Report on the EMC Testing of:

DMR RECEIVER

Model(s): KD-X472DBT

In accordance with EN 55032: 2015

PSB Singapore

Add value.
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JVCKenwood Technologies Singapore Pte Ltd
1, Ang Mo Kio Street 63,
Singapore 569110

COMMERCIAL-IN-CONFIDENCE

Document Number: 7191208111-EEC19/03 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Chua Choon Meng	11 Oct 2019	
Authorised Signatory	Quek Keng Huat	10 Oct 2019	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD PSB document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with the mentioned standard(s).

TÜV SÜD PSB

ilac-MRA

Accredited Laboratory SAC-SINGLAS

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LA-2007-0381-F LA-2007-0386-C
LA-2007-0382-B LA-2010-0464-D
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LA-2007-0384-G LA-2018-0703-G

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	11 Oct 2019

1.2 Introduction

Applicant	:	JVCKenwood Technologies Singapore Pte Ltd 1, Ang Mo Kio Street 63, Singapore 569110
Manufacturer	:	JVCKenwood Corporation 2967-8, Ishikawa-machi, Hachioji-shi, Tokyo, Japan
Factory	:	JVCKenwood Technologies Singapore Pte Ltd 1, Ang Mo Kio Street 63, Singapore 569110
Model Number(s)	:	KD-X472DBT
Serial Number(s)	:	134X0019
Number of Samples Tested	:	1
Test Sample(s) Condition	:	Good
Quotation Reference	:	5195150
Test Specification/Issue/Date	:	EN 55032: 2015
Test Sample(s) Received Date	:	02 Oct 2019
Start of Test	:	02 Oct 2019
Finish of Test	:	09 Oct 2019

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with the specifications as shown below.

Specification Clause	Test Description	Result	Comments/Base Standard
EN 55032			
A.3	Conducted Emissions at Mains Terminals (Class B)	Not Applicable *See Note 1	EN 55016-2-1: 2009 + A1: 2011 + A2: 2013 *(CISPR 16-2-1: 2008 + A1: 2010 + A2: 2013)*
A.3	Asymmetric Mode Conducted Emissions (Class B)	Pass	EN 55016-2-1: 2009 + A1: 2011 + A2: 2013 *(CISPR 16-2-1: 2008 + A1: 2010 + A2: 2013)*
A.3	Conducted Differential Voltage Emissions (Class B)	Pass	EN 55016-2-1: 2009 + A1: 2011 + A2: 2013 *(CISPR 16-2-1: 2008 + A1: 2010 + A2: 2013)*
A.2	Radiated Emissions (Class B)	Pass	EN 55016-2-3: 2010 + A1: 2010 + A2: 2014 *(CISPR 16-2-3: 2010 + A1: 2010 + A2: 2014)*
A.2	Radiated Emissions for FM Receivers	Pass	EN 55016-2-3: 2010 + A1: 2010 + A2: 2014 *(CISPR 16-2-3: 2010 + A1: 2010 + A2: 2014)*
A.2	Radiated Emissions for Outdoor Units of Home Satellite Receiving Systems	Not Applicable *See Note 2	EN 55016-2-3: 2010 + A1: 2010 + A2: 2014 *(CISPR 16-2-3: 2010 + A1: 2010 + A2: 2014)*

Notes

1. The Equipment Under Test (EUT) is a 12Vdc battery-operated device and contains no provision for public utility connections.

2. The Equipment Under Test (EUT) is not an outdoor units of home satellite receiving system.

1.4 Product Information

1.4.1 Technical Description

Description	:	The Equipment Under Test(s) (EUT(s)) is a **DMR RECEIVER.**
Microprocessor	:	Si4763-A42-GM9
Operating Frequency	:	8.2GHz
Clock / Oscillator Frequency	:	a. 37.209375MHz b. 93 kHz (AM MW) c. 0.128MHz (FM Tuner) d. 1.536MHz (Digital Tuner)
Modulation	:	Not Applicable
Antenna Gain	:	Not Applicable
Port / Connectors	:	1 X DAB Antenna Jack 1 X Mic Jack 1 X Front USB connector 1 X AUX Connector 1 X Tuner Antenna Jack 3 X Pre-Out 1 X DC connector (Mitsumi to ISO)
Rated Power	:	12V DC
Accessories	:	1 X Microphone

1.4.2 Test Configuration and Modes of Operation

Mode(s)	Description
a. USB playback + FM 98MHz b. USB playback + DAB Band III: 9D c. Bluetooth playback + FM 88MHz d. iTouch playback + FM 108MHz e. AM 531kHz	The EUT was exercised in the mode(s) throughout the test(s). a. Playback 1kHz audio test signal.

1.4.3 Performance Criteria and Monitoring Methods

Not Applicable.

1.5 Deviations from the Standard

Nil.

1.6 EUT Modification Record

No modifications were made.

1.7 Test Location(s)

TÜV SÜD PSB Pte Ltd
Electrical & Electronics Centre (EEC), Product Services,
No. 1 Science Park Drive, Singapore 118221

1.8 Test Facilities Registrations

Requirements	Registration Numbers
FCC	994109 (Test Firm Registration Number) SG0002 (Designation Number)
ISED	SGAP01 (CAB Identifier) <u>Science Park</u> 2932I-1 (3m and 10m Semi-Anechoic Chamber) <u>International Business Park</u> 2932N-1 (10m Semi-Anechoic Chamber)
VCCI	<u>Science Park</u> R-1335 (10m ANC) C-2306 (C.E @ Lab 3) T-1471 (Telecom Ports @ Lab 3) <u>International Business Park</u> R-3324 (10m ANC), G-10203 (10mANC) C-4933 (C.E @ CEIBP) T-2403 (Telecom Ports @ CEIBP)
BSMI	SL2-IS-E-6001R *[CNS-13803 (ISM Equipment)]* SL2-IN-E-6001R *[CNS-13438 (IT Equipment)]* SL2-R1/R2-E-6001R *[CNS-13439 (Broadcast Receivers)]* SL2-A1-E-6001R *[CNS-13783-1 (Household Appliances)]* SL2-L1-E-6001R *[CNS-14115 (Lighting Equipment)]*
SABS	SABS/A-LAB/0029/2018

1.9 Supporting Equipment

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Apple iPOD	M/N: A1574 S/N: CCQXM08GGK9 FCC ID: BCGA1574	0.8m USB lightning cable
SanDisk USB Flashdrive	M/N: SDCZ71-008G S/N: Nil FCC ID: DoC	Nil
Samsung Mobile Phone	M/N: SM-J720F/DS S/N: R28K61DBX7R FCC ID: A3LSM720F	Nil
Kingston USB Thumbdrive	M/N: DTSE9 S/N: NIL FCC ID: DoC	Nil
Samsung Mobile Phone	M/N: GT-S7272 S/N: S7272GSMH FCC ID: A3LGTS7272	Nil
Lenovo Laptop (For Setting R&S USB Compact Modulator)	M/N: 2537-HD1 S/N: R8-0BVN3 10/08 FCC ID: DoC	3.00m USB cable
Lenovo AC Adapter	M/N: 42T4424 S/N: 11S42T4424Z1ZFE07N5DS FCC ID: Nil	1.00m unshielded power cable
R&S USB Compact Modulator	M/N: SFC-U S/N: 101295 FCC ID: Nil	3.00m USB cable 1.80m 75 ohms coaxial cable
EOS AC Adapter (For R&S USB Compact Modulator)	M/N: ZVC60NP12E4 S/N: Nil FCC ID: Nil	2.35m unshielded power cable
R&S Signal Generator	M/N: SMX S/N: 825295/078 FCC ID: Nil	2.35m unshielded power cable 1.80m 75ohms coaxial cable

2 Test Details

2.1 Asymmetric Mode Conducted Emissions

2.1.1 Test Limits

Class B

Frequency Range (MHz)	Voltage Limits (dBµV)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	84 - 74 *	74 - 64 *
0.5 - 30.0	74	64
* Decreasing linearly with the logarithm of the frequency		

2.1.2 Test Setup

2.1.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.

2.1.2.2 The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains. All other supporting equipment were powered separately from another LISN.

2.1.2.3 An ISN was used for measurement. The ISN was placed on and grounded directly to the horizontal ground-plane. The communication port was connected to the EUT port of ISN, the AE port of ISN was connected to associated equipment. The cable length between the EUT and ISN was about 1 meter.

2.1.2.4 The RF OUT of the ISN was connected to the EMI test receiver via a low-loss coaxial cable.

2.1.3 Test Method

2.1.3.1 The EUT was switched on and allowed to warm up to its normal operating condition. Then, communication was built up between the EUT and the associated equipment.

2.1.3.2 A scan was made over the required frequency range using an EMI test receiver.

2.1.3.3 High peaks, relative to the limit line, were then selected.

2.1.3.4 The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.

Sample Calculation Example

At 20 MHz	Q-P limit (Class B) = 74.0 dBμV
Transducer factor of cable loss at 20 MHz = 1.0 dB	
Q-P reading obtained directly from EMI Receiver = 58.5 dBμV (Calibrated for system losses)	
Therefore, Q-P margin = 74.0 – 58.5 = 15.5	i.e. 15.5 dB below Q-P limit

2.1.4 Test Setup Photographs

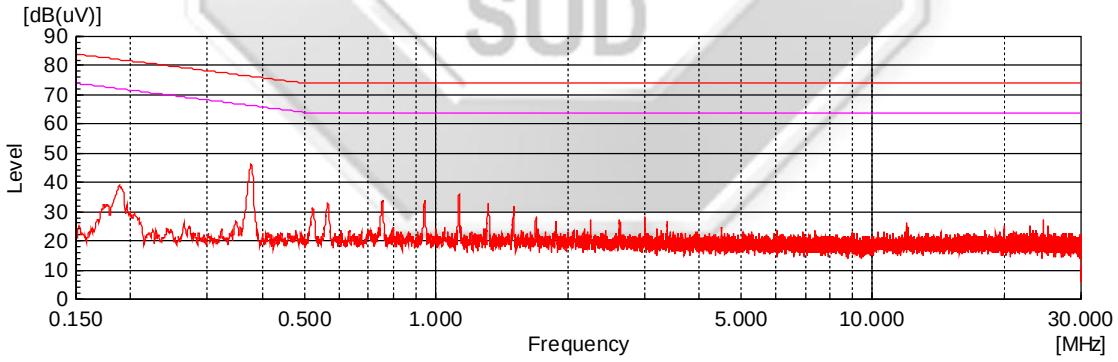
Asymmetric Mode Conducted Emissions Test Setup

2.1.5 Test Results

The detailed of the test results are shown below.

Operating Mode	FM Tuner @ 88MHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

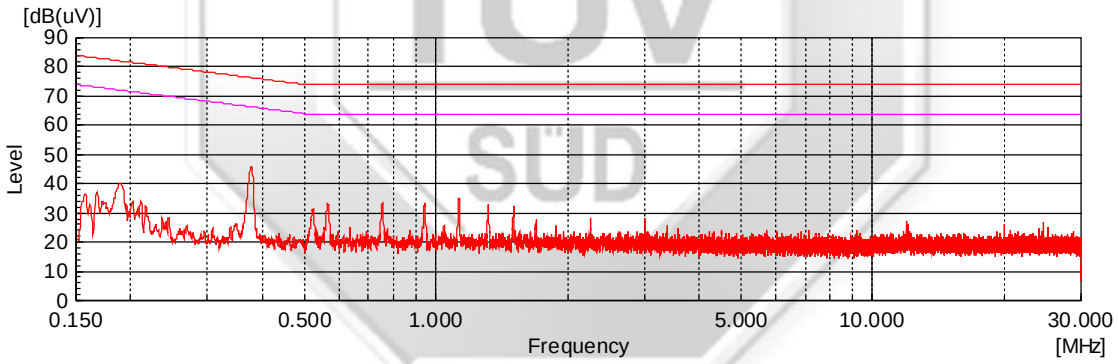
Frequency (MHz)	Peak Value (dBµV) *See Note 4	Q-P Limit (dBµV)	Q-P Margin (dB)	Peak Value (dBµV) *See Note 4	AV Limit (dBµV)	AV Margin (dB)
0.1886	38.8	82.1	43.3	38.8	72.1	33.3
0.3778	46.1	76.3	30.2	46.1	66.3	20.2
0.5645	33.0	74.0	41.0	33.0	64.0	31.0
0.7544	33.8	74.0	40.2	33.8	64.0	30.2
0.9423	34.0	74.0	40.0	34.0	64.0	30.0
1.1303	35.9	74.0	38.1	35.9	64.0	28.1



Emissions Plot – Tuner Port

Operating Mode	FM Tuner @ 98MHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

Frequency (MHz)	**Peak Value (dBµV)** *See Note 4	**Q-P Limit (dBµV)**	**Q-P Margin (dB)**	**Peak Value (dBµV)** *See Note 4	**AV Limit (dBµV)**	**AV Margin (dB)**
0.1898	40.0	82.0	42.0	40.0	72.0	32.0
0.3778	45.8	76.3	30.5	45.8	66.3	20.5
0.5652	33.5	74.0	40.5	33.5	64.0	30.5
0.7544	33.5	74.0	40.5	33.5	64.0	30.5
0.9423	33.6	74.0	40.4	33.6	64.0	30.4
1.1315	35.2	74.0	38.8	35.2	64.0	28.8



Emissions Plot – Tuner Port

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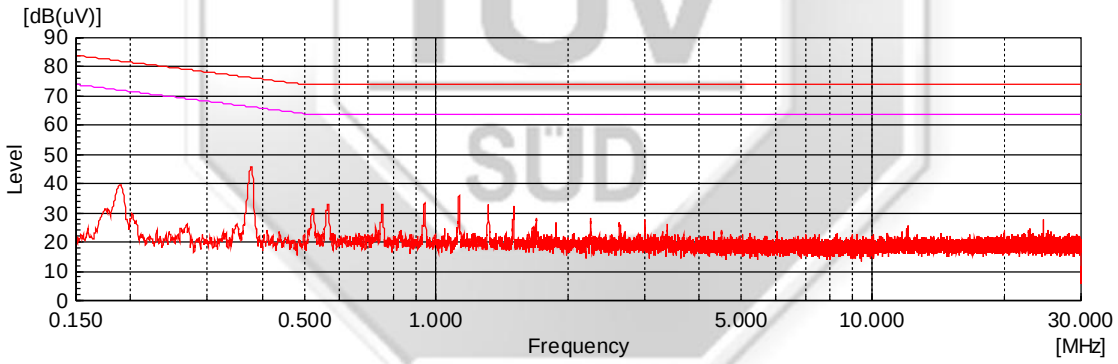
Operating Mode	FM Tuner @ 108MHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

Frequency (MHz)	**Peak Value (dBµV)** *See Note 4	**Q-P Limit (dBµV)**	**Q-P Margin (dB)**	**Peak Value (dBµV)** *See Note 4	**AV Limit (dBµV)**	**AV Margin (dB)**
0.1892	39.6	82.1	42.5	39.6	72.1	32.5
0.3778	45.8	76.3	30.5	45.8	66.3	20.5
0.5645	32.9	74.0	41.1	32.9	64.0	31.1
0.7544	33.2	74.0	40.8	33.2	64.0	30.8
0.9423	33.5	74.0	40.5	33.5	64.0	30.5
1.1297	36.0	74.0	38.0	36.0	64.0	28.0

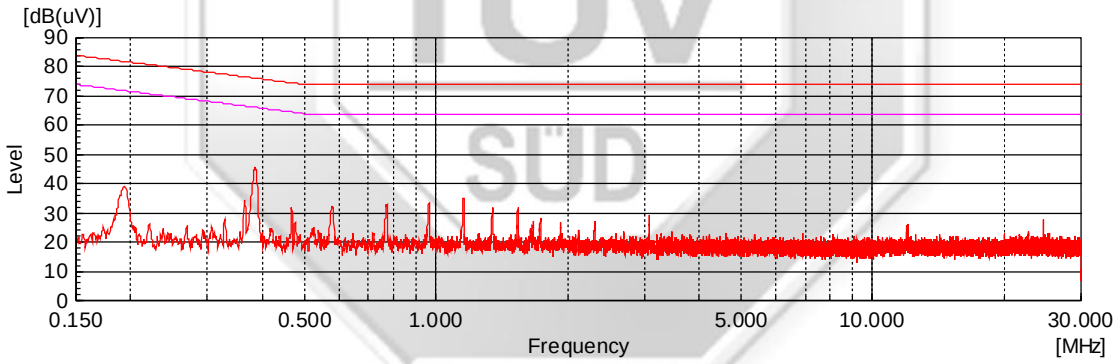


Emissions Plot – Tuner Port

PSB Singapore

Operating Mode	AM Tuner @ 531kHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

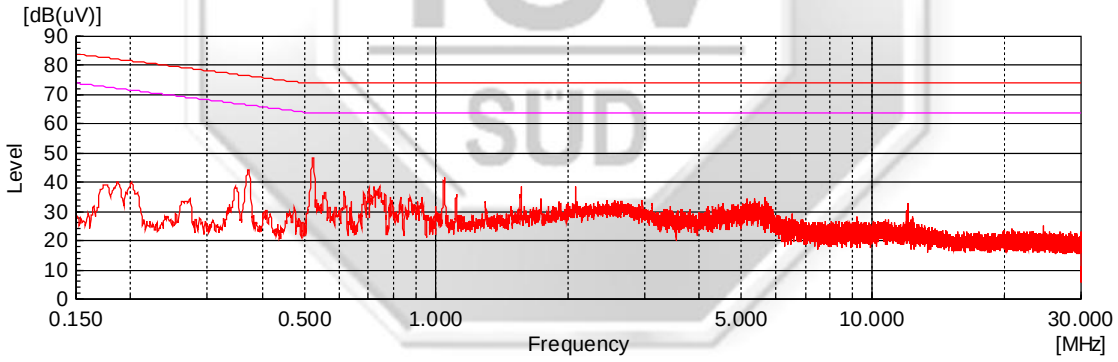
Frequency (MHz)	**Peak Value (dBµV)** *See Note 4	**Q-P Limit (dBµV)**	**Q-P Margin (dB)**	**Peak Value (dBµV)** *See Note 4	**AV Limit (dBµV)**	**AV Margin (dB)**
0.1935	39.2	81.9	42.7	39.2	71.9	32.7
0.3857	45.6	76.2	30.6	45.6	66.2	20.6
0.5780	32.5	74.0	41.5	32.5	64.0	31.5
0.7721	32.8	74.0	41.2	32.8	64.0	31.2
0.9644	33.6	74.0	40.4	33.6	64.0	30.4
1.1560	35.1	74.0	38.9	35.1	64.0	28.9



Emissions Plot – Tuner Port

Operating Mode	Digital Tuner Band III: 5A @174.928MHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

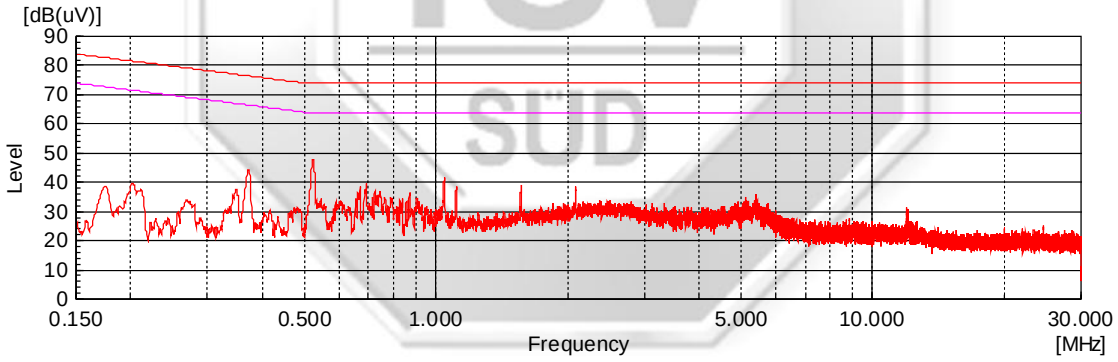
Frequency (MHz)	**Peak Value (dBµV)** *See Note 4	**Q-P Limit (dBµV)**	**Q-P Margin (dB)**	**Peak Value (dBµV)** *See Note 4	**AV Limit (dBµV)**	**AV Margin (dB)**
0.1874	40.4	82.2	41.8	40.4	72.2	31.8
0.3723	44.2	76.5	32.3	44.2	66.5	22.3
0.5229	48.3	74.0	25.7	48.3	64.0	15.7
0.7433	38.8	74.0	35.2	38.8	64.0	25.2
1.0464	41.6	74.0	32.4	41.6	64.0	22.4
1.5675	38.7	74.0	35.3	38.7	64.0	25.3



Emissions Plot – Tuner Port

Operating Mode	Digital Tuner Band III: 9D 206.352MHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

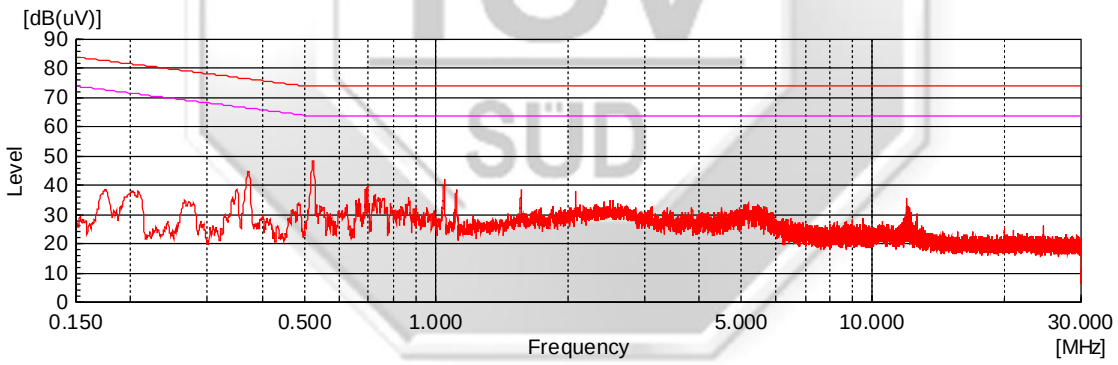
Frequency (MHz)	**Peak Value (dBµV)** *See Note 4	**Q-P Limit (dBµV)**	**Q-P Margin (dB)**	**Peak Value (dBµV)** *See Note 4	**AV Limit (dBµV)**	**AV Margin (dB)**
0.2021	39.7	81.5	41.8	39.7	71.5	31.8
0.3723	44.5	76.5	32.0	44.5	66.5	22.0
0.5229	48.1	74.0	25.9	48.1	64.0	15.9
0.6919	39.5	74.0	34.5	39.5	64.0	24.5
1.0458	41.7	74.0	32.3	41.7	64.0	22.3
1.5675	39.2	74.0	34.8	39.2	64.0	24.8



Emissions Plot – Tuner Port

Operating Mode	Digital Tuner Band III: 13F @ 239.20MHz	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Line Under Test	Asymmetric Mode – Tuner Port	Atmospheric Pressure	1030mbar
Class	B	Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

Frequency (MHz)	**Peak Value (dBµV)** *See Note 4	**Q-P Limit (dBµV)**	**Q-P Margin (dB)**	**Peak Value (dBµV)** *See Note 4	**AV Limit (dBµV)**	**AV Margin (dB)**
0.1751	38.6	82.7	44.1	38.6	72.7	34.1
0.3723	44.8	76.5	31.7	44.8	66.5	21.7
0.5229	48.5	74.0	25.5	48.5	64.0	15.5
0.6974	40.0	74.0	34.0	40.0	64.0	24.0
1.0458	42.3	74.0	31.7	42.3	64.0	21.7
1.1150	38.7	74.0	35.3	38.7	64.0	25.3



Emissions Plot – Tuner Port

Notes

1.	All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst-case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 150kHz - 30MHz RBW: 9kHz VBW: 30kHz
4.	As the measured peak shows compliance to quasi-peak and average limits, the EUT is deemed to meet both the quasi-peak and average requirements.

2.2 Conducted Differential Voltage Emissions

2.2.1 Test Limits

TV receiver (analogue or digital), video recorder and PC TV broadcast tuner cards working in channels between 30MHz and 1GHz, and digital audio receivers

Frequency (MHz)	**Quasi-peak (Q-P) Limits** *See Note **(dBµV) 75Ω**		
	Local Oscillator – Fundamental	Local Oscillator – Harmonics	Others
30 - 950	46	46	46
950 - 2150	54	54	46
Note : For frequencies at 1GHz and above, the limits indicated are peak limits.			

Frequency Modulation Car Radios

Frequency (MHz)	**Quasi-peak (Q-P) Limits (dBµV) 75Ω**		
	Local Oscillator – Fundamental	Local Oscillator – Harmonics	Others
30 – 300	66	59	46
300 - 1000	66	52	46

2.2.2 Test Setup

2.2.2.1 The test was performed as shown in the setup photos.

2.2.2.2 The 75Ω antenna terminal was connected to the spectrum analyser's 50Ω input via matching pads and a 75Ω splitter / combining network.

2.2.2.3 The required test signal was supplied to the EUT from an appropriate signal generator via the splitter / combining network.

2.2.3 Test Method

2.2.3.1 The EUT was switched on and allowed to warm up to its test operating condition.

2.2.3.2 The channel was then set as required.

2.2.3.3 Measurements were made on the tuned local oscillator frequency, harmonics and other emissions using the spectrum analyser in the peak detection mode. The spectrum analyser was set for a resolution bandwidth of 120 kHz and a video bandwidth of 1 MHz for measurement up to 1GHz. For frequency above 1GHz, both resolution and video bandwidths are set to 1MHz.

2.2.3.4 The 75Ω / 50Ω matching pad and splitter / combining network total insertion loss of 12.4 dB (maximum value) was then added to the peak level measured. The resultant was then compared with the limit requirements. Note that for frequency below and up to 1GHz, no quasi-peak measurements were done on peak-measured emissions that were below the limit; this being the worst-case emission level. Quasi-peak measurements would only be made in cases where the limit was exceeded.

2.2.3.5 For emissions that were not detectable above the ambient noise floor, the noise floor level at that particular frequency was noted for reference.

2.2.3.6 The measurements were then repeated for the next harmonic or local oscillator frequency or other emissions until all selected channels were tested.

2.2.4 Test Setup Photographs

Conducted Differential Voltage Emissions Test Setup

2.2.5 Test Results

The detailed of the test results are shown below.

Operating Mode	FM Tuner	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Intermediate Frequency	128kHz	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

Channel (MHz)	LO Harmonic Number	Frequency (MHz)	Peak Value (dBµV) *See Note 5	Q-P Limit (dBµV)	Q-P Margin (dB)
88.0	1	88.128	40.9	66.0	25.1
	2	176.256	30.4	59.0	28.6
	3	264.384	30.4	59.0	28.6
	4	352.512	30.6	52.0	21.4
	5	440.640	30.1	52.0	21.9
	6	528.768	31.4	52.0	20.6
	7	616.896	32.9	52.0	19.1
	8	705.024	40.4	52.0	11.6
	9	793.152	30.4	52.0	21.6
	10	881.280	31.5	52.0	20.5
	11	969.408	30.9	52.0	21.1
98.0	1	98.128	40.3	66.0	25.7
	2	196.256	31.9	59.0	27.1
	3	294.384	30.1	59.0	28.9
	4	392.512	32.1	52.0	19.9
	5	490.640	32.4	52.0	19.6
	6	588.768	32.2	52.0	19.8
	7	686.896	32.4	52.0	19.6
	8	785.024	35.4	52.0	16.6
	9	883.152	32.4	52.0	19.6
	10	981.280	32.2	52.0	19.8

108.0	1	108.128	40.3	66.0	25.7
	2	216.256	31.8	59.0	27.2
	3	324.384	32.8	52.0	19.2
	4	432.512	32.2	52.0	19.8
	5	540.640	32.1	52.0	19.9
	6	648.768	32.1	52.0	19.9
	7	756.896	32.2	52.0	19.8
	8	865.024	35.2	52.0	16.8
	9	973.152	31.6	52.0	20.4
Others	Not applicable	--	--	--	--

Operating Mode	Digital Tuner	Temperature	22ºC
Test Input Power	12Vdc Battery	Relative Humidity	57%
Intermediate Frequency	1.536MHz	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit
		Test Date	02 Oct 2019

Channel (MHz)	LO Harmonic Number	Frequency (MHz)	Peak Value (dBµV) *See Note 5	Q-P Limit (dBµV)	Q-P Margin (dB)
174.928	1	176.464	21.4	46.0	24.6
	2	352.928	24.6	46.0	21.4
	3	529.392	22.3	46.0	23.7
	4	705.856	23.5	46.0	22.5
	5	882.320	23.8	46.0	22.2
	6	1058.784	32.3	54.0	21.7
	7	1235.248	32.6	54.0	21.4
	8	1411.712	32.1	54.0	21.9
	9	1588.176	32.9	54.0	21.1
	10	1764.640	32.8	54.0	21.2
	11	1941.104	33.2	54.0	20.8
	12	2117.568	33.5	54.0	20.5
206.352	1	207.888	21.2	46.0	24.8
	2	415.776	23.8	46.0	22.2
	3	623.664	25.1	46.0	20.9
	4	831.552	25.5	46.0	20.5
	5	1039.440	31.7	54.0	22.3
	6	1247.328	32.2	54.0	21.8
	7	1455.216	31.6	54.0	22.4
	8	1663.104	32.5	54.0	21.5
	9	1870.992	33.6	54.0	20.4
	10	2078.880	32.9	54.0	21.1

239.200	1	240.736	20.7	46.0	25.3
	2	481.472	24.1	46.0	21.9
	3	722.208	23.6	46.0	22.4
	4	962.944	23.8	54.0	30.2
	5	1203.68	32.8	54.0	21.2
	6	1444.416	32.6	54.0	21.4
	7	1685.152	32.5	54.0	21.5
	8	1925.888	32.9	54.0	21.1
Others 174.928	Not applicable	700.000	35.6	46.0	10.4
Others 206.352	Not applicable	825.380	31.8	46.0	14.2

Notes

1.	Emissions were measured using the correct CISPR detectors. For “other” emissions, only the highest emission for that channel is reported.
2.	A "positive margin” indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a “negative margin” indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 30MHz - 1GHz RBW: 120kHz VBW: 1MHz >1GHz RBW: 1MHz VBW: 1MHz
4.	Local Oscillator (LO) frequency, f_{lo} = Channel frequency, f_{ch} + Intermediate Frequency.
5.	As the measured peak shows compliance to quasi-peak limits, the EUT is deemed to meet quasi-peak requirement.

2.3 Radiated Emissions

2.3.1 Test Limits

Class B

Frequency Range (MHz)	Quasi-Peak Limits (dBµV/m) @ 3m	Quasi-Peak Limits (dBµV/m) @ 10m
30 - 230	40	30
230 - 1000	47	37
Note : At transition frequency, lower limit applies.		

Frequency Range (GHz)	Average Limits (dBµV/m) @ 3m	Peak Limits (dBµV/m) @ 3m
1 - 3	50	70
3 - 6	54	74
Note : At transition frequency, lower limit applies.		

2.3.2 Test Setup

2.3.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.

2.3.2.2 The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

2.3.2.3 The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

2.3.3 Test Method

2.3.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.3.3.2 A pre-scan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the pre-scan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.

2.3.3.3 The test was carried out at the selected frequency points obtained from the pre-scan. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:

a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.

2.3.3.4 A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.

2.3.3.5 The measurements were repeated for the next frequency point, until all selected frequency points were measured.

Sample Calculation Example

At 300 MHz Q-P limit (Class B) = 37.0 dBμV/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB
Q-P reading obtained directly from EMI Receiver = 31.0 dBμV/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 37.0 - 31.0 = 6.0 i.e. 6.0 dB below Q-P limit

2.3.4 Test Setup Photographs

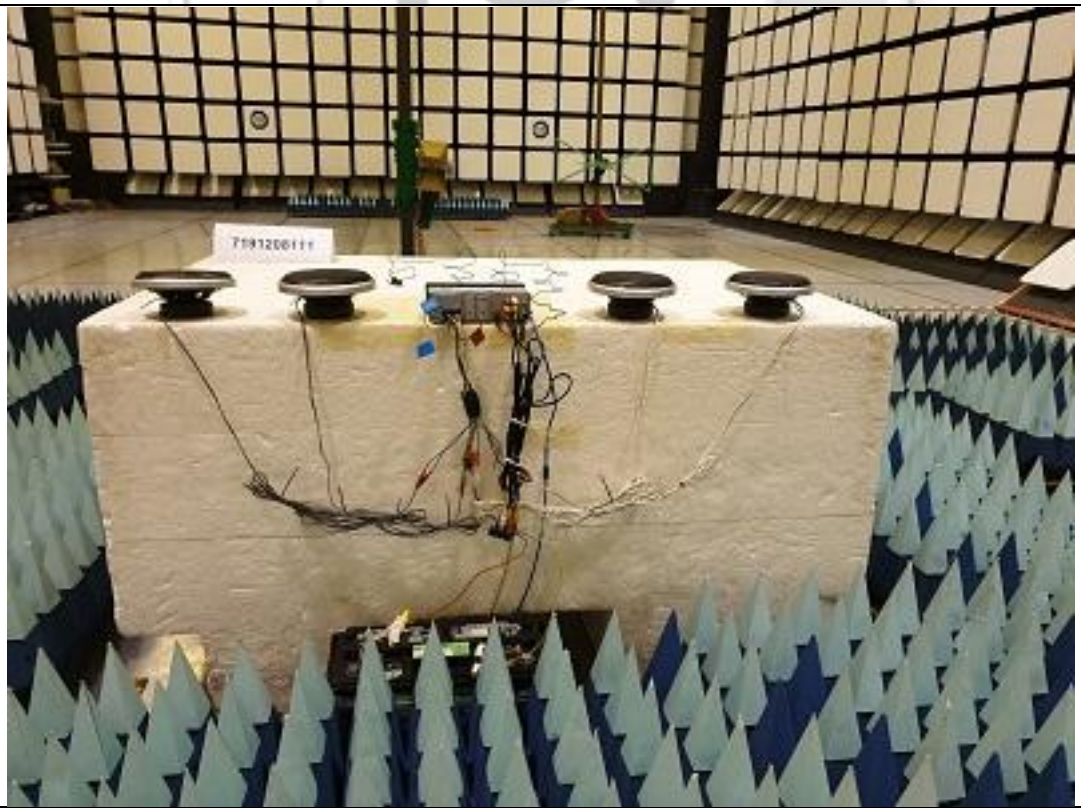
30MHz – 1GHz Test Setup

Radiated Emissions Test Setup (Front View)

Radiated Emissions Test Setup (Rear View)

1GHz – 6GHz Test Setup

Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

2.3.5 Test Results

The detailed of the test results are shown below.

Operating Mode	USB Playback + Digital Tuner Band III: 9D @ 206.352MHz	Temperature	24°C
Test Input Power	12Vdc	Relative Humidity	56%
Test Distance	3m (30MHz – 1GHz) 3m (>1GHz – 6GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Dylan Lin Chang Wai Kit
		Test Date	08 Oct 2019 – 09 Oct 2019

Emissions from 30MHz – 1GHz

Frequency (MHz)	Peak Value (dBµV) *See Note 5	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarisation (H/V)
30.3430	23.7	40.0	16.3	198	154	V
81.1890	22.7	40.0	17.3	100	109	V
134.5340	23.5	40.0	16.5	100	138	V
396.1140	34.6	47.0	12.4	100	259	H
403.9510	33.8	47.0	13.2	100	259	H
462.2930	32.0	47.0	15.0	201	278	H

Emissions above 1GHz - 6GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Peak Value (dBµV/m) *See Note 6	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
1.6150	37.1	70.0	32.9	37.1	50.0	12.9	102	327	V
1.8585	38.8	70.0	31.2	38.8	50.0	11.2	200	323	V
1.8850	38.2	70.0	31.8	38.2	50.0	11.8	300	315	V
4.9511	45.3	74.0	28.7	45.3	54.0	8.7	102	359	V
5.1404	45.8	74.0	28.2	45.8	54.0	8.2	200	183	V
5.1965	46.5	74.0	27.5	46.5	54.0	7.5	102	334	V

Operating Mode	USB Playback + FM 98MHz	Temperature	24ºC
Test Input Power	12Vdc	Relative Humidity	56%
Test Distance	3m (30MHz – 1GHz) 3m (>1GHz – 6GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Dylan Lin Chang Wai Kit
		Test Date	08 Oct 2019 – 09 Oct 2019

Emissions from 30MHz – 1GHz

Frequency (MHz)	Peak Value (dBµV) *See Note 5	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarisation (H/V)
30.9310	23.8	40.0	16.2	400	149	V
108.1310	22.5	40.0	17.5	100	150	H
134.5340	23.6	40.0	16.4	100	147	V
396.4080	34.7	47.0	12.3	100	259	H
403.8050	33.2	47.0	13.8	100	259	H
465.2810	32.1	47.0	14.9	100	150	H

Emissions above 1GHz - 6GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Peak Value (dBµV/m) *See Note 6	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
1.7976	37.3	70.0	32.7	37.3	50.0	12.7	398	256	V
1.8542	38.3	70.0	31.7	38.3	50.0	11.7	200	315	V
1.8834	38.3	70.0	31.7	38.3	50.0	11.7	398	256	V
5.0430	44.6	74.0	29.4	44.6	54.0	9.4	200	285	V
5.1877	46.0	74.0	28.0	46.0	54.0	8.0	300	163	V
5.1993	46.4	74.0	27.6	46.4	54.0	7.6	200	42	V

Operating Mode	Bluetooth Playback + FM 88MHz	Temperature	24ºC
Test Input Power	12Vdc	Relative Humidity	56%
Test Distance	3m (30MHz – 1GHz) 3m (>1GHz – 6GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Dylan Lin Chang Wai Kit
		Test Date	08 Oct 2019 – 09 Oct 2019

Emissions from 30MHz – 1GHz

Frequency (MHz)	**Peak Value (dBµV)** *See Note 5	**Q-P Limit (dBµV/m)**	**Q-P Margin (dB)**	**Height (cm)**	**Azimuth (Degrees)**	**Polarisation (H/V)**
370.8380	31.5	47.0	15.5	100	241	H
396.0160	38.5	47.0	8.5	100	250	H
403.9020	38.1	47.0	8.9	100	268	H
440.0530	32.3	47.0	14.7	100	241	H
466.1130	33.6	47.0	13.4	202	278	H
469.6890	35.0	47.0	12.0	202	278	H

Emissions above 1GHz - 6GHz

Freq (GHz)	**Peak Value (dBµV/m)**	**Peak Limit (dBµV/m)**	**Peak Margin (dB)**	**Peak Value (dBµV/m)** *See Note 6	**AV Limit (dBµV/m)**	**AV Margin (dB)**	**Height (cm)**	**Azimuth (Degrees)**	**Pol (H/V)**
1.5845	36.3	70.0	33.7	36.3	50.0	13.7	398	40	V
1.6143	37.0	70.0	33.0	37.0	50.0	13.0	102	326	V
1.8711	38.7	70.0	31.3	38.7	50.0	11.3	200	329	V
4.894	45.2	74.0	28.8	45.2	54.0	8.8	300	17	V
5.1215	46.5	74.0	27.5	46.5	54.0	7.5	200	170	V
5.1766	46.2	74.0	27.8	46.2	54.0	7.8	398	256	V

Operating Mode	iTouch Playback + FM 108MHz	Temperature	24ºC
Test Input Power	12Vdc	Relative Humidity	56%
Test Distance	3m (30MHz – 1GHz) 3m (>1GHz – 6GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Dylan Lin Chang Wai Kit
		Test Date	08 Oct 2019 – 09 Oct 2019

Emissions from 30MHz – 1GHz

Frequency (MHz)	Peak Value (dBµV) *See Note 5	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarisation (H/V)
38.3760	29.2	40.0	10.8	100	65	V
134.5340	25.7	40.0	14.3	201	69	H
199.8310	25.8	40.0	14.2	201	259	H
396.0160	36.9	47.0	10.1	100	359	H
403.9020	36.1	47.0	10.9	100	187	H
722.2070	33.1	47.0	13.9	100	305	H

Emissions above 1GHz - 6GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
4.8058	49.4	74.0	24.6	29.3	54.0	24.7	272	22	V
4.8185	44.4	74.0	29.6	29.2	54.0	24.8	363	105	V
4.9370	44.8	74.0	29.2	29.6	54.0	24.4	183	116	V
4.9441	45.8	74.0	28.2	29.6	54.0	24.4	246	317	V
4.9400	47.8	74.0	26.2	29.6	54.0	24.4	267	195	V
4.9520	48.7	74.0	25.3	29.8	54.0	24.2	245	294	V

Operating Mode	AM 531kHz	Temperature	24ºC
Test Input Power	12Vdc	Relative Humidity	56%
Test Distance	3m (30MHz – 1GHz) 3m (>1GHz – 6GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Dylan Lin Chang Wai Kit
		Test Date	08 Oct 2019 – 09 Oct 2019

Emissions from 30MHz – 1GHz

Frequency (MHz)	Peak Value (dBµV) *See Note 5	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarisation (H/V)
30.3430	24.3	40.0	15.7	199	35	V
134.5830	23.0	40.0	17.0	100	155	V
159.8590	26.7	40.0	13.3	100	147	V
396.0160	39.1	47.0	7.9	100	258	H
396.4080	37.3	47.0	9.7	100	258	H
403.8540	38.0	47.0	9.0	100	277	H

Emissions above 1GHz - 6GHz

Freq (GHz)	Peak Value (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	AV Value (dBµV/m)	AV Limit (dBµV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
4.8305	44.5	74.0	29.5	29.3	54.0	24.7	379	253	V
4.8765	44.2	74.0	29.8	29.1	54.0	24.9	260	293	V
4.9361	51.2	74.0	22.8	29.9	54.0	24.1	334	360	V
4.9424	44.5	74.0	29.5	29.7	54.0	24.3	394	251	V
4.9518	44.8	74.0	29.2	29.9	54.0	24.1	147	95	V
4.9559	51.7	74.0	22.3	30.1	54.0	23.9	158	18	V

Notes

1.	All possible modes of operation were investigated. Only the worst-case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 30MHz - 1GHz RBW: 120kHz VBW: 1MHz 1GHz – 6GHz RBW: 1MHz VBW: 3MHz
4.	The highest frequency of internal sources of the EUT is above 1GHz, as such, the measurement was made up to 6GHz.
5.	As the measured peak shows compliance to quasi-peak limits, the EUT is deemed to meet quasi-peak requirement.
6.	As the measured peak shows compliance to average limits, the EUT is deemed to meet average requirement.

2.4 Radiated Emissions for FM Receivers

2.4.1 Test Limits

Frequency (MHz)	Quasi-peak (Q-P) Limits (dBµV/m) @ 3m			Quasi-peak (Q-P) Limits (dBµV/m) @ 10m		
	Local Oscillator – Fundamental	Local Oscillator – Harmonics	Others	Local Oscillator – Fundamental	Local Oscillator – Harmonics	Others
30 - 230	60	52	40	50	42	30
230 - 300	60	52	47	50	42	37
300 - 1000	60	56	47	50	46	37

2.4.2 Test Setup

2.4.2.1 The EUT and supporting equipment were set up as shown in the setup photos.

2.4.2.2 The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

2.4.2.3 The relevant broadband antenna was set at the required test distance away from the centre of the EUT.

2.4.3 Test Method

2.4.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.4.3.2 The test was carried out on the EUT's local oscillator frequency, harmonics and other emissions for each selected channel. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:

a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.

2.4.3.3 A Quasi-peak measurement was then made for that frequency point.

2.4.3.4 The measurements were repeated for the next frequency point, until all selected frequency points were measured.

2.4.4 Test Setup Photographs

Radiated Emissions for FM Receiver Test Setup (Front View)

Radiated Emissions for FM Receiver Test Setup (Rear View)

2.4.5 Test Results

The detailed of the test results are shown below.

Operating Mode	FM	Temperature	24ºC
Test Input Power	12Vdc battery	Relative Humidity	56%
Intermediate Frequency	0.128MHz	Atmospheric Pressure	1030mbar
Test Distance	3m	Tested By	Dylan Lin Chang Wai Kit
		Test Date	08 Oct 2019 – 09 Oct 2019

Channel (MHz)	LO Harmonic Number	Frequency (MHz)	Antenna Pol (H/V)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)
88.0	--	--	--	--	--	--
98.0	--	--	--	--	--	--
108.0	--	--	--	--	--	--

Notes

1.	Emissions were measured using the correct CISPR detectors. For “other” emissions, only the highest emission for that channel is reported.
2.	A "positive margin” indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a “negative margin” indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 30MHz - 1GHz RBW: 120kHz VBW: 1MHz
4.	Local Oscillator (LO) frequency, f_{lo} = Channel frequency, f_{ch} + Intermediate Frequency.
5.	“--” indicates emissions of Fundamental & Harmonics frequencies are below the limits. Refer to Section 2.3.5 Radiated Emission Test Results for others frequency test results.

3 Photographs

View 1

View 2

4 Test Equipment

Instrument	Model	S/No	Cal Due Date
Asymmetric Mode Conducted Emissions			
Agilent EMC Analyzer	E7403A	US41160166	17 Jun 2020
R&S EMI Test Receiver	ESPI3	100349	01 Feb 2020
Schaffner LISN	NNB42	00008	08 May 2020
EMCO LISN (for supporting)	3825/2	9309-2127	06 Oct 2020
Teseq Coupling Decoupling Network (75 ohms BNC)	S751A	35800	01 Aug 2020
Conducted Differential Voltage Emissions			
Agilent EMC Analyzer (100Hz-26.5GHz)	E7405A	MY45106084	09 Jul 2020
Radiated Emissions & Radiated Emissions for FM Receivers			
R&S EMI Test Receiver	ESR26	101671	14 Mar 2020
Com-Power Preamplifier (1MHz - 1GHz)	PAM-103	441096	18 Jul 2020
Schaffner Bilog Antenna	CBL6112B	2593	21 Jan 2020
R&S Preamplifier (1GHz - 18GHz)	SCU18	102191	15 Jan 2020
ETS Horn Antenna (1GHz - 18GHz)	3115	0003-6088	01 Mar 2020

5 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Conducted Emissions at Mains Terminals	9kHz to 30MHz, ±2.4dB
Asymmetric Mode Conducted Emissions	9kHz to 30MHz, ±2.4dB
Conducted Differential Voltage Emissions	30MHz to 2150MHz, ±0.52dB
Radiated Emissions	30MHz to 1GHz @ 10m, ±4.0dB 30MHz to 1GHz @ 3m, ±5.6dB >1GHz to 40GHz @3m, ±5.0dB

PSB Singapore

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July 2011

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End of the Test Report