FCC RADIO TEST REPORT

FCC ID	:	**UZ7RFD90**
Equipment	:	**RFID Sled**
Brand Name	:	**ZEBRA**
Model Name	:	**RFD90**
Applicant	:	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Manufacturer	:	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Nov. 15, 2021 and testing was performed from Nov. 30, 2021 to Feb. 18, 2022. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR1N1506D	01	Initial issue of report	Feb. 25, 2022
FR1N1506D	02	1. Revise Product Feature and remark of 1.2 section 2. Revise Radiated Band Edges and Radiated Spurious Emission Remark	Mar. 02, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(1)	Number of Channels	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	Pass	-
3.4	2.1049	99% Occupied Bandwidth	Reporting only	-
3.5	15.247(b)(1)	Peak Output Power	Pass	-
3.6	15.247(d)	Conducted Band Edges	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	24.87 dB under the limit at 2781.750 MHz
3.9	15.207	AC Conducted Emission	Pass	14.56 dB under the limit at 0.152 MHz
3.10	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Wei Chen

Report Producer: Clio Lo

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	RFID Sled
Brand Name	ZEBRA
Model Name	RFD90
FCC ID	UZ7RFD90
Sample 1	long range with SE4850
Sample 2	standard range with SE4850
Sample 3	long range with SE4750
Sample 4	standard range with SE4750
EUT supports Radios application	UHF RFID
HW Version	EV1.5
SW Version	SAAFKS00-002-B18E0
MFD	25OCT21
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories				
Battery	**Brand Name**	ZEBRA	**Model Name**	BT-000380

Supported Unit used in test configuration and system				
AC Adapter	**Brand Name**	ZEBRA	**Part Number**	PWR-BGA12V50W0WW
USB Cable 1	**Brand Name**	ZEBRA	**Part Number**	CBL-TC7X-USB1-01
USB Cable 2	**Brand Name**	ZEBRA	**Part Number**	CBL-RFD49-USB1-01
Touch Computer	**Brand Name**	ZEBRA	**Model Name**	TC77HL
Touch Computer	**Brand Name**	ZEBRA	**Model Name**	TC26BK
Touch Computer	**Brand Name**	ZEBRA	**Model Name**	TC520L
Battery for TC77HL	**Brand Name**	ZEBRA	**Model Name**	BT-000318
Battery for TC26BK	**Brand Name**	ZEBRA	**Model Name**	BT-000409A
Battery for TC520L	**Brand Name**	ZEBRA	**Model Name**	BT-000314

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx/Rx Frequency Range	902.75 MHz ~ 927.25 MHz
Number of Channels	50
Maximum Output Power to Antenna	**<Long Range>:** 29.90 dBm (0.9772W) **<Standard Range>:** 29.92 dBm (0.9817W)
20dB Bandwidth	**<Standard Range>:** 0.088 MHz
99% Occupied Bandwidth	**<Standard Range>:** 0.080 MHz
Antenna Type / Gain	**<Long Range>:** Linear Antenna with gain 6.02 dBi **<Standard Range>:** Helix Antenna with gain -0.87 dBi
Type of Modulation	ASK

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.
2. dBi = dBic – 3.

1.3 Modification of EUT

No modifications made to the EUT during the testing.

1.4 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH02-HY, CO05-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH11-HY (TAF Code: 3786)
Remark	The Radiated Spurious Emissions test item subcontracted to Sporton International Inc. Wensan Laboratory.

FCC designation No.: TW1190 and TW3786

1.5 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
902.75-927.25 MHz	0	902.75	27	916.25
	1	903.25	28	916.75
	2	903.75	29	917.25
	3	904.25	30	917.75
	4	904.75	31	918.25
	5	905.25	32	918.75
	6	905.75	33	919.25
	7	906.25	34	919.75
	8	906.75	35	920.25
	9	907.25	36	920.75
	10	907.75	37	921.25
	11	908.25	38	921.75
	12	908.75	39	922.25
	13	909.25	40	922.75
	14	909.75	41	923.25
	15	910.25	42	923.75
	16	910.75	43	924.25
	17	911.25	44	924.75
	18	911.75	45	925.25
	19	912.25	46	925.75
	20	912.75	47	926.25
	21	913.25	48	926.75
	22	913.75	49	927.25
	23	914.25		
	24	914.75		
	25	915.25		
	26	915.75		

2.2 Test Mode

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find X plane as worst plane.

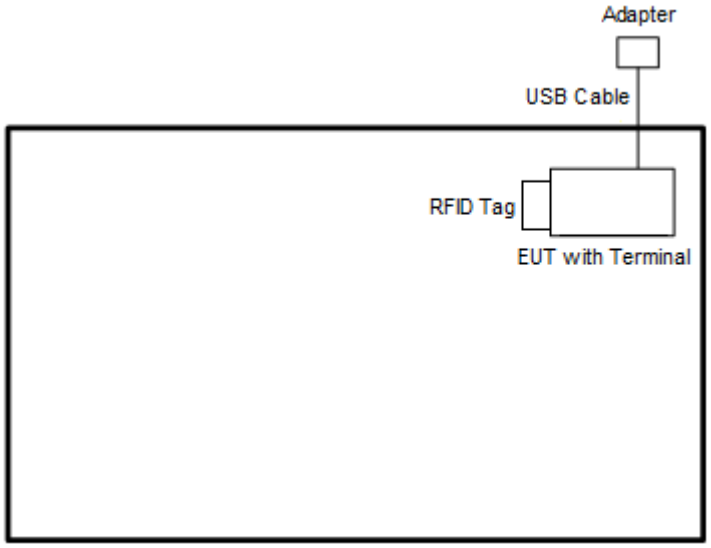
b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

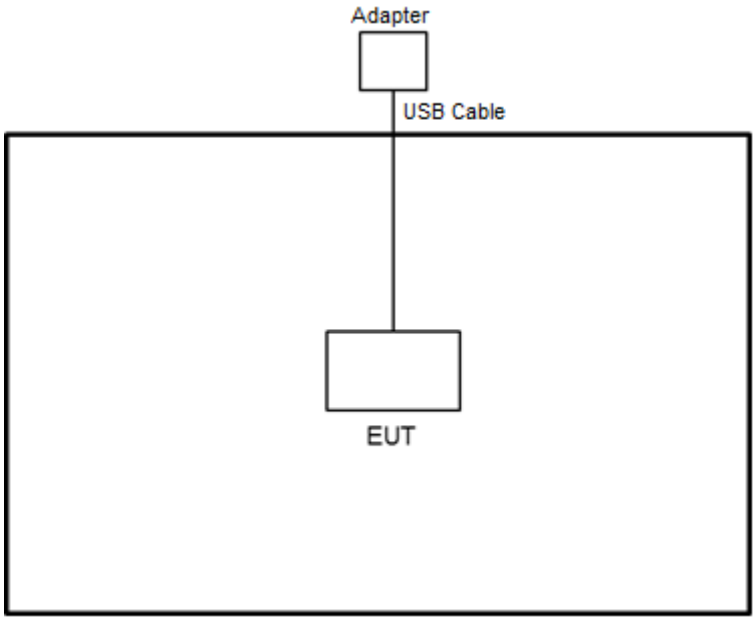
Summary table of Test Cases	
Test Item	**UHF RFID**
Conducted Test Cases	**<Long Range>** Mode 1: UHF RFID Tx CH00_902.75 MHz Mode 2: UHF RFID Tx CH24_914.75 MHz Mode 3: UHF RFID Tx CH49_927.25 MHz **<Standard Range>** Mode 1: UHF RFID Tx CH00_902.75 MHz Mode 2: UHF RFID Tx CH24_914.75 MHz Mode 3: UHF RFID Tx CH49_927.25 MHz
Radiated Test Cases	**<Long Range>** Mode 1: UHF RFID Tx CH00_902.75 MHz for Sample 3 Mode 2: UHF RFID Tx CH24_914.75 MHz for Sample 3 Mode 3: UHF RFID Tx CH49_927.25 MHz for Sample 3 **<Standard Range>** Mode 1: UHF RFID Tx CH00_920.75 MHz for Sample 2 Mode 2: UHF RFID Tx CH24_914.75 MHz for Sample 2 Mode 3: UHF RFID Tx CH49_927.25 MHz for Sample 2
AC Conducted Emission	Mode 1: EUT with Terminal PDA + RFID Link + USB Cable 2 (Charging from AC Adapter) + Scan Bar Code for Sample 3
Remark: 1. For Conducted Test Cases, the Long Range mode has no higher power than Standard Range mode, thus the Standard Range mode is chosen as main test configuration, and the Long Range mode is verified the power. 2. For Radiated Test Cases, the tests were performed with USB Cable 2.	

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<Radiated Spurious Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	RFID Tag	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “Version 4.89” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.
Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 902.75-927.25 MHz band shall use at least 25 channels.

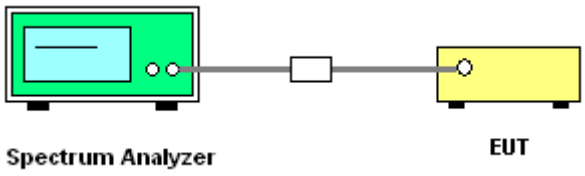
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300 kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup

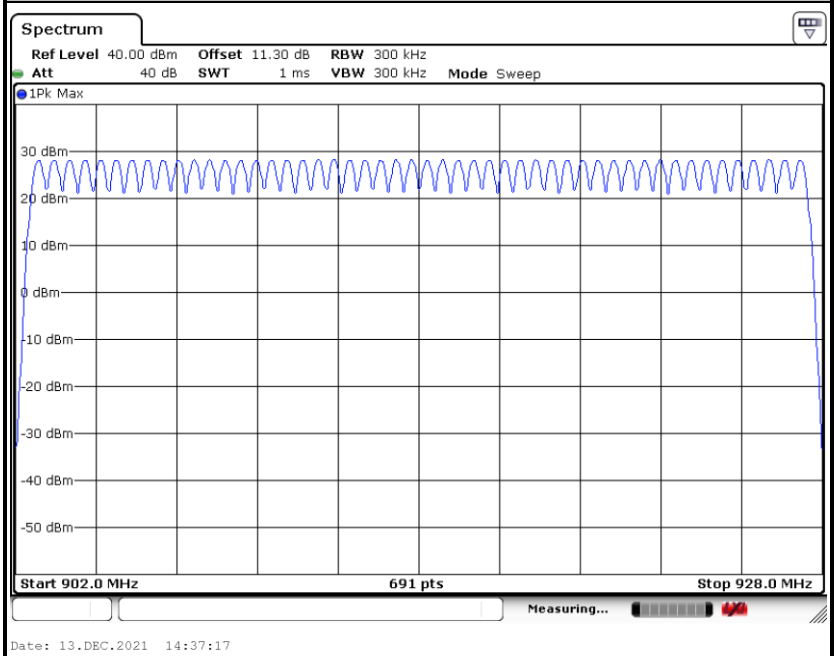


3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
50	> 25	Pass

Number of Hopping Channel Plot on Channel 00 - 49



3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 902.75-927.25 MHz band may have hopping channel carrier frequencies that are 20 dB bandwidth of the hopping channel, whichever is greater.

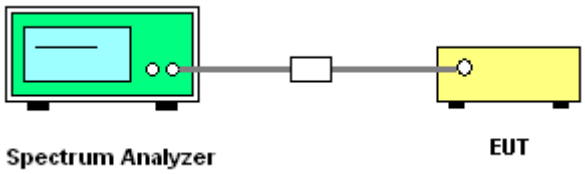
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300 kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup

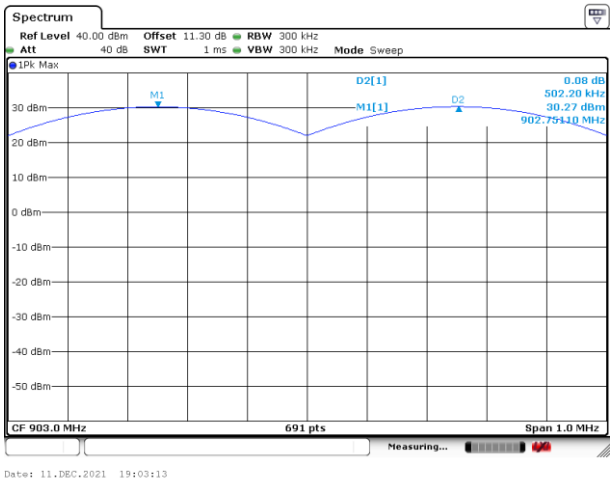


3.2.5 Test Result of Hopping Channel Separation

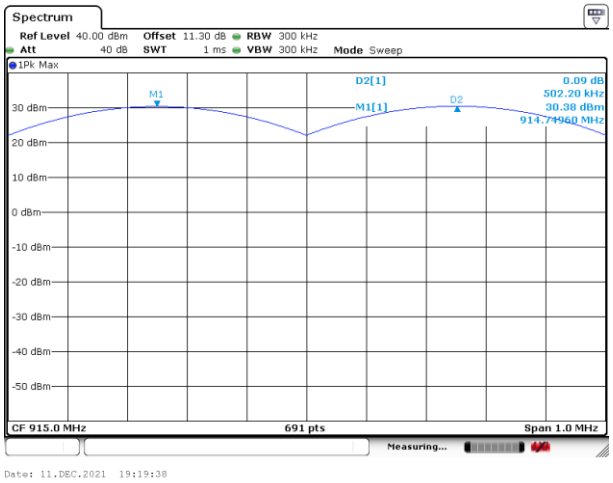
Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Mod.	NTX	CH.	Freq. (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
UHF RFID	1	0	902.75	0.502	0.0883	Pass
UHF RFID	1	24	914.75	0.502	0.0883	Pass
UHF RFID	1	49	927.25	0.502	0.0883	Pass

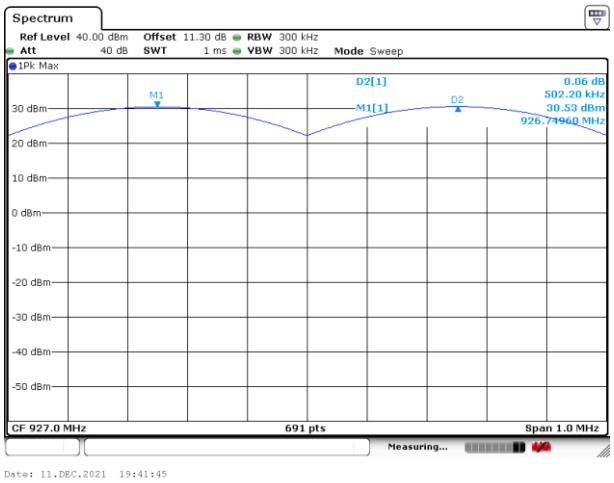
Channel Separation Plot on Channel 00 - 01



Channel Separation Plot on Channel 24 - 25



Channel Separation Plot on Channel 48 - 49



NA

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds multiplied by the number of hopping channels employed.

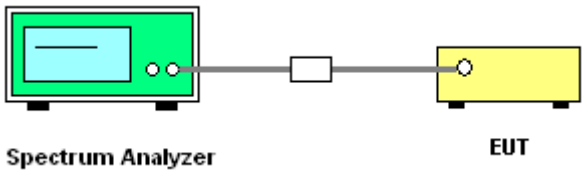
3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup

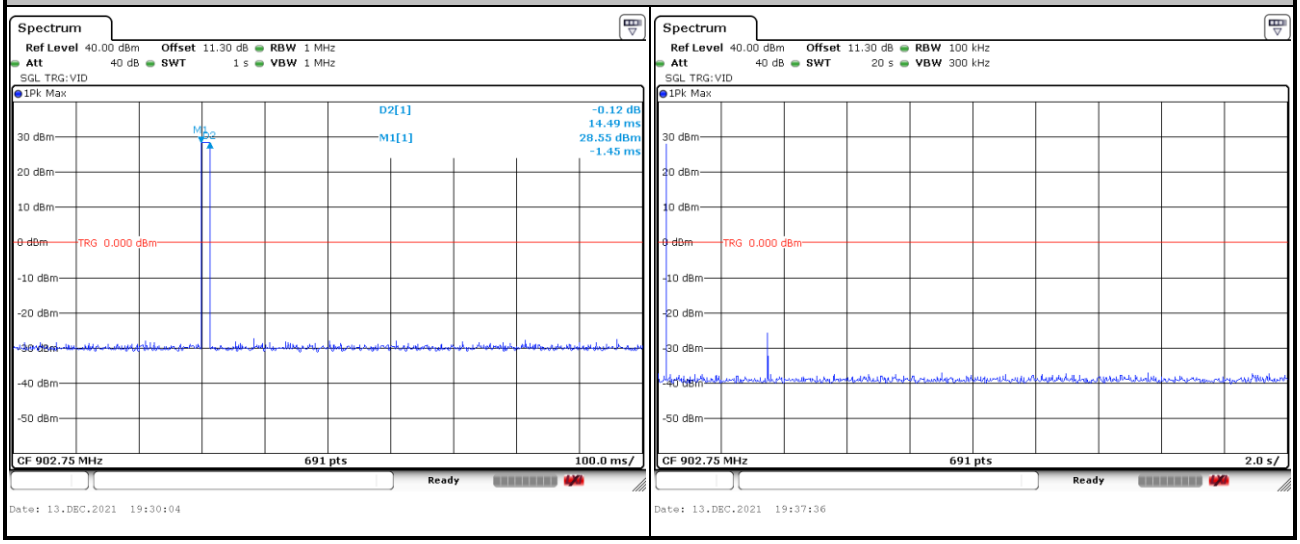


3.3.5 Test Result of Dwell Time

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Mod.	Channel Number Rate	Package Transfer Time (msec)	Hops Over Occupancy Time (hops)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Normal	50	14.49	1.00	0.014	0.4	Pass

Package Transfer Time Plot



Remark: Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Use the following spectrum analyzer settings for 20 dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1-5% of the 99% bandwidth; VBW ≥ 3 * RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

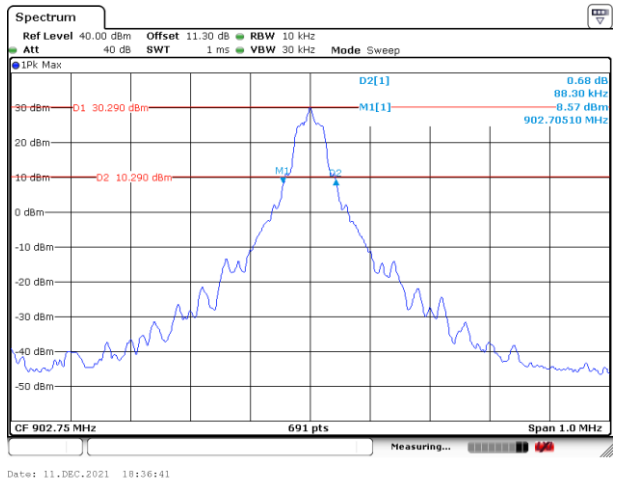
3.4.4 Test Setup

3.4.5 Test Result of 20dB Bandwidth

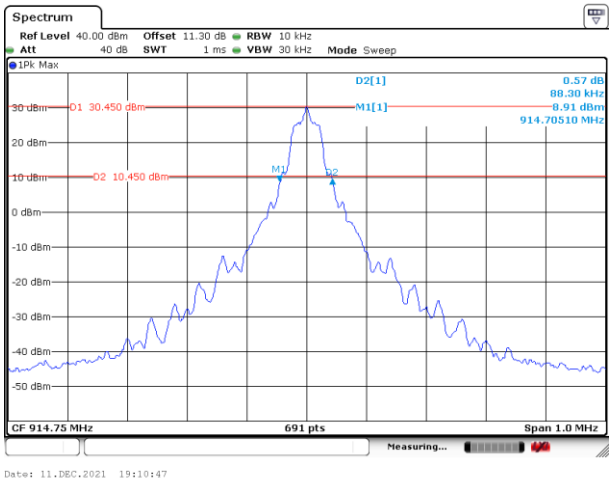
Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Mod.	NTX	CH.	Freq.(MHz)	20db BW (MHz)	Pass/Fail
UHF RFID	1	0	902.75	0.088	Pass
UHF RFID	1	24	914.75	0.088	Pass
UHF RFID	1	49	927.25	0.088	Pass

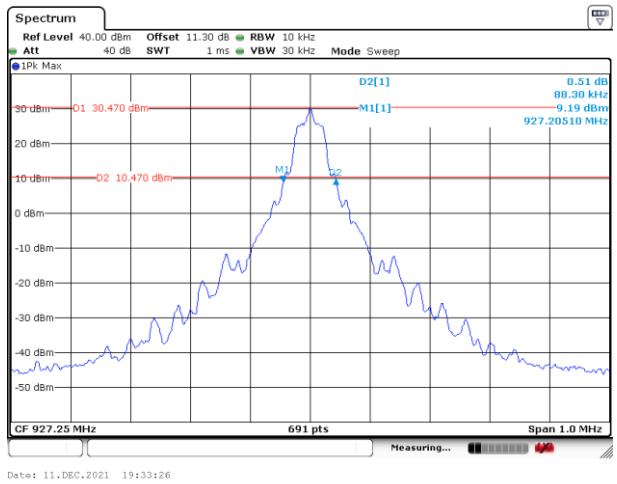
20 dB Bandwidth Plot on Channel 00



20 dB Bandwidth Plot on Channel 24



20 dB Bandwidth Plot on Channel 49



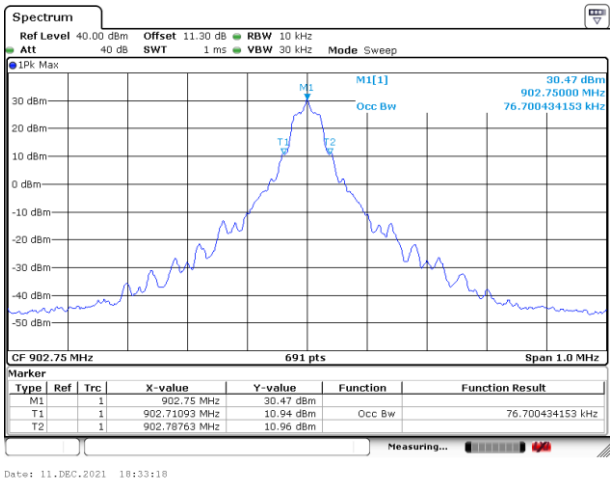
NA

3.4.6 Test Result of 99% Occupied Bandwidth

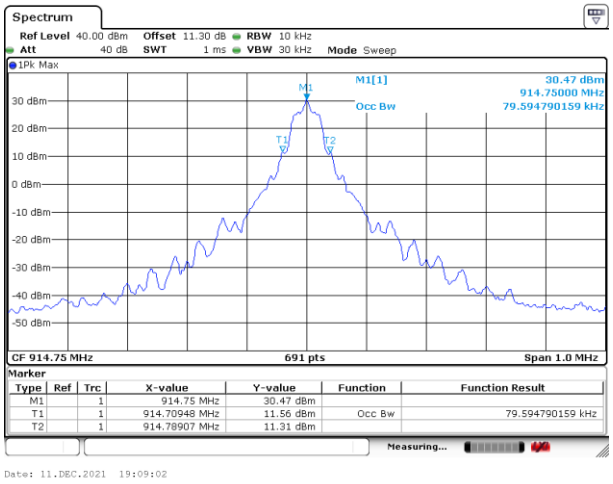
Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Mod.	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	Pass/Fail
UHF RFID	1	0	902.75	0.077	Pass
UHF RFID	1	24	914.75	0.080	Pass
UHF RFID	1	49	927.25	0.080	Pass

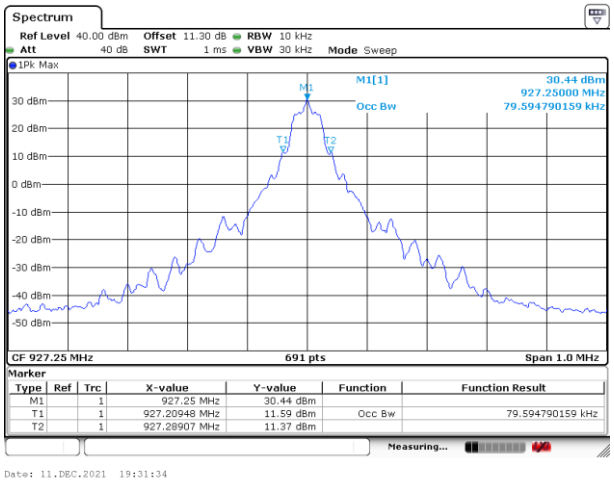
99% Occupied Bandwidth Plot on Channel 00



99% Occupied Bandwidth Plot on Channel 24



99% Occupied Bandwidth Plot on Channel 49



NA

3.5 Output Power Measurement

3.5.1 Limit of Output Power

Section 15.247 (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions: (1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

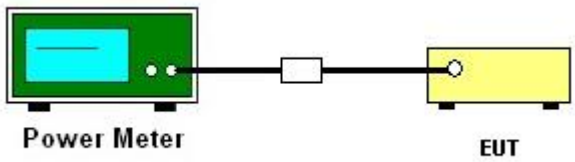
3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Output Power

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

<Long Range>

Channel	Frequency (MHz)	RF Power (dBm)			Setting
		UHF	Max. Limits (dBm)	Pass/Fail	
0	902.75	29.72	30.00	Pass	290
24	914.75	29.86	30.00	Pass	290
49	927.25	29.90	30.00	Pass	290

<Standard Range>

Channel	Frequency (MHz)	RF Power (dBm)			Setting
		UHF	Max. Limits (dBm)	Pass/Fail	
0	902.75	29.81	30.00	Pass	290
24	914.75	29.89	30.00	Pass	290
49	927.25	29.92	30.00	Pass	290

3.5.6 Test Result of Average Power (Reporting Only)

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

<Long Range>

Channel	Frequency (MHz)	RF Power (dBm)
		UHF
0	902.75	29.32
24	914.75	29.49
49	927.25	29.53

<Standard Range>

Channel	Frequency (MHz)	RF Power (dBm)
		UHF
0	902.75	29.43
24	914.75	29.52
49	927.25	29.56

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

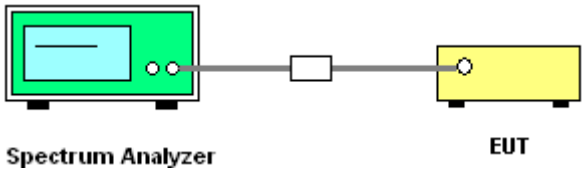
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

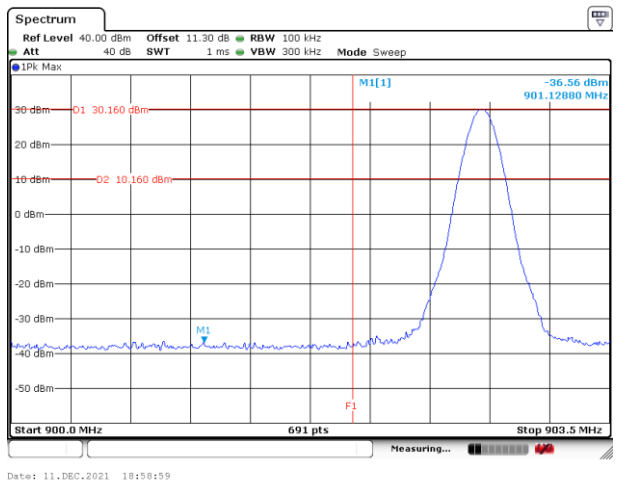
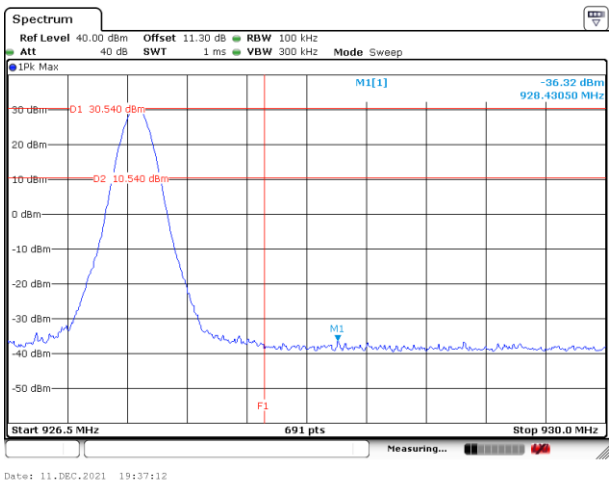
1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set the maximum power setting and enable the EUT to transmit continuously.
3. Set RBW = 100 kHz, VBW = 300 kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2 and 3.
5. Measure and record the results in the test report.

3.6.4 Test Setup



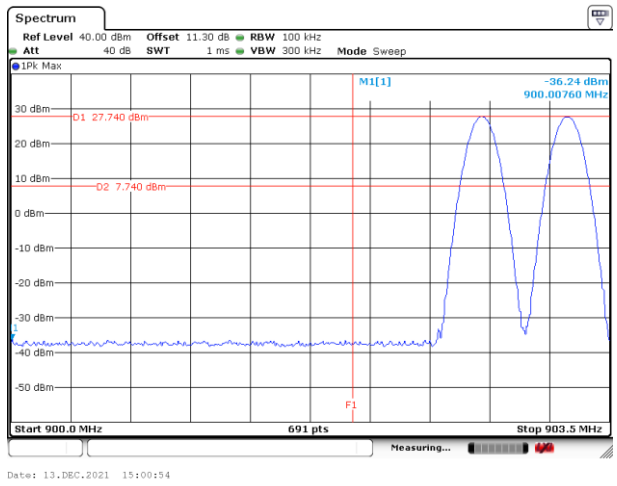
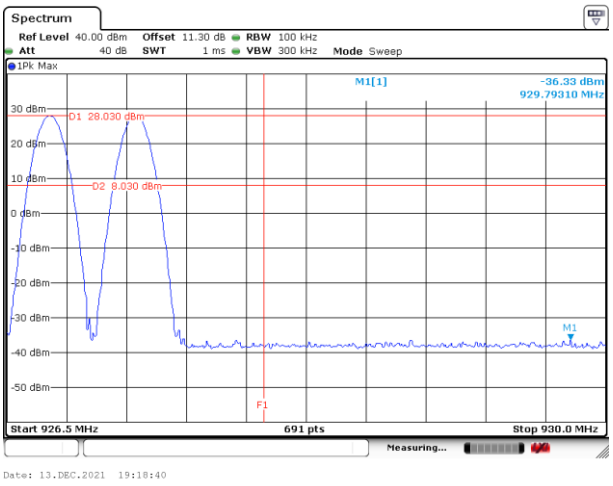
3.6.5 Test Result of Conducted Band Edges

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 49
	

3.6.6 Test Result of Conducted Hopping Mode Band Edges

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot
	

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

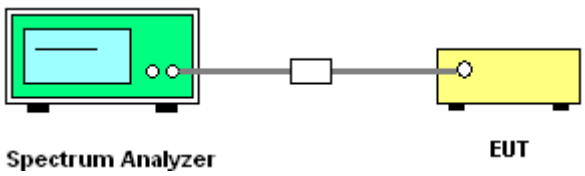
3.7.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.7.3 Test Procedure

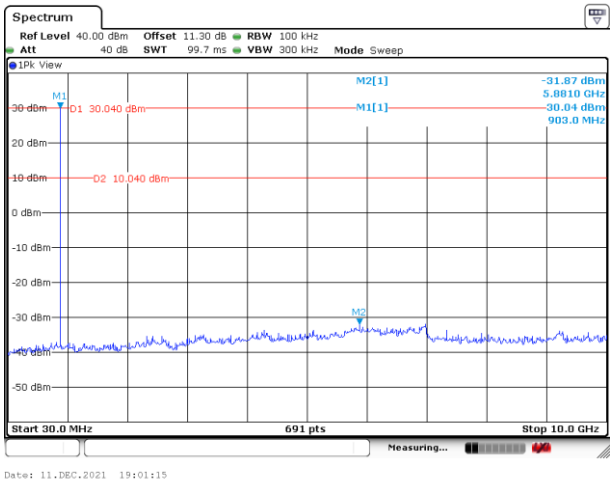
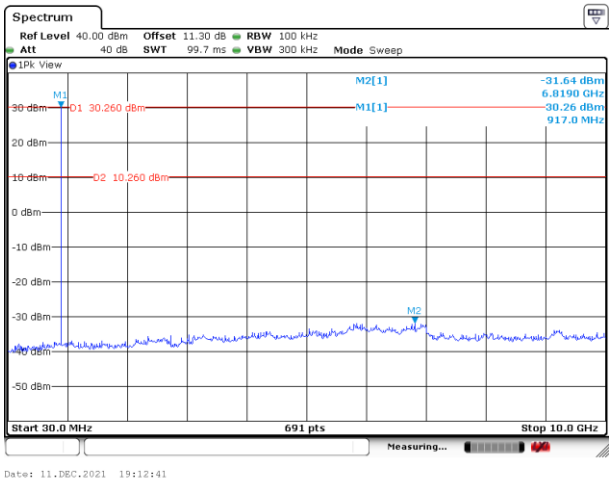
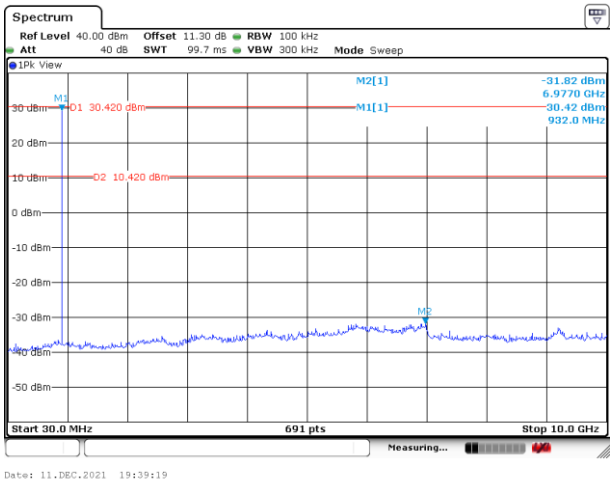
1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurious must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7.4 Test Setup



3.7.5 Test Result of Conducted Spurious Emission

Test Mode :	UHF	Temperature :	20~25℃
Test Engineer :	Tommy Lee	Relative Humidity :	50~56%

CSE Plot on Channel 00 between 30MHz ~ 10 GHz	CSE Plot on Channel 24 between 30MHz ~ 10 GHz
	
CSE Plot on Channel 49 between 30MHz ~ 10 GHz	**NA**
	

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.8.2 Measuring Instruments

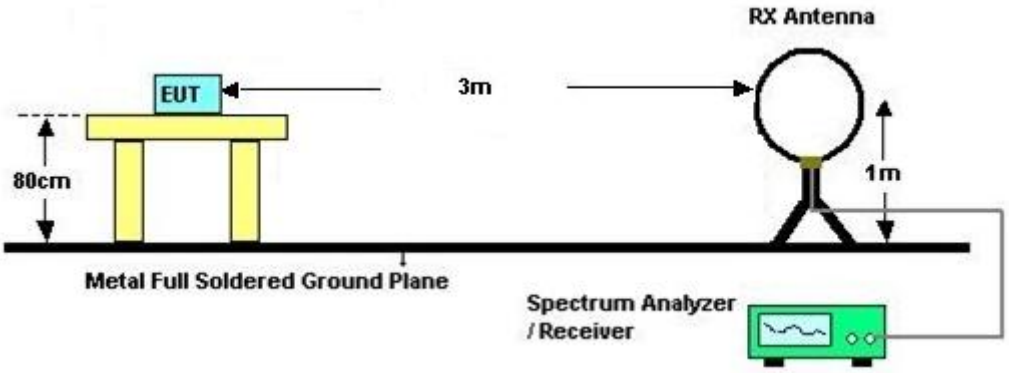
Please refer to the measuring equipment list in this test report.

3.8.3 Test Procedures

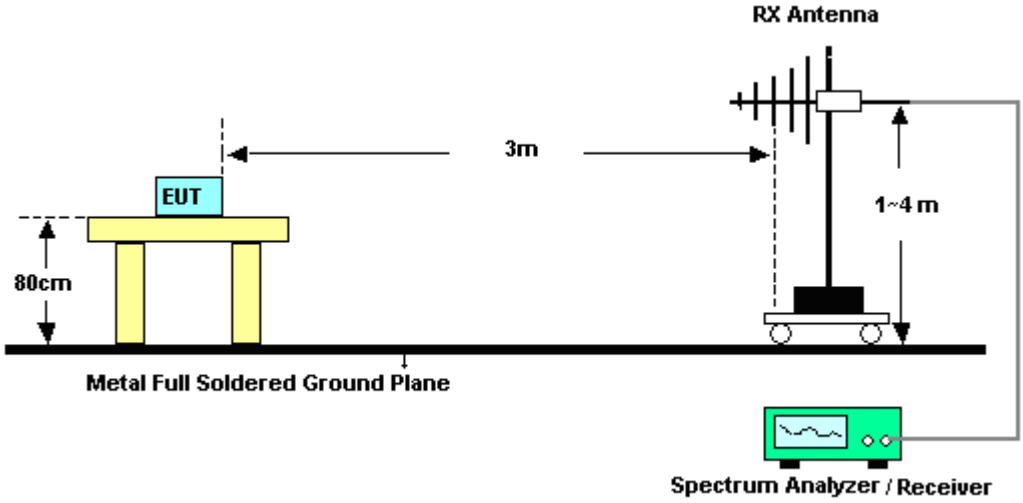
1. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT is 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 to comply with the guidelines.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz, RBW = 1 MHz for f>1 GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log (Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".
8. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".

3.8.4 Test Setup

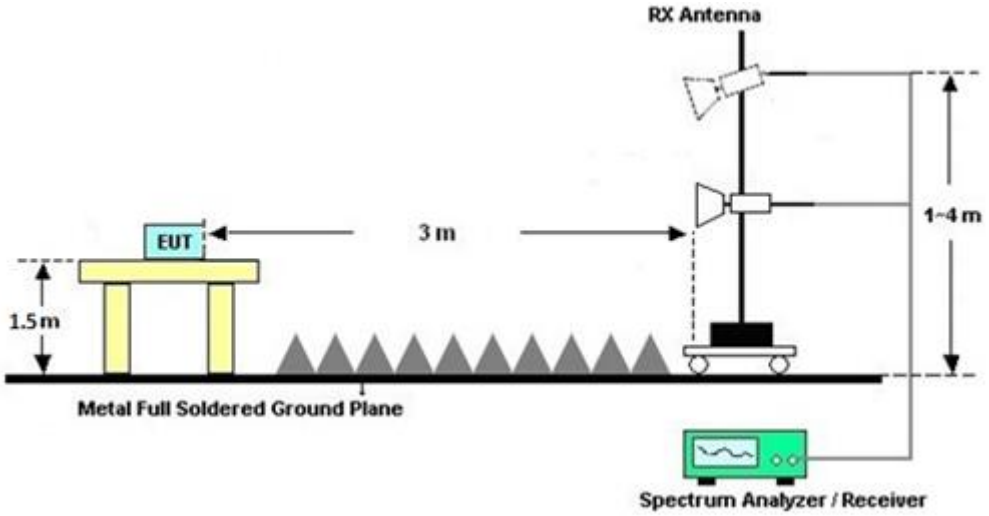
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated emissions above 1GHz



3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.8.7 Duty Cycle

Please refer to Appendix D.

3.8.8 Test Result of Radiated Spurious Emission

Please refer to Appendix B and C.

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

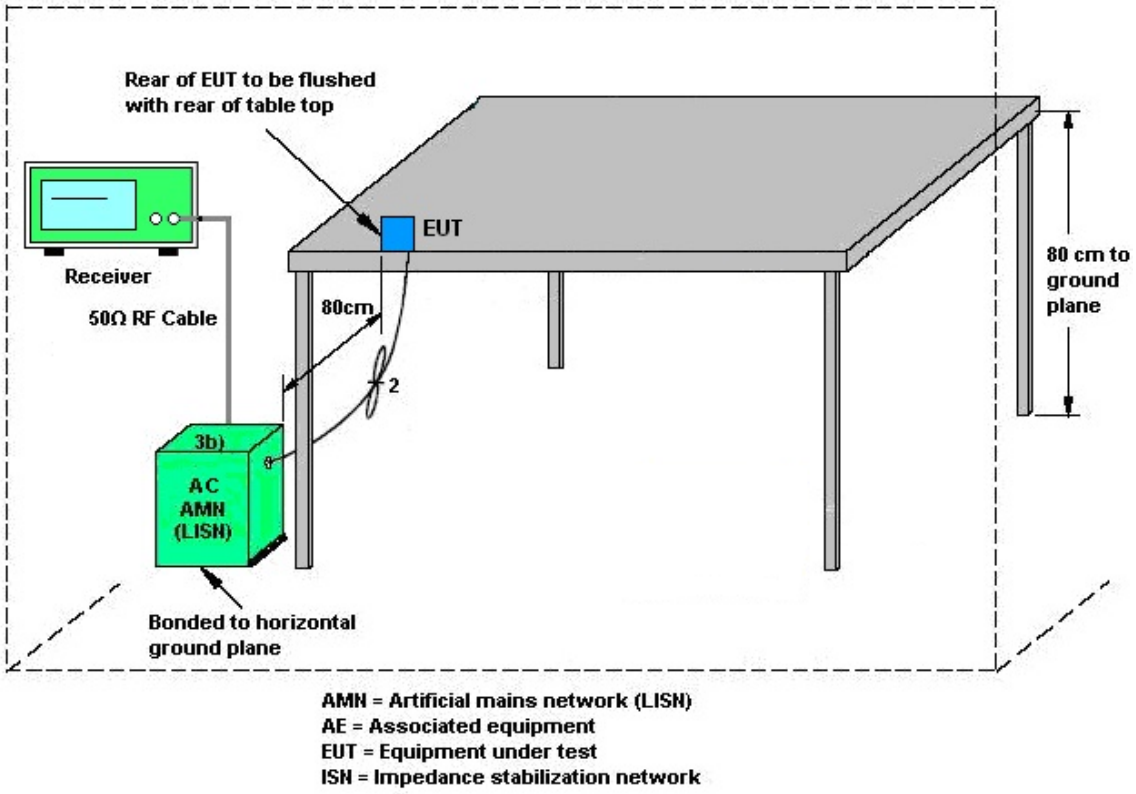
3.9.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.9.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix A.

3.10 Antenna Requirements

3.10.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 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 rule.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 15, 2021	Jan. 07, 2022~ Feb. 18, 2022	Dec. 14, 2022	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 09, 2021	Jan. 07, 2022~ Feb. 18, 2022	Oct. 08, 2022	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz~18GHz	Oct. 25, 2021	Jan. 07, 2022~ Feb. 18, 2022	Oct. 24, 2022	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTM-303B	TP140325	N/A	Nov. 26, 2021	Jan. 07, 2022~ Feb. 18, 2022	Nov. 25, 2022	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTM-303B	TP200880	QA-3-031	Sep. 30, 2021	Jan. 07, 2022~ Feb. 18, 2022	Sep. 29, 2022	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2021	Jan. 07, 2022~ Feb. 18, 2022	Nov. 09, 2022	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-303	17100018000 55007	1GHz~18GHz	Jun. 16, 2021	Jan. 07, 2022~ Feb. 18, 2022	Jun. 15, 2022	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 15, 2021	Jan. 07, 2022~ Feb. 18, 2022	Oct. 14, 2022	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0SS	SN3	3GHz High Pass Filter	Sep. 13, 2021	Jan. 07, 2022~ Feb. 18, 2022	Sep. 12, 2022	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-15 30-8000-40SS	SN11	1.53GHz Low Pass Filter	Sep. 13, 2021	Jan. 07, 2022~ Feb. 18, 2022	Sep. 12, 2022	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz~40GHz	Mar. 11, 2021	Jan. 07, 2022~ Feb. 18, 2022	Mar. 10, 2022	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102，SUCOFLEX 104	811852/4,MY 2859/2,MY98 37/4PE	30MHz~18GHz	Nov. 15, 2021	Jan. 07, 2022~ Feb. 18, 2022	Nov. 14, 2022	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Jan. 07, 2022~ Feb. 18, 2022	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jan. 07, 2022~ Feb. 18, 2022	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jan. 07, 2022~ Feb. 18, 2022	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY55420170	20MHz~8.4GHz	Jul. 15, 2021	Jan. 07, 2022~ Feb. 18, 2022	Jul. 14, 2022	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-935- 1000-15000-40 ST	SN1	1GHz High Pass Filter	Apr. 29, 2021	Jan. 07, 2022~ Feb. 18, 2022	Apr. 28, 2022	Radiation (03CH11-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Nov. 30, 2021	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Oct. 21, 2021	Nov. 30, 2021	Oct. 20, 2022	Conduction (CO05-HY)
Hygrometer	TECPEL	DTM-303A	TP201973	N/A	Oct. 22, 2021	Nov. 30, 2021	Oct. 21, 2022	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 16, 2021	Nov. 30, 2021	Nov. 15, 2022	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Nov. 30, 2021	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Jul. 28, 2021	Nov. 30, 2021	Jul. 27, 2022	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 31, 2020	Nov. 30, 2021	Dec. 30, 2021	Conduction (CO05-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	TECPEL	TR-32	HE17XB2468	N/A	Mar. 09, 2021	Dec. 09, 2021~ Dec. 13, 2021	Mar. 08, 2022	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	932001	N/A	Sep. 30, 2021	Dec. 09, 2021~ Dec. 13, 2021	Sep. 29, 2022	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	846202	N/A	Sep. 30, 2021	Dec. 09, 2021~ Dec. 13, 2021	Sep. 29, 2022	Conducted (TH02-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz ~ 40GHz	Aug. 30, 2021	Dec. 09, 2021~ Dec. 13, 2021	Aug. 29, 2022	Conducted (TH02-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2021	Dec. 09, 2021~ Dec. 13, 2021	Mar. 16, 2022	Conducted (TH02-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.1 dB**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.8 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.4 dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.9 dB**

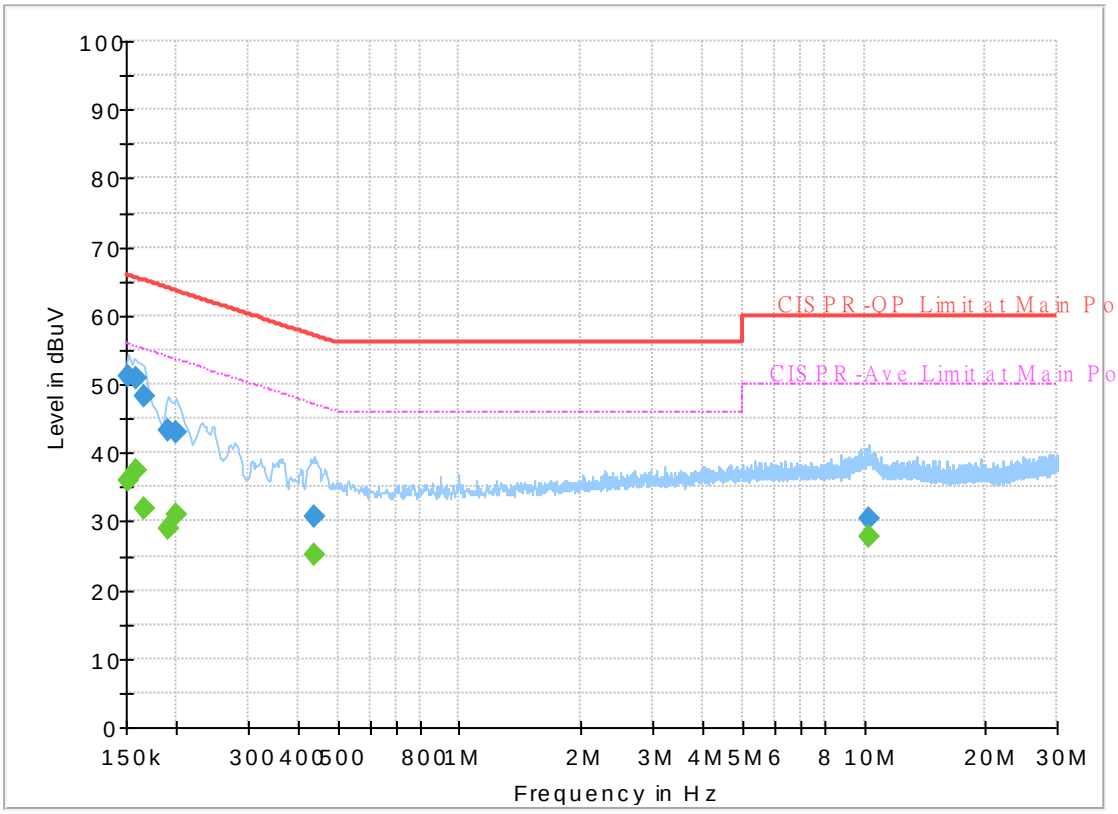
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Tom Lee	**Temperature :**	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO :	1N1506
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

Full Spectrum



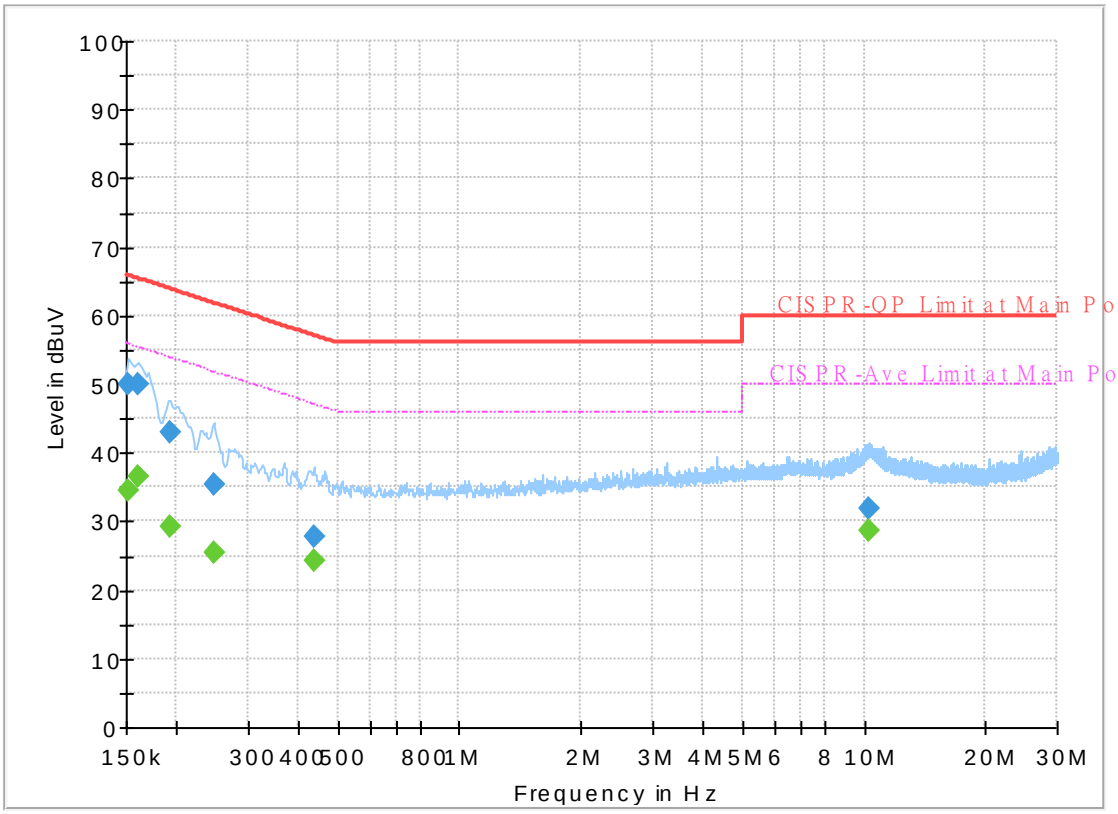
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	35.99	55.88	19.89	L1	OFF	19.6
0.152250	51.32	---	65.88	14.56	L1	OFF	19.6
0.159000	---	37.47	55.52	18.05	L1	OFF	19.6
0.159000	50.91	---	65.52	14.61	L1	OFF	19.6
0.165750	---	31.74	55.17	23.43	L1	OFF	19.6
0.165750	48.14	---	65.17	17.03	L1	OFF	19.6
0.190500	---	28.96	54.02	25.06	L1	OFF	19.6
0.190500	43.39	---	64.02	20.63	L1	OFF	19.6
0.199500	---	30.86	53.63	22.77	L1	OFF	19.6
0.199500	43.12	---	63.63	20.51	L1	OFF	19.6
0.435750	---	25.09	47.14	22.05	L1	OFF	19.7
0.435750	30.70	---	57.14	26.44	L1	OFF	19.7
10.297500	---	27.64	50.00	22.36	L1	OFF	20.1
10.297500	30.42	---	60.00	29.58	L1	OFF	20.1

EUT Information

Report NO :	1N1506
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	34.48	55.88	21.40	N	OFF	19.6
0.152250	49.87	---	65.88	16.01	N	OFF	19.6
0.161250	---	36.44	55.40	18.96	N	OFF	19.6
0.161250	49.86	---	65.40	15.54	N	OFF	19.6
0.192750	---	29.13	53.92	24.79	N	OFF	19.6
0.192750	42.88	---	63.92	21.04	N	OFF	19.6
0.246750	---	25.42	51.87	26.45	N	OFF	19.6
0.246750	35.44	---	61.87	26.43	N	OFF	19.6
0.435750	---	24.16	47.14	22.98	N	OFF	19.7
0.435750	27.63	---	57.14	29.51	N	OFF	19.7
10.338000	---	28.68	50.00	21.32	N	OFF	20.1
10.338000	31.86	---	60.00	28.14	N	OFF	20.1

Appendix B. Radiated Spurious Emission

Test Engineer :	Troye Hsieh	Temperature :	20.1~21.8°C
		Relative Humidity :	56.8~67.7%

<Long Range with SE4750>

UHF (Band Edge @ 3m)

UHF	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		30	31.57	-8.43	40	28.99	24.27	10.67	32.36	-	-	P	H
		53.28	25.19	-14.81	40	33.96	12.7	11.01	32.48	-	-	P	H
		147.37	38.84	-57.51	96.35	42.62	16.98	11.69	32.45	-	-	P	H
		797.27	40.35	-56	96.35	29.87	28.09	14.16	31.77	-	-	P	H
		864.2	41.37	-54.98	96.35	29.26	29.15	14.38	31.42	-	-	P	H
	*	902.75	116.35	-	-	104.23	28.85	14.48	31.21	133	336	P	H
		940.83	42.99	-53.36	96.35	29.47	29.92	14.56	30.96	-	-	P	H
UHF													H
902.75MHz		30	32.38	-7.62	40	29.8	24.27	10.67	32.36	-	-	P	V
		53.28	32.7	-7.3	40	41.47	12.7	11.01	32.48	-	-	P	V
		94.99	28.69	-14.81	43.5	34.63	15.1	11.35	32.39	-	-	P	V
		841.89	40.51	-55.85	96.36	28.94	28.79	14.31	31.53	-	-	P	V
		864.2	41.23	-55.13	96.36	29.12	29.15	14.38	31.42	-	-	P	V
	*	902.75	116.36	-	-	104.24	28.85	14.48	31.21	200	300	P	V
		958.29	42.36	-54	96.36	27.78	30.82	14.6	30.84	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		30	30.47	-9.53	40	27.89	24.27	10.67	32.36	-	-	P	H
		53.28	25.64	-14.36	40	34.41	12.7	11.01	32.48	-	-	P	H
		183.26	35.18	-8.32	43.5	41.18	14.57	11.93	32.5	-	-	P	H
		844.8	40.94	-55.73	96.67	29.19	28.95	14.32	31.52	-	-	P	H
		876.81	41.54	-55.13	96.67	29.51	28.97	14.41	31.35	-	-	P	H
	*	914.75	116.67	-	-	104.34	28.96	14.5	31.13	134	344	P	H
		953.44	45.02	-51.65	96.67	30.73	30.57	14.59	30.87	-	-	P	H
UHF													H
914.75MHz		30	31.97	-8.03	40	29.39	24.27	10.67	32.36	-	-	P	V
		53.28	33.41	-6.59	40	42.18	12.7	11.01	32.48	-	-	P	V
		95.96	29.19	-14.31	43.5	34.92	15.3	11.36	32.39	-	-	P	V
		859.35	41.47	-55.19	96.66	29.39	29.15	14.37	31.44	-	-	P	V
		878.75	41.65	-55.01	96.66	29.6	28.97	14.42	31.34	-	-	P	V
	*	914.75	116.66	-	-	104.33	28.96	14.5	31.13	199	297	P	V
		953.44	42.9	-53.76	96.66	28.61	30.57	14.59	30.87	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		30	31.15	-8.85	40	28.57	24.27	10.67	32.36	-	-	P	H
		128.94	27.47	-16.03	43.5	30.87	17.41	11.61	32.42	-	-	P	H
		220.12	38.2	-7.8	46	43.42	15.08	12.14	32.44	-	-	P	H
		867.11	40.91	-5.09	97.24	28.79	29.14	14.38	31.4	-	-	P	H
		888.45	41.72	-4.28	97.24	29.71	28.85	14.45	31.29	-	-	P	H
	*	927.25	117.24	-	-	104.47	29.28	14.54	31.05	133	344	P	H
		951.5	43.75	-2.25	97.24	29.58	30.47	14.58	30.88	-	-	P	H
UHF													H
927.25MHz		30	31.28	-8.72	40	28.7	24.27	10.67	32.36	-	-	P	V
		54.25	30.36	-9.64	40	39.4	12.43	11.01	32.48	-	-	P	V
		126.03	32.1	-11.4	43.5	35.63	17.34	11.55	32.42	-	-	P	V
		850.62	40.6	-56.63	97.23	28.71	29.04	14.34	31.49	-	-	P	V
		876.81	42.2	-55.03	97.23	30.17	28.97	14.41	31.35	-	-	P	V
	*	927.25	117.23	-	-	104.46	29.28	14.54	31.05	200	300	P	V
		959.26	42.17	-55.06	97.23	27.53	30.87	14.6	30.83	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

UHF (Harmonic @ 3m)

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		1805.5	47.89	-26.11	74	50.46	25.13	6.58	34.28	-	-	P	H
		2708.25	42.85	-31.15	74	40.84	27.93	7.98	33.9	-	-	P	H
		3611	39.26	-34.74	74	58.18	29.22	11.06	59.2	-	-	P	H
													H
													H
UHF													H
902.75MHz		1805.5	45.24	-28.76	74	47.81	25.13	6.58	34.28	-	-	P	V
		2708.25	42.53	-31.47	74	40.52	27.93	7.98	33.9	-	-	P	V
		3611	42.97	-31.03	74	61.89	29.22	11.06	59.2	-	-	P	V
													V
													V
													V
		1829.5	46.46	-27.54	74	48.79	25.28	6.64	34.25	-	-	P	H
		2744.25	43.31	-30.69	74	41.09	28.08	8.04	33.9	-	-	P	H
		3659	39.75	-34.25	74	58.5	29.28	11.08	59.11	-	-	P	H
		4573.75	38.36	-35.64	74	53.83	30.8	12.14	58.41	-	-	P	H
		5488.5	38.44	-35.56	74	52.75	32	12.58	58.89	-	-	P	H
UHF		6403.25	43.81	-30.19	74	55.69	34	13.38	59.26	-	-	P	H
914.75MHz		1829.5	43.49	-30.51	74	45.82	25.28	6.64	34.25	-	-	P	V
		2744.25	43.78	-30.22	74	41.56	28.08	8.04	33.9	-	-	P	V
		3659	41.86	-32.14	74	60.61	29.28	11.08	59.11	-	-	P	V
		4573.75	41.48	-32.52	74	56.95	30.8	12.14	58.41	-	-	P	V
		5488.5	38.25	-35.75	74	52.56	32	12.58	58.89	-	-	P	V
		6403.25	44.36	-29.64	74	56.24	34	13.38	59.26	-	-	P	V

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		1854.5	42.22	-31.78	74	44.31	25.42	6.71	34.22	-	-	P	H
		2781.75	43.13	-30.87	74	40.8	28.1	8.12	33.89	-	-	P	H
		3709	40.27	-33.73	74	58.96	29.24	11.09	59.02	-	-	P	H
		4636.25	37.82	-36.18	74	53.04	31.05	12.16	58.43	-	-	P	H
		5563.5	38.24	-35.76	74	52.54	32	12.63	58.93	-	-	P	H
		6490.75	45.13	-28.87	74	56.7	34.24	13.49	59.3	-	-	P	H
UHF													
927.25MHz		1854.5	41.53	-32.47	74	43.62	25.42	6.71	34.22	-	-	P	V
		2781.75	43	-31	74	40.67	28.1	8.12	33.89	-	-	P	V
		3709	40.16	-33.84	74	58.85	29.24	11.09	59.02	-	-	P	V
		4636.25	40.49	-33.51	74	55.71	31.05	12.16	58.43	-	-	P	V
		5563.5	39.23	-34.77	74	53.53	32	12.63	58.93	-	-	P	V
		6490.75	46.62	-27.38	74	58.19	34.24	13.49	59.3	-	-	P	V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

<Standard Range with SE4850>

UHF (Band Edge @ 3m)

UHF	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		30	31.28	-8.72	40	28.68	24.27	10.67	32.34	-	-	P	H
		147.37	31.89	-11.61	43.5	35.51	16.98	11.69	32.29	-	-	P	H
		266.68	33.96	-12.04	46	34.44	19.37	12.37	32.22	-	-	P	H
		803.09	40.05	-56.41	96.46	29.81	28.06	14.18	32	-	-	P	H
		854.5	41.87	-54.59	96.46	30.17	29.11	14.35	31.76	-	-	P	H
	*	902.75	116.46	-	-	104.64	28.85	14.48	31.51	149	360	P	H
		956.35	42.95	-53.51	96.46	28.71	30.71	14.59	31.06	-	-	P	H
UHF													H
902.75MHz		30	32.9	-7.1	40	30.3	24.27	10.67	32.34	-	-	P	V
		56.19	32.07	-7.93	40	41.23	12.14	11.03	32.33	-	-	P	V
		147.37	34.93	-8.57	43.5	38.55	16.98	11.69	32.29	-	-	P	V
		806.97	40.14	-56.33	96.47	29.96	27.97	14.19	31.98	-	-	P	V
		846.74	40.4	-56.07	96.47	28.89	28.98	14.32	31.79	-	-	P	V
	*	902.75	116.47	-	-	104.65	28.85	14.48	31.51	111	293	P	V
		956.35	43.09	-53.38	96.47	28.85	30.71	14.59	31.06	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		30	32.06	-7.94	40	29.46	24.27	10.67	32.34	-	-	P	H
		183.26	30.77	-12.73	43.5	36.54	14.57	11.93	32.27	-	-	P	H
		266.68	33.46	-12.54	46	33.94	19.37	12.37	32.22	-	-	P	H
		838.01	40.85	-55.94	96.79	29.79	28.61	14.29	31.84	-	-	P	H
		876.81	41.78	-55.01	96.79	30.05	28.97	14.41	31.65	-	-	P	H
	*	914.75	116.79	-	-	104.74	28.96	14.5	31.41	142	350	P	H
		954.41	42.49	-54.3	96.79	28.37	30.61	14.59	31.08	-	-	P	H
UHF													H
914.75MHz		30	32.2	-7.8	40	29.6	24.27	10.67	32.34	-	-	P	V
		57.16	32.82	-7.18	40	42.22	11.92	11.01	32.33	-	-	P	V
		183.26	31.4	-12.1	43.5	37.17	14.57	11.93	32.27	-	-	P	V
		768.17	40.21	-56.58	96.79	30.27	27.98	14.07	32.11	-	-	P	V
		863.23	41.83	-54.96	96.79	30.01	29.15	14.38	31.71	-	-	P	V
	*	914.75	116.79	-	-	104.74	28.96	14.5	31.41	109	316	P	V
		953.44	42.61	-54.18	96.79	28.54	30.57	14.59	31.09	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		30	32.8	-7.2	40	30.2	24.27	10.67	32.34	-	-	P	H
		135.73	27.56	-15.94	43.5	30.88	17.32	11.65	32.29	-	-	P	H
		266.68	34.37	-11.63	46	34.85	19.37	12.37	32.22	-	-	P	H
		838.01	40.01	-57.31	97.32	28.95	28.61	14.29	31.84	-	-	P	H
		860.32	40.64	-56.68	97.32	28.85	29.15	14.37	31.73	-	-	P	H
	*	927.25	117.32	-	-	104.81	29.28	14.54	31.31	142	357	P	H
		956.35	43.59	-53.73	97.32	29.35	30.71	14.59	31.06	-	-	P	H
UHF													H
927.25MHz		30	32.1	-7.9	40	29.5	24.27	10.67	32.34	-	-	P	V
		56.19	32.19	-7.81	40	41.35	12.14	11.03	32.33	-	-	P	V
		129.91	27.36	-16.14	43.5	30.62	17.42	11.62	32.3	-	-	P	V
		844.8	40.84	-56.49	97.33	29.37	28.95	14.32	31.8	-	-	P	V
		879.72	41.23	-56.1	97.33	29.48	28.96	14.42	31.63	-	-	P	V
	*	927.25	117.33	-	-	104.82	29.28	14.54	31.31	108	346	P	V
		952.47	42.88	-54.45	97.33	28.87	30.52	14.59	31.1	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

UHF (Harmonic @ 3m)

UHF	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
UHF 902.75MHz		1805.5	44.67	-29.33	74	47.24	25.13	6.58	34.28	-	-	P	H
		2708.25	42.67	-31.33	74	40.66	27.93	7.98	33.9	-	-	P	H
		3611	39.34	-34.66	74	58.26	29.22	11.06	59.2	-	-	P	H
		4513.75	39.85	-34.15	74	55.64	30.56	12.05	58.4	-	-	P	H
		5416.5	39.49	-34.51	74	53.99	31.8	12.53	58.83	-	-	P	H
		6319.25	41.71	-32.29	74	54.05	33.54	13.35	59.23	-	-	P	H
		1805.5	41.93	-32.07	74	44.5	25.13	6.58	34.28	-	-	P	V
		2708.25	43.44	-30.56	74	41.43	27.93	7.98	33.9	-	-	P	V
		3611	43.07	-30.93	74	61.99	29.22	11.06	59.2	-	-	P	V
		4513.75	41.67	-32.33	74	57.46	30.56	12.05	58.4	-	-	P	V
		5416.5	39.63	-34.37	74	54.13	31.8	12.53	58.83	-	-	P	V
		6319.25	42.8	-31.2	74	55.14	33.54	13.35	59.23	-	-	P	V
UHF 914.75MHz		1829.5	45.04	-28.96	74	47.37	25.28	6.64	34.25	-	-	P	H
		2744.25	43.74	-30.26	74	41.52	28.08	8.04	33.9	-	-	P	H
		3659	38.17	-35.83	74	56.92	29.28	11.08	59.11	-	-	P	H
		4573.75	39.55	-34.45	74	55.02	30.8	12.14	58.41	-	-	P	H
		5488.5	38.53	-35.47	74	52.84	32	12.58	58.89	-	-	P	H
		6403.25	42.28	-31.72	74	54.16	34	13.38	59.26	-	-	P	H
		1829.5	40.98	-33.02	74	43.31	25.28	6.64	34.25	-	-	P	V
		2744.25	42.79	-31.21	74	40.57	28.08	8.04	33.9	-	-	P	V
		3659	41.36	-32.64	74	60.11	29.28	11.08	59.11	-	-	P	V
		4573.75	43.09	-30.91	74	58.56	30.8	12.14	58.41	-	-	P	V
		5488.5	39.34	-34.66	74	53.65	32	12.58	58.89	-	-	P	V
		6403.25	44.45	-29.55	74	56.33	34	13.38	59.26	-	-	P	V

UHF	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
UHF 927.25MHz		1854.5	42.37	-31.63	74	44.46	25.42	6.71	34.22	-	-	P	H
		2781.75	48.75	-25.25	74	46.42	28.1	8.12	33.89	-	-	P	H
		3709	38.09	-35.91	74	56.78	29.24	11.09	59.02	-	-	P	H
		4636.25	39.8	-34.2	74	55.02	31.05	12.16	58.43	-	-	P	H
		5563.5	41.67	-32.33	74	55.97	32	12.63	58.93	-	-	P	H
		6490.75	44.41	-29.59	74	55.98	34.24	13.49	59.3	-	-	P	H
		1854.5	40.97	-33.03	74	43.06	25.42	6.71	34.22	-	-	P	V
		2781.75	49.13	-24.87	74	46.8	28.1	8.12	33.89	-	-	P	V
		3709	41.91	-32.09	74	60.6	29.24	11.09	59.02	-	-	P	V
		4636.25	43.19	-30.81	74	58.41	31.05	12.16	58.43	-	-	P	V
		5563.5	41.42	-32.58	74	55.72	32	12.63	58.93	-	-	P	V
		6490.75	44.84	-29.16	74	56.41	34.24	13.49	59.3	-	-	P	V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. Non restricted band limit is radio frequency level down 20db.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

UHF	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
UHF 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

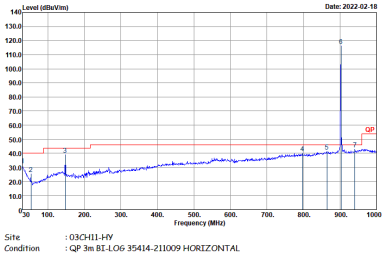
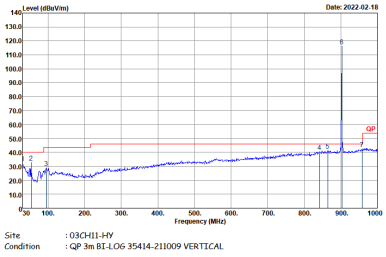
Both peak and average measured complies with the limit line, so test result is "PASS".

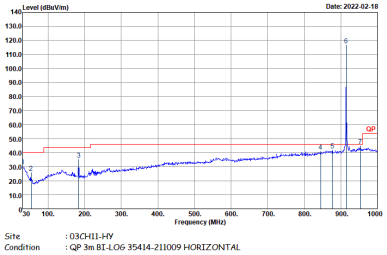
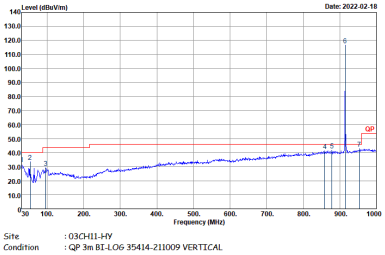
Appendix C. Radiated Spurious Emission Plots

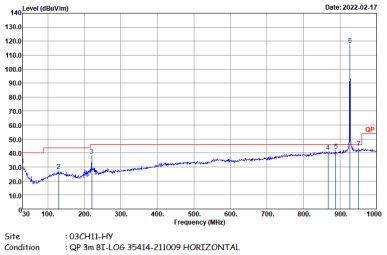
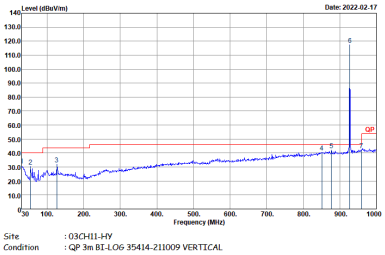
Test Engineer :	Troye Hsieh	**Temperature :**	20.1~21.8°C
		Relative Humidity :	56.8~67.7%

<Long Range with SE4750>

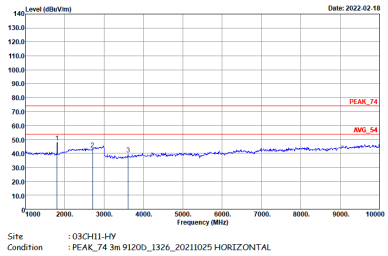
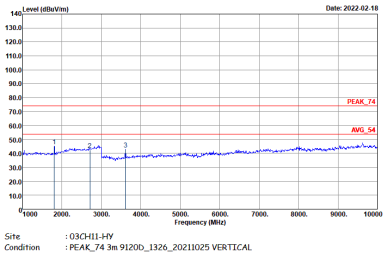
UHF (Band Edge @ 3m)

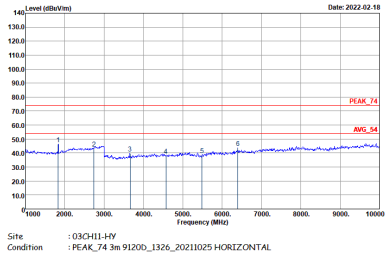
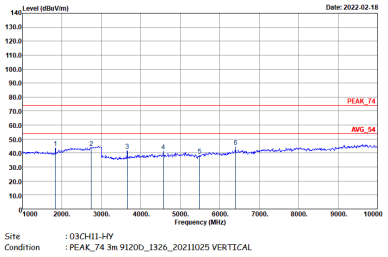
UHF	**UHF**	
	RFID 902.75MHz	
	Horizontal	**Vertical**
QP / Peak		

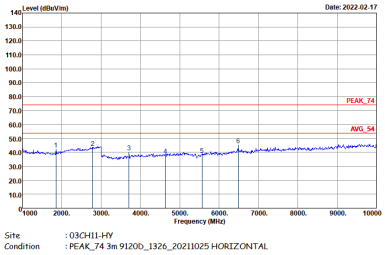
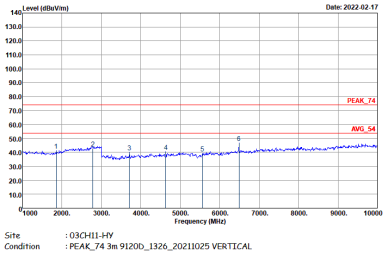
UHF	UHF	
	RFID 914.75MHz	
	Horizontal	Vertical
QP / Peak		

UHF	UHF	
	RFID 927.25MHz	
	Horizontal	Vertical
Peak Avg.		

UHF (Harmonic @ 3m)

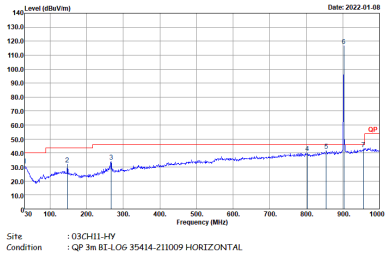
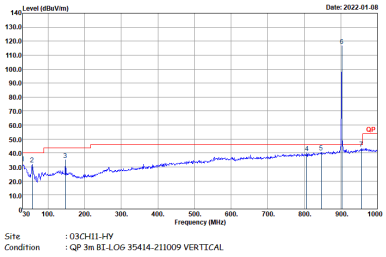
UHF	UHF	
	RFID 902.75MHz	
	Horizontal	Vertical
Peak Avg.		

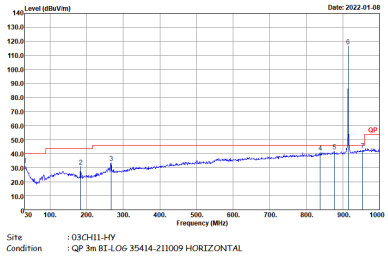
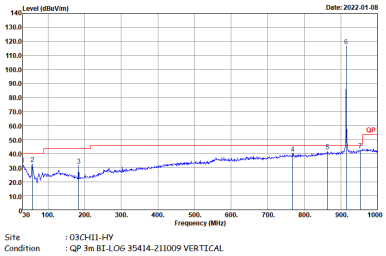
UHF	UHF	
	RFID 914.75MHz	
	Horizontal	Vertical
Peak Avg.		

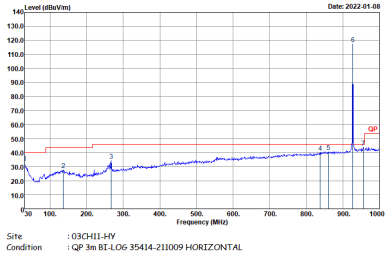
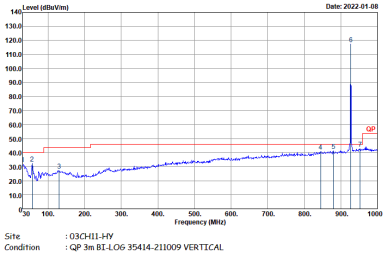
UHF	UHF	
	RFID 927.25MHz	
	Horizontal	Vertical
Peak Avg.		

<Standard Range with SE4850>

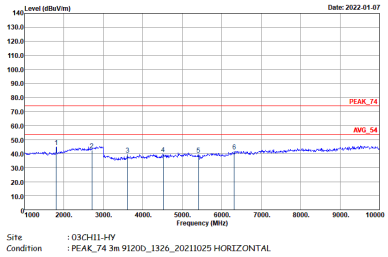
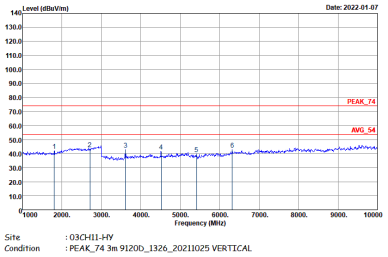
UHF (Band Edge @ 3m)

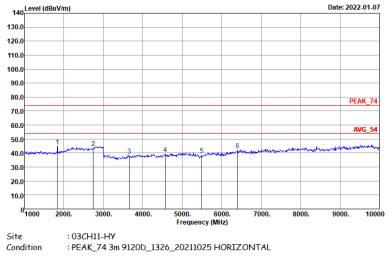
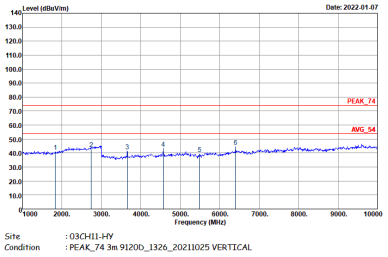
UHF	UHF	
	RFID 902.75MHz	
	Horizontal	Vertical
QP / Peak		

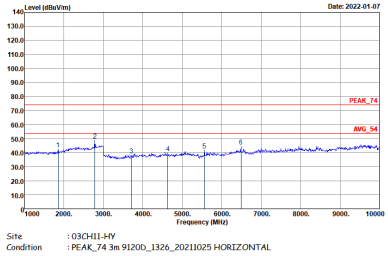
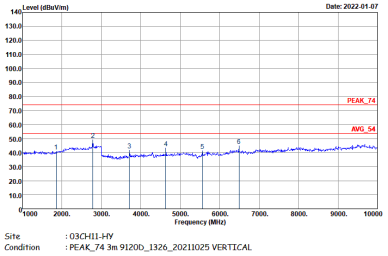
UHF	UHF	
	RFID 914.75MHz	
	Horizontal	Vertical
QP / Peak		

UHF	UHF	
	RFID 927.25MHz	
	Horizontal	Vertical
Peak Avg.		

UHF (Harmonic @ 3m)

UHF	UHF	
	RFID 902.75MHz	
	Horizontal	Vertical
Peak Avg.		

UHF	UHF	
	RFID 914.75MHz	
	Horizontal	Vertical
Peak Avg.		

UHF	UHF	
	RFID 927.25MHz	
	Horizontal	Vertical
Peak Avg.		

Appendix D. Duty Cycle Plot

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
UHF	100.00	-	-	10Hz

UHF RFID