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Test Report for FCC

FCC ID :TKWBSA2-OMPW2

Report Number		ESTRFC2112-002		
Applicant	Company name	Suprema Inc		
	Address	17F-5, Parkview Office Tower, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea		
	Telephone	+82-31-710-4908		
	Contack person	Jae-Won Lee, Han-Chul Kim		
Product	Product name	Biostation A2		
	Model No.	BSA2-OMPW	Manufacturer	Suprema Inc
	Serial No.	None	Country of origin	KOREA
Test date	14-Oct-21 ~ 22-Oct-21		Date of issue	10-Dec-21
Testing location	140-16, Eongmalli-ro, Majang-myeon, Icheon-si, Gyeonggi-do, Rep. of Korea			
Standard	FCC PART 15 Subpart C (15.247) , ANSI C 63.10(2013) , KDB 558074 D01(2018)			
Measurement facility registration number	659627			
Tested by	Senior Engineer H.G. Lee	(Signature)		
Reviewed by	Engineering Manager I.K. Hong	(Signature)		
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable			

* Note

- This test report is not permitted to copy partly without our permission
- This test result is dependent on only equipment to be used
- This test result based on a single evaluation of one sample of the above mentioned
- This test report is not related to KOLAS accreditation
- Additional models name:BSA2-OIPW
- Basic and additional Model(s) are same products, only model name are different
- The support card is different for each model. But, the software supports several different cards.

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Contents

1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report.
ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.
ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Suite 1015 World Meridian II, 123 Gasan Digital 2-ro, Geumcheon-gu, Seoul 153-759, R. O. Korea

EMC/Telecom/Safety Test Lab : 140-16, Eongmalli-ro, Majang-myeon, Icheon-si, Gyeonggi-do, Rep. of Korea

1.3 Official Qualification(s)

MSIP : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication
KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC requirements
FCC : Conformity Assessment Body(CAB) with registration number 659627 under APEC TEL MRA between the RRA and the FCC
VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test

Modulation Type	:	CCK, OFDM
Transfer Rate	:	11 Mbps , 54 Mbps
Number of Channel	:	11 ch
PEAK Output Power	:	5.38 dBm
Rating	:	INPUT: AC(100 - 240) V, (50-60)Hz, 1A OUTPUT: DC 12 V, 0.8 A
Receipt Date	:	20-Aug-21
X-tal list(s) or Frequencies generated	:	The highest operating frequency is 2 462 MHz

2.2 General descriptions of EUT

Category	Feature	Specification
Credential	Biometric	Fingerprint
	RF Option	• BSA2-OEPW: 125kHz EM • BSA2-OHPW: 125kHz HID Prox • BSA2-OIPW: 13.56MHz iCLASS SE/SR/Seos, NFC • BSA2-OMPW: 13.56MHz MIFARE, MIFARE Plus, DESFire EV1/EV2*, FeliCa, NFC
	RF read range *	EM/HID Prox: 50 mm, MIFARE: 50 mm, DESFire: 50 mm, Felica: 30 mm
	LFD	Supported
General	CPU	1.0 GHz Quad Core
	Memory	8 GB Flash + 1 GB RAM
	LCD type	5” color TFT touch
	LCD resolution	480 x 854
	LED	Multiple colors
	Sound	24 bit/Voice DSP (echo cancel)
	Operating temperature	-25 °C ~ 50 °C
	Storage temperature	-40 °C ~ 70 °C
	Operating humidity	0% ~ 80 %, non-condensing
	Camera type	CMOS 2M pixels
	Dimension (W x H x D)	155 mm x 155 mm x 40 mm
	Weight	Device: 440 g Bracket: 89 g (Including washer and bolt)

Category	Feature	Specification
Interface	Wi-Fi	Supported
	Ethernet	Supported (10/100 Mbps, auto MDI/MDI-X)
	RS-485	1ch Master or Slave (Selectable)
	Wiegand	1 ch Input / Output (Selectable)
	TTL input	1 ch Input
	Relay	2 Relay
	PoE	Supported (IEEE 802.3af compliant)
	USB	USB 2.0 (Host)
	Tamper	Supported
Electrical	Power	DC 12V (Max. 0.8A)
	Switch input VIH	Min. 3V, Max. 5V
	Switch input VIL	Max. 1V
	Wiegand output Pull-up resistance	Internally pulled-up with 1 kΩ
	Switch Pull-up resistance	4.7kΩ (The input ports are pulled up with 4.7kΩ.)
	Relay	Voltage: Max. 30 VDC, Current: Max. 1A

3. Test Standards

Test Standard : FCC PART 15 Subpart C (15.247)

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of

Test Method : ANSI C 63.10 (2013) & KDB558074 D01(2018)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain decides that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment These method apply to the measurement of individual units or systems comprised

Summary of Test Results

Applied Satandard : 47 CFR Part 15 Subpart C				remark
Standard	Test Type	Result	Remark	Limit
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.205 & 15.209	Restricted band / Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement	Min. 500 kHz
	99 % Bandwidth			
15.247(b)(3)	Maximum Peak /Average ouput power	Pass	Meet the requirement	Max. 30 dBm
15.209	Transmitter Radiated Emission	Pass	Meet the requirement	Table 15.209
15.247(e)	Power Spectral Density	Pass	Meet the requirement	Max. 8 dBm
15.247(d)	Band Edge Measurement	Pass	Meet the requirement	20 dB less

4. Measurement Condition

4.1 EUT Operation

a. Channel

Ch.	Frequency	Ch.	Frequency
1	2 412 MHz	7	2 442 MHz
2	2 417 MHz	8	2 447 MHz
3	2 422 MHz	9	2 452 MHz
4	2 427 MHz	10	2 457 MHz
5	2 432 MHz	11	2 462 MHz
6	2 437 MHz		

b. Measurement Channel : WLAN : Low(2 412 MHz), Middle(2 437 MHz), High(2 462 MHz)

c. Test Mode : Continuous Output, CCK, OFDM

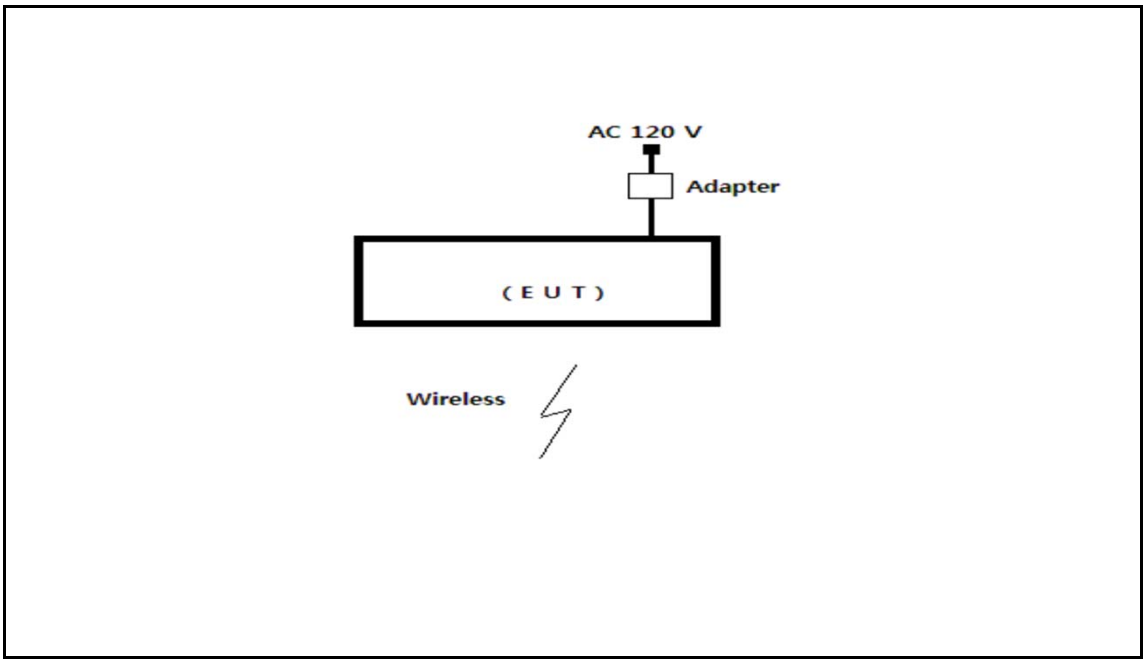
d. Test rate : 11 Mbps, 54 Mbps

4.2 EUT Operation

- The EUT was in the following operation mode during all testing

* Wireless LAN 2.4 GHz operation check
* Transmit mode were measured each channels(802.11b, 802.11g)

4.3 Configuration and Peripherals



4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Biostation A2	BSA2-OMPW	NONE	Suprema Inc	EUT
Adapter	KPL-060M	NONE	Channel Well Technology(Guangzhou)Co., Ltd.	

4.5 Cable Connecting

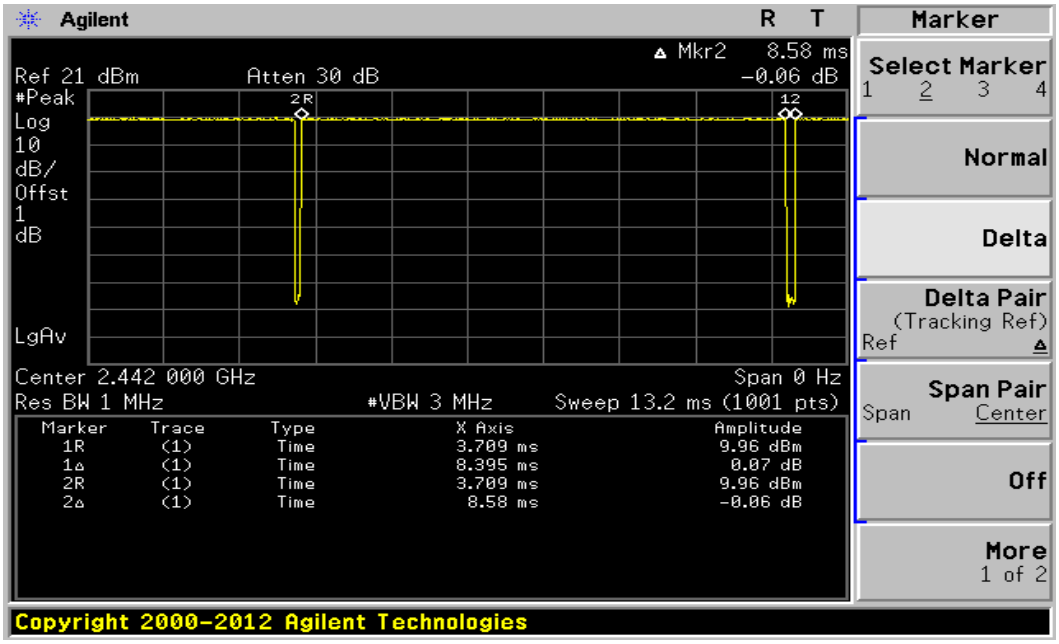
Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
0	Power	Adapter	-	2	Unshielded	

4.6 DUTY CYCLE OF TEST SIGNAL

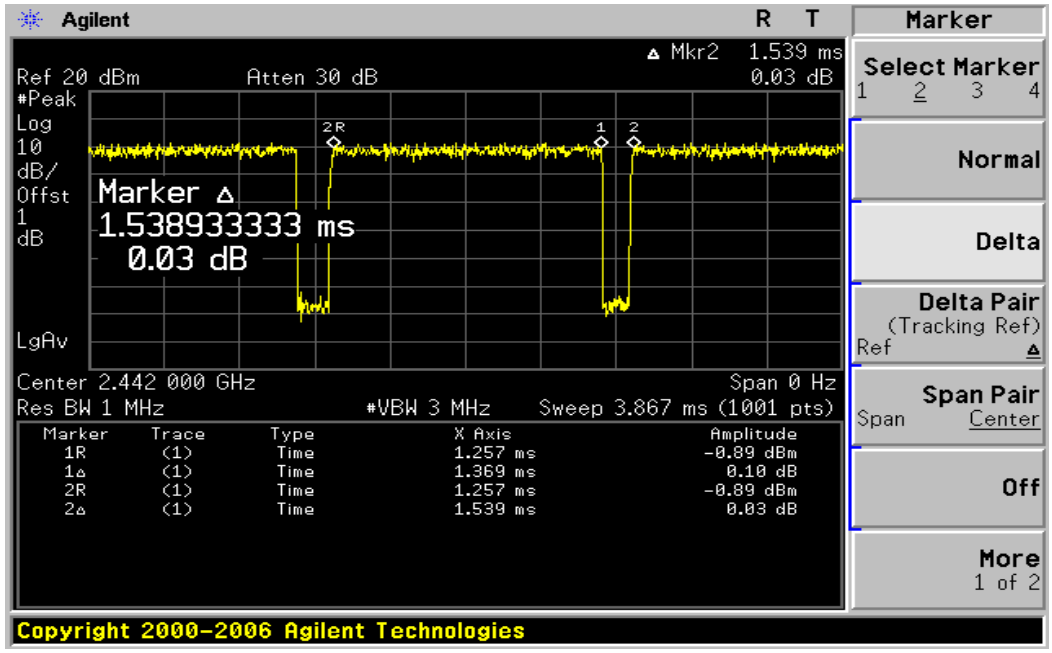
Duty cycle is > 98 %, duty factor shall be considered.

802.11b

duty cycle = 97.8 % , duty factor = 10*log(1/0.978) =0.096



duty cycle = 89.0 % , duty factor = 10*log(1/0.89) =0.506



5. DTS bandwidth

5.1 Test procedure

558074 D01 DTS Meas Guidance v05 8.2 Option 2 :The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 x RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

5.2 might be > 6 dB Test instruments and measurement setup

The spectrum analyzer is set to as following.

. RBW= 100 KHz . VBW≥ 3 x RBW

. Span= 50 MHz . Sweep= suitable duration based on the EUT specification.

Limits : FCC § 15.247(a)(2)

6dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	28-Nov-22
RF Cable	Length: 30 cm	-	
-Spectrum Analyzer <=> EUT	Loss: 1.0 dB	-	

5.3 Measurement results

EUT	Biostation A2	MODEL	BSA2-OMPW
MODE	802.11b, g	ENVIRONMENTAL CONDITION	23.2 ℃, 46.0 % R.H.
INPUT POWER	DC 12.0 V		

MODE - 802.11b

Channel Frequency (MHz)	Emission bandwidth (MHz)	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
2 412	16.34	9.69	0.5	PASS
2 442	15.00	9.48	0.5	PASS
2 462	14.94	10.06	0.5	PASS

MODE - 802.11g

Channel Frequency (MHz)	Emission bandwidth (MHz)	Bandwidth at 6dB below(MHz)	Minimum Limit (MHz)	PASS/FAIL
2 412	16.42	16.44	0.5	PASS
2 442	16.43	16.47	0.5	PASS
2 462	16.55	16.43	0.5	PASS

5.4 Trace data - 802.11b

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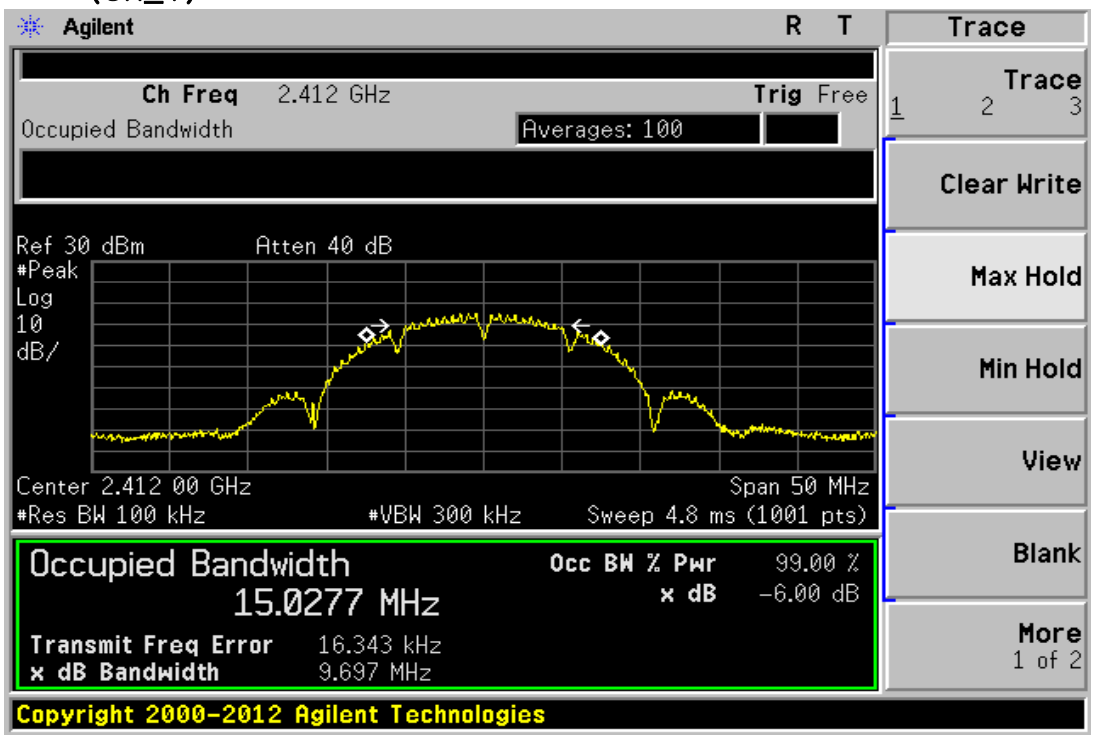

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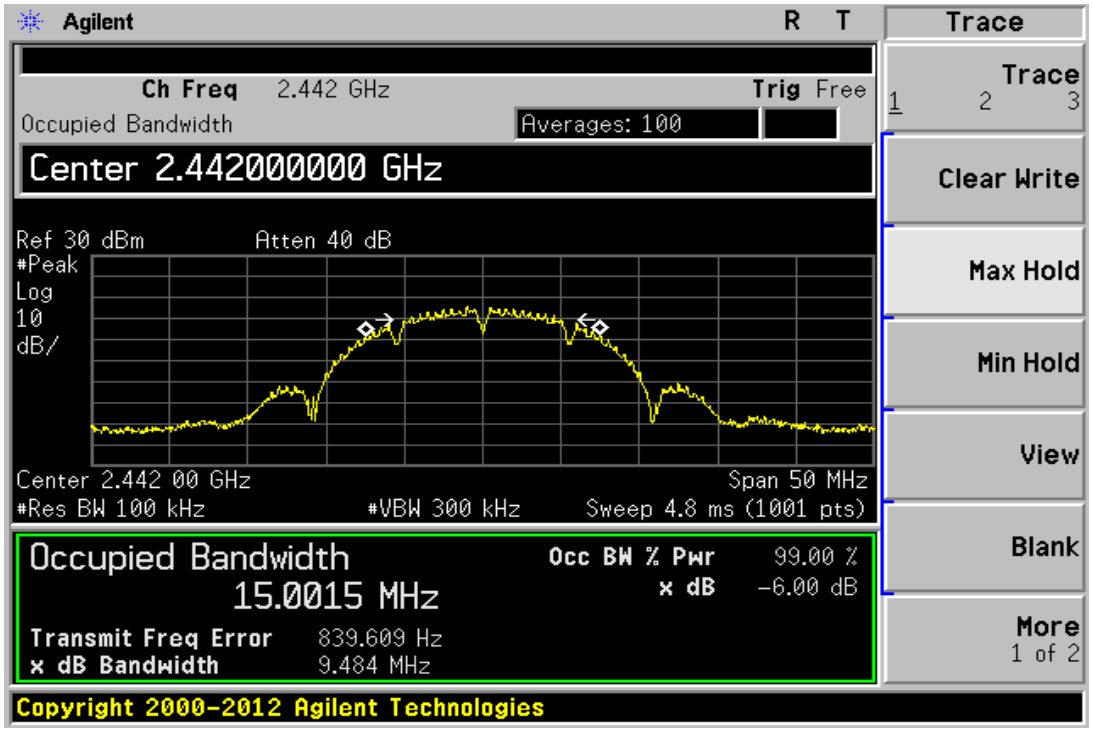

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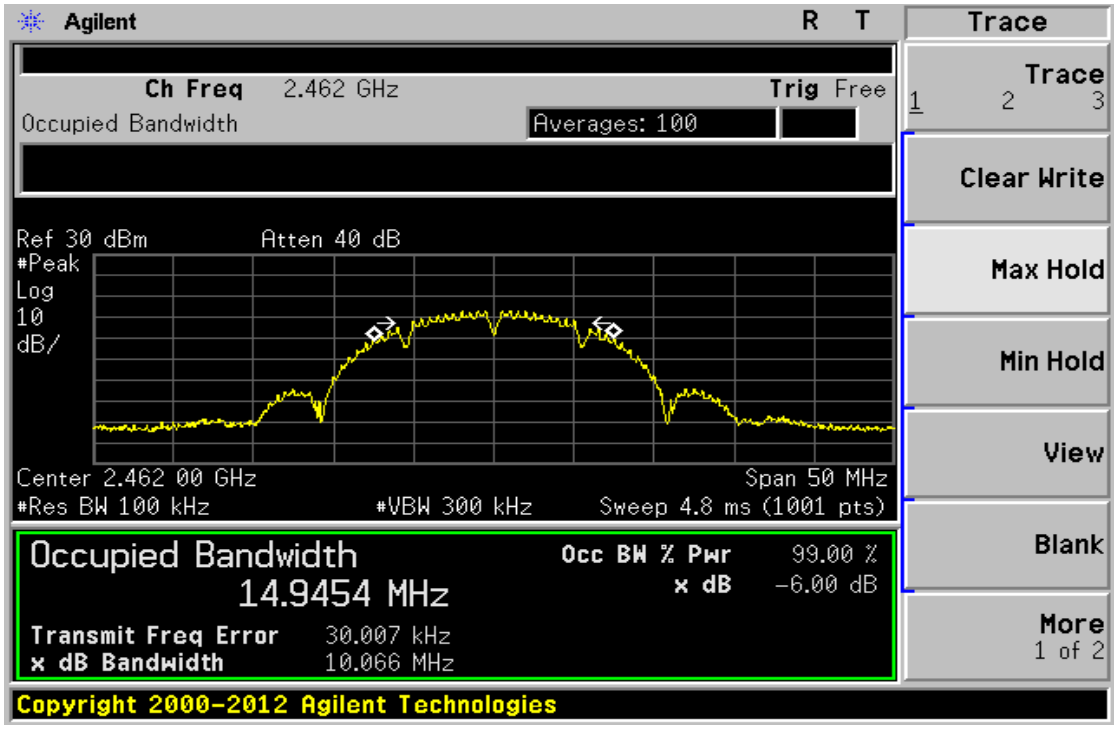
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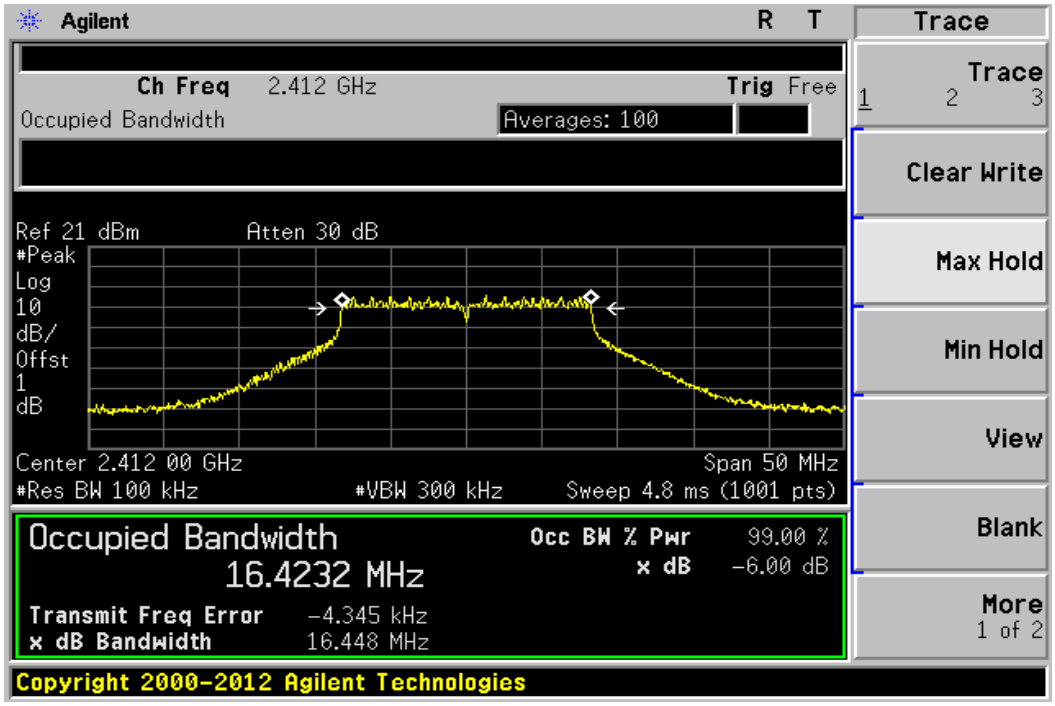
Span 50 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4.8 ms (1001 pts)
Occupied Bandwidth
14.9454 MHz
Occ BW % Pwr 99.00 %
x dB -6.00 dB
Transmit Freq Error 30.007 kHz
x dB Bandwidth 10.066 MHz
Copyright 2000-2012 Agilent Technologies

5.4 Trace data - 802.11g

(ch_1)



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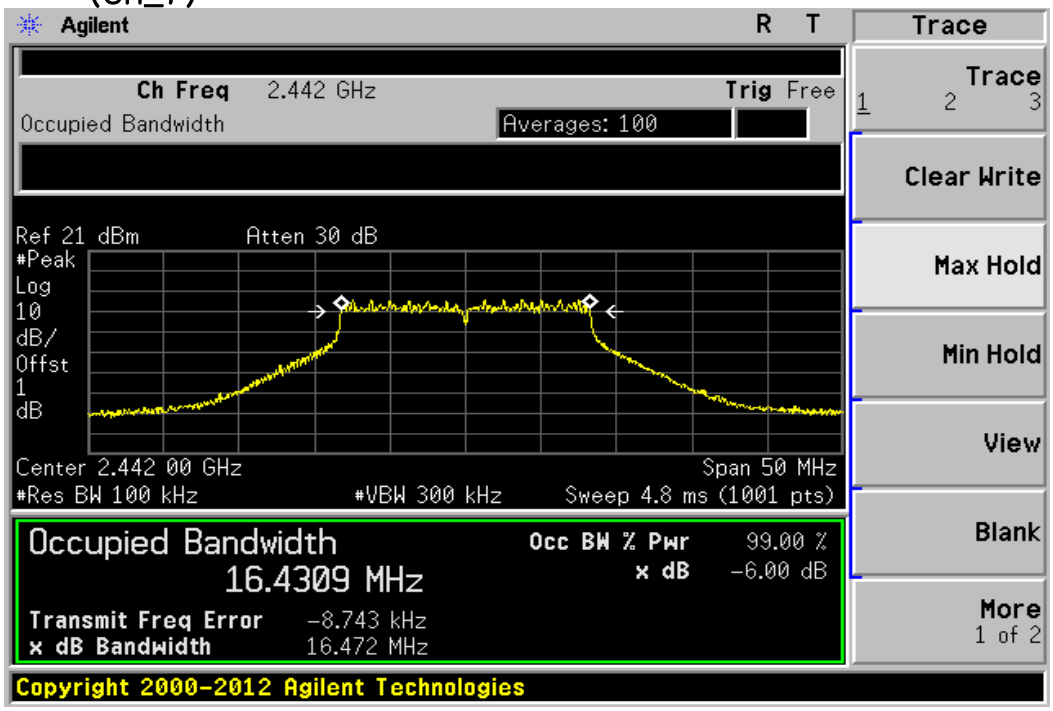

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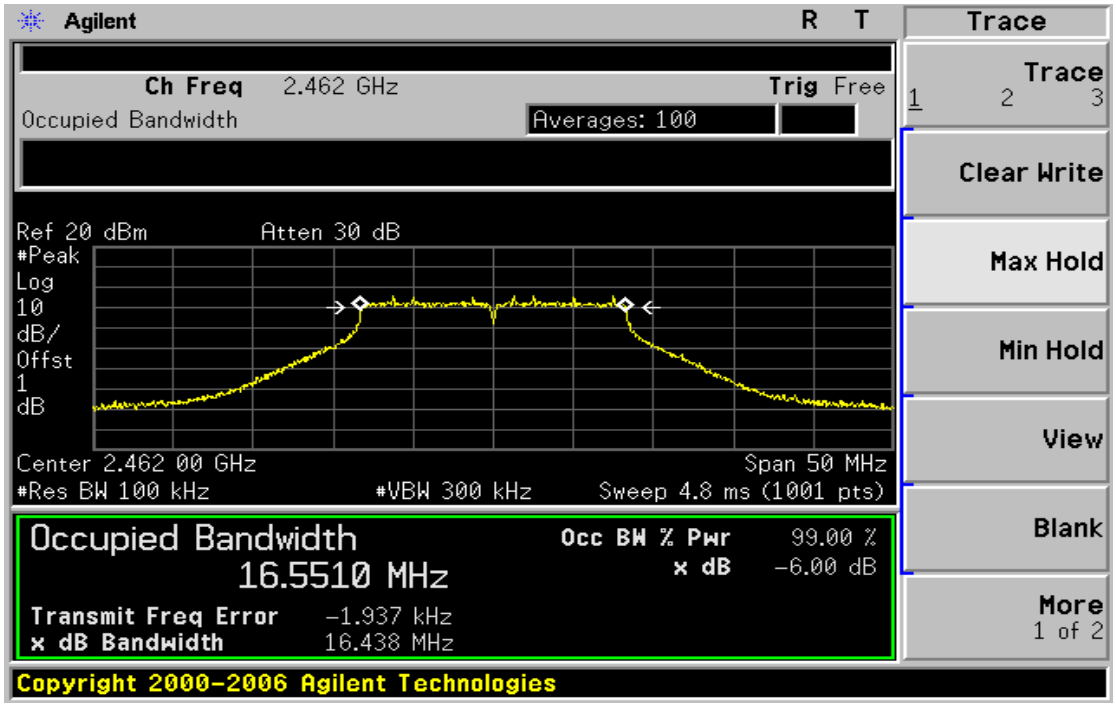
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Ch Freq 2.462 GHz
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Occupied Bandwidth
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Center 2.462 00 GHz
Span 50 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 4.8 ms (1001 pts)
Occupied Bandwidth
16.5510 MHz
Occ BW % Pwr 99.00 %
x dB -6.00 dB
Transmit Freq Error -1.937 kHz
x dB Bandwidth 16.438 MHz
Copyright 2000-2006 Agilent Technologies

6. Maximum peak conducted output power

6.1 Test procedure

The transmitter antenna terminal is connected to the input of a Power Sensor. Measurement is made while EUT is operating in transmission mode at the appropriate center frequency. The maximum peak output power measurement is 30 dBm.

Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Power Meter	N1921A	MY45100570	30-Nov-22
Power Sensor	N1921A	MY45240427	30-Nov-22
Power Meter <=> EUT	Loss: 1 dB	-	

6.2 Measurement results

EUT	Biostation A2	MODEL	BSA2-OMPW
MODE	802.11b, g	ENVIRONMENTAL CONDITION	23.2 ℃, 46.0 % R.H.
INPUT POWER	DC 12.0 V		

MODE - 802.11b

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Limit[1W] (dBm)	PASS/FAIL
		Detector	(dBm)	(W)		
1	2 412	PEAK	5.10	0.0032	30.0	PASS
7	2 442	PEAK	5.38	0.0035	30.0	PASS
11	2 462	PEAK	4.92	0.0031	30.0	PASS

MODE - 802.11g

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Limit[1W] (dBm)	PASS/FAIL
		Detector	(dBm)	(W)		
1	2 412	PEAK	4.04	0.0025	30.0	PASS
7	2 442	PEAK	3.74	0.0024	30.0	PASS
11	2 462	PEAK	3.46	0.0022	30.0	PASS

7. Maximum conducted (average) output power

7.1 Test procedure

The transmitter antenna terminal is connected to the input of a Power Sensor. Measurement is made while EUT is operating in transmission mode at the appropriate center frequency. The maximum Average output power measurement is 30 dBm.

Maximum conducted (average) output power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Power Meter	N1921A	MY45100570	30-Nov-22
Power Sensor	N1921A	MY45240427	30-Nov-22
Power Meter <=> EUT	Loss: 1 dB	-	

7.2 Measurement results

EUT	Biostation A2	MODEL	BSA2-OMPW
MODE	802.11b, g	ENVIRONMENTAL CONDITION	23.2 ℃, 46.0 % R.H.
INPUT POWER	DC 12.0 V		

MODE - 802.11b

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Measured + Duty Cycle(dBm)	Measured + Duty Cycle(W)
		Detector	(dBm)	Duty Cycle		
1	2 412	AVG	-1.09	0.06	-1.03	0.0008
7	2 442	AVG	-0.99	0.06	-0.93	0.0008
11	2 462	AVG	-0.96	0.06	-0.90	0.0008

MODE - 802.11g

CHANNEL	Channel requency (MHz)	Conducted Power Output(dBm)			Measured + Duty Cycle(dBm)	Measured + Duty Cycle(W)
		Detector	(dBm)	Duty Cycle		
1	2 412	AVG	-4.51	0.35	-4.16	0.0004
7	2 442	AVG	-4.66	0.35	-4.31	0.0004
11	2 462	AVG	-4.49	0.35	-4.14	0.0004

8. Maximum power spectral density level in the fundamental emission

8.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V05 10.2 Method PKPSD (peak PSD)

8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

a) Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the DTS bandwidth.

c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

d) Set the VBW ≥ 3 x RBW. e) Detector = peak.

f) Sweep time = auto couple. g) Trace mode = max hold.

h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum amplitude level within the RBW.

j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Limits FCC § 15.247

The peak power density Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	FSV40	100393	30-Nov-22
Spectrum Analyzer	E4440A	US42041291	30-Nov-22
RF Cable	Length: 30 cm	-	
Spectrum Analyzer <=> EUT	Loss: 1.0 dB	-	

8.3 Measurement results

EUT	Biostation A2	MODEL	BSA2-OMPW
MODE	802.11b, g	ENVIRONMENTAL CONDITION	23.2 ℃, 46.0 % R.H.
INPUT POWER	DC 12.0 V		

MODE - 802.11b

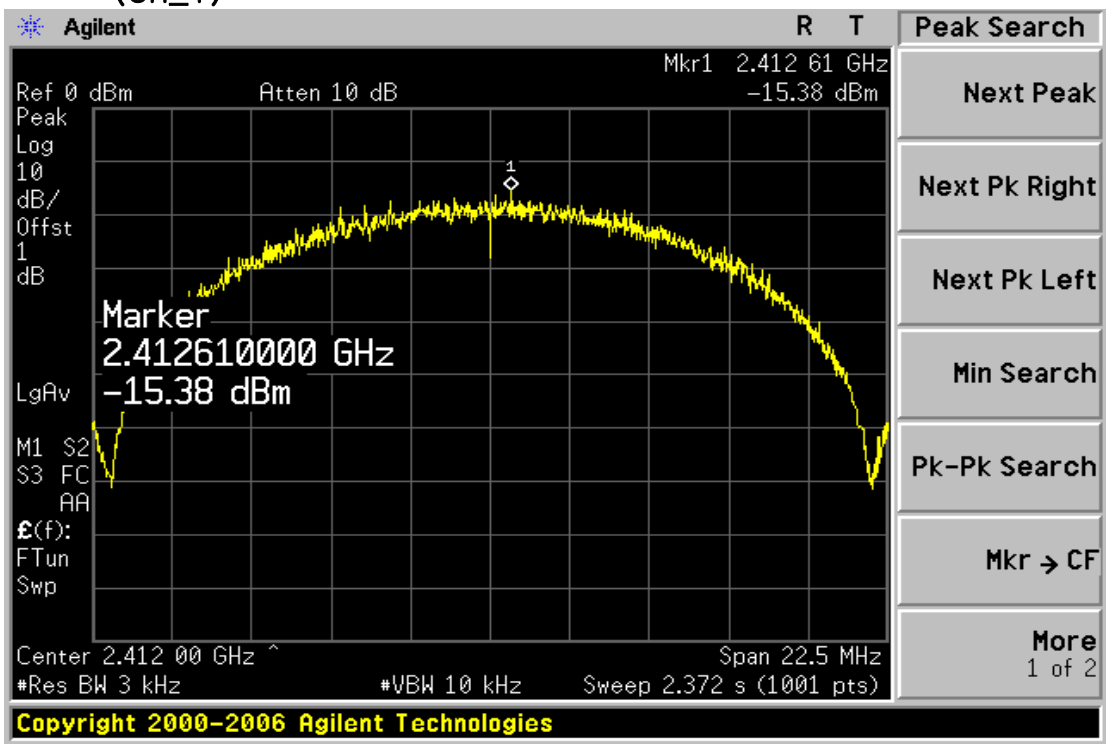
CHANNEL	Channel Frequency (MHz)	Measured Power Spectral Density (dBm)	Maximum Permissible Power Density (dBm/3kHz)	Margin
1	2 412	-15.38	8.00	23.38
7	2 442	-15.98	8.00	23.98
11	2 462	-16.11	8.00	24.11

MODE - 802.11g

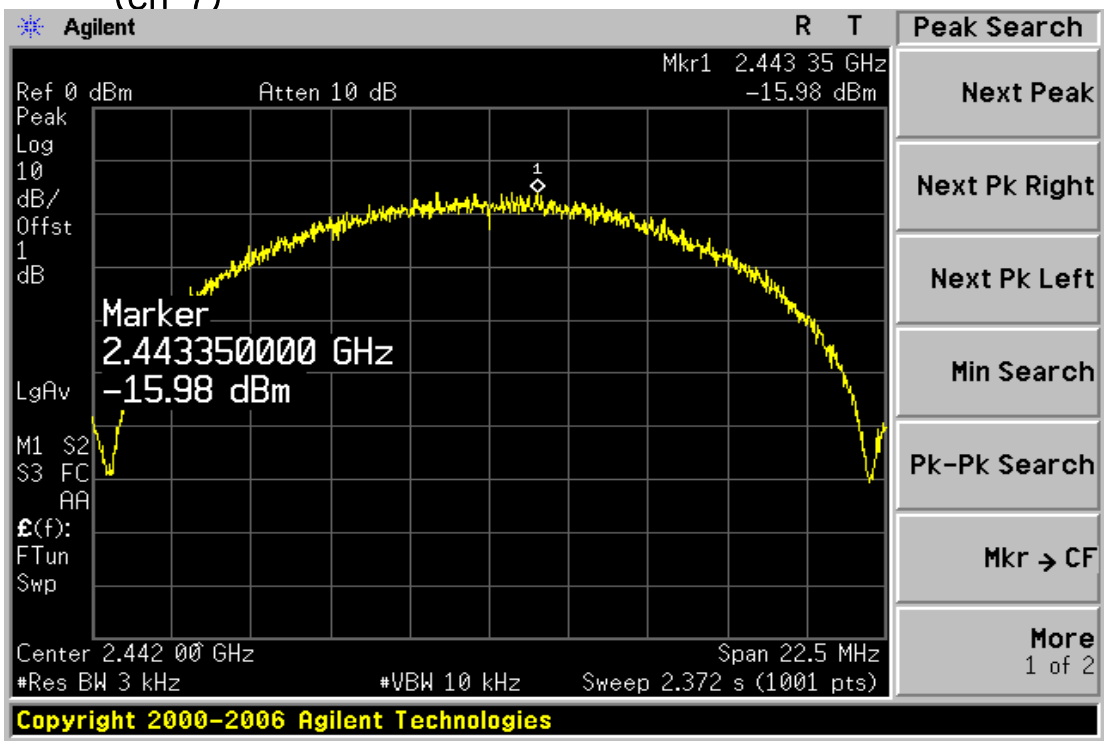
CHANNEL	Channel Frequency (MHz)	Measured Power Spectral Density (dBm)	Maximum Permissible Power Density (dBm/3kHz)	Margin
1	2 412	-19.67	8.00	27.67
7	2 442	-19.41	8.00	27.41
11	2 462	-19.15	8.00	27.15

8.4 Trace data - 802.11b mode

(ch_1)

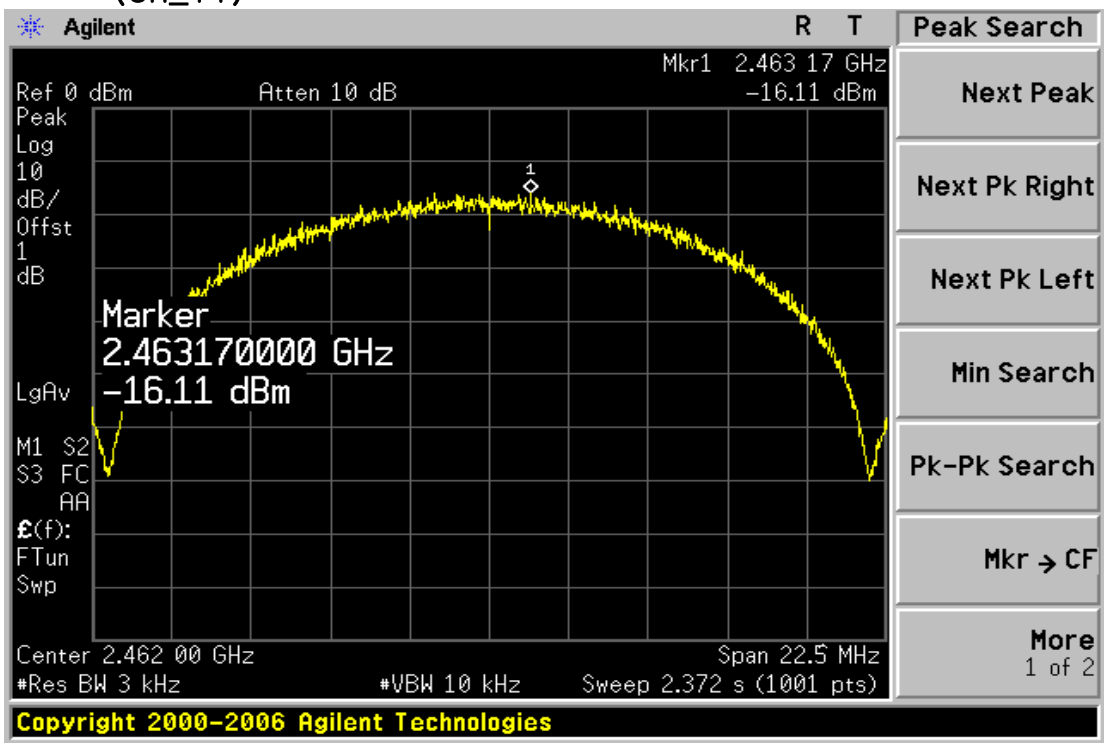


(ch_7)



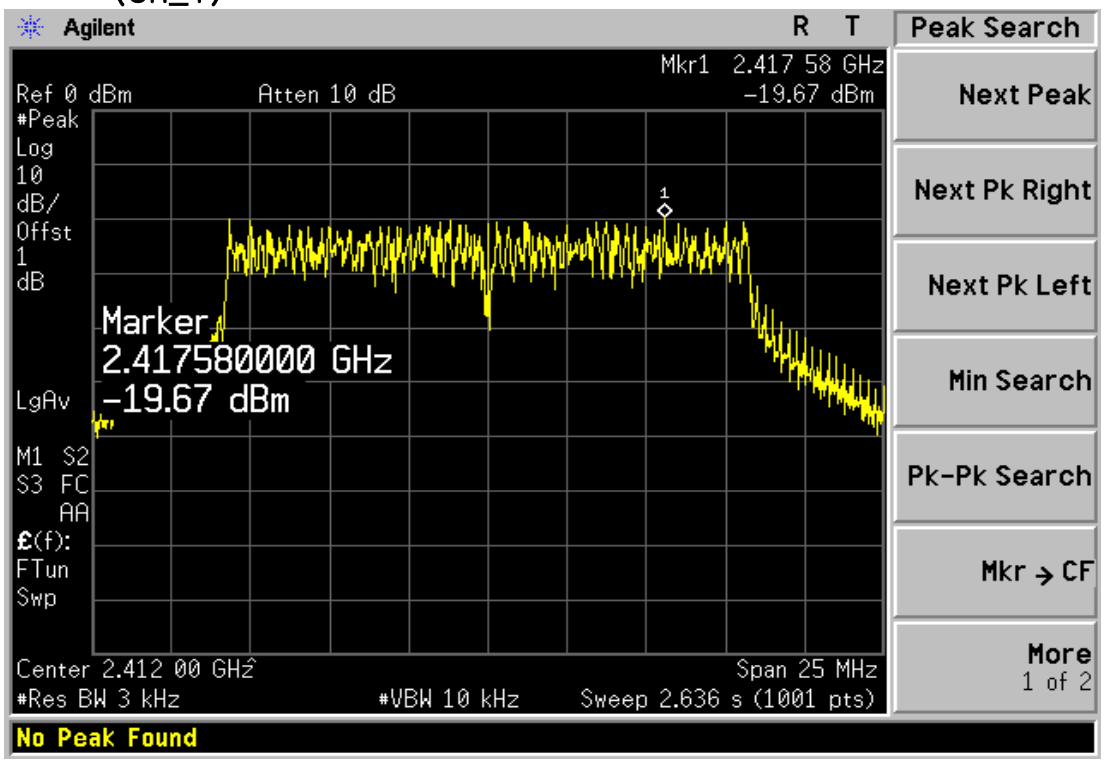
8.4 Trace data - 802.11b

(ch_11)



8.4 Trace data - 802.11g mode

(ch_1)



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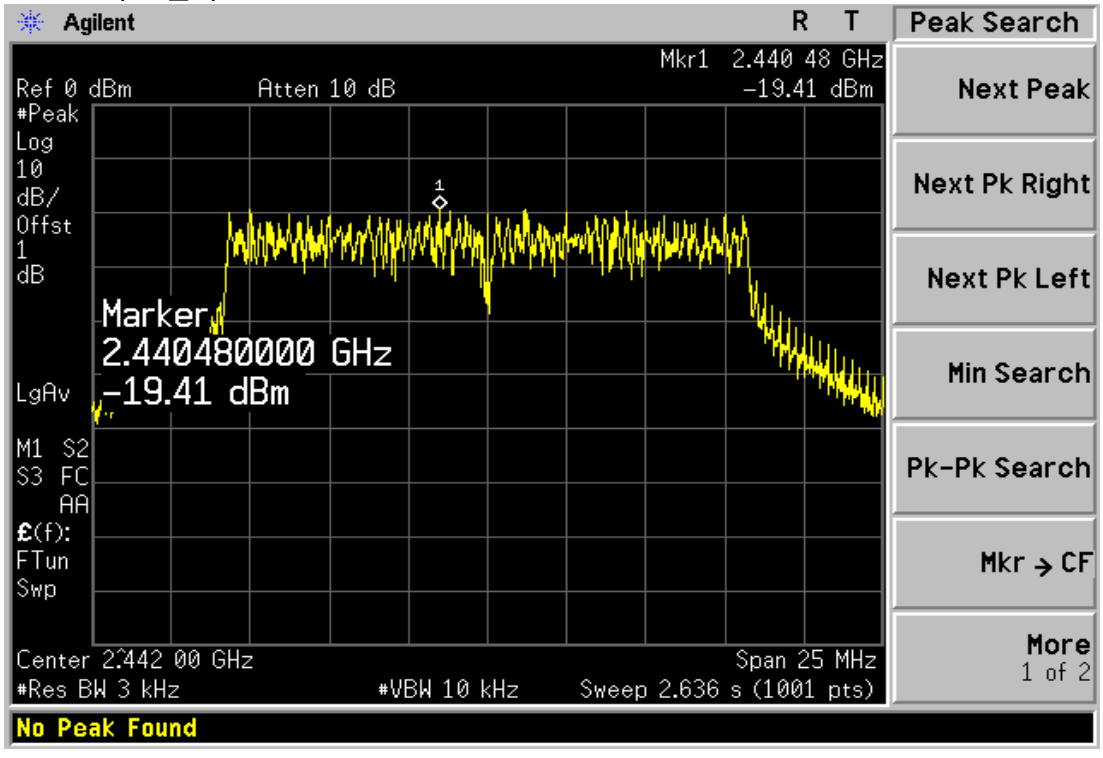
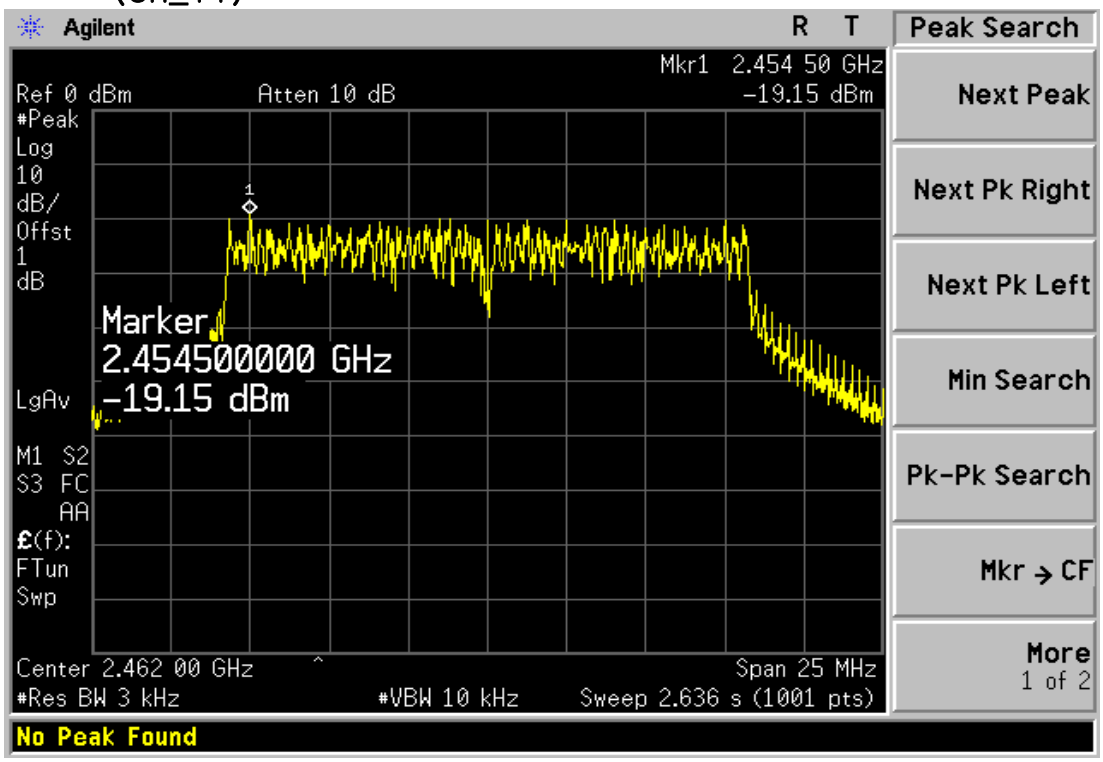


8.4 Trace data - 802.11g mode

(ch_11)



9. Emissions in non-restricted frequency bands

9.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V05

9.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

a) Set instrument center frequency to DTS channel center frequency.

b) Set the span to ≥ 1.5 times the DTS bandwidth.

c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 x RBW.

e) Detector = peak. f) Sweep time = auto couple.

g) Trace mode = max hold. h) Allow trace to fully stabilize.

i) Use the peak marker function to determine the maximum PSD level.

Limits FCC § 15.247

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	30-Nov-22
Spectrum Analyzer	FSV40	100939	30-Nov-22
RF Cable	Length: 30 cm		-
-Spectrum Analyzer <=> EUT	Loss: 1.0 dB		-

9.3 Measurement results of band-edge & out of emission - Adapter

EUT	Biostation A2	MODEL	BSA2-OMPW
MODE	802.11b, g	ENVIRONMENTAL CONDITION	23.2 ℃, 46.0 % R.H.
INPUT POWER	DC 12.0 V		

MODE -802.11b

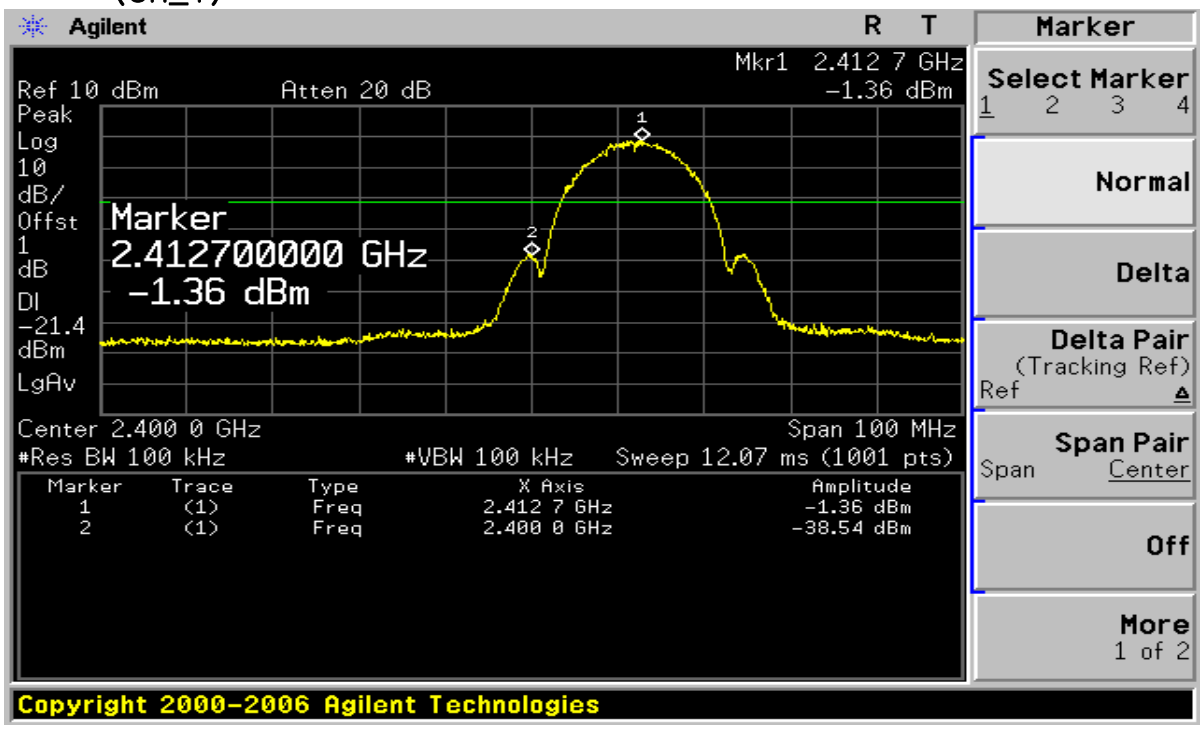
CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
1	2 412	20dBc	PASS
11	2 462	20dBc	PASS

MODE -802.11g

CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
1	2 412	20dBc	PASS
11	2 462	20dBc	PASS

9.4 Trace data of band-edge & Out of Emission - 802.11b mode

(ch_1)



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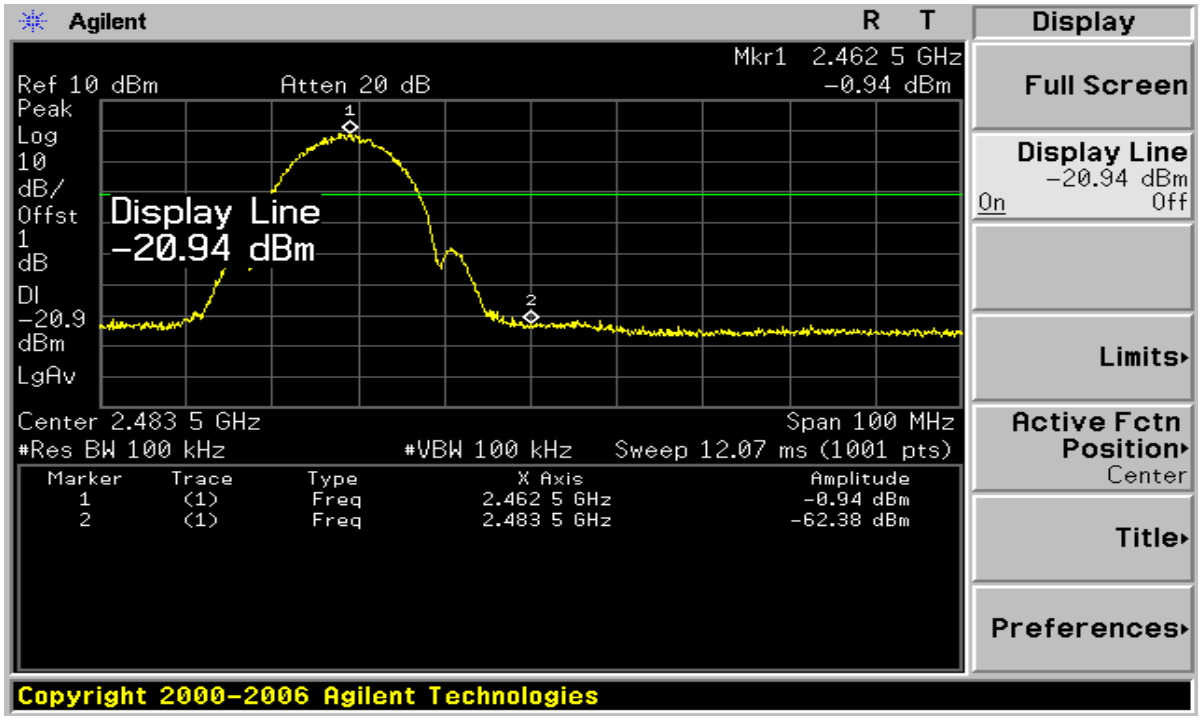
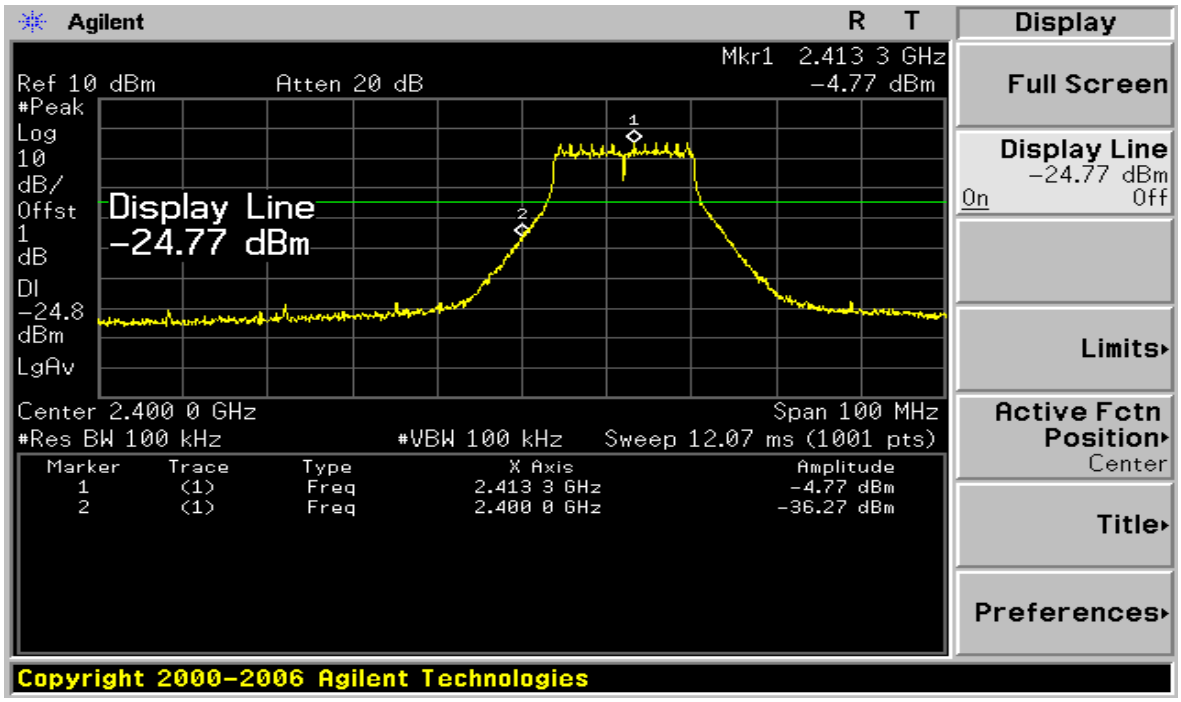


9.4 Trace data of band-edge & Out of Emission - 802.11g mode

(ch_1)



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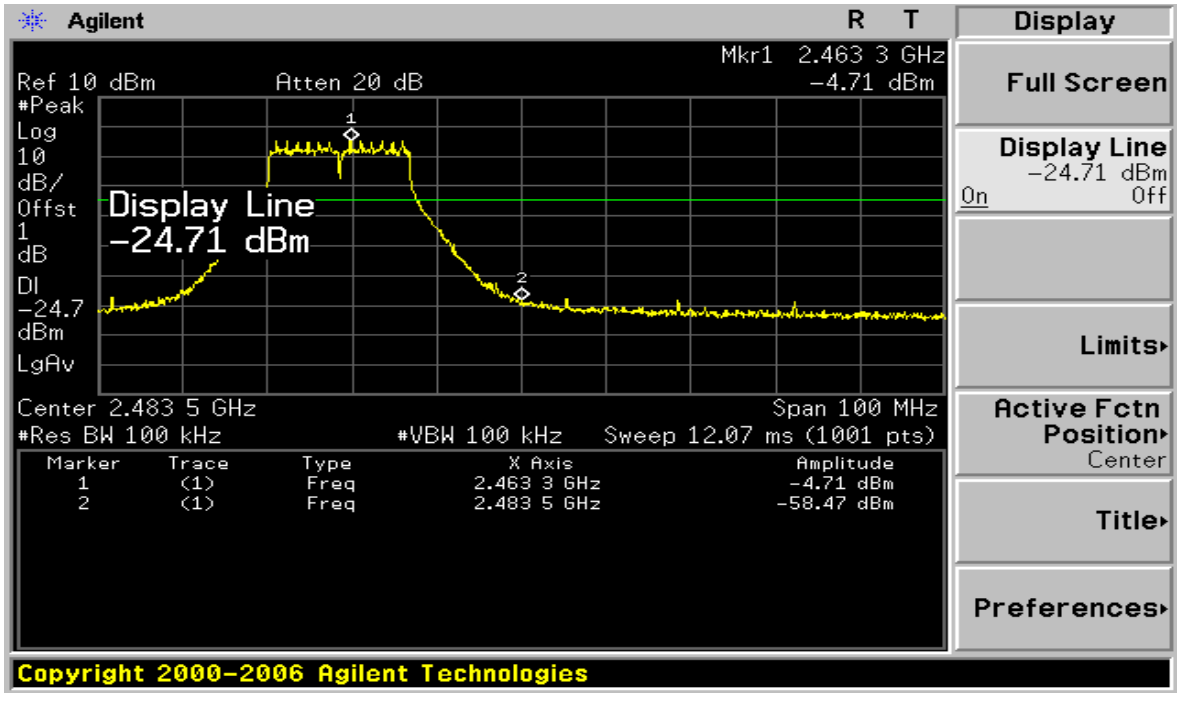
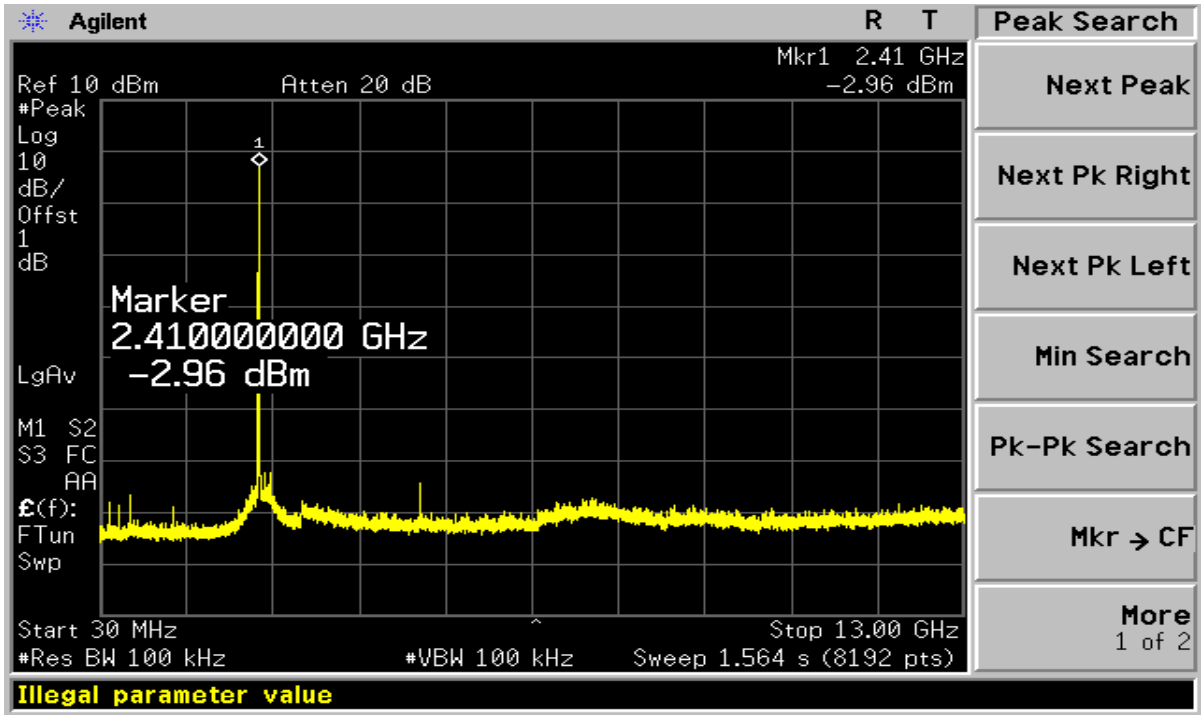
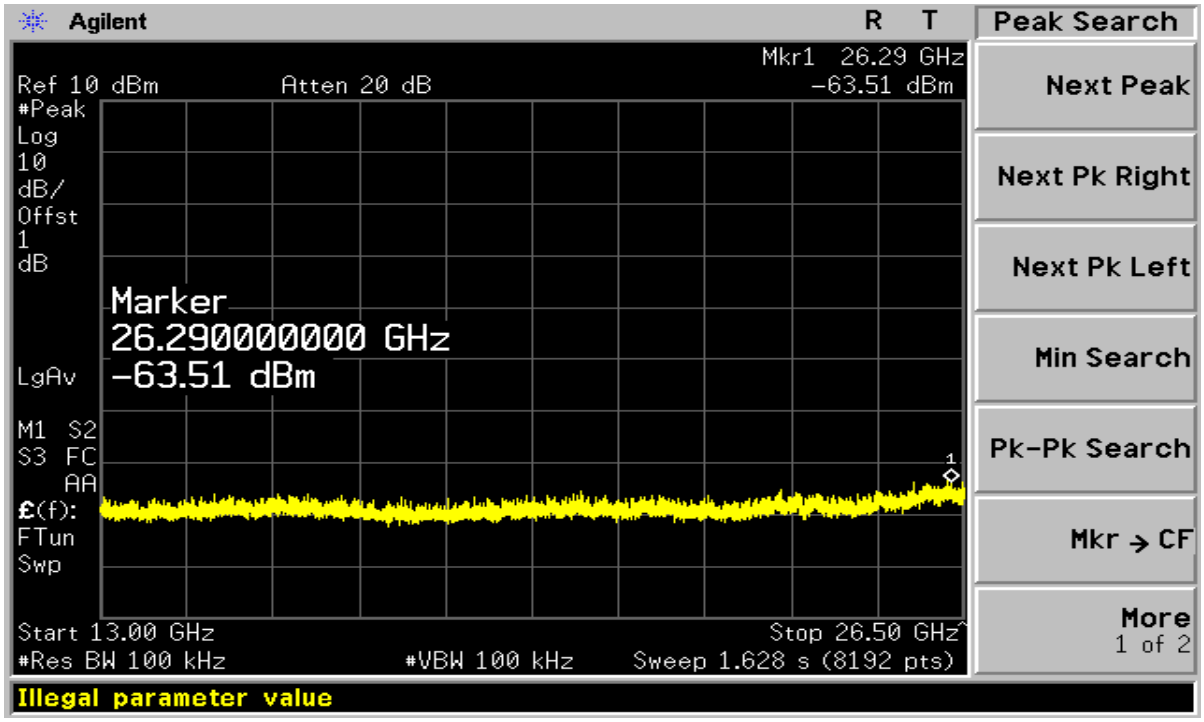


9.4 Trace data of Out of Emission – 802.11b mode

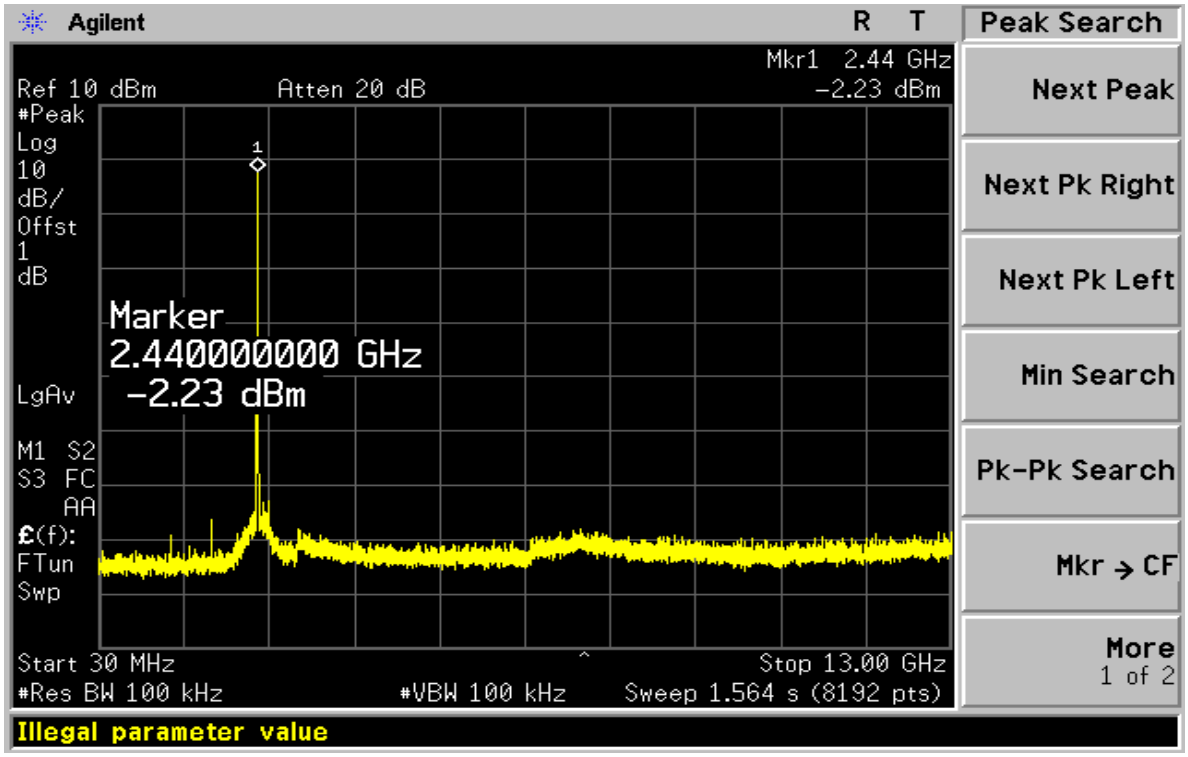
(ch_1)

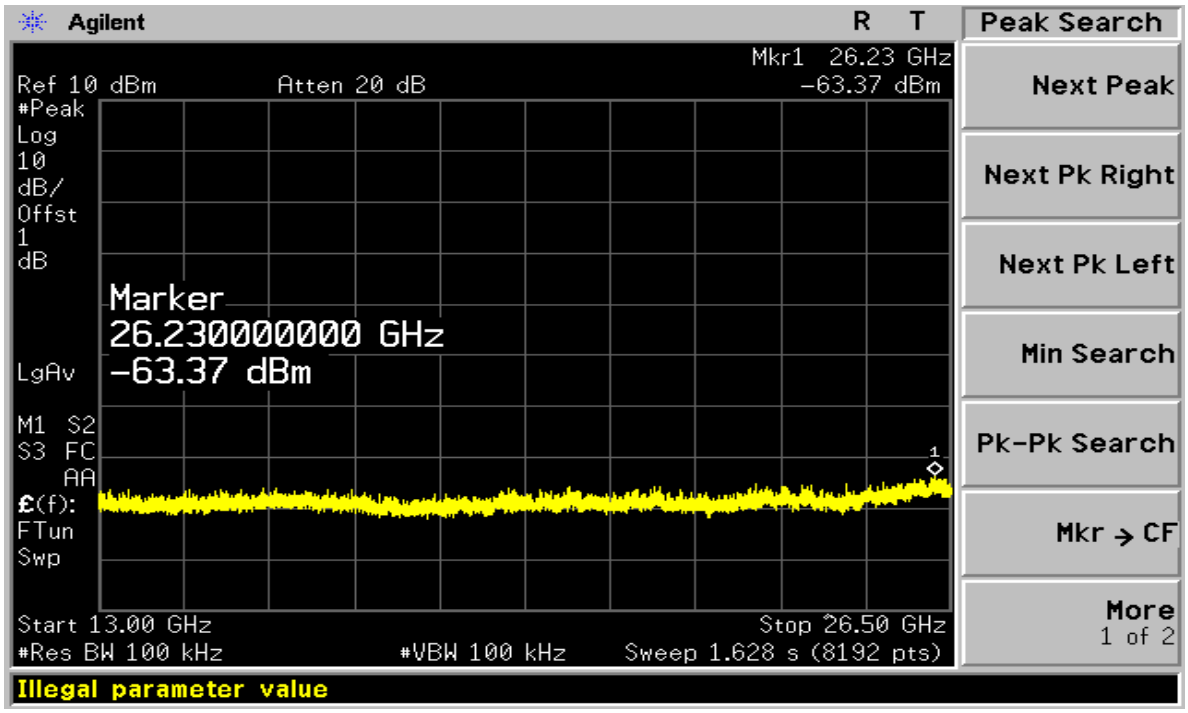




9.4 Trace data of Out of Emission – 802.11b mode

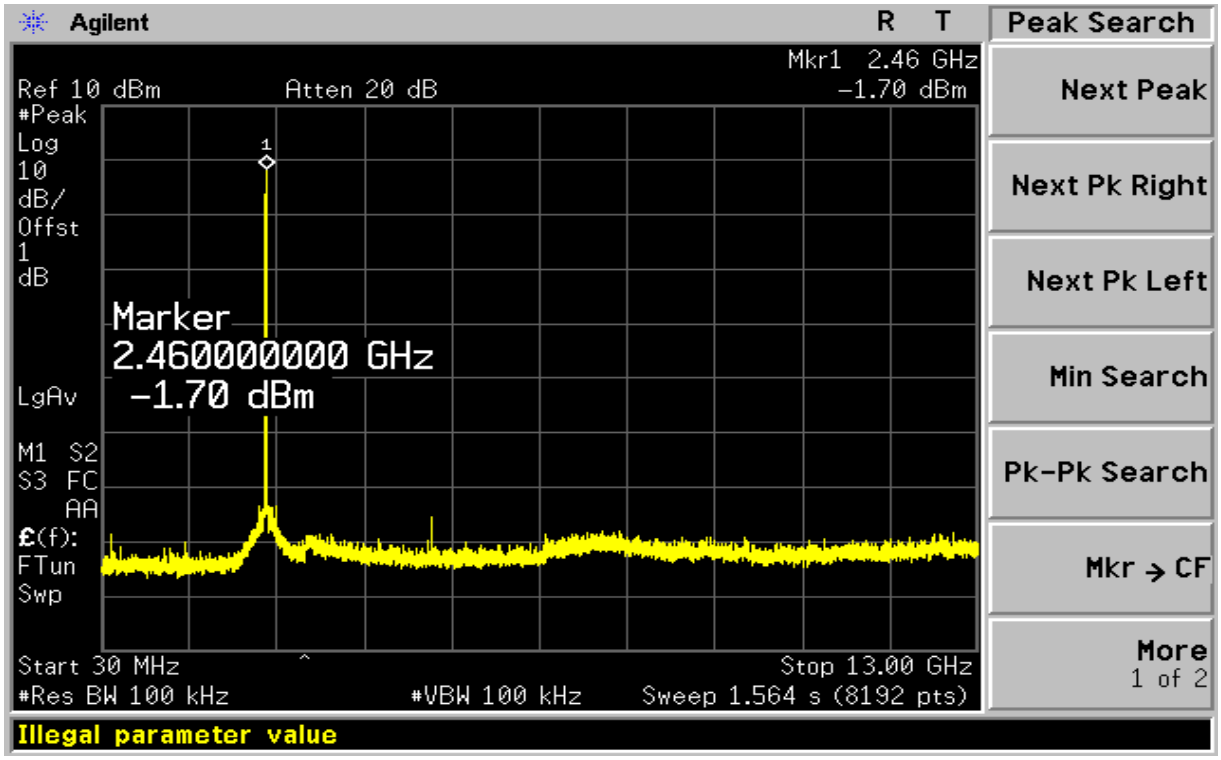
(ch_7)

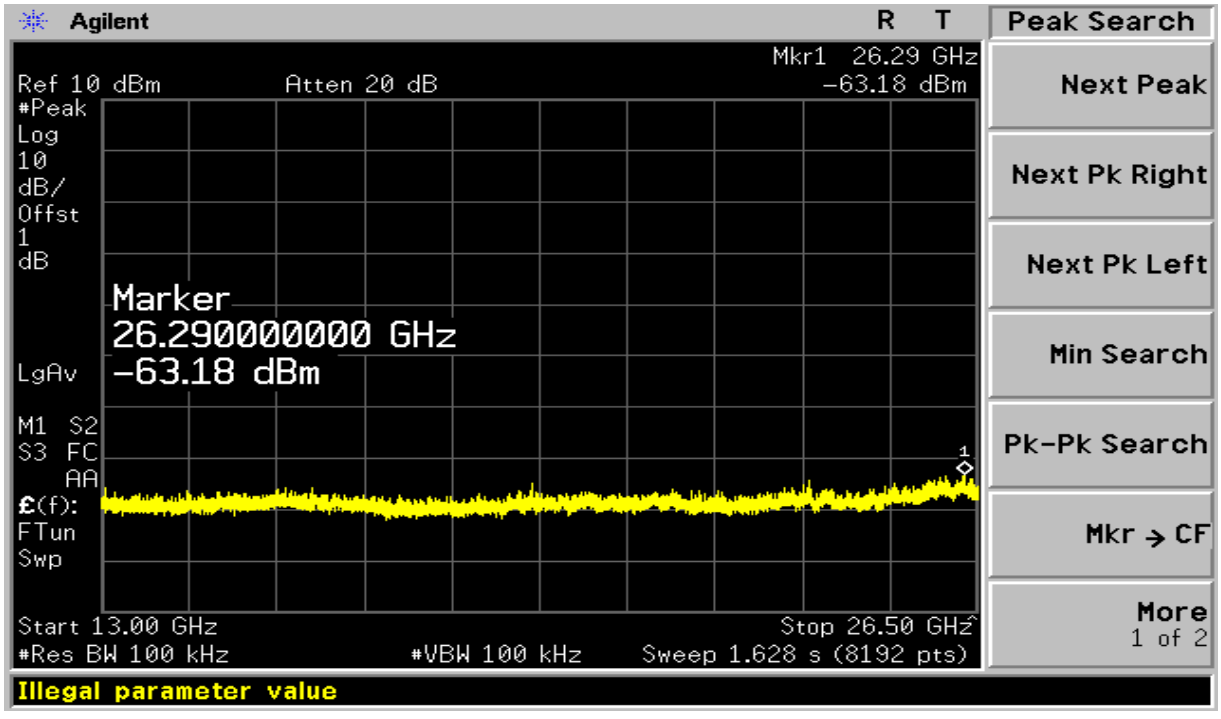




9.4 Trace data of Out of Emission – 802.11b mode

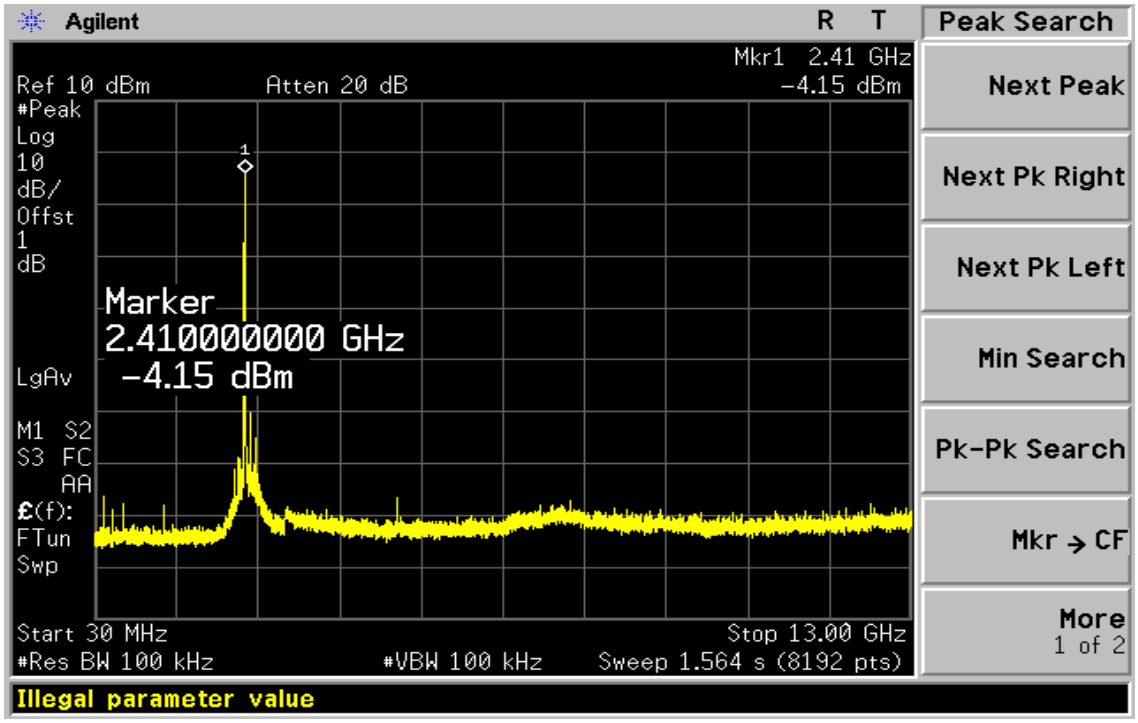
(ch_11)

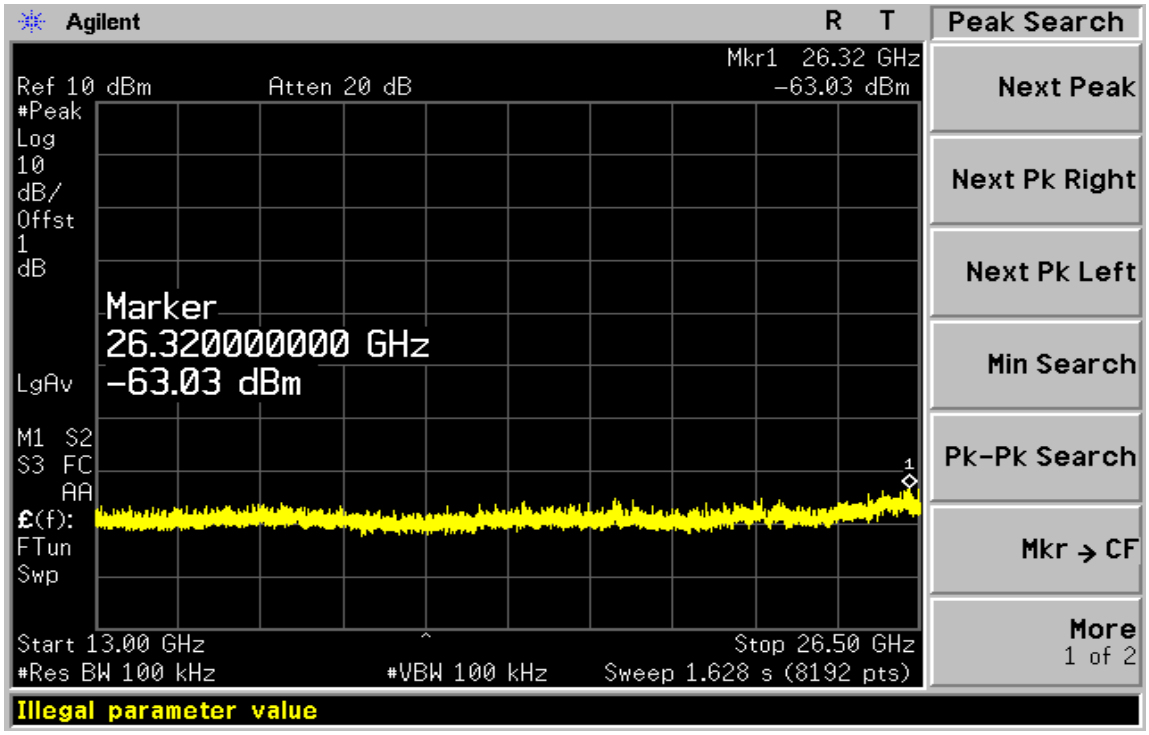




9.4 Trace data of Out of Emission – 802.11g mode

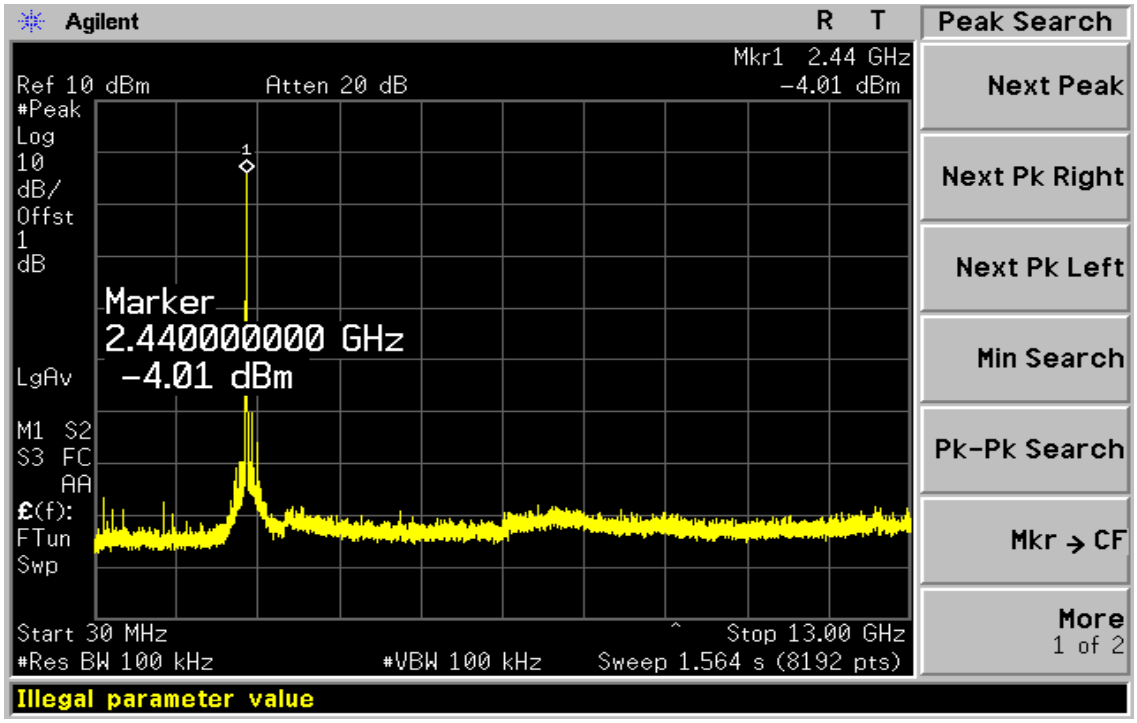
(ch_1)

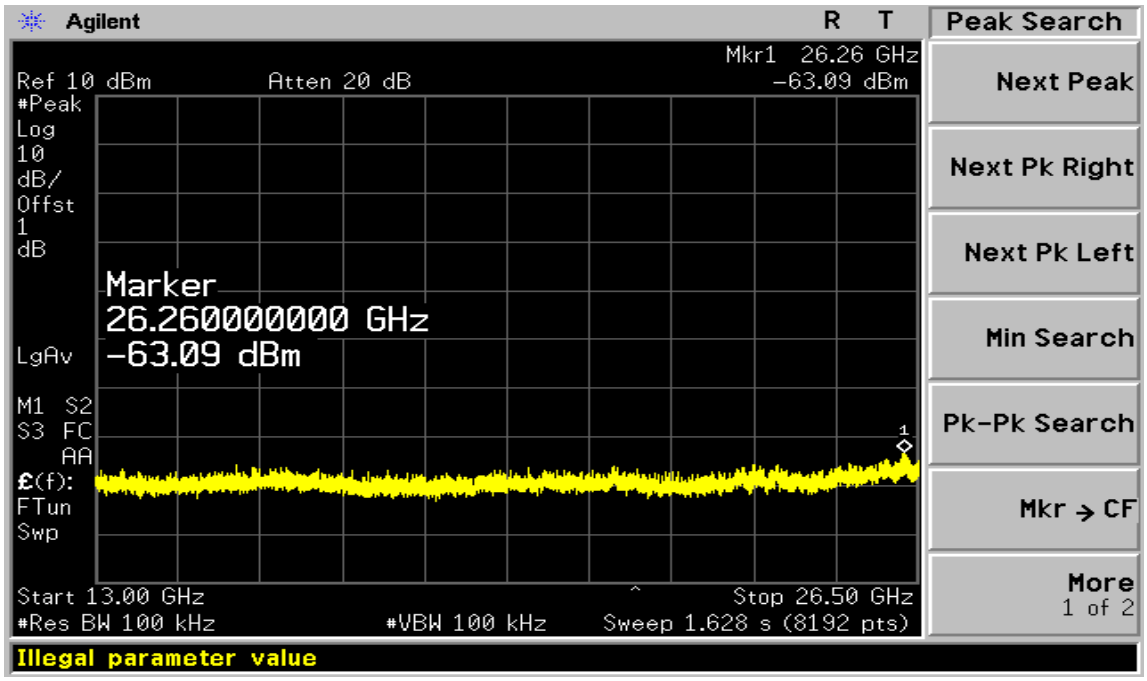




9.4 Trace data of Out of Emission – 802.11g mode

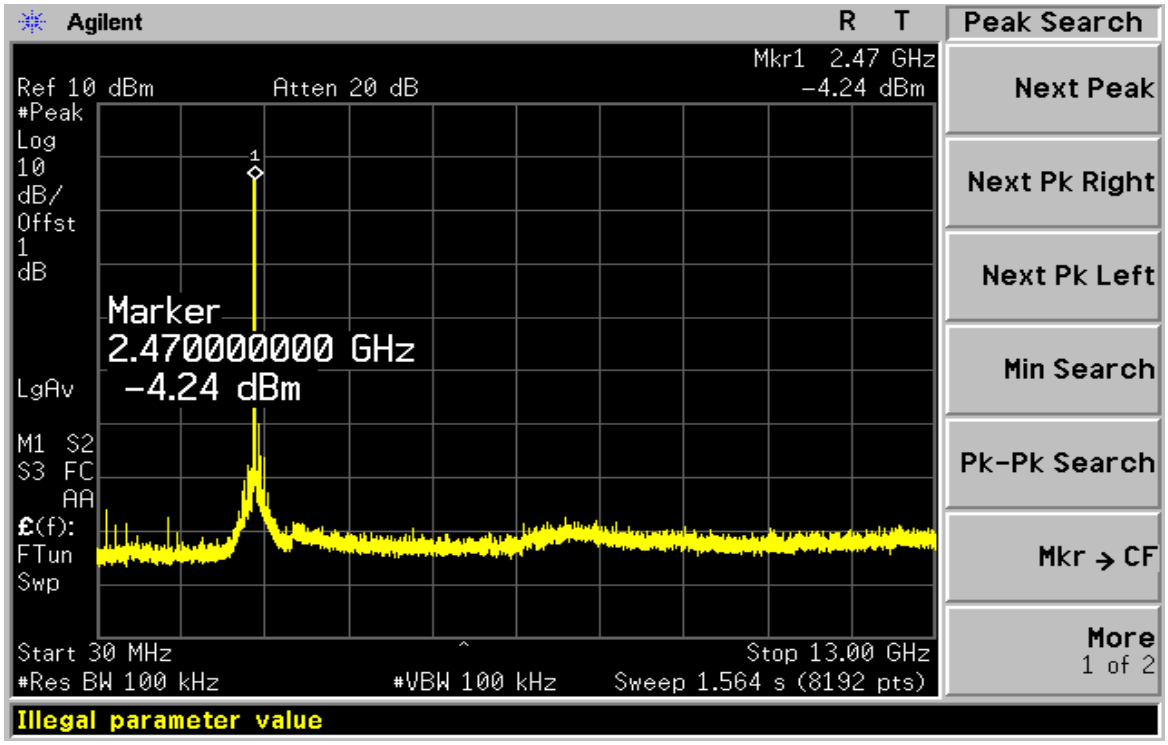
(ch_7)

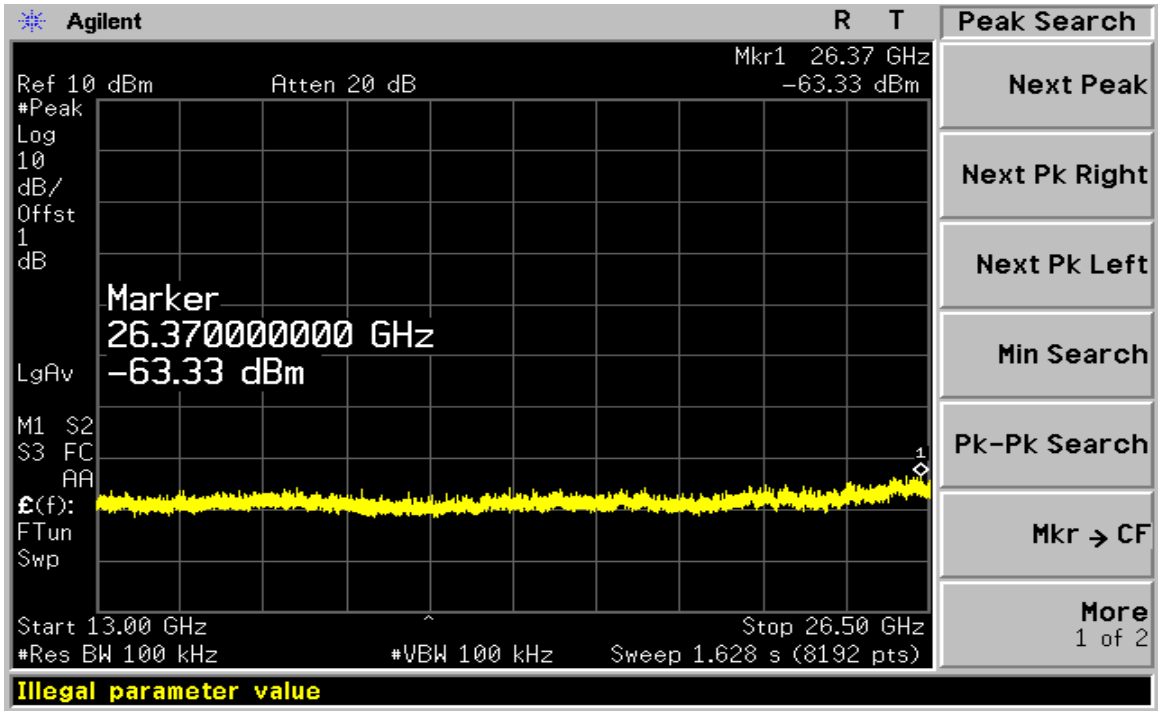




9.4 Trace data of Out of Emission – 802.11g mode

(ch_11)





10. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209 . The test setup was made according to ANSI C 63.10 (2013) & KDB 558074 D01 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam. turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

10.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	100916	19-Jul-22
Logbicon Antenna	VULB 9168	SCHWARZBECK	193	14-Jan-22
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00581	20-Jul-22
Horn Antenna	BBHA9120D	SCHWARZBECK	469	24-Dec-21
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	30-Nov-22
Signal Analyzer	FSV40	ROHDE & SCHWARZ	100393	30-Nov-22
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Horn Antenna	BBHA 9170	SCHWARZBECK	752	24-Dec-21
Antenna Master & Turn table controller	C02000-P	Innco System GmbH	CO2000/642 /28051111/L	-

10.2 Environmental Condition

Below 1 GHz -Test Place : 10 m Semi-anechoic chamber

WLAN 802.11 b,g Mode

Temperature (°C) : 24.4 ℃

Humidity (% R.H.) : 46.7 % R.H.

Above 1 GHz-Test Place : 3 m Semi-anechoic chamber

WLAN 802.11 b,g Mode

Temperature (°C) : 24.2 ℃

Humidity (% R.H.) : 47.2 % R.H.

10.3 Measurement Instrument setting for Radiated Emission

10.3.1 Frequency range below 1 GHz

Detector : Quasi-Peak

10.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 558074 section 12.2.4)

a. RBW : 1 MHz , VBW : 3 MHz
b. Trace mode = max hold
c. Detector : Peak
d. Sweep time = auto

Average Power Measurement Procedures (KDB 558074 section 12.2.5.2)

a. Set analyzer center frequency to the frequency associated with the emission
b. RBW : 1 MHz , VBW : 3 MHz
c. Detector : RMS
d. Sweep time = auto

* Note

Band	Duty cycle(%)	Ton (ms)	Ton + Toff (ms)	DCF=10*log(1/Duty) (dB)
802.11b	97.8	8.395	8.580	0.090
802.11g	89.0	1.369	1.539	0.506

* This was not applied of duty cycle factor for average value because of measured with the EUT transmitting continuously more than 98 % duty cycle at its maximum power control level.

10.4-1 Test Data (802.11 b)

Test Date 14-Oct-21 Measurement Distance : 3 m

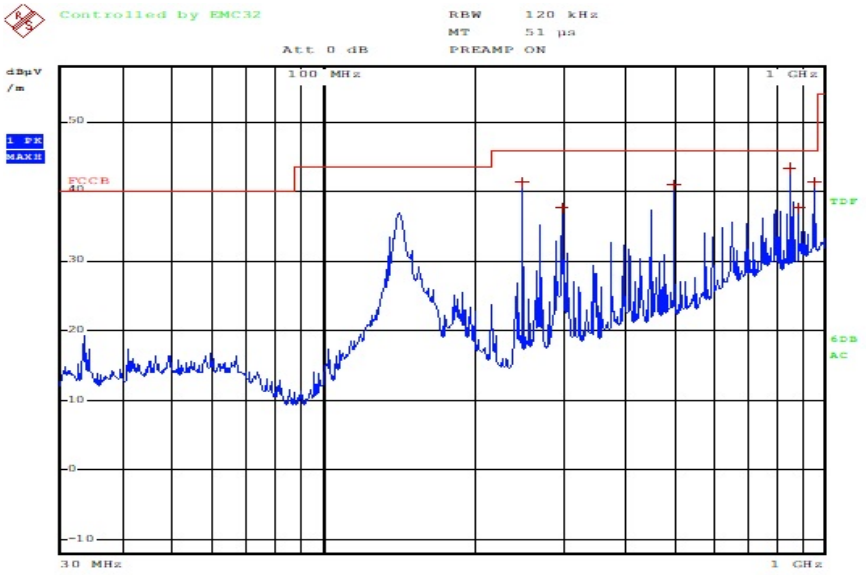
Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
142.10	24.95	V	1.0	12.82	1.73	43.50	39.50	4.00
250.00	26.23	H	1.0	11.70	2.17	46.00	40.10	5.90
450.00	19.71	V	1.0	17.80	3.19	46.00	40.70	5.30
500.00	16.51	V	1.4	21.90	3.99	46.00	42.40	3.60
850.00	15.60	H	1.0	22.60	4.32	46.00	42.52	3.48
950.00	14.54	V	1.5	23.48	4.53	46.00	42.55	3.45

Remark	H : Horizontal, V : Vertical *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *CL = Cable Loss(In case of below 1 000 MHz) *Result Value = Reading + Ant Factor + Cable loss *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.

10.4-2 radiated Graph(30 MHz ~ 1 GHz)

*802.11b Mode

Polarity:Horizontal



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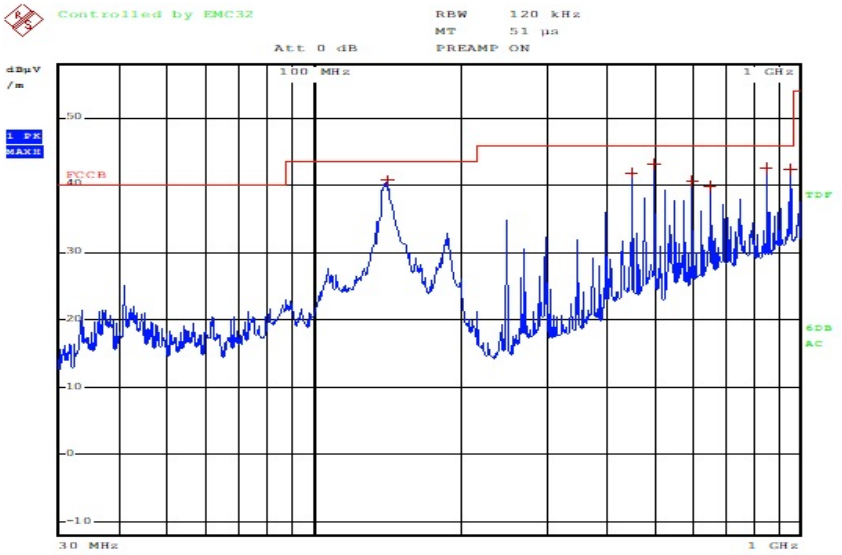
Polarity:Vertical



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10.4-3 Test Data

Test Date : 17-Oct-21 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2389.00	50.40	H	1.5	27.78	-40.42		74.00	37.76	36.24
2388.00	47.11	V	1.6	27.78	-40.42		74.00	34.47	39.53
4824.00	48.56	H	1.5	31.52	-37.60		74.00	42.48	31.52
4824.00	46.98	V	1.6	31.52	-37.60		74.00	40.90	33.10
AV(RBW: 1 MHz VBW: 3 MHz)									
2390.00	35.72	H	1.5	27.78	-40.42	0.09	54.00	23.17	30.83
2390.00	35.08	V	1.6	27.78	-40.42	0.09	54.00	22.53	31.47
4824.00	35.11	H	1.5	31.52	-37.60	0.09	54.00	29.12	24.88
4824.00	34.80	V	1.6	31.52	-37.60	0.09	54.00	28.81	25.19

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11 b - CH 1(2 412 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction *This test was radiated up to 26.5 GHz but no noise was measured.

10.4-4 Test Data

Test Date : 17-Oct-21 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
4874.00	50.40	H	1.6	31.57	-37.62		74.00	44.35	29.65
4874.00	49.30	V	1.5	31.57	-37.62		74.00	43.25	30.75
AV(RBW: 1 MHz VBW: 3 MHz)									
4874.00	35.21	H	1.6	31.57	-37.62	0.09	54.00	29.25	24.75
4874.00	34.87	V	1.5	31.57	-37.62	0.09	54.00	28.91	25.09

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11 b - CH 6(2 437 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction *This test was radiated up to 26.5 GHz but no noise was measured.

10.4-5 Test Data

Test Date : 17-Oct-21 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2484.60	47.89	H	1.6	27.63	-40.31		74.00	35.21	38.79
2484.70	46.95	V	1.5	27.63	-40.31		74.00	34.27	39.73
4924.00	49.64	H	1.6	31.67	-37.61		74.00	43.70	30.30
4924.00	48.10	V	1.5	31.67	-37.61		74.00	42.16	31.84
AV(RBW: 1 MHz VBW: 3 MHz)									
2483.50	35.16	H	1.6	27.63	-40.31	0.06	54.00	22.54	31.46
2483.50	35.10	V	1.5	27.63	-40.31	0.06	54.00	22.48	31.52
4924.00	36.20	H	1.6	31.67	-37.61	0.06	54.00	30.32	23.68
4924.00	35.10	V	1.5	31.67	-37.61	0.06	54.00	29.22	24.78

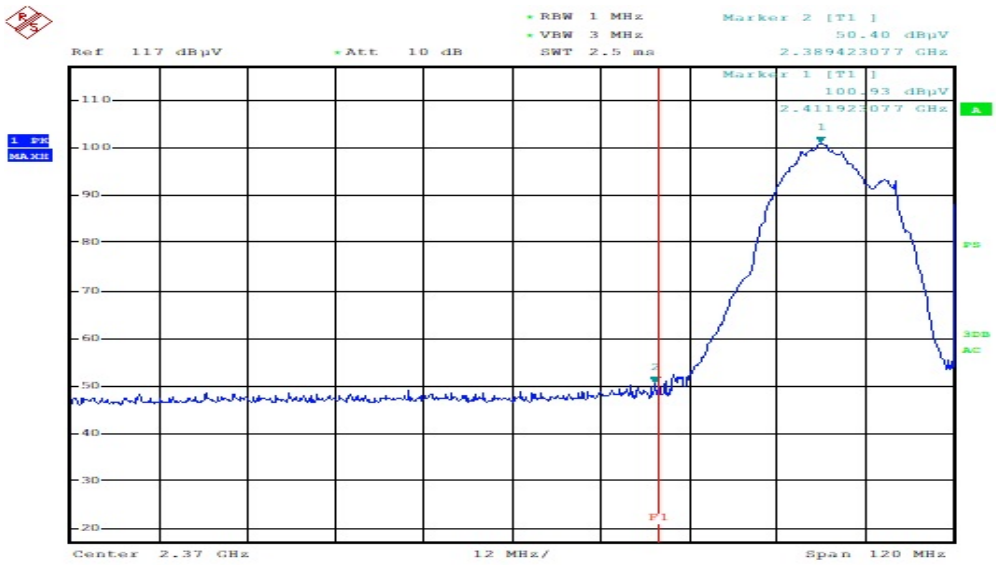
Remark	H : Horizontal, V : Vertical TEST MODE : 802.11 b - CH 11(2 462 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction *This test was radiated up to 26.5 GHz but no noise was measured.

10.4-6 Restricted Band Edges

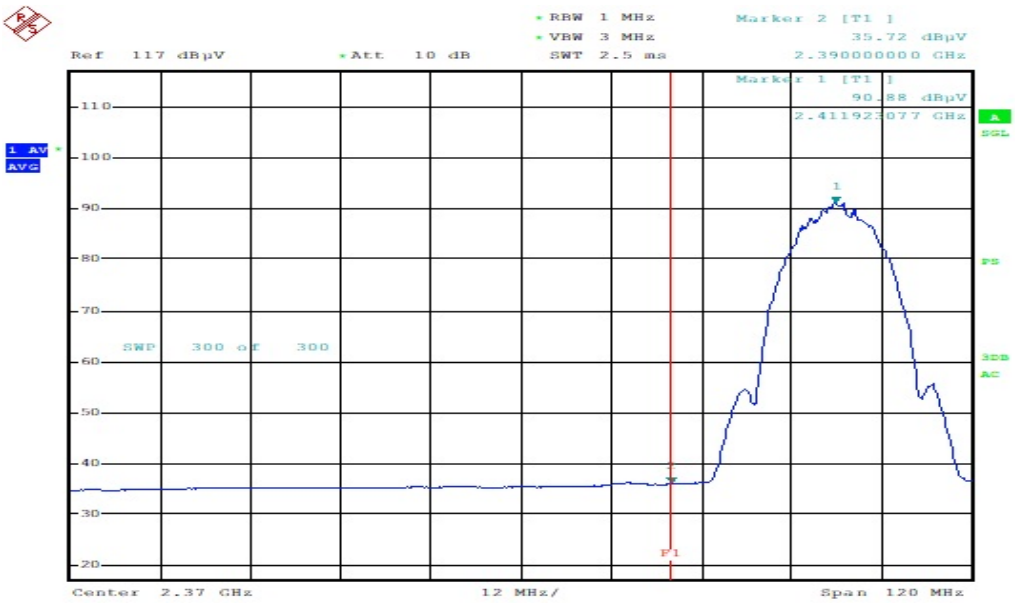
*802.11b Mode

Band Edges(CH Low)

Detector mode:Peak Polarity:Horizontal

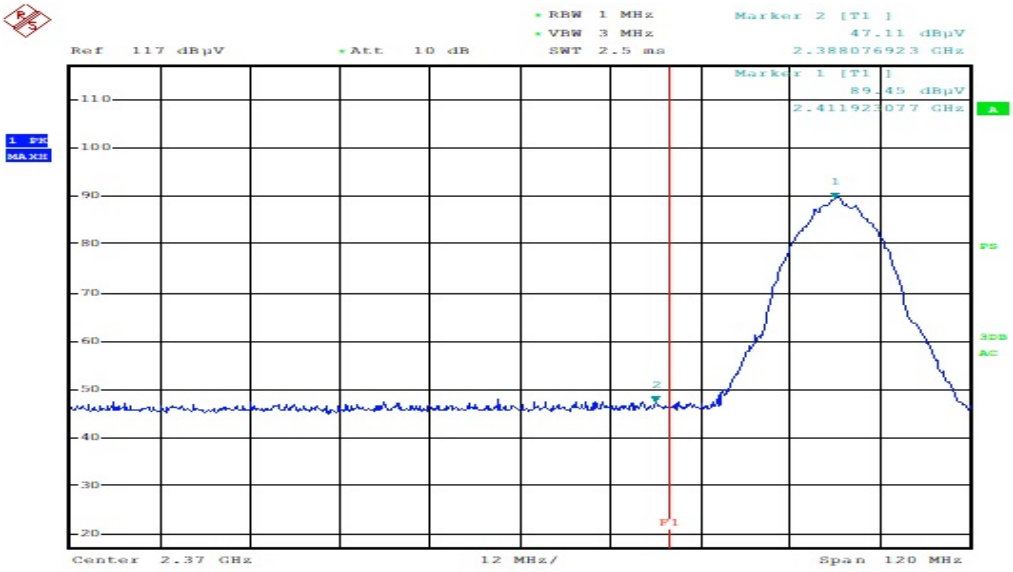


Detector mode:Average Polarity:Horizontal

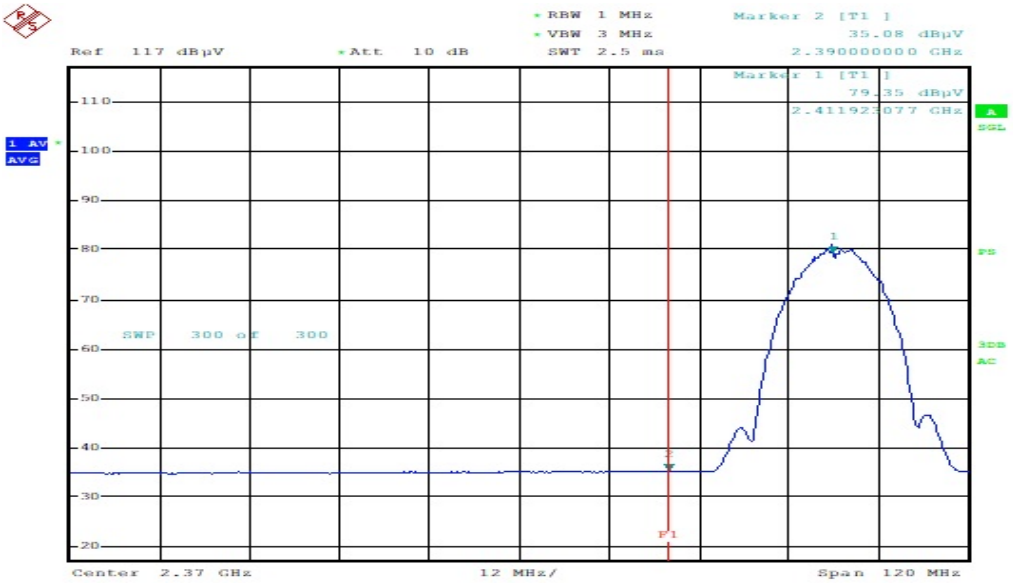


Band Edges(CH Low)

Detector mode:Peak Polarity:Vertical

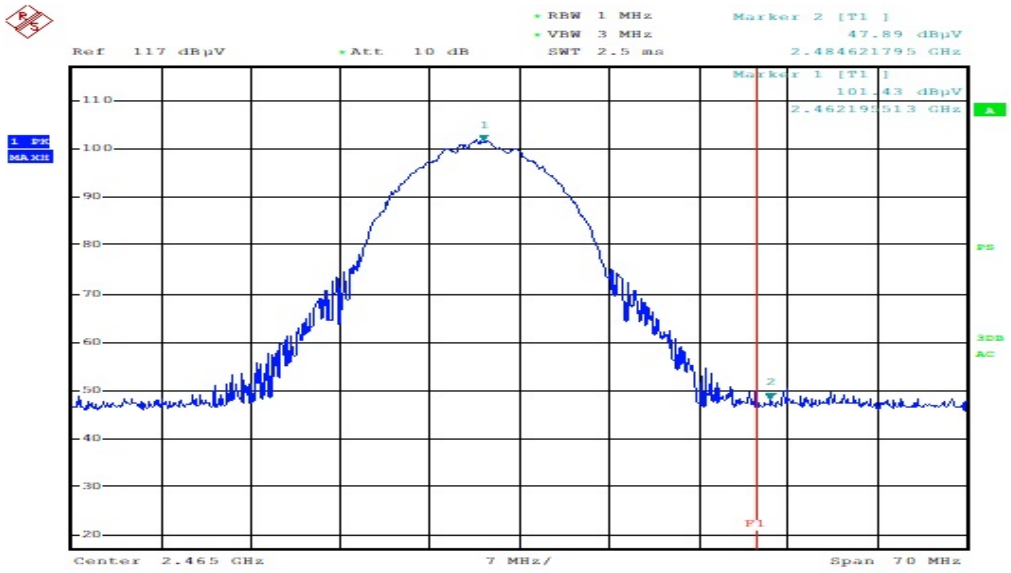


Detector mode:Average Polarity:Vertical

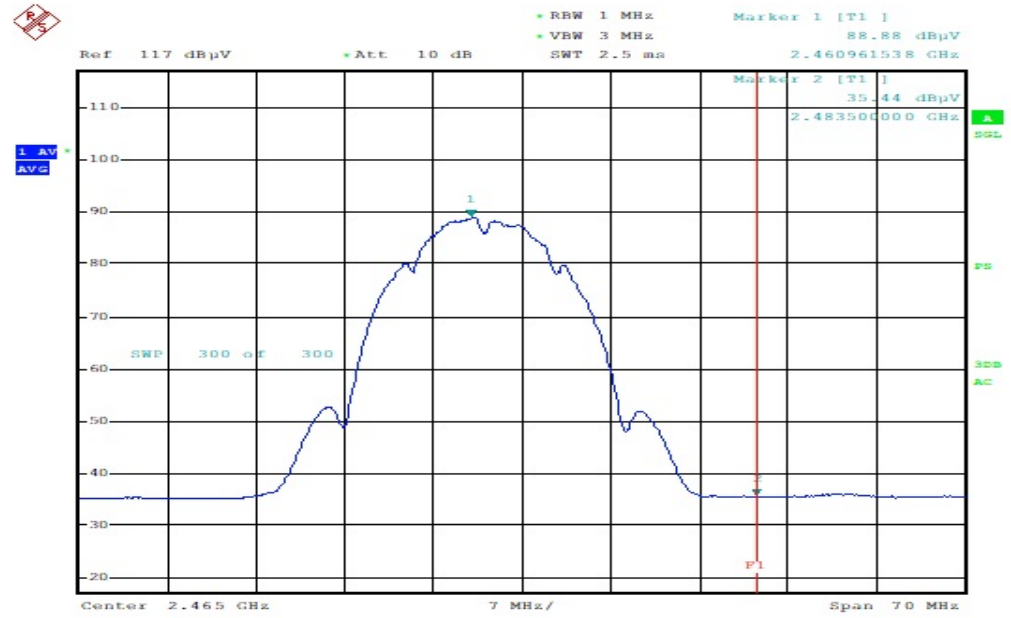


Band Edges(CH High)

Detector mode:Peak Polarity:Horizontal

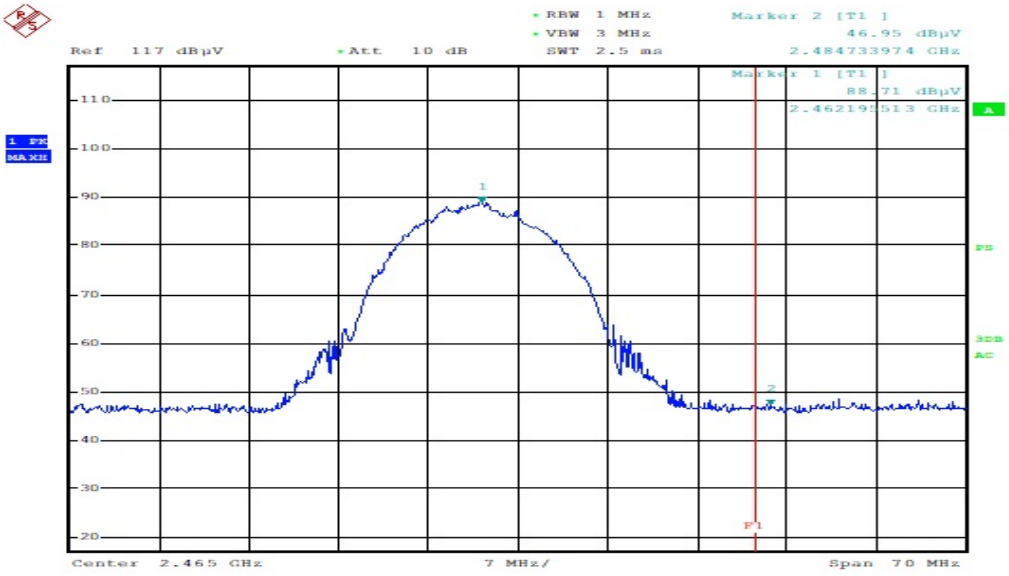


Detector mode:Average Polarity:Horizontal

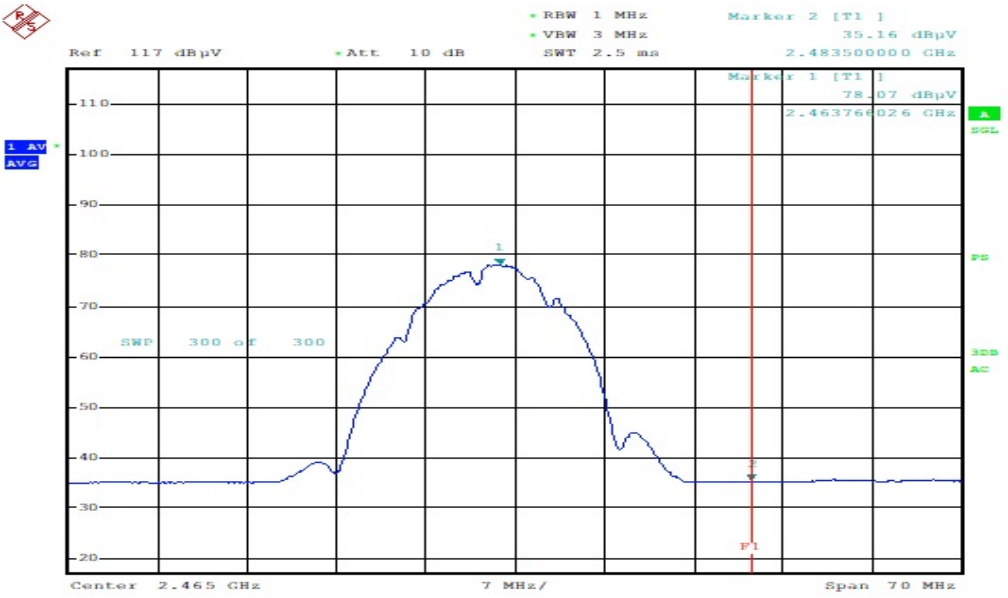


Band Edges(CH High)

Detector mode:Peak Polarity:Vertical

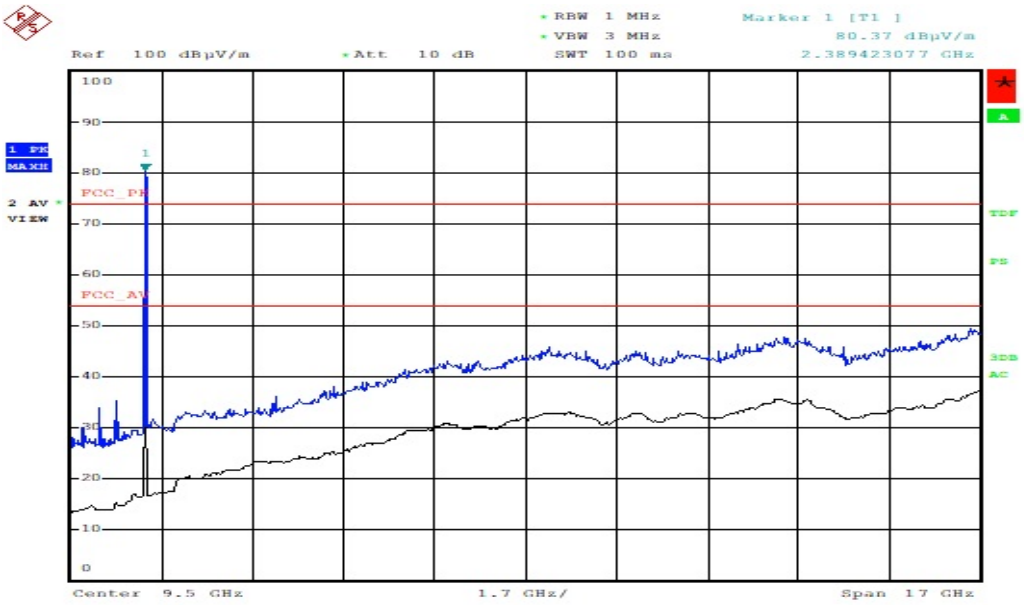


Detector mode:Average Polarity:Vertical

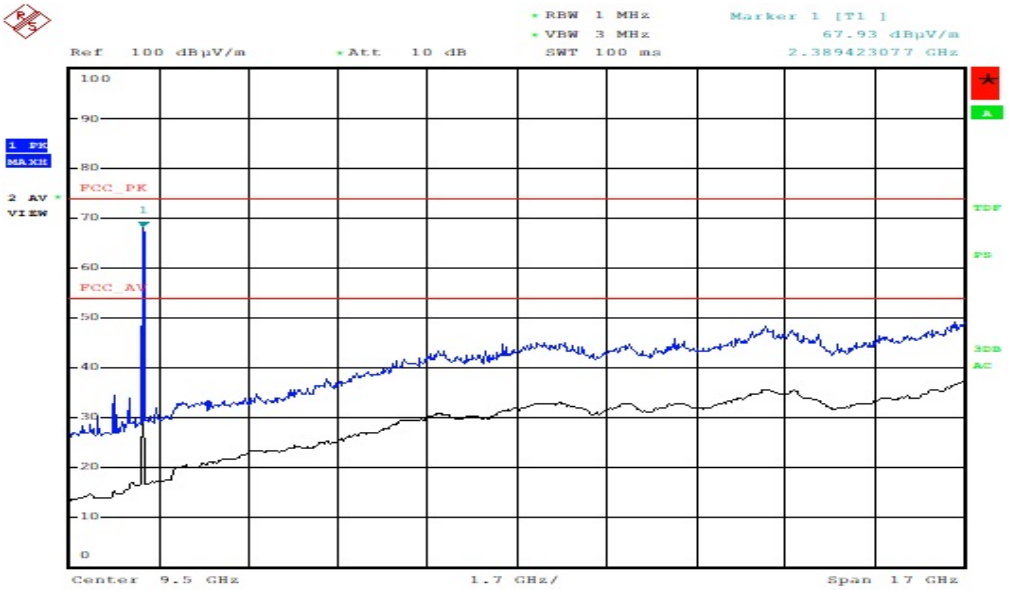


10.4-7 Restricted Band Edges

*802.11b Mode CH1 Polarity:Horizontal

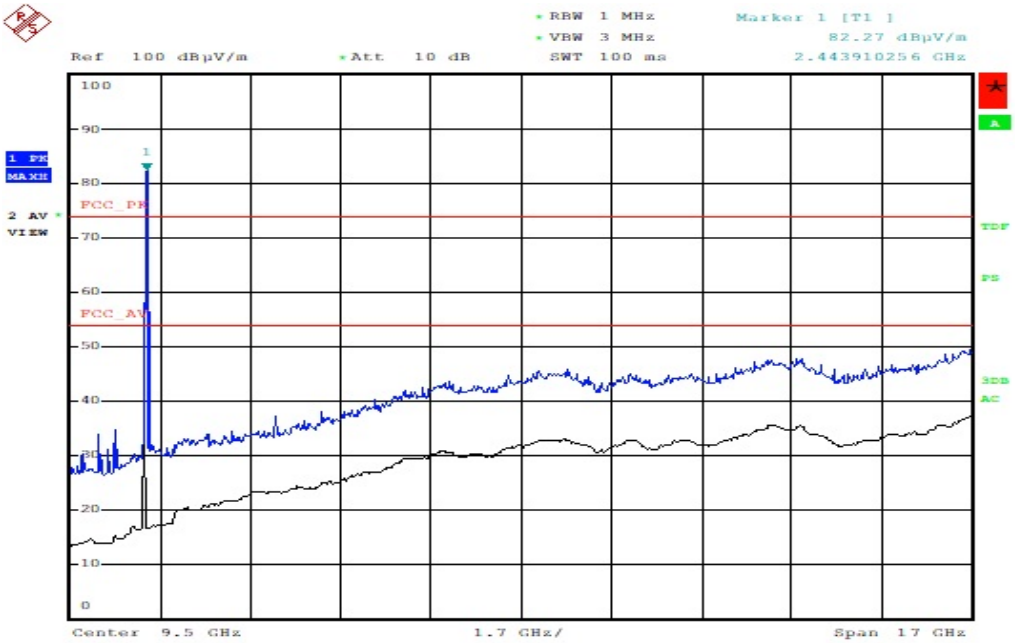


Polarity:Vertical

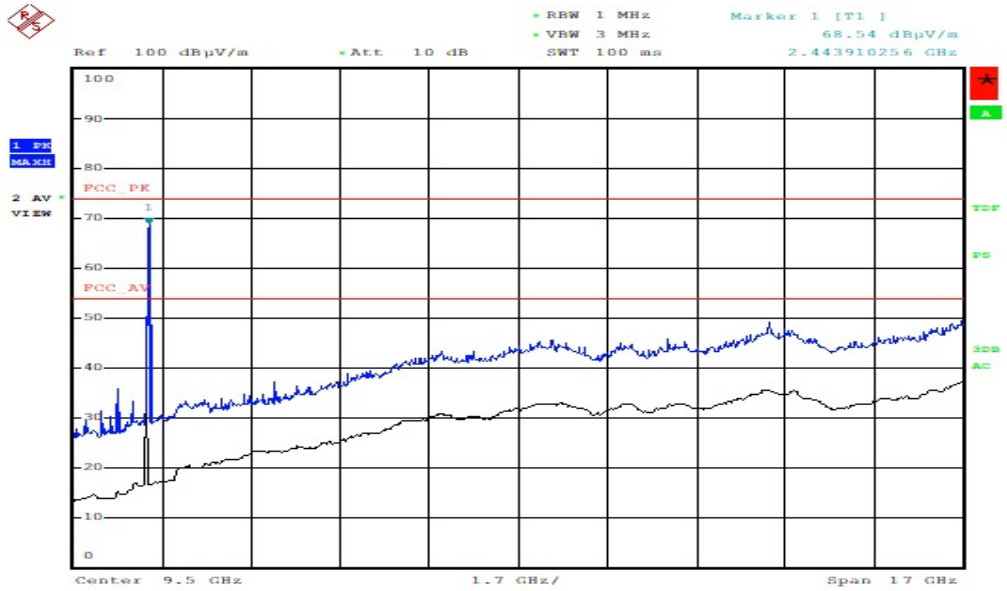


*802.11b Mode CH7

Polarity:Horizontal

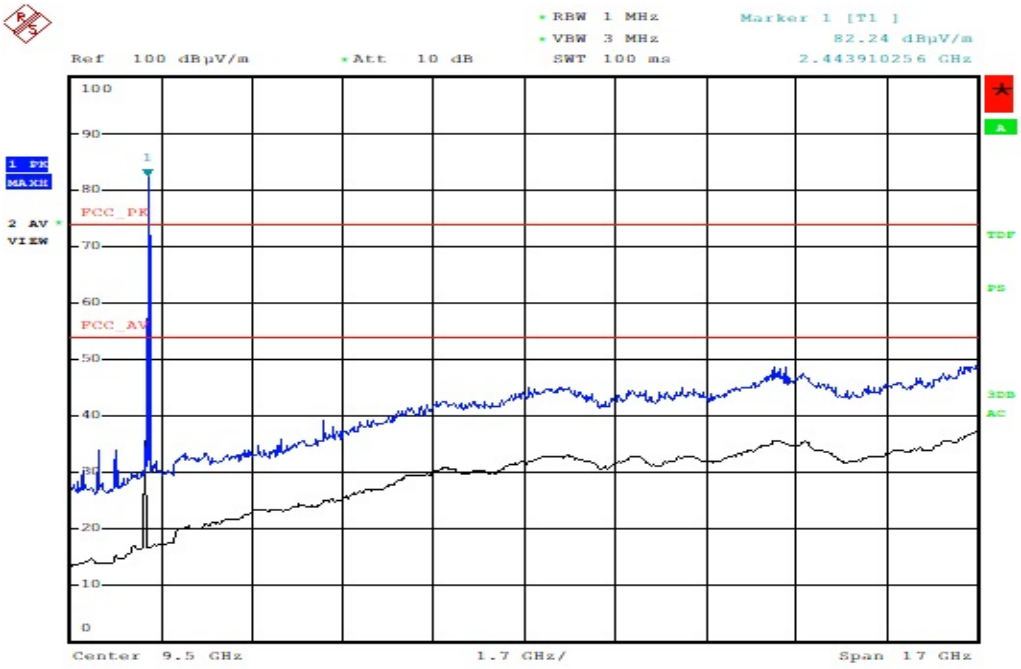


Polarity:Vertical

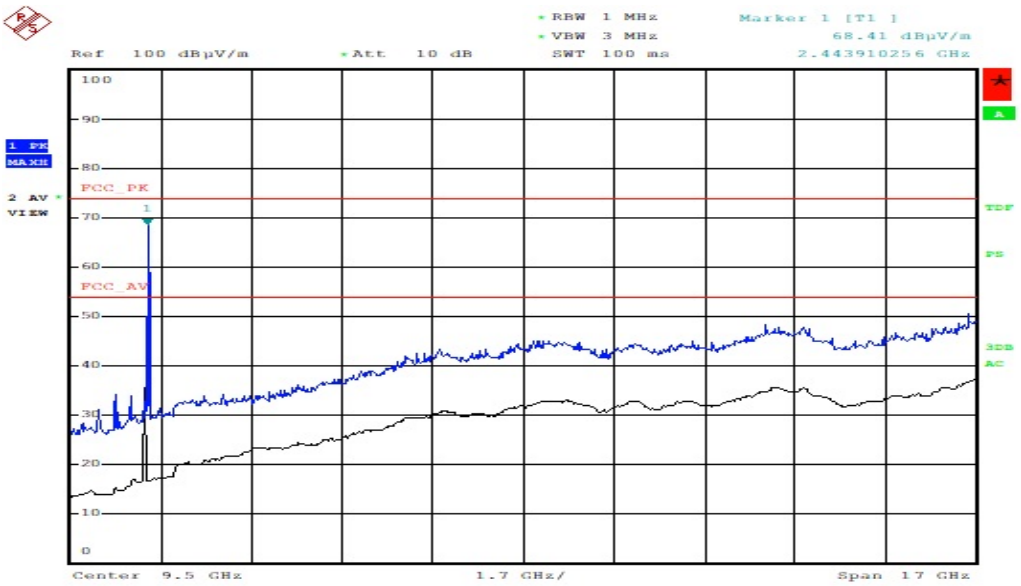


*802.11b Mode CH11

Polarity:Horizontal



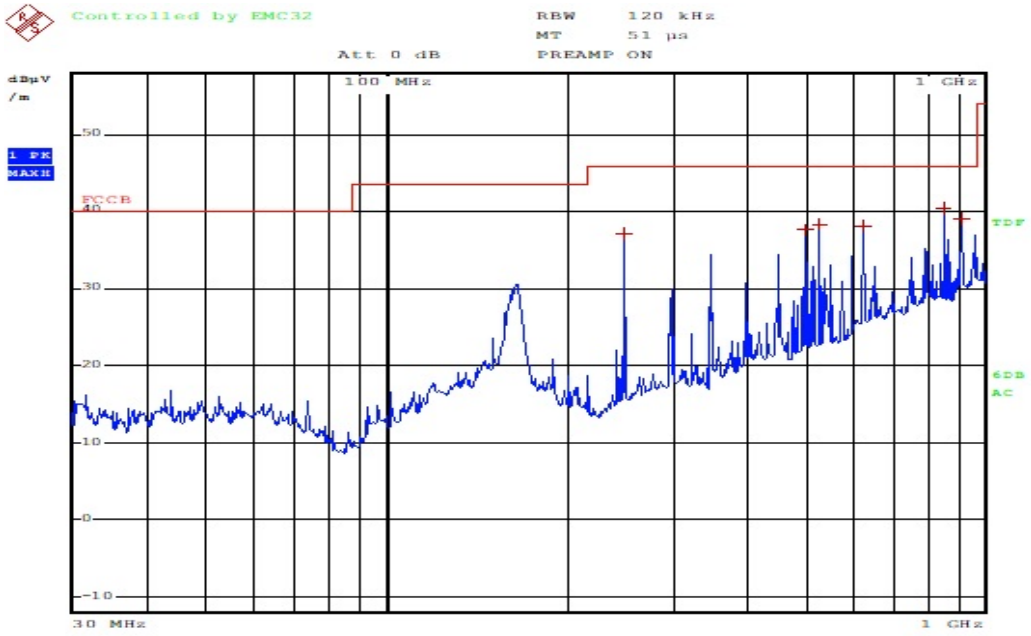
Polarity:Vertical



10.4-9 radiated Graph(30 MHz ~ 1 GHz)

*802.11g Mode

Polarity:Horizontal



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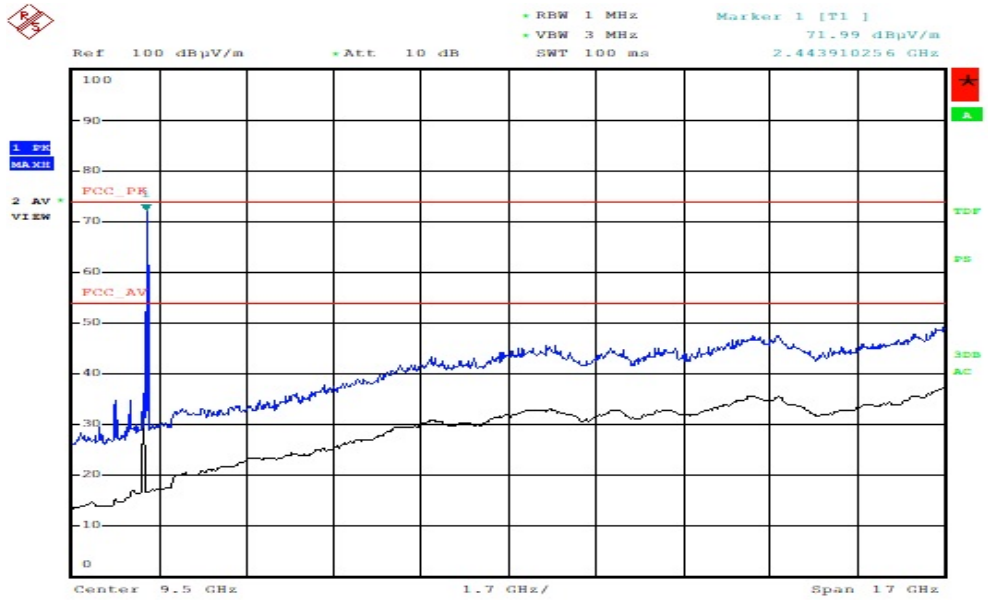
Polarity:Vertical



10.4-8 Test Data (802.11 g)

Test Date : 14-Oct-21 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
141.70	25.26	V	1.0	12.81	1.73	43.50	39.80	3.70
250.00	27.33	H	1.4	11.70	2.17	46.00	41.20	4.80
500.00	21.01	V	1.4	17.80	3.19	46.00	42.00	4.00
600.00	14.41	V	1.5	21.90	3.99	46.00	40.30	5.70
850.00	14.58	H	1.0	22.60	4.32	46.00	41.50	4.50
950.00	11.89	H	1.0	23.48	4.53	46.00	39.90	6.10

Remark	H : Horizontal, V : Vertical *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *CL = Cable Loss(In case of below 1 000 MHz) *Result Value = Reading + Ant Factor + Cable loss *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.

10.4-10 Test Data

Test Date : 18-Oct-21 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2390.00	51.75	H	1.6	27.78	-40.42		74.00	39.11	34.89
2390.00	45.29	V	1.6	27.78	-40.42		74.00	32.65	41.35
4824.00	51.10	H	1.6	31.52	-37.60		74.00	45.02	28.98
4824.00	49.20	V	1.6	31.52	-37.60		74.00	43.12	30.88
AV(RBW: 1 MHz VBW: 3 MHz)									
2390.00	36.92	H	1.6	27.78	-40.42	0.51	54.00	24.79	29.21
2390.00	35.11	V	1.6	27.78	-40.42	0.51	54.00	22.98	31.02
4824.00	36.74	H	1.6	31.52	-37.60	0.51	54.00	31.17	22.83
4824.00	35.12	V	1.6	31.52	-37.60	0.51	54.00	29.55	24.45

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11 g - CH 1(2 412 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction *This test was radiated up to 26.5 GHz but no noise was measured.

10.4-11 Test Data

Test Date : 18-Oct-21 Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
4874.00	49.20	H	1.5	31.57	-37.62		74.00	43.15	30.85
4874.00	47.60	V	1.5	31.57	-37.62		74.00	41.55	32.45
AV(RBW: 1 MHz VBW: 3 MHz)									
4874.00	37.00	H	1.5	31.57	-37.62	0.51	54.00	31.46	22.54
4874.00	35.34	V	1.5	31.57	-37.62	0.51	54.00	29.80	24.20

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11 g - CH 6(2 437 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction *This test was radiated up to 26.5 GHz but no noise was measured.

10.4-12 Test Data

Test Date : 18-Oct-21 Measurement Distance : 3 m

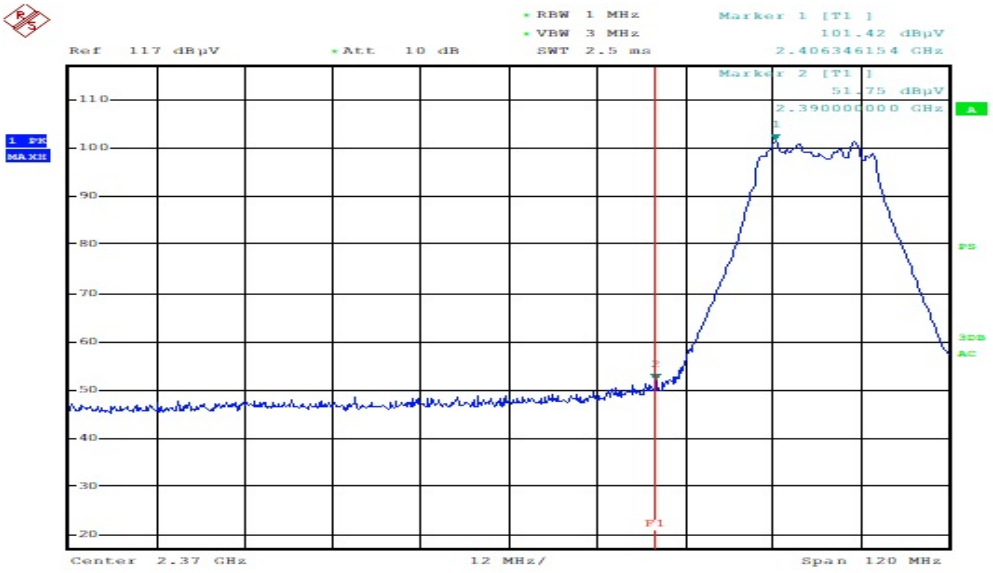
Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2483.50	51.68	H	1.6	27.63	-40.31		74.00	39.00	35.00
2483.50	47.47	V	1.5	27.63	-40.31		74.00	34.79	39.21
4924.00	50.74	H	1.6	31.67	-37.61		74.00	44.80	29.20
4924.00	47.69	V	1.5	31.67	-37.61		74.00	41.75	32.25
AV(RBW: 1 MHz VBW: 3 MHz)									
2483.50	36.33	H	1.6	27.63	-40.31	0.35	54.00	24.00	30.00
2483.50	35.19	V	1.5	27.63	-40.31	0.35	54.00	22.86	31.14
4924.00	37.20	H	1.6	31.67	-37.61	0.35	54.00	31.61	22.39
4924.00	36.10	V	1.5	31.67	-37.61	0.35	54.00	30.51	23.49

Remark	H : Horizontal, V : Vertical TEST MODE : 802.11g - CH 11(2 462 MHz) *The TX signal wasn't detected from 3th harmonics. *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction *This test was radiated up to 26.5 GHz but no noise was measured.

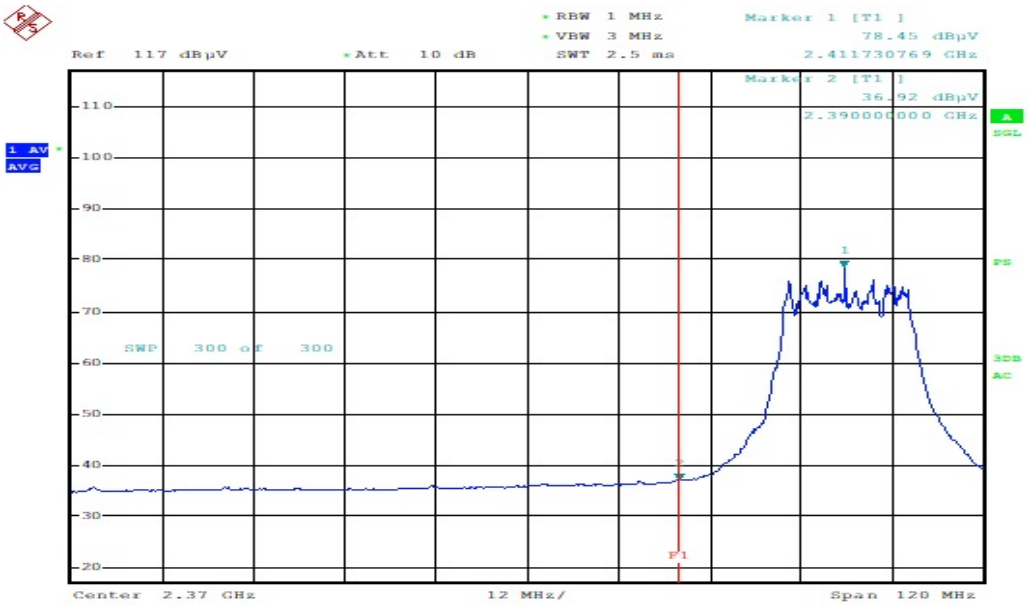
10.4-13 Restricted Band Edges
*802.11g Mode

Band Edges(CH Low)

Detector mode:Peak Polarity:Horizontal

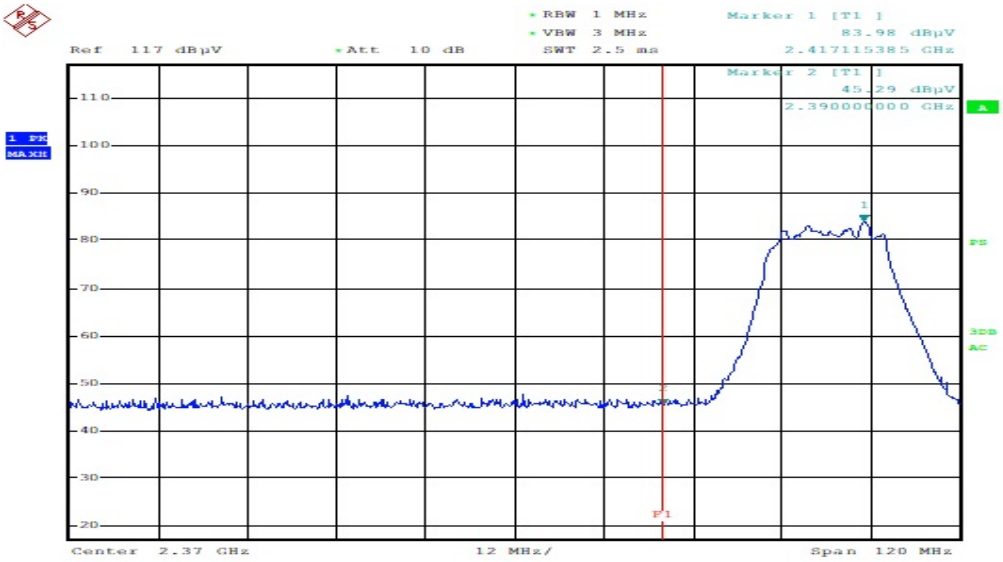


Detector mode:Average Polarity:Horizontal

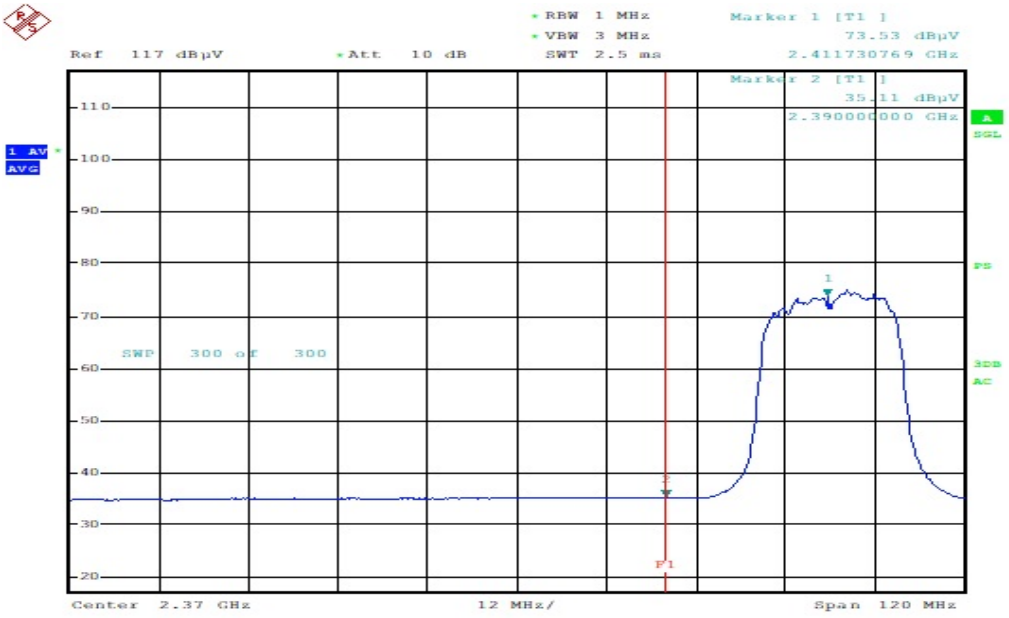


Band Edges(CH Low)

Detector mode:Peak Polarity:Vertical

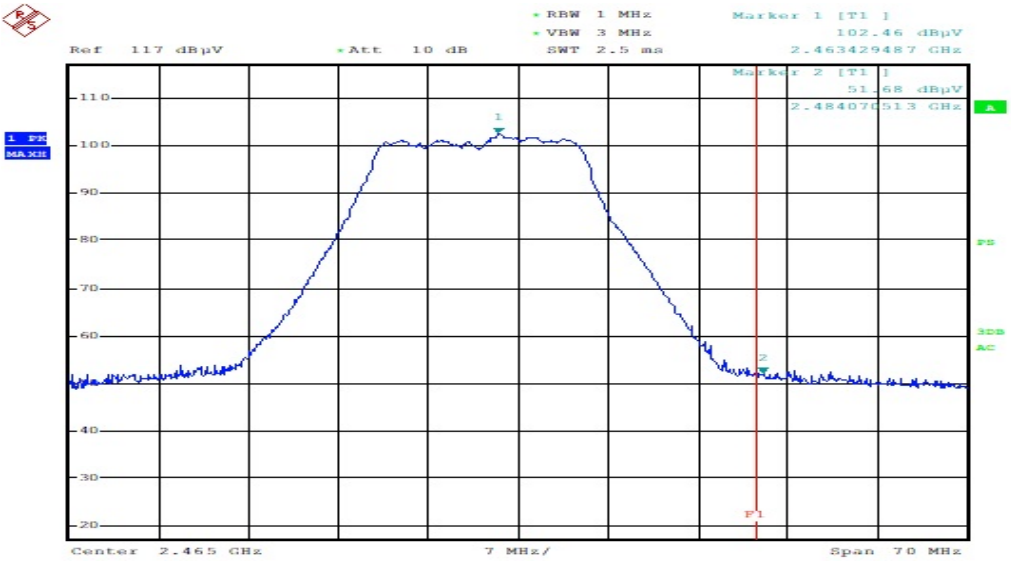


Detector mode:Average Polarity:Vertical

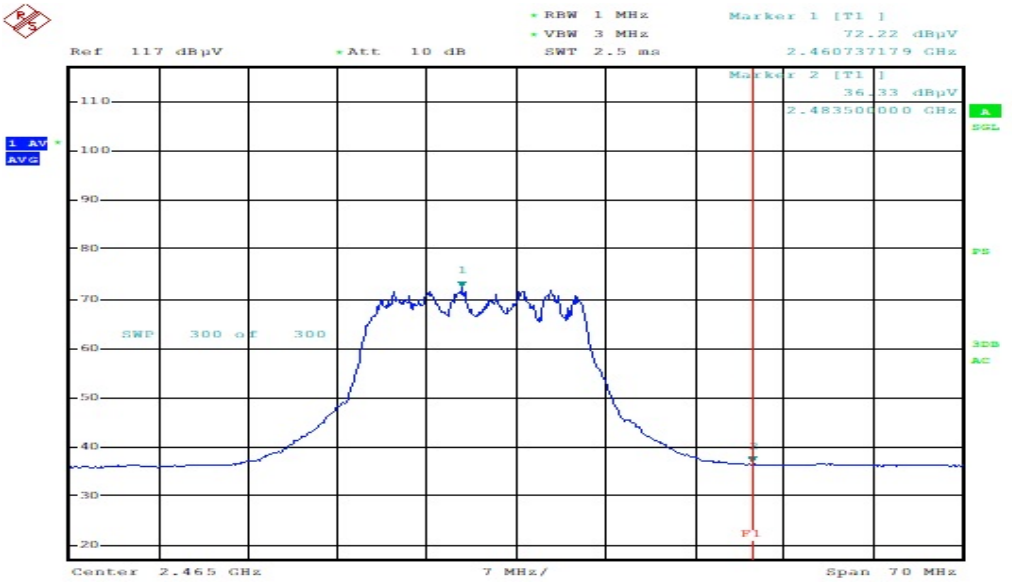


Band Edges(CH High)

Detector mode:Peak Polarity:Horizontal

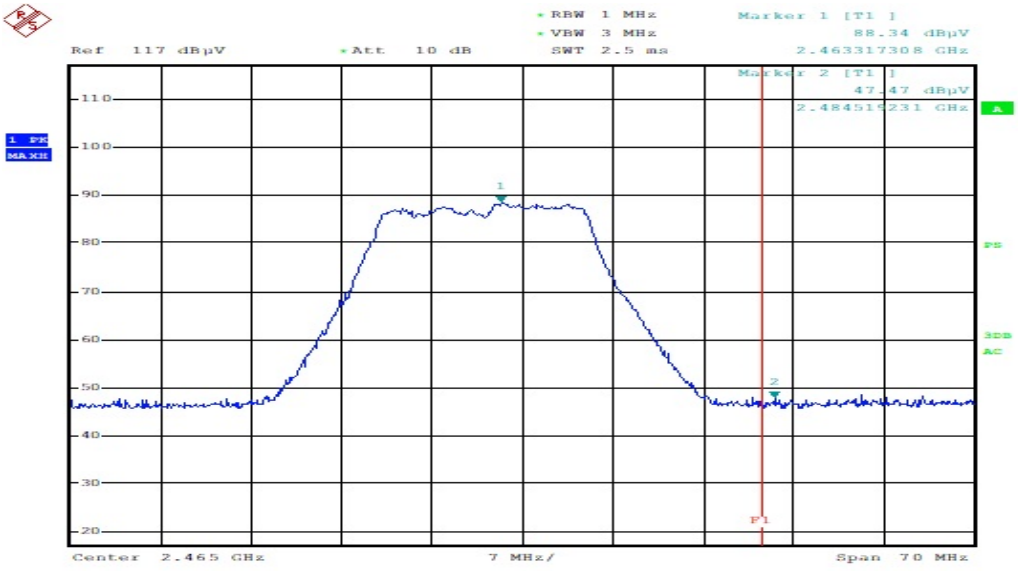


Detector mode:Average Polarity:Horizontal

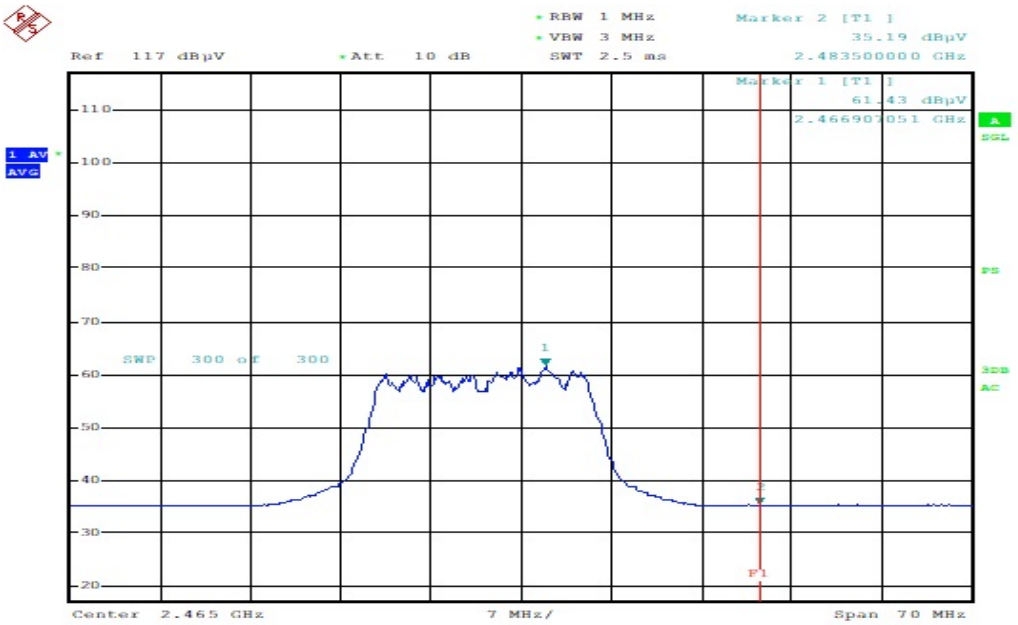


Band Edges(CH High)

Detector mode:Peak Polarity:Vertical



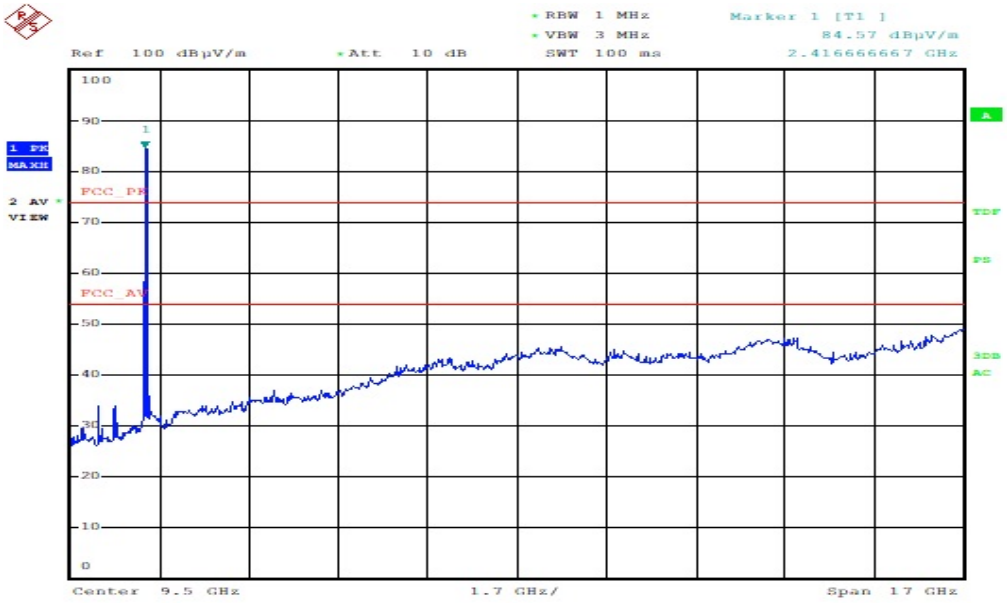
Detector mode:Average Polarity:Vertical



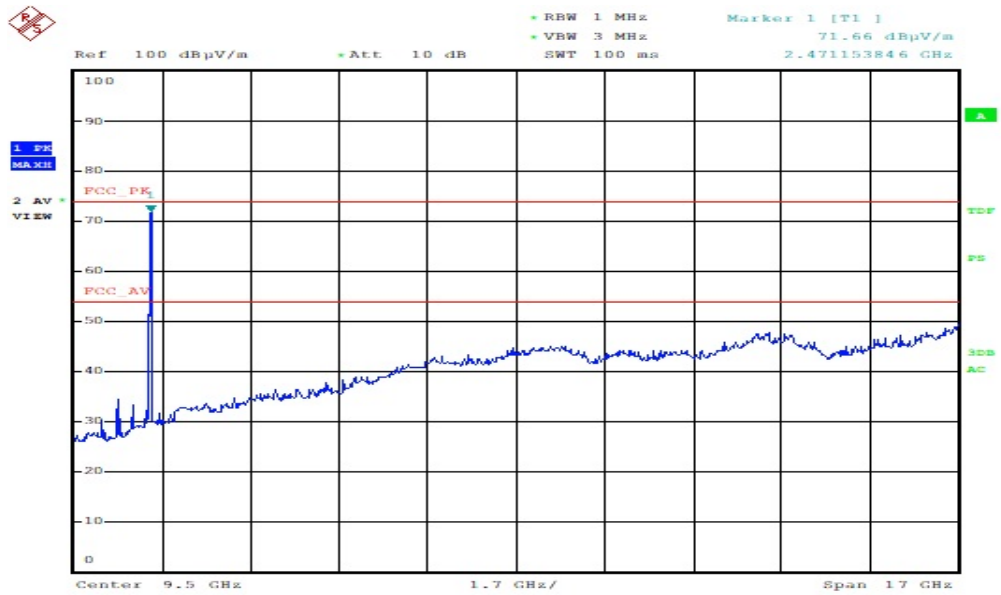
10.4-14 Restricted Band Edges

*802.11g Mode CH1

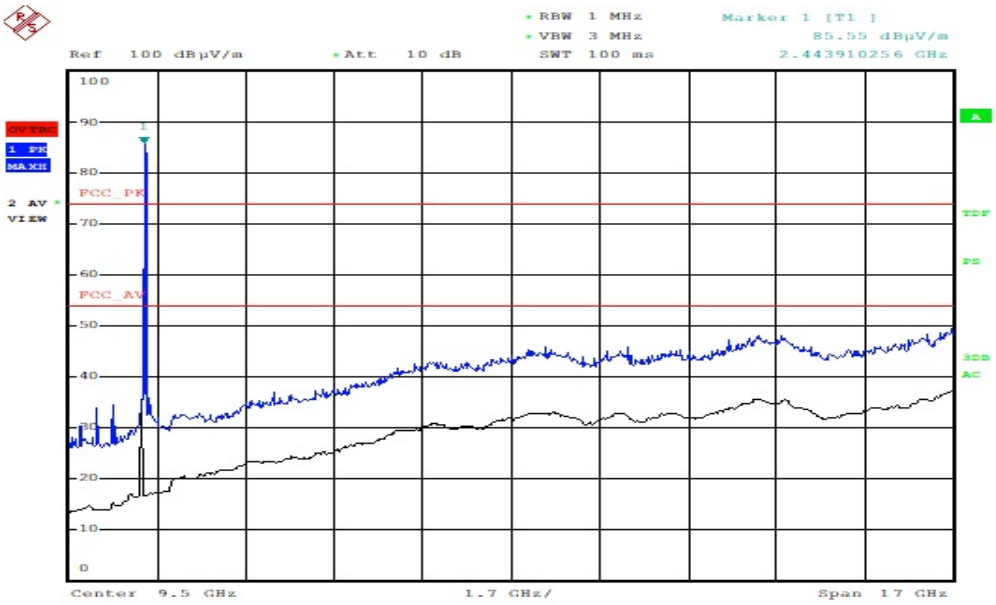
Polarity:Horizontal



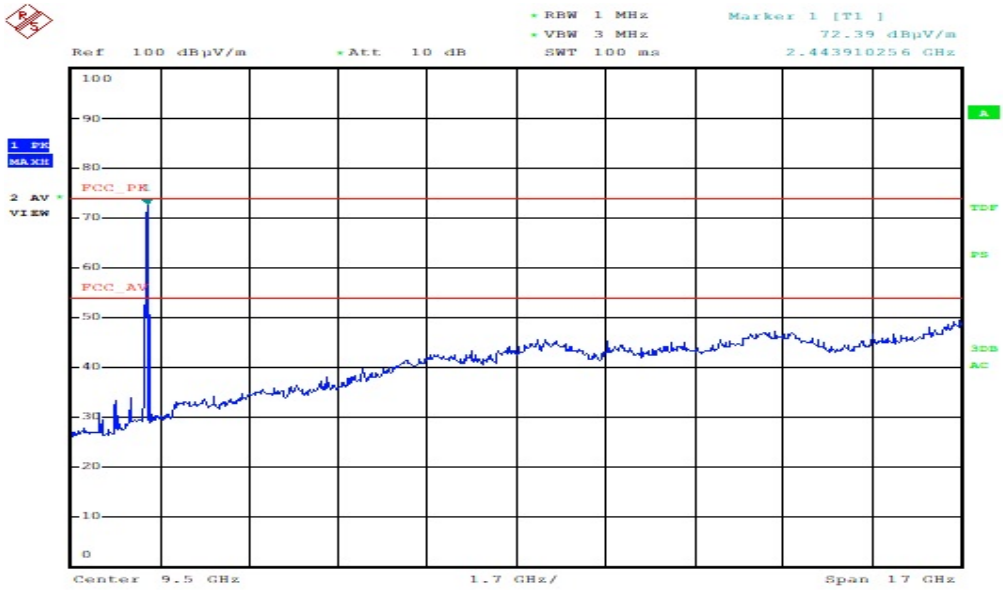
Polarity:Vertical



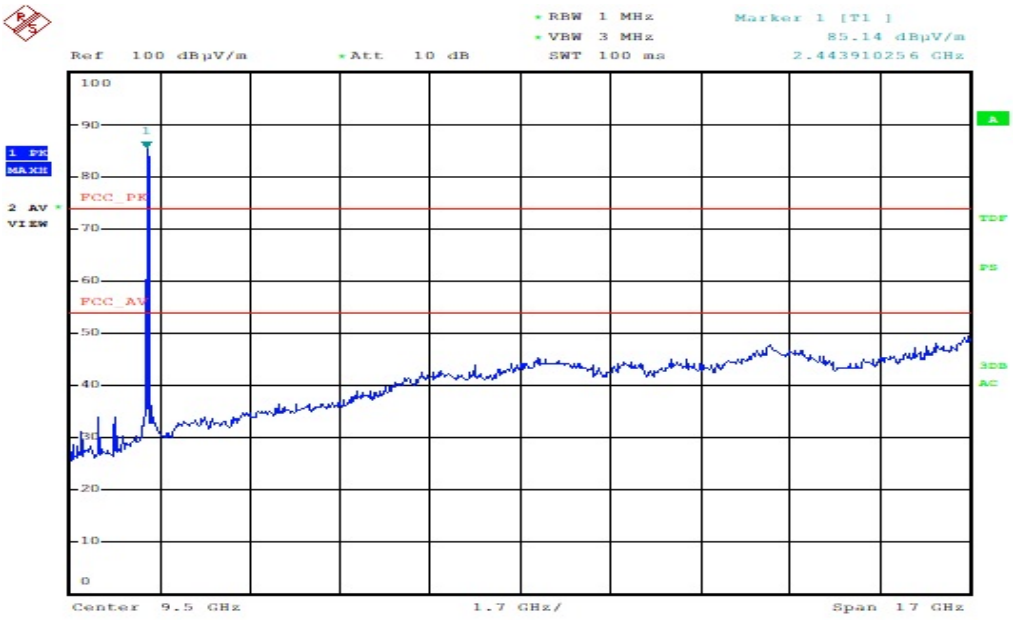
*802.11g Mode CH7 Polarity:Horizontal



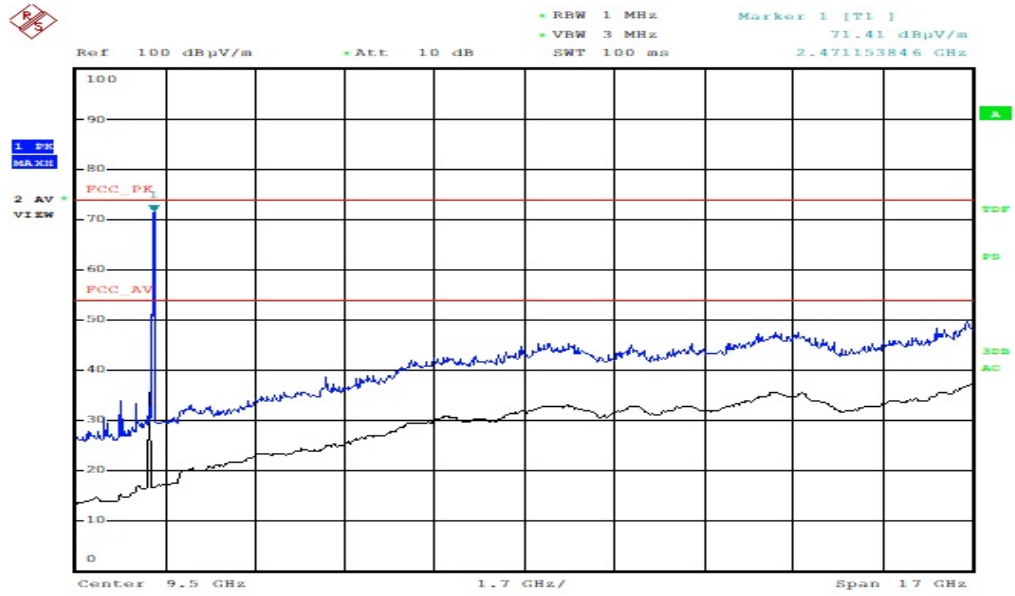
Polarity:Vertical



*802.11g Mode CH11 Polarity:Horizontal



Polarity:Vertical



11. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207. The test setup was made according to ANSI C 63.10 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

11.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST RECEIVER	ESPI	Rohde & Schwarz	100005	19-Jul-22
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	19-Jul-22
LISN	ENV216	Rohde & Schwarz	101231	19-Jul-22
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	19-Jul-22

11.2 Environmental Condition

Test Place : Shielded Room

Temperature (°C) : 23.6 °C
Humidity (% R.H.) : 46.8 % R.H.

11.3-1 Test Data (802.11 b)

Test Date : 16-Oct-21

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
0.15	0.06	0.17	H	65.84	41.98	42.21	55.84	24.96	25.19
0.16	0.06	0.17	N	65.67	42.66	42.89	55.67	24.85	25.08
0.18	0.06	0.17	H	64.35	36.08	36.31	54.35	21.76	21.99
0.42	0.04	0.32	H	57.51	30.69	31.05	47.51	21.29	21.65
1.15	0.04	0.32	N	56.00	29.44	29.80	46.00	19.44	19.80
27.00	0.04	0.46	N	60.00	28.49	28.99	50.00	25.10	25.60
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								

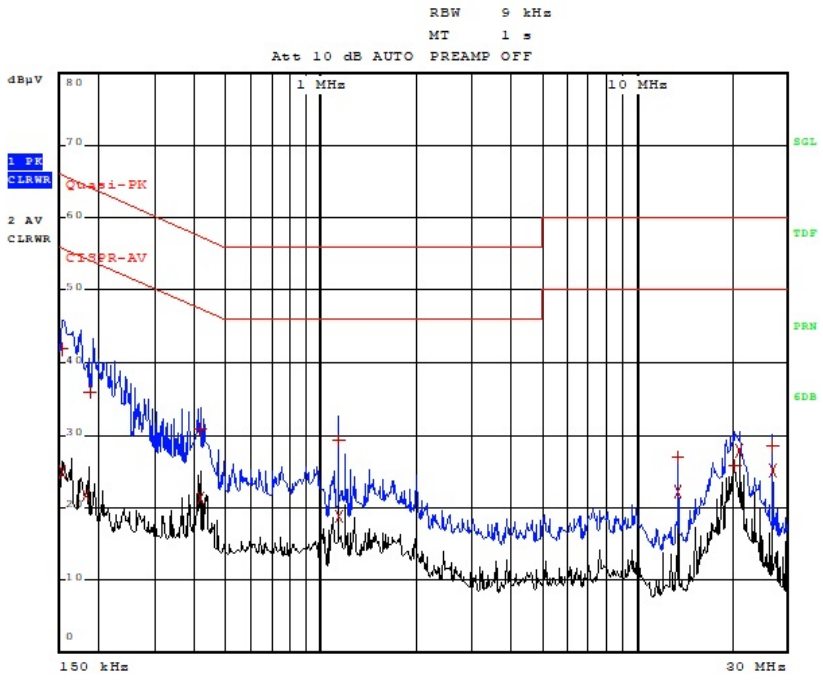
11.3-2 Test Data (802.11 g)

Test Date : 16-Oct-21

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dBμV)	Reading (dBμV)	Result (dBμV)	Limit (dBμV)	Reading (dBμV)	Result (dB)
0.15	0.06	0.17	H	66.00	41.21	41.44	56.00	25.71	25.94
0.16	0.06	0.17	N	65.67	42.44	42.67	55.67	25.10	25.33
0.20	0.06	0.17	H	63.45	34.58	34.81	53.45	21.39	21.62
0.41	0.04	0.32	H	57.57	30.70	31.06	47.57	22.77	23.13
1.15	0.04	0.32	N	56.00	29.62	29.98	46.00	19.53	19.89
21.22	0.04	0.46	H	60.00	29.81	30.31	50.00	27.26	27.76
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								

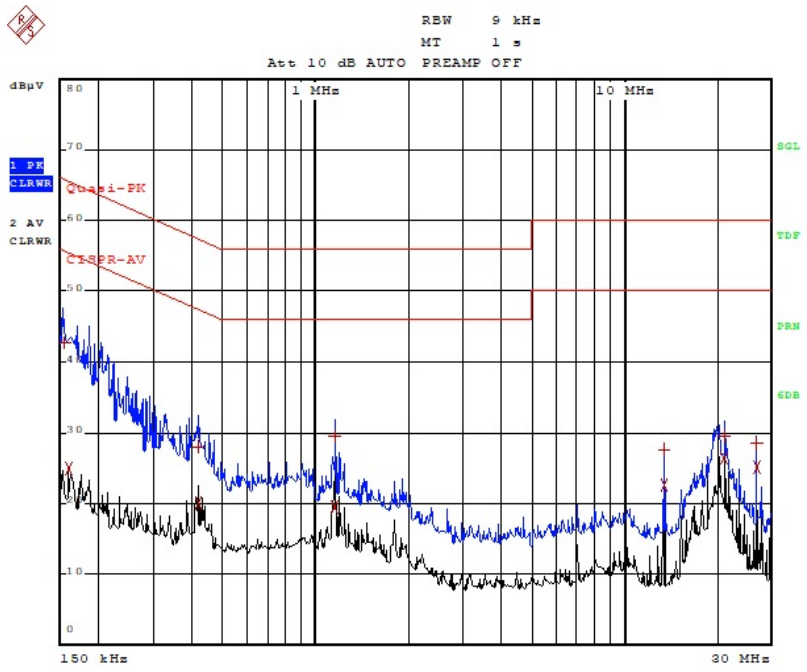
Appendix 1. Special diagram (802.11 b)

* HOT LINE



Comment: ESTR-21-00276

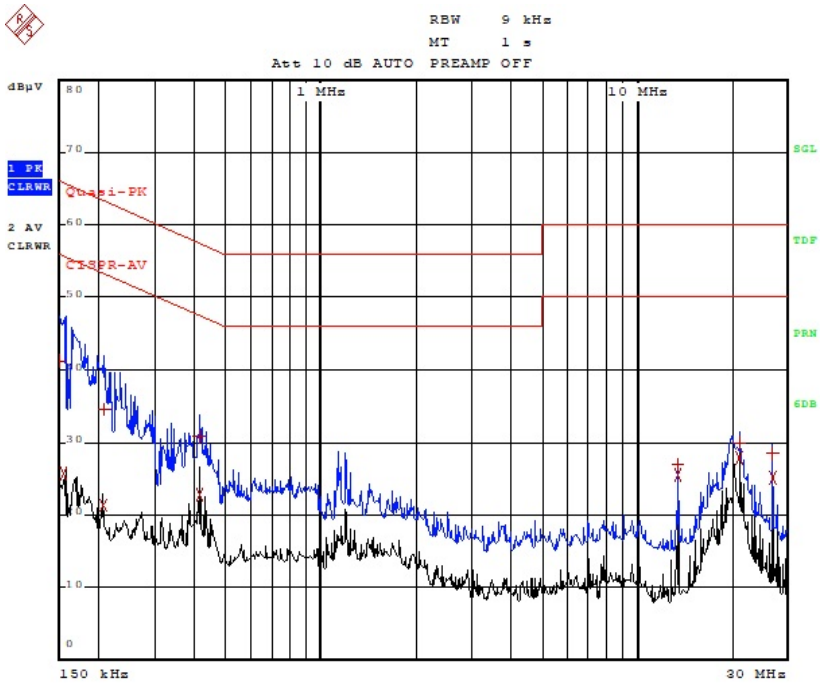
* NEUTRAL LINE



Comment: ESTR-21-00276

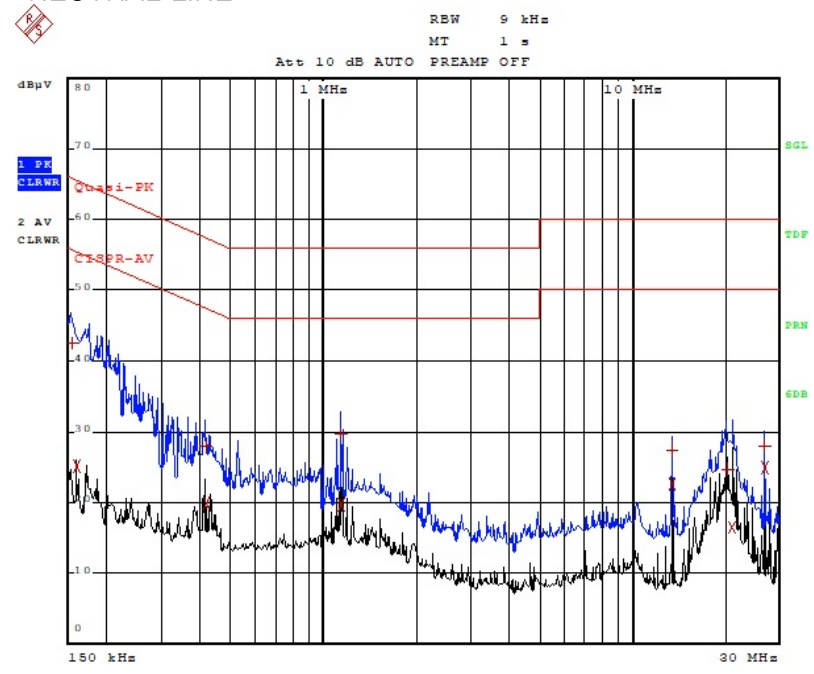
Appendix 1. Special diagram (802.11 g)

* HOT LINE



Comment: ESTR-21-00276

* NEUTRAL LINE



Comment: ESTR-21-00276

Appendix 2. Antenna information

1. Antenna information

antenna type : PCB Antenna.
antenna location : Integnal
antenna gain : 2.1 dBi
No temporary RF connector provided