EMC
TEST REPORT

Report No. : TS12060205-EME
Model No. : F21-2S-TX
Issued Date : Jul. 13, 2012

Applicant: **Intercontinental Technologies, Ltd.**
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Test Method/ Standard: **47 CFR FCC Part 15.231 & ANSI C63.4 2003**

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Summary of Tests

Test Item	Reference	Results
Radiated Emission test	15.231(b), 15.209	Pass
Measured bandwidth	15.231(c)	Pass
Timing requirement of manually operated transmitter	15.231(a)(1)	Pass
Conducted Emission test	15.231(b), 15.207	N/A

1. General information

1.1 Identification of the EUT

Product:	Industrial Radio Remote Controller
Model No.:	F21-2S-TX
FCC ID.:	JI9-F21-2S-028
Frequency Range:	317.2550 MHz
Channel Number:	Single channel
Frequency of Each Channel:	317.2550 MHz
Access scheme:	AFSK
Power Supply:	DC 3 V from battery
Power Cord:	N/A
Sample Received:	Jun. 22, 2012
Test Date(s):	Jun. 26, 2012 ~ Jul. 11, 2012
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Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is Industrial Radio Remote Controller, and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.3 Antenna description

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain	: ≦1.5 dBi
Antenna Type	: Dipole antenna
Connector Type	: 2-Pin connect

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 2.1053 and the requirement in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

The EUT was supplied with DC 3 V from battery and transmitted RF signal continuously by pressing UP button during the test.

2.3 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2011/12/6	2012/12/4
Spectrum Analyzer	Rohde&schwarz	FSP30	100137	2012/6/25	2013/6/25
Spectrum Analyzer	Rohde&schwarz	FSEK30	100186	2012/2/6	2013/2/5
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2010/8/31	2012/8/30
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2011/7/26	2013/7/25
Pre-Amplifier	MITEQ	AFS44-00102650 --42-10P-44	1495287	2011/10/27	2013/10/26
Pre-Amplifier	MITEQ	JS4-26004000--2 7-8A	828825	2010/9/8	2012/9/7

Note: The above equipments are within the valid calibration period.

3. Radiated emission test FCC 15.231 (b)

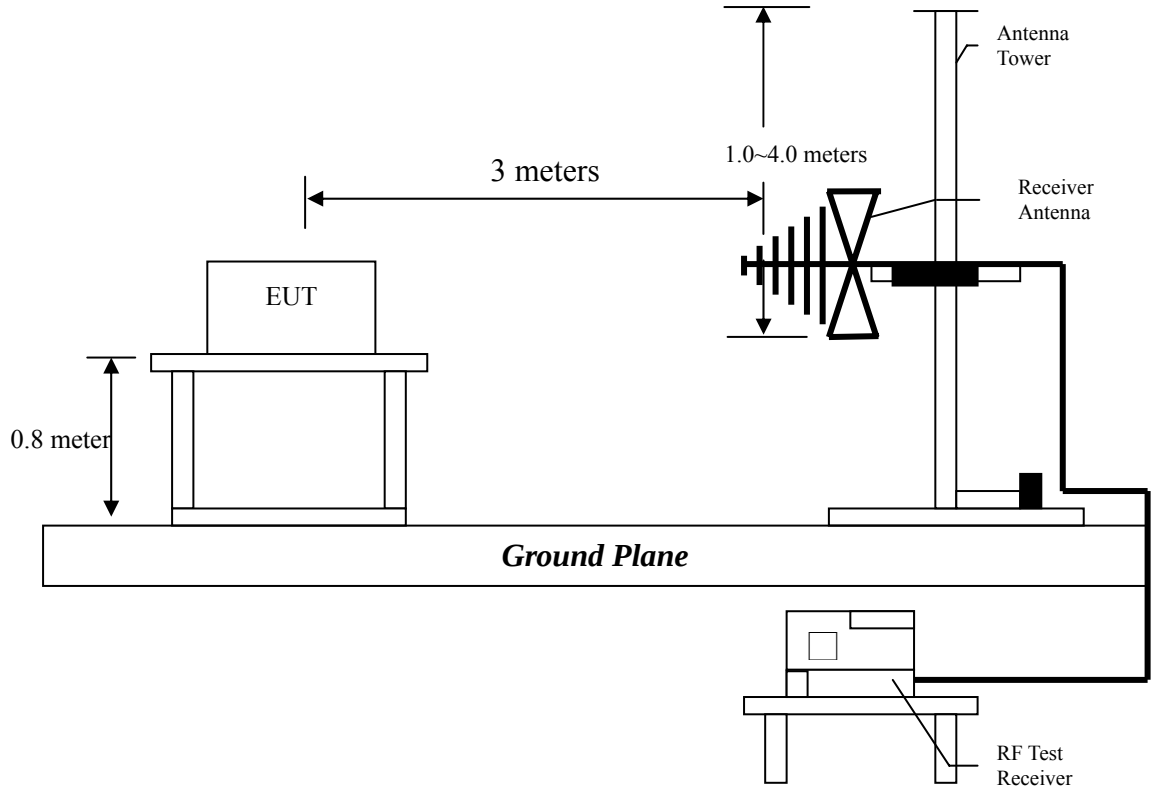
3.1 Operating environment

Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure	1008	hPa

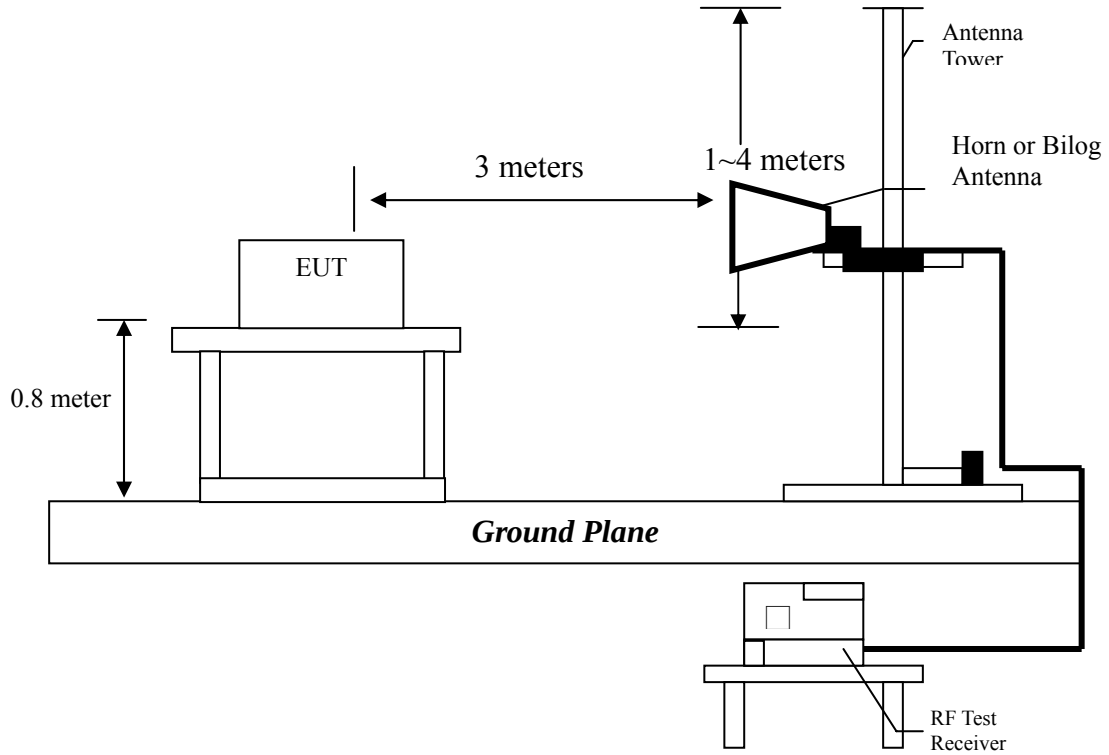
3.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.

The frequency spectrum from 30MHz to 1000MHz was investigated.



The frequency spectrum from over 1GHz was investigated.



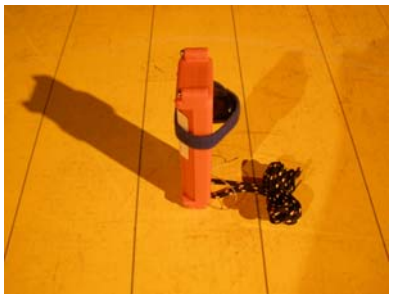
The signal is maximized through rotation and placement in the three orthogonal axes.
The frequency range of radiated measurements is starting at the lowest RF signal generated in the device (without < 9 kHz) and up to the tenth harmonic of thehighest fundamental frequency or to 40 GHz, whichever is lower, for transmitter operates below 10 GHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1 GHz, 1MHz – for frequencies above 1 GHz.
The EUT for testing is arranged on a fiberglass turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The signal is maximized through rotation and placement in the three orthogonal axes.

X axis

Y axis



Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

The EUT configuration please refer to the "Spurious set-up photo.pdf".

3.3 Radiated emission limit

3.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3 m)	(dBuV/m@3 m)	(uV/m@3 m)	(dBuV/m@3 m)
317.2550	6137.6201	75.76	613.76201	55.76

3.3.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency MHz	15.209 Limits (dBμV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty
Radiated Emission	±5.056 dB
Conducted Emission	±2.786 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

3.4 Radiated emission test data FCC 15.231

3.4.1 Measurement results: Fundamental emission

EUT : F21-2S-TX
Worst Case : Tx at 317.2550 MHz at X axis

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	317.2550	PK	14.10	41.45	55.55	75.76	-20.21
Horizontal	317.2550	PK	14.32	57.13	71.44	75.76	-4.32

Remark:
1. Calculated = Reading + Corr. Factor
2. Margin= Calculated – Limit

3.4.2 Measurement results: frequencies equal to or less than 1 GHz

EUT : F21-2S-TX
Worst Case : Tx at 317.2550 MHz at X axis

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	634.51000	PK	21.53	23.42	44.95	55.76	-10.81
Vertical	951.76500	PK	25.54	14.96	40.50	55.76	-15.26
Horizontal	634.51000	PK	21.55	25.00	46.54	55.76	-9.22
Horizontal	951.76500	PK	25.54	24.31	49.85	55.76	-5.91

Remark:
1. Calculated = Reading + Corr. Factor – Average Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin= Calculated – Limit

3.4.3 Measurement results: frequency above 1GHz

EUT : F21-2S-TX
Worst Case : Tx at 317.2550 MHz at X axis

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
1269.02	PK	V	34.90	27.98	41.45	34.53	55.76	-21.23
1586.28	PK	V	34.90	29.16	39.72	33.98	54.00	-20.02
1903.53	PK	V	34.90	29.16	41.76	36.02	55.76	-19.74
2220.79	PK	V	34.40	30.35	40.44	36.39	54.00	-17.61
2538.04	PK	V	34.10	32.51	42.05	40.46	55.76	-15.30
2855.30	PK	V	34.10	32.51	39.05	37.46	54.00	-16.54
3172.55	PK	V	33.80	36.24	42.13	44.57	55.76	-11.19
1269.02	PK	H	34.90	27.98	40.12	33.20	55.76	-22.56
1586.28	PK	H	34.90	29.16	39.87	34.13	54.00	-19.87
1903.53	PK	H	34.90	29.16	40.49	34.75	55.76	-21.01
2220.79	PK	H	34.40	30.35	43.94	39.89	54.00	-14.11
2538.04	PK	H	34.10	32.51	44.17	42.58	55.76	-13.18
2855.30	PK	H	34.10	32.51	38.68	37.09	54.00	-16.91
3172.55	PK	H	33.80	36.24	39.26	41.70	55.76	-14.06

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain

4. Measured bandwidth FCC 15.231(C)

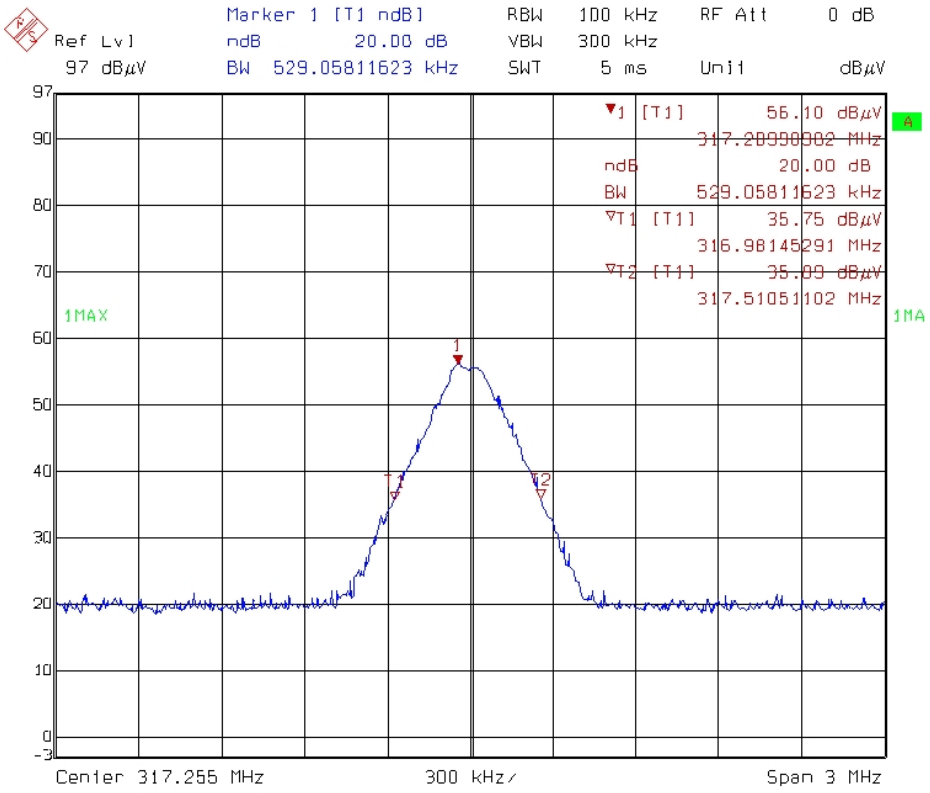
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

B.W(20dBc) Limit = 0.25% × f(MHz) = 0.25% ×317.2550 MHz = 0.7931 MHz

From the plot, the bandwidth is observed to be 529 kHz at 20dBc, where the bandwidth limit is 0.7931 MHz.

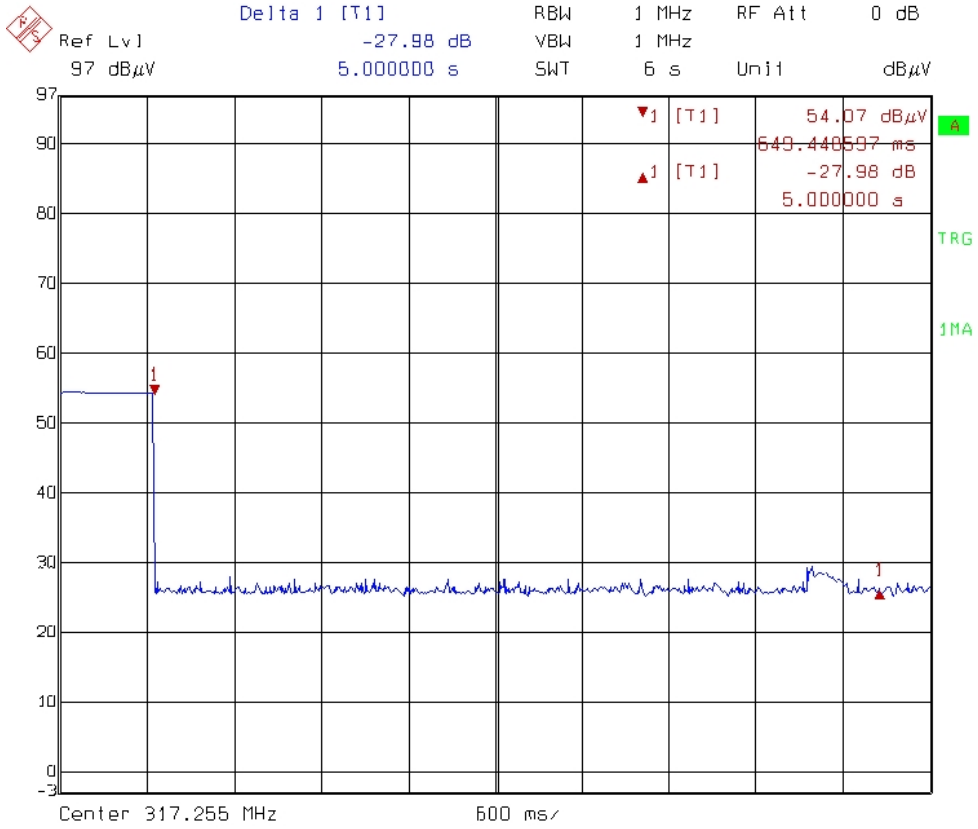
Please see the plot below.

Bandwidth



5. Timing requirement of manually operated transmitter

Release Time



6. Conducted emission FCC 15.207

According to FCC 15.207, the EUT only employs battery power for operation and does not operate from the AC power lines. Therefore, the test can be exempted.