

# TEST REPORT



**DT&C Co., Ltd.**

42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042  
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No. : DREFCC1909-0261

2. Client / Applicant

• Name : MOTREX CO., LTD.

• Address : Seoyoung Bldg., 25, Hwangsaeu-ro 258beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

3. Use of Report : Grant of Certification

4. Product Name / Model Name / FCC ID : SMART DISPLAY / MS300ADEPE / BP9-MS300ADEPE

5. Test Standard : ANSI C 63.4 : 2014

FCC Part 15 Subpart B

(FM Broadcast receiver)

6. Date of Test : Jul. 22. 2019 ~ Jul. 23. 2019

7. Testing Environment : Temperature 24 °C , Humidity (45 ~ 52) % R.H.

8. Test Result : Refer to the attached Test Result

Affirmation	Tested by Name : MinWoo Park (Signature)	Reviewed by Name : DaeHwa Eun (Signature)
-------------	--	---

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose.

This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

**Sep. 26. 2019**

**DT&C Co., Ltd.**

If this report is required to confirmation of authenticity, please contact [report@dtnc.net](mailto:report@dtnc.net)

## **CONTENTS**

<b>1. General Remarks .....</b>	3
<b>2. Test Laboratory.....</b>	3
<b>3. General Information of EUT.....</b>	4
<b>4. EUT Operations and Test Configurations .....</b>	5
4.1 Principle of Configuration Selection .....	5
4.2 EUT Operation Mode .....	5
4.3 Test Configuration Mode.....	5
4.4 Supported Equipment .....	6
4.5 EUT In/Output Port .....	6
4.6 Test Voltage and Frequency .....	6
<b>5. Test Summary .....</b>	7
<b>6. Test Environment.....</b>	7
<b>7. Test Results : Emission.....</b>	8
7.1 Conducted Disturbance .....	8
7.2 Radiated Disturbance .....	10
7.3 Antenna Power Conduction .....	42
<b>8. Revision History.....</b>	44

## 1. General Remarks

This report contains the result of tests performed by :

**DT&C Co., Ltd.**

42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042

<http://www.dtnc.net>

Tel: +82-31-321-2664 Fax: +82-31-321-1664

## 2. Test Laboratory

DT&C Co., Ltd. has been accredited / filed / authorized by the agencies listed in the following table;

Certificate	Nation	Agency	Code	Remark
Accreditation	Korea	KOLAS	393	ISO/IEC 17025
	South Africa	SABS	0006	ISO/IEC 17025
	Ghana	NCA	NCA agreement 23rd,Oct,2018	-
Site Filing	USA	FCC	KR0034 101842 678747, 596748, 804488, 165783	Accredited 2.948 Listed
	Canada	IC	5740A-3 5740A-4	Registered
	Japan	VCCI	C-1427 R-3385, R-4076, R-4180, R-4496, T-1442, G-10338, G-754, G-10815, G-20051	Registered
Certification	Korea	KC	KR0034	Designation
	Germany	TUV	CARAT 089112 0006 Rev.00	ISO/IEC 17025
	Russia	RMRS	17.10189.296	ISO/IEC 17025

Quality control in the testing laboratory is implemented as per ISO/IEC 17025  
which is the "General requirements for the competent of calibration and testing laboratory".

### 3. General Information of EUT

Applicant	MOTREX CO., LTD. Seoyoung Bldg., 25, Hwangsaeul-ro 258beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
Manufacturer	MOTREX CO., LTD. Seoyoung Bldg., 25, Hwangsaeul-ro 258beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
Factory	MOTREX CO., LTD. 62-7, Pungsesandan 4-ro, Pungse-myeon, Dongnam-gu, Cheonan-si, Chungcheongnam-do, Korea
Product Name	SMART DISPLAY
Model Name	MS300ADEPE
Add Model Name	None
FCC ID	BP9-MS300ADEPE
Maximum Internal Frequency	1 GHz
Software Version	DEP.MEX.0000.009.190701
Hardware Version	Rev0.1
Rated Power	DC 12 V
Remarks	

**Related Submittal(s) / Grant(s)****Original submittal only**

## 4. EUT Operations and Test Configurations

### 4.1 Principle of Configuration Selection

**Emission :**

The equipment under test (EUT) was configured to measure its highest possible radiation level.

The test modes were adapted accordingly in reference to the instructions for use.

For each testing mode different configurations were used,

Refer to the individual tests.

### 4.2 EUT Operation Mode

No.	Mode	Description
1	AM	AM receiving mode(MF)
2	FM	FM receiving mode (VHF)
3	USB	USB play mode(1 kHz tone)

### 4.3 Test Configuration Mode

No.	Mode	Description
1	Receiving	The EUT is connected to the SIGNAL GENERATOR and is receiving radio frequency. And continuously output audio signal. EMS testing we checked the SNR by audio analyzer
2	USB	The EUT is connected to USB memory to play the music. (1 kHz tone). EMS testing we checked the SNR by audio analyzer.

## 4.4 Supported Equipment

Used*	Product Type	Manufacturer	Model	Remarks
AE	DC Power supply	SMtechno	SPD30-5D	305DPL226
AE	SPEAKER	N/A	N/A	None
AE	USB	Sandisk	ULTRA FLAIR 3.0	None
SIM	SIGNAL GENERATOR	Rohde & Schwarz	SMT03	100417

\*Abbreviations:

AE - Auxiliary/Associated Equipment, or  
SIM - Simulator

## 4.5 EUT In/Output Port

Name	Type*	Cable Max. >3 m	Cable Shielded	Cable Back shell	Remarks
DC IN	DC	1.8	Non shield	Plastic	None
Antenna	I/O	3.0	Shield	Plastic	None
Speaker	I/O	1.6	Non shield	Plastic	None
Multimedia box	I/O	1.8	Non shield	Plastic	None

\*Abbreviations:  
AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical  
I/O = Signal Input or Output Port  
TP = Telecommunication Ports

## 4.6 Test Voltage and Frequency

Case	Voltage (V)	Frequency (Hz)	Phases	Remarks
1	12 V DC	-	-	None

## 5. Test Summary

Test Items	Applied Standards	Results
Conducted Disturbance	ANSI C63.4 : 2014	N/A (Note 1)
Radiated Disturbance	ANSI C63.4 : 2014	C
Antenna Power Conduction	ANSI C63.4 : 2014	C
Note 1) The EUT is not a device connected to the AC mains.		
C=Comply N/C=Not Comply N/T=Not Tested N/A=Not Applicable		

-Conducted Disturbance

Frequency [MHz]	Phase	Result [dB $\mu$ V]	Detector	Limit [dB $\mu$ V]	Margin [dB]
-	-	-	-	-	-

-Radiated Disturbance

Frequency [MHz]	Pol.	Result [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Margin [dB]
223.904	H	35.33	Quasi-Peak	46.00	10.67

## 6. Test Environment

Test Items	Test date (YYYY-MM-DD)	Temp. (°C)	Humidity (% R.H.)	Pressure (kPa)
Radiated Disturbance	2019-07-22 2019-07-23	24 24	46 45	-
Antenna Power Conduction	2019-07-23	24	52	

## 7. Test Results : Emission

### 7.1 Conducted Disturbance

ANSI C63.4	Mains terminal disturbance voltage		Result		
<b>Method:</b> The AMN placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN. The measuring port of the LISN for EUT was connected to spectrum analyzer. Using conducted emission test software, the emissions were scanned with peak detector mode. After scanning over the frequency range, suspected emissions were selected to perform final measurement. When performing final measurement, the receiver was used which has Quasi-Peak detector and CISPR Average detector. For (0.15 ~ 30) MHz frequency range, Quasi-Peak detector with 10 kHz RBW and 30 kHz VBW was used. By varying the configuration of the test sample and the cable routing it was attempted to maximize the emission.			<b>Not Applicable</b>		
<b>Fully configured sample scanned over the following frequency range</b>		Frequency range on each side of line	Measurement Point		
		150 kHz to 30 MHz	Mains		
<b>EUT mode</b> (Refer to clauses 4)		Test configuration mode	N/A		
		EUT Operation mode	N/A		
Limits – Class A					
Frequency (MHz)	Limit dB $\mu$ V				
	Quasi-Peak	Average			
0.15 to 0.50	79	66			
0.50 to 30	73	60			
Limits – Class B					
Frequency (MHz)	Limit dB $\mu$ V				
	Quasi-Peak	Average			
0.15 to 0.50	66 to 56	56 to 46			
0.50 to 5	56	46			
5 to 30	60	50			

Measurement Instrument					
Description	Model	Manufacturer	Identifier	Cal. Date	Cal. Due
-	-	-	-	-	-

<b>Mains terminal disturbance voltage _ Measurement data</b>			
<b>Test configuration mode</b>	<b>N/A</b>	<b>EUT Operation mode</b>	<b>N/A</b>
<b>Test voltage (V)</b>	<b>N/A</b>	<b>Test Frequency (Hz)</b>	<b>N/A</b>

**Calculation**

N : Neutral phase, L1 : Live phase

C.FACTOR(dB) : Pulse Limiter(dB) + Cable loss(dB) + Insertion loss of LISN(dB)

Result(dB $\mu$ V) : Reading Value(dB $\mu$ V) + C.FACTOR(dB)Margin(dB) : Limit(dB $\mu$ V) - Result(dB $\mu$ V)

## 7.2 Radiated Disturbance

ANSI C63.4	Radiated disturbance 30 MHz – 40 GHz			Result		
<u>Method:</u> Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10 or 3 meter below 1GHz and 3 meter above 1GHz. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. For final measurement below 1 GHz frequency range, Quasi-Peak detector with (RBW = 120 kHz Bandwidth) was used. For final measurement above 1 GHz frequency range, Peak detector with (RBW = 1 MHz Bandwidth) and CISPR Average detector with (RBW = 1 MHz Bandwidth) were used.						
<b>EUT mode</b> (Refer to clauses 4)		<b>Test configuration mode</b>	1, 2			
		<b>EUT Operation mode</b>	1, 2, 3			
<b>Radiated Disturbance below 1 000 MHz</b>						
<b>Frequency range</b> (MHz)	<b>Quasi-peak limit dB<math>\mu</math>V/m</b>					
	<b>Class A (10 m distance)</b>		<b>Class B (3 m distance)</b>			
30 to 88	39.1		40			
88 to 216	43.5		43.5			
216 to 960	46.4		46			
960 to 1 000	49.5		54			
According to 15.109(g), as an alternative to the radiated emission limit shown above, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22 shown.						
<b>Frequency range</b> (MHz)	<b>Quasi-peak limit dB<math>\mu</math>V/m</b>					
	<b>Class A (10 m distance)</b>		<b>Class B (10 m distance)</b>			
30 to 230	40		30			
230 to 1 000	47		37			
<b>Radiated Disturbance for above 1 000 MHz at a measurement distance of 3 m</b>						
<b>Frequency range</b> (GHz)	<b>Peak limit dB<math>\mu</math>V/m</b>		<b>Average limit dB<math>\mu</math>V/m</b>			
	<b>Class A</b>	<b>Class B</b>	<b>Class A</b>	<b>Class B</b>		
1 to 40	80	74	60	54		
<b>The test frequency range of Radiated Disturbance measurements are listed below.</b>						
<b>Highest frequency generated or used in the device or on which the device operates or tunes (MHz)</b>		<b>Upper frequency of measurement range (MHz)</b>				
Below 108		1 000				
108 – 500		2 000				
500 – 1 000		5 000				
Above 1 000		5 <sup>th</sup> harmonic of the highest frequency or 40 GHz, whichever is lower				

<b>Measurement Instrument</b>					
<b>Description</b>	<b>Model</b>	<b>Manufacturer</b>	<b>Identifier</b>	<b>Cal. Date</b>	<b>Cal. Due</b>
MEASUREMENT SOFTWARE	EMI-R VER. 2.00.0177	TSJ	N/A	N/A	N/A
EMI TEST RECEIVER	ESU40	ROHDE&SCHWARZ	100525	2018.12.18	2019.12.18
TRILOG BROADBAND TEST-ANTENNA WITH 6DB ATT	VULB9160	SCHWARZBECK	9160-3339	2018.10.22	2020.10.22
	8491B	H.P	18403	2018.10.22	2020.10.22
LOW NOISE PRE AMPLIFIER	MLA-100K01-B01-26	TSJ	1252741	2019.02.18	2020.02.18
HORN ANTENNA	3117	ETS-LINDGREN	152093	2018.03.26	2020.03.26
PRE AMPLIFIER	8449B	H.P	3008A00887	2018.08.31	2019.08.31
HORN ANTENNA WITH	EM-6969	ELECTRO-METRICS	156	2019.02.13	2021.02.13
PREAMPLIFIER	MLA-0618-B03-34	TSJ	1785642	2018.12.27	2019.12.27

(NOTE : THE MEASUREMENT ANTENNAS WERE CALIBRATED IN ACCORDANCE TO THE REQUIREMENTS OF C63.5-2017.)

Radiated disturbance at (30 ~ 1000) MHz _Measurement data			
Test configuration mode	1	EUT Operation mode	1
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

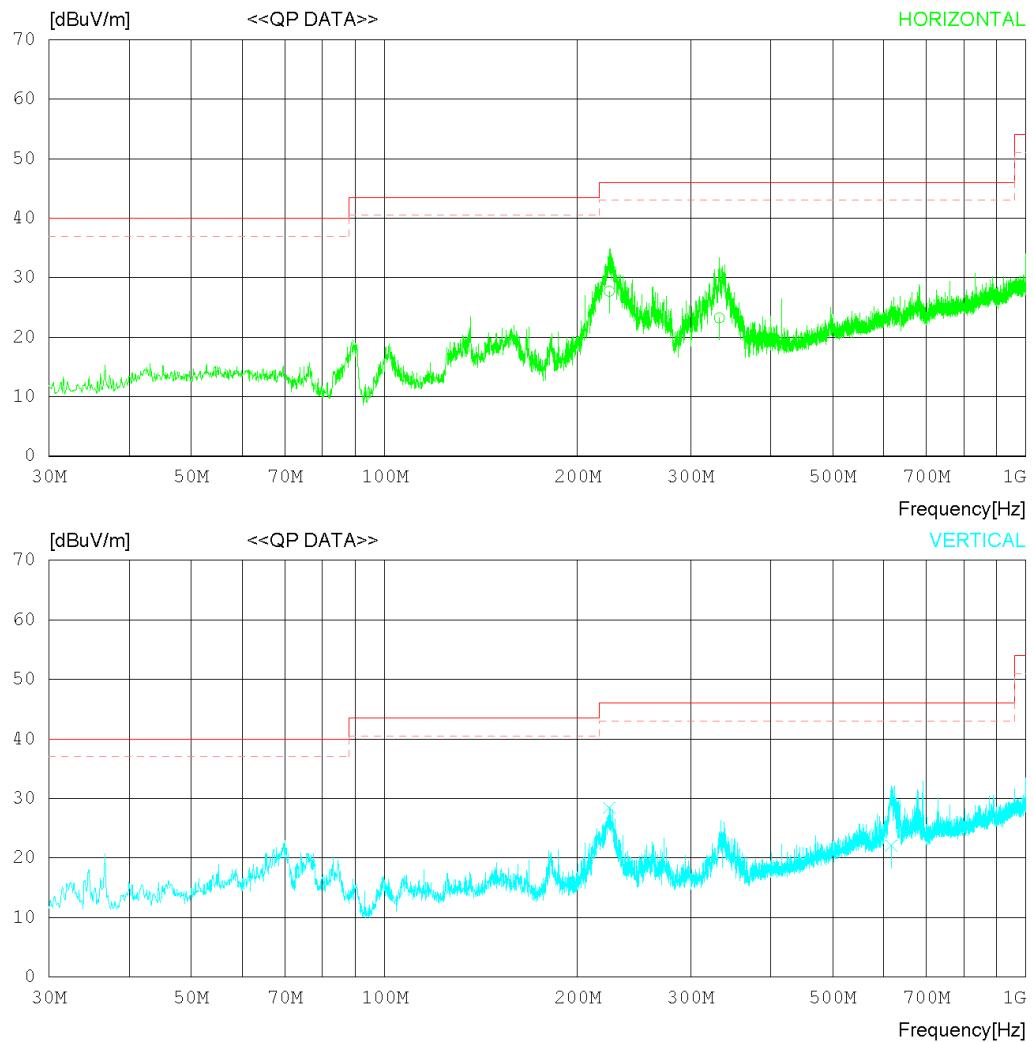
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m)  
 MARGIN: 3 dB



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m)  
MARGIN: 3 dB

No.	FREQ [MHz]	READING [dBuV]	ANT QF [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	224.087	34.30	17.10	2.00	25.67	27.73	46.00	18.27	108	185
2	332.597	26.90	19.85	2.36	25.88	23.23	46.00	22.77	137	300
<hr/>										
<hr/>										
3	224.183	35.00	17.11	2.00	25.67	28.44	46.00	17.56	190	80
4	616.942	18.80	25.67	3.13	25.52	22.08	46.00	23.92	123	145

Radiated disturbance at (1 ~ 6) GHz _ Peak measurement data			
Test configuration mode	1	EUT Operation mode	1
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

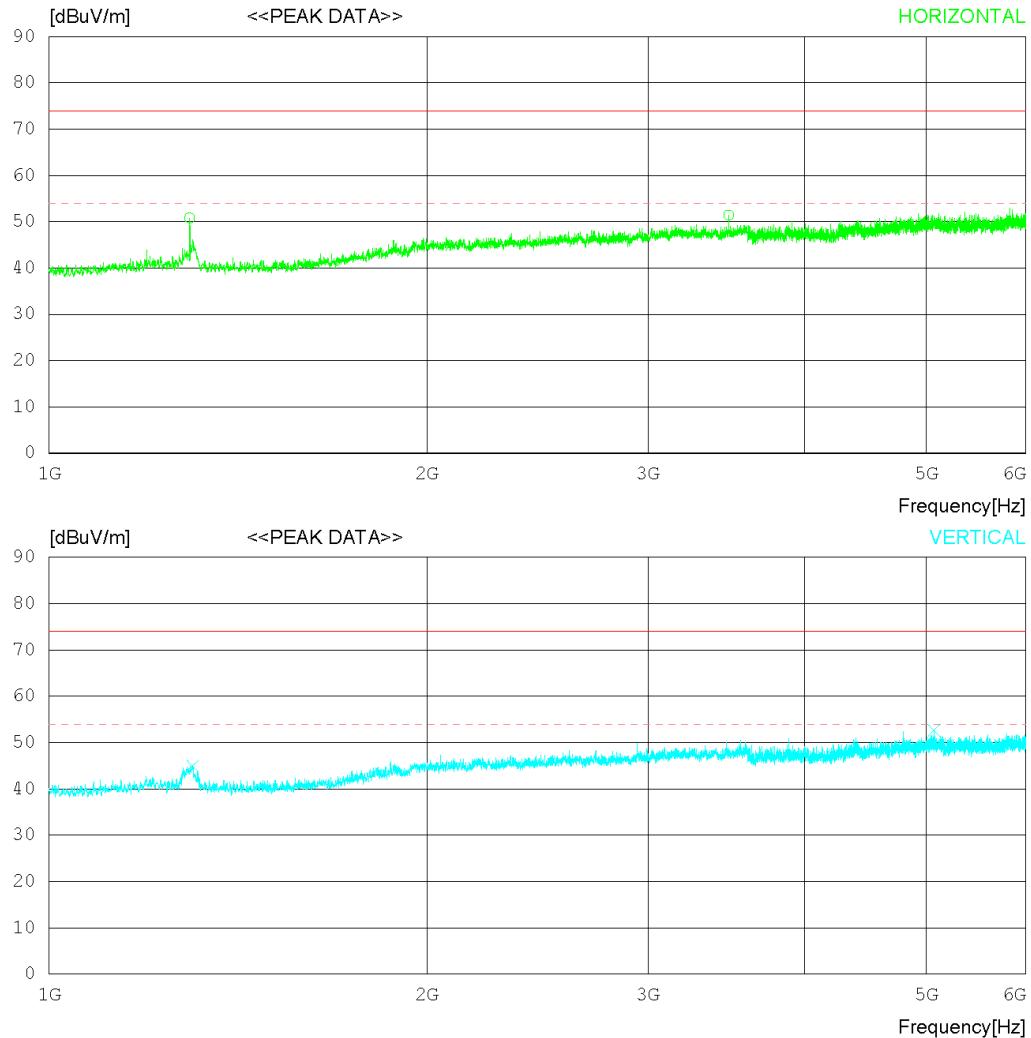
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Average)



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
FCC Part15 Subpart.B Class B (3m) - GHz(Average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1294.375	52.70	28.79	4.86	35.55	50.80	74.0	23.2	199	358
2	3478.125	45.10	32.80	8.15	34.60	51.45	74.0	22.55	130	119
----- Vertical -----										
3	1301.250	46.80	28.78	4.88	35.54	44.92	74.0	29.08	100	254
4	5068.750	42.40	34.16	10.71	34.65	52.62	74.0	21.38	250	0

Radiated disturbance at (1 ~ 6) GHz _Average measurement data			
Test configuration mode	1	EUT Operation mode	1
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

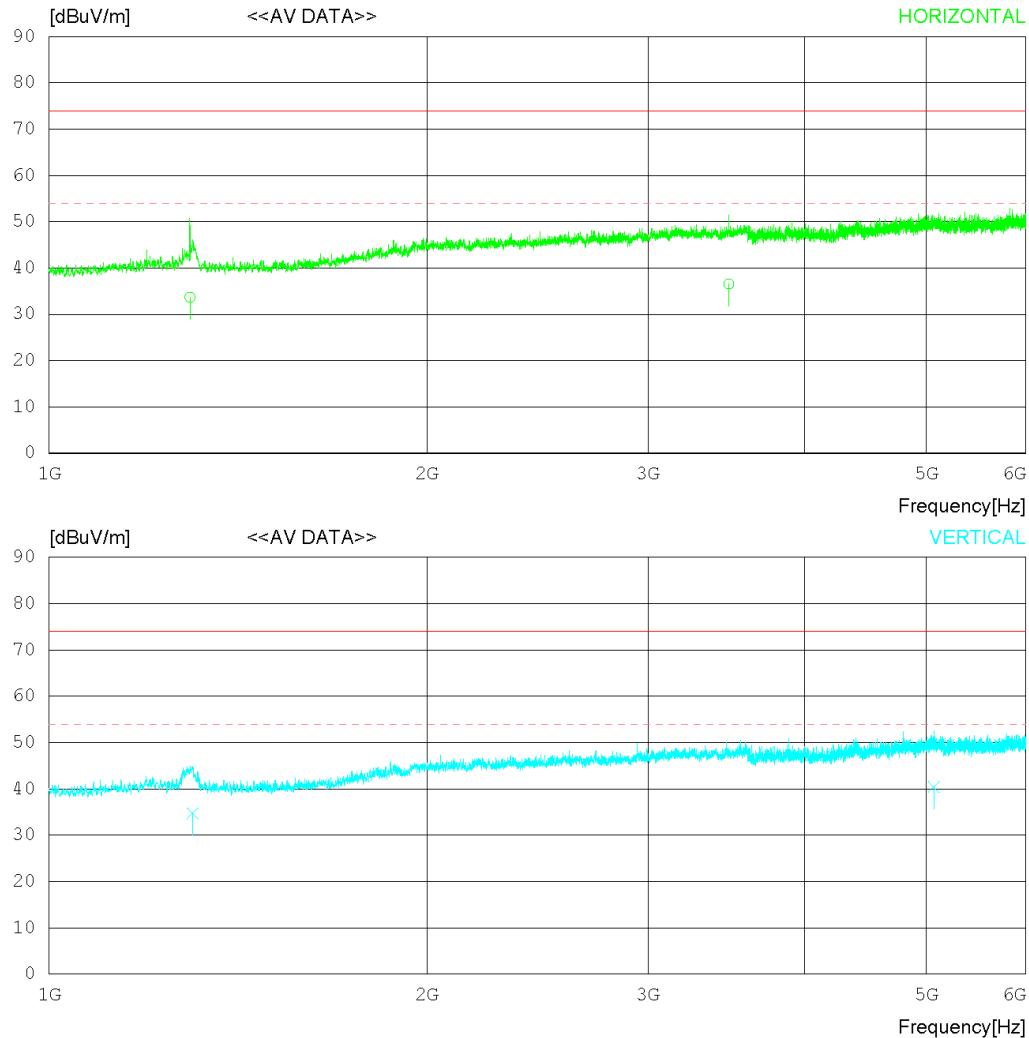
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition AM

## Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Peak)



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
FCC Part15 Subpart.B Class B (3m) - GHz(Peak)

No.	FREQ [MHz]	READING CAV [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1294.771	35.60	28.79	4.86	35.55	33.70	54.00	20.30	205	30
2	3480.152	30.20	32.80	8.15	34.60	36.55	54.00	17.45	121	202
----- Vertical -----										
3	1300.470	36.60	28.79	4.88	35.54	34.73	54.00	19.27	106	315
4	5068.143	30.20	34.16	10.71	34.65	40.42	54.00	13.58	184	74

Radiated disturbance at (6 ~ 18) GHz _Peak measurement data			
Test configuration mode	1	EUT Operation mode	1
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

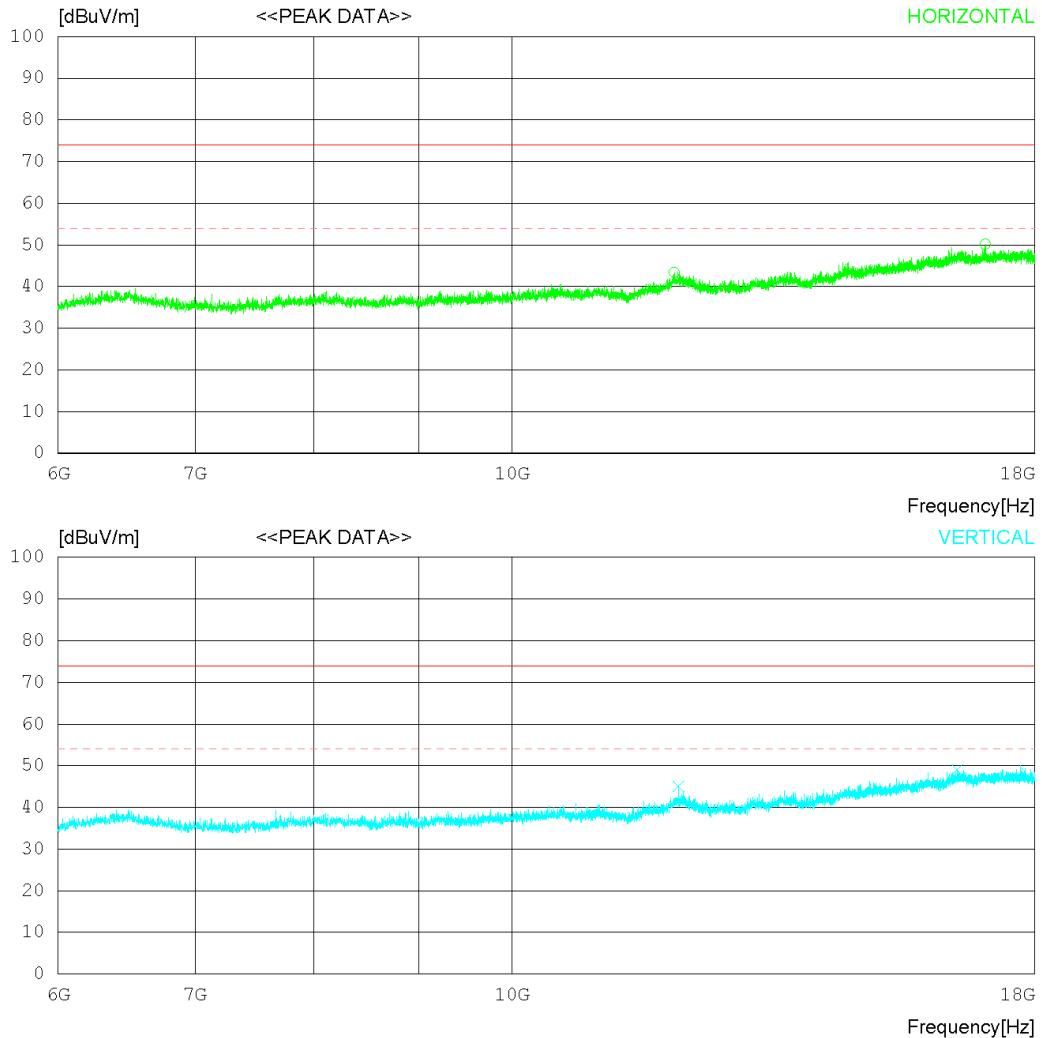
## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 46 % R.H.  
 Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Average)



\* The measurement is performed above 18 GHz up to 40 GHz and not found emissions above 18 GHz.

## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 46 % R.H.  
Test Condition AM

## Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
FCC Part15 Subpart.B Class B (3m) - GHz(Average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	11997.00031.90	33.46	15.68	37.67	43.37	74.0	30.63	112	216	
2	17020.50029.80	37.57	20.10	37.28	50.19	74.0	23.81	108	145	
<hr/>										
----- Vertical -----										
3	12060.00033.70	33.47	15.64	37.77	45.04	74.0	28.96	207	123	
4	16494.00029.20	36.98	19.58	36.81	48.95	74.0	25.05	241	0	

Radiated disturbance at (6 ~ 18) GHz _ Average measurement data			
Test configuration mode	1	EUT Operation mode	1
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

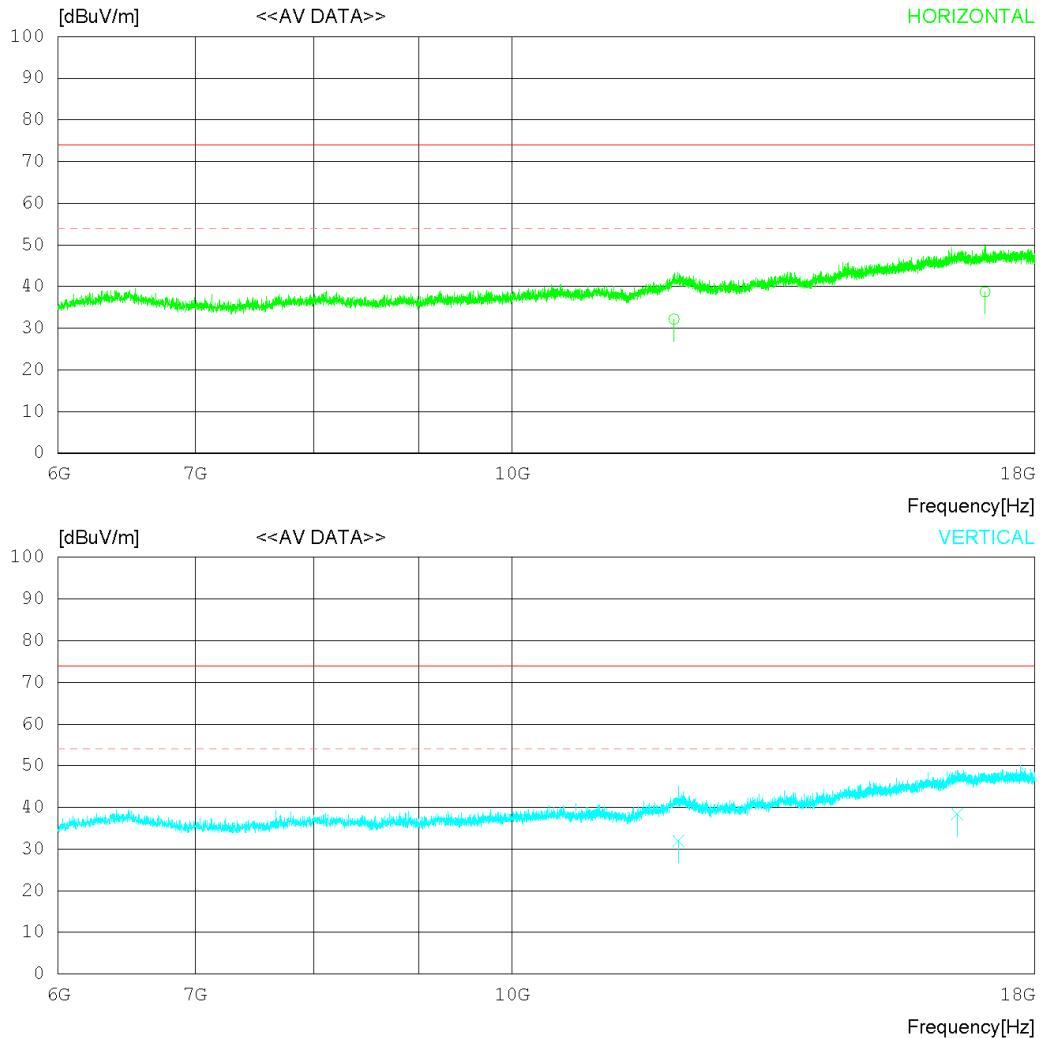
## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 46 % R.H.  
 Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Peak)



\* The measurement is performed above 18 GHz up to 40 GHz and not found emissions above 18 GHz.

## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 46 % R.H.  
Test Condition AM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
FCC Part15 Subpart.B Class B (3m) - GHz(Peak)

No.	FREQ [MHz]	READING CAV [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	11995.63020.70	33.46	15.68	37.67	32.17	54.00	21.83	134	300	
2	17019.73018.30	37.57	20.11	37.28	38.70	54.00	15.30	105	120	
<hr/>										
<hr/>										
3	12058.83020.60	33.47	15.64	37.76	31.95	54.00	22.05	194	36	
4	16496.27018.60	36.98	19.59	36.81	38.36	54.00	15.64	188	258	

Radiated disturbance at (30 ~ 1000) MHz _ Measurement data			
Test configuration mode	1	EUT Operation mode	2
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

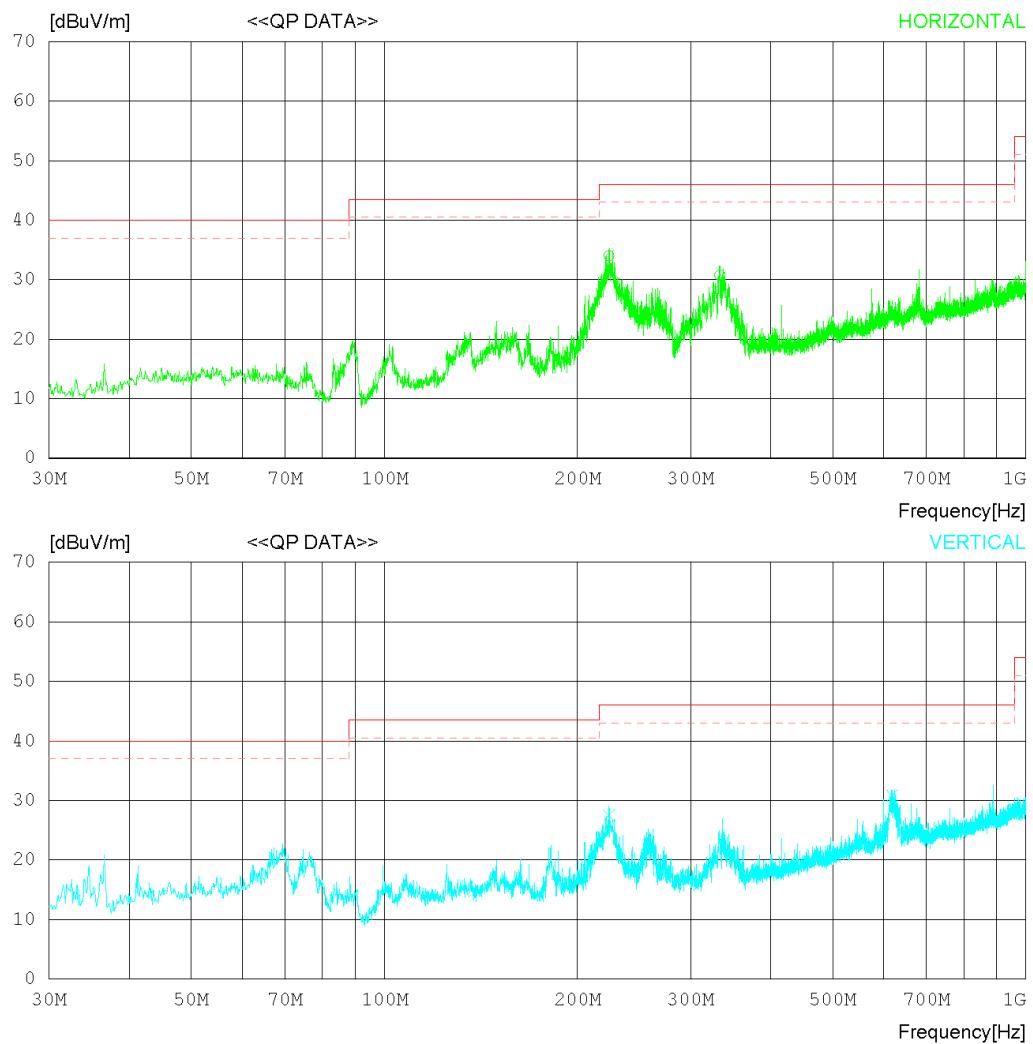
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 'C 45 % R.H.  
Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m)  
MARGIN: 3 dB



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m)  
MARGIN: 3 dB

No.	FREQ [MHz]	READING [dBuV]	ANT QF [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	223.890	40.60	17.09	2.00	25.67	34.02	46.00	11.98	136	50
2	333.143	34.40	19.86	2.36	25.88	30.74	46.00	15.26	107	6
<hr/>										
<hr/>										
3	224.038	34.10	17.10	2.00	25.67	27.53	46.00	18.47	152	321
4	618.739	27.50	25.69	3.14	25.52	30.81	46.00	15.19	115	246

Radiated disturbance at (1 ~ 6) GHz _ Peak measurement data			
Test configuration mode	1	EUT Operation mode	2
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

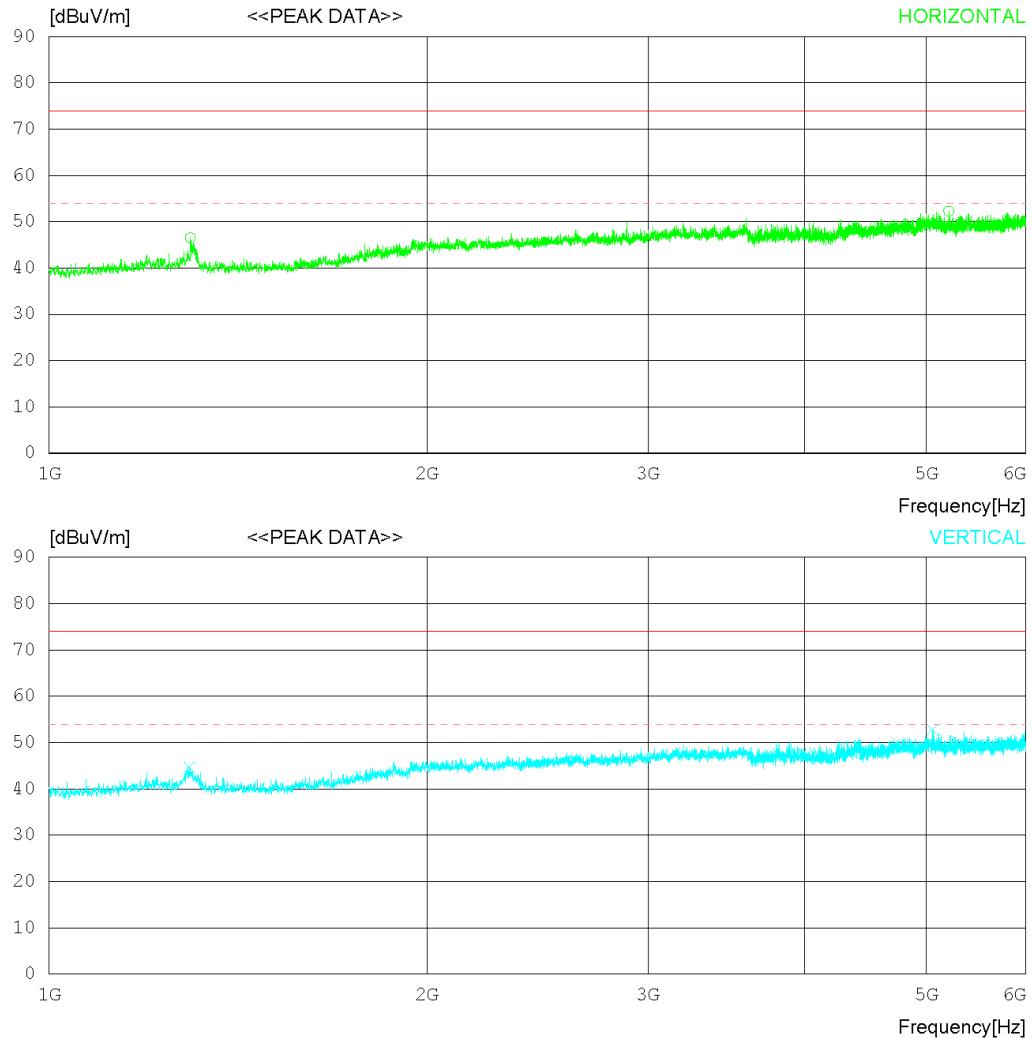
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Average)



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
FCC Part15 Subpart.B Class B (3m) - GHz(Average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1296.250	48.40	28.79	4.86	35.54	46.51	74.0	27.49	100	358
2	5208.125	42.00	34.22	10.70	34.66	52.26	74.0	21.74	278	0
----- Vertical -----										
3	1293.750	46.50	28.79	4.86	35.55	44.60	74.0	29.4	107	231
4	5058.750	42.50	34.18	10.71	34.65	52.74	74.0	21.26	219	9

Radiated disturbance at (1 ~ 6) GHz _Average measurement data			
Test configuration mode	1	EUT Operation mode	2
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

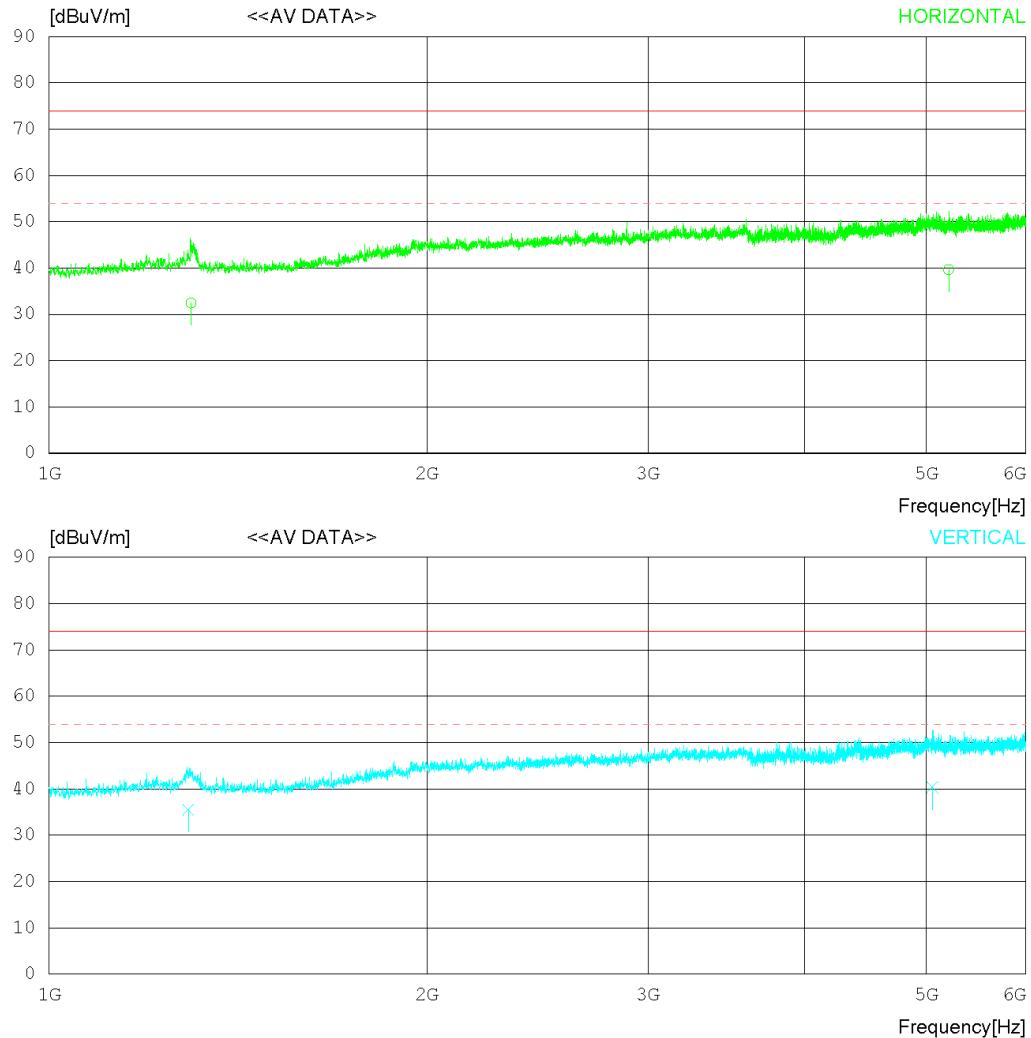
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Peak)



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
FCC Part15 Subpart.B Class B (3m) - GHz(Peak)

No.	FREQ [MHz]	READING CAV [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	1297.705	34.30	28.80	4.86	35.54	32.42	54.00	21.58	107	54
2	5207.838	29.40	34.22	10.70	34.66	39.66	54.00	14.34	221	100
<hr/>										
<hr/>										
3	1290.911	37.40	28.78	4.85	35.55	35.48	54.00	18.52	116	319
4	5056.035	30.10	34.19	10.70	34.65	40.34	54.00	13.66	217	8

Radiated disturbance at (6 ~ 18) GHz _Peak measurement data			
Test configuration mode	1	EUT Operation mode	2
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

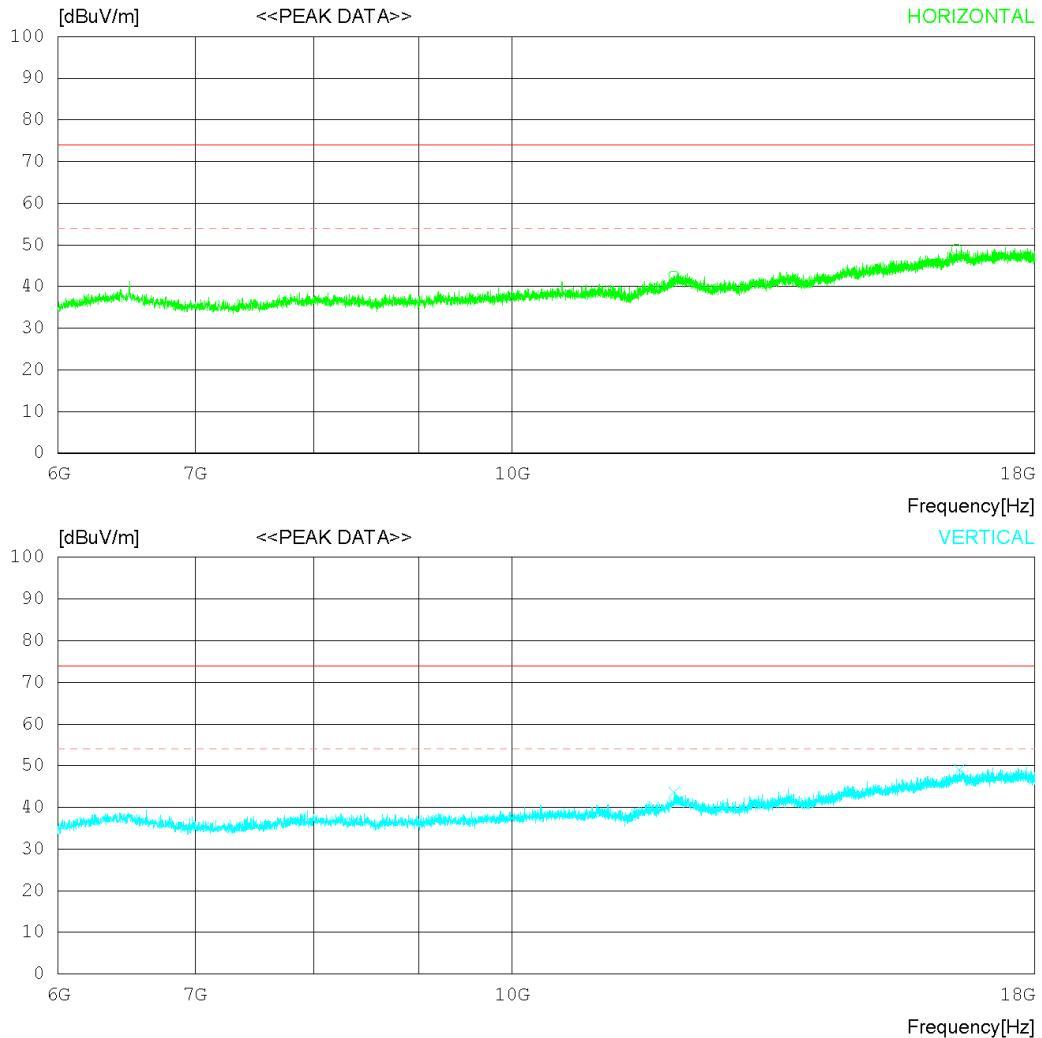
## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 46 % R.H.  
 Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Average)



\* The measurement is performed above 18 GHz up to 40 GHz and not found emissions above 18 GHz.

## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 46 % R.H.  
Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
FCC Part15 Subpart.B Class B (3m) - GHz(Average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	11994.00031.10	33.45	15.66	37.67	42.54	74.0	31.46	106	354	
2	16482.00029.30	36.96	19.52	36.81	48.97	74.0	25.03	234	57	
<hr/>										
<hr/>										
3	11998.50032.10	33.46	15.68	37.66	43.58	74.0	30.42	100	134	
4	16542.00029.00	37.03	19.81	36.85	48.99	74.0	25.01	137	352	

Radiated disturbance at (6 ~ 18) GHz _Average measurement data			
Test configuration mode	1	EUT Operation mode	2
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

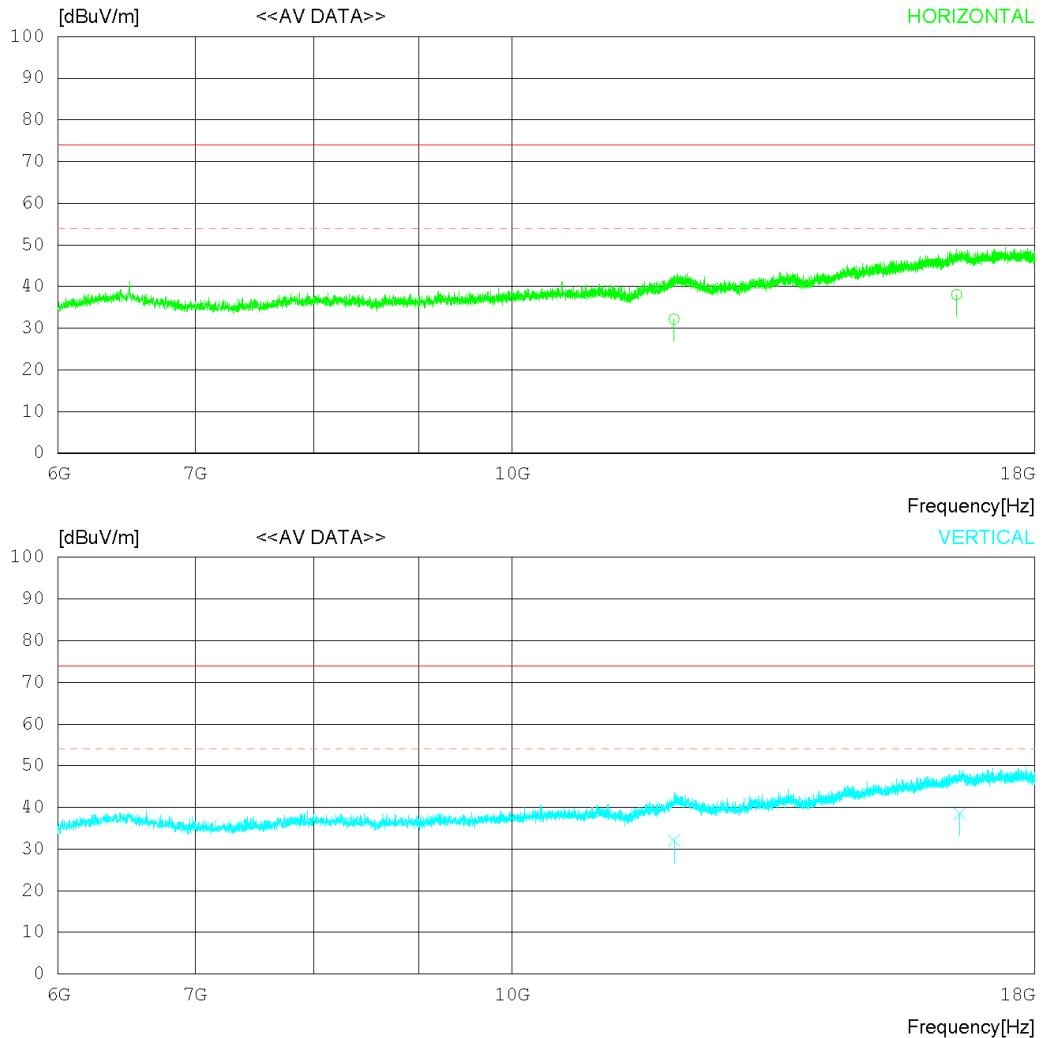
## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 46 % R.H.  
 Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Peak)



\* The measurement is performed above 18 GHz up to 40 GHz and not found emissions above 18 GHz.

## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 'C 46 % R.H.  
Test Condition FM

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
FCC Part15 Subpart.B Class B (3m) - GHz(Peak)

No.	FREQ [MHz]	READING CAV [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	11995.88020.70	33.46	15.68	37.67	32.17	54.00	21.83	100	330	
2	16482.67018.40	36.97	19.52	36.81	38.08	54.00	15.92	219	130	
<hr/>										
<hr/>										
3	11997.95020.60	33.46	15.68	37.66	32.08	54.00	21.92	134	122	
4	16541.84018.50	37.03	19.81	36.85	38.49	54.00	15.51	110	270	

Radiated disturbance at (30 ~ 1000) MHz _Measurement data			
Test configuration mode	2	EUT Operation mode	3
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

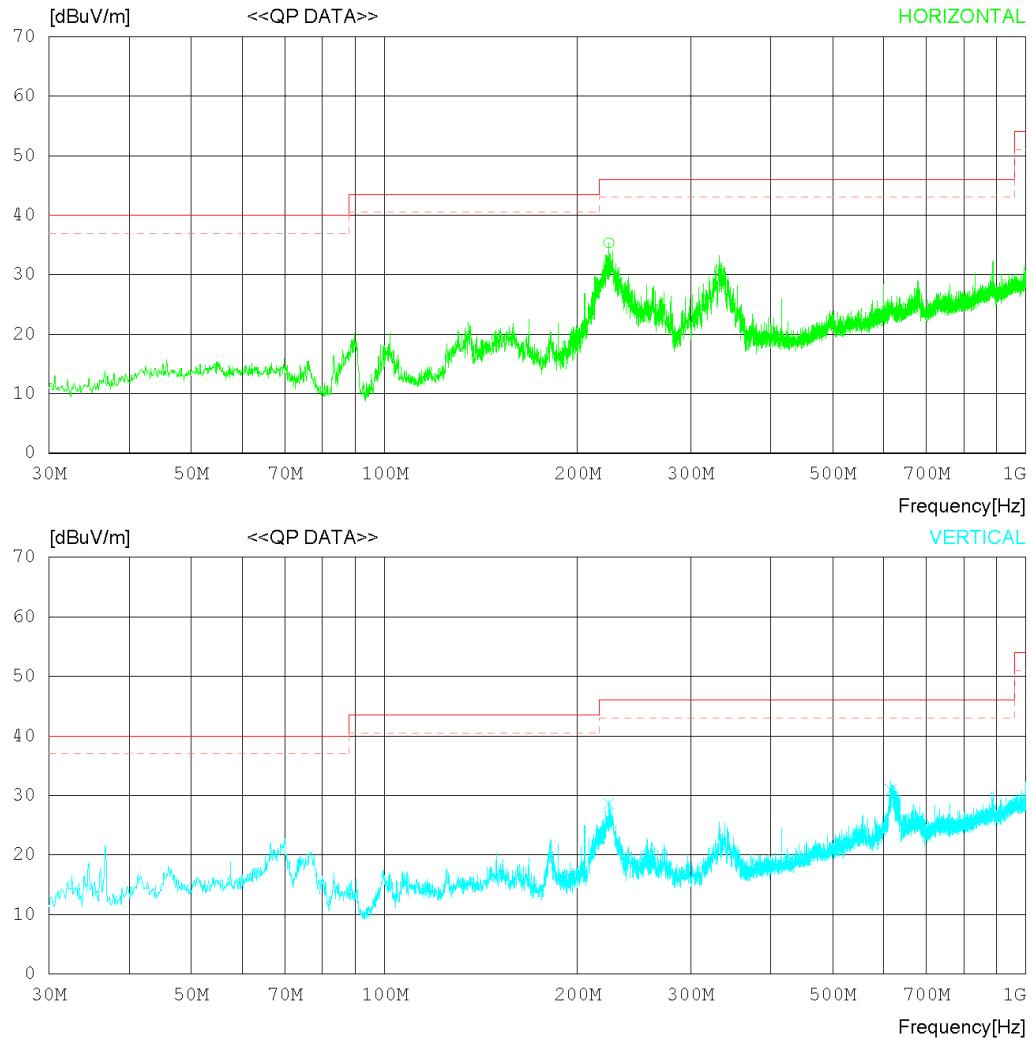
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m)  
 MARGIN: 3 dB



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m)  
MARGIN: 3 dB

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	223.904	41.90	17.10	2.00	25.67	35.33	46.00	10.67	134	267
2	332.717	34.30	19.85	2.36	25.88	30.63	46.00	15.37	113	348
----- Vertical -----										
3	223.936	35.20	17.10	2.00	25.67	28.63	46.00	17.37	140	5
4	615.743	27.70	25.66	3.13	25.52	30.97	46.00	15.03	126	112

Radiated disturbance at (1 ~ 6) GHz _ Peak measurement data			
Test configuration mode	2	EUT Operation mode	3
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

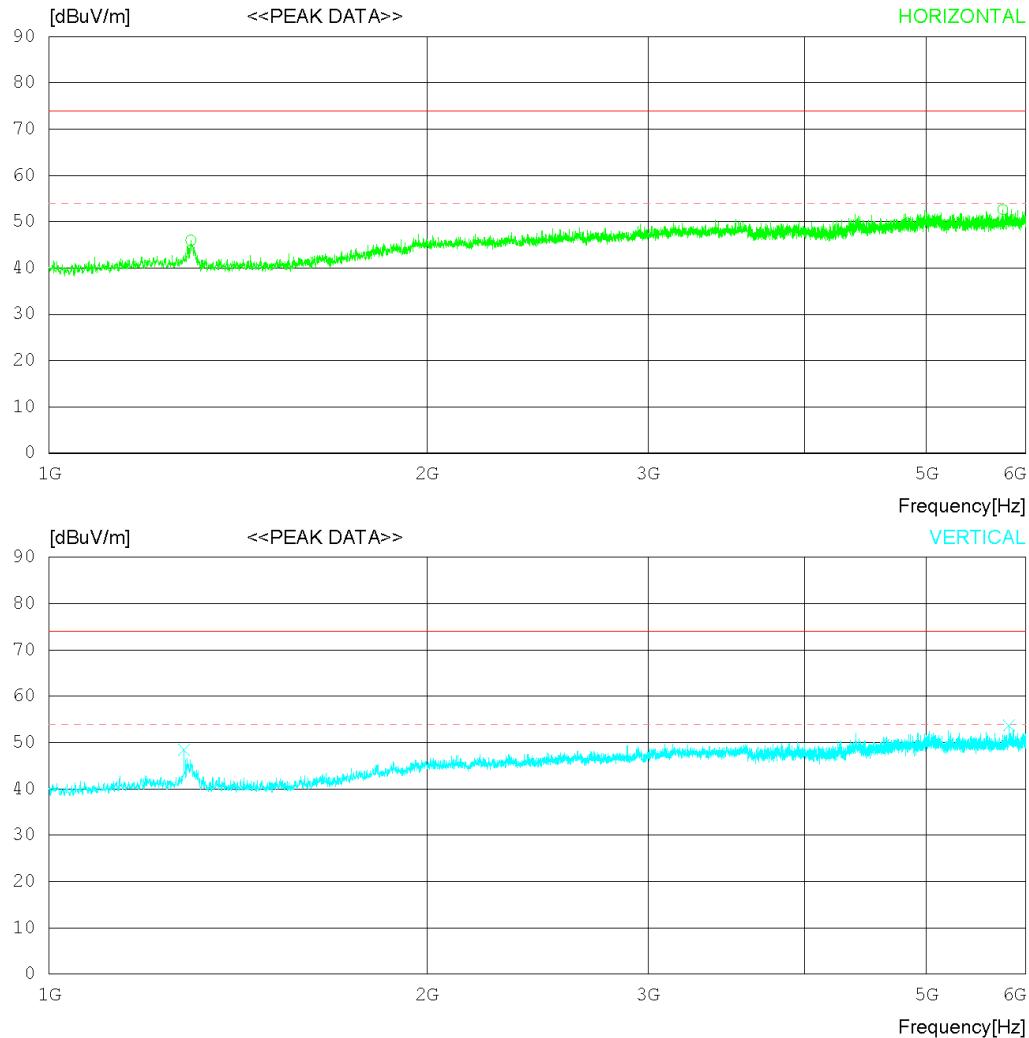
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Average)



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
FCC Part15 Subpart.B Class B (3m) - GHz(Average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	1296.875	47.90	28.79	4.86	35.54	46.01	74.0	27.99	300	129
2	5751.875	41.50	34.70	11.16	34.73	52.63	74.0	21.37	100	267
<hr/>										
<hr/>										
3	1280.625	50.40	28.76	4.85	35.56	48.45	74.0	25.55	100	180
4	5815.625	42.40	34.76	11.27	34.74	53.69	74.0	20.31	300	27

Radiated disturbance at (1 ~ 6) GHz _Average measurement data			
Test configuration mode	2	EUT Operation mode	3
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

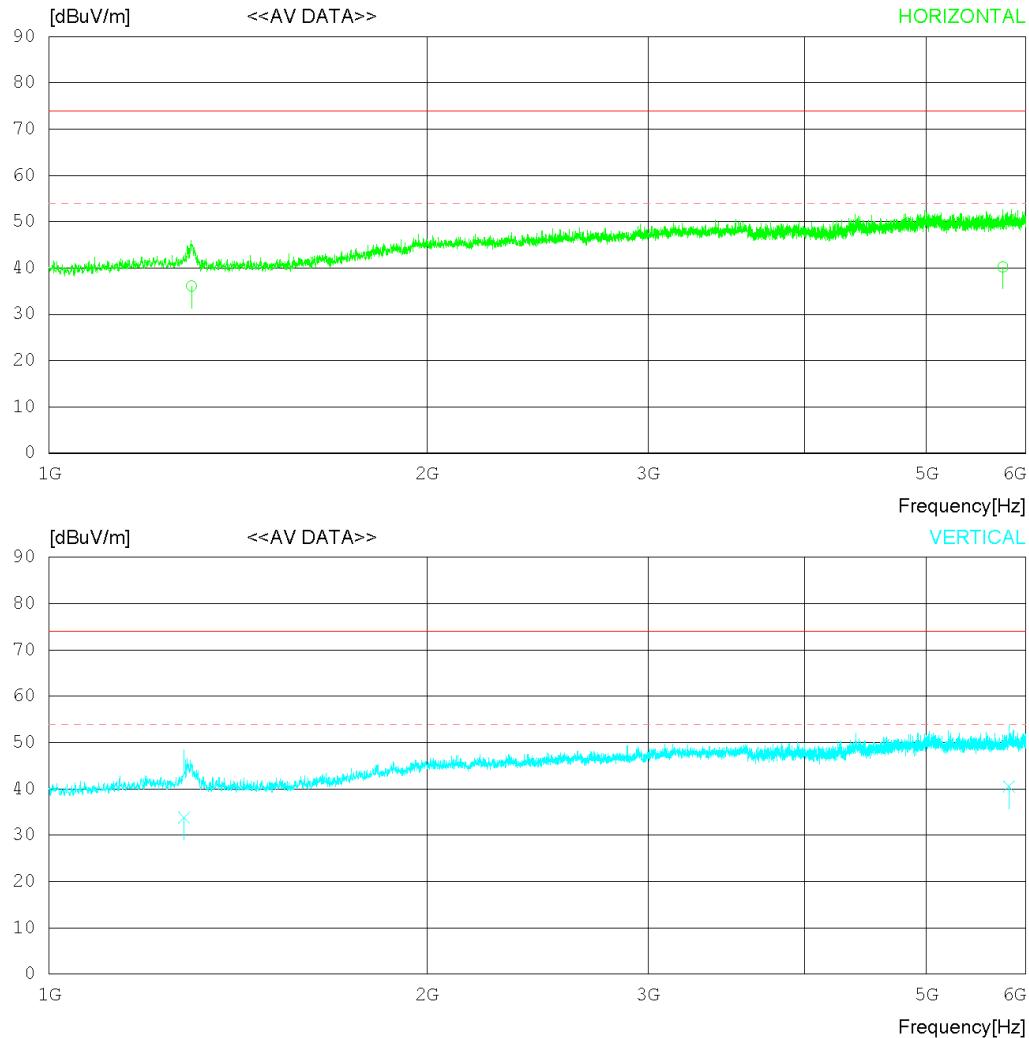
## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 45 % R.H.  
 Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Peak)



## RADIATED EMISSION

Date 2019-07-23

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 45 % R.H.  
Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
FCC Part15 Subpart.B Class B (3m) - GHz(Peak)

No.	FREQ [MHz]	READING CAV [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	1298.471	38.00	28.80	4.86	35.54	36.12	54.00	17.88	287	201
2	5751.578	29.10	34.70	11.16	34.73	40.23	54.00	13.77	163	308
----- Vertical -----										
3	1281.260	35.70	28.76	4.85	35.56	33.75	54.00	20.25	127	94
4	5816.256	29.20	34.77	11.26	34.74	40.49	54.00	13.51	309	156

Radiated disturbance at (6 ~ 18) GHz _Peak measurement data			
Test configuration mode	2	EUT Operation mode	3
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

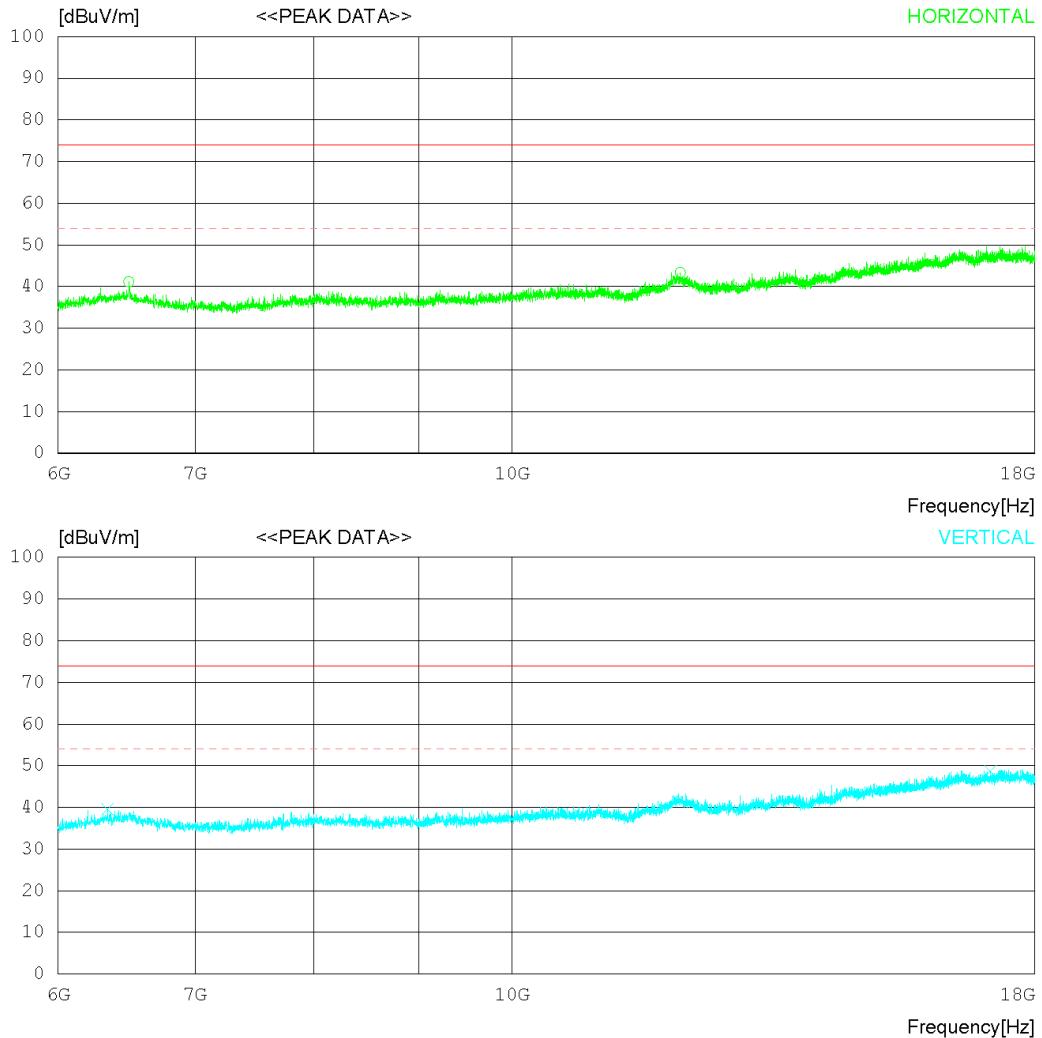
## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 46 % R.H.  
 Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Average)



\* The measurement is performed above 18 GHz up to 40 GHz and not found emissions above 18 GHz.

## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 46 % R.H.  
Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Peak)  
FCC Part15 Subpart.B Class B (3m) - GHz(Average)

No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	6496.500	36.90	31.59	11.20	38.54	41.15	74.0	32.85	115	358
2	12081.00032.10	33.47	15.63	37.80	43.40		74.0	30.6	193	0
<hr/>										
<hr/>										
3	6343.500	35.60	31.63	11.07	38.73	39.57	74.0	34.43	134	358
4	17119.27028.80	37.64	19.60	37.36	48.68		74.0	25.32	104	358

Radiated disturbance at (6 ~ 18) GHz _Average measurement data			
Test configuration mode	2	EUT Operation mode	3
Test voltage (V)	DC 12 V	Test Frequency (Hz)	-

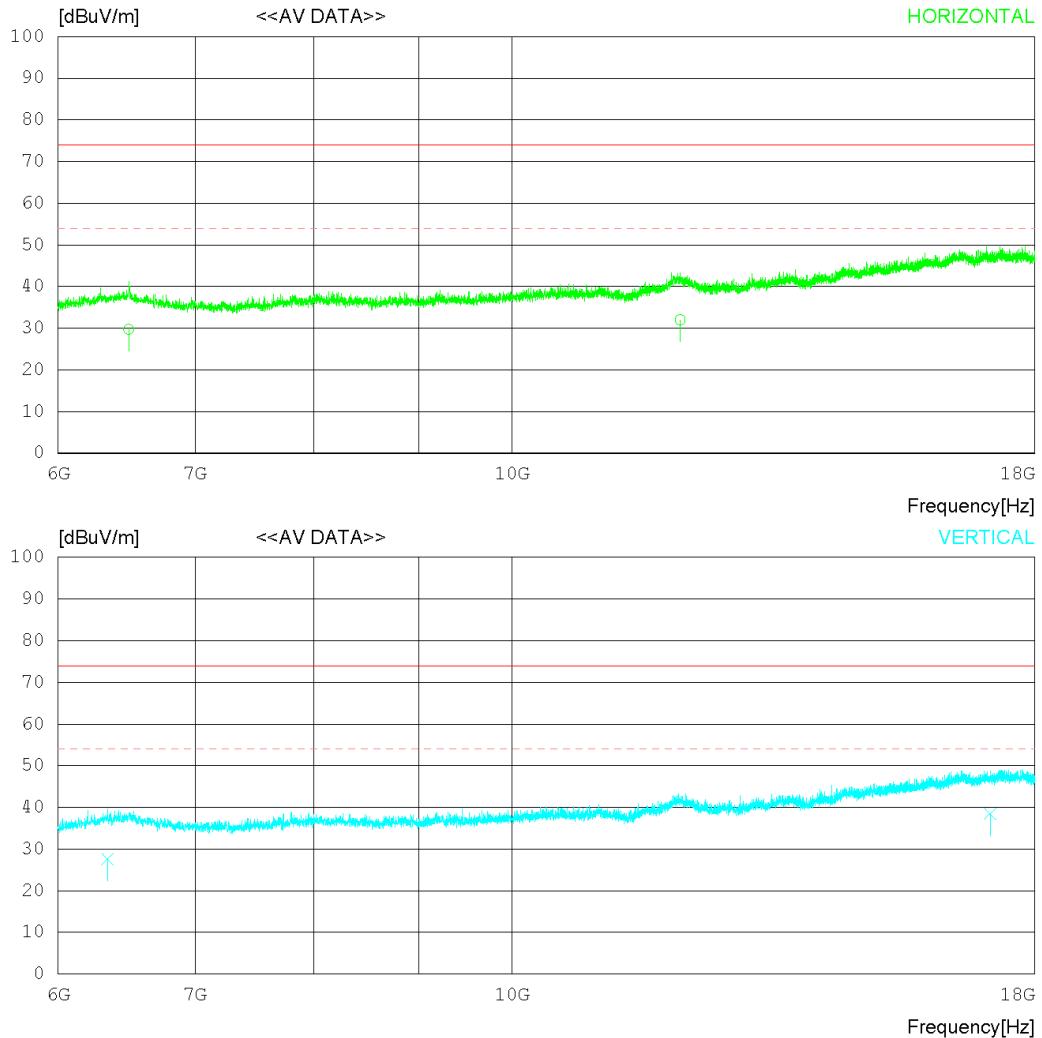
## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
 Power Supply DC 12 V  
 Temp/Humi 24 'C 46 % R.H.  
 Test Condition USB

## Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
 FCC Part15 Subpart.B Class B (3m) - GHz(Peak)



\* The measurement is performed above 18 GHz up to 40 GHz and not found emissions above 18 GHz.

## RADIATED EMISSION

Date 2019-07-22

Order No. DTNC1907-05559  
Power Supply DC 12 V  
Temp/Humi 24 °C 46 % R.H.  
Test Condition USB

Memo

LIMIT : FCC Part15 Subpart.B Class B (3m) - GHz(Average)  
FCC Part15 Subpart.B Class B (3m) - GHz(Peak)

No.	FREQ [MHz]	READING [dBuV]	ANT CAV	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
<hr/>										
1	6495.596	25.50	31.59	11.20	38.54	29.75	54.00	24.25	107	311
2	12079.73020	20.70	33.47	15.63	37.80	32.00	54.00	22.00	245	8
<hr/>										
3	6344.445	23.60	31.63	11.07	38.73	27.57	54.00	26.43	124	76
4	17118.37018	60	37.64	19.60	37.36	38.48	54.00	15.52	101	289

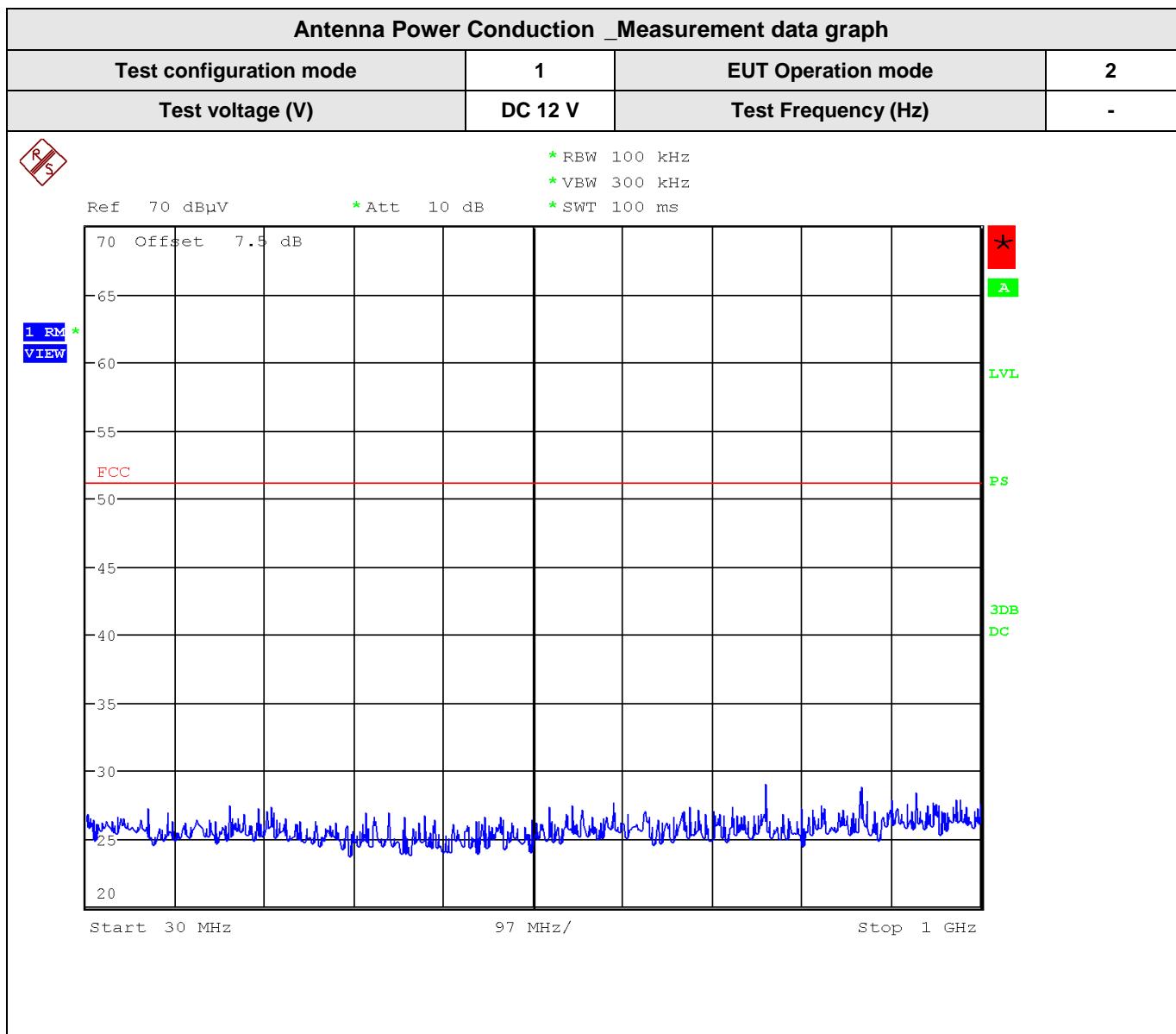
### Calculation

N : Neutral phase, L1 : Live phase
C.FACTOR(dB) : Pulse Limiter(dB) + Cable loss(dB) + Insertion loss of LISN(dB)
Result(dB $\mu$ V) : Reading Value(dB $\mu$ V) + C.FACTOR(dB)
Margin(dB) : Limit(dB $\mu$ V) - Result(dB $\mu$ V)

## 7.3 Antenna Power Conduction

ANSI C63.4	Antenna power conduction		Result
<u>Method:</u> Power on the receive antenna terminals was to be determined by measurement of the voltage present at these terminals. Antenna conducted power measurements was performed with the EUT antenna terminals connected directly to measuring instrument using a impedance-Matching network to connect the measurement Instrument to the antenna terminals of the EUT. The losses in decibels in impedance-matching network and cables was added to the measured values in dB $\mu$ V. The measurements were repeated with the receiver tuned to a frequency until all of frequencies had been successively measured. Power in the receive antenna terminals in the ratio of $V^2/R$ , where V is the loss-corrected voltage measured at the antenna terminals, and R is the impedance of the measuring instrument			Comply
<b>Fully configured sample scanned over the following frequency range</b>	<b>Frequency range on each side of line</b>	<b>Limit</b>  2 nW (51.7 dB $\mu$ V)	
<b>Measurement Point</b>	<b>Tuner port</b>		
<b>EUT mode</b> <b>(Refer to clauses 4)</b>	<b>Test configuration mode</b>	1	
	<b>EUT Operation mode</b>	2	

Measurement Instrument					
Description	Model	Manufacturer	Identifier	Cal. Date	Cal. Due
EMI TEST RECEIVER	ESU	ROHDE & SCHWARZ	100538	2019.01.23	2020.01.23
SPLITTER	ZFRSC-123-S+	MINI CIRCUITS	SF139801142	2019.07.15	2020.07.15



## 8. Revision History

Date	Description	Revised By	Reviewed By
Sep. 26. 2019	Initial report	MinWoo Park	DaeHwa Eun

-End of test report-