FCC Radio Test Report

FCC ID: 2AET8-TI4520

Report No.	:	TB-FCC153676
Applicant	:	GUANGZHOU TAIMA(TICODE) ELECTRONICS TECHNOLOGY LTD.
Equipment Under Test (EUT)		
EUT Name	:	Wireless 2D Barcode Scanner
Model No.	:	TI4520
Serial Model No.	:	Please see the page of 4
Brand Name	:	TICODE
Receipt Date	:	2017-04-12
Test Date	:	2017-04-13 to 2017-05-17
Issue Date	:	2017-05-18
Standards	:	FCC Part 15, Subpart C (15.231(a):2016)
Test Method	:	ANSI C63.10:2013
Conclusions	:	**PASS**

In the configuration tested, the EUT complied with the standards specified above,

The EUT technically complies with the FCC requirements

Test/Witness Engineer : Wan Su

Approved& Authorized :

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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Contents

1. General Information about EUT

1.1 Client Information

Applicant	:	GUANGZHOU TAIMA(TICODE) ELECTRONICS TECHNOLOGY LTD.
Address	:	NO.768, Shenzhou Road, Science City, Luogang Guangzhou, China
Manufacturer	:	GUANGZHOU TAIMA(TICODE) ELECTRONICS TECHNOLOGY LTD.
Address	:	NO.768, Shenzhou Road, Science City, Luogang Guangzhou, China

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	Wireless 2D Barcode Scanner	
Models No.	:	TI4520, TI4520AT, TI4520H, TI4520HAT, TI4120, TI4120AT, TI4120H, TI4120HAT, TI4125, TI4125AT, TI4125H, TI4125HAT, TI4126, TI4126AT, TI4126H, TI4126HAT	
Model Difference	:	All models are identical in the same PCB layout interior structure and electrical circuits, They are different in optical parameters and appearance.	
Product Description	:	Operation Frequency:	460MHz~469.5MHz
		Operation Channel:	96 Channels
		Out Power:	78.24 dBuV/m (PK Max.) 63.22 dBuV/m (AV Max.)
		Antenna Gain:	Integral Antenna(2 dBi)
		Channel Spacing	0.1MHz
		Modulation Type:	FSK
Power Supply	:	DC power by Li-ion battery.	
Power Rating	:	DC 3.7V by Li-ion Battery.	
Connecting I/O Port(S)	:	Please refer to the User's Manual	

Note:

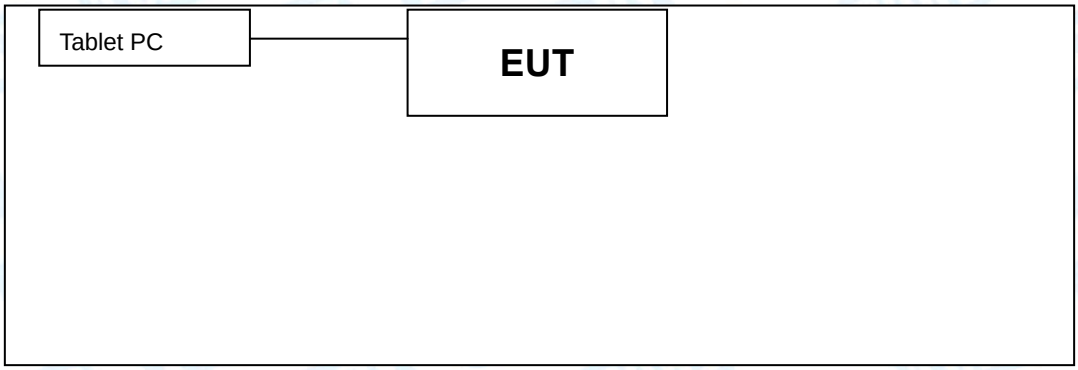
(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

(2) Channel List

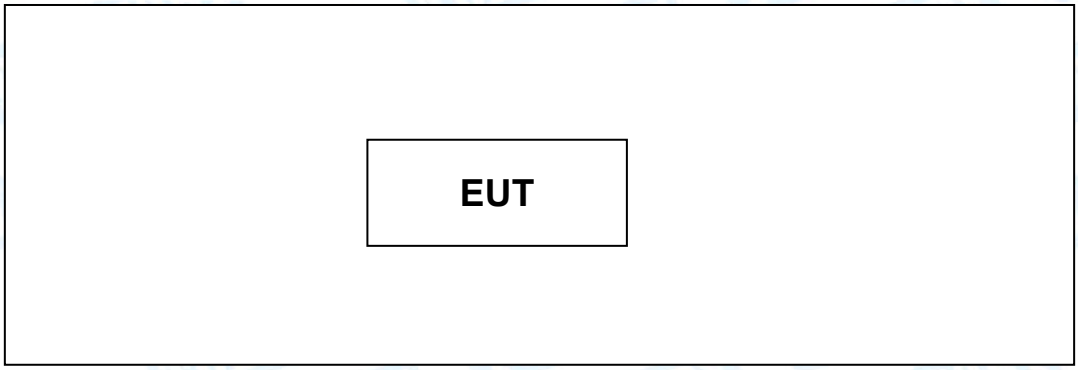
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	460	03	460.3	⋮	⋮
01	460.1	04	460.4		
02	460.2	05	460.5	90	469.5
Note: Operation Frequency 460MHz~469.5MHz has 96 Channels (460+(0.1*n)MHz (n=0~95))					

1.3 Block Diagram Showing the Configuration of System Tested

Charging Mode



TX Mode



1.4 Description of Support Units

Equipment Information				
Name	**Model**	**FCC ID/DOC**	**Manufacturer**	**Used "√"**
Tablet PC	TP60	-----	Thinkpad	√
Cable Information				
Number	**Shielded Type**	**Ferrite Core**	**Length**	**Note**
Cable 1	NO	NO	1.5M	

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

Test Items	Note
Conducted Emission	Charging Mode
Radiated Emission	Continuously transmitting
Bandwidth	Continuously transmitting
Duty Cycle	Continuously transmitting
Release Time	Normal Mode
Note: Only test Low and High Channel, CH00: 460MHz, CH95: 469.5MHz	

Note:

(1) During the testing procedure, the continuously transmitting mode was programmed by the customer.

(2) The EUT is considered a portable unit, and it was pre-tested on the positioned of each 3 axis: X axis, Y axis and Z axis. The worst case was found positioned on Z-plane. There for only the test data of this Z-plane were used for radiated emission measurement test.

1.6 Description of Test Software Setting

During testing channel& Power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of transmitting mode.

RF Power Setting in Test SW:	DEF

1.7 Measurement Uncertainty

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %.

Test Item	Parameters	Expanded Uncertainty (U_{Lab})
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	 ±3.42 dB ±3.42 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.40 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.8 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

FCC List No.: (811562)

The Laboratory is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 811562.

IC Registration No.: (11950A-1)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.

2. Test Summary

FCC Part 15 Subpart (15.231(a))/ RSS 210 Issue 8: Annex 1				
Standard Section		**Test Item**	**Judgment**	**Remark**
FCC	**IC**			
15.203		Antenna Requirement	PASS	**N/A**
15.207	RSS-GEN 8.8	Conducted Emission	PASS	**N/A**
15.231	RSS-210 Annex 1 RSS-GEN 8.9/8.10	Release Time	PASS	**N/A**
		Radiation Emission	PASS	**N/A**
		20 dB Bandwidth	PASS	**N/A**
		Duty Cycle	PASS	**N/A**
Note: N/A is an abbreviation for Not Applicable.				

3. Test Equipment

Conducted Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
EMI Test Receiver	Rohde & Schwarz	ESCI	100321	Jul. 22, 2016	Jul. 21, 2017
RF Switching Unit	Compliance Direction Systems Inc	RSU-A4	34403	Jul. 22, 2016	Jul. 21, 2017
AMN	SCHWARZBECK	NNBL 8226-2	8226-2/164	Jul. 22, 2016	Jul. 21, 2017
LISN	Rohde & Schwarz	ENV216	101131	Jul. 22, 2016	Jul. 21, 2017
Radiation Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 22, 2016	Jul. 21, 2017
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 22, 2016	Jul. 21, 2017
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.25, 2017	Mar. 24, 2018
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar.25, 2017	Mar. 24, 2018
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.24, 2017	Mar. 23, 2018
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar.24, 2017	Mar. 23, 2018
Loop Antenna	Laplace instrument	RF300	0701	Mar.24, 2017	Mar. 23, 2018
Pre-amplifier	Sonoma	310N	185903	Mar.25, 2017	Mar. 24, 2018
Pre-amplifier	HP	8449B	3008A00849	Mar.26, 2016	Mar. 25, 2017
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.26, 2016	Mar. 25, 2017
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 22, 2016	Jul. 21, 2017
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 22, 2016	Jul. 21, 2017
Power Meter	Anritsu	ML2495A	25406005	Jul. 22, 2016	Jul. 21, 2017
Power Sensor	Anritsu	ML2411B	25406005	Jul. 22, 2016	Jul. 21, 2017

4. Conducted Emission Test

4.1 Test Standard and Limit

4.1.1Test Standard

FCC 15.207/RSS Gen 8.8

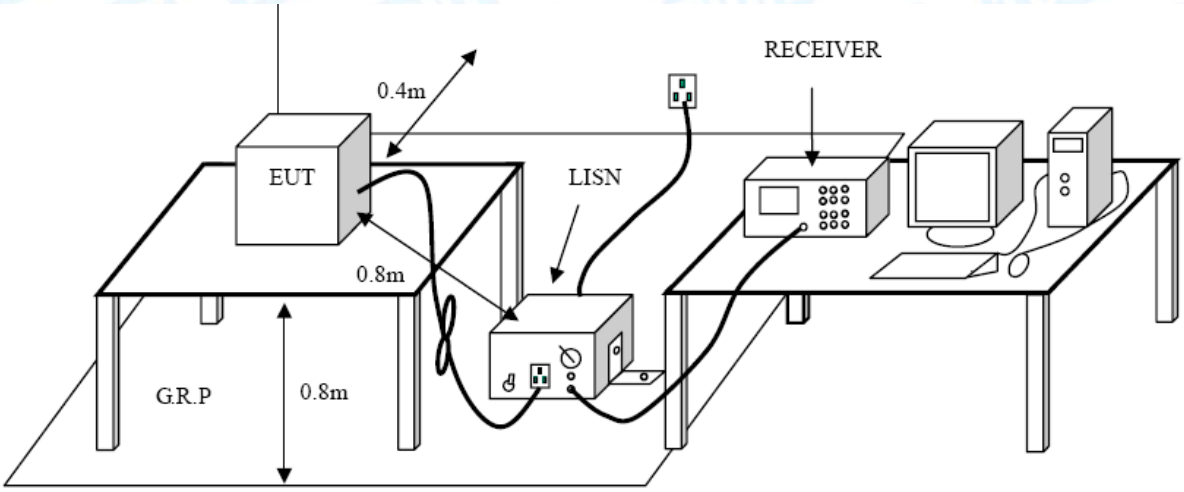
4.1.2 Test Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:
(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.
(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2 Test Setup



4.3 Test Procedure

The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

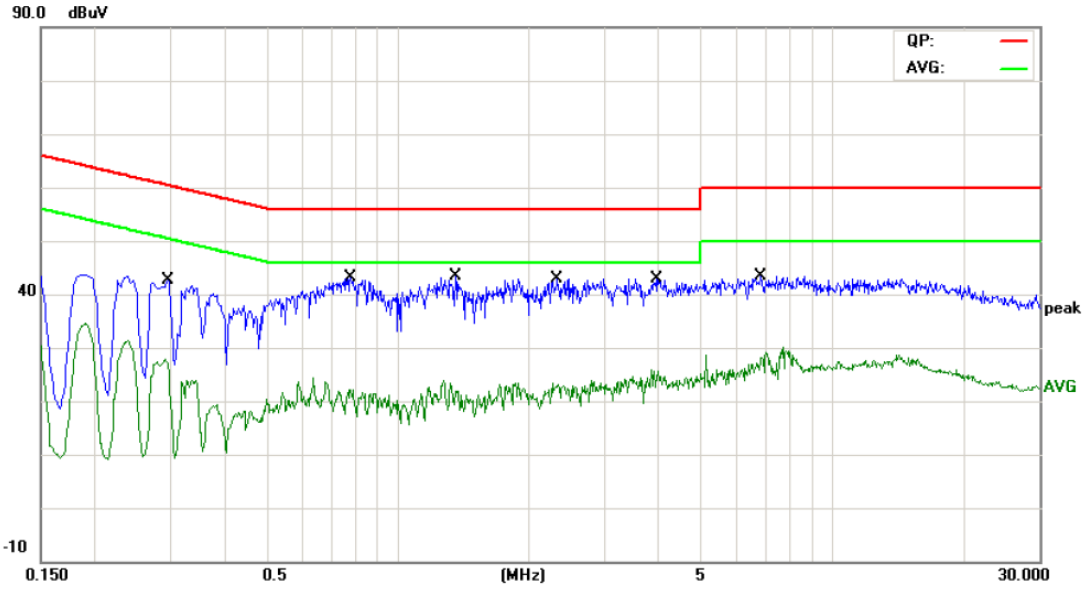
LISN at least 80 cm from nearest part of EUT chassis.

The bandwidth of EMI test receiver is set at 9kHz, and the test frequency band is from 0.15MHz to 30MHz.

4.4 Test Data

Please see the next page.

EUT:	Wireless 2D Barcode Scanner	Model Name :	TI4520
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60Hz		
Terminal:	Line		
Test Mode:	Charging Mode		
Remark:	Only worse case is reported		

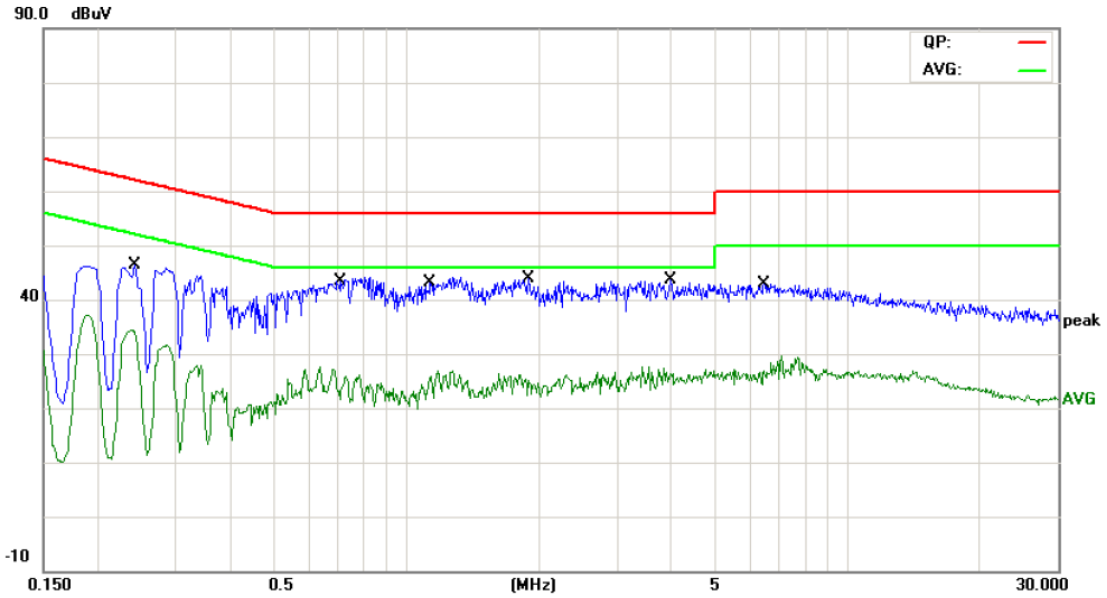


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2940	29.53	10.02	39.55	60.41	-20.86	QP
2		0.2940	17.75	10.02	27.77	50.41	-22.64	AVG
3		0.7780	29.91	10.10	40.01	56.00	-15.99	QP
4		0.7780	12.15	10.10	22.25	46.00	-23.75	AVG
5	*	1.3580	30.16	10.06	40.22	56.00	-15.78	QP
6		1.3580	13.88	10.06	23.94	46.00	-22.06	AVG
7		2.3300	28.19	10.05	38.24	56.00	-17.76	QP
8		2.3300	13.22	10.05	23.27	46.00	-22.73	AVG
9		3.9340	28.67	10.00	38.67	56.00	-17.33	QP
10		3.9340	15.79	10.00	25.79	46.00	-20.21	AVG
11		6.8500	29.61	10.05	39.66	60.00	-20.34	QP
12		6.8500	19.16	10.05	29.21	50.00	-20.79	AVG

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Wireless 2D Barcode Scanner	Model Name :	TI4520
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	AC 120V/60Hz		
Terminal:	Neutral		
Test Mode:	Charging Mode		
Remark:	Only worse case is reported		

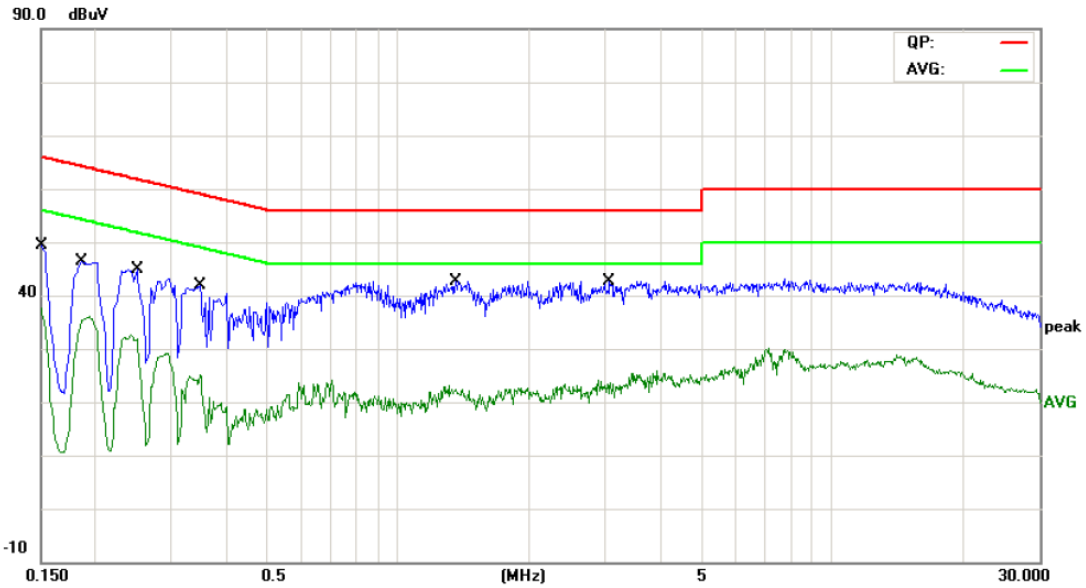


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2420	32.34	10.11	42.45	62.02	-19.57	QP
2		0.2420	24.20	10.11	34.31	52.02	-17.71	AVG
3		0.7100	29.67	10.02	39.69	56.00	-16.31	QP
4		0.7100	17.62	10.02	27.64	46.00	-18.36	AVG
5		1.1300	29.59	10.15	39.74	56.00	-16.26	QP
6		1.1300	16.73	10.15	26.88	46.00	-19.12	AVG
7	*	1.8940	30.04	10.07	40.11	56.00	-15.89	QP
8		1.8940	16.07	10.07	26.14	46.00	-19.86	AVG
9		3.9780	29.38	10.06	39.44	56.00	-16.56	QP
10		3.9780	17.27	10.06	27.33	46.00	-18.67	AVG
11		6.4780	28.20	10.06	38.26	60.00	-21.74	QP
12		6.4780	18.68	10.06	28.74	50.00	-21.26	AVG

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Wireless 2D Barcode Scanner	**Model Name :**	TI4520
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	AC 240V/60Hz		
Terminal:	Line		
Test Mode:	Charging Mode		
Remark:	Only worse case is reported		

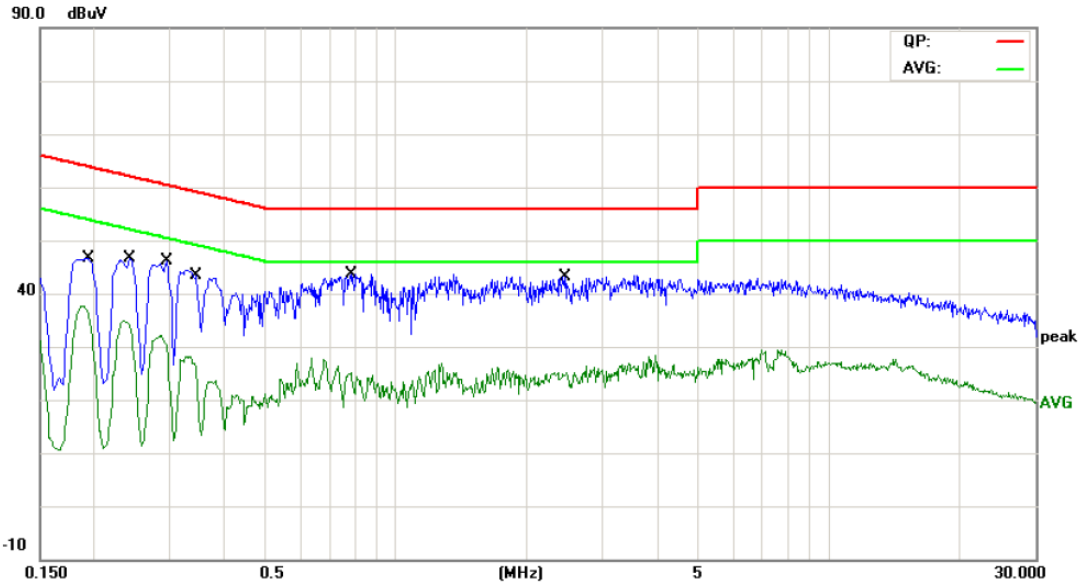


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1500	35.23	10.12	45.35	65.99	-20.64	QP
2		0.1500	27.56	10.12	37.68	55.99	-18.31	AVG
3		0.1860	33.18	10.12	43.30	64.21	-20.91	QP
4		0.1860	25.92	10.12	36.04	54.21	-18.17	AVG
5		0.2500	30.75	10.10	40.85	61.75	-20.90	QP
6		0.2500	22.47	10.10	32.57	51.75	-19.18	AVG
7		0.3500	27.57	10.07	37.64	58.96	-21.32	QP
8		0.3500	14.96	10.07	25.03	48.96	-23.93	AVG
9	*	1.3540	28.11	10.12	38.23	56.00	-17.77	QP
10		1.3540	13.06	10.12	23.18	46.00	-22.82	AVG
11		3.0700	28.11	10.06	38.17	56.00	-17.83	QP
12		3.0700	13.97	10.06	24.03	46.00	-21.97	AVG

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

EUT:	Wireless 2D Barcode Scanner	Model Name :	TI4520
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	AC 240V/60Hz		
Terminal:	Neutral		
Test Mode:	Charging Mode		
Remark:	Only worse case is reported		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1940	33.22	10.12	43.34	63.86	-20.52	QP
2		0.1940	27.41	10.12	37.53	53.86	-16.33	AVG
3		0.2420	33.01	10.11	43.12	62.02	-18.90	QP
4		0.2420	24.79	10.11	34.90	52.02	-17.12	AVG
5		0.2940	32.58	10.09	42.67	60.41	-17.74	QP
6		0.2940	22.01	10.09	32.10	50.41	-18.31	AVG
7		0.3460	29.51	10.07	39.58	59.06	-19.48	QP
8		0.3460	18.02	10.07	28.09	49.06	-20.97	AVG
9		0.7860	29.16	10.06	39.22	56.00	-16.78	QP
10		0.7860	16.37	10.06	26.43	46.00	-19.57	AVG
11	*	2.4539	29.66	10.06	39.72	56.00	-16.28	QP
12		2.4539	15.07	10.06	25.13	46.00	-20.87	AVG

*:Maximum data x:Over limit !:over margin

Emission Level= Read Level+ Correct Factor

5. Radiated Emission Test

5.1 Test Standard and Limit

5.1.1 Test Standard

FCC 15.231/RSS 210 Annex 1

5.1.2 Test Limit

According to FCC 15.231 Table A requirement:

In addition to the provisions of RSS Gen 8.9 and 8.10, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolt/meter) at 3m	Field Strength of Spurious Emissions (microvolt/meter) at 3m
40.66~40.70	2250	225
70~130	1250	125
130~174	1250 to 3750(**)	125 to 375(**)
174~260	3750	375
260~470	3750 to 12500(**)	375 to 1250(**)
Above 470	12500	1250

** Linear interpolations, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

(1) for the band 130~174 MHz, uV/m at 3 meters= 56.81818(F)-6136.3636;

(2) for the band 260~470 MHz, uV/m at 3 meter= 41.6667(F)-7083.3333.

(3) The maximum permitted unwanted emissions level is 20 dB below the maximum permitted fundamental level. In addition field strength of any emissions which appear inside of the restriction band shall not exceed the general radiated emissions limits in RSS Gen 8.9.

Frequency (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	2400/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3

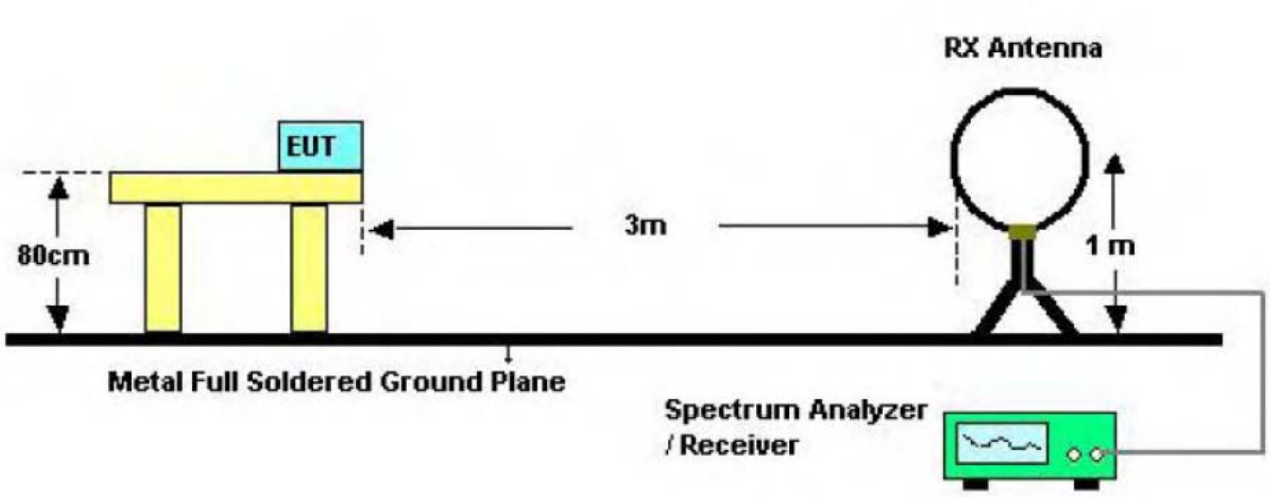
216~960	200	3
Above 960	500	3

Note:
(1) The tighter limit applies at the band edges.
(2) Emission Level(dBuV/m)=20log Emission Level(uV/m)

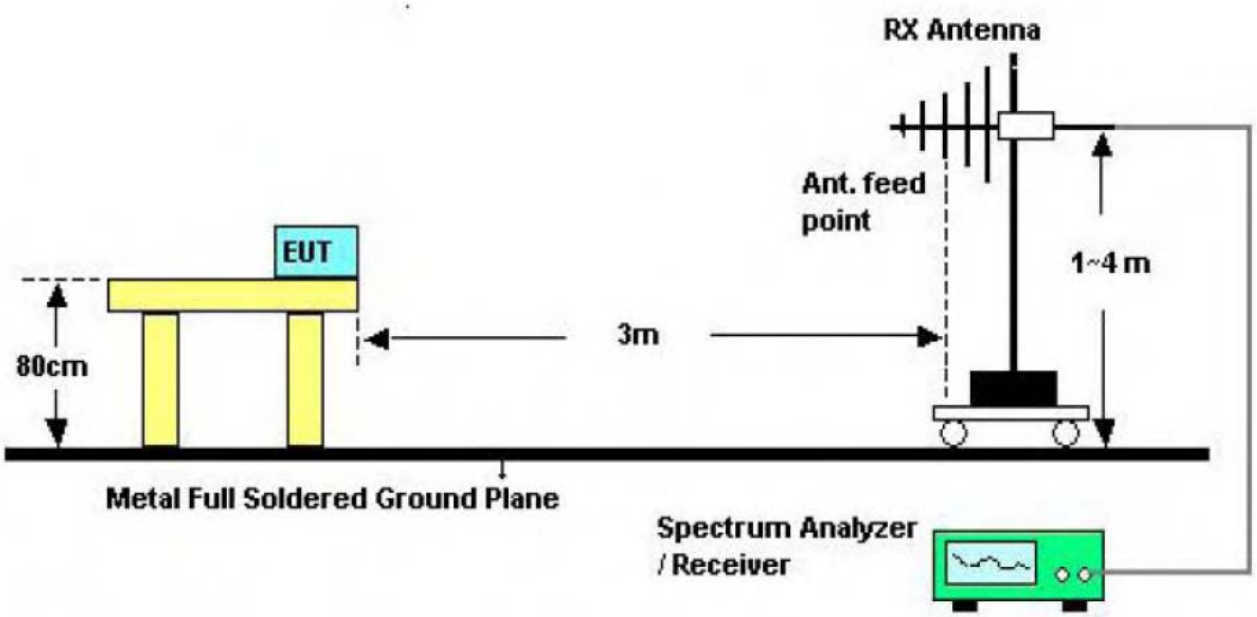
So the field strength of emission limits have been calculated in below table.

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolt/meter) at 3m
460 MHz	81.64 (Average)
460 MHz	101.64 (Peak)
469.5 MHz	81.92 (Average)
469.5 MHz	101.92 (Peak)

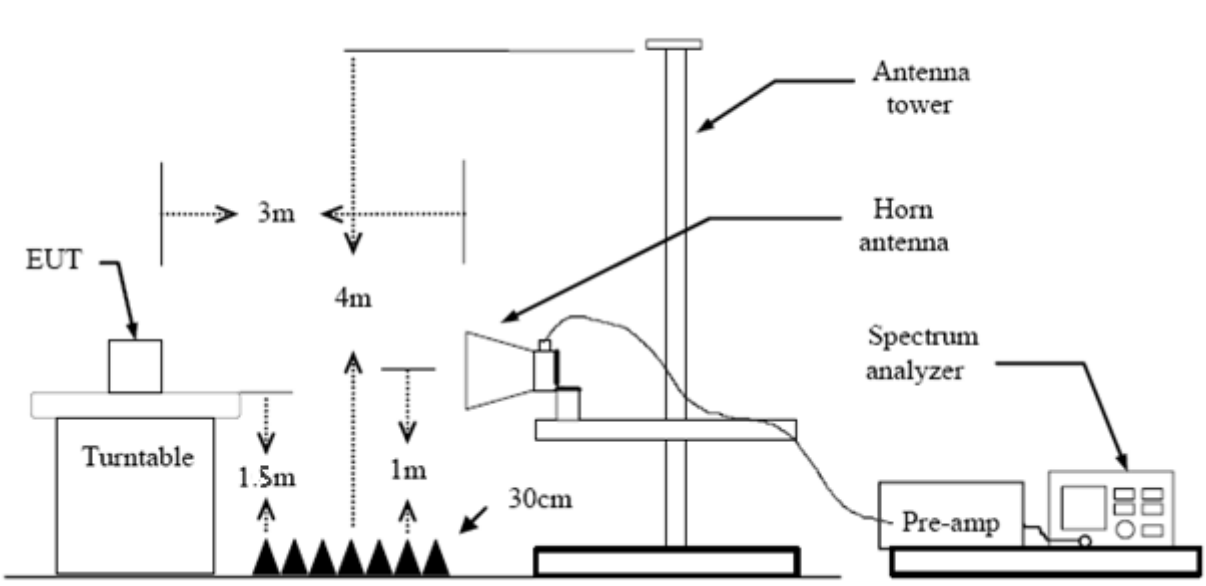
5.2 Test Setup



Bellow 30MHz Test Setup



Bellow 1000MHz Test Setup



Above 1GHz Test Setup

5.3 Test Procedure

(1) The measuring distance of 3m shall be used for measurements at frequency up to 1GHz. The EUT was placed on a rotating 0.8m high above the ground, the table was rotated 360 degrees to determine the position of the highest radiation.

(2) Measurements at frequency above 1GHz. The EUT was placed on a rotating 1.5m high above the ground. RF absorbers covered the ground plane with a minimum area of 3.0m by

3.0m between the EUT and measurement receiver antenna. The RF absorber shall not exceed 30cm in high above the conducting floor. The table was rotated 360 degrees to determine the position of the highest radiation.

(3) The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set to make measurement.

(4) The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

(5) If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit Bellow 1 GHz, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed. But the Peak Value and average value both need to comply with applicable limit above 1 GHz.

(6) Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.

(7) Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values, and use RBW=1 MHz and VBW=10 Hz with Peak Detector for Average Values.

(8) For the actual test configuration, please see the test setup photo.

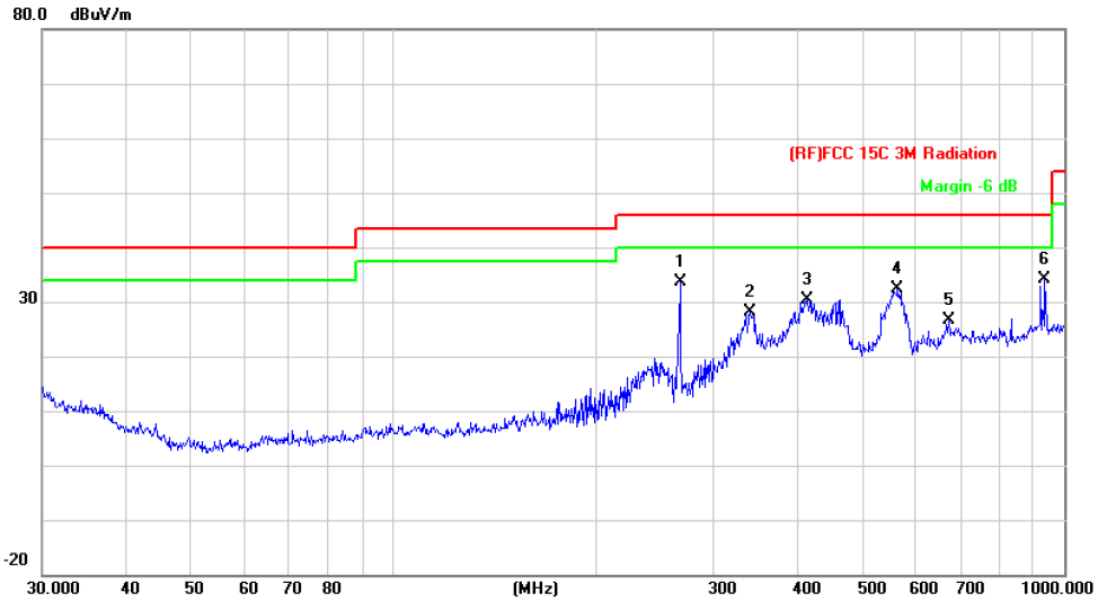
5.4 EUT Operating Condition

The Equipment Under Test was set to Continual Transmitting in maximum power.

5.5 Test Data

Fundamental and Harmonics emissions

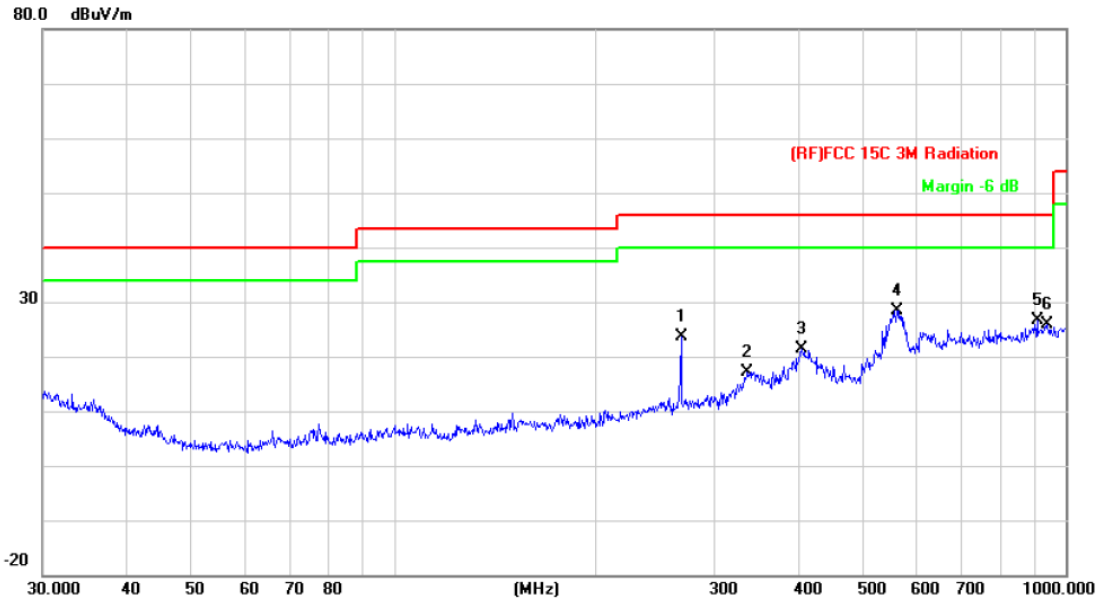
EUT:	Wireless 2D Barcode Scanner	**Model Name :**	TI4520
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	Standby Mode		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		267.5455	50.92	-17.32	33.60	46.00	-12.40	peak
2		339.5887	42.84	-14.79	28.05	46.00	-17.95	peak
3		414.7223	42.73	-12.41	30.32	46.00	-15.68	peak
4		564.6389	41.89	-9.47	32.42	46.00	-13.58	peak
5		672.8444	33.28	-6.75	26.53	46.00	-19.47	peak
6	*	935.5463	37.28	-3.27	34.01	46.00	-11.99	peak

Emission Level= Read Level+ Correct Factor

EUT:	Wireless 2D Barcode Scanner	**Model Name :**	TI4520
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	Standby Mode		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		267.5455	40.86	-17.32	23.54	46.00	-22.46	peak
2		336.0351	32.10	-15.01	17.09	46.00	-28.91	peak
3		404.6664	33.71	-12.36	21.35	46.00	-24.65	peak
4	*	560.6928	37.88	-9.48	28.40	46.00	-17.60	peak
5		906.4824	30.07	-3.52	26.55	46.00	-19.45	peak
6		938.8326	29.06	-3.27	25.79	46.00	-20.21	peak

Emission Level= Read Level+ Correct Factor

Note: (1) All Readings are Peak Value.
(2) Emission Level= Reading Level+ Probe Factor +Cable Loss
(3) The QP measurement was not performed when the peak measured data under the limit of QP detection.

Fundamental and Harmonics emissions

Below 1G

EUT:	Wireless 2D Barcode Scanner	**Model Name :**	TI4520
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode 460MHz		
Remark:			

Freq. (MHz)	Ant.Pol H/V	Emission Level (dBuV/m)		Limit 3m (dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
460.00	H	73.15	58.13	101.64	81.64	-28.49	-23.51
920.00	H	44.05	29.03	81.64	61.64	-37.59	-32.61
460.00	V	71.98	56.96	101.64	81.64	-29.66	-24.68
920.00	V	45.79	30.77	81.64	61.64	-35.85	-30.87

Average Value=Peak Value-15.02

Margin=Emission Level-Limit

EUT:	Wireless 2D Barcode Scanner	Model Name :	TI4520
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	TX Mode 469.5MHz		
Remark:			

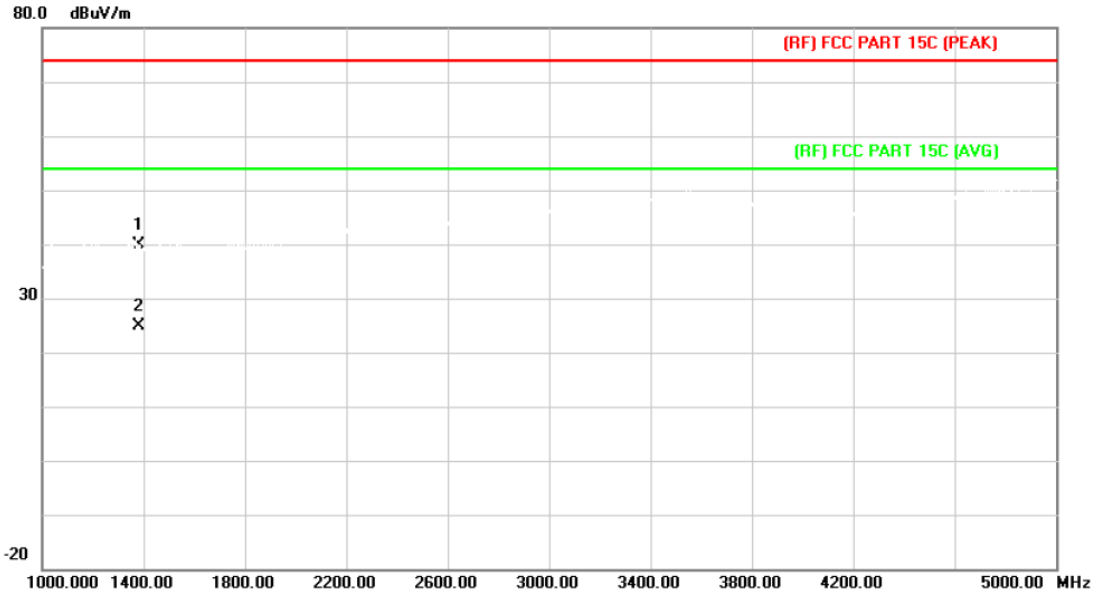
Freq. (MHz)	Ant.Pol H/V	Emission Level (dBuV/m)		Limit 3m (dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
469.5	H	75.68	60.66	101.92	81.92	-26.24	-21.26
939.00	H	47.65	32.63	81.92	61.92	-34.27	-29.29
469.5	V	78.24	63.22	101.92	81.92	-23.68	-18.70
939.00	V	48.32	33.30	81.92	61.92	-33.60	-28.62

Average Value=Peak Value-15.02

Margin=Emission Level-Limit

Above 1G

EUT:	Wireless 2D Barcode Scanner	Model Name :	TI4520
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 460MHz		
Remark:	No report for the emission which more than 20 dB below the prescribed limit.		

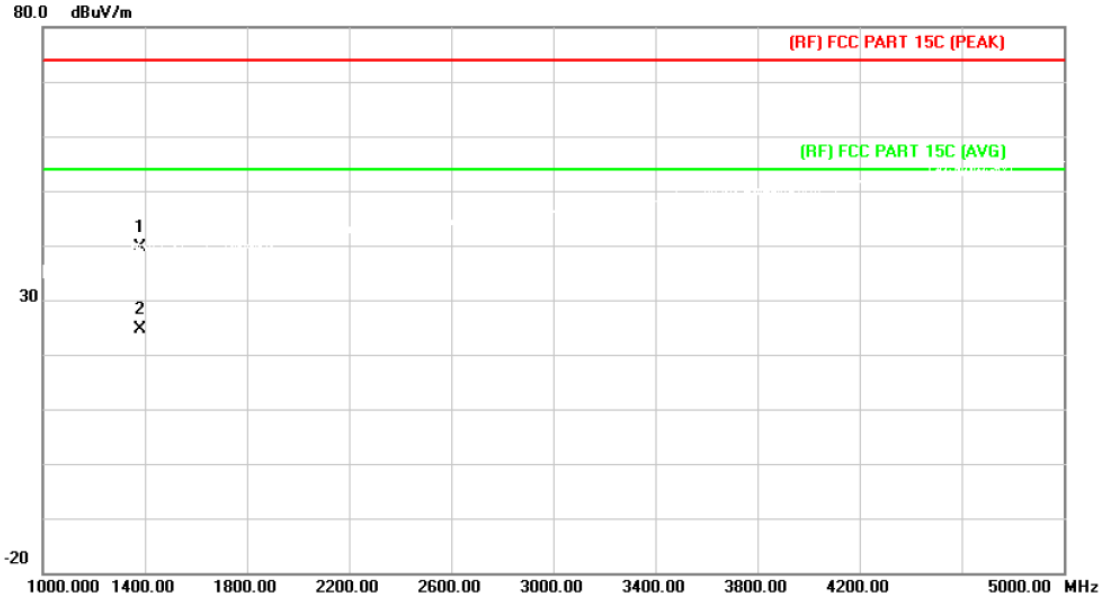


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		1380.000	43.98	-4.16	39.82	74.00	-34.18	peak
2	*	1380.000	28.96	-4.16	24.80	54.00	-29.20	AVG

Emission Level= Read Level+ Correct Factor

Average Value=Peak Value-15.02

EUT:	Wireless 2D Barcode Scanner	**Model Name :**	TI4520
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 460MHz		
Remark:	No report for the emission which more than 20 dB below the prescribed limit.		

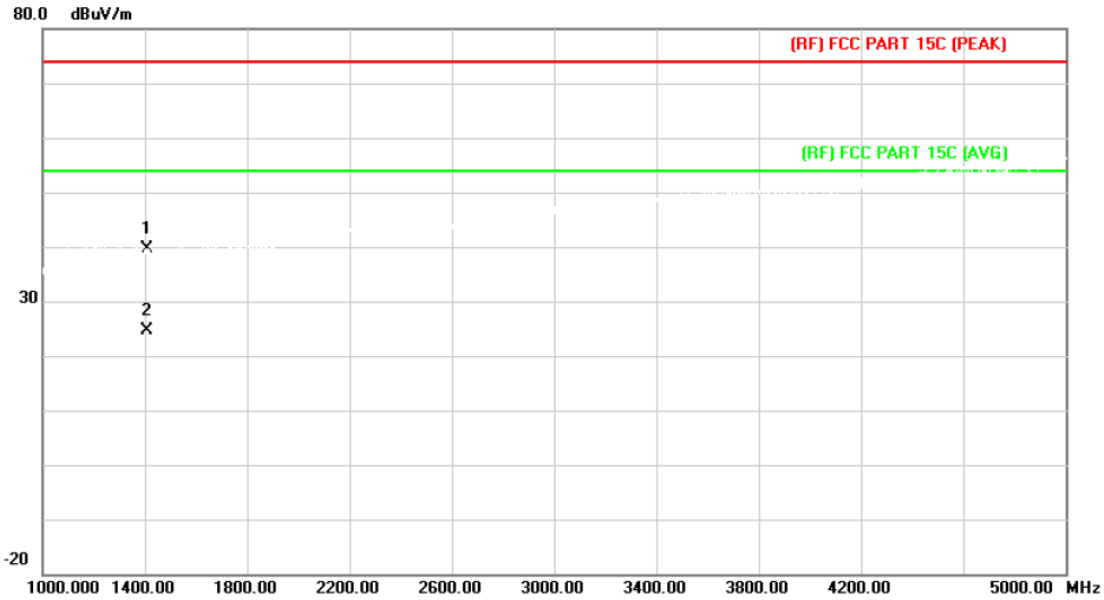


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		1380.000	43.81	-4.16	39.65	74.00	-34.35	peak
2	*	1380.000	28.79	-4.16	24.63	54.00	-29.37	AVG

Emission Level= Read Level+ Correct Factor

Average Value=Peak Value-15.02

EUT:	Wireless 2D Barcode Scanner	**Model Name :**	TI4520
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 469.5MHz		
Remark:	No report for the emission which more than 20 dB below the prescribed limit.		

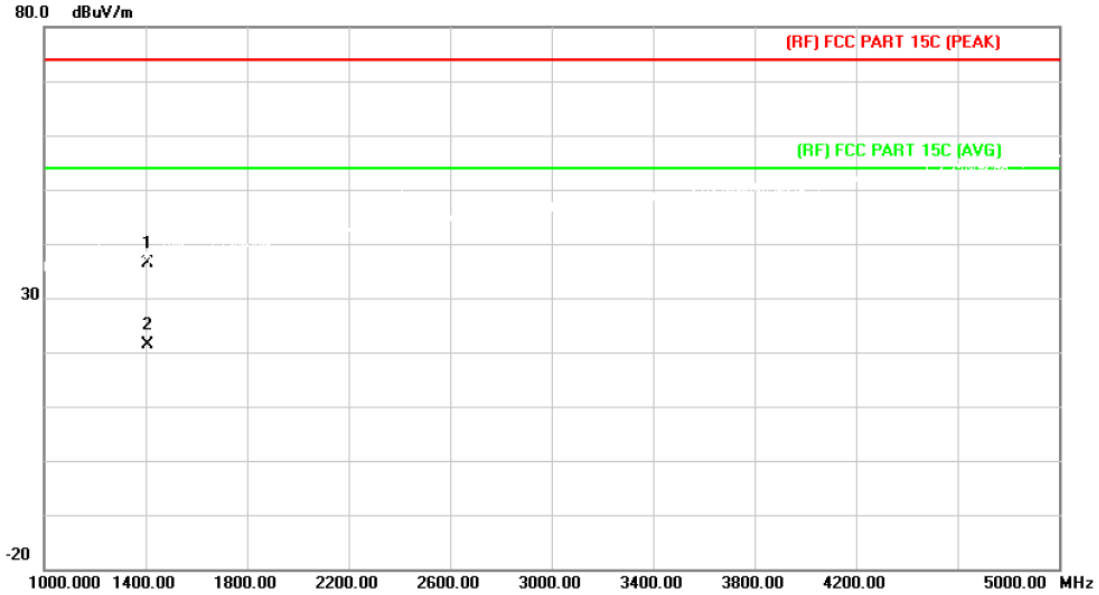


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		1409.000	43.96	-4.21	39.75	74.00	-34.25	peak
2	*	1409.000	28.94	-4.21	24.73	54.00	-29.27	AVG

Emission Level= Read Level+ Correct Factor

Average Value=Peak Value-15.02

EUT:	Wireless 2D Barcode Scanner	Model Name :	TI4520
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 469.5MHz		
Remark:	No report for the emission which more than 20 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		1409.000	40.58	-4.21	36.37	74.00	-37.63	peak
2	*	1409.000	25.56	-4.21	21.35	54.00	-32.65	AVG

Emission Level= Read Level+ Correct Factor

Average Value=Peak Value-15.02

Other harmonics emissions are lower than 20dB below the allowable limit.

Note: (1) All Readings are Peak Value and AV. And AV is calculated by the following:
Testing frequency range below 1GHz the measuring instrument use VBW=120 kHz with Quasi-peak detection.
Testing frequency range above 1GHz the measuring instrument use RBW=1 MHz and VBW=3 MHz with Peak Detector for Peak Values.
Average Values=Peak Values+20log (Duty Cycle)
(2) Emission Level= Reading Level + Probe Factor +Cable Loss
(3) Data of measurement within this frequency range shown " -- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Pulse Desensitization Correction Factor

Note:
(1)The Smallest Pulse Width (PW)= 9ms

(2) 2/PW=2/9 (ms)= 0.22 kHz<100 kHz

Because 2/PW<RBW, so the PDCF is not needed.

6. Bandwidth

6.1 Test Standard and Limit

6.1.1 Test Standard

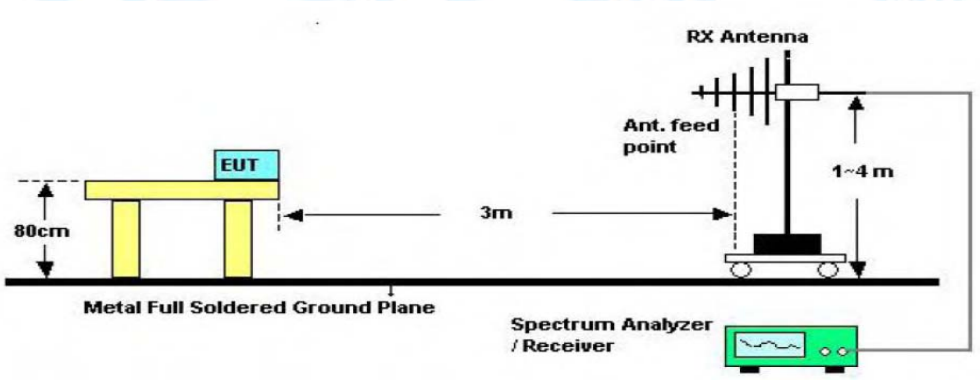
FCC 15.231/RSS 210 Annex 1

6.1.2 Test Limit

The 99%bandwidth of the emissions shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. So the emission bandwidth limits have been calculated in below table.

Fundamental Frequency	20 dB Bandwidth Limits (MHz)
460 MHz	1.15
469.5 MHz	1.18

6.2 Test Setup



6.3 Test Procedure

(1) Set Spectrum Analyzer Center Frequency= Fundamental Frequency, RBW=10 kHz, VBW= 30 kHz.

(2) Measured the spectrum width with power higher than 20 dB below carrier.

6.4 EUT Operating Condition

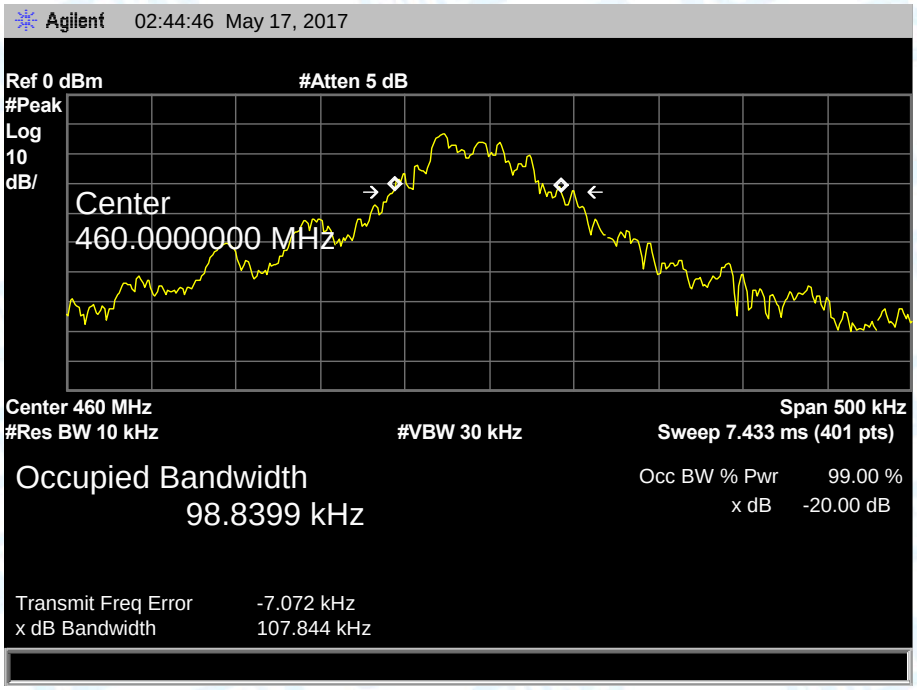
The Equipment Under Test was Programmed to be in continuously transmitting mode.

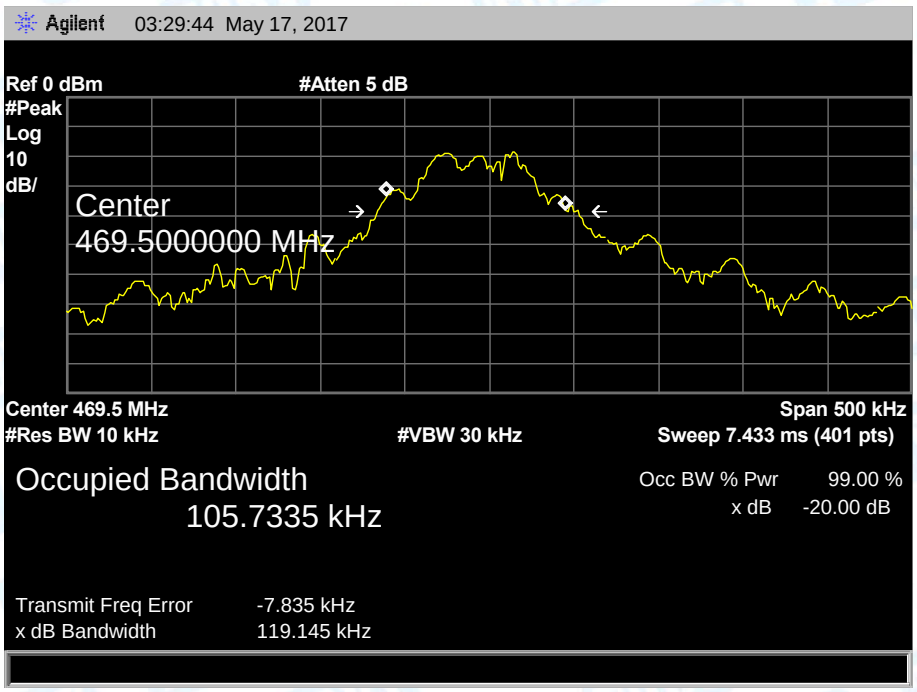
6.5 Test Condition

Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 3.7V

6.6 Test Data

Frequency (MHz)	20 dBc Bandwidth (kHz)	99% OBW (kHz)	Result
460	107.844	98.8399	PASS
469.5	119.145	105.7335	





7. Release Time Measurement

7.1 Test Standard and Limit

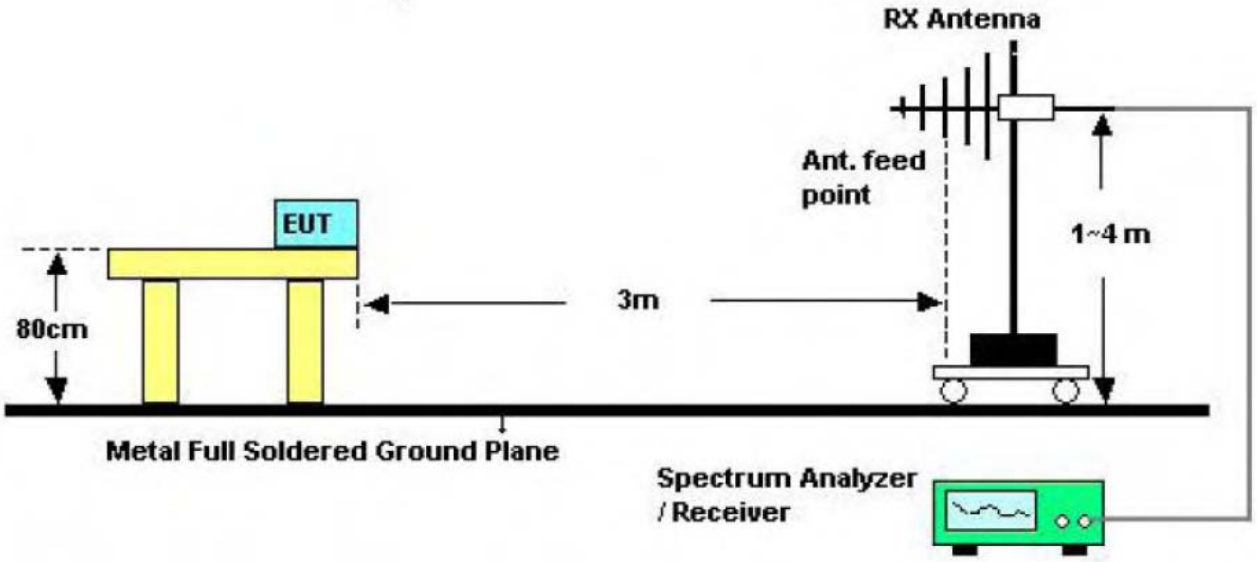
7.1.1 Test Standard

FCC 15.231/RSS 210 Annex 1

7.1.2 Test Limit

According to RSS 210 Annex 1 A1.1.1, A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

7.2 Test Setup



7.3 Test Procedure

(1) Setup the EUT as show in the block diagram above.
(2) Set Spectrum Analyzer Centre Frequency= Fundamental Frequency, RBW=100 kHz, VBW= 300 kHz, Span= 0 Hz. Sweep Time= 5 Seconds.
(3) Setup the EUT as normal operation and press Transmitter button.
(4) Set Spectrum Analyzer View, Delta Mark time.

7.4 EUT Operating Condition

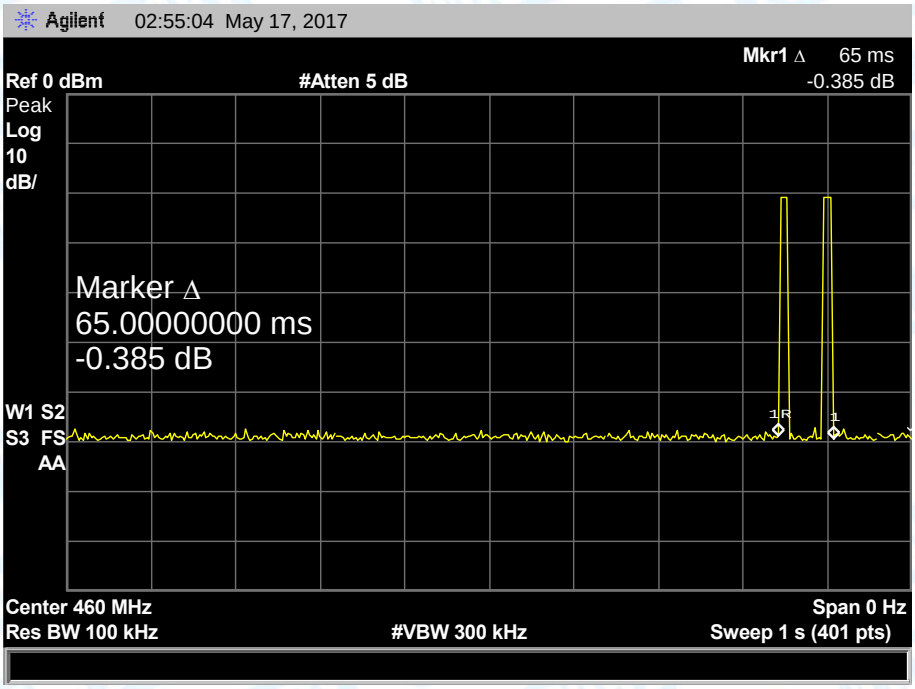
The EUT was set to work in transmitting mode.

7.5 Test Condition

Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 3.7V

7.6 Test Data

Release Time (s)	Limit (s)	Result
0.065	5	PASS
Note: Only show the data of CH00 460MHz.		



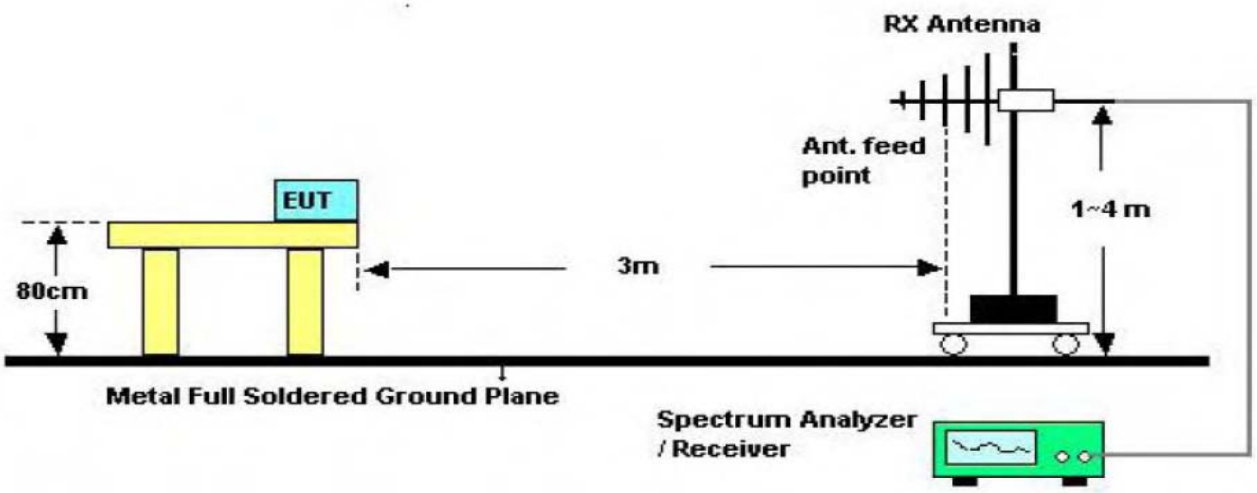
8. Duty Cycle

8.1 Test Standard and Limit

5.1.1 Test Standard

FCC 15.231/RSS 210 Annex 1

8.2 Test Setup



8.3 Test Procedure

(1) The EUT was placed on a turntable which is 0.8m above ground plane.
(2) Set EUT operating in continuous transmitting mode.
(3) Set the Spectrum Analyzer to the transmitter carrier frequency, and set the spectrum analyzer resolution bandwidth (RBW) to 100 kHz and video bandwidth (VBW) to 300 kHz, Span was set to 0 Hz.
(4) The Duty Cycle was measured and recorded.

8.4 EUT Operating Condition

The EUT was programmed to be in transmitting mode.

8.5 Test Condition

Temperature	:	25 ℃
Relative Humidity	:	65 %
Pressure	:	1010 hPa
Test Power	:	DC 3.7V

8.6 Test Data

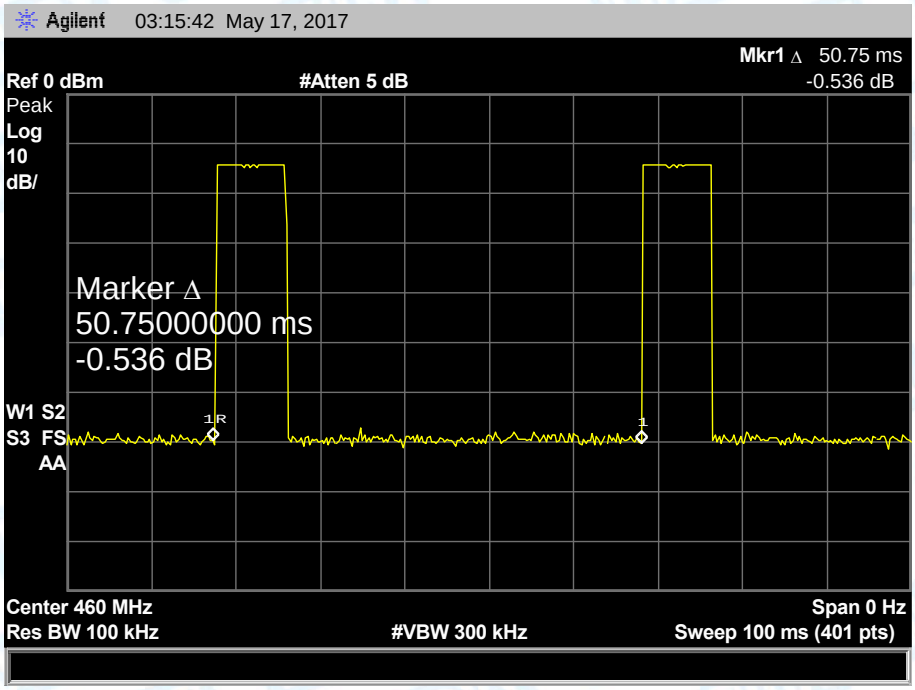
Please refer the following pages:

Plot 1: transmit once in 100ms, and each cycle is 50.75 ms there are one kinds of pulse in each cycle.

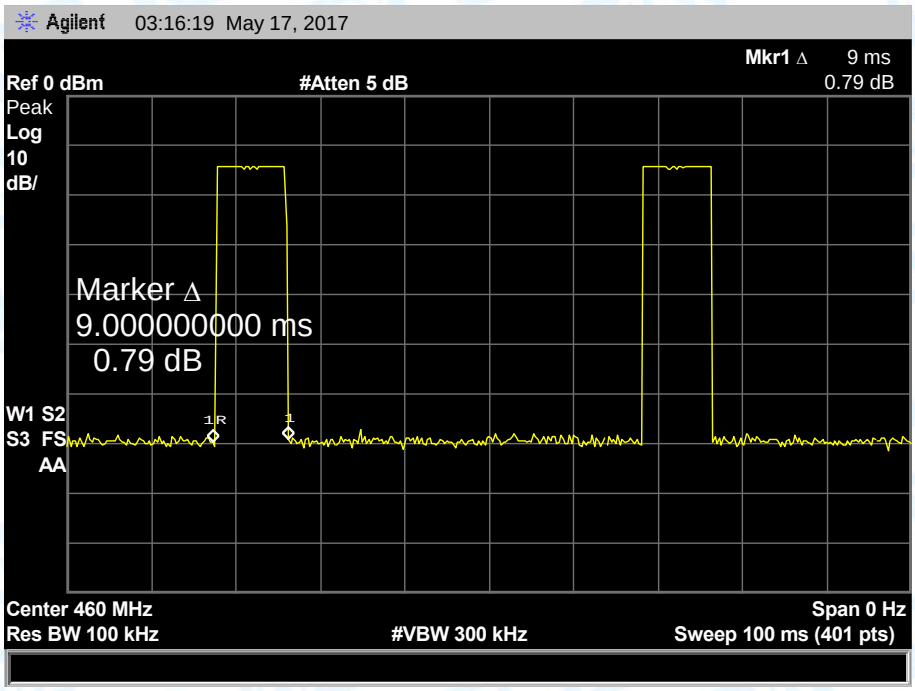
Plot 2: one large pulse in a time period of 9 ms

Duty Cycle=ON/Total=9/50.75=39.96/74.6=17.73%
20 log(Duty Cycle)=-15.02
Average=Peak Value+ 20log(Duty Cycle), AV=PK-15.02

Plot 1



Plot 2


Agilent 03:16:19 May 17, 2017
Mkr1 Δ 9 ms
Ref 0 dBm #Atten 5 dB 0.79 dB
Peak
Log
10
dB/
Marker Δ
9.000000000 ms
0.79 dB
W1 S2
S3 FS
AA
Center 460 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 100 ms (401 pts)

9. Antenna Requirement

9.1 Standard Requirement

9.1.1 Standard

FCC Part 15.203

9.1.2 Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

9.2 Antenna Connected Construction

The directional gains of the antenna used for transmitting is 2 dBi, and the antenna connector is de-signed with permanent attachment and no consideration of replacement. Please see the EUT photo for details.

Result

The EUT antenna is an Integral Antenna. It complies with the standard requirement.

Antenna Type
☑ Permanent attached antenna
☐ Unique connector antenna
☐ Professional installation antenna