

TEST REPORT

Reference No...... : WTS19S09066147W001 V1
FCC ID : ZLZ-WMTSTM70
Applicant..... : Shenzhen Mindray BIO-Medical electronics Co.,LTD.
Address..... : Mindray Building, Keji 12th Road South, Hi-tech Ind, Shenzhen, China
Manufacturer : The same as above
Address..... : The same as above
Product..... : Telemetry Monitor
Model(s) : TM70
Brand Name..... : Mindray
Standards..... : FCC CFR47 Part 95 Subpart H
Date of Receipt sample : 2019-09-23
Date of Test : 2019-09-24 to 2019-11-25
Date of Issue..... : 2020-03-17
Test Result..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS19S09066 147W001	2019-09-23	2019-09-24	2019-11-25	original	-	Replaced
WTS19S09066 147W001 V1	2019-09-23	2019-09-24	2020-03-17	Version 1	Updated	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	Telemetry Monitor
Model(s):	TM70
Model Description:	N/A
Support:	WMTS
Hardware Version:	1.0
Software Version:	1.0

4.2 Details of E.U.T.

Operation Frequency:	608MHz(608-614MHz) 1.4GHz(1395-1400MHz) 1.4GHz(1427-1432MHz)
Max. RF output power:	608MHz: 95.60 dBuV/m ,1.4GHz: 93.15 dBuV/m
Type of Modulation:	GFSK
Antenna installation:	WMTS: External antenna
Ratings:	DC 3.8V 3800mA

4.3 Test Mode

All channels and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Support Band	Channel Frequency
608-614MHz	608.66 MHz
	611.06 MHz
	613.46 MHz
1395-1400MHz and 1427-1432 MHz(wide band)	1395.5 MHz
	1399.5 MHz
	1431.5 MHz
1395-1400MHz and 1427-1432 MHz(narrow band)	1395.4 MHz
	1399.6 MHz
	1431.6 MHz

5 Test Summary

Test Items	Test Requirement	Result
FIELD STRENGTH OF FUNDAMENTAL	95.2369(a)(b)	PASS
FIELD STRENGTH OF SPURIOUS EMISSIONS	95.2379(a)(b)	PASS
OCCUPIED BANDWIDTH	2.1049	PASS
FREQUENCY STABILITY	95.2365	PASS

6 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

7 Equipment Used during Test

7.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2019-04-19	2020-04-18
2	LARGE LOOP ANTENNA	Laplace	RF300	9057	2019-09-17	2020-09-16
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2019-04-28	2020-04-27
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2019-04-28	2020-04-27
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2019-04-19	2020-04-18
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2019-04-28	2020-04-27
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-19	2020-04-18
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2019-04-19	2020-04-18
10	Signal Generator	R&S	SMR20	100046	2019-07-12	2020-07-11
11	Smart Antenna	SCHWARZBECK	HA08	-	2019-04-09	2020-04-08
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2019-04-20	2020-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-05-24	2020-05-23
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2019-04-19	2020-04-18
4	Cable	HUBER+SUHNER	CBL2	525178	2019-04-20	2020-04-19
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2019-09-12	2020-09-11

7.2 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64 dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Radio Frequency	$\pm 1 \times 10^{-7}$ Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7 dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

7.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

8 FIELD STRENGTH OF FUNDAMENTAL

Test Requirement:	95.2369(a)(b)
Test Method:	ANSI/TIA-603-E-2016
Test Mode:	TX transmitting

8.1 EUT Operation

Operating Environment :

Temperature:	22.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

8.2 Test Procedure

Radiated method:

1. The setup of EUT is according with per TIA/EIA/EIA Standard 603-C.
2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.
4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

8.3 Test limits

(a) For WMTS transmitter types operating in the 608-614 MHz band, the field strength of the transmitted signal must not exceed 200 mV/m, measured at a distance of 3 meters, using instrumentation with a CISPR quasi-peak detector.

(b) For WMTS transmitter types operating in the 1395-1400 MHz and 1427-1432 MHz bands, the field strength of the transmitted signal must not exceed 740 mV/m, measured at 3 meters, using instrumentation with an averaging detector and a 1MHz reference bandwidth.

8.4 Test Result

FIELD STRENGTH OF FUNDAMENTAL

Test channels(MHz)	Field Strength(dBuv/m)	limits(dBuv/m)	Result
608.66 MHz	92.90	106	PASS
611.06 MHz	95.60	106	PASS
613.46 MHz	93.80	106	PASS
1395.5 MHz(WB)	92.69	117.4	PASS
1399.5 MHz(WB)	91.40	117.4	PASS
1431.5 MHz(WB)	93.01	117.4	PASS
1395.4 MHz(NB)	91.26	117.4	PASS
1399.6 MHz(NB)	92.65	117.4	PASS
1431.6 MHz(NB)	93.15	117.4	PASS

9 FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Requirement: 95.2379(a)(b)
Test Method: ANSI/TIA-603-E-2016
Test Mode: TX transmitting

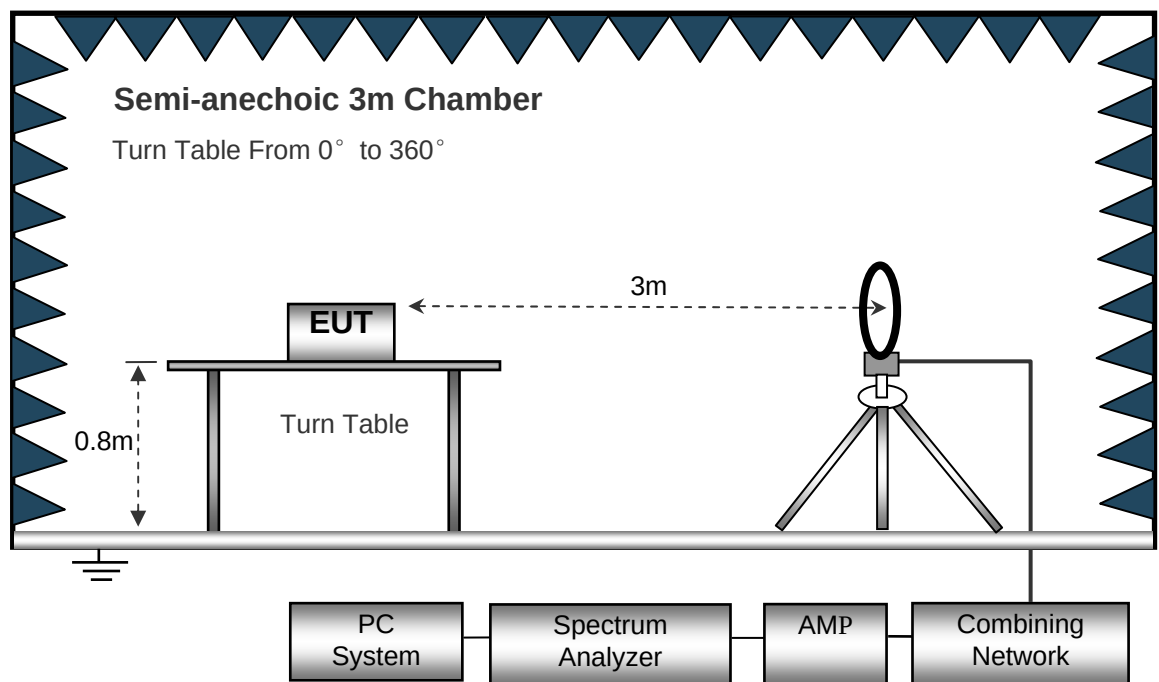
9.1 EUT Operation

Operating Environment :

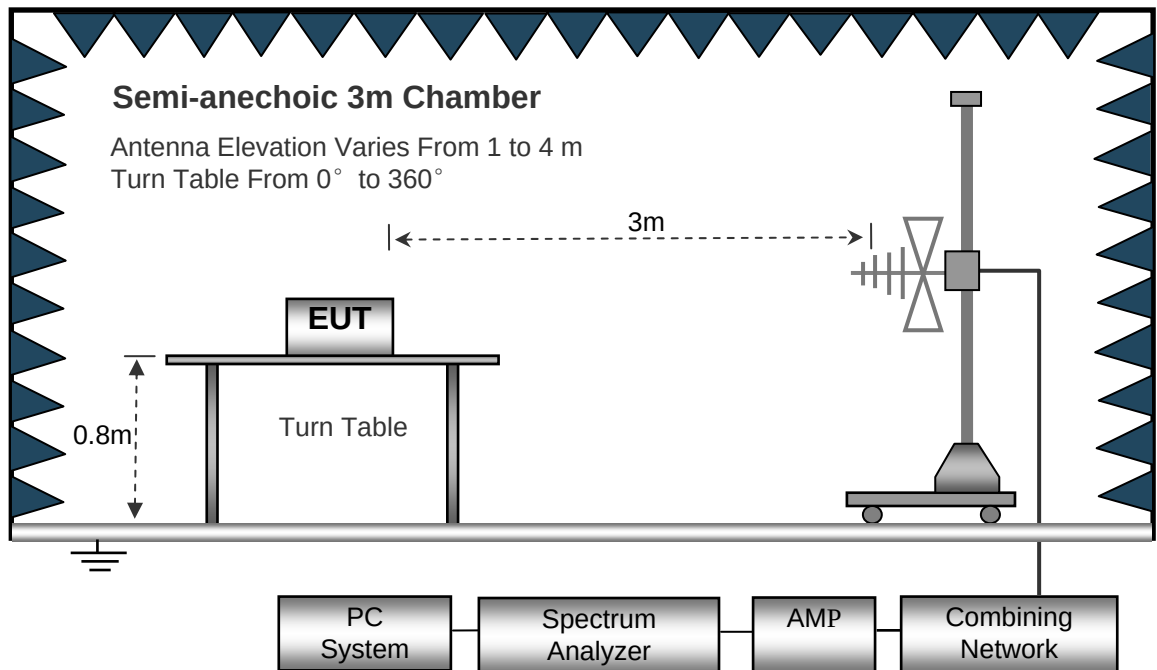
Temperature: 23.5 °C
Humidity: 52.1 % RH
Atmospheric Pressure: 101.2kPa

9.2 Test Setup

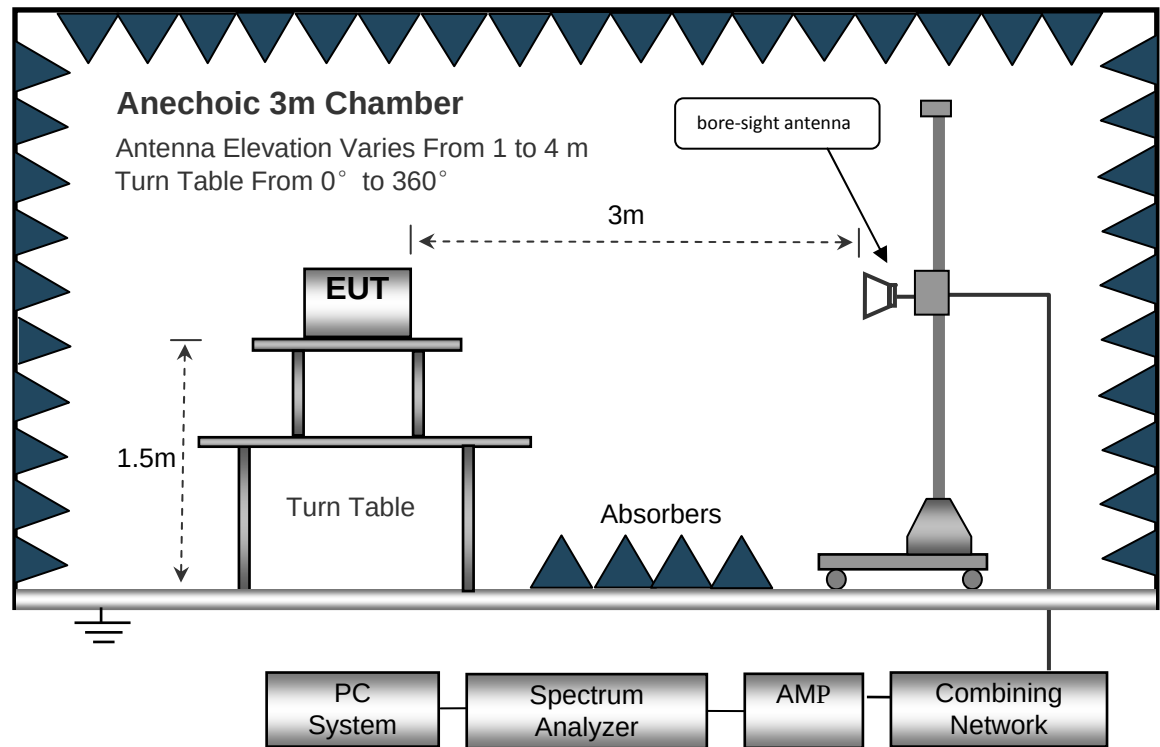
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site.
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



9.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz
Detector QP.
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz

9.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m for below 1GHz and 1.5m for above 1GHz above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from 30MHz up to the tenth harmonic of the highest fundamental frequency.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.
7. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level
Spurious attenuation limit in dB = $43 + 10 \lg (\text{power out in Watts})$
8. Repeat above procedures until the measurements for all frequencies are completed.

9.5 Summary of Test Results

For 26MHz~30MHz,

The measurements were more than 20 dB below the limit and not reported.

Remark: Test performed from 30MHz to 10th harmonics with low/middle/high channels, only the worst data were recorded.

Middle channel(1399.5MHz WB)

Freq (MHz)	Reading (dBuv/m)	Factor (dB)	Polar (V/H)	Result (dBuv/m)	Limit (dBuv/m)	Margin (dB)	Detector
468.8762	31.24	-10.54	V	20.70	46.00	-25.30	QP
629.4772	31.59	-7.37	V	24.22	46.00	-21.78	QP
223.7334	40.73	-17.14	H	23.59	46.00	-22.41	QP
480.5276	31.21	-10.36	H	20.85	46.00	-25.15	QP
2799.000	36.45	-10.90	V	25.55	54.00	-28.45	AV
4198.500	37.38	-4.66	V	32.72	54.00	-21.28	AV
2799.000	32.73	-7.20	H	25.53	54.00	-28.47	AV
4198.500	37.30	-4.60	H	32.70	54.00	-21.30	AV

Middle channel(1399.6MHz NB)

Freq (MHz)	Reading (dBuv/m)	Factor (dB)	Polar (V/H)	Result (dBuv/m)	Limit (dBuv/m)	Margin (dB)	Detector
211.5265	32.80	-17.59	V	20.09	46.00	-28.29	QP
631.6884	35.23	-7.33	V	27.90	46.00	-18.10	QP
451.1350	30.86	-10.80	H	20.06	46.00	-25.94	QP
742.2587	30.39	-5.48	H	24.91	46.00	-21.09	QP
2799.200	36.29	-10.90	V	25.39	54.00	-28.61	AV
4198.800	37.31	-4.66	V	32.65	54.00	-21.35	AV
2799.200	32.52	-7.20	H	25.32	54.00	-28.68	AV
4198.800	37.38	-4.60	H	32.78	54.00	-21.22	AV

Low channel(608.66MHz)

Freq (MHz)	Reading (dBuv/m)	Factor (dB)	Polar (V/H)	Result (dBuv/m)	Limit (dBuv/m)	Margin (dB)	Detector
451.1350	34.79	-10.80	V	23.99	46.00	-22.01	QP
900.1474	30.19	-3.15	V	27.04	46.00	-18.96	QP
511.8352	29.99	-9.87	H	20.12	46.00	-25.88	QP
766.0571	30.24	-5.04	H	25.20	46.00	-20.80	QP
1217.320	40.37	-14.91	V	25.46	54.00	-28.54	AV
1825.980	36.47	-11.65	V	24.82	54.00	-29.18	AV
1198.000	46.74	-12.80	H	33.94	54.00	-20.06	AV
1217.320	36.45	-12.70	H	23.75	54.00	-30.25	AV

Note: Margin = Limit-Result

10 OCCUPIED BANDWIDTH

Test Requirement:	2.1049
Test Method:	ANSI/TIA-603-E-2016
Test Mode:	TX transmitting

10.1 EUT Operation

Operating Environment :	
Temperature:	23.5 °C
Humidity:	52.3 % RH
Atmospheric Pressure:	101.3kPa

10.2 Test Procedure

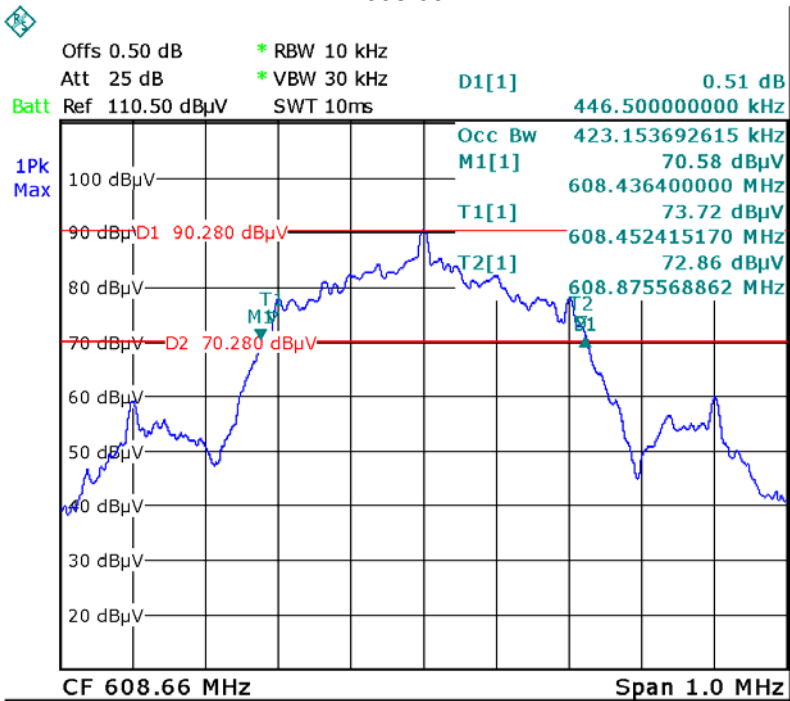
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 10kHz, VBW = 30kHz

10.3 Test Result

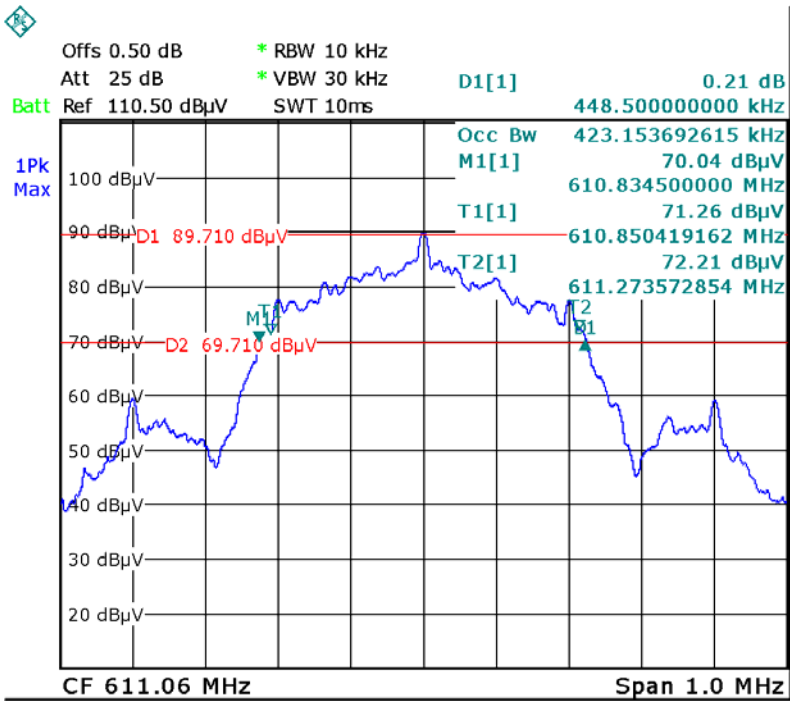
Test Channel	Bandwidth(KHz)
608.66 MHz	446.50
611.06 MHz	448.50
613.46 MHz	449.10
1395.5 MHz(WB)	877.20
1399.5 MHz(WB)	878.20
1431.5 MHz(WB)	878.20
1395.4 MHz(NB)	441.10
1399.6 MHz(NB)	439.10
1431.6 MHz(NB)	441.10

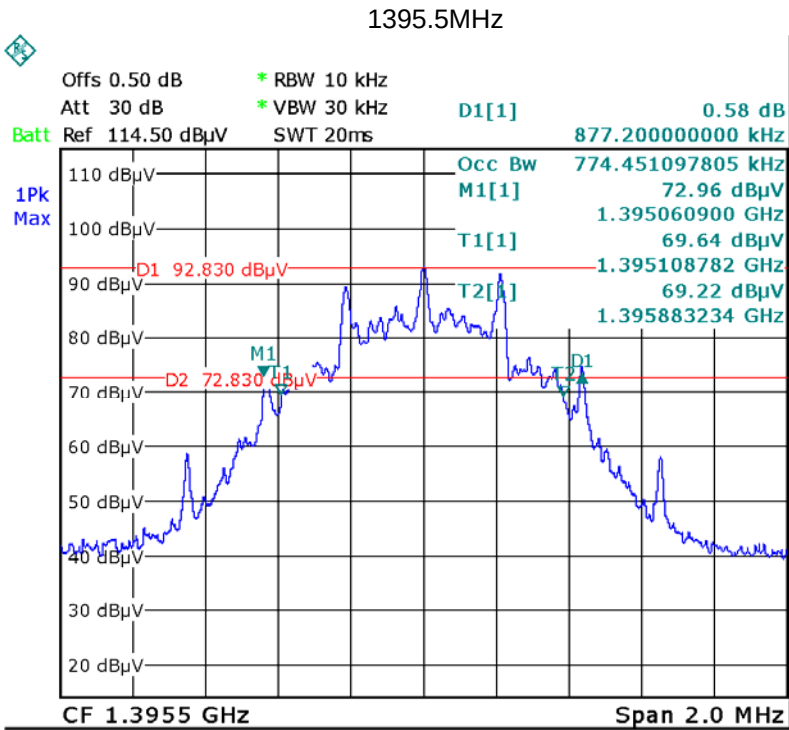
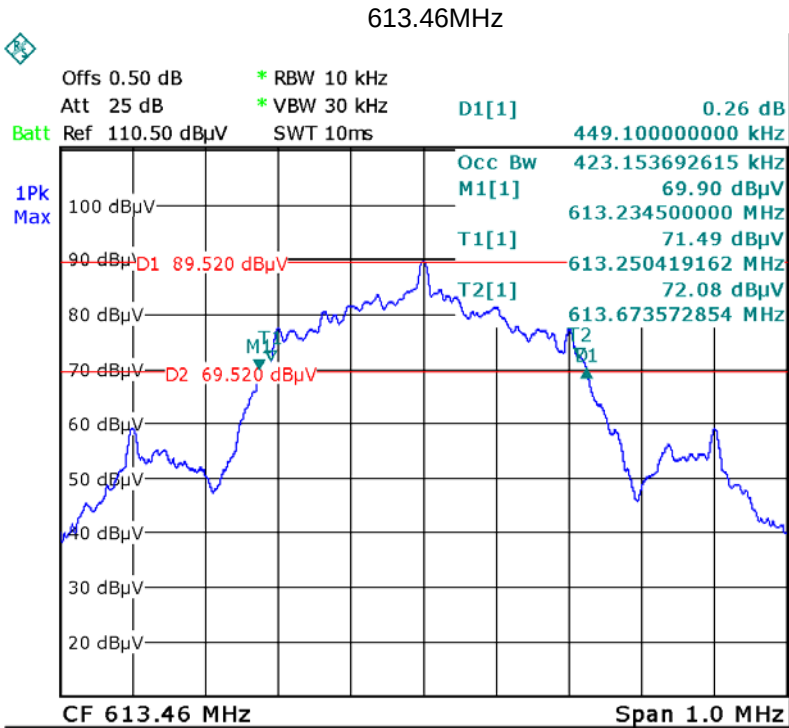
Test plots

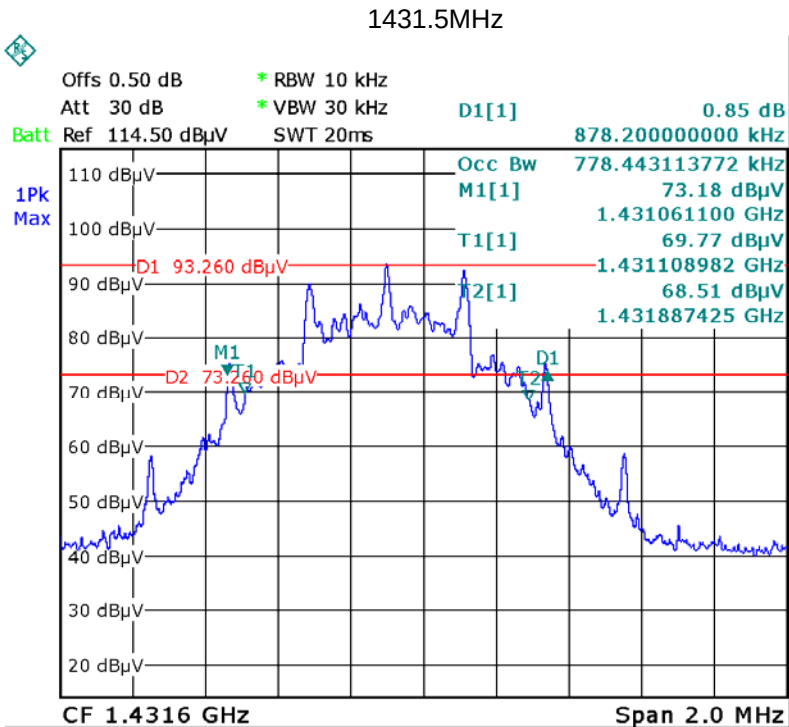
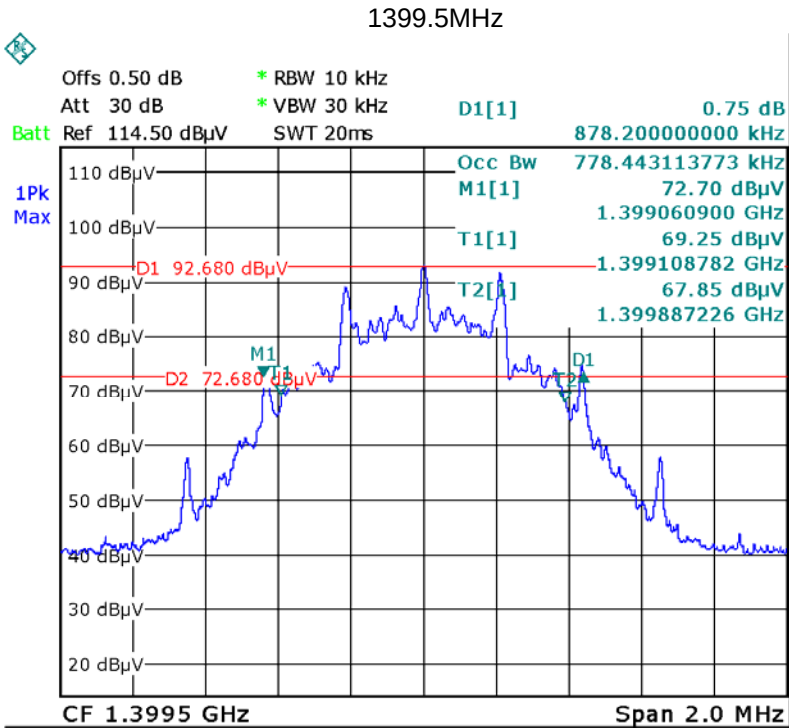
608.66 MHz

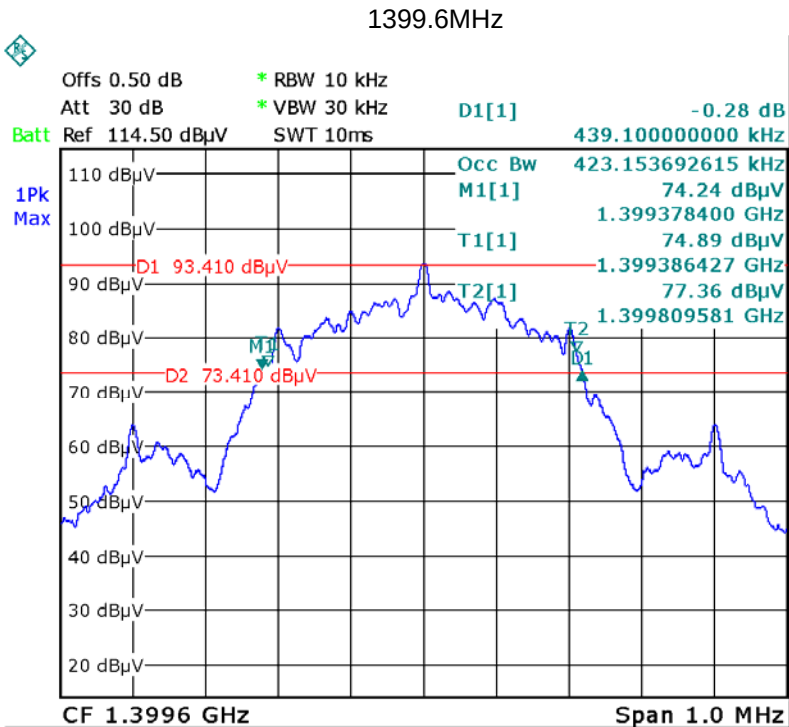
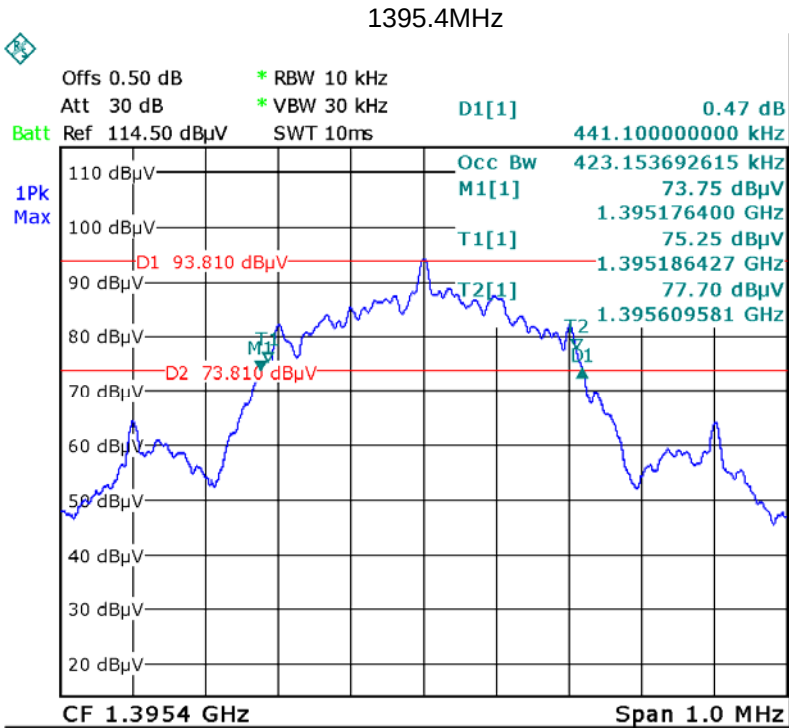


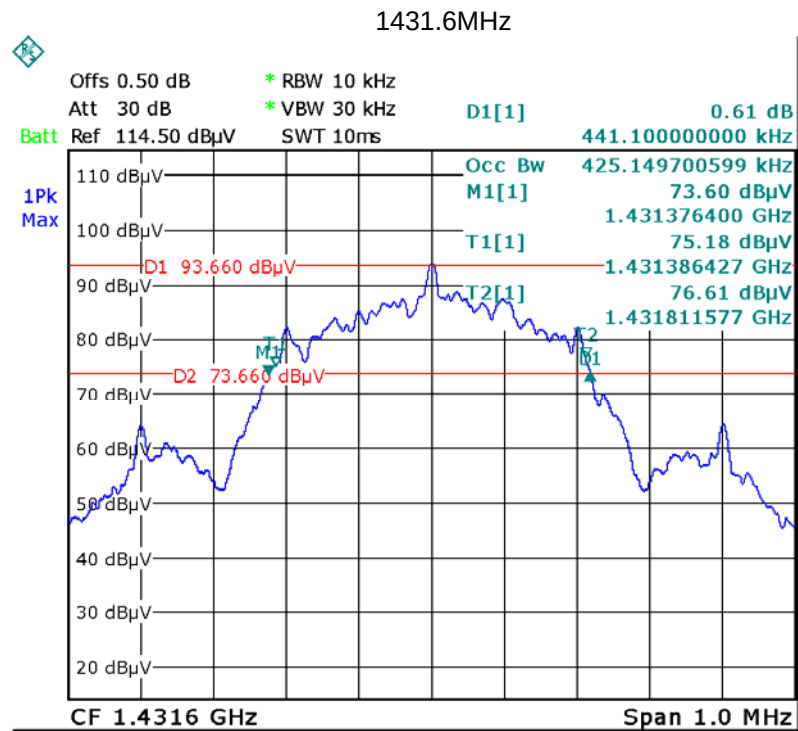
611.06MHz











11 FREQUENCY STABILITY

Test Requirement:	FCC Part 2.1055
Test Method:	ANSI/TIA-603-E-2016 ANSI C63.26:2015
Test Mode:	TX transmitting
Note:	Only the worst data is recorded on the report

11.1 EUT Operation

Operating Environment :

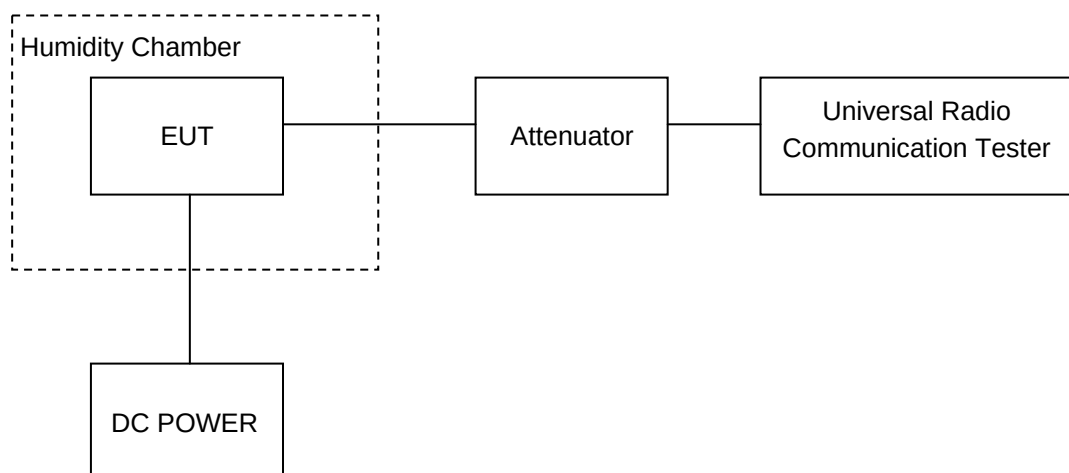
Temperature:	22.9 °C
Humidity:	52.0 % RH
Atmospheric Pressure:	101.3kPa

11.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



11.3 Test Result

Test Frequency:1395.5MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	15	0.0107	100
40		13	0.0093	100
30		1	0.0007	100
20		8	0.0057	100
10		3	0.0021	100
0		3	0.0021	100
-10		1	0.0007	100
-20		3	0.0021	100
-30		3	0.0021	100
20	3.6	13	0.0093	100
20	4.2	15	0.0107	100

Test Frequency:1399.5MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	7	0.0050	100
40		2	0.0014	100
30		5	0.0036	100
20		7	0.0050	100
10		3	0.0021	100
0		3	0.0021	100
-10		8	0.0057	100
-20		3	0.0021	100
-30		3	0.0021	100
20	3.6	16	0.0114	100
20	4.2	-1	-0.0007	100

Test Frequency:1431.5MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	4	0.0028	100
40		4	0.0028	100
30		10	0.0070	100
20		8	0.0056	100
10		0	0.0000	100
0		2	0.0014	100
-10		1	0.0007	100
-20		15	0.0105	100
-30		4	0.0028	100
20	3.6	2	0.0014	100
20	4.2	8	0.0056	100

Test Frequency:1395.4MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	4	0.0029	100
40		15	0.0107	100
30		9	0.0064	100
20		8	0.0057	100
10		14	0.0100	100
0		9	0.0064	100
-10		2	0.0014	100
-20		7	0.0050	100
-30		4	0.0029	100
20	3.6	0	0.0000	100
20	4.2	12	0.0086	100

Test Frequency:1399.6MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	12	0.0086	100
40		6	0.0043	100
30		4	0.0029	100
20		7	0.0050	100
10		10	0.0071	100
0		4	0.0029	100
-10		2	0.0014	100
-20		10	0.0071	100
-30		0	0.0000	100
20	3.6	1	0.0007	100
20	4.2	4	0.0029	100

Test Frequency:1431.6MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	9	0.0063	100
40		16	0.0112	100
30		2	0.0014	100
20		8	0.0056	100
10		7	0.0049	100
0		3	0.0021	100
-10		15	0.0105	100
-20		15	0.0105	100
-30		13	0.0091	100
20	3.6	0	0.0000	100
20	4.2	6	0.0042	100

Test Frequency:608.66MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	14	0.0230	100
40		10	0.0164	100
30		12	0.0197	100
20		9	0.0148	100
10		1	0.0016	100
0		4	0.0066	100
-10		9	0.0148	100
-20		3	0.0049	100
-30		2	0.0033	100
20	3.6	4	0.0066	100
20	4.2	15	0.0246	100

Test Frequency:611.06MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	5	0.0082	100
40		13	0.0213	100
30		13	0.0213	100
20		9	0.0147	100
10		3	0.0049	100
0		18	0.0295	100
-10		9	0.0147	100
-20		2	0.0033	100
-30		4	0.0065	100
20	3.6	1	0.0016	100
20	4.2	6	0.0098	100

Test Frequency:613.46MHz				
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.8	5	0.0082	100
40		9	0.0147	100
30		13	0.0212	100
20		9	0.0147	100
10		5	0.0082	100
0		4	0.0065	100
-10		17	0.0277	100
-20		10	0.0163	100
-30		13	0.0212	100
20	3.6	4	0.0065	100
20	4.2	16	0.0261	100

12 RF Exposure

Remark: refer to MPE test report: WTS19S09066147W003

13 Photographs of test setup and EUT.

Note: Please refer to appendix TM70-Photo.

===== End of Report =====