Testing Tomorrow's Technology

Application for Certification

Per
Title 47 USC Part 2, Subpart J, Equipment Authorization Procedures, Paragraph 2.907, Certification and Part 15, Subpart C, Intentional Radiators, Paragraph 15.231, Periodic Operation in the band 40.66 MHz to 40.70 MHz and above 70 MHz
And

For the

Custom Molded Products

Model: 26400-009-000
FCC ID: 2ANM6CMPB2GC395915

UST Project: 17-0364
Issue Date: September 29, 2017

Number of Pages in this report: 20

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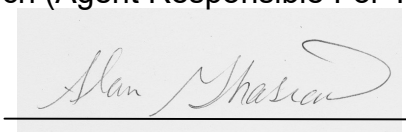
Testing Tomorrow's Technology

I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US Tech (Agent Responsible For Test):

By: 

Name: Alan Ghasiani

Title: President – Consulting Engineer

Date: September 29, 2017

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TESTING
NVLAP LAB CODE 200162-0

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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Custom Molded Products
MODEL: 26400-009-000
FCC ID: 2ANM6CMPB2GC395915
DATE: September 29, 2017

This report concerns (check one): Original grant X
Class II change_____

Equipment type: 433 MHz transmitter module

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No X

If yes, defer until:_____
date

N.A. agrees to notify the Commission by N.A.
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

US Tech
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
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1. General Information

This report is prepared as a means of presenting test data to be used by a Telecom Certification Body in determination of whether this product is permitted for unlicensed dissemination to the general public according to FCC Rules and Regulations for RF Devices Intentional Radiators Part 15.231.

1.1 Product Description

The Equipment under Test (EUT) is the Custom Molded Products model 26400-009-000, handheld 433 MHz remote transmitter. The EUT is designed to be used with a number of bath box receiver devices. It controls features such as LED lighting, blow and pump motors as well as other features depending on the bath box capabilities.

The EUT operates between 433.00 MHz to 433.92 MHz.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on August 28, 2017 in good operating condition.

1.3 Related Submittal(s)/Grant(s)

The EUT is subject to the following FCC Equipment Authorizations:

a) Certification of the transmitter.

b) Verification as a class B digital device.

2. Tests and Measurements

2.1 Configuration of Tested System

The Test sample was tested per *ANSI C63.10:2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* to show compliance to CFR 47, Part 15.231.

All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was set to 3 times the resolution bandwidth or off throughout the evaluation process. There were no interconnecting cables to manipulate in an attempt to maximize emissions; however, the physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The worse case position is the position used for final measurements and is gathered in this test report. A block diagram of the tested system is shown in Figure 1.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC, under site registration number 186022, designation number US5301. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 9900A-1 and is also a NVLAP accredited test lab; lab code 200162-0.

2.3 Test Equipment

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID	CABLES P/D
Handheld remote Custom Molded Products (EUT)	26400-009-000	Engineering Sample	2ANM6CMPB2GC395915	N/A

S= Shielded, U=Unshielded, P= Power line, D= Data line

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	8593E	Hewlett Packard	3205A00124	11/23/2017 Extended
SPECTRUM ANALYZER	DSA815	RIGOL	DSA8A18030 0138	9/30/2017 Extended
LOOP ANTENNA	SAS-200/562	A. H. Systems	142	9/28/2017 2 yr
BICONICAL ANTENNA	3110B	EMCO	9307-1431	11/25/2017 2 yr Extended
LOG PERIODIC ANTENNA	3146	EMCO	9305-3600	9/21/2018 2 yr
HORN ANTENNA	3115	EMCO	9107-3723	9/22/2018 2 yr
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	3/07/2018
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	10/26/2017

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.4 EUT Antenna Description (FCC Sec. 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 Custom Molded Products, Model 26400-009-000 incorporates the antennas detailed in Table 3 for the CMP transmitter.

Table 3. Antenna Description

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB_i	TYPE OF CONNECTOR
None	CMP	Trace	Trace	0.0	PCB Trace

2.5 Modifications to Equipment

No modifications were needed to bring the EUT into compliance with the FCC Part or IC RSS requirements.

2.6 Test Procedure

The EUT was configured as shown in the following block diagram(s) and photograph(s). The sample was tested per ANSI C63.10:2013. Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz depending on the frequency range of testing, 150 kHz-30 MHz or 30 MHz to 1000 MHz, respectively. All measurements are peak unless stated otherwise. The video filter on the spectrum analyzer was set to 3x the RBW throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. The EUT was rotated 360 degrees with the turntable to maximize emissions. The physical position of the EUT was varied through the three mutually exclusive orthogonal planes in an attempt to maximize the emissions. The final setup description is found in the test section of this report.

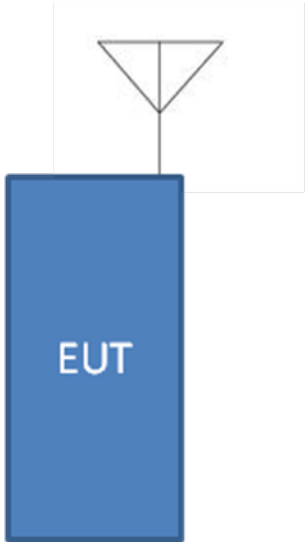


Figure 1. Block Diagram of Test Configuration

2.7 Compliance to CFR 15.231(a) Transmitter Activation/Deactivation

According to CFR 15.231(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.

The transmitter meets this requirement.

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

The transmitter is manually operated.

(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.

This does not apply; the transmitter does not have periodic transmissions at pre-determined intervals, and does not have polling or supervision transmissions to determine system integrity.

(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.

This does not apply; the transmitter is not employed for radio control purposes during emergencies.

(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.

This does not apply; the transmitter is not used for security systems.

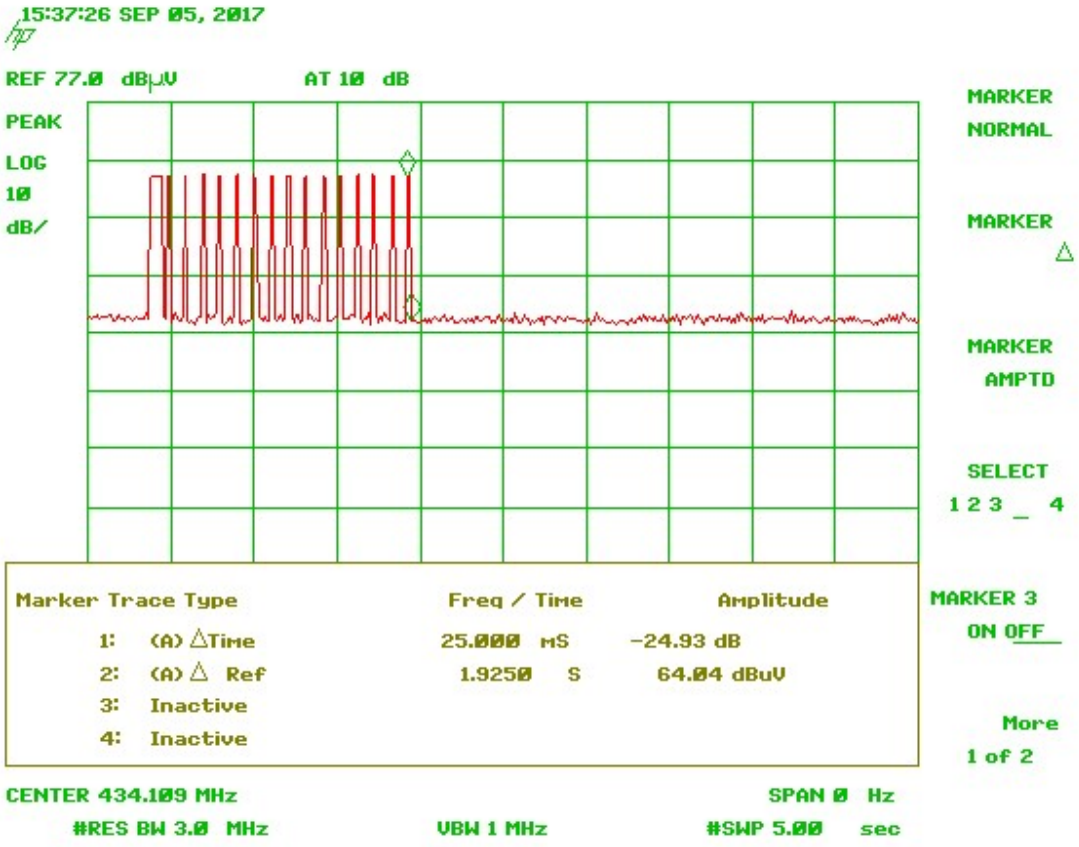


Figure 2. Deactivation per 15.231(a)(1)

Note 1: The EUT deactivates within 5 seconds.

2.8 Field Strength of Fundamental (47 CFR 15.231(b))

The results of the measurements for peak fundamental emissions are given in Table 4. The EUT emissions measurement was started by setting up the Antenna in the vertical orientation at a distance of 3 meters from the EUT and at a height of 1.0 meters above the ground. The EUT's major axis was set normal to the direction of the measuring antenna.

The Spectrum Analyzer (SA) displays were set to: Channel A free-running, Channel B to Max-Hold. Choose a frequency or frequency range and scan it at a coupled rate. When a signal is detected, raise and lower the antenna to maximize the signal.

When the signal has been maximized, the antenna height is fixed the turn-table is rotated through 360 degrees to further maximize the signal.

When all signals have been maximized for antenna height and direction, the EUT case is carefully maneuvered in each of the three mutually exclusive orthogonal planes while observing the same Max-hold/free-running SA display indication. When the EUT position is found that further maximizes the signal, record the antenna height, rotation orientation, EUT orthogonal position and signal strength on the data sheet for that particular frequency.

Next, the measurement antenna is re-oriented to a Horizontal polarization at 1 meter height and the process described above is repeated. All signals within 6 dB of the limit are recorded.

Finally, the collected data is input into the calculation spread sheet. The spread sheet is designed to calculate for the true value that is collected. The spread sheet takes into account the SA reading, the antenna correction factor, cable losses and duty cycle factors. See the data tables herein.

2.9 Limits for Operation in the Band above 70 MHz (CFR15.231 (b))

This limit versus frequency table is as follows (test distance = 3.0 meters):

Fundamental Frequency (MHz)	Limit Fundamental (Average) uV/m	Limit Harmonics and other spurious (Average) uV/m
260 to 470	3750 to 12500 *, 1	375 to 1250 *,2
* Linear Interpolation		

Note: formula 1: $limit_1 = E = 41.667F – 7083.5$
2: $limit_2 = E = 4.1667F – 708.35$
E= Electric field strength
F= fundamental frequency in MHz

The frequency spectrum above the fundamental to its 10th harmonic was examined and measured for signals falling into the restricted bands of 15.205. If average emissions measurements are employed, the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions were applied. Spurious and harmonics signals meet the requirements of the above table or the requirements of 15.209, whichever requirement permits higher field strength.

2.10 Radiated Spurious Emissions

The radiated spurious emissions were measured over the frequency range of 30 MHz to the 10th harmonic of the fundamental frequency of the intentional transmitter. The test results are shown below.

Table 4. Intentional Radiated Emissions, Peak Measurements

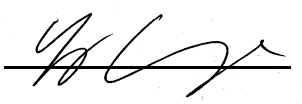
Tested By: GY		Test: Part 15.209, 15.231		Client: Custom Molded			
		Project: 17-0364		Model: 26400-009-000			
Frequency (MHz)	**Test Data (dBuV)**	**Additional Factor (dB)**	**AF+CL-PA (dB/m)**	**Corrected Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Distance / Polarization**	**Margin (dB)**	**Detection Method**
433.49	76.98	0.0	19.85	96.83	100.5*	3m./VERT	3.7	**PK**
433.49	43.28	0.0	19.85	63.13	80.5	3m./VERT	17.4	**AVG**
867.34	53.22	0.0	6.23	59.45	61.9	3m./VERT	2.4	**PK**
1301.41	58.93	0.0	-6.70	52.23	61.9	3.0m./VERT	9.7	**PK**
1735.11	60.55	0.0	-4.20	56.35	61.9	3.0m./VERT	5.6	**PK**
2169.15	49.99	0.0	-1.88	48.11	61.9	3.0m./VERT	13.8	**PK**
2603.05	50.04	0.0	-0.13	49.91	61.9	3.0m./VERT	12.0	**PK**
No other emissions found less than 20 dB from the applicable limit. EUT investigated from 150kHz to 10th harmonic of fundamental frequency.								

1. (*) PEAK limit applied versus PEAK detection result
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic

Sample Calculation at 433.49:

Magnitude of Measured Frequency	76.98	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	19.85	dB/m
+Additional Factor	0	dB
Corrected Result	96.83	dBuV/m

Note: The transmitter was programmed to transmit at >98% duty cycle; therefore wherever applicable, the duty cycle factor calculated above was applied to correct for the actual duty cycle of the transmitter.

Test Dates: September 1, and 5, 2017
Tested By
Signature:  Name: George Yang

2.11 Bandwidth of Fundamental (CFR15.231 (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. Bandwidth is determined by those frequencies that are at least 20 dB down on either side of the center frequency of the pulse.

0.0025 x 433,000,000.00 = 1.082 MHz

The measured bandwidth is 535 kHz, well within the limit. See the figure below.

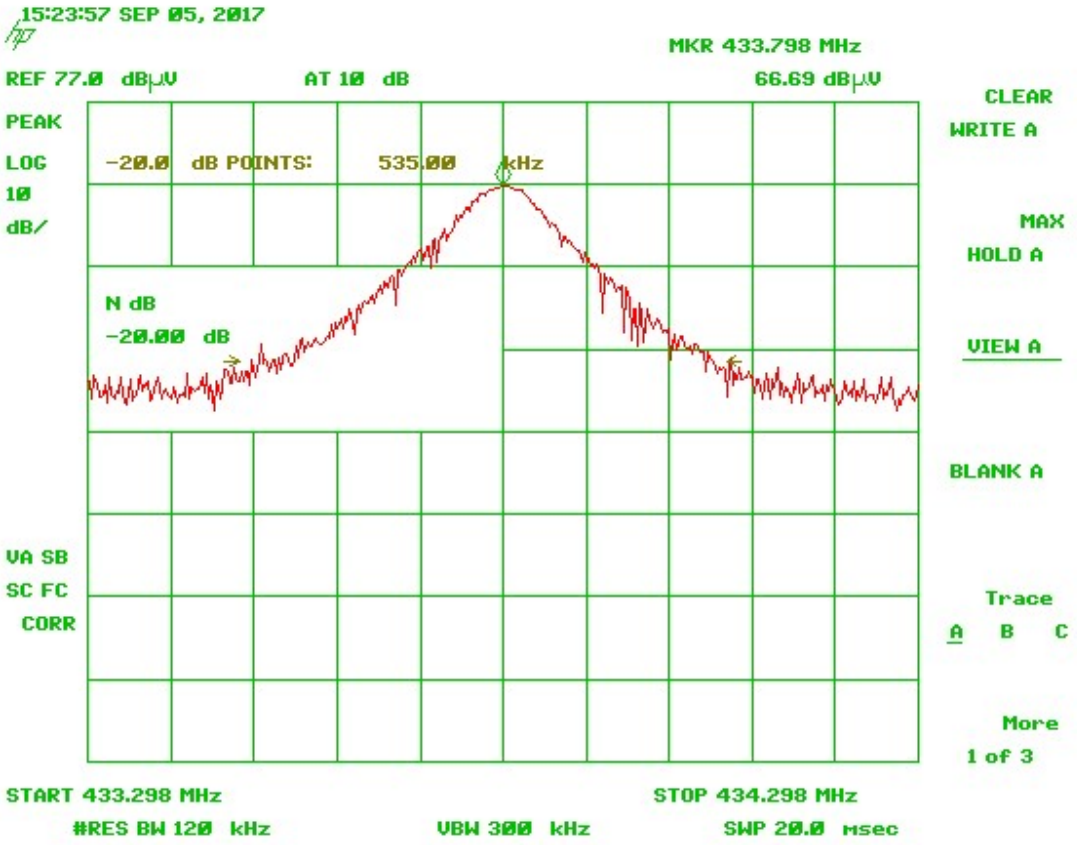


Figure 3. Occupied Bandwidth (20 dB BW)

2.12 Powerline Conducted Emissions (CFR 15.107/15.209)

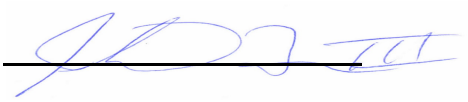
The power line conducted voltage emission measurements are not applicable. The EUT is battery powered and does not have provision for connecting to the AC mains supply.

Table 5. Transmitter Power Line Conducted Emissions Test Data, Part 15.107, 15.207

150KHz to 30 MHz with Class B Limits						
Test: Power Line Conducted Emissions				**Client:** CMP		
Project: 17-0364				**Model:** 26400-009-000		
Frequency (MHz)	**Test Data (dBuv)**	**LISN+CL-PA (dB)**	**Results (dBuV)**	**AVG Limits (dBuV)**	**Margin (dB)**	**Detector PK, QP, or AVG**
Not Applicable. EUT does not connect to AC mains.						

Sample Calculation

Date: September 18, 2017

Signature:  Name: John Freeman

NOTE: The test data provided in this section is to support the Verification requirement for the digital apparatus and the radios within.

2.13 Spurious Radiated Emissions (CFR 15.109, 15.209)

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 30 MHz to the 10th harmonic of the fundamental frequency. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit. During testing the EUT was programmed for continuous transmission to simulate worst case condition.

The test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

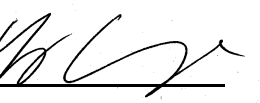
The worst-case radiated emissions in the range of 30 MHz to 10th harmonic of the fundamental frequency are more than 20 dB below the limit.

Table 6. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109, 15.209), 30 MHz to 1000 MHz

30 MHz to 1000 MHz with Class B Limits							
Test: Radiated Emissions				**Client:** CMP			
Project: 17-0364				**Model:** 26400-009-000			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**QP Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or QP**
No emissions seen greater than 20 dB below the applicable limit.							

SAMPLE CALCULATION: N/A

Date: September 1 and 5, 2017

Evaluated by
Signature:  Name: George Yang

NOTE: The test data provided in this section is to support the Verification requirement for the digital apparatus and the radios within.

Table 7. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109, 15.209) above 1 GHz

1 GHz to 10th harmonic of fundamental frequency with Class B Limits							
Test: Radiated Emissions				**Client:** CMP			
Project: 17-0364				**Model:** 433M remote			
Frequency (MHz)	**Test Data (dBuv)**	**AF+CA-AMP (dB/m)**	**Results (dBuV/m)**	**AVG Limits (dBuV/m)**	**Antenna Distance/ Polarization**	**Margin (dB)**	**Detector PK, or AVG**
No emissions seen greater than 20 dB below the applicable limit.							

SAMPLE CALCULATION: N/A

Date: September 1 & 5, 2017

Evaluated by
Signature: _____ Name: George Yang

NOTE: The test data provided in this section is to support the Verification requirement for the digital apparatus and the radios within.

2.14 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4-2:2011. A coverage factor of k=2 was used to give a level of confidence of approximately 95%.

2.14.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.85 dB.

This EUT is battery powered; therefore this tested was deemed not applicable.

2.14.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.40 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.19 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.08 dB.

3. Test Results

The EUT is deemed to have met all the applicable requirements for this evaluation.