



# FCC PART 15C TEST REPORT No.I21Z70659-EMC08

for

**Samsung Electronics Co., Ltd.**

**Notebook PC**

**NP750XEE**

with

**FCC ID: ZCANP750XEE**

**Hardware Version: REV1.0**

**Software Version: Windows11**

**Issued Date: 2022-01-26**

**Note:**

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The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I21Z70659-EMC08	Rev.0	1st edition	2022-01-26

## **CONTENTS**

<b>1. TEST LABORATORY .....</b>	<b>4</b>
1.1. INTRODUCTION & ACCREDITATION .....	4
1.2. TESTING LOCATION .....	4
1.3. TESTING ENVIRONMENT .....	4
1.4. PROJECT DATA .....	4
1.5. SIGNATURE .....	4
<b>2. CLIENT INFORMATION.....</b>	<b>5</b>
2.1. APPLICANT INFORMATION .....	5
2.2. MANUFACTURER INFORMATION .....	5
<b>3. PRODUCT INFORMATION .....</b>	<b>6</b>
3.1. ABOUT EUT .....	6
3.2. INTERNAL IDENTIFICATION OF EUT .....	6
3.3. INTERNAL IDENTIFICATION OF AE.....	6
3.4. GENERAL DESCRIPTION.....	7
3.5. TEST CONFIGURATION .....	7
3.6. INTERPRETATION OF THE TEST ENVIRONMENT.....	7
<b>4. REFERENCE DOCUMENTS.....</b>	<b>8</b>
4.1. DOCUMENTS SUPPLIED BY APPLICANT .....	8
4.2. REFERENCE DOCUMENTS FOR TESTING.....	8
<b>5. TEST RESULTS .....</b>	<b>9</b>
5.1. SUMMARY OF TEST RESULTS .....	9
5.2. STATEMENTS.....	9
5.3. TEST CONDITIONS .....	9
<b>6. TEST FACILITIES UTILIZED.....</b>	<b>10</b>
<b>7. MEASUREMENT UNCERTAINTY .....</b>	<b>11</b>
<b>ANNEX A: EUT PARAMETERS .....</b>	<b>12</b>
<b>ANNEX B: ANTENNA REQUIREMENTS .....</b>	<b>12</b>
<b>ANNEX C: DETAILED TEST RESULTS.....</b>	<b>13</b>
C.1. RADIATED SPURIOUS EMISSION .....	13
C.1.1 RADIATED SPURIOUS EMISSION- ABOVE 1GHZ .....	15
C.1.2 RADIATED SPURIOUS EMISSION- BELOW 1GHZ .....	27
C.1.3 BAND EDGES COMPLIANCE– RADIATED .....	28
C.2. AC POWERLINE CONDUCTED EMISSION .....	35

## 1. Test Laboratory

### 1.1. Introduction & Accreditation

**Telecommunication Technology Labs, CAICT** is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

### 1.2. Testing Location

Location: CTTL (Huayuan North Road)

Address: No. 52 Huayuan North Road, Haidian District, Beijing 100191, P.R. China

### 1.3. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

### 1.4. Project data

Testing Start Date: 2021-12-10

Testing End Date: 2022-01-24

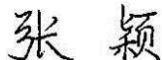
### 1.5. Signature



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Li Yan

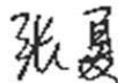
(Prepared this test report)



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Zhang Ying

(Reviewed this test report)



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Zhang Xia

Deputy Director of the laboratory

(Approved this test report)



## **2. Client Information**

### **2.1. Applicant Information**

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Fax: /

### **2.2. Manufacturer Information**

Company Name: Samsung Electronics Co., Ltd.  
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Email: ggobi.cho@samsung.com  
Telephone: +82-10-2722-4159  
Fax: /

### 3. PRODUCT INFORMATION

#### 3.1. About EUT

Description	Notebook PC
Model name	NP750XEE
FCC ID	ZCANP750XEE

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of T CTTL-Telecommunication Technology Labs, CAICT

#### 3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	2170659UT13a	REV1.0	Windows11
EUT2	2170659UT22a	REV1.0	Windows11

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

#### 3.3. Internal Identification of AE

AE ID*	Description	SN	Remarks
AE1	Travel Adapter	/	/
AE2	Data Cable	/	/
AE3	battery	/	Inbuilt

##### AE1

Model	EP-TA865
Manufacturer	DONGYANG E&P Inc
Length of cable	/

##### AE2

Model	/
Manufacturer	/
Length of cable	/

##### AE3

Model	/
Manufacturer	/

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

### 3.4. General Description

The Equipment Under Test (EUT) was a Notebook PC with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac/ax capabilities in the 2.4 GHz and 5 GHz bands.

Antenna information

Item	Spec.	Vendor	Vendor P/N	Sample under test
Antenna	Main antenna (Chain A)	INNOWAVE	/	EUT1
	Auxiliary antenna (Chain B)			
Antenna	Main antenna (Chain A)	SPEED	/	EUT2
	Auxiliary antenna (Chain B)			

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the Client.

For more EUT information please refer to the manufacturer's specifications or user's manual.

### 3.5. Test Configuration

Test Mode		Transmitting Frequency (MHz)		
GFSK	Antenna INNOWAVE(EUT1)	2402(CH0)	2441 (CH39)	2480 (CH78)
	Antenna SPEED(EUT2)	2402(CH0)	2441 (CH39)	2480 (CH78)
$\pi/4$ DQPSK	Antenna INNOWAVE(EUT1)	2402(CH0)	2441 (CH39)	2480 (CH78)
	Antenna SPEED(EUT2)	2402(CH0)	2441 (CH39)	2480 (CH78)
8DPSK	Antenna INNOWAVE(EUT1)	2402(CH0)	2441 (CH39)	2480 (CH78)
	Antenna SPEED(EUT2)	2402(CH0)	2441 (CH39)	2480 (CH78)

For Bluetooth mode the EUT can transmit only at CHAIN A RF output.

The software DRTU provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

### 3.6. Interpretation of the Test Environment

For the test methods, the test environment uncertainty figures correspond to an expansion factor  $k=2$ .

Measurement Uncertainty

Parameter	Uncertainty
temperature	0.48°C
humidity	2 %
DC voltages	0.003V

## 4. Reference Documents

### 4.1. Documents supplied by applicant

EUT parameters, referring to Annex A for detailed information, is 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, 2400-2483.5 MHz, and 5725-5850 MHz.	2021
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices Federal Communications Commission Office of Engineering and Technology Laboratory Division	2013
KDB 558074 D01	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES	2019

Note: The test methods have no deviation with standards.



## 5. Test Results

### 5.1. Summary of Test Results

Abbreviations used in this clause:

- P** Pass, The EUT complies with the essential requirements in the standard.
- F** Fail, The EUT does not comply with the essential requirements in the standard
- NA** Not Applicable, The test was not applicable
- NP** Not Performed, The test was not performed by CTTL

SUMMARY OF MEASUREMENT RESULTS	Sub-clause of Part15C	Verdict
Radiated Spurious Emission	15.247, 15.205, 15.209	<b>P</b>
AC Power line Conducted Emission	15.107, 15.207	<b>P</b>

Please refer to **ANNEX C** for detail.

The measurement is made according to ANSI C63.10.

### 5.2. Statements

CTTL has evaluated the test cases requested by the applicant /manufacturer as listed in section 5.1 of this report for the EUT specified in section 3 according to the standards or reference documents listed in section 4.2

### 5.3. Test Conditions

T nom	Normal Temperature
T min	Low Temperature
T max	High Temperature
V nom	Normal Voltage

For this report, if the test cases listed above are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

Temperature	T nom	22-26°C
Voltage	V nom	15.4V
Humidity	H nom	20-75%

## 6. Test Facilities Utilized

### Radiated emission test system

No.	Equipment	Model	Manufacturer	Serial Number	Calibration Period	Calibration Due date
1	Test Receiver	ESW44	R&S	103023	1 year	2022-10-18
2	Analytical Spectrometer	FSW67	R&S	103290	1 year	2022-01-20
3	EMI Antenna	VULB 9163	SCHWARZB ECK	01223	1 year	2022-03-22
4	EMI Antenna	3115	ETS-Lindgren	00167250	1 year	2022-07-01
5	EMI Antenna	3116	ETS-Lindgren	2663	1 year	2022-08-10
6	Loop Antenna	HFH2-Z2	R&S	829324/007	1 year	2022-12-22
7	Bluetooth Tester	CBT	R&S	101042	1 year	2022-12-23

Note: the Analytical Spectrometer which Serial Number is 103290 was before Calibration Due date when used.

### AC Power Line Conducted Emission

No.	Equipment	Model	Manufacturer	Serial Number	Calibration Period	Calibration Due date
1	LISN	ENV216	R&S	101200	1 year	2022-05-30
2	Test Receiver	ESCI	R&S	100344	1 year	2022-02-23
3	Bluetooth Tester	CBT	R&S	101042	1 year	2022-12-23

## 7. Measurement Uncertainty

### Radiated Spurious Emission

#### Measurement Uncertainty:

Frequency Range	Uncertainty(dBm) (k=2)
9kHz-30MHz	/
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.16
$1\text{GHz} \leq f \leq 18\text{GHz}$	5.44
$18\text{GHz} \leq f \leq 40\text{GHz}$	5.28

### AC Power-line Conducted Emission

Measurement Uncertainty (k=2)	3.08dB
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## **ANNEX A: EUT parameters**

Disclaimer: The antenna gain and setting power provided by the client may affect the validity of the measurement results in this report, and the client shall bear the impact and consequences arising therefrom.

## **ANNEX B: Antenna Requirements**

According to FCC 47 CFR § 15.203:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- (1) The antennas of the EUT are permanently attached.
- (2) The EUT complies with the requirement of §15.203

## **ANNEX C: Detailed Test Results**

### **C.1. Radiated Spurious Emission**

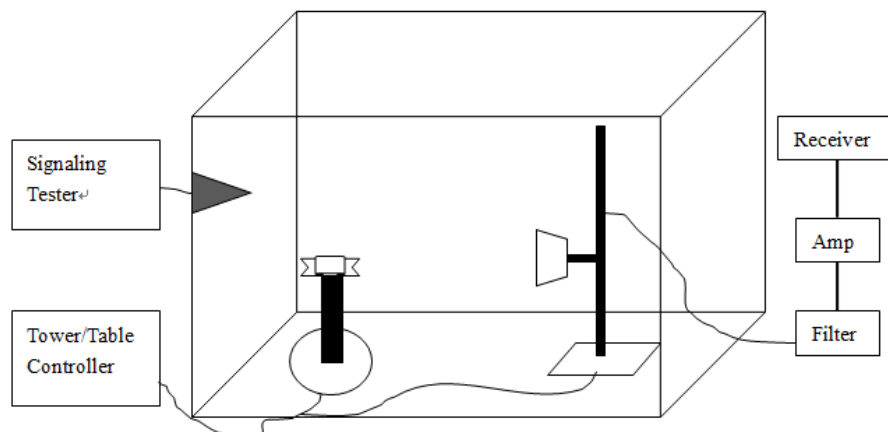
#### **Specification Reference**

FCC 47 CFR Part 15.247, 15.205, 15.209

#### **Method of Measurement**

Testing was performed in accordance with ANSI C63.10-2013 and KDB 558074.

The radiated emission test is performed in a semi-anechoic chamber. The distance from the EUT to the reference point of measurement antenna is 3m. The test is carried out on both vertical and horizontal polarization and only the maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result.



#### **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 (MHz)	Field strength( $\mu\text{V}/\text{m}$ )	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30

Frequency of emission (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

### **Test settings**

Frequency of emission (MHz)	RBW/VBW
30-1000	100kHz/300kHz
1000-4000	1MHz/3MHz
4000-18000	1MHz/3MHz
18000-26500	1MHz/3MHz

### **Sample Calculation**

The measurement results are obtained as described below:

$$\text{Result} = P_{\text{Mea}} + A_{\text{Rpl}} = P_{\text{Mea}} + \text{Cable Loss} + \text{Antenna Factor}$$

A "reference path loss" is established and the  $A_{\text{Rpl}}$  is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

$P_{\text{Mea}}$  is the field strength recorded from the instrument.

### **Test Notes**

1. The EUT is operating at its maximum duty cycle and its maximum power control level.
2. Investigation has been done on all channel, modes and modulations/data rates. Only the radiated emissions of the configurations that produced the worst case emissions are reported in this section.

### C.1.1 Radiated Spurious Emission- above 1GHz

#### INNOWAVE

##### Peak Measurement results

##### GFSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17995.000	54.90	-25.50	46.70	33.70	74.00	19.10	V
14156.500	51.35	-29.00	42.00	38.35	74.00	22.65	V
12853.500	49.43	-30.70	39.10	40.93	74.00	24.57	H
9626.500	47.70	-33.10	38.00	42.80	74.00	26.30	V
7994.000	46.38	-34.80	37.10	44.08	74.00	27.62	V
2351.500	56.59	-20.10	28.00	48.69	74.00	17.41	H

##### GFSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17614.500	53.68	-25.70	46.00	33.48	74.00	20.32	V
14171.000	50.77	-29.00	42.00	37.77	74.00	23.23	V
12847.500	49.11	-30.70	39.10	40.61	74.00	24.89	H
9136.000	47.53	-33.80	38.10	43.33	74.00	26.47	V
7766.000	46.18	-34.80	37.00	44.08	74.00	27.82	V
4834.500	41.16	-37.50	33.10	45.46	74.00	32.84	H

##### GFSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17987.000	54.00	-25.50	46.70	32.80	74.00	20.00	V
14257.000	50.44	-28.40	42.30	36.54	74.00	23.56	V
12766.500	48.97	-30.50	39.10	40.37	74.00	25.03	V
9977.500	48.09	-33.60	38.10	43.59	74.00	25.91	H
7998.000	46.14	-34.80	37.10	43.84	74.00	27.86	V
2499.500	57.12	-20.00	28.40	48.72	74.00	16.88	V

**$\pi/4$  DQPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17978.000	53.96	-25.50	46.70	32.76	74.00	20.04	H
13744.500	50.91	-29.10	40.90	39.11	74.00	23.09	V
12841.500	48.89	-30.70	39.10	40.39	74.00	25.11	V
9023.500	46.78	-33.80	38.10	42.38	74.00	27.22	V
7890.500	46.02	-34.90	37.10	43.82	74.00	27.98	H
2387.500	56.07	-20.00	28.10	48.07	74.00	17.93	V

 **$\pi/4$  DQPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17986.500	54.30	-25.50	46.70	33.10	74.00	19.70	V
13540.500	50.50	-29.60	40.00	40.10	74.00	23.50	V
12975.500	50.10	-30.50	39.20	41.40	74.00	23.90	V
9105.500	47.22	-33.80	38.10	42.82	74.00	26.78	V
7986.000	45.96	-34.80	37.10	43.66	74.00	28.04	V
4914.500	41.40	-37.10	33.30	45.20	74.00	32.60	V

 **$\pi/4$  DQPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17776.000	54.51	-25.50	46.70	33.31	74.00	19.49	H
13690.500	50.90	-29.50	40.40	40.00	74.00	23.10	V
12868.500	48.94	-30.70	39.10	40.44	74.00	25.06	H
9517.000	46.87	-33.20	37.90	42.17	74.00	27.13	H
7896.000	46.27	-34.90	37.10	44.07	74.00	27.73	H
2488.600	56.52	-20.00	28.30	48.22	74.00	17.48	H



**8DPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17970.500	54.35	-25.50	46.70	33.15	74.00	19.65	V
13586.000	50.93	-29.50	40.40	40.03	74.00	23.07	V
12845.500	49.39	-30.70	39.10	40.89	74.00	24.61	H
9339.500	47.05	-33.90	38.00	42.95	74.00	26.95	H
7249.000	46.39	-35.00	36.50	44.79	74.00	27.61	H
2325.300	56.06	-20.10	27.90	48.16	74.00	17.94	V

**8DPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17431.000	54.25	-26.90	45.20	35.85	74.00	19.75	V
13715.500	51.00	-29.10	40.90	39.20	74.00	23.00	H
12878.500	48.79	-30.70	39.10	40.29	74.00	25.21	H
9627.500	46.83	-33.10	38.00	41.93	74.00	27.17	H
7325.000	45.92	-35.10	36.60	44.42	74.00	28.08	V
4643.000	41.04	-37.50	32.80	45.74	74.00	32.96	V

**8DPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17989.000	54.14	-25.50	46.70	32.94	74.00	19.86	V
14003.500	51.59	-29.40	41.70	39.39	74.00	22.41	H
12910.000	49.17	-30.50	39.20	40.47	74.00	24.83	V
9085.000	46.80	-33.80	38.10	42.40	74.00	27.20	V
7986.000	45.91	-34.80	37.10	43.61	74.00	28.09	H
2491.700	57.14	-20.00	28.30	48.84	74.00	16.86	V

**Average Measurement results**
**GFSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17977.500	42.63	-25.50	46.70	21.43	54.00	11.37	H
14181.000	39.15	-29.00	42.00	26.15	54.00	14.85	V
12918.500	37.57	-30.50	39.20	28.87	54.00	16.43	H
9085.000	35.21	-33.80	38.10	30.81	54.00	18.79	V
7817.500	34.09	-35.10	37.00	32.19	54.00	19.91	H
2363.900	42.75	-20.10	28.00	34.75	54.00	11.25	V

**GFSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17601.500	42.51	-25.70	46.00	22.31	54.00	11.49	H
14160.500	39.69	-29.00	42.00	26.69	54.00	14.31	V
12889.000	37.59	-30.70	39.10	29.09	54.00	16.41	V
9215.000	35.47	-33.70	38.00	31.17	54.00	18.53	H
7999.500	34.29	-34.80	37.10	31.99	54.00	19.71	H
4792.500	29.43	-37.30	33.00	33.63	54.00	24.57	V

**GFSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17597.500	42.66	-25.70	46.00	22.46	54.00	11.34	H
14158.000	39.35	-29.00	42.00	26.35	54.00	14.65	V
12850.500	37.46	-30.70	39.10	28.96	54.00	16.54	H
9784.000	35.34	-33.50	38.00	30.84	54.00	18.66	V
7988.500	34.78	-34.80	37.10	32.48	54.00	19.22	H
2493.300	43.20	-20.00	28.30	34.90	54.00	10.80	V

**$\pi/4$  DQPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17993.500	42.70	-25.50	46.70	21.50	54.00	11.30	H
13715.000	39.22	-29.10	40.90	27.42	54.00	14.78	V
12847.500	37.63	-30.70	39.10	29.13	54.00	16.37	V
9957.000	35.42	-33.50	38.10	30.82	54.00	18.58	V
7990.500	34.35	-34.80	37.10	32.05	54.00	19.65	H
2370.600	42.77	-20.10	28.00	34.77	54.00	11.23	V

 **$\pi/4$  DQPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17984.000	42.45	-25.50	46.70	21.25	54.00	11.55	V
14193.500	39.53	-29.00	42.00	26.53	54.00	14.47	V
12766.500	37.61	-30.50	39.10	29.01	54.00	16.39	V
9099.000	35.36	-33.80	38.10	30.96	54.00	18.64	H
7786.000	34.21	-35.10	37.00	32.31	54.00	19.79	H
4851.500	29.71	-37.50	33.10	34.01	54.00	24.29	V

 **$\pi/4$  DQPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17592.000	42.60	-25.70	46.00	22.40	54.00	11.40	V
14206.000	39.29	-29.00	42.00	26.29	54.00	14.71	H
12775.500	37.72	-30.70	39.10	29.22	54.00	16.28	H
9116.500	35.17	-33.80	38.10	30.97	54.00	18.83	H
7796.500	34.23	-35.10	37.00	32.33	54.00	19.77	H
2495.400	43.11	-20.00	28.30	34.81	54.00	10.89	V

**8DPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17995.500	42.67	-25.50	46.70	21.47	54.00	11.33	H
14564.500	39.32	-27.30	41.90	24.72	54.00	14.68	H
12355.500	37.52	-31.10	38.90	29.72	54.00	16.48	H
9107.000	35.30	-33.80	38.10	31.10	54.00	18.70	V
7895.500	34.20	-34.90	37.10	32.00	54.00	19.80	V
2341.500	42.76	-20.10	28.00	34.86	54.00	11.24	V

**8DPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17607.000	42.59	-25.70	46.00	22.39	54.00	11.41	H
14146.500	39.39	-29.00	42.00	26.39	54.00	14.61	V
12366.000	37.58	-31.10	38.90	29.78	54.00	16.42	V
9642.500	35.24	-33.10	38.00	30.34	54.00	18.76	V
7793.500	34.42	-35.10	37.00	32.52	54.00	19.58	V
4868.000	29.72	-37.20	33.20	33.72	54.00	24.28	V

**8DPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17408.000	42.54	-26.90	45.20	24.14	54.00	11.46	V
14128.000	39.20	-29.00	42.00	26.20	54.00	14.80	V
12828.500	37.72	-30.70	39.10	29.22	54.00	16.28	H
9093.000	35.18	-33.80	38.10	30.78	54.00	18.82	H
7996.500	34.28	-34.80	37.10	31.98	54.00	19.72	V
2497.700	43.14	-20.00	28.30	34.84	54.00	10.86	V

Note: the spurious emission above 18G is noise only.

**Conclusion: Pass**

## SPEED

### Peak Measurement results

#### GFSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17928.000	54.68	-25.50	46.70	33.48	74.00	19.32	V
14219.500	51.09	-29.00	42.00	38.09	74.00	22.91	H
12756.000	50.06	-30.50	39.10	41.46	74.00	23.94	H
9580.000	47.02	-33.10	38.00	42.12	74.00	26.98	H
7144.500	46.52	-35.40	36.30	45.62	74.00	27.48	H
2343.600	56.55	-20.10	28.00	48.65	74.00	17.45	V

#### GFSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17589.500	55.54	-25.70	46.00	35.34	74.00	18.46	V
13311.500	51.20	-29.50	39.70	41.00	74.00	22.80	V
12748.000	50.12	-30.50	39.10	41.52	74.00	23.88	H
9215.500	47.49	-33.70	38.00	43.19	74.00	26.51	V
7336.000	46.28	-35.10	36.60	44.78	74.00	27.72	H
4858.000	41.71	-37.50	33.10	46.01	74.00	32.29	V

#### GFSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17607.500	54.24	-25.70	46.00	34.04	74.00	19.76	H
14143.500	51.58	-29.00	42.00	38.58	74.00	22.42	H
12354.500	49.35	-31.10	38.90	41.55	74.00	24.65	H
9108.000	47.12	-33.80	38.10	42.92	74.00	26.88	V
7824.000	46.12	-35.10	37.00	44.22	74.00	27.88	V
2493.400	56.06	-20.00	28.30	47.76	74.00	17.94	H

**$\pi/4$  DQPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17814.500	53.75	-25.50	46.70	32.55	74.00	20.25	H
13194.000	51.62	-29.70	39.60	41.72	74.00	22.38	H
12908.500	49.42	-30.50	39.20	40.72	74.00	24.58	H
9536.500	47.00	-33.20	37.90	42.30	74.00	27.00	H
7982.500	46.94	-34.80	37.10	44.64	74.00	27.06	V
2364.600	56.89	-20.10	28.00	48.89	74.00	17.11	V

 **$\pi/4$  DQPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17398.000	54.29	-26.90	45.20	35.89	74.00	19.71	H
13641.500	51.26	-29.50	40.40	40.36	74.00	22.74	V
12854.500	49.42	-30.70	39.10	40.92	74.00	24.58	V
9103.000	47.32	-33.80	38.10	42.92	74.00	26.68	V
7785.000	46.19	-35.10	37.00	44.29	74.00	27.81	V
4628.500	41.02	-37.30	32.70	45.72	74.00	32.98	V

 **$\pi/4$  DQPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17899.500	54.65	-25.50	46.70	33.45	74.00	19.35	V
13688.000	50.47	-29.50	40.40	39.57	74.00	23.53	H
12908.000	49.03	-30.50	39.20	40.33	74.00	24.97	H
9714.500	47.17	-33.00	38.00	42.17	74.00	26.83	H
7927.000	46.06	-34.80	37.10	43.76	74.00	27.94	V
2499.700	56.81	-20.00	28.40	48.41	74.00	17.19	V

**8DPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17987.500	54.54	-25.50	46.70	33.34	74.00	19.46	H
14205.000	51.15	-29.00	42.00	38.15	74.00	22.85	H
12568.000	49.23	-31.00	39.00	41.33	74.00	24.77	V
9115.500	47.29	-33.80	38.10	43.09	74.00	26.71	V
7871.500	45.98	-34.90	37.10	43.78	74.00	28.02	V
2345.700	55.84	-20.10	28.00	47.94	74.00	18.16	V

**8DPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17430.000	54.12	-26.90	45.20	35.72	74.00	19.88	V
14206.500	51.37	-29.00	42.00	38.37	74.00	22.63	H
12750.500	49.38	-30.50	39.10	40.78	74.00	24.62	H
9512.500	47.38	-33.20	37.90	42.68	74.00	26.62	V
7039.000	46.07	-35.40	36.20	45.17	74.00	27.93	H
4917.000	40.88	-37.10	33.30	44.68	74.00	33.12	V

**8DPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17809.500	54.76	-25.50	46.70	33.56	74.00	19.24	H
14045.500	50.55	-29.40	41.70	38.35	74.00	23.45	H
11618.000	49.14	-32.30	38.90	42.54	74.00	24.86	H
8994.000	47.64	-33.30	38.20	42.74	74.00	26.36	H
7440.500	46.00	-35.20	36.70	44.40	74.00	28.00	H
2493.200	55.98	-20.00	28.30	47.68	74.00	18.02	H

**Average Measurement results**
**GFSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17398.500	43.29	-26.90	45.20	24.89	54.00	10.71	H
14165.500	39.76	-29.00	42.00	26.76	54.00	14.24	V
12962.000	38.31	-30.50	39.20	29.61	54.00	15.69	V
9702.000	35.77	-33.00	38.00	30.77	54.00	18.23	V
7973.500	34.85	-34.80	37.10	32.55	54.00	19.15	H
2363.300	42.86	-20.10	28.00	34.86	54.00	11.14	V

**GFSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17600.500	43.09	-25.70	46.00	22.89	54.00	10.91	V
14220.500	39.79	-29.00	42.00	26.79	54.00	14.21	V
12862.500	37.93	-30.70	39.10	29.43	54.00	16.07	V
9106.000	35.60	-33.80	38.10	31.20	54.00	18.40	H
7864.500	34.72	-34.90	37.10	32.52	54.00	19.28	V
4716.500	30.10	-37.40	32.90	34.60	54.00	23.90	H

**GFSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17391.500	43.02	-26.90	45.20	24.62	54.00	10.98	H
14166.500	39.85	-29.00	42.00	26.85	54.00	14.15	H
12842.000	37.74	-30.70	39.10	29.24	54.00	16.26	V
9098.000	35.66	-33.80	38.10	31.26	54.00	18.34	H
7797.500	34.51	-35.10	37.00	32.61	54.00	19.49	H
2499.300	43.50	-20.00	28.40	35.10	54.00	10.50	H



**$\pi/4$  DQPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17402.500	42.96	-26.90	45.20	24.56	54.00	11.04	H
14150.000	39.51	-29.00	42.00	26.51	54.00	14.49	H
12911.500	37.76	-30.50	39.20	29.06	54.00	16.24	H
9092.500	35.76	-33.80	38.10	31.36	54.00	18.24	H
7980.000	34.57	-34.80	37.10	32.27	54.00	19.43	H
2358.800	42.90	-20.10	28.00	34.90	54.00	11.10	V

 **$\pi/4$  DQPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17994.500	42.93	-25.50	46.70	21.73	54.00	11.07	H
14202.500	39.47	-29.00	42.00	26.47	54.00	14.53	H
12770.000	37.81	-30.50	39.10	29.21	54.00	16.19	V
9210.000	35.20	-33.70	38.00	30.90	54.00	18.80	H
7883.500	34.35	-34.90	37.10	32.15	54.00	19.65	H
4795.500	30.03	-37.30	33.00	34.23	54.00	23.97	V

 **$\pi/4$  DQPSK Ch 78**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17913.000	42.60	-25.50	46.70	21.40	54.00	11.40	V
14194.000	39.20	-29.00	42.00	26.20	54.00	14.80	H
12851.000	37.73	-30.70	39.10	29.23	54.00	16.27	V
9710.000	35.51	-33.00	38.00	30.51	54.00	18.49	H
7800.500	34.20	-35.10	37.00	32.30	54.00	19.80	H
2499.800	43.55	-20.00	28.40	35.15	54.00	10.45	H

**8DPSK Ch 0**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17985.500	42.62	-25.50	46.70	21.42	54.00	11.38	H
14158.000	39.38	-29.00	42.00	26.38	54.00	14.62	H
12975.500	37.67	-30.50	39.20	28.97	54.00	16.33	H
9108.500	35.41	-33.80	38.10	31.21	54.00	18.59	H
7975.500	34.24	-34.80	37.10	31.94	54.00	19.76	H
2360.800	43.26	-20.10	28.00	35.26	54.00	10.74	V

**8DPSK Ch 39**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17996.500	42.53	-25.50	46.70	21.33	54.00	11.47	V
14186.000	39.18	-29.00	42.00	26.18	54.00	14.82	H
12858.500	37.63	-30.70	39.10	29.13	54.00	16.37	H
9112.000	35.18	-33.80	38.10	30.98	54.00	18.82	V
7956.500	34.12	-34.80	37.10	31.82	54.00	19.88	H
4784.000	29.46	-37.30	33.00	33.66	54.00	24.54	V

**8DPSK Ch 78**

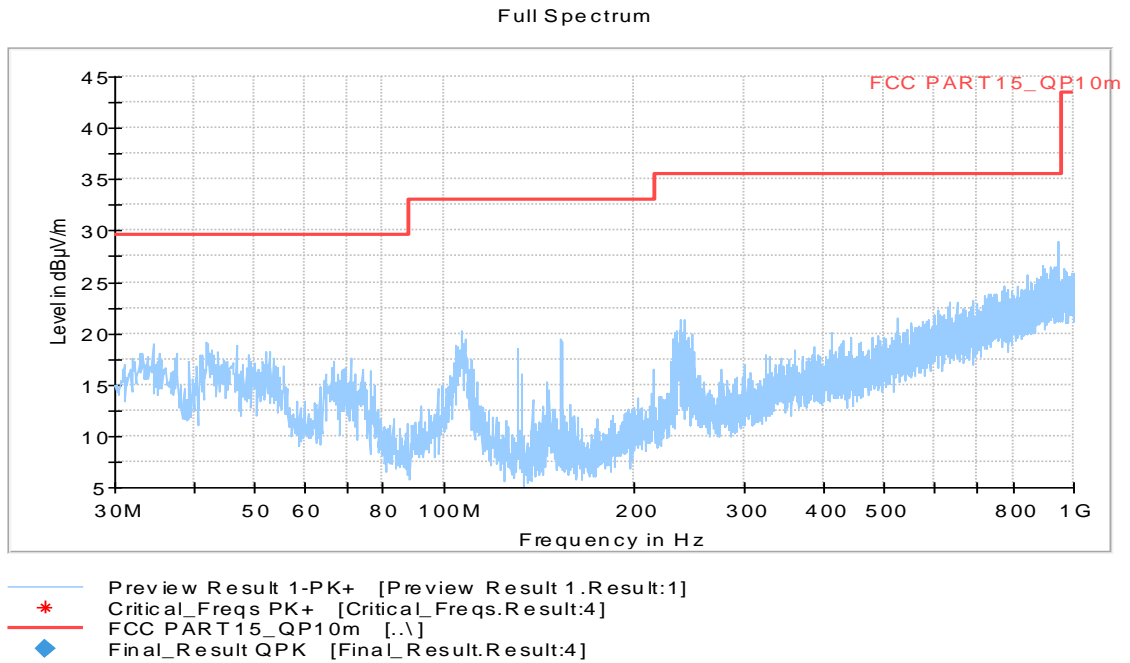
Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17938.500	42.36	-25.50	46.70	21.16	54.00	11.64	H
14138.500	39.13	-29.00	42.00	26.13	54.00	14.87	H
12845.500	37.51	-30.70	39.10	29.01	54.00	16.49	V
9091.500	35.50	-33.80	38.10	31.10	54.00	18.50	H
7875.500	34.30	-34.90	37.10	32.10	54.00	19.70	H
2485.100	43.48	-20.00	28.30	35.18	54.00	10.52	H

Note: the spurious emission above 18G is noise only.

**Conclusion: Pass**

### C.1.2 Radiated Spurious Emission- Below 1GHz

#### WOSRT CASE BELOW 1GHz



Note: 10 meters' limit is got by converting from 3 meters test distance.  
 Limit (10m) = limit (3m) + 20(log (3/10))

#### BELOW 30MHz

No emissions were found within 20dB of the limit below 30MHz.

### C.1.3 Band Edges Compliance– Radiated

#### INNOWAVE

Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	2.31GHz ~2.45GHz	Fig.1	P
	78	2.45GHz ~2.5GHz	Fig.2	P

Mode	Channel	Frequency Range	Test Results	Conclusion
$\pi/4$ DQPSK	0	2.31GHz ~2.43GHz	Fig.3	P
	78	2.45GHz ~2.5GHz	Fig.4	P

Mode	Channel	Frequency Range	Test Results	Conclusion
8DPSK	0	2.31GHz ~2.45GHz	Fig.5	P
	78	2.45GHz ~2.5GHz	Fig.6	P

#### SPEED

Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	2.31GHz ~2.45GHz	Fig.7	P
	78	2.45GHz ~2.5GHz	Fig.8	P

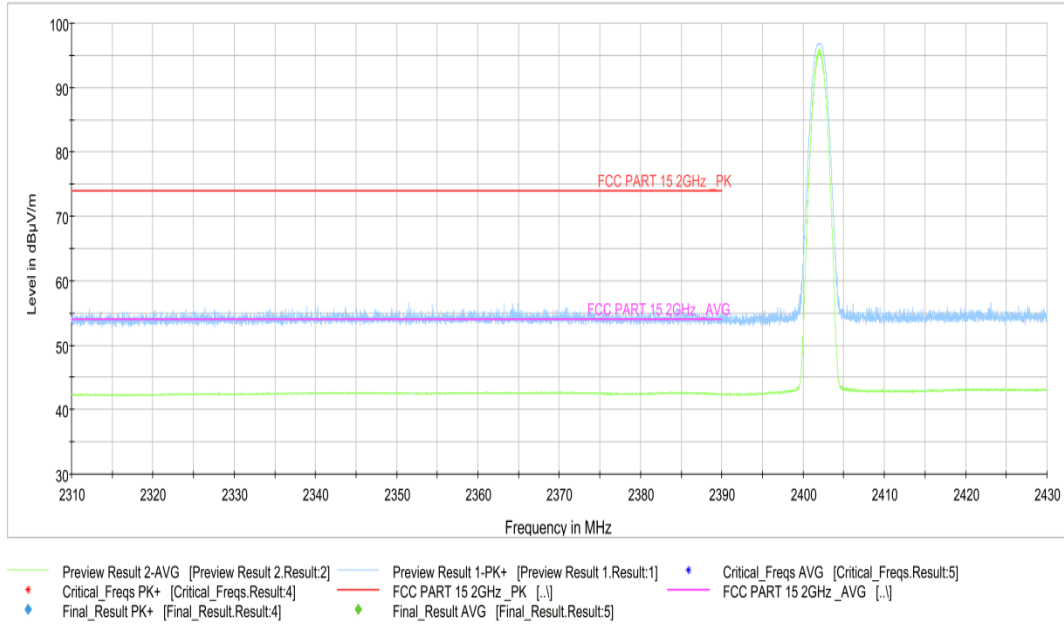
Mode	Channel	Frequency Range	Test Results	Conclusion
$\pi/4$ DQPSK	0	2.31GHz ~2.43GHz	Fig.9	P
	78	2.45GHz ~2.5GHz	Fig.10	P

Mode	Channel	Frequency Range	Test Results	Conclusion
8DPSK	0	2.31GHz ~2.45GHz	Fig.11	P
	78	2.45GHz ~2.5GHz	Fig.12	P

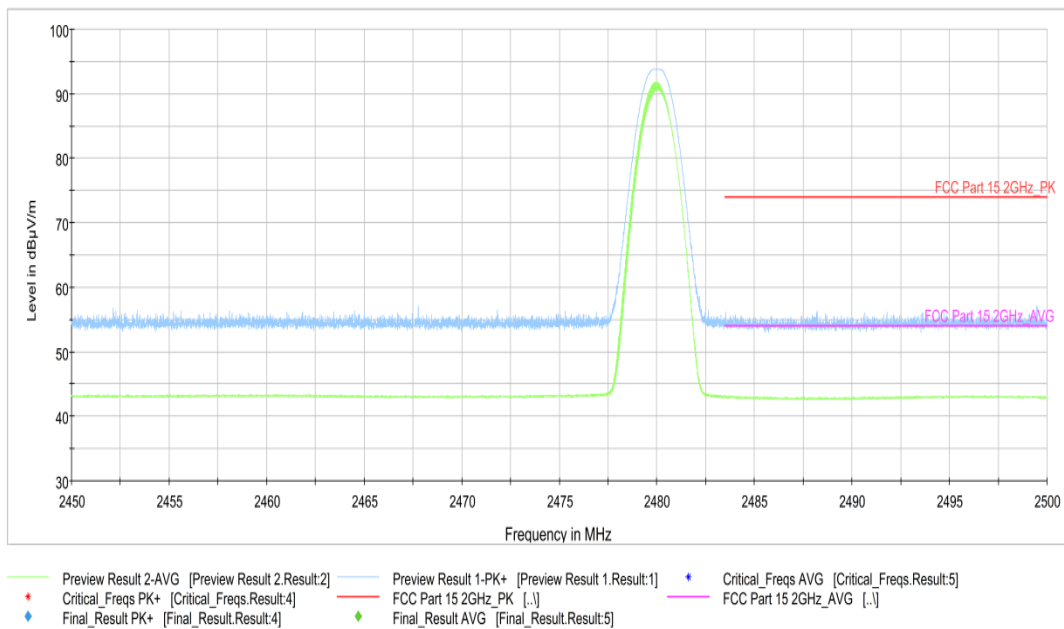
**Conclusion: PASS**

Test graphs as below

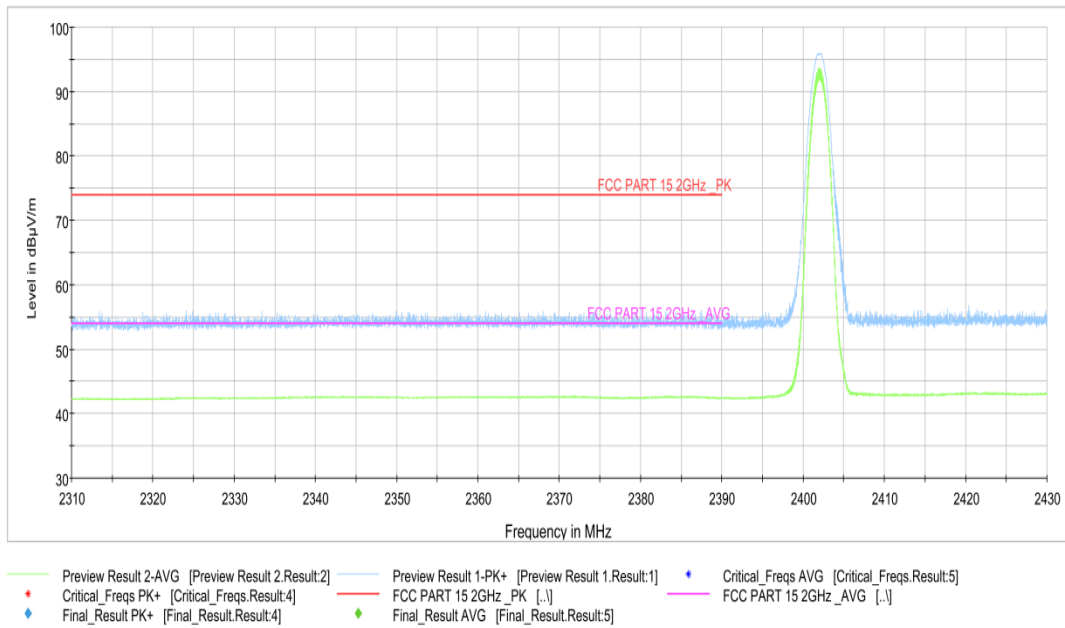
**INNOWAVE**



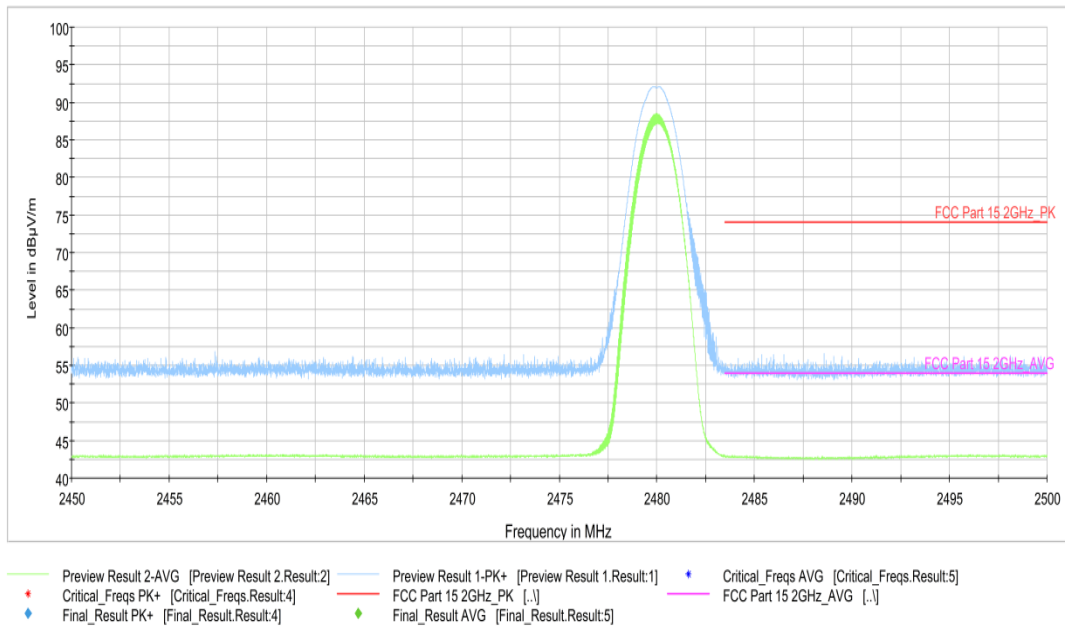
**Fig.1. Frequency Band Edges: GFSK, Channel 0, 2.31 GHz – 2.45GHz**



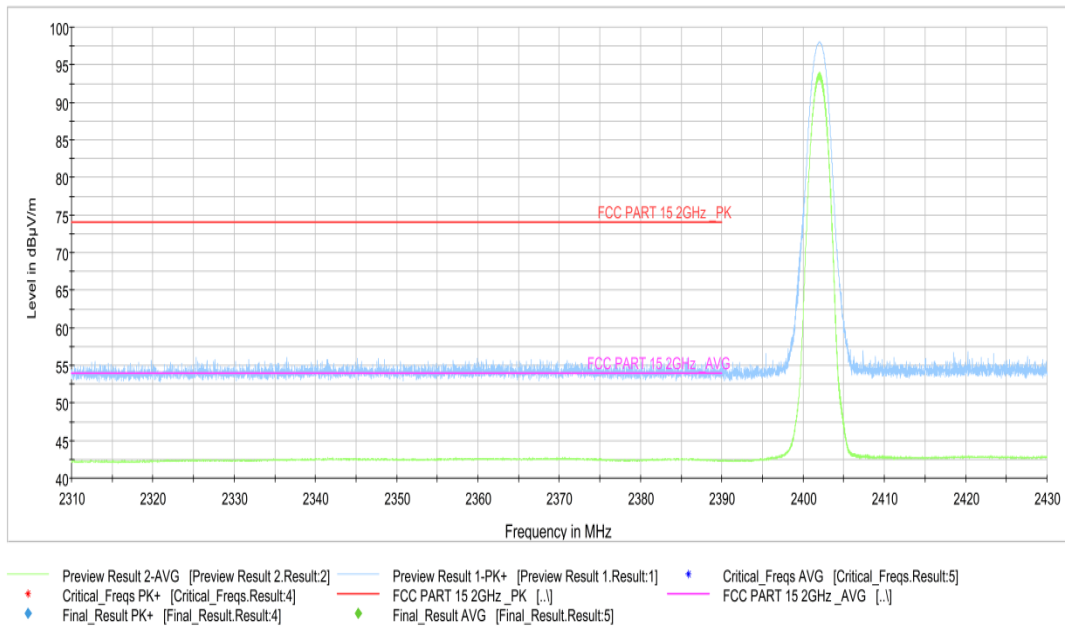
**Fig.2. Frequency Band Edges: GFSK, Channel 78, 2.45 GHz - 2.50GHz**



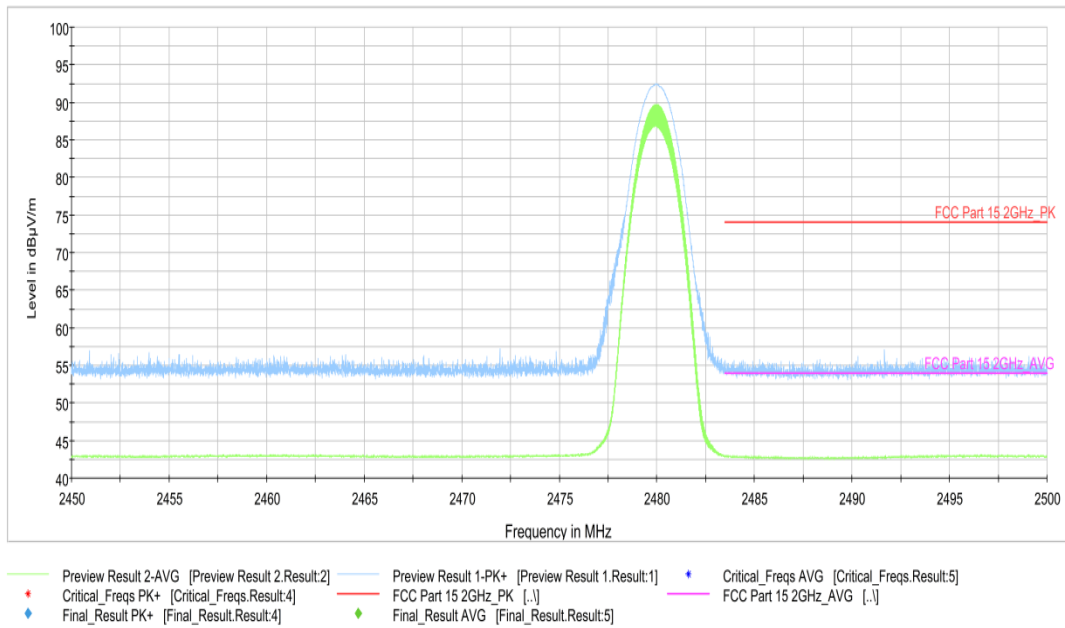
**Fig.3. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 0, H2.31 GHz - 2.45GHz**



**Fig.4. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 78, 2.45 GHz - 2.50GHz**

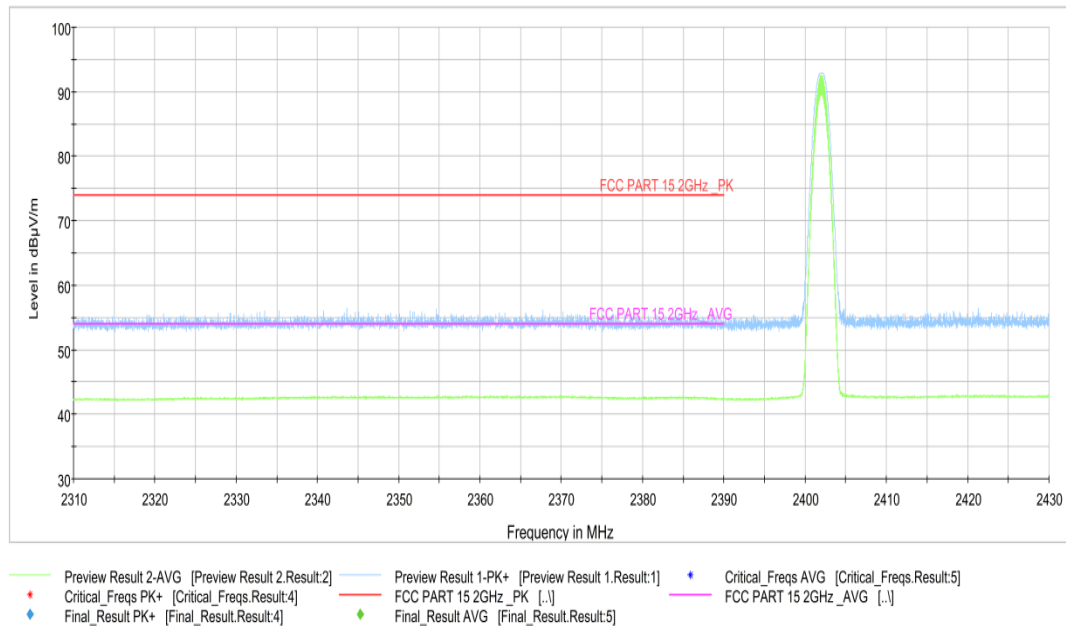


**Fig.5. Frequency Band Edges: 8DPSK, Channel 0, 2.31 GHz - 2.45GHz**

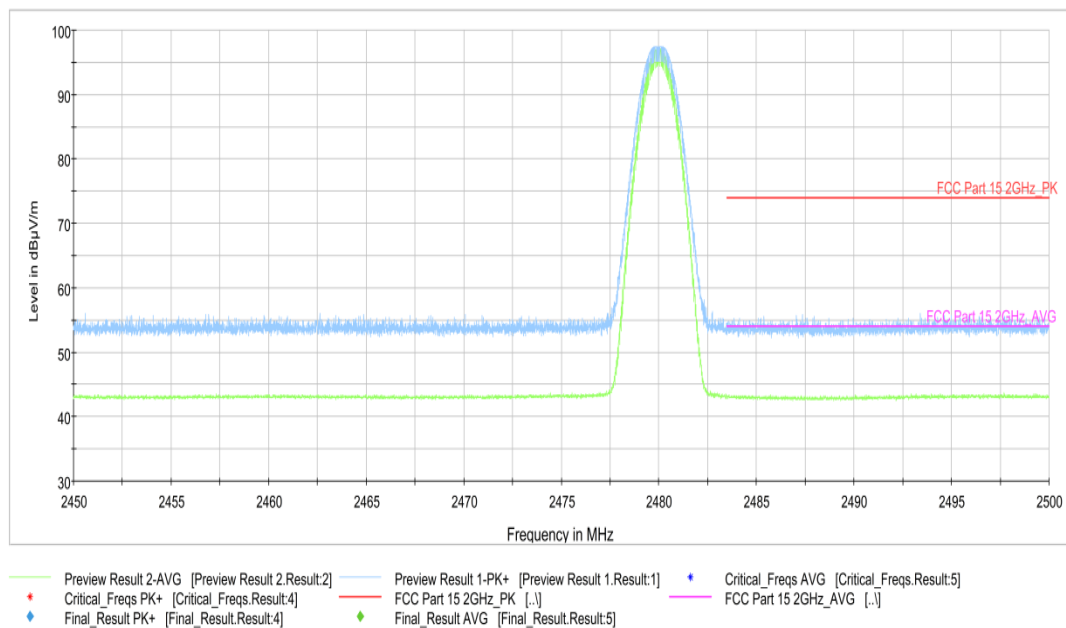


**Fig.6. Frequency Band Edges: 8DPSK, Channel 78, 2.45 GHz - 2.50GHz**

## SPEED

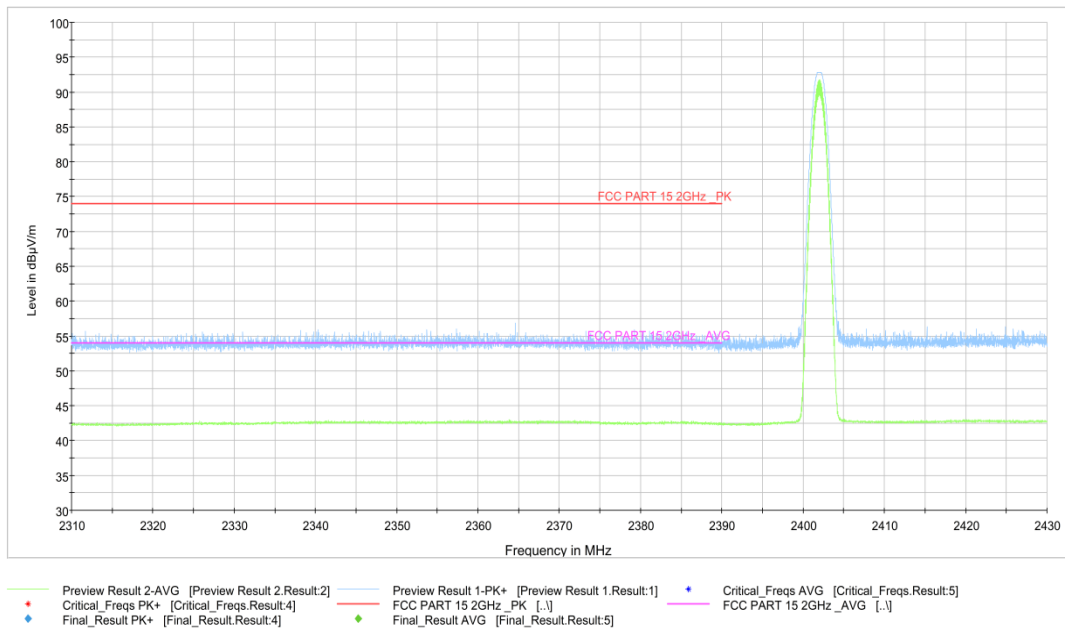


**Fig.7. Frequency Band Edges: GFSK, Channel 0, Hopping Off, 2.31 GHz – 2.45GHz**

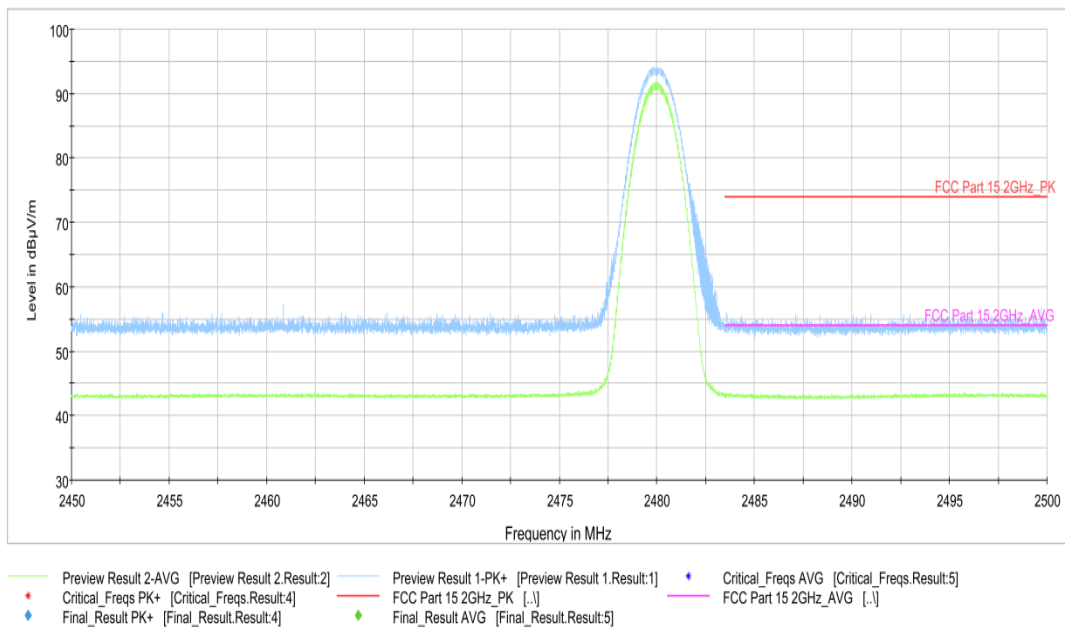


**Fig.8. Frequency Band Edges: GFSK, Channel 78, Hopping Off, 2.45 GHz - 2.50GHz**

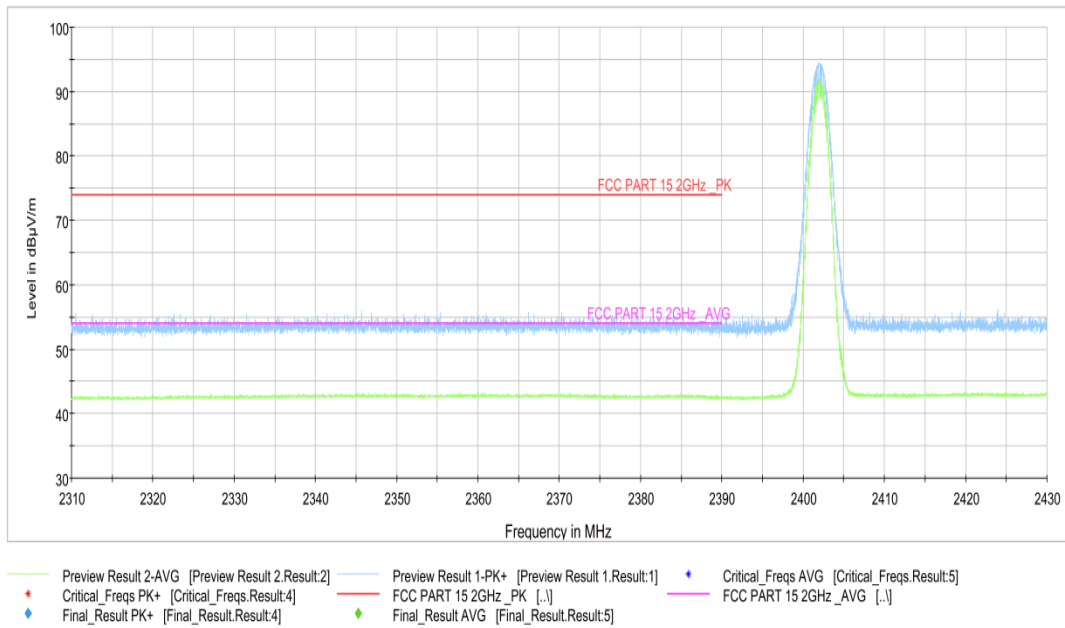




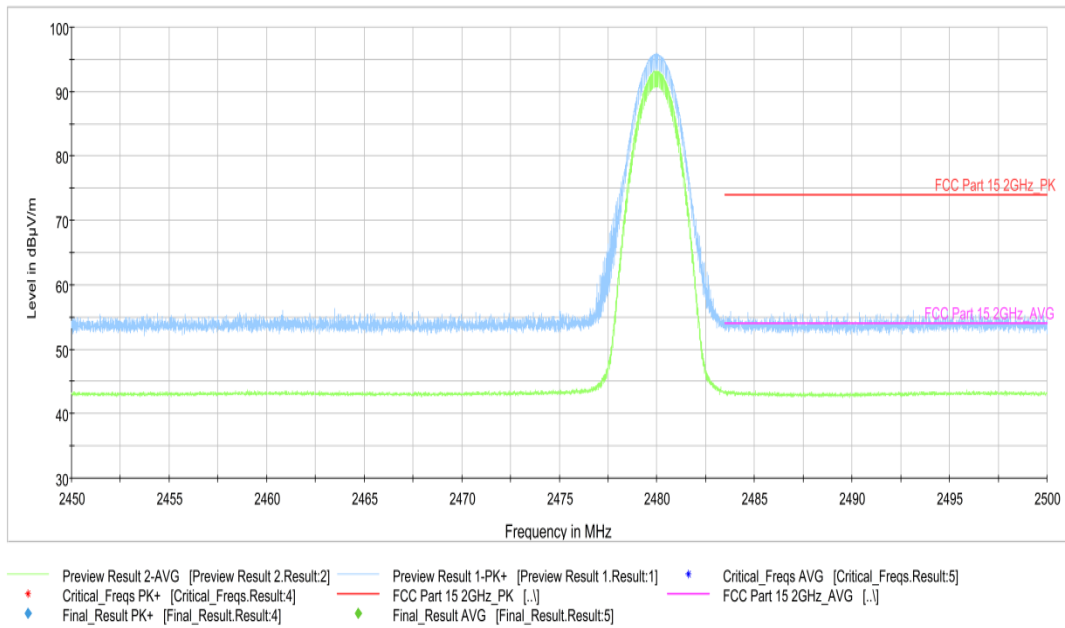
**Fig.9. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 0, Hopping Off, 2.31 GHz - 2.45GHz**



**Fig.10. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 78, Hopping Off, 2.45 GHz - 2.50GHz**



**Fig.11. Frequency Band Edges: 8DPSK, Channel 0, 2.31 GHz - 2.45GHz**



**Fig.12. Frequency Band Edges: 8DPSK, Channel 78, 2.45 GHz - 2.50GHz**

## C.2. AC Powerline Conducted Emission

### Specification Reference

FCC 47 CFR Part 15.207, 15.107

### Method of Measurement:

See Clause 6.2 of ANSI C63.10-2013 specifically.

See Clause 4 and Clause 5 of ANSI C63.10-2013 generally.

The conducted emissions from the AC port of the EUT are measured in a shielding room. The EUT is connected to a Line Impedance Stabilization Network (LISN). An overview sweep with peak detection was performed. The measurements were performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detector of the test receiver: Quasi-Peak / Average Detector.

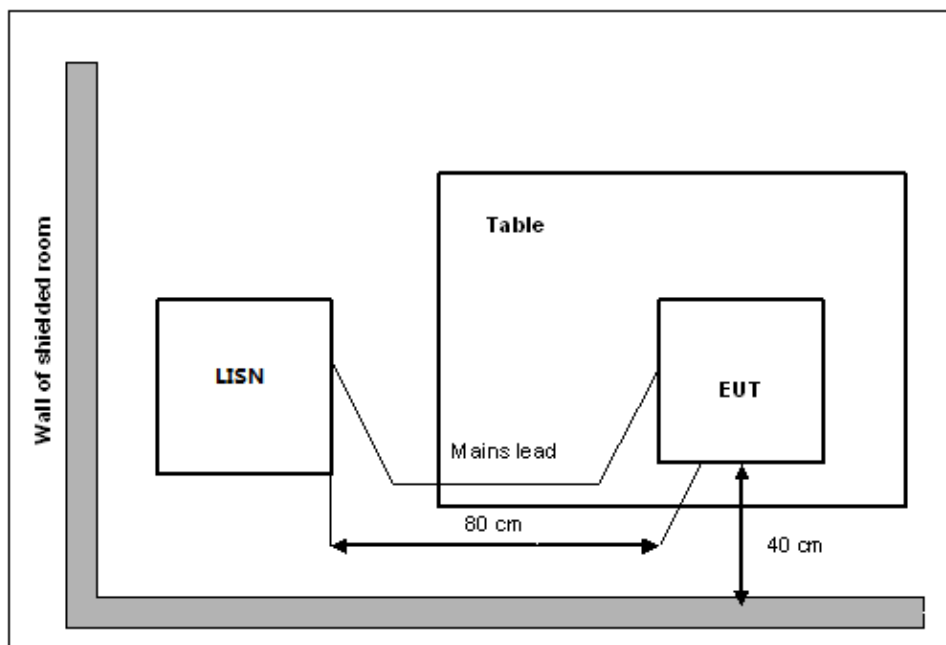
The measurement bandwidth is:

Frequency of Emission (MHz)	RBW/IF bandwidth	Sweep Time(s)
0.15-30	9kHz	1

### Test Condition:

Voltage (V)	Frequency (Hz)
120	60

### Measurement Setup



### EUT Operating Mode and Test Conditions

The measurement of EUT is carried out under the transmit state.

The EUT is powered by an AC/travel adapter.

**Measurement Result and limit:**

## Bluetooth (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dB $\mu$ V)	Result (dB $\mu$ V)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	66 to 56	Fig.C.2.1	Fig.C.2.2	<b>P</b>
0.5 to 5	56			
5 to 30	60			

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

## Bluetooth (Average Limit)

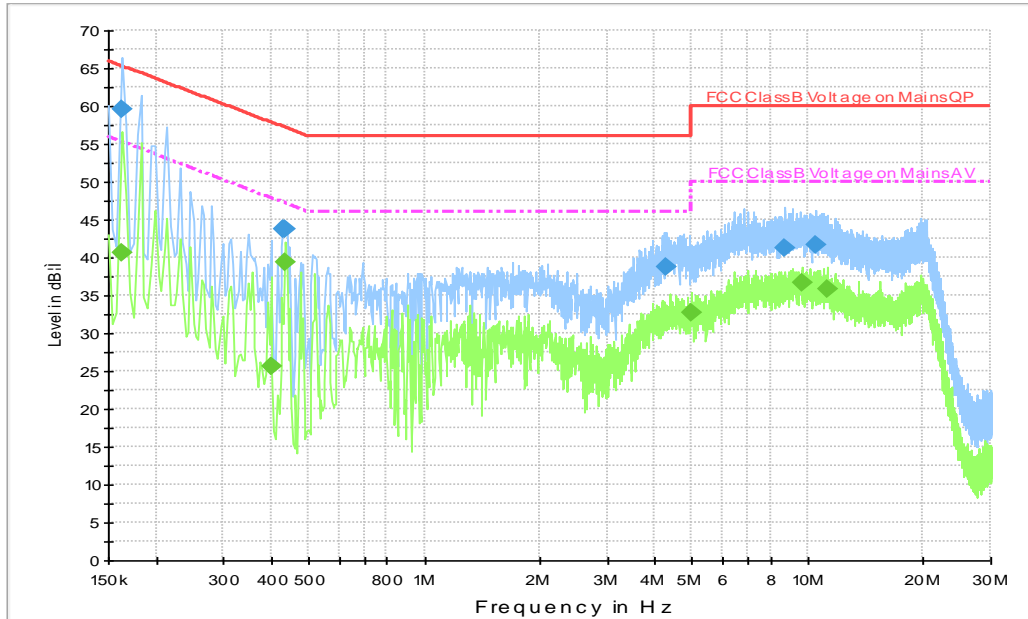
Frequency range (MHz)	Average Limit (dB $\mu$ V)	Result (dB $\mu$ V)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	56 to 46	Fig.C.2.1	Fig.C.2.2	<b>P</b>
0.5 to 5	46			
5 to 30	50			

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Note: all modes have been tested and the worst results shown here.

**Conclusion: Pass**

**Test graphs as below:**



**Fig.C.2.1 AC Power line Conducted Emission- Bluetooth**

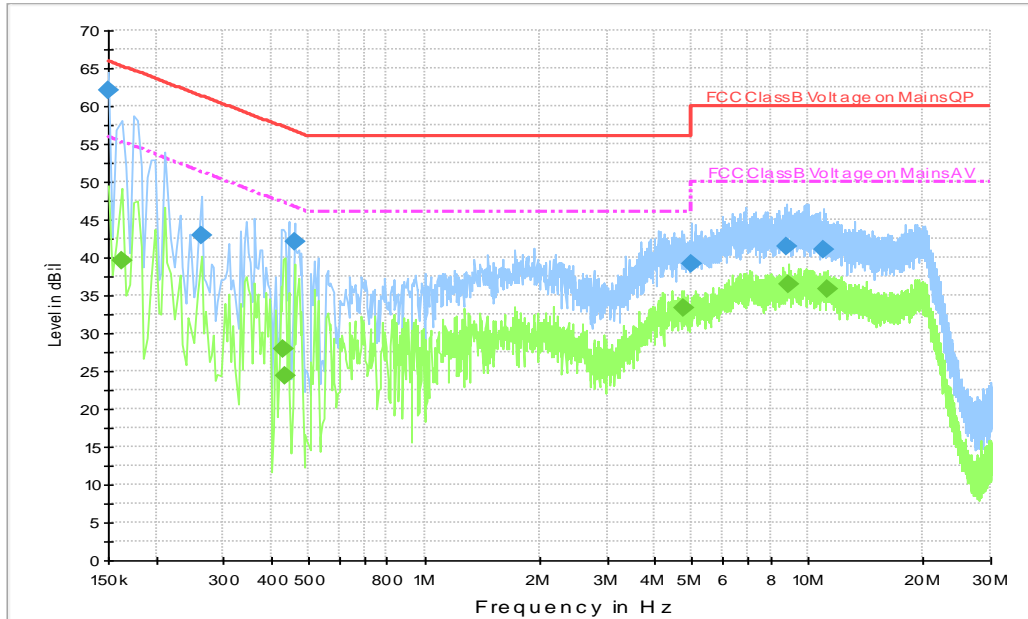
Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.162000	59.6	2000.	9.000	L1	20.0	5.8	65.4
0.430000	43.8	2000.	9.000	L1	19.9	13.4	57.3
0.434000	43.7	2000.	9.000	L1	19.9	13.5	57.2
4.278000	38.8	2000.	9.000	N	19.7	17.2	56.0
8.710000	41.2	2000.	9.000	N	19.8	18.8	60.0
10.534000	41.6	2000.	9.000	N	19.8	18.4	60.0

**Final Result 2**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.162000	40.6	2000.0	9.000	L1	20.0	14.7	55.4
0.398000	25.6	2000.0	9.000	N	19.9	22.3	47.9
0.434000	39.4	2000.0	9.000	L1	19.9	7.8	47.2
4.982000	32.6	2000.0	9.000	N	19.7	13.4	46.0
9.634000	36.7	2000.0	9.000	N	19.8	13.3	50.0
11.258000	35.9	2000.0	9.000	N	19.7	14.1	50.0



**Fig.C.2.2 AC Power line Conducted Emission-Idle**

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	62.0	2000.	9.000	N	20.0	4.0	66.0
0.262000	42.8	2000.	9.000	N	19.8	18.5	61.4
0.458000	42.2	2000.	9.000	N	20.0	14.6	56.7
4.994000	39.3	2000.	9.000	N	19.7	16.7	56.0
8.798000	41.5	2000.	9.000	N	19.8	18.5	60.0
10.986000	41.1	2000.	9.000	N	19.8	18.9	60.0

**Final Result 2**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.162000	39.5	2000.0	9.000	N	19.6	15.8	55.4
0.430000	27.8	2000.0	9.000	L1	19.9	19.4	47.3
0.434000	24.3	2000.0	9.000	L1	19.9	22.8	47.2
4.754000	33.4	2000.0	9.000	N	19.7	12.6	46.0
8.882000	36.4	2000.0	9.000	N	19.8	13.6	50.0
11.194000	35.9	2000.0	9.000	N	19.7	14.1	50.0

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