FCC RADIO TEST REPORT

FCC ID: 2A4THMJ-6709

Sample:	Barcode Scanner
Trade Name:	symcode alacrity
Main Model:	MJ-6709 Series
Additional Model:	MJ-1400 Series, MJ-1911 Series, MJ-2020 Series, MJ-2030 Series, MJ-2080 Series, MJ-2806 Series, MJ-6708 Series, MJ-6706 Series, MJ-9200 Series, MJ-1900 Series, MJ-1902 Series, MJ-1930 Series, MJ-1932 Series, MJ-2877 Series, R30, R35, R38, R40, R45, R50, R55, R60, R70, R80, R90, X5, X6, X7, X8, X9, Q10, R10
Report No.:	UNIA22021604ER-63

Prepared for

Shenzhen Alacrity Barcode Technology Co., Ltd

5F,Building B,Southern Pearl Technology Park,No.83,Yingtai Road,Dalang, Longhua,Shenzhen,Guangdong,China

Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, XixiangStr, Bao'an District, Shenzhen, China

TEST RESULTCERTIFICATION

Applicant:	Shenzhen Alacrity Barcode Technology Co., Ltd
Address:	5F,Building B,Southern Pearl Technology Park,No.83,Yingtai Road,Dalang, Longhua,Shenzhen,Guangdong,China
Manufacturer:	Shenzhen Alacrity Barcode Technology Co., Ltd
Address:	5F,Building B,Southern Pearl Technology Park,No.83,Yingtai Road,Dalang, Longhua,Shenzhen,Guangdong,China

Product description

Product:	Barcode Scanner
Trade Name:	symcode alacrity
Model Name:	MJ-6709 Series, MJ-1400 Series, MJ-1911 Series, MJ-2020 Series, MJ-2030 Series, MJ-2080 Series, MJ-2806 Series, MJ-6708 Series, MJ-6706 Series, MJ-9200 Series, MJ-1900 Series, MJ-1902 Series, MJ-1930 Series, MJ-1932 Series, MJ-2877 Series, R30, R35, R38, R40, R45, R50, R55, R60, R70, R80, R90, X5, X6, X7, X8, X9, Q10, R10
Test Methods:	FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date (s) of performance of tests:	Feb. 16, 2022 ~ Mar. 18, 2022
Date of Issue:	Mar. 18, 2022
Test Result:	Pass

Prepared by: Jackson Fang

Jackson Fang/Editor

Reviewer: kahn.yang

Kahn yang/Supervisor

Approved & Authorized Signer: Liuze

Liuze/Manager

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GENERAL INFORMATION

GENERAL DESCRIPTION OF EUT

Product:	Barcode Scanner
Trade Name:	symcode alacrity
Main Model:	MJ-6709 Series
Additional Model:	MJ-1400 Series, MJ-1911 Series, MJ-2020 Series, MJ-2030 Series, MJ-2080 Series, MJ-2806 Series, MJ-6708 Series, MJ-6706 Series, MJ-9200 Series, MJ-1900 Series, MJ-1902 Series, MJ-1930 Series, MJ-1932 Series, MJ-2877 Series, R30, R35, R38, R40, R45, R50, R55, R60, R70, R80, R90, X5, X6, X7, X8, X9, Q10, R10
Model Difference:	All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: MJ-6709 Series.
FCC ID:	2A4THMJ-6709
Operation Frequency:	2410MHz~2470MHz
Number of Channels:	61CH
Modulation Type:	GFSK
Antenna Type:	Internal Antenna
Antenna Gain:	0dBi
Battery:	Li-ion 18650
Adapter:	N/A
Power Source:	DC 5.0V from USB Port of Laptop

CARRIER FREQUENCY OF CHANNELS

Channel List							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2410	17	2426	33	2442	49	2458
02	2411	18	2427	34	2443	50	2459
03	2412	19	2428	35	2444	51	2460
04	2413	20	2429	36	2445	52	2461
05	2414	21	2430	37	2446	53	2462
06	2415	22	2431	38	2447	54	2463
07	2416	23	2432	39	2448	55	2464
08	2417	24	2433	40	2449	56	2465
09	2418	25	2434	41	2450	57	2466
10	2419	26	2435	42	2451	58	2467
11	2420	27	2436	43	2452	59	2468
12	2421	28	2437	44	2453	60	2469
13	2422	29	2438	45	2454	61	2470
14	2423	30	2439	46	2455		
15	2424	31	2440	47	2456		
16	2425	32	2441	48	2457		

1.3 EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a hopping sequence in data mode:

40, 21, 44, 23, 04, 15, 56, 19, 07, 28, 55, 36, 45, 05, 13, 43, 57, 35, 02, 34, 54, 42, 11, 30, 06, 25, 48, 17, 33, 58, 01, 29, 14, 51, 03, 31, 50, 61, 18, 10, 47, 12, 08, 49, 20, 09, 16, 60, 41, 24, 53, 38, 26, 46, 37, 32, 52, 27, 59, 22, 39

1.4 EST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013).

Radiated testing was performed at an antenna to EUT distance 3 meters.

2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 150kHz	2.96	
		150kHz ~ 30MHz	2.44	

B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 30MHz	2.50	
		30MHz ~ 1000MHz	4.80	
		Above 1000MHz	4.13	

3 DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
10	Hopping mode GFSK

Note:

1.Only the result of the worst case was recorded in the report, if no other cases.

2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

3. ForConductedTestmethod,atemporaryantennaconnectorisprovidedbythemanufacture.

4 SYSTEM TEST CONFIGURATION

4.1 CONFIGURATION OF EUT SYSTEM

Operation of EUT during Conducted and Radiation testing:

4.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Barcode Scanner	MJ-6709 Series	2A4THMJ-6709	EUT
2	Laptop	CQ45	Compaq	AE
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A

4.3 SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(1)	Peak Output Power	Compliant
15.247(a)(1)	20 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.209	Radiated Emission	Compliant
15.247 (a)(1)(iii)	Number of Hopping Frequency	Compliant
15.247 (a)(1)(iii)	Time of Occupancy	Compliant
15.247 (a)(1)	Frequency Separation	Compliant
15.207	Conducted Emission	Compliant

5 TEST FACILITY

Test Laboratory : Shenzhen United Testing Technology Co., Ltd.
Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd,Tiegang Community, XixiangStr, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:
A2LA Certificate Number: 4747.01
The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885
The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947
The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

6 TEST EQUIPMENT OF RADIATED EMISSION TEST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
Conduction Emissions Measurement					
1	Conducted Emission Test Software	EZ-EMC	Ver.CCS-3A1-CE	N/A	N/A
2	AMN	Schwarzbeck	NNLK8121	8121370	2022.09.22
3	AAN	TESEQ	T8-Cat6	38888	2022.09.22
4	Pulse Limiter	CYBRTEK	EM5010	E115010056	2022.05.17
5	EMI Test Receiver	Rohde&Schwarz	ESCI	101210	2022.09.22
Radiated Emissions Measurement					
1	Radiated Emission Test Software	EZ-EMC	Ver.CCS-03A1	N/A	N/A
2	Horn Antenna	Sunol	DRH-118	A101415	2022.09.27
3	Broadband Hybrid Antenna	Sunol	JB1	A090215	2024.02.26
4	PREAMP	HP	8449B	3008A00160	2022.09.22
5	PREAMP	HP	8447D	2944A07999	2022.05.17
6	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2022.09.22
7	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2022.09.22
8	Signal Generator	Agilent	E4421B	MY4335105	2022.09.22
9	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2022.09.22
10	MXA Signal Analyzer	Keysight	N9020A	MY51110104	2022.09.22
11	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2022.05.17
12	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2022.05.17
13	RF power divider	Anritsu	K241B	992289	2022.09.22
14	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2022.09.22
15	Active Loop Antenna	Com-Power	AL-130R	10160009	2022.07.25
16	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2022.09.22
17	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2022.05.23
18	Horn Antenna	A-INFOMW	LB-180400-KF	J211060660	2022.09.27
19	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2022.09.22
20	Signal Generator	Agilent	N5183A	MY47420153	2022.09.22
21	Spctrum Analyzer	Rohde&Schwarz	FSP 40	100501	2022.09.22
22	Power Meter	KEYSIGHT	N1911A	MY50520168	2022.09.22

23	Frequency Meter	VICTOR	VC2000	997406086	2022.09.22
24	DC Power Source	HYELEC	HY5020E	055161818	2022.09.22

7 PEAK OUTPUT POWER

7.1 MEASUREMENT PROCEDURE

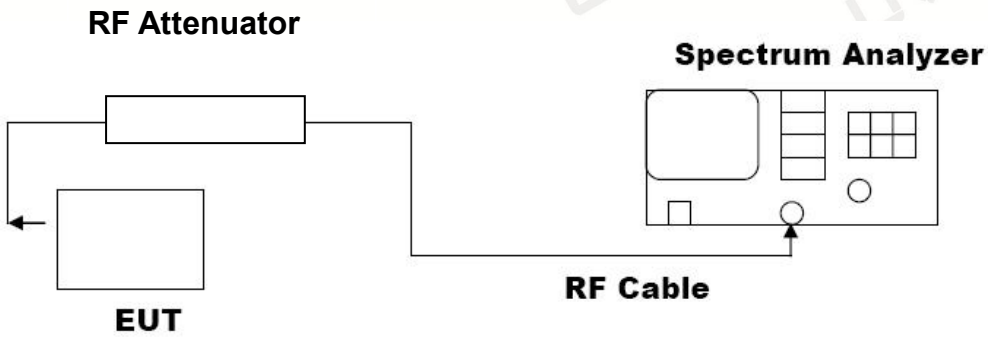
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
3. RBW > 20 dB bandwidth of the emission being measured.
4. VBW ≥RBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



7.3 LIMITS AND MEASUREMENT RESULT

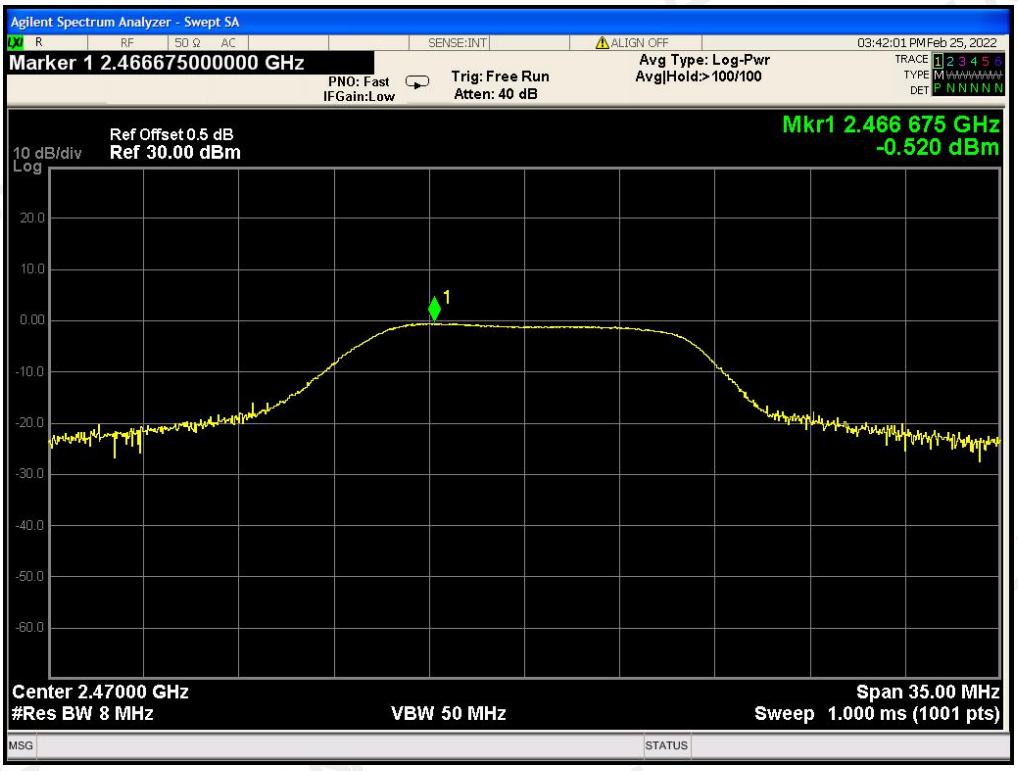
PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.410	1.067	21	Pass
2.440	-0.028	21	Pass
2.470	-0.520	21	Pass

CH01

CH31


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.435940000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
03:38:09 PM Feb 25, 2022
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.435 940 GHz
-0.028 dBm
Center 2.44000 GHz
#Res BW 8 MHz
VBW 50 MHz
Span 35.00 MHz
Sweep 1.000 ms (1001 pts)

CH61

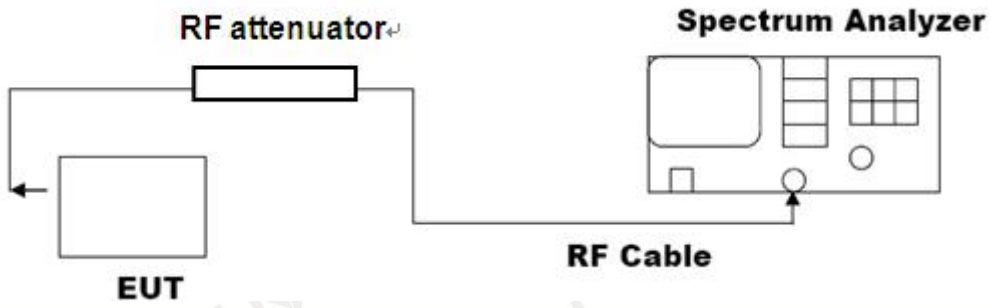

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.466675000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
03:42:01 PM Feb 25, 2022
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 2.466 675 GHz
-0.520 dBm
Center 2.47000 GHz
#Res BW 8 MHz
VBW 50 MHz
Span 35.00 MHz
Sweep 1.000 ms (1001 pts)

8 20DB BANDWIDTH

8.1 MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
   The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

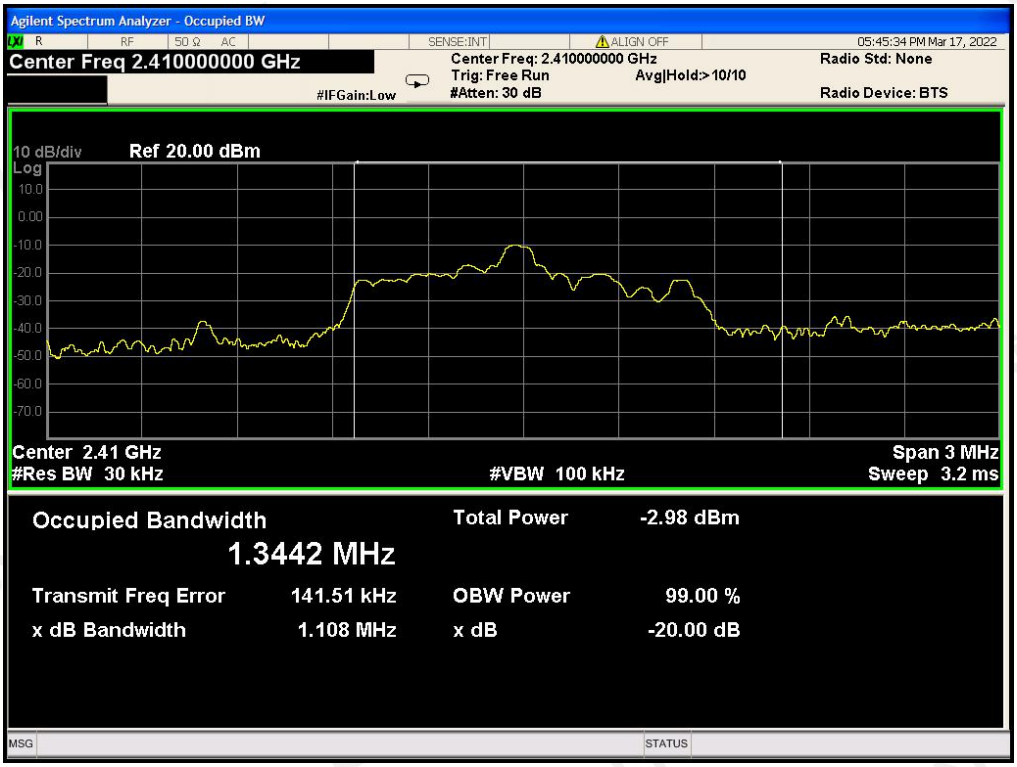
8.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



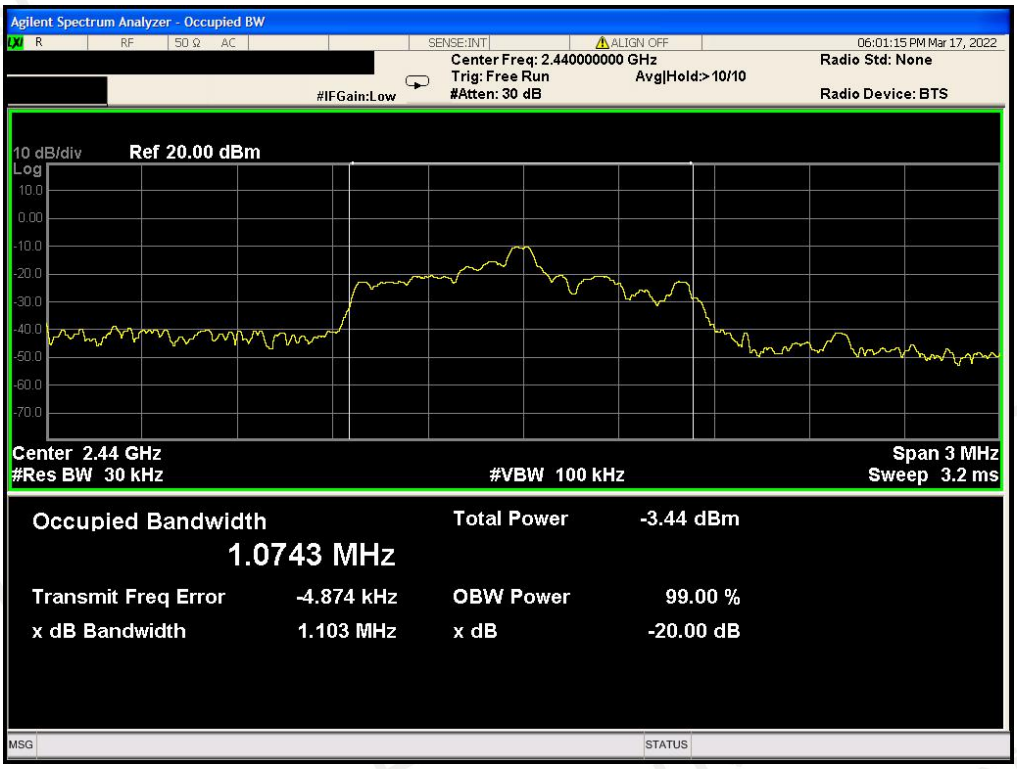
8.3 LIMITS AND MEASUREMENT RESULTS

GFSK MOUDULATION			
Applicable Limits	Measurement Result		
	Test Data (MHz)		Criteria
N/A	Low Channel	1.108	PASS
	Middle Channel	1.103	PASS
	High Channel	1.104	PASS

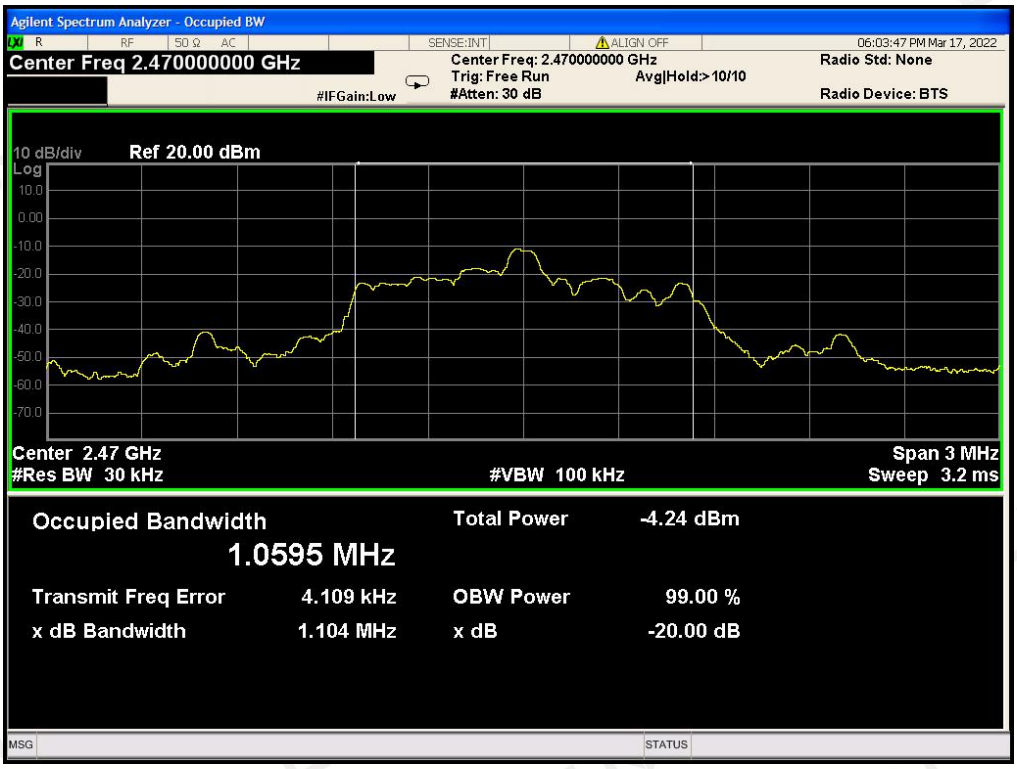
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



9 CONDUCTED SPURIOUS EMISSION

9.1 MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
   RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

9.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

9.3 MEASUREMENT EQUIPMENT USED

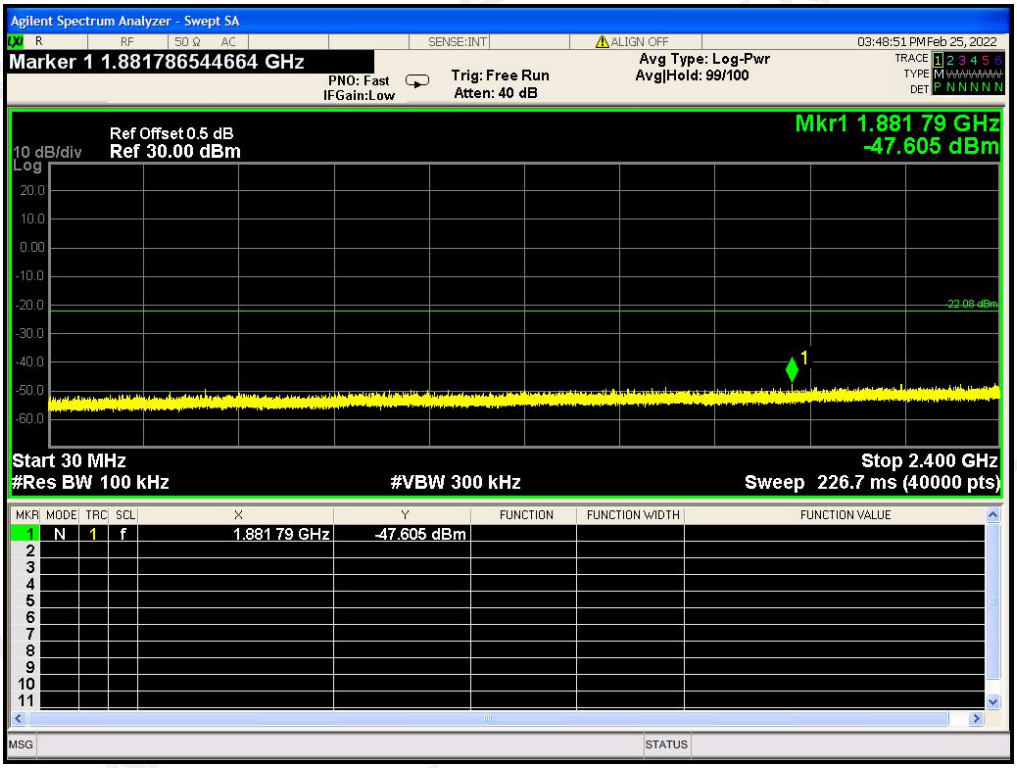
The same as described in section 6

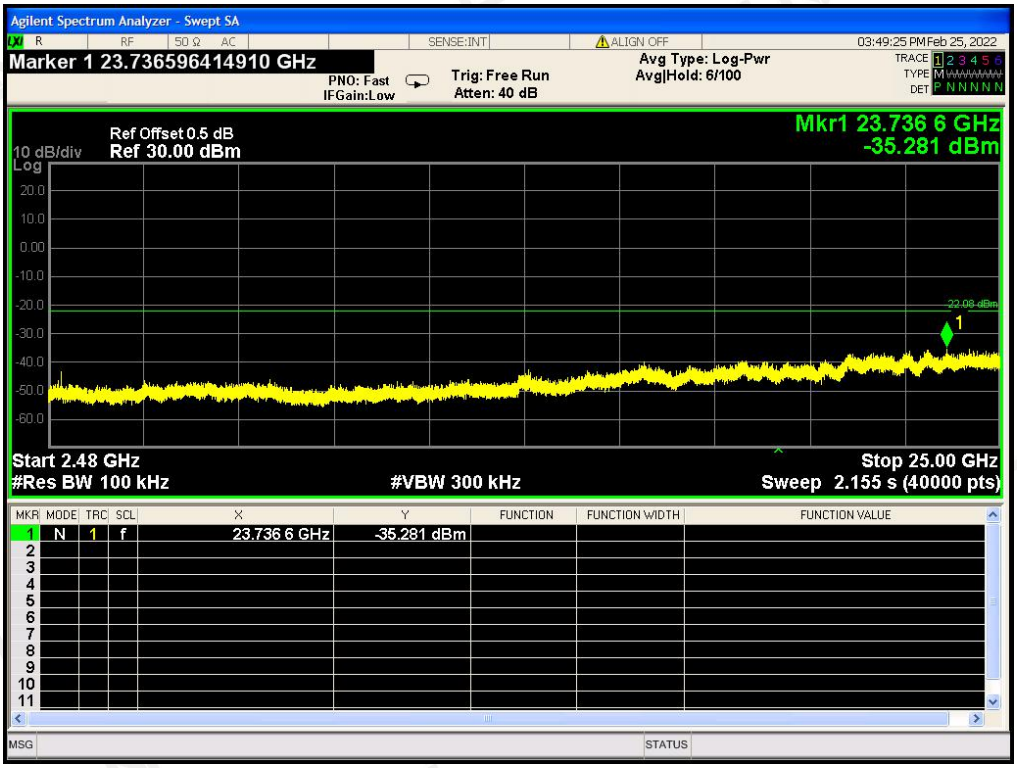
9.4 LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation 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))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

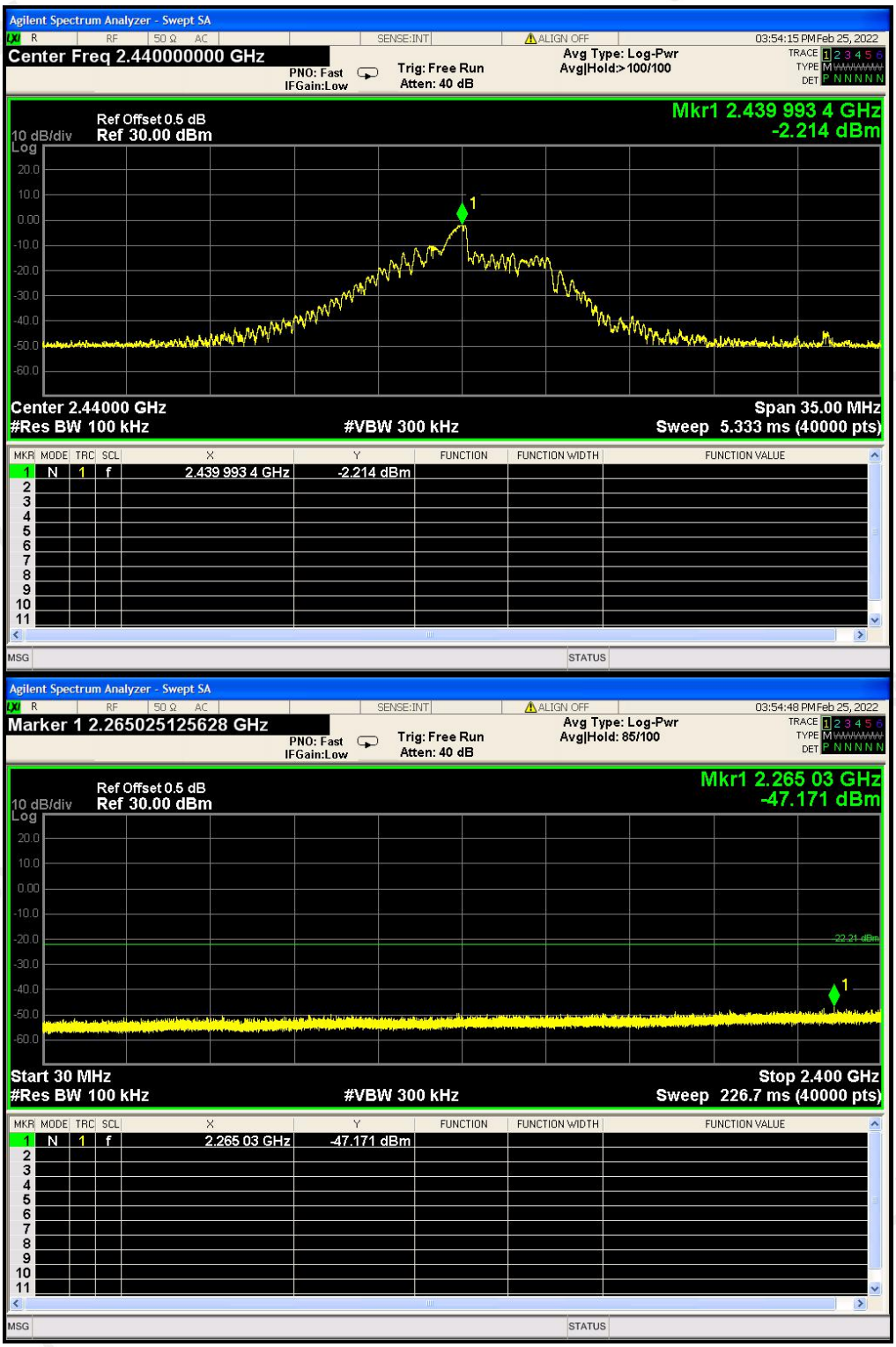
TEST RESULT FOR ENTIRE FREQUENCY RANGE

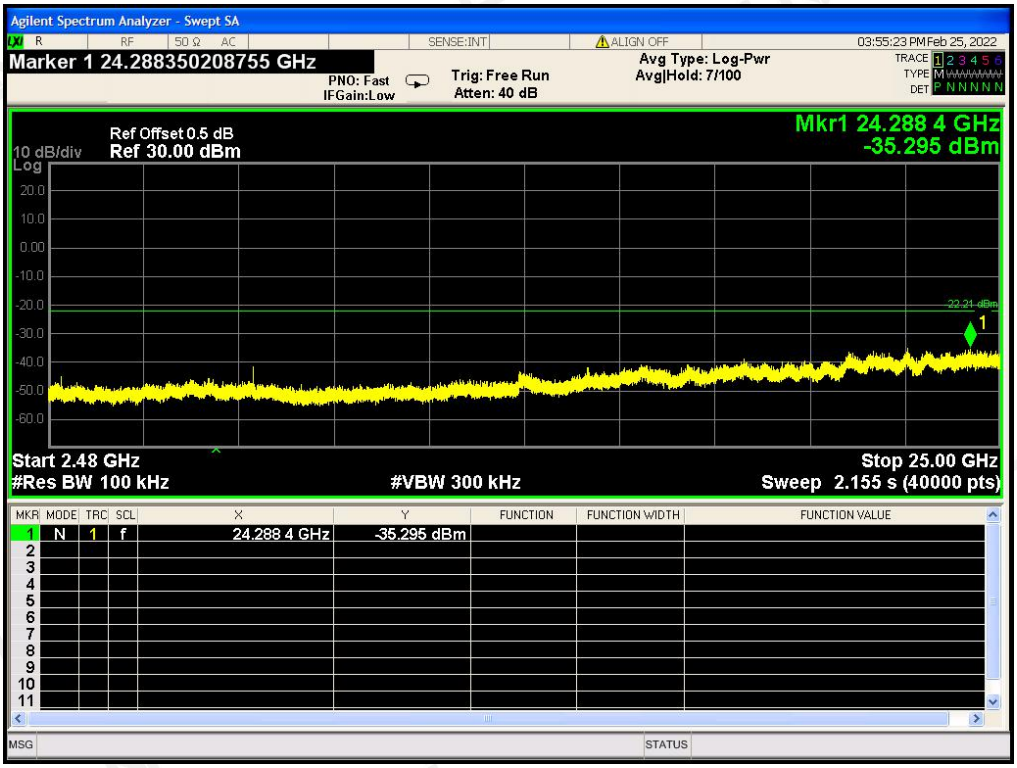
GFSK MODULATION IN LOW CHANNEL


Agilent Spectrum Analyzer - Swept SA
SENSE:INT
ALIGN OFF
03:48:51 PM Feb 25, 2022
Marker 1 1.881786544664 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 99/100
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 1.881 79 GHz
-47.605 dBm
22.08 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.400 GHz
Sweep 226.7 ms (40000 pts)
1 N 1 f 1.881 79 GHz -47.605 dBm
MSG
STATUS

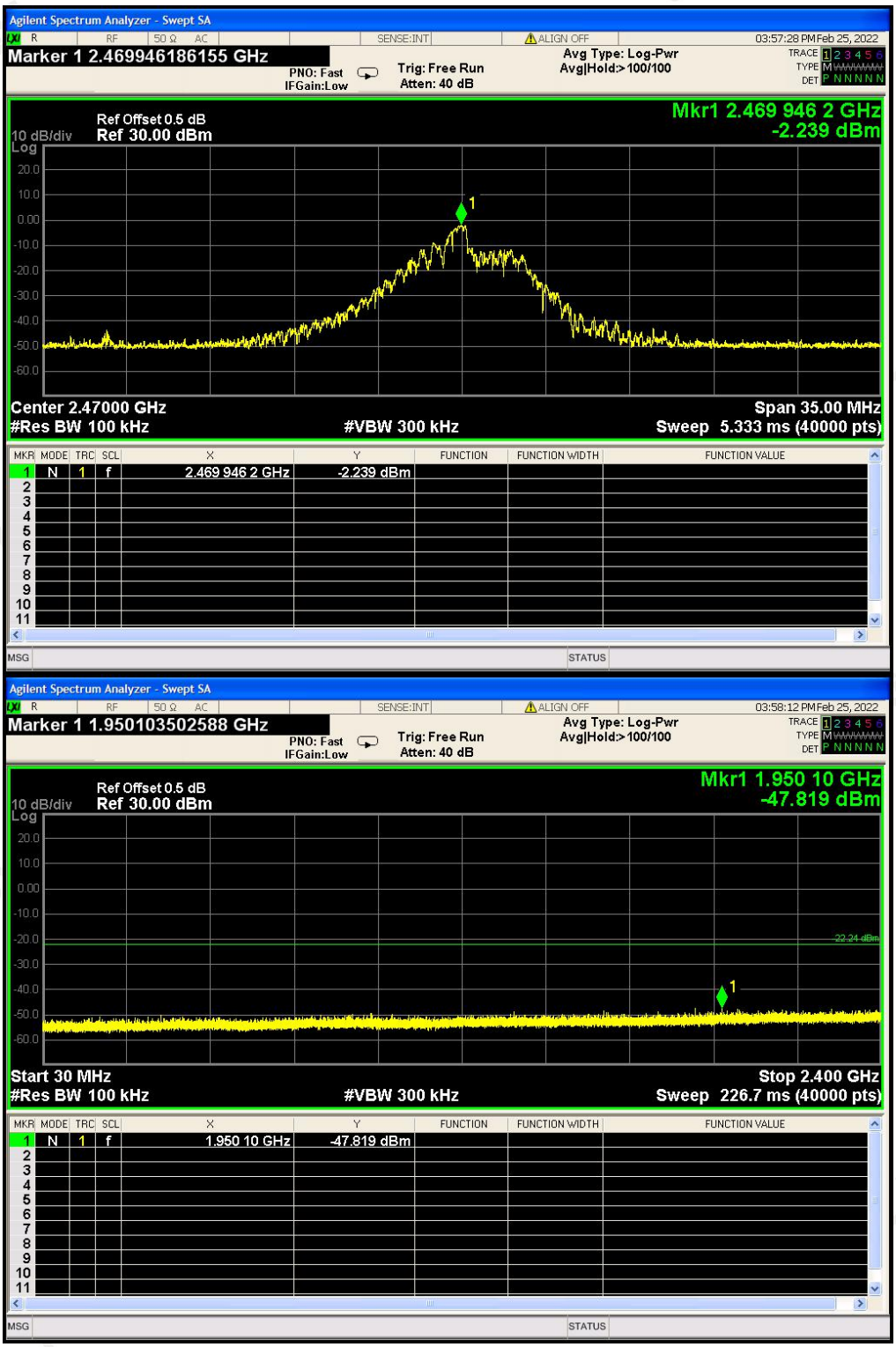

Agilent Spectrum Analyzer - Swept SA
SENSE:INT
ALIGN OFF
03:49:25 PM Feb 25, 2022
Marker 1 23.736596414910 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 6/100
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 23.736 6 GHz
-35.281 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.155 s (40000 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 23.736 6 GHz -35.281 dBm
MSG
STATUS

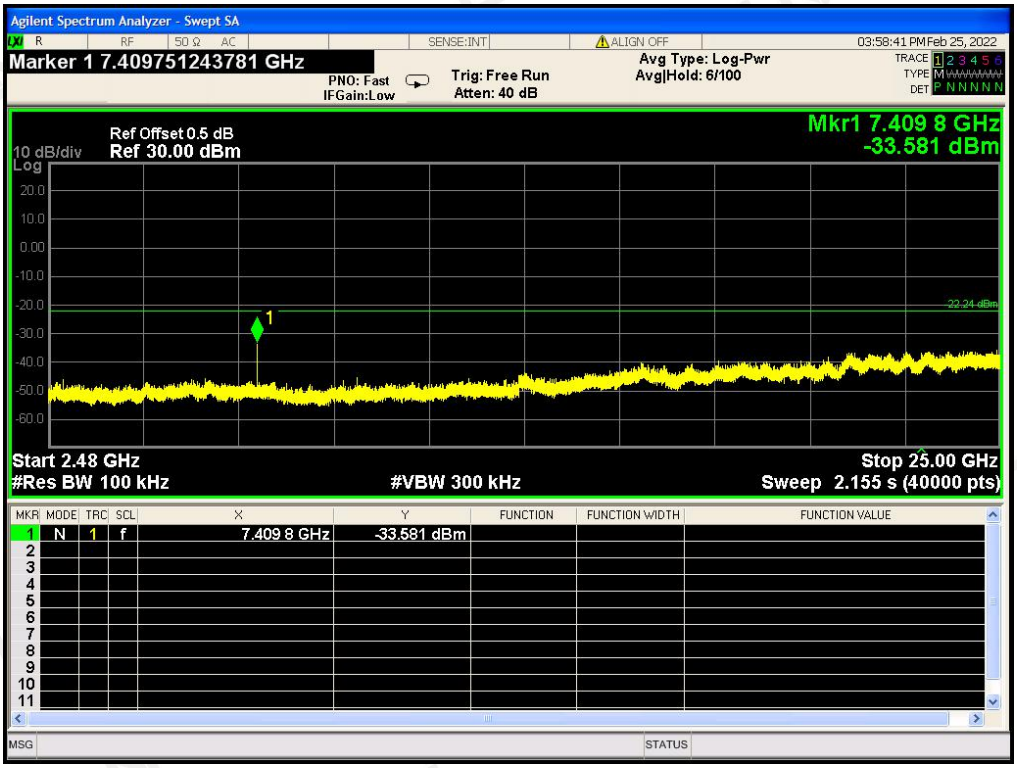
GFSK MODULATION IN MIDDLE CHANNEL




Agilent Spectrum Analyzer - Swept SA
SENSE:INT
ALIGN OFF
03:55:23 PM Feb 25, 2022
Marker 1 24.288350208755 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 7/100
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 24.288 4 GHz
-35.295 dBm
22.21 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.155 s (40000 pts)
1 N 1 f 24.288 4 GHz -35.295 dBm
MSG
STATUS

GFSK MODULATION IN HIGH CHANNEL

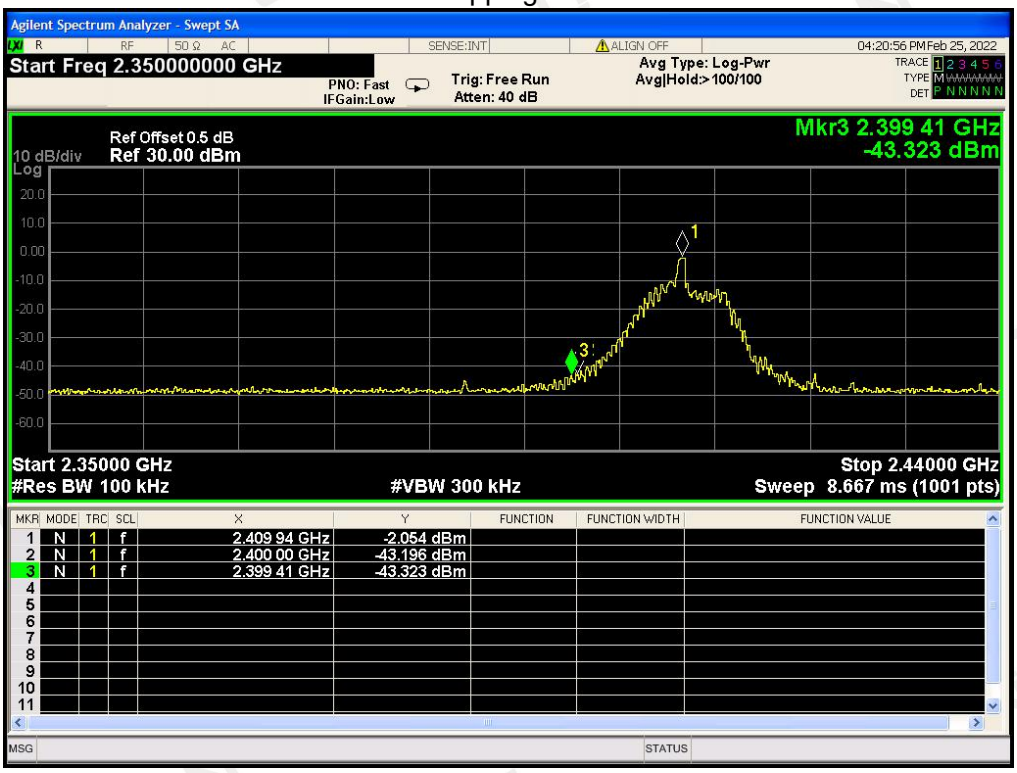



Agilent Spectrum Analyzer - Swept SA
Marker 1 7.409751243781 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 6/100
03:58:41 PM Feb 25, 2022
Ref Offset 0.5 dB
10 dB/div
Ref 30.00 dBm
Log
Mkr1 7.409 8 GHz
-33.581 dBm
-22.24 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.155 s (40000 pts)
1 N 1 f 7.409 8 GHz -33.581 dBm
MSG
STATUS

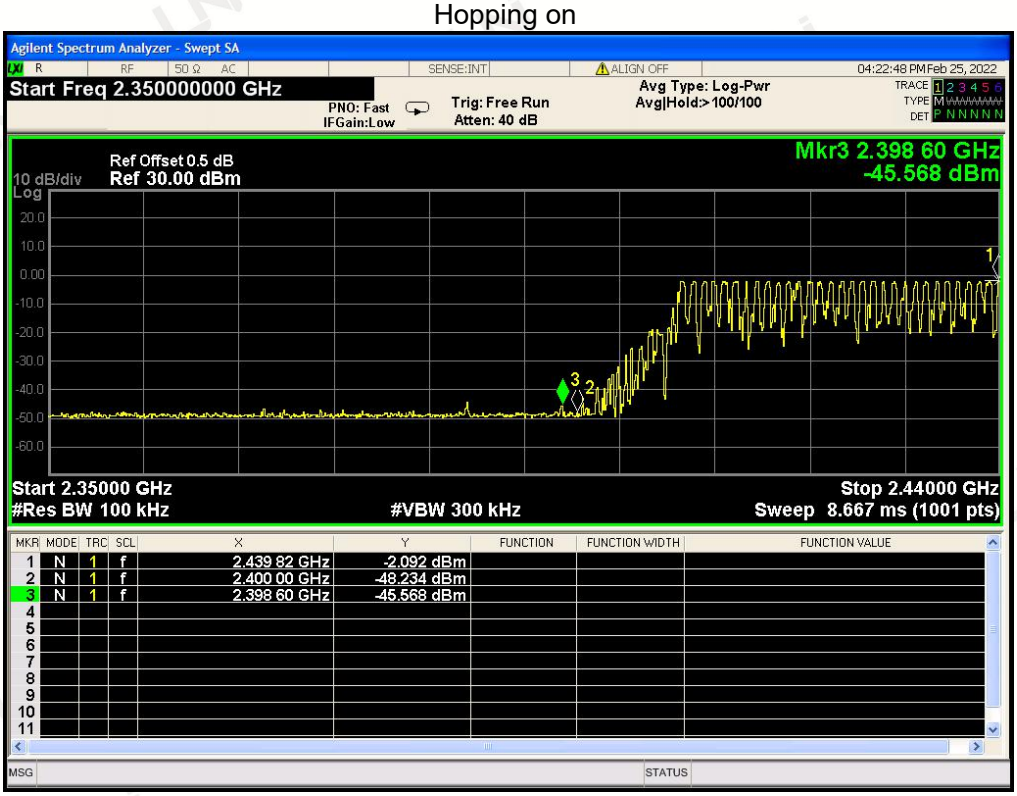
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off

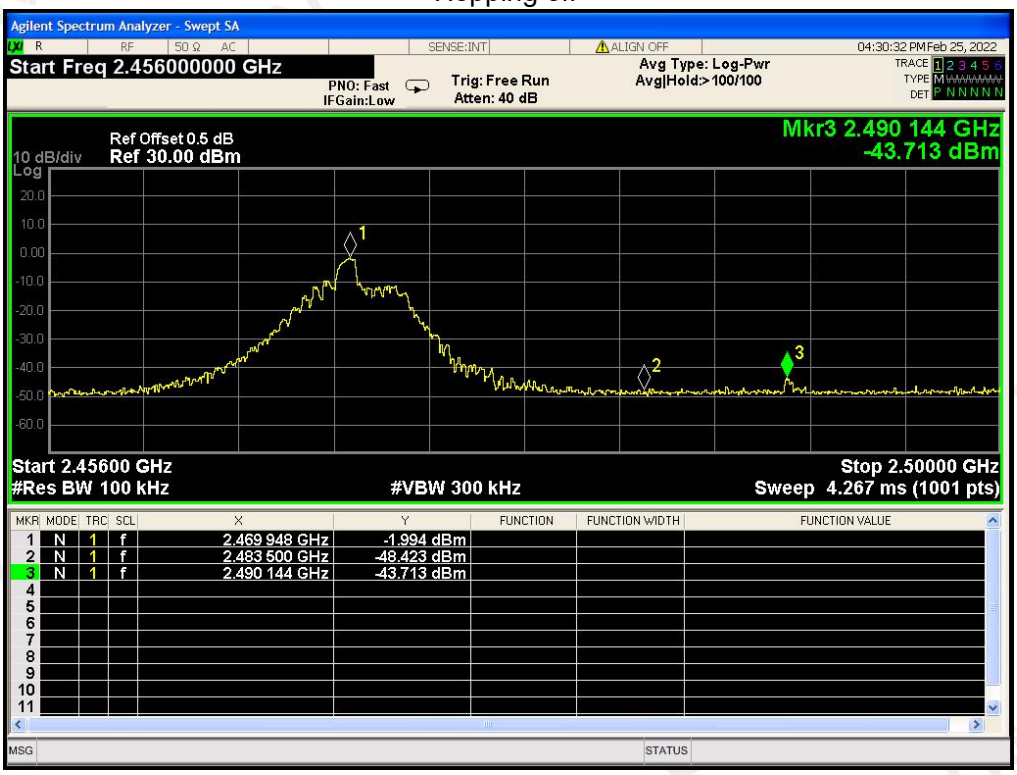


Hopping on



GFSK MODULATION IN HIGH CHANNEL

Hopping off



Hopping on

10 RADIATED EMISSION

10.1 MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

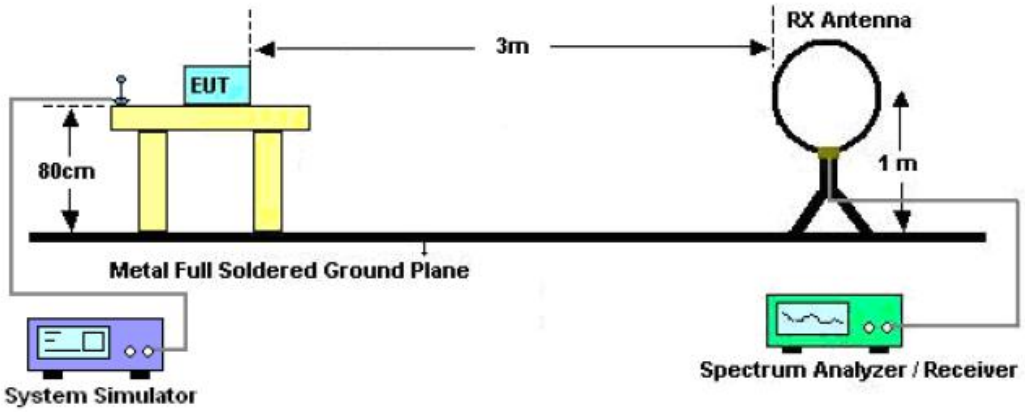
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/3MHz for Peak, 1MHz/3MHz for Average

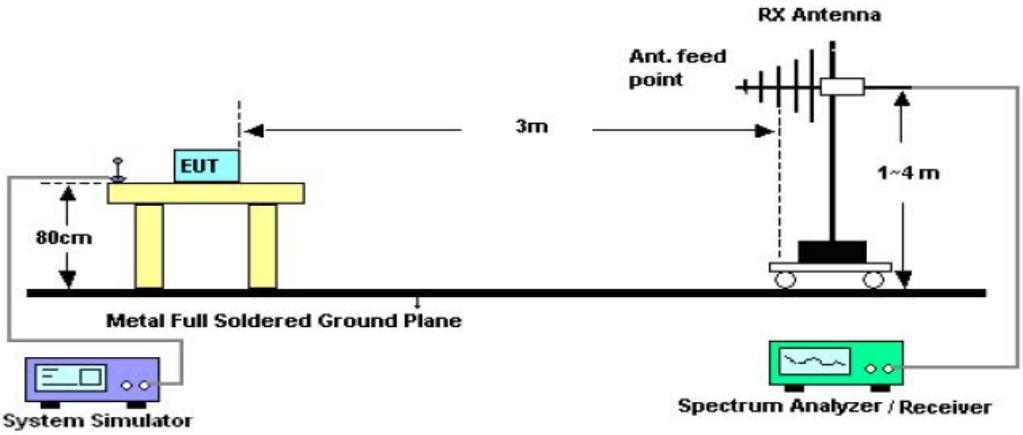
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

10.2 TEST SETUP

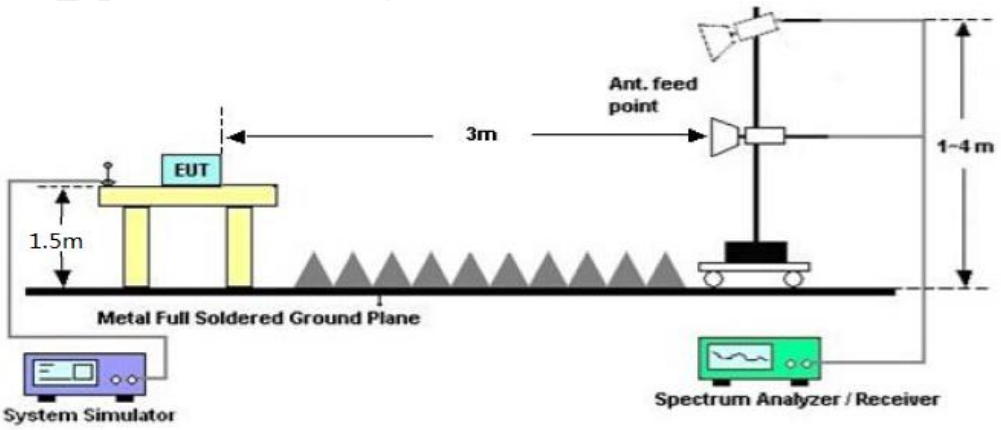
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



10.3 LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

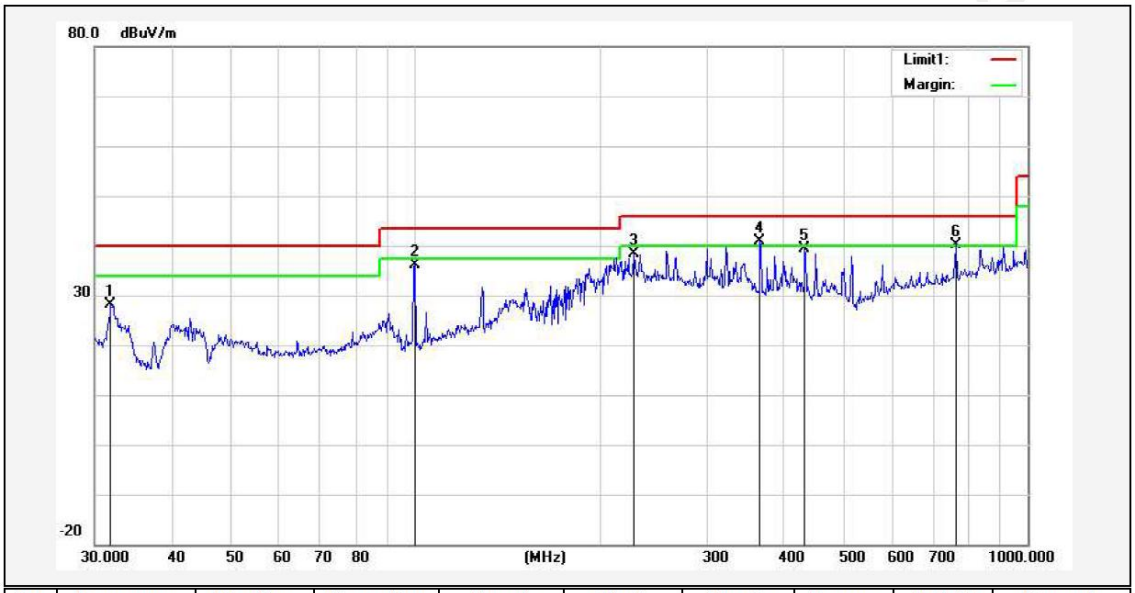
10.4 TEST RESULT

RADIATED EMISSION BELOW 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

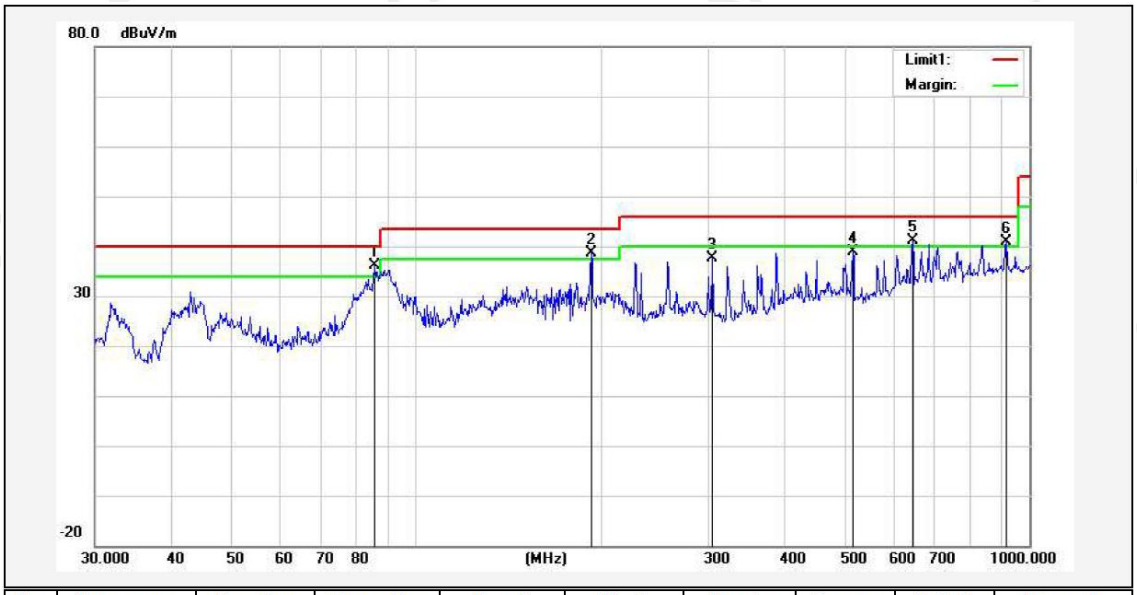
RADIATED EMISSION BELOW 1GHz

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Feb. 23, 2022	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Horizontal
Test Mode:	Transmitting mode of GFSK 2410MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	31.8427	36.65	-8.49	28.16	40.00	-11.84	80	100	peak
2	99.8777	55.14	-19.12	36.02	43.50	-7.48	100	100	peak
3	227.6905	56.11	-17.64	38.47	46.00	-7.53	120	100	peak
4*	365.5391	54.87	-13.91	40.96	46.00	-5.04	150	100	peak
5	432.5457	51.93	-12.60	39.33	46.00	-6.67	180	100	peak
6!	763.3757	47.58	-7.44	40.14	46.00	-5.86	200	100	peak

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Feb. 23, 2022	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Vertical
Test Mode:	Transmitting mode of GFSK 2410MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1*	85.5977	56.99	-20.77	36.22	40.00	-3.78	80	100	peak
2!	193.0945	55.78	-17.27	38.51	43.50	-4.99	100	100	peak
3	304.6100	52.43	-14.72	37.71	46.00	-8.29	120	100	peak
4	515.4374	51.49	-12.67	38.82	46.00	-7.18	160	100	peak
5!	645.1195	50.07	-8.84	41.23	46.00	-4.77	180	100	peak
6!	916.0687	46.03	-5.07	40.96	46.00	-5.04	200	100	peak

RESULT: PASS

Note: Factor=Antenna Factor+ Cable loss, Margin=Measurement-Limit.

Above 1 GHz Test Results:

GFSK Modulation:
CH01 (2410MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4820	60.36	-3.64	56.72	74	-17.28	PK
4820	49.78	-3.64	46.14	54	-7.86	AV
7230	56.87	-0.95	55.92	74	-18.08	PK
7230	46.75	-0.95	45.80	54	-8.20	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4820	60.27	-3.64	56.63	74	-17.37	PK
4820	49.82	-3.64	46.18	54	-7.82	AV
7230	56.93	-0.95	55.98	74	-18.02	PK
7230	46.72	-0.95	45.77	54	-8.23	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH31 (2440MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4880	60.21	-3.51	56.70	74	-17.30	PK
4880	49.83	-3.51	46.32	54	-7.68	AV
7320	56.80	-0.82	55.98	74	-18.02	PK
7320	46.56	-0.82	45.74	54	-8.26	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4880	60.15	-3.51	56.64	74	-17.36	PK
4880	49.76	-3.51	46.25	54	-7.75	AV
7320	56.71	-0.82	55.89	74	-18.11	PK
7320	46.46	-0.82	45.64	54	-8.36	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH61 (2470MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4940	60.11	-3.43	56.68	74	-17.32	PK
4940	49.55	-3.43	46.12	54	-7.88	AV
7410	56.47	-0.75	55.72	74	-18.28	PK
7410	46.53	-0.75	45.78	54	-8.22	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4940	60.13	-3.43	56.70	74	-17.30	PK
4940	49.68	-3.43	46.25	54	-7.75	AV
7410	56.53	-0.75	55.78	74	-18.22	PK
7410	46.47	-0.75	45.72	54	-8.28	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

RESULT: PASS

Note:

The amplitude of other spurious emissions from 1 to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor=Antenna Factor+ Cable loss-Amplifier gain, Over=Measure-Limit.
The “Factor” value can be calculated automatically by software of measurement system.

11 NUMBER OF HOPPING FREQUENCY

11.1 MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW ≥ RBW. Sweep: Auto.Detector function: Peak. Trace: Max hold.
4. Allow the trace to stabilize.

11.2 TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

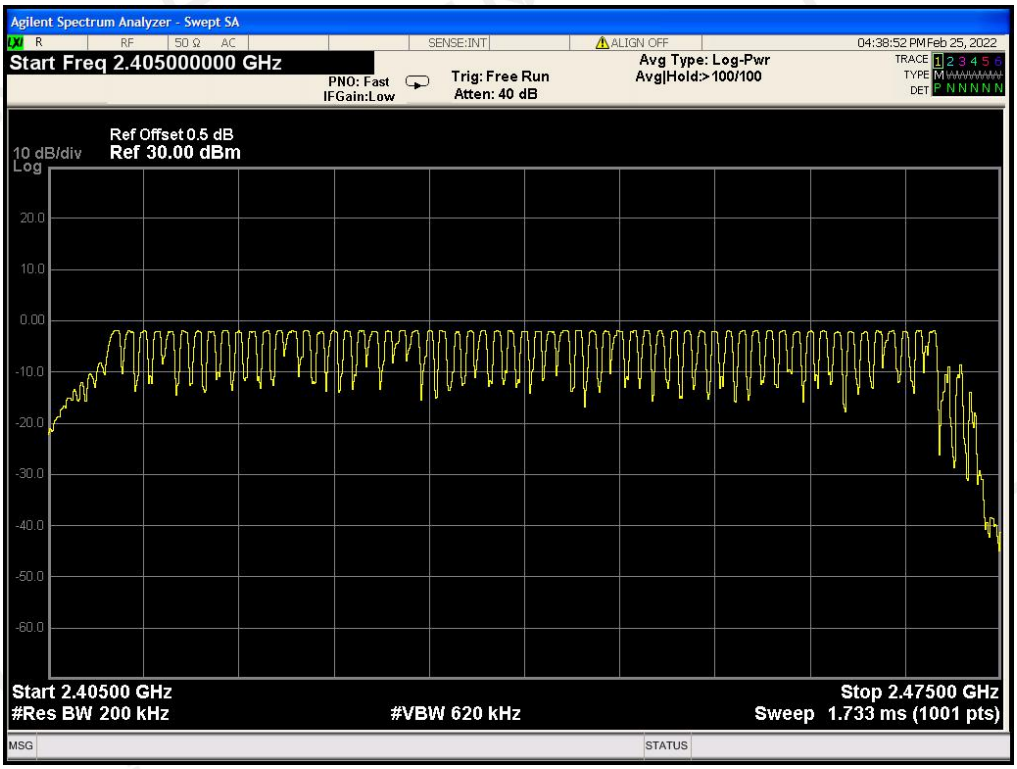
11.3 MEASUREMENT EQUIPMENT USED

The same as described in section 6

11.4 LIMITS AND MEASUREMENT RESULT

TOTAL NO. OF HOPPING CHANNEL	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT
	>=15	61	PASS

TEST PLOT FOR NO. OF TOTAL CHANNELS



12 TIME OF OCCUPANCY (DWELL TIME)

12.1 MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
1. Span: Zero span, centered on a hopping channel.
2. RBW shall be≤channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)
7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

12.2 TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

12.3 MEASUREMENT EQUIPMENT USED

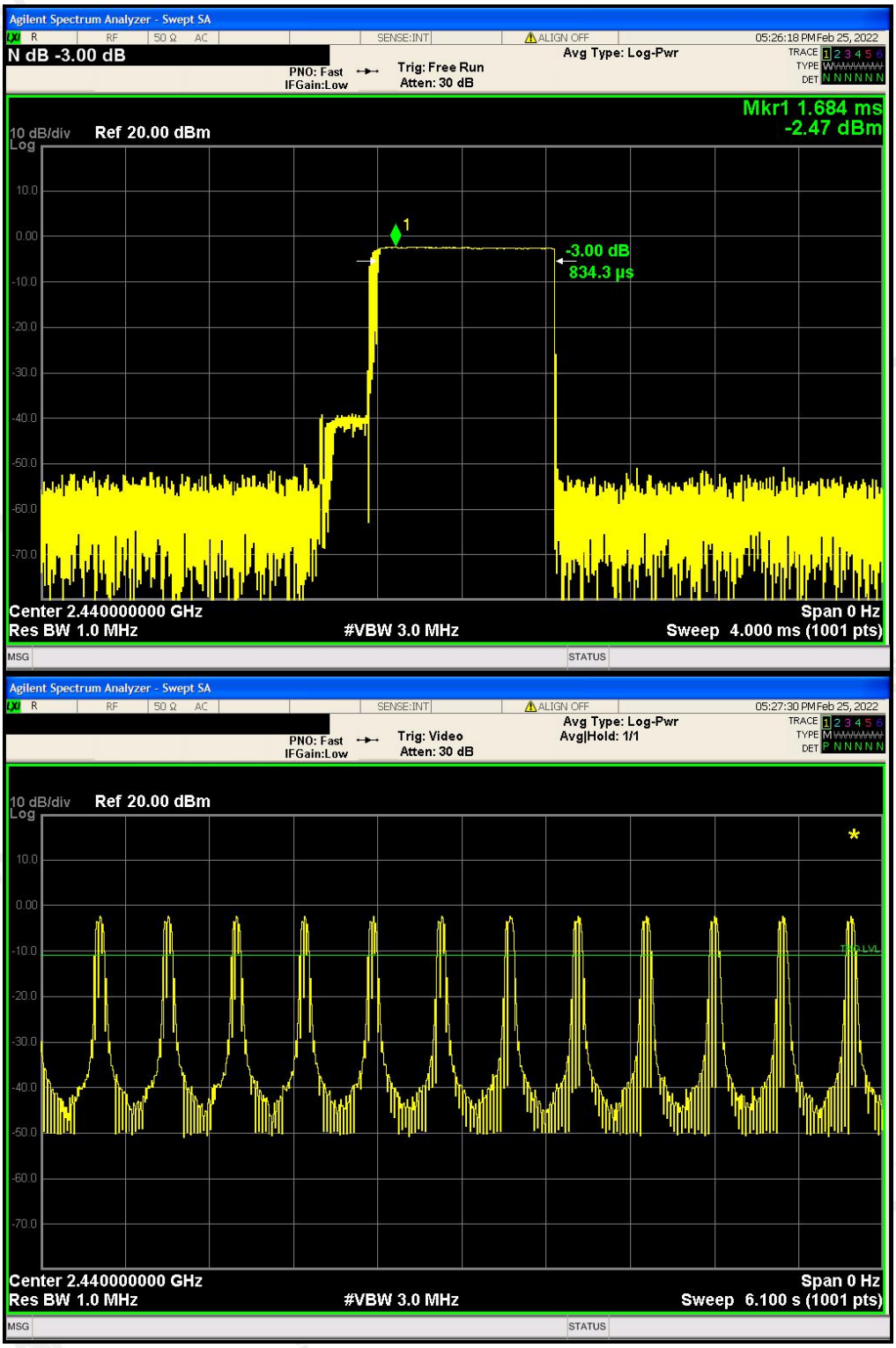
The same as described in section 6

12.4 LIMITS AND MEASUREMENT RESULT

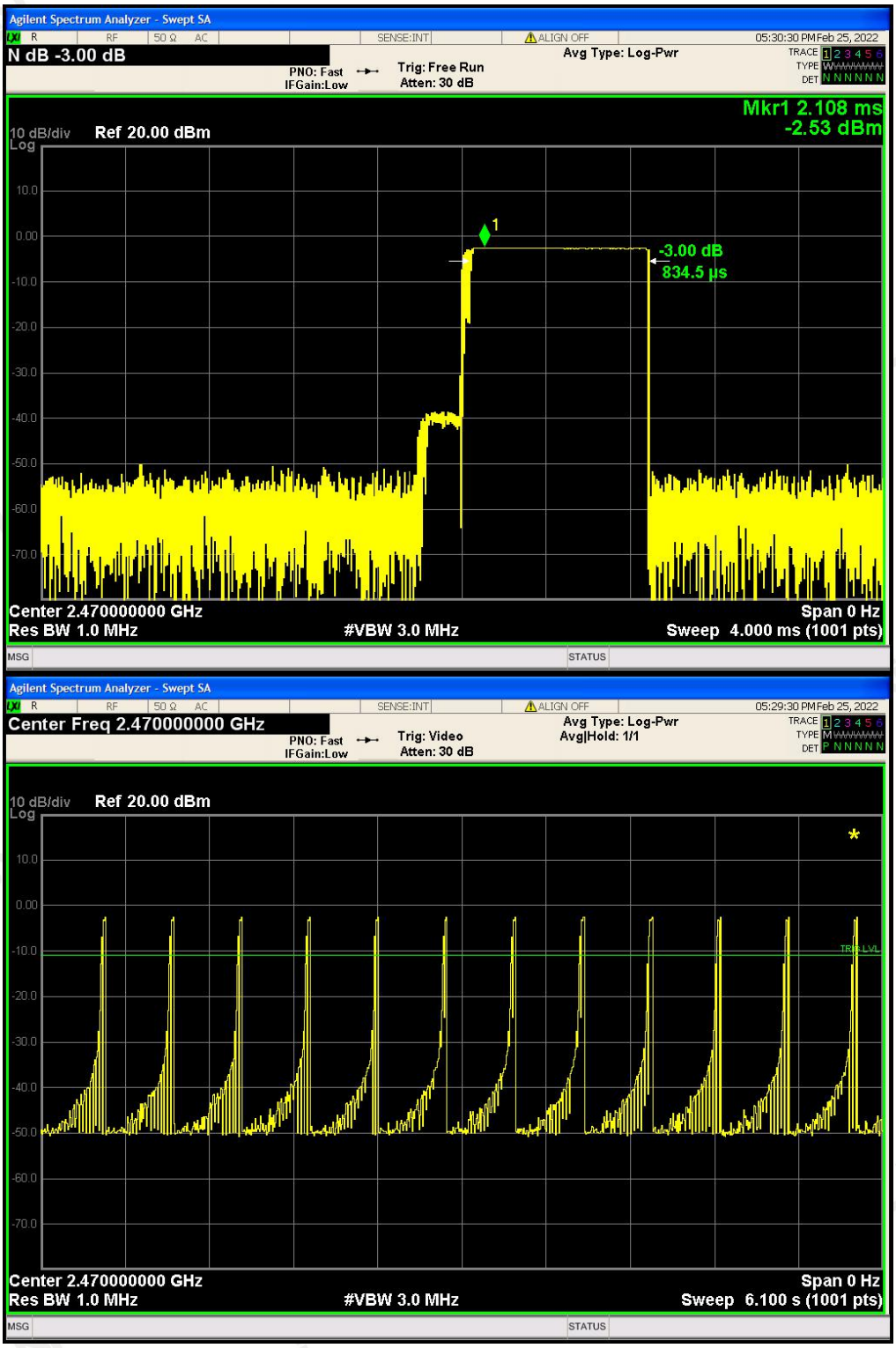
Channel	Time of Pulse for GFSK (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)
Low	0.835	26*4	86.840	400
Middle	0.834	27*4	90.072	400
High	0.835	27*4	90.180	400

TEST PLOT OF LOW CHANNEL

TEST PLOT OF MIDDLE CHANNEL



TEST PLOT OF HIGH CHANNEL



13 FREQUENCY SEPARATION

13.1 MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
1. Span: Wide enough to capture the peaks of two adjacent channels.
2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. Video (or average) bandwidth (VBW) ⩾ RBW.
4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.
Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

13.2 TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

13.3 MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

13.4 LIMITS AND MEASUREMENT RESULT

TEST MODE	CHANNEL SEPARATION	LIMIT (MHz)	RESULT
	MHz		
Hopping Mode	2.005	>= 0.739	Pass

TEST PLOT FOR FREQUENCY SEPARATION

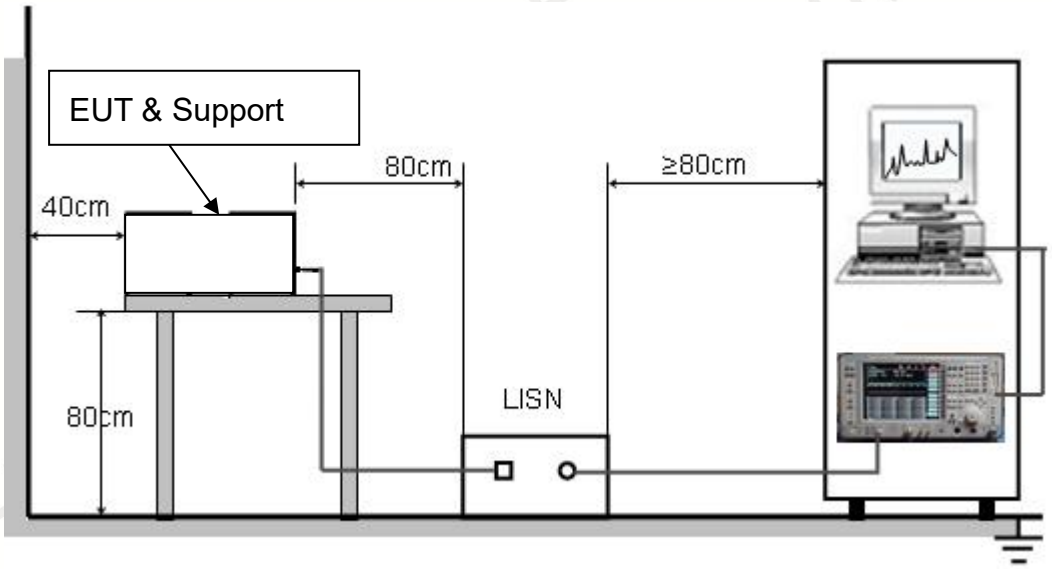
14 FCC LINE CONDUCTED EMISSION TEST

14.1 LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P. (dBμV)	Average (dBμV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note: 1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

14.2 BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



14.3 PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipment received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC 5V power fromadapter which received AC120V/60Hz power from a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

14.4 FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

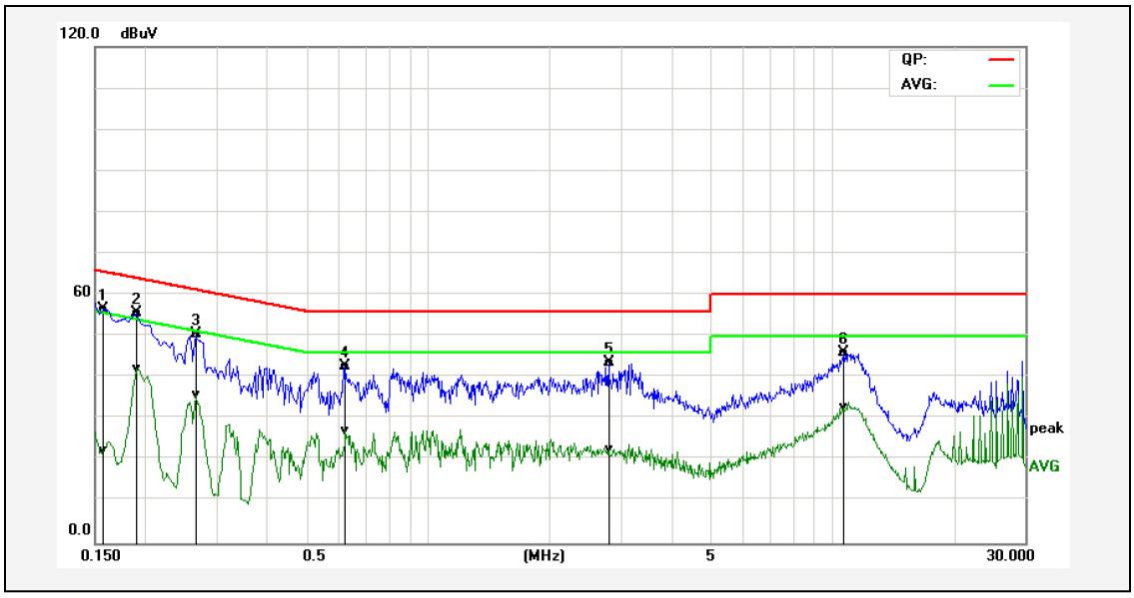
1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

14.5 TEST RESULT OF LINE CONDUCTED EMISSION TEST

PASS

Remark:
1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes were test at Low, Middle, and High channel, only the worst result of GFSK Low Channel was reported.

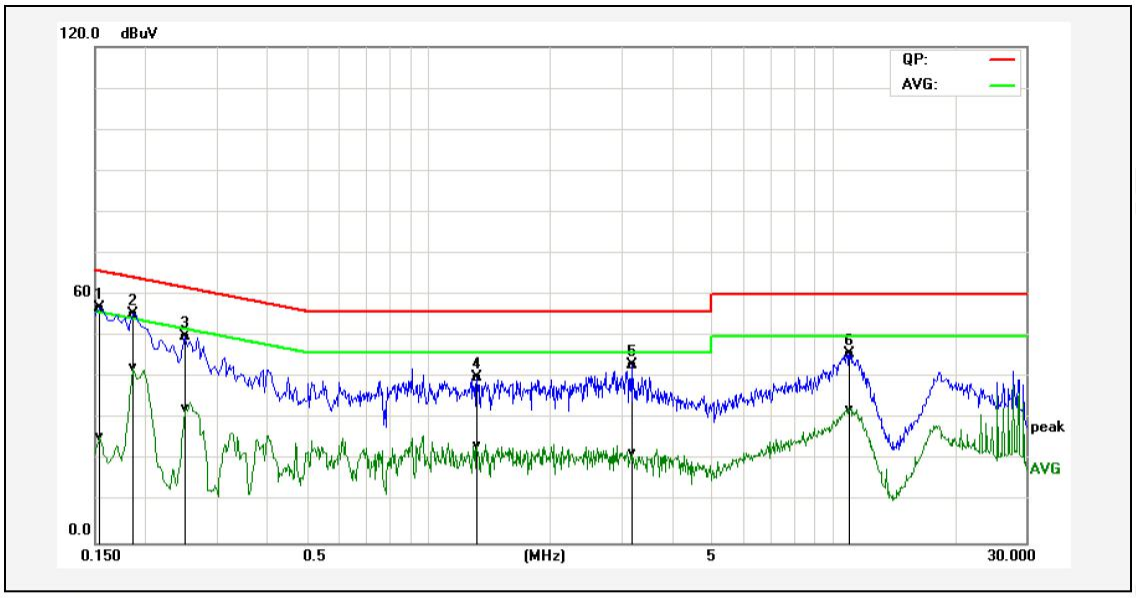
Temperature:	24℃	Relative Humidity:	48%
Test Date:	Feb. 22, 2022	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Line
Test Mode:	Transmitting mode of GFSK 2410MHz		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.1580	46.57	12.42	10.01	56.58	22.43	65.57	55.57	-8.99	-33.14	Pass
2*	0.1900	45.72	32.13	10.02	55.74	42.15	64.04	54.04	-8.30	-11.89	Pass
3P	0.2660	40.62	25.85	10.00	50.62	35.85	61.24	51.24	-10.62	-15.39	Pass
4P	0.6260	32.75	17.32	9.98	42.73	27.30	56.00	46.00	-13.27	-18.70	Pass
5P	2.8060	33.50	12.71	10.06	43.56	22.77	56.00	46.00	-12.44	-23.23	Pass
6P	10.6780	35.80	22.71	10.11	45.91	32.82	60.00	50.00	-14.09	-17.18	Pass

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Feb. 22, 2022	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Neutral
Test Mode:	Transmitting mode of GFSK 2410MHz		

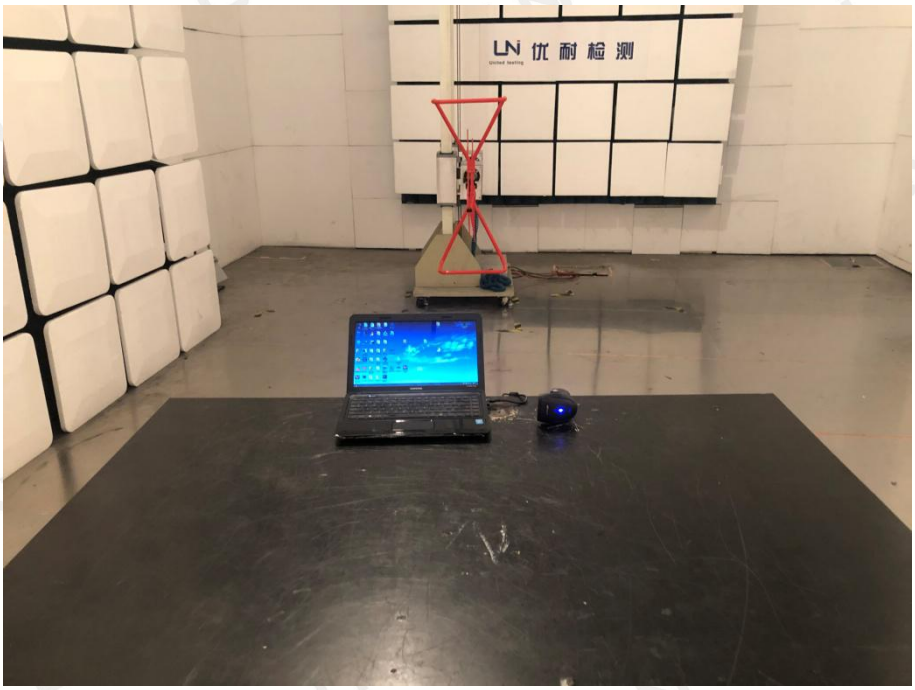


No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1*	0.1540	46.96	15.69	10.01	56.97	25.70	65.78	55.78	-8.81	-30.08	Pass
2P	0.1860	45.36	32.46	10.02	55.38	42.48	64.21	54.21	-8.83	-11.73	Pass
3P	0.2500	40.03	22.44	10.01	50.04	32.45	61.76	51.76	-11.72	-19.31	Pass
4P	1.3180	29.91	13.62	10.02	39.93	23.64	56.00	46.00	-16.07	-22.36	Pass
5P	3.1780	32.95	11.55	10.07	43.02	21.62	56.00	46.00	-12.98	-24.38	Pass
6P	10.9740	35.49	22.01	10.12	45.61	32.13	60.00	50.00	-14.39	-17.87	Pass

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

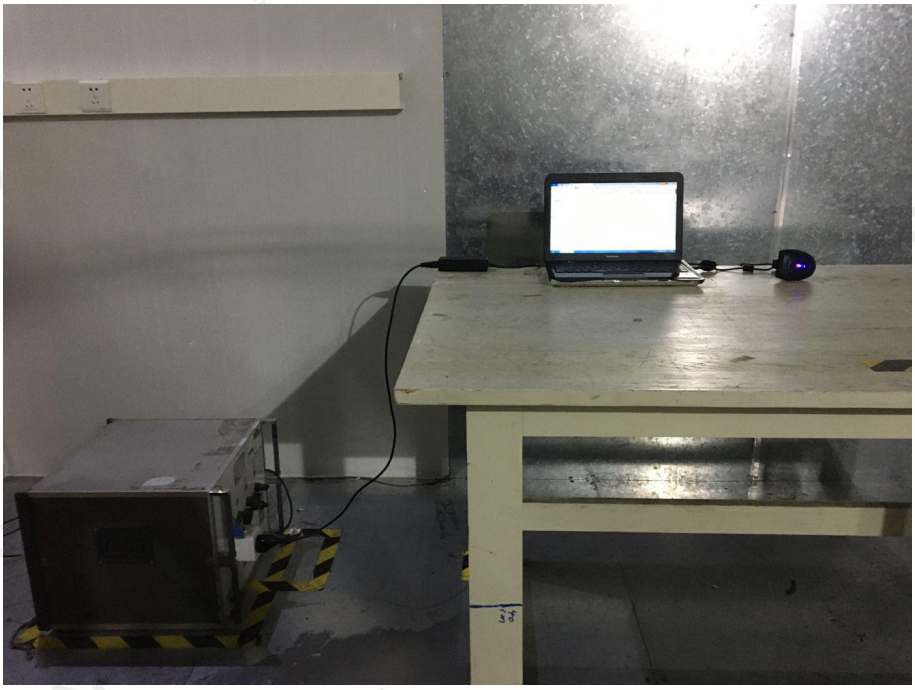
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

FCC RADIATED EMISSION TEST SETUP BELOW 1GHZ



FCC RADIATED EMISSION TEST SETUP ABOVE 1GHZ

FCC LINE CONDUCTED EMISSION TEST SETUP



----END OF REPORT----