



Test report No. : 4789106212-US-R0-V0
Page : 1 of 29
Issued date : Jan. 9, 2020
FCC ID : 2ADEZ836MCSM

RADIO TEST REPORT

Product : MultiDrop Combi Smart 2
Model Name : 836
FCC ID : 2ADEZ836MCSM
Test Regulation : FCC 47 CFR Part 15 Subpart C (Section 15.209)
Received Date : Oct. 28, 2019
Test Date : Nov. 4, 2019 ~ Jan 9, 2020
Issued Date : Jan. 9, 2020

Applicant : Life Technologies Holdings Pte Ltd
Blk 33, Marsiling Industrial Estate Road 3, #07-06 Singapore
739256

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



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Doc No: 17-EM-F0972 / 1.0



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1. Attestation of Test Results

APPLICANT: Life Technologies Holdings Pte Ltd
 Blk 33, Marsiling Industrial Estate Road 3, #07-06 Singapore
 739256

MANUFACTURER Life Technologies Holdings Pte Ltd
 Blk 33, Marsiling Industrial Estate Road 3, #07-06 Singapore
 739256

EUT DESCRIPTION: MultiDrop Combi Smart 2

BRAND: thermoscientific

MODEL: 836

SAMPLE STAGE: DVT

DATE of TESTED: Nov. 4, 2019 ~ Jan 9, 2020

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.209)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Cindy Hsin
 Project Handler

Date : Jan. 9, 2020

Approved and Authorized By:

Stanley Wu
 Senior Project Engineer

Date : Jan. 9, 2020

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2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.209	Radiated Emissions	PASS
15.207	AC Power Conducted Emission	PASS
2.1049	20dB Bandwidth	N/A (See Note1)
15.203	Antenna Requirement	PASS

Note :

1. After measuring RFID and confirmed with the client, the fundamental frequency (250kHz) signal was lower than the spectrum analyzer's background noise signal.

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3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398

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5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.7
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	2.2
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.3

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6. Equipment under Test

6.1. Description of EUT

Product	MultiDrop Combi Smart 2
Brand Name	thermoscientific
Model Name	836
Product Serial No.	836-80042SM
Operating Frequency	250 kHz
Normal Voltage	100~240Vac , 50/60Hz
Hardware Version	RFID module model number: IR6070B
Software Version	2.01.4

Note:

1. The EUT contains following accessory devices

Product	Brand	Model	Description
RS232 Cable	N/A	N/A	1.8 meter, Unshielded cable, 1 ferrite core

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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6.2. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Radiated Spurious Emission	966-2	22~24°C / 60~68%RH	120Vac / 60 Hz	Nov. 4, 2019 ~ Jan. 9, 2020	Will Chen
AC power Line Conducted Emission	SR1	23~24°C / 60~63%RH	120Vac / 60 Hz	Nov. 12, 2019	Will Chen

FCC Test Firm Registration Number: 498077

6.3. Description Of Available Antennas

Brand Name	Model Name	Antenna Type	Antenna Gain(dBi)
N/A	N/A	Inductive loop	N/A

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

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6.4. Test Mode Applicability and Tested Channel Detail

Test item	Operating Mode	Power Mode
Radiated Emissions	Transmission Mode	AC Power
AC Power Line Conducted Emission	Transmission Mode	AC Power

Note:

1. The product does not need to verify three orthogonal axes X / Y / Z.
2. For 9 kHz to 30 MHz, the loop antenna is studied in three polarization parallel / perpendicular / ground-parallel directions, and polarization parallel has been determined to be the worst case of pre-scan radiation.
3. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 300 m open area test site. 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 D01.

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7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	Nov. 8, 2018	1 year
				Nov. 13, 2019	1 year
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	Nov. 8, 2018	1 year
				Dec. 17, 2019	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 11, 2018	1 year
				Dec. 19, 2019	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	Jan. 14, 2019	1 year
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	Jan. 30, 2019	1 year
RF Cable (9 KHz~18 GHz)	UltraPhase & EMC Instrument	A1K50-UP0358-A1K50-1500&EMC106-NM-SM-2500/7000	170111-4&170219/170102	Jan. 29, 2019	1 year
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 14, 2018	1 year
V-LISN	SCHWARZBECK	NSLK 8127	8127-946	Oct. 17, 2019	1 year
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	Aug. 6, 2019	1 year
Cables	HARBOUR INDUSTRIES	LL142	170205-5000-1	Jan. 29, 2019	1 year

UL Software		
Description	Name	Version
Radiated measurement	EZ_EMCC	1.1.4.2
AC power Line Conducted Emission	EZ_EMCC	1.1.4.2

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8. Description of Test Setup

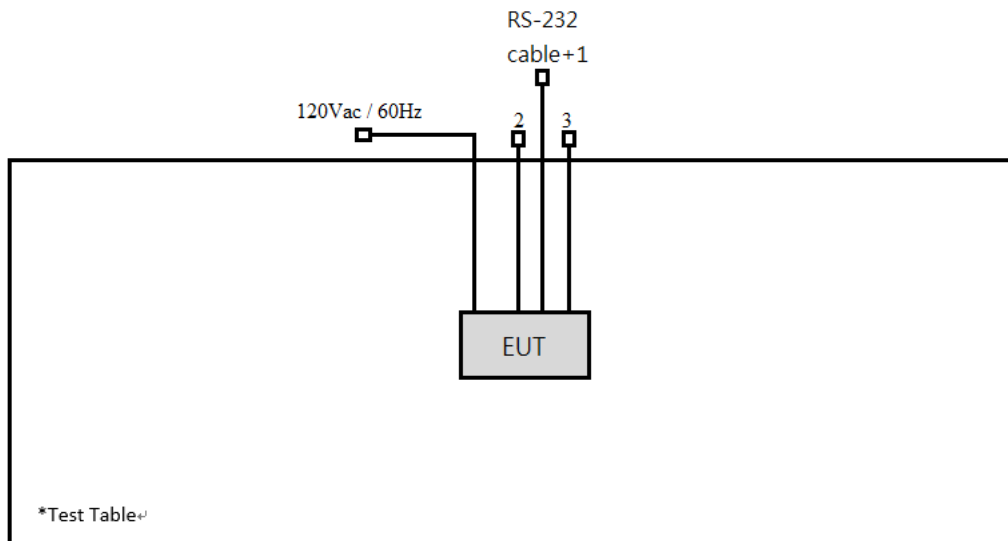
Support Equipment

Item	Equipment	Brand Name	Model Name	Remark
1	Cable	N/A	N/A	RS232 to USB type-A
2	Cable	N/A	N/A	USB type-B to USB type-A
3	Cable	N/A	N/A	RS232 15pin to RS232 9pin

Test Setup

Controlled using a bespoke application (HWDoctor version 3.6.15) on a test Notebook.
The application was used to enable a continuous transmission mode.

Setup Diagram for Test



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9. Test Results

9.1. Radiated Spurious Emission

Requirements

According to FCC Clause 15.209 (a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

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Test Procedures

[For 9 kHz ~ 30 MHz]

- 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. For measurement below 30MHz, 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 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.

NOTE:

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

[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 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. 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 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.

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. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported.

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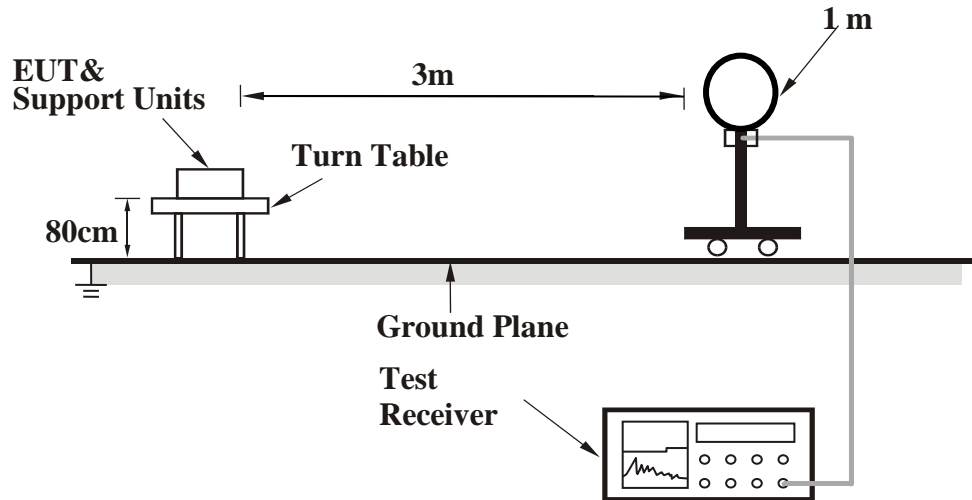
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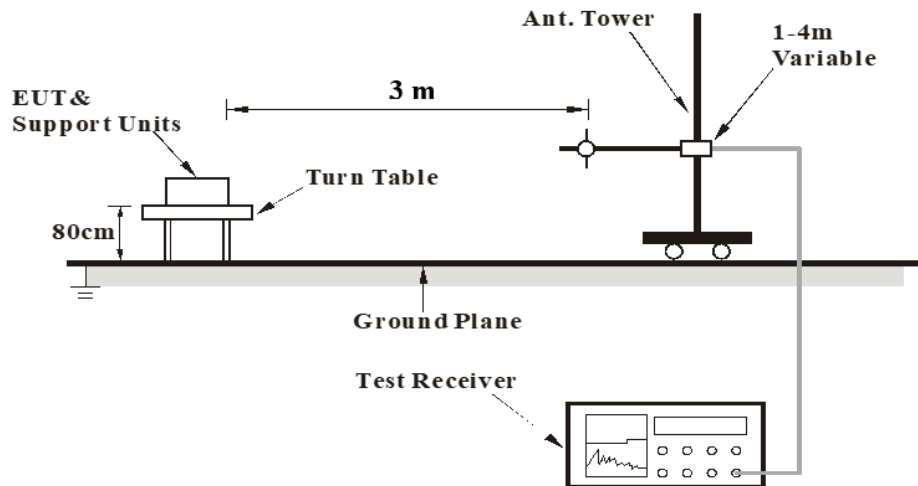
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Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



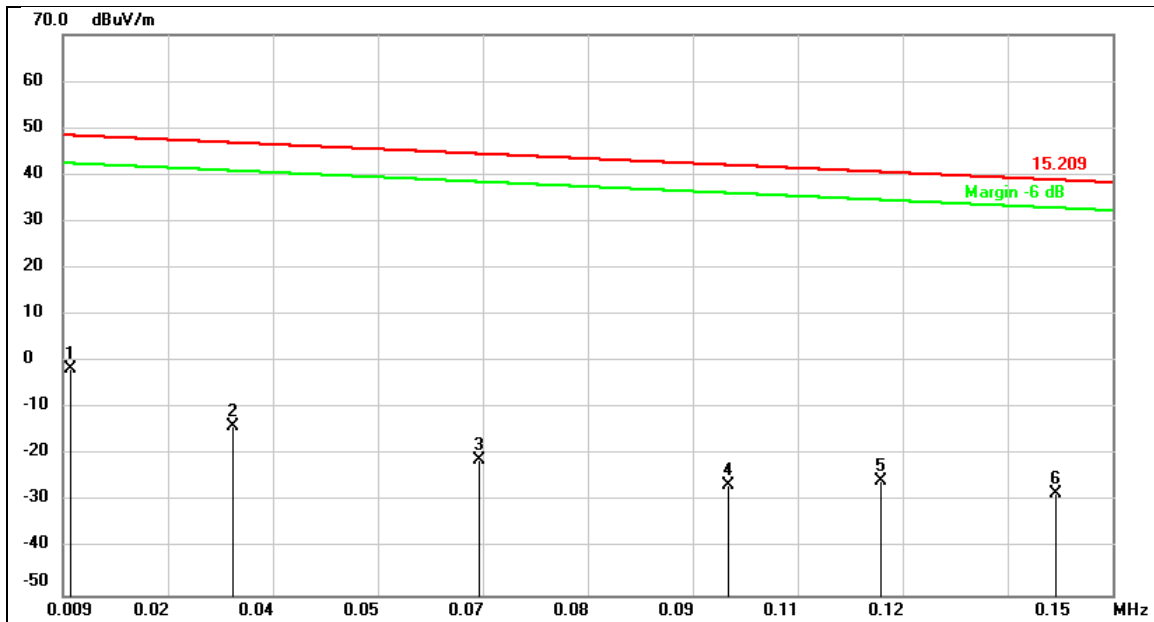
For the actual test configuration, please refer to the Setup Configurations.



Test Data

9 kHz ~ 30 MHz Data

EUT Test Condition		Measurement Detail	
Frequency Range	9 kHz ~ 0.15 MHz	Antenna Polarity	Polarization parallel



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Notation	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
-	0.0098	58.82	-60.34	-1.52	48.45	-49.97	peak
-	0.0317	51.92	-65.73	-13.81	46.87	-60.68	peak
-	0.0649	46.26	-67.34	-21.08	44.47	-65.55	peak
-	0.0984	41.45	-67.83	-26.38	42.06	-68.44	peak
-	0.1185	42.49	-67.99	-25.50	40.60	-66.10	peak
-	0.1423	39.60	-67.85	-28.25	38.89	-67.14	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB)
+ Convert Distance Factor (dB)
4. In 0.009MHz – 0.49MHz frequency domain, measurement distance shows 300 meters,
Convert Distance Factor (dB) = $40 \log (3/300) = -80 \text{ dB}$.
5. In 0.49MHz – 30MHz frequency, measurement distance shows 30 meters,
Convert Distance Factor (dB) = $40 \log (3/30) = -40 \text{ dB}$.
6. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
7. After testing RSE during RFID two states (on and off) and compared both the test results, there were no emissions caused by RFID enabled.

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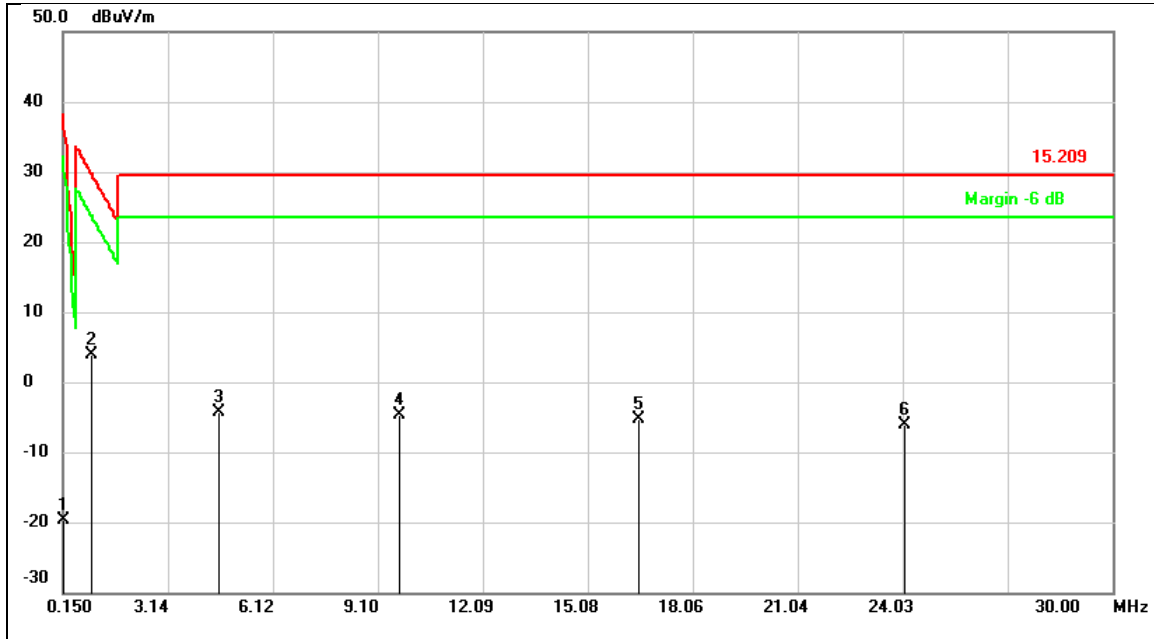
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EUT Test Condition		Measurement Detail	
Frequency Range	0.15 MHz ~ 30 MHz	Antenna Polarity	Polarization parallel



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Notation	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
-	0.1649	48.15	-67.88	-19.73	37.26	-56.99	peak
-	0.9390	32.03	-28.04	3.99	29.80	-25.81	peak
-	4.5966	24.07	-28.44	-4.37	29.54	-33.91	peak
-	9.6840	23.73	-28.37	-4.64	29.54	-34.18	peak
-	16.5237	23.31	-28.58	-5.27	29.54	-34.81	peak
-	24.0648	23.40	-29.42	-6.02	29.54	-35.56	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB)
+ Convert Distance Factor (dB)
4. In 0.009MHz – 0.49MHz frequency domain, measurement distance shows 300 meters,
Convert Distance Factor (dB) = $40 \log (3/300) = -80 \text{ dB}$.
5. In 0.49MHz – 30MHz frequency domain, measurement distance shows 30 meters,
Convert Distance Factor (dB) = $40 \log (3/30) = -40 \text{ dB}$.
6. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
7. After testing RSE during RFID two states (on and off) and compared both the test results, there were no emissions caused by RFID enabled.

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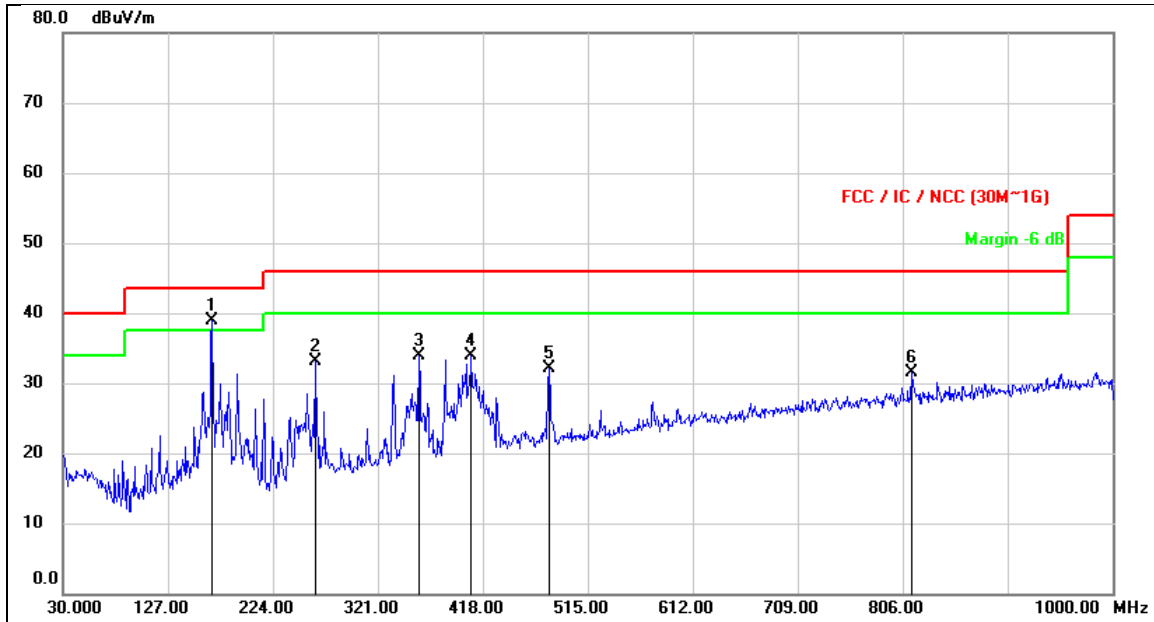
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30 MHz ~ 1 GHz Data

EUT Test Condition		Measurement Detail	
Frequency Range	30MHz ~ 1 GHz	Antenna Polarity	Horizontal



Notation	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
-	167.8047	53.94	-15.05	38.89	43.50	-4.61	peak
-	263.6407	48.46	-15.39	33.07	46.00	-12.93	peak
-	359.6383	46.65	-12.72	33.93	46.00	-12.07	peak
-	407.4270	45.21	-11.30	33.91	46.00	-12.09	peak
-	479.4010	41.82	-9.74	32.08	46.00	-13.92	peak
-	814.5683	35.28	-3.72	31.56	46.00	-14.44	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. After testing RSE during RFID two states (on and off) and compared both the test results, there were no emissions caused by RFID enabled.

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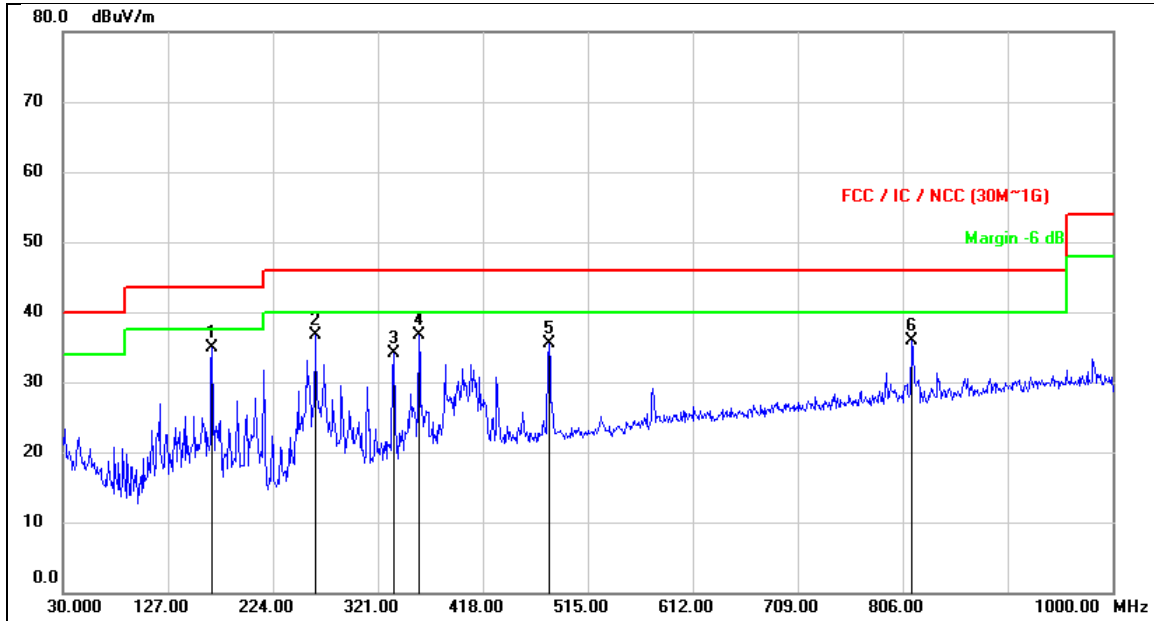
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EUT Test Condition		Measurement Detail	
Frequency Range	30MHz ~ 1 GHz	Antenna Polarity	Vertical



Notation	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
-	167.8047	49.99	-15.05	34.94	43.50	-8.56	peak
-	263.6083	52.15	-15.40	36.75	46.00	-9.25	peak
-	335.6147	47.19	-13.14	34.05	46.00	-11.95	peak
-	359.5736	49.35	-12.72	36.63	46.00	-9.37	peak
-	479.4657	45.28	-9.74	35.54	46.00	-10.46	peak
-	814.9887	39.58	-3.72	35.86	46.00	-10.14	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. After testing RSE during RFID two states (on and off) and compared both the test results, there were no emissions caused by RFID enabled.

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9.2. AC Power Line Conducted Emission

Requirements

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	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.

Test Procedures

- a. 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.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE:

1. 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.

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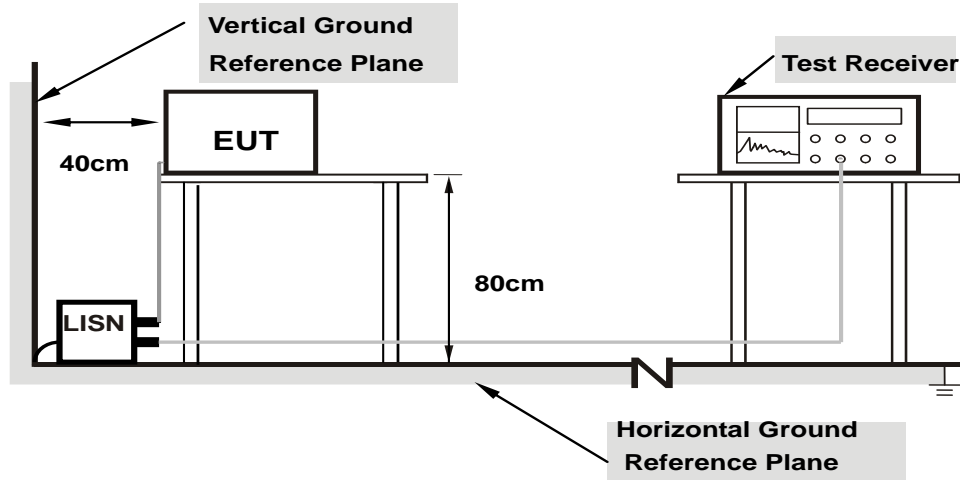
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Test Setup



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

For the actual test configuration, please refer to the Setup Configurations.

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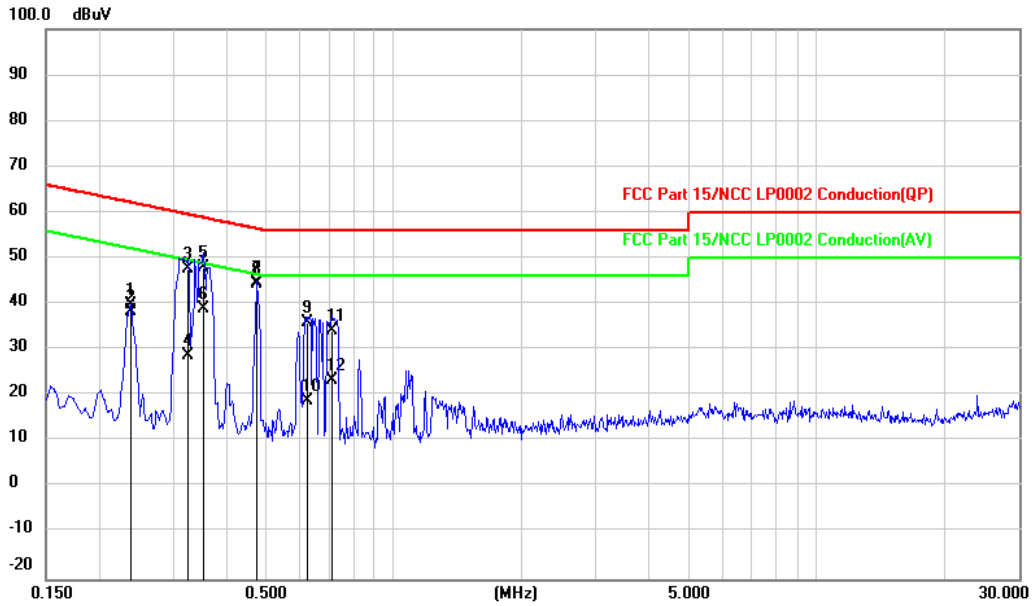
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Test Data

EUT Test Condition		Measurement Detail	
Mode	Transmission Mode	Frequency Range	150 kHz ~ 30 MHz

Phase of Power : Line (L)



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No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2380	29.66	10.07	39.73	62.17	-22.44	QP
2	0.2380	28.43	10.07	38.50	52.17	-13.67	AVG
3	0.3260	37.60	10.07	47.67	59.55	-11.88	QP
4	0.3260	18.62	10.07	28.69	49.55	-20.86	AVG
5	0.3540	37.94	10.07	48.01	58.87	-10.86	QP
6	0.3540	28.92	10.07	38.99	48.87	-9.88	AVG
7	0.4743	34.71	10.07	44.78	56.44	-11.66	QP
8	0.4743	34.31	10.07	44.38	46.44	-2.06	AVG
9	0.6220	25.75	10.07	35.82	56.00	-20.18	QP
10	0.6220	8.75	10.07	18.82	46.00	-27.18	AVG
11	0.7140	24.12	10.08	34.20	56.00	-21.80	QP
12	0.7140	13.42	10.08	23.50	46.00	-22.50	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV).
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB).
4. After measuring RFID and confirmed with the client, the fundamental frequency(250kHz) signal was lower than the spectrum analyzer's background noise signal.
5. The other emission levels were very low against the limit.

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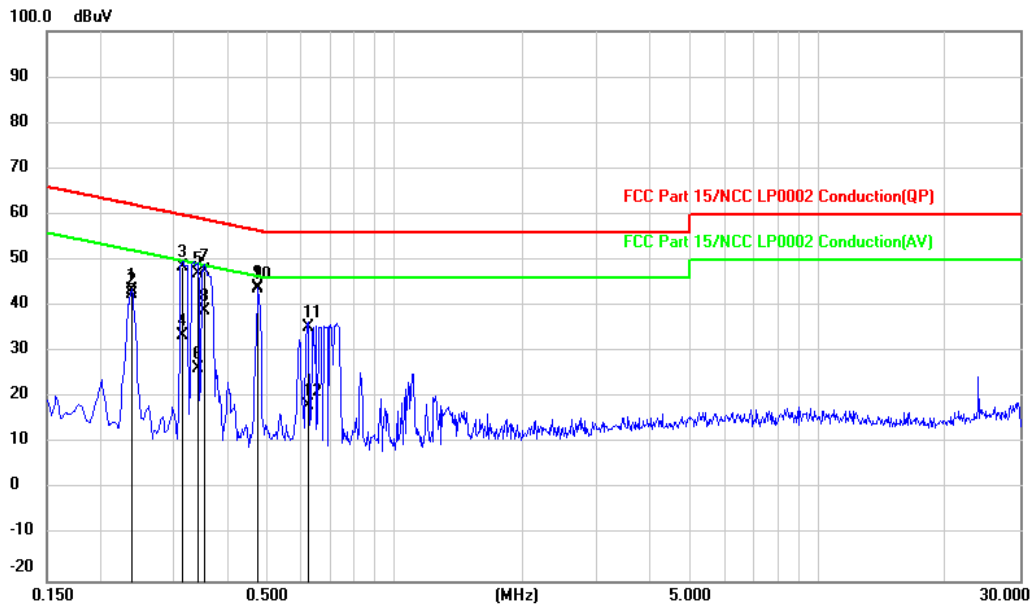
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Phase of Power : Neutral (N)



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No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2380	33.30	10.06	43.36	62.17	-18.81	QP
2	0.2380	32.45	10.06	42.51	52.17	-9.66	AVG
3	0.3140	38.41	10.06	48.47	59.86	-11.39	QP
4	0.3140	23.36	10.06	33.42	49.86	-16.44	AVG
5	0.3420	36.91	10.06	46.97	59.15	-12.18	QP
6	0.3420	16.28	10.06	26.34	49.15	-22.81	AVG
7	0.3540	37.69	10.06	47.75	58.87	-11.12	QP
8	0.3540	28.87	10.06	38.93	48.87	-9.94	AVG
9	0.4749	34.04	10.06	44.10	56.43	-12.33	QP
10	0.4749	33.64	10.06	43.70	46.43	-2.73	AVG
11	0.6220	25.34	10.06	35.40	56.00	-20.60	QP
12	0.6220	8.13	10.06	18.19	46.00	-27.81	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV).
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB).
4. After measuring RFID and confirmed with the client, the fundamental frequency(250kHz) signal was lower than the spectrum analyzer's background noise signal.
5. The other emission levels were very low against the limit.

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9.3. 20dB Bandwidth

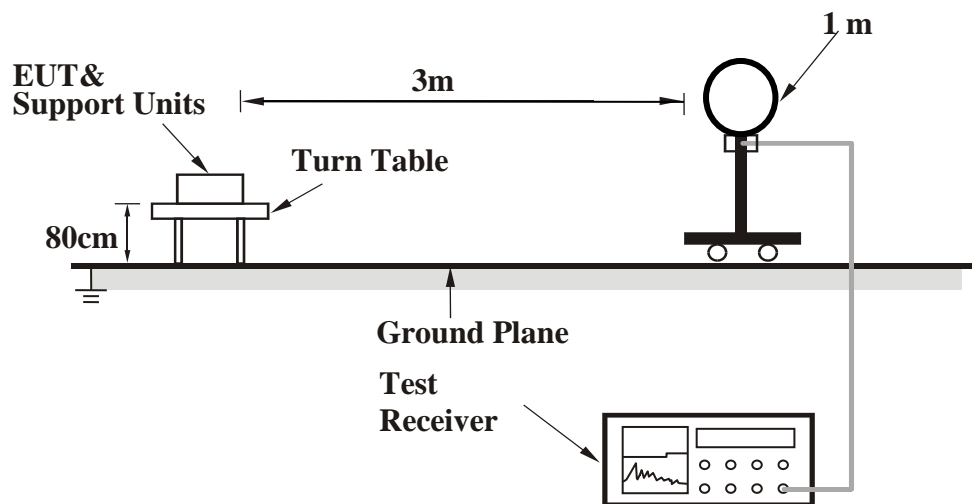
Requirements

The 20 dB bandwidth shall be specified in operating frequency band.

Test Procedures

- The testing follows the guidelines in ANSI C63.10-2013.
- 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 is 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.
- The EUT was placed on a turntable with 0.8m above ground.
- The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- The bandwidth of the fundamental frequency was measured by spectrum analyzer with 200Hz RBW and 620Hz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Setup



For the actual test configuration, please refer to the Setup Configurations.

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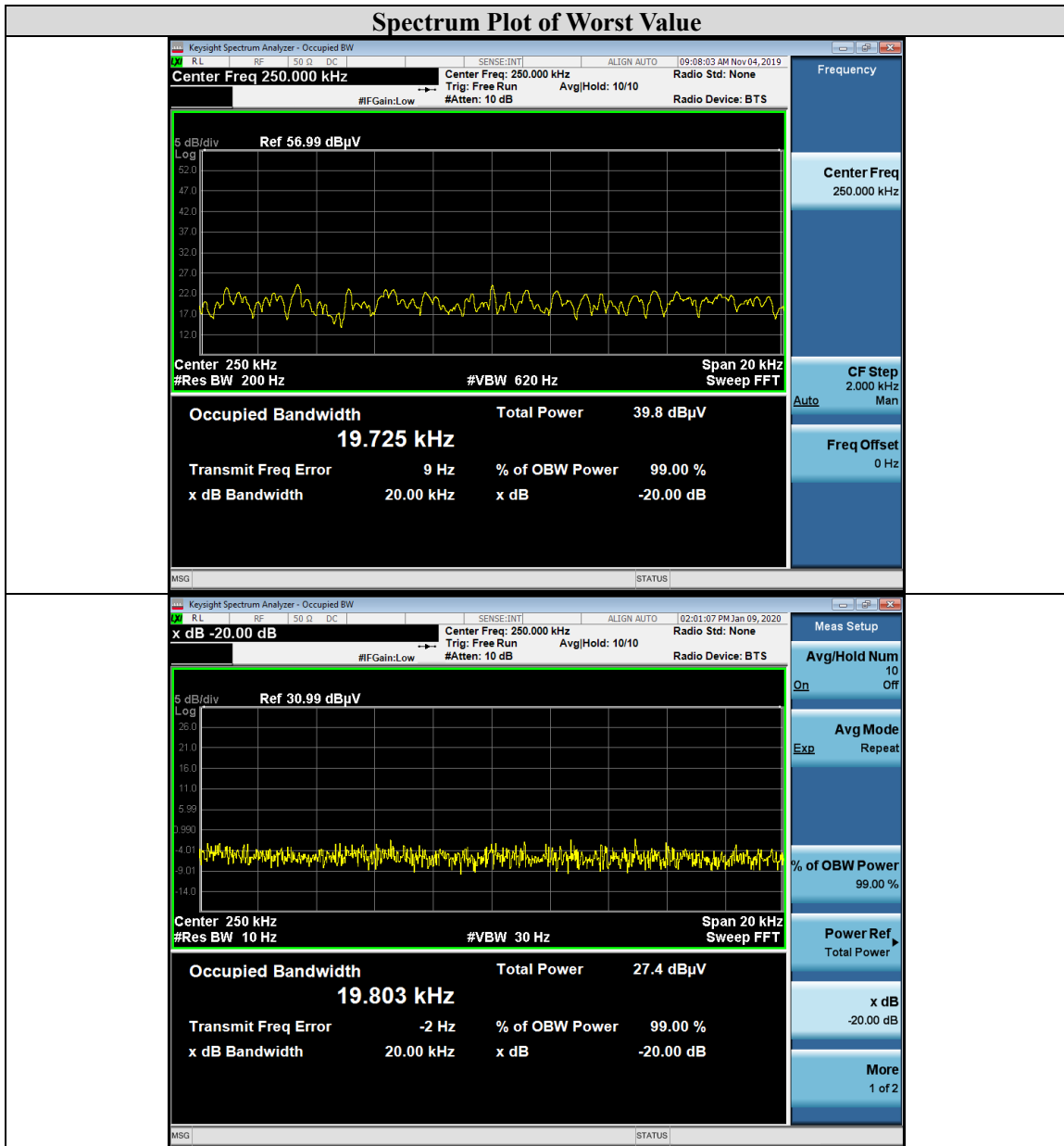
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Test Data

Frequency (kHz)	20dB Bandwidth (kHz)
250	See Note1



Note:

1. After measuring RFID (also verified decrease RBW setting to 10Hz and VBW setting to 30Hz) and confirmed with the client, the fundamental frequency (250kHz) signal was lower than the spectrum analyzer's background noise signal.

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