FCC IC Test Report

Report No.:	FCC_IC_SL02152022-XIR-001B_2.4G_CS35235_CS35236
FCC ID:	GKM-XT2594
IC ID:	10281A-XT2594
Test Model:	XT2594
FVIN:	XT2594-01
Received Date:	04/12/2022
Test Date:	04/12/2022-05/13/2022 & 11/16/2022 & 01/09/2023
Issued Date:	11/29/2022
Applicant:	Xirgo Technologies, LLC
Address:	1461 Lawrence Drive, Suite 1, Thousand Oaks, CA 91320
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035
FCC Registration / Designation Number:	540430 / US1109
ISED# / CAB identifier:	4842D / US0160

TESTING CERT # 2742-01

Table of Contents

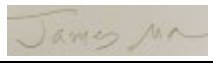
Release Control Record

Issue No.	Description	Date Issued
FCC_IC_SL02152022-XIR-001_2.4G	Orignal Release	05/16/2022
FCC_IC_SL02152022-XIR-001A_2.4G	Correction per comment	11/15/2022
FCC_IC_SL02152022-XIR-001B_2.4G	Correct antenna Gain & Added Conducted Out Power Plots.	01/09/2023

1 Certificate of Conformity

Product:	Asset Tracking Device
Test Model:	XT2594
Applicant:	Xirgo Technologies, LLC
Test Date:	04/12/2022-05/13/2022 & 11/16/2022 & 01/09/2023
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) RSS 247 Issue 2, February 2017 ANSI C63.10: 2013 RSS Gen Issue 5, February 2021 KDB 558074 D01 15.247 Meas Guidance v05r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :	Pooja Pandya	**, Date:**	05/16/2022
	Pooja Pandya / Test Engineer		
		**, Date:**	11/29/2022
	James Ma / Test Engineer		
Approved by :	Suresh Kondapalli	**, Date:**	11/29/2022
	Suresh Kondapalli / Engineer Reviewer		

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247) RSS 247 Issue2, RSS Gen Issue5			
Standard	Test Item	Result	Remarks
15.207 RSS Gen 8.8	AC Power Conducted Emission	N/A	Meet the requirement of limit.
15.205 &15.209 & 15.247(d) RSS 247 5.5	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit.
15.205 RSS Gen 8.10	Restricted Band of Operation	Pass	Meet the requirement of limit.
RSS Gen (7.3)	Receiver Spurious Emissions	Pass	Meet the requirement of limit.
15.247(a)(2) RSS 247 5.2 RSS Gen 6.7	6dB bandwidth & 99% bandwidth	Pass	Meet the requirement of limit.
15.247(b) / RSS 247 5.4.d	Maximum Peak Output Power	Pass	Meet the requirement of limit.
15.247(e) / RSS 247 5.2.b	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	The EUT uses a chip antenna and permanently attached to the PCB.

Note: EUT worked with 14VDC power.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Asset Tracking Device
Test Model	XT2594
Power Supply Rating	14VDC
Modulation Type	Compatible to BLE 4.2
Modulation Technology	GFSK
Transfer Rate	1Mbps (As per client's operational description)
Operating Frequency	2402MHz – 2480MHz
Number of Channels	Channel 0, Channel 19, Channel 39
Antenna Type	RF ANT 2.4GHZ CHIP SOLDER SMD (Johanson Technology Inc, P/N: 2450AT18D0100E)
Antenna Gain	1.5dBi @ 2.4-2.5 GHz
Antenna Connection	Internal, Surface Mount Chip

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.
2. Statement provided by the customer: "The Sensata|Xirgo BLE implementation is based off the TI Simplelink SDK (Version 3.40) which only supports BLE 4.2 with a datarate of 1 Mb/s."

3.2 Description of Test Modes

Three Low/Mid/High channels were tested:

Channel	Frequency
0	2402MHz
19	2440MHz
39	2480MHz

Power setting is as below:

Channel	Power Setting
0	5dBm
19	5dBm
39	5dBm

Note: As per test software BTool version v1.42.13 (BLE5) from Texas Instruments, provided by the customer, the maximum power level was 5dBm.

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	N/A	√	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	BLE	0 to 39	0, 19, 39	OFDM	GFSK	1

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	BLE	0 to 39	0, 19, 39	OFDM	GFSK	1

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

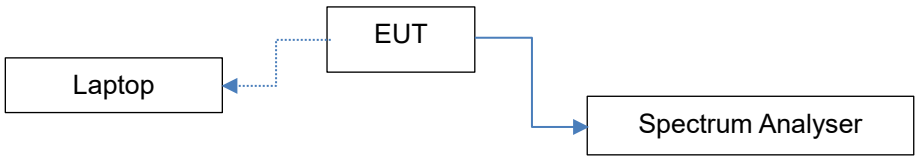
EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	BLE	0 to 39	0, 19, 39	OFDM	GFSK	1

3.3 Test Condition:

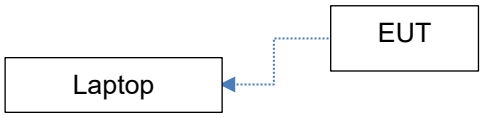
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25° C, 65%RH	14V DC Powered	Pooja Pandya & James Ma
RE<1G	25° C, 65%RH	14V DC Powered	Pooja Pandya & James Ma
APCM	25° C, 68%RH	14V DC Powered	Pooja Pandya & James Ma

3.4 Configuration of System under Test

RF Conducted Measurement



RF Radiated Measurement



Note: Laptop connected for configuration only.

3.5 EUT Operating Conditions

For RF Condcuted Measurements:
a. Connected the EUT with the laptop via cable.
b. Controlling software has been activated to set the EUT on specific status.

For Radiated Emissions:
a. Connected the EUT with the laptop via cable.
b. Controlling software has been activated to set the EUT on specific status.
c. EUT is disconnected with the laptop and cable, and removed from the 10m chamber.

3.6 Description of Support Units

For Radiated Emissions testing, the EUT was 14VDC powered. For a Conducted RF testing, a laptop with a cable was used to change radio setting, such as changing channels and power setting.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
1	Laptop	Lenovo Thinkpad	X1 Carbon	-	-	
2	DC Power Supply	BK Precision	1665			

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
	USB Cable	1	1	Yes	N/A	

Note: 1. During testing, EUT was not connected to any peripheral devices. EUT was the only device on the non-conductive table.

3.6.1 Duty Cycle of Test Signal

EUT CONFIGURE MODE	Channels	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)	Duty Cycle	Duty Cycle Correction Factor
-	0, 19, 39	OFDM	GFSK	1	100%	0dB

3.7 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart C (Section 15.247)
RSS-247 Issue 2, February 2017
ANSI C63.10: 2013
RSS-Gen Issue 5, February 2021
558074 D01 15.247 Meas Guidance v05r02

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission, Bandedge Measurement and Receiver Radiated Emissions

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Limits of Receiver Radiated Emission

RSS GEN 7.3

Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna ports. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least five times the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

Spurious emissions from receivers shall not exceed the radiated emissions limits shown in table below.

Frequency (MHz)	**Field strength (μV/m at 3 metres)[Note 1]**
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

4.1.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer KEYSIGHT	N9030B	MY57140100	07/22/2020	07/22/2022
EMI Test Receiver Rohde & Schwarz	ESW44	1328.4100K44-101662-MH	9/22/2021	9/22/2022
Horn Antenna ETS-Lindgren	3117	218554	04/21/2021	04/21/2023
Pre-Amplifier RF-Lambda	RAMP00M50GA	17032300048	02/28/2022	02/28/2023
18-40 GHz Horn Antenna A.H. Systems, Inc.	SAS-574	579	08/05/2020	08/05/2022
Biconilog Antenna Sunol	JB6	A111717	9/4/2020	9/4/2022
SMA Fixed Attenuator(50ohm, 2w, 10dB, DC-6GHz)	VAT-03W2+	n/a	07/21/2021	07/21/2022
2.4 GHz Notch Filter Micro-Tronics	2300 – 2500 MHz	N/A	N/A	N/A
FSB Antenna Cable, 0.5m (Microwave Town)	FSB360PK-KMKM-00.50M	201906110002	10/1/2021	10/1/2022
FSB Antenna Cable, 4m (Microwave Town)	FSB360PK-KMKM-400M	202103270001	10/1/2021	10/1/2022
10m Semi-Anechoic Chamber (ETS-Lindgren)	S2010BL8X8	1462	07/21/2020	07/21/2022

Additional Test performed on 11/15/2022

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EXA Signal Analyzer	N9010A 9KHz – 26.5GHz	MY50210206	09-20-2022	09-20-2023

4.1.4 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

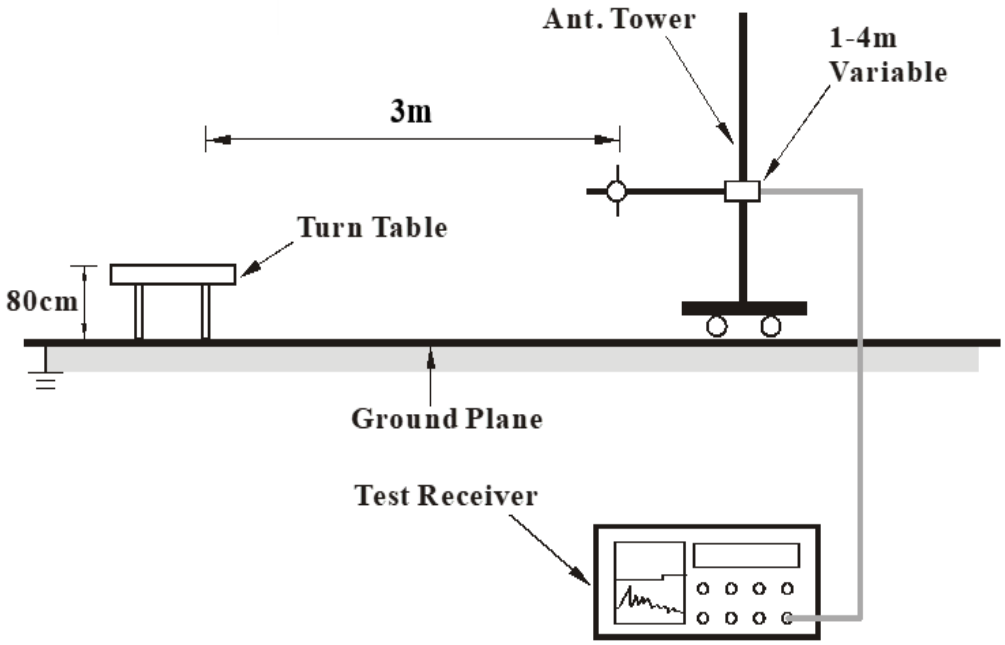
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated, and the worst-case emissions are reported.

4.1.5 Deviation from Test Standard

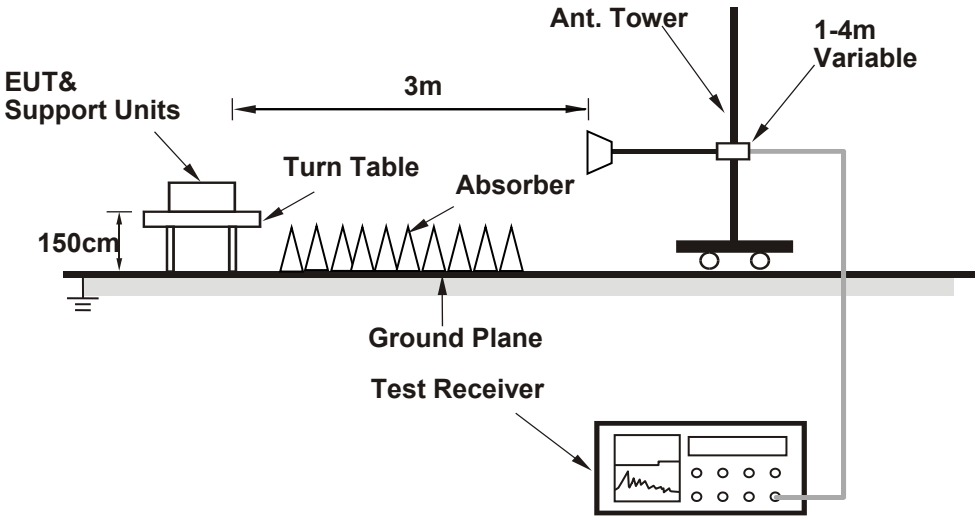
No deviation.

4.1.6 Test Setup

For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.7 EUT Operating Conditions

a. The EUT has been tested as an independent unit without any other accessories or support units. The EUT is DC Power Supply powered. A laptop with a USB dongle was used to change radio setting, such as changing channels, data rate and power setting.

4.1.8 Test Results

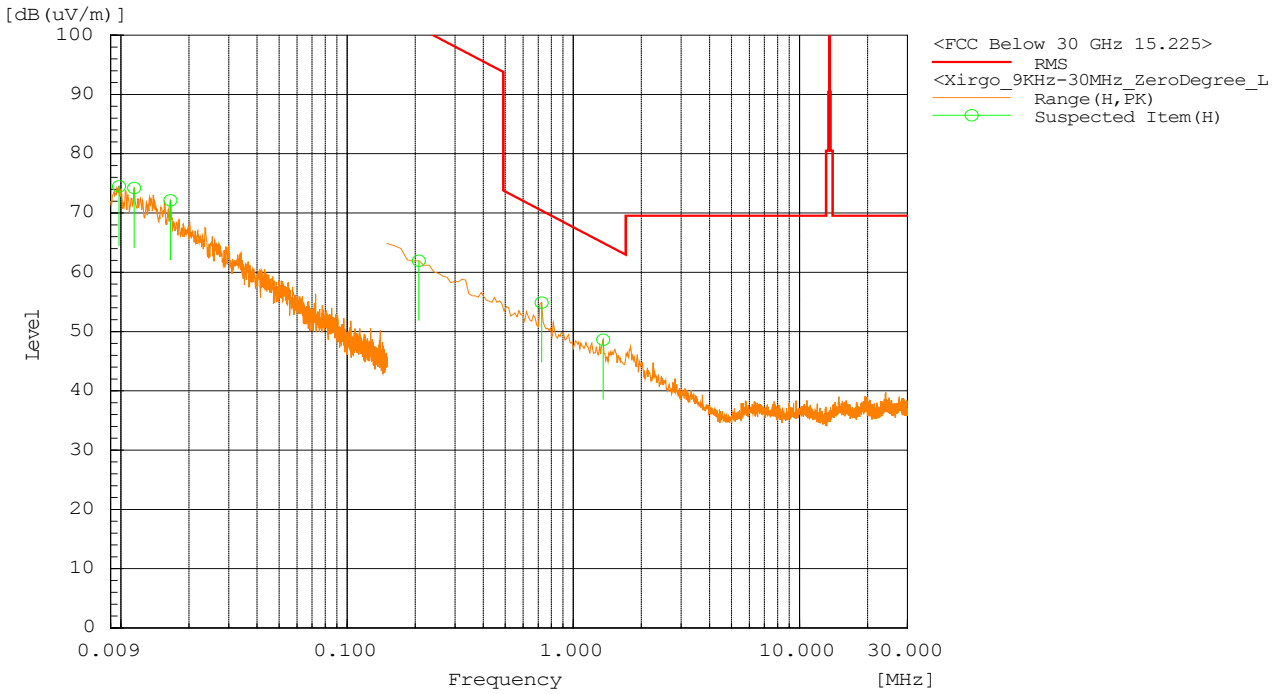
9KHz-30MHz Test Data:

CHANNEL	Channel 0, 2402MHz, Zero Degree, TX ON	**TEST DISTANCE**	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.724	H	6.1	48.8	54.9	70.4	15.5	100	116	Pass
2	1.355	H	4.6	44	48.6	65	16.4	100	235.7	Pass
3	0.207	H	2.7	59.2	61.9	101.3	39.4	100	348.4	Pass
4	0.011	H	-9.2	83.4	74.2	126.4	52.2	100	9.8	Pass
5	0.017	H	-9.3	81.4	72.1	123.2	51.1	100	37.8	Pass
6	0.01	H	-9	83.5	74.5	127.8	53.3	100	11.6	Pass

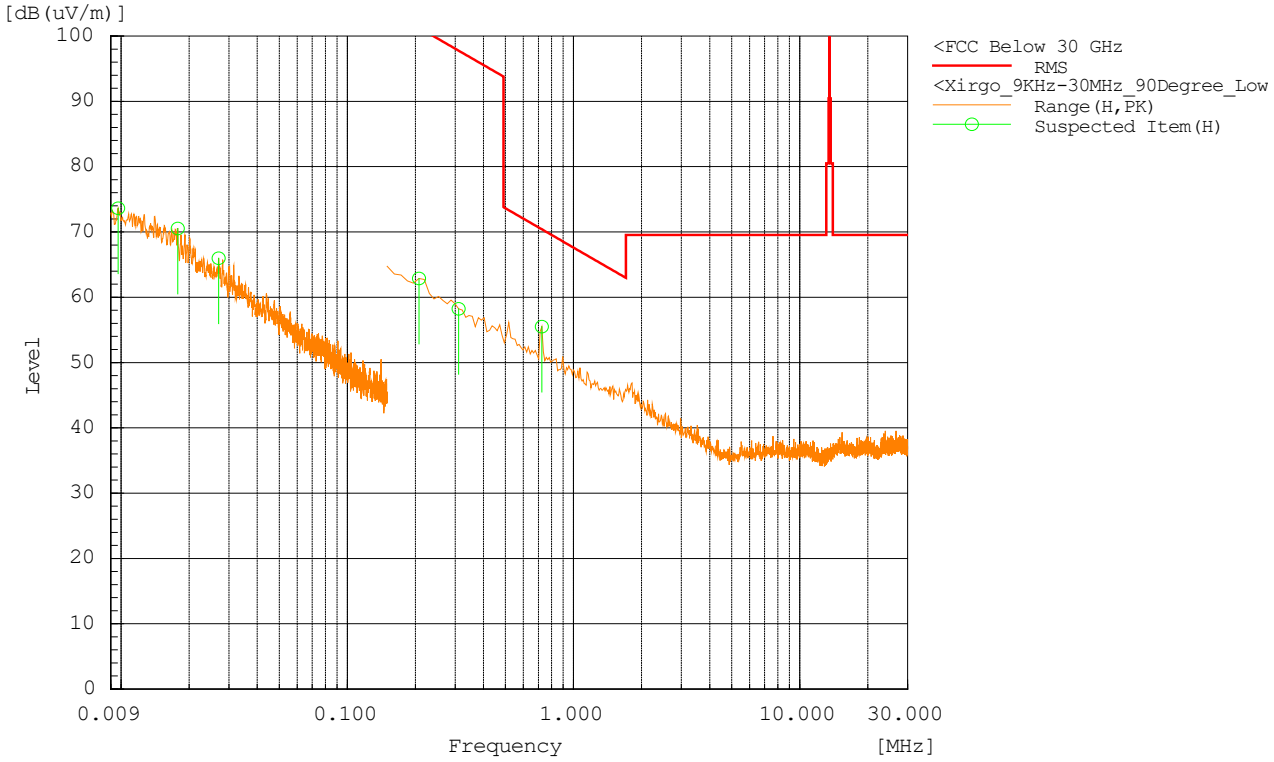
REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



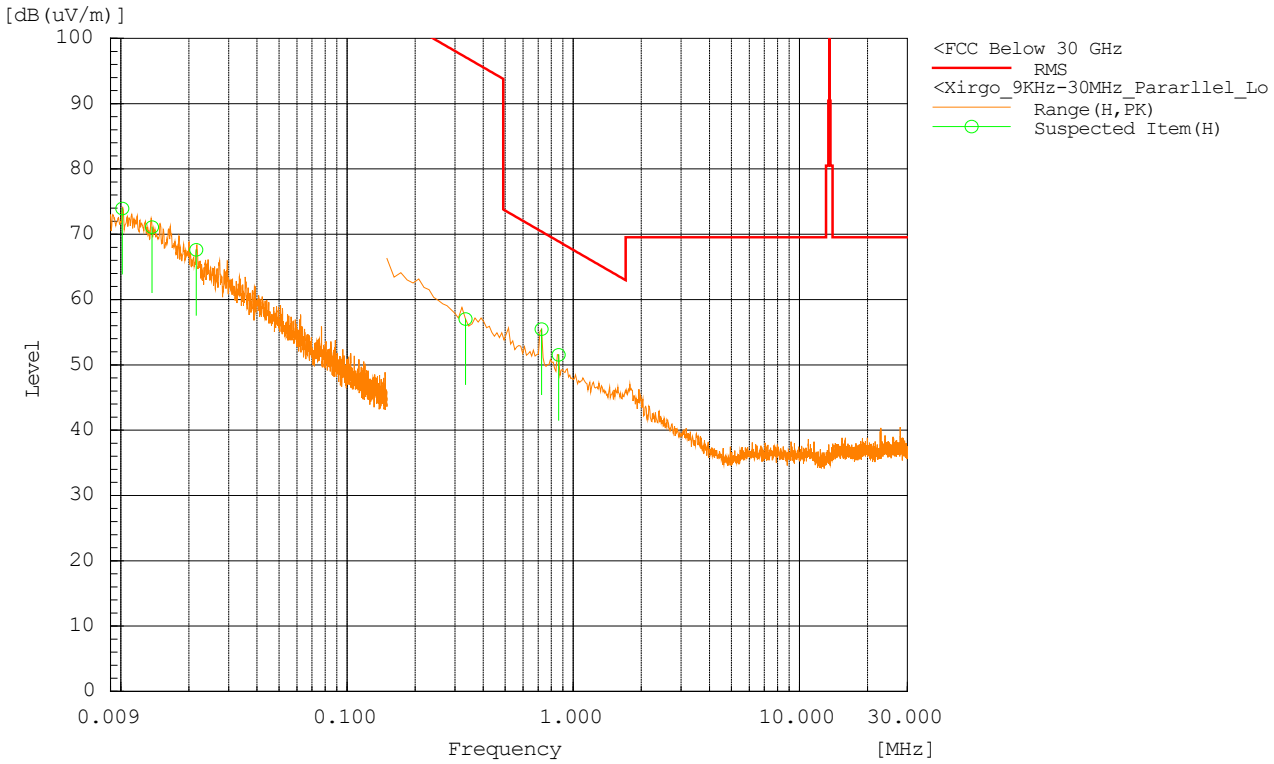
CHANNEL	Channel 0, 2402MHz, 90 Degree, TX ON	**TEST DISTANCE**	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.724	H	6.7	48.8	55.5	70.4	14.9	100	92.4	Pass
2	0.207	H	3.7	59.2	62.9	101.3	38.4	100	143	Pass
3	0.311	H	2.6	55.6	58.2	97.8	39.6	100	25.7	Pass
4	0.01	H	-9.9	83.5	73.6	127.9	54.3	100	0.5	Pass
5	0.018	H	-10.2	80.7	70.5	122.6	52.1	100	56.7	Pass
6	0.027	H	-11	77	66	119	53	100	41	Pass



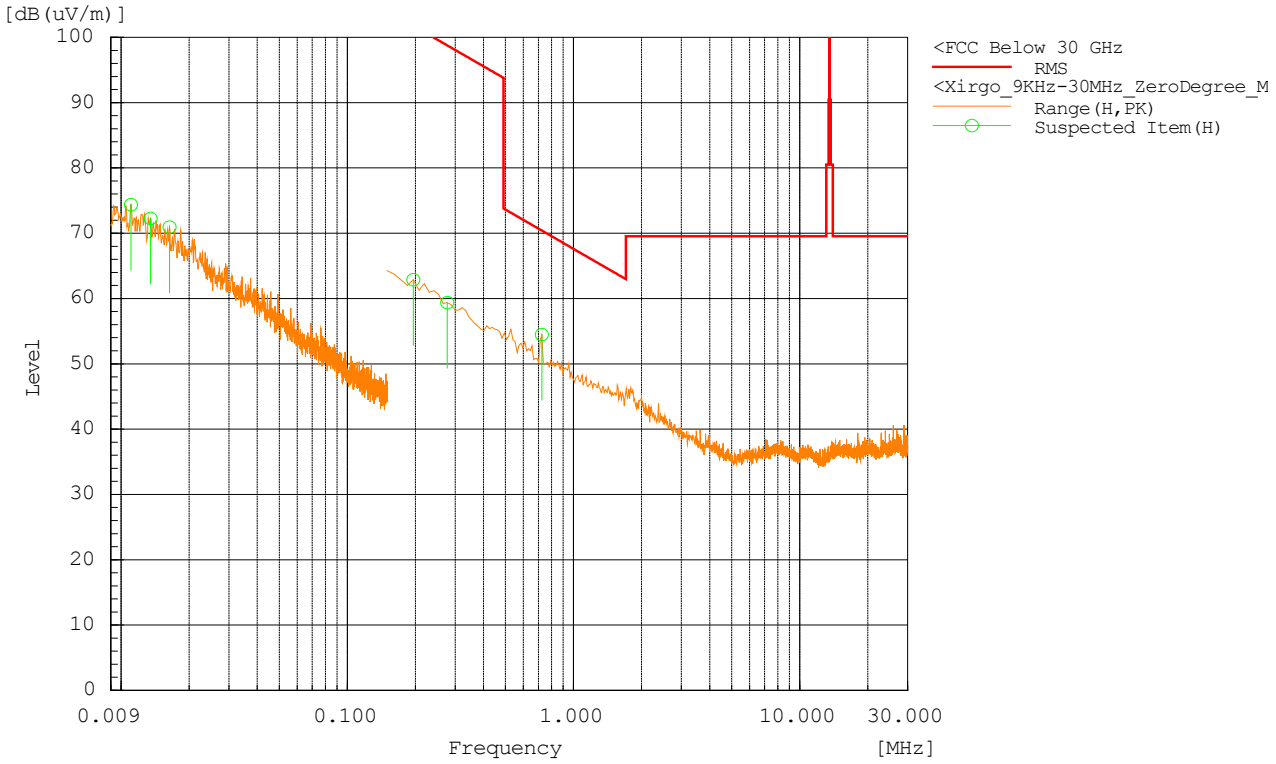
CHANNEL	Channel 0, 2402MHz, Parallel-to-Ground,TX ON	**TEST DISTANCE**	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.724	H	6.7	48.8	55.5	70.4	14.9	100	37.8	Pass
2	0.334	H	2.0	55	57.0	97.1	40.1	100	266.5	Pass
3	0.862	H	4.1	47.4	51.5	68.9	17.4	100	358.9	Pass
4	0.01	H	-9.6	83.5	73.9	127.5	53.6	100	320.7	Pass
5	0.022	H	-11.3	78.9	67.6	120.9	53.3	100	131.7	Pass
6	0.014	H	-11.6	82.7	71.1	124.9	53.8	100	122.8	Pass



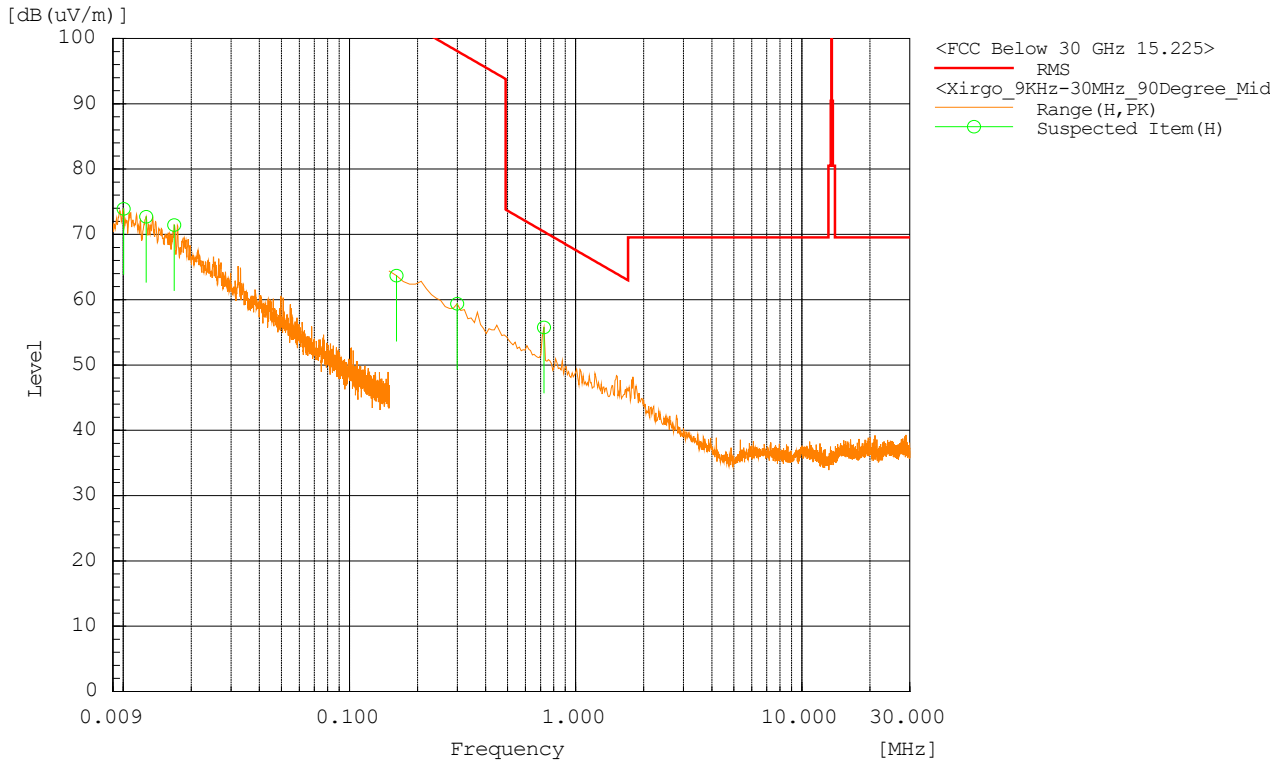
CHANNEL	Channel 19, 2440MHz, Zero Degree, TX ON	**TEST DISTANCE**	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.196	H	3.3	59.6	62.9	101.8	38.9	100	287.6	Pass
2	0.276	H	2.7	56.7	59.4	98.8	39.4	100	13	Pass
3	0.724	H	5.7	48.8	54.5	70.4	15.9	100	264.9	Pass
4	0.011	H	-9	83.4	74.4	126.7	52.3	100	206	Pass
5	0.014	H	-10.5	82.8	72.3	125	52.7	100	296.4	Pass
6	0.016	H	-10.6	81.5	70.9	123.3	52.4	100	65.4	Pass



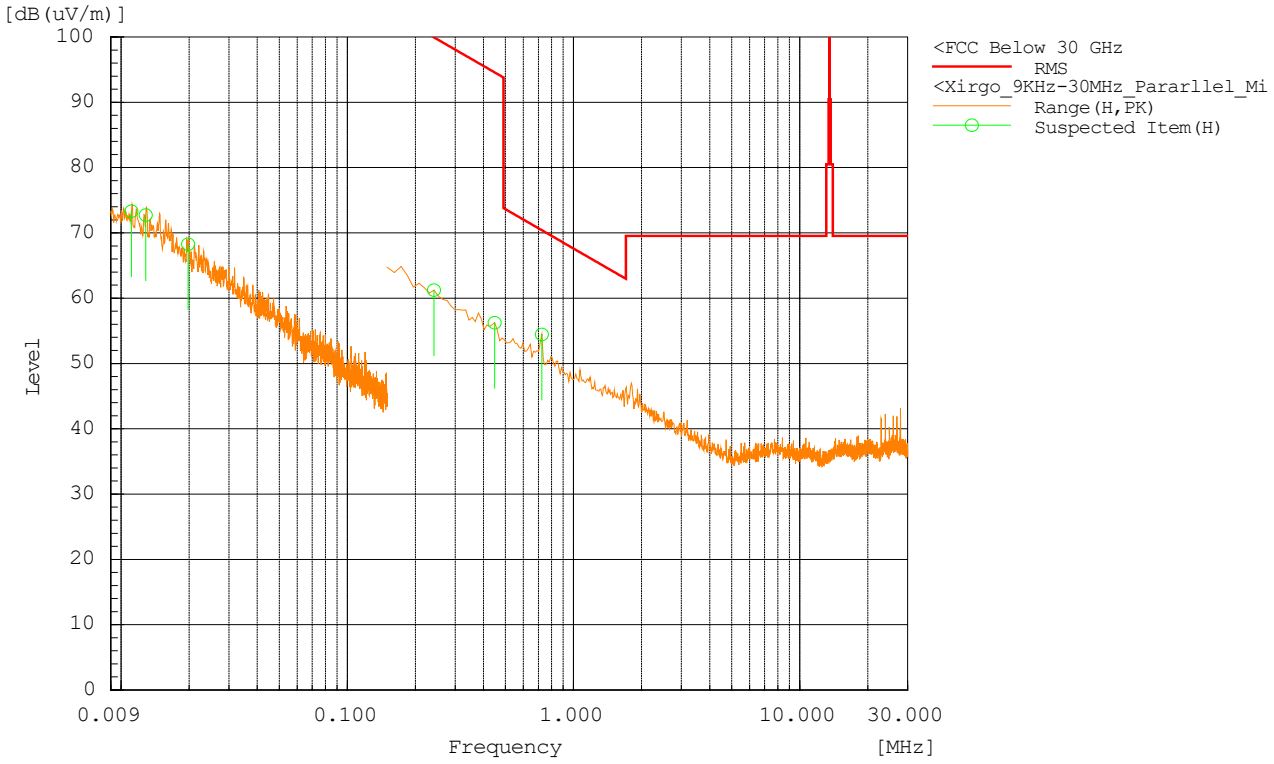
CHANNEL	Channel 19, 2440MHz, 90 Degree, TX ON	**TEST DISTANCE**	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.161	H	2.9	60.8	63.7	103.4	39.7	100	221.3	Pass
2	0.299	H	3.5	55.9	59.4	98.1	38.7	100	342.4	Pass
3	0.724	H	7	48.8	55.8	70.4	14.6	100	186.6	Pass
4	0.01	H	-9.6	83.5	73.9	127.6	53.7	100	8.9	Pass
5	0.013	H	-10.4	83.1	72.7	125.6	52.9	100	310.7	Pass
6	0.017	H	-9.9	81.3	71.4	123.1	51.7	100	10.1	Pass



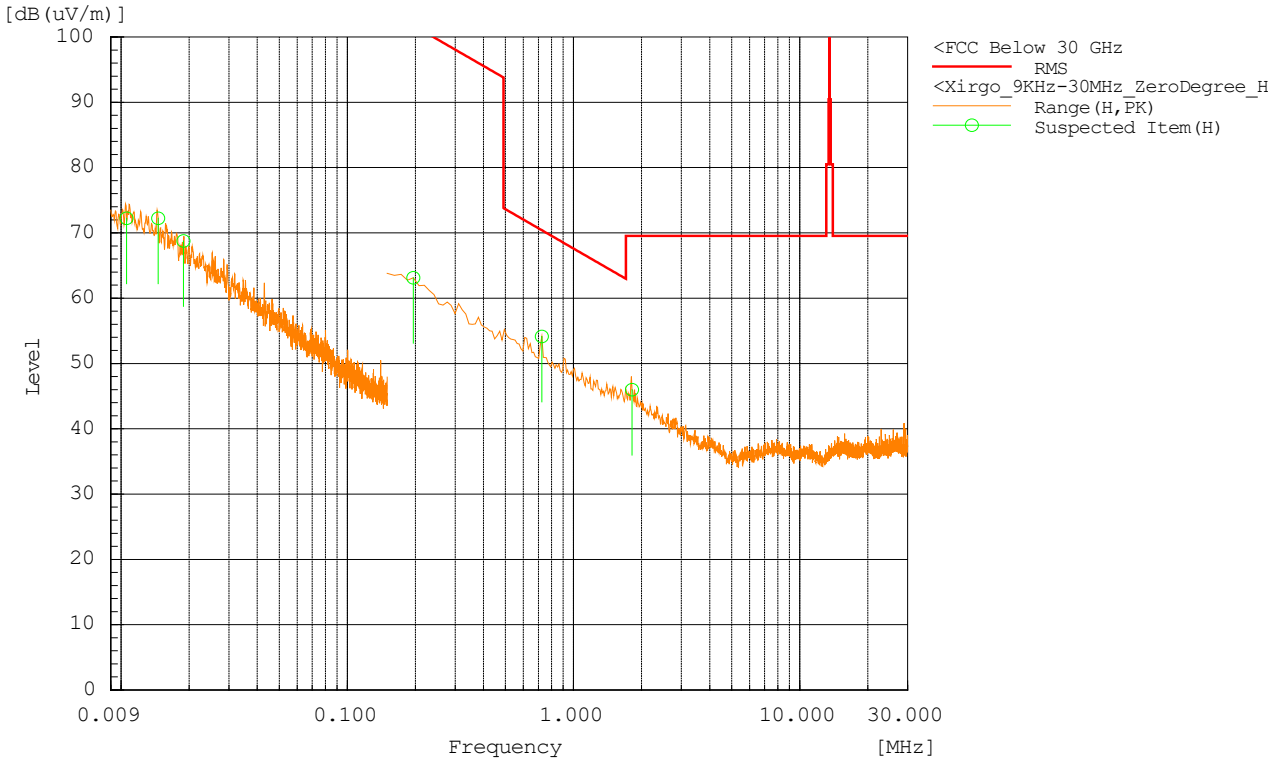
CHANNEL	Channel 19, 2440MHz, Parallel-to-Ground, TX ON	TEST DISTANCE	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.724	H	5.7	48.8	54.5	70.4	15.9	100	351.1	Pass
2	0.242	H	3.3	57.9	61.2	99.9	38.7	100	2.4	Pass
3	0.449	H	3.6	52.6	56.2	94.6	38.4	100	28.2	Pass
4	0.011	H	-10.1	83.4	73.3	126.7	53.4	100	163.7	Pass
5	0.013	H	-10.3	83	72.7	125.4	52.7	100	171.5	Pass
6	0.02	H	-11.4	79.7	68.3	121.7	53.4	100	6.9	Pass



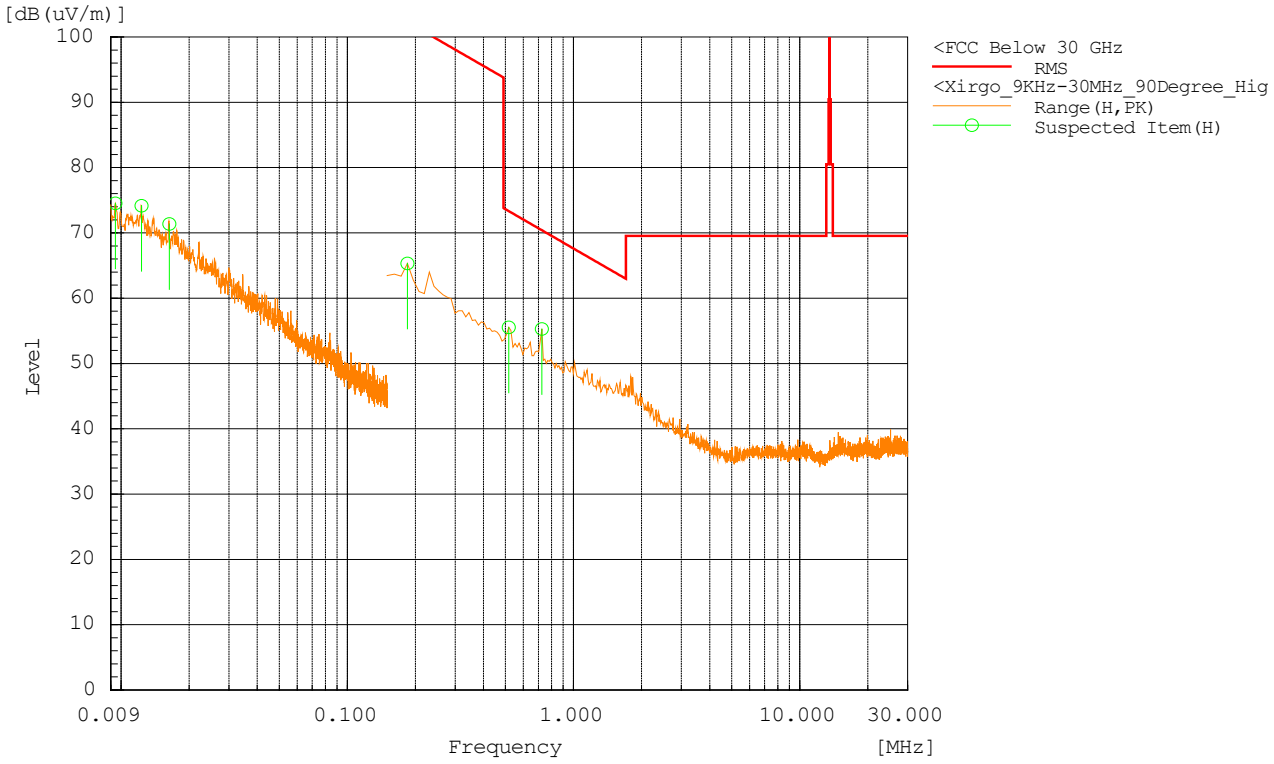
CHANNEL	Channel 39, 2480MHz, Zero Degree, TX ON	**TEST DISTANCE**	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.196	H	3.5	59.6	63.1	101.8	38.7	100	157.6	Pass
2	0.724	H	5.3	48.8	54.1	70.4	16.3	100	290.3	Pass
3	1.815	H	4	42	46	69.5	23.5	100	263.6	Pass
4	0.015	H	-10.1	82.3	72.2	124.3	52.1	100	7.8	Pass
5	0.011	H	-11.3	83.5	72.2	127.1	54.9	100	154.2	Pass
6	0.019	H	-11.4	80.2	68.8	122.1	53.3	100	22.7	Pass



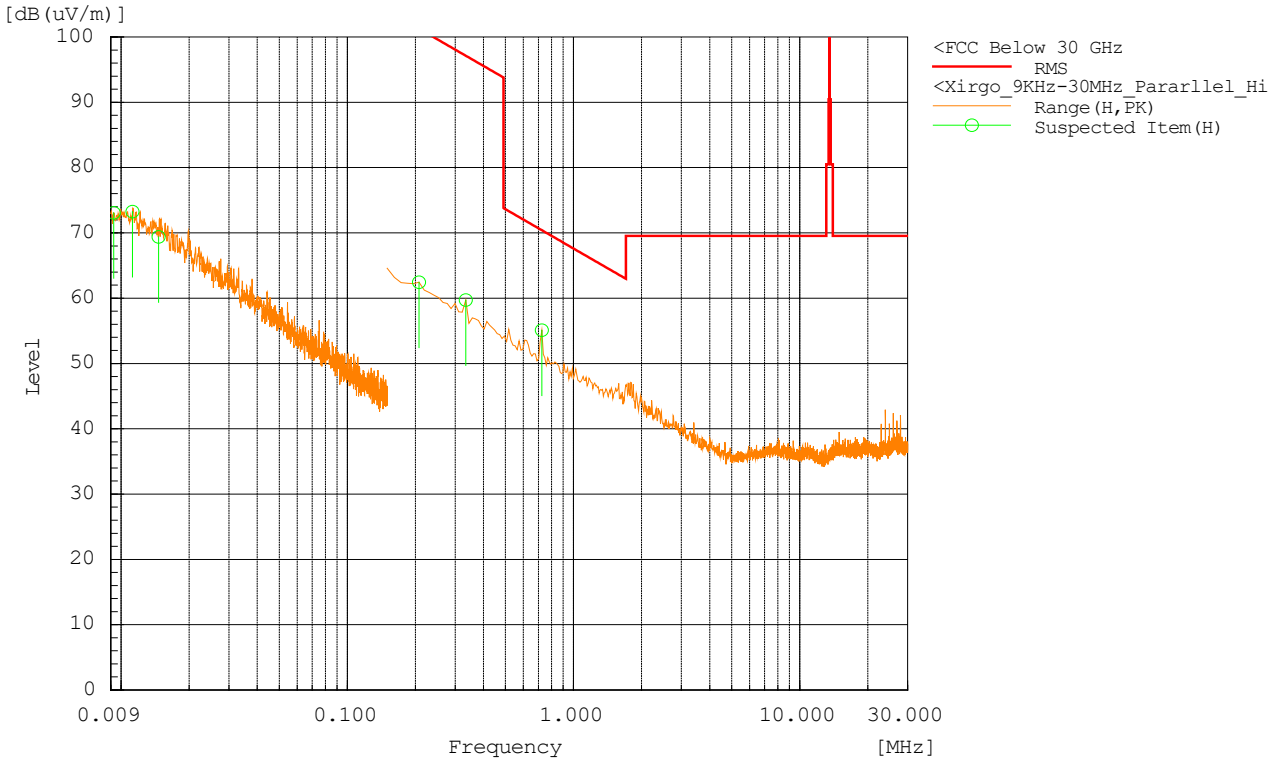
CHANNEL	Channel 39, 2480MHz, 90 Degree, TX ON	TEST DISTANCE	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.184	H	5.4	59.9	65.3	102.3	37	100	10.5	Pass
2	0.517	H	4.1	51.4	55.5	73.3	17.8	100	97.1	Pass
3	0.724	H	6.5	48.8	55.3	70.4	15.1	100	59.6	Pass
4	0.009	H	-9	83.5	74.5	128.1	53.6	100	120.8	Pass
5	0.012	H	-9	83.2	74.2	125.8	51.6	100	220.2	Pass
6	0.016	H	-10.1	81.5	71.4	123.3	51.9	100	353.4	Pass



CHANNEL	Channel 39, 2480MHz, Parallel-to-Ground, TX ON	TEST DISTANCE	3 meter
FREQUENCY RANGE	9KHz – 30MHz		

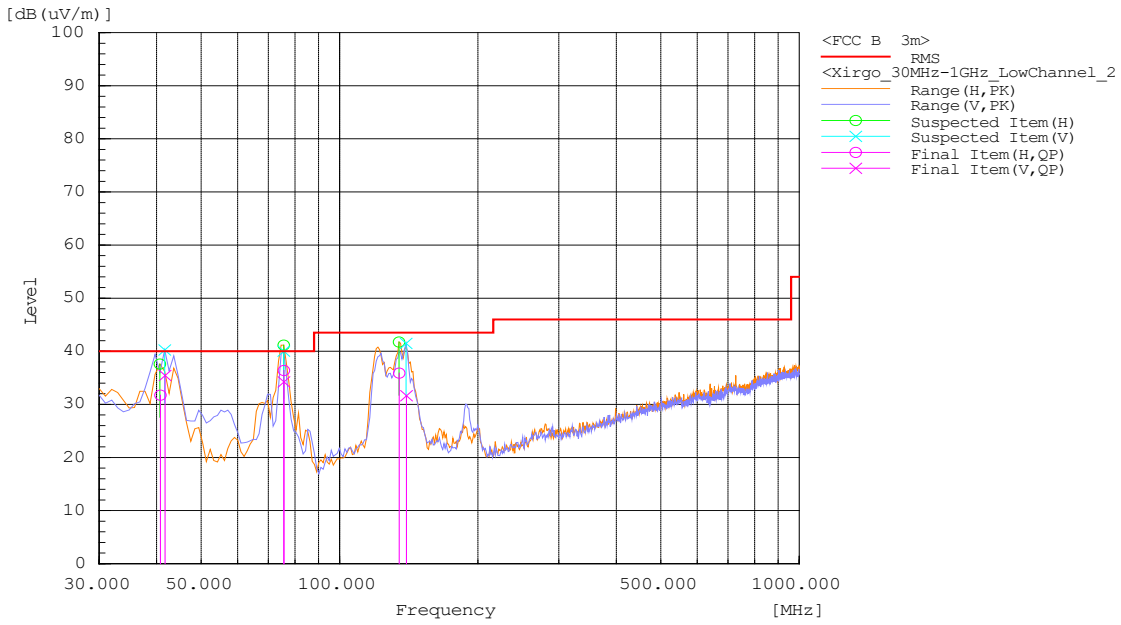
Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading Pk [dB(uV)]	Factor [dB(1/m)]	Level Pk [dB(uV/m)]	Limit\Pk dB(uV/m)	Margin Pk [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	0.207	H	3.3	59.2	62.5	101.3	38.8	100	81.2	Pass
2	0.334	H	4.7	55	59.7	97.1	37.4	100	162.7	Pass
3	0.724	H	6.3	48.8	55.1	70.4	15.3	100	141.6	Pass
4	0.011	H	-10.1	83.4	73.3	126.6	53.3	100	204.2	Pass
5	0.015	H	-12.9	82.3	69.4	124.3	54.9	100	304.3	Pass
6	0.009	H	-10.4	83.5	73.1	128.3	55.2	100	356.6	Pass



30MHz – 1GHz Data:

CHANNEL	Channel 0, 2402MHz	**DETECTOR FUNCTION**	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	40.759	H	12.6	19.1	31.7	40	-8.3	276.1	109.7	Pass
2	41.738	V	18.2	17.2	35.4	40	-4.6	328.9	334.1	Pass
3	75.693	H	23.1	13.3	36.4	40	-3.6	376.3	49	Pass
4	75.678	V	21.5	12.8	34.3	40	-5.7	380.4	144.6	Pass
5	134.897	H	16.6	19.3	35.9	43.5	-7.6	175.7	233.8	Pass
6	139.768	V	12.3	19.4	31.7	43.5	-11.8	146.2	200.7	Pass

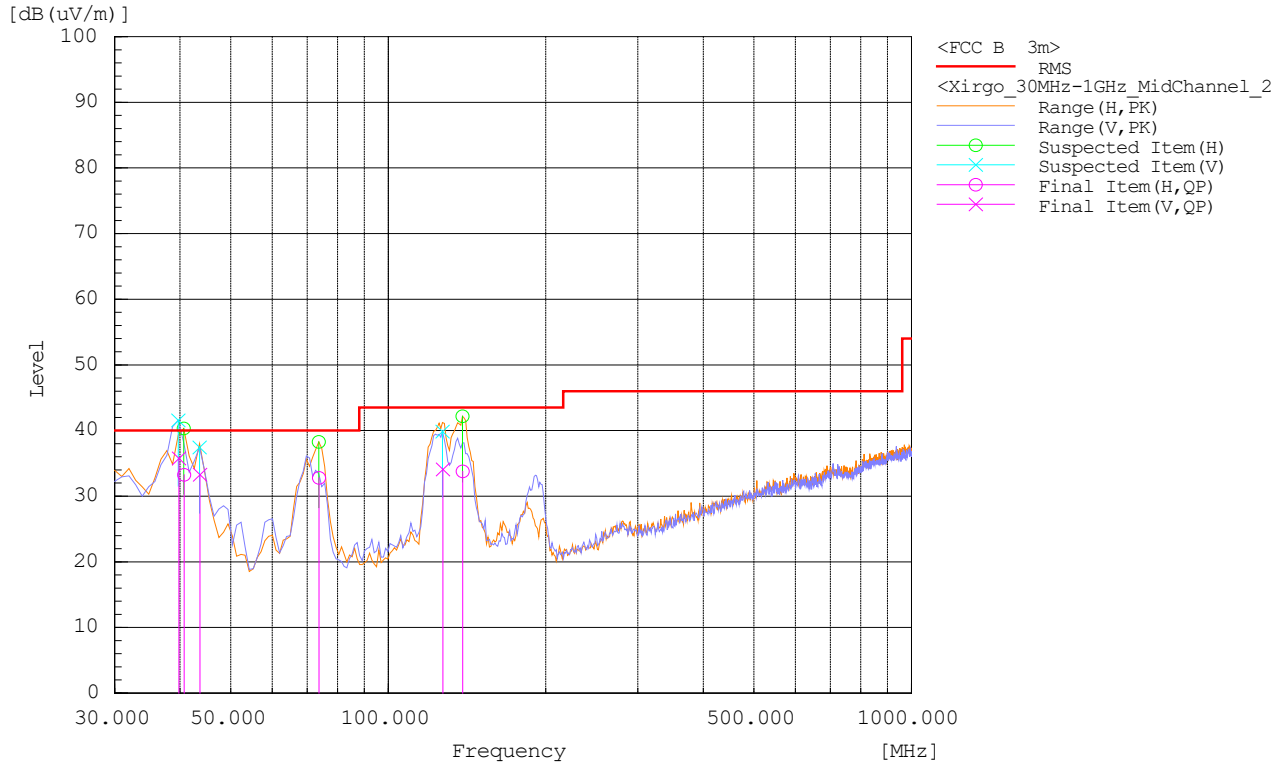


REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

CHANNEL	Channel 19, 2440MHz	**DETECTOR FUNCTION**	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	39.793	V	17.3	18.5	35.8	40	-4.2	100.1	350.7	Pass
2	40.756	H	14.1	19.1	33.2	40	-6.8	282.8	359.4	Pass
3	43.658	V	17.3	16	33.3	40	-6.7	350.4	87.3	Pass
4	73.729	H	19.4	13.4	32.8	40	-7.2	231.6	63.2	Pass
5	127.144	V	14.5	19.6	34.1	43.5	-9.4	397.7	0	Pass
6	138.749	H	14.7	19.1	33.8	43.5	-9.7	157.5	232.2	Pass

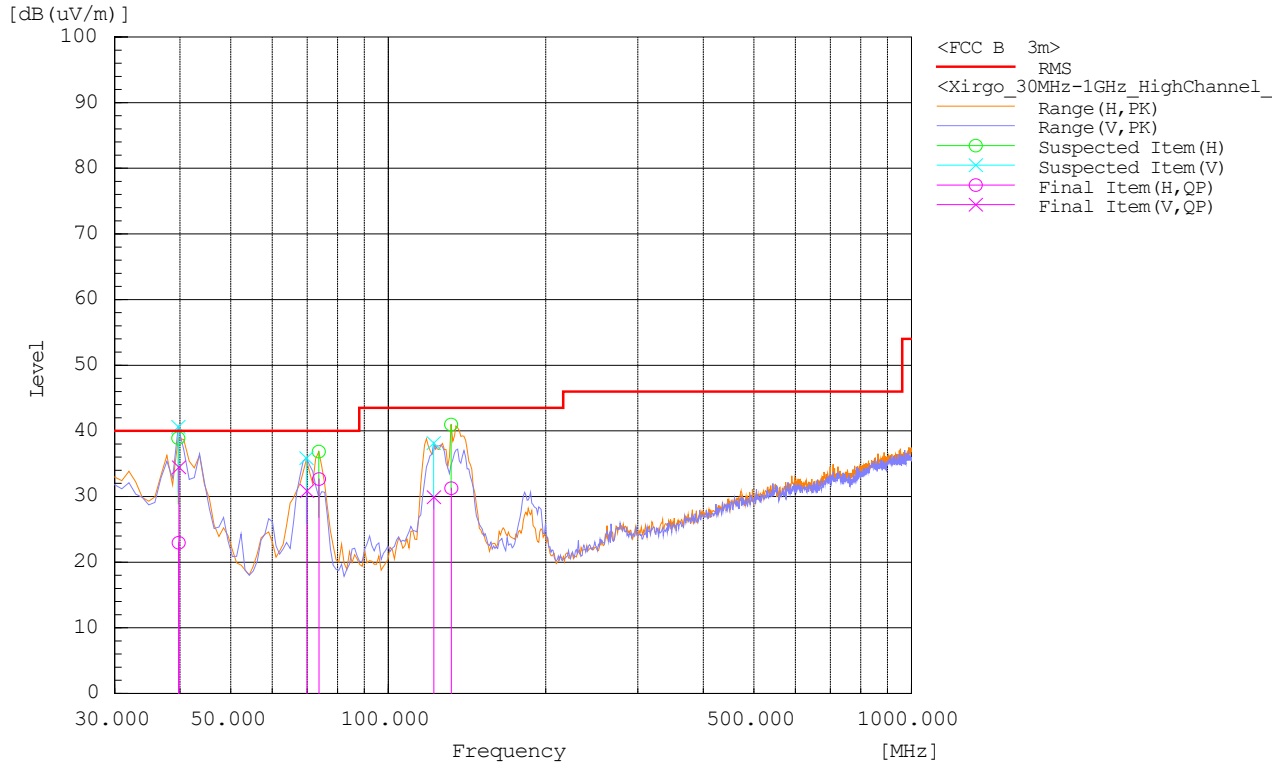


REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

CHANNEL	Channel 39, 2480MHz	**DETECTOR FUNCTION**	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	39.795	V	16.0	18.5	34.5	40	-5.5	110.9	313.3	Pass
2	39.784	H	3.3	19.7	23.0	40	-17.0	132.7	0	Pass
3	69.917	V	17.9	13	30.9	40	-9.1	269.4	1.1	Pass
4	73.765	H	19.4	13.3	32.7	40	-7.3	219.9	136.7	Pass
5	122.268	V	10.4	19.5	29.9	43.5	-13.6	400.0	229.6	Pass
6	132.033	H	12.0	19.3	31.3	43.5	-12.2	297.1	237.1	Pass



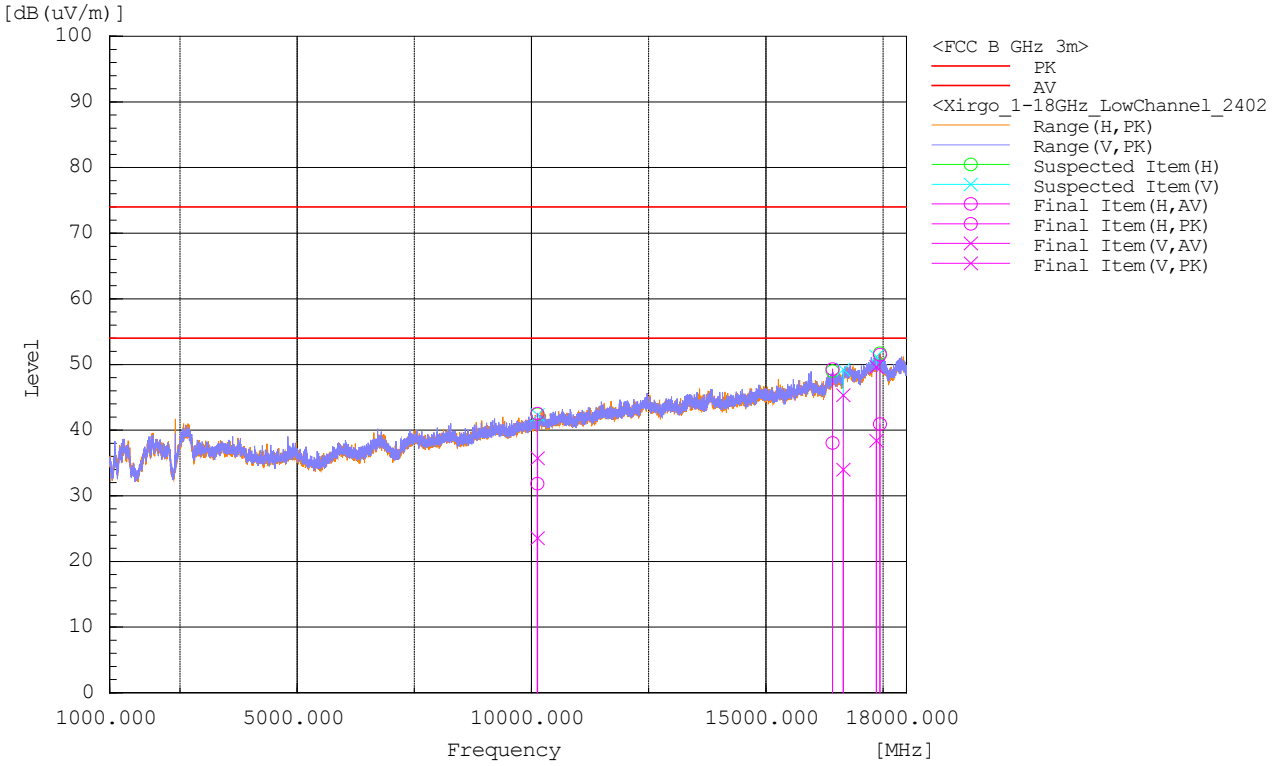
REMARKS:

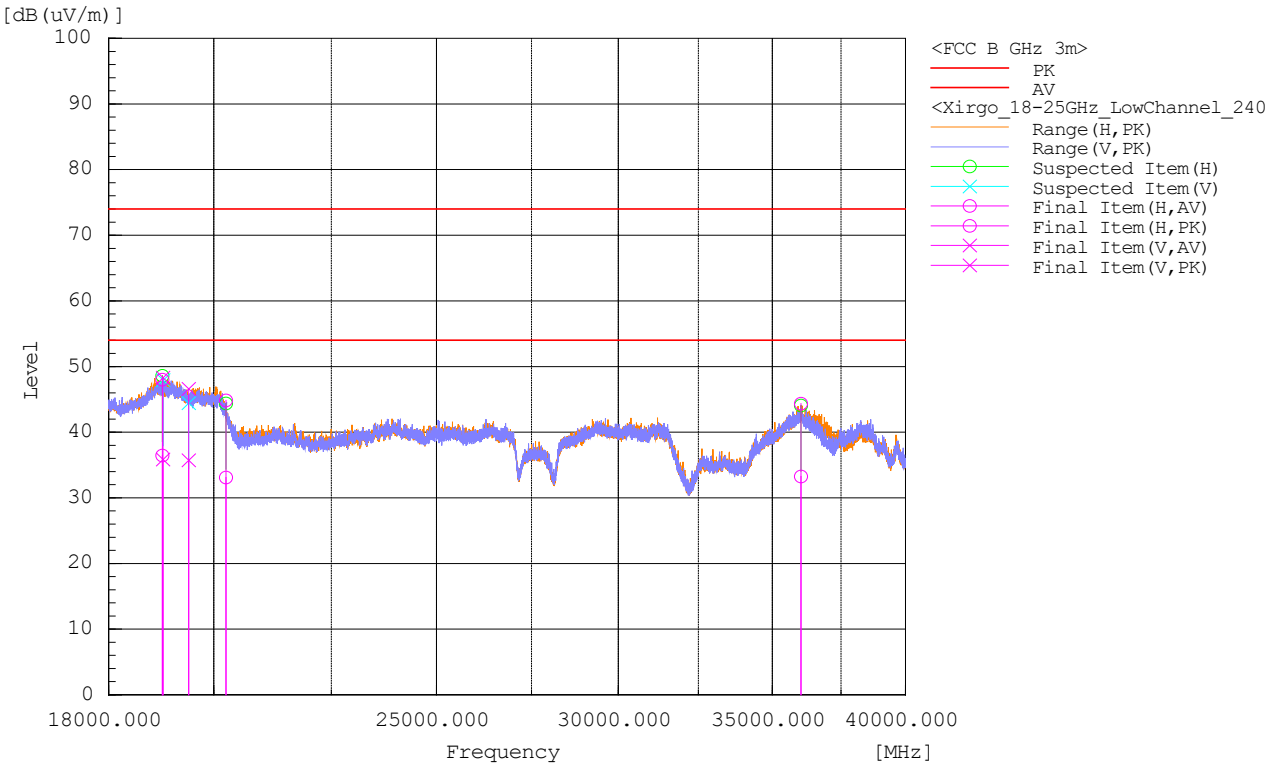
1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

1 GHz – 25 GHz Test Data:

CHANNEL	Channel 0, 2402MHz	**DETECTOR FUNCTION**	Peak / Average
FREQUENCY RANGE	1 GHz – 25 GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	**Frequency (MHz)**	**Polarization (H/V)**	**Reading AV [dB(uV)]**	**Reading PK [dB(uV)]**	**Factor [dB(1/m)]**	**Level AV [dB(uV/m)]**	**Level PK dB(uV/m)**	**Limit AV dB(uV/m)**	**Limit PK [dB(uV/m)**	**Margin AV [dB]**	**Margin PK [dB]**	**Height (cm)**	**Angle (Deg)**	**Pass/ Fail**
1	10127.87	V	24.7	36.8	-1.1	23.6	35.7	54	74	-30.4	-38.3	224.7	234.2	Pass
2	10126.72	H	33	43.6	-1.1	31.9	42.5	54	74	-22.1	-31.5	344.6	186.3	Pass
3	18997.29	H	26.9	38.5	9.5	36.4	48.0	54	74	17.6	-26.0	196.9	107.3	Pass
4	19008.97	V	26.4	38.8	9.5	35.9	48.3	54	74	18.1	-25.7	225.5	218.0	Pass
5	20246.13	H	28.2	39.9	4.9	33.1	44.8	54	74	20.9	-29.2	262.8	287.7	Pass
6	19503.22	V	26.9	37.8	8.8	35.7	46.6	54	74	18.3	-27.4	400	250.0	Pass



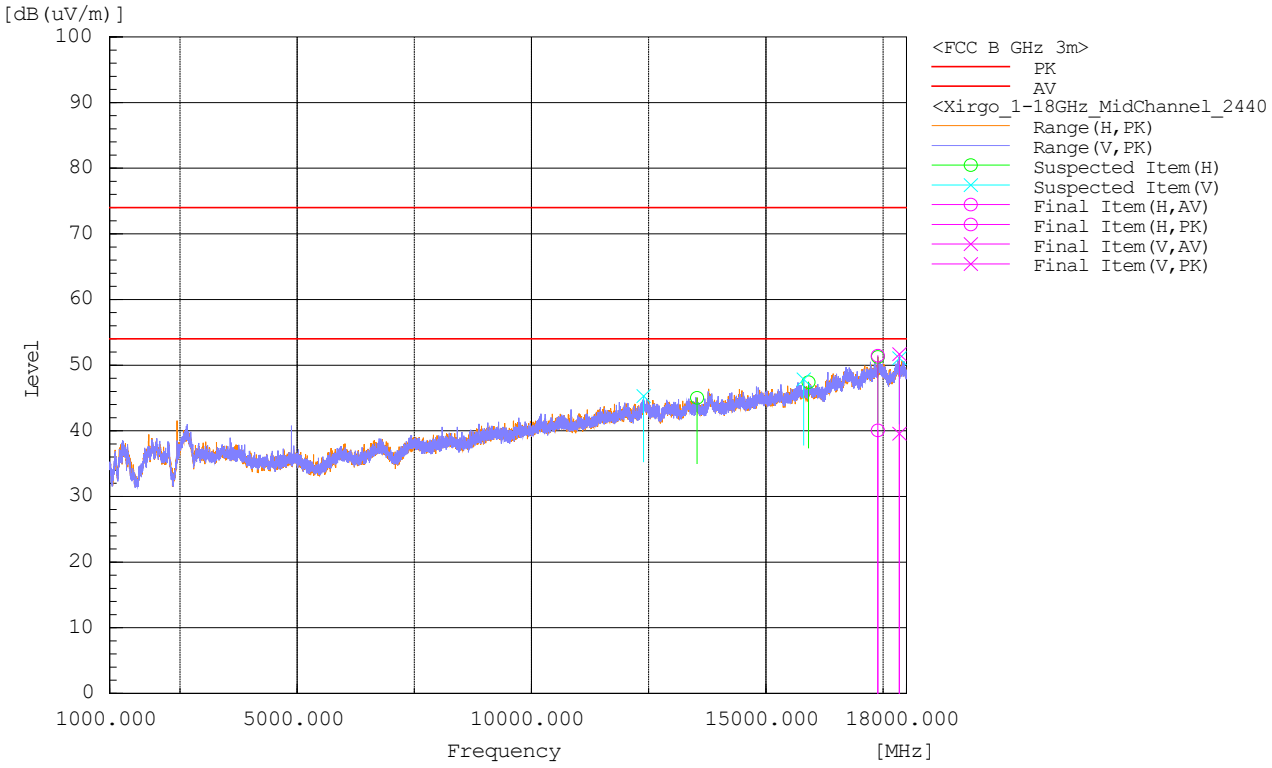


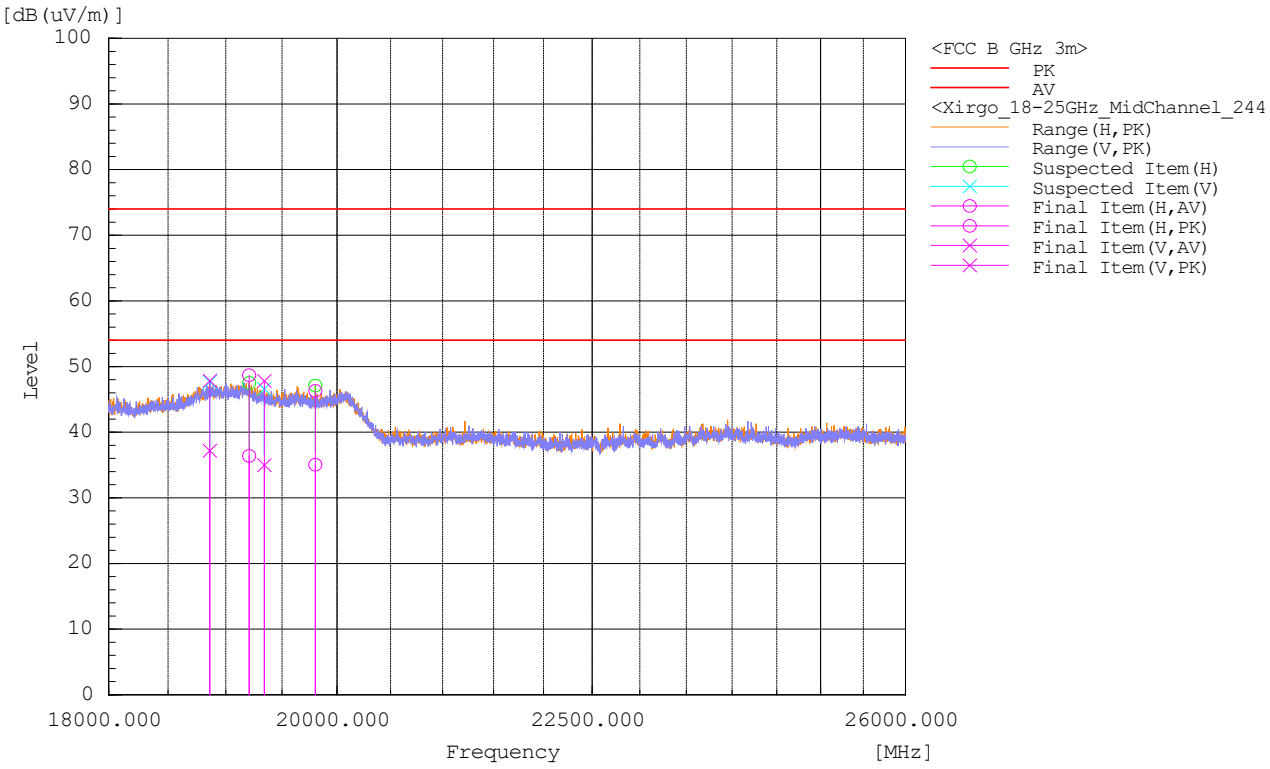
REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.

CHANNEL	Channel 19, 2440MHz	**DETECTOR FUNCTION**	Peak / Average
FREQUENCY RANGE	1 GHz – 25 GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	**Frequency (MHz)**	**Polarization (H/V)**	**Reading AV [dB(uV)]**	**Reading PK [dB(uV)]**	**Factor [dB(1/m)]**	**Level AV [dB(uV/m)]**	**Level PK dB(uV/m)**	**Limit AV dB(uV/m)**	**Limit PK [dB(uV/m)**	**Margin AV [dB]**	**Margin PK [dB]**	**Height (cm)**	**Angle (Deg)**	**Pass/ Fail**
1	17390.2	H	31.6	42.9	8.5	40.1	51.4	54	74	-13.9	-22.6	143.3	147.6	Pass
2	17848.85	V	30.1	42.2	9.5	39.6	51.7	54	74	-14.4	-22.3	176.5	33.1	Pass
3	18859.26	V	27.8	38.4	9.4	37.2	47.8	54	74	-16.8	-26.2	306.9	202.6	Pass
4	19206.71	H	27.2	39.5	9.2	36.4	48.7	54	74	-17.6	-25.3	351.7	29.5	Pass
5	19341.07	V	26.0	38.8	9.0	35.0	47.8	54	74	-19.0	-26.2	323.9	3.7	Pass
6	19802.0	H	27.0	38.2	8.1	35.1	46.3	54	74	-18.9	-27.7	130.4	300.4	Pass



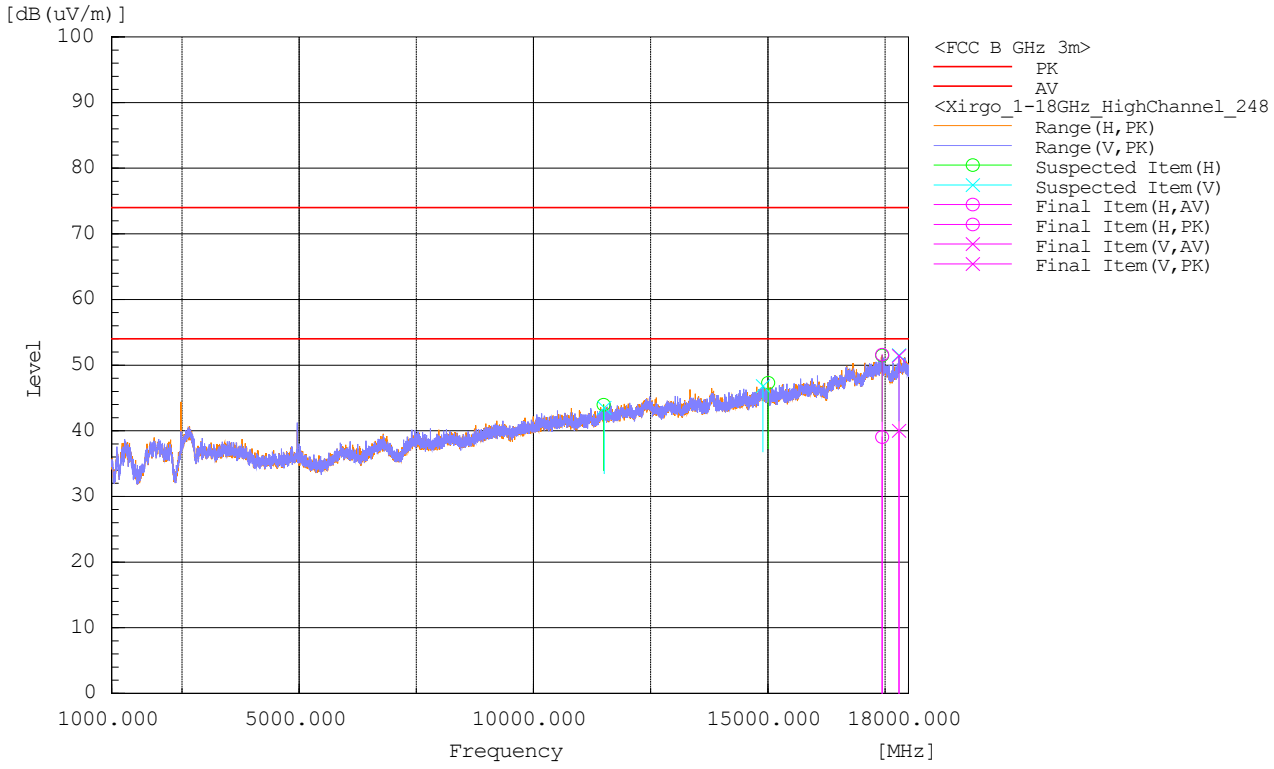


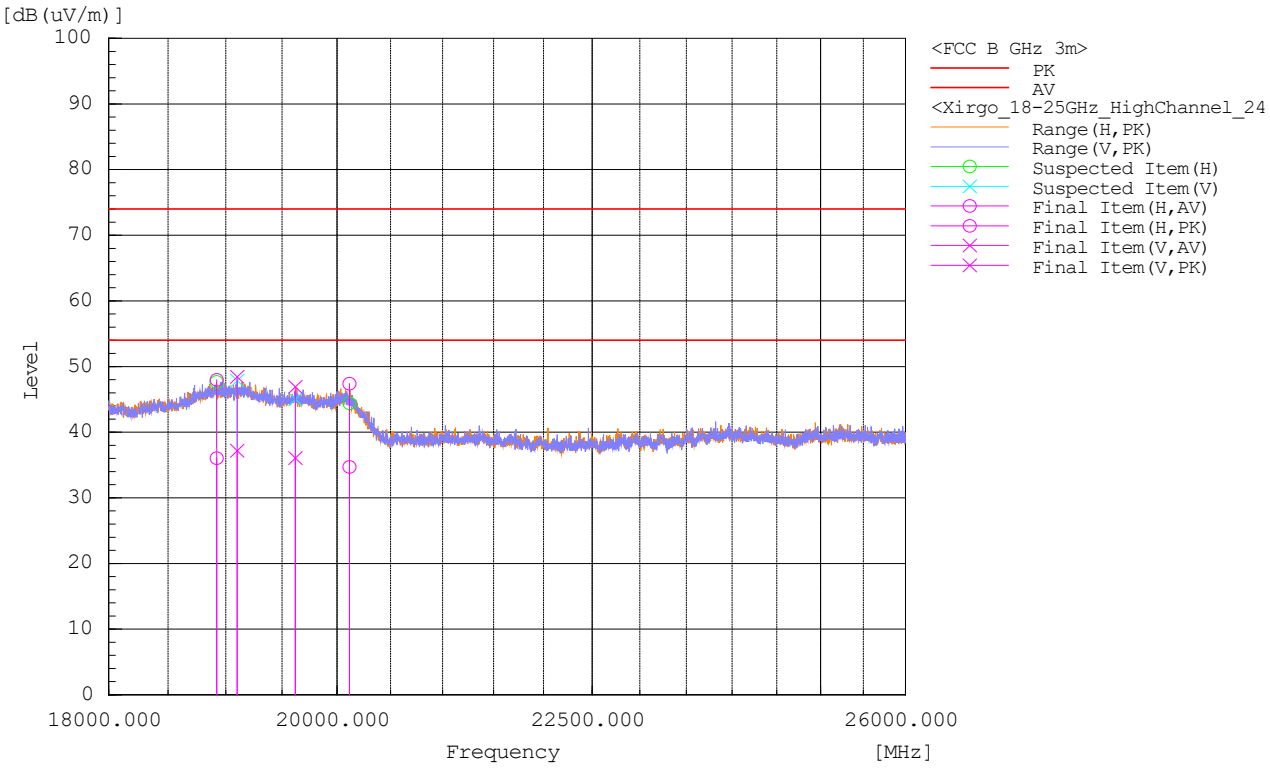
REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.

CHANNEL	Channel 39, 2480MHz	DETECTOR FUNCTION	Peak / Average
FREQUENCY RANGE	1 GHz – 25 GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	17437.87	H	30	42.6	9	39	51.6	54	74	-15.0	-22.4	296.9	0	Pass
2	17797.95	V	30.7	42.1	9.3	40	51.4	54	74	-14.0	-22.6	175.8	173.4	Pass
3	18920.83	H	26.6	38.6	9.4	36	48	54	74	-18.0	-26.0	262.9	186.6	Pass
4	19100.51	V	27.8	39	9.4	37.2	48.4	54	74	-16.8	-25.6	396	131.5	Pass
5	19618.51	V	27.4	38.2	8.7	36.1	46.9	54	74	-17.9	-27.1	296.7	287.2	Pass
6	20115.55	H	27.3	40	7.4	34.7	47.4	54	74	-19.3	-26.6	263	133.8	Pass





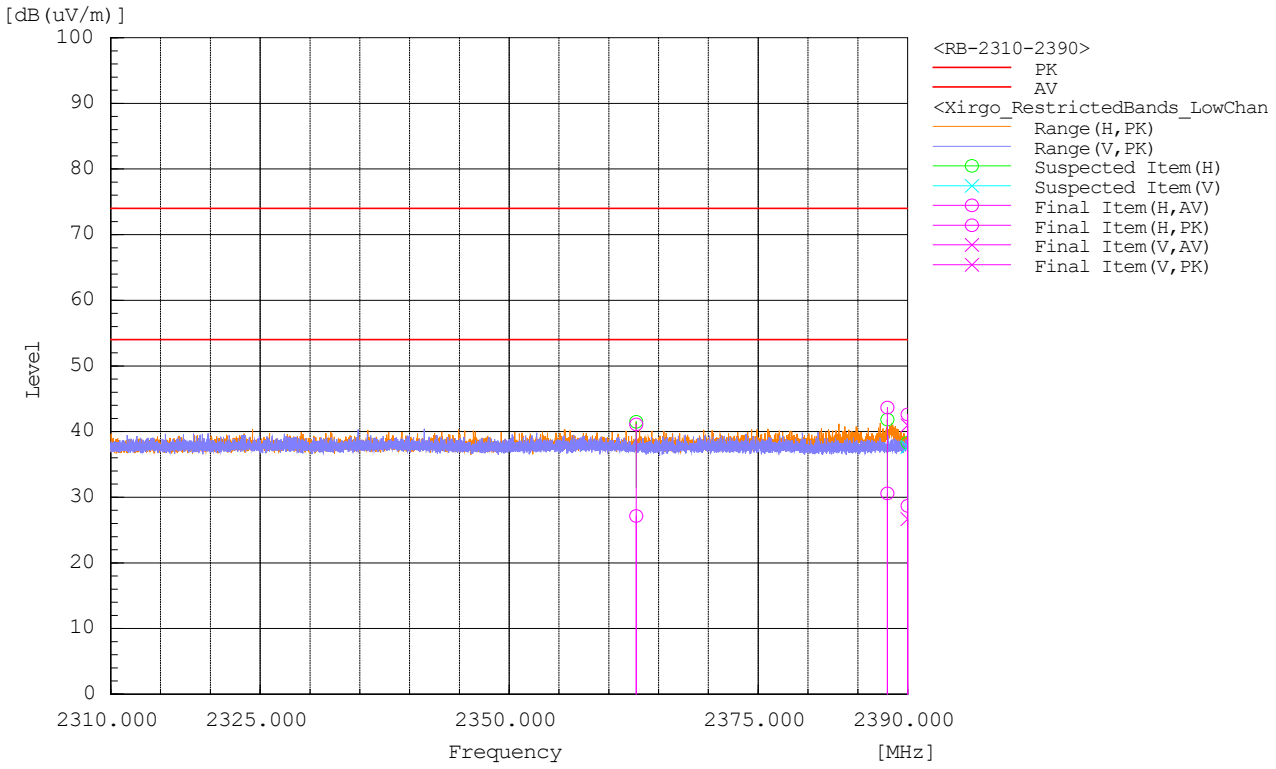
REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.

Restricted Band

CHANNEL	Channel 0, 2402MHz	DETECTOR FUNCTION	Peak / Average
FREQUENCY RANGE	2310 - 2390 MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	2362.76	H	38.9	52.9	-11.8	27.1	41.1	54	74	-26.9	-32.9	323	189.9	Pass
2	2387.968	H	42.3	55.4	-11.7	30.6	43.7	54	74	-23.4	-30.3	135.3	287	Pass
3	2390	H	40.4	54.3	-11.7	28.7	42.6	54	74	-25.3	-31.4	312.5	321.1	Pass
4	2390	V	38.4	52.7	-11.7	26.7	41	54	74	-27.3	-33.0	351.1	226.3	Pass



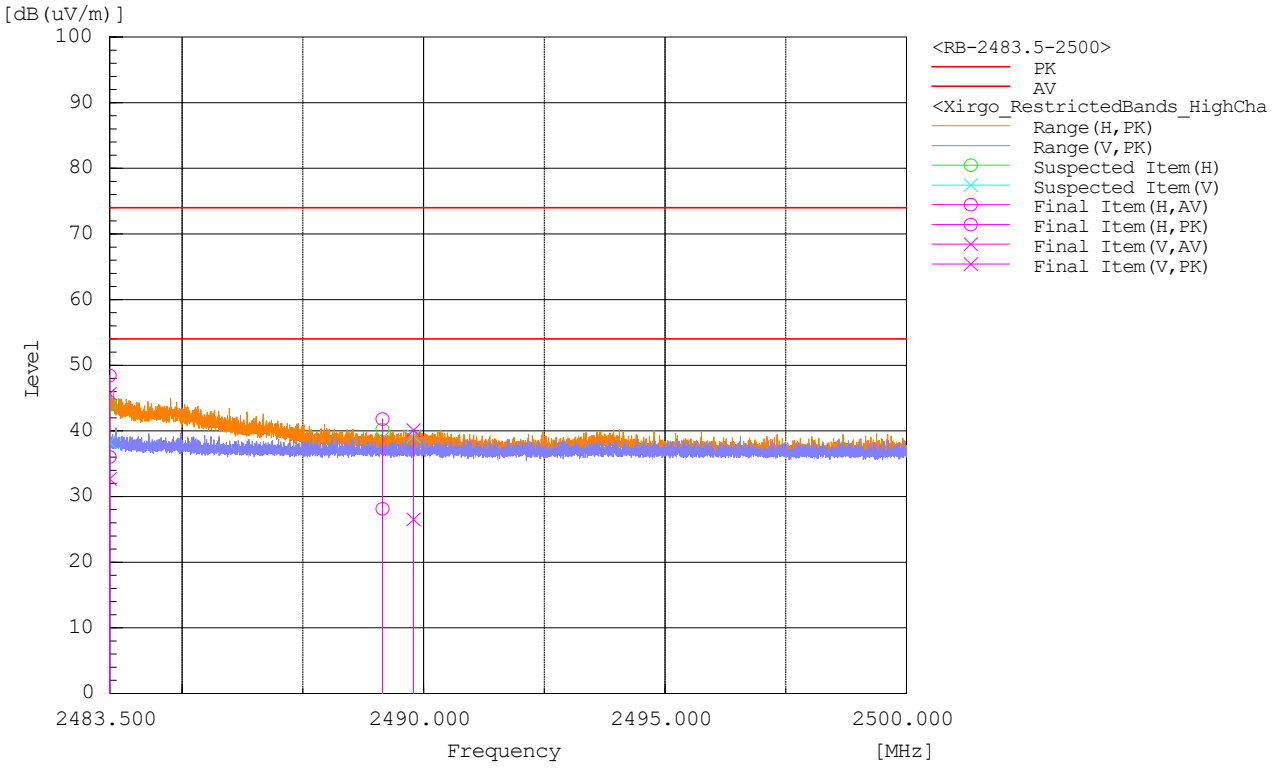
REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) –Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value (dBuV/m)

Restricted Band

CHANNEL	Channel 39, 2480MHz	DETECTOR FUNCTION	Peak / Average
FREQUENCY RANGE	2483.5 - 2500 MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	2483.5	H	48.9	61.3	-12.9	36	48.4	54	74	-18.0	-25.6	153.4	56.8	Pass
2	2483.5	V	45.6	58.6	-12.9	32.7	45.7	54	74	-21.3	-28.3	384.9	275.3	Pass
3	2489.15	H	41.1	54.7	-12.9	28.2	41.8	54	74	-25.8	-32.2	316.6	86.9	Pass
4	2489.792	V	39.4	53	-12.9	26.5	40.1	54	74	-27.5	-33.9	367.4	240.1	Pass



REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) –Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value (dBuV/m)

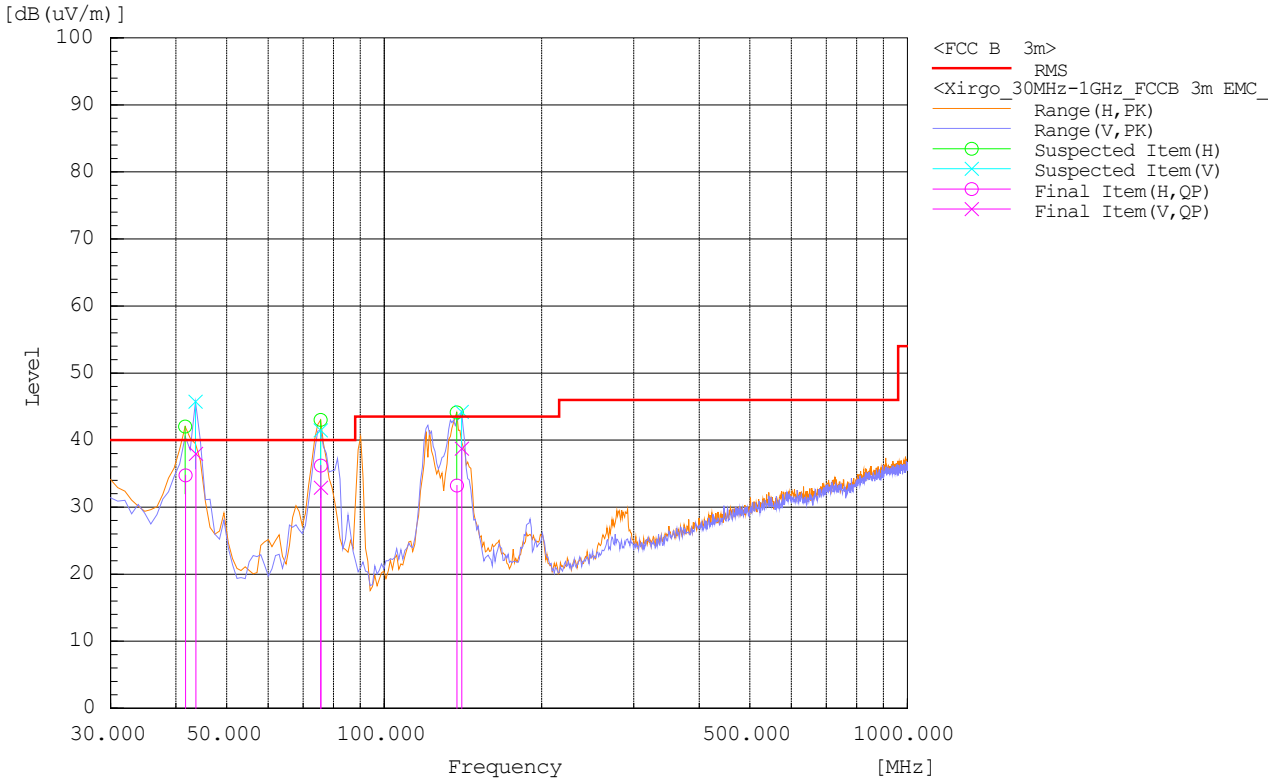
Receiver Spurious Emissions

Mode	Receiver Mode	DETECTOR FUNCTION	Peak / Average
FREQUENCY RANGE	30 - 1000 MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No	Frequency (MHz)	Polarization	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	41.747	H	16.4	18.3	34.7	40	-5.3	363.7	215.0	Pass
2	43.668	V	22.0	16.0	38.0	40	-2.0	310.9	357.8	Pass
3	75.705	H	22.9	13.3	36.2	40	-3.8	227.7	178.6	Pass
4	75.713	V	20.1	12.8	32.9	40	-7.1	366.0	221.8	Pass
5	137.697	H	14.0	19.2	33.2	43.5	-10.3	311.1	217.9	Pass
6	140.704	V	19.4	19.3	38.7	43.5	-4.8	372.2	192.0	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) –Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value (dBuV/m)

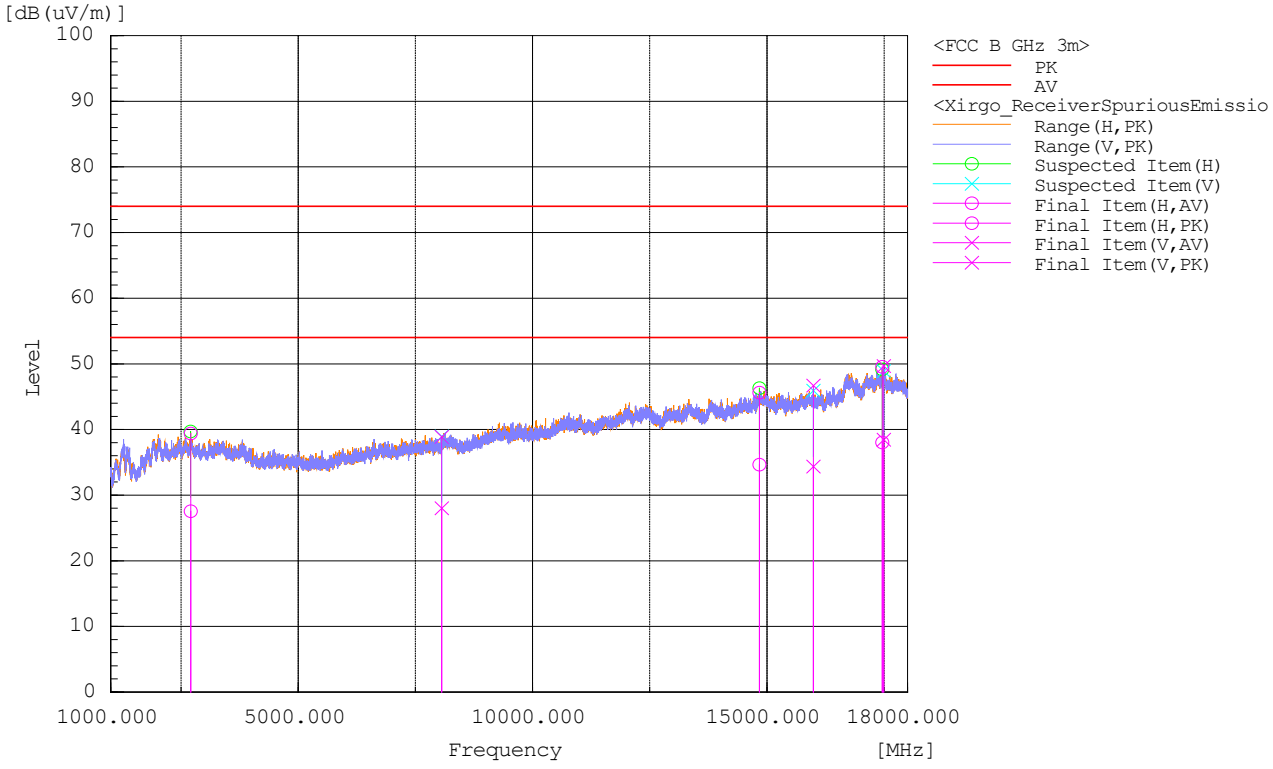


Receiver Spurious Emissions

Mode	Receiver Mode	DETECTOR FUNCTION	Peak / Average
FREQUENCY RANGE	1 – 18 GHz MHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No	Frequency (MHz)	Polarization	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	2706.19	H	40.0	51.9	-12.5	27.5	39.4	54	74	-26.5	34.6	308.4	228.0	Pass
2	8061.112	V	32.6	43.5	-4.6	28.0	38.9	54	74	-26.0	35.1	198.8	359.9	Pass
3	14841.44	H	30.3	41.3	4.3	34.6	45.6	54	74	-19.4	28.4	264.1	330.8	Pass
4	15992.56	V	28.5	40.8	5.9	34.4	46.7	54	74	-19.6	27.3	114.9	202.4	Pass
5	17461.2	H	28.8	40.3	9.2	38.0	49.5	54	74	-16.0	24.5	396.0	355.8	Pass
6	17494.04	V	29.1	40.4	9.3	38.4	49.7	54	74	-15.6	24.3	165.4	157.2	Pass

REMARKS:
1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) –Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value (dBuV/m)

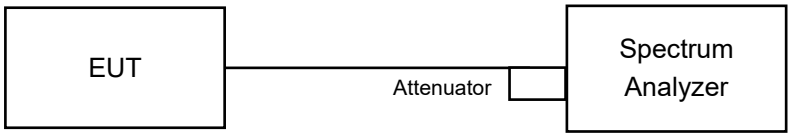


4.2 Conducted Ouput Power Measurement

4.2.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.2.2 Test Setup



4.2.1 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.2.2 Test Procedures

C63.10 Method AVGSA-1
558074 D01 15.247 Meas Guidance v05r02, 8.3.2.2

1. Set span to at least 1.5 times the OBW.
2. Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
3. Set VBW ≥ [3 × RBW].
4. Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto.
6. Detector = RMS (i.e., power averaging), if available. Otherwise, use the sample detector mode.
7. Do not use sweep triggering. Allow the sweep to “free run.”
8. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.
9. Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

4.2.3 Deviation from Test Standard

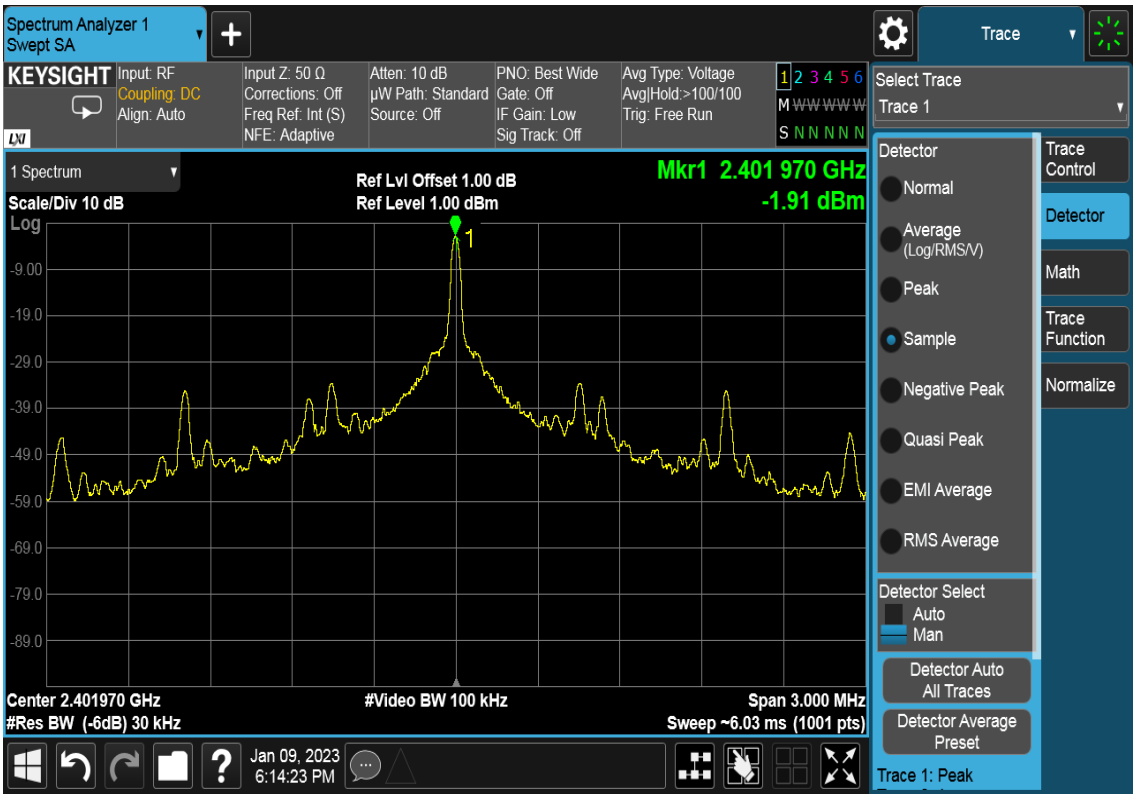
No deviation.

4.2.4 EUT Operating Conditions

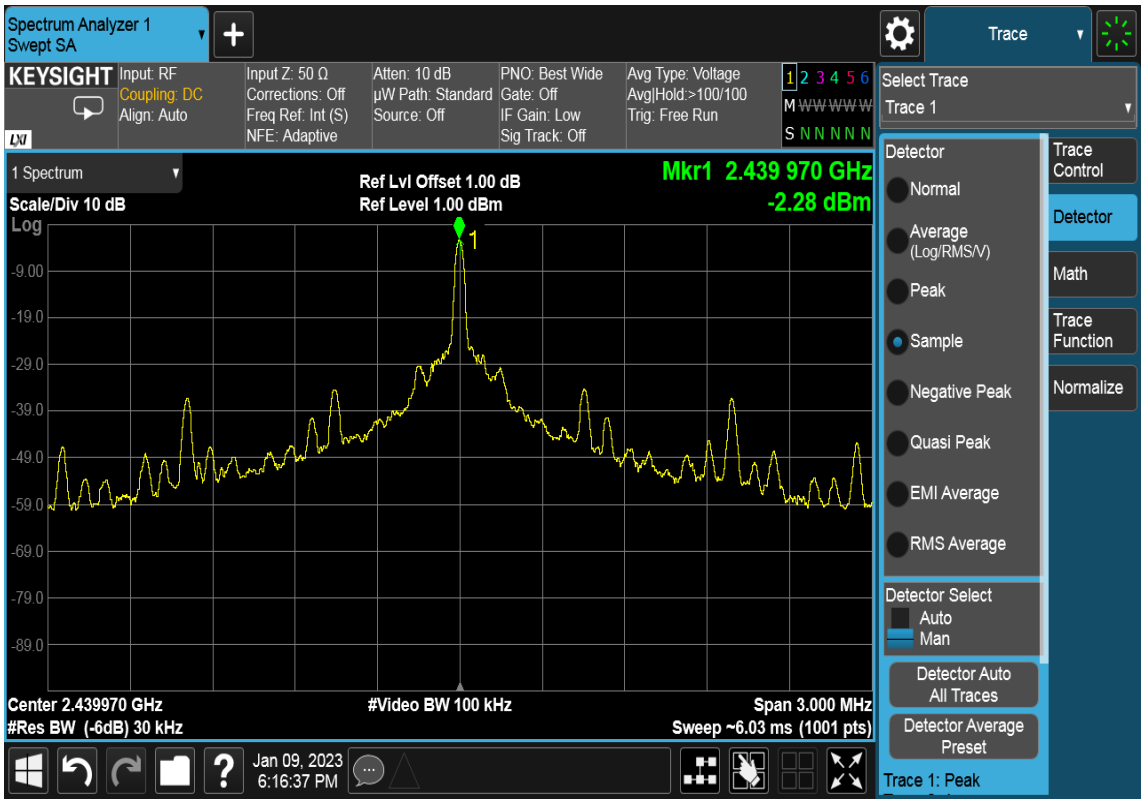
Same as Item 4.1.7.

4.2.5 Test Result

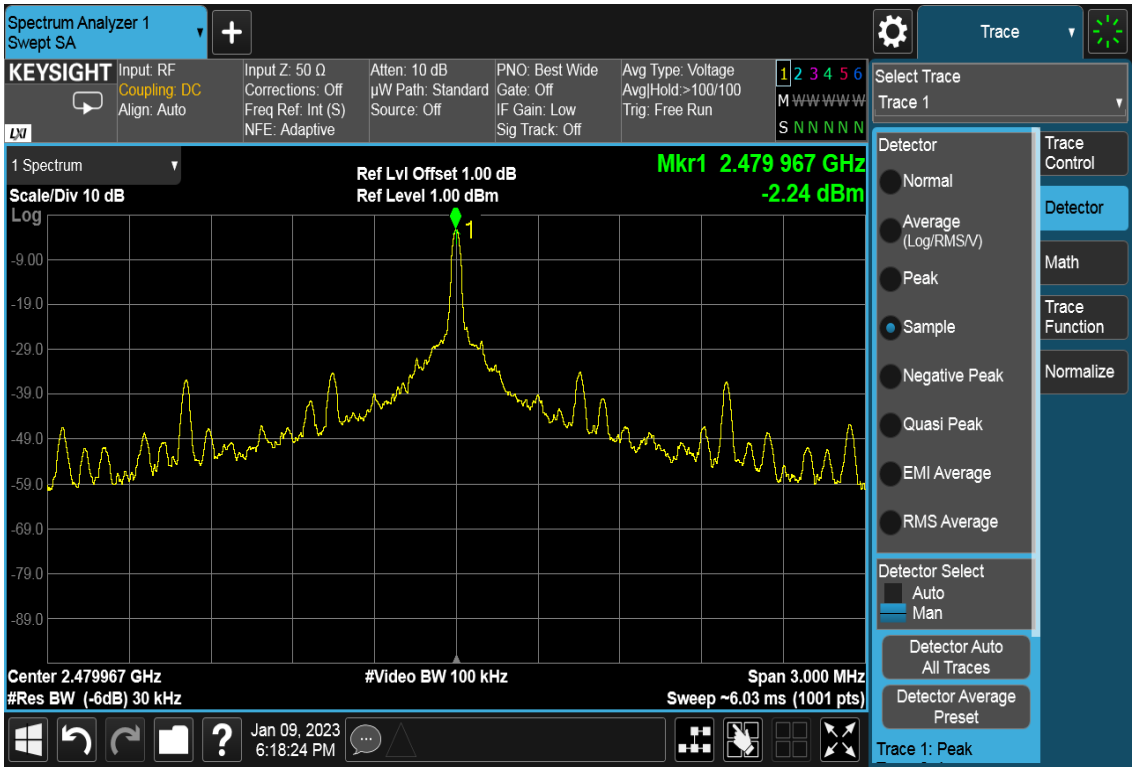
BLE Mode						
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty Cycle Correction Factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	-1.91	0	-1.91	30	Pass
19	2440	-2.28	0	-2.28	30	Pass
39	2480	-2.24	0	-2.24	30	Pass
Reference Level Offset = Cable Loss + Duty Cycle Correction Factor (Reference Level Offset = 1.0dB + 0dB = 1.0dB)						



CH 0


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
Atten: 10 dB
µW Path: Standard
Source: Off
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Voltage
Avg|Hold:>100/100
Trig: Free Run
Trace
Select Trace
Trace 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 1.00 dB
Ref Level 1.00 dBm
Mkr1 2.439 970 GHz
-2.28 dBm
-9.00
-19.0
-29.0
-39.0
-49.0
-59.0
-69.0
-79.0
-89.0
Center 2.439970 GHz
#Res BW (-6dB) 30 kHz
#Video BW 100 kHz
Span 3.000 MHz
Sweep ~6.03 ms (1001 pts)
Detector
Normal
Average
(Log/RMS/V)
Peak
Sample
Negative Peak
Quasi Peak
EMI Average
RMS Average
Detector Select
Auto
Man
Detector Auto
All Traces
Detector Average
Preset
Trace 1: Peak
Trace
Control
Detector
Math
Trace
Function
Normalize
Jan 09, 2023
6:16:37 PM

CH 19


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
Atten: 10 dB
µW Path: Standard
Source: Off
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Voltage
Avg|Hold:>100/100
Trig: Free Run
Trace
Select Trace
Trace 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 1.00 dB
Ref Level 1.00 dBm
Mkr1 2.479 967 GHz
-2.24 dBm
-9.00
-19.0
-29.0
-39.0
-49.0
-59.0
-69.0
-79.0
-89.0
Center 2.479967 GHz
#Res BW (-6dB) 30 kHz
#Video BW 100 kHz
Span 3.000 MHz
Sweep ~6.03 ms (1001 pts)
Detector
Normal
Average
(Log/RMS/V)
Peak
Sample
Negative Peak
Quasi Peak
EMI Average
RMS Average
Detector Select
Auto
Man
Detector Auto
All Traces
Detector Average
Preset
Trace 1: Peak
Trace
Control
Detector
Math
Trace
Function
Normalize
Jan 09, 2023
6:18:24 PM

CH 39

4.3 6dB & 99% Occupied Bandwidth

4.3.1 Limits of 6dB & 99% Occupied Bandwidth

6dB BW ≥ 500 KHz

4.5.2 Test Setup

4.3.2 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.3.3 Test Procedures

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

For 6dB Bandwith:

RBW = 100 KHz.
VBW ≥ 3 x RBW.
Detector = Peak.
Sweep time = Auto coupled.
Trace mode = max hold
Allow sweep to continue until the trace stabilizes.
Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the mazimum level measured in the fundamental emissions.

For 99% Occupied Bandwidth:

. The span range for the spectrum analyzer shall be between two times and five times the OBW.
. The nominal IF filter bandwith (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwith (VBW) shall be approximately three times RBW.

4.3.4 Deviation from Test Standard

No deviation.

4.3.5 EUT Operating Conditions

Same as Item 4.1.7.

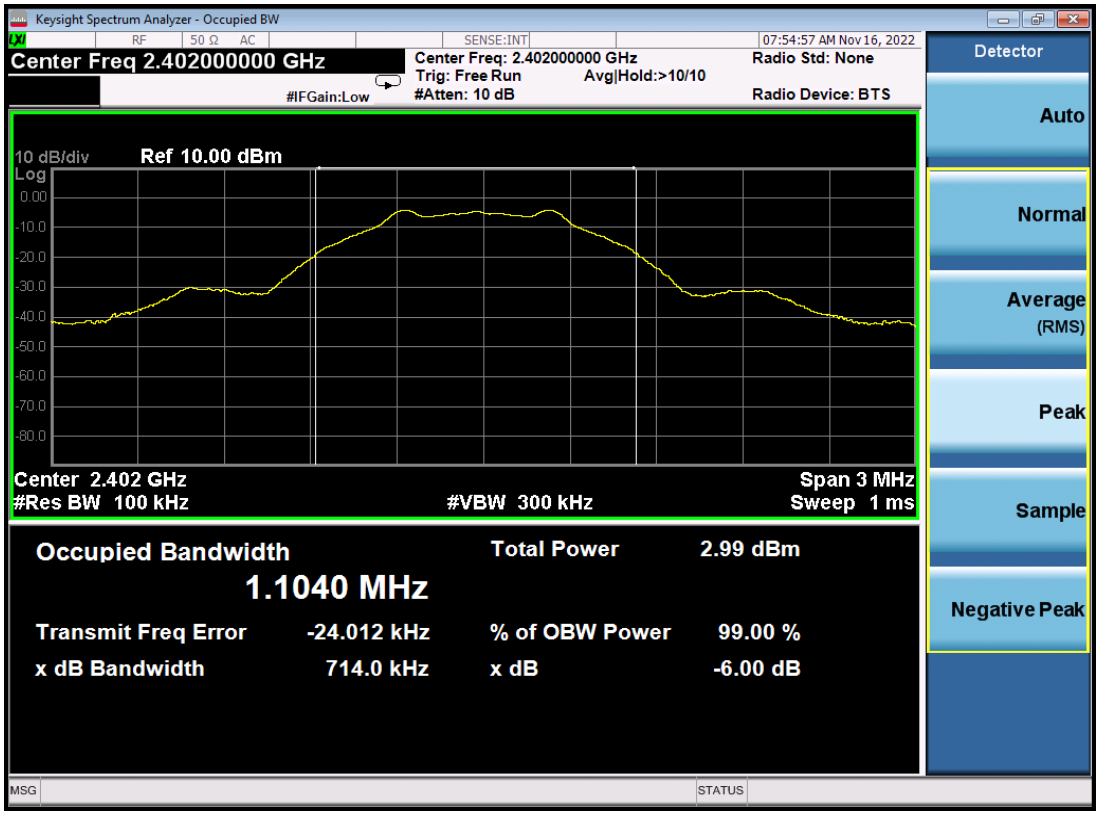
4.3.6 Test Results

Test Results are done by James Ma

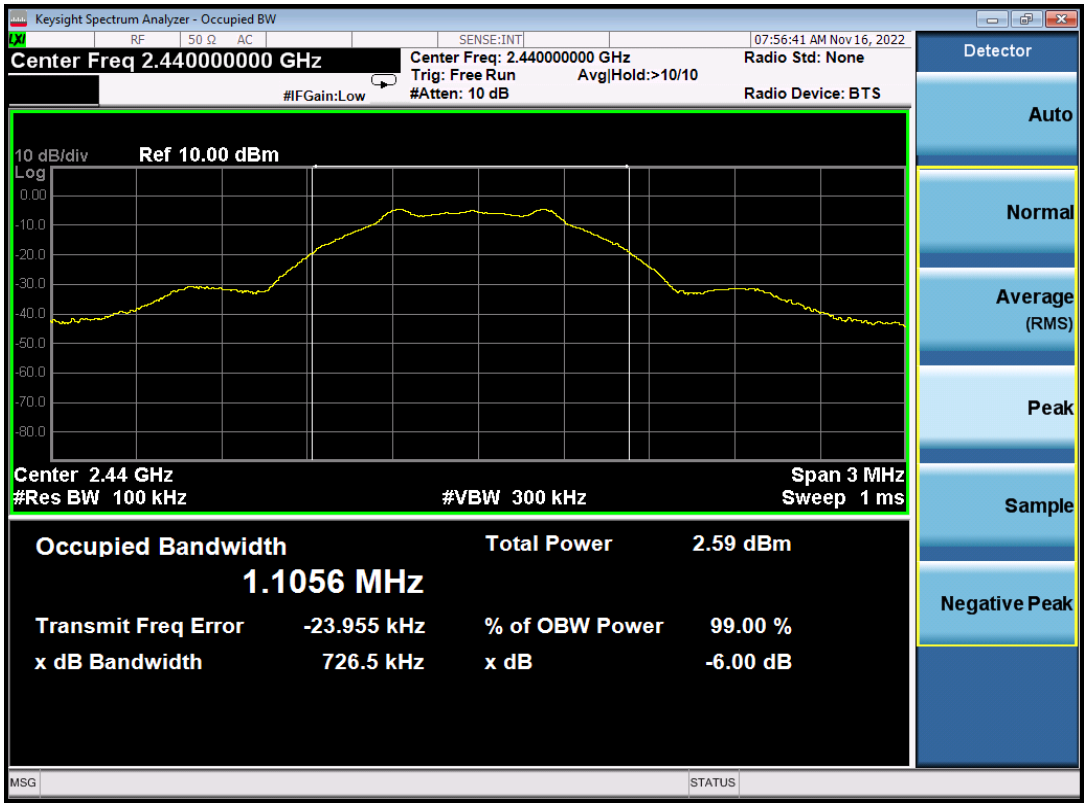
BLE					
6dB BW	Channel	Frequency (MHz)	Result (kHz)	Limit ≥ (KHz)	Pass/Fail
	0	2402	714.0	500	Pass
	19	2440	726.5	500	Pass
	39	2480	738.8	500	Pass

BLE			
99% OBW	Channel	Frequency (MHz)	Result (MHz)
	0	2402	1.0711
	19	2440	1.0796
	39	2480	1.0818

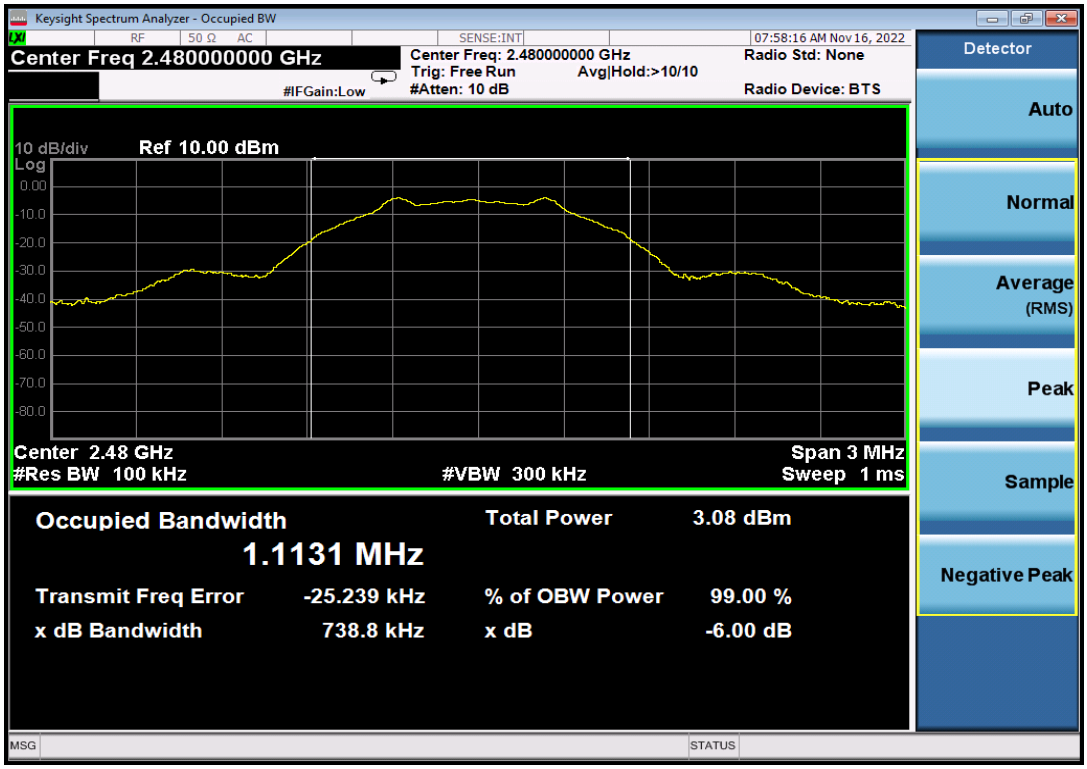
Test Plots:



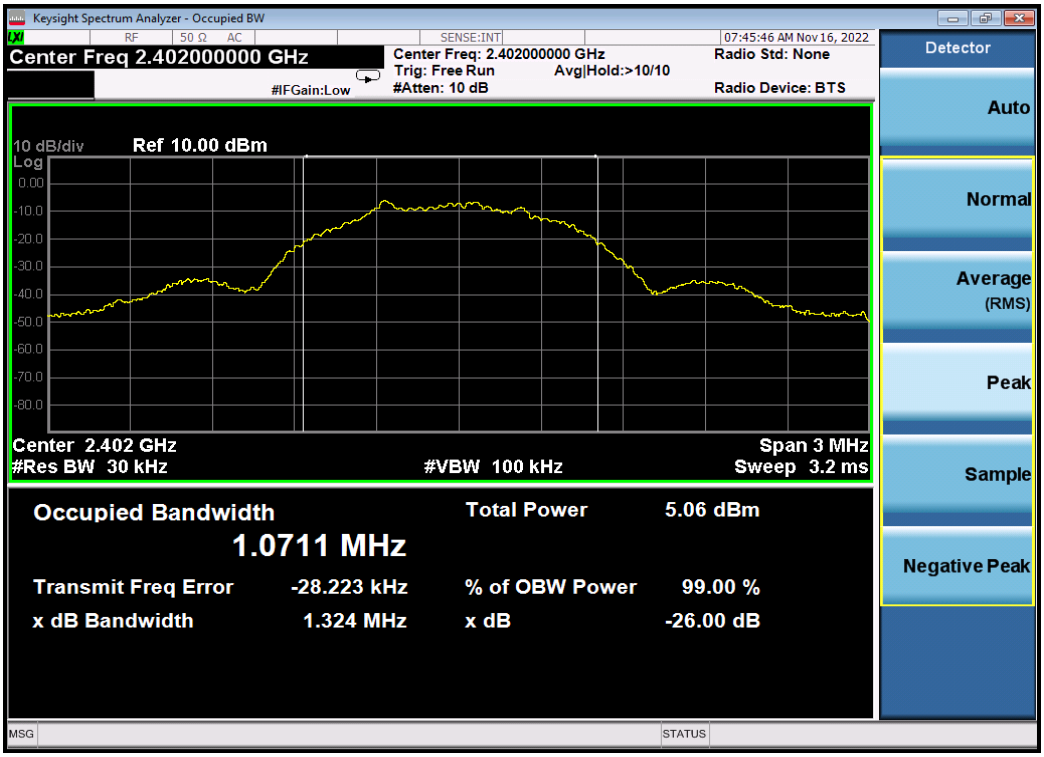
6dB Bandwidth, Channel 0 – 2402MHz



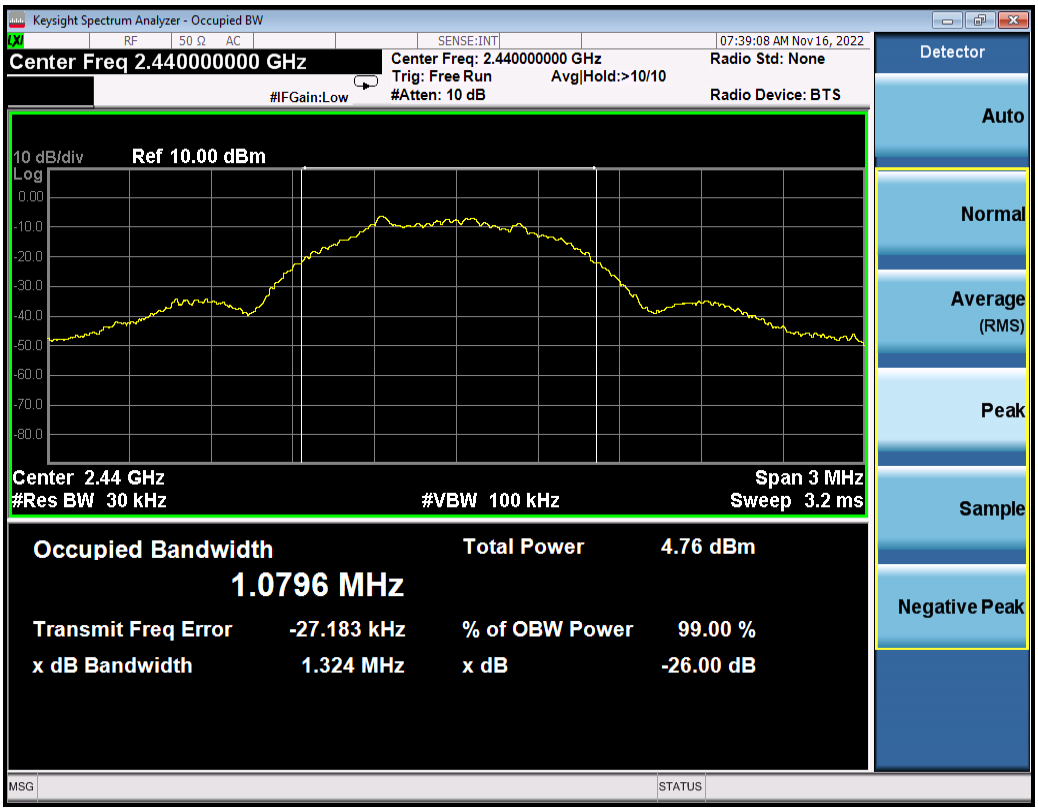
6dB Bandwidth, Channel 19 – 2440MHz



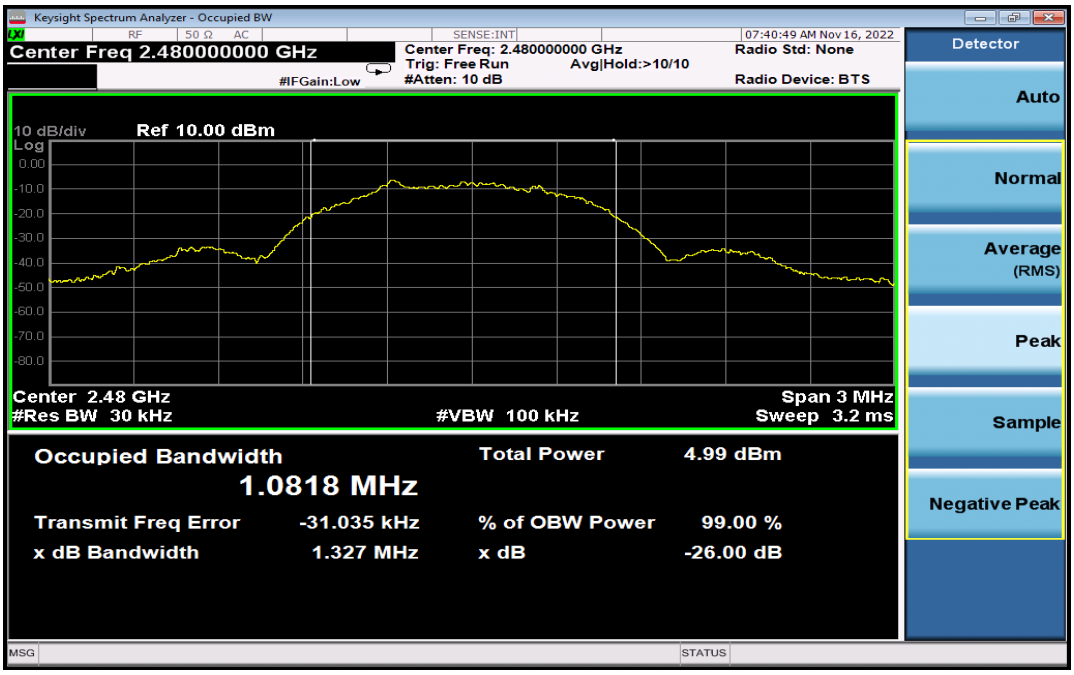
6dB Bandwidth, Channel 39 – 2480MHz



OBW Bandwidth, Channel 0 – 2402MHz



OBW Bandwidth, Channel 19 – 2440MHz



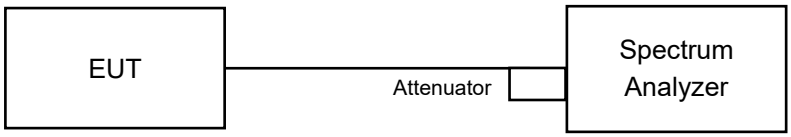
OBW Bandwidth, Channel 39 – 2480MHz

4.4 Conducted Spurious Emissions Measurement

4.4.1 Limits of Conducted Spurious Emission Measurement

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.4.4 Test Procedures

Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

4.4.5 Deviation from Test Standard

No deviation.

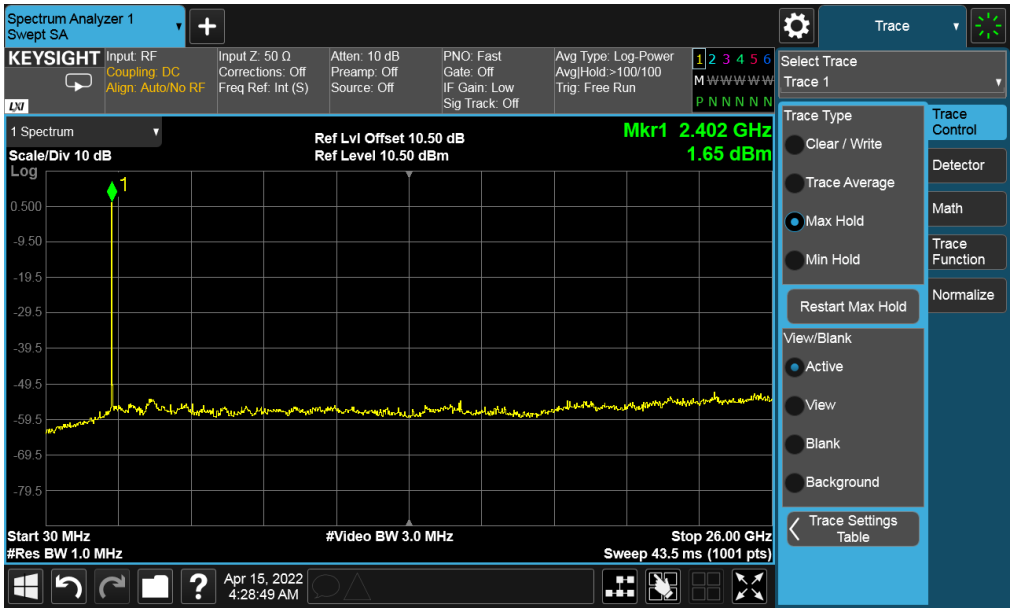
4.4.6 EUT Operating Conditions

Same as Item 4.1.7.

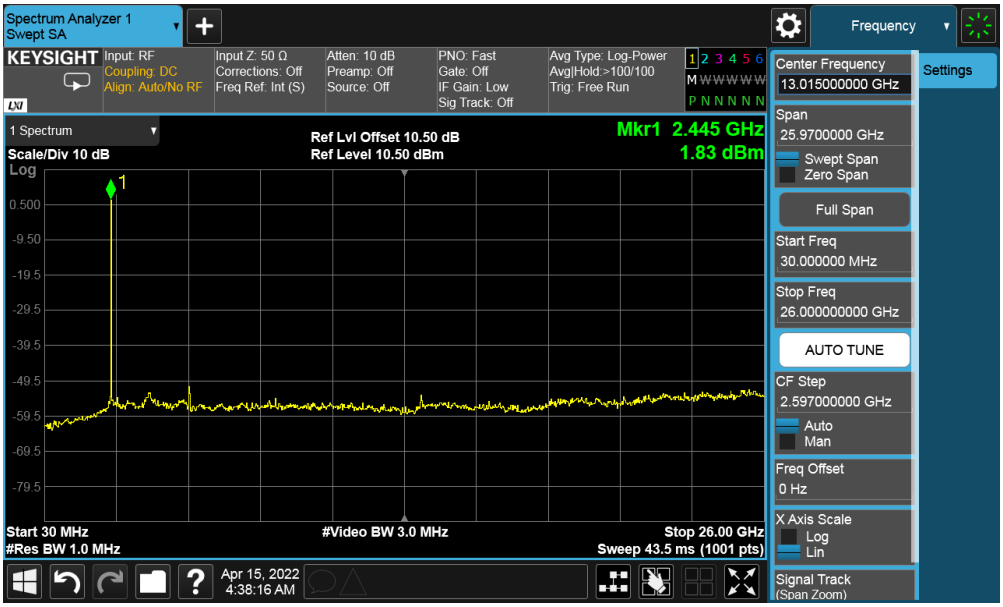
4.4.7 Test Results

Channel	Frequency (MHz)	Pass/Fail
0	2402	Pass
19	2440	Pass
39	2480	Pass

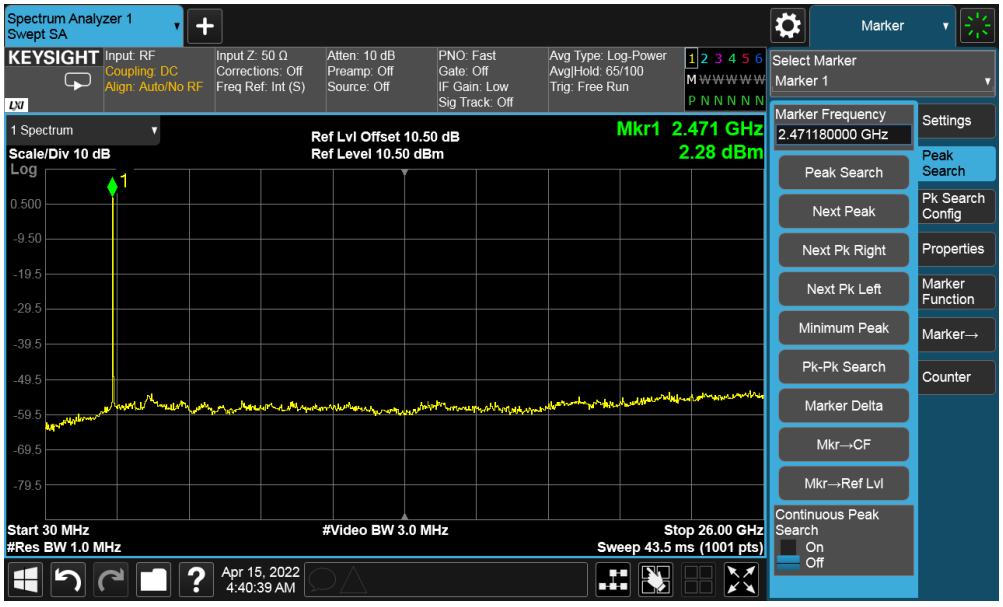
Test Plots:



Channel 0 – 2402MHz



Channel 19 – 2440MHz



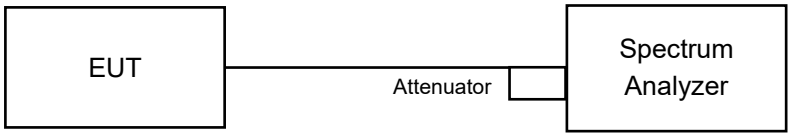
Channel 39 – 2480MHz

4.5 Peak Spectral Density

4.5.1 Limits of Band Edge Measurement

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 determinted in accordance with the provision of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.5.4 Test Procedures
The measurement is made according to ANSI C63.10 clause 11.10.2
558074 D01 DTS Meas Guidance v04, 10.2 Method PKPSD (peak PSD)

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Turn on the EUT and connect it to measurement instrument. Then set analyzer center frequency to DTS channel center frequency. Set a reference level on the measuring instrument equal to the highest peak value.
d. Span = 1.5x the DTS bandwidth.
e. RBW = 3 KHz ≤ RBW ≤ 100 KHz.
f. VBW ≥ [3 x RBW].
g. Detector = Peak.
h. Sweep time = Auto coupled.
i. Trace mode = max hold
j. Allow trace to fully stabilizes.
k. Use the peak marker function to determine the maximum amplitude level within the RBW.
l. If measured value exceeds limit, reduce RBW (no less than 3 KHz) and repeat.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

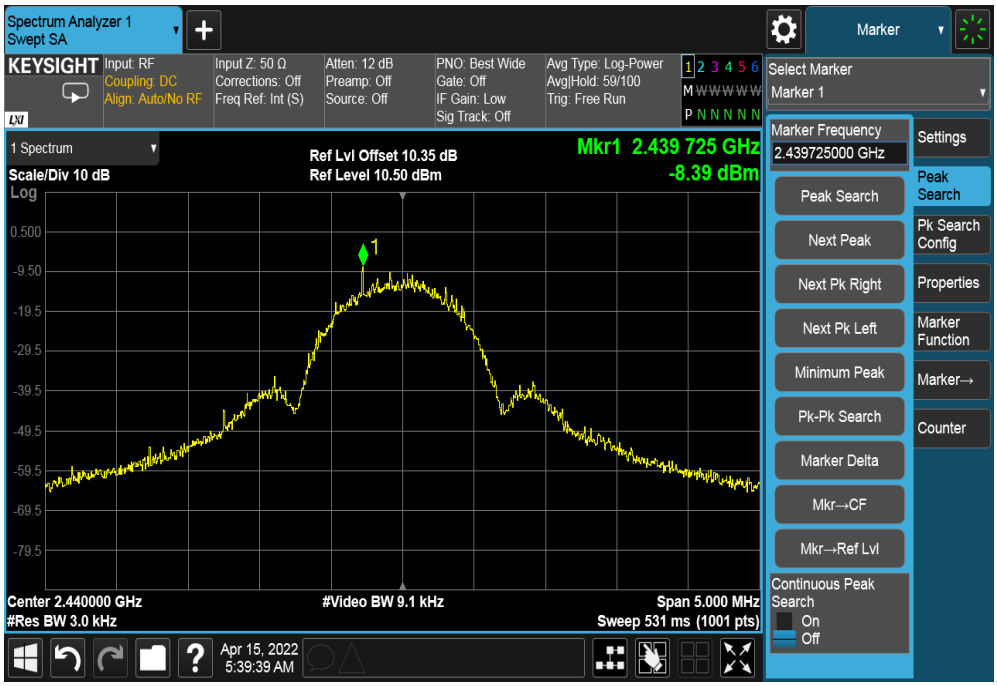
Same as Item 4.1.7.

4.5.7 Test Results

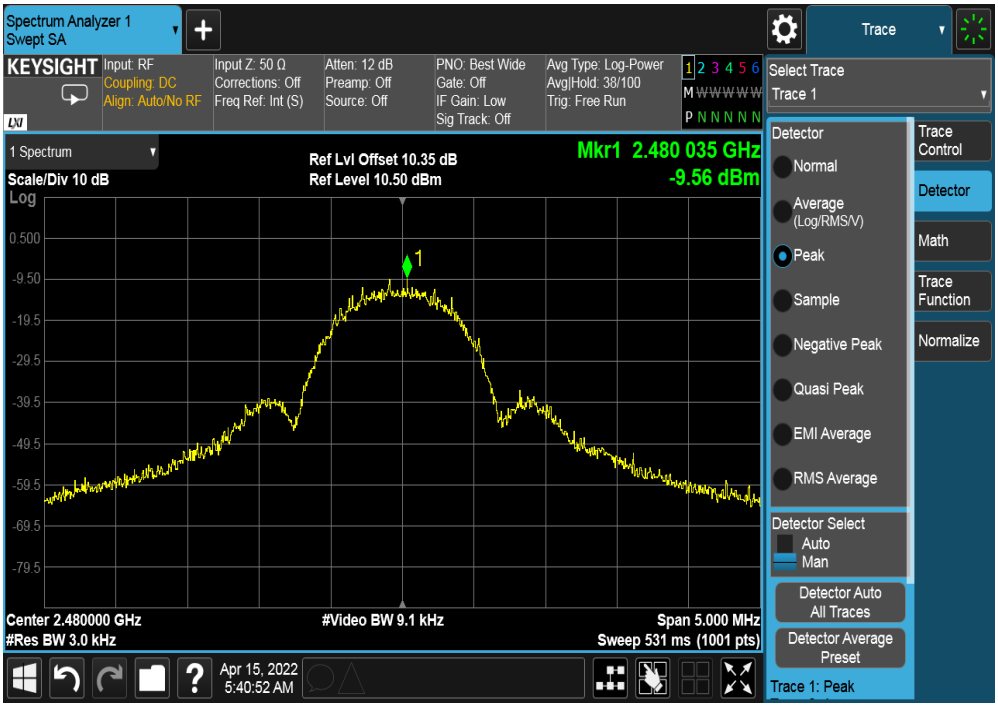
Channel	Frequency (MHz)	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Pass/Fail
0	2402	-7.85	≤ 8	Pass
19	2440	-8.39	≤ 8	Pass
39	2480	-9.56	≤ 8	Pass

4.5.8 Test Plots

Peak Spectral Density, Channel 0 – 2402MHz



Peak Spectral Density, Channel 19 – 2440MHz



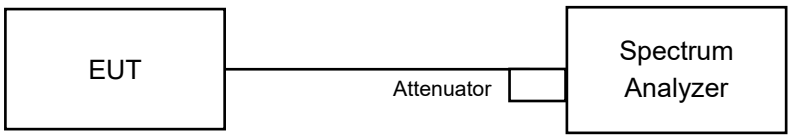
Peak Spectral Density, Channel 39 – 2480MHz

4.6 Band Edge Measurement

4.6.1 Limits of Band Edge Measurement

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.6.4 Test Procedures

a. Set the EUT to maximum power setting and enable the EUT transmit continuously.
b. Band edge emsissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attunation shall be 30 dB instead of 20 dB when Peak conducted output power procedure is used.
c. Change modulation and channel bandwidth then repeat step 1 to 2.
d. Measure and record the result in the tewt report

4.6.5 Deviation from Test Standard

No deviation.

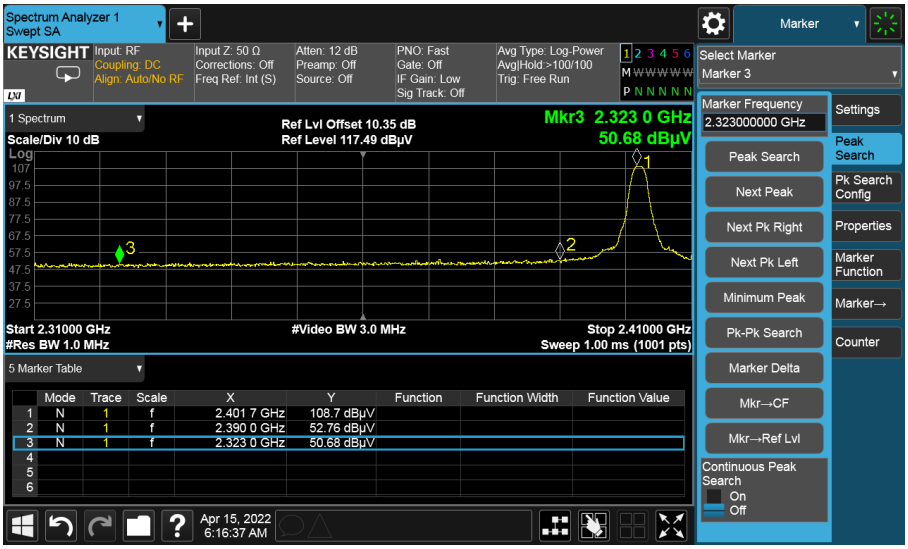
4.6.6 EUT Operating Conditions

Same as Item 4.1.7.

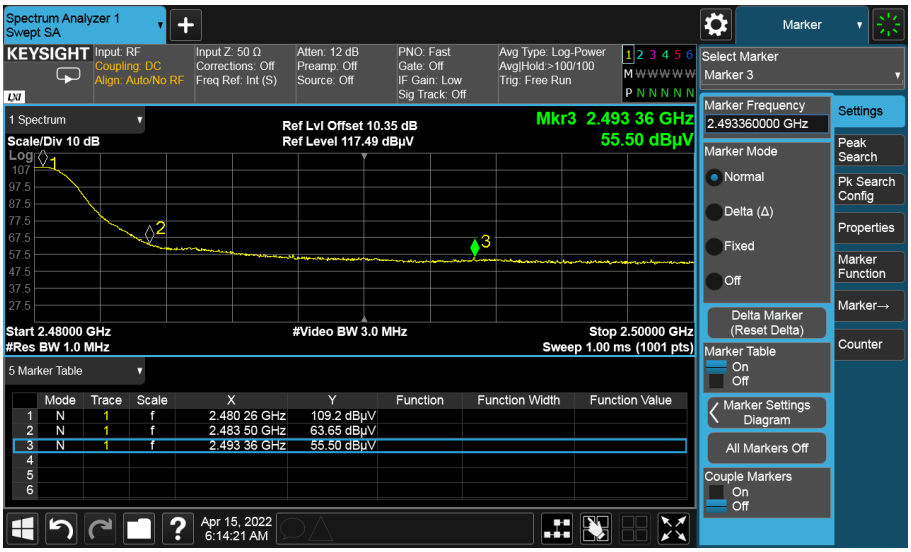
4.6.7 Test Results

Channel	Frequency (MHz)	Pass/Fail
0	2402	Pass
19	2440	Pass
39	2480	Pass

Test Plots:



Band Edge, CH0, 2402MHz



Band Edge, CH39, 2480MHz

5 Pictures of Test Arrangements

Please see setup photo file.

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

Milpitas EMC/RF/Safety/Telecom Lab
775 Montague Expressway, Milpitas, CA 95035
Tel: +1 408 526 1188

Sunnyvale OTA/Bluetooth Lab
1293 Anvilwood Avenue, Sunnyvale, CA 94089
Tel: +1 669 600 5293

Littleton EMC/RF/Safety/Environmental Lab
1 Distribution Center Cir #1, Littleton, MA 01460
Tel: +1 978 486 8880

Email: sales.eaw@us.bureauveritas.com
Web Site: www.cps.bureauveritas.com

The address and road map of all our labs can be found in our web site also.

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