

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant: GadgeTek Inc.
7F.-5,NO.369,FUXING N.RD.,SONGSHAN DIST.,TAIPEI CITY
10541,TAIWAN

Product Name: Smart Cross

Brand Name: GTI

Model No.: GWD901

Model Difference: N/A

FCC ID: 2AT5G-GWD901

Report Number: T190313W07-RP3

FCC Rule Part Part 15C

Issue Date: Aug. 08, 2019

Date of Test: May 08, 2019 ~ Aug. 01, 2019

Date of EUT Received: May 08, 2019

Issued by Compliance Certification Services Inc.Wugu Lab.
No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891,
Taiwan. (R.O.C.)
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The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.
The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory).

Tested By:

Henry Chiang / Engineer

Approved By:

Kevin Tsai / Deputy Manager



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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
T190313W07-RP3	Rev.00	Initial creation of document	All	Aug. 08, 2019	Elle Chang

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Table of Contents

1 GENERAL INFORMATION	4
2 SYSTEM TEST CONFIGURATION	6
3 SUMMARY OF TEST RESULTS	9
4 DESCRIPTION OF TEST MODES.....	9
5 MEASUREMENT UNCERTAINTY	10
6 CONDUCTED EMISSIONS TEST	11
7 RADIATED EMISSION TEST	13
8 20 dB OCCUPIED BANDWIDTH MEASUREMENT	22
9 ANTENNA REQUIREMENT	23

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Smart Cross	
Brand Name:	GTI	
Model No.:	GWD901	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Wireless Charger:	Model No.: GWD901C, Supplier: GadgeTek Inc.	
Power Supply:	3.7Vdc from Rechargeable Battery or 5.0V from wireless charger	
	Battery:	Model No.: PL400811D, Supplier: Huizhou Everpower Technology Co., Ltd.

Radio Technology:	WPC
Operating Frequency	150.9kHz ~ 207.4kHz
Transmit Power	78.02 dBuV/m @ 3m
Number of Channels	1
Antenna Type	Wireless Charging Receiver Coil Module
Modulation Type	ASK

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1.2 Test Methodology

FCC Part 15, Subpart C

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards..

1.3 Test Facility

Compliance Certification Services Inc. Wugu Lab. No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.) (TAF code 1309)

FCC Designation number: TW1309

1.4 Special Accessories

There is no special accessory used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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- Remark 1. Emission level in dBuV/m= $20 \log (\mu\text{V/m})$
: 2. Measurement was performed at an antenna to the closed point of EUT distance of 3 meters.
3. Distance extrapolation factor = $40 \log (\text{required distance/ test distance})$ (dB);
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
Ex. $20 \log (30)+40 \log (30 / 3)=69.54 \text{ dBuV/m}$
5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
6. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

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2.4 Configuration of Tested System

Fig. 2-1 Emission test set up configuration

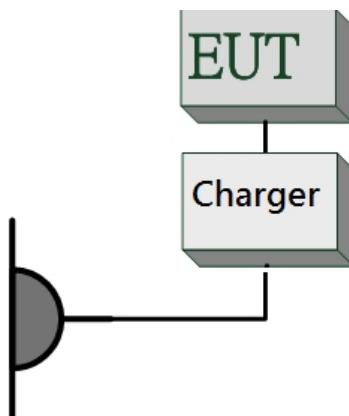


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WPC Test software	Tera Term	N/A	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	N/A
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.215 (c)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

The EUT stay in continuous transmitting mode. The frequency 156kHz is the default channel to test, where it is the only manipulative channel as this application supports.

The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode), the worst case E2 position was reported.

The data rate as the lowest supported is selected while tests are conducted.

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5 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 20dB bandwidth	+/- 0.0014
RF output power, conducted	+/- 1.14
Power density, conducted	+/- 1.40
3M Semi Anechoic Chamber / 30M~200M	+/- 4.12
3M Semi Anechoic Chamber / 200M~1000M	+/- 4.68
3M Semi Anechoic Chamber / 1G~8G	+/- 5.18
3M Semi Anechoic Chamber / 8G~18G	+/- 5.47
3M Semi Anechoic Chamber / 18G~26G	+/- 3.81
3M Semi Anechoic Chamber / 26G~40G	+/- 3.87

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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6 CONDUCTED EMISSIONS TEST

6.1 Limitation

Conducted Emission

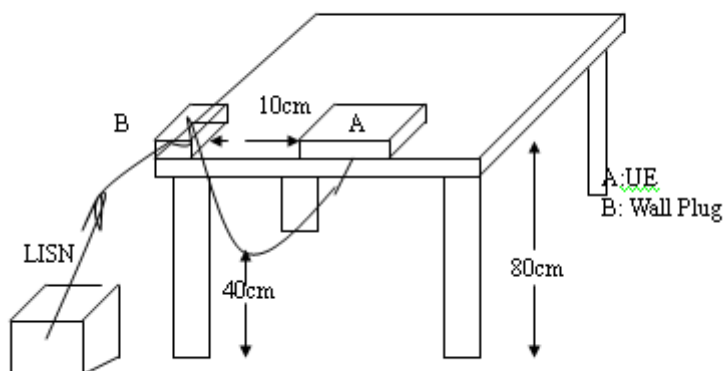
According to section 15.207(a) Conducted Emission Limits is as following.

Frequency range MHz	Limits dB (uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Sweep frequency starting from 150 kHz to 30 MHz for phase L1.
4. Repeating the measurement as lists above for phase neutral.

6.3 Test SET-UP (Block Diagram of Configuration)



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6.4 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
CABLE	EMCI	CFD300-NL	CERF	06/27/2019	06/26/2020
EMI Test Receiver	R&S	ESCI	101203	10/29/2018	10/28/2019
LISN	SCHWARZBECK	NSLK 8127	8127-541	01/31/2019	01/30/2020
LISN	SCHAFFNER	NNB 41	03/10013	02/13/2019	02/12/2020
Software	EZ-EMC(CCS-3A1-CE)				

6.5 Measurement Result:

N/A, EUT powered from Wireless Charger.

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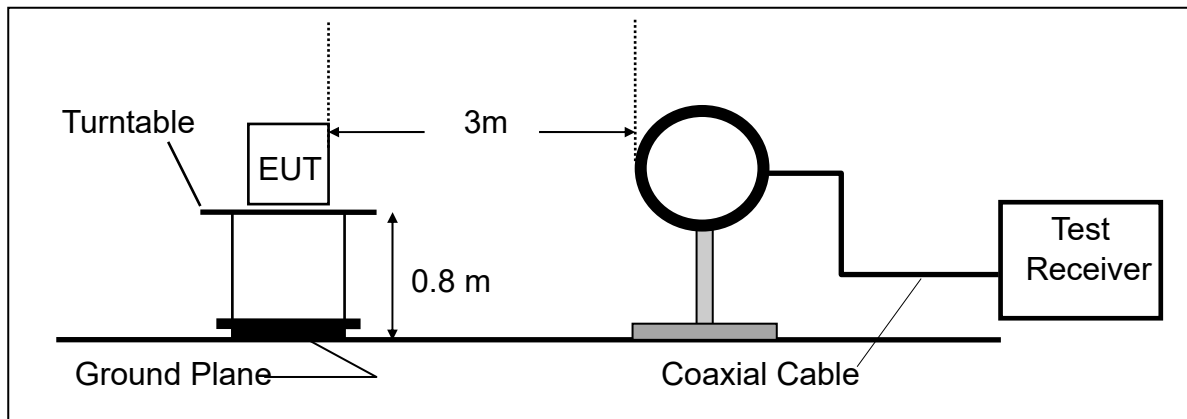
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

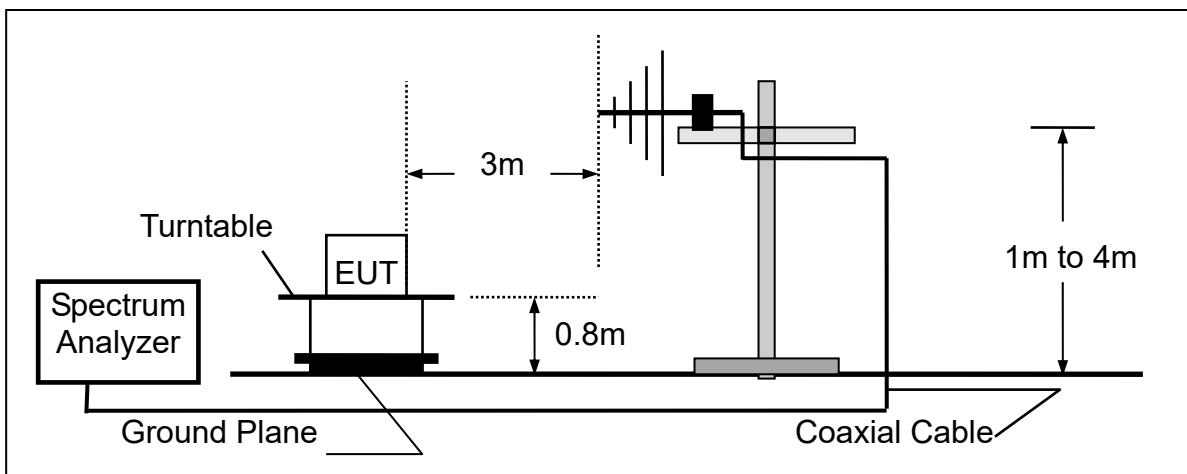
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

7.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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7.3 Measurement Equipment Used:

966A Chamber					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Bilog Antenna	Sunol Sciences	JB3	A030105	07/26/2019	07/25/2020
Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/26/2019	02/25/2020
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	01/30/2019	01/29/2020
Loop Ant	COM-POWER	AL-130	121051	03/22/2019	03/21/2020
Pre-Amplifier	EMEC	EM330	060609	02/26/2019	02/25/2020
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	05/29/2019	05/28/2020
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	e3 V6.11-20180413				

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7.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

7.5 Field Strength of Fundamental Emission

7.5.1 Limit

Below 30MHz

Frequency (MHz)	Limit (μV/m)	Measurement distance (meters)	Remark
0.009-0.490	2400/F(kHz)	300	Quasi-Peak Value
0.490-1.705	24000/F(kHz)	30	Quasi-Peak Value
1.705-30.0	30	30	Quasi-Peak Value

Above 30MHz

Frequency (MHz)	Limit (dBμV/m @3m)	Remark
30-88	40	Quasi-Peak Value
88-216	43.5	Quasi-Peak Value
216-960	46	Quasi-Peak Value
Above 960	54	Quasi-Peak Value
Above 1GHz	54	Average Value
	74	Peak Value

Note:

- The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement. Ex. $20 \cdot \log(30) + 40 \cdot \log(30/3) = 69.54 \text{ dBuV/m}$
- The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
- Actual FS(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)
Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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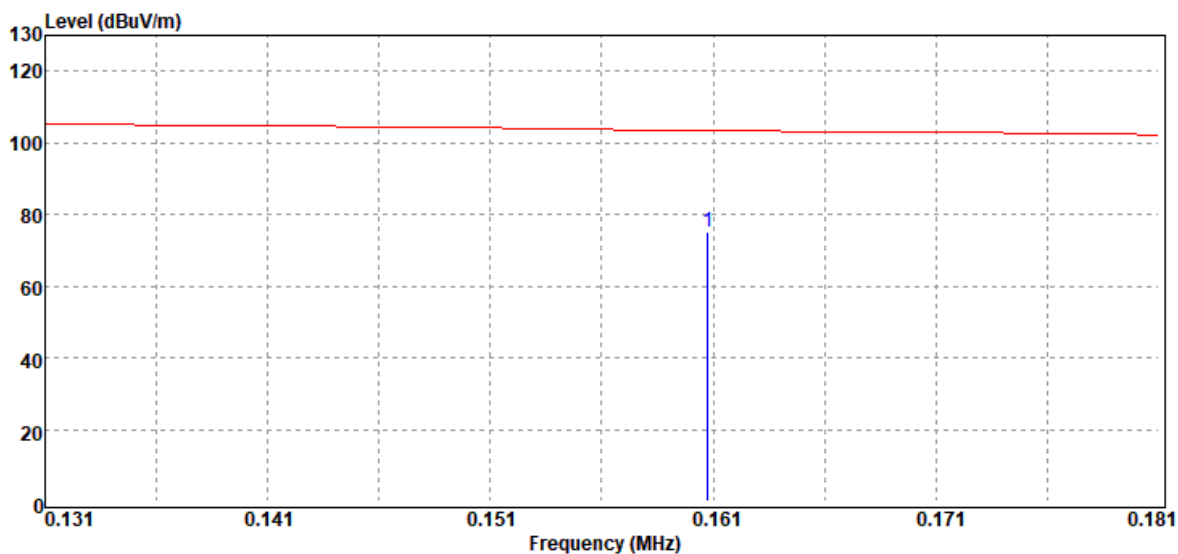
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7.5.2 Below 30 MHz test result

Project Number :T190313W07
Operation Band :WPC
Fundamental Frequency :156K Hz
Operation Mode :Main CH Mid
EUT Pol. :E2 Plan

Test Date :2019-07-29
Temp./Humi. :26.3/43
Engineer :Kailin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
0.16	Peak	61.24	13.74	74.98	103.49	-28.51

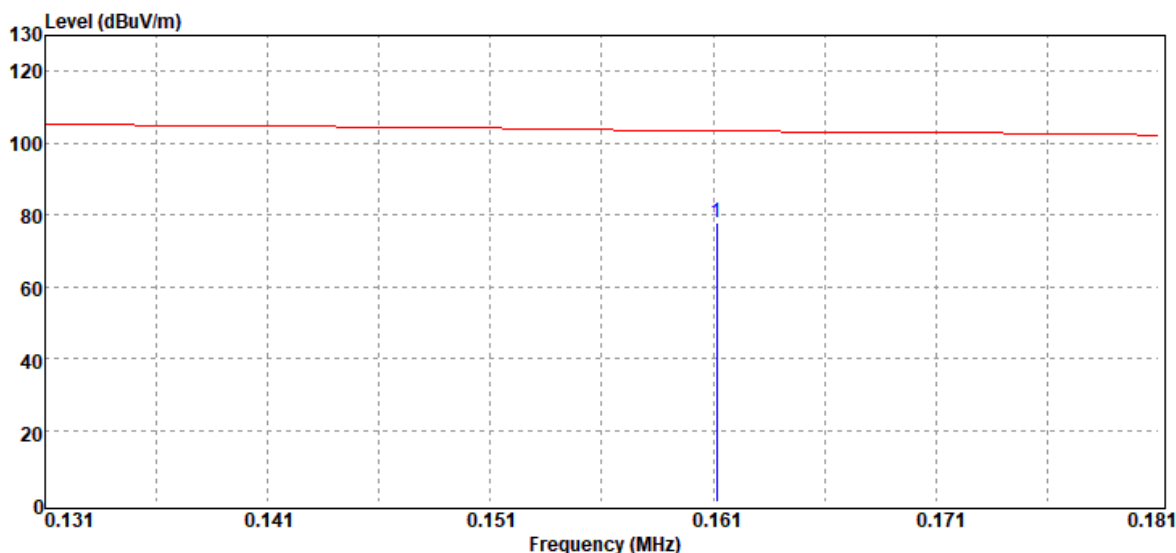
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Project Number :T190313W07
Operation Band :WPC
Fundamental Frequency :156K Hz
Operation Mode :Main CH Mid
EUT Pol. :E2 Plan

Test Date :2019-07-29
Temp./Humi. :26.3/43
Engineer :Kailin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
0.16	Peak	64.28	13.74	78.02	103.47	-25.45

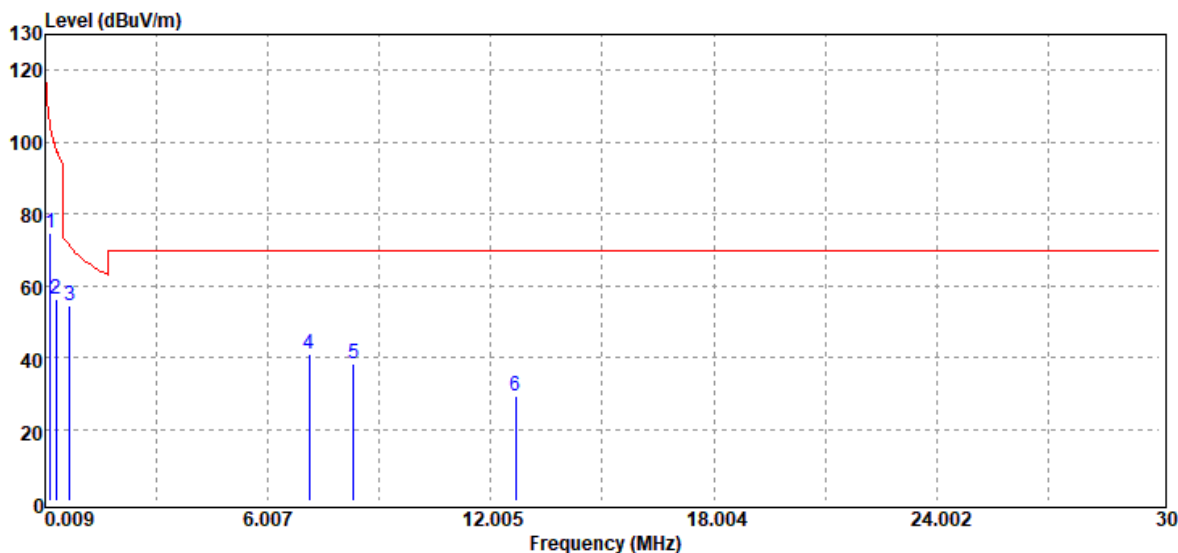
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Project Number :T190313W07
Operation Band :WPC
Fundamental Frequency :156 KHz
Operation Mode :Tx CH Mid
EUT Pol. :E2 Plan

Test Date :2019-07-29
Temp./Humi. :26.3/43
Engineer :Kailin
Measurement Antenna Pol. :VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
0.16	Peak	60.84	13.73	74.57	103.58	-29.01
0.31	Peak	41.73	14.30	56.03	97.73	-41.70
0.67	Peak	40.04	14.50	54.54	71.11	-16.57
7.12	Peak	25.26	15.77	41.03	69.54	-28.51
8.32	Peak	22.42	15.95	38.37	69.54	-31.17
12.67	Peak	13.48	15.96	29.44	69.54	-40.10

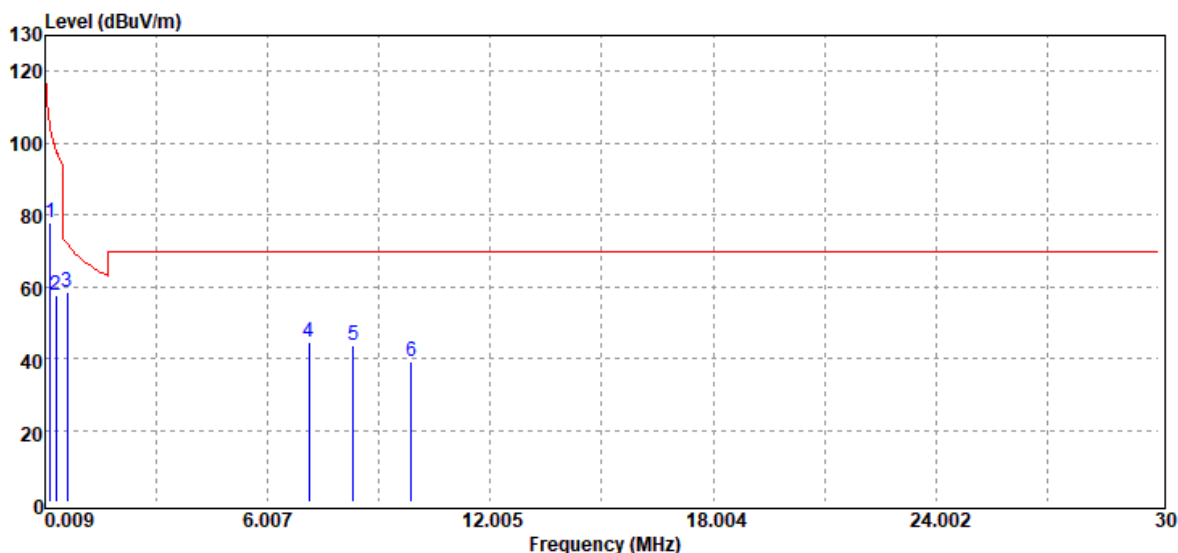
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Project Number :T190313W07
Operation Band :WPC
Fundamental Frequency :156 KHz
Operation Mode :Tx CH Mid
EUT Pol. :E2 Plan

Test Date :2019-07-29
Temp./Humi. :26.3/43
Engineer :Kailin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
0.16	Peak	64.19	13.73	77.92	103.58	-25.66
0.31	Peak	43.21	14.30	57.51	97.73	-40.22
0.61	Peak	44.01	14.47	58.48	71.92	-13.44
7.12	Peak	28.98	15.77	44.75	69.54	-24.79
8.32	Peak	27.58	15.95	43.53	69.54	-26.01
9.88	Peak	22.83	16.15	38.98	69.54	-30.56

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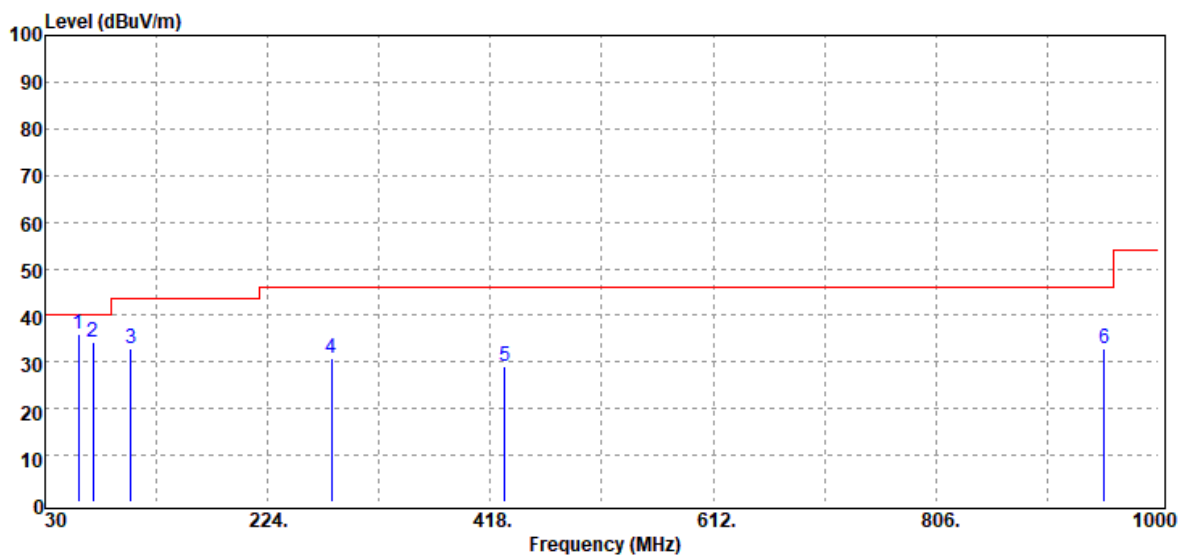
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7.5.3 Above 30MHz test result

Project Number : T190313W07
Operation Band : WPC
Fundamental Frequency : 156 KHz
Operation Mode : Tx CH Mid
EUT Pol. : E2 Plan

Test Date : 2019-07-29
Temp./Humi. : 26.3/43
Engineer : Kailin
Measurement Antenna Pol. : VERTICAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
59.10	Peak	51.99	-15.96	36.03	40.00	-3.97
71.71	Peak	48.87	-14.74	34.13	40.00	-5.87
104.69	Peak	44.03	-11.18	32.85	43.50	-10.65
279.29	Peak	39.06	-8.40	30.66	46.00	-15.34
430.61	Peak	33.63	-4.47	29.16	46.00	-16.84
952.47	Peak	28.80	4.24	33.04	46.00	-12.96

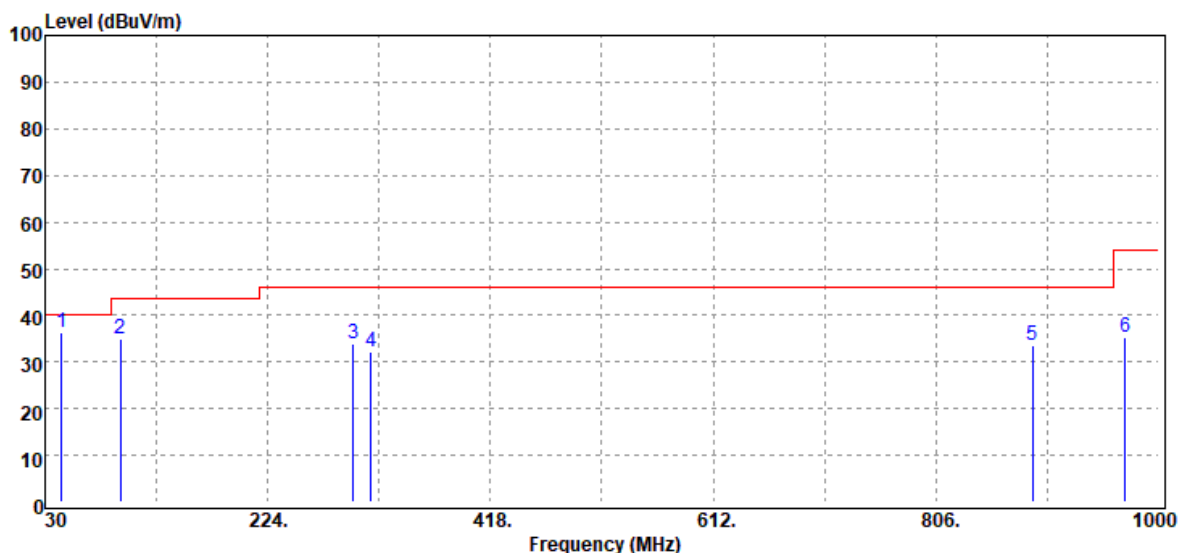
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Project Number :T190313W07
Operation Band :WPC
Fundamental Frequency :156 KHz
Operation Mode :Tx CH Mid
EUT Pol. :E2 Plan

Test Date :2019-07-29
Temp./Humi. :26.3/43
Engineer :Kailin
Measurement Antenna Pol. :HORIZONTAL



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
44.55	Peak	48.94	-12.72	36.22	40.00	-3.78
95.96	Peak	48.80	-13.95	34.85	43.50	-8.65
298.69	Peak	42.06	-8.27	33.79	46.00	-12.21
314.21	Peak	39.95	-7.76	32.19	46.00	-13.81
890.39	Peak	29.47	4.00	33.47	46.00	-12.53
970.90	Peak	30.05	5.37	35.42	54.00	-18.58

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8 20 dB OCCUPIED BANDWIDTH MEASUREMENT

8.1 Standard Applicable:

§2.1049 & §15.215 (c)

8.2 Limit:

None

8.3 Test Set-up

Refer to section 6.2 in this report

8.4 Measurement Procedure

20dB bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 200 Hz and the video bandwidth of 1 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

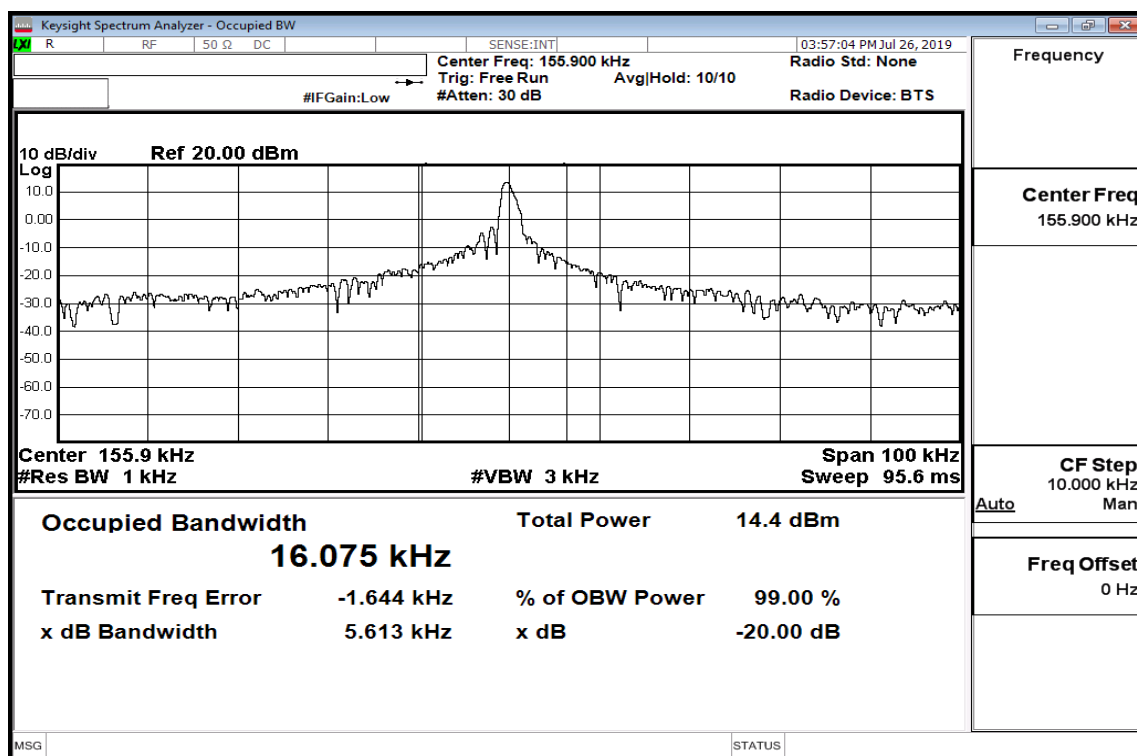
8.5 Measurement Equipment Used:

Refer to section 8.3 in this report

8.6 Measurement Result

-20dB Bandwidth

20dB Bandwidth	Limit
5.613kHz	No requirement



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9 ANTENNA REQUIREMENT

9.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

9.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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