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

Test Report No.	**: OT-202-RWD-013**
AGR No.	**: A19NA-063**
Applicant	**: SOOIL Development Co., Ltd.**
Address	**: 62, Yonggu-daero 2325beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, 16922, Korea**
Manufacturer	**: SOOIL Development Co., Ltd (Heukseok)**
Address	**: 62, Yonggu-daero 2325beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, 16922, Korea**
Type of Equipment	**: Insulin Pump**
FCC ID.	**: VF9DANAI5**
Model Name	**: Diabecare DANA-i5**
Serial number	**: N/A**
Total page of Report	**: 57 pages (including this page)**
Date of Incoming	**: December 30, 2019**
Date of issue	**: February 10, 2020**

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.

Reviewed by: Tae-Ho, Kim / Senior Manager
ONETECH Corp.

Approved by: Ki-Hong, Nam / General Manager
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-202-RWD-013	February 10, 2020	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : SOOIL Development Co., Ltd.
Address : 62, Yonggu-daero 2325beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, 16922, Korea
Contact Person : Geun-Sang, Lim / General Manager
Telephone No. : +82-2-2824-2133
FCC ID : VF9DANAI5
Model Name : Diabecare DANA-i5
Brand Name : -
Serial Number : N/A
Date : February 10, 2020

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Insulin Pump
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 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	10 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 battery.

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-4112/ C-14617/ G-10666 / T-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

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 SOOIL Development Co., Ltd., Model Diabecare DANA-i5 (referred to as the EUT in this report) is an Insulin Pump, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Insulin Pump
Temperature Range	1 °C ~ 40 °C
Operating Frequency	2 402 MHz ~ 2 480 MHz
Modulation Type	GFSK
RF Output Power	125 kbps: -6.08 dBm 1 Mbps: -6.08 dBm
ANTENNA TYPE	Chip Antenna
ANTENNA GAIN	1.05 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	32.768 kHz
RATED SUPPLY VOLTAGE	DC 1.5 V

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

-. None

4. EUT MODIFICATIONS

-. None

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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	SOOIL Development Co., Ltd (Heukseok)	Dana-i Main V1.0	N/A
Sub Board	SOOIL Development Co., Ltd (Heukseok)	Dana-i Sub V1.0	N/A
BLE Board	SOOIL Development Co., Ltd (Heukseok)	Dana-i Ble5 V1.0	N/A
LCD	KJC Display Corp.	EG1206AK-C2_A	N/A
Button Board	N/A	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
Diabecare DANA-i5	SOOIL Development Co., Ltd (Heukseok)	Insulin Pump(EUT)	-
DIP232RL V1.0	N/A	Jig Board	EUT / Notebook PC
HP ProtectSmart	HP	Notebook PC	Jig Board
PPP009C	HP	AC Adapter	Notebook PC

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 “XZ” axis, but the worst data was recorded in this report.

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-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
Bluetooth LE (125 kbps)	17.00	0.50	97.14	0.13
Bluetooth LE (1 Mbps)	2.14	0.36	85.60	0.68

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

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

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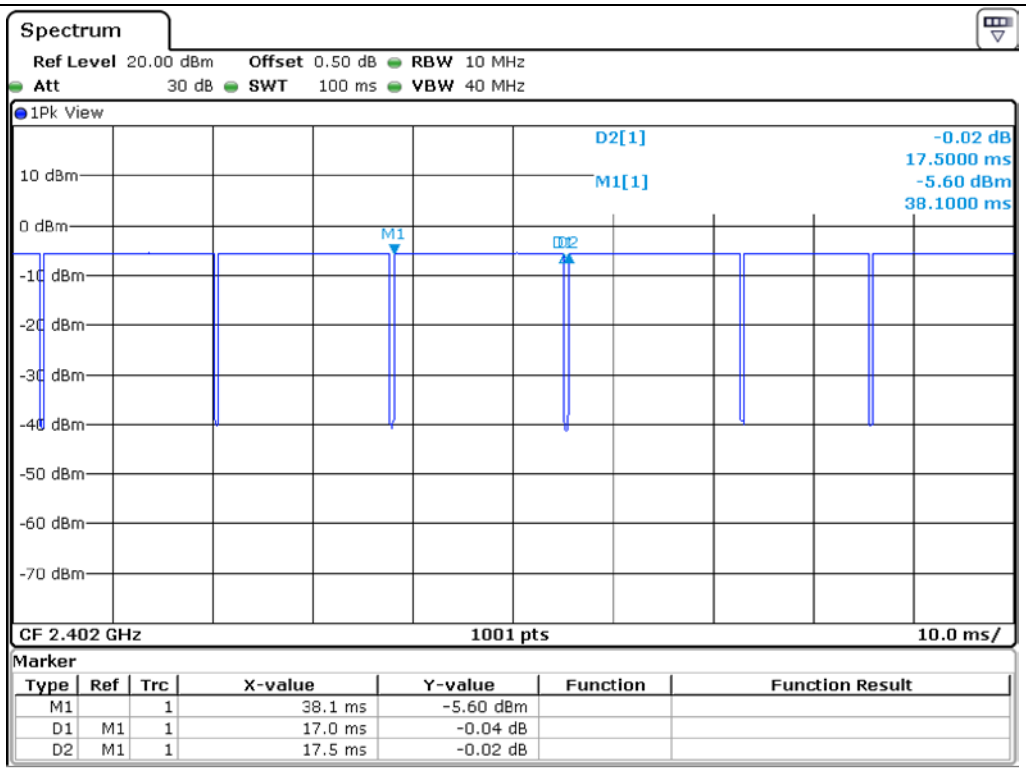
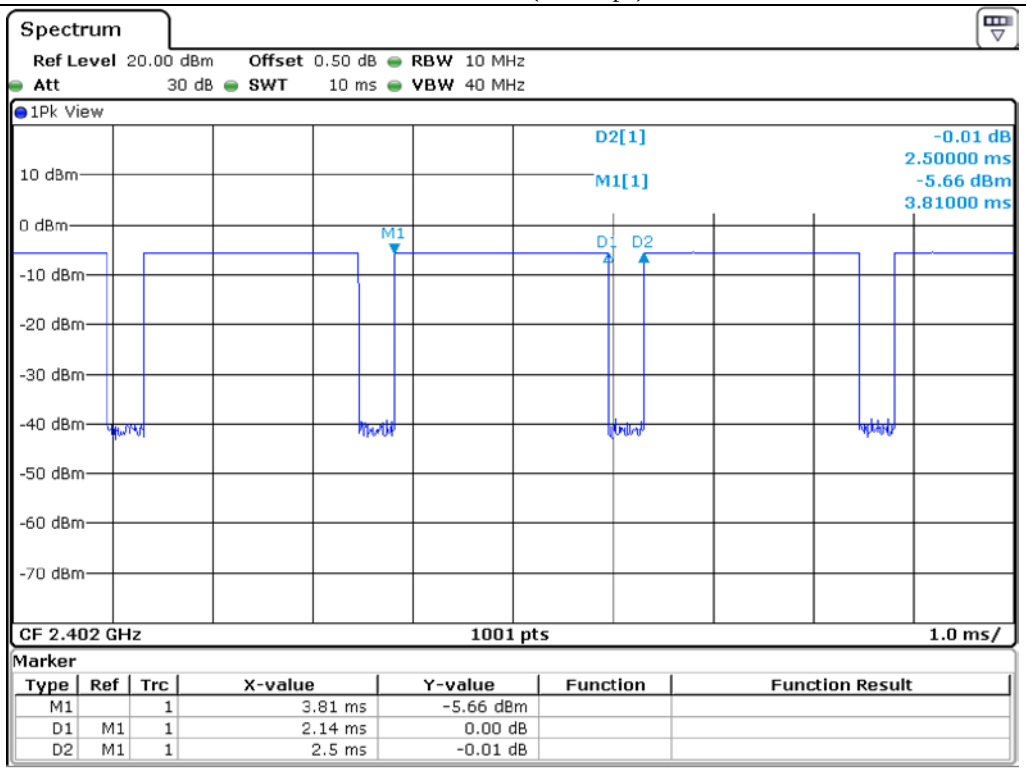
.-. Test Plot



Bluetooth LE (125 kbps)



Bluetooth LE (1 Mbps)

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 battery.

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

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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 battery.	

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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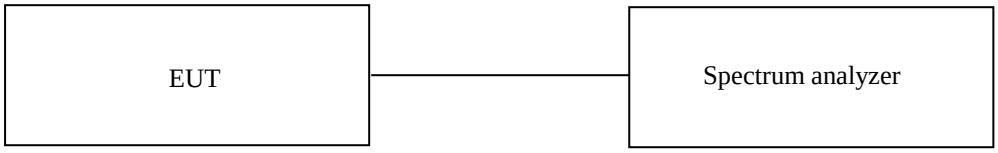
7. MINIMUM 6 dB BANDWIDTH

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 equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

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7.4 Test data for 125 kbps

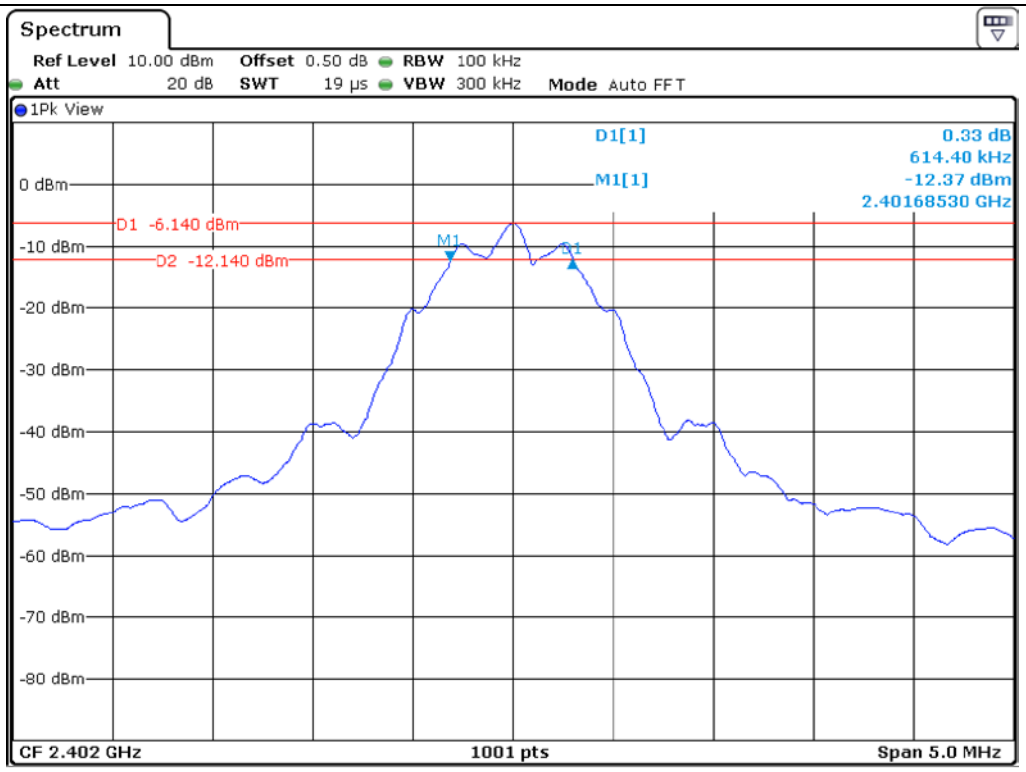
-. Test Date : December 30, 2019 ~ January 03, 2020

-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	614.40	500.00	114.40
Middle	2 440.00	609.40	500.00	109.40
High	2 480.00	614.40	500.00	114.40

Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel

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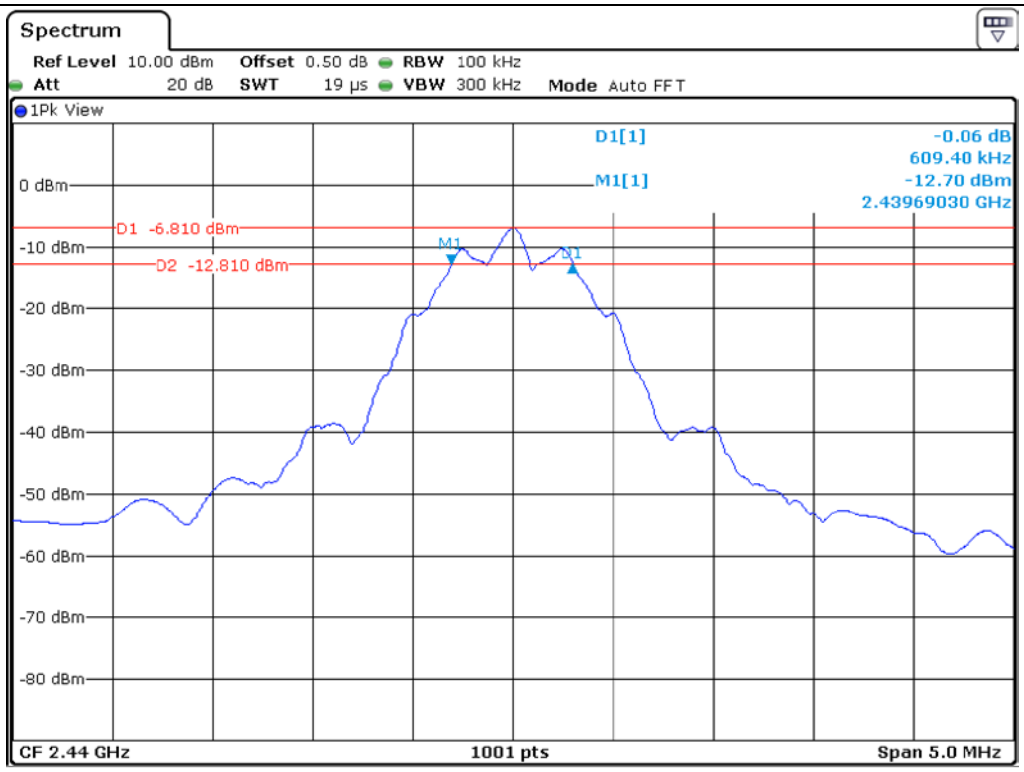
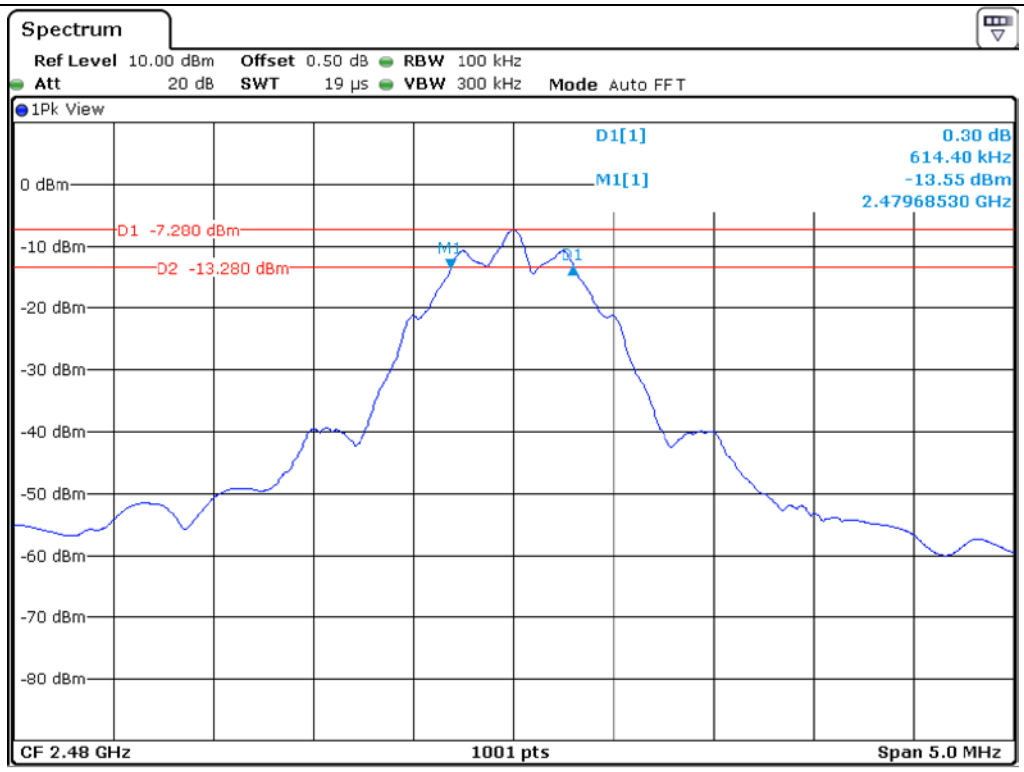


Middle Channel



High Channel

7.5 Test data for 1 Mbps

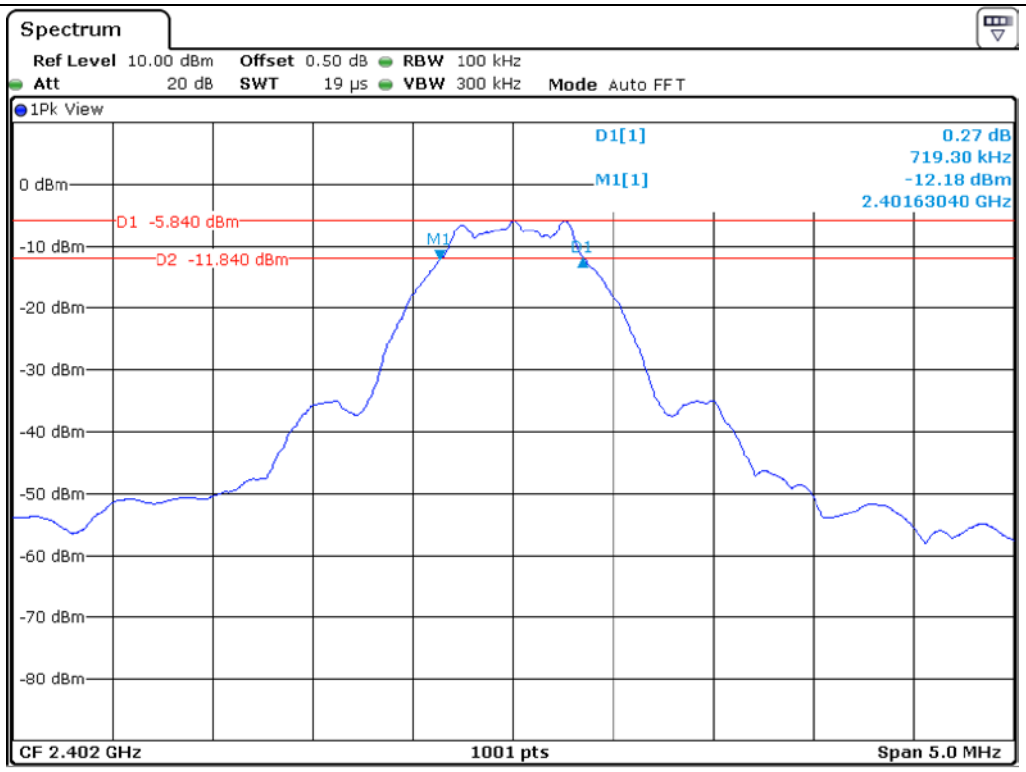
-. Test Date : December 30, 2019 ~ January 03, 2020

-. Test Result : Pass

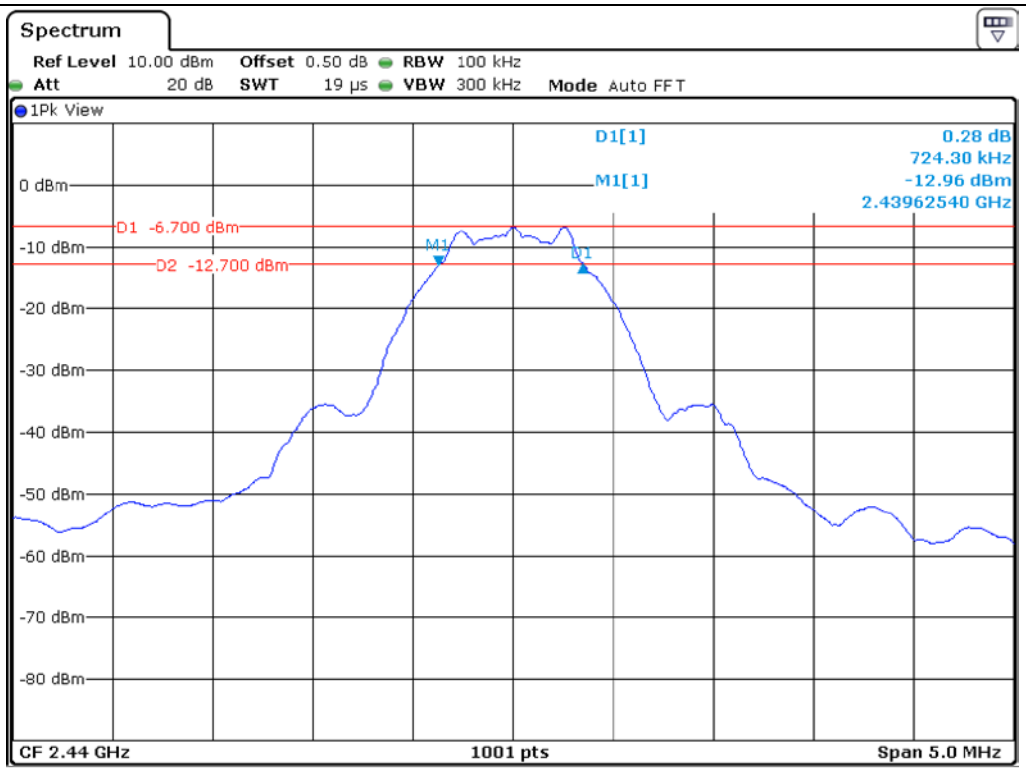
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	719.30	500.00	219.30
Middle	2 440.00	724.30	500.00	224.30
High	2 480.00	724.30	500.00	224.30

Remark. Margin = Measured Value - Limit

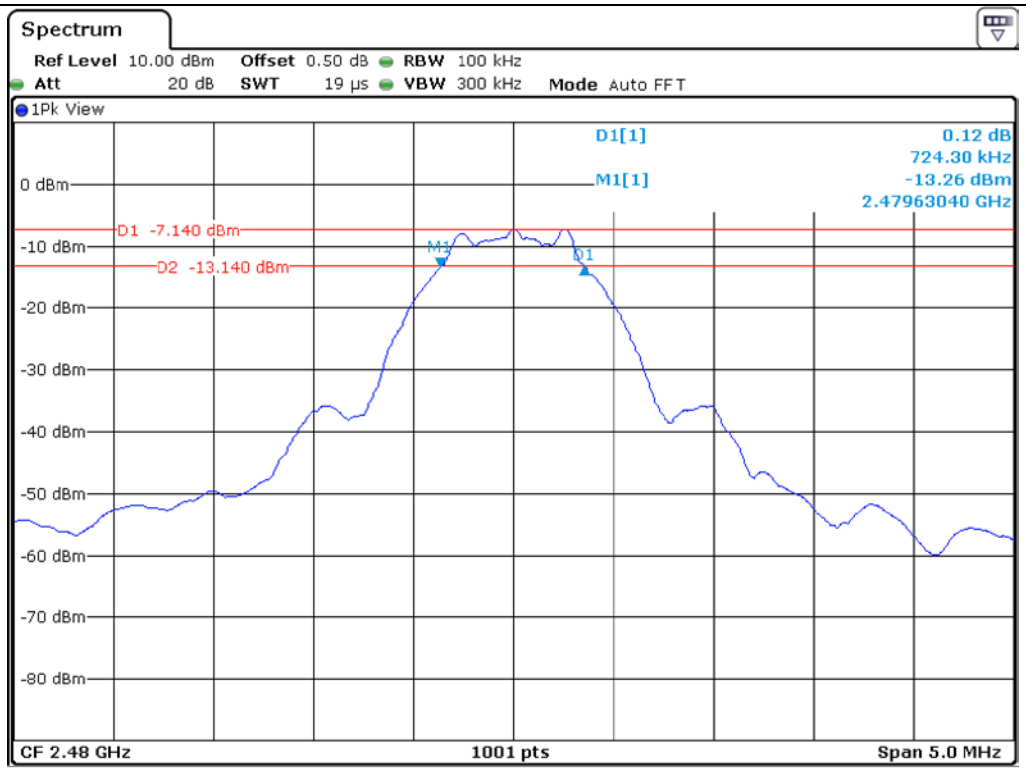
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

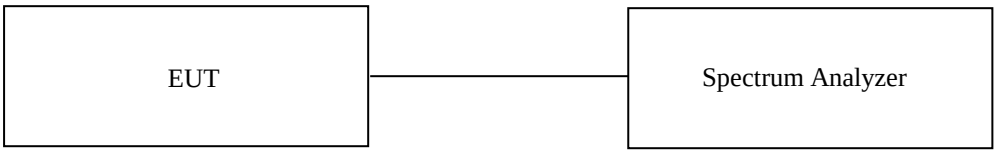
Temperature : 23 °C

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 equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

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8.4 Test data for 125 kbps

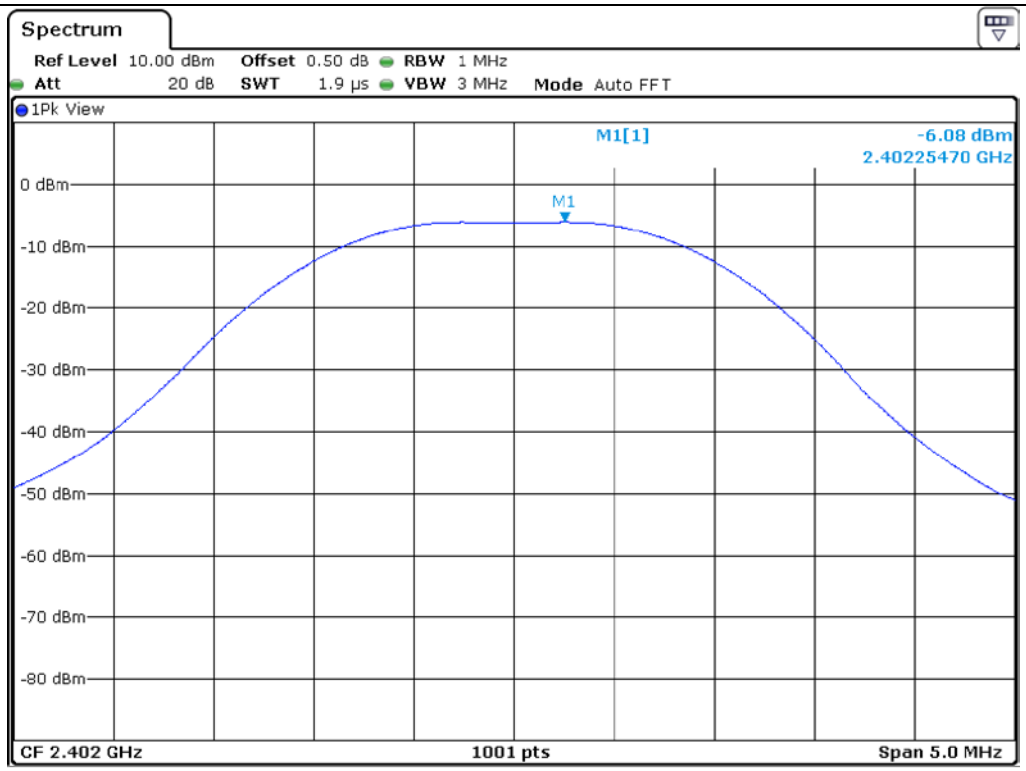
-. Test Date : December 30, 2019 ~ January 03, 2020

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	-6.08	30.00	36.08
MIDDLE	2 440.00	-6.70	30.00	36.70
HIGH	2 480.00	-7.16	30.00	37.16

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

Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel

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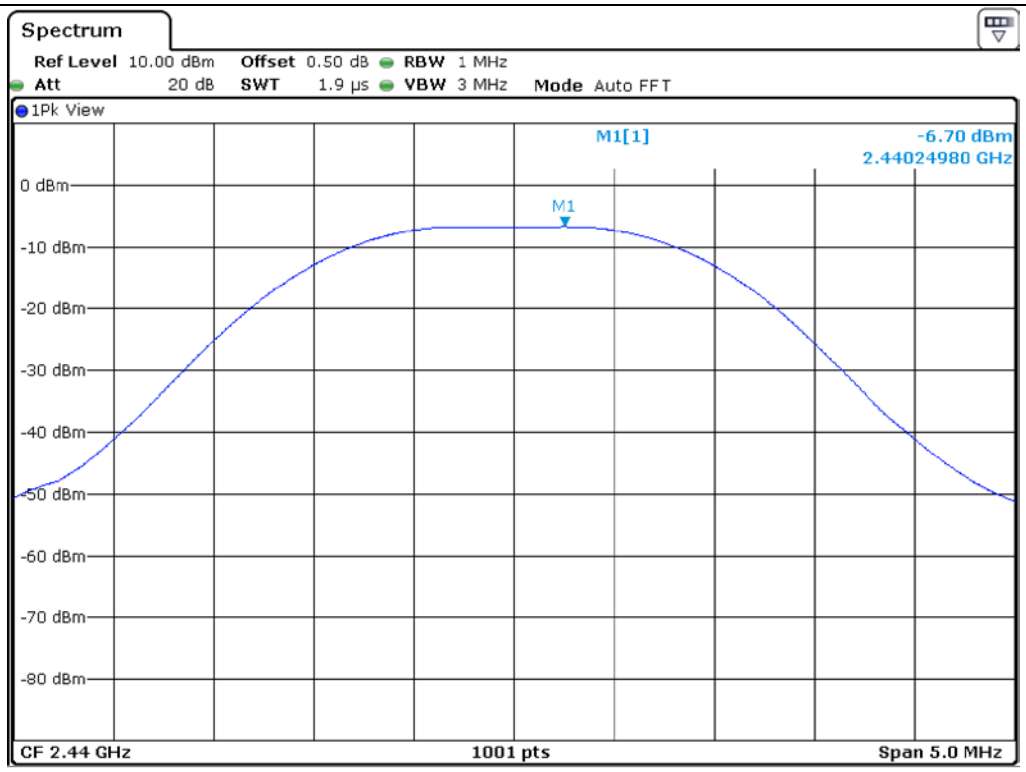
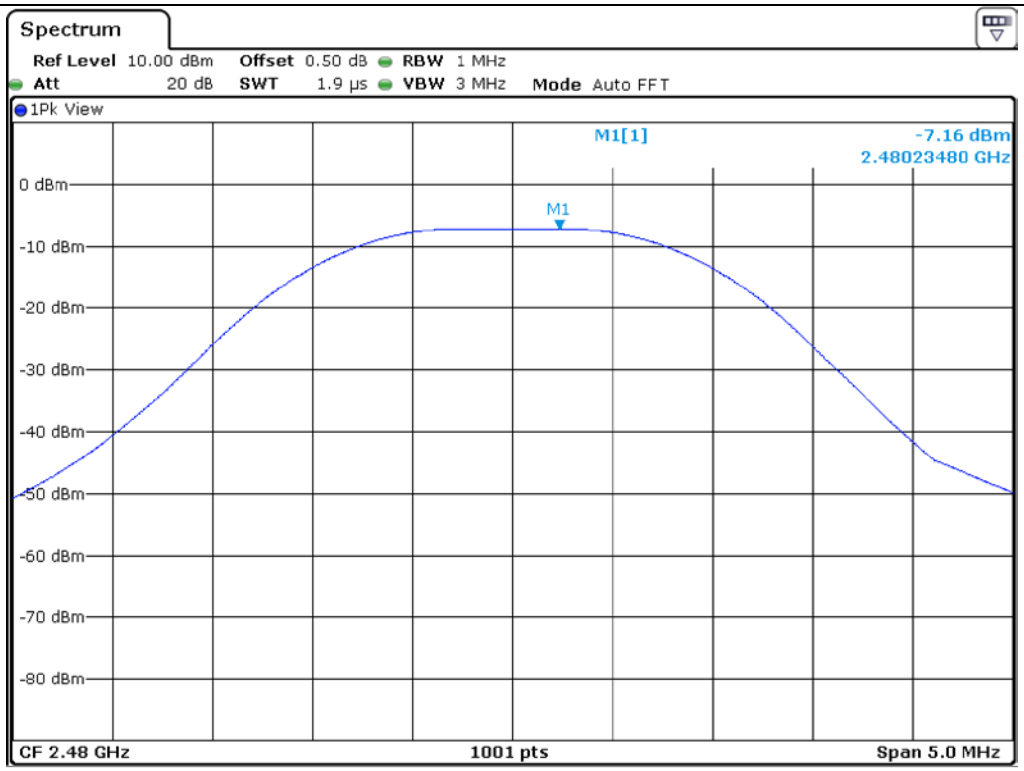


Middle Channel



High Channel

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8.5 Test data for 1 Mbps

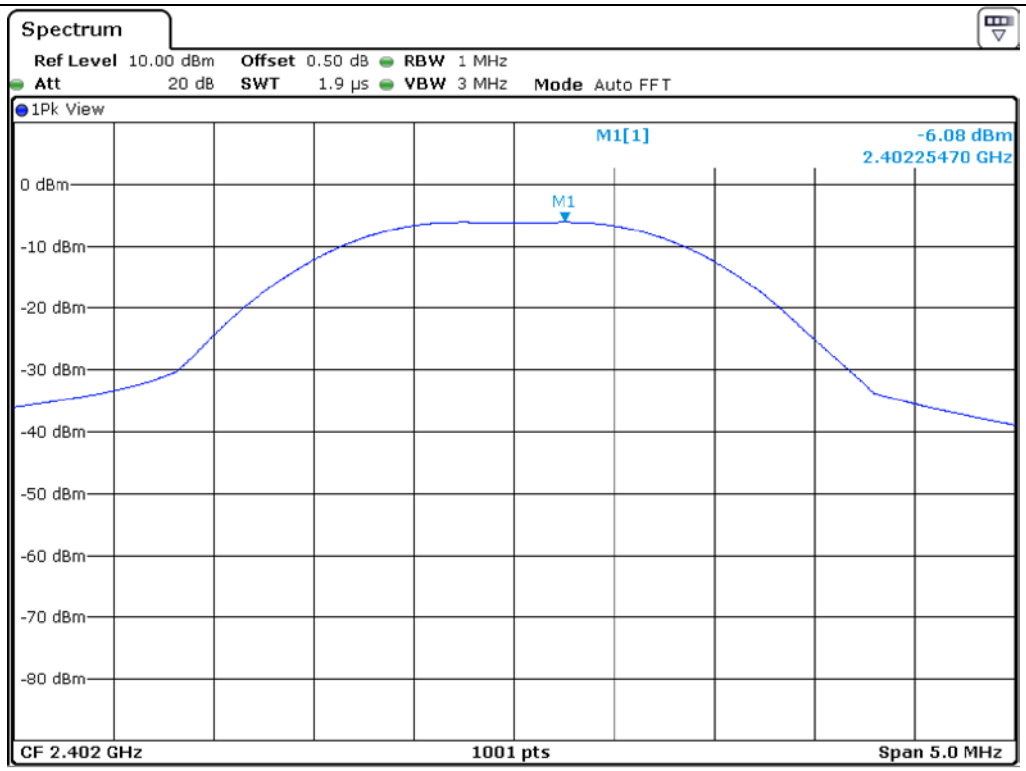
-. Test Date : December 30, 2019 ~ January 03, 2020

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	-6.08	30.00	36.08
MIDDLE	2 440.00	-6.69	30.00	36.69
HIGH	2 480.00	-7.15	30.00	37.15

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

Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel

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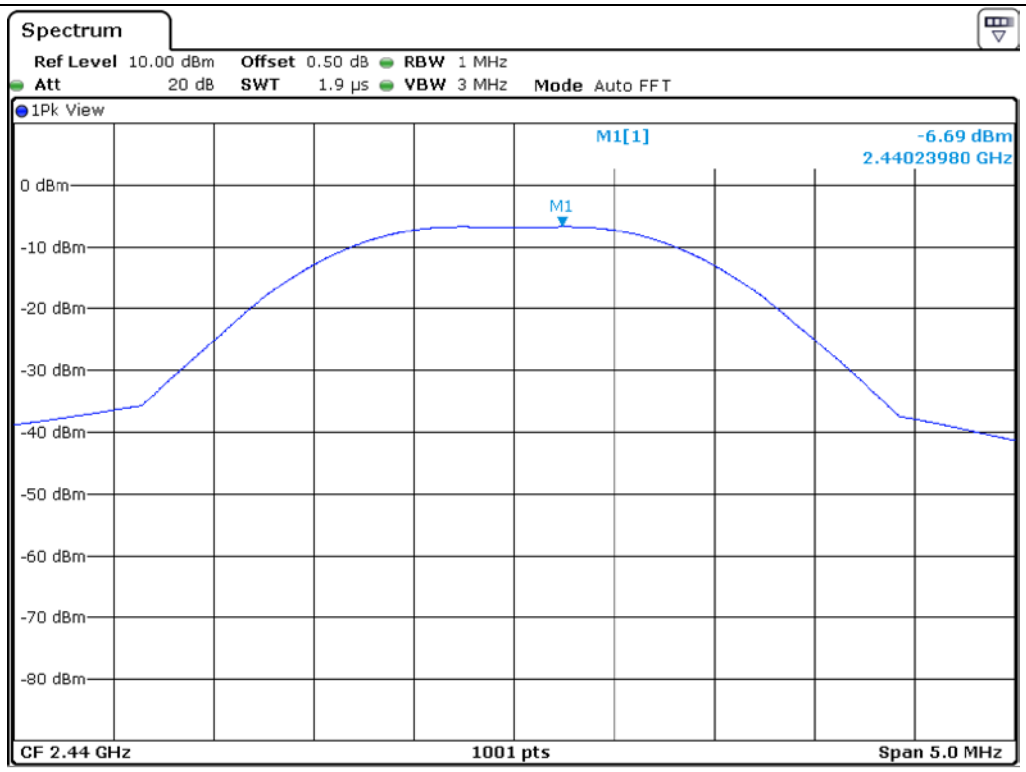
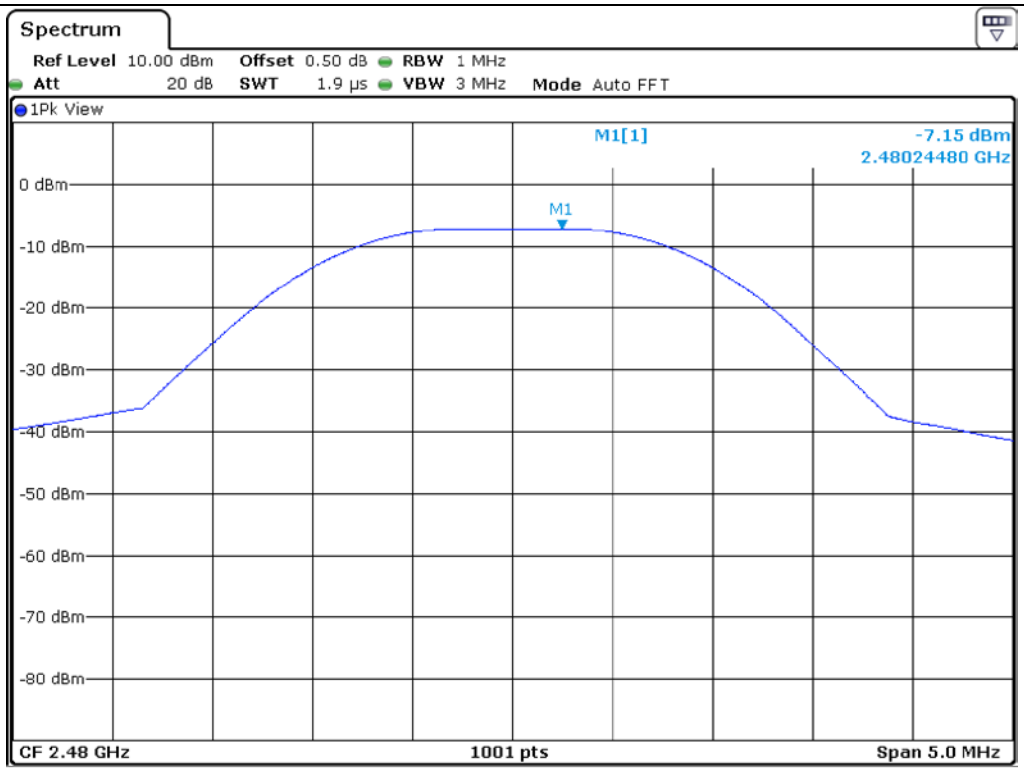


Middle Channel



High Channel

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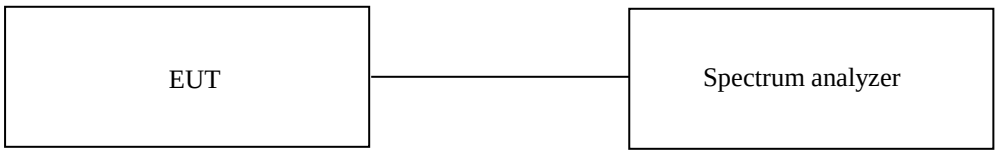
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

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.

9.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 28, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718B	Schwarzbeck	Amplifier	009	Mar. 20, 2019 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 2019 (1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)
■ -	VAMP9243	Schwarzbeck	ROD ANTENNA	VAMP9243	Mar. 14, 2019 (2Y)

All test equipment used is calibrated on a regular basis.

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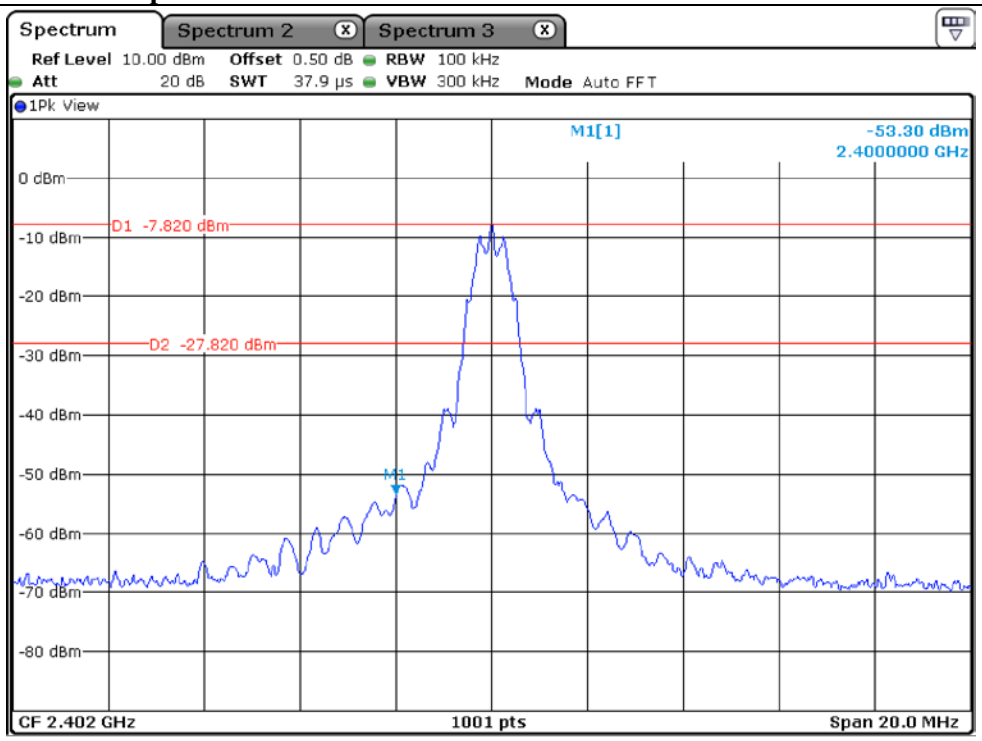
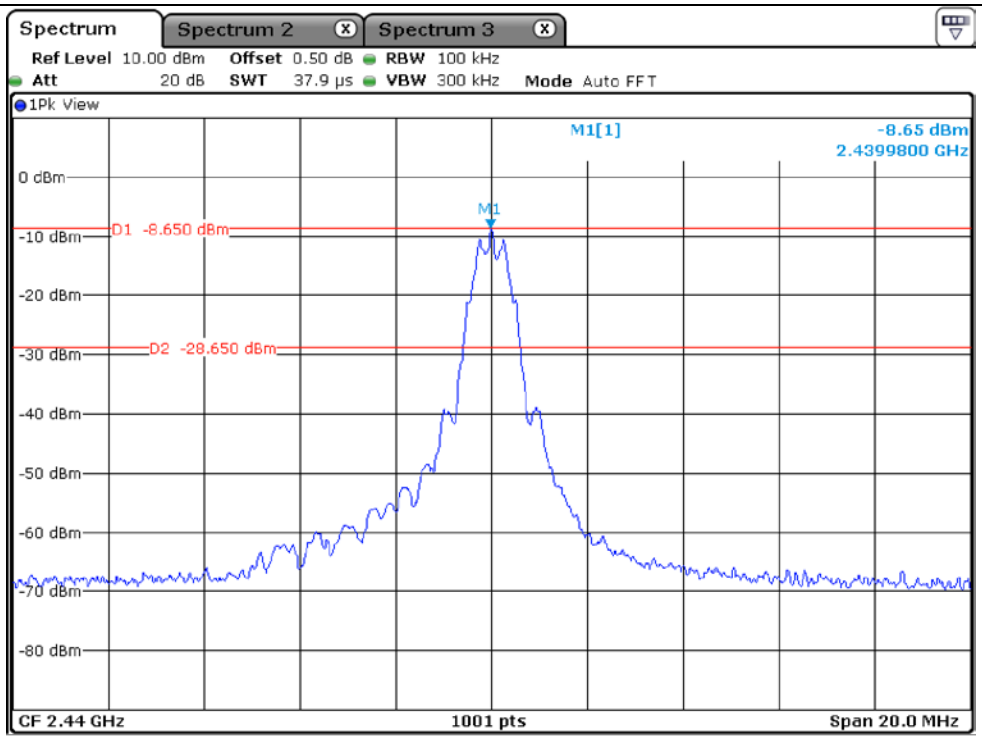
9.5 Test data for conducted emission

9.5.1 Test data for 125 kbps



Low Channel



Middle Channel

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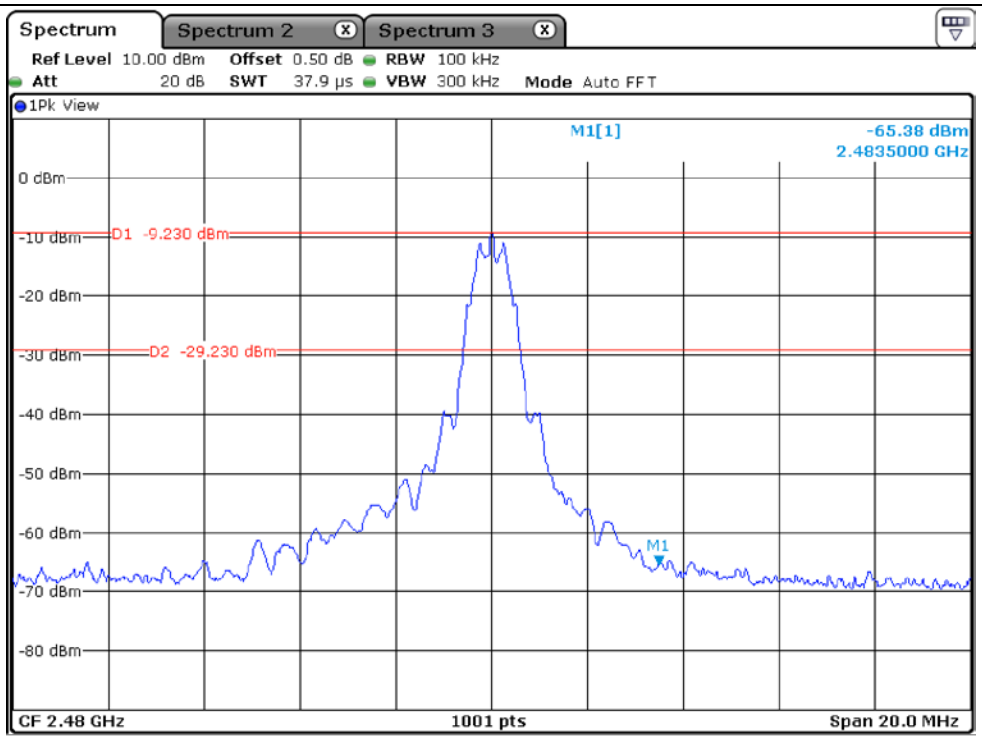

High Channel

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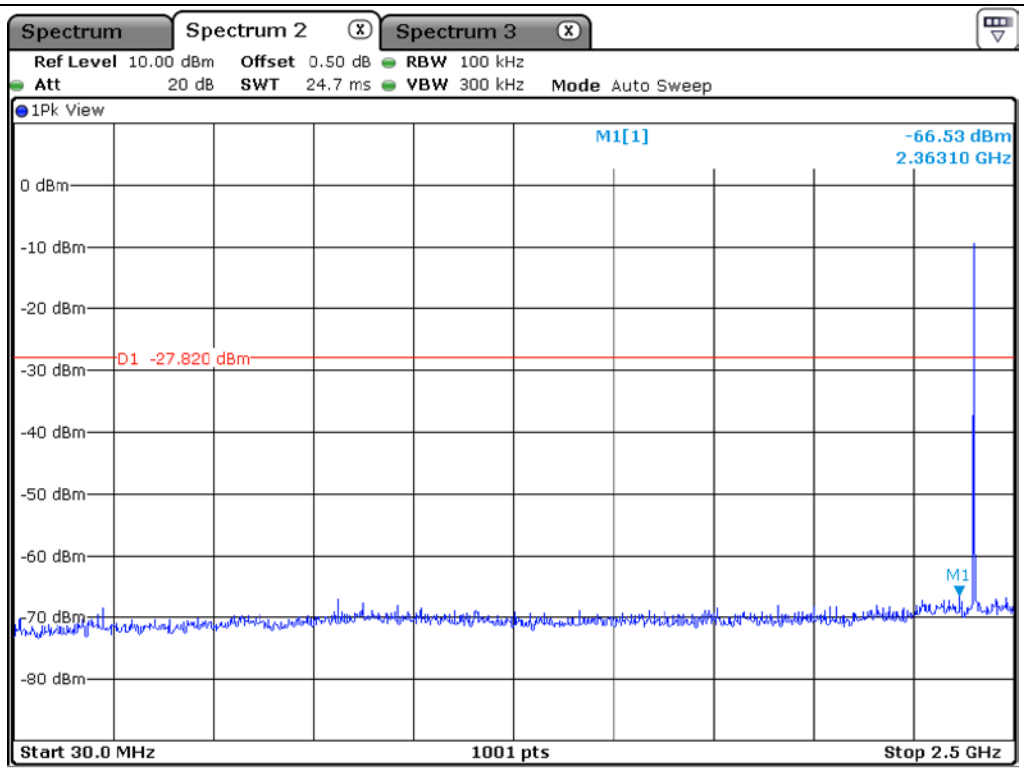
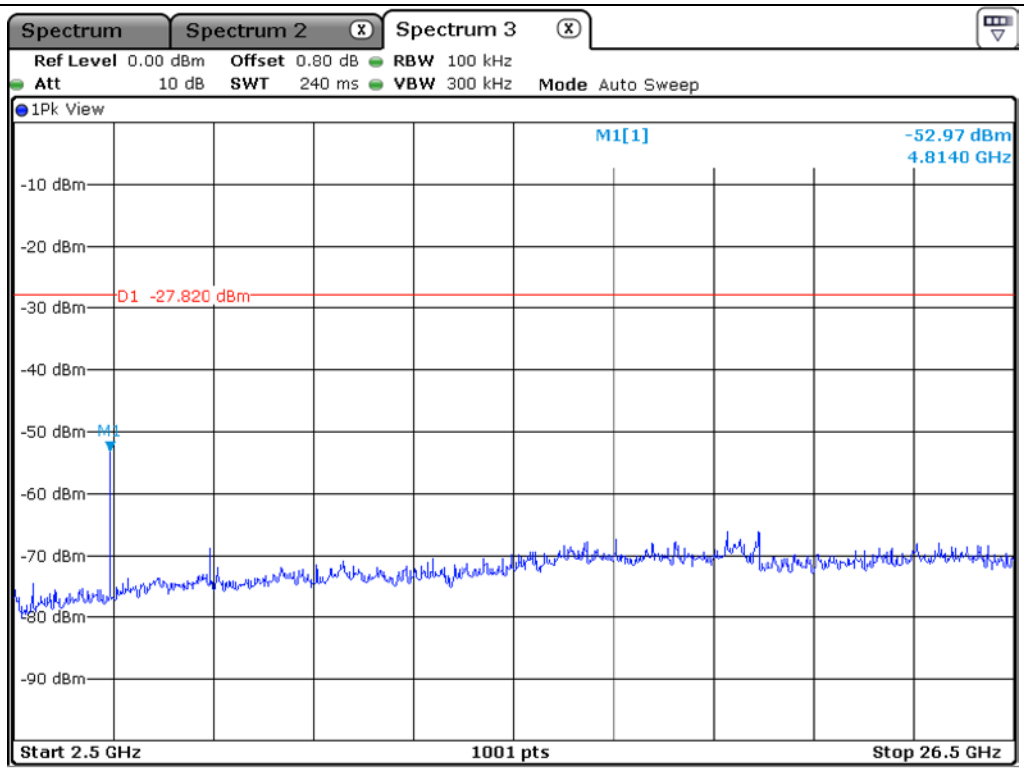
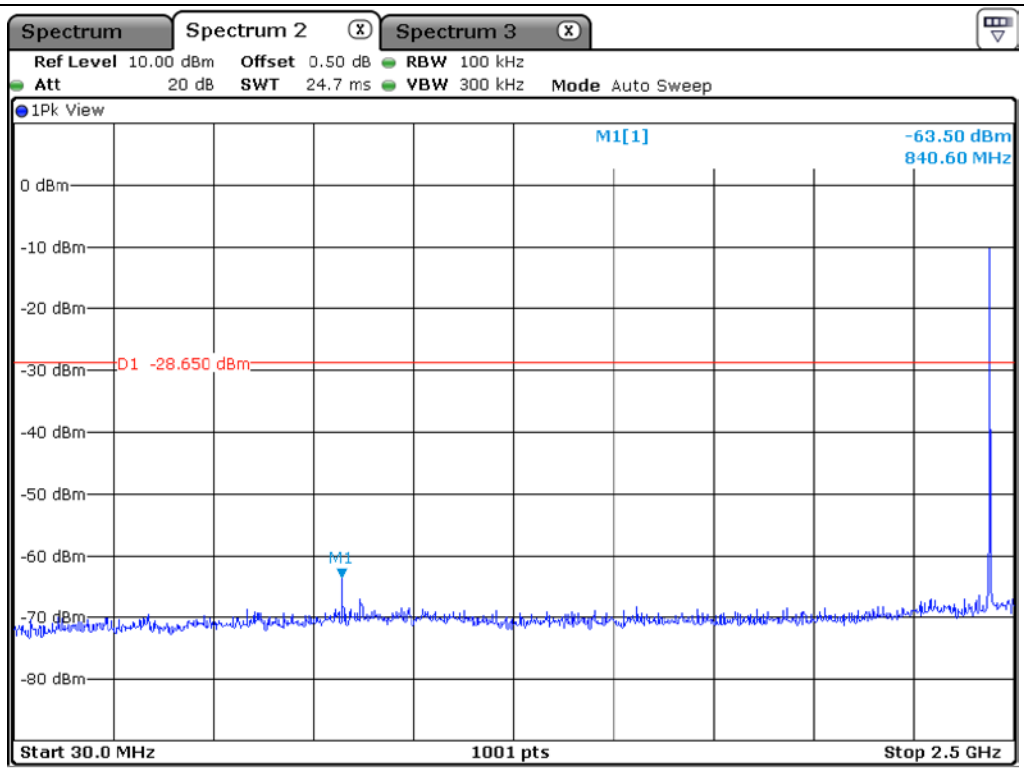


Low Channel

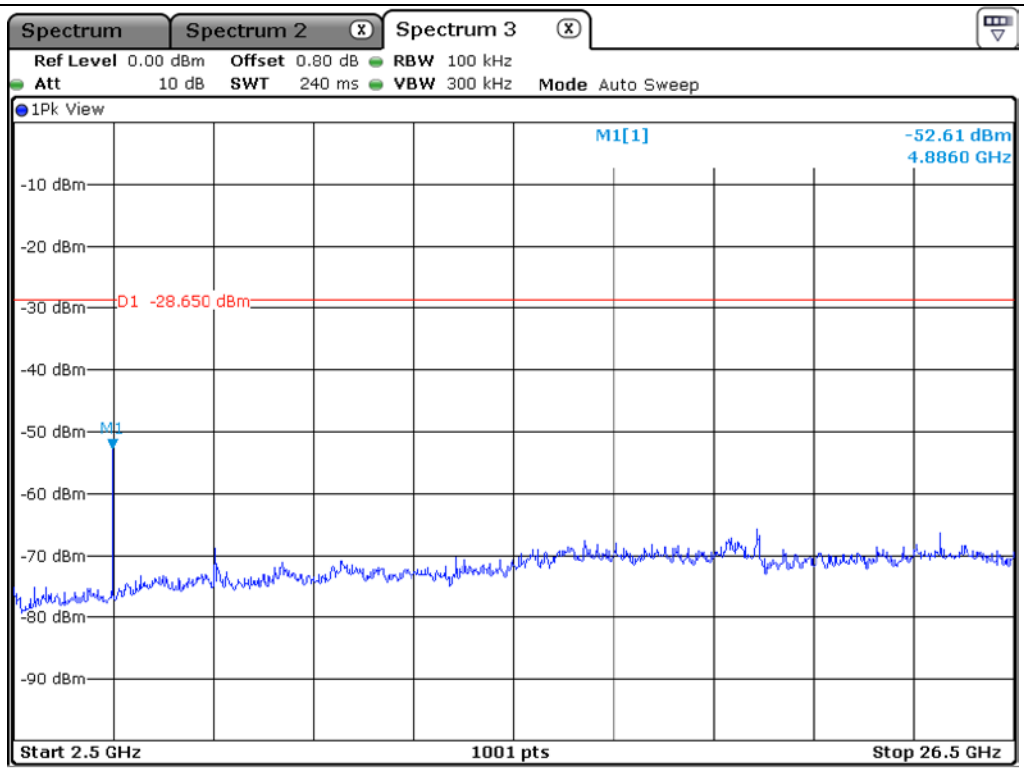


Low Channel

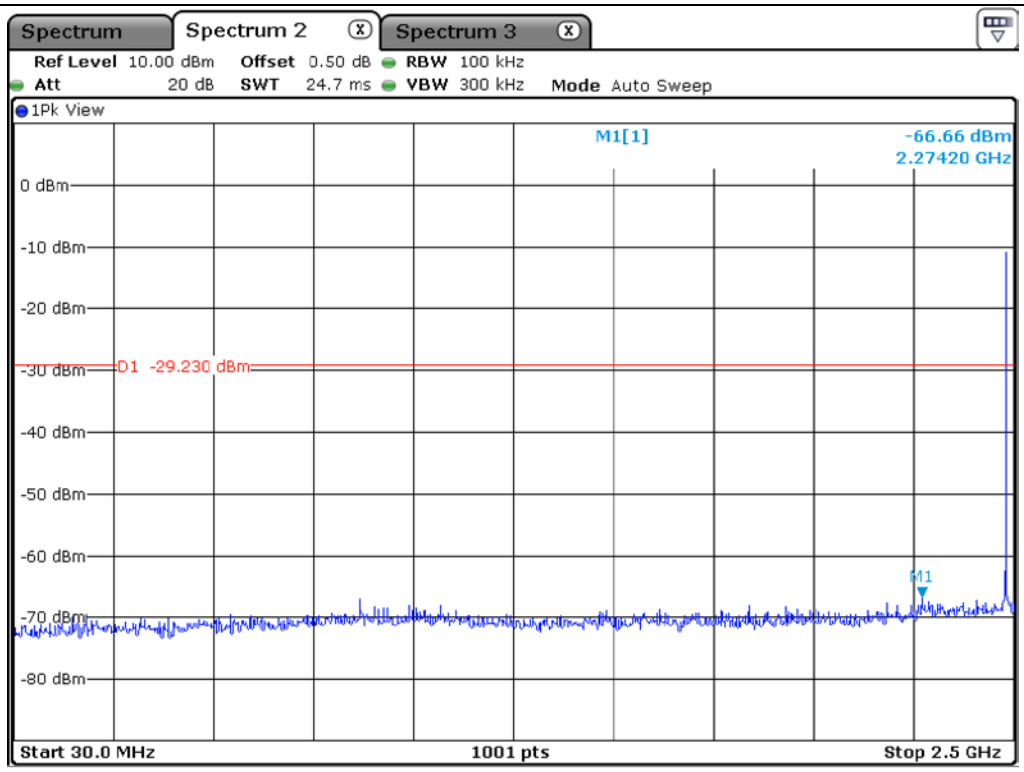
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



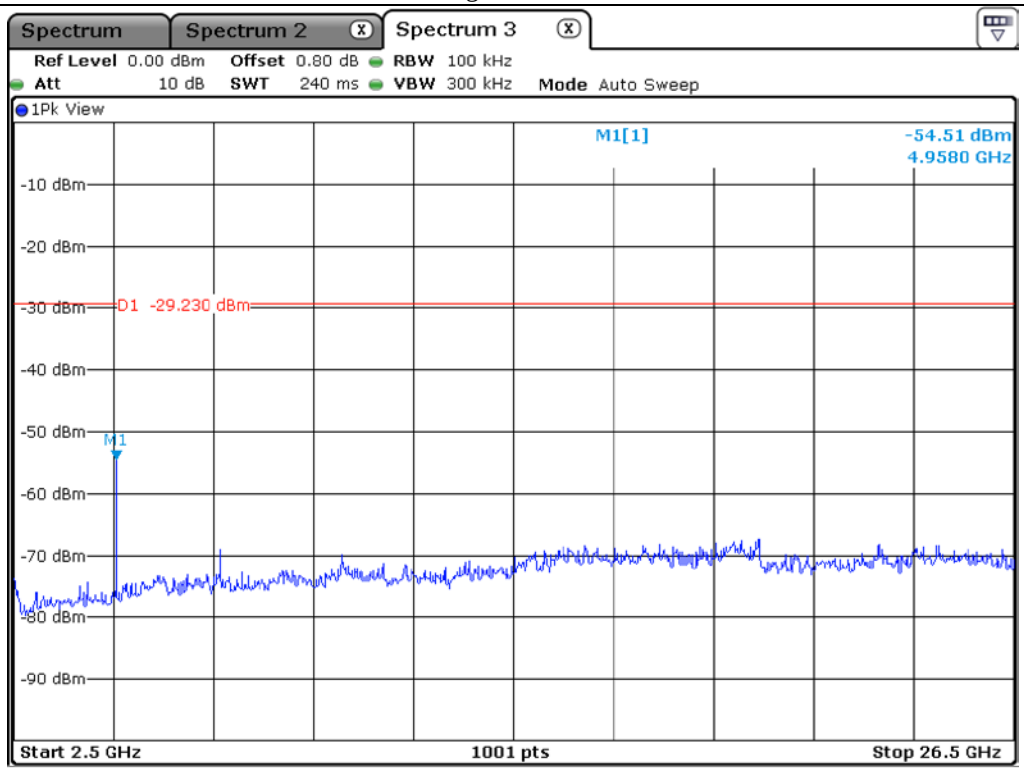
Middle Channel



Middle Channel



High Channel



High Channel

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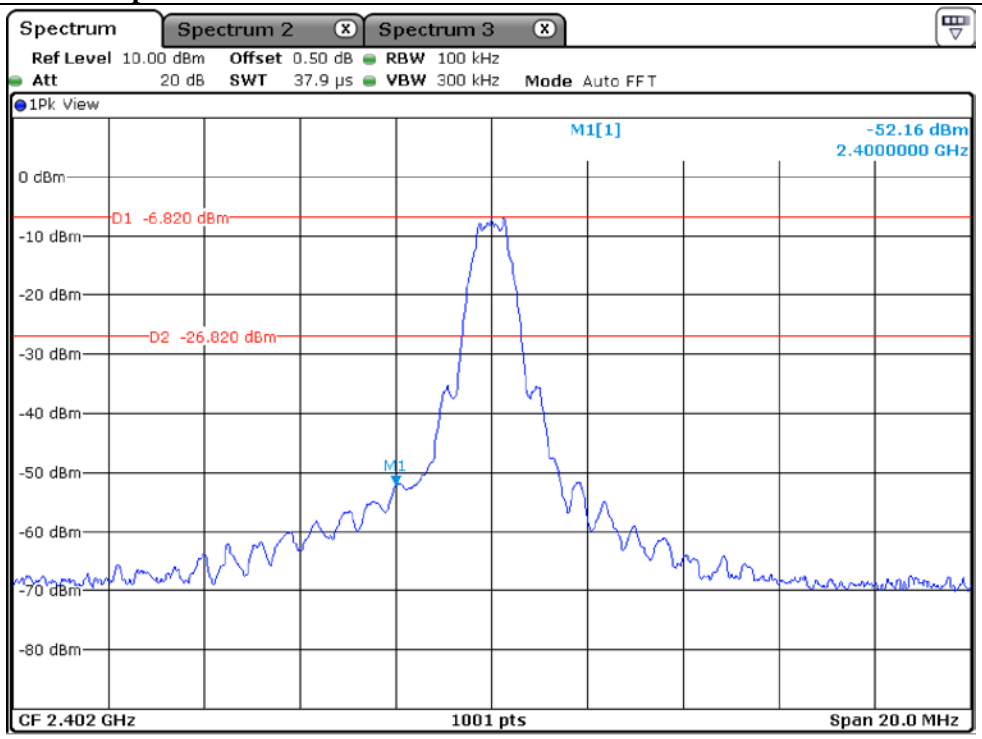
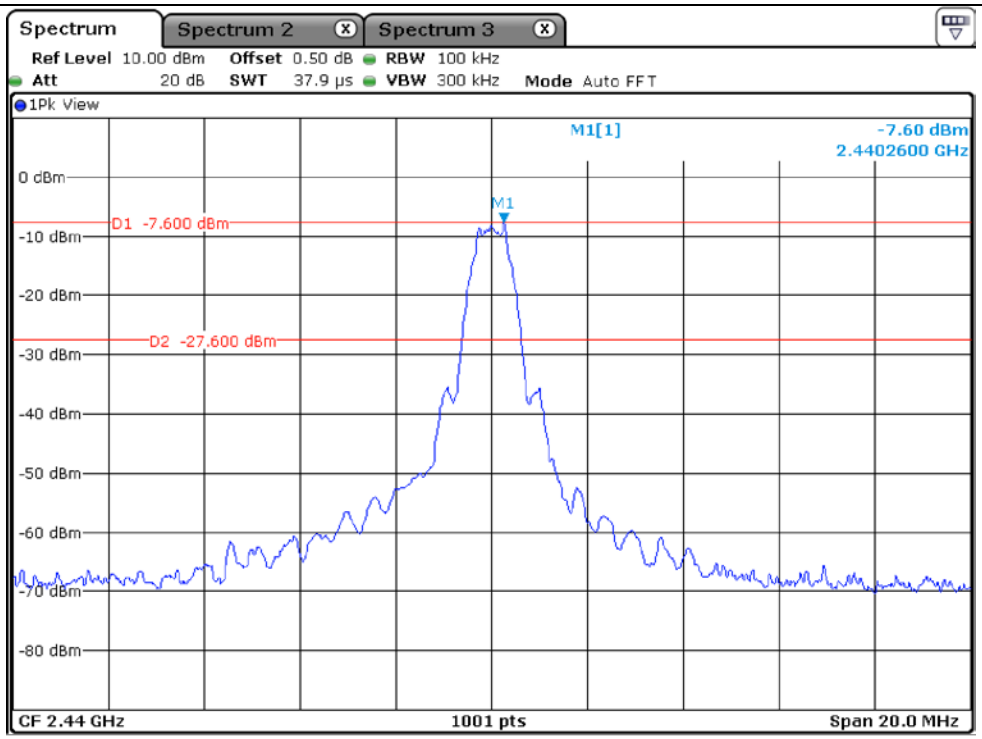
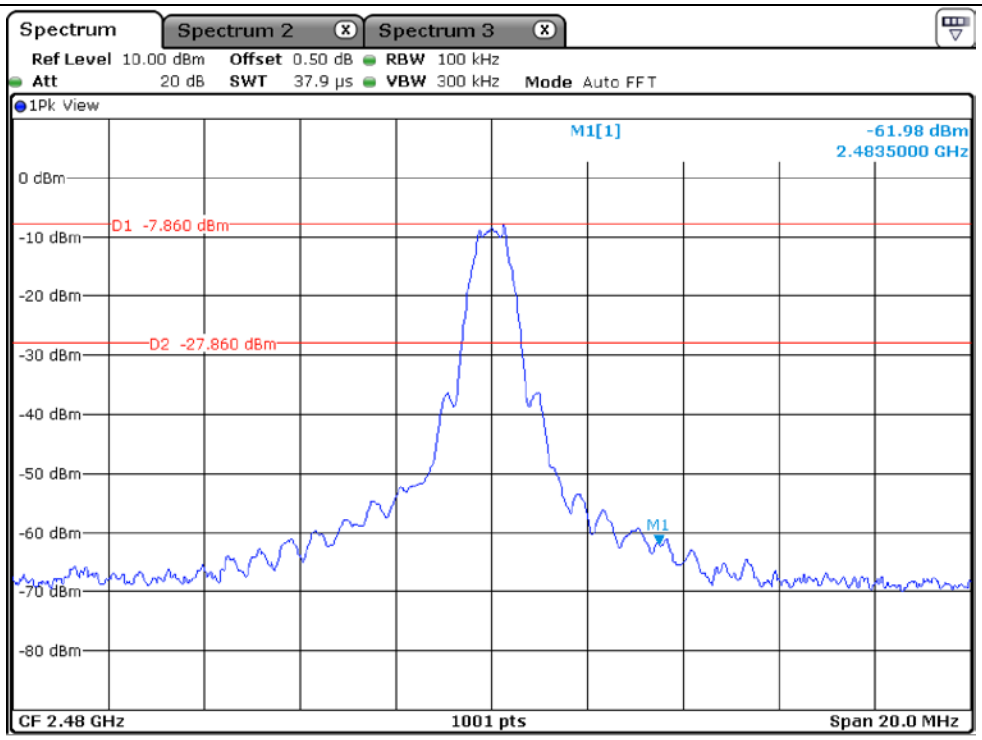
9.5.2 Test data for 1 Mbps



Low Channel

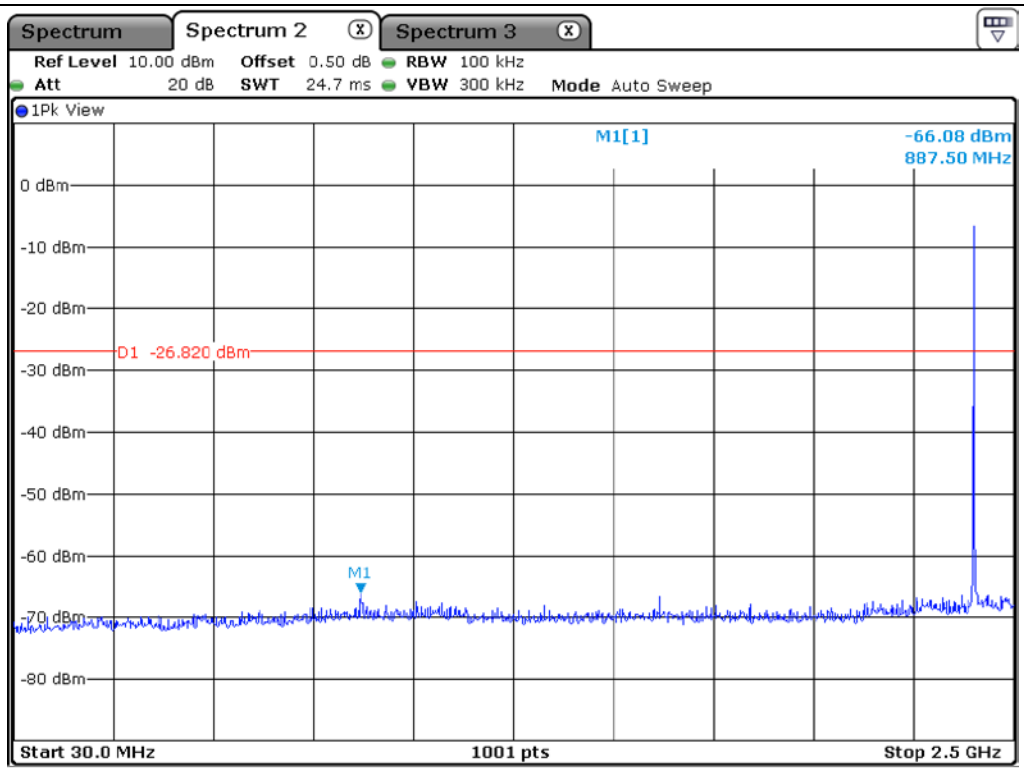


Middle Channel

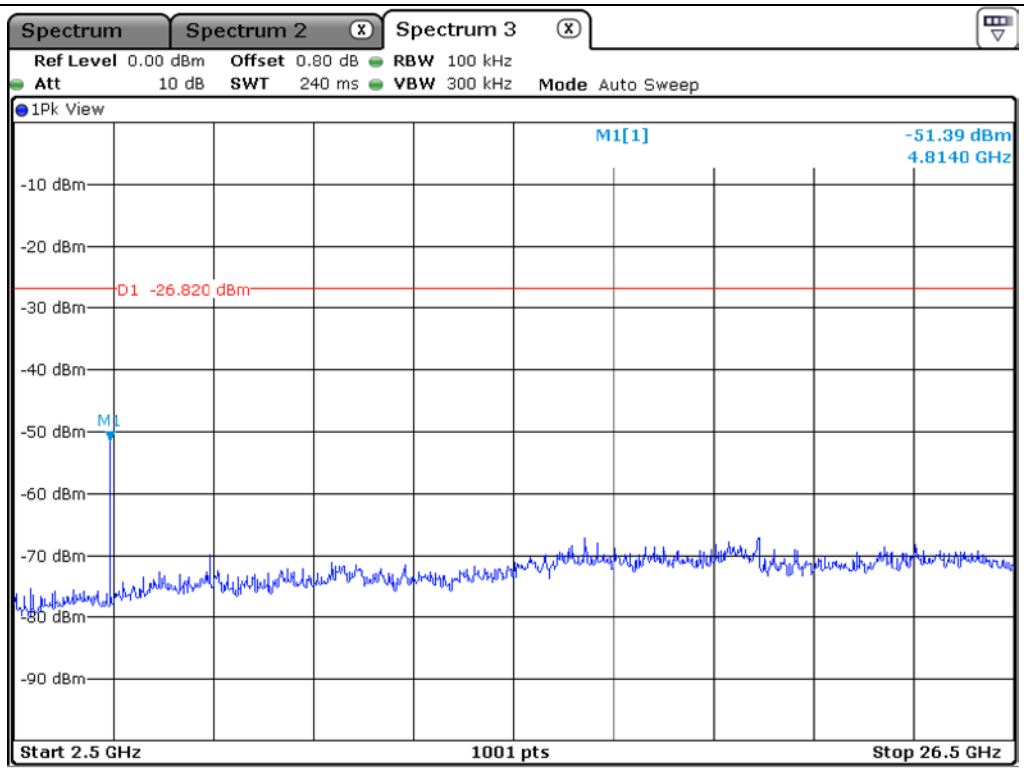


High Channel

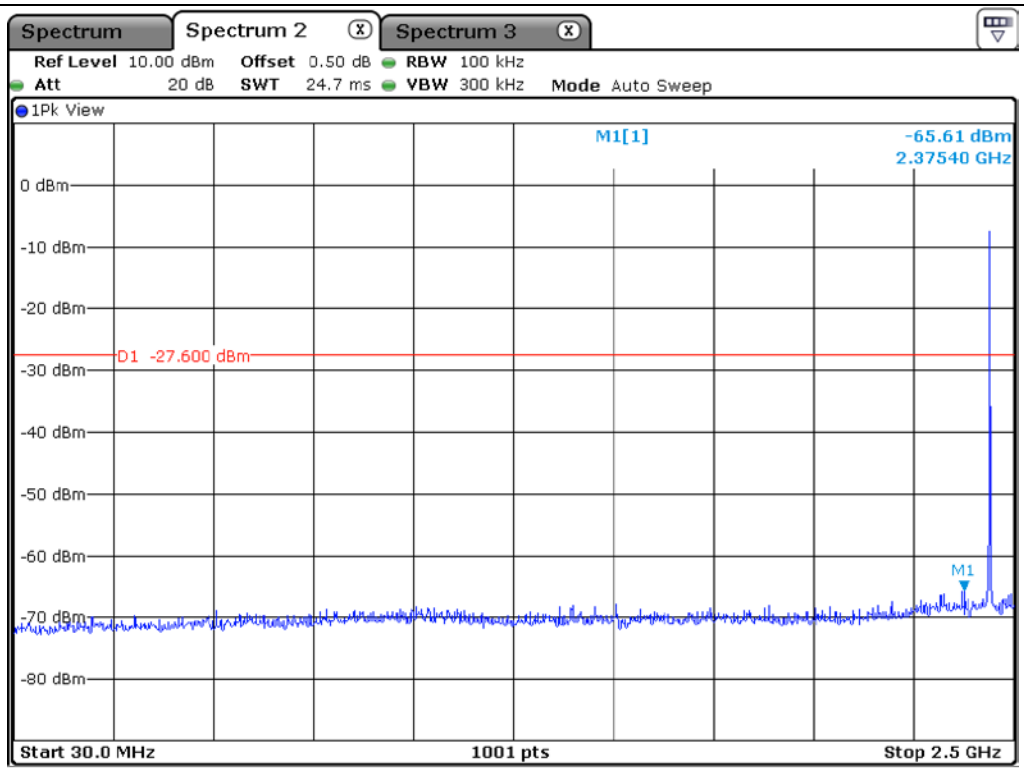
ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)



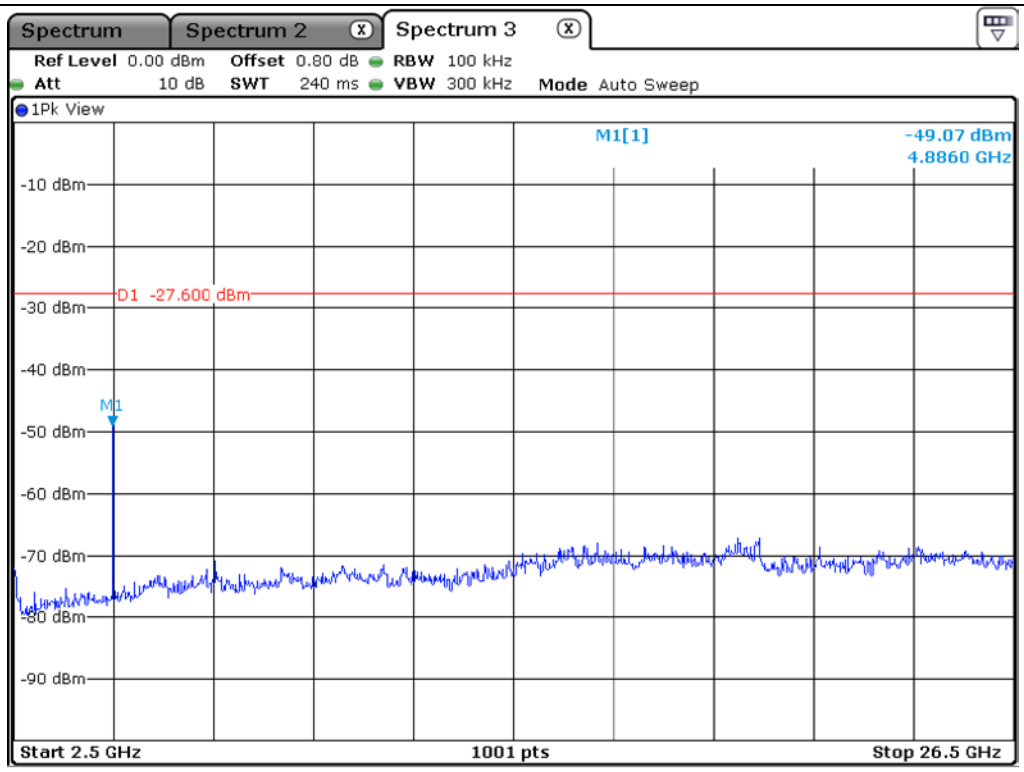
Low Channel



Low Channel



Middle Channel



Middle Channel

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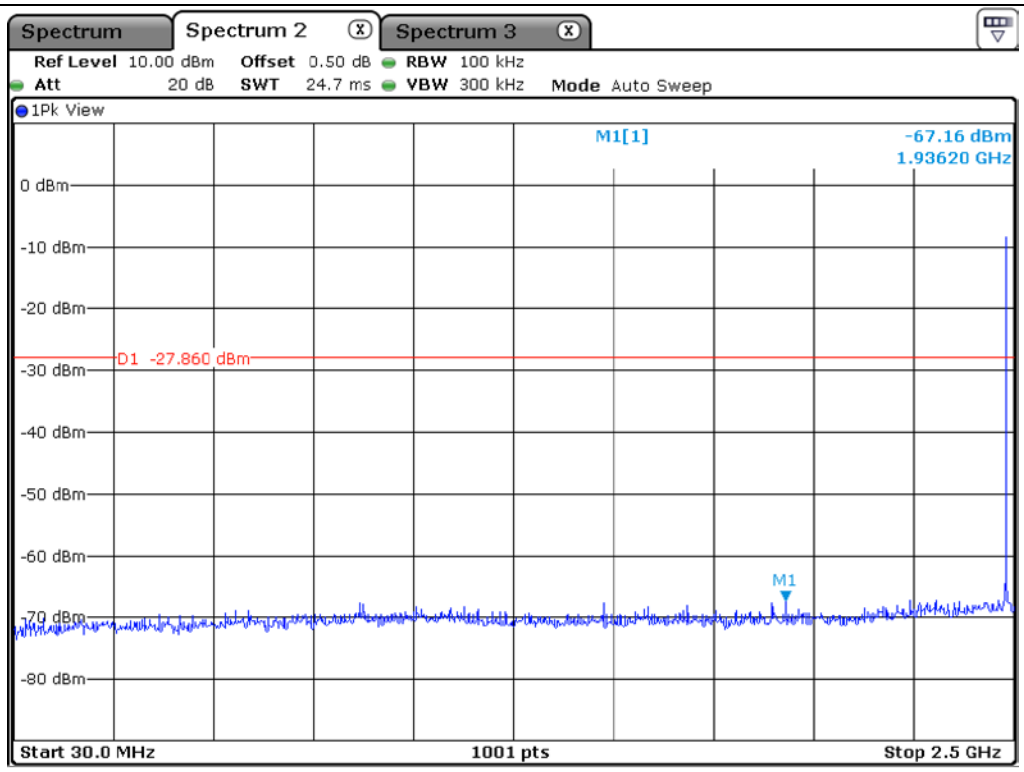
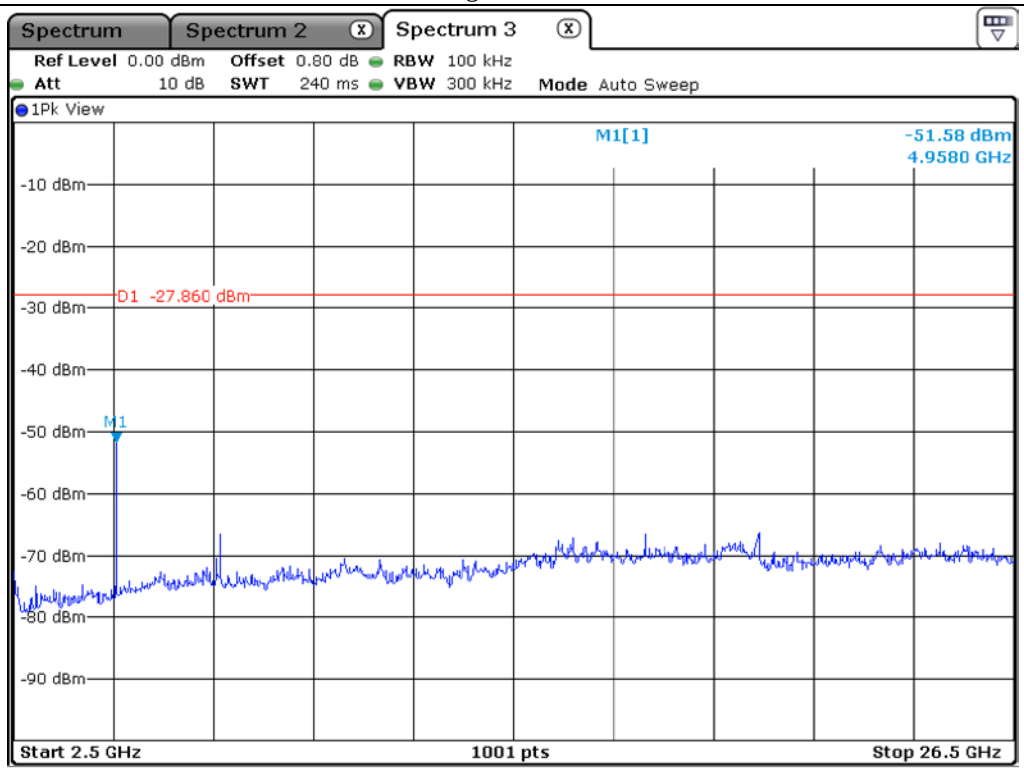


High Channel



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 125 kbps

-. Test Date : December 30, 2019 ~ January 03, 2020

-. 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 : 97.14 %

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 370.060	14.40	Peak	H	26.94	9.20	-	50.54	74.00	23.46
2 352.330	3.31	Average	H			0.13	39.58	54.00	14.42
2 388.057	14.27	Peak	V			-	50.41	74.00	23.59
2 370.377	3.05	Average	V			0.13	39.32	54.00	14.68
Test Data for High Channel									
2 495.084	14.60	Peak	H	27.47	9.49	-	51.56	74.00	22.44
2 485.922	2.81	Average	H			0.13	39.90	54.00	14.10
2 487.185	14.83	Peak	V			-	51.79	74.00	22.21
2 494.437	2.88	Average	V			0.13	39.97	54.00	14.03

Tabulated test data for Restricted Band

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

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

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

Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.1.2 Test data for 1 Mbps

-. Test Date : December 30, 2019 ~ January 03, 2020

-. 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 : 85.60 %

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 370.060	14.38	Peak	H	26.94	9.20	-	50.52	74.00	23.48
2 352.318	3.29	Average	H			0.68	40.11	54.00	13.89
2 388.042	14.44	Peak	V			-	50.58	74.00	23.42
2 370.380	3.27	Average	V			0.68	40.09	54.00	13.91
Test Data for High Channel									
2 495.080	14.57	Peak	H	27.47	9.49	-	51.53	74.00	22.47
2 485.915	2.76	Average	H			0.68	40.40	54.00	13.60
2 487.184	14.80	Peak	V			-	51.76	74.00	22.24
2 494.437	2.80	Average	V			0.68	40.44	54.00	13.56

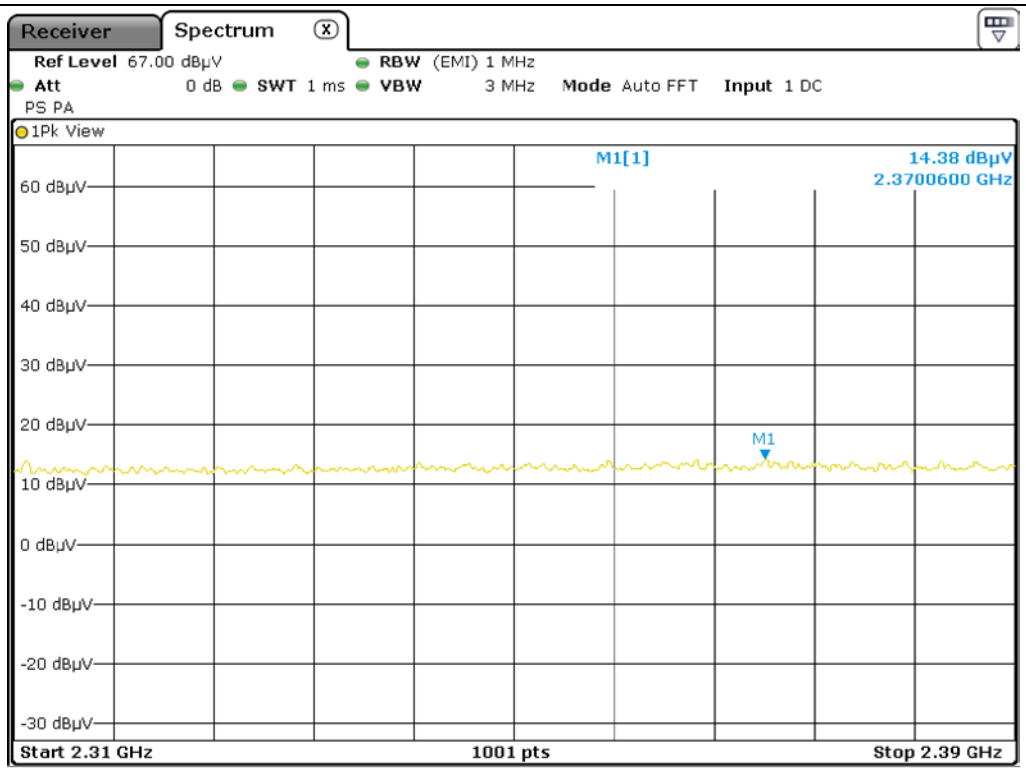
Tabulated test data for Restricted Band

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

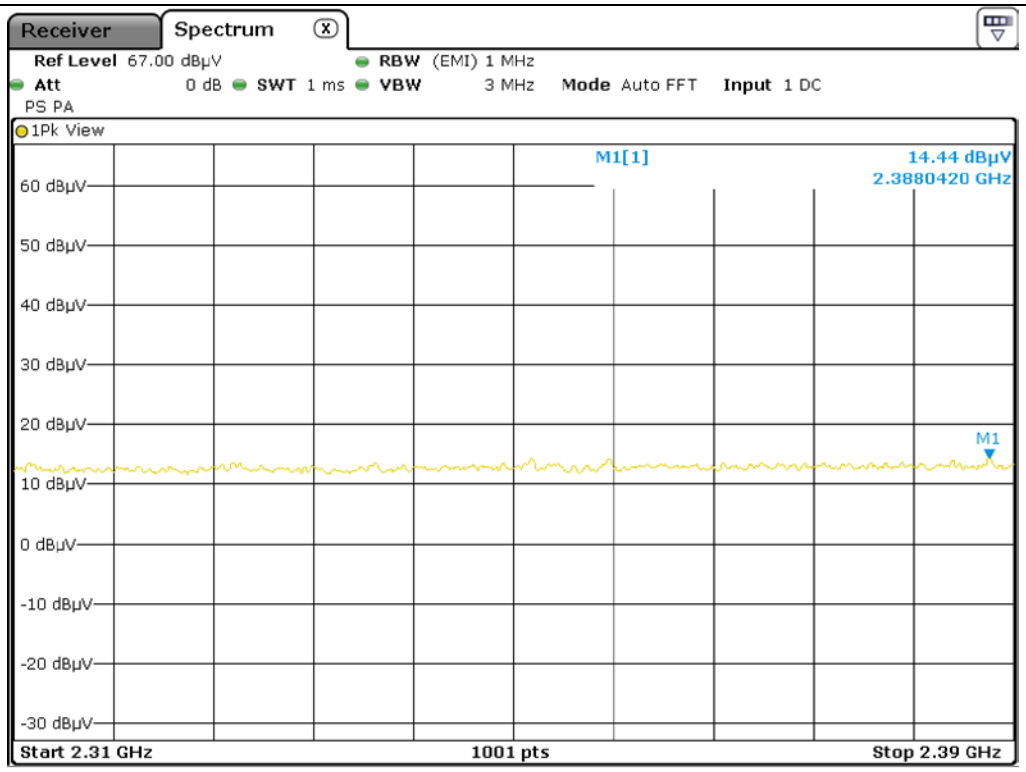
Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

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

Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel_Peak_H



Low Channel_Peak_V

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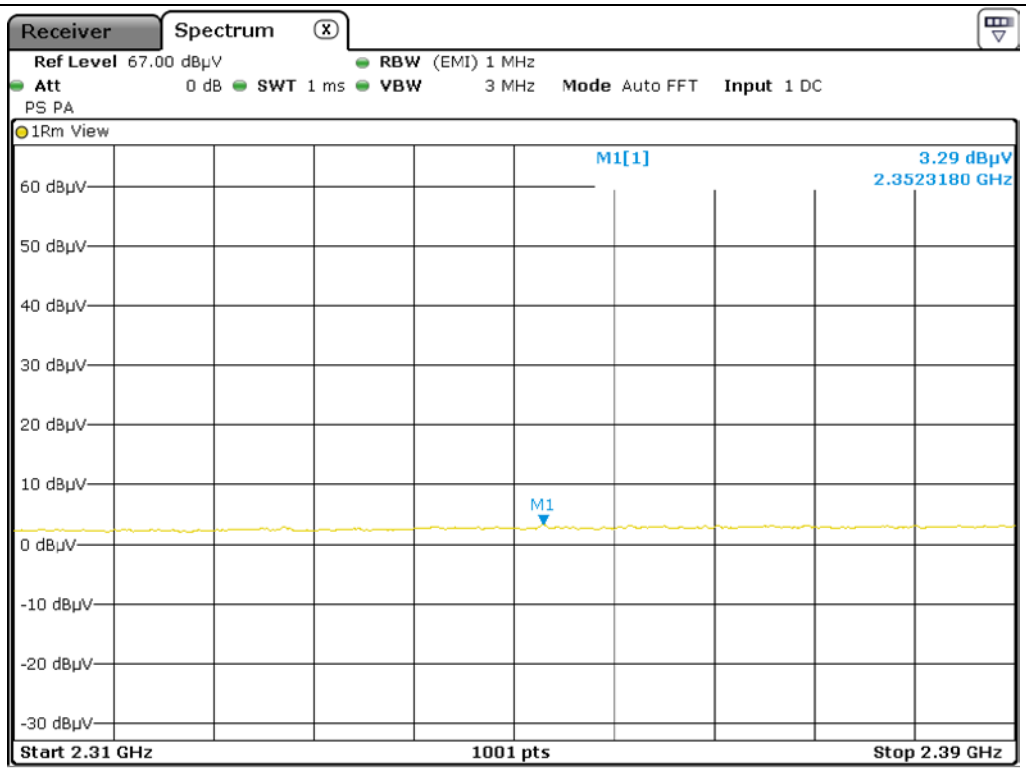
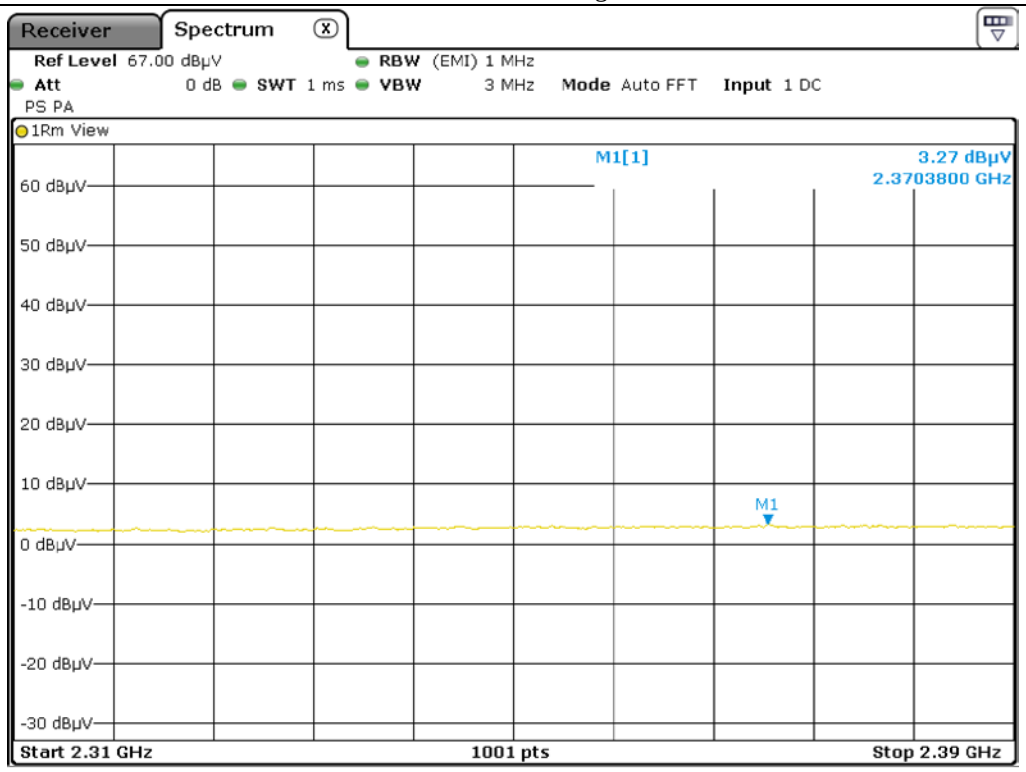
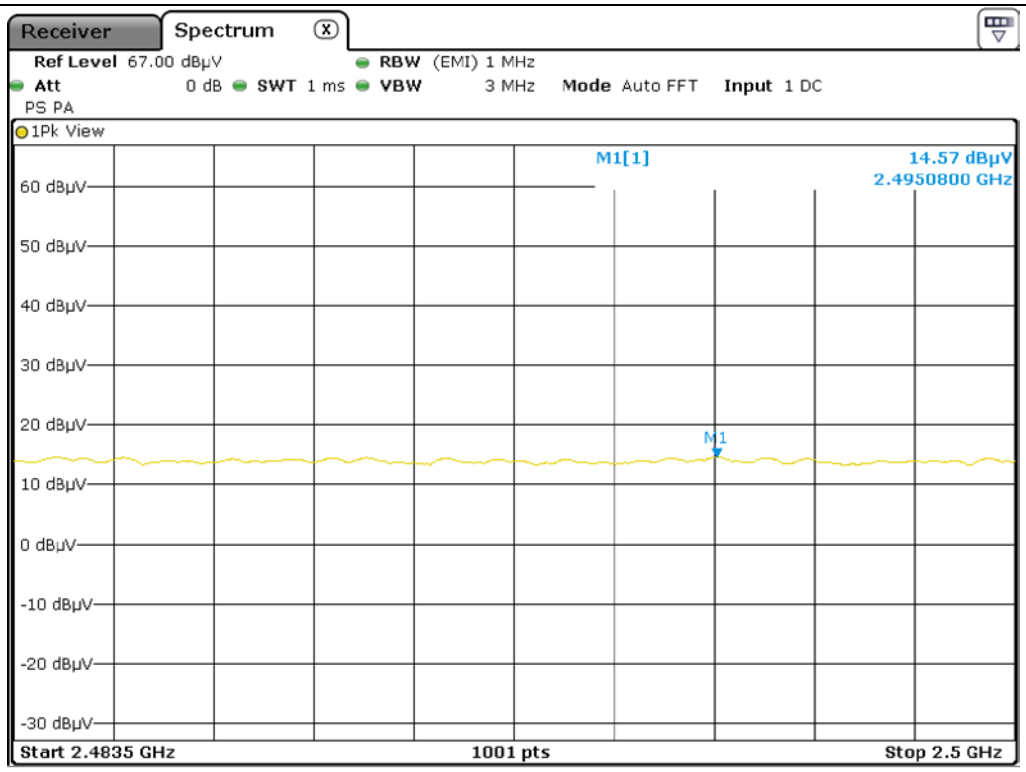


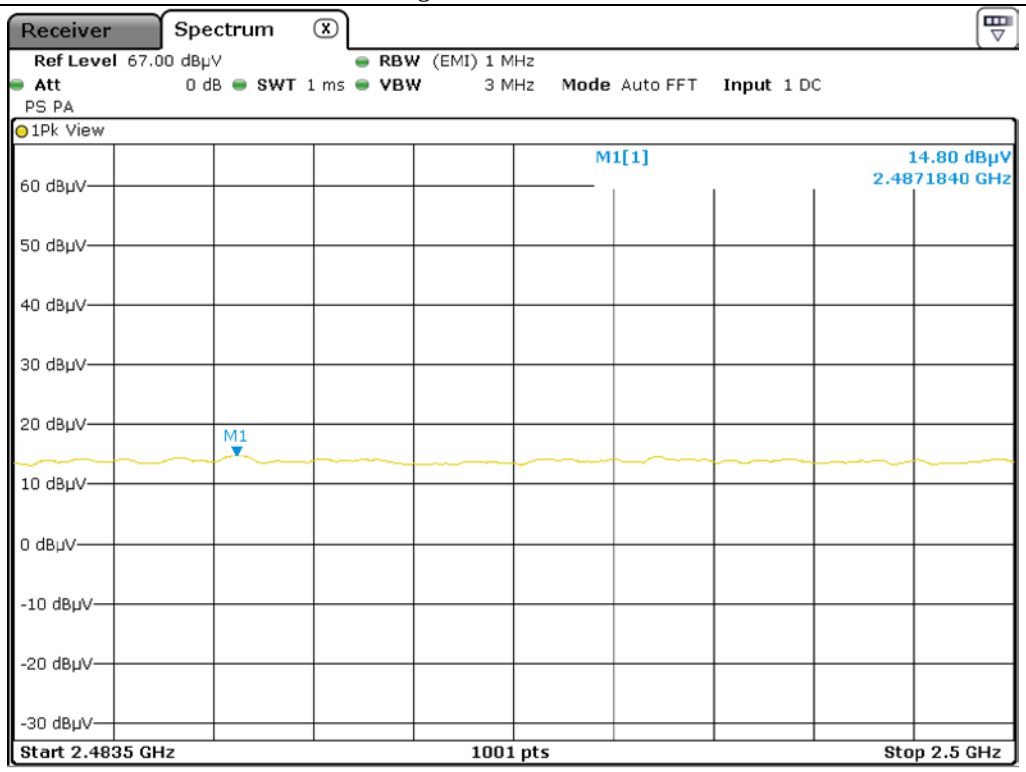
Low Channel_Average_H



Low Channel_Average_V



High Channel_Peak_H



High Channel_Peak_V

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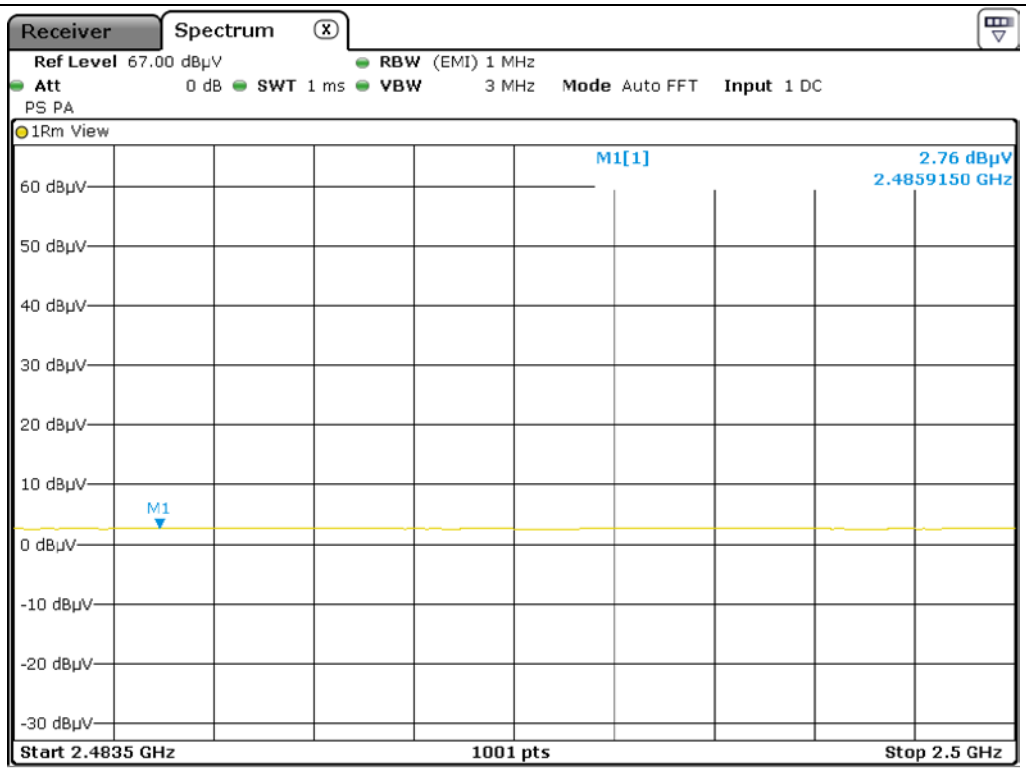
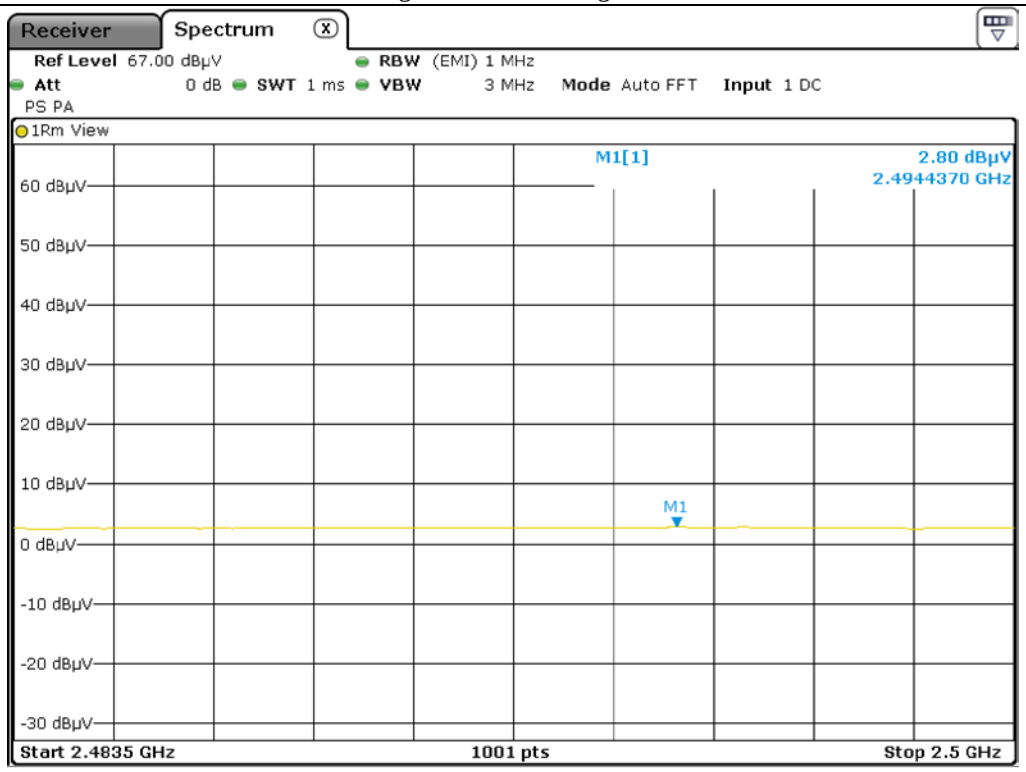


High Channel_Average_H



High Channel_Average_V

9.6.2 Spurious & Harmonic Radiated Emission

9.6.2.1 Test data for 125 kbps

-. Test Date : December 30, 2019 ~ January 03, 2020

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz 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 : 97.14 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	16.24	Peak	H	28.84	10.31	-	55.39	74.00	18.61
	4.70	Average	H			0.13	43.98	54.00	10.02
	16.77	Peak	V			-	55.92	74.00	18.08
	4.90	Average	V			0.13	44.18	54.00	9.82
Test Data for Middle Channel									
4 880.00	16.85	Peak	H	28.01	10.43	-	55.29	74.00	18.71
	4.56	Average	H			0.13	43.13	54.00	10.87
	17.39	Peak	V			-	55.83	74.00	18.17
	4.78	Average	V			0.13	43.35	54.00	10.65
Test Data for High Channel									
4 960.00	16.31	Peak	H	29.15	10.81	-	56.27	74.00	17.73
	4.55	Average	H			0.13	44.64	54.00	9.36
	17.42	Peak	V			-	57.38	74.00	16.62
	4.50	Average	V			0.13	44.59	54.00	9.41

Tabulated test data for Restricted Band

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

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

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

Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.2.2 Test data for 1 Mbps

-. Test Date : December 30, 2019 ~ January 03, 2020

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz 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 : 85.60 %

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
4 804.00	16.38	Peak	H	28.84	10.31	-	55.53	74.00	18.47
4 804.00	4.83	Average	H			0.68	44.66	54.00	9.34
4 804.00	16.73	Peak	V			-	55.88	74.00	18.12
4 804.00	4.82	Average	V			0.68	44.65	54.00	9.35
Test Data for Middle Channel									
4 880.00	16.88	Peak	H	28.01	10.43	-	55.32	74.00	18.68
4 880.00	4.73	Average	H			0.68	43.85	54.00	10.15
4 880.00	17.30	Peak	V			-	55.74	74.00	18.26
4 880.00	4.70	Average	V			0.68	43.82	54.00	10.18
Test Data for High Channel									
4 960.00	16.28	Peak	H	29.15	10.81	-	56.24	74.00	17.76
4 960.00	4.51	Average	H			0.68	45.15	54.00	8.85
4 960.00	17.36	Peak	V			-	57.32	74.00	16.68
4 960.00	4.54	Average	V			0.68	45.18	54.00	8.82

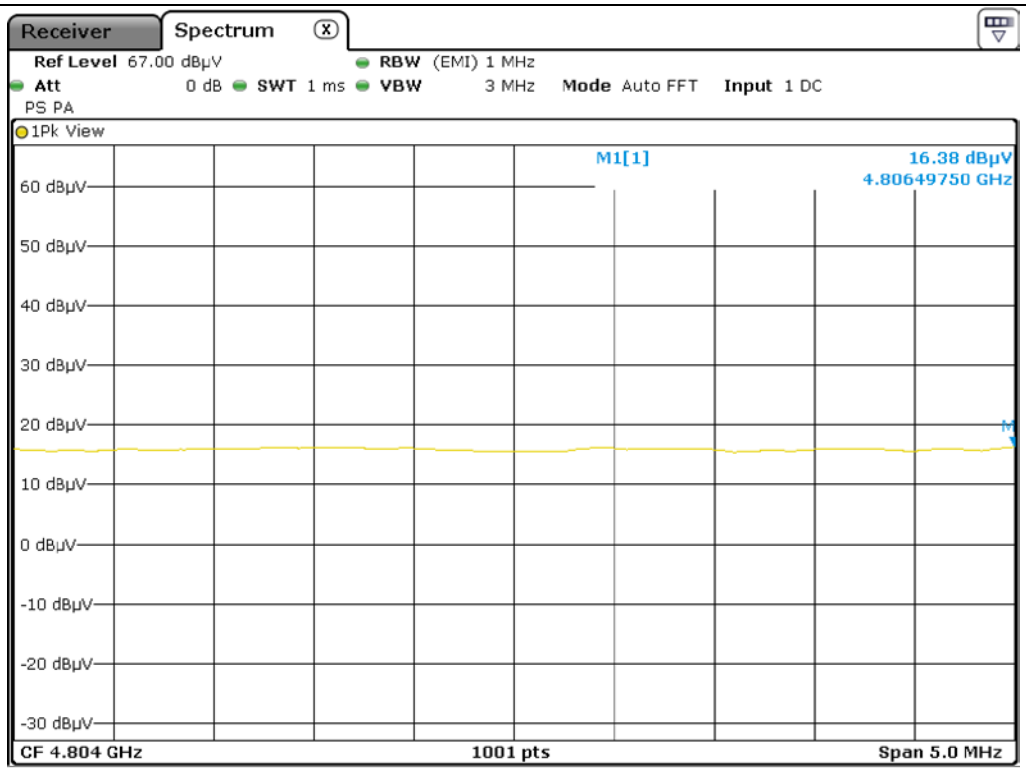
Tabulated test data for Restricted Band

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

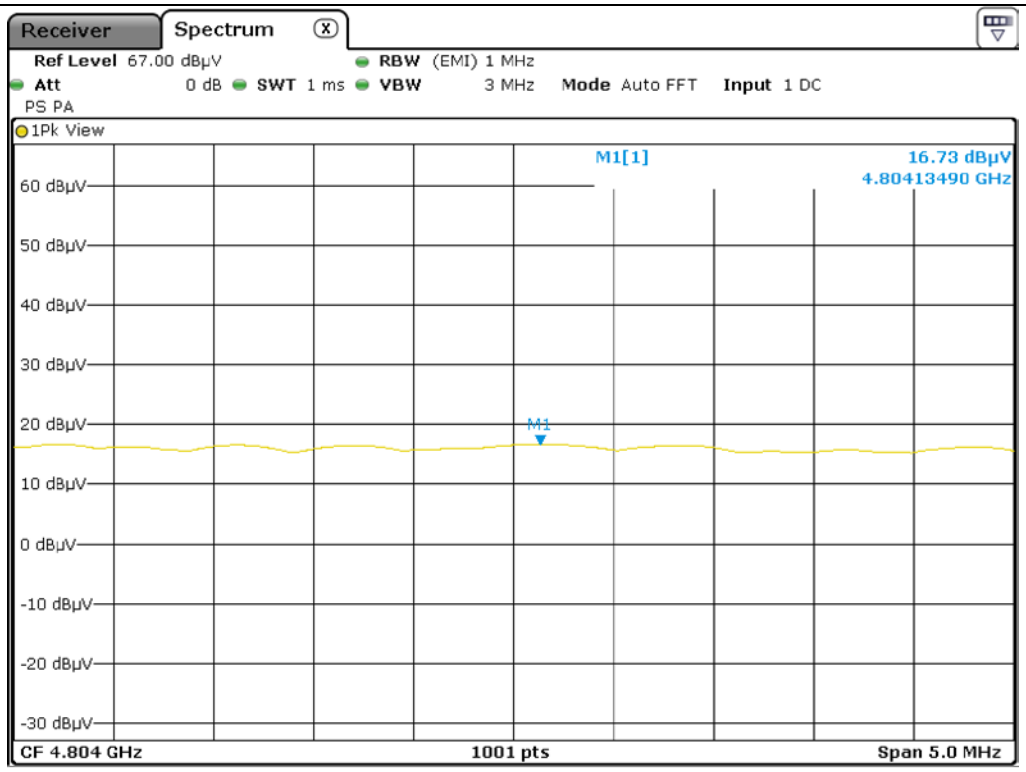
Margin (dB) = Limits (dBµV/m) - Total Level (dBµV/m)

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

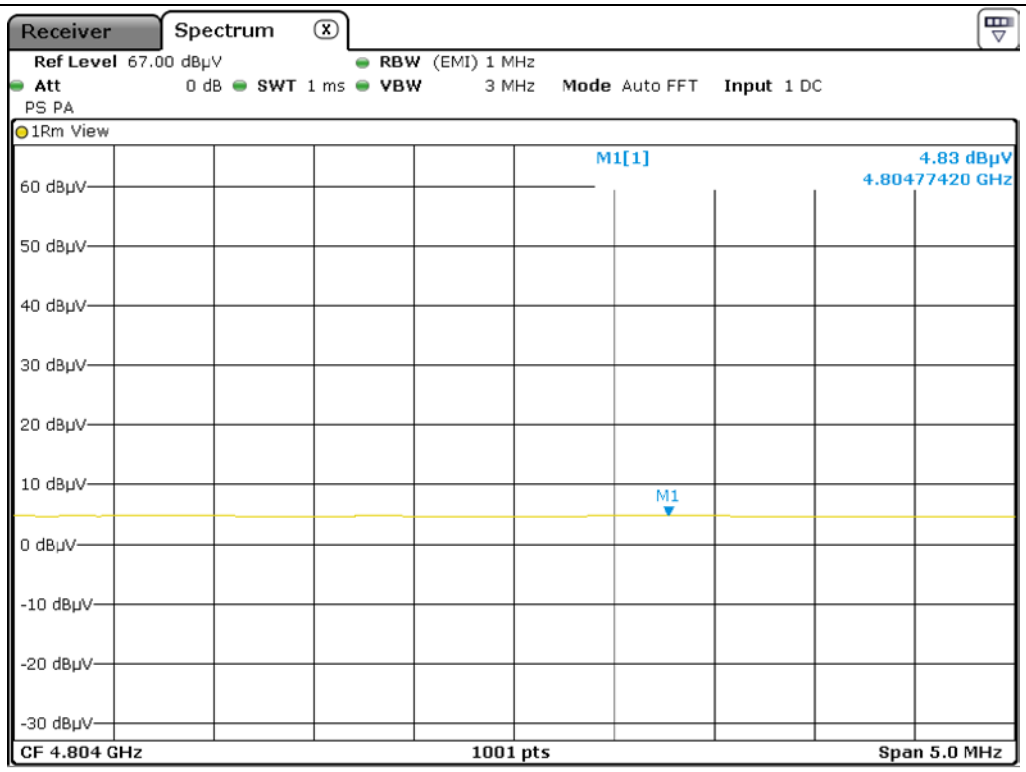
Tested by: Hyung-Kwon, Oh / Assistant Manager



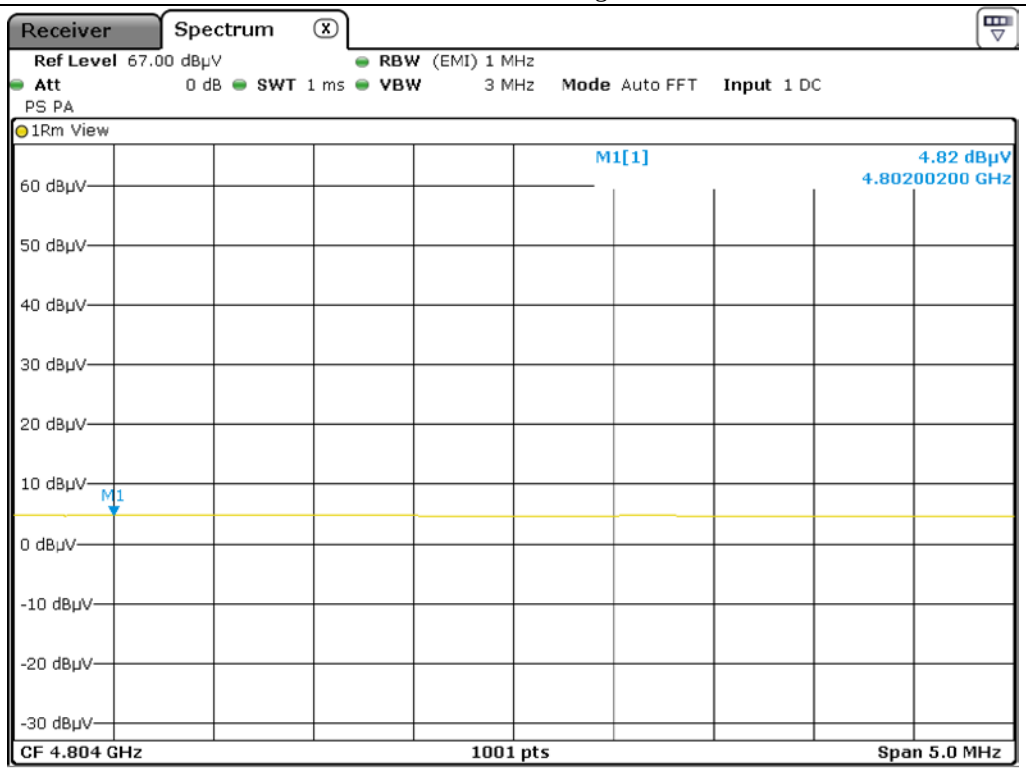
Low Channel_Peak_H



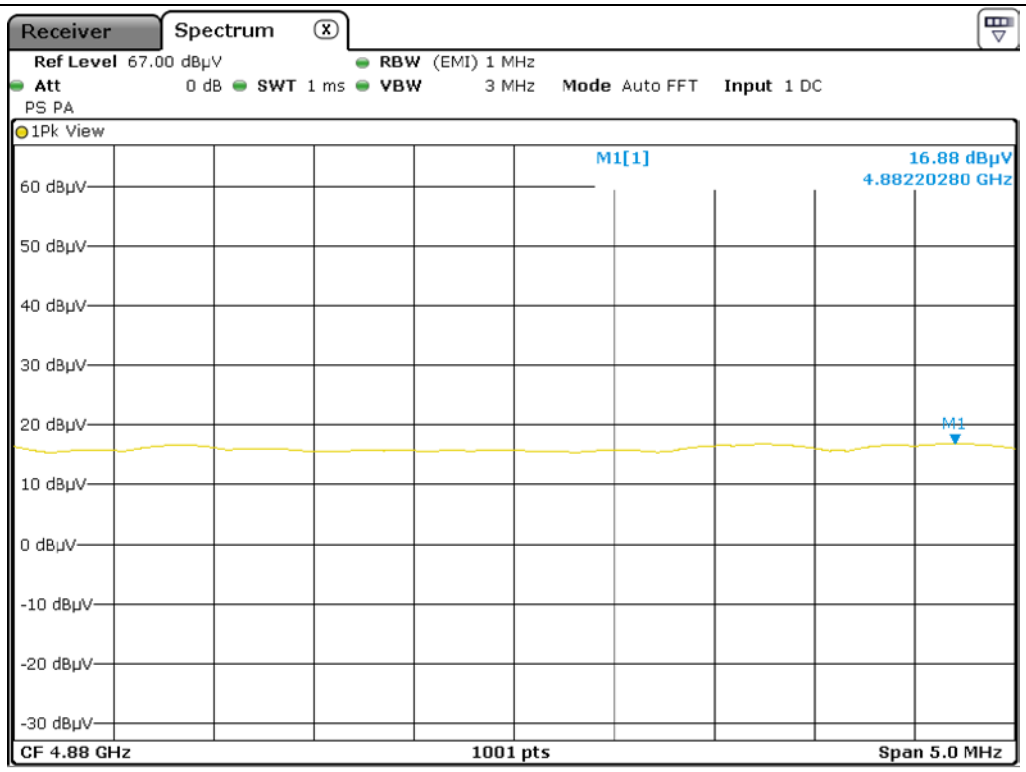
Low Channel_Peak_V



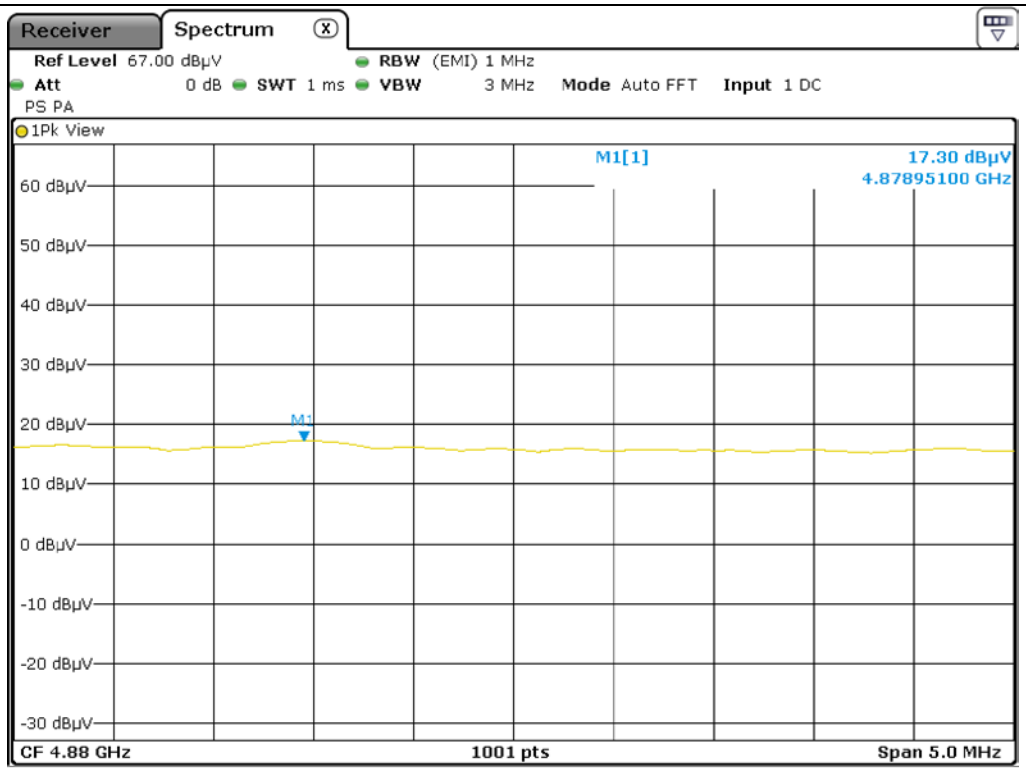
Low Channel_Average_H



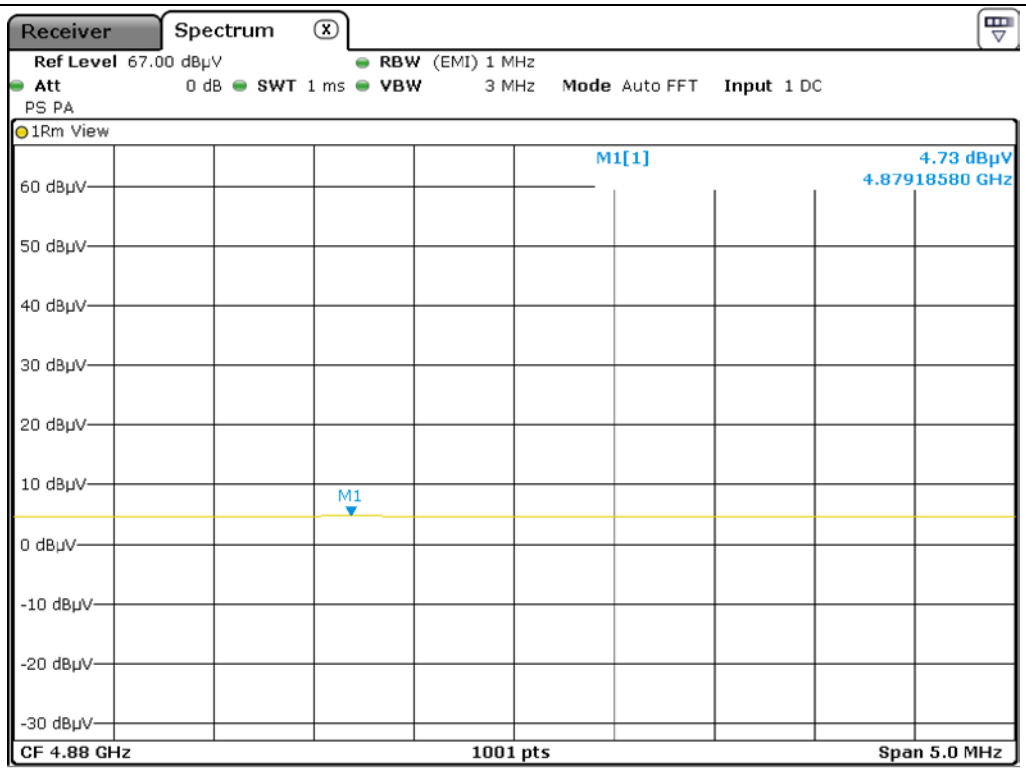
Low Channel_Average_V



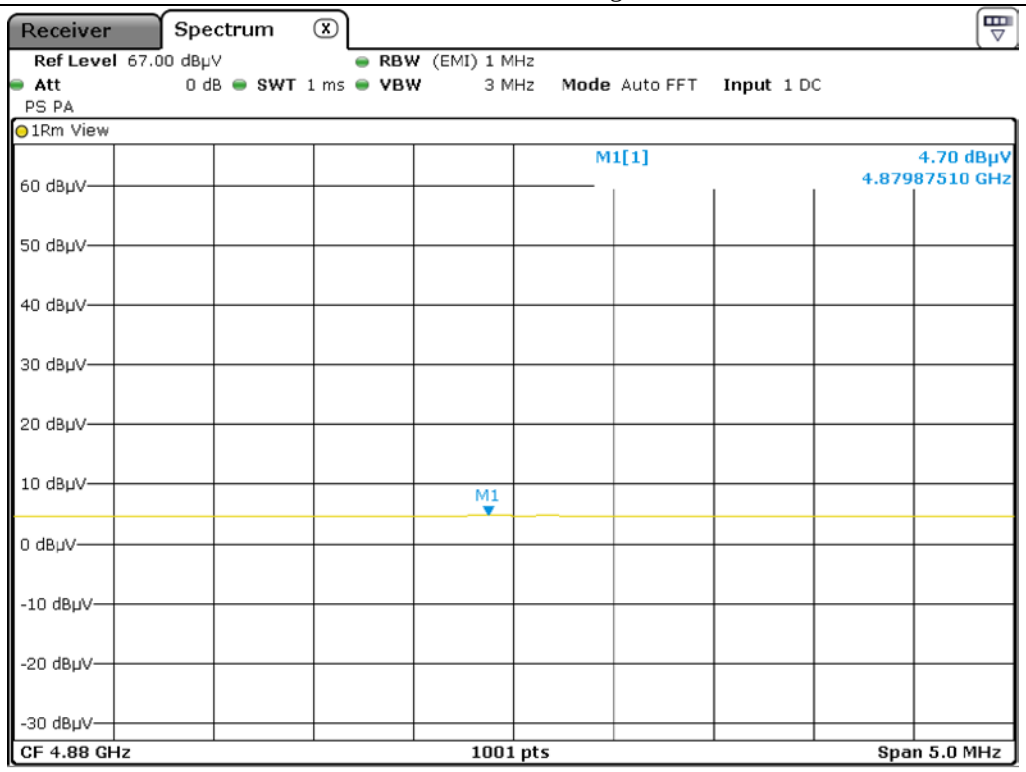
Middle Channel_Peak_H



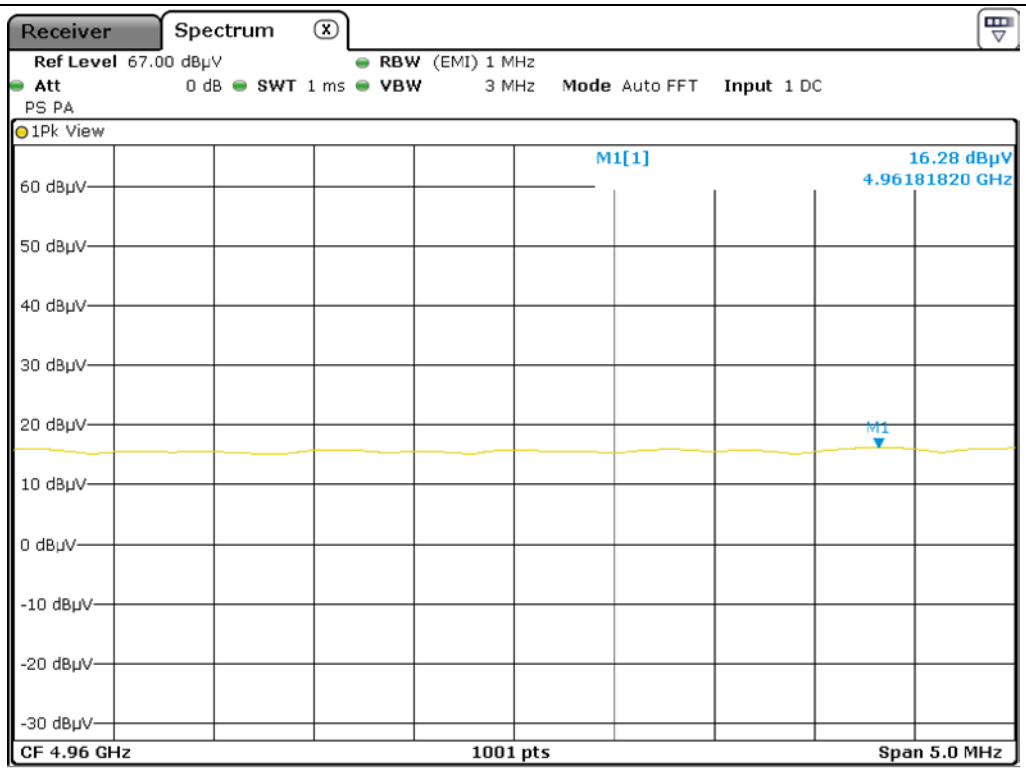
Middle Channel_Peak_V



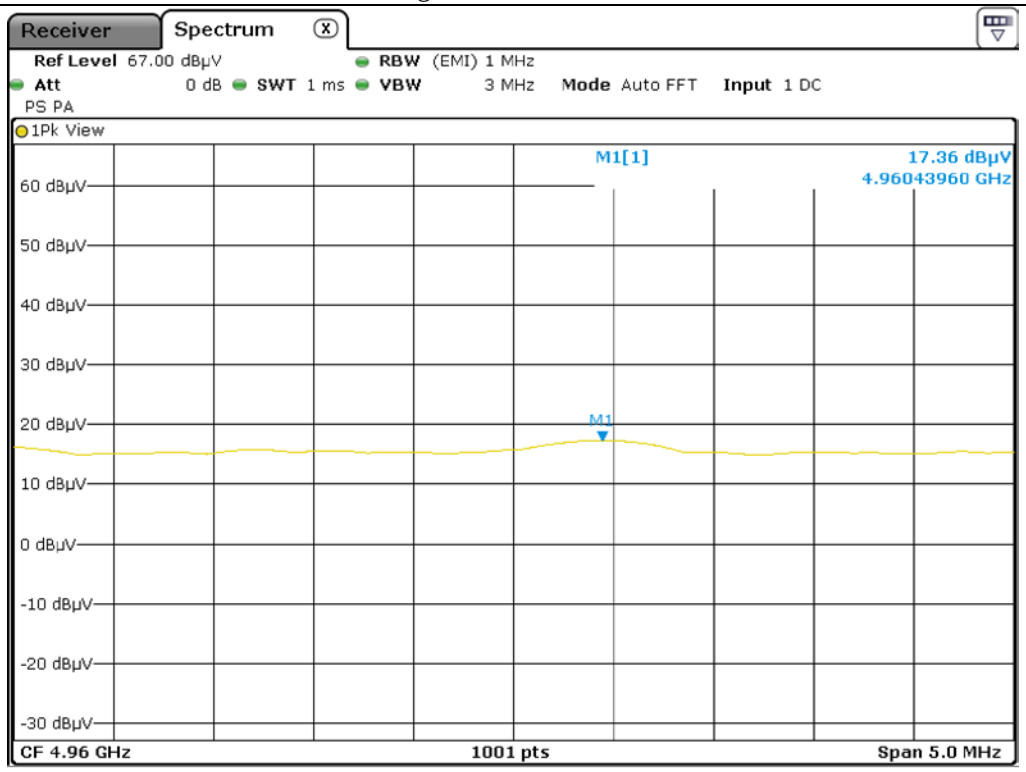
Middle Channel_Average_H



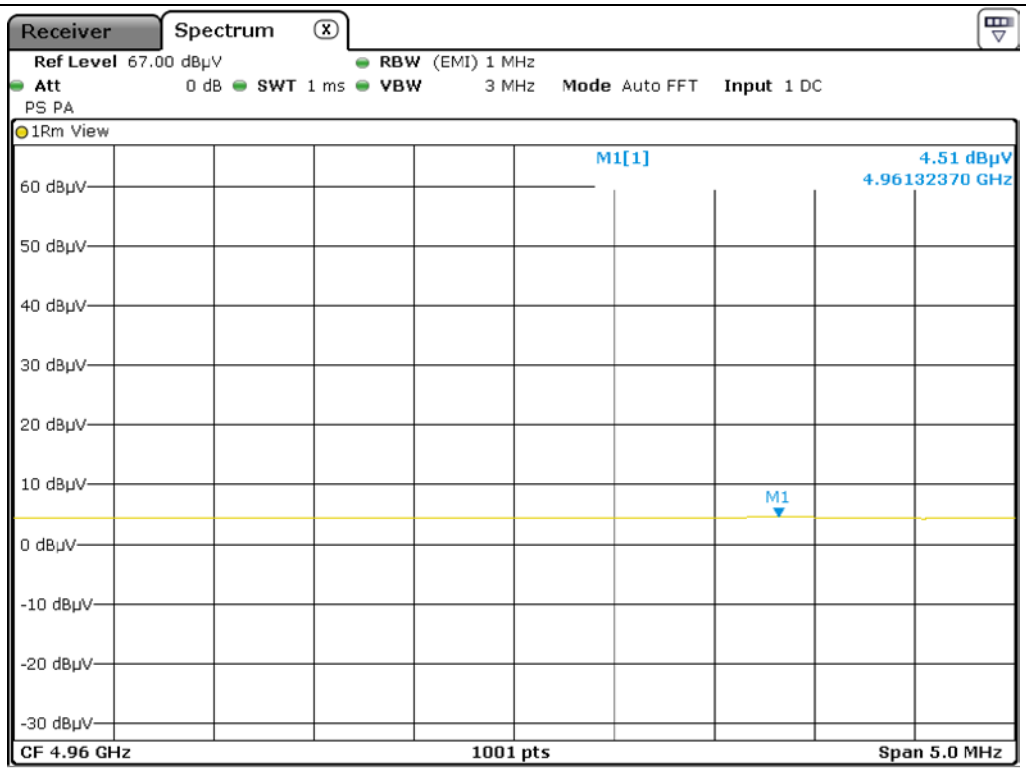
Middle Channel_Average_V



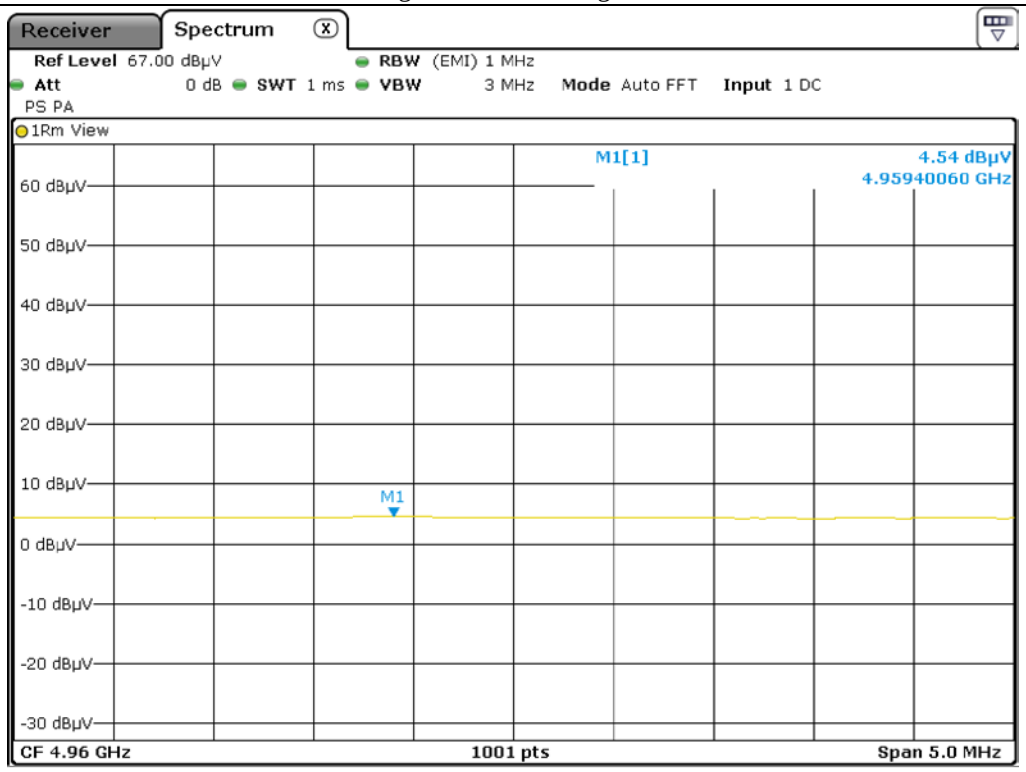
High Channel_Peak_H



High Channel_Peak_V



High Channel_Average_H



High Channel_Average_V

10. PEAK POWER SPECTRAL DENSITY

10.1 Operating environment

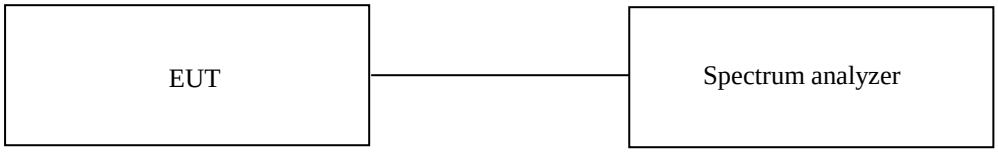
Temperature : 23 °C

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 equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

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10.4 Test data for 125 kbps

-. Test Date : December 30, 2019 ~ January 03, 2020

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-12.48	8.00	20.48
Middle	2 440.00	-13.13	8.00	21.13
High	2 480.00	-13.28	8.00	21.28

Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Assistant Manager

Low Channel

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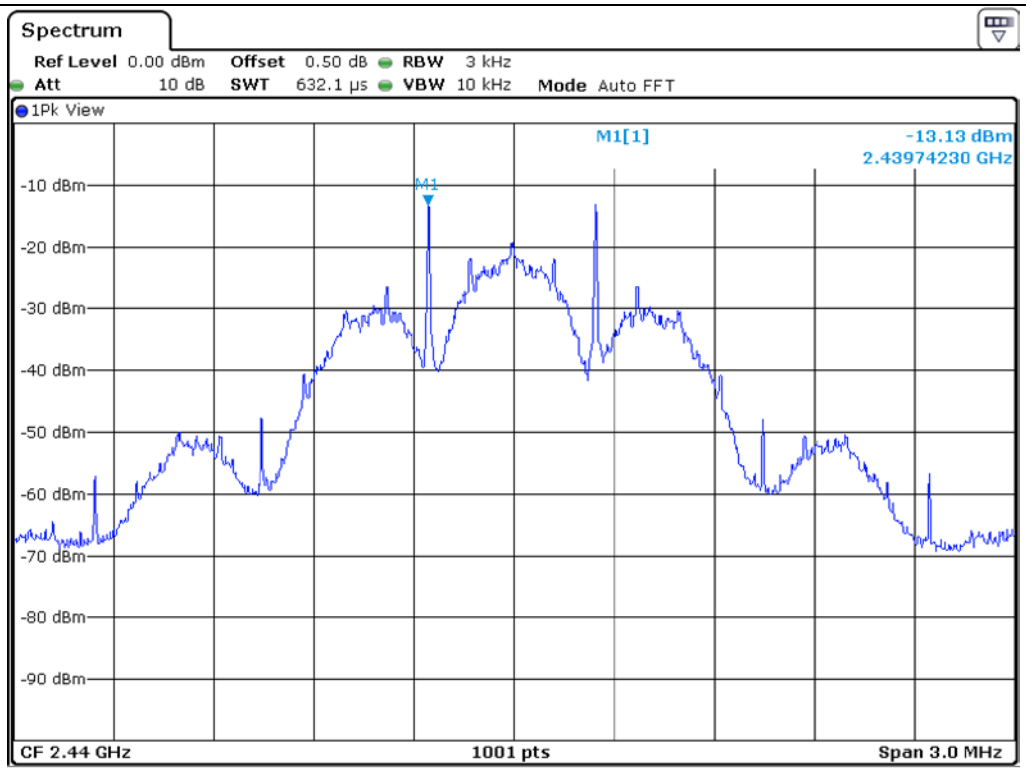
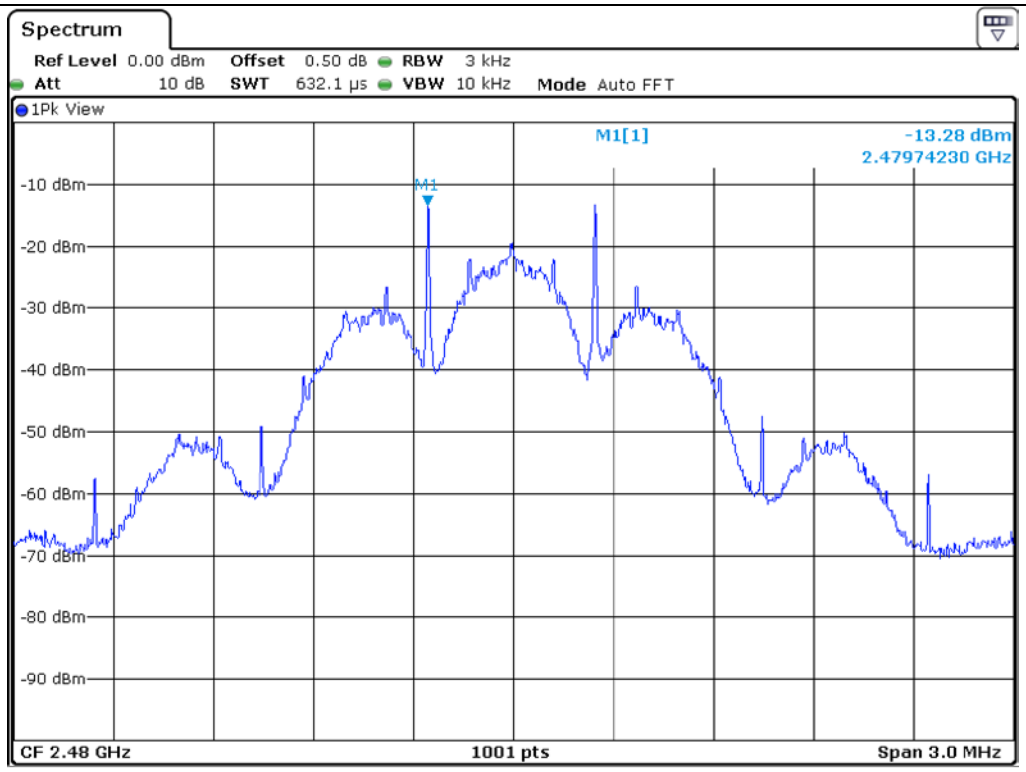


Middle Channel



High Channel

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10.5 Test data for 1 Mbps

-. Test Date : December 30, 2019 ~ January 03, 2020

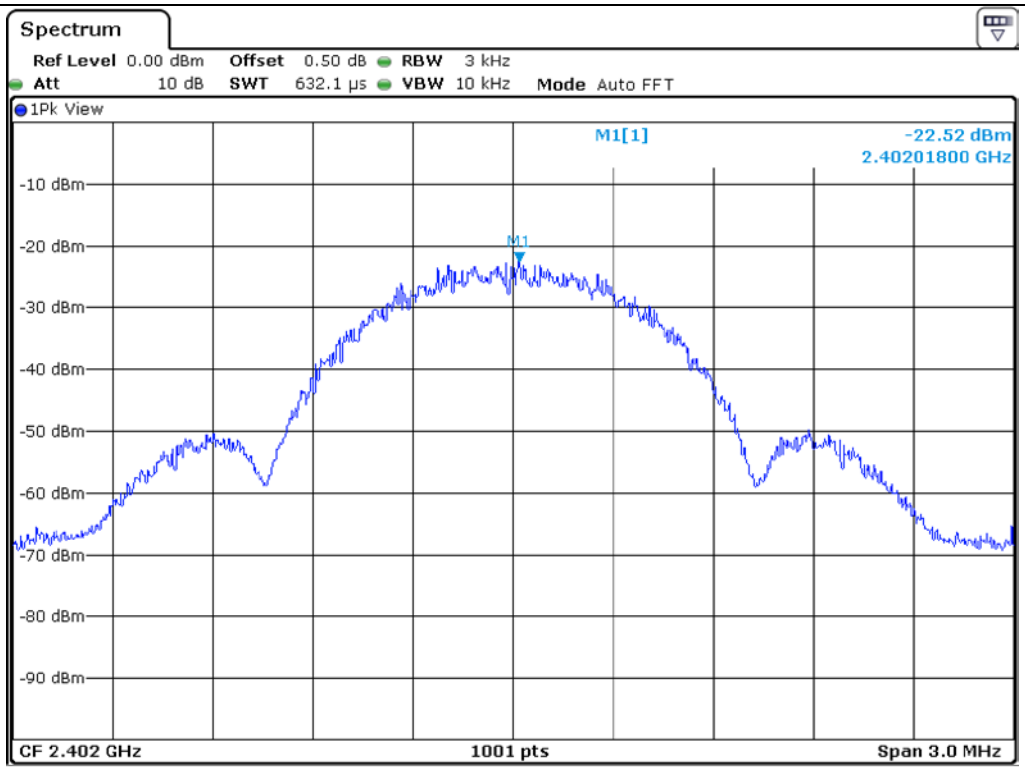
-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-22.52	8.00	30.52
Middle	2 440.00	-23.23	8.00	31.23
High	2 480.00	-23.49	8.00	31.49

Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel

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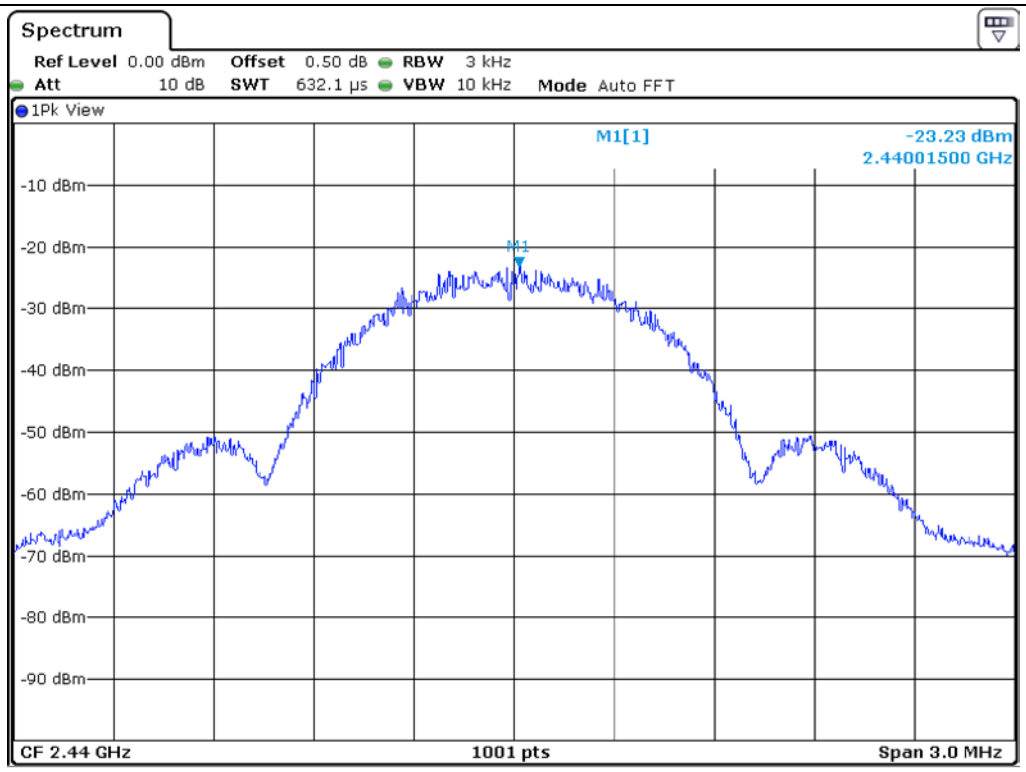
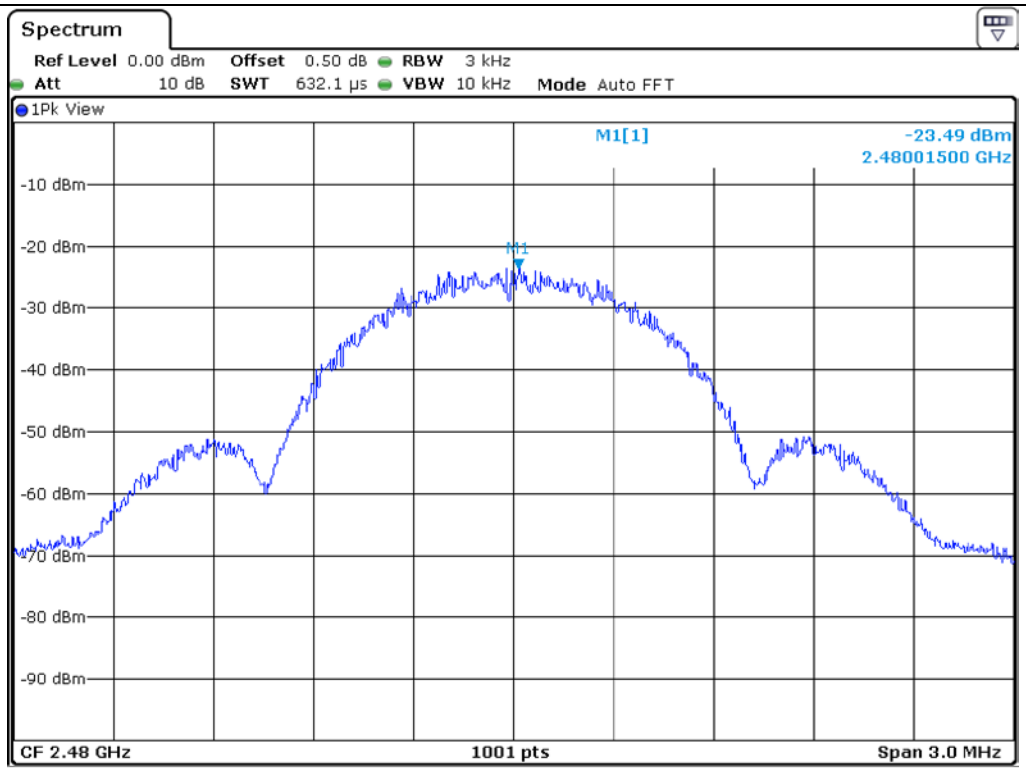


Middle Channel



High Channel

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.

11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 28, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718B	Schwarzbeck	Amplifier	009	Mar. 20, 2019 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 2019 (1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)
■ -	VAMP9243	Schwarzbeck	ROD ANTENNA	VAMP9243	Mar. 14, 2019 (2Y)

All test equipment used is calibrated on a regular basis.

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11.4 Test data for 125 kbps

11.4.1 Test data for 30 MHz ~ 1 GHz

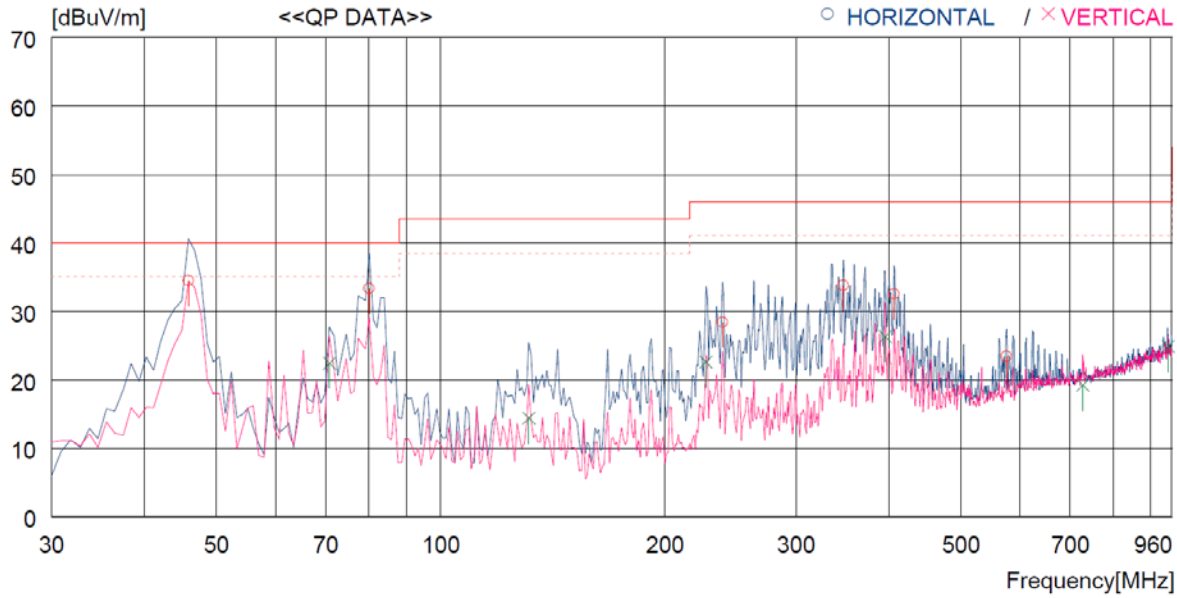
Humidity Level : 45 % R.H. Temperature: 23 °C

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

Result : PASSED

EUT : Insulin Pump Date: December 30, 2019 ~ January 03, 2020

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	45.810	51.7	14.4	1.5	33.1	34.5	40.0	5.5	300	170
2	80.220	56.6	7.7	2.0	33.0	33.3	40.0	6.7	400	0
3	239.249	45.5	12.2	3.6	32.9	28.4	46.0	17.6	200	74
4	347.128	47.8	14.7	4.3	33.0	33.8	46.0	12.2	100	359
5	406.648	45.1	15.9	4.6	33.1	32.5	46.0	13.5	100	219
6	574.977	32.2	19.0	5.5	33.3	23.4	46.0	22.6	200	0
----- Vertical ------										
7	70.920	44.4	9.1	2.0	33.1	22.4	40.0	17.6	100	0
8	131.370	35.8	9.0	2.6	33.0	14.4	43.5	29.1	200	359
9	395.488	39.0	15.8	4.6	33.1	26.3	46.0	19.7	300	250
10	728.425	25.9	20.4	6.2	33.3	19.2	46.0	26.8	400	359
11	948.834	26.4	23.2	7.2	31.9	24.9	46.0	21.1	200	359
12	227.159	40.2	11.8	3.5	32.9	22.6	46.0	23.4	100	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

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11.4.2 Test data for Below 30 MHz

-. Test Date : December 30, 2019 ~ January 03, 2020

-. 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)
It was not observed any emissions from the EUT.									

11.4.3 Test data for above 1 GHz

-. Test Date : December 30, 2019 ~ January 03, 2020

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

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for 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)
It was not observed any emissions from the EUT.									

Tested by: Hyung-Kwon, Oh / Assistant Manager

11.5 Test data for 1 Mbps

11.5.1 Test data for 30 MHz ~ 1 GHz

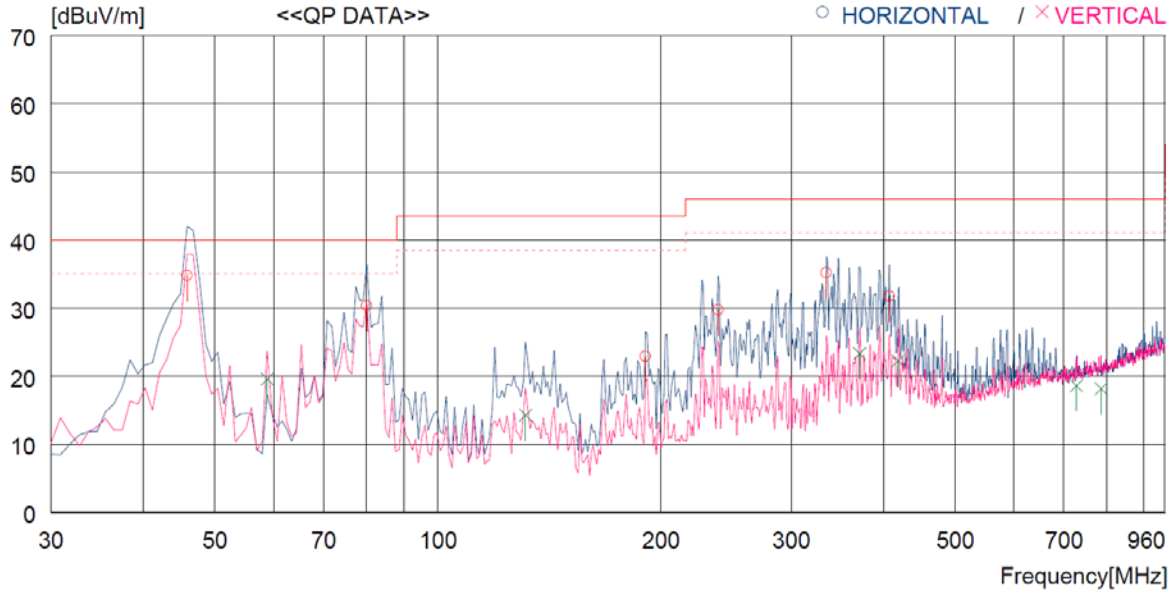
Humidity Level : 45 % R.H. Temperature: 23 °C

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

Result : PASSED

EUT : Insulin Pump Date: December 30, 2019 ~ January 03, 2020

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	45.810	52.2	14.1	1.5	33.1	34.7	40.0	5.3	400	0
2	80.220	53.8	7.7	1.9	33.1	30.3	40.0	9.7	400	164
3	190.890	43.3	10.0	2.7	33.1	22.9	43.5	20.6	200	0
4	239.249	47.7	12.0	3.0	33.0	29.7	46.0	16.3	100	80
5	335.038	50.4	14.4	3.5	33.1	35.2	46.0	10.8	100	113
6	407.578	45.0	16.1	3.8	33.2	31.7	46.0	14.3	100	359
----- Vertical ------										
7	58.830	37.7	13.3	1.7	33.1	19.6	40.0	20.4	100	232
8	131.370	35.8	9.3	2.2	33.0	14.3	43.5	29.2	300	0
9	371.308	37.5	15.3	3.7	33.2	23.3	46.0	22.7	300	271
10	418.738	35.1	16.3	3.9	33.1	22.2	46.0	23.8	300	0
11	728.425	26.6	20.0	5.3	33.3	18.6	46.0	27.4	400	55
12	786.085	25.4	20.6	5.4	33.2	18.2	46.0	27.8	300	2

Tested by: Hyung-Kwon, Oh / Assistant Manager

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11.5.2 Test data for Below 30 MHz

-. Test Date : December 30, 2019 ~ January 03, 2020

-. 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)
It was not observed any emissions from the EUT.									

11.5.3 Test data for above 1 GHz

-. Test Date : December 30, 2019 ~ January 03, 2020

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

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for 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)
It was not observed any emissions from the EUT.									

Tested by: Hyung-Kwon, Oh / Assistant Manager