FCC Test Report

Report No: FCS20240524W01

Issued for

Applicant:	Dongguan Kaiyueda Technology Co., Ltd.
Address:	No. 49, Tianfeng Road, Yangwu, Dalingshan Town, Dongguan City, Guangdong Province
Product Name:	Tire pressure monitoring system sensor
Brand Name:	车悦达®
Model Name:	PBN-1515
Series Model:	PBN-1516,PBN-1517,PBN-1518,PBN-1519,PBN-1520, PBN-1521,PBN-1522,PBN-1523,PBN-1524 PBN-1525,PBN-1526
FCC ID:	2BL54-PBN
Issued By: Flux Compliance Service Laboratory Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan Tel: 0769-27280901 Fax:0769-27280901 http://www.FCS-lab.com	

TEST RESULT CERTIFICATION

Applicant's Name..... :	Dongguan Kaiyueda Technology Co., Ltd.
Address..... :	No. 49, Tianfeng Road, Yangwu, Dalingshan Town, Dongguan City, Guangdong Province
Manufacture's Name..... :	Dongguan Kaiyueda Technology Co., Ltd.
Address..... :	No. 49, Tianfeng Road, Yangwu, Dalingshan Town, Dongguan City, Guangdong Province

Product Description

Product Name..... :	Tire pressure monitoring system sensor
Brand Name ..... :	车悦达
Model Name..... :	PBN-1515
Series Model..... :	PBN-1516,PBN-1517,PBN-1518,PBN-1519,PBN-1520, PBN-1521,PBN-1522,PBN-1523,PBN-1524 PBN-1525,PBN-1526
Test Standards..... :	FCC Rules and Regulations Part 15 Subpart C, Section 231
Test Procedure..... :	ANSI C63.10:2013

This device described above has been tested FCS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test..... :	
Date (s) of performance of tests. :	October 31,2024 ~November 6, 2024
Date of Issue..... :	November 6, 2024
Test Result..... :	Pass

Tested by : Scott Shen
(Scott Shen)

Reviewed by : Duke Qian
(Duke Qian)

Approved by : Jack Wang
(Jack Wang)

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Revision History

Rev.	Issue Date	Effect Page	Contents
00	November 6, 2024	N/A	Initial Issue

1. SUMMARY OF TEST RESULTS

FCC Part 15.231,Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.209, 15.231(b)	Radiated Emission	PASS	--
15.231(a) (1)	Transmitter time	PASS	--
15.231(c)	20dB Bandwidth	PASS	
15.231	Duty cycle	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) All tests are according to ANSI C63.10-2013

1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-0769-27280901
Fax:	+86-0769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number：5545.01	

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ±**U**, where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.71dB
2	Unwanted Emissions, conducted	±2.98 dB
3	Conducted Emission (9KHz-150KHz)	±4.13 dB
4	Conducted Emission (150KHz-30MHz)	±4.74 dB
5	All emissions,radiated(<1G) 30MHz-1000MHz	±3.2 dB
6	All emissions,radiated (1GHz -18GHz)	±3.66 dB
7	All emissions,radiated (18GHz -40GHz)	±4.31 dB
8	Occupied bandwidth	4(%)

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Tire pressure monitoring system sensor
Trade Name	车悦达
Model Name	PBN-1515
Series Model	PBN-1516,PBN-1517,PBN-1518,PBN-1519,PBN-1520, PBN-1521,PBN-1522,PBN-1523,PBN-1524 PBN-1525,PBN-1526
Model Difference	We (Dongguan Kaiyueda Technology Co., Ltd.) hereby state that all the models are electrical identical including the same software parameter and hardware design (i.e., circuit design, PCB Layout, RF module/circuit, antenna type(s) and antenna location, components on PCB, etc.,), same mechanical structure and design (including product enclosure, materials, etc.,), the only difference is the model name and appearance color.
Frequency	315MHZ
Modulation	FSK
Antenna type	external antenna
Power Supply	DC 3V
Battery	DC 3V
Hardware version number	V1.0
Software version number	V1.0
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Table for Filed Antenna

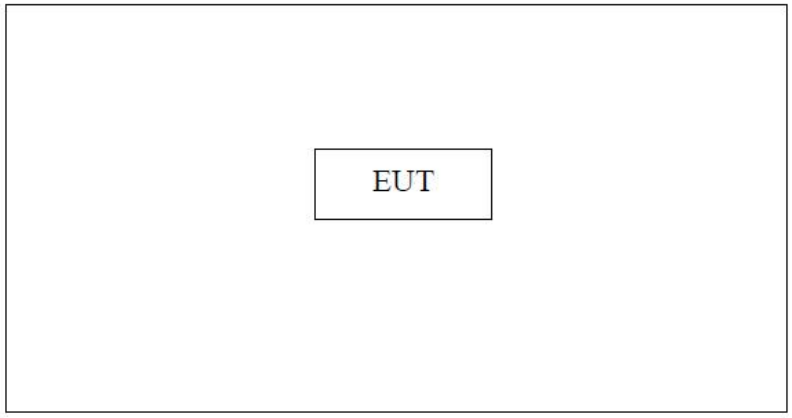
Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	external Antenna	N/A	0dBi	Antenna

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

This sample triggers the emission frequency via the remote control.

Configuration and peripherals



Test environment conditions
During the measurement the environmental conditions were within the listed ranges:
Temperature range: 21-25℃
Humidity range: 40-75%
Pressure range: 86-106kPa

2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.
(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.4 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2023.08.28	2024.08.27
Signal Analyzer	R&S	FSV40-N	FCS-E012	2023.08.28	2024.08.27
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2023.08.28	2024.08.27
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2023.08.28	2024.08.27
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2023.08.28	2024.08.27
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2023.08.28	2024.08.27
Pre-Amplifier(0.1M-3GHz)	EMCI	EM330N	FCS-E004	2023.08.28	2024.08.27
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2023.08.28	2024.08.27
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2023.08.28	2024.08.27
Temperature & Humidity	HTC-1	victor	FCS-E005	2023.08.28	2024.08.27

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2023.08.28	2024.08.27
LISN	R&S	ENV216	FCS-E007	2023.08.28	2024.08.27
LISN	ETS	3810/2NM	FCS-E009	2023.08.28	2024.08.27
Temperature & Humidity	HTC-1	victor	FCS-E008	2023.08.28	2024.08.27

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
Spectrum Analyzer	Keysight	N9020A	FCS-E015	2023.08.28	2024.08.27
Spectrum Analyzer	Agilent	E4447A	MY50180039	2023.08.28	2024.08.27
Spectrum Analyzer	R&S	FSV-40	101499	2023.08.28	2024.08.27

3. RADIATED EMISSION MEASUREMENT

3.1 LIMIT

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009mhz - 1000mhz)

Frequencies (MHz)	Field Strength (micorvolts/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

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

LIMITS OF FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
315	100.83	80.83

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz.Radiated emissions limits in these three bands are based on measurements employing an average detector

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:
Limit3m(dBuV/m)= Limit300m(dBuV/m) + 40Log(300m/3m) = Limit300m(dBuV/m) + 80
Limit3m(dBuV/m)= Limit30m(dBuV/m) + 40Log(30m/3m) = Limit30m(dBuV/m) + 40

(3) Limit for this EUT
All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions include fundamental emission shall not exceed FCC 15.231 section (b) limit of comply with FCC 15.209 limit which permit higher emission level.

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

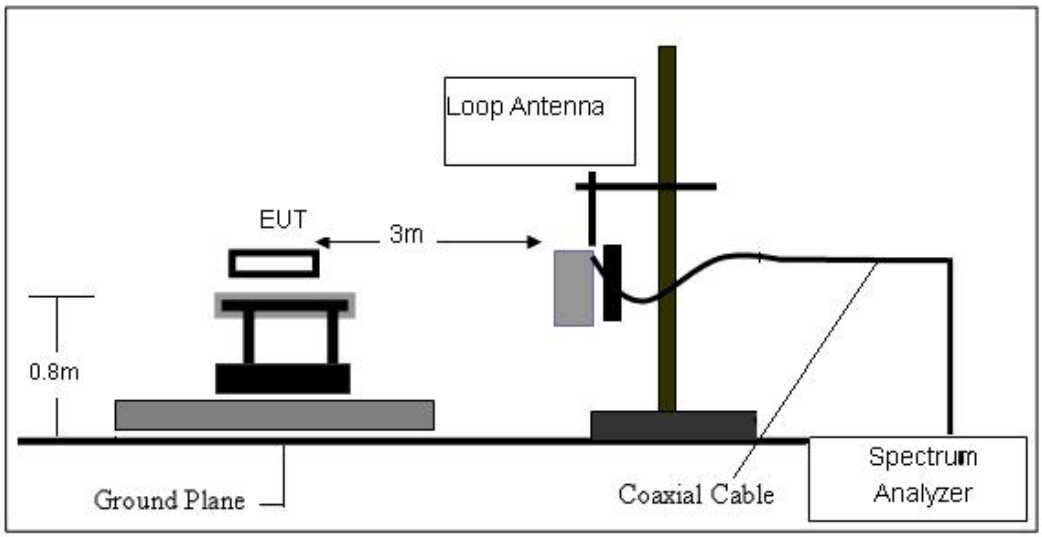
3.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz,and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

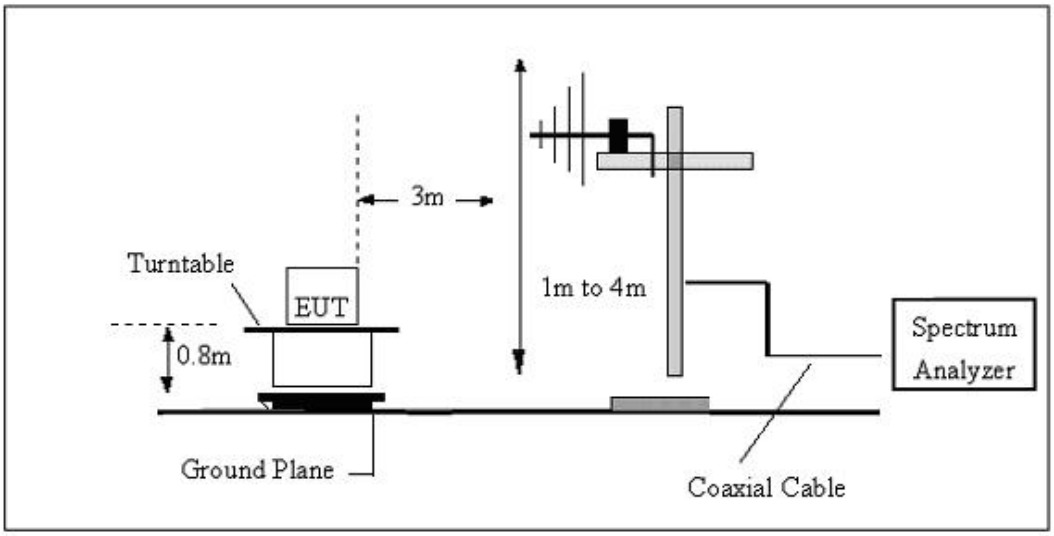
Note:
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3 TEST SETUP

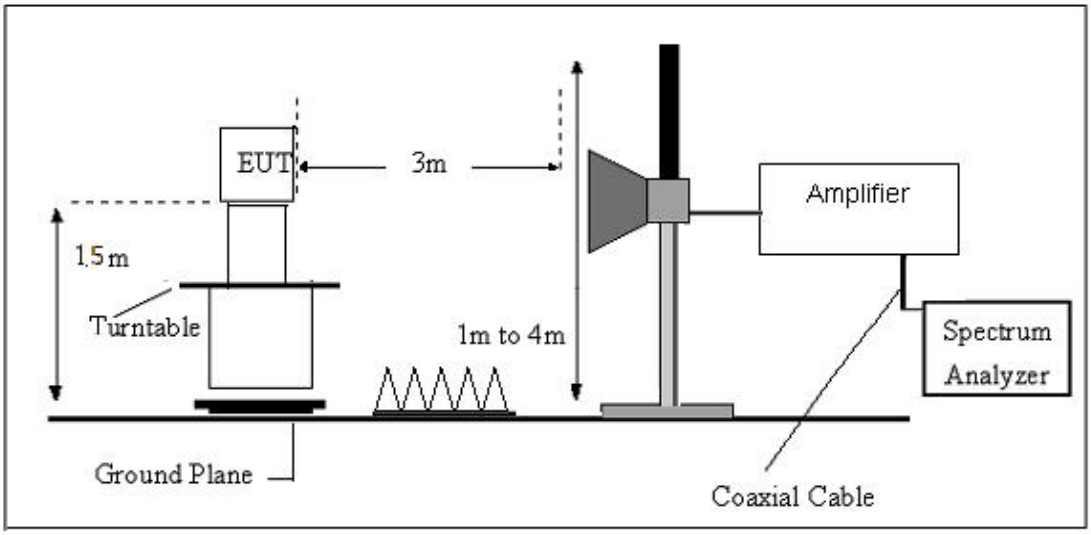
（A） Radiated Emission Test-Up Frequency Below 30MHz



（B） Radiated Emission Test-Up Frequency 30MHz~1GHz



（C） Radiated Emission Test-Up Frequency Above 1GHz



3.4 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Mode:	FSK	Test Voltage:	DC 3V

For field strength of the fundamental signal

Pake

Frequency (MHz)	Read Level (dBuV)	Antenna Factor(dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
315	84.52	17.53	3.02	29.43	75.64	100.83	-25.19	Horizontal
315	85.53	17.53	3.02	29.43	76.65	100.83	-24.18	Vertical

AVG

Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
315	75.64	-8.17	67.47	80.83	-13.36	Horizontal
315	76.65	-8.17	68.48	80.83	-12.35	Vertical

Note: av Level=pk level +PDCF
Duty cycle factor= -8.17dB

For spurious emission

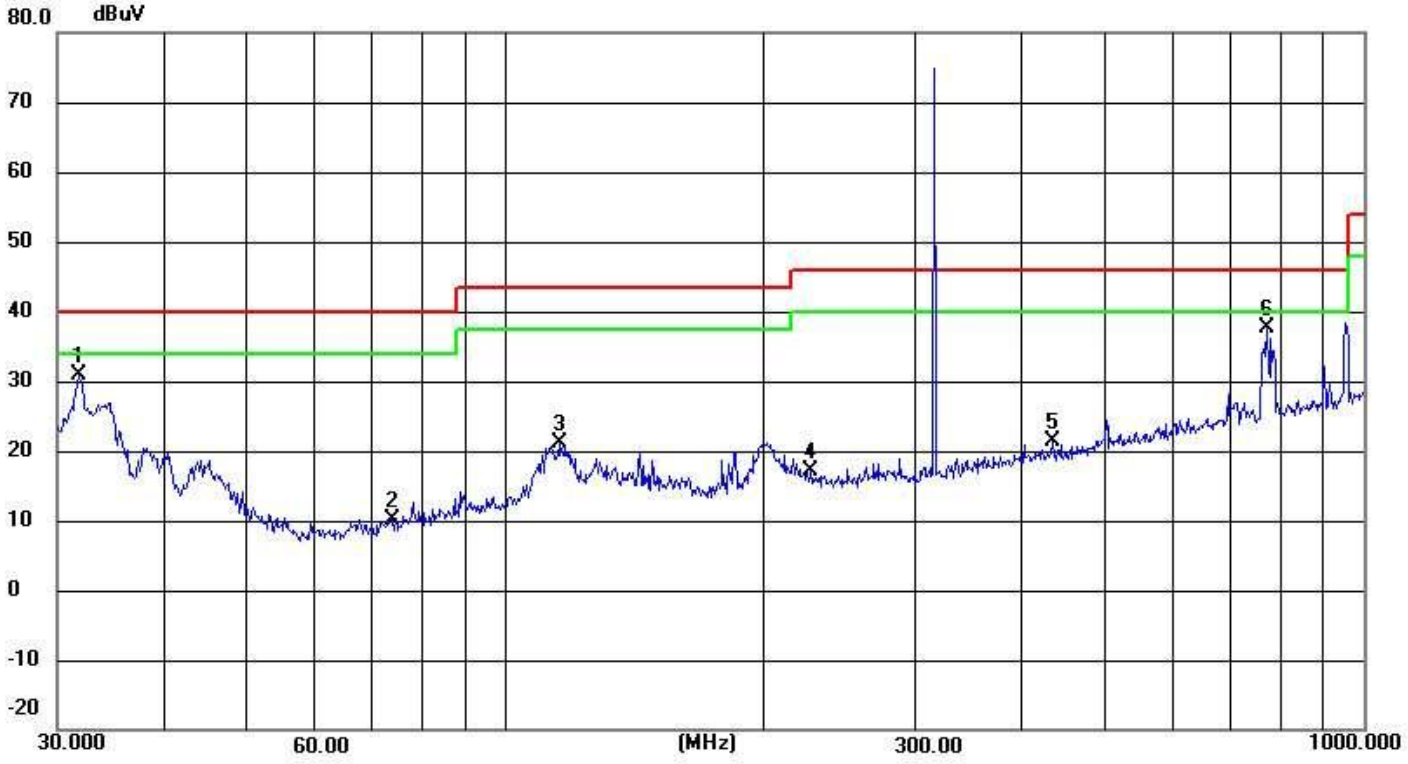
(9KHz-30MHz)

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits (dBuv) + distance extrapolation factor.

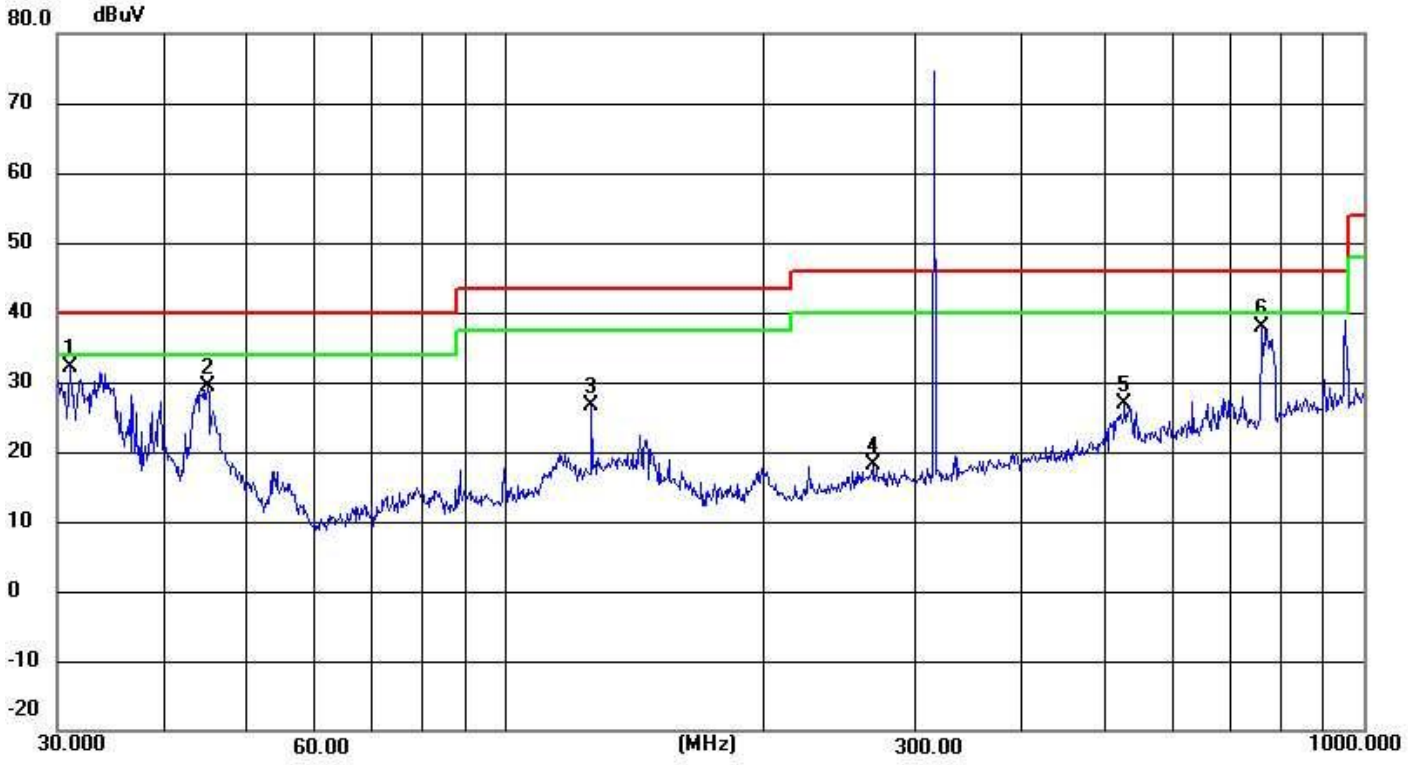
(30MHZ-1000MHZ)

Temperature:	23.7℃	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	FSK		



No.	Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	31.7313	39.35	-8.46	30.89	40.00	-9. 11	QP
2	73.8756	42.47	-32.25	10.22	40.00	-29.78	QP
3	115.3205	53.34	-32.28	21.06	43.50	-22.44	QP
4	226.8936	49.39	-32.17	17.22	46.00	-28.78	QP
5	434.0651	53.29	-31.97	21.32	46.00	-24.68	QP
6	771.4486	69.07	-31.54	37.53	46.00	-8.47	QP

Temperature:	22.7℃	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	FSK		



No.	Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	31.0706	40.10	-8.03	32.07	40.00	-7.93	QP
2	44.9006	45.15	-15.84	29.31	40.00	-10.69	QP
3	125.8864	58.82	-32.27	26.55	43.50	-16.95	QP
4	267.5454	50.37	-32.13	18.24	46.00	-27.76	QP
5	526.3967	58.85	-31.86	26.99	46.00	-19.01	QP
6	760.7036	69.41	-31.55	37.86	46.00	-8.14	QP

(Above ~ 1GHz)

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1260.00	60.38	25.05	4.82	34.00	56.25	74.00	-17.75	Vertical
1575.00	56.92	27.74	5.15	34.27	55.54	74.00	-18.46	Vertical
1890.00	53.07	27.82	5.58	33.78	52.69	74.00	-21.31	Vertical
1260.00	60.10	25.05	4.82	34.00	55.97	74.00	-18.03	Horizontal
1575.00	55.53	27.74	5.15	34.27	54.15	74.00	-19.85	Horizontal
1890.00	54.79	27.82	5.58	33.78	54.41	74.00	-19.59	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1260.00	56.25	-8.17	48.08	54.00	-5.92	Vertical
1575.00	55.54	-8.17	47.37	54.00	-6.63	Vertical
1890.00	52.69	-8.17	44.52	54.00	-9.48	Vertical
1260.00	55.97	-8.17	47.8	54.00	-6.20	Horizontal
1575.00	54.15	-8.17	45.98	54.00	-8.02	Horizontal
1890.00	54.41	-8.17	46.24	54.00	-7.76	Horizontal

Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss - Preamplifier Factor*
2. AVERAGE VALUE=PEAK VALUE + DUTY CYCLE FACTOR

4 CONDUCTED EMISSION MEASUREMENT

4.1 LIMIT

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:
(1) The tighter limit applies at the band edges.
(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

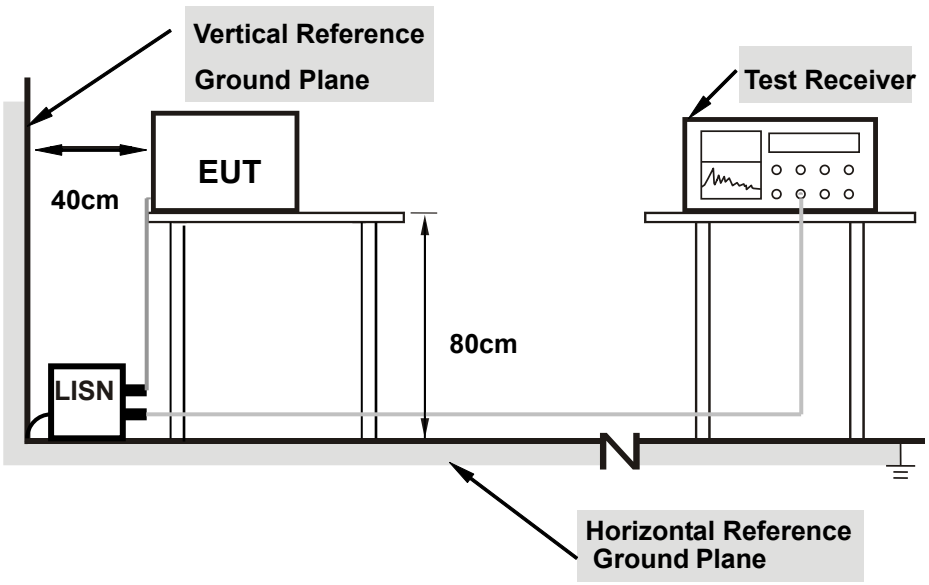
4.2 TEST PROCEDURE

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.3 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

4.4 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	N/A	Test Voltage:	N/A
Phase:	N/A	Result:	N/A

5. TRANSMITTER TIME

5.1 LIMIT

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

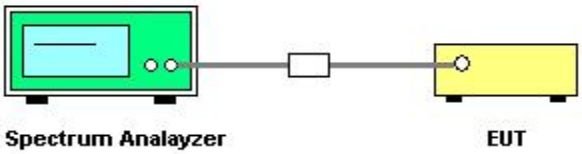
5.2 TEST PROCEDURE

a. The EUT’s RF signal was coupled to spectrum analyzer by antenna connected to spectrum analyzer.

b. Set the spectrum to zero span mode, and centered of EUT frequency.

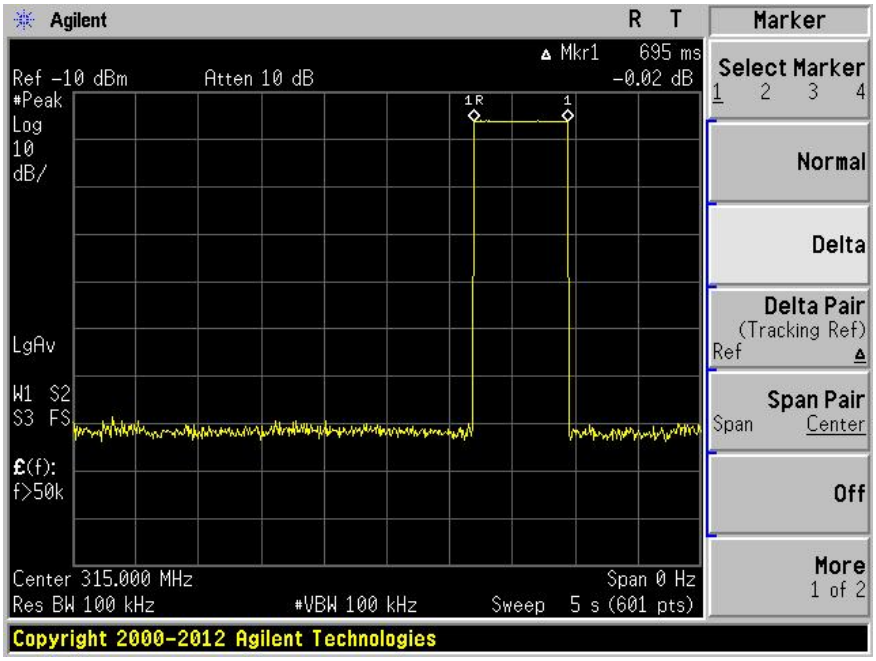
c. Measure the stop transmitting time after release EUT button

5.3 TEST SETUP



5.4 TEST RESULTS

Frequency(MHz)	Limit	Result
315	≤5s	Pass



6. 20 DB BANDWIDTH TEST

6.1 LIMIT

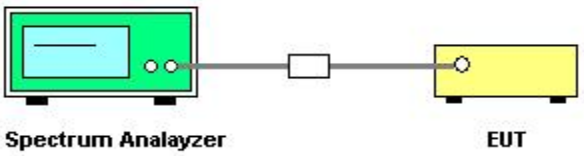
The bandwidth of the emission shall be no wider than 0.25% of the center frequency of devices operation above 70MHz and below 900MHz.

6.2 TEST PROCEDURE

a. Connect EUT’s antenna output to spectrum analyzer by RF cable.

b. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10kHz RBW and 30kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB

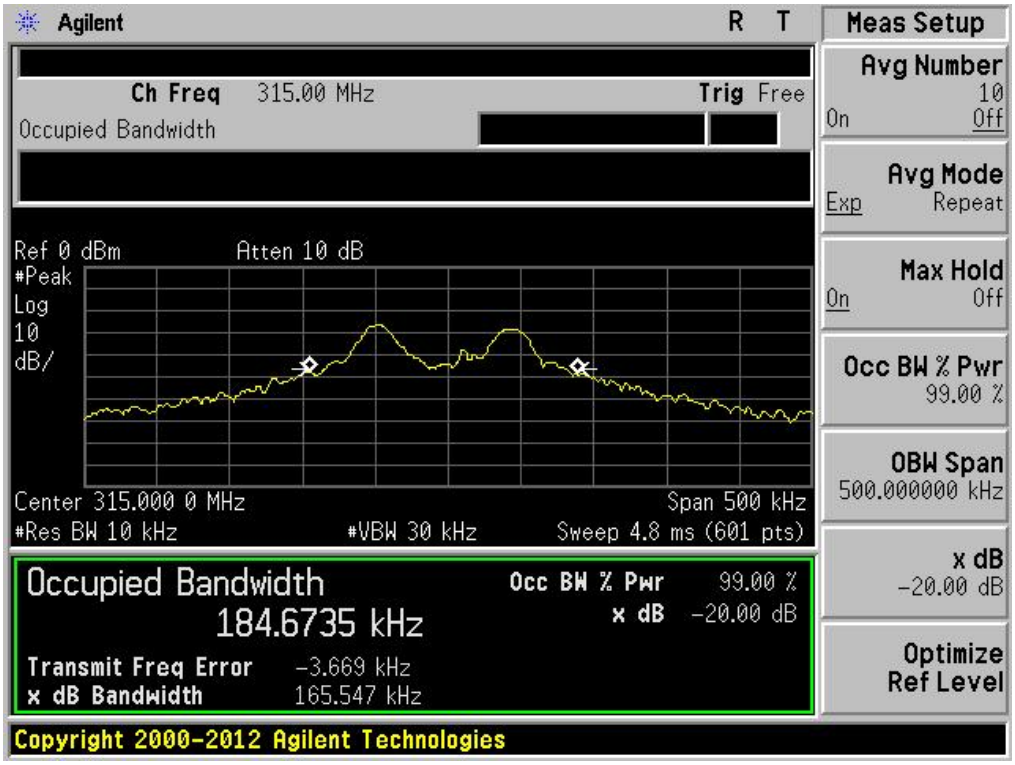
6.3 TEST SETUP



6.4 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	ASK	Test Voltage:	DC 3V

Frequency	20dB Bandwidth (KHz)	Result
315 MHz	165.547	PASS



7. DUTY CYCLE

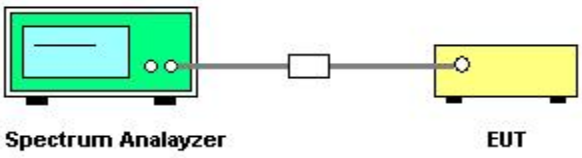
7.1 LIMIT

None: for reporting purposes only.

7.2 TEST PROCEDURE

Test chart 1	Set the Centre frequency of the spectrum analyzer to the transmitting frequency; Set the span=0MHz, RBW=1MHz, VBW=3MHz, Sweep time=100ms; Trace mode = Single hold
Test chart 2	Set the Centre frequency of the spectrum analyzer to the transmitting frequency; Set the span=0MHz, RBW=1MHz, VBW=3MHz, Sweep time=60.07ms; Trace mode = Single hold

7.3 TEST SETUP



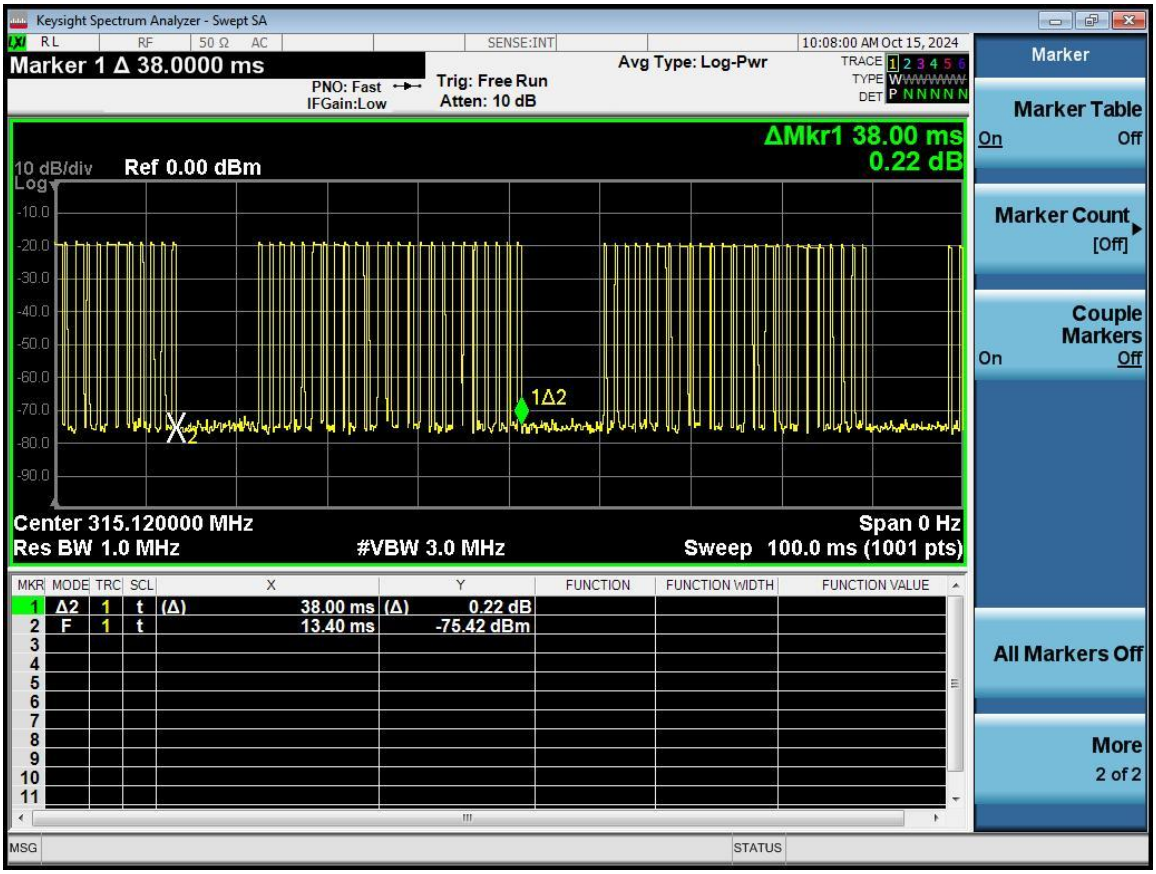
7.4 TEST RESULTS

Frequency	Duty Cycle
315 MHz	39.05%

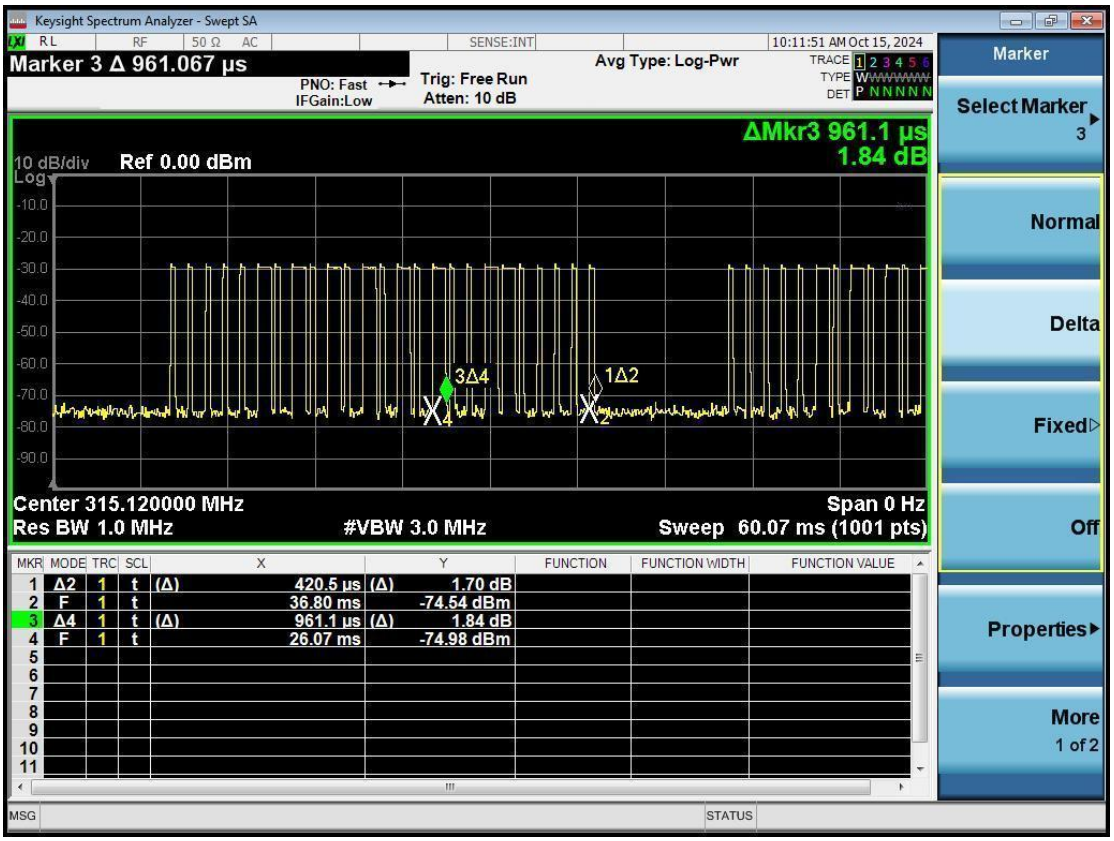
The duty cycle is simply the on time divided by the period:
The duration of one cycle = 38ms
Effective period of the cycle = (0.9611ms*8+0.4205ms*17)=14.84ms
Duty Cycle = 14.84ms/38ms = 0.3905=39.05%
Duty Cycle Factor(dB)=20log (duty cycle(%))= -8.17dB

Original test data

Test chart 1



Test chart 2


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
10:11:51 AM Oct 15, 2024
Marker 3 Δ 961.067 µs
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE WWWWW
DET P N N N N N
ΔMkr3 961.1 µs
1.84 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
3Δ4
1Δ2
Center 315.120000 MHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 60.07 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 Δ2 1 t (Δ) 420.5 µs (Δ) 1.70 dB
2 F 1 t 36.80 ms -74.54 dBm
3 Δ4 1 t (Δ) 961.1 µs (Δ) 1.84 dB
4 F 1 t 26.07 ms -74.98 dBm
5
6
7
8
9
10
11
MSG
STATUS
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

8 ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

8.2 EUT ANTENNA

The antennas used for this product are external antenna and other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 0dBi.

※※※※※END OF THE REPORT※※※※※