TEST REPORT

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1. Client

- Name : HYUNDAI MOBIS CO., LTD.
- Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
- Date of Receipt : 2019-09-20

2. Use of Report : Certification

3. Name of Product and Model : WIDE AVN / ATC32HYAN

4. Manufacturer and Country of Origin : Hyundai Mobis., Ltd. / Korea

5. FCC ID : TQ8-ATC32HYAN

6. Date of Test : 2019-10-16 to 2020-02-20

7. Test Standards : FCC Part 2
FCC Part 22 subpart H
FCC Part 24 subpart E
FCC Part 27 subpart C

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Heesu Ahn (Signature)

2020-02-21

KCTL Inc.

Report revision history

Date	Revision	Page No
2020-02-09	Initial report	-
2020-02-21	Updated	3,9,24,25,26,27

Note. The report No. KR20-SRF0055 is superseded by the report No. KR20-SRF0055-A.

CONTENTS

1. General information

Client	:	HYUNDAI MOBIS CO., LTD.
Address	:	203, Teheran-ro, Gangnam-gu, Seoul, 06141, Korea
Manufacturer	:	HYUNDAI MOBIS CO., LTD.
Address	:	95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do 27862 Korea
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 Industry Canada Registration No. : 8035A KOLAS No.: KT231

2. Device information

Equipment under test	:	WIDE AVN
Model	:	ATC32HYAN
Derivative model	:	ATC32HCAN, ATC35HCAN
Frequency range	:	779.5 ㎒ ~ 784.5 ㎒ (LTE Band 13) 824.7 ㎒ ~ 848.3 ㎒ (LTE Band 5) 1 710.7 ㎒ ~ 1 754.3 ㎒ (LTE Band 4) 1 850.7 ㎒ ~ 1 909.3 ㎒ (LTE Band 2) 824.7 ㎒ ~ 848.31 ㎒ (CDMA BC0) 1 851.25 ㎒ ~ 1 908.75 ㎒ (CDMA BC1)
Modulation technique	:	QPSK, 16-QAM (LTE) QPSK (CDMA)
Power source	:	DC 14.4 V
Antenna specification	:	C-PAD Antenna(LTE), Shark Antenna(CDMA)
Software version	:	MQ4.USA.0000.V028.001.190821
Hardware version	:	MQ4.USA.STD_AVN_G5_WIDE.004.001
Test device serial No.	:	N/A
Operation temperature	:	-20 ℃ ~ 70 ℃

2.1. Information about derivative model

The difference between basic model and derivative models is:

The derivative models have a different product identification number.

ATC32HCAN(96560 P4720), ATC35HCAN(96560 P4920)

2.2. Frequency/channel operations

This device contains the following capabilities:
LTE Band 13, LTE Band 5, LTE Band 4, LTE Band 2, CDMA 850/1900(BC0, BC1)

LTE Band 13

Ch.	Frequency (㎒)
23205	779.5
23230	782.0
23255	784.5

Table 2.2.1. 5M BW

Ch.	Frequency (㎒)
-	-
23230	782.0
-	-

Table 2.2.2. 10M BW

LTE Band 5

Ch.	Frequency (㎒)
20407	824.7
20525	836.5
20643	848.3

Table 2.2.3. 1.4M BW

Ch.	Frequency (㎒)
20415	825.5
20525	836.5
20635	847.5

Table 2.2.4. 3M BW

Ch.	Frequency (㎒)
20425	826.5
20525	836.5
20625	846.5

Table 2.2.5. 5M BW

Ch.	Frequency (㎒)
20450	829.0
20525	836.5
20600	844.0

Table 2.2.6. 10M BW

LTE Band 4

Ch.	Frequency (㎒)
19957	1 710.7
20175	1 732.5
20393	1 754.3

Table 2.2.7 1.4M BW

Ch.	Frequency (㎒)
19965	1 711.5
20175	1 732.5
20385	1 753.5

Table 2.2.8 3M BW

Ch.	Frequency (㎒)
19975	1 712.5
20175	1 732.5
20375	1 752.5

Table 2.2.9. 5M BW

Ch.	Frequency (㎒)
20000	1 715.0
20175	1 732.5
20350	1 750.0

Table 2.2.10. 10M BW

Ch.	Frequency (㎒)
20025	1 717.5
20175	1 732.5
20325	1 747.5

Table 2.2.11. 15M BW

Ch.	Frequency (㎒)
20050	1 720.0
20175	1 732.5
20300	1 745.0

Table 2.2.12. 20M BW

LTE Band 2

Ch.	Frequency (㎒)
18607	1 850.7
18900	1 880.0
19193	1 909.3

Table 2.2.13 1.4M BW

Ch.	Frequency (㎒)
18615	1 851.5
18900	1 880.0
19185	1 908.5

Table 2.2.14 3M BW

Ch.	Frequency (㎒)
18625	1 852.5
18900	1 880.0
19175	1 907.5

Table 2.2.15. 5M BW

Ch.	Frequency (㎒)
18650	1 855.0
18900	1 880.0
19150	1 905.0

Table 2.2.16 10M BW

Ch.	Frequency (㎒)
18675	1 857.5
18900	1 880.0
19125	1 902.5

Table 2.2.17 15M BW

Ch.	Frequency (㎒)
18700	1 860.0
18900	1 880.0
19100	1 900.0

Table 2.2.18 20M BW

3. Maximum ERP/EIRP power

LTE Band 13

Mode	Tx frequency (㎒)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 13	779.5 ~ 718.4	4M53G7D	18.43	0.070
		4M53W7D	17.81	0.060
	782.0	8M92G7D	**18.63**	**0.073**
		8M94W7D	17.46	0.056

LTE Band 5

Mode	Tx frequency (㎒)	Emission designator	ERP	
			Max. power (dBm)	Max. power (W)
LTE Band 5	824.7 ~ 848.3	1M10G7D	**20.39**	**0.109**
		1M10W7D	19.48	0.089
	825.5 ~ 847.5	2M71G7D	20.11	0.103
		2M71W7D	18.98	0.079
	826.5 ~ 846.5	4M53G7D	19.28	0.085
		4M53W7D	18.07	0.064
	829.0 ~ 844.0	8M94G7D	19.49	0.089
		8M94W7D	18.26	0.067

LTE Band 4

Mode	Tx frequency (㎒)	Emission designator	EIRP	
			Max. power (dBm)	Max. power (W)
LTE Band 4	1 710.7 ~ 1 754.3	1M10G7D	**21.51**	**0.142**
		1M10W7D	20.71	0.118
	1 711.5 ~ 1 753.5	2M71G7D	21.20	0.132
		2M71W7D	20.15	0.104
	1 712.5 ~ 1 752.5	4M53G7D	21.24	0.133
		4M53W7D	20.23	0.105
	1 715.0 ~ 1 750.0	8M97G7D	21.32	0.136
		8M94W7D	20.69	0.117
	1 717.5 ~ 1 747.5	13M5G7D	21.36	0.137
		13M5W7D	20.62	0.115
	1 720.0 ~ 1 745.0	17M9G7D	18.62	0.073
		17M9W7D	17.50	0.056

LTE Band 2

Mode	Tx frequency (㎒)	Emission designator	EIRP	
			Max. power (dBm)	Max. power (W)
LTE Band 2	1 850.7 ~ 1 909.3	1M10G7D	21.68	0.147
		1M10W7D	20.42	0.110
	1 851.5 ~ 1 908.5	2M71G7D	21.68	0.147
		2M72W7D	20.10	0.102
	1 852.5 ~ 1 907.5	4M52G7D	21.57	0.144
		4M54W7D	20.04	0.101
	1 855.0 ~ 1 905.0	8M94G7D	21.34	0.136
		8M94W7D	20.48	0.112
	1 857.5 ~ 1 902.5	13M5G7D	21.74	0.149
		13M5W7D	21.13	0.130
	1 860.0 ~ 1 900.0	17M9G7D	**22.28**	**0.169**
		17M9W7D	21.53	0.142

4. Summary of tests

FCC Part Section(s)	Parameter	Test results
2.1046 22.913(a)(5) 24.232(c) 27.50(c),(d) ,(h)(2)	Conducted Output Power	N/T(note1)
2.1049	Occupied Bandwidth & 26 dB Bandwidth	N/T(note1)
2.1051 22.917(a) 24.238(a) 27.53(c)(2) ,(h)(1)	Band Edge Emissions at Antenna Terminal	N/T(note1)
	Spurious Emissions at Antenna Terminal	N/T(note1)
22.913(d) 24.232(d) 27.50(d)(5)	Peak to Average Power Ratio	N/T(note1)
2.1055 22.355 24.235 27.54	Frequency stability	N/T(note1)
22.913(a)(5) 24.232(c) 27.50(b)(10) ,(d)(4)	Effective Radiated Power & Equivalent Isotropic Radiated Power	Passs
22.917(a) 24.238(a) 27.53(c)(2), ,(h)(1)	Radiated Spurious Emissions	Pass

Notes: (N/T: Not Tested, N/A: Not Applicable)

1. This test item was not performed by the request of manufacturer. Please refer to original test report no. F690501/RF-RTL011907-1 issued on Nov. 09, 2017 by SGS Korea Co., Ltd. (Gunpo Laboratory)
2. All modes of operation were investigated and the worst case emissions are reported with the EUT positioning, modulations and paging service configurations in the test data.
3. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.
4. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.26-2015
   - ANSI/TIA-603-E-2016
   - KDB 971168 D01 v03r01

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014.

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

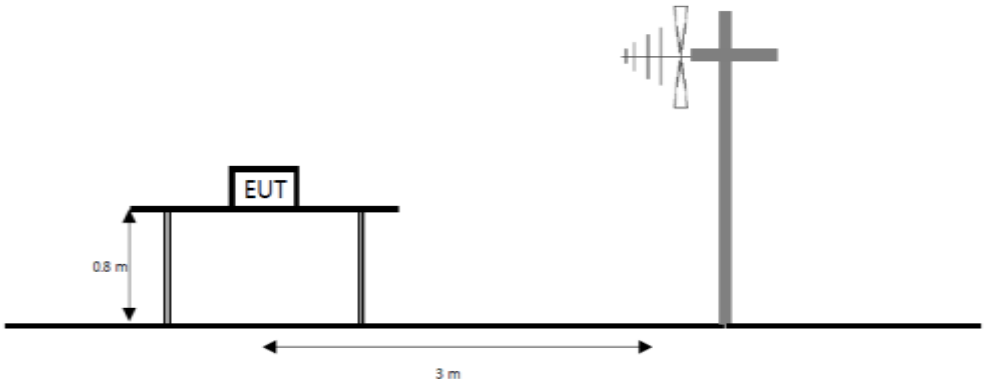
Parameter	Expanded uncertainty(±)	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒	2.28 ㏈
	30 ㎒ ~ 1 ㎓	3.68 ㏈
	Above 1 ㎓	5.72 ㏈

6. Test results

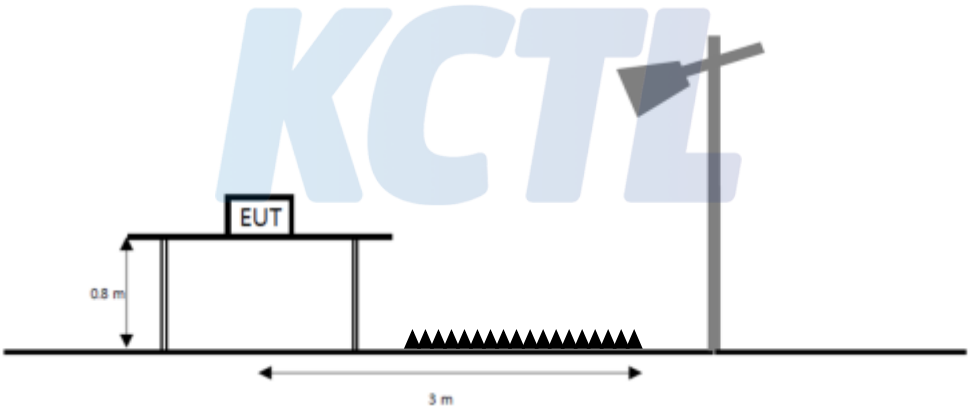
6.1. Radiated Power (ERP/EIRP)

Test setup

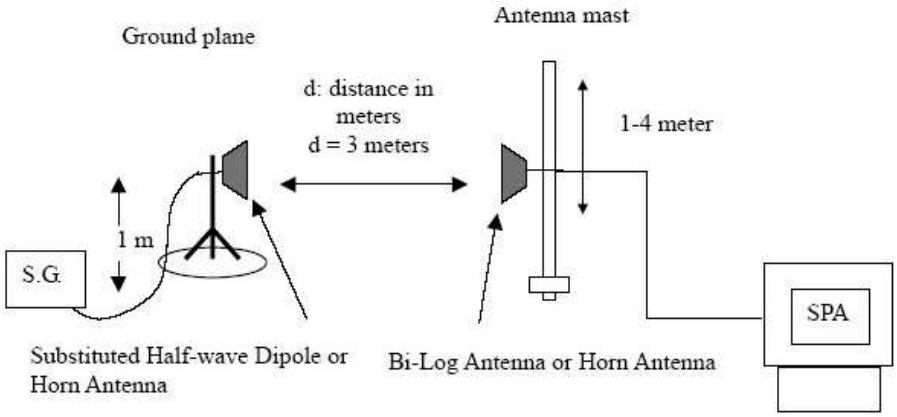
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



The diagram below shows the test setup for substituted method.



Limit

According to §22.913(a)(5), the ERP of transmitters in the cellular radiotelephone service must not exceed the limits in this section. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to §24.232(c) mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to § 27.50(b)(10) Portable stations (hand-held devices) transmitting in the 746-757 ㎒, 776-788 ㎒, and 805-806 ㎒ bands are limited to 3 watts ERP.

According to § 27.50(d)(4) fixed, mobile, and portable (hand-held) stations operating in the 1710~1755 ㎒ band and mobile and portable stations operating in the 1695~1710 ㎒ and 1755~1780 ㎒ bands are 1 watt EIRP.

Test procedure

971168 D01 v03r01 - Section 5.2.2
ANSI 63.26-2015 – Section 5.2.4.4.1
ANSI/TIA-603-E-2016 - Section 2.2.17

Test settings

1) RBW = 1 % to 5 % of the OBW.
2) VBW ≥ 3 × RBW.
3) SPAN = 2 × to 3 × the OBW.
4) Number of measurement points in sweep ≥ 2 × span / RBW.
5) Sweep time :
   1) Auto couple, or
   2) ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
6) Detector = RMS
7) If the EUT can be configured to transmit continuously, then set the trigger to free run.
8) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full -power transmissions).
9) Trace mode = trace averaging (RMS) over 100 sweeps.
10) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
11) Allow trace to fully stabilize.

Notes:

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close To normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected
   to a signal generator.
   The power is calculated by the following formula;
   Pd(㏈m) = Pg(㏈m) – Cable loss (㏈) + Antenna gain (㏈)
   Note. Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

Test results

Test mode: LTE Band 13

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	779.5	H	0.00	3.59	21.66	18.07	0.064
		782.0	H	0.10	3.62	21.62	18.10	0.065
		784.5	H	0.10	3.62	21.95	18.43	0.070
	16QAM	779.5	H	0.00	3.59	20.47	16.88	0.049
		782.0	H	0.10	3.62	20.40	16.88	0.049
		784.5	H	0.10	6.62	24.33	17.81	0.060
10 M	QPSK	782.0	H	0.10	3.62	22.15	18.63	0.073
	16QAM	782.0	H	0.10	3.62	20.98	17.46	0.056

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode: LTE Band 5

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	824.70	H	-0.60	3.69	24.68	20.39	0.109
		836.50	H	-0.50	3.72	23.48	19.26	0.084
		848.30	H	-0.50	3.74	22.71	18.47	0.070
	16QAM	824.70	H	-0.60	3.69	23.77	19.48	0.089
		836.50	H	-0.50	3.72	22.85	18.63	0.073
		848.30	H	-0.50	3.74	21.43	17.19	0.052
3 M	QPSK	825.50	H	-0.60	3.70	24.41	20.11	0.103
		836.50	H	-0.50	3.72	23.68	19.46	0.088
		847.50	H	-0.50	3.74	22.11	17.87	0.061
	16QAM	825.50	H	-0.60	3.70	23.28	18.98	0.079
		836.50	H	-0.50	3.72	22.56	18.34	0.068
		847.50	H	-0.50	3.74	20.45	16.21	0.042
5 M	QPSK	826.50	H	-0.60	3.71	23.59	19.28	0.085
		836.50	H	-0.50	3.72	22.77	18.55	0.072
		846.50	H	-0.50	3.73	22.35	18.12	0.065
	16QAM	826.50	H	-0.60	3.71	22.38	18.07	0.064
		836.50	H	-0.50	3.72	22.16	17.94	0.062
		846.50	H	-0.50	3.73	20.92	16.69	0.047
10 M	QPSK	829.00	H	-0.60	3.71	23.80	19.49	0.089
		836.50	H	-0.50	3.72	23.11	18.89	0.077
		844.00	H	-0.50	3.73	23.03	18.80	0.076
	16QAM	829.00	H	-0.60	3.71	22.43	18.12	0.065
		836.50	H	-0.50	3.72	22.48	18.26	0.067
		844.00	H	-0.50	3.73	21.60	17.37	0.055

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode: LTE Band 4

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 710.7	V	6.35	5.48	20.64	21.51	0.142
		1 732.5	V	6.32	5.52	19.86	20.66	0.116
		1 754.3	V	6.29	5.56	19.31	20.04	0.101
	16QAM	1 710.7	V	6.35	5.48	19.84	20.71	0.118
		1 732.5	V	6.32	5.52	18.92	19.72	0.094
		1 754.3	V	6.29	5.56	17.96	18.69	0.074
3 M	QPSK	1 711.5	V	6.35	5.48	20.33	21.20	0.132
		1 732.5	V	6.32	5.52	19.99	20.79	0.120
		1 753.5	V	6.30	5.56	19.15	19.89	0.097
	16QAM	1 711.5	V	6.35	5.48	19.28	20.15	0.104
		1 732.5	V	6.32	5.52	19.23	20.03	0.101
		1 753.5	V	6.30	5.56	18.31	19.05	0.080
5 M	QPSK	1 712.5	V	6.35	5.49	20.39	21.24	0.133
		1 732.5	V	6.32	5.52	19.93	20.73	0.118
		1 752.5	V	6.30	5.55	19.20	19.95	0.099
	16QAM	1 712.5	V	6.35	5.49	19.07	19.92	0.098
		1 732.5	V	6.32	5.52	19.43	20.23	0.105
		1 752.5	V	6.30	5.55	18.05	18.80	0.076
10 M	QPSK	1 715.0	V	6.34	5.50	20.48	21.32	0.136
		1 732.5	V	6.32	5.52	20.41	21.21	0.132
		1 750.0	V	6.30	5.54	19.32	20.08	0.102
	16QAM	1 715.0	V	6.34	5.50	19.42	20.26	0.106
		1 732.5	V	6.32	5.52	19.89	20.69	0.117
		1 750.0	V	6.30	5.54	18.01	18.77	0.075
15 M	QPSK	1 717.5	V	6.34	5.49	20.51	21.36	0.137
		1 732.5	V	6.32	5.52	19.98	20.78	0.120
		1 747.5	V	6.30	5.54	19.34	20.10	0.102
	16QAM	1 717.5	V	6.34	5.49	19.77	20.62	0.115
		1 732.5	V	6.32	5.52	19.10	19.90	0.098
		1 747.5	V	6.30	5.54	18.43	19.19	0.083
20 M	QPSK	1 720.0	V	6.34	5.50	16.46	17.30	0.054
		1 732.5	V	6.32	5.52	17.10	17.90	0.062
		1 745.0	V	6.31	5.56	17.87	18.62	0.073
	16QAM	1 720.0	V	6.34	5.50	15.66	16.50	0.045
		1 732.5	V	6.32	5.52	16.70	17.50	0.056
		1 745.0	V	6.31	5.56	16.75	17.50	0.056

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode: LTE Band 2

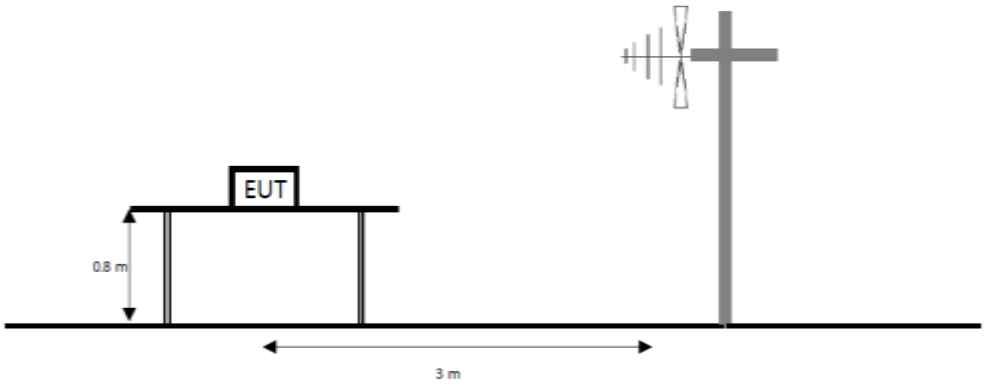
Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 850.7	V	6.18	5.74	19.26	19.70	0.093
		1 880.0	V	6.14	5.78	20.65	21.01	0.126
		1 909.3	V	6.11	5.81	21.38	21.68	0.147
	16QAM	1 850.7	V	6.18	5.74	18.34	18.78	0.076
		1 880.0	V	6.14	5.78	19.67	20.03	0.101
		1 909.3	V	6.11	5.81	20.12	20.42	0.110
3 M	QPSK	1 851.5	V	6.18	5.74	19.23	19.67	0.093
		1 880.0	V	6.14	5.78	20.70	21.06	0.128
		1 908.5	V	6.11	5.81	21.38	21.68	0.147
	16QAM	1 851.5	V	6.18	5.74	18.09	18.53	0.071
		1 880.0	V	6.14	5.78	19.72	20.08	0.102
		1 908.5	V	6.11	5.81	19.80	20.10	0.102
5 M	QPSK	1 852.5	V	6.18	5.74	19.35	19.79	0.095
		1 880.0	V	6.14	5.78	20.72	21.08	0.128
		1 907.5	V	6.11	5.80	21.26	21.57	0.144
	16QAM	1 852.5	V	6.18	5.74	18.21	18.65	0.073
		1 880.0	V	6.14	5.78	19.68	20.04	0.101
		1 907.5	V	6.11	5.80	19.72	20.03	0.101
10 M	QPSK	1 855.0	V	6.17	5.75	20.03	20.45	0.111
		1 880.0	V	6.14	5.78	20.98	21.34	0.136
		1 905.0	V	6.11	5.79	20.90	21.22	0.132
	16QAM	1 855.0	V	6.17	5.75	18.79	19.21	0.083
		1 880.0	V	6.14	5.78	20.12	20.48	0.112
		1 905.0	V	6.11	5.79	19.89	20.21	0.105
15 M	QPSK	1 857.5	V	6.17	5.75	19.88	20.30	0.107
		1 880.0	V	6.14	5.78	21.38	21.74	0.149
		1 902.5	V	6.12	5.79	21.39	21.72	0.149
	16QAM	1 857.5	V	6.17	5.75	18.80	19.22	0.084
		1 880.0	V	6.14	5.78	20.77	21.13	0.130
		1 902.5	V	6.12	5.79	20.50	20.83	0.121
20 M	QPSK	1 860.0	V	6.17	5.75	19.76	20.18	0.104
		1 880.0	V	6.14	5.78	21.68	22.04	0.160
		1 900.0	V	6.12	5.79	21.95	22.28	0.169
	16QAM	1 860.0	V	6.17	5.75	19.15	19.57	0.091
		1 880.0	V	6.14	5.78	20.22	20.58	0.114
		1 900.0	V	6.12	5.79	21.20	21.53	0.142

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

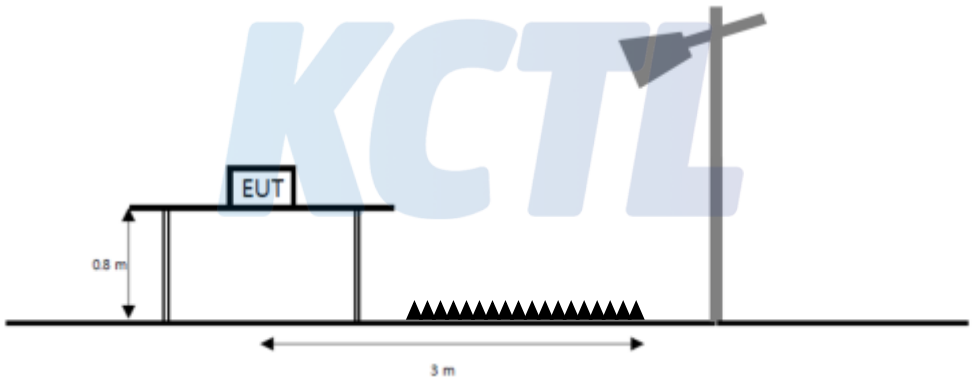
6.2. Radiated Spurious Emissions

Test setup

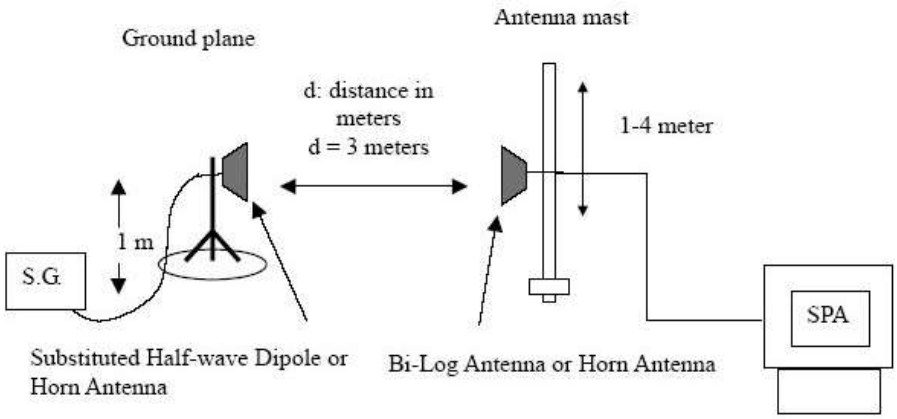
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



The diagram below shows the test setup for substituted method.



Limit

According to §22.917(a), §24.238(a) the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log($P_{[Watts]}$) dB.

According to §27.53(g) on any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB

According to §27.53(h) the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10log($P_{[Watts]}$) dB.

Test procedure

971168 D01 v03r01 - Section 5.8
ANSI 63.26-2015 – Section 5.5
ANSI/TIA-603-E-2016 - Section 2.2.12

Test settings

1) RBW = 1 kHz for below 1 GHz and 1 MHz for above 1 GHz.
2) VBW ≥ 3 × RBW.
3) Detector = RMS
4) Trace mode = Max hold
5) Sweep time = Auto couple
6) Number of sweep points ≥ 2 × span / RBW
7) Allow trace to fully stabilize.

Notes:

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close To normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 GHz below) or horn antenna (1 GHz above) connected to a signal generator.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

Test results (Above 1 000 ㎒)

Test mode : LTE Band 13
Frequency(㎒) : 782.0
Channel : 23230
Bandwidth(㎒) 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 573.04	V	6.51	5.23	-52.48	-51.20	-13.00	38.20
	2 361.09	V	6.00	6.48	-60.92	-61.40	-13.00	48.40
	2 385.09	V	6.00	6.51	-53.39	-53.90	-13.00	40.90
	3 148.13	H	7.03	7.48	-59.75	-60.20	-13.00	47.20
	3 406.65	V	7.59	7.79	-55.30	-55.50	-13.00	42.5

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)

Test mode : LTE Band 13
Frequency(㎒) : 782.0
(1 559 ~ 1 610 ㎒)
Channel : 23230
Bandwidth(㎒) 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 572.85	V	6.51	5.23	-84.98	-83.70	-50.00	33.70
	1 606.10	H	6.47	5.28	-92.49	-91.30	-50.00	41.30

Note.
1. Limit Calculation of wide-band (dBm/㎒) = -70 dBW/㎒ (-40 dBm/㎒)
2. Limit Calculation of narrow-band (dBm) = -80 dBW (-50 dBm)

Test mode : LTE Band 5
Frequency(㎒) : 824.7
Channel : 20407
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 648.54	H	6.42	5.36	-50.56	-49.50	-13.00	36.50
	2 471.09	H	6.00	6.63	-57.27	-57.90	-13.00	44.90
	3 299.14	V	7.36	7.66	-57.60	-57.90	-13.00	44.90
	4 121.70	H	8.72	8.59	-59.43	-59.30	-13.00	46.30

Test mode : LTE Band 5
Frequency(㎒) : 836.5
Channel : 20525
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 674.04	H	6.42	5.36	-53.46	-52.40	-13.00	39.40
	2 512.59	H	6.00	6.63	-58.37	-59.00	-13.00	46.00
	3 347.65	V	7.36	7.66	-57.80	-58.10	-13.00	45.10
	4 186.70	V	8.72	8.59	-59.93	-59.80	-13.00	46.80

Test mode : LTE Band 5
Frequency(㎒) : 848.3
Channel : 20643
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 697.04	V	6.36	5.45	-56.71	-55.80	-13.00	42.80
	2 546.60	H	6.07	6.73	-58.14	-58.80	-13.00	45.80
	3 393.15	V	7.56	7.78	-57.58	-57.80	-13.00	44.80
	4 231.20	H	8.83	8.69	-58.74	-58.60	-13.00	45.60

Note.
1. Limit Calculation(㏈m)= 43 + 10log(P[Watts])

Test mode : LTE Band 4
Frequency(㎒) : 1 717.5
Channel : 20025
Bandwidth(㎒) 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 421.50	V	7.63	7.81	-34.82	-35.00	-13.00	22.00
	5 132.50	H	10.09	9.67	-43.32	-42.90	-13.00	29.90
	6 843.50	V	11.04	11.28	-47.96	-48.20	-13.00	35.20
	8 554.50	V	12.98	12.61	-46.97	-46.60	-13.00	33.60

Test mode : LTE Band 4
Frequency(㎒) : 1 732.5
Channel : 20175
Bandwidth(㎒) 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 465.50	H	7.72	7.87	-27.65	-27.80	-13.00	14.80
	5 198.00	V	10.18	9.73	-35.05	-34.60	-13.00	21.60
	6 930.50	V	11.07	11.40	-40.07	-40.40	-13.00	27.40
	10 015.50	V	12.71	13.70	-49.41	-50.40	-13.00	37.40

Test mode : LTE Band 4
Frequency(㎒) : 1 747.5
Channel : 20325
Bandwidth(㎒) 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 508.00	V	7.81	7.92	-32.29	-32.40	-13.00	19.40
	5 262.50	V	10.27	9.69	-42.28	-41.70	-13.00	28.70
	7 016.50	V	11.13	11.34	-50.49	-50.70	-13.00	37.70
	8 775.00	V	12.89	12.90	-55.89	-55.90	-13.00	42.90

Note.
1. Limit Calculation(㏈m)= 43 + 10log(P[Watts])

Test mode : LTE Band 2
Frequency(㎒) : 1 857.5
Channel : 18675
Bandwidth(㎒) 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 728.50	V	8.17	8.18	-21.29	-21.30	-13.00	8.30
	5 592.50	H	10.60	10.08	-34.52	-34.00	-13.00	21.00
	7 456.50	V	11.92	11.67	-43.45	-43.20	-13.00	30.20
	9 321.00	H	12.99	13.26	-51.63	-51.90	-13.00	38.90

Test mode : LTE Band 2
Frequency(㎒) : 1 880.0
Channel : 18900
Bandwidth(㎒) 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 773.00	V	8.24	8.25	-24.09	-24.10	-13.00	11.10
	5 660.00	V	10.60	10.20	-42.80	-42.40	-13.00	29.40
	7 546.50	V	12.05	11.85	-43.40	-43.20	-13.00	30.20
	9 437.00	V	13.06	13.33	-53.33	-53.60	-13.00	40.60

Test mode : LTE Band 2
Frequency(㎒) : 1 902.5
Channel : 19125
Bandwidth(㎒) 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 791.50	V	8.27	8.27	-31.90	-31.90	-13.00	18.90
	5 687.50	V	10.60	10.22	-38.98	-38.60	-13.00	25.60
	7 583.50	V	12.08	11.87	-46.21	-46.00	-13.00	33.00
	9 475.50	V	13.09	13.35	-55.54	-55.80	-13.00	42.80

Note.
1. Limit Calculation(㏈m)= 43 + 10log(P[Watts])

Test mode : Simultaneously
LTE Band 2
+ 2.4G WIFI 802.11g
Frequency(㎒) : 1 880.0 + 2 412
Channel : 18900, 1
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + OFDM	1 346.09	V	5.12	4.83	-18.89	-18.60	-13.00	5.60
	2 946.49	V	6.63	7.23	-25.99	-26.60	-13.00	13.60
	3 759.00	V	8.21	8.24	-33.78	-33.80	-13.00	20.80
	4 824.50	V	9.62	9.30	-57.72	-57.40	-13.00	44.40
	5 638.50	V	10.60	10.18	-48.22	-47.80	-13.00	34.80
	7 235.00	H	11.52	11.53	-50.99	-51.00	-13.00	38.00

Test mode : Simultaneously
LTE Band 2
+ 5G WIFI 802.11a
Frequency(㎒) : 1 880.0 + 5 500
Channel : 18900, 100
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + OFDM	1 740.07	V	6.31	5.53	-19.78	-19.00	-13.00	6.00
	2 019.09	V	6.00	5.95	-19.65	-19.60	-13.00	6.60
	3 759.00	V	8.21	8.24	-34.87	-34.90	-13.00	21.90
	5 638.50	H	10.60	10.18	-47.62	-47.20	-13.00	34.20
	11 008.00	V	12.90	14.33	-51.77	-53.20	-13.00	40.20
	16 500.40	V	12.80	17.79	-46.11	-51.10	-13.00	38.10

Note.
1. Limit Calculation(㏈m)= 43 + 10log(P[Watts])

Test mode : Simultaneously
LTE Band 2 + BT
Frequency(㎒) : 1 880.0 + 2 441
Channel : 18900, 39
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + GFSK	1 318.08	V	4.85	4.78	-15.47	-15.40	-13.00	2.40
	3 759.00	V	8.21	8.24	-36.48	-36.50	-13.00	23.50
	4 883.50	V	9.71	9.44	-56.37	-56.10	-13.00	43.10
	5 638.50	H	10.60	10.18	-48.02	-47.60	-13.00	34.60
	7 323.00	V	11.68	11.56	-53.92	-53.80	-13.00	40.80

Test mode : Simultaneously
LTE Band 2 + BT
+ 2.4G WIFI 802.11g
Frequency(㎒) : 1 880.0 + 2 441
+ 2 412
Channel : 18900, 39, 1
Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + GFSK + OFDM	1 318.08	V	4.85	4.78	-15.57	-15.50	-13.00	2.50
	1 348.09	V	5.14	4.84	-17.51	-17.20	-13.00	4.20
	2 949.99	V	6.63	7.24	-25.59	-26.20	-13.00	13.20
	2 976.49	V	6.67	7.27	-29.40	-30.00	-13.00	17.00
	3 759.00	V	8.21	8.24	-34.08	-34.10	-13.00	21.10
	4 823.00	H	9.62	9.30	-56.62	-56.30	-13.00	43.30
	4 883.00	H	9.71	9.44	-56.97	-56.70	-13.00	43.70
	5 638.50	V	10.60	10.18	-48.72	-48.30	-13.00	35.30
	7 236.50	V	11.53	11.53	-49.40	-49.40	-13.00	36.40
	7 321.50	H	11.68	11.56	-54.82	-54.70	-13.00	41.70

Note.
1. Limit Calculation(dBm)= 43 + 10log(P[Watts])

Test mode : Simultaneously
LTE Band 2 + BT
+ 5G WIFI 802.11a

Frequency(㎒) : 1 880.0 + 2 441
+ 5 500

Channel : 18900, 39, 100

Bandwidth(㎒) 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK + GFSK + OFDM	1 318.03	V	4.85	4.78	-16.17	-16.10	-13.00	3.10
	1 740.07	V	6.31	5.53	-19.98	-19.20	-13.00	6.20
	3 759.00	V	8.21	8.24	-36.37	-36.40	-13.00	23.40
	4 882.50	H	9.71	9.44	-55.37	-55.10	-13.00	42.10
	5 638.50	V	10.60	10.18	-48.92	-48.50	-13.00	35.50
	11 003.40	H	12.90	14.32	-51.98	-53.40	-13.00	40.40
	16 500.86	V	12.80	17.79	-42.31	-47.30	-13.00	34.30

Note.
1. Limit Calculation(㏈m)= 43 + 10log(P[Watts])

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Biconical VHF-UHF Broadband Antenna	SCHWARZBECK	VUBA9117	275	19.04.13	20.04.13
Bilog Antenna	Teseq GmbH	CBL 6143A	35039	19.05.21	21.05.21
Horn Antenna	ETS.lindgren	3117	00161083	19.09.18	20.09.18
Horn Antenna	ETS.lindgren	3117	161225	19.05.22	20.05.22
Horn Antenna	Steatite Antennas	QMS-00225	17790	19.08.12	20.08.12
Horn Antenna	ETS.lindgren	3116	00086635	19.05.09	20.05.09
High pass Filter	Wainwright Instruments GmbH	WHKX3.0/18G-12SS	44	20.01.21	21.01.21
High pass Filter	Wainwright Instruments GmbH	WHKX1.0/1.5S-10SS	14	20.01.21	21.01.21
Attenuator	Weinschel ENGINEERING	10	AJ1239	19.05.14	20.05.14
Attenuator	API Inmet	40AH2W-10	12	19.05.15	20.05.15
Amplifier	SONOMA INSTRUMENT	310N	185799	20.01.21	21.01.21
Amplifier	L-3 Narda-MITEQ	AMF-7D-01001800-22-10P	2031196	20.02.12	21.02.12
Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	19.08.01	20.08.01
Spectrum Analyzer	AGILENT	N9040B	MY57010132	19.07.31	20.07.31
Signal Generator	R&S	SMB100A	176206	20.01.21	21.01.21
Widebnad Radio Communication Tester	R & S	CMW500	141780	19.04.18	20.04.18
Antenna Mast	MATURO	EAS 1.5	042/8941211	N/A	N/A
Antenna Mast	MATURO	EAS 1.5	043/8941211	N/A	N/A
Turn Table	MATURO	TT 0.8 PF	041/8941211	N/A	N/A
Cable Assembly	Radiall	R286303620	1649.241	N/A	N/A
Cable Assembly	Radiall	TESTPRO 3	-	N/A	N/A

End of test report