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TIMCO ENGINEERING, Inc.

An IIA Company

FCC PART 15.231
Momentary Transmitter Test Report

APPLICANT	SHENZHEN CONSTANT ELECTRONICS CO., LTD.
ADDRESS	F5, NO. 2 BLDG., EAST BRIGHT INDUSTRY REGION NO. 83 DABAO ROAD BAO'AN 33 DISTRICT SHENZHEN, GUANGDONG CHINA
FCC ID	WH2-2610LL
MODEL NUMBER	2610LL
PRODUCT DESCRIPTION	PULL CORD BUTTON
DATE SAMPLE RECEIVED	09/18/2019
FINAL TEST DATE	10/11/2019
TESTED BY	Tim Royer
APPROVED BY	Franklin Rose
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Report Version	Description	Issue Date
2511UT19TestReport	Rev1	Initial Issue	10/11/2019
	Rev2	Clerical Updates	7/15/2020

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GENERAL REMARKS

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669
Designation #: US1070

Tested by:

Sr. EMC Engineer
EMC-003838-NE

Name and Title	Tim Royer, Project Manager/Testing Engineer
Date	10/11/2019

Reviewed and Approved by:

Name and Title	Franklin Rose, Project Manager / EMC Testing Technician
Date	10/17/2019

GENERAL INFORMATION

EUT Information

EUT Description	PULL CORD BUTTON		
FCC ID	WH2-2610LL		
Model Number	2610LL		
EUT Power Source	☐110–120Vac, 50–60Hz	☐ DC Power (12V)	☒ Battery Operated
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☒ Fixed	☐ Mobile	☐ Portable
Antenna Connector	No Antenna Connector		
Test Conditions	The temperature was 26ºC Relative humidity of 50%.		
Modification to the EUT	EUT was not modified		
Applicable Standards	FCC 47 CFR Part 2, Part 15, Referring to ANSI C63.10-2013 for Test Procedures		
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070		

Peripherals Used in Testing

Description	Type	Connector	Length
n/a	n/a	n/a	n/a

Frequency Range(s) of EUT

Test Frequencies	433.5 MHz

Definition of EUT

FCC RULE PART NO.: FCC PART 15.3

§15.3 Definitions.

(i) *Class B digital device.* A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

NOTE: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

(o) *Intentional radiator.* A device that intentionally generates and emits radio frequency energy by radiation or induction.

Note: The device is a momentarily operated transmitter.

Measurement Standards

FCC RULE PART NO.: FCC PART 15.31

§15.31 Measurement standards.

(a) The following measurement procedures are used by the Commission to determine compliance with the technical requirements in this part. Except where noted, copies of these procedures are available from the Commission's current duplicating contractor whose name and address are available from the Commission's Consumer and Governmental Affairs Bureau at 1-888-CALL-FCC (1-888-225-5322).

(2) Unlicensed Personal Communications Service (UPCS) devices are to be measured for compliance using ANSI C63.17-2013: "American National Standard Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices" (incorporated by reference, see §15.38).

(3) Other intentional radiators are to be measured for compliance using the following procedure: ANSI C63.10-2013 (incorporated by reference, see §15.38).

(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

(l) Measurements of radio frequency emissions conducted to the public utility power lines shall be performed using a 50 ohm/50 uH line-impedance stabilization network (LISN).

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle.
1 to 10 MHz	2	1 near top and 1 near bottom.
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom.

(o) The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

Method of Measurement

FCC RULE PART NO.: FCC PART 15.35

§15.35 Measurement detector functions and bandwidths.

The conducted and radiated emission limits shown in this part are based on the following, unless otherwise specified in this part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

(b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, *e.g.,* see §§15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, *e.g.,* the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

(c) Unless otherwise specified, *e.g.,* §§15.255(b), and 15.256(l)(5), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to Supplier's Declaration of Conformity.

SUMMARY OF TESTING

FCC Rule Part No.	Test Item	Result
15.231(a)	Periodic Operation	**Pass**
-	Duty Cycle*	-
2.1046, 15.231(b)	Radiated Field Strength of the Fundamental	**Pass**
2.1053, 15.231(b), 15.209(a), 15.205(a), (b)	Radiated Field Strength of Spurious Emissions	**Pass**
2.1049, 15.231(c)	Occupied Bandwidth	**Pass**
15.207(a), (c)	AC Powerline Conducted Emissions	**n/a**

*__Note__: Duty Cycle Measurements are necessary for Duty Cycle correction, used in conjunction with Peak Measurements to show compliance with the Average Limits. The test data has been included for informational purposes only.

PERIODIC OPERATION

FCC RULE PART NO.: 15.231(a), RSS-210 Annex 1, Section A.1.1

Requirements:

§15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

(a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

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

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

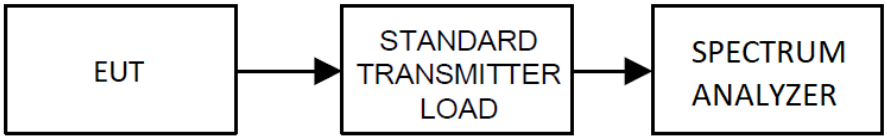
(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

Test Procedure: ANSI C63.10 § 7.4

Test Setup:



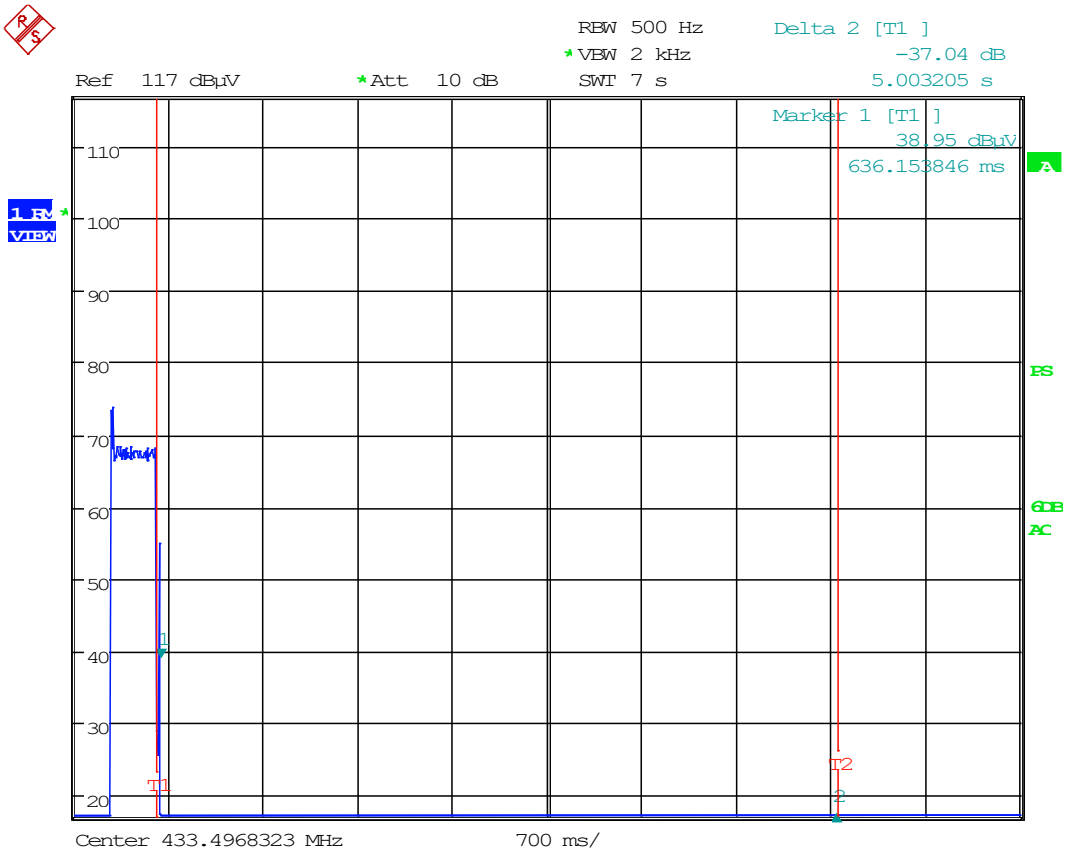
PERIODIC OPERATION

Device Information

Item	Description	Yes	No
1	Does this device transmit a signal that is only used to control another device?		X
2	Does this device send data with this control signal?		X
3	Does this device send data? Data is, things like: temperature, wind direction, fluid amount, rate of flow, etc.		X
4	Does this device transmit: continuously or automatically		X
5	If manually operated does this device stop transmitting within 5 seconds of releasing the button?	X	
6	If automatically operated does it deactivate 5 seconds after activation?		
7	Does it transmit at regular predetermined intervals?		X
8	Does it poll or send supervisory information?		X
	If yes does it do a system integrity check?		
	If yes, How often?		
9	Is this a fire, security or safety of life device?	X	
	If Yes, does the device stop transmitting after the alarm condition is satisfied?	X	
10	The device's Duty cycle:	100%	
	Maximum Pulse On-time (in 100 ms Period):	100 ms	
	On-time Period (if other than 100 ms):	-	
11	Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, On-Off Keying, etc.	FSK	

PERIODIC OPERATION

Test Data: 5 Second Turn-Off Period Plot



Date: 11.OCT.2019 12:02:50

DUTY CYCLE

FCC RULE PART NO.: ANSI C63.10 Section 4.1.4.2.4, Section 7.5

Requirements:

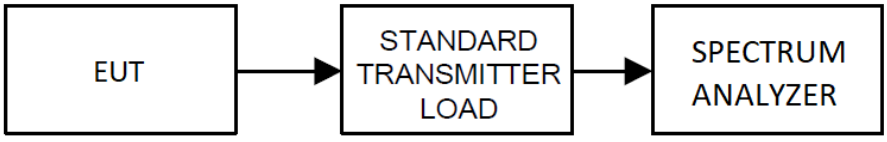
4.1.4.2.4 Average value of pulsed emissions

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission and pulsed operation is employed, the average measurement shall be determined from the peak field strength after correcting for the worst-case duty cycle as described in 7.5. The exact method of calculating the average field strength shall be included in the test report.

7.5 Procedure for determining the average value of pulsed emissions

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s (100 ms). In cases where the pulse train exceeds 0.1 s, the measured field strength shall be determined during a 0.1 s interval.[64] The following procedure is an example of how the average value may be determined. The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown in Equation (10):

Test Setup:



DUTY CYCLE

Duty Cycle Formula: ANSI C63.10 Section 7.5, Equation 10:

$$\delta\ (dB) = 20 \log [\Sigma\ (n_1 t_1 + n_2 t_{2...}) / T]$$

Where:

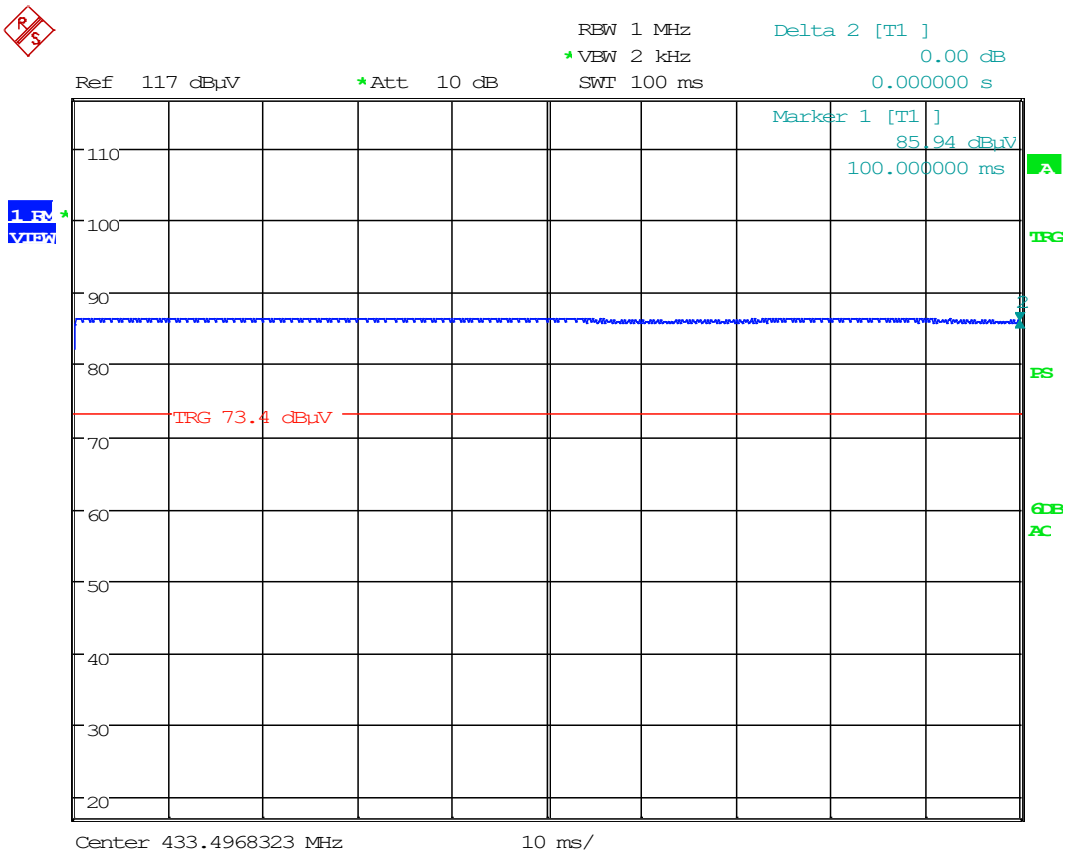
δ is the duty cycle correction factor (dB)
T is the pulse is the period that the pulses are averaged over, (≤ 100 ms).
t_1 is the pulse width of subpulse 1
t_2 is the pulse width of subpulse 2 (and so on)
n_1 is the number of t_1 pulses
n_2 is the number of t_2 pulses (and so on)

Test Data: Duty Cycle Calculation Table

Pulse	Pulse On-Time (ms)	Period (ms)	Duty Cycle
1	100.00	100.00	100.00%

DUTY CYCLE

Test Data: Subpulse 1 Activity in 100 ms Plot

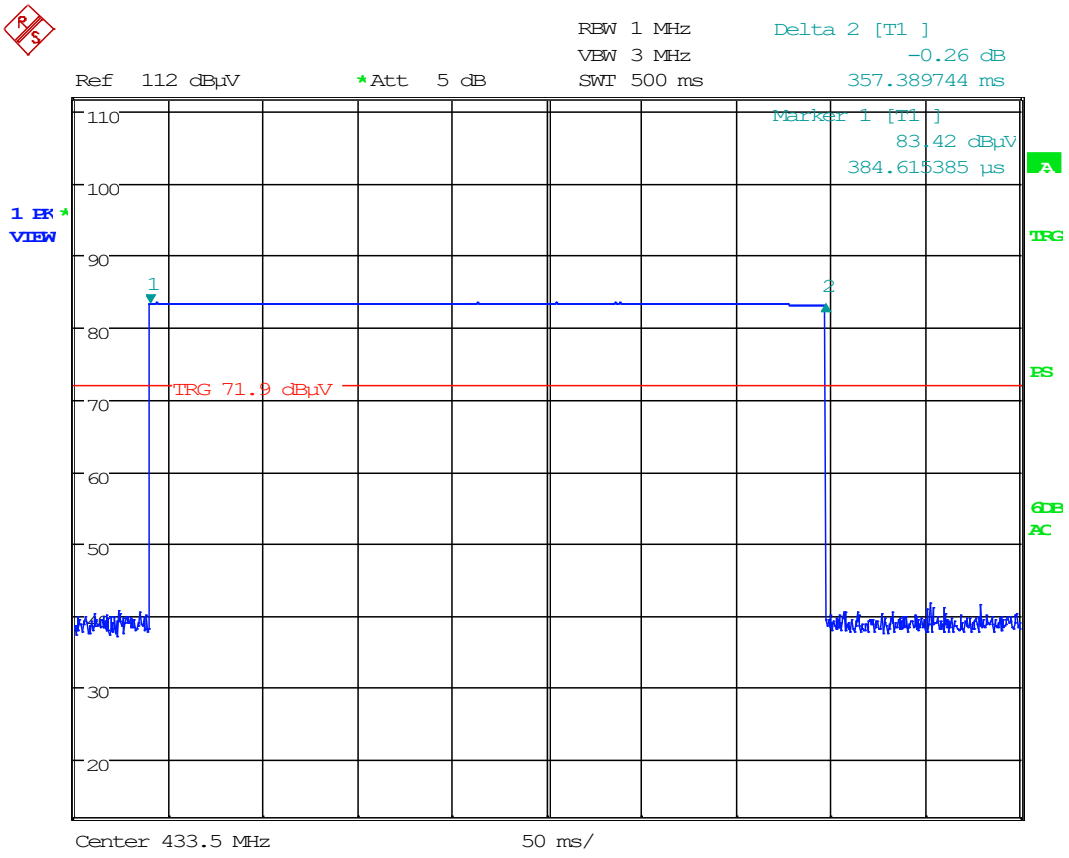


Date: 11.OCT.2019 13:14:51

Pulse Trains = 1

DUTY CYCLE

Test Data: Subpulse 1 Duration



Date: 11.OCT.2019 16:24:32

Subpulse 1 Duration = 357.39 ms

OCCUPIED BANDWIDTH

FCC RULE PART NO.: 2.1049, 15.231(c), 15.215(c)

Requirements:

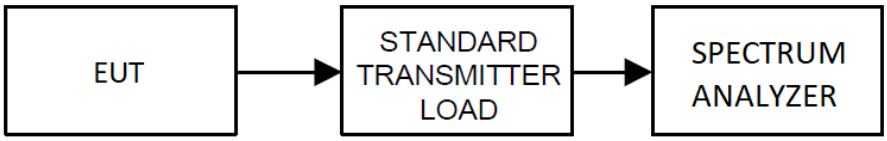
§15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

§15.215 Additional provisions to the general radiated emission limitations.

(c) 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. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Setup:



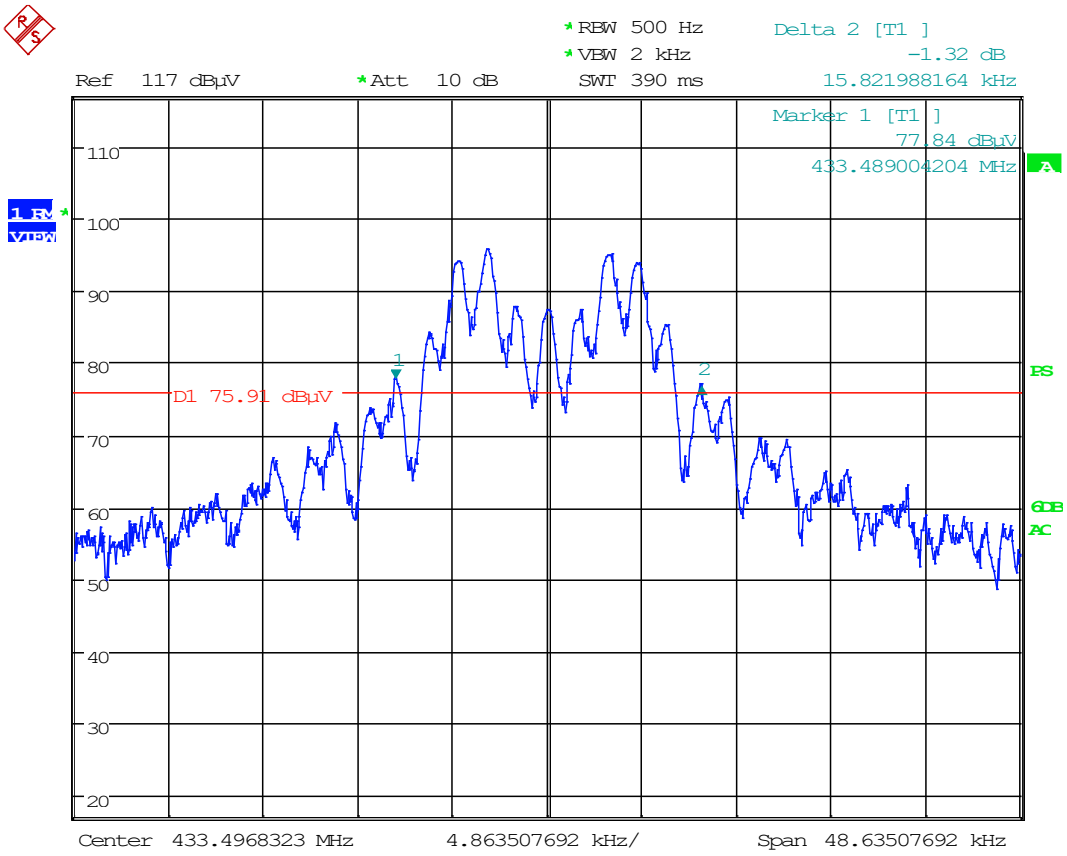
Test Data: Occupied Bandwidth Measurement Table

Tuned Frequency (MHz)	Occupied Bandwidth Limit (KHz)
433.8	1084.5

Measured 20 dB BW (KHz)	15.82
Margin (KHz)	**1068.68**

OCCUPIED BANDWIDTH

Test Data: 20 dB Occupied Bandwidth Measurement Plot



Date: 11.OCT.2019 11:56:26

20 dB Occupied Bandwidth = 15.82 kHz

FIELD STRENGTH OF EMISSIONS

FCC RULE PART NO.: 2.1046, 2.1053, 15.231(b), 15.35(c), 15.205(a)(b), 15.209 (a)

Requirements:

§15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	[1]1,250 to 3,750	[1]125 to 375
174-260	3,750	375
260-470	[1]3,750 to 12,500	[1]375 to 1,250
Above 470	12,500	1,250

[1]Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

FIELD STRENGTH OF EMISSIONS

§15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2]Above 38.6

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

§15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

FIELD STRENGTH OF EMISSIONS

Measurement Range

Requirements: Part 15.33(b)(1)

§15.33 Frequency range of radiated measurements.

(b) For unintentional radiators:

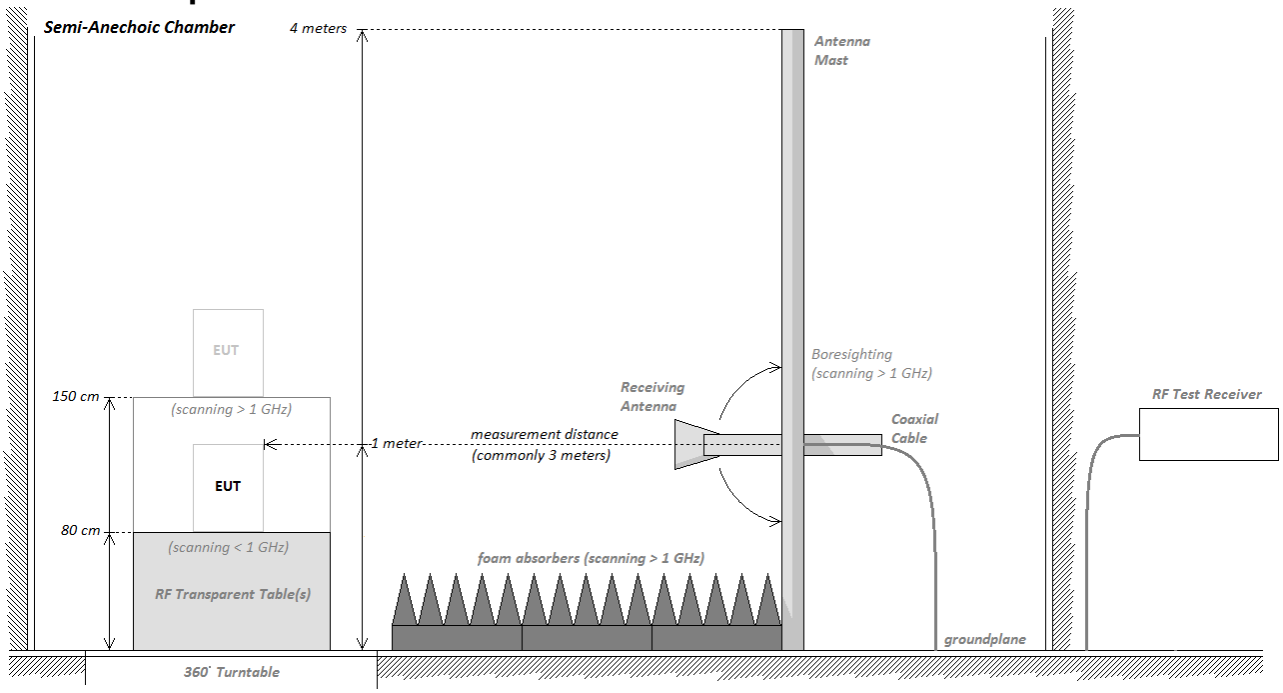
(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3) of this section, for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

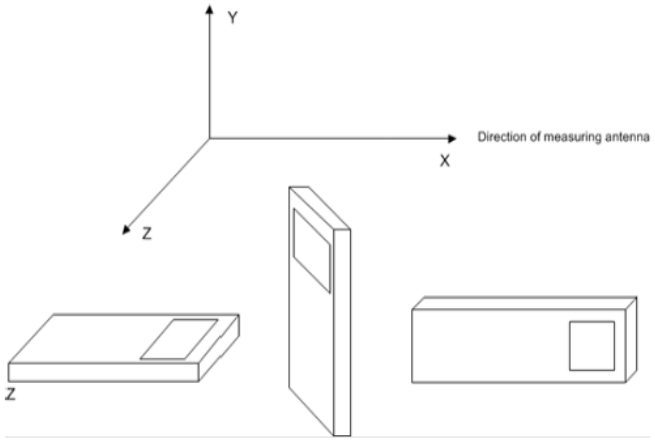
FIELD STRENGTH OF EMISSIONS

Method of Measurement: ANSI C63.10, 6.3 – 6.6 "Radiated Emissions"

Test Site Setup:



EUT Orientation(s):



Formula of Conversion Factors:

The field strength at 3m was established by adding the meter reading of the spectrum analyzer to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB/m. The gain of the preselector was accounted for internally in the spectrum analyzer reading. An example is given below:

Freq. MHz	Meter Reading dBµV	ACF dB/m	Cable Loss dB	Field Strength dBµV/m @ 3 m
33	20	+10.36	+1.2	= 31.56

FIELD STRENGTH OF EMISSIONS

Limit Calculations

Method of Calculation: ANSI C63.10, 7.6.2

Step 1: Limit Interpolation Formula:

$$\text{Limit } (\mu V/m) = L_l + (f - f_l)*((L_h - L_l)/(f_h - f_l))$$

Where:

f = fundamental emission frequency (MHz)

f_l = Low-End frequency of the linear interpolation band (MHz)

f_h = High-End frequency of the linear interpolation band (MHz)

L_l = Low-End Limit of the linear interpolation band (μV/m)

L_h = High-End Limit of the linear interpolation band (μV/m)

Step 2: Limit Conversion Formula:

$$\text{Limit } (dB\mu V/m) = 20 \log (\mu V/m)$$

15.231(b) - Limit Lookup Chart					
Fundamental Frequency (MHz)	433.5				
"X" The Applied Limit	Limit Frequency (MHz)	Fundamental Field Strength (uV/m)	Fundamental Field Strength (dBuV/m)	Spurious Field Strength (uV/m)	Spurious Field Strength (dBuV/m)
	40.66-40.70	2250	**67.04**	225	**47.04**
	70-130	1250	**61.94**	125	**41.94**
	174-260	3750	**71.48**	375	**51.48**
X	433.5	10979	**80.81**	1098	**60.81**
	≥ 470	12500	**81.94**	1250	**61.94**

Note: The measurements below represent the worst case of all the frequencies tested. The six (6) highest emissions or more of each worst-case operational modes of the EUT are represented below. Emissions 20 dB below the limit are not required to be reported, but may be shown for informational purposes.

FIELD STRENGTH OF EMISSIONS

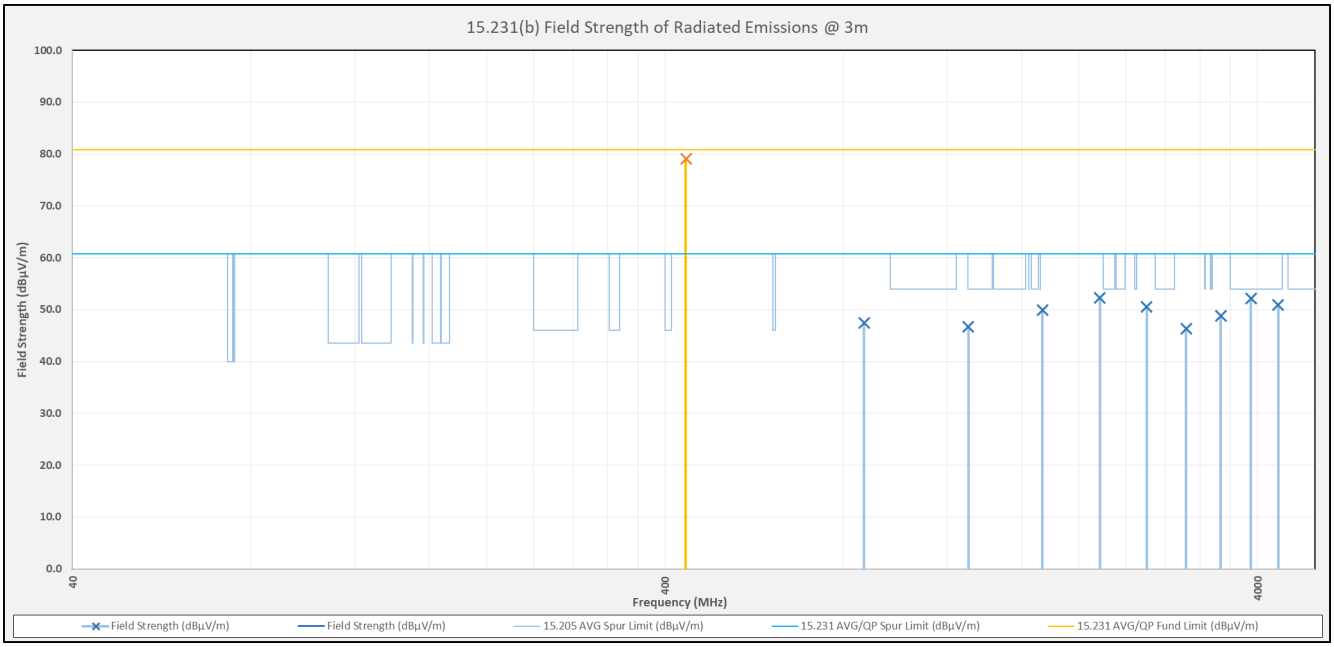
Test Data: Radiated Field Strength of the Fundamental

Tuned Frequency (MHz)	Detector	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	15.231 Fundamental Limit	Margin (dBm)
433.50	PK	60.54	H	2.39	0.00	15.79	3.00	78.72	80.81	2.09
433.50	PK	60.93	V	2.39	0.00	15.79	3.00	79.11	80.81	1.70

Test Data: Radiated Field Strength of Spurious Emissions

Tuned Frequency (MHz)	Emission Frequency (MHz)	15.205 Restricted Band	15.205, 15.35, 15.247(d) Detector	Meter Reading (dBµV)	Antenna Polarity	Coax Loss (dB)	Duty Cycle Correction (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBµV/m)	15.231 Spurious Limit	Margin (dBm)
433.50	867.00		PK	21.41	H	3.51	0.00	22.52	3.00	47.44	60.81	13.37
433.50	1300.50	X	PK	12.82	H	4.18	0.00	28.68	3.00	45.67	60.81	15.14
433.50	1734.00		PK	9.89	H	4.83	0.00	29.52	3.00	44.23	60.81	16.58
433.50	2167.50		PK	10.06	H	5.35	0.00	31.27	3.00	46.68	60.81	14.13
433.50	2601.00		PK	11.70	H	5.79	0.00	32.41	3.00	49.90	60.81	10.91
433.50	3034.50		PK	10.34	H	6.38	0.00	32.60	3.00	49.32	60.81	11.49
433.50	3468.00		PK	11.42	H	6.89	0.00	32.63	3.00	50.95	60.81	9.87
433.50	3901.50	X	PK	12.03	H	6.96	0.00	33.23	3.00	52.22	60.81	8.59
433.50	4335.00	X	PK	9.58	H	7.47	0.00	33.54	3.00	50.59	60.81	10.23
433.50	867.00		PK	20.93	V	3.51	0.00	22.52	3.00	46.96	60.81	13.85
433.50	1300.50	X	PK	9.61	V	4.18	0.00	28.68	3.00	42.46	60.81	18.35
433.50	1734.00		PK	12.02	V	4.83	0.00	29.52	3.00	46.36	60.81	14.45
433.50	2167.50		PK	10.99	V	5.35	0.00	31.27	3.00	47.61	60.81	13.20
433.50	2601.00		PK	10.57	V	5.79	0.00	32.41	3.00	48.77	60.81	12.04
433.50	3034.50		PK	11.52	V	6.38	0.00	32.60	3.00	50.50	60.81	10.31
433.50	3468.00		PK	12.67	V	6.89	0.00	32.63	3.00	52.20	60.81	8.62
433.50	3901.50	X	PK	10.54	V	6.96	0.00	33.23	3.00	50.73	60.81	10.08
433.50	4335.00	X	PK	9.95	V	7.47	0.00	33.54	3.00	50.96	60.81	9.86

Test Data: Radiated Field Strength Plot



POWER LINE CONDUCTED INTERFERENCE

FCC Rule Part No.: FCC Part 15.207(a)

Requirements:

§15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

	Conducted limit (dBμV)	
Frequency of emission (MHz)	**Quasi-peak**	**Average**
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtainig their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

Method of Measurement:

The procedure used was ANSI C63.4 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

The following plots represent the emissions for power line conducted. Both lines were observed.

Test Data: N/A

The EUT does not connect to an external powerline.

POWER LINE CONDUCTED INTERFERENCE

TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/20
Antenna: Log-Periodic 1243	Electro-Metrics	LPA-25	1243	03/29/18	03/29/20
CHAMBER	Panashield	3M	N/A	12/31/17	12/31/19
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/20
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/11/19
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	08/28/18	08/28/21
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	KMKM-0244-01; KMKM-0670-00; KFKF-0198-01	02/29/19	02/29/21
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

MEASUREMENT UNCERTAINTY

TEI Tab Lic Devices Uc 170428

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

END OF REPORT