

### **Gold Light Toys Factory**

## **TEST REPORT**

SCOPE OF WORK FCC TESTING- MODEL: 33568A20106

REPORT NUMBER GZHH00356805-001

ISSUE DATE APR 29, 2020

**PAGES** 24

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#### **Gold Light Toys Factory**

#### Application for Certification

#### FCC ID: QW9JG2020A24GT

#### **Drone DX 5inch Stunt**

#### Model: 33568A20106

2.4GHz Transmitter

#### Report No.: GZHH00356805-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-19]

Prepared and Checked by:

Approved by:

Sign on file

Terry Tang Senior Engineer *Kidd Yang Technical Supervisor Date: Apr 29, 2020* 

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#### Intertek Testing Service Shenzhen Ltd. Longhua Branch

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Version: 01-November-2017



#### **MEASUREMENT/TECHNICAL REPORT**

This report concerns (che	eck one:)	Original Grant _	<u>X</u>	Class II C	Change					
Equipment Type: <u>DXX - F</u>	Equipment Type: DXX - Part 15 Low Power Communication Device Transmitter									
Deferred grant requested	per 47 CFR (	0.457(d)(1)(ii)?	Yes		No <u>X</u>					
	If yes, defer until:date									
Company Name agrees t	o notify the Co	ommission by:								
date of the intended date of announcement of the product so that the grant can be issued on that date.										
Transition Rules Request	: per 15.37?		Yes		No <u>X</u>					
If no, assumed Part 15, Edition] provision.	Subpart C f	for intentional rad	iator – t	he new 47	' CFR [10-1-19					
Report prepared by:										
Report prepared by: Terry Tang Intertek Testing Services Shenzhen Ltd. Longhua Branch 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community GuanHu Subdistrict, LongHua District, Shenzhen People's Republic of China Tel / Fax: 86-755-8601 6288/86-755-8601 6751										



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#### 1.0 Summary of Test Result

Applicant: Gold Light Toys Factory Applicant Address: Gangxia Road, Pumei ChengHai City, China

Manufacturer: Gold Light Toys Factory Manufacturer Address: Gangxia Road, Pumei ChengHai City, China

MODEL: 33568A20106

FCC ID: QW9JG2020A24GT

Test Specification	Reference	Results
Transmitter Radiated Emission	15.249 &15.209 &15.205	Pass
Bandedge		
20dB Bandwidth	15.215(c)	Pass

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.



#### 2.0 <u>General Description</u>

2.1 Product Description

The equipment under test (EUT) is a Drone DX 5inch Stunt operating at 2.4G Band. The EUT can be powered by DC 9.0V (6 x 1.5V AA batteries). For more detail information pls. refer to the user manual.

Antenna Type: Integral antenna Modulation Type: GFSK Antenna Gain: 0dBi

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

2.2 Related Submittal(s) Grants

This is an application for certification of controller unit for the Drone DX 5inch Stunt, and the corresponding car unit which associated with this EUT is subjected to FCC SDOC.

2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in Semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The Semi-anechoic chamber used to collect the radiated data is **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community GuanHu Subdistrict, LongHua District, Shenzhen, People's Republic of China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: CN1188).



#### 3.0 System Test Configuration

#### 3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The EUT was powered by DC 9.0V (6 x 1.5V AA batteries) during the test, only the worst data was reported in this report.

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Section 4.

The EUT was operated standalone and placed in the central of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

3.2 EUT Exercising Software

There was no special software to exercise the device.

3.3 Special Accessories

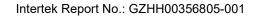
No special accessories used.

3.4 Equipment Modification Any modifications installed previous to testing by Gold Light Toys Factory will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd Longhua Branch.

- 3.5 Measurement Uncertainty When determining the test conclusion, the Measurement Uncertainty of test has been considered.
- 3.6 Support Equipment List and Description

Description	Manufacturer	Model No.
N/A	N/A	N/A





#### 4.0 Emission Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

4.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

4.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in  $dB\mu V/m$  RA = Receiver Amplitude (including preamplifier) in  $dB\mu V$  CF = Cable Attenuation Factor in dB AF = Antenna Factor in dB AG = Amplifier Gain in dB PD = Pulse Desensitization in dBAV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA =  $62.0 \text{ dB}\mu\text{V}$ AF = 7.4 dB CF = 1.6 dB AG = 29.0 dB PD = 0 dB AV = -10 dB FS =  $62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V/m}$ 

Level in  $\mu$ V/m = Common Antilogarithm [(42 dB $\mu$ V/m)/20] = 125.9  $\mu$ V/m



#### 4.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

#### 4.1.3 Radiated Emissions

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission at 826.615000 MHz

Judgement: Passed by 13.5 dB

#### TEST PERSONNEL:

Sign on file

<u>Terry Tang, Senior Engineer</u> *Typed/Printed Name* 

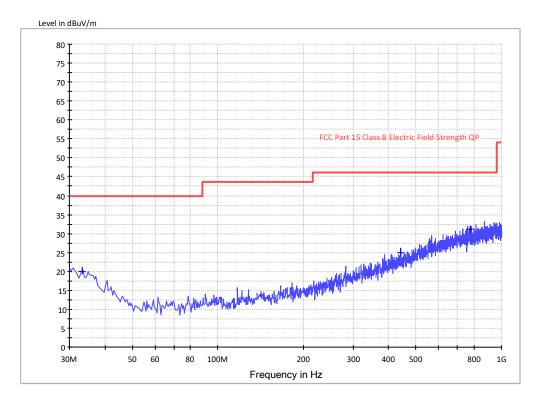
<u>Apr 21, 2020</u> Date



#### Applicant: Gold Light Toys Factory Date of Test: Apr 21, 2020 Worst Case Operating Mode:

Model: 33568A20106 Transmitting(2404.000MHz)

#### ANT Polarity: Horizontal



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
32.955000	19.3	1000.0	120.000	Н	17.3	20.7	40.0
442.125000	25.2	1000.0	120.000	Н	9.8	20.8	46.0
781.055000	31.1	1000.0	120.000	Н	24.4	14.9	46.0

Remark:

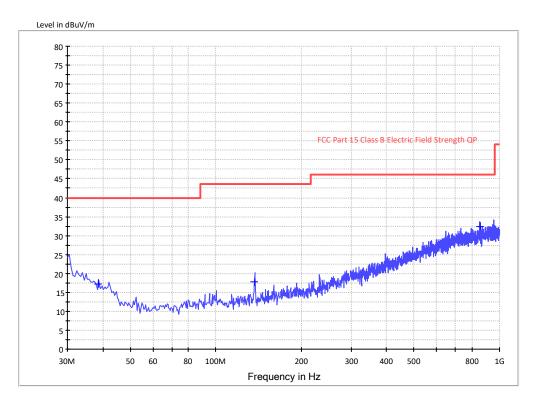
- 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
- 2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
- 3. Margin (dB) = Limit Line(dBµV/m) Level (dBµV/m)



#### Applicant: Gold Light Toys Factory Date of Test: Apr 21, 2020 Worst Case Operating Mode:

Model: 33568A20106 Transmitting(2404.000MHz)

#### ANT Polarity: Vertical



Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
38.380000	17.1	1000.0	120.000	V	16.1	22.9	40.0
143.220000	17.9	1000.0	120.000	V	15.4	25.6	43.5
826.615000	32.5	1000.0	120.000	V	22.1	13.5	46.0

Remark:

- 1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
- 2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
- 3. Margin (dB) = Limit Line(dB $\mu$ V/m) Level (dB $\mu$ V/m)



#### 4.1.4 Transmitter Spurious Emissions (Radiated)

#### Worst Case Radiated Emission at 2400.000 MHz

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 8.4 dB

#### TEST PERSONNEL:

Sign on file

Terry Tang, Senior Engineer Typed/Printed Name

<u>Apr 21, 2020</u> Date



#### Applicant: Gold Light Toys Factory Date of Test: Apr 21, 2020 Worst Case Operating Mode:

Model: 33568A20106 Transmitting

#### Table 1

	Radiated Emissions (2404 MHz)									
Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)			
Horizontal	2404.000	99.0	36.7	28.1	90.4	114.0	-23.6			
Horizontal	4808.000	59.3	36.7	35.5	58.1	74.0	-15.9			
Horizontal	7212.000	59.2	36.7	35.5	58.0	74.0	-16.0			

Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2404.000	99.0	36.7	28.1	23.9	66.5	94.0	-27.5
Horizontal	4808.000	59.3	36.7	35.5	23.9	34.2	54.0	-19.8
Horizontal	7212.000	59.2	36.7	35.5	23.9	34.1	54.0	-19.9

Notes: 1. Peak Detector Data unless otherwise stated.

- 2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- 3. Negative value in the margin column shows emission below limit.
- 4. Horn antenna is used for the emission over 1000MHz.



#### Applicant: Gold Light Toys Factory Date of Test: Apr 21, 2020 Worst Case Operating Mode:

Model: 33568A20106 Transmitting

#### Table 2

#### Radiated Emissions

	(2440 MHz)										
Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)				
Horizontal	2440.000	98.8	36.7	28.1	90.2	114.0	-23.8				
Horizontal	4880.000	58.4	36.7	35.5	57.2	74.0	-16.8				
Horizontal	7320.000	58.6	36.7	35.5	57.4	74.0	-16.6				

Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2440.000	98.8	36.7	28.1	23.9	66.3	94.0	-27.7
Horizontal	4880.000	58.4	36.7	35.5	23.9	33.3	54.0	-20.7
Horizontal	7320.000	58.6	36.7	35.5	23.9	33.5	54.0	-20.5

Notes: 1. Peak Detector Data unless otherwise stated.

- 2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- 3. Negative value in the margin column shows emission below limit.
- 4. Horn antenna is used for the emission over 1000MHz.



Polarization

Margin

#### Applicant: Gold Light Toys Factory Date of Test: Apr 21, 2020 Worst Case Operating Mode:

Model: 33568A20106 Transmitting

#### Table 3

# Radiated Emissions<br/>(2476 MHz)Frequency<br/>(MHz)Reading<br/>(dBµV)Pre-<br/>Amp<br/>GainNet<br/>(dBµV)Peak Limit<br/>at 3m<br/>(dBµV/m)

	(MHZ)	(dBhA)	Amp Gain (dB)	Factor (dB)	at 3m (dBµV/m)	at 3m (dBµV/m)	(dB)
Horizontal	2476.000	100.0	36.7	28.1	91.4	114.0	-22.6
Horizontal	4952.000	58.9	36.7	35.5	57.7	74.0	-16.3
Horizontal	7428.000	58.4	36.7	35.5	57.2	74.0	-16.8

Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2476.000	100.0	36.7	28.1	23.9	67.5	94.0	-26.5
Horizontal	4952.000	58.9	36.7	35.5	23.9	33.8	54.0	-20.2
Horizontal	7428.000	58.4	36.7	35.5	23.9	33.3	54.0	-20.7

Notes: 1. Peak Detector Data unless otherwise stated.

- 2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
- 3. Negative value in the margin column shows emission below limit.
- 4. Horn antenna is used for the emission over 1000MHz.



#### 5.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

#### 6.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

#### 7.0 <u>Technical Specifications</u>

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

#### 8.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.



#### 9.0 <u>Miscellaneous Information</u>

This miscellaneous information includes details of the measured bandedge, 20dB Bandwidth, the test procedure and calculation of factor such as pulse desensitization.

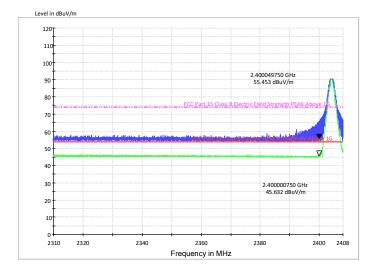
#### 9.1 Bandedge Plot

The test plots are attached as below. From the plot, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

#### Peak Measurement

Restricted-band band-edge tests shall be performed as radiated measurements, i.e (Band-edge Plot).

#### (i) Lower channel 2404.000 MHz:

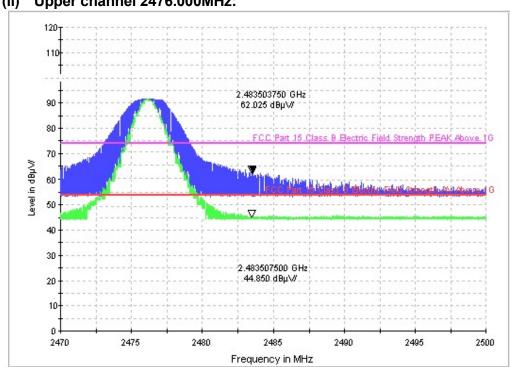


Polarizatio	n Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizonta	I 2400.000	64.1	36.7	28.1	55.5	74.0	-18.5

Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m	Margin (dB)
Horizontal	2400.000	54.2	36.7	28.1	45.6	54.0	-8.4

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dBµv/m (Peak Limit) and 54dBµv/m (Average Limit).





#### (ii) Upper channel 2476.000MHz:

Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2483.500	69.7	36.8	29.1	62.0	74.0	-12.0

Polarization	Frequency (MHz)	Reading (dBµV)	Pre- Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m	Margin (dB)
Horizontal	2483.500	52.6	36.8	29.1	44.9	54.0	-9.1

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dBµv/m (Peak Limit) and 54dBµv/m (Average Limit).



#### 9.2 20dB Bandwidth

Pursuant to FCC part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered. The test plots are reported as below.

Spectrur	n							E
Ref Level	102.00	dBuV	<b>●</b> F	RBW 100 kHz				(•)
Att				<b>/BW</b> 300 kHz	Mode Auto FFT			
⊖1Pk Max								
					M1[1]		83.44	dBµV
							2.404130	
90 dBµV—					ndB			00 dB
				M1	DW		1.31700000	
80 dBµV—				∧	Q factor		. 1	825.6
				$\sim$				
70 dBµV—				- d				
				TĮ	<u>t</u> 2			
60 dBµV—				n I				
00 000			-		(h			
50 dBµV—					- Vm			
50 apps			~J 7	~	U 1	Lp_		
40 dBµV—		$h/\sim$						
								λ
30 dBµV—								
30 ubµv—								
00 40.44								
20 dBµV—								
10 10 11								
10 dBµV—								
CF 2.404	GHz			691 pt	s		Span 10.0	MHZ
Marker								
Type Re		X-value		Y-value	Function	Fun	ction Result	
M1								
	1	2.4041		83.44 dBµV	ndB down		1.317	
T1 T2		2.4041 2.4034 2.40476	15 GHz	83.44 dBµV 63.05 dBµV 63.19 dBµV	ndB down ndB Q factor		20.0	0 dB 25.6
T1 T2 Spectrun	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV <b>CBW</b> 100 kHz	ndB Q factor		20.0	0 dB 25.6
T1 T2 Spectrun Ref Level Att	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV	ndB		20.0	0 dB 25.6
T1 T2 Spectrun Ref Level Att	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV <b>CBW</b> 100 kHz	ndB Q factor Mode Auto FF1	-	20.0	0 dB 25.6
T1 T2 Spectrun Ref Level Att	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV <b>CBW</b> 100 kHz	ndB Q factor	-	20.0	0 dB 25.6 ▼
T1 T2 Spectrun Ref Level Att ) IPk Max	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV <b>CBW</b> 100 kHz	ndB Q factor Mode Auto FF1		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ ↓ dBµ\ 50 GH: .00 dE
T1 T2 Spectrun Ref Level Att ) IPk Max	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1 T2 Spectrun Ref Level Att )1Pk Max	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV <b>CBW</b> 100 kHz	ndB Q factor Mode Auto FFT M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1 T2 Spectrun Ref Level Att )1Pk Max	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1 T2 Spectrum Ref Level Att 11Pk Max 20 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1 T2 Spectrum Ref Level Att 11Pk Max 20 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1           T2           Spectrun           Ref Level           Att           10 dBµV           10 dBµV           10 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	•5 GHz 57 GHz	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           11Pk Max           00 dBµV           30 dBµV           70 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           11Pk Max           10 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           11Pk Max           10 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           10 dBµV           10 dBµV           10 dBµV           10 dBµV           10 dBµV           10 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           11Pk Max           30 dBµV           70 dBµV           30 dBµV           30 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           Att           NO dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH: .00 dB 0 MH:
T1           T2           Spectrun           Ref Level           Att           11Pk Max           30 dBµV           30 dBµV           50 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw	·	20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1           T2           Spectrun           Ref Level           Att           D1Pk Max           30 dBµV           30 dBµV           70 dBµV           50 dBµV           50 dBµV           50 dBµV           30 dBµV           30 dBµV           30 dBµV           30 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1           T2           Spectrun           Ref Level           Att           D1Pk Max           30 dBµV           30 dBµV           70 dBµV           50 dBµV           50 dBµV           50 dBµV           30 dBµV           30 dBµV           30 dBµV           30 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ₩ 0 GHz .00 dE 0 MHz
T1           T2           Spectrun           Ref Level           Att           90 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw	·	20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1           T2           Spectrun           Ref Level           Att           90 dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1           T2           Spectrun           Ref Level           Att           Att           NO dBµV	1 1 102.00 d	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 M1[1] ndB Bw		20.0 182 80.14 2.476145 20	0 dB 25.6 ▼ • dBµ\ 50 GH .00 dE 0 MH
T1           T2           Spectrun           Ref Level           Att           D1Pk Max           30 dBµV           30 dBµV           70 dBµV           50 dBµV		2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz /BW 300 kHz	ndB Q factor Mode Auto FF1 		20.0 182 80.14 2.476145 20	0 dB 25.6 ↓ dBµ\ 0 GH; 0 0 dE 0 0 HH; 972.;
T1           T2           Spectrun           Ref Level           Att           91Pk Max           30 dBµV           30 dBµV           50 dBµV           50 dBµV           50 dBµV           50 dBµV           50 dBµV           50 dBµV           10 dBµV           20 dBµV           10 dBµV           CF 2.476 C		2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz 7BW 300 kHz 100 kHz 100 kHz	ndB Q factor Mode Auto FF1 		20.0 182 80.14 2.476145 20 2.54700000	0 dB 25.6
T1           T2           Spectrun           Ref Level           Att           91Pk Max           90 dBµV           90 dBµV           90 dBµV           70 dBµV           70 dBµV           90 dBµV </td <td>1 102.00 d 11</td> <td>2.4034 2.40476 ВµV</td> <td>45 GHz 17 GHz ● R .9 μs ● V</td> <td>63.05 dBµV 63.19 dBµV 8BW 100 kHz 7BW 300 kHz 100 kHz 100 kHz</td> <td>ndB Q factor Mode Auto FF1 </td> <td></td> <td>20.0 182 80.14 2.476145 20 2.54700000</td> <td>0 dB 25.6</td>	1 102.00 d 11	2.4034 2.40476 ВµV	45 GHz 17 GHz ● R .9 μs ● V	63.05 dBµV 63.19 dBµV 8BW 100 kHz 7BW 300 kHz 100 kHz 100 kHz	ndB Q factor Mode Auto FF1 		20.0 182 80.14 2.476145 20 2.54700000	0 dB 25.6
T1           T2           Spectrun           Ref Level           Att           91Pk Max           90 dBµV           30 dBµV           50 dBµV           50 dBµV           50 dBµV           50 dBµV           40 dBµV           50 dBµV           50 dBµV           50 dBµV           60 dBµV           70 dBµV           60 dBµV           70 dBµV </td <td>1 102.00 d 11</td> <td>2.4034 2.40476</td> <td>5 GHZ</td> <td>63.05 dBµV 63.19 dBµV 8BW 100 kHz 7BW 300 kHz M1 M1 M1 691 pt 691 pt 7-value 80.14 dBµV</td> <td>ndB Q factor Mode Auto FF1 </td> <td></td> <td>20.0 182 80.14 2.476145 20 2.54700000 2.54700000 5900000 5900000000000000000000000</td> <td>0 dB 25.6</td>	1 102.00 d 11	2.4034 2.40476	5 GHZ	63.05 dBµV 63.19 dBµV 8BW 100 kHz 7BW 300 kHz M1 M1 M1 691 pt 691 pt 7-value 80.14 dBµV	ndB Q factor Mode Auto FF1 		20.0 182 80.14 2.476145 20 2.54700000 2.54700000 5900000 5900000000000000000000000	0 dB 25.6
T1           T2           Spectrun           Ref Level           Att           D1Pk Max           30 dBµV           30 dBµV           70 dBµV           50 dBµV           50 dBµV           30 dBµV           30 dBµV           30 dBµV           30 dBµV           30 dBµV           30 dBµV           10 dBµV           20 dBµV           10 dBµV	1 102.00 d 11 102.00 d 102.00 d 11 102.00 d 11 102.00 d 11 102.00 d 102.00 d 11 102.00 d 102.00	2.4034 2.40476	5 GHz 5 GHz 5 GHz 5 GHz 8 GHz	63.05 dBµV 63.19 dBµV 8BW 100 kHz 7BW 300 kHz 9DW 300	ndB Q factor Mode Auto FF1 ———————————————————————————————————		20.0 182 80.14 2.47614 20 2.54700000 2.54700000 5.547000000 5.547000000 5.547000000 5.54700000000000000000000000000000000000	0 dB 25.6



#### 9.3 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period ( $T_{eff}$ ) is approximately 478.3µs for a digital "1" bit, as shown in the plots of Section 9.4 With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was 0 dB

9.4 Calculation of Average Factor

Averaging factor in  $dB = 20 \log (duty cycle)$ 

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 7.4783ms Effective period of the cycle =  $478.3\mu$ s = 0.4783ms DC = 0.4783ms / 7.4783ms = 0.0640 or 6.40%

Therefore, the averaging factor is found by  $20 \log_{10} (0.0640) = -23.9 dB$ 

The test plots are attached as below.



Kel Level 10%	2.00 dBµV			🗑 RBW	3 MHz							( )
Att		💩 SWT										
SGL 1Pk Max												
IPK Max										-		
	l l											
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O dBµV	_					_	<u> </u>				_	
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0 dBµV		-			-				-			
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	man	Ilmonder	Withhata	J humber	Mulbourse	in hunderhad	Allindul	monen	al house	mulu	Undre	bower has be
0 dBµV												0
and the second												
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0 dBµV				0		8			\$		6	
0 dBµV				8								
о авру												
E 2.404 GHz					691	nts					10	).0 ms/
CF 2.404 GHz					691	pts					10	).0 ms/
CF 2.404 GHz Spectrum					691	pts					10	
				RBW		pts					10	
Spectrum Ref Level 102 Att	2.00 dBµV	swt			3 MHz	pts					10	
Gpectrum Ref Level 10: Att GGL	2.00 dBµV	swt			3 MHz	pts					10	
Spectrum Ref Level 10: Att SGL	2.00 dBµV	e swt			3 MHz		1[1]				10	
Gpectrum Ref Level 10: Att GGL	2.00 dBµV	e swt			3 MHz	D	1[1]				7.	0.03 d
Gpectrum Ref Level 10: Att GGL 1Pk Max	2.00 dBµV	e swt		VBW	3 MHz 3 MHz	D	11[1]				7. 84	0.03 d 4783 m 31 dBµ
Spectrum Ref Level 10: Att GGL 1Pk Max	2.00 dBµV	SWT		VBW	3 MHz	D	11[1]				7. 84	0.03 d 4783 m 31 dBµ
Spectrum Ref Level 102 SGL 1PK Max 0 dBµV	2.00 dBµV	swt		VBW	3 MHz 3 MHz	D	11[1]				7. 84	0.03 d 4783 m 31 dBµ
Spectrum Ref Level 102 SGL 1PK Max 0 dBµV	2.00 dBµV	swt		VBW	3 MHz 3 MHz	D	11[1]	D1			7. 84	0.03 d 4783 m 31 dBµ
Spectrum Ref Level 10: Att SGL 1Pk Max 0 dBµV 0 dBµV	2.00 dBµV	e swt		VBW	3 MHz 3 MHz	D	11[1]				7. 84	0.03 d 4783 m 31 dBµ
Spectrum Ref Level 10; Att GGL 1Pk Max 0 dBµV 0 dBµV 0 dBµV	2.00 dBµV	SWT		VBW	3 MHz 3 MHz	D	11[1]				7. 84	0.03 d 4783 m 31 dBµ
Spectrum Ref Level 10; Att GGL 1Pk Max 0 dBµV 0 dBµV 0 dBµV	2.00 dBµV	SWT		VBW	3 MHz 3 MHz	D	11[1]	Dl			7. 84	0.03 d 4783 m 31 dBµ
Spectrum           Ref Level 10:           Att           SGL           1Pk Max           0 dBµV           0 dBµV           0 dBµV           0 dBµV           0 dBµV	2.00 dBµV	swt		VBW	3 MHz 3 MHz	D	11[1]				7. 84	0.03 d 4783 m 31 dBµ
Spectrum           Ref Level 10:           SGL           1Pk Max           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M					7. 84. 13.	0.03 d 4783 m 31 dBµ 2609 m
Spectrum           Ref Level 10:           SGL           1Pk Max           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M			utyteau		7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m
Spectrum           Ref Level 10:           SGL           1Pk Max           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D			uhreau		7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m
Spectrum           Ref Level 10:           Att           SGL           IPk Max           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M				ridiandel	7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m
Spectrum Ref Level 102	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M			แก่งอาง		7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m
Spectrum           Ref Level 10:           SGL           1Pk Max           0 dBµV           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M			านหาะนาง		7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m
Spectrum           Ref Level 10:           SGL           IPk Max           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M			แห่ง-นะเง		7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m
Spectrum           Ref Level 10:           SGL           1Pk Max           0 dBµV           0 dBµV	2.00 dBµV 15 dB		30 ms	• VBW	3 MH2 3 MH2	D M			MARA		7. 84. 13.	0.03 d 4783 m .31 dBµ 2609 m



Spectrum							
Ref Level 102.00 dB Att 15 SGL	uµV dB <mark>e SWT</mark> 30 m	● RBW ЗМ s ● VBW ЗМ					
90 dBµV		мЪ		D1[1] M1[1]		84.	-0.02 dB 478.3 µs 31 dBµV 2609 ms
80 dBµV				-			-
70 dBµV	<u></u>			_			5
60 dBµV							
50 dBµV	d him many many	www.	www.	wanthingther	hayyyury	allowednessingar	y hir
30 dвµV			0 				
20 dBµV							
10 dBµV	-						
CF 2.404 GHz			691 pts			3	.0 ms/



#### 9.5 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10 - 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter and approximately 0.8 meter up to 1GHz and 1.5 meter above 1GHz in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Section 9.4.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



#### 9.5 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Section 9.2). Above 1000 MHz, a resolution bandwidth of 1 MHz is used, RBW 3MHz used for fundamental emission.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.



#### 10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-12	BiConiLog Antenna	ETS	3142E	00166158	14-Sep-2018	14-Sep-2020
SZ185-01	EMI Receiver	R&S	ESCI	100547	24-Dec-2019	24-Dec-2020
SZ061-09	Horn Antenna	ETS	3115	00092346	16-Oct-2019	16-Oct-2020
SZ061-06	Active Loop Antenna	Electro- Metrics	EM-6876	217	24-May-2019	24-May-2020
SZ061-15	Double- Ridged Waveguide Horn Antenna	ETS	3116C-PA	00224718	25-Oct-2018	25-Oct-2020
SZ056-06	Spectrum Analyzer	R&S	FSV40	101101	28-May-2019	28-May-2020
SZ181-04	Preamplifie r	Agilent	8449B	3008A024 74	5-Jul-2019	5-Jul-2020
SZ188-01	Anechoic Chamber	ETS	RFD-F/A- 100	4102	15-Dec-2018	15-Dec-2020
SZ062-02	RF Cable	RADIALL	RG 213U		19-Dec-2019	19-Jun-2020
SZ062-05	RF Cable	RADIALL	0.04- 26.5GHz		23-Feb-2020	23-Aug-2020
SZ062-12	RF Cable	RADIALL	0.04- 26.5GHz		23-Feb-2020	23-Aug-2020
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02		28-May-2019	28-May-2020