FCC CFR47 PART 25

CERTIFICATION TEST REPORT

FOR

Multi Path Blue Force Tracker

MODEL NUMBER : mBFT17(V)

FCC ID: 2AL3AHDJC-1801

REPORT NUMBER: 4788319772-E2V3

ISSUE DATE: MAR 05, 2018

Prepared for
Hyundai J-Comm. Co. Ltd
27, Sagimakgol-ro 105beon-gil, Jungwon-gu, Seongnam-Si,
GYEONGGI-DO, 13201, KOREA

Prepared by
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Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902

ACCREDITED
Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/30/18	Initial issue	Hyunsik Yun
V2	02/26/18	Revised missed typo and added OBW	Hyunsik Yun
V3	03/05/18	Change the FCC ID and Report No.	Hyunsik Yun

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_25
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TABLE OF CONTENTS

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_25
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Hyundai J-Comm. Co. Ltd

EUT DESCRIPTION: Multi Path Blue Force Tracker

MODEL NUMBER: mBFT17(V)

SERIAL NUMBER: 0008

DATE TESTED: JAN 18, 2018 – JAN 23, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 25	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Hyunsik Yun
Laboratory Engineer
UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 25
2. FCC CFR 47 Part 2
3. ANSI TIA-603-E
4. KDB 971168 D01 Power Meas License Digital Systems v03

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☐ Chamber 1
☒ Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Multi Path Blue Force Tracker.
This test report addresses the Satellite communication operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum radiated EIRP output powers as follows:

Part 25		
Frequency Range	Radiated	
[MHz]	Avg [dBm]	Avg [mW]
1 616~1 626	40.72	11 803.21

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a external antenna for the [List the bands supported] with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
1 616-1 626 MHz	5

Note: Peak Gain (dBi) = 2 dBic + 3 dB

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5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List					
No	Description	Manufacturer	Model	Serial Number	FCC ID
1	Adapter	Hyundai J.Comm Co.,Ltd.	Blue Force Tracker17/V	0024	N/A
2	External 3G modem	Hyundai J.Comm Co.,Ltd.	mBFT17(V)-WCDMA	N/A	2AL3AHDJC-1802

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	2-PIN	Shielded	1 m	N/A
2	AC Power	2	AC	Shielded	1.1 m	N/A

TEST SETUP

The EUT is the unit with external 3G modem(Optional accessory) during the tests.
Test software exercised the EUT to enable continuouse Tx mode.

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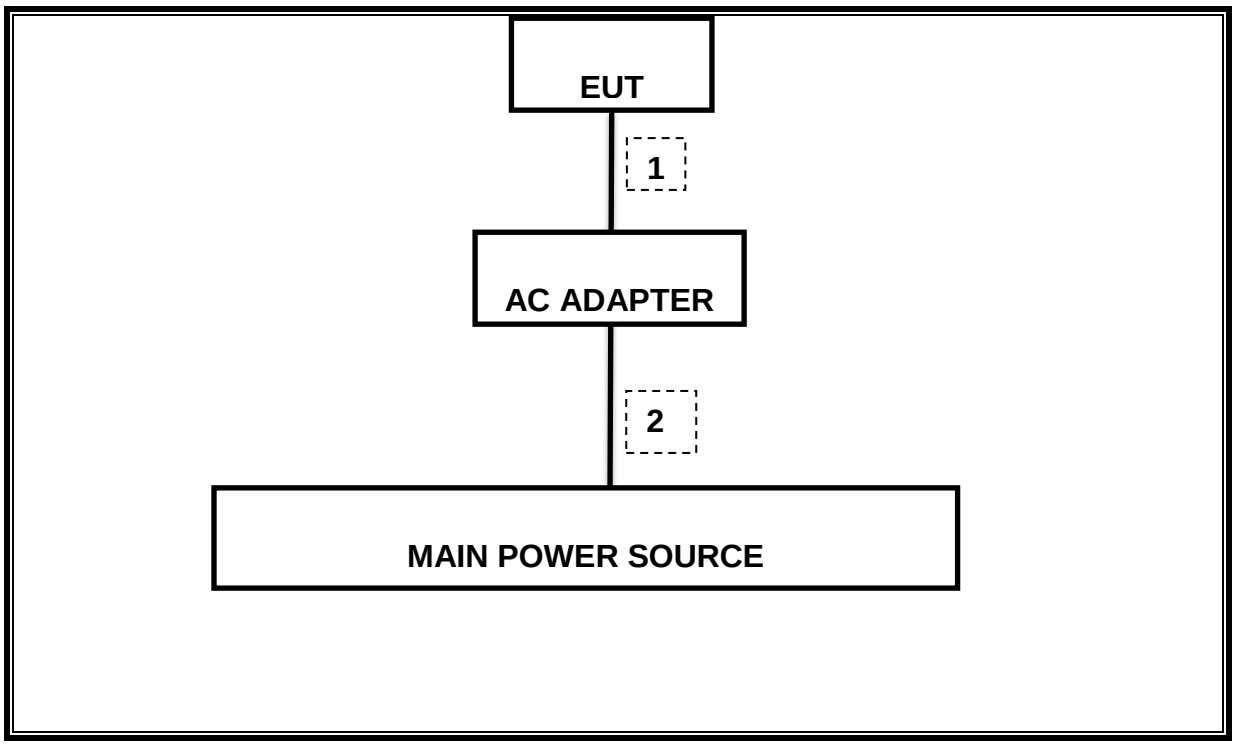
SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Horn, 40 GHz	ETS	3116C	00166155	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	11-13-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-14-19
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-10-19
Antenna, Horn, 18 GHz	ETS	3117	00168724	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00168717	05-31-19
DC Power Supply	Agilent / HP	E3640A	MY54226395	08-07-18
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-09-18
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-18
Preamplifier	ETS	3115-PA	00167475	08-09-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-08-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-08-18
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	08-09-18
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	08-08-18
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	08-09-18
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	08-08-18
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	08-09-18
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	08-08-18
Attenuator	PASTERNACK	PE7087-10	A009	08-08-18
Attenuator	SRTechnology	F04-N1330-01	14020602	08-01-18

7. REFERENCE MEASUREMENT RESULTS

7.1. OUTPUT POWER

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss(30 dB + 10 dB attenuator) was entered as an offset in the power meter to allow for direct reading of power. Duty cycle correction factor is already added to the average output power results.

Results

Channel	Frequency	Meas Power
	[MHz]	[dBm]
Low	1616.020803	36.89
Mid	1621.020803	36.94
High	1625.979167	37.01
Worst		37.01

8. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Note
2.1049	Occupied Band width	N/A	Conducted	N/A	30.969 kHz
25.202(f)	Emission Limit	See module test report		N/P	See module test report
25.216	Limits on Emissions from Mobile Earth stations for protection of aeronautical Radionavigation-Satellite Service	See module test report		N/P	See module test report
2.1047(d)	Modulation charateristics	N/A		N/P	See module test report
25.202(d) 2.1055	Frequency Stability	10 ppm		N/P	See module test report
25.204(a)	Equivalent Isotropic Radiated Power	40dBW(70dBm)	Radiated	Pass	40.72 dBm
25.202(f)	Emission Limit	See the section 8.2		Pass	-16.4 dBm

N/P : Not performed

- NOTE

All conducted test didn't performed because conducted output power of this device is in the module's conducted power tolerance range(36 dBm ~ 38 dBm). Also module was installed on this device as same condition with original approval condition.

Please refer to the original approval FCC Part 25 test report.
(FCC ID : Q639523, Document TRA-006099-00-W-US1)

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9. CONDUCTED TEST RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band.

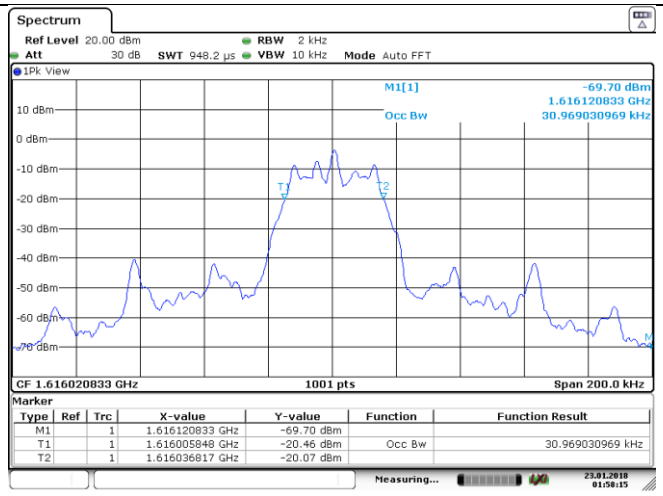
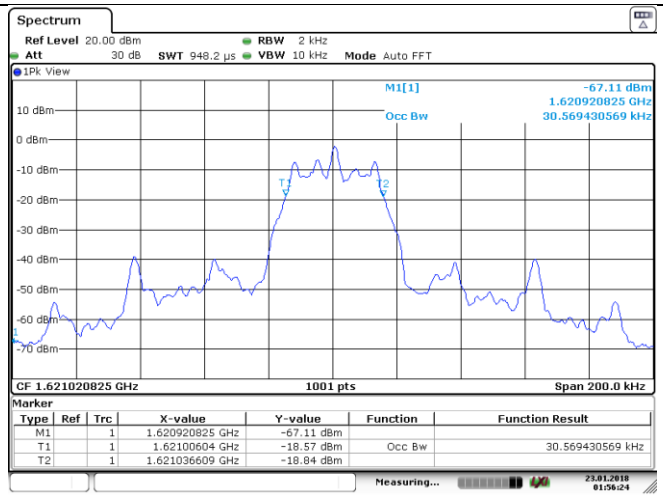
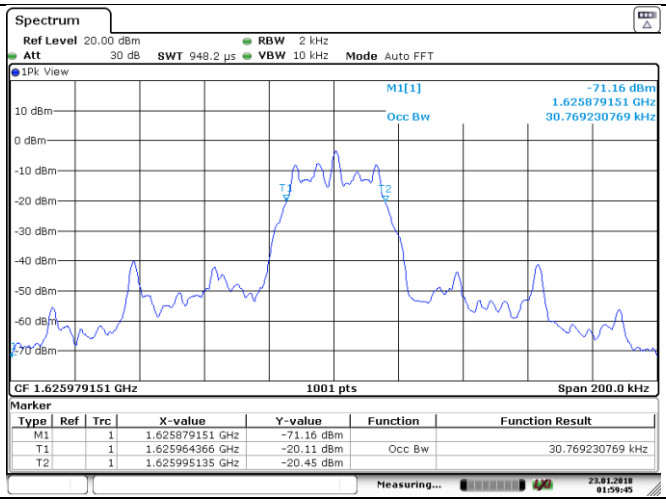
(KDB 971168 D01 Power Meas License Digital Systems v03)

9.1.1. OCCUPIED BANDWIDTH RESULTS

WCDMA

Mode	Channel	f [MHz]	99% BW [kHz]
Satellite	1	1616.0208033	30.969
	121	1621.0208033	30.569
	240	1625.979167	30.769

9.1.2. OCCUPIED BANDWIDTH PLOTS

Low	
Mid	
	

10. RADIATED TEST RESULTS

10.1. RADIATED POWER (EIRP)

RULE PART(S)

FCC: §2.1046, §25.204(a)

LIMITS

25.204 - (a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+ 40 dBW in any 4 kHz band for θ ≤0°

+ 40 + 3θ dBW in any 4 kHz band for 0° <θ ≤5°

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.17; ESU40 setting reference to 971168 D01 v03

For peak power measurement with a ESU40:

a) Set the RBW ≥ OBW; b) Set VBW ≥ 3 × RBW; c) Set span ≥ 2 x RBW; d) Sweep time = auto couple; e) Detector = peak; f) Ensure that the number of measurement points ≥ span/RBW; g) Trace mode = max hold;

For average power measurement with a ESU40:

a) Set span to at least 1.5 times the OBW; b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz; c) Set VBW ≥ 3 x RBW; d) Set number of points in sweep ≥ 2 × span / RBW; e) Sweep time = auto-couple; f) Detector = RMS (power averaging); g) Use free run trigger If burst duty cycle ≥ 98; h) Use trigger to capture bursts If burst duty cycle < 98; i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode. j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function.

TEST RESULTS

10.1.1. ERP/EIRP Results

Satellite

Mode	Channel	f [MHz]	ERP / EIRP	
			[dBm]	[mW]
Satellite	1	1616.0208033	39.15	8222.43
	121	1621.0208033	39.82	9594.01
	240	1625.979167	40.72	11803.21

10.1.2. ERP/EIRP DATA

Satellite

Satellite

UL Verification Services, Inc.
High Frequency Substitution Measurement

Company: HYUNDAI J-COMM. CO., LTD.
Project #: 4788319770
Date: 2018-01-19
Test Engineer: HyunSik Yun
Configuration: EUT Only, X Position
Location: Chamber 2
Mode: Part25 FUND

Test Equpment:
Receiving: Horn 3117[00168724], and Chamber 2 SMA Cables
Substitution: Horn 3115[00161451], 3m N-type Cable

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch								
1616.02	29.77	V	4.2	8.9	34.51	70.0	-35.5	
1616.02	34.41	H	4.2	8.9	39.15	70.0	-30.8	
Mid Ch								
1621.02	31.42	V	4.2	9.0	36.19	70.0	-33.8	
1621.02	35.05	H	4.2	9.0	39.82	70.0	-30.2	
High Ch								
1625.98	31.57	V	4.2	9.0	36.36	70.0	-33.6	
1625.98	35.92	H	4.2	9.0	40.72	70.0	-29.3	

10.2. FIELD STRENGTH OF SPURIOUS RADIATION

RULE PART(S)

FCC: §2.1053, §25.202(f)

LIMIT

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth;
2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth;
3) 43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth.

TEST PROCEDURE

ANSI / TIA / EIA 603 E Clause 2.2.12; ESU40 setting reference to 971168 D01 v03

For peak power measurement with a ESU40:

a) Set the RBW = 100 KHz for emission below 1GHz and 1MHz for emissions above 1GHz

b) Set VBW ≥ 3 × RBW;

c) Set span ≥ 1.5 times the OBW;

d) Sweep time = auto couple;

e) Detector = peak ;

f) Ensure that the number of measurement points ≥ span/RBW;

g) Trace mode = max hold;

RESULTS

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10.2.1. SPURIOUS RADIATION PLOTS

Satellite

Satellite

UL Verification Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company:	HYUNDAI J-COMM. CO., LTD.
Project #:	4788319770
Date:	2018-01-20 ~ 2018-01-23
Test Engineer:	HyunSik Yun
Configuration:	EUT Only, X Position
Location:	Chamber 2
Mode:	Part25 Harmonics

f MHz	SG reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
Low Ch, 1616.02MHz									
3232.00	6.9	V	3.0	39.4	1.0	-31.5	-13.0	-18.5	
4848.00	10.3	V	3.0	39.8	1.0	-28.4	-13.0	-15.4	
6464.00	13.1	V	3.0	39.9	1.0	-25.7	-13.0	-12.7	
8080.10	14.6	V	3.0	39.1	1.0	-23.5	-13.0	-10.5	
9696.12	14.8	V	3.0	38.7	1.0	-22.9	-13.0	-9.9	
11312.14	11.8	V	3.0	38.5	1.0	-25.7	-13.0	-12.7	
12928.16	14.7	V	3.0	39.4	1.0	-23.6	-13.0	-10.6	
14544.18	7.9	V	3.0	40.9	1.0	-32.0	-13.0	-19.0	
3232.00	8.3	H	3.0	39.4	1.0	-30.1	-13.0	-17.1	
4848.00	14.3	H	3.0	39.8	1.0	-24.5	-13.0	-11.5	
6464.00	12.7	H	3.0	39.9	1.0	-26.2	-13.0	-13.2	
8080.10	14.5	H	3.0	39.1	1.0	-23.7	-13.0	-10.7	
9696.12	13.1	H	3.0	38.7	1.0	-24.5	-13.0	-11.5	
11312.14	9.8	H	3.0	38.5	1.0	-27.7	-13.0	-14.7	
12928.16	18.0	H	3.0	39.4	1.0	-20.3	-13.0	-7.3	
14544.18	18.5	H	3.0	40.9	1.0	-21.4	-13.0	-8.4	
Mid Ch, 1621.02MHz									
3242.00	5.7	V	3.0	39.4	1.0	-32.7	-13.0	-19.7	
4863.00	22.3	V	3.0	39.8	1.0	-16.5	-13.0	-3.5	
6484.00	11.5	V	3.0	39.9	1.0	-27.3	-13.0	-14.3	
8105.10	14.9	V	3.0	39.1	1.0	-23.3	-13.0	-10.3	
9726.12	13.5	V	3.0	38.6	1.0	-24.1	-13.0	-11.1	
11347.14	11.5	V	3.0	38.5	1.0	-26.0	-13.0	-13.0	
12968.16	13.4	V	3.0	39.4	1.0	-25.0	-13.0	-12.0	
14589.18	11.8	V	3.0	40.9	1.0	-28.2	-13.0	-15.2	
3242.00	11.1	H	3.0	39.4	1.0	-27.3	-13.0	-14.3	
4863.00	22.4	H	3.0	39.8	1.0	-16.4	-13.0	-3.4	
6484.00	11.1	H	3.0	39.9	1.0	-27.7	-13.0	-14.7	
8105.10	15.6	H	3.0	39.1	1.0	-22.5	-13.0	-9.5	
9726.12	9.1	H	3.0	38.6	1.0	-28.5	-13.0	-15.5	
11347.14	13.1	H	3.0	38.5	1.0	-24.4	-13.0	-11.4	
12968.16	15.7	H	3.0	39.4	1.0	-22.7	-13.0	-9.7	
14589.18	14.2	H	3.0	40.9	1.0	-25.7	-13.0	-12.7	
High Ch, 1625.98MHz									
3251.90	3.4	V	3.0	39.4	1.0	-35.0	-13.0	-22.0	
4877.90	21.8	V	3.0	39.8	1.0	-17.0	-13.0	-4.0	
6503.90	13.4	V	3.0	39.8	1.0	-25.4	-13.0	-12.4	
8129.90	11.4	V	3.0	39.1	1.0	-26.7	-13.0	-13.7	
9755.88	11.7	V	3.0	38.6	1.0	-25.9	-13.0	-12.9	
11381.86	9.7	V	3.0	38.5	1.0	-27.8	-13.0	-14.8	
13007.84	12.5	V	3.0	39.4	1.0	-25.9	-13.0	-12.9	
14633.82	10.5	V	3.0	41.0	1.0	-29.4	-13.0	-16.4	
3251.90	13.4	H	3.0	39.4	1.0	-25.0	-13.0	-12.0	
4877.90	22.1	H	3.0	39.8	1.0	-16.7	-13.0	-3.7	
6503.90	12.9	H	3.0	39.8	1.0	-25.9	-13.0	-12.9	
8129.90	14.2	H	3.0	39.1	1.0	-24.0	-13.0	-11.0	
9755.88	7.5	H	3.0	38.6	1.0	-30.2	-13.0	-17.2	
11381.86	9.9	H	3.0	38.5	1.0	-27.6	-13.0	-14.6	
13007.84	15.1	H	3.0	39.4	1.0	-23.4	-13.0	-10.4	
14633.82	15.7	H	3.0	41.0	1.0	-24.2	-13.0	-11.2	

END OF REPORT