ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : **OT-212-RWD-020**

Reception No. : **2101000175**

Applicant : **LG Electronics USA**

Address : **111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States**

Manufacturer : **LG Electronics Inc**

Address : **10, Magokjungang 10-ro, Gangseo-gu, Seoul, Republic of Korea**

Type of Equipment : **NAVIGATION RADIO**

FCC ID. : **BEJLANR22**

Model Name : **LANR22**

Multiple Model Name : **N/A**

EUT Part Number : **ASRNCNAG1A1**

Serial Part Number : **Refer to the clause 3.2**

Total page of Report : **52 pages (including this page)**

Date of Incoming : **January 28, 2021**

Date of issue : **February 08, 2021**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247***

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Tested by	Reviewed by	Approved by
Hyung-Kwon, Oh / Manager	Tae-Ho, Kim / Senior Manager	Ki-Hong, Nam / General Manager
ONETECH Corp.	ONETECH Corp.	ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-212-RWD-020	February 08, 2021	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA

Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States

Contact Person : Dae Woong Kim / Director, Regulatory and Environmental Affairs

Telephone No. : 201-266-2215

FCC ID : BEJLANR22

Model Name : LANR22

Brand Name : Alliance-RNM

Serial Number : N/A

Date : February 08, 2021

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	NAVIGATION RADIO
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Peak Power Spectral Density	Met the Limit / PASS
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	N/A (See Note)
15.203	Antenna Requirement	Met requirement / PASS

Note: This test is not performed because the EUT is operated by DC Power.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-20122/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The LG Electronics USA, Model LANR22 (referred to as the EUT in this report) is a NAVIGATION RADIO. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	NAVIGATION RADIO	
Temperature Range	-40 °C ~ 80 °C	
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz
	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20))
		5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40))
		5 210 MHz (802.11ac(VHT80))
	5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 805 MHz (802.11a/n(HT20)/ac(VHT20))
		5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40))
		5 775 MHz (802.11ac(VHT80))
MODULATION TYPE	Bluetooth LE	GFSK for 1 Mbps / 2 Mbps
	Bluetooth	GFSK for 1 Mbps, π/4-DQPSK for 2 Mbps, 8-DPSK for 3 Mbps
	WLAN 2.4 GHz	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK) 802.11g/n(HT20): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
	WLAN 5 GHz	802.11a/n(HT20)/n(HT40)/ac(VHT80): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)

RF OUTPUT POWER	Bluetooth LE	1 Mbps	-2.62 dBm
		2 Mbps	-2.89 dBm
	Bluetooth	1 Mbps	-3.01 dBm
		2 Mbps	-4.21 dBm
		3 Mbps	-3.73 dBm
	WLAN 2.4 GHz	16.35 dBm(802.11b) 16.52 dBm(802.11g) 15.47 dBm(802.11n_HT20)	
	5 150 MHz ~ 5 250 MHz Band	13.44 dBm(802.11a) 9.37 dBm(802.11n_HT20) 8.70 dBm(802.11n_HT40) 6.72 dBm(802.11ac_VHT80)	
	5 725 MHz ~ 5 850 MHz Band	11.70 dBm(802.11a) 11.60 dBm(802.11n_HT20) 12.44 dBm(802.11n_HT40) 9.47 dBm(802.11ac_VHT80)	
ANTENNA TYPE	Bluetooth LE	Chip Antenna	
	Bluetooth	Chip Antenna	
	WLAN 2.4 GHz	PCB Antenna	
	WLAN 5 GHz	Chip Antenna	
ANTENNA GAIN	Bluetooth LE	2.49 dBi	
	Bluetooth	2.49 dBi	
	WLAN 2.4 GHz	-2.91 dBi	
	5 150 MHz ~ 5 250 MHz Band	2.89 dBi	
	5 725 MHz ~ 5 850 MHz Band	2.53 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		32.768 kHz, 20 MHz, 25 MHz, 28.636 36 MHz, 38.4 MHz, 55.466 67 MHz	

3.2 Alternative type(s)/model(s); also covered by this test report.

-. The following lists consist of the added model and their differences.

Model Name : LANR22

Tested sample P/N : ASRNCNAG1A1

Variant P/N :

A	S	#	#	C	N	A	G	1	#	#
A1	A2	B1	B2	C1	C2	C3	C4	D1	E1	F1

The # in P/N can be 0 to 9 or A to Z
according to below Character or Number table.

A1/A2 (Platform)	
AS	AV Silver Box

B1/B2 (Customer Code)	
RN	Renault
NS	Nissan
RS	Infinity

C1/C2/C3/C4 (Product spec.)	
CNAG	Ext. Display/Radio/RVC/Bluetooth/Wi-fi

D1 (Generation)	
1	Generation 1

E1 (Production Year)	
A	2021
B	2022
C	2023
D	2024
E	2025
F	2026

F1 (Country Information)	
1	EU/Canada
2	Mexico
3	USA
4	EU
5	Else
6	Japan
7	Korea

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	LG Electronics Inc	N/A	N/A
Audio Board	LG Electronics Inc	N/A	N/A
Antenna Board	LG Electronics Inc	N/A	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
LANR22	LG Electronics Inc	NAVIGATION RADIO (EUT)	
PWS-3003D	Protek	DC Power Supply (DC 30 V 3 A)	

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 2 402 MHz, 2 440 MHz, and 2 480 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this report.

-. Channel List (Bluetooth LE)

Channel	Frequency[MHz]	Channel	Frequency[MHz]	Channel	Frequency[MHz]
0	2 402.00	14	2 430.00	28	2 458.00
1	2 404.00	15	2 432.00	29	2 460.00
2	2 406.00	16	2 434.00	30	2 462.00
3	2 408.00	17	2 436.00	31	2 464.00
4	2 410.00	18	2 438.00	32	2 466.00
5	2 412.00	19	2 440.00	33	2 468.00
6	2 414.00	20	2 442.00	34	2 470.00
7	2 416.00	21	2 444.00	35	2 472.00
8	2 418.00	22	2 446.00	36	2 474.00
9	2 420.00	23	2 448.00	37	2 476.00
10	2 422.00	24	2 450.00	38	2 478.00
11	2 424.00	25	2 452.00	39	2 480.00
12	2 426.00	26	2 454.00		
13	2 428.00	27	2 456.00		

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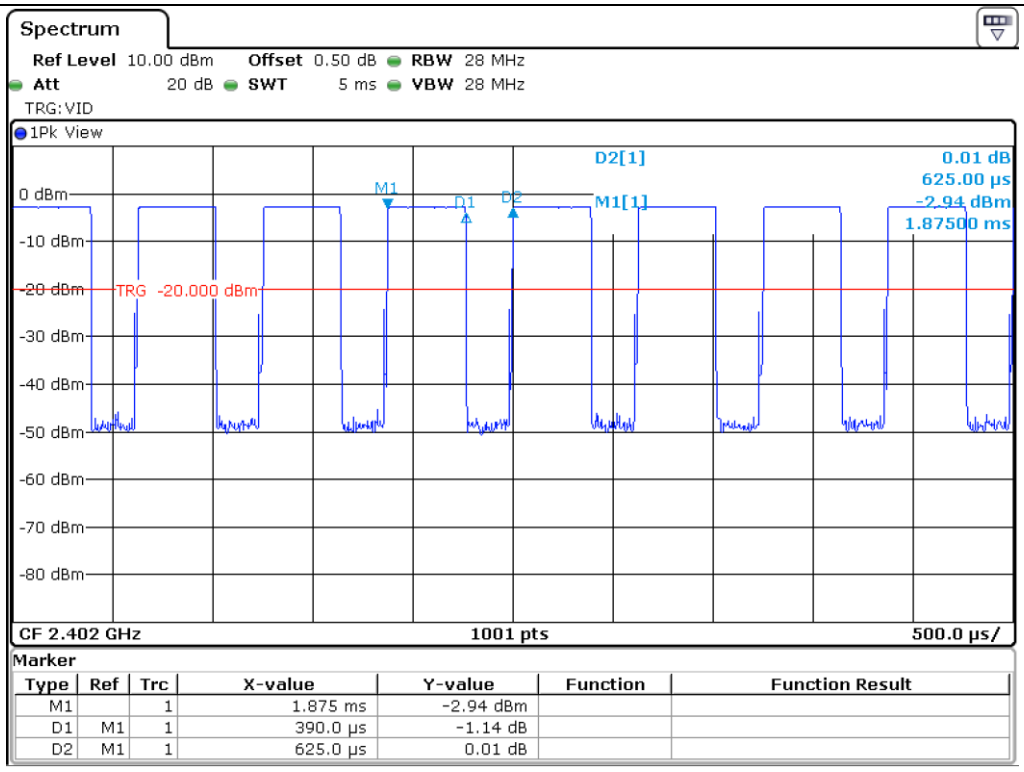
-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
Bluetooth LE [1 Mbps]	0.390	0.235	62.40	2.05
Bluetooth LE [2 Mbps]	0.194	0.432	30.99	5.09

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

-. Test Plot



Bluetooth LE_1 Mbps

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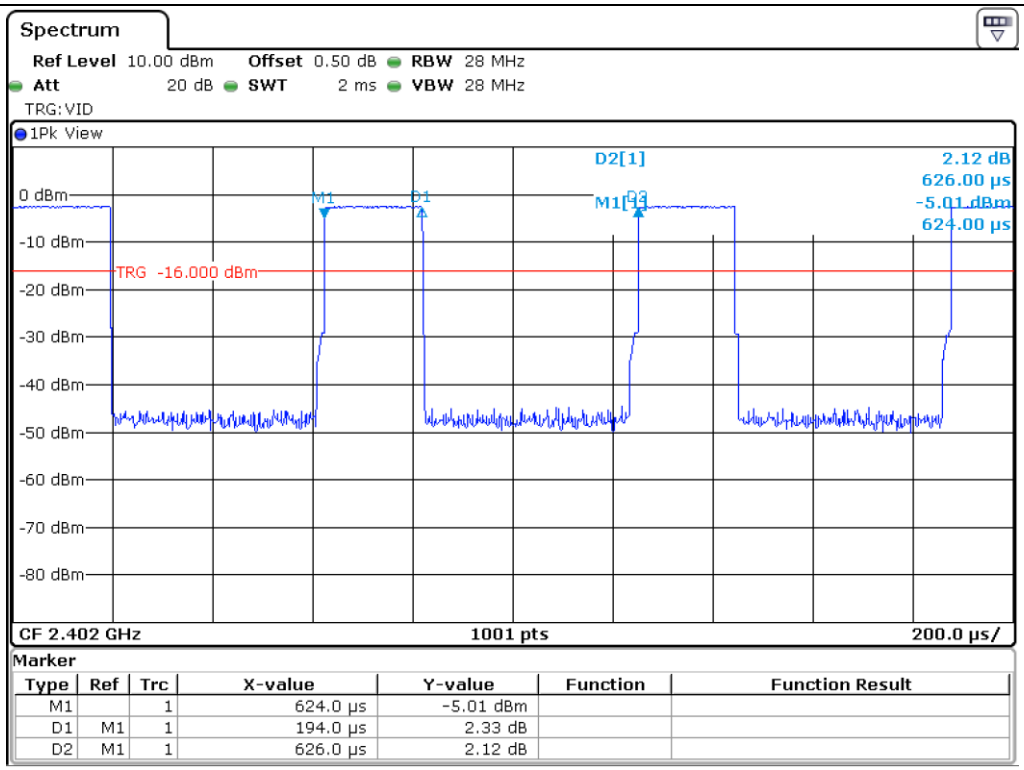

Bluetooth LE_2 Mbps

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5.4 Configuration of Test System

Line Conducted Test: It is not need to test this requirement, because the EUT shall be operated by DC Power.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The antenna of the EUT is a Chip Antenna on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied by DC Power.	

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

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7. MINIMUM 6 dB BANDWIDTH

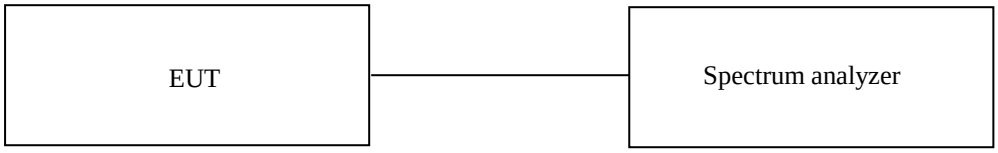
7.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



7.3 Test Date

January 28, 2021 ~ February 04, 2021

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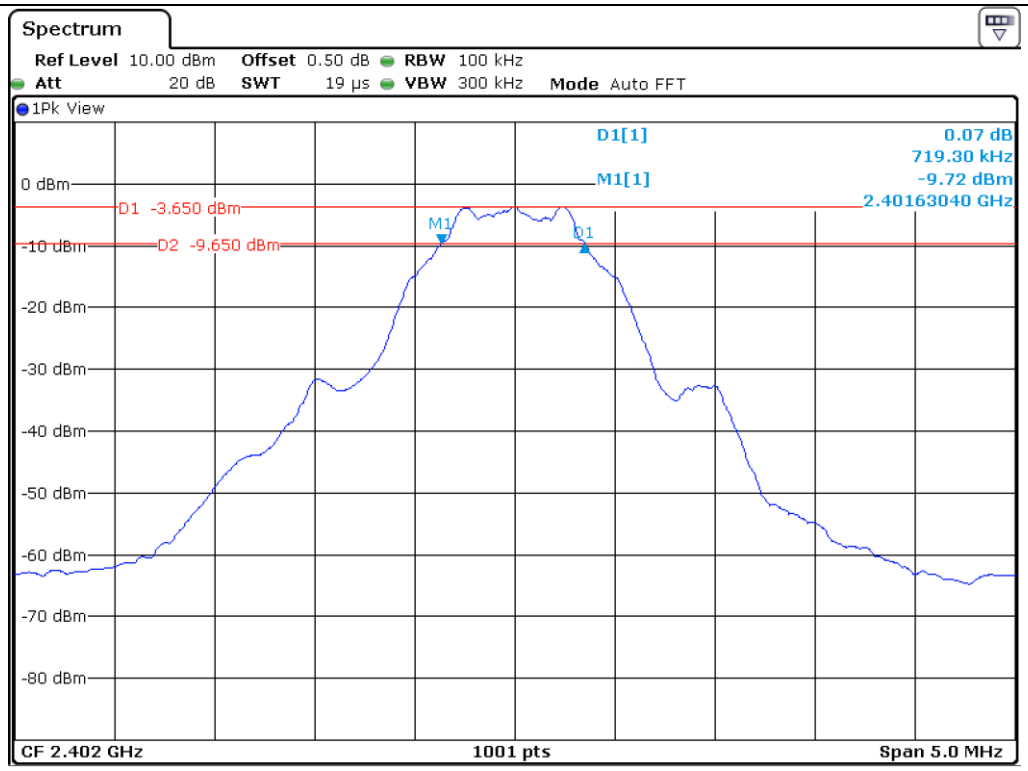
7.4 Test data for 1 Mbps

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	719.30	500.00	219.30
Middle	2 440.00	729.30	500.00	229.30
High	2 480.00	719.30	500.00	219.30

Remark. Margin = Measured Value - Limit



Low Channel

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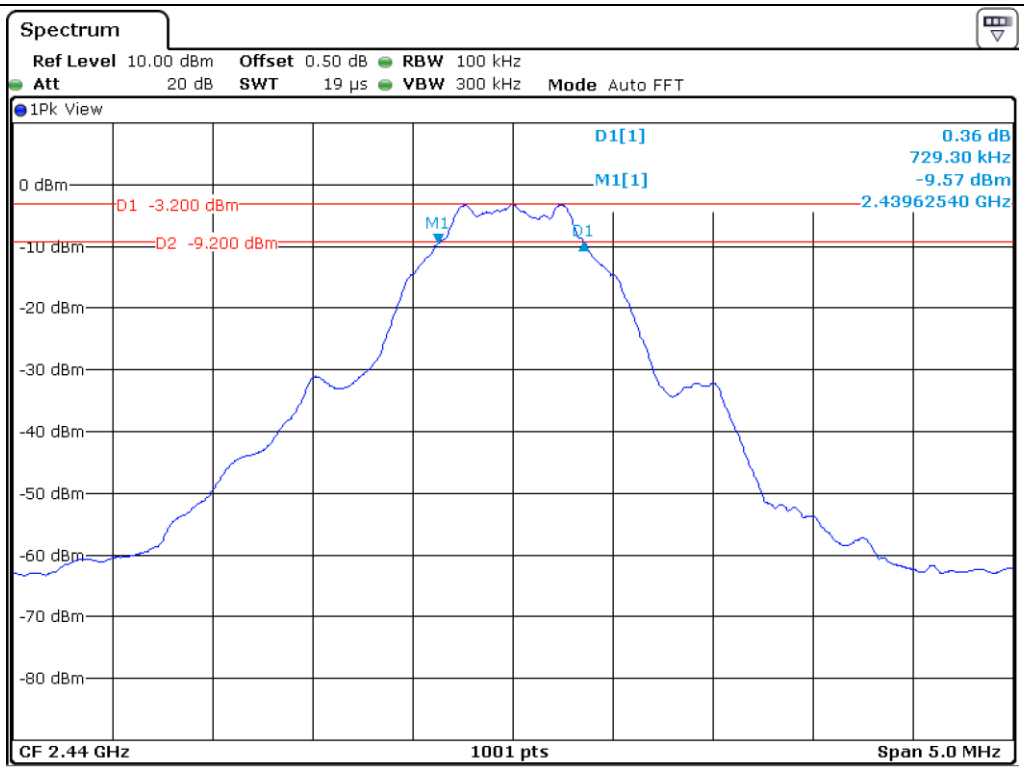
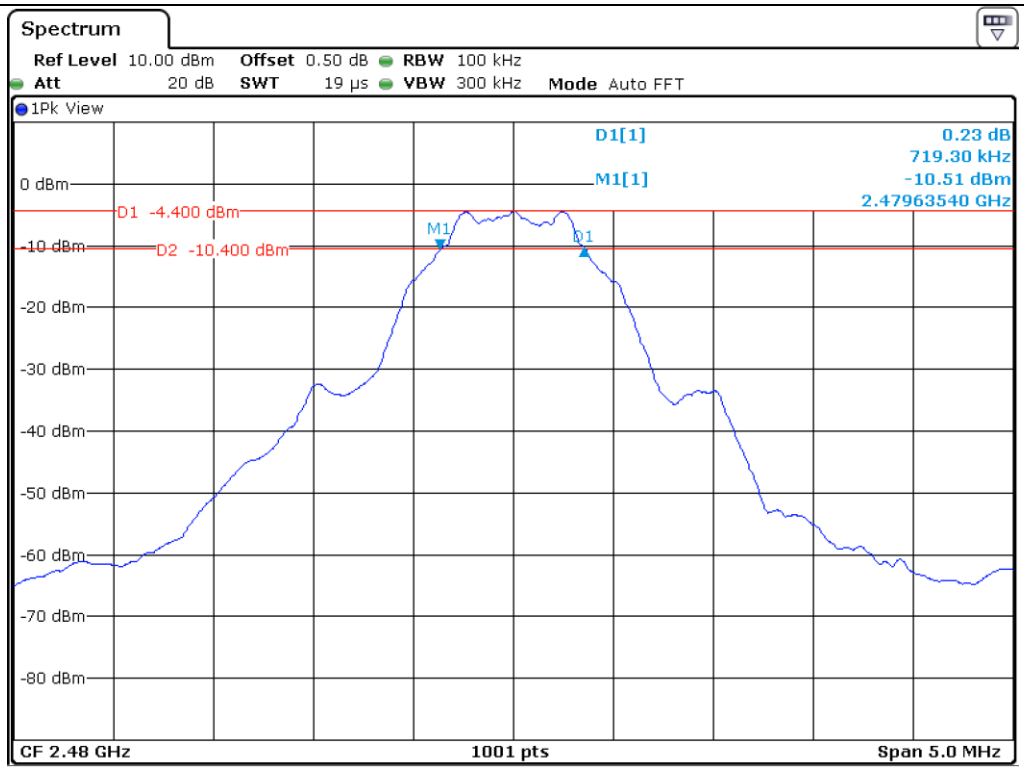


Middle Channel



High Channel

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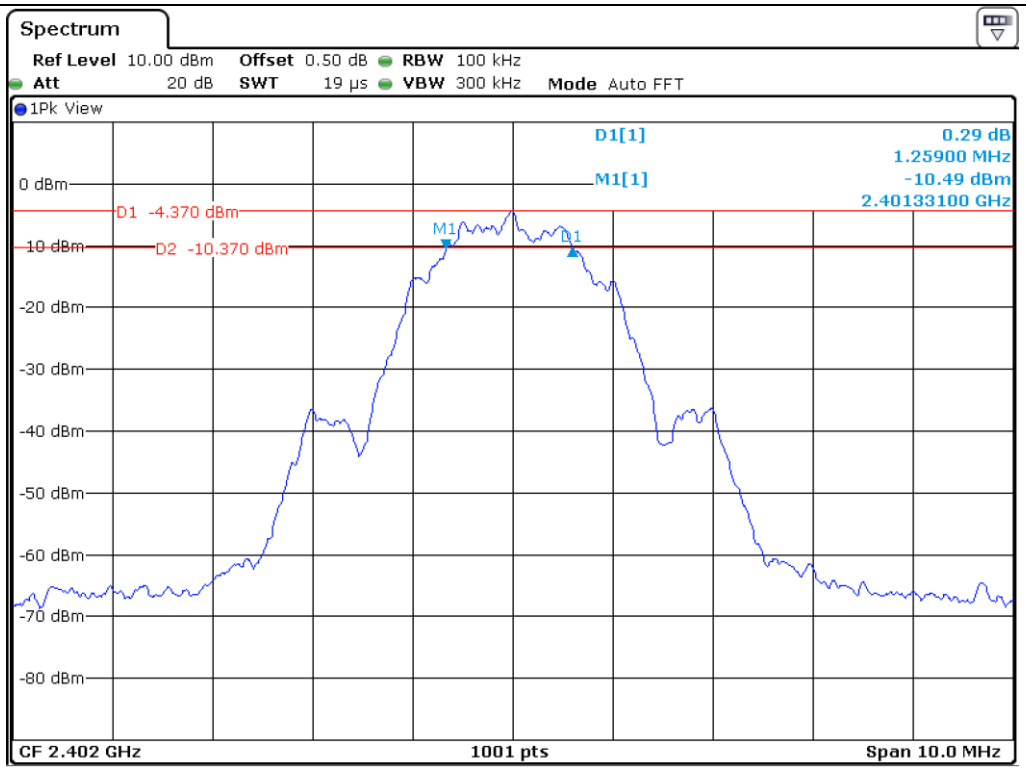
7.5 Test data for 2 Mbps

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	1 259.00	500.00	759.00
Middle	2 440.00	1 249.00	500.00	749.00
High	2 480.00	1 259.00	500.00	759.00

Remark. Margin = Measured Value - Limit



Low Channel

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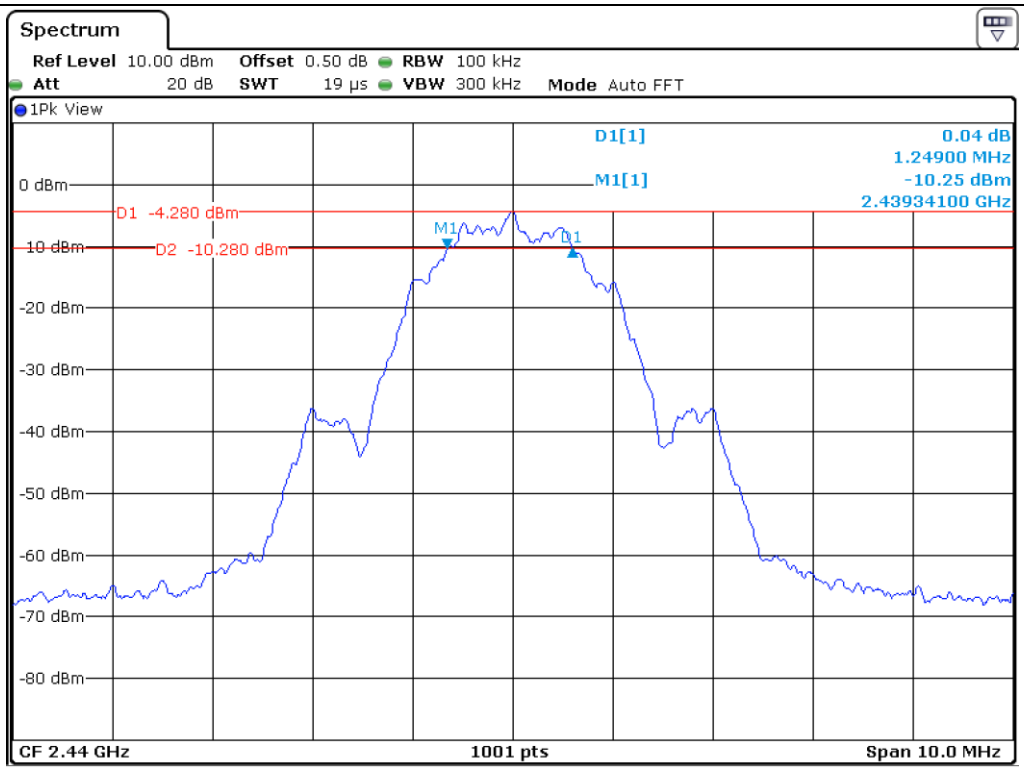
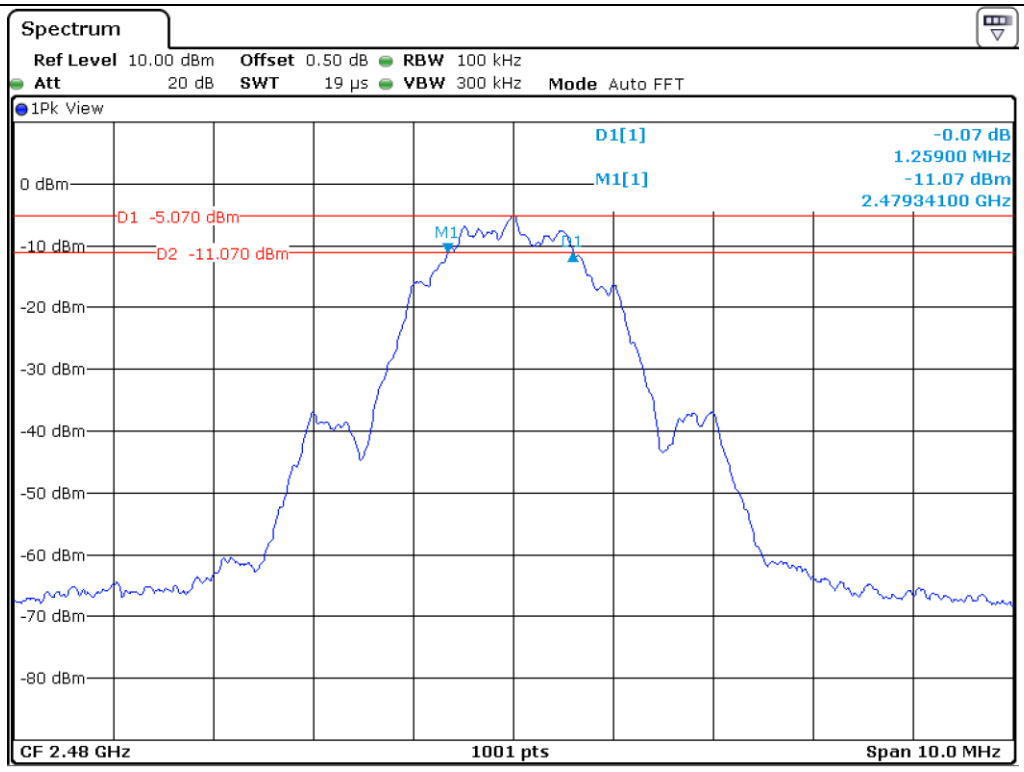


Middle Channel



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8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

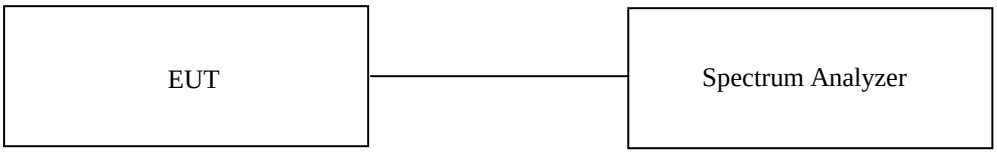
Temperature : 23 °C

Relative humidity : 45 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to ≥ DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



8.3 Test Date

January 28, 2021 ~ February 04, 2021

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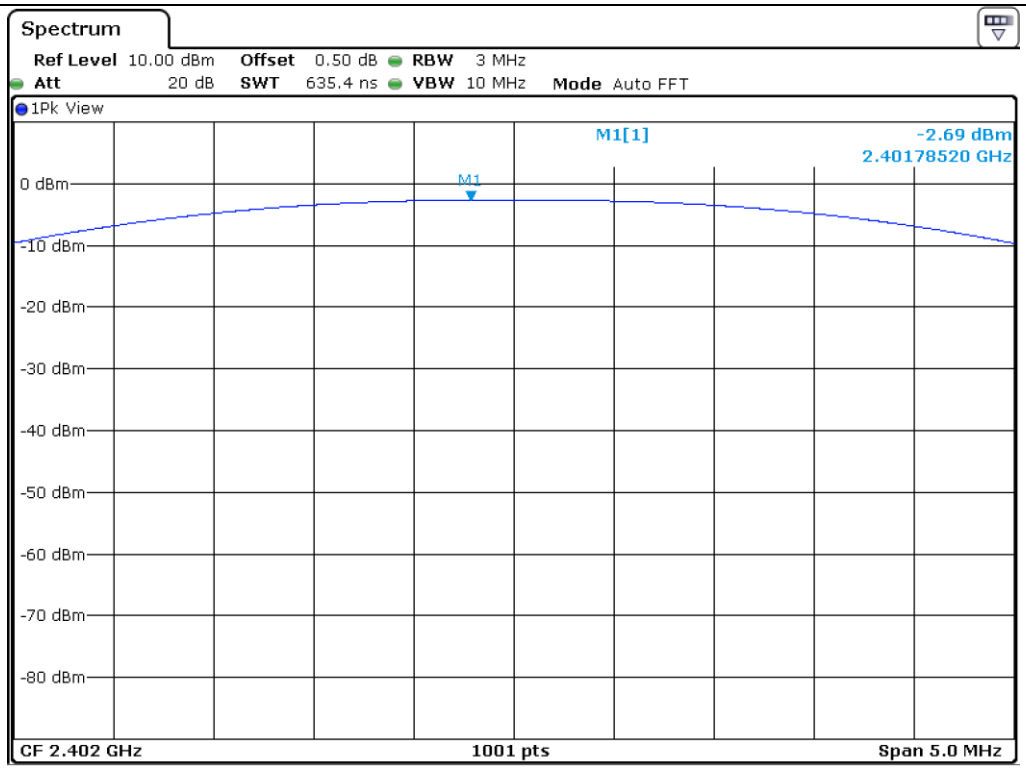
8.4 Test data for 1 Mbps

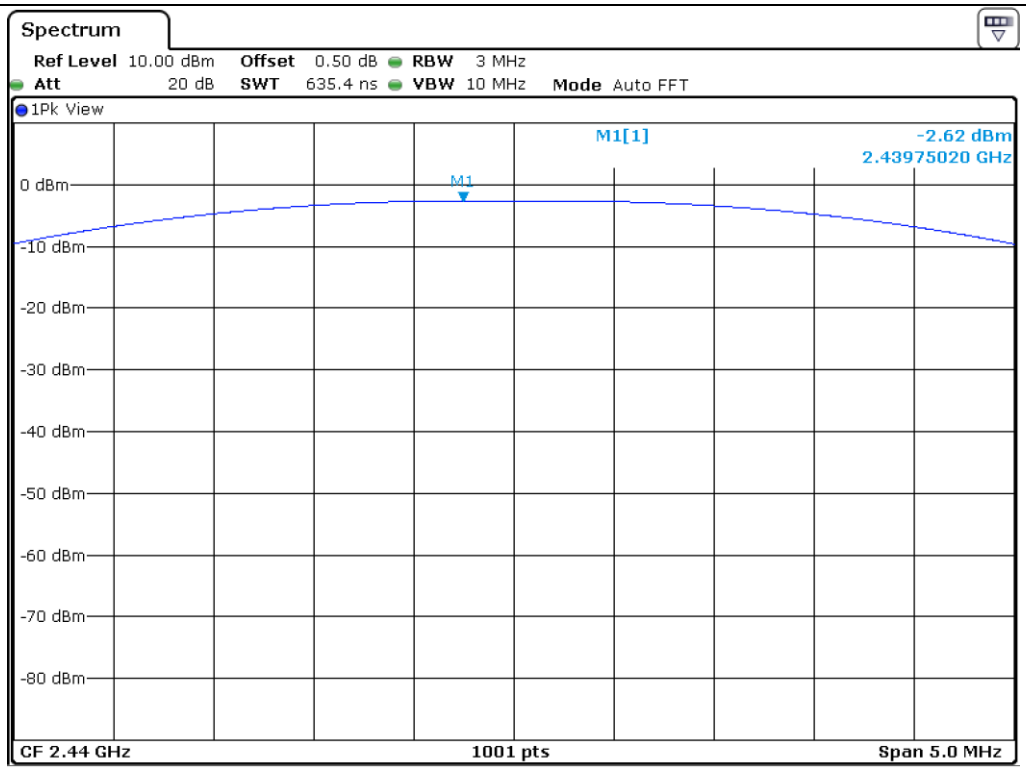
-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	-2.69	30.00	32.69
MIDDLE	2 440.00	-2.62	30.00	32.62
HIGH	2 480.00	-3.78	30.00	33.78

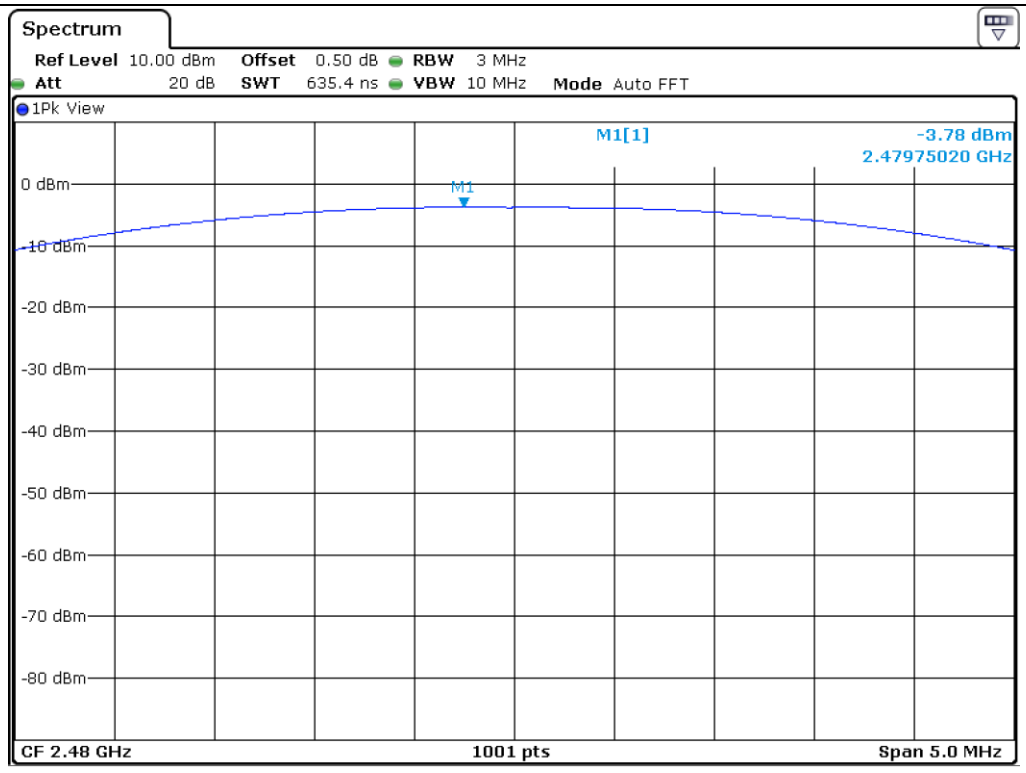
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)



Low Channel



Middle Channel



High Channel

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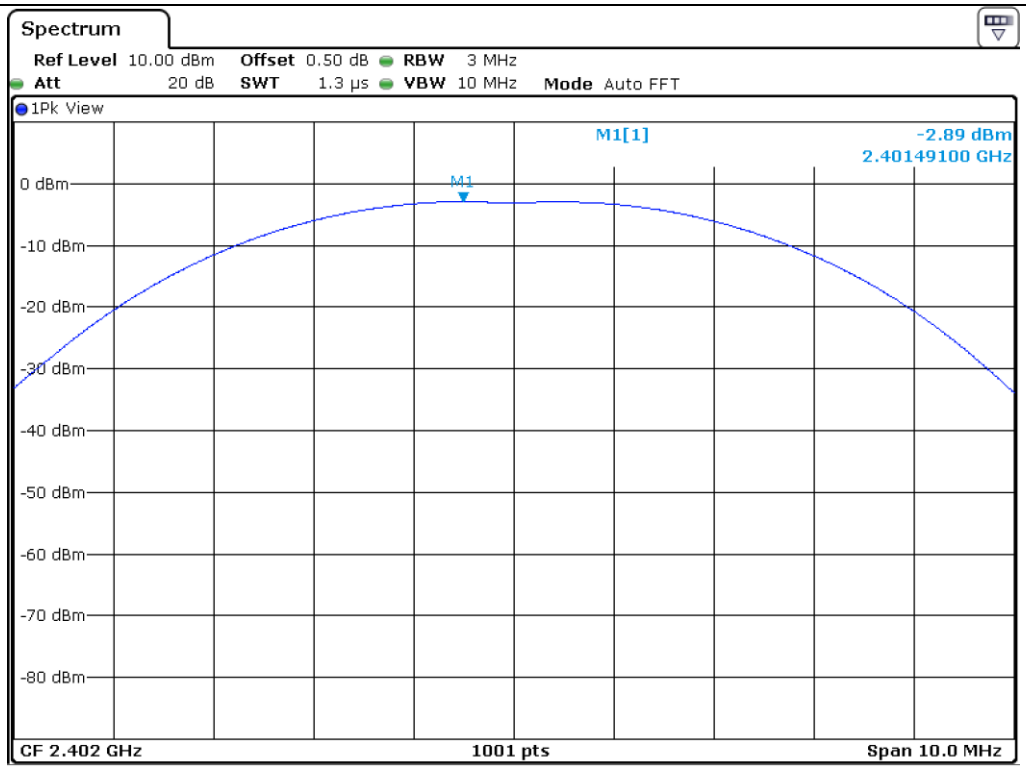
8.5 Test data for 2 Mbps

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	-2.89	30.00	32.89
MIDDLE	2 440.00	-3.03	30.00	33.03
HIGH	2 480.00	-3.38	30.00	33.38

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)



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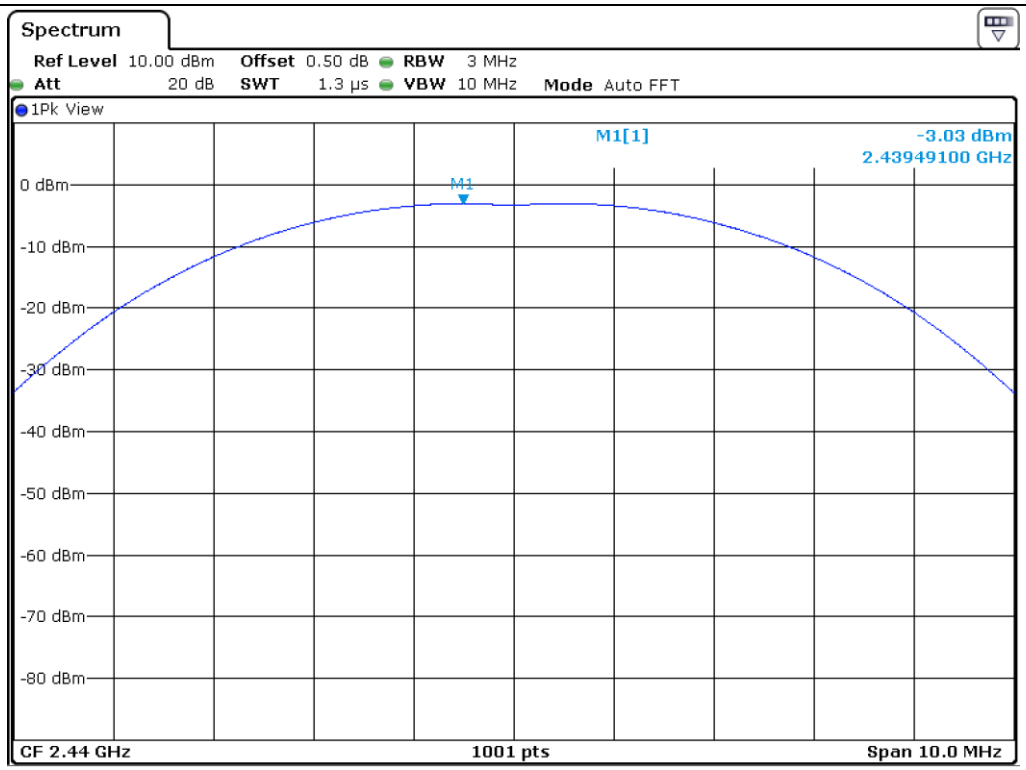
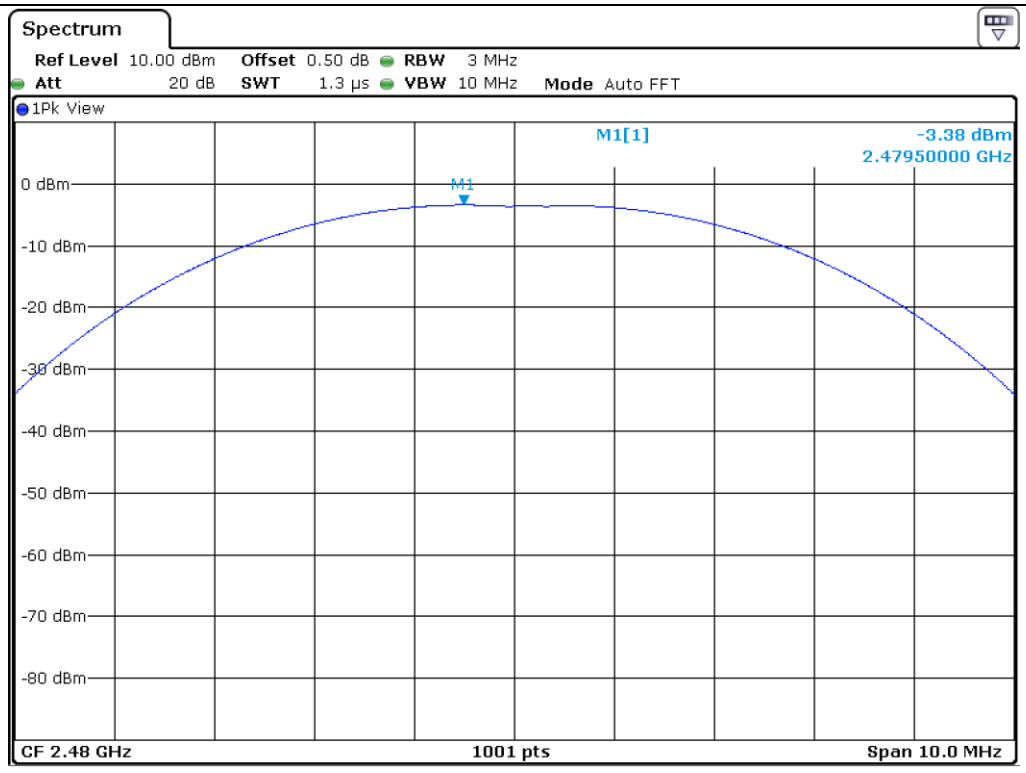


Middle Channel



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9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

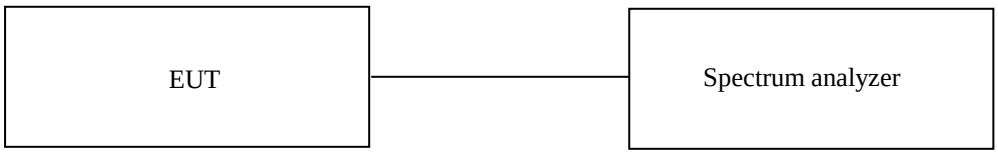
9.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, the video bandwidth is set to 3 times the resolution bandwidth and peak detection was used.



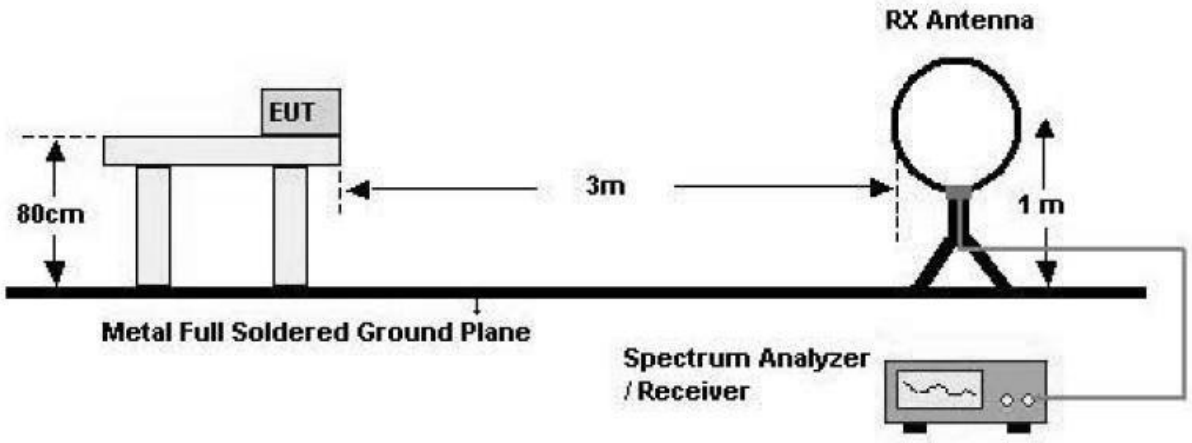
9.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

- Test Configuration

1. Below 30 MHz



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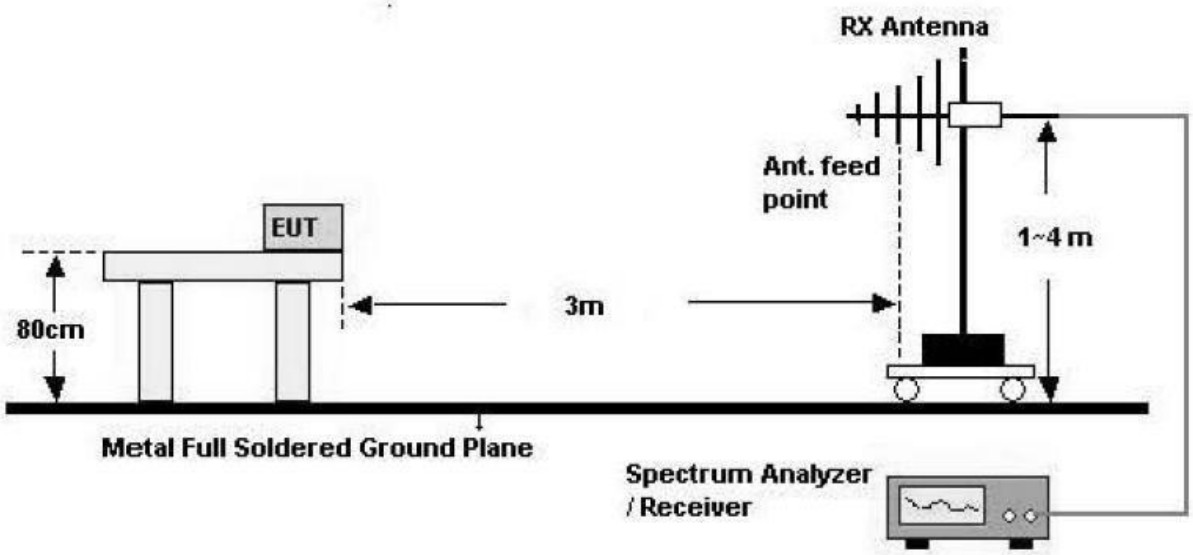
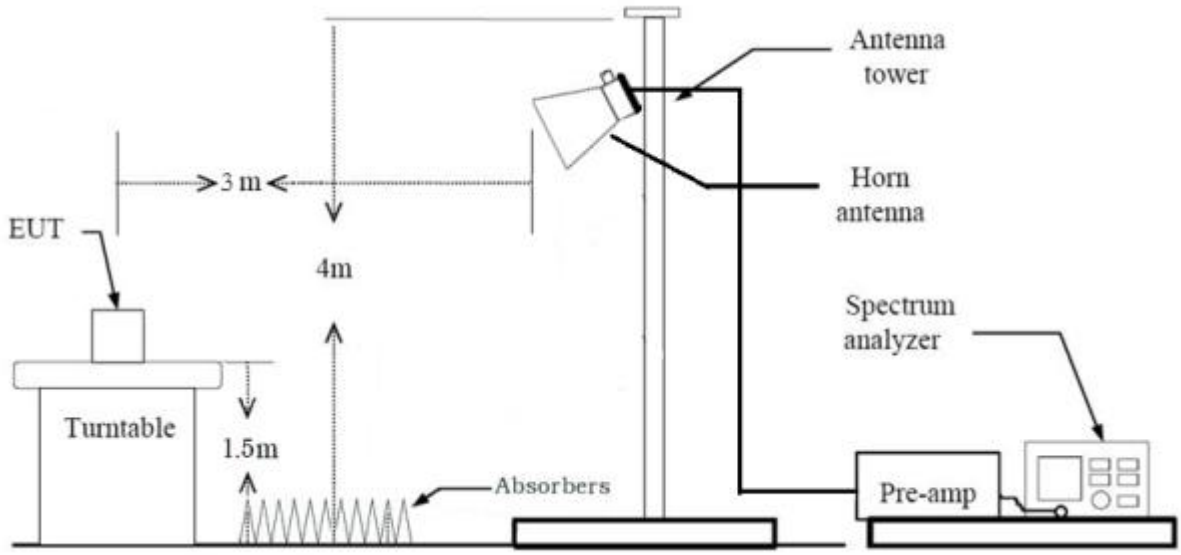
2. 30 MHz - 1 GHz



3. Above 1 GHz



9.4 Test Date

January 28, 2021 ~ February 04, 2021

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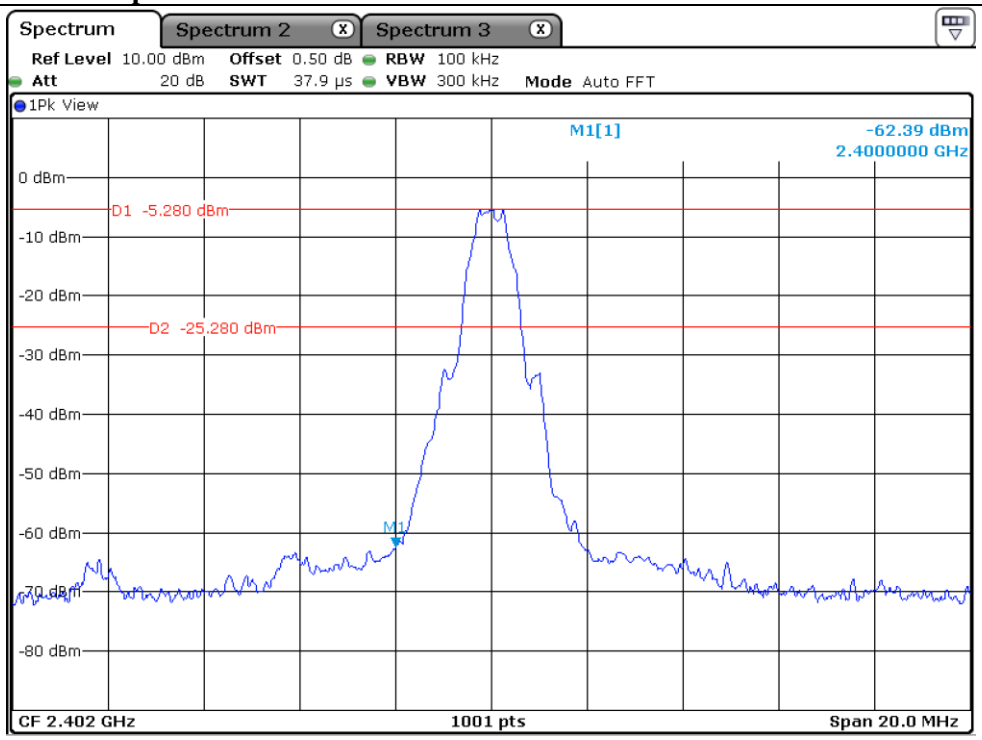
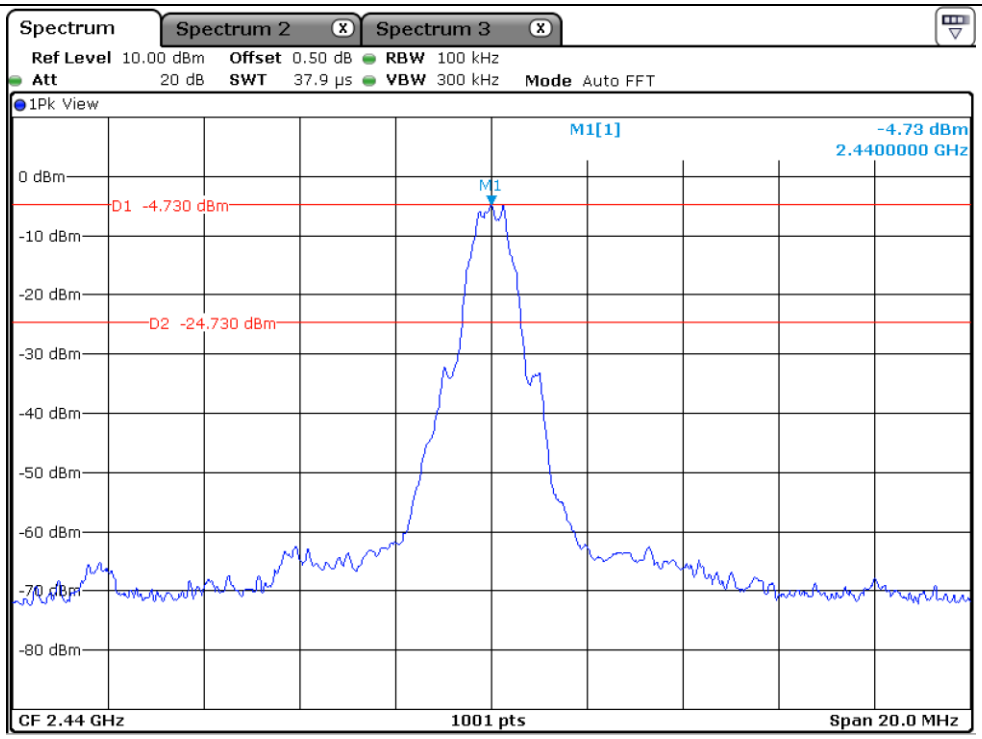
9.5 Test data for conducted emission

9.5.1 Test data for 1 Mbps



Low Channel



Middle Channel

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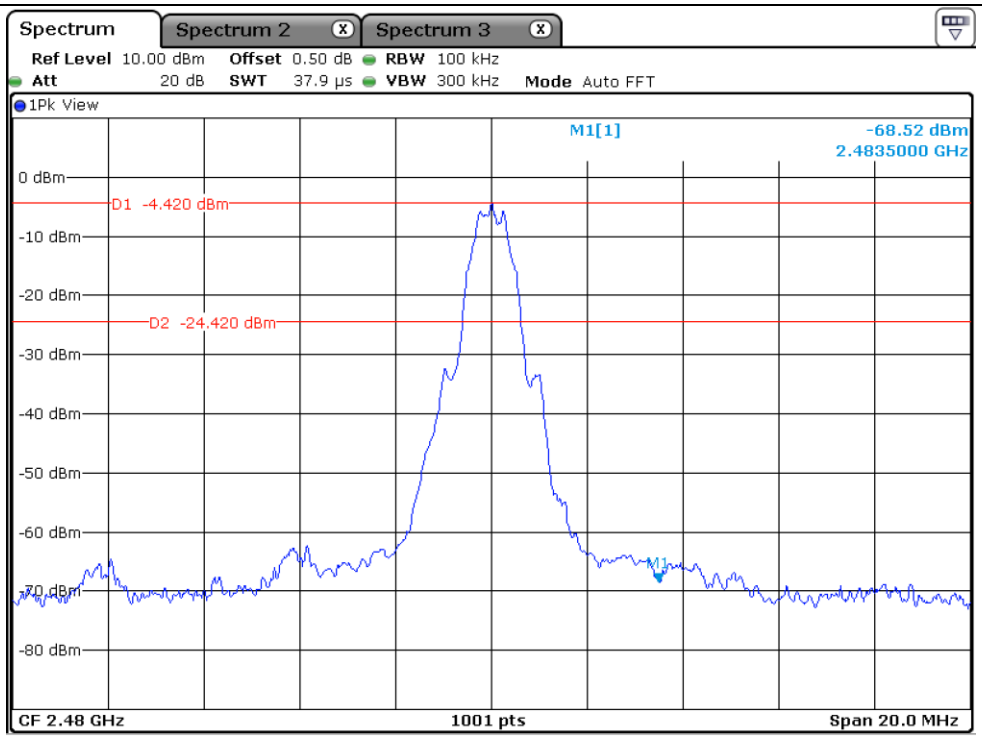
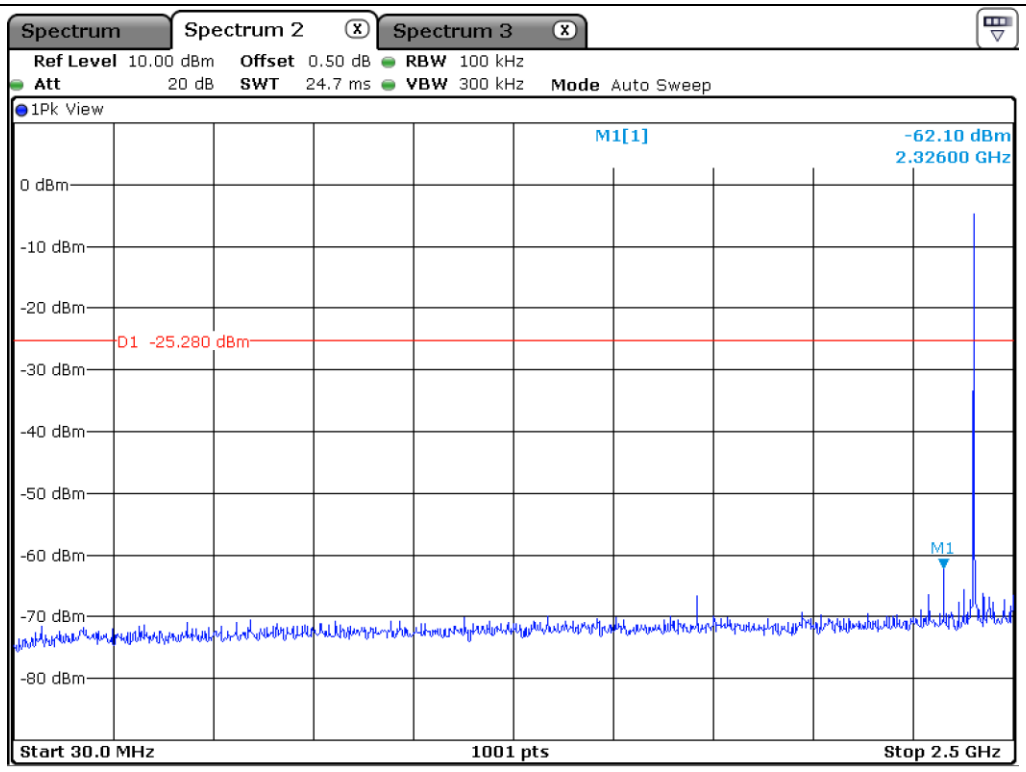
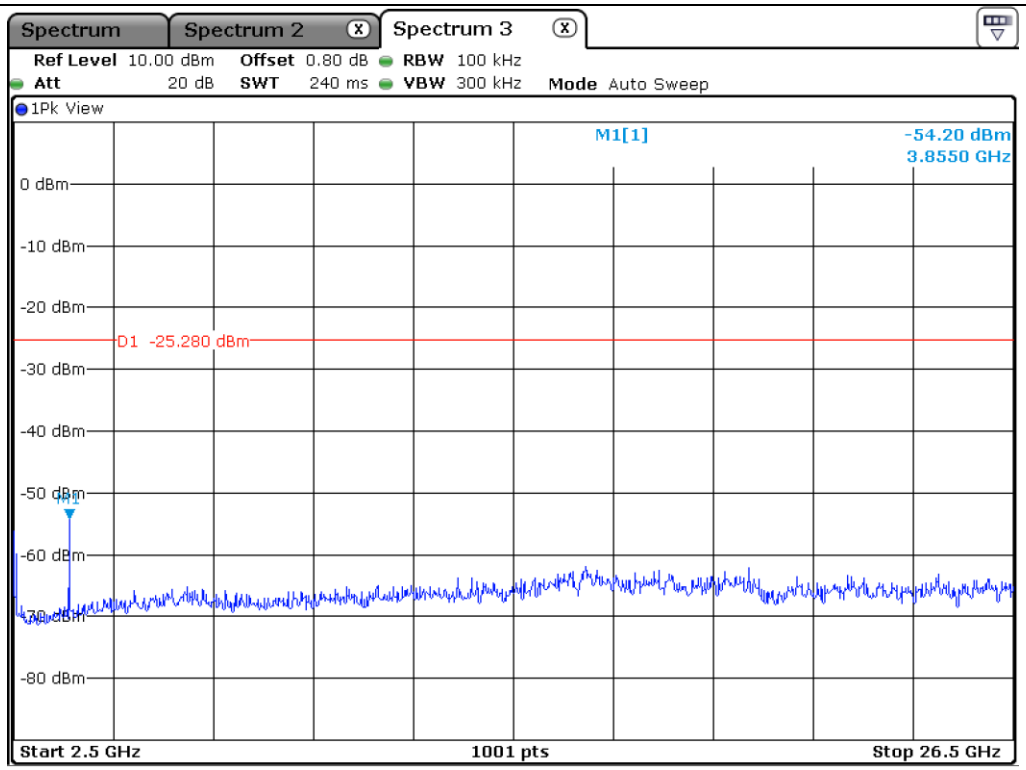


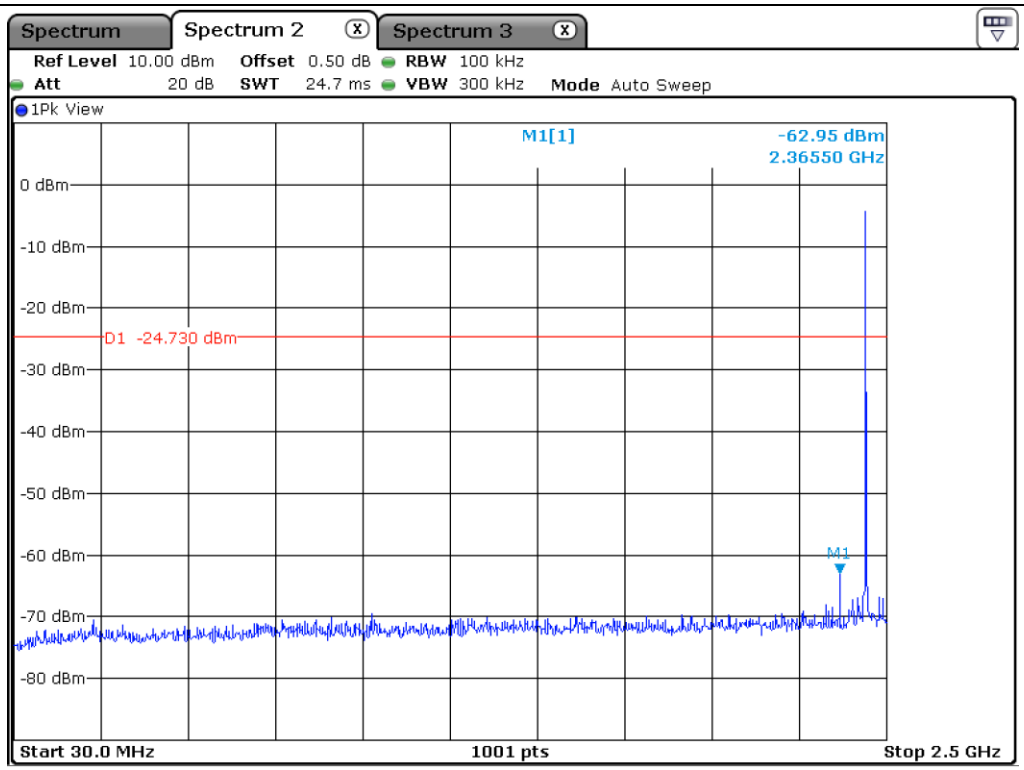
High Channel



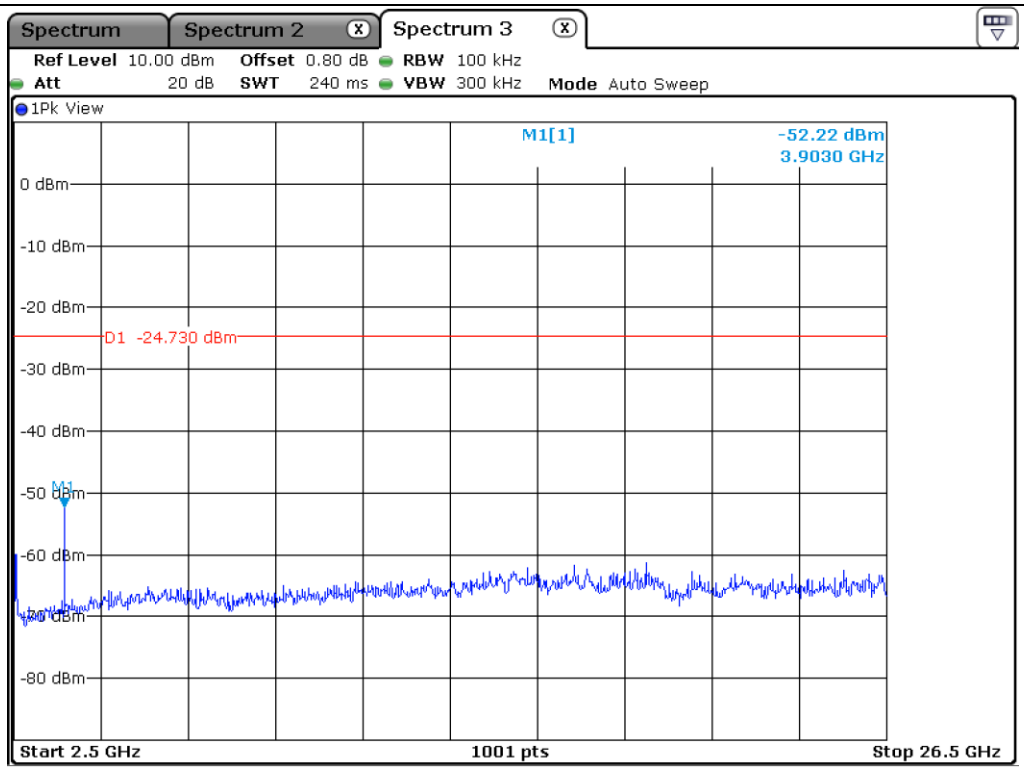
Low Channel



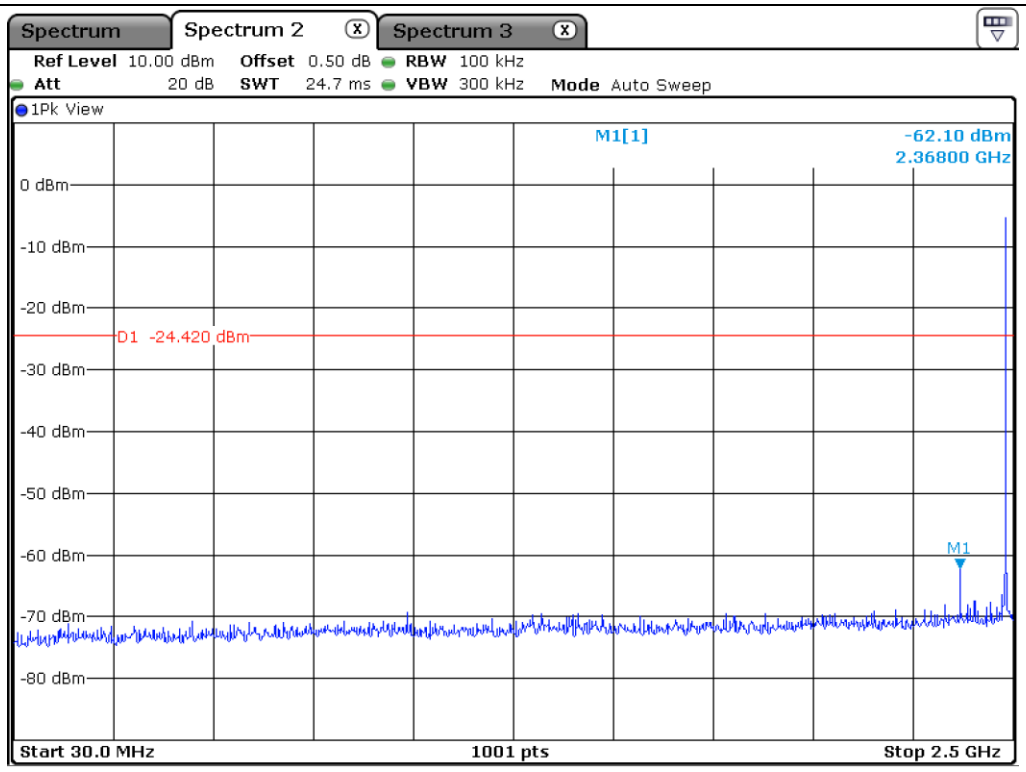
Low Channel



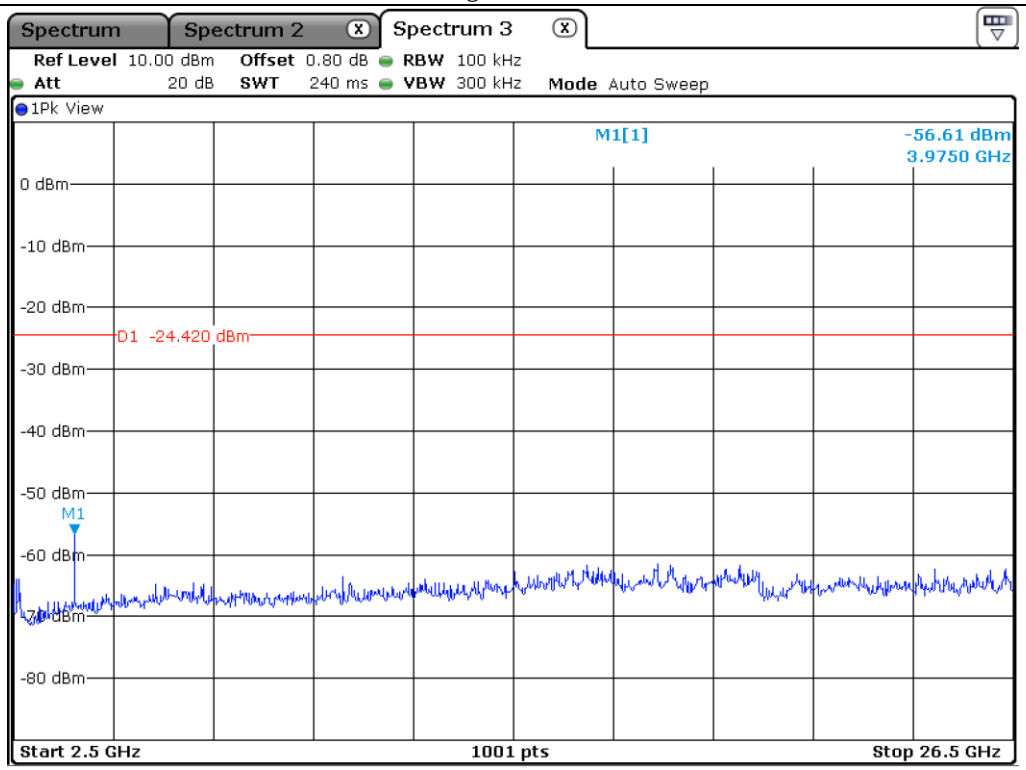
Middle Channel



Middle Channel

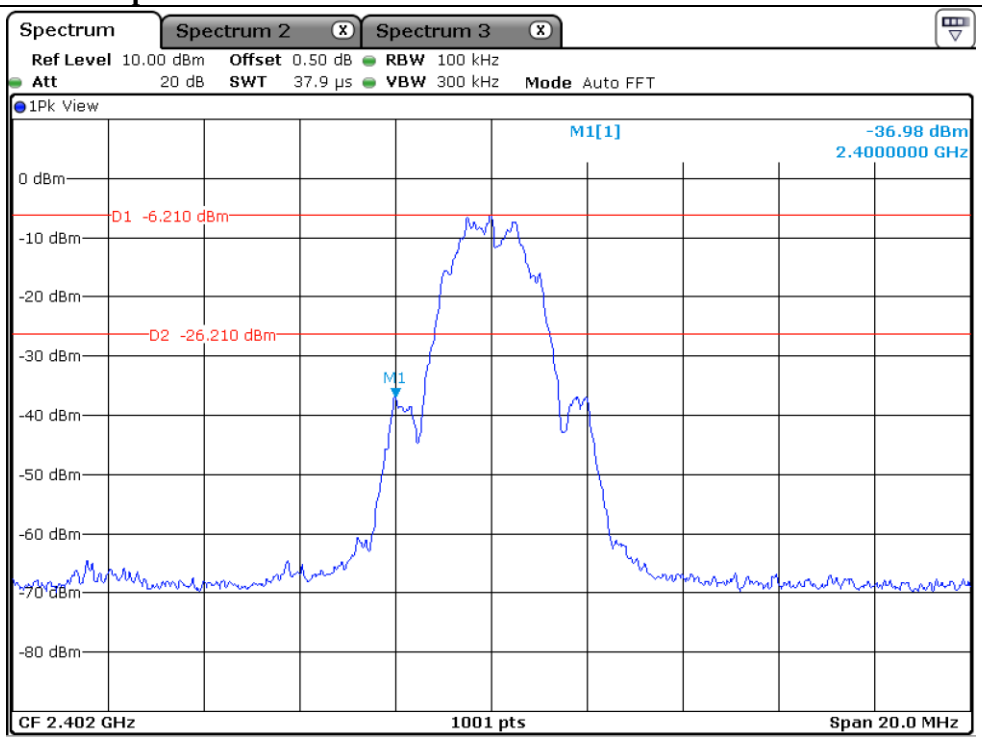


High Channel

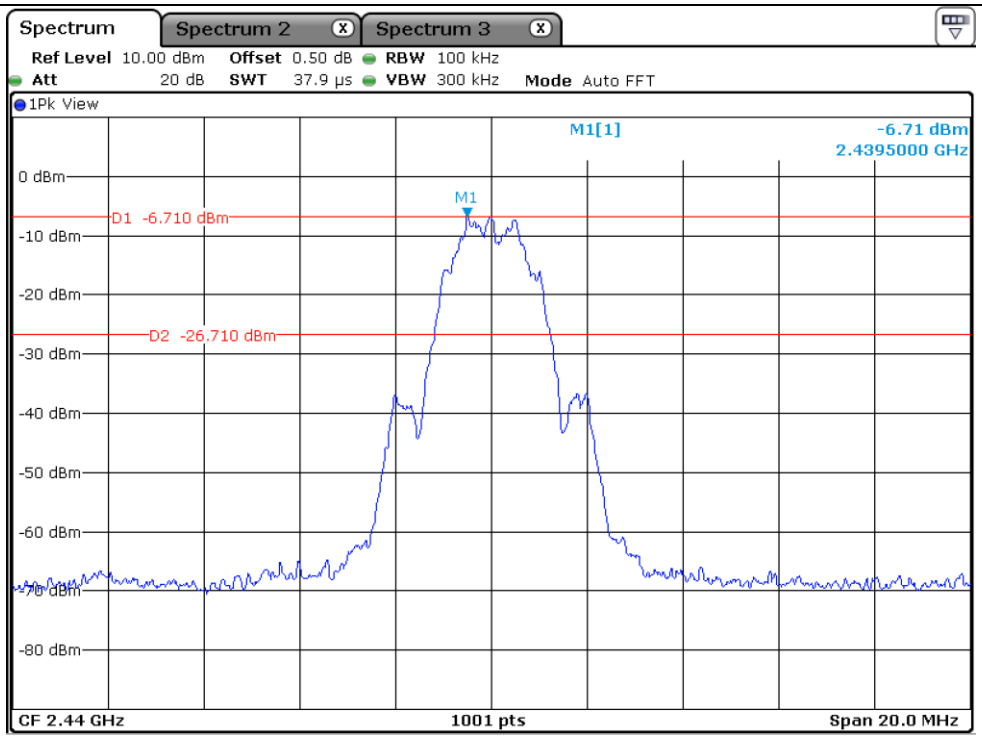


High Channel

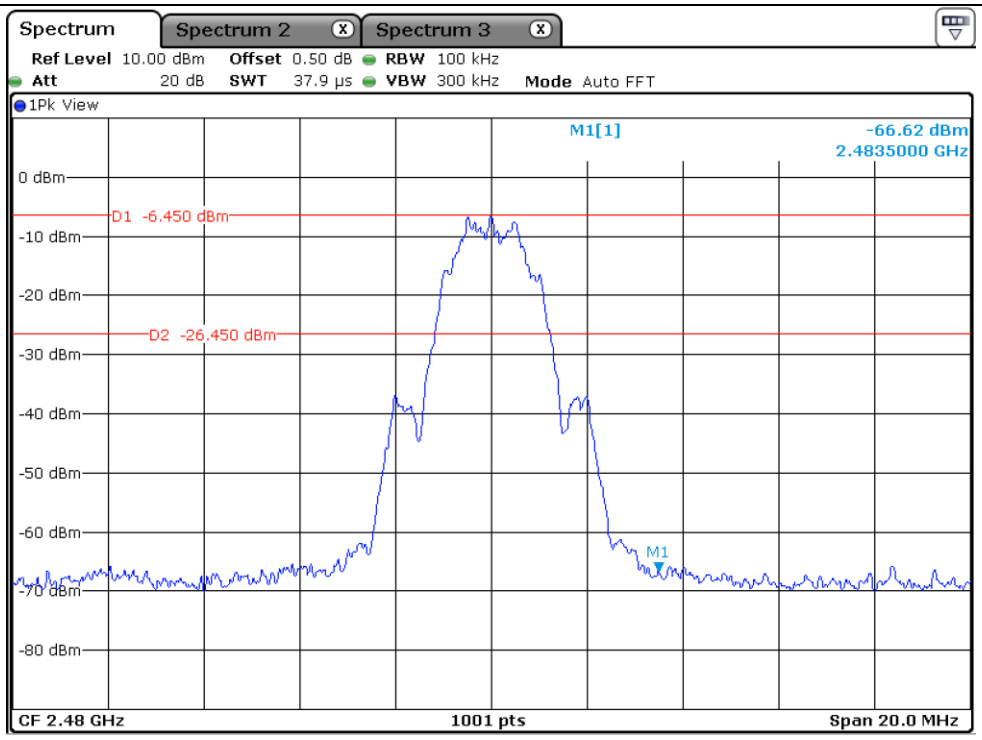
9.5.2 Test data for 2 Mbps



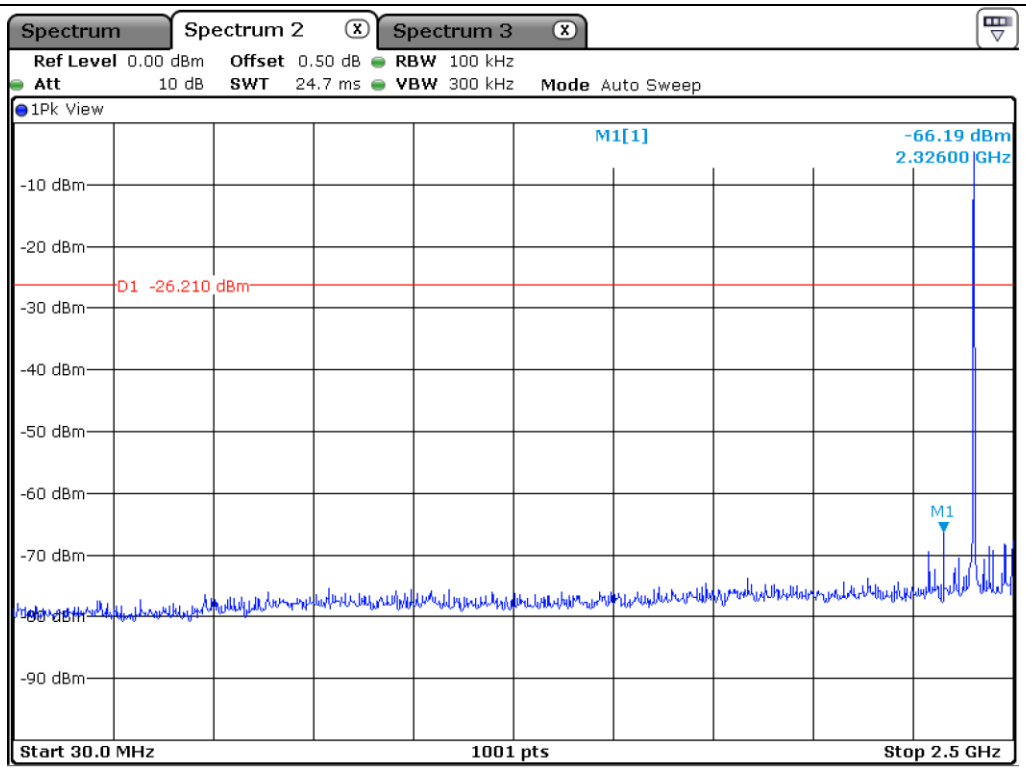
Low Channel



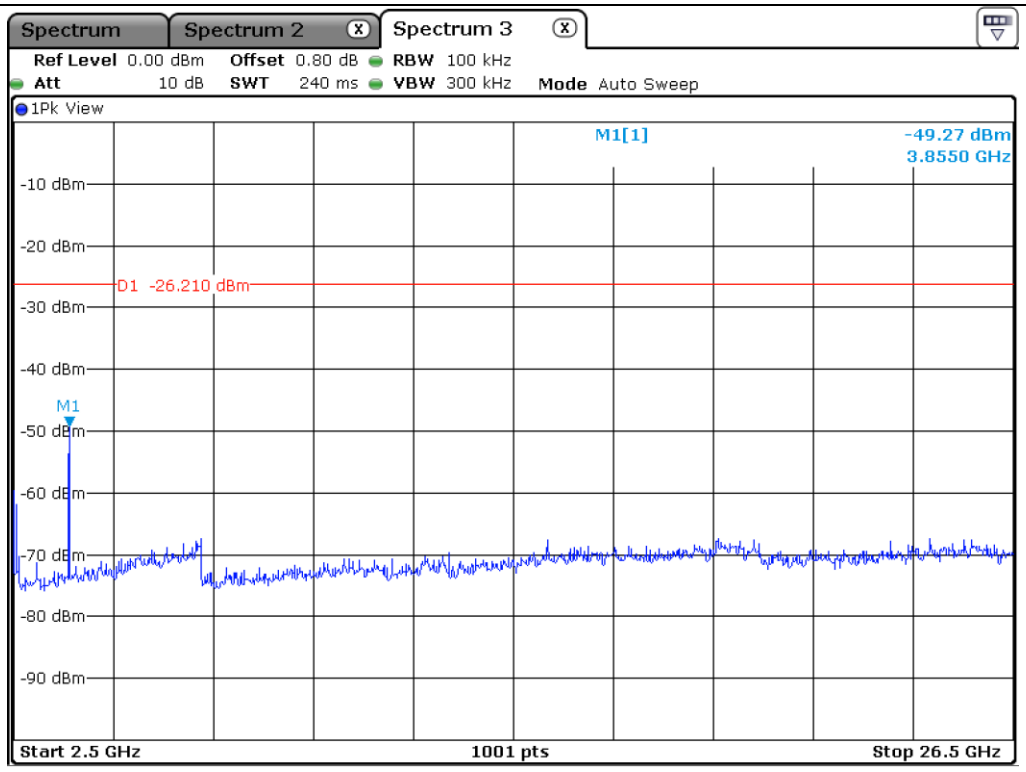
Middle Channel



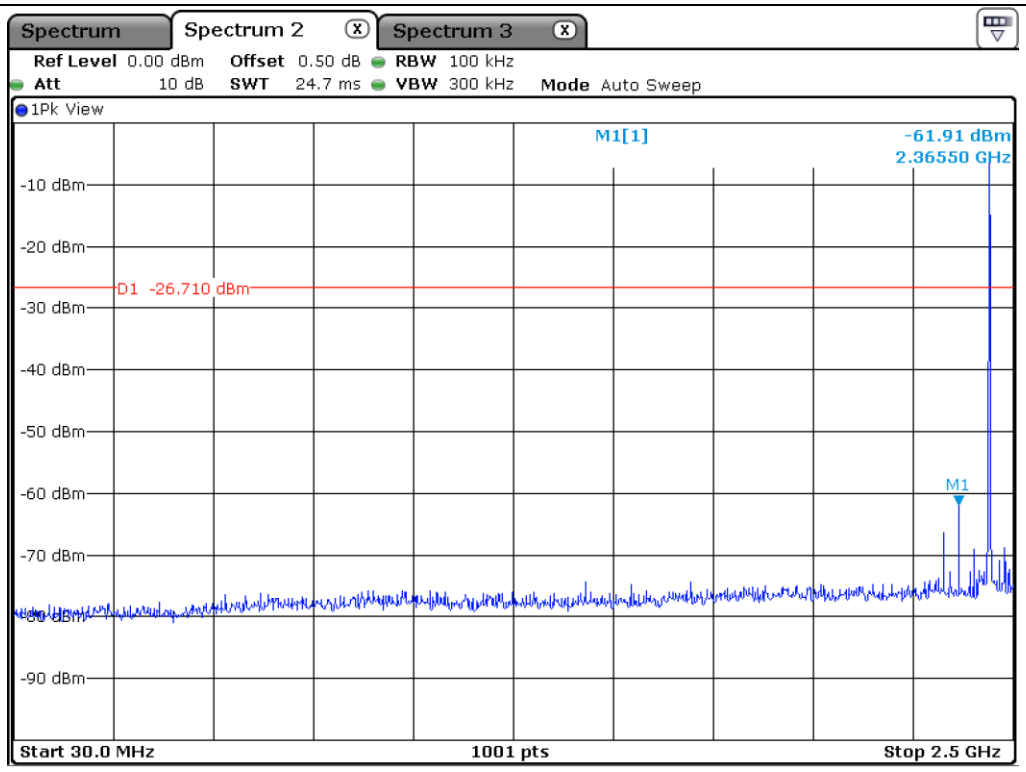
High Channel



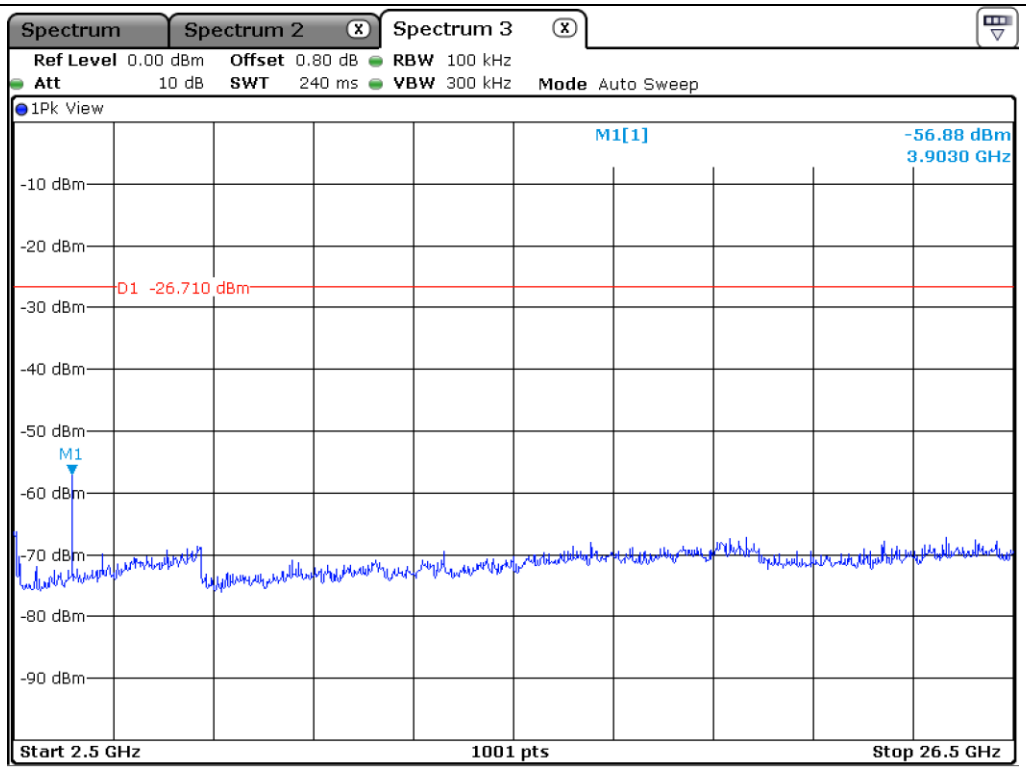
Low Channel



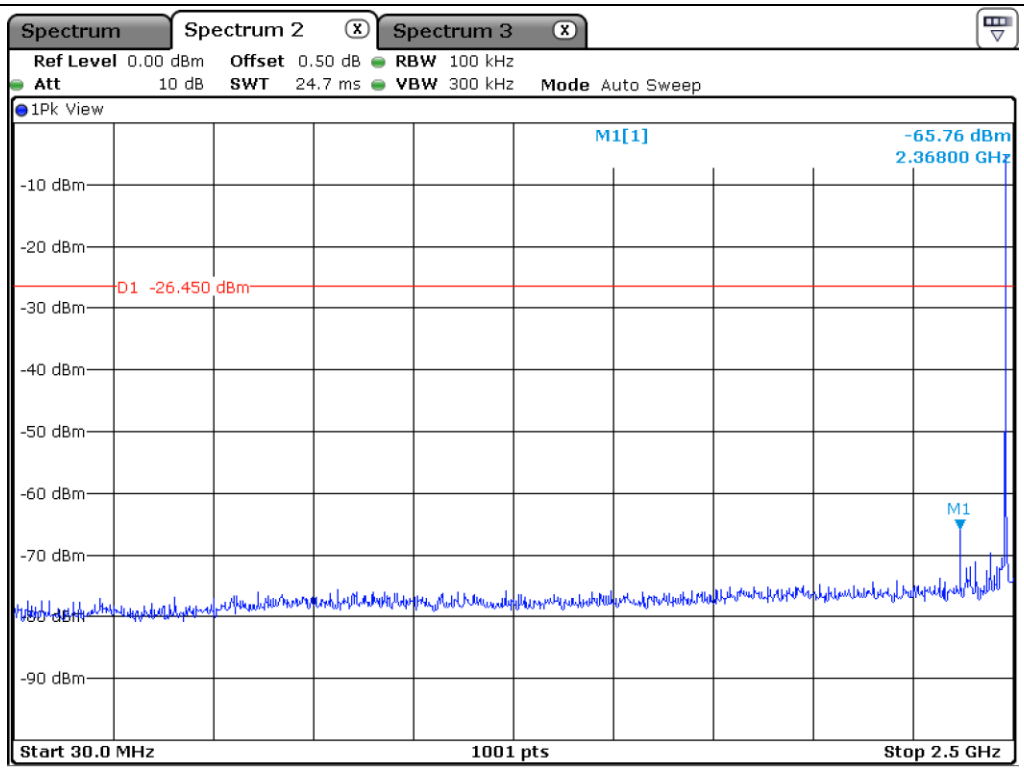
Low Channel



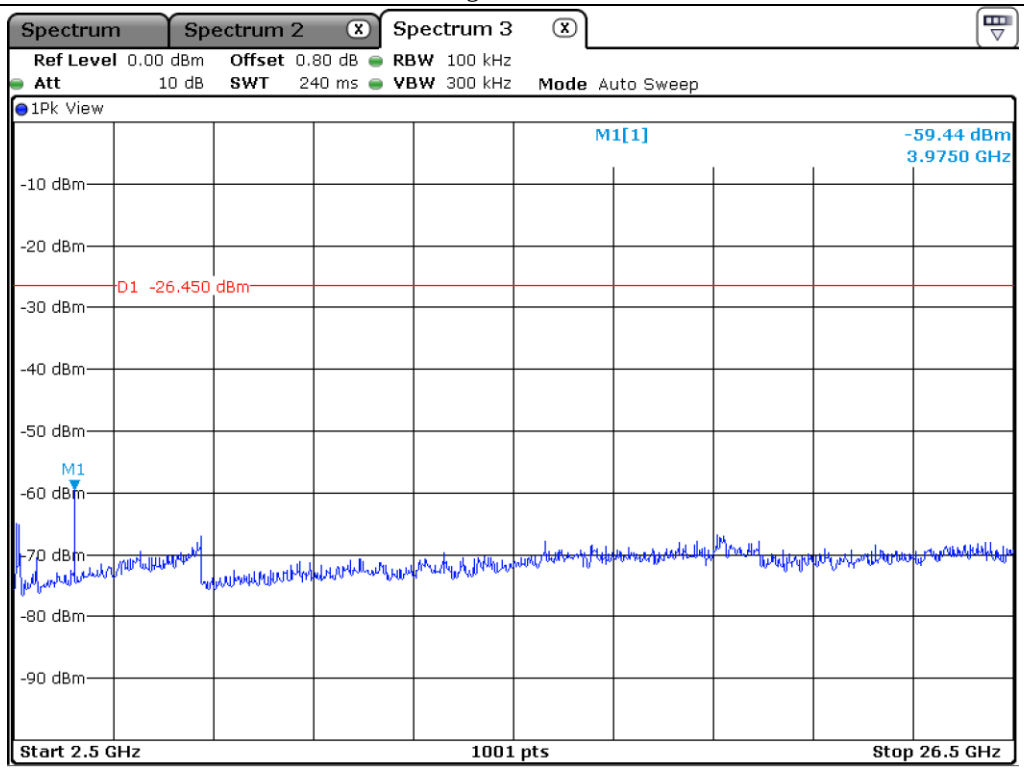
Middle Channel



Middle Channel



High Channel



High Channel

9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

9.6.1.1 Test data for 1 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 62.40 %

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 310.453	19.79	Peak	H	28.30	8.20	-	56.29	74.00	17.71
2 340.356	7.73	Average	H	28.30	8.20	2.05	46.28	54.00	7.72
2 362.658	19.14	Peak	V	28.30	8.20	-	55.64	74.00	18.36
2 312.526	7.29	Average	V	28.30	8.20	2.05	45.84	54.00	8.16
Test Data for High Channel									
2 494.781	19.08	Peak	H	28.70	8.23	-	56.01	74.00	17.99
2 492.335	7.05	Average	H	28.70	8.23	2.05	46.03	54.00	7.97
2 483.762	18.81	Peak	V	28.70	8.23	-	55.74	74.00	18.26
2 483.598	6.52	Average	V	28.70	8.23	2.05	45.50	54.00	8.50

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

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9.6.1.2 Test data for 2 Mbps

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Measurement distance : 3 m

-. Duty Cycle : 30.99 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
2 343.252	18.32	Peak	H	28.30	8.20	-	54.82	74.00	19.18
2 343.638	7.93	Average	H	28.30	8.20	5.09	49.52	54.00	4.48
2 335.381	18.24	Peak	V	28.30	8.20	-	54.74	74.00	19.26
2 312.487	7.56	Average	V	28.30	8.20	5.09	49.15	54.00	4.85
Test Data for High Channel									
2 486.362	19.45	Peak	H	28.70	8.23	-	56.38	74.00	17.62
2 483.508	6.76	Average	H	28.70	8.23	5.09	48.78	54.00	5.22
2 490.773	18.26	Peak	V	28.70	8.23	-	55.19	74.00	18.81
2 489.653	7.36	Average	V	28.70	8.23	5.09	49.38	54.00	4.62

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

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9.6.2 Spurious & Harmonic Radiated Emission

9.6.2.1 Test data for 1 Mbps

-. Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 62.40 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	14.06	Peak	H	33.40	11.21	-	58.67	74.00	15.33
4 804.00	3.27	Average	H	33.40	11.21	2.05	49.93	54.00	4.07
4 804.00	13.34	Peak	V	33.40	11.21	-	57.95	74.00	16.05
4 804.00	2.54	Average	V	33.40	11.21	2.05	49.20	54.00	4.80
Test Data for Middle Channel									
4 880.00	12.77	Peak	H	33.50	11.23	-	57.50	74.00	16.50
4 880.00	2.24	Average	H	33.50	11.23	2.05	49.02	54.00	4.98
4 880.00	12.62	Peak	V	33.50	11.23	-	57.35	74.00	16.65
4 880.00	2.76	Average	V	33.50	11.23	2.05	49.54	54.00	4.46
Test Data for High Channel									
4 960.00	12.55	Peak	H	33.30	11.25	-	57.10	74.00	16.90
4 960.00	3.26	Average	H	33.30	11.25	2.05	49.86	54.00	4.14
4 960.00	13.06	Peak	V	33.30	11.25	-	57.61	74.00	16.39
4 960.00	2.94	Average	V	33.30	11.25	2.05	49.54	54.00	4.46

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

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9.6.2.2 Test data for 2 Mbps

-. Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 30.99 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	13.75	Peak	H	33.40	11.21	-	58.36	74.00	15.64
4 804.00	2.83	Average	H	33.40	11.21	5.09	52.53	54.00	1.47
4 804.00	12.78	Peak	V	33.40	11.21	-	57.39	74.00	16.61
4 804.00	3.00	Average	V	33.40	11.21	5.09	52.70	54.00	1.30
Test Data for Middle Channel									
4 880.00	13.14	Peak	H	33.50	11.23	-	57.87	74.00	16.13
4 880.00	2.83	Average	H	33.50	11.23	5.09	52.65	54.00	1.35
4 880.00	12.61	Peak	V	33.50	11.23	-	57.34	74.00	16.66
4 880.00	2.76	Average	V	33.50	11.23	5.09	52.58	54.00	1.42
Test Data for High Channel									
4 960.00	12.40	Peak	H	33.30	11.25	-	56.95	74.00	17.05
4 960.00	3.24	Average	H	33.30	11.25	5.09	52.88	54.00	1.12
4 960.00	13.42	Peak	V	33.30	11.25	-	57.97	74.00	16.03
4 960.00	3.24	Average	V	33.30	11.25	5.09	52.88	54.00	1.12

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

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10. PEAK POWER SPECTRAL DENSITY

10.1 Operating environment

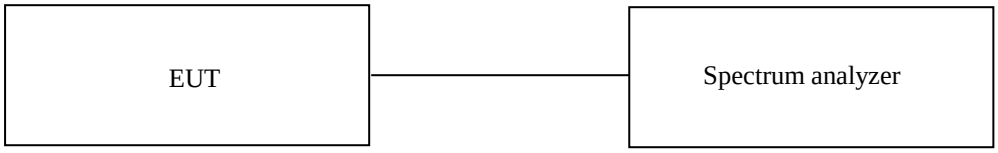
Temperature : 23 °C

Relative humidity : 45 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to 3 kHz ≤ RBW ≤100 kHz, the video bandwidth is set to 3 times the resolution bandwidth.



10.3 Test Date

January 28, 2021 ~ February 04, 2021

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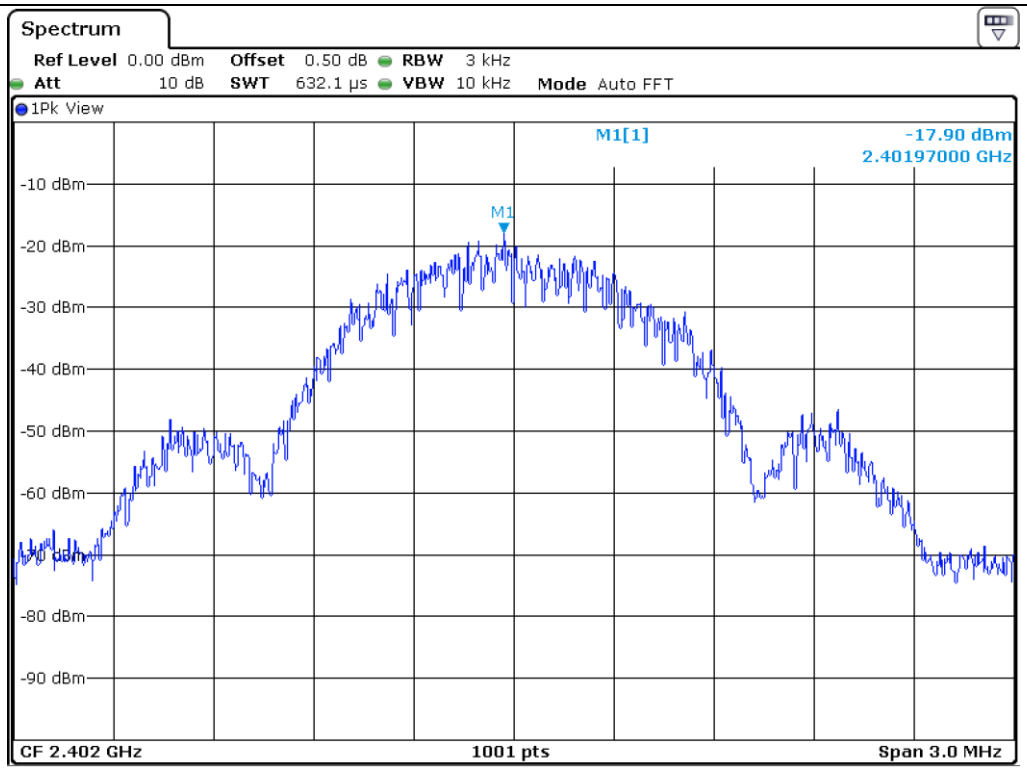
10.4 Test data for 1 Mbps

-. Test Result : Pass

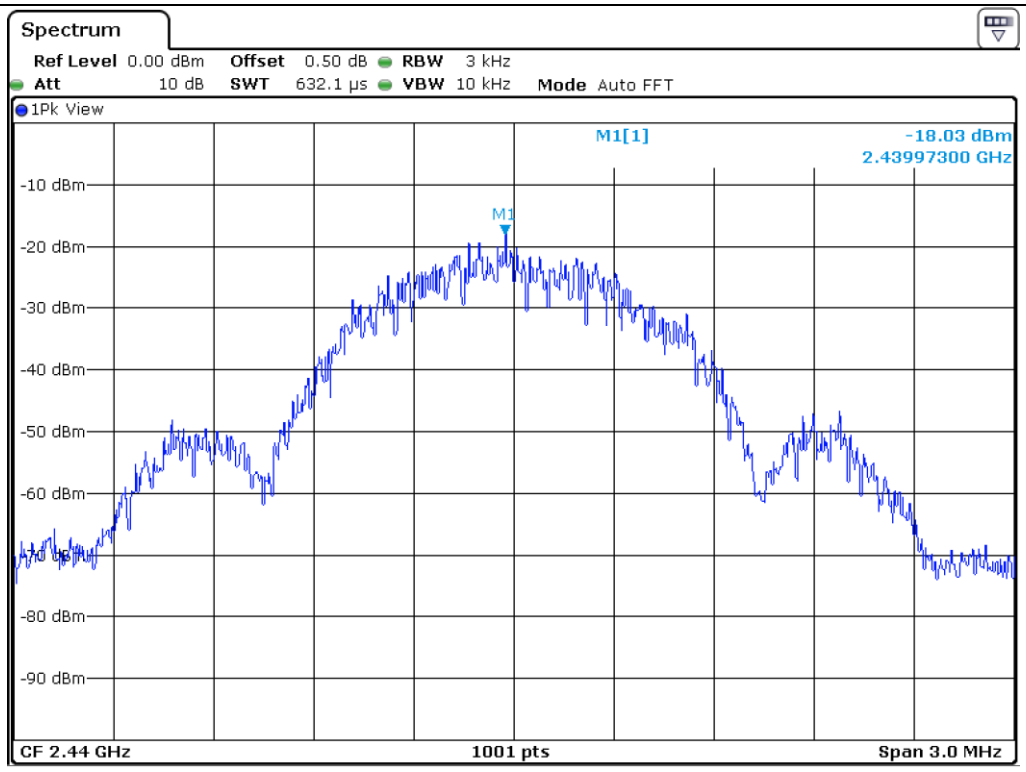
-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-17.90	8.00	25.90
Middle	2 440.00	-18.03	8.00	26.03
High	2 480.00	-17.93	8.00	25.93

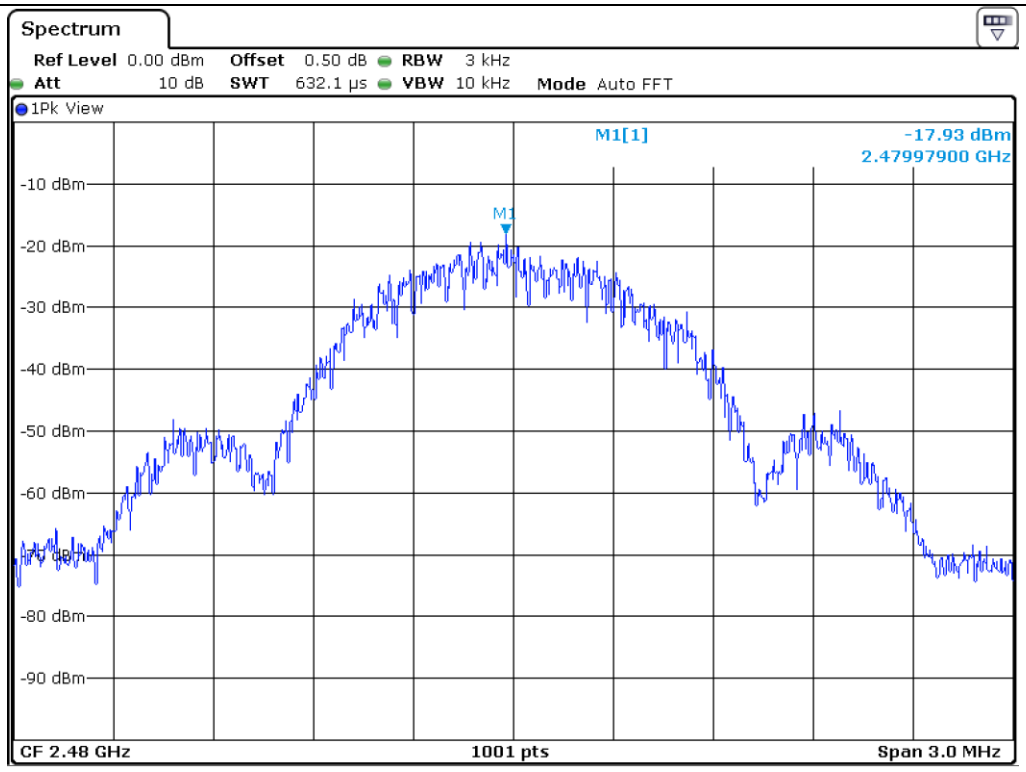
Remark. Margin = Limit – Measured value



Low Channel



Middle Channel



High Channel

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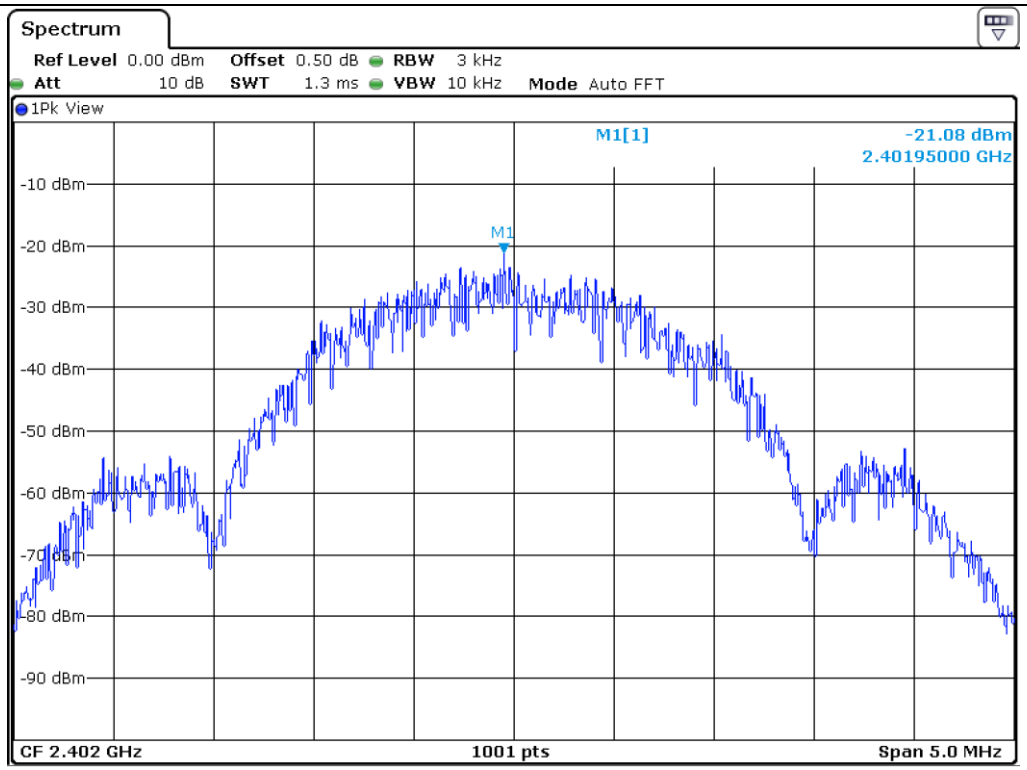
10.5 Test data for 2 Mbps

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-21.08	8.00	29.08
Middle	2 440.00	-21.13	8.00	29.13
High	2 480.00	-21.47	8.00	29.47

Remark. Margin = Limit – Measured value



Low Channel

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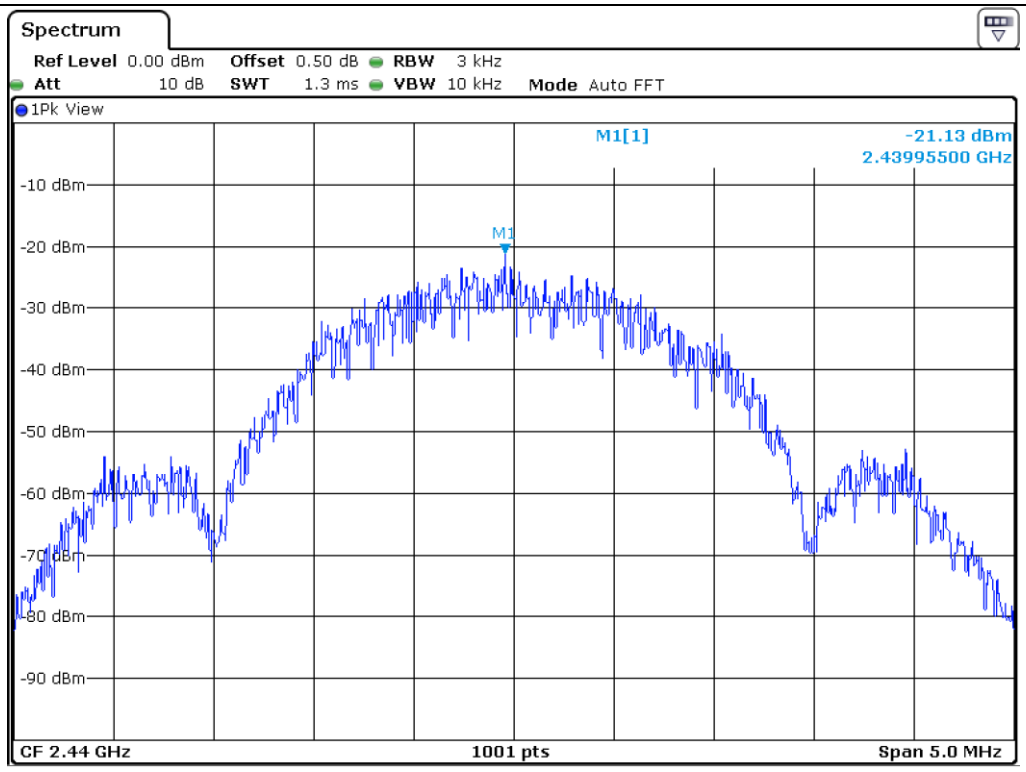
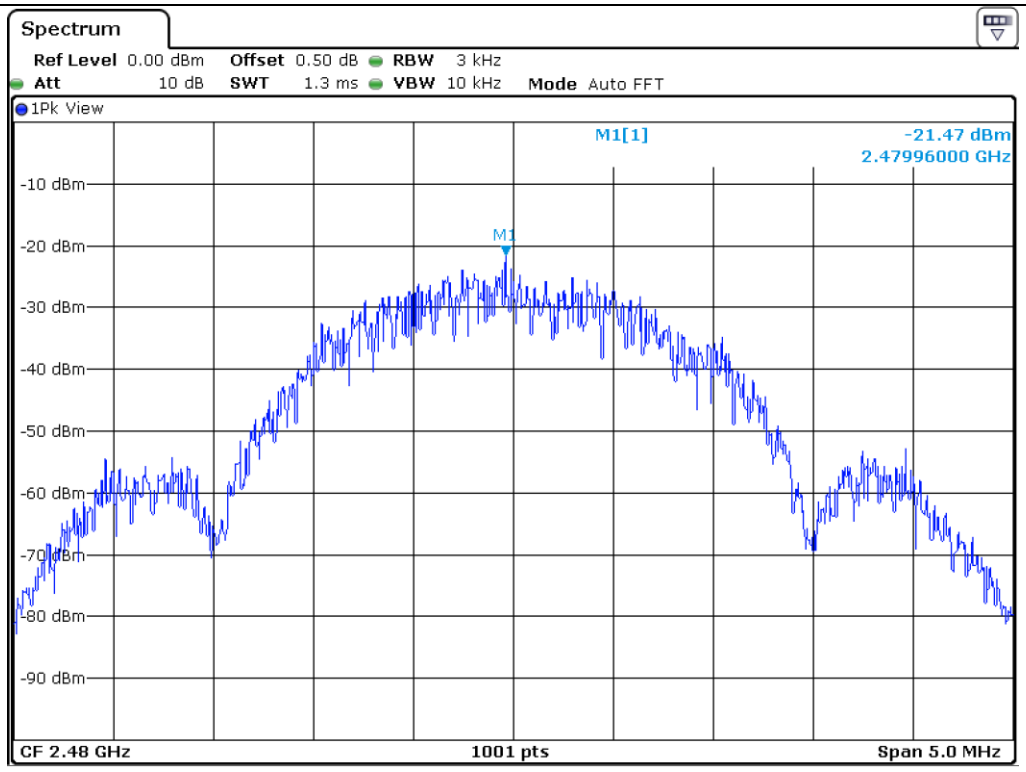


Middle Channel



High Channel

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11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

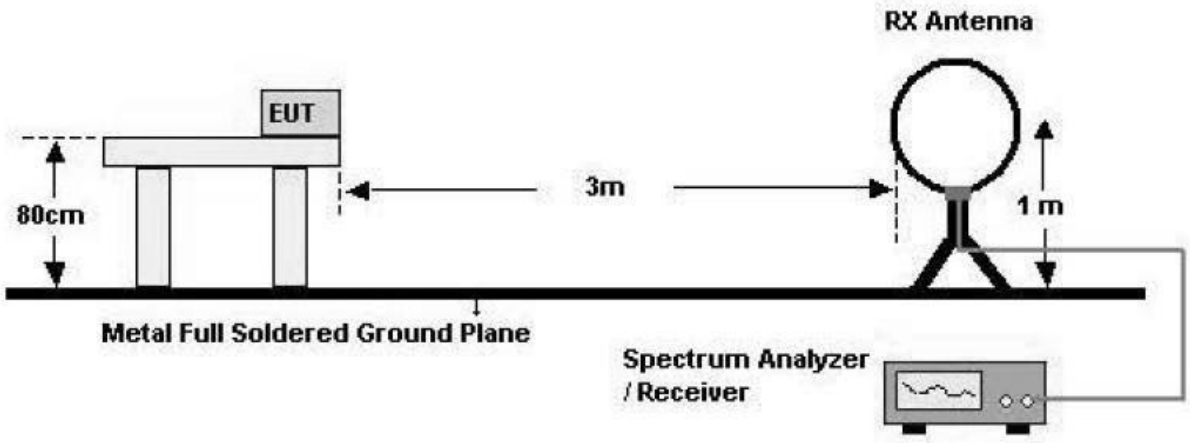
11.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

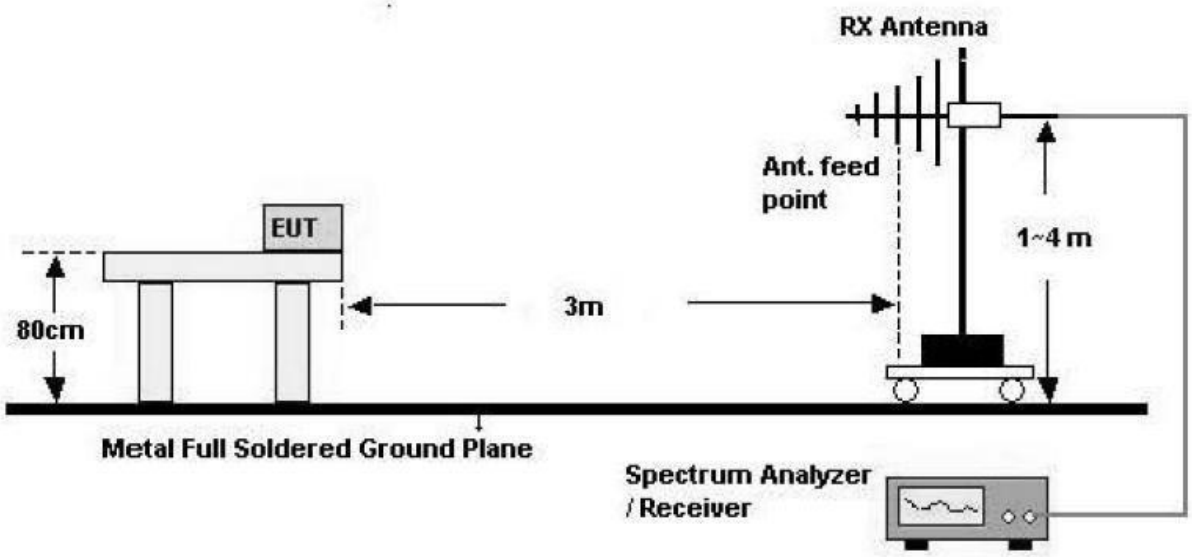
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

- Test Configuration

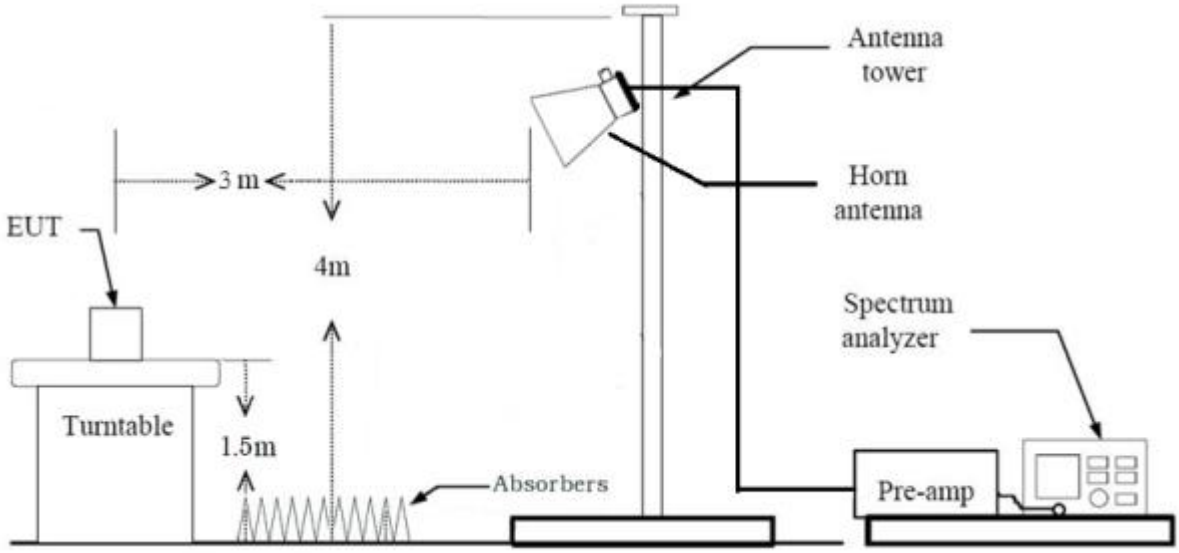
1. Below 30 MHz



2. 30 MHz - 1 GHz



3. Above 1 GHz



11.3 Test Date

January 28, 2021 ~ February 04, 2021

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

11.4 Test data for 30 MHz ~ 1 000 MHz

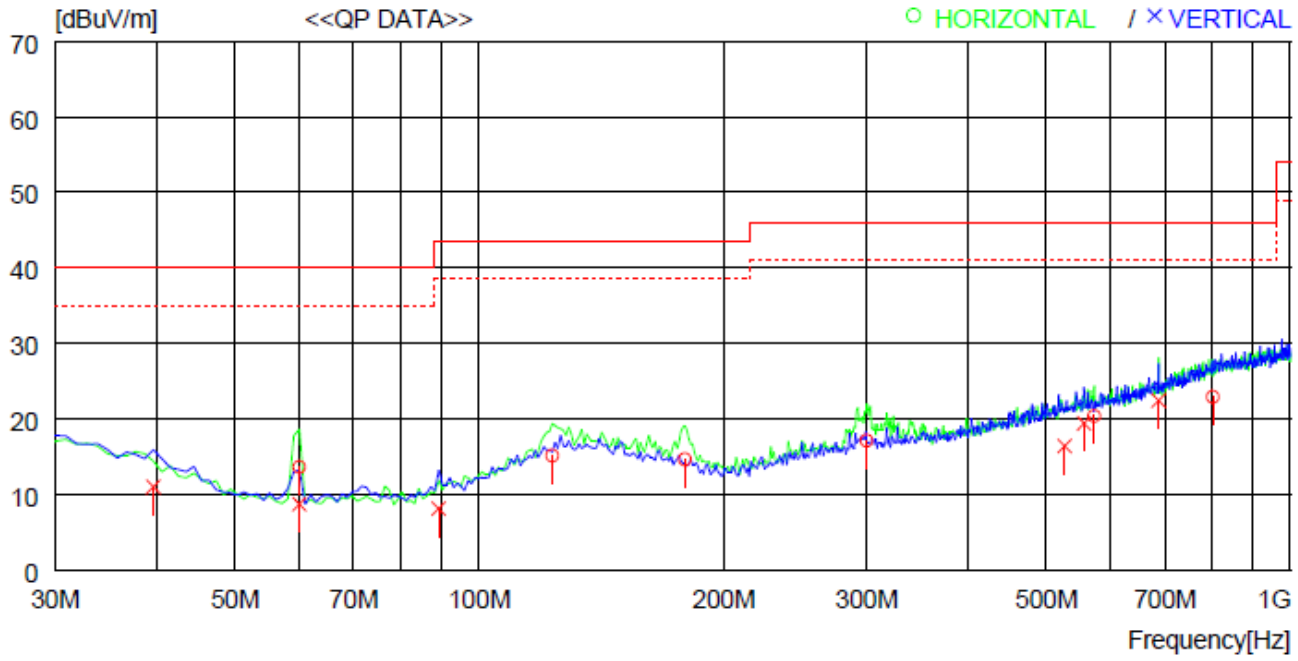
11.4.1 Test data for Bluetooth LE

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : NAVIGATION RADIO

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	60.070	36.2	9.4	0.7	32.7	13.6	40.0	26.4	300	359
2	123.120	36.0	10.8	1.0	32.7	15.1	43.5	28.4	200	171
3	179.380	32.8	13.1	1.3	32.6	14.6	43.5	28.9	300	359
4	300.630	34.5	13.6	1.7	32.7	17.1	46.0	28.9	100	359
5	573.199	31.8	19.3	2.3	33.0	20.4	46.0	25.6	400	0
6	802.112	31.5	22.0	2.0	32.6	22.9	46.0	23.1	200	112
----- Vertical ------										
7	39.700	32.5	10.7	0.5	32.7	11.0	40.0	29.0	100	0
8	60.070	31.3	9.4	0.7	32.7	8.7	40.0	31.3	400	359
9	89.170	32.0	7.9	0.9	32.7	8.1	43.5	35.4	100	0
10	526.640	28.8	18.3	2.2	32.9	16.4	46.0	29.6	300	0
11	556.709	31.2	18.9	2.3	33.0	19.4	46.0	26.6	100	59
12	687.655	32.0	20.8	2.5	32.9	22.4	46.0	23.6	100	284

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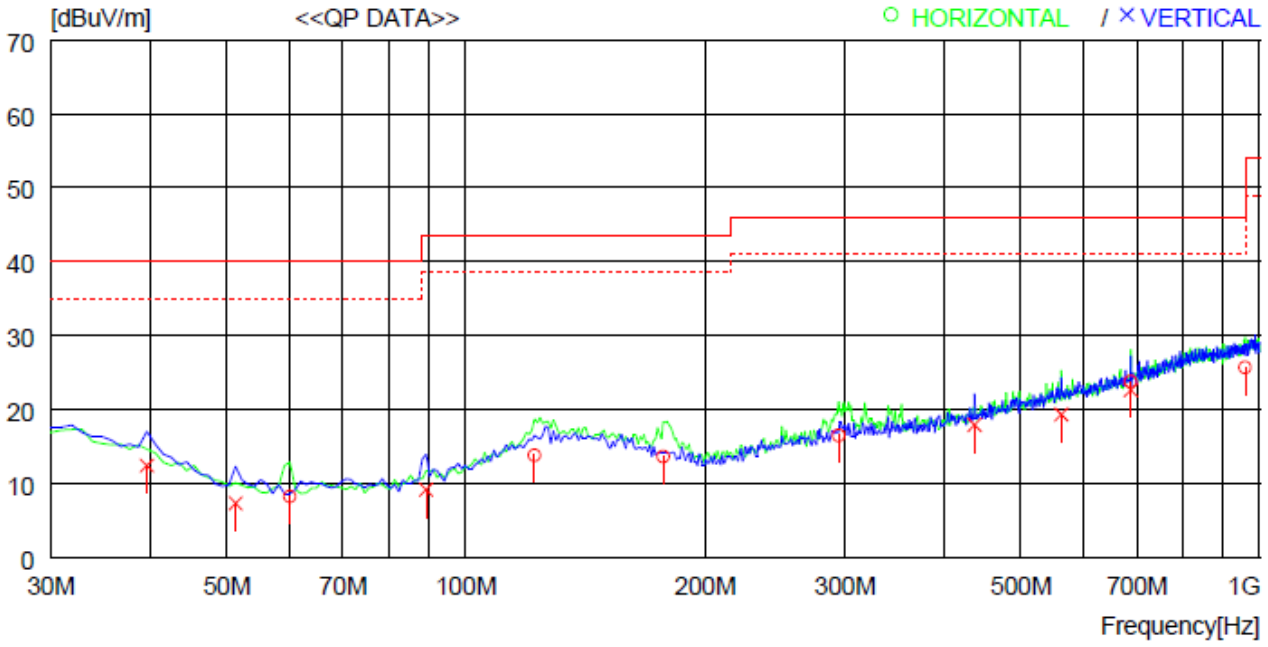
11.4.2 Test data for Intermodulation Mode(Bluetooth LE + WLAN 2.4 GHz)

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : NAVIGATION RADIO

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	60.070	30.8	9.4	0.7	32.7	8.2	40.0	31.8	200	35
2	122.150	34.7	10.8	1.0	32.7	13.8	43.5	29.7	300	358
3	177.440	31.9	13.0	1.3	32.6	13.6	43.5	29.9	200	0
4	294.810	34.4	13.2	1.6	32.7	16.5	46.0	29.5	100	359
5	687.655	33.4	20.8	2.5	32.9	23.8	46.0	22.2	300	31
6	958.277	30.9	23.5	3.0	31.7	25.7	46.0	20.3	400	0
----- Vertical ------										
7	39.700	33.9	10.7	0.5	32.7	12.4	40.0	27.6	100	0
8	51.340	29.7	9.7	0.6	32.7	7.3	40.0	32.7	100	0
9	89.170	33.0	7.9	0.9	32.7	9.1	43.5	34.4	100	0
10	437.401	31.8	16.9	2.0	32.8	17.9	46.0	28.1	100	1
11	562.529	30.9	19.1	2.3	33.0	19.3	46.0	26.7	100	0
12	687.655	32.2	20.8	2.5	32.9	22.6	46.0	23.4	200	5

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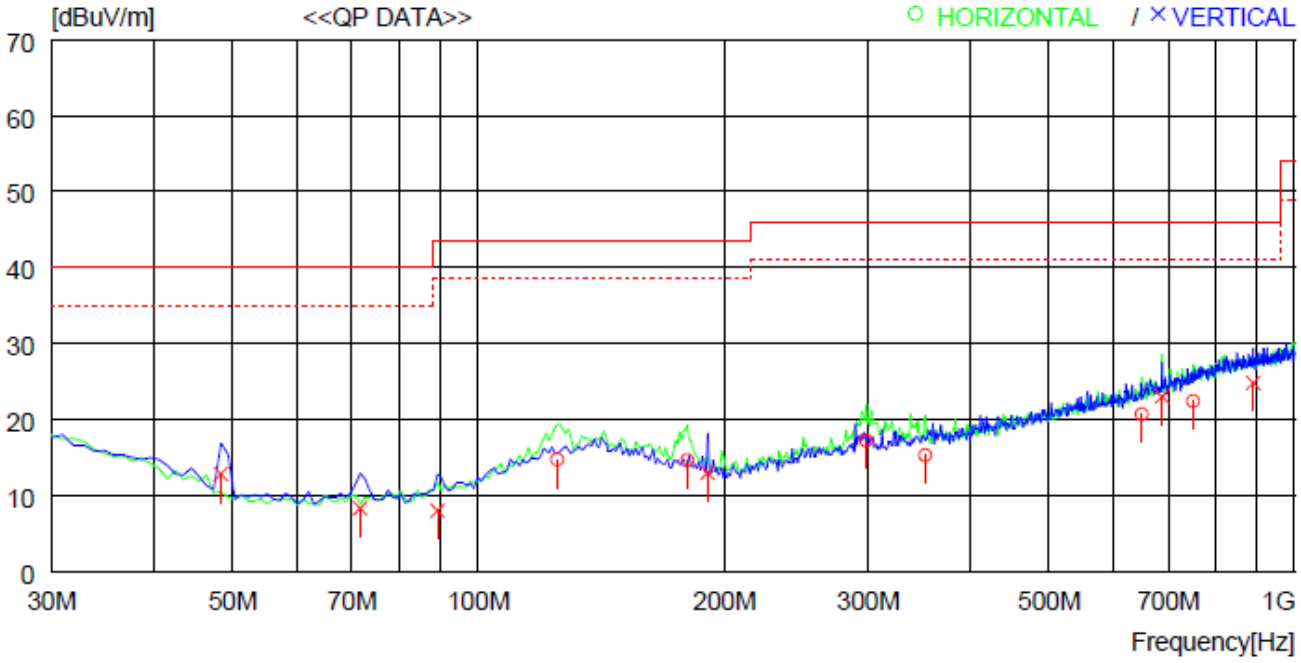
11.4.3 Test data for Intermodulation Mode(Bluetooth LE + WLAN 5 GHz)

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : NAVIGATION RADIO

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	125.060	35.5	10.8	1.1	32.7	14.7	43.5	28.8	300	359
2	180.350	32.8	13.1	1.3	32.6	14.6	43.5	28.9	200	0
3	298.690	34.7	13.5	1.7	32.7	17.2	46.0	28.8	100	359
4	353.010	31.1	15.1	1.8	32.7	15.3	46.0	30.7	100	106
5	649.826	30.8	20.4	2.5	33.0	20.7	46.0	25.3	400	0
6	750.703	31.4	21.4	2.3	32.7	22.4	46.0	23.6	200	209
----- Vertical ------										
7	48.430	34.9	10.0	0.6	32.7	12.8	40.0	27.2	400	359
8	71.710	31.5	8.7	0.8	32.7	8.3	40.0	31.7	100	53
9	89.170	31.9	7.9	0.9	32.7	8.0	43.5	35.5	100	0
10	191.020	31.5	12.8	1.3	32.6	13.0	43.5	30.5	100	0
11	687.655	32.6	20.8	2.5	32.9	23.0	46.0	23.0	300	0
12	889.409	30.9	23.2	2.8	32.1	24.8	46.0	21.2	200	76

11.5 Test data for Below 30 MHz

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

11.6 Test data for above 1 GHz

-. Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

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13. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSV40-N	Rohde & Schwarz	Signal Analyzer	102177	Apr. 20, 2020 (1Y)
FSW43	Rohde & Schwarz	Signal Analyzer	104544	Jul. 15, 2020 (1Y)
ESW	Rohde & Schwarz	EMI Test Receiver	101851	Mar. 27, 2020 (1Y)
310N	Sonoma Instrument	Pre-Amplifier	392756	Oct. 16, 2020 (1Y)
PAM-118A	Com-Power	Pre-Amplifier	18040081	Oct. 12, 2020 (1Y)
PAM-840A	Com-Power	Pre-Amplifier	461339	Oct. 16, 2020 (1Y)
DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
FMZB 1513	Schwarzbeck	Loop Antenna	1513-235	Mar. 24, 2020 (2Y)
HLP-2008	TDK	Hybrid Antenna	131316	Feb. 27, 2020 (2Y)
AH-118	Com-Power	Horn Antenna	10050061	Oct. 15, 2020 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2020(1Y)
ESR	Rohde & Schwarz	EMI TEST RECEIVER	102602	Mar. 17, 2020 (1Y)

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