TEST REPORT

No. I19D000121-SRD01

For

Client: Shanghai Sunmi Technology Co.,Ltd.

Production: Smart POS system

Model Name: T6900

Brand Name: SUNMI

FCC ID: 2AH25T6900

Hardware Version: B1691_MAIN_PCB

Software Version: V1.0.1

Issued date: 2019-08-28

NOTE

1. The test results in this test report relate only to the devices specified in this report.
2. This report shall not be reproduced except in full without the written approval of East China Institute of Telecommunications.
3. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

Test Laboratory:
East China Institute of Telecommunications
Add: 7-8F, G Area, No.668, Beijing East Road, Huangpu District, Shanghai, P. R. China
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Revision Version

Report Number	Revision	Date	Memo
I19D00121-SRD01	00	2019-08-28	Initial creation of test report

CONTENTS

1. Test Laboratory

1.1. Testing Location

Company Name	East China Institute of Telecommunications
Address	7-8/F., Area G, No.668, Beijing East Road, Shanghai, China
Postal Code	200001
Telephone	+86 21 63843300
Fax	+86 21 63843301
FCC registration No	CN1177

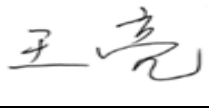
1.2. Testing Environment

Normal Temperature	15℃-35℃
Relative Humidity	20%-75%

1.3. Project Data

Project Leader	Chen Minfei
Testing Start Date	2019-08-06
Testing End Date	2019-08-08

1.4. Signature



Wang Liang
(Prepared this test report)

Fan Songyan
(Reviewed this test report)

Zheng Zhongbin
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 605, Block 7, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	86-18721763396
Postcode	/

2.2. Manufacturer Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 605, Block 7, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	86-18721763396
Postcode	/

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

3.1. About EUT

Production	Smart POS system
Model name	T6900
BT Frequency	2402MHz-2480MHz
BT Channel	Channel0-Channel78
BT type of modulation	GFSK/ π /4 DQPSK/8DPSK
Additional Communication Function	BT/BLE/2.4G WLAN 802.11 b/g/n20/n40/5G WLAN 802.11 a/n20/n40
Extreme Temperature	0/+45℃
Nominal Voltage	7.6V
Extreme High Voltage	8.7V
Extreme Low Voltage	6.8V
Maximum of Antenna Gain	Bluetooth: 0.74dBi

Note:

a. Photographs of EUT are shown in ANNEX A of this test report.

b. The value of the antenna gain is provided by the customer. For specific antenna information, please check the antenna specifications of the customer.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
N02	865150030742925 865150030742926	B1691_MAIN_PCB	V1.0.1	2019-08-06
N04	865150030742925 865150030742926	B1691_MAIN_PCB	V1.0.1	2019-08-06

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

3.3. Internal Identification of AE used during the test

AE ID*	Description	Type	Manufacturer
AE1	RF cable	---	AE1

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

4. Reference Documents

4.1. Documents supplied by applicant

All technical documents are supplied by the client or manufacturer, which is the basis of testing.

4.2. 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.	2018-10-01
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
KDB 558074	Guidance for Performing Compliance Measurements on Frequency Hopping Spread Spectrum systems (DSS) Operating Under §15.247	v05r02

5. Test Results

5.1. Summary of Test Results

Measurement Items	Sub-clause of Part15C	Verdict
Maximum Peak Output Power	15.247(b)	P
20dB Occupied Bandwidth	15.247(a)	P
Band Edges Compliance	15.247(b)	P
Time Of Occupancy (Dwell Time)	15.247(a)	P
Carrier Frequency Separation	15.247(a)	P
Number Of Hopping Channels	15.247(a)	P
Transmitter Spurious Emission-Conducted	15.247	P
Transmitter Spurious Emission-Radiated	15.247,15.209,	P
AC Powerline Conducted Emission	15.107,15.207	P

Note: please refer to Annex A in this test report for the detailed test results.

The following terms are used in the above table.

P	Pass, the EUT complies with the essential requirements in the standard.
NP	Not Perform, the test was not performed by ECIT.
NA	Not Applicable, the test was not applicable.
F	Fail, the EUT does not comply with the essential requirements in the standard.

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	25℃
Voltage	Vnom	7.6V
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 T6900 is an initial product for testing.
ECIT only performed test cases which identified with P/NP/NA/F results in Annex A.

ECIT 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. Test Equipments Utilized

6.1. Conducted Test System

Item	Instrument Name	Type	SN	Manufacturer	Cal. Date	Cal. interval
1	Vector Signal Analyzer	FSQ26	101091	R&S	2019-05-10	1 year
2	DC Power Supply	ZUP60-14	LOC-220Z006-0007	TDL-Lambda	2019-05-10	1 year

6.2. Radiated Emission Test System

Item	Instrument Name	Type	SN	Manufacturer	Cal. Date	Cal. interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	2019-05-10	1 year
2	EMI Test Receiver	ESU40	100307	R&S	2018-05-11	1 year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2017-02-25	3 years
4	Double- ridged Waveguide Antenna	ETS-3117	00135890	ETS	2017-01-11	3 years
5	2-Line V-Network	ENV216	101380	R&S	2019-05-10	1 year

Anechoic chamber

Fully anechoic chamber by ETS.

7. Measurement Uncertainty

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

8. Test Environment

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

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

ANNEX A. Detailed Test Results

ANNEX A.1. Peak Output Power-Conducted

A.1.1 Measurement Limit

Standard	Limit (dBm)
FCC Part 15.247(b)(1)	< 21

A.1.2 Test Condition:

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

A.1.3 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:

For GFSK

Channel	Ch0 2402 MHz	Ch39 2441 MHz	CH78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	5.51	4.83	5.26	P
	Fig.1	Fig.2	Fig.3	

For π/4 DQPSK

Channel	Ch0 2402 MHz	Ch39 2441 MHz	CH78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.31	3.84	4.01	P
	Fig.4	Fig.5	Fig.6	

For 8DPSK

Channel	Ch0 2402 MHz	Ch39 2441 MHz	CH78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.49	3.71	4.19	P
	Fig.7	Fig.8	Fig.9	

Conclusion: PASS

Test graphs an below

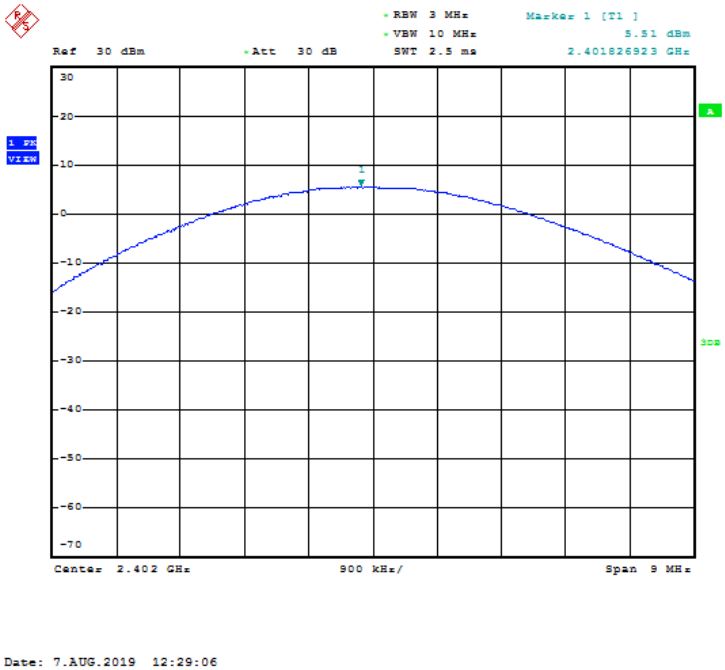


Fig.1 Peak Conducted Output Power CH0, DH1

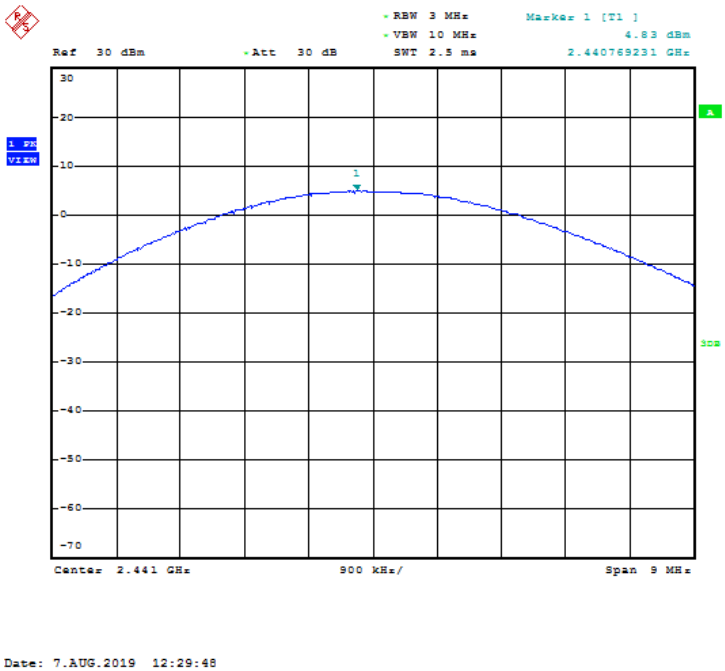


Fig.2 Peak Conducted Output Power CH39, DH1

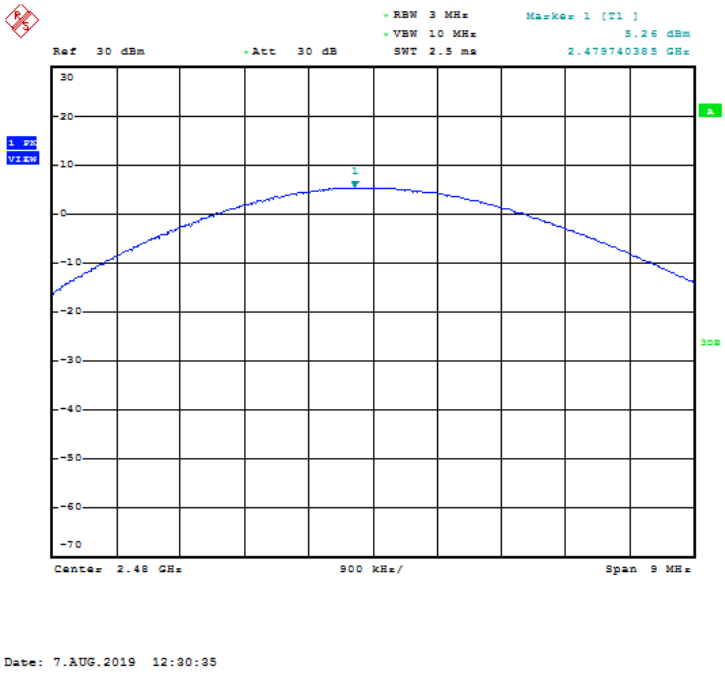


Fig.3 Peak Conducted Output Power CH78, DH1

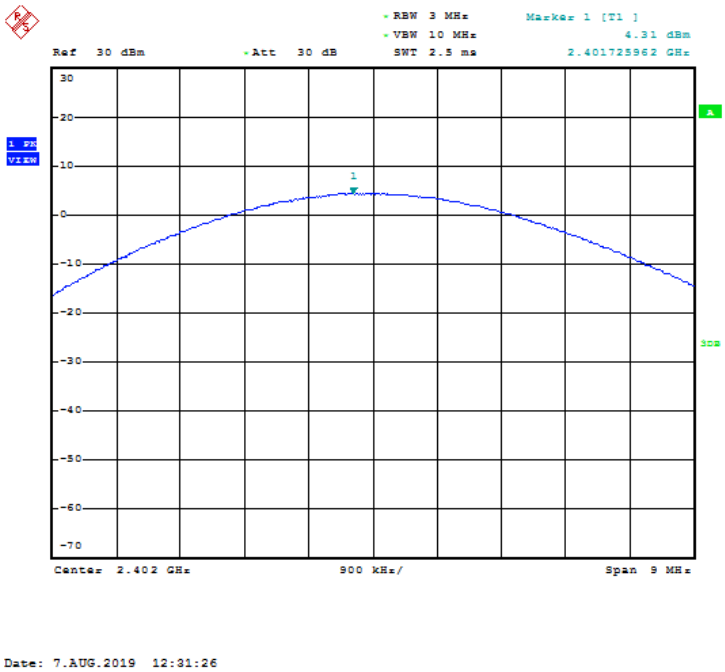


Fig.4 Peak Conducted Output Power CH0, 2DH1

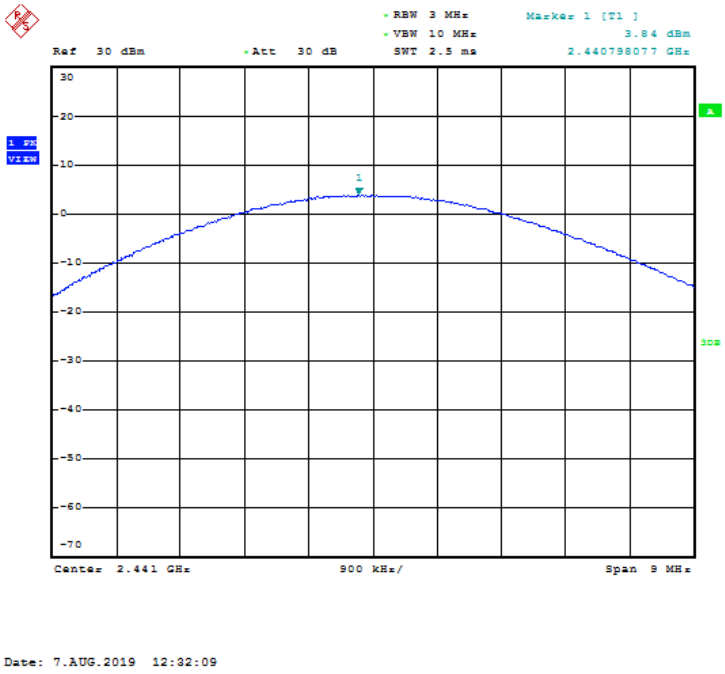


Fig.5 Peak Conducted Output Power CH39, 2DH1

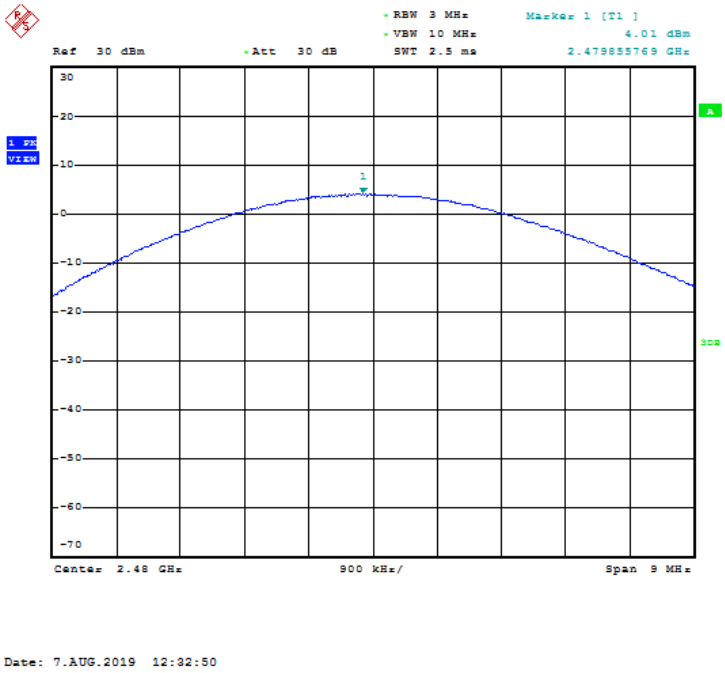


Fig.6 Peak Conducted Output Power CH78, 2DH1

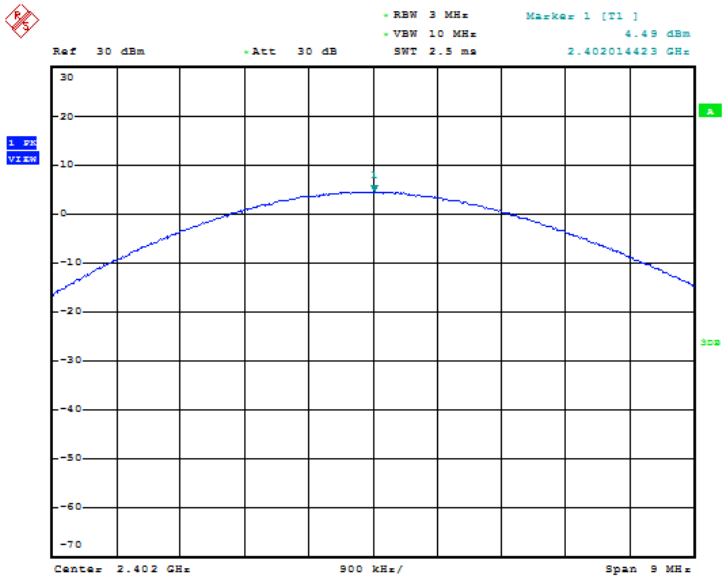


Fig.7 Peak Conducted Output Power CH0, 3DH1

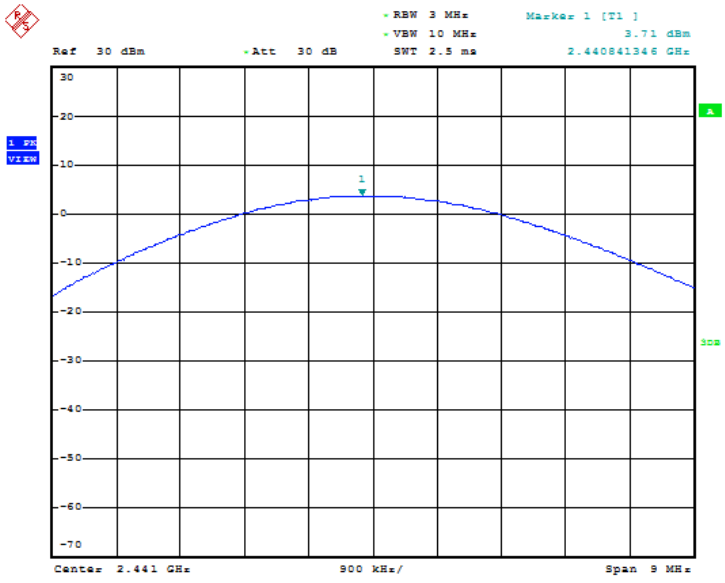


Fig.8 Peak Conducted Output Power CH39, 3DH1

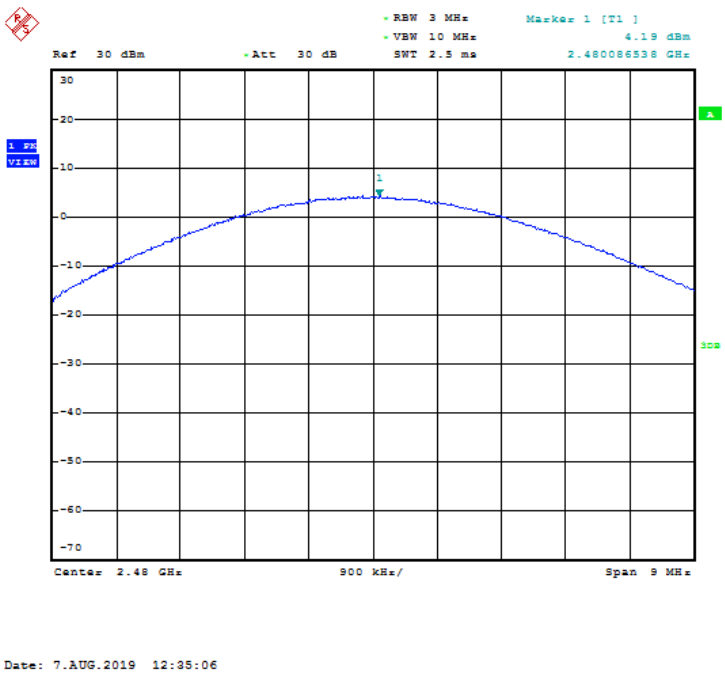


Fig.9 Peak Conducted Output Power CH78, 3DH1

ANNEX A.2. Frequency Band Edges-Conducted

A.2.1 Measurement Limit:

Standard	Limited(dBc)
FCC 47 CFR Part 15.247(d)	>20

A.2.2 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

For GFSK

Channel	Hopping	Band Edge Power (dBc)	Conclusion
0	Hopping OFF	Fig.10	P
	Hopping ON	Fig.11	P
78	Hopping OFF	Fig.12	P
	Hopping ON	Fig.13	P

For π/4 DQPSK

Channel	Hopping	Band Edge Power (dBc)	Conclusion
0	Hopping OFF	Fig.14	P
	Hopping ON	Fig.15	P
78	Hopping OFF	Fig.16	P
	Hopping ON	Fig.17	P

For 8DPSK

Channel	Hopping	Band Edge Power (dBc)	Conclusion
0	Hopping OFF	Fig.18	P
	Hopping ON	Fig.19	P
78	Hopping OFF	Fig.20	P
	Hopping ON	Fig.21	P

Conclusion: PASS

Test graphs an below

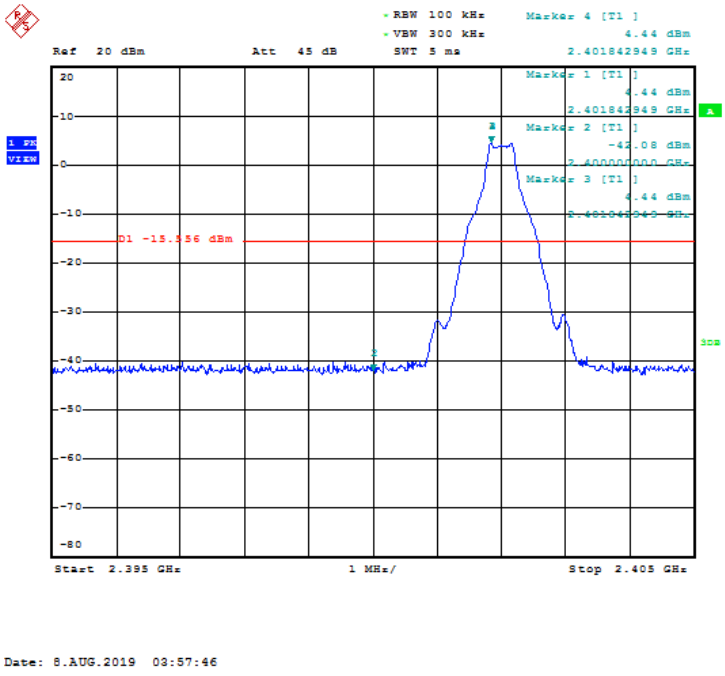


Fig.10 Frequency Band Edge: GFSK, Ch0, Hopping OFF

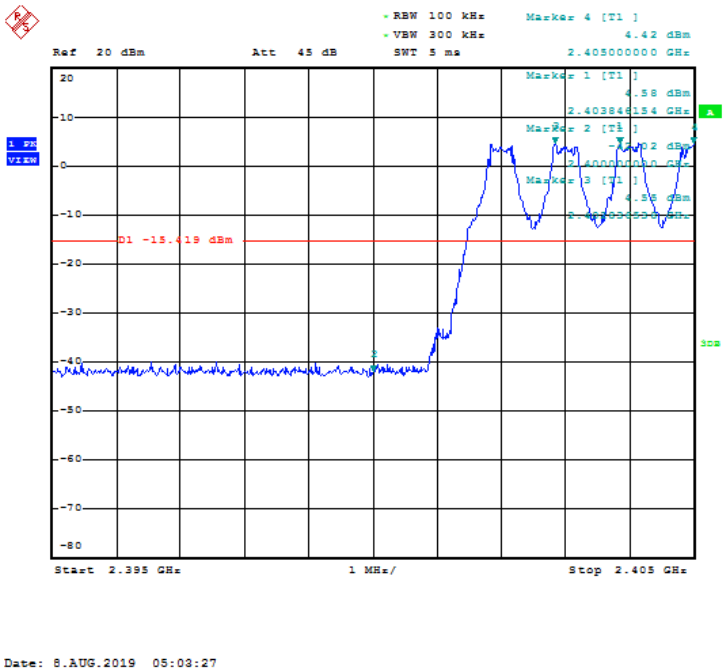
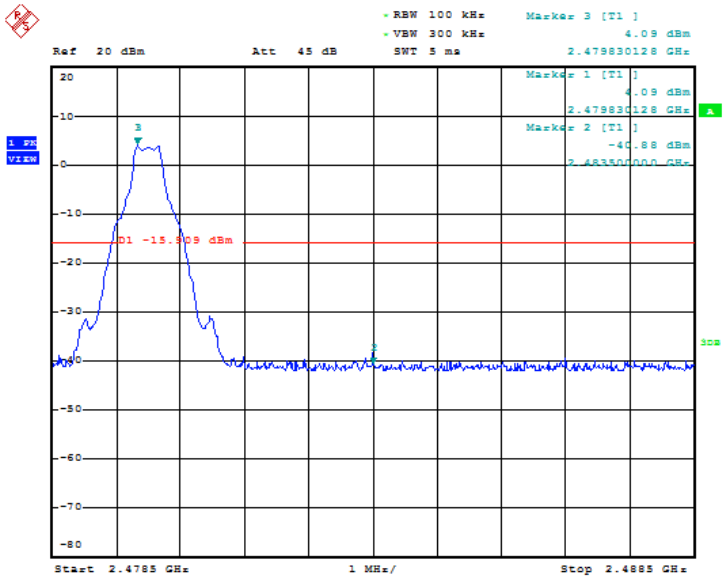


Fig.11 Frequency Band Edge: GFSK, Ch0, Hopping ON



Date: 8.AUG.2019 04:10:33

Fig.12 Frequency Band Edge: GFSK, Ch78, Hopping OFF

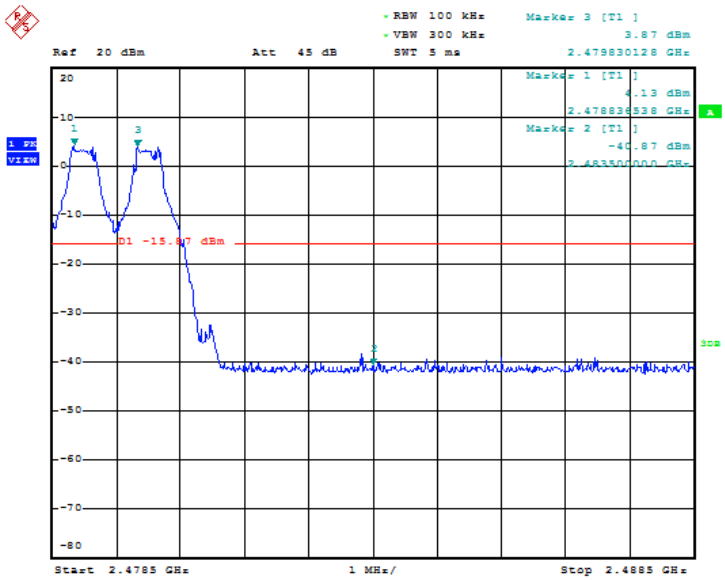


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Fig.13 Frequency Band Edge: GFSK, Ch78, Hopping ON

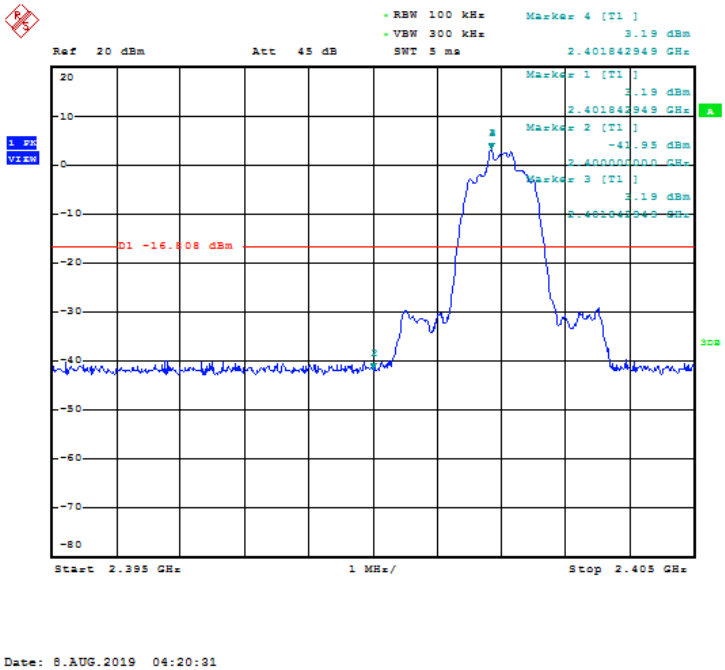

Fig.14 Frequency Band Edge: π/4 DQPSK, Ch0, Hopping OFF

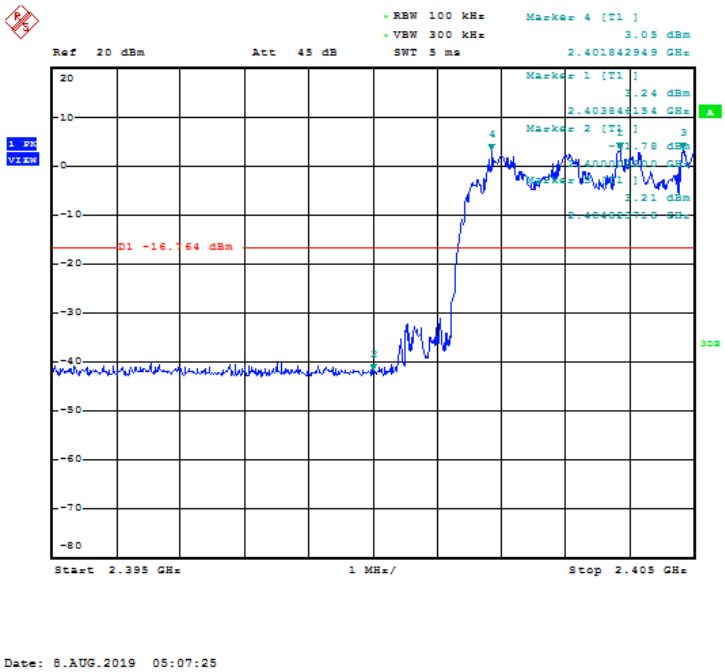

Fig.15 Frequency Band Edge: π/4 DQPSK, Ch0, Hopping ON

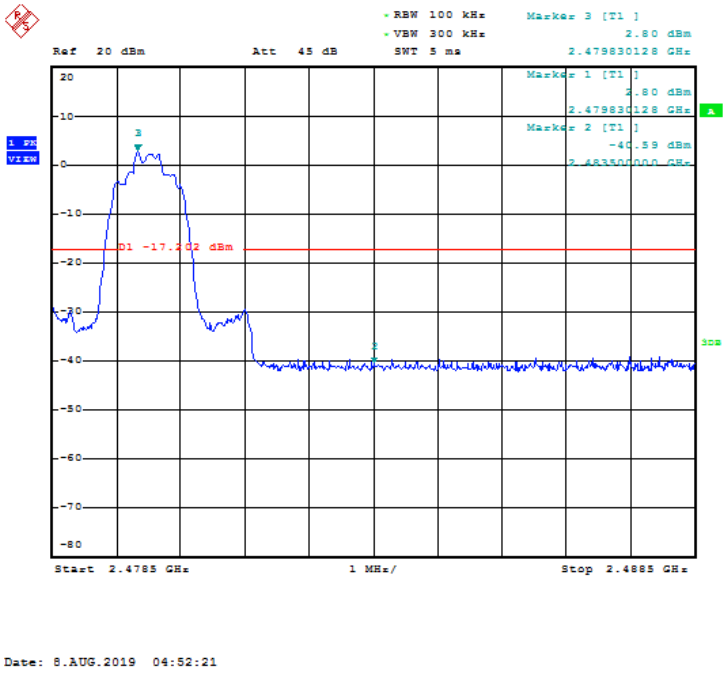

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Fig.16 Frequency Band Edge: π/4 DQPSK, Ch78, Hopping OFF

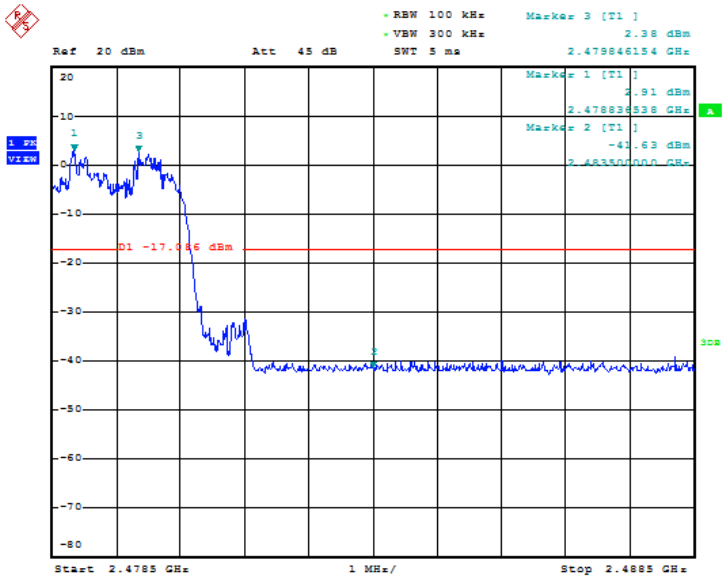

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Fig.17 Frequency Band Edge: π/4 DQPSK, Ch78, Hopping ON

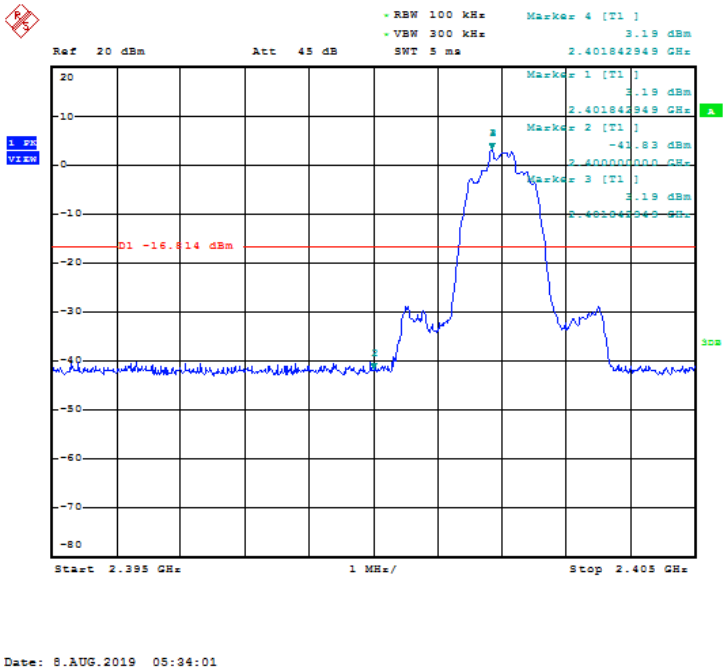


Fig.18 Frequency Band Edge: 8DPSK, Ch0, Hopping OFF

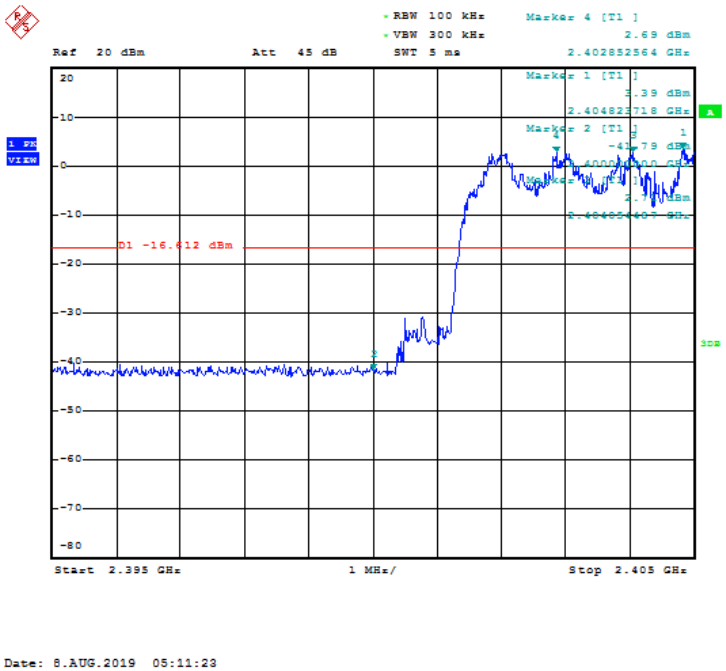


Fig.19 Frequency Band Edge: 8DPSK, Ch0, Hopping ON

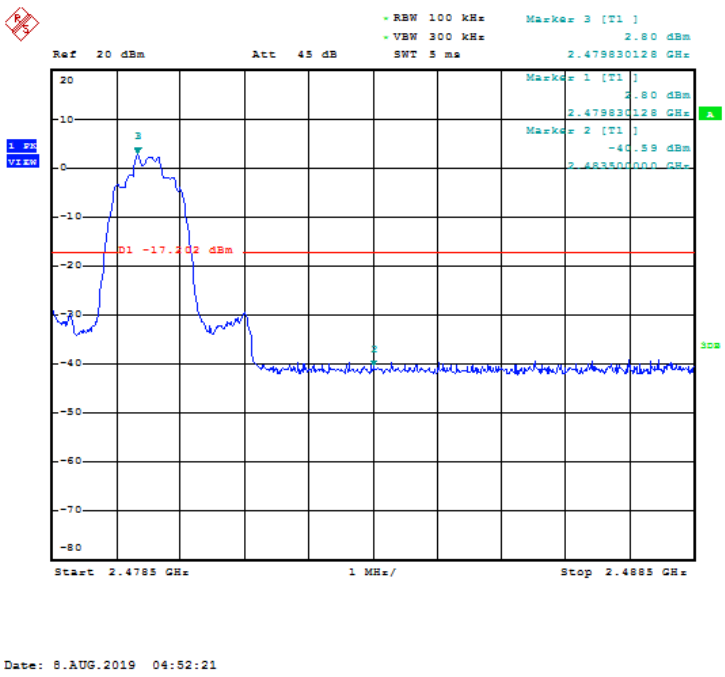


Fig.20 Frequency Band Edge: 8DPSK, Ch78, Hopping OFF

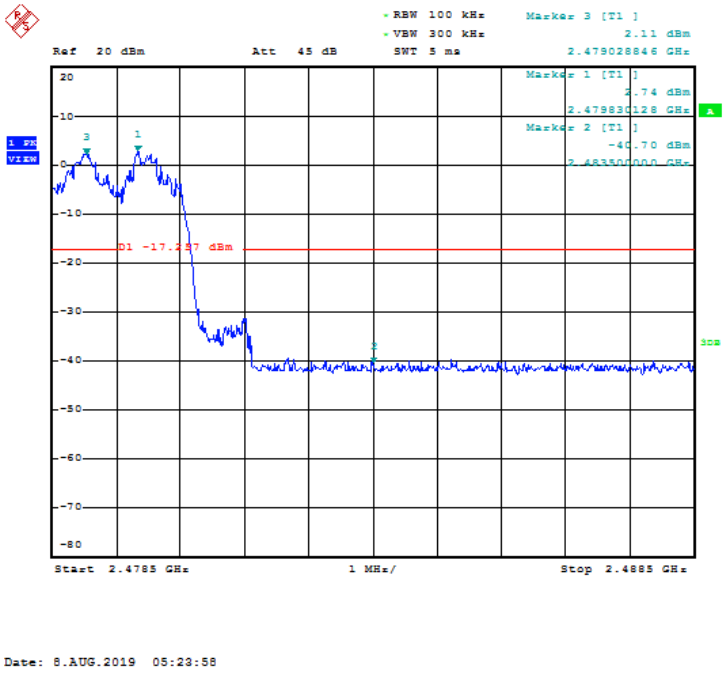


Fig.21 Frequency Band Edge: 8DPSK, Ch78, Hopping ON

ANNEX A.3. Conducted Emission

A.3.1 Measurement Limit:

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

A.3.2 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:

For GFSK

Channel	Frequency Range	Test Results	Conclusion
Ch0 2402MHz	30MHz~26GHz	Fig.22	P
Ch39 2441MHz	30MHz~26GHz	Fig.23	P
Ch78 2480MHz	30MHz~26GHz	Fig.24	P

For π/4 DQPSK

Channel	Frequency Range	Test Results	Conclusion
Ch0 2402MHz	30MHz~26GHz	Fig.25	P
Ch39 2441MHz	30MHz~26GHz	Fig.26	P
Ch78 2480MHz	30MHz~26GHz	Fig.27	P

For 8DPSK

Channel	Frequency Range	Test Results	Conclusion
Ch0 2402MHz	30MHz~26GHz	Fig.28	P
Ch39 2441MHz	30MHz~26GHz	Fig.29	P
Ch78 2480MHz	30MHz~26GHz	Fig.30	P

Conclusion: PASS

Test graphs as below

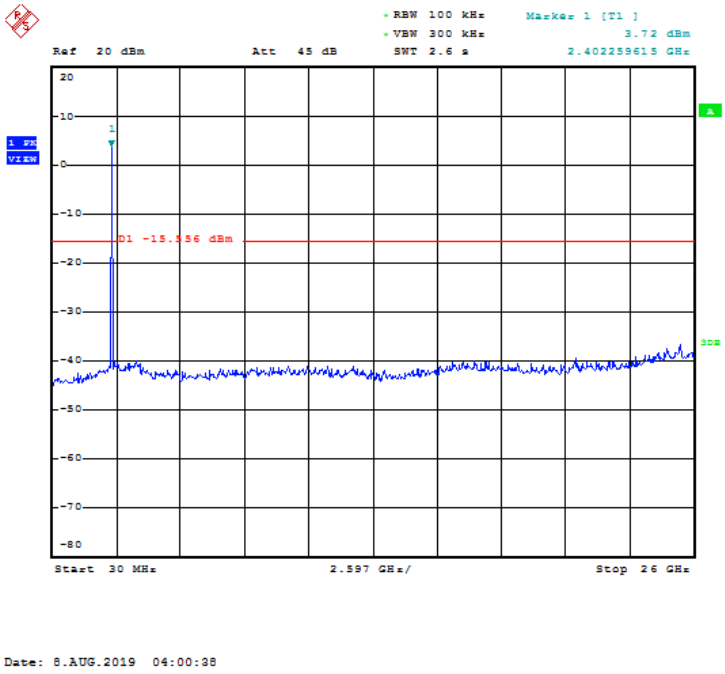


Fig.22 Conducted spurious emission: GFSK, Ch0, 30MHz~26GHz

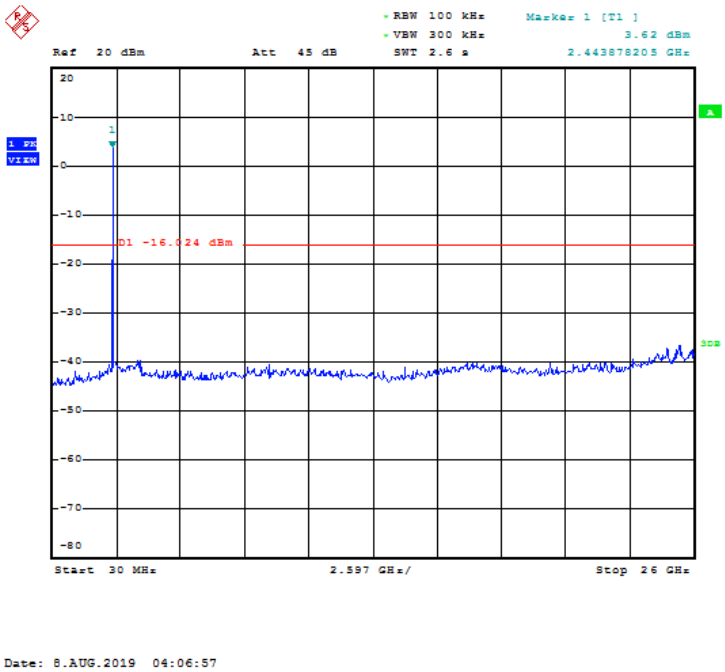


Fig.23 Conducted spurious emission: GFSK, Ch39, 30MHz~26GHz

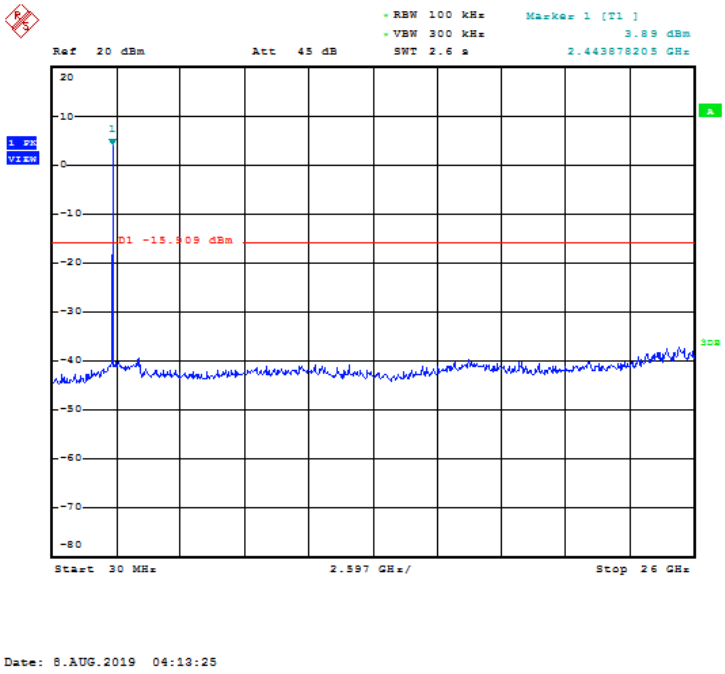


Fig.24 Conducted spurious emission: GFSK, Ch78, 30MHz~26GHz

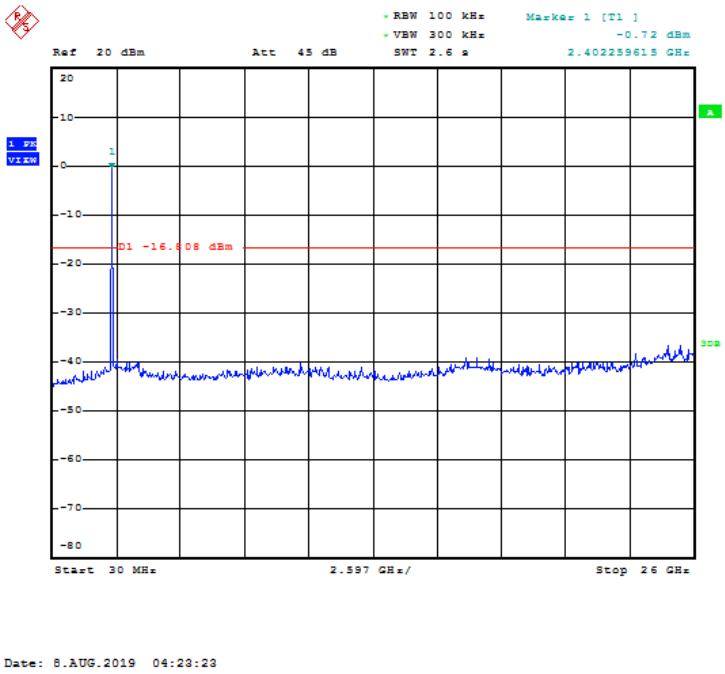


Fig.25 Conducted spurious emission: π/4 DQPSK, Ch0, 30MHz~26GHz

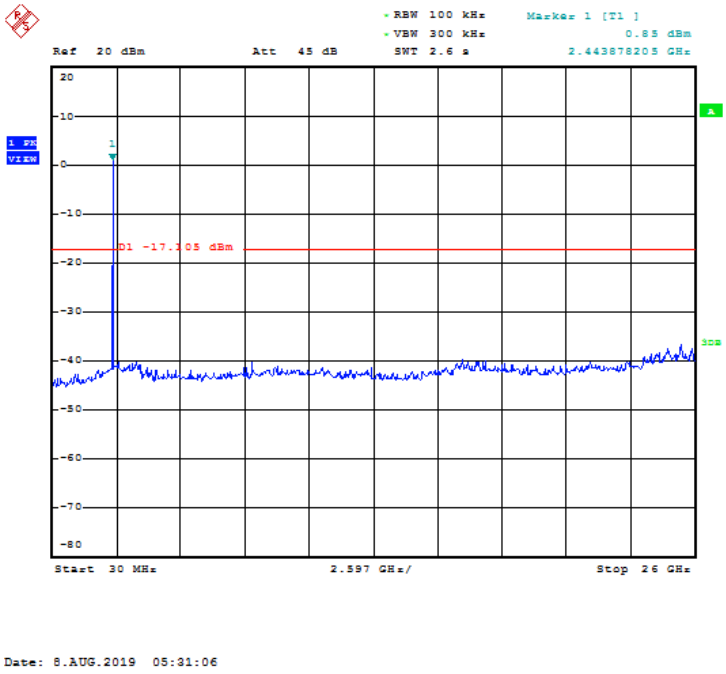


Fig.26 Conducted spurious emission: π/4 DQPSK, Ch39, 30MHz~26GHz

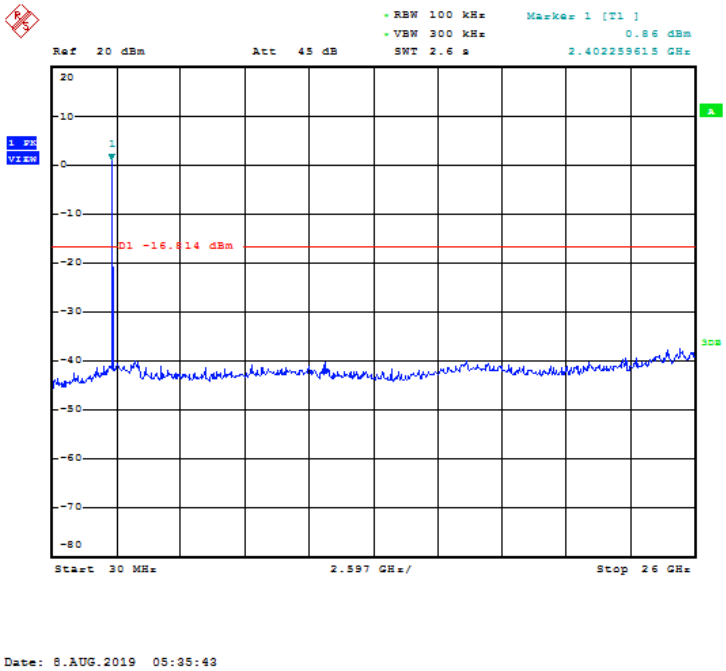


Fig.27 Conducted spurious emission: π/4 DQPSK, Ch78, 30MHz~26GHz

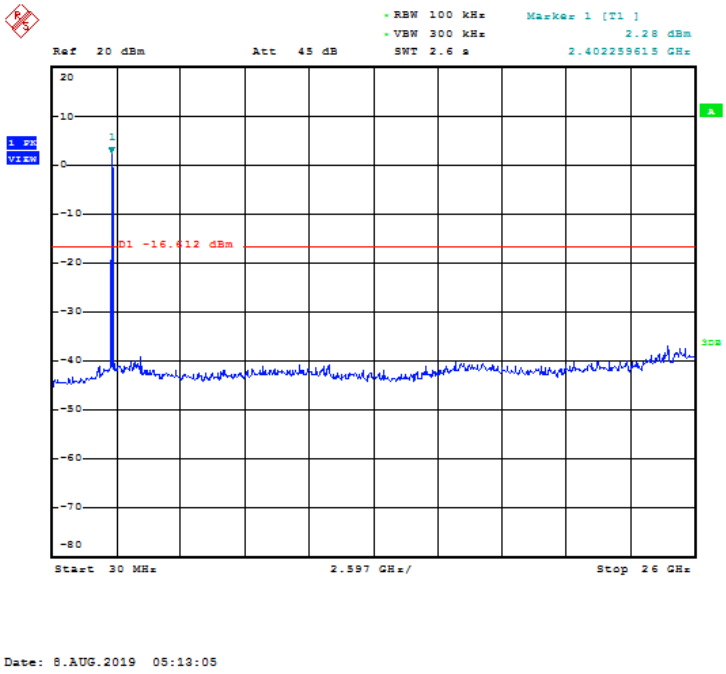


Fig.28 Conducted spurious emission: 8DPSK, Ch0, 30MHz~26GHz

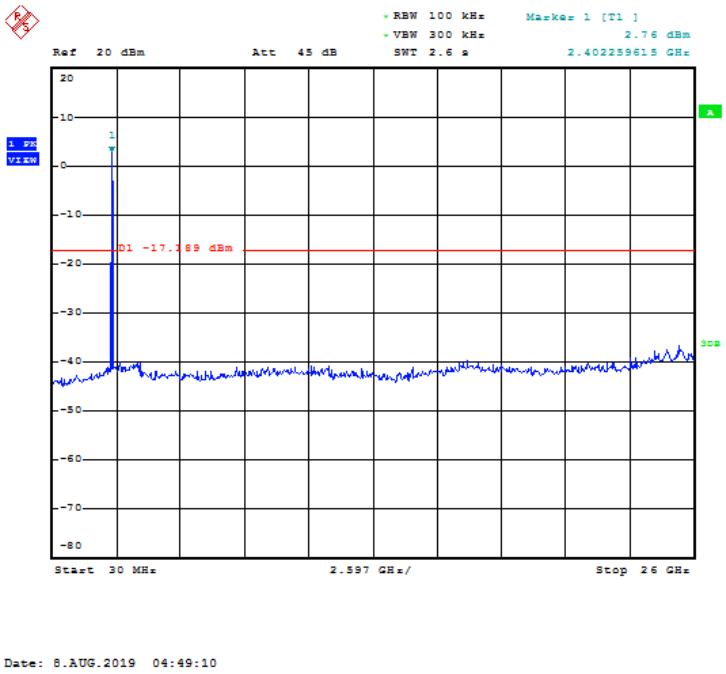


Fig.29 Conducted spurious emission: 8DPSK, Ch39, 30MHz~26GHz

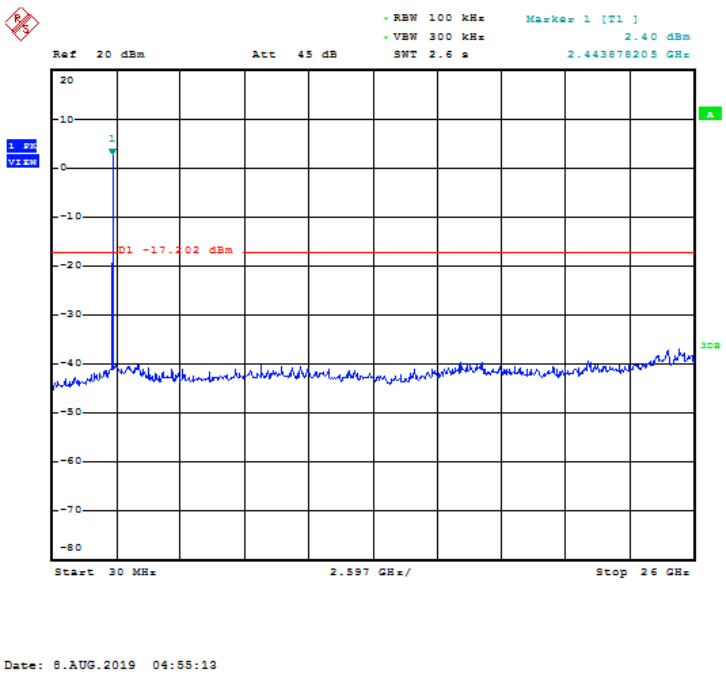


Fig.30 Conducted spurious emission: 8DPSK, Ch78, 30MHz~26GHz

ANNEX A.4. Radiated Emission

A.4.1 Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	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 (MHz)	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

A.4.2 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 (MHz)	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

A.4.3 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 Gain-Preamplifier gain

Result=P_{Mea} + A_{Rpi}

For GFSK

Channel	Frequency Range	Test Results	Conclusion
Ch0 2402MHz	30MH~1GHz	Fig.31	P
	1GHz~3GHz	Fig.32	P
	3GHz~18GHz	Fig.33	P
Bandedge (low)	2.31GHz~2.5GHz	Fig.34	P
Bandedge (high)	2.31GHz~2.5GHz	Fig.35	P

For π/4 DQPSK

Channel	Frequency Range	Test Results	Conclusion
Ch0 2402MHz	30MH~1GHz	Fig.36	P
	1GHz~3GHz	Fig.37	P
	3GHz~18GHz	Fig.38	P
Bandedge (low)	2.31GHz~2.5GHz	Fig.39	P
Bandedge (high)	2.31GHz~2.5GHz	Fig.40	P

For 8DPSK

Channel	Frequency Range	Test Results	Conclusion
Ch0 2402MHz	30MH~1GHz	Fig.41	P
	1GHz~3GHz	Fig.42	P
	3GHz~18GHz	Fig.43	P
Bandedge (low)	2.31GHz~2.5GHz	Fig.44	P
Bandedge (high)	2.31GHz~2.5GHz	Fig.45	P

GFSK Ch0 30MHz-1GHz

Frequency(MHz)	Result(dBuV/m)	ARpl(dB)	PMea(dBuV/m)	Polarity
35.2	14.73	-27.4	42.13	V
44.3	21.13	-25.6	46.73	V
55.2	19.99	-26.1	46.09	V
140.9	11.26	-31.2	42.46	H
437.9	23.78	-23	46.78	V
564.5	27.62	-20.4	48.02	V

GFSK Ch0 1GHz-3GHz (Peak)

Frequency(MHz)	Result(dBuV/m)	ARpl(dB)	PMea(dBuV/m)	Polarity
2584.6	53.08	3.7	49.38	H
2663.5	53.96	4.5	49.46	V
2757.4	55.45	4.3	51.15	V
2824.0	54.55	4.7	49.85	H
2885.0	55.5	5.6	49.9	H
2976.0	55.07	5.5	49.57	V

GFSK Ch0 1GHz-3GHz (Average)

Frequency(MHz)	Result(dBuV/m)	ARpl(dB)	PMea(dBuV/m)	Polarity
2757.4	42.07	4.3	37.77	V
2824.0	42.54	4.7	37.84	H
2885.0	43.24	5.6	37.64	H
2976.0	42.85	5.5	37.35	V
2757.4	42.07	4.3	37.77	V

GFSK Ch0 3GHz-18GHz (Peak)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
13326.2	52.5	16.9	35.6	H
14333.7	54.09	20.2	33.89	H

15339.3	55.67	22	33.67	H
16132.0	58.17	24.9	33.27	V
16908.6	59.72	27.4	32.32	H
17778.9	60.61	28.2	32.41	V

GFSK Ch0 3GHz-18GHz (Average)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
14333.7	42.17	20.2	21.97	H
15339.3	43.4	22	21.4	H
16132.0	46.21	24.9	21.31	V
16908.6	48.2	27.4	20.8	H
17778.9	48.4	28.2	20.2	V

π/4 DQPSK Ch0 30MHz-1GHz

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
34.5	14.7	-27.5	42.2	V
44.4	25.89	-25.6	51.49	V
72.1	18.14	-30.2	48.34	V
145.7	19.06	-31.2	50.26	V
432.5	28.94	-23	51.94	V
555.0	30.14	-20.5	50.64	V

π/4 DQPSK Ch0 1GHz-3GHz (Peak)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
2560.2	53.87	3.6	50.27	V
2636.9	54.27	4.2	50.07	V
2691.9	54.4	4.6	49.8	V
2797.8	54.02	4.4	49.62	V
2873.1	56.27	5.4	50.87	V

2931.1	55.33	5.5	49.83	V

π/4 DQPSK Ch0 1GHz-3GHz (Average)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
2636.9	41.78	4.2	37.58	V
2691.9	42.28	4.6	37.68	V
2797.8	42.05	4.4	37.65	V
2873.1	43.07	5.4	37.67	V
2931.1	43.53	5.5	38.03	V

π/4 DQPSK Ch0 3GHz-18GHz (Peak)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
14302.4	54.82	20.8	34.02	V
15118.9	54.94	21.3	33.64	V
15495.8	57.38	22.6	34.78	V
16084.9	58.72	24.9	33.82	V
16646.6	57.88	25.7	32.18	H
17234.2	60.45	27.2	33.25	H

π/4 DQPSK Ch0 3GHz-18GHz (Average)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
14302.4	43.11	20.8	22.31	V
15118.9	43.01	21.3	21.71	V
15495.8	43.67	22.6	21.07	V
16084.9	46.54	24.9	21.64	V
16646.6	46	25.7	20.3	H

8DPSK Ch0 30MHz-1GHz

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
35.6	14.79	-27.3	42.09	V

44.2	21.07	-25.7	46.77	V
72.6	13.71	-30.3	44.01	V
141.1	10.55	-31.2	41.75	H
252.7	20.23	-26.7	46.93	V
541.5	21.5	-20.8	42.3	V

8DPSK Ch0 1GHz-3GHz (Peak)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
2607.3	53.8	3.8	50	V
2670.2	54.51	4.5	50.01	V
2712.8	54.08	4.6	49.48	H
2812.5	53.96	4.6	49.36	V
2872.3	55.41	5.4	50.01	H
2960.3	55.6	5.4	50.2	V

8DPSK Ch0 1GHz-3GHz (Average)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
2670.2	42.48	4.5	37.98	V
2712.8	42.19	4.6	37.59	H
2872.3	43.05	5.4	37.65	H
2960.3	43.2	5.4	37.8	V
2670.2	42.48	4.5	37.98	V
2712.8	42.19	4.6	37.59	H

8DPSK Ch0 3GHz-18GHz (Peak)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
13930.6	52.9	18.5	34.4	V
14340.0	53.95	20.1	33.85	H
14827.6	55.01	20.5	34.51	V

16098.1	59.11	24.9	34.21	V
16953.4	61.37	27.2	34.17	H
17818.3	60.88	28.2	32.68	V

8DPSK Ch0 3GHz-18GHz (Average)

Frequency(MHz)	Result(dBuV/m)	ARpl (dB)	PMea(dBuV/m)	Polarity
14827.6	42.66	20.5	22.16	V
16098.1	46.44	24.9	21.54	V
16953.4	48.24	27.2	21.04	H
17818.3	48.53	28.2	20.33	V

Note: Only the worst case is written in the report.

Conclusion: PASS

Test graphs as below:

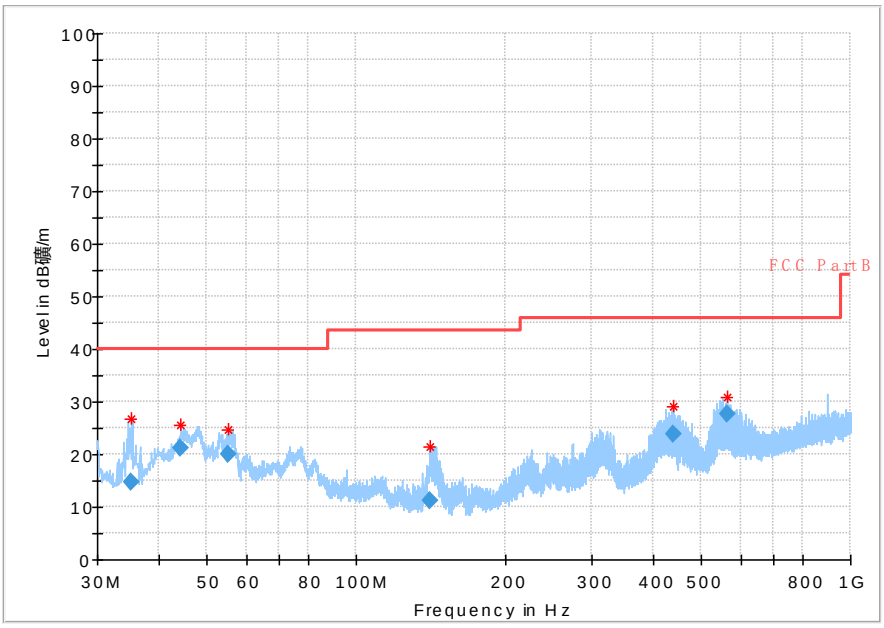


Fig.31 Radiated emission: GFSK, Ch0, 30MHz~1GHz

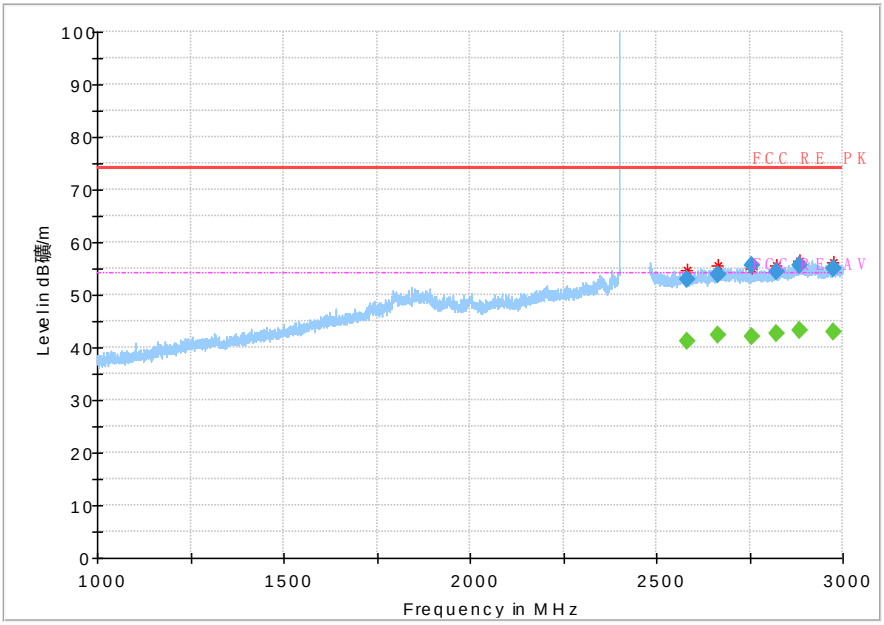


Fig.32 Radiated emission: GFSK, Ch0, 1GHz~3GHz

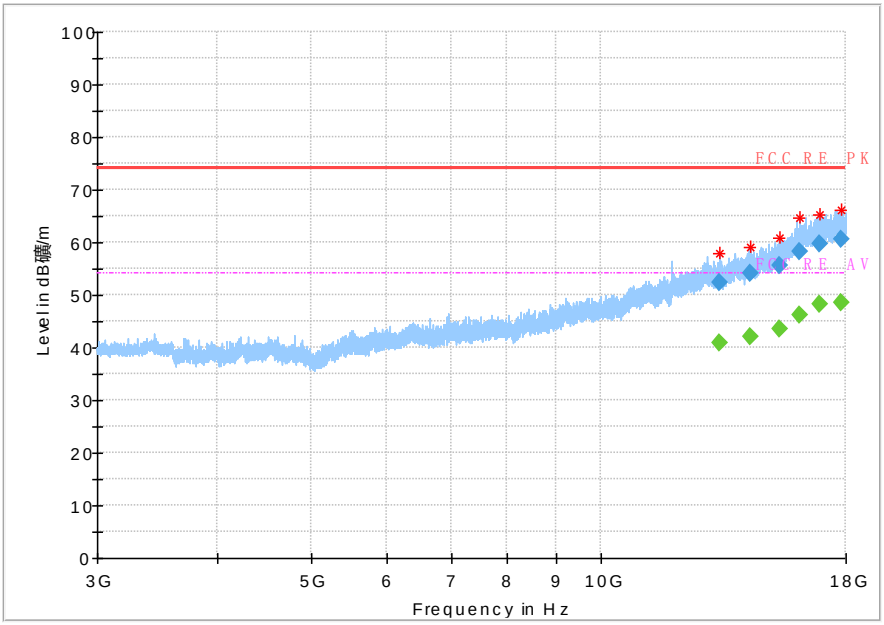


Fig.33 Radiated emission: GFSK, Ch0, 3GHz~18GHz

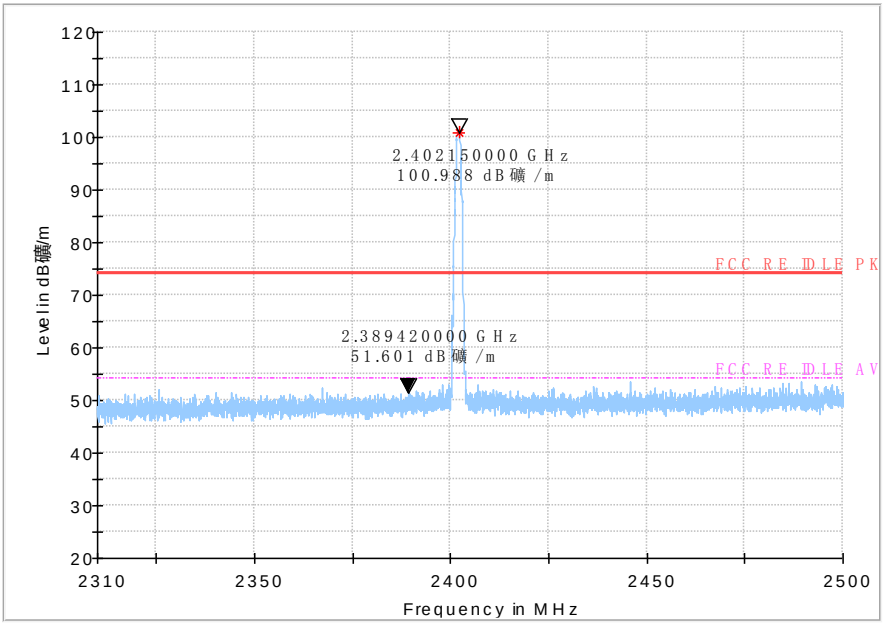


Fig.34 Bandedge (Low): GFSK, low channel

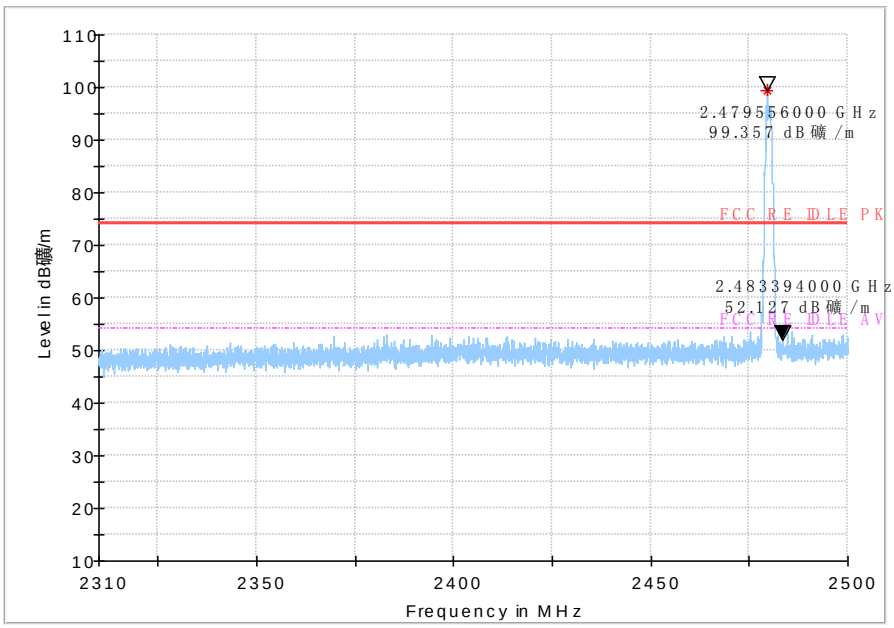


Fig.35 Bandedge (High): GFSK, high channel

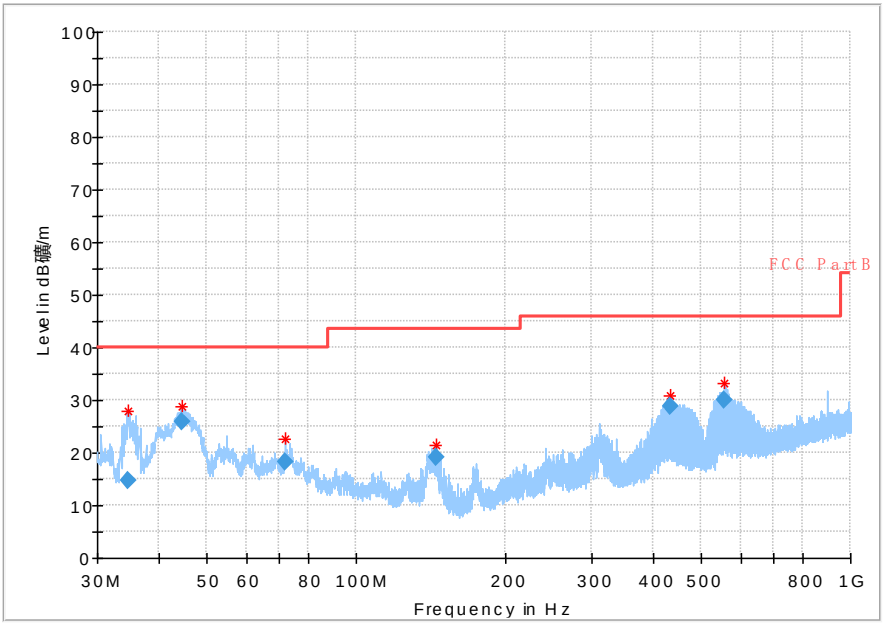


Fig.36 Radiated emission: π/4 DQPSK, Ch0, 30MHz~1GHz

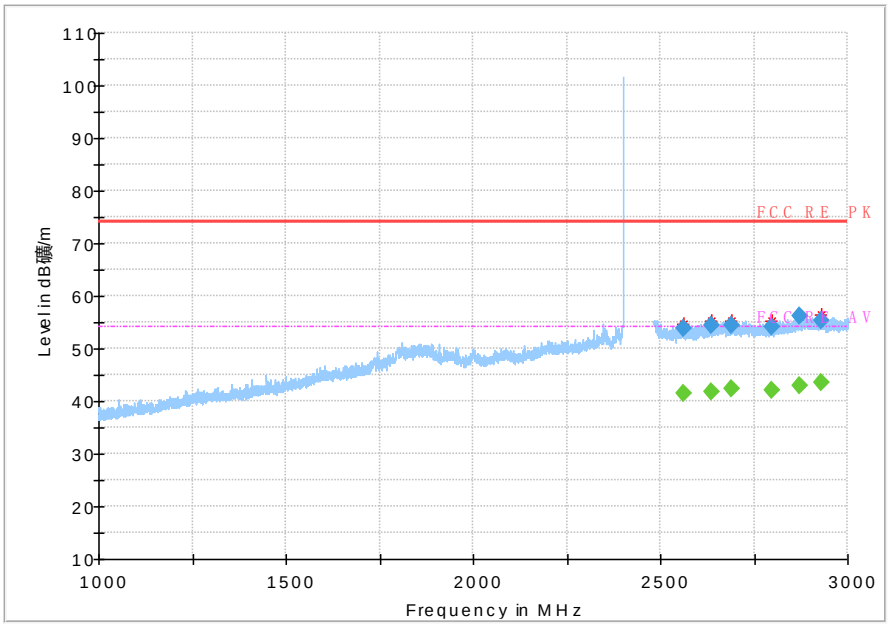


Fig.37 Radiated emission: π/4 DQPSK, Ch0, 1GHz~3GHz

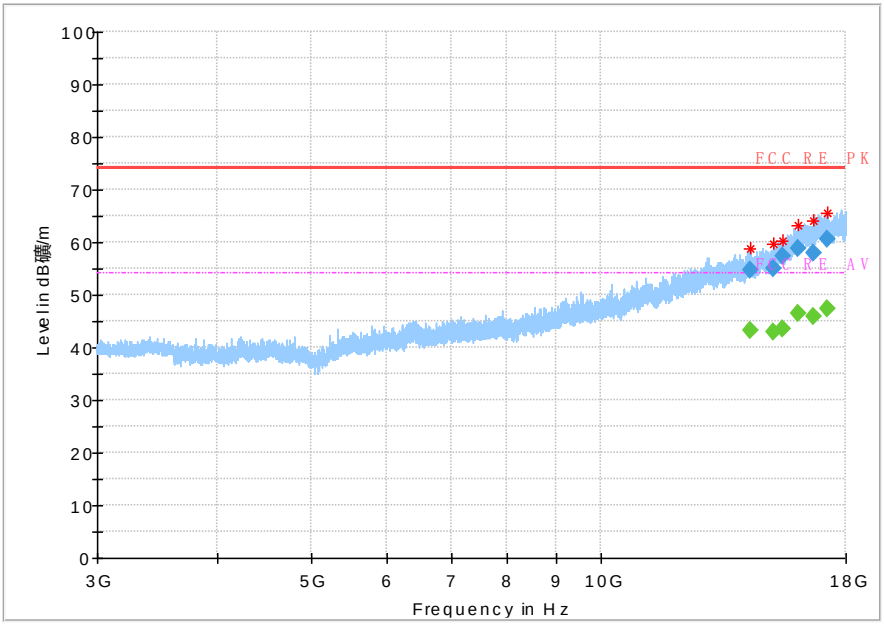


Fig.38 Radiated emission: π/4 DQPSK, Ch0, 3GHz~18GHz

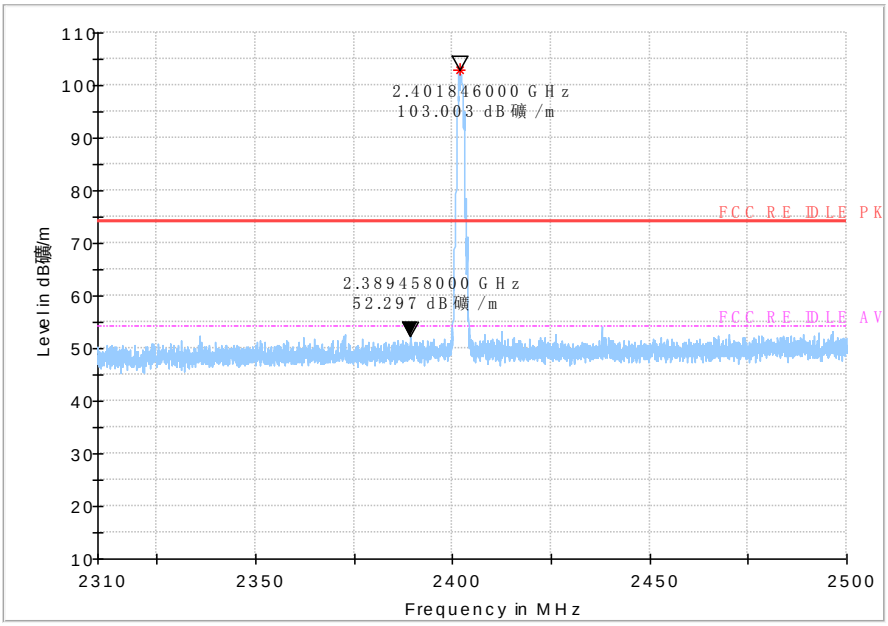


Fig.39 Bandedge (Low): π/4 DQPSK, low channel

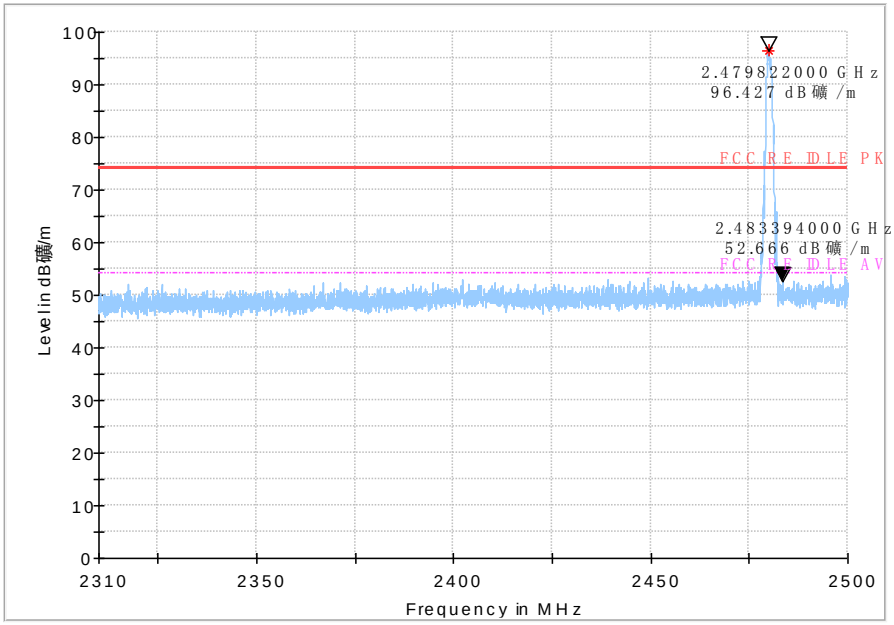


Fig.40 Bandedge (High): π/4 DQPSK, high channel

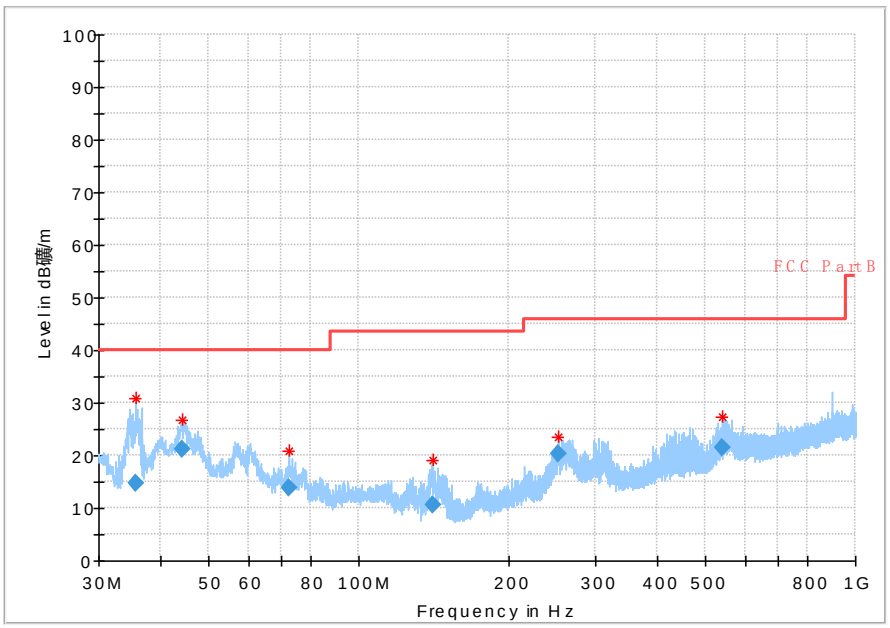


Fig.41 Radiated emission: 8DPSK, Ch0, 30MHz~1GHz

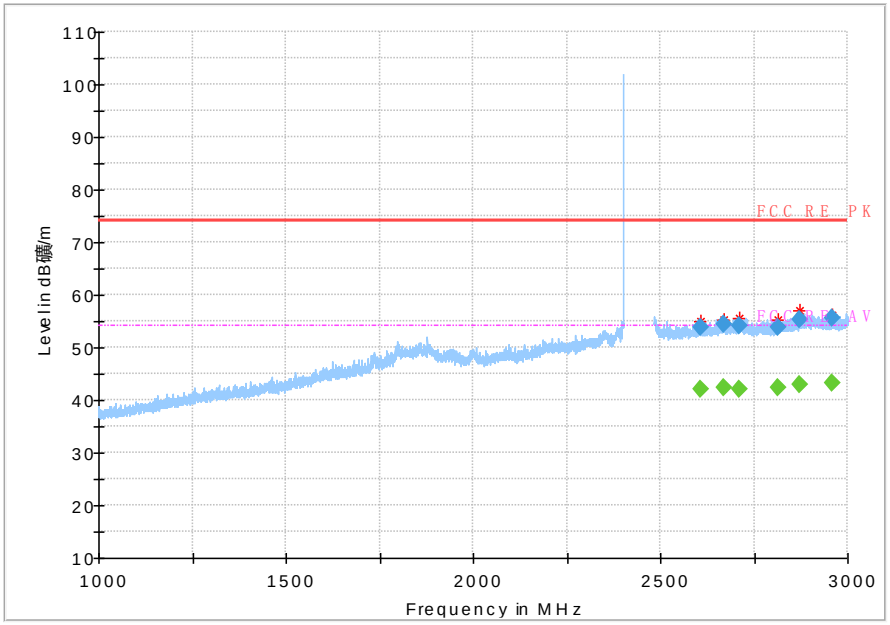


Fig.42 Radiated emission: 8DPSK, Ch0, 1GHz~3GHz

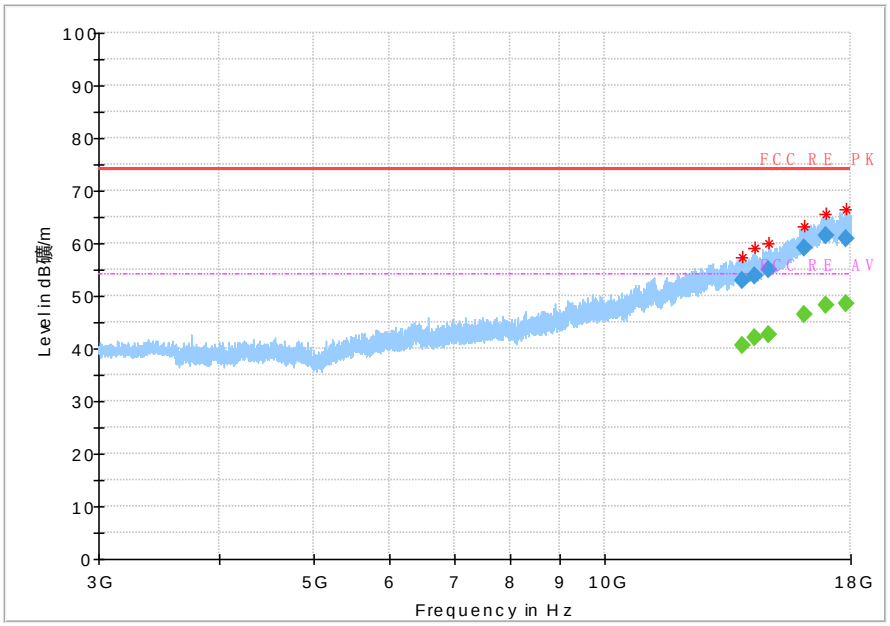


Fig.43 Radiated emission: 8DPSK, Ch0, 3GHz~18GHz

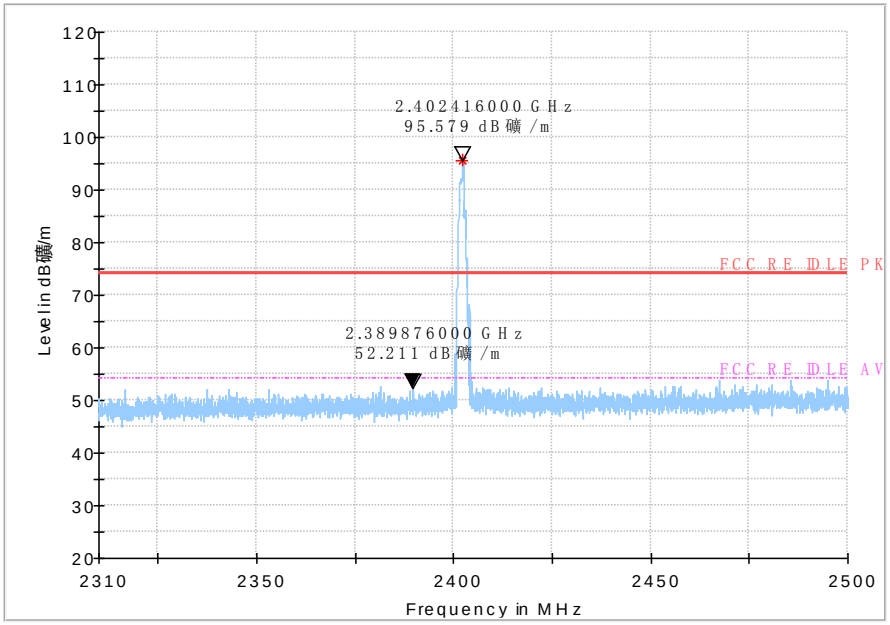


Fig.44 Bandedge (Low): 8DPSK, low channel

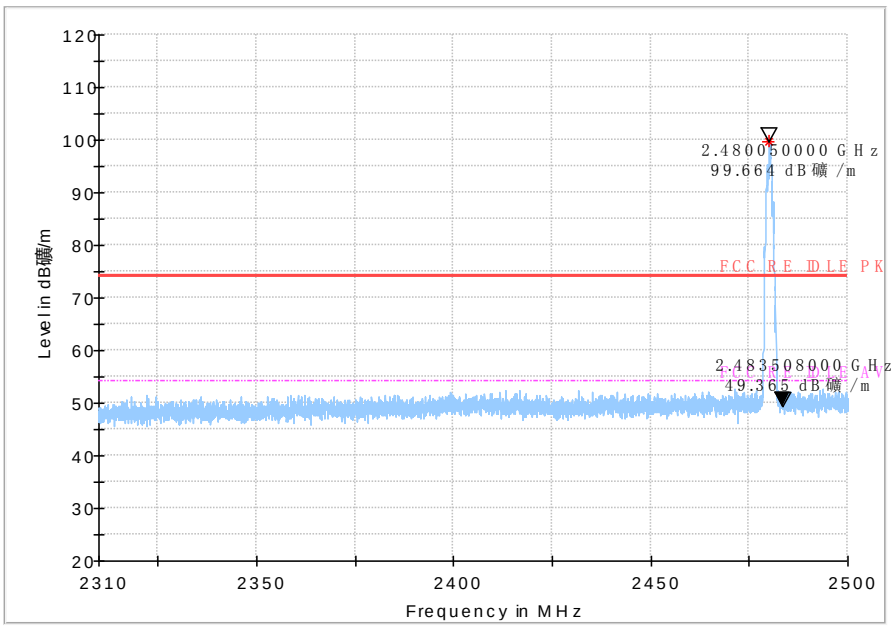
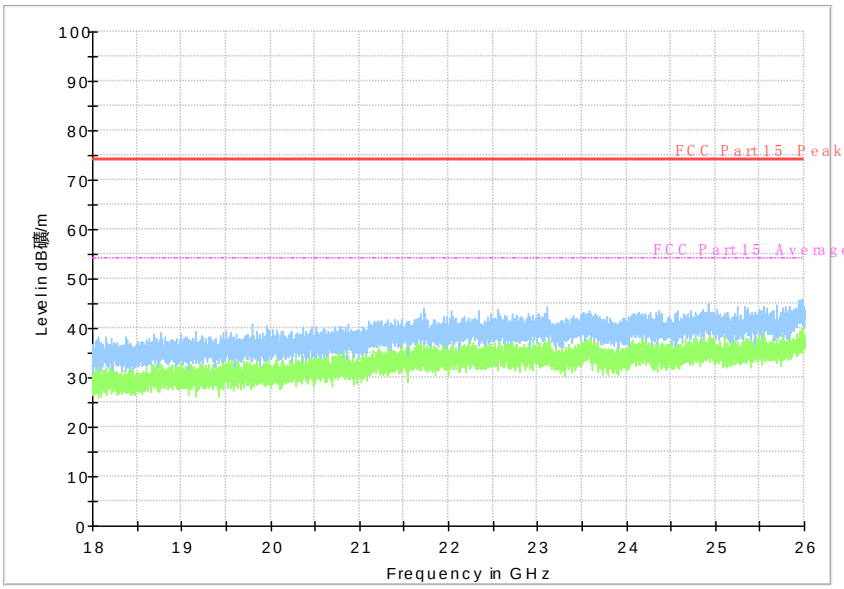


Fig.45 Bandedge (High): 8DPSK, high channel



ALL Channel 18GHz~26GHz

ANNEX A.5. Time Of Occupancy (Dwell Time)

A.5.1 Measurement Limit:

Standard	Limit (ms)
FCC 47CFR Part 15.247 (a) (1) (iii)	< 400

A.5.2 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)	Dwell Time (ms)	Limit(ms)	Conclusion
AFH(GFSK DH5)	2402-2421MHz	63.36	400	P
AFH(π/4 DQPSK DH5)	2402-2421MHz	67.2	400	P
AFH(8DPSK DH5)	2402-2421MHz	65.6	400	P

Measurement Result

For GFSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.46	61.46	P
		Fig.47		
	DH3	Fig.48	197.47	P
		Fig.49		
	DH5	Fig.50	227.52	P
		Fig.51		

For π/4 DQPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	2DH1	Fig.52	63.36	P
		Fig.53		
	2DH3	Fig.54	197.47	P
		Fig.55		
	2DH5	Fig.56	204.48	P
		Fig.57		

For 8DPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	3DH1	Fig.58	64.13	P
		Fig.59		
	3DH3	Fig.60	192.58	P
		Fig.61		
	3DH5	Fig.62	254.85	P
		Fig.63		

Conclusion: PASS

Test graphs as below:

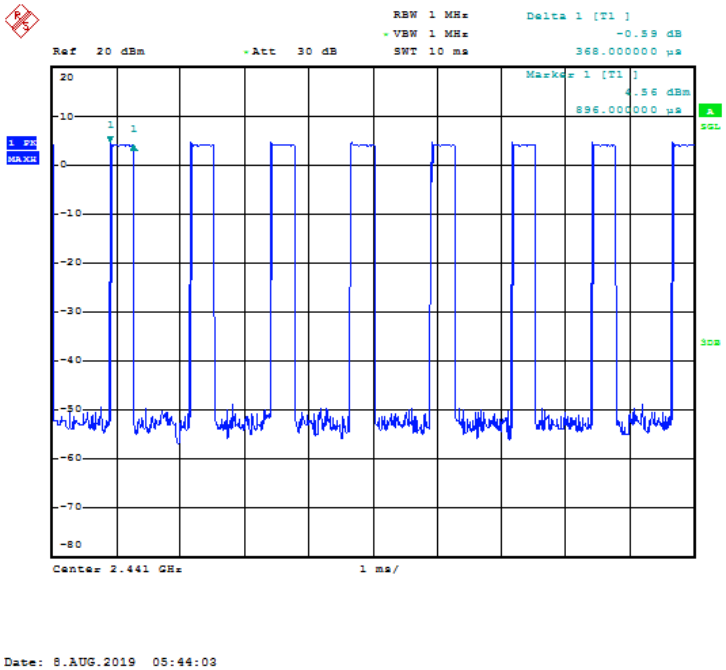


Fig.46 Time of occupancy (Dwell Time): Ch39, Packet DH1

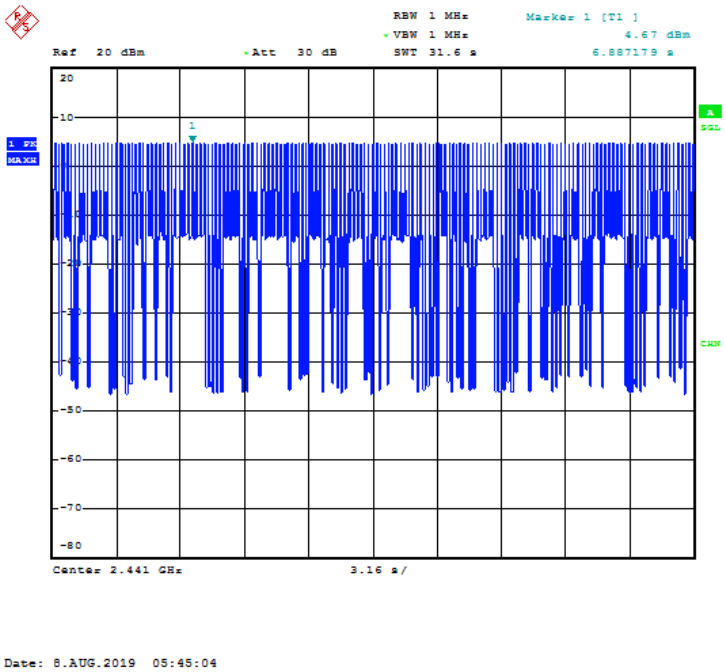


Fig.47 Number of Transmissions Measurement: Ch39, Packet DH1

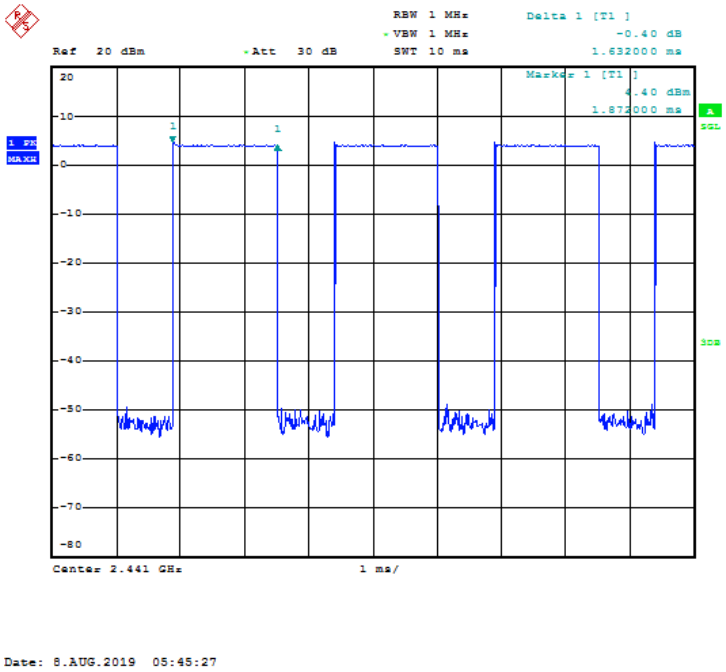


Fig.48 Time of occupancy (Dwell Time): Ch39, Packet DH3

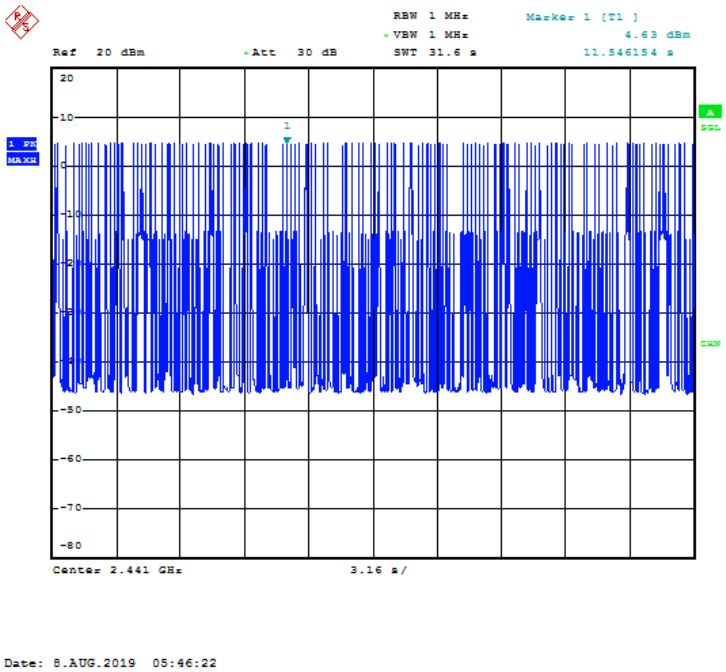


Fig.49 Number of Transmissions Measurement: Ch39, Packet DH3

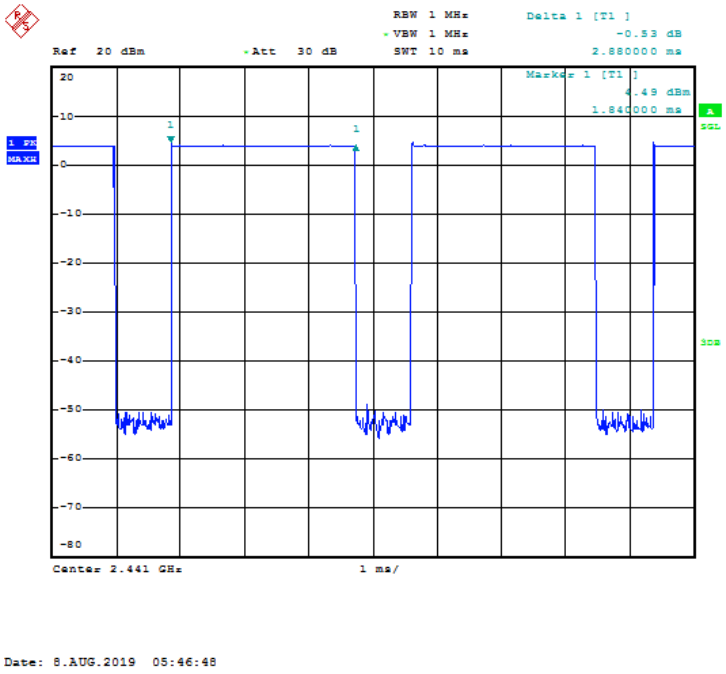


Fig.50 Time of occupancy (Dwell Time): Ch39,Packet DH5

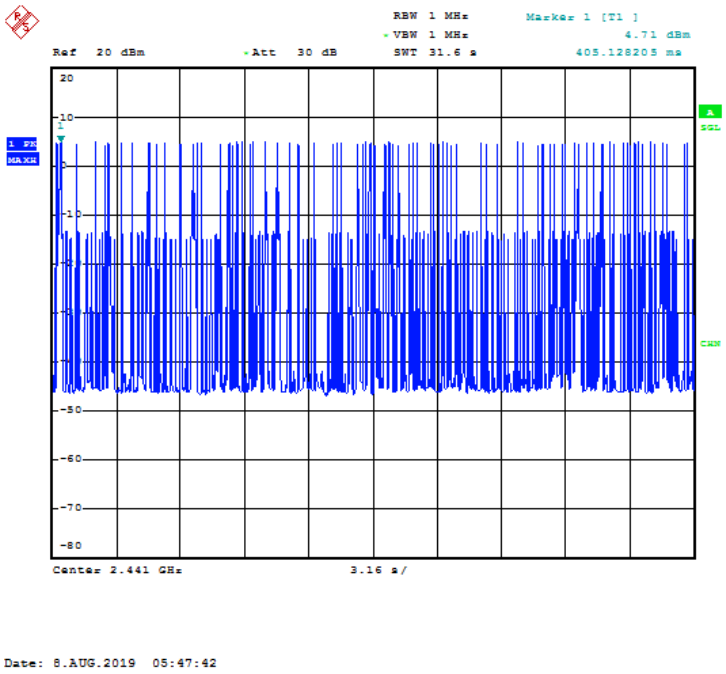


Fig.51 Number of Transmissions Measurement: Ch39, Packet DH5

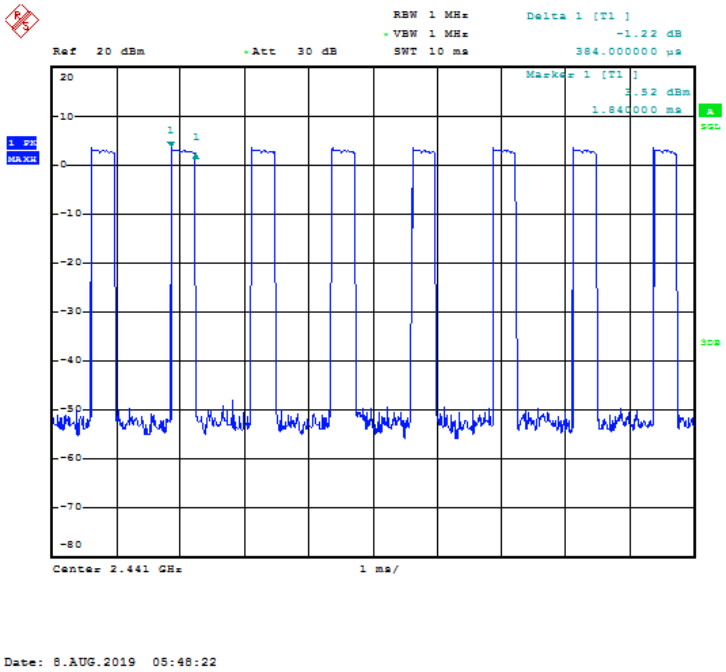


Fig.52 Time of occupancy (Dwell Time): Ch39, Packet 2-DH1

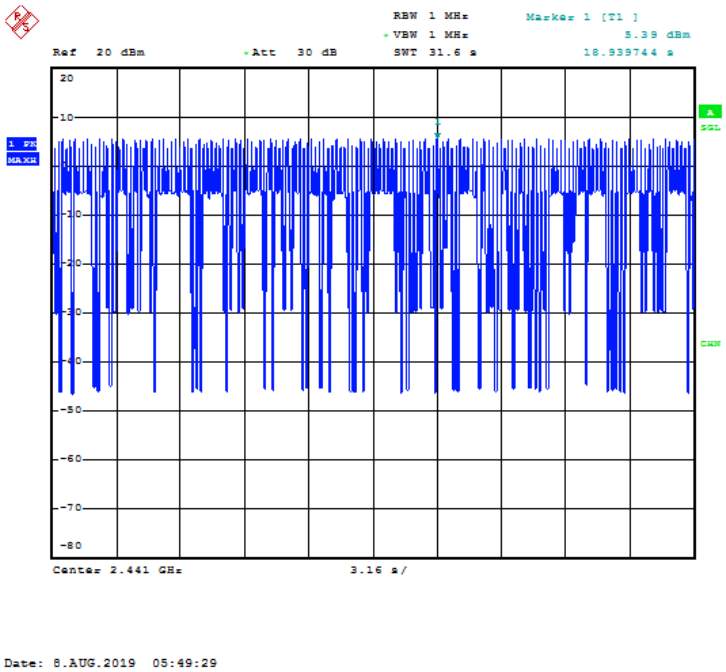


Fig.53 Number of Transmissions Measurement: Ch39, Packet 2-DH1

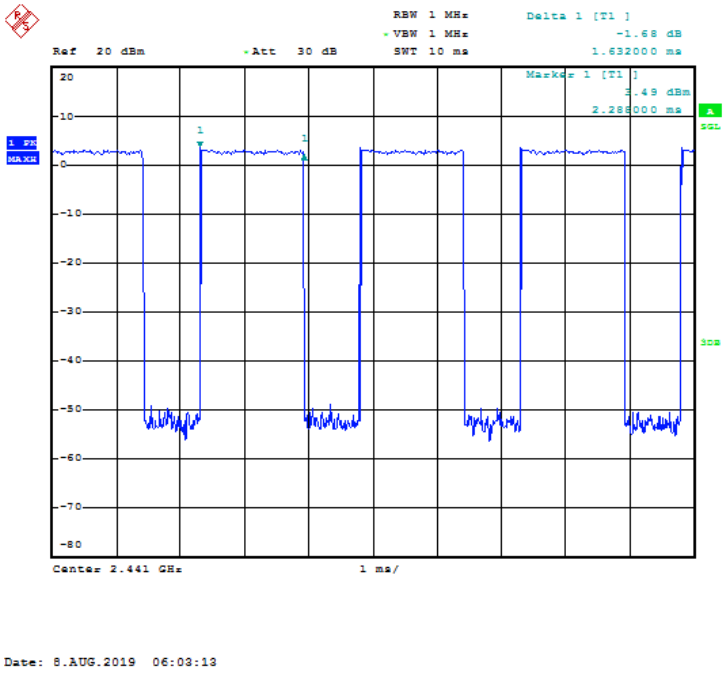


Fig.54 Time of occupancy (Dwell Time): Ch39,Packet 2-DH3

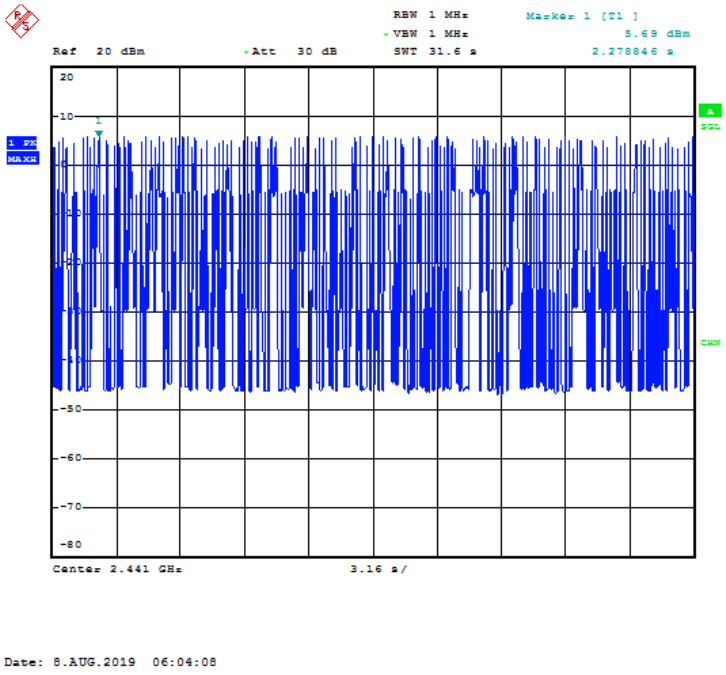


Fig.55 Number of Transmissions Measurement: Ch39, Packet 2-DH3

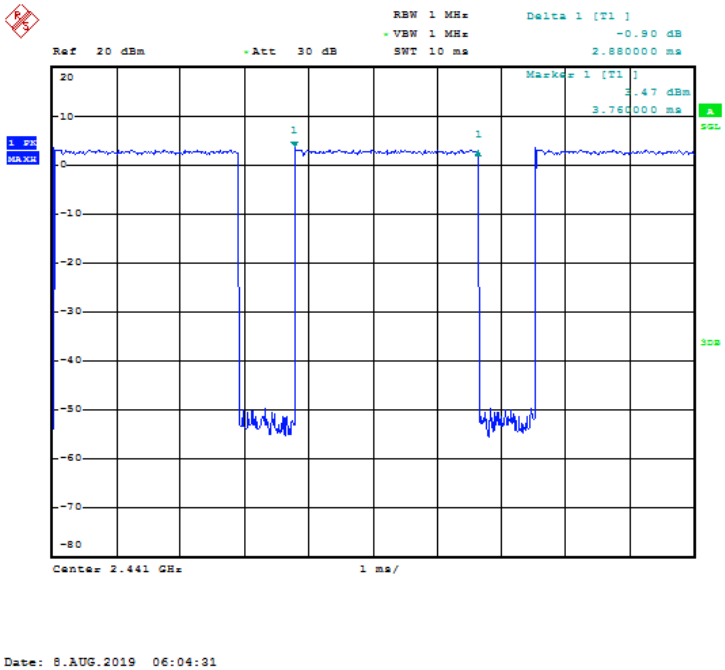


Fig.56 Time of occupancy (Dwell Time): Ch39, Packet 2-DH5

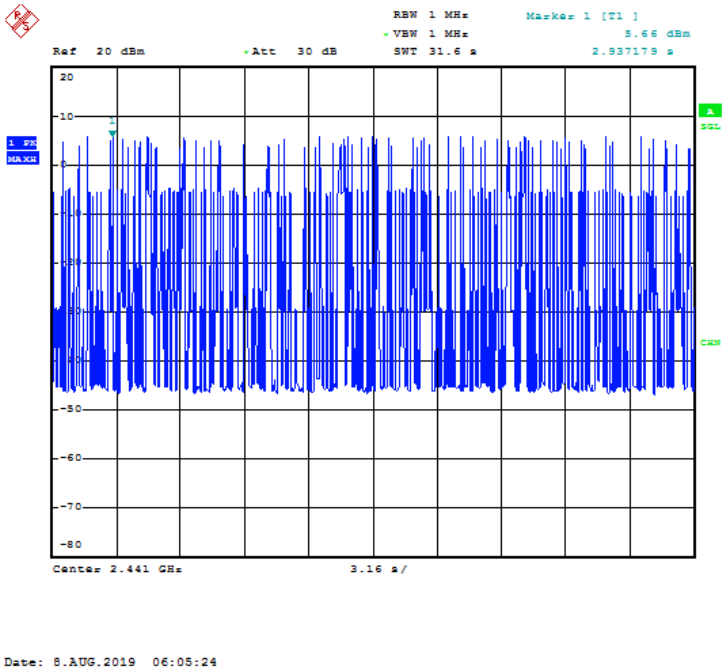


Fig.57 Number of Transmissions Measurement: Ch39, Packet 2-DH5

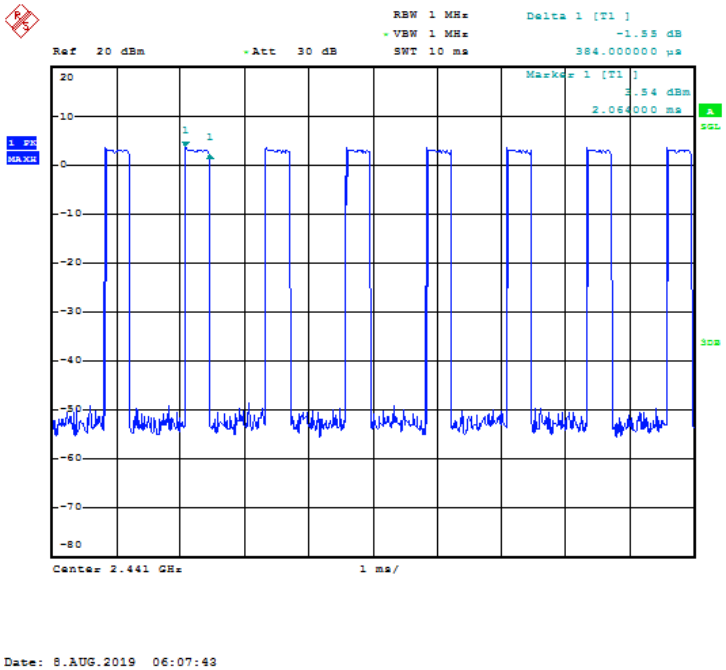


Fig.58 Time of occupancy (Dwell Time): Ch39,Packet 3-DH1

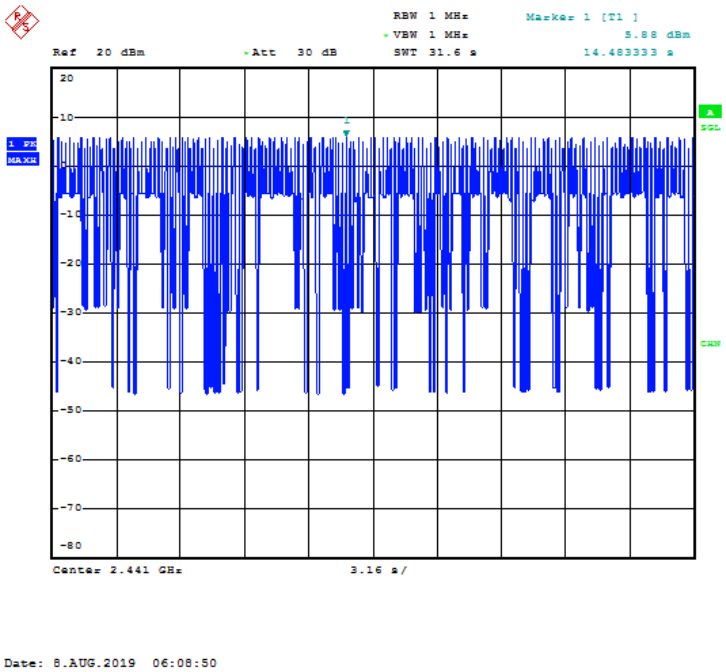


Fig.59 Number of Transmissions Measurement: Ch39, Packet 3-DH1

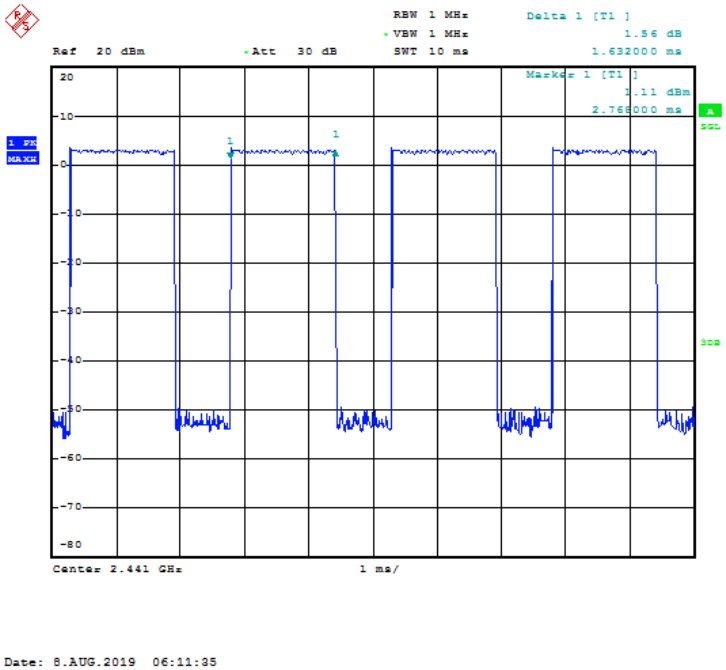


Fig.60 Time of occupancy (Dwell Time): Ch39,Packet 3-DH3

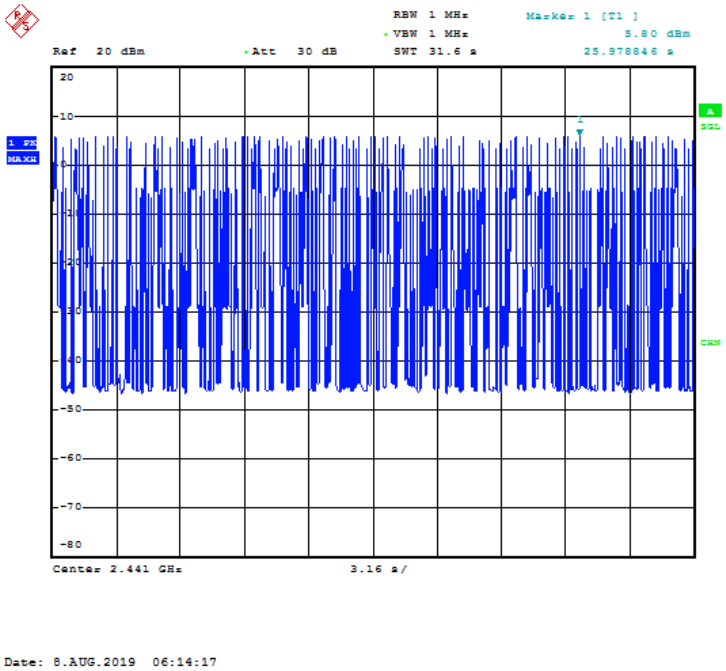


Fig.61 Number of Transmissions Measurement: Ch39, Packet 3-DH3

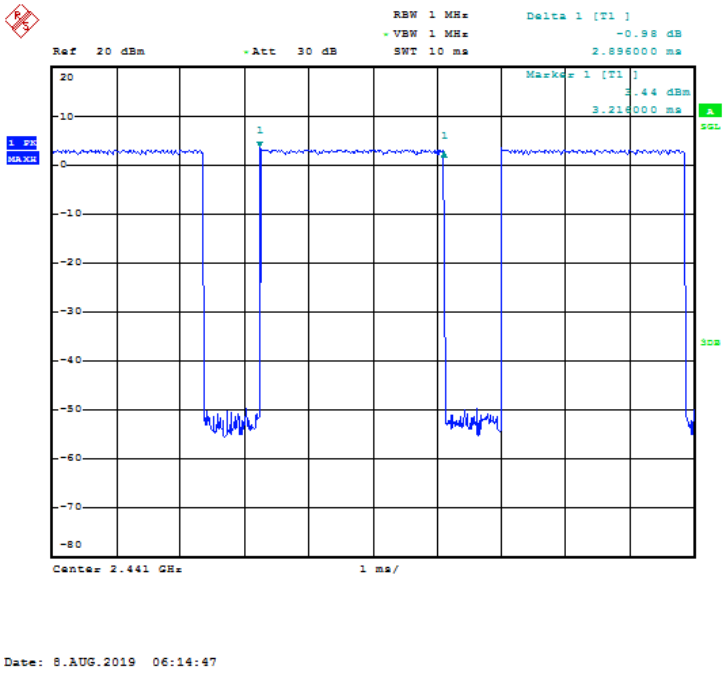


Fig.62 Time of occupancy (Dwell Time): Ch39,Packet 3-DH5

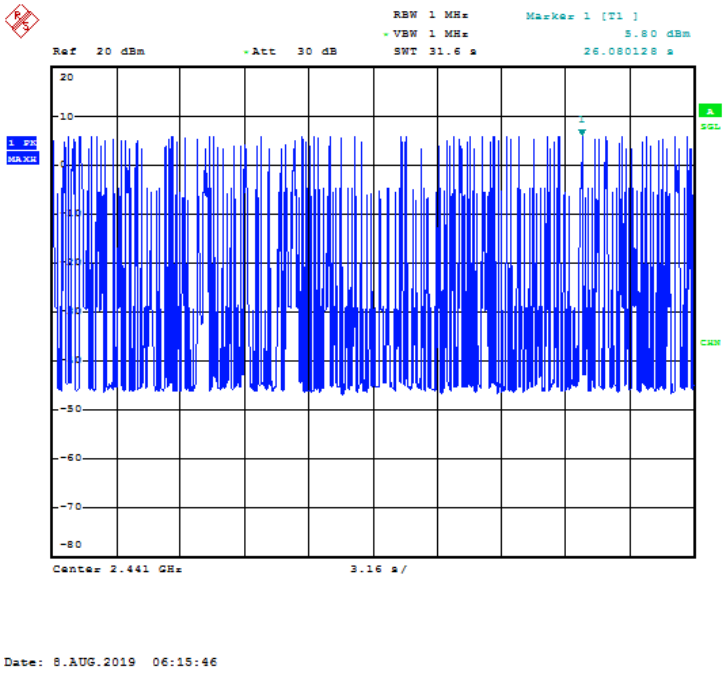


Fig.63 Number of Transmissions Measurement: Ch39, Packet 3-DH5

ANNEX A.6. 20dB Bandwidth

A.6.1 Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (a) (1)	N/A

A.6.2 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:

For GFSK

Channel	20dB Bandwidth (MHz)		Conclusion
0	Fig.64	0.764	P
39	Fig.65	0.769	P
78	Fig.66	0.764	P

For π/4 DQPSK

Channel	20dB Bandwidth (MHz)		Conclusion
0	Fig.67	1.216	P
39	Fig.68	1.225	P
78	Fig.69	1.211	P

For 8DPSK

Channel	20dB Bandwidth (MHz)		Conclusion
0	Fig.70	1.221	P
39	Fig.71	1.221	P
78	Fig.72	1.216	P

Conclusion: PASS

Test graphs as below:

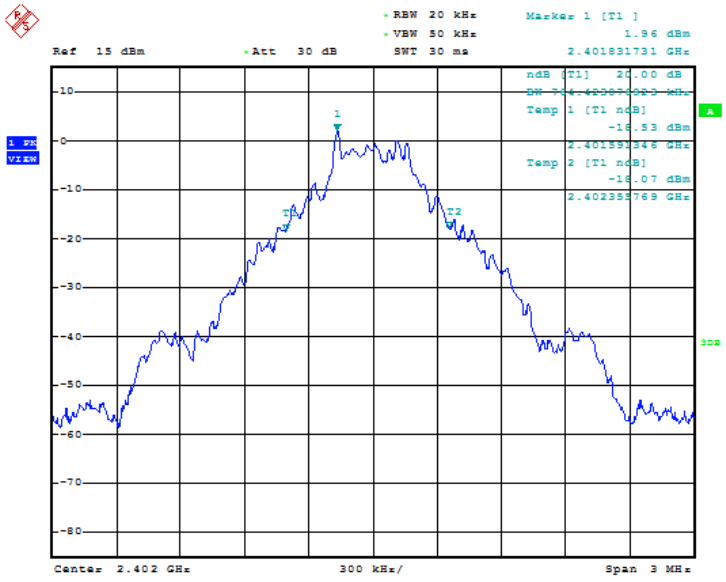


Fig.64 20dB Bandwidth: GFSK, Ch0

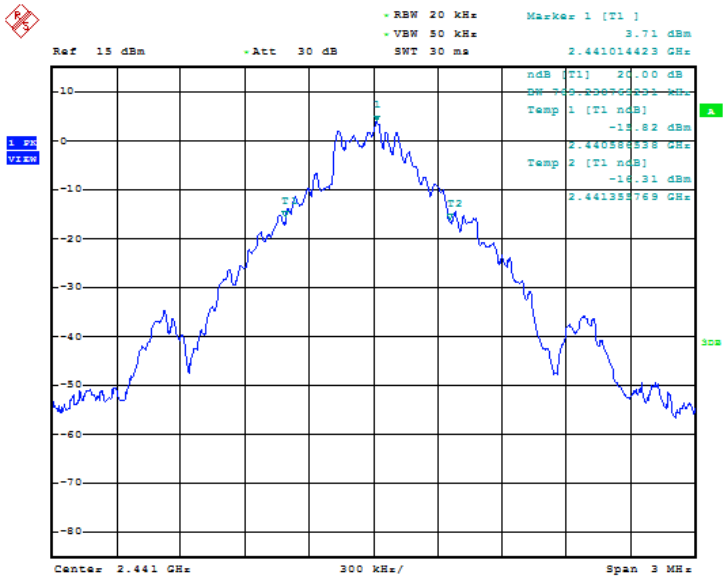


Fig.65 20dB Bandwidth: GFSK, Ch39

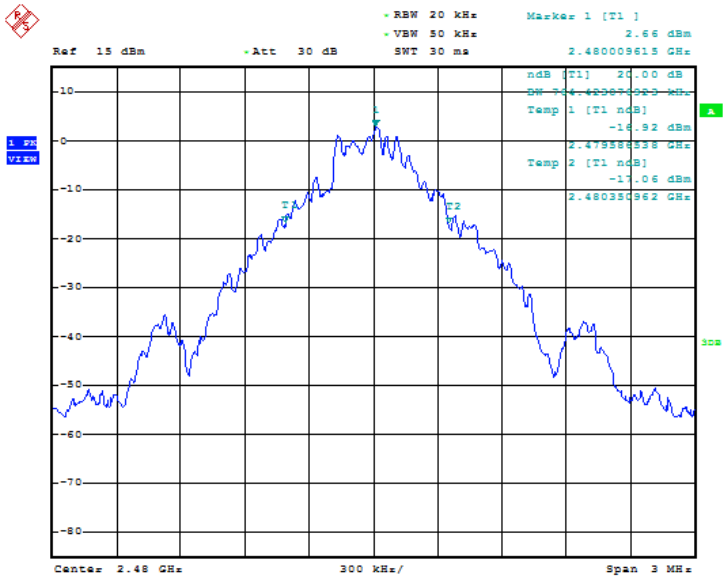


Fig.66 20dB Bandwidth: GFSK, Ch78

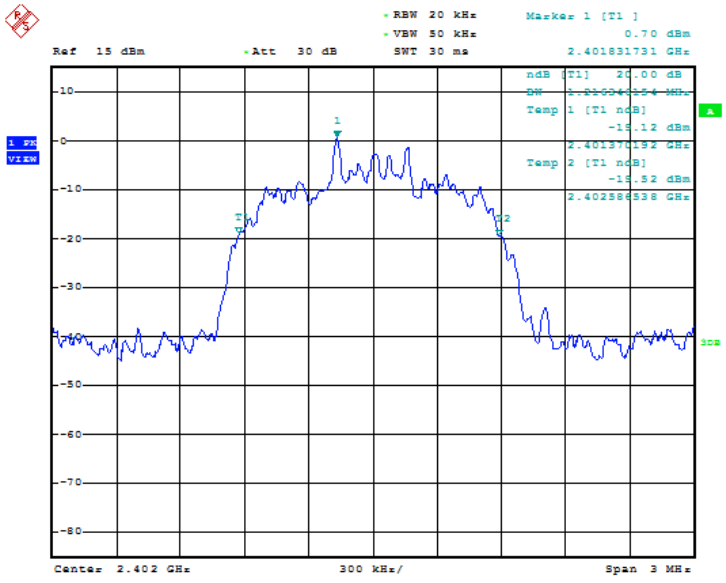


Fig.67 20dB Bandwidth: π/4 DQPSK, Ch0

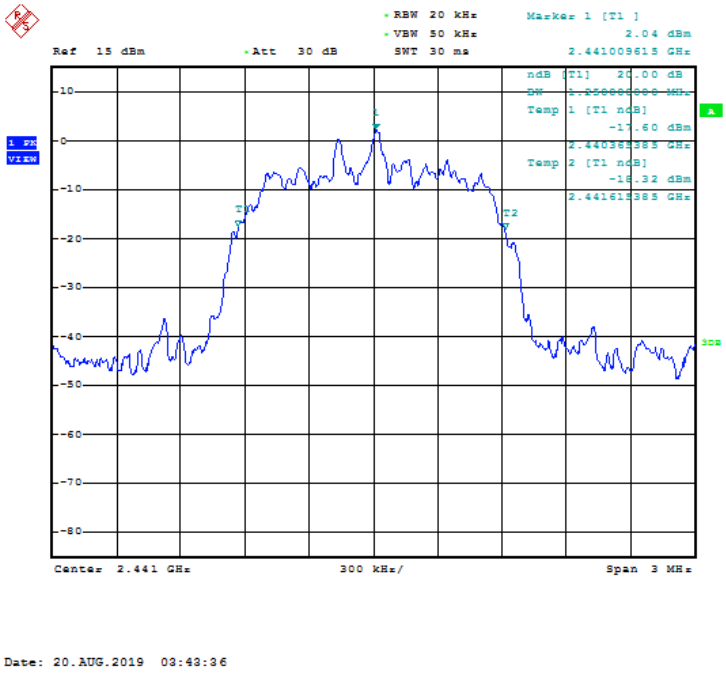


Fig.68 20dB Bandwidth: π/4 DQPSK, Ch39

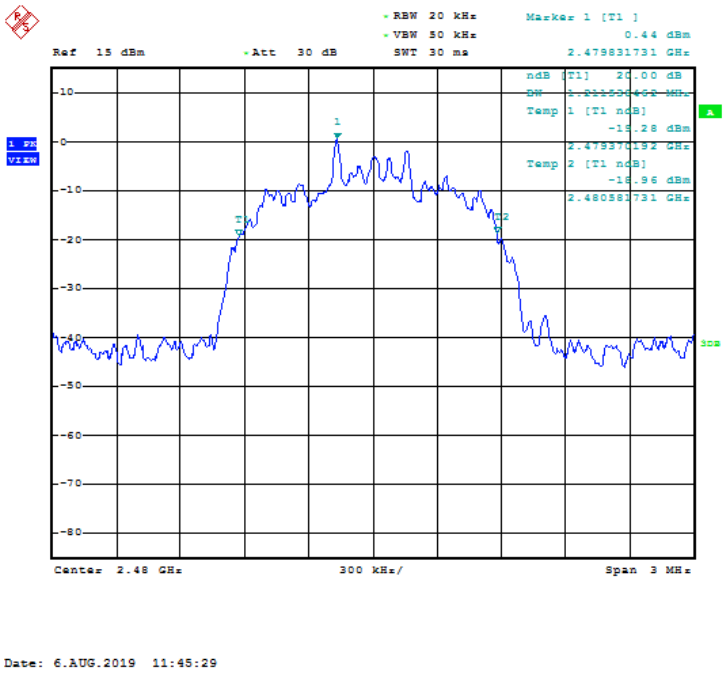


Fig.69 20dB Bandwidth: π/4 DQPSK, Ch78

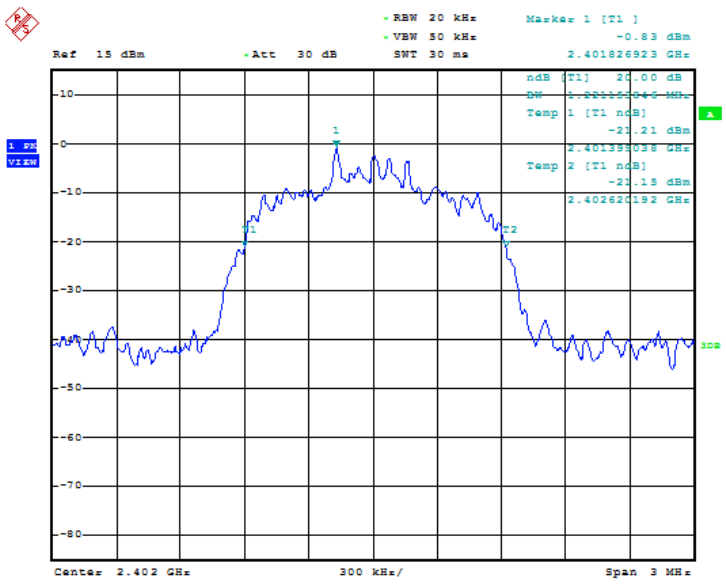


Fig.70 20dB Bandwidth: 8DPSK, Ch0

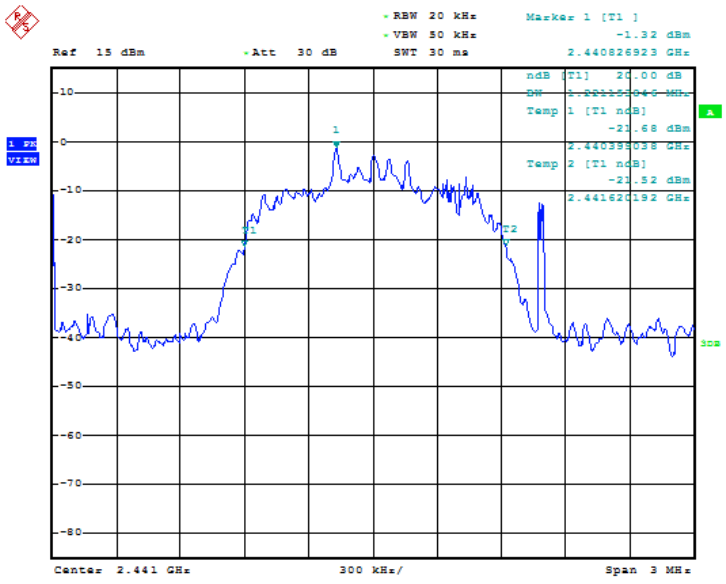


Fig.71 20dB Bandwidth: 8DPSK, Ch39

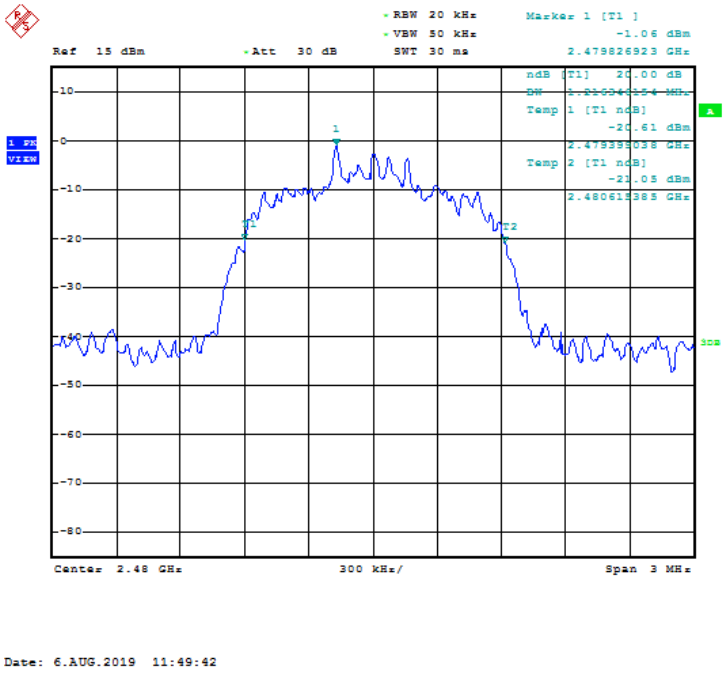


Fig.72 20dB Bandwidth: 8DPSK, Ch78

ANNEX A.7. Carrier Frequency Separation

A.7.1 Measurement Limit:

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

A.7.2 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:

For GFSK

Channel	Carrier separation (KHz)		Conclusion
39	Fig.73	993.6	P

For π/4 DQPSK

Channel	Carrier separation (KHz)		Conclusion
39	Fig.74	1008	P

For 8DPSK

Channel	Carrier separation (KHz)		Conclusion
39	Fig.75	1012.8	P

Conclusion: PASS

Test graphs as below:

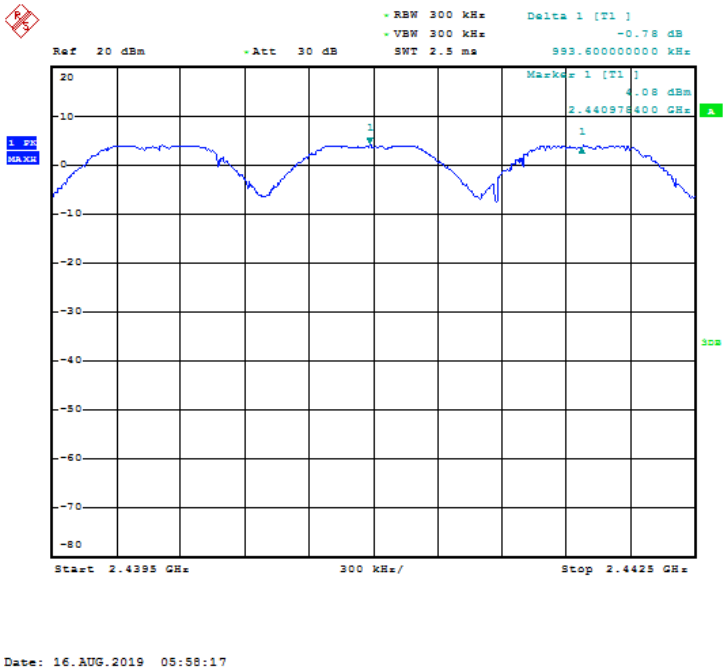


Fig.73 Carrier separation measurement: GFSK, Ch39

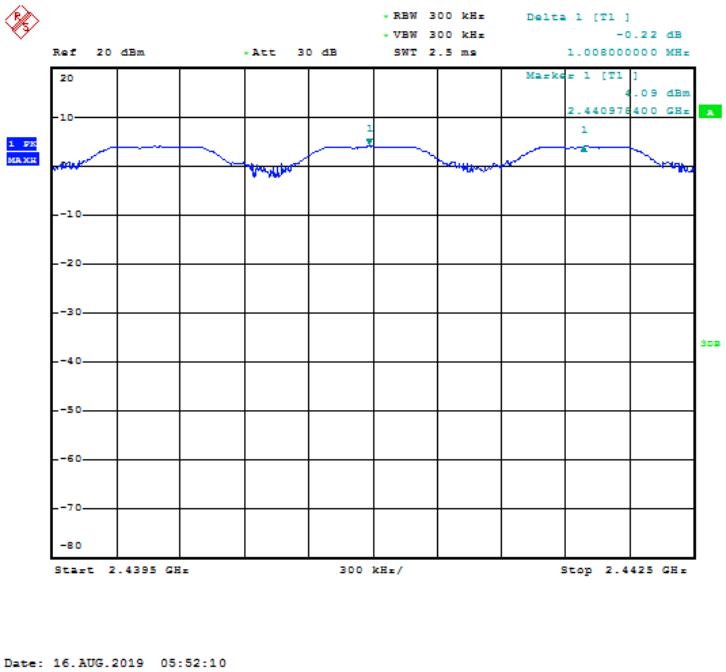


Fig.74 Carrier separation measurement: π/4 DQPSK, Ch39

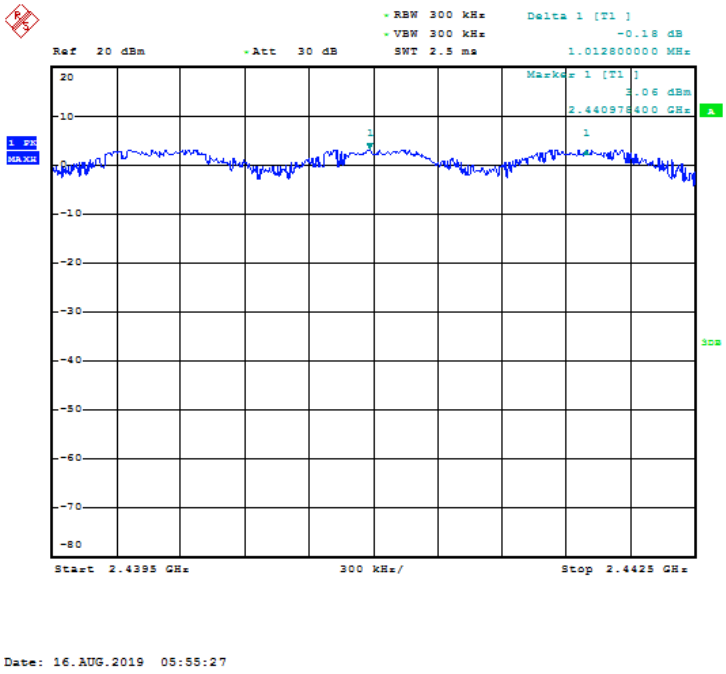


Fig.75 Carrier separation measurement: 8DPSK, Ch39

ANNEX A.8. Number Of Hopping Channels

A.8.1 Measurement Limit:

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

A.8.2 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 rsults.

Measurement Result:

For GFSK

Channel	Number of hopping channels		Conclusion
0~39	Fig.76	79	P
40~78	Fig.77		P

For π/4 DQPSK

Channel	Number of hopping channels		Conclusion
0~39	Fig.78	79	P
40~78	Fig.79		P

For 8DPSK

Channel	Number of hopping channels		Conclusion
0~39	Fig.80	79	P
40~78	Fig.81		P

Conclusion: PASS

Test graphs as below:

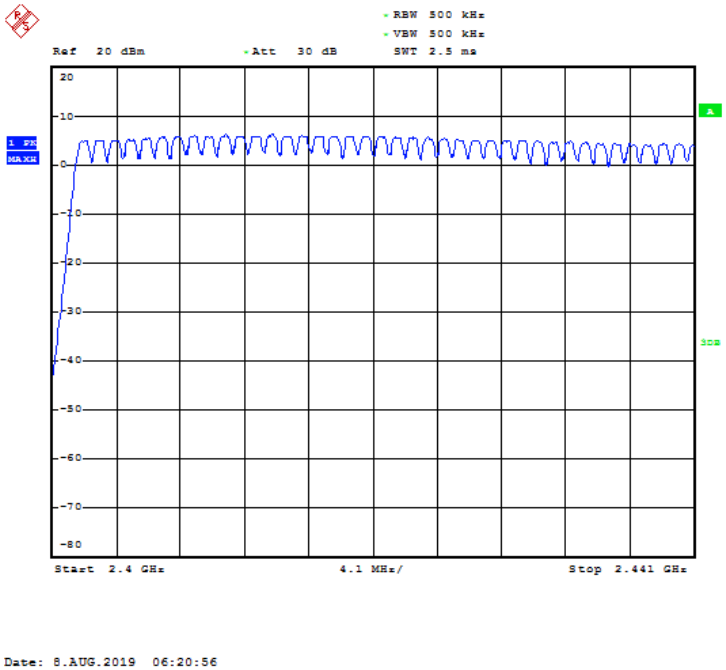


Fig.76 Number of hopping frequency: GFSK, Ch0~39

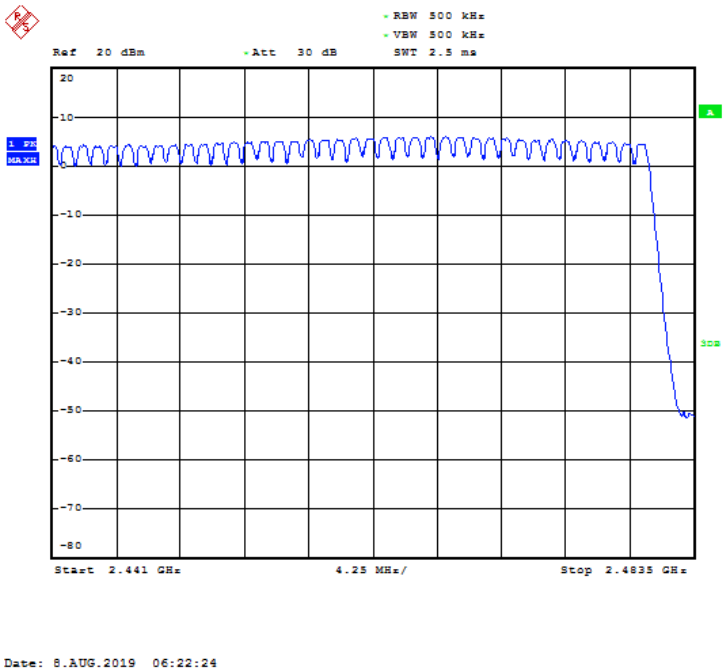


Fig.77 Number of hopping frequency: GFSK, Ch40~78

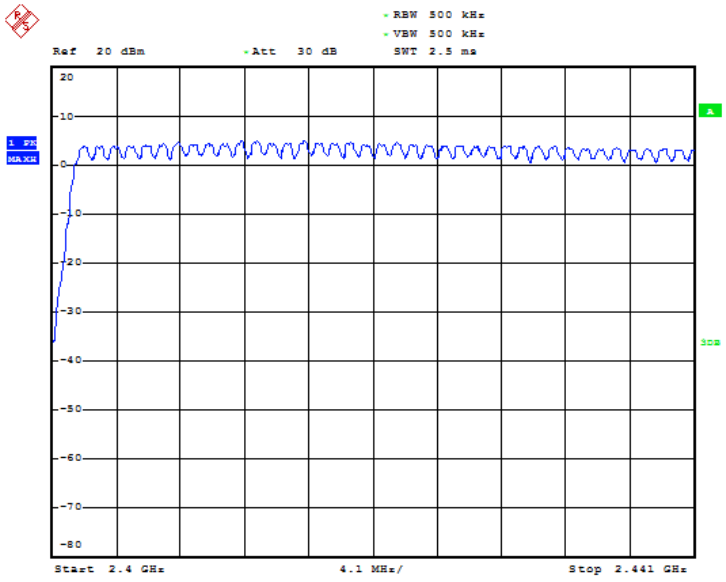


Fig.78 Number of hopping frequency: π/4 DQPSK, Ch0~39

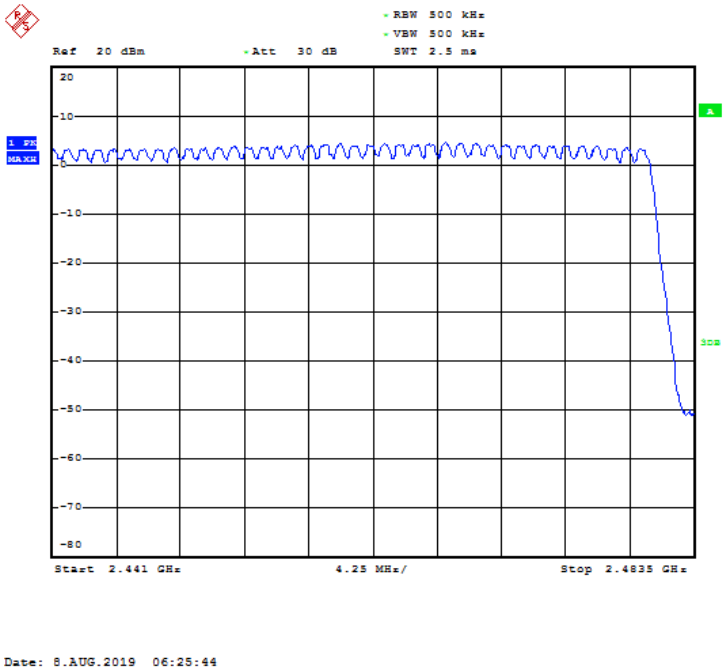


Fig.79 Number of hopping frequency: π/4 DQPSK, Ch40~78

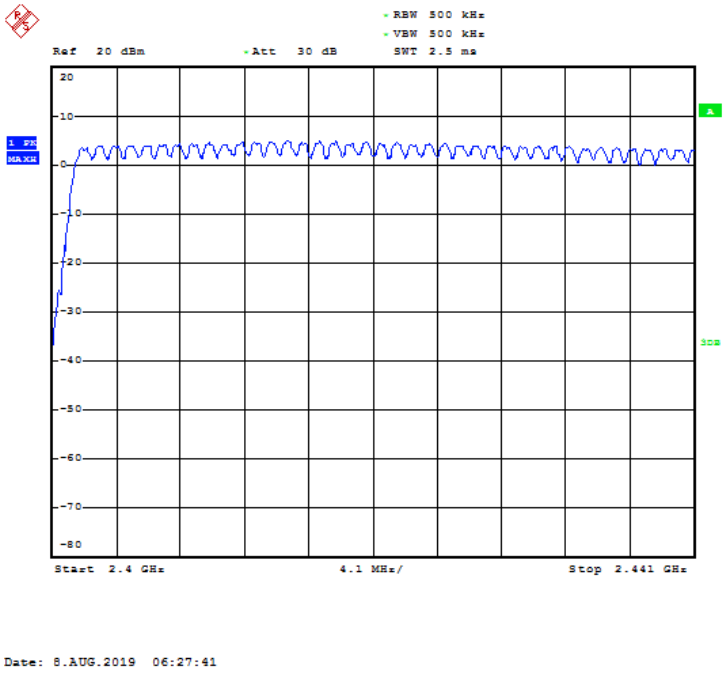


Fig.80 Number of hopping frequency: 8DPSK, Ch0~39

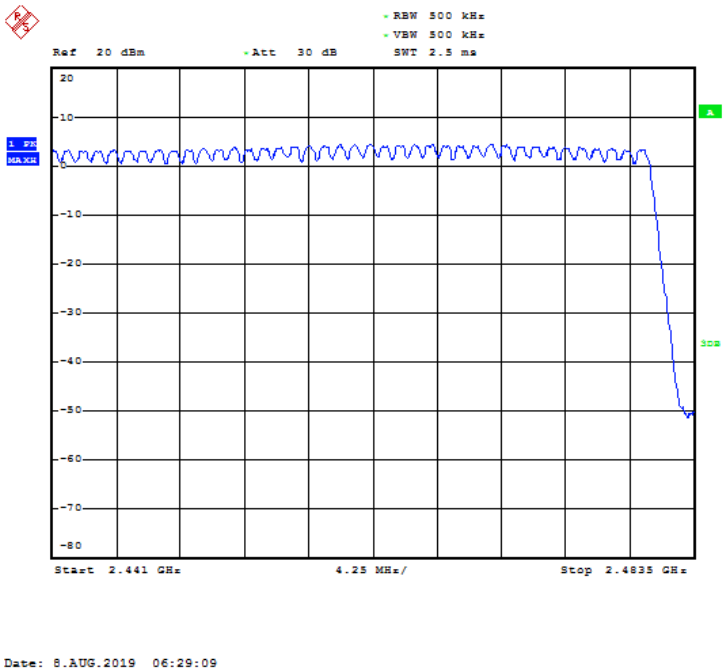


Fig.81 Number of hopping frequency: 8DPSK, Ch40~78

ANNEX A.9. AC Powerline Conducted Emission

Method of Measurement: See 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.

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)	Result (dBμV)	Conclusion
			With charger	
			BT	
0.15 to 0.5	66 to 56	56 to 46	Fig.82	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.				

Conclusion: Pass

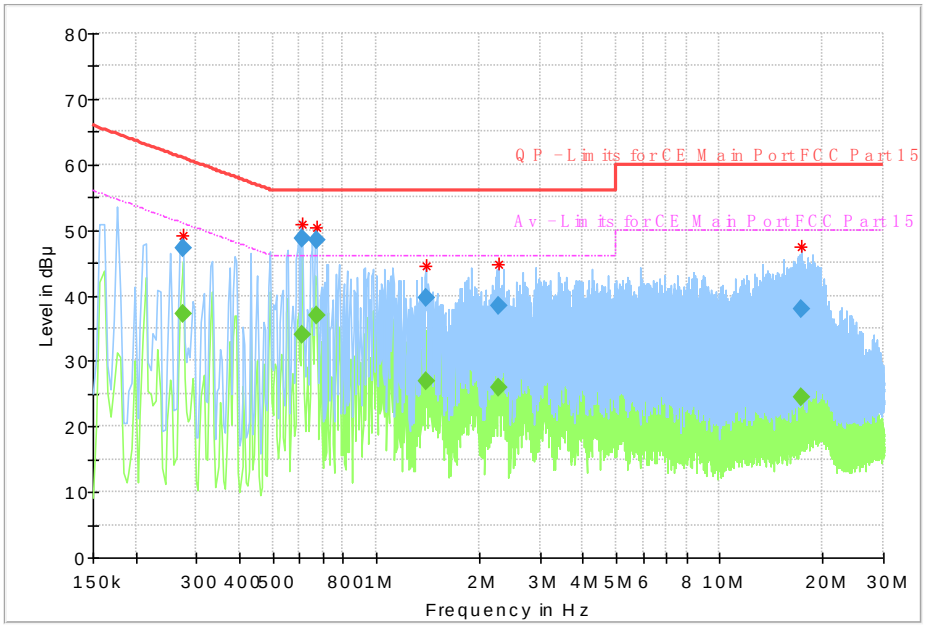


Fig.82 AC Powerline Conducted Emission

Frequency (MHz)	QuasiPeak (dB µ V)	Average (dB µ V)	Limit (dB µ	Margin (dB)	Meas. Time	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.273131	---	37.17	51.02	13.85	15000.	9.000	L1	ON	9.8
0.273131	47.16	---	61.02	13.86	15000.	9.000	L1	ON	9.8
0.608944	---	33.94	46.00	12.06	15000.	9.000	L1	ON	9.8
0.608944	48.61	---	56.00	7.39	15000.	9.000	L1	ON	9.8
0.668644	---	36.91	46.00	9.09	15000.	9.000	L1	ON	9.8
0.668644	48.38	---	56.00	7.62	15000.	9.000	L1	ON	9.8
1.396238	---	26.97	46.00	19.03	15000.	9.000	L1	ON	9.9
1.396238	39.70	---	56.00	16.30	15000.	9.000	L1	ON	9.9
2.280544	---	25.90	46.00	20.10	15000.	9.000	L1	ON	10.0
2.280544	38.48	---	56.00	17.52	15000.	9.000	L1	ON	10.0
17.224200	---	24.39	50.00	25.61	15000.	9.000	N	ON	13.4
17.224200	38.02	---	60.00	21.98	15000.	9.000	N	ON	13.4

ANNEX B. Accreditation Certificate

Accredited Laboratory

A2LA has accredited

EAST CHINA INSTITUTE OF TELECOMMUNICATIONS

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 6th day of May 2019.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2021

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

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