EMC
TEST REPORT

Report No. : TS12110095-EME
Model No. : DIR-300 V
Issued Date : Jan. 11, 2013

Applicant: **TRANS ELECTRIC CO., LTD**
771, Sec. 2, Chungsan Road, Huatang, Changhua, Taiwan

Test Method/ Standard: **47 CFR FCC Part 15.231 & ANSI C63.4 2003**

Test By: **Intertek Testing Services Taiwan Ltd.**
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Summary of Tests

Test Item	Reference	Results
Radiated Emission test	15.231(b), 15.209	Pass
Measured bandwidth	15.231(c)	Pass
Timing requirement of manually operated transmitter	15.231(a)(1)	Pass
Conducted Emission test	15.231(b), 15.207	N/A

1. General information

1.1 Identification of the EUT

Product:	DIGITAL REMOTE CONTROL EXTENDER
Model No.:	DIR-300 V
FCC ID.:	BY4-DIR300V
Frequency Range:	433.92 MHz
Channel Number:	Single Channel
Frequency of Each Channel:	433.92 MHz
Access scheme:	FSK
Power Supply:	DC 12 V from Adapter
Power Cord:	N/A
Sample Received:	Nov. 15, 2012
Test Date(s):	Nov. 26, 2012 ~ Jan.08, 2013
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Brand	Model no.	Specification
Adapter	N/A	S005IU1200025	I/P:120V, 60Hz, 150 mA O/P:12 V, 250 mA

1.3 Additional information about the EUT

The EUT is DIGITAL REMOTE CONTROL EXTENDER, and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.4 Antenna description

The EUT uses a permanently connected antenna

Antenna Gain : 0 dBi
Antenna Type : Rod antenna
Connector Type : Fixed

1.5 Peripherals equipment

Peripherals	Brand	Model No.	Serial No.
DVD Player	SONY	DVP-NS718HP	S01-1003271-0
Remote Controller	PX	VC-181	N/A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 2.1053 and the requirement in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

The EUT was supplied with DC 12V from adapter(Test voltage: 120Vac, 60 Hz), when the remote control device send a IR signal, the IR sensor of the Transmitter to detect IR signal from the remote controller and then converts the IR signal into an 433.92MHz RF signal to transmit.

2.3 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2012/11/30	2013/11/29
Spectrum Analyzer	Rohde&schwarz	FSP30	100137	2012/6/25	2013/6/25
Spectrum Analyzer	Rohde&schwarz	FSEK30	100186	2012/2/6	2013/2/5
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2012/9/3	2014/9/3
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2011/7/26	2013/7/25
Pre-Amplifier	MITEQ	AFS44-00102650 --42-10P-44	1495287	2011/10/27	2013/10/26
Pre-Amplifier	MITEQ	JS4-26004000--2 7-8A	828825	2012/9/18	2014/9/18

Note: The above equipments are within the valid calibration period.

3. Radiated emission test FCC 15.231 (b)

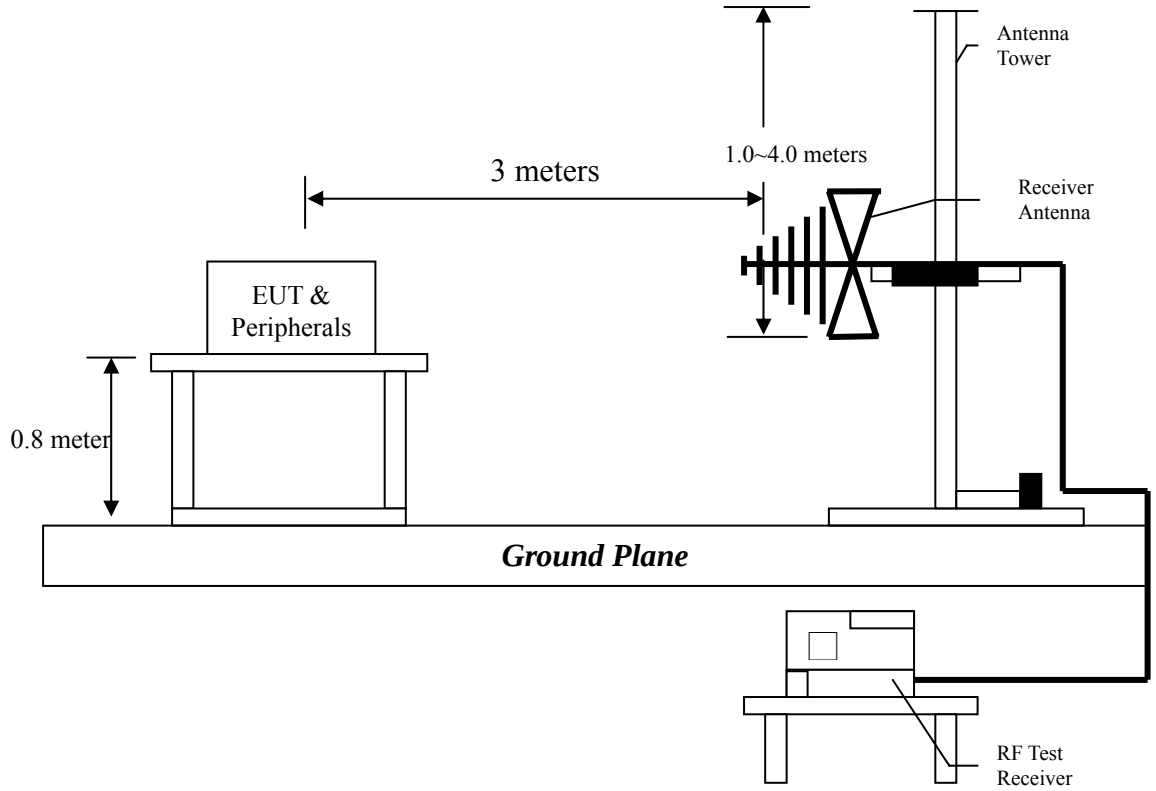
3.1 Operating environment

Temperature:	21	℃
Relative Humidity:	55	%
Atmospheric Pressure	1008	hPa

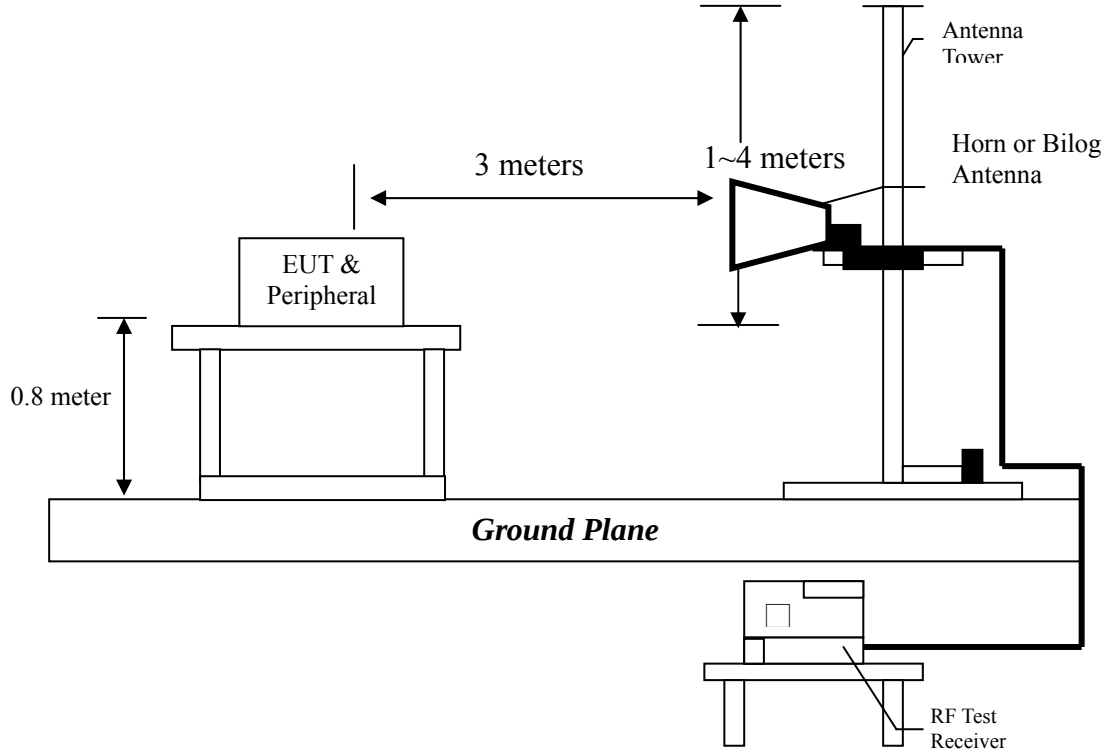
3.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.

The frequency spectrum from 30MHz to 1000MHz was investigated.



The frequency spectrum from over 1GHz was investigated.



The signal is maximized through rotation and placement in the three orthogonal axes.
The frequency range of radiated measurements is starting at the lowest RF signal generated in the device (without < 9 kHz) and up to the tenth harmonic of thehighest fundamental frequency or to 40 GHz, whichever is lower, for transmitter operates below 10 GHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1 GHz, 1MHz – for frequencies above 1 GHz.
The EUT for testing is arranged on a fiberglass turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.3 Radiated emission limit

3.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3 m)	(dBuV/m@3 m)	(uV/m@3 m)	(dBuV/m@3 m)
433.9200	11002.7185	80.83	1100.2718	60.83

3.3.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency MHz	15.209 Limits (dBμV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty
Radiated Emission	±5.056 dB
Conducted Emission	±2.786 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

3.4 Radiated emission test data FCC 15.231

3.4.1 Measurement results: Fundamental emission

EUT : DIR-300 V
Test condition : Tx mode

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	433.9200	PK	17.64	63.24	80.88	100.83	-19.95
Vertical	433.9200	AV	17.64	62.66	80.30	80.83	-0.53
Horizontal	433.9200	PK	18.12	58.95	77.07	100.83	-23.76
Horizontal	433.9200	AV	18.12	58.33	76.45	80.83	-4.38

Remark:
1. Calculated = Reading + Corr. Factor
2. Margin= Calculated – Limit

3.4.2 Measurement results: frequencies equal to or less than 1 GHz

EUT : DIR-300 V
Test condition : Tx mode

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	381.14000	PK	16.40	15.23	31.63	80.83	-49.20
Vertical	381.14000	AV	16.40	13.31	29.71	60.83	-31.12
Vertical	421.88000	PK	16.47	28.65	45.12	80.83	-35.71
Vertical	421.88000	AV	16.47	27.36	43.83	60.83	-17.00
Vertical	447.10000	PK	18.12	24.68	42.80	80.83	-38.03
Vertical	447.10000	AV	18.12	23.25	41.37	60.83	-19.46
Vertical	485.90000	PK	18.64	16.98	35.62	80.83	-45.21
Vertical	485.90000	AV	18.64	16.13	34.77	60.83	-26.06
Vertical	538.28000	PK	19.65	12.64	32.29	80.83	-48.54
Vertical	538.28000	AV	19.65	11.24	30.89	60.83	-29.94
Vertical	868.08000	PK	24.12	22.83	46.94	80.83	-33.89
Vertical	868.08000	AV	24.12	20.57	44.68	60.83	-16.15
Horizontal	41.64000	PK	14.20	13.16	27.36	80.83	-53.47
Horizontal	41.64000	AV	14.20	12.15	26.35	60.83	-34.48
Horizontal	278.32000	QP	13.21	11.67	24.87	46.00	-21.13
Horizontal	381.14000	PK	16.74	12.27	29.01	80.83	-51.82
Horizontal	381.14000	AV	16.74	11.60	28.34	60.83	-32.49
Horizontal	421.88000	PK	16.81	22.97	39.78	80.83	-41.05
Horizontal	421.88000	AV	16.81	21.38	38.19	60.83	-22.64
Horizontal	447.10000	PK	18.12	21.97	40.09	80.83	-40.74
Horizontal	447.10000	AV	18.12	20.72	38.84	60.83	-21.99
Horizontal	868.08000	PK	24.12	18.02	42.13	80.83	-38.70
Horizontal	868.08000	AV	24.12	16.54	40.65	60.83	-20.18

Remark:
1. Calculated = Reading + Corr. Factor – Average Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin= Calculated – Limit

3.4.3 Measurement results: frequency above 1GHz

EUT : DIR-300 V
Test condition : Tx mode

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
2169.60	PK	V	34.4	30.35	46.57	42.52	54	-11.48
2603.52	PK	V	34.1	32.51	44.63	43.04	54	-10.96
3037.44	PK	V	33.8	36.24	41.7	44.14	54	-9.86
3471.36	PK	V	33.8	36.24	43.02	45.46	54	-8.54
1735.68	PK	H	34.9	29.16	46.99	41.25	54	-12.75
2169.60	PK	H	34.4	30.35	45.83	41.78	54	-12.22
2603.52	PK	H	34.1	32.51	43.62	42.03	54	-11.97
3037.44	PK	H	33.8	36.24	42.33	44.77	54	-9.23
3471.36	PK	H	33.8	36.24	42.16	44.60	54	-9.40

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

4. Measured bandwidth FCC 15.231(C)

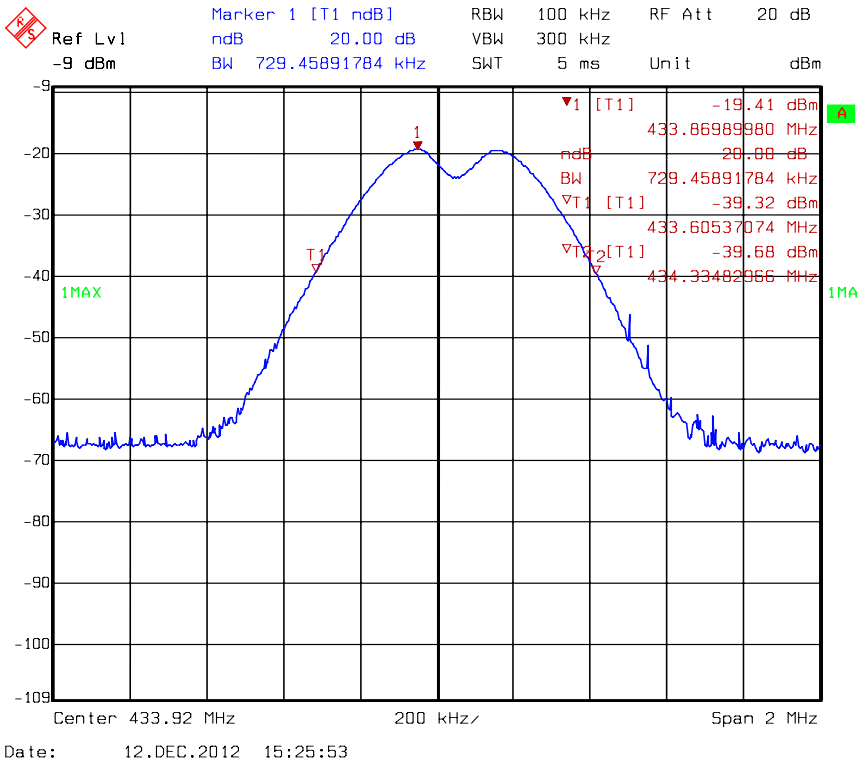
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

B.W(20dBc) Limit = 0.25% × f(MHz) = 0.25% × 433.92 MHz = 1.0848 MHz

From the plot, the bandwidth is observed to be 729 kHz at 20dBc, where the bandwidth limit is 1.0848 MHz.

Please see the plot below.

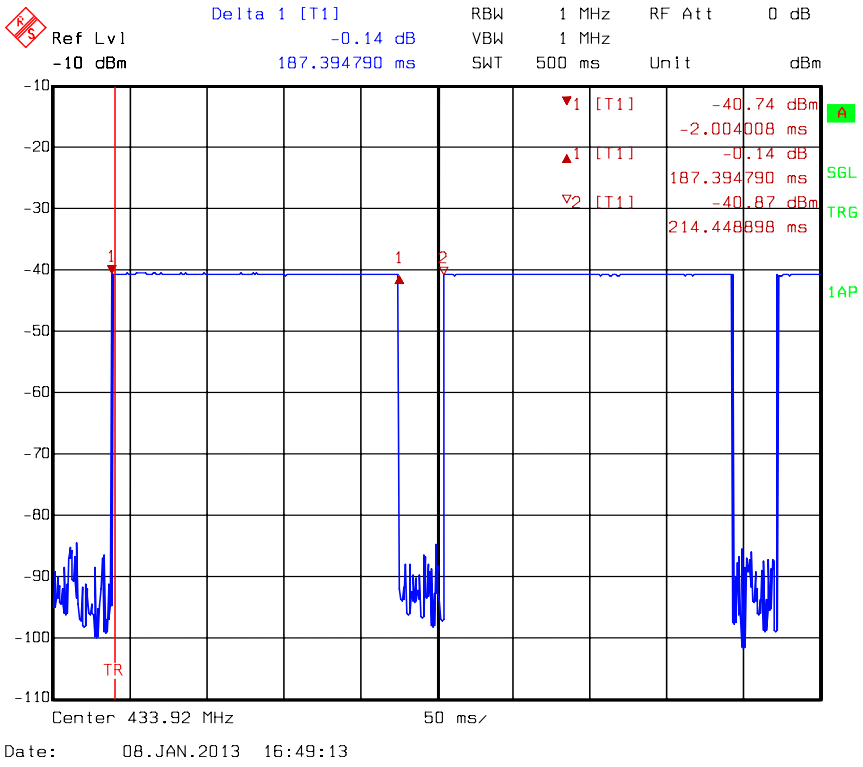
Bandwidth



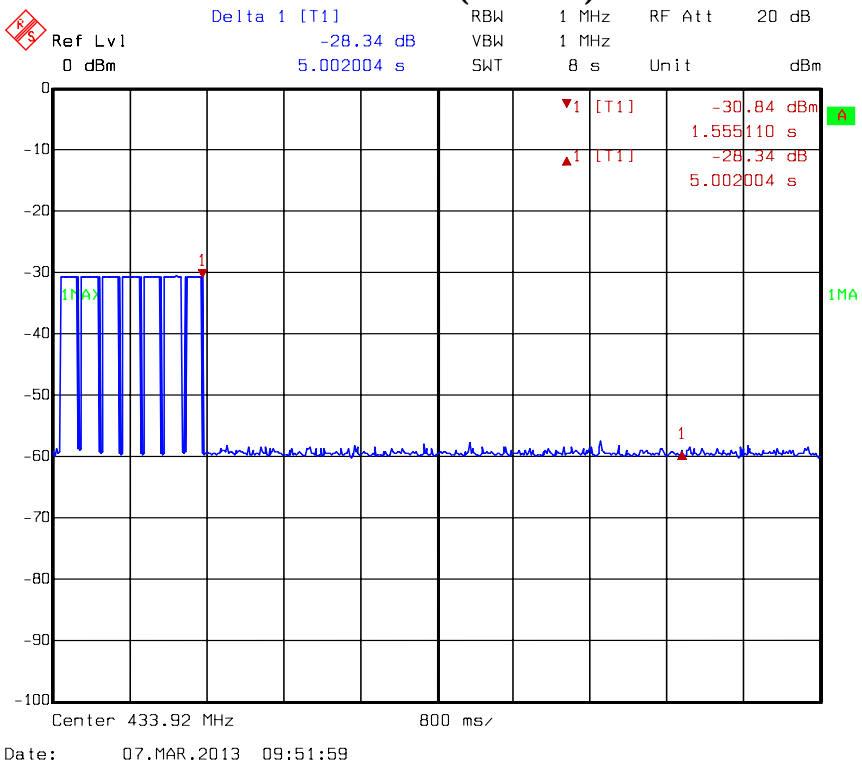
5. Timing requirement of manual activation operated transmitter

A transmitter manual activation shall cease transmission within 5 seconds after activation

Release Time



Release Time(After 5s)



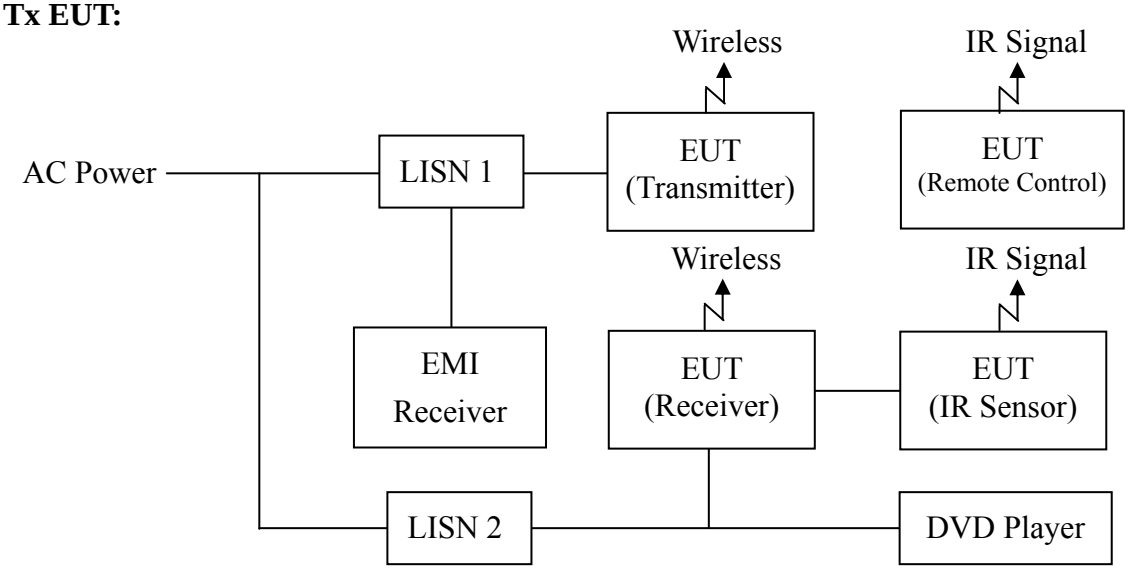
6. Conducted emission FCC 15.207

6.1 Operating environment

Temperature:	23	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa

6.2 Test setup & procedure

Tx EUT:



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/1992 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

The EUT configuration please refer to the “Conducted set-up photo.pdf”.

6.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

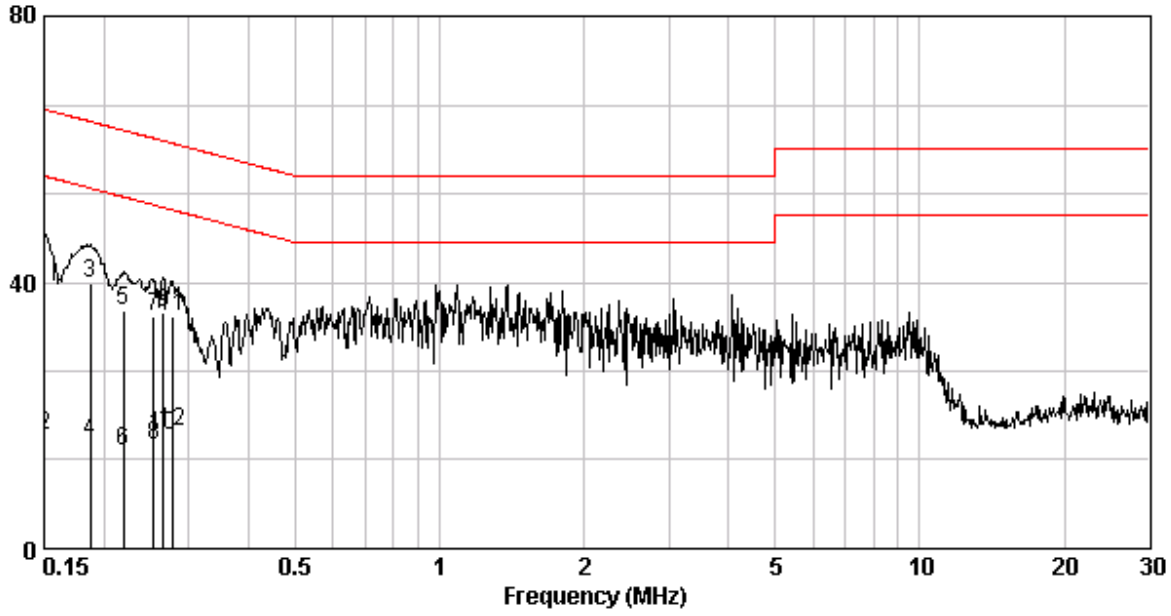
*Decreases with the logarithm of the frequency.

6.4 Conducted emission data FCC 15.207

Phase: Line
Model No.: DIR-300V
Test Condition: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.150	0.11	40.88	66.00	16.92	56.00	-25.12	-39.08
0.187	0.09	39.91	64.15	16.03	54.15	-24.24	-38.12
0.220	0.09	35.72	62.83	14.56	52.83	-27.11	-38.27
0.253	0.09	34.95	61.64	15.58	51.64	-26.70	-36.07
0.266	0.09	35.43	61.25	16.88	51.25	-25.82	-34.37
0.277	0.09	34.77	60.90	17.60	50.90	-26.13	-33.30

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
Model No.: DIR-300V
Test Condition: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.150	0.23	40.94	66.00	19.81	56.00	-25.06	-36.19
0.185	0.20	40.46	64.24	16.94	54.24	-23.78	-37.30
0.221	0.19	36.10	62.79	15.82	52.79	-26.69	-36.97
0.264	0.19	35.55	61.29	16.19	51.29	-25.75	-35.11
0.442	0.18	28.92	57.02	15.36	47.02	-28.10	-31.66
0.866	0.20	28.60	56.00	14.10	46.00	-27.40	-31.90

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)