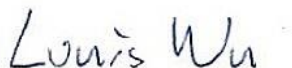


NCC RADIO TEST REPORT

Equipment : Advanced Array RFID Reader
Brand Name : ZEBRA
Model Name : ATR7000
Applicant : 台灣斑馬科技股份有限公司
台北市信義區松高路 9 號 13 樓
Manufacturer : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Standard : NCC LP0002 (2018-01-10)

The product was received on Aug. 17, 2020 and testing was started from Aug. 25, 2020 and completed on Sep. 22, 2020. 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 NCC LP0002 (2018-01-10) 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 of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issued Date
TR031015	01	Initial issue of report	Sep. 29, 2020
TR031015	02	Revise the reference standard clause	Oct. 27, 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	LP0002 4.8.1.5 (1)	Number of Channels	Pass	-
3.2	LP0002 4.8.1.5 (1)	Hopping Channel Separation	Pass	-
3.3	LP0002 4.8.1.5 (1)	Dwell Time of Each Channel	Pass	-
3.4	LP0002 4.8.1.5 (1)	20dB Bandwidth	Pass	-
3.4	-	99% Occupied Bandwidth	Reporting Only	-
3.5	LP0002 4.8.1.2 (1)(A) 4.8.1.2 (1)(B) 4.8.1.2 (2)	Output Power	Pass	-
3.6	LP0002 4.8.1.4	Conducted Band Edges	Pass	-
3.7	LP0002 4.8.1.4	Conducted Spurious Emission	Pass	-
3.8	LP0002 4.8.1.4	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 6.07 dB at 893.300 MHz & 806.000 MHz
3.9	LP0002 2.3	AC Conducted Emission	Pass	Under limit 17.68 dB at 0.387MHz
3.10	LP0002 4.8.1.3	Antenna Requirement	Pass	-
Annex A	LP0002 2.11	Receiver Radiated Emission	Pass	Please refer to Annex A
Annex B	LP0002 5.20.2	Maximum Power Density	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang
Report Producer: Yimin Ho

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Advanced Array RFID Reader
Brand Name	ZEBRA
Model Name	ATR7000
EUT supports Radios application	UHF RFID
HW Version	0.0.12.0
FW Version	2.16.1.0 (LLRP FW)
MFD	18MAY19
EUT Stage	Identical Prototype

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

Specification of Accessories				
AC Adapter	Brand Name	ZEBRA	Model Name	PS000088A01

Supported Unit Used in Test Configuration and System				
PoE	Brand Name	Microsemi	Model Name	PD-9001GR/AT/AC

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	920 ~ 928 MHz
Number of Channels	14
Maximum Output Power to Antenna	23.13 dBm (0.2056 W)
20dB Bandwidth	0.071 MHz
99% Occupied Bandwidth	0.068 MHz
Type of Modulation	FHSS

Antenna Information				
Antenna	Brand Name	Laird	Peak Gain	12.5 dBi
	Model Name	AN-000196-01	Type	Dual Bifilar (7X) Antenna

Remark: The detail internal, external and transmit antenna photo please refer to Sporton report no.: EP031015.

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, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	Sporton Site No.	
	TH05-HY	CO05-HY

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

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory	
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855	
Test Site No.	Sporton Site No.	
	03CH11-HY	

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

FCC designation No.: TW1190 and TW0007

1.5 Applicable Standards

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

- ♦ NCC LP0002 (2018-01-10)
- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r01
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
920.75-927.25 MHz	0	920.75	7	924.25
	1	921.25	8	924.75
	2	921.75	9	925.25
	3	922.25	10	925.75
	4	922.75	11	926.25
	5	923.25	12	926.75
	6	923.75	13	927.25

2.2 Test Mode

- 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, pre-scanned in two config., EUT Horizontal and EUT Vertical. The worst cases (EUT Horizontal) were recorded in this report.
- AC power line Conducted Emission was tested under maximum output power.

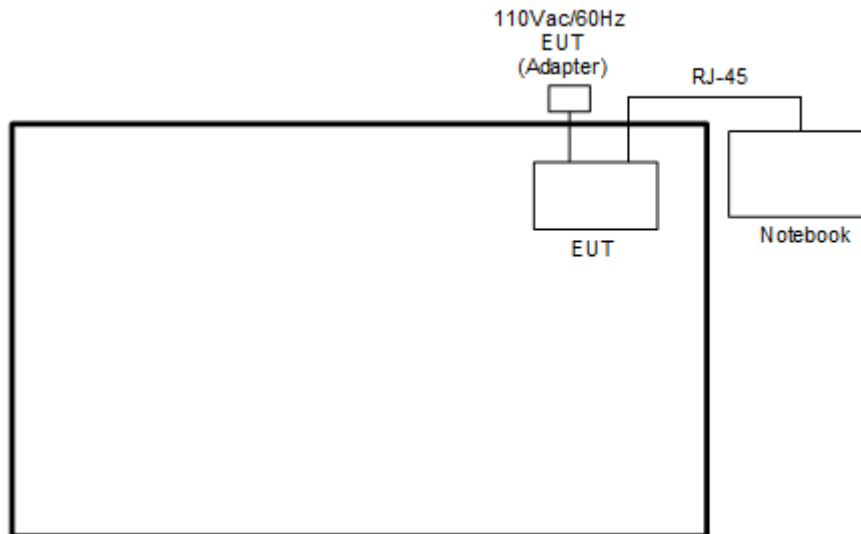
The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	UHF RFID
Conducted Test Cases	Mode 1: UHF RFID Tx CH00_920.75 MHz Mode 2: UHF RFID Tx CH07_924.25 MHz Mode 3: UHF RFID Tx CH13_927.25 MHz
Radiated Test Cases	Mode 1: UHF RFID Tx CH00_920.75 MHz Mode 2: UHF RFID Tx CH07_924.25 MHz Mode 3: UHF RFID Tx CH13_927.25 MHz
AC Conducted Emission	Mode 1: UHF RFID On + AC Adapter + RJ45 Link with Notebook

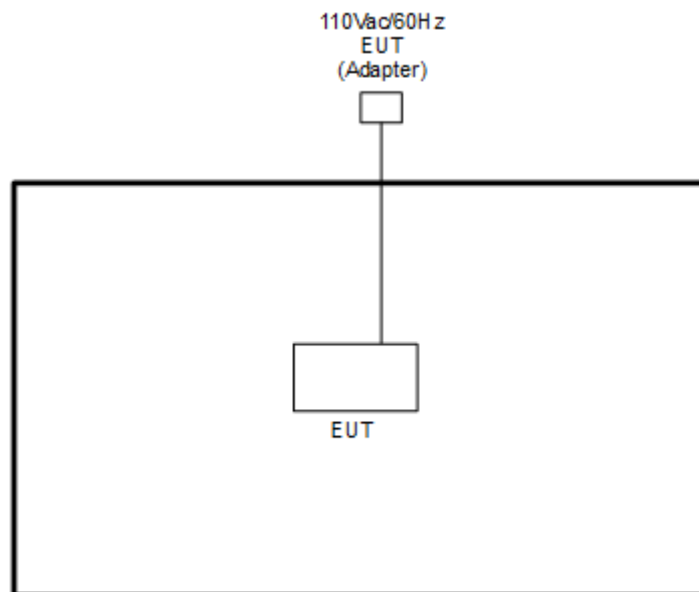
Remark: For Conducted Test Cases, pre-test the power from Ant. Port 1~13, the worst cases (Ant. Port 8) were recorded in this report.

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<WLAN Tx Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

Remark: Applicant has ensured accessory would not be attached with the product on the market, accessory is provided by lab for testing.

2.5 EUT Operation Test Setup

The RF test items, utility “Tera term Version 4.67” 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 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 920.75-927.25 MHz band shall use at least 14 channels.

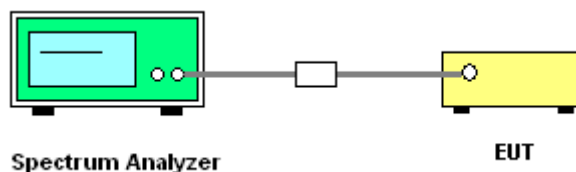
3.1.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300kHz; VBW $\geq$ 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.

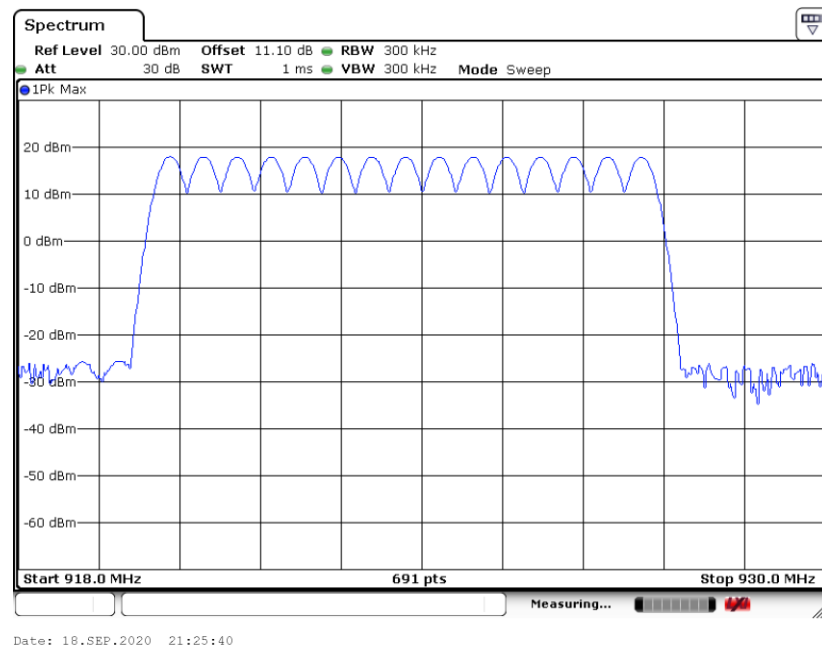
3.1.4 Test Setup



3.1.5 Test Result of Number of Hopping Frequency

Test Engineer :	Tommy Lee	Temperature :	23.7~24℃
		Relative Humidity :	53.7~54.2%
Number of Hopping (Channel)	Limits (Channel)	Pass/Fail	
14	> 14	Pass	

Number of Hopping Channel Plot on Channel 00-13



3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

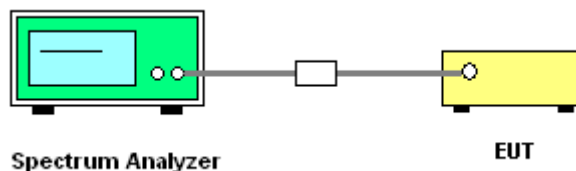
3.2.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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 = 300kHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup

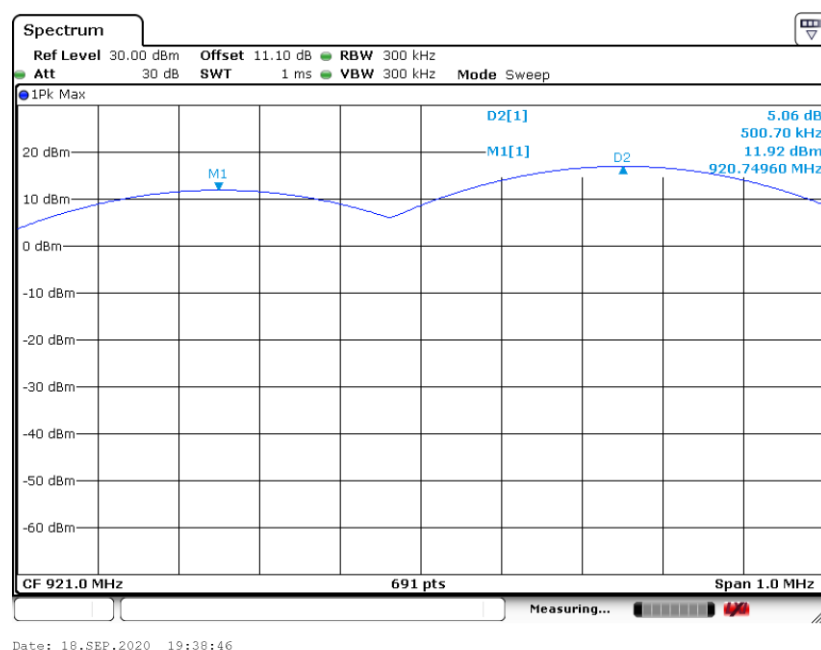


3.2.5 Test Result of Hopping Channel Separation

Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

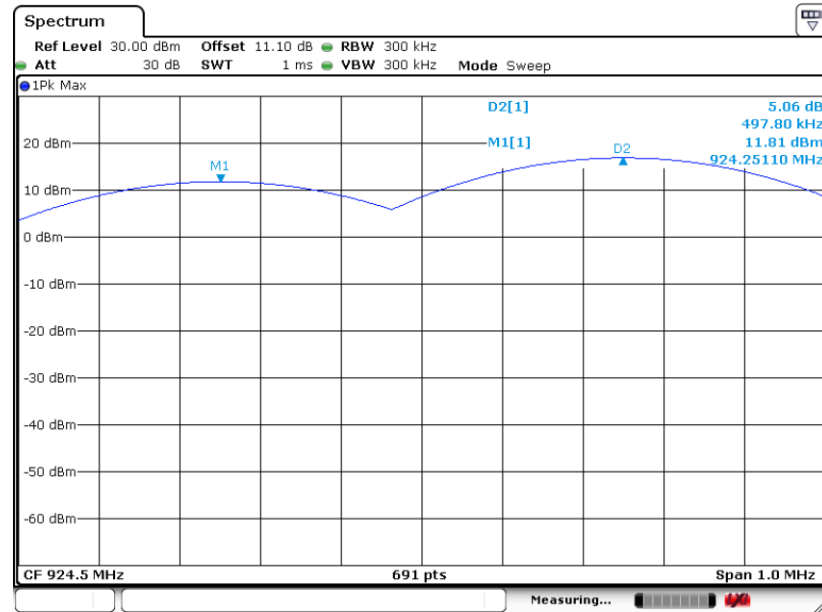
Mod.	NTX	CH.	Freq. (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Limit (MHz)	Pass/Fail
UHF RFID	1	00	920.75	0.501	0.0695	Pass
UHF RFID	1	07	924.25	0.498	0.0709	Pass
UHF RFID	1	13	927.25	0.544	0.0709	Pass

Channel Separation Plot on Channel 00 - 01



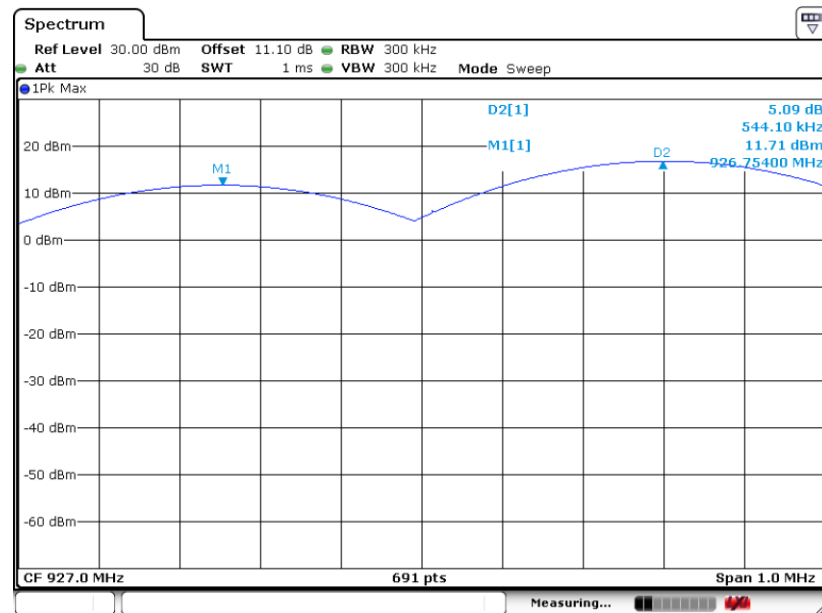


Channel Separation Plot on Channel 07 - 08



Date: 18.SEP.2020 19:53:28

Channel Separation Plot on Channel 12 - 13



Date: 18.SEP.2020 20:40:33

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

Frequency hopping systems, the average time of occupancy on any frequency each times shall be less than or equal 0.4 seconds within a time period in seconds equal to the number of hopping channels limit employed multiplied by 0.4.

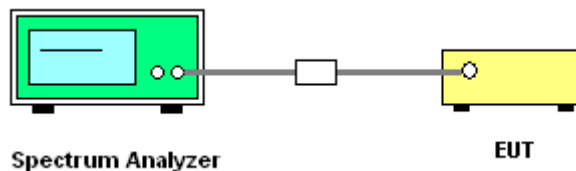
3.3.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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 $\geq$ 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

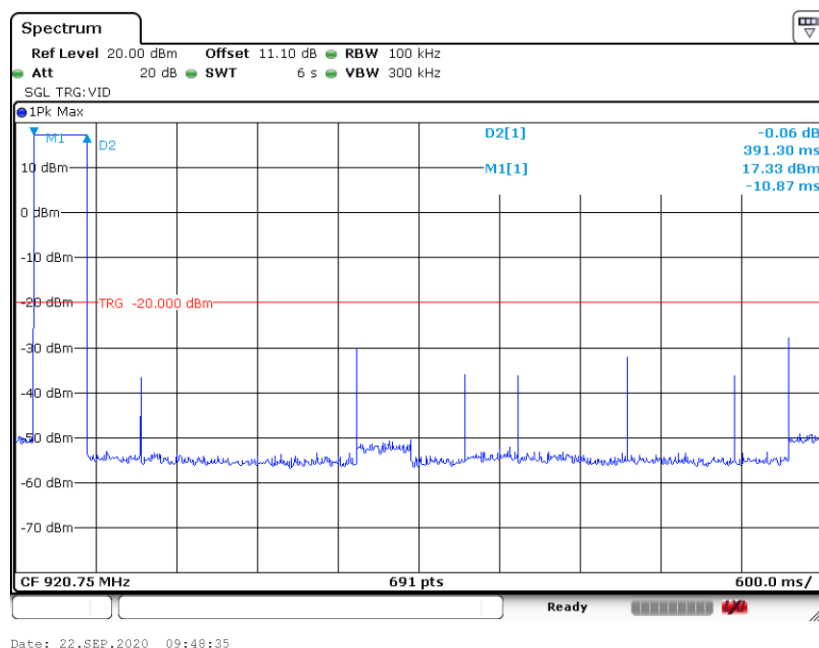


3.3.5 Test Result of Dwell Time

Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

Mod.	Channel Number Rate	Package Transfer Time (msec)	Hops Over Occupancy Time (hops)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	14	391.30	1.00	0.39	< 0.4s	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

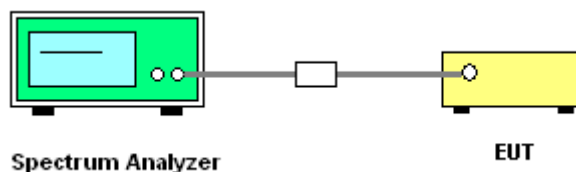
3.4.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
RBW $\geq$ 1% of the 20 dB bandwidth; VBW $\geq$ 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 $\geq$ 1-5% of the 99% bandwidth; VBW $\geq$ 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

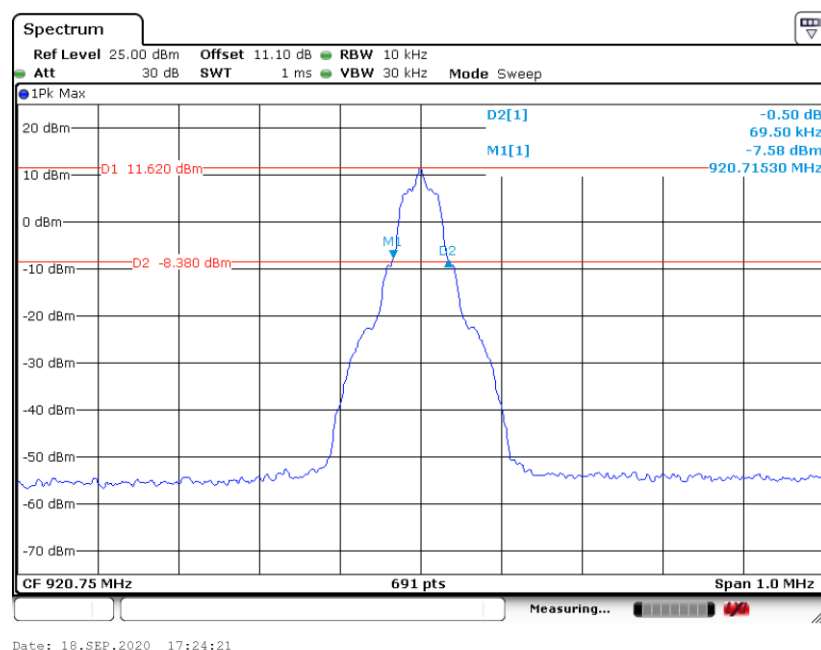


3.4.5 Test Result of 20dB Bandwidth

Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

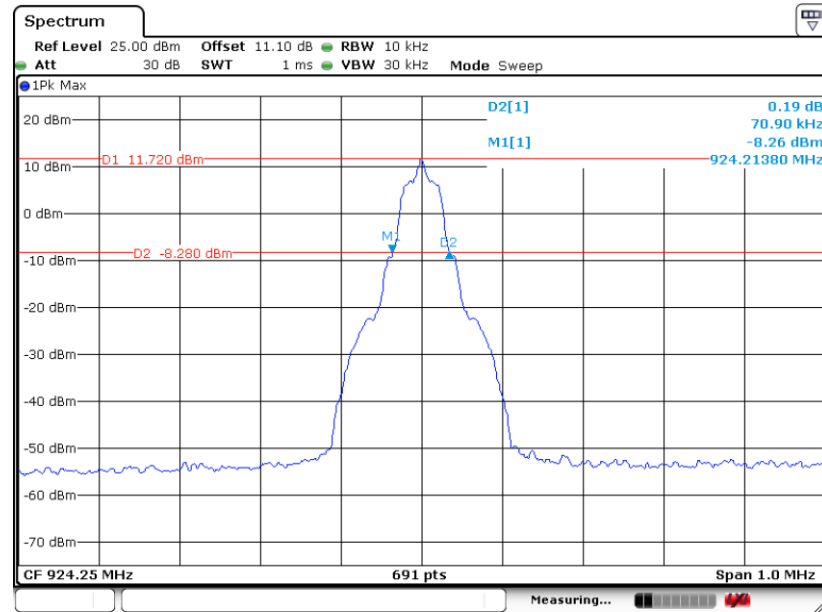
Mod.	NTX	CH.	Freq.(MHz)	20db BW (MHz)	Pass/Fail
UHF RFID	1	00	920.75	0.070	Pass
UHF RFID	1	07	924.25	0.071	Pass
UHF RFID	1	13	927.25	0.071	Pass

20 dB Bandwidth Plot on Channel 00



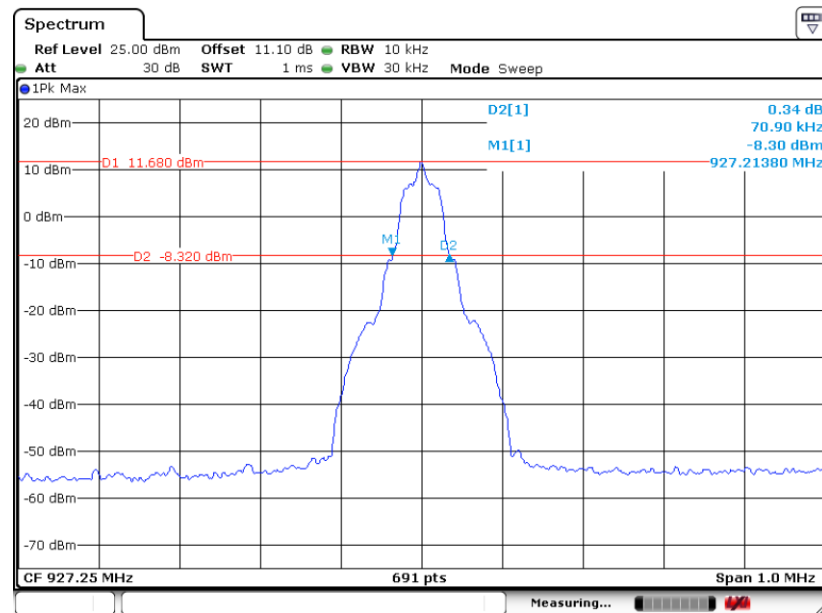


20 dB Bandwidth Plot on Channel 07



Date: 18.SEP.2020 17:37:10

20 dB Bandwidth Plot on Channel 13



Date: 18.SEP.2020 17:41:07

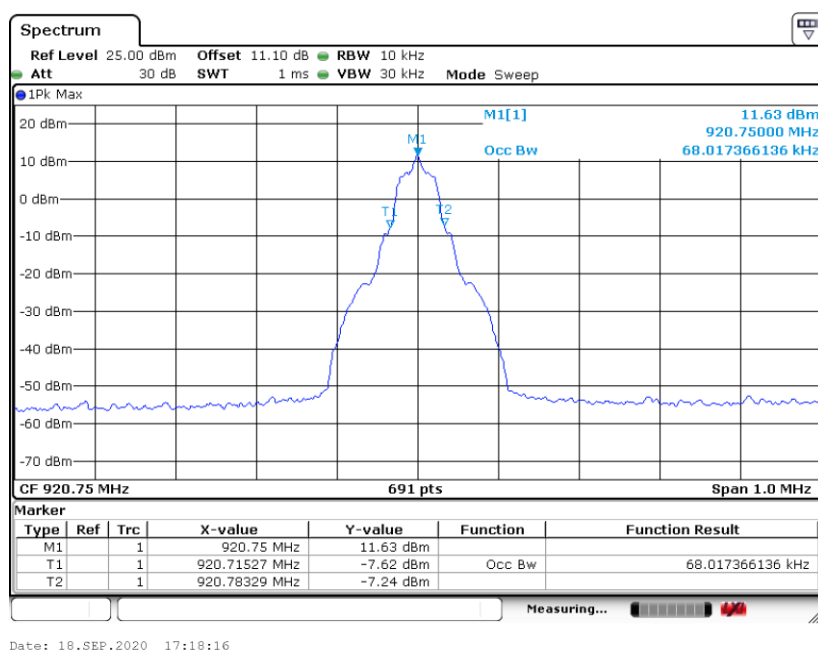


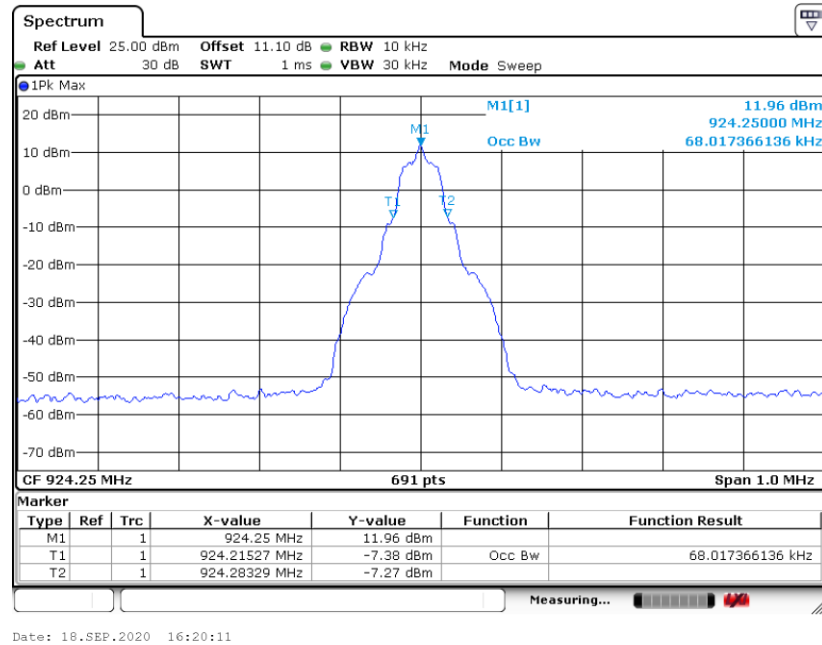
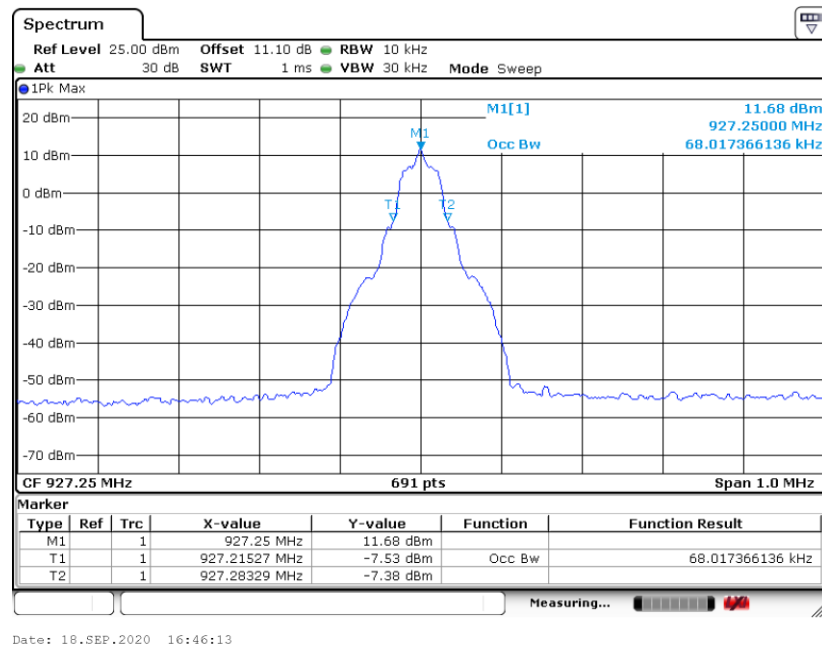
3.4.6 Test Result of 99% Occupied Bandwidth

Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

Mod.	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	Pass/Fail
UHF RFID	1	00	920.75	0.068	Pass
UHF RFID	1	07	924.25	0.068	Pass
UHF RFID	1	13	927.25	0.068	Pass

99% Occupied Bandwidth Plot on Channel 00



99% Occupied Bandwidth Plot on Channel 07

99% Occupied Bandwidth Plot on Channel 13


Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.5 Output Power Measurement

3.5.1 Limit of Output Power

Installed areas and the maximum peak output power limit:

- (A) For devices installed indoor or specific area: the maximum peak output power limit up to 1 W (inclusive).
- (B) For devices installed outdoor: the maximum peak output power limit up to 0.5 W (inclusive).

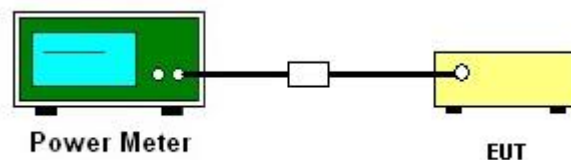
3.5.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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 Engineer :	Tommy Lee	Temperature :	23.7~24℃
		Relative Humidity :	53.7~54.2%

900 MHz Band														
Mod.	Freq. (MHz)	Peak Conducted Power (dBm)								DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail	Power Setting
		Port 0	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	SUM					
		Port 7	Port 8	Port 9	Port 10	Port 11	Port 12	Port 13						
RFID	920.75	11.57	11.72	11.67	11.76	11.73	11.20	11.75	23.13	12.50	35.63	36.00	Pass	110
		11.74	11.90	11.84	11.64	11.76	11.59	11.50						
RFID	924.25	11.28	11.54	11.58	11.71	11.58	11.07	11.60	23.05	12.50	35.55	36.00	Pass	110
		11.70	11.92	11.77	11.57	11.82	11.53	11.56						
RFID	927.25	11.40	11.55	11.50	11.78	11.51	11.14	11.50	23.03	12.50	35.53	36.00	Pass	110
		11.61	11.88	11.69	11.63	11.71	11.58	11.49						

900 MHz Band																			
Mod.	Freq. (MHz)	Duty Factor (dB)							Average Conducted Power (dBm)							DG (dBi)	EIRP Power (dBm)	Power Setting	
		Port 0	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 0	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	SUM	SUM		SUM
		Port 7	Port 8	Port 9	Port 10	Port 11	Port 12	Port 13	Port 7	Port 8	Port 9	Port 10	Port 11	Port 12	Port 13				
RFID	920.75	0.60	0.60	0.60	0.60	0.62	0.60	0.62	10.87	11.08	10.99	11.03	10.98	10.60	10.87	22.39	12.50	34.89	110
		0.60	0.60	0.60	0.60	0.60	0.60	0.60	11.11	11.17	11.10	10.93	10.67	10.78	10.83				
RFID	924.25	0.60	0.60	0.60	0.60	0.62	0.60	0.62	10.61	11.04	10.90	11.11	10.81	10.44	10.77	22.34	12.50	34.84	110
		0.60	0.60	0.60	0.60	0.60	0.60	0.60	10.92	11.39	10.90	10.88	10.90	10.76	10.84				
RFID	927.25	0.60	0.60	0.60	0.60	0.62	0.60	0.62	10.52	11.05	10.80	11.10	10.78	10.45	10.75	22.29	12.50	34.79	110
		0.60	0.60	0.60	0.60	0.60	0.60	0.60	10.81	11.07	10.99	10.90	10.77	10.83	10.72				

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power shall be attenuated at least 20 dB.

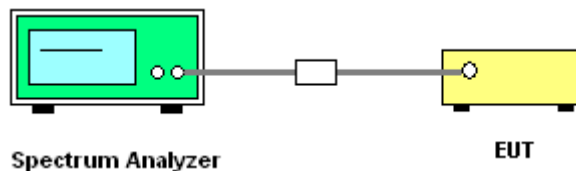
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz 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

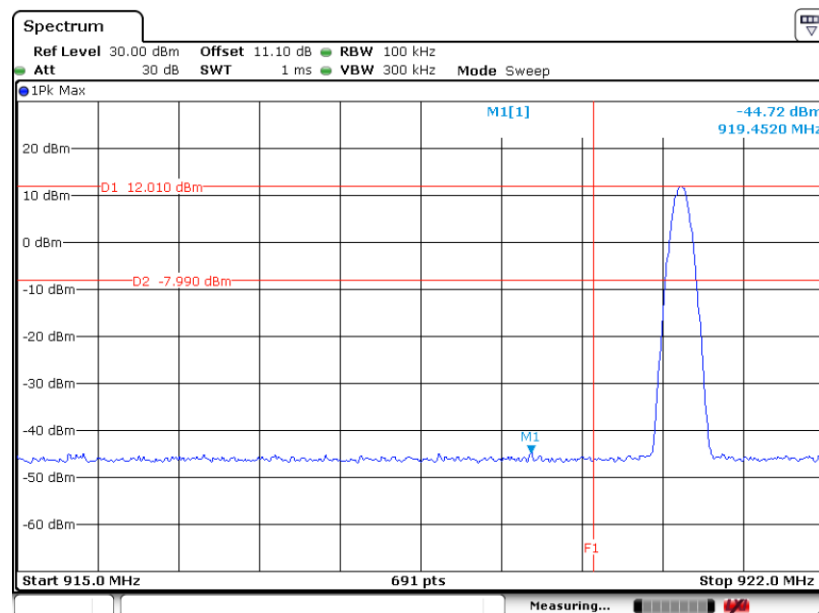




3.6.5 Test Result of Conducted Band Edges

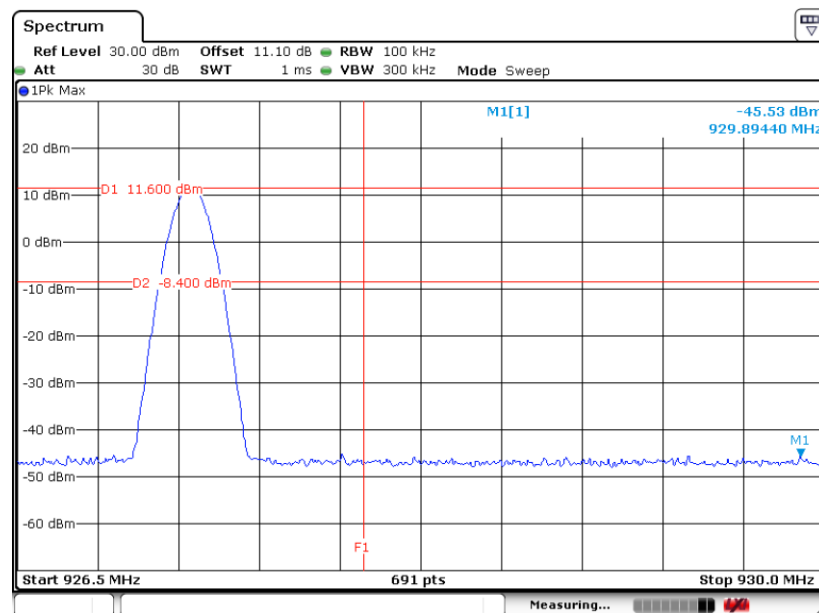
Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

Low Band Edge Plot on Channel 00



Date: 18.SEP.2020 18:47:29

High Band Edge Plot on Channel 13



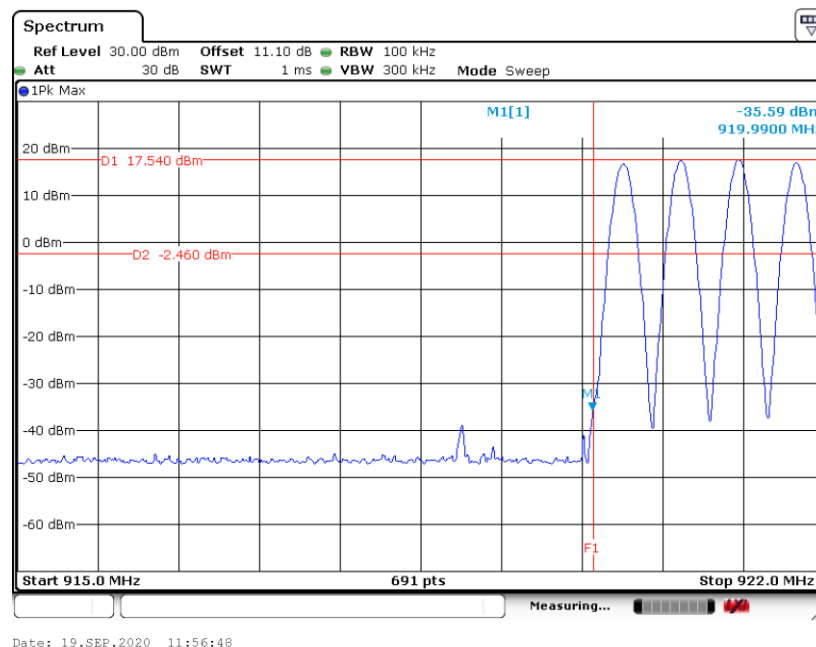
Date: 18.SEP.2020 18:03:54



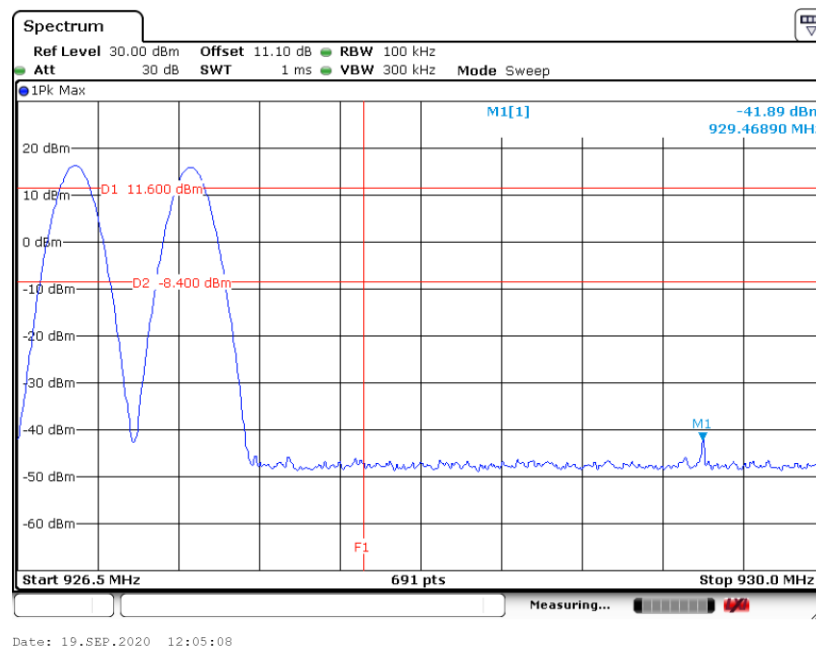
3.6.6 Test Result of Conducted Hopping Mode Band Edges

Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

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 frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power shall be attenuated at least 20 dB.

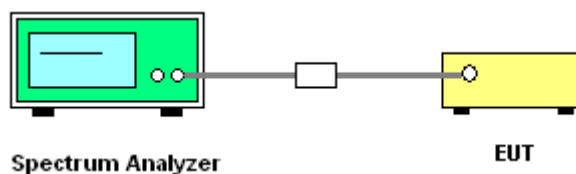
3.7.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs 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

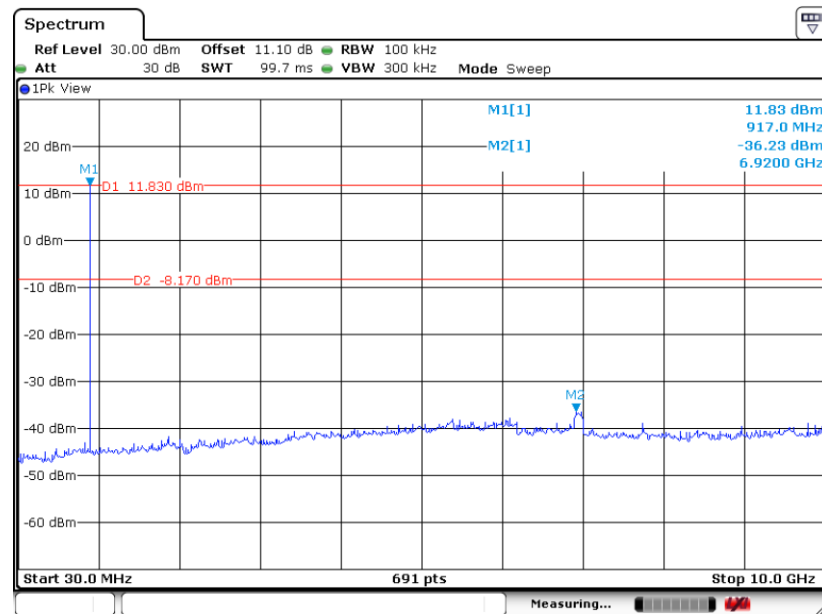




3.7.5 Test Result of Conducted Spurious Emission

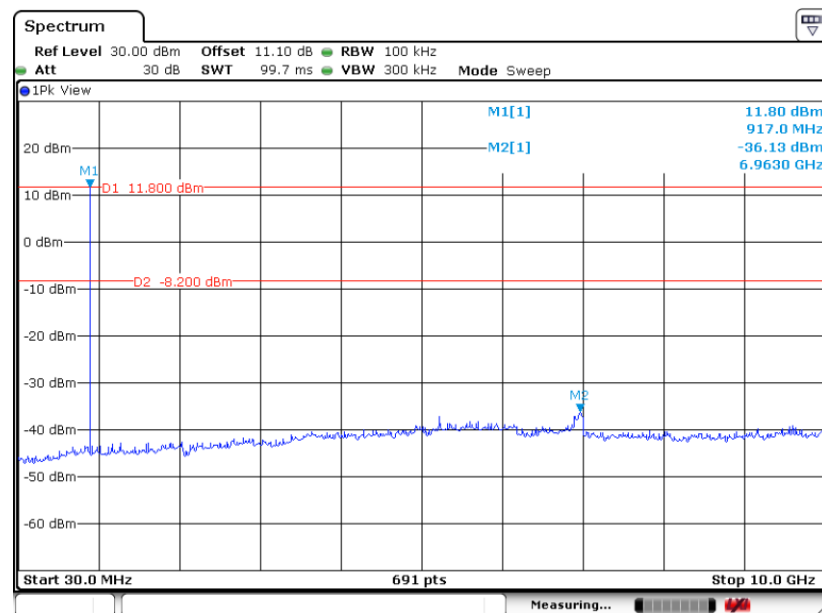
Test Engineer :	Tommy Lee	Temperature :	23.7~24°C
		Relative Humidity :	53.7~54.2%

CSE Plot on Ch 00 between 30MHz ~ 10 GHz



Date: 18.SEP.2020 19:09:36

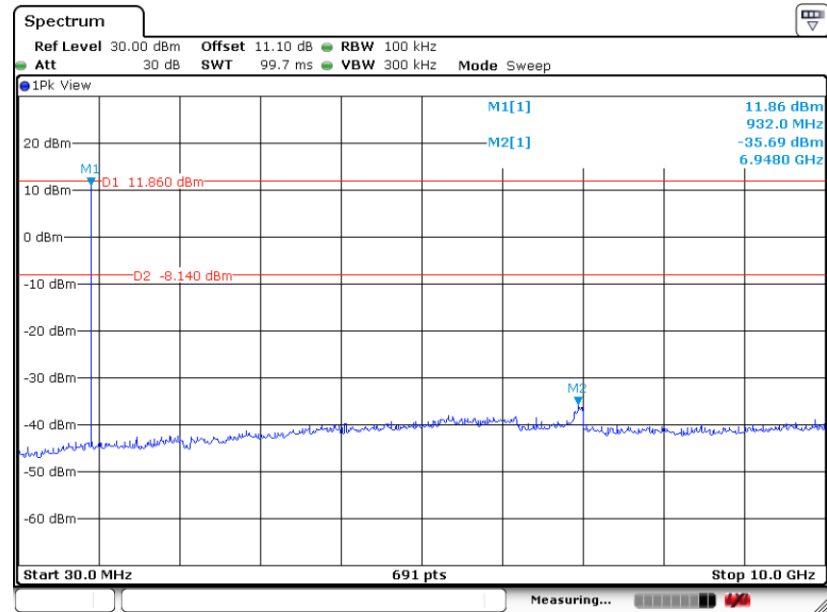
CSE Plot on Ch 07 between 30MHz ~ 10 GHz



Date: 18.SEP.2020 19:06:00



CSE Plot on Ch 13 between 30MHz ~ 10 GHz



Date: 18.SEP.2020 19:24:49

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 frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power shall be attenuated at least 20 dB and the measured RMS shall be 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, for radiated emissions that fall under Section 2.7 the restricted bands must also comply with the radiated emission limit specified in Section 2.8 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

See list of measuring equipment of this test report.

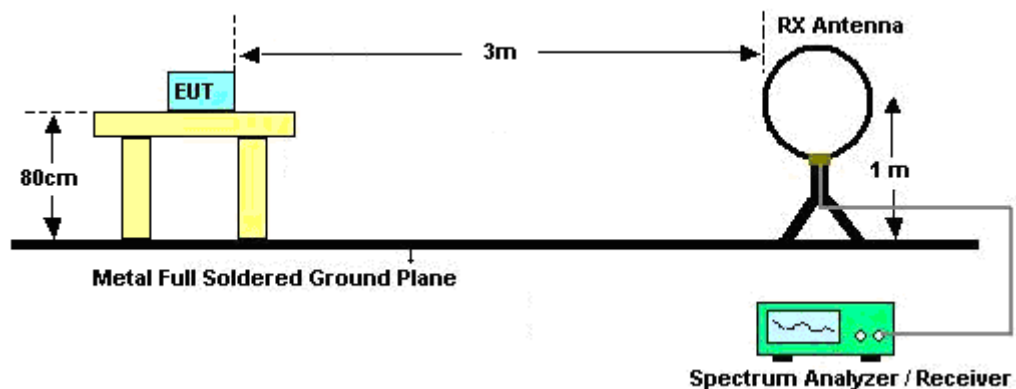
3.8.3 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.

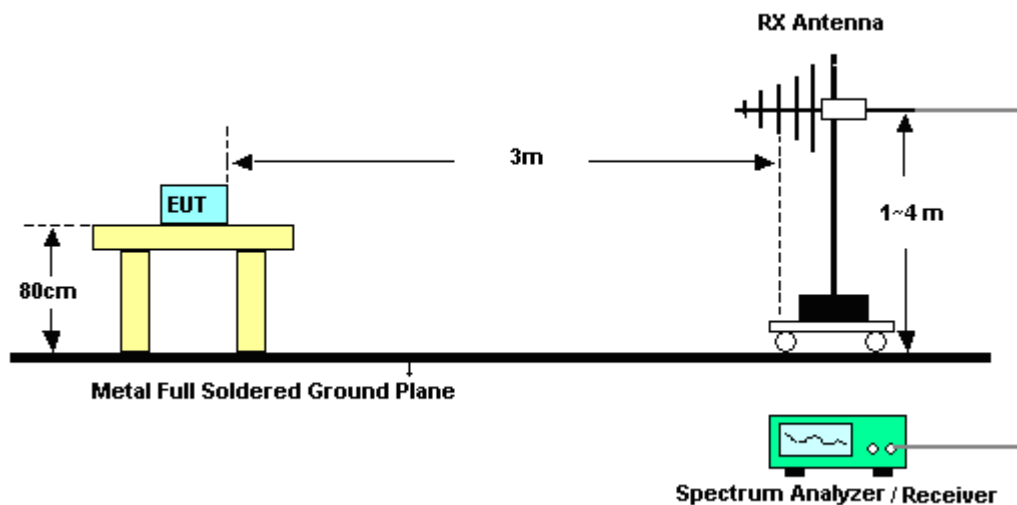
5. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
 Duty cycle = On time/100 milliseconds
 On time = $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$
 Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
 Average Emission Level = Peak Emission Level + $20 \cdot \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.8.4 Test Setup

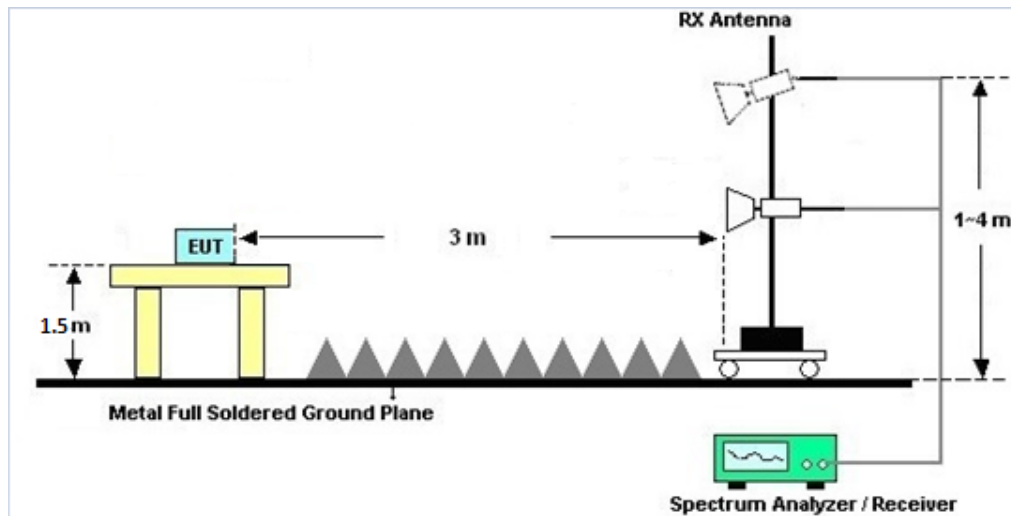
For radiated emissions below 30MHz



For radiated emissions 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 started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 5.13 was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came 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 Power Line Conducted Emissions 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 (dB μ V)	
	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.

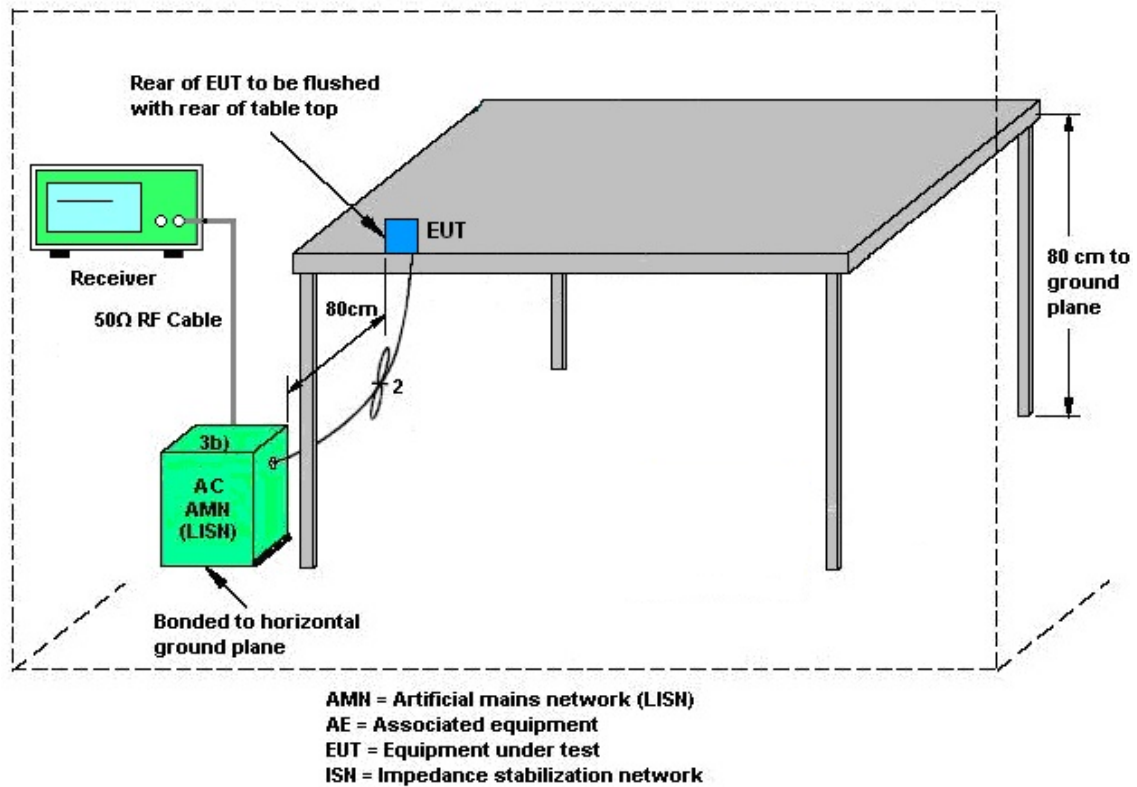
3.9.2 Measuring Instruments

See list of measuring equipment of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was 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 should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test setup



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 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 power limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

	DG	Power
	for	Limit
Ant.	Power	Reduction
(dBi)	(dBi)	(dB)
12.50	12.50	6.50

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

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. 04, 2018	Sep. 04, 2020~ Sep. 05, 2020	Dec. 03, 2019	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-0 6	35414&AT- N0602	30MHz~1GHz	Oct. 12, 2019	Sep. 04, 2020~ Sep. 05, 2020	Oct. 11, 2020	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-132 6	1GHz ~ 18GHz	Nov. 04, 2019	Sep. 04, 2020~ Sep. 05, 2020	Nov. 03, 2020	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jul. 14, 2020	Sep. 04, 2020~ Sep. 05, 2020	Jul. 13, 2021	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY532700 80	1GHz~26.5GHz	Nov. 14, 2018	Sep. 04, 2020~ Sep. 05, 2020	Nov. 13, 2020	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY542004 86	10Hz ~ 44GHz	Oct. 28, 2019	Sep. 04, 2020~ Sep. 05, 2020	Oct. 27, 2020	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Sep. 04, 2020~ Sep. 05, 2020	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1~4m	N/A	Sep. 04, 2020~ Sep. 05, 2020	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Sep. 04, 2020~ Sep. 05, 2020	N/A	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03	171000180 0055007	1GHz~18GHz	Mar. 31, 2020	Sep. 04, 2020~ Sep. 05, 2020	Mar. 30, 2021	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	May 22, 2020	Sep. 04, 2020~ Sep. 05, 2020	May 21, 2021	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-00104 2	N/A	N/A	Sep. 04, 2020~ Sep. 05, 2020	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz-30MHz	Mar. 12, 2019	Sep. 04, 2020~ Sep. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 12, 2020	Sep. 04, 2020~ Sep. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	30M-18G	Mar. 12, 2020	Sep. 04, 2020~ Sep. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz-40GHz	Mar. 12, 2020	Sep. 04, 2020~ Sep. 05, 2020	Mar. 11, 2021	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN11	1.53GHz Low Pass Filter	Jul. 03, 2020	Sep. 04, 2020~ Sep. 05, 2020	Jul. 02, 2021	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-108 0-1200-15000 -60SS	SN2	1.2GHz High Pass Filter	Sep. 15, 2019	Sep. 04, 2020~ Sep. 05, 2020	Sep. 14, 2020	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTM-303B	TP161237	N/A	Oct. 25, 2019	Sep. 04, 2020~ Sep. 05, 2020	Oct. 24, 2020	Radiation (03CH11-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2020	Sep. 14, 2020~ Sep. 22, 2020	Mar. 01, 2021	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	1218006	N/A	Oct. 14, 2019	Sep. 14, 2020~ Sep. 22, 2020	Oct. 13, 2020	Conducted (TH05-HY)
Power Meter	Anritsu	MA2411B	1207363	300MHz~40GHz	Oct. 14, 2019	Sep. 14, 2020~ Sep. 22, 2020	Oct. 13, 2020	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 15, 2019	Sep. 14, 2020~ Sep. 21, 2020	Nov. 14, 2020	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2020	Sep. 14, 2020~ Sep. 22, 2020	Mar. 16, 2021	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Aug. 25, 2020	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 15, 2019	Aug. 25, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 07, 2019	Aug. 25, 2020	Nov. 06, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 20, 2019	Aug. 25, 2020	Nov. 19, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 15, 2019	Aug. 25, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Aug. 25, 2020	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2020	Aug. 25, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 02, 2020	Aug. 25, 2020	Jan. 01, 2021	Conduction (CO05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.3
---	-----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.4
---	-----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.2
---	-----

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.1
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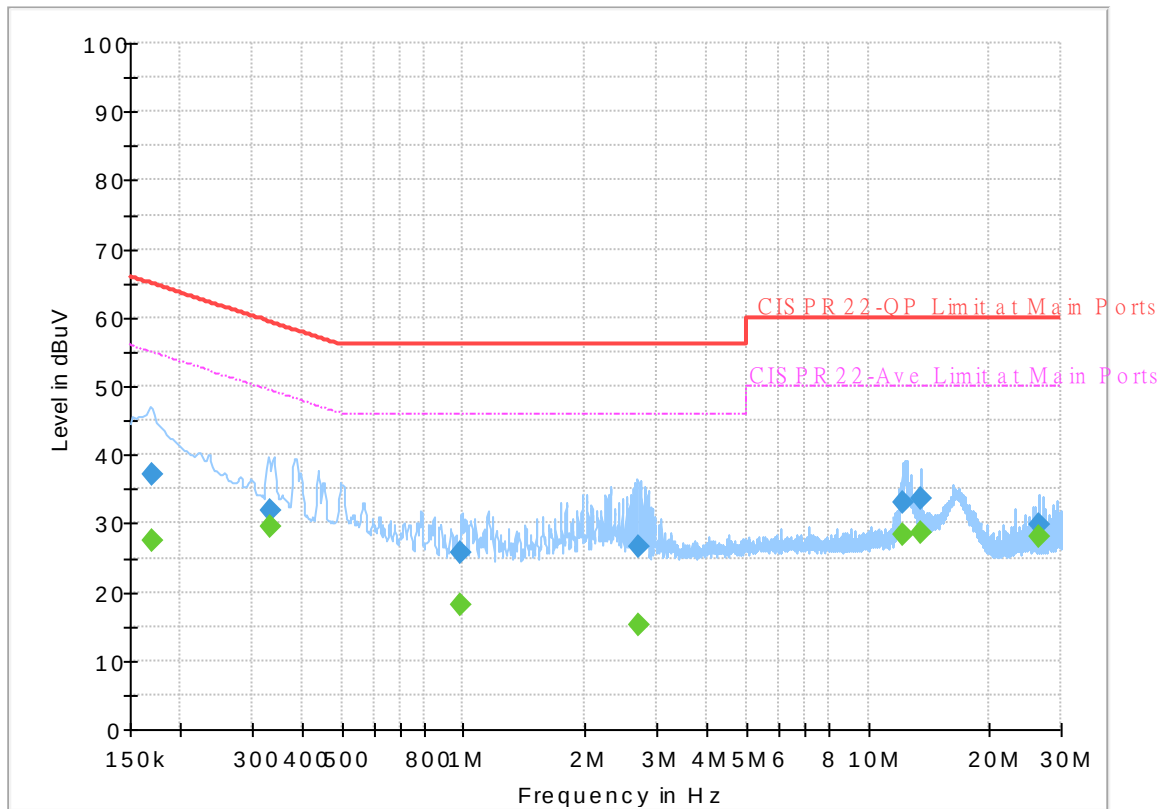
Appendix A. AC Conducted Emission Test Results

Test Engineer :	Howard Huang	Temperature :	21~25℃
		Relative Humidity :	40~42%

EUT Information

Report NO : 031015
Test Mode : Mode 1
Test Voltage : 110Vac/60Hz
Phase : Line

Full Spectrum



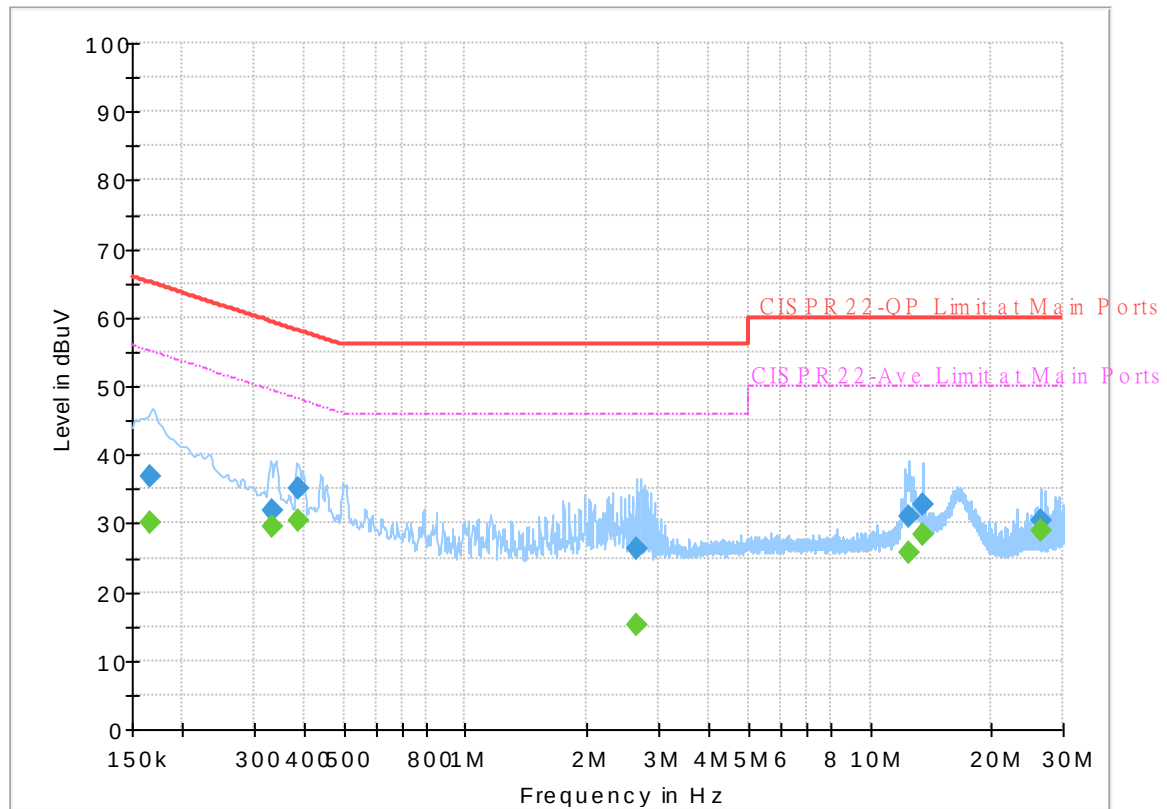
Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.169350	---	27.49	54.99	27.50	L1	OFF	19.5
0.169350	37.06	---	64.99	27.93	L1	OFF	19.5
0.334500	---	29.48	49.34	19.86	L1	OFF	19.5
0.334500	32.01	---	59.34	27.33	L1	OFF	19.5
0.988530	---	18.27	46.00	27.73	L1	OFF	19.5
0.988530	25.64	---	56.00	30.36	L1	OFF	19.5
2.696730	---	15.30	46.00	30.70	L1	OFF	19.6
2.696730	26.71	---	56.00	29.29	L1	OFF	19.6
12.196140	---	28.40	50.00	21.60	L1	OFF	19.8
12.196140	32.99	---	60.00	27.01	L1	OFF	19.8
13.560000	---	28.73	50.00	21.27	L1	OFF	19.8
13.560000	33.50	---	60.00	26.50	L1	OFF	19.8
26.486250	---	28.09	50.00	21.91	L1	OFF	19.8
26.486250	29.85	---	60.00	30.15	L1	OFF	19.8

EUT Information

Report NO : 031015
Test Mode : Mode 1
Test Voltage : 110Vac/60Hz
Phase : Neutral

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.166020	---	29.98	55.16	25.18	N	OFF	19.5
0.166020	36.81	---	65.16	28.35	N	OFF	19.5
0.334500	---	29.66	49.34	19.68	N	OFF	19.5
0.334500	32.01	---	59.34	27.33	N	OFF	19.5
0.386970	---	30.45	48.13	17.68	N	OFF	19.5
0.386970	35.05	---	58.13	23.08	N	OFF	19.5
2.643000	---	15.24	46.00	30.76	N	OFF	19.6
2.643000	26.42	---	56.00	29.58	N	OFF	19.6
12.501330	---	25.74	50.00	24.26	N	OFF	19.9
12.501330	30.94	---	60.00	29.06	N	OFF	19.9
13.560000	---	28.32	50.00	21.68	N	OFF	19.9
13.560000	32.77	---	60.00	27.23	N	OFF	19.9
26.608920	---	28.81	50.00	21.19	N	OFF	20.0
26.608920	30.50	---	60.00	29.50	N	OFF	20.0

Appendix B. Radiated Spurious Emission

Test Engineer :	Troye Hsieh	Temperature :	20.5~27.7°C
		Relative Humidity :	46.5~65.9%

920.75MHz RFID_Tx (30MHz ~ 1GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
920.75MHz		30	29.99	-10.01	40	27.62	24.15	10.64	32.42	-	-	P	H
		81.41	24.21	-15.79	40	32.03	13.43	11.19	32.44	-	-	P	H
		249.22	36.84	-9.16	46	39.56	17.45	12.23	32.4	-	-	P	H
		499.48	38.88	-7.12	46	34.93	23.64	13.09	32.78	-	-	P	H
		806	39.02	-6.98	46	29.2	27.98	13.97	32.13	-	-	P	H
		868.08	39.23	-6.77	46	27.88	29.05	14.17	31.87	100	0	P	H
	*	920.75	106.4	-	-	94.59	28.99	14.28	31.46	-	-	P	H
													H
													H
													H
													H
		30	29.47	-10.53	40	27.1	24.15	10.64	32.42	-	-	P	V
		67.83	33.56	-6.44	40	43.17	11.81	11.06	32.48	-	-	P	V
		174.53	27.69	-15.81	43.5	33.32	15.06	11.85	32.54	-	-	P	V
		268.62	33.56	-12.44	46	33.93	19.66	12.3	32.33	-	-	P	V
		499.48	38.51	-7.49	46	34.56	23.64	13.09	32.78	100	340	Q	V
		864.2	39.28	-6.72	46	27.97	29.02	14.17	31.88	-	-	P	V
	*	920.75	106.4	-	-	94.59	28.99	14.28	31.46	-	-	P	V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

**920.75MHz RFID _Tx (1GHz ~ 10GHz @ 3m)**

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
920.75MHz		2762.25	39.85	-34.15	74	64.79	27.67	8.21	60.82	100	0	P	H
		3683	46.34	-27.66	74	67.87	29.03	9.23	59.79	100	0	P	H
													H
													H
													H
													H
													H
		2762.25	41.99	-32.01	74	66.93	27.67	8.21	60.82	100	0	P	V
		3683	48.21	-25.79	74	69.74	29.03	9.23	59.79	100	0	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



924.25MHz RFID _Tx (30MHz ~ 1GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
924.25MHz		30	29.85	-10.15	40	27.48	24.15	10.64	32.42	-	-	P	H
		42.61	24.56	-15.44	40	28.32	17.91	10.82	32.49	-	-	P	H
		67.83	24.15	-15.85	40	33.76	11.81	11.06	32.48	-	-	P	H
		249.22	36.34	-9.66	46	39.06	17.45	12.23	32.4	-	-	P	H
		499.48	38.88	-7.12	46	34.93	23.64	13.09	32.78	-	-	P	H
		893.3	39.93	-6.07	46	28.5	28.97	14.22	31.76	100	0	P	H
	*	924.25	106.52	-	-	94.62	29.03	14.28	31.41	-	-	P	H
													H
													H
													H
													H
													H
		30	29.67	-10.33	40	27.3	24.15	10.64	32.42	-	-	P	V
		68.8	33.43	-6.57	40	42.95	11.89	11.07	32.48	-	-	P	V
		268.62	36	-10	46	36.37	19.66	12.3	32.33	-	-	P	V
		499.48	38.7	-7.3	46	34.75	23.64	13.09	32.78	100	342	Q	V
		517.91	38.03	-7.97	46	33.78	23.82	13.17	32.74	-	-	P	V
		806	39.93	-6.07	46	30.11	27.98	13.97	32.13	-	-	P	V
	*	924.25	106.52	-	-	94.62	29.03	14.28	31.41	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



924.25MHz RFID _Tx (1GHz ~ 10GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
924.25MHz		2772.75	40.42	-33.58	74	65.24	27.74	8.22	60.78	100	0	P	H
		3697	46.04	-27.96	74	67.54	29.01	9.25	59.76	100	0	P	H
													H
													H
													H
													H
													H
		2772.75	41.35	-32.65	74	66.17	27.74	8.22	60.78	100	0	P	V
		3697	49.88	-24.12	74	71.38	29.01	9.25	59.76	100	0	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



927.25MHz RFID _Tx (30MHz ~ 1GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
927.25MHz		30.97	29.29	-10.71	40	27.19	23.86	10.66	32.42	-	-	P	H
		47.46	24.25	-15.75	40	30.77	15.13	10.87	32.52	-	-	P	H
		70.74	28.1	-11.9	40	37.34	12.14	11.09	32.47	-	-	P	H
		268.62	38.52	-7.48	46	38.89	19.66	12.3	32.33	-	-	P	H
		499.48	39.17	-6.83	46	35.22	23.64	13.09	32.78	-	-	P	H
		851.59	39.5	-6.5	46	28.47	28.83	14.14	31.94	100	0	P	H
	*	927.25	106.57	-	-	94.56	29.08	14.3	31.37	-	-	P	H
													H
													H
													H
													H
													H
		30	30.68	-9.32	40	28.31	24.15	10.64	32.42	-	-	P	V
		46.49	30.32	-9.68	40	36.15	15.83	10.86	32.52	-	-	P	V
		81.41	31.05	-8.95	40	38.87	13.43	11.19	32.44	-	-	P	V
		499.48	38.69	-7.31	46	34.74	23.64	13.09	32.78	100	344	Q	V
		866.14	39.12	-6.88	46	27.8	29.03	14.17	31.88	-	-	P	V
	*	927.25	106.58	-	-	94.57	29.08	14.3	31.37	-	-	P	V
		957.32	39.55	-6.45	46	25.66	30.51	14.35	30.97	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



927.25MHz RFID _Tx (1GHz ~ 10GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
927.25MHz		2781.75	39.17	-34.83	74	63.88	27.79	8.24	60.74	100	0	P	H
		3709	44.67	-29.33	74	66.11	29.02	9.28	59.74	100	0	P	H
													H
													H
													H
													H
		2781.75	41.51	-32.49	74	66.22	27.79	8.24	60.74	100	0	P	V
		3709	49.51	-24.49	74	70.95	29.02	9.28	59.74	100	0	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



RFID _Rx (30MHz ~ 1GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Rx		30	20.8	-19.2	40	28.31	24.15	0.76	32.42	-	-	P	H
		35.82	18.7	-21.3	40	29.01	21.29	0.85	32.45	-	-	P	H
		131.85	20.79	-22.71	43.5	34.27	17.33	1.64	32.45	-	-	P	H
		499.48	37.09	-8.91	46	43.03	23.64	3.2	32.78	-	-	P	H
		748.77	35.72	-10.28	46	36.04	27.73	3.96	32.01	-	-	P	H
		915.61	39.22	-6.78	46	37.5	28.9	4.34	31.52	100	0	P	H
													H
													H
													H
													H
													H
													H
		48.43	25.67	-14.33	40	42.52	14.67	1.01	32.53	-	-	P	V
		81.41	22.34	-17.66	40	40.04	13.43	1.31	32.44	-	-	P	V
		132.82	26.42	-17.08	43.5	39.83	17.39	1.65	32.45	-	-	P	V
		499.48	39.36	-6.64	46	45.3	23.64	3.2	32.78	100	0	P	V
		748.77	34.93	-11.07	46	35.25	27.73	3.96	32.01	-	-	P	V
		915.61	38.75	-7.25	46	37.03	28.9	4.34	31.52	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



RFID _Rx (1GHz ~ 10GHz @ 3m)

ANT	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Rx		3664	46.1	-27.9	74	67.65	29.07	9.2	59.82	100	0	P	H
													H
													H
													H
													H
													H
		3664	47.82	-26.18	74	69.37	29.07	9.2	59.82	100	0	P	V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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.
QP/P/A	Quasi Peak or Peak or Average
H/V	H orizontal or V ertical

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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable 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) + Cable 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)

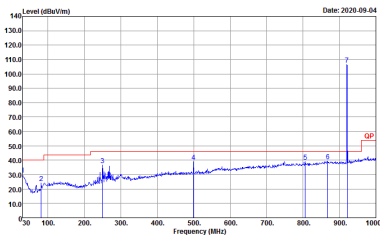
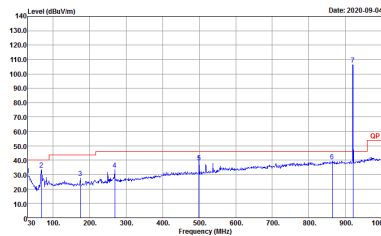
Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix C. Radiated Spurious Emission Plots

Test Engineer :	Troye Hsieh	Temperature :	20.5~27.7°C
		Relative Humidity :	46.5~65.9%

920.75MHz RFID_Tx (30MHz ~ 1GHz @ 3m)

ANT	902.75MHz UHF RFID (30MHz ~ 1GHz @ 3m)	
	RFID 920.75 MHz	
	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m 81-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 031015 ramp : 170	 Site : 03CH11-HY Condition : QP 3m 81-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 031015 ramp : 170

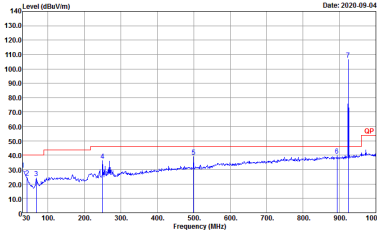
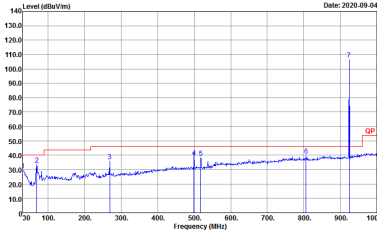


920.75MHz RFID_Tx (1GHz ~ 10GHz @ 3m)

ANT	920.75MHz RFID (1GHz ~ 10GHz @ 3m)	
	RFID 920.75 MHz	
	Horizontal	Vertical
Peak Avg.	Level (dBuV/m) Date: 2020-09-04 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 031015 ramp : 170	Level (dBuV/m) Date: 2020-09-04 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 031015 ramp : 170

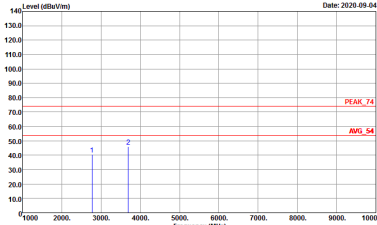
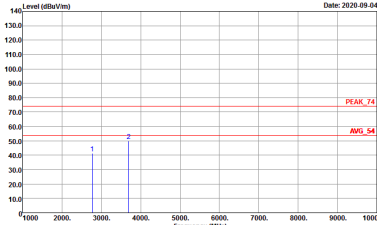


924.25MHz RFID_Tx (30MHz ~ 1GHz @ 3m)

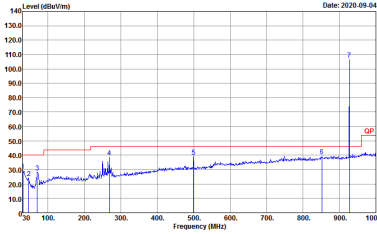
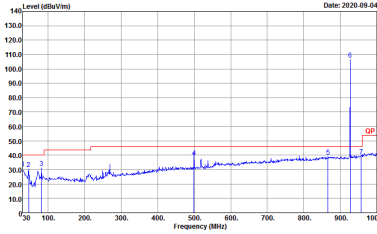
ANT	924.25MHz RFID (30MHz ~ 1GHz @ 3m)	
	RFID_Tx 924.25 MHz	
	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : QP 3m BT-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 031015 ramp : 170	 Site : 03CH11-HY Condition : QP 3m BT-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 031015 ramp : 170



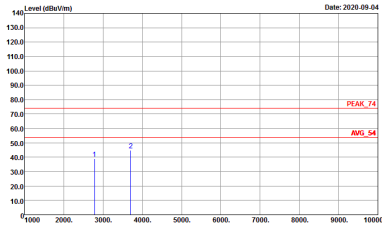
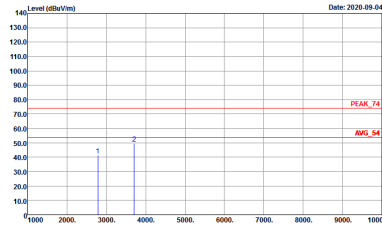
924.25MHz RFID_Tx (1GHz ~ 10GHz @ 3m)

ANT	924.25MHz RFID (1GHz ~ 10GHz @ 3m)	
	RFID 924.25 MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 031015 ramp : 170	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 031015 ramp : 170

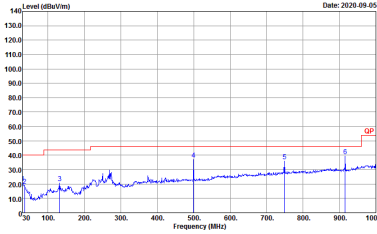
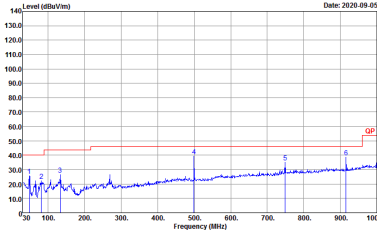
927.25MHz RFID_Tx (30MHz ~ 1GHz @ 3m)

ANT	927.25MHz RFID (30MHz ~ 1GHz @ 3m)	
	RFID 927.25 MHz	
	Horizontal	Vertical
QP / Peak	 Site : 03CHI1-HY Condition : QP 3m BT-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 031015 ramp : 170	 Site : 03CHI1-HY Condition : QP 3m BT-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 031015 ramp : 170

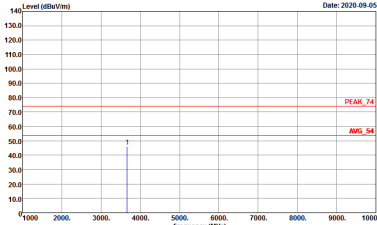
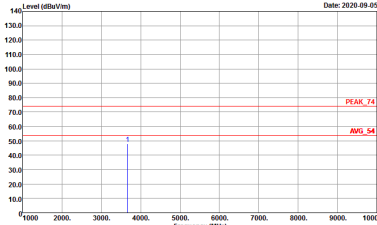
927.25MHz RFID_Tx (1GHz ~ 10GHz @ 3m)

ANT	927.25MHz RFID (1GHz ~ 10GHz @ 3m)	
	RFID 927.25 MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 031015 ramp : 170	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 031015 ramp : 170

RFID_Rx (30MHz ~ 1GHz @ 3m)

ANT	RFID (30MHz ~ 1GHz @ 3m)	
	RFID Rx	
	Horizontal	Vertical
QP / Peak	 Site : 03CHI1-HY Condition : QP 3m BT-LOG 6111D-LF_ETC HORIZONTAL Detector : Peak Project : 031015	 Site : 03CHI1-HY Condition : QP 3m BT-LOG 6111D-LF_ETC VERTICAL Detector : Peak Project : 031015

RFID_Rx (1GHz ~ 10GHz @ 3m)

ANT	RFID (1GHz ~ 10GHz @ 3m)	
	RFID Rx	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 031015	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 031015

Annex. A Receiver Radiated Emission Measurement

A.1 Limit of Receiver Radiated Emission

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

A.2 Measuring Instruments

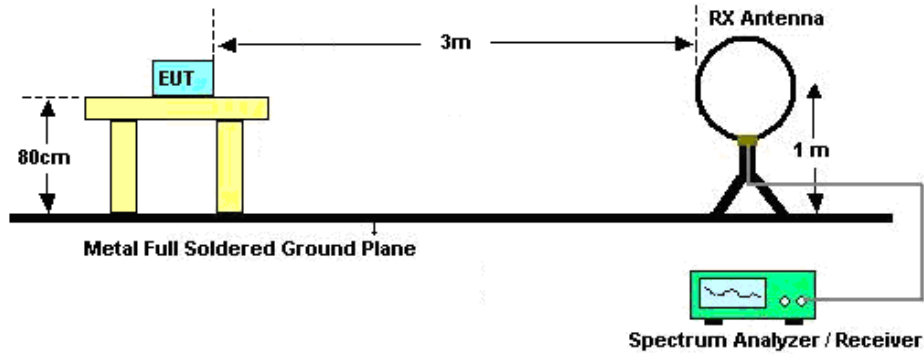
See list of measuring equipment of this test report.

A.3 Test Procedures

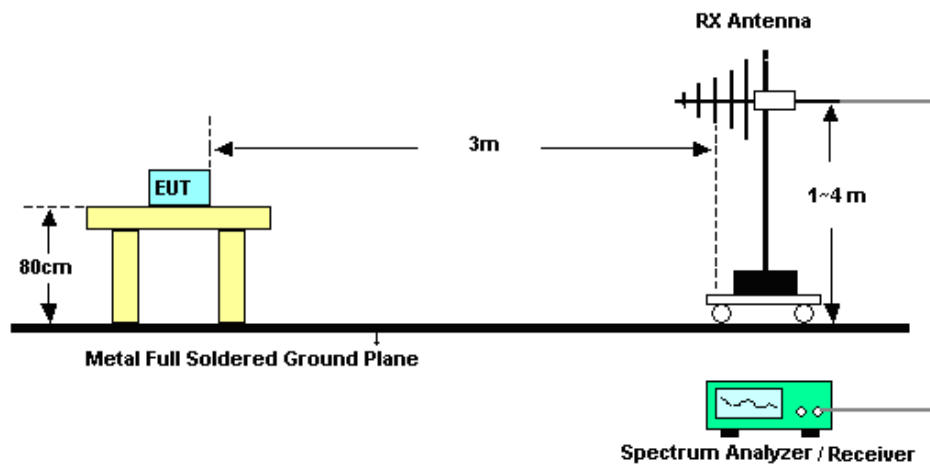
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, 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.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dBμV/m) = 20 log Emission level (μV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

A.4 Test Setup

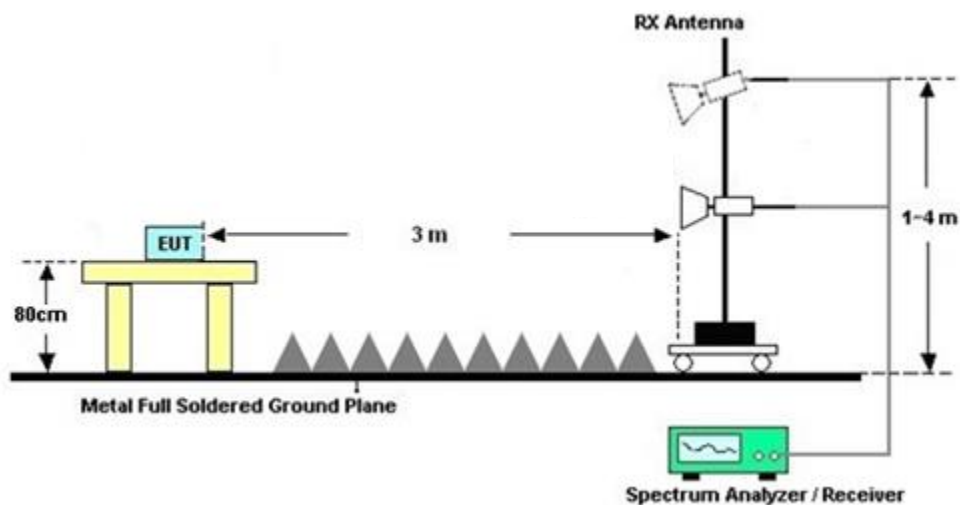
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

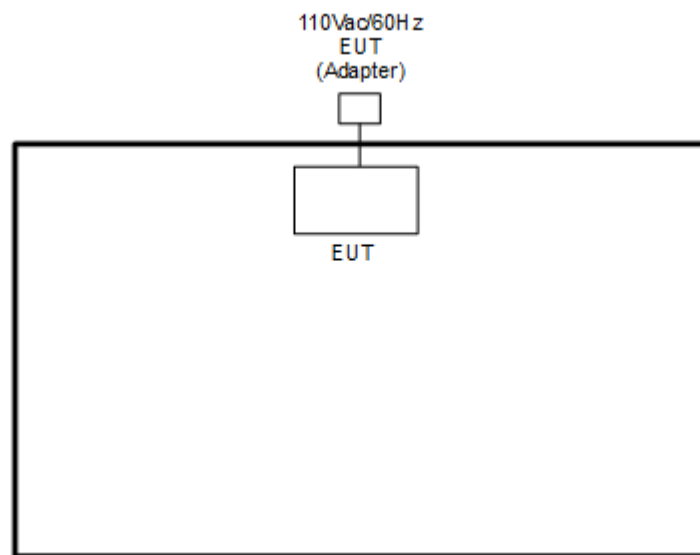


A.5 Test Result of Receiver Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 5.13 was not reported.

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

A.6 Connection Diagram of Test System





A.7 Test Result Results of Receiver Radiated Spurious Emissions

Test Engineer :	Troye Hsieh	Temperature :	20.5~27.7°C
		Relative Humidity :	46.5~65.9%
Frequency	499.480 MHz	Margin	Under 6.64 dB

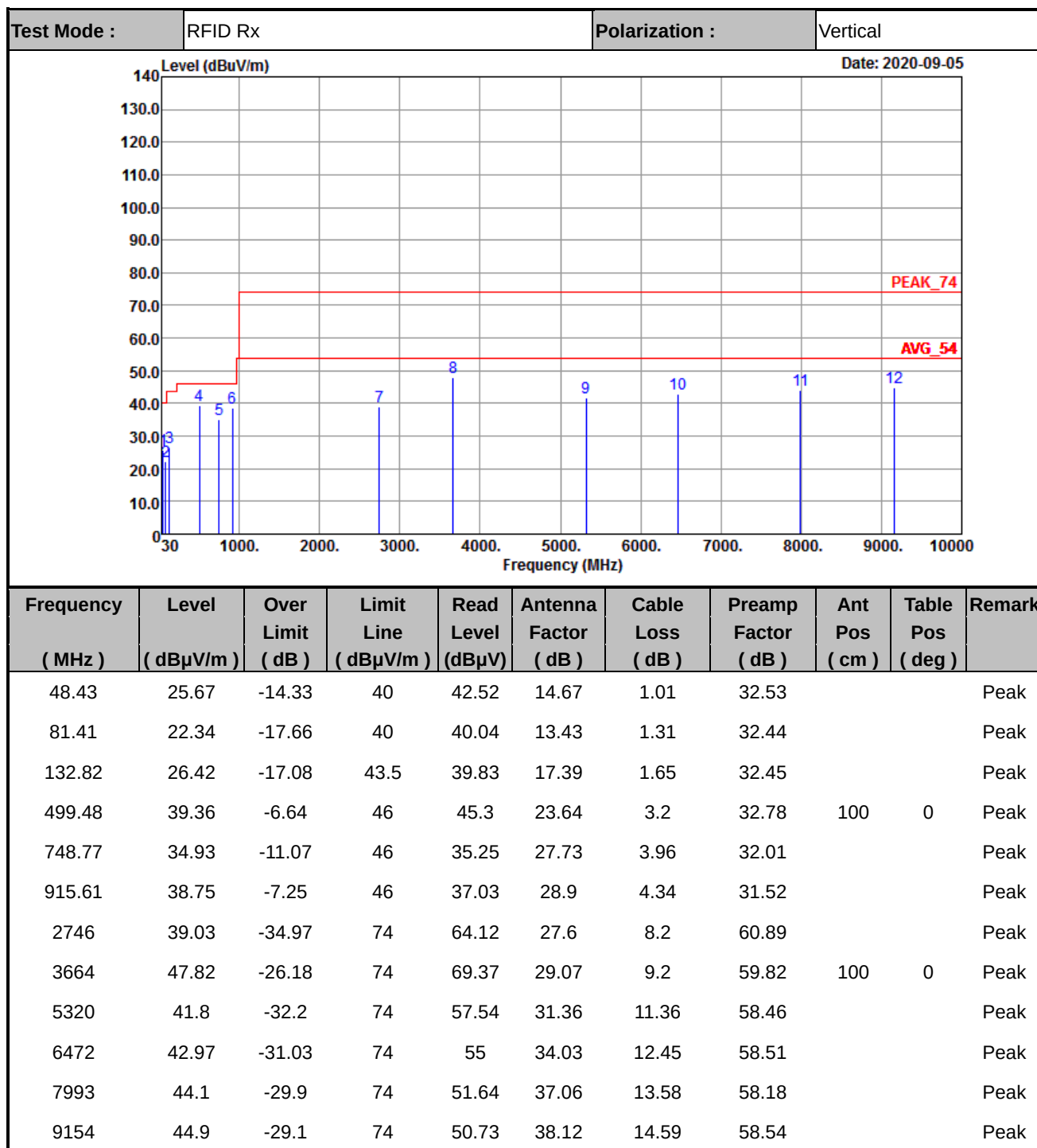
Test Mode :	RFID Rx	Polarization :	Horizontal
-------------	---------	----------------	------------

Level (dBuV/m)

Frequency (MHz)

Date: 2020-09-05

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
30	20.8	-19.2	40	28.31	24.15	0.76	32.42	-	-	Peak
35.82	18.7	-21.3	40	29.01	21.29	0.85	32.45	-	-	Peak
131.85	20.79	-22.71	43.5	34.27	17.33	1.64	32.45	-	-	Peak
499.48	37.09	-8.91	46	43.03	23.64	3.2	32.78	-	-	Peak
748.77	35.72	-10.28	46	36.04	27.73	3.96	32.01	-	-	Peak
915.61	39.22	-6.78	46	37.5	28.9	4.34	31.52	100	0	Peak
2854	38.68	-35.32	74	62.72	28.11	8.3	60.45	-	-	Peak
3664	46.1	-27.9	74	67.65	29.07	9.2	59.82	100	0	Peak
5122	42.16	-31.84	74	57.67	31.8	11.03	58.34	-	-	Peak
6373	43.39	-30.61	74	56.15	33.49	12.28	58.53	-	-	Peak
7939	44.19	-29.81	74	52.06	36.76	13.6	58.23	-	-	Peak
8938	45.06	-28.94	74	51.54	37.72	14.15	58.35	-	-	Peak


Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor= Level.

Annex. B Maximum Power Density

B.1 RF Exposure Limit Introduction

According to NCC LP0002, the criteria listed in Table shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §5.20.2.1 and §5.20.2.2.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

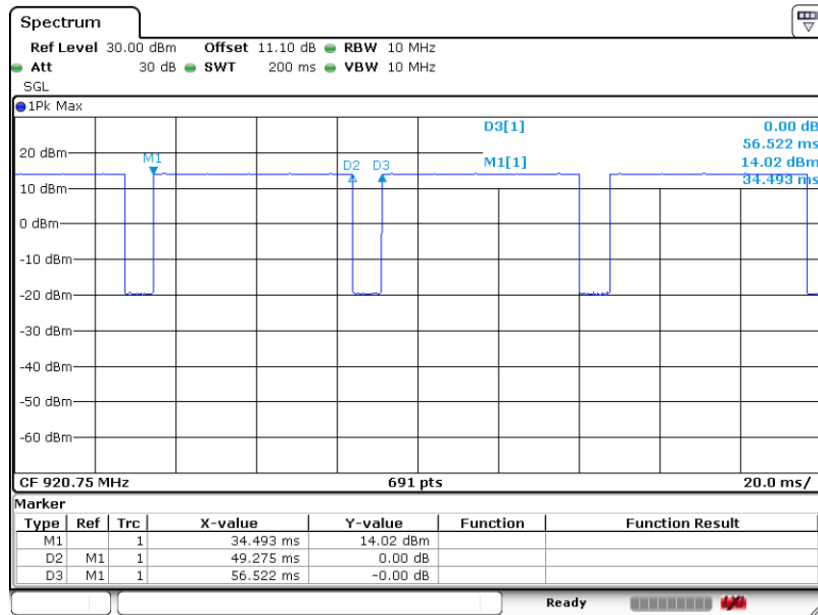
B.2 Standalone Power Density Calculation

Maximum Power Density				
Max. Power	Gain	EIRP	20 cm PSD	Limit
11.39	12.50	23.89	0.0487	0.614
dBm	dBi	dBm	mW/cm ²	mW/cm ²

Appendix D. Duty Cycle Plots

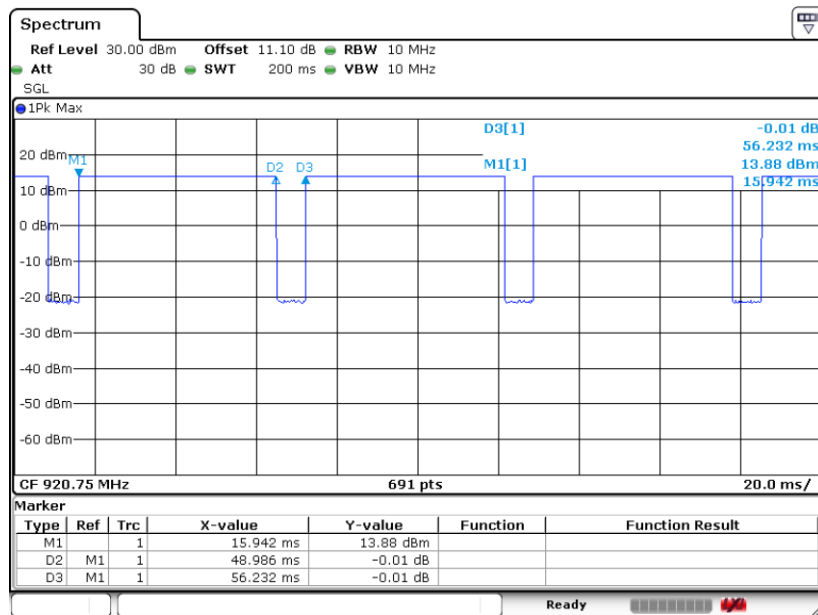
Port	Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
0	UHF RFID	87.18	49275	0.02	30Hz	0.60
1	UHF RFID	87.11	48986	0.02	30Hz	0.60
2	UHF RFID	87.18	49275	0.02	30Hz	0.60
3	UHF RFID	87.18	49275	0.02	30Hz	0.60
4	UHF RFID	86.67	48986	0.02	30Hz	0.62
5	UHF RFID	87.18	49275	0.02	30Hz	0.60
6	UHF RFID	86.67	48986	0.02	30Hz	0.62
7	UHF RFID	87.18	49275	0.02	30Hz	0.60
8	UHF RFID	87.18	49275	0.02	30Hz	0.60
9	UHF RFID	87.11	48986	0.02	30Hz	0.60
10	UHF RFID	87.18	49275	0.02	30Hz	0.60
11	UHF RFID	87.18	49275	0.02	30Hz	0.60
12	UHF RFID	87.11	48986	0.02	30Hz	0.60
13	UHF RFID	87.11	49275	0.02	30Hz	0.60

Port 0



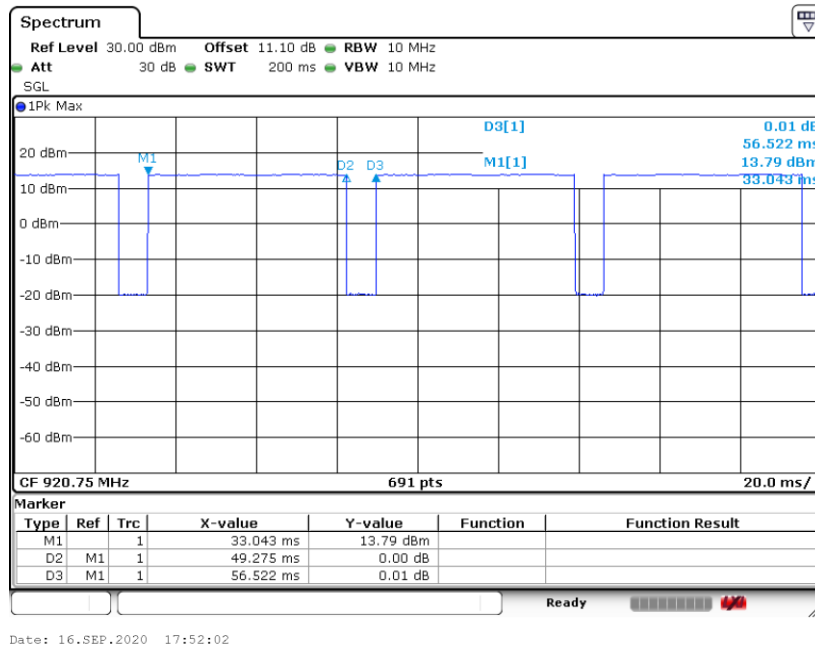
Date: 16.SEP.2020 17:48:03

Port 1

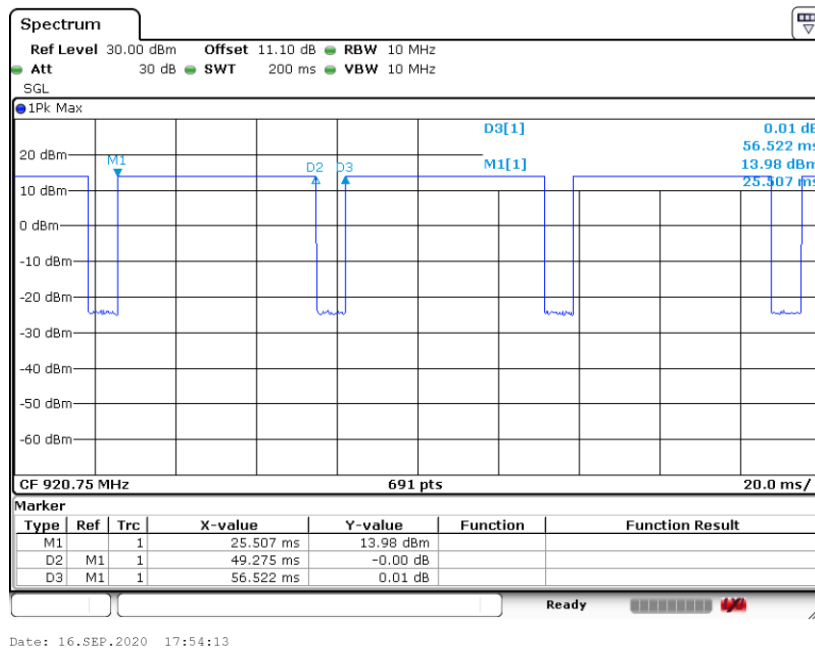


Date: 16.SEP.2020 17:49:28

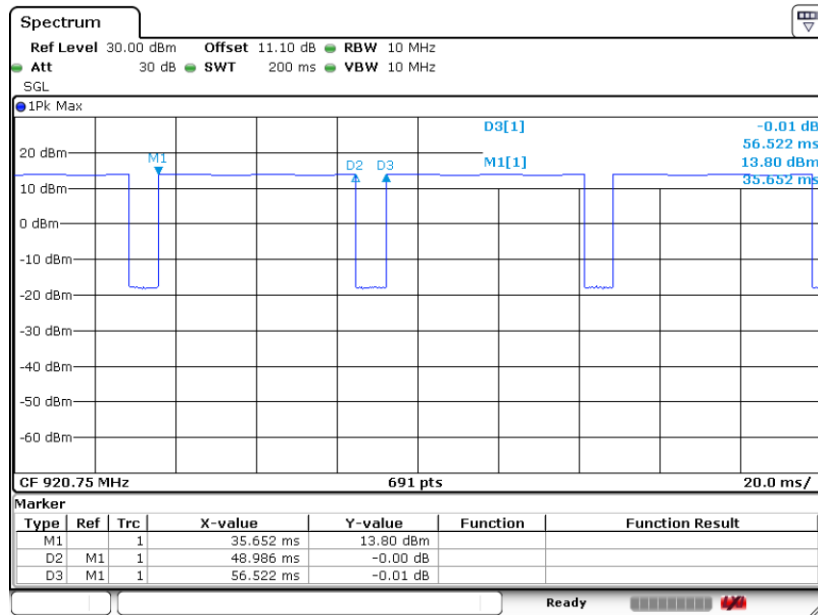
Port 2



Port 3

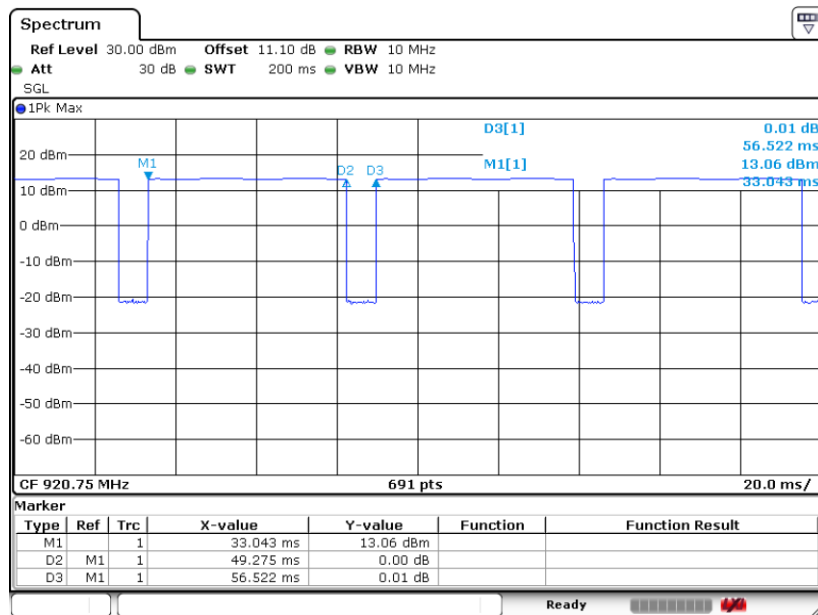


Port 4



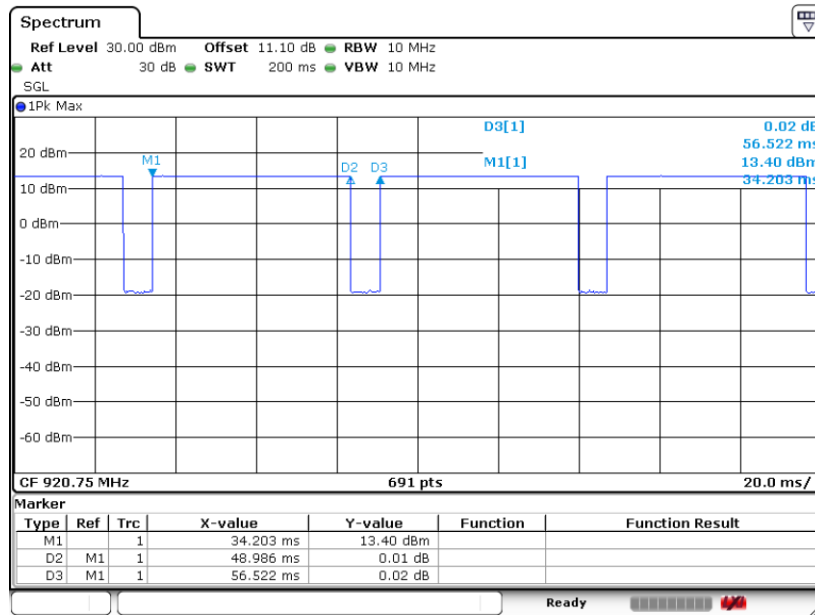
Date: 16.SEP.2020 18:01:29

Port 5



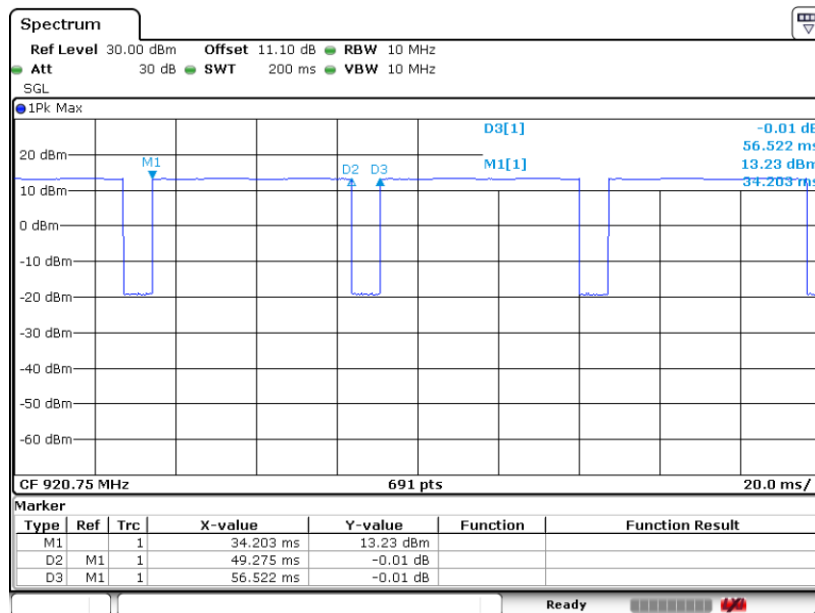
Date: 16.SEP.2020 20:37:31

Port 6



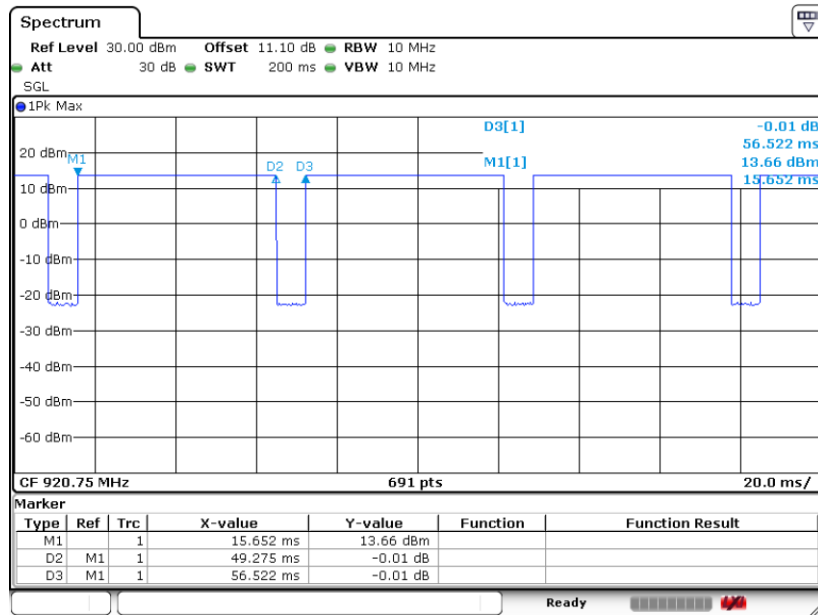
Date: 17.SEP.2020 15:43:08

Port 7



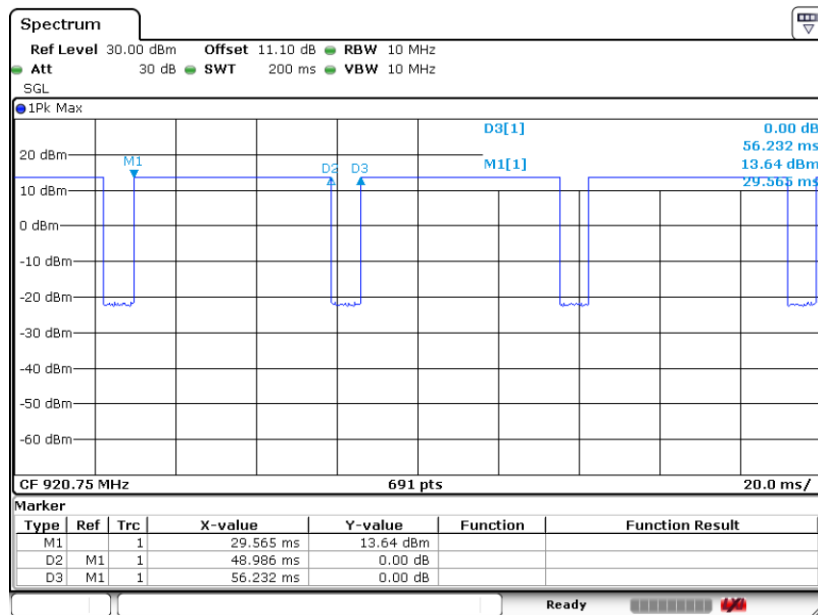
Date: 17.SEP.2020 15:48:55

Port 8



Date: 17.SEP.2020 15:51:00

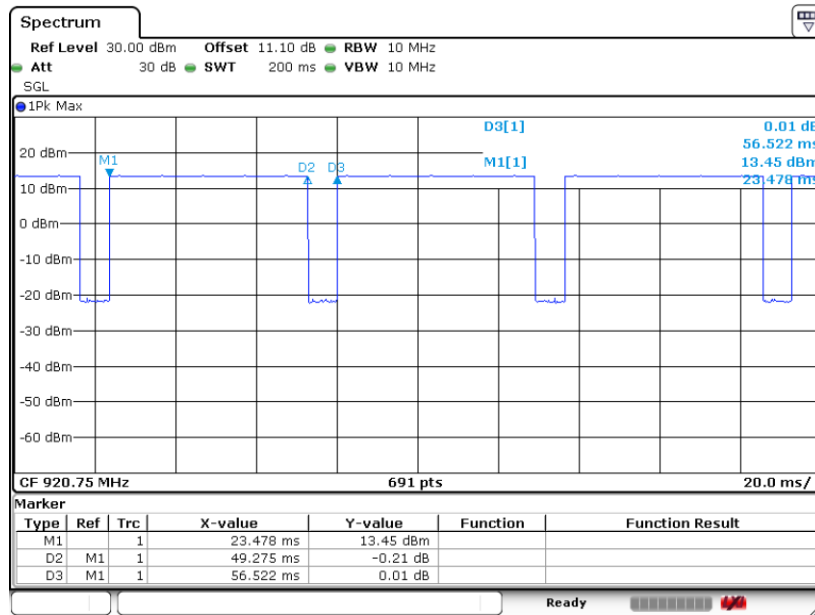
Port 9



Date: 17.SEP.2020 15:53:24

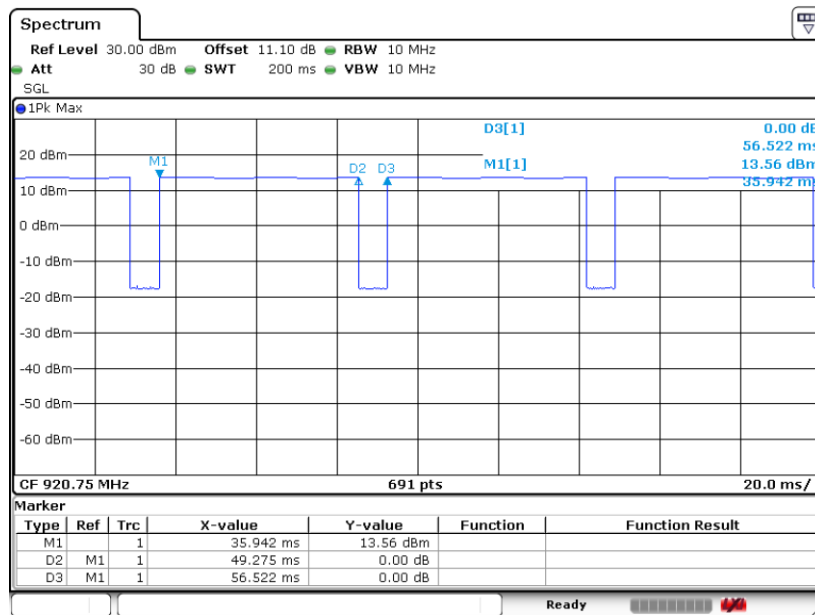


Port 10



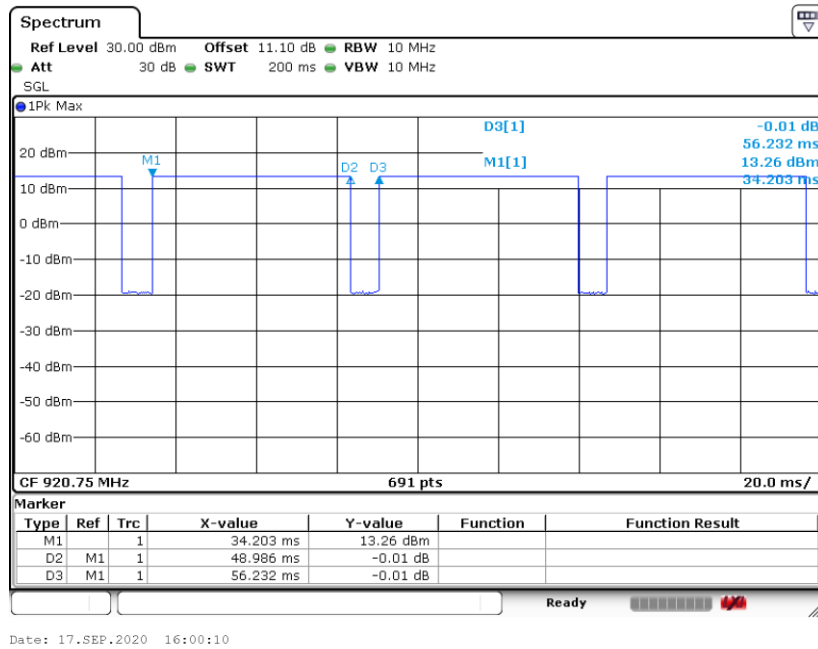
Date: 17.SEP.2020 15:57:01

Port 11



Date: 17.SEP.2020 15:58:43

Port 12



Port 13

