ACCREDITED
CERTIFICATE #5473.01

Test Report No.:
FCC2022-0047-RF1

RF Test Report

EUT	:	**Wall Switch**
MODEL	:	**WS501-915M**
BRAND NAME	:	**Milesight**
APPLICANT	:	**Xiamen Milesight IoT Co., Ltd.**
CLASSIFICATION OF TEST	:	**N/A**

CVC Testing Technology Co., Ltd.

Applicant	**Name: Xiamen Milesight IoT Co., Ltd.** **Address: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China**
Manufacturer	**Name: Xiamen Milesight IoT Co., Ltd.** **Address: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China**
Equipment Under Test	**Name: Wall Switch** **Model/Type: WS501-915M** **Additional Model/Type: See Section 2.2** **Brand: Milesight** **Serial No.: N/A** **Sampe No.: 3-1**

Date of Receipt.	**2022.08.17**	Date of Testing	**2022.08.17～2022.11.29**

Test Specification	**Test Result**
FCC Part 15, Subpart C, Section 15.247	PASS

Evaluation of Test Result	The equipment under test was found to comply with the requirements of the standards applied. Seal of CVC **Issue Date: 2022.12.01**

Tested by:	Reviewed by:	Approved by:
Xu ZhenFei	**Liu YongHai**	**Chen HuaWen**
Name Signature	Name Signature	Name Signature

Other Aspects: NONE.

Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested

This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCC2022-0047-RF1	Original release	2022.12.01

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15 Subpart C			
STANDARD SECTION	**TEST TYPE AND LIMIT**	**RESULT**	**REMARK**
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit
15.247(a)(1)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)	Hopping Channel Separation	PASS	Meet the requirement of limit.
15.247(f)	Average time of Occupancy for hybrid System	PASS	Meet the requirement of limit.
15.247(a)(1)	20dB Emissions Bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(d), 15.209,15.205	Radiated Emission and Restricted bands Measurements	PASS	Meet the requirement of limit.
15.247(d)	Out of band Emission and Band edge measurements	PASS	Meet the requirement of limit.
15.203 15.247(b)	Antenna Requirement	PASS	No antenna connector is used.

1.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

Test Equipment	Type/Mode	SERIAL NO.	Equipment No.	Manufacturer	Cal. Due
WIFI & Bluetooth Test System 1					/
Communication Shielded Room 2	4m*3m*3m	CRTDSWKSR44301	VGDS-0700	CRT	2024/04/24
Bluetooth system integration	/	/	-	Tonscend	/
Spectrum Analyzer	FSV40	101580	DZ-000238-3	R&S	2023/06/05
Comprehensive Test Instrument	CMW270	100304	DZ-000240-1	R&S	2023/12/06
Analog Signal Generator	SMB100A	181858	DZ-000238-2	R&S	2023/06/05
Vector Signal Generator	SGT100A	111661	DZ-000238-1	R&S	2023/06/05
RF Radio Frequency Switch	JS0806-2	19H9080187	`	Tonscend	2023/06/06
Programmable DC Power Supply	E3644A	MY58036222	DZ-000178	KEYSIGHT	2023/04/21
Radiation Spurious Test System					/
3m Semi-Anechoic Chamber	FACT-4	ST08035	WKNA-0024	ETS	2024/12/12
Spectrum Analyzer	N9010B	MY57470323	DZ-000174	KEYSIGHT	2023/03/02
EMI Test Receiver	N9038A-508	MY532290079	EM-000397	Agilent	2023/03/02
Broadband Antenna	VULB 9163	9163-530	EM-000342	SCHWARZBECK	2023/06/25
Waveguide Horn Antenna	HF906	360306/008	EM-000093	R&S	2023/03/04
Waveguide Horn Antenna	BBHA9170	00949	DZ-000209-2	SCHWARZBECK	2023/07/31
Preamplifier	BBV 9721	9721-050	DZ-000209-1	SCHWARZBECK	2023/06/05
5G Bandstop Filters	WRCJV12-4900-5100-5900-6100-50EE	851770	DZ-000186	WI	2023/12/06
Comprehensive tester	CMW500	159000	DZ-000240-2	R&S	2023/12/06
Conducted emission					/
EMI Test Receiver	ESCI	100857	WKNB-0081	R&S	2023-12-08
EMI Test Receiver	ESR3	102394	VGDY-0705	R&S	2023-03-04
LISN	NSLK 8127	8127644	VGDY-0150	SCHWARZBECK	2023-09-04
LISN	NSLK 8128	8128-316	VGDY-0149	SCHWARZBECK	2023-09-04
LISN	NSLK 8129	8129-268	EM-000388	SCHWARZBECK	2023-03-03
Plus Limiter（#1）	VTSD 9561 F-N	00515	VGDY-0808	SCHWARZBECK	2023-03-04
Plus Limiter（#2）	VTSD 9561	9561-F017	VGDY-0152	SCHWARZBECK	2024-09-04
Impedance Stabilization Network	ISN T800	27095	WKNE-0195	TESEQ	2023-09-04
Impedance Stabilization Network	NTFM8158	8158-0092	VGDY-0356	SCHWARZBECK	2023-06-07
ImpedanceStabilizationNetwork	NTFM8131	#184	EM-000498	SCHWARZBECK	2023-06-07
Voltage Probe	TK9420	9420-499	VGDY-0128	SCHWARZBECK	2023-03-04
Power Divider	4901.17.B	22643830	DB-0016	HUBER+SUHNER	2023-09-01
Video Signal Generator	GV-798+	151064920001	VGDS-0215	PROMAX	2023-05-30
Audio Signal Generator	GAG-810	EK871591	EM-000309	GW	2023-12-08
Shielding Room(#1)	GP1A	001	WKNF-0001	LEINING	2024-08-08
Shielding Room(#2)	GP1A	002	WKNF-0006	LEINING	2024-08-08
Current probe	EZ-17	0816.2063.02	EM-000567	R&S	2023-01-16

1.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

No.	ITEM	FREQUENCY	UNCERTAINTY
1	Conducted Emissions	9kHz~30MHz	±2.66dB
2	Radiated Spurious Emissions	9KHz ~ 30MHz	±0.769dB
		30MHz ~ 1GMHz	±0.877dB
		1GHz ~ 18GHz	±0.777dB
		18GHz ~ 40GHz	±1.315dB

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

1.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab. of CVC Testing Technology Co., Ltd.

Address: No.3,TiantaiyiRoad,KaitaiAvenue,ScienceCity,Guangzhou,China
Post Code：510663 Tel：020-32293888
FAX：020-32293889 E-mail：office@cvc.org.cn

2 GENERAL INFORMATION

2.1 GENERAL PRODUCT INFORMATION

PRODUCT	Wall Switch
BRAND	Milesight
MODEL	WS501-915M
ADDITIONAL MODEL	See Section 2.2
FCC ID	2AYHY-WS50X
POWER SUPPLY	AC 120V/60Hz
MODULATION TYPE	FHSS
OPERATING FREQUENCY	Hybrid 125kHz, 902.3MHz~927.6MHz
NUMBER OF CHANNEL	127
PEAK OUTPUT POWER	20.42dBm (Max. Measured)
ANTENNA TYPE (Remakr 3)	PCB Antenna, -1.79dBi Gain
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

Remark:

1. For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Please refer to the antenna report.
4. EUT photo refer to the report (Report NO.: FCC2022-0047-E).
5. The EUT have SISO function, provides 1 completed transmitter and 1 receiver.

2.2 ADDITIONAL MODEL/TYPE

Models	
1	NE501-915M
2	WS501-9M
3	NE501-9M

Note:
The only differences are silk-screen 、trade name and model no. for trading purpose.

2.3 OTHER INFORMATION

Operation Frequency Each of Channel							
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	**902.3**	32	908.7	64	915.2	96	921.6
1	902.5	33	908.9	65	915.4	97	921.8
2	902.7	34	909.1	66	915.6	98	922
3	902.9	35	909.3	67	915.8	99	922.2
4	903.1	36	909.5	68	916	100	922.4
5	903.3	37	909.7	69	916.2	101	922.6
6	903.5	38	909.9	70	916.4	102	922.8
7	903.7	39	910.1	71	916.6	103	923
8	903.9	40	910.3	72	916.8	104	923.2
9	904.1	41	910.5	73	917	105	923.4
10	904.3	42	910.7	74	917.2	106	923.6
11	904.5	43	910.9	75	917.4	107	923.8
12	904.7	44	911.1	76	917.6	108	924
13	904.9	45	911.3	77	917.8	109	924.2
14	905.1	46	911.5	78	918	110	924.4
15	905.3	47	911.7	79	918.2	111	924.6
16	905.5	48	911.9	80	918.4	112	924.8
17	905.7	49	912.1	81	918.6	113	925
18	905.9	50	912.3	82	918.8	114	925.2
19	906.1	51	912.5	83	919	115	925.4
20	906.3	52	912.7	84	919.2	116	925.6
21	906.5	53	912.9	85	919.4	117	925.8
22	906.7	54	913.1	86	919.6	118	926
23	906.9	55	913.3	87	919.8	119	926.2
24	907.1	56	913.5	88	920	120	926.4
25	907.3	57	913.7	89	920.2	121	926.6
26	907.5	58	913.9	90	920.4	122	926.8
27	907.7	59	914.1	91	920.6	123	927
28	907.9	60	914.3	92	920.8	124	927.2
29	908.1	61	914.5	93	921	125	927.4
30	908.3	62	914.7	94	921.2	**126**	**927.6**
31	908.5	**63**	**914.9**	95	921.4		

2.4 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, xyz axis and antenna ports

The worst case was found when positioned on xaxis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TEST ITEMS				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
A	√	√	√	√	LORA link

Where **RE<1G:** Radiated Emission below 1GHz. **RE≥1G:** Radiated Emission above 1GHz.
PLC: Power Line Conducted Emission. **APCM:** Antenna Port Conducted Measurement.

POWER LINE CONDUCTED EMISSION TEST:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	TESTED CONDITION
A	Lora Link

RADIATED EMISSION TEST (BELOW 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
A	0 to 126	0	FHSS	DR0

For the test results, only the worst case was shown in test report.

RADIATED EMISSION TEST (ABOVE 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
A	0 to 126	0,63,126	FHSS	DR0

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
A	0 to 126	0,63,126	FHSS	DR0

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RE<1G	25.2deg. C, 55%RH	AC 120V/60Hz	Li JiaLing
RE≥1G	25.2deg. C, 55%RH	AC 120V/60Hz	Li JiaLing
PLC	25.2deg. C, 55%RH	AC 120V/60Hz	Li JiaLing
APCM	26.2deg. C, 58%RH	AC 120V/60Hz	Li JiaLing

2.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC PART 15, Subpart C. Section 15.247
KDB 558074 D01 15.247 Meas Guidance v05r02
ANSI C63.10-2020

All test items have been performed and recorded as per the above standards

2.6 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support Equipment					
NO	Description	Brand	Model No.	Serial Number	Supplied by
1	N/A	N/A	N/A	N/A	N/A

Support Cable							
NO	Description	Quantity (Number)	Length (m)	Detachable (Yes/ No)	Shielded (Yes/ No)	Cores (Number)	Supplied by
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3 TEST TYPES AND RESULTS

3.1 CONDUCTED EMISSION

3.1.1 Limits

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107) and ICES-003 (Class A: section 6.1)

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50
NOTE: 1. The lower limit shall apply at the transition frequencies. NOTE: 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz. NOTE: 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.				

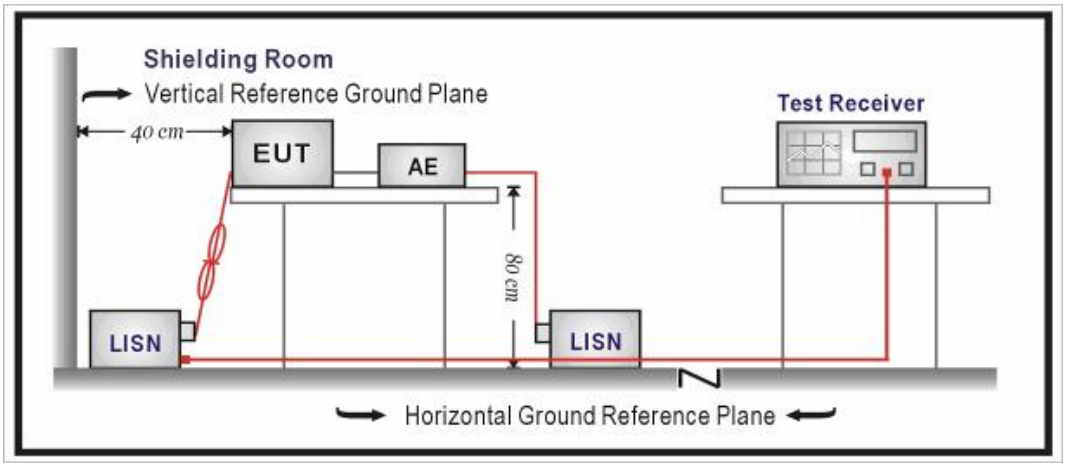
3.1.2 Test Procedures

The basic test procedure was in accordance with ANSI C63.4:2014 (section 7).

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

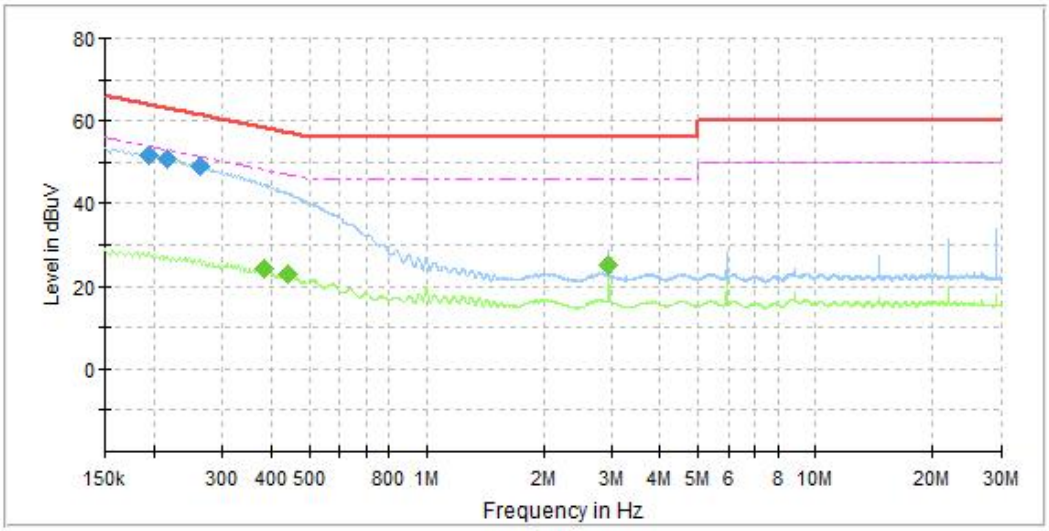
3.1.3 Test setup



3.1.4 Test Results

CONDUCTED WORST-CASE DATA:

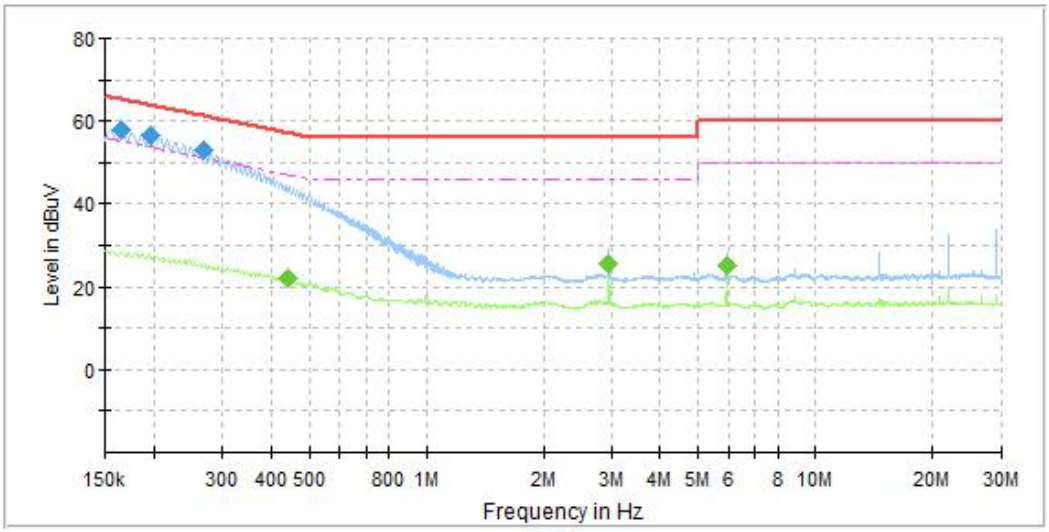
Test Mode	LORA Link	Frequency Range	150KHz ~ 30MHz
Test Voltage	AC 120V/60Hz	PHASE	Line (L)
Environmental Conditions	25.2deg. C, 55%RH	Tested By	Li JiaLing



NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)
1	0.195	51.9	---	63.8	11.9	L1	19.5
2	0.218	50.9	---	62.9	12.0	L1	19.5
3	0.263	49.2	---	61.4	12.2	L1	19.5
4	0.382	---	24.2	48.2	24.1	L1	19.5
5	0.443	---	23.0	47.0	24.0	L1	19.5
6	2.960	---	25.2	46.0	20.8	L1	19.6

Remark: The emission levels of other frequencies were very low against the limit.

Test Mode	LORA Link	Frequency Range	150KHz ~ 30MHz
Test Voltage	AC 120V/60Hz	PHASE	Line (N)
Environmental Conditions	25.2deg. C, 55%RH	Tested By	Li JiaLing



NO	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr.Factor (dB)
1	**0.166**	**57.9**	**---**	**65.2**	**7.3**	**N**	**19.5**
2	0.197	56.4	---	63.7	7.3	N	19.5
3	0.269	52.9	---	61.1	8.2	N	19.6
4	0.443	---	21.9	47.0	25.1	N	19.6
5	2.960	---	25.7	46.0	20.3	N	19.6
6	5.919	---	25.0	50.0	25.0	N	19.7

Remark: The emission levels of other frequencies were very low against the limit.

3.2 RADIATED EMISSION AND RESTRICTED BANDS MEASUREMENTS

3.2.1 Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). Other emissions shall be at least 20dB below the highest level of the desired power.

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: 1. The lower limit shall apply at the transition frequencies.
NOTE: 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
NOTE: 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

3.2.2 Measurement procedure

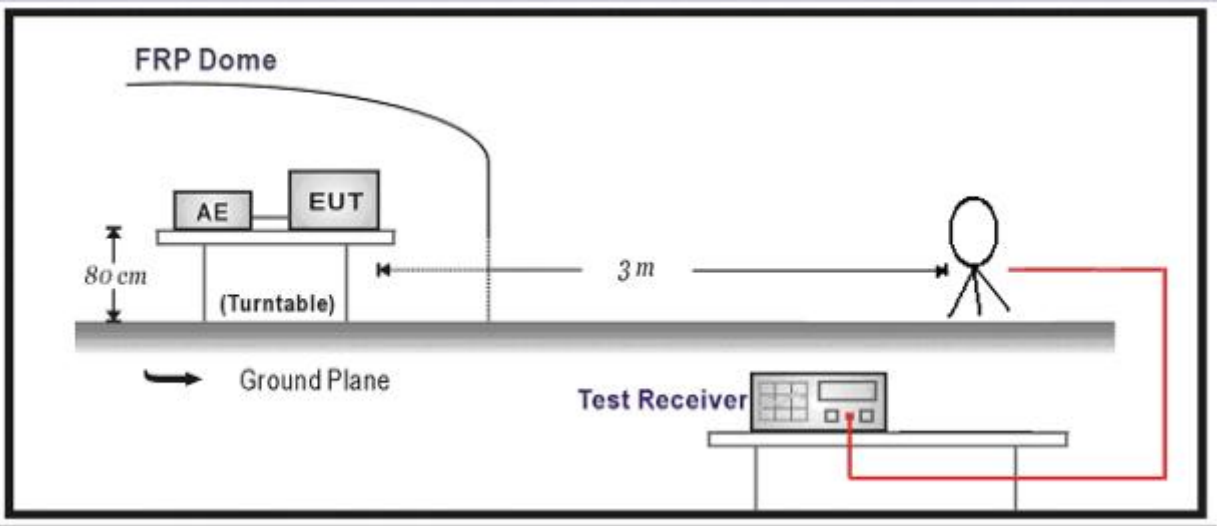
a. The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

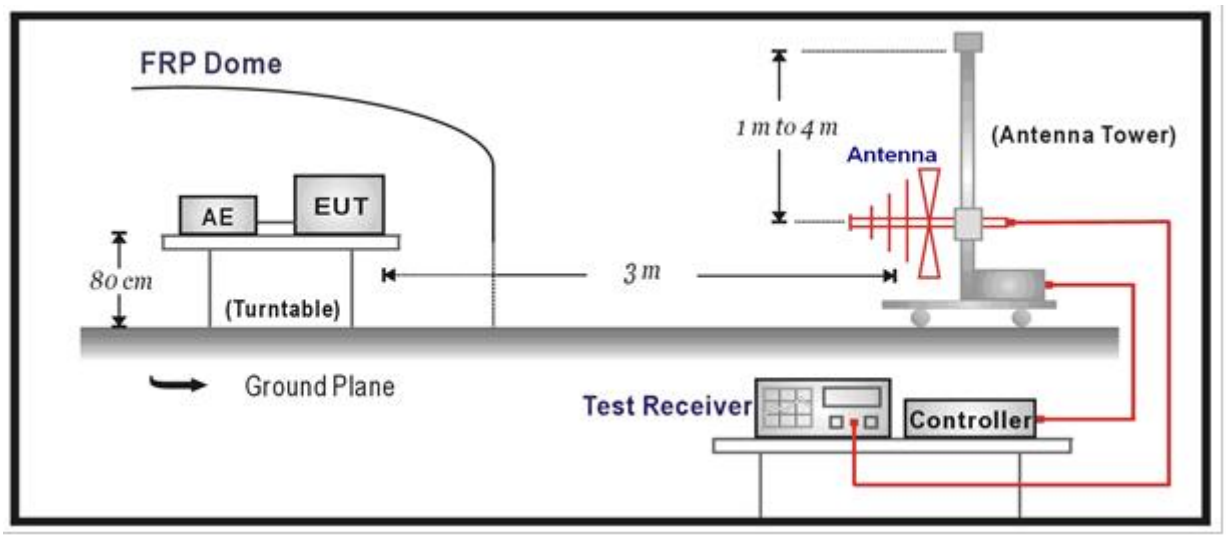
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ⩾ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

3.2.3 Test setup

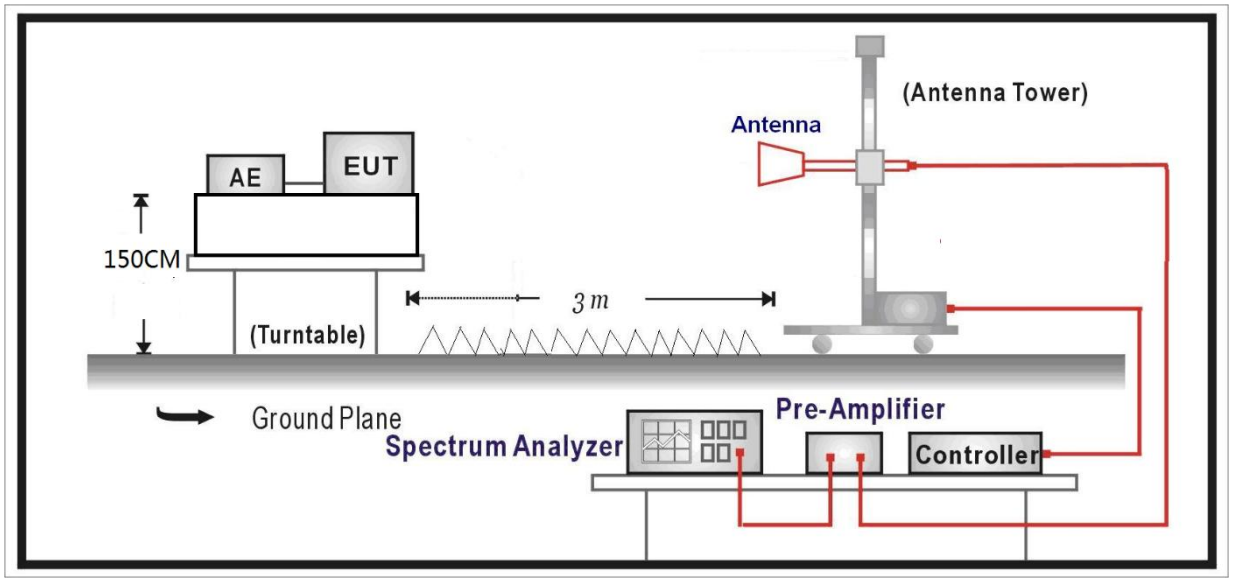
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:

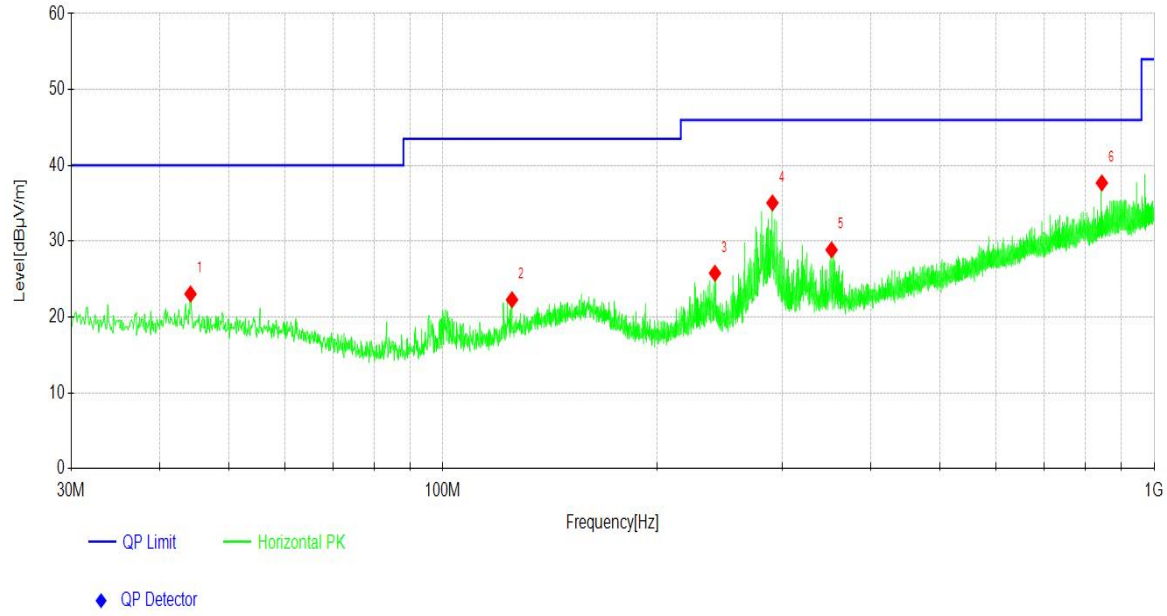


3.2.3.1 Test results

BELOW 1GHz WORST-CASE DATA:

Worst Test Mode	DR0	Channel	CH 0
Frequency Range	9KHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Horizontal

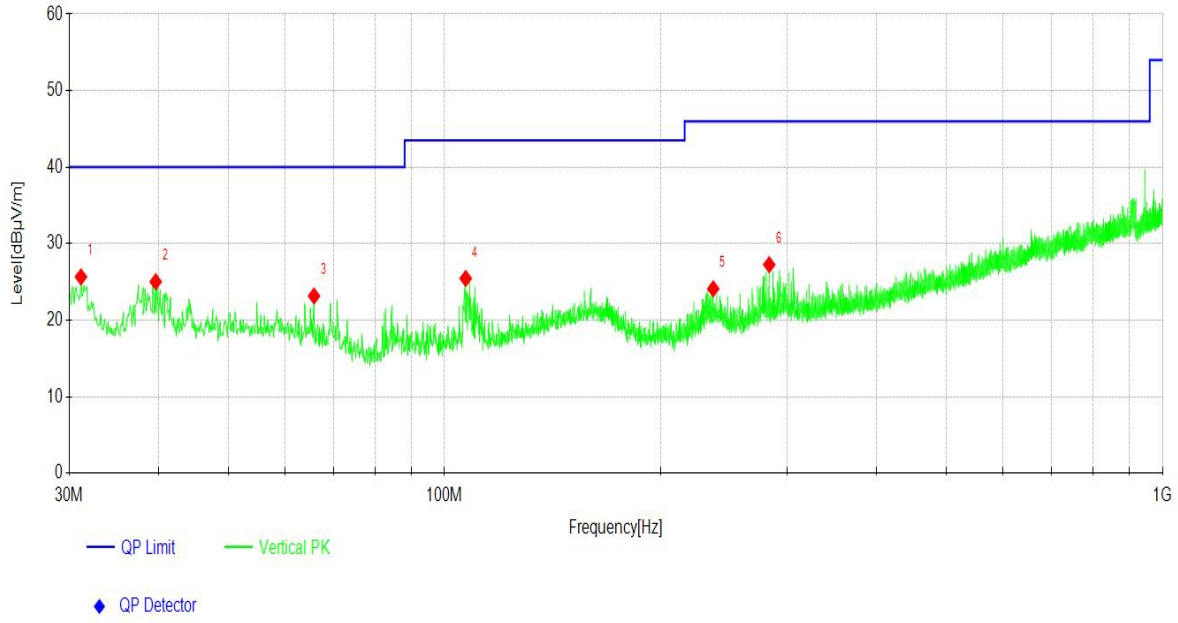


NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	44.1634	3.55	19.49	23.04	40.00	16.96	300	143
2	125.0695	4.06	18.22	22.28	43.50	21.22	200	217
3	241.2871	7.37	18.41	25.78	46.00	20.22	100	245
4	290.6651	15.39	19.66	35.05	46.00	10.95	100	245
5	351.9752	8.08	20.78	28.86	46.00	17.14	100	63
6	**844.3964**	**8.18**	**29.51**	**37.69**	**46.00**	**8.31**	**100**	**63**

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.
2. The emission levels of other frequencies were greater than 20dB margin.
3. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
4. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
5. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

Worst Test Mode	DR0	**Channel**	CH 0
Frequency Range	9KHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Vertical



NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	31.1641	6.58	19.08	25.66	40.00	14.34	100	43
2	39.6040	5.47	19.56	25.03	40.00	14.97	100	37
3	65.7966	5.38	17.78	23.16	40.00	16.84	100	94
4	107.0257	8.73	16.72	25.45	43.50	18.05	300	32
5	236.7277	5.83	18.27	24.10	46.00	21.90	100	300
6	283.2923	7.85	19.41	27.26	46.00	18.74	100	37

Remark: 1. 9KHz~30MHz have been test and test data more than 20dB margin.
2. The emission levels of other frequencies were greater than 20dB margin.
3. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
4. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
5. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]

ABOVE 1GHz DATA

Channel	CH 0	Frequency	902.3MHz
Frequency Range	1GHz~9.3G	Detector Function	PK/AV

Horizontal

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector
1	1804.6000	46.81	7.73	54.54	74.00	19.46	187	335	PK
2	1804.6000	41.32	7.73	49.05	54.00	4.95	131	359	AV
3	2706.9000	37.25	11.20	48.45	54.00	5.55	297	335	AV
4	2706.9000	44.93	11.20	56.13	74.00	17.87	222	118	PK
5	3609.2000	43.30	14.86	58.16	74.00	15.84	112	177	PK
6	3609.2000	35.63	14.86	50.49	54.00	3.51	174	236	AV

Vertical

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector
1	1804.6000	45.63	7.73	53.36	74.00	20.64	297	185	PK
2	1804.6000	38.47	7.73	46.20	54.00	7.80	179	172	AV
3	2706.9000	36.17	11.20	47.37	54.00	6.63	196	198	AV
4	2706.9000	43.71	11.20	54.91	74.00	19.09	191	269	PK
5	3609.2000	43.14	14.86	58.00	74.00	16.00	309	322	PK
6	3609.2000	35.62	14.86	50.48	54.00	3.52	169	113	AV

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dBμV/m] - Level [dBμV/m]

Channel	CH 63	Frequency	914.9MHz
Frequency Range	1GHz~9.3G	Detector Function	PK/AV

Horizontal

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector
1	1829.8000	45.84	7.86	53.70	74.00	20.30	306	357	PK
2	1829.8000	39.05	7.86	46.91	54.00	7.09	112	359	AV
3	2744.7000	36.59	11.20	47.79	54.00	6.21	282	85	AV
4	2744.7000	43.49	11.20	54.69	74.00	19.31	116	119	PK
5	3659.6000	36.31	14.86	51.17	54.00	2.83	110	295	AV
6	3659.6000	44.48	14.86	59.34	74.00	14.66	211	164	PK

Vertical

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector
1	1829.8000	44.54	7.86	52.40	74.00	21.60	282	130	PK
2	1829.8000	37.20	7.86	45.06	54.00	8.94	133	158	AV
3	2744.7000	35.86	11.20	47.06	54.00	6.94	169	151	AV
4	2744.7000	43.28	11.20	54.48	74.00	19.52	264	230	PK
5	3659.6000	43.98	14.86	58.84	74.00	15.16	303	170	PK
6	3659.6000	35.66	14.86	50.52	54.00	3.48	235	18	AV

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dBμV/m] - Level [dBμV/m]

Channel	CH 126	**Frequency**	927.6MHz
Frequency Range	1GHz~9.3G	**Detector Function**	PK/AV

Horizontal

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector
1	1855.2000	45.38	8.05	53.43	74.00	20.57	194	349	PK
2	1855.2000	38.72	8.05	46.77	54.00	7.23	252	11	AV
3	2782.8000	36.67	11.24	47.91	54.00	6.09	218	57	AV
4	2782.8000	45.56	11.24	56.80	74.00	17.20	163	243	PK
5	3710.4000	35.67	15.34	51.01	54.00	2.99	133	103	AV
6	3710.4000	43.12	15.34	58.46	74.00	15.54	130	349	PK

Vertical

NO.	Freq. [MHz]	Reading [dBμV/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector
1	1855.2000	44.68	8.05	52.73	74.00	21.27	282	104	PK
2	1855.2000	36.75	8.05	44.80	54.00	9.20	252	156	AV
3	2782.8000	36.50	11.24	47.74	54.00	6.26	272	156	AV
4	2782.8000	43.78	11.24	55.02	74.00	18.98	253	359	PK
5	3710.4000	35.62	15.34	50.96	54.00	3.04	149	256	AV
6	3710.4000	43.55	15.34	58.89	74.00	15.11	258	359	PK

Remark: 1. The emission levels of other frequencies were greater than 20dB margin.
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
4. Margin(dB) = Limit[dBμV/m] - Level [dBμV/m]

3.3 NUMBER OF HOPPING FREQUENCY USED

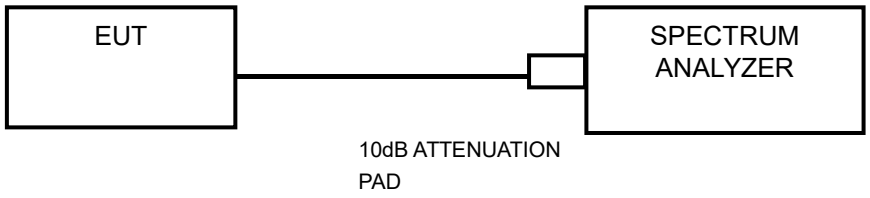
3.3.1 Limits

At least 50 channels frequencies and should be equally spaced.

3.3.2 Measurement procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
d. Set the SA on View mode and then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were completed.

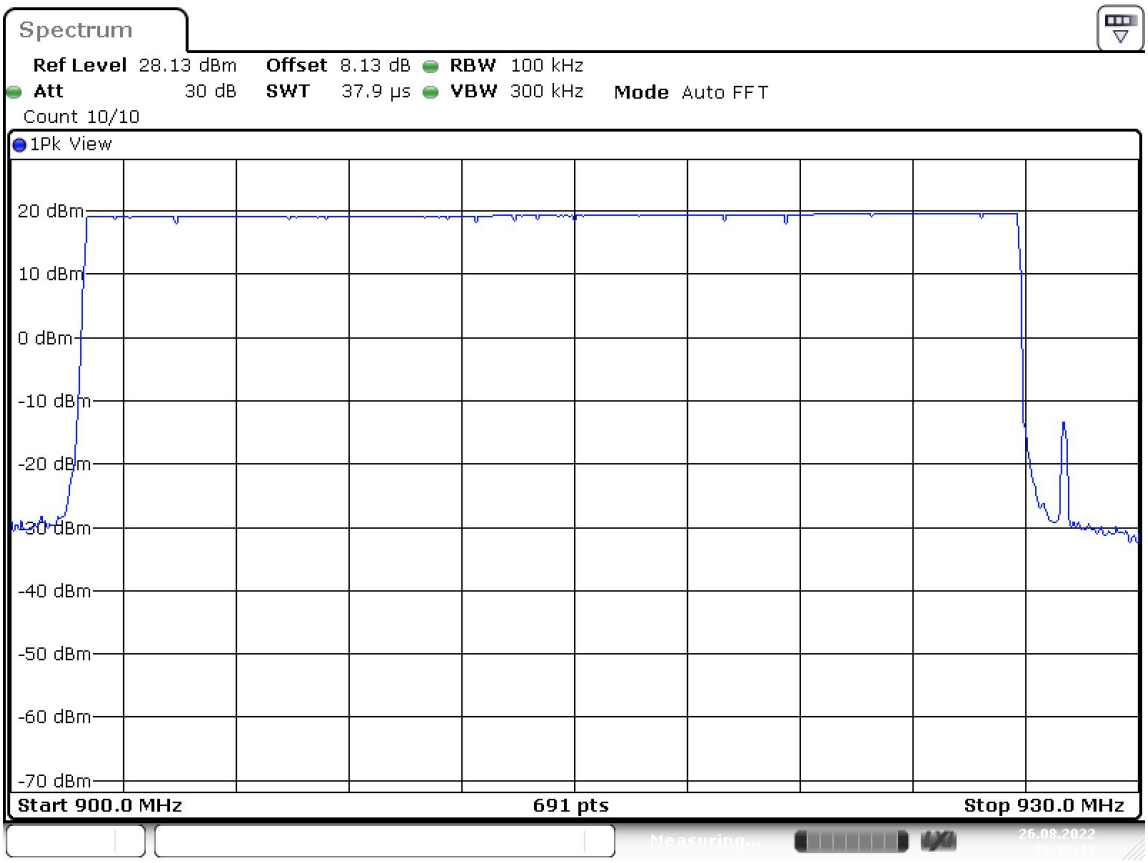
3.3.3 Test setup



3.3.4 Test result

There are 127 hopping frequencies in the hopping mode. Please refer to the following figure for test results. On the plots, it shows that the hopping frequencies are equally spaced.

Mode	Channel	Result [Num]	Limit [Num]	Verdict
DR0	Hop	127	≥50	PASS



3.4 AVERAGE TIME OF OCCUPANCY FOR HYBRID SYSTEM

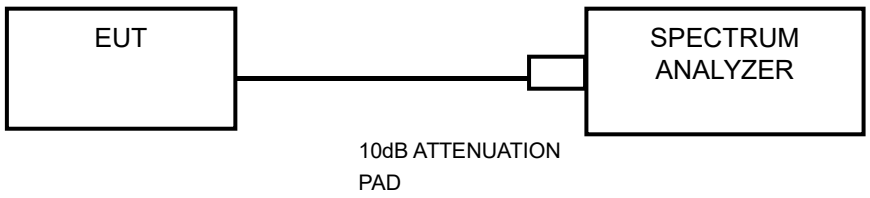
3.4.1 Limits

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.

3.4.2 Measurement procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

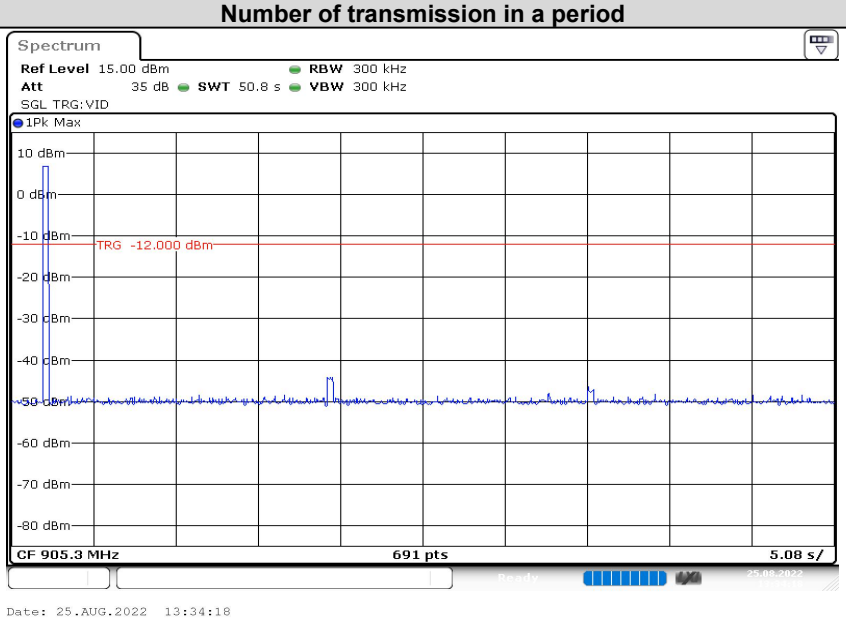
3.4.3 Test setup



3.4.4 Test result

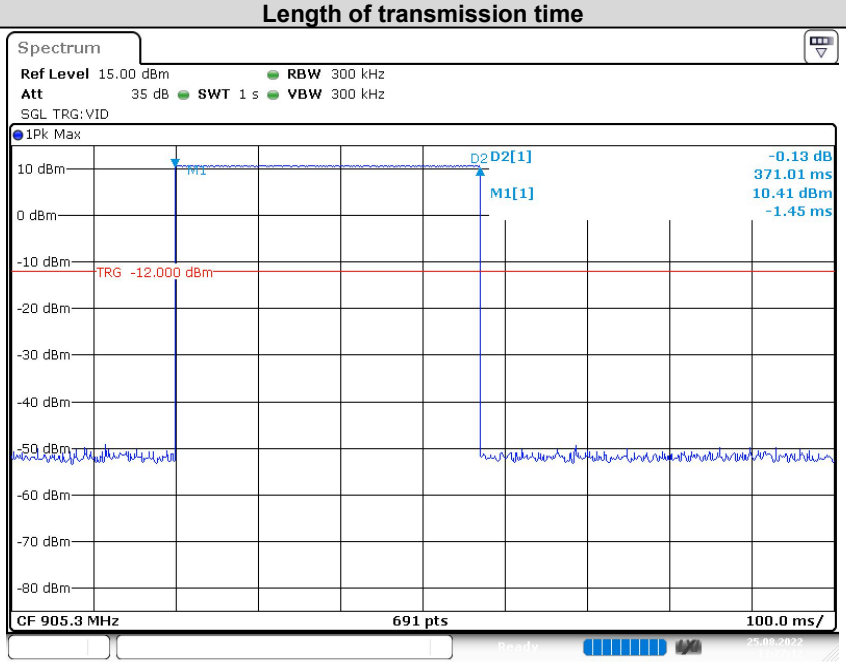
Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)	Length of transmission time (msec)	Result (msec)	Limit (msec)	Verdict
DR0	127	50.8	0.371	0.371	⩽0.4	PASS

Number of transmission in a period



Date: 25.AUG.2022 13:34:18

Length of transmission time



Date: 25.AUG.2022 13:27:13

3.5 20dB EMISSION BANDWIDTH

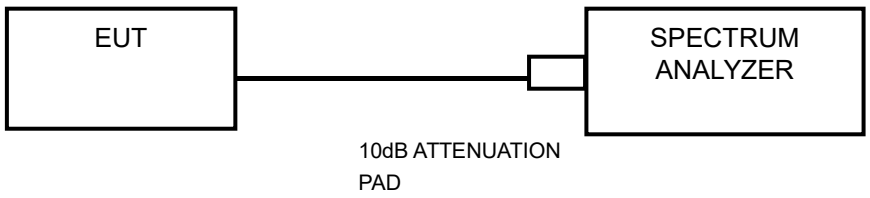
3.5.1 Limits

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

3.5.2 Measurement procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

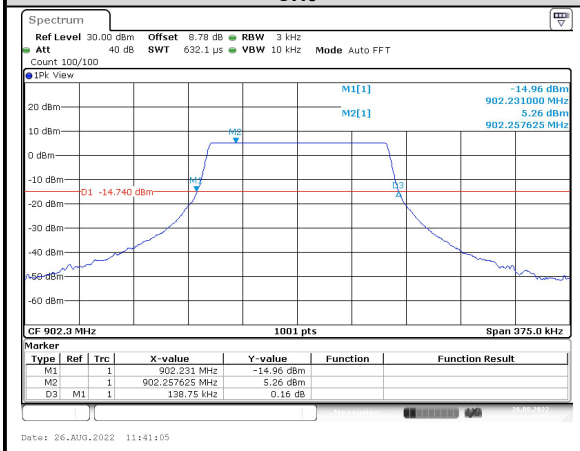
3.5.3 Test setup



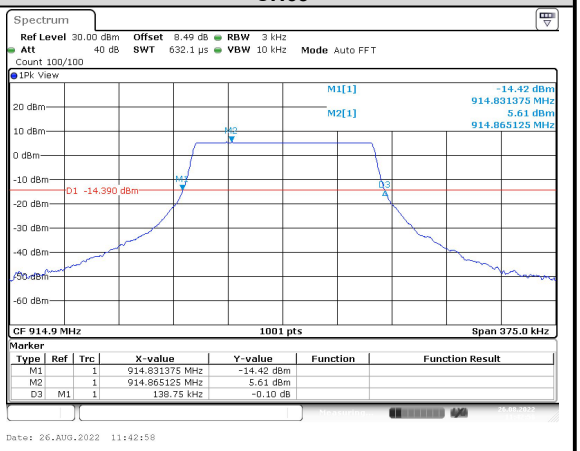
3.5.4 Test result

Mode	Channel	Channel Frequency (MHz)	20dB Emission Bandwidth(kHz)	Limit (kHz)
DH0	0	902.3	138.75	⩽250
	63	914.9	138.75	⩽250
	126	927.6	138.75	⩽250

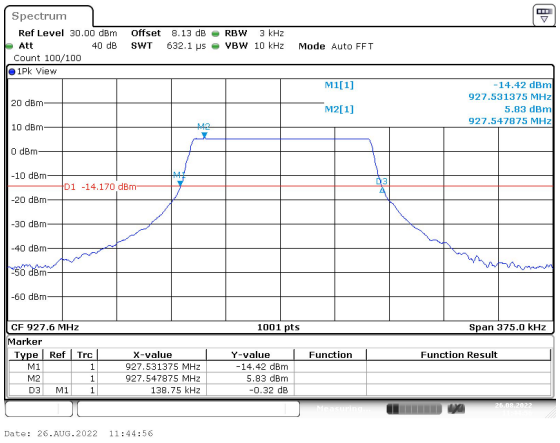
CH0



CH63



CH126



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3.6 HOPPING CHANNEL SEPARATION

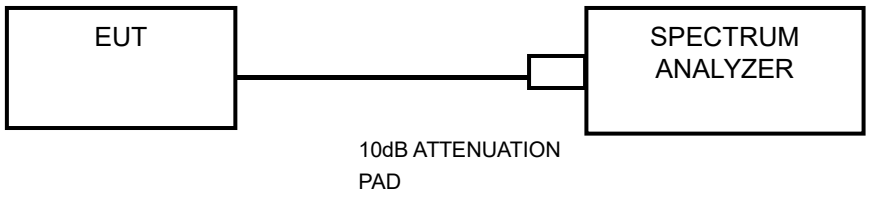
3.6.1 Limits

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

3.6.2 Measurement procedure

a. Span: Wide enough to capture the peaks of two adjacent channels.
b. 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.
c. Video (or average) bandwidth (VBW) ⩾ RBW.
d. Sweep: Auto.
e. Detector function: Peak.
f. Trace: Max hold.
g. Allow the trace to stabilize.

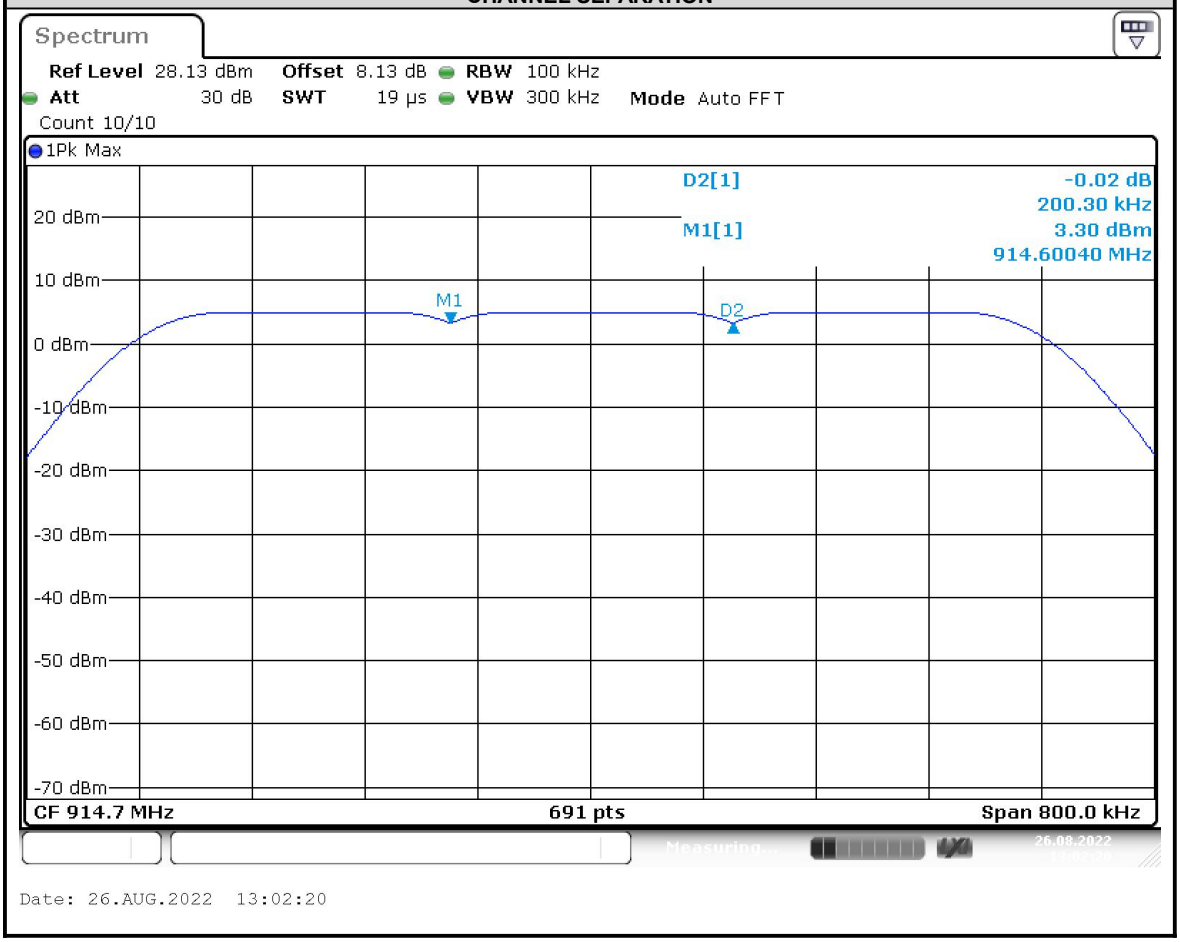
3.6.3 Test setup



3.6.4 Test result

Mode	Adjacent Channel Separation (kHz)	Minimum Limit 20dB Bandwidth (kHz)	Verdict
DR0	200.30	138.75	PASS

CHANNEL SEPARATION



3.7 CONDUCTED OUTPUT POWER

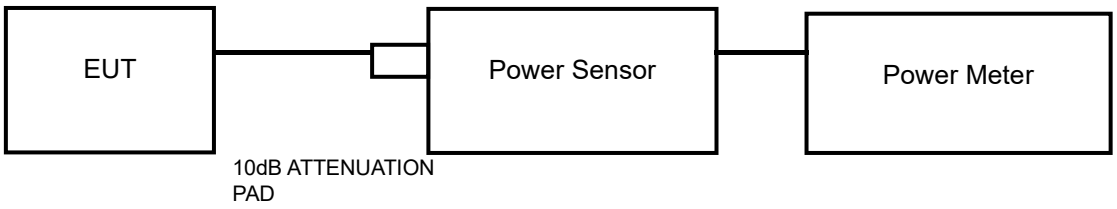
3.7.1 Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

3.7.2 Measurement procedure

a. A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor and set the detector to PEAK. Record the power level.
b. Anaverage power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power senso and set the detector to AVERAGE. Record the power level.

3.7.3 Test setup



3.7.4 Test result

PEAK OUTPUT POWER

GFSK

CHANNEL	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Peak Power Limit (mW)	Verdict
0	902.3	20.18	104.23	1000	PASS
63	914.9	20.09	102.93	1000	PASS
126	927.6	20.42	110.15	1000	PASS

AVERAGE OUTPUT POWER (For reference)

Mode	Channel Frequency (MHz)	Average Power (dBm)	Average Power (mW)	Average Power Limit (mW)	Verdict
0	902.3	5.19	3.30	1000	PASS
63	914.9	5.38	3.45	1000	PASS
126	927.6	5.37	3.44	1000	PASS

3.8 POWER SPECTRAL DENSITY MEASUREMENT

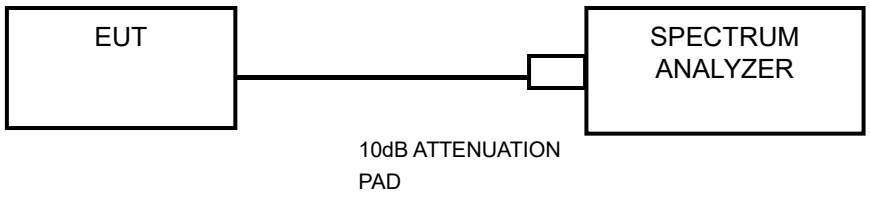
3.8.1 Limits

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

3.8.2 Measurement procedure

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set RBW to: 3KHz
4. Set VBW ≥3 x RBW.
5. Detector = peak
6. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
7. Sweep time = auto couple.
8 .Use the peak marker function to determine the maximum amplitude level.

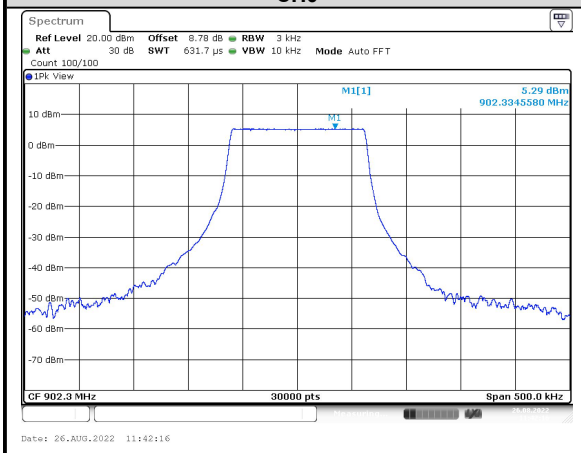
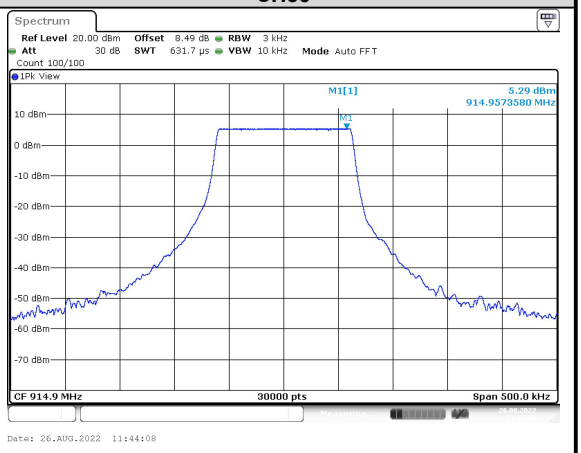
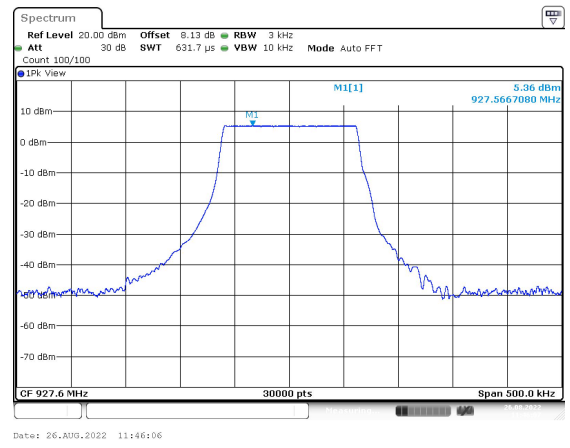
3.8.3 Test setup



3.8.4 Test result

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS / FAIL
0	902.3	5.29	8	PASS
63	914.9	5.29	8	PASS
126	927.6	5.36	8	PASS

Test Plot:

CH0	CH36
	
CH63	**--**
	--

3.9 OUT OF BAND EMISSION AND BAND EDGE MEASUREMENTS

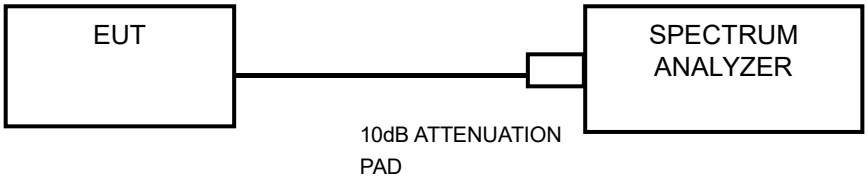
3.9.1 Limits

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

3.9.2 Measurement procedure

The transmitter output was connected to the spectrum analyzer via a low loss cable. of Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

3.9.3 Test setup

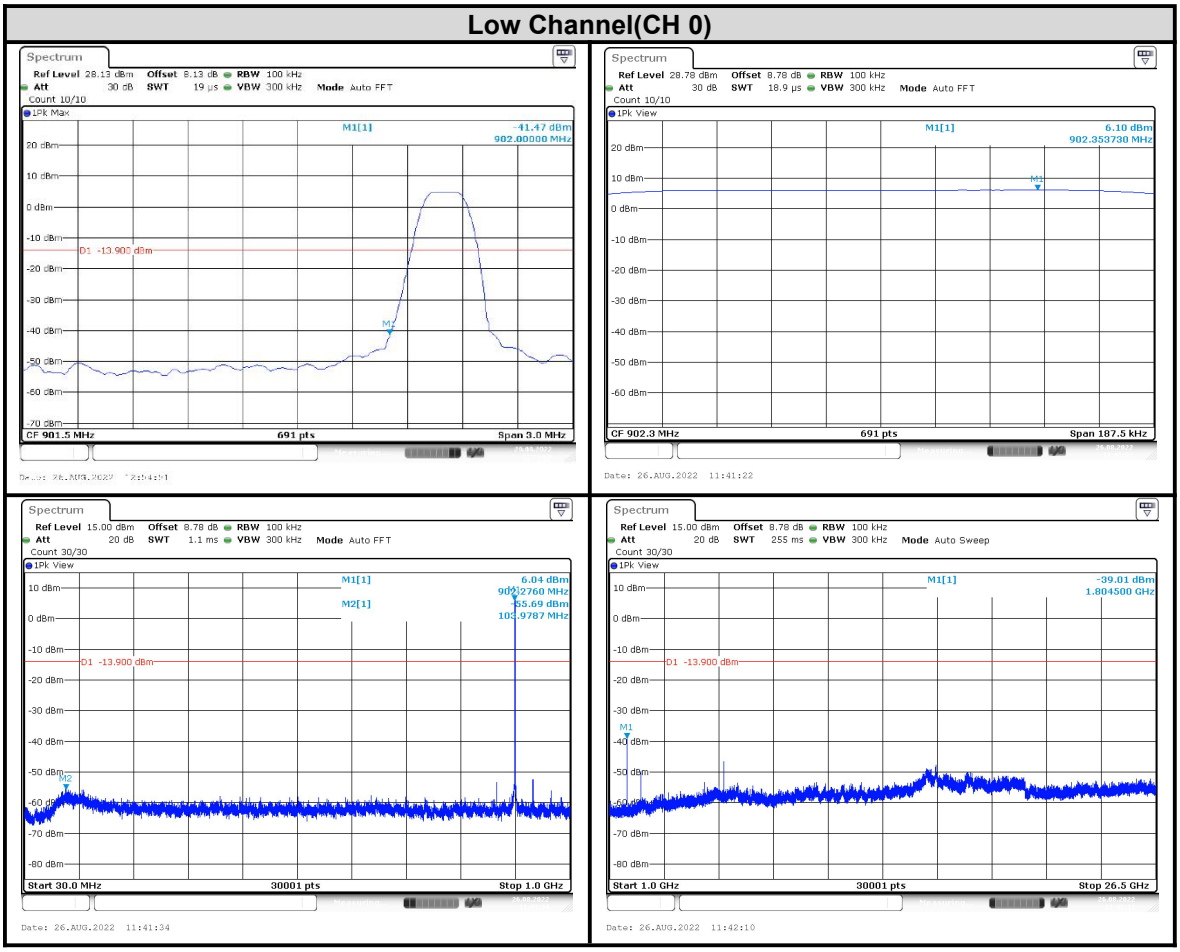


3.9.4 Test result

The spectrum plots are attached on the following images.

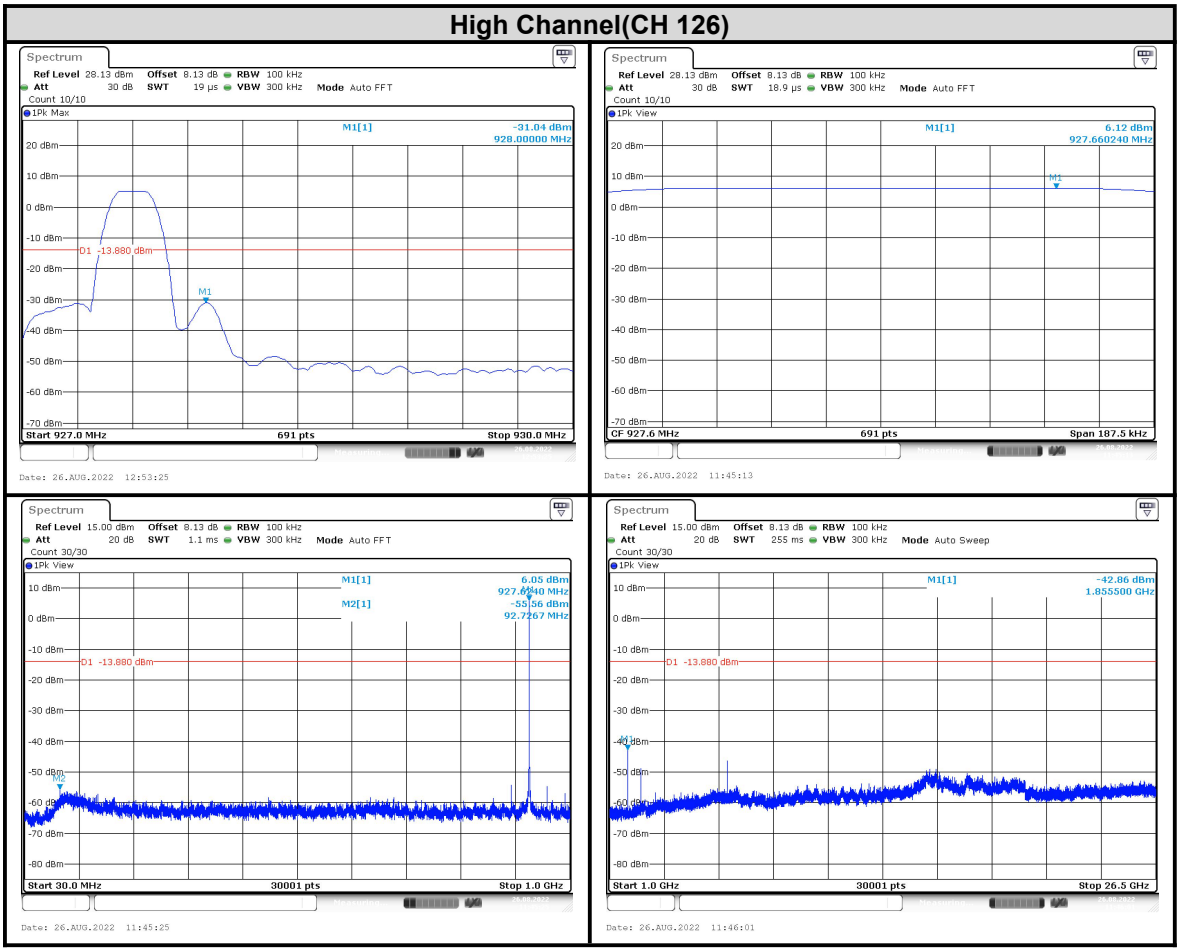
DR0

Low Channel(CH 0)



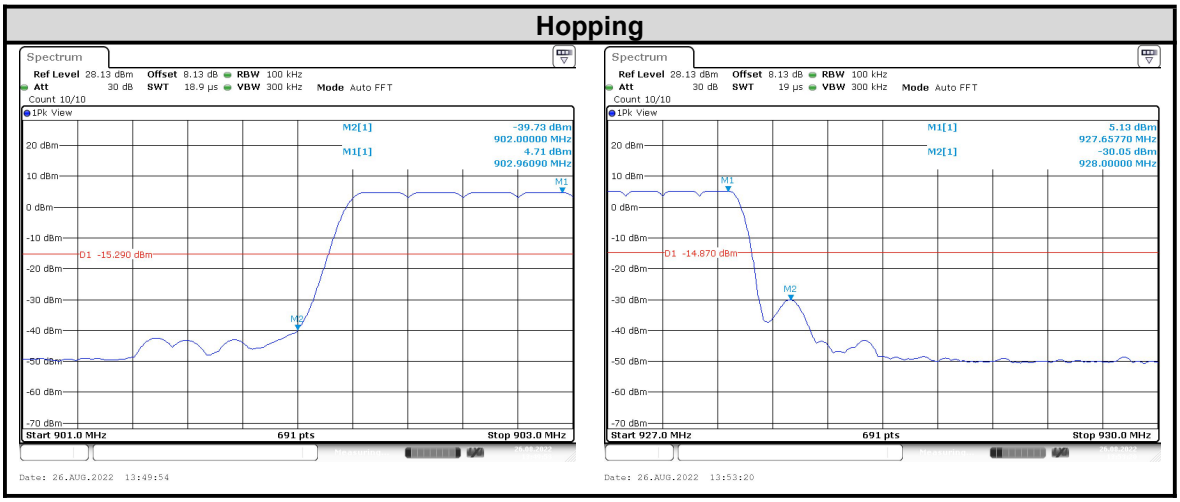
DR0

High Channel(CH 126)



DR0-HOPPING

Hopping



4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Photos).

5 PHOTOGRAPHS OF THE EUT

Please refer to the attached file (External Photos and Internal Photos report).

Important

(1) The test report is valid without the official stamp of CVC;

(2) Any part photocopies of the test report are forbidden without the written permission from CVC;

(3) The test report is invalid without the signatures of Approval and Reviewer;

(4) The test report is invalid if altered;

(5) Objections to the test report must be submitted to CVC within 15 days.

(6) Generally, commission test is responsible for the tested samples only.

(7) As for the test result “-” or “N” means “not applicable”, “/” means “not test”, “P” means “pass” and “F” means “fail”

The test data and test results given in this test report should only be used for purposes of scientific research, teaching and internal quality control when the CMA symbol is not presented.

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