



RADIO TEST REPORT

Report No.: STS2111186W01

Issued for

DSP Group Ltd.

3 Arik Einstein Street., Herzeliya 4659071 Israel

Product Name:	DHAN Module
Brand Name:	
Model Name:	DHAN-M
Series Model:	N/A
FCC ID:	2AOUK-DHANM
Test Standard:	Title 47 of the CFR, Part 15 Subpart D

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TEST RESULT CERTIFICATION

Applicant's Name : DSP Group Ltd.
Address : 3 Arik Einstein Street., Herzeliya 4659071 Israel
Manufacturer's Name : DSP Group Ltd.
Address : 3 Arik Einstein Street., Herzeliya 4659071 Israel
Factory's Name : MeiZhou GuoWei Electronics Co., Ltd.
Address : AD1 Section, The Economy Exploitation Area, Meizhou, Guangdong Province, China.

Product Description

Product Name : DHAN Module
Brand Name : DSP GROUP
Model Name : DHAN-M
Series Model : N/A

Test Standards : Title 47 of the CFR, Part 15. Subpart D
Test procedure : ANSI C63.17-2013

This device described above has been tested by STS and 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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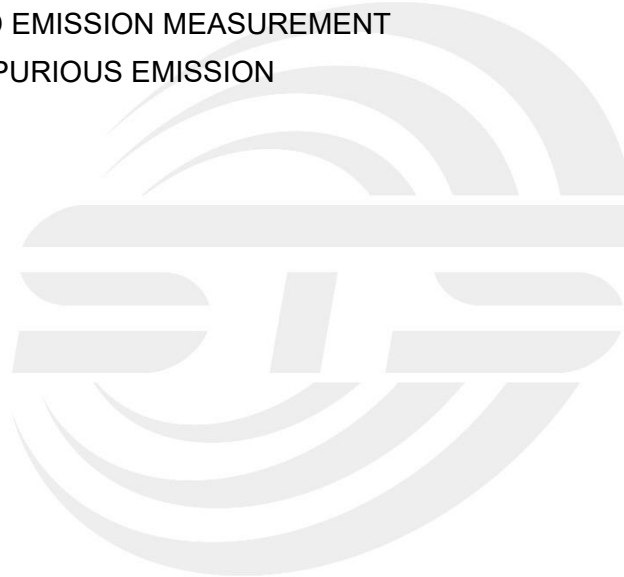
Date of Test :
Date of receipt of test item : 23 Feb. 2022
Date of performance of tests : 23 Feb. 2022 ~ 02 Mar. 2022
Date of Issue : 02 Mar. 2022
Test Result : Pass

Testing Engineer : Chris Chen (Chris Chen)
Technical Manager : Sean She (Sean she)
Authorized Signatory : Vita Li (Vita Li)





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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	02 Mar. 2022	STS2111186W01	ALL	Initial Issue





SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart D.

Requirement	FCC Part	Test Procedure	Result
Conducted Emissions	15.315 & 15.207	ANSI C63.4	Compliant
Radiated Out of Band Emissions	15.319 (g), 15.309 (b) & FCC Part 15 Subpart B, 15.109 and 15.209	--	Compliant





1 INTRODUCTION

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded 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	$\pm 0.68\text{dB}$
2	Unwanted Emissions, conducted	$\pm 2.988\text{dB}$
3	All emissions, radiated 30-1GHz	$\pm 4.39\text{dB}$
4	All emissions, radiated 1G-6GHz	$\pm 5.10\text{dB}$
5	All emissions, radiated >6G	$\pm 5.48\text{dB}$
6	Conducted Emission (9KHz-150KHz)	$\pm 2.79\text{dB}$
7	Conducted Emission (150KHz-30MHz)	$\pm 2.80\text{dB}$



2 PRODUCT INFORMATION

Product Name	DHAN Module
Brand Name	
Model Name	DHAN-M
Series Model	N/A
Product Differences	N/A
Hardware version number	N/A
Software version number	N/A
EUT Frequency Ranges	1921.536-1928.448MHz
Type of Modulations	GFSK
Packet type	PP32Z
Number of Channels	5 CH. Please see Note 1.
Antenna Type	PCB Antenna
Antenna Gain	0dBi
Rating	USB DC 5V or DC 3V
Work Temperature	-40°C to 85°C

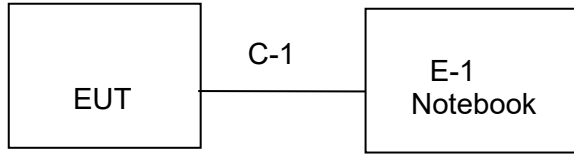
Note: 1. Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
04	1921.536	03	1923.264	02	1924.992
01	1926.720	00	1928.448	--	--

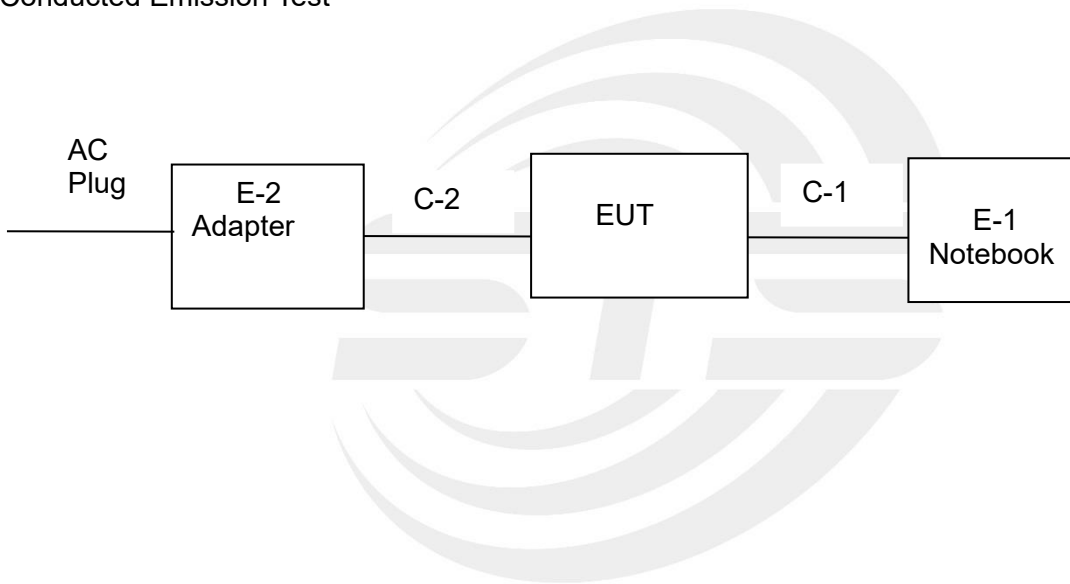


3 TEST CONFIGURATION OF EQUIPMENT UNDER TEST

Radiated Spurious Emission Test



Conducted Emission Test





3.1 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.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-1	Notebook	Lenovo	ThinkPad E470	N/A	N/A
E-2	Adapter	amazon	FANA7R	N/A	N/A
C-1	USB Cable	N/A	N/A	185cm	NO

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (2) "YES" means "with core"; "NO" means "without core".



4 MEASUREMENT INSTRUMENTS

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2021.09.30	2022.09.29
Signal Analyzer	R&S	FSV 40-N	101823	2021.09.30	2022.09.29
Active loop Antenna	ZHINAN	ZN30900C	16035	2021.04.11	2023.04.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2021.10.11	2023.10.10
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2021.10.08	2022.10.07
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2021.09.30	2022.09.29
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2021.09.28	2022.09.27
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2021.09.30	2022.09.29
LISN	R&S	ENV216	101242	2021.09.30	2022.09.29
LISN	EMCO	3810/2NM	23625	2021.09.30	2022.09.29
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Equipment with a calibration date of "NCR" shown in this list was not used to make direct calibrated measurements.



5 TEST ITEMS

5.1 CONDUCTED EMISSION MEASUREMENT

POWER LINE CONDUCTED EMISSION LIMITS

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 Emission limit (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.

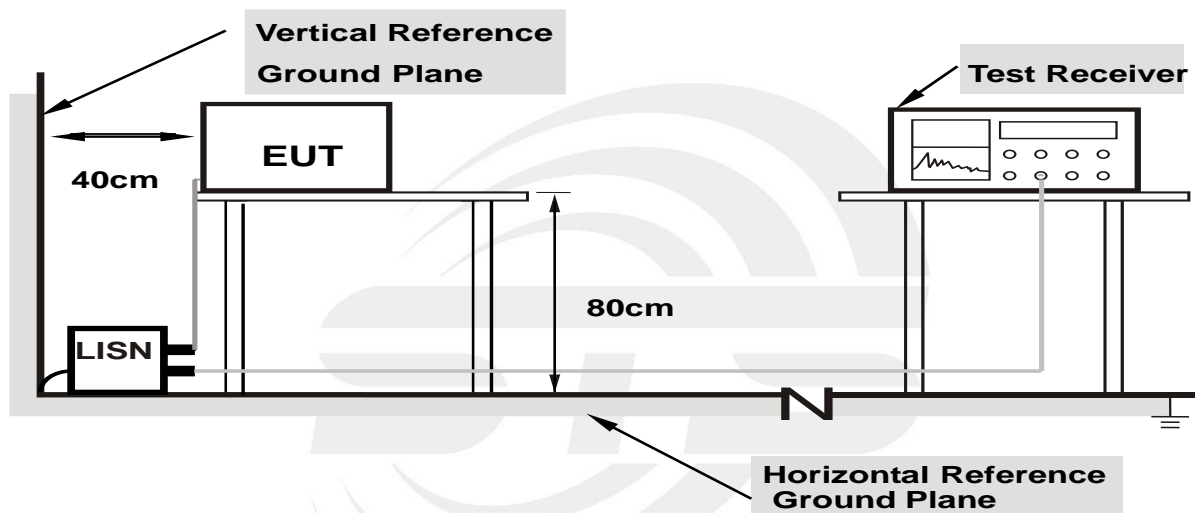
The following table is the setting of the receiver

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

TEST PROCEDURE

- 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.
- 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.
- 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.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

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 cm from other units and other metal planes

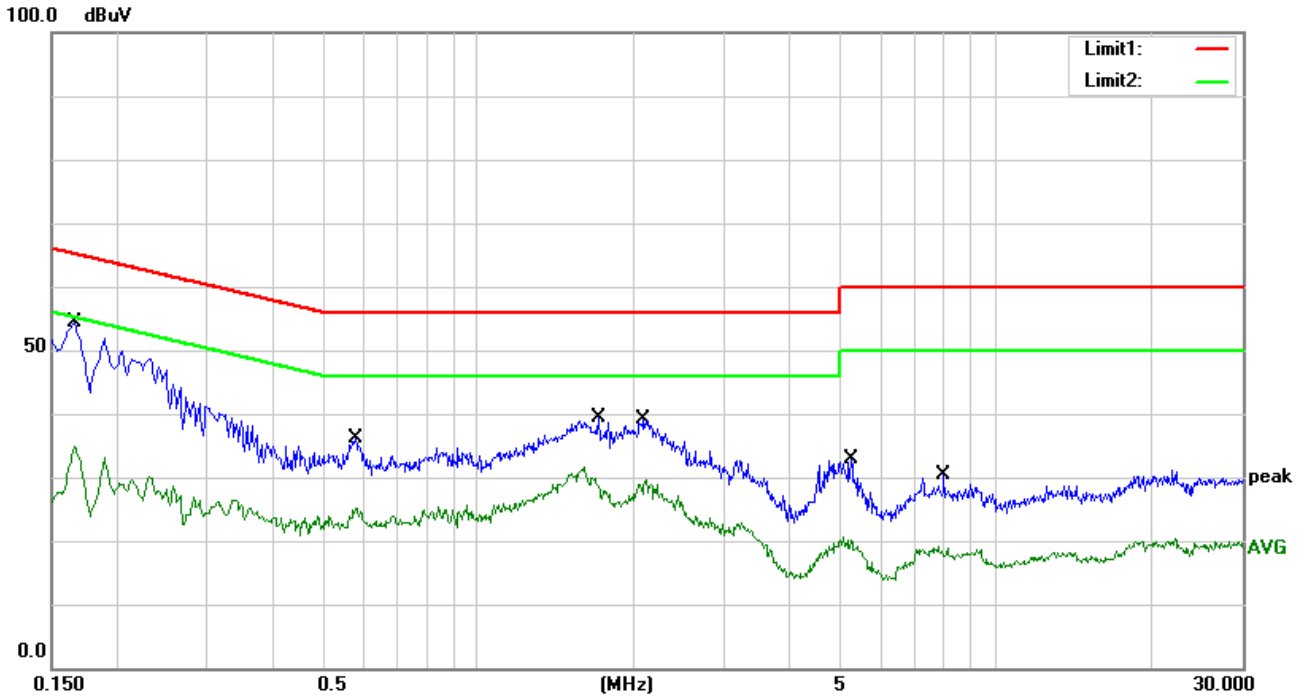
EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



TEST RESULTS

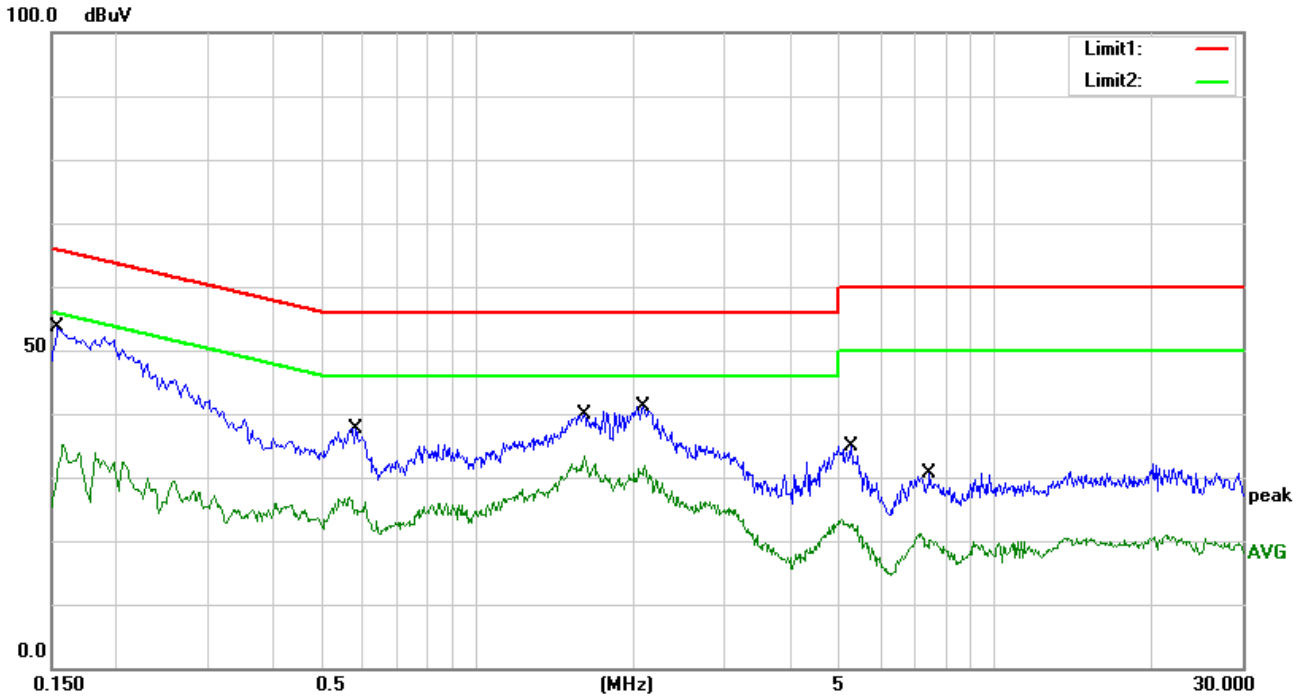
Temperature:	26.1 (C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	TX Mode		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1660	33.93	20.33	54.26	65.16	-10.90	QP
2	0.1660	14.62	20.33	34.95	55.16	-20.21	AVG
3	0.5820	15.77	20.44	36.21	56.00	-19.79	QP
4	0.5820	4.80	20.44	25.24	46.00	-20.76	AVG
5	1.7100	19.11	20.36	39.47	56.00	-16.53	QP
6	1.7100	11.16	20.36	31.52	46.00	-14.48	AVG
7	2.0900	18.75	20.39	39.14	56.00	-16.86	QP
8	2.0900	9.30	20.39	29.69	46.00	-16.31	AVG
9	5.2620	12.40	20.54	32.94	60.00	-27.06	QP
10	5.2620	0.05	20.54	20.59	50.00	-29.41	AVG
11	7.9660	9.62	20.69	30.31	60.00	-29.69	QP
12	7.9660	-1.57	20.69	19.12	50.00	-30.88	AVG



Temperature:	26.1 (C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	TX Mode		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1540	33.33	20.30	53.63	65.78	-12.15	QP
2	0.1540	14.89	20.30	35.19	55.78	-20.59	AVG
3	0.5820	17.28	20.44	37.72	56.00	-18.28	QP
4	0.5820	6.48	20.44	26.92	46.00	-19.08	AVG
5	1.6020	19.62	20.35	39.97	56.00	-16.03	QP
6	1.6020	12.99	20.35	33.34	46.00	-12.66	AVG
7	2.0980	20.75	20.39	41.14	56.00	-14.86	QP
8	2.0980	11.44	20.39	31.83	46.00	-14.17	AVG
9	5.2620	14.36	20.54	34.90	60.00	-25.10	QP
10	5.2620	2.80	20.54	23.34	50.00	-26.66	AVG
11	7.4580	10.10	20.63	30.73	60.00	-29.27	QP
12	7.4580	0.42	20.63	21.05	50.00	-28.95	AVG



5.2 RADIATED SPURIOUS EMISSION
RADIATED EMISSION LIMITS

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

LIMITS OF RADIATED EMISSION MEASUREMENT (Frequency Range 9kHz-1000MHz)

Frequencies (MHz)	Field Strength (micovolts/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 (Above 1000MHz)

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

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz

Receiver Parameter	Setting
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

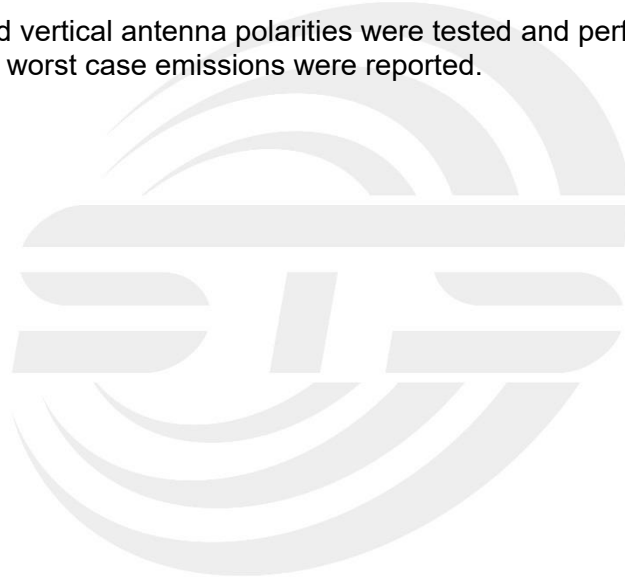


TEST PROCEDURE

- 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. 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 ANT Ore 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 Quasi Peak 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.

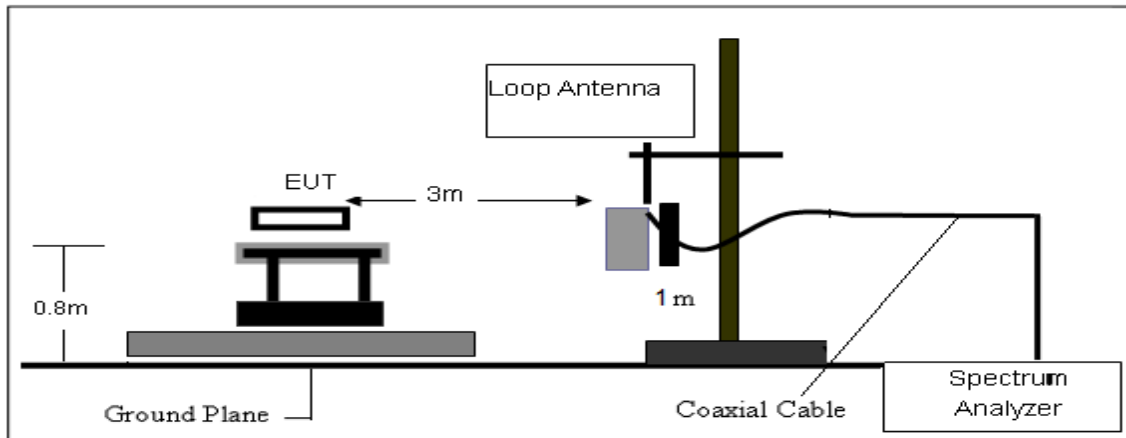
Note:

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

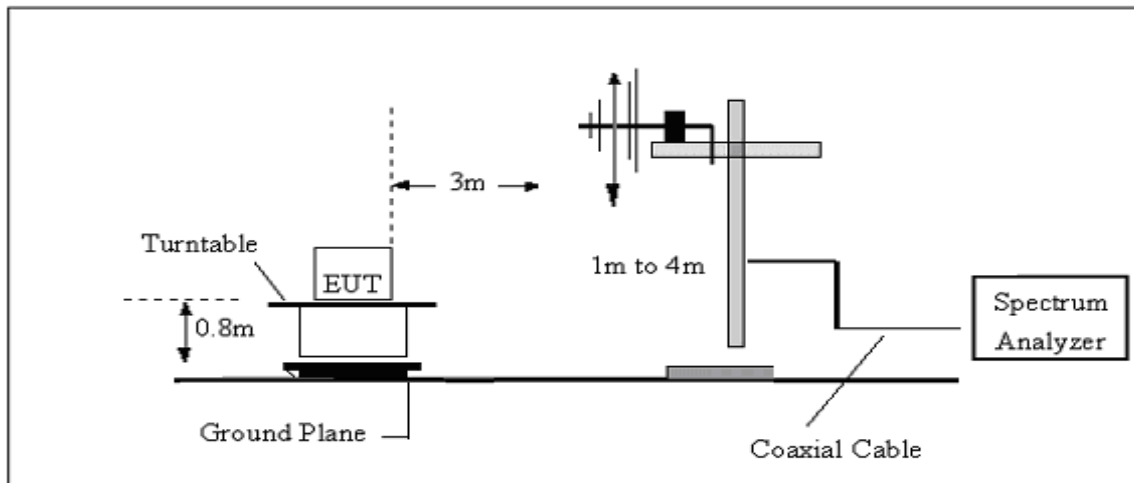


TEST SETUP

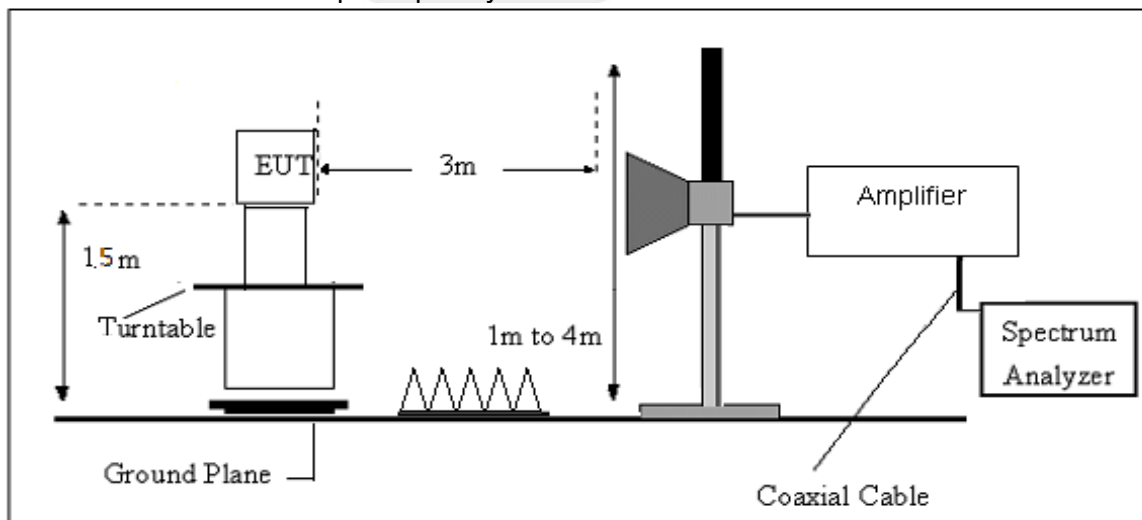
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



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:

Margin=PL-PK L or AL- AV L; Margin only shown the worst case.

Where

PR = Peak Reading

AR = Average Reading

PL = Peak Level

AL = Average Level

AF = Antenna Factor

PK L = Peak Limit

AV L = AV Limit

For example

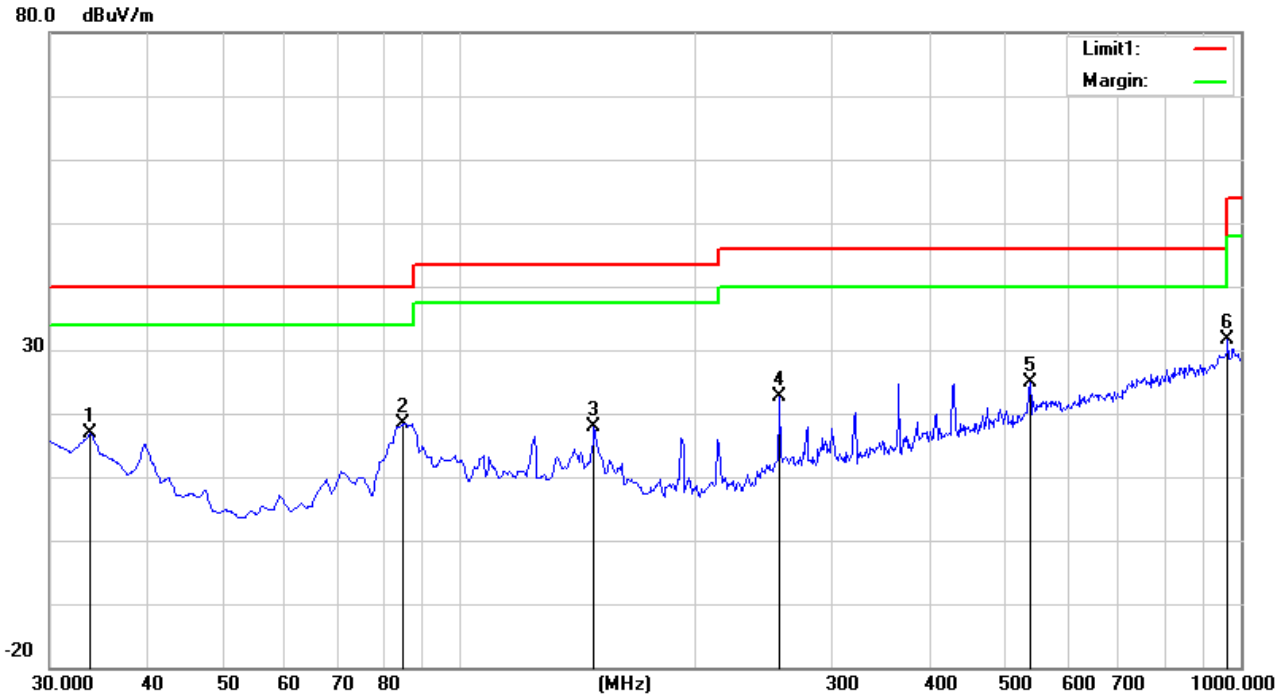
Frequency	PR	AR	AF	PL	AL	PK L	AV L	Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB μ V/m)	(dB)
2178	40.23	30.31	9.83	50.06	40.14	74.00	54.00	-13.86

Factor=AF+CL-AG



TEST RESULTS(30MHz – 1GHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	TX Mode		

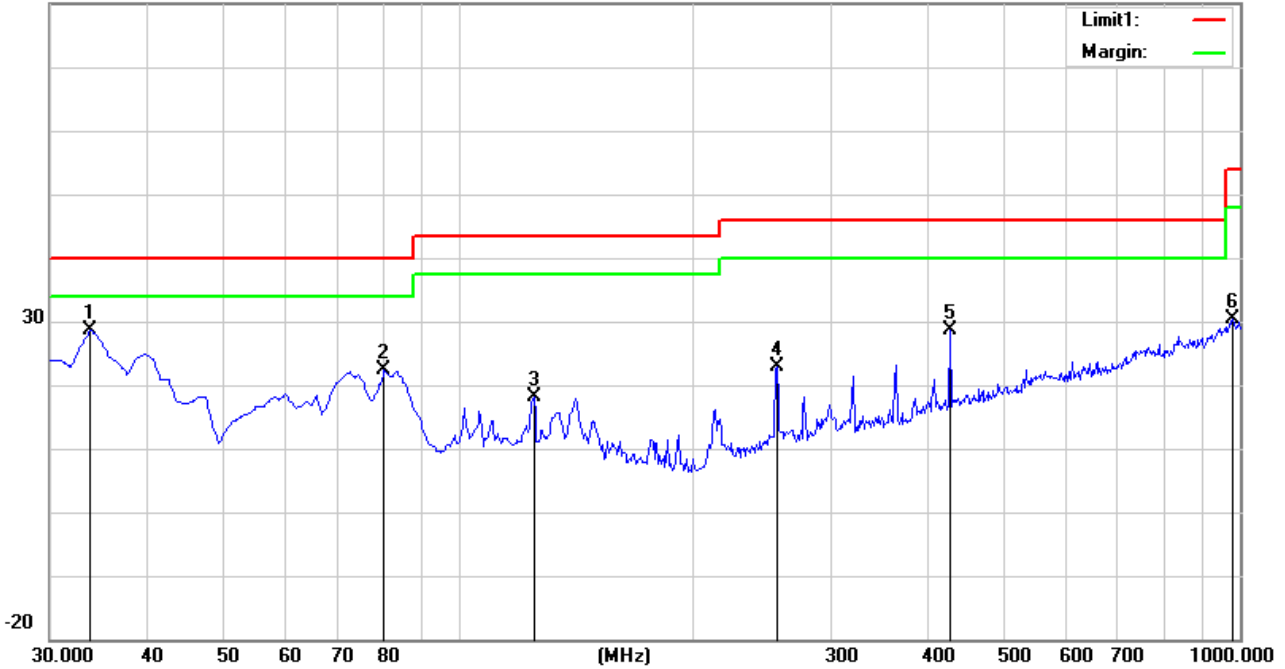


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.8800	31.62	-14.80	16.82	40.00	-23.18	QP
2	85.2900	40.61	-22.13	18.48	40.00	-21.52	QP
3	149.3100	36.27	-18.49	17.78	43.50	-25.72	QP
4	257.9500	37.61	-15.02	22.59	46.00	-23.41	QP
5	538.2800	31.73	-6.96	24.77	46.00	-21.23	QP
6	965.0800	29.73	1.89	31.62	54.00	-22.38	QP



Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	TX Mode		

80.0 dBuV/m



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.8800	43.45	-14.80	28.65	40.00	-11.35	QP
2	80.4400	45.27	-22.93	22.34	40.00	-17.66	QP
3	125.0600	36.24	-18.22	18.02	43.50	-25.48	QP
4	256.0100	38.05	-15.24	22.81	46.00	-23.19	QP
5	427.7000	38.88	-10.13	28.75	46.00	-17.25	QP
6	981.5700	27.83	2.57	30.40	54.00	-23.60	QP



APENDIX B PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※ END OF THE REPORT ※※※※※

