TEST REPORT

Report Number: C21T00142-SRD01-V01

Applicant	Shanghai Sunmi Technology Co.,Ltd.
Product Name	Data Processing Terminal
Model Name	L3561
Brand Name	SUNMI
FCC ID	2AH25D2SKDS
IC	22621-D2SKDS

Industrial Internet Innovation Center (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in FCC Part15, ANSI C63.10-2013, KDB 558074, RSS-Gen Issue 5，RSS-247 Issue 2.

Prepared by	范宇航	Reviewed by	王长青
Approved by		Issue Date	2022-01-24

Industrial Internet Innovation Center (Shanghai) Co., Ltd.

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10. The measurement uncertainty is not taken into account when deciding conformity, and the results of measurement (or the average of measurement results) are directly used as the criterion for the stating conformity.

Test Laboratory:
Industrial Internet Innovation Center (Shanghai) Co., Ltd.
Add: Building 4, No. 766 Jingang Rd, Pudong, Shanghai, China
Tel: +86 21 68866880

Revision Version

Report Number	Revision	Date	Memo
C21T00142-SRD01-V00	00	2022-01-14	Initial creation of test report
C21T00142-SRD01-V01	01	2022-01-24	1. Update the result of Carrier Frequency Separation 2. Update the Testing End Date

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1. Test Laboratory

1.1. Testing Location

Primary Lab:

Company Name	Industrial Internet Innovation Center (Shanghai) Co., Ltd.
Address	Building 4, No. 766 Jingang Rd, Pudong, Shanghai, China
FCC Registration No.	958356
FCC Designation No.	CN1177
IC designation No.	CN0067

1.2. Testing Environment

Normal Temperature	15℃~35℃
Relative Humidity	30%RH~60%RH
Supply Voltage	120V/60Hz

1.3. Project Information

Project Leader	Wang Wenwen
Testing Start Date	2021-12-01
Testing End Date	2022-01-24

2. Client Information

2.1. Applicant Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	+86 18501703215

2.2. Manufacturer Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	+86 18501703215

3. Equipment under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Product Name	Data Processing Terminal
Model name	L3561
Supported Radio Technology and Bands	BT4.2 WLAN 802.11b,g,n WLAN 802.11a, n, ac
Hardware Version	Athens_MB_V1.1
Software Version	d2-userdebug 11 RQ1D.210105.003 97 release-keys
FCC ID	2AH25D2SKDS
IC	22621-D2SKDS

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of Receipt
N01	DK03D1B240017	Athens_MB_V1.1	d2-userdebug 11 RQ1D.210105.003 97 release-keys	2021-12-01
N02	DK03D1B240033	Athens_MB_V1.1	d2-userdebug 11 RQ1D.210105.003 97 release-keys	2021-12-01
N03	DK03D1B240014	Athens_MB_V1.1	d2-userdebug 11 RQ1D.210105.003 97 release-keys	2021-12-01
N04	DK134259200019D05L2	Athens_MB_V1.1	d2-userdebug 11 RQ1D.210105.003 97 release-keys	2021-12-10

*EUT ID: is internally used to identify the test sample in the lab.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	SN/Remark
CA02	Adapter	CYZS36-240150	N/A
UB01	Serial port line	N/A	N/A
AE1	Notebook PC	DELL Latitude E6510	N/A
AE2	LAN Cable	N/A	N/A
AE3	USB Cable	N/A	N/A
AE4	Keyboard	KB212-B	CN-0Y88XT-65890-12I-005Q-A00
AE5	Mouse	MS111-P	CN-011D3V-71581-19J-1A64
AE6	Micro SD Card	Kingston SDC4/4GB 77	N/A
AE7	U-disk	DataTraveler 100 G3 64GB	N/A

AE8	Earphone	N/A	N/A
AE9	RF Cable	N/A	N/A

*AE ID: is internally used to identify the test sample in the lab.

*The AE is provided by the client.

4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.	2020
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
KDB 558074 D01	Guidance for Performing Compliance Measurements on Frequency Hopping Spread Spectrum systems (DSS) Operating Under §15.247	2019
RSS-247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	2017
RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus	2021

4.2. Reference Information from client

Information of the test sample provided by the client.
Antenna gain of EUT 1.58 dBi

5. Test Summary

5.1. Summary of Test Results

Measurement Items	Sub-clause of Part15C	Sub-clause of IC	Verdict
Maximum Peak Output Power	15.247(b)	RSS-247 5.4	Pass
20dB Occupied Bandwidth	15.247(a)	RSS-247 5.1	Pass
99% Occupied Bandwidth	N/A	RSS-Gen 6.7	Pass
Band Edges Compliance	15.247 (d)	RSS-247 5.5	Pass
Time Of Occupancy (Dwell Time)	15.247(a)	RSS-247 5.1	Pass
Carrier Frequency Separation	15.247(a)	RSS-247 5.1	Pass
Number Of Hopping Channels	15.247(a)	RSS-247 5.1	Pass
Transmitter Spurious Emission-Conducted	15.247(d)	RSS-247 5.5	Pass
Transmitter Spurious Emission-Radiated	15.247,15.209,15.205	RSS-Gen 8.9,8.10	Pass
AC Powerline Conducted Emission	15.207	RSS-Gen 8.8	Pass

Test Conditions

Tnom	Normal Temperature
Tmin	Low Temperature
Tmax	High Temperature
Vnom	Normal Voltage
Vmin	Low Voltage
Vmax	High Voltage
Hnom	Norm Humidity
Anom	Norm Air Pressure

For this report, all the test case listed above are tested under Normal Temperature and Normal Voltage, and also under norm humidity, the specific conditions as following:

Temperature	Tnom	24℃
Voltage	Vnom	230V
Humidity	Hnom	48%
Air Pressure	Anom	1010hPa

Note:

a. All the test data for each data were verified, but only the worst case was reported.

b.The GFSK, π/4 DQPSK and 8DPSK were set in DH1 for GFSK, 2-DH1 for π/4 DQPSK, 3-DH1 for 8DPSK.

c.The DC and low frequency voltages' measurement uncertainty is ±2%.

5.2. Statements

The L3561 supporting BT/WLAN, manufactured by Shanghai Sunmi Technology Co.,Ltd. is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 5.1.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

6. Measurement Results

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5 Ω
Temperature	Min. = 15 ℃, Max. = 35 ℃

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. =30 %, Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber1 (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

6.1. Peak Output Power-Conducted

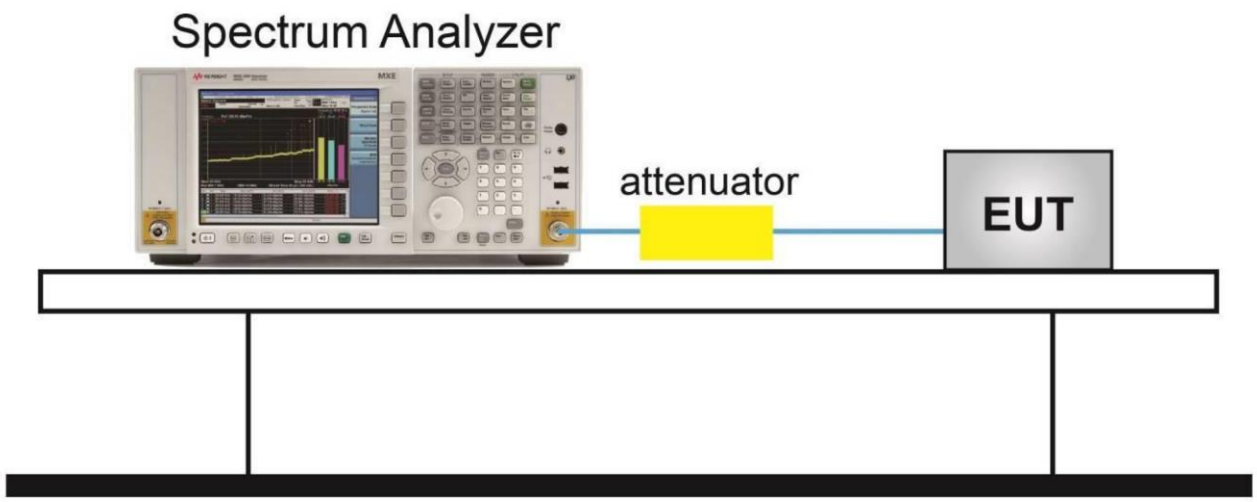
6.1.1. Measurement Limit

Standard	Limit（dBm）
FCC 47 Part 15.247(b)(1)	<30
RSS-247 5.4(b)	<30

6.1.2. Test Condition

Hopping Mode	RBW	VBW	Span	Sweeptime
Hopping OFF	3MHz	10MHz	9MHz	Auto

6.1.3. Test Setup



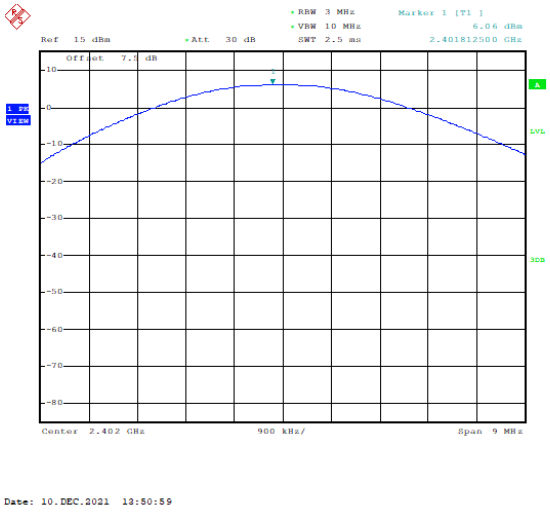
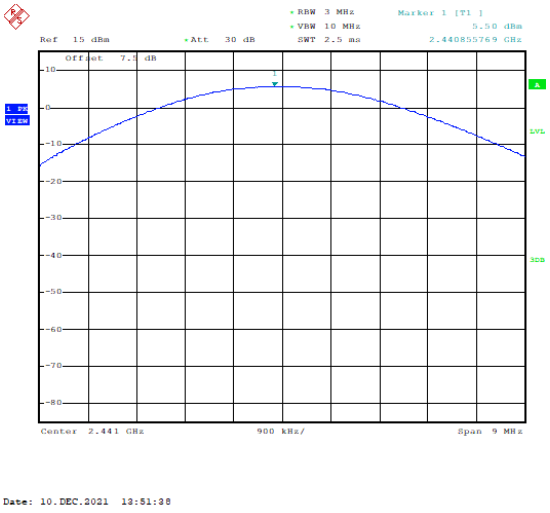
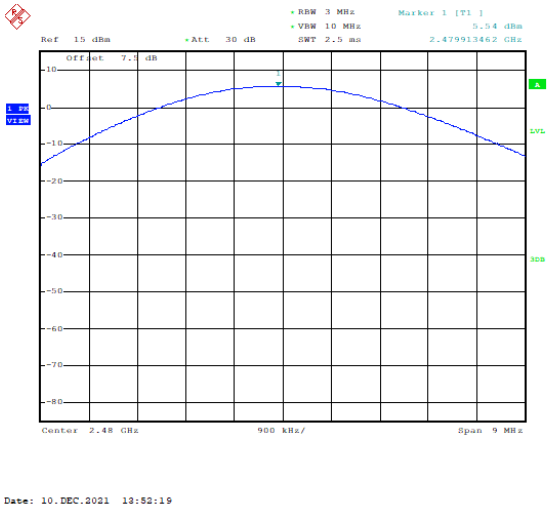
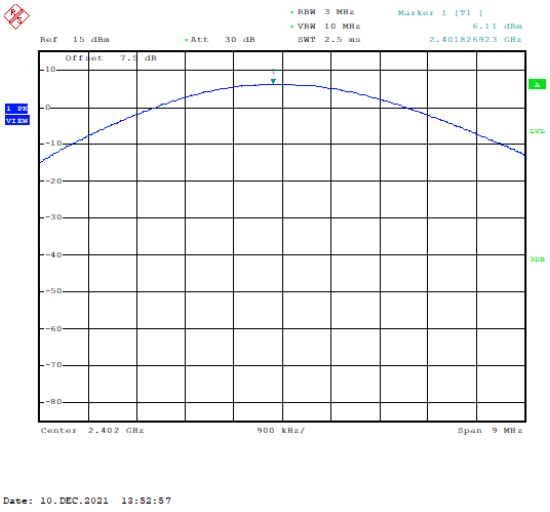
6.1.4. Test procedure

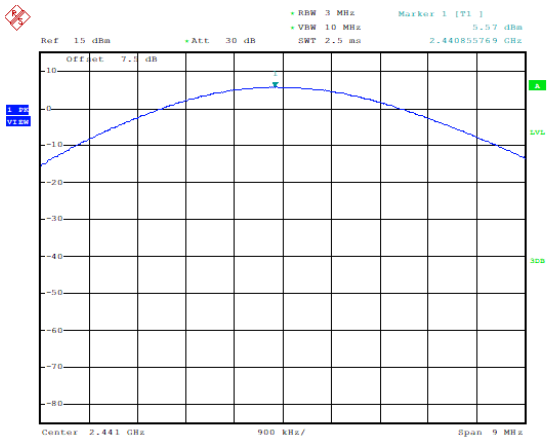
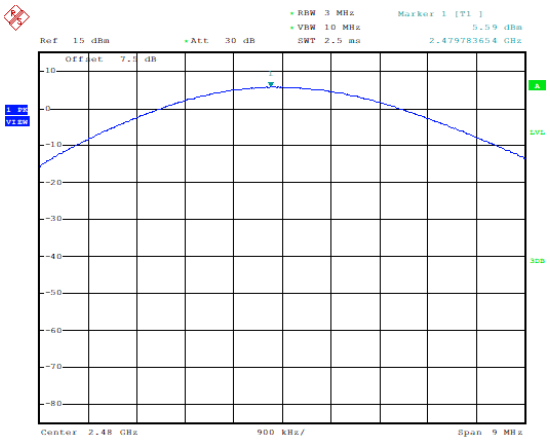
The measurement is according to ANSI C63.10 clause 7.8.5.

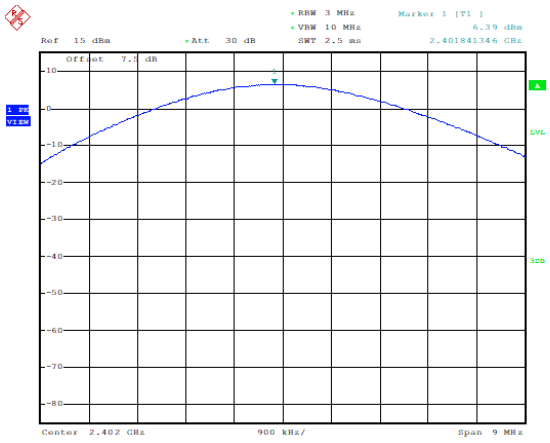
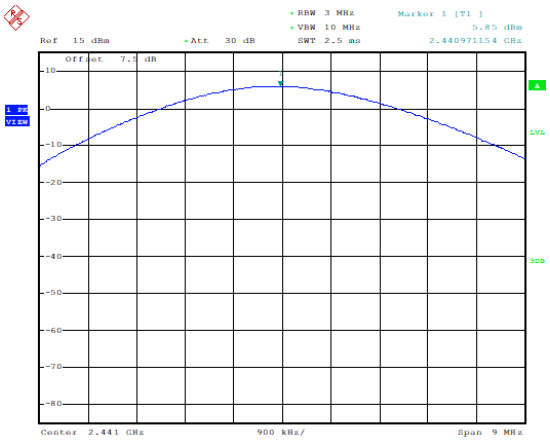
1. The output power of EUT was connected to the spectrum analyzer and CBT32 by cable and divide. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Measure the conducted output power and record the results it.

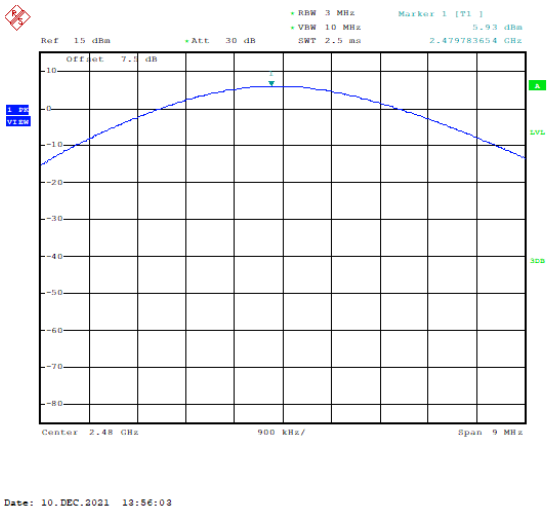
Measurement Results

Note: Bold font is the maximum Value

Peak Conducted Output Power GFSK, CH0 (dBm)	**6.06**	Peak Conducted Output Power GFSK, CH39 (dBm)	5.50
			
Peak Conducted Output Power GFSK, CH78 (dBm)	5.54	Peak Conducted Output Power π/4 DQPSK, CH0 (dBm)	**6.11**
			

Peak Conducted Output Power π /4 DQPSK, CH39 (dBm)	5.57	Peak Conducted Output Power π/4 DQPSK, CH78 (dBm)	5.59
			

Peak Conducted Output Power 8DPSK, CH0 (dBm)	**6.39**	Peak Conducted Output Power 8DPSK, CH39 (dBm)	5.85
			

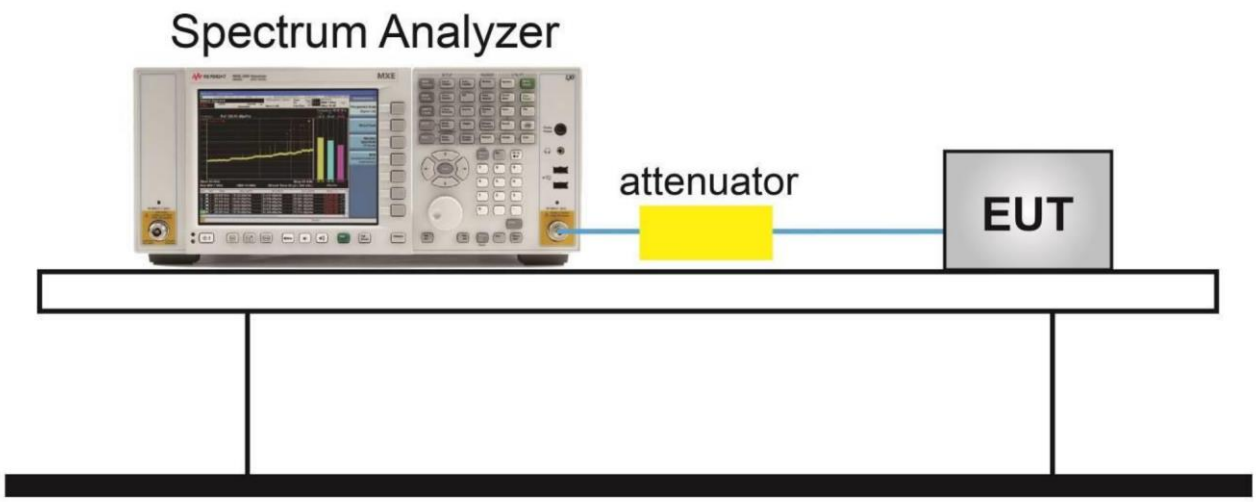
Peak Conducted Output Power 8DPSK, CH78 (dBm)	5.93	/	/
		/	

6.2. Frequency Band Edges-Conducted

6.2.1. Measurement Limit

Standard	Limited(dBc)
FCC 47 CFR Part 15.247(d)	>20
RSS-247 5.5	>20

6.2.2. Test Setup

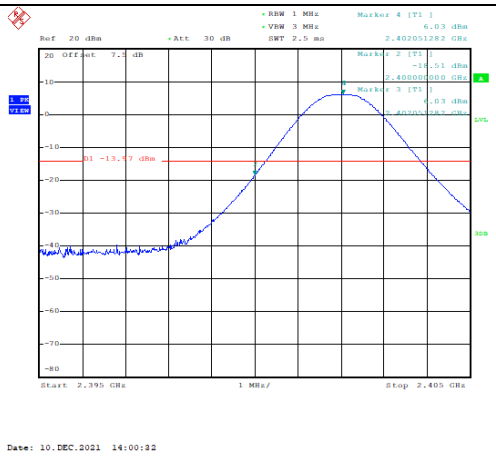
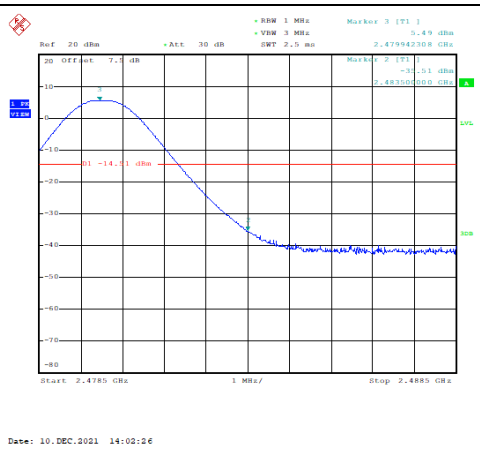
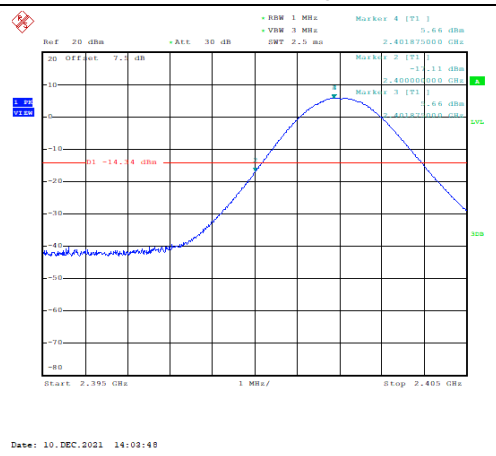
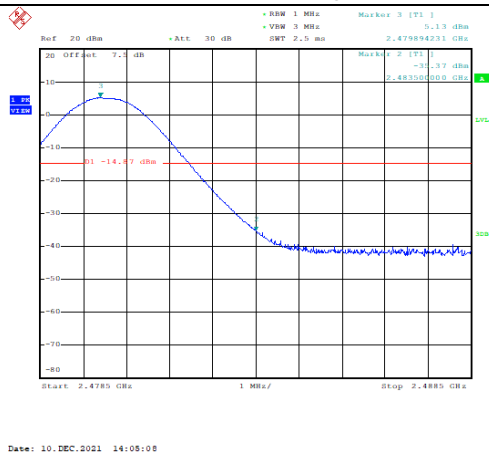
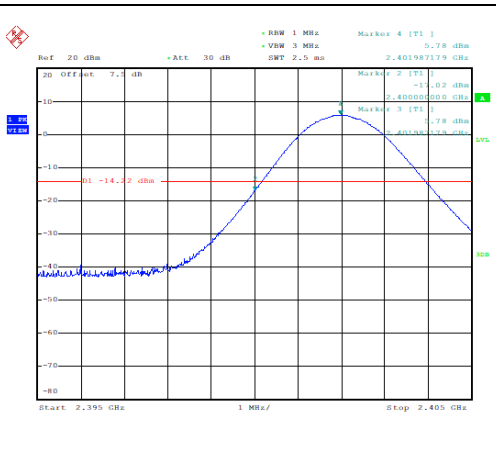
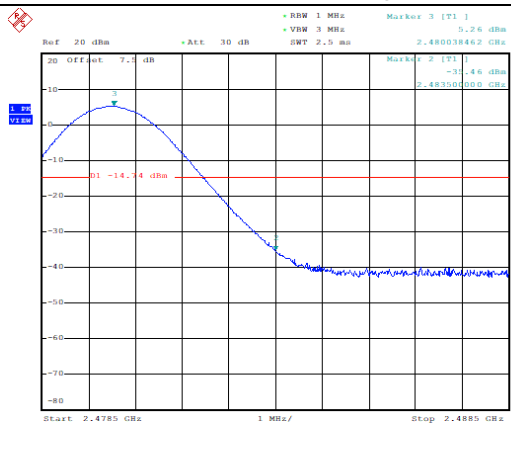


6.2.3. Test procedure

The measurement is according to ANSI C63.10 clause 7.8.6.

1. Connect the EUT to spectrum analyzer.
2. Set RBW=100KHz, VBW=300KHz, span more than 1.5 times channel bandwidth (2MHz).
3. Detector =peak, sweep time=auto couple, trace mode=max hold.
4. Allow sweep to continue until the trace stabilizes.

Measurement results

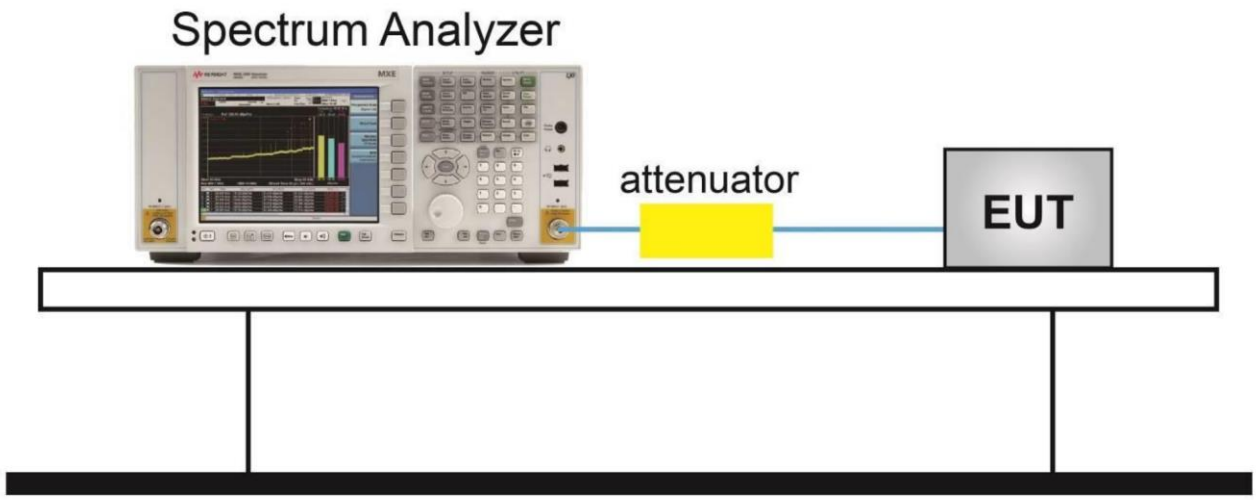
Frequency Band Edge: GFSK, Ch0, Hopping OFF	Frequency Band Edge: GFSK,Ch78, Hopping OFF
	
Frequency Band Edge: π/4 DQPSK, Ch0, Hopping OFF	Frequency Band Edge: π/4 DQPSK, Ch78, Hopping OFF
	
Frequency Band Edge: 8DPSK,Ch0, Hopping OFF	Frequency Band Edge:8DPSK, Ch78, Hopping OFF
	

6.3. Conducted Emission

6.3.1 Measurement Limit

Standard	Limit
FCC 47 CFR Part15.247 (d)	20dB below peak output power in 100KHz bandwidth
RSS-247 5.5	20dB below peak output power in 100KHz bandwidth

6.3.2. Test Setup

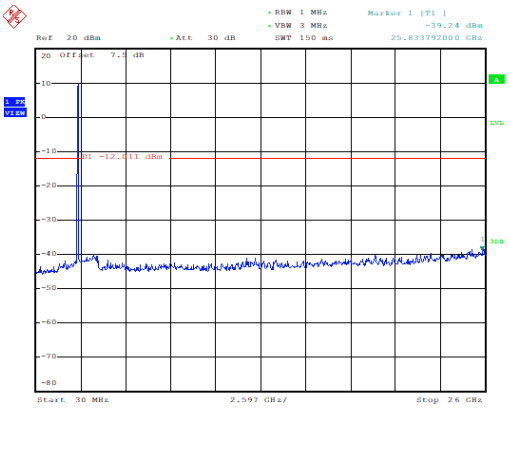
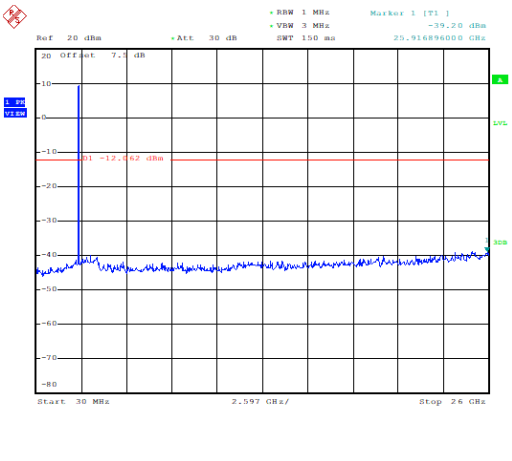
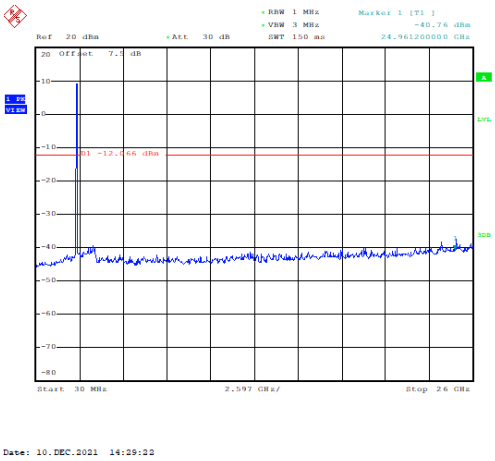
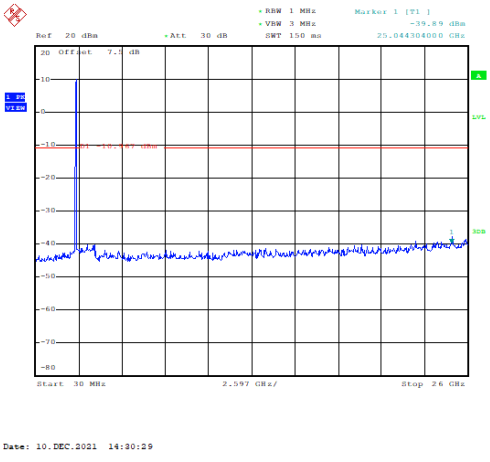
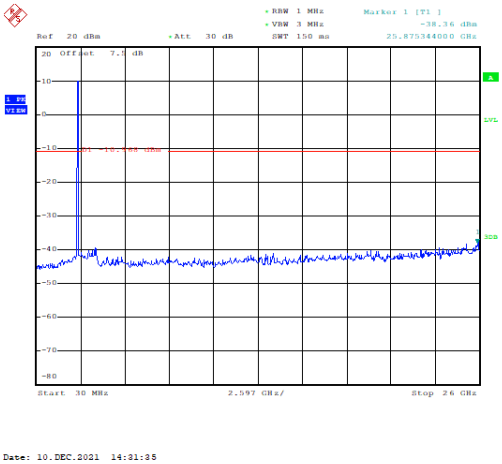
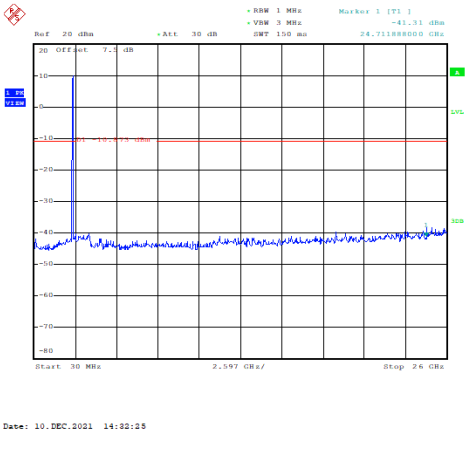


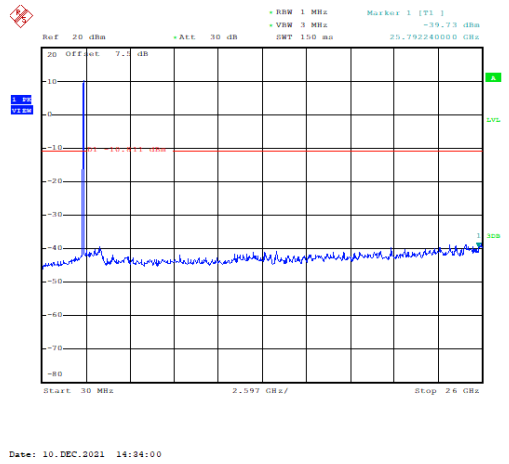
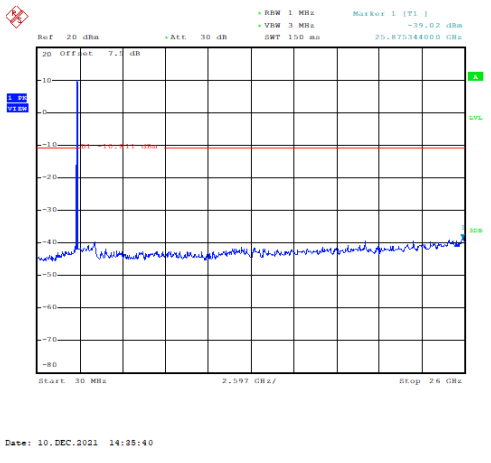
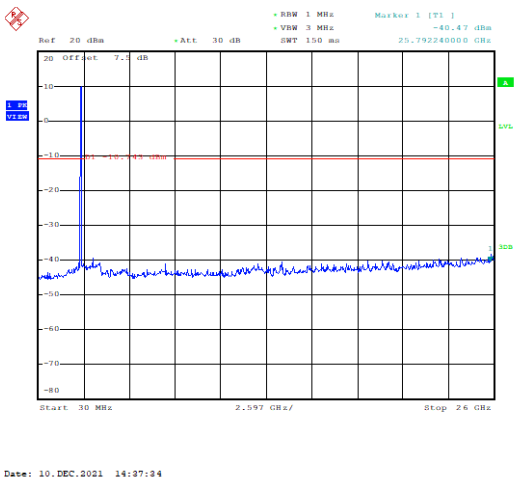
6.3.3 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.8.

1. Connect the EUT to spectrum analyzer.
2. Set RBW=100KHz, VBW=300KHz.
3. Detector =peak, sweep time=auto couple, trace mode=max hold.

Measurement Results

Conducted spurious emission: GFSK, Ch0, 30MHz~26GHz	Conducted spurious emission: GFSK, Ch39, 30MHz~26GHz
	
Conducted spurious emission: GFSK, Ch78, 30MHz~26GHz	Conducted spurious emission: π/4 DQPSK, Ch0, 30MHz~26GHz
	
Conducted spurious emission: π/4 DQPSK, Ch39, 30MHz~26GHz	Conducted spurious emission: π/4 DQPSK, Ch78, 30MHz~26GHz
	

Conducted spurious emission: 8DQPSK, Ch0, 30MHz~26GHz	Conducted spurious emission: 8DQPSK, Ch39, 30MHz~26GHz
	
Conducted spurious emission: 8DQPSK, Ch78, 30MHz~26GHz	/
	/

6.4. Radiated Emission

6.4.1. Measurement Limit

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power
RSS-Gen 8.9,8.10	20dB below peak output power

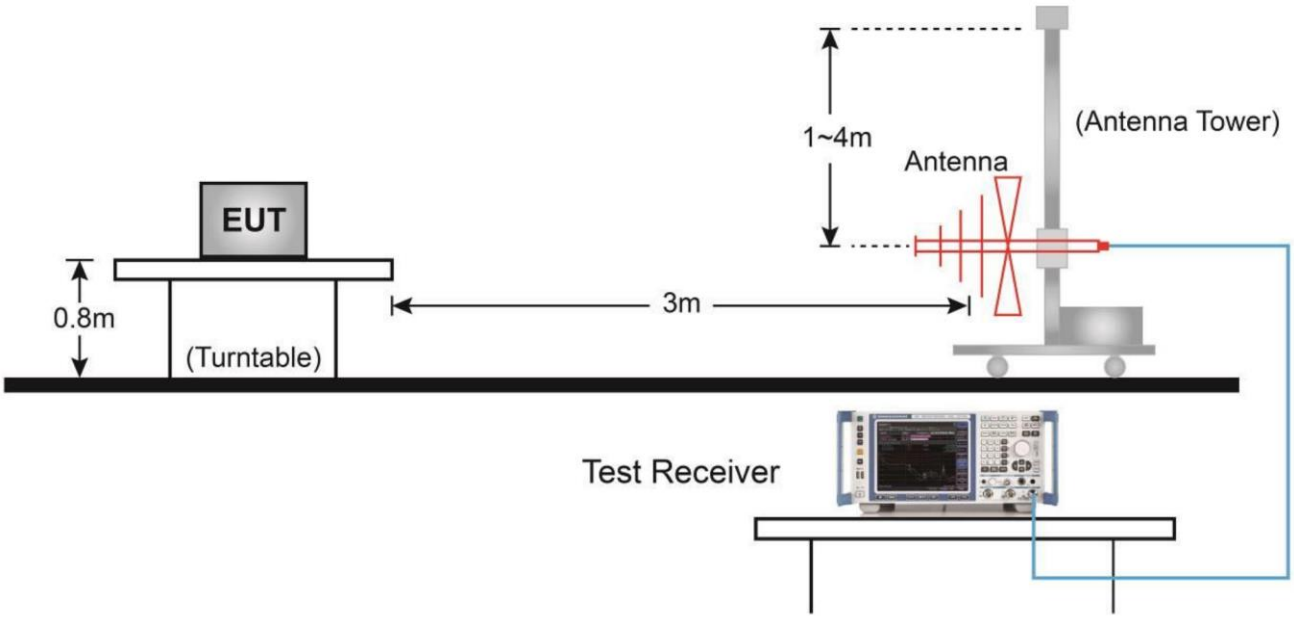
In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

Limit in restricted band

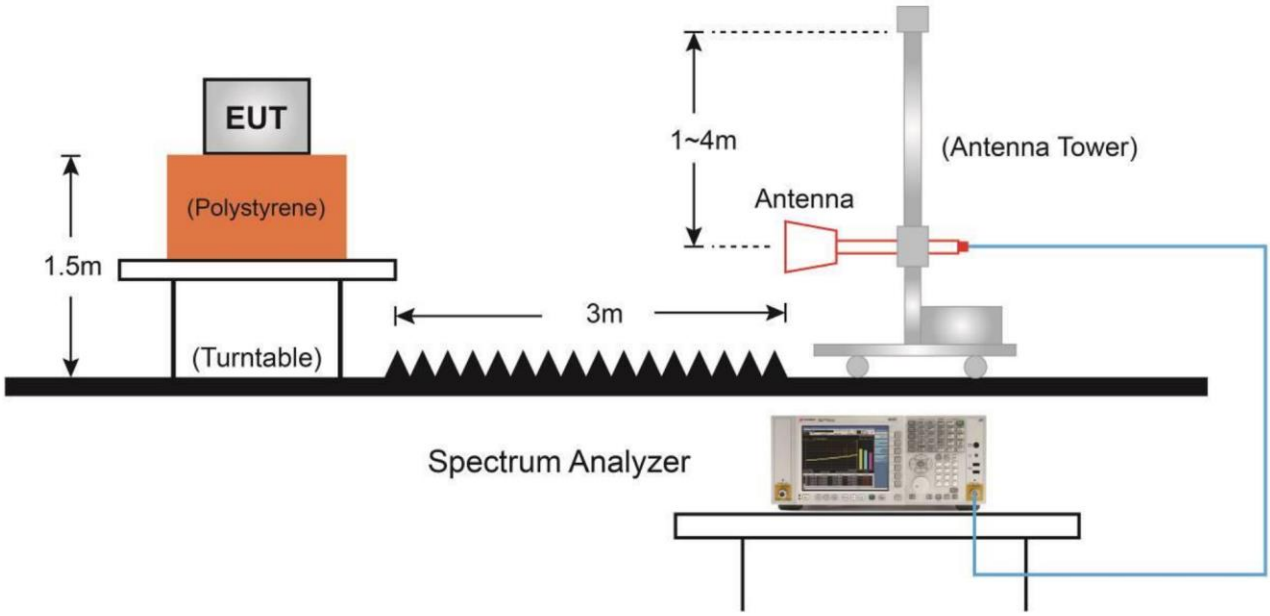
Frequency of emission	Field strength (uV/m)	Field strength (dBuV/m)
30~88	100	40
88~216	150	43.5
216~960	200	46
Above 960	500	54

6.4.2. Test Setup

Below 1GHz Test Setup



Above 1GHz Test Setup



6.4.3. Test Method

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. but it may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Frequency of emission	RBW/VBW	Sweep Time (s)
30~1000	100KHz/300KHz	5
1000~4000	1MHz/3MHz	15
4000~18000	1MHz/3MHz	40
18000~26500	1MHz/3MHz	20

Measurement Results

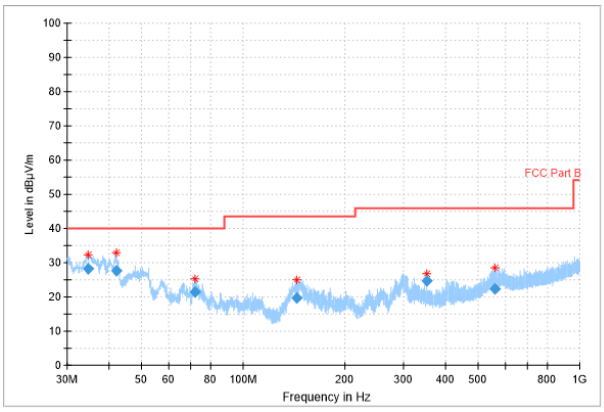
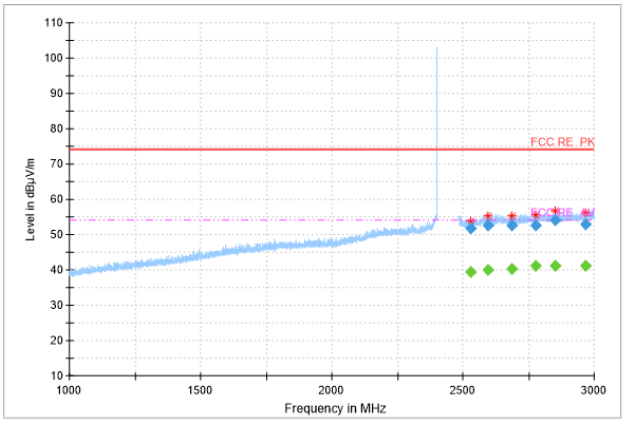
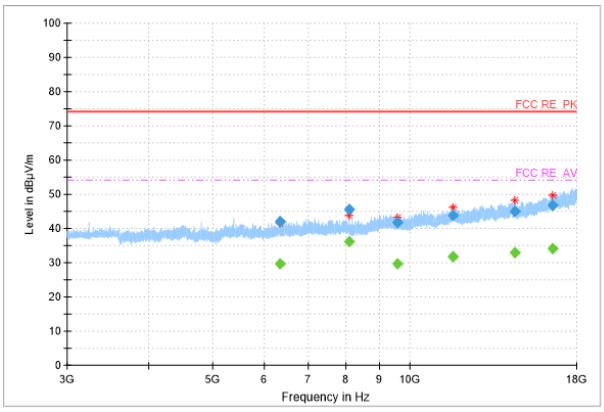
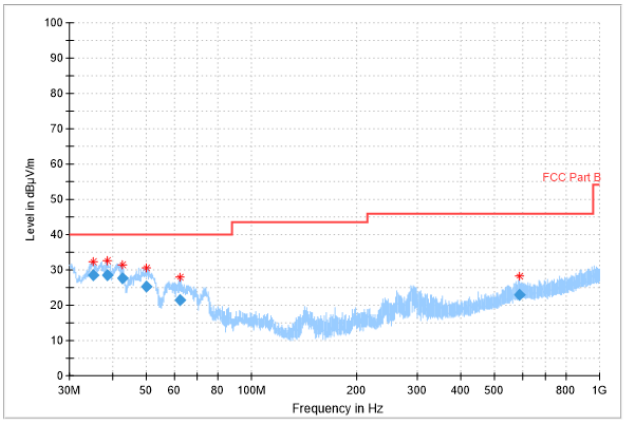
A “reference path loss” is established and A_{Rpi} is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

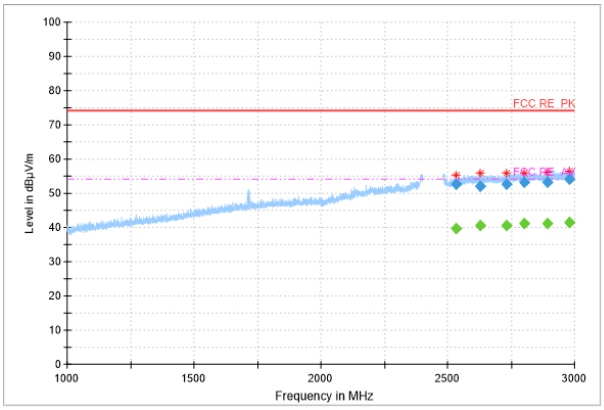
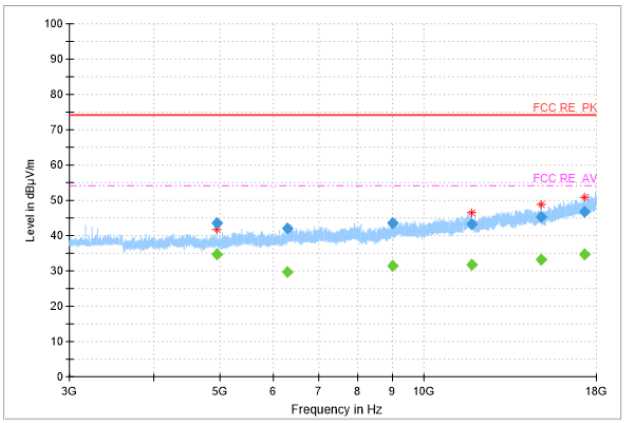
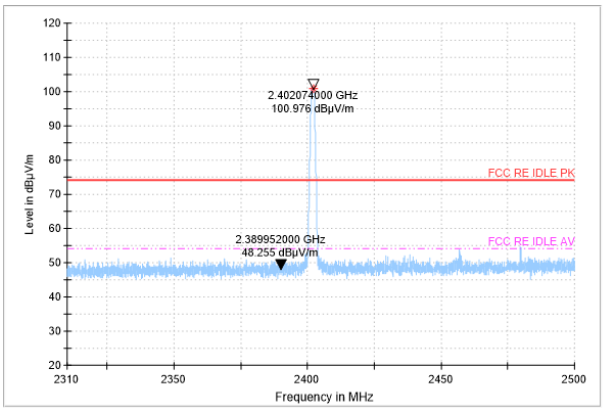
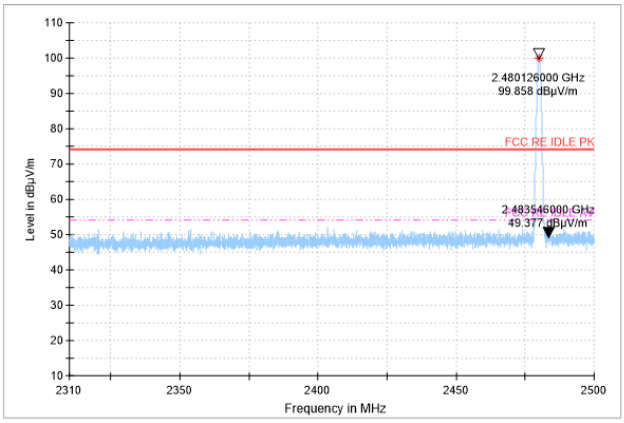
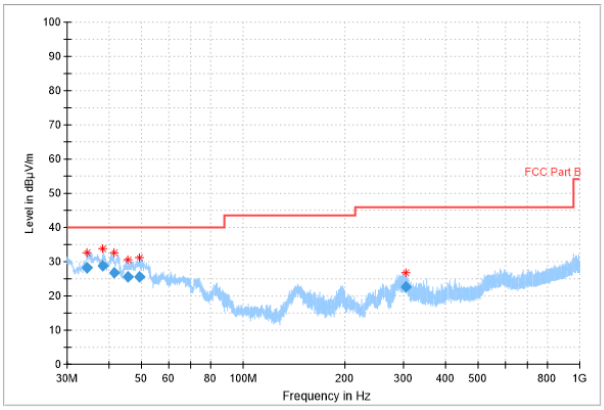
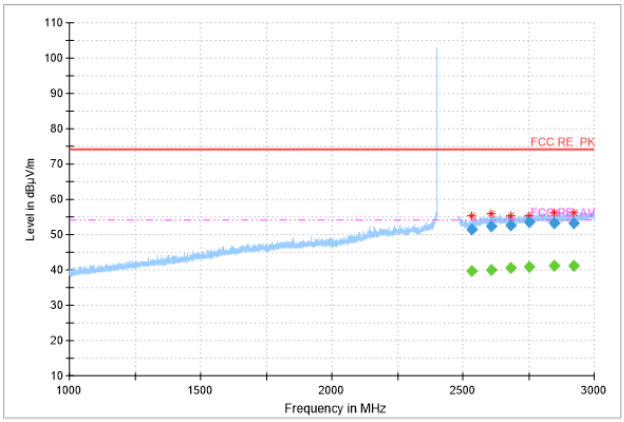
The measurement results are obtained as described below:

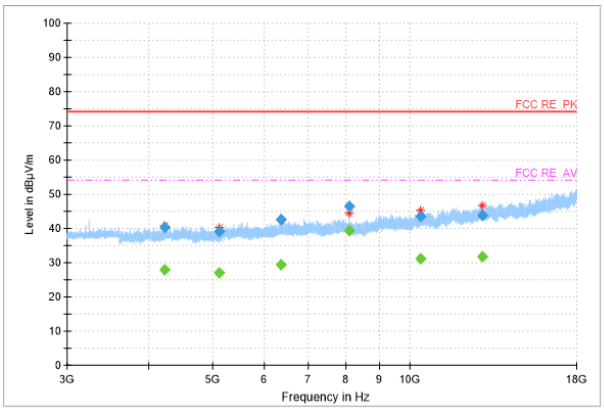
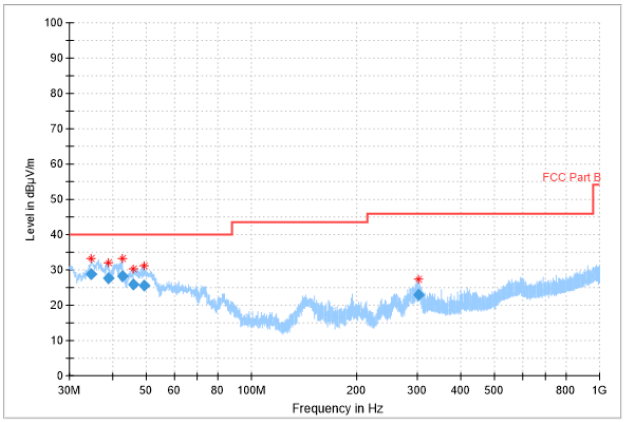
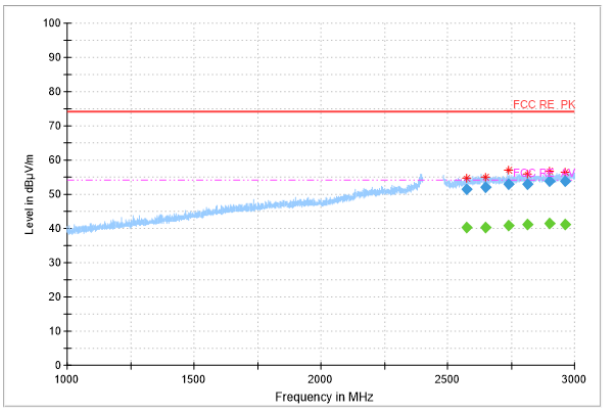
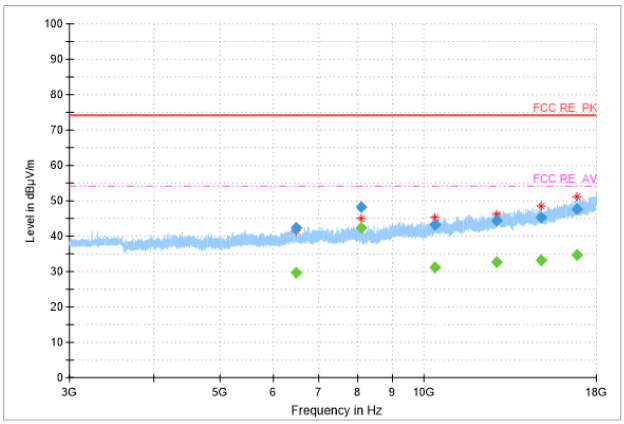
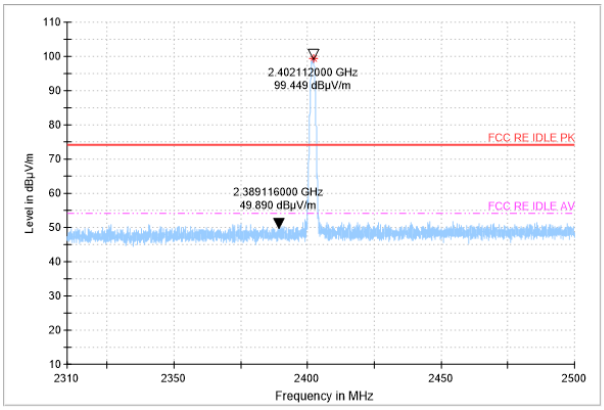
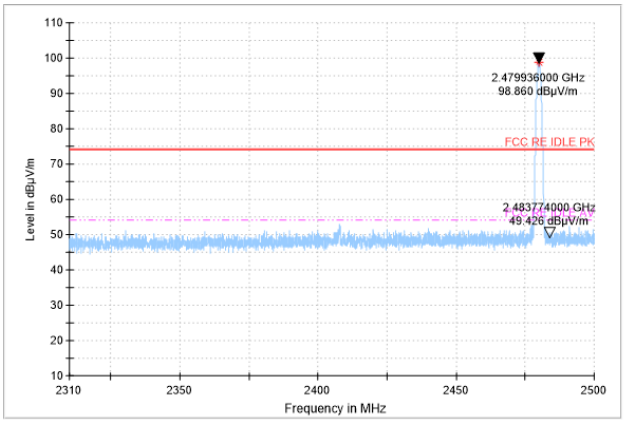
A_{Rpi} = Cable loss + Antenna Factor-Preamplifier gain

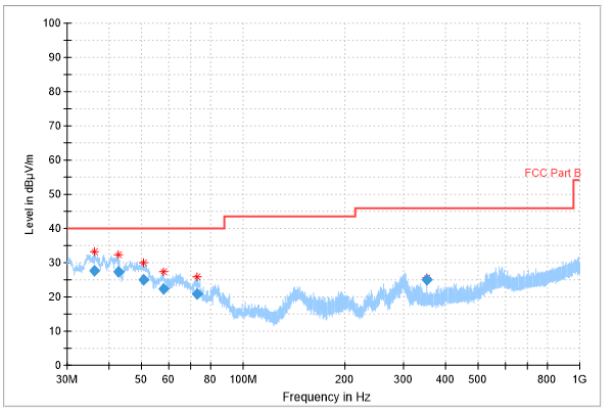
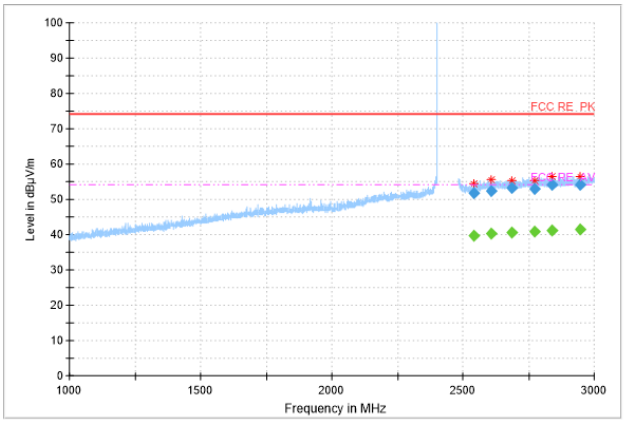
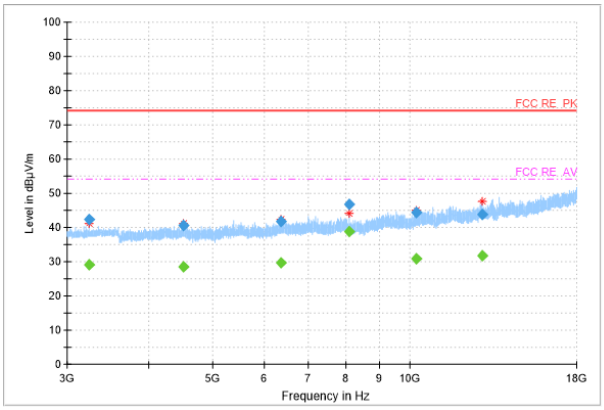
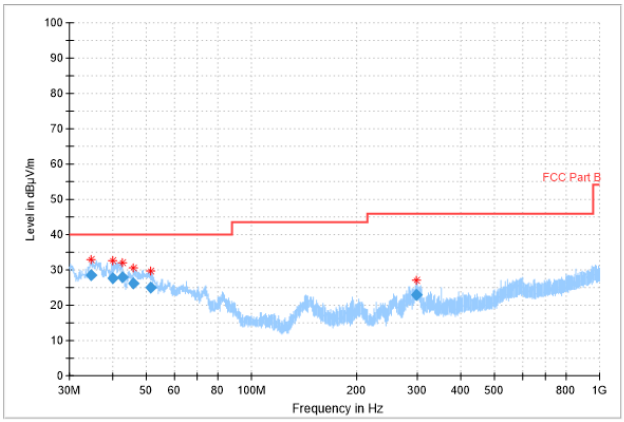
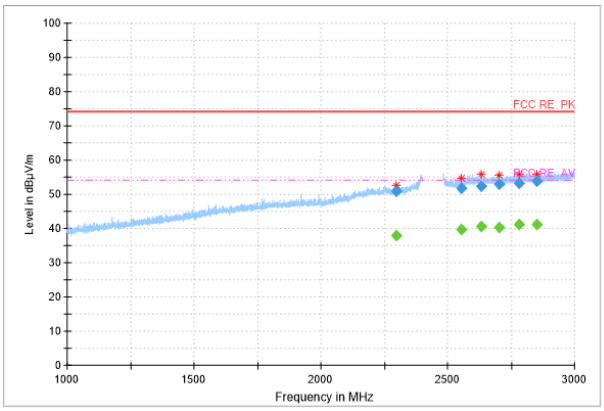
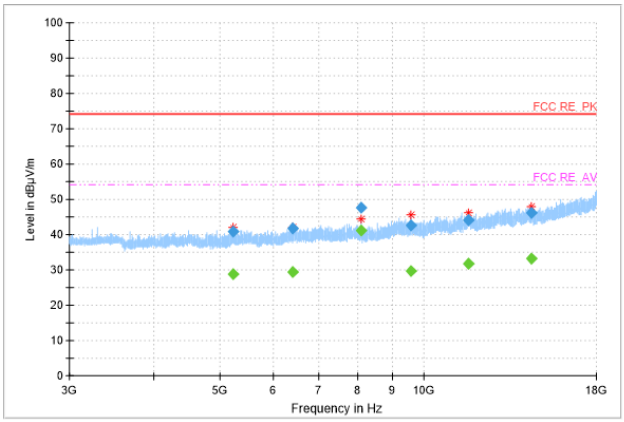
Result=P_{Mea} + A_{Rpi}

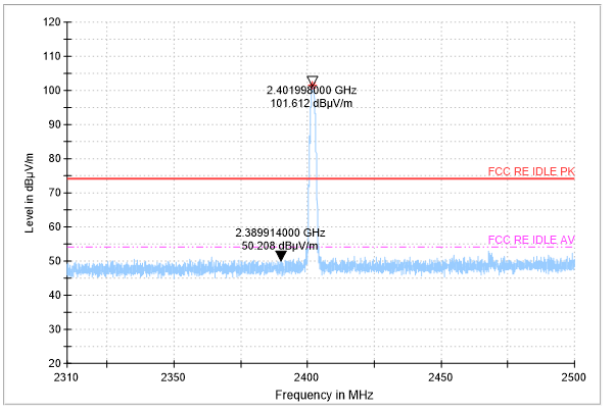
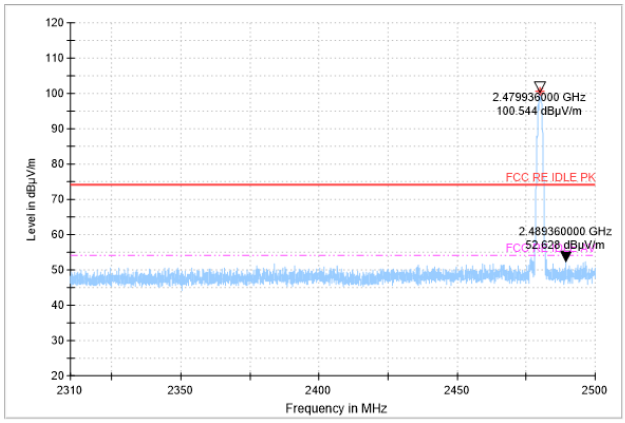
Mainly Supply

Radiated emission: GFSK, Ch0, 30MHz~1GHz	Radiated emission: GFSK, Ch0, 1GHz~3GHz
	
Radiated emission: GFSK, Ch0, 3GHz~18GHz	**Radiated emission: GFSK, Ch78, 30MHz~1GHz**
	

Radiated emission: GFSK, Ch78, 1GHz~3GHz	Radiated emission: GFSK, Ch78, 3GHz~18GHz
	
Bandedge (Low): GFSK, low channel	**Bandedge (High): GFSK, high channel**
	
Radiated emission: π/4 DQPSK, Ch0, 30MHz~1GHz	**Radiated emission: π/4 DQPSK, Ch0, 1GHz~3GHz**
	

Radiated emission: π/4 DQPSK, Ch0, 3GHz~18GHz	Radiated emission: π/4 DQPSK, Ch78, 30MHz~1GHz
	
Radiated emission: π/4 DQPSK, Ch78, 1GHz~3GHz	**Radiated emission: π/4 DQPSK, Ch78, 3GHz~18GHz**
	
Bandedge (Low): π/4 DQPSK, low channel	**Bandedge (Low): π/4 DQPSK, high channel**
	

Radiated emission: 8DPSK, Ch0, 30MHz~1GHz	Radiated emission: 8DPSK, Ch0, 1GHz~3GHz
	
Radiated emission: 8DPSK, Ch0, 3GHz~18GHz	**Radiated emission: 8DPSK, Ch78, 30MHz~1GHz**
	
Radiated emission: 8DPSK, Ch78, 1GHz~3GHz	**Radiated emission: 8DPSK, Ch78, 3GHz~18GHz**
	

Bandedge (Low): 8DPSK, low channel	Bandedge (High): 8DPSK, high channel
	

GFSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
34.6	28.1	-14.1	42.2	V
41.9	27.77	-12.6	40.37	V
72.2	21.54	-16.2	37.74	V
143.8	19.56	-17.1	36.66	H
350.0	24.57	-9.4	33.97	H
559.2	22.49	-4.3	26.79	H

GFSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2528.6	51.84	14.7	37.14	V
2596.9	52.55	15.5	37.05	H
2684.5	52.53	15.9	36.63	V
2777.3	52.64	16.4	36.24	V
2850.2	54.24	16.6	37.64	V
2965.0	52.95	17	35.95	H

GFSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
6331.6	42.06	-2.5	44.56	V
8099.5	45.54	-1.5	47.04	H
9594.3	41.77	-0.7	42.47	H
11667.4	43.75	2.1	41.65	V
14507.1	45.04	5.1	39.94	V
16527.9	46.89	8.3	38.59	V

GFSK CH78 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
35.0	28.4	-14	42.4	V
38.6	28.52	-13.2	41.72	V
42.7	27.63	-12.6	40.23	V
49.9	25.34	-11.9	37.24	V
62.2	21.54	-13.1	34.64	V
589.3	23.02	-3.9	26.92	V

GFSK Ch78 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2534.6	52.52	14.8	37.72	V
2628.7	52.03	15.7	36.33	V
2732.6	52.52	16.1	36.42	V
2803.5	53.19	16.6	36.59	H
2893.5	53.26	16.7	36.56	V
2980.9	54.24	17.1	37.14	H

GFSK Ch78 1GHz-3GHz (Average)

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2980.9	41.6	17.1	24.5	H

GFSK Ch78 3GHz-18GHz(Peak)

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
4960.0	43.6	-4.2	47.8	H
6296.7	42.02	-2.4	44.42	H
8993.2	43.64	-0.5	44.14	H
11774.7	43.31	2	41.31	V
14921.4	45.41	5.8	39.61	H
17302.2	46.84	9.3	37.54	V

π/4 DQPSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
34.5	28.12	-14.1	42.22	V
38.4	28.7	-13.2	41.9	V
41.4	26.82	-12.7	39.52	V
45.3	25.62	-12.3	37.92	V
49.4	25.52	-12	37.52	V
304.4	22.77	-10.7	33.47	H

π/4 DQPSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2531.4	51.56	14.7	36.86	V
2607.3	52.46	15.6	36.86	V
2680.2	52.76	15.9	36.86	V
2750.9	53.39	16.2	37.19	V
2847.6	53.31	16.6	36.71	V
2922.3	53.19	16.8	36.39	V

π/4 DQPSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
4221.6	40.36	-5.6	45.96	V
5113.1	39.25	-1.7	40.95	V

6368.0	42.63	-2.5	45.13	V
8099.7	46.49	-1.5	47.99	V
10391.0	43.49	0.6	42.89	H
12931.1	43.78	3.4	40.38	V

π /4 DQPSK Ch78 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
34.7	28.7	-14.1	42.8	V
38.9	27.73	-13.1	40.83	V
42.7	28.12	-12.6	40.72	V
45.7	25.99	-12.3	38.29	V
49.1	25.63	-12	37.63	V
301.6	23.04	-10.8	33.84	H

π /4 DQPSK Ch78 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2576.3	51.5	15.3	36.2	H
2649.2	52.2	15.9	36.3	V
2738.4	52.91	16.1	36.81	H
2815.7	52.85	16.6	36.25	H
2901.7	53.81	16.7	37.11	V
2962.1	53.94	16.9	37.04	V

π /4 DQPSK Ch78 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
6478.0	42.41	-2.6	45.01	H
8099.9	48.1	-1.5	49.6	V
10394.4	43.1	0.6	42.5	H
12799.2	44.49	3	41.49	V
14922.3	45.2	5.8	39.4	V
16843.6	47.71	8.9	38.81	H

8DPSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
36.1	27.78	-13.8	41.58	V
42.5	27.45	-12.6	40.05	V
50.5	25.14	-11.9	37.04	V
58.1	22.24	-12.2	34.44	V
73.0	20.94	-16.4	37.34	V
350.0	24.96	-9.4	34.36	H

8DPSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2540.5	51.71	14.9	36.81	V
2608.8	52.5	15.6	36.9	V
2685.5	53.09	15.9	37.19	H
2771.3	52.85	16.4	36.45	H
2840.9	54.26	16.6	37.66	H
2947.0	54.19	16.8	37.39	H

8DPSK Ch0 1GHz-3GHz (Average)

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2840.9	41.3	16.6	24.7	H
2947.0	41.53	16.8	24.73	H

8DPSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
3240.1	42.26	-7.3	49.56	V
4510.2	40.47	-4.9	45.37	H
6356.5	41.7	-2.5	44.2	H
8100.1	46.62	-1.5	48.12	V
10238.1	44.38	0.1	44.28	H

12906.7	43.7	3.3	40.4	H

8DPSK Ch78 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
34.7	28.54	-14.1	42.64	V
40.0	27.51	-12.8	40.31	V
42.7	27.85	-12.6	40.45	V
45.7	26.19	-12.3	38.49	V
51.3	25.14	-12	37.14	V
296.9	22.9	-10.9	33.8	H

8DPSK Ch78 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2297.6	50.79	13.2	37.59	V
2555.4	51.89	15.2	36.69	V
2630.3	52.5	15.7	36.8	V
2702.2	52.9	15.9	37	H
2779.9	53.34	16.4	36.94	H
2850.6	53.78	16.6	37.18	H

8DPSK Ch78 3GHz-18GHz

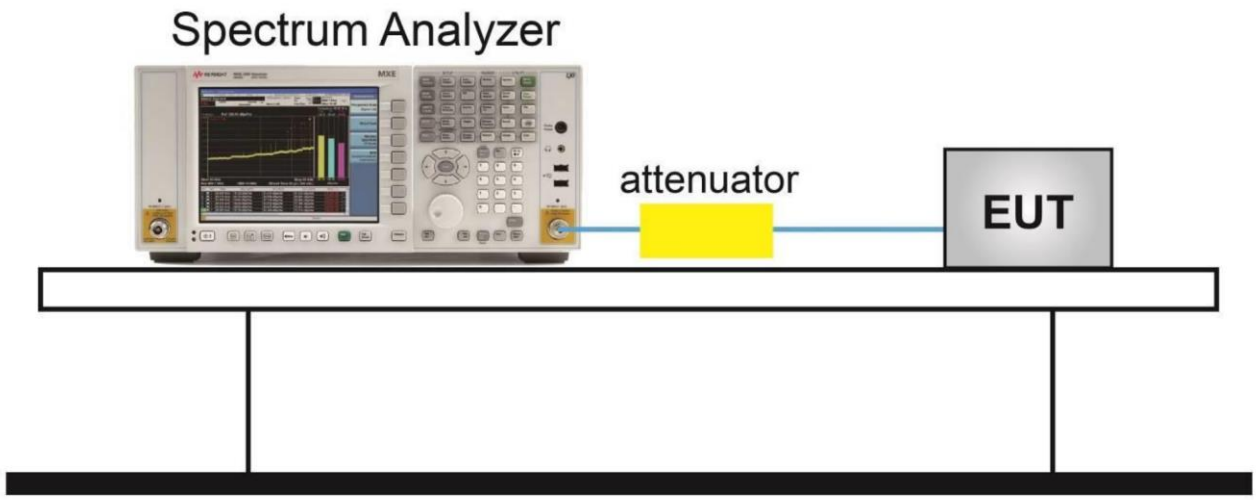
Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
5234.8	40.95	-1.4	42.35	V
6408.4	41.62	-2.6	44.22	V
8099.9	47.55	-1.5	49.05	V
9598.1	42.71	-0.8	43.51	V
11631.0	44.18	2.2	41.98	H
14437.3	46.15	5.1	41.05	H

6.5. Time Of Occupancy (Dwell Time)

6.5.1. Measurement Limit

Standard	Limit (ms)
FCC 47 Part 15.247 (a) (1) (iii)	< 400
RSS-247 5.5	< 400

6.5.2. Test Setup



6.5.3. Test procedures

The measurement is according to ANSI C63.10 clause 7.8.4

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit maximum power.
3. Set the spectrum analyzer as step 4 to step 8.
4. Span: Zero span, centered on a hopping channel.
5. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
6. 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 showtwo successive hops on a channel.
7. Detector function: Peak.
8. Trace: Max hold.
9. Use the marker-delta function, and record it.

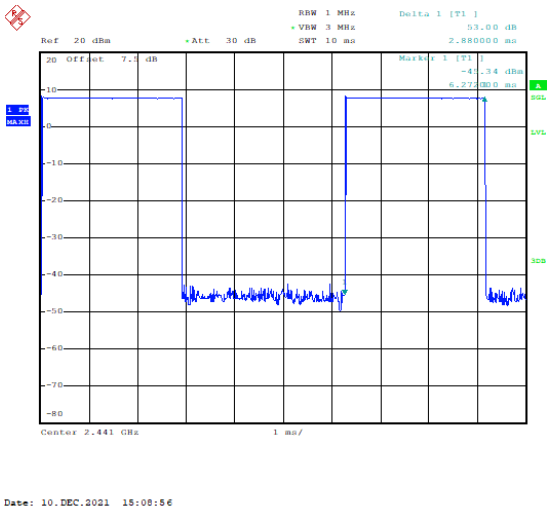
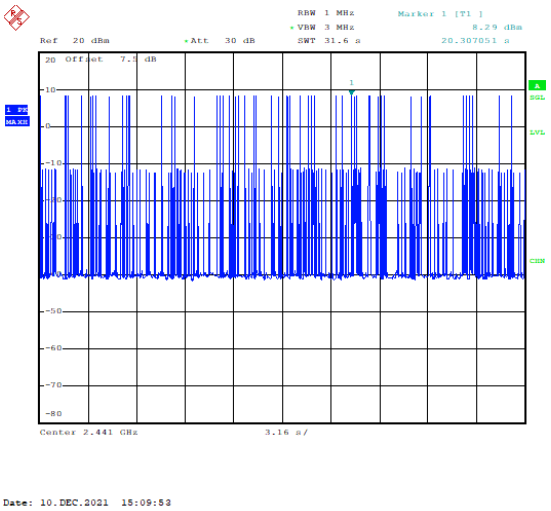
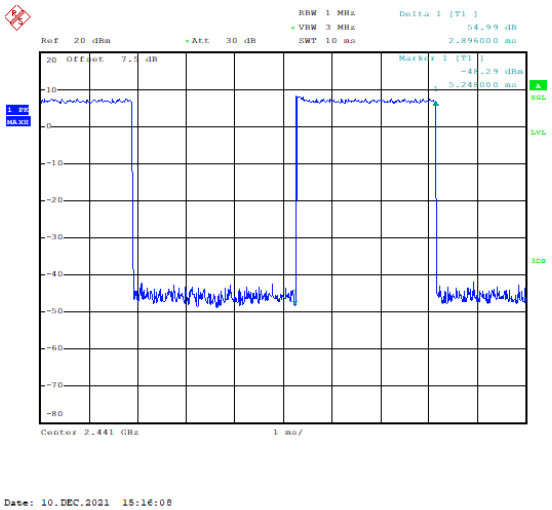
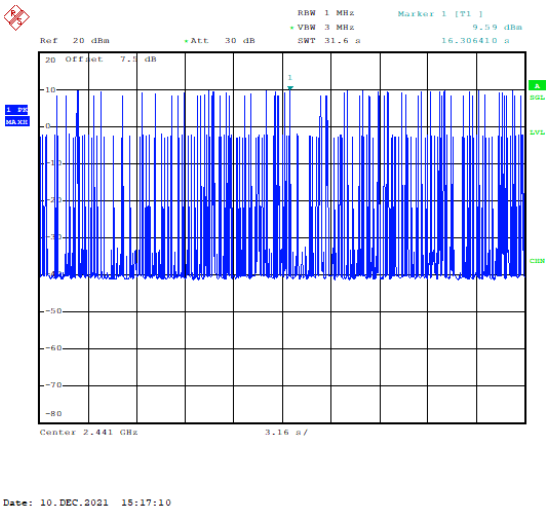
Note: For AFH mode, Test Period = 0.4 (second/ channel) x 20 Channel = 8 sec,

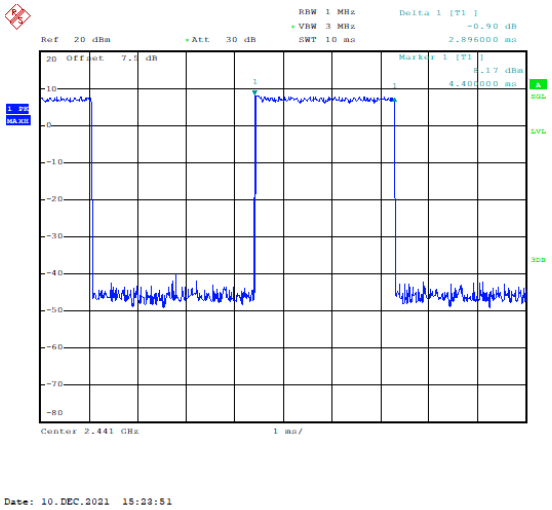
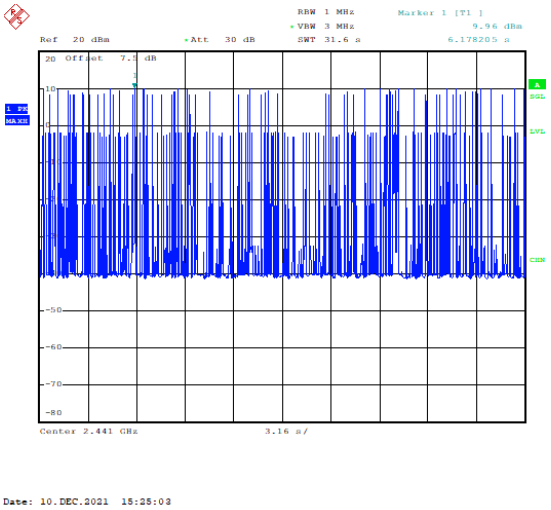
For FHSS mode, Test Period = 0.4 (second/ channel) x 79 Channel = 31.6 sec,
So the Time of Occupancy (Dwell Time) of AFH mode= Time of Occupancy (Dwell Time) of FHSS mode / 79 Channel x 20 Channel

Modulation type	Frequency (MHz)	Time slot length (ms)	Hop number	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK DH5	2402-2480	2.88	51	146.88	400	P
π/4 DQPSK 2DH5	2402-2480	2.90	58	167.97	400	P
8DPSK 3DH5	2402-2480	2.90	62	179.55	400	P

Note: Dwell time = time slot length * hop rate

Measurement Result

For GFSK, Ch39,Packet DH5 Time of occupancy (Dwell Time): 2.88ms	For GFSK, Ch39,Packet DH5 Number of Transmissions Measurement
	
For π/4 DQPSK, Ch39,Packet 2DH5 Time of occupancy (Dwell Time):2.9 ms	For π/4 DQPSK, Ch39,Packet 2DH5 Number of Transmissions Measurement
	

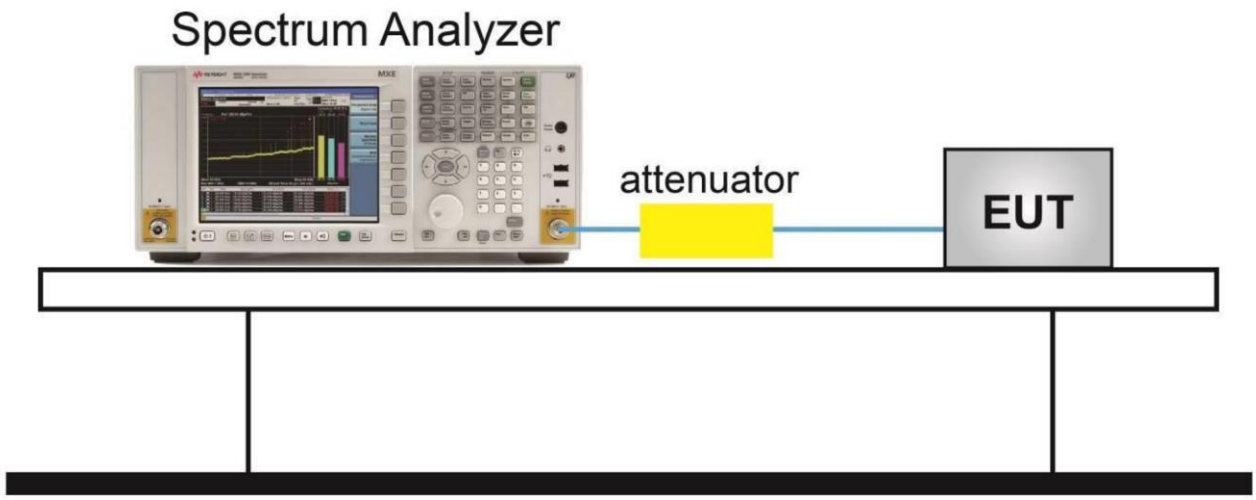
For 8DPSK, Ch39,Packet 3DH5 Time of occupancy (Dwell Time):2.90ms	For 8DPSK, Ch39,Packet 3DH5 Number of Transmissions Measurement
	

6.6. 20dB Bandwidth

6.6.1. Measurement Limit

Standard	Limit
FCC 47 Part 15.247 (a) (1)	N/A
RSS-247 5.1(b)	N/A

6.6.2. Test Setup



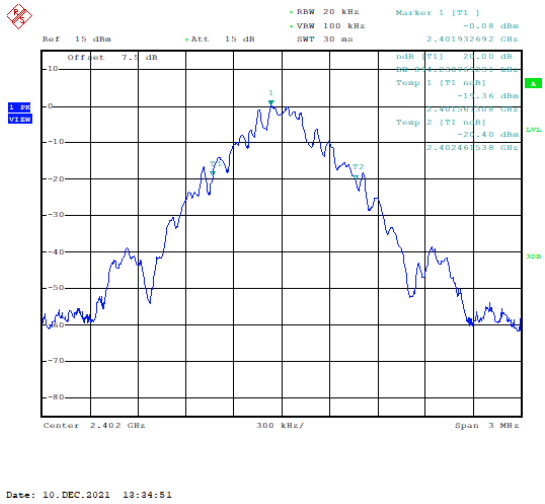
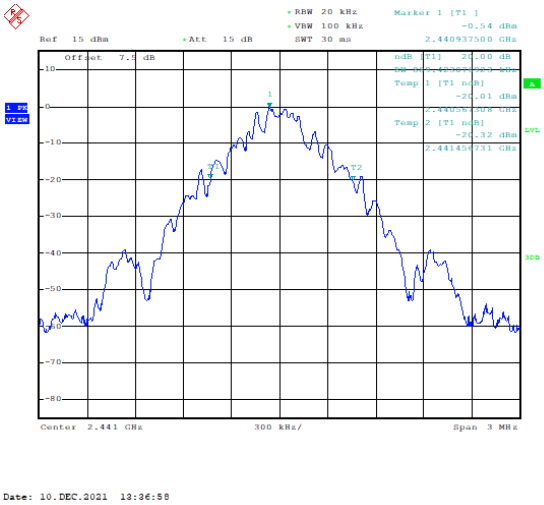
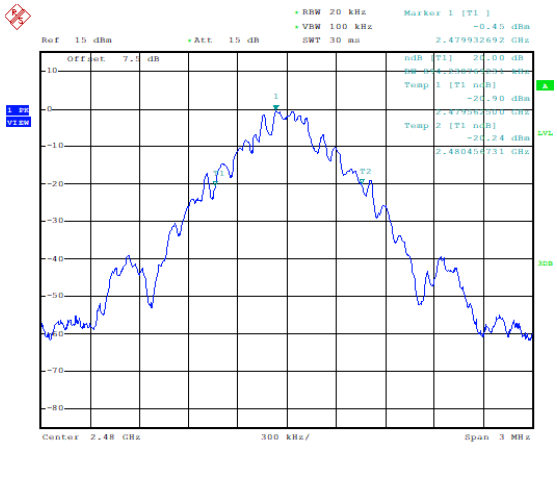
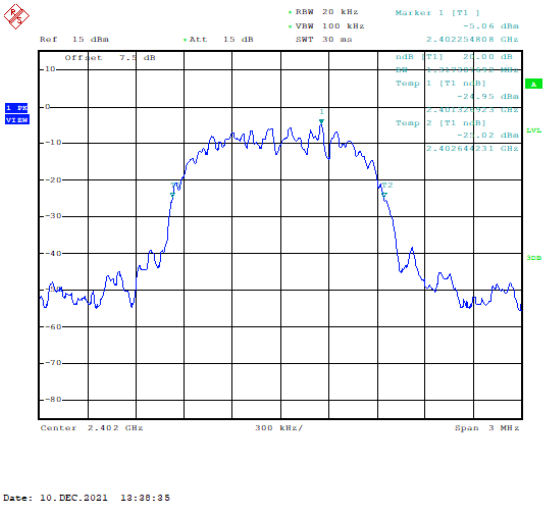
6.6.3. Test procedures

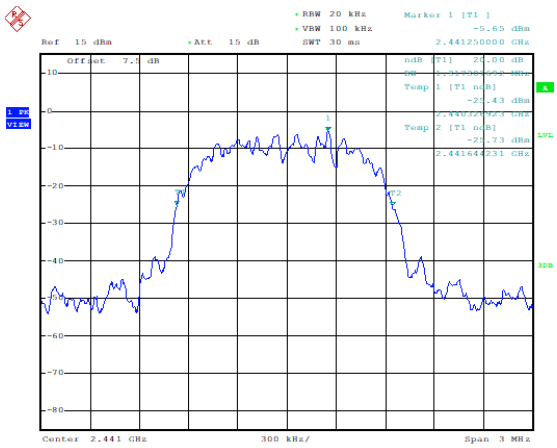
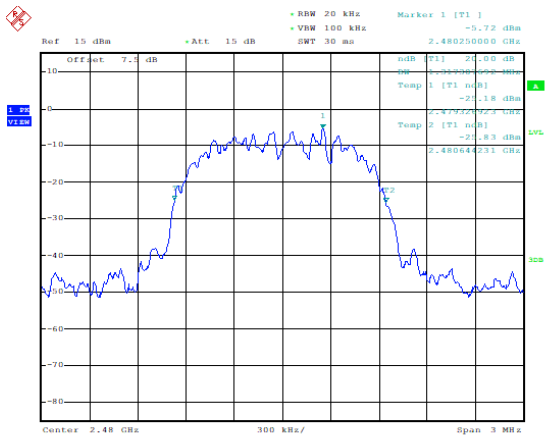
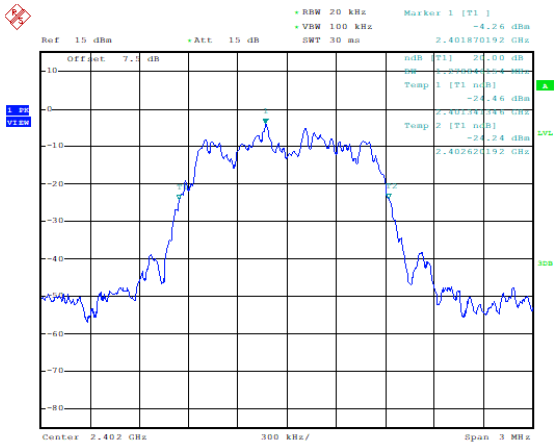
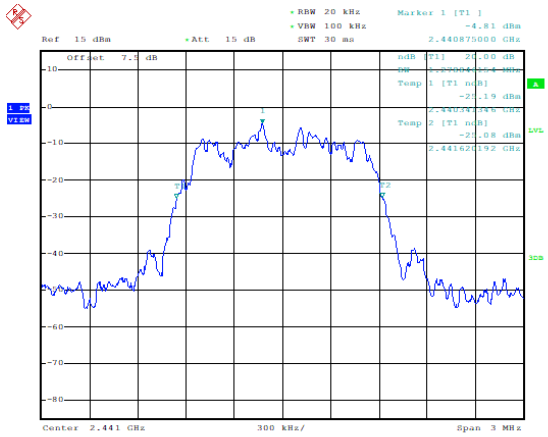
The measurement is according to ANSI C63.10 clause 7.8.7

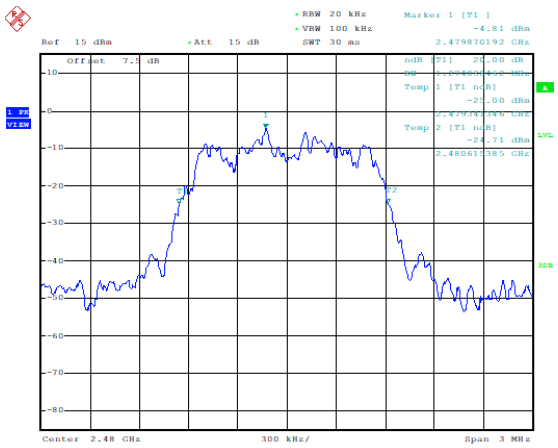
1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit maximum power.
3. Set the spectrum analyzer as step 4 to step 7.
4. Span: two or five times of OBW
5. RBW= 1% to 5% of the OBW; VBW is approximately three times of RBW; Max Hold.
6. Select the max peak, and N DB DOWN=20dB.
7. Record the results.

Measurement Result

Note: Bold font is the maximum Value

20dB Bandwidth: GFSK, Ch0(MHz)	0.894	20dB Bandwidth: GFSK, Ch39(MHz)	0.894
			
20dB Bandwidth: GFSK, Ch78(MHz)	0.894	20dB Bandwidth: π/4 DQPSK, Ch0(MHz)	1.317
			

20dB Bandwidth: π/4 DQPSK, Ch39(MHz)	1.317	20dB Bandwidth: π/4 DQPSK, Ch78(MHz)	1.317
			
Date: 10.DEC.2021 13:39:14		Date: 10.DEC.2021 13:39:51	
20dB Bandwidth: 8DPSK, Ch0(MHz)	1.270	20dB Bandwidth: 8DPSK, Ch39(MHz)	1.270
			
Date: 10.DEC.2021 13:40:36		Date: 10.DEC.2021 13:41:10	

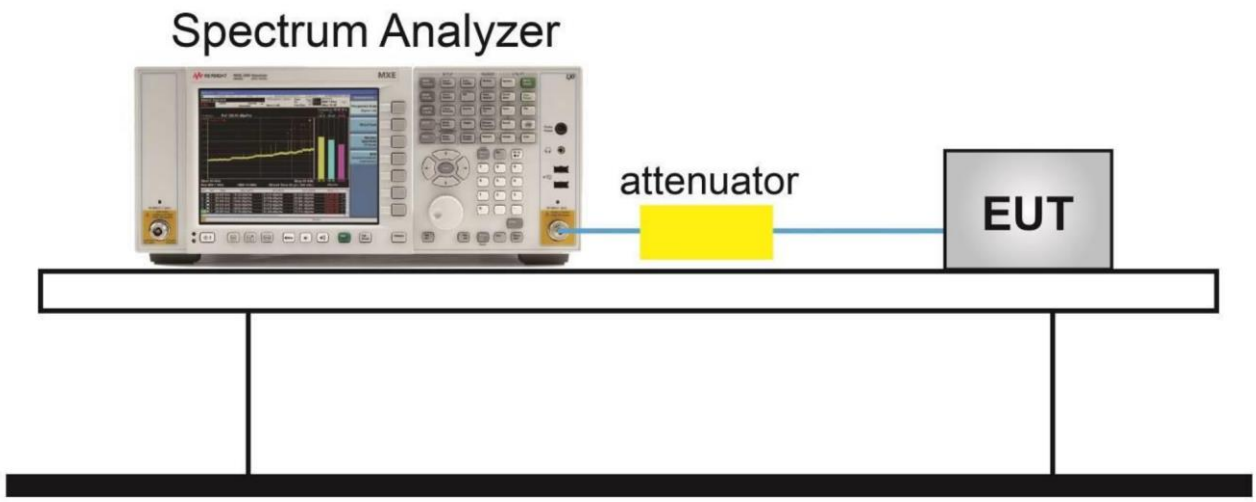
20dB Bandwidth: 8DPSK, Ch78(MHz)	1.274	/
		/

6.7. 99% Occupied Bandwidth

6.7.1. Measurement Limit

Standard	Limit
RSS-Gen 6.7	N/A

6.7.2. Test Setup



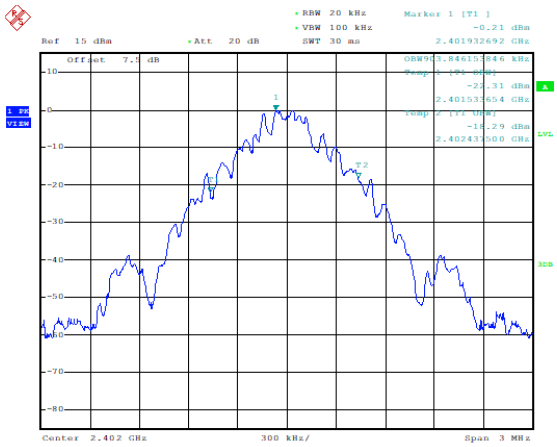
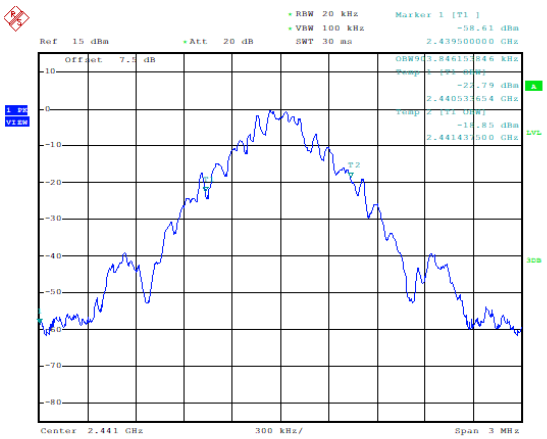
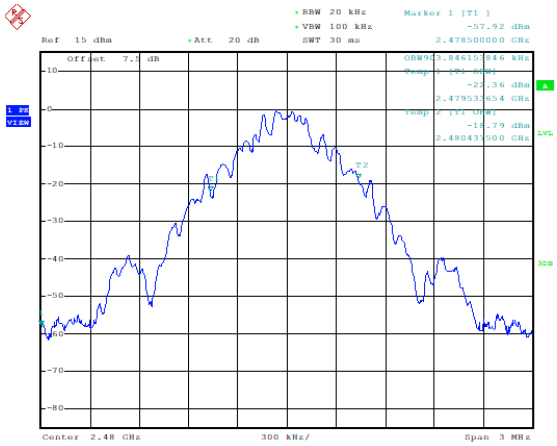
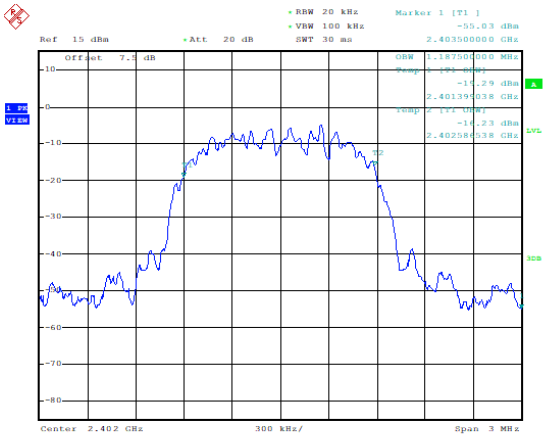
6.7.3. Test procedures

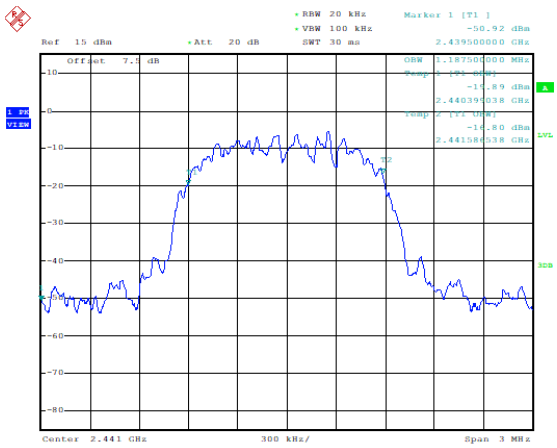
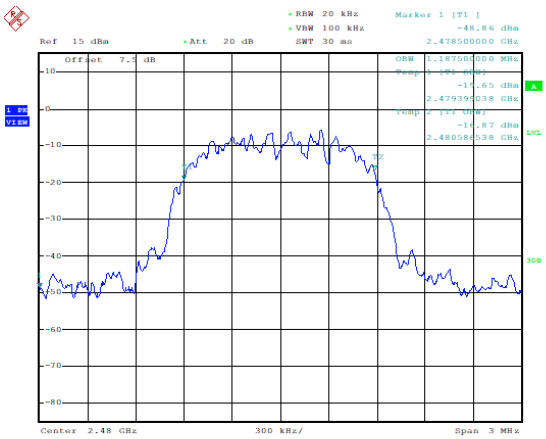
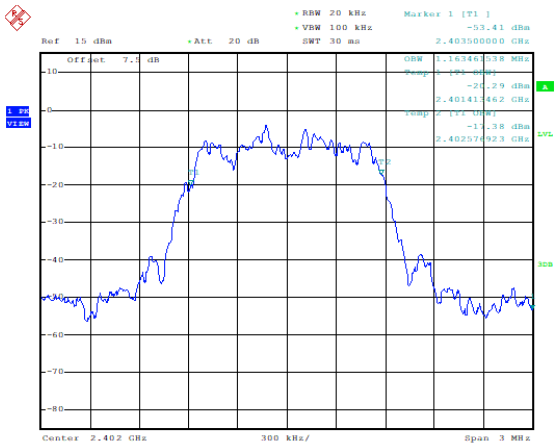
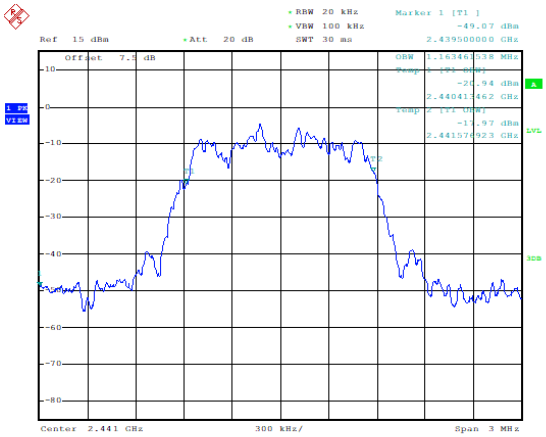
The measurement is according to ANSI C63.10 clause 6.9.3.

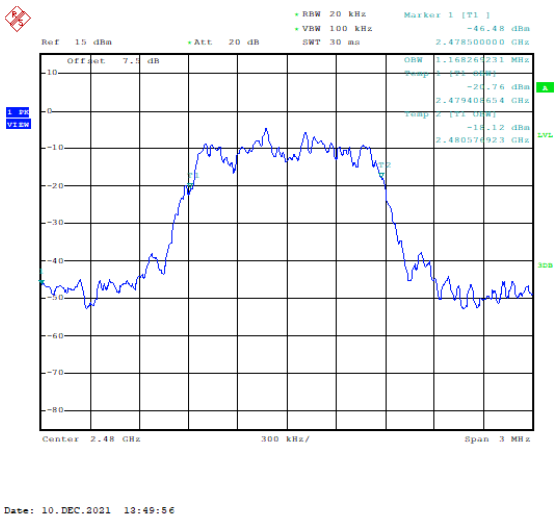
1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW shall be in the range of 1% to 5% of the OBW.
4. Set the VBW ⩾ [3 × RBW].
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

Measurement Result

Note: Bold font is the maximum Value

99% Bandwidth: GFSK, Ch0 (KHz)	**903.846**	99% Bandwidth: GFSK, Ch39 (KHz)	903.846
			
99% Bandwidth: GFSK, Ch78 (KHz)	903.846	99% Bandwidth: DQPSK, Ch0 (KHz)	**1187.5**
			

99% Bandwidth: DQPSK, Ch39(KHz)	1187.5	99% Bandwidth: DQPSK, Ch78(KHz)	1187.5
			
99% Bandwidth: 8DPSK, Ch0 (KHz)	1163.462	99% Bandwidth: 8DPSK, Ch39 (KHz)	1163.462
			

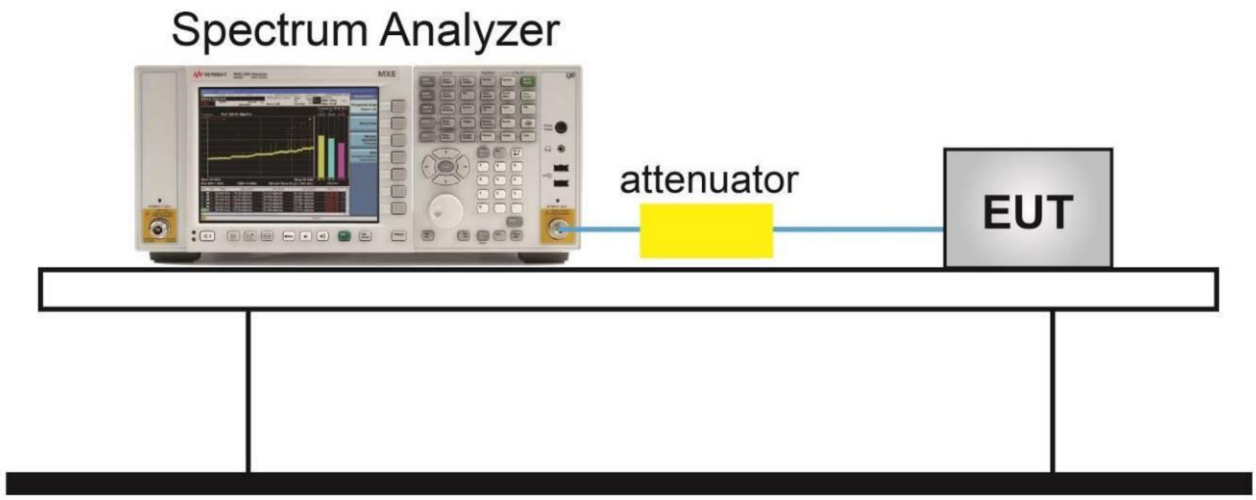
99% Bandwidth: 8DPSK, Ch78(KHz)	**1168.265**	/	/
 		/	

6.8. Carrier Frequency Separation

6.8.1. Measurement Limit

Standard	Limit (KHz)
FCC 47 Part 15.247 (a) (1)	Over 25KHz or (2/3)*20dB bandwidth
RSS-247 5.1	Over 25KHz or (2/3)*20dB bandwidth

6.8.2 Test Setup



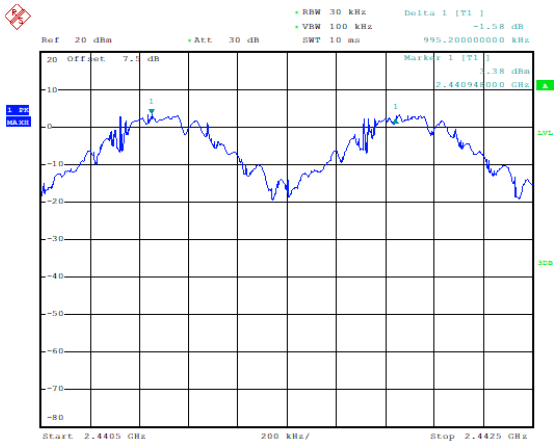
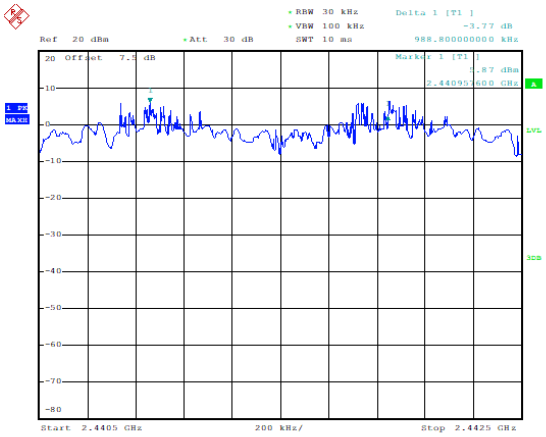
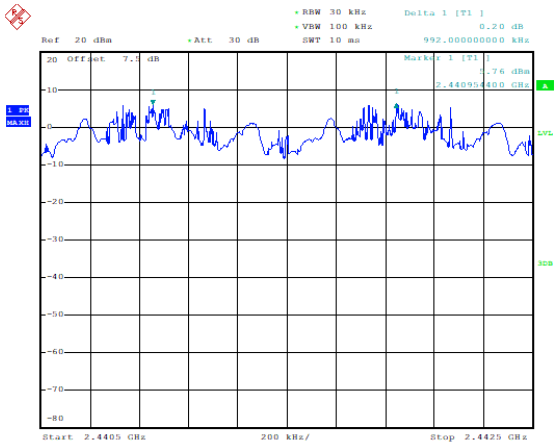
6.8.3. Test procedures

The measurement is according to ANSI C63.10 clause 7.8.2.

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit in hopping mode.
3. Span: Wide enough to capture the peaks of two adjacent channels.
4. 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.
5. Video (or average) bandwidth (VBW) ≥ RBW.
6. Sweep: Auto.
7. Detector function: Peak.
8. Trace: Max hold.
9. Allow the trace to stabilize.

Measurement Result

Note: Bold font is the maximum Value

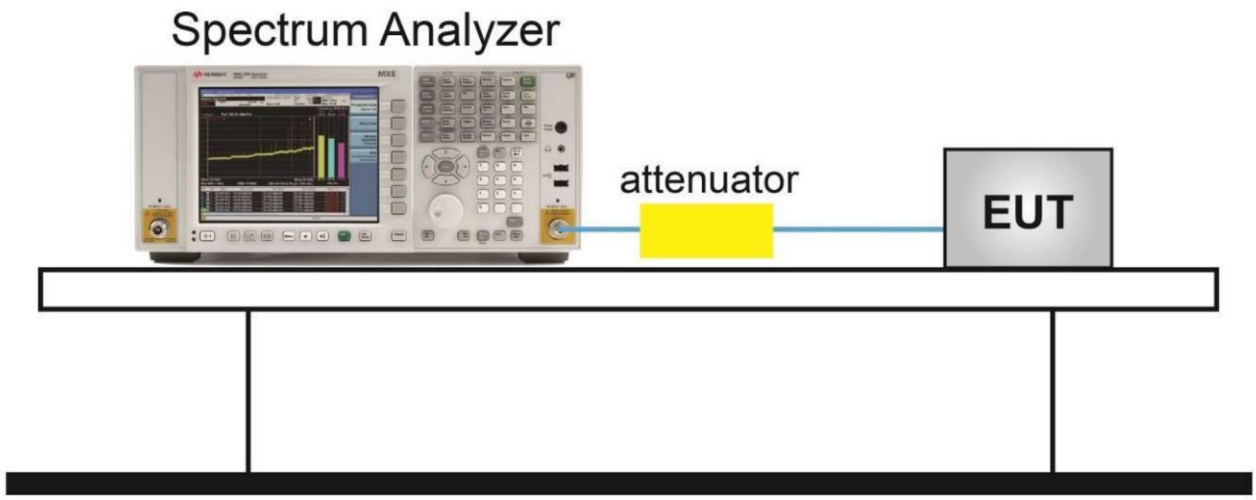
Carrier separation measurement: GFSK, Ch39 (kHz)	**995.2**	Carrier separation measurement: π/4 DQPSK, Ch39(kHz)	988.8
			
Carrier separation measurement: 8DPSK, Ch39(kHz)	992.0	/	
		/	

6.9. Number Of Hopping Channels

6.9.1. Measurement Limit

Standard	Limit
FCC 47 CFR Part 15.247 (a)(1)(iii)	At least 15 non-overlapping channels
RSS-247 5.1	At least 15 non-overlapping channels

6.9.2. Test Setup

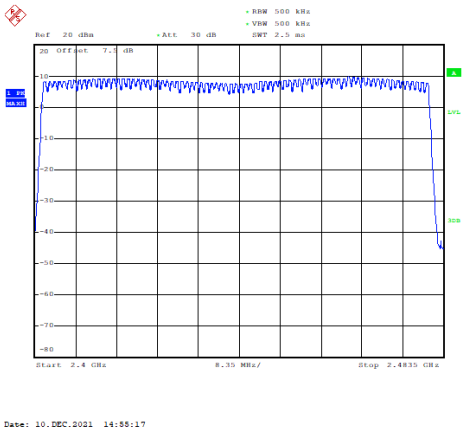
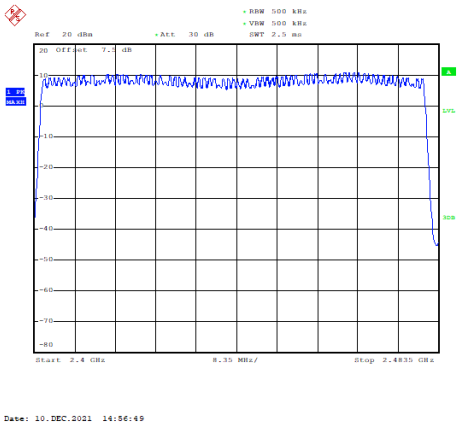
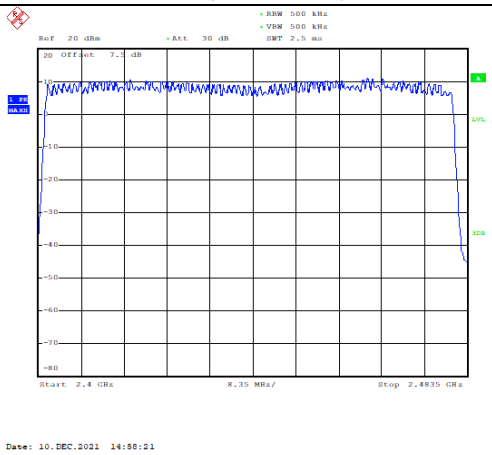


6.9.3. Test procedure

The measurement is according to ANSI C63.10 clause 7.8.3.

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit in hopping mode.
3. 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.
4. 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.
5. VBW ≥ RBW.
6. Sweep: Auto.
7. Detector function: Peak.
8. Trace: Max hold.
9. Allow the trace to stabilize.
10. Record the test results.

Measurement Result:

Number of hopping frequency GFSK Ch0~78:79	Number of hopping frequency π/4 DQPSK Ch0~78:79
	
Number of hopping frequency 8PSK Ch0~78:79	
	

6.10. AC Powerline Conducted Emission

6.10.1. Method of Measurement: ANSI C63.10-2013-clause 6.2

1 The one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT.

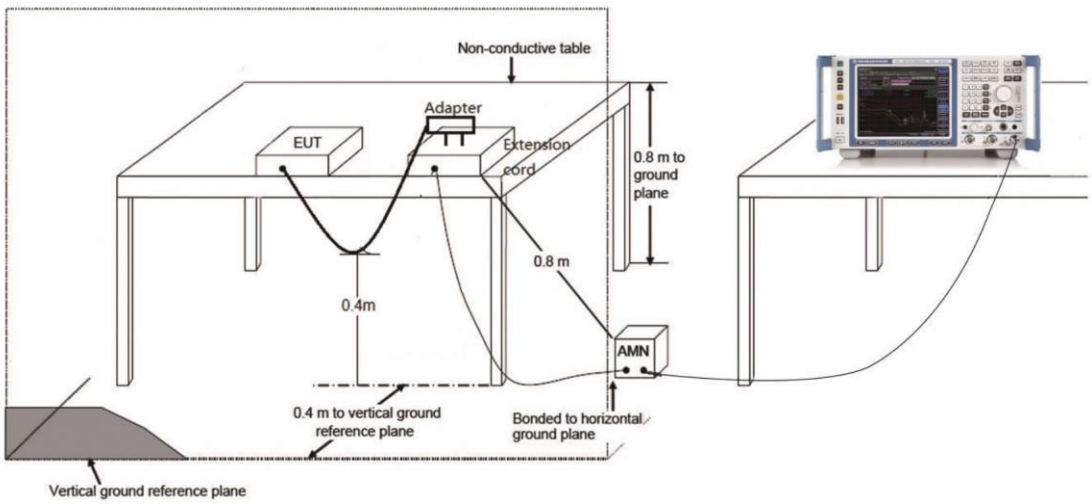
2 If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed.

3 The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation.

4 If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. When measuring the ac conducted emissions from a device that operates between 150 kHz and 30 MHz a non-detachable antenna may be replaced with a dummy load for the measurements within the fundamental emission band of the transmitter, but only for those measurements.36 Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

6.10.2. Test Setup



6.10.3. Test Condition

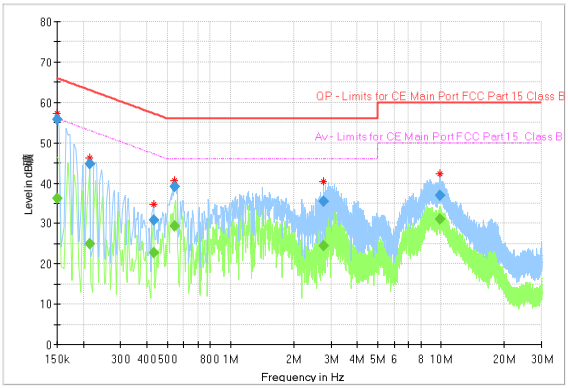
Voltage（V）	Frequency（Hz）
120	60

Measurement Result and limit

(Quasi-peak-average Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Average Limit (dBμV)	Conclusion
0.15 to 0.5	66 to 56	56 to 46	P
0.5 to 5	56	46	
5 to 30	60	50	
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.			

Mainly Supply

CA02	/
	/

CA02

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	36.20	56.00	19.80	15000.0	9.000	L1	ON	9.6
0.150000	55.71	---	66.00	10.29	15000.0	9.000	L1	ON	9.6
0.213431	---	25.06	53.07	28.01	15000.0	9.000	L1	ON	9.6
0.213431	44.67	---	63.07	18.40	15000.0	9.000	L1	ON	9.6
0.429844	---	22.72	47.26	24.54	15000.0	9.000	N	ON	9.6
0.429844	30.94	---	57.26	26.31	15000.0	9.000	N	ON	9.6
0.541781	---	29.43	46.00	16.57	15000.0	9.000	N	ON	9.6
0.541781	39.19	---	56.00	16.81	15000.0	9.000	N	ON	9.6
2.765606	---	24.36	46.00	21.64	15000.0	9.000	N	ON	9.7
2.765606	35.51	---	56.00	20.49	15000.0	9.000	N	ON	9.7
9.892294	---	31.14	50.00	18.86	15000.0	9.000	N	ON	9.9
9.892294	37.05	---	60.00	22.95	15000.0	9.000	N	ON	9.9

7. Test Equipment List

7.1. Conducted Test System

Item	Equipment Name	Type	Serial Number	Manufacturer	Cal. Date	Cal. interval
1	Vector Signal Analyzer	FSQ26	101091	R&S	2021-05-10	1 year
2	DC Power Supply	ZUP60-14	LOC-220Z006-0007	TDL-Lambda	2021-05-10	1 year
3	Eagle Test Software	Eagle V3.1 FCC BT/WIFI	N/A	ECIT	N/A	N/A

7.2. Radiated Emission Test System

Item	Equipment Name	Type	Serial Number	Manufacturer	Cal. Date	Cal. interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	2021-05-10	1 year
2	EMI Test Receiver	ESU40	100307	R&S	2021-03-03	1 year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2021-02-03	2 years
4	Double- ridged Waveguide Antenna	ETS-3117	00135890	ETS	2020-02-28	3 years
5	Universal Radio Communication Tester	CMW500	104178	R&S	2021-05-10	1 year
6	EMI Test Software	EMC32 V 9.15.00	N/A	R&S	N/A	N/A

Anechoic chamber

Fully anechoic chamber by ETS.

Annex A: Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in 3IN documents. The detailed measurement uncertainty is defined in 3IN documents.

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Peak Output Power-Conducted	2402MHz-2480MHz	95%	0.544dB
Frequency Band Edges-Conducted	2402MHz-2480MHz	95%	0.544dB
Conducted Emission	30MHz-2GHz	95%	0.90dB
Conducted Emission	2GHz-3.6GHz	95%	0.88dB
Conducted Emission	3.6GHz-8GHz	95%	0.96dB
Conducted Emission	8GHz-20GHz	95%	0.94dB
Conducted Emission	20GHz-22GHz	95%	0.88dB
Conducted Emission	22GHz-26GHz	95%	0.86dB
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	5.66dB
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	4.98dB
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	5.06dB
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	5.20dB
Dwell Time	2402MHz-2480MHz	95%	0.218ms
20dB Bandwidth	2402MHz-2480MHz	95%	62.04Hz
AC Power line Conducted Emission	0.15MHz-30MHz	95%	3.66 dB

Annex B: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

INDUSTRIAL INTERNET INNOVATION CENTER (SHANGHAI) CO., LTD.

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 12th day of April 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

**********END OF REPORT**********