

**Produkte**  
*Products*

<b>Prüfbericht - Nr.:</b> 14043219 001		Seite 1 von 18	
<i>Test Report No.:</i>		<i>Page 1 of 18</i>	
<b>Auftraggeber:</b> <i>Client:</i>	Shing Hing Industrial Limited Rm 2105-06, 21/F, Cheung Tat Centre 18 Cheung Lee Street, Chai Wan Hong Kong		
<b>Gegenstand der Prüfung:</b> <i>Test Item:</i>	Short Range Device - Bluetooth Dartboard		
<b>Bezeichnung:</b> <i>Identification:</i>	GUZ2	<b>Serien-Nr.:</b> <i>Serial No.:</i>	Engineering sample
<b>Wareneingangs-Nr.:</b> <i>Receipt No.:</i>	A000323181-002	<b>Eingangsdatum:</b> <i>Date of Receipt:</i>	02.03.2016
<b>Prüfört:</b> <i>Testing Location:</i>	TÜV Rheinland Hong Kong Ltd. 8/F, First Group Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong <b>Hong Kong Productivity Council</b> HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong		
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of test item at delivery:</i>	Test samples are not damaged and suitable for testing.		
<b>Prüfgrundlage:</b> <i>Test Specification:</i>	FCC Part 15 Subpart B and C ANSI C63.10-2013 ANSI C63.4-2014		
<b>Prüfergebnis:</b> <i>Test Results:</i>	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.  The above mentioned product was tested and <b>passed</b> .		
<b>Prüflaboratorium:</b> <i>Testing Laboratory:</i>	TÜV Rheinland Hong Kong Ltd. 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong		
<b>geprüft/ tested by:</b>		<b>kontrolliert/ reviewed by:</b>	
03.05.2016	Benny Lau Senior Project Manager	03.05.2016	Sharon Li Department Manager
<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>
			<b>Name/Stellung</b> <i>Name/Position</i>
			<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges:</b> <i>Other Aspects</i>	FCC ID: 2AFZGDB-GZ003		
<b>Abkürzungen:</b>	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	<b>Abbreviations:</b>	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

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## Product information

### Manufacturers declarations

	<b>Transceiver</b>
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	PCB Antenna
Antenna gain (dBi)	-3 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	$V_{nor}$ : 100-240VAC and 6 VDC
Independent Operation Modes	Transmitting

### Product function and intended use

The equipment under test (EUT) is a Bluetooth low energy device.

FCC ID: 2AFZWGDB-GZ003

<b>Models</b>	<b>Product description</b>
GUZ2	Short Range Device - Bluetooth Dartboard

### Submitted documents

Circuit Diagram  
 Block Diagram  
 Bill of material  
 User manual  
 Label

### Independent Operation Modes

The basic operation modes are:

- Transmitting mode.

For further information refer to User Manual

### Related Submittal(s) Grants

This is a single application for certification of the transmitter.

**Remark**

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

## Test Set-up and Operation Mode

### Principle of Configuration Selection

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

### Test Operation and Test Software

Test operation should refer to test methodology.

- There was no special software to exercise the device.

### Special Accessories and Auxiliary Equipment

- AC-DC adaptor model: IPC12-050-2000D (Provided by Appliant)

### Countermeasures to achieve EMC Compliance

- none

## Test Methodology

### Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013. The radiated emission measurements of the digital part were performed according to the procedures in ANSI C63.4-2014.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

### Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

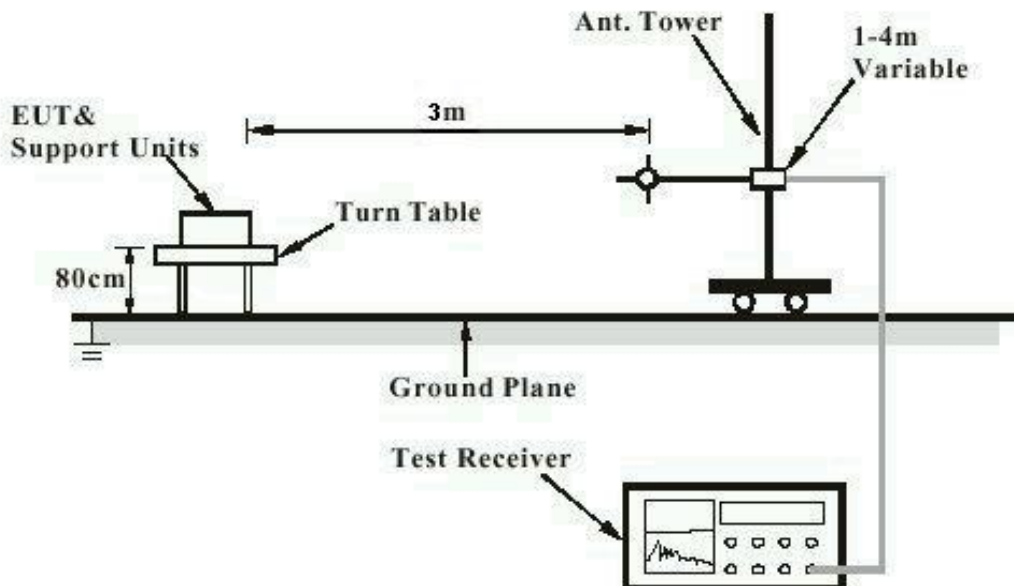
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.  
R = Reading of Spectrum Analyzer in dBuV.  
AF = Antenna Factor in dB.  
CF = Cable Attenuation Factor in dB.  
FA = Filter Attenuation Factor in dB.  
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

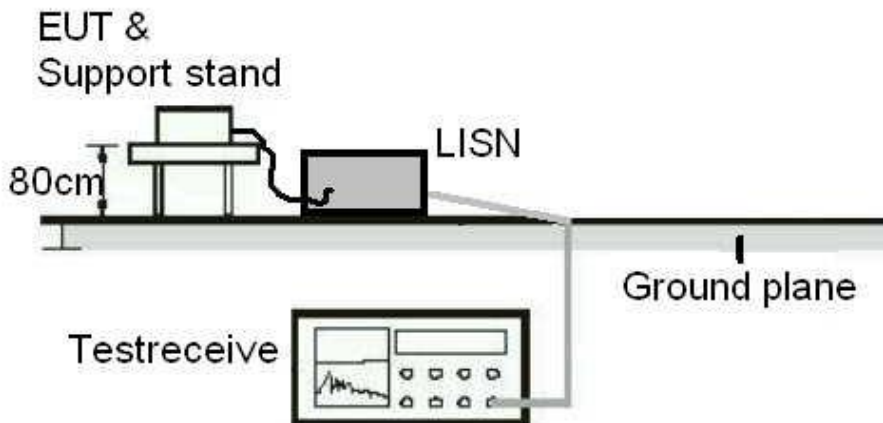
## Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



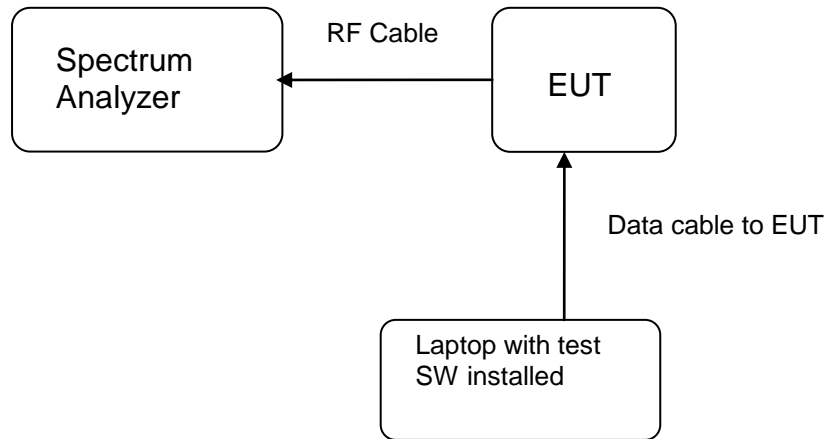
Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)





**Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)**



## List of Test and Measurement Instruments

Hong Kong Productivity Council (Registration number: 90656)

### Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	25-Apr-16	25-Apr-17
New Fully Anchoic Chamber	TDK	N/A	19-Apr-16	19-Apr-17
Cable	Hubersuhner	SUCOFLEX 104	31-Mar-16	31-Mar-18
Test Receiver	R & S	ESU26	7-Dec-15	07-Dec-16
Bi-conical Antenna	R & S	HK116	1-Sep-15	01-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	01-Sep-17
Coaxial cable	Harbour	LL335	10-Jun-14	10-Jun-16
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	17-Jul-14	17-Jul-16
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17
Horn Antenna	EMCO	3115	26-Aug-15	26-Aug-17
Active Loop Antenna	EMCO	6502	15-Aug-15	15-Aug-16

### AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESU40	7-Dec-15	07-Dec-16
RF Voltage Probe	Schwarzbeck	TK9416	10-Feb-16	10-Feb-17
LISN	R&S	ESH3-Z5	15-Jun-15	15-Jun-16
Double Shield Cable	Radiall	RG142	14-Sep-15	14-Sep-17
Pulse Limiter	R&S	ESH3-Z2	4-Jun-14	04-Jun-16

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### Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	12-Jan-15	12-Jan-2017

## Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is  $\pm 3.43\text{dB}$ .

The estimated combined standard uncertainty for radiated emissions measurements is  $\pm 5.10\text{dB}$  (30MHz to 200MHz) and  $\pm 5.08\text{dB}$  (200MHz to 1000MHz) and is  $\pm 5.10\text{dB}$  (30MHz to 200MHz) and  $\pm 5.08\text{dB}$  (above 1GHz).

The estimated combined standard uncertainty for antenna conducted emission is  $\pm 1.56\text{dB}$

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of  $k=2$ , which for the level of confidence is approximately 95%.

## Results FCC Part 15 – Subpart C

<b>FCC 15.203 – Antenna Requirement 1</b>		<b>Pass</b>
<b>FCC Requirement:</b> No antenna other than that furnished by the responsible party shall be used with the device		
<b>Results:</b>	a) Antenna type:	Integral PCB antenna
	b) Manufacturer and model no:	N/A
	c) Peak Gain:	-3 dBi
<b>Verdict:</b>	Pass	

<b>FCC 15.204 – Antenna Requirement 2</b>		<b>N/A</b>
<b>FCC Requirement:</b> An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
<b>Results:</b>	Only one integral antenna can be used.	
<b>Verdict:</b>	N/A	

<b>FCC 15.207 – Conducted Emission on AC Mains</b>		<b>Pass</b>				
Test Specification : ANSI C63.10 – 2013						
Mode of operation : TX mode						
Port of testing : AC Mains input port of power supply						
Detector : Quasi-peak and Average						
RBW : 9 kHz						
Supply voltage : 120Vac 60Hz						
Temperature : 23°C						
Humidity : 50%						
Requirement:	15.207(a)					
<b>Results:</b>	Pass					
<b>Live measurement</b>						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.430	41.7	30.2	66 - 56	56 - 46	Pass
> 0,5 - 5	0.830	37.7	22.2	56	46	Pass
> 5 - 30	24.002	48.7	45.2	60	50	Pass
<b>Neutral measurement</b>						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.422	38.1	26.9	66 - 56	56 - 46	Pass
> 0,5 - 5	0.718	32.7	18.0	56	46	Pass
> 5 - 30	24.002	50.2	45.3	60	50	Pass

**Results:** Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2.

**FCC 15.247 (a)(2) – 6dB Bandwidth Measurement** **Pass**

**FCC Requirement:** Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.

Test Specification : ANSI C63.10 – 2013  
 Mode of operation : TX mode  
 Port of testing : Temporary antenna port  
 Detector : Peak  
 RBW/VBW : 100KHz/ 300KHz  
 Supply voltage : 3.7 Vdc  
 Temperature : 23°C  
 Humidity : 50%

**Results:** For test protocols please refer to Appendix 1

Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (kHz)
2402	2401.732	2402.404	672.000
2440	2439.744	2440.388	644.000
2480	2479.732	2480.396	664.000

**FCC 15.247(b)(3) – Maximum Peak Conducted Output Power** **Pass**

**FCC Requirement:** For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)

Test Specification : ANSI C63.10 – 2013  
 Mode of operation : TX mode  
 Port of testing : Temporary antenna port  
 Detector : Peak  
 Supply voltage : 3.7 Vdc  
 Temperature : 23°C  
 Humidity : 50%

**Results:** For test protocols please refer to Appendix 1

Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2402	-1.86	1 / 30.0	Pass
2440	-2.38	1 / 30.0	Pass
2480	-3.08	1 / 30.0	Pass

<b>FCC 15.247(e) – Power Spectral Density</b>		<b>Pass</b>	
<b>FCC Requirement:</b> For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.			
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW : ≥100 KHz / ≥3xRBW span : ≥1.5 x DTS BW Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%			
<b>Results:</b> For test protocols please refer to Appendix 1			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-1.78	8.0	Pass
2440	-2.33	8.0	Pass
2480	-3.06	8.0	Pass

<b>FCC 15.247(d) – Spurious Conducted Emissions</b>		<b>Pass</b>			
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.7 Vdc Temperature : 23 °C Humidity : 50 %					
<b>FCC Requirement:</b> In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 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.					
<b>Results:</b> Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.					
Only the worst cases is shown below. For test protocols refer to Appendix 1					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	2400.000	-41.29	-1.78	-39.51	Pass
2440	2456.000	-44.28	-2.33	-41.95	Pass
2480	2488.000	-44.76	-3.06	-41.70	Pass

<b>FCC 15.205 – Radiated Emissions in Restricted Frequency Bands</b>		<b>Pass</b>
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%		
<b>FCC Requirement:</b> In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).		
<b>Results:</b> Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.  All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.		
Mode: 2402MHz TX		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
48.003	39.80*	40.0 / QP
2390.000	45.98	74.0 / PK
2390.000	33.92	54.0 / AV
4804.000	52.93	74.0 / PK
4804.000	40.03	54.0 / AV
7206.000	60.34	74.0 / PK
7206.000	45.74	54.0 / AV
Mode: 2402 MHz TX		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2390.000	46.45	74.0 / PK
2390.000	33.77	54.0 / AV
7206.000	61.47	74.0 / PK
7206.000	51.08	54.0 / AV
Mode: 2440 MHz TX		Vertical Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
48.003	39.70*	40.0 / QP
4880.000	53.47	74.0 / PK
4880.000	42.14	54.0 / AV
Mode: 2440 MHz TX		Horizontal Polarization
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
No peak found	---	74.0 / PK

No peak found	---	54.0 / AV
Mode: 2480MHz TX Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
48.000	39.80*	74.0 / PK
2483.500	54.36	74.0 / PK
2483.500	42.11	54.0 / AV
4960.000	55.75	74.0 / PK
4960.000	46.06	54.0 / AV
7440.000	60.56	74.0 / PK
7440.000	48.37	54.0 / AV
Mode: 2480 MHz TX Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	54.53	74.0 / PK
2483.500	40.54	54.0 / AV
7440.000	60.76	74.0 / PK
7440.000	49.77	54.0 / AV

Remark\*) Marginal Pass



## Results FCC Part 15 – Subpart B

FCC 15.107 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.4 – 2014 Mode of operation : Normal Operating mode Port of testing : AC Mains input port of power supply Detector : Quasi-peak and Average RBW : 9 kHz Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.107(a)						
Results: Pass						
<b>Live measurement</b>						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.434	42.6	36.2	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	24.002	51.7	46.8	60	50	Pass
<b>Neutral measurement</b>						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.430	45.8	36.6	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	24.002	49.2	43.9	60	50	Pass

<b>FCC 15.109 – Radiated Emission</b>		<b>Pass</b>
Test Specification : ANSI C63.4 – 2014 Mode of operation : Normal Operating mode Port of testing : Enclosure Detector : QP RBW/VBW : 120 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 120VAC Temperature : 23°C Humidity : 50%		
<b>FCC Requirement:</b> 15.109(a)		
<b>Results:</b> Pass		
Vertical Polarization		
<b>Freq MHz</b>	<b>Level dBuV/m</b>	<b>Limit/ Detector dBuV/m</b>
30.190	29.7	40.0 / QP
48.003	39.8*	40.0 / QP
Horizontal Polarization		
<b>Freq MHz</b>	<b>Level dBuV/m</b>	<b>Limit/ Detector dBuV/m</b>
30.190	18.0	40.0 / QP
48.003	21.8	40.0 / QP

Remark\*) Marginal Pass