

TEST REPORT

Receipt No.	STB20-1599		
Test Report No.	W20WD-002		
Date of test	March. 25, 2020.	Date of Issue	May. 21, 2020.

Applicant	GeniRobot Co., Ltd.
Address	1003ho, Simin-daero 260, Dongan-gu, Anyang-si, Gyeonggi-do, Republic of Korea
Manufacturer	KOREADIGITAL CO., Ltd
Address	#804, AceTwin Tower 2 273 Digital-ro, Guro-gu, Seoul, South Korea, 152-779

Type of Equipment	2.4GHz Band Low-Power Data Communication System
Model Name	GB1
Multi Model Name	N/A

Standards	ARIB STD-T66
	Certification Ordinance Article 2 Clause 1 Item19
	Ministry of Internal Affairs and Communications Notification Article 88 Appendix 43
Test Result	Compliance

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

Tested by:

 2020.05.21

Joon-Young, Jeon / Associate Research Engineer
StandardBank / RF Testing Team

Reviewed by:

 2020.5.21

Kug-Kyoung, Yoon / Senior Research Engineer
StandardBank / RF Testing Team

CONTENTS

1. GENERAL INFORMATION.....	4
2. SUMMARY.....	5
3. FREQUENCY TOLERANCE	6
4. OCCUPIED BANDWIDTH (99 %)	9
5. ANTENNA POWER	12
6. CONDUCTED SPURIOUS EMISSION	15
7. CONDUCTED RECEIVER SPURIOUS EMISSIONS	21
8. INTERFERENCE PREVENTION FUNCTION.....	25
9. EQUIPMENT LIST	26
APPENDIX. THE PHOTO OF TEST SETUP.....	26

Revision History

Issued Date.	Issue Report No	Description
May. 21, 2020.	W20WD-002	Initial Issue
-	-	-

1. General Information

1.1 Information of Test Laboratory.

Name	Standardbank Co.,Ltd.
Address	48, Gunpocheomdansaneop 2-ro, Gunpo-Si, Gyeonggi-do, 15880, Republic of Korea
Tel/Fax	+82-31-393-9394/ +82-31-393-9392

1.2 Details of EUT

Model	GB1
Multi Model	N/A
Kind of Product	Educational Robot
Frequency Range	2402 MHz ~ 2480 MHz (Bluetooth LE)
Modulation Type	GFSK
Number of Channel	40
Data Rate	1 Mbps
Antenna Type	Chip Antenna
Antenna Gain	0.5 dBi
RF Power	0.3 mW
Operating Voltage	DC 3.7 V (Rechageable Li-Polymer Battery)
Serial Number	N/A

1.3 Tested Frequency

Mode	Low Frequency	Middle Frequency	High Frequency
BLE	2402 MHz	2440 MHz	2480 MHz

1.4 Test Environment

Temperature	Relative Humidity
(22.0 ± 1.6) °C	(53.8 ± 1.2) % R.H.

2. SUMMARY

ARIB-STD_T66	Parameter	Limit	Test Result
3.2 (4)	Frequency Tolerance	$\pm 50 \times 10^{-6}$ (± 50 ppm)	C
3.2 (7)	Occupied Bandwidth (99 %)	Equal or less than 26 MHz	C
3.2 (2), (3)	Antenna Power	Equal or less than 10 mW Tolerance: 20 % and -80 %	C
3.2 (6)	Unwanted Spurious Emission	30 MHz < F < 2 387 MHz: 2.5 μ W or less 2 387 MHz \leq F \leq 2 400 MHz: 25 μ W or less 2 483.5 MHz < F \leq 2 496.5 MHz: 25 μ W or less 2 496.5 MHz < F < 12 500 MHz: 2.5 μ W or less	C
3.3 (1)	Rx Spurious Emission	30 MHz < F < 1 000 MHz: 4 nW μ W or less 1000 MHz \leq F < 12 500 MHz: 20 μ W or less	C
3.4.1	Interference prevention function	Radio equipment used mainly on the same premised and automatically transmits or receives identification code	C

Note: C = Comply, NC = Not Comply, NT = Not Tested, NA = Not Applicable

Tested according to Appendix No. 43.

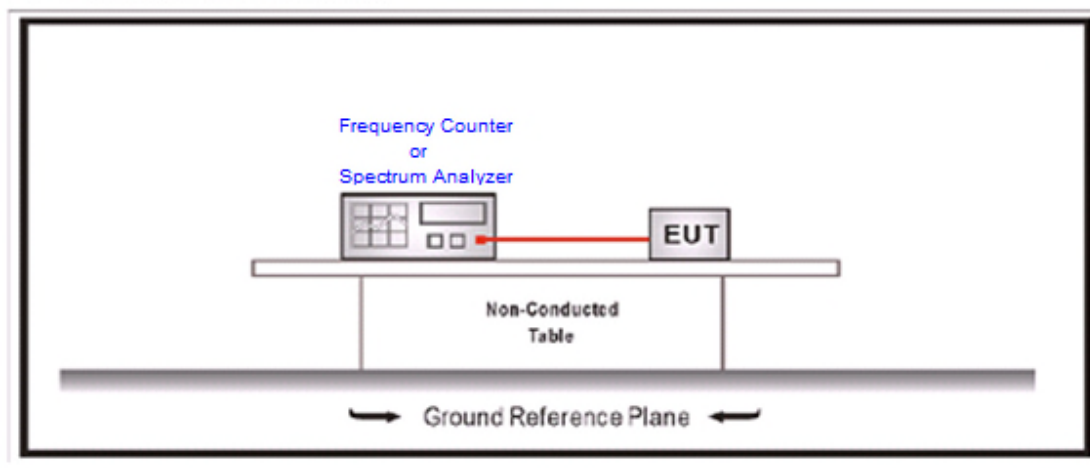
3. Frequency Tolerance

3.1 Limit

Tolerance of frequency shall be $\pm 50 \times 10^{-6}$ ($\pm 50\text{ppm}$)

3.2 Test Configuration

RF Conducted Measurement:



3.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect to measurement instrument. Then set 'tested frequency' within its operating range.
3. Set the marker to the peak of the emission. (or use frequency counter).
4. Use the following spectrum analyser setting:
 - a) Span : ~600 kHz
 - b) RBW < 5 kHz
 - c) VBW \geq RBW
 - d) Sweep : Auto
 - e) Detector function : Peak
 - f) Trace : Max hold

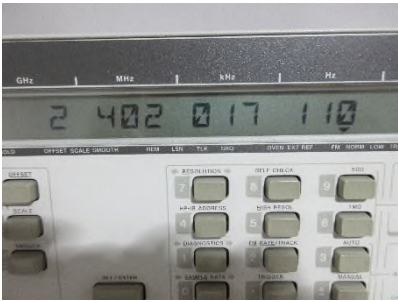

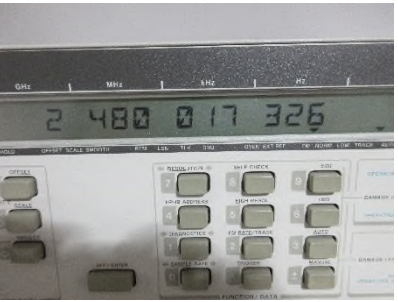
3.4 Test Result

Test Mode	Volage.	Channel	Freq. (MHz)	Frequency Tolerance (ppm)	Limit	Result
BLE (GFSK)	-10 %	Low	2402.017110	7.1232	±50 ppm	Pass
		Middle	2440.017196	7.0475		
		High	2480.017326	6.9863		
	Normal	Low	2402.017144	7.1374		
		Middle	2440.017227	7.0602		
		High	2480.017337	6.9907		
	+10 %	Low	2402.017065	7.1045		
		Middle	2440.017121	7.0168		
		High	2480.017308	6.9790		



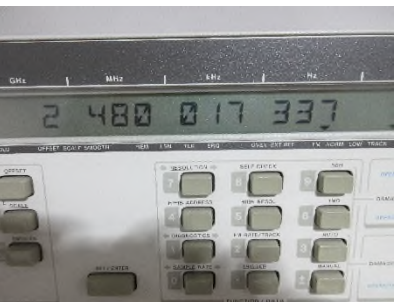
Note: Frequency Tolerance(ppm) = [(Freq. (MHz) – Tested frequency (MHz))/ Tested frequency (MHz)] x 10⁻⁶

3.5 Test Plots

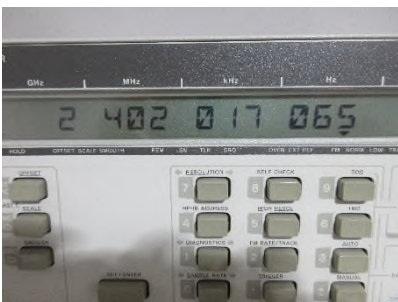
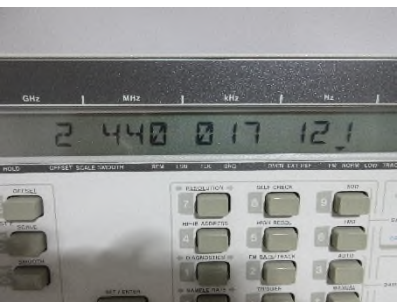

-10 % Voltage

		
Low frequency	Middle frequency	High frequency

Normal Voltage

		
Low frequency	Middle frequency	High frequency

+ 10 % Voltage

		
Low frequency	Middle frequency	High frequency

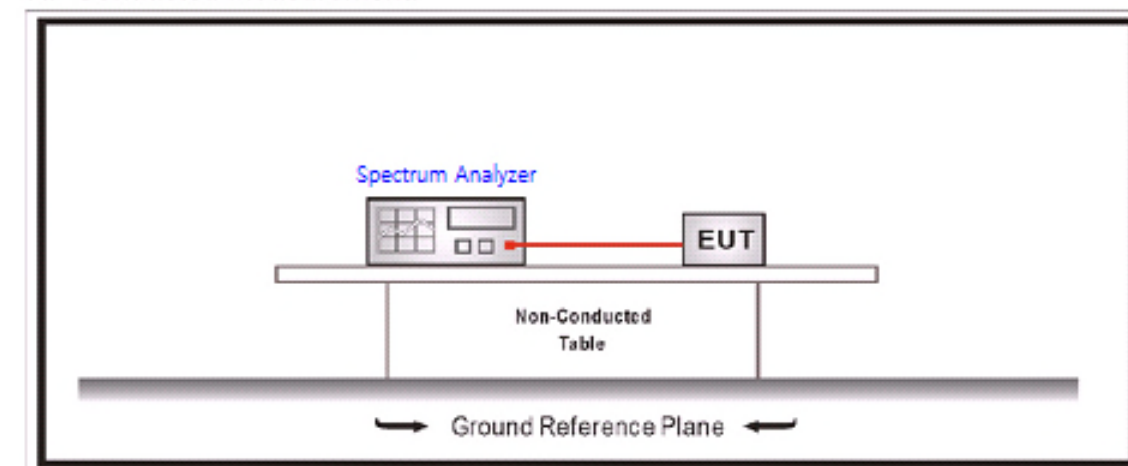
4. Occupied Bandwidth (99 %)

4.1 Limit

Other systems shall be 26 MHz or less

4.2 Test Configuration

RF Conducted Measurement:



4.3 Test Procedure

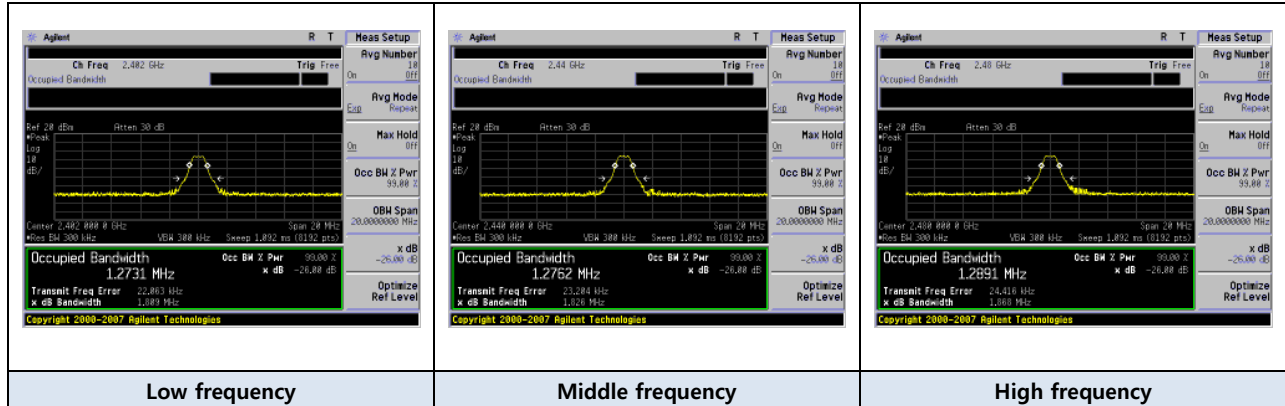
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect to measurement instrument.
3. Use the following spectrum analyser setting :
 - a) Span : Wide enough to capture the channel (20 MHz)
 - b) RBW : ~3 % of Nominal bandwidth. (300 kHz)
 - c) VBW >= RBW.
 - d) Sweep : Auto.
 - e) Detector function : peak
 - f) Trace : Max hold
 - g) Allow the trace to stabilize.
4. Use the OBW function to determine results.

4.4 Test Result

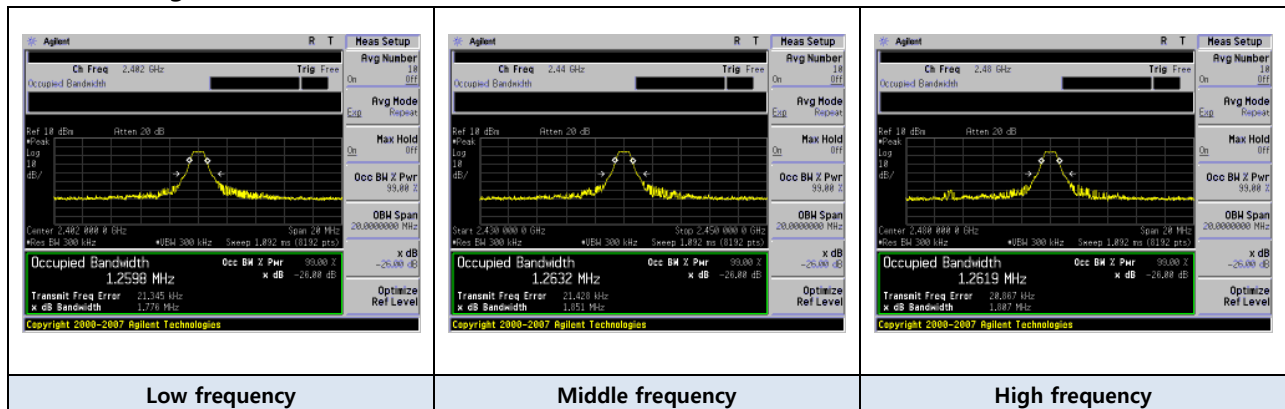
Test Mode	Voltage	Channel	OBW Bandwidth (MHz)	Limit	Result
BLE (GFSK)	-10 %	Low	1.2731	≤26 MHz	pass
		Middle	1.2762		
		High	1.2891		
	Normal	Low	1.2598		
		Middle	1.2632		
		High	1.2619		
	+10 %	Low	1.2758		
		Middle	1.2777		
		High	1.2829		

4.5 Test Plots

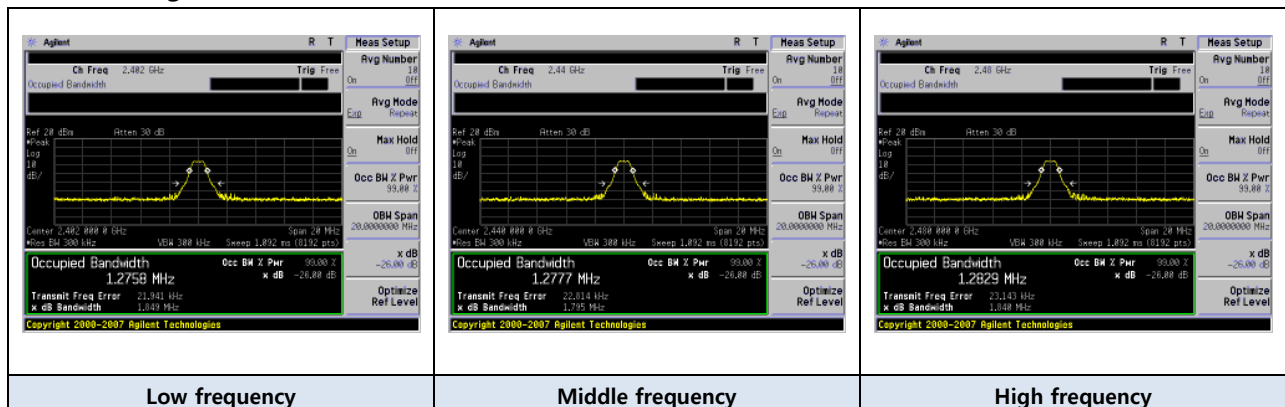
-10 % Voltage



Normal Voltage



+ 10 % Voltage



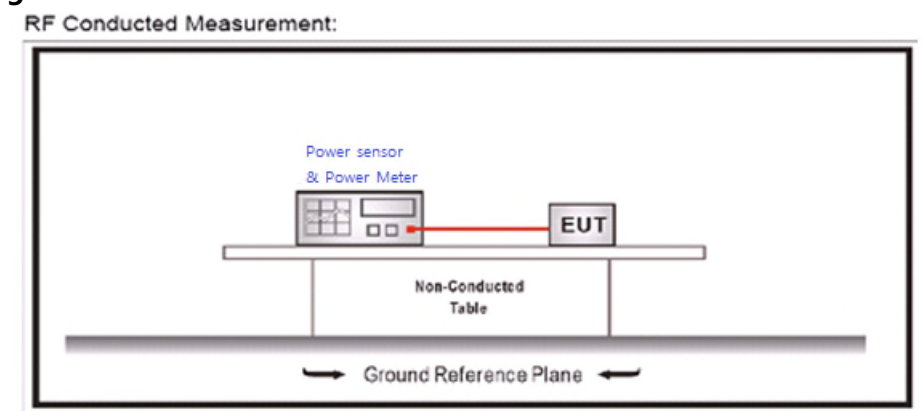
5. Antenna Power

5.1 Limit

Output Power shall be 10 mW or less.

Tolerance of power is Maximum 20 % and Minimum -80 %.

5.2 Test Configuration



5.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. The EUT is connected to the Power sensor and measure output power.
3. The EUT shall have its non-hopping function enabled.

5.4 Test Result

Test Mode	Volage.	Channel	Measured value (dBm)	Antenna Power (mW)	Tolerance (%)	Limit	Result
BLE (GFSK)	-10 %	Low	-7.37	0.2908	-3.0817	≤10 mW (-80 % ~ +20 % ~) (0.06 ~ 0.36 mW)	Pass
		Middle	-7.55	0.2790	-7.0166		
		High	-7.74	0.2670	-10.9968		
	Normal	Low	-7.38	0.2902	-3.2679		
		Middle	-7.50	0.2823	-5.9041		
		High	-7.84	0.2610	-12.9897		
	+10 %	Low	-7.42	0.2869	-4.3796		
		Middle	-7.48	0.2829	-5.6915		
		High	-7.77	0.2647	-11.7833		
Antenna gain (dBi)				0.5			
Declaration Output Power (mW)				0.3			
Declaration Output Power (dBm)				-5.23			
E.I.R.P.				-4.73			

Note: Antenna Power(mW) = $10^{(\text{Measured value(dBm)}/10)/\text{burst ratio}}$




Burst ratio = Tx on / (Tx on + off)

Tolerance (%) = $((\text{Antenna Power(mW)} - \text{Declared Power(mW)})/\text{Declared Power(mW)}) \times 100$




E.I.R.P = Declaration Output Power (dBm) + Antenna gain (dBi)

5.5 Test Plots




-10 % Voltage

		
2402 MHz / DH5	2440 MHz / DH5	2480 MHz / DH5

Normal Voltage

		
2402 MHz / DH5	2440 MHz / DH5	2480 MHz / DH5

+ 10 % Voltage

		
2402 MHz / DH5	2440 MHz / DH5	2480 MHz / DH5

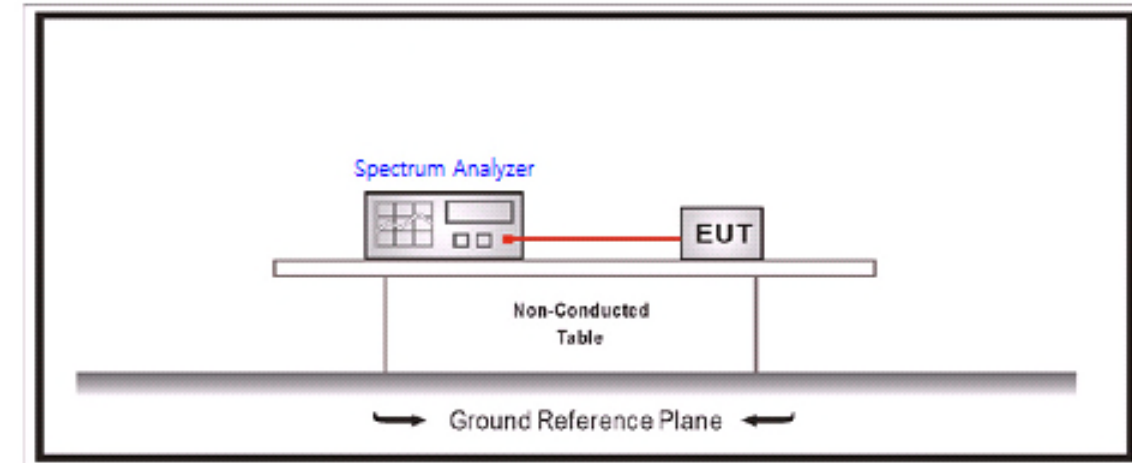
6. Conducted Spurious Emission

6.1 Limit

30 MHz to 2 387 MHz and 2 496.5 MHz to 12 500 MHz: 2.5 μ W/MHz or below
2 387 MHz to 2 400 MHz and 2 483.5 MHz to 2 496.5 MHz: 25 μ W/MHz or below

6.2 Test Configuration

RF Conducted Measurement:



6.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Use the following spectrum analyser setting:
 - a) Span : 30 MHz to 2 387 MHz
2 387 MHz to 2 400 MHz
2 483.5 MHz to 2 496.5 MHz
2 496.5 MHz to 12 500 MHz
 - b) RBW : 1 MHz
 - c) VBW : 1 MHz
 - d) Sweep time : Auto
 - e) Trace : Max hold
 - f) Detector : Peak
3. Measure the peak point using marker peak function.
4. In case of the measurements exceeded the limit. Use the following spectrum analyzer setting:
 - a) Center frequency: Searched frequency at step 3.
 - b) span : 0 Hz
 - c) RBW : 1 MHz or 30 kHz
 - d) VBW : Similar RBW
 - e) Sweep time : Auto
 - f) Trace : Max hold
 - g) Detector : Peak or Sample
6. Measure the peak point using marker peak function.
7. If set to RBW 30 kHz, the measurements are rewarded 15.2 dB. ($10\log(1\text{MHz}/30\text{ kHz})$)

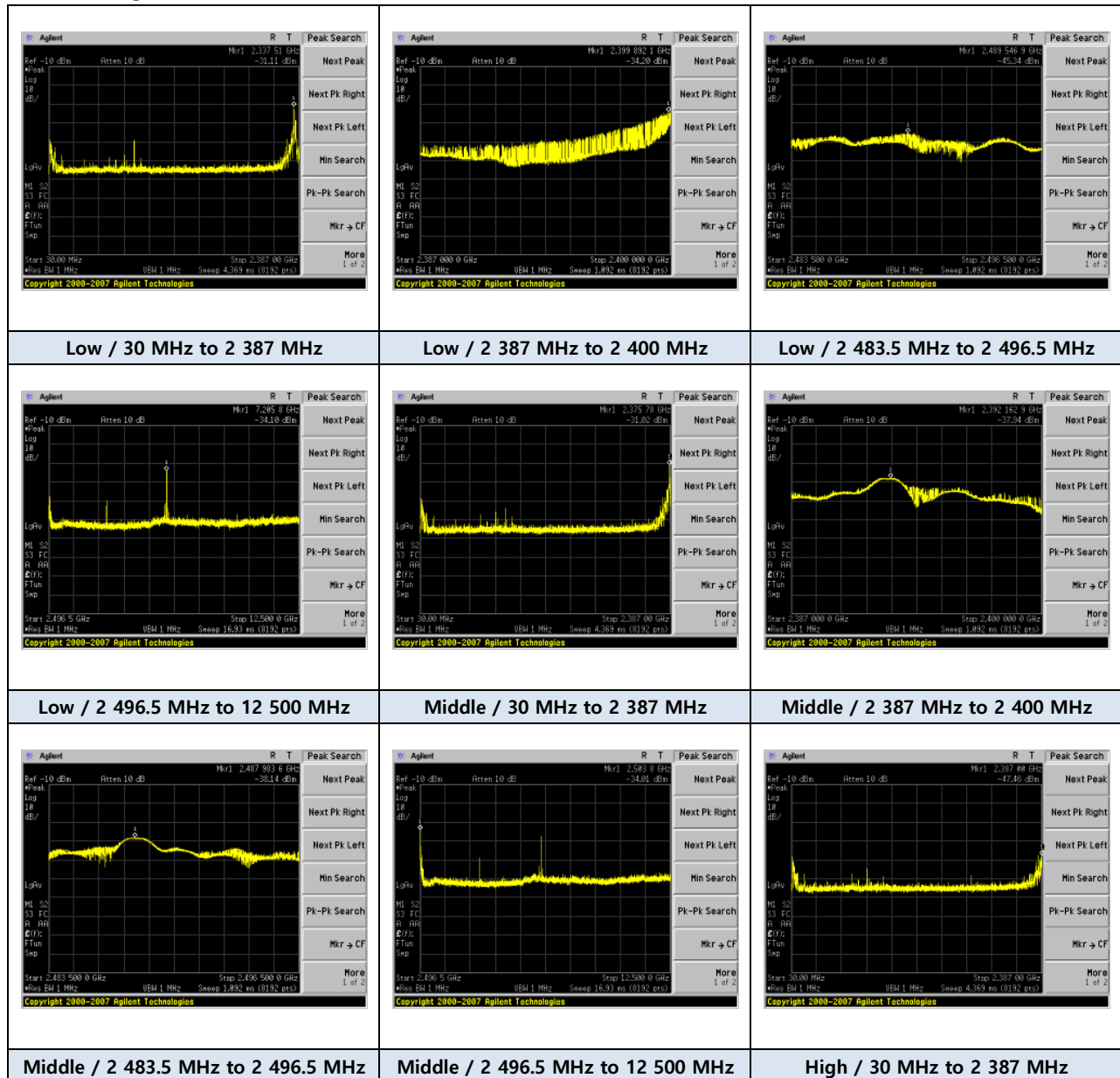
6.4 Test Result

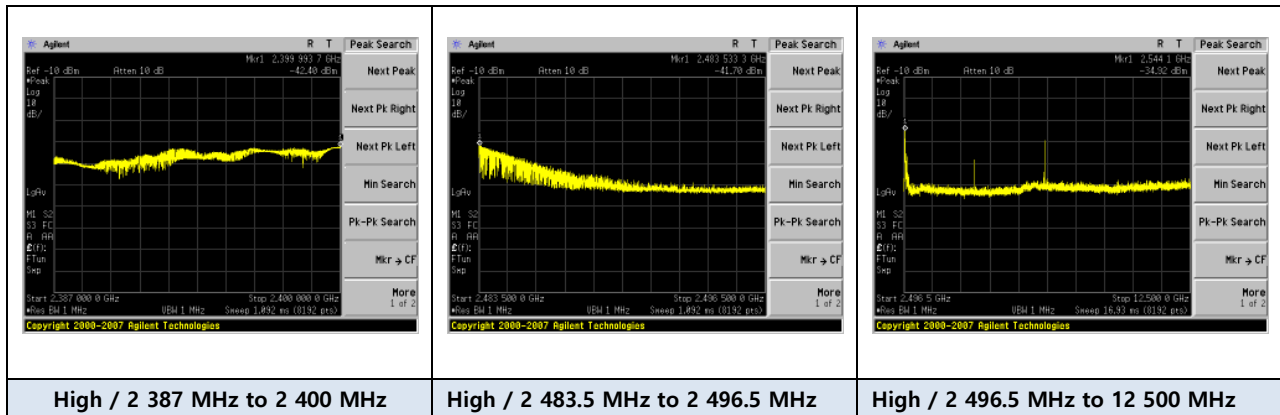
Test Mode	Voltage	Frequency range	Unit	Tested frequency			Limit	Result
				Low	Middle	High		
BLE (GFSK)	-10 %	30 MHz to 2 387 MHz	Level (μW/MHz)	0.7745	0.7907	0.0179	2.5 μW/MHz or less	Pass
			Frequency (MHz)	2337.5100	2375.7800	2387.0000		
		2 387 MHz to 2 400 MHz	Level (μW/MHz)	0.3802	0.1607	0.0575	25 μW/MHz or less	
			Frequency (MHz)	2399.8921	2392.1629	2399.9937		
		2 483.5 MHz to 2 496.5 MHz	Level (μW/MHz)	0.0292	0.1535	0.0676	25 μW/MHz or less	
			Frequency (MHz)	2489.5469	2487.9836	2483.5333		
		2 496.5 Mhz to 12 500 MHz	Level (μW/MHz)	0.3890	0.3972	0.3221	2.5 μW/MHz or less	
			Frequency (MHz)	7205.8000	2503.8000	2544.1000		
	Normal	30 MHz to 2 387 MHz	Level (μW/MHz)	0.6902	0.7834	0.0182	2.5 μW/MHz or less	
			Frequency (MHz)	2338.3700	2376.0700	2351.8900		
		2 387 MHz to 2 400 MHz	Level (μW/MHz)	0.4055	0.1633	0.0557	25 μW/MHz or less	
			Frequency (MHz)	2399.9690	2392.2430	2399.8300		
		2 483.5 MHz to 2 496.5 MHz	Level (μW/MHz)	0.0292	0.0294	0.0679	25 μW/MHz or less	
			Frequency (MHz)	2489.2610	2489.3620	2483.5710		
		2 496.5 Mhz to 12 500 MHz	Level (μW/MHz)	0.4217	0.3837	0.2547	2.5 μW/MHz or less	
			Frequency (MHz)	7205.8000	7205.8000	2544.1000		
	+10 %	30 MHz to 2 387 MHz	Level (μW/MHz)	0.0640	0.0098	0.0046	2.5 μW/MHz or less	
			Frequency (MHz)	2382.2860	2283.2920	2330.4320		
		2 387 MHz to 2 400 MHz	Level (μW/MHz)	12.0781	0.0164	0.0012	25 μW/MHz or less	
			Frequency (MHz)	2399.9480	2399.6880	2390.9260		
		2 483.5 MHz to 2 496.5 MHz	Level (μW/MHz)	0.0029	0.0056	2.4491	25 μW/MHz or less	
			Frequency (MHz)	2485.3200	2483.9420	2483.5780		
		2 496.5 Mhz to 12 500 MHz	Level (μW/MHz)	0.0091	0.0079	0.0501	2.5 μW/MHz or less	
			Frequency (MHz)	4793.2840	2578.5280	2496.5000		

6.5 Test Plots

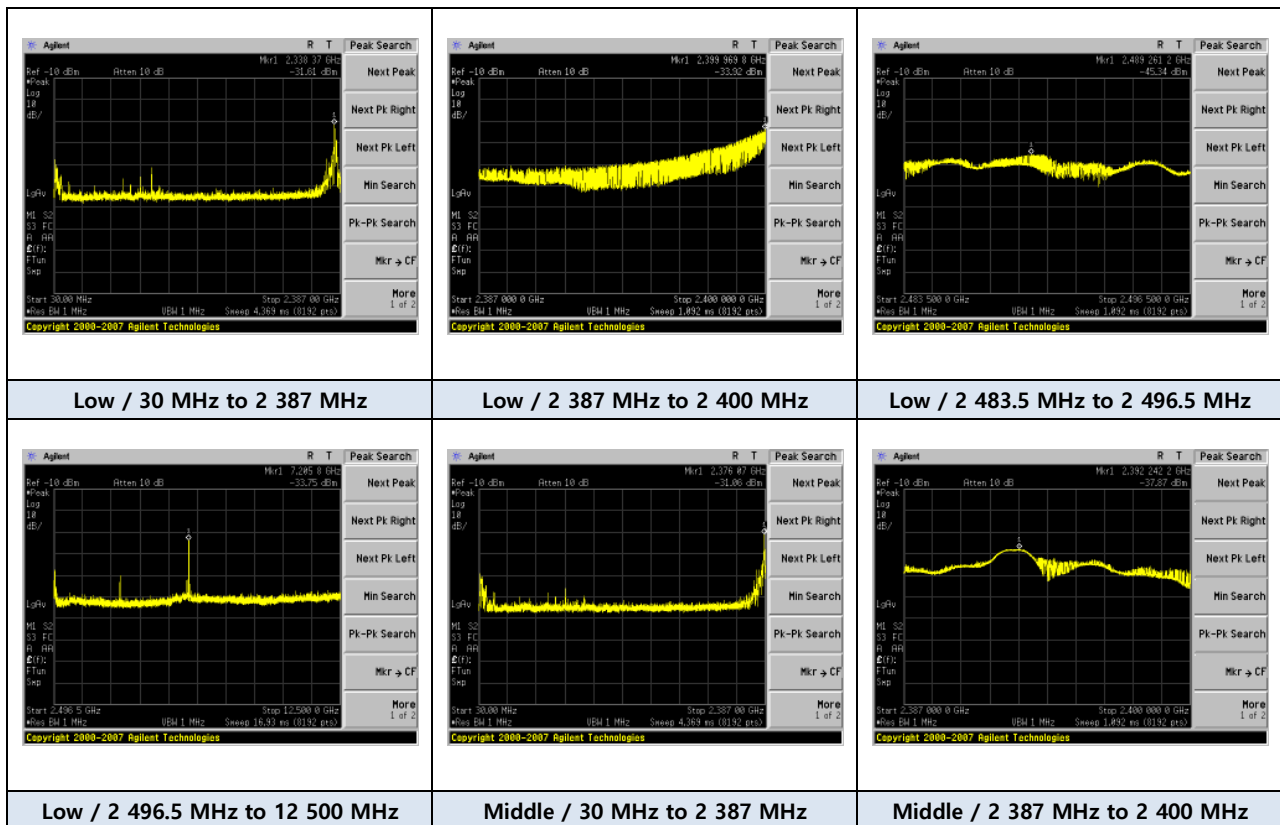
BLE(GFSK)

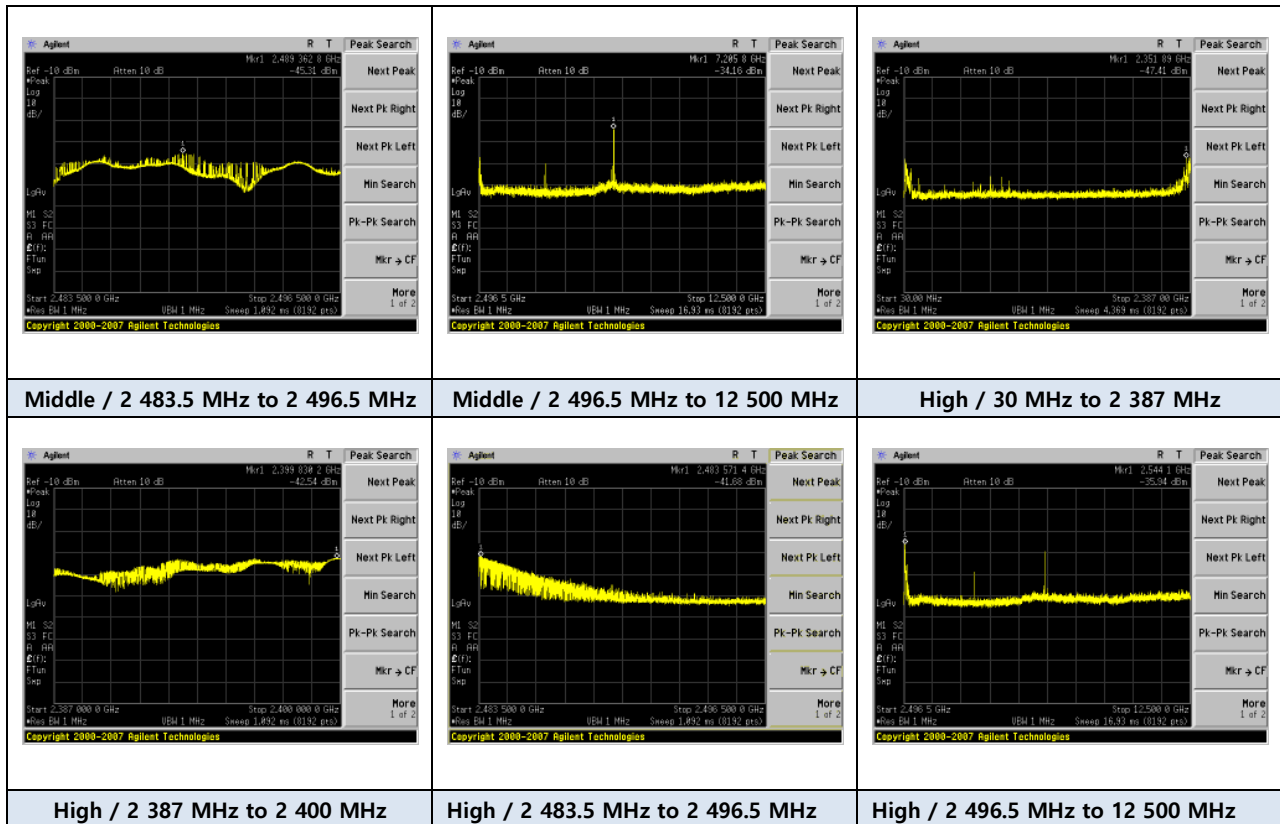
-10 % Voltage



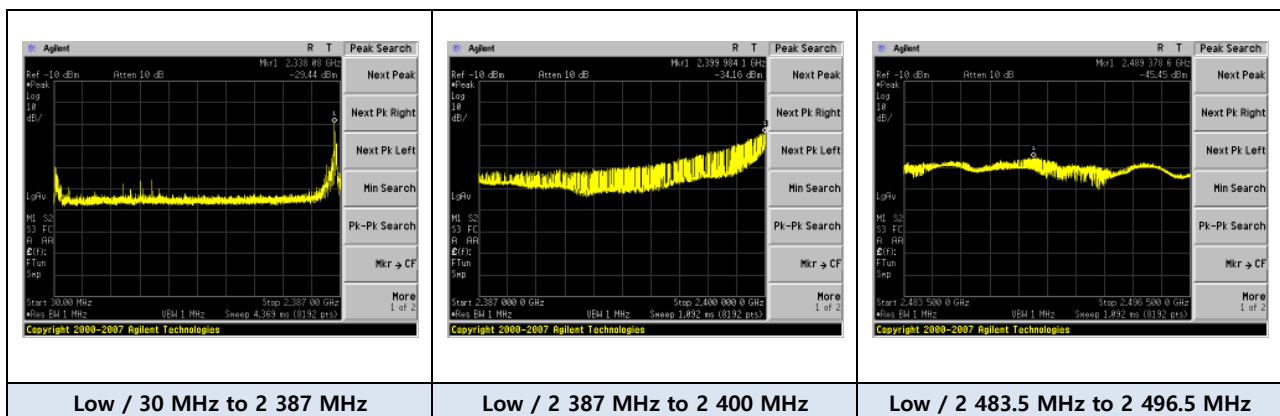


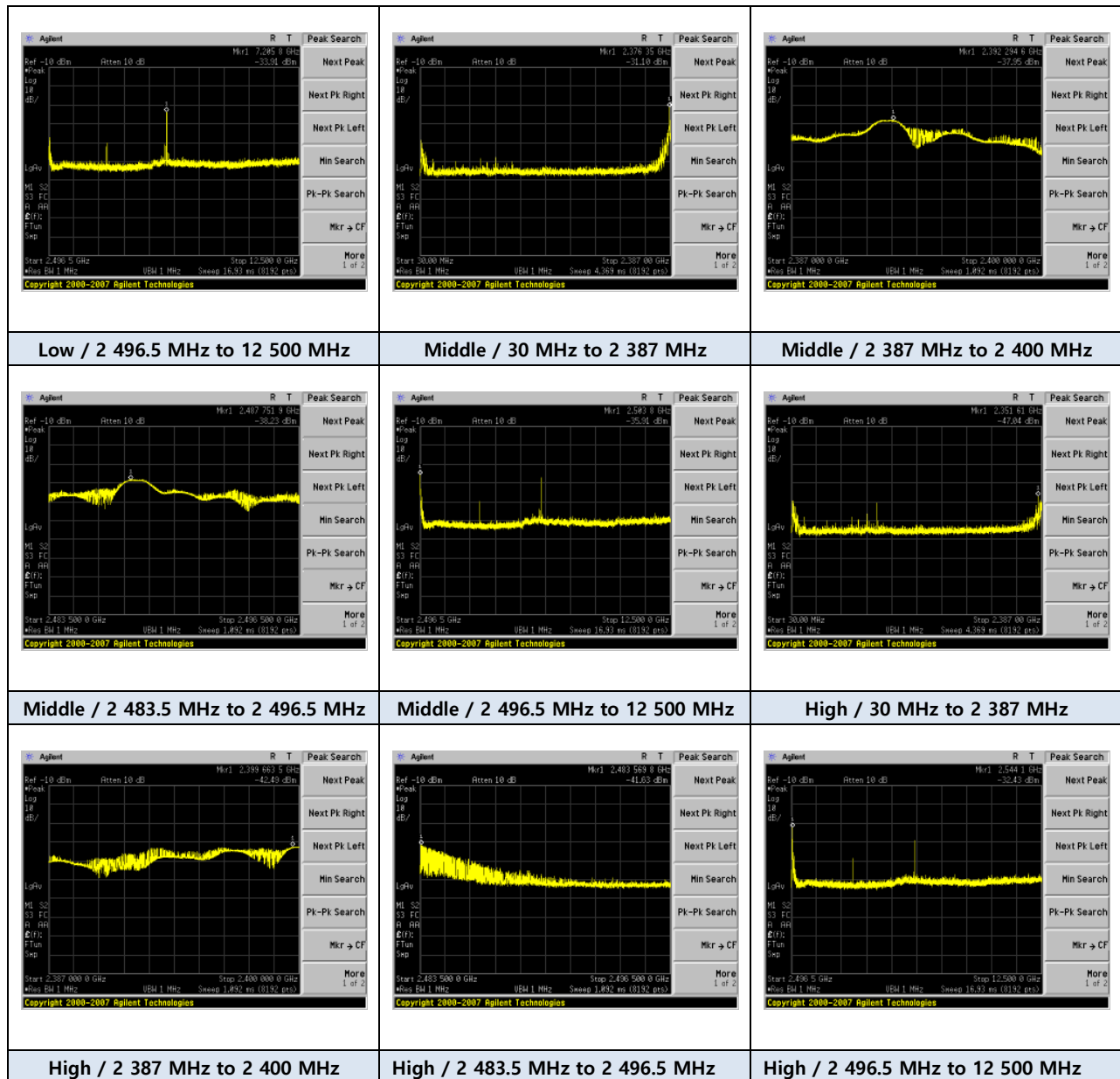
Normal





+10 % Voltage





7. Conducted Receiver spurious emissions

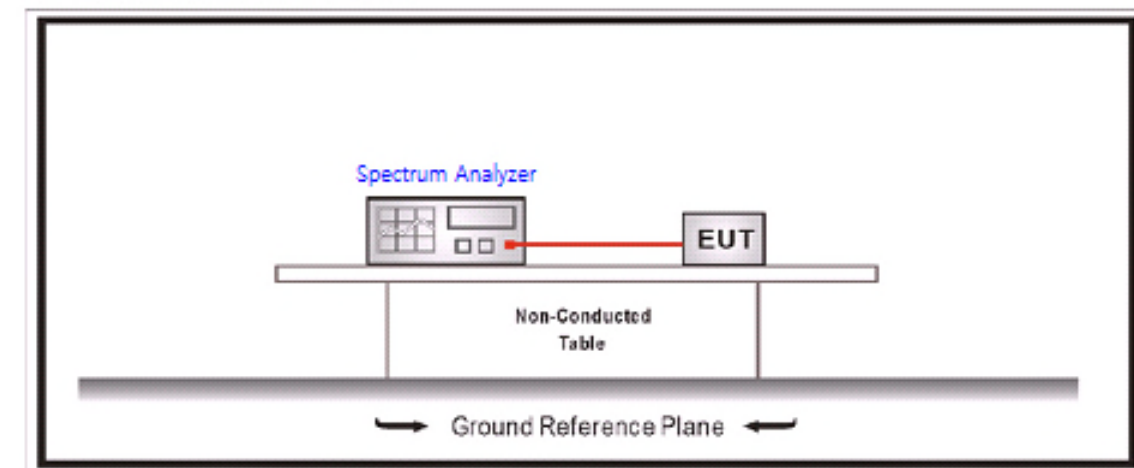
7.1 Limit

30 MHz to 1 000 MHz: 4 nW or below

1 000 MHz to 12 500 MHz: 20 nW or below

7.2 Test Configuration

RF Conducted Measurement:



7.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the EUT to Receiving mode.
3. Use the following spectrum analyser setting:
 - a) Span : 30 MHz to 1 000 MHz
1 000 MHz to 12 500 MHz
 - b) RBW : (Below 1 GHz: 100 kHz/ Above 1 GHz: 1 MHz)
 - c) VBW : (Below 1 GHz: 100 kHz/ Above 1 GHz: 1 MHz)
 - d) Sweep time : Auto
 - e) Trace : Max hold
 - f) Detector : Peak
4. Measure the peak point using marker peak function.
5. In case of the measurements are more than (limit – 6 dB), Use the following spectrum analyzer setting:
 - a) Center frequency: Searched frequency at step 3.
 - b) span : 0 Hz
 - c) RBW : (Below 1 GHz: 100 kHz/ Above 1 GHz: 1 MHz)
 - d) VBW : (Below 1 GHz: 100 kHz/ Above 1 GHz: 1 MHz)
 - e) Sweep time : Auto
 - f) Trace : Max hold
 - g) Detector : Sample
6. Measure the peak point using marker peak function.

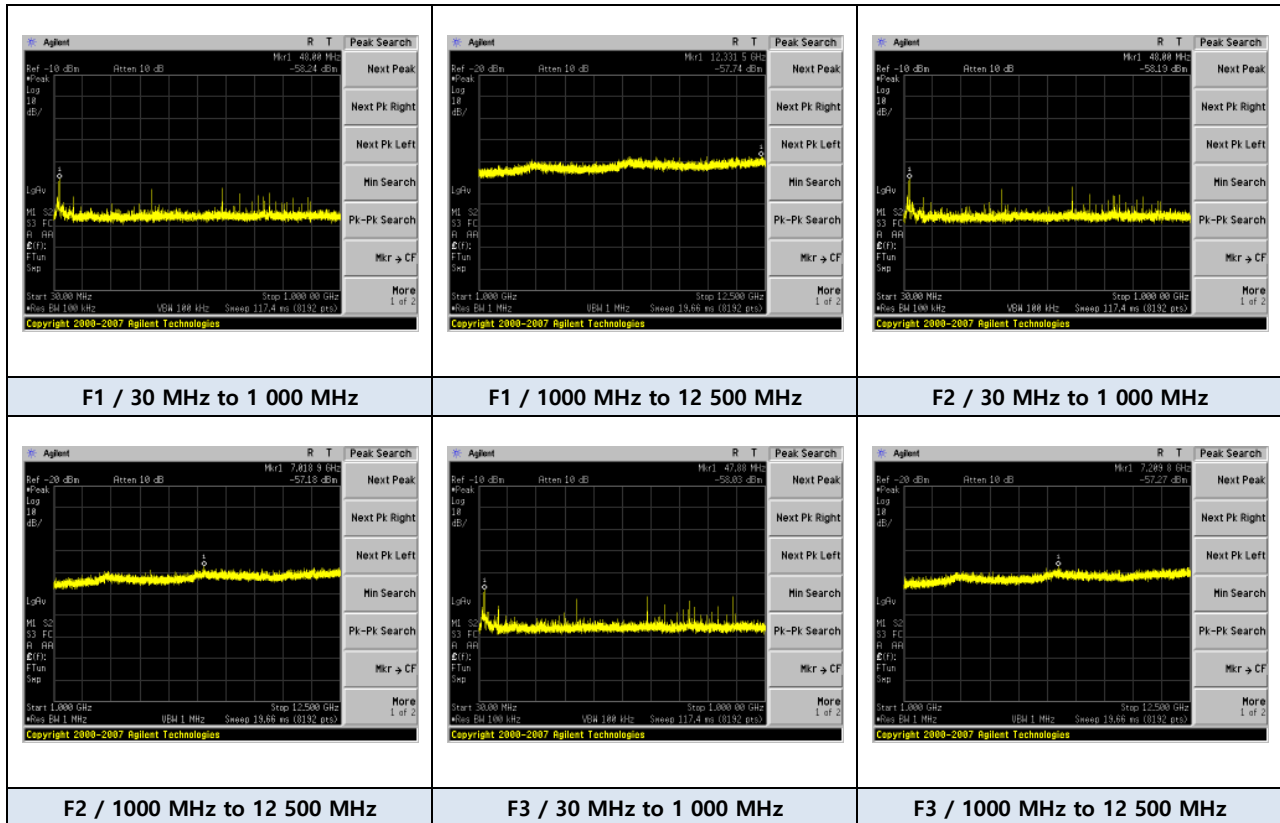
7.4 Test Result

Test Mode	Voltage	Frequency range	Unit	Tested frequency			Limit	Result
				Low	Middle	High		
BLE (GFSK)	-10 %	30 MHz to 1 000 MHz	Level (μW/MHz)	1.8880	1.5171	1.5740	4 nW or less	Pass
			Frequency (MHz)	48.0000	48.0000	47.8800		
		1 000 MHz to 12 500 MHz	Level (μW/MHz)	1.6827	1.9143	1.8750	20 nW or less	
			Frequency (MHz)	12331.5000	7018.9000	7209.8000		
	Normal	30 MHz to 1 000 MHz	Level (μW/MHz)	1.4028	1.4622	1.4555	4 nW or less	
			Frequency (MHz)	47.8800	47.8800	47.7600		
		1 000 MHz to 12 500 MHz	Level (μW/MHz)	1.9364	1.8281	1.7579	20 nW or less	
			Frequency (MHz)	12233.2000	12276.8000	11237.8000		
	+10 %	30 MHz to 1 000 MHz	Level (μW/MHz)	1.7539	1.6144	1.5276	4 nW or less	
			Frequency (MHz)	47.8800	48.0000	48.0000		
		1 000 MHz to 12 500 MHz	Level (μW/MHz)	1.6596	1.9498	1.5959	20 nW or less	
			Frequency (MHz)	7082.0000	12401.7000	7702.6000		

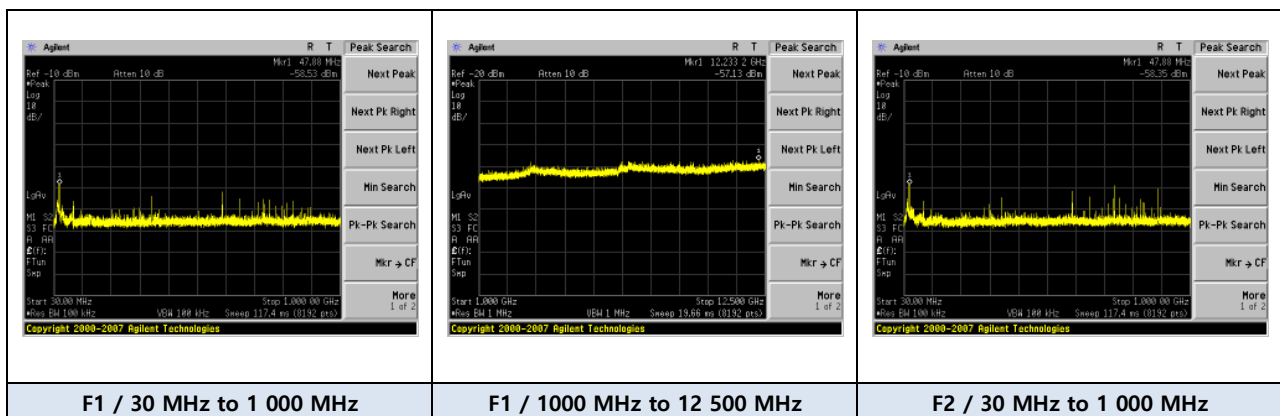
7.5 Test Plots

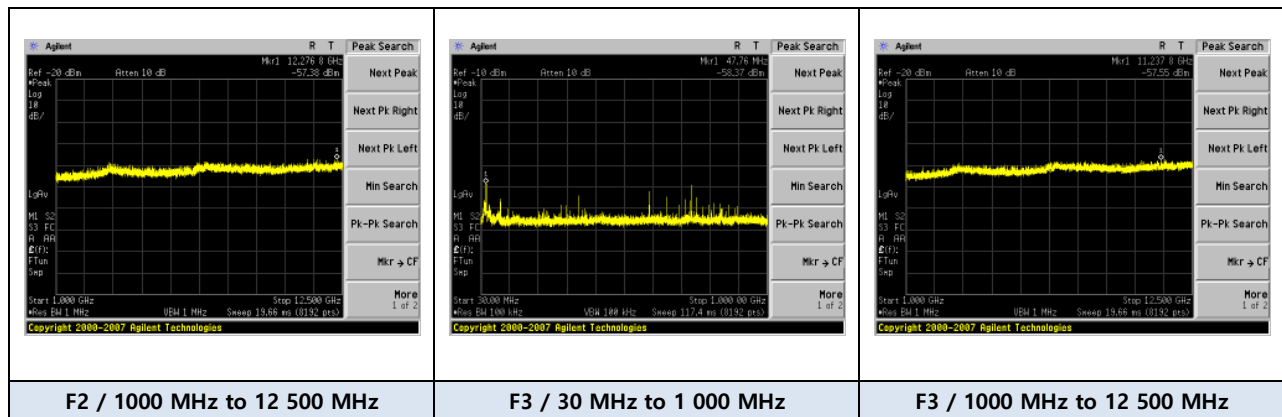
BDR(GFSK)

-10 % Voltage

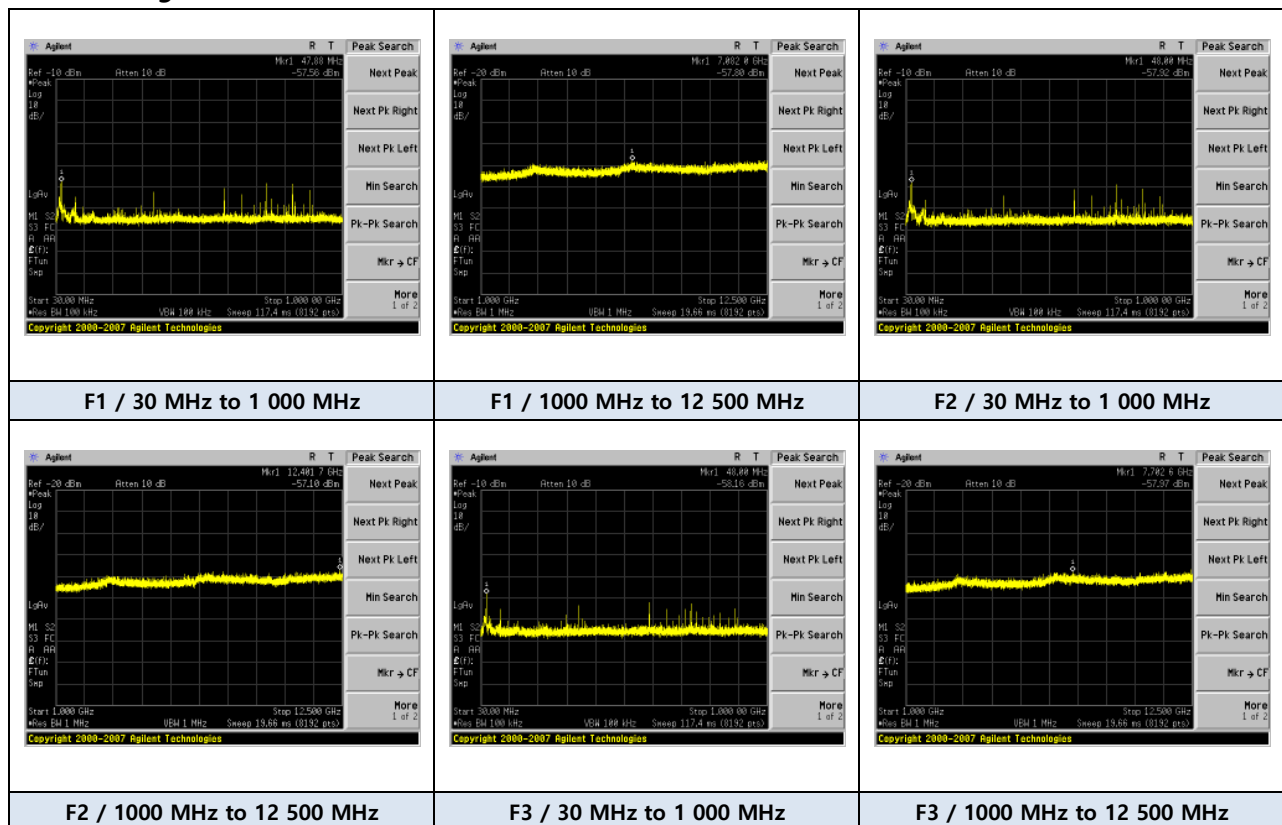


Normal





+10 % Voltage



8. Interference prevention function

8.1 Limit

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

8.2 Test Result

Test Mode	Voltage	Low channel	Middle channel	High channel
BLE (GFSK)	-10 %	pass		
	Normal	pass		
	+10 %	pass		

9. Equipment List

	Test Equipment	Model	Mfg.	Serial No.	Cal. Date	Cal. Due Date
<input checked="" type="checkbox"/>	Spectrum Analyzer	E4440A	Agilent	MY46115274	2019.11.29	2020.11.29
<input checked="" type="checkbox"/>	10 dB Attenuator	SA26B	FAIRVIEW	N/A	2019.12.02	2020.12.02
<input checked="" type="checkbox"/>	Frequency Counter	5351B	Hewlett-Packard	3049A01621	2019.11.29	2020.11.29
<input checked="" type="checkbox"/>	Power Meter	E4416A	Agilent	GB41050459	2019.11.29	2020.11.29
<input checked="" type="checkbox"/>	Avg. Power Sensor	E9304A	Agilent	MY51110045	2019.11.29	2020.11.29
<input checked="" type="checkbox"/>	True RMS Multimeter	87-V	FLUKE	14990137	2019.11.29	2020.11.29
<input checked="" type="checkbox"/>	DC Power Supply	IPS-30B05DD	INTERACT	N/A	2019.06.14	2020.06.14
<input checked="" type="checkbox"/>	Signal Generator	83640L	Hewlett-Packard	3722A00285	2019.06.14	2020.06.14

Appendix. The Photo of Test Setup

