


FCC PART 95 MEASUREMENT AND TEST REPORT

For

Altis Technology (Hong Kong) Ltd.

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FCC ID: 2AHJMMUAEJJ

Report Type: Original Report	Product Type: Walkie Talkie Two-way Radio
Report Number: RSZ200910001-00A	
Report Date: 2020-10-22	
Jacob Kong 	
Reviewed By: RF Engineer	
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TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
TEST METHODOLOGY	3
MEASUREMENT UNCERTAINTY	4
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	5
DESCRIPTION OF TEST CONFIGURATION	5
EQUIPMENT MODIFICATIONS	5
SUPPORT EQUIPMENT LIST AND DETAILS	5
EXTERNAL I/O CABLE.....	5
BLOCK DIAGRAM OF TEST SETUP	5
SUMMARY OF TEST RESULTS	6
TEST EQUIPMENT LIST	7
FCC §1.1307(b) & §2.1093 - RF EXPOSURE.....	8
APPLICABLE STANDARD	8
FCC §2.1046, §95.2767 - RF OUTPUT POWER.....	9
APPLICABLE STANDARD	9
TEST PROCEDURE	9
TEST DATA	9
FCC §2.1049, §95.2773 & §95.2779(a) - OCCUPIED BANDWIDTH AND EMISSION MASK	11
APPLICABLE STANDARD	11
TEST PROCEDURE	12
TEST DATA	12
FCC §2.1051 & §95.2779 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS	15
APPLICABLE STANDARD	15
TEST PROCEDURE	15
TEST DATA	15
FCC §2.1053 & §95.2779 - RADIATED SPURIOUS EMISSION	18
APPLICABLE STANDARD	18
TEST PROCEDURE	18
TEST DATA	18
FCC§2.1055 (d), §95.2765 - FREQUENCY STABILITY	20
APPLICABLE STANDARD	20
TEST PROCEDURE	20
TEST DATA	20
FCC §2.1047 & §95.2775 - MODULATION CHARACTERISTIC.....	22
APPLICABLE STANDARD	22
TEST PROCEDURE	22
TEST DATA	22

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

Product	Walkie Talkie Two-way Radio
Tested Model	MU1500
Multiple Models	MU1500-2, MU1500-BCH6
Model Difference	Refer to the DoS letter
Frequency Range	151.820 MHz, 151.880 MHz, 151.940 MHz, 154.570 MHz, 154.600 MHz
Transmit Power (ERP)	32.67 dBm (151.88 MHz) 32.62 dBm (154.6 MHz)
Modulation Technique	FM
Antenna Specification	External Antenna, 1.8dBi
Voltage Range	DC 3.7V from battery
Date of Test	2020-09-18 to 2020-10-22
Sample serial number	RSZ200910001-RF-S1 (Assigned by BACL, Shenzhen)
Received date	2020-09-10
Sample/EUT Status	Good condition

Objective

This report is in accordance with Part 2 and Part 95, Subpart J of the Federal Communication Commissions rules.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with Part 95 Subpart A, Subpart J of the Federal Communication Commissions rules with TIA-603-E, Land Mobile FM or PM-Communications Equipment-Measurement and Performance Standards.ANSI C63.26-2015, American National Standard for Compliance testing of Transmitters Used in Licensed Radio Services.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1 °C
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user).

Note:

Transmitter channel frequencies are 151.820 MHz, 151.880 MHz, 151.940 MHz, 154.570 MHz and 154.600 MHz.

Equipment Modifications

No modification was made to the EUT tested.

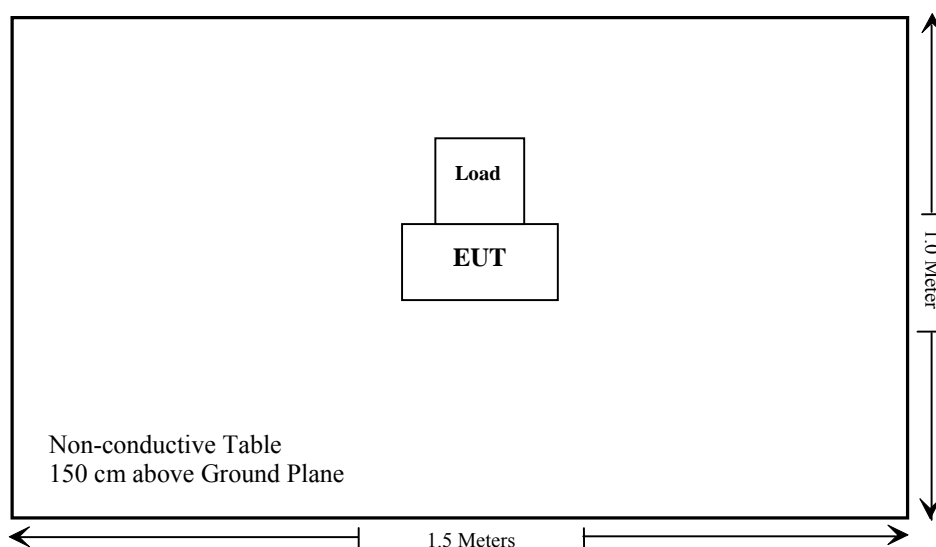
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Unknown	Load	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From / Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§1.1307(b) & §2.1093	RF EXPOSURE	Compliance
§2.1046, §95.2767	RF Output Power	Compliance
§2.1049, §95.2773 & §95.2779(a)	Occupied Bandwidth and Emission Mask	Compliance
§2.1051 & §95.2779	Spurious Emission at Antenna Terminal	Compliance
FCC §2.1053 & §95.2779	Radiated Spurious Emission	Compliance
§2.1055 (d), §95.2765	Frequency Stability	Compliance
§2.1047 & §95.2775	Modulation Characteristic	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
COM-POWER	Dipole Antenna	AD-100	721027	NCR	NCR
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 4	EC-007	2019/11/29	2020/11/28
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
A.H.System	Horn Antenna	SAS-200/571	135	2018/09/01	2021/08/31
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
RF Conducted test					
HP Agilent	RF Communication test set	8920A	3325UC0859	2020/07/31	2021/07/30
HP	Microwave frequency counter	5343A	2232A00827	2019/08/29	2022/08/29
Fluke	Digital Multimeter	287	19000011	2020/07/23	2021/07/22
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2019/12/21	2020/12/21
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
Unknown	notch filter	SKU 5G3	ATR0205-04- 13	2020/04/20	2021/04/20
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200982	2020/08/04	2021/08/03
Ducommun technologies	RF Cable	RG-214	3	2020/05/22	2021/05/22

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1307(b) & §2.1093 - RF EXPOSURE

Applicable Standard

According to FCC §1.1307(b) and §2.1093, portable device operates Part 95 should be subjected to routine environmental evaluation for RF exposure prior or equipment authorization or use.

Result: Compliance.

Please refer to SAR Report Number: RSZ200910001-SA.

FCC §2.1046, §95.2767 - RF OUTPUT POWER**Applicable Standard**

Each MURS transmitter type must be designed such that the transmitter power output does not exceed 2 Watts under normal operating conditions

Test Procedure

Conducted RF Output Power:

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

R B/W Video B/W
100 kHz 300 kHz

Test Data**Environmental Conditions**

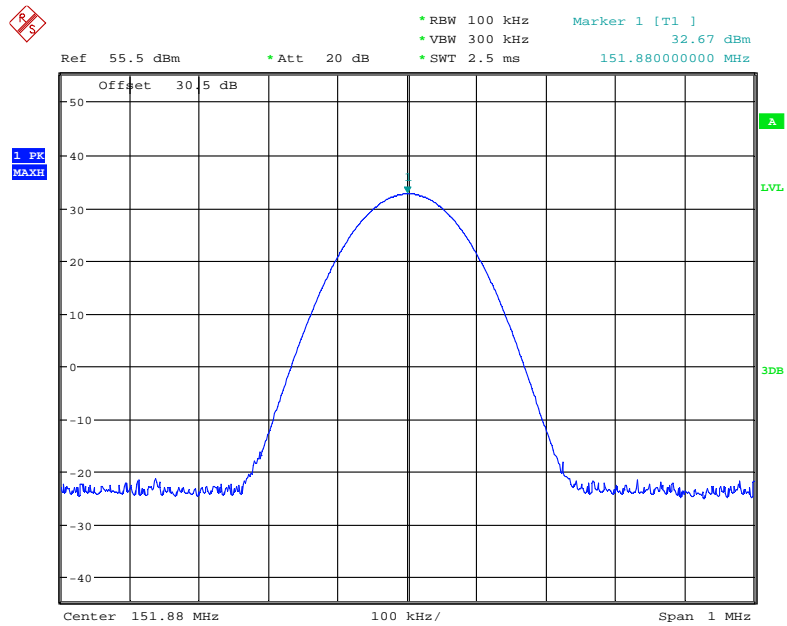
Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by James Fu on 2020-09-18.

Test Mode: Transmitting

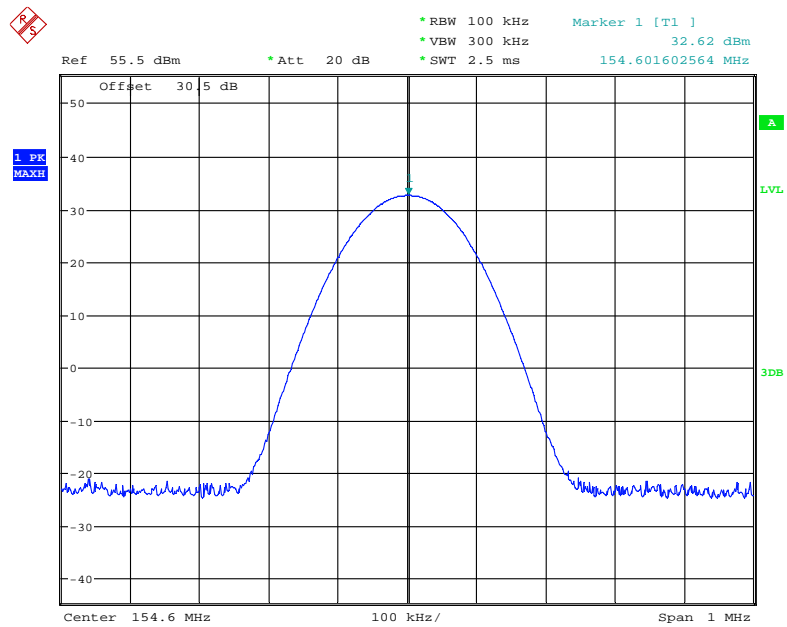
Item	Frequency (MHz)	Output Power		Limit (W)	Result
		(dBm)	(W)		
MURS	151.88	32.67	1.85	2	Pass
MURS	154.6	32.62	1.83	2	Pass

151.88 MHz



Date: 18.SEP.2020 21:01:34

154.6 MHz



Date: 18.SEP.2020 20:59:18

FCC §2.1049, §95.2773 & §95.2779(a) - OCCUPIED BANDWIDTH AND EMISSION MASK

Applicable Standard

According to §95.2773, the MURS transmitter type must be designed to meet the emission bandwidth limitations in this section:

- (a) The occupied bandwidth of emissions transmitted on the center frequencies 151.820 MHz, 151.880 MHz, and 151.940 MHz must not exceed 11.25 kHz.
- (b) The occupied bandwidth of emissions transmitted on the center frequencies 154.570 MHz and 154.600 MHz must not exceed 20.0 kHz.
- (c) The occupied bandwidth of type A3E emissions must not exceed 8.0 kHz.

According to § 95.2779(a), for transmitters designed to operate in the MURS, transmitters shall comply with the following:

Channel center frequencies (MHz)	Paragraphs
151.820, 151.880 and 151.940	(1), (2).
154.570 & 154.600, with audio filter	(3), (4), (7).
154.570 & 154.600, without audio filter	(5), (6), (7).

(1) Each MURS transmitter type that transmits F3E or G3E emissions on 154.570 MHz or 154.600 MHz and incorporates an audio filter satisfying the requirements of §95.2775 in its design may comply with the less stringent unwanted emissions attenuation requirements set forth in paragraphs (b)(3), (4), and (7) of this section.

(2) Each MURS transmitter type that transmits on 154.570 MHz or 154.600 MHz, but does not incorporate an audio filter satisfying the requirements of §95.2775 in its design, must comply with the unwanted emissions attenuation requirements set forth in paragraphs (b)(5) through (7) of this section.

(b) Attenuation requirements. The power of unwanted emissions must be attenuated below the transmitter output power in Watts (P) by at least:

(1) $7.27(f_d - 2.88 \text{ kHz}) \text{ dB}$ on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 5.625 kHz, but not more than 12.5 kHz.

(2) $50 + 10 \log (P) \text{ dB}$ or 70 dB, whichever is the lesser attenuation, on any frequency removed from the channel center frequency by more than 12.5 kHz.

(3) 25 dB on any frequency removed from the channel center frequency by more than 10 kHz, but not more than 20 kHz.

(4) 35 dB on any frequency removed from the channel center frequency by more than 20 kHz, but not more than 50 kHz.

(5) $83 \log (f_d \div 5)$ dB on any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) that is more than 5 kHz, but not more than 10 kHz.

(6) $29 \log (f_d \div 11)$ dB or 50 dB, whichever is the lesser attenuation on any frequency removed from the channel center frequency by a displacement frequency (f_d in kHz) that is more than 10 kHz, but not more than 50 kHz.

(7) $43 + 10 \log(P)$ dB on any frequency removed from the channel center frequency by more than 50 kHz.

(c) Measurement bandwidths. The power of unwanted emissions in the frequency bands specified in paragraphs (b)(1) and (3) through (6) of this section is measured with a reference bandwidth of 300 Hz. The power of unwanted emissions in the frequency ranges specified in paragraphs (b)(2) and (7) of this section is measured with a reference bandwidth of at least 30 kHz.

Test Procedure

ANSI C63.26-2015

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

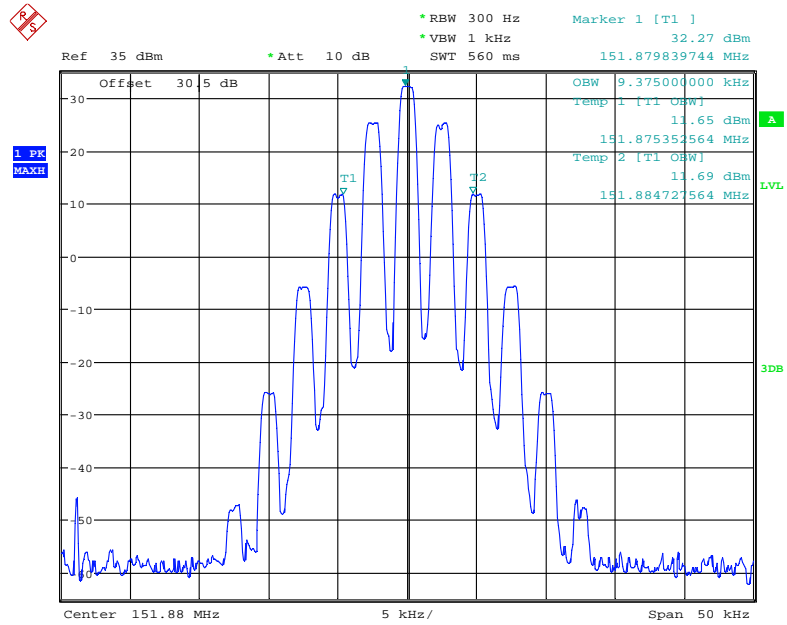
The testing was performed by James Fu from 2020-09-22 to 2020-10-22.

Test Mode: Transmitting

Item	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
MURS	151.88	9.375	11.25	Pass
MURS	154.6	11.22	20	Pass

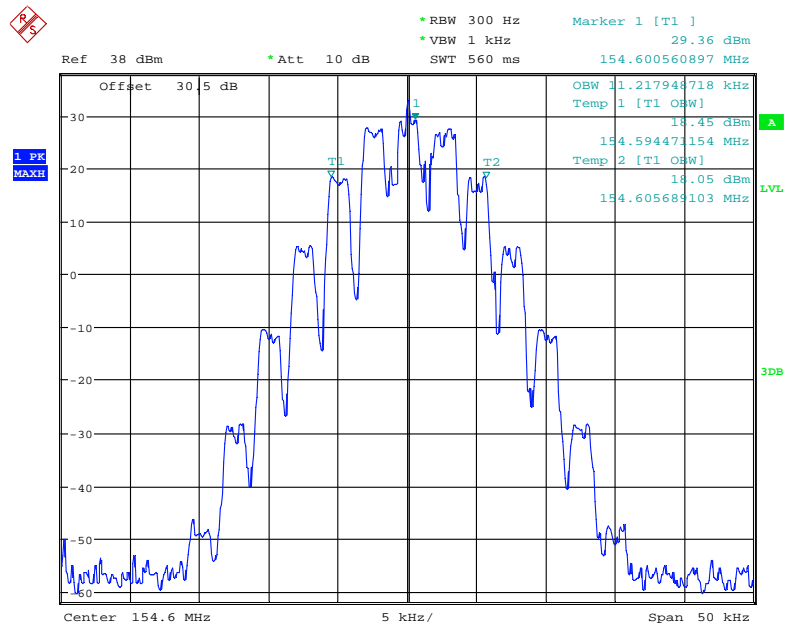
Occupied Bandwidth:

151.88 MHz



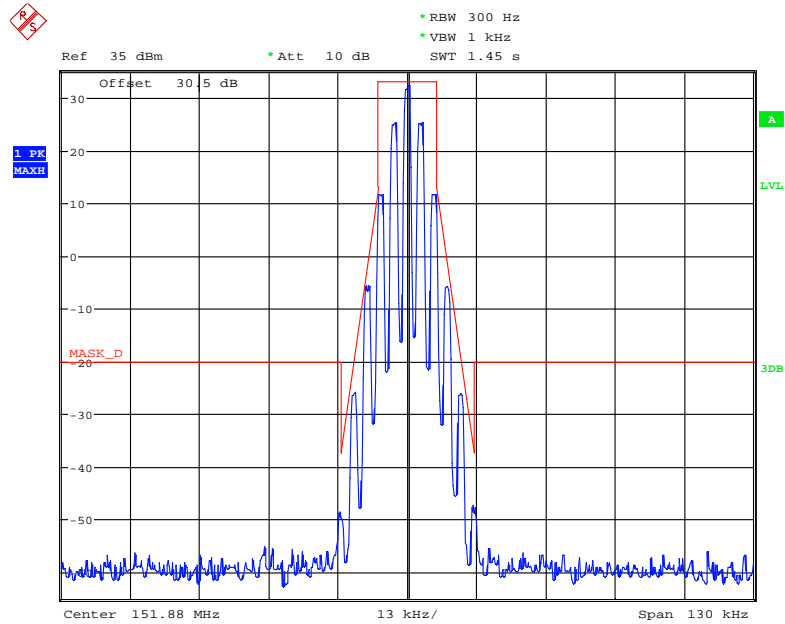
Date: 22.SEP.2020 20:08:39

154.6 MHz

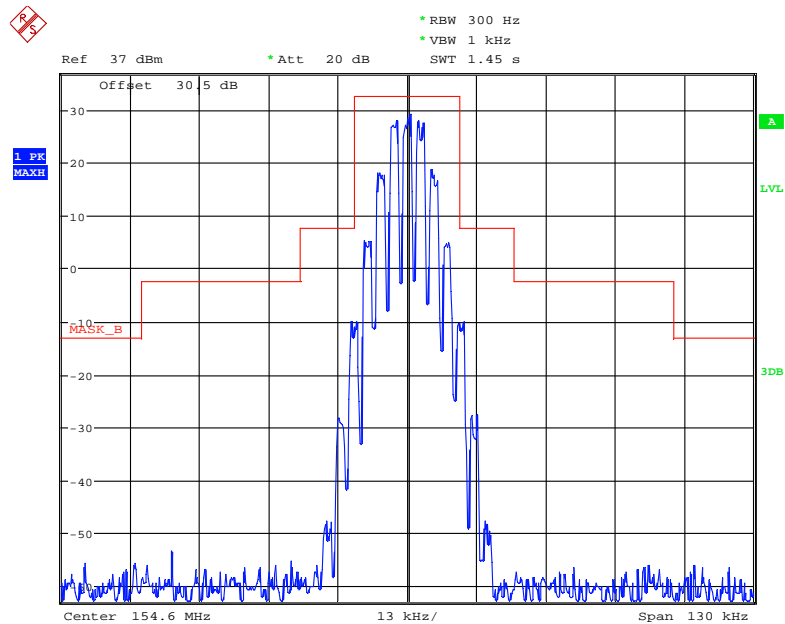


Date: 29.SEP.2020 10:54:59

Emission Mask: (Note: EUT equipped with audio filter)

151.88 MHz

Date: 22.SEP.2020 19:56:09

154.6 MHz

Date: 22.OCT.2020 13:44:30

FCC §2.1051 & § 95.2779 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

According to §95.2779, for transmitters designed to operate in the MURS, transmitters shall comply with the following:

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001)-the absolute level

For 151.820 MHz, 151.880 MHz and 151.940 MHz:

Spurious attenuation limit in dB = 50+10 Log₁₀ (power out in Watts)

For 154.570 MHz and 154.600 MHz:

Spurious attenuation limit in dB = 43+10 Log₁₀ (power out in Watts)

Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1GHz, and 1MHz for above 1GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Data

Environmental Conditions

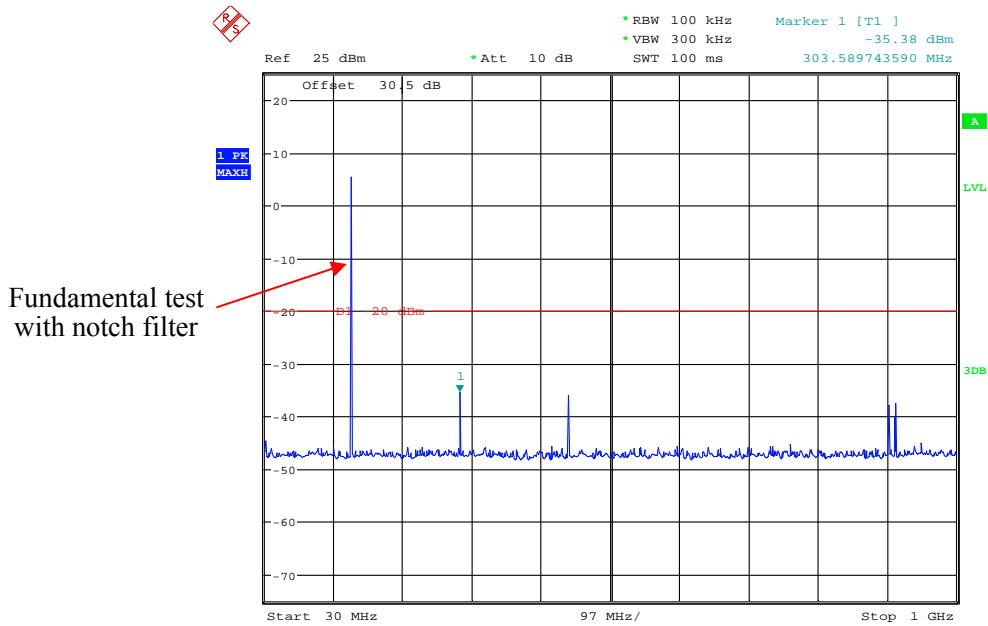
Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by James Fu on 2020-09-18.

Test Mode: Transmitting

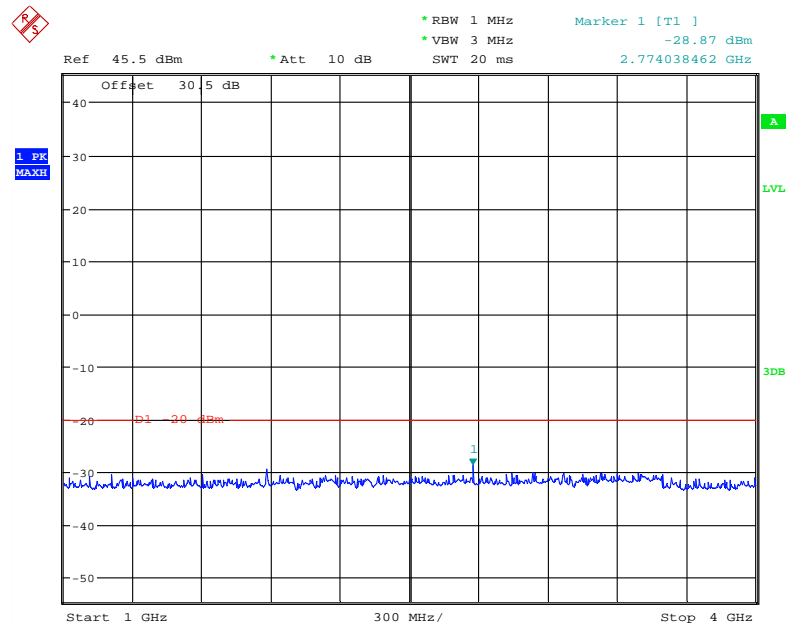
Please refer to the following plots.

30 MHz – 1 GHz, 151.88 MHz



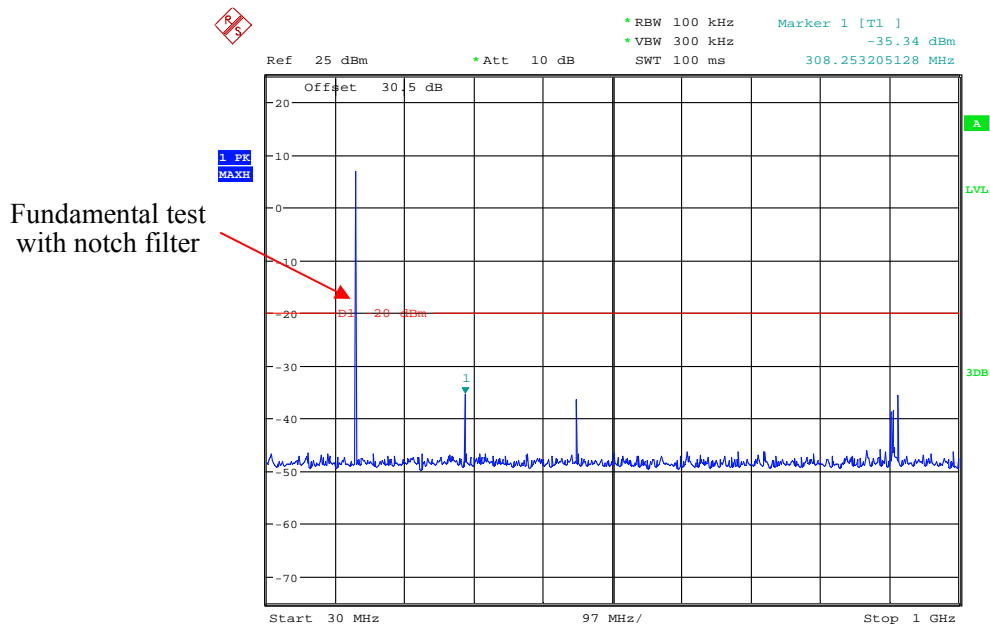
Date: 18.SEP.2020 21:55:51

1 GHz – 4 GHz, 151.88 MHz



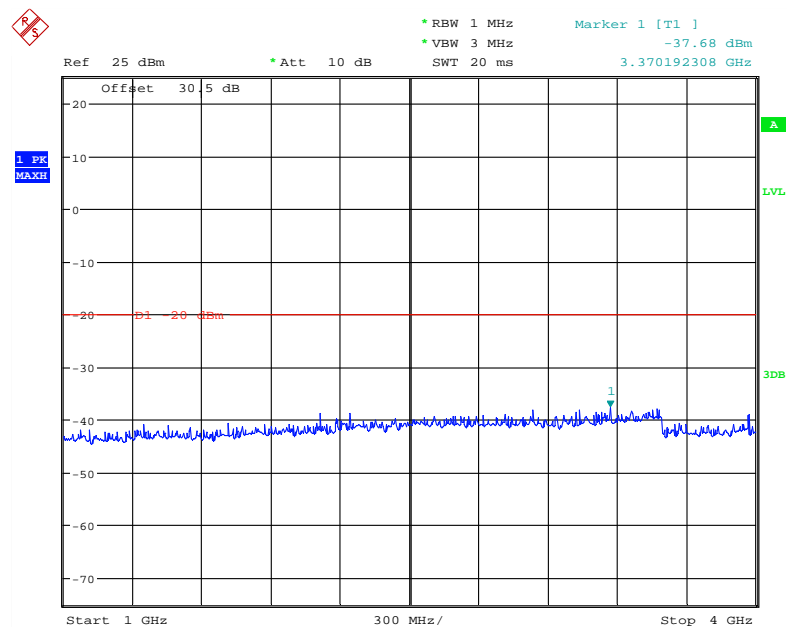
Date: 18.SEP.2020 21:51:11

30 MHz – 1 GHz, 154.6 MHz



Date: 18.SEP.2020 21:57:03

1 GHz – 4 GHz, 154.6 MHz



Date: 18.SEP.2020 21:57:23

FCC §2.1053 & §95.2779 - RADIATED SPURIOUS EMISSION**Applicable Standard**

FCC §2.1053 & §95.2779

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

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.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

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 (TXpwr in Watts/0.001)-the absolute level

For 151.820 MHz, 151.880 MHz and 151.940 MHz:

Spurious attenuation limit in dB = 50+10 Log₁₀ (power out in Watts)

For 154.570 MHz and 154.600 MHz:

Spurious attenuation limit in dB = 43+10 Log₁₀ (power out in Watts)

Test Data**Environmental Conditions**

Temperature:	28.9 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Harris He on 2020-09-30 for below 1GHz and Lovan Liang on 2020-09-30 for above 1GHz.

Test Mode: Transmitting

Channel: 151.88MHz

Indicated		Table Angle Degree	Test Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	Receiver Reading (dBuV)		Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
303.76	72.36	259	1.6	H	-29.1	0.71	0.0	-29.81	-20	9.81
303.76	61.89	226	1.3	V	-38.0	0.71	0.0	-38.71	-20	18.71
455.64	61.61	134	1.5	H	-35.3	0.91	0.0	-36.21	-20	16.21
455.64	45.68	190	1.3	V	-49.6	0.91	0.0	-50.51	-20	30.51
1063.16	56.74	78	1.4	H	-52.0	1.60	6.20	-47.40	-20	27.40
1063.16	54.21	12	1.4	V	-55.4	1.60	6.20	-50.80	-20	30.80

Channel: 154.6 MHz

Indicated		Table Angle Degree	Test Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
Frequency (MHz)	Receiver Reading (dBuV)		Height (m)	Polar (H/V)	Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
309.2	73.52	242	2.4	H	-27.0	0.71	0.0	-27.71	-13	14.71
309.2	61.82	345	2.3	V	-38.0	0.71	0.0	-38.71	-13	25.71
463.8	61.02	310	1.6	H	-35.9	0.91	0.0	-36.81	-13	23.81
463.8	46.25	348	2.0	V	-49.0	0.91	0.0	-49.91	-13	36.91
1082.20	55.54	1	1.8	H	-53.2	1.60	6.20	-48.60	-13	35.60
1082.20	53.84	354	1.4	V	-55.7	1.60	6.20	-51.10	-13	38.10

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

Note 2: Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

FCC§2.1055 (d), §95.2765 - FREQUENCY STABILITY**Applicable Standard**

According to FCC §2.1055(a) (1), the frequency stability shall be measured with variation of ambient temperature from -30 °C to +50 °C, and according to FCC 2.1055(d) (2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

(a) MURS transmitters that operate with an emission bandwidth of 6.25 kHz or less must be designed such that the carrier frequencies remain within ± 2.0 parts-per-million (ppm) of the channel center frequencies specified in §95.2763 during normal operating conditions.

(b) MURS transmitters that operate with an emission bandwidth greater than 6.25 kHz must be designed such that the carrier frequencies remain within ± 5.0 ppm of the channel center frequencies specified in §95.2763 during normal operating conditions.

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 a Frequency Counter 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 Frequency Counter.

Frequency Stability vs. Voltage:

1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

The output frequency was recorded for each voltage.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by James Fu on 2020-09-18.

Test Mode: Transmitting

MURS: 151.88 MHz

Reference Frequency: 151.88 MHz, Limit: ± 5 ppm			
Environment Temperature (°C)	Voltage Supplied (V _{DC})	Measurement Frequency (MHz)	Frequency Error (ppm)
Frequency Stability Ver. Temperature			
50	3.7	151.879956	-0.290
40	3.7	151.880068	0.448
30	3.7	151.880073	0.481
20	3.7	151.880051	0.336
10	3.7	151.880082	0.540
0	3.7	151.880076	0.500
-10	3.7	151.880095	0.625
-20	3.7	151.880104	0.685
-30	3.7	151.88049	3.226
Frequency Stability Ver. Input Voltage			
20	3.3	151.880082	0.540
20	4.2	151.880091	0.599

MURS: 154.6 MHz

Reference Frequency: 154.6 MHz, Limit: ± 5 ppm			
Environment Temperature (°C)	Voltage Supplied (V _{DC})	Measurement Frequency (MHz)	Frequency Error (ppm)
Frequency Stability Ver. Temperature			
50	3.7	154.600039	0.252
40	3.7	154.600061	0.395
30	3.7	154.600063	0.408
20	3.7	154.599952	-0.310
10	3.7	154.600071	0.459
0	3.7	154.600072	0.466
-10	3.7	154.600081	0.524
-20	3.7	154.600082	0.530
-30	3.7	154.600058	0.375
Frequency Stability Ver. Input Voltage			
20	3.3	154.600066	0.427
20	4.2	154.600072	0.466

FCC §2.1047 & §95.2775 - MODULATION CHARACTERISTIC**Applicable Standard**

Per FCC §2.1047 and §95.2775: The audio filter must be between the modulation limiter and the modulated stage of the transmitter. And at any frequency (f in kHz) between 3 and 15 kHz, the filter must have an attenuation of at least $40 \log(f/3)$ dB more than the attenuation at 1 kHz. Above 15 kHz, it must have an attenuation of at least 28 dB more than the attenuation at 1 kHz.

Test Procedure

Test Method: ANSI C63.26-2015

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by James Fu on 2020-09-18.

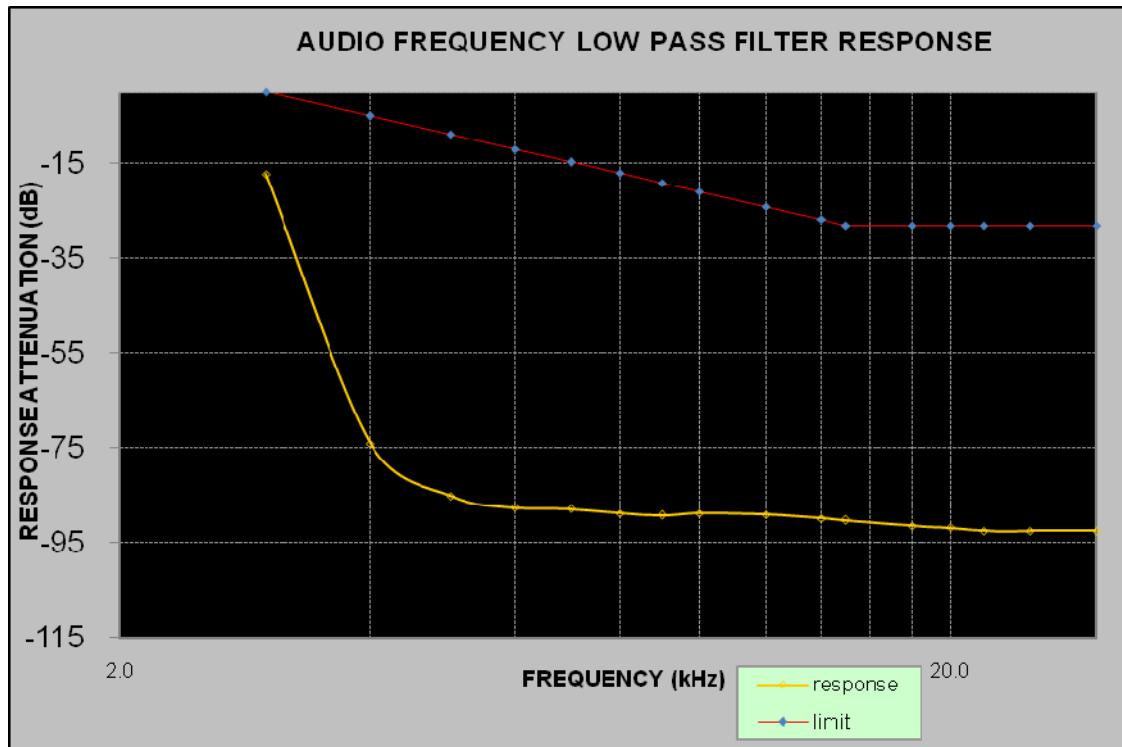
Please refer to the following tables and plots.

Test Mode: Transmitting

Audio frequency lows pass filter response

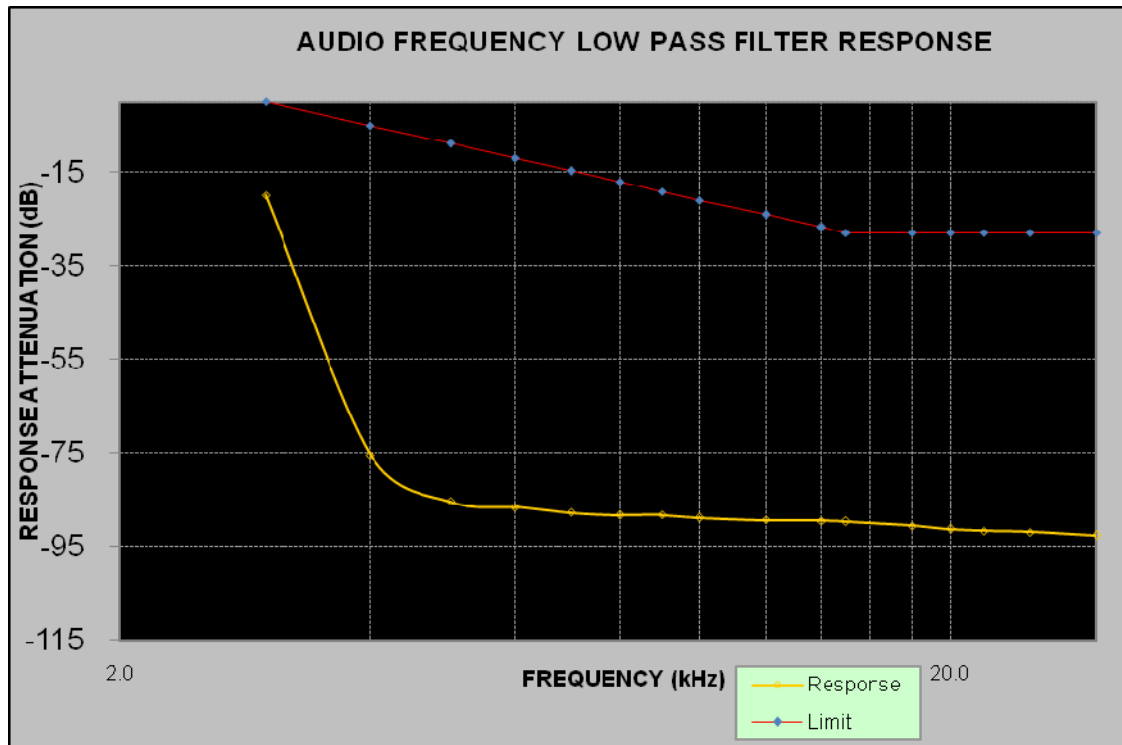
Carrier Frequency: 151.88MHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-17.3	0.0
4.0	-74.1	-5.0
5.0	-85.1	-8.9
6.0	-87.6	-12.0
7.0	-87.8	-14.7
8.0	-88.8	-17.0
9.0	-89.3	-19.1
10.0	-88.8	-20.9
12.0	-89.1	-24.1
14.0	-89.8	-26.8
15.0	-90.3	-28.0
18.0	-91.5	-28.0
20.0	-91.8	-28.0
22.0	-92.5	-28.0
25.0	-92.5	-28.0
30.0	-92.6	-28.0



Carrier Frequency: 154.6MHz

Audio Frequency (kHz)	Response Attenuation (dB)	Limit (dB)
1.0	0.0	/
3.0	-19.9	0.0
4.0	-75.4	-5.0
5.0	-85.3	-8.9
6.0	-86.6	-12.0
7.0	-87.8	-14.7
8.0	-88.3	-17.0
9.0	-88.3	-19.1
10.0	-88.8	-20.9
12.0	-89.4	-24.1
14.0	-89.5	-26.8
15.0	-89.7	-28.0
18.0	-90.6	-28.0
20.0	-91.2	-28.0
22.0	-91.7	-28.0
25.0	-91.8	-28.0
30.0	-92.6	-28.0



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