

EMC Measurement and Test Report

For

Shenzhen Concox Information Technology Co., Ltd

4/F, Building C, Gaoxinqi Industrial Park, Liuxian 1st Road, No.67 Xin'an

Street Bao'an District, Shenzhen, China

Test Standards: Draft ETSI EN 301 489-1 V2.2.0 (2017-03)
Draft ETSI EN 301 489-19 V2.1.0 (2017-03)
Draft ETSI EN 301 489-52 V1.1.0 (2016-11)

Product Description: GPS VEHICLE TRACKER

Tested Model: X3

Report No.: STR18038161E-4

Tested Date: 2018-03-15 to 2018-04-09

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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM. Test Technology Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Manufacturer: Shenzhen Concox Information Technology Co., Ltd
Address of manufacturer: 4/F, Building C, Gaoxingqi Industrial Park, Liuxian 1st Road,
No.67 Xin'an Street Bao'an District, Shenzhen, China

General Description of EUT	
Product Name:	GPS VEHICLE TRACKER
Brand Name:	/
Model No.:	X3
Adding Model(s):	GT810
Rated Voltage:	DC Port: DC12V/24V; Battery: DC 3.7V
Battery Capacity:	450mAh
Adapter Model:	/
Software Version:	NT37_10_A1D_D23_R0_V02_WM_20180322_1004
Hardware Version:	NT37_MB_V1.2
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Technical Characteristics of EUT	
2G	
Support Networks:	GSM, GPRS
Support Bands:	GSM900, DCS1800
Frequency Range:	GSM900: Tx: 880-915MHz, Rx: 925-960MHz
	DCS1800: Tx: 1710-1785MHz, Rx: 1805-1880MHz
RF Output Power:	GSM900: 32.80dBm, GSM1800: 29.30dBm
Modulation Type:	GMSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM900: -0.5dBi, DCS1800:0dBi
GPRS Class:	Class 12
GPS	
Frequency Range:	1575.42MHz

1.2 Test Standards

The tests were performed according to following standards:

Draft ETSI EN 301 489-1 V2.2.0 (2017-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU.

Draft ETSI EN 301 489-19 V2.1.0 (2017-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation, and timing data; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU.

Draft ETSI EN 301 489-52 V1.1.0 (2016-11) Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication Mobile and portable (UE) radio and ancillary equipment; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the emission/immunity should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with the standard ETSI EN 301489-1, Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM. Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Operation Mode

The equipment under test (EUT) was configured to measure its highest possible emission/immunity level. The test modes were adapted according to the operation manual for use, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Normal working	Working in DC12V
TM2	Normal working	Working in DC24V
TM3	GPS	Receive 1575.42MHz
TM4	GSM900	TT, CT, TR, CR for EMS testing
TM5	GSM1800	TT, CT, TR, CR for EMS testing
TM6	GPRS900	TT, CT, TR, CR for EMS testing
TM7	GPRS1800	TT, CT, TR, CR for EMS testing

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
Power Cord; UL1007 22# KKSGT810-2000MM	2.0	Unshielded	Without Core
relay socket: HVF4-1C	0.1	Unshielded	Without Core
Pasted microphone: SS-17033001	2.8	Unshielded	Without Core
Audio line: 2468 24#*2 KKSGT810-29-100mm	0.1	Unshielded	Without Core
SOS switch extension line: 2468 24AWG 2000mm	2.0	Unshielded	Without Core
Input-output extension line: KKSGT06E-3P	2.0	Unshielded	Without Core

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
AUX Cable	0.5	Unshielded	Without Core

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Speaker	AngSi Technology	OontZ Angle 3ULTRA	/
Relay	Tianbo	TRV3-L-12V-S-ZF	/

1.6 Performance Criteria for EMS

➤ EN 301 489-19, The performance criteria are:

The present document, together with ETSI EN 301 489-1 [1], covers the assessment of Receive Only Mobile Earth Stations (ROMES) and GNSS receivers operating in the RNSS band (ROGNSS), as defined in annex B, and associated ancillary equipment in respect of ElectroMagnetic Compatibility (EMC).

Technical specifications related to the antenna port and emissions from the enclosure port of ROMES are not included in the present document. Such technical specifications are found in the relevant product standards for the effective use of the radio spectrum.

The present document specifies the applicable test conditions, performance assessment and performance criteria for ROMES and associated ancillary equipment. ROMESs can have several configurations, including:

- portable equipment;
- fixed equipment;
- a number of modules including a display/control interface to the user.

The performance criteria used in the present document require that the satellite communications system of which the ROMES is a part provides reliable delivery of data or messages.

In case of differences (for instance concerning special conditions, definitions, abbreviations) between the present document and ETSI EN 301 489-1 [1], the provisions of the present document take precedence.

The environmental classification and the emission and immunity requirements used in the present document are as stated in ETSI EN 301 489-1 [1], except for any special conditions included in the present document. The applicable environments referred to in ETSI EN 301 489-1 [1] where ROMES and or ROGNSS may be used should be declared by the manufacturer.

➤ **EN 301 489-52, The performance criteria are:**

According to the section 6.1 and 6.2 EN301489-52, the test data has been collected, reduced, and analyzed within this report in accordance with Immunity requires the following as specific performance criteria:

The equipment shall meet the performance criteria specified in this clause and clauses 6.1.1 to 6.1.4, as appropriate.

Portable equipment intended for use whilst powered by the main battery of a vehicle shall additionally fulfil the applicable requirements set out in ETSI EN 301 489-1 [1], clauses 7.1 and 7.2 for mobile equipment.

Portable or mobile equipment powered by the AC mains shall additionally fulfil the applicable requirements of ETSI EN 301 489-1 [1], clauses 7.1 and 7.2 for radio and ancillary equipment for fixed use.

The establishment and maintenance of a communications link, the assessment of RXQUAL, and the assessment of the audio breakthrough by monitoring the speech output signal level, are used as performance criteria to ensure that all primary functions of the transmitter and receiver are evaluated during the immunity tests. In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The maintenance of a communications link shall be assessed using an indicator which may be part of the test system or the EUT.

If an equipment is of a specialized nature, such that the performance criteria described in the following clauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

The equipment shall meet the performance criteria specified in this clause and clauses 6.2.2 and 6.2.3 as appropriate.

The maintenance of a communications link shall be assessed by using an indicator, which may be part of the test system or the equipment under test.

If an equipment is of a specialized nature, that the performance criteria described in the following clauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after testing, as required by the present document.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate. The requirements apply to all types of UTRA and E-UTRA (FDD or TDD) for the UE.

1.7 Measurement Uncertainty

Measurement uncertainty	
Parameter	Uncertainty
Uncertainty for Radiated Emission in 3m chamber	@30-200MHz $\pm 4.52\text{dB}$ @0.2-1GHz $\pm 5.56\text{dB}$ @1-6GHz $\pm 3.84\text{dB}$ @6-18GHz $\pm 3.92\text{dB}$
Uncertainty for Conducted Emission	@9-150kHz $\pm 3.74\text{dB}$ @0.15-30MHz $\pm 3.34\text{dB}$
Uncertainty for Harmonic test	3.26%
Uncertainty for Flicker test	4.76%
Uncertainty for RS test	21%, k=2
Uncertainty for CS test	29%, k=2
Uncertainty for ESD test	The immunity measurement system uncertainty is within standard requirement and is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
Uncertainty for EFT test	
Uncertainty for Surges test	
Uncertainty for Voltage Dips, Voltage Variations and Short Interruptions Test	
Uncertainty for PFMF test	

1.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2017-06-12	2018-06-11
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2018-06-07
Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11
AC LISN	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
DC LISN	Schwarz beck	NNBM8126D	279	2017-06-12	2018-06-11
8-WIRE LISN	Schwarz beck	8158	CAT3-8158-0059	2017-06-12	2018-06-11
8-WIRE LISN	Schwarz beck	8158	CAT5-8158-0117	2017-06-12	2018-06-11
Digital Power Analyzer	California Instrument	PACS-1	72831	2017-06-12	2018-06-11
Power Source	California Instrument	5001iX	25965	2017-06-12	2018-06-11
ESD Generator	LIOGCEL	ESD-203B	0170901	2017-08-15	2018-08-14
Signal Generator	Rohde & Schwarz	SMT03	100059	2017-06-12	2018-06-11
Voltage Probe	Rohde & Schwarz	URV5-Z2	100013	2017-06-12	2018-06-11
Power Amplifier	AR	150W1000	300999	2017-06-12	2018-06-11
Power Amplifier	AR	25S1G4AM1	305993	2017-06-12	2018-06-11
Transient 2000	EMC PARTNER	TRA2000	863	2017-06-12	2018-06-11
CW Simulator	EM Test	CWS 500C	0900-03	2017-06-12	2018-06-11
CDN	Luthi	L-801M2/M3	2665	2017-06-12	2018-06-11
Attenuator	EMCI	MA-5100/6BF2	1009	2017-06-12	2018-06-11
EMC PRO	KEYTEK	EMCPro	0509124	2017-06-12	2018-06-11
Coil	KEYTEK	F-1000-4-8	0533	2017-06-12	2018-06-11
Audio analyzer	Rohde & Schwarz	UPA	829743/001	2017-06-12	2018-06-11
GSM Tester	Rhode & Schwarz	CMU200	112012	2017-06-12	2018-06-11
Communication Tester	Rohde & Schwarz	CMW500	148650	2017-06-12	2018-06-11
Audio Power Amplifier	B&K	2716-C-001	/	2017-06-12	2018-06-11
Conditioning Amplifier	B&K	2690-0S2	/	2017-06-12	2018-06-11
Mouth Simulator	B&K	4227	/	2017-06-12	2018-06-11
Sound Calibrator	B&K	4231	/	2017-06-12	2018-06-11
1/2" Pressure-field Microphone	B&K	4192	/	2017-06-12	2018-06-11
Ear Simulator for Telephonometry	B&K	4185	/	2017-06-12	2018-06-11
Telephone Test Head	B&K	4206 B	/	2017-06-12	2018-06-11
Anechoic chamber	Albatross Projects	MCDC	----	2017-06-12	2018-06-11

2. SUMMARY OF TEST RESULTS

Standards	Reference	Description of Test Item	Result
Draft ETSI EN 301 489-1	8.2	Radiated Emissions	Pass
	8.3	Conducted Emissions for DC Power Port	Pass
	8.4	Conducted Emissions for AC Power Port	N/A
	8.5	Harmonic Current Emissions	N/A
	8.6	Voltage Fluctuations and Flicker	N/A
	8.7	Telecommunication Ports	N/A
	9.2	Radio Frequency Electromagnetic Field	Pass
	9.3	Electrostatic Discharge	N/A
	9.4	Fast Transients, Common Mode	N/A
	9.5	Radio Frequency, Common Mode	Pass
	9.6	Transient and Surges in the Vehicular Environment	Pass
	9.7	Voltage Dips and Interruptions	N/A
	9.8	Surges	N/A
Pass: The EUT complies with the essential requirements in the standard Fail: The EUT does not comply with the essential requirements in the standard N/A: not applicable			

3. Conducted Emissions

3.1 Measurement Uncertainty

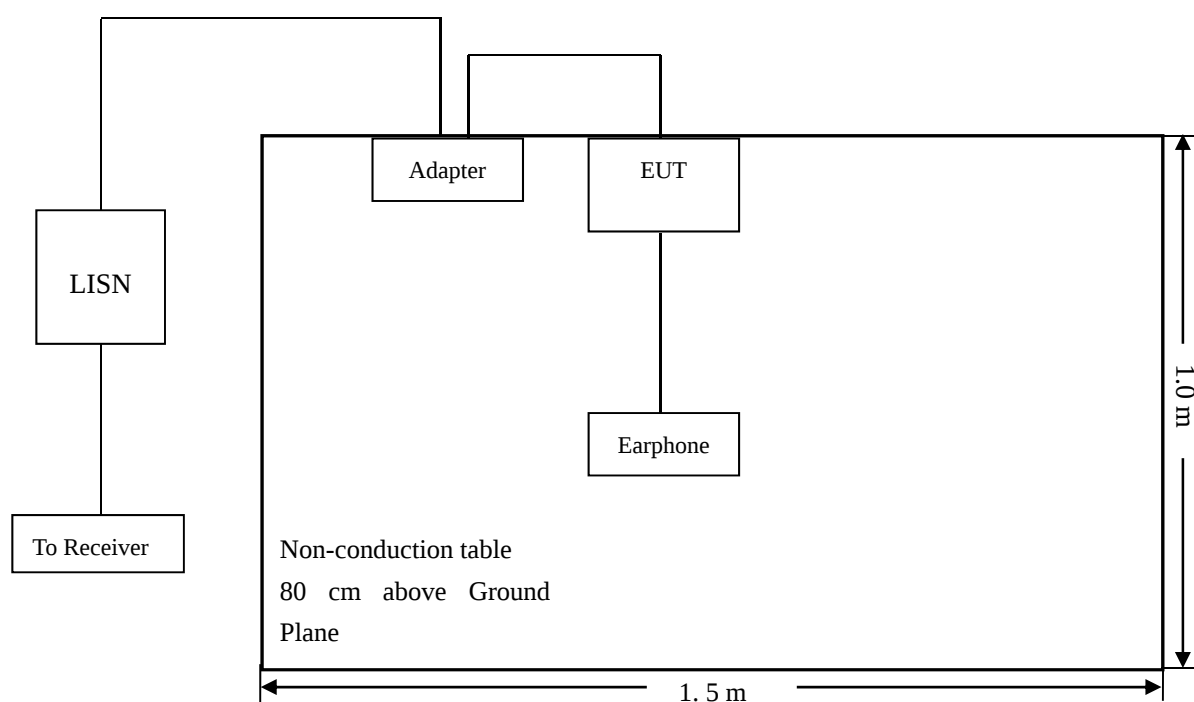
Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is

Parameter	Uncertainty
Uncertainty for Conducted Emission	@9-150kHz $\pm 3.74\text{dB}$ @0.15-30MHz $\pm 3.34\text{dB}$

3.2 Test Procedure

Test is conducting under the description of EN55032 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

3.3 Basic Test Setup Block Diagram



3.4 Environmental Conditions

Temperature:	22 ° C
Relative Humidity:	55 %
ATM Pressure:	1015 mbar

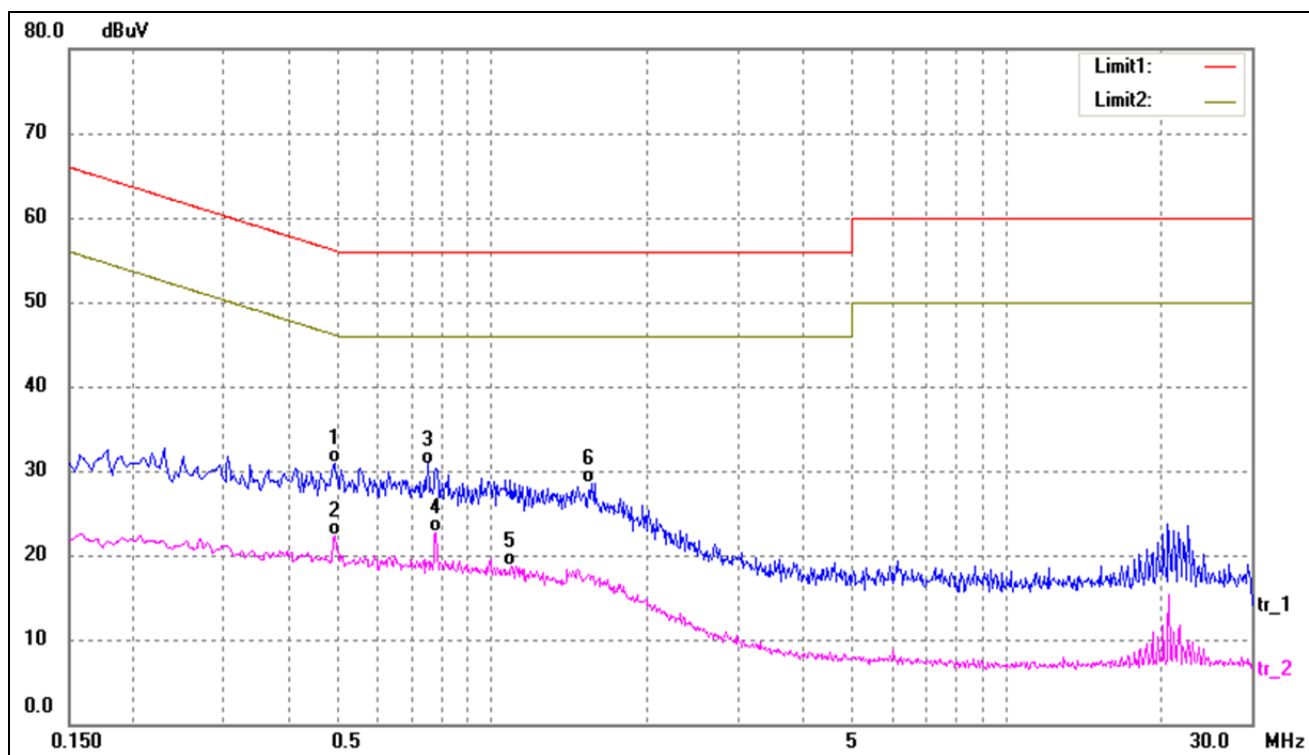
3.5 Summary of Test Results/Plots

According to the data in section 3.7, the EUT complied with the EN 301489 Conducted margin for a Class B device, with the *worst* margin reading of:

-22.49 dB at 0.4940 MHz in the Line I Mode, TM1 mode, AVG detector, 0.15-30MHz

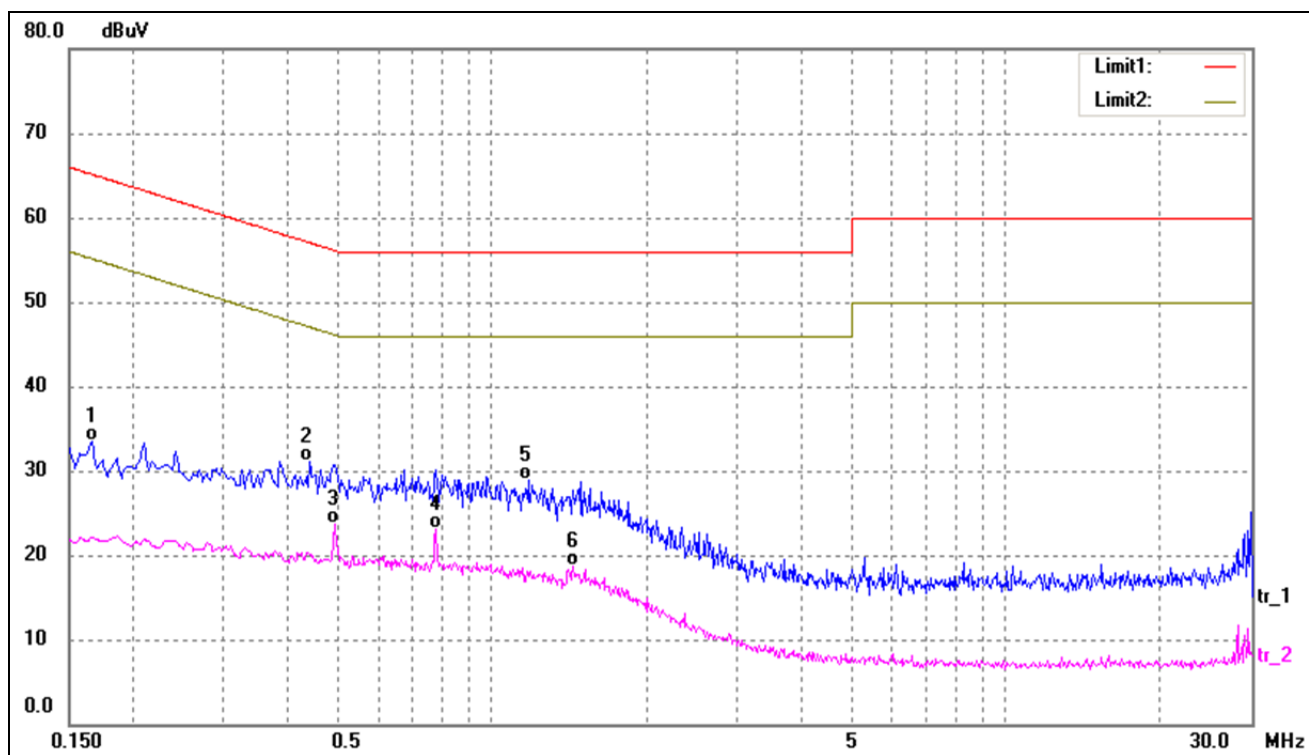
3.6 Conducted Emissions Test Data

Test mode:	TM1	Polarity:	Neutral
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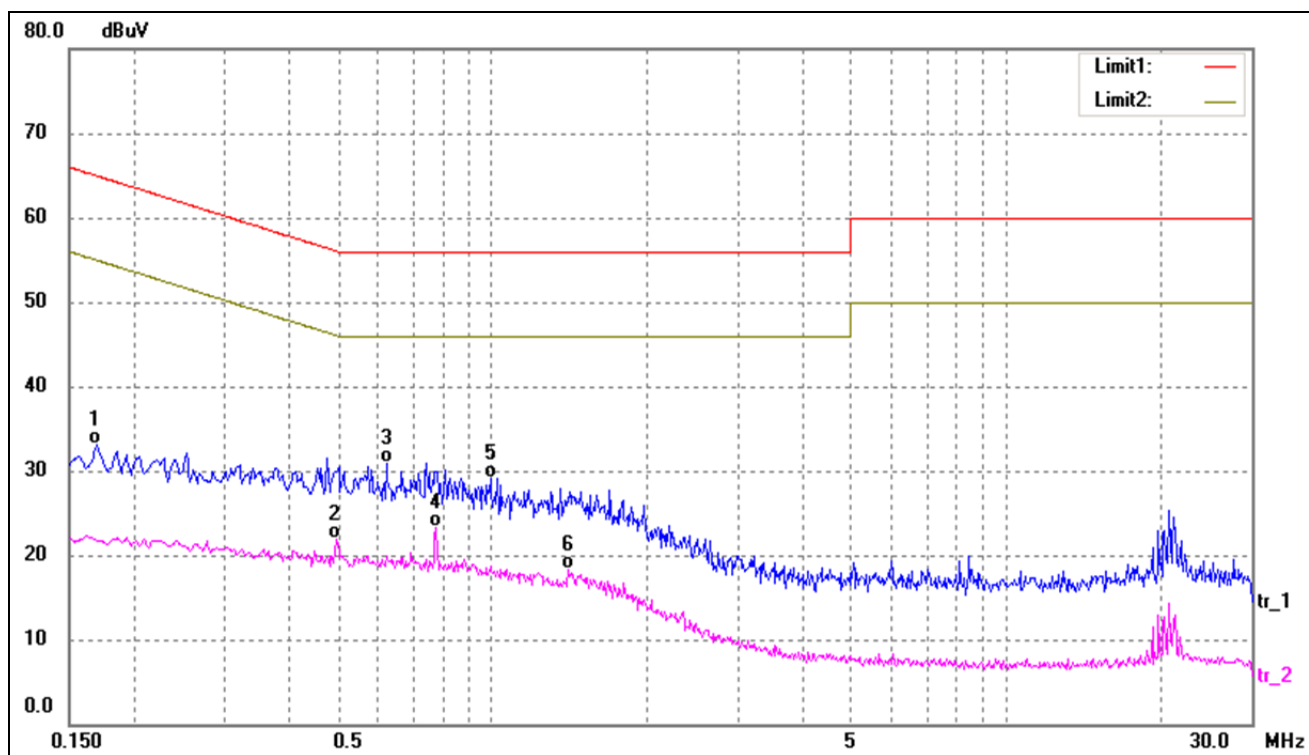
No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.4940	21.13	9.80	30.93	56.10	-25.17	QP
2	0.4940	12.54	9.80	22.34	46.10	-23.76	AVG
3	0.7500	21.02	9.78	30.80	56.00	-25.20	QP
4*	0.7780	12.94	9.78	22.72	46.00	-23.28	AVG
5	1.0900	8.94	9.76	18.70	46.00	-27.30	AVG
6	1.5620	18.73	9.75	28.48	56.00	-27.52	QP

Test mode:	TM1	Polarity:	Line
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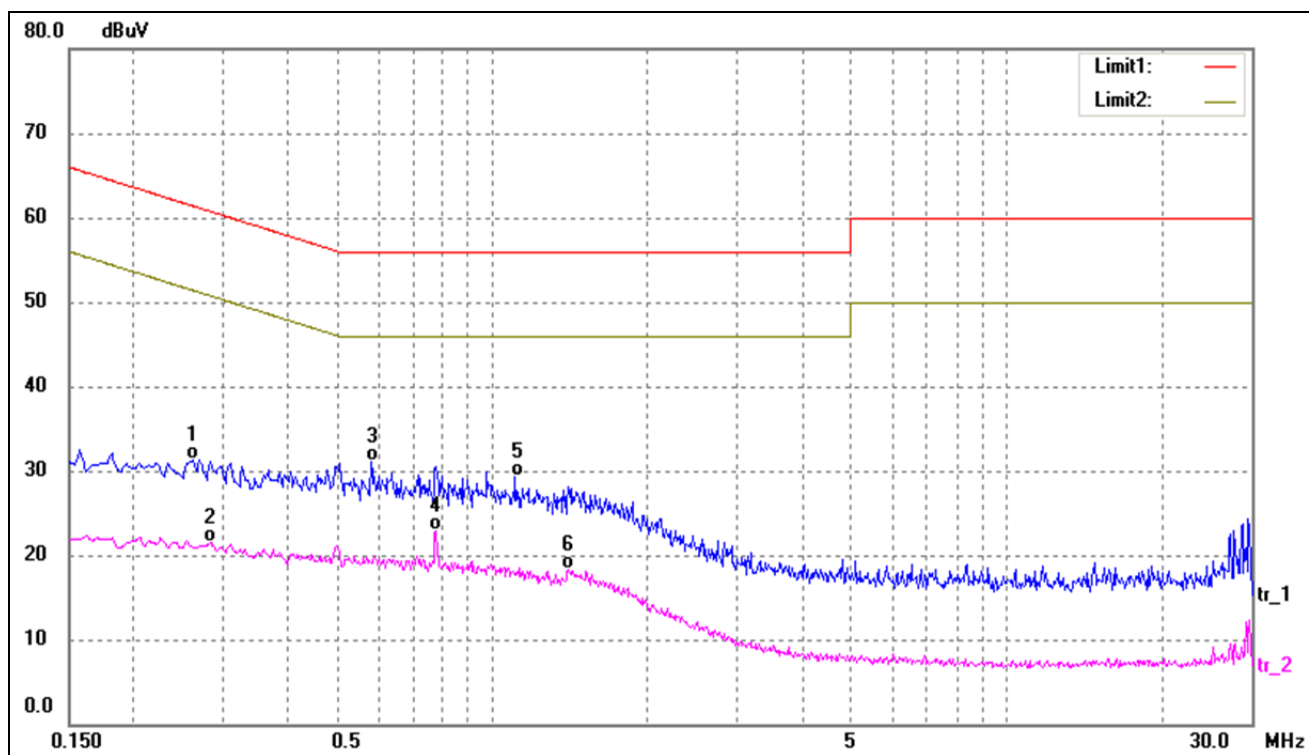
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1660	23.62	9.83	33.45	65.16	-31.71	QP
2	0.4420	21.22	9.80	31.02	57.02	-26.00	QP
3*	0.4940	13.81	9.80	23.61	46.10	-22.49	AVG
4	0.7780	13.37	9.78	23.15	46.00	-22.85	AVG
5	1.1740	19.16	9.76	28.92	56.00	-27.08	QP
6	1.4340	8.94	9.75	18.69	46.00	-27.31	AVG

Test mode:	TM2	Polarity:	NEG
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1700	23.18	9.83	33.01	64.96	-31.95	QP
2	0.4980	12.03	9.80	21.83	46.03	-24.20	AVG
3	0.6220	21.03	9.79	30.82	56.00	-25.18	QP
4*	0.7780	13.46	9.78	23.24	46.00	-22.76	AVG
5	0.9940	19.33	9.76	29.09	56.00	-26.91	QP
6	1.4060	8.50	9.75	18.25	46.00	-27.75	AVG

Test mode:	TM2	Polarity:	POS
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No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.2620	21.47	9.80	31.27	61.37	-30.10	QP
2	0.2820	11.77	9.80	21.57	50.76	-29.19	AVG
3	0.5820	21.24	9.79	31.03	56.00	-24.97	QP
4*	0.7780	13.21	9.78	22.99	46.00	-23.01	AVG
5	1.1100	19.47	9.76	29.23	56.00	-26.77	QP
6	1.4060	8.58	9.75	18.33	46.00	-27.67	AVG

4. Radiated Emissions

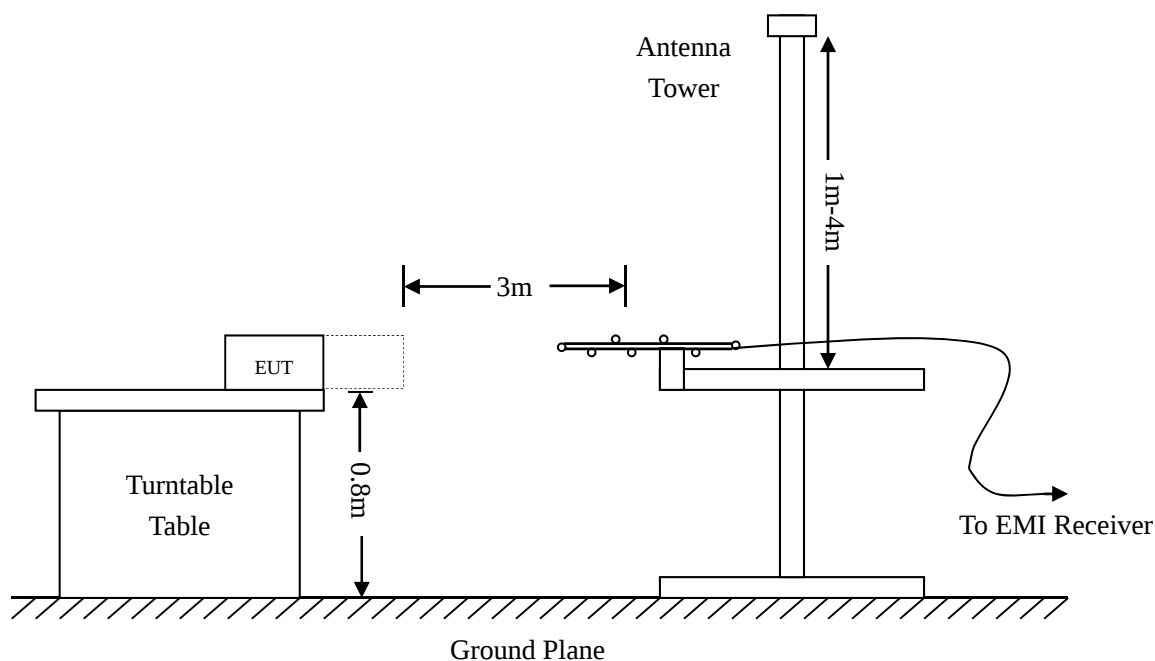
4.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any radiation emissions measurement is

Parameter	Uncertainty
Uncertainty for Radiated Emission in 3m chamber	@30-200MHz $\pm 4.52\text{dB}$ @0.2-1GHz $\pm 5.56\text{dB}$ @1-6GHz $\pm 3.84\text{dB}$ @6-18GHz $\pm 3.92\text{dB}$

4.2 Test Procedure

Test is conducting under the description of EN55032 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.



4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B device. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{EN 301489 Class B Limit}$$

4.4 Environmental Conditions

Temperature:	23° C
Relative Humidity:	53%
ATM Pressure:	1011 mbar

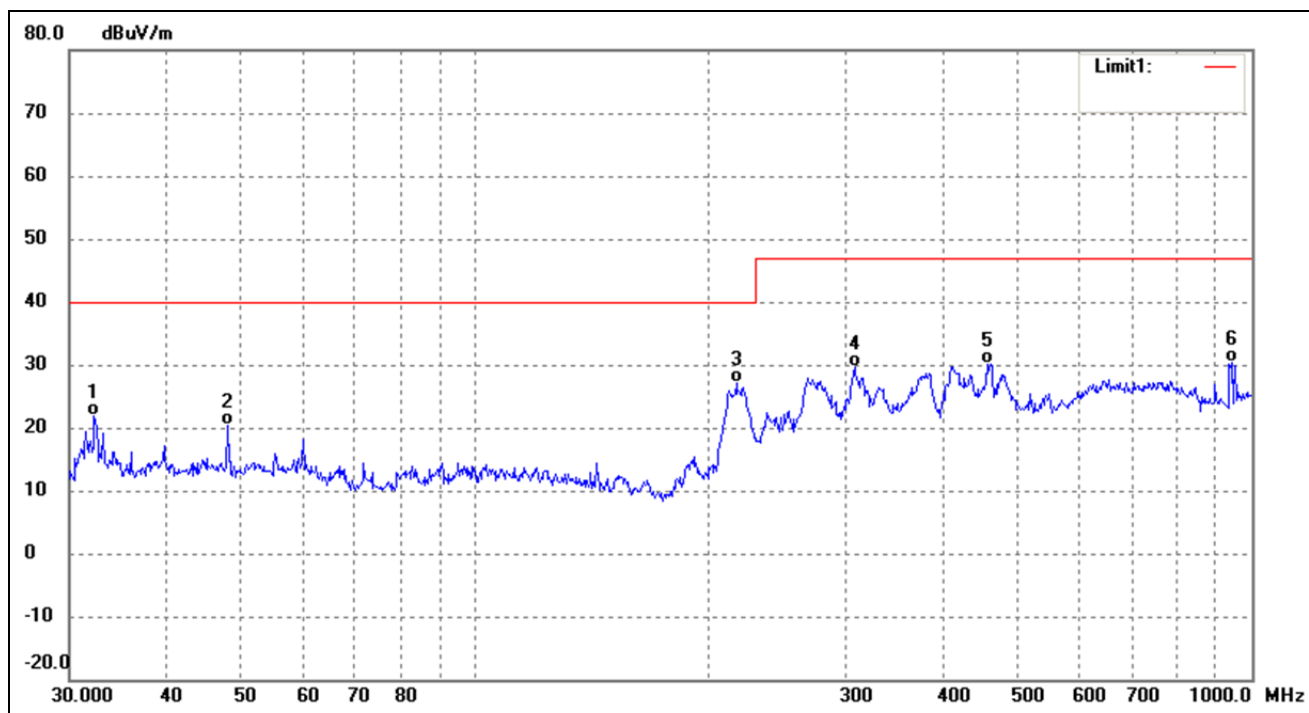
4.5 Summary of Test Results/Plots

According to the data in section 4.6, the EUT complied with the EN 301489 Class B standards, and had the worst margin is:

-11.88 dB at 416.1791 MHz in the Horizontal polarization, TM2 Mode, 30 MHz to 6 GHz, 3Meters

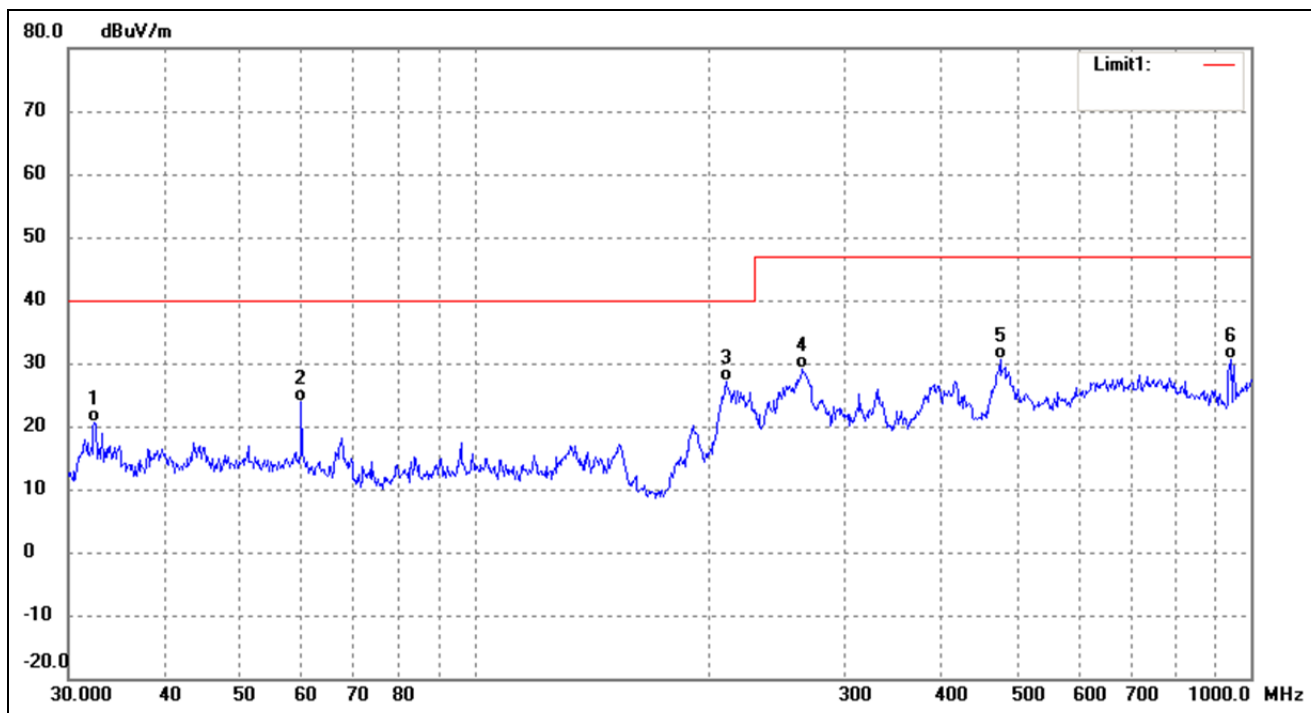
➤ 30MHz to 1GHz

Test mode:	TM1	Polarity:	Horizontal
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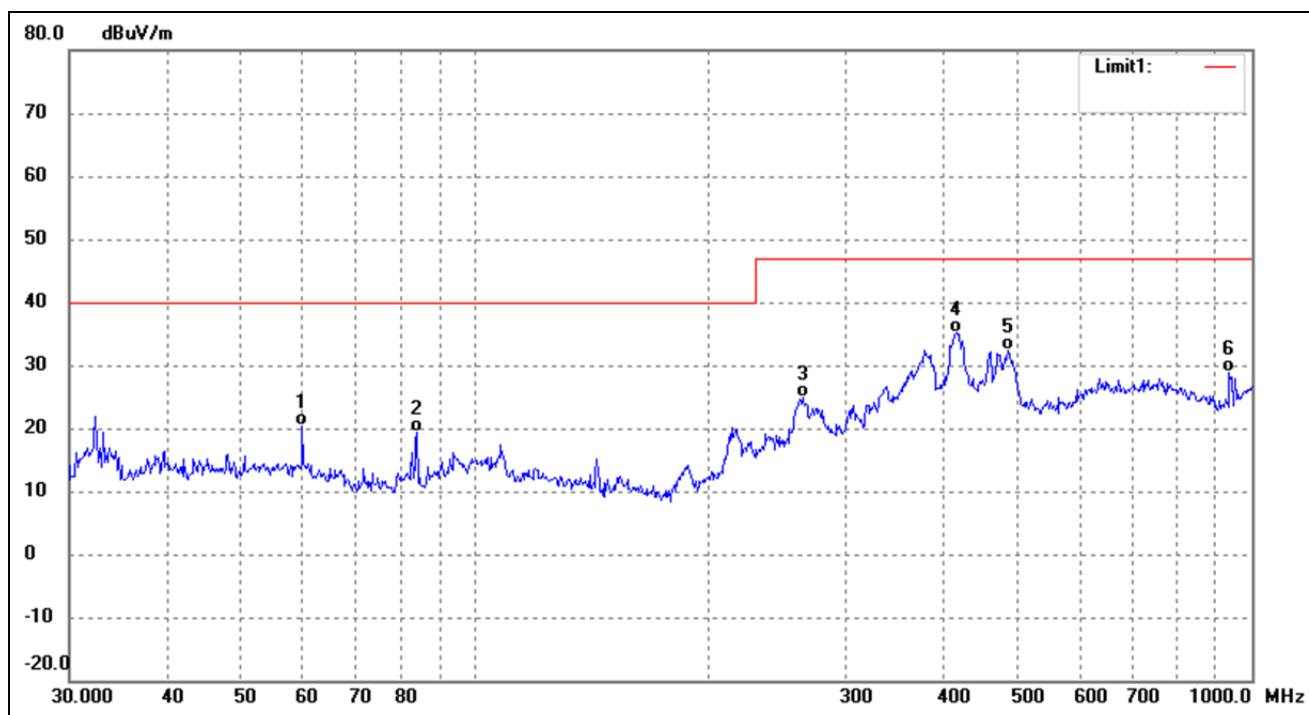
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	32.2925	39.75	-17.79	21.96	40.00	-18.04	290	100	QP
2	47.9940	36.86	-16.53	20.33	40.00	-19.67	91	100	QP
3	216.7828	41.57	-14.54	27.03	40.00	-12.97	335	100	QP
4	307.8313	39.17	-9.50	29.67	47.00	-17.33	107	100	QP
5	455.9058	36.92	-6.85	30.07	47.00	-16.93	86	100	QP
6	942.1305	34.16	-3.73	30.43	47.00	-16.57	290	100	QP

Test mode:	TM1	Polarity:	Vertical
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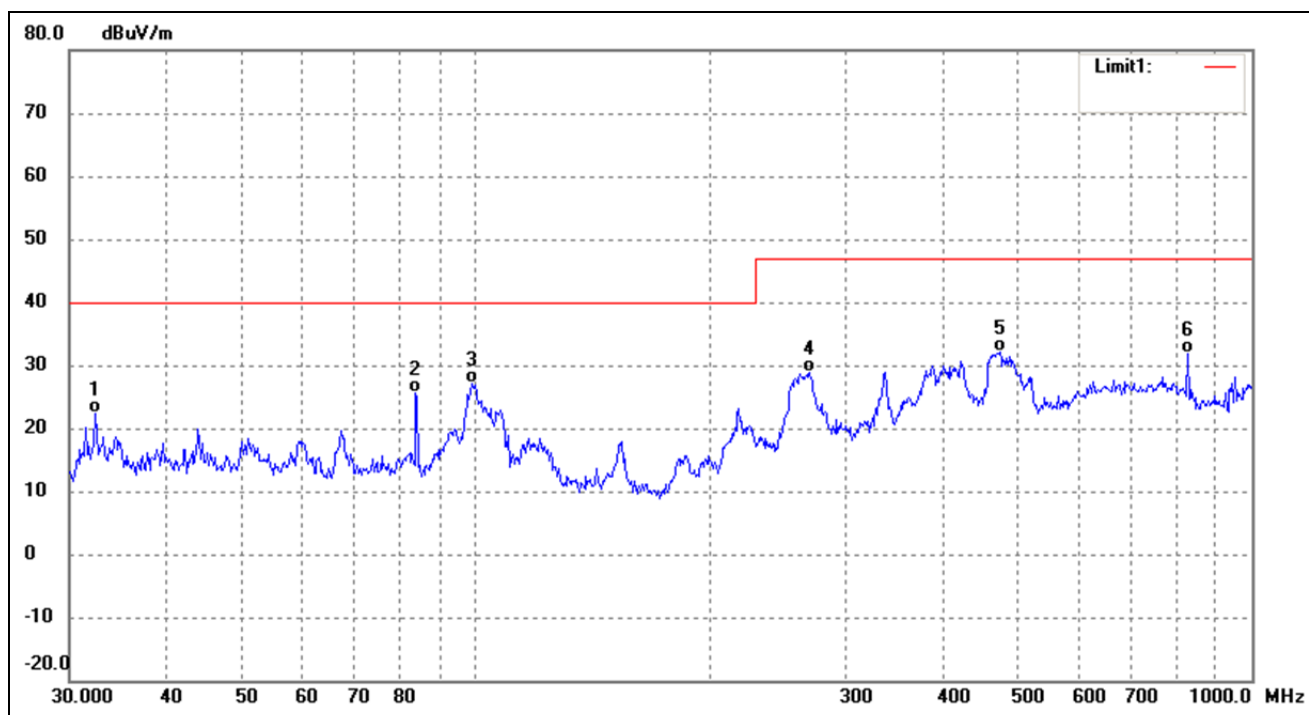
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	32.4059	38.43	-17.77	20.66	40.00	-19.34	290	100	QP
2	59.8588	40.47	-16.51	23.96	40.00	-16.04	94	100	QP
3	210.7860	42.91	-15.85	27.06	40.00	-12.94	55	100	QP
4	264.7457	40.61	-11.44	29.17	47.00	-17.83	113	100	QP
5	475.4991	37.51	-6.83	30.68	47.00	-16.32	171	100	QP
6	942.1305	34.45	-3.73	30.72	47.00	-16.28	327	100	QP

Test mode:	TM2	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	59.8588	36.95	-16.51	20.44	40.00	-19.56	176	100	QP
2	84.1100	38.57	-19.11	19.46	40.00	-20.54	327	100	QP
3	263.8190	36.48	-11.51	24.97	47.00	-22.03	70	100	QP
4	416.1791	43.36	-8.24	35.12	47.00	-11.88	195	100	QP
5	485.6093	39.03	-6.58	32.45	47.00	-14.55	148	100	QP
6	935.5463	32.82	-3.89	28.93	47.00	-18.07	176	100	QP

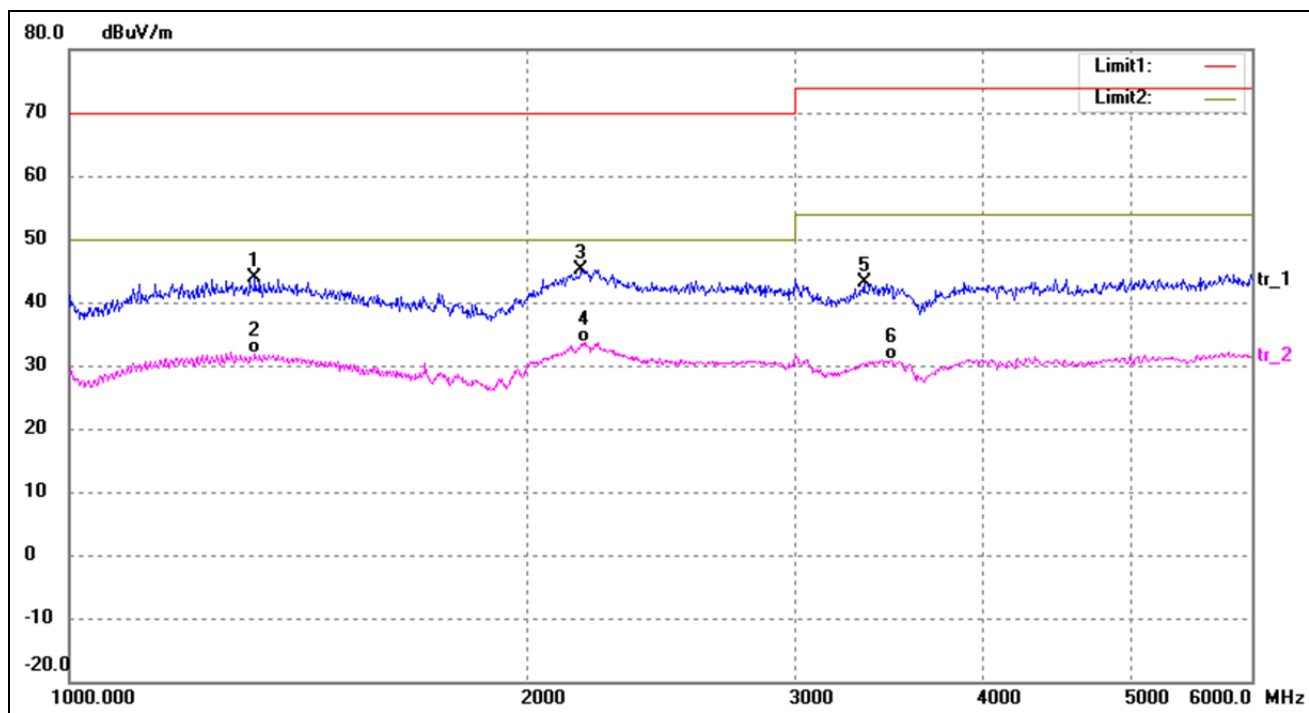
Test mode:	TM2	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	32.4059	40.10	-17.77	22.33	40.00	-17.67	80	100	QP
2	83.8156	44.84	-19.16	25.68	40.00	-14.32	183	100	QP
3	98.8326	43.78	-16.73	27.05	40.00	-12.95	64	100	QP
4	269.4284	39.93	-11.12	28.81	47.00	-18.19	145	100	QP
5	473.8347	38.95	-6.82	32.13	47.00	-14.87	327	100	QP
6	827.4934	34.48	-2.67	31.81	47.00	-15.19	80	100	QP

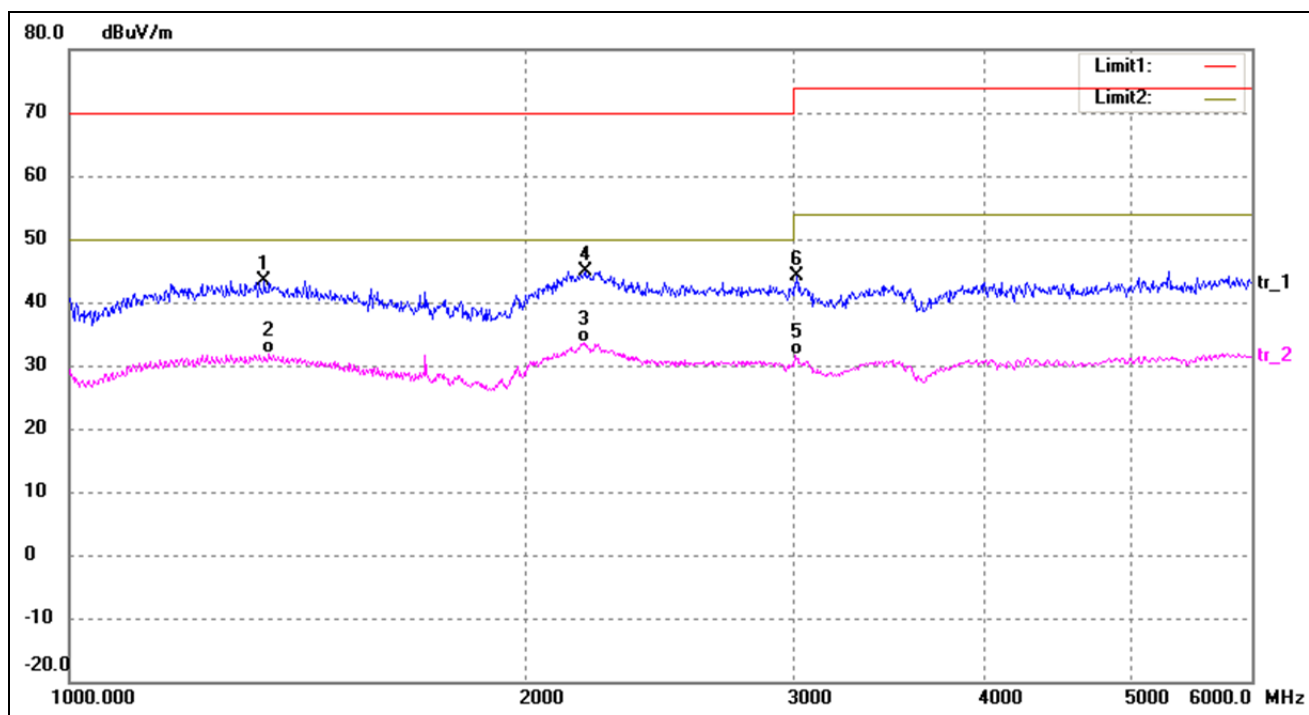
➤ Above 1GHz

Test mode:	TM2(worst case)	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	1324.859	52.20	-8.39	43.81	70.00	-26.19	292	100	peak
2	1324.859	40.26	-8.39	31.87	50.00	-18.13	99	100	AVG
3	2172.398	50.45	-5.22	45.23	70.00	-24.77	321	100	peak
4	2180.197	38.78	-5.12	33.66	50.00	-16.34	107	100	AVG
5	3333.632	52.10	-8.87	43.23	74.00	-30.77	346	100	peak
6	3473.883	39.45	-8.63	30.82	54.00	-23.18	210	100	AVG

Test mode:	TM2(worst case)	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	1343.987	51.82	-8.35	43.47	70.00	-26.53	118	100	peak
2	1353.654	40.18	-8.33	31.85	50.00	-18.15	318	100	AVG
3	2180.197	38.71	-5.12	33.59	50.00	-16.41	82	100	AVG
4	2184.107	49.97	-5.08	44.89	70.00	-25.11	335	100	peak
5	3004.588	38.99	-7.36	31.63	54.00	-22.37	297	100	AVG
6	3009.976	51.57	-7.40	44.17	74.00	-29.83	312	100	peak

5. Radio Frequency Electromagnetic Field (R/S)

5.1 Test Procedure

Test is conducting under the description of IEC61000-4-3.

5.2 Test Performance

Performance Criterion: Pass for GSM, GPRS_CT, CR

A for GPS_CR

A for Normal working

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1010 mbar

5.3 Continuous Radiated Disturbances Test Data

Frequency step: 1% of fundamental

Dwell time: 1 second

Modulation: AM by 1kHz sine wave with 80% modulation depth

Test model: GSM900_CT, CR

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
1000-3000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
3000-6000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Test model: GSM1800_CT, CR

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
1000-3000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
3000-6000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Test model: GPRS900_CT, CR

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
1000-3000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
3000-6000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Test model: GPRS1800_CT, CR

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
1000-3000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
3000-6000	3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Test model: GPS_CR

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	A	A	A	A	A	A	A	A
1000-3000	3	A	A	A	A	A	A	A	A
3000-6000	3	A	A	A	A	A	A	A	A

Test model: Normal working (Working in DC12V)

Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	A	A	A	A	A	A	A	A
1000-3000	3	A	A	A	A	A	A	A	A
3000-6000	3	A	A	A	A	A	A	A	A

Test model: Normal working (Working in DC24V)

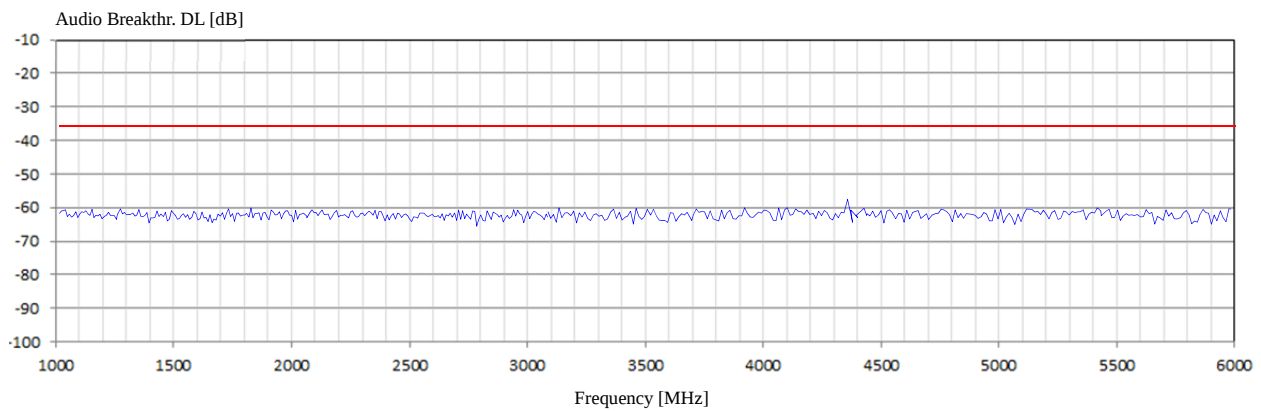
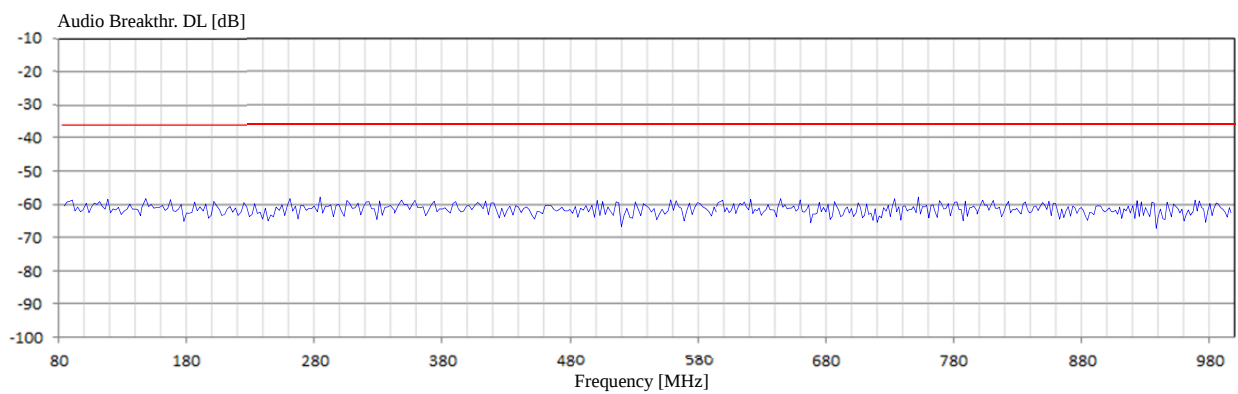
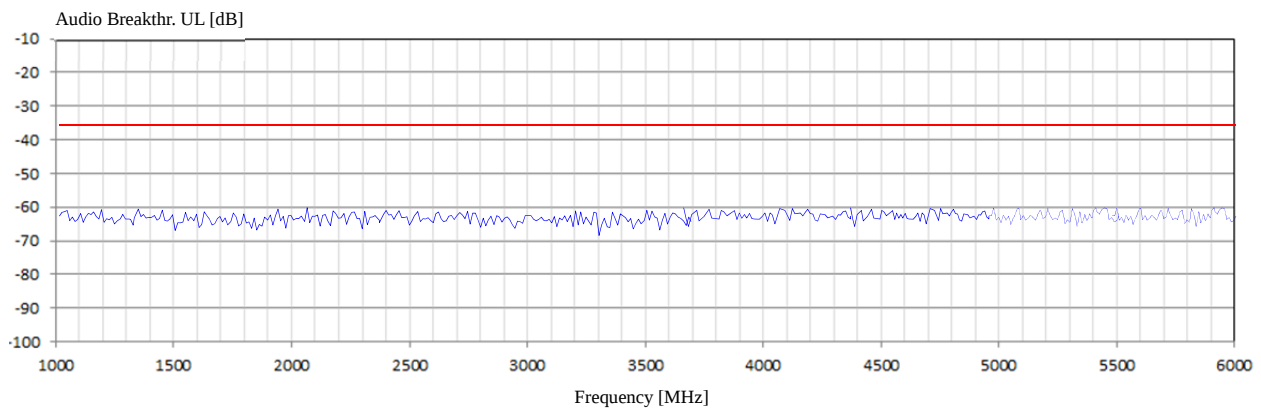
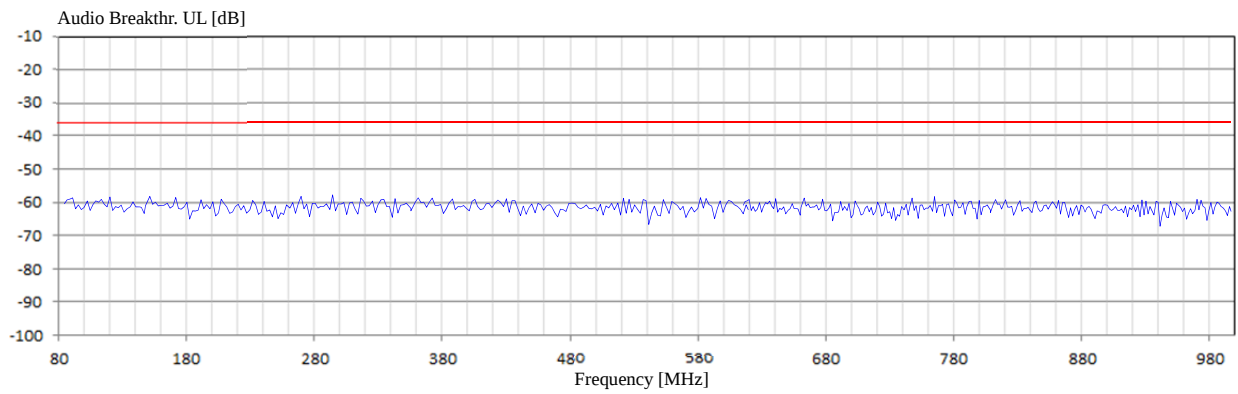
Frequency Range(MHz)	Field (V/m)	Front		Rear		Left Side		Right Side	
		VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	3	A	A	A	A	A	A	A	A
1000-3000	3	A	A	A	A	A	A	A	A
3000-6000	3	A	A	A	A	A	A	A	A

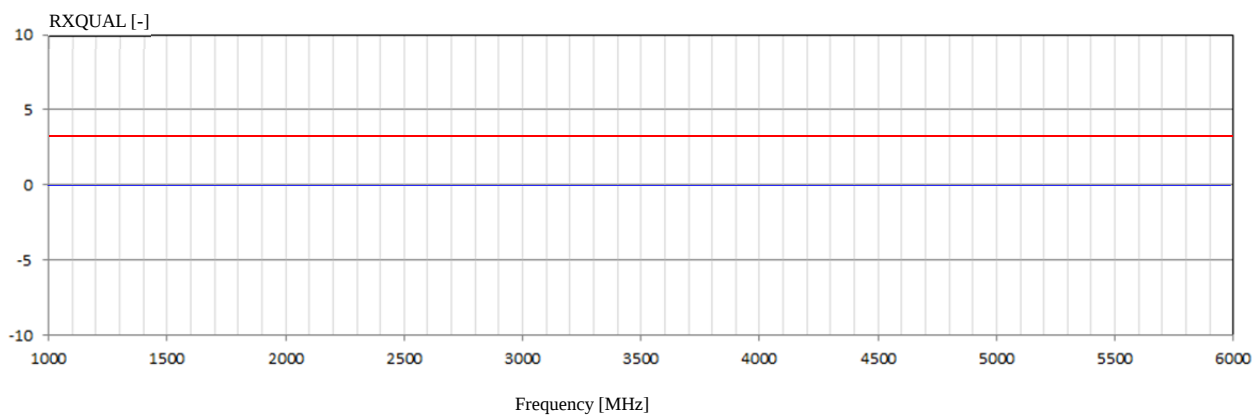
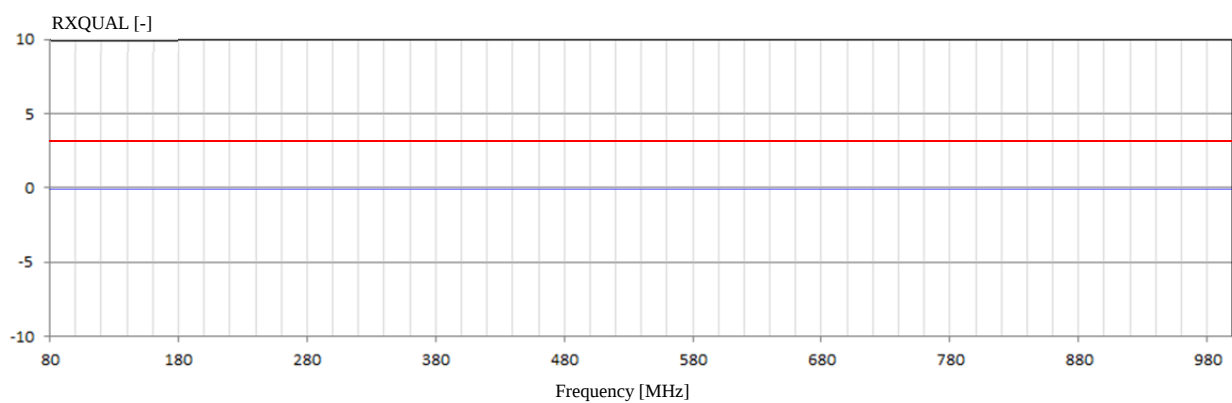
For 2G

Band	BER	BER Limit
GSM900	0.00036	<0.001
GSM1800	0.00047	<0.001

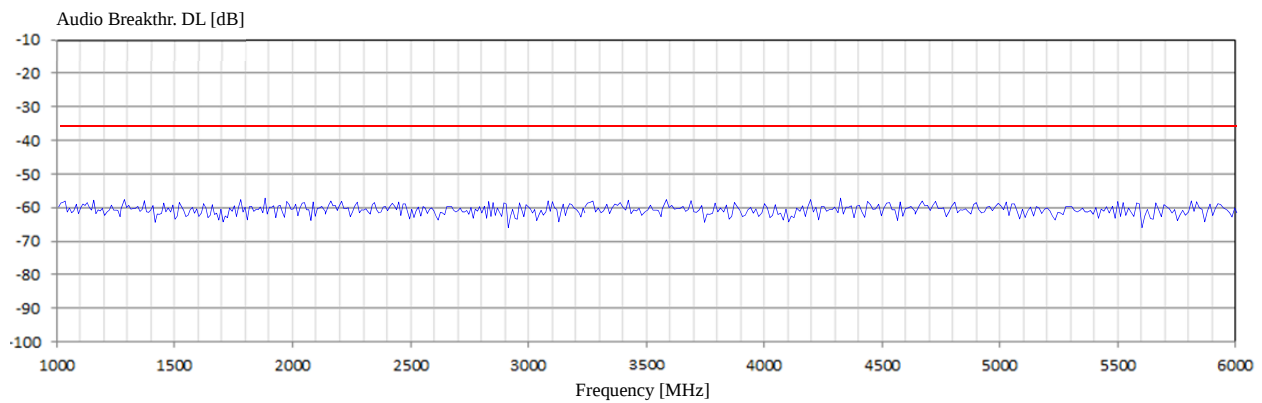
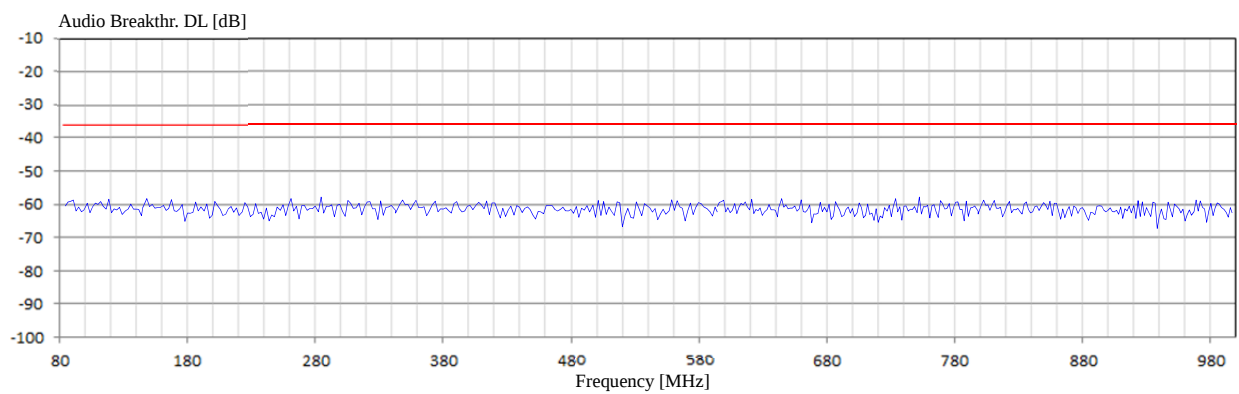
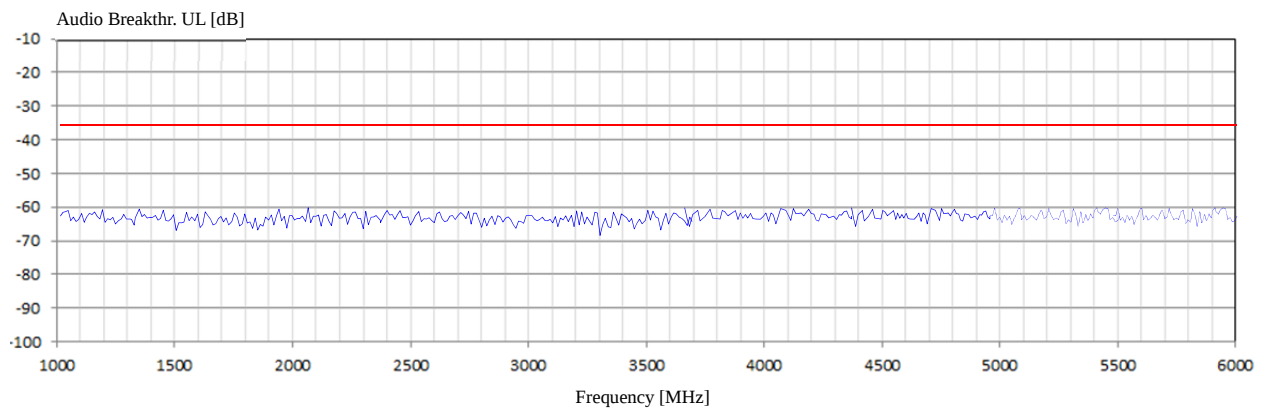
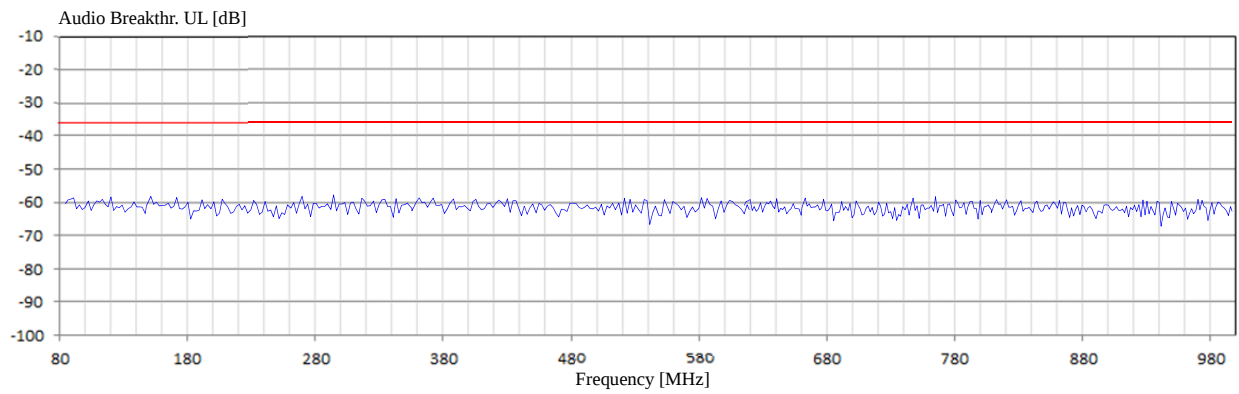
Test Result: Pass

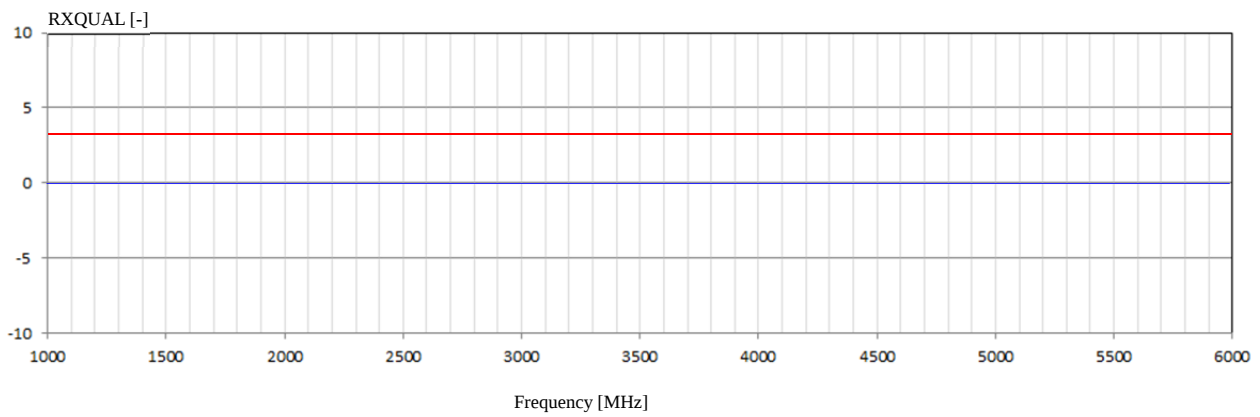
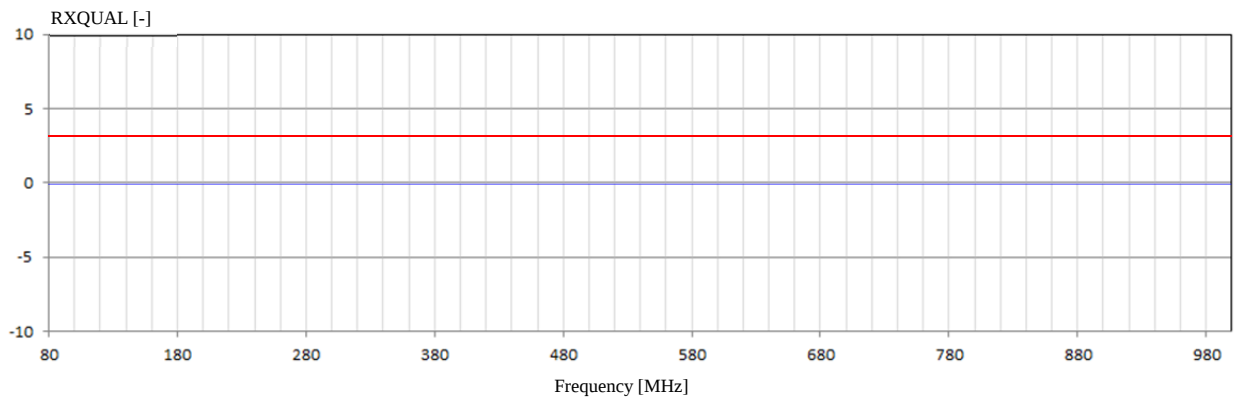
GSM900





DCS1800





Idle mode cannot get any unintentionally operation.

Test Result: Pass

6. Radio Frequency, Common Mode (C/S)

6.1 Test Procedure

Test is conducting under the description of IEC 61000-4-6.

6.2 Test Performance

Performance Criterion: Pass for GSM, GPRS_CT, CR

A for GPS_CR

A for Normal working

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1011 mbar

6.3 Continuous Conducted Disturbances Test Data

Sweep frequency range: 150kHz~80MHz

Frequency step: 1% of fundamental

Dwell time: 1 second

Test mode: GSM900_CT, CR

Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	Pass	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test mode: GSM1800_CT, CR

Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	Pass	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test mode: GPRS900_CT, CR

Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	Pass	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test mode: GPRS1800_CT, CR

Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	Pass	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test mode: GPS_CR

Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test model: Normal working (Working in DC12V)

Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

Test model: Normal working (Working in DC24V)

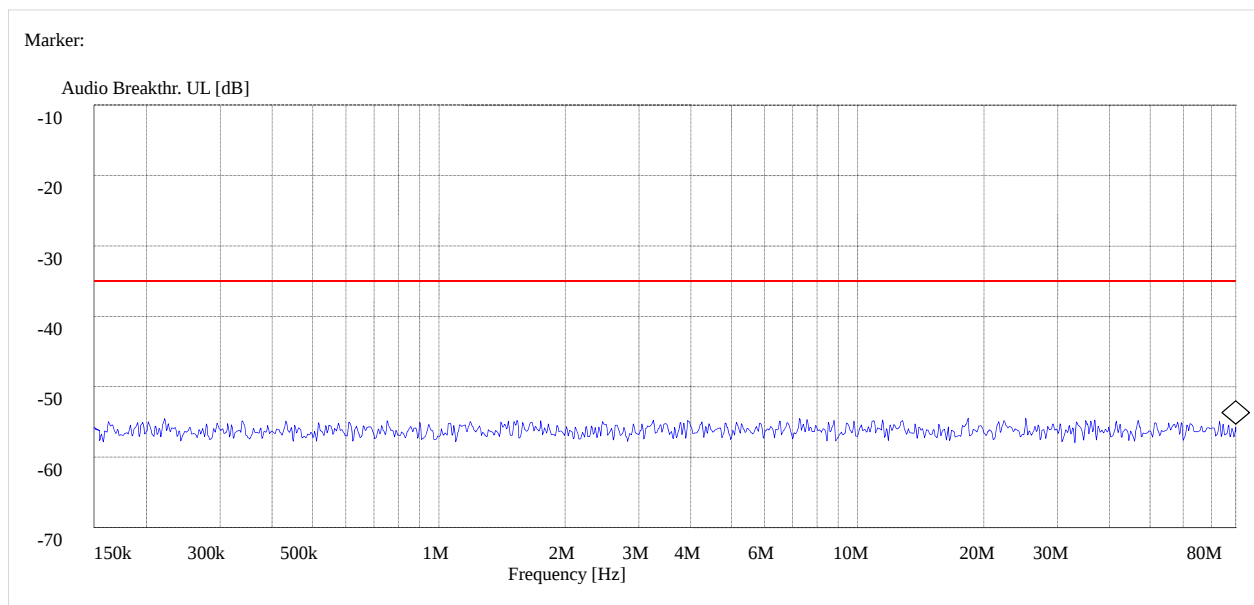
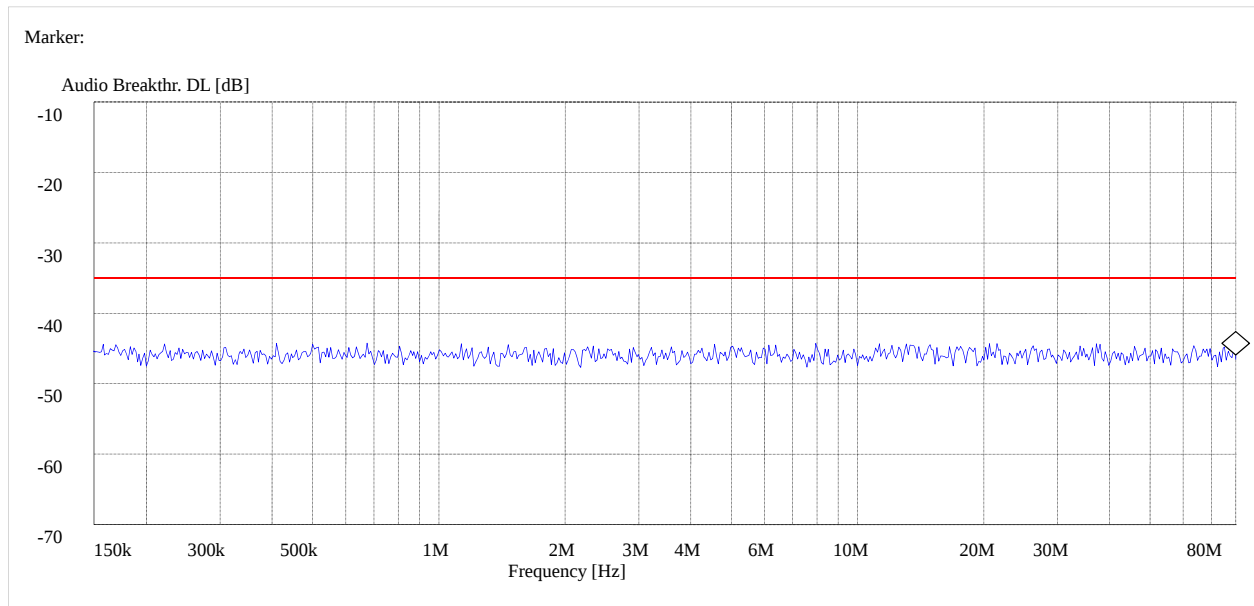
Level	Voltage (V) (rms, unmodulated)	Modulation:	Pass	Fail
1	1	AM 80%, 1kHz sinewave	/	/
2	3	AM 80%, 1kHz sinewave	A	/
3	10	AM 80%, 1kHz sinewave	/	/
X	Special	/	/	/

For 2G

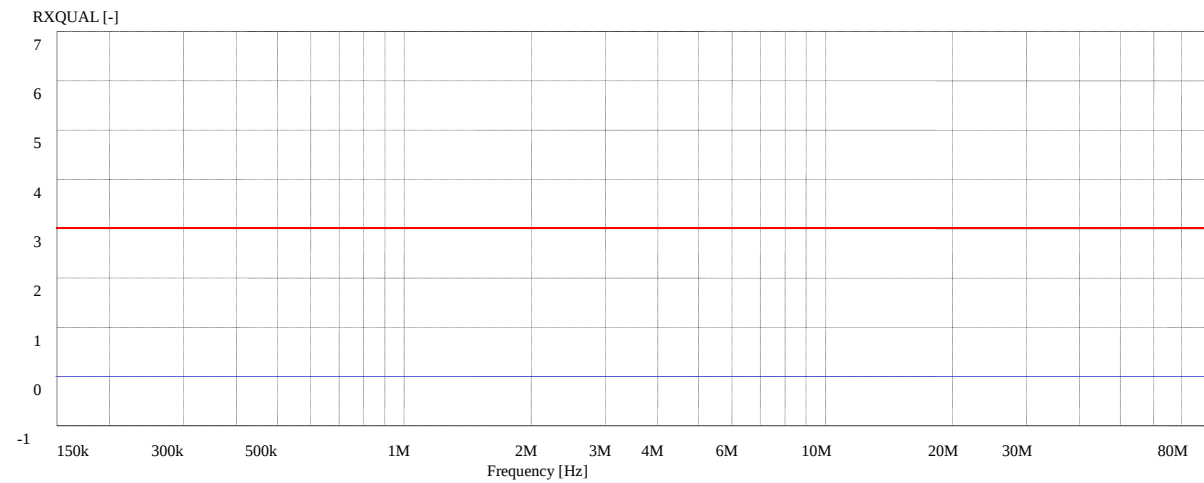
Band	BER	BER Limit
GSM900	0.00024	<0.001
GSM1800	0.00037	<0.001

Test Result: Pass

GSM900 Mode:

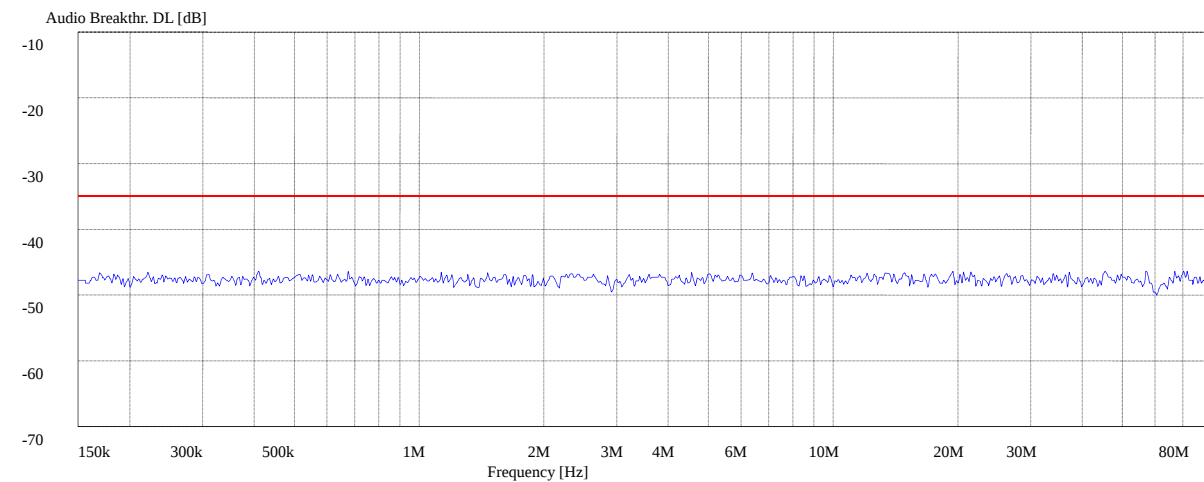


Marker:

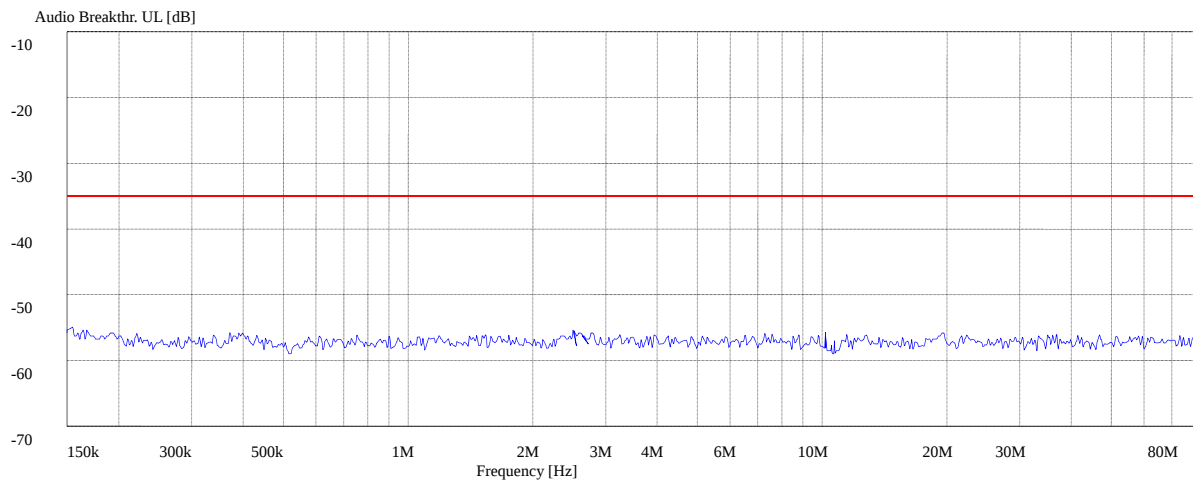


DCS1800:

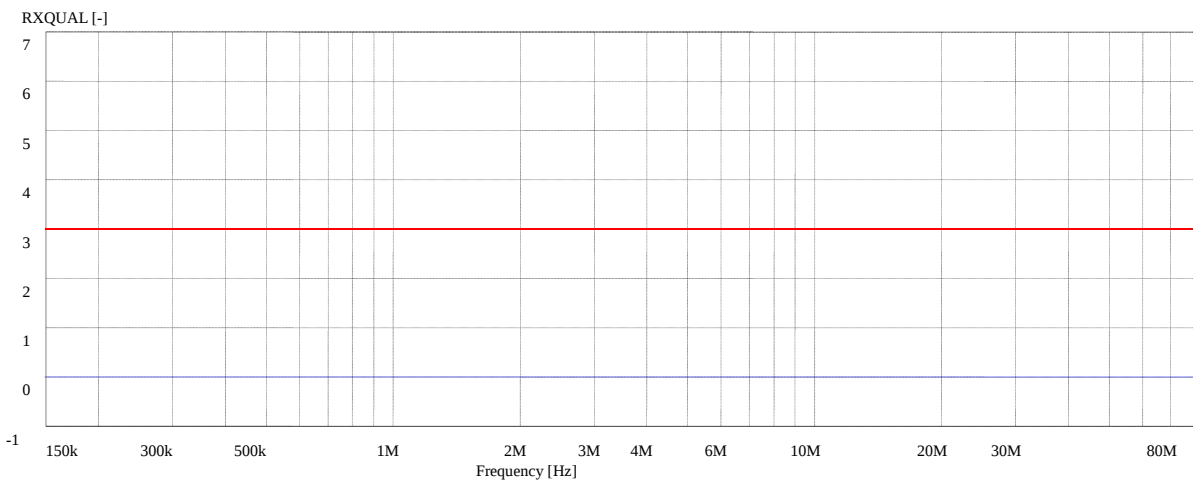
Marker:



Marker:



Marker:



Idle mode cannot get any unintentionally operation.

Test Result: Pass

7. Transients and Surges in the Vehicle Environment

7.1 Test Equipment

Item	Model	Manufacturer	Description	Cal. Date	Due. Date
1	EFT 200	EM TEST	ISO 7637 test system	2017-05-28	2018-05-27
2	MPG 200	EM TEST	ISO 7637 test system	2017-05-28	2018-05-27
3	LD 200	EM TEST	ISO 7637 test system	2017-05-28	2018-05-27
4	CAN 200	EM TEST	ISO 7637 test system	2017-05-28	2018-05-27
5	VDS 200	EM TEST	ISO 7637 test system	2017-05-28	2018-05-27

7.2 Test Procedure

Test is conducting under the description of ISO/DIS 7637-2

7.3 Test Data/Plots

Test mode: TM1/TM2

Transients and Surges in the Vehicle Environment

Test Method:	ISO 7637-2				
Test date:	2018-Apr-04				
Test Level:	Pulse 1, 2a, 2b, 3a and 3b and 4.				
Polarity:	Positive & Negative				
EUT Operation:	Running with monitor functions				
Ambient:	Temp.: 21 °C,	Humid.: 53%	Press.: 1011	mbar	

Test Results:
DC12V

Test Level, Us (V)	Requirement	Pulse No. or test time	Result / Observations (GSM)	Result / Observations (GPS)
-75	Pulse 1	10 with 2.5s interval	A(TT,TR)	A(TR)
+37	Pulse 2a	10 with 2.5s interval	A(TT,TR)	A(TR)
+10	Pulse 2b	10 with 2.5s interval	A(TT,TR)	A(TR)
-112	Pulse 3a	20 minutes	A(CT,CR)	A(CR)
+75	Pulse 3b	20 minutes	A(CT,CR)	A(CR)
-6	Pulse 4	10 with 60 seconds cycle	A(TT,TR)	A(TR)

Test Results:
DC 24V

Test Level, Us (V)	Requirement	Pulse No. or test time	Result / Observations (GSM)	Result / Observations (GPS)
-450	Pulse 1	10 with 2.5s interval	A(TT,TR)	A(TR)
+37	Pulse 2a	10 with 2.5s interval	A(TT,TR)	A(TR)
+20	Pulse 2b	10 with 2.5s interval	A(TT,TR)	A(TR)
-150	Pulse 3a	20 minutes	A(CT,CR)	A(CR)
+150	Pulse 3b	20 minutes	A(CT,CR)	A(CR)
-12	Pulse 4	10 with 60 seconds cycle	A(TT,TR)	A(TR)

Note: No performance degradation during test. (A)

EXHIBIT 1 - PRODUCT LABELING

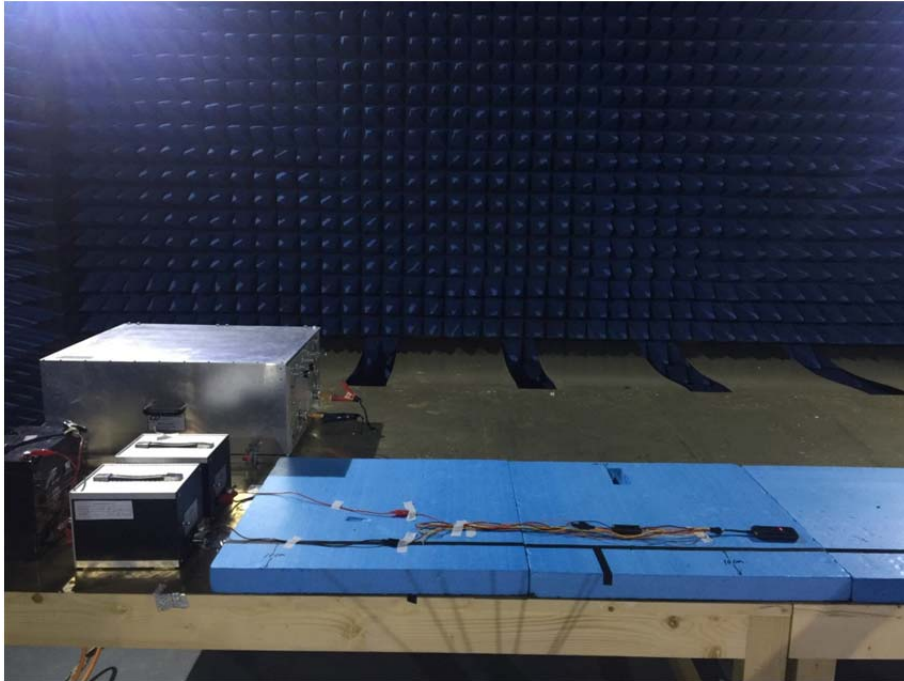
Please refer to “ANNEX_EUT Label & Photos”.

EXHIBIT 2 - EUT PHOTOGRAPHS

Please refer to “ANNEX_EUT Label & Photos”.

EXHIBIT 3 - TEST SETUP PHOTOGRAPHS

Conduction Emission and Transient and Surges Test View



Radiation Emission Test View (Below 1GHz)



Radiation Emission Test Setup (Above 1GHz)



IEC61000-4-3 Test View



IEC61000-4-6 Test View

******* END OF REPORT *******