

FCC Test Report

Report No.: RF190109C01-3

FCC ID: S6J2173

Test Model: 2173

Received Date: Jan. 30, 2019

Test Date: Feb. 23 ~ Mar. 20, 2019

Issued Date: Mar. 27, 2019

Applicant: Technology Solutions (UK) Ltd

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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R.O.C.

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FCC Registration / 788550 / TW0003
Designation Number:



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Release Control Record

Issue No.	Description	Date Issued
RF190109C01-3	Original release	Mar. 27, 2019

1 Certificate of Conformity

Product: 2173 BLUETOOTH LF, HF & NFC RFID READER

Brand: TECHNOLOGY SOLUTIONS (UK) LTD

Model No.: 2173

Sample Status: Engineering sample

Applicant: Technology Solutions (UK) Ltd

Test Date: Feb. 23 ~ Mar. 20, 2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.209)
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Pettie Chen , **Date:** Mar. 27, 2019
Pettie Chen / Senior Specialist

Approved by : Bruce Chen , **Date:** Mar. 27, 2019
Bruce Chen / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.209)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -9.93dB at 0.58750MHz.
15.209	Radiated Emission Test	Pass	Meet the requirement of limit. Minimum passing margin is -4.80dB at 55.13MHz.
2.202	Bandwidth Measurement	Pass	Meet the requirement of limit.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.94 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.63 dB
	200MHz ~ 1000MHz	3.64 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	2173 BLUETOOTH LF, HF & NFC RFID READER
Brand	TECHNOLOGY SOLUTIONS (UK) LTD
Test Model	2173
Sample Status	Engineering sample
Power Supply Rating	5Vdc (adapter) 3.7Vdc (battery)
Modulation Type	ASK, FSK, PSK
Data Rate	1 kBit/s to 8 kBit/s
Operating Frequency	125kHz, 134.2kHz
Field Strength	125kHz: 72.33dBuV/m 134.2kHz: 71.27dBuV/m
Antenna Type	Coil antenna
Accessory Device	Refer to Note
Data Cable Supplied	0.96m shielded USB cable without core

Note:

1. All models are listed as below. PN: 2173-BT-LF-HF-IMG was chosen for final test.

Model	PN	Description
2173	2173-BT-IMG	2D Barcode Imager Only (Without HF/LF RFID) The RFID function will be disabled by software
	2173-BT-LF-HF-A1	HF/LF RFID Only (Without 2D Barcode Scanner)
	2173-BT-LF-HF-IMG	HF/LF RFID with 2D Barcode Imager

2. The EUT consumes power from the following adapter and battery.

Adapter	
Brand	STONTRONICS
Model	DSA-10PFP-05
Input Power	100-240Vac, ~50/60Hz, 0.3A
Output Power	5Vdc, 2A

Battery	
Brand	VARTA
Model	56456 701 099 - 1ICP5/35/62
Rating	3.7Vdc, 1200mAh, 4.5Wh

3.2 Description of Test Modes

2 channels are provided to this EUT

Channel	Freq. (kHz)
1	125
2	134.2

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO		DESCRIPTION
	RE<1G	PLC	
A	√	√	125kHz
B	√	√	134.2kHz

Where **RE<1G**: Radiated Emission below 1GHz **PLC**: Power Line Conducted Emission

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel
A	1, 2	1
B	1, 2	2

Power Line Conducted Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel
A	1, 2	1
B	1, 2	2

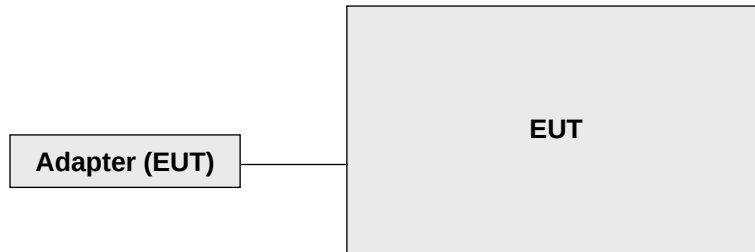
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE<1G	25 deg. C, 70% RH	120Vac, 60Hz	Noah Chang
PLC	25 deg. C, 70% RH	120Vac, 60Hz	Luis Lee

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.209)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

For Frequency below 30MHz

Frequency (MHz)	Field Strength (dBuV/m)		Measurement Distance (meters)
	uV/m	dBuV/m	
0.009 – 0.490	2400 / F (kHz)	48.52-13.80	300
0.490 – 1.705	24000 / F (kHz)	33.80-22.97	30
1.705 – 30.0	30	29.54	30

For Frequency between 30-1000MHz

Frequency (MHz)	Class A (at 10m)		Class B (at 3m)	
	uV/m	dBuV/m	uV/m	dBuV/m
30-88	90	39.1	100	40.0
88-216	150	43.5	150	43.5
216-960	210	46.4	200	46.0
Above 960	300	49.5	500	54.0

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Jan. 03, 2019	Jan. 02, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 25, 2018	Sep. 24, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Nov. 21, 2018	Nov. 20, 2019
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Nov. 25, 2018	Nov. 24, 2019
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 25, 2018	Nov. 24, 2019
Loop Antenna TESEQ	HLA 6121	45745	Jun. 14, 2018	Jun. 13, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10631	Aug. 08, 2018	Aug. 07, 2019
Preamplifier KEYSIGHT (Above 1GHz)	83017A	MY53270295	Jul. 02, 2018	Jul. 01, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Aug. 08, 2018	Aug. 07, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Aug. 08, 2018	Aug. 07, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 4.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is 7450F-4.

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

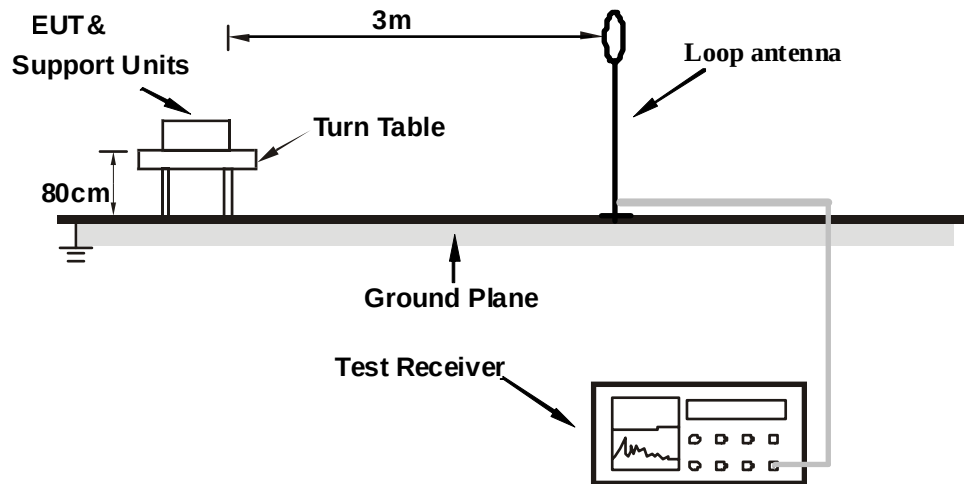
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

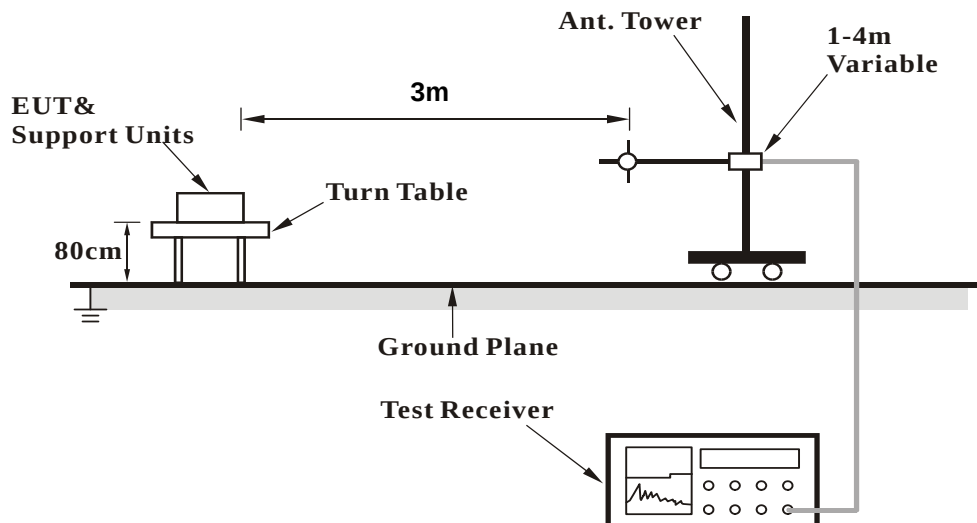
No deviation.

4.1.5 Test Set Up

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

- Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Below 30MHz Data:

Channel	TX Channel 1	Detector Function	Peak (PK)
Frequency Range	9 kHz ~ 30 MHz		Average (AV)
Test Mode	A		

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA OPEN AT 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.125	72.9 PK	125.7	-52.8	1.00	25	53.2	19.7
2	*0.125	72.3 AV	105.7	-33.4	1.00	25	52.6	19.7
ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA CLOSE AT 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.125	68.8 PK	125.7	-56.9	1.00	333	49.1	19.7
2	*0.125	68.0 AV	105.7	-37.7	1.00	333	48.3	19.7
ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA GROUND-PARALLEL AT 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.125	66.9 PK	125.7	-58.8	1.00	171	47.2	19.7
2	*0.125	66.5 AV	105.7	-39.2	1.00	171	46.8	19.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80

Channel	TX Channel 1	Detector Function	Peak (PK)
Frequency Range	9 kHz ~ 30 MHz		Average (AV)
Test Mode	B		

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA OPEN AT 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.1342	72.4 PK	125.1	-52.7	1.00	342	52.7	19.7
2	*0.1342	71.3 AV	105.1	-33.8	1.00	342	51.6	19.7
ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA CLOSE AT 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.1342	68.1 PK	125.1	-57.0	1.00	211	48.4	19.7
2	*0.1342	67.2 AV	105.1	-37.9	1.00	211	47.5	19.7
ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA GROUND-PARALLEL AT 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*0.1342	67.3 PK	125.1	-57.8	1.00	177	47.6	19.7
2	*0.1342	66.2 AV	105.1	-38.9	1.00	177	46.5	19.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80

Channel	TX Channel 1	Detector Function	Quasi-Peak
Frequency Range	9 kHz ~ 30 MHz		
Test Mode	A		

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA OPEN AT 3m

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2.71	36.74	69.54	-32.80	1.00	316	17.15	19.59
2	6.07	36.02	69.54	-33.52	1.00	7	15.21	20.81
3	7.15	35.87	69.54	-33.67	1.00	306	14.79	21.08
4	10.69	37.89	69.54	-31.65	1.00	293	16.10	21.79
5	26.10	35.85	69.54	-33.69	1.00	299	13.79	22.06
6	29.64	36.60	69.54	-32.94	1.00	353	14.41	22.19

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA CLOSE AT 3m

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1.51	42.56	64.03	-21.47	1.00	198	22.65	19.91
2	6.67	36.29	69.54	-33.25	1.00	334	15.33	20.96
3	9.73	37.10	69.54	-32.44	1.00	150	15.38	21.72
4	14.16	36.70	69.54	-32.84	1.00	79	14.89	21.81
5	19.56	37.88	69.54	-31.66	1.00	245	16.03	21.85
6	24.00	36.72	69.54	-32.82	1.00	251	14.73	21.99

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA GROUND-PARALLEL AT 3m

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4.33	35.96	69.54	-33.58	1.00	69	15.77	20.19
2	7.15	35.87	69.54	-33.67	1.00	306	14.79	21.08
3	9.19	36.24	69.54	-33.30	1.00	259	14.65	21.59
4	19.86	37.50	69.54	-32.04	1.00	289	15.65	21.85
5	24.36	35.08	69.54	-34.46	1.00	67	13.08	22.00
6	26.22	35.23	69.54	-34.31	1.00	0	13.16	22.07

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

Channel	TX Channel 1	Detector Function	Quasi-Peak
Frequency Range	9 kHz ~ 30 MHz		
Test Mode	B		

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA OPEN AT 3m

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1.2086	37.23	65.96	-28.73	1.00	75	17.24	19.99
2	6.1272	36.05	69.54	-33.49	1.00	345	15.23	20.82
3	10.2659	38.99	69.54	-30.55	1.00	121	17.20	21.79
4	14.2847	35.70	69.54	-33.84	1.00	346	13.88	21.82
5	16.0842	36.22	69.54	-33.32	1.00	62	14.39	21.83
6	23.4620	39.44	69.54	-30.10	1.00	200	17.47	21.97

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA CLOSE AT 3m

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	0.6088	40.36	71.91	-31.55	1.00	67	20.18	20.18
2	1.9284	37.85	69.54	-31.69	1.00	28	18.05	19.80
3	5.9472	36.18	69.54	-33.36	1.00	22	15.40	20.78
4	12.6052	36.44	69.54	-33.10	1.00	217	14.63	21.81
5	23.4620	38.73	69.54	-30.81	1.00	117	16.76	21.97
6	26.4011	35.65	69.54	-33.89	1.00	255	13.58	22.07

ANTENNA POLARITY & TEST DISTANCE: LOOP ANTENNA GROUND-PARALLEL AT 3m

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5.9472	36.18	69.54	-33.36	1.00	22	15.40	20.78
2	12.6052	36.44	69.54	-33.10	1.00	217	14.63	21.81
3	15.8442	36.77	69.54	-32.77	1.00	266	14.94	21.83
4	19.5631	36.29	69.54	-33.25	1.00	137	14.44	21.85
5	25.8013	34.24	69.54	-35.30	1.00	2	12.19	22.05
6	28.8004	35.49	69.54	-34.05	1.00	225	13.33	22.16

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

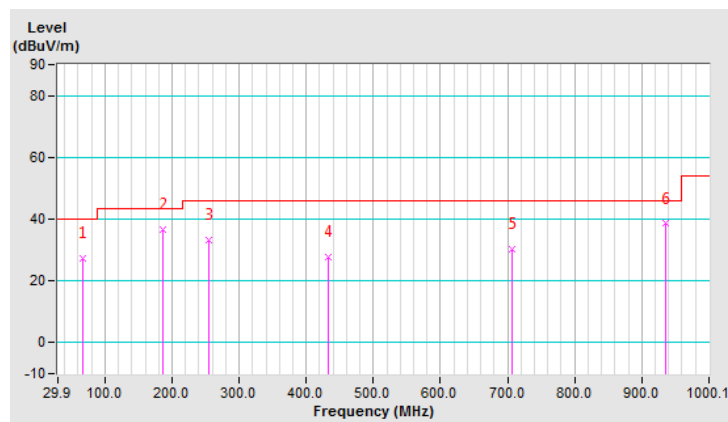
Below 1GHz Data:

Channel	TX Channel 1	Detector Function	Quasi-Peak
Frequency Range	30 MHz ~ 1GHz		
Test Mode	A		

Antenna Polarity & Test Distance: Horizontal At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	66.77	27.20 QP	40.00	-12.80	1.01 H	339	37.80	-10.60
2	187.07	36.70 QP	43.50	-6.80	1.01 H	273	47.60	-10.90
3	254.99	33.30 QP	46.00	-12.70	1.01 H	247	42.60	-9.30
4	433.50	27.60 QP	46.00	-18.40	1.50 H	234	33.50	-5.90
5	707.10	30.40 QP	46.00	-15.60	1.01 H	133	30.80	-0.40
6	936.07	38.50 QP	46.00	-7.50	1.01 H	29	34.50	4.00

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

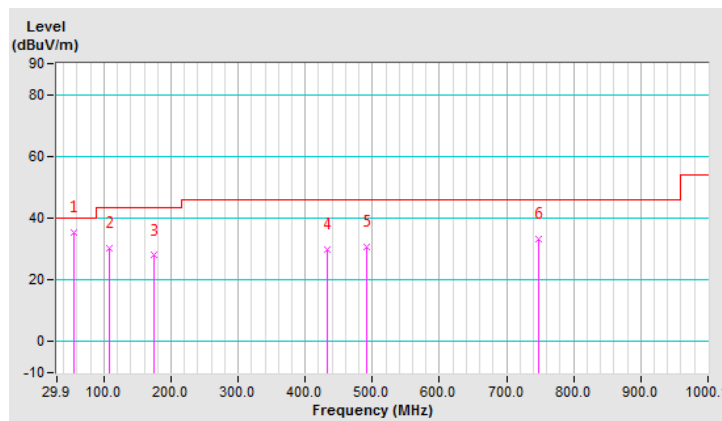


Channel	TX Channel 1	Detector Function	Quasi-Peak
Frequency Range	30 MHz ~ 1GHz		
Test Mode	A		

Antenna Polarity & Test Distance: Vertical At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	55.13	35.20 QP	40.00	-4.80	1.00 V	317	44.40	-9.20
2	107.52	30.40 QP	43.50	-13.10	1.49 V	44	42.60	-12.20
3	175.43	27.90 QP	43.50	-15.60	1.00 V	91	37.60	-9.70
4	433.50	29.70 QP	46.00	-16.30	1.00 V	291	35.60	-5.90
5	491.72	30.80 QP	46.00	-15.20	1.49 V	148	36.00	-5.20
6	747.85	33.40 QP	46.00	-12.60	1.00 V	171	32.50	0.90

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

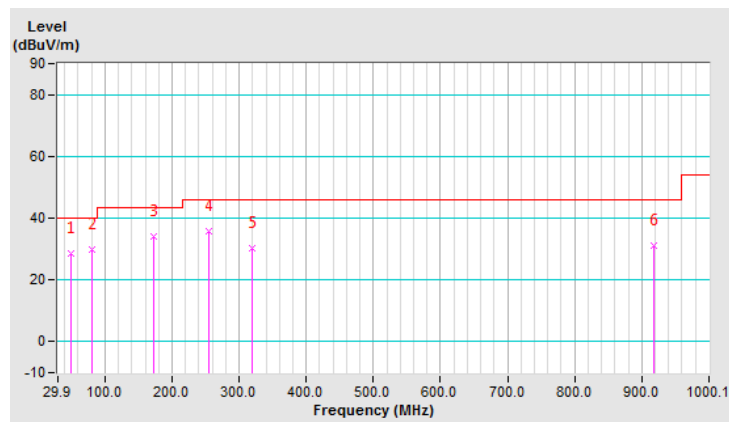


Channel	TX Channel 1	Detector Function	Quasi-Peak
Frequency Range	30 MHz ~ 1GHz		
Test Mode	B		

Antenna Polarity & Test Distance: Horizontal At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	49.30	28.40 QP	40.00	-11.60	1.00 H	312	37.30	-8.90
2	80.35	30.00 QP	40.00	-10.00	1.49 H	272	43.50	-13.50
3	173.49	34.20 QP	43.50	-9.30	1.49 H	267	43.80	-9.60
4	254.99	35.60 QP	46.00	-10.40	1.00 H	275	44.90	-9.30
5	319.02	30.10 QP	46.00	-15.90	1.00 H	6	37.60	-7.50
6	918.60	31.10 QP	46.00	-14.90	1.00 H	132	27.30	3.80

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

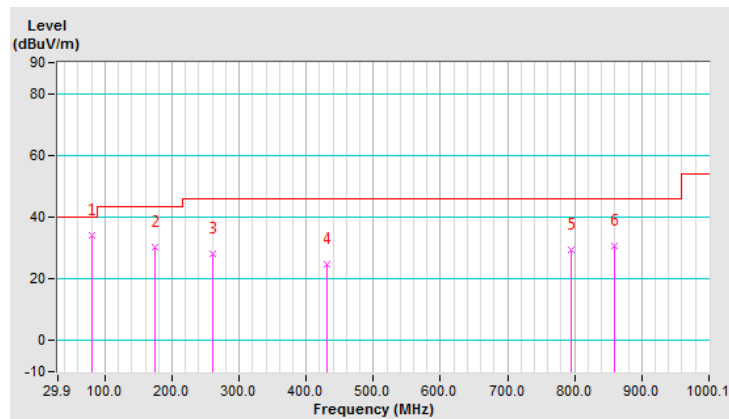


Channel	TX Channel 1	Detector Function	Quasi-Peak
Frequency Range	30 MHz ~ 1GHz		
Test Mode	B		

Antenna Polarity & Test Distance: Vertical At 3m								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	80.35	34.00 QP	40.00	-6.00	1.51 V	188	47.50	-13.50
2	175.43	30.40 QP	43.50	-13.10	1.01 V	240	40.10	-9.70
3	260.81	28.10 QP	46.00	-17.90	1.01 V	329	37.30	-9.20
4	431.56	24.80 QP	46.00	-21.20	2.00 V	153	30.80	-6.00
5	794.42	29.20 QP	46.00	-16.80	1.01 V	61	27.60	1.60
6	858.45	30.60 QP	46.00	-15.40	1.01 V	305	28.00	2.60

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS 30	100288	Jan. 03, 2019	Jan. 02, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2018	Sep. 04, 2019
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 21, 2019	Feb. 20, 2020
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 19, 2018	Aug. 18, 2019
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-12040.

4. Test date: Feb. 23, 2019

4.2.3 Test Procedures

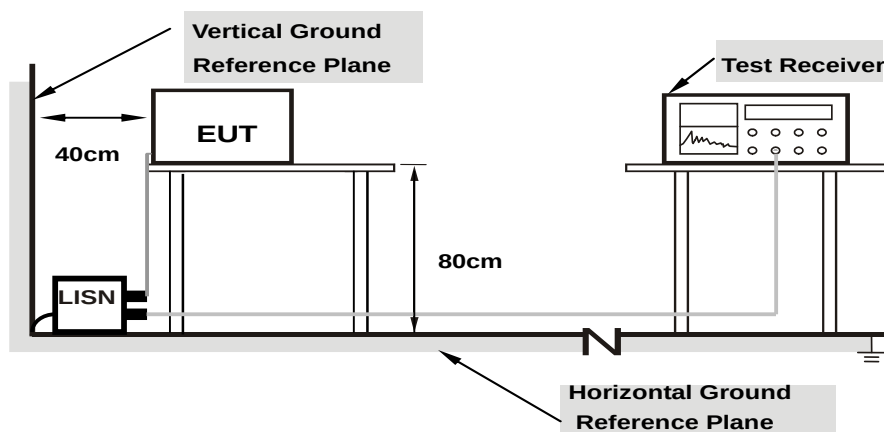
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

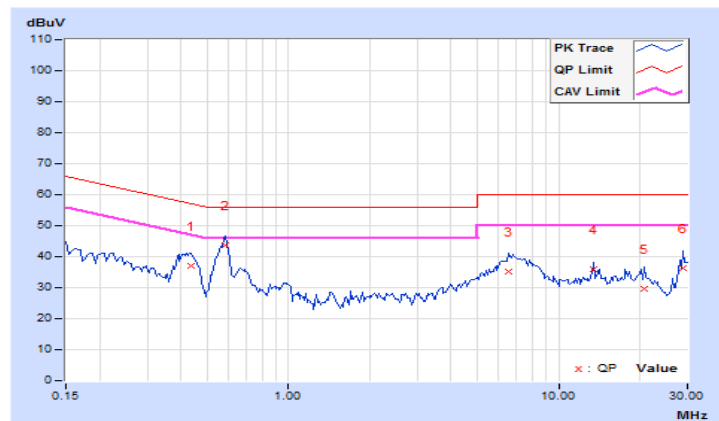
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.43516	10.18	27.03	15.43	37.21	25.61	57.15	47.15	-19.94	-21.54
2	0.58750	10.19	33.51	25.88	43.70	36.07	56.00	46.00	-12.30	-9.93
3	6.50000	12.22	22.95	13.05	35.17	25.27	60.00	50.00	-24.83	-24.73
4	13.41797	15.01	20.80	15.21	35.81	30.22	60.00	50.00	-24.19	-19.78
5	20.87109	16.51	12.99	5.96	29.50	22.47	60.00	50.00	-30.50	-27.53
6	28.86719	16.64	19.68	11.80	36.32	28.44	60.00	50.00	-23.68	-21.56

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

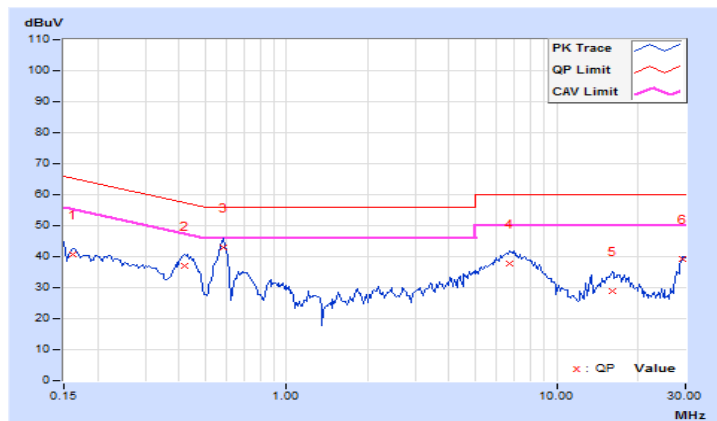


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	10.22	30.43	20.77	40.65	30.99	65.38	55.38	-24.73	-24.39
2	0.41953	10.19	26.91	13.95	37.10	24.14	57.46	47.46	-20.36	-23.32
3	0.58359	10.19	32.65	21.73	42.84	31.92	56.00	46.00	-13.16	-14.08
4	6.69141	11.98	25.73	12.47	37.71	24.45	60.00	50.00	-22.29	-25.55
5	16.08594	14.60	14.13	4.24	28.73	18.84	60.00	50.00	-31.27	-31.16
6	29.23828	16.18	23.20	17.68	39.38	33.86	60.00	50.00	-20.62	-16.14

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

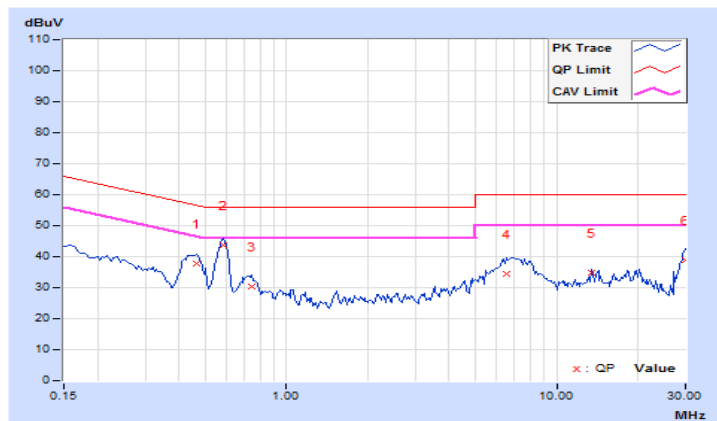


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.46250	10.18	27.49	16.90	37.67	27.08	56.65	46.65	-18.98	-19.57
2	0.58359	10.19	33.52	25.09	43.71	35.28	56.00	46.00	-12.29	-10.72
3	0.73984	10.20	20.10	10.11	30.30	20.31	56.00	46.00	-25.70	-25.69
4	6.51953	12.23	22.39	12.61	34.62	24.84	60.00	50.00	-25.38	-25.16
5	13.41797	15.01	19.87	15.15	34.88	30.16	60.00	50.00	-25.12	-19.84
6	29.90625	16.57	22.18	16.94	38.75	33.51	60.00	50.00	-21.25	-16.49

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

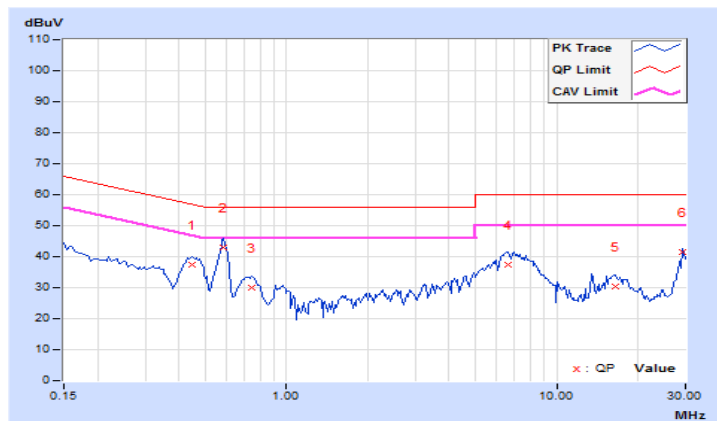


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.44688	10.19	27.05	14.47	37.24	24.66	56.93	46.93	-19.69	-22.27
2	0.58750	10.19	32.93	21.85	43.12	32.04	56.00	46.00	-12.88	-13.96
3	0.74375	10.20	19.70	7.28	29.90	17.48	56.00	46.00	-26.10	-28.52
4	6.60547	11.95	25.41	12.22	37.36	24.17	60.00	50.00	-22.64	-25.83
5	16.47266	14.61	15.74	9.09	30.35	23.70	60.00	50.00	-29.65	-26.30
6	29.23438	16.18	25.35	21.06	41.53	37.24	60.00	50.00	-18.47	-12.76

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



4.3 Bandwidth Measurement

4.3.1 Test Procedures

The EUT configuration shown in Section 5.1 was located in a semi-anechoic chamber. A receive loop antenna was located 3 meters from the EUT and connected directly to the input of the spectrum analyzer via a coaxial cable.

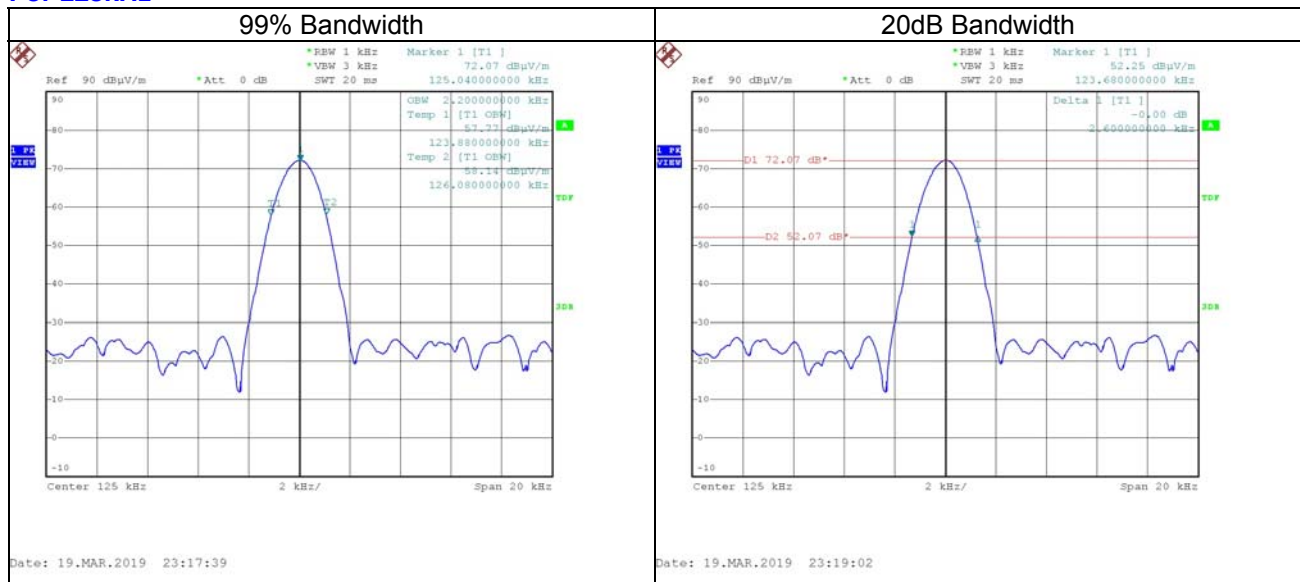
For measuring the 99% bandwidth, the resolution and video bandwidths of the analyzer were set to 300 Hz and 1 kHz, respectively. The frequency span was set to 50 kHz so that the entire channel of operation could be displayed on the spectrum analyzer. The integrated bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth of the transmitted signal.

For measuring the 20 dB bandwidth, the resolution and video bandwidths of the analyzer were set to 1 kHz and 3 kHz, respectively. The frequency span was set to 50 kHz so that the entire channel of operation could be displayed on the spectrum analyzer. Markers were then used to measure the upper and lower frequencies where the amplitude was 20 dB below the point of maximum amplitude. The difference in the frequencies of these two markers is the 20 dB bandwidth.

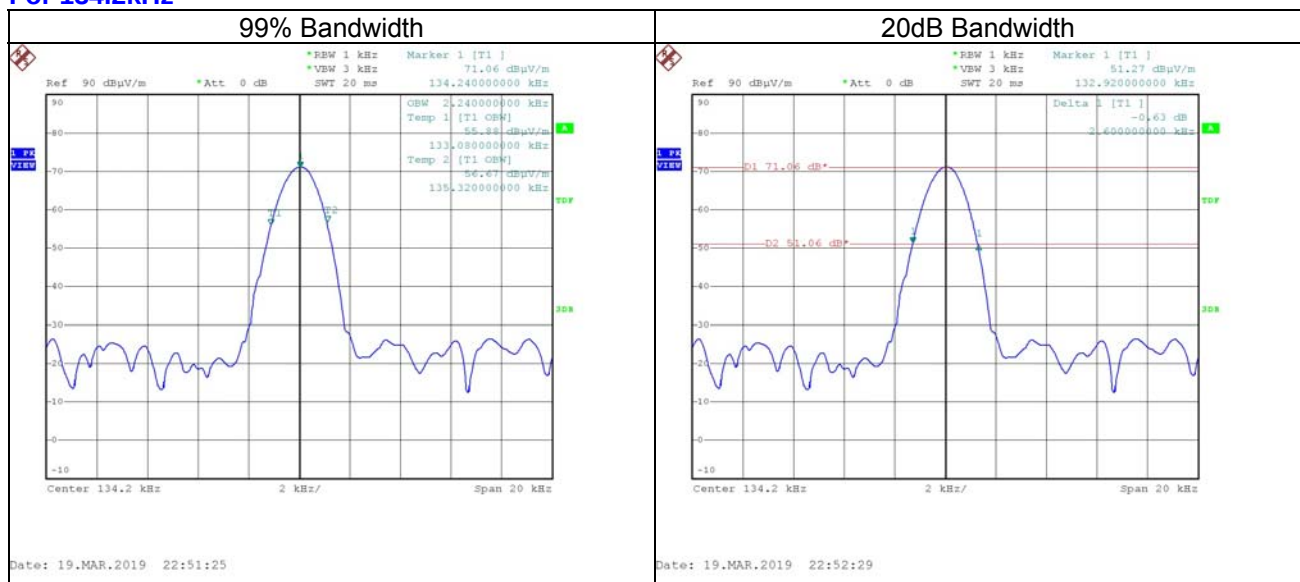
4.3.2 Test Results

Frequency	99% Bandwidth (kHz)	20dB Bandwidth (kHz)
125kHz	2.20	2.60
134.2kHz	2.24	2.60

For 125kHz



For 134.2kHz



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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