FCC 47 CFR PART 15 SUBPART C
ISED RSS-210 ISSUE 10

CERTIFICATION TEST REPORT

For

Read-write card module

MODEL NUMBER: MK-NFC-001

PROJECT NUMBER: 4789002290

REPORT NUMBER: 4789002290-1

FCC ID: 2ASR8MKNFC001

IC: 25370-MKNFC001

ISSUE DATE: Sep. 17, 2020

Prepared for

Qingdao Haier Biomedical Co.,Ltd

Prepared by

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	09/17/2020	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	Transmitter AC Conducted Emissions	Part 15.207 RSS-GEN Clause 8.8	PASS
2	Transmitter Fundamental Field Strength	Part 15.225(a)(b)(c)(d) RSS-210 Clause B.6 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	PASS
3	Transmitter Radiated Emissions	Part 15.209(a)/ 15.225(d) RSS-210 Clause B.6 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	PASS
4	Transmitter 99% Emission Bandwidth / 20dB Bandwidth	Part 15.215 (c) RSS-GEN Clause 6.7	PASS
5	Transmitter Frequency Stability (Temperature & Voltage Variation)	Part 15.225(e) RSS-210 Clause B.6 RSS-GEN Clause 8.11	PASS
6	Antenna Requirement	FCC 15.203	PASS
Remark: 1) The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, RSS-GEN , RSS-210, FCC CFR 47 Part 2, FCC CFR 47 Part 15> when <Accuracy Method> decision rule is applied.			

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	Qingdao Haier Biomedical Co.,Ltd
Address:	HAIER INDUSTRIAL PARK ECONOMIC TECHNOLOGY DEVELOPMENT ZONE ,QINGDAO,SHANDONG 266510 CHINA

Manufacturer Information

Company Name:	Qingdao Haier Biomedical Co.,Ltd
Address:	HAIER INDUSTRIAL PARK ECONOMIC TECHNOLOGY DEVELOPMENT ZONE ,QINGDAO,SHANDONG 266510 CHINA

EUT Description

Product Name	Read-write card module
Model Name	MK-NFC-001
Sample Number	2350244
Data of Receipt Sample	Jul. 01, 2020
Date Tested	Jul. 01, 2020~ Sep. 16, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	PASS
RSS 210 ISSUE 10	PASS

Prepared By:

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Laboratory Leader

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, RSS-GEN Issue 4, RSS-210 Issue 10, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 4829.01)** **UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA.** **FCC (FCC Designation No.: CN1247)** **UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.** **IC (IC Designation No.: 25056)** **UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.**

Note 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.

Note 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.1dB
Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	3.3dB
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	3.3dB
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Product Name:	Read-write card module
Model No.:	MK-NFC-001
Antenna Type:	PCB Antenna
Antenna Gain:	0 dBi

5.2. MAXIMUM OUTPUT POWER

Frequency (MHz)	Number of Transmit Chains (NTX)	Frequency (MHz)	Channel Number	Max Power (dBμV/m)
13.56	1	13.56	1	66.23

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	13.56	2	N/A	3	N/A	4	N/A

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	13.56	PCB Antenna	0

Frequency (MHz)	Transmit and Receive Mode	Description
13.56	☒1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

5.5. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	56%	
Atmospheric Pressure:	102KPa	
Temperature	TN	23 °C
Voltage :	VL	N/A
	VN	AC120V,60Hz
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Information
1	Power Supply	Tektronix (Supply by the customer)	PWS2326 DC Power Supply	N/AC

I/O PORT

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	N/A	N/A	N/A	N/A	N/A

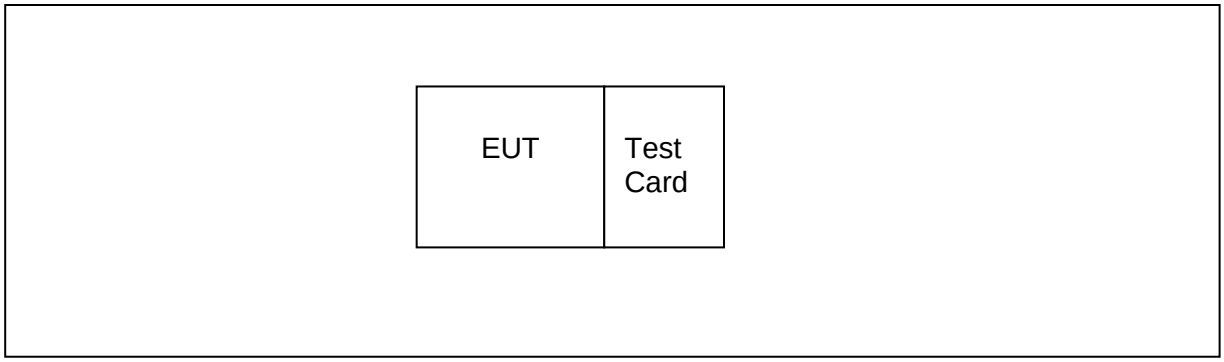
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

TEST SETUP

The EUT can continue work normally when a card touched.

SETUP DIAGRAM FOR TESTS



Remark: The Test card is a passive tag.

5.7. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions (Instrument**)**							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	EMI Test Receiver	R&S	ESR3	126700	2017-12-14	2018-12-13	2019-12-12
☑	Four -Line V-Network	R&S	ENV432	127008	2018-07-11	2019-05-12	2020-05-11
Software							
Used	Description		Manufacturer	Name	Version		
☑	Test Software for Conducted disturbance		R&S	EMC32	Ver. 9.25		
Radiated Emissions (Instrument**)**							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	EMI test receiver	R&S	ESR26	1267603	2017-12-14	2018-12-13	2019-12-22
☑	Receiver Antenna (9KHz-30MHz)	Schwarzbeck	FMZB1513	513-265	2018-06-17	2019-06-16	2020-06-15
☑	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	126704	2018-03-01	2019-01-28	2022-01-27
Software							
Used	Description		Manufacturer	Name	Version		
☑	Test Software for Radiated disturbance		Tonscend	JS32-RE	2.5		
Other instruments							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Next Cal.	
☑	Spectrum Analyzer	Keysight	N9010B	MY57110128	2018.05.26	2019.05.25	2020.05.24

6. ANTENNA PORT TEST RESULTS

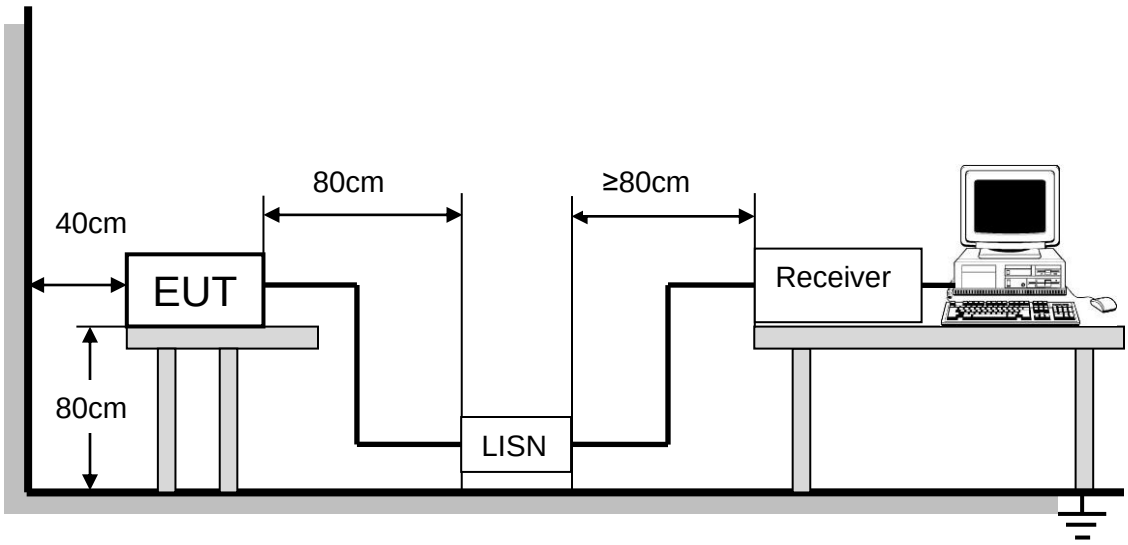
6.1. AC Conducted Spurious Emissions

LIMITS

Reference:	Part 15.207 ISED RSS-Gen Clause 8.8
Test Method Used:	ANSI C63.10 Section 6.2

FREQUENCY (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

TEST SETUP AND PROCEDURE



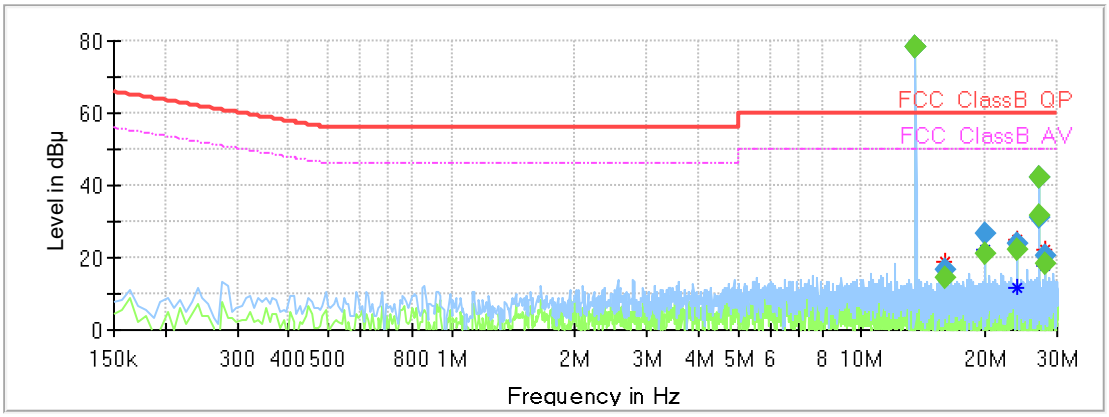
The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2003.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST ENVIRONMENT

Temperature	23°C	Relative Humidity	56%
Atmosphere Pressure	102kPa	Test Voltage	AC120V

1) For Normal Test Result

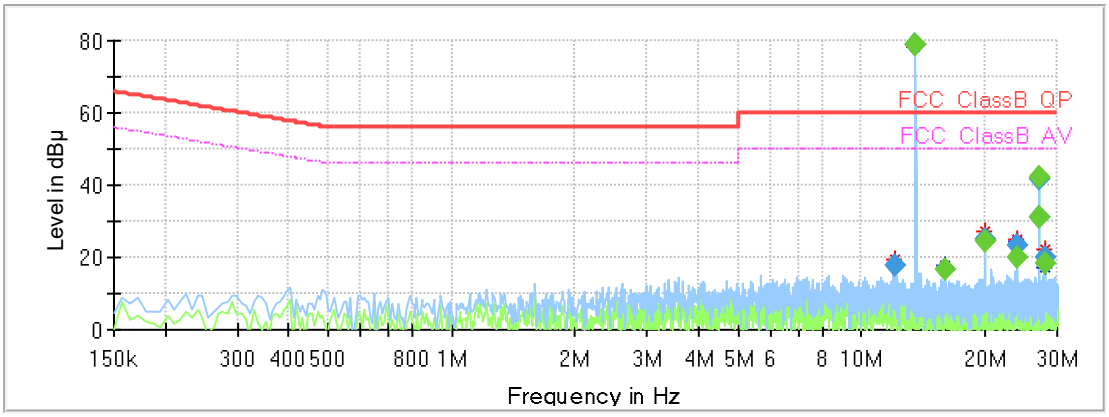
LINE N RESULTS (WORST-CASE CONFIGURATION)



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
13.560113	---	78.39	50.00	-28.39	1000.0	9.000	N	OFF	10.0
13.560113	78.39	---	60.00	-18.39	1000.0	9.000	N	OFF	10.0
16.022738	---	14.72	50.00	35.28	1000.0	9.000	N	OFF	10.1
16.022738	16.73	---	60.00	43.27	1000.0	9.000	N	OFF	10.1
20.030100	26.69	---	60.00	33.31	1000.0	9.000	N	OFF	10.5
20.030100	---	20.84	50.00	29.16	1000.0	9.000	N	OFF	10.5
24.044925	23.89	---	60.00	36.11	1000.0	9.000	N	OFF	10.3
24.044925	---	22.31	50.00	27.69	1000.0	9.000	N	OFF	10.3
27.126938	31.36	---	60.00	28.64	1000.0	9.000	N	OFF	10.2
27.126938	---	31.55	50.00	18.45	1000.0	9.000	N	OFF	10.2
28.044825	---	18.07	50.00	31.93	1000.0	9.000	N	OFF	10.1
28.044825	20.72	---	60.00	39.28	1000.0	9.000	N	OFF	10.1

Note: 1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

LINE L RESULTS (WORST-CASE CONFIGURATION)

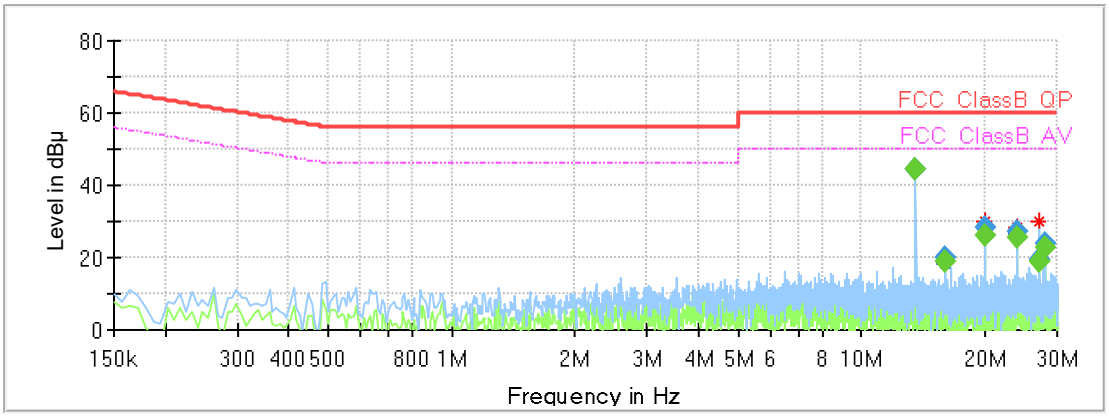


Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
12.022838	17.77	---	60.00	42.23	1000.0	9.000	L1	OFF	10.0
13.560113	---	78.66	50.00	-28.66	1000.0	9.000	L1	OFF	10.0
13.560113	78.63	---	60.00	-18.63	1000.0	9.000	L1	OFF	10.0
16.030200	---	16.56	50.00	33.44	1000.0	9.000	L1	OFF	10.2
20.037563	---	24.34	50.00	25.66	1000.0	9.000	L1	OFF	10.6
20.045025	24.97	---	60.00	35.03	1000.0	9.000	L1	OFF	10.6
24.044925	23.29	---	60.00	36.71	1000.0	9.000	L1	OFF	10.3
24.044925	---	19.93	50.00	30.07	1000.0	9.000	L1	OFF	10.3
27.126938	30.93	---	60.00	29.07	1000.0	9.000	L1	OFF	10.1
27.126938	---	31.37	50.00	18.63	1000.0	9.000	L1	OFF	10.1
28.052288	---	18.44	50.00	31.56	1000.0	9.000	L1	OFF	10.1
28.052288	19.93	---	60.00	40.07	1000.0	9.000	L1	OFF	10.1

Note: 1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

1) For Terminal Test Result

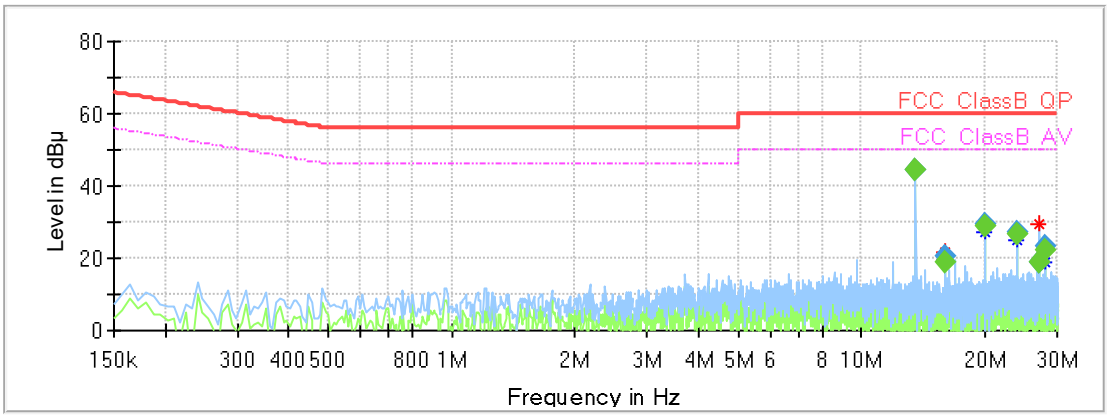
LINE N RESULTS (WORST-CASE CONFIGURATION)



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
13.560113	---	44.37	50.00	5.63	1000.0	9.000	N	OFF	10.0
13.560113	44.29	---	60.00	15.71	1000.0	9.000	N	OFF	10.0
15.963038	---	18.92	50.00	31.08	1000.0	9.000	N	OFF	10.1
15.963038	20.15	---	60.00	39.85	1000.0	9.000	N	OFF	10.1
19.955475	---	26.34	50.00	23.66	1000.0	9.000	N	OFF	10.5
19.955475	28.43	---	60.00	31.57	1000.0	9.000	N	OFF	10.5
23.947913	27.06	---	60.00	32.94	1000.0	9.000	N	OFF	10.3
23.947913	---	25.48	50.00	24.52	1000.0	9.000	N	OFF	10.3
27.126938	19.22	---	60.00	40.78	1000.0	9.000	N	OFF	10.2
27.126938	---	19.13	50.00	30.87	1000.0	9.000	N	OFF	10.2
27.940350	---	22.88	50.00	27.12	1000.0	9.000	N	OFF	10.1
27.940350	23.88	---	60.00	36.12	1000.0	9.000	N	OFF	10.1

Note: 1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

LINE L RESULTS (WORST-CASE CONFIGURATION)



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
13.560113	---	44.30	50.00	5.70	1000.0	9.000	L1	OFF	10.0
13.560113	44.23	---	60.00	15.77	1000.0	9.000	L1	OFF	10.0
15.963038	---	18.79	50.00	31.21	1000.0	9.000	L1	OFF	10.1
15.963038	20.65	---	60.00	39.35	1000.0	9.000	L1	OFF	10.1
19.955475	---	28.64	50.00	21.36	1000.0	9.000	L1	OFF	10.5
19.955475	29.43	---	60.00	30.57	1000.0	9.000	L1	OFF	10.5
23.947913	27.00	---	60.00	33.00	1000.0	9.000	L1	OFF	10.3
23.947913	---	26.63	50.00	23.37	1000.0	9.000	L1	OFF	10.3
27.126938	19.14	---	60.00	40.86	1000.0	9.000	L1	OFF	10.1
27.126938	---	19.03	50.00	30.97	1000.0	9.000	L1	OFF	10.1
27.940350	---	22.02	50.00	27.98	1000.0	9.000	L1	OFF	10.1
27.940350	23.43	---	60.00	36.57	1000.0	9.000	L1	OFF	10.1

Note: 1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

6.2. RADIATED EMISSION

TEST PROCEDURE

Fundamental field strength

Reference:	Part 15.225(a)(b)(c)(d) & 15.209(a) ISED RSS-210 Clause B.6, ISED RSS-GEN Clause 8.9&6.13
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4 and 6.5

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m) at 30M	Field Strength (dBuV/m) at 3M
13.553-13.567	15848	84	123.90
13.410-13.553/13.567-13.710	334	50.47	90.47
13.110-13.410/13.710-14.010	106	40.51	80.51

Note(s):
1. The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

2. The limit is specified at a test distance of 30 meters. However, as specified by FCC Section 15.31 (f)(2) / RSS-Gen Section 6.4, measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Please refer to ISED RSS-GEN Clause 8.9 (Transmitter)
Radiation Disturbance Test Limit for ISED

Table 5 – General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field strength (µV/m at 3 m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) (µA/m)	Measurement distance (m)
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement

procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

Restricted bands of operation

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

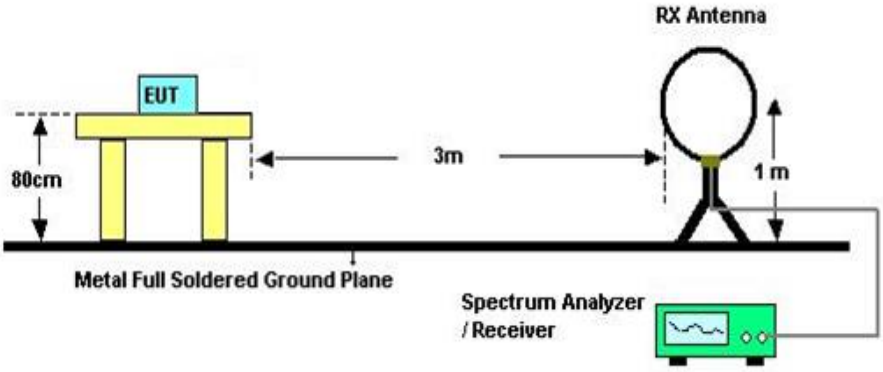
Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

Table 7 – Restricted frequency bands[Note 1]		
MHz	**MHz**	**GHz**
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

TEST SETUP

Below 30MHz



The setting of the spectrum analyser

RBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
Sweep	Auto
Detector	Peak/QP/ Average
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80cm meter above ground.

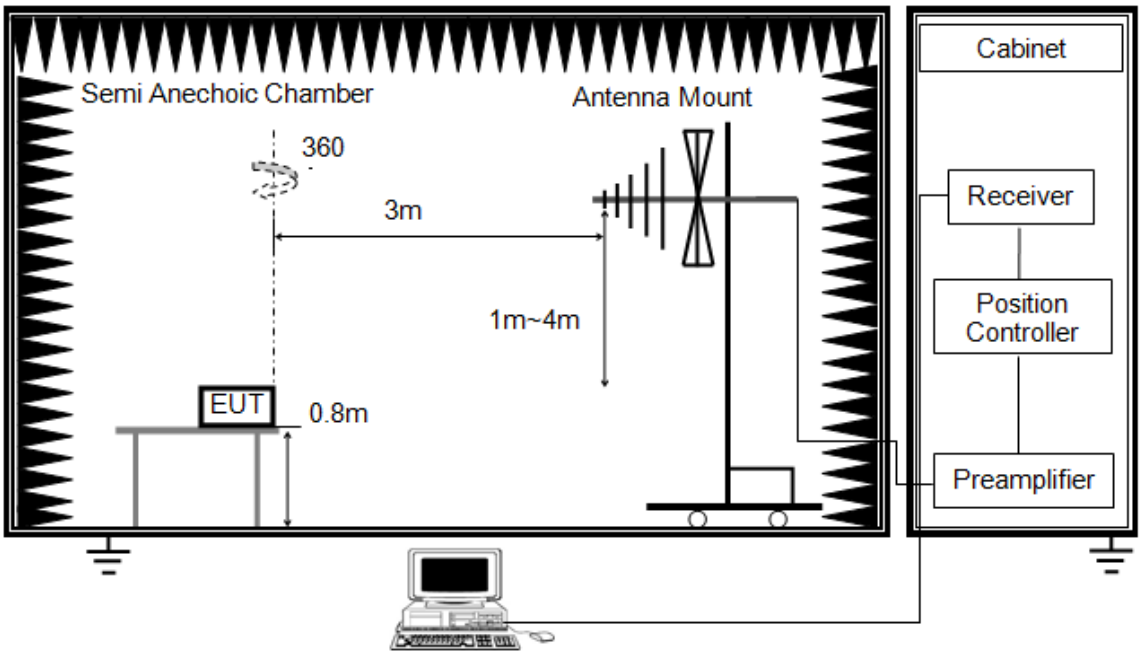
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1m height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

7. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m OFS. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Below 1G



The setting of the spectrum analyser

RBW	120K
VBW	300K
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

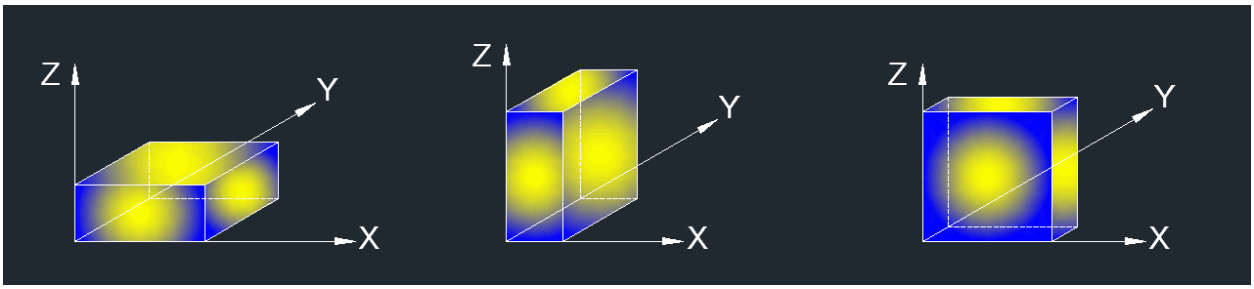
1. The testing follows the guidelines in ANSI C63.10-2013.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 0.8 meter above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

X axis, Y axis, Z axis positions:



Note: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (Z axis) data recorded in the report.

RESULTS

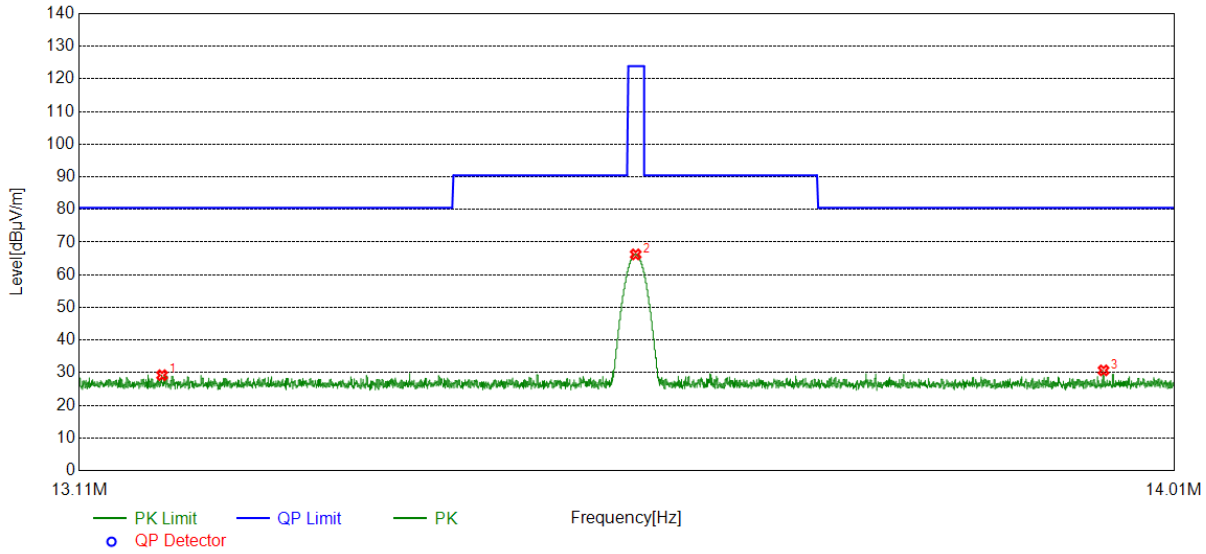
TEST ENVIRONMENT

Temperature	23°C	Relative Humidity	56%
Atmosphere Pressure	102kPa	Test Voltage	AC120V

Remark: Through pre-testing all test polarizations, including Horizontal, Face-on and Face-off polarizations of the antenna, but only the data of the worst case is included in this test report.

6.2.1. FUNDAMENTAL FIELD STRENGTH

Face-on (THE WORST CASE)

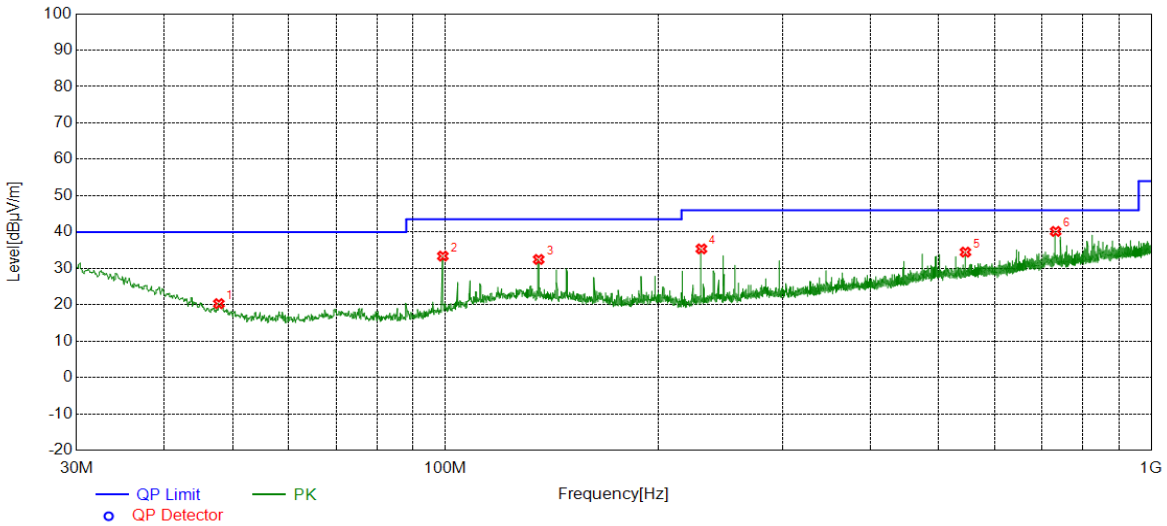


No.	Frequency	Reading	Correct	Result 3m	Result 30m	Limit (30m)	Margin (30m)	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	13.1761	8.48	20.75	29.23	-10.77	40.51	-51.28	peak
2	13.5601	45.51	20.72	66.23	26.23	83.90	-57.67	peak
3	13.9504	10.03	20.68	30.71	-9.29	40.51	-49.80	peak

Note: 1. Result 3m= Reading+ Correct Factor
2. Result 30m= Result 3m-40 dBuV/m

6.2.2. SPURIOUS EMISSIONS BELOW 1G

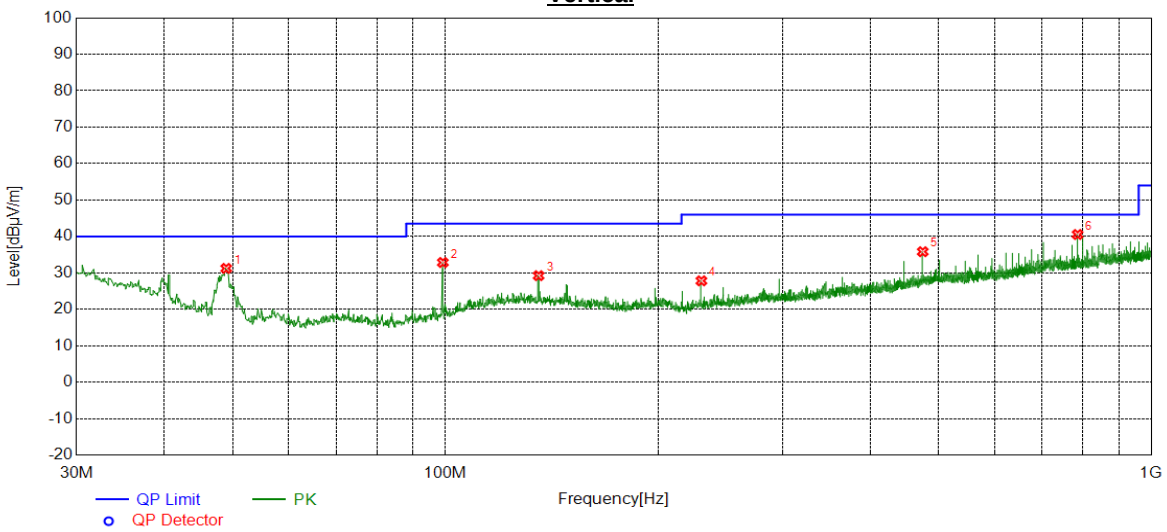
Horizontal



No.	Frequency (MHz)	Reading [dBµV/m]	Factor [dB]	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	47.7528	4.35	15.95	20.30	40.00	-19.70	QP
2	99.1679	16.74	16.63	33.37	43.50	-10.13	QP
3	135.5466	12.43	20.02	32.45	43.50	-11.05	QP
4	230.5191	17.12	18.24	35.36	46.00	-10.64	QP
5	545.5096	8.37	26.09	34.46	46.00	-11.54	QP
6	732.2532	11.23	28.93	40.16	46.00	-5.84	QP

Note: 1. Result Level = Read Level + Correct Factor.
2. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Vertical



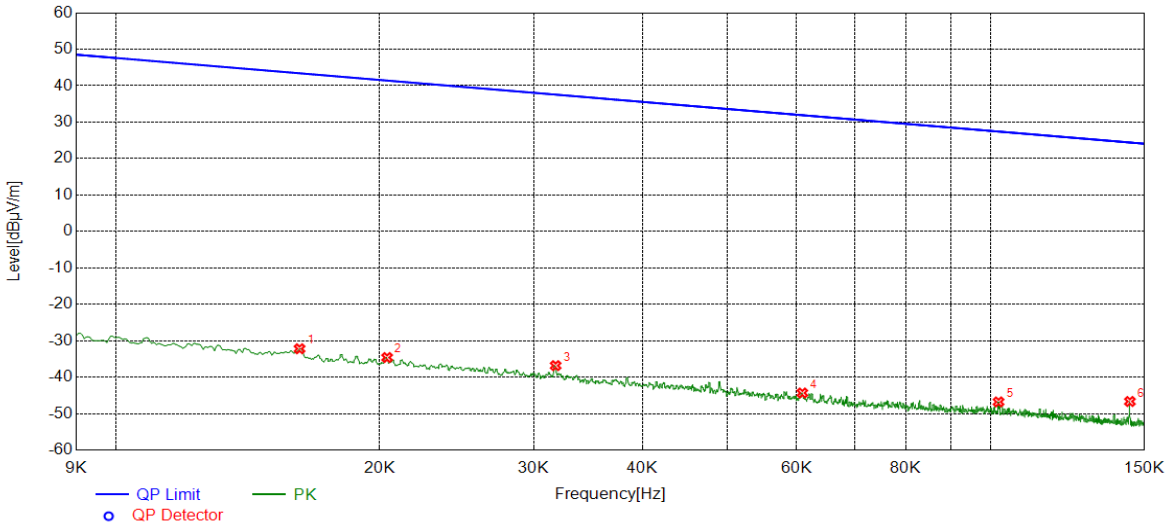
No.	Frequency (MHz)	Reading [dBµV/m]	Factor [dB]	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	48.9169	16.01	15.22	31.23	40.00	-8.77	QP
2	99.1679	16.21	16.63	32.84	43.50	-10.66	QP
3	135.5466	9.21	20.02	29.23	43.50	-14.27	QP
4	230.5191	9.57	18.24	27.81	46.00	-18.19	QP
5	474.5955	10.81	25.00	35.81	46.00	-10.19	QP
6	786.4816	10.93	29.61	40.54	46.00	-5.46	QP

Note: 1. Result Level = Read Level + Correct Factor.
2. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

6.2.3. SPURIOUS EMISSIONS BELOW 30M

HORIZONTAL(THE WORST CASE)

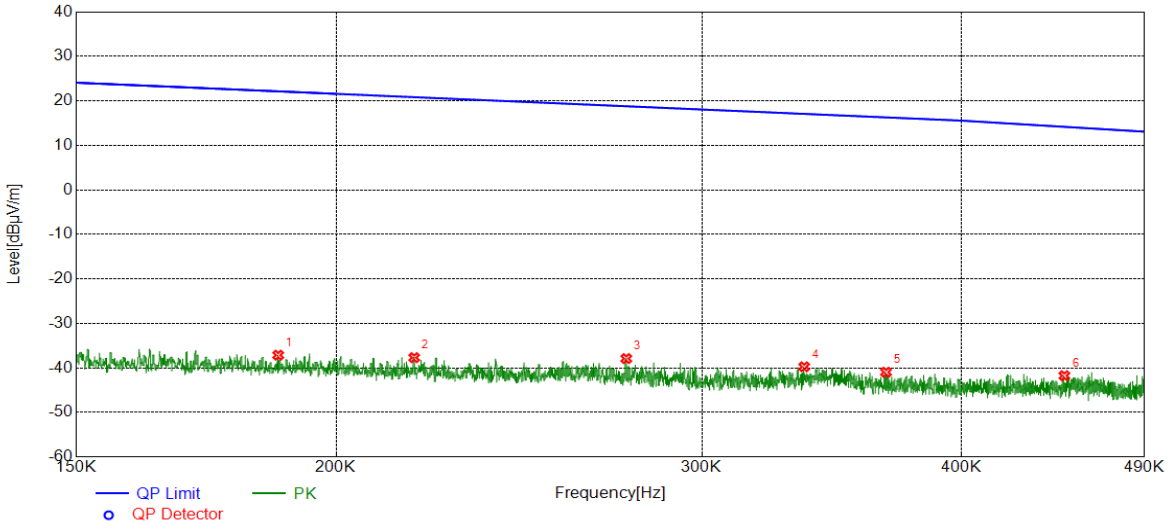
9KHz~ 150KHz



No.	Frequency	Reading	Factor	FCC Result	FCC Limit	IC Result	IC Limit	Margin	Remark
	(MHz)	[dBµV/m]	[dB]	(dBuV/m)	(dBuV/m)	(dBuA/m)	(dBuA/m)	(dB)	
1	0.0162	28.87	-61.07	-32.20	43.39	-83.70	-8.11	-75.59	peak
2	0.0204	26.35	-60.96	-34.61	41.42	-86.11	-10.08	-76.03	peak
3	0.0318	24.21	-61.04	-36.83	37.57	-88.33	-13.93	-74.40	peak
4	0.0609	16.99	-61.33	-44.34	31.92	-95.84	-19.58	-76.26	peak
5	0.1021	14.09	-60.88	-46.79	27.42	-98.29	-24.08	-74.21	peak
6	0.1443	14.71	-61.38	-46.67	24.42	-98.17	-27.08	-71.09	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations(Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report

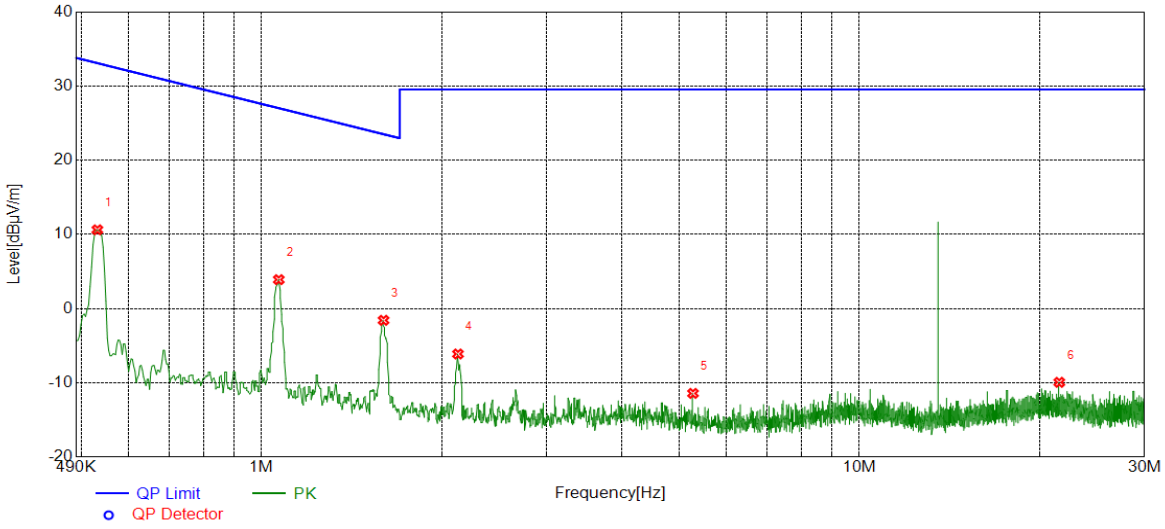
150KHz ~ 490KHz



No.	Frequency	Reading	Factor	FCC Result	FCC Limit	IC Result	IC Limit	Margin	Remark
	(MHz)	[dBµV/m]	[dB]	(dBuV/m)	(dBuV/m)	(dBuA/m)	(dBuA/m)	(dB)	
1	0.1876	24.13	-61.26	-37.13	22.14	-88.63	-29.36	-59.27	peak
2	0.2181	23.41	-61.10	-37.69	20.83	-89.19	-30.67	-58.52	peak
3	0.2759	23.02	-60.92	-37.90	18.79	-89.40	-32.71	-56.69	peak
4	0.3360	21.12	-60.87	-39.75	17.08	-91.25	-34.42	-56.83	peak
5	0.3679	19.88	-60.84	-40.96	16.29	-92.46	-35.21	-57.25	peak
6	0.4483	19.02	-60.77	-41.75	14.17	-93.25	-37.33	-55.92	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations(Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report

490KHz ~ 30MHz



No.	Frequency	Reading	Factor	FCC Result	FCC Limit	IC Result	IC Limit	Margin	Remark
	(MHz)	[dBµV/m]	[dB]	(dBuV/m)	(dBuV/m)	(dBuA/m)	(dBuA/m)	(dB)	
1	0.5313	31.36	-20.74	10.62	33.10	-40.88	-18.40	-22.48	peak
2	1.0685	24.38	-20.48	3.90	27.03	-47.60	-24.47	-23.13	peak
3	1.5997	18.81	-20.39	-1.58	23.52	-53.08	-27.98	-25.10	peak
4	2.1309	14.24	-20.36	-6.12	29.54	-57.62	-21.96	-35.66	peak
5	5.2681	8.87	-20.30	-11.43	29.54	-62.93	-21.96	-40.97	peak
6	21.5947	7.73	-17.67	-9.94	29.54	-61.44	-21.96	-39.48	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All 3 polarizations(Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report

6.3. 99%/20dB BANDWIDTH

LIMITS

FCC Part15 Subpart C		
Section	Test Item	Limit
Part 15.215 (c)	20 Bandwidth	For reporting purposes only.
RSS-GEN Clause 6.7	99% Bandwidth	For reporting purposes only.

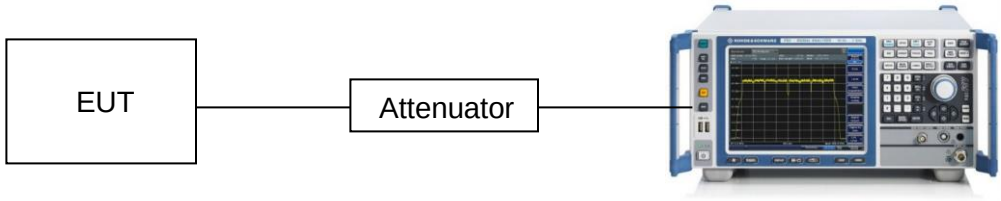
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	1% to 5% of the occupied bandwidth
VBW	approximately 3×RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 99% relative to the maximum level measured in the fundamental emission.

TEST SETUP

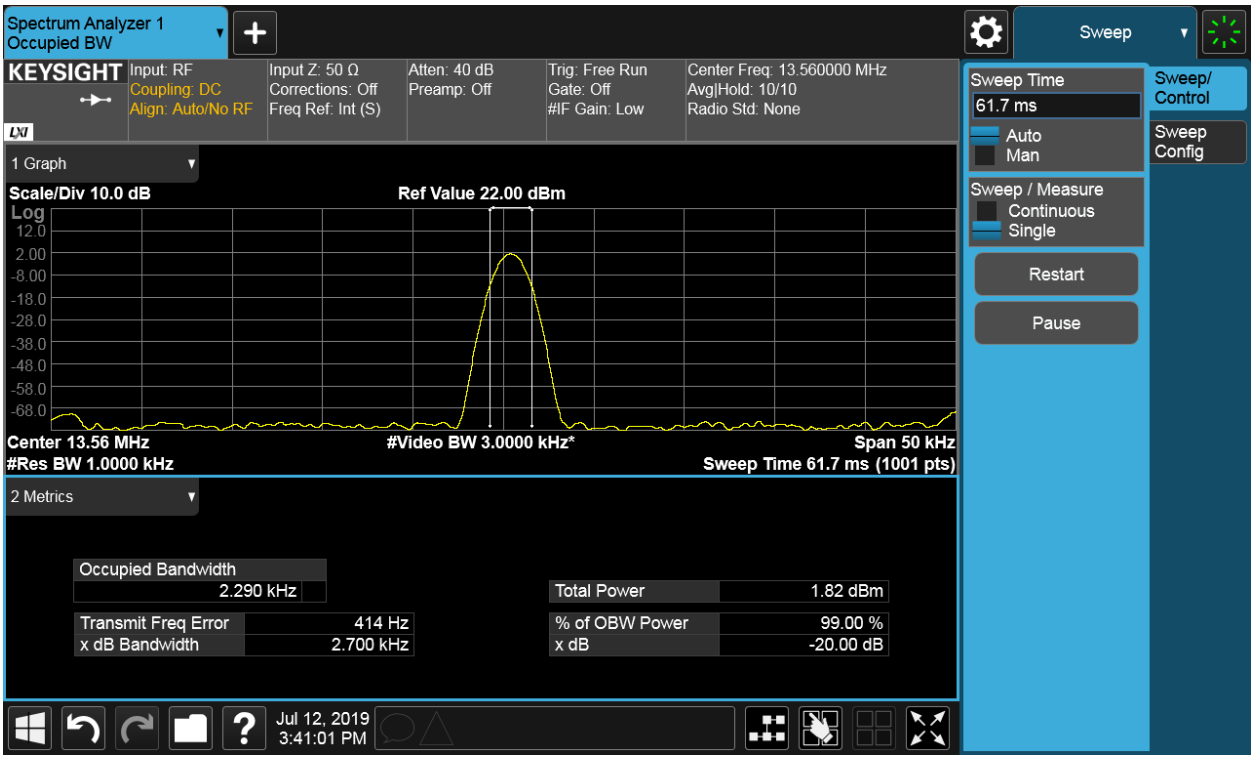


TEST ENVIRONMENT

Temperature	23°C	Relative Humidity	56%
Atmosphere Pressure	102kPa	Test Voltage	AC120V

RESULTS

Frequency (MHz)	99% bandwidth (KHz)	20dB bandwidth (KHz)
13.56	2.290	2.700



Remark: Because the measured signal is CW or CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW. And the signal was narrowband, therefore it was impossible to set RBW within 1% – 5%.

6.4. TRANSMITTER FREQUENCY STABILITY

LIMITS

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

TEST SETUP AND PROCEDURE

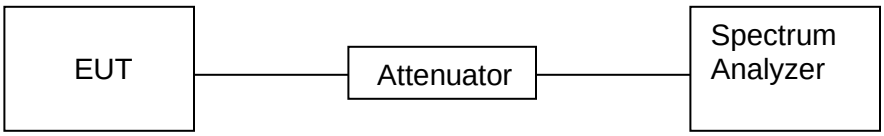
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	PEAK
RBW	10KHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

Allow the trace to stabilize, find the peak value of the power envelope and record the frequency, then calculated the frequency drift.

The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

TEST SETUP



TEST ENVIRONMENT

Temperature	23°C	Relative Humidity	56%
Atmosphere Pressure	102kPa	Test Voltage	AC120V

TEST RESULTS

Maximum frequency error of the EUT with variations in ambient temperature

Temperature (°C)	Time After(Mins)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
-20	0	13.5604	400	0.004	0.01	0.006	Pass
	2	13.5606	600	0.006	0.01	0.004	Pass
	5	13.5605	500	0.005	0.01	0.005	Pass
	10	13.5606	600	0.006	0.01	0.004	Pass
-10	0	13.5605	500	0.005	0.01	0.005	Pass
	2	13.5605	500	0.005	0.01	0.005	Pass
	5	13.5606	600	0.006	0.01	0.004	Pass
	10	13.5604	400	0.004	0.01	0.006	Pass
0	0	13.5605	500	0.005	0.01	0.005	Pass
	2	13.5605	500	0.005	0.01	0.005	Pass
	5	13.5604	400	0.004	0.01	0.006	Pass
	10	13.5604	400	0.004	0.01	0.006	Pass
10	0	13.5606	600	0.006	0.01	0.004	Pass
	2	13.5606	600	0.006	0.01	0.004	Pass
	5	13.5606	600	0.006	0.01	0.004	Pass
	10	13.5605	500	0.005	0.01	0.005	Pass
20	0	13.5604	400	0.004	0.01	0.006	Pass
	2	13.5606	600	0.006	0.01	0.004	Pass
	5	13.5604	400	0.004	0.01	0.006	Pass
	10	13.5605	500	0.005	0.01	0.005	Pass
30	0	13.5606	600	0.006	0.01	0.004	Pass
	2	13.5605	500	0.005	0.01	0.005	Pass
	5	13.5605	500	0.005	0.01	0.005	Pass
	10	13.5605	500	0.005	0.01	0.005	Pass
40	0	13.5605	500	0.005	0.01	0.005	Pass
	2	13.5606	600	0.006	0.01	0.004	Pass
	5	13.5605	500	0.005	0.01	0.005	Pass
	10	13.5605	500	0.005	0.01	0.005	Pass
50	0	13.5606	600	0.006	0.01	0.004	Pass
	2	13.5603	300	0.003	0.01	0.007	Pass
	5	13.5605	500	0.005	0.01	0.005	Pass
	10	13.5605	500	0.005	0.01	0.005	Pass

Maximum frequency error of the EUT with variations in nominal operating voltage at an ambient

Normal temperature

Supply Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
102	13.56	13.5606	600	0.006	0.01	0.004	Pass
120	13.56	13.5605	500	0.005	0.01	0.005	Pass
138	13.56	13.5606	600	0.006	0.01	0.004	Pass

7. ANTENNA REQUIREMENTS

PPLICABLE REQUIREMENTS

Please refer to FCC §15.203

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

ANTENNA CONNECTOR

EUT has an PCB antenna without antenna connector.

ANTENNA GAIN

The antenna gain of EUT is less than 6 dBi.

END OF REPORT