

10. PEAK POWER SPECTRUL DENSITY

10.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % 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 $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$, 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. 14, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data for 802.11b WLAN Mode

10.4.1 Test data for Antenna 0

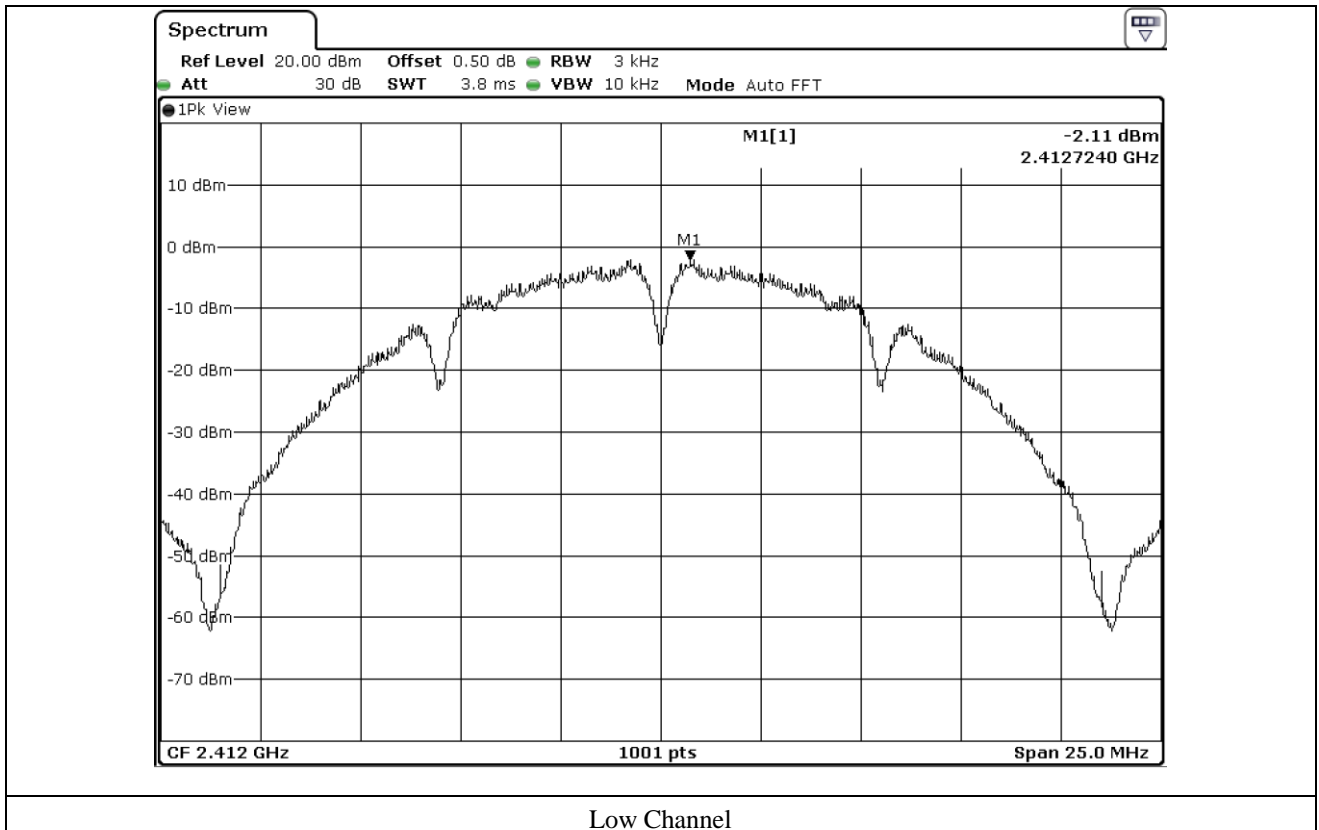
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

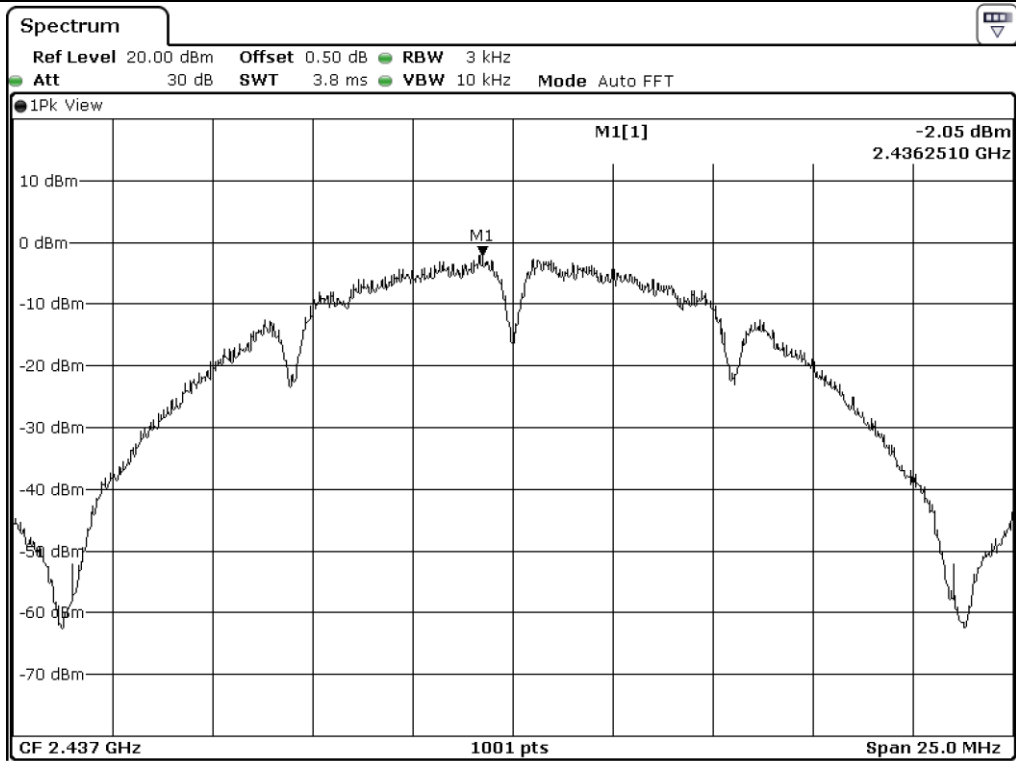
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-2.11	8.00	10.11
Middle	2 437.00	-2.05	8.00	10.05
High 11	2 462.00	-1.81	8.00	9.81
High 12	2 467.00	-3.00	8.00	11.00
High 13	2 472.00	-5.67	8.00	13.67

Remark. Margin = Limit – Measured value

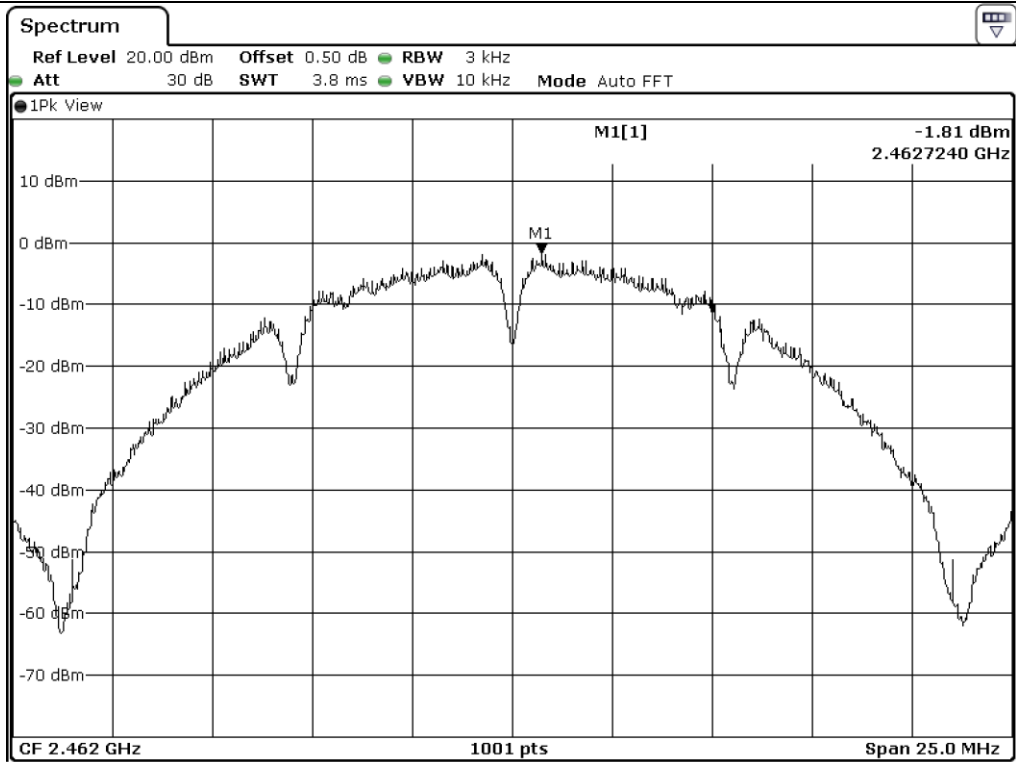


Tested by: Tae-Ho, Kim / Senior Manager

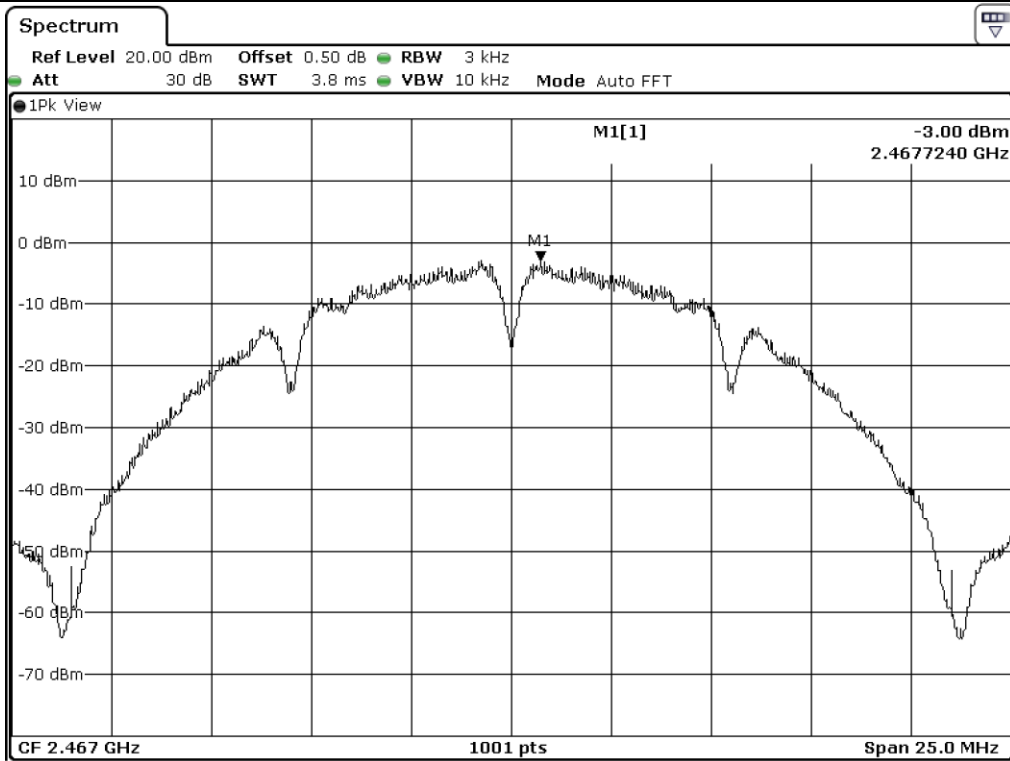




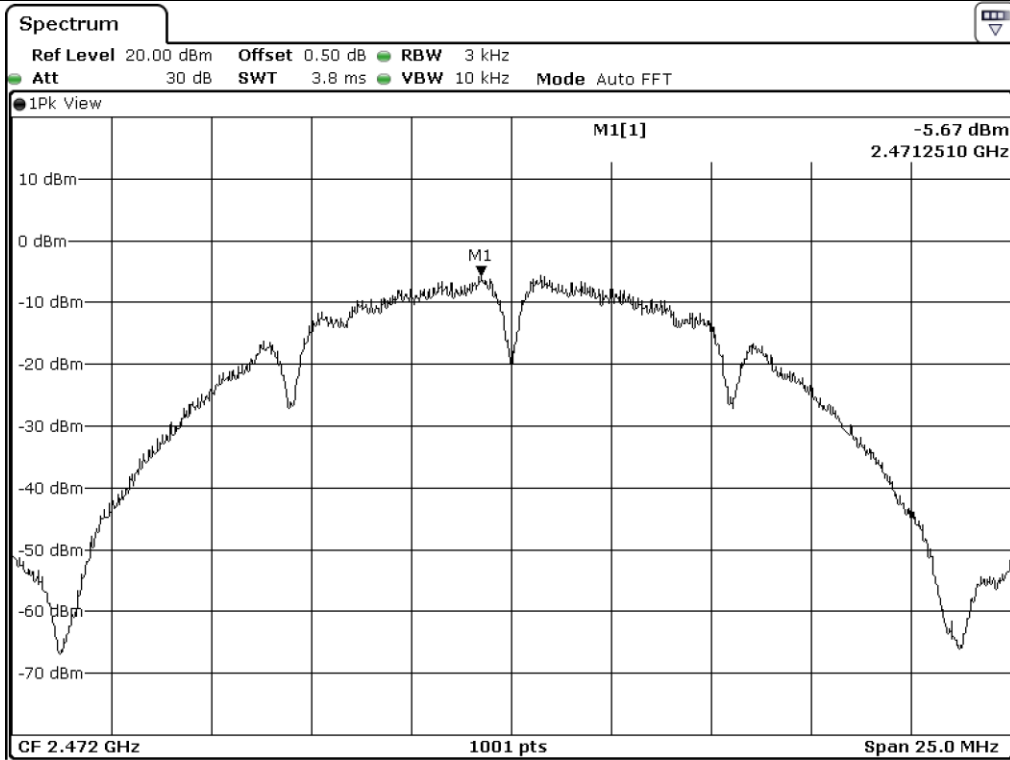
Middle Channel



High Channel 11



High Channel 12



High Channel 13

10.4.2 Test data for Antenna 1

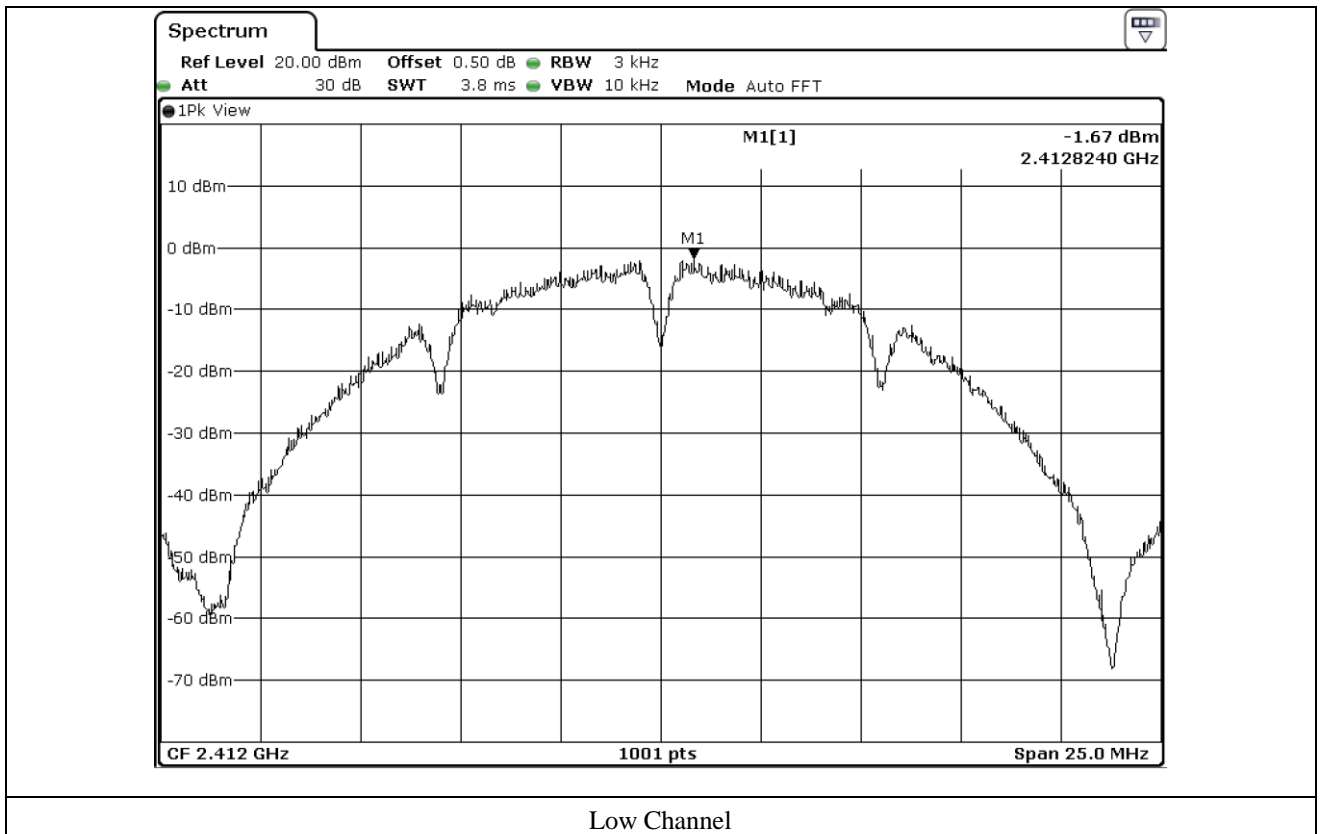
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

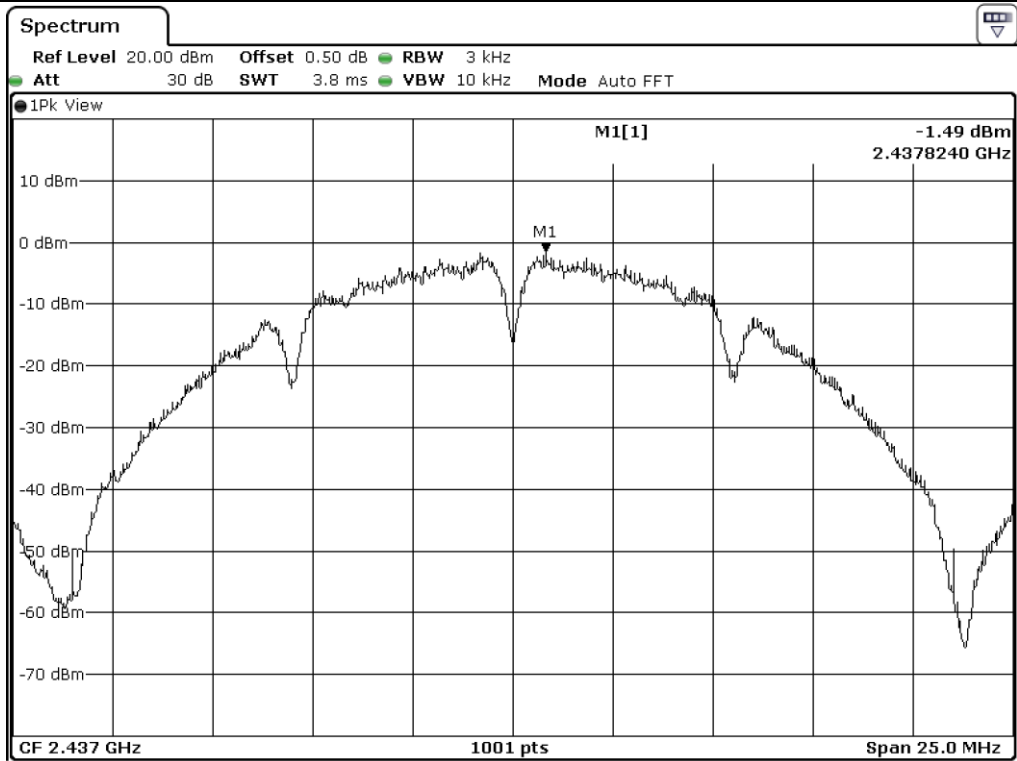
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-1.67	8.00	9.67
Middle	2 437.00	-1.49	8.00	9.49
High 11	2 462.00	-1.65	8.00	9.65
High 12	2 467.00	-3.07	8.00	11.07
High 13	2 472.00	-6.90	8.00	14.90

Remark. Margin = Limit – Measured value

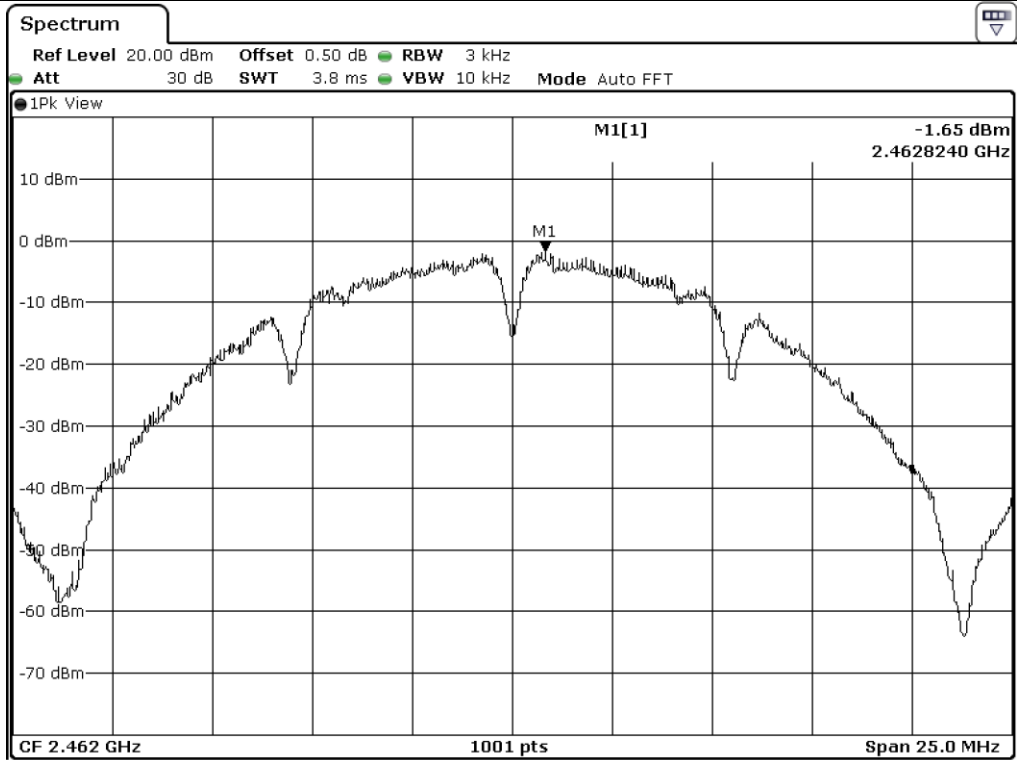


Tested by: Tae-Ho, Kim / Senior Manager

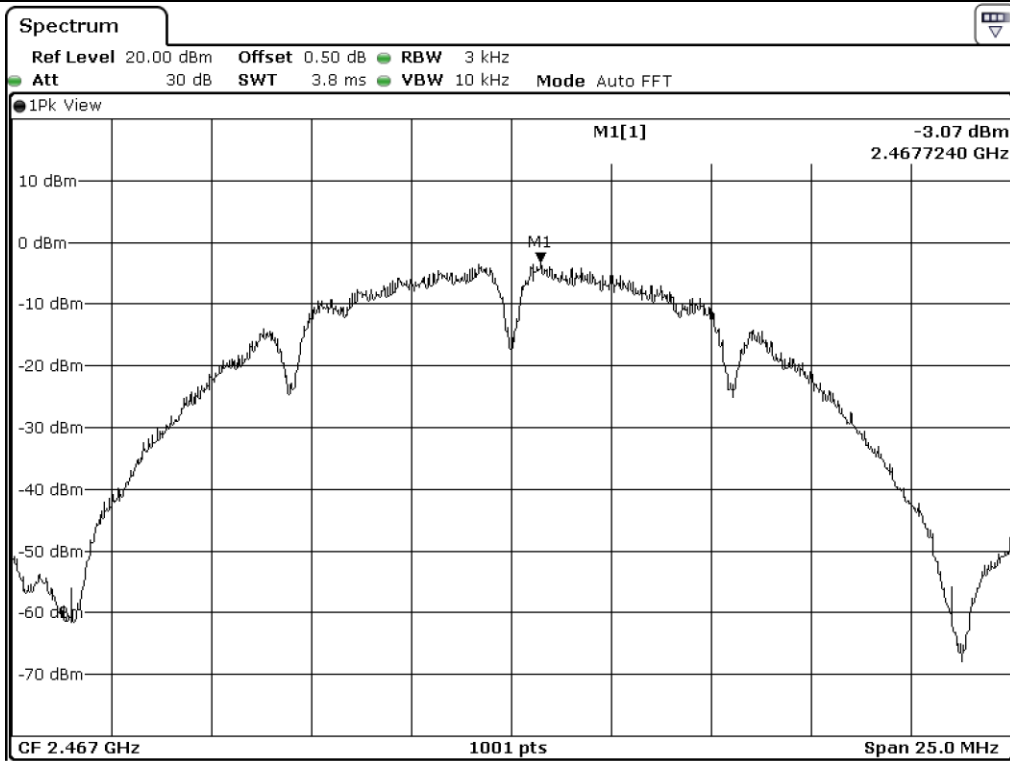




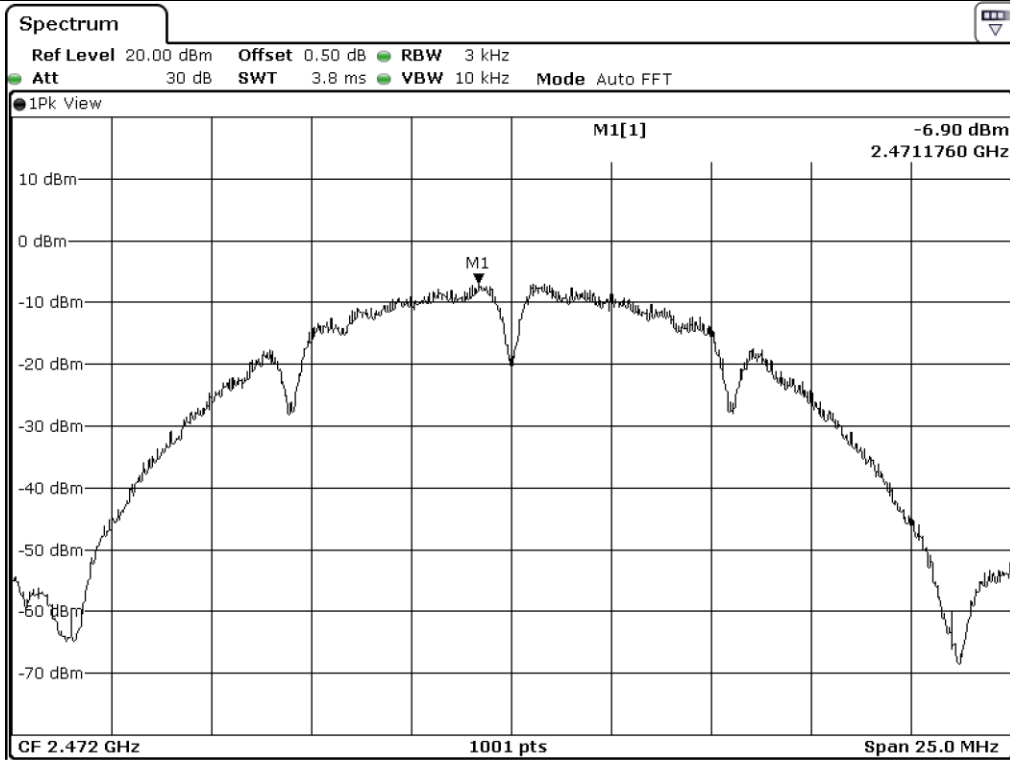
Middle Channel



High Channel 11



High Channel 12



High Channel 13

10.5 Test data for 802.11g WLAN Mode

10.5.1 Test data for Antenna 0

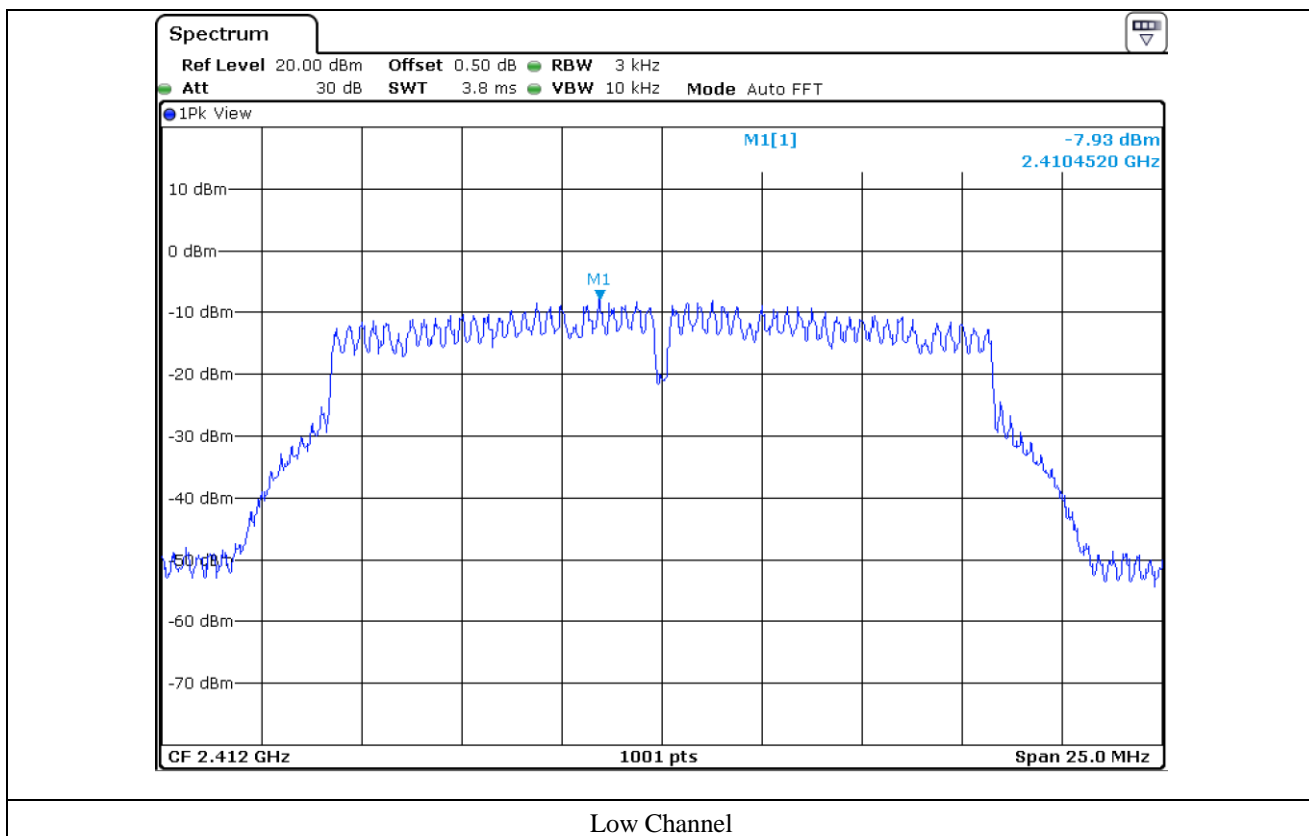
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

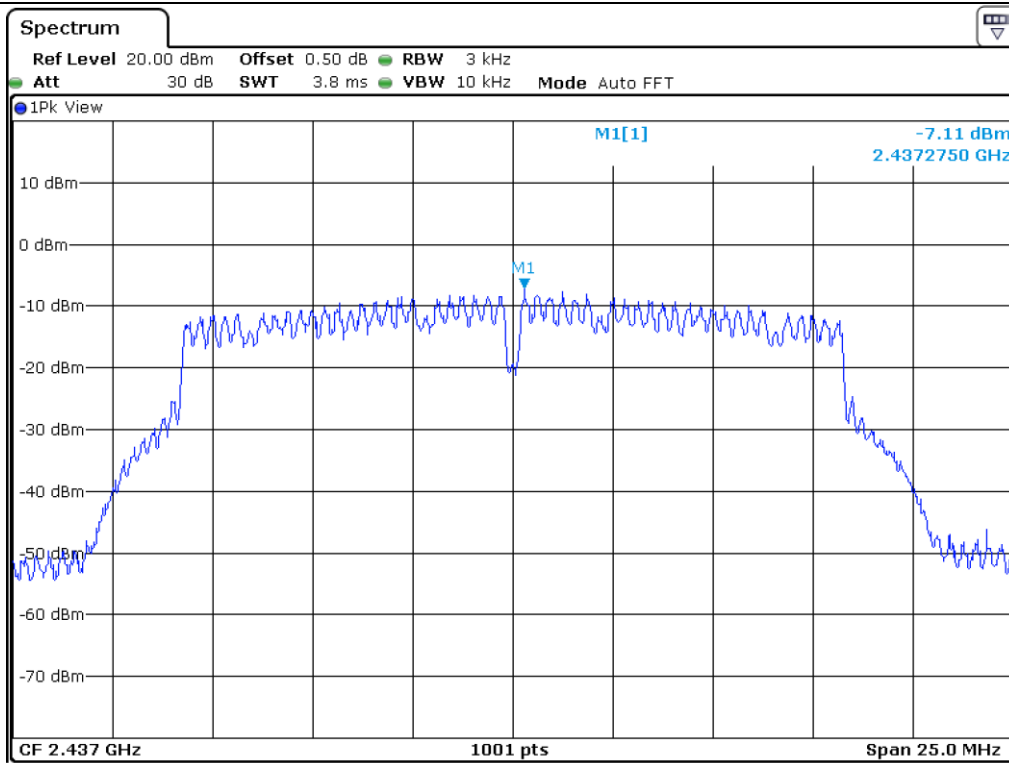
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-7.93	8.00	15.93
Middle	2 437.00	-7.11	8.00	15.11
High 11	2 462.00	-8.57	8.00	16.57
High 12	2 467.00	-13.96	8.00	21.96
High 13	2 472.00	-14.38	8.00	22.38

Remark. Margin = Limit – Measured value

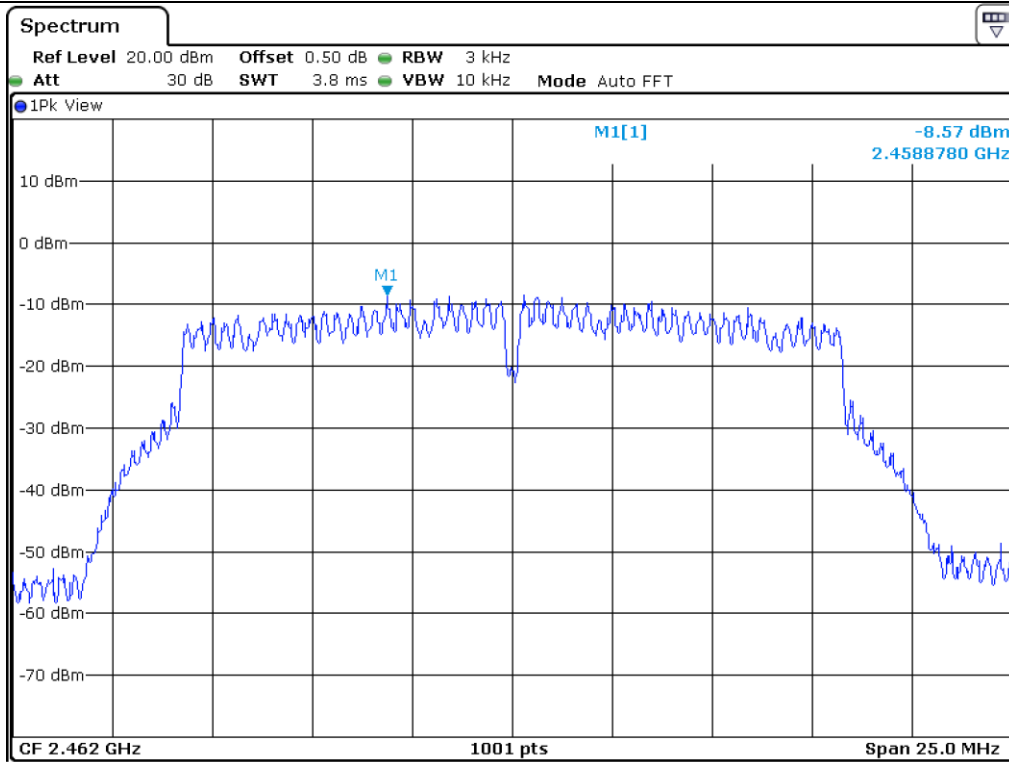


Tested by: Tae-Ho, Kim / Senior Manager

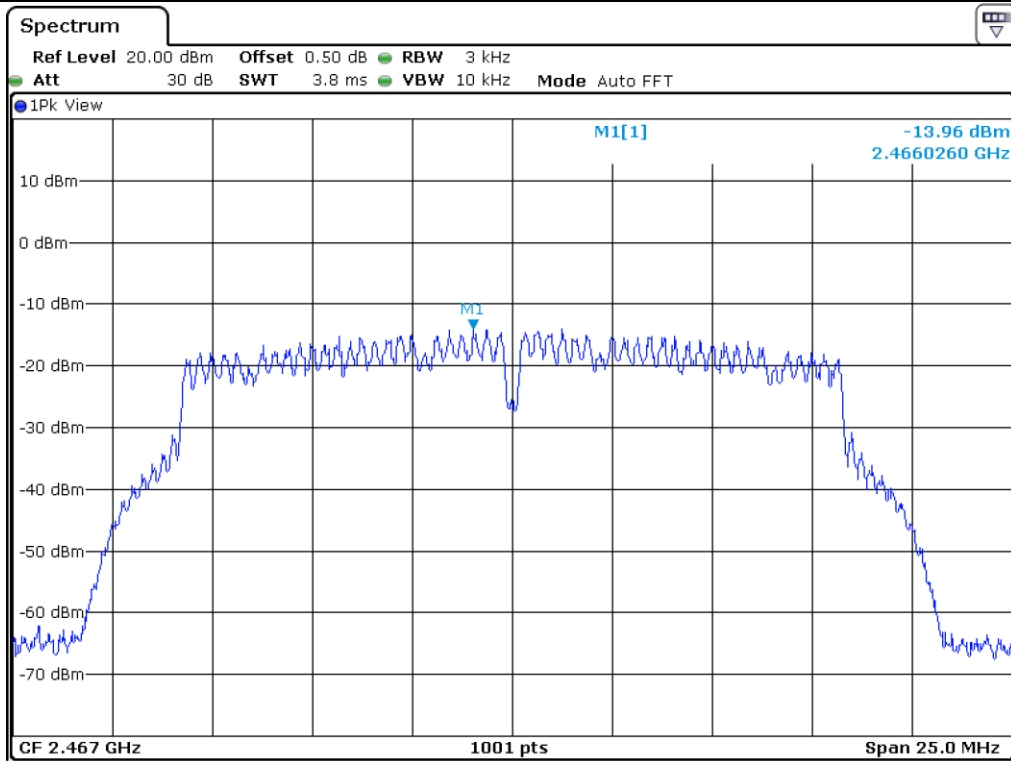




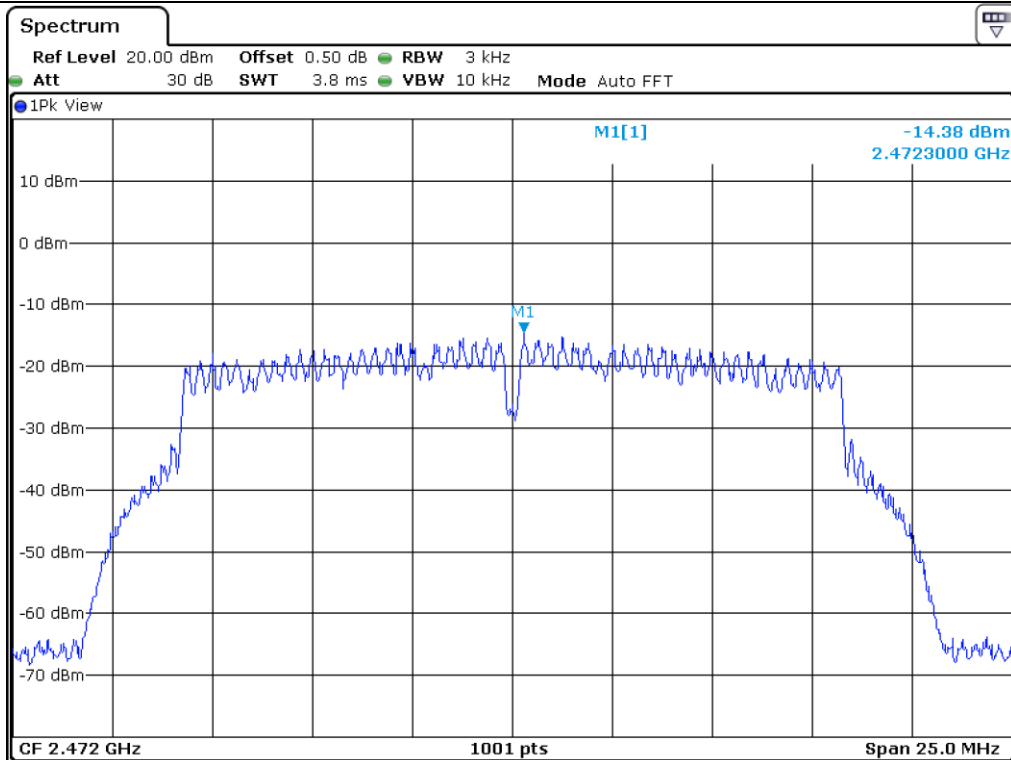
Middle Channel



High Channel 11



High Channel 12



High Channel 13

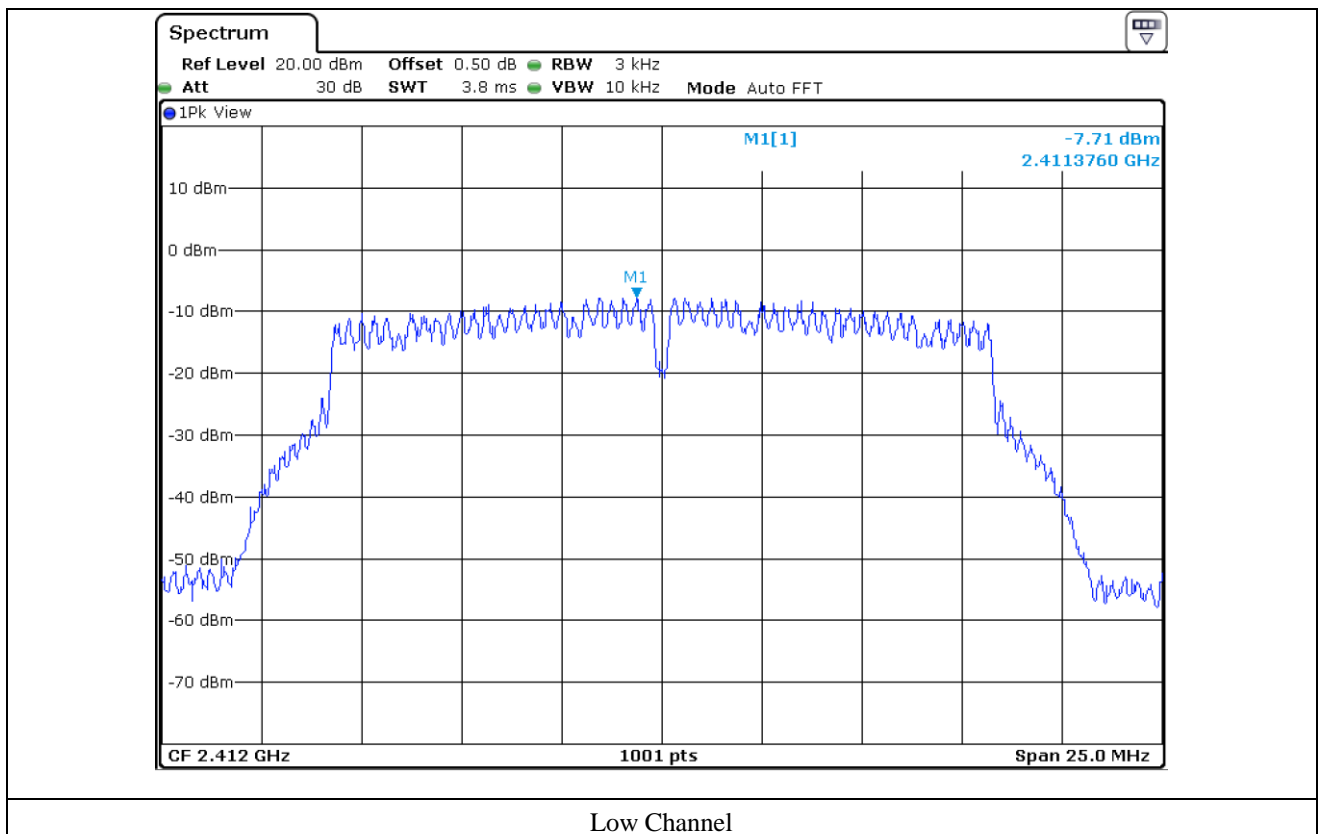
10.5.2 Test data for Antenna 1

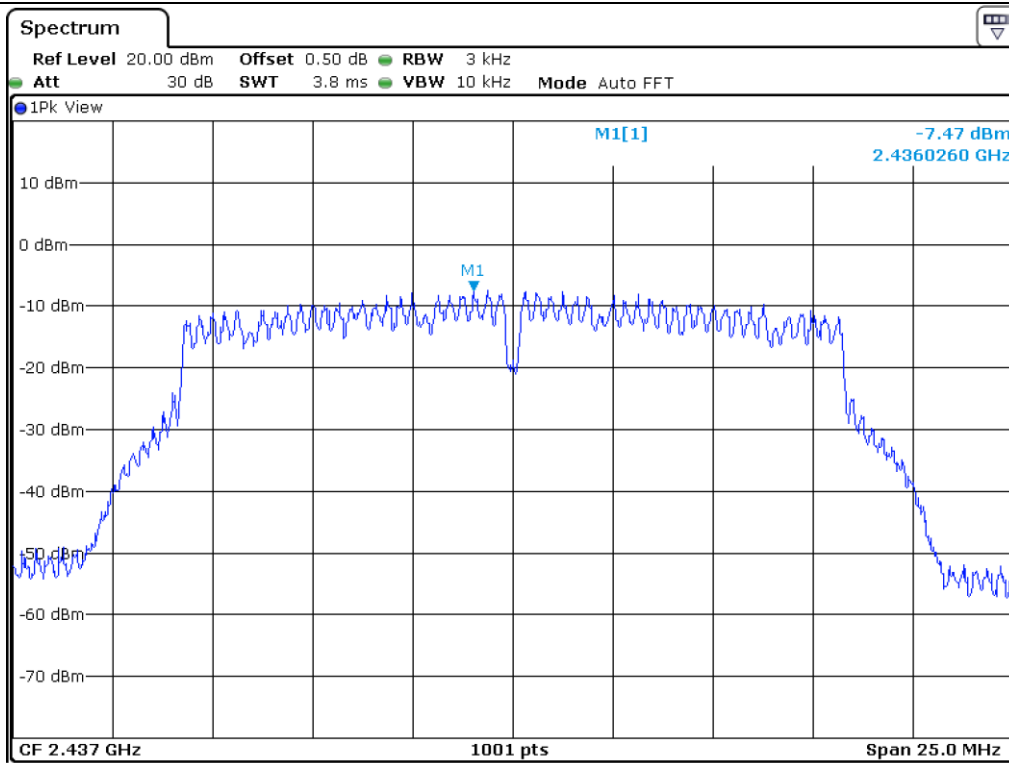
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-7.71	8.00	15.71
Middle	2 437.00	-7.47	8.00	15.47
High 11	2 462.00	-8.28	8.00	16.28
High 12	2 467.00	-13.11	8.00	21.11
High 13	2 472.00	-14.20	8.00	22.20

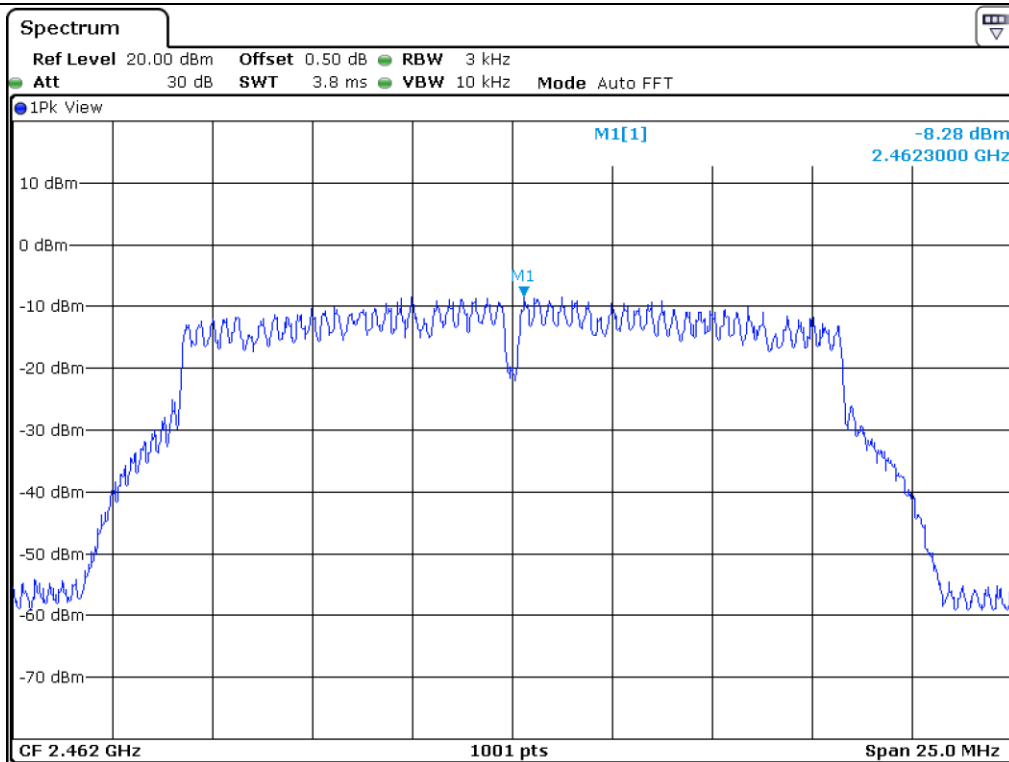
Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Senior Manager

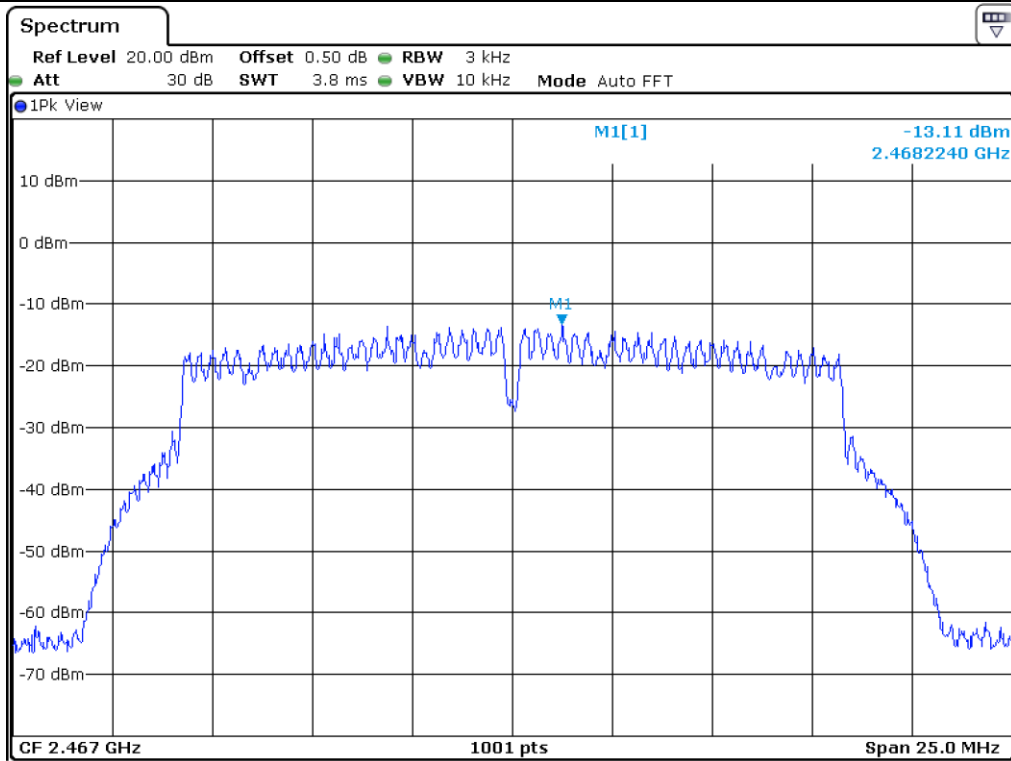




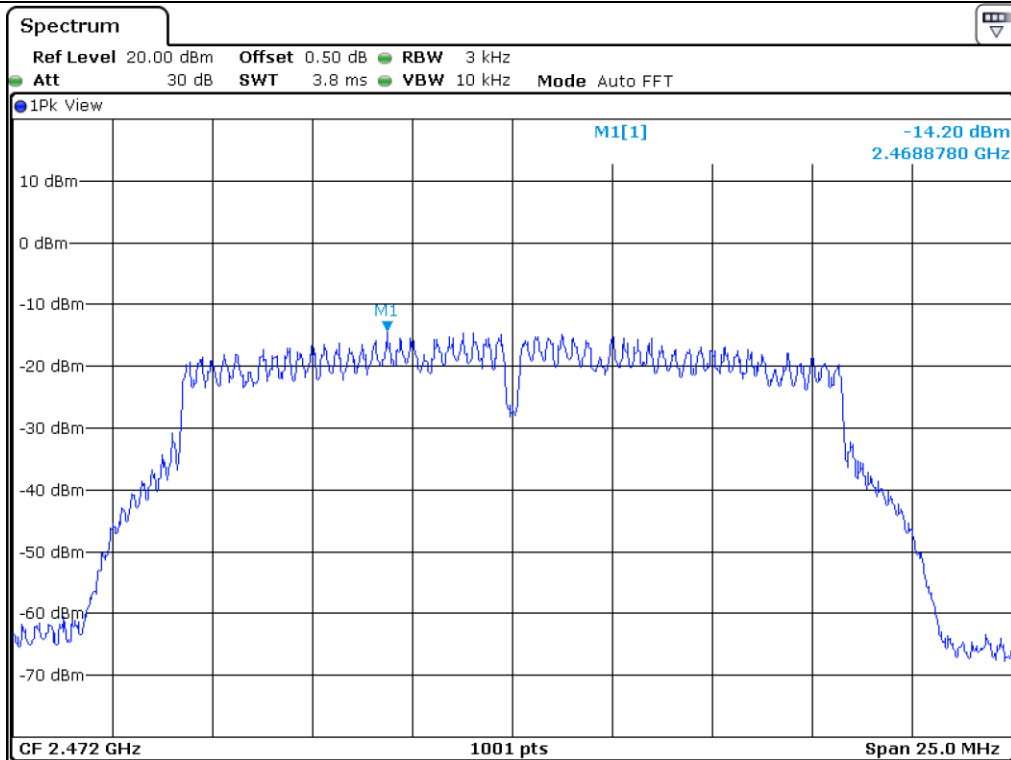
Middle Channel



High Channel 11



High Channel 12



High Channel 13

10.5.3 Test data for Multiple Transmit

-. Test Date : September 28, 2018 ~ October 24, 2018

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-4.81	8.00	12.81
Middle	2 437.00	-4.28	8.00	12.28
High 11	2 462.00	-5.41	8.00	13.41
High 12	2 467.00	-10.50	8.00	18.50
High 13	2 472.00	-11.28	8.00	19.28

Remark 1 : Margin = Limit – Measured value

Remark 2 : Calculated Power Density = $10\log (10^{(\text{Antenna 0 Power Density}/10)}+10^{(\text{Antenna 1 Power Density}/10)})$

Remark 3 : Directional gain = $10*\log[(10^{G0/20}+10^{G1/20})^2/N]$ dBi



Tested by: Tae-Ho, Kim / Senior Manager

10.6 Test data for 802.11n_HT20 WLAN Mode

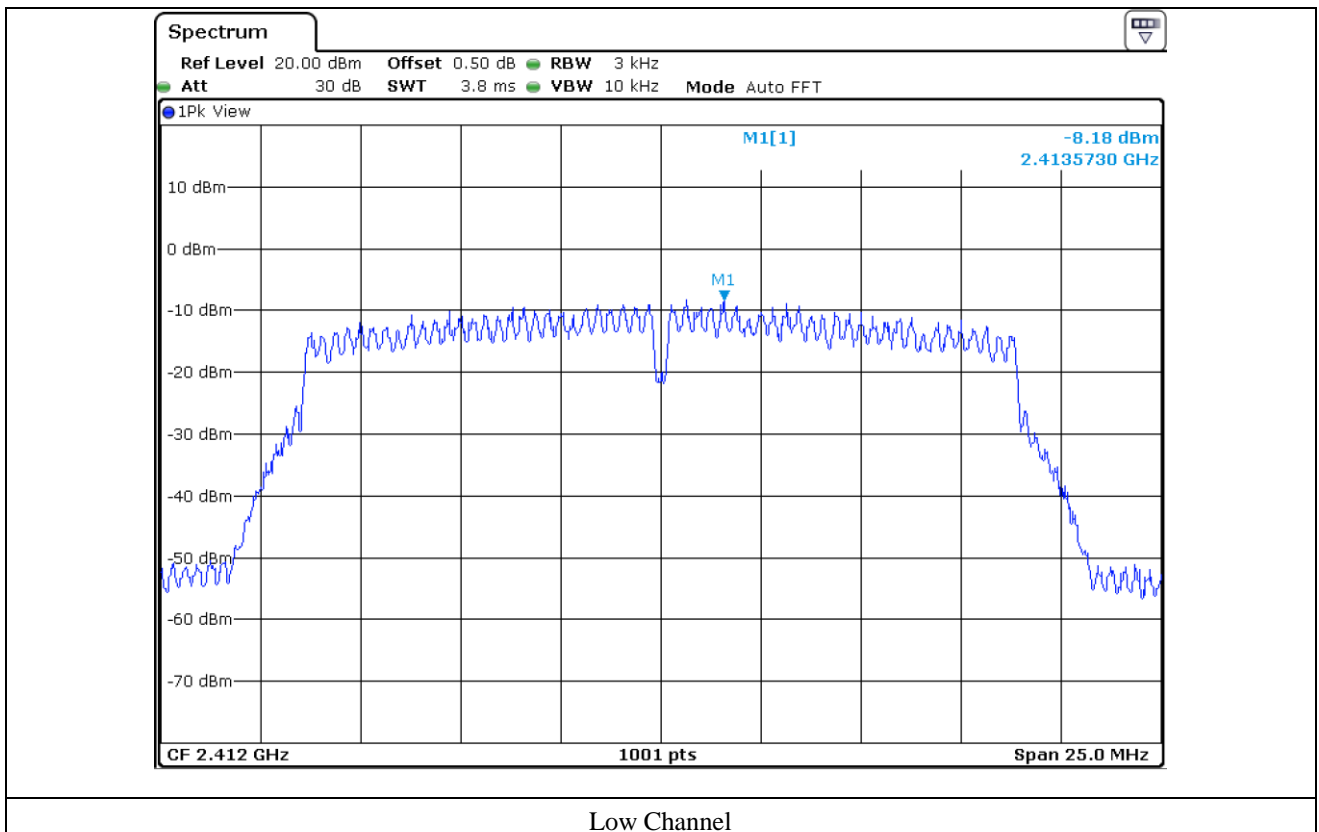
10.6.1 Test data for Antenna 0

- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

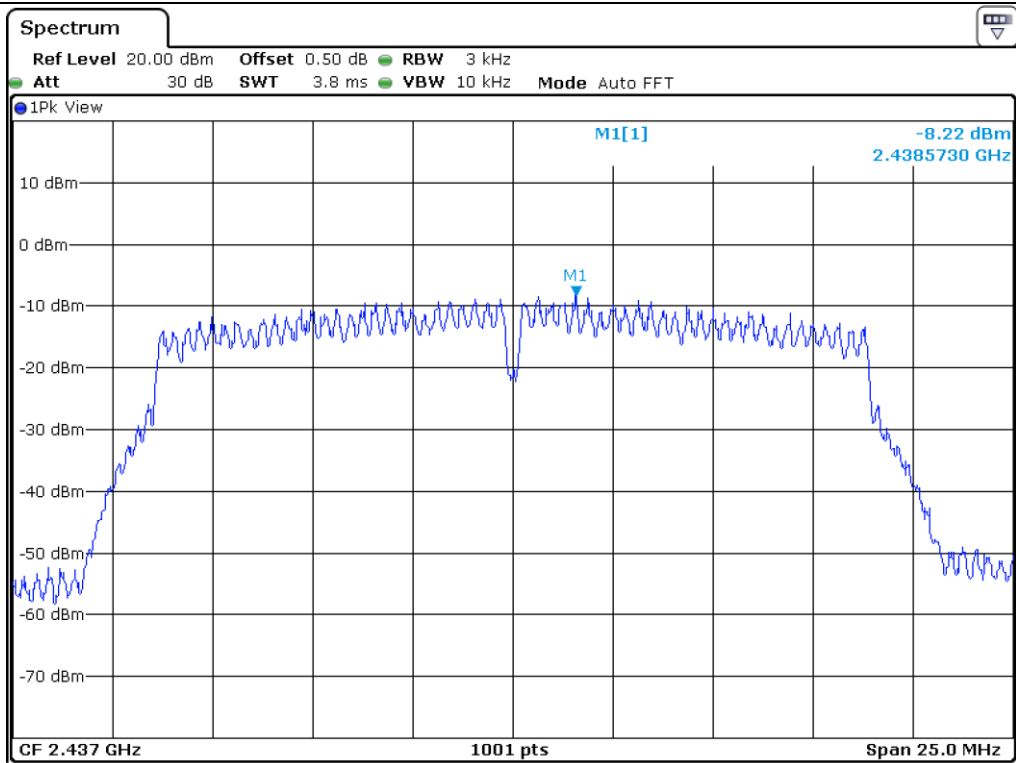
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-8.18	8.00	16.18
Middle	2 437.00	-8.22	8.00	16.22
High 11	2 462.00	-9.02	8.00	17.02
High 12	2 467.00	-14.01	8.00	22.01
High 13	2 472.00	-14.31	8.00	22.31

Remark. Margin = Limit – Measured value

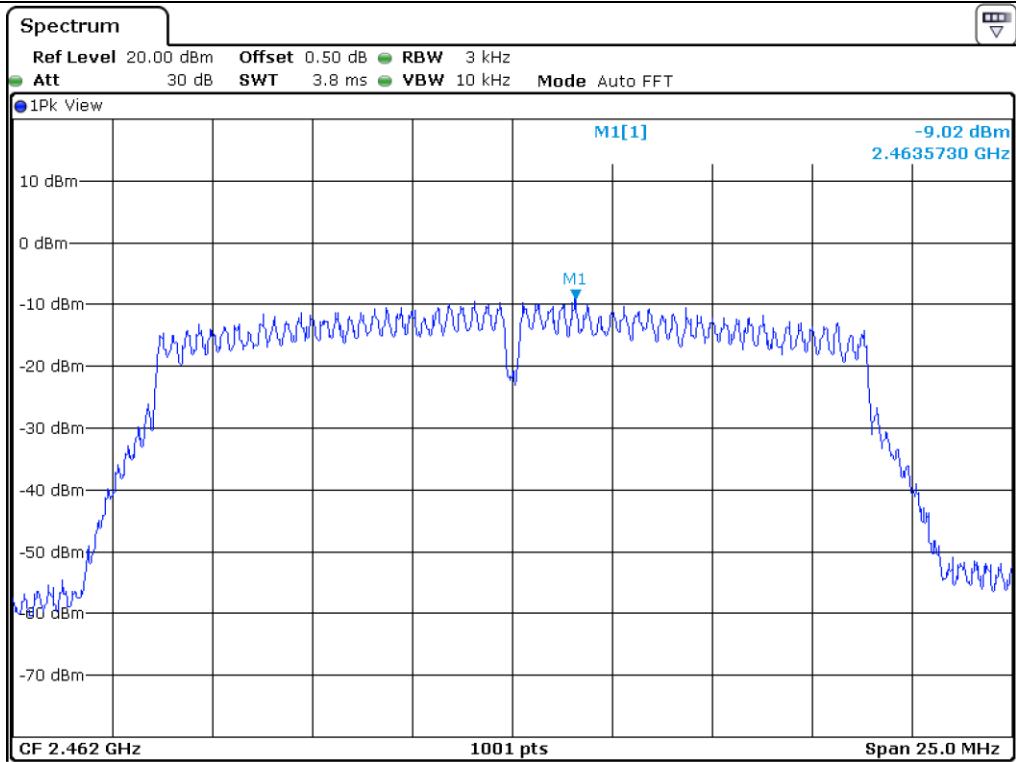
Tested by: Tae-Ho, Kim / Senior Manager



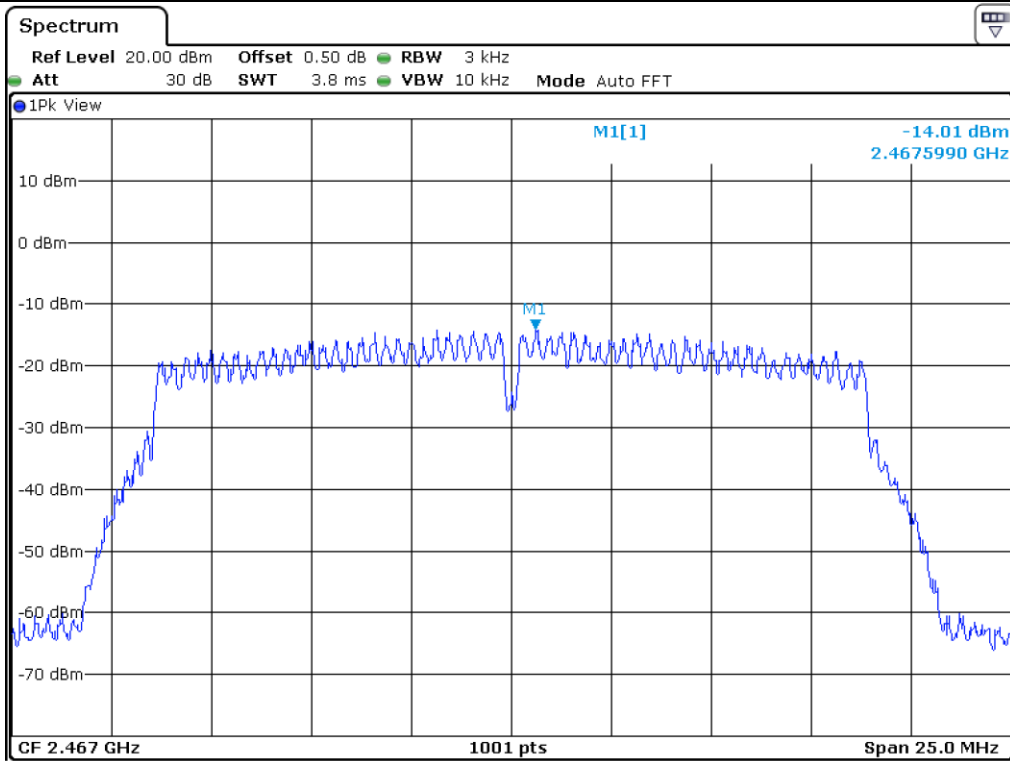
Low Channel



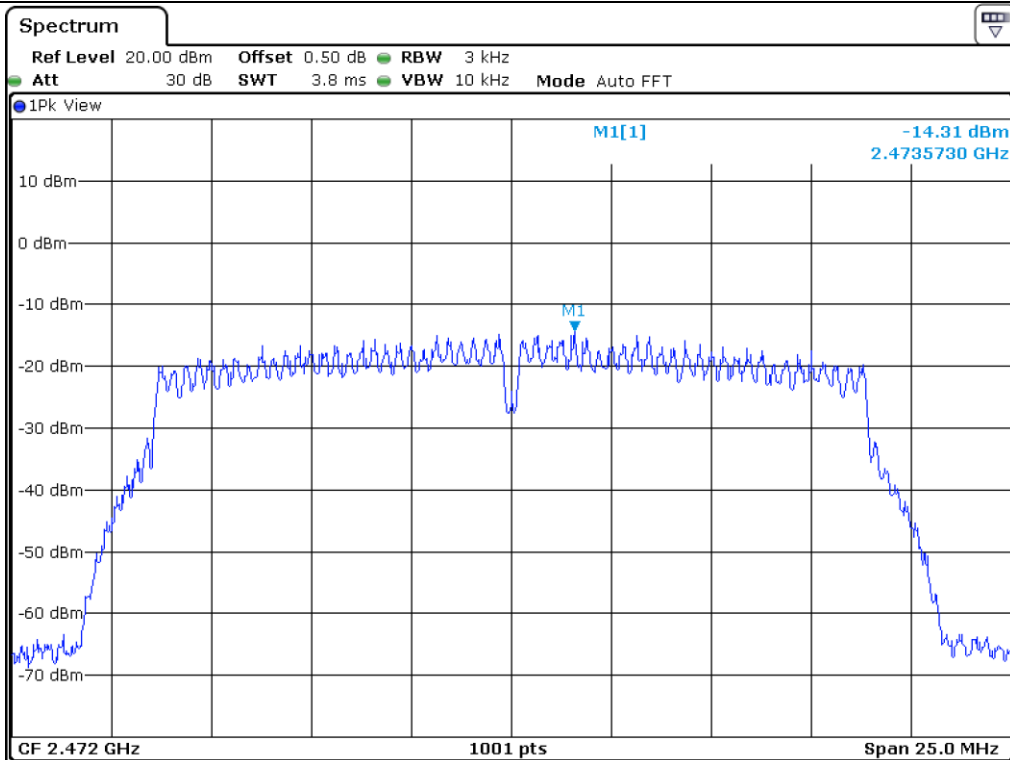
Middle Channel



High Channel 11



High Channel 12



High Channel 13

10.6.2 Test data for Antenna 1

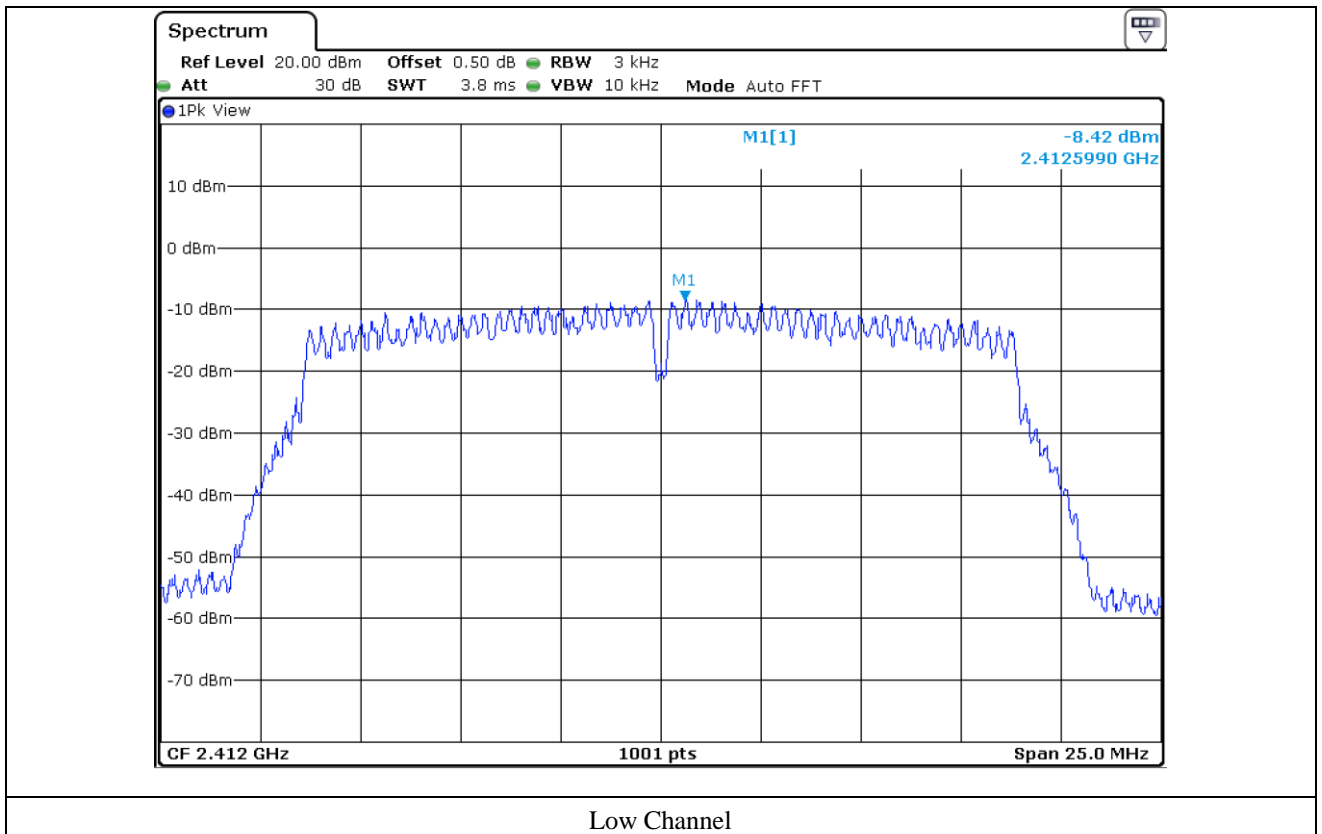
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

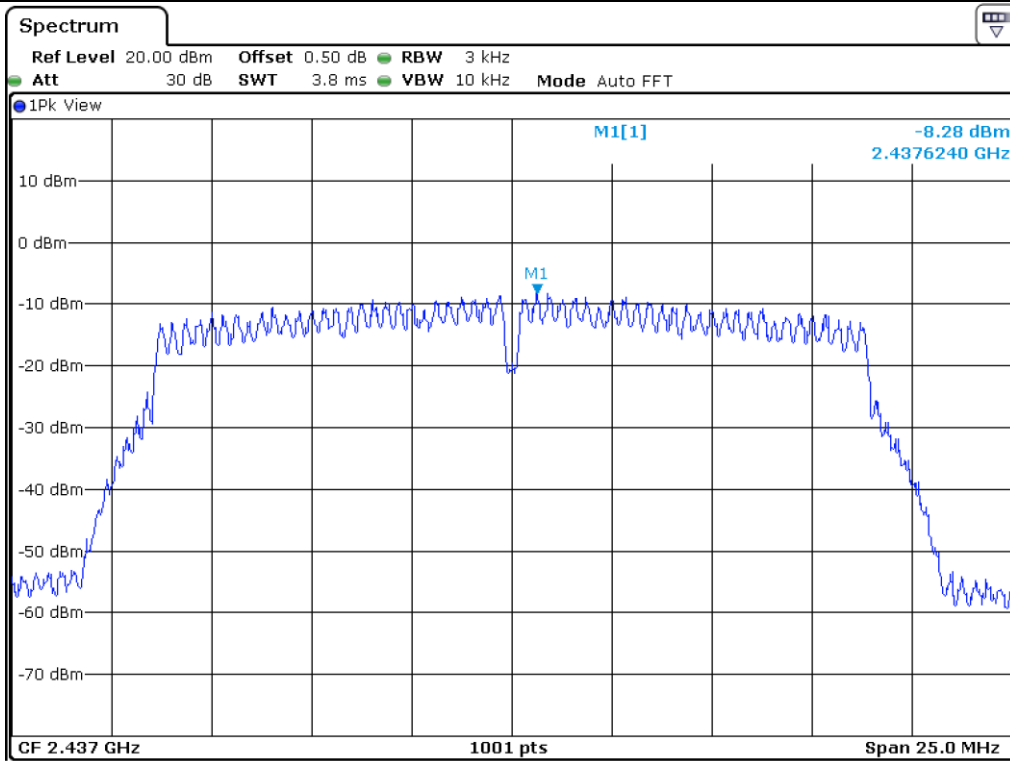
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-8.42	8.00	16.42
Middle	2 437.00	-8.28	8.00	16.28
High 11	2 462.00	-9.38	8.00	17.38
High 12	2 467.00	-13.21	8.00	21.21
High 13	2 472.00	-14.29	8.00	22.29

Remark. Margin = Limit – Measured value

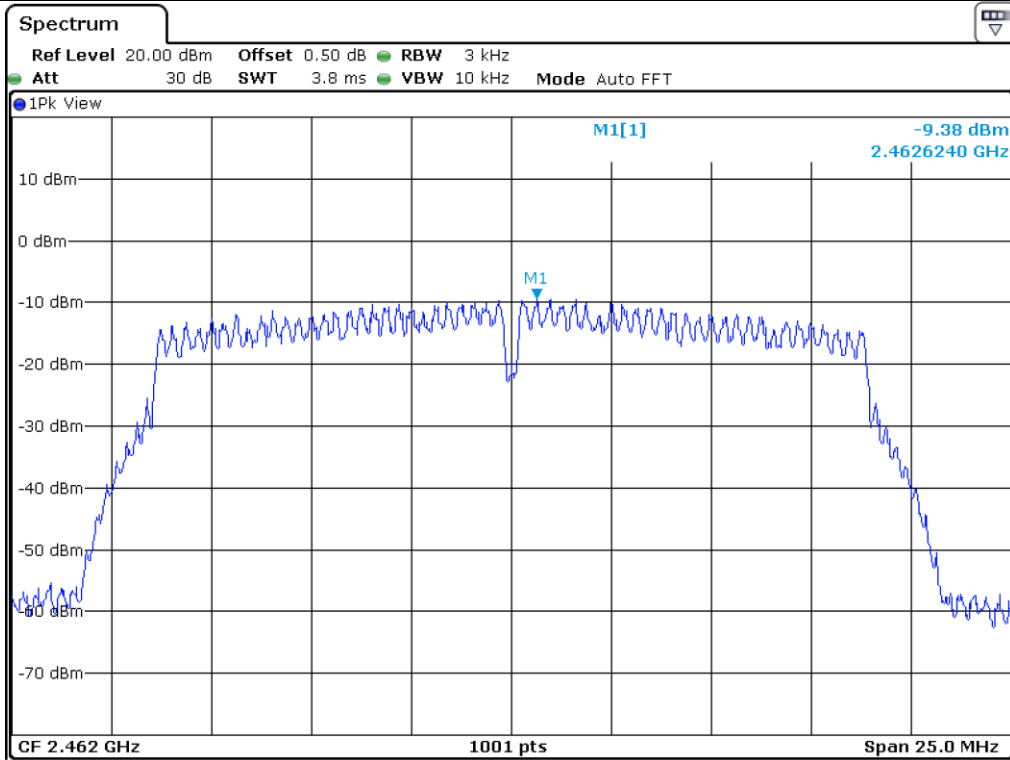


Tested by: Tae-Ho, Kim / Senior Manager

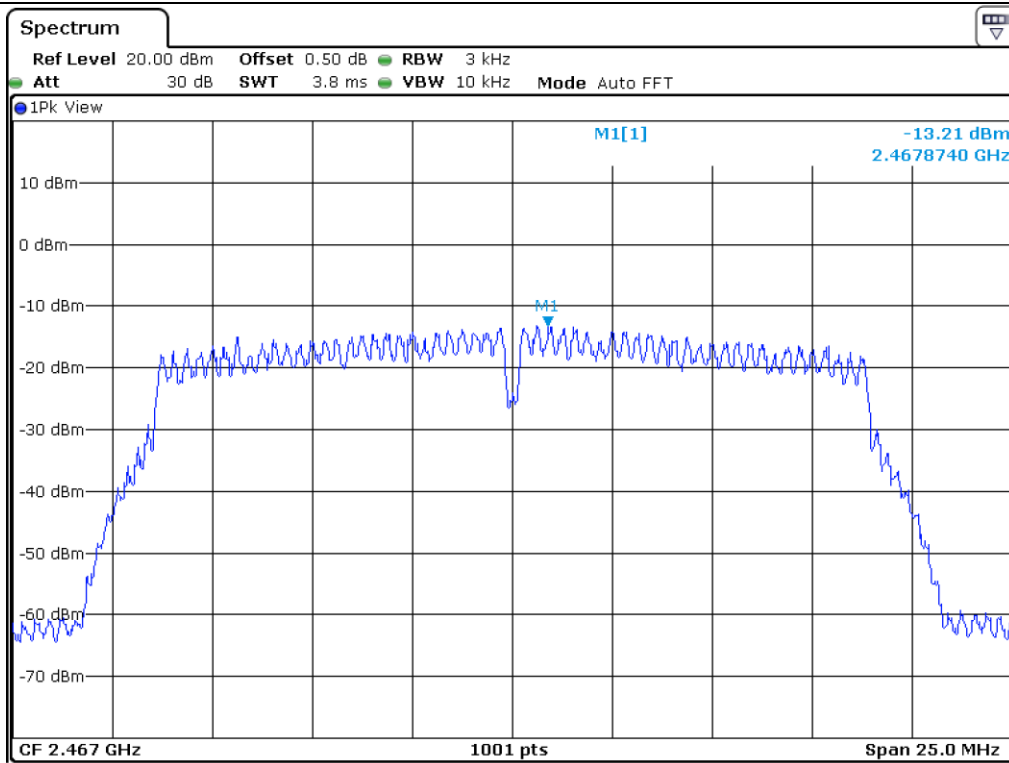




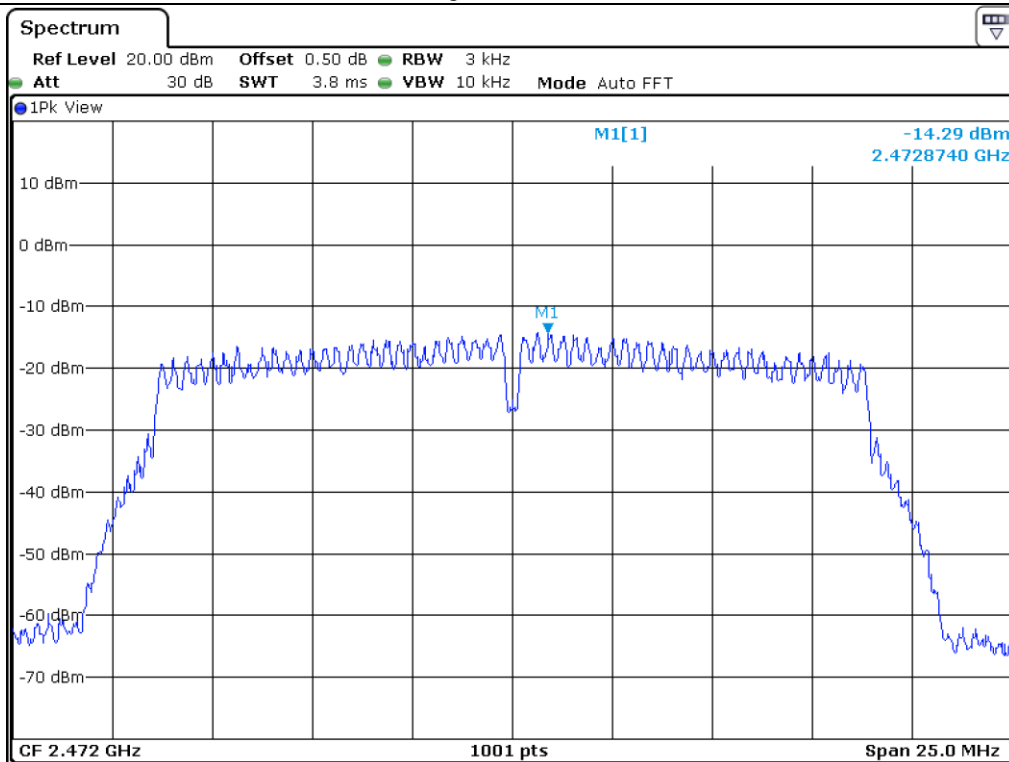
Middle Channel



High Channel 11



High Channel 12



High Channel 13

10.6.3 Test data for Multiple Transmit

-. Test Date : September 28, 2018 ~ October 24, 2018

-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-5.29	8.00	13.29
Middle	2 437.00	-5.24	8.00	13.24
High 11	2 462.00	-6.19	8.00	14.19
High 12	2 467.00	-10.58	8.00	18.58
High 13	2 472.00	-11.29	8.00	19.29

Remark 1 : Margin = Limit – Measured value

Remark 2 : Calculated Power Density = $10\log (10^{(\text{Antenna 0 Power Density}/10)} + 10^{(\text{Antenna 1 Power Density}/10)})$

Remark 3 : Directional gain = $10*\log[(10^{G0/20} + 10^{G1/20})^2/N]$ dBi



Tested by: Tae-Ho, Kim / Senior Manager

10.7 Test data for 802.11n_HT40 WLAN Mode

10.7.1 Test data for Antenna 0

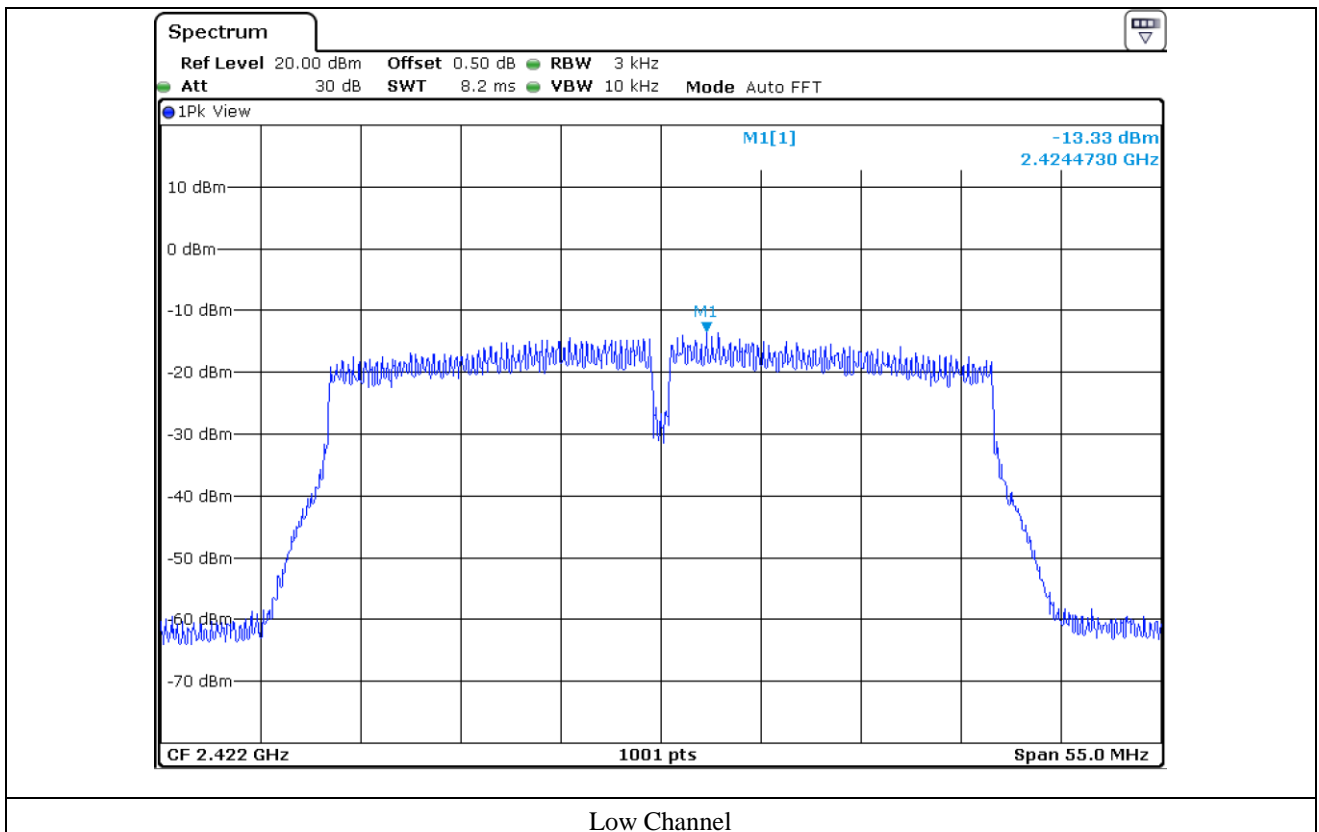
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

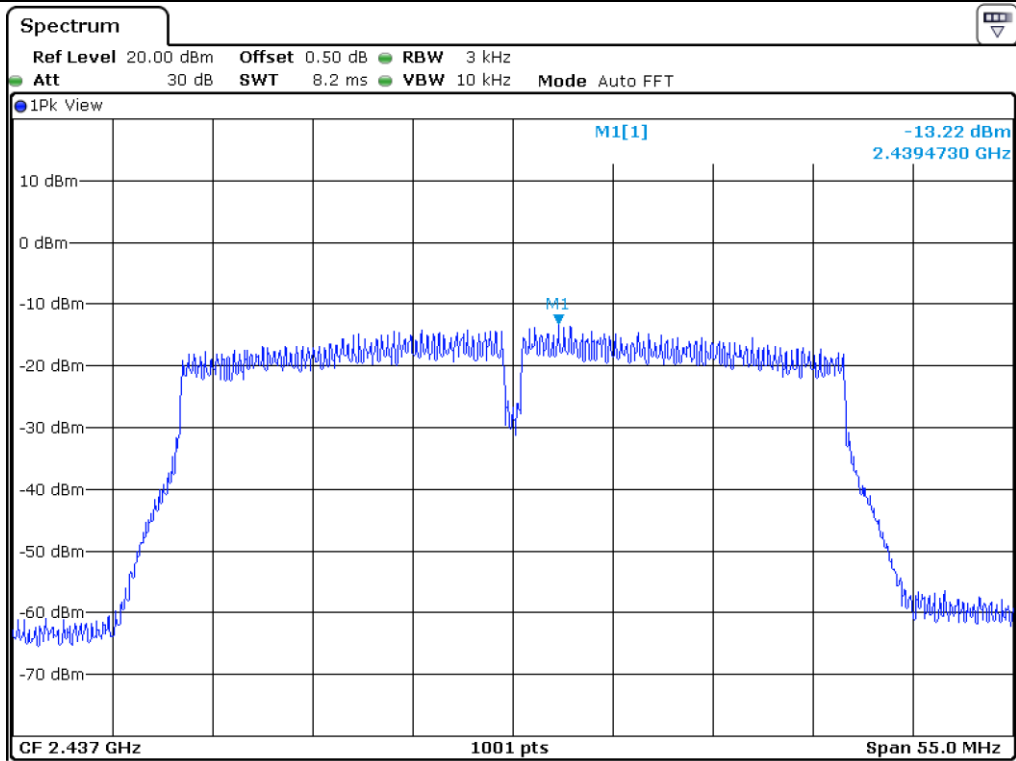
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-13.33	8.00	21.33
Middle	2 437.00	-13.22	8.00	21.22
High 9	2 452.00	-13.95	8.00	21.95
High 10	2 457.00	-15.94	8.00	23.94
High 11	2 462.00	-16.99	8.00	24.99

Remark. Margin = Limit – Measured value

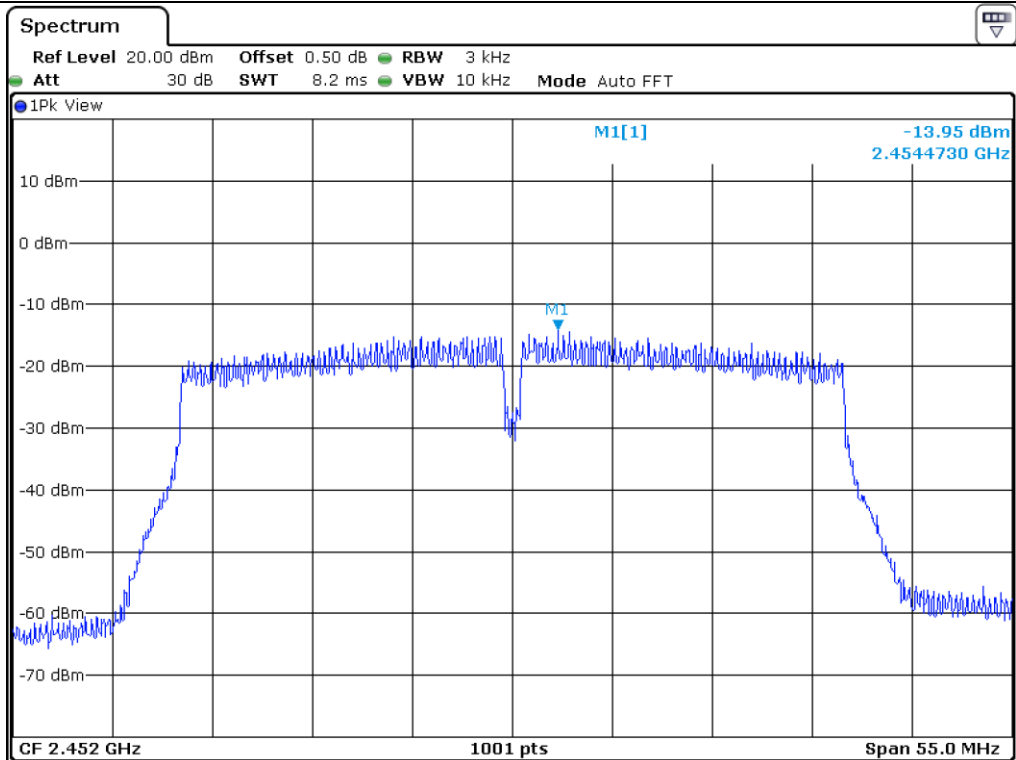


Tested by: Tae-Ho, Kim / Senior Manager

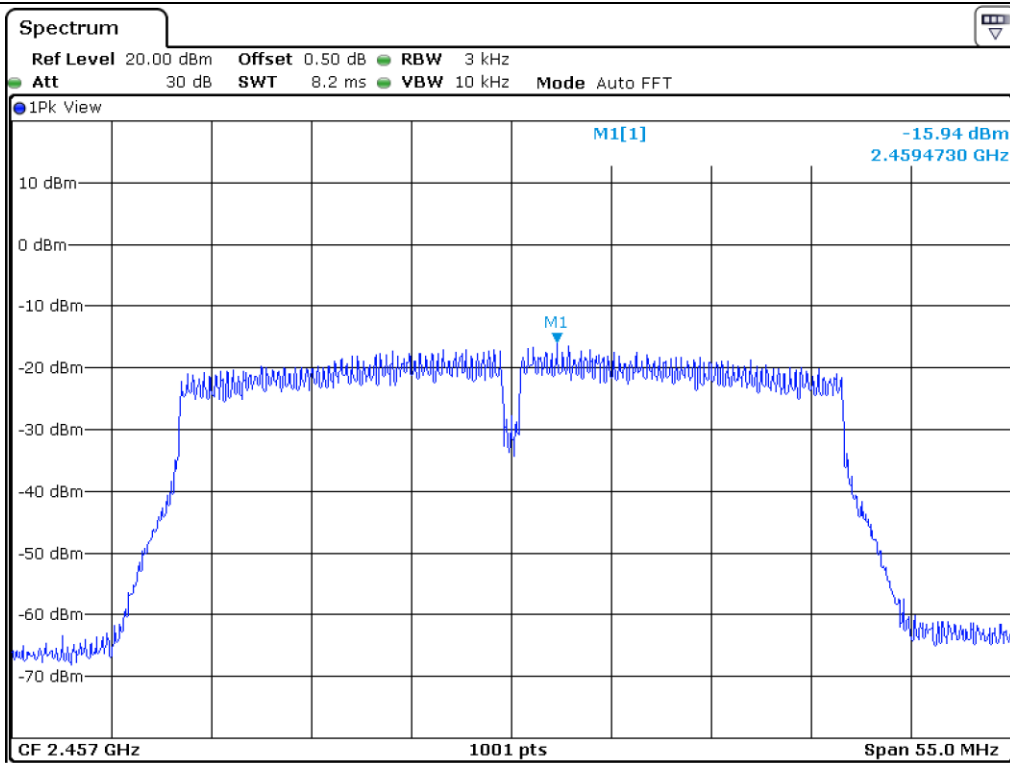




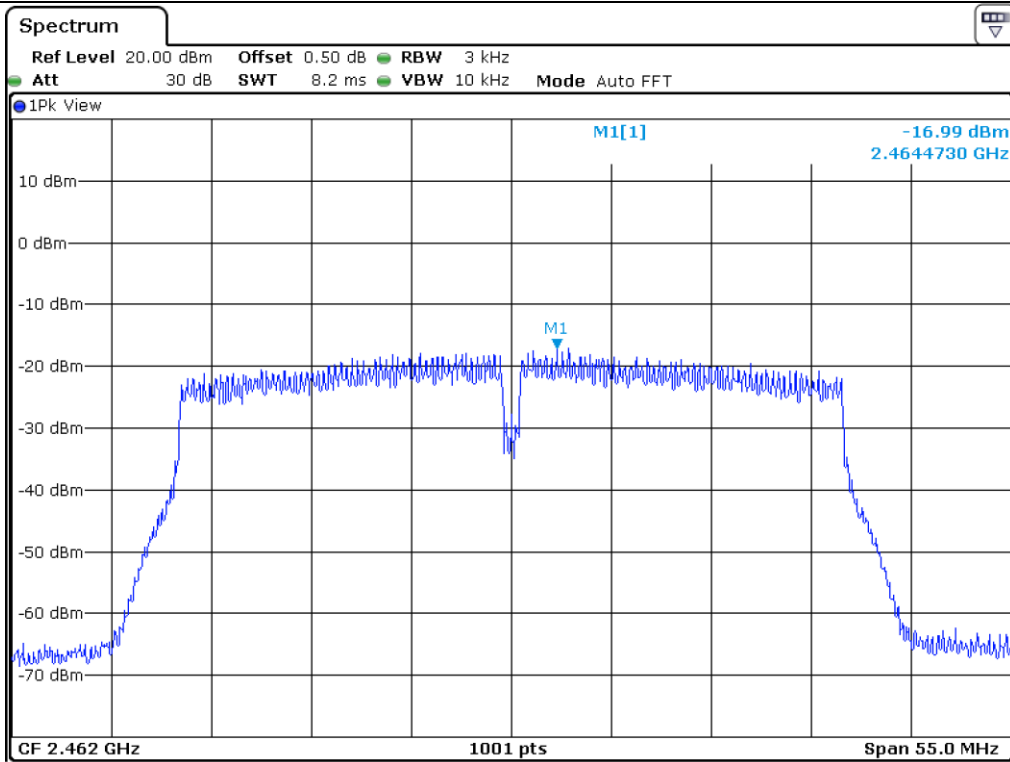
Middle Channel



High Channel 9



High Channel 10



High Channel 11

10.7.2 Test data for Antenna 1

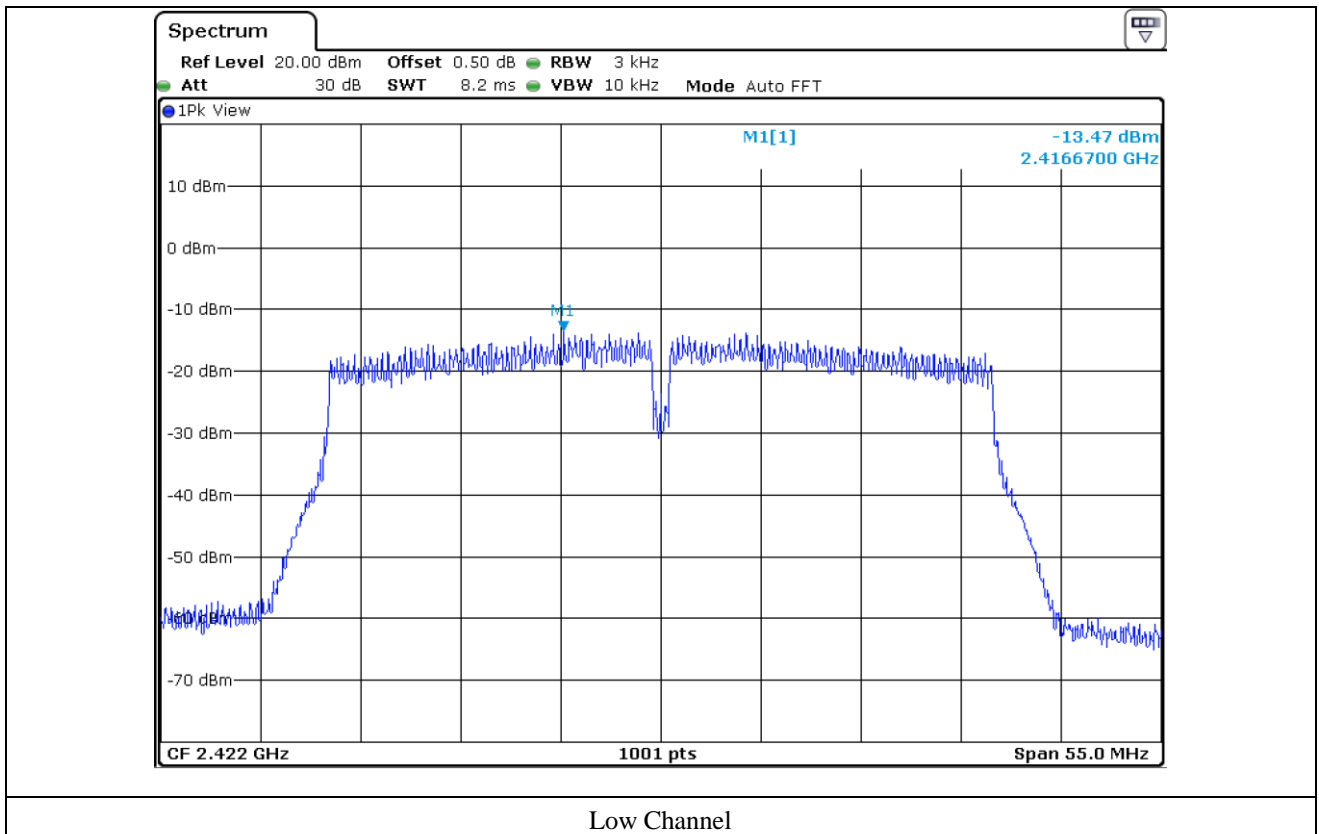
- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

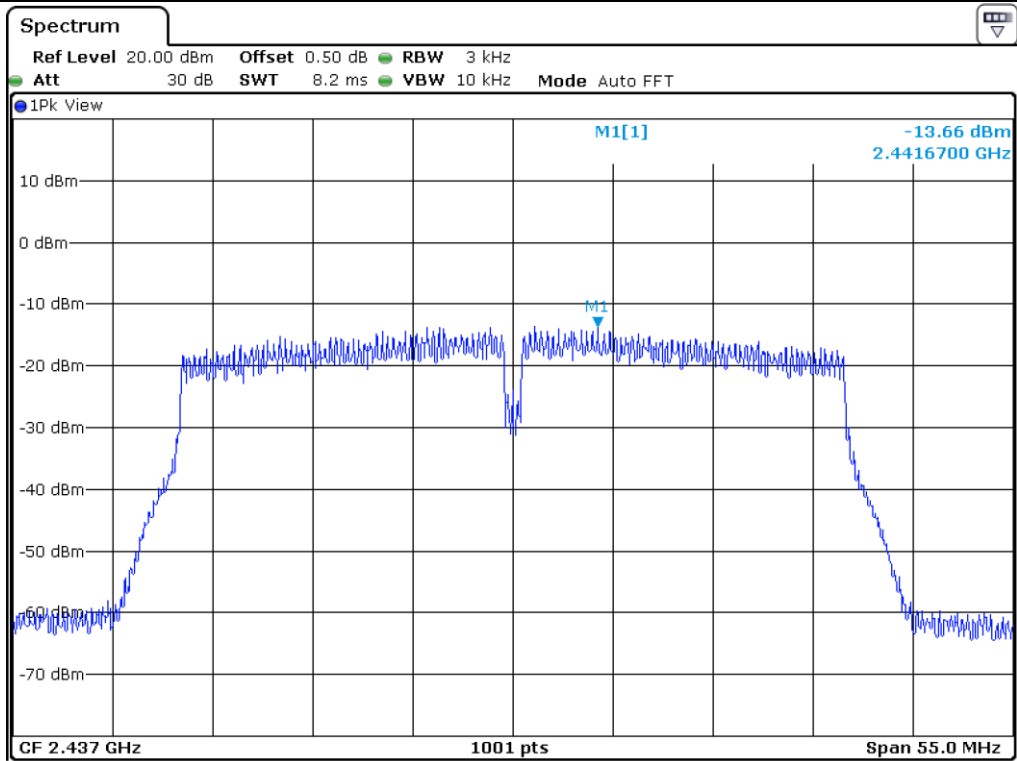
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-13.47	8.00	21.47
Middle	2 437.00	-13.66	8.00	21.66
High 9	2 452.00	-13.87	8.00	21.87
High 10	2 457.00	-15.20	8.00	23.20
High 11	2 462.00	-17.26	8.00	25.26

Remark. Margin = Limit – Measured value

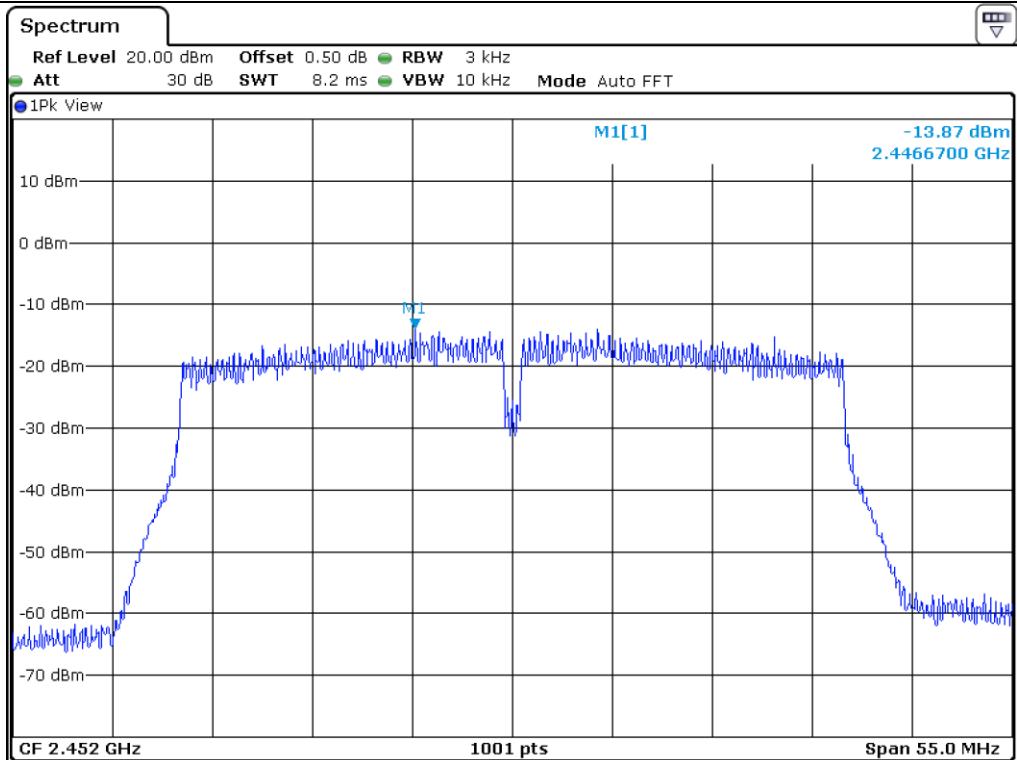


Tested by: Tae-Ho, Kim / Senior Manager

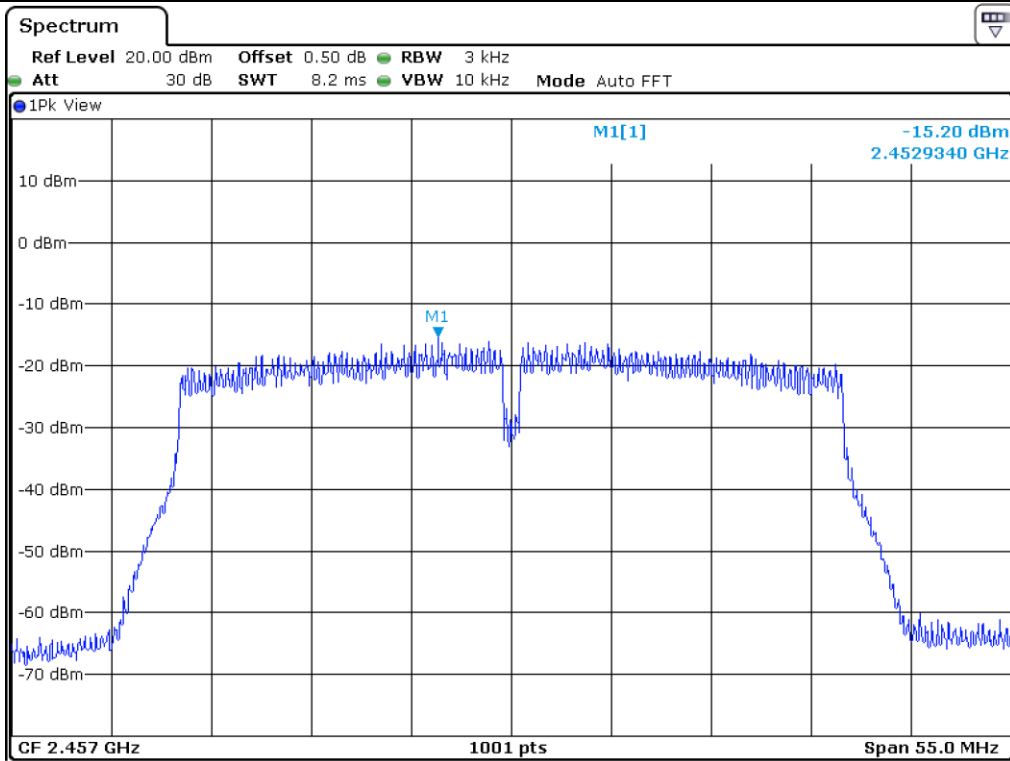




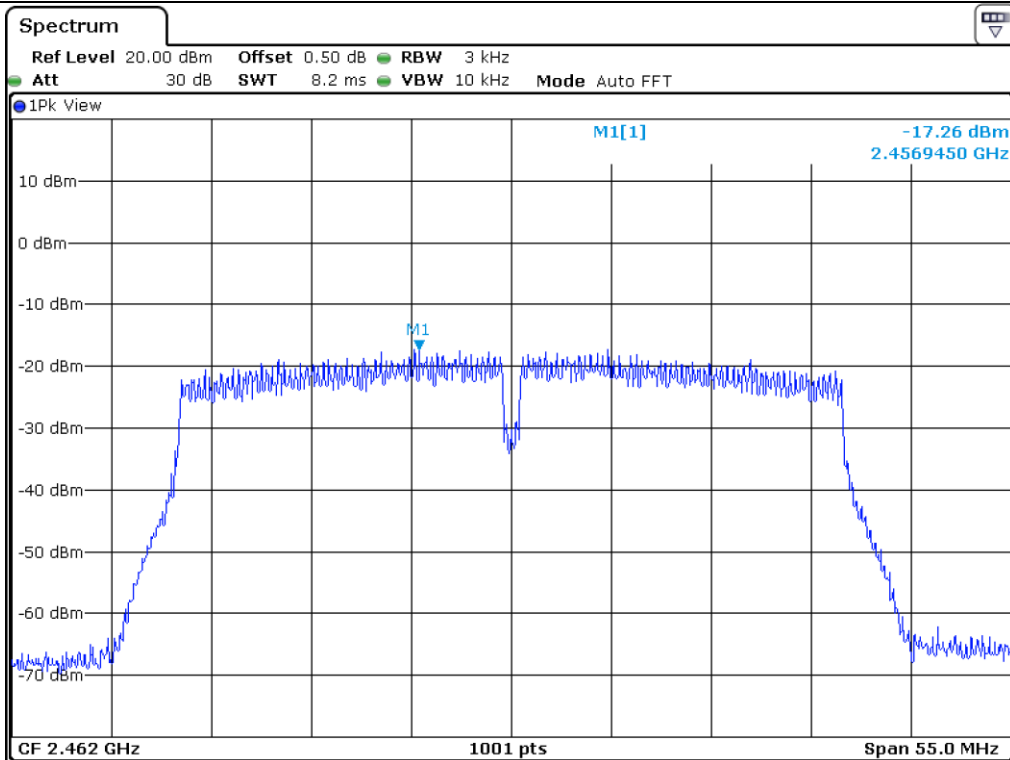
Middle Channel



High Channel 9



High Channel 10



High Channel 11

10.7.3 Test data for Multiple Transmit

- Test Date : September 28, 2018 ~ October 24, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-10.39	8.00	18.39
Middle	2 437.00	-10.42	8.00	18.42
High 9	2 452.00	-10.90	8.00	18.90
High 10	2 457.00	-12.54	8.00	20.54
High 11	2 462.00	-14.11	8.00	22.11

Remark 1 : Margin = Limit – Measured value

Remark 2 : Calculated Power Density = $10\log (10^{(\text{Antenna 0 Power Density}/10)}+10^{(\text{Antenna 1 Power Density}/10)})$

Remark 3 : Directional gain = $10*\log[(10^{G0/20}+10^{G1/20})^2/N]$ dBi



Tested by: Tae-Ho, Kim / Senior Manager

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % 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 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. 14, 2018 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 29, 2018 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 28, 2018 (1Y)
■ - BBV 9718 B	Schwarzbeck	Amplifier	009	Mar. 16, 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	777	Apr. 13, 2018 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data

11.4.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 46 % R.H. Temperature: 25 °C

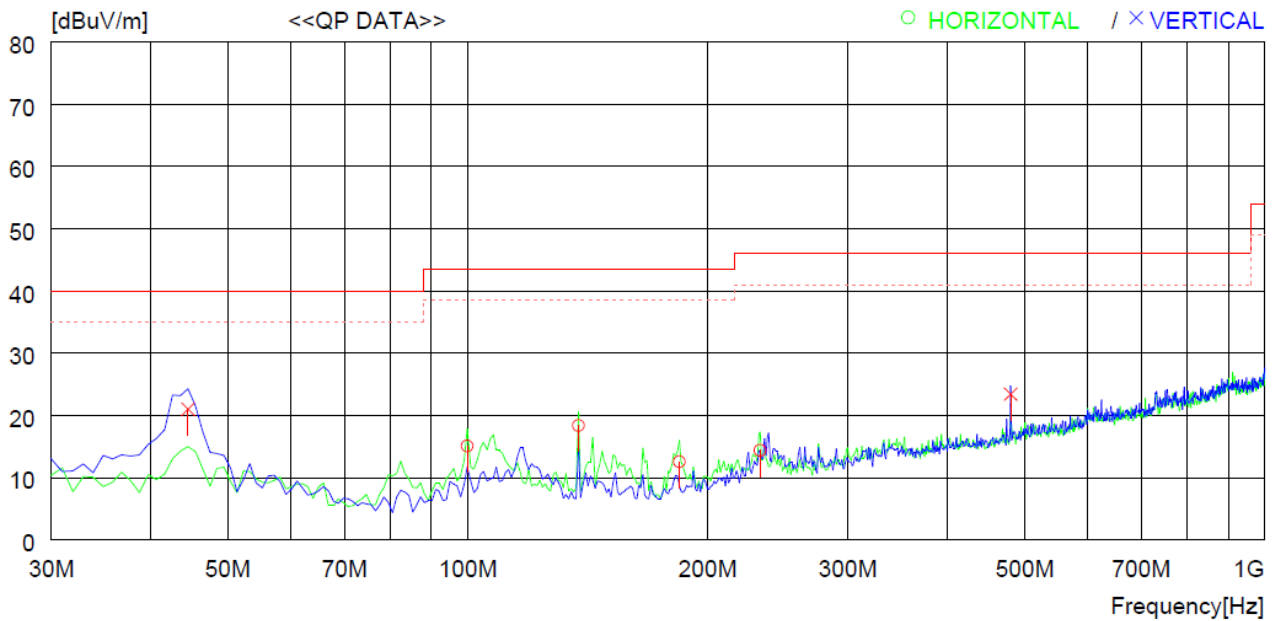
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED


EUT : Wi-Fi/BT Transceiver Date: September 28, 2018 ~ October 24, 2018

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

-Antenna 0, Antenna 1 and Multiple transmit tested, but the worst data were recorded.



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	99.840	33.7	12.1	2.3	33.0	15.1	43.5	28.4	400	0
2	137.670	40.1	8.6	2.7	33.0	18.4	43.5	25.1	400	160
3	184.230	32.5	10.0	3.1	33.0	12.6	43.5	30.9	400	0
4	232.730	31.8	12.0	3.5	32.9	14.4	46.0	31.6	400	0
---- Vertical ----										
5	44.550	38.5	14.1	1.5	33.1	21.0	40.0	19.0	300	12
6	480.081	34.6	16.9	5.1	33.2	23.4	46.0	22.6	300	54


Tested by: Tae-Ho, Kim / Senior Manager

11.4.2 Test data for Below 30 MHz


- . Test Date : September 28, 2018 ~ October 24, 2018
- . 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 : September 28, 2018 ~ October 24, 2018
- . 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: Tae-Ho, Kim / Senior Manager

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 25 °C
 Relative humidity : 46 % R.H.

12.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

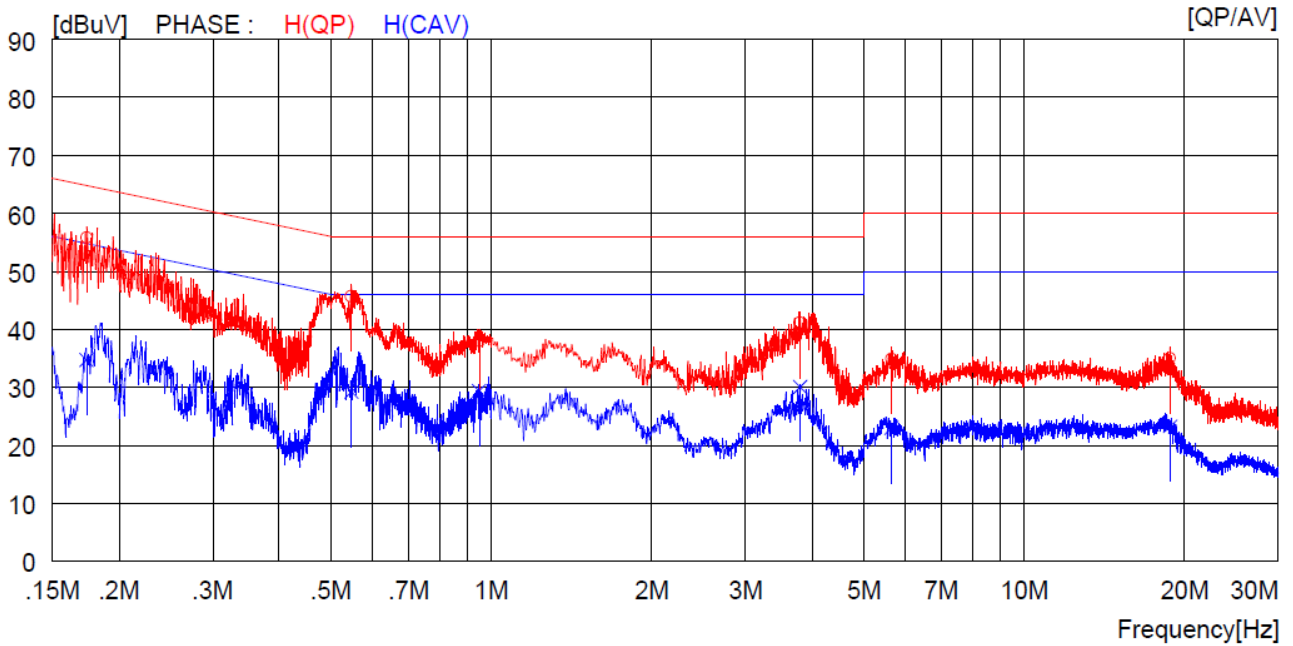
12.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ - ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 22, 2018 (1Y)
□ - ESHS10	Rohde & Schwarz	Test Receiver	834467/007	Mar. 29, 2018 (1Y)
□ - NSLK8128	Schwarzbeck	AMN	8128-216	Mar. 29, 2018 (1Y)
■ - NSLK8126	Schwarzbeck	AMN	8126-404	Apr. 04, 2018 (1Y)
□ - 3825/2	EMCO	AMN	9109-1869	Apr. 11, 2018 (1Y)
■ - 3825/2	EMCO	AMN	9109-1867	Mar. 28, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

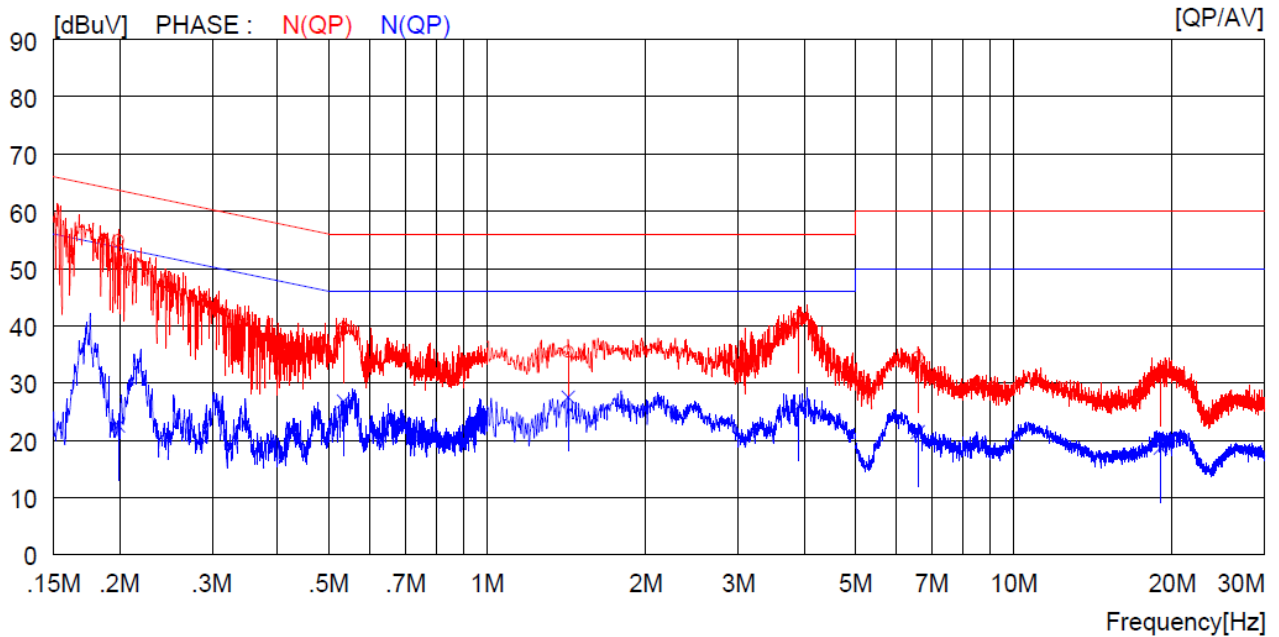
12.4 Test data

- Test Date : September 28, 2018 ~ October 24, 2018
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE
- Antenna 0, Antenna 1 and Multiple transmit tested, but the worst data were recorded.



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.17400	45.9	----	9.9	55.8	----	64.8	----	9.0	----	H (QP)
2	0.54600	35.7	----	10.0	45.7	----	56.0	----	10.3	----	H (QP)
3	0.94900	28.0	----	10.0	38.0	----	56.0	----	18.0	----	H (QP)
4	3.79600	30.9	----	10.2	41.1	----	56.0	----	14.9	----	H (QP)
5	5.63500	24.7	----	10.2	34.9	----	60.0	----	25.1	----	H (QP)
6	18.80000	24.6	----	10.4	35.0	----	60.0	----	25.0	----	H (QP)
7	0.17400	----	24.8	9.9	----	34.7	----	54.8	----	20.1	H (CAV)
8	0.54600	----	19.2	10.0	----	29.2	----	46.0	----	16.8	H (CAV)
9	0.94900	----	19.4	10.0	----	29.4	----	46.0	----	16.6	H (CAV)
10	3.79600	----	19.9	10.2	----	30.1	----	46.0	----	15.9	H (CAV)
11	5.63500	----	12.8	10.2	----	23.0	----	50.0	----	27.0	H (CAV)
12	18.80000	----	12.9	10.4	----	23.3	----	50.0	----	26.7	H (CAV)

- Test Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19900	45.0	----	9.9	54.9	----	63.7	----	8.8	----	N(QP)
2	0.53300	29.5	----	10.0	39.5	----	56.0	----	16.5	----	N(QP)
3	1.42400	25.5	----	10.0	35.5	----	56.0	----	20.5	----	N(QP)
4	3.90400	31.1	----	10.2	41.3	----	56.0	----	14.7	----	N(QP)
5	6.57500	24.2	----	10.2	34.4	----	60.0	----	25.6	----	N(QP)
6	19.03000	21.5	----	10.4	31.9	----	60.0	----	28.1	----	N(QP)
7	0.19900	----	12.7	9.9	----	22.6	----	53.7	----	31.1	N(CAV)
8	0.53300	----	16.8	10.0	----	26.8	----	46.0	----	19.2	N(CAV)
9	1.42400	----	17.5	10.0	----	27.5	----	46.0	----	18.5	N(CAV)
10	3.90400	----	15.8	10.2	----	26.0	----	46.0	----	20.0	N(CAV)
11	6.57500	----	11.2	10.2	----	21.4	----	50.0	----	28.6	N(CAV)
12	19.03000	----	8.3	10.4	----	18.7	----	50.0	----	31.3	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Tae-Ho, Kim / Senior Manager