# Application Document For
# FCC Certification

# FCC ID: BFYM3047

## Applicant: Shintom Co., Ltd.

# LIST OF EXHIBITS

| EXHIBIT NO. | DESCRIPTION |
|---|---|
| 1 | Grantee's Certification |
| 2 | Test Data Certification (2 Pages) |
| 3 | Descriptive Information (17 Pages) |
| 4 | Technical Description (2 Pages) |
| 5 | FCC Label |
| 6 | Photograph: Front View |
| 7 | Photograph: Back View Showing FCC Label |
| 8 | Photograph: Top View |
| 9 | Photograph: Bottom View |
| 10 | Photograph: Right Side View |
| 11 | Photograph: Left Side View |
| 12 | Photograph: Front View of PC Board |
| 13 | Photograph: Back View of PC Board |
| 14 | Diagrams of Integrated Circuit and Active Device (157 Pages) |
| 15 | Block Diagram of Cellular Telephone Transmitter |
| 16 | Schematic Diagram of Transceiver |
| 17 | Block Diagram of TCXO System |
| 18 | Schematic Diagram of VCXO |
| 19 | Schematic Diagram of TX VCO |

# LIST OF EXHIBITS (Continued)

| EXHIBIT NO. | DESCRIPTION |
|---|---|
| 20 | Operating Instructions (32 Pages) |
| 21 | Tune-Up Procedure (4 Pages) |
| 22 | Data: Report of Measurement (KEC) (18 Pages) |
| 23 | Graph: SAT Filter Response |
| 24 | Graph: ST and Wide Band Data Filter Response |
| 25 | Graph: Post-Limiter Filter Response |
| 26 | Graph: Transmit Audio Frequency Response (2 Pages) |
| 27 | Graph: Modulation Limiting |
| 28 | Graph: Occupied Bandwidth (No Modulation) |
| 29 | Graph: Occupied Bandwidth (Audio) |
| 30 | Graph: Occupied Bandwidth (SAT) |
| 31 | Graph: Occupied Bandwidth (Audio Plus SAT) |
| 32 | Graph: Occupied Bandwidth (DTMF Plus SAT) |
| 33 | Graph: Occupied Bandwidth (WBD) (2 Pages) |
| 34 | Graph: Occupied Bandwidth (ST) |
| 35 | Graph: Occupied Bandwidth (SAT Plus ST) |
| 36 | Graph: Transmitter Conducted Spurious Emissions (5 Pages) |

## LIST OF EXHIBITS (Continued)

| EXHIBIT NO. | DESCRIPTION |
|---|---|
| 37 | Graph: Transmitter Conducted Spurious Emissions (Receive Band, 3 pages) |
| 38 | Graph: Frequency Stability-Temperature Variation |
| 39 | Graph: Frequency Stability-Voltage Variation |
| 40 | Data: Report of Measurements (26 Pages) (3D-EMC Laboratory, Inc.) |

Applicant : Shintom Co., Ltd. Transmitter Type: BFYM3047

**Shintom Co., Ltd.**
1-19-20 Shin-Yokohama, Kohoku-ku
Yokohama 222, Japan

Telephone : 045-476-3551
Facsimile : 045-476-3550

February 1, 1999

GRANTEE'S STATEMENT OF CERTIFICATION FOR TRANSCEICER BFYM3047

To Whom It May Concern

This is to certify that to the best of my knowledge and belief, the facts set forth in this application and accompanying technical data are true and correct.

Kenichi Saito
Director
Shintom Co., Ltd.

EXHIBIT 1

**Shintom Co., Ltd.**
1-19-20 Shin-Yokohama, Kohoku-ku
Yokohama 222, Japan
Telephone : 045-476-3551
Facsimile : 045-476-3550

AFFIDAVIT

I hereby certify that transceiver FCC ID : BFYM3047 manufactured by Shintom Co., Ltd. complies with all requirements of OET Bulletin 53 as referenced in Section 22.915 of the FCC Rules.

Shintom Co., Ltd.
1-19-20 Shin-Yokohama, Kohoku-ku
Yokohama 222-0033, Japan

Date: January 7, 1999

K. Sakayori
Kijiro Sakayori
Engineer
Shintom Co., Ltd.

**Shintom Co., Ltd.**
1-19-20 Shin-Yokohama, Kohoku-ku
Yokohama 222, Japan
Telephone : 045-476-3551
Facsimile : 045-476-3550

# CERTIFICATION OF TEST DATA

TO: Federal Communications Commission

Subject: FCC ID - BFYM3017

The technical data supplied with this application, having been taken under my direction and supervision, is hereby duly certified.

Sincerely,

Shintom Co., Ltd.

1-19-20 Shin-Yokohama, Kohoku-ku
Yokohama 222-0033, Japan

Date: January 7, 1999

K. Sakayori

Kijiro Sakayori
Engineer
Shintom Co., Ltd.

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|
| 2.1033(c)(1) | Applicant: Shintom Co., Ltd.<br>1-19-20 Shin-Yokohama, Kohoku-ku<br>Yokohama 222-0033, Japan<br><br>Manufacturer: Shintom Co., Ltd. |
| 2.1033(c)(2) | FCC ID: BFYM3047 |
| 2.1033(c)(3) | Operating Instruction Book: See Exhibit 20. |
| 2.1033(c)(4) | Emission Types: 40K0F8W and 40K0F1D |
| 2.1033(c)(5) | Frequency Range: 824.04 to 848.97 MHz |
| 2.1033(c)(6) | Range of Operating Power: +7.8dBm to +27.8dBm with the capability of reducing the maximum power in five steps of 4dB each on command from a Land Station. Each power level is maintained within +2/-4dB of its nominal level over the temperature range of -30 to +60 degrees Centigrade and +20/-17 % change of the Battery voltage, accumulative. |
| 2.1033(c)(7) | Maximum Power Rating: 0.6 Watts |
| 2.1033(c)(8) | DC Voltage and Current to the Final Amplifier Module:<br>Supply Voltage: 4.80 V DC<br>Drain Voltage: 4.66 V DC<br>Drain Current: 0.32 to 0.039 A |
| 2.1033(c)(9) | Tune-Up Procedure: See Exhibit 21. |
| 2.1033(c)(10) | Circuit Diagrams:<br><br>Transceiver Block Diagram: See Exhibit 15.<br>Transceiver Schematic Diagram: See Exhibit 16.<br>TCXO System Block Diagram: See Exhibit 17.<br>VCXO Schematic Diagram: See Exhibit 18.<br>TX VCO Schematic Diagram: See Exhibit 19. |

## DESCRIPTIVE INFORMATION (Continued)

**Subsection** **Description**

2.1033(c)(10) Function of Active Devices: See Exhibit 14.

| Reference No. | Function | Part No. |
|---|---|---|
| | **Base Band Circuit** | |
| IC401 | Signal Audio Processing LSI (Including Base Band Filters, Pre-emphasis, Limiter, Mute Switch, Compandor, DTMF Signal Generator, Electrical Volume, D/A converters, Wideband Data Encoder, DSAT, DST Encoder, SAT Transponder, DSAT, DST Transponder, AFC Counter) | AK2336 |
| IC402 | Ringer Audio Amp | NJM2113V |
| IC403 | Speaker Amp | NJM2113V |
| | **TCXO Block** | |
| F302 | Crystal | CX-91F(14.4MHz) or TOP-B(14.4MHz) |
| IC303 | Crystal Oscillator IC which includes Temperature Sensor | BH4435FV |
| D303 | Voltage-Variable Capacitance Diodes | HVU358T |
| D304 | Voltage-Variable Capacitance Diodes | HVU358T |
| | **PLL Synthesizer** | |
| IC301 | DUAL PLL IC | LMA1015M/CI.CT |
| MX301 | TX VCO | IL108 |
| MX301 | RX VCO | URAA8-D22A |

# DESCRIPTIVE INFORMATION (Continued)

**Subsection** **Description**

2.1033(c)(10) (Continued)

| Reference No. | Function | Part No. |
|---|---|---|
| | Base Band Circuit | |
| IC201 | RF Power Amp. Module | PF0045A |
| IC202 | Automatic Power Cont. | NJM2904V |
| Q201 | TX Buffer Amp. | 2SC4903 |
| Q202 | TX Buffer Amp. | 2SC5015 |
| | Digital Circuit | |
| IC601 | Microprocessor | UPD78058GCB69 |
| IC602 | Reset IC | S-80727SN-DQ |
| IC603 | EEPROM | AT24C16N10SI27 |
| Q301 | TX Control Switching | DTA123YUAT |
| | Receiver | |
| Q101 | RF Amp. | 2SC5015 |
| Q102 | 1st Mixer | 2SC4903 |
| Q103 | 1st Local Buffer | 2SC4903 |
| IC101 | FM IC (2nd Local OSC., 2nd Mixer, 2nd IF Amp., 2nd IF Filter, FM Demodulator) | TA31181FN |
| IC302 | DUAL PLL | BU2630FV |

DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|

2.1033(c)(10) (Continued)

| Reference No. | Function | Part No. |
|---|---|---|
| | Power Supply | |
| IC701 | Voltage Regulator | MM1385ENLE or TK11133SCL |
| IC702 | Voltage Regulator | MM1385ENLE or TK11133SCL |
| Q701 | Switching | NDS9953A |
| Q702 | Switching | UMG2NT |
| Q703 | Batt. Charged Switching | 2SJ355T |
| Q704 | Batt. Charged Switching | UMG2NT |
| Q705 | Batt. Charged Switching | UMC4NTR |

2.1033(c)(10) Technical Description: See Exhibit 4.

2.1033(c)(10) Description of Frequency Stabilization System: (TCXO System)

The TCXO System consists of VCXO Circuit and Temperature Sensor (F302, D303, D304, IC304), EEPROM (IC603), CPU (IC601), Signal Audio Processing LSI (DAC2, DAC3, AFC Counter Block inside IC401) and 2nd IF IC (IC101) of Receiver Section. See Exhibit 17 to 18.

DESCRIPTIVE INFORMATION (Continued)

Subsection Description

2.1033(c)(10) (Continued)

With regard to the Frequency Stability:

1) The data which compensates the Frequency Temperature Characteristics of Crystal Oscillator (F302) is pre-recorded at EEPROM (IC603).
2) The information from Temperature Sensor (IC304) is analyzed by CPU (IC601) and the environmental temperature of Crystal Oscillator (F302) becomes known.
3) The data which compensates the Frequency Temperature Characteristics of Crystal Oscillator (F302) corresponding to the environmental temperature of item 2 is read at CPU (IC601) from EEPROM. The result is outputted to DAC3 of Signal Audio Processing LSI (IC401).
4) The data outputted in the item 3 is converted to DC Voltage at DAC3. The result is outputted to Variable Capacitance Diodes (D304) to control Oscillating frequency of Crystal Oscillator (F302).

5) The fixed DC voltage is outputted to D303 by DAC2.

By the processes No. 1 to 5, Frequency Stability of ±2.5ppm is ensured under the temperature range of -30°C to +60°C.

On the other hand, when RF signal from a base station is received.

6) The 2nd IF Signal Frequency from 2nd IF IC (IC101) of Receiver Section is counted with Counter Block (IC401).
The result is led to CPU (IC601) and the error from the transmit frequency of the base station is calculated.

7) The data calculated at CPU (IC601) to minimize the error from the transmit frequency of the base station is outputted to DAC2 of Signal Audio Processing LSI (IC401).

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|

2.1033(c)(10) (Continued)

8) The data outputted in the item 7 is converted to DC voltage at DAC2. The result is outputted to Variable Capacitance Diode (D303) to control Oscillating Frequency of Crystal Oscillator (F302).

The Frequency Stability of ±1.0ppm is ensured by Automatic Frequency Control (AFC) System which consists of the processes No. 6 to 8.

The result of AFC control is as follows:

9) The data which compensates Frequency Temperature Characteristics of Crystal Oscillator (F302) Recorded at EEPROM (IC603) is renewed.
10) For the renewal, the information from Temperature Sensor (IC304) is analyzed by CPU (IC601). The data portion corresponding to the environmental temperature of Crystal Oscillator (F302) is renewed.

By renewing the data which compensates the Frequency Temperature Characteristics of Crystal Oscillator (F302) recorded at EEPROM (IC603), the Frequency Stability of ±1.0ppm is further maintained as stable status under the temperature range of −30℃ to +60℃.

The above is operational explanation of the TCXO System.

2.1033(c)(10) Description of Circuits for Suppression of Spurious Radiation, for Limiting Modulation, and for Limiting Power:

Means for Attenuation of Spurious Emissions: Spurious and Harmonic Suppression is obtained by Proper shielding techniques, and the use of filters. The following data are attached as reference:

DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|

2.1033(c)(10) (Continued)

SAT Filter Response: See Exhibit 23.
ST and Wide Band Data Filter Response: See Exhibit 24.
Post-Limiter Filter Response: See Exhibit 25.

Means of Limiting Modulation:
This transmitter is equipped with a device which automatically prevents Modulation in excess of 100 %. This device, an instantaneous deviation control circuit, precedes the modulator of the transmitter. It is instantaneous in action for controlling the modulating wave introduced into the transmitter's frequency modulator. The modulation limiter is incorporated in the Signal Audio Processing LSI (IC401).

The deviation limit can be set to the Channel Width Requirement of ±12KHz with the Electrical Volume incorporated in IC401. The deviation of Wide Band Data and Signaling Tone can be set to a Maximum of ±8KHz with the Electrical Volume Incorporated in IC401.

The modulating waveform of the signaling channel follows the format specified in the Cellular Compatibility Standards specified in OET Bulletin 53 as referenced in Section 22.915 (a) of the FCC rules.

Means for Limiting Power:
Power limiting is obtained via the Automatic Power Control (AFC) Circuit. Adjustment of the transmitter's power for each of the 6 levels is made according to data stored in EEPROM (IC603).

2.1033 (c)(11) Equipment Identification:
Equipment's Identification Label and its intended location are shown in Exhibit 5 (FCC Label), and in Exhibit 7 (Photograph of Back View of Transceiver showing FCC Label).

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|

2.1033 (c)(12) Photographs:

A complete set of the photographs showing external and internal views of circuit details and construction are provided. See Exhibit 6 to 13.

2.1033(c)(13) Not applicable

2.1033 (c)(14) Standard Test Conditions:

The following conditions and procedures were followed during testing of this transmitter:

Room temperature: 23 - 27 Degrees Celsius
Room Humidity: 30 - 50 %
Supply Voltage: 4.8 V DC (Nominal Battery Voltage)

Prior to testing, the unit was tuned-up according to the manufacturer's alignment procedure.
Test procedures were according to EIA specification IS19B.

The following equipment were used for testing.

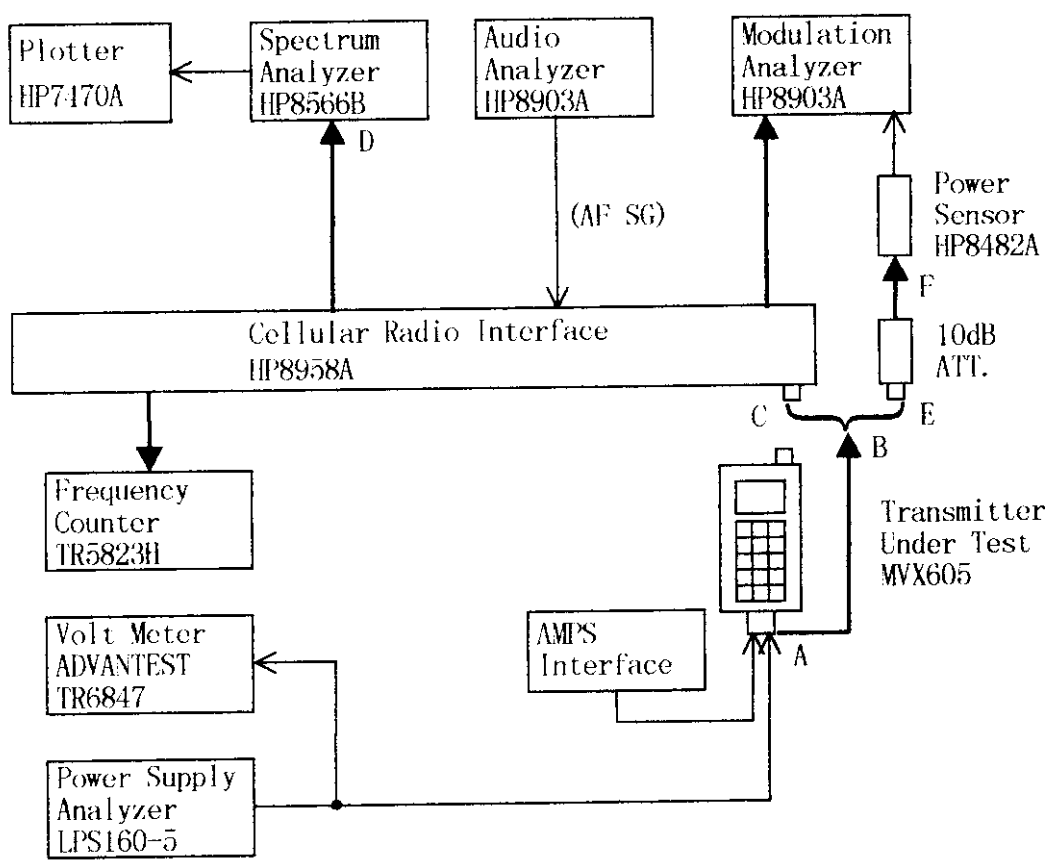
| Equipment | Manufacturer | Type No. |
|---|---|---|
| Modulation Analyzer | Hewlett Packard | 8901B |
| Power Sensor | Hewlett Packard | 8482A |
| Audio Analyzer | Hewlett Packard | 8903A |
| Spectrum Analyzer | Hewlett Packard | 8566B |
| RF Signal Generator | Hewlett Packard | 8642A |
| RF Signal Generator | Hewlett Packard | 8642A |
| RF Signal Generator | Hewlett Packard | 8665A |
| Cellular Interface | Hewlett Packard | 8958A |
| Plotter | Hewlett Packard | 7470A |
| Power Supply | Hewlett Packard | 6024A |
| AF Signal Generator | Matsushita | VP7214A |
| Frequency Counter | Advantest | TR5823H |
| Volt Meter | Advantest | TR6847 |
| Power Supply | Leader | LPS160-5 |

DESCRIPTIVE INFORMATION (Continued)

Subsection Description

2.1033(c)(14) (Continued)

Standard Set-up:




Cable Loss (A--B): 1.0dB
Attenuation (C--D): 32.8dB
(HP8958A)
Attenuation (E--F): 9.8dB
(10dB ATT.)

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|
| 2.1033(c)(15) | Not Applicable |
| 2.1033(c)(16) | Not Applicable |
| 2.1033(c)(17) | Not Applicable |
| 2.1046(a)(c) | RF Power Output: The test set-up for RF Power Output is as per Page 9 of Exhibit 3. |

The Power Output was then measured.

Supply Voltage: 4.8 V DC
Modulation: None

Results:

| Channel No. | Nominal Frequency (MHz) | Power Output (Watts) Hi | Power Output (Watts) Low |
|---|---|---|---|
| 991 | 824.04 | 0.551 | 0.006 |
| 383 | 836.49 | 0.600 | 0.006 |
| 799 | 848.97 | 0.478 | 0.005 |

Note: Channel capacity = 832

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|
| 2.1047(a)<br>22.915(d)(1) | Transmitter Audio Frequency Response:<br>The test set-up for the Transmitter Frequency Response is as per Page 9 of Exhibit 3. (Using HP8901B Modulation Meter).<br><br>Operate the transmitter with the compressor Disabled, and monitor the output with a frequency deviation meter of standard test receiver without standard 750-microsecond de-emphasis, with expandor disabled. Apply the sine wave audio input to the transmitter external audio input port, vary the modulating frequency from 300 to 3000 Hz, and observe the input levels necessary to maintain a constant ±2.9KHz system deviation.<br><br>Adjust the audio input frequency to 1000 Hz, and adjust the input level to 20 dB greater than that required to produce ±8KHz deviation. Note the output level on the frequency deviation meter or standard test receiver. Using this output level from 3000 Hz to 30,000 Hz, and observe the change in output while maintaining a constant audio input level.<br><br>The results are shown in Exhibit 26 (2 Pages).<br><br>Response of Post-Limiter Filter:<br>The low pass filter installed between the modulation limiter and the modulation stage is incorporated in the Signal Audio Processing LSI (IC401).<br><br>The response of this filter is shown in Exhibit 25. |
| 2.1047(b)<br>22.915(b)(1), (c) | Modulation Limiting:<br>The test set-up for the Modulation Limiting is as per Page 9 of Exhibit 3. The deviation is to be observed by varying the input voltage. Test has been performed for three different modulation frequencies.<br><br>The results are shown in Exhibit 27. |

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|
| 2.1049(c)(1)<br>22.917 | Occupied Bandwidth:<br>The test set-up for the Occupied Bandwidth is as per Page 9 of Exhibit 3.<br>The Audio SG was adjusted to the frequency of 1 KHz. The output level was set to ±6 KHz deviation.<br><br>With level constant, the frequency was set to 2,500 Hz. Then the audio signal level was increased by 16 dB.<br><br>In addition, occupied bandwidth data was obtained for the SAT (Supervisory Audio Tone), ST (Signaling Tone), WBD (Wideband Data), and DTMF (Dual Tone Multi Frequencies).<br><br>The results are also shown on the attached graphs: |

| | |
|---|---|
| Occupied Bandwidth (No modulation): | See Exhibit 28. |
| Occupied Bandwidth (Audio): | See Exhibit 29. |
| Occupied Bandwidth (SAT): | See Exhibit 30. |
| Occupied Bandwidth (Audio Plus SAT): | See Exhibit 31. |
| Occupied Bandwidth (DTMF Plus SAT): | See Exhibit 32. |
| Occupied Bandwidth (WBD) (2 Pages): | See Exhibit 33. |
| Occupied Bandwidth (ST): | See Exhibit 34. |
| Occupied Bandwidth (ST Plus SAT): | See Exhibit 35. |

| Subsection | Description |
|---|---|
| 2.1051<br>22.917 | Spurious Emission at Antenna Terminal:<br>The test set-up for the Spurious Emission at the Antenna Terminal is as per Page 9 of Exhibit 3.<br><br>The level of the carrier and the various conducted spurious and harmonic frequencies were measured by means of a calibrated Spectrum Analyzer. The spectrum was scanned from the lowest frequency generated in the equipment to 10 GHz. |

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|

2.1051
22.917

(Continued)

Output Power: 0.6 Watts
Modulation Condition: Audio Plus SAT

Audio:
Frequency: 2,500 Hz
Input Level: 16 dB greater than the level to produce ±6KHz deviation
SAT:
Frequency: 6,000 Hz
Deviation: ±2KHz

| Harmonics | Spurious Level Below Carrier (dBc) (Nominal Frequency in MHz) | | |
|---|---|---|---|
| | 824.04 | 836.49 | 848.97 |
| 2nd | < -60 dBc | < -60 dBc | < -60 dBc |
| 3rd to 6th | < -65 dBc | < -65 dBc | < -65 dBc |
| 7th to 11th | < -70 dBc | < -70 dBc | < -70 dBc |

All other Spurious readings were below -55 dBc.

Limit: $-(43 + 10 \log 0.6)$ dBc = -40.8 dBc.

Power outputs of 0.095, 0.00603 watts were measured, and the results were the same as those shown.
The graphs measured by the spectrum analyzer are shown in Exhibit 36 (5 Pages).

2.1051
22.917 (f)

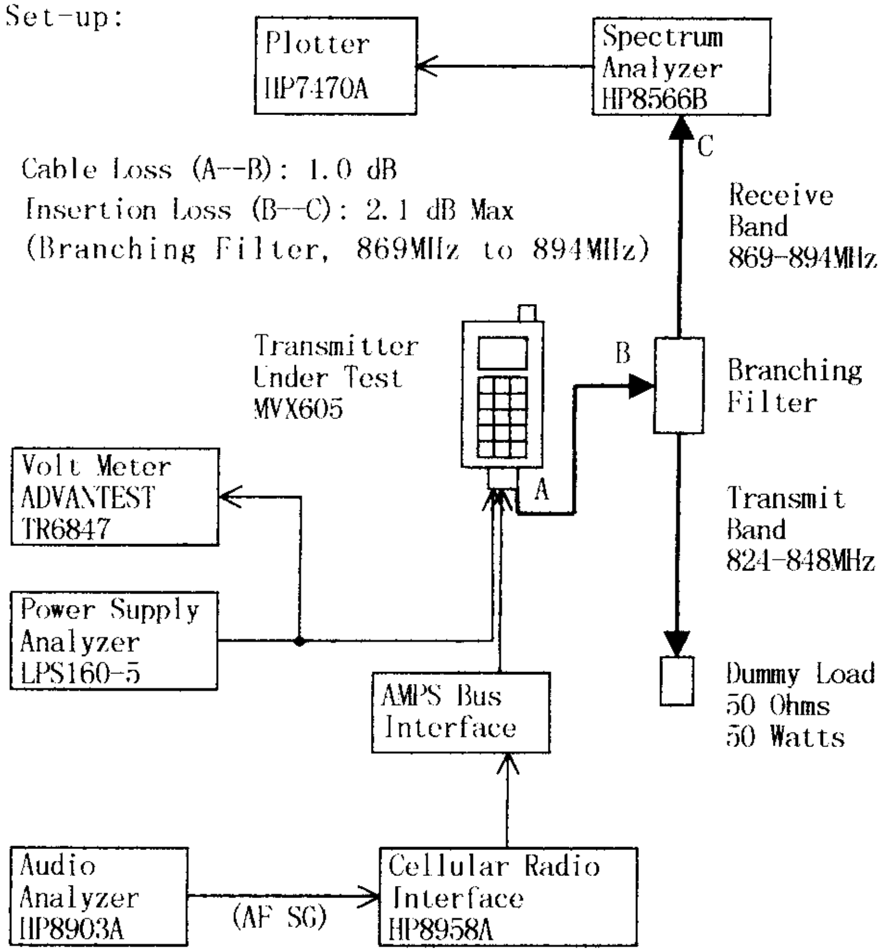
Spurious Emission at Antenna Terminal:
The test set-up for the spurious emission in the receiving frequency band is as per the following figure.

The mean power of any emissions appearing in the base station frequency range from the transmitter were measured by means of a calibrated spectrum analyzer.

DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
| --- | --- |
| 2.1051<br>22.917 (f) | (Continued) |

Set-up:



## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|
| 2.1051<br>22.917 (f) | (Continued)<br>Results:<br>The spectrum was scanned in the frequency range of 869-894 MHz. Then the level of emissions were below -90 dBm.<br><br>Limit: Below -80 dBm.<br><br>Carrier frequency of 824.04, 836.49, 848.97 MHz and power outputs of 0.6, 0.095, 0.00603 watts were measured, and the results were the same as those shown previously.<br><br>The graphs measured by the spectrum analyzer are shown in Exhibit 37 (3 Pages). |
| 2.1053<br>22.917<br>22.913(a) | Field Strength of Spurious Radiation:<br>The measurement was performed by KEC (Kansai Electronic Industry Development Center).<br><br>The report of measurement by KEC is attached as Exhibit 22. |
| 2.1055(a)(1) | Frequency Stability-Temperature Variation:<br>The EUT was placed in a temperature chamber, decreased to -30℃, and permitted to stabilize for one hour. Power was applied and maximum frequency change within one minute was measured.<br><br>With the power OFF, temperature was raised in 10℃ (or 15℃) steps. The next step was permitted to stabilize for one half hour. Power was applied and frequency was measured.<br><br>Carrier frequency: 836.49 MHz<br>Supply Voltage: 4.8 V DC |

## DESCRIPTIVE INFORMATION (Continued)

Subsection Description

2.1055(a)(1) (Continued)

Results:

| Temperature (℃) | Frequency (MHz) | Frequency (Hz) | Change (ppm) |
|---|---|---|---|
| -30.0 | 836.489932 | -68 | -0.081 |
| -20.0 | 836.489991 | -9 | -0.011 |
| -10.0 | 836.490064 | 64 | 0.076 |
| 0.0 | 836.489767 | -234 | -0.279 |
| 10.0 | 836.489864 | -136 | -0.163 |
| 25.0 | 836.489914 | -86 | -0.103 |
| 40.0 | 836.489876 | -124 | -0.149 |
| 50.0 | 836.489700 | -300 | -0.359 |
| 60.0 | 836.489838 | -162 | -0.194 |

See Exhibit 38.

2.1055(d) Frequency Stability-Voltage Variation:
The test set-up for the Frequency Stability-Voltage Variation is as per Page 9 of Exhibit 3.

With power OFF, the sample was permitted to stabilize at +25±2℃. Power was then applied at 83, 90, 95, 100, 105, 110, 115 and 120% of the standard test voltage (STV). The frequency change within one minute was recorded.

Note: Battery Nominal Supply Voltage = 4.80 V
Battery Primary Supply Voltage = 5.76 V
Battery Operating End Voltage = 4.00 V

Carrier Frequency: 836.49 MHz

| STV (%) | Supply Voltage (Vdc) | Frequency (MHz) | Frequency (Hz) | Change (ppm) |
|---|---|---|---|---|
| 83 | 4.00 | 836.489855 | -145 | -0.173 |
| 90 | 4.32 | 836.489896 | -104 | -0.124 |
| 95 | 4.56 | 836.489790 | -210 | -0.251 |
| 100 | 4.80 | 836.489955 | -45 | -0.054 |
| 105 | 5.04 | 836.489832 | -168 | -0.201 |
| 110 | 5.28 | 836.489880 | -120 | -0.143 |
| 115 | 5.52 | 836.489845 | -155 | -0.185 |
| 120 | 5.76 | 836.489802 | -198 | -0.237 |

Limit: ±2.5ppm = ±2091 Hz
See Exhibit 39.

## DESCRIPTIVE INFORMATION (Continued)

| Subsection | Description |
|---|---|
| 2.1093 | The SAR (Specific Absorption Rate) measurement was performed by 3D-EMC Laboratory, Inc.<br><br>The report of measurement by 3D-EMC Laboratory, Inc. is attached as Exhibit 40. |
| 22.919(a)(b)(c) | Electronic Serial Number: |

The transceiver FCC ID: BFYM3047 has an Electronic Serial Number (ESN) of 32 bit which is uniquely written at the factory. The host component of ESN (EEPROM) is soldered to the main circuit board of the transceiver and contains encoded information of 128 bit memory.

The 128 bit memory includes ESN (32 bit), check-sum-adjust (8 bit), checksum (8 bit), and an additional information (80 bit).
The additional information includes a random data which depends on an individual transceiver unit.
The checksum will be used for checking whether the 128 bit memory is correct or not.
The 128 bit memory is encoded by particular method and the encoded data (128 bit) is written into the host component (EEPROM) in the transceiver unit at the factory.

The method of encoding 128 bit memory is a kind of bit location conversion from 128 bit to 128 bit and then ESN bits are spread over various non-sequential memory location.
The operating software within the transceiver Decodes the encoded 128 bit memory and check whether the decoded 128 bit memory is correct or not. The 128 bit memory which is not correct causes the software to make the transceiver inoperative.
Therefore, the ESN is not alterable in the field without the information of 128 bit memory with respect to the structure, the encoding method performed in the factory and the checking method.
And any attempt to remove, tamper with, or change ESN will render the transceiver inoperative.

# TECHNICAL DESCRIPTION

The transmitter has been specially designed for the Domestic Public Cellular Radiotelephone Communications Service. The rated maximum power output is 0.6 watts with the capability of reducing the maximum power in five steps of 4dB each on command from a Base Station. Each power level is maintained within +2/-4 dB of its nominal level over the temperature range from -30 to +60 degrees Centigrade and +20/-17 % change of the supply voltage, accumulative. This transmitter operates in the frequency range of 824.04 to 848.97 MHz. The frequencies are generated by Phase Locked Loop Frequency Synthesizers which are controlled by the closest Base Station in the system and the frequency stability of carrier is better than ±2.5 ppm.

The transmitter is equipped with an audio compressor having 2:1 syllabic compandor, a pre-emphasis audio circuit having a 6dB/octave response, an instantaneous deviation limiter to limit deviation to ±12KHz, and a post deviation limiter filter having a -18dB/octave response above 3000 Hz.

The transmitter carrier frequency is generated by a Phase Locked Loop (PLL) circuit. The PLL circuit consists of a TX Voltage Controlled Oscillator (TX VCO, MX301), a PLL integrated circuit (IC301), a loop filter and a reference frequency oscillator (TCXO system, see Pages 4 to 6 of Exhibit 3).

The frequency of the TCXO system is 14.4 MHz with stability better than ±2.5ppm over the temperature range of -30 to +60 degrees Centigrade. The frequency of TCXO system can be controlled by AFC (Automatic Frequency Control) circuit so that the receiving frequency agrees with the Base Station transmit frequency. In this mode, the frequency stability of TCXO system is maintained within ±1.0ppm over the temperature range of -30 to +60 degrees Centigrade. The reference divider provides a reference signal to the phase comparator by dividing an output of the TCXO system.

The programmable divider, which is controlled by digital circuitry, provides a signal to the phase comparator by dividing an output of the TX VCO (MX301).

The phase comparator controls a frequency of the TX VCO through the charge pump and the loop filter so that the phase of the signal from the programmable divider agrees with the phase of the reference signal. Therefore, the frequency of the TX VCO is controlled by the digital Circuitry with the stability of the TCXO system. The TX PLL synthesizer Provides a RF signal to a driver (Q202) through a buffer amplifier (Q201).

## TECHNICAL DESCRIPTION (Continued)

The TX PLL circuit also acts as a frequency modulator which provides the peak frequency deviation within ±12 KHz and the constant deviation and low distortion within the operating bandwidth. The frequency modulator is preceded by a Signal Audio Processing LSI (IC101) which contains a band pass filter, compressor, pre-emphasis, limiter, post-limiter filter, and a mute switch, to provide appropriate voice band processing. Supervisory Audio Tone (SAT), Signaling Tone (ST), and Wide Band Data (WBD) are generated within the Microprocessor (IC601) and transmitted to the frequency modulator through the filter included in the Signal Audio Processing LSI (IC101).

The power amplifier circuit, which consists of a RF power amplifier module (IC201), a band pass filter (F202), the driver (Q202), and a power control circuit, amplifiers the 0.5 milliwatt from the TX frequency synthesizer circuit and provides at least 1.1 watts output. The output of the power amplifier is connected to an antenna terminal through a directional coupler (F203) and a Band Pass Filter (F101). The output of the power amplifier provides adequate margin to compensate for losses in the directional coupler and bandpass filter.

The Power Control circuit (APC) consists of a power level detector (D201), comparator (IC203), and a D/A converter incorporated in IC601. The power detector provides the comparator with a DC voltage which indicates the power level. The D/A converter, which is controlled by the digital circuitry provides the reference DC voltage to the comparator. The comparator controls the RF power amplifier module so that the voltage detected by the power level detector is equal to the reference voltage. The D/A converter converts the binary data from the digital circuitry into the analog reference voltage. Binary data, which corresponding to the six different power levels, is stored in the EEPROM of the digital circuitry and controls the power level adjustment. The transmitter has the capability of reducing the maximum output power level in 5 steps of 4 dB each.

The digital circuitry continuously monitors the power output at the output of the power detector. If the power output is detected and the CARRIER ON command is not enabled by the digital circuitry, the transmitter will be deactivated through independent action of controlling TX Enable Switch (Q301) to turn off the power of TX Buffer Amp. (Q201) and through action of controlling Power Supply Switch (Q702) with signal (TXTS) to turn off the power of RF Power Amp. Module (IC201), TX Buffer Amp. (Q202) and Automatic Power Control (IC202).