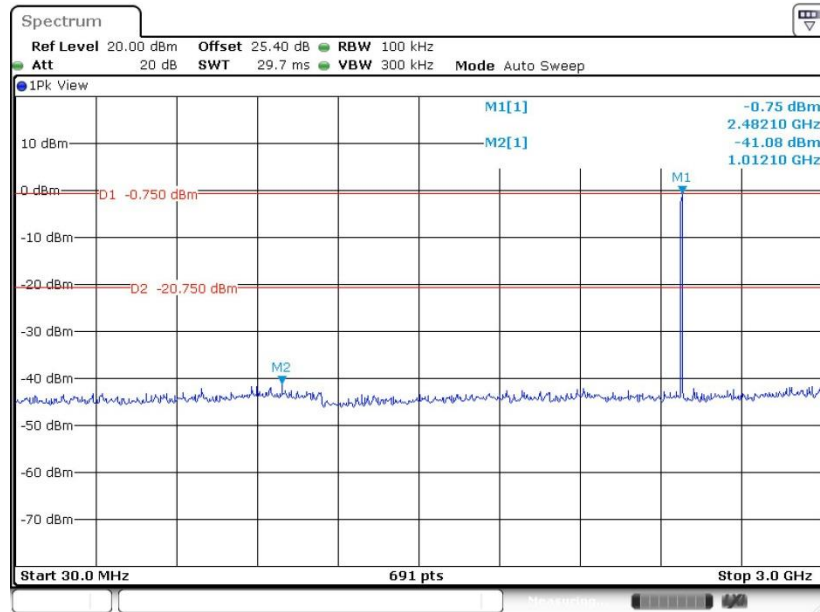
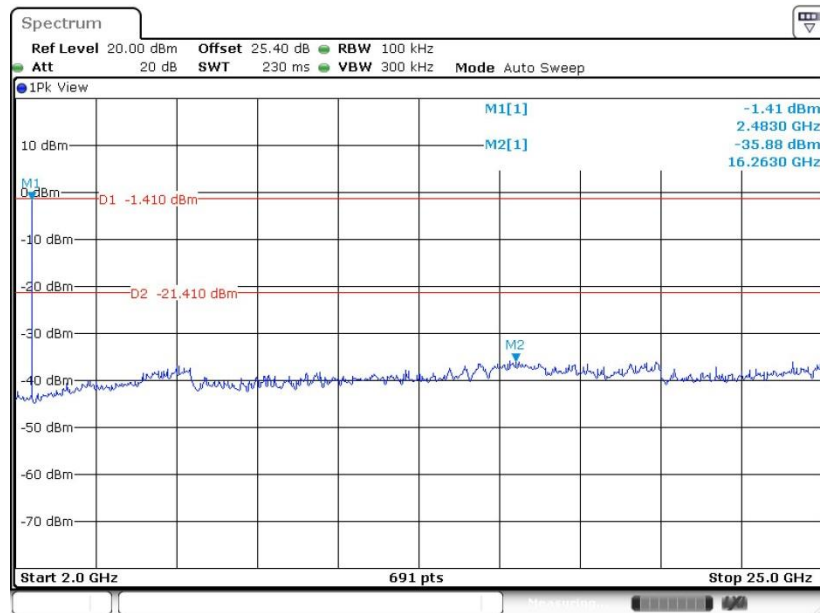


**CSE Plot on Ch 78 between 30MHz ~ 3 GHz**

Date: 10.SEP.2018 01:08:19

**CSE Plot on Ch 78 between 2 GHz ~ 25 GHz**

Date: 10.SEP.2018 01:08:53

### 3.8 Radiated Band Edges and Spurious Emission Measurement

#### 3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

#### 3.8.2 Measuring Instruments

See list of measuring equipment of this test report.

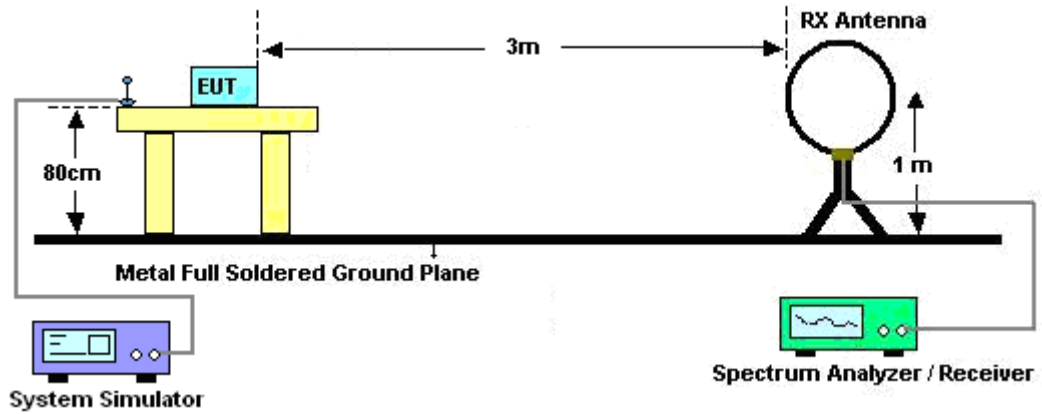
### 3.8.3 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for  $f < 1$  GHz, RBW=1MHz for  $f > 1$ GHz ; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
  - (3) For average measurement: use duty cycle correction factor method per 15.35(c).  
Duty cycle = On time/100 milliseconds  
On time =  $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$   
Where  $N_1$  is number of type 1 pulses,  $L_1$  is length of type 1 pulses, etc.  
Average Emission Level = Peak Emission Level +  $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

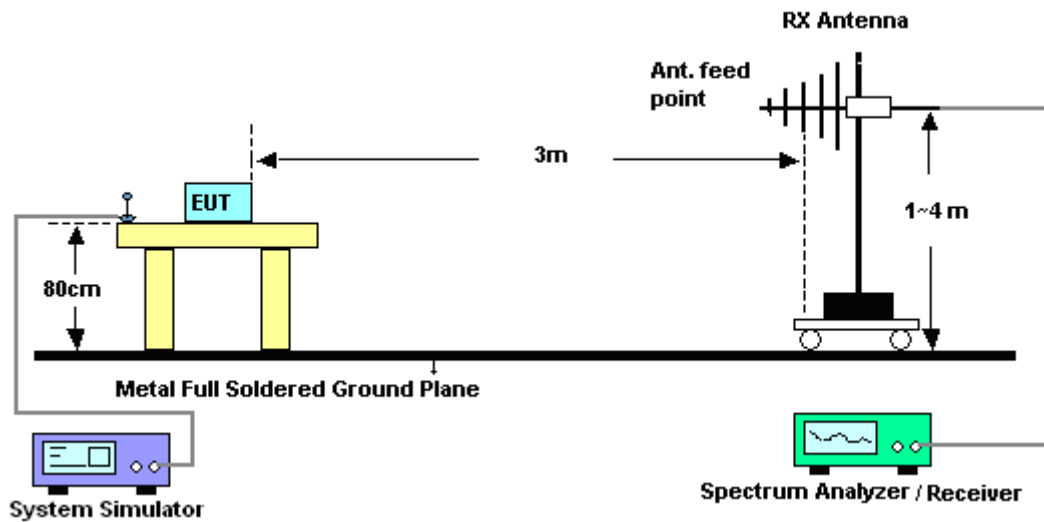
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from  $20 \log(\text{dwell time}/100\text{ms})$ . This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

### 3.8.4 Test Setup

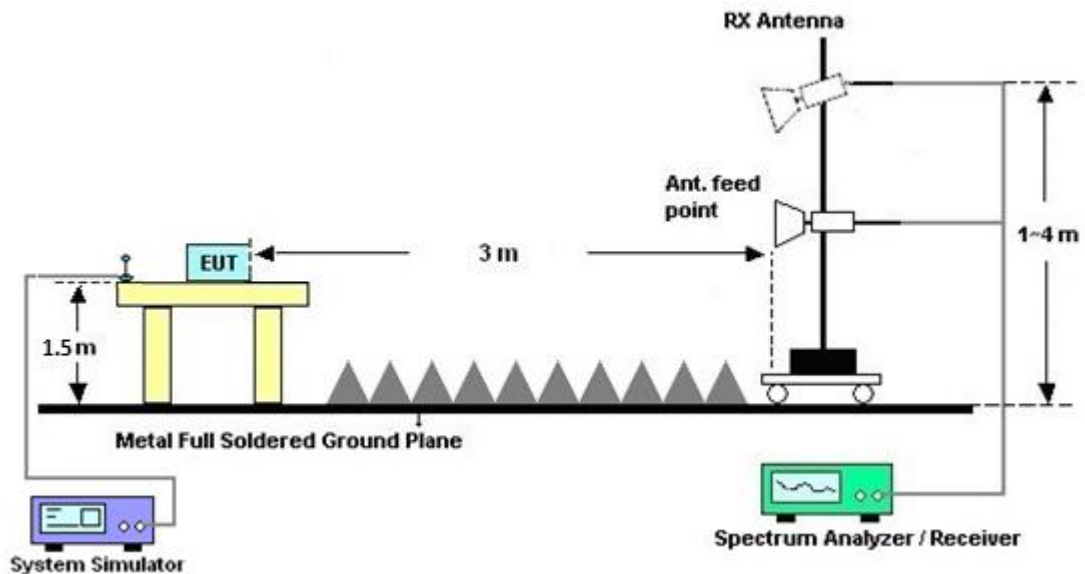
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



### 3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

### 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

### 3.8.7 Duty Cycle

Please refer to Appendix D.

### 3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix B and C.

### 3.9 AC Conducted Emission Measurement

#### 3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

For terminal test result, the testing follows FCC KDB 174176.

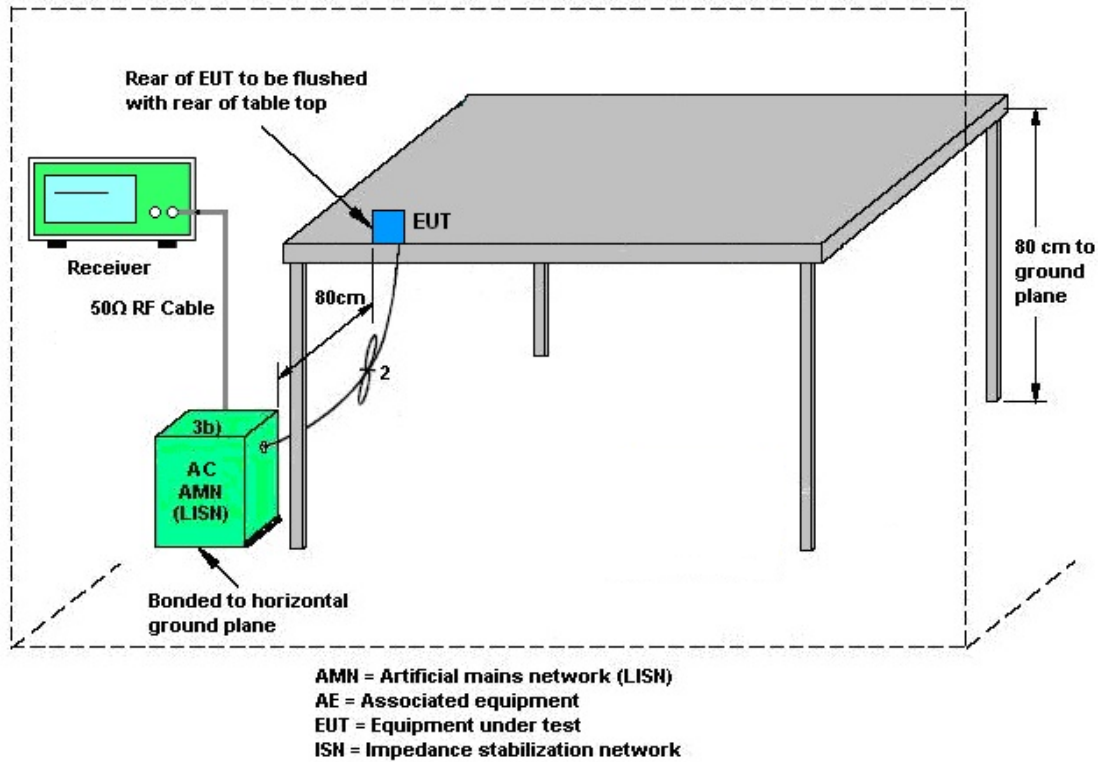
#### 3.9.2 Measuring Instruments

See list of measuring equipment of this test report.

#### 3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

### 3.9.4 Test Setup



### 3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



## **3.10 Antenna Requirements**

### **3.10.1 Standard Applicable**

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

### **3.10.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.10.3 Antenna Gain**

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.





## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Agilent	E4416A	GB41292344	N/A	Dec. 20, 2017	Sep. 04, 2018 ~ Sep. 10, 2018	Dec. 19, 2018	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Dec. 20, 2017	Sep. 04, 2018 ~ Sep. 10, 2018	Dec. 19, 2018	Conducted (TH05-HY)
BT Base Station (Measure)	Rohde & Schwarz	CBT	101136	BT 3.0	Sep. 20, 2017	Sep. 04, 2018 ~ Sep. 10, 2018	Sep. 19, 2018	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 07, 2017	Sep. 04, 2018 ~ Sep. 10, 2018	Nov. 06, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Mar. 01, 2018	Sep. 04, 2018 ~ Sep. 10, 2018	Feb. 28, 2019	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Aug. 07, 2018 ~ Aug. 11, 2018	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9KHz~3.6GHz	Dec. 08, 2017	Aug. 07, 2018 ~ Aug. 11, 2018	Dec. 07, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 30, 2017	Aug. 07, 2018 ~ Aug. 11, 2018	Nov. 29, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 08, 2017	Aug. 07, 2018 ~ Aug. 11, 2018	Dec. 07, 2018	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Aug. 07, 2018 ~ Aug. 11, 2018	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 03, 2018	Aug. 07, 2018 ~ Aug. 11, 2018	Jan. 02, 2019	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 03, 2018	Aug. 07, 2018 ~ Aug. 11, 2018	Jan. 02, 2019	Conduction (CO05-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	35419&03	30MHz to 1GHz	Dec. 18, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Dec. 17, 2018	Radiation (03CH07-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz~18GHz	Aug. 06, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Aug. 05, 2019	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Nov. 10, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Nov. 09, 2018	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz ~ 18GHz	Apr. 25, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Apr. 24, 2019	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	May 21, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	May 20, 2019	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Oct. 30, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Oct. 29, 2018	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Apr. 17, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Apr. 16, 2019	Radiation (03CH07-HY)
Filter	Microwave	H1G013G1	SN477215	1.0G High Pass	Dec. 07, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Dec. 06, 2018	Radiation (03CH07-HY)
Filter	Wainwright	WLKS1200-8S S	SN3	1.2G Low Pass	Nov. 21, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Nov. 20, 2018	Radiation (03CH07-HY)
Filter	Microwave	H3G018G1	SN477220	3.0G High Pass	Nov. 21, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Nov. 20, 2018	Radiation (03CH07-HY)
Filter	Microwave	WHKX7.0/26.5 G-6SS	SN4	7G High Pass	Nov. 21, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Nov. 20, 2018	Radiation (03CH07-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4, MY28655/4	9KHz~30MHz	Jan. 02, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Jan. 01, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4, MY24971/4, MY15682/4	30MHz~1GHz	Feb. 27, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Feb. 26, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4, MY24971/4, MY15682/4	1GHz~18GHz	Feb. 27, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Feb. 26, 2019	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 27, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Feb. 26, 2019	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Aug. 07, 2018 ~ Sep. 05, 2018	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Aug. 07, 2018 ~ Sep. 05, 2018	N/A	Radiation (03CH07-HY)
Amplifier	MITEQ	TTA1840-35-H G	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 16, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Jul. 15, 2019	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA91702 51	18GHz- 40GHz	Nov. 10, 2017	Aug. 07, 2018 ~ Sep. 05, 2018	Nov. 09, 2018	Radiation (03CH07-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY5329005 3	20Hz to 26.5GHz	Jan. 16, 2018	Aug. 07, 2018 ~ Sep. 05, 2018	Jan. 15, 2019	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	8050400465 6H	N/A	N/A	Aug. 07, 2018 ~ Sep. 05, 2018	N/A	Radiation (03CH07-HY)

## 5 Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ )	2.2
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ )	5.7
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ )	5.5
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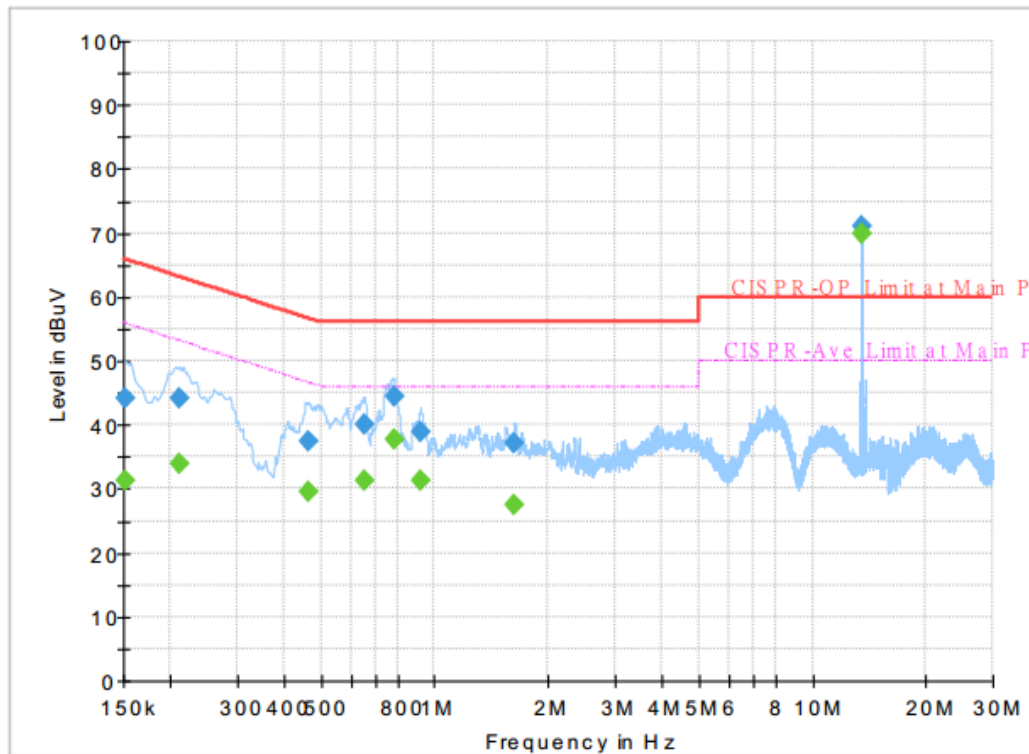
### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ )	5.2
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## Appendix A. AC Conducted Emission Test Results

<Original test result with NFC antenna>

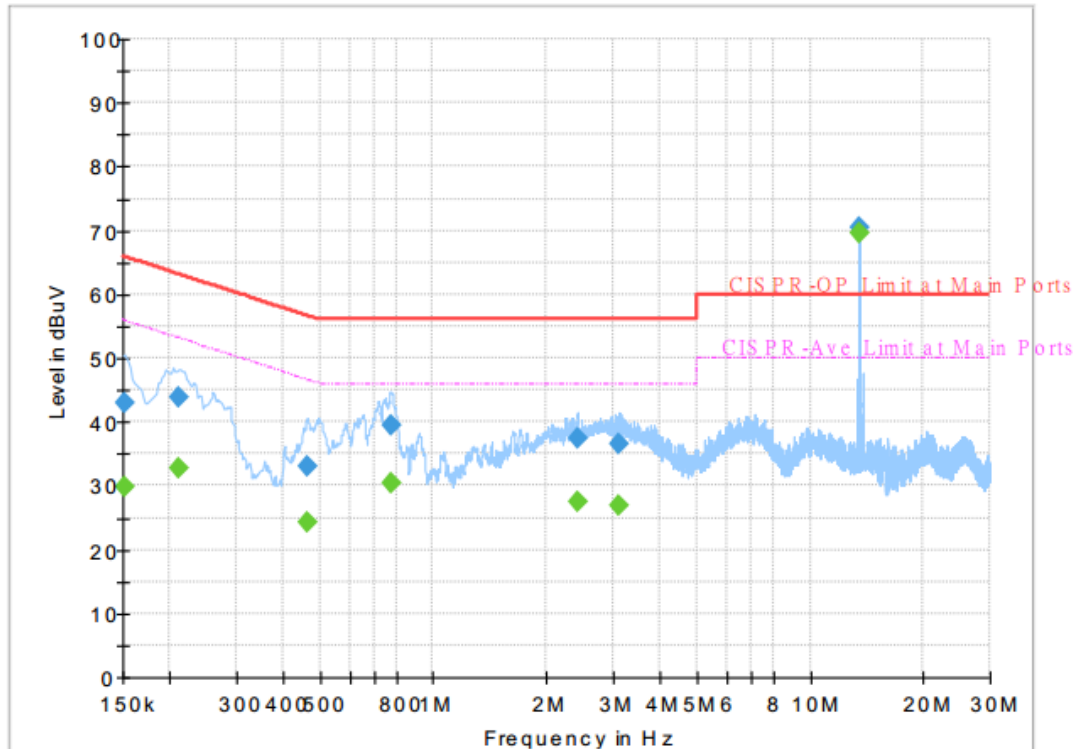
Test Mode :	Mode 1	Temperature :	25~27°C
Test Engineer :	Kai-Chun Chu	Relative Humidity :	50~52%
Test Voltage :	120Vac / 60Hz	Phase :	Line



### Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	31.25	55.88	24.63	L1	OFF	19.5
0.152250	44.13	---	65.88	21.75	L1	OFF	19.5
0.210750	---	34.00	53.18	19.18	L1	OFF	19.5
0.210750	44.23	---	63.18	18.95	L1	OFF	19.5
0.462750	---	29.63	46.64	17.01	L1	OFF	19.5
0.462750	37.37	---	56.64	19.27	L1	OFF	19.5
0.649500	---	31.17	46.00	14.83	L1	OFF	19.5
0.649500	40.12	---	56.00	15.88	L1	OFF	19.5
0.780000	---	37.77	46.00	8.23	L1	OFF	19.5
0.780000	44.48	---	56.00	11.52	L1	OFF	19.5
0.919500	---	31.21	46.00	14.79	L1	OFF	19.5
0.919500	38.82	---	56.00	17.18	L1	OFF	19.5
1.630500	---	27.49	46.00	18.51	L1	OFF	19.6
1.630500	37.08	---	56.00	18.92	L1	OFF	19.6
13.560000	---	70.00	50.00	-20.00	L1	OFF	19.7
13.560000	70.91	---	60.00	-10.91	L1	OFF	19.7

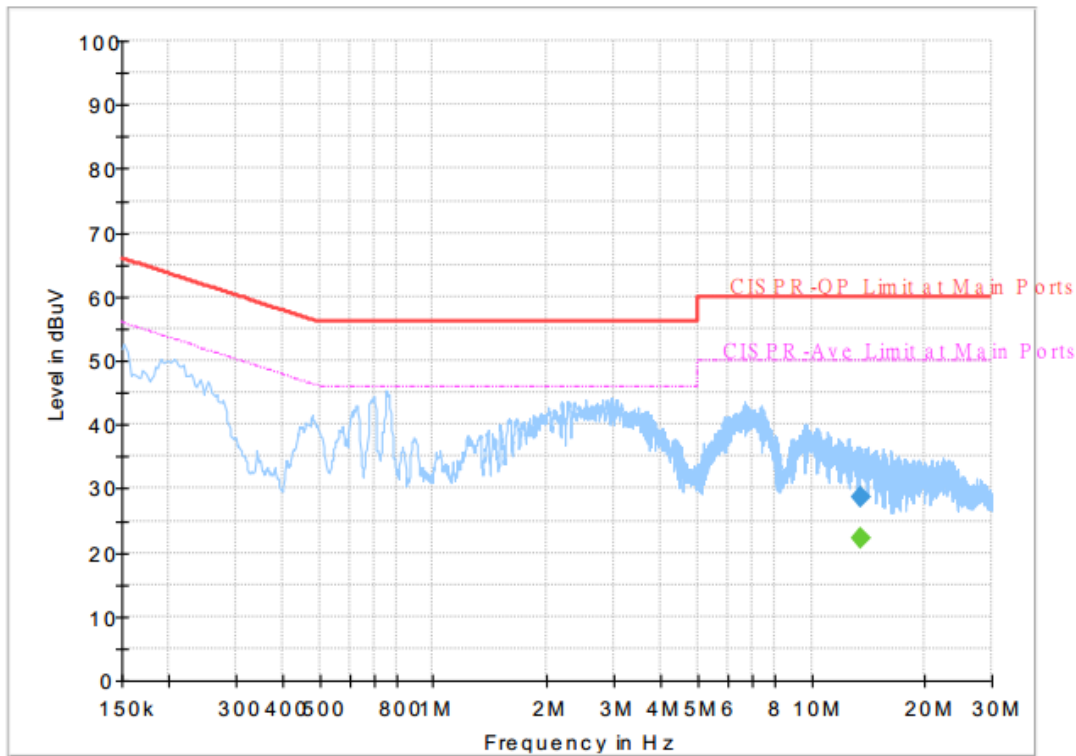
<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	29.87	55.88	26.01	N	OFF	19.5
0.152250	42.92	---	65.88	22.96	N	OFF	19.5
0.210750	---	32.68	53.18	20.50	N	OFF	19.5
0.210750	43.89	---	63.18	19.29	N	OFF	19.5
0.462750	---	24.15	46.64	22.49	N	OFF	19.5
0.462750	33.12	---	56.64	23.52	N	OFF	19.5
0.771000	---	30.42	46.00	15.58	N	OFF	19.5
0.771000	39.34	---	56.00	16.66	N	OFF	19.5
2.411250	---	27.51	46.00	18.49	N	OFF	19.5
2.411250	37.31	---	56.00	18.69	N	OFF	19.5
3.124500	---	26.82	46.00	19.18	N	OFF	19.6
3.124500	36.60	---	56.00	19.40	N	OFF	19.6
13.560000	---	69.52	50.00	-19.52	N	OFF	19.8
13.560000	70.59	---	60.00	-10.59	N	OFF	19.8

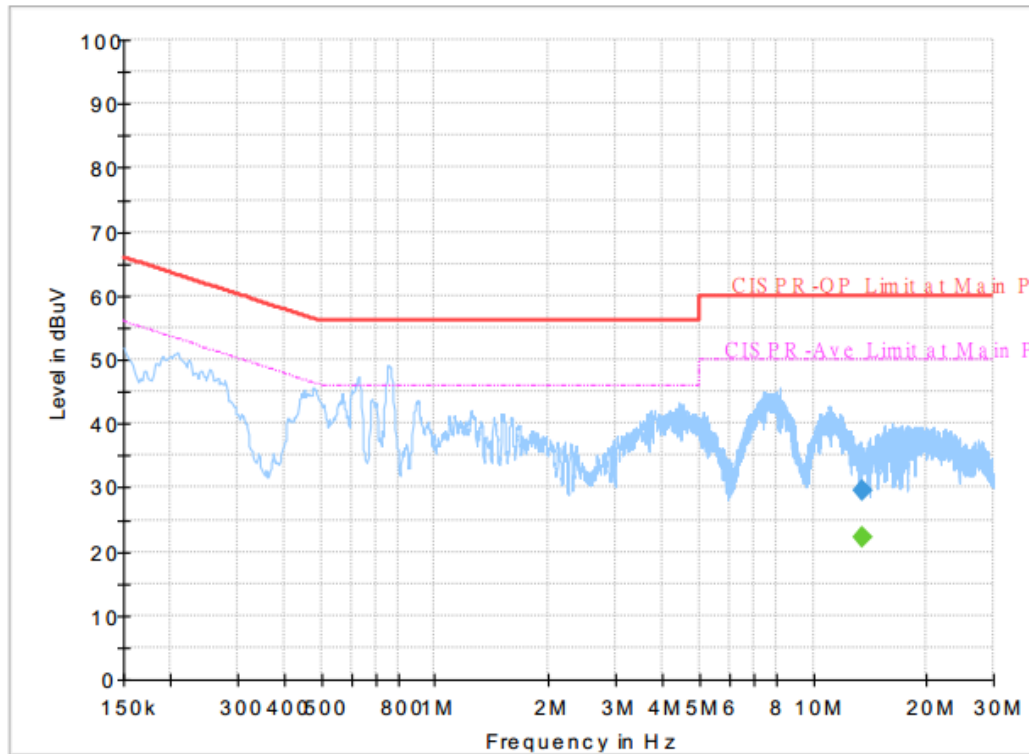
**<Terminal test result with dummy load>**

<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
13.560000	---	22.20	50.00	27.80	L1	OFF	19.7
13.560000	28.57	---	60.00	31.43	L1	OFF	19.7

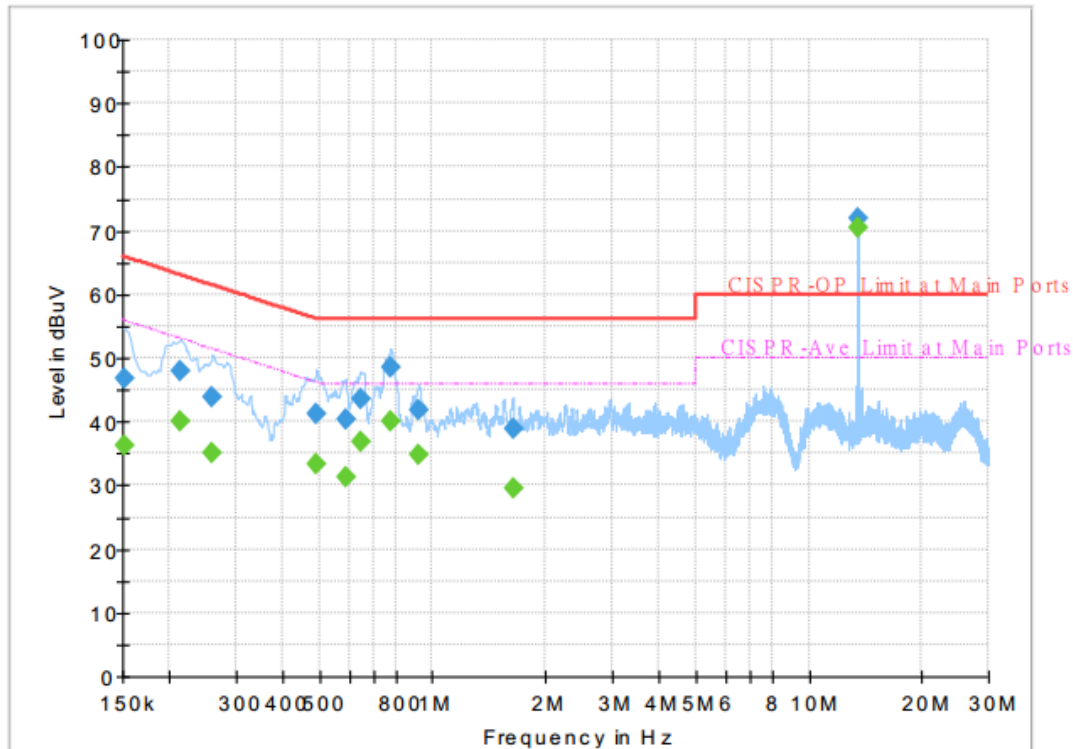
<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
13.560000	---	22.27	50.00	27.73	N	OFF	19.8
13.560000	29.39	---	60.00	30.61	N	OFF	19.8

**<Original test result with NFC antenna>**

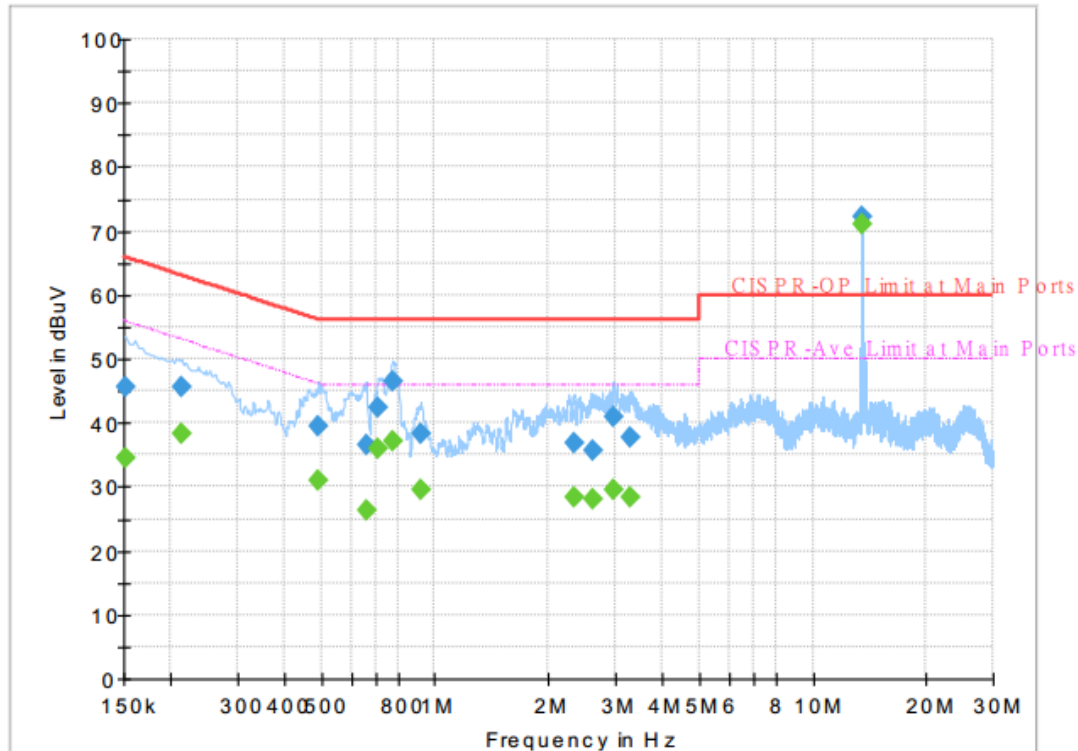
<b>Test Mode :</b>	Mode 2	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	36.20	55.88	19.68	L1	OFF	19.5
0.152250	46.85	---	65.88	19.03	L1	OFF	19.5
0.213000	---	40.19	53.09	12.90	L1	OFF	19.5
0.213000	48.09	---	63.09	15.00	L1	OFF	19.5
0.260250	---	35.09	51.42	16.33	L1	OFF	19.5
0.260250	43.76	---	61.42	17.66	L1	OFF	19.5
0.492000	---	33.25	46.13	12.88	L1	OFF	19.5
0.492000	41.28	---	56.13	14.85	L1	OFF	19.5
0.586500	---	31.28	46.00	14.72	L1	OFF	19.5
0.586500	40.21	---	56.00	15.79	L1	OFF	19.5
0.642750	---	36.84	46.00	9.16	L1	OFF	19.5
0.642750	43.59	---	56.00	12.41	L1	OFF	19.5
0.773250	---	40.16	46.00	5.84	L1	OFF	19.5
0.773250	48.66	---	56.00	7.34	L1	OFF	19.5
0.917250	---	34.80	46.00	11.20	L1	OFF	19.5
0.917250	41.89	---	56.00	14.11	L1	OFF	19.5
1.635000	---	29.51	46.00	16.49	L1	OFF	19.6
1.635000	38.96	---	56.00	17.04	L1	OFF	19.6
13.560000	---	70.57	50.00	-20.57	L1	OFF	19.7
13.560000	71.84	---	60.00	-11.84	L1	OFF	19.7



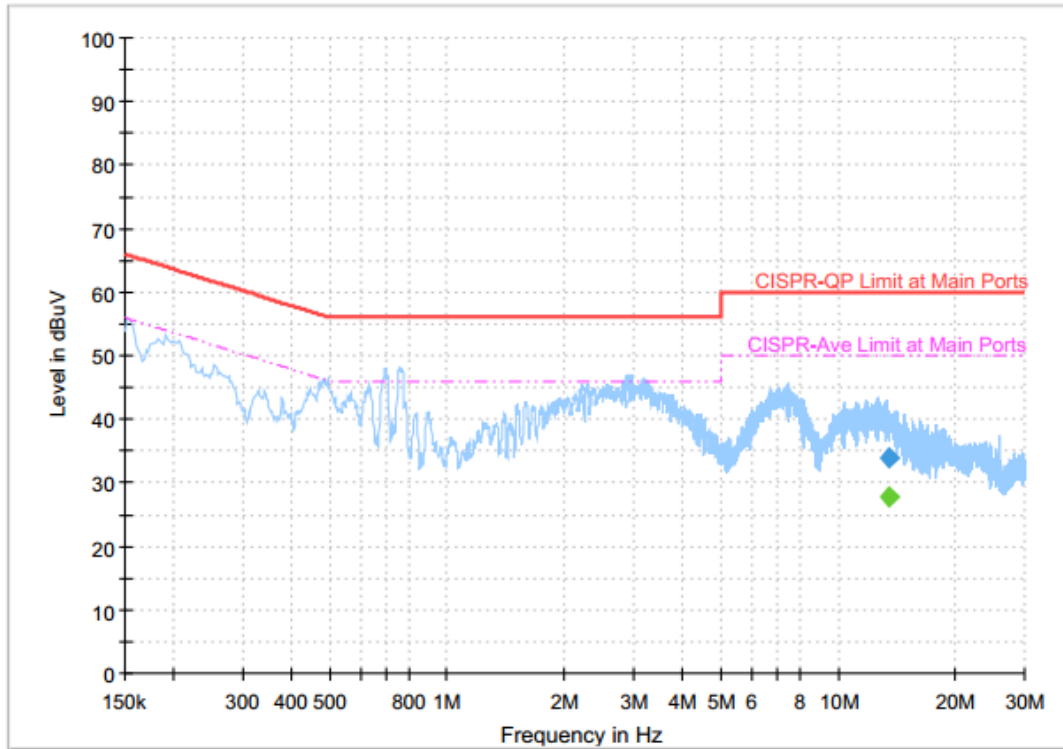
<b>Test Mode :</b>	Mode 2	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	34.58	55.88	21.30	N	OFF	19.5
0.152250	45.50	---	65.88	20.38	N	OFF	19.5
0.213000	---	38.17	53.09	14.92	N	OFF	19.5
0.213000	45.71	---	63.09	17.38	N	OFF	19.5
0.492000	---	31.02	46.13	15.11	N	OFF	19.5
0.492000	39.54	---	56.13	16.59	N	OFF	19.5
0.656250	---	26.45	46.00	19.55	N	OFF	19.5
0.656250	36.66	---	56.00	19.34	N	OFF	19.5
0.710250	---	35.90	46.00	10.10	N	OFF	19.5
0.710250	42.46	---	56.00	13.54	N	OFF	19.5
0.773250	---	37.16	46.00	8.84	N	OFF	19.5
0.773250	46.50	---	56.00	9.50	N	OFF	19.5
0.919500	---	29.43	46.00	16.57	N	OFF	19.5
0.919500	38.17	---	56.00	17.83	N	OFF	19.5
2.328000	---	28.50	46.00	17.50	N	OFF	19.5
2.328000	36.89	---	56.00	19.11	N	OFF	19.5
2.629500	---	28.03	46.00	17.97	N	OFF	19.5
2.629500	35.59	---	56.00	20.41	N	OFF	19.5
2.955750	---	29.60	46.00	16.40	N	OFF	19.6
2.955750	41.02	---	56.00	14.98	N	OFF	19.6
3.306750	---	28.48	46.00	17.52	N	OFF	19.6
3.306750	37.58	---	56.00	18.42	N	OFF	19.6
13.560000	---	70.94	50.00	-20.94	N	OFF	19.8
13.560000	72.12	---	60.00	-12.12	N	OFF	19.8

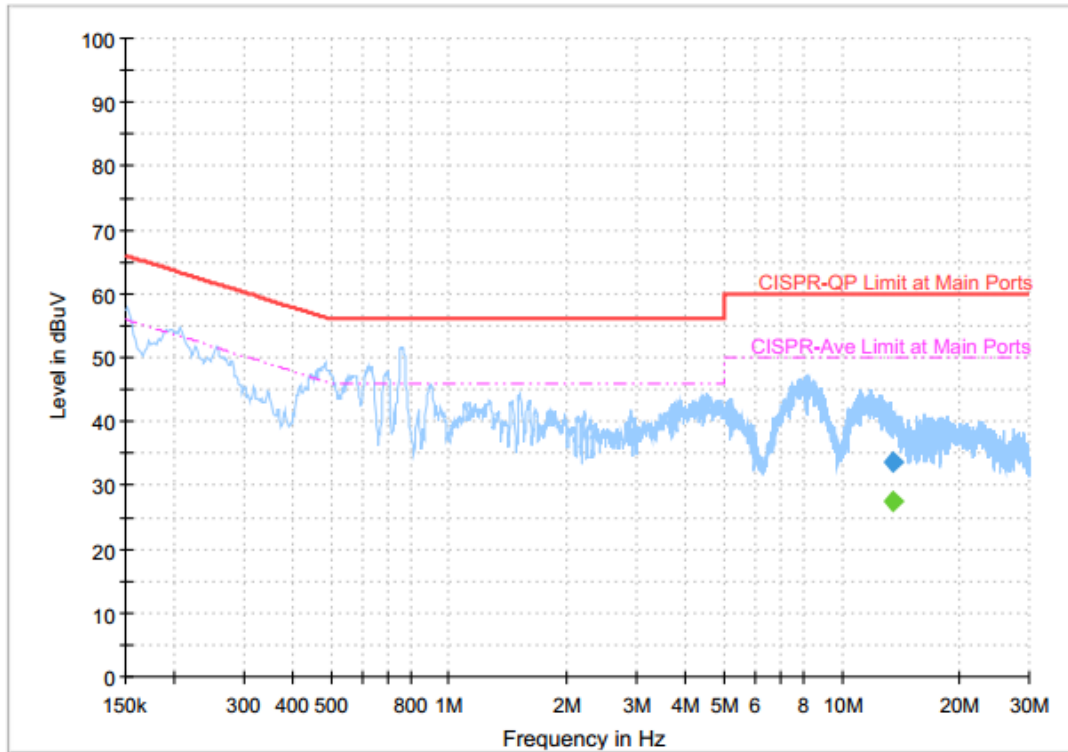
**<Terminal test result with dummy load>**

<b>Test Mode :</b>	Mode 2	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
13.560000	---	27.73	50.00	22.27	L1	OFF	19.7
13.560000	33.82	---	60.00	26.18	L1	OFF	19.7

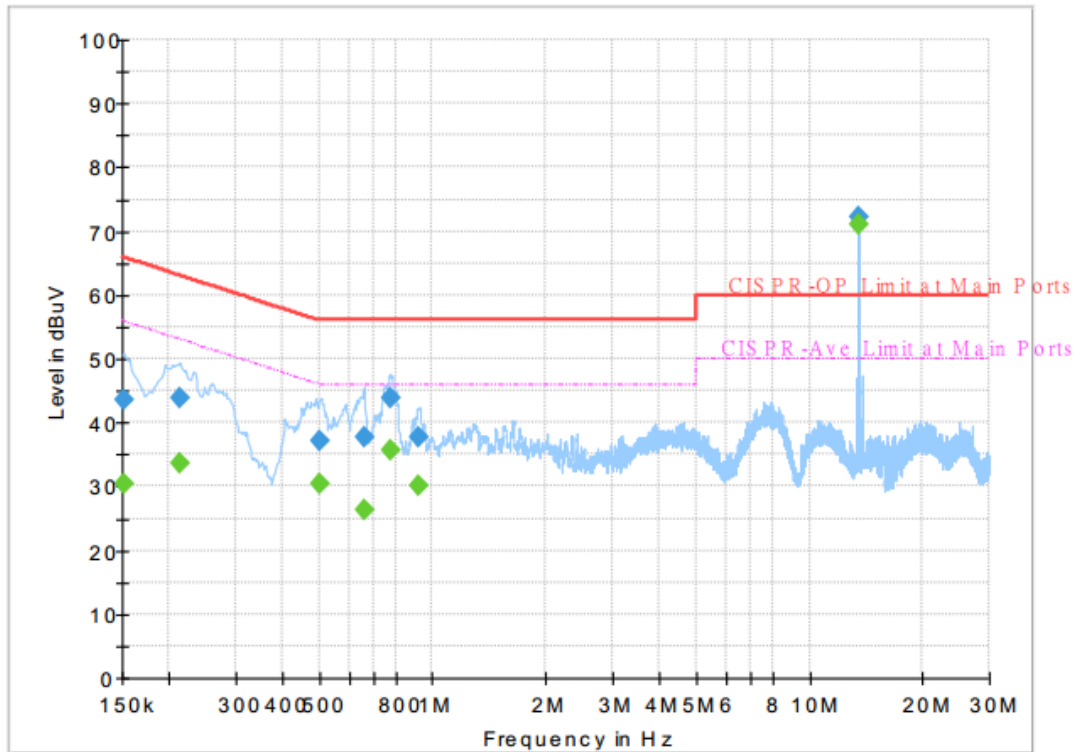
<b>Test Mode :</b>	Mode 2	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
13.560000	---	27.56	50.00	22.44	N	OFF	19.8
13.560000	33.69	---	60.00	26.31	N	OFF	19.8

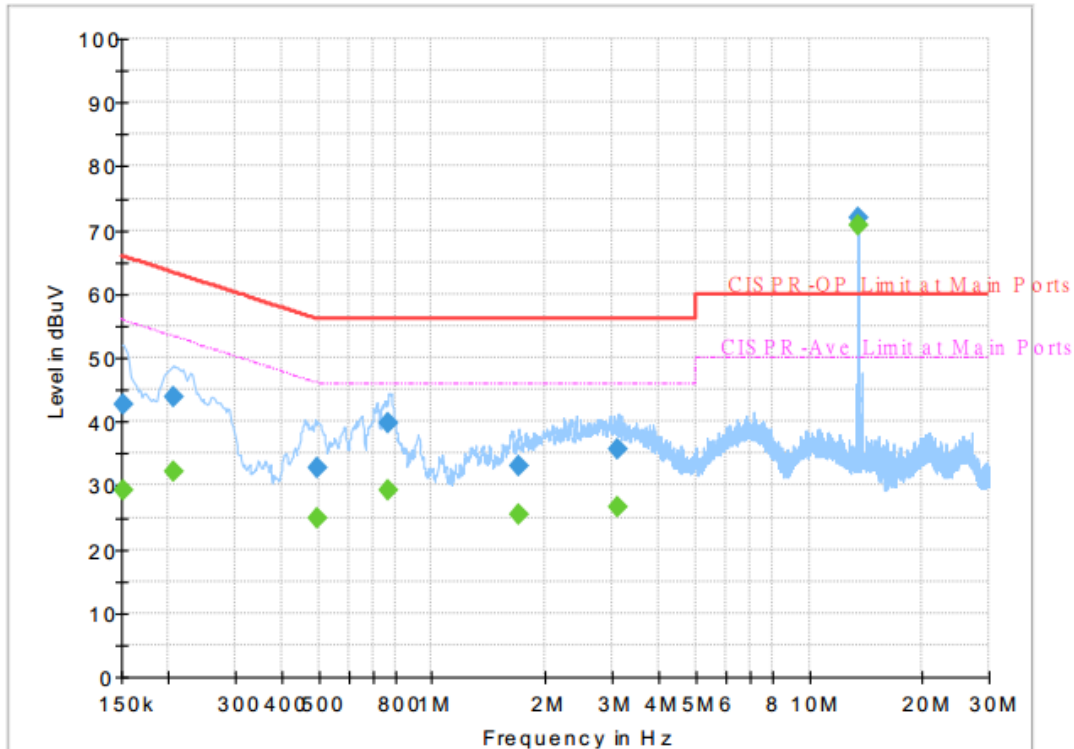
**<Original test result with NFC antenna>**

<b>Test Mode :</b>	Mode 3	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	30.37	55.88	25.51	L1	OFF	19.5
0.152250	43.59	---	65.88	22.29	L1	OFF	19.5
0.213000	---	33.56	53.09	19.53	L1	OFF	19.5
0.213000	43.99	---	63.09	19.10	L1	OFF	19.5
0.503250	---	30.33	46.00	15.67	L1	OFF	19.5
0.503250	37.02	---	56.00	18.98	L1	OFF	19.5
0.656250	---	26.42	46.00	19.58	L1	OFF	19.5
0.656250	37.76	---	56.00	18.24	L1	OFF	19.5
0.773250	---	35.61	46.00	10.39	L1	OFF	19.5
0.773250	43.77	---	56.00	12.23	L1	OFF	19.5
0.921750	---	30.21	46.00	15.79	L1	OFF	19.5
0.921750	37.83	---	56.00	18.17	L1	OFF	19.5
13.560000	---	71.16	50.00	-21.16	L1	OFF	19.7
13.560000	72.11	---	60.00	-12.11	L1	OFF	19.7

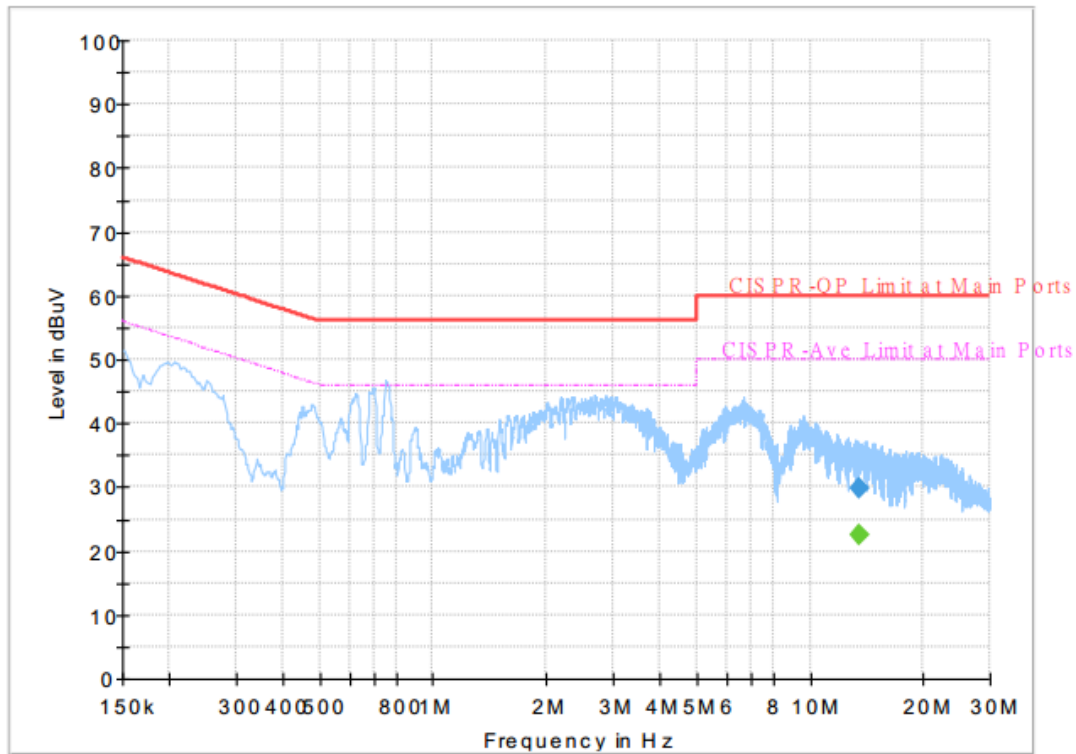
<b>Test Mode :</b>	Mode 3	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	29.18	55.88	26.70	N	OFF	19.5
0.152250	42.59	---	65.88	23.29	N	OFF	19.5
0.206250	---	32.19	53.36	21.17	N	OFF	19.5
0.206250	44.00	---	63.36	19.36	N	OFF	19.5
0.494250	---	24.76	46.10	21.34	N	OFF	19.5
0.494250	32.68	---	56.10	23.42	N	OFF	19.5
0.768750	---	29.36	46.00	16.64	N	OFF	19.5
0.768750	39.72	---	56.00	16.28	N	OFF	19.5
1.698000	---	25.48	46.00	20.52	N	OFF	19.5
1.698000	33.12	---	56.00	22.88	N	OFF	19.5
3.124500	---	26.62	46.00	19.38	N	OFF	19.6
3.124500	35.58	---	56.00	20.42	N	OFF	19.6
13.560000	---	70.80	50.00	-20.80	N	OFF	19.8
13.560000	71.89	---	60.00	-11.89	N	OFF	19.8

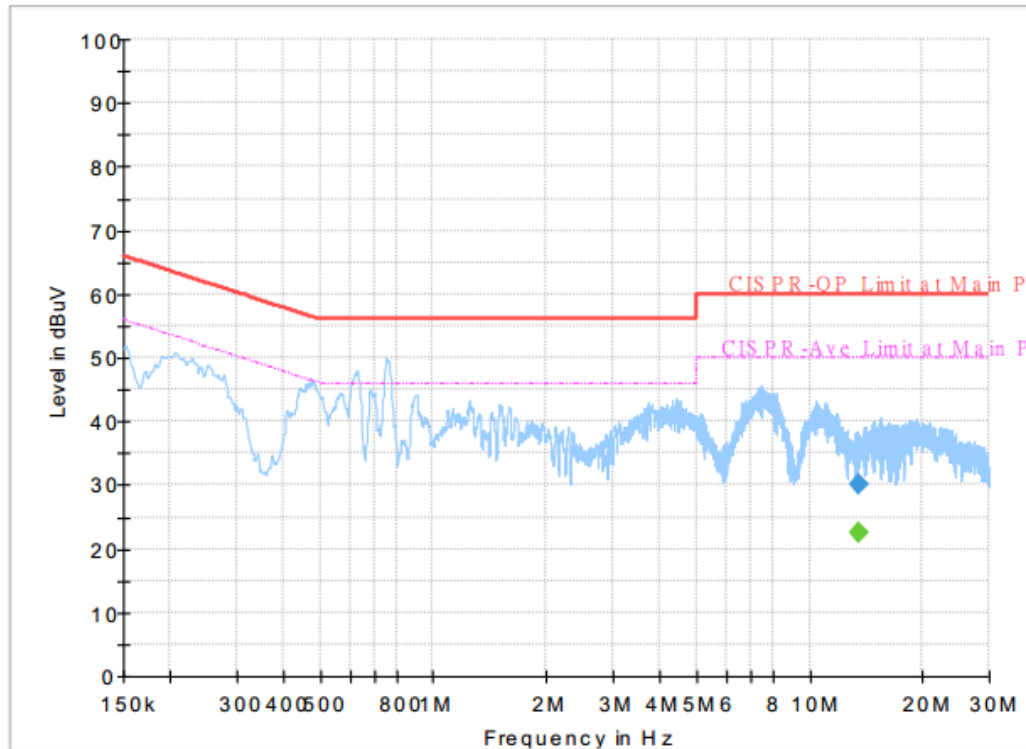
**<Terminal test result with dummy load>**

<b>Test Mode :</b>	Mode 3	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
13.560000	---	22.55	50.00	27.45	L1	OFF	19.7
13.560000	29.77	---	60.00	30.23	L1	OFF	19.7

<b>Test Mode :</b>	Mode 3	<b>Temperature :</b>	25~27°C
<b>Test Engineer :</b>	Kai-Chun Chu	<b>Relative Humidity :</b>	50~52%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
13.560000	---	22.49	50.00	27.51	N	OFF	19.8
13.560000	30.09	---	60.00	29.91	N	OFF	19.8



## Appendix B. Radiated Spurious Emission

Test Engineer :	Jesse Wang, Stan Hsieh and Nick Yu	Temperature :	24~26°C
		Relative Humidity :	51~53%

## 2.4GHz 2400~2483.5MHz

## BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
BT CH00 2402MHz		2387.49	45.48	-28.52	74	40.92	32.16	7.44	35.04	100	263	P	H
		2387.49	20.69	-33.31	54	-	-	-	-	-	-	A	H
	*	2402	94.22	-	-	89.67	32.16	7.44	35.05	100	263	P	H
	*	2402	69.43	-	-	-	-	-	-	-	-	A	H
													H
													H
		2349.795	45.13	-28.87	74	40.64	32.14	7.38	35.03	100	233	P	V
		2349.795	20.34	-33.66	54	-	-	-	-	-	-	A	V
	*	2402	93.16	-	-	88.61	32.16	7.44	35.05	100	233	P	V
	*	2402	68.37	-	-	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		2347.1	45.57	-28.43	74	41.08	32.14	7.38	35.03	100	283	P	H
		2347.1	20.78	-33.22	54	-	-	-	-	-	-	A	H
	*	2441	91.5	-	-	86.88	32.18	7.5	35.06	100	283	P	H
	*	2441	66.71	-	-	-	-	-	-	-	-	A	H
		2484.46	45.56	-28.44	74	40.88	32.19	7.56	35.07	100	283	P	H
		2484.46	20.77	-33.23	54	-	-	-	-	-	-	A	H
		2318.12	45.22	-28.78	74	40.79	32.13	7.32	35.02	100	231	P	V
		2318.12	20.43	-33.57	54	-	-	-	-	-	-	A	V
	*	2441	91.99	-	-	87.37	32.18	7.5	35.06	100	231	P	V
	*	2441	67.2	-	-	-	-	-	-	-	-	A	V
		2492.86	44.73	-29.27	74	40.05	32.2	7.56	35.08	100	231	P	V
		2492.86	19.94	-34.06	54	-	-	-	-	-	-	A	V





<b>BT CH 78 2480MHz</b>	*	2480	91.46	-	-	86.78	32.19	7.56	35.07	100	282	P	H
	*	2480	66.67	-	-	-	-	-	-	-	-	A	H
		2484.12	44.86	-29.14	74	40.18	32.19	7.56	35.07	100	282	P	H
		2484.12	20.07	-33.93	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	91.64	-	-	86.96	32.19	7.56	35.07	100	236	P	V
	*	2480	66.85	-	-	-	-	-	-	-	-	A	V
		2489.4	45.36	-28.64	74	40.67	32.2	7.56	35.07	100	236	P	V
		2489.4	20.57	-33.43	54	-	-	-	-	-	-	A	V
													V
													V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

BT	Note	Frequency ( MHz )	Level ( dBμV/m )	Over Limit ( dB )	Limit Line ( dBμV/m )	Read Level ( dBμV )	Antenna Factor ( dB/m )	Path Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Peak Avg. ( P/A )	Pol. ( H/V )
BT CH 00 2402MHz		4804	42.88	-31.12	74	56.71	34.62	10.93	59.38	100	0	P	H
		4804	18.09	-35.91	54	-	-	-	-	-	-	A	H
													H
													H
		4804	42.71	-31.29	74	56.54	34.62	10.93	59.38	100	0	P	V
		4804	17.92	-36.08	54	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		4882	41.87	-32.13	74	55.43	34.65	11.03	59.24	100	0	P	H
		4882	17.08	-36.92	54	-	-	-	-	-	-	A	H
		7323	42.17	-31.83	74	50.94	35.73	13.66	58.16	100	0	P	H
		7323	17.38	-36.62	54	-	-	-	-	-	-	A	H
		4882	42.48	-31.52	74	56.04	34.65	11.03	59.24	100	0	P	V
		4882	17.69	-36.31	54	-	-	-	-	-	-	A	V
		7323	43.7	-30.3	74	52.47	35.73	13.66	58.16	100	0	P	V
		7323	18.91	-35.09	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	42.14	-31.86	74	55.38	34.69	11.14	59.07	100	0	P	H
		4960	17.35	-36.65	54	-	-	-	-	-	-	A	H
		7440	43.53	-30.47	74	52.36	35.71	13.79	58.33	100	0	P	H
		7440	18.74	-35.26	54	-	-	-	-	-	-	A	H
		4960	42.25	-31.75	74	55.49	34.69	11.14	59.07	100	0	P	V
		4960	17.46	-36.54	54	-	-	-	-	-	-	A	V
		7440	43.84	-30.16	74	52.67	35.71	13.79	58.33	100	0	P	V
		7440	19.05	-34.95	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



## Emission below 1GHz

## 2.4GHz BT (LF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz BT LF		30.54	21.91	-18.09	40	27.85	24.09	1.33	31.36	-	-	P	H
		75.63	20.91	-19.09	40	37.94	12.84	1.71	31.58	-	-	P	H
		152.31	31.11	-12.39	43.5	43.42	16.94	2.25	31.5	100	0	P	H
		386.8	27.61	-18.39	46	34.3	21.2	3.26	31.15	-	-	P	H
		883.8	30.82	-15.18	46	27.59	28.87	4.89	30.53	-	-	P	H
		953.1	32.07	-13.93	46	26.99	30.54	5.05	30.51	-	-	P	H
													H
													H
													H
													H
													H
													H
		30	32	-8	40	37.42	24.6	1.33	31.35	100	0	P	V
		74.55	28.84	-11.16	40	45.97	12.75	1.71	31.59	-	-	P	V
		97.23	30.7	-12.8	43.5	45.07	15.45	1.74	31.56	-	-	P	V
		782.3	29.85	-16.15	46	27.88	27.98	4.6	30.61	-	-	P	V
		854.4	31.12	-14.88	46	28.05	28.88	4.74	30.55	-	-	P	V
		956.6	33.28	-12.72	46	28.05	30.69	5.05	30.51	-	-	P	V
													V
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													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



**Note symbol**

*	<b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	<b>Peak</b> or <b>Average</b>
H/V	<b>Horizontal</b> or <b>Vertical</b>



A calculation example for radiated spurious emission is shown as below:

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
BT CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =  
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)  
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)  
= 55.45 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 55.45(dBμV/m) – 74(dBμV/m)  
= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)  
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)  
= 43.54 (dBμV/m)
2. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 43.54(dBμV/m) – 54(dBμV/m)  
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.



## Appendix C. Radiated Spurious Emission Plots

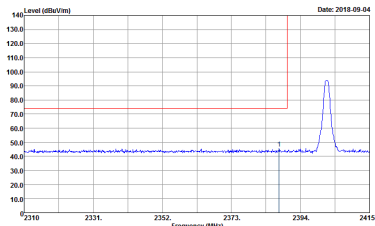
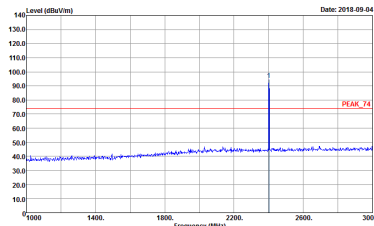
Test Engineer :	Jesse Wang, Stan Hsieh and Nick Yu	Temperature :	24~26°C
		Relative Humidity :	51~53%

### Note symbol

-L	Low channel location
-R	High channel location

2.4GHz 2400~2483.5MHz

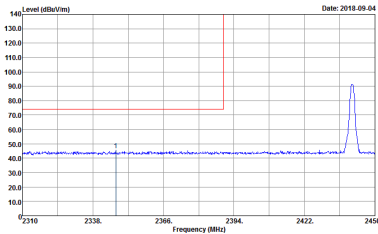
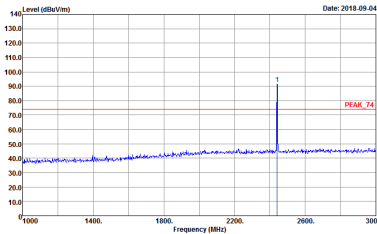
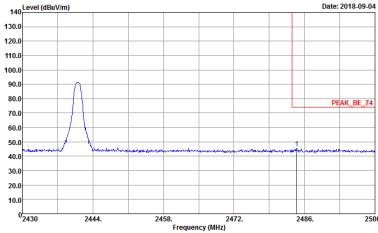
BT (Band Edge @ 3m)

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH00 2402MHz	
1	Horizontal	Fundamental
Peak	 <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00066583 HORIZONTAL Detector : RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Project : Peak Node : 872506 Mode : 1</p>	 <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00066583 HORIZONTAL Detector : RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Project : Peak Node : 872506 Mode : 1</p>

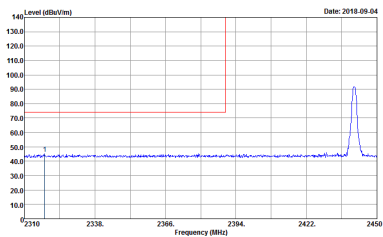
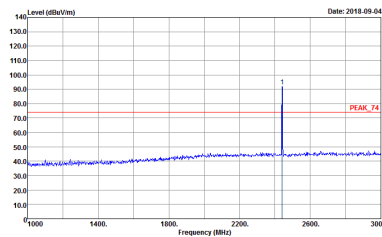
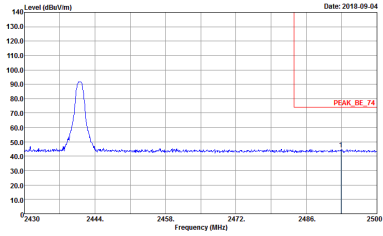


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH00 2402MHz	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CM07-HY Condition : PEAK_BE_74_3m HF_ANT_00066583 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Detector : Peak Project : 872506 Mode : 1</p></div>	<div><p>Site : 03CM07-HY Condition : PEAK_74_3m HF_ANT_00066583 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Detector : Peak Project : 872506 Mode : 1</p></div>

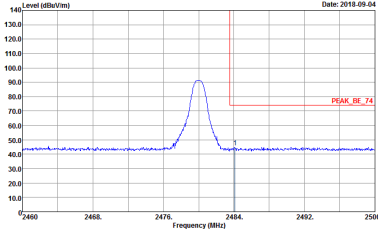
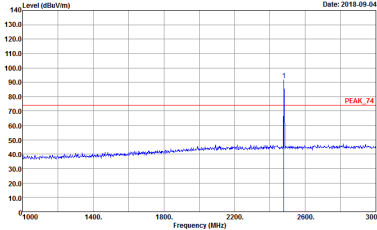


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH39 2441MHz	
1	Horizontal	Fundamental
Peak	 <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00066583 HORIZONTAL Detector : Peak Project : 872506 Mode : 2</p>	 <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00066583 HORIZONTAL Detector : Peak Project : 872506 Mode : 2</p>
	 <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00066583 HORIZONTAL Detector : Peak Project : 872506 Mode : 2</p>	Left blank

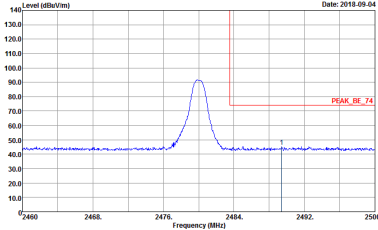
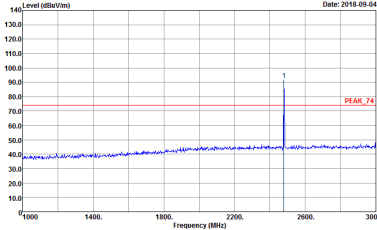


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH39 2441MHz	
1	Vertical	Fundamental
Peak	 <p>           Site : 03CH07-HY            Condition : PEAK_BE_74 3m HF_ANT_00066583 VERTICAL            Detector : Peak            Project : 872506            Mode : 2         </p>	 <p>           Site : 03CH07-HY            Condition : PEAK_74 3m HF_ANT_00066583 VERTICAL            Detector : Peak            Project : 872506            Mode : 2         </p>
	 <p>           Site : 03CH07-HY            Condition : PEAK_BE_74 3m HF_ANT_00066583 VERTICAL            Detector : Peak            Project : 872506            Mode : 2         </p>	Left blank



BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
1	Horizontal	Fundamental
Peak	<div><p>Site : 03CM07-HY Condition : PEAK BE 74 3m HF ANT 00066583 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Detector : Peak Project : 872506 Mode : 3</p></div>	<div><p>Site : 03CM07-HY Condition : PEAK 74 3m HF ANT 00066583 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Detector : Peak Project : 872506 Mode : 3</p></div>

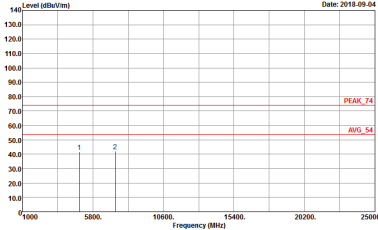
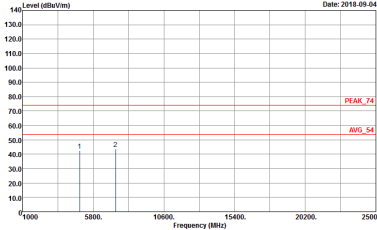


BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BT CH78 2480MHz	
1	Vertical	Fundamental
Peak	<div><p>Site : 03CM07-HY Condition : PEAK BE 74 3m HF ANT 00066583 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Detector : Peak Project : 872506 Mode : 3</p></div>	<div><p>Site : 03CM07-HY Condition : PEAK 74 3m HF ANT 00066583 VERTICAL RBW:1000.000kHz VBW:3000.000kHz SMT:Auto Detector : Peak Project : 872506 Mode : 3</p></div>

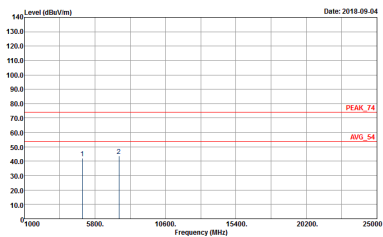
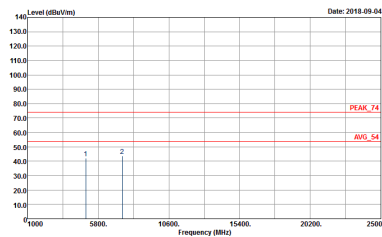
**2.4GHz 2400~2483.5MHz****BT (Harmonic @ 3m)**

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH00 2402MHz	
1	Horizontal	Vertical
<b>Peak</b> <b>Avg.</b>	<p>Site : 03CH07-HY Condition : PEAK_74 3m SHF-EHF_131029 HORIZONTAL Detector : Peak Project : 872506 Mode : 1</p>	<p>Site : 03CH07-HY Condition : PEAK_74 3m SHF-EHF_131029 VERTICAL Detector : Peak Project : 872506 Mode : 1</p>

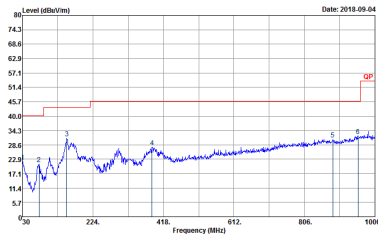
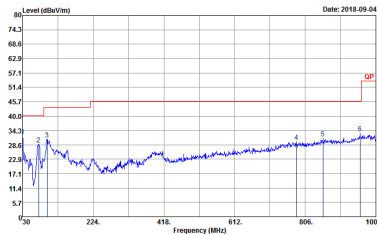


BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH39 2441MHz	
1	Horizontal	Vertical
Peak Avg.	 <p>Site : 03CM07-HY Condition : PEAK_74 3m SHF-EHF_131029 HORIZONTAL Detector : Peak Project : 872506 Mode : 2</p>	 <p>Site : 03CM07-HY Condition : PEAK_74 3m SHF-EHF_131029 VERTICAL Detector : Peak Project : 872506 Mode : 2</p>



BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	BT CH78 2480MHz	
1	Horizontal	Vertical
Peak Avg.	 <p>Site : 03CM07-HY Condition : PEAK_74 3m SHF-EHF_131029 HORIZONTAL Detector : Peak Project : 872506 Mode : 3</p>	 <p>Site : 03CM07-HY Condition : PEAK_74 3m SHF-EHF_131029 VERTICAL Detector : Peak Project : 872506 Mode : 3</p>

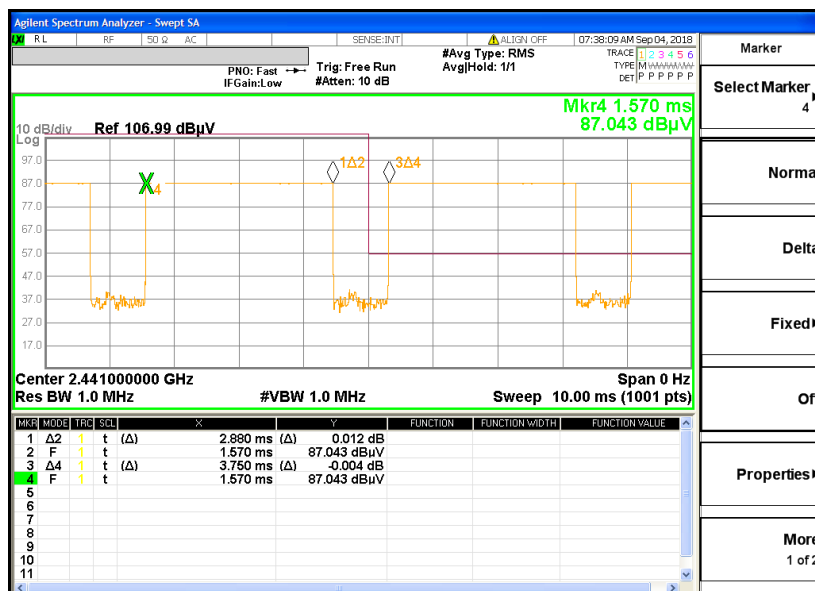
**Emission below 1GHz****2.4GHz BT (LF)**

BT	2.4GHz 2400~2483.5MHz	
ANT	BT LF	
1	Horizontal	Vertical
QP / Peak	 <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL Detector : Peak Project : 872506 Mode : 79</p>	 <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL Detector : Peak Project : 872506 Mode : 79</p>

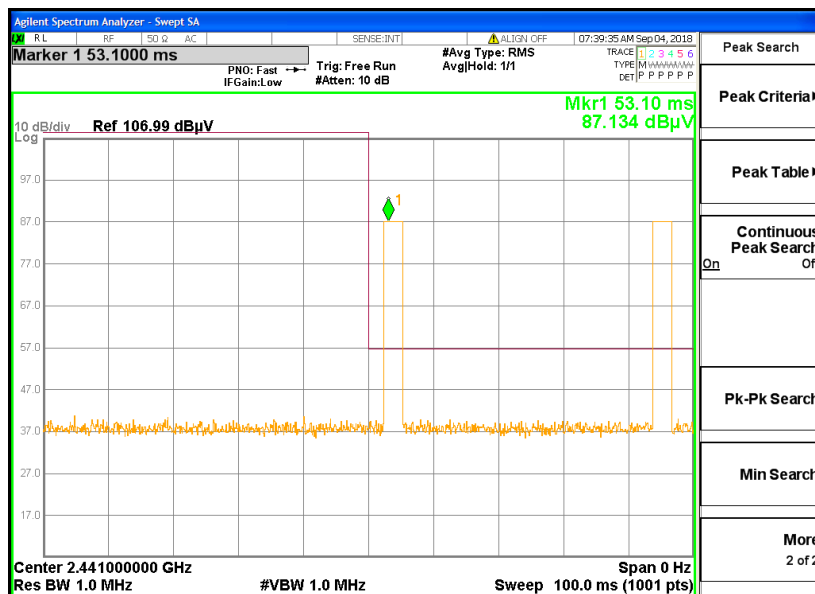


## Appendix D. Duty Cycle Plots

### DH5 on time (One Pulse) Plot on Channel 39



### on time (Count Pulses) Plot on Channel 39



#### Note:

1. Worst case Duty cycle = on time/100 milliseconds =  $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor =  $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.



**Duty Cycle Correction Factor Consideration for AFH mode:**

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period.  $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$