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TEST REPORT For FCC

FCC Standards : FCC 47CFR part 15 subpart C

Test Report No.	:	CTK-2016-01124	
Date of Issue	:	2016-09-05	
FCC ID	:	2AJOX-CTD-S100	
Model/Type No.	:	CTD-S100	
Kind of Product	:	Container Tracer Device	
Applicant	:	S-winnus Co., Ltd	
Applicant Address	:	CVT bldg.3F306, 41, Centum dong-ro, Haeundae-Gu, Busan, Korea (ZIP 48059)	
Manufacturer	:	S-winnus Co., Ltd	
Manufacturer Address	:	CVT bldg.3F306, 41, Centum dong-ro, Haeundae-Gu, Busan, Korea (ZIP 48059)	
Contact Person	:	Jang Young Chul	
Telephone	:	+82-51-747-8935	
Received Date	:	2016-07-21	
Test period	:	Start : 2016-08-04	End : 2016-08-31
Test Results	:	☒ **In Compliance**	☐ **Not in Compliance**

The test results presented in this report relate only to the object tested.

Tested by

Y. T. Lee

Young-taek Lee
Test Engineer
Date: 2016-09-05

Reviewed by

Y. J. Park

Young-Joon, Park
Technical Manager
Date: 2016-09-05

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REPORT REVISION HISTORY

Date	Revision	Revision
2016-09-05	Issued (CTK-2016-01124)	

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1.0 General Product Description

1.0.1 Tested Equipment

☒ Unless otherwise indicated, all tests were conducted on Model CTD-S100.
☐ Tests performed on Model _____ were considered to be representative of Model(s) _____.

1.0.2 Equipment Size, Mobility and Identification

Dimensions:	258(W) by 134(L) by 73(H)	☒ mm
Mobility:	☐ Portable ☐ Table-top	☒ Built-in
	☐ Floor-standing	
Serial No.:	Prototype	

1.0.3 Electrical Ratings

Input :	3.7 Vdc (Rechargeable Li-ion Battery)
Output :	-

1.0.4 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

Voltage:	3.7 Vdc (Battery)
Frequency:	-

1.1 Model Differences

Not applicable

1.2 Device Modifications

Not applicable

1.3 EUT Configuration(s)

See Appendix A for individual test set-up configuration(s). The following peripheral devices and/or interface cables were connected during the measurement:

☐ Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC

☐ Cable Description

#	Description	Ferrite Core	Length (m)	Other Details

1.4 Test Software

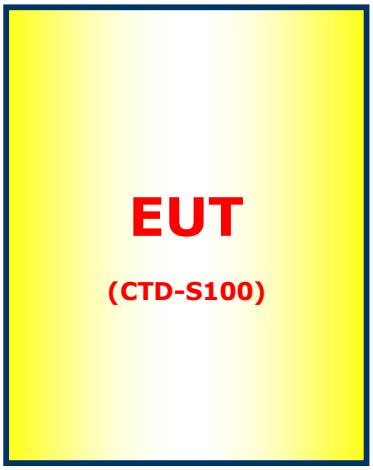
☐ EMC Test V 1.0
☐ Display Test Patterns – V1.5
☐ Ping.exe
☒ Not applicable

1.5 EUT Operating Mode(s)

Equipment under test was operated during the measurement under the following conditions:

☐ Standby
☐ Display circles pattern
☒ Practice operation – EUT transmitting at 13.56 MHz continuously
☐ Scrolling 'H'
☐ Read / Write

1.6 Configuration



1.7 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.8 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

1.9 Measurement Procedure

Preliminary AC power line conducted emissions tests were performed shielded room. To find worst mode, several typical mode and typical cable position were tested.
Final AC power line conducted emissions test was performed shielded room. (location is same as Preliminary test)
Based on the preliminary tests of the EUT, final test was proceeded worst case test mode and cable configuration.

Preliminary radiated emissions test were performed anechoic chamber (Distance of antenna and EUT was 3 m). To find worst mode, several typical mode and typical cable position were tested and peak level and frequency were recorded.

Final radiated emissions test was performed Open Area Test Site. Based on the preliminary tests of the EUT, final test was proceeded worst case test mode and cable configuration.

* Measurement procedures was In accordance with ANSI C63.10-2013.

1.10 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	KR0025	

2.0 Emissions Test Regulations

The emissions tests were performed according to following regulations:

☐ EN 61000-6-3:2007		
☐ EN 61000-6-4:2007		
☐ EN 55011:2007 +A2:2007	☐ Group 1 ☐ Class A	☐ Group 2 ☐ Class B
☐ EN 55013:2001 +A1:2003 +A2:2006		
☐ EN 55014-1:2006		
☐ EN 55015:2006		
☐ EN 61204-3:2000	☐ Class A	☐ Class B
☐ EN 61131-2:2003		
☐ EN 61326-1:2006	☐ Class A	☐ Class B
☐ EN 55022:2006	☐ Class A	☐ Class B
☐ EN 61000-3-2:2006		
☐ EN 61000-3-3:1995 +A1:2001 +A2:2005		
☐ VCCI V-3/2008.04	☐ Class A	☐ Class B
☐ AS/NZS CISPR22:2006	☐ Class A	☐ Class B
☒ FCC Part 15 Subpart C		
☐ CISPR 22:2006	☐ Class A	☐ Class B

2.1 Radiated Electric Field Emissions - 15.225(a)

Reference Standard
FCC Part 15.225(a)

Test Date
2016-08-04

Test Location
☒ EMI-Anechoic chamber with a conductive ground plane:
Testing was performed at a test distance of 3 m

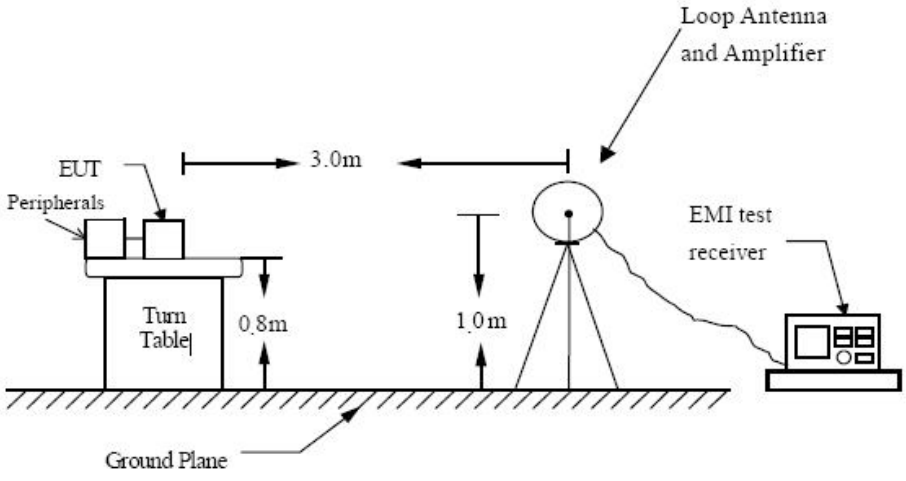
Test Equipment

Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2015-11-02	2016-11-02
Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
6dB Attenuator	R&S	DNF	272.4110.50-2	2015-11-03	2016-11-03

Frequency Range of Measurement
13.553 MHz to 13.567 MHz

Instrument Settings
IF Band Width: 9 kHz

Test Setup



Measurement Procedure(below 30 MHz)

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. Three orientation for the EUT were tried to find out which orientation produces the worst emissions.
3. The loop antenna was also moved around to find out worst position for the emissions.
4. Set the spectrum analyzer in the following setting as:
   For Below 30 MHz :
   RBW = 9 kHz / VBW = 30 kHz / Sweep = AUTO
5. Repeat above procedures until the measurements for all frequencies are complete.

Radiated emission limits

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 uV/m at 30 meters.

Test Results

Frequency (MHz)	Field Strength of Fundamental (dBuV/m @ 3 m)			Field Strength of Fundamental (dBuV/m @ 30 m)	Field Strength of Fundamental (uV/m @ 30 m)
	Reading	Factor(dB)	Result		
13.553-13.567	25.84	26.6	52.44	12.44	4.19

* Result = Reading + Factor
* Factor = Antenna Factor + Cable Loss + Attenuator

The requirements are:

☒ MET
☐ NOT MET
☐ NOT APPLICABLE

Remarks

See Appendix A for test data

2.2 Radiated Electric Field Emissions - 15.225(b)(c)

Reference Standard
FCC Part 15.225(b)(c)

Test Date
2016-08-04

Test Location
☒ EMI-Anechoic chamber with a conductive ground plane:
Testing was performed at a test distance of 3 m

Test Equipment

Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2015-11-02	2016-11-02
Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
6dB Attenuator	R&S	DNF	272.4110.50-2	2015-11-03	2016-11-03

Frequency Range of Measurement
13.410 MHz to 13.553 MHz, 13.567 MHz to 13.710 MHz
13.110 MHz to 13.410 MHz, 13.710 MHz to 14.010 MHz

Instrument Settings
IF Band Width: 9 kHz

Radiated emission limits

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 uV/m at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 uV/m at 30 meters.

Test Results

Frequency (MHz)	Field Strength of Fundamental (dBuV/m @ 3 m)			Field Strength of Fundamental (dBuV/m @ 30 m)	Field Strength of Fundamental (uV/m @ 30 m)
	Reading	Factor(dB)	Result		
13.110-13.410	7.87	26.6	34.47	-5.53	0.53
13.410-13.553	14.24	26.6	40.84	0.84	1.10
13.567-13.710	11.03	26.6	37.63	-2.37	0.76
13.710-14.010	5.20	26.6	31.80	-8.20	0.39

* Result = Reading + Factor
* Factor = Antenna Factor + Cable Loss + Attenuator

The requirements are:

☒ MET
☐ NOT MET
☐ NOT APPLICABLE

2.3 Radiated Electric Field Emissions - 15.225(d)

Reference Standard
FCC Part 15.225(d), 15.209

Test Date
2016-08-04

Test Location
☒ EMI-Anechoic chamber with a conductive ground plane:
Testing was performed at a test distance of 3 m

Test Equipment

Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2015-11-02	2016-11-02
Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-13	2018-05-13
6dB Attenuator	Rohde & Schwarz	DNF	272.4110.50-1	2016-02-04	2017-02-04
AMPLIFIER	SONOMA	310	291721	2016-02-02	2017-02-02
Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2016-05-16	2018-05-16
6dB Attenuator	R&S	DNF	272.4110.50-2	2015-11-03	2016-11-03

Frequency Range of Measurement
9 kHz to 1000 MHz

Instrument Settings
IF Band Width: 9 kHz (9 kHz to 30 MHz)
IF Band Width: 120 kHz (30 MHz to 1000 MHz)

Measurement Procedure(above 30 MHz)
1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
   For 30 MHz ~ 1000 MHz :
   RBW = 120 kHz / VBW = 300 kHz / Sweep = AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

Radiated emission limits

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
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

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Test Results

The requirements are:

☒ MET
☐ NOT MET
☐ NOT APPLICABLE

Remarks

See Appendix A for test data

2.4 Frequency Stability – 15.225(e)

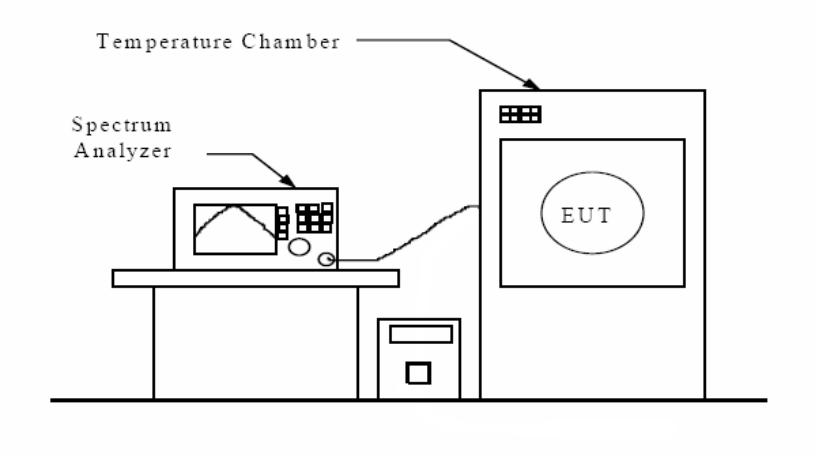
Reference Standard
FCC Part 15.225(e)

Test Date
2016-08-12 ~ 2016-08-16

Test Equipment

Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
Signal Analyzer	F&S	FSP-30	100994	2015-11-02	2016-11-02
Temp & Humi Chamber	ESPEC CORP.	SH-242	93008423	2015-10-01	2016-10-01

Test Setup



Test Procedure

A. Frequency stability vs. temperature measurement
- The EUT was placed into the constant temperature chamber.
- The spectrum analyzer was used to read the EUT operating frequency.
- Set the constant temperature chamber temperature within the range of -20 °C to +50 °C

B. Frequency stability vs. input voltage measurement
- The EUT was placed into the constant temperature chamber and set the temperature to 20 °C.
- The spectrum analyzer was used to read the EUT operating frequency.
- The EUT is powered with the DC Power Supplied it with 85 % and 115 % voltage, and measured the EUT operating frequency.

Frequency tolerance Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01 % of the operating frequency over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 °C.
- Operating frequency : 13.56 MHz
- Limit : 13.56 MHz * (±) 0.0001 = (±) 1356 Hz
- Within the band : 13.558644 MHz to 13.561356 MHz

Test Data

Timing	-20 °C	-10 °C	0 °C	10 °C	20 °C	30 °C	40 °C	50 °C
Start-up	13.559650	13.559657	13.559653	13.559639	13.559615	13.559573	13.559529	13.559511
10 min	13.559649	13.559658	13.559650	13.559626	13.559590	13.559560	13.559524	13.559510
30 min	13.559648	13.559659	13.559649	13.559623	13.559588	13.559528	13.559523	13.559510

Timing	Power 85 %	Power 115 %
Start-up	Not Applicable (Battery Power)	Not Applicable (Battery Power)
10 min	Not Applicable (Battery Power)	Not Applicable (Battery Power)
30 min	Not Applicable (Battery Power)	Not Applicable (Battery Power)

Test Results

The requirements are:

☒ MET
☐ NOT MET
☐ NOT APPLICABLE

2.5 Conducted Voltage Emissions – 15.207

Reference Standard
FCC Part 15.207

Test Date
2016-08-04

Test Location
Shielded Room

Test Equipment

Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI7	100816	2015-11-02	2016-11-02
LISN	Rohde & Schwarz	ENV216	101760	2016-02-05	2017-02-05

Frequency Range of Measurement
150 kHz to 30 MHz

Instrument Settings
IF Band Width: 9 kHz

Conducted Emission limits

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Test Results
The requirements are:

☒ MET

Frequency (MHz)	Measured Data (dBuV)	Margin (dB)	Remark
13.56	42.6	7.4	Average

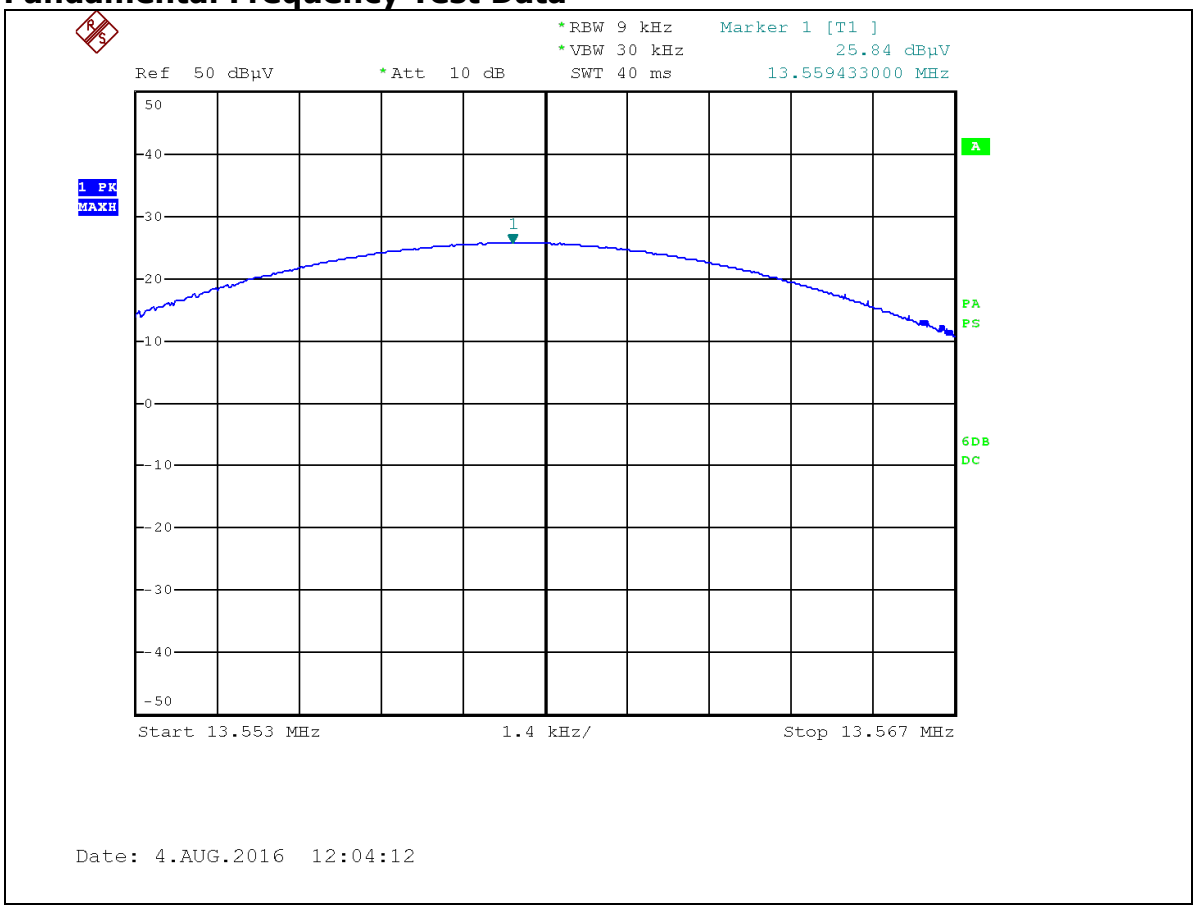
☐ NOT MET
☒ NOT APPLICABLE

Remarks

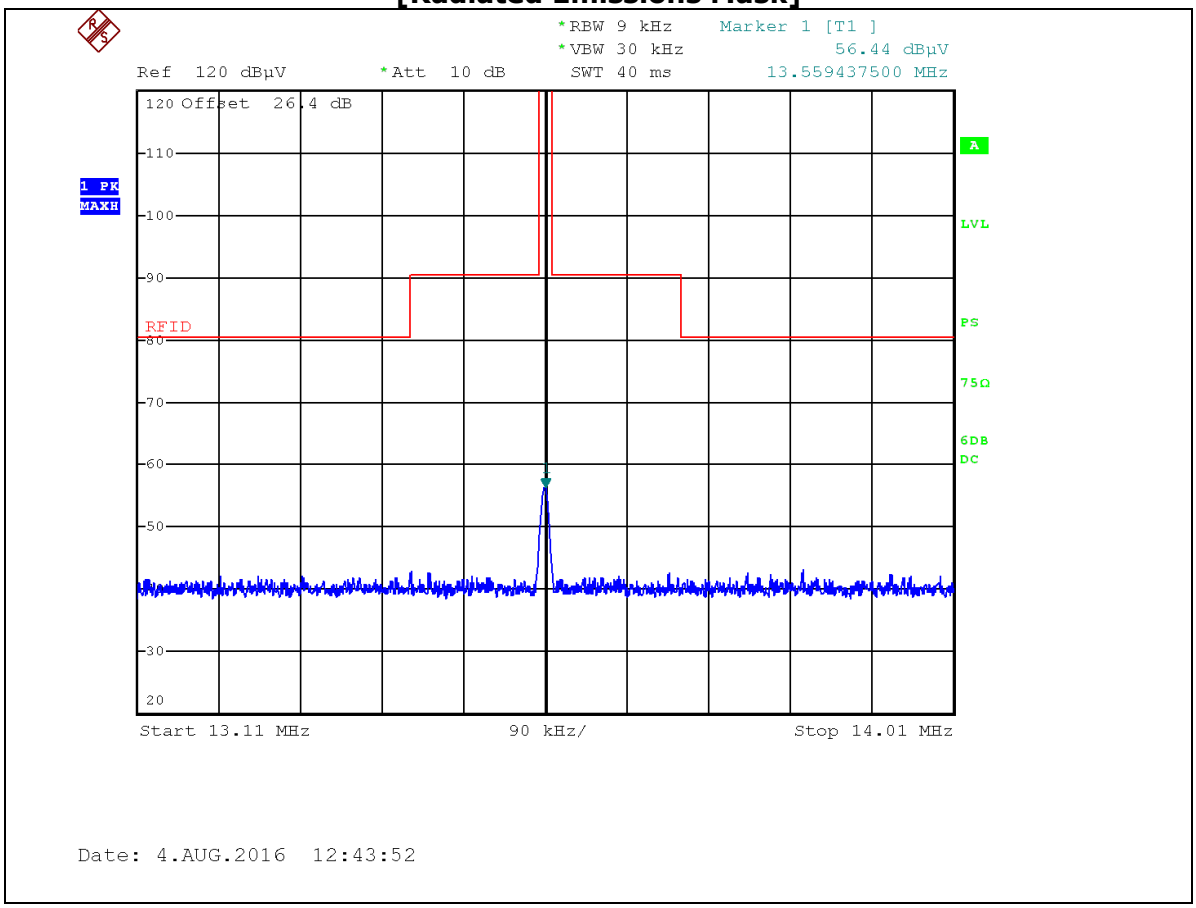
APPENDIX A – TEST DATA

Radiated Electric Field Emissions

1) Fundamental Frequency Test Data



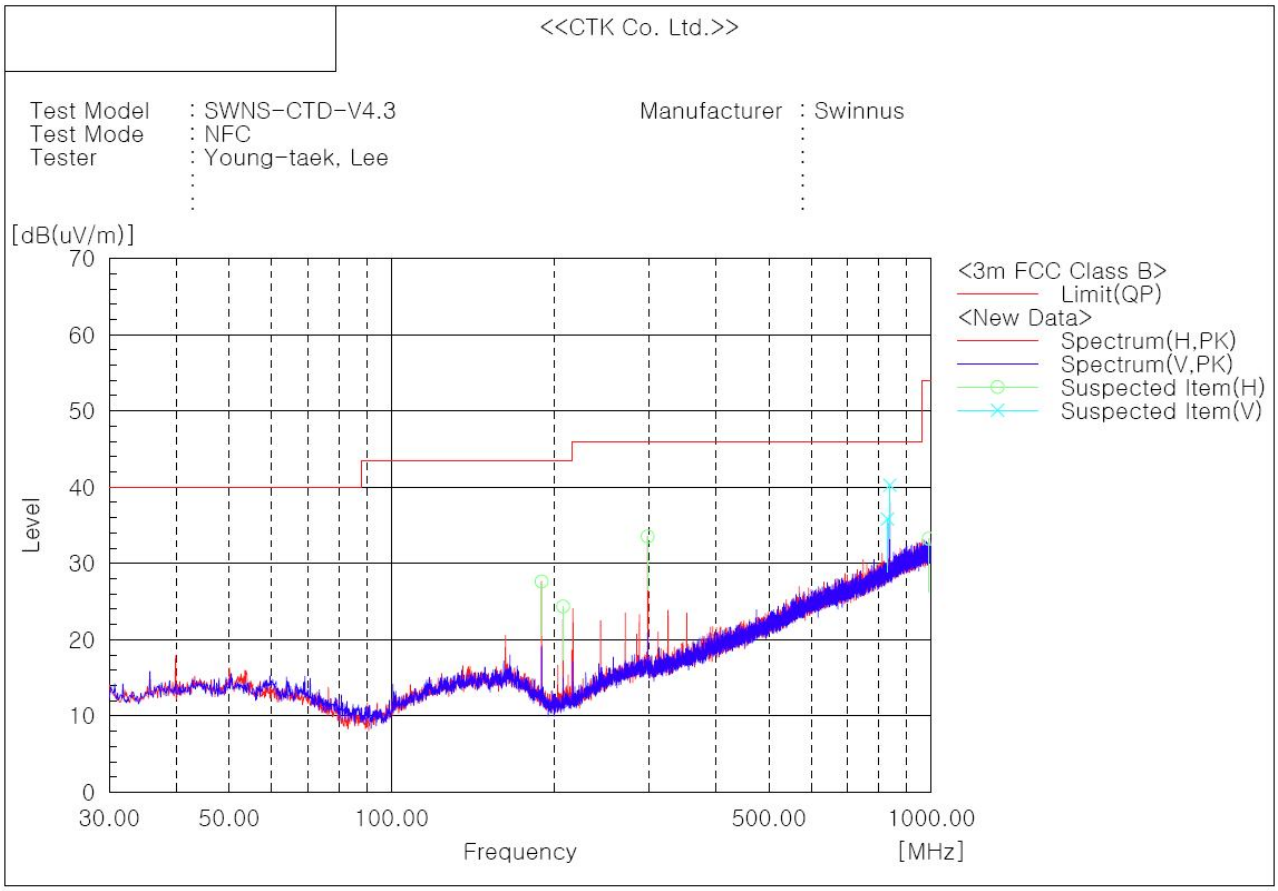
[Radiated Emissions Mask]



2) Frequency Range from 9 kHz to 30 MHz Test Data

Frequency [MHz]	Reading [dBuV/m] @ 3 m	Pol.	Height [m]	Correction Factor		Limits [dBuV/m] @ 3 m	Result [dBuV/m] @ 3 m	Margin [dB]
				Antenna	Cable			
0.012	30.7	V	1.0	19.6	5.7	126.0	56.0	70.0
0.150	18.5	V	1.0	19.6	5.8	104.1	43.9	60.2
17.310	3.8	V	1.0	20.2	6.3	69.5	30.3	39.2

3) Frequency Range from 30 MHz to 1000 MHz Test Data

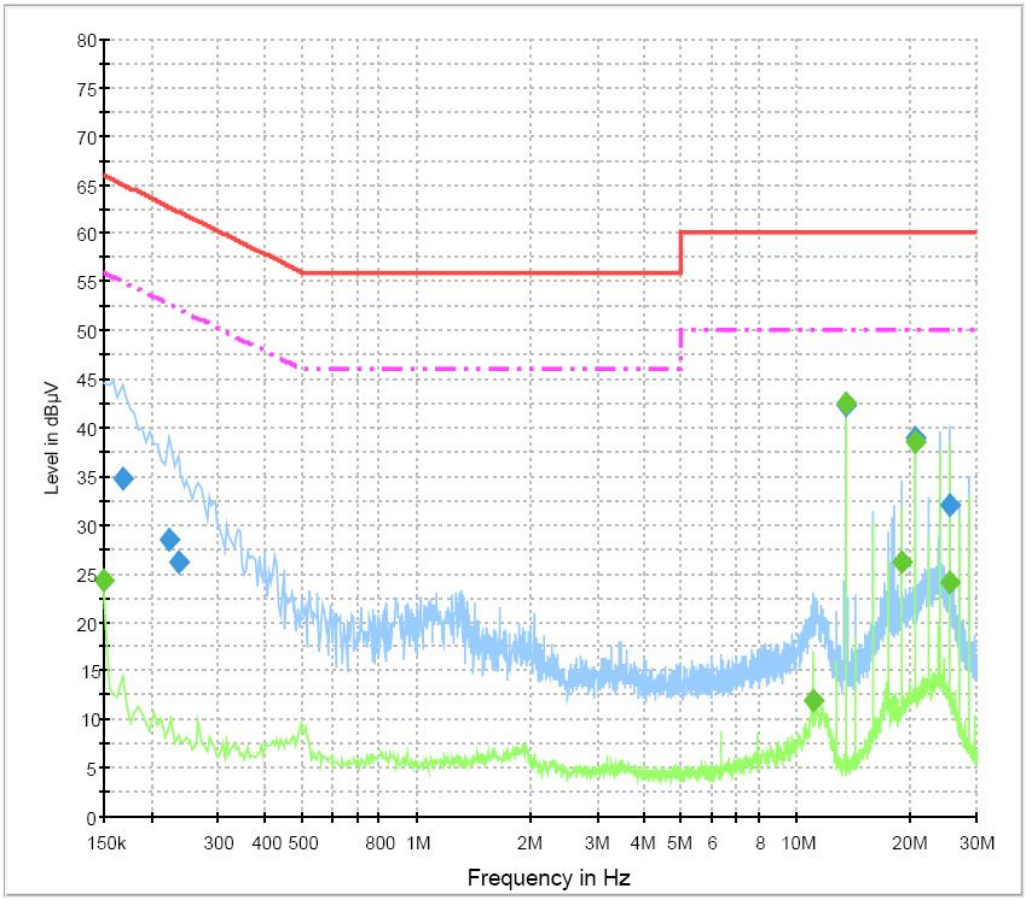


Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	189.808	H	40.1	-12.5	27.6	43.5	15.9	205.0	0.0
2	207.995	H	37.4	-13.0	24.4	43.5	19.1	205.0	235.0
3	298.326	H	41.5	-8.0	33.5	46.0	12.5	100.0	199.0
4	830.008	V	30.6	5.2	35.8	46.0	10.2	193.0	12.0
5	838.010	V	34.8	5.5	40.3	46.0	5.7	100.0	88.0
6	989.572	H	24.3	9.0	33.3	54.0	20.7	400.0	50.0

Conducted Voltage Emissions

[Line : L1]



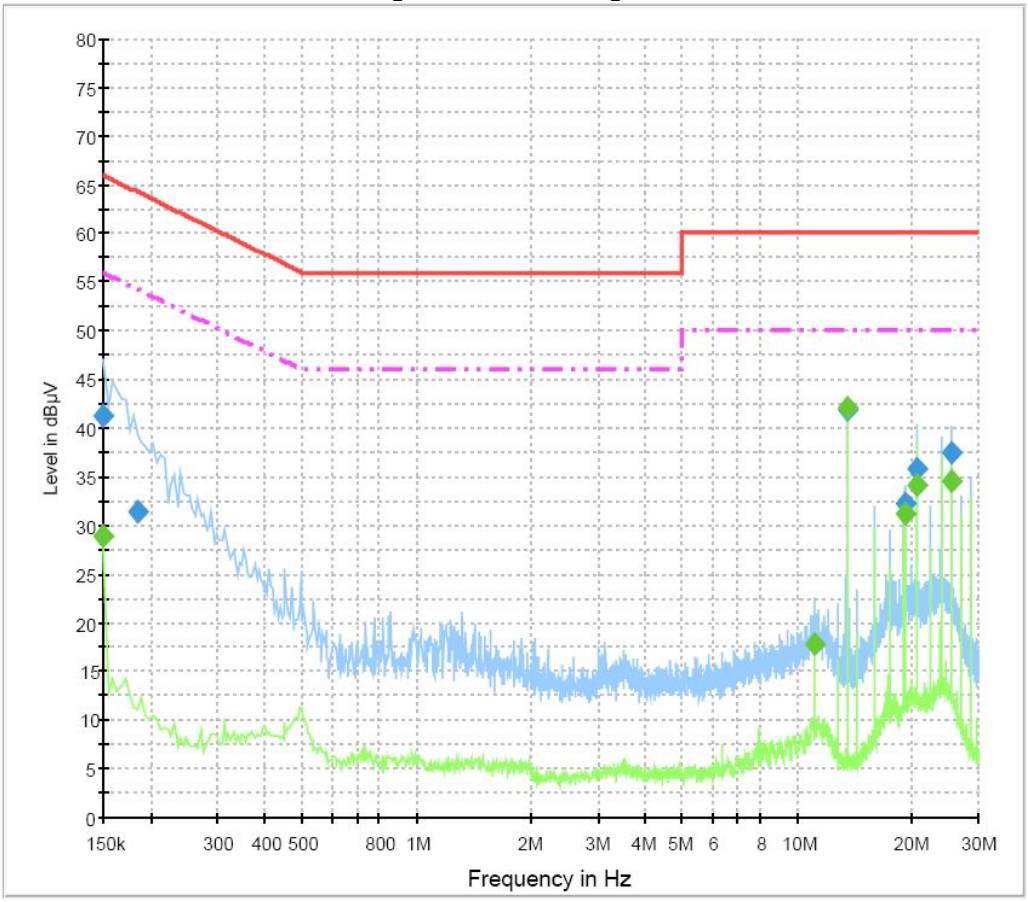
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.168000	34.8	1000.0	9.000	On	L1	9.8	30.3	65.1
0.222000	28.5	1000.0	9.000	On	L1	9.7	34.2	62.7
0.235500	26.2	1000.0	9.000	On	L1	9.7	36.1	62.3
13.560000	42.3	1000.0	9.000	On	L1	9.9	17.7	60.0
20.724000	39.0	1000.0	9.000	On	L1	9.9	21.0	60.0
25.503000	32.0	1000.0	9.000	On	L1	9.9	28.0	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	24.3	1000.0	9.000	On	L1	9.7	31.7	56.0
11.152500	12.0	1000.0	9.000	On	L1	9.8	38.0	50.0
13.560000	42.6	1000.0	9.000	On	L1	9.9	7.4	50.0
19.126500	26.2	1000.0	9.000	On	L1	9.9	23.8	50.0
20.724000	38.5	1000.0	9.000	On	L1	9.9	11.5	50.0
25.503000	24.1	1000.0	9.000	On	L1	9.9	25.9	50.0

[Line : Neutral]



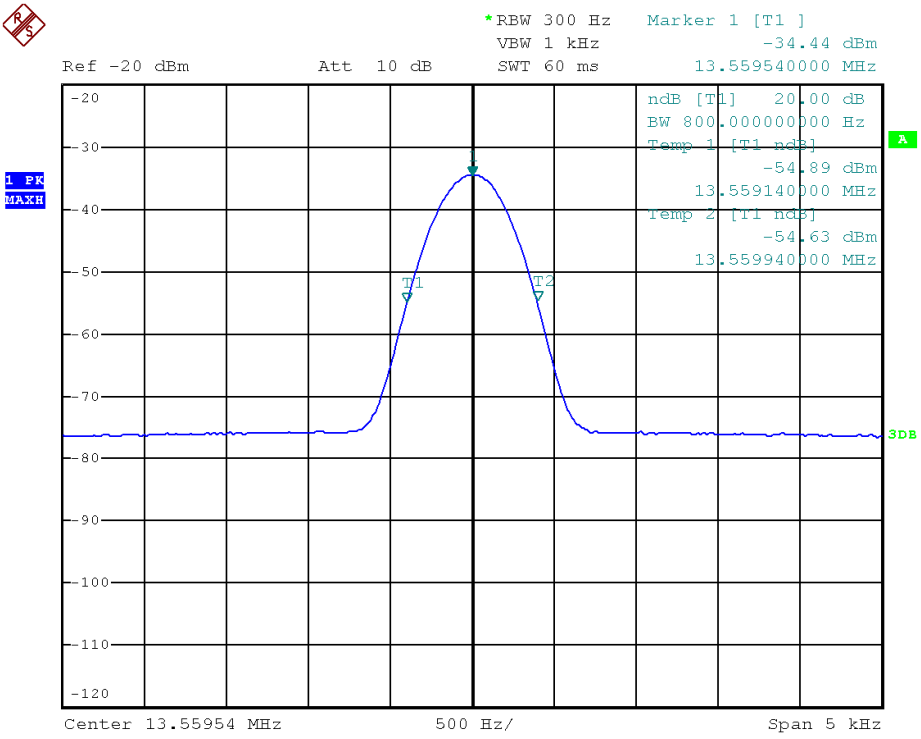
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	41.3	1000.0	9.000	On	N	9.7	24.7	66.0
0.186000	31.4	1000.0	9.000	On	N	9.8	32.8	64.2
13.560000	41.8	1000.0	9.000	On	N	9.9	18.2	60.0
19.144500	32.3	1000.0	9.000	On	N	9.9	27.7	60.0
20.737500	35.9	1000.0	9.000	On	N	10.0	24.1	60.0
25.525500	37.5	1000.0	9.000	On	N	10.0	22.5	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	28.9	1000.0	9.000	On	N	9.7	27.1	56.0
11.170500	17.7	1000.0	9.000	On	N	9.8	32.3	50.0
13.560000	42.2	1000.0	9.000	On	N	9.9	7.8	50.0
19.144500	31.3	1000.0	9.000	On	N	9.9	18.7	50.0
20.737500	34.1	1000.0	9.000	On	N	10.0	15.9	50.0
25.525500	34.7	1000.0	9.000	On	N	10.0	15.3	50.0

Bandwidth of the Operating Frequency



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