TEST REPORT

Part 15 Subpart E 15.407

Equipment under test NETWORK VIDEO RECORDER

Model name TRM-810S

FCC ID NLMTRM810S

Applicant Hanwha Techwin Co., Ltd.

Manufacturer Hanwha Techwin (Tianjin) Co.,Ltd.
Hanwha Techwin Security Vietnam Co.,Ltd.
D-TECH Co.,Ltd.

Date of test(s) 2019.01.07 ~ 2019.01.30

Date of issue 2019.02.14

Issued to
Hanwha Techwin Co., Ltd.
6, Pangyo-ro 319 Beon-gil, Bundang-gu Seongnam-si,
Gyeonggi-do, 13488, Korea
Tel: +82-70-7147-8361/ Fax: +82-31-8108-3717

Issued by
KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, Kore
473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	Report approval by :
Young-Jin Lee Test engineer	Hyeon-Su, Jang Technical manager

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Revision history

Revision	Date of issue	Test report No.	Description
-	2019.02.14	KES-RF-19T0015	Initial

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

TABLE OF CONTENTS

1. General information 4
1.1. EUT description 4
1.2. Test configuration 5
1.3. Accessory information 5
1.4. Software and Firmware description 5
1.5. Measurement results explanation example 6
1.6. Measurement Uncertainty 6
1.7. Frequency/channel operations 7
1.8. Maximum average output power 7
2. Summary of tests 8
3. Test results 9
3.1. 26 dB bandwidth & 99% Occupied Bandwidth 9
3.2. 6 dB bandwidth 22
3.3. Maximum conducted output power 27
3.4. Power spectral density 32
3.5. Frequency Stability 42
3.6. Radiated restricted band and emissions 47
Appendix A. Measurement equipment 109
Appendix B. Test setup photos 110

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

1. General information

Applicant:	Hanwha Techwin Co., Ltd.
Applicant address:	6, Pangyo-ro 319 Beon-gil, Bundang-gu Seongnam-si, Gyeonggi-do, 13488, Korea
Test site:	KES Co., Ltd.
Test site address:	3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s):	15.247
FCC ID:	NLMTRM810S
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	NETWORK VIDEO RECORDER	
Frequency range	UNII-1	5 180 ㎒ ~ 5 240 ㎒ (11ac_VHT20)
		5 190 ㎒ ~ 5 230 ㎒ (11ac_VHT40)
		5 210 ㎒ (11ac_VHT80)
	UNII-2A	5 260 ㎒ ~ 5 320 ㎒ (11ac_VHT20)
		5 270 ㎒ ~ 5 310 ㎒ (11ac_VHT40)
		5 290 ㎒ (11ac_VHT80)
	UNII-2C	5 500 ㎒ ~ 5 720 ㎒ (11ac_VHT20)
		5 510 ㎒ ~ 5 710 ㎒ (11ac_VHT40)
		5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80)
	UNII-3	5 745 ㎒ ~ 5 825 ㎒ (11ac_VHT20)
		5 755 ㎒ ~ 5 795 ㎒ (11ac_VHT40)
		5 775 ㎒ (11ac_VHT80)
	GPS	1 575.42 ㎒ (GPS)
Model:	TRM-810S	
Modulation technique	OFDM	
Antenna specification	5 ㎓_UNII 1, 2A // Dipole Antenna & 2.72 ㏈i	
	5 ㎓_UNII 2C // Dipole Antenna & 3.45 ㏈i	
	5 ㎓_UNII 3 // Dipole Antenna & 5.63 ㏈i	
Power source	DC 9V~36V	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Number of channels

5 180 ㎒ ~ 5 240 ㎒ (11ac_VHT20) : 4ch
5 190 ㎒ ~ 5 230 ㎒ (11ac_VHT40) : 2ch
5 210 ㎒ (11ac_VHT80) : 1ch
5 260 ㎒ ~ 5 320 ㎒ (11ac_VHT20) : 4ch
5 270 ㎒ ~ 5 310 ㎒ (11ac_VHT40) : 2ch
5 290 ㎒ (11ac_VHT80) : 1ch
5 500 ㎒ ~ 5 720 ㎒ (11ac_VHT20) : 12ch
5 510 ㎒ ~ 5 710 ㎒ (11ac_VHT40) : 6ch
5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80) : 3ch
5 745 ㎒ ~ 5 825 ㎒ (11ac_VHT20) : 5ch
5 755 ㎒ ~ 5 795 ㎒ (11ac_VHT40) : 2ch
5 775 ㎒ (11ac_VHT80) : 1ch
1 575.42 ㎒ (GPS) : 1ch

1.2. Test configuration

The **Hanwha Techwin Co., Ltd. NETWORK VIDEO RECORDER FCC ID: NLMTRM810S** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.407
KDB 789033 D02 v02r01
ANSI C63.10-2013

1.3. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Control Box	Hanwha Techwin(Tianjin) Co., Ltd.	-	-	-

1.4. Software and Firmware description

The software and firmware installed in the EUT is version V1.00_190129183607

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

1.5. Measurement results explanation example

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator 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.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 1.70 + 10 = 11.70 (dB)

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.62 dB
Uncertainty for Radiation emission test (include Fundamental emission)	9kHz - 30MHz	4.54 dB
	30MHz - 1GHz	4.36 dB
	Above 1GHz	5.00 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

1.7. Frequency/channel operations

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
36	5 180	52	5 260	100	5 500	149	5 745
44	5 220	56	5 280	120	5 600	157	5 785
48	5 240	64	5 320	144	5 720	165	5 825

Table 1.7-1. 802.11ac_VHT20 mode

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
38	5 190	54	5 270	102	5 510	151	5 755
46	5 230	62	5 310	118	5 590	159	5 795
				142	5 710		

Table 1.7-2. 802.11ac_VHT40 mode

UNII-1		UNII-2A		UNII-2C		UNII-3	
Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)	Ch.	Frequency (㎒)
42	5 210	58	5 290	106	5 530	155	5 775
				122	5 610		
				138	5 690		

Table 1.7-3. 802.11ac_VHT80 mode

1.8. Maximum average output power

Refer to the average output power.

Note.

1. Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates as provided by the client were:
   UNII-1 ac_VHT20 : **MCS8**, ac_VHT40/80 : **MCS9**
   UNII-2A ac_VHT20 : **MCS8**, ac_VHT40/80 : **MCS9**
   UNII-2C ac_VHT20 : **MCS8**, ac_VHT40/80 : **MCS9**
   UNII-3 ac_VHT20 : **MCS8**, ac_VHT40/80 : **MCS9**
3. This report contains the worst case data from the following mode of the test in 20/40/80 MHz signal bandwidth.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

2. Summary of tests

Reference	Parameter	Test results
15.407(a)	26 dB bandwidth & 99 % Occupied Bandwidth	Pass
15.407(e)	6 dB bandwidth	Pass
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Power spectral density	Pass
15.407(g)	Frequency stability	Pass
15.205 15.209	Radiated restricted band and emission	Pass
15.407(d)	General field strength limit (Restricted bands and radiated emission limit)	Pass
15.207	AC power line conducted emissions	N/A Note.1

Note.

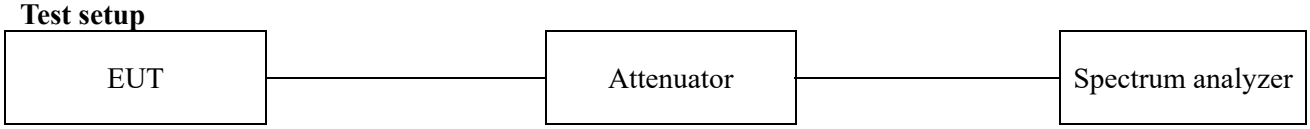
1. This device doesn't required AC conducted emission test because only use DC power.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

3. Test results

3.1. 26 dB bandwidth & 99% Occupied Bandwidth

Test setup



Test procedure

<u>26 dB bandwidth</u>

KDB 789033 D02 v02r01– Section C.1

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Limit

N/A

<u>99 % bandwidth</u>

KDB 789033 D02 v02r01– Section D

1. Set span = 1.5 times to 5.0 times the OBW.
2. Set RBW = 1% to 5% of the OBW
3. Set the VBW > 3 x RBW.
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak bandwidth function of the instrument (if available).
5. Use the 99% power bandwidth function of the instrument (if available).
6. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

In the result,
-DFS requirements are not applicable in the 5 150 ㎒ ~ 5 250 ㎒.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

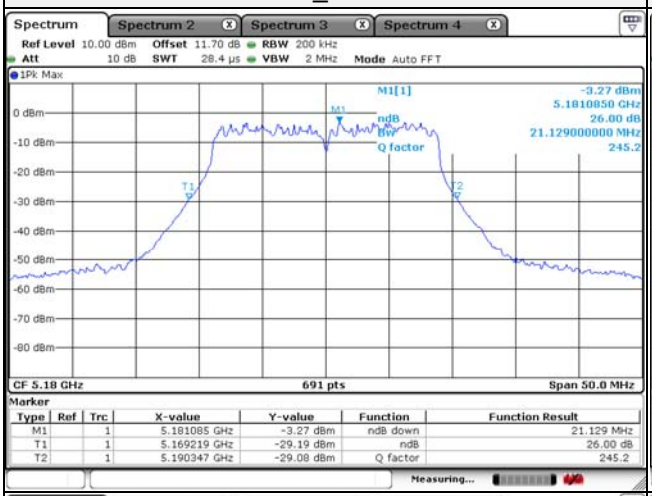
Test results

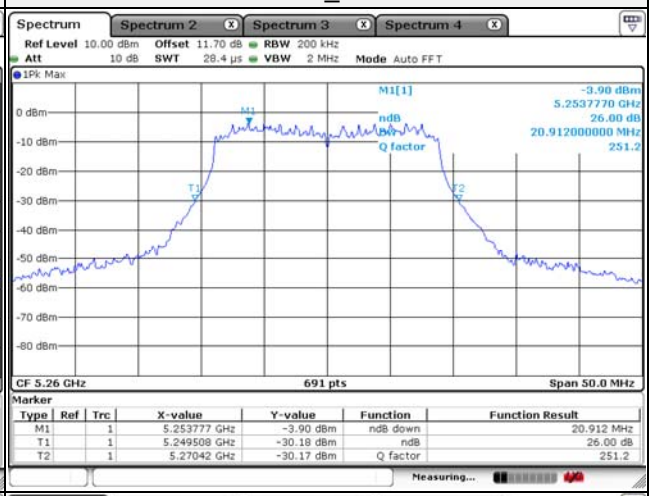
Band	Frequency(㎒)	Mode	26 dB bandwidth(㎒)	99 % bandwidth(㎒)
UNII-1	5 180	VHT20	21.129	17.873
	5 220		20.912	17.800
	5 240		20.695	17.728
UNII-2A	5 260		20.912	17.873
	5 280		20.839	17.945
	5 320		20.839	17.728
UNII-2C	5 500		20.550	17.728
	5 600		20.622	17.800
	5 720		20.695	17.945
UNII-3	5 745		20.622	17.728
	5 785		20.622	17.873
	5 825		20.695	17.873
UNII-1	5 190	VHT40	42.840	36.700
	5 230		42.260	37.279
UNII-2A	5 270		41.790	36.932
	5 310		42.840	36.816
UNII-2C	5 510		42.490	37.048
	5 590		40.980	36.932
	5 710		42.140	36.816
UNII-3	5 755		43.300	37.164
	5 795		42.140	37.279
UNII-1	5 210	VHT80	82.490	75.716
UNII-2A	5 290		81.620	75.543
UNII-2C	5 530		82.140	75.543
	5 610		82.660	75.543
	5 690		82.840	75.543
UNII-3	5 775		83.010	75.890
UNII-2C (Band-crossing channel)	5 720	VHT20	15.420	-
	5 710	VHT40	36.300	-
	5 690	VHT80	76.130	-

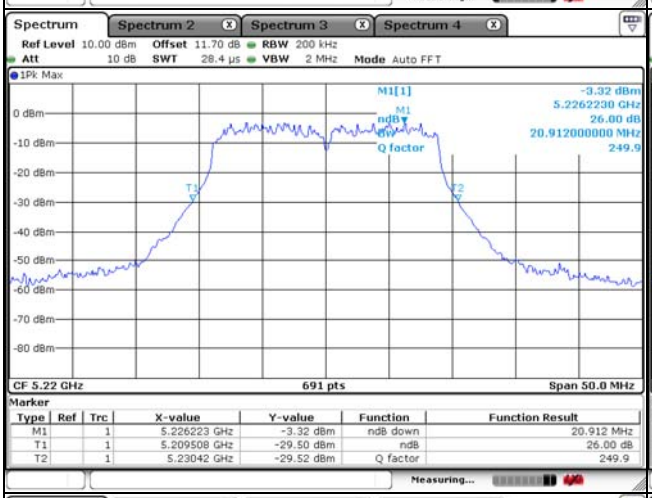
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

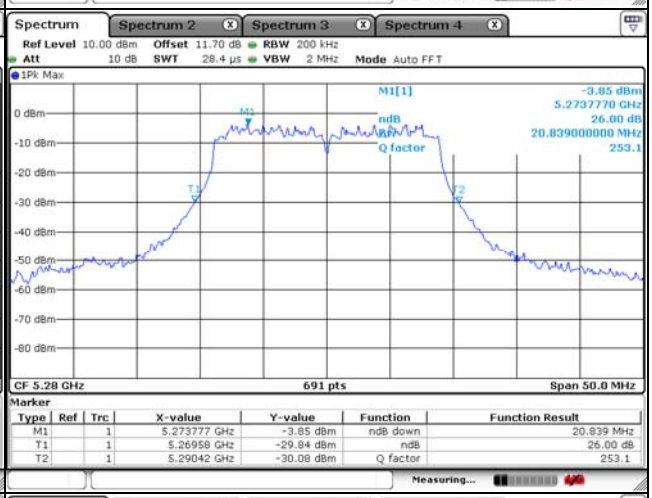
26 dB bandwidth

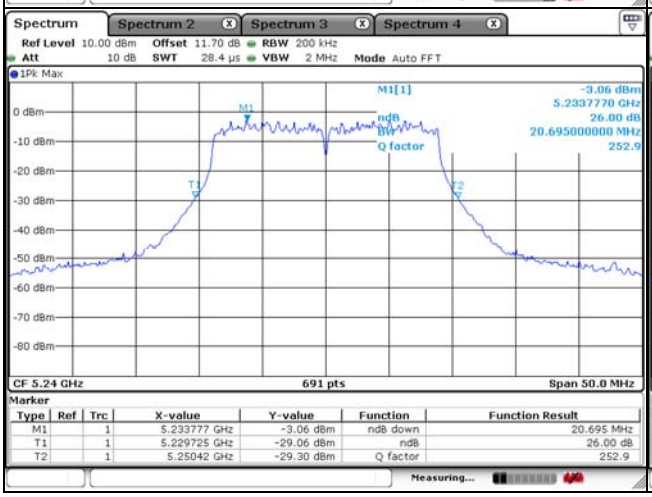
UNII-1_ VHT20	UNII-2A_ VHT20

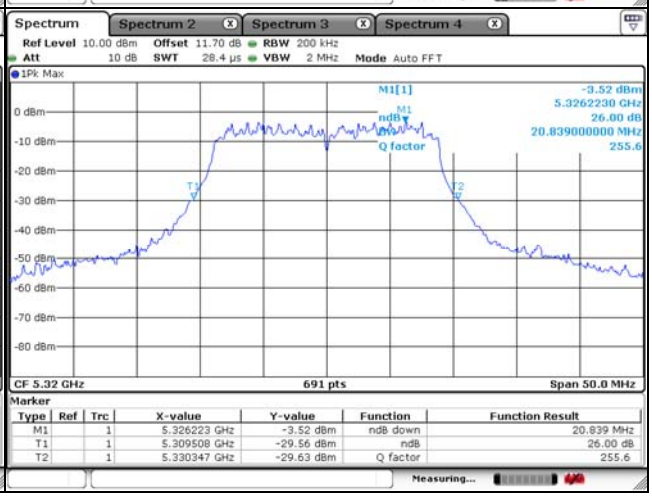






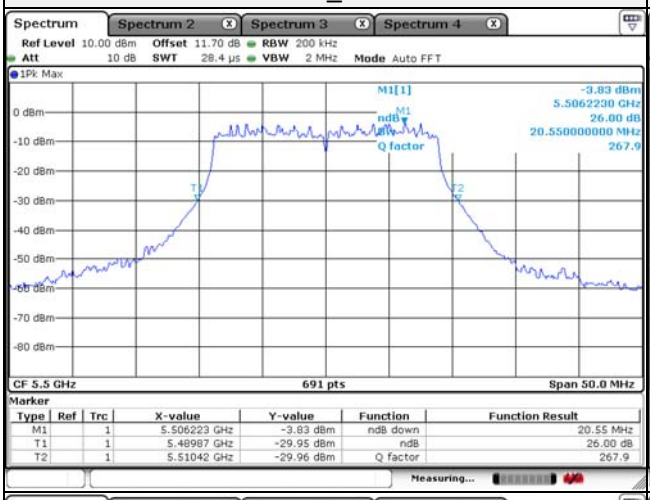


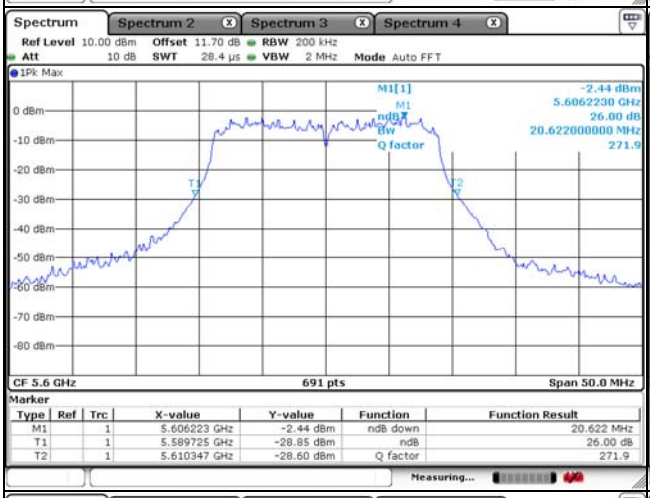


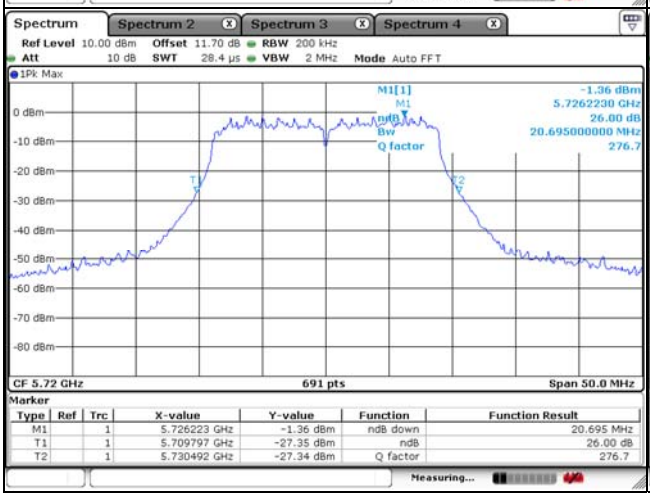


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

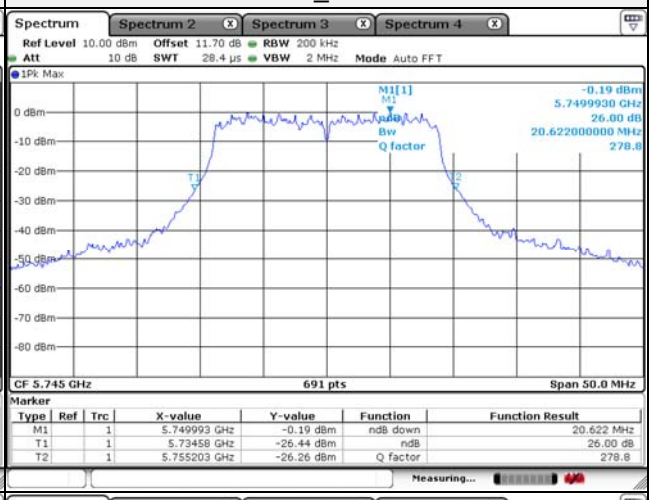
UNII-2C_VHT20

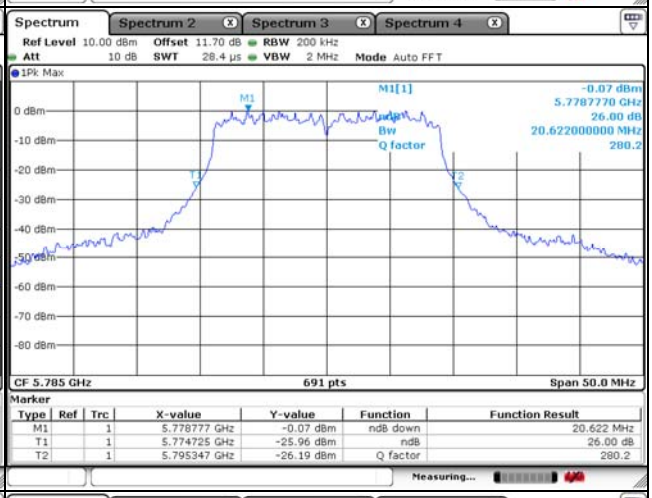


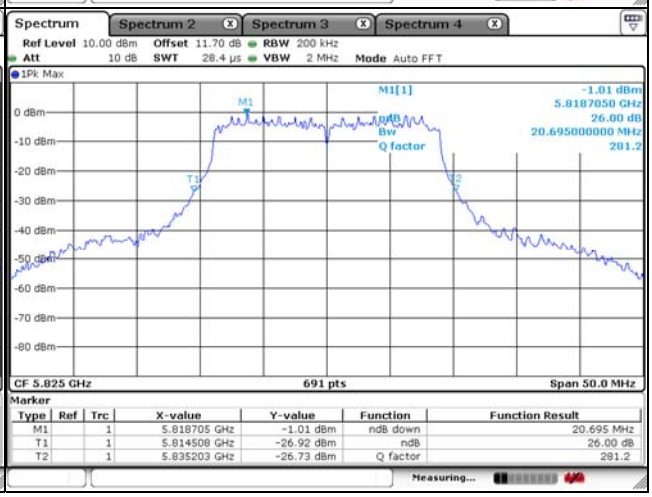




UNII-3_ VHT20

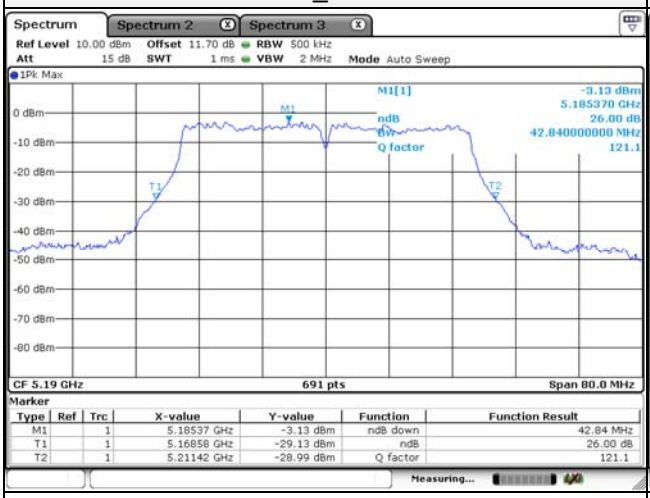




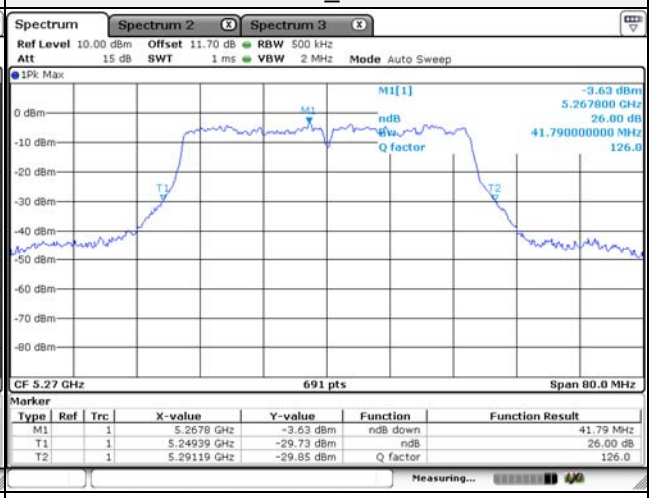


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

UNII-1_ VHT40

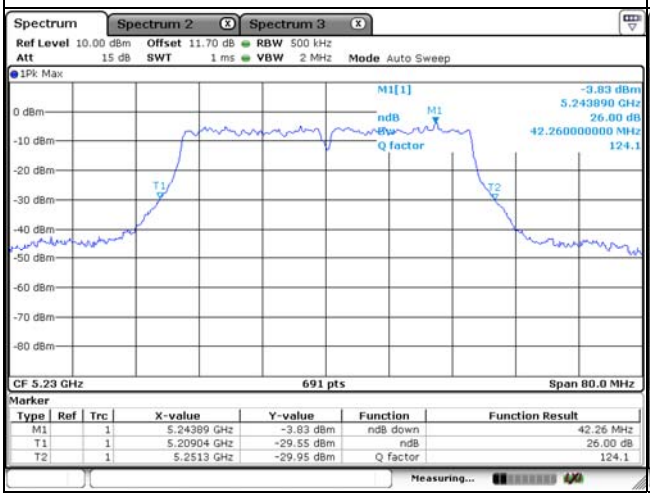


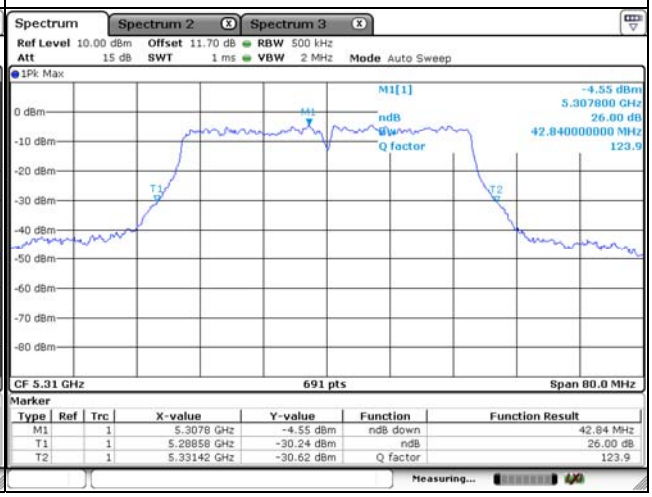
UNII-2A_ VHT40



Blank

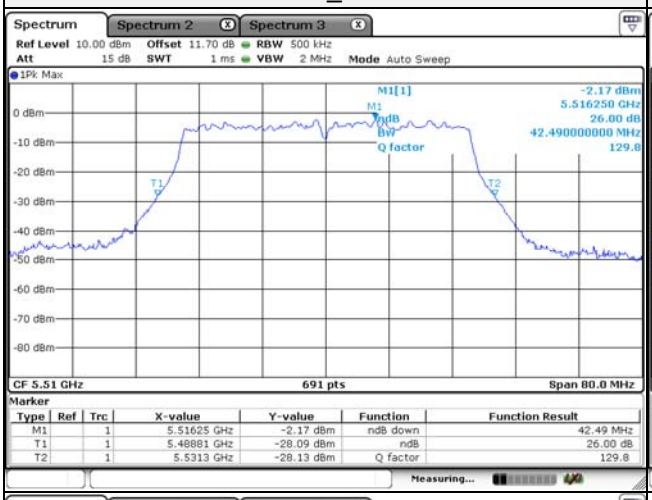
Blank



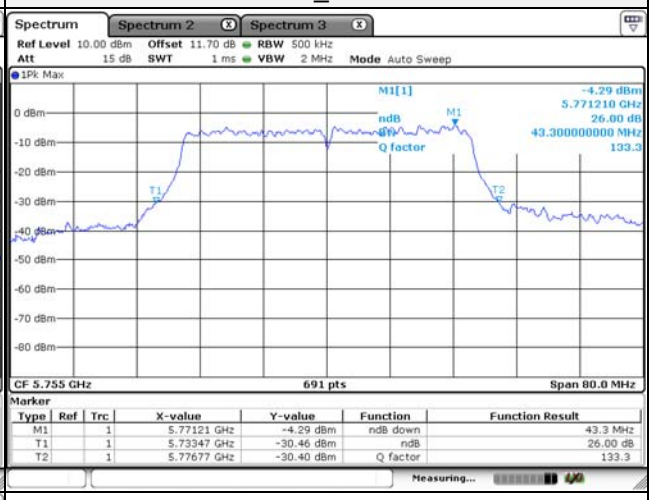


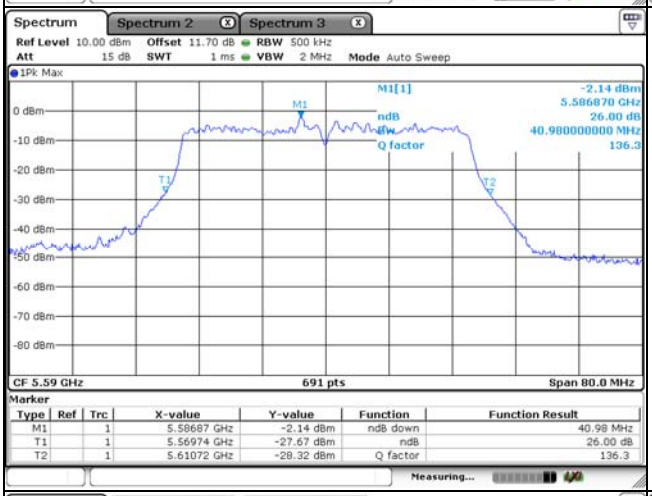
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

UNII-2C_VHT40

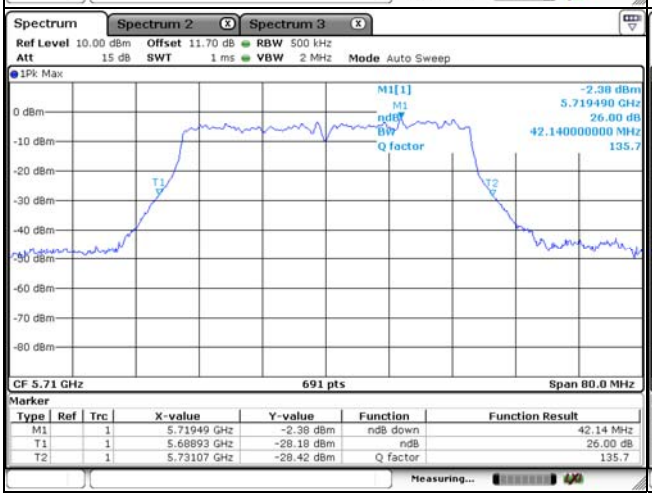


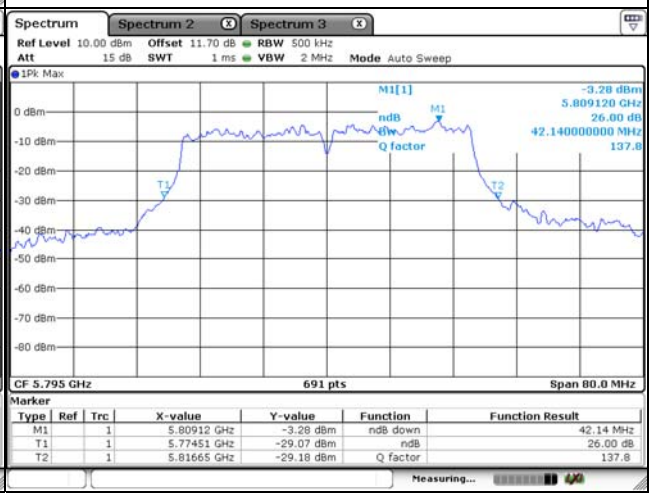
UNII-3_ VHT40





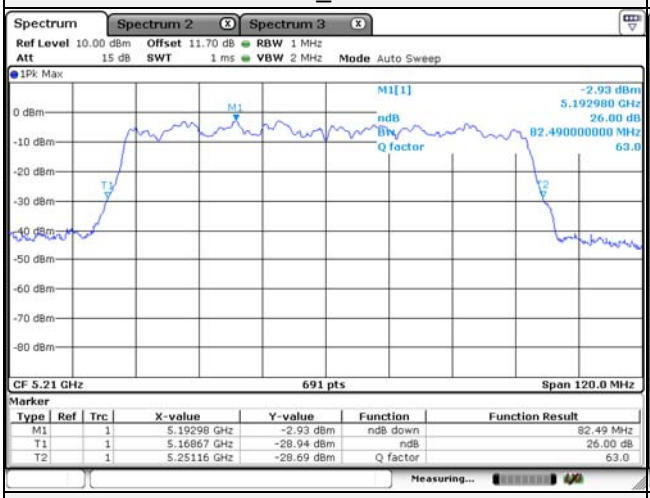
Blank



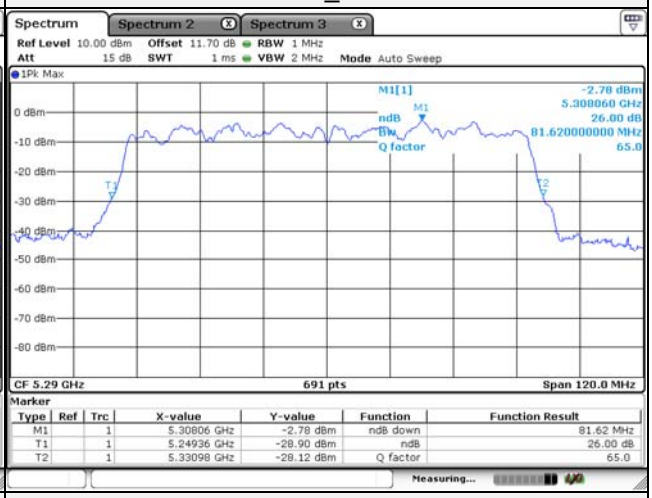


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

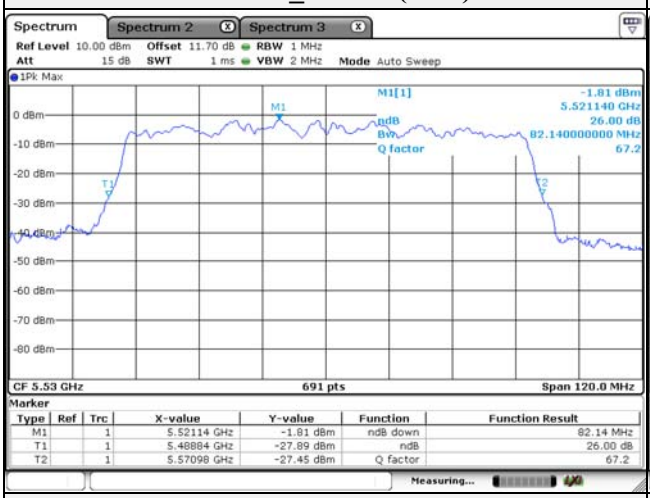
UNII-1_VHT80



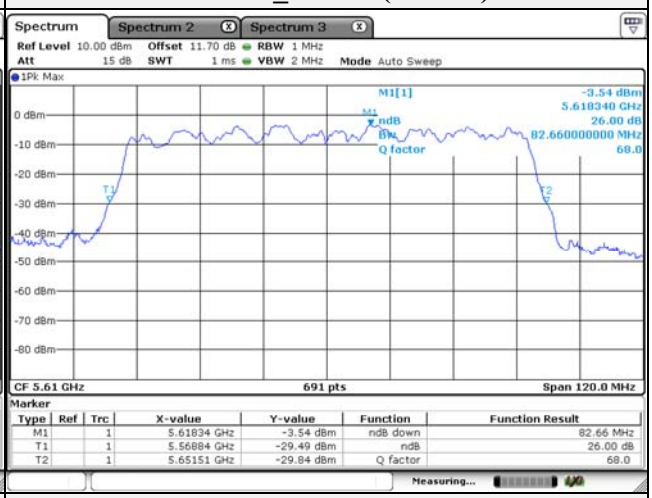
UNII-2A_ VHT80



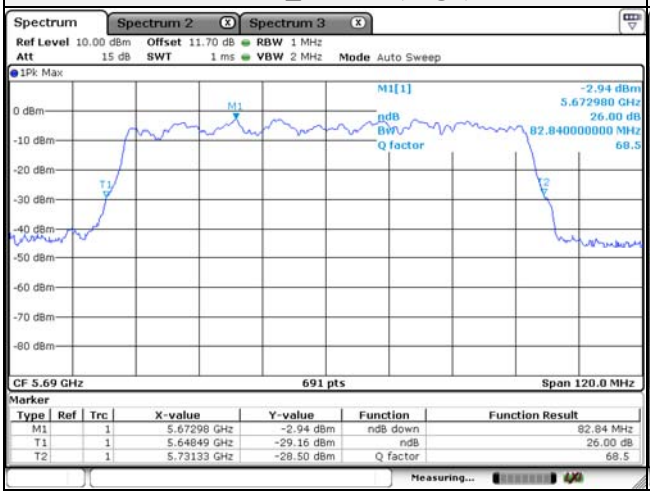
UNII-2C_VHT80(Low)



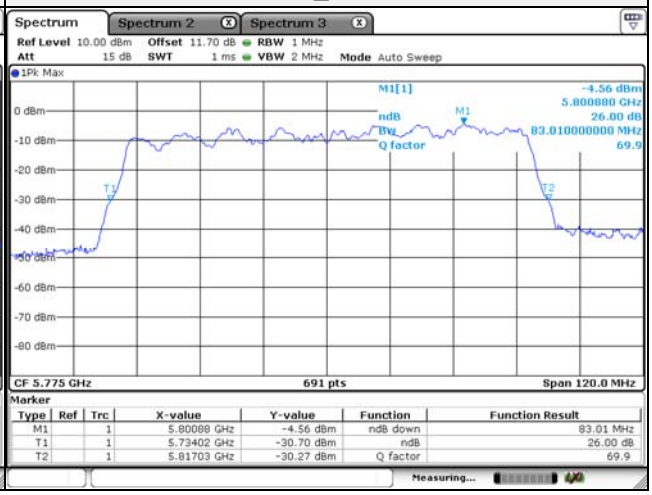
UNII-2C_VHT80(Middle)



UNII-2C_VHT80(High)



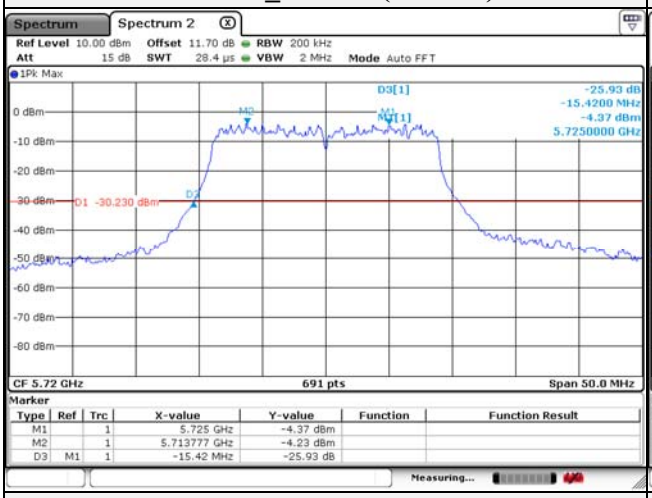
UNII-3_ VHT80



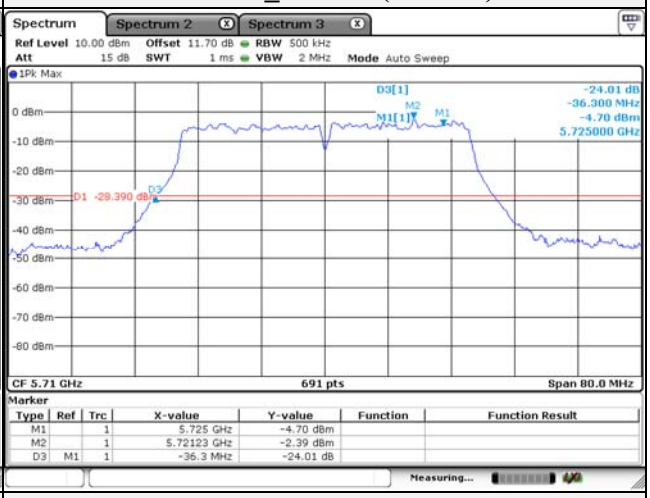
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Band-crossing channels

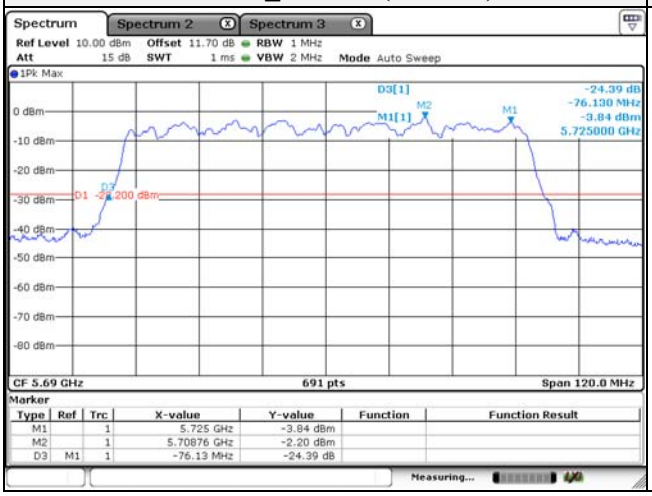
UNII-2C_VHT20 (Ch. 144)



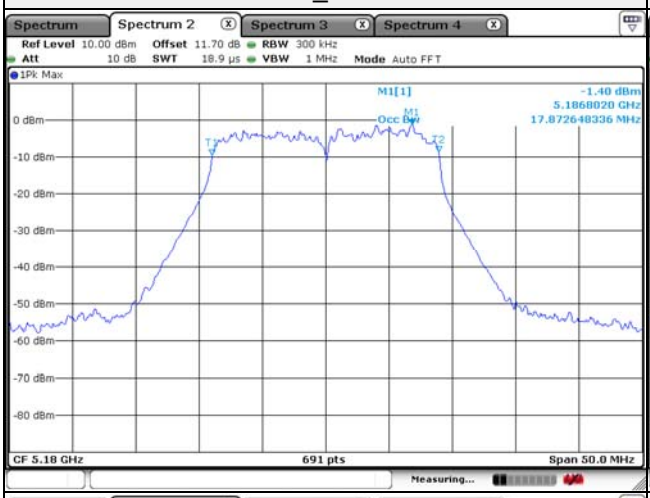
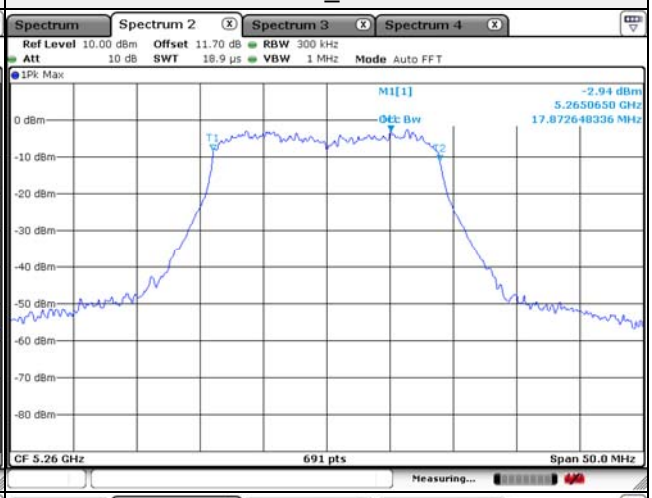
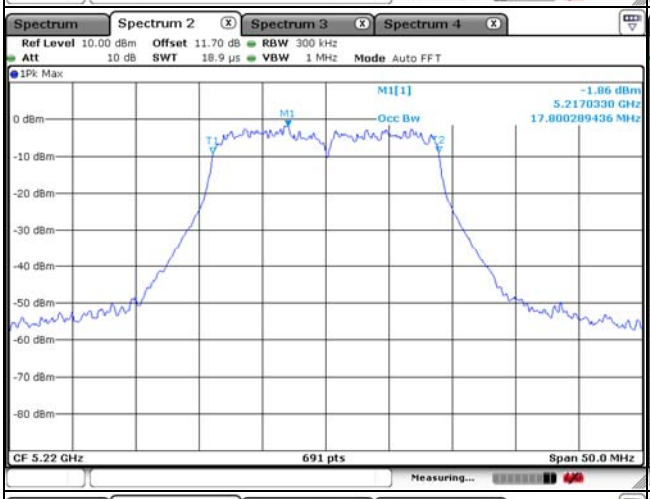
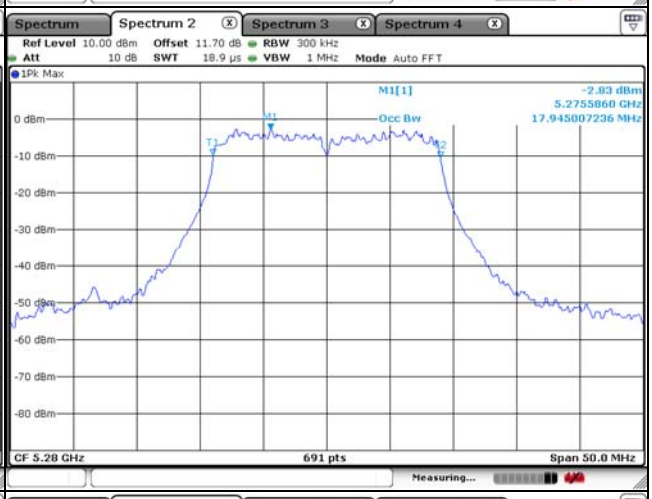
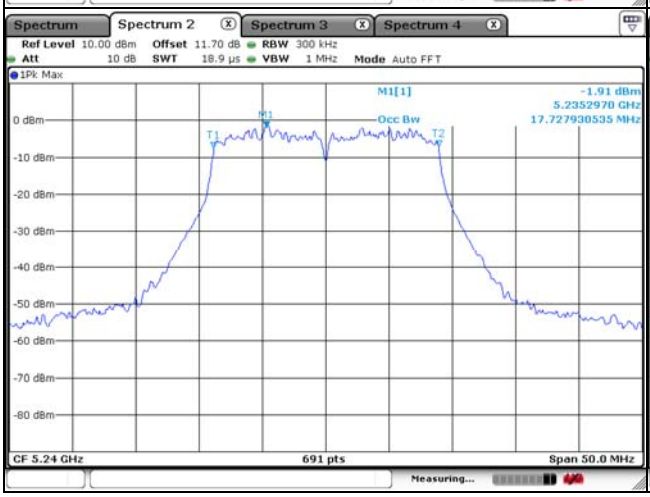
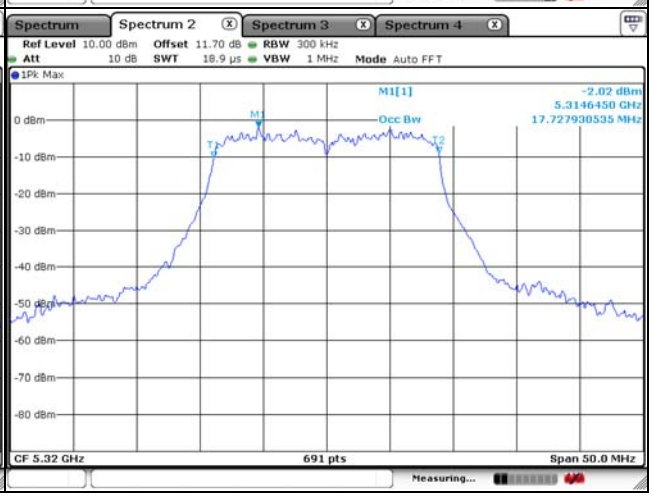
UNII-2C_VHT40 (Ch. 142)



UNII-2C_VHT80 (Ch. 138)

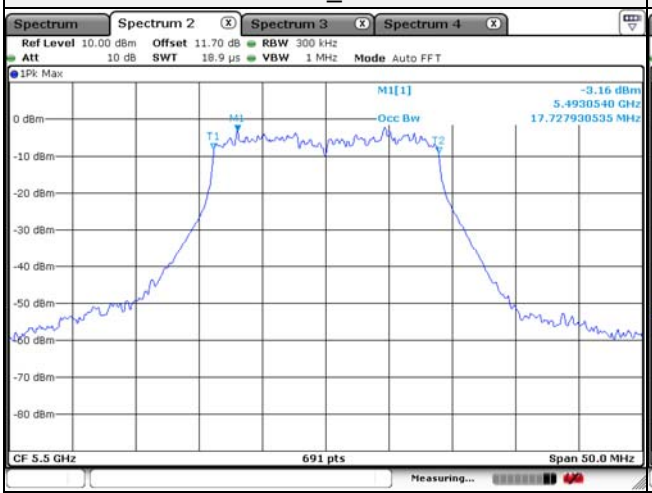


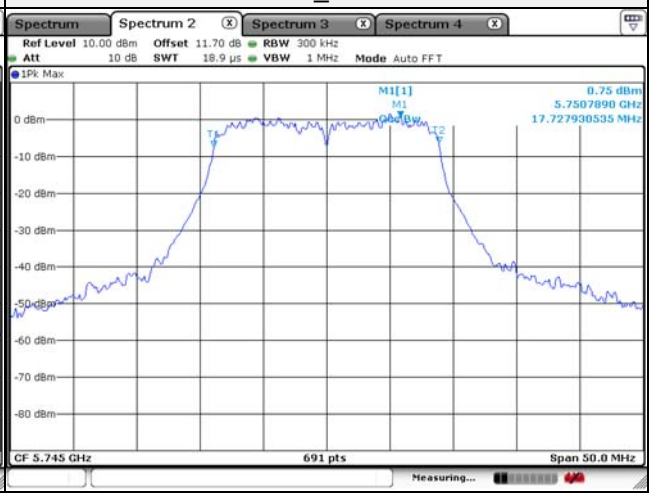
99% bandwidth

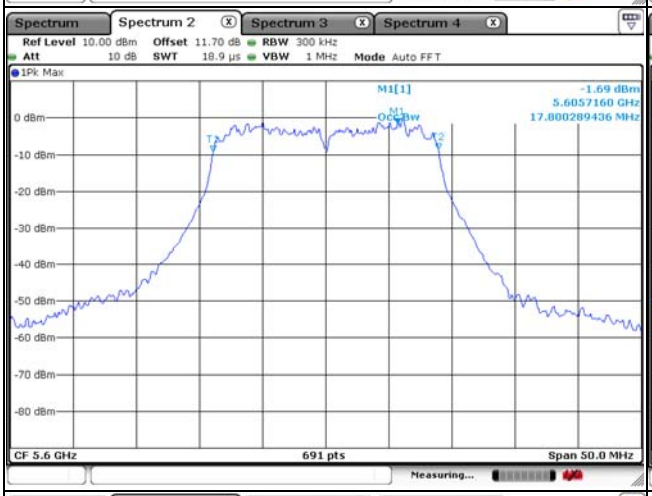
UNII-1_ VHT20	UNII-2A_ VHT20
	
	
	

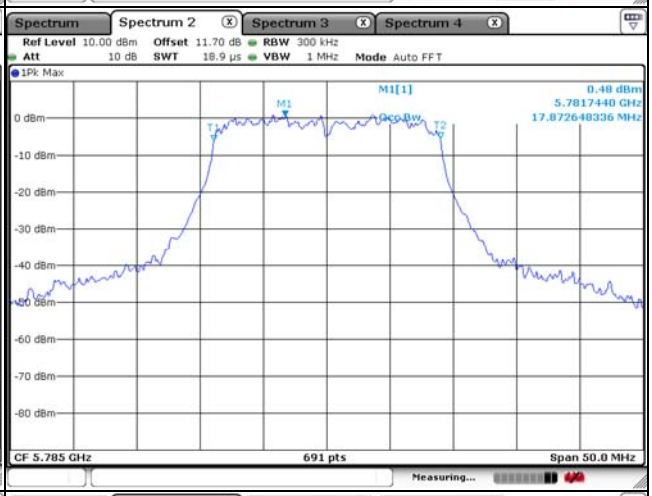
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

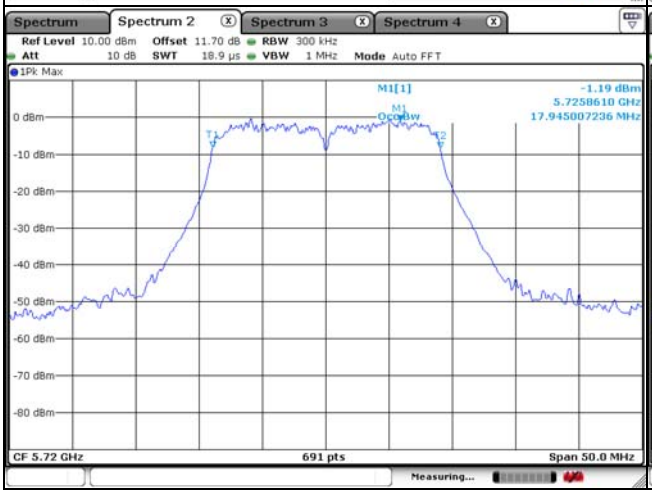
UNII-2C_VHT20	UNII-3_ VHT20

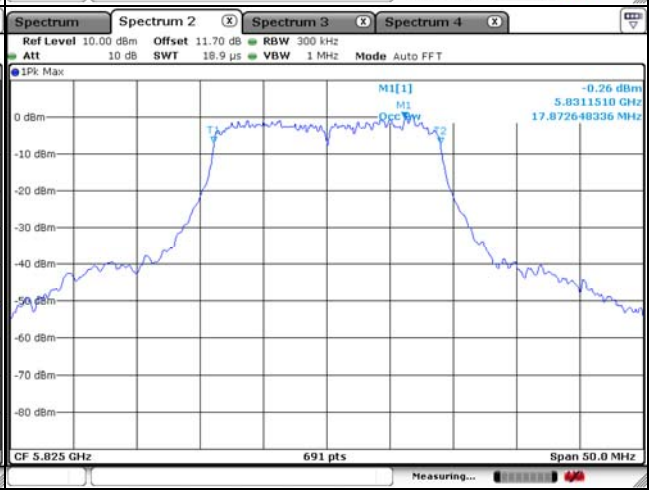




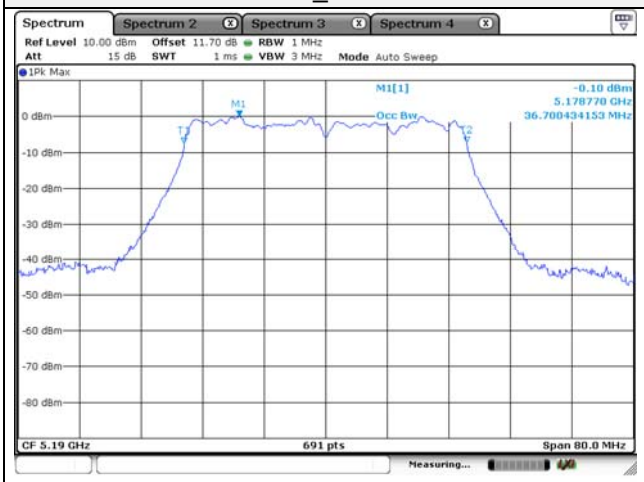
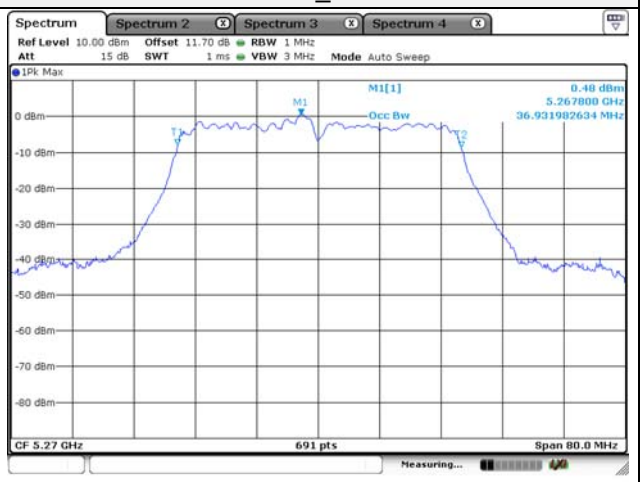
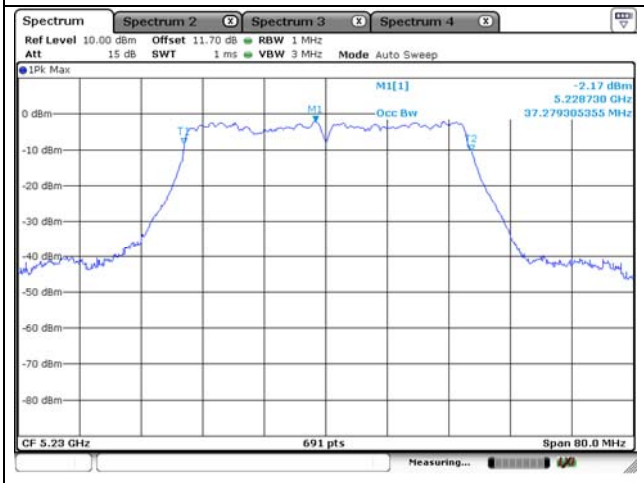
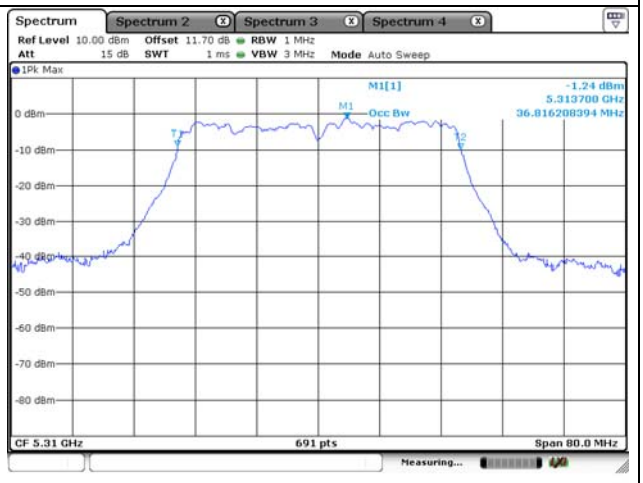




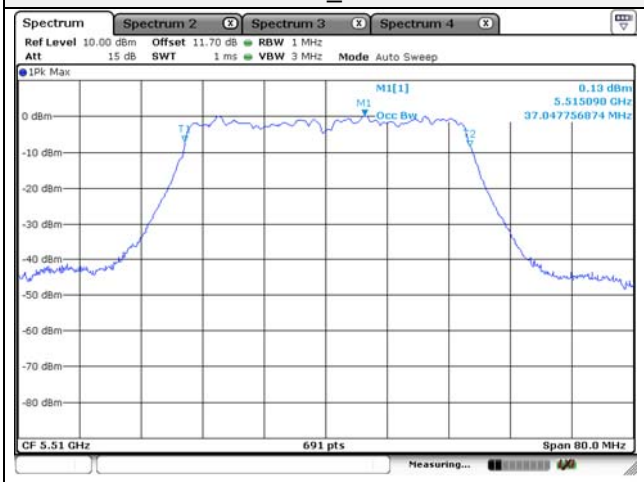
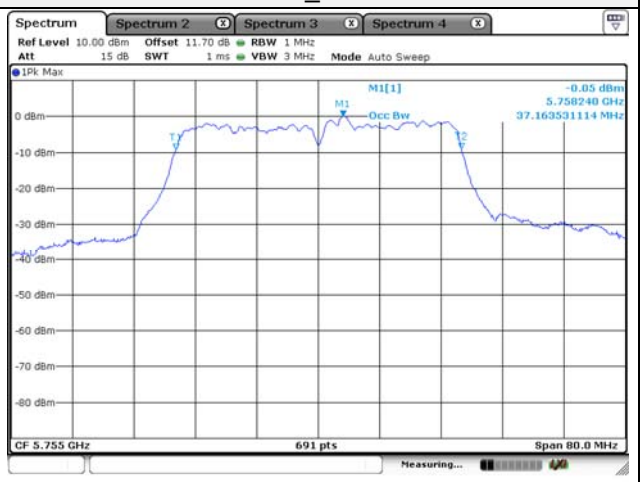
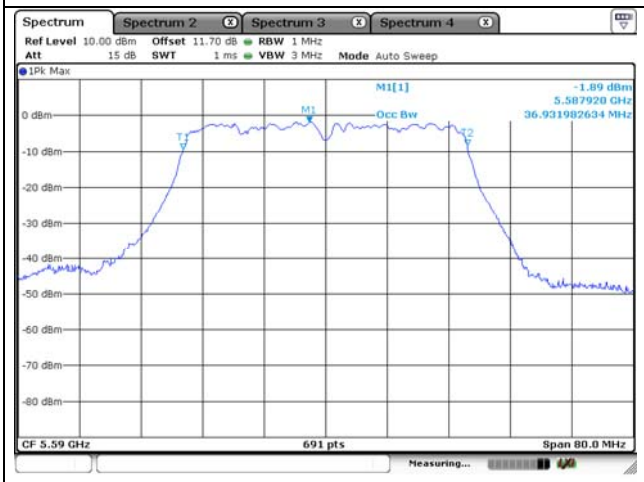
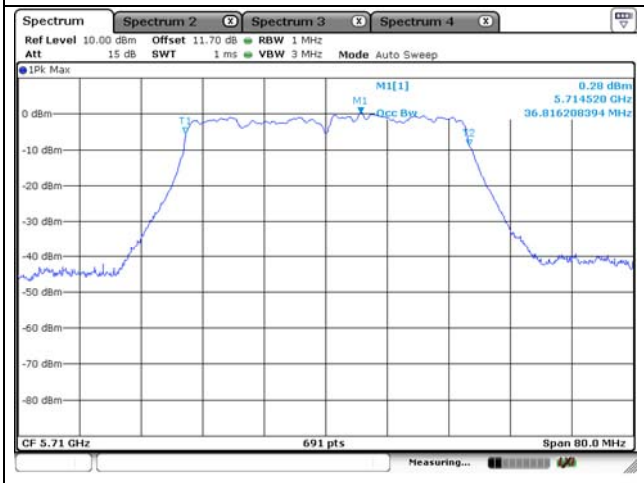
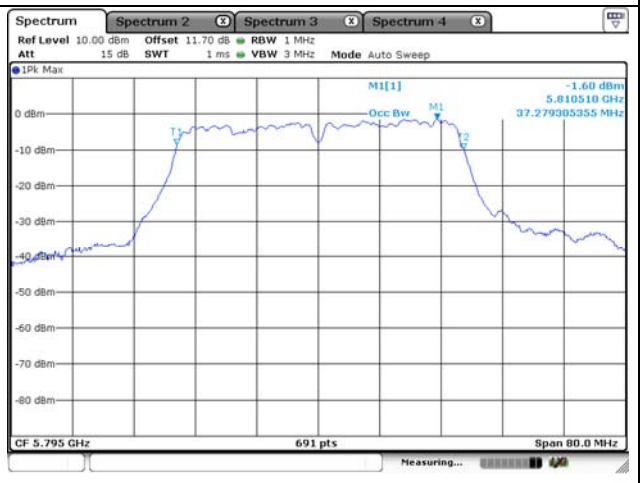




This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

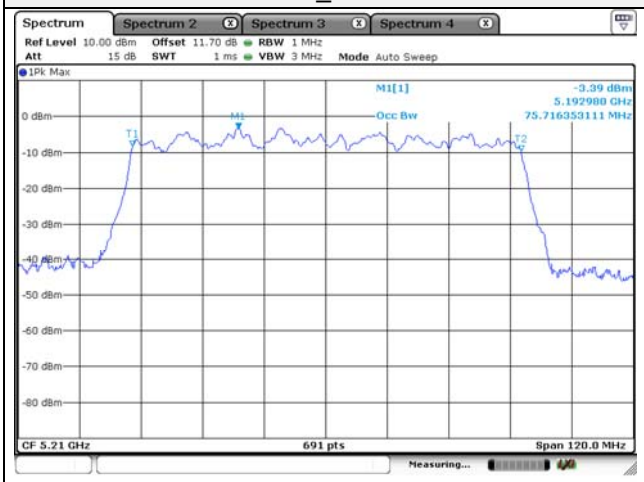
UNII-1_ VHT40	UNII-2A_ VHT40
	
Blank	Blank
	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

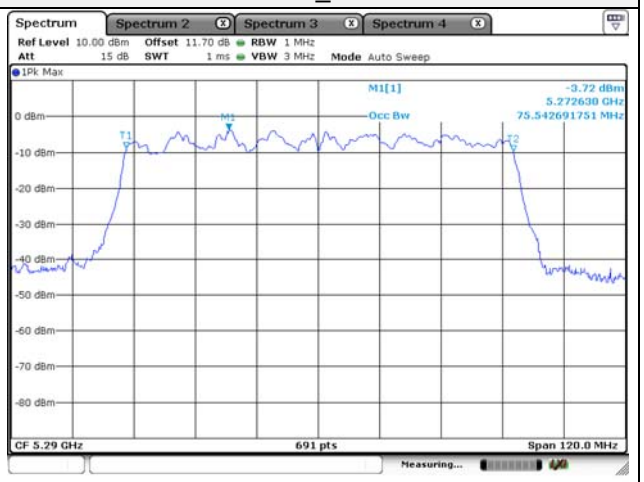
UNII-2C_VHT40	UNII-3_ VHT40
	
	Blank
	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

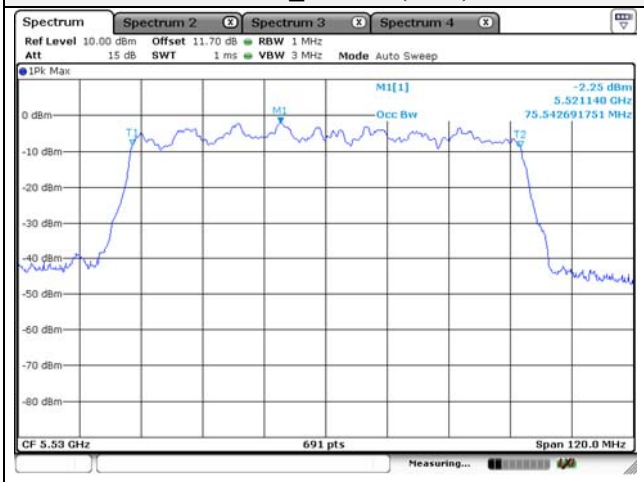
UNII-1_VHT80



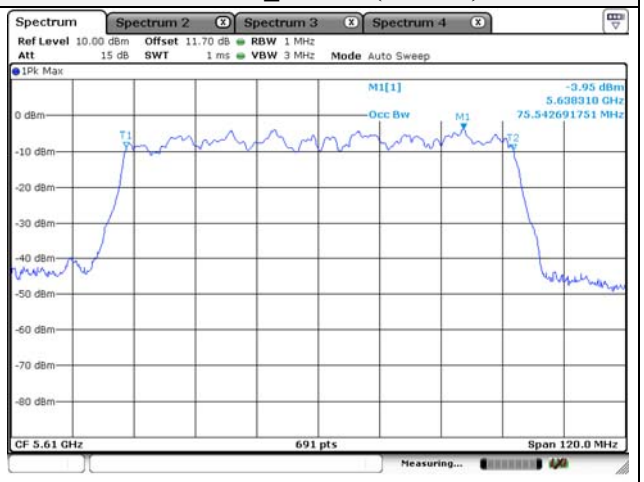
UNII-2A_ VHT80



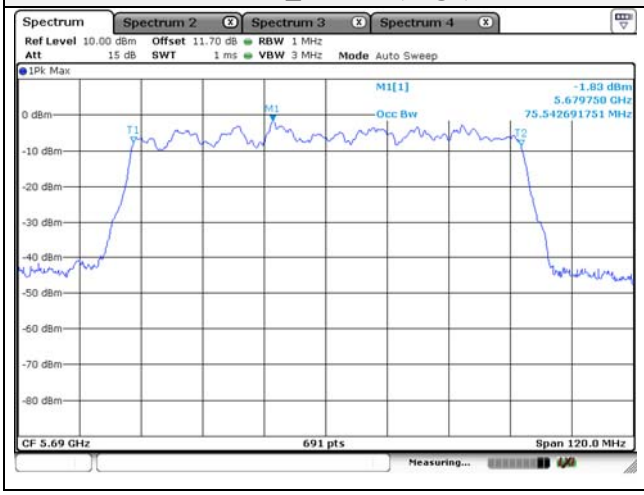
UNII-2C_VHT80(Low)



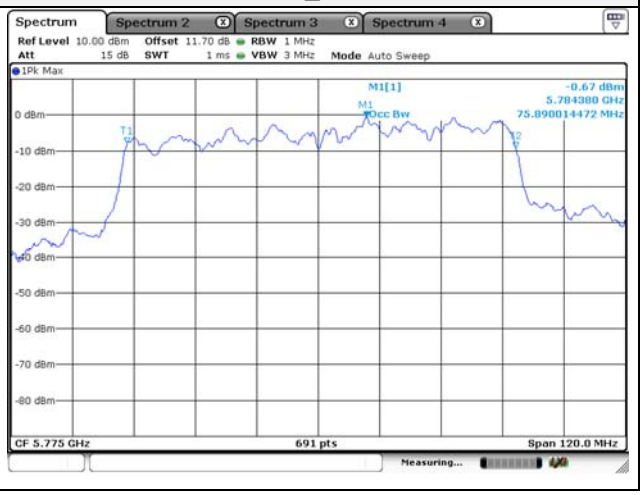
UNII-2C_VHT80(Middle)



UNII-2C_VHT80(High)



UNII-3_ VHT80



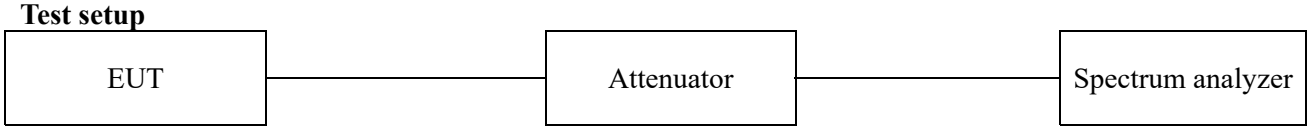
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

3.2. 6 dB bandwidth

Test procedure

KDB 789033 D02 v02r01– Section C.2

Test setup



Section C.2

1. Set RBW = 100 ㎑
2. Set the video bandwidth (VBW) ≥ 3 × RBW.
3. Detector = peak.
4. Sweep = auto couple.
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 ㏈ relative to the maximum level measured in the fundamental emission.

Limit

Within the 5.725-5.85 ㎓ band, the minimum 6 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

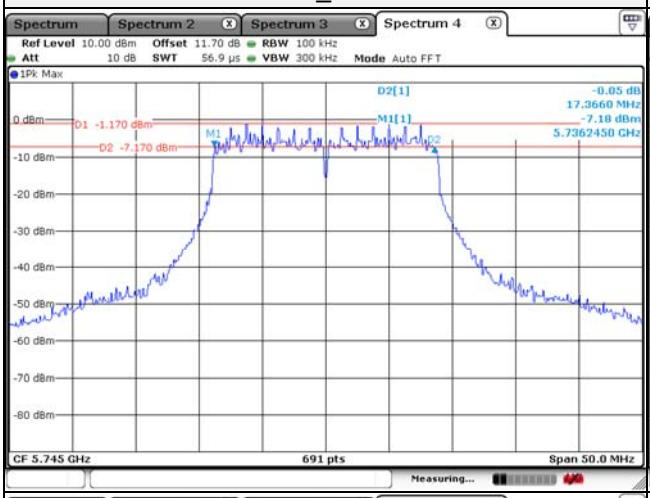
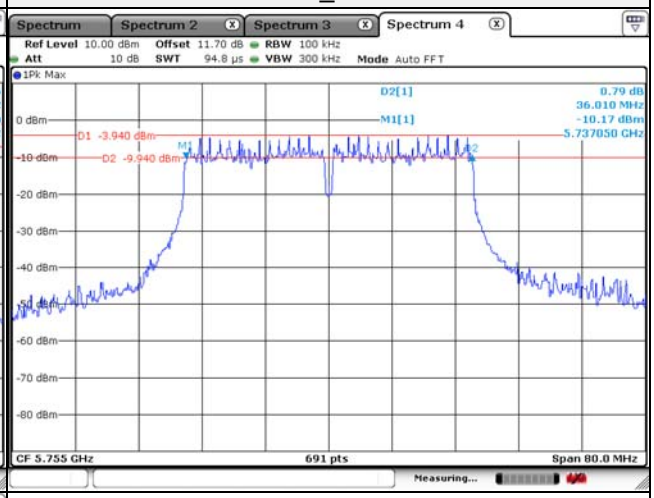
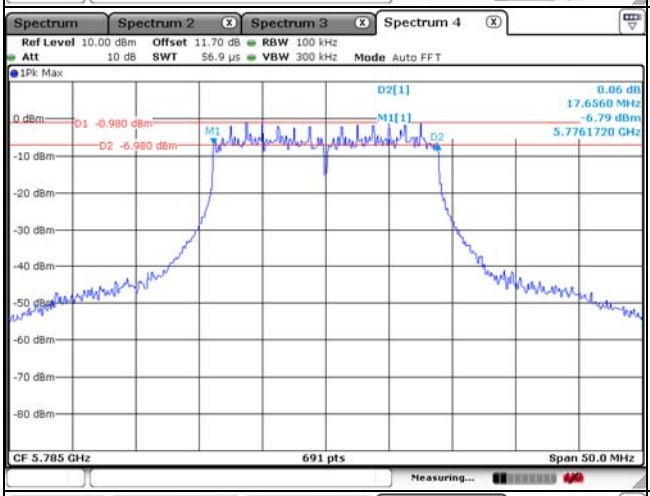
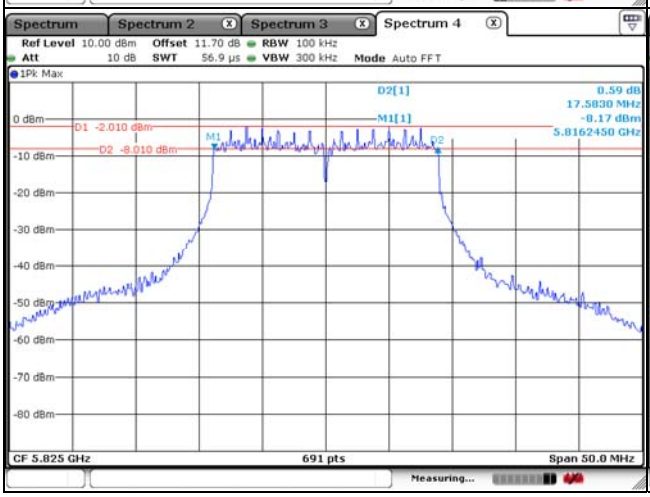
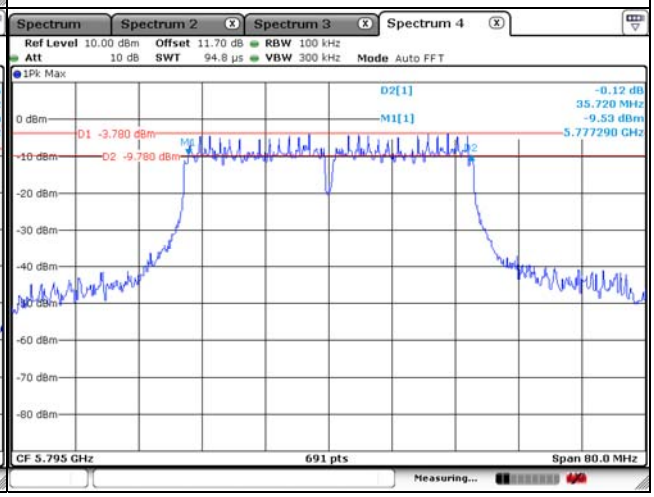
According to RSS-247 6.1 (1), equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

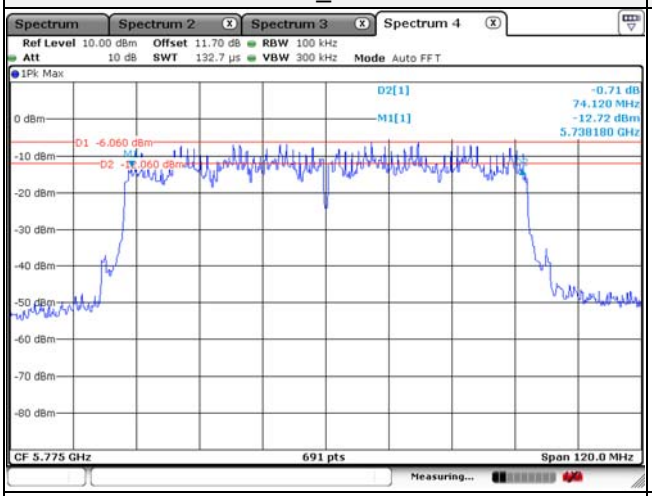
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Test results

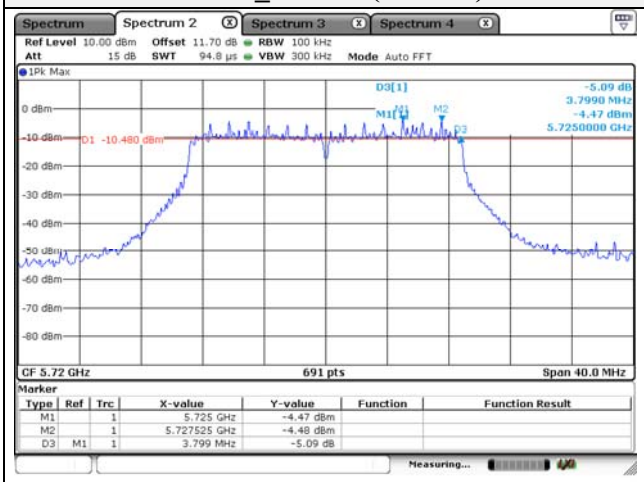
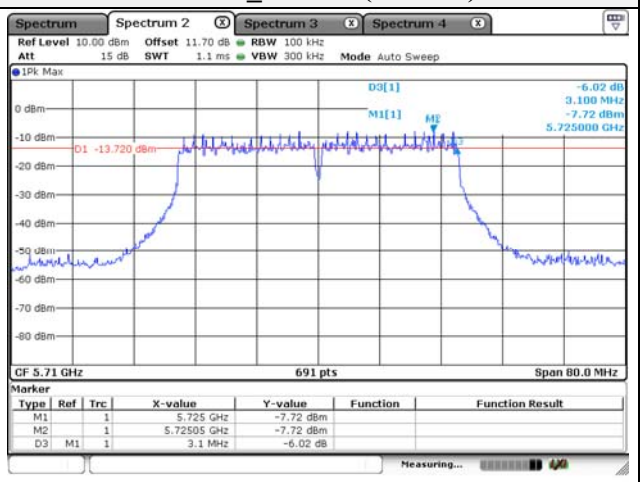
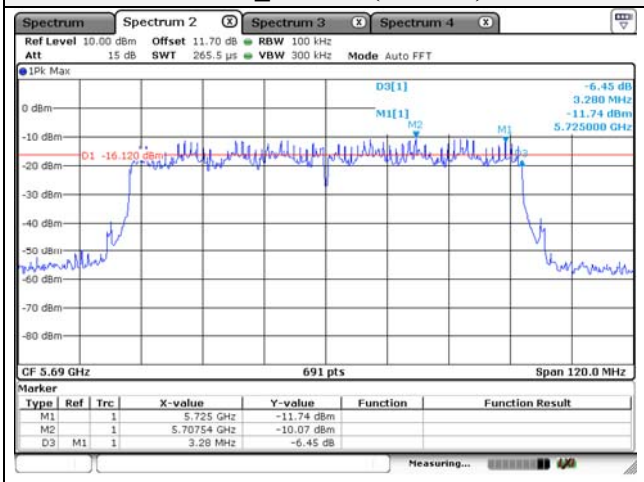
Band	Frequency(㎒)	Mode	6 dB bandwidth(㎒)
UNII-3	5 745	VHT20	17.366
	5 785		17.656
	5 825		17.583
	5 755	VHT40	36.010
	5 795		35.720
	5 775	VHT80	74.120
UNII-3 (Band-crossing channels)	5 720	VHT20	3.799
	5 710	VHT40	3.100
	5 690	VHT80	3.280

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

UNII-3_VHT20	UNII-3_VHT40
	
	Blank
	

UNII-3_VHT80	
	Blank
Blank	Blank

Band-crossing channels

UNII-3_VHT20 (Ch. 144)	UNII-3_VHT40 (Ch. 142)
	
UNII-3_VHT80 (Ch. 138)	
	Blank

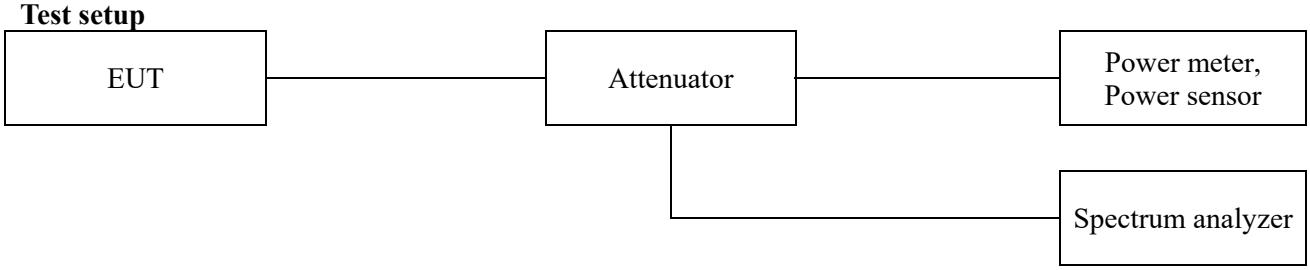
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

3.3. Maximum conducted output power

Test procedure

KDB 789033 D02 v02r01– Section E.3.a) or b)
Used test method is Section E.3.b)

Test setup



Section E.3.a)

Method PM (Measurement using an RF average power meter):

i. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

ii. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

iii. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

iv. Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25 %).

Section E.3.b)

Method PM-G (Measurement using a gated RF average power meter):

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Limit
FCC

Band	EUT Category		Limit
UNII-1		Outdoor access point	1 W (30 dBm)
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	250 mW(24 dBm)
UNII-2A	✓		250 mW or 11 dBm + 10logB*
UNII-2C	✓		250 mW or 11 dBm + 10logB*
UNII-3	✓		1 W (30 dBm)

Note.

1. FCC Limit B is the 26 dB emission bandwidth.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Test results

Band	Frequency (MHz)	Mode	Detector mode	Output power (dBm)	Limit(dBm) FCC
UNII-1	5 180	VHT20	AV	8.79	24.00
	5 220		AV	8.07	
	5 240		AV	8.41	
UNII-2A	5 260		AV	7.68	24.00
	5 280		AV	7.09	
	5 320		AV	7.31	
UNII-2C	5 500		AV	6.04	24.00
	5 600		AV	7.22	
	5 720		AV	7.57	
UNII-3	5 745		AV	9.22	30.00
	5 785		AV	10.08	
	5 825		AV	11.94	

Band	Frequency (MHz)	Mode	Detector mode	Output power (dBm)	Limit(dBm) FCC
UNII-1	5 190	VHT40	AV	7.08	24.00
	5 230		AV	6.66	
UNII-2A	5 270		AV	6.01	24.00
	5 310		AV	5.55	
UNII-2C	5 510		AV	5.80	24.00
	5 590		AV	5.98	
	5 710		AV	7.28	
UNII-3	5 755		AV	7.81	30.00
	5 795		AV	8.33	

Band	Frequency (MHz)	Mode	Detector mode	Output power (dBm)	Limit(dBm) FCC
UNII-1	5 210	VHT80	AV	7.01	24.00
UNII-2A	5 290		AV	5.67	24.00
UNII-2C	5 530		AV	5.02	24.00
	5 610		AV	6.03	
	5 690		AV	7.00	
UNII-3	5 775		AV	8.10	30.00

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

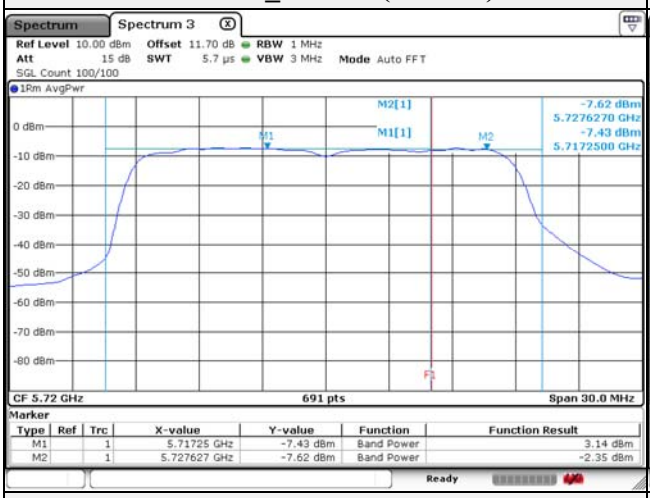
Band-crossing channels

Band	Frequency (㎒)	Mode	Detector mode	Output power (dBm)	Limit(dBm)
					FCC
UNII-2C	5 720	VHT20	AV	3.14	22.90
	5 710	VHT40	AV	2.18	24.00
	5 690	VHT80	AV	0.09	24.00
UNII-3	5 720	VHT20	AV	-2.35	30.00
	5 710	VHT40	AV	-8.16	
	5 690	VHT80	AV	-11.87	

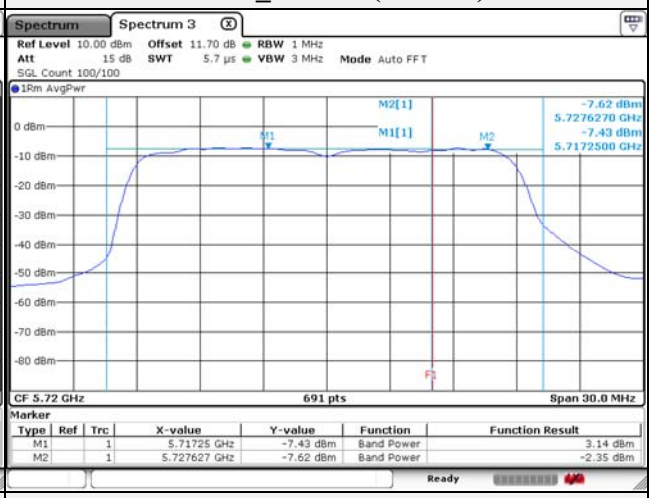
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Band-crossing channels

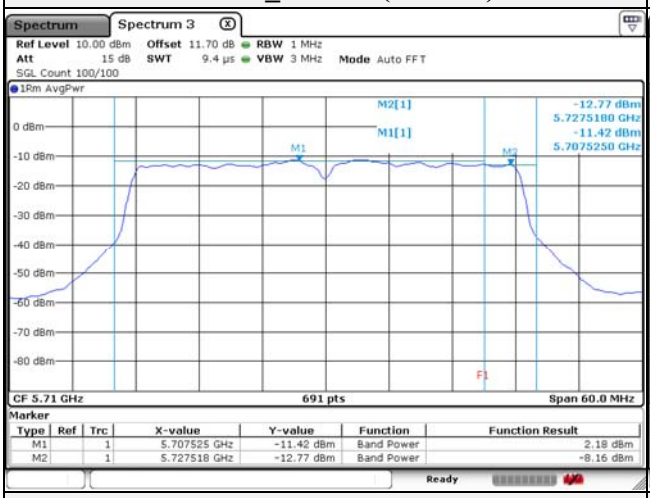
UNII-2C_VHT20 (Ch. 144)



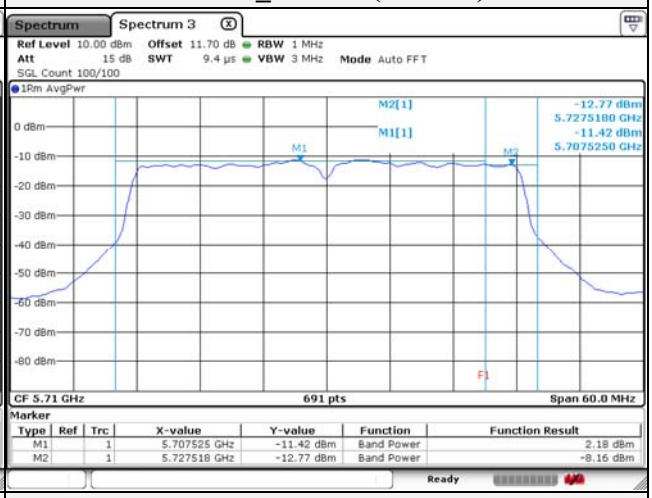
UNII-3_VHT20 (Ch. 144)



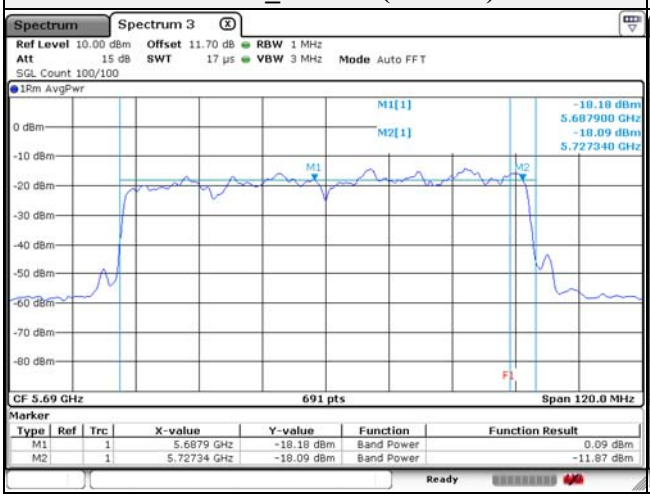
UNII-2C_VHT40 (Ch. 142)



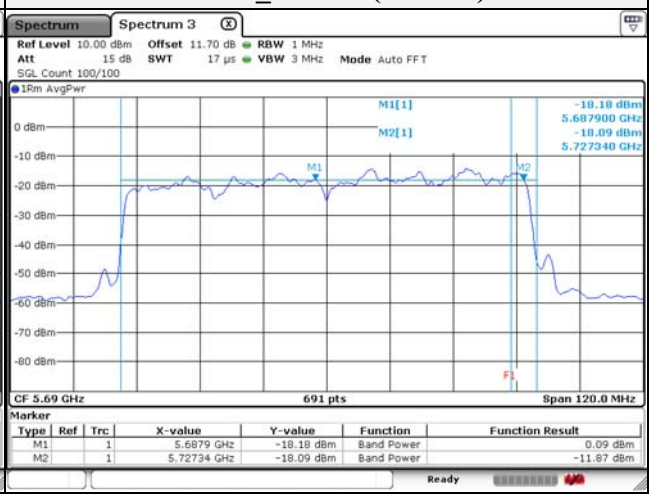
UNII-3_VHT40 (Ch. 142)



UNII-2C_VHT80 (Ch. 138)



UNII-3_VHT80 (Ch. 138)



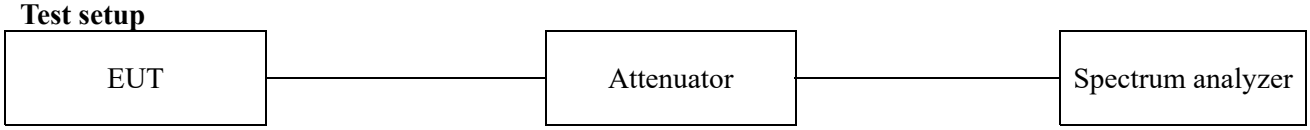
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

3.4. Power spectral density

Test procedure

KDB 789033 D02 v02r01 – Section F

Test setup



Section F

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power…." (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
   a) If Method SA-2 or SA-2 Alternative was used, add 10 log (1/x), where x is the duty cycle, to the peak of the spectrum.
   b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

   a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a)
   b) Set VBW ≥ 3 RBW.
   c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
   d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1 MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
   e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note.

As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW=100 kHz is available on nearly all spectrum analyzers.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Limit
FCC

Band	EUT Category		Limit
UNII-1		Outdoor access point	17 dBm/㎒
		Indoor access point	
		Fixed point-to-point access point	
	✓	Mobile and portable client device	11 dBm/㎒
UNII-2A	✓		11 dBm/㎒
UNII-2C	✓		11 dBm/㎒
UNII-3	✓		30 dBm/500 ㎑

Note.

1. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Test results

Band	Frequency (MHz)	Mode	PSD (dBm/MHz)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/MHz) FCC
UNII-1	5 180	VHT20	-6.40	-	1.62	-4.78	11.00
	5 220		-6.35			-4.73	
	5 240		-6.05			-4.43	
	5 190	VHT40	-8.91		3.15	-5.76	
	5 230		-9.52			-6.37	
	5 210	VHT80	-11.07		3.43	-7.64	

Band	Frequency (MHz)	Mode	PSD (dBm/MHz)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/MHz) FCC
UNII-2A	5 260	VHT20	-6.74	-	0.93	-5.81	11.00
	5 280		-6.59			-5.66	
	5 320		-5.87			-4.94	
	5 270	VHT40	-9.93		3.42	-6.51	
	5 310		-10.58			-7.16	
	5 290	VHT80	-14.07		4.97	-9.10	

Band	Frequency (MHz)	Mode	PSD (dBm/MHz)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/MHz) FCC
UNII-2C	5 500	VHT20	-6.31	-	2.24	-4.07	11.00
	5 600		-5.14			-2.90	
	5 720		-4.30			-2.06	
	5 500	VHT40	-12.08		3.43	-8.65	
	5 600		-9.02			-5.59	
	5 720		-8.23			-4.80	
	5 530	VHT80	-12.95		3.70	-9.25	
	5 610		-12.62			-8.92	
	5 690		-11.61			-7.91	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Band	Frequency (㎒)	Mode	PSD (dBm/500㎑)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒) FCC
UNII-3	5 745	VHT20	-5.21	-	2.29	-2.92	30.00
	5 785		-5.67			-3.38	
	5 825		-6.92			-4.63	
	5 755	VHT40	-9.44		2.76	-6.68	
	5 795		-9.27			-6.51	
	5 775	VHT80	-11.95		3.58	-8.37	

Band-crossing channels

Band	Frequency (㎒)	Mode	PSD (dBm/㎒)	RBWF Note1	DCF Note2	Sum Note3	Limit(dBm/㎒) FCC
UNII-2C	5 720	VHT20	-7.50	-	2.24	-5.26	11.00
	5 710	VHT40	-11.23	-	3.43	-7.80	
	5 690	VHT80	-14.76	-	3.70	-11.06	

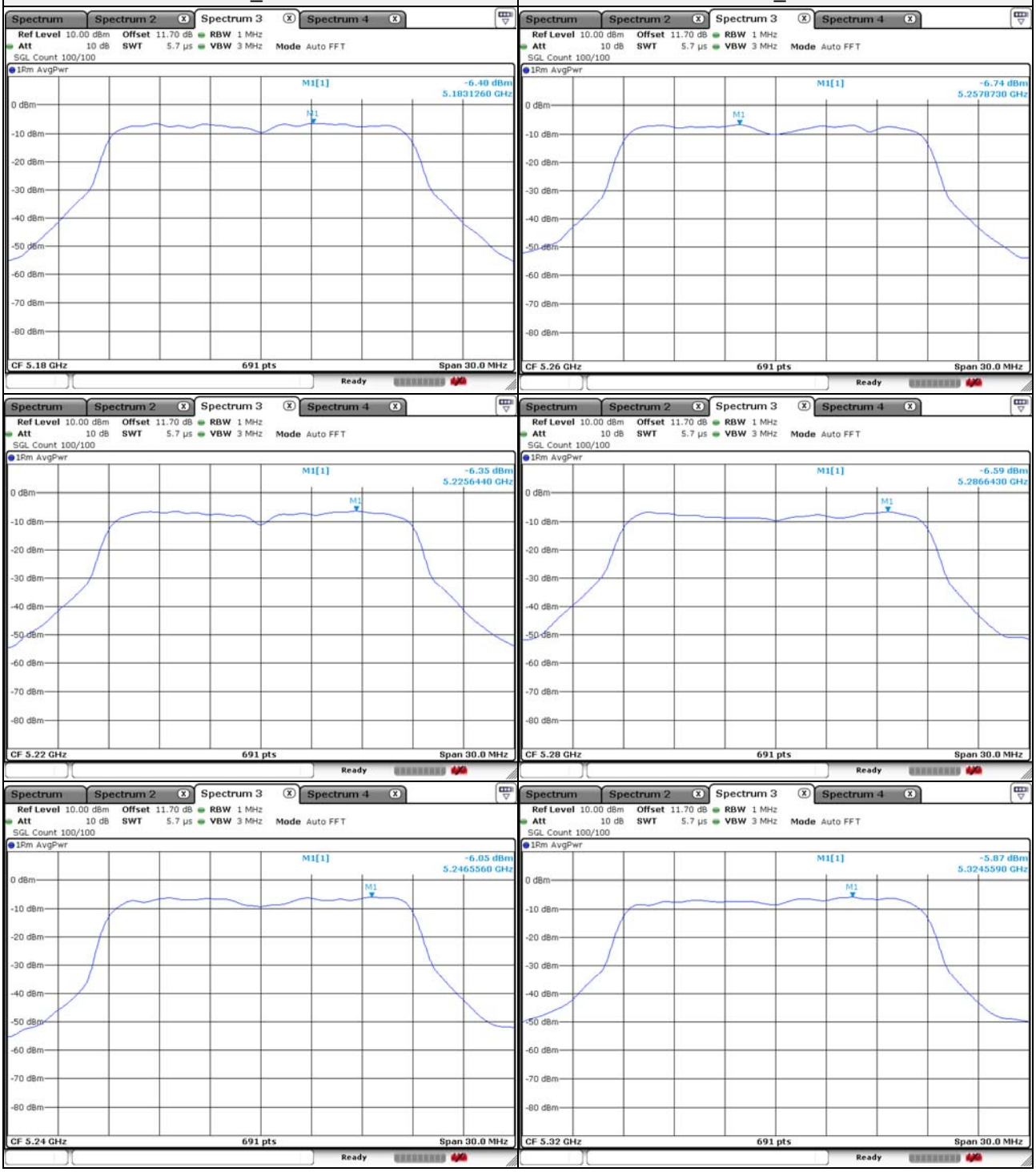
Band	Frequency (㎒)	Mode	PSD (dBm/500㎑)	RBWF Note1	DCF Note2	Sum Note3	Limit (dBm/500㎑) FCC
UNII-3	5 720	VHT20	-10.15	-	2.29	-7.86	30.00
	5 710	VHT40	-14.79	-	2.76	-12.03	
	5 690	VHT80	-19.27	-	3.58	-15.69	

Note.

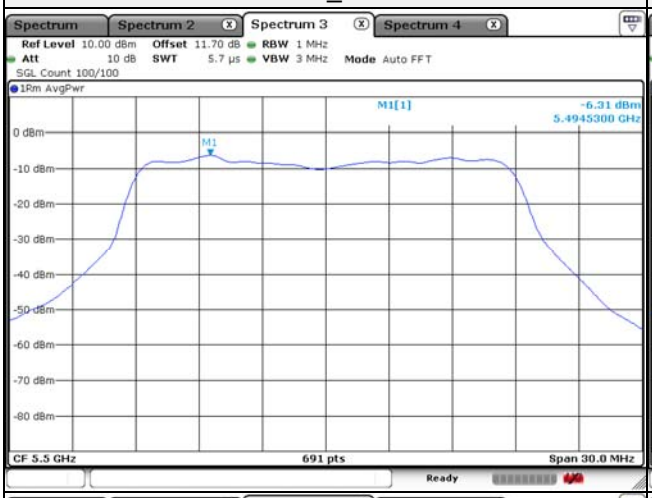
1. UNII-1 = 10log(1 ㎒/1 ㎒)
   UNII-2A = 10log(1 ㎒/1 ㎒)
   UNII-2C = 10log(1 ㎒/1 ㎒)
   UNII-3 = 10log(500 ㎑ /500 ㎑)
2. Refer to the page 52 on this report.
3. Sum(dBm) = PSD(dBm) + RBWF + Duty correction factor (dB)

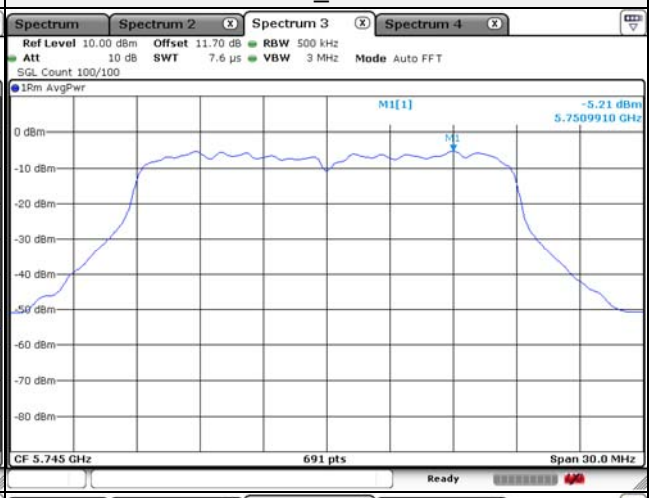
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

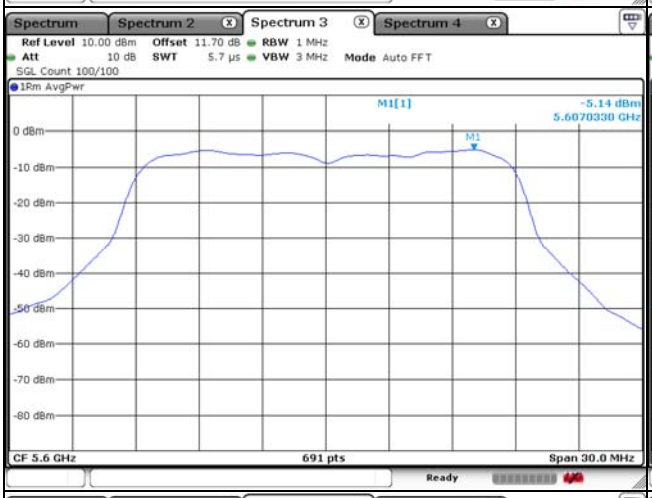
UNII-1_ VHT20	UNII-2A_ VHT20

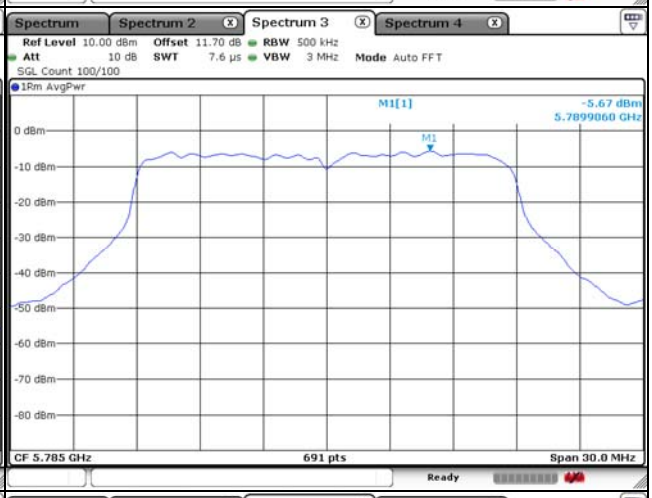


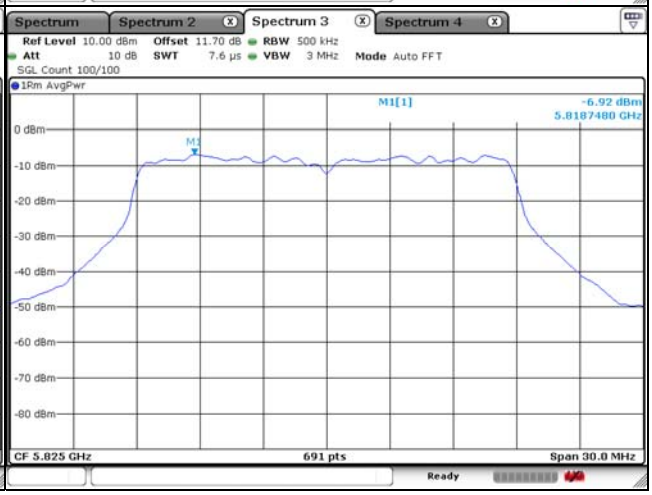
UNII-2C_VHT20	UNII-3_ VHT20



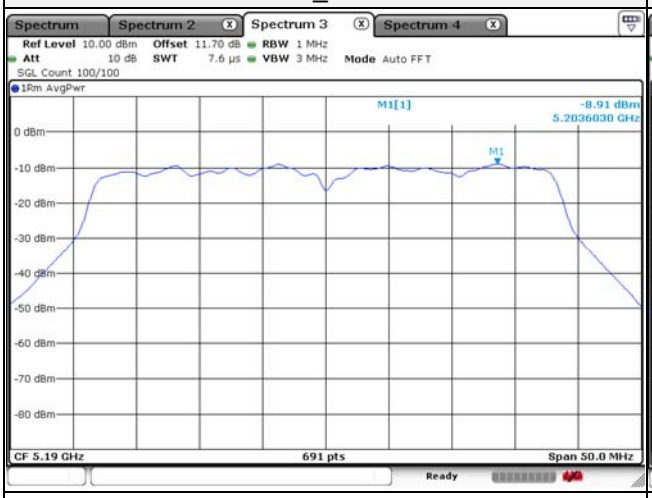
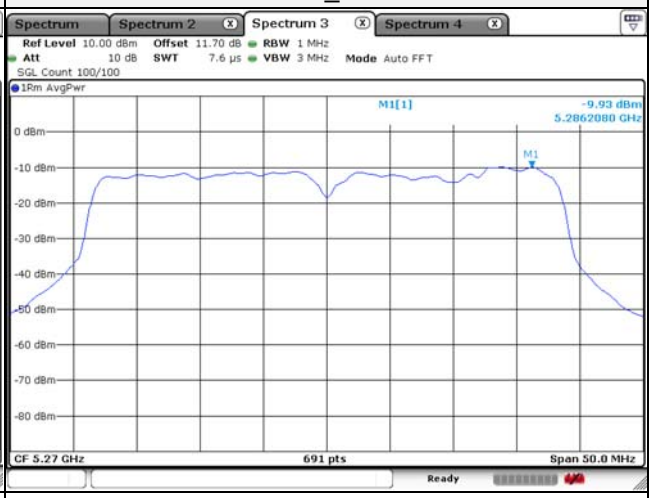
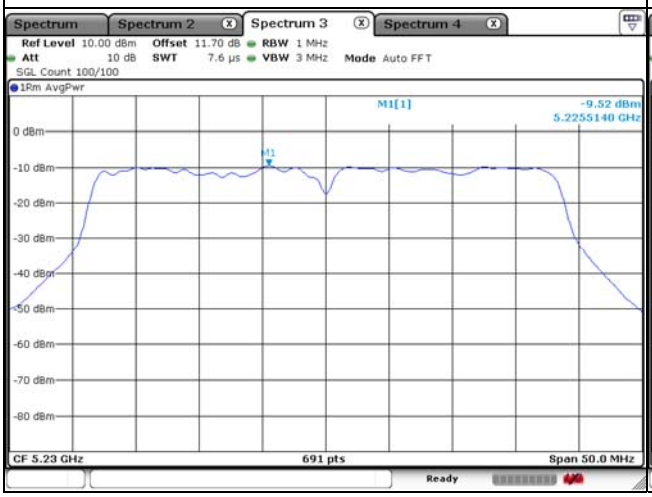
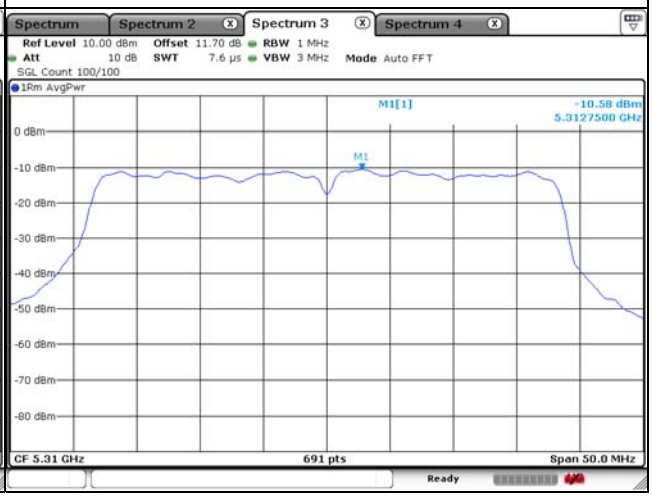




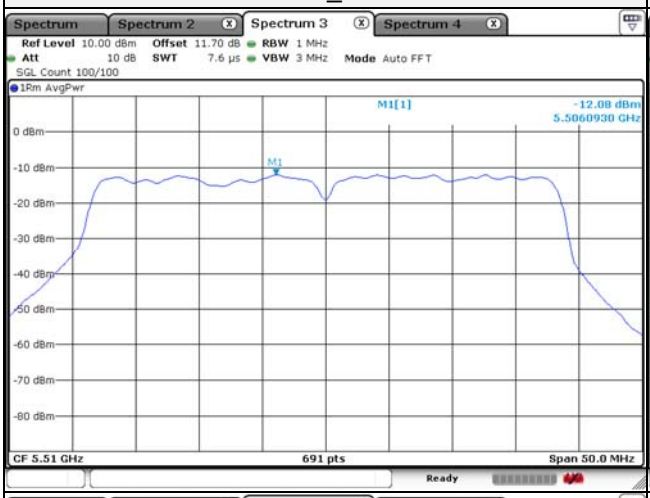
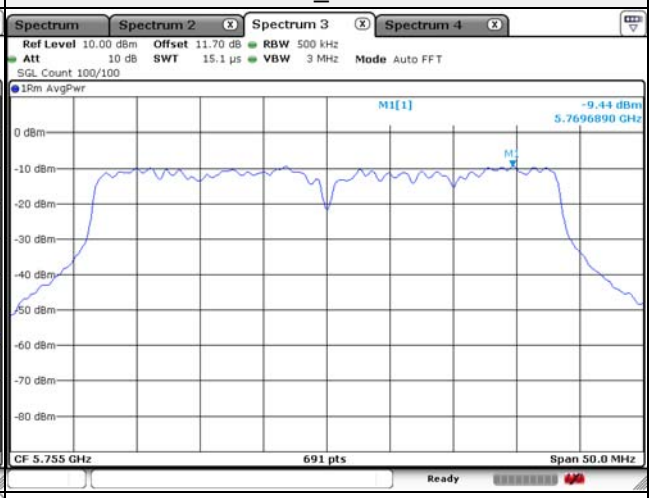
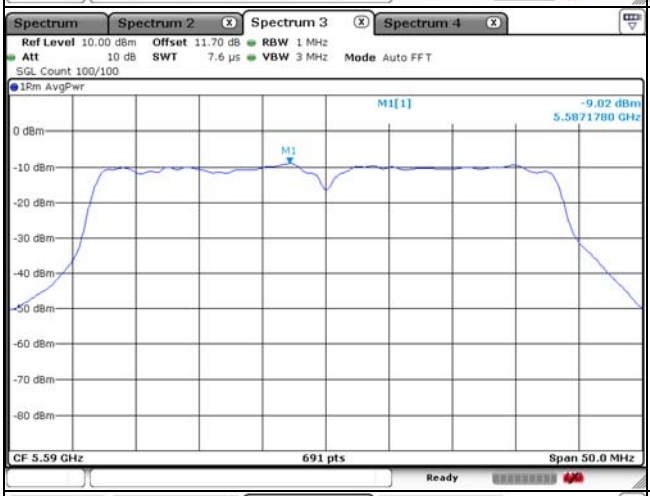
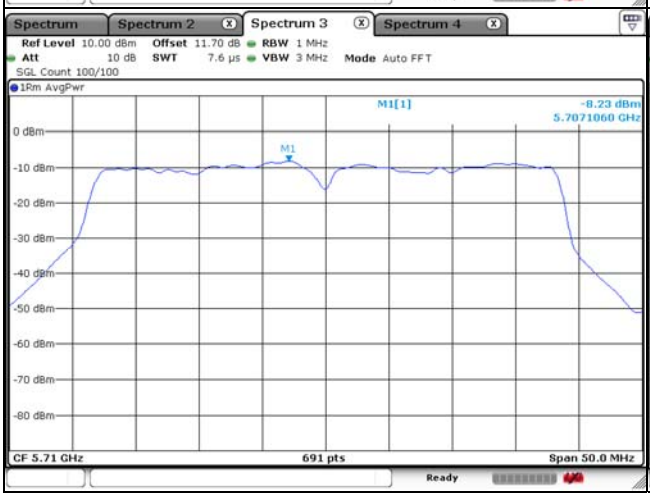
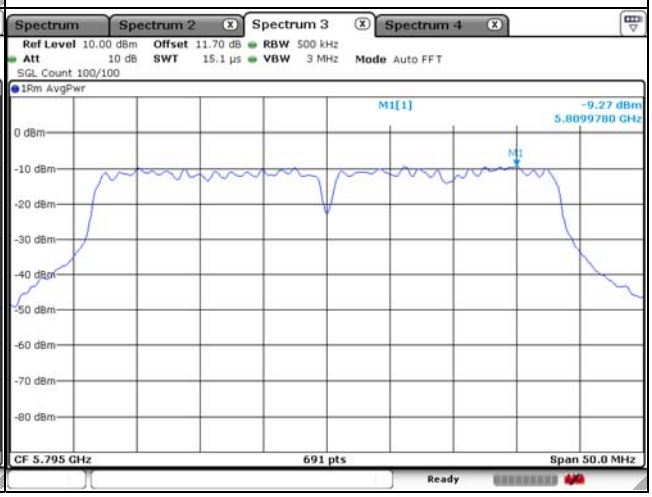




This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

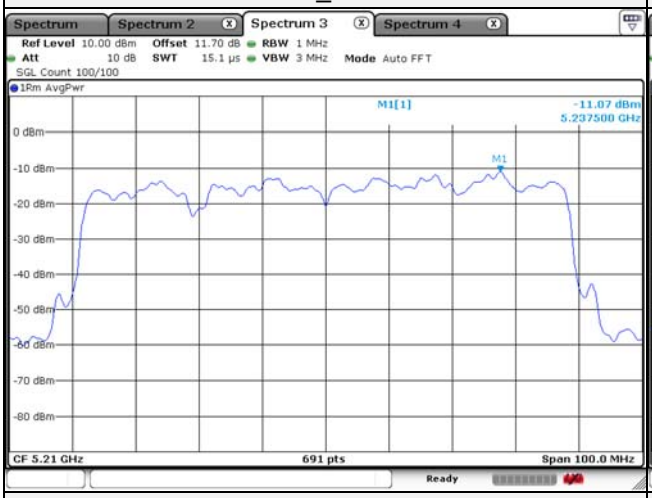
UNII-1_ VHT40	UNII-2A_ VHT40
	
Blank	Blank
	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

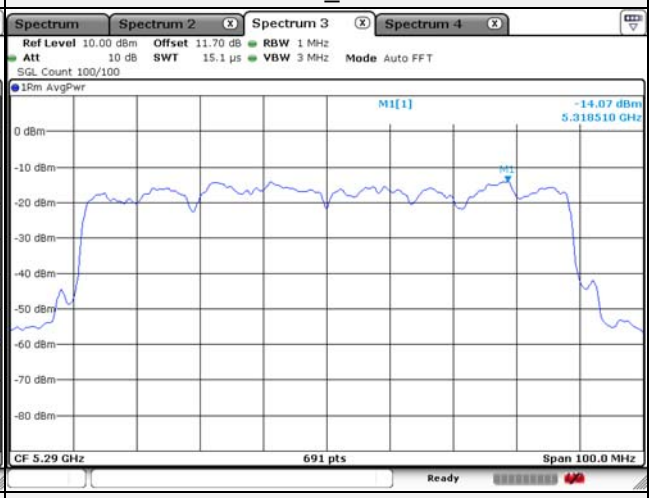
UNII-2C_VHT40	UNII-3_ VHT40
	
	Blank
	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

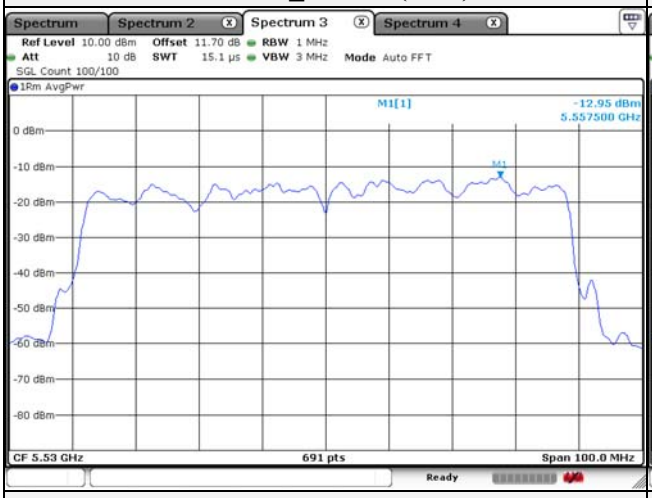
UNII-1_VHT80



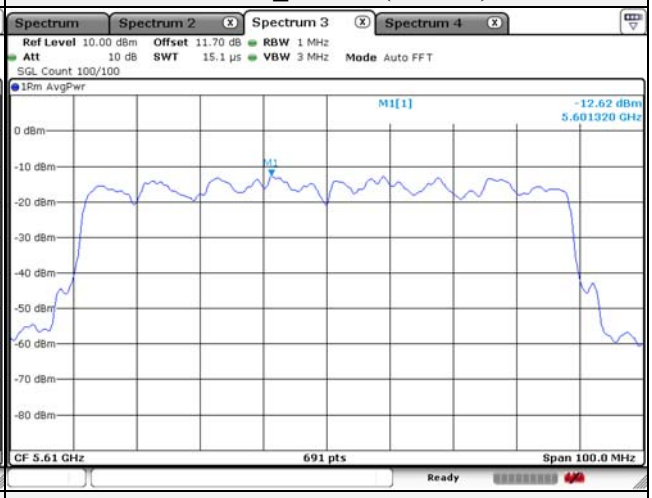
UNII-2A_ VHT80



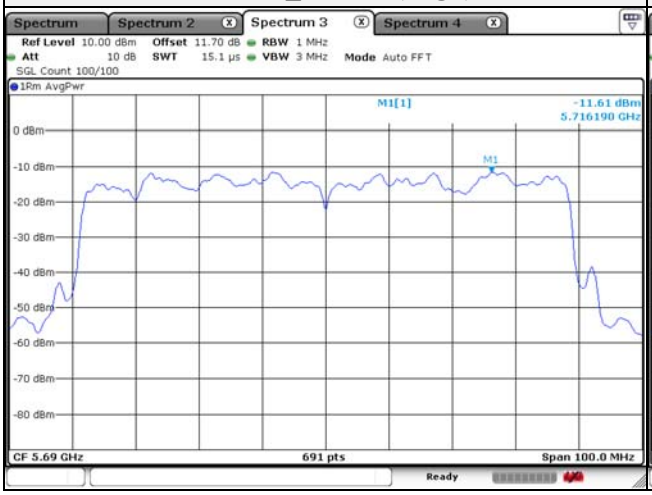
UNII-2C_VHT80(Low)



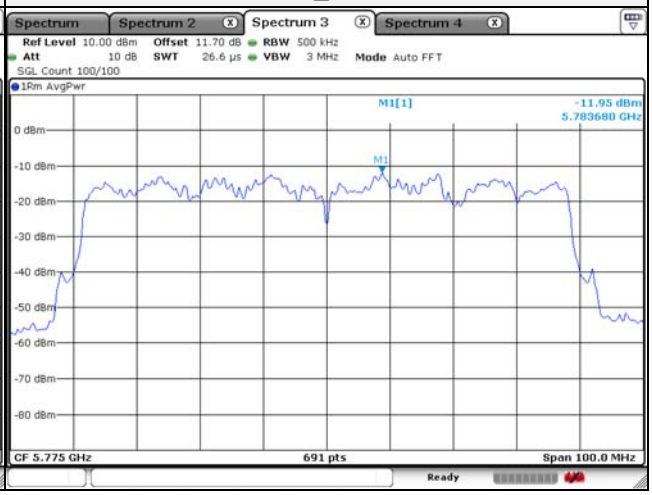
UNII-2C_VHT80(Middle)



UNII-2C_VHT80(High)



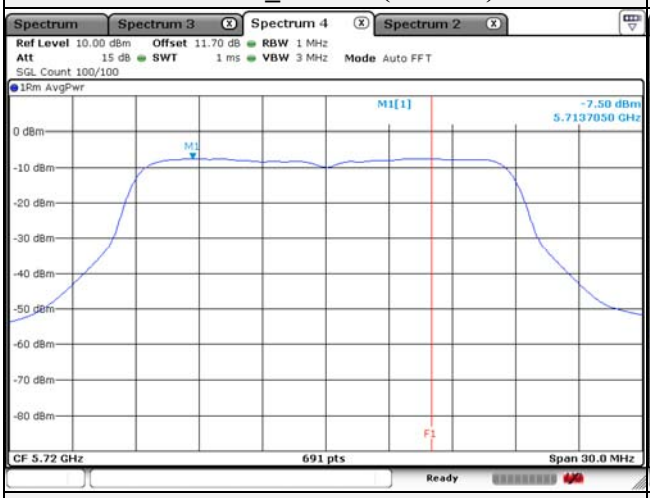
UNII-3_ VHT80



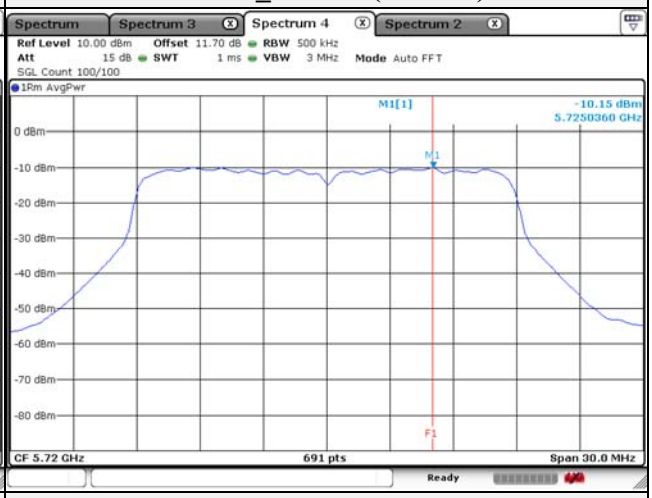
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Band-crossing channels

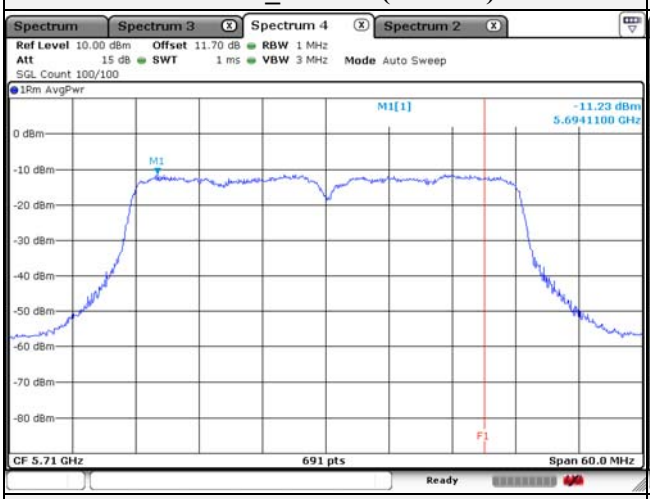
UNII-2C_VHT20 (Ch. 144)



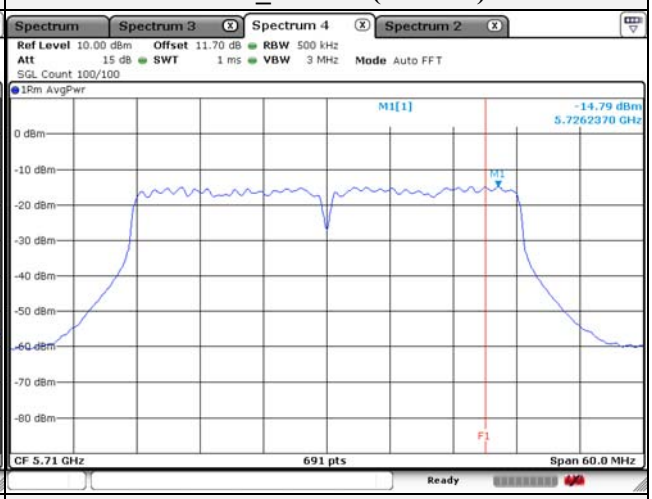
UNII-3_VHT20 (Ch. 144)



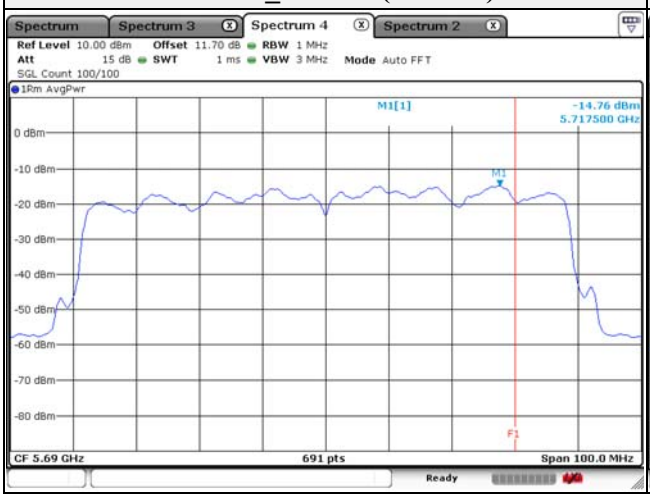
UNII-2C_VHT40 (Ch. 142)



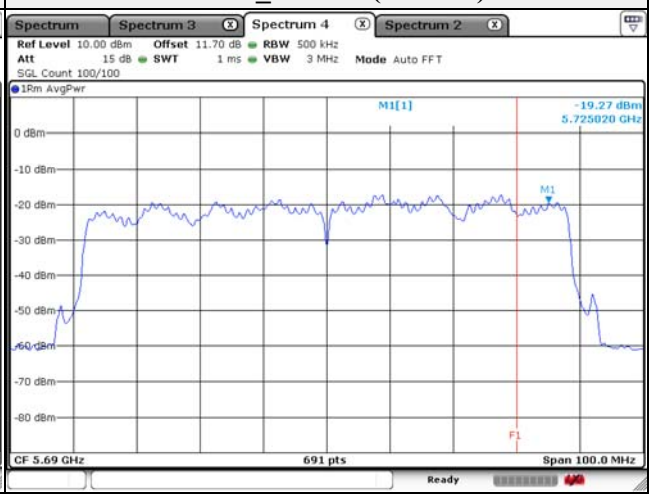
UNII-3_VHT40 (Ch. 142)



UNII-2C_VHT80 (Ch. 138)



UNII-3_VHT80 (Ch. 138)



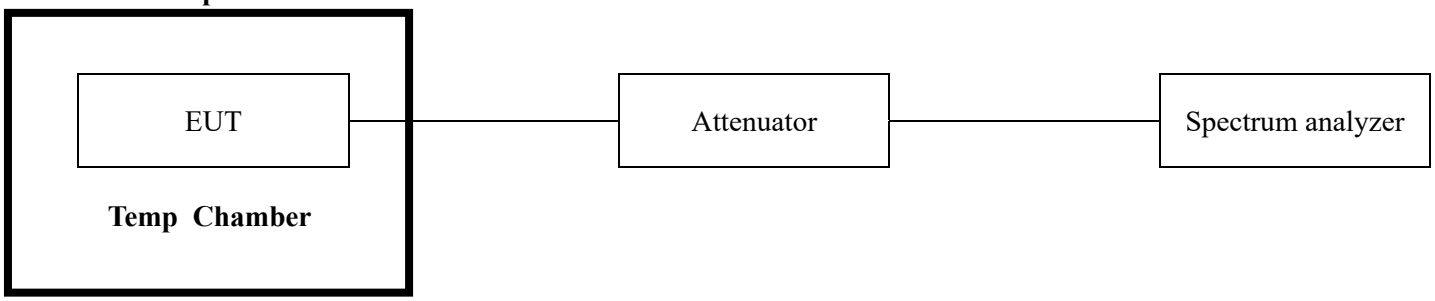
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

3.5. Frequency Stability

Test procedure

ANSI C63.10-2013, clause 6.8.1

Test setup



1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
7. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

Limit

N/A

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Test results

Mode: UNII-1

Operating frequency: 5 180 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 180.028 385	28 385	0.000 548
			2 minutes	5 180.027 981	27 981	0.000 540
			5 minutes	5 180.027 141	27 141	0.000 524
			10 minutes	5 180.026 930	26 930	0.000 520
100 %		-10	Startup	5 180.024 261	24 261	0.000 468
			2 minutes	5 180.024 179	24 179	0.000 467
			5 minutes	5 180.023 701	23 701	0.000 458
			10 minutes	5 180.023 432	23 432	0.000 452
100 %		0	Startup	5 180.016 678	16 678	0.000 322
			2 minutes	5 180.016 605	16 605	0.000 321
			5 minutes	5 180.016 522	16 522	0.000 319
			10 minutes	5 180.015 131	15 131	0.000 292
100 %		10	Startup	5 180.009 385	9 385	0.000 181
			2 minutes	5 180.009 295	9 295	0.000 179
			5 minutes	5 180.009 200	9 200	0.000 178
			10 minutes	5 180.008 625	8 625	0.000 166
100 %		20	Startup	5 180.008 043	8 043	0.000 155
			2 minutes	5 180.007 448	7 448	0.000 144
			5 minutes	5 180.007 161	7 161	0.000 138
			10 minutes	5 180.006 464	6 464	0.000 125
100 %		23	Startup	5 180.006 705	6 705	0.000 129
			2 minutes	5 180.006 499	6 499	0.000 125
			5 minutes	5 180.005 542	5 542	0.000 107
			10 minutes	5 180.005 217	5 217	0.000 101
100 %		30	Startup	5 180.005 845	5 845	0.000 113
			2 minutes	5 180.006 417	6 417	0.000 124
			5 minutes	5 180.006 103	6 103	0.000 118
			10 minutes	5 180.005 155	5 155	0.000 100
100 %		40	Startup	5 179.991 169	-883 1	-0.000 170
			2 minutes	5 179.991 027	-897 3	-0.000 173
			5 minutes	5 179.990 908	-909 2	-0.000 176
			10 minutes	5 179.990 078	-992 2	-0.000 192
100 %		50	Startup	5 179.987 722	-122 78	-0.000 237
			2 minutes	5 179.987 579	-124 21	-0.000 240
			5 minutes	5 179.987 231	-127 69	-0.000 247
			10 minutes	5 179.986 937	-130 63	-0.000 252
85 %	DC 20.4	23	Startup	5 180.008 186	8 186	0.000 158
			2 minutes	5 180.007 868	7 868	0.000 152
			5 minutes	5 180.007 584	7 584	0.000 146
			10 minutes	5 180.007 545	7 545	0.000 146
115 %	DC 27.6	23	Startup	5 180.008 797	8 797	0.000 170
			2 minutes	5 180.008 289	8 289	0.000 160
			5 minutes	5 180.008 277	8 277	0.000 160
			10 minutes	5 180.007 435	7 435	0.000 144

Note.

1. All 9-36V DC mode were investigated and the data 24VDC was reported in this section is the worst case condition

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Mode: UNII-2A

Operating frequency: 5 260 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 260.028 295	28 295	0.000 538
			2 minutes	5 260.028 173	28 173	0.000 536
			5 minutes	5 260.027 784	27 784	0.000 528
			10 minutes	5 260.026 830	26 830	0.000 510
100 %		-10	Startup	5 260.025 120	25 120	0.000 478
			2 minutes	5 260.024 956	24 956	0.000 474
			5 minutes	5 260.024 468	24 468	0.000 465
			10 minutes	5 260.023 625	23 625	0.000 449
100 %		0	Startup	5 260.016 263	16 263	0.000 309
			2 minutes	5 260.015 557	15 557	0.000 296
			5 minutes	5 260.015 159	15 159	0.000 288
			10 minutes	5 260.015 044	15 044	0.000 286
100 %		10	Startup	5 260.010 160	10 160	0.000 193
			2 minutes	5 260.009 172	9 172	0.000 174
			5 minutes	5 260.008 795	8 795	0.000 167
			10 minutes	5 260.008 673	8 673	0.000 165
100 %		20	Startup	5 260.007 733	7 733	0.000 147
			2 minutes	5 260.007 719	7 719	0.000 147
			5 minutes	5 260.006 921	6 921	0.000 132
			10 minutes	5 260.006 277	6 277	0.000 119
100 %		23	Startup	5 260.007 107	7 107	0.000 135
			2 minutes	5 260.006 977	6 977	0.000 133
			5 minutes	5 260.006 093	6 093	0.000 116
			10 minutes	5 260.005 454	5 454	0.000 104
100 %		30	Startup	5 260.004 528	4 528	0.000 086
			2 minutes	5 260.005 335	5 335	0.000 101
			5 minutes	5 260.005 097	5 097	0.000 097
			10 minutes	5 260.004 105	4 105	0.000 078
100 %		40	Startup	5 259.991 257	-874 3	-0.000 166
			2 minutes	5 259.990 881	-911 9	-0.000 173
			5 minutes	5 259.990 812	-918 8	-0.000 175
			10 minutes	5 259.990 355	-964 5	-0.000 183
100 %		50	Startup	5 259.988 344	-116 56	-0.000 222
			2 minutes	5 259.988 224	-117 76	-0.000 224
			5 minutes	5 259.987 563	-124 37	-0.000 236
			10 minutes	5 259.987 293	-127 07	-0.000 242
85 %	DC 20.4	23	Startup	5 260.008 708	8 708	0.000 166
			2 minutes	5 260.008 241	8 241	0.000 157
			5 minutes	5 260.008 145	8 145	0.000 155
			10 minutes	5 260.007 877	7 877	0.000 150
115 %	DC 27.6	23	Startup	5 260.009 264	9 264	0.000 176
			2 minutes	5 260.008 514	8 514	0.000 162
			5 minutes	5 260.008 448	8 448	0.000 161
			10 minutes	5 260.008 413	8 413	0.000 160

Note.

1. All 9-36V DC mode were investigated and the data 24VDC was reported in this section is the worst case condition

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Mode: UNII-2C

Operating frequency: 5500 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 500.028807	28 807	0.000 524
			2 minutes	5 500.028707	28 707	0.000 522
			5 minutes	5 500.027321	27 321	0.000 497
			10 minutes	5 500.027036	27 036	0.000 492
100 %		-10	Startup	5 500.024961	24 961	0.000 454
			2 minutes	5 500.023891	23 891	0.000 434
			5 minutes	5 500.023773	23 773	0.000 432
			10 minutes	5 500.023719	23 719	0.000 431
100 %		0	Startup	5 500.016738	16 738	0.000 304
			2 minutes	5 500.016322	16 322	0.000 297
			5 minutes	5 500.016265	16 265	0.000 296
			10 minutes	5 500.014990	14 990	0.000 273
100 %		10	Startup	5 500.010528	10 528	0.000 191
			2 minutes	5 500.010158	10 158	0.000 185
			5 minutes	5 500.009687	9 687	0.000 176
			10 minutes	5 500.008898	8 898	0.000 162
100 %		20	Startup	5 500.007707	7 707	0.000 140
			2 minutes	5 500.007163	7 163	0.000 130
			5 minutes	5 500.006787	6 787	0.000 123
			10 minutes	5 500.006395	6 395	0.000 116
100 %		23	Startup	5 500.007038	7 038	0.000 128
			2 minutes	5 500.006406	6 406	0.000 116
			5 minutes	5 500.006008	6 008	0.000 109
			10 minutes	5 500.005361	5 361	0.000 097
100 %		30	Startup	5 500.005946	5 946	0.000 108
			2 minutes	5 500.006083	6 083	0.000 111
			5 minutes	5 500.006081	6 081	0.000 111
			10 minutes	5 500.004990	4 990	0.000 091
100 %		40	Startup	5 499.990837	-916 3	-0.000 167
			2 minutes	5 499.990436	-956 4	-0.000 174
			5 minutes	5 499.990232	-976 8	-0.000 178
			10 minutes	5 499.989935	-100 65	-0.000 183
100 %		50	Startup	5 499.988198	-118 02	-0.000 215
			2 minutes	5 499.988015	-119 85	-0.000 218
			5 minutes	5 499.987686	-123 14	-0.000 224
			10 minutes	5 499.987663	-123 37	-0.000 224
85 %	DC 20.4	23	Startup	5 500.008375	8 375	0.000 152
			2 minutes	5 500.007763	7 763	0.000 141
			5 minutes	5 500.007623	7 623	0.000 139
			10 minutes	5 500.007468	7 468	0.000 136
115 %	DC 27.6	23	Startup	5 500.008257	8 257	0.000 150
			2 minutes	5 500.007890	7 890	0.000 143
			5 minutes	5 500.007822	7 822	0.000 142
			10 minutes	5 500.007592	7 592	0.000 138

Note.

1. All 9-36V DC mode were investigated and the data 24VDC was reported in this section is the worst case condition

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Mode: UNII-3

Operating frequency: 5 745 ㎒

Test voltage (%)	Test voltage (V)	Temperature (℃)	Maintaining time	Measure frequency (㎒)	Frequency deviation (㎐)	Deviation (%)
100 %	DC 24	-20	Startup	5 745.028 509	28 509	0.000 496
			2 minutes	5 745.028 291	28 291	0.000 492
			5 minutes	5 745.027 075	27 075	0.000 471
			10 minutes	5 745.026 919	26 919	0.000 469
100 %		-10	Startup	5 745.025 371	25 371	0.000 442
			2 minutes	5 745.024 696	24 696	0.000 430
			5 minutes	5 745.024 032	24 032	0.000 418
			10 minutes	5 745.023 996	23 996	0.000 418
100 %		0	Startup	5 745.016 814	16 814	0.000 293
			2 minutes	5 745.016 637	16 637	0.000 290
			5 minutes	5 745.015 579	15 579	0.000 271
			10 minutes	5 745.015 294	15 294	0.000 266
100 %		10	Startup	5 745.010 578	10 578	0.000 184
			2 minutes	5 745.010 517	10 517	0.000 183
			5 minutes	5 745.009 084	9 084	0.000 158
			10 minutes	5 745.008 907	8 907	0.000 155
100 %		20	Startup	5 745.008 340	8 340	0.000 145
			2 minutes	5 745.006 878	6 878	0.000 120
			5 minutes	5 745.006 830	6 830	0.000 119
			10 minutes	5 745.006 513	6 513	0.000 113
100 %		23	Startup	5 745.007 032	7 032	0.000 122
			2 minutes	5 745.006 499	6 499	0.000 113
			5 minutes	5 745.006 485	6 485	0.000 113
			10 minutes	5 745.006 337	6 337	0.000 110
100 %		30	Startup	5 745.006 052	6 052	0.000 105
			2 minutes	5 745.005 864	5 864	0.000 102
			5 minutes	5 745.005 810	5 810	0.000 101
			10 minutes	5 745.005 547	5 547	0.000 097
100 %		40	Startup	5 744.991 748	-825 3	-0.000 144
			2 minutes	5 744.991 603	-839 8	-0.000 146
			5 minutes	5 744.989 995	-100 06	-0.000 174
			10 minutes	5 744.989 818	-101 83	-0.000 177
100 %		50	Startup	5 744.987 543	-124 58	-0.000 217
			2 minutes	5 744.987 541	-124 60	-0.000 217
			5 minutes	5 744.987 421	-125 80	-0.000 219
			10 minutes	5 744.987 090	-129 11	-0.000 225
85 %	DC 20.4	23	Startup	5 745.008 764	8 764	0.000 153
			2 minutes	5 745.008 710	8 710	0.000 152
			5 minutes	5 745.008 581	8 581	0.000 149
			10 minutes	5 745.007 996	7 996	0.000 139
115 %	DC 27.6	23	Startup	5 745.009 183	9 183	0.000 160
			2 minutes	5 745.008 623	8 623	0.000 150
			5 minutes	5 745.008 311	8 311	0.000 145
			10 minutes	5 745.007 761	7 761	0.000 135

Note.

1. All 9-36V DC mode were investigated and the data 24VDC was reported in this section is the worst case condition

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr