

FCC PART 15 SUBPART C

FCC PART 15.247

TEST REPORT

FCC ID:2BTQV-AK-3116

Report No: CTSL2521220076ER

Product Name: Amplifier

Main Test Model: AK-3116

Series Models: AK3116Pro,AK-35,AK-35Pro,AK-36,AK-38,AK-45,AK-45Pro,AK-50,AK-52,AK-55,AK-65,AK-75,AK-85,AK-95,AK-898,AK-998,AK-280,AK-370,AK-380,AK-390,AK-580,AK-590,ST-838,KS-33BT,KS-39BT,S-188Pro,S-288,S-299,S-388,S-399,S-588,S-599,BT-298A,BT-298Pro,BT-398A,BT-598A,AS-22,AS-33,ST-839,AK-280BT,SK-5,SK-6,SK-8,SK-9(The differences between models are limited to the front trim panel, housing color, knob and button colors, speaker color, and light ring configuration, No impact on electrical performance and RF circuits)

Applicant: Jieyang Rongcheng District Baitong Electronics Factory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be in compliance with FCC PART 15C, FCC PART 15 SUBPART C (15.247).

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CTSL Testing (Dongguan) Co., Ltd.

Main company address: Hexing Building, Houjie Avenue, Houjie Road Houjie Town, Guangdong Province Dongguan City, People's Republic of China

Test Report

FCC ID:2BTQV-AK-3116

Applicant Name	Jieyang Rongcheng District Baitong Electronics Factory				
Applicant Address	Industrial Zone,Xizhai Village,Xinan, Rongcheng District,Jieyang City,China				
Manufacturer Name	Jieyang Rongcheng District Baitong Electronics Factory				
Manufacturer Address	Industrial Zone,Xizhai Village,Xinan, Rongcheng District,Jieyang City,China				
Trade Mark	--				
Product name	Amplifier				
Main Test Model	AK-3116				
Series Models	See the first page of the report				
Standard	FCC Part 15 Subpart C (15.247) ANSI C63.10:2020 FCC KDB 558074 D01 15.247 Meas Guidance v05r02				
Test Location	ISO/IEC 17025 by ILAC-MRA is A2LA 7556.01 CTSL Testing (Dongguan) Co., Ltd. Room 112, Building 1, No. 15, Jiaoyuansongshan Hetian Village, Houjie Town Dongguan City, Guangdong, People's Republic of China				
Receipt Date	2025.11.25	Test period	2025.11.25-2025.12.10	Issue Date	2025.12.10
Conclusion	The equipment under test was found to be compliance with the requirements of the standards applied.				
Performs Testing:	Ethan Zhao				
Test Report Reviewer:	Steve Qin				
Test Report Authorizer:	Alan Li				

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1.GENERAL INFORMATION

1.1.General Description of EUT (Equipment Under Test)

Product Information	
Product Name	: Amplifier
Main Test Model	: AK-3116
Series Models	: See the first page of the report
Power supply	: INPUT:AC 100V-240V~50Hz/60Hz, 1.7A OUTPUT:DC 12-24V, 5.0A
Battery	: --
Software Version	: V1.0
Hardware Version	: V1.0
Equipment Under Test	
Testing sample ID	: CTSL2521220076-1
Test supplied	: ☐ supplied by the manufacturer ☒ supplied by the lab
Adapter information (Auxiliary test supplied by test Lab)	: AC 100-240V, 50/60Hz Output: DC 5V, 2A
Wireless Specification	
Supported Type	: Bluetooth (BR)
Modulation Type	: GFSK
Operation frequency	: 2402MHz-2480MHz
Number of channels	: 79
Transmitter rate	: 1MHz
Antenna Gain& type	: Refer to Section 1.2 of the report.
Sample Type	: Prototype production
Connecting I/O Port(s)	: Please refer to the User's Manual
Type of Device	: ☒ Portable Device; ☐ Mobile Device; ☐ Modular Device

Note: For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2. Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	2400 ~ 2500MHz	LY-00047	Rubber tube antenna	SMA-Male	2
Note: 1. The antenna gain is declared by the customer and the laboratory is not responsible for the accuracy of the antenna gain. 2. The test results of this report only apply to the sample as received.					

1.3. Information of RF Cable

Cable Loss(dB)	Provided by
1.0	Dongguan Haoyidian Electronics Technology Co
Note: 1. The customer declared the loss value of the RF Cable. and the test results of this report only apply to the sample as received. 2. The laboratory is not responsible for the accuracy of the cable loss.	

2.SUMMARY OF TEST

2.1.Test Standards

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

ANSI C63.10:2020: American National Standard for Testing Unlicensed Wireless Devices
FCC KDB 558074 D01 15.247 Meas Guidance v05r02

2.2.Summary of test result

No.	Description of Test Item	FCC Standard Section	Results
1	Maximum Peak Output Power	§15.247(a)(1)	PASS
2	20dB Bandwidth 99% Bandwidth	§15.247(a)(1)	PASS
3	Carrier Frequency Separation	§15.247(a)(1)	PASS
4	Number Of Hopping Channels	§15.247(a)(1)(iii)	PASS
5	Time of Occupancy (Time of Occupancy (Dwell Time))	§15.247(a)(1)(iii)	PASS
6	Conducted Band Edge	§15.247(d)	PASS
7	Conducted Spurious Emissions	§15.247(d)	PASS
8	Radiated Spurious Emissions and Band Edge	§15.205 §15.209(a) §15.247(d)	PASS
9	AC Power Line Conducted Emissions	§15.107(a) §15.207	PASS
10	Antenna Requirement	§15.203	PASS

Note: "N/A" denotes test is not applicable in this test report.

2.3. Test Facilities

EMC Lab :

A2LA Certificate Number: 7556.01;
CTSL Testing (Dongguan) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

FCC-Registration No.: 0037614732;
Test Firm Registration Number: 750639;
CTSL Testing (Dongguan) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

Industry Canada Registration Number. Is: 34801;
CAB identifier: CN0192;
CTSL Testing (Dongguan) Co., Ltd. The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

Name of Firm : CTSL Testing (Dongguan) Co., Ltd.

EMC test location/satellite location:

Room 112, Building 1, No. 15, Jiaoyuansongshan Hetian Village, Houjie Town Dongguan City, Guangdong, People's Republic of China City, Guangdong, China

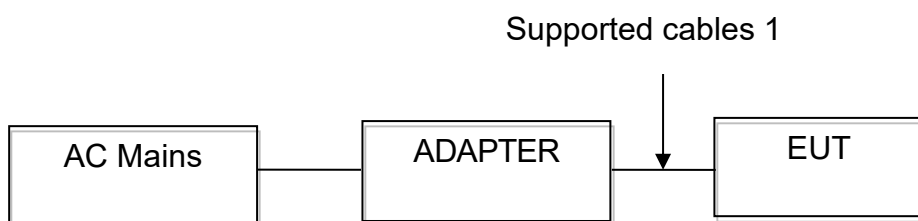
2.4.Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	±3.48dB
Uncertainty for spurious emissions test (Below 30MHz)	±1.62 dB
Uncertainty for spurious emissions test (30MHz-1GHz)	±4.60 dB(Polarize: H)
	±4.68 dB(Polarize: V)
Uncertainty for spurious emissions test (1GHz to 25GHz)	±4.96dB
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB

Note: This uncertainty represents an expanded uncertainty expressed at approximately The 95% confidence level using a coverage factor of k=2.

2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into Bluetooth test mode by software before test.



(EUT: Amplifier)

2.6. Assistant equipment used for test

Item	Equipment	Brand	Model Name/Type No.	FCC ID	Series No.
1	ADAPTER (supplied by the manufacturer.)	-	BK-1903AP	-	-

Supported cables				
Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	0.5m	USB Extension Cable (supplied by the Lab.)

2.7.Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	01	2403	02	2404	03	2405
04	2406	05	2407	06	2408	07	2409
08	2410	09	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	-	-

2.8. Test Equipment

For Conducted Emission Test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESCI 3	AT005	GUANGZHOU NEM	May 16,25	May 15,26
LISN	Rohde & Schwarz	ENV216	AT006	LISAI	July 31,25	July 30,26
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	AT007	CCIC (Shenzhen)	July 10,25	July 09,26
CE Cable	Times Microwave	LMR195UF-N MNM-1.50M	AT041	GUANGZHOU NEM	May 16,25	May 15,26
Test Software	FARAD	EZ-EMC Ver.3A1.1+	N/A	N/A	N/A	N/A

For Radiated Emission Test (9kHz-30MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESCI 7	AT001	Ti Group	July 31,24	July 30,26
Active Loop Antenna	ZHINAN	ZN30900C	AT063	LISAI	Aug 03,24	Aug 02,26
Test Software	FARAD	EZ-EMC Ver.3A1.1+	N/A	N/A	N/A	N/A
9kHz-30MHz Cable	Times Microwave	LMR195UF-N MNM-9M	AT045	GUANGZHOU NEM	May 16,25	May 15,26

For Radiated Emissions Test (30MHz-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESCI 7	AT001	Ti Group	Jun 12,25	Jun 11,26
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	AT002	LISAI	Aug 03,24	Aug 02,26
Test Software	FARAD	EZ-EMC Ver.3A1.1+	N/A	N/A	May 16,25	May 15,26
30-1000MHz Cable	Times Microwave Systems	LMR195UF-N MRNMR-3.00M+ LMR400UF-N MNM-3.00M+ LMR400UF-N MNM-3.00M	AT042+AT043+AT044	GUANGZHOU NEM	May 16,25	May 15,26

For Radiated Emission Test (Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna 1-18G	SCHWARZBECK	BBHA 9120 D	AT003	Shenzhen Academy of Metrology & Quality Inspection	Sep 23,24	Sep 22,26
Horn Antenna 18-40GHz	XIBAO	XB-WDB18-40K	AT064	LISAI	Feb 25,25	Feb 24,26
Broadband Preamplifier	SCHWARZBECK	BBV 9718 D	AT004	CCIC (Shenzhen)	July 10,25	July 9,26
Low Noise Amplifier	MWRFTest	DLA8-18-40G-2078	AT065	GUANGZHOU NEM	July 10,25	July 9,26
Spectrum Analyzer 40G	Keysight	N9020B	AT066	GUANGZHOU NEM	May 13,25	May 12,26
Spectrum Analyzer 26.5G	Keysight	N9020A	AT050	GUANGZHOU NEM	Jun 12,25	Jun 11,26
Radio switching unit	TiGroup	SU319	AT055	N/A	N/A	N/A
Filtering unit	TiGroup	SU319F	AT056	N/A	N/A	N/A
Test Software	BL	BL410-E V25.5 en	N/A	N/A	N/A	N/A
Above 1GHz Cable	Times Microwave Systems	SFT205-NMN M-7.0M+ SFT205-NMN M-2.0M	AT057+ AT058	N/A	N/A	N/A

For Connect EUT Antenna Terminal Test (RF Test system)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Spectrum analyzer	Keysight	N9020A	AT050	GUANGZHOU NEM	Jun 12,25	Jun 11,26
Analog signal source	Keysight	N5173B	AT051	GUANGZHOU NEM	Jun 12,25	Jun 11,26
WIDEBAND RADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	AT052	GUANGZHOU NEM	Jun 12,25	Jun 11,26
Power probe unit	Ti Group	SU319P	AT053	GUANGZHOU NEM	Jun 12,25	Jun 11,26
Switch unit	Ti Group	SU319S	AT054	N/A	N/A	N/A
Test Software	BL	BL410R 3.5.2.621	N/A	N/A	N/A	N/A

Remark: The power sensor is integrated into the Power Probe unit

3. MAXIMUM PEAK OUTPUT POWER

3.1. Limit

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2. Test Setup



3.3. Test Procedure

- Connect each EUT's antenna output to power sensor by RF cable.
- Measure the PK output power of each antenna port by power sensor.
-

3.4. Test Result

Test Mode	Antenna	Channel & Frequency	Conducted Peak Power	Conducted Limit	Result
		MHz	dBm	dBm	
GFSK DH5 (Non-Hopping)	Ant1	CH01 2402	6.16	≤20.97	PASS
		CH39 2441	6.08	≤20.97	PASS
		CH78 2480	5.85	≤20.97	PASS

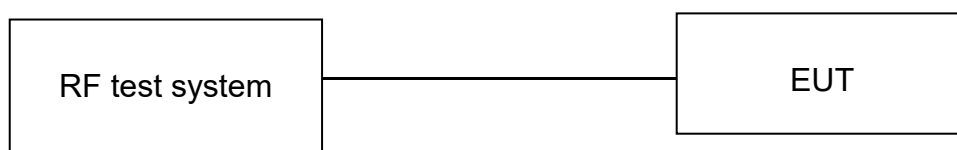
4. 20DB BANDWIDTH AND 99% BANDWIDTH

4.1.Limit

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.2.Test Setup



4.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	30KHz
VBW	100KHz
Span	2MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

4.4.20DB bandwidthTest Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 4.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the ndB down function to measure 20dB Bandwidth.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

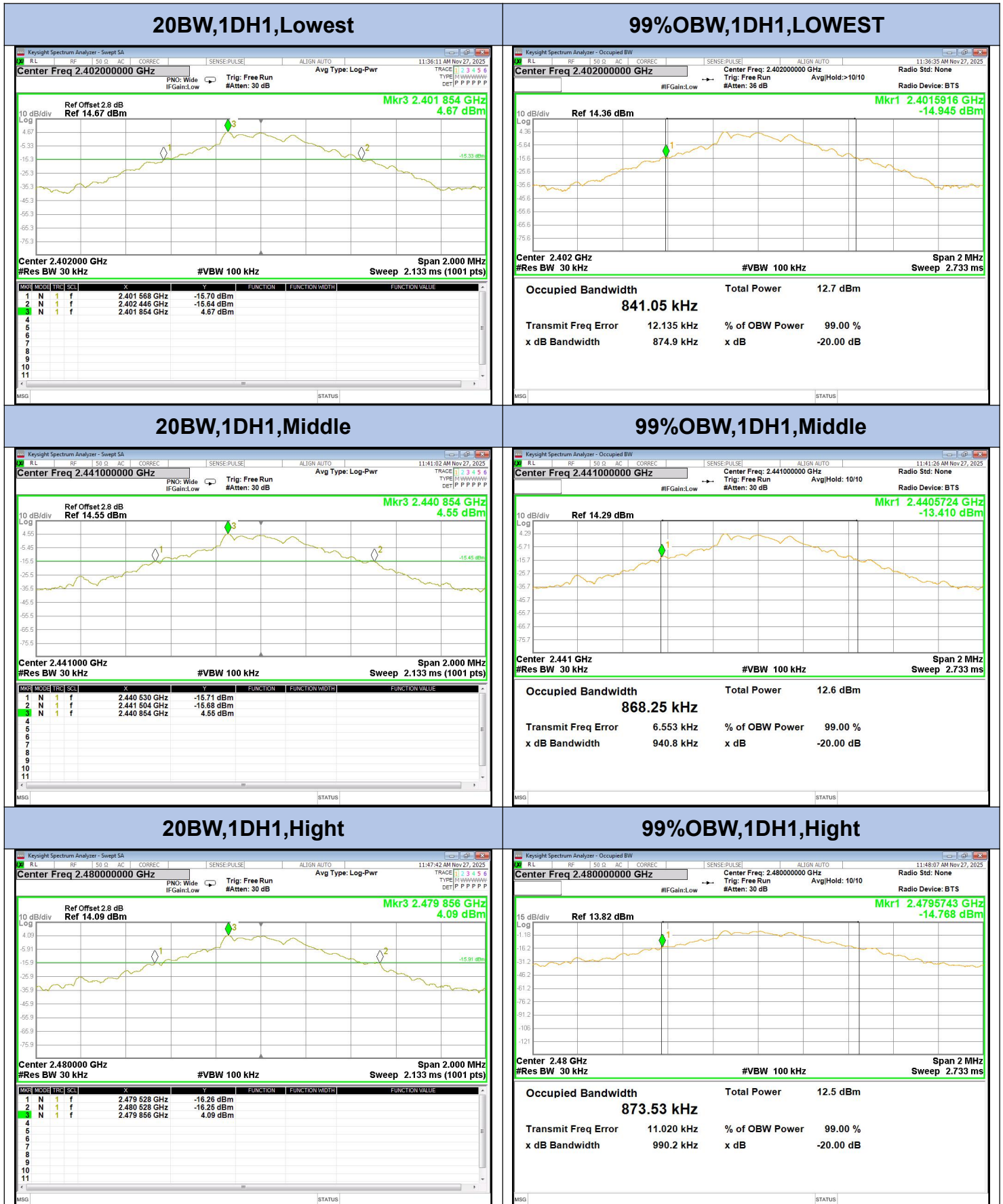
4.5.99% bandwidthTest Procedure

- The test according to ANSI C63.10 clause 6.9.3.
- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 4.3.
- Set the EUT transmit continuously with maximum output power.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

4.6. Test Result

Condition	Mode	Frequency(MHz)	99%OBW(MHz)	20BW(MHz)	Frequency Range(MHz)	Result
NVNT	1DH1	2402	0.841	0.878	2400-2483.5	Pass
NVNT	1DH1	2441	0.868	0.974	2400-2483.5	Pass
NVNT	1DH1	2480	0.874	1.000	2400-2483.5	Pass

4.7.Original Test record



5.CARRIER FREQUENCY SEPARATION

5.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.2.Test Setup



5.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	30KHz
VBW	100KHz
Span	2MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

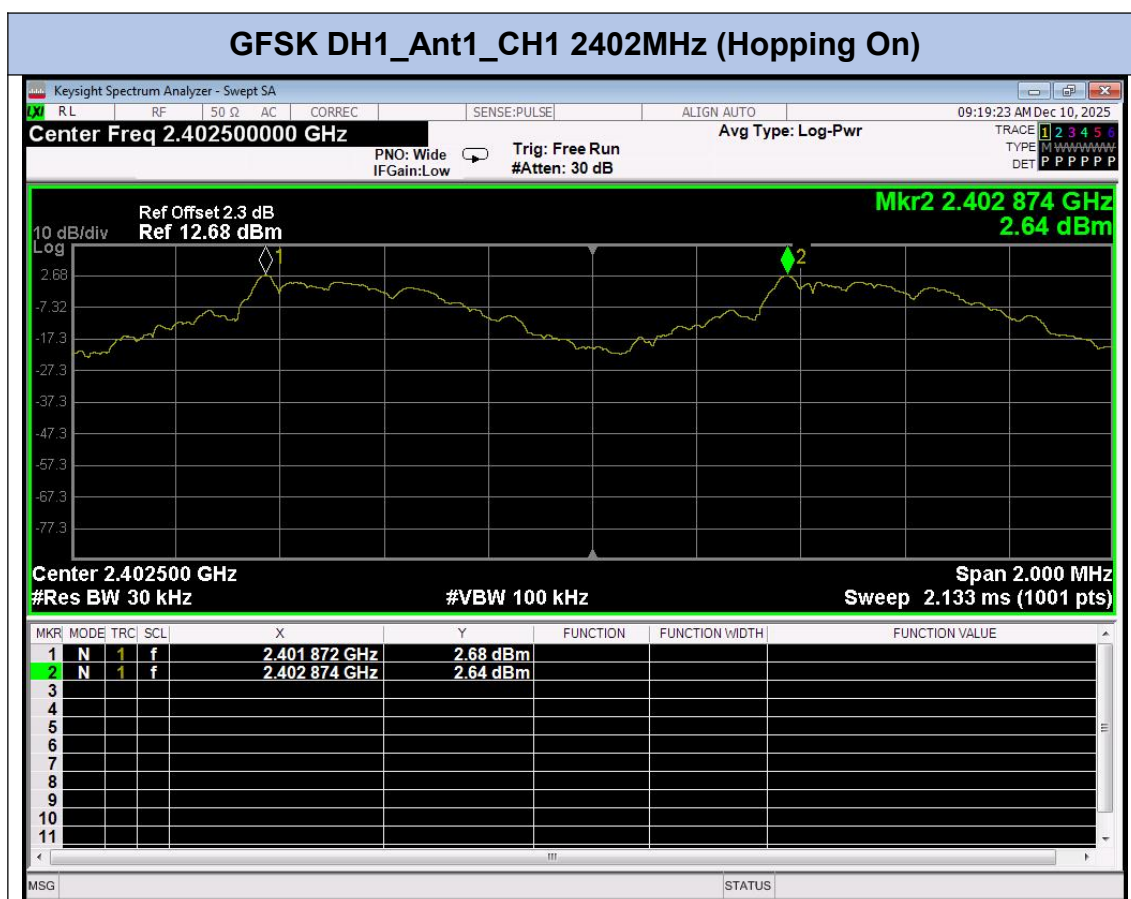
5.4.Test Procedure

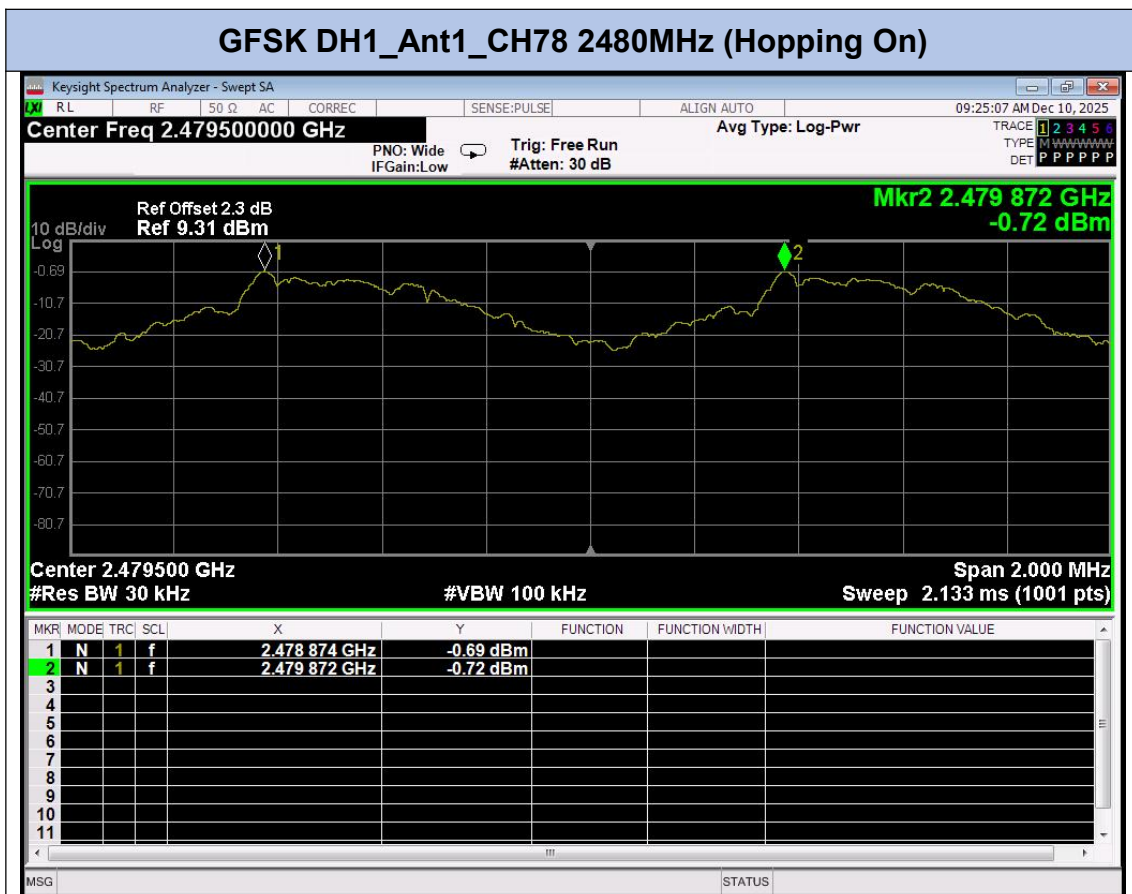
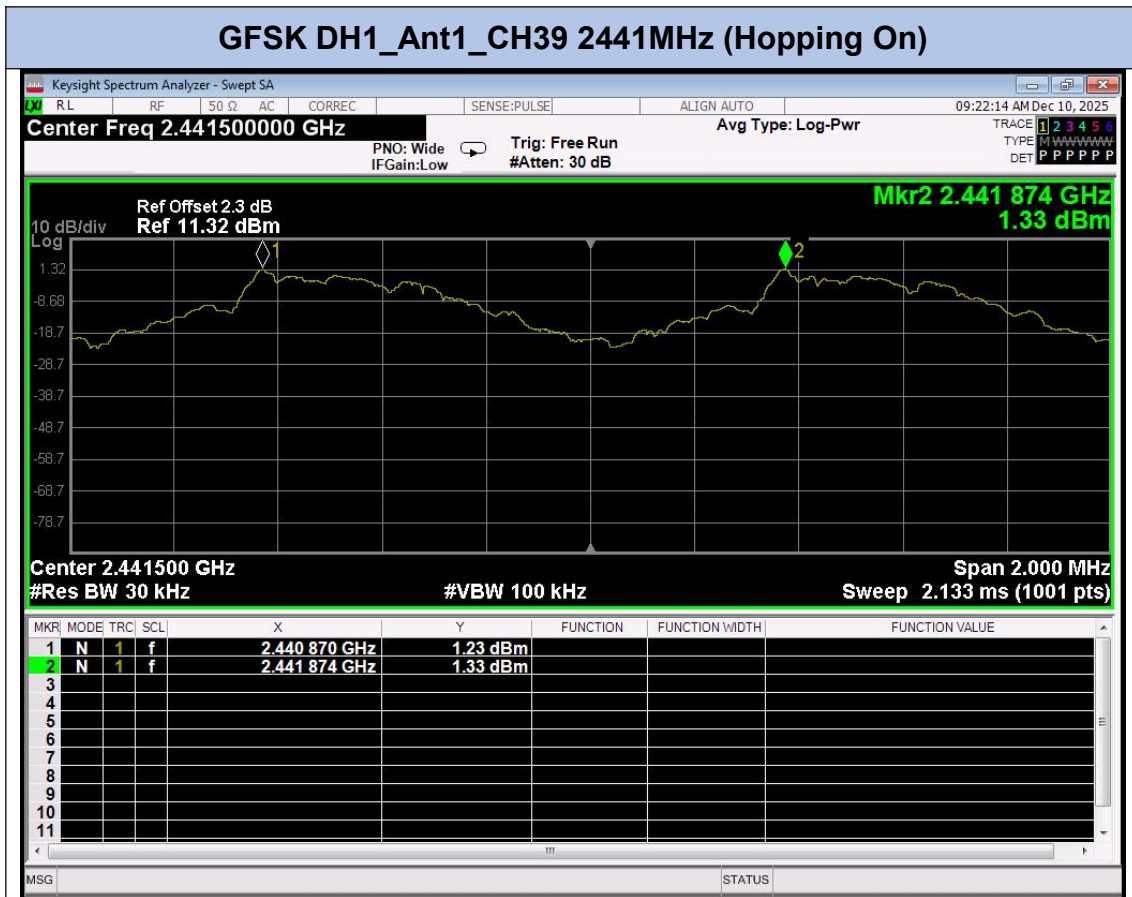
- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 5.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-delta function to measure channel separation between two adjacent channels.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

5.5. Test Result

Test Mode	Antenna	Channel	Frequency	Channel Separation	Limit	Result
			MHz	MHz	MHz	
GFSK DH1 (Hopping On)	Ant1	CH1	2402	1.002	> 0.59	PASS
GFSK DH1 (Hopping On)	Ant1	CH39	2441	1.004	> 0.65	PASS
GFSK DH1 (Hopping On)	Ant1	CH78	2480	0.998	> 0.67	PASS

5.6. Original Test record



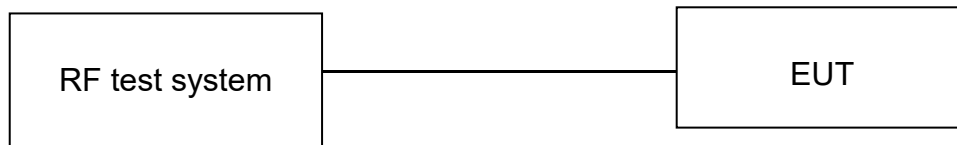


6. NUMBER OF HOPPING CHANNEL

6.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

6.2. Test Setup



6.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Start frequency	2400MHz
Stop frequency	2483.5MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

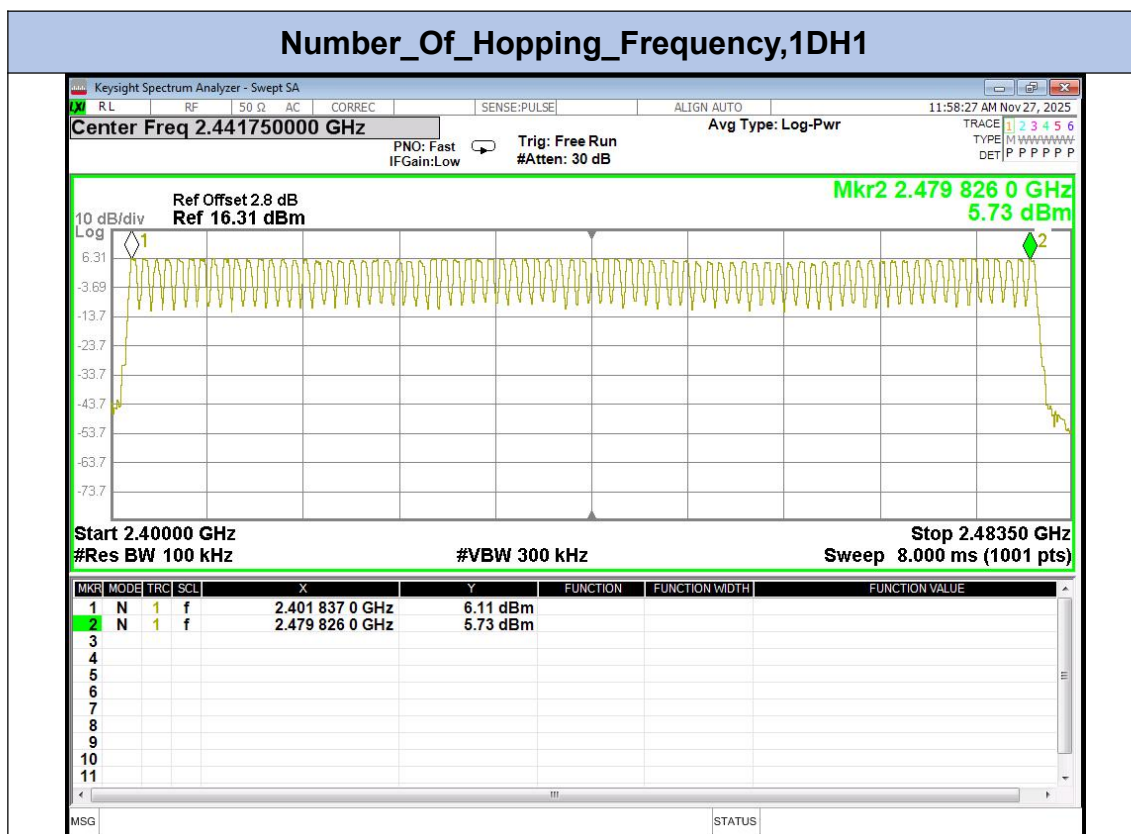
6.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 6.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-peak function to mark the first and last frequency hopping channel.
- Repeat above procedures until all test modes were measured.
- Record the results in the test report.

6.5. Test Result

Condition	Mode	Hopping Number	Limit	Frequency Range(MHz)	Results
NVNT	GFSK	79	>15	2400-2483.5	Pass

6.6. Original Test record

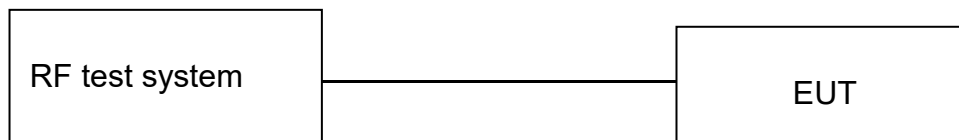


7.TIME OF OCCUPANCY (DWELL TIME)

7.1.Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

7.2.Test Setup



7.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	1MHz
VBW	MHz
Span	Zero
Detector	Peak
Sweep Time	1.133ms(DH1)/3.133ms(DH3)/4ms(DH5)
Sweep Mode	Single Sweep

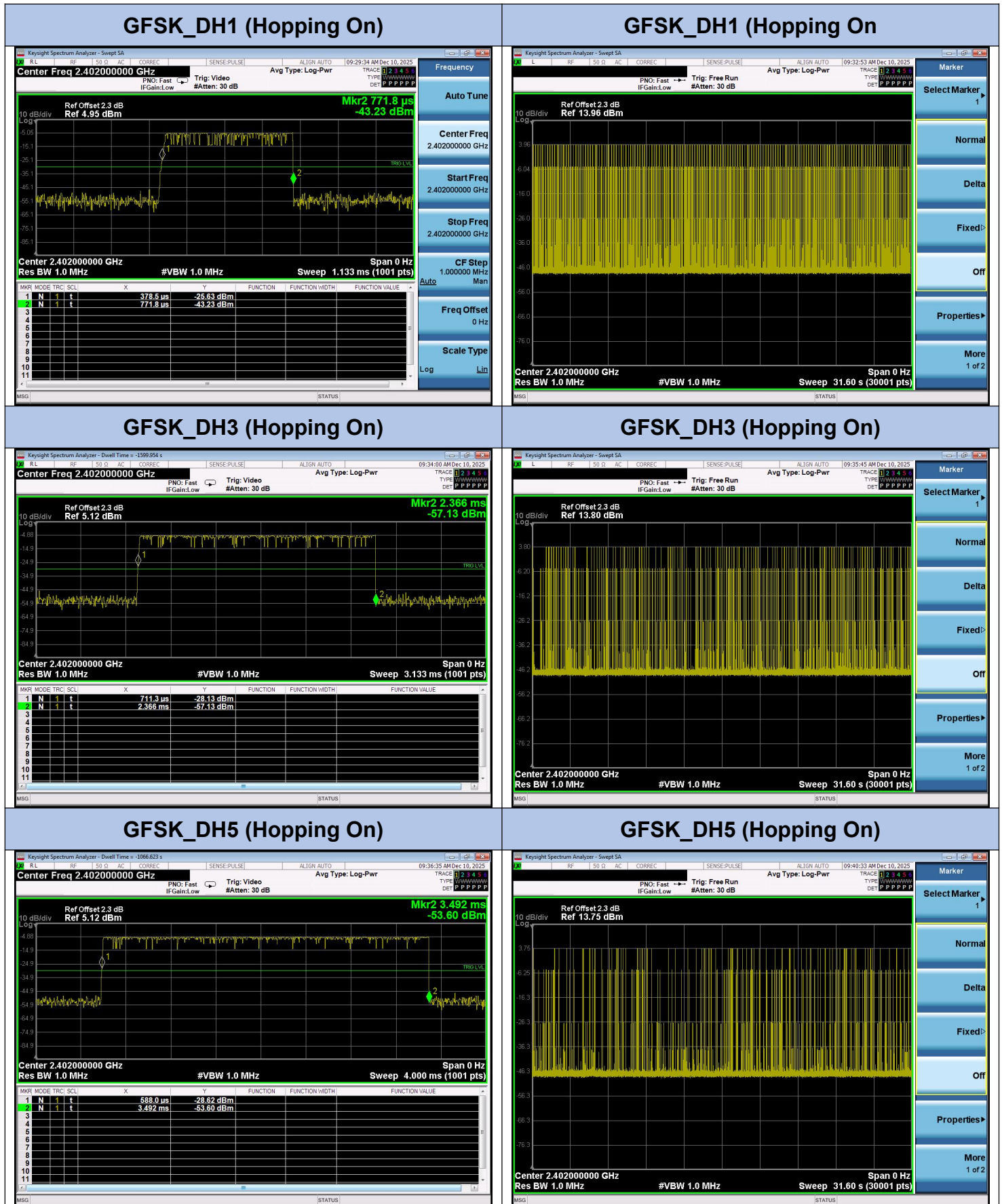
7.4.Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 7.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-delta function to measure single pulse duration.
- Repeat above procedures until all test modes were measured.
- Record the results in the test report.

7.5. Test Result

CONDITION	MODE	FREQUENCY (MHZ)	PULSE TIME (MS)	AVERAGE TIME OF OCCUPANCY (MS)	LIMIT (MS)	BURST NUMBER	RESULTS	CONDITION
NVNT	1DH1	2402	0.3933	126.296	400	320	PASS	NVNT
NVNT	1DH3	2402	1.6547	262.048	400	159	PASS	NVNT
NVNT	1DH5	2402	2.9040	318.121	400	110	PASS	NVNT

7.6.Original Test record

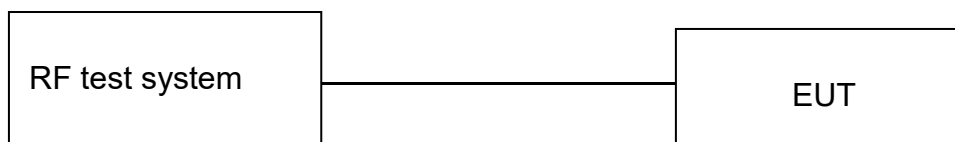


8.CONDUCTED BAND EDGE

8.1.Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.2.Test Setup



8.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	100MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

8.4.Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 8.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels and test modes were measured(including frequency hopping off and frequency hopping on).
- Record the results in the test report.

8.5. Test Result

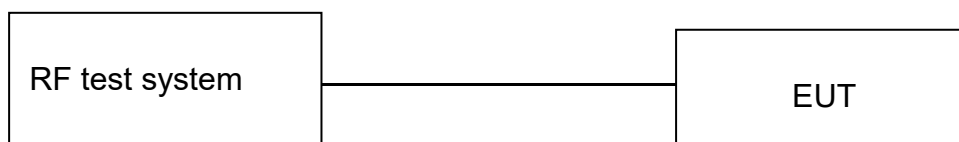


9. CONDUCTED SPURIOUS EMISSIONS

9.1. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

9.2. Test Setup



9.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	25GHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

9.4. Test Procedure

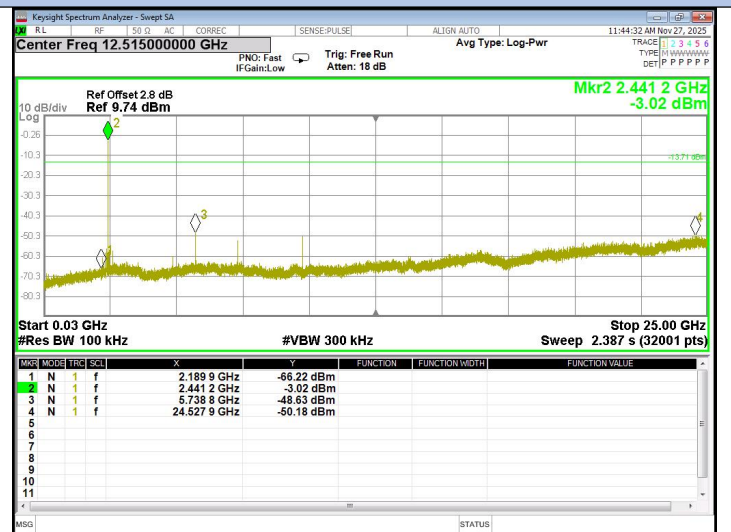
- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 9.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

9.5. Test Result

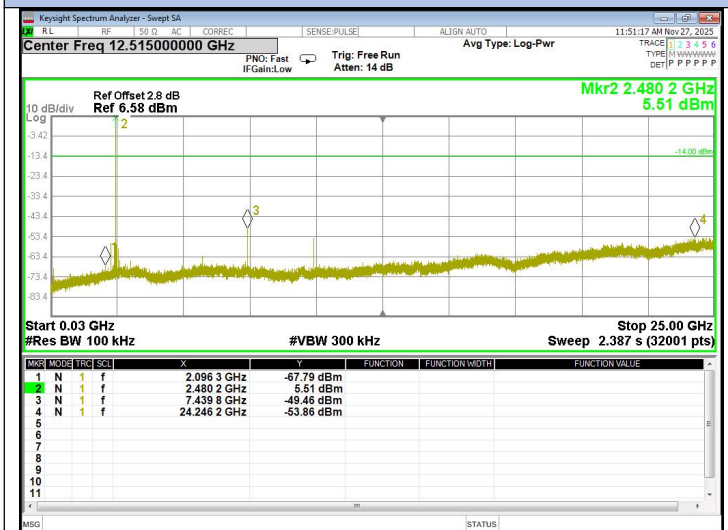
Low Channel 30MHz-25GHz



MIDDLE Channel 30MHz-25GHz



HIGHEST Channel 30MHz-25GHz



10. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

10.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

15.209 Limit

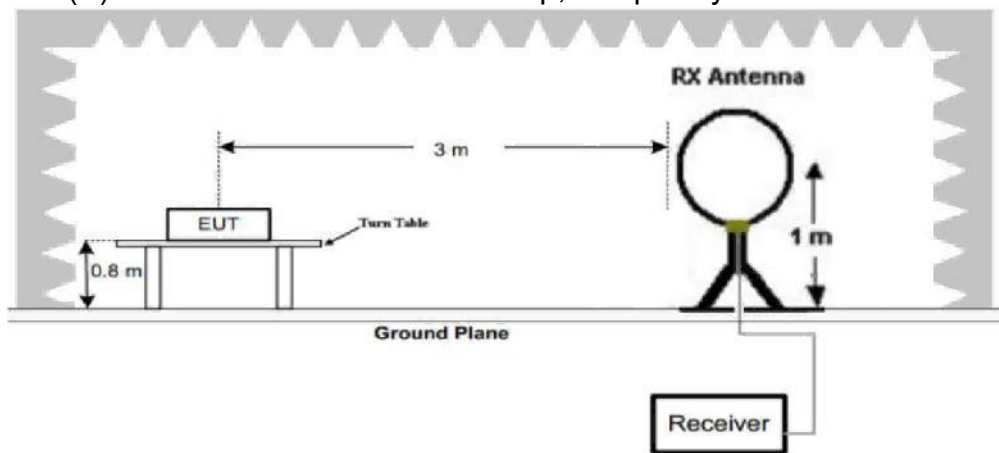
Frequency (MHz)	Field Strength(μV/m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

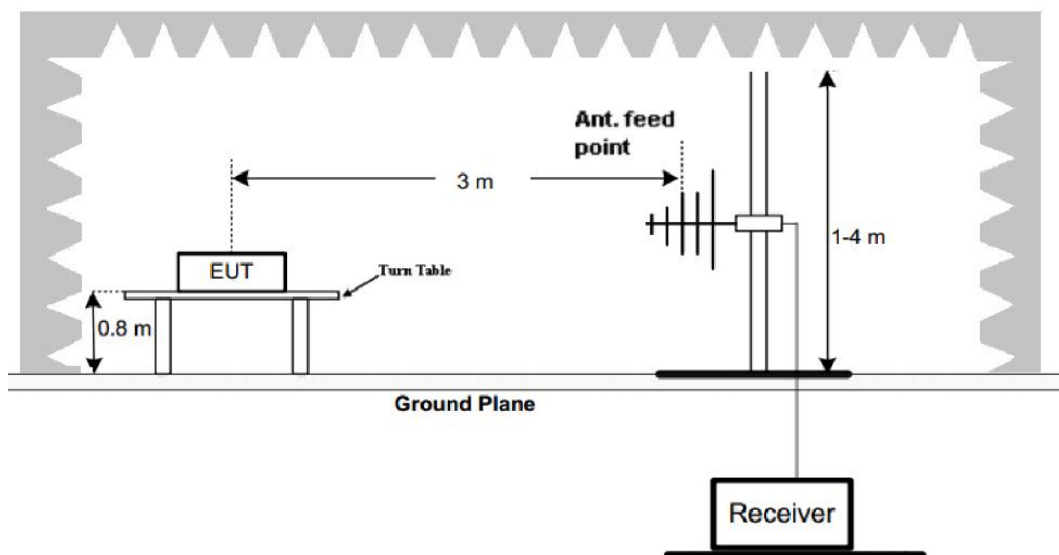
- (1) Emission level dBμV = 20 log Emission level μV/m.
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

10.2. Test Setup

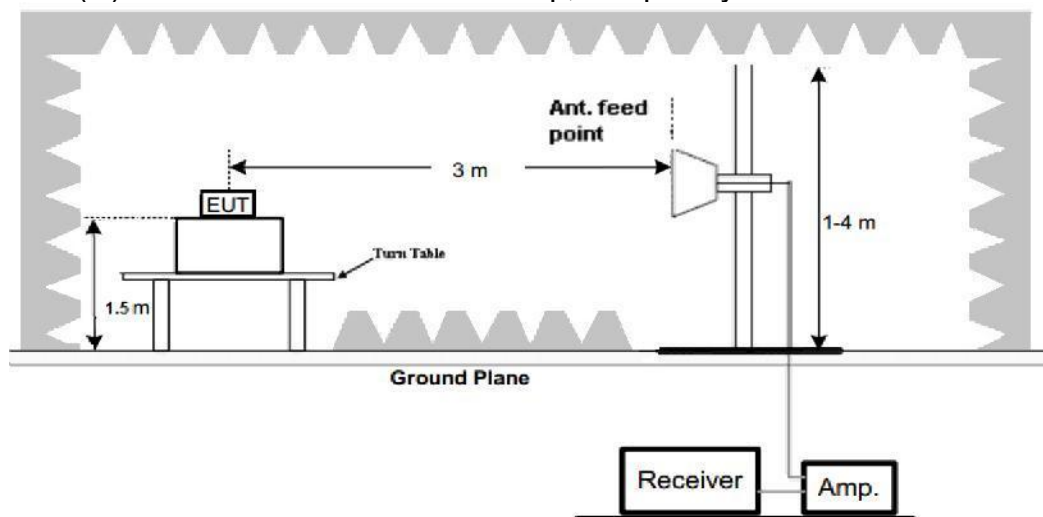
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz

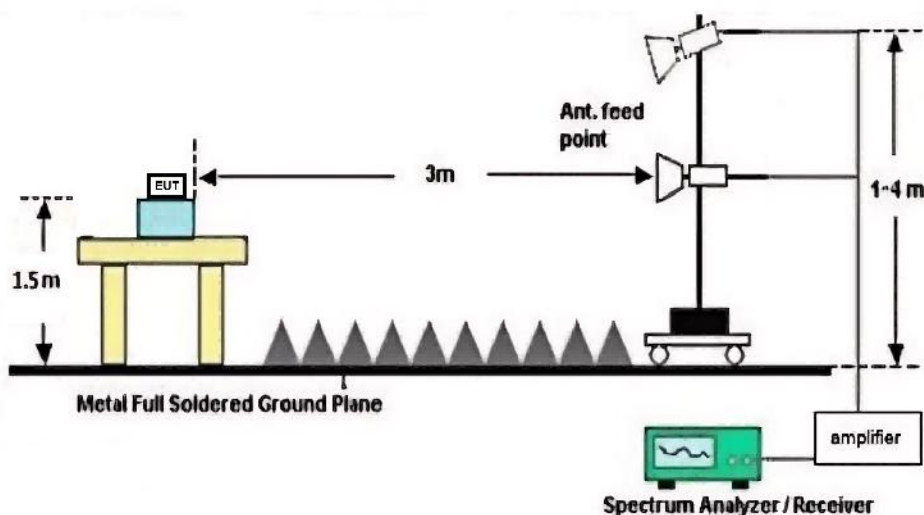


(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1GHz





10.3. Spectrum Analyzer Setting

For 9KHz-150KHz

Spectrum Parameters	Setting
RBW	300Hz (for Peak&AVG)/CISPR 200Hz (for QP)
VBW	300Hz (for Peak&AVG)/CISPR 200Hz (for QP)
Start frequency	9KHz
Stop frequency	150KHz
Sweep Time	Auto
Detector	PEAK/QP/AVG
Trace Mode	Max Hold

For 150KHz-30MHz

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For 30MHz-1GHz

Spectrum Parameters	Setting
RBW	120KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	1GHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For Above 1GHz

Spectrum Parameters	Setting	
RBW	1MHz	
VBW	PEAK Measurement	AVG Measurement
	3MHz	Duty cycle $\geq$ 98%, VBW=10Hz
		Duty cycle $<$ 98%, VBW $\geq$ 1/T
Start frequency	1GHz	
Stop frequency	25GHz	
Sweep Time	Auto	
Detector	PEAK	
Trace Mode	Max Hold	

10.4. Test Procedure

- a. EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test, and which is 1.5 meter high above ground for above 1GHz test.
- b. The diameter of the turntable is 2 meters. The EUT is located at the center of the edge of the test support table. Since the turntable is large enough, the EUT is placed at the center of the edge of the test support table as well as at the center of the turntable.
- c. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
- d. Set the EUT transmit continuously with maximum output power.
- e. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
- f. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
- g. EMI Test Receiver setting parameters in accordance with section 10.3.
- h. Repeat above procedures until all channels and test modes were measured.
- i. Record the results in the test report.

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

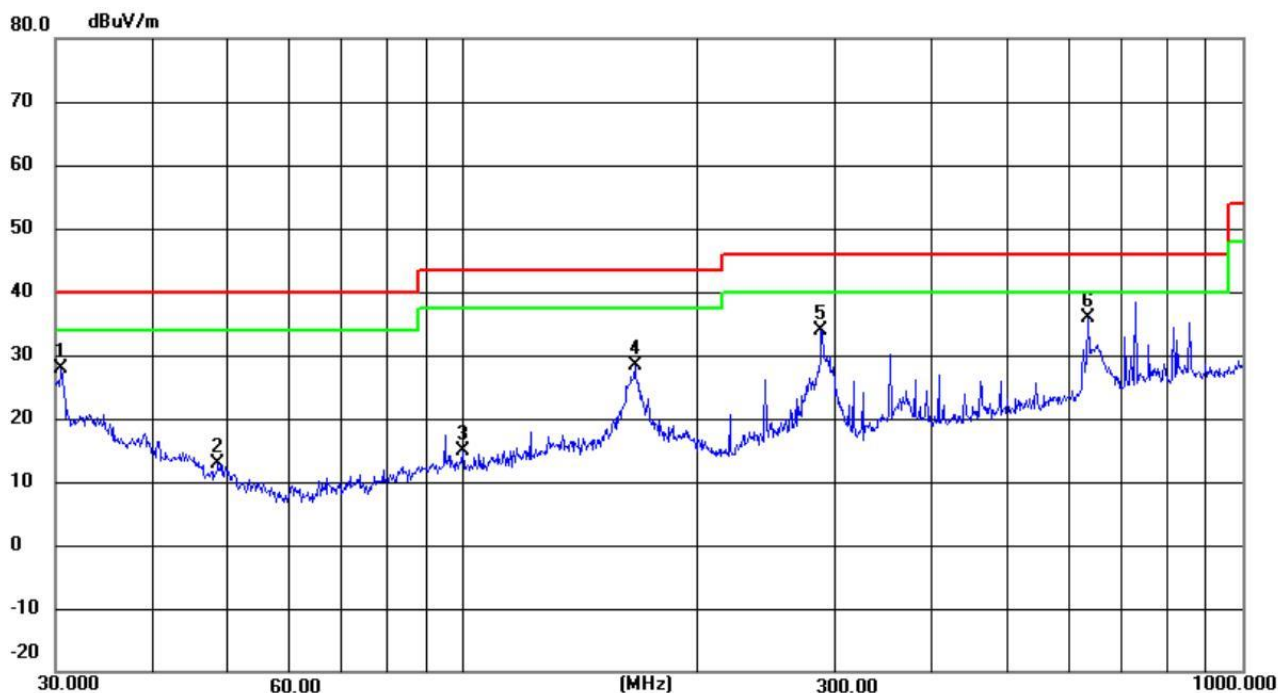
Limit line = specific limits (dBuv) + distance extrapolation factor.

10.5. Test Result

Radiated Emissions 30-1000MHz

EUT: Amplifier
M/N: AK-3116
Test Voltage: DC 24V by Adapter
Ant. Pol.: Horizontal
Test Mode: TX Mode
Note: only worse case: GFSK mode with CH1 2402MHz is reported

Detailed results are shown below

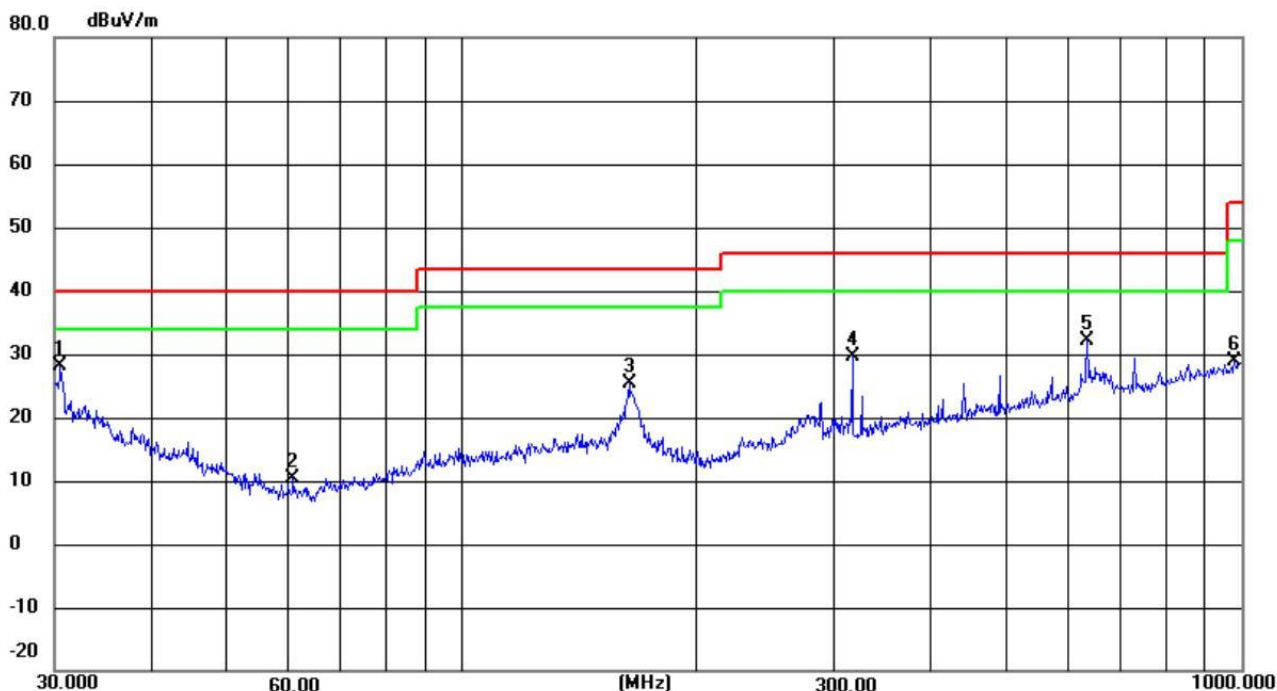


No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	33.7986	31.42	-9.74	21.68	40.00	-18.32	QP
2	77.5928	53.03	-32.16	20.87	40.00	-19.13	QP
3	144.8418	57.50	-32.13	25.37	43.50	-18.13	QP
4	224.5193	60.06	-32.01	28.05	46.00	-17.95	QP
5	570.6100	55.55	-31.18	24.37	46.00	-21.63	QP
6	1000.0000	60.15	-30.60	29.55	54.00	-24.45	QP

Remarks:

Margin = Result (Result = Reading + Factor) - Limit

EUT: Amplifier
M/N: AK-3116
Test Voltage: DC 24V by Adapter
Ant. Pol.: Vertical
Test Mode: TX Mode
Note: only worse case: GFSK mode with CH1 2402MHz is reported
Detailed results are shown below



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	36.8953	45.70	-11.79	33.91	40.00	-6.09	QP
2	83.2298	59.75	-32.17	27.58	40.00	-12.42	QP
3	142.3243	58.15	-32.14	26.01	43.50	-17.49	QP
4	286.9823	53.65	-31.92	21.73	46.00	-24.27	QP
5	612.0642	56.43	-31.11	25.32	46.00	-20.68	QP
6	996.4996	59.91	-30.60	29.31	54.00	-24.69	QP

Remarks: 1). Level (dBμV/m) = Reading (dBμV/m) + Factor (dB/m)
2). Factor(dB/m) = Antenna Factor (dB/m) + Cable loss (dB)
3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

Radiated Emissions Above 1GHz - GFSK

Temperature:	24.6 °C	Relative Humidity:	60%
Test Mode:	Low CH (GFSK)	Test Voltage:	DC 24V by Adapter

Peak

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804.00	37.59	31.78	8.6	32.09	45.88	74	-28.12	Vertical
7206.00	35.58	36.15	11.65	32	51.38	74	-22.62	Vertical
9608.00	36.46	37.95	14.14	31.62	56.93	74	-17.07	Vertical
12010.00	*					74		Vertical
14412.00	*					74		Vertical
4804.00	40.19	31.78	8.6	32.09	48.48	74	-25.52	Horizontal
7206.00	35.38	36.15	11.65	32	51.18	74	-22.82	Horizontal
9608.00	34.51	37.95	14.14	31.62	54.98	74	-19.02	Horizontal
12010.00	*					74		Horizontal
14412.00	*					74		Horizontal

Avg

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804.00	30.29	31.78	8.6	32.09	38.58	54	-15.42	Vertical
7206.00	22.43	36.15	11.65	32	38.23	54	-15.77	Vertical
9608.00	21.17	37.95	14.14	31.62	41.64	54	-12.36	Vertical
12010.00	*					54		Vertical
14412.00	*					54		Vertical
4804.00	34.31	31.78	8.6	32.09	42.6	54	-11.4	Horizontal
7206.00	24.25	36.15	11.65	32	40.05	54	-13.95	Horizontal
9608.00	21.36	37.95	14.14	31.62	41.83	54	-12.17	Horizontal
12010.00	*					54		Horizontal
14412.00	*					54		Horizontal

Remark:

- 1.Final Level =Receiver Read level + Antenna Factor + Cable Loss- Preamplifier Factor
- 2.The emission levels of other frequencies are very lower than the limit and not show in test report.
3. "※", means this data is the too weak instrument of signal is unable to test.

Temperature:	24.6 °C	Relative Humidity:	60%
Test Mode:	Middle CH (GFSK)	Test Voltage:	DC 24V by Adapter

Peak

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4882	39.07	31.85	8.67	32.12	47.47	74	-26.53	Vertical
7323	33.28	36.37	11.72	31.89	49.48	74	-24.52	Vertical
9764	33.35	38.35	14.25	31.62	54.33	74	-19.67	Vertical
12205	*					74		Vertical
14646	*					74		Vertical
4882	43.49	31.85	8.67	32.12	51.89	74	-22.11	Horizontal
7323	35.18	36.37	11.72	31.89	51.38	74	-22.62	Horizontal
9764	35.26	38.35	14.25	31.62	56.24	74	-17.76	Horizontal
12205	*					74		Horizontal
14646	*					74		Horizontal

Avg

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4882	28.35	31.85	8.67	32.12	36.75	54	-17.25	Vertical
7323	23.28	36.37	11.72	31.89	39.48	54	-14.52	Vertical
9764	19.37	38.35	14.25	31.62	40.35	54	-13.65	Vertical
12205	*					54		Vertical
14646	*					54		Vertical
4882	30.64	31.85	8.67	32.12	39.04	54	-14.96	Horizontal
7323	24.11	36.37	11.72	31.89	40.31	54	-13.69	Horizontal
9764	23.23	38.35	14.25	31.62	44.21	54	-9.79	Horizontal
12205	*					54		Horizontal
14646	*					54		Horizontal

Temperature:	24.6 °C	Relative Humidity:	60%
Test Mode:	Hight CH (GFSK)	Test Voltage:	DC 24V by Adapter

Peak

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4960.00	36.31	31.93	8.73	32.16	44.81	74	-29.19	Vertical
7440.00	35.13	36.59	11.79	31.78	51.73	74	-22.27	Vertical
9920.00	35.52	38.81	14.38	31.88	56.83	74	-17.17	Vertical
12400.00	*					74		Vertical
14880.00	*					74		Vertical
4960.00	40.88	31.93	8.73	32.16	49.38	74	-24.62	Horizontal
7440.00	36.67	36.59	11.79	31.78	53.27	74	-20.73	Horizontal
9920.00	34.25	38.81	14.38	31.88	55.56	74	-18.44	Horizontal
12400.00	*					74		Horizontal
14880.00	*					74		Horizontal

Avg

Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4960.00	26.38	31.93	8.73	32.16	34.88	54	-19.12	Vertical
7440.00	20.49	36.59	11.79	31.78	37.09	54	-16.91	Vertical
9920.00	19.61	38.81	14.38	31.88	40.92	54	-13.08	Vertical
12400.00	*					54		Vertical
14880.00	*					54		Vertical
4960.00	34.83	31.93	8.73	32.16	43.33	54	-10.67	Horizontal
7440.00	24.77	36.59	11.79	31.78	41.37	54	-12.63	Horizontal
9920.00	21.99	38.81	14.38	31.88	43.3	54	-10.7	Horizontal
12400.00	*					54		Horizontal
14880.00	*					54		Horizontal

Radiated Band Edge data

Low CH (GFSK)

Peak

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	41.23	27.61	5.36	30.18	44.02	74	-29.98	Horizontal
2390.00	40.25	27.59	5.38	30.18	43.04	74	-30.96	Horizontal
2400.00	55.37	27.58	5.39	30.18	58.16	74	-15.84	Horizontal
2310.00	38.26	27.61	5.36	30.18	41.05	74	-32.95	Vertical
2390.00	41.45	27.59	5.38	30.18	44.24	74	-29.76	Vertical
2400.00	46.38	27.58	5.39	30.18	49.17	74	-24.83	Vertical

Avg

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	35.17	27.61	5.36	30.18	37.96	54	-16.04	2310.00
2390.00	30.28	27.59	5.38	30.18	33.07	54	-20.93	2390.00
2400.00	42.86	27.58	5.39	30.18	46.12	54	-7.88	2400.00
2310.00	34.98	27.61	5.36	30.18	37.77	54	-16.23	2310.00
2390.00	32.92	27.59	5.38	30.18	35.71	54	-18.29	2390.00
2400.00	41.66	27.58	5.39	30.18	44.45	54	-9.55	2400.00

High CH(GFSK)

Peak

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	40.18	27.53	5.47	29.93	43.25	74	-30.75	Horizontal
2500.00	42.24	27.55	5.49	29.93	45.35	74	-28.65	Horizontal
2483.50	44.97	27.53	5.47	29.93	48.04	74	-25.96	Vertical
2500.00	41.68	27.55	5.49	29.93	44.79	74	-29.21	Vertical

Avg

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	35.24	27.53	5.47	29.93	38.31	54	-15.69	Horizontal
2500.00	34.07	27.55	5.49	29.93	37.18	54	-16.82	Horizontal
2483.50	36.31	27.53	5.47	29.93	39.38	54	-14.62	Vertical
2500.00	31.56	27.55	5.49	29.93	34.67	54	-19.33	Vertical

11. AC POWER LINE CONDUCTED EMISSIONS

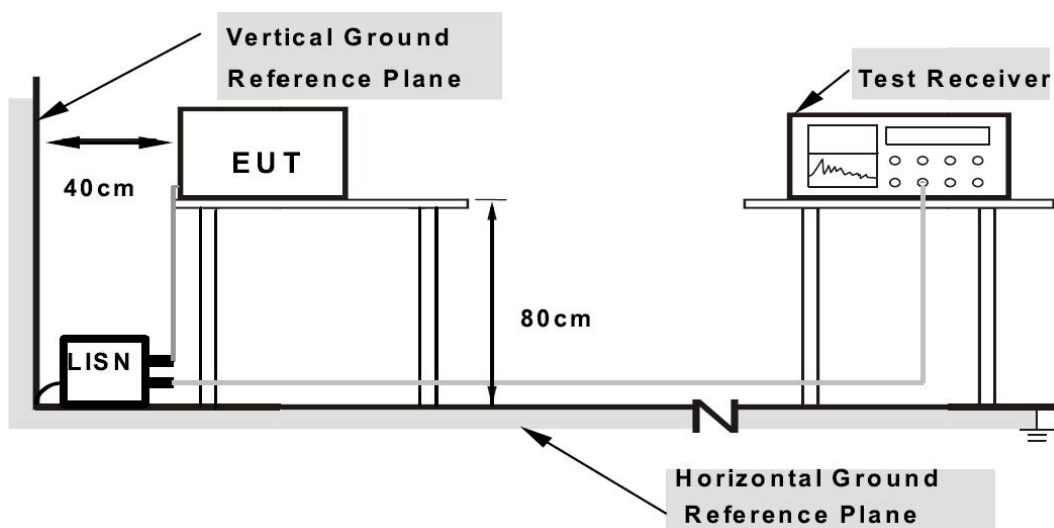
11.1. Limit

Frequency			Maximum RF Line Voltage	
			Quasi-Peak Level dB(μ V)	Average Level dB(μ V)
150kHz	~	500kHz	66 ~ 56*	56 ~ 46*
500kHz	~	5MHz	56	46
5MHz	~	30MHz	60	50

Note:

1. * Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

11.2. Test Setup



11.3. Spectrum Analyzer Setting

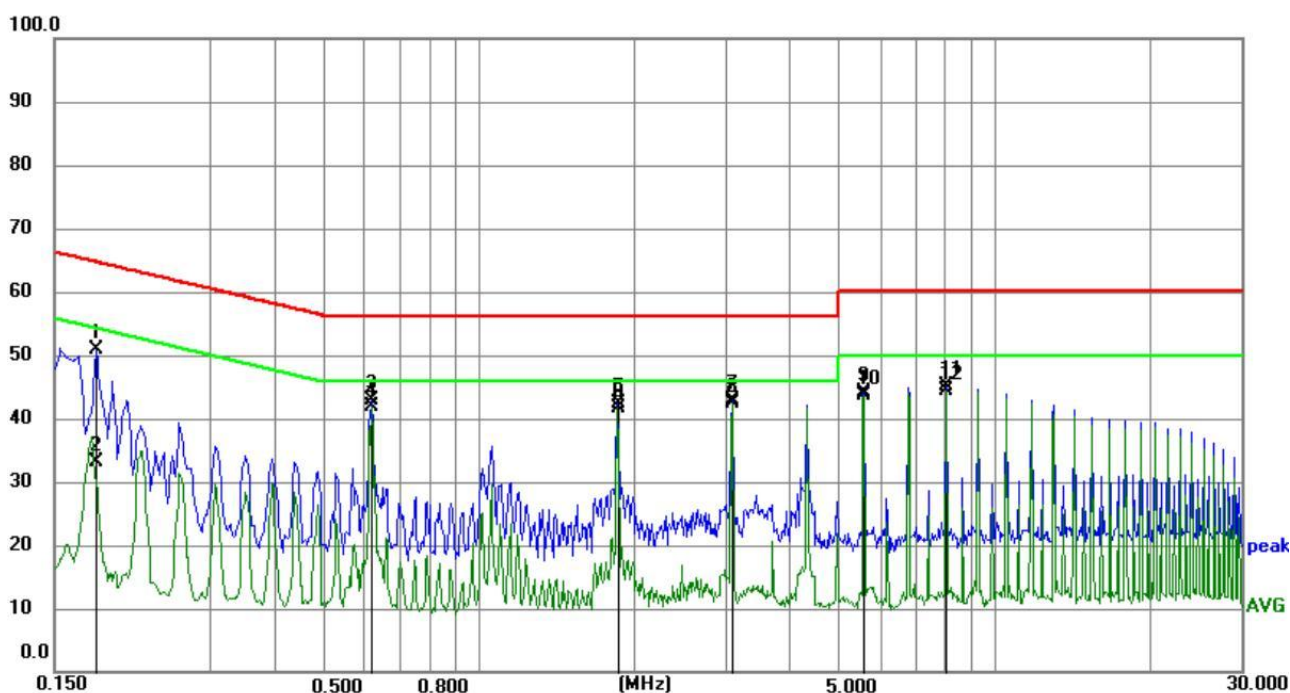
Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP/AVG
Trace Mode	Max Hold

11.4. Test Procedure

- a. The EUT was placed on a non-metallic table, 80cm above the ground plane.
- b. The EUT Power connected to the power mains through a line impedance stabilization network.
- c. Provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs).
- d. Set the EUT transmit continuously with maximum output power.
- e. Spectrum analyzer setting parameters in accordance with section 11.3.
- f. The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10:2020 on Conducted Emission Test.
- g. It was conducted under both AC 120V/60Hz and AC 240V/50Hz input voltages, there was no significant change in radiation emission. Only worse case: GFSK mode with CH1 2402MHz with AC 120V/60Hz voltage is reported.

11.5. Test Result

EUT: Amplifier
M/N: AK-3116
Test Voltage: AC120V/60Hz
Phase: Live
Test Mode: TX Mode
Note: only worse case: GFSK mode with CH1 2402MHz is reported
Detailed results are shown below

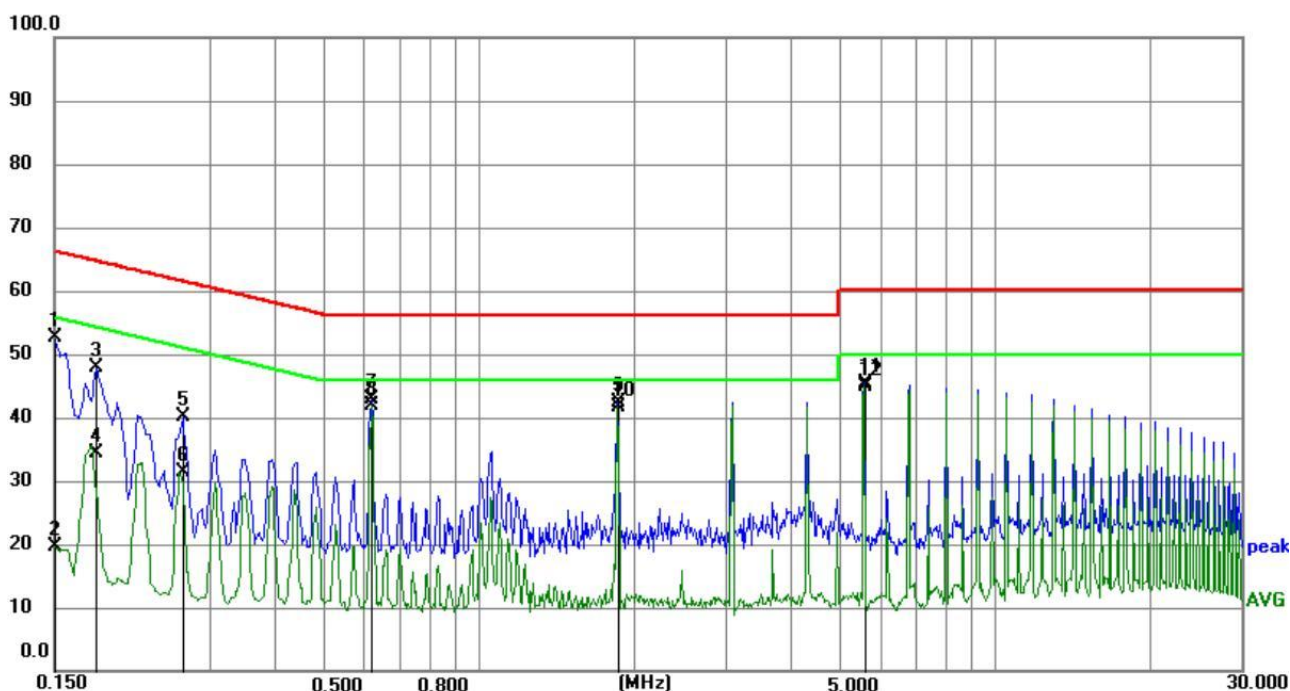


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1814	40.77	10.18	50.95	64.42	13.47	QP
2	0.1814	22.87	10.18	33.05	54.42	21.37	AVG
3	0.6179	32.77	10.22	42.99	56.00	13.01	QP
4	0.6179	31.64	10.22	41.86	46.00	4.14	AVG
5	1.8552	31.93	10.38	42.31	56.00	13.69	QP
6	1.8552	31.21	10.38	41.59	46.00	4.41	AVG
7	3.0929	32.40	10.41	42.81	56.00	13.19	QP
8	3.0929	31.94	10.41	42.35	46.00	3.65	AVG
9	5.5678	33.63	10.46	44.09	60.00	15.91	QP
10	5.5678	33.11	10.46	43.57	50.00	6.43	AVG
11	8.0385	34.59	10.46	45.05	60.00	14.95	QP
12	8.0385	34.02	10.46	44.48	50.00	5.52	AVG

Remark: The test Result=Reading+ Lisn+ Cab L.

If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

EUT: Amplifier
M/N: AK-3116
Test Voltage: AC120V/60Hz
Phase: Neutral
Test Mode: TX Mode
Note: only worse case: GFSK mode with CH1 2402MHz is reported
Detailed results are shown below



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	42.51	10.17	52.68	66.00	13.32	QP
2	0.1500	9.47	10.17	19.64	56.00	36.36	AVG
3	0.1814	37.80	10.11	47.91	64.42	16.51	QP
4	0.1814	24.17	10.11	34.28	54.42	20.14	AVG
5	0.2670	29.89	10.13	40.02	61.21	21.19	QP
6	0.2670	21.33	10.13	31.46	51.21	19.75	AVG
7	0.6179	32.53	10.26	42.79	56.00	13.21	QP
8	0.6179	31.68	10.26	41.94	46.00	4.06	AVG
9	1.8553	31.87	10.39	42.26	56.00	13.74	QP
10	1.8553	31.20	10.39	41.59	46.00	4.41	AVG
11	5.5679	35.02	10.40	45.42	60.00	14.58	QP
12	5.5679	34.43	10.40	44.83	50.00	5.17	AVG

Remark: The test Result=Reading+ Lisn+ Cab L.

If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

12. ANTENNA REQUIREMENTS

12.1. Limit

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

12.2. Test Result

The antennas used for this product is Rubber tube antenna, so compliance with antenna requirements. (Please refer to the EUT photo for details)

13. APPENDIX

"EUT of External Photos, EUT Internal Photos & Test Setup Photos" Please refer to the Annex A, Annex B & Annex C document.

Annex A. EUT External Photos

Annex B. EUT Internal Photos

Annex C. Test Setup Photos

-----*End of Test Report*-----