.83
		50	0	2	21.62	21.77	21.98	
		64QAM	1	0	2	21.15	21.45	21.46
1			25	2	21.15	21.42	21.56	
1			49	2	21.30	21.42	21.53	
25			0	3	20.53	20.88	20.91	
25	12		3	20.54	20.84	20.86		
25	25		3	20.50	20.88	20.92		
50	0	3	20.55	20.73	21.00			

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

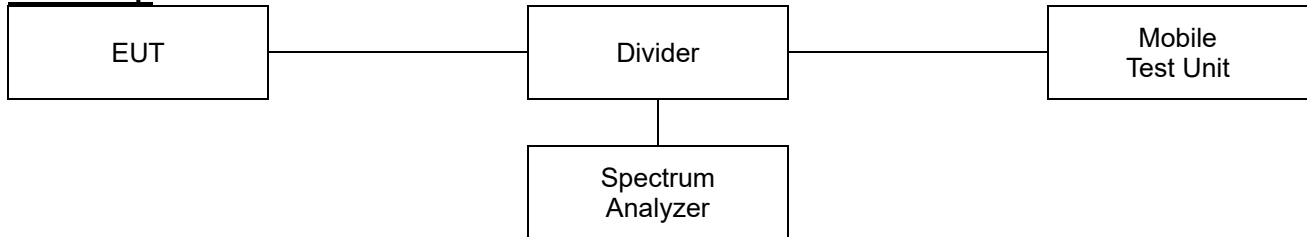
Page (17) of (103)



Test Band	Bandwidth (MHz)	Test mode	RB size	RB offset	MPR	Maximum power		
						Frequency (MHz)		
						Low	Middle	High
LTE Band 41	15	QPSK	1	0	0	23.62	23.63	23.55
			1	36	0	23.86	23.78	23.76
			1	74	0	23.81	23.63	23.72
			36	0	1	22.84	22.83	22.94
			36	18	1	22.93	22.85	22.82
			36	37	1	22.83	22.77	22.81
		75	0	1	22.80	22.70	22.74	
		16QAM	1	0	1	22.92	22.71	21.87
			1	36	1	22.99	22.87	21.67
			1	74	1	22.77	22.67	21.80
			36	0	2	21.86	21.72	21.90
			36	18	2	21.76	21.82	21.91
			36	37	2	21.71	21.74	21.73
		75	0	2	21.80	21.70	21.78	
		64QAM	1	0	2	21.39	21.36	21.35
			1	36	2	21.54	21.53	21.61
			1	74	2	21.35	21.34	21.49
			36	0	3	20.68	20.73	20.96
	36		18	3	20.86	20.73	20.87	
	36		37	3	20.75	20.66	20.68	
	75	0	3	20.81	20.71	20.91		
	20	QPSK	1	0	0	23.16	23.48	23.85
			1	49	0	23.49	23.77	23.88
			1	99	0	23.21	23.49	23.68
			50	0	1	22.34	22.51	22.76
			50	24	1	22.36	22.64	22.80
			50	50	1	22.32	22.51	22.67
		100	0	1	22.40	22.53	22.79	
		16QAM	1	0	1	22.34	22.55	22.66
			1	49	1	22.66	22.90	22.97
			1	99	1	22.37	22.53	22.78
			50	0	2	21.41	21.55	21.85
			50	24	2	21.37	21.64	21.87
			50	50	2	21.39	21.54	21.74
		100	0	2	21.40	21.59	21.86	
		64QAM	1	0	2	20.96	21.18	21.33
1			49	2	21.27	21.51	21.71	
1			99	2	21.00	21.21	21.43	
50			0	3	20.33	20.55	20.86	
50	24		3	20.39	20.68	20.88		
50	50		3	20.32	20.55	20.71		
100	0	3	20.37	20.58	20.80			

7.2. 99% Occupied Bandwidth & 26 dB Bandwidth

Test setup



Limit

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

- 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 $\geq 3 \times$ 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 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.”
- 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 $1.5 \times \text{OBW}$ 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 $\geq 3 \times \text{RBW}$.
- 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.

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

Page (20) of (103)

KCTL**Test results**

Test Band	Bandwidth (MHz)	Frequency (MHz)	Test mode	26dB bandwidth (MHz)	99 % bandwidth (MHz)
LTE Band 5	1.4	824.7	QPSK	1.28	1.10
			16QAM	1.29	1.09
		836.5	QPSK	1.29	1.09
			16QAM	1.31	1.10
		848.3	QPSK	1.30	1.10
			16QAM	1.28	1.09
	3	825.5	QPSK	2.89	2.69
			16QAM	2.92	2.68
		836.5	QPSK	2.90	2.69
			16QAM	2.91	2.69
		847.5	QPSK	2.90	2.69
			16QAM	2.91	2.68
	5	826.5	QPSK	4.96	4.51
			16QAM	4.91	4.47
		836.5	QPSK	4.96	4.52
			16QAM	4.93	4.51
		846.5	QPSK	4.95	4.50
			16QAM	4.98	4.52
	10	829.0	QPSK	9.72	8.97
			16QAM	9.72	8.97
		836.5	QPSK	9.74	8.97
			16QAM	9.97	8.99
		844.0	QPSK	9.69	8.97
			16QAM	9.67	8.99

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

Page (21) of (103)

KCTL

Test Band	Bandwidth (MHz)	Frequency (MHz)	Test mode	26dB bandwidth (MHz)	99 % bandwidth (MHz)
LTE Band 12	1.4	699.7	QPSK	1.30	1.10
			16QAM	1.28	1.09
		707.5	QPSK	1.29	1.10
			16QAM	1.29	1.09
		715.3	QPSK	1.29	1.09
			16QAM	1.31	1.10
	3	700.5	QPSK	2.90	2.69
			16QAM	2.91	2.69
		707.5	QPSK	2.90	2.69
			16QAM	2.90	2.69
		714.5	QPSK	2.91	2.69
			16QAM	2.91	2.67
	5	701.5	QPSK	5.21	4.53
			16QAM	5.22	4.52
		707.5	QPSK	5.17	4.51
			16QAM	5.16	4.53
		713.5	QPSK	5.16	4.50
			16QAM	5.22	4.53
	10	704.0	QPSK	9.99	9.04
			16QAM	9.94	8.99
707.5		QPSK	9.97	8.97	
		16QAM	9.97	9.02	
711.0		QPSK	10.02	9.02	
		16QAM	10.02	8.99	

KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

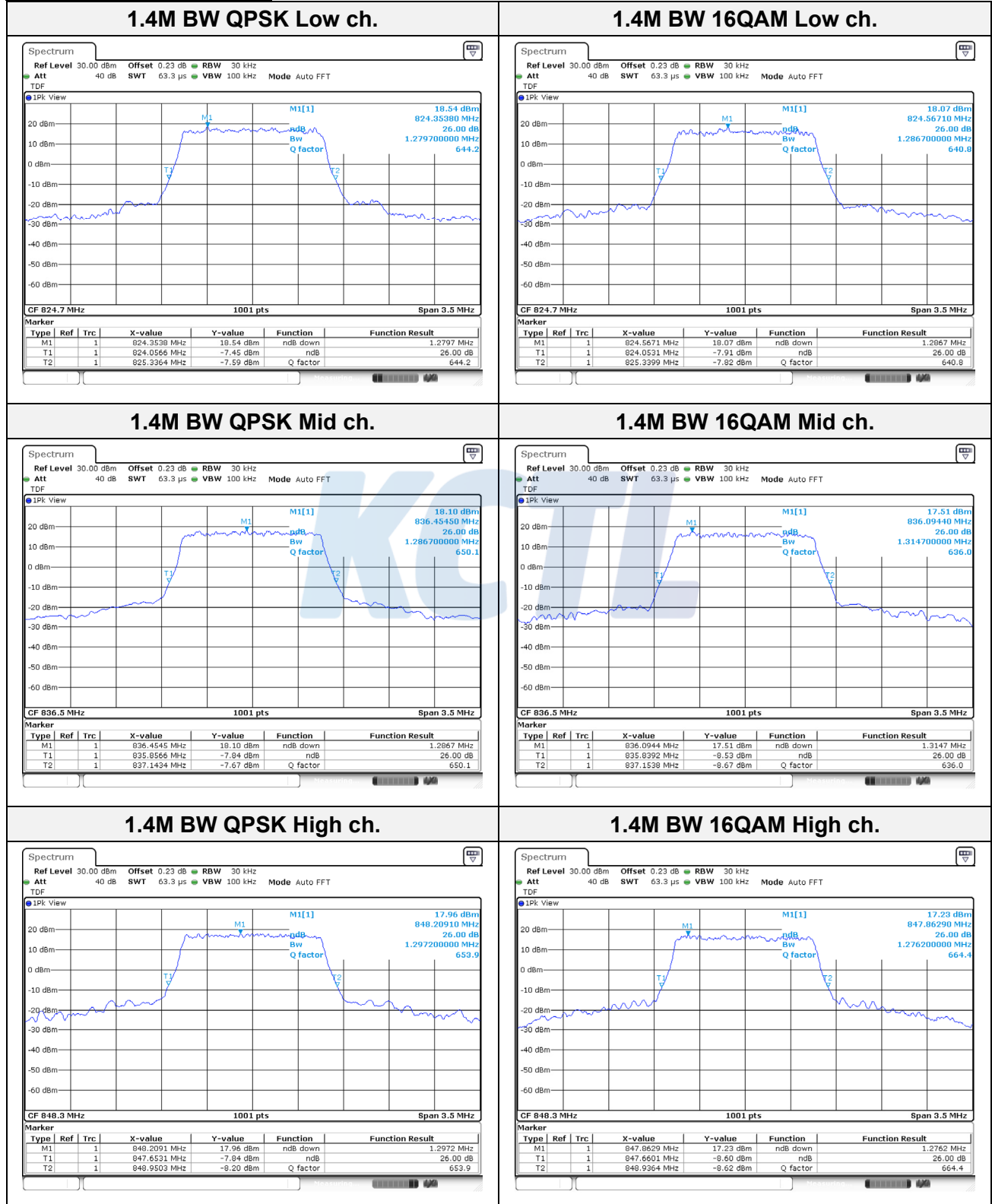
Page (22) of (103)

KCTL

Test Band	Bandwidth (MHz)	Frequency (MHz)	Test mode	26dB bandwidth (MHz)	99 % bandwidth (MHz)
LTE Band 41	5	2498.5	QPSK	4.93	4.51
			16QAM	5.00	4.48
		2593.0	QPSK	4.96	4.50
			16QAM	5.05	4.52
		2687.5	QPSK	5.02	4.50
			16QAM	4.90	4.47
	10	2501.0	QPSK	9.67	8.99
			16QAM	9.67	8.99
		2593.0	QPSK	9.77	8.97
			16QAM	9.72	8.97
		2685.0	QPSK	9.59	8.97
			16QAM	9.72	9.02
	15	2503.5	QPSK	14.76	13.45
			16QAM	14.54	13.49
		2593.0	QPSK	14.61	13.45
			16QAM	14.57	13.45
		2682.5	QPSK	14.50	13.41
			16QAM	14.46	13.49
	20	2506.0	QPSK	19.33	17.98
			16QAM	19.33	17.98
		2593.0	QPSK	19.28	17.98
			16QAM	19.28	17.93
		2680.0	QPSK	19.23	17.98
			16QAM	19.23	18.03

26dB Bandwidth

Test mode: LTE Band 5



KCTL Inc.

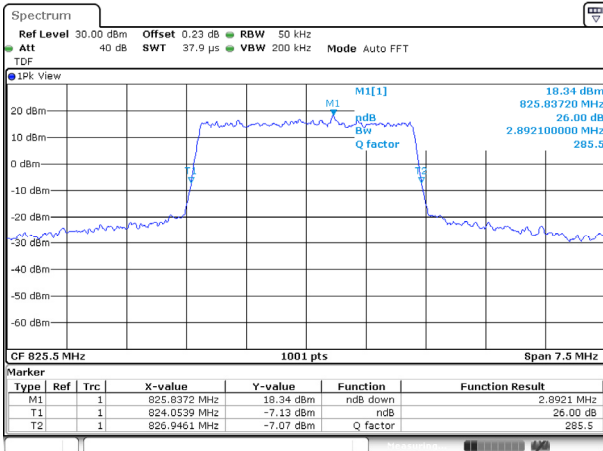
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

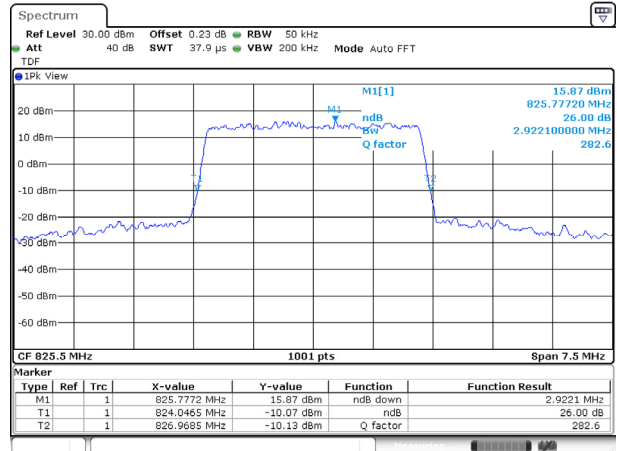
Page (24) of (103)



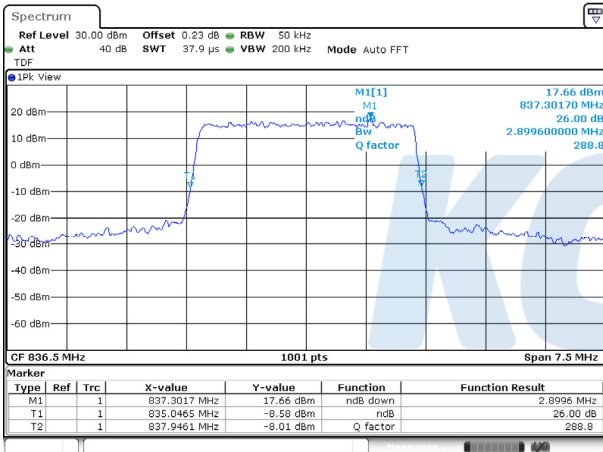
3M BW QPSK Low ch.



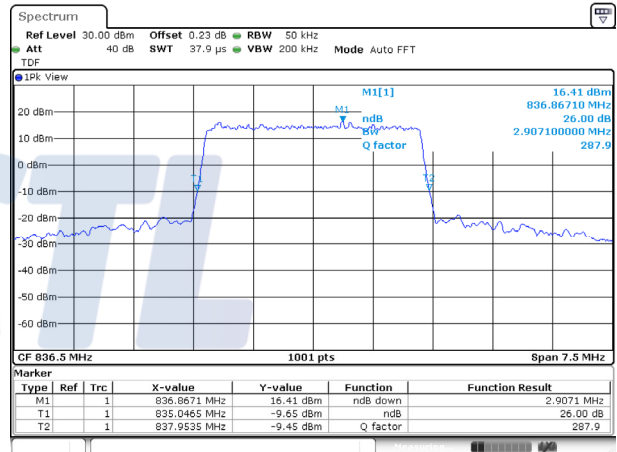
3M BW 16QAM Low ch.



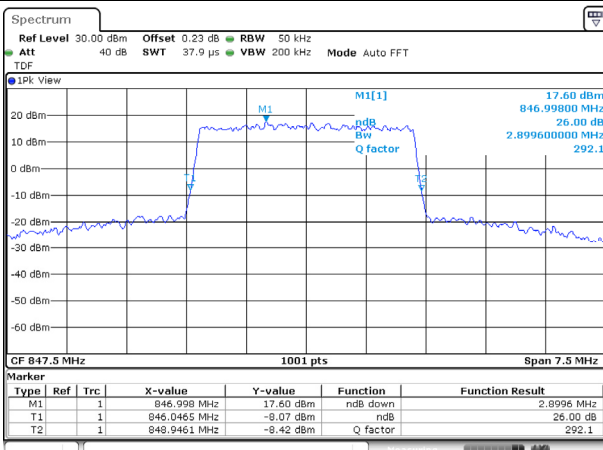
3M BW QPSK Mid ch.



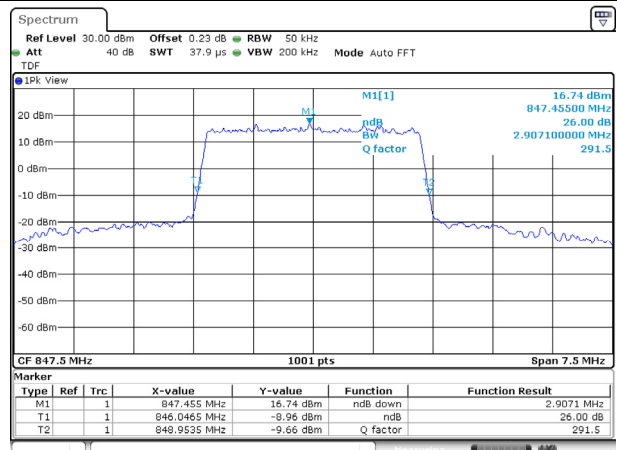
3M BW 16QAM Mid ch.



3M BW QPSK High ch.



3M BW 16QAM High ch.



KCTL Inc.

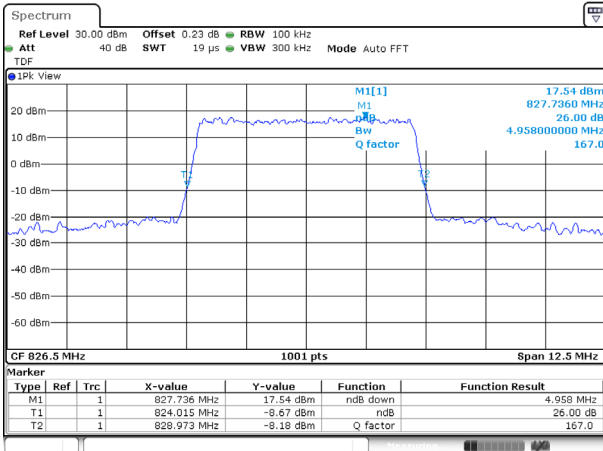
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
www.kctl.co.kr

Report No.:
KR20-SRF0115-A

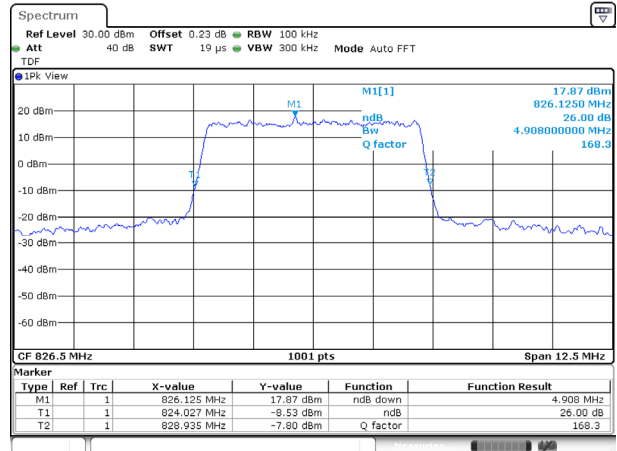
Page (25) of (103)



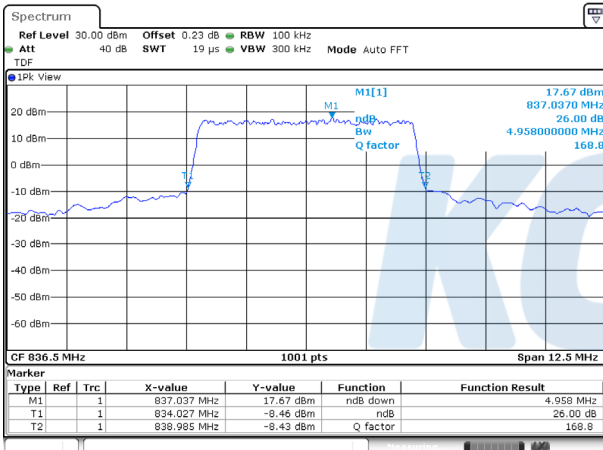
5M BW QPSK Low ch.



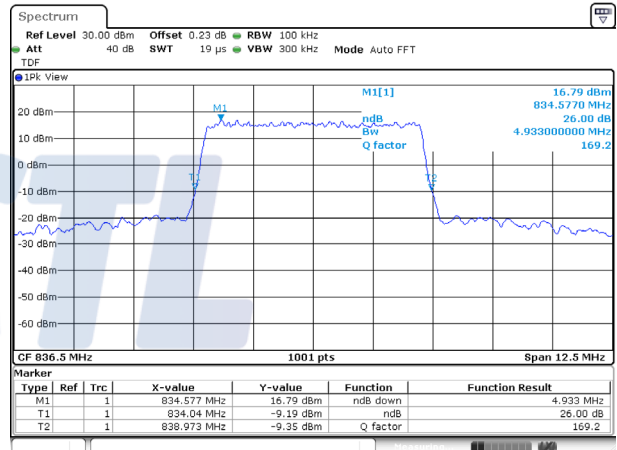
5M BW 16QAM Low ch.



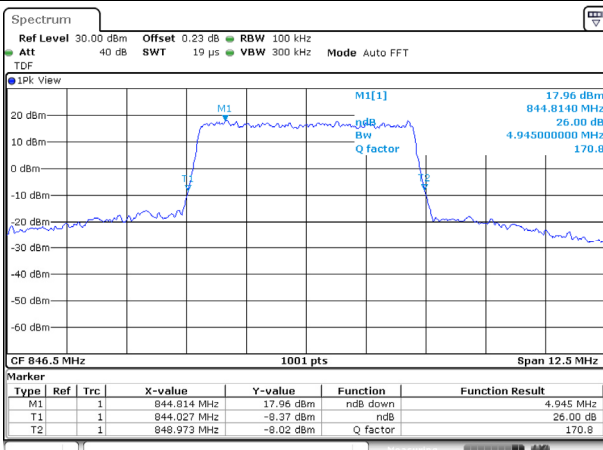
5M BW QPSK Mid ch.



5M BW 16QAM Mid ch.



5M BW QPSK High ch.



5M BW 16QAM High ch.

