

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT OF

Product Name: SecureAlert RF Beacon

Marketing Name: HomeAware™ RF Beacon

Brand Name: SecureAlert

Model No.: v3

Model Different: N/A

FCC ID: TPO-B03

Report No.: E2/2013/90018

Issue Date: Oct. 18, 2013

Rule Part: §15.231

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VERIFICATION OF COMPLIANCE

Applicant: SecureAlert
150 West Civic Center Drive, South Jordan, UT, USA

Product Name: SecureAlert RF Beacon

Marketing Name: HomeAware™ RF Beacon

Brand Name: SecureAlert

FCC ID: TPO-B03

Model No.: v3

Model Difference: N/A

File Number: E2/2013/90018

Date of test: Sep. 30, 2013 ~ Oct. 18, 2013

Date of EUT Received: Sep. 30, 2013

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.231.

The test results of this report relate only to the tested sample identified in this report.

Test By:	<u>Jazz Huang</u>	Date:	<u>Oct. 18, 2013</u>
	Jazz Huang / Sr.Engineer		
Prepared By:	<u>Judy Hsu</u>	Date:	<u>Oct. 18, 2013</u>
	Judy Hsu / Clerk		
Approved By:	<u>Jim Chang</u>	Date:	<u>Oct. 18, 2013</u>
	Jim Chang / Supervisor		

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Version

Version No.	Date	Description
00	Oct. 18, 2013	Initial creation of document

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1. GENERAL INFORMATION

1.1 Product Description

Product Name:	SecureAlert RF Beacon
Marketing Name:	HomeAware™ RF Beacon
Brand Name:	SecureAlert
Model No.	v3
Model Difference:	N/A
Hardware Version:	10323A0
Software Version:	V27
Power Supply:	3Vdc from 1.5V AA batteries x 2

433.92 MHz:

Operating Frequency	433.92 MHz
Transmit Power	<80.8 dBuV/m Max.
Modulation Technique	GFSK
Number of Channels	1 Channel

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1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **TPO-B03** filing to comply with Section 15.231 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2009). Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number are: 990257, Canada Registration Number: 4620A-4

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 & 10 meters) and FCC Registration Number: 94644.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

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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 (Not apply in the report)

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7.3.1 of ANSI C63.4-2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. 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 hand-held 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. according to the requirements in Section 8 and 13 and Subclause 8.3.1.2 of ANSI C63.4-2009.

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2.4 Limitation

(1) 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.		

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(2) Radiated Emission

According to 15.231(b), the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)
40.66 - 40.70	67.04	2,250	47	225
70 - 130	61.94	1,250	41.9	125
130 - 174	* 61.94 - 71.48	* 1,250 - 3,750	* 41.9 - 51.48	* 125 to 375
174 - 260	71.48	3,750	51.48	375
260 - 470	* 71.48 - 81.94	* 3,750 - 12,500	* 51.48 - 54	* 375 to 1250
above 470	81.94	12,500	74	1250

- Remark:
1. Emission level in dBuV/m = $20 \log(uV/m)$
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205
 4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of § 15.205, then the general radiated emission limits in § 15.209 apply.
 5. For the band 130-174MHz, uV/m at 3meters = $56.81818(F) - 6136.3636$;
For the band 260-470MHz uV/m at 3meters = $41.6667(F) - 7083.3333$;
Where F is the frequency in MHz.
 6. $433.92 \text{ MHz limit} = 41.6667 * 433.92 - 7083.3333 = 10996.681134 \text{ uV/m}$
= 80.8 dBuV/m

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2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

EUT
(TX)

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	N/A					

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§ 15.207	Conducted Emission	Compliant
§ 15.231	Radiated Emission	Compliant
§ 15.231(c)	20dB Bandwidth	Compliant
	Duty Cycle Test (Pulse Modulation)	Compliant
§ 15.231(a)(1)	Release Time Measurement	Compliant
	MAXIMUM PERMISSIBLE EXPOSURE	Compliant

4. Description of test modes

The EUT has been tested under engineering test mode condition. and the EUT staying in continuous transmitting mode. The Frequency 434 MHz is chosen for testing.

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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
20dB Bandwidth	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz - 417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: +/- 4.22dB
	167MHz - 500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

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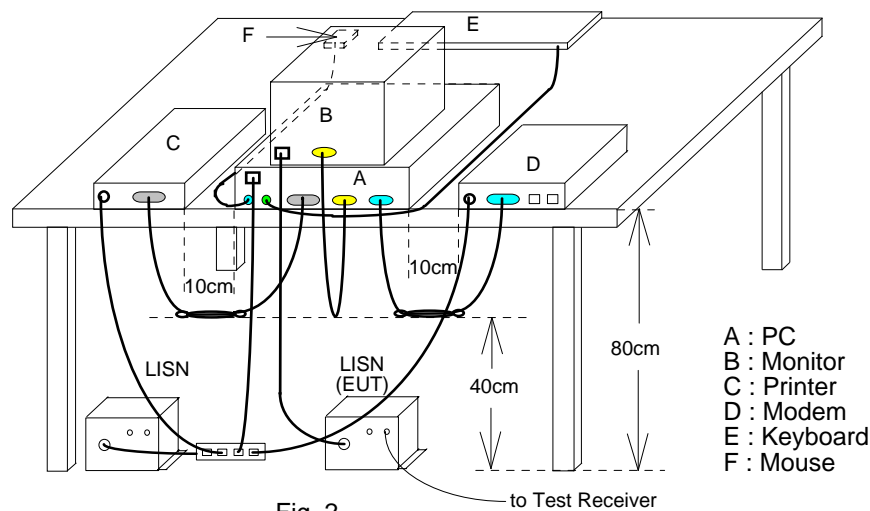
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6. CONDUCTED EMISSIONS TEST

6.1 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. Repeat above procedures until all frequency measured were complete.

6.2 Test SET-UP (Block Diagram of Configuration)



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6.3 Measurement Equipment Used:

SGS Conducted Emission Test Site No.A					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI 7	100924	05/10/2013	05/09/2014
Coaxial Cables	N/A	N30N30-1042-150cm	N/A	02/07/2013	02/06/2014
LISN	SCHWARZBECK	NSLK 8127	8127-648	12/13/2012	12/12/2013
LISN	Rolf-Heine	NNB-2/16Z	99012	03/22/2013	03/21/2014
ISN	TESEQ	ISN T800	34384	02/27/2013	02/26/2014
RF Current Probe	FCC	F-35A	139	03/27/2013	03/26/2014
Capacitive Voltage Probe	FCC	F-CVP-1	97	03/27/2013	03/26/2014
DC LISN	SCHWARZBECK	NNBM 8125	8125-1598	05/31/2013	05/31/2014
DC LISN	MESS TEC	LN-KFZ/200	02/10163	09/25/2012	09/24/2013
High Voltage Probe	SCHWARZBECK	TK 9420	TK 9420-5223	03/04/2013	03/03/2014
Test Software	Farad	EZ-EMC	Ver. SGS-03A1	N.C.R.	N.C.R.

6.4 Measurement Result:

N/A, Powered from battery

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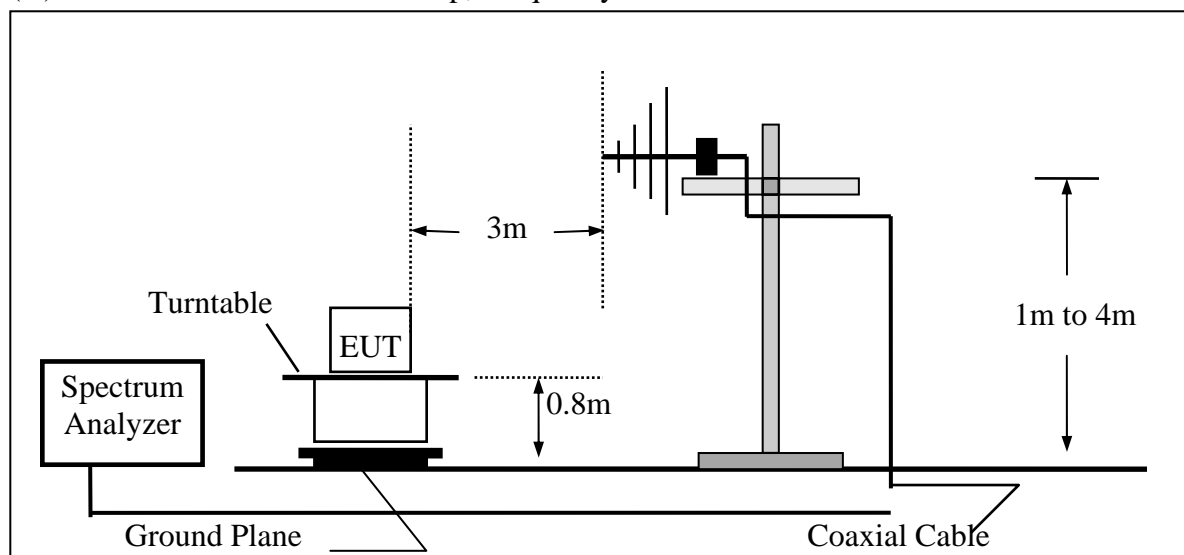
7. RADIATED EMISSION TEST

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.
4. Repeat above procedures until all frequency measured were complete.

7.2 Test SET-UP (Block Diagram of Configuration)

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



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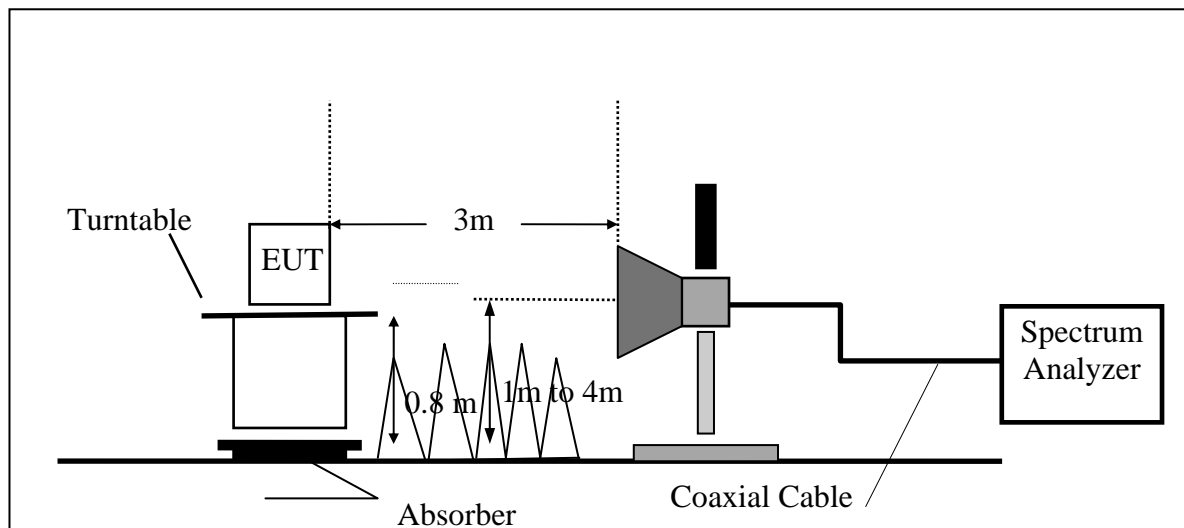
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(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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7.3 Measurement Equipment Used:

SGS SAC Chamber No.C (FCC/IC/NCC)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESU 40	100363	01/30/2013	01/29/2014
Broadband Antenna	TESEQ	CBL 6112D	35240	02/04/2013	02/03/2014
Horn Antenna	ETS-Lindgren	3117	00143272	01/16/2013	01/15/2014
Horn Antenna	ETS-Lindgren	3160-09	00117911	02/14/2013	02/13/2014
Pre-Amplifier	R&S	SCU-18	10203	01/21/2013	01/20/2014
Pre-Amplifier	EM Electronics Corp.	EMC330	980096	01/04/2013	01/03/2014
Pre-Amplifier	EM Electronics Corp.	EMC184045	980135	01/28/2013	01/27/2014
Coaxial Cable	Huber+Suhner	SAC-C TX-30M-1GHz	TX1	04/22/2013	04/21/2014
Coaxial Cable	Huber+Suhner	SAC-C TX-1-26.5GHz	TX2	04/22/2013	04/21/2014
Coaxial Cable	Huber+Suhner	SAC-C RX-150k-30MHz	RX1	04/22/2013	04/21/2014
Coaxial Cable	Huber+Suhner	SAC-C RX-30M-1GHz	RX2	04/22/2013	04/21/2014
Coaxial Cable	Huber+Suhner	SAC-C RX-1-26.5GHz	RX3	04/22/2013	04/21/2014
Controller	Chance Most	886	N/A	N.C.R.	N.C.R.
Antenna Master	Chance Most	N/A	N/A	N.C.R.	N.C.R.
Turn Table	Chance Most	N/A	N/A	N.C.R.	N.C.R.
Filter Bank	R&S	TS8996	SCIN.EMC.1023.12	04/22/2013	04/21/2014
Test Software	World-Pallas	Dr. E	V 3.0 Lite	N.C.R.	N.C.R.

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:

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

Average Value = Peak Value + 20 Log (Ton/Tp) Pulse Modulation

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

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7.5 Measurement Result

Operation Band	:433.92 MHz	Test Date	:2012-10-18
Fundamental Frequency	:433.92 MHz	Temp./Humi.	:24.5deg_C/57RH
Operation Mode	:TX MAIN	Engineer	:Vito
EUT Pol.	:E2 PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
433.87	F	Peak	85.81	-15.28	70.53	100.82	-30.29
433.87	F	Average	-	-24.79	45.74	80.82	-35.08

Operation Band	:434 MHz	Test Date	:2012-10-18
Fundamental Frequency	:434 MHz	Temp./Humi.	:24.5deg_C/57RH
Operation Mode	:TX MAIN	Engineer	:Vito
EUT Pol.	:E2 PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
434.11	F	Peak	95.53	-15.29	80.23	100.82	-20.59
434.11	F	Average	-	-24.79	55.44	80.82	-25.38

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Fundamental Frequency	:433.92 MHz	Temp./Humi.	:24.5deg_C/57RH
Operation Mode	:TX	Engineer	:Vito
EUT Pol.	:E2 PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
31.94	S	Peak	38.52	-16.84	21.69	40.00	-18.31
99.84	S	Peak	42.26	-23.19	19.07	43.50	-24.43
256.01	S	Peak	39.10	-19.75	19.35	46.00	-26.65
321.00	S	Peak	39.27	-18.27	21.00	46.00	-25.00
547.98	S	Peak	39.44	-12.49	26.95	46.00	-19.05
754.59	S	Peak	39.26	-10.42	28.84	46.00	-17.16
868.00	H	Peak	38.12	-9.74	28.38	46.00	-17.62
868.00	H	Average	-	-24.79	3.59	46.00	-42.41
1302.00	H	Peak	52.35	-9.81	42.54	74.00	-31.46
1302.00	H	Average	-	-24.79	17.75	54.00	-36.25
1736.00	H	Peak	-	-	-	-	-
2170.00	H	Peak	49.59	-5.82	43.77	74.00	-30.23
2170.00	H	Average	-	-24.79	18.98	54.00	-35.02
2604.00	H	Peak	-	-	-	-	-
3038.00	H	Peak	44.82	-3.43	41.39	74.00	-32.61
3038.00	H	Average	-	-24.79	16.60	54.00	-37.40
3472.00	H	Peak	-	-	-	-	-
3906.00	H	Peak	53.10	-1.43	51.68	74.00	-22.32
3906.00	H	Average	-	-24.79	26.89	54.00	-27.11
4340.00	H	Peak	-	-	-	-	-
4774.00	H	Peak	49.33	0.33	49.66	74.00	-24.34
4774.00	H	Average	-	-24.79	24.87	54.00	-29.13

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Fundamental Frequency	:433.92 MHz	Temp./Humi.	:24.5deg_C/57RH
Operation Mode	:TX	Engineer	:Vito
EUT Pol.	:E2 PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

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“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
390.84	S	Peak	47.59	-16.25	31.34	46.00	-14.66
394.72	S	Peak	46.01	-16.00	30.00	46.00	-16.00
405.39	S	Peak	43.12	-15.46	27.66	46.00	-18.34
427.70	S	Peak	47.82	-15.03	32.78	46.00	-13.22
438.37	S	Peak	45.37	-15.41	29.97	46.00	-16.03
771.08	S	Peak	40.00	-10.43	29.57	46.00	-16.43
868.08	H	Peak	45.80	-9.73	36.07	46.00	-9.93
868.08	H	Average	-	-24.79	11.28	46.00	-34.72
1302.00	H	Peak	52.80	-6.81	45.99	74.00	-28.01
1302.00	H	Average	-	-24.79	21.20	54.00	-32.80
1736.00	H	Peak	-	-	-	-	-
2170.00	H	Peak	48.23	-5.83	42.40	74.00	-31.60
2170.00	H	Average	-	-24.79	17.61	54.00	-36.39
2604.00	H	Peak	-	-	-	-	-
3038.00	H	Peak	57.90	-4.72	53.18	74.00	-20.82
3038.00	H	Average	-	-24.79	28.39	54.00	-25.61
3472.00	H	Peak	-	-	-	-	-
3906.00	H	Peak	52.59	-1.43	51.16	74.00	-22.84
3906.00	H	Average	-	-24.79	26.37	54.00	-27.63
4340.00	H	Peak	-	-	-	-	-
4774.00	H	Peak	49.96	0.33	50.29	74.00	-23.71
4774.00	H	Average	-	-24.79	25.50	54.00	-28.50

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8. 20DB OCCUPIED BANDWIDTH

8.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10KHz, Span =100KHz.
4. Set SPA Max hold. Mark peak, -20dB.

8.2 Test SET-UP (Block Diagram of Configuration)

Same as 7.3 Radiated Emission Measurement.

8.3 Measurement Equipment Used:

Same as 7.3 Radiated Emission Measurement.

8.4 Measurement Results

Refer to attached data chart.

The center frequency f_c is **433.92MHz**, according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$433.92 \times 0.0025 = 1.0848(\text{MHz})$$

So, the Uper/Lower frequencies limit should be specified as:

$$f_{(U)} = f_c + \Delta f/2 = 433.92 + 0.5424 = 434.46 \text{ (MHz)}$$

$$f_{(L)} = f_c - \Delta f/2 = 433.92 - 0.5424 = 433.377 \text{ (MHz)}$$

Measurement Result:

-20dB bandwidth =517.4 kHz which within allowed frequency range.

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20dB Band Width Test Data



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9. DUTY CYCLE MEASUREMENT

9.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set ETU normal operating mode.
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 100KHz, Span =0 Hz. Adjacent sweep.
4. Set SPA View. Mark delta.

9.2 Test SET-UP (Block Diagram of Configuration)

Same as 7.3 Radiated Emission Measurement.

9.3 Measurement Equipment Used:

Same as 7.3 Radiated Emission Measurement.

9.4 Measurement Results:

$$T_{on} = 1.9 \text{ (ms)} * 2 = 3.8 \text{ (ms)}$$

$$T_p = 66 \text{ (ms)}$$

$$\begin{aligned} \text{Average Correction Factory} &= 20\log(T_{on}/T_p) = 20\log(3.8/66) \\ &= -24.79 \text{ dB} \end{aligned}$$

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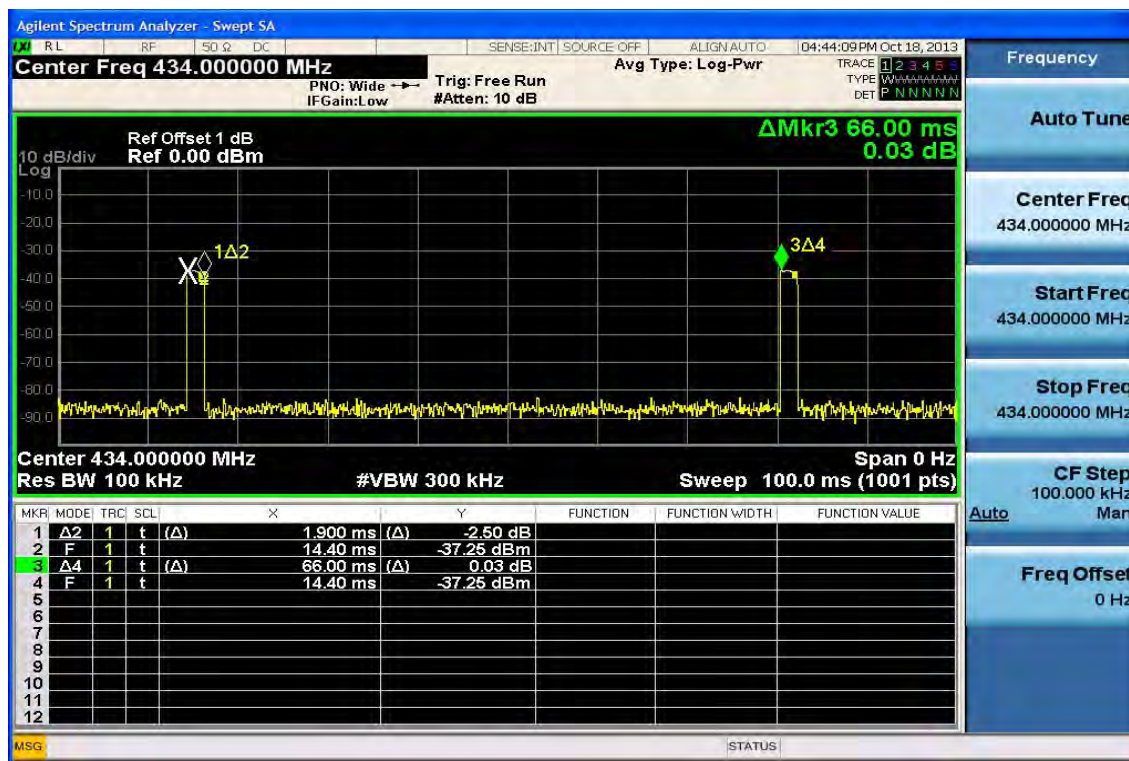
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Measurement: $T_p = 66$ ms

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10. RELEASE TIME MEASUREMENT:

15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

10.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 100 KHz, Span =0Hz. Sweep Time= 5s.
3. Set EUT as normal operation and press Transmitter bottom for 2 s,
4. Set SPA Max hold. Delta Mark.

10.2 Test SET-UP (Block Diagram of Configuration)

Same as 7.3 Radiated Emission Measurement.

10.3 Measurement Equipment Used:

Same as 7.3 Radiated Emission Measurement.

10.4 Measurement Results

The release time less than 5 s.

Refer to attached data chart.

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