



**LABORATORIUM VOOR OMGEVINGSMETINGEN
LABORATOIRE D'ESSAIS D'ENVIRONNEMENT
ENVIRONMENTAL TEST LABORATORIA**

NOTIFIED BODY (NB2758) UNDER EU-DIRECTIVE 2014/30/EU	 041-TEST
ACCREDITED FOR NBN EN ISO 17025 BY BELAC 041-TEST - ISO17025	
RECOGNISED TESTING AUTHORITY FOR AUSTRALIA	
CONFORMITY ASSESSMENT BODY MRA US-EU SECTORAL ANNEX EMC (FCC)	

TESTREPORT

Product	Docking Station
Standard	FCC part 15 subpart c
Test Report	PCC-RAD-5475
LDN Number	LDN4551
Date of issue	2022-05-04
Edition	03

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This Test Report contains 60 pages
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SECTION 1: IDENTIFICATION OF THE TEST LABORATORIA

LABORATORIA DE NAYER Product Certification Centre (PCC)	
J.De Nayerlaan 9 B-2860 St.-Katelijne-Waver Belgium Tel: +32 (0) 15 30 54 00 Fax: +32 (0) 15 32 1212	Direct phone numbers and e-mail address: (Test engineer) J. De Vos +32(0)15 30 54 04 j.de.vos@labodenayer.be

TEST LABORATORY RESPONSIBILITIES			
Function	Name(s)	Date	Signature
Test Operator	Jan De Vos Jochen Geens (trannie)	2021-10-28	
Author Report	Jan De Vos	2022-05-04	
Technical Expert	ir. Filip Nauwelaerts	2022-03-14	



041-TEST – ISO17025

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The results refer to the described sample or equipment under test only.

Neither the accredited status of Laboratoria De Nayer v.z.w., nor this test report implies that the sample or equipment under test is approved by BELAC or any other establishment.

In case the customer wants to refer to his appeal to our accredited laboratories, he will use the following orequivalent sentence: "Tested by Laboratoria De Nayer, E.M.C.department, accredited by BELAC for EMC-immunity and EMC-emission under registration number 041-TEST".

SECTION 2: CUSTOMER INFORMATION AND DATES

CUSTOMER INFORMATION

Company name: Byteflies NV
Address: Borsbeeksebrug 22, 6th floor
B-2600 Antwerpen
Contact person: Niels Van Thienen
Telephone nr: +32479383735
E-mail: niels.vanthienen@byteflies.com

DATES

Receipt of the EUT: 2021-08-30
Start of tests: 2021-09-06
End of tests: 2022-05-04

SECTION 3: EQUIPMENT UNDER TEST (E.U.T.)

The correctness of the description and identification of the equipment under test, its operating conditions, possible modifications and monitoring of its behaviour during and/ or after the test conditions generated by the De Nayer Environmental Test Laboratory are under the responsibility of the customer.

IDENTIFICATION OF THE E.U.T.

Intended use:	The Byteflies Kit is a multisensor device intended to collect non-invasive physiological and behavioral signals to be used in the clinic and/or home for Users that need continuous monitoring.
Manufacturer:	Byteflies NV
Marketing name:	Docking Station
Model / Type:	Docking Station 1.2.1
Software Version:	hw-dock-wifitest@2fa9cf07aef78f4f41c41f6d9333a7066cb2d87c hw-dock-bletest@d92ad1953a4ca9e7d25ade055b1eee76f9644c80
used frequency range:	BLE :2400 - 2483 MHz WiFi :2401-2473MHz
Used modulation types :	BLE :GFSK WiFi :DSSS, CCK, OFDM
Frequency hopping channels ;	BLE: during test no hopping applied WiFi: N/A
Used antenna:	FXP73.07.0100A
AC/DC adapter:	Friwo FW8002 MUSB/05
Serial Number:	Dock-c0847dde409a (Radiated) Dock-c0847db30598 (Conducted)
FCC-ID number:	---

Illustrations: (Equipment under test)

Photo : EUT top



Photo : rear



photo internal :



Photo : PSU



SECTION 4: TEST SPECIFICATIONS AND TEST METHODS

Applied Tests or Technical Standards		
Emission:		
Test or Technical Standard	Title	
FCC CFR47 part 15	Code of Federal Regulations , part 15 , Subpart C , intentional Radiators	
ANSI C63.10 (2013)	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	
KDB558074 D01 v05r02	GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER §15.247	

(*) if the log  is mentioned, the measurement is under accreditation : 041-TEST – ISO17025

MRA : between E.C. and USA : CAB (EMC) [designation number BE0002] date of validation 15.01.2002

Equipment Classifications

Field Strength Calculation.

The field strength is calculated in the receiver , for conducted emission on the mains LISN-2line is selected , for spurious radiated emission the LDNRE_band-CD (30-1000MHz) and LDNRE_FCChigh(>1GHz) is selected

LISN-2line is the Transducer Factor for the LISN (combination of the attenuation of the LISN and cable in the range 150kHz-30MHz)

LDNRE_band-CD is the Transducer factor for the bilog antenna (combination of the AF of the R&S antenna , pre-amplifier and cables in the range 30MHz-1GHz) .

LDNRE_FCChigh is the Transducer factor for the horn antenna (combination of the AF of the horn antenna , pre-amplifier and cables in the range >1GHz.

SECTION 5: OPERATION OF EUT DURING TESTING

The following performance criteria are described in the standard .

Operating modes during testing

The device was configured, depending on the test being done:

1. Continuous TX with configured modulation

SECTION 6: SUMMARY OF TEST RESULTS

6.1 Test results of the tests.

emission measurement according to : FCC part 15		
Test §	The EUT complies limits	remarks
§ 15.207 : AC power conducted emissions	pass	
§ 15.247(b) : peak output power / EIRP	pass	
§ 15.247(a) : 6dB and 99% power bandwidth	pass	
§ 15.247 (d): 100kHz bandwidth of frequency band edges	pass	
§ 15.247(d) : spurious emission	pass	
§ 15.247(e) : PSD	pass	

Section 15.19 Labelling requirements.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules.
 Operation is subject to the following two conditions:
 (1) this device may not cause harmful interference,
 and (2) this device must accept any interference received, including
 interference that may cause undesired operation.

For certification, the product shall bear a nameplate or label with the FCC Identifier (FCC ID), as defined in Section 2.925. The FCC ID must always be accessible when using the product. The placement of the FCC ID must be a physical label on the product, unless an e-label is used.

SECTION 7: DETAILED TEST RESULTS

7.1. EMISSION TEST

The test has been performed according to the standard: CFR 47 part15 Subpart c.

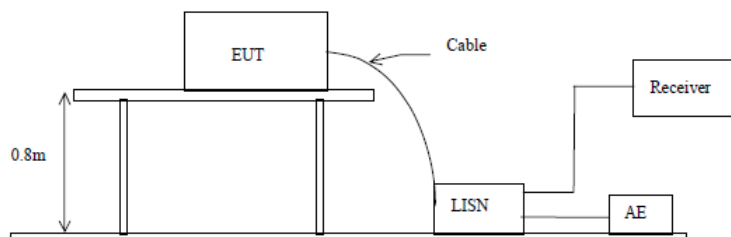
7.2 CONDUCTED EMISSION TEST : power

CONDITIONS

The equipment was placed at ± 80 cm above the floor.
The test has been performed in a shielded room.
The conducted emission level was measured with a LISN according to CISPR16/ANSI C36.4 (0.15 MHz - 30 MHz).
Test voltage : 115V /60Hz
Specification reference :C.F.R.47 part 15.207
Test specification : ANSI C63.10 section 6.2
The upper limit line is the quasi-peak limit line .
The lower limit line is the average limit line.
Test date :2021-09-06

Test equipment :
Receiver: R&S ESW26; MN: 20180039
LISN: R&S ESH3-Z5, MN 20190039
Pulse Limiter: R&S ESH3Z2, MN: 20190032
Cable: IR05, IR35, IR217

Test Setup:



Hardware Setup:	LISN-2-FCC-ENV423 ESW26
Receiver:	[ESW26]
Level Unit:	dB μ V
LISN TDF :	Correction Table (Line 0): 2-Line-LISN ENV432 Line N
	Correction Table (Line 1): 2-Line-LISN ENV432 Line L1

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	5 kHz	PK+; AVG	9 kHz	0,02 s	0 dB

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.16	36.93	65.73	28.8	1000.0	9.000	L1

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.16	32.91	55.73	22.8	1000.0	9.000	L1

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.16	44.40	65.73	21.3	1000.0	9.000	N
0.63	30.98	56.00	25.0	1000.0	9.000	N

Frequency (MHz)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line
0.16	43.04	55.73	12.7	1000.0	9.000	N
0.18	25.13	54.72	29.6	1000.0	9.000	N
0.63	24.88	46.00	21.1	1000.0	9.000	N

Test result	pass
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fig Conducted emission L1-PE

Full Spectrum

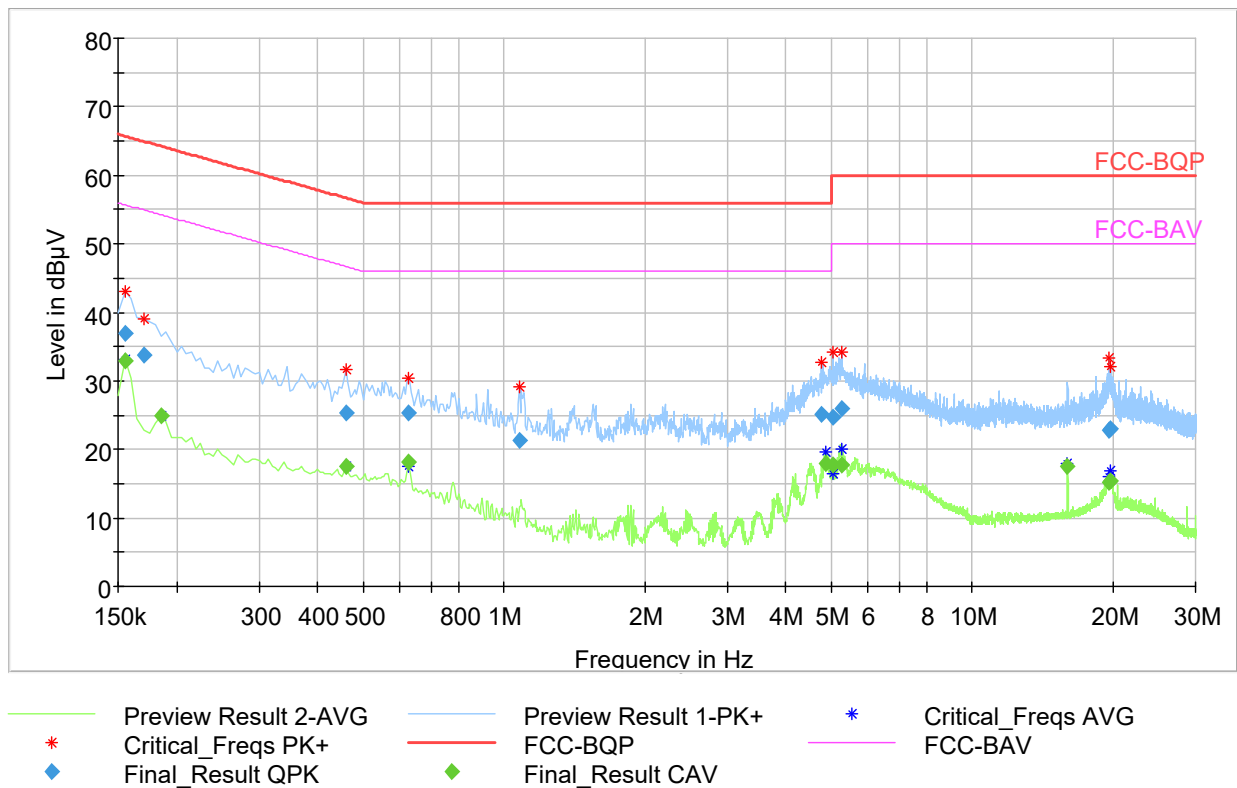
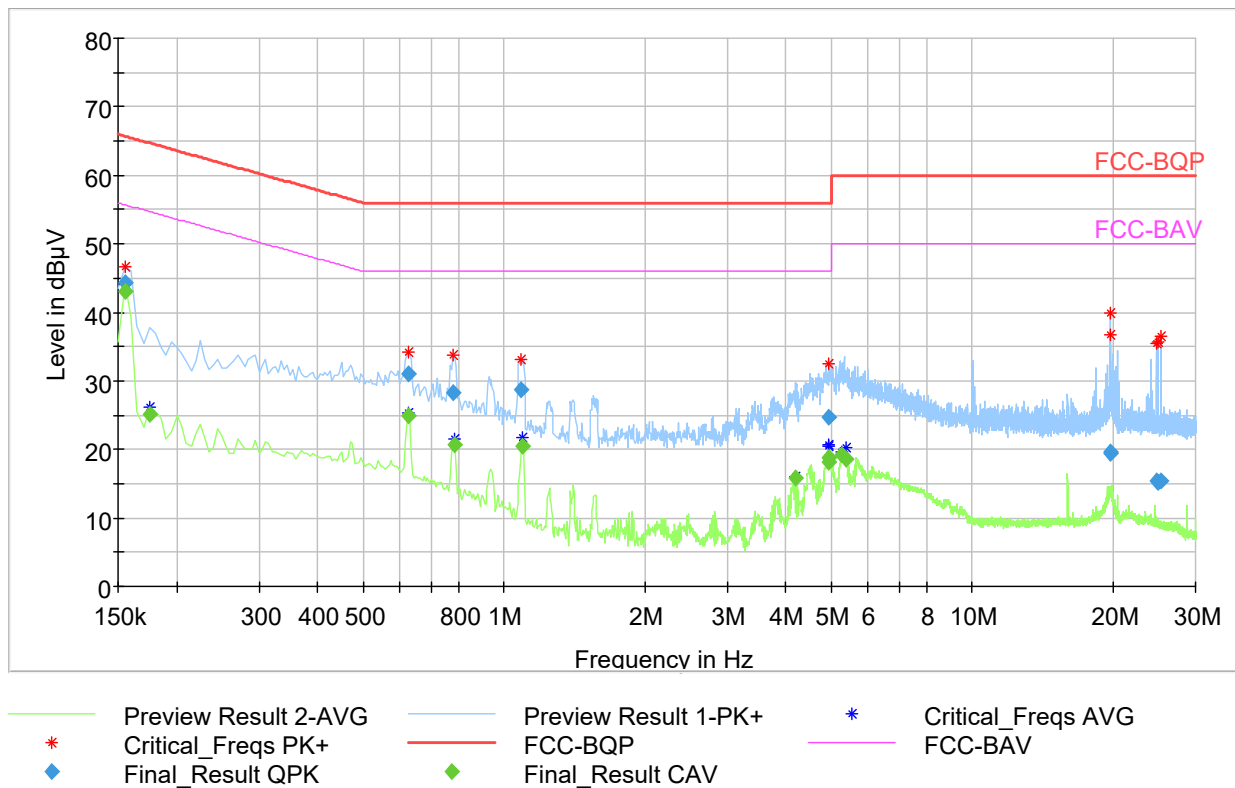


fig Conducted emission N-PE

Full Spectrum



7.3 peak output power / EIRP

CONDITIONS
peak output power / EIRP Test voltage : internal battery PC : EUT Specification reference : C.F.R.47 part 15.247(b)(3) Test date : 2021-09-29 and 2022-05-04
Test equipment : Receiver : ESR7 , MN : 201112504 Power sensor : L2061XA , MN : 20180040 Attenuator VAT10 ; MN : 201112546

Maximum Peak Conducted Output Power :

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt (+30dBm) . As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

The conducted power is the measured power and the correction factor of the attenuator and cable .

BLE

Frequency (GHz)	Conducted Power [dBm] /W	Limit [dBm] /W	Margin [dB]
2.402	7.6/5.8mW	30 /1	22.4
2.44	7.7/5.8mW	30 /1	22.3
2.480	7.4/5.5mW	30 /1	22.6

Wifi 0

Frequency (GHz)	Conducted Power [dBm] /W	Limit [dBm] /W	Margin [dB]
2.402	9.5/8.9mW	30 /1	20.5
2.44	9.8/9.5mW	30 /1	20.2
2.48	10.3/107mW	30 /1	19.7

Wifi 108

Frequency (GHz)	Conducted Power [dBm] /W	Limit [dBm] /W	Margin [dB]
2.402	17.0/501mW	30 /1	13.0
2.44	16.8/478mW	30 /1	13.2
2.48	18.7/741mW	30 /1	11.3

Test result	pass
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7.4 Spurious emission TEST

CONDITIONS

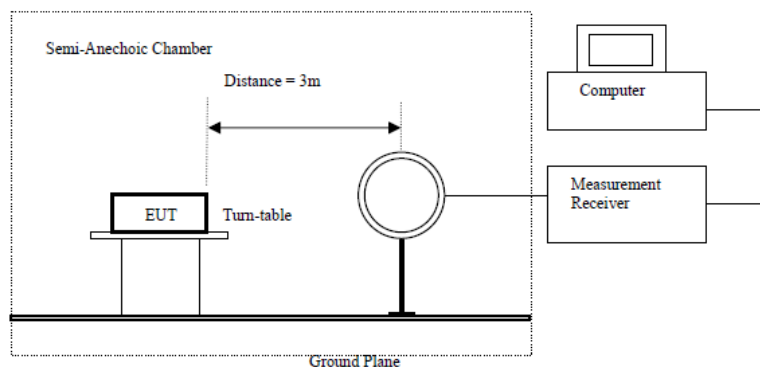
The equipment was placed in a semi anechoic room (10x6x6) with metal groundplane on the floor.
The chamber complies with the ANSI C63.4/5 and CISPR 16.
The radiated emission level was measured with a bilog antenna (30-1000MHz) and a horn antenna ($f > 1\text{GHz}$).
Test $f > 1\text{GHz}$ floor absorbers were used.
The height of the table is 80cm (9k-1GHz) and 1.5m $f > 1\text{GHz}$
Test voltage : 115Vac/60Hz
Specification reference : C.F.R.47 part 15.247(b)
Test specification : ANSI C63.10 section 6.3 and 6.5 ($f < 1\text{GHz}$)
Test specification : ANSI C63.10 section 6.3 and 6.6 ($f > 1\text{GHz}$)
The limit line 1 is the quasi-peak limit line . ($f < 1\text{GHz}$)
The limit line 1 is peak limit and line 2 is average limit ($f > 1\text{GHz}$)
Test date : 2021-09-14 ,20 and 27

Test equipment :
Receiver: R&S ESW26; MN: 20180039
Preamp: ZKL: MN: 201112419
Antenna: Chase CBL6111B, MN: 458580
Attenuator: Mini-Circuits 15542, 6dB, MN:20180026
Antenna mast: Maturo AM4.0, MN: 20112341
Turntable: Maturo TT2.0-2t, MN: 20112343
Controller: Maturo MCU, MN: 20112342
Cables: IR32, IR83, IR103, IR120
Antenna: R&S HF906, MN: 2006054
Preamp: LDN PAM3-, MN: 20170072
Preamp: LDN PAM4, MN: 475058
Receiver: R&S ESU40 , MN : 20112350
Antenna : Schwarzbeck BBHA9170 , MN :20170015
Preamp : Schwarzbeck BBV9721 , MN :20170014

Measurement results Radiated emission :

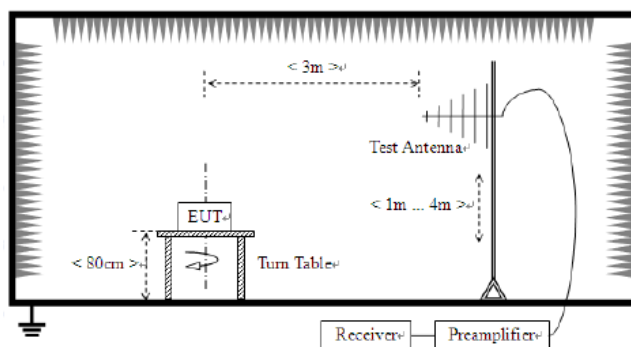
Hardware Setup:	ESW26 RE 9k-30MHz
Receiver:	[ESW 26]
Level Unit:	dB μ V/m
TDF :	Correction Table (vertical): HFH2-Z2v
	Correction Table (horizontal): HFH2-Z2v

Subrange	Detectors	IF BW
9kHz – 150kHz	PK+	200Hz
150kHz – 30MHz	PK+	9kHz



Hardware Setup:	ESW26 RE 30M-1G 3m FCC
Receiver:	[ESW 26]
Level Unit:	dB μ V/m
TDF :	Correction Table (vertical): CBL6111sar
	Correction Table (horizontal): CBL6111sar

Subrange	Detectors	IF BW
30 MHz – 1000MHz	PK+	120 kHz



Range : 1-6GHz

Hardware Setup:	ESW26 RE 1-12G 3m FCC
Receiver:	[ESW 26]
Level Unit:	dBμV/m
TDF :	Correction Table (vertical): HF906-3m-PCC2
	Correction Table (horizontal): HF906-3m-PCC2

Subrange	Detectors	IF BW
1 GHz- 6 GHz	PK + ; AV	1MHz

Range : 6-18GHz

Hardware Setup:	FCC-RE-6 18
Receiver:	[ESU 40]
Level Unit:	dBμV/m
TDF :	Correction Table (vertical): HF906-3m-JAN
	Correction Table (horizontal): HF906-3m-JAN

Subrange	Detectors	IF BW
18 GHz- 40 GHz	PK + ; AV	1MHz

Range : 18-25GHz

Hardware Setup:	FCC-RE-18 40
Receiver:	[ESU 40]
Level Unit:	dBμV/m
TDF :	Correction Table (vertical): BBHA9170 1m
	Correction Table (horizontal): BBHA9170 1m

Subrange	Detectors	IF BW
18 GHz- 25 GHz	PK + ; AV	1MHz

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
30.00	23.97	40.00	16.0	1000.0	120.000	100.0	V
30.16	23.21	40.00	16.8	1000.0	120.000	125.0	V
30.48	22.96	40.00	17.0	1000.0	120.000	100.0	V
30.72	22.70	40.00	17.3	1000.0	120.000	100.0	V
42.64	25.49	40.00	14.5	1000.0	120.000	100.0	V
42.80	25.71	40.00	14.3	1000.0	120.000	100.0	V
43.12	25.41	40.00	14.6	1000.0	120.000	100.0	V
46.48	26.35	40.00	13.7	1000.0	120.000	100.0	V
162.96	20.06	43.50	23.4	1000.0	120.000	175.0	H
204.00	22.29	43.50	21.2	1000.0	120.000	125.0	H
480.00	34.78	46.00	11.2	1000.0	120.000	175.0	H
816.08	25.44	46.00	20.6	1000.0	120.000	100.0	H

Wifi

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1008.00	39.49	74.00	34.5	5.0	1000.000	175.0	H	300.0
1126.00	35.82	74.00	38.2	5.0	1000.000	175.0	V	225.0
1149.20	38.82	74.00	35.2	5.0	1000.000	175.0	V	270.0
1228.40	41.47	74.00	32.5	5.0	1000.000	150.0	V	15.0
1230.80	40.61	74.00	33.4	5.0	1000.000	150.0	V	135.0
1232.00	38.73	74.00	35.3	5.0	1000.000	150.0	V	345.0
1235.60	37.89	74.00	36.1	5.0	1000.000	150.0	V	345.0
1440.00	41.36	74.00	32.6	5.0	1000.000	150.0	V	285.0
1461.60	36.56	74.00	37.4	5.0	1000.000	175.0	H	300.0
1522.80	38.14	74.00	35.9	5.0	1000.000	175.0	H	345.0
1525.20	35.73	74.00	38.3	5.0	1000.000	175.0	H	225.0
2039.20	37.53	74.00	36.5	5.0	1000.000	175.0	H	315.0
2133.20	37.67	74.00	36.3	5.0	1000.000	175.0	H	255.0
2258.00	38.73	74.00	35.3	5.0	1000.000	150.0	V	345.0
2295.20	38.46	74.00	35.5	5.0	1000.000	150.0	V	345.0
2380.80	57.27	74.00	16.7	5.0	1000.000	175.0	V	165.0
2383.60	64.23	74.00	9.8	5.0	1000.000	150.0	V	90.0
2392.40	66.12	74.00	7.9	5.0	1000.000	150.0	V	315.0
2411.20	97.08	74.00	*	5.0	1000.000	175.0	H	285.0
2412.80	97.23	74.00	*	5.0	1000.000	175.0	H	285.0
2466.00	41.78	74.00	32.2	5.0	1000.000	175.0	H	285.0

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1000.00	23.25	54.00	30.7	5.0	1000.000	175.0	H	300.0
1440.00	38.00	54.00	16.0	5.0	1000.000	150.0	V	285.0
1621.20	20.45	54.00	33.5	5.0	1000.000	175.0	V	180.0
1640.80	20.44	54.00	33.6	5.0	1000.000	150.0	H	45.0
1703.60	20.89	54.00	33.1	5.0	1000.000	150.0	V	90.0
1742.80	21.54	54.00	32.5	5.0	1000.000	175.0	H	150.0
1831.60	21.77	54.00	32.2	5.0	1000.000	175.0	H	105.0
1920.00	25.54	54.00	28.5	5.0	1000.000	150.0	V	45.0
1974.80	22.58	54.00	31.4	5.0	1000.000	150.0	H	210.0
2374.40	39.18	54.00	14.8	5.0	1000.000	150.0	H	270.0
2411.20	94.66	54.00	*	5.0	1000.000	175.0	H	285.0
2413.20	94.14	54.00	*	5.0	1000.000	175.0	H	285.0
2466.00	31.00	54.00	23.0	5.0	1000.000	175.0	H	285.0
2467.20	30.72	54.00	23.3	5.0	1000.000	150.0	H	285.0
2740.40	25.64	54.00	28.4	5.0	1000.000	150.0	V	45.0
2812.00	25.58	54.00	28.4	5.0	1000.000	150.0	H	330.0
2856.00	38.42	54.00	15.6	5.0	1000.000	150.0	V	240.0

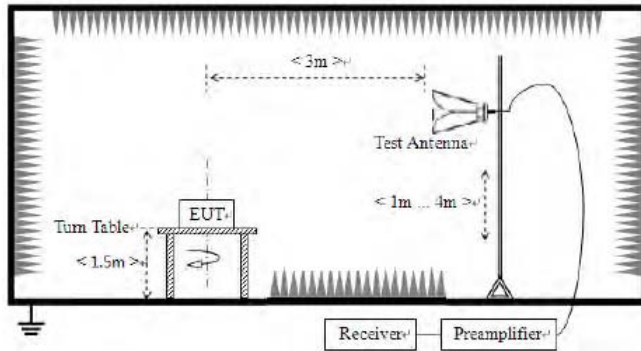
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Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1008.00	44.00	74.00	30.0	5.0	1000.000	150.0	V	75.0
2291.60	38.73	74.00	35.3	5.0	1000.000	150.0	H	15.0
2296.40	38.59	74.00	35.4	5.0	1000.000	150.0	H	270.0
2310.80	48.62	74.00	25.4	5.0	1000.000	150.0	H	45.0
2400.00	76.48	74.00	*	5.0	1000.000	175.0	V	270.0
2401.20	96.08	74.00	*	5.0	1000.000	175.0	V	270.0
2407.60	80.99	74.00	-7.0	5.0	1000.000	150.0	V	150.0
2408.40	69.04	74.00	5.0	5.0	1000.000	150.0	V	150.0
2409.60	67.07	74.00	6.9	5.0	1000.000	150.0	V	150.0
2414.40	48.69	74.00	25.3	5.0	1000.000	175.0	H	60.0
2416.00	72.18	74.00	1.8	5.0	1000.000	175.0	H	60.0
2518.00	39.39	74.00	34.6	5.0	1000.000	175.0	H	240.0

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
1008.00	23.20	54.00	30.8	5.0	1000.000	150.0	H	90.0
1224.00	39.52	54.00	14.5	5.0	1000.000	175.0	H	45.0
1440.00	38.01	54.00	16.0	5.0	1000.000	150.0	V	300.0
2154.40	23.56	54.00	30.4	5.0	1000.000	150.0	V	30.0
2165.60	23.85	54.00	30.2	5.0	1000.000	175.0	H	150.0
2400.00	61.99	54.00	*	5.0	1000.000	175.0	V	270.0
2401.20	88.74	54.00	*	5.0	1000.000	175.0	V	270.0
2407.60	35.07	54.00	18.9	5.0	1000.000	150.0	V	150.0
2416.00	35.26	54.00	18.7	5.0	1000.000	175.0	H	60.0

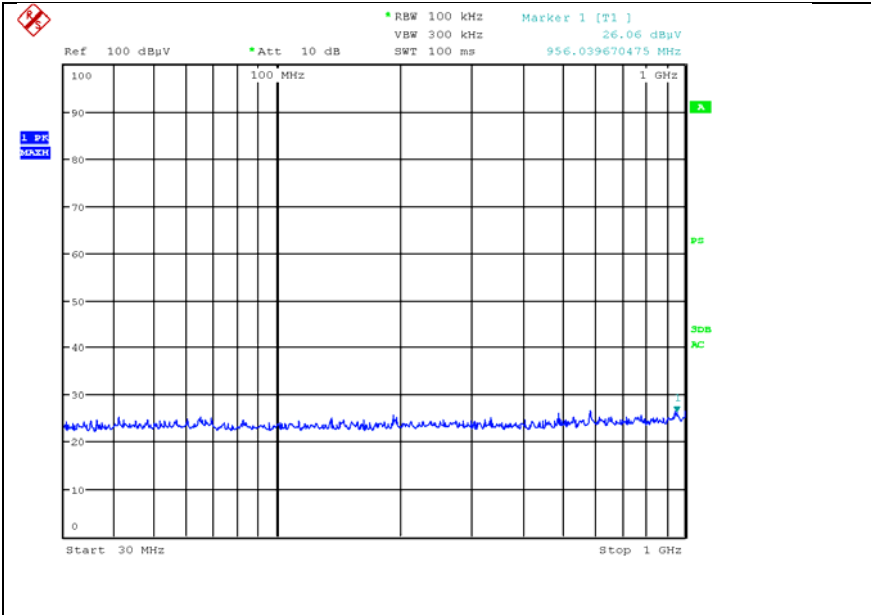
Setup : 1-25GHz

distance antenna-EUT is 1m in the range 18-25GHz

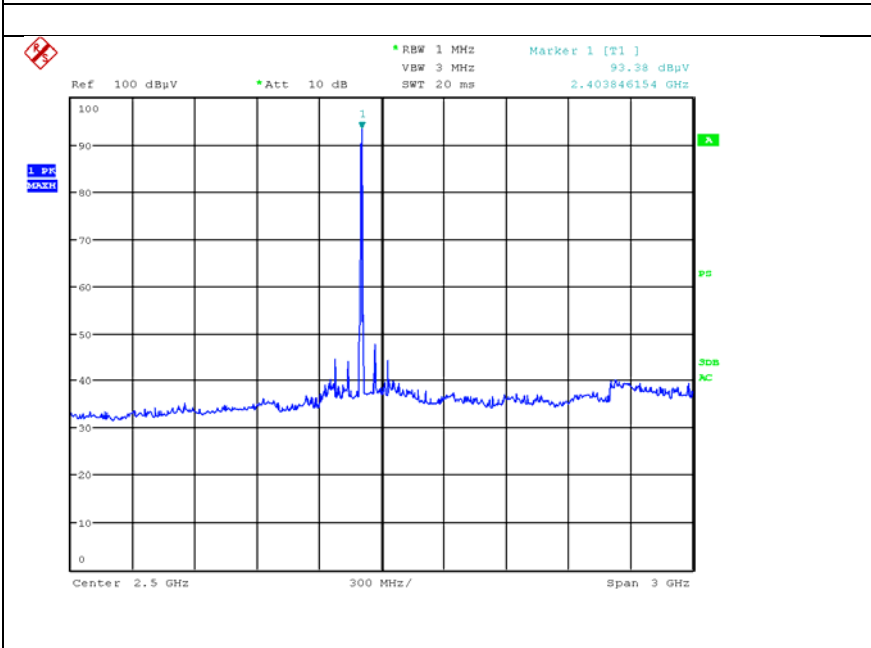


Test result	pass
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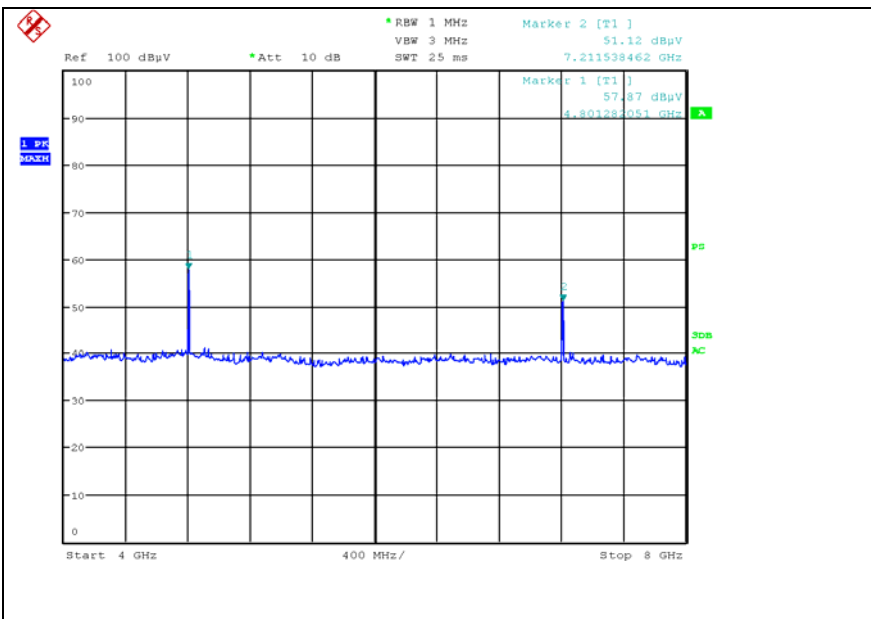
Plot conducted BLE
2402MHz



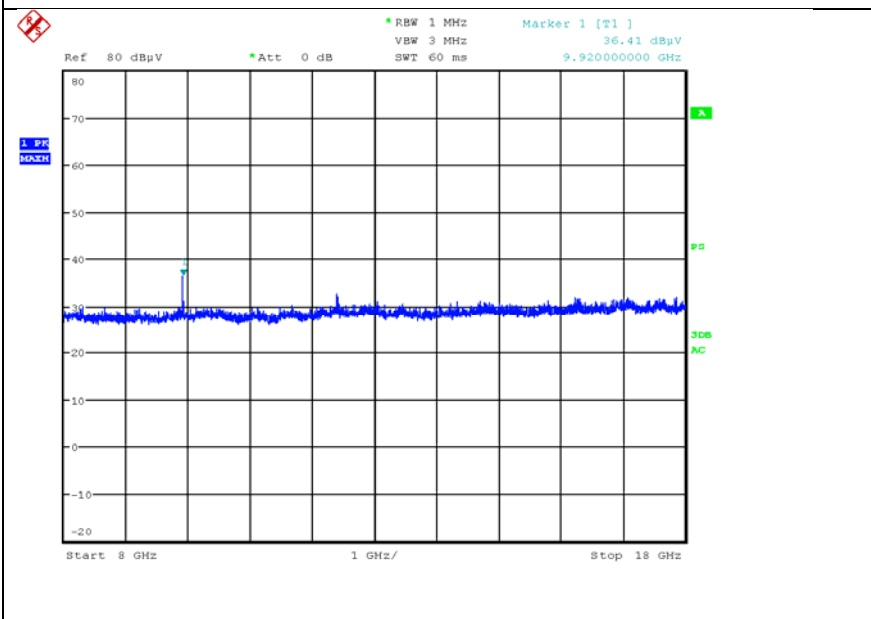
30-1000MHz



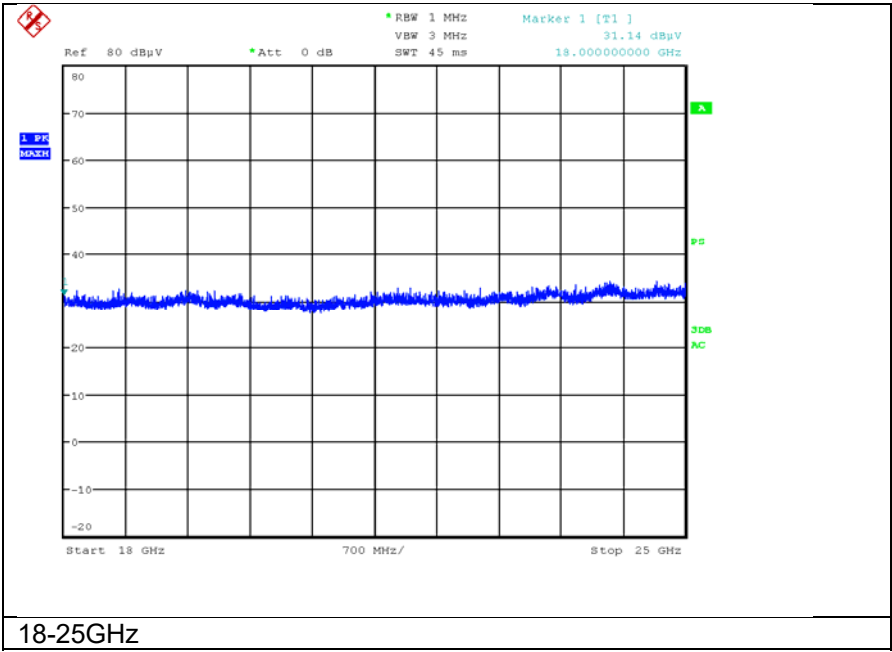
1-4GHz



4-8GHz

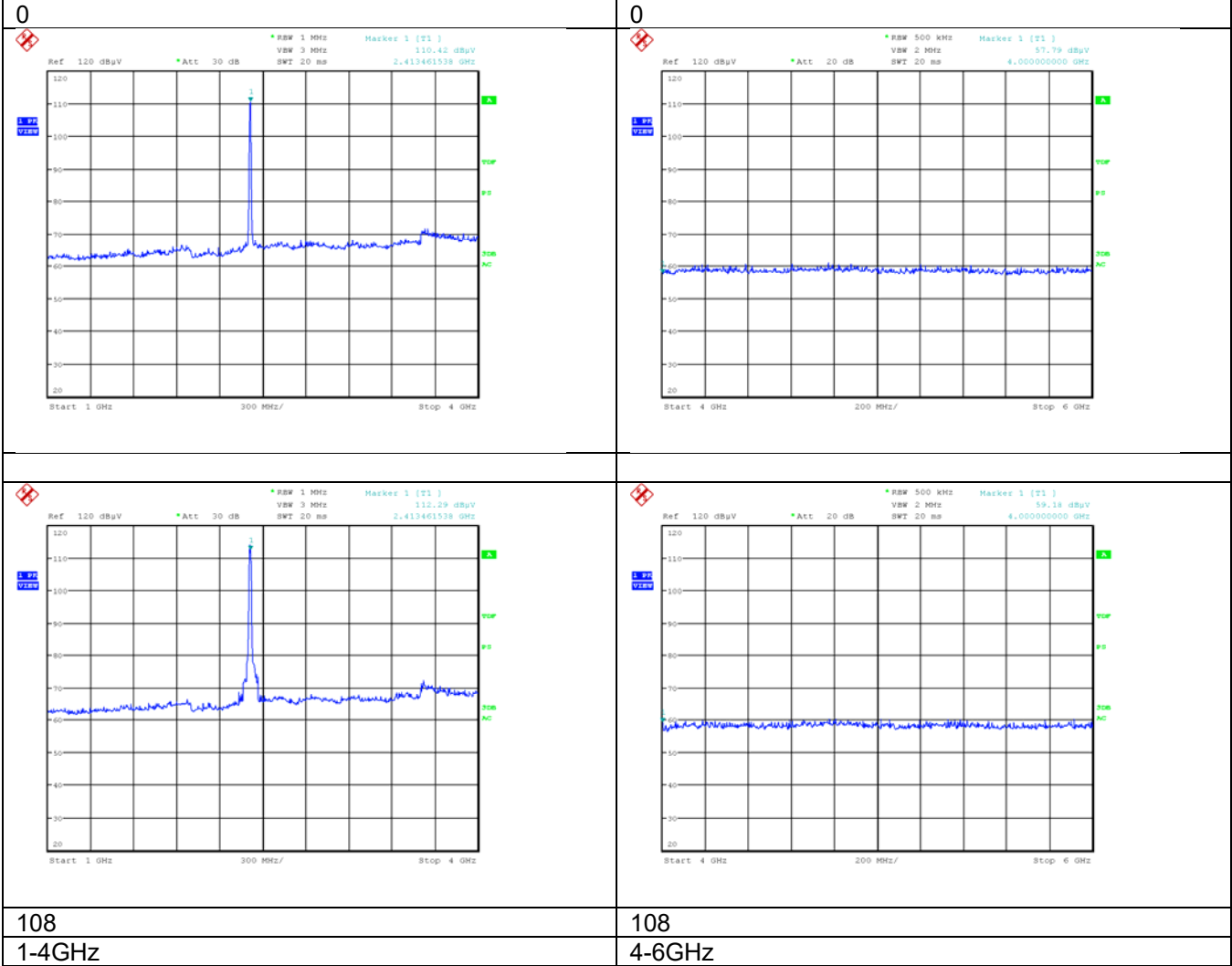


8-18GHz

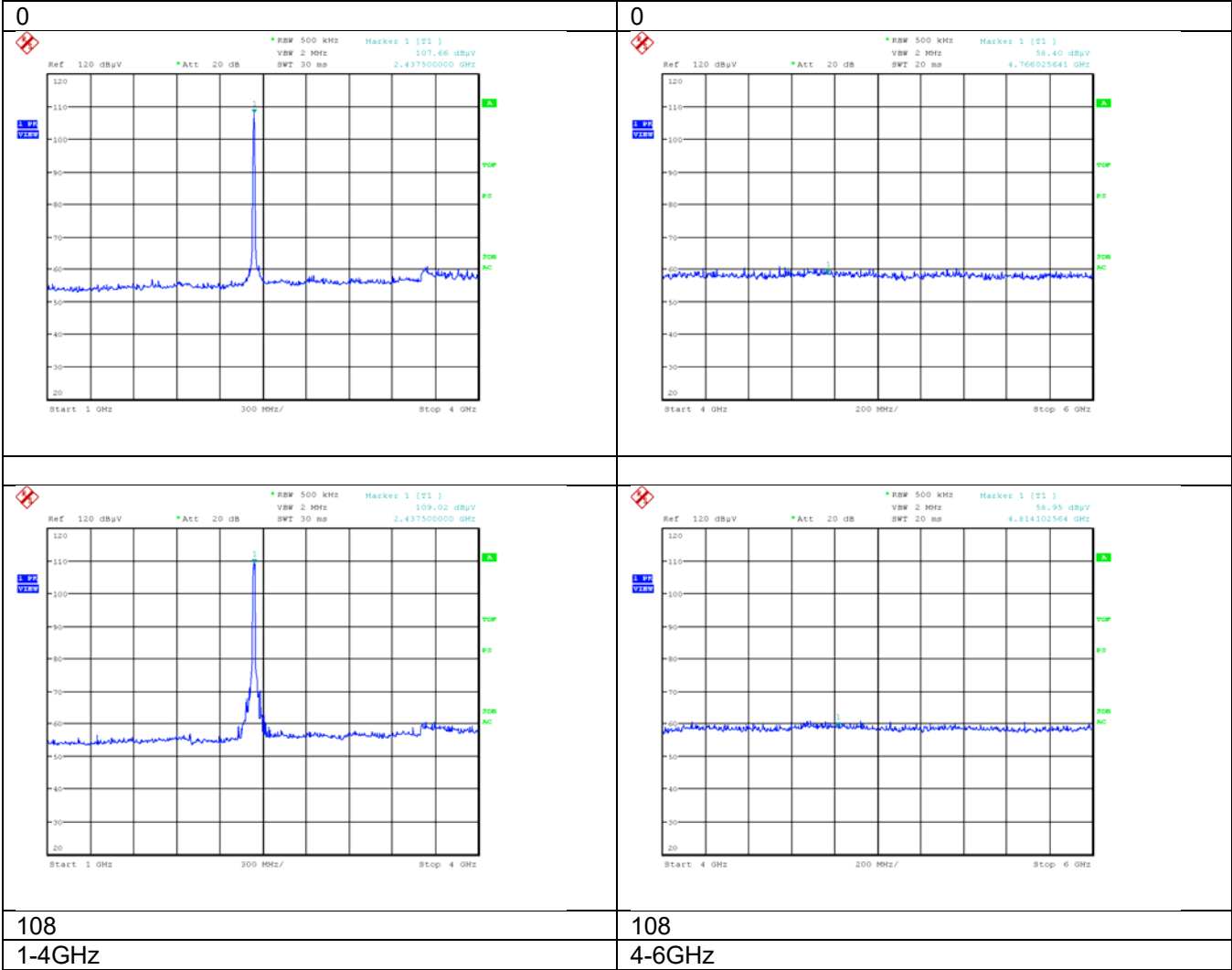


Plot conducted Wifi

2402MHz



2441MHz



2480MHz

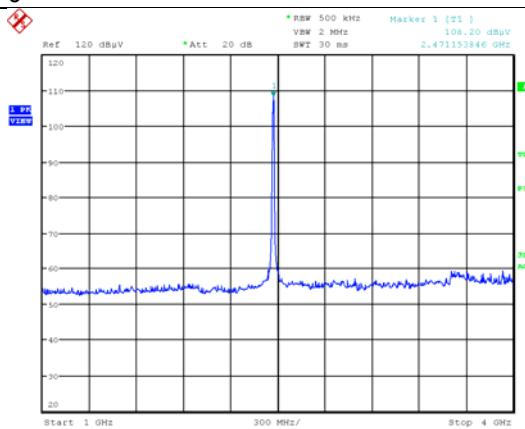
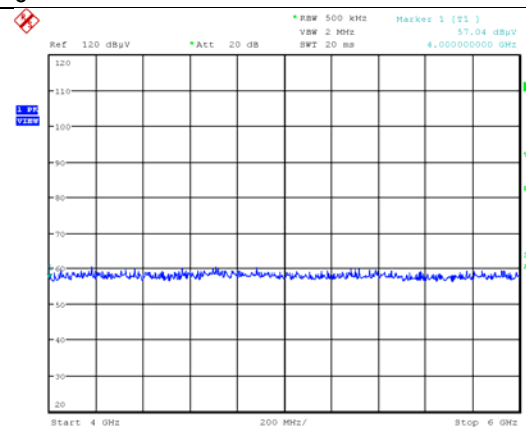
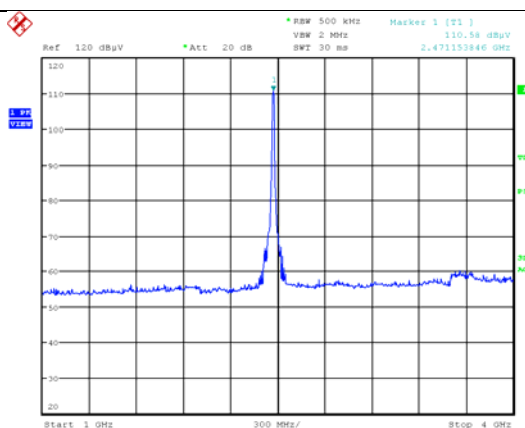
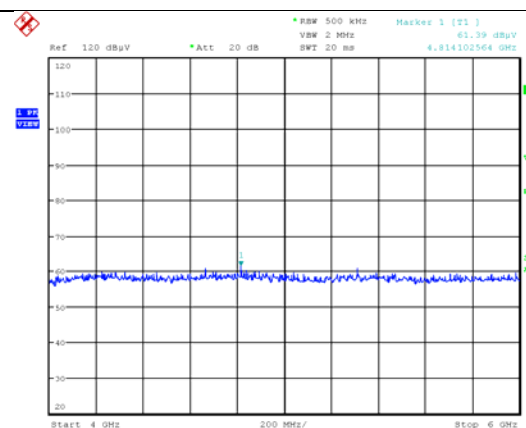
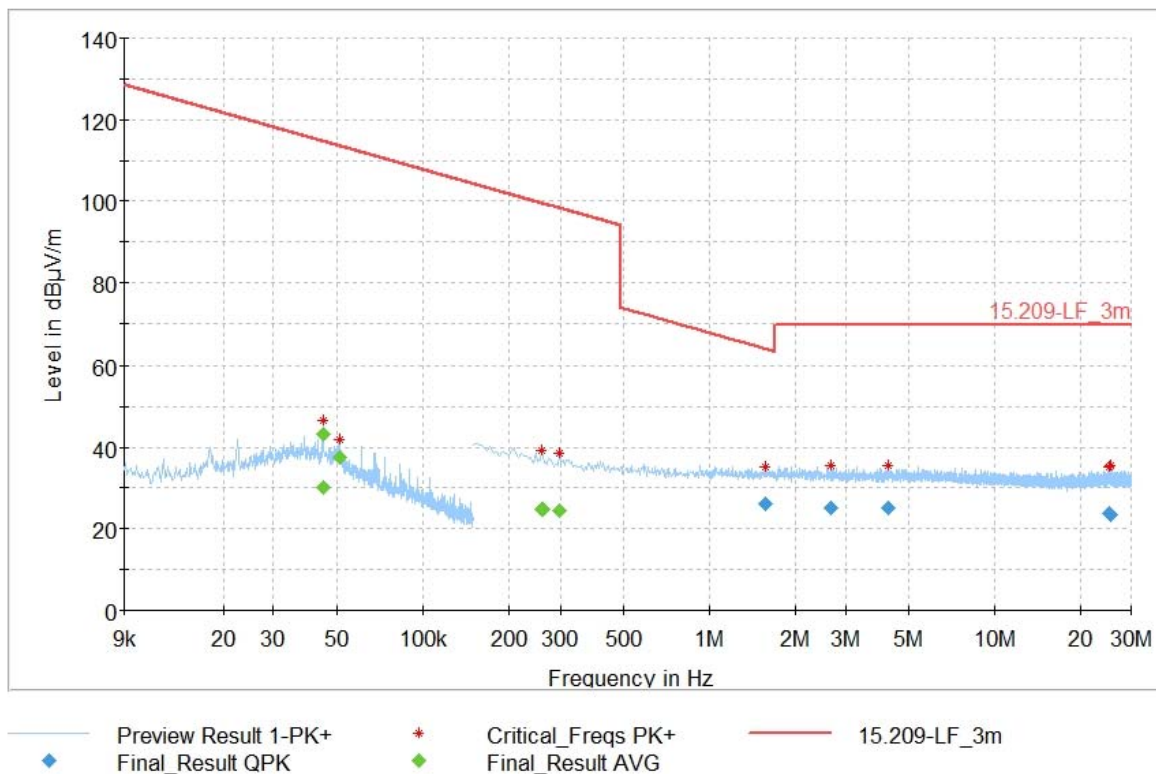
0 	0 
108 	108 
1-4GHz	4-6GHz

Fig : Radiated emission (9k-30MHz)
0°



90°

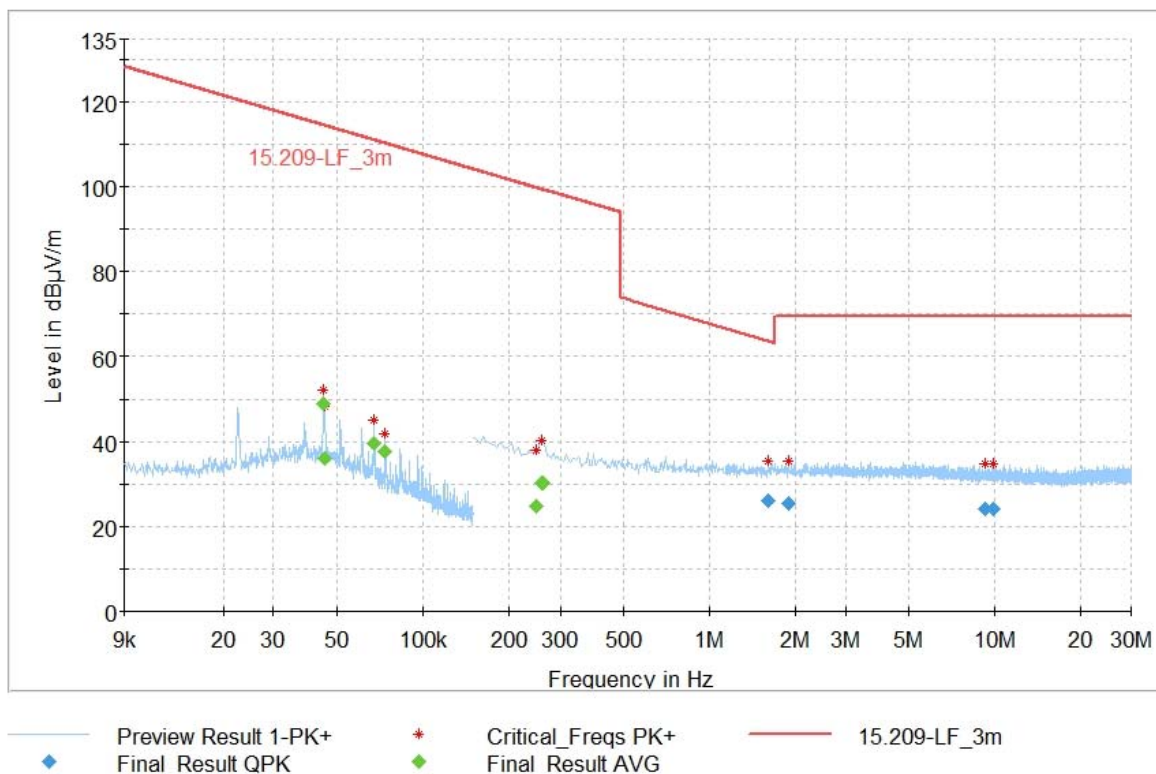


Fig : Radiated emission (30M-1000MHz)

Full Spectrum

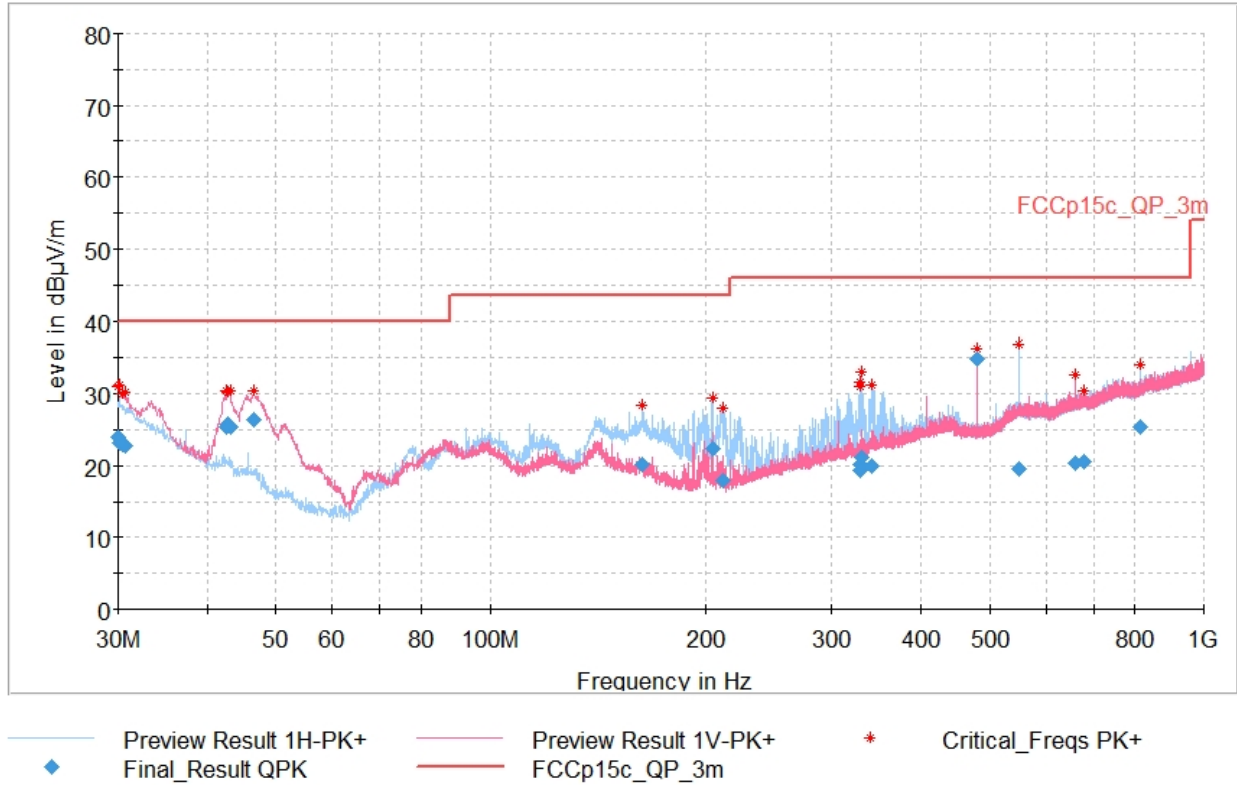
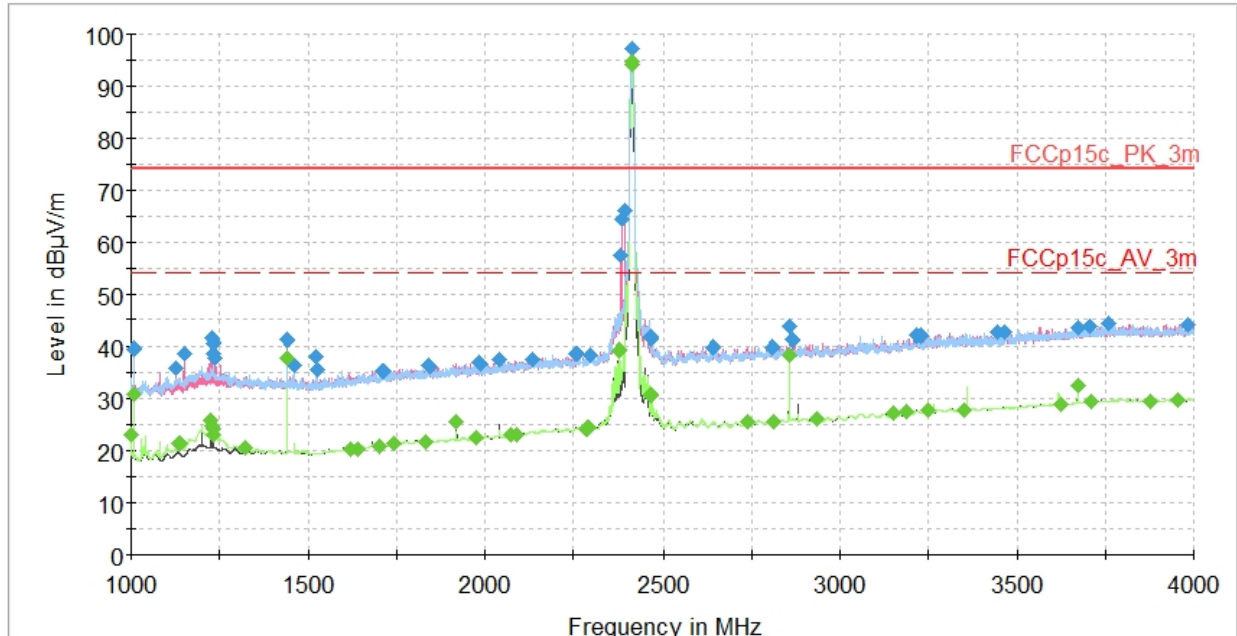
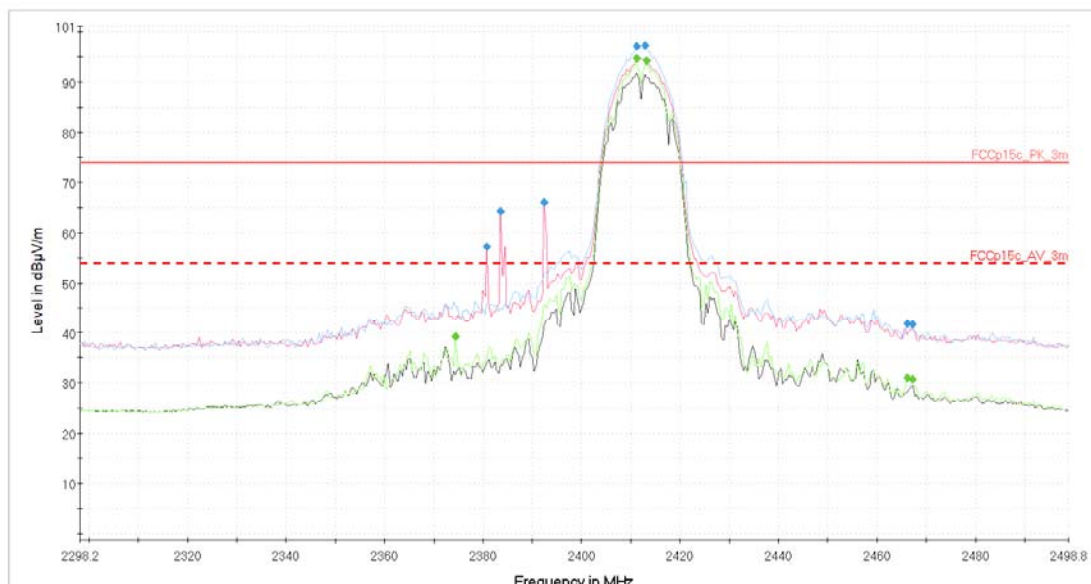


Fig : Radiated emission (1-4GHz)
Wifi

Full Spectrum



Preview Result 2V-AVG
 Preview Result 1H-PK+
 FCCp15c_PK_3m
 Final_Result AVG
 Preview Result 1V-PK+
 Critical_Freqs AVG
 FCCp15c_AV_3m
 Preview Result 2H-AVG
 Critical_Freqs PK+
 Final_Result PK+



Preview Result 2V-AVG
 Critical_Freqs PK+
 Preview Result 1V-PK+
 FCCp15c_PK_3m
 Preview Result 2H-AVG
 FCCp15c_AV_3m
 Preview Result 1H-PK+
 Final_Result PK+
 Critical_Freqs AVG
 Final_Result AVG

BLE

Full Spectrum

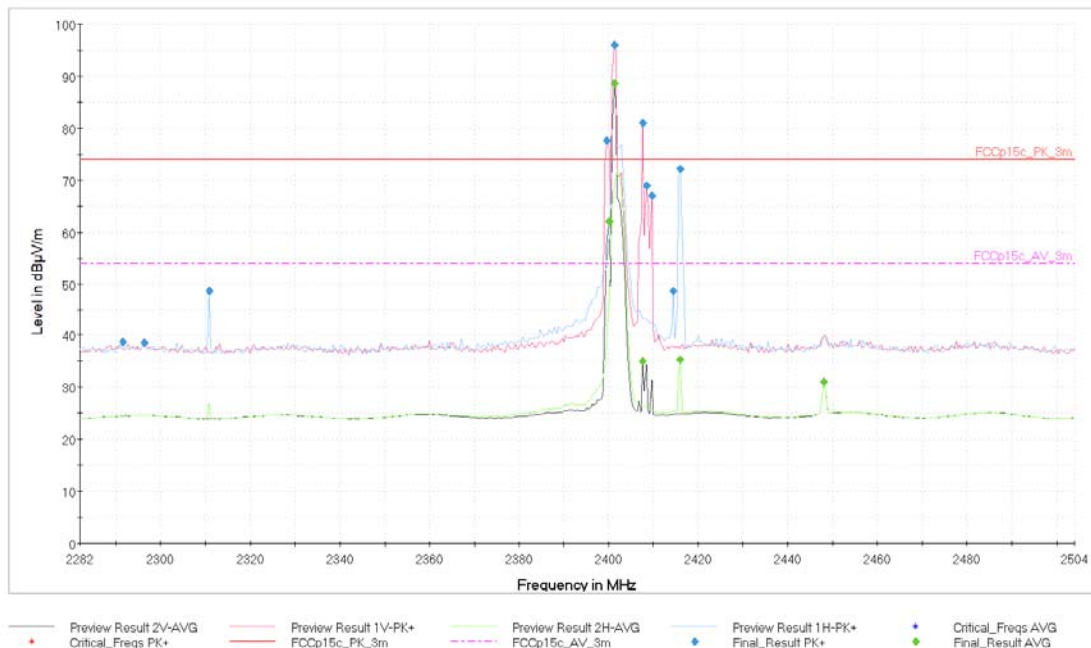
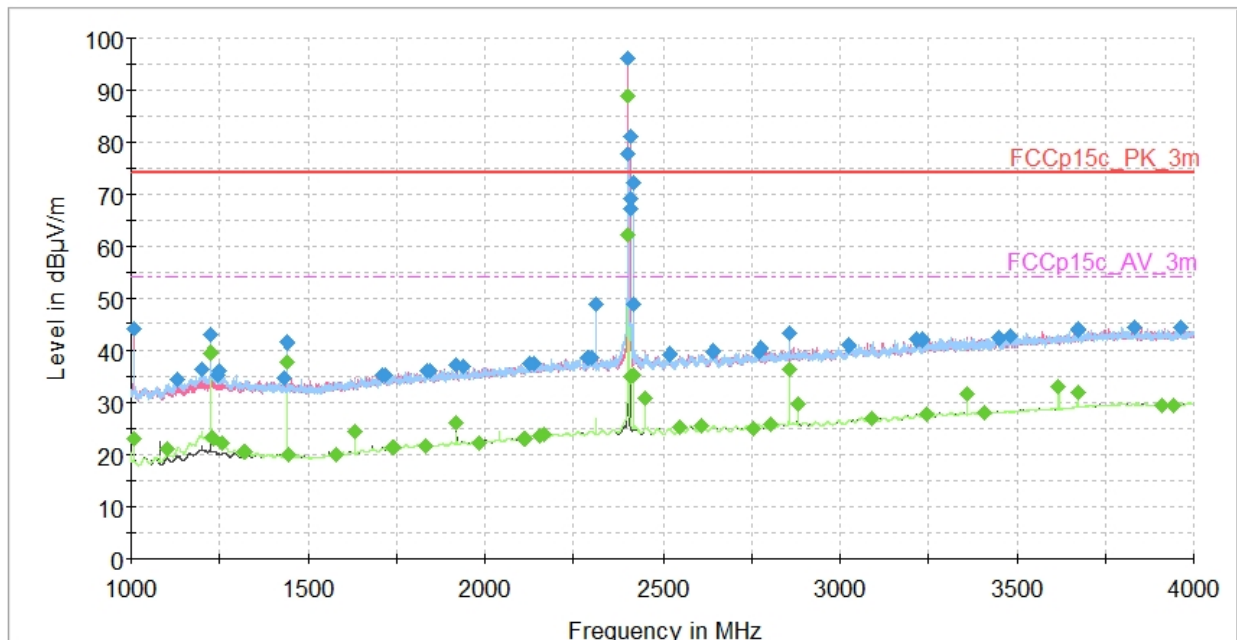


Fig : Radiated emission (4-6GHz)

Full Spectrum

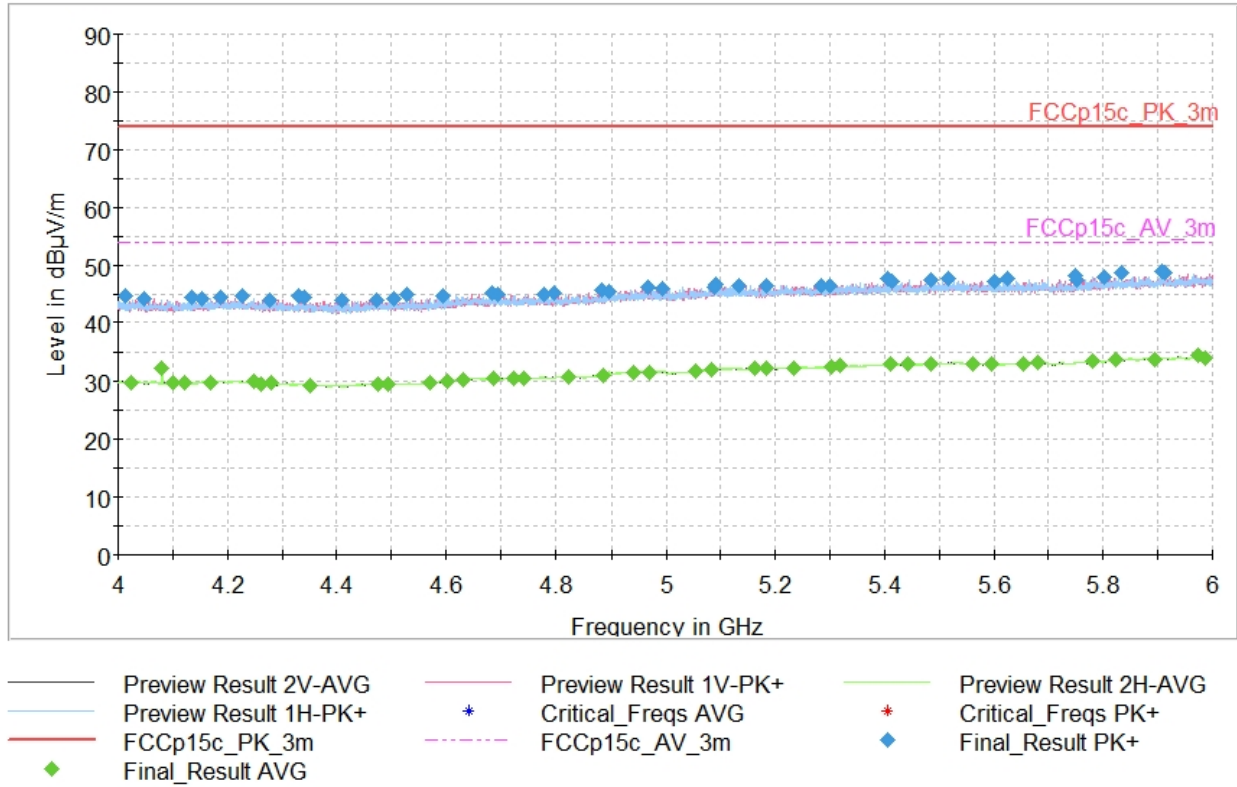


Fig : Radiated emission (6-18GHz)

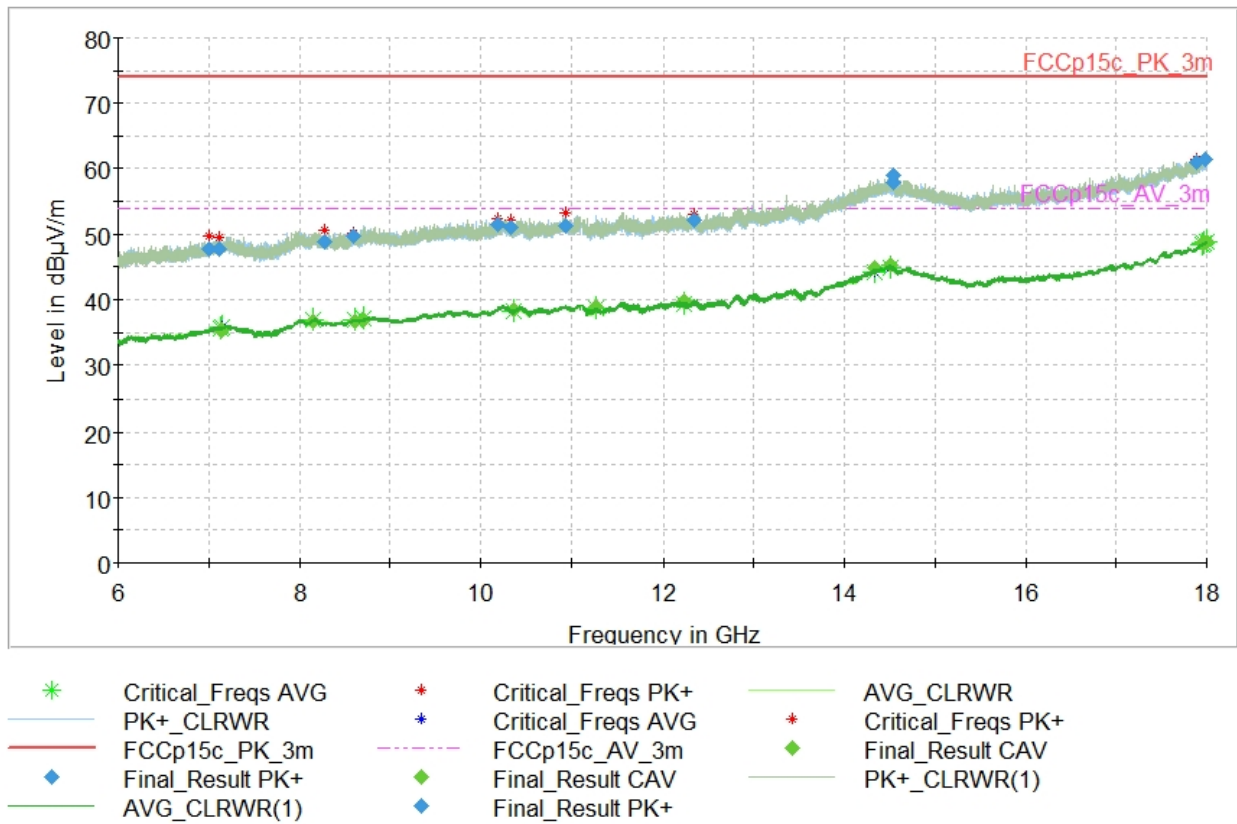
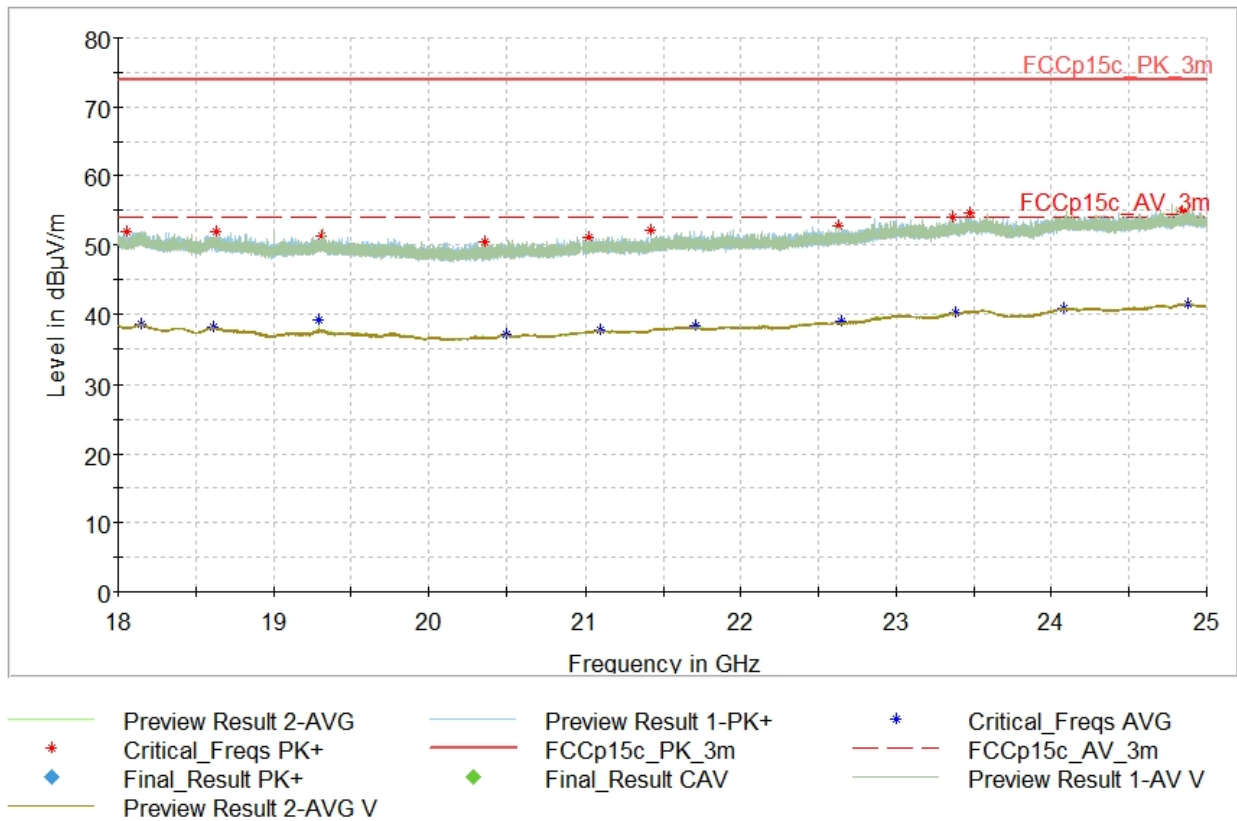


Fig Radiated emission (18-25GHz)



7.5 6dB power bandwidth TEST

CONDITIONS
The EUT was direct connected to the spectrum analyzer (conducted emission) Test voltage : internal battery ANSI C63.10- sec 11.8 Specification reference :C.F.R.47 part 15.247(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions: (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. Test date : 2021-09-28 Test equipment : Receiver: R&S ESU40 , MN : 20112350 DC block MCL BLK-89 : , MN : 20180031 Attenuator VAT10 ; MN : 201112546 cable : IR228

BLE

Measured 6dB Bandwidth :

Frequency (GHz)	6dB BW (MHz)
2.402	1.67
2.44	1.80
2.48	1.76

Wifi

Frequency (GHz)	6dB BW (MHz) mod 0	6dB BW (MHz) mod 108
2.402	7.99	16.47
2.44	10.2	16.62
2.48	7.78	16.61

BLE

Measured 99% :

Frequency (GHz)	(MHz)
2.402	2.21
2.44	2.44
2.48	2.23

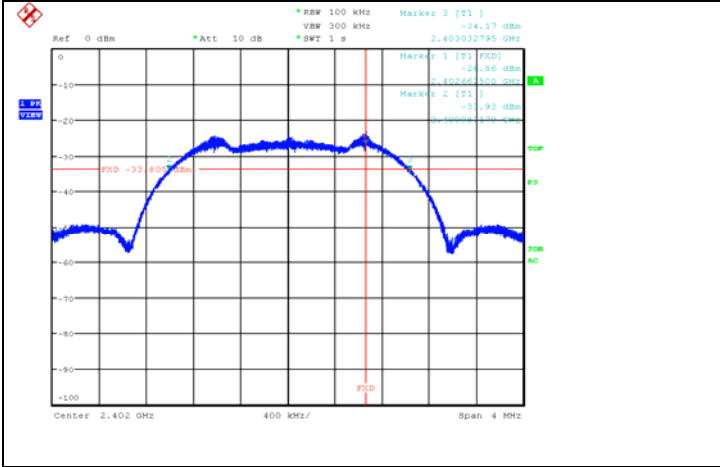
Wifi

Frequency (GHz)	(MHz) mod 0	(MHz) mod 108
2.402	13.94	16.39
2.44	13.94	16.53
2.48	13.89	16.47

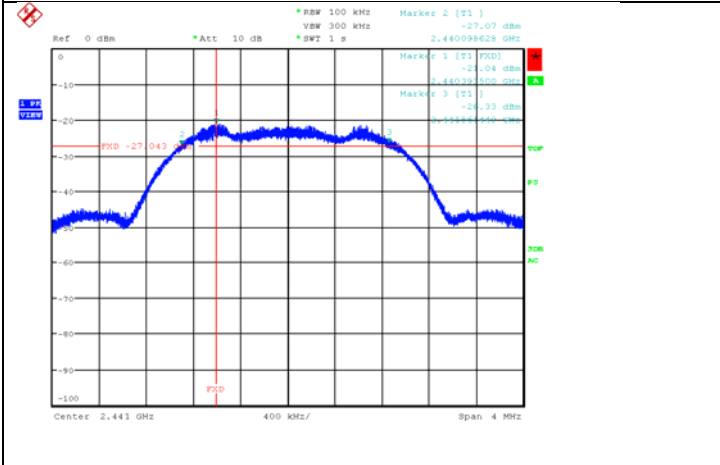
Limits : system using digital modulation techniques : BW > 500kHz

Test result	Pass
-------------	------

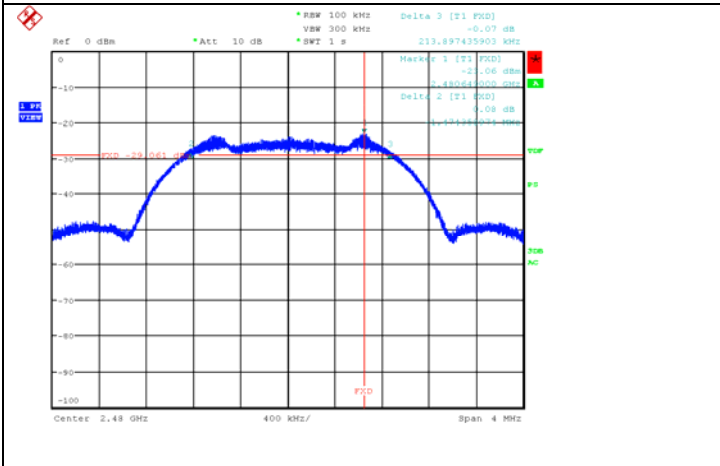
Plot : 6dB bandwidth



2402MHz



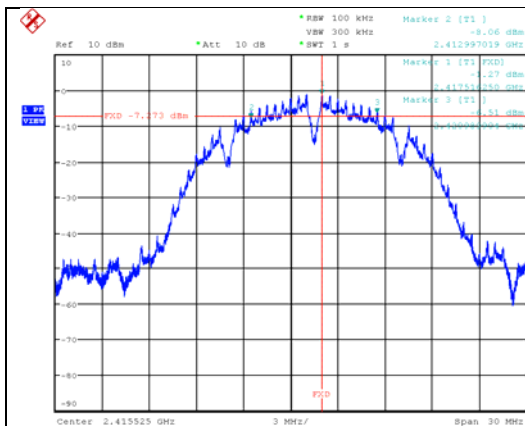
2439MHz



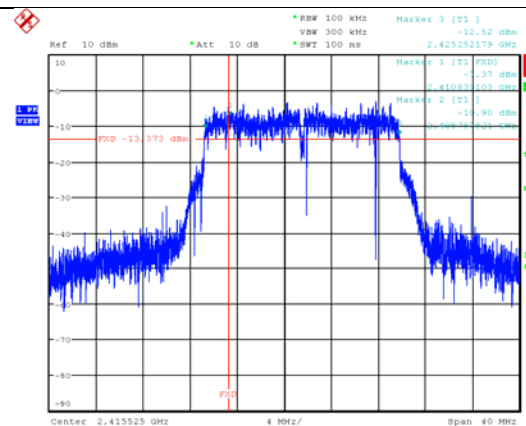
2480MHz

Wifi

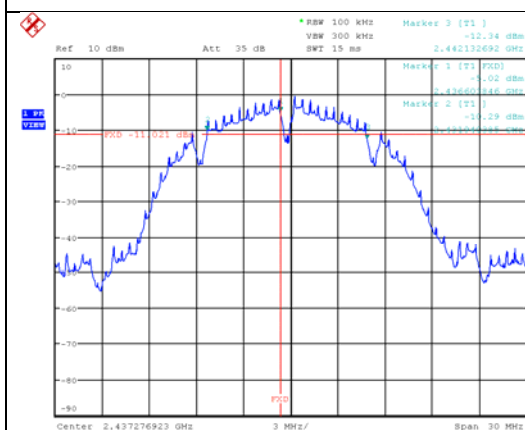
Plot 6dB



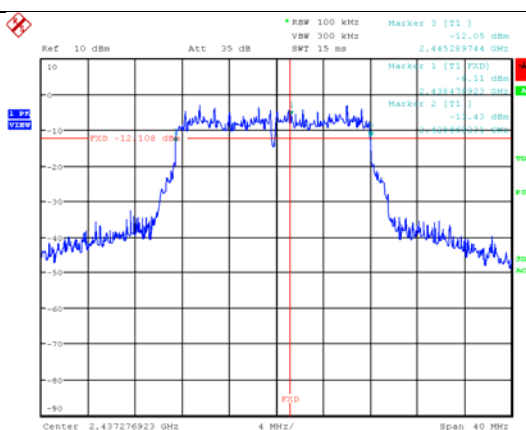
2402MHz ; 0



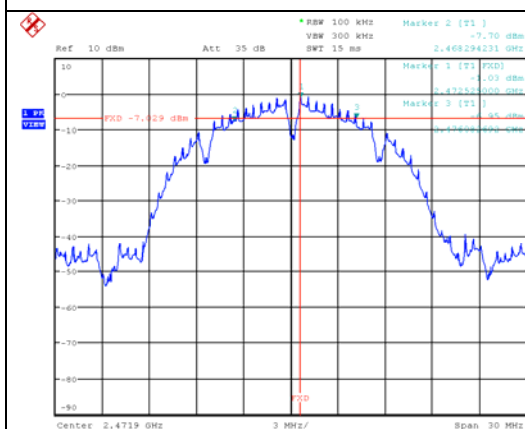
2402MHz ;108



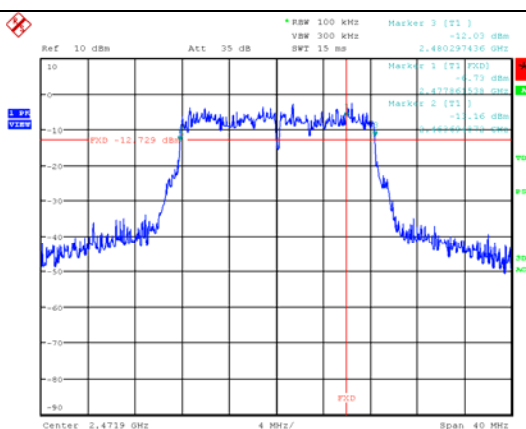
2439MHz ; 0



2439MHz ;108



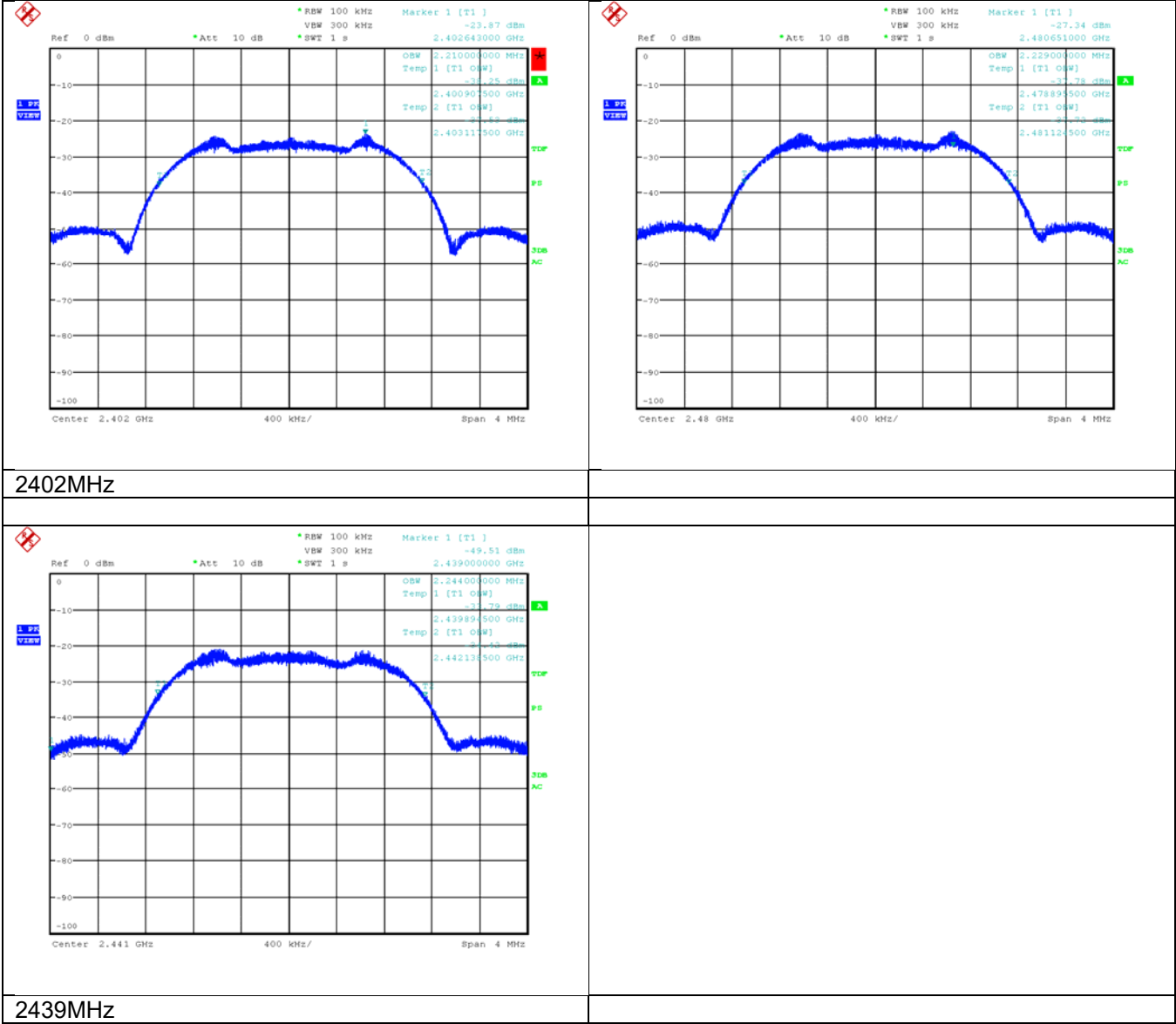
2480MHz ;0



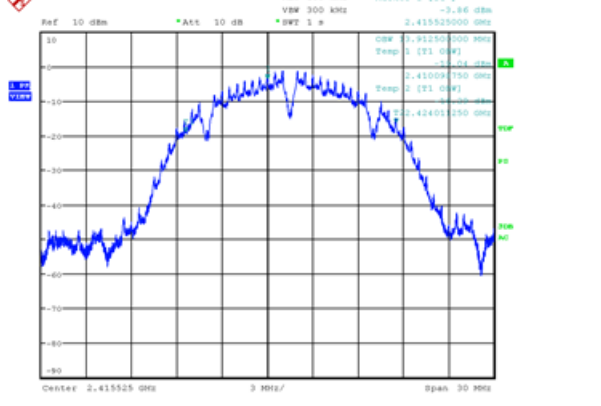
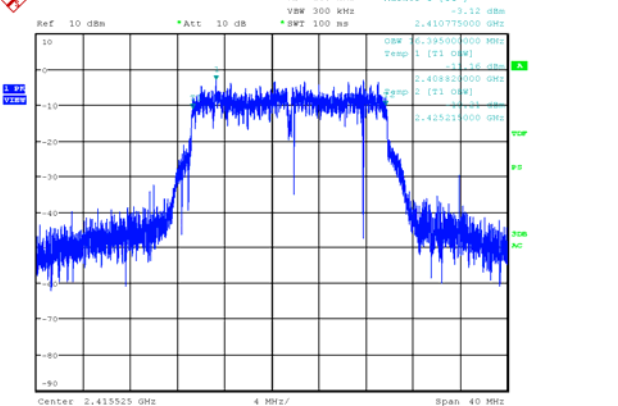
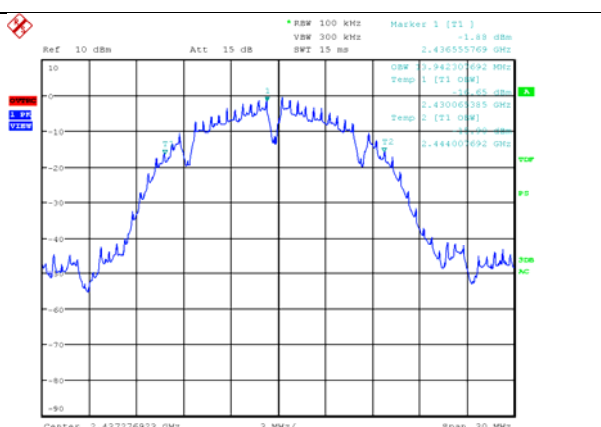
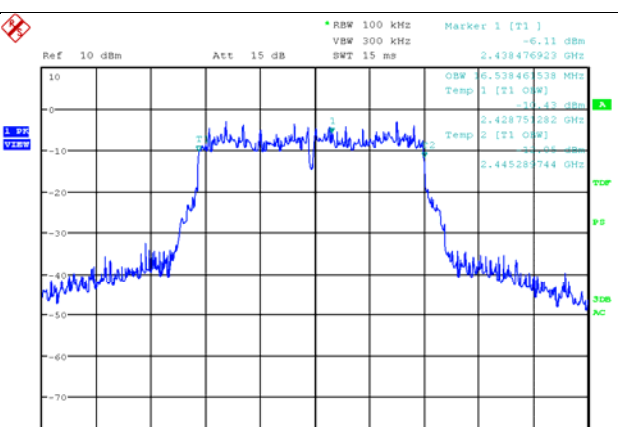
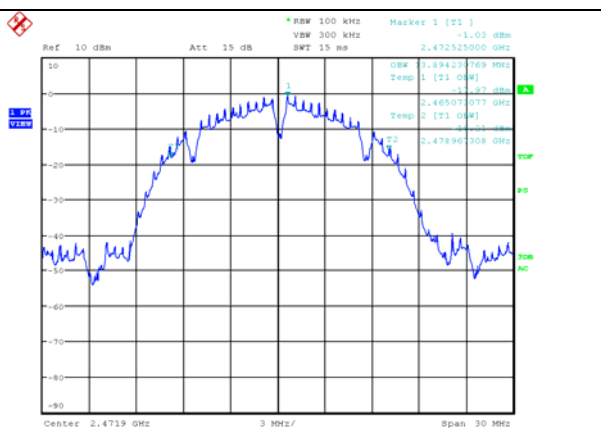
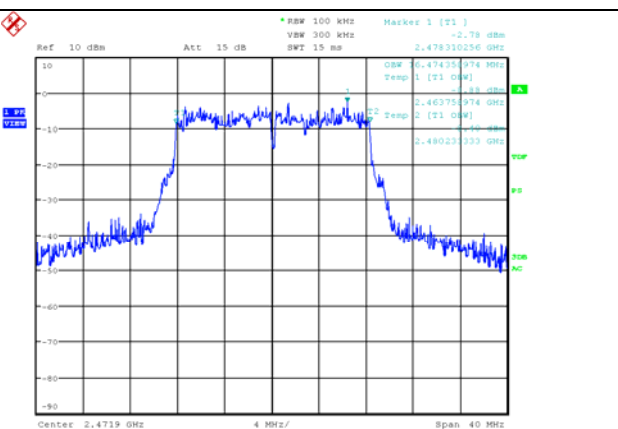
2480MHz ;108

Plot 99 %

BLE



Wifi

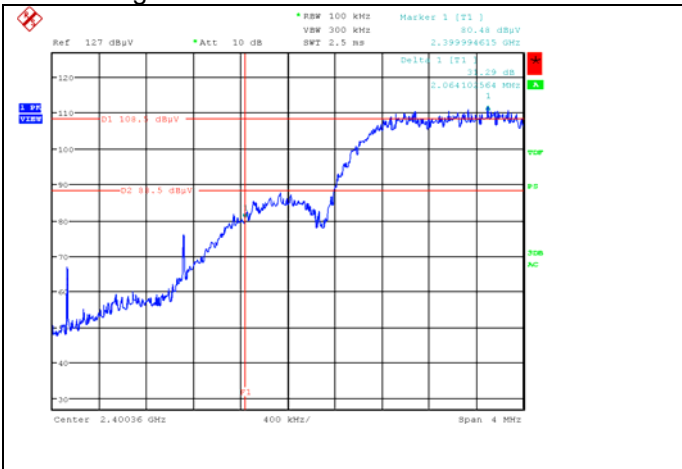
 Ref 10 dBm Att 10 dB RBW 100 kHz VBW 300 kHz Marker 1 [T1] -3.86 dBm 2.415525000 GHz OSW 2.415525000 MHz Temp 1 [T1] 0 dBm OSW 2.415525000 MHz Temp 2 [T1] 0 dBm OSW 2.415525000 MHz Temp 3 [T1] 0 dBm Center 2.415525 GHz 3 MHz/ Span 30 MHz	 Ref 10 dBm Att 10 dB RBW 100 kHz VBW 300 kHz Marker 1 [T1] -3.12 dBm 2.410775000 GHz OSW 2.410775000 MHz Temp 1 [T1] 0 dBm OSW 2.410775000 MHz Temp 2 [T1] 0 dBm OSW 2.410775000 MHz Temp 3 [T1] 0 dBm Center 2.410775 GHz 4 MHz/ Span 40 MHz
2402MHz ; 0	2402MHz ; 108
 Ref 10 dBm Att 15 dB RBW 100 kHz VBW 300 kHz Marker 1 [T1] -1.89 dBm 2.437276923 GHz OSW 2.437276923 MHz Temp 1 [T1] 0 dBm OSW 2.437276923 MHz Temp 2 [T1] 0 dBm OSW 2.437276923 MHz Temp 3 [T1] 0 dBm Center 2.437276923 GHz 3 MHz/ Span 30 MHz	 Ref 10 dBm Att 15 dB RBW 100 kHz VBW 300 kHz Marker 1 [T1] -6.11 dBm 2.428476923 GHz OSW 2.428476923 MHz Temp 1 [T1] 0 dBm OSW 2.428476923 MHz Temp 2 [T1] 0 dBm OSW 2.428476923 MHz Temp 3 [T1] 0 dBm Center 2.428476923 GHz 4 MHz/ Span 40 MHz
2439MHz ; 0	2439MHz ; 108
 Ref 10 dBm Att 15 dB RBW 100 kHz VBW 300 kHz Marker 1 [T1] -1.03 dBm 2.472525000 GHz OSW 2.472525000 MHz Temp 1 [T1] 0 dBm OSW 2.472525000 MHz Temp 2 [T1] 0 dBm OSW 2.472525000 MHz Temp 3 [T1] 0 dBm Center 2.472525 GHz 3 MHz/ Span 30 MHz	 Ref 10 dBm Att 15 dB RBW 100 kHz VBW 300 kHz Marker 1 [T1] -2.78 dBm 2.478310256 GHz OSW 2.478310256 MHz Temp 1 [T1] 0 dBm OSW 2.478310256 MHz Temp 2 [T1] 0 dBm OSW 2.478310256 MHz Temp 3 [T1] 0 dBm Center 2.478310 GHz 4 MHz/ Span 40 MHz
2480MHz ; 0	2480MHz ; 108

7.6 Band edge conducted spurious emissions

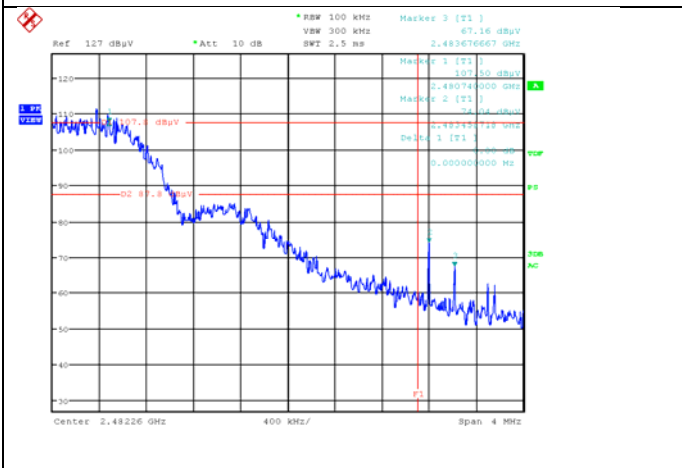
CONDITIONS
Test specification : ANSI C63.10 section 6.10.4 Specification reference : C.F.R.47 part 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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)). Test date : 2021-09-29
Test equipment : Receiver: R&S ESU40 , MN : 20112350 DC block MCL BLK-89 : , MN : 20180031 Attenuator VAT10 ; MN : 201112546 cable : IR228

Test result	Pass
-------------	------

Plot low edge BLE

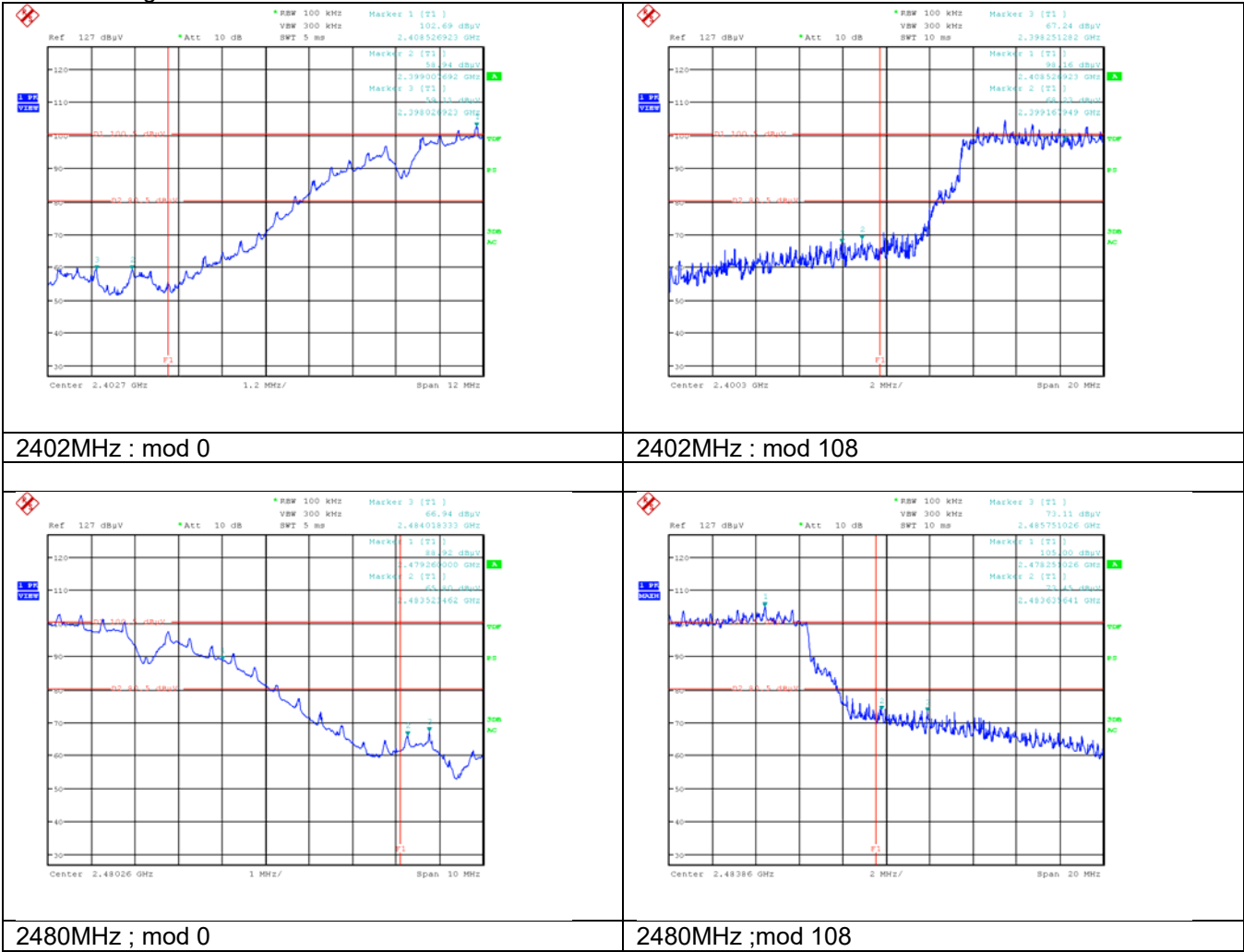


2402MHz



2480

Plot 20dB edge Wifi



7.7. Power Spectral Density TEST

CONDITIONS

PSD : Power Spectral Density

Standard : ANSI C63.10 section 11.10.2

Specification reference : C.F.R.47 part 15.247(e)

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test date : 2021-09-28

Test equipment :

Receiver: R&S ESU40 , MN : 20112350

DC block MCL BLK-89 : , MN : 20180031

Attenuator VAT10 ; MN : 201112546

cable : IR228

BLE

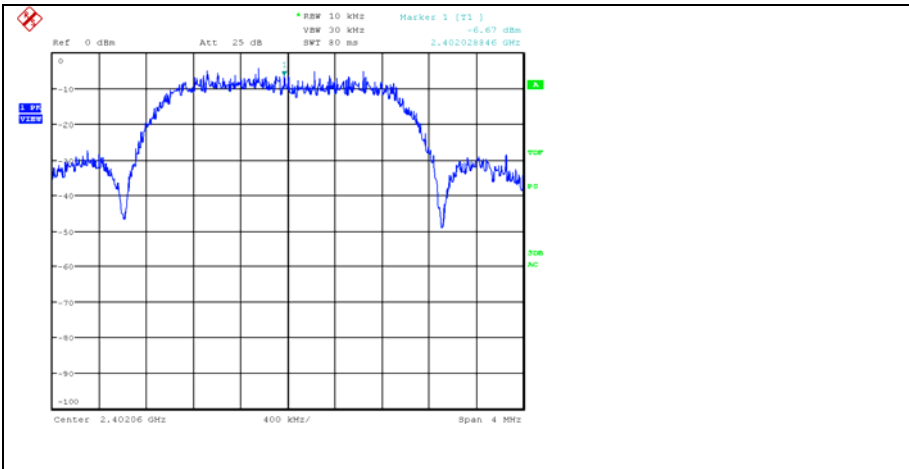
f(MHz)	10kHz (dBm)	limit (dBm)	P/F
2402	-6.6	8	P
2441	-10.1	8	P
2480	-6.6	8	P

Wifi

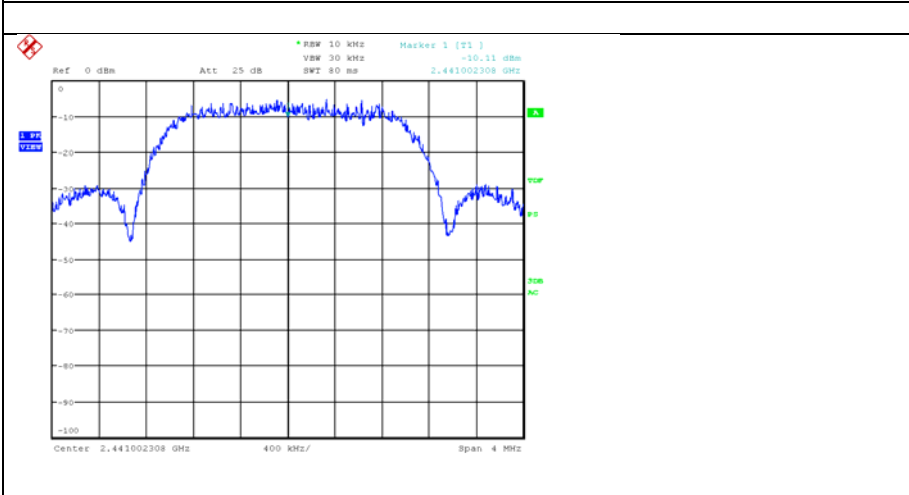
f(MHz)	mod	10kHz (dBm)	limit (dBm)	P/F
2402	0	-10.2	8	P
2439	0	-9.2	8	P
2480	0	-12.3	8	P
2402	108	-10.2	8	P
2439	108	-12.2	8	P
2480	108	-11.3	8	P

Remark : measurement in 10kHz RBW , due levels < 8dBm no calculation / measurement is done for 3kHz

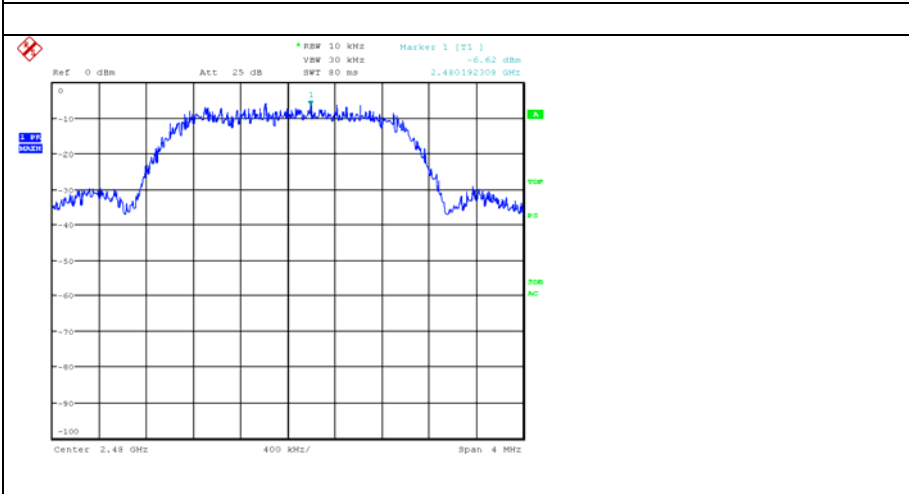
Plot BLE



2402MHz

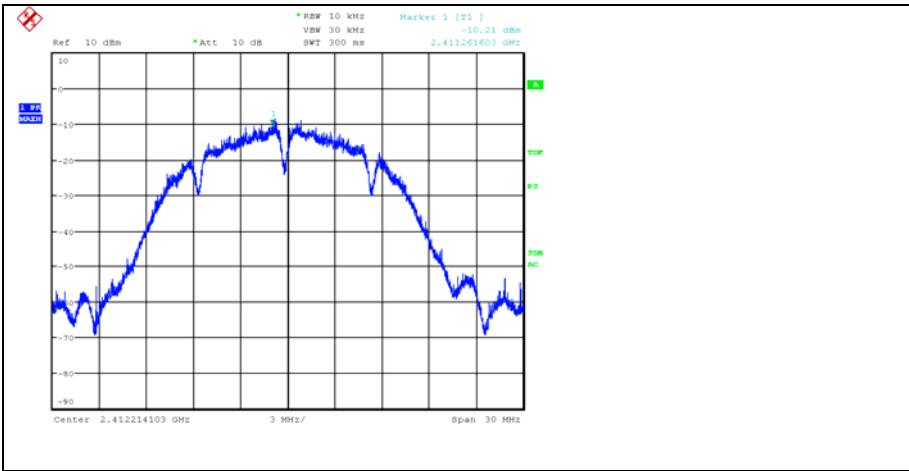


2441MHz

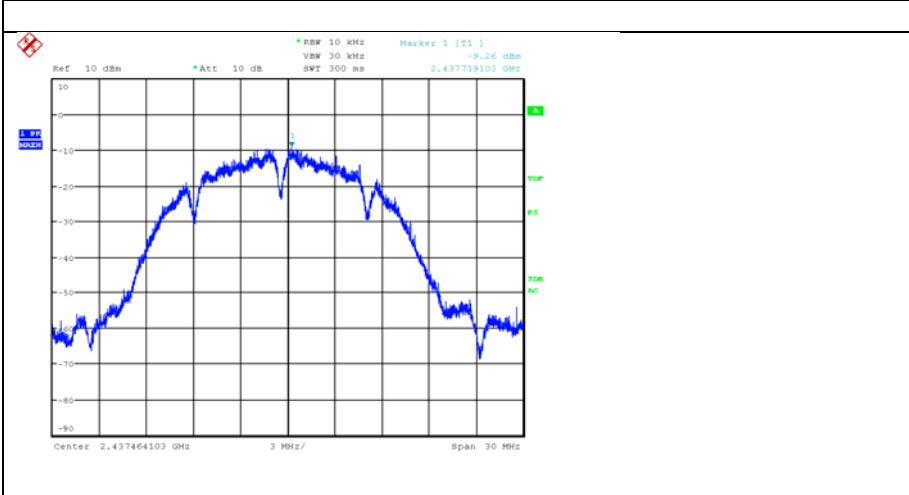


2480MHz

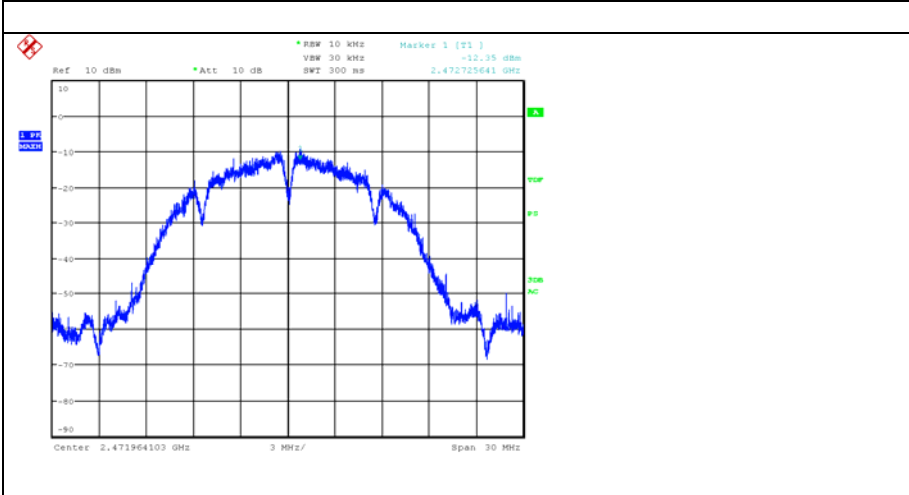
Plot Wifi mod 0



2402

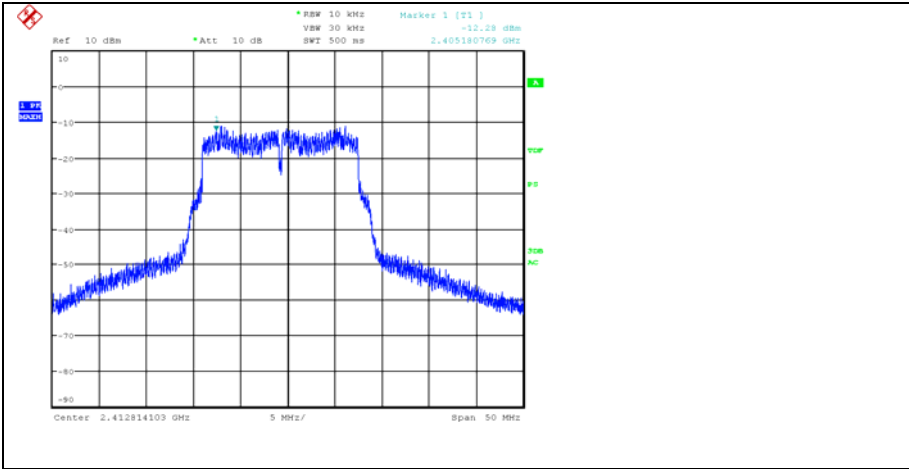


2439

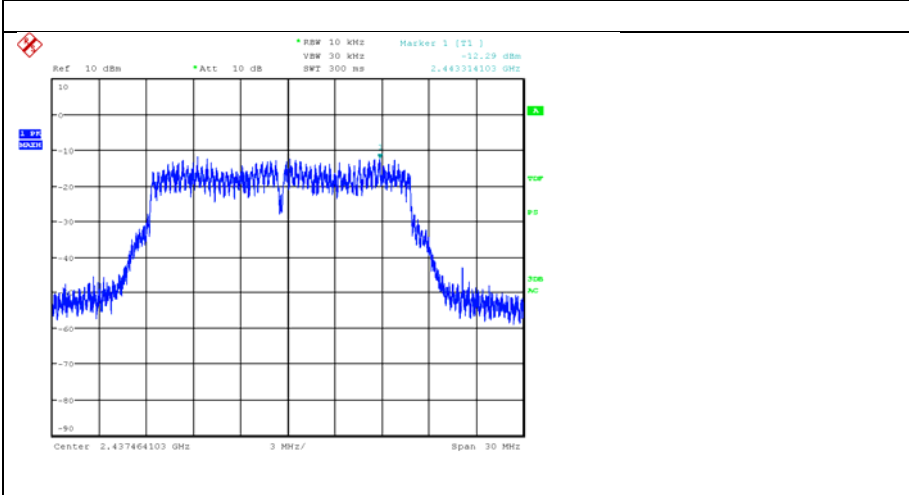


2480

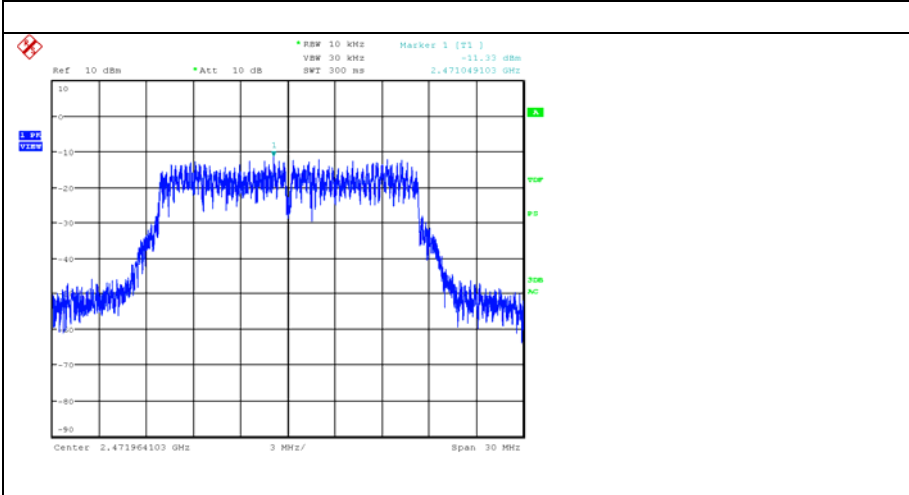
Plot Wifi mod 108



2402



2439



2480

7.8. limits

Table : CE on mains (class)

frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15-0.50	66	56
0.50-5.0	56	46
5.0-30	60	50

Table : RE @ 3m (class)

Frequency (MHz)	QP (dB μ V/m)	AV (dB μ V/m)	Peak (dB μ V/m)
0.009 (*)	128	128	--
0.49 (*)	94	94	--
0.49 (*)	73	73	--
1.705	63		--
1.705	69.5		--
30	69.5		--
30-88	40	--	--
88-216	43.5	--	--
216-960	46	--	--
960-1000	54	--	--
1000-40000	--	54	74

(*) : The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz Radiated emission limits in these bands are based on measurements employing an average detector.

7.9. Test dates and Climate conditions.

date	2021-09-06 , 14, 20,27,28 and 29 ; 2022-05-04
ambient temperature	22/20/20/20/20/20/22°C
relative humidity	55/61/57/65/56/60/34%
atmospheric pressure	1023/1013/1018/1013/1023/1015/1019hPa

7.10. Used equipment calibration

Equipment

MN	Last cal	Next cal
20112350	2021-01-15	2022-02
20180034	2021-07-27	2023-08
458580	2021-02-08	2024-03
2006054	2021-02-25	2024-03
20170015	2019-09-16	2022-10
201112419	2020-11-03	2021-12
20170072	2021-03-24	2022-04
475058	2021-03-24	2022-04
201112504	2021-07-13	2022-08

SECTION 8: MEASUREMENT UNCERTAINTIES

RF-frequency:	+/- 0.1 ppm
RF power conducted:	+/- 1.5 dB
RF power radiated:	+/- 5.8 dB
Spurious emission conducted:	+/- 3 dB
Spurious emission radiated:	+/- 5.8 dB
RH	+/- 5%
T°	+/- 1°C
Vdc	+/- 0.5%
Vac	+/-2%

SECTION 9: PHOTOGRAPHS OF EQUIPMENT AND TEST SET-UP

Photo : EUT

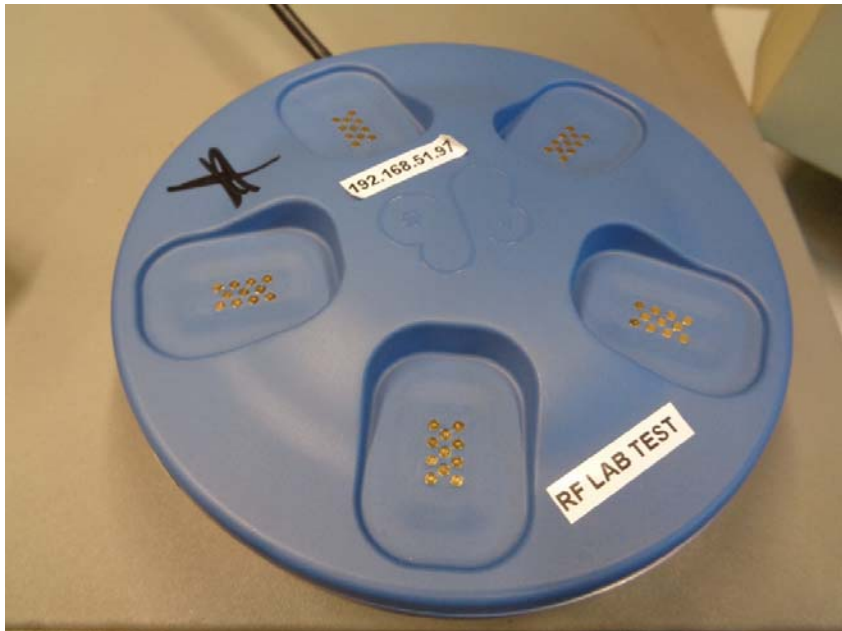


Photo : antenna



Photo : AC/DC adapter and dock



SECTION 10: ADDITIONAL INFORMATION GIVEN BY THE CUSTOMER

Applicant's role during testing

none

EUT information given by the customer

Auxiliary equipment connected during testing

Modulation

For mode 0:
This mode uses DSSS with BPSK at 11 megachips per second. The transmitted data is a 11-bit barker code (10110111000). The final data throughput is thus 1 megabit per second. The transmit spectrum is filtered at 16MHz to reduce adjacent channel bandwidth.

For mode 108:
The is an OFDM mode using 64-QAM modulation on 52 data subcarriers and 4 additional carriers that are used as continuous pilots. A convolutional code with rate 5/6 is used to enhance reliability. The final throughput is 65mbps.

The Bluetooth radio mode: 2 megabits per second. The binary symbols are fed to a GFSK modulator with a modulation index between 0.45 and 0.55 (+/-500kHz for 2mbps mode).
The Gaussian filter has a BT of 0.5.

Cables

USB cable of AC/DC adapter

SECTION 11: MODIFICATIONS OF EUT

MODIFICATIONS OF EUT : none

SECTION 12: HISTORY OF THE TEST REPORT

HISTORY OF THE TEST REPORT (EDITION)

Edition	Adjustment (reason for up-grade)
PCC-EMC-5475_ed.1	Original
PCC-EMC-5475_ed.2	Adding test result antenna port , change limit emission range 18-25GHz
PCC-EMC-5475_ed.3	Adding test results peak output power BLE

SECTION 13: ACCREDITATION CERTIFICATE



Organisme belge d'Accréditation
Belgische Accreditatieinstelling
Belgische Akkreditierungsstelle
Belgian Accreditation Body

EA MLA Signatory

Accreditation Certificate No. 041-TEST

In compliance with the provisions of the Royal Decree of 31 January 2006 setting up BELAC, the Accreditation Board hereby declares to have granted accreditation conform the requirements of the standard EN ISO/IEC 17025:2017 to:

Laboratoria De Nayer vzw
Jan Pieter de Nayerlaan 9
2860 Sint-Katelijne-Waver

The body demonstrated the competence to perform the activities in the activity sites, as described in the scope of accreditation 041-TEST which is an integral part of the present certificate.

The current version of the scope of accreditation is available at www.belac.be.

This certificate remains valid as long as the body continues to meet the accreditation conditions.

The Chair of the Accreditation Board BELAC,

Maureen LOGGHE

Version : 8

Validity period : 2020-10-22 - 2024-01-07

Original version of this certificate is in Dutch.

.be

BELAC 6-319 RO-2020

FCC :

FEDERAL COMMUNICATIONS COMMISSION

**Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046**

To: Tina Vounasi
SPF Economie, PME, Classes moyennes et Energie
GROW-NANDO-ADMINISTRATOR@ec.europa.eu
From: George Tannahill
George.Tannahill@fcc.gov
Date: April 03, 2020

Test Firm Name: Laboratoria De Nayer
Designation Number: BE0002
Test Firm Registration Number: 963303

Subject: **FCC recognition of accreditation for Laboratoria De Nayer**

We have been notified by SPF Economie, PME, Classes moyennes et Energie that Laboratoria De Nayer has been accredited as a testing laboratory.

At this time Laboratoria De Nayer is hereby recognized to perform compliance testing on equipment subject to the Commission's Declaration Of Conformity (DOC) and Certification rules for the following scope(s):

Unintentional Radiators - FCC Part15, Subpart B
Industrial, Scientific, and Medical Equipment - FCC Part 18
Intentional Radiators - FCC Part 15 Subpart C

This recognition will expire upon expiration of the accreditation or notification of withdrawal of Commission's recognition.

Any questions about this recognition should be submitted as an inquiry to the FCC Knowledge Database at www.fcc.gov/kdb.