



FCC PART 15.249  
TEST REPORT

For

**Hobbico Inc**

2904 Research Road Champaign Illinois United States

**FCC ID: IYFMR110**

<b>Report Type:</b> Original Report	<b>Product Type:</b> MR110 Transmitter
<b>Report Number:</b> RSZ180207801-00	
<b>Report Date:</b> 2018-03-22	
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Hobbico Inc*'s product, model number: *DIDJ1110* (FCC ID: *IYFMR110*) in this report is a *MR110 Transmitter*, which was measured approximately: 19.0 cm (L) \* 15.0 cm (W) \* 4.0 cm (H), rated with input voltage: DC 4 \* 1.5 V AAA battery.

*\*All measurement and test data in this report was gathered from production sample serial number: 180207801 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-02-07.*

### Objective

This type approval report is prepared on behalf of *Hobbico Inc* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

### Related Submittal(s)/Grant(s)

Part of system submission with FCC ID: IYF120.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### Measurement Uncertainty

Parameter	uncertainty
Occupied Channel Bandwidth	±5%
RF Output Power with Power meter	±0.5dB
RF conducted test with spectrum	±1.5dB
AC Power Lines Conducted Emissions	±1.95dB
All emissions, radiated	±4.88dB
Temperature	±3°C
Humidity	±6%
Supply voltages	±0.4%

### **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

## SYSTEM TEST CONFIGURATION

### Justification

The system was configured for testing by manufacturer.

6 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2453	4	2465
1	2457	5	2470
2	2460	6	2475

Channel 0, Channel 4 and Channel 6 were selected for testing.

### EUT Exercise Software

No software was used.

### Equipment Modifications

No modifications were made to the unit tested.

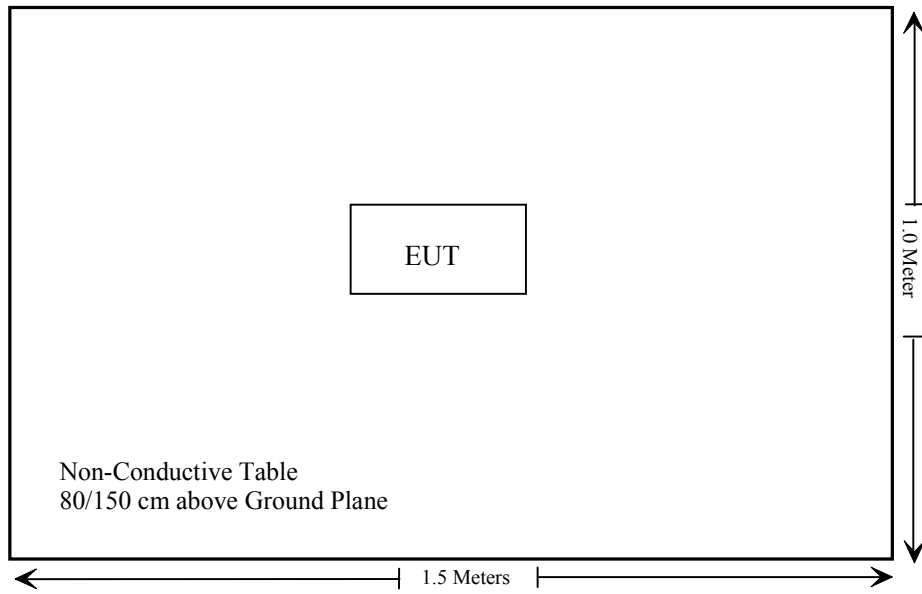
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	N/A	N/A	N/A

### Support Cable Descriptions

Cable Description	Length (m)	From/Port	To
N/A	N/A	N/A	N/A

**Block Diagram of Test Setup**



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Not Applicable
15.205, §15.209, §15.249(d)	Radiated Emissions& Outside of Band Emission	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

Not Applicable: The EUT was powered by battery only.

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
A.H.System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2017-04-24	2018-04-24
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-05-21	2018-05-21
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-21
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	1	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	2	2017-11-19	2018-05-21
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-04	2017-12-29	2020-12-28
Ducommun Technologies	Pre-amplifier	ALN-22093530-01	991373-01	2017-08-03	2018-08-03
Sinoscite	Notch Filter	BSF2402-2480MN-0898-001	N/A	2017-05-21	2018-05-21
<b>RF Conducted Test</b>					
WEINSCHTEL	3dB Attenuator	N/A	N/A	2017-11-22	2018-11-22
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
Ducommun technologies	RF Cable	RG-214	3	2017-11-22	2018-05-22

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).



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## **FCC§15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to FCC § 15.203, 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.

### **Antenna Connector Construction**

The EUT has one monopole antenna which was permanently attached and the antenna gain is 1.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

**FCC§15.205, §15.209 & §15.249(d) - RADIATED EMISSIONS****Applicable Standard**

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

<b>Fundamental frequency</b>	<b>Field strength of fundamental (millivolts/meter)</b>	<b>Field strength of harmonics (microvolts/meter)</b>
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

As per FCC§15.249 (d), Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

**Test Equipment Setup**

The spectrum analyzer or receiver is set as:

Below 1000MHz:

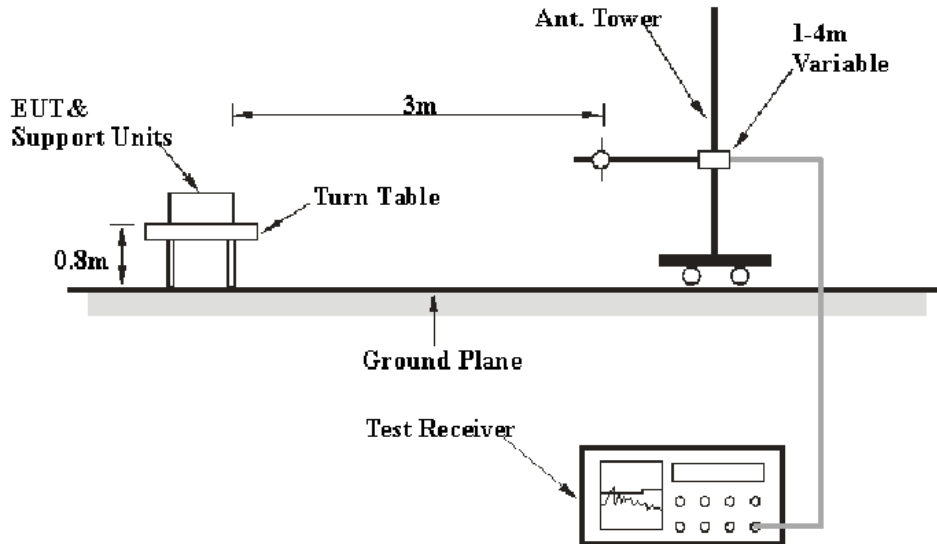
$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000MHz:

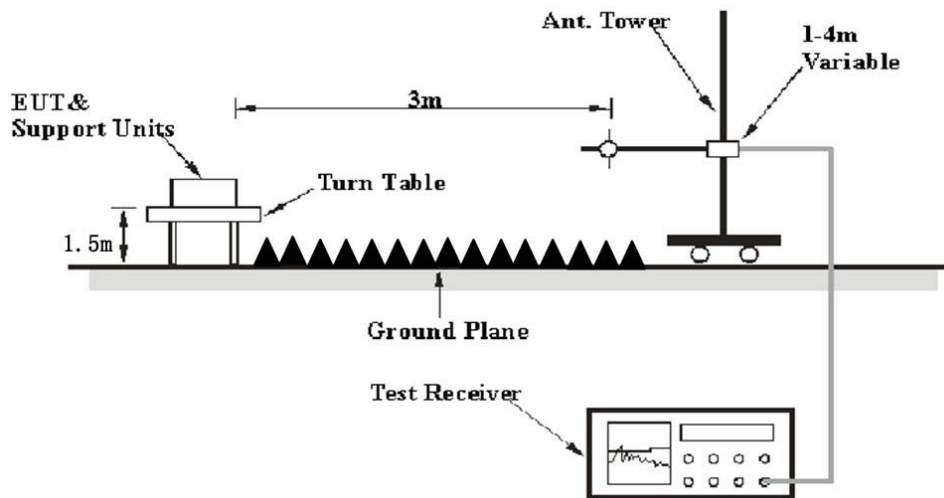
$$\begin{aligned} \text{Peak: RBW} &= 1\text{MHz} / \text{VBW} = 1\text{MHz} / \text{Sweep} = \text{Auto} \\ \text{Average: RBW} &= 1\text{MHz} / \text{VBW} = 10\text{Hz} / \text{Sweep} = \text{Auto} \end{aligned}$$

**EUT Setup**

**Below 1GHz:**



**Above 1GHz:**



The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 limits.

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane for below 1GHz or 1.5 meter for above 1GHz, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.205, 15.209 & §15.249

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BAEL,  $U_{(Lm)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

## Test Data

### Environmental Conditions

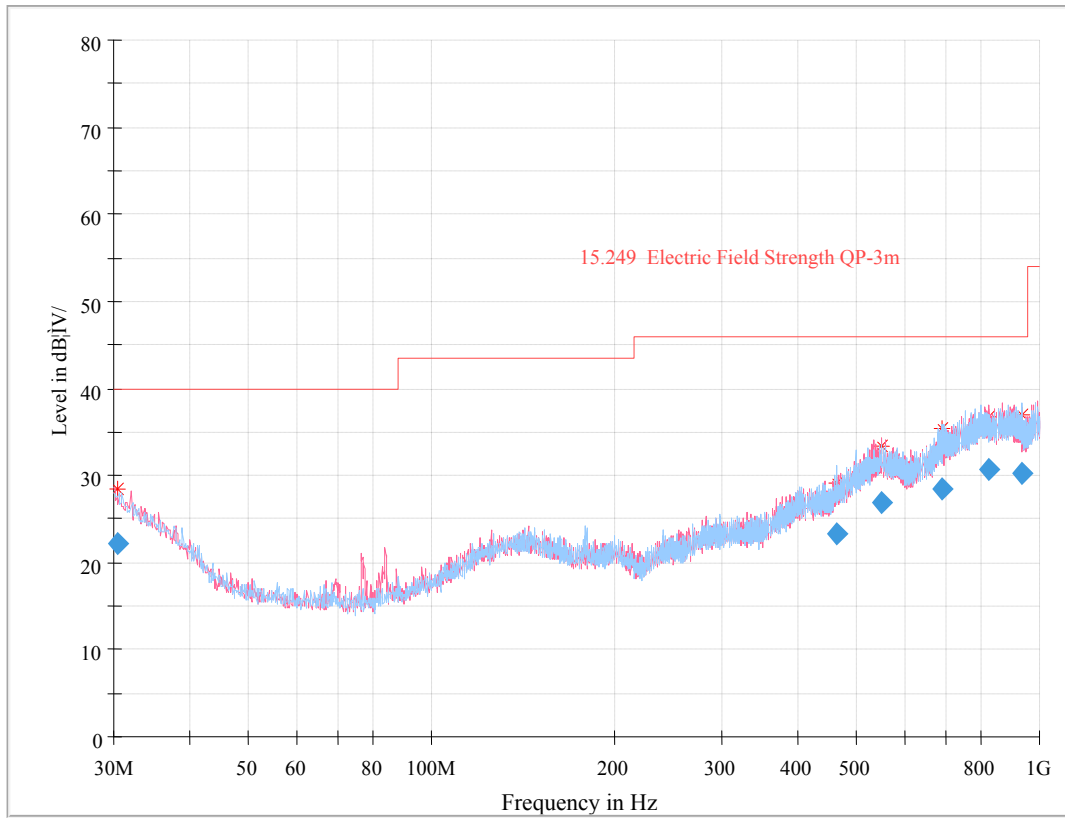
<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Tracy Hu on 2018-03-20.*

*Test Mode: Transmitting*

30MHz – 1 GHz:

Full Spectrum



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.494750	22.18	176.0	V	316.0	0.0	40.00	17.82
463.099750	23.24	385.0	H	196.0	1.0	46.00	22.76
550.754750	26.92	357.0	V	199.0	4.9	46.00	19.08
692.694500	28.36	309.0	H	19.0	6.4	46.00	17.64
824.900000	30.71	113.0	V	115.0	9.0	46.00	15.29
934.089000	30.16	294.0	H	293.0	8.7	46.00	15.84

1 GHz - 25 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.249&15.209	
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
<b>Low Channel (2453 MHz)</b>									
2453.00	60.05	PK	55	1.4	H	34.08	94.13	114	19.87
2453.00	39.28	Ave.	55	1.4	H	34.08	73.36	94	20.64
2453.00	55.22	PK	101	1.3	V	34.08	89.30	114	24.70
2453.00	34.12	Ave.	101	1.3	V	34.08	68.20	94	25.8
2325.22	27.33	PK	169	1.6	H	33.83	61.16	74	12.84
2325.22	13.54	Ave.	169	1.6	H	33.83	47.37	54	6.63
2348.67	27.11	PK	303	1.3	H	33.83	60.94	74	13.06
2348.67	13.36	Ave.	303	1.3	H	33.83	47.19	54	6.81
2484.92	26.95	PK	347	2.4	H	34.08	61.03	74	12.97
2484.92	13.29	Ave.	347	2.4	H	34.08	47.37	54	6.63
4906.00	50.33	PK	229	1.5	H	6.21	56.54	74	17.46
4906.00	31.58	Ave.	229	1.5	H	6.21	37.79	54	16.21
7359.00	47.64	PK	159	1.3	H	13.02	60.66	74	13.34
7359.00	30.61	Ave.	159	1.3	H	13.02	43.63	54	10.37
<b>Middle Channel (2465 MHz)</b>									
2465.00	58.92	PK	186	1.0	H	34.08	93.00	114	21
2465.00	36.85	Ave.	186	1.0	H	34.08	70.93	94	23.07
2465.00	55.82	PK	115	1.3	V	34.08	89.90	114	24.1
2465.00	35.24	Ave.	115	1.3	V	34.08	69.32	94	24.68
2371.56	27.11	PK	170	1.6	H	33.92	61.03	74	12.97
2371.56	13.28	Ave.	170	1.6	H	33.92	47.20	54	6.80
2382.46	26.89	PK	52	2.2	H	33.92	60.81	74	13.19
2382.46	13.15	Ave.	52	2.2	H	33.92	47.07	54	6.93
2490.55	27.35	PK	264	2.4	H	34.08	61.43	74	12.57
2490.55	13.58	Ave.	264	2.4	H	34.08	47.66	54	6.34
4930.00	48.51	PK	97	1.9	H	6.21	54.72	74	19.28
4930.00	30.56	Ave.	97	1.9	H	6.21	36.77	54	17.23
7395.00	45.33	PK	228	1.8	H	13.02	58.35	74	15.65
7395.00	29.48	Ave.	228	1.8	H	13.02	42.50	54	11.50

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.249&15.209	
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
<b>High Channel (2475 MHz)</b>									
2475.00	58.33	PK	348	1.3	H	34.08	92.41	114	21.59
2475.00	39.28	Ave.	348	1.3	H	34.08	73.36	94	20.64
2475.00	55.41	PK	164	1.5	V	34.08	89.49	114	24.51
2475.00	35.92	Ave.	164	1.5	V	34.08	70.00	94	24
2366.43	26.87	PK	21	2.1	H	33.92	60.79	74	13.21
2366.43	13.21	Ave.	21	2.1	H	33.92	47.13	54	6.87
2483.51	29.47	PK	88	1.2	H	34.08	63.55	74	10.46
2483.51	13.22	Ave.	88	1.2	H	34.08	47.30	54	6.70
2484.22	29.76	PK	136	2.4	H	34.08	63.84	74	10.16
2484.22	13.06	Ave.	136	2.4	H	34.08	47.14	54	6.86
4950.00	48.14	PK	210	1.9	H	7.82	55.96	74	18.04
4950.00	30.22	Ave.	210	1.9	H	7.82	38.04	54	15.96
7425.00	45.27	PK	314	1.7	H	13.02	58.29	74	15.71
7425.00	29.35	Ave.	314	1.7	H	13.02	42.37	54	11.63

**Note:**

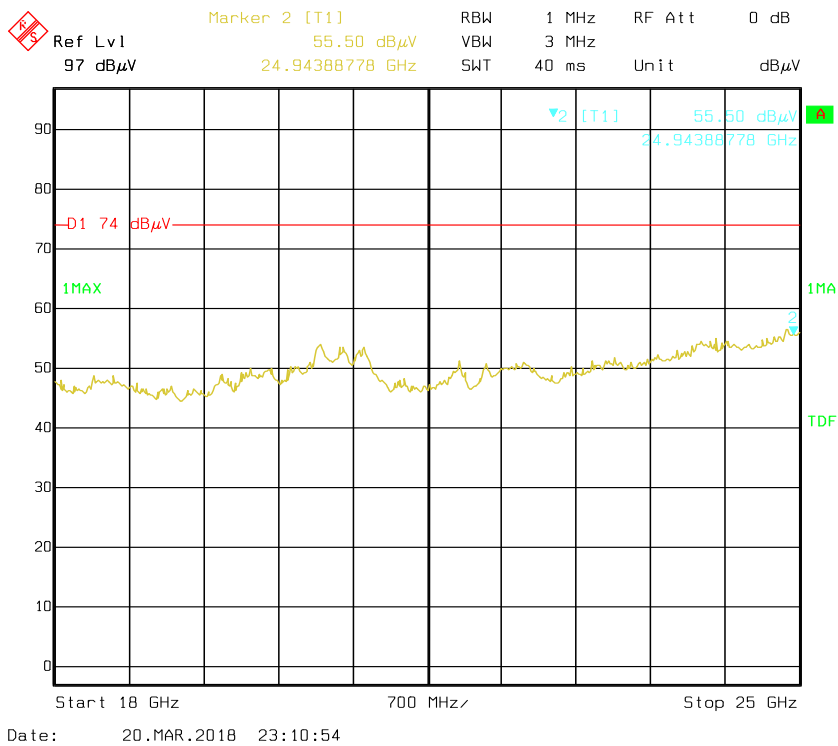
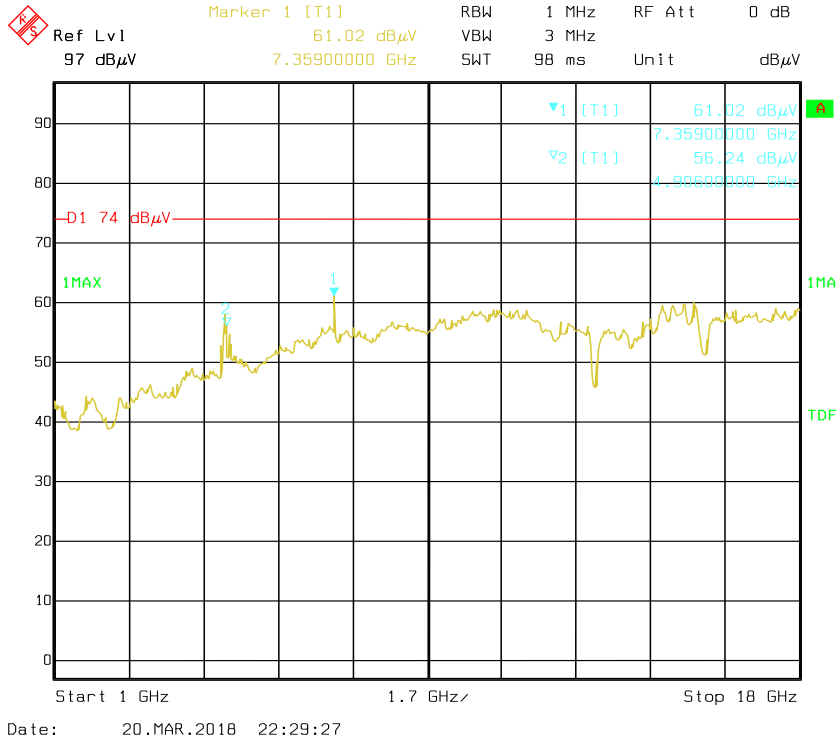
Corrected Amplitude = Corrected Factor + Reading

Corrected Factor=Antenna factor (RX) +cable loss – amplifier factor

Margin = Limit- Corr. Amplitude

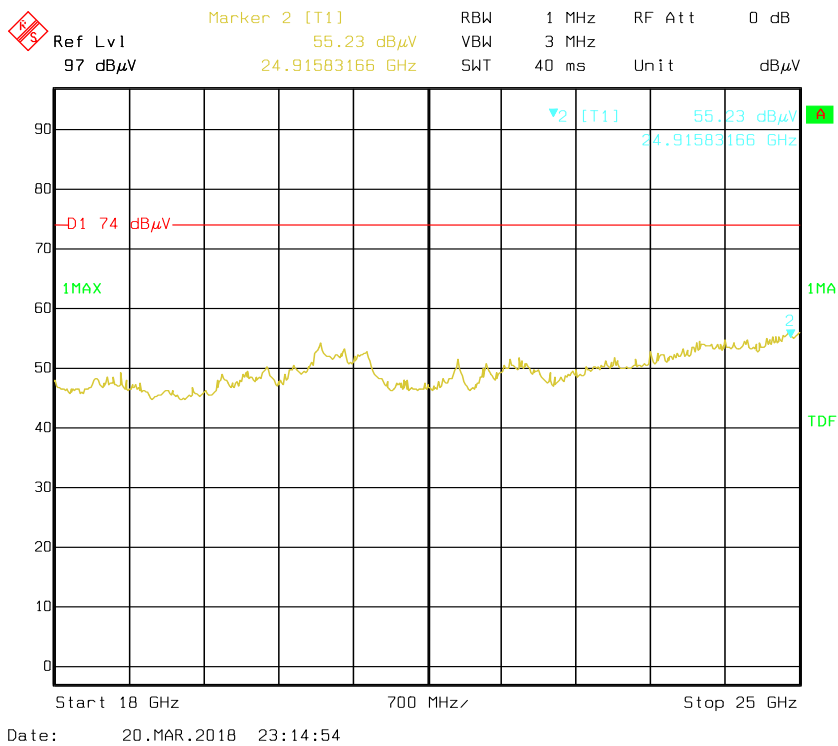
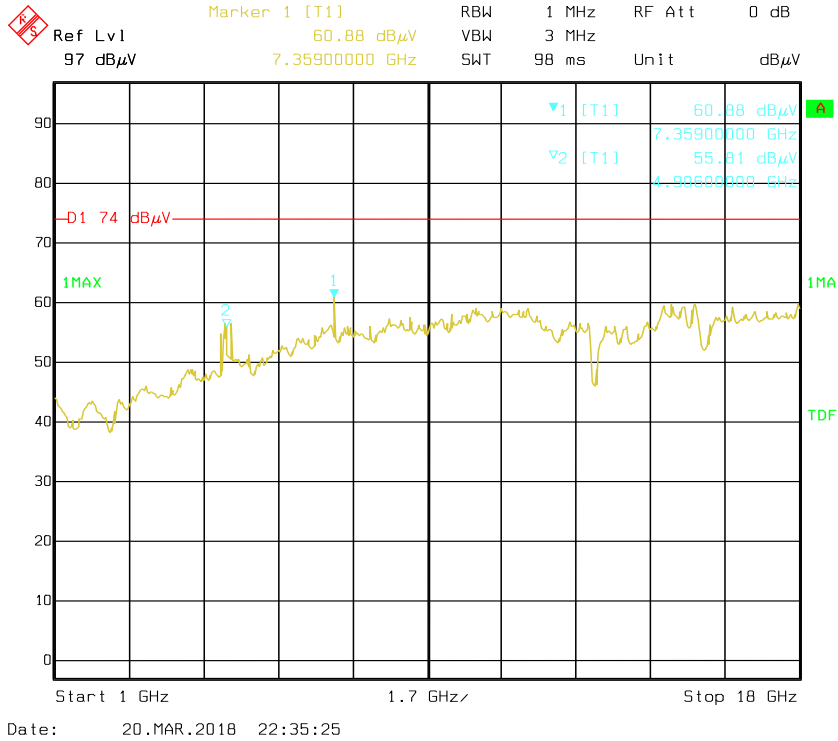
The emission more than 20dB below the limit was not required to be recorded.

### Pre-scan with Low channel Peak Horizontal

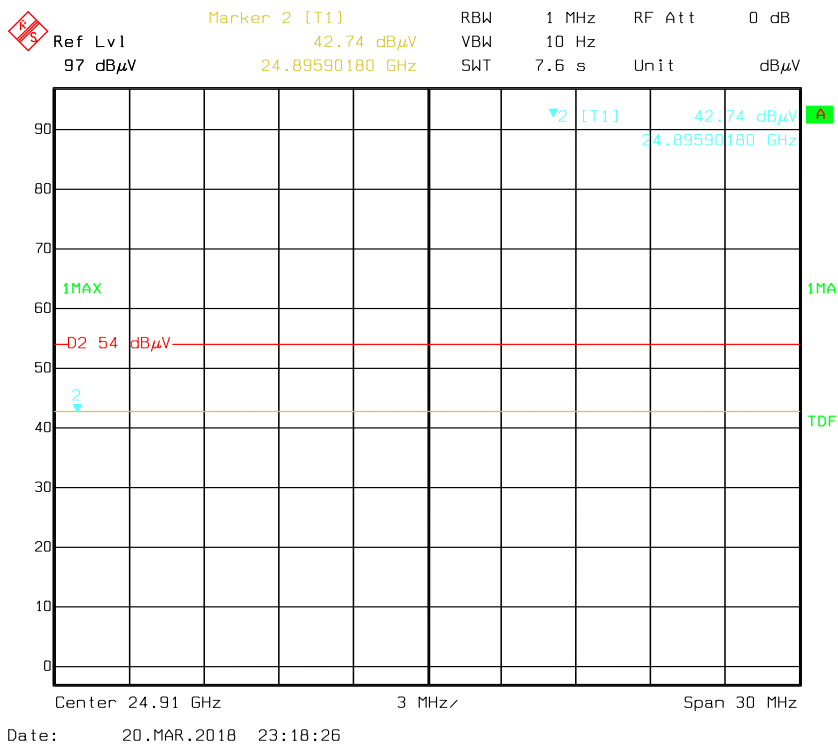
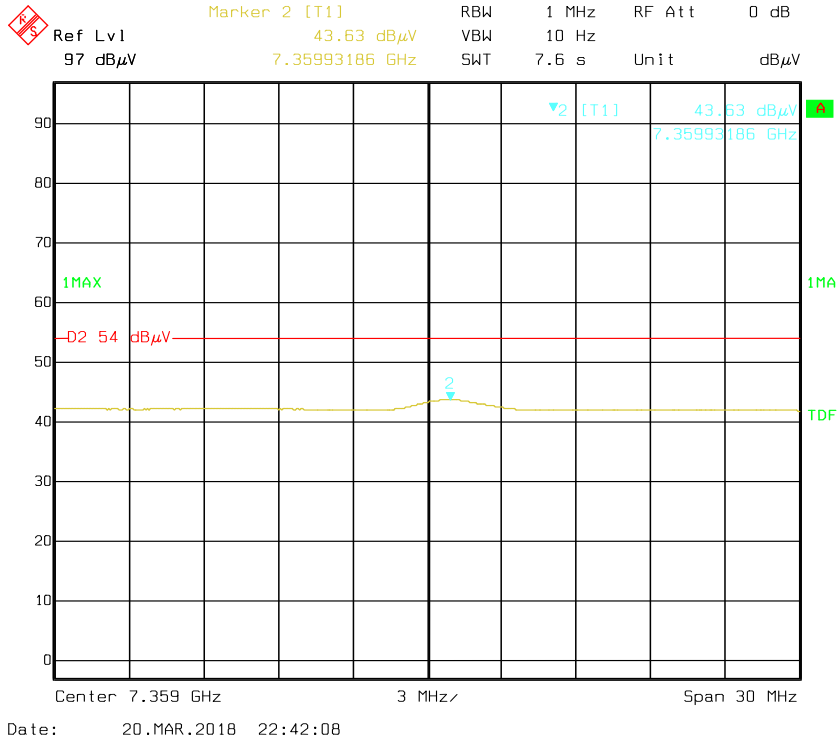




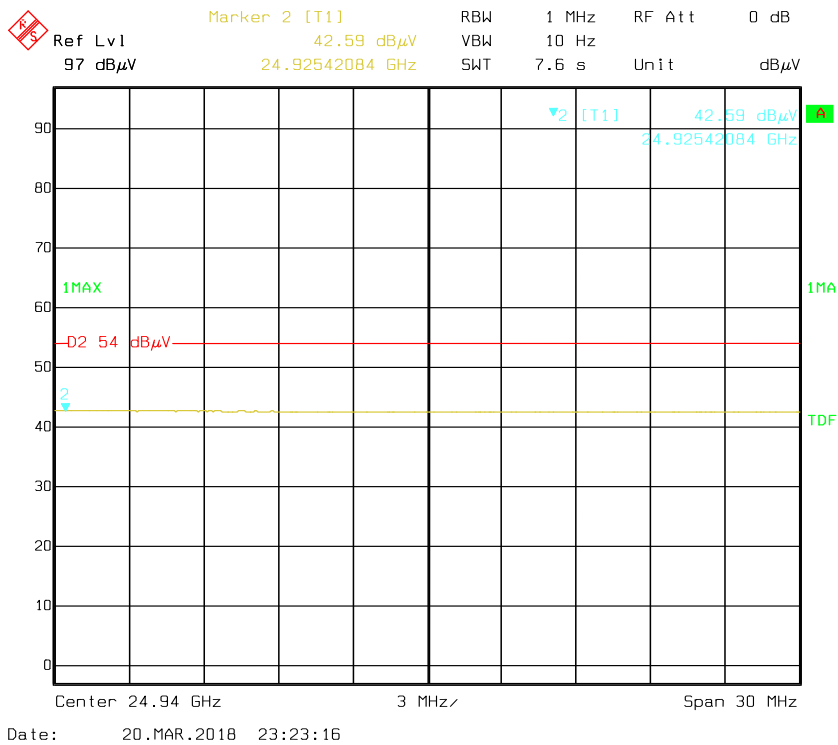
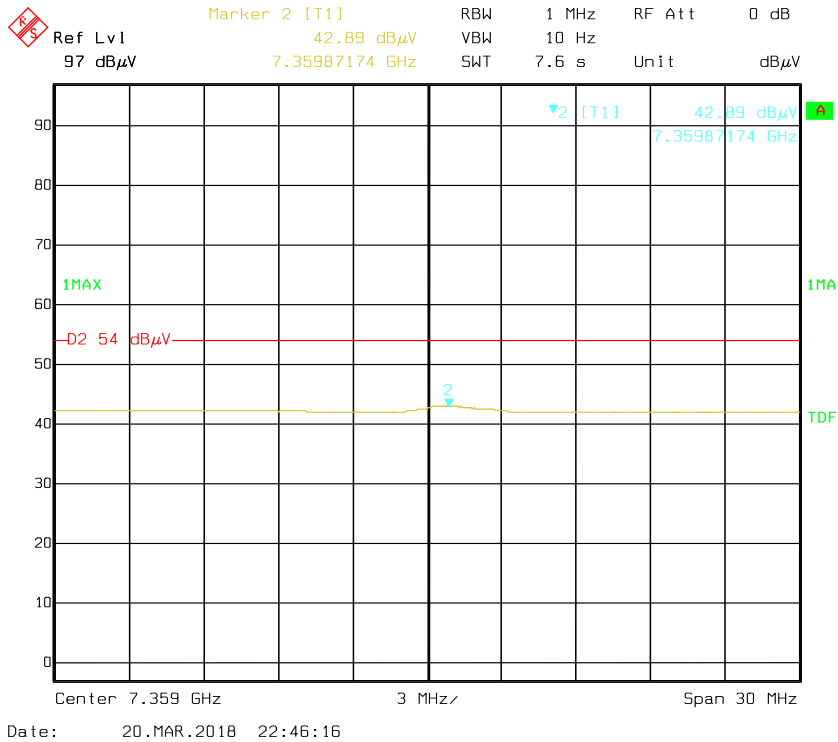
Vertical



**Average value for the peak point at pre-scan  
Horizontal**



Vertical



## FCC§15.215(c) - 20dB EMISSION BANDWIDTH

### Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that indicated 20dB bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	101.0 kPa

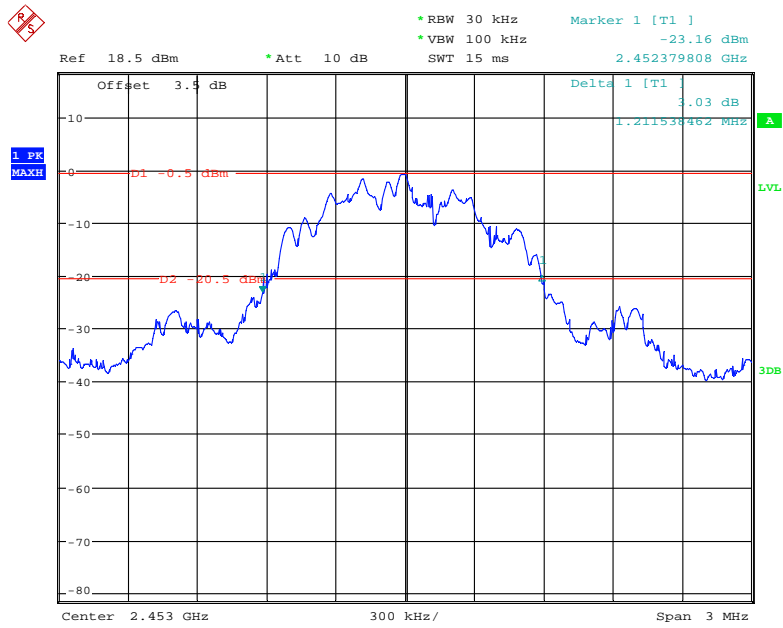
*The testing was performed by Tracy Hu on 2018-02-24.*

*Test Mode: Transmitting*

*Please refer to the following table and plots.*

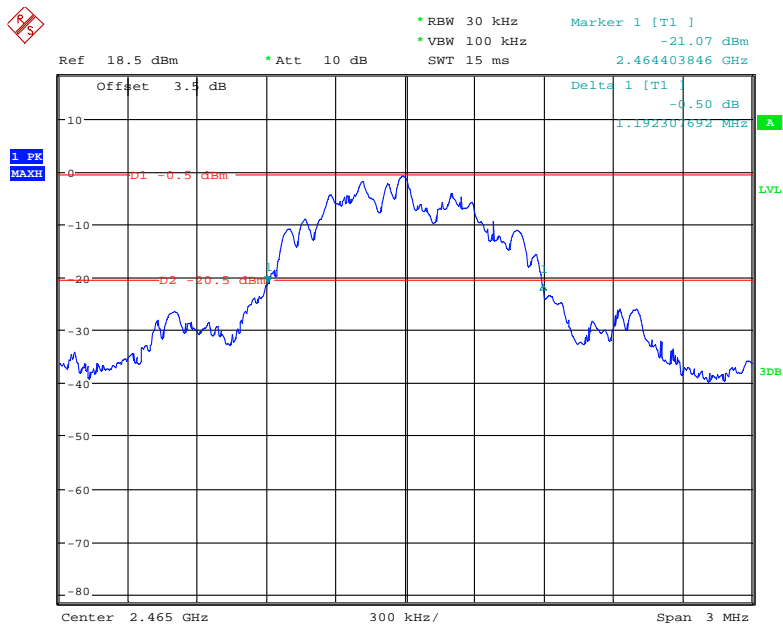
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2453	1.212
Middle	2465	1.192
High	2475	1.216

### Low Channel



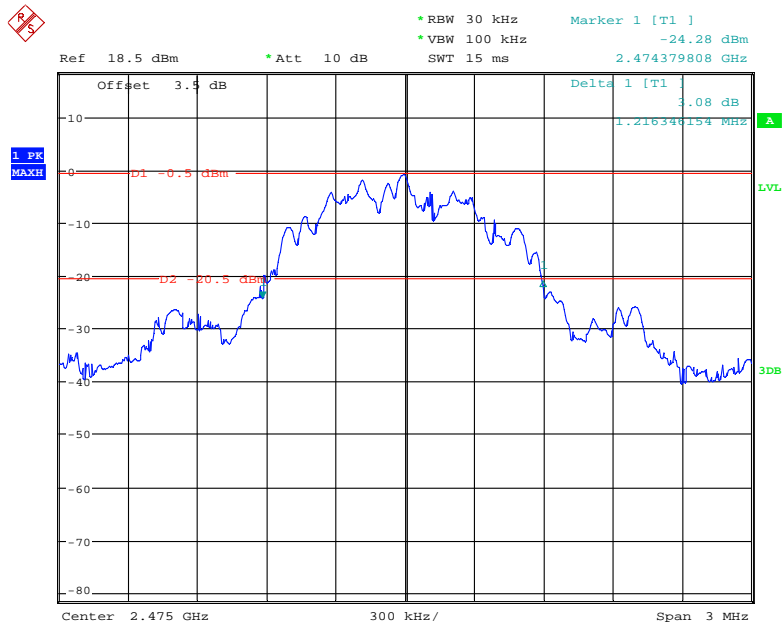
Date: 24.FEB.2018 18:47:07

### Middle Channel



Date: 24.FEB.2018 18:49:47

### High Channel



Date: 24.FEB.2018 18:52:20

\*\*\*\*\* END OF REPORT \*\*\*\*\*