

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant: INVENTEC CORPORATION
66 Hou-Kang st., Shih-Lin District, Taipei, Taiwan, R.O.C

Product Name: All-in-One PC

Brand Name: HP

Model No.: TPC-I037-24

Model Difference: N/A

Report Number: E2/2019/B0024

FCC ID: DGI-TPC-I037-2401

FCC Rule Part: Part 15C

Issue Date: Dec. 30, 2019

Date of Test: Nov. 27, 2019 ~ Dec. 20, 2019

Date of EUT Received: Nov. 27, 2019

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 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 15C.

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

Approved By:

Jazz Huang

Jazz Huang / Asst. Supervisor



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Revision History

Revision	Description	Issue Date	Remark
Rev.00	Original.	Dec. 30, 2019	Revised By: Susan Lin

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	All-in-One PC	
Brand Name:	HP	
Model No.:	TPC-I037-24	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	19.5Vdc from AC/DC Adapter	
	Adapter:	Model No.: TPN-CA22, Supplier: Chicony Power Technology Co., Ltd

Radio Technology:	WPC
Operating Frequency:	120~130 kHz
Transmit Power:	80.68dBuV/m at 3m.
Number of Channels:	1
Antenna Type:	Loop Antenna
Modulation Type:	ASK/FSK

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1.2 Test Methodology

FCC Part 15, Subpart C

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd.,
Guishan District, Taoyuan City, Taiwan 333 (TAF code 0513)

FCC Designation number: TW0002

1.4 Special Accessories

There is no special accessory used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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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

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. 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 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.

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- Remark: 1. Emission level in dBuV/m= $20 \log (\mu\text{V/m})$
2. Measurement was performed at an antenna to the closed point of EUT distance of 3 meters.
3. Distance extrapolation factor = $40 \log (\text{required distance/ test distance})$ (dB);
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
Ex. $20 \cdot \log(30) + 40 \cdot \log(30/3) = 69.54 \text{ dBuV/m}$
5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
6. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

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2.4 Configuration of Tested System

Fig. 2-1 Emission test set up configuration

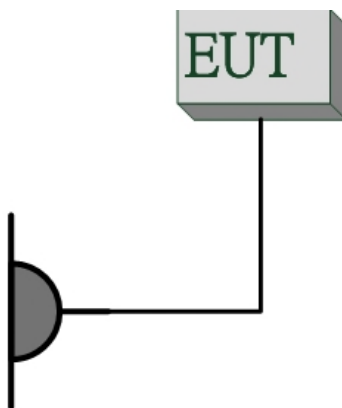


Fig. 2-2 Conduction test set up configuration

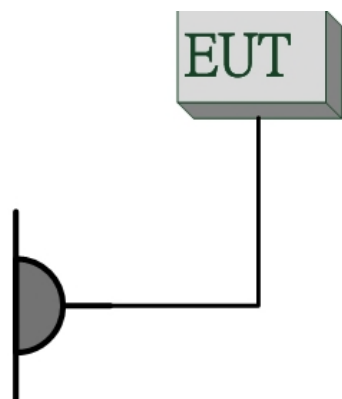


Table 2-1 Equipment Used in Tested System

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

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.215 (c)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

AC POWER LINE CONDUCTED EMISSION TEST:

Test Condition	AC Power line conducted emission for line and neutral
Worst Case	Operation in normal mode

The EUT stay in continuous transmitting mode. The frequency 120~130kHz is the default channel to test, where it is the only manipulative channel as this application supports.

The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode), the worst case H position was reported.

The data rate as the lowest supported is selected while tests are conducted.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Frequency Stability	+/- 123.36 Hz
20 dB OCCUPIED BANDWIDTH	+/- 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	9kHz~30MHz: +2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 CONDUCTED EMISSIONS TEST

6.1 Limitation

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

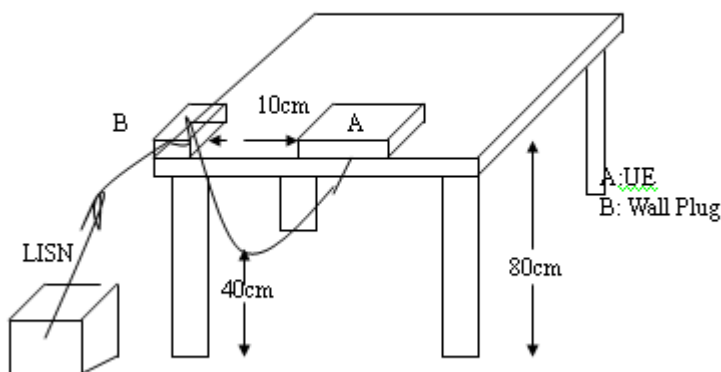
Note

- 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.

6.2 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. Sweep frequency starting from 150 kHz to 30 MHz for phase L1.
4. Repeating the measurement as lists above for phase neutral.

6.3 Test SET-UP (Block Diagram of Configuration)



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6.4 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	NETZNACHBILDUNG	NSLK8127	8127648	07/12/2019	07/11/2020
EMI Test Receiver	R&S	ESCI	101300	11/14/2019	11/13/2020

6.5 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

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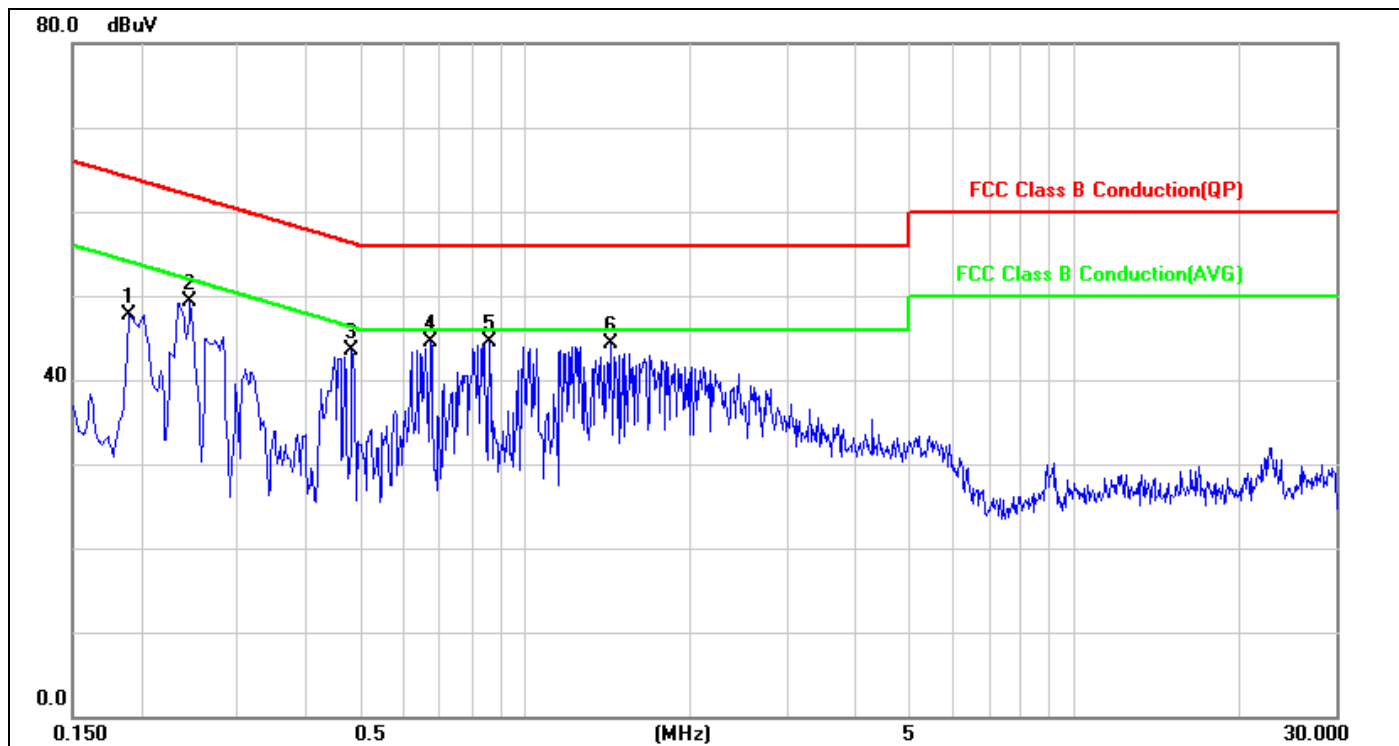
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Description:	Operation	Date:	2019/12/4
Line:	L1	Temp.(°C)/Hum.(%):	22.0(°C)/42%
Test Voltage:	AC 120V/60Hz	Test By:	Ashton



No.	Mk.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.1900	28.24	19.53	47.77	64.04	-16.27	peak	
2		0.2460	29.63	19.58	49.21	61.89	-12.68	peak	
3		0.4860	23.72	19.75	43.47	56.24	-12.77	peak	
4		0.6740	24.68	19.76	44.44	56.00	-11.56	peak	
5	*	0.8620	24.70	19.77	44.47	56.00	-11.53	peak	
6		1.4340	24.41	19.86	44.27	56.00	-11.73	peak	

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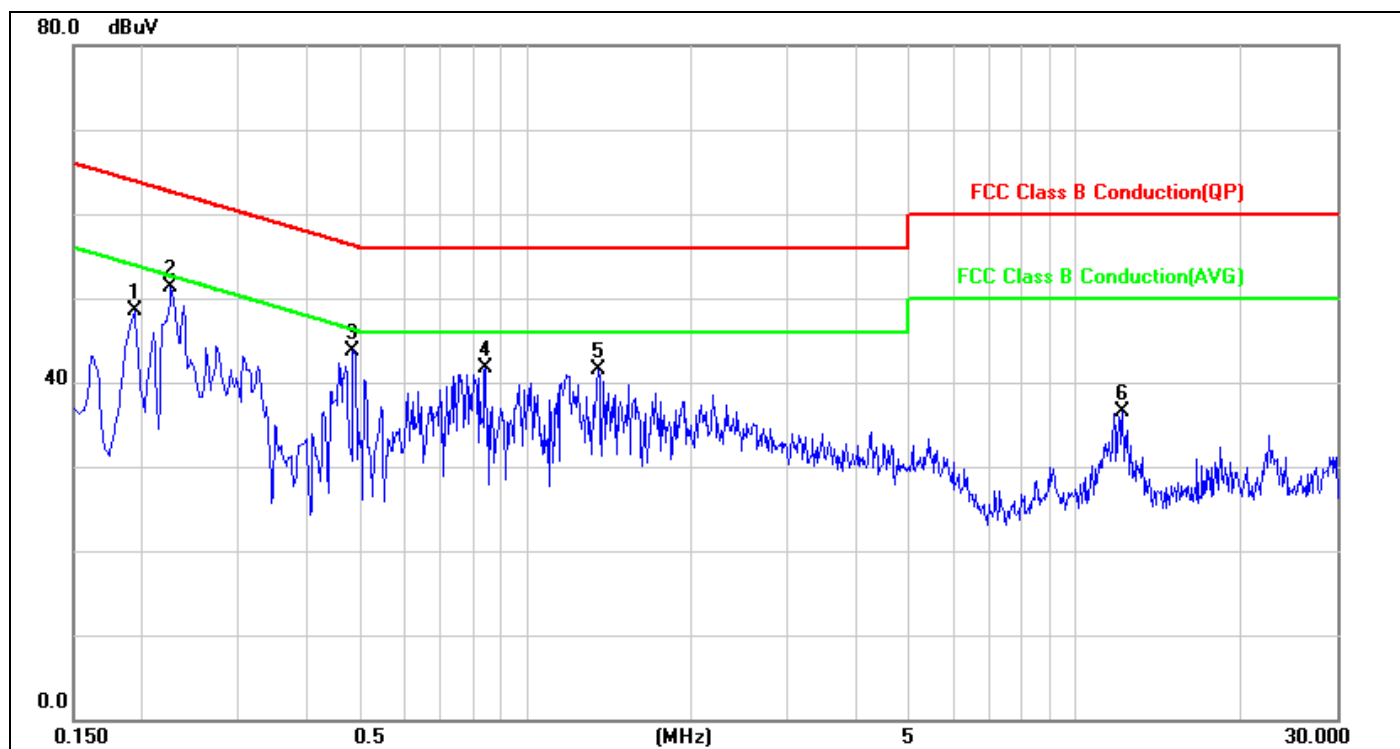
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Description: Operation
Line: N
Test Voltage: AC 120V/60Hz

Date: 2019/12/4
Temp.(°C)/Hum.(%): 22.0(°C)/42%
Test By: Ashton



No.	Mk.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.1940	28.75	19.77	48.52	63.86	-15.34	peak	
2	*	0.2260	31.41	19.80	51.21	62.60	-11.39	peak	
3		0.4860	23.68	19.96	43.64	56.24	-12.60	peak	
4		0.8460	21.75	19.98	41.73	56.00	-14.27	peak	
5		1.3580	21.52	20.06	41.58	56.00	-14.42	peak	
6		12.2180	16.32	20.21	36.53	60.00	-23.47	peak	

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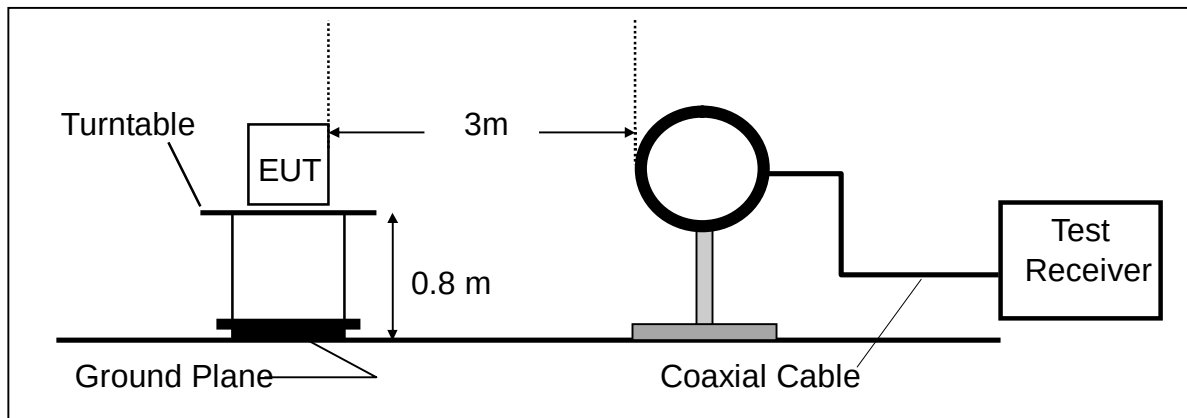
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

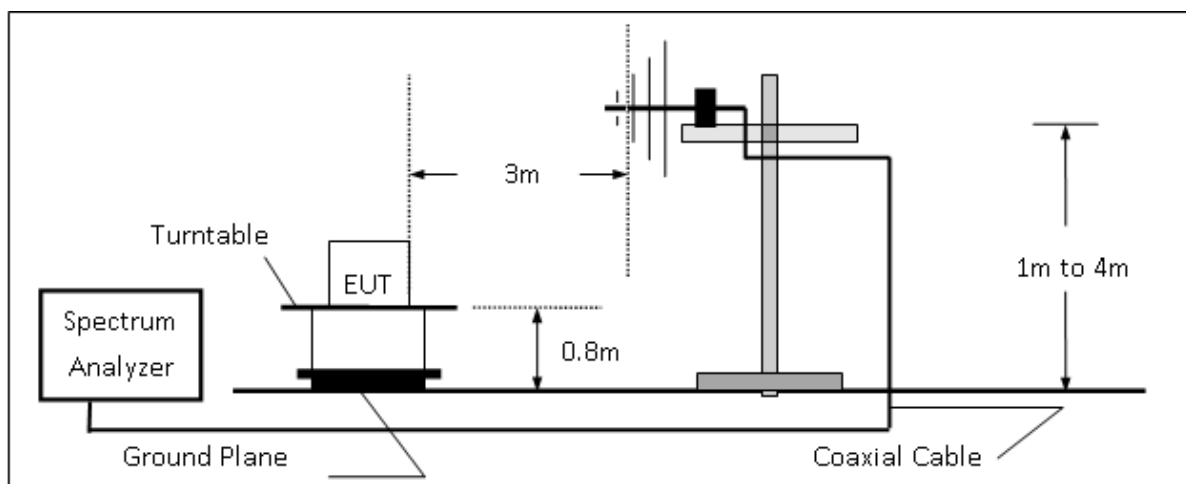
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

7.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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7.3 Measurement Equipment Used:

SGS 966 Chamber No.C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	TESEQ	CBL 6112D	35240	09/09/2019	09/08/2020
Loop Antenna	ETS.LINDGREN	6502	143303	04/25/2019	04/24/2020
EMI Test Receiver	R&S	ESU 40	100363	04/15/2019	04/14/2020
Pre-Amplifier	EMC Instruments	EMC330	980096	11/20/2019	11/19/2020
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/20/2019	11/19/2020

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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:

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

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

7.5 Field Strength of Fundamental Emission

7.5.1 Limit

Below 30MHz

Frequency (MHz)	Limit (μV/m)	Measurement distance (meters)	Remark
0.009-0.490	2400/F(kHz)	300	Quasi-Peak Value
0.490-1.705	24000/F(kHz)	30	Quasi-Peak Value
1.705-30.0	30	30	Quasi-Peak Value

Above 30MHz

Frequency (MHz)	Limit (dBμV/m @3m)	Remark
30-88	40	Quasi-Peak Value
88-216	43.5	Quasi-Peak Value
216-960	46	Quasi-Peak Value
Above 960	54	Quasi-Peak Value
Above 1GHz	54	Average Value
	74	Peak Value

Note:

- The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement. $Ex. 20 \cdot \log(30) + 40 \cdot \log(30/3) = 69.54 \text{ dBuV/m}$
- The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
- Actual FS(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)
Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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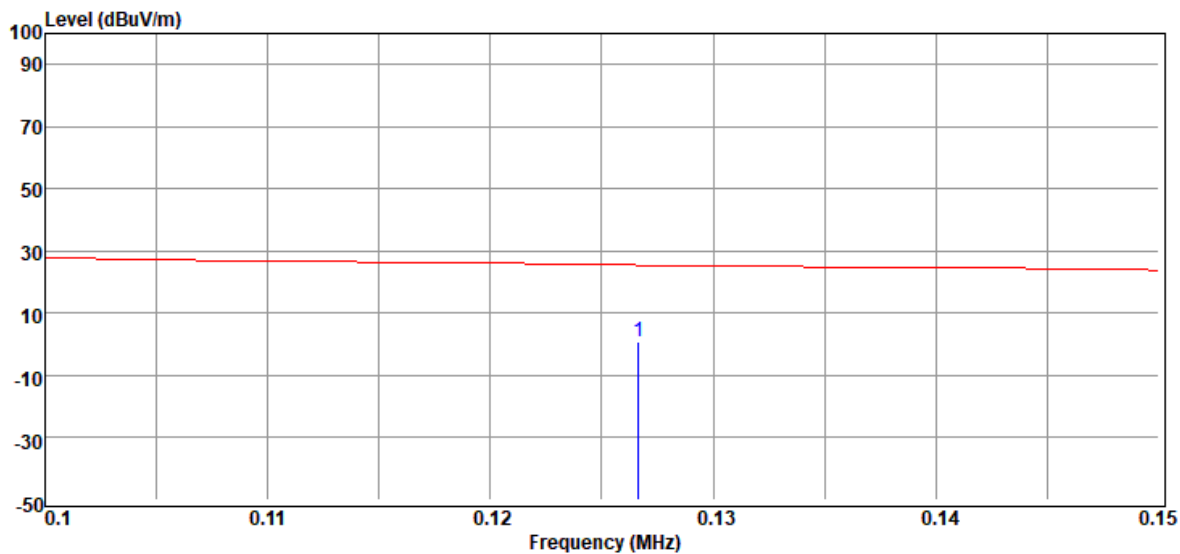
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7.5.2 Below 30 MHz test result

Report Number :E2/2019/B0024
 Operation Mode :WPC
 Test Channel :120kHz~130kHz
 Test Mode :Main CH MID
 EUT Pol :H Plan

Test Date :2019-12-03
 Temp./Humi. :22.9/41
 Antenna Pol. :VERTICAL
 Engineer :Ashton



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual @300/30m dBμV/m	Limit @300/30m dBμV/m	Margin dB
0.12665	Peak	70.05	-69.37	0.68	25.55	-24.87

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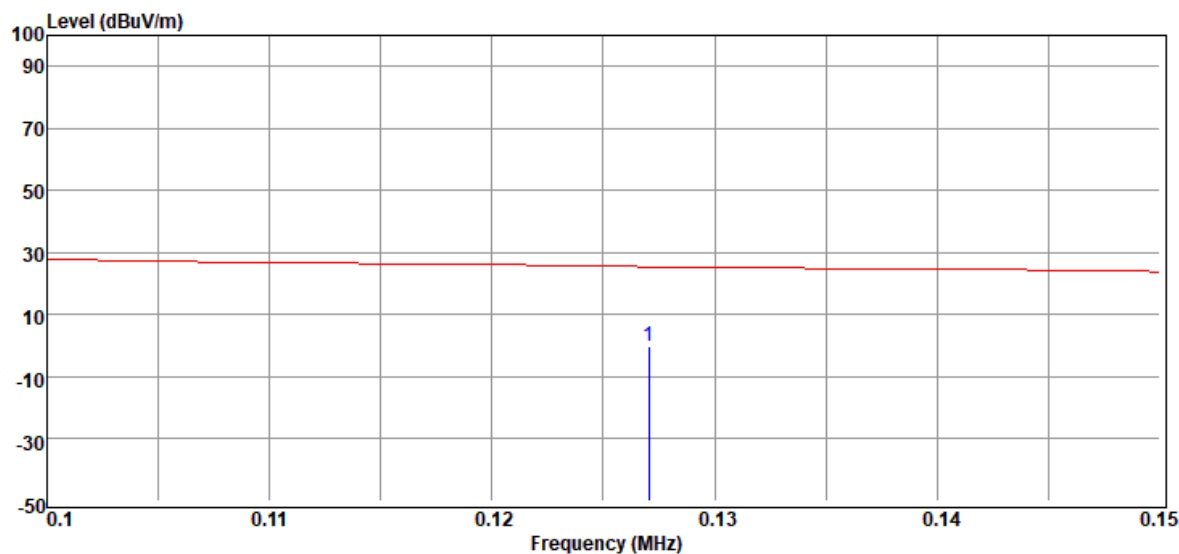
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Report Number :E2/2019/B0024
Operation Mode :WPC
Test Channel :120kHz~130kHz
Test Mode :Main CH MID
EUT Pol :H Plan

Test Date :2019-12-03
Temp./Humi. :22.9/41
Antenna Pol. :HORIZONTAL
Engineer :Ashton



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual @300/30m dBμV/m	Limit @300/30m dBμV/m	Margin dB
0.12705	Peak	69.38	-69.37	0.01	25.53	-25.52

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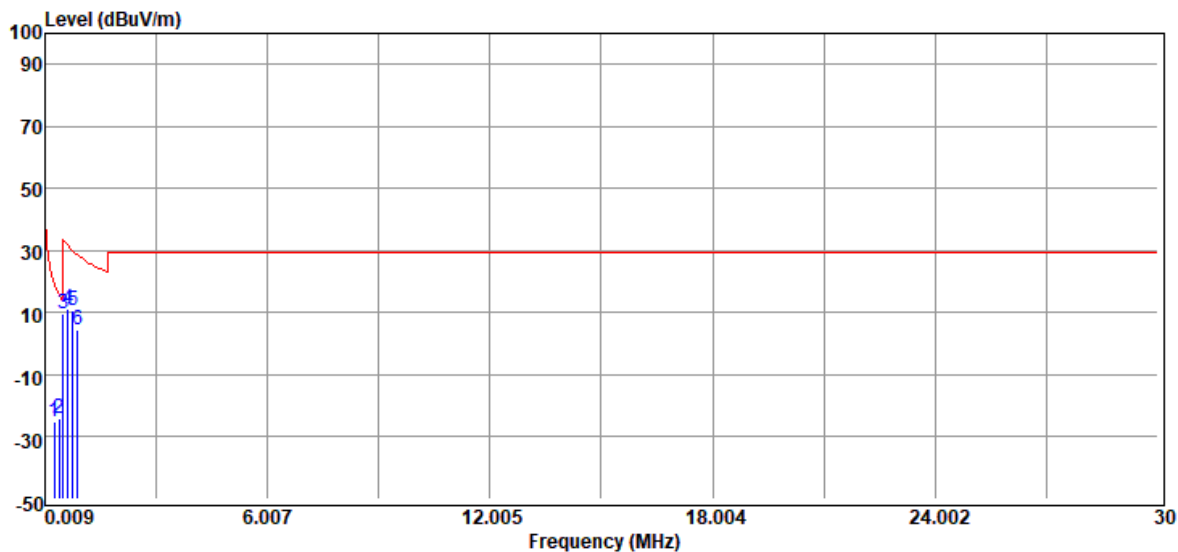
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Report Number :E2/2019/B0024
Operation Mode :WPC
Test Channel :120kHz~130kHz
Test Mode :TX CH MID
EUT Pol :H Plan

Test Date :2019-12-03
Temp./Humi. :22.9/41
Antenna Pol. :VERTICAL
Engineer :Ashton



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual @300/30m dBμV/m	Limit @300/30m dBμV/m	Margin dB
0.25	Peak	44.00	-68.99	-24.99	19.65	-44.64
0.38	Peak	44.60	-68.81	-24.21	16.01	-40.22
0.50	Peak	38.20	-28.73	9.47	33.62	-24.15
0.63	Peak	39.86	-28.67	11.19	31.63	-20.44
0.75	Peak	39.55	-28.62	10.93	30.10	-19.17
0.88	Peak	32.85	-28.59	4.26	28.72	-24.46

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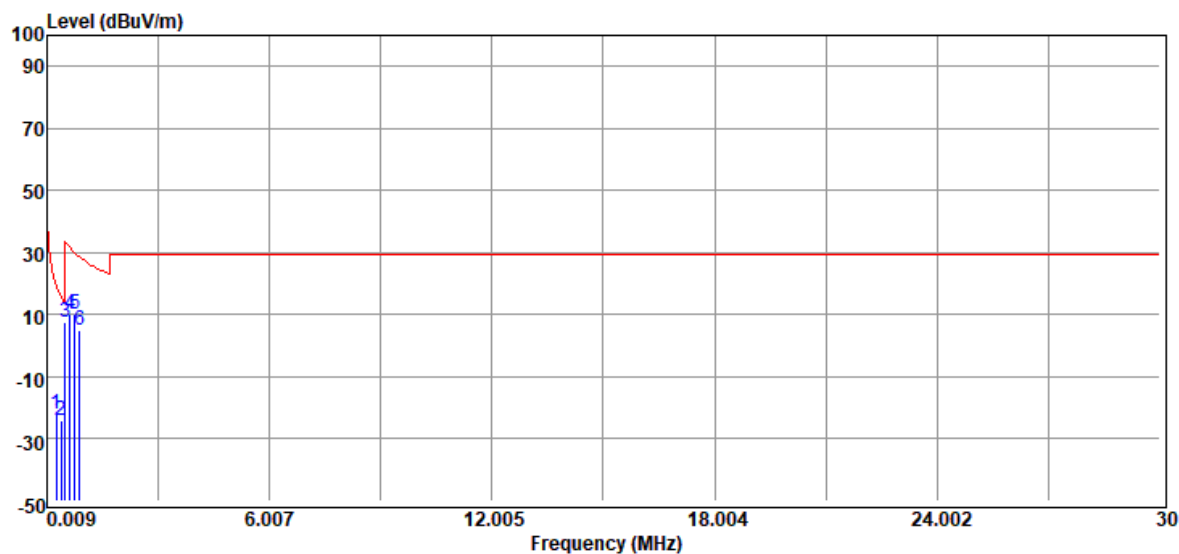
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Report Number :E2/2019/B0024
Operation Mode :WPC
Test Channel :120kHz~130kHz
Test Mode :TX CH MID
EUT Pol :H Plan

Test Date :2019-12-03
Temp./Humi. :22.9/41
Antenna Pol. :HORIZONTAL
Engineer :Ashton



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual @300/30m dBμV/m	Limit @300/30m dBμV/m	Margin dB
0.25	Peak	46.93	-68.99	-22.06	19.65	-41.71
0.38	Peak	44.54	-68.81	-24.27	16.01	-40.28
0.50	Peak	36.19	-28.73	7.46	33.62	-26.16
0.63	Peak	38.79	-28.67	10.12	31.63	-21.51
0.75	Peak	38.72	-28.62	10.10	30.10	-20.00
0.88	Peak	33.62	-28.59	5.03	28.72	-23.69

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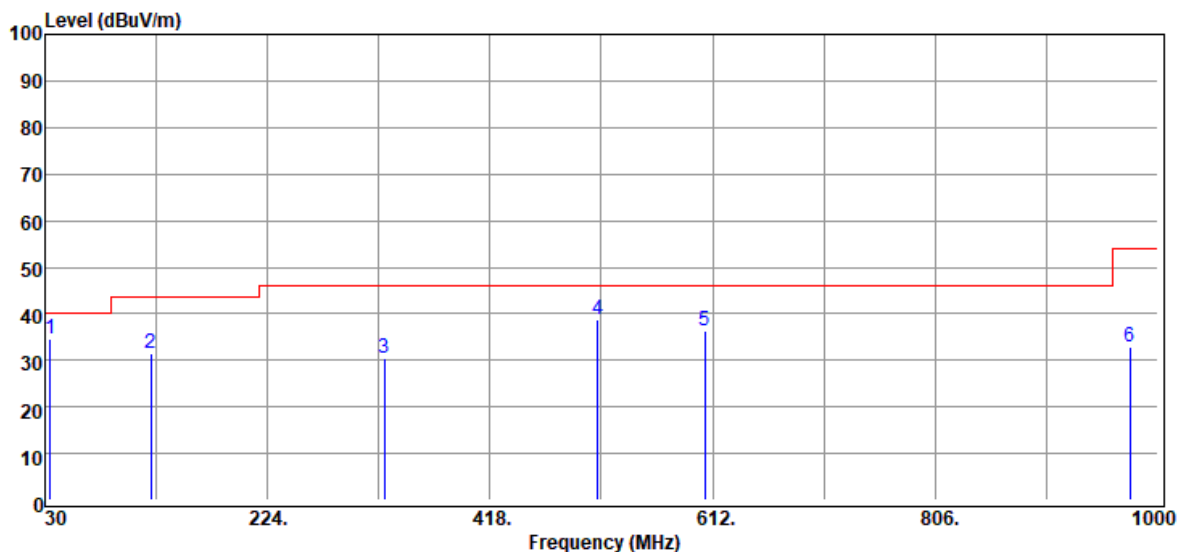
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7.5.3 Above 30MHz test result

Report Number :E2/2019/B0024
Operation Mode :WPC
Test Channel :120kHz~130kHz
Test Mode :TX CH MID
EUT Pol :H Plan

Test Date :2019-12-03
Temp./Humi. :22.9/41
Antenna Pol. :VERTICAL
Engineer :Ashton



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
34.85	Peak	40.15	-5.52	34.63	40.00	-5.37
122.15	Peak	44.17	-12.83	31.34	43.50	-12.16
325.85	Peak	39.90	-9.50	30.40	46.00	-15.60
512.09	Peak	43.62	-4.97	38.65	46.00	-7.35
605.21	Peak	39.43	-3.23	36.20	46.00	-9.80
975.75	Peak	31.06	1.64	32.70	54.00	-21.30

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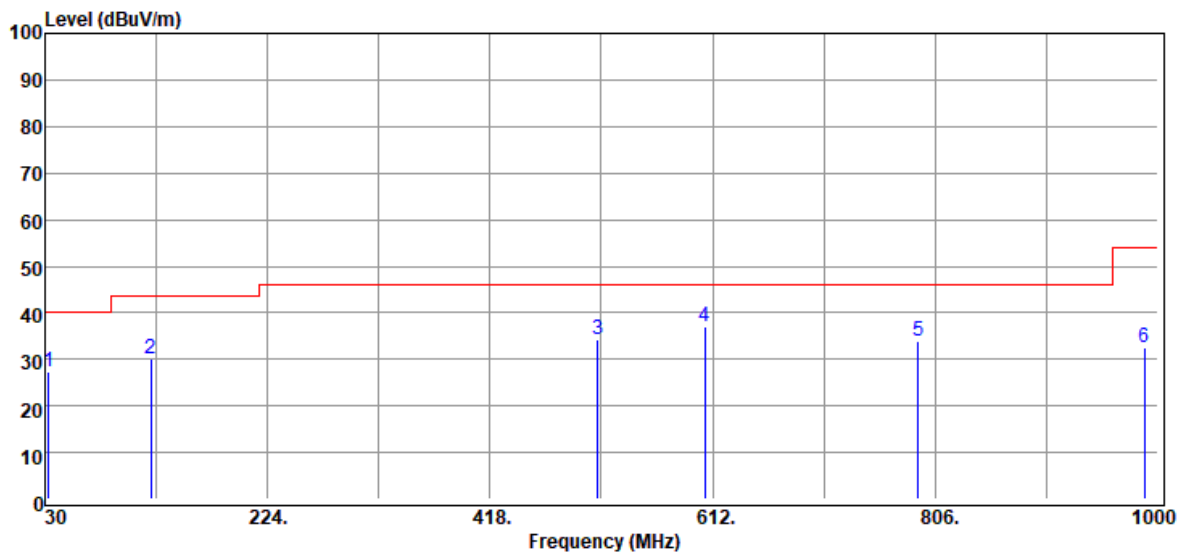
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Report Number :E2/2019/B0024
Operation Mode :WPC
Test Channel :120kHz~130kHz
Test Mode :TX CH MID
EUT Pol :H Plan

Test Date :2019-12-03
Temp./Humi. :22.9/41
Antenna Pol. :HORIZONTAL
Engineer :Ashton



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
32.91	Peak	32.29	-4.98	27.31	40.00	-12.69
122.15	Peak	42.94	-12.83	30.11	43.50	-13.39
512.09	Peak	39.37	-4.97	34.40	46.00	-11.60
605.21	Peak	40.23	-3.23	37.00	46.00	-9.00
791.45	Peak	33.71	0.24	33.95	46.00	-12.05
988.36	Peak	30.60	1.76	32.36	54.00	-21.64

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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8 20 dB OCCUPIED BANDWIDTH MEASUREMENT

8.1 Standard Applicable:

§2.1049 & §15.215 (c)

8.2 Limit:

None

8.3 Test Set-up

Refer to section 6.2 in this report.

8.4 Measurement Procedure

20dB bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 200 Hz and the video bandwidth of 1 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

8.5 Measurement Equipment Used:

Refer to section 7.3 in this report.

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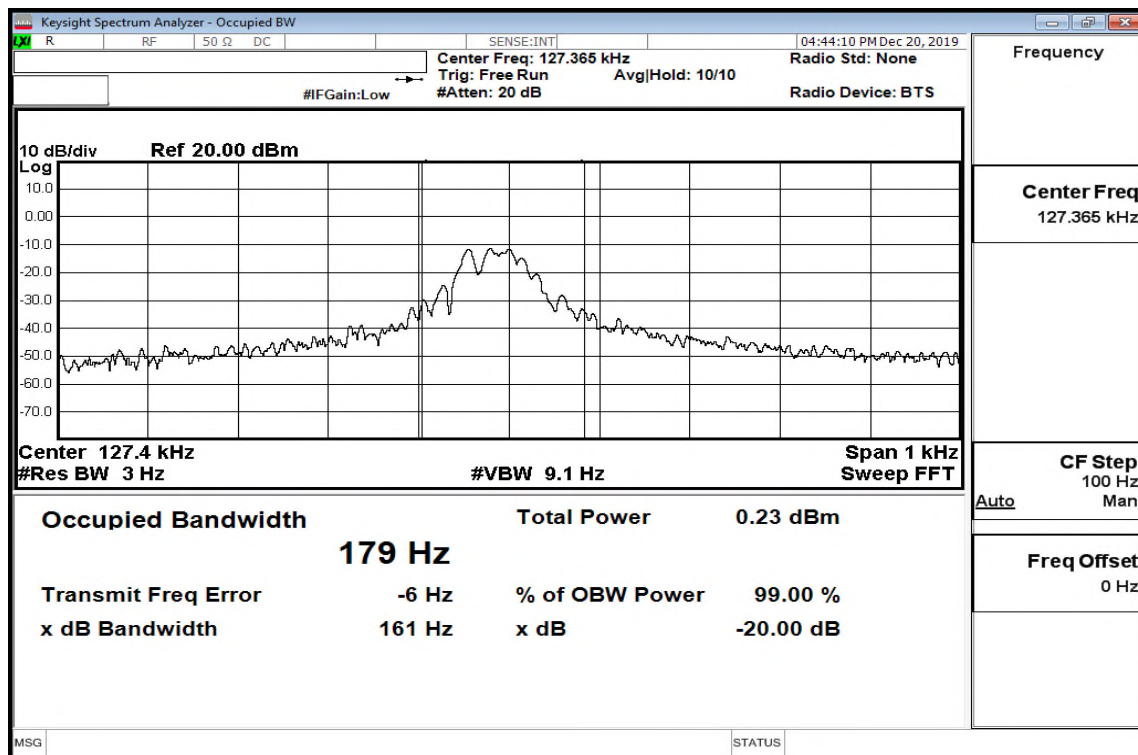
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8.6 Measurement Result

-20dB Bandwidth

20dB Bandwidth	Limit
161Hz	No requirement



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9 ANTENNA REQUIREMENT

9.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

9.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo and antenna spec. for details.

~ End of Report ~

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