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

Test Report No.	**: OT-189-RWD-050**
AGR No.	**: A189A-120**
Applicant	**: Samsung Electronics Co., Ltd.**
Address	**: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 17113 Republic of Korea**
Manufacturer	**: Samsung Electronics Co., Ltd.**
Address	**: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 17113 Republic of Korea**
Type of Equipment	**: ARTIK-0530**
FCC ID.	**: A3LSIP005AFS30**
IC Certification No.	**: 649E-SIP005AFS30**
Model Name	**: SIP005AFS30**
Multiple Model Name	**: N/A**
Serial number	**: N/A**
Total page of Report	**: 42 pages (including this page)**
Date of Incoming	**: September 02, 2018**
Date of issue	**: September 28, 2018**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247 and IC RSS-Gen Issue 4 Nov 2014 and RSS-247 Issue 2 February 2017***

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: Ki-Hong, Nam / Chief Engineer, ONETECH Corp.

Approved by: Keun-Young, Choi / Vice President, 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)

CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE 4

2. TEST SUMMARY 5

2.1 TEST ITEMS AND RESULTS 5

2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS 5

2.3 RELATED SUBMITTAL(S) / GRANT(S) 5

2.4 PURPOSE OF THE TEST 5

2.5 TEST METHODOLOGY 5

2.6 TEST FACILITY 6

3. GENERAL INFORMATION 7

3.1 PRODUCT DESCRIPTION 7

3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT. 7

3.3 MODE OF OPERATION DURING THE TEST 7

4. EUT MODIFICATIONS 8

5. TRANSMITTER RADIATED SPURIOUS EMISSIONS 9

5.1 OPERATING ENVIRONMENT 9

5.2 TEST SET-UP FOR RADIATED MEASUREMENT 9

5.3 TEST EQUIPMENT USED 9

5.4 TEST DATA FOR DADIATED EMISSION 10

5.4.1 Radiated Emission which fall in the Restricted Band(GFSK_1 Mbps) 10

5.4.2 Radiated Emission which fall in the Restricted Band(Pi/4-DPSK_2 Mbps) 15

5.4.3 Radiated Emission which fall in the Restricted Band(8PSK_3 Mbps) 20

5.4.4 Spurious & Harmonic Radiated Emission(GFSK_1 Mbps) 25

5.4.5 Spurious & Harmonic Radiated Emission(Pi/4-DPSK_2 Mbps) 29

5.4.6 Spurious & Harmonic Radiated Emission(8PSK_3 Mbps) 33

5.4.7 Test Data FCC for below 1 000 MHz 37

5.4.8 Test Data IC for below 1 000 MHz 39

6. MAXIMUM PEAK CONDUCTED OUTPUT POWER 41

6.1 OPERATING ENVIRONMENT 41

6.2 TEST SET-UP 41

6.3 TEST EQUIPMENT USED 41

6.4 TEST RESULT(GFSK_1 MBPS) 42

6.5 TEST RESULT(Π/4-DQPSK_2 MBPS) 42

6.6 TEST RESULT(8 DPSK_3 MBPS) 42

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

Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-189-RWD-050	2018.09.28	Initial Release	All

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

1. VERIFICATION OF COMPLIANCE

Applicant	: Samsung Electronics Co., Ltd.
Address	: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 17113 Republic of Korea
Contact Person	: Lee, Jae-Hyuk
Telephone No.	: +82-10-8848-6628
FCC ID	: A3LSIP005AFS30
IC Certification No.	: 649E-SIP005AFS30
Model Name	: SIP005AFS30
Serial Number	: N/A
Date	: September 28, 2018

EQUIPMENT CLASS	FCC: DSS – PART 15 SPREAD SPECTRUM TRANSMITTER IC : Low Power License-Exempt Radio-communication Device
E.U.T. DESCRIPTION	Modular Transmitter, ARTIK-0530
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, RSS-Gen Issue 4 Nov 2014, RSS-247 Issue 2 February 2017
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&IC 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.

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

2. TEST SUMMARY

2.1 Test items and results

SECTION		TEST ITEMS	RESULTS
15.205(a) 15.209 15.247(d)	RSS-247 Issue 2 5.5 RSS-Gen Issue 4 8.9	Transmitter Radiated Spurious Emissions	Met the Limit / PASS
15.247(a)(1)	RSS-247 Issue 2 5.2(2) RSS-Gen Issue 4 6.6	20 dB Bandwidth & 99 % Bandwidth	PASS (Note1)
15.247(b)(1)	RSS-247 Issue 2 5.4(2)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247(a)(1)	RSS-247 Issue 2 5.1(2)	Carrier Frequency Separation	PASS (Note1)
15.247(a)(1)(iii)	RSS-247 Issue 2 5.4(4)	Number of Hopping Frequency	PASS (Note1)
15.247(a)(1)(iii)	RSS-247 Issue 2 5.1(4)	Time of Occupancy (Dwell Time)	PASS (Note1)
15.207	RSS-Gen Issue 4 8.8	AC Power Line Conducted Emissions	PASS (Note1)

Note1 - The EUT have a RF Test already approved. (Report No: 16K23791-E3V3)

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, IC RSS-Gen Issue 4 Nov 2014 and RSS-247 Issue 2 February 2017

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.

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

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

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

3. GENERAL INFORMATION

3.1 Product Description

The Samsung Electronics Co., Ltd., Model SIP005AFS30 (referred to as the EUT in this report) is a ARTIK-0530. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	ARTIK-0530	
Operating Frequency	2 402 MHz ~ 2 480 MHz (Bluetooth, Bluetooth Low Energy), 2 405 MHz ~ 2 475 MHz (Zigbee), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 5 745 MHz ~ 5 825 MHz (UNII 3: 11a/n_HT20), 5 755 MHz ~ 5 795 MHz (UNII 3: 11n_HT40), 5 180 MHz ~ 5 240 MHz (UNII 1: 11a/n_HT20), 5 190 MHz ~ 5 230 MHz (UNII 1: 11n_HT40), 5 260 MHz ~ 5 320 MHz (UNII 2A: 11a/n_HT20), 5 270 MHz ~ 5 310 MHz (UNII 2A: 11n_HT40), 5 500 MHz ~ 5 720 MHz (UNII 2C: 11a/n_HT20), 5 510 MHz ~ 5 710 MHz (UNII 2C: 11n_HT40),	
Modulation Type	DSSS, OFDM, GFSK, π/4DQPSK, 8DPSK	
Number of Channels	79 channel (Bluetooth), 40 channel (Bluetooth Low Energy), 15 channel (Zigbee), 11 channel (11b/g/n_HT20), 5 channel (UNII 3: 11a/n_HT20), 2 channel (UNII 3: 11n_HT40), 4 channel (UNII 1: 11a/n_HT20), 2 channel (UNII 1: 11n_HT40), 4 channel (UNII 2A: 11a/n_HT20), 2 channel (UNII 2A: 11n_HT40), 9 channel (UNII 2C: 11a/n_HT20), 4 channel (UNII 2C: 11n_HT40)	
Antenna Type	Dipole antenna	
Antenna Gain	Bluetooth(BDR / EDR / LE), Zigbee WLAN 2.4 GHz Band	3.80 dBi
	WLAN 5 GHz Band	5.50 dBi

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

-. None

3.3 Mode of operation during the test

To get a maximum radiated 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 test report.

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

4. EUT MODIFICATIONS

-. None

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

5. Transmitter Radiated Spurious Emissions

5.1 Operating environment

Temperature : 24.3 ℃

Relative humidity : 43.9 % R.H.

5.2 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.

5.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 14, 2018 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 29, 2018 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 28, 2018 (1Y)
■ -	BBV9718	Schwarzbeck	Amplifier	310	Mar. 30, 2018 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 15, 2018 (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	9163-419	Oct. 17, 2017 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jul. 28, 2017 (2Y)

All test equipment used is calibrated on a regular basis.

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

5.4 Test Data for Dadiated Emission

5.4.1 Radiated Emission which fall in the Restricted Band(GFSK_1 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. 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

-. Result : PASSED

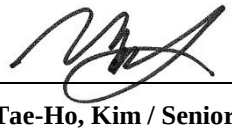
Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 328.510	44.48	Peak	H	26.91	9.17	34.30	46.26	74.00	27.74
2 324.000	34.27	Average	H	26.91	9.17	34.30	36.05	54.00	17.95
2 385.890	45.24	Peak	V	26.91	9.17	34.30	47.02	74.00	26.98
2 390.000	35.43	Average	V	26.91	9.17	34.30	37.21	54.00	16.79
Test Data for High Channel									
2 483.500	44.91	Peak	H	27.47	9.49	34.46	47.41	74.00	26.59
2 483.500	36.11	Average	H	27.47	9.49	34.46	38.61	54.00	15.39
2 483.500	44.90	Peak	V	27.47	9.49	34.46	47.40	74.00	26.60
2 483.500	35.27	Average	V	27.47	9.49	34.46	37.77	54.00	16.23

Tabulated test data for Restricted Band

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

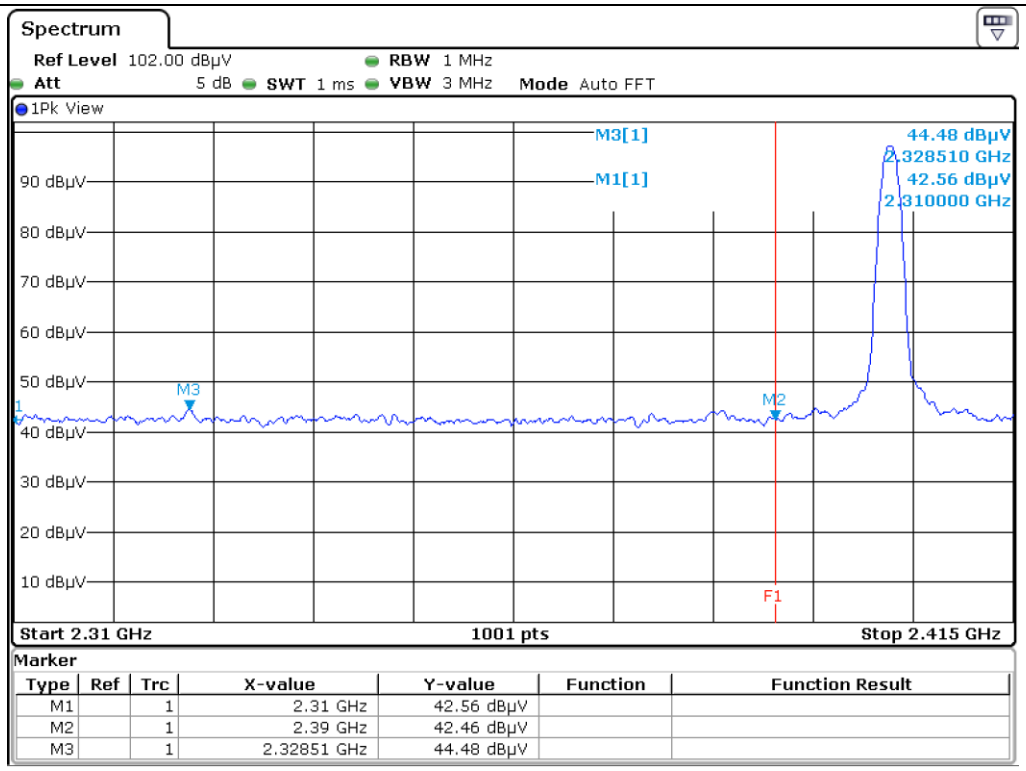
Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

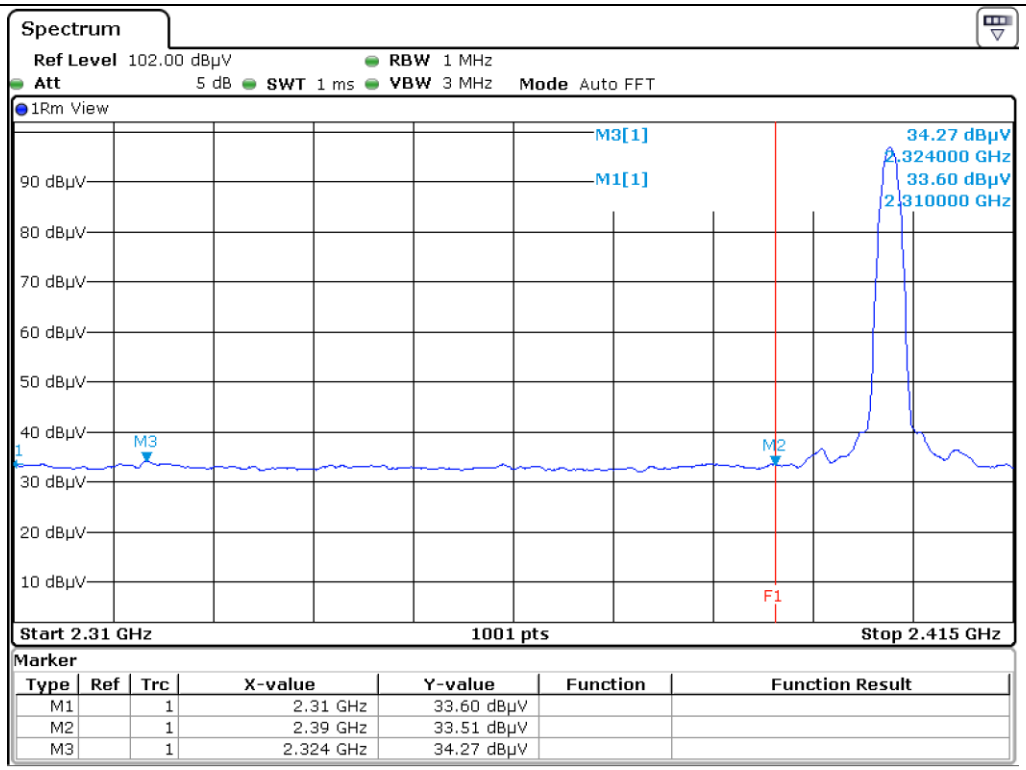


Tested by: Tae-Ho, Kim / Senior Manager

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

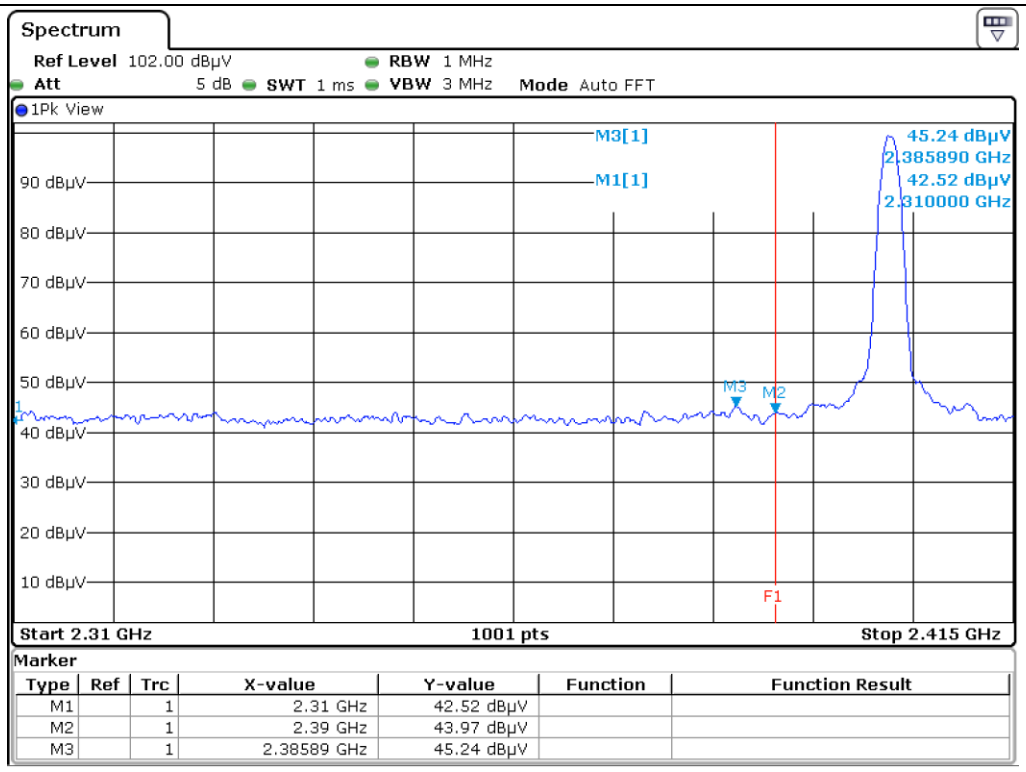


Low Channel_Horizontal_Peak

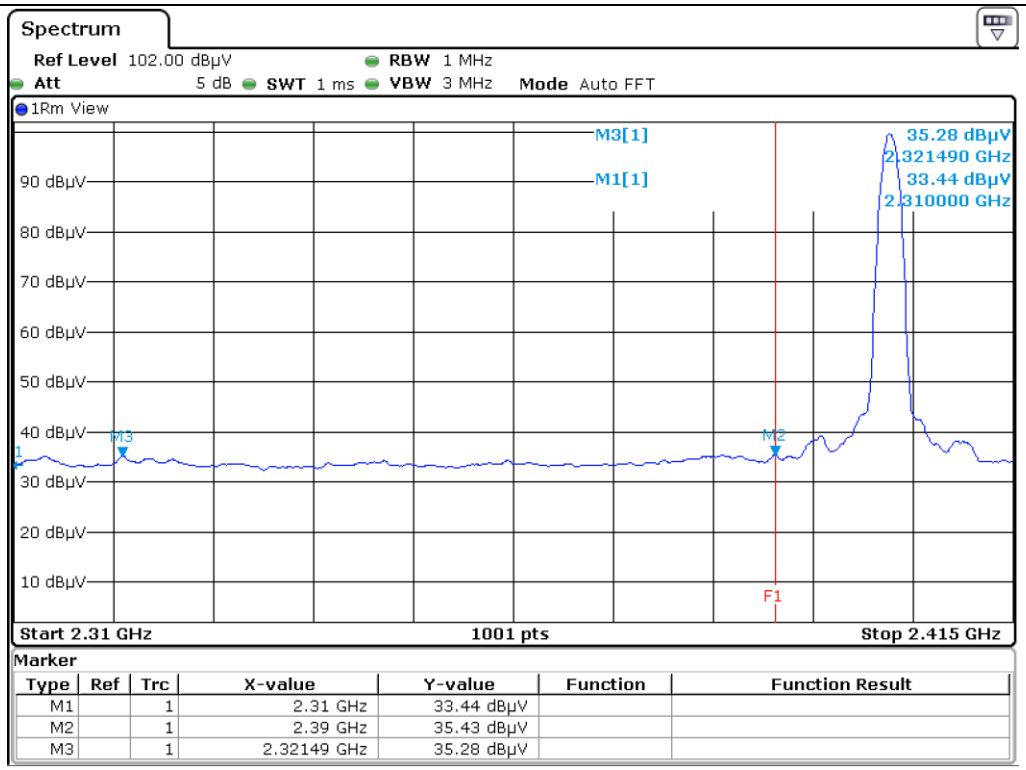


Low Channel_Horizontal_Average

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

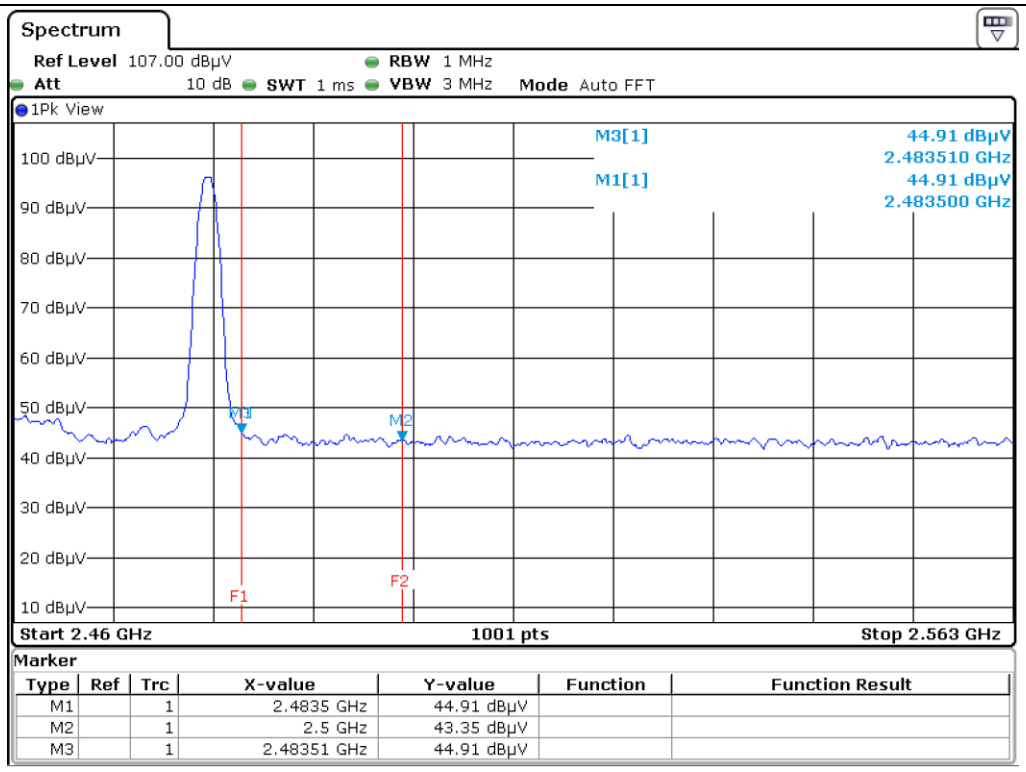


Low Channel_Vertical_Peak

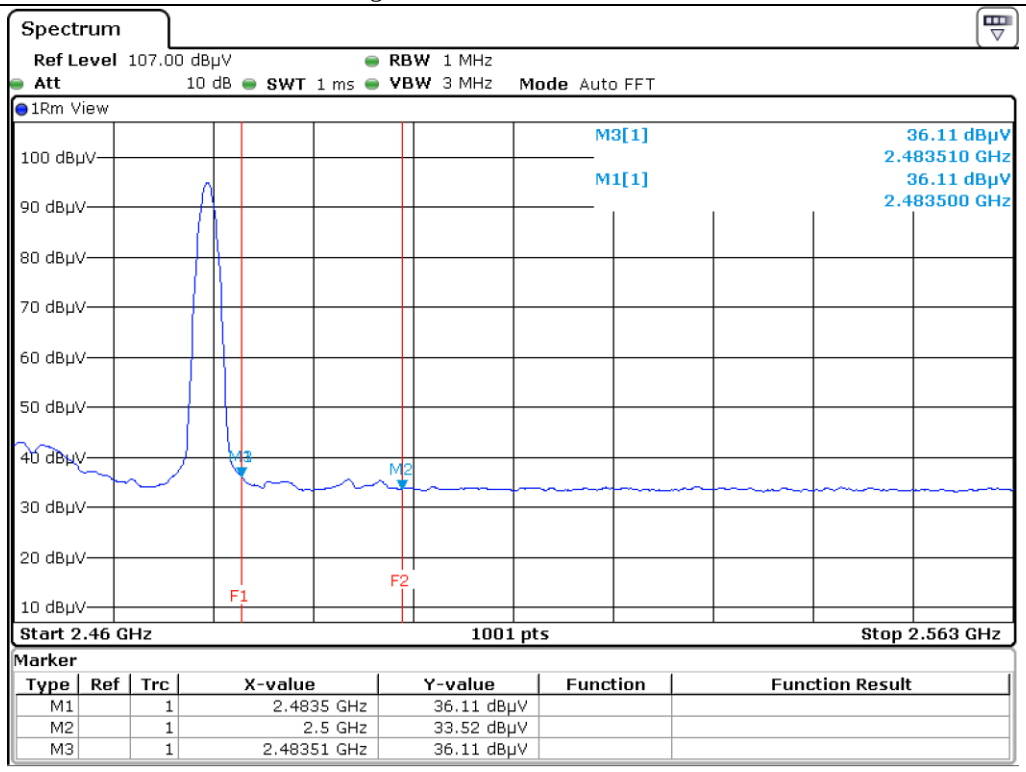


Low Channel_Vertical_Average

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

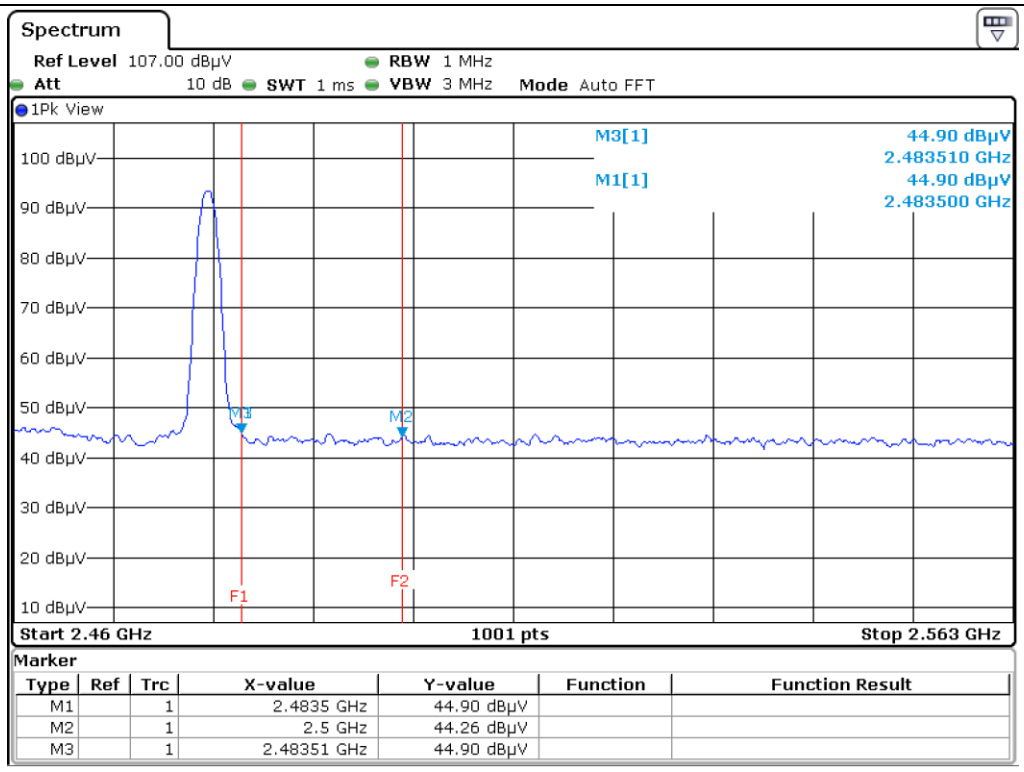


High Channel_Horizontal_Peak

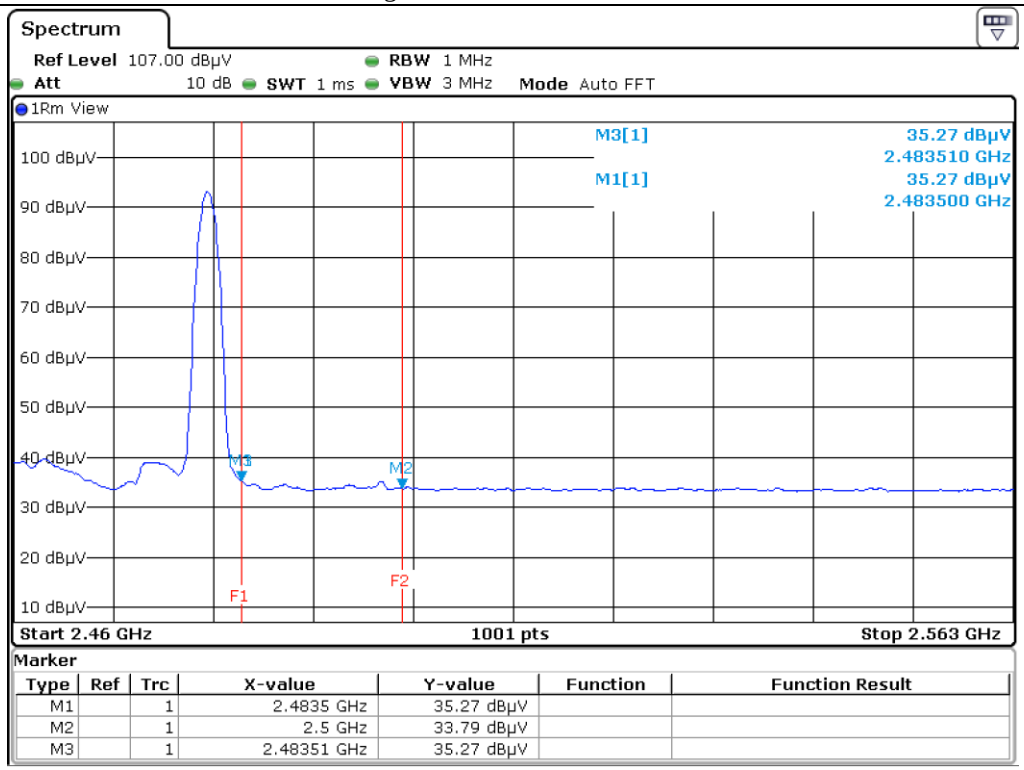


High Channel_Horizontal_Average

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



High Channel_Vertical_Peak



High Channel_Vertical_Average

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

5.4.2 Radiated Emission which fall in the Restricted Band(Pi/4-DPSK_2 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. 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

-. Result : PASSED

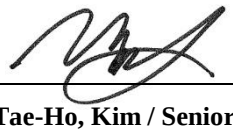
Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 363.130	45.23	Peak	H	26.91	9.17	34.30	47.01	74.00	26.99
2 312.150	35.22	Average	H	26.91	9.17	34.30	37.00	54.00	17.00
2 335.020	46.53	Peak	V	26.91	9.17	34.30	48.31	74.00	25.69
2 325.050	36.71	Average	V	26.91	9.17	34.30	38.49	54.00	15.51
Test Data for High Channel									
2 483.500	48.57	Peak	H	27.47	9.49	34.46	51.07	74.00	22.93
2 483.500	37.86	Average	H	27.47	9.49	34.46	40.36	54.00	13.64
2 483.500	47.21	Peak	V	27.47	9.49	34.46	49.71	74.00	24.29
2 483.500	36.03	Average	V	27.47	9.49	34.46	38.53	54.00	15.47

Tabulated test data for Restricted Band

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

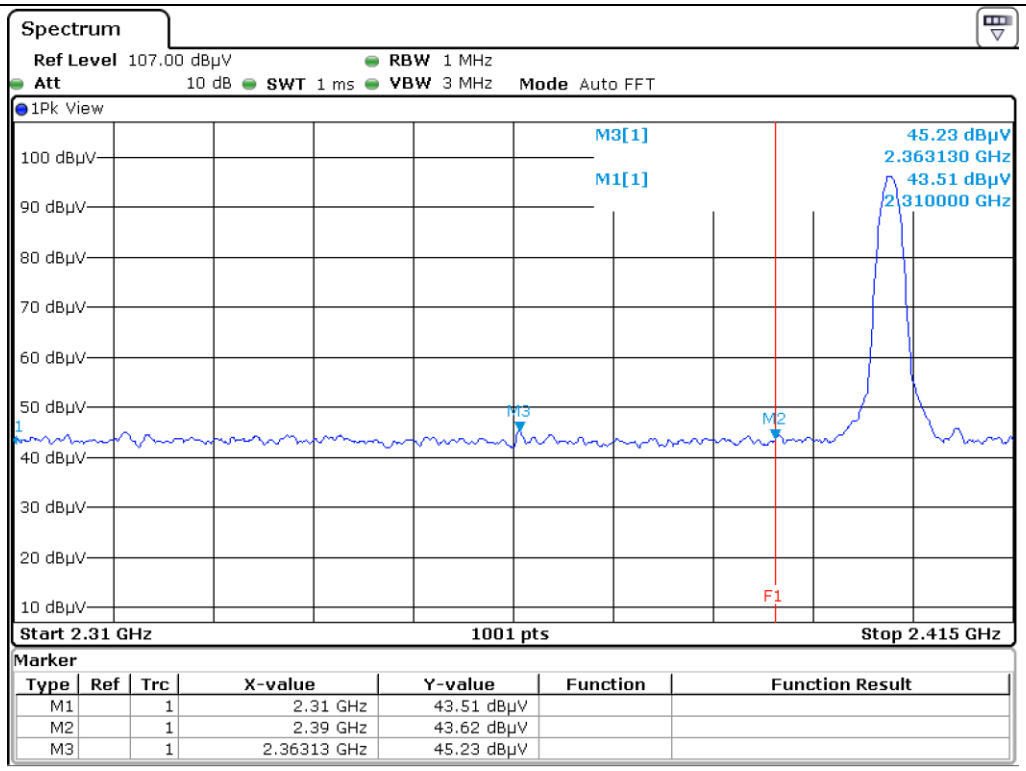
Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

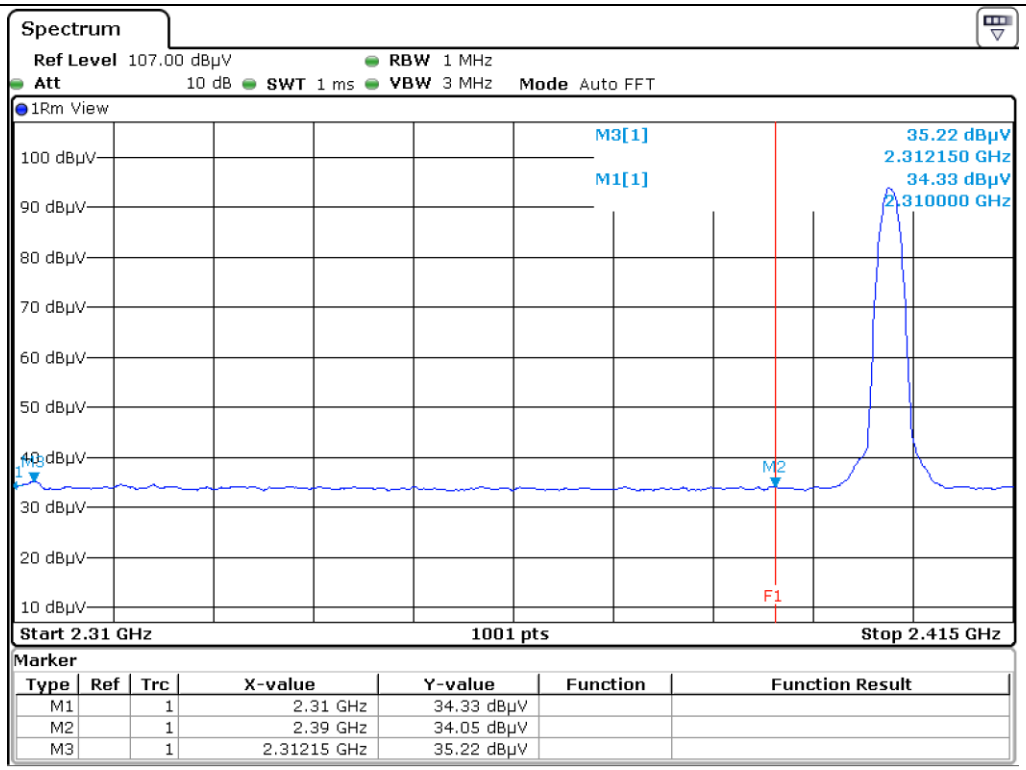


Tested by: Tae-Ho, Kim / Senior Manager

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

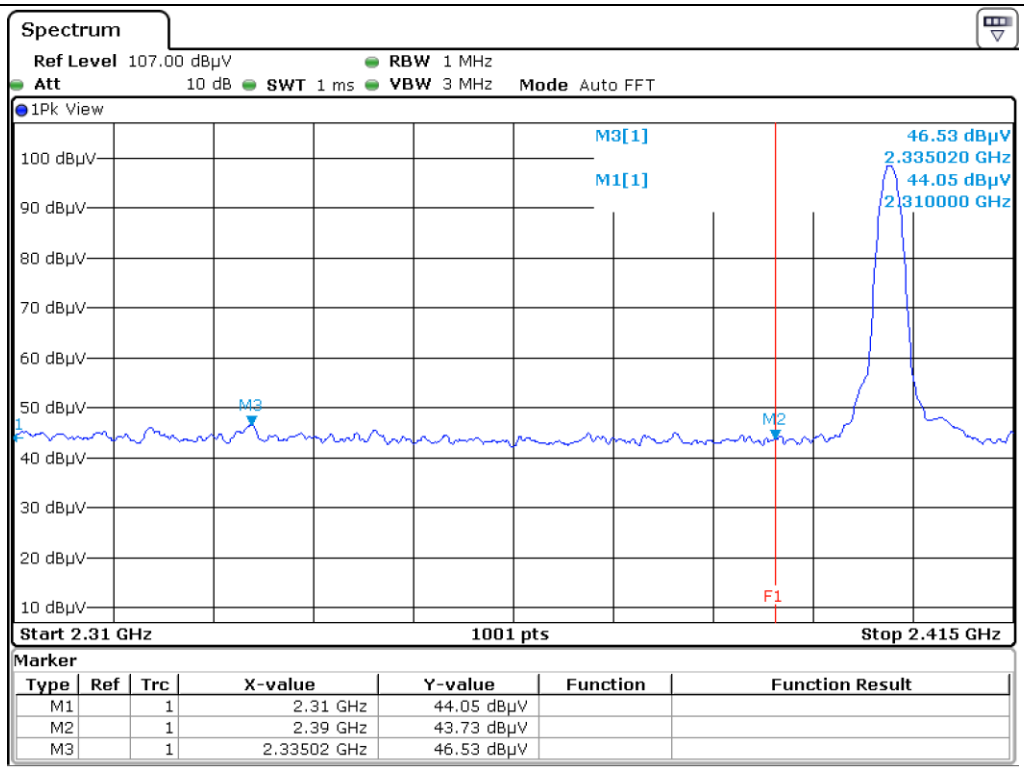


Low Channel_Horizontal_Peak

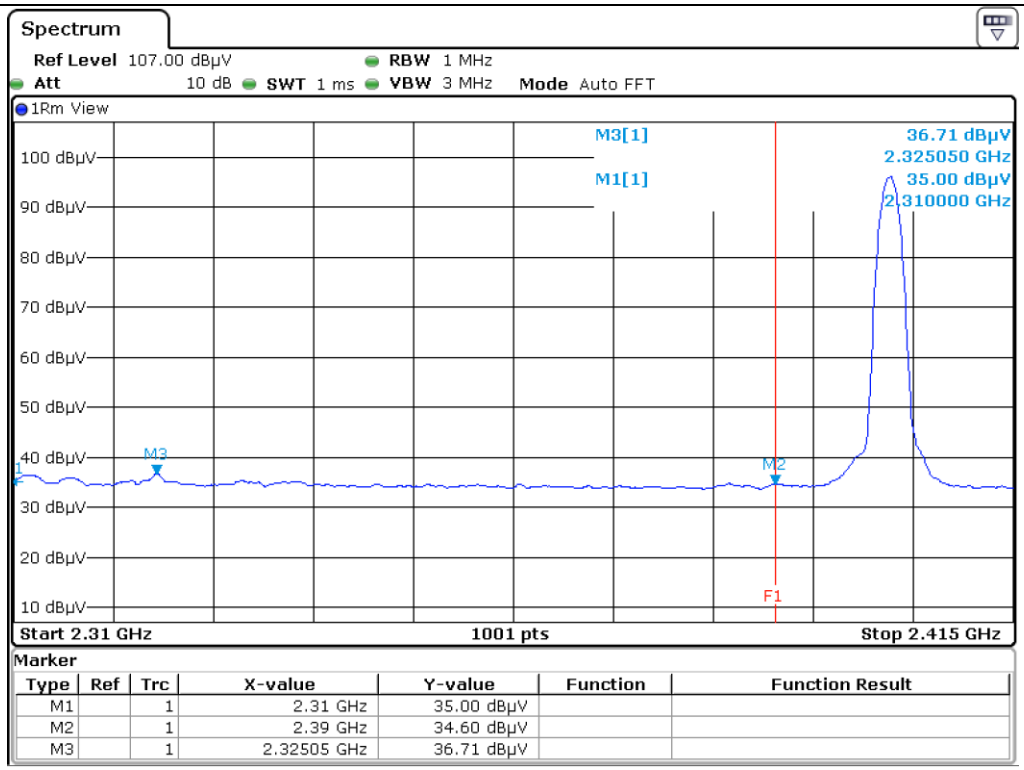


Low Channel_Horizontal_Average

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

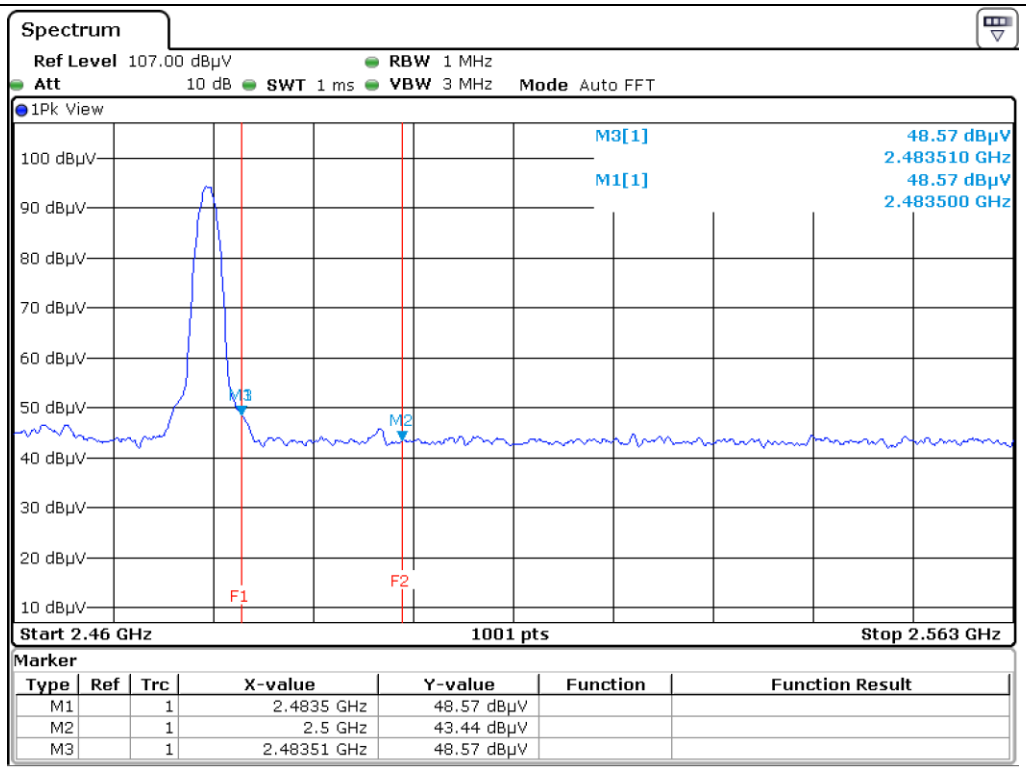


Low Channel_Vertical_Peak

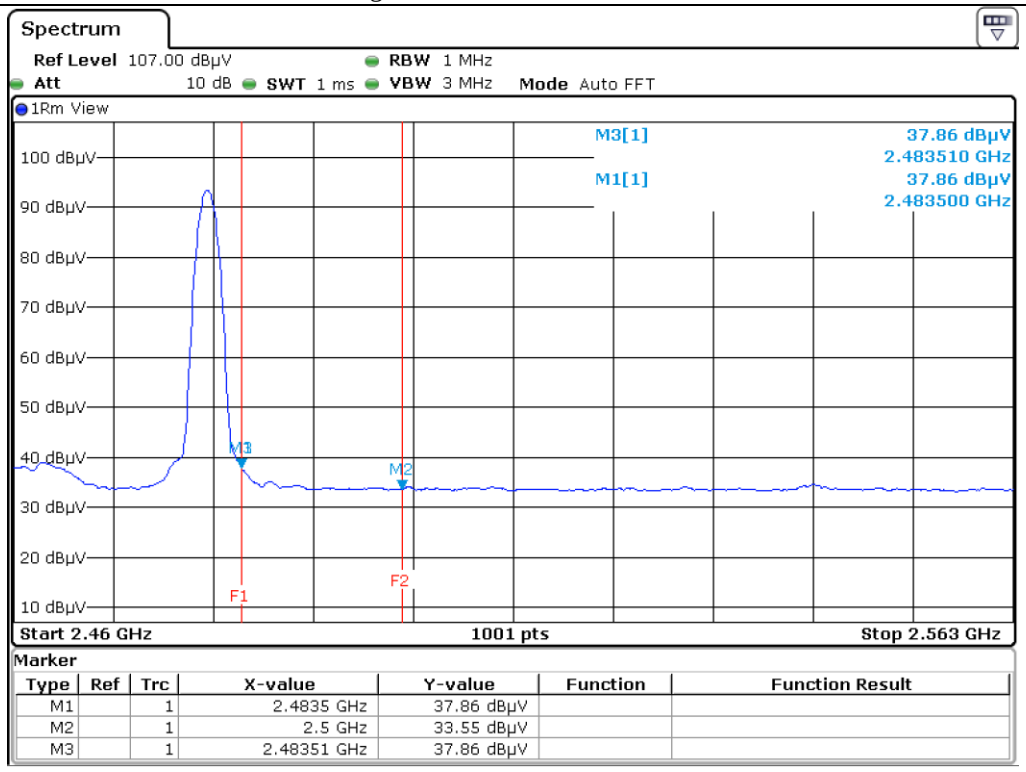


Low Channel_Vertical_Average

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

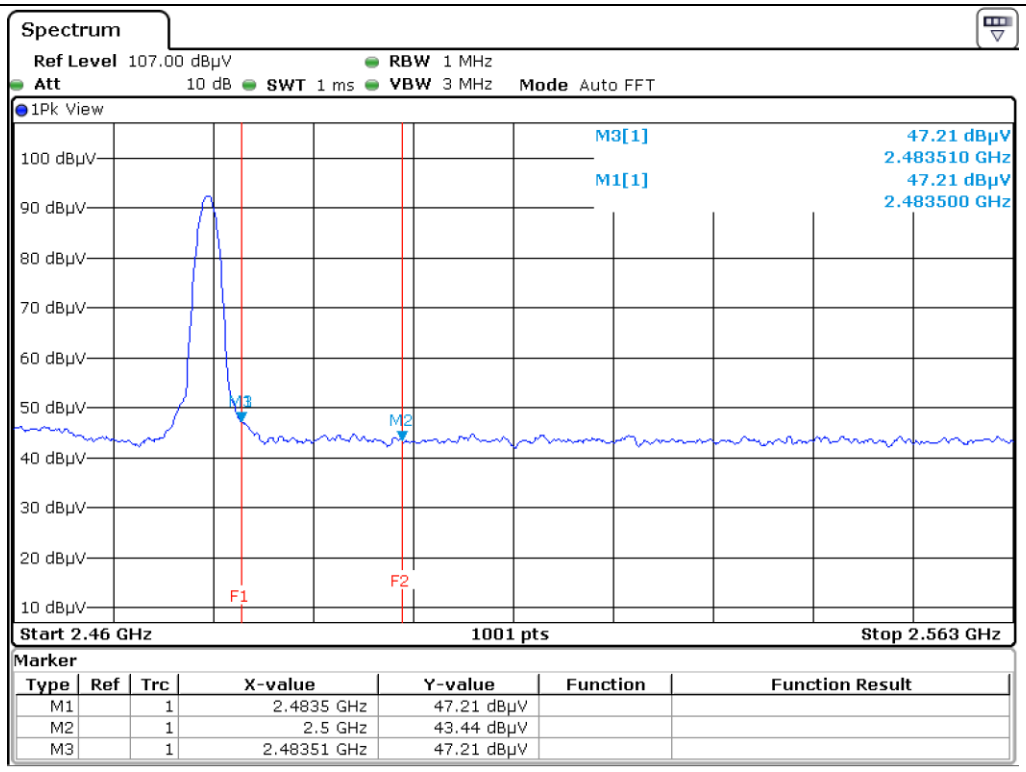


High Channel_Horizontal_Peak

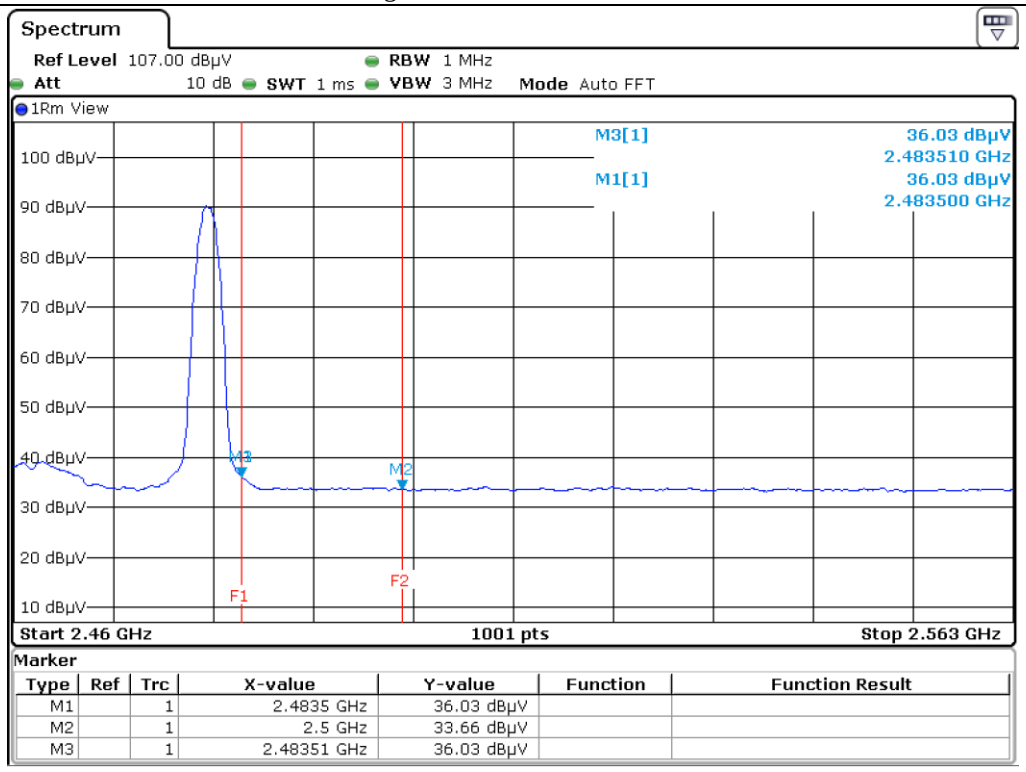


High Channel_Horizontal_Average

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



High Channel_Vertical_Peak



High Channel_Vertical_Average

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

5.4.3 Radiated Emission which fall in the Restricted Band(8PSK_3 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. 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

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 329.560	45.26	Peak	H	26.91	9.17	34.30	47.04	74.00	26.96
2 348.130	34.39	Average	H	26.91	9.17	34.30	36.17	54.00	17.83
2 361.770	47.96	Peak	V	26.91	9.17	34.30	49.74	74.00	24.26
2 324.210	35.45	Average	V	26.91	9.17	34.30	37.23	54.00	16.77
Test Data for High Channel									
2 483.500	50.19	Peak	H	27.47	9.49	34.46	52.69	74.00	21.31
2 483.500	39.00	Average	H	27.47	9.49	34.46	41.50	54.00	12.50
2 483.500	47.16	Peak	V	27.47	9.49	34.46	49.66	74.00	24.34
2 483.500	37.12	Average	V	27.47	9.49	34.46	39.62	54.00	14.38

Tabulated test data for Restricted Band

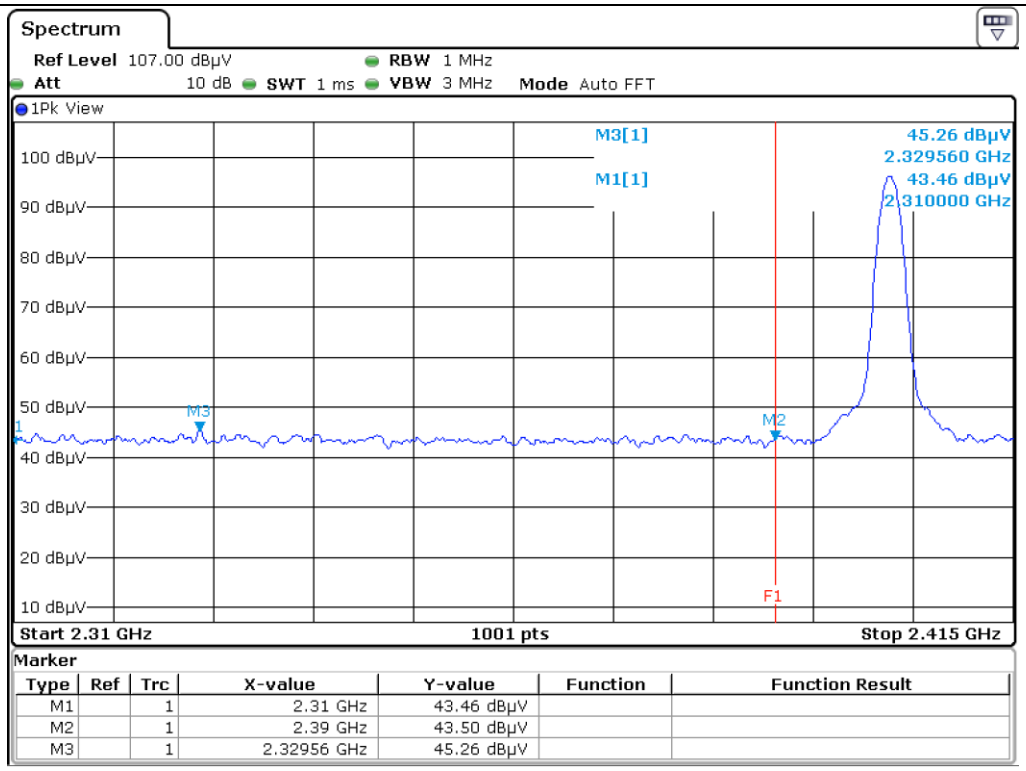
Remark: “H”: Horizontal, “V”: Vertical

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

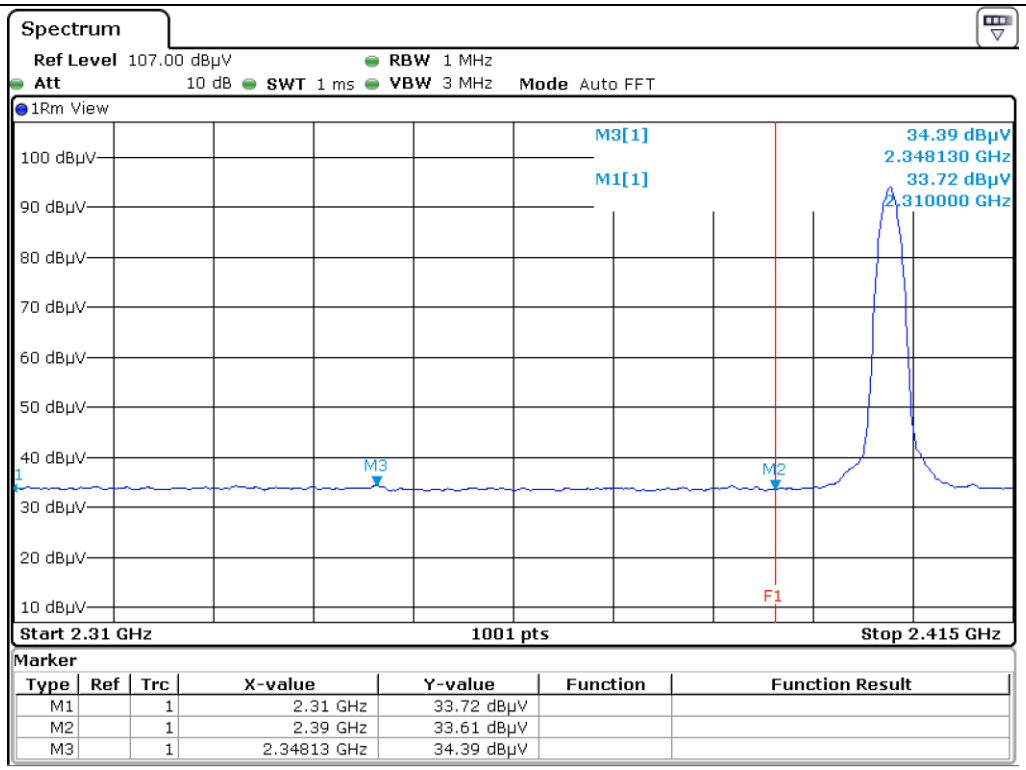
Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Senior Manager

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

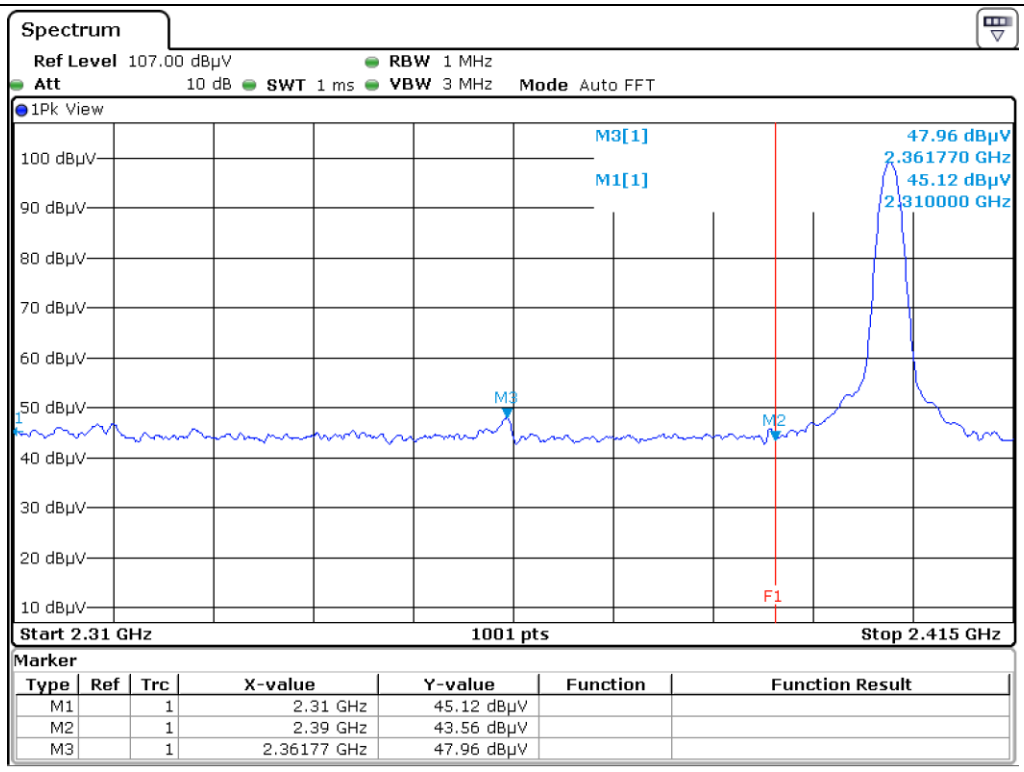


Low Channel_Horizontal_Peak

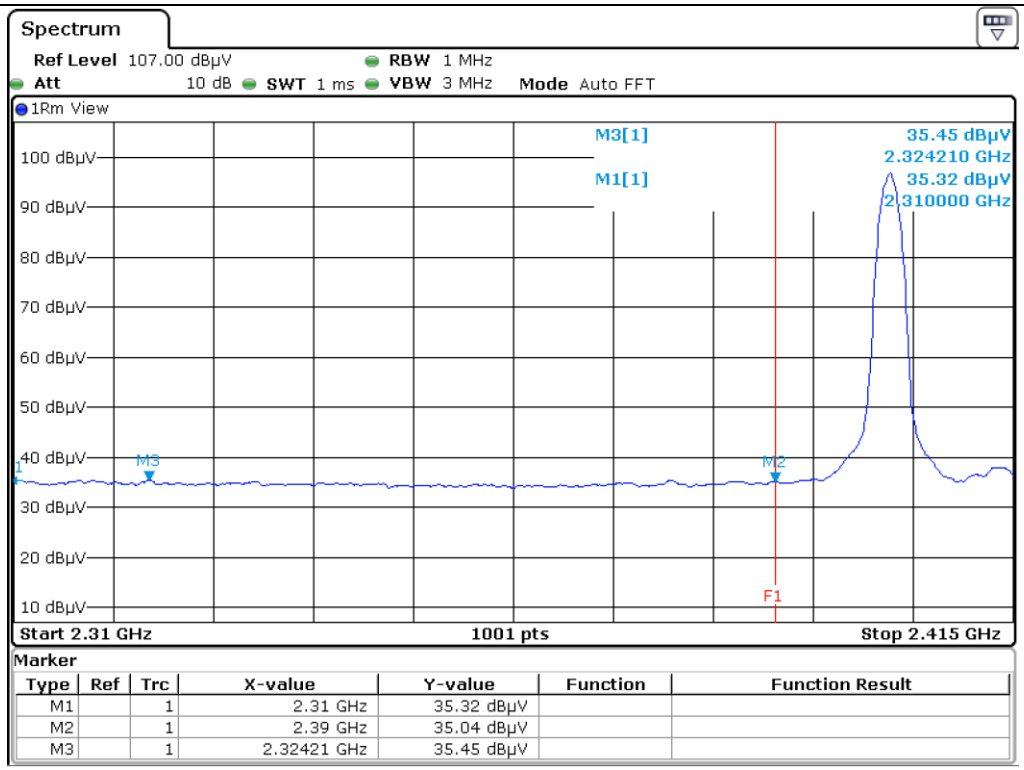


Low Channel_Horizontal_Average

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

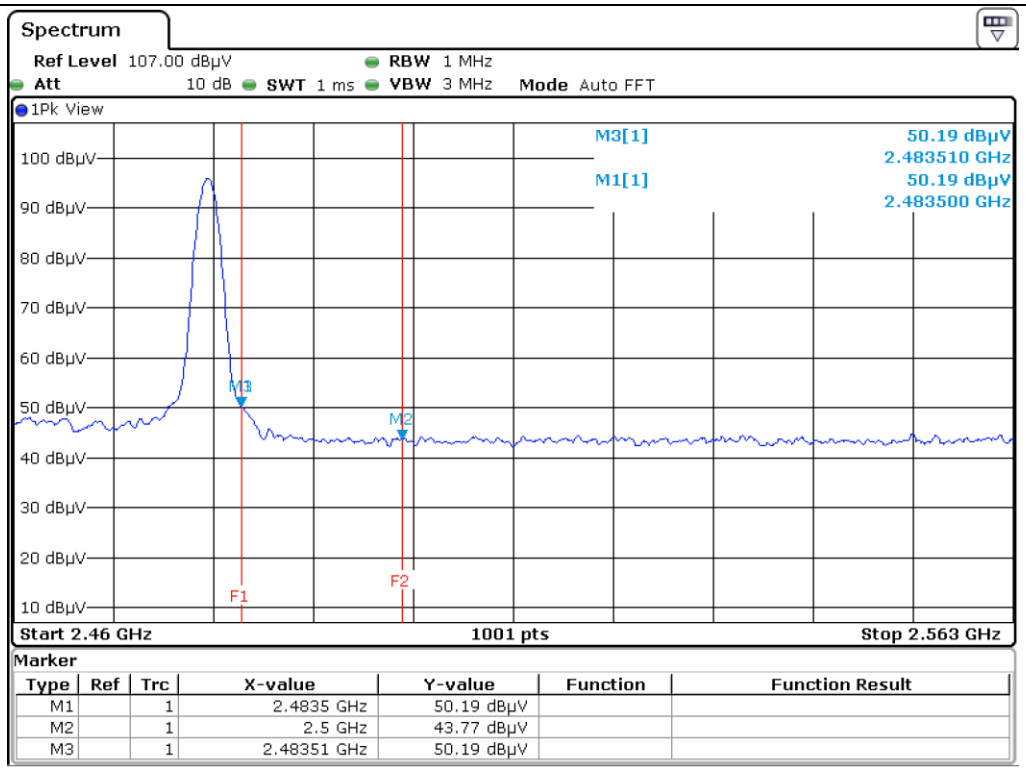


Low Channel_Vertical_Peak

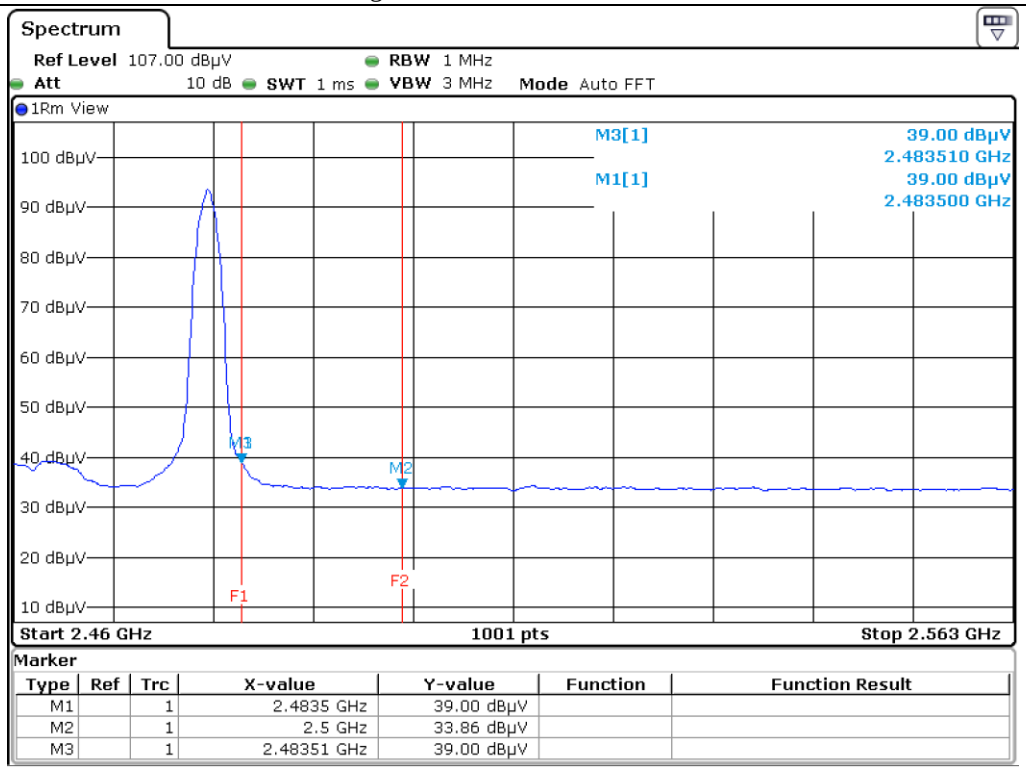


Low Channel_Vertical_Average

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

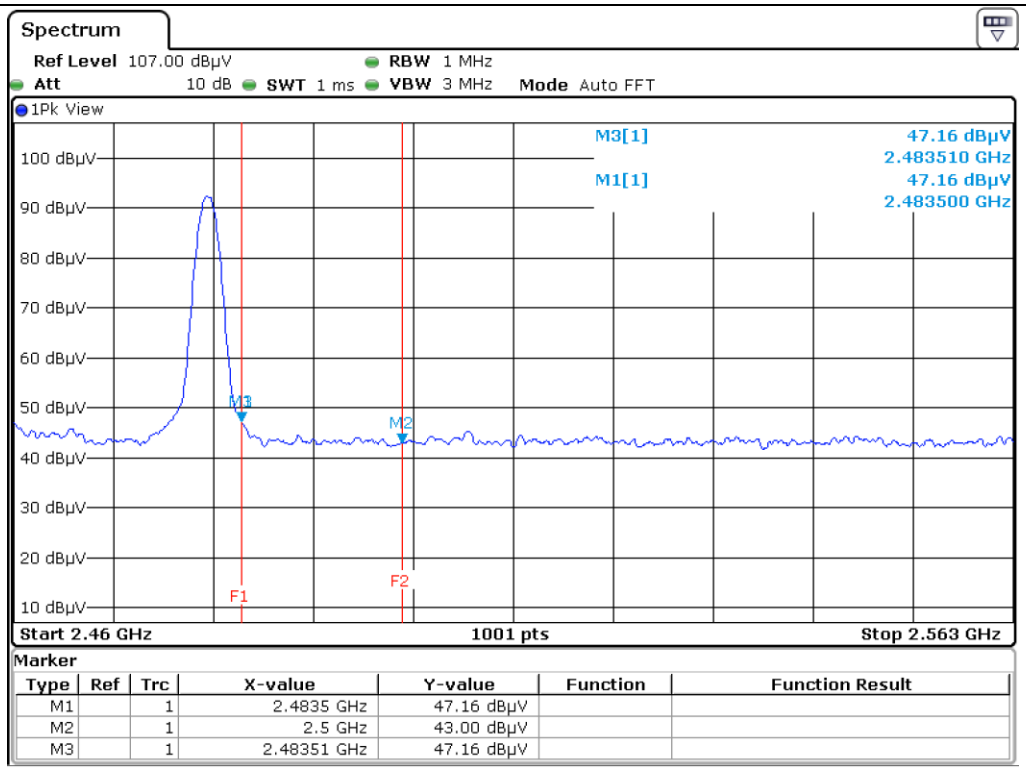


High Channel_Horizontal_Peak

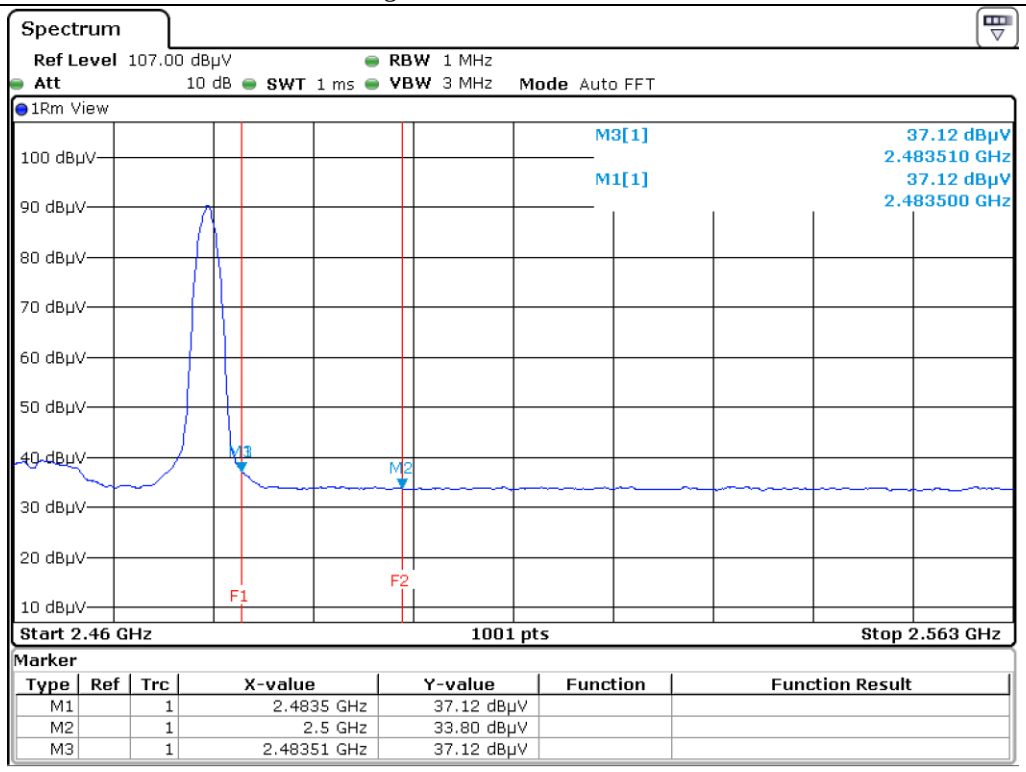


High Channel_Horizontal_Average

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



High Channel_Vertical_Peak



High Channel_Vertical_Average

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

5.4.4 Spurious & Harmonic Radiated Emission(GFSK_1 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. 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 : 30 kHz for Peak and Average Mode

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
9 608.000	37.99	Peak	H	30.84	12.43	33.58	47.68	74.00	26.32
9 608.000	36.78	Peak	V	30.84	12.43	33.58	46.47	74.00	27.53
Test Data for Middle Channel									
9 764.000	36.79	Peak	H	30.84	12.43	33.70	46.36	74.00	27.64
9 764.000	37.44	Peak	V	30.84	12.43	33.70	47.01	74.00	26.99
Test Data for High Channel									
9 920.000	37.31	Peak	H	30.85	12.44	33.86	46.74	74.00	27.26
9 920.000	37.41	Peak	V	30.85	12.44	33.86	46.84	74.00	27.16

Tabulated test data for Restricted Band

Remark 1: “H”: Horizontal, “V”: Vertical

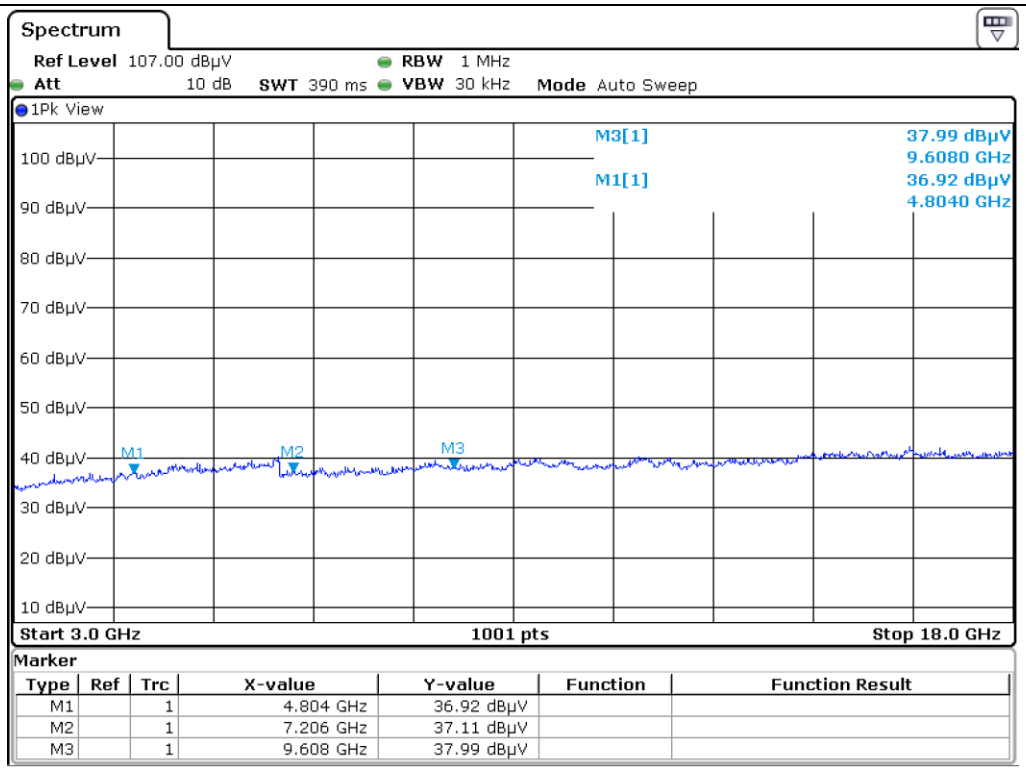
Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

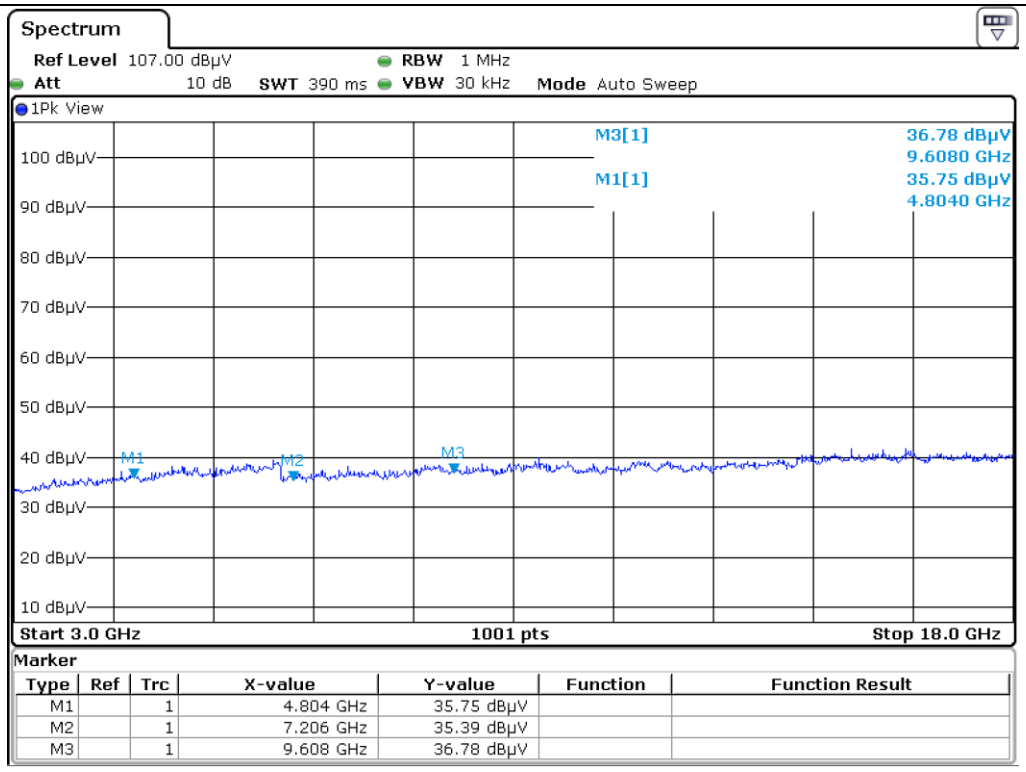
Remark 2: maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.(ANSI C63.10-2013)

Tested by: Tae-Ho, Kim / Senior Manager

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

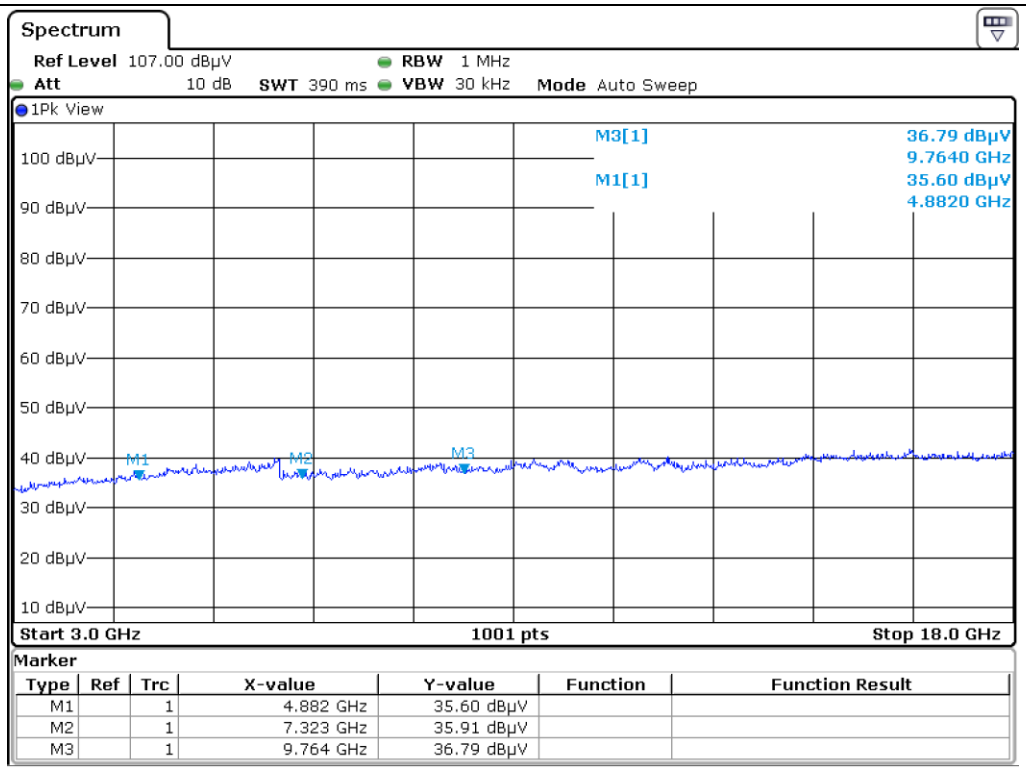


Low Channel_Horizontal_Peak

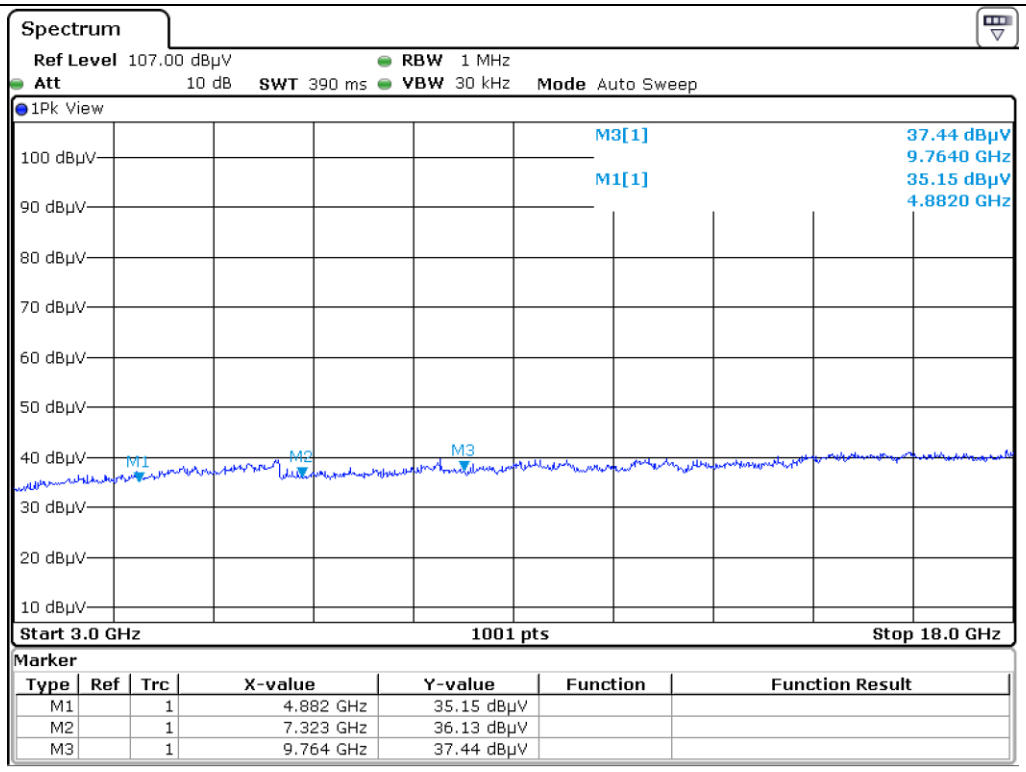


Low Channel_Vertical_Peak

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

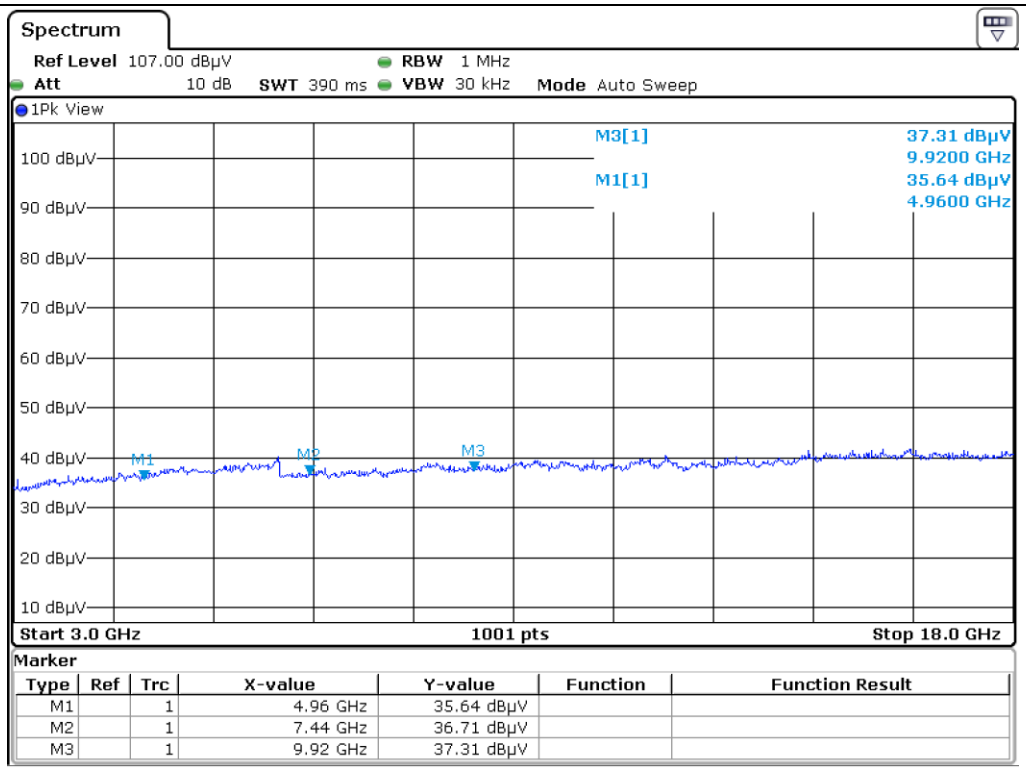


Middle Channel_Horizontal_Peak

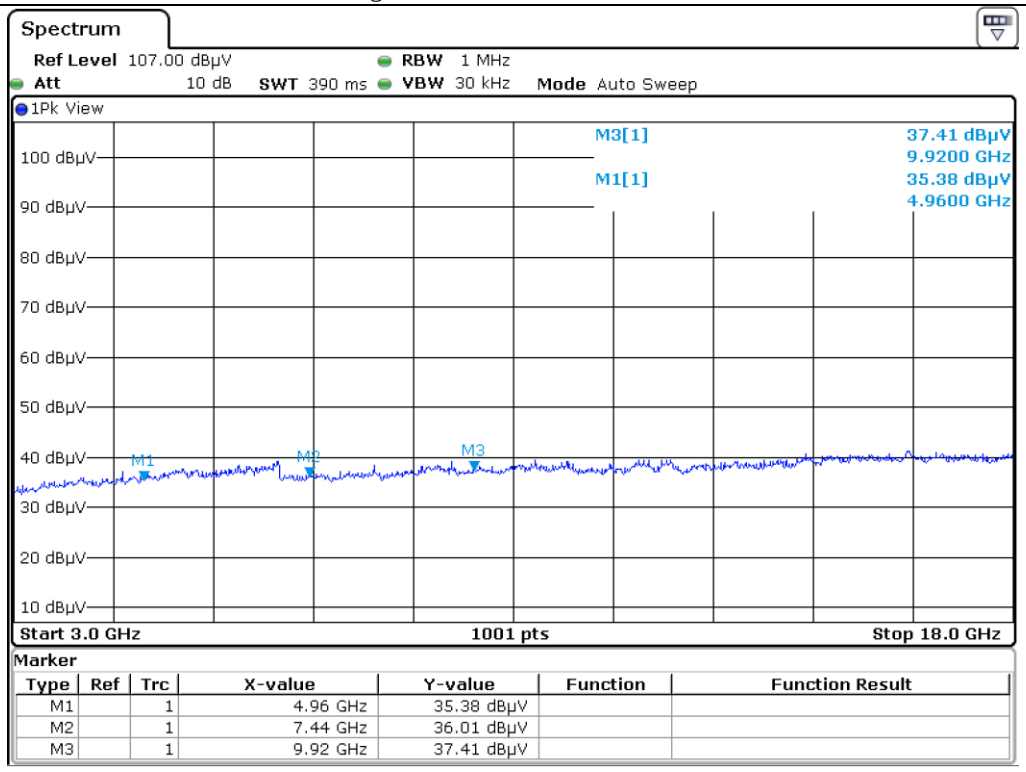


Middle Channel_Vertical_Peak

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



High Channel_Horizontal_Peak



High Channel_Vertical_Peak

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

5.4.5 Spurious & Harmonic Radiated Emission(Pi/4-DPSK_2 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. 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 : 30 kHz for Peak and Average Mode

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 804.000	32.20	Peak	H	30.01	12.31	35.23	39.29	74.00	34.71
4 804.000	32.04	Peak	V	30.01	12.31	35.23	39.13	74.00	34.87
Test Data for Middle Channel									
4 882.000	32.02	Peak	H	30.01	12.31	35.26	39.08	74.00	34.92
9 764.000	32.13	Peak	V	30.84	12.43	33.70	41.70	74.00	32.30
Test Data for High Channel									
4 960.000	31.73	Peak	H	30.01	12.31	35.29	38.76	74.00	35.24
4 960.000	31.85	Peak	V	30.01	12.31	35.29	38.88	74.00	35.12

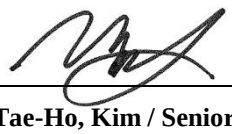
Tabulated test data for Restricted Band

Remark 1: “H”: Horizontal, “V”: Vertical

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

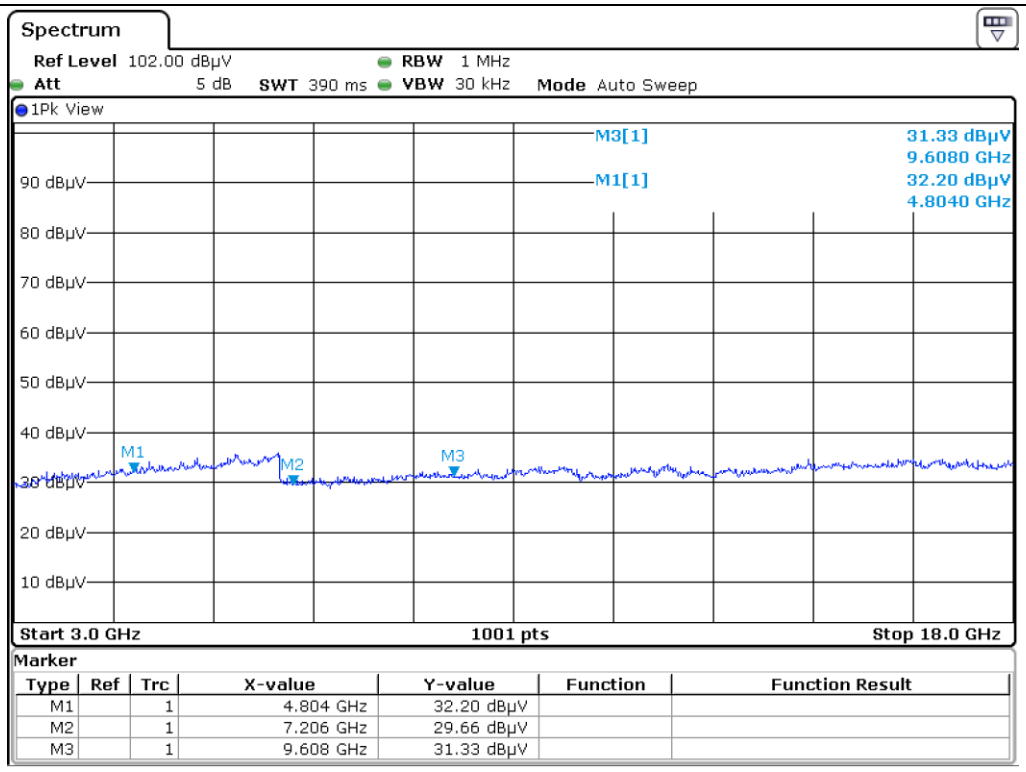
Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Remark 2: maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.(ANSI C63.10-2013)

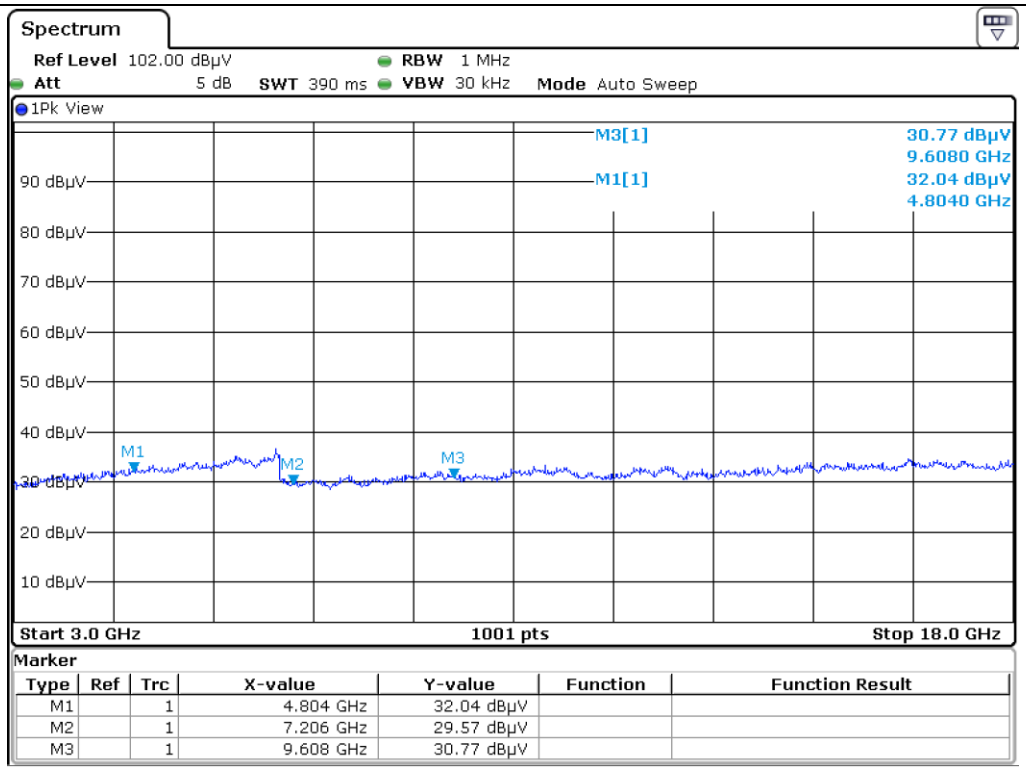


Tested by: Tae-Ho, Kim / Senior Manager

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

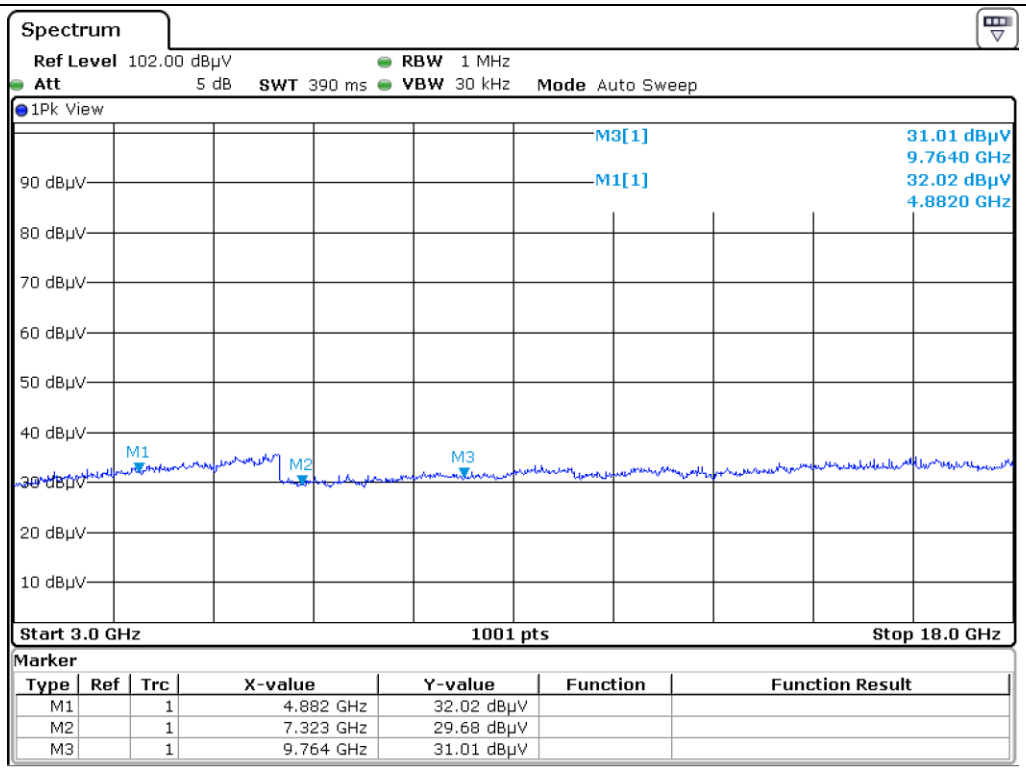


Low Channel_Horizontal_Peak

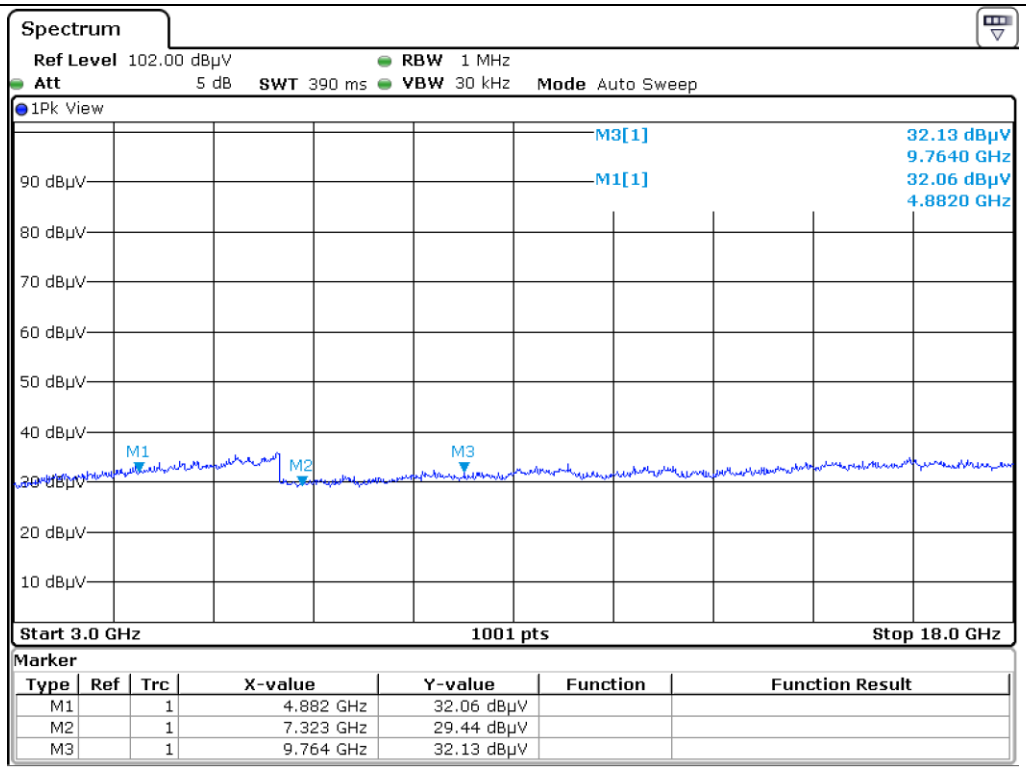


Low Channel_Vertical_Peak

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

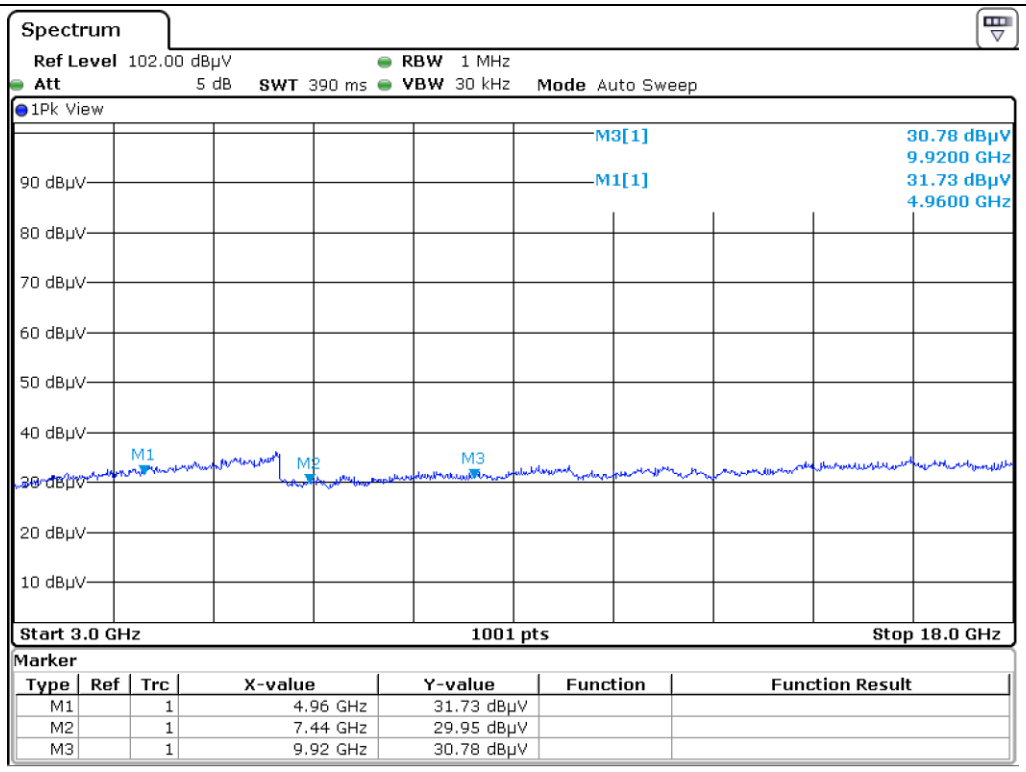


Middle Channel_Horizontal_Peak

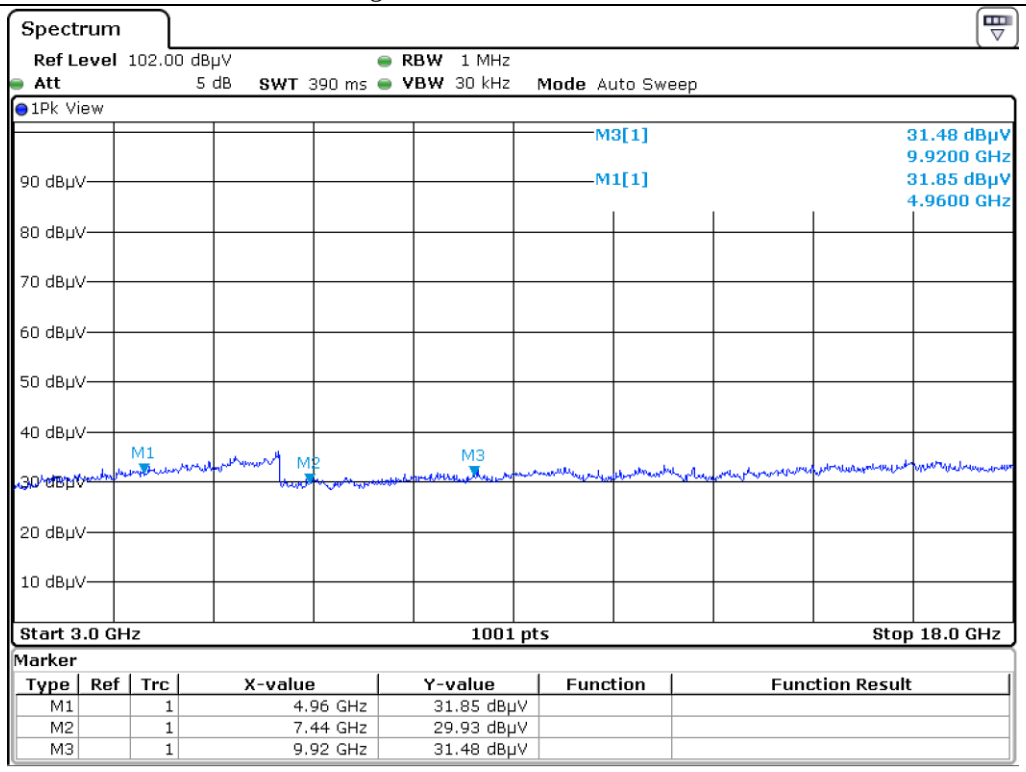


Middle Channel_Vertical_Peak

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



High Channel_Horizontal_Peak



High Channel_Vertical_Peak

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

5.4.6 Spurious & Harmonic Radiated Emission(8PSK_3 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. 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 : 30 kHz for Peak and Average Mode

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 804.000	31.96	Peak	H	30.01	12.31	35.23	39.05	74.00	34.95
4 804.000	32.42	Peak	V	30.01	12.31	35.23	39.51	74.00	34.49
Test Data for Middle Channel									
4 882.000	32.70	Peak	H	30.01	12.31	35.26	39.76	74.00	34.24
4 882.000	32.04	Peak	V	30.01	12.31	35.26	39.10	74.00	34.90
Test Data for High Channel									
4 960.000	32.48	Peak	H	30.01	12.31	35.29	39.51	74.00	34.49
4 960.000	32.16	Peak	V	30.01	12.31	35.29	39.19	74.00	34.81

Tabulated test data for Restricted Band

Remark 1: “H”: Horizontal, “V”: Vertical

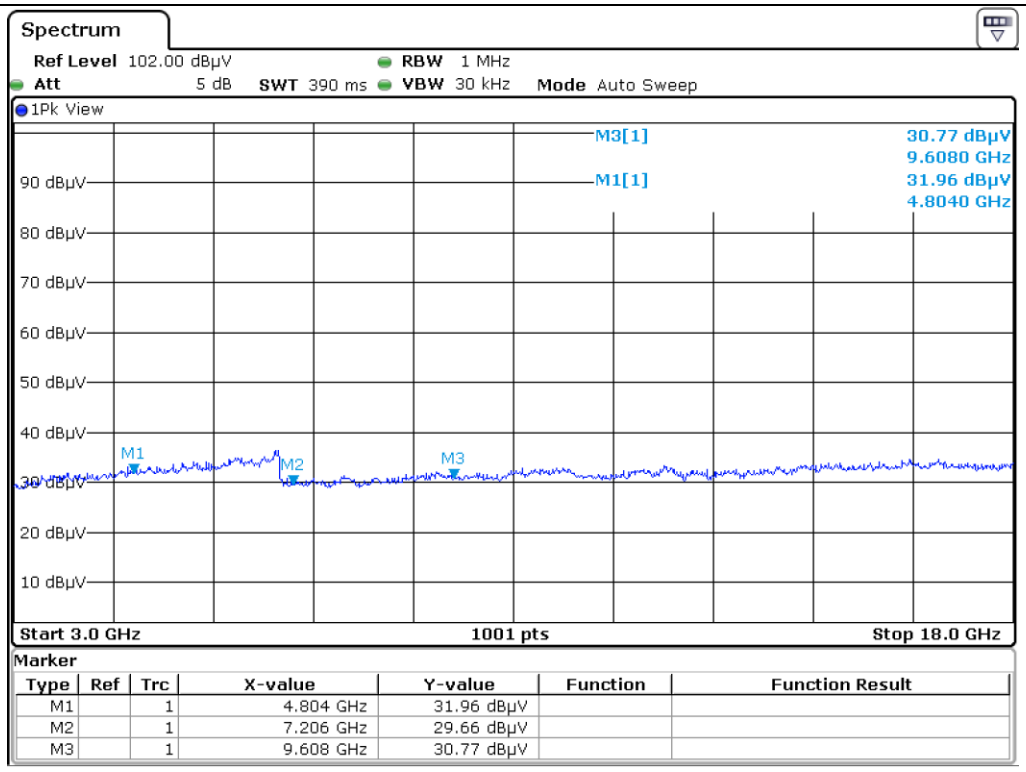
Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

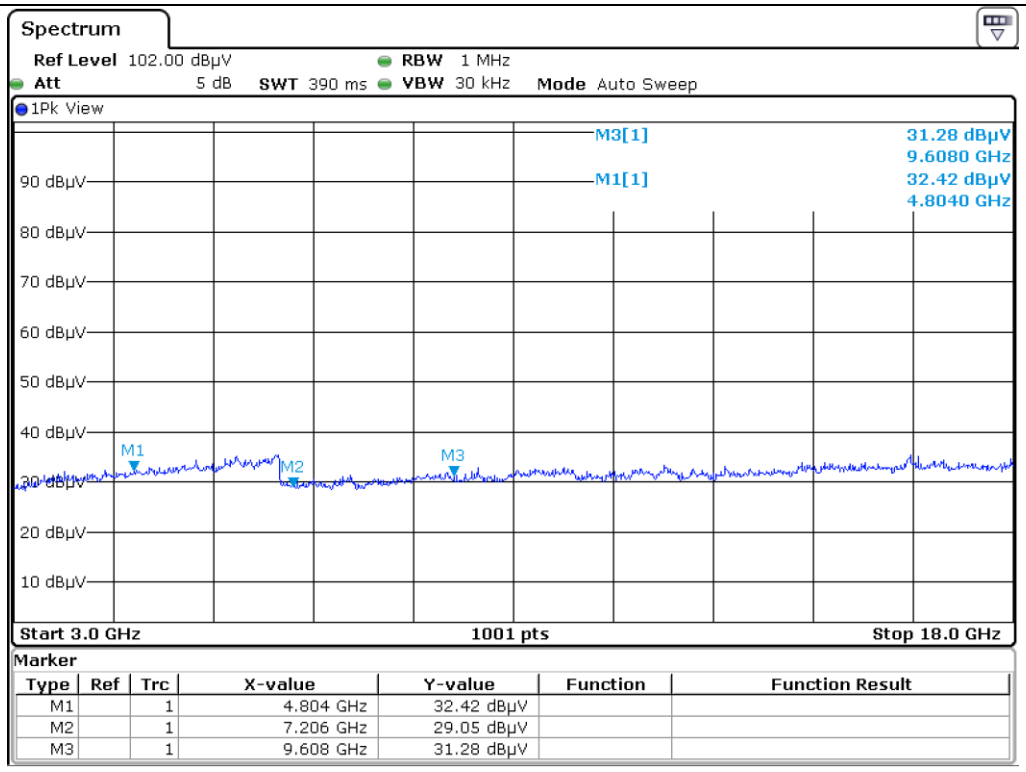
Remark 2: maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.(ANSI C63.10-2013)

Tested by: Tae-Ho, Kim / Senior Manager

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

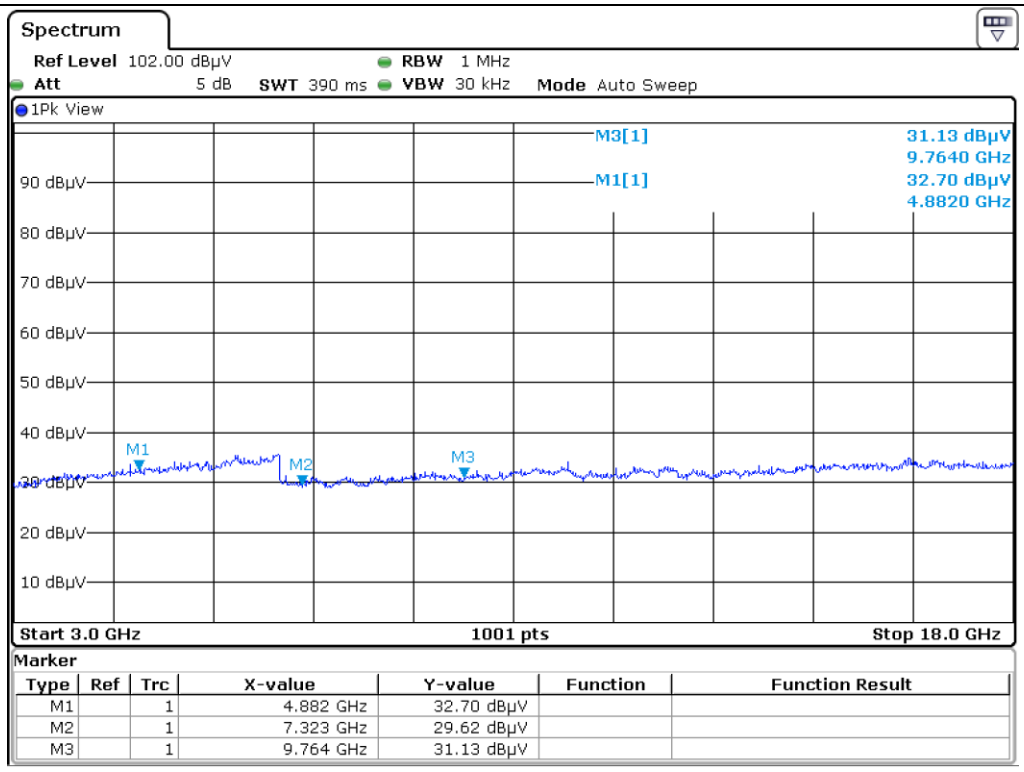


Low Channel_Horizontal_Peak

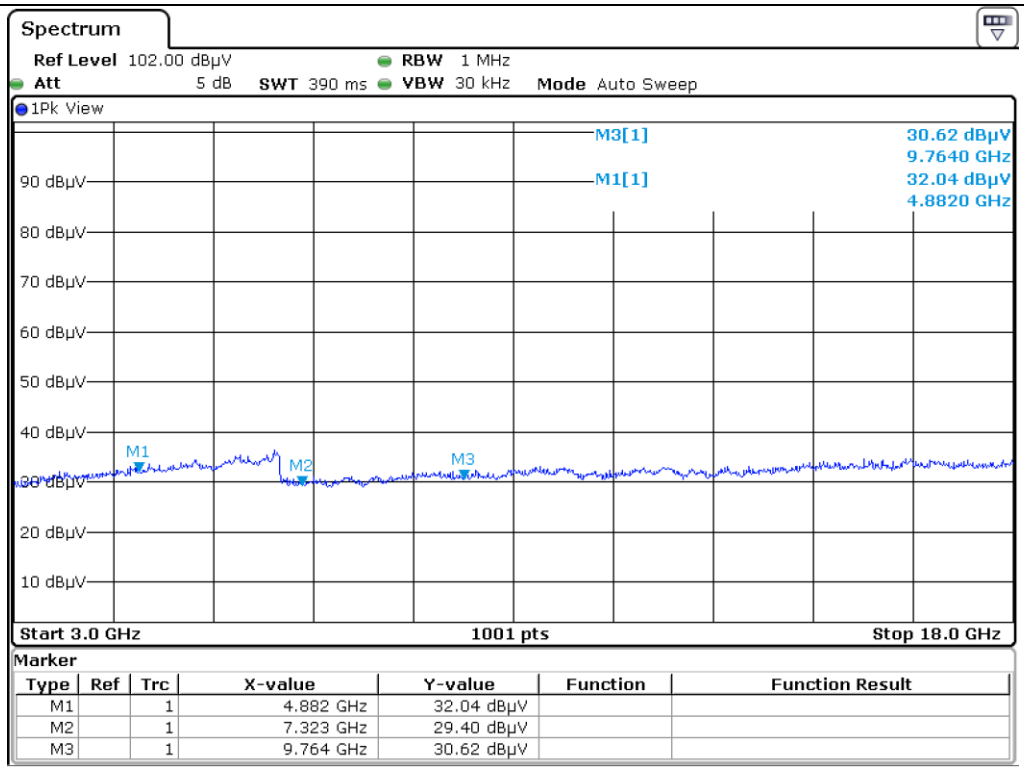


Low Channel_Vertical_Peak

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

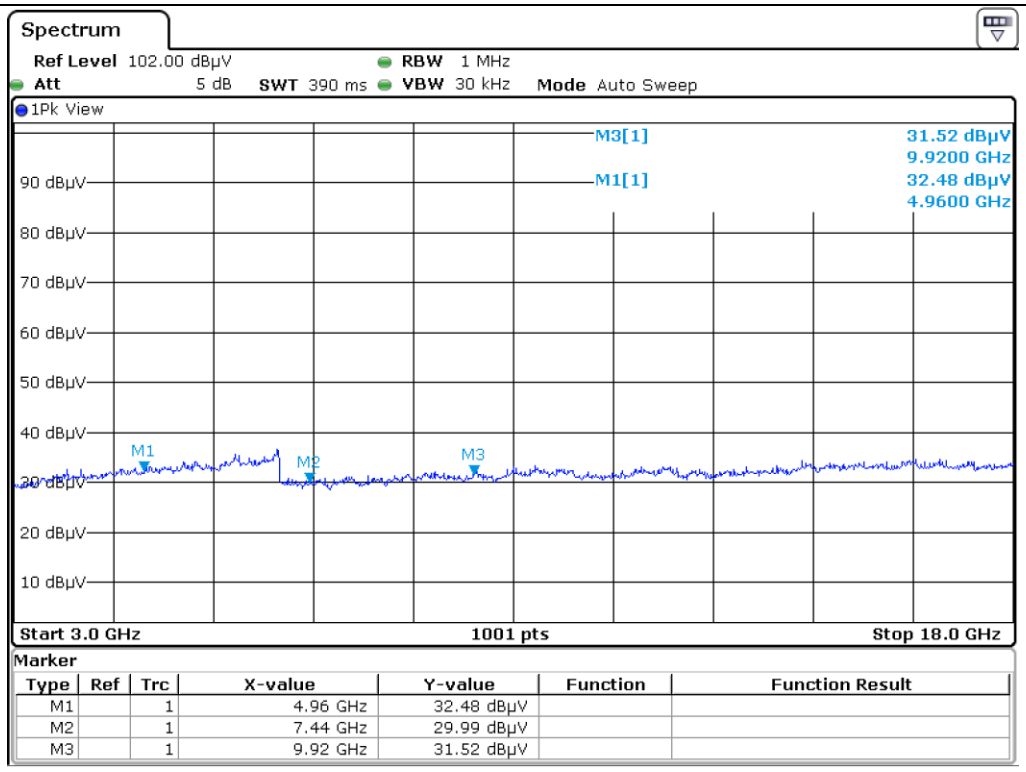


Middle Channel_Horizontal_Peak

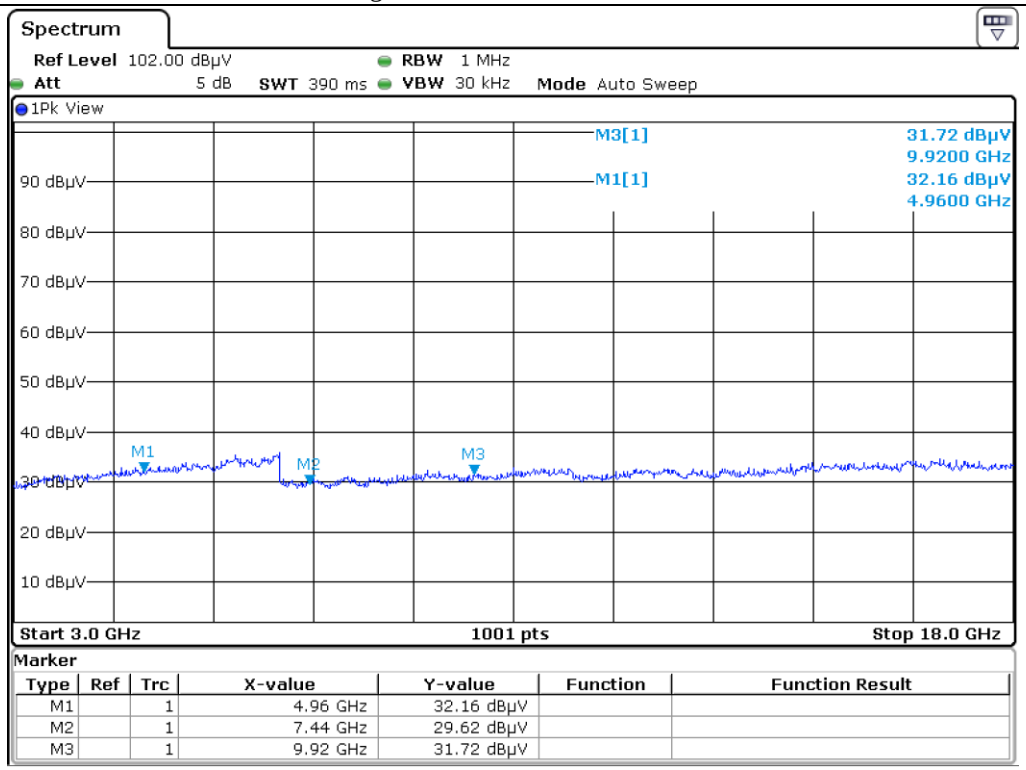


Middle Channel_Vertical_Peak

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



High Channel_Horizontal_Peak



High Channel_Vertical_Peak

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

5.4.7 Test Data FCC for below 1 000 MHz

Humidity Level : 43.9 % R.H. Temperature: 24.3 ℃

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

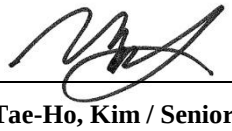
Result : PASSED

EUT EUT : ARTIK-0530 Date: September 12, 2018 ~ September 21, 2018

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

The frequency spectrum from 9 kHz to 1 000 MHz was investigated.

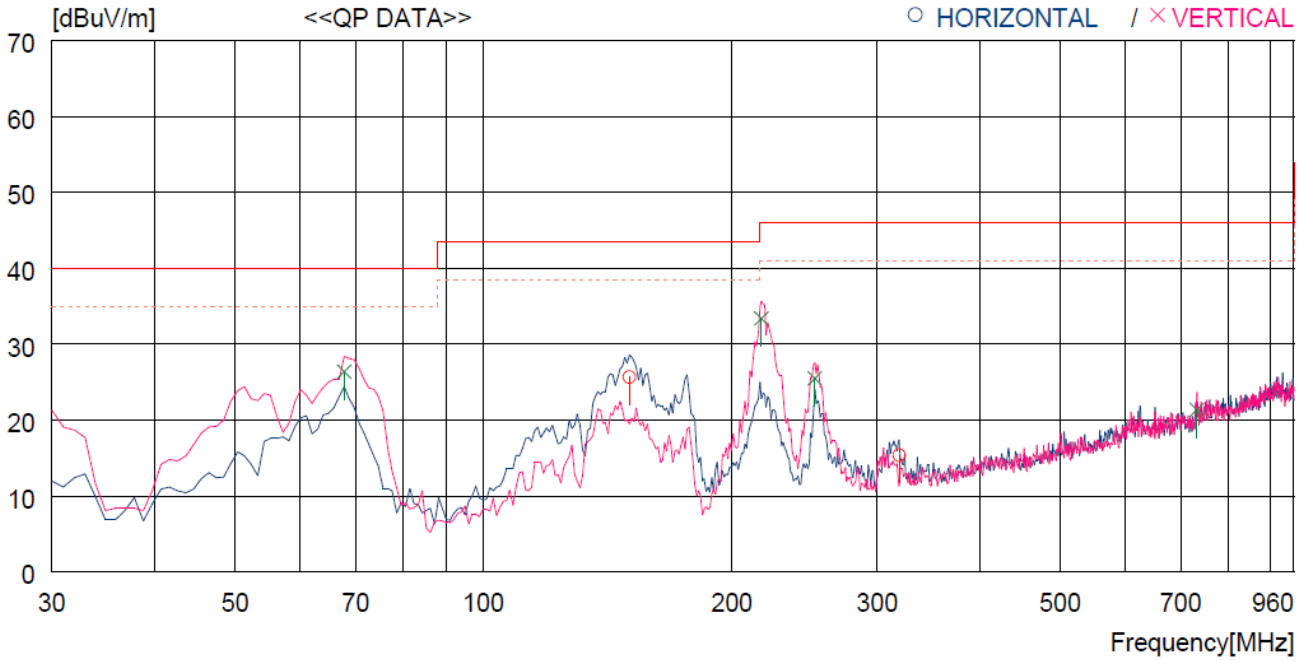
Frequency [MHz]	Reading [dBuV]	Ant Pol.	Ant Factor [dB]	Cable Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
67.830	47.0	V	10.5	2.0	33.1	26.4	40.0	13.6
150.280	48.0	H	7.7	2.9	32.9	25.7	43.5	17.8
217.210	52.1	V	11.1	3.4	33.2	33.4	46.0	12.6
252.130	42.5	V	12.4	3.7	33.1	25.5	46.0	20.5
319.060	30.7	H	13.6	4.1	33.0	15.4	46.0	30.6
732.274	28.6	V	20.0	6.2	33.4	21.4	46.0	24.6



Tested by: Tae-Ho, Kim / Senior Manager

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

- Result Plot



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	150.280	48.0	7.7	2.9	32.9	25.7	43.5	17.8	400	93
2	319.060	30.7	13.6	4.1	33.0	15.4	46.0	30.6	400	146
----- Vertical ------										
3	67.830	47.0	10.5	2.0	33.1	26.4	40.0	13.6	400	173
4	217.210	52.1	11.1	3.4	33.2	33.4	46.0	12.6	400	182
5	252.130	42.5	12.4	3.7	33.1	25.5	46.0	20.5	400	15
6	732.274	28.6	20.0	6.2	33.4	21.4	46.0	24.6	400	120

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

5.4.8 Test Data IC for below 1 000 MHz

Humidity Level : 43.9 % R.H. Temperature: 24.3 ℃

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

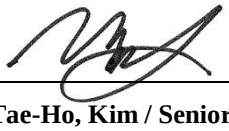
Result : PASSED

EUT EUT : ARTIK-0530 Date: September 12, 2018 ~ September 21, 2018

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

The frequency spectrum from 9 kHz to 1 000 MHz was investigated.

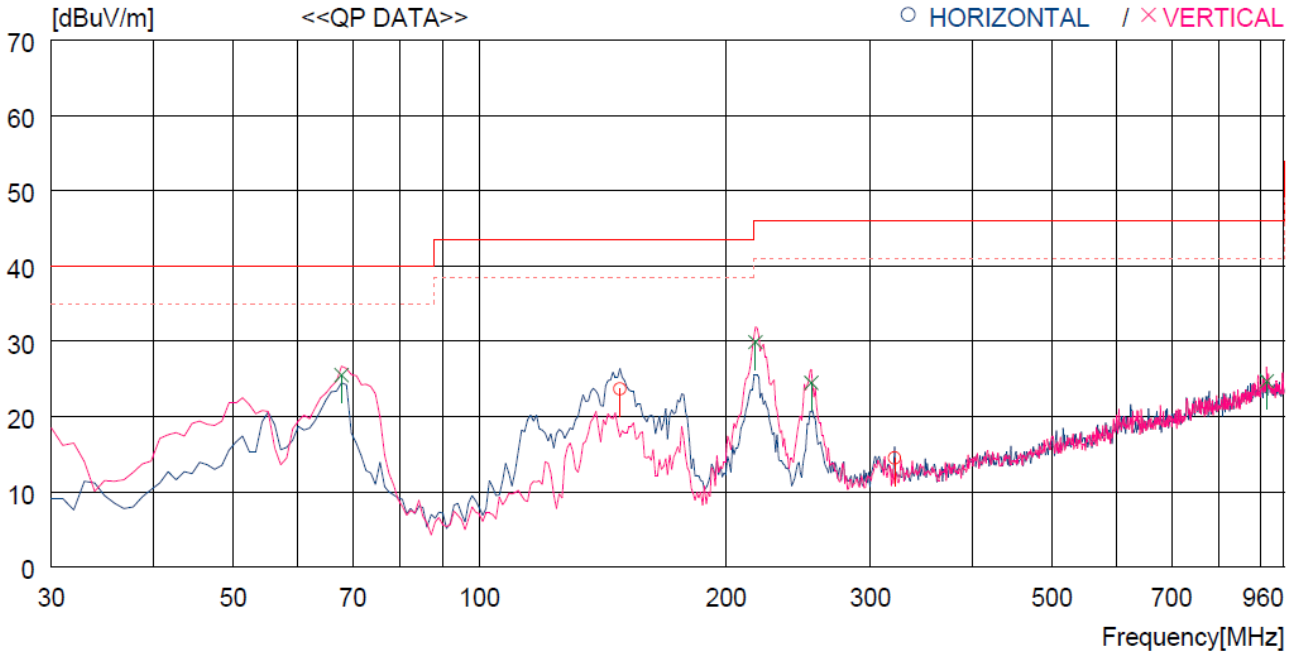
Frequency [MHz]	Reading [dBuV]	Ant Pol.	Ant Factor [dB]	Cable Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
67.830	46.2	V	10.4	2.0	33.1	25.5	40.0	14.5
148.340	45.7	H	8.1	2.9	33.0	23.7	46.5	19.8
217.210	48.2	V	11.2	3.4	32.9	29.9	46.0	16.1
254.070	41.2	V	12.5	3.7	32.9	24.5	46.0	21.5
321.000	29.5	H	13.9	4.1	33.0	14.5	46.0	31.5
914.628	27.3	V	22.5	7.1	32.2	24.7	46.0	21.3



Tested by: Tae-Ho, Kim / Senior Manager

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

- Result Plot



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	148.340	45.7	8.1	2.9	33.0	23.7	43.5	19.8	400	359
2	321.000	29.5	13.9	4.1	33.0	14.5	46.0	31.5	400	359
----- Vertical ------										
3	67.830	46.2	10.4	2.0	33.1	25.5	40.0	14.5	400	11
4	217.210	48.2	11.2	3.4	32.9	29.9	46.0	16.1	400	11
5	254.070	41.2	12.5	3.7	32.9	24.5	46.0	21.5	400	11
6	914.628	27.3	22.5	7.1	32.2	24.7	46.0	21.3	400	194

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

6. Maximum Peak Conducted Output Power

6.1 Operating environment

Temperature : 24.3 ℃

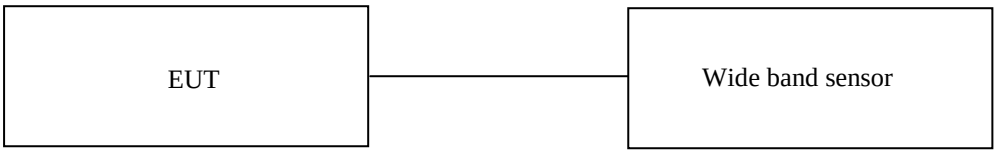
Relative humidity : 43.9 % R.H.

6.2 Test set-up

The maximum peak output power was measured with the wide band sensor connected to the antenna output of the EUT.

The Wide Band Sensor is measured when the EUT is transmitting at the appropriate center frequency its maximum power control level as described in Section 9.2.3(KDB 558074 D01 DTS Meas Guidance V04).

Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.



6.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	NRP-Z81	Rohde & Schwarz	Wide band Sensor	101975	Mar. 15, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

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

6.4 TEST Result(GFSK_1 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	6.74	21.00	14.26
MIDDLE	2 441.00	5.37	21.00	15.63
HIGH	2 480.00	5.26	21.00	15.74

Remark : Margin = Limit – Measured Value (=Power Sensor Reading - Cable Loss)

6.5 TEST Result(π/4-DQPSK_2 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	6.26	21.00	14.74
MIDDLE	2 441.00	5.03	21.00	15.97
HIGH	2 480.00	4.89	21.00	16.11

Remark : Margin = Limit – Measured Value (=Power Sensor Reading - Cable Loss)

6.6 TEST Result(8 DPSK_3 Mbps)

-. Test Date : September 12, 2018 ~ September 21, 2018

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	6.56	21.00	14.44
MIDDLE	2 441.00	5.24	21.00	15.76
HIGH	2 480.00	5.18	21.00	15.82

Remark : Margin = Limit – Measured Value (=Power Sensor Reading - Cable Loss)

Tested by: Tae-Ho, Kim / Senior Manager

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