

TEST REPORT

STANDARD : FCC Part15B Class B -Peripherals-

Applicant	Testing Laboratory
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Equipment Type	144 MHz FM TRANSCEIVER
Trademark	KENWOOD
Model(s)	TM-281A
Serial No.	00000088
Equipment Authorization	Certification
FCC ID	K44441700
Report Number	JT11050013
Report Issue Date	June 20, 2011

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Approved by

Kazuo Gokita
[Manager]

Tested by



Atsuyuki Morishima



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SECTION 1. GENERAL INFORMATION

Test Performed

EUT Received	May 25, 2011
Date of Test	From June 1, 2011 to June 2, 2011
Standard Applied	FCC Part15B Class B -Peripherals-
Test methods	ANSI C63.4-2003
Deviation from Standard(s)	None

Qualifications of Testing Laboratory

Accreditation	Scope	Lab. Code	Remarks
VLAC	EMC Testing	VLAC-008-5	JAPAN
BSMI	EMC Testing	SL2-IN-E-6017, SL2-AI-E-6017	TAIWAN
Filing			
VCCI	EMC Testing	R-257, C-260, C-284, T-1736, T-1737, G-124 R-258, C-261, C-285, T-1738, T-1739 R-259, C-262, T-1740, G-125	JAPAN
FCC	EMC Testing	Designation Number : JP0011	USA
IC	EMC Testing	2042P-1, 2042P-2	CANADA
SAUDI ARABIA	EMC Testing	N/A	

Abbreviations

EUT	Equipment Under Test	DoC	Declaration of Conformity
AMN	Artificial Mains Network	ISN	Impedance Stabilization Network
LISN	Line Impedance Stabilization Network	Q-P	Quasi-peak
AMP	Amplifier	AVG	Average
ATT	Attenuator	PK	Peak
ANT	Antenna	Cal	Calibration
BBA	Broadband Antenna	N/A	Not applicable or Not available
DIP	Dipole Antenna	LCD	Liquid-Crystal Display
AE	Associated Equipment	HDMI	High-Definition Multimedia Interface

SECTION 2. SUMMARY OF TEST RESULTS

See Section9 for the detailed result.

Standard Applied	FCC Part15B Class B -Peripherals-		
Test Item	Minimum margin		Remarks
Conducted disturbance at mains terminals	7.5 dB (0.2018 MHz) [Q-P]	PC mode	
Radiated disturbance	5.3 dB (96.03 MHz)	PC mode	

SECTION 3. EQUIPMENT UNDER TEST

The equipment under test (EUT) consisted of the following apparatus.

3.1 System Configuration

Symbol	Item	Model No.	Serial No.	Manufacturer
A	144 MHz FM TRANSCEIVER	TM-281A	00000088	KENWOOD
Rated Power : DC13.8 V(DC11.7-15.9 V), 2.0 A max.				
Supplied Power : DC13.8 V				
Condition of Equipment	Prototype			
Type	Tabletop			
Suppression Devices	No Modifications by the laboratory were made to the device			

3.2 Overview of EUT

Frequency Ranges	136-174 MHz
Receiver Type	Double Conversion
Model of Operation	F3E

3.3 Intermediate Frequencies

1st	49.95 MHz (upper)
2nd	450 kHz (upper)

3.4 Port(s)/Connector(s)

Port Name	Connector Type	Connector Pin	Remarks
External Speaker	3.5 ϕ	2pin	
Antenna	M	2pin	
Microphone	RJ-45	8pin	

3.5 Highest Frequency Generated / Used

Base Clock	Operating Frequency	Board Name	Remarks
447.895 MHz	447.895 MHz	TX RX UNIT	

SECTION 4. SUPPORT EQUIPMENT

The EUT was supported by the following equipment during the test.

Symbol	Item	Model No.	Serial No.	Manufacturer	FCC ID
B	DC Power Supply	PS-60	00148	KENWOOD	N/A
C	External Speaker	SP-50B	None	KENWOOD	N/A
D	Programming cable	KPG-46A	None	KENWOOD	N/A
E	USB Adapter	KCT-53U	None	KENWOOD	K44403500
F	Dummy Antenna	CT-01	None	TME	N/A
G	Computer	DMC	FXYKV1X	DELL	DoC
H	LCD Monitor	E176FPb	None	DELL	DoC
I	Keyboard	SK-8115	None	DELL	DoC
J	Mouse	MO56UOA	E1900IT0	DELL	DoC
K	Printer	C8154AL	TH71Q5Z0GT	HEWLETT PACKARD	DoC
L	AC Adapter	0957-2171	E151B100TC02L	HEWLETT PACKARD	N/A
Supplied Power:					
B, G, H, L	AC120 V, 60 Hz				
F	50ohms				

SECTION 5. USED CABLE(S)

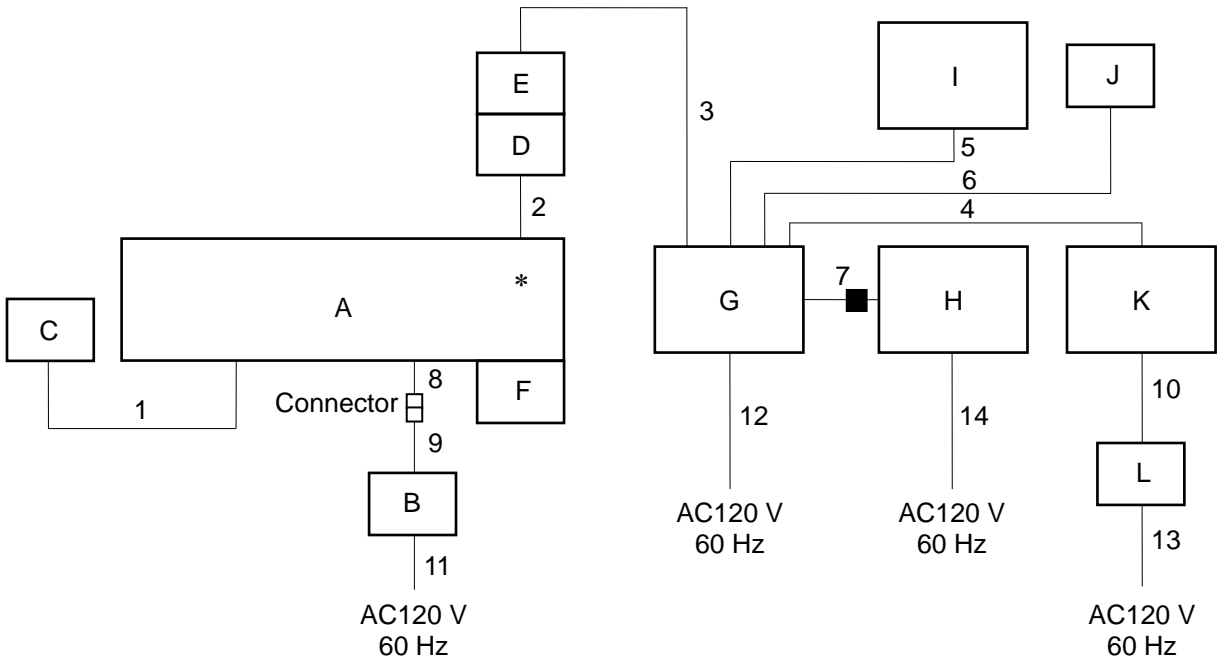
The following cable(s) was used for the test.

No.	Name	Length (m)	Shield	Metal Connector	Ferrite Core
1	Speaker cable	2.55	No	No	
2	Programming cable	1.50	No	No	
3	USB cable	0.35	Yes	No	
4	Centronics cable	2.40	Yes	Yes	
5	Keyboard cable	2.00	Yes	Yes	
6	Mouse cable	1.90	Yes	Yes	
7	Video cable	1.80	Yes	Yes	Fixed x 1
8	Power cable for EUT (DC)	0.25	No	No	
9	Power cable for EUT (DC)	2.00	No	No	
10	Power cable for Printer(K) (DC)	1.70	No	No	
11	Power cable for DC Supply(B)	2.00	No	No	
12	Power cable for Computer(G)	1.90	No	No	
13	Power cable for Printer(K) (AC)	0.90	No	No	
14	Power cable for LCD(H) (AC)	1.75	No	No	

Note : Cable No.7 is supplied together with LCD Monitor(H).

SECTION 6. TEST CONFIGURATION

* : EUT
■ : Ferrite core



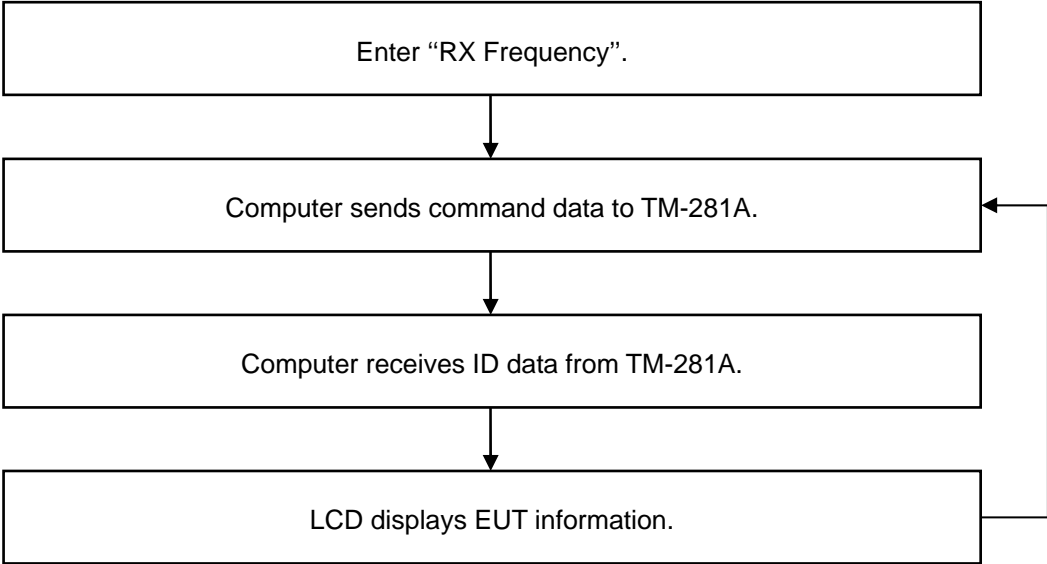
The symbols and numbers assigned to the equipments and cables on this diagram correspond to the ones in Sections 3 to 5.

SECTION 7. OPERATING CONDITION

The test was carried out under the following mode.

PC mode

Cycle time for operation: Continuity



SECTION 8. UNCERTAINTY

Traceability to national standard in SI units is ensured with these values.
Compliance with the limits in this standard are determined without in consideration of the measurement uncertainty of the measurement instrumentation.

Radiated disturbance at 3m	$U_{lab} [k = 2]$	U_{cispr}
30 MHz – 1000 MHz	+/- 3.52 dB	5.2 dB
Above 1 GHz CISPR22	+/- 4.18 dB	
ANCI 63.4	+/- 4.26 dB	
Radiated disturbance at 10m		
30 MHz – 1000 MHz	+/- 4.25 dB	5.1 dB
Above 1 GHz	+/- 4.26 dB	
Radiated disturbance at 30m		
	N/A	5.2 dB
Conducted disturbance at mains terminals		
9 kHz – 150 kHz	+/- 2.76 dB	4.0 dB
150 kHz – 30 MHz		3.6 dB
Conducted disturbance at telecommunication ports (ISN)		
150 kHz – 30 MHz	+/- 2.76 dB	Nil
Conducted disturbance at telecommunication ports (Capacitive Voltage Probe)		
150 kHz – 30 MHz	+/- 3.10 dB	Nil
Conducted disturbance at telecommunication ports (Current Probe)		
150 kHz – 30 MHz	+/- 2.86 dB	Nil
Conducted disturbance at terminals		
150 kHz – 30 MHz	+/- 2.79 dB	Nil
Disturbance power		
30 MHz – 300 MHz	+/- 3.00 dB	4.5 dB
Conducted Power on Antenna Port		
30 MHz – 1000 MHz	+/- 2.90 dB	Nil
Above 1 GHz	+/- 1.60 dB	

The above expanded instrumentation uncertainty, U_{lab} , is estimated in accordance with CISPR 16-4-2.

SECTION 9. EVALUATION OF TEST RESULTS

Location	Tochigi No.1 Test Site
Test Engineer	Atsuyuki Morishima

Frequency Range of Measurements

	Required Measurement Frequency Range	Measured Frequency Range
Conducted	0.15 – 30 MHz	0.15 – 30 MHz
Radiated	30 – 2000 MHz	30 – 2000 MHz

Test Procedure

Item	Document number
Conducted disturbance at mains terminals	RJP-EM001
Radiated disturbance	RJP-EM003

Setting for the Measuring instruments

Frequency [MHz]	Instrument	Detector	Resolution Bandwidth	Video Bandwidth
0.15 – 30	Receiver	Quasi Peak	10 kHz	N/A
		Average	10 kHz	N/A
30 – 1000	Receiver	Quasi Peak	120 kHz	N/A
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
		Average	1 MHz	10 Hz

< Measurement data correction >

* Conducted disturbance at mains terminals

Emission Level [dB μ V] = Meter Reading [dB μ V] + Factor [dB]

Margin [dB] = Limit [dB μ V] - Emission Level [dB μ V]

* Factor = LISN Factor + Cable Loss + ATT

* Radiated disturbance

Emission Level [dB μ V/m] = Meter Reading [dB μ V] + Factor [dB/m]

Margin [dB] = Limit [dB μ V/m] - Emission Level [dB μ V/m]

* Factor = Antenna Factor + Cable Loss - Amplifier Gain + ATT
 (– Distance Conversion Factor)

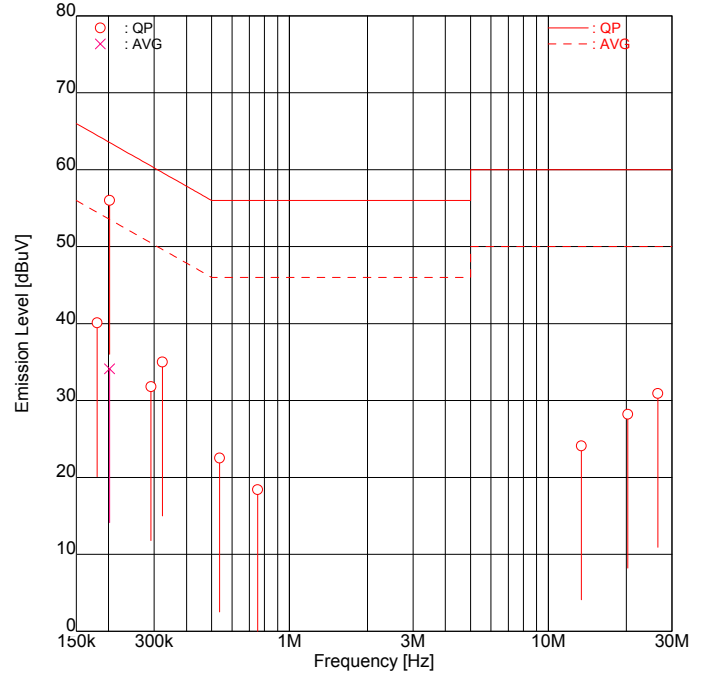
9.1 Conducted disturbance at mains terminals

Intertek Japan K.K.

Tochigi No.1 Test Site

Conducted Voltages on Mains Port

APPLICANT : Kenwood Corporation
 EUT NAME : 144MHz FM TRANSCEIVER
 MODEL NO. : TM-281A
 SERIAL NO. : 00000088
 TEST MODE : PC mode
 POWER SOURCE : DC 13.8V
 DATE TESTED : Jun 01 2011
 FILE NO. : -
 REGULATION : FCC Part15B Class B
 TEST METHOD : ANSI C63.4-2003
 TEMPERATURE : 18.0 [degC]
 HUMIDITY : 51.0 [%]
 NOTE :



ENGINEER : Atsuyuki Morishima

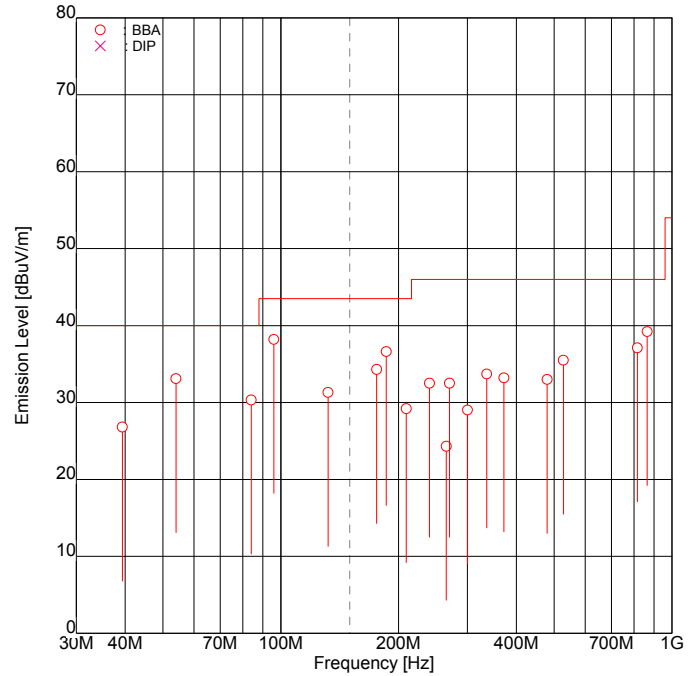
FREQUENCY [No]	MODE [MHz]	MODE	READING [dBuV]		FACTOR [dB]		EMISSION [dBuV]		LIMIT [dBuV]	MARGIN [dB]	
			Line1	Line2	Line1	Line2	Line1	Line2		Line1	Line2
1	0.1807	QP	<u>29.8</u>	28.5	10.3	10.3	<u>40.1</u>	38.8	64.5	<u>24.4</u>	25.7
2	0.2018	QP	<u>45.7</u>	45.4	10.3	10.3	<u>56.0</u>	55.7	63.5	<u>7.5</u>	7.8
3	0.2018	AVG	22.1	<u>23.8</u>	10.3	10.3	32.4	<u>34.1</u>	53.5	21.1	<u>19.4</u>
4	0.2916	QP	13.7	<u>21.5</u>	10.3	10.3	24.0	<u>31.8</u>	60.5	36.5	<u>28.7</u>
5	0.3227	QP	9.7	<u>24.7</u>	10.3	10.3	20.0	<u>35.0</u>	59.6	39.6	<u>24.6</u>
6	0.5372	QP	6.9	12.2	10.3	10.3	17.2	22.5	56.0	38.8	33.5
7	0.7534	QP	3.0	8.1	10.3	10.3	13.3	18.4	56.0	42.7	37.6
8	13.3962	QP	13.1	12.8	11.0	11.1	24.1	23.9	60.0	35.9	36.1
9	20.2800	QP	16.8	16.7	11.4	11.5	28.2	28.2	60.0	31.8	31.8
10	26.4720	QP	<u>19.6</u>	18.9	11.3	11.5	<u>30.9</u>	30.4	60.0	<u>29.1</u>	29.6

Higher six points are underlined.
 Other frequencies : Below the FCC Part15B Class B limit
 Emission Level = Read + Factor(LISN,Pad,Cable)

9.2 Radiated disturbance
 30 MHz – 1000 MHz

Intertek Japan K.K.
 Tochigi No.1 Test Site
 Radiated Electric Field

APPLICANT : Kenwood Corporation
 EUT NAME : 144MHz FM TRANSCEIVER
 MODEL NO. : TM-281A
 SERIAL NO. : 00000088
 TEST MODE : PC mode
 POWER SOURCE : DC 13.8V
 DATE TESTED : Jun 02 2011
 FILE NO. : -
 REGULATION : FCC Part15B Class B
 TEST METHOD : ANSI C63.4-2003
 DISTANCE : 3.00 [m]
 TEMPERATURE : 20.0 [degC]
 HUMIDITY : 60.0 [%]
 NOTE :



ENGINEER : Atsuyuki Morishima

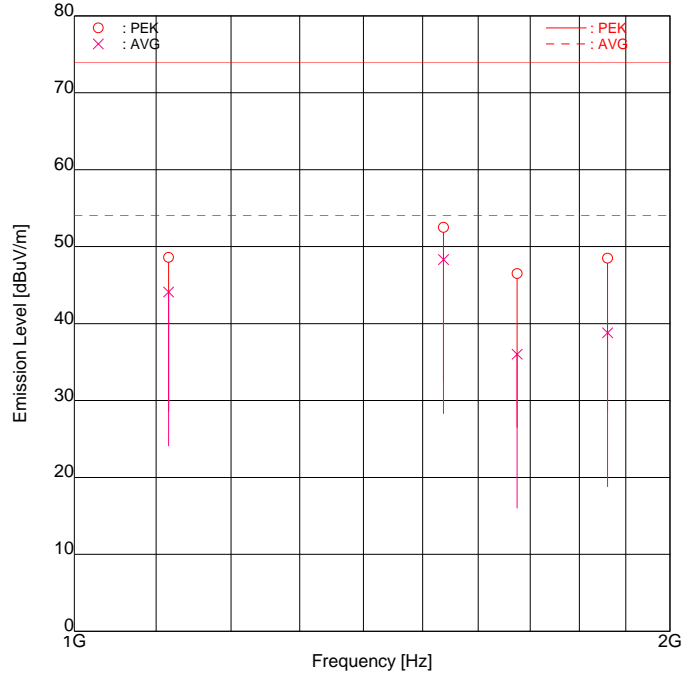
FREQ [No]	FREQ [MHz]	ANT.	READING [dBuV]		FACTOR [dB/m]		EMISSION [dBuV/m]		LIMIT [dBuV/m]		MARGIN [dB]	
			Hori	Vert	Hori	Vert	Hori	Vert	Hori	Vert	Hori	Vert
1	39.37	BBA	-	33.4	-6.6	-6.6	-	26.8	40.0	-	13.2	
2	53.99	BBA	-	<u>38.9</u>	-5.8	-5.8	-	<u>33.1</u>	40.0	-	<u>6.9</u>	
3	84.03	BBA	-	40.5	-10.2	-10.2	-	30.3	40.0	-	9.7	
4	96.03	BBA	47.0	<u>48.5</u>	-10.3	-10.3	36.7	<u>38.2</u>	43.5	6.8	<u>5.3</u>	
5	132.05	BBA	37.1	34.8	-5.8	-5.8	31.3	29.0	43.5	12.2	14.5	
6	175.98	BBA	-	<u>39.6</u>	-5.3	-5.3	-	<u>34.3</u>	43.5	-	<u>9.2</u>	
7	186.00	BBA	41.5	<u>42.6</u>	-6.0	-6.0	35.5	<u>36.6</u>	43.5	8.0	<u>6.9</u>	
8	209.41	BBA	-	35.6	-6.4	-6.4	-	29.2	43.5	-	14.3	
9	240.08	BBA	33.0	37.4	-4.9	-4.9	28.1	32.5	46.0	17.9	13.5	
10	264.90	BBA	-	28.0	-3.7	-3.7	-	24.3	46.0	-	21.7	
11	269.94	BBA	36.0	-	-3.5	-3.5	32.5	-	46.0	13.5	-	
12	300.10	BBA	30.9	29.0	-1.9	-1.9	29.0	27.1	46.0	17.0	18.9	
13	336.11	BBA	35.0	-	-1.3	-1.3	33.7	-	46.0	12.3	-	
14	372.00	BBA	33.9	31.8	-0.7	-0.7	33.2	31.1	46.0	12.8	14.9	
15	480.06	BBA	29.5	31.2	1.8	1.8	31.3	33.0	46.0	14.7	13.0	
16	528.07	BBA	30.8	32.3	3.2	3.2	34.0	35.5	46.0	12.0	10.5	
17	816.11	BBA	<u>28.0</u>	27.1	9.1	9.1	<u>37.1</u>	36.2	46.0	<u>8.9</u>	9.8	
18	864.11	BBA	27.3	<u>29.0</u>	10.2	10.2	<u>37.5</u>	<u>39.2</u>	46.0	<u>8.5</u>	<u>6.8</u>	

Higher six points are underlined.
 Other frequencies : Below the FCC Part15B Class B limit
 Emission Level = Read + Factor(Antenna, Antenna Pad, Cable, Preamp)
 ANT. : Used antenna (BBA = Broadband antenna, DIP = Dipole antenna)

1000 MHz – 2000 MHz

Intertek Japan K.K.
Tochigi No.1 Test Site
 Radiated Electric Field

APPLICANT : Kenwood Corporation
 EUT NAME : 144MHz FM TRANSCEIVER
 MODEL NO. : TM-281A
 SERIAL NO. : 00000088
 TEST MODE : PC mode
 POWER SOURCE : DC 13.8V
 DATE TESTED : Jun 02 2011
 FILE NO. : -
 REGULATION : FCC Part15B Class B
 TEST METHOD : ANSI C63.4-2003
 DISTANCE : 3.00 [m]
 TEMPERATURE : 20.0 [degC]
 HUMIDITY : 60.0 [%]
 NOTE :



ENGINEER : Atsuyuki Morishima

FREQUENCY [No]	MODE [MHz]		READING [dBuV]		FACTOR [dB]		EMISSION [dBuV/m]		LIMIT [dBuV/m]		MARGIN [dB]	
			Hori	Vert	Hori	Vert	Hori	Vert	Hori	Vert		
1	1116.00	PEK	47.8	<u>50.9</u>	-2.3	-2.3	45.5	<u>48.6</u>	74.0	28.5	<u>25.4</u>	
2	1116.00	AVG	39.9	<u>46.4</u>	-2.3	-2.3	37.6	<u>44.1</u>	54.0	16.4	<u>9.9</u>	
3	1536.67	PEK	51.3	<u>52.6</u>	-0.1	-0.1	51.2	<u>52.5</u>	74.0	22.8	<u>21.5</u>	
4	1536.67	AVG	46.8	<u>48.4</u>	-0.1	-0.1	46.7	<u>48.3</u>	54.0	7.3	<u>5.7</u>	
5	1674.24	PEK	44.9	<u>45.8</u>	0.7	0.7	45.6	<u>46.5</u>	74.0	28.4	<u>27.5</u>	
6	1674.24	AVG	<u>35.3</u>	<u>34.9</u>	0.7	0.7	<u>36.0</u>	<u>35.6</u>	54.0	<u>18.0</u>	<u>18.4</u>	
7	1859.98	PEK	45.3	<u>46.9</u>	1.6	1.6	46.9	<u>48.5</u>	74.0	27.1	<u>25.5</u>	
8	1859.98	AVG	32.3	<u>37.2</u>	1.6	1.6	33.9	<u>38.8</u>	54.0	20.1	<u>15.2</u>	

Higher six points are underlined.
 Other frequencies : Below the FCC Part15B Class B limit
 Emission Level = Read + Factor(Antenna, Antenna Pad, Cable, Preamp)
 ANT. : Used antenna(BBA = Broadband antenna, DIP = Dipole antenna)

emiT 3, 0, 0, 0

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SECTION 10. LIST OF MEASURING INSTRUMENTS

Test instruments are calibrated according to Quality Manual and Calibration Rules of Intertek Japan K.K.

Instrument	Model No.	Serial No.	Manufacturer	Cal. Interval	Effective period
Conducted disturbance at mains terminals					
LISN (EUT)	ESH2-Z5	845268/023	Rohde & Schwarz	1 Y	Jun, 2011
10dB Attenuator	CFA-01(BPJ-10)	None	TAMAGAWA	1 Y	Apr, 2012
LISN (Peripheral)	KNW-407	8-1395-5	Kyoritsu	1 Y	Jul, 2011
50Ω Termination	CT-01	None	TAMAGAWA	1 Y	Jul, 2011
Coaxial cable(C1)	5D-2W(6.0 m)	1CL01a	Intertek	1 Y	Apr, 2012
Coaxial cable(C2)	RG-5A/U(7.0 m)	1CL02	Intertek	1 Y	Apr, 2012
Coaxial cable(C3)	5D-2W(0.1 m)	1CL03	Intertek	1 Y	Apr, 2012
Coaxial cable(C4)	5D-2W(1.7 m)	1CL04	Intertek	1 Y	Apr, 2012
Radiated disturbance					
Broad Band antenna	VULB9168	217	Schwarzbeck	1 Y	Apr, 2012
6dB Attenuator	CFA-01(NPJ-6)	None	TAMAGAWA	1 Y	Apr, 2012
Step Attenuator	8494B	2805A14560	Hewlett Packard	1 Y	Apr, 2012
Amplifier	8447D	2727A05322	Hewlett Packard	1 Y	Apr, 2012
Double ridged antenna	3115	9903-5699	EMCO	1 Y	Mar, 2012
6dB Attenuator	8493C	75550	Agilent	1 Y	Apr, 2012
Spectrum analyzer	8563E (Firmware Revision 971024)	3821A09565	Hewlett Packard	1 Y	May, 2012
Coaxial cable(R1)	5D-2W(10.0 m)	1R1001a	Intertek	1 Y	Apr, 2012
Coaxial cable(R2)	RG-177/U(20.0 m)	1R1002	Intertek	1 Y	Apr, 2012
Coaxial cable(R3)	RG-5A/U(1.3 m)	1R1003	Intertek	1 Y	Apr, 2012
Coaxial cable(R4)	RG-5A/U(0.2 m)	1R1004	Intertek	1 Y	Apr, 2012
Coaxial cable(R5)	5D-2W(0.7 m)	1R1005	Intertek	1 Y	Apr, 2012
Coaxial cable(R6)	5D-2W(0.1 m)	1R1006	Intertek	1 Y	Apr, 2012
Coaxial cable(R7)	5D-2W(1.7 m)	1R1007	Intertek	1 Y	Apr, 2012
Coaxial cable(R8)	5D-2W(6.0 m)	1R1008a	Intertek	1 Y	Apr, 2012
Coaxial cable(RG1)	SUCOFLEX(1.5 m)	290799/4	SUHNER	1 Y	Apr, 2012
Coaxial cable(RG2)	SUCOFLEX(6.0 m)	290800/4	SUHNER	1 Y	Apr, 2012
Site Attenuation				1 Y	Aug, 2011
Common					
Test receiver	ESS (Firmware Version 1.08)	845420/009	Rohde & Schwarz	1 Y	Jul, 2011
RF Switch	ACX-150	None	Intertek	1 Y	Apr, 2012
Testing Software	emiT (Version 3,0,0,0)				

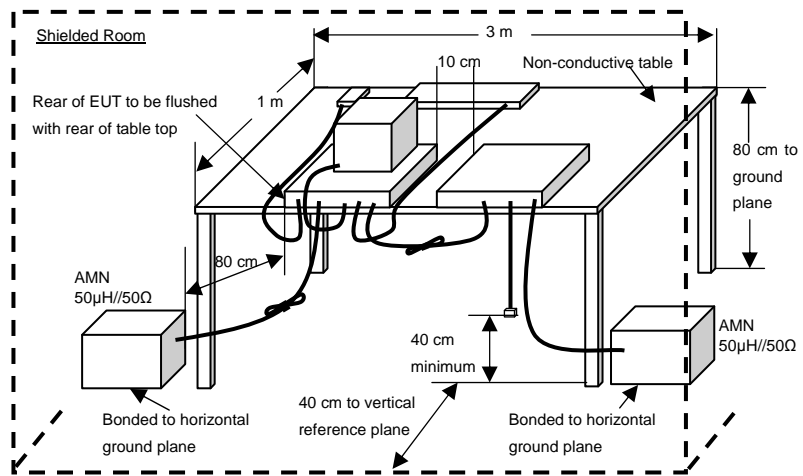
ANNEX

A. TEST PROCEDURE(S)

Test was carried out under the following conditions.

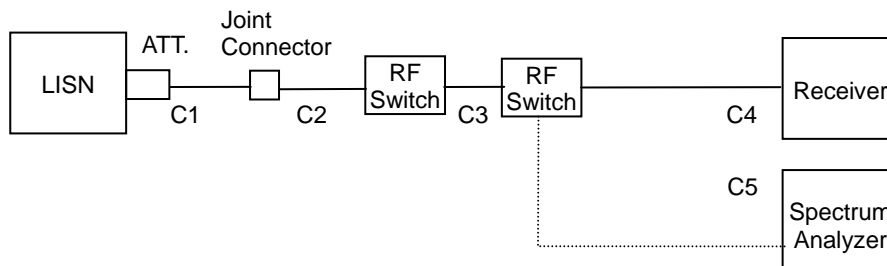
Conducted disturbance at mains terminals

Test setup as per standard



* Reference Ground plane : greater than 2 x 2m

Diagram of the measuring instruments



[Preliminary Measurement]

EUT is tested on all operating conditions.

The spectrum analyzer is controlled by the computer program to sweep the frequency range to be measured, then spectrum chart is plotted out to find the worst emission conditions in operating mode and/or configuration decision for the final test.

All leads other than safety ground are tested.

[Final Measurement]

The EUT is operated in the worst emission condition found by the preliminary test.

The equipment and cables are arranged or manipulated within the range of the test standard in the above condition.

At least six highest spectrum are measured in quasi-peak and average (if necessary) using the test receiver.

Test was carried out under the following conditions.

Radiated disturbance
Test setup as per standard

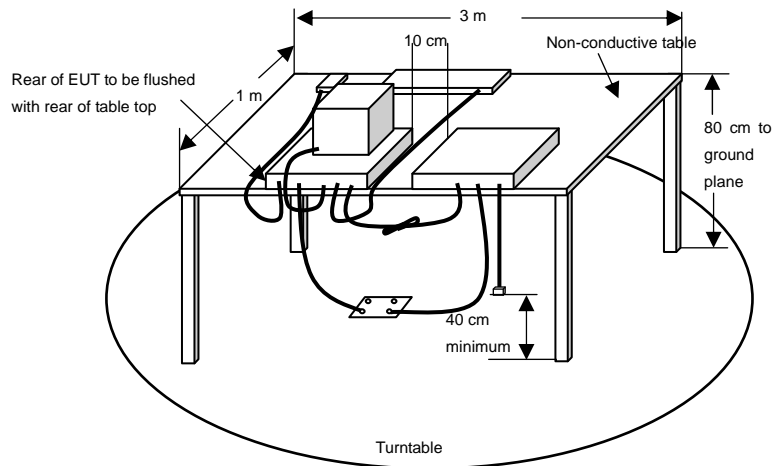
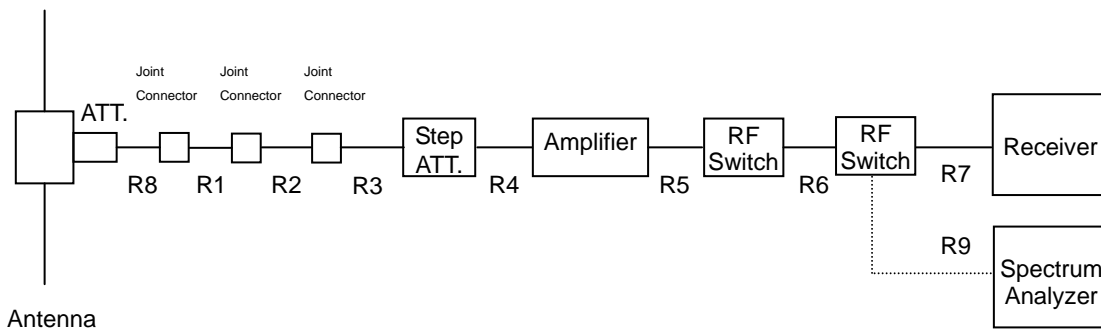
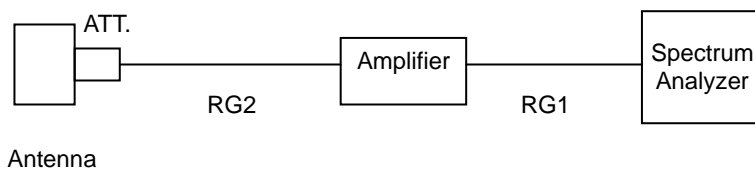


Diagram of the measuring instruments (30 – 1000 MHz)



Above 1GHz



[Preliminary Measurement]

EUT is tested on all operating conditions.
 The spectrum analyzer is set max-hold mode and swept during turntable was rotated 0 to 360 degree,
 And find the worst emission conditions in configuration, operating mode, or ambient noise notation.

[Final Measurement]

The EUT operated in the worst emission condition found by the preliminary test.
 The turntable azimuth (EUT direction) and antenna height are adjusted the position so that maximum field strength is obtained for each frequency spectrum to be measured.
 The equipment and cables are arranged or manipulated within the range of the test standard in the above condition. At least six highest spectrums are measured by the test receiver (quasi-peak) and spectrum analyzer (peak and average). When the uncertain result was obtained (30 – 1000 MHz), the measurement is retried by using the half wave dipole antenna instead of the broadband antenna.